Optoelectronics Designer's Catalog
Hewlett-Packard is one of the world’s leading designers and manufacturers of electronic, medical, analytical, and computing instruments and systems, diodes, transistors, and optoelectronic products. Since its founding in Palo Alto, California, in 1939, HP has done its best to offer only products that represent significant technological advancements.

To maintain its leadership in instrument and component technology, Hewlett-Packard invests heavily in new product development. Research and development expenditures traditionally average about 10 percent of sales revenue, and 1,500 engineers and scientists are assigned the responsibilities of carrying out the company’s various R and D projects.

HP produces more than 3,500 products at 26 domestic divisions in California, Colorado, Oregon, Idaho, Massachusetts, New Jersey and Pennsylvania and at overseas plants located in the German Federal Republic, Scotland, France, Japan, Singapore, and Brazil.

However, for the customer, Hewlett-Packard is no farther away than the nearest telephone. There are 172 HP sales and service offices located in 65 countries around the world.

These field offices are staffed by trained engineers, each of whom has the primary responsibility of providing technical assistance and data to customers. A vast communications network has been established to link each field office with the factories and with corporate offices. No matter what the product or the request, a customer can be accommodated by a single contact with the company.

Hewlett-Packard is guided by a set of written objectives. One of these is “to provide products and services of the greatest possible value to our customers.” Through application of advanced technology, efficient manufacturing, and imaginative marketing, it is the customer that the more than 30,000 Hewlett-Packard people strive to serve. Every effort is made to anticipate the customer’s needs, to provide the customer with products that will enable more efficient operation, to offer the kind of service and reliability that will merit the customer’s highest confidence, and to provide all of this at a reasonable price.

To better serve its many customers’ broad spectrum of technological needs, Hewlett-Packard publishes several catalogs. Among these are:

- Electronic Instruments and Systems for Measurement/Computation (General Catalog)
- DC Power Supply Catalog
- Medical Instrumentation Catalog
- Analytical Instruments for Chemistry Catalog
- Coax. and W/G Measurement Accessories Catalog
- Diode and Transistor Catalog

All catalogs are available at no charge from your local HP sales office.
A decade of intensive solid state research, the development of advanced manufacturing techniques and continued expansion has enabled Hewlett-Packard to become a high volume supplier of quality, competitively priced LED displays, LED lamps, isolators, and photodetectors. In addition to our broad product line, Hewlett-Packard also offers the following services: immediate delivery from any of our authorized stocking distributors, applications support, special QA testing, and a one year guarantee on all of our optoelectronic products. This package of products and services has enabled Hewlett-Packard to become a recognized leader in the optoelectronic industry.

About this Catalog

This Optoelectronics Designer’s Catalog contains detailed, up-to-date specifications on our complete optoelectronic product line. It is divided into four major product sections: LED Lamps, LED Displays, Isolators, and Detectors. It also includes an Index on optoelectronic Application Notes which are available from any of the Hewlett-Packard Sales and Service Offices listed on page 150, and from any of the Distributors listed on page 148.

How To Use This Catalog

Three methods are incorporated for locating components:
• a Table of Contents that allows you to locate components by their general description,
• a Numeric Index that lists all components by part number, and
• a Selection Guide for each product group giving a brief overview of the product line.

How To Order

All Hewlett-Packard components may be ordered through any of the Sales and Service Offices listed on page 150. In addition, for immediate delivery of Hewlett-Packard optoelectronic components, contact any of the world-wide stocking distributors listed on page 148.

Hewlett-Packard assumes no responsibility for the use of any circuits described herein and makes no representations or warranties, express or implied, that such circuits are free from patent infringement.
# Table of Contents

**Numeric Index**  
vi

**Solid State Lamps**  
Selection Guide  
Red, High Efficiency Red, Yellow and Green Lamps  
Integrated Lamps  
Hermetically Sealed Lamps  
Panel Mounting Kit  
2  
5  
33  
37  
43

**Solid State Displays**  
Selection Guide  
Red, High Efficiency Red, Yellow and Green Seven Segment Displays  
Integrated Displays  
Hermetically Sealed Integrated Displays  
Alphanumeric Displays  
Chips  
46  
50  
85  
95  
108  
111

**Isolators**  
Selection Guide  
High Speed Isolators  
High Reliability Isolators  
Low Input Current/High Gain Isolators  
116  
117  
133  
137

**Photodetectors**  
Selection Guide  
PIN Photodiodes  
141  
142

**Application Note Index**  
146

**Distributor Stocking Locations**  
148

**Hewlett-Packard Sales and Service Offices**  
150

**Profile and Inquiry Card**
# Numeric Index

<table>
<thead>
<tr>
<th>PHOTODETECTORS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-4203</td>
<td>142</td>
</tr>
<tr>
<td>5082-4204</td>
<td>142</td>
</tr>
<tr>
<td>5082-4205</td>
<td>142</td>
</tr>
<tr>
<td>5082-4207</td>
<td>142</td>
</tr>
<tr>
<td>5082-4220</td>
<td>142</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTICALLY COUPLED ISOLATORS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX-4365</td>
<td>133</td>
</tr>
<tr>
<td>TXB-4365</td>
<td>133</td>
</tr>
<tr>
<td>5082-4350</td>
<td>117</td>
</tr>
<tr>
<td>5082-4351</td>
<td>117</td>
</tr>
<tr>
<td>5082-4352</td>
<td>117</td>
</tr>
<tr>
<td>5082-4354</td>
<td>121</td>
</tr>
<tr>
<td>5082-4355</td>
<td>121</td>
</tr>
<tr>
<td>5082-4360</td>
<td>125</td>
</tr>
<tr>
<td>5082-4364</td>
<td>129</td>
</tr>
<tr>
<td>5082-4365</td>
<td>133</td>
</tr>
<tr>
<td>5082-4370</td>
<td>137</td>
</tr>
<tr>
<td>5082-4371</td>
<td>137</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAMPS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1N5765</td>
<td>37</td>
</tr>
<tr>
<td>JAN 1N5765</td>
<td>37</td>
</tr>
<tr>
<td>JANTX 1N5765</td>
<td>37</td>
</tr>
<tr>
<td>5082-4100</td>
<td>19</td>
</tr>
<tr>
<td>5082-4101</td>
<td>19</td>
</tr>
<tr>
<td>5082-4150</td>
<td>19</td>
</tr>
<tr>
<td>5082-4160</td>
<td>19</td>
</tr>
<tr>
<td>5082-4190</td>
<td>19</td>
</tr>
<tr>
<td>5082-4403</td>
<td>29</td>
</tr>
<tr>
<td>5082-4415</td>
<td>29</td>
</tr>
<tr>
<td>5082-4420</td>
<td>37</td>
</tr>
<tr>
<td>5082-4440</td>
<td>29</td>
</tr>
<tr>
<td>5082-4444</td>
<td>29</td>
</tr>
<tr>
<td>5082-4468</td>
<td>35</td>
</tr>
<tr>
<td>5082-4480</td>
<td>32</td>
</tr>
<tr>
<td>5082-4483</td>
<td>32</td>
</tr>
<tr>
<td>5082-4484</td>
<td>32</td>
</tr>
<tr>
<td>5082-4486</td>
<td>32</td>
</tr>
<tr>
<td>5082-4487</td>
<td>32</td>
</tr>
<tr>
<td>5082-4488</td>
<td>32</td>
</tr>
<tr>
<td>5082-4494</td>
<td></td>
</tr>
<tr>
<td>5082-4520</td>
<td></td>
</tr>
<tr>
<td>5082-4550</td>
<td></td>
</tr>
<tr>
<td>5082-4555</td>
<td></td>
</tr>
<tr>
<td>5082-4557</td>
<td></td>
</tr>
<tr>
<td>5082-4558</td>
<td></td>
</tr>
<tr>
<td>5082-4584</td>
<td></td>
</tr>
<tr>
<td>5082-4590</td>
<td></td>
</tr>
<tr>
<td>5082-4592</td>
<td></td>
</tr>
<tr>
<td>5082-4595</td>
<td></td>
</tr>
<tr>
<td>5082-4597</td>
<td></td>
</tr>
<tr>
<td>5082-4620</td>
<td></td>
</tr>
<tr>
<td>5082-4650</td>
<td></td>
</tr>
<tr>
<td>5082-4655</td>
<td></td>
</tr>
<tr>
<td>5082-4657</td>
<td></td>
</tr>
<tr>
<td>5082-4658</td>
<td></td>
</tr>
<tr>
<td>5082-4684</td>
<td></td>
</tr>
<tr>
<td>5082-4690</td>
<td></td>
</tr>
<tr>
<td>5082-4693</td>
<td></td>
</tr>
<tr>
<td>5082-4694</td>
<td></td>
</tr>
<tr>
<td>5082-4695</td>
<td></td>
</tr>
<tr>
<td>5082-4707</td>
<td></td>
</tr>
<tr>
<td>5082-4732</td>
<td></td>
</tr>
<tr>
<td>5082-4790</td>
<td></td>
</tr>
<tr>
<td>5082-4791</td>
<td></td>
</tr>
<tr>
<td>5082-4850</td>
<td></td>
</tr>
<tr>
<td>5082-4855</td>
<td></td>
</tr>
<tr>
<td>5082-4860</td>
<td></td>
</tr>
<tr>
<td>5082-4880</td>
<td></td>
</tr>
<tr>
<td>5082-4881</td>
<td></td>
</tr>
<tr>
<td>5082-4882</td>
<td></td>
</tr>
<tr>
<td>5082-4883</td>
<td></td>
</tr>
<tr>
<td>5082-4884</td>
<td></td>
</tr>
<tr>
<td>5082-4885</td>
<td></td>
</tr>
<tr>
<td>5082-4886</td>
<td></td>
</tr>
<tr>
<td>5082-4887</td>
<td></td>
</tr>
<tr>
<td>5082-4888</td>
<td></td>
</tr>
<tr>
<td>5082-4920</td>
<td></td>
</tr>
<tr>
<td>5082-4950</td>
<td></td>
</tr>
<tr>
<td>5082-4955</td>
<td></td>
</tr>
<tr>
<td>5082-4957</td>
<td></td>
</tr>
</tbody>
</table>
# Numeric Index

<table>
<thead>
<tr>
<th>LAMPS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-4958</td>
<td>5</td>
</tr>
<tr>
<td>5082-4984</td>
<td>15</td>
</tr>
<tr>
<td>5082-4990</td>
<td>9</td>
</tr>
<tr>
<td>5082-4992</td>
<td>9</td>
</tr>
<tr>
<td>5082-4995</td>
<td>9</td>
</tr>
<tr>
<td>5082-4997</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISPLAYS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7001</td>
<td>106</td>
</tr>
<tr>
<td>5082-7010</td>
<td>95</td>
</tr>
<tr>
<td>5082-7011</td>
<td>95</td>
</tr>
<tr>
<td>5082-7100</td>
<td>107</td>
</tr>
<tr>
<td>5082-7101</td>
<td>107</td>
</tr>
<tr>
<td>5082-7102</td>
<td>107</td>
</tr>
<tr>
<td>5082-7240</td>
<td>81</td>
</tr>
<tr>
<td>5082-7241</td>
<td>81</td>
</tr>
<tr>
<td>5082-7300</td>
<td>85</td>
</tr>
<tr>
<td>5082-7302</td>
<td>85</td>
</tr>
<tr>
<td>5082-7304</td>
<td>85</td>
</tr>
<tr>
<td>5082-7340</td>
<td>85</td>
</tr>
<tr>
<td>5082-7356</td>
<td>89</td>
</tr>
<tr>
<td>5082-7357</td>
<td>89</td>
</tr>
<tr>
<td>5082-7359</td>
<td>89</td>
</tr>
<tr>
<td>5082-7391</td>
<td>101</td>
</tr>
<tr>
<td>5082-7392</td>
<td>101</td>
</tr>
<tr>
<td>5082-7395</td>
<td>101</td>
</tr>
<tr>
<td>5082-7402</td>
<td>65</td>
</tr>
<tr>
<td>5082-7403</td>
<td>65</td>
</tr>
<tr>
<td>5082-7404</td>
<td>65</td>
</tr>
<tr>
<td>5082-7405</td>
<td>65</td>
</tr>
<tr>
<td>5082-7412</td>
<td>65</td>
</tr>
<tr>
<td>5082-7413</td>
<td>65</td>
</tr>
<tr>
<td>5082-7414</td>
<td>65</td>
</tr>
<tr>
<td>5082-7415</td>
<td>65</td>
</tr>
<tr>
<td>5082-7432</td>
<td>69</td>
</tr>
<tr>
<td>5082-7433</td>
<td>69</td>
</tr>
<tr>
<td>5082-7440</td>
<td>73</td>
</tr>
<tr>
<td>5082-7441</td>
<td>73</td>
</tr>
<tr>
<td>5082-7442</td>
<td>77</td>
</tr>
<tr>
<td>5082-7444</td>
<td>77</td>
</tr>
<tr>
<td>5082-7445</td>
<td>111</td>
</tr>
<tr>
<td>5082-7447</td>
<td>111</td>
</tr>
<tr>
<td>5082-7448</td>
<td>111</td>
</tr>
<tr>
<td>5082-7449</td>
<td>111</td>
</tr>
<tr>
<td>5082-7500</td>
<td>111</td>
</tr>
<tr>
<td>5082-7650</td>
<td>111</td>
</tr>
<tr>
<td>5082-7651</td>
<td>111</td>
</tr>
<tr>
<td>5082-7652</td>
<td>111</td>
</tr>
<tr>
<td>5082-7653</td>
<td>111</td>
</tr>
<tr>
<td>5082-7660</td>
<td>111</td>
</tr>
<tr>
<td>5082-7661</td>
<td>111</td>
</tr>
<tr>
<td>5082-7662</td>
<td>111</td>
</tr>
<tr>
<td>5082-7663</td>
<td>111</td>
</tr>
<tr>
<td>5082-7670</td>
<td>50</td>
</tr>
<tr>
<td>5082-7671</td>
<td>50</td>
</tr>
<tr>
<td>5082-7672</td>
<td>50</td>
</tr>
<tr>
<td>5082-7673</td>
<td>50</td>
</tr>
<tr>
<td>5082-7730</td>
<td>55</td>
</tr>
<tr>
<td>5082-7731</td>
<td>55</td>
</tr>
<tr>
<td>5082-7732</td>
<td>55</td>
</tr>
<tr>
<td>5082-7740</td>
<td>59</td>
</tr>
<tr>
<td>5082-7750</td>
<td>61</td>
</tr>
<tr>
<td>5082-7751</td>
<td>61</td>
</tr>
<tr>
<td>5082-7752</td>
<td>61</td>
</tr>
<tr>
<td>5082-7760</td>
<td>61</td>
</tr>
<tr>
<td>5082-7811</td>
<td>111</td>
</tr>
<tr>
<td>5082-7821</td>
<td>111</td>
</tr>
<tr>
<td>5082-7832</td>
<td>111</td>
</tr>
<tr>
<td>5082-7842</td>
<td>111</td>
</tr>
<tr>
<td>5082-7851</td>
<td>111</td>
</tr>
<tr>
<td>5082-7852</td>
<td>111</td>
</tr>
<tr>
<td>5082-7853</td>
<td>111</td>
</tr>
<tr>
<td>5082-7861</td>
<td>111</td>
</tr>
<tr>
<td>5082-7862</td>
<td>111</td>
</tr>
<tr>
<td>5082-7863</td>
<td>111</td>
</tr>
<tr>
<td>5082-7871</td>
<td>111</td>
</tr>
<tr>
<td>5082-7881</td>
<td>111</td>
</tr>
<tr>
<td>5082-7890</td>
<td>111</td>
</tr>
<tr>
<td>5082-7892</td>
<td>111</td>
</tr>
<tr>
<td>5082-7893</td>
<td>111</td>
</tr>
</tbody>
</table>
Solid State Lamps

Selection Guide  2

- Red, High Efficiency Red, Yellow and Green Lamps
- Integrated Lamps
- Hermetically Sealed Lamps
- Panel Mounting Kit
**High Efficiency Red, Yellow, Green LED Lamps**

<table>
<thead>
<tr>
<th>Device</th>
<th>Part No.</th>
<th>Color</th>
<th>Device Description</th>
<th>Lens Package</th>
<th>Luminous Intensity</th>
<th>Forward Voltage</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Efficiency Red (635nm)</td>
<td>4650</td>
<td>GaAs on GaP</td>
<td>Red Diffused</td>
<td>T-1%; Plastic; Long, General Purpose Leads</td>
<td>2.0mcd @10mA</td>
<td>90°</td>
<td>5</td>
</tr>
<tr>
<td>4655</td>
<td></td>
<td></td>
<td>Red Non-Diffused</td>
<td>4.0mcd @10mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4657</td>
<td></td>
<td></td>
<td>50°</td>
<td>35°</td>
<td>4.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4658</td>
<td></td>
<td></td>
<td>90°</td>
<td>50°</td>
<td>4.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4690</td>
<td></td>
<td></td>
<td>Red Diffused</td>
<td>T-1% (Low Profile) Plastic; Long, General Purpose Leads</td>
<td>3.5mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4693</td>
<td></td>
<td></td>
<td>50°</td>
<td>45°</td>
<td>7.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4694</td>
<td></td>
<td></td>
<td>45°</td>
<td>45°</td>
<td>8.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4695</td>
<td></td>
<td></td>
<td>45°</td>
<td></td>
<td>11.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4684</td>
<td></td>
<td></td>
<td>Red Diffused</td>
<td>T-1; Plastic; Long Leads</td>
<td>2.5mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4160</td>
<td></td>
<td></td>
<td>70°</td>
<td></td>
<td>3.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4550</td>
<td></td>
<td>Yellow (583nm)</td>
<td>GaAsP on GaP</td>
<td>Red Diffused</td>
<td>1.8mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4555</td>
<td></td>
<td></td>
<td>90°</td>
<td></td>
<td>3.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4557</td>
<td></td>
<td></td>
<td>60°</td>
<td></td>
<td>9.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4558</td>
<td></td>
<td></td>
<td>45°</td>
<td></td>
<td>16.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4590</td>
<td></td>
<td></td>
<td>Yellow Diffused</td>
<td>T-1% (Low Profile) Plastic; Long, General Purpose Leads</td>
<td>3.5mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4592</td>
<td></td>
<td></td>
<td>50°</td>
<td></td>
<td>6.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4595</td>
<td></td>
<td></td>
<td>50°</td>
<td></td>
<td>6.5mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4597</td>
<td></td>
<td></td>
<td>45°</td>
<td></td>
<td>11.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4584</td>
<td></td>
<td></td>
<td>Yellow Diffused</td>
<td>T-1; Plastic; Long Leads</td>
<td>2.5mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4150</td>
<td></td>
<td></td>
<td>60°</td>
<td></td>
<td>2.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4550</td>
<td></td>
<td>Green (565nm)</td>
<td>GaP</td>
<td>Yellow Diffused</td>
<td>1.8mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4555</td>
<td></td>
<td></td>
<td>90°</td>
<td></td>
<td>3.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4557</td>
<td></td>
<td></td>
<td>60°</td>
<td></td>
<td>9.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4558</td>
<td></td>
<td></td>
<td>45°</td>
<td></td>
<td>16.0mcd @10mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4990</td>
<td></td>
<td></td>
<td>Green Diffused</td>
<td>T-1% (Low Profile) Plastic; Long General Purpose Leads</td>
<td>4.5mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4992</td>
<td></td>
<td></td>
<td>50°</td>
<td></td>
<td>7.5mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4995</td>
<td></td>
<td></td>
<td>50°</td>
<td></td>
<td>6.5mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4997</td>
<td></td>
<td></td>
<td>40°</td>
<td></td>
<td>11.0mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4984</td>
<td></td>
<td></td>
<td>Green Diffused</td>
<td>T-1; Plastic; Long Leads</td>
<td>2.0mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4190</td>
<td></td>
<td></td>
<td>60°</td>
<td></td>
<td>1.5mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4950</td>
<td></td>
<td></td>
<td>Green Diffused</td>
<td>Submin.; Plastic; Radial Leads</td>
<td>1.5mcd @20mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4955</td>
<td></td>
<td></td>
<td>70°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. θ% is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. Peak Wavelength.
3. Panel Mountable. For Panel Mounting Kit, see page 51.
4. PC Board Mountable.

For Applications Information, see pages 146-147.
## Red LED Lamps

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Typical Luminous Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo</td>
<td>Part No.</td>
<td>26°/28°</td>
</tr>
<tr>
<td>4850</td>
<td>Red (655nm)</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4855</td>
<td></td>
<td>1.4mcd @20mA</td>
</tr>
<tr>
<td>4484</td>
<td></td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4494</td>
<td></td>
<td>1.2mcd @20mA</td>
</tr>
<tr>
<td>4790</td>
<td>Red Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4791</td>
<td></td>
<td>1.6 Volts @20mA</td>
</tr>
<tr>
<td>4480</td>
<td>Red Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4483</td>
<td>Clear Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4486</td>
<td>Clear Non-Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4487</td>
<td>Clear Non-Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4488</td>
<td>T-1 (Low Profile); Plastic; Long Leads[4]</td>
<td>Guaranteed Min. 0.3mcd @20mA</td>
</tr>
<tr>
<td>4100</td>
<td>Red Diffused</td>
<td>0.5mcd @10mA</td>
</tr>
<tr>
<td>4101</td>
<td></td>
<td>1.6 Volts @10mA</td>
</tr>
<tr>
<td>4403</td>
<td>Red Diffused</td>
<td>1.2mcd @20mA</td>
</tr>
<tr>
<td>4415</td>
<td>T-1; Plastic; Short, Bent Leads[4]</td>
<td>1.6 Volts @20mA</td>
</tr>
<tr>
<td>4440</td>
<td>T-1; Plastic; Short Leads[3]</td>
<td>0.7mcd @20mA</td>
</tr>
<tr>
<td>4444</td>
<td>T-1; Plastic; Short, Bent Leads[4]</td>
<td>0.7mcd @20mA</td>
</tr>
<tr>
<td>4880</td>
<td>Red Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4883</td>
<td>Clear Non-Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4886</td>
<td>Clear Diffused</td>
<td>0.8mcd @20mA</td>
</tr>
<tr>
<td>4881</td>
<td>Red Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
<tr>
<td>4884</td>
<td>Clear Non-Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
<tr>
<td>4887</td>
<td>Clear Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
<tr>
<td>4882</td>
<td>Red Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
<tr>
<td>4885</td>
<td>Clear Non-Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
<tr>
<td>4888</td>
<td>Clear Diffused</td>
<td>1.3mcd @20mA</td>
</tr>
</tbody>
</table>

**NOTES:**
1. 95° is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. Peak Wavelength.
3. Panel Mountable. For Panel Mounting Kit, see page 51.
4. PC Board Mountable.

For Applications Information, see pages 146-147.
## Integrated LED Lamps

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Typical Luminous Intensity</th>
<th>2Ω%</th>
<th>Typical Forward Current</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo</td>
<td>Part No.</td>
<td>Color</td>
<td>Integration</td>
<td>Lens</td>
<td>Package</td>
</tr>
<tr>
<td></td>
<td>5082-4732</td>
<td>Red (655nm)</td>
<td>Voltage Sensing IC integrated with GaAsP LED chip</td>
<td>Red Diffused</td>
<td>T-1; Plastic; Long Leads(4)</td>
</tr>
<tr>
<td></td>
<td>5082-4860</td>
<td>Resistor chip integrated with GaAsP LED chip</td>
<td>Red Diffused</td>
<td>T-1%; Plastic; Long Leads(3)</td>
<td>0.8mcd @ 5.0V</td>
</tr>
<tr>
<td></td>
<td>5082-4468</td>
<td>Clear</td>
<td>Integrated Diffused Leads(4)</td>
<td>Clear Diffused</td>
<td>T-1; Plastic; Long Leads(4)</td>
</tr>
</tbody>
</table>

## Hermetically Sealed LED Lamps

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Minimum Luminous Intensity</th>
<th>2Ω%</th>
<th>Typical Forward Voltage</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo</td>
<td>Part No.</td>
<td>Color</td>
<td>Emitting Material</td>
<td>Lens</td>
<td>Package</td>
</tr>
<tr>
<td></td>
<td>5082-5765[5]</td>
<td>Red (655nm)</td>
<td>GaAsP on GaAs</td>
<td>Red Diffused</td>
<td>Hermetic/TO-46; Long Leads(4)</td>
</tr>
<tr>
<td></td>
<td>5082-5082-4620</td>
<td>High Eff. Red (655nm)</td>
<td>GaAsP on GaP</td>
<td>Red Diffused</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5082-4520</td>
<td>Yellow (583nm)</td>
<td>GaAsP on GaP</td>
<td>Yellow Diffused</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5082-4920</td>
<td>Green (565nm)</td>
<td>GaP</td>
<td>Green Diffused</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. θ/2 is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. Peak Wavelength.
3. Panel Mountable. For Panel Mounting Kit, see page 51.
4. PC Board Mountable.
5. Military Approved and qualified for High Reliability Applications.

For Applications Information, see pages 146-147.
Features

• HIGH INTENSITY
• CHOICE OF 3 BRIGHT COLORS
  High Efficiency Red
  Yellow
  Green
• POPULAR T-1⅛ DIAMETER PACKAGE
• LIGHT OUTPUT CATEGORIES
• WIDE VIEWING ANGLE AND NARROW VIEWING ANGLE TYPES
• GENERAL PURPOSE LEADS
• IC COMPATIBLE/LOW CURRENT REQUIREMENTS
• RELIABLE AND RUGGED

Package Dimensions

Description

The 5082-4650 Series are Gallium Arsenide Phosphide on Gallium Phosphide High Efficiency Red Light Emitting Diodes packaged in a T-1⅛ outline. The 5082-4650/4655 have a red diffused lens which provides excellent on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4657/4658 have a red non-diffused lens which provides excellent on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.

The 5082-4550 Series are Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diodes packaged in a T-1⅛ outline. The 5082-4550/4555 have a yellow diffused lens which provides good on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4557/4558 have a yellow non-diffused lens which provides good on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.

The 5082-4950 Series are Gallium Phosphide Green Light Emitting Diodes packaged in a T-1⅛ outline. The 5082-4950/4955 have a green diffused lens which provides good on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4957/4958 have a green non-diffused lens which provides good on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Device</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_v )</td>
<td>Luminous Intensity</td>
<td>4650</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
<td>mc.</td>
<td>( I_f = 10 \text{mA} ) (Fig. 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4655</td>
<td>3.0</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4657</td>
<td>9.0</td>
<td>12.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4658</td>
<td>15.0</td>
<td>24.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550</td>
<td>1.0</td>
<td>1.8</td>
<td></td>
<td>mc.</td>
<td>( I_f = 10 \text{mA} ) (Fig. 8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4555</td>
<td>2.2</td>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4557</td>
<td>6.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4558</td>
<td>12.0</td>
<td>16.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950</td>
<td>1.0</td>
<td>1.8</td>
<td></td>
<td>mc.</td>
<td>( I_f = 20 \text{mA} ) (Fig. 13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4955</td>
<td>2.2</td>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4957</td>
<td>6.0</td>
<td>9.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4958</td>
<td>12.0</td>
<td>16.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 2\theta_v )</td>
<td>Included Angle Between Half Luminous Intensity Points</td>
<td>4650</td>
<td>90</td>
<td></td>
<td></td>
<td>Deg.</td>
<td>( I_f = 10 \text{mA} ) See Note 1 (Fig. 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4655</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4657</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4658</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550</td>
<td>90</td>
<td></td>
<td></td>
<td>Deg.</td>
<td>( I_f = 10 \text{mA} ) See Note 1 (Fig. 11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4555</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4557</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4558</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950</td>
<td>90</td>
<td></td>
<td></td>
<td>Deg.</td>
<td>( I_f = 20 \text{mA} ) See Note 1 (Fig. 16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4955</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4957</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4958</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \lambda_{\text{PEAK}} )</td>
<td>Peak Wavelength</td>
<td>4650s</td>
<td>635</td>
<td></td>
<td></td>
<td>nm</td>
<td>Measurement at Peak (Fig. 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>583</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>566</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \lambda_d )</td>
<td>Dominant Wavelength</td>
<td>4650s</td>
<td>826</td>
<td></td>
<td></td>
<td>nm</td>
<td>See Note 2 (Fig. 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>585</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>572</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \tau_S )</td>
<td>Speed of Response</td>
<td>4650s</td>
<td>90</td>
<td></td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Capacitance</td>
<td>4650s</td>
<td>16</td>
<td></td>
<td></td>
<td>pF</td>
<td>( V_F = 0, f = 1 \text{MHz} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \theta_{\text{JC}} )</td>
<td>Thermal Resistance</td>
<td>4650s</td>
<td>135</td>
<td></td>
<td></td>
<td>°C/W</td>
<td>Junction to Cathode Lead at Seating Plane</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>135</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>145</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_F )</td>
<td>Forward Voltage</td>
<td>4650s</td>
<td>2.2</td>
<td>3.0</td>
<td></td>
<td>V</td>
<td>( I_F = 10 \text{mA} ) (Fig. 2, 7, 12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>2.2</td>
<td>3.0</td>
<td></td>
<td></td>
<td>( I_F = 10 \text{mA} ) (Fig. 7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>2.4</td>
<td>3.0</td>
<td></td>
<td></td>
<td>( I_F = 20 \text{mA} ) (Fig. 12)</td>
</tr>
<tr>
<td>( B_{\text{VR}} )</td>
<td>Reverse Breakdown Volt. All</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>( I_R = 100 \mu\text{A} )</td>
</tr>
<tr>
<td>( \eta_L )</td>
<td>Luminous Efficacy</td>
<td>4650s</td>
<td>147</td>
<td></td>
<td></td>
<td>lumens/watt</td>
<td>See Note 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4550s</td>
<td>570</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4950s</td>
<td>665</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. \( \theta_v \) is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, \( \lambda_d \), is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant intensity, \( I_r \), in watts/steradian, may be found from the equation \( I_r = I_v / \eta_L \), where \( I_v \) is the luminous intensity in candela and \( \eta_L \) is the luminous efficacy in lumens/watt.
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>High Efficiency Red 4650 Series</th>
<th>Yellow 4550 Series</th>
<th>Green 4950 Series</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation (derate linearly from 50°C at 1.6mW/°C)</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td>Average Forward Current</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Operating Forward Current (0.5 ma sec pulse width)</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>-50°C to +100°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead-Solder Temperature (1.6 mm [0.063 inch] below package base)</td>
<td>260°C for 5 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Graph showing relative intensity vs. wavelength](image)

**Figure 1.** Relative Intensity vs. Wavelength.

---

### High Efficiency Red 5082-4650 Series

![Graph showing forward current vs. forward voltage](image)

**Figure 2.** Forward Current vs. Forward Voltage

![Graph showing relative luminous intensity vs. forward current](image)

**Figure 3.** Relative Luminous Intensity vs. Forward Current.

![Graph showing relative efficiency vs. peak current](image)

**Figure 4.** Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

![Graph showing maximum tolerable peak current vs. pulse duration](image)

**Figure 5.** Maximum Tolerable Peak Current vs. Pulse Duration. (\(I_{DC \ MAX}\) as per MAX Ratings.)

![Graph showing relative luminous intensity vs. angular displacement](image)

**Figure 6.** Relative Luminous Intensity vs. Angular Displacement.
Yellow 5082-4550 Series

Figure 7. Forward Current vs. Forward Voltage.

Figure 8. Relative Luminous Intensity vs. Forward Current.

Figure 9. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration. (I\text{DC MAX} as per MAX Ratings)

Figure 11. Relative Luminous Intensity vs. Angular Displacement.

Green 5082-4950 Series

Figure 12. Forward Current vs. Forward Voltage.

Figure 13. Relative Luminous Intensity vs. Forward Current.

Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 15. Maximum Tolerable Peak Current vs. Pulse Duration. (I\text{DC MAX} as per MAX Ratings)

Figure 16. Relative Luminous Intensity vs. Angular Displacement.
Features

- HIGH INTENSITY
- LOW PROFILE: 5.8mm (0.23 in) NOMINAL
- T-1¾ DIAMETER PACKAGE
- LIGHT OUTPUT CATEGORIES
- DIFFUSED AND NON-DIFFUSED TYPES
- GENERAL PURPOSE LEADS
- IC COMPATIBLE/LOW CURRENT REQUIREMENTS
- RELIABLE AND RUGGED
- CHOICE OF 4 BRIGHT COLORS
  - Red
  - High Efficiency Red
  - Yellow
  - Green

Package Dimensions

Description

The 5082-4790/4791 are Gallium Arsenide Phosphide Red Light Emitting Diodes packaged in a Low Profile T-1¾ outline with a red diffused lens which provides good on-off contrast ratio, good axial luminous intensity, and a wide viewing angle.

The 5082-4690 Series are Gallium Arsenide Phosphide on Gallium Phosphide High Efficiency Red Light Emitting Diodes packaged in a Low Profile T-1¾ outline. The 5082-4690/4693 have a red diffused lens which provides excellent on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4694/4695 have a red non-diffused lens which provides excellent on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.

The 5082-4590 Series are Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diodes packaged in a Low Profile T-1¾ outline. The 5082-4590/4592 have a yellow diffused lens which provides good on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4595/4597 have a yellow non-diffused lens which provides good on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.

The 5082-4990 Series are Gallium Phosphide Green Light Emitting Diodes packaged in a Low Profile T-1¾ outline. The 5082-4990/4992 have a green diffused lens which provides good on-off contrast ratio, high axial luminous intensity and a wide viewing angle. The 5082-4995/4997 have a green non-diffused lens which provides good on-off contrast ratio, very high axial luminous intensity and a narrow viewing angle.
### Absolute Maximum Ratings at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Red 4790 Series</th>
<th>Hi-Eff. Red 4690 Series</th>
<th>Yellow 4590 Series</th>
<th>Green 4990 Series</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation (derate linearly from $50^\circ C$ at 1.6mW/°C)</td>
<td>100</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td>Average Forward Current</td>
<td>50</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>1000</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>See Fig. 5</td>
<td>See Fig. 10</td>
<td>See Fig. 15</td>
<td>See Fig. 20</td>
<td></td>
</tr>
<tr>
<td>Lead Solder Temperature (1.6mm [0.63 inch] from body)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230°C for 7 Seconds</td>
</tr>
</tbody>
</table>

**Figure 1.** Relative Intensity versus Wavelength.
## RED 5082-4790 SERIES
### Electrical Specifications at $T_A = 25^\circ$C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Device 5082 Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Axial Luminous Intensity</td>
<td>4790</td>
<td>0.8</td>
<td>1.2</td>
<td>mod</td>
<td>$I_F = 20$mA (Fig. 3)</td>
</tr>
<tr>
<td>$2\theta_{1/2}$</td>
<td>Included Angle Between Half Luminous Intensity Points</td>
<td>4791</td>
<td>1.6</td>
<td>2.5</td>
<td>deg.</td>
<td>Note 1 (Fig. 6)</td>
</tr>
<tr>
<td>$\lambda_{\text{PEAK}}$</td>
<td>Peak Wavelength</td>
<td>665</td>
<td>nm</td>
<td></td>
<td></td>
<td>Measurement @ Peak (Fig. 1)</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td>648</td>
<td>nm</td>
<td></td>
<td></td>
<td>Note 2</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>15</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>100</td>
<td>pF</td>
<td></td>
<td></td>
<td>$V_F = 0$; $f = 1$ MHz</td>
</tr>
<tr>
<td>$\theta_JC$</td>
<td>Thermal Resistance</td>
<td>125</td>
<td>$^\circ$C/W</td>
<td>Junction to Cathode Lead 1.6 mm (0.063 in.) from Body</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>V</td>
<td></td>
<td>$I_F = 20$mA (Fig. 2)</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td>3</td>
<td>10</td>
<td>V</td>
<td></td>
<td>$I_R = 100$µA</td>
</tr>
<tr>
<td>$\eta_v$</td>
<td>Luminous Efficacy</td>
<td>55</td>
<td>Im/W</td>
<td></td>
<td></td>
<td>Note 3</td>
</tr>
</tbody>
</table>

**Notes:**
1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. Dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant Intensity $I_e$, in watts/steradian may be found from the equation $I_e = I_v/\eta_v$, where $I_v$ is the luminous intensity in candela and $\eta_v$ is the luminous efficacy in lumens/watt.

---

**Graphs and Figures:**
- **Figure 2.** Forward Current versus Forward Voltage.
- **Figure 3.** Relative Luminous Intensity versus Forward Current.
- **Figure 4.** Relative Efficiency versus Peak Current.
- **Figure 5.** Maximum Tolerable Peak Current versus Pulse Duration. ($I_{DC \text{ MAX}}$ as per MAX Ratings)
- **Figure 6.** Relative Luminous Intensity versus Angular Displacement.
HIGH EFFICIENCY RED 5082-4690 SERIES
Electrical Specifications at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Device 5082</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Axial Luminous Intensity</td>
<td>4690</td>
<td>1.5</td>
<td>3.5</td>
<td></td>
<td>mod</td>
<td>$I_F = 10, mA$ (Fig. 8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4693</td>
<td>5.0</td>
<td>7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4694</td>
<td>4.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4695</td>
<td>8.0</td>
<td>11.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2\theta_{1/2}$</td>
<td>Included Angle Between</td>
<td>4690</td>
<td>50</td>
<td></td>
<td></td>
<td>deg.</td>
<td>Note 1 (Fig. 11)</td>
</tr>
<tr>
<td></td>
<td>Half Luminous Intensity Points</td>
<td>4693</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4694</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4695</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Peak Wavelength</td>
<td>635</td>
<td>nm</td>
<td></td>
<td></td>
<td></td>
<td>Measurement @ Peak (Fig. 1)</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td>626</td>
<td>nm</td>
<td></td>
<td></td>
<td></td>
<td>Note 2</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>90</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>16</td>
<td>pF</td>
<td></td>
<td></td>
<td></td>
<td>$V_F = 0; f = 1, MHz$</td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td>130</td>
<td>$^\circ C/W$</td>
<td></td>
<td></td>
<td>junction to cathode lead 1.6mm (0.063 in.) from body</td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>2.2</td>
<td>3.0</td>
<td>V</td>
<td></td>
<td></td>
<td>$I_F = 10, mA$ (Fig. 7)</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td>5.0</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>$I_B = 100, \mu A$</td>
</tr>
<tr>
<td>$\eta_V$</td>
<td>Luminous Efficacy</td>
<td>147</td>
<td>lm/W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity. 2. Dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device. 3. Radiant Intensity $I_B$ in watts/steradian may be found from the equation $I_B = I_v/n_v$, where $I_v$ is the luminous intensity in candelas and $n_v$ is the luminous efficacy in lumens/watt.
YELLOW 5082-4590 SERIES
Electrical Specifications at T_A = 25°C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Device 5082-4590</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_v</td>
<td>Axial Luminous Intensity</td>
<td>4590</td>
<td>1.5</td>
<td>3.5</td>
<td></td>
<td>mCd</td>
<td>I_F = 10mA (Fig. 13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4592</td>
<td>4.5</td>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4595</td>
<td>4.0</td>
<td>6.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4597</td>
<td>8.0</td>
<td>11.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20°½</td>
<td>Included Angle Between Half Luminous Intensity Points</td>
<td>4590</td>
<td>50</td>
<td></td>
<td></td>
<td>deg.</td>
<td>Note 1 (Fig. 16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4592</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4595</td>
<td></td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4597</td>
<td></td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \lambda_{\text{peak}} )</td>
<td>Peak Wavelength</td>
<td>583</td>
<td></td>
<td></td>
<td></td>
<td>nm</td>
<td>Measurement @ Peak (Fig. 1)</td>
</tr>
<tr>
<td>( \lambda_d )</td>
<td>Dominant Wavelength</td>
<td>585</td>
<td></td>
<td></td>
<td></td>
<td>nm</td>
<td>Note 2</td>
</tr>
<tr>
<td>( \tau_s )</td>
<td>Speed of Response</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Capacitance</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td>pF</td>
<td>( V_F = 0; f = 1 \text{ MHz} )</td>
</tr>
<tr>
<td>( \theta_{JC} )</td>
<td>Thermal Resistance</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>°C/W</td>
<td>Junction to Cathode Lead 1.6mm (0.063 in.) from Body</td>
</tr>
<tr>
<td>V_F</td>
<td>Forward Voltage</td>
<td>2.2</td>
<td></td>
<td>3.0</td>
<td></td>
<td>V</td>
<td>I_F = 10mA (Fig. 12)</td>
</tr>
<tr>
<td>BVR</td>
<td>Reverse Breakdown Voltage</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>I_{P} = 100μA</td>
</tr>
<tr>
<td>( \eta_v )</td>
<td>Luminous Efficacy</td>
<td>570</td>
<td></td>
<td></td>
<td></td>
<td>lm/W</td>
<td>Note 3</td>
</tr>
</tbody>
</table>

Notes:
1. \( \theta_{1/2} \) is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. Dominant wavelength, \( \lambda_d \), is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant Intensity \( I_v \), in watts/steradian may be found from the equation \( I_v = I_v / \eta_v \), where \( I_v \) is the luminous intensity in candelas and \( \eta_v \) is the luminous efficacy in lumens/watt.

Figure 12. Forward Current versus Forward Voltage.
Figure 13. Relative Luminous Intensity versus Forward Current.
Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) versus Peak Current.
Figure 15. Maximum Tolerable Peak Current versus Pulse Duration. (I_{DC MAX} as per MAX Ratings).
Figure 16. Relative Luminous Intensity versus Angular Displacement.
GREEN 5082-4990 SERIES
Electrical Specifications at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Device 5082</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Axial Luminous Intensity</td>
<td>4990</td>
<td>2.0</td>
<td>4.5</td>
<td></td>
<td>mcd</td>
<td>$I_F = 20, mA$ (Fig.18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4992</td>
<td>6.0</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4995</td>
<td>3.5</td>
<td>6.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4997</td>
<td>8.0</td>
<td>11.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2\theta_{1/2}$</td>
<td>Included Angle Between Half Luminous Intensity Points</td>
<td>4990</td>
<td>50</td>
<td></td>
<td></td>
<td>deg.</td>
<td>Note 1 (Fig.21)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4992</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4995</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4997</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Peak Wavelength</td>
<td></td>
<td>565</td>
<td></td>
<td></td>
<td>nm</td>
<td>Measurement @ Peak (Fig. 1)</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td></td>
<td>570</td>
<td></td>
<td></td>
<td>nm</td>
<td>Note 2</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td></td>
<td>200</td>
<td></td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Capacitance</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td>pF</td>
<td>$V_F = 0; f = 1, MHz$</td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td></td>
<td>90</td>
<td></td>
<td></td>
<td>$^\circ C/W$</td>
<td>Junction to Cathode Lead 1.6mm (0.063 in.) from Body</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td></td>
<td>2.4</td>
<td>3.0</td>
<td></td>
<td>V</td>
<td>$I_F = 20, mA$ (Fig. 17)</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
<td>V</td>
<td>$I_T = 100, \mu A$</td>
</tr>
<tr>
<td>$\eta_V$</td>
<td>Luminous Efficacy</td>
<td></td>
<td>665</td>
<td></td>
<td></td>
<td>lm/W</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity. 2. Dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device. 3. Radiant Intensity $I_r$, in watts/steradian may be found from the equation $I_r = I_V/\eta_V$, where $I_V$ is the luminous intensity in candelas and $\eta_V$ is the luminous efficacy in lumens/watt.
Features

- HIGH INTENSITY
- WIDE VIEWING ANGLE
- SMALL SIZE T-1 DIAMETER 3.18mm (0.125 inch)
- IC COMPATIBLE
- RELIABLE AND RUGGED
- CHOICE OF 3 BRIGHT COLORS
  HIGH EFFICIENCY RED
  YELLOW
  GREEN

Package Dimensions

Description

The 5082-4684 is a Gallium Arsenide Phosphide on Gallium Phosphide High Efficiency Red Light Emitting Diode packaged in a T-1 outline with a red diffused lens, which provides excellent on-off contrast ratio, high axial luminous intensity and a wide viewing angle.

The 5082-4584 is a Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diode packaged in a T-1 outline with a yellow diffused lens, which provides good on-off contrast ratio, high axial luminous intensity and a wide viewing angle.

The 5082-4984 is a Gallium Phosphide Green Light Emitting Diode packaged in a T-1 outline with a green diffused lens, which provides good on-off contrast ratio, high axial luminous intensity, and a wide viewing angle.

The 5082-4684, -4584, and -4984 are designed for applications where space is at a premium, such as in high density arrays.
Absolute Maximum Ratings at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>High Efficiency Red 4684</th>
<th>Yellow 4584</th>
<th>Green 4984</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation (derate linearly from 50°C at 1.6mW/°C)</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td>Average Forward Current</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>-55°C to 100°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td>230°C for 7 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. $\theta_{85}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant intensity, $I_e$, in watts/steradian, may be found from the equation $I_e = I_V/n_V$, where $I_V$ is the luminous intensity in candelas and $n_V$ is the luminous efficacy in lumens/watt.

---

Electrical/Optical Characteristics at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Axial Luminous Intensity</td>
<td>0.8</td>
<td>2.0</td>
<td></td>
<td>0.8</td>
<td>2.0</td>
<td></td>
<td>0.8</td>
<td>2.0</td>
<td></td>
<td>mcd</td>
<td>$I_F = 10\text{mA}$, Figs. 3, 8, 13</td>
</tr>
<tr>
<td>$2\theta_{85}$</td>
<td>Included Angle</td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>60</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td>deg.</td>
<td>Note 1, Figures 6, 11, 16</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Peak Wavelength</td>
<td>656</td>
<td>583</td>
<td>566</td>
<td>565</td>
<td>583</td>
<td>572</td>
<td>565</td>
<td>583</td>
<td>572</td>
<td>nm</td>
<td>Measurement at Peak</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td>628</td>
<td>585</td>
<td>572</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>nm</td>
<td>Note 2</td>
</tr>
<tr>
<td>$r_s$</td>
<td>Speed of Response</td>
<td>90</td>
<td>90</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>20</td>
<td>15</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pF</td>
<td>$V_F = 0\text{V}$; $f = 1\text{MHz}$</td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td></td>
<td></td>
<td></td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>°C/W</td>
<td>Junction to Cathode Lead at 0.79mm (0.031 in.) from Body</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>2.2</td>
<td>3.0</td>
<td>2.2</td>
<td>3.0</td>
<td>2.4</td>
<td>3.0</td>
<td>2.4</td>
<td>3.0</td>
<td>3.0</td>
<td>V</td>
<td>$I_F = 10\text{mA}$, Figures 2, 7, 12</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>$I_R = 100\mu\text{A}$</td>
</tr>
<tr>
<td>$n_V$</td>
<td>Luminous Efficacy</td>
<td>147</td>
<td>570</td>
<td>605</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>lm/W</td>
<td>Note 3</td>
</tr>
</tbody>
</table>

NOTES:
4. $\theta_{85}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
5. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
6. Radiant intensity, $I_e$, in watts/steradian, may be found from the equation $I_e = I_V/n_V$, where $I_V$ is the luminous intensity in candelas and $n_V$ is the luminous efficacy in lumens/watt.

---

![Figure 1. Relative Intensity vs. Wavelength.](image-url)
High Efficiency Red 5082-4684

Figure 2. Forward Current vs. Forward Voltage.
Figure 3. Relative Luminous Intensity vs. Forward Current.
Figure 4. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 5. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DCMAX} as per MAX Ratings).
Figure 6. Relative Luminous Intensity vs. Angular Displacement.

Yellow 5082-4584

Figure 7. Forward Current vs. Forward Voltage.
Figure 8. Relative Luminous Intensity vs. Forward Current.
Figure 9. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DCMAX} as per MAX Ratings.)
Figure 11. Relative Luminous Intensity vs. Angular Displacement.
Green 5082-4984

Figure 12. Forward Current vs. Forward Voltage.

Figure 13. Relative Luminous Intensity vs. Forward Current.

Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 15. Maximum Tolerable Peak Current vs. Pulse Duration. (I(DC MAX as per MAX Ratings.)

Figure 16. Relative Luminous Intensity vs. Angular Displacement.
Features
• SUBMINIATURE PACKAGE STYLE
• END STACKABLE ON 2.21mm (0.087 in.) CENTERS
• LOW PACKAGE PROFILE
• RADIAL LEADS
• WIDE VIEWING ANGLE
• LONG LIFE — SOLID STATE RELIABILITY
• CHOICE OF 4 BRIGHT COLORS
  Red
  High Efficiency Red
  Yellow
  Green

Description
The 5082-4100/4101, 4150, 4160 and 4190 are solid state lamps encapsulated in a radial lead subminiature package of molded epoxy. They utilize a tinted, diffused lens providing high on-off contrast and wide-angle viewing.

The -4100/4101 utilizes a GaAsP LED chip in a deep red molded package.

The -4160 has a high-efficiency red GaAsP on GaP LED chip in a light red molded package. This lamp's efficiency is comparable to that of the GaP red but does not saturate at low current levels.

The -4150 provides a yellow GaAsP on GaP LED chip in a yellow molded package.

The -4190 provides a green GaP LED chip in a green molded package.

Arrays are available upon special request. They are comprised of a group of the subminiature lamps arranged in a molded linear configuration with separately accessible radial leads for each device. The center-to-center spacing is 2.54mm (0.100 in.).

Package Dimensions
Absolute Maximum Ratings at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Red 4100/4101</th>
<th>High Eff. Red 4160</th>
<th>Yellow 4150</th>
<th>Green 4190</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation (derate linearly from 50°C at 1.6mW/°C)</td>
<td>100</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td>Average Forward Current</td>
<td>50</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>1000</td>
<td>See Fig. 5</td>
<td>60</td>
<td>See Fig. 10</td>
<td>mA</td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>-55°C to 100°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Soldering Temperature [1.6mm (0.063 in.) from body]</td>
<td></td>
<td>260°C for 5 seconds.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant intensity, $I_r$, in watts/steradian, may be found from the equation $I_r=I_v/\eta_v$, where $I_v$ is the luminous intensity in candelas and $\eta_v$ is the luminous efficacy in lumens/watt.

Electrical/Optical Characteristics at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>5082-4100/4101</th>
<th>5082-4160</th>
<th>5082-4150</th>
<th>5082-4190</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Axial Luminous Intensity</td>
<td>-0.5 / 0.5</td>
<td>1.0 / 1.0</td>
<td>1.0 / 2.0</td>
<td>0.9 / 1.5</td>
<td>mcd</td>
<td>$I_v=10$mA, Figs. 3, 8, 13, 16</td>
</tr>
<tr>
<td>$2\theta_{1/2}$</td>
<td>Included Angle Between Half Luminous Intensity Points</td>
<td>45</td>
<td>80</td>
<td>90</td>
<td>70</td>
<td>deg</td>
<td>Note 1, Figures 6, 11, 16, 21</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td>655</td>
<td>638</td>
<td>583</td>
<td>565</td>
<td>nm</td>
<td>Measurement at Peak</td>
</tr>
<tr>
<td>$\lambda_m$</td>
<td>Speed of Response</td>
<td>640</td>
<td>628</td>
<td>586</td>
<td>572</td>
<td>ns</td>
<td>Note 2</td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>100</td>
<td>11</td>
<td>15</td>
<td>13</td>
<td>pF</td>
<td>$V_F=0$, $f=1$ MHz</td>
</tr>
<tr>
<td>$R_{thC}$</td>
<td>Thermal Resistance</td>
<td>125</td>
<td>120</td>
<td>100</td>
<td>100</td>
<td>°C/W</td>
<td>Junction to Cathode Lead at 0.79mm (0.031 in) from Body</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>2.2</td>
<td>2.2</td>
<td>V</td>
<td>$I_F=10$mA, Figures 2, 7, 12, 17</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>V</td>
<td>$I_F=100$µA</td>
</tr>
<tr>
<td>$\eta_v$</td>
<td>Luminous Efficacy</td>
<td>55</td>
<td>147</td>
<td>570</td>
<td>665</td>
<td>lm/W</td>
<td>Note 3</td>
</tr>
</tbody>
</table>

NOTES:
1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Radiant intensity, $I_r$, in watts/steradian, may be found from the equation $I_r=I_v/\eta_v$, where $I_v$ is the luminous intensity in candelas and $\eta_v$ is the luminous efficacy in lumens/watt.

Figure 1. Relative Intensity vs. Wavelength.
Red 5082-4100/4101

![Graphs](image1.png)

**Figure 2.** Forward Current vs. Forward Voltage.

**Figure 3.** Relative Luminous Intensity vs. Forward Current.

**Figure 4.** Relative Efficiency (Luminous intensity per Unit Current) vs. Peak Current.

![Graphs](image2.png)

**Figure 5.** Maximum Tolerable Peak Current vs. Pulse Duration. ($i_{DC MAX}$ as per MAX Ratings)

**Figure 6.** Relative Luminous Intensity vs. Angular Displacement.

High Efficiency Red 5082-4160

![Graphs](image3.png)

**Figure 7.** Forward Current vs. Forward Voltage.

**Figure 8.** Relative Luminous Intensity vs. Forward Current.

**Figure 9.** Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

![Graphs](image4.png)

**Figure 10.** Maximum Tolerable Peak Current vs. Pulse Duration. ($i_{DC MAX}$ as per MAX Ratings)

**Figure 11.** Relative Luminous Intensity vs. Angular Displacement.
Features

- **LOW COST: BROAD APPLICATION**
- **LONG LIFE: SOLID STATE RELIABILITY**
- **LOW POWER REQUIREMENTS: 20mA @ 1.6V**
- **HIGH LIGHT OUTPUT**
  - 0.8 mcd TYPICAL FOR 5082-4850/4484
  - 1.4 mcd TYPICAL FOR 5082-4855/4494
- **WIDE VIEWING ANGLE**
- **RED DIFFUSED LENS**

Description

The 5082-4850/4855 and 5082-4484/4494 are Gallium Arsenide Phosphide Light Emitting Diodes intended for High Volume/Low Cost applications such as indicators for appliances, automobile instrument panels and many other commercial uses.

The 5082-4850/4855 are T-1 ½ lamp size, have red diffused lenses and can be panel mounted using mounting clip 5082-4707.

The 5082-4484/4494 are T-1 lamp size, have red diffused lenses and are ideal where space is at a premium, such as high density arrays.

Absolute Maximum Ratings at $T_A=25^\circ C$

- **Power Dissipation** ........................................... 100mW
  (Derate linearly from 50°C at 1.6mW/°C)
- **DC Forward Current** ................................. 50mA
- **Peak Forward Current** ................................. 1Amp
  (1µsec pulse width, 300pps)
- **Operating and Storage**
  - **Temperature Range** ...................... -55°C to +100°C
- **Lead Soldering Temperature** .................. 230°C for 7 sec.
Electrical Characteristics at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters</th>
<th>5082-4850</th>
<th>5082-4855</th>
<th>5082-4484</th>
<th>5082-4494</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Luminous intensity</td>
<td>0.8</td>
<td>0.8</td>
<td>1.4</td>
<td>0.8</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Wavelength</td>
<td>655</td>
<td>655</td>
<td>655</td>
<td>655</td>
<td>nm</td>
<td>Measurement at Peak</td>
</tr>
<tr>
<td>$t_s$</td>
<td>Speed of Response</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>pF</td>
<td>$V_F = 0$, $f = 1MHz$</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>1.6</td>
<td>2.0</td>
<td>1.6</td>
<td>2.0</td>
</tr>
<tr>
<td>$BVR$</td>
<td>Reverse Breakdown Voltage</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

![Figure 1. Forward Current Versus Forward Voltage Characteristic For 5082-4850/4855/4484/4494.](image1)

![Figure 2. Relative Luminous Intensity Versus Angular Displacement For 5082-4850/4855.](image2)

![Figure 3. Relative Luminous Intensity Versus Angular Displacement For 5082-4484/4494.](image3)

![Figure 4. Relative Luminous Intensity Versus Forward Current For 5082-4850/4855/4484/4494.](image4)
Features

- **HIGH INTENSITY**: 0.8mcd TYPICAL
- **WIDE VIEWING ANGLE**
- **SMALL SIZE T-1 DIAMETER 3.18mm (0.125")**
- **IC COMPATIBLE**
- **RELIABLE AND RUGGED**

Description

The 5082-4480 is a series of Gallium Arsenide Phosphide Light Emitting Diodes designed for applications where space is at a premium, such as in high density arrays. The 5082-4480 series is available in three lens configurations.

5082-4480 — Red Diffused lens provides excellent on-off contrast ratio, high axial luminous intensity, and wide viewing angle.

5082-4483 — Same as 5082-4480, but Untinted Diffused to mask red color in the “off” condition.

5082-4486 — Clear plastic lens provides a point source. Useful when illuminating external lens, annunciators, or photo-detectors.

**Maximum Ratings at $T_A=25^\circ C$**

- **DC Power Dissipation** ...................... 100mW
  (Derate linearly from 60°C at 1.6mW/°C)
- **DC Forward Current** ..................... 50mA
- **Peak Forward Current** ................... 1 Amp
  *(1 μsec pulse width, 300 pps)*
- **Operating and Storage Temperature Range** .................. -55°C to +100°C
- **Lead Soldering Temperature** ............. 230°C for 7 sec.

**Electrical Characteristics at $T_A=25^\circ C$**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>5082-4480</th>
<th>5082-4483</th>
<th>5082-4486</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
</tr>
<tr>
<td>$I_F$</td>
<td>Luminous Intensity</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Wavelength</td>
<td>655</td>
<td>nm</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>15</td>
<td>ns</td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>200</td>
<td>pF</td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td>270</td>
<td>°C/W</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
</tr>
<tr>
<td>$BV_F$</td>
<td>Reverse Breakdown Voltage</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>
Figure 1. Relative Luminous Intensity vs. Angular Displacement.

Figure 2. Relative Luminous Intensity vs. Angular Displacement.

Figure 3. Forward Current vs. Voltage Characteristic.

Figure 4. Luminous Intensity vs. Forward Current ($I_F$).
Features

- LOW COST: BROAD APPLICATION
- LOW PROFILE: 4.57mm (0.18") LENS HEIGHT TYPICAL
- HIGH DENSITY PACKAGING
- LONG LIFE: SOLID STATE RELIABILITY
- LOW POWER REQUIREMENTS: 20mA @ 1.6V
- HIGH LIGHT OUTPUT: 0.8mcd TYPICAL

Description

The 5082-4487 and 5082-4488 are Gallium Arsenide Phosphide Light Emitting Diodes for High Volume/ Low Cost Applications such as indicators for calculators, cameras, appliances, automobile instrument panels, and many other commercial uses.

The 5082-4487 is a clear lens, low profile T-1 LED lamp, and has a typical light output of 0.8 mcd at 20 mA.

The 5082-4488 is a clear lens, low profile T-1 LED lamp, and has a guaranteed minimum light output of 0.3 mcd at 20mA.

Absolute Maximum Ratings at \( T_A = 25^\circ C \)

DC Power Dissipation [Derate linearly from 50°C at 1.6mW/°C] .......................... 100mW
DC Forward Current .......................................................... 50mA
Peak Forward Current [1μsec pulse width, 300pps] ........................................ 1 Amp
Operating and Storage Temperature Range ..................................................... \(-55^\circ C \) to \(+100^\circ C\)
Lead Soldering Temperature .................................................. 230°C for 7 sec.
### Electrical/Optical Characteristics at $T_A = 25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters</th>
<th>5082-4487</th>
<th>5082-4488</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Luminous Intensity</td>
<td>Min. 0.8</td>
<td>Typ. 0.3</td>
<td>Max. 0.8</td>
<td>mcd $I_F = 20,mA$</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Wavelength</td>
<td>Min. 655</td>
<td>Typ. 655</td>
<td>Max. 655</td>
<td>nm Measurement at Peak</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>Min. 10</td>
<td>Typ. 10</td>
<td>Max. ns</td>
<td>ns</td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>Min. 100</td>
<td>Typ. 100</td>
<td>Max. 100</td>
<td>pF $V_F = 0, f = 1,MHz$</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>Min. 1.6</td>
<td>Typ. 2.0</td>
<td>Max. 1.6</td>
<td>V $I_F = 20,mA$</td>
</tr>
<tr>
<td>$BV_R$</td>
<td>Reverse Breakdown Voltage</td>
<td>Min. 3</td>
<td>Typ. 10</td>
<td>Max. 3</td>
<td>V $I_R = 100,\mu A$</td>
</tr>
</tbody>
</table>

#### Figures

**Figure 1.** Typical Forward Current Versus Voltage Characteristic.

**Figure 2.** Typical Luminous Intensity Versus Forward Current.

**Figure 3.** Typical Relative Luminous Intensity Versus Angular Displacement.
Features
- EASILY PANEL MOUNTABLE
- HIGH BRIGHTNESS OVER A WIDE VIEWING ANGLE
- RUGGED CONSTRUCTION FOR EASE OF HANDLING
- STURDY LEADS ON 25.4mm (0.10 in.) CENTERS
- IC COMPATIBLE/LOW POWER CONSUMPTION
- LONG LIFE

Description
The 5082-4403, -4415, -4440 and -4444 are plastic encapsulated Gallium Arsenide Phosphide Light Emitting Diodes. They radiate light in the 655 nanometer (red light) region.

The 5082-4403 and -4415 are LEDs with a red diffused plastic lens, providing high visibility for circuit board or panel mounting with a clip.

Both LEDs are designed for low power consumption, thus applicable for use in mobile and portable equipment.

The 5082-4440 and -4444 are economically priced LEDs with a red diffused plastic lens, providing a wide viewing angle for circuit board or panel mounting with clip. Both LEDs are designed for circuit status and other light indicating functions.

The 5082-4415 and -4444 have the added feature of a 90° lead bend for edge mounting on circuit boards.

Electrical Characteristics at $T_A = 25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters</th>
<th>5082-4403</th>
<th>5082-4415</th>
<th>5082-4440</th>
<th>5082-4444</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Luminous Intensity</td>
<td>0.8</td>
<td>1.2</td>
<td>0.3</td>
<td>0.7</td>
<td>mcd</td>
<td>$I_e = 20 \text{ mA}$</td>
</tr>
<tr>
<td>$\lambda_{\text{PEAK}}$</td>
<td>Wavelength</td>
<td>640</td>
<td>655</td>
<td>670</td>
<td>640</td>
<td>655</td>
<td>670</td>
</tr>
<tr>
<td>$r_s$</td>
<td>Speed of Response</td>
<td>15</td>
<td>15</td>
<td>pF</td>
<td>V</td>
<td>Junction to Cathode Lead</td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>200</td>
<td>200</td>
<td>pF</td>
<td>V</td>
<td>Junction to Cathode Lead</td>
<td></td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td>270</td>
<td>270</td>
<td>°C/W</td>
<td>V</td>
<td>Junction to Cathode Lead</td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>1.6</td>
<td>2.0</td>
<td>V</td>
<td>$I_e = 20 \text{ mA}$</td>
</tr>
<tr>
<td>$B_{VR}$</td>
<td>Reverse Breakdown Voltage</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>10</td>
<td>V</td>
<td>$I_e = 10 \text{ mA}$</td>
</tr>
</tbody>
</table>
PC Board Mounting Information

The 5082-4403 and 5082-4440 are intended to be versatile in their mounting capability, as shown in the sketches following. Various printed circuit board mounting means are shown in Figures 4, 5, and 6. The enlarged lead section provides a controlled spacing for perpendicular mounting shown in Figure 4.

For right angle mounting as shown in Figure 6, order either a 5082-4415 or 5082-4444. The leads are bent at 90°, ready for insertion.
Features

- **WIRE WRAPPABLE**
- **EASILY PANEL MOUNTABLE; CLIP AVAILABLE**
- **STURDY WELDABLE LEADS: ON 2.54mm (0.10") CENTERS**
- **HIGH BRIGHTNESS OVER A WIDE VIEWING ANGLE**
- **RUGGED CONSTRUCTION FOR EASE OF HANDLING**
- **IC COMPATIBLE/LOW POWER CONSUMPTION**
- **LONG LIFE**

Description

**Wire Wrappable**

The 5082-4880 series is designed to be wire wrapped with the Gardner Denver Models 14R2, 14XL1, and 14X2 or equivalent. The LED can be panel or PC mounted and the leads directly wire wrapped without the use of a socket.

**Light Output Selection**

The 5082-4880 series is available with graded light output levels, so you can select the proper uniform light level for your application.

**Lens Appearance**

The 5082-4880 series is available in three different lens configurations. These are Red Diffused, Untinted Diffused, and Clear.

The Red Diffused lens provides an excellent off/on contrast ratio. The Clear lens is designed for applications where a point source is desired. It is particularly useful where the light must be focused or diffused with external optics. The Untinted Diffused lens is useful in masking the red color in the off condition.

LED SELECTION GUIDE

<table>
<thead>
<tr>
<th>MINIMUM LIGHT OUTPUT (cd)</th>
<th>LENS TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Red Diffused Lens</td>
</tr>
<tr>
<td>0.5</td>
<td>5082-4880</td>
</tr>
<tr>
<td>1.0</td>
<td>5082-4881</td>
</tr>
<tr>
<td>1.6</td>
<td>5082-4882</td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Power Dissipation</td>
<td>100 mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Forward Current</td>
<td>50 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>1 Amp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1 μsec pulse width, 300 pps)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation Voltage (between lead and case)</td>
<td>300V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>-55°C to +100°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td>230°C for 7 sec</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electrical Characteristics at $T_A=25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters</th>
<th>5082 - 4880</th>
<th>5082 - 4881</th>
<th>5082 - 4882</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5082 - 4883</td>
<td>5082 - 4884</td>
<td>5082 - 4885</td>
</tr>
<tr>
<td>$I_V$</td>
<td>Luminous Intensity</td>
<td>0.5</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>$I_V$</td>
<td>Luminous Intensity</td>
<td>0.8</td>
<td>1.3</td>
<td>1.6</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Wavelength</td>
<td>665</td>
<td>665</td>
<td>665</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>100</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>$\theta_{JC}$</td>
<td>Thermal Resistance</td>
<td>270</td>
<td>270</td>
<td>270</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>1.6</td>
</tr>
<tr>
<td>$BV_R$</td>
<td>Reverse Breakdown Voltage</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

TYPICAL RELATIVE LUMINOUS INTENSITY VERSUS ANGULAR DISPLACEMENT

Figure 1. Forward Current vs. Voltage Characteristic.

Figure 2. Luminous Intensity vs. Forward Current ($I_F$).
Features

- **HIGH SENSITIVITY**: 10mV ON TO OFF
- **BUILT IN LED CURRENT LIMITING**
- **TEMPERATURE COMPENSATED THRESHOLD VOLTAGE**
- **COMPACT**: PACKAGE INCLUDES INTEGRATED CIRCUIT AND LED
- **GUARANTEED MINIMUM LUMINOUS INTENSITY**
- **THRESHOLD VOLTAGE CAN BE INCREASED WITH EXTERNAL COMPONENT**

Applications

- Push-to-test battery voltage tester (pagers, cameras, appliances, radios, test equipment...)
- Logic level indicator
- Power supply voltage monitor
- V-U meter
- Analog level sense
- Voltage indicating arrays — use several with different thresholds
- Current monitor

Description

The HP voltage sensing LEDs use an integrated circuit and a red GaAsP LED to provide a complete voltage sensing function in a standard red diffused T-1 LED package. When the input voltage ($V_{IN}$) exceeds the threshold voltage ($V_{TH}$), the LED turns "on". The high gain of the comparator provides unambiguous indication by the LED of the input voltage with respect to the threshold voltage. The V-I characteristics are resistive above and below the threshold voltage. This allows battery testing under simulated load conditions. Use of a resistor, diode or zener in series allows the threshold voltage to be increased to any desired voltage. A resistor in parallel allows the sensing LED to be used as a current threshold indicator.

The 5082-4732 has a nominal threshold voltage of 2.5V.

Absolute Maximum Ratings

- **Storage Temperature**: $-55^\circ C$ to $+100^\circ C$
- **Operating Temperature**: $-55^\circ C$ to $+85^\circ C$
- **Lead Solder Temperature**: $230^\circ C$ for 7 Sec
- **Input Voltage — $V_{IN}$**: $+5$V dc
- **Reverse Input Voltage — $V_R$**: $-0.5$V

**NOTES:**
1. Derate linearly above $50^\circ C$ free-air temperature at a rate of $37mV/\circ C$. 

Electro-Optical Characteristics at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Voltage</td>
<td>$V_{TH}$</td>
<td>2.3</td>
<td>2.5</td>
<td>2.75</td>
<td>V</td>
<td></td>
<td>1,2</td>
</tr>
<tr>
<td>Temperature Coefficient of Threshold</td>
<td>$\Delta V_{TH}/\Delta T_A$</td>
<td>-1</td>
<td></td>
<td></td>
<td>mV/$^\circ$C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Current</td>
<td>$I_{IN}$</td>
<td>13</td>
<td>33</td>
<td>50</td>
<td>mA</td>
<td>$V_{IN}=2.75V$</td>
<td>2</td>
</tr>
<tr>
<td>Luminous Intensity</td>
<td>$I_p$</td>
<td>0.3</td>
<td>0.7</td>
<td></td>
<td>mA</td>
<td>$V_{IN}=5.0V$</td>
<td>2</td>
</tr>
<tr>
<td>Wavelength</td>
<td>$\lambda_{peak}$</td>
<td>656</td>
<td></td>
<td></td>
<td>nm</td>
<td>Measurement at peak</td>
<td>1</td>
</tr>
<tr>
<td>Dominant Wavelength</td>
<td>$\lambda_d$</td>
<td>639</td>
<td></td>
<td></td>
<td>nm</td>
<td>Note 1</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
2. $I_{TH}$ is the maximum current just below the threshold, $V_{TH}$. Since both $I_{TH}$ and $V_{TH}$ are variable, a precise value of $V_{TH}$ is obtainable only by selecting $R$ to fit the measured characteristics of the individual devices (e.g., with curve tracer).
3. The temperature coefficient (TC) will be a function of the resistor TC and the value of the resistor.

Techniques For Increasing The Threshold Voltage

<table>
<thead>
<tr>
<th>External Component</th>
<th>$V_{TH}$</th>
<th>TC</th>
<th>$\frac{\Delta V_{TH}}{\Delta T_A}$ (mV/$^\circ$C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schottky Diode (HP 5082-2835)</td>
<td>$V_{TH}+0.45V$</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>P-N Diode (1N914)</td>
<td>$V_{TH}+0.75V$</td>
<td>-2.5</td>
<td></td>
</tr>
<tr>
<td>LED (HP 5082-4464)</td>
<td>$V_{TH}+1.6V$</td>
<td>-2.9</td>
<td></td>
</tr>
<tr>
<td>Zener Diode</td>
<td>$V_{TH}+V_Z$</td>
<td>-1</td>
<td>$+Zener$ TC</td>
</tr>
<tr>
<td>Series Resistor</td>
<td>$V_{TH}+I_{TH}R$</td>
<td>Note 3</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
2. $I_{TH}$ is the maximum current just below the threshold, $V_{TH}$. Since both $I_{TH}$ and $V_{TH}$ are variable, a precise value of $V_{TH}$ is obtainable only by selecting $R$ to fit the measured characteristics of the individual devices (e.g., with curve tracer).
3. The temperature coefficient (TC) will be a function of the resistor TC and the value of the resistor.
Description

The HP Resistor-LED series provides an integral current limiting resistor in series with the LED. Applications include panel mounted indicators, cartridge indicators, and lighted switches.

The 5082-4860 is a standard red diffused 5.08mm (.200") diameter (T-1 size) LED, with long wire wrapable leads.

The 5082-4468 is a clear diffused 3.18mm (.125") diameter (T-1 size) LED.

Absolute Maximum Ratings at \( T_A = 25^\circ C \)

- **DC Forward Voltage** [Derate linearly to 5V @ 100\(^\circ\) C] ....................................................... 7.5V
- **Reverse Voltage** .................................................................................................................. 7V
- **Isolation Voltage** [between lead and base of the 5082-4860] ........................................... 300V
- **Operating and Storage Temperature Range** ............................................................... \(-55^\circ C\) to \(+100^\circ C\)
- **Lead Soldering Temperature** .................................................................................. 230°C for 7 sec.
### Electrical Characteristics at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters</th>
<th>5082-4860/4468</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>Luminous Intensity</td>
<td>min. 0.3</td>
<td>typ. 0.8</td>
</tr>
<tr>
<td>$\lambda_{PEAK}$</td>
<td>Wavelength</td>
<td>655 nm</td>
<td>ns</td>
</tr>
<tr>
<td>$\tau_S$</td>
<td>Speed of Response</td>
<td>15 ns</td>
<td></td>
</tr>
<tr>
<td>$I_F$</td>
<td>Forward Current</td>
<td>16 mA</td>
<td>20 mA</td>
</tr>
<tr>
<td>$BV_R$</td>
<td>Reverse Breakdown Voltage</td>
<td>3 V</td>
<td>10 $\mu$A</td>
</tr>
</tbody>
</table>

**TYPICAL RELATIVE LUMINOUS INTENSITY VERSUS ANGULAR DISPLACEMENT**

**Figure 1.** Typical DC Forward Current – Voltage Characteristic

**Figure 2.** Relative Luminosity vs. Case Temperature

**Figure 3.** Relative Luminous Intensity vs. Voltage
Features
- DESIGNED FOR HIGH-RELIABILITY APPLICATIONS
- HERMETICALLY SEALED
- LONG LIFE
- HIGH BRIGHTNESS OVER A WIDE VIEWING ANGLE
- IC COMPATIBLE/LOW POWER CONSUMPTION

Description
The 1N5765 is a Gallium Arsenide Phosphide Light Emitting Diode, Solid State Lamp, designed for High Reliability applications. This hermetically sealed LED has been formally approved for use in military systems as a JAN/JAN TX component. HP commercial part number 5082-4420 is equivalent to the 1N5765.

Absolute Maximum Ratings at $T_A=25^\circ C$
- Breakdown Voltage .................. 4Vdc
- Forward Current [see Note 1] ........ 50mAdc
- Power Dissipation .................. 150mW
- Peak Forward Current ............. 3 Amp (1µs Pulse Width, 300pps)

Operating Temperature Range .......... $-65^\circ C$ to $+100^\circ C$
Storage Temperature Range .......... $-65^\circ C$ to $+100^\circ C$

Electrical / Optical Characteristics at $T_A=25^\circ C$
(Per Table I, Group A Testing of MIL-S 19500/467)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity (Axial)</td>
<td>$I_v1$</td>
<td>0.5</td>
<td>3.0</td>
<td>mcd</td>
<td>$I_F = 20\text{mAdc}, \theta = 0^\circ$</td>
</tr>
<tr>
<td>Luminous Intensity (off Axis)</td>
<td>$I_v2$</td>
<td>0.3</td>
<td></td>
<td>mcd</td>
<td>$I_F = 20\text{mAdc}, \theta = 30^\circ$ [see Note 2]</td>
</tr>
<tr>
<td>Wavelength</td>
<td>$\lambda_v$</td>
<td>630</td>
<td>700</td>
<td>nM</td>
<td>Design Parameter</td>
</tr>
<tr>
<td>Capacitance</td>
<td>$C$</td>
<td>300</td>
<td></td>
<td>pF</td>
<td>$V_R = 0$, $f = 1\text{MHz}$</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>$V_F$</td>
<td>2.0</td>
<td></td>
<td>Vdc</td>
<td>$I_F = 20\text{mAdc}$</td>
</tr>
<tr>
<td>Reverse Current</td>
<td>$I_R$</td>
<td>1</td>
<td></td>
<td>µAdc</td>
<td>$V_R = 3\text{Vdc}$ [see Note 2]</td>
</tr>
</tbody>
</table>

NOTES:
1. Derate 0.67 mAdc/°C for $T_A$ above 25°C.
2. These specifications apply only to JAN/JAN TX levels.
JAN 1N5765: Samples of each lot are subjected to Group A inspection for parameters listed in Table I, and to Group B and Group C tests listed below. All tests are to the conditions and limits specified by MIL-S-19500/467. A summary of the data gathered in Groups A, B, and C lot acceptance testing is supplied with each shipment.

JAN TX 1N5765: Devices undergo 100% screening tests as listed below to the conditions and limits specified by MIL-S-19500/467. The JAN TX lot is then subjected to Group A, Group B and Group C tests as for the JAN 1N5765 above. A summary of the data gathered in Groups A, B and C acceptance testing is supplied with each shipment.

<table>
<thead>
<tr>
<th>Group B Sample Acceptance Tests</th>
<th>Method</th>
<th>Group C Sample Acceptance Tests</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Dimensions</td>
<td>2066</td>
<td>Low Temp. Operation (−55°C)</td>
<td>4021</td>
</tr>
<tr>
<td>Solderability</td>
<td>2026</td>
<td>Breakdown Voltage</td>
<td>4021</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>1056A</td>
<td>Temperature Cycling</td>
<td>1051A</td>
</tr>
<tr>
<td>Temperature Cycling</td>
<td>1051A</td>
<td>Resistance to Solvents</td>
<td>*</td>
</tr>
<tr>
<td>Fine Leak Test</td>
<td>1071H</td>
<td>Temp. Storage (100°C, 1K hours)</td>
<td>1031</td>
</tr>
<tr>
<td>Gross Leak Test</td>
<td>1071C</td>
<td>Operating Life (50mA, 1K hours)</td>
<td>1026</td>
</tr>
<tr>
<td>Moisture Resistance</td>
<td>1021</td>
<td>Peak Forward Pulse Current</td>
<td></td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>2016</td>
<td>TX Screening (100%)</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>2056</td>
<td>Temp. Storage (100°C, 72 hours)</td>
<td></td>
</tr>
<tr>
<td>Constant Acceleration</td>
<td>2006</td>
<td>Temperature Cycling</td>
<td>1051A</td>
</tr>
<tr>
<td>Terminal Strength</td>
<td>2036E</td>
<td>Constant Acceleration</td>
<td>2006</td>
</tr>
<tr>
<td>Salt Atmosphere</td>
<td>1041</td>
<td>Fine Leak Test</td>
<td>1071H</td>
</tr>
<tr>
<td>Temp. Storage (100°C, 340 hours)</td>
<td>1032</td>
<td>Gross Leak Test</td>
<td>1071C</td>
</tr>
<tr>
<td>Operating Life (50mA, 340 hours)</td>
<td>1027</td>
<td>Burn-in (50mA, 168 hours)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluation of Drift</td>
<td></td>
</tr>
</tbody>
</table>

*MIL-STD-202 Method 215

**Typical Characteristic Curves**

![Figure 1. Forward Current vs. Voltage Characteristic.](image1)

![Figure 2. Luminous Intensity vs. Forward Current (I_F).](image2)

![Figure 3. Relative Luminous Intensity vs. Angular Displacement.](image3)

Figure 1. Forward Current vs. Voltage Characteristic.

Figure 2. Luminous Intensity vs. Forward Current (I_F).

Figure 3. Relative Luminous Intensity vs. Angular Displacement.
Features

- CHOICE OF 4 COLORS
  - Red
  - High Efficiency Red
  - Yellow
  - Green
- DESIGNED FOR HIGH-RELIABILITY APPLICATIONS
- HERMETICALLY SEALED
- WIDE VIEWING ANGLE
- LOW POWER OPERATION
- IC COMPATIBLE
- LONG LIFE

Package Dimensions

Description

The 5082-4420, 4620, 4520, and 4920 are hermetically sealed solid state lamps encapsulated in a TO-46 package with a tinted diffused plastic lens over a glass window. These hermetic lamps provide good on-off contrast, high axial luminous intensity and a wide viewing angle.

The 5082-4420 utilizes a GaAsP LED chip with a red diffused plastic lens over a glass window.

The 5082-4620 has a high efficiency red GaAsP on GaP LED chip with a red diffused plastic lens over a glass window. This lamp's efficiency is comparable to that of the GaP red but does not saturate at low current levels.

The 5082-4520 provides a yellow GaAsP on GaP LED chip with a yellow diffused plastic lens over a glass window.

The 5082-4920 provides a green GaP LED chip with a green diffused plastic lens over a glass window.
Absolute Maximum Ratings at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Red 4420</th>
<th>High Eff. Red 4620</th>
<th>Yellow 4520</th>
<th>Green 4920</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation</td>
<td>90</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td>(derate linearly from 50°C at 1.6mW/°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Forward Current</td>
<td>50</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Transient Forward Current</td>
<td>1 (1 usec pulse width; 300 pps)</td>
<td></td>
<td></td>
<td></td>
<td>Amp</td>
</tr>
<tr>
<td>Peak Operating Forward Current</td>
<td>100</td>
<td>60 (0.5 msec pulse width)</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-55°C to 100°C</td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>260°C for 7 seconds</td>
</tr>
</tbody>
</table>

NOTES:
1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Junction to Cathode Lead with 3.18mm (0.125 inch) of leads exposed between base of flange and heat sink.
4. Radiant intensity, $I_e$, in watts/steradian, may be found from the equation $I_e = I_v/\eta_v$, where $I_v$ is the luminous intensity in candelas and $\eta_v$ is the luminous efficacy in lumens/watt.

Electrical/Optical Characteristics at $T_A=25^\circ$C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>5082-4420</th>
<th>5082-4620</th>
<th>5082-4520</th>
<th>5082-4920</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_a$</td>
<td>Axial Luminous Intensity</td>
<td>0.5</td>
<td>1.0</td>
<td>2.5</td>
<td>1.0</td>
<td>2.5</td>
<td>0.8</td>
</tr>
<tr>
<td>$2\theta_{1/2}$</td>
<td>Included Angle Between Half Luminous Points</td>
<td>60</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>deg</td>
<td>Note 1, Figures 8, 11, 16, 21</td>
</tr>
<tr>
<td>$A_{\lambda\nu}$</td>
<td>Peak Wavelength</td>
<td>655</td>
<td>635</td>
<td>583</td>
<td>565</td>
<td>nm</td>
<td>Measurement at Peak</td>
</tr>
<tr>
<td>$\lambda_d$</td>
<td>Dominant Wavelength</td>
<td>640</td>
<td>626</td>
<td>585</td>
<td>558</td>
<td>nm</td>
<td>Note 2</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>Speed of Response</td>
<td>10</td>
<td>200</td>
<td>200</td>
<td>50</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Capacitance</td>
<td>200</td>
<td>30</td>
<td>35</td>
<td>35</td>
<td>pF</td>
<td>$V_f = 0.1$–1 MHz</td>
</tr>
<tr>
<td>$R_T$</td>
<td>Thermal Resistance</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>°C/W</td>
<td>Note 3</td>
</tr>
<tr>
<td>$V_f$</td>
<td>Forward Voltage</td>
<td>1.6</td>
<td>2.0</td>
<td>2.0</td>
<td>3.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>$B_{Vr}$</td>
<td>Reverse Breakdown Voltage</td>
<td>4</td>
<td>5</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>V</td>
</tr>
<tr>
<td>$\eta_v$</td>
<td>Luminous Efficacy</td>
<td>50</td>
<td>140</td>
<td>455</td>
<td>600</td>
<td>lm/W</td>
<td>Note 4</td>
</tr>
</tbody>
</table>

NOTES:
1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Junction to Cathode Lead with 3.18mm (0.125 inch) of leads exposed between base of flange and heat sink.
4. Radiant intensity, $I_e$, in watts/steradian, may be found from the equation $I_e = I_v/\eta_v$, where $I_v$ is the luminous intensity in candelas and $\eta_v$ is the luminous efficacy in lumens/watt.

Figure 1. Relative Intensity vs. Wavelength.
**YELLOW 5082-4520**

Figure 12. Forward Current vs. Forward Voltage.

Figure 13. Relative Luminous Intensity vs. Forward Current.

Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 15. Maximum Tolerable Peak Current vs. Pulse Duration. ($I_{DC\ MAX}$ as per MAX Ratings)

Figure 16. Relative Luminous Intensity vs. Angular Displacement.

**GREEN 5082-4920**

Figure 17. Forward Current vs. Forward Voltage.

Figure 18. Relative Luminous Intensity vs. Forward Current.

Figure 19. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Figure 20. Maximum Tolerable Peak Current vs. Pulse Duration. ($I_{DC\ MAX}$ as per MAX Ratings)

Figure 21. Relative Luminous Intensity vs. Angular Displacement.
Description

The 5082-4707 is a black plastic mounting clip and retaining ring. It is designed to panel mount Hewlett Packard Solid State T-1½ size lamps. This clip and ring combination is intended for installation in instrument panels up to 3.18mm (.125") thick. For panels greater than 3.18mm (.125"), counterboring is required to the 3.18mm (.125") thickness.

Mounting Instructions

1. Drill a 6.35mm (.250") dia. hole in the panel. Deburr but do not chamfer the edges of the hole.

2. Press the panel clip into the hole from the front of the panel.

3. Press the LED into the clip from the back. Use blunt long nose pliers to push on the LED. Do not use force on the LED leads. A tool such as a nut driver may be used to press on the clip.

4. Slip a plastic retaining ring onto the back of the clip and press tight using tools such as two nut drivers.
Solid State Displays

Selection Guide

☐ Red, High Efficiency Red, Yellow and Green Seven Segment Displays

☐ Integrated Displays

☐ Hermetically Sealed Displays

☐ Alphanumeric Displays

☐ Chips
# Red, High Efficiency Red, Yellow and Green Seven Segment LED Displays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Package</th>
<th>Application</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7650</td>
<td>10.92mm (.43&quot;) High Efficiency Red, Common Anode, LHDP</td>
<td>14 Pin Epoxy, .762mm (.3&quot;) DIP</td>
<td>General Purpose Market • Test Equipment • Digital Clocks • Clock Radios • TV Channel Indicators • Business Machines • Digital Instruments • Automobiles</td>
<td>50</td>
</tr>
<tr>
<td>5082-7651</td>
<td>10.92mm (.43&quot;) High Efficiency Red, Common Anode, RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7653</td>
<td>10.92mm (.43&quot;) High Efficiency Red, Universal Polarity &amp; Overflow Indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7656</td>
<td>10.92mm (.43&quot;) High Efficiency Red, Universal Polarity &amp; Overflow Indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7660</td>
<td>10.92mm (.3&quot;) Yellow Common Anode LHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7661</td>
<td>10.92mm (.3&quot;) Yellow Common Anode RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7663</td>
<td>10.92mm (.3&quot;) Yellow Common Cathode RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7666</td>
<td>10.92mm (.3&quot;) Yellow Universal Polarity &amp; Overflow Indicator RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7670</td>
<td>10.92mm (.3&quot;) Green Common Anode LHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7671</td>
<td>10.92mm (.3&quot;) Green Common Anode RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7673</td>
<td>10.92mm (.3&quot;) Green Common Cathode RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7676</td>
<td>10.92mm (.3&quot;) Green Universal Polarity &amp; Overflow Indicator RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7730</td>
<td>7.62mm (.3&quot;) Red, Common Anode, LHDP</td>
<td>14 Pin Epoxy, .762mm (.3&quot;) DIP</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>5082-7731</td>
<td>7.62mm (.3&quot;) Red, Common Anode, RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7732</td>
<td>7.62mm (.3&quot;) Red, Common Anode, Polarity &amp; Overflow Indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7740</td>
<td>7.62mm (.3&quot;) Red, Common Cathode, RHDP</td>
<td>10 Pin Epoxy, .762mm (.3&quot;) DIP</td>
<td></td>
<td>59</td>
</tr>
<tr>
<td>5082-7750</td>
<td>10.92mm (.43&quot;) Red, Common Anode, LHDP</td>
<td>14 Pin Epoxy, .762mm (.3&quot;) DIP</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>5082-7751</td>
<td>10.92mm (.43&quot;) Red, Common Anode, RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7756</td>
<td>10.92mm (.43&quot;) Red, Universal Polarity &amp; Overflow Indicator, RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7760</td>
<td>10.92mm (.43&quot;) Red, Common Cathode, RHDP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Red, Yellow and Green Seven Segment LED Displays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Package</th>
<th>Application</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7402</td>
<td>2.79mm(.11&quot;) Red, 3 Digits, Right,[1] Centered D.P.</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td>Small Display Market, Portable/Battery Power Instruments, Portable Calculators</td>
<td>65</td>
</tr>
<tr>
<td>5082-7403</td>
<td>2.79mm(.11&quot;) Red, 3 Digits, Left,[1] Centered D.P.</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td>For further information ask for Application Note 937 (See page 146)</td>
<td></td>
</tr>
<tr>
<td>5082-7404</td>
<td>2.79mm(.11&quot;) Red, 4 Digits, Centered D.P.</td>
<td>14 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7405</td>
<td>2.79mm(.11&quot;) Red, 5 Digits, Centered D.P.</td>
<td>14 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7412</td>
<td>2.79mm(.11&quot;) Red, 3 Digits, Right,[1] RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>5082-7413</td>
<td>2.79mm(.11&quot;) Red, 3 Digits, Left,[1] RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7414</td>
<td>2.79mm(.11&quot;) Red, 4 Digits, RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7415</td>
<td>2.79mm(.11&quot;) Red, 5 Digits, RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7432</td>
<td>2.79mm(.11&quot;) Red, 2 Digits, Right,[2] RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7433</td>
<td>2.79mm(.11&quot;) Red, 3 Digits, RHDP</td>
<td>12 Pin Epoxy, 7.62mm (.3&quot;) DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7442</td>
<td>2.67mm(.105&quot;) Red, 8 Digits, Mounted on P.C Board</td>
<td>50.8mm(2&quot;) P.C Bd., 17 Term. Edge Con.</td>
<td></td>
<td>73</td>
</tr>
<tr>
<td>5082-7448</td>
<td>2.67mm(.105&quot;) Red, 8 Digits, Mounted on P.C Board</td>
<td>60.3mm(2.375&quot;) PC Bd., 17 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7444</td>
<td>2.67mm(.105&quot;) Red, 9 Digits, Mounted on P.C Board</td>
<td>50.8mm(2&quot;) P.C Bd., 17 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7449</td>
<td>2.67mm(.105&quot;) Red, 9 Digits, Mounted on P.C Board</td>
<td>60.3mm(2.375&quot;) PC Bd., 17 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7442</td>
<td>2.54mm(.100&quot;) Red, 12 Digits, Mounted on P.C Board</td>
<td>60.3mm(2.375&quot;) PC Bd., 20 Term. Edge Con.</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>5082-7445</td>
<td>2.54mm(.100&quot;) Red, 12 Digits, Mounted on P.C Board</td>
<td>59.6mm(2.345&quot;) PC Bd., 20 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7444</td>
<td>2.54mm(.100&quot;) Red, 14 Digits, Mounted on P.C Board</td>
<td>60.3mm(2.375&quot;) PC Bd., 20 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7447</td>
<td>2.85mm(.112&quot;) Red, 14 Digits, Mounted on P.C Board</td>
<td>50.8mm(2&quot;) P.C Bd., 17 Term. Edge Con.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7240</td>
<td>2.59mm(.102&quot;) Red, 8 Digits, Mounted on P.C Board</td>
<td>50.8mm(2&quot;) P.C Bd., 17 Term. Edge Con.</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>5082-7241</td>
<td>2.59mm(.102&quot;) Red, 9 Digits, Mounted on P.C Board</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Integrated LED Displays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Package</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7300</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, RHDP, Built-In Decoder/Driver/Memory</td>
<td>8 Pin Epoxy, 15.2mm (.6&quot;) DIP</td>
<td>General Purpose Market, Test Equipment, Business Machines, Computer Peripherals, Avionics</td>
</tr>
<tr>
<td>5082-7302</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, LHDP, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7340</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Hexadecimal, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7304</td>
<td>7.4mm (.29&quot;) Overrange Character Plus/Minus Sign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7356</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, RHDP, Built-In Decoder/Driver/Memory</td>
<td>8 Pin Glass Ceramic 15.2mm (.6&quot;) DIP</td>
<td>Medical Equipment, Industrial and Process Control Equipment, Computers, Where Ceramic Package IC's are required.</td>
</tr>
<tr>
<td>5082-7357</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, LHDP, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7359</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Hexadecimal, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7500</td>
<td>38.1mm (1.5&quot;) 5x7 Single Digit LHDP, Built-In Decoder/Driver</td>
<td>P.C. Board 10 Pin Edge Card Connector .396mm (.156&quot;) Centers</td>
<td>General Purpose Market, Test Equipment, Medical Equipment, Industrial Controls</td>
</tr>
</tbody>
</table>

## Hermetically Sealed Integrated LED Displays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Package</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7010</td>
<td>6.8mm (.27&quot;) 5x7 Single Digit Numeric, LHDP, Built-In Decoder/Driver/Memory</td>
<td>8 Pin Hermetic 25.4mm (.1&quot;) Pin Centers</td>
<td>Ground, Airborne, Shipboard Equipment, Fire Control Systems, Space Flight Systems</td>
</tr>
<tr>
<td>5082-7011</td>
<td>6.8mm (.27&quot;) Plus/Minus Sign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7001</td>
<td>6.8mm (.27&quot;) 5x7 Three Digit Numeric, LHDP, Built-In Decoder/Driver</td>
<td>24 Pin Hermetic 25.4mm (.1&quot;) Pin Centers</td>
<td>Ground, Airborne, Shipboard Equipment, Fire Control Systems, Space Flight Systems, Other High Reliability Applications (TX Programs available, see page 101)</td>
</tr>
<tr>
<td>5082-7391</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, RHDP, Built-In Decoder/Driver/Memory</td>
<td>8 Pin Hermetic 15.2mm (.6&quot;) DIP with Gold Plated Leads</td>
<td>Ground, Airborne, Shipboard Equipment, Fire Control Systems, Space Flight Systems, Other High Reliability Applications (TX Programs available, see page 101)</td>
</tr>
<tr>
<td>5082-7392</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Numeric, LHDP, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-7395</td>
<td>7.4mm (.29&quot;) 4x7 Single Digit Hexadecimal, Built-In Decoder/Driver/Memory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Alphanumeric LED Displays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Package</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7100</td>
<td>7.4mm (.29&quot;) 5x7 Three Digit Alphanumeric</td>
<td>22 Pin Hermetic 15.2mm (.6&quot;) DIP</td>
<td>General Purpose Market, Business Machines, Calculators, Solid State CRT, High Reliability Applications</td>
</tr>
<tr>
<td>5082-7101</td>
<td>7.4mm (.29&quot;) 5x7 Four Digit Alphanumeric</td>
<td>28 Pin Hermetic 15.2mm (.6&quot;) DIP</td>
<td></td>
</tr>
<tr>
<td>5082-7102</td>
<td>7.4mm (.29&quot;) 5x7 Five Digit Alphanumeric</td>
<td>36 Pin Hermetic 15.2mm (.6&quot;) DIP</td>
<td></td>
</tr>
<tr>
<td>Device</td>
<td>Description</td>
<td>Shipping Carrier</td>
<td>Tilt Angle</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>5082-7811</td>
<td>7 Seg. 53 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>6°</td>
</tr>
<tr>
<td>5082-7821</td>
<td>7 Seg. 53 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7832</td>
<td>7 Seg. 80 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>5°</td>
</tr>
<tr>
<td>5082-7842</td>
<td>7 Seg. 80 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7851</td>
<td>7 Seg. 100 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>5°</td>
</tr>
<tr>
<td>5082-7861</td>
<td>7 Seg. 100 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7852</td>
<td>9 Seg. 100 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>5°</td>
</tr>
<tr>
<td>5082-7862</td>
<td>9 Seg. 100 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7853</td>
<td>2 Seg. 100 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>5°</td>
</tr>
<tr>
<td>5082-7863</td>
<td>2 Seg. 100 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7871</td>
<td>7 Seg. 120 mil Character Height Monolithic LED Chip in Scribed &amp; Broken Wafer Form</td>
<td>Wafer Mounted On Vinyl Film</td>
<td>5°</td>
</tr>
<tr>
<td>5082-7881</td>
<td>7 Seg. 120 mil Character Height Monolithic LED Chip</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7892</td>
<td>11 mil Discrete LED</td>
<td>Waffle Pack</td>
<td></td>
</tr>
<tr>
<td>5082-7893</td>
<td>11 mil Discrete LED</td>
<td>Glass Vial</td>
<td></td>
</tr>
</tbody>
</table>
Features

• LARGE DIGIT
  Viewing up to 6 meters (19.7 feet)

• CHOICE OF 3 BRIGHT COLORS
  High Efficiency Red
  Yellow
  Green

• LOW CURRENT OPERATION
  As Low as 3mA per Segment
  Designed for Multiplex Operation

• EXCELLENT CHARACTER APPEARANCE
  Evenly Lighted Segments
  Wide Viewing Angle
  Body Color Improves “Off” Segment Contrast

• EASY MOUNTING ON PC BOARD OR SOCKETS
  Industry Standard 7.62mm (.3”) DIP
  Leads on 2.54mm (.1”) Centers

• CATEGORIZED FOR LUMINOUS INTENSITY
  Assures Uniformity of Light Output from Unit to Unit within a Single Category

• IC COMPATIBLE

• MECHANICALLY RUGGED

Description

The 5082-7650, -7660, and -7670 series are large 10.92mm (.43 in.) Red, Yellow, and Green seven segment displays. These displays are designed for use in instruments, point of sale terminals, clocks, and appliances.

The -7650 and -7660 series devices utilize high efficiency LED chips which are made from GaAsP on a transparent GaP substrate.

The -7670 series devices utilize chips made from GaP on a transparent GaP substrate.

Devices

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Color</th>
<th>Description</th>
<th>Package Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7650</td>
<td>High Efficiency Red</td>
<td>Common Anode Left Hand Decimal</td>
<td>A</td>
</tr>
<tr>
<td>5082-7651</td>
<td>High Efficiency Red</td>
<td>Common Anode Right Hand Decimal</td>
<td>B</td>
</tr>
<tr>
<td>5082-7653</td>
<td>High Efficiency Red</td>
<td>Common Cathode Right Hand Decimal</td>
<td>C</td>
</tr>
<tr>
<td>5082-7656</td>
<td>High Efficiency Red</td>
<td>Universal Overflow ±1 Right Hand Decimal</td>
<td>D</td>
</tr>
<tr>
<td>5082-7660</td>
<td>Yellow</td>
<td>Common Anode Left Hand Decimal</td>
<td>A</td>
</tr>
<tr>
<td>5082-7661</td>
<td>Yellow</td>
<td>Common Anode Right Hand Decimal</td>
<td>B</td>
</tr>
<tr>
<td>5082-7663</td>
<td>Yellow</td>
<td>Common Cathode Right Hand Decimal</td>
<td>C</td>
</tr>
<tr>
<td>5082-7666</td>
<td>Yellow</td>
<td>Universal Overflow ±1 Right Hand Decimal</td>
<td>D</td>
</tr>
<tr>
<td>5082-7670</td>
<td>Green</td>
<td>Common Anode Left Hand Decimal</td>
<td>A</td>
</tr>
<tr>
<td>5082-7671</td>
<td>Green</td>
<td>Common Anode Right Hand Decimal</td>
<td>B</td>
</tr>
<tr>
<td>5082-7673</td>
<td>Green</td>
<td>Common Cathode Right Hand Decimal</td>
<td>C</td>
</tr>
<tr>
<td>5082-7676</td>
<td>Green</td>
<td>Universal Overflow ±1 Right Hand Decimal</td>
<td>D</td>
</tr>
</tbody>
</table>

Note: Universal pinout brings the anode and cathode of each segment's LED out to separate pins, see internal diagram D.
Internal Circuit Diagram

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>DC Power Dissipation Per Segment or D.P.</th>
<th>50mW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range</td>
<td>-20°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-20°C to +85°C</td>
</tr>
<tr>
<td>Peak Forward Current Per Segment or D.P.</td>
<td>60mA</td>
</tr>
<tr>
<td>DC Forward Current Per Segment or D.P.</td>
<td>20mA</td>
</tr>
<tr>
<td>Reverse Voltage Per Segment or D.P.</td>
<td>6.0V</td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td>230°C for 3 Sec</td>
</tr>
</tbody>
</table>

Notes: 1. See power derating curve (Fig.2). 2. Derate average current from 50°C at 0.4mA/°C per segment. 3. See Maximum Tolerable Segment Peak Current vs. Pulse Duration curve, (Fig. 1). 4. Clean only in water, isopropanol, ethanol, Freon TF or TE (or equivalent) and Genesolv DI-15 or DE-15 (or equivalent).
### Electrical/Optical Characteristics at \( T_A = 25^\circ C \)

#### HIGH EFFICIENCY RED 5082-7650/-7651/-7653/-7656

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment(5,8)</td>
<td>( I_1 )</td>
<td>5mA D.C.</td>
<td>135</td>
<td>300</td>
<td>( \mu cd )</td>
<td></td>
</tr>
<tr>
<td>(Digit Average)</td>
<td></td>
<td>20mA D.C.</td>
<td>1720</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( \lambda_{PEAK} )</td>
<td>60mA Pk: 1 of 6 Duty Factor</td>
<td>970</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominant Wavelength(6)</td>
<td>( \lambda_d )</td>
<td>626</td>
<td>nm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or D.P.</td>
<td>( V_F )</td>
<td>( I_F = 5mA )</td>
<td>1.7</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 20mA )</td>
<td>2.0</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 60mA )</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Current/Segment or D.P.</td>
<td>( I_R )</td>
<td>( V_R = 6V )</td>
<td>10</td>
<td>( \mu A )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time(7)</td>
<td>( t_r, t_f )</td>
<td>90</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient of ( V_F )/Segment or D.P.</td>
<td>( \Delta V_F / ^\circ C )</td>
<td>-2.0</td>
<td>mV/(^\circ C)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### YELLOW 5082-7660/-7661/-7663/-7666

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment(5,8)</td>
<td>( I_1 )</td>
<td>5mA D.C.</td>
<td>100</td>
<td>250</td>
<td>( \mu cd )</td>
<td></td>
</tr>
<tr>
<td>(Digit Average)</td>
<td></td>
<td>20mA D.C.</td>
<td>1500</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( \lambda_{PEAK} )</td>
<td>60mA Pk: 1 of 6 Duty Factor</td>
<td>925</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominant Wavelength(6)</td>
<td>( \lambda_d )</td>
<td>583</td>
<td>nm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or D.P.</td>
<td>( V_F )</td>
<td>( I_F = 5mA )</td>
<td>1.8</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 20mA )</td>
<td>2.2</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 60mA )</td>
<td>3.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Current/Segment or D.P.</td>
<td>( I_R )</td>
<td>( V_R = 6V )</td>
<td>90</td>
<td>( \mu A )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time(7)</td>
<td>( t_r, t_f )</td>
<td>90</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient of ( V_F )/Segment or D.P.</td>
<td>( \Delta V_F / ^\circ C )</td>
<td>-2.0</td>
<td>mV/(^\circ C)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### GREEN 5082-7670/-7671/-7673/-7676

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment(5,8)</td>
<td>( I_1 )</td>
<td>10mA D.C.</td>
<td>125</td>
<td>250</td>
<td>( \mu cd )</td>
<td></td>
</tr>
<tr>
<td>(Digit Average)</td>
<td></td>
<td>20mA D.C.</td>
<td>640</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( \lambda_{PEAK} )</td>
<td>60mA Pk: 1 of 6 Duty Factor</td>
<td>450</td>
<td>( \mu cd )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominant Wavelength(6)</td>
<td>( \lambda_d )</td>
<td>572</td>
<td>nm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or D.P.</td>
<td>( V_F )</td>
<td>( I_F = 10mA )</td>
<td>1.9</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 20mA )</td>
<td>2.2</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 60mA )</td>
<td>2.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Current/Segment or D.P.</td>
<td>( I_R )</td>
<td>( V_R = 6V )</td>
<td>10</td>
<td>( \mu A )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time(7)</td>
<td>( t_r, t_f )</td>
<td>90</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient of ( V_F )/Segment or D.P.</td>
<td>( \Delta V_F / ^\circ C )</td>
<td>-2.0</td>
<td>mV/(^\circ C)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
5. The digits are categorized for luminous intensity with the intensity category designated by a letter located on the right hand side of the package.
6. The dominant wavelength, \( \lambda_d \), is derived from the C.I.E. Chromaticity Diagram and is that single wavelength which defines the color of the device.
7. Time for a 10% - 90% change of light intensity for step change in current.
8. Temperature coefficient of luminous intensity \( I_v, ^\circ C \) is determined by the formula: \( I_{1, TA} = I_{1, 25^\circ C} (0.982)^{[TA - 25^\circ C]} \)

---

52
Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration.

Figure 2. Maximum Allowable DC Current and DC Power Dissipation Per Segment as a Function of Ambient Temperature.

Figure 3. Relative Luminous Efficiency (Luminous Intensity per Unit Current) vs. Peak Segment Current.

Figure 4. Forward Current vs. Forward Voltage Characteristic.

Figure 5. Normalized Angular Distribution of Luminous Intensity.
Operational Considerations

ELECTRICAL

The 5082-7600 series of display products are arrays of eight light emitting diodes which are optically magnified to form seven individual segments plus a decimal point. The diodes in these displays utilize a Gallium Arsenide Phosphide junction on a Gallium Phosphide substrate to produce high efficiency red and yellow emission spectra and a Gallium Phosphide junction for the green. In the case of the red displays, efficiency is improved by at least a factor of 4 over the standard Gallium Arsenide Phosphide based technology. The use of Gallium Phosphide as the substrate does result in an internal dynamic resistance in the range of 12-48Ω. It is this resistance which causes the substantially higher forward voltage specifications in the new devices.

The user should be careful to scale the appropriate forward voltage from the \( V_f \) versus \( I_f \) curve, Figure 4, when designing for a particular forward current. Another way to obtain \( V_f \) would be to use the following formula:

\[ V_f = V_{SMA} + R_S (I_{F} - 5mA) \]

where \( V_{SMA} \) and \( R_S \) are found in the following table:

<table>
<thead>
<tr>
<th>Device</th>
<th>( V_{SMA} )</th>
<th>( R_S )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7650 Series</td>
<td>1.65V</td>
<td>21Ω</td>
</tr>
<tr>
<td>-7660 Series</td>
<td>1.75V</td>
<td>25Ω</td>
</tr>
<tr>
<td>-7670 Series</td>
<td>1.85V</td>
<td>19Ω</td>
</tr>
</tbody>
</table>

Figure 1 relates refresh rate, \( f \), and pulse duration, \( t_p \), to a ratio which defines the maximum desirable operating peak current as a function of derated dc current, \( I_{P MAX/IDC MAX} \). To most effectively utilize Figure 1, perform the following steps:

1. Determine desired duty factor.
   Example: Four digit display, duty factor = 1/4

2. Determine desired refresh rate, \( f \). Use duty factor to calculate pulse duration, \( t_p \).
   Note: \( t_p = \) Duty Factor
   Example: \( f = 1 \) kHz; \( t_p = 250 \mu \text{sec} \)

3. Enter Figure 1 at the calculated \( t_p \). Move vertically to the refresh rate line and then record the corresponding value of \( I_{P MAX/IDC MAX} \).
   Example: At \( t_p = 250 \mu \text{sec} \) and \( f = 1 \) kHz, \( I_{P MAX/IDC MAX} = 2.5 \)

4. From Figure 2, determine the value for \( I_{DC MAX} \).
   Note: \( I_{DC MAX} \) is derated above \( T_A = 50^\circ \text{C} \)
   Example: At \( T_A = 70^\circ \text{C} \), \( I_{DC MAX} = 12mA \)

5. Calculate \( I_{P MAX} \) from \( I_{P MAX/IDC MAX} \) ratio and calculate \( I_{AVG} \) from \( I_P \) and duty factor.
   Example: \( I_p = (2.5) (12mA) = 30mA \) peak
   \( I_{AVG} = (1/4) (30mA) = 7.5mA \) average.

The above calculations determine the maximum tolerable strobing conditions. Operation at a reduced peak current or duty factor is suggested to help insure even more reliable operation.

Refresh rates of 1kHz or faster provide the most efficient operation resulting in the maximum possible time average luminous intensity.

These displays may be operated in the strobed mode at currents up to 60mA peak. When operating at peak currents above \( 5mA \) for red and yellow or \( 10mA \) for green, there will be an improvement in the relative efficiency of the display (see Figure 3). Light output at higher currents can be calculated using the following relationship:

\[
I_{V TIME AVG} = \left[ \frac{I_{AVG}}{I_{AVG SPEC}} \right] \left[ \eta_{PEAK} \right] \left[ I_{V SPEC} \right] \]

\( I_{AVG} = \) Operating point average current
\( I_{AVG SPEC} = \) Average current for data sheet luminous intensity value, \( I_{V SPEC} \)
\( \eta_{PEAK} = \) Relative efficiency at operating peak current.
\( \eta_{PEAK SPEC} = \) Relative efficiency at data sheet peak current where luminous intensity \( I_{V SPEC} \) is specified.
\( I_{V SPEC} = \) Data sheet luminous intensity, specified at \( I_{AVG SPEC} \) and \( \eta_{PEAK SPEC} \).

Example: \( I_p = 40mA \) and \( I_{AVG} = 10mA \):
\[
I_{V TIME AVG} = \left( \frac{10mA}{5mA} \right) \left( \frac{1.58}{1} \right) (300\mu \text{cd}) = 948\mu \text{cd/sec.}
\]

CONTRAST ENHANCEMENT

The 5082-7600 series devices have been optimized for use in actual display systems. In order to maximum "ON-OFF" contrast, the bodies of the displays have been painted to match the appearance of an unilluminated segment. The emission wavelength of the red displays has been shifted from the standard GaAsP ~ 655nm to 635nm in order to provide an easier to read device.

All of the colored display products should be used in conjunction with contrast enhancing filters. Some suggested contrast filters: for red displays, Panelgraphic Scarlet Red 65 or Homalite 1670; for yellow displays, Panelgraphic Amber 23 or Homalite (100-1720, 100-1726); for green, Panelgraphic Green 48 or Homalite (100-1440, 100-1425). Another excellent contrast enhancement material for all colors is the 3M light control film.

MECHANICAL

The 5082-7600 series devices are constructed utilizing a lead frame in a standard DIP package. The individual packages may be close-packed on 12.7mm (.5in.) centers on a PC board. Also, the larger character height allows other character spacing options when desired. The leadframe has an integral seating plane which will hold the package approximately 1.52mm (.060 in.) above the PC board during standard soldering and flux removal operation. To optimize device performance, new materials are used that are limited to certain solvent materials for flux removal. It is recommended that only mixtures of Freon and alcohol be used for post solder vapor cleaning processes, with an immersion time in the vapors up to two minutes maximum. Suggested products are Freon TF, Freon TE, Genesol DI-15 and Genesol DE-15. Isoprop-?
Features

• 5082-7730
  Common Anode
  Left Hand D.P.

• 5082-7731
  Common Anode
  Right Hand D.P.

• 5082-7732
  Common Anode
  Polarity and Overflow Indicator

• EXCELLENT CHARACTER APPEARANCE
  Continuous Uniform Segments
  Wide Viewing Angle
  High Contrast

• IC COMPATIBLE

• STANDARD 0.3" DIP LEAD
  CONFIGURATION
  PC Board or Standard Socket Mountable

• CATEGORIZED FOR LUMINOUS
  INTENSITY
  Assures Uniformity of Light Output from
  Unit to Unit within a Single Category

Description

The HP 5082-7730 series devices are common anode LED displays. The series includes a left hand and a right hand decimal point numeric display as well as a polarity and overflow indicator. The large 7.62mm (0.3 in.) high character size generates a bright, continuously uniform seven segment display. Designed for viewing distances of up to 10 feet, these single digit displays provide a high contrast ratio and a wide viewing angle.

The 5082-7730 series devices utilize a standard 7.62mm (0.3 in.) dual-in-line package configuration that permits mounting on PC boards or in standard IC sockets. Requiring a low forward voltage, these displays are inherently IC compatible, allowing for easy integration into electronic instrumentation, point of sale terminals, TVs, radios, and digital clocks.

### Package Dimensions

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7730</td>
<td>5082-7731</td>
</tr>
<tr>
<td>1</td>
<td>CATHODE - a</td>
</tr>
<tr>
<td>2</td>
<td>CATHODE - f</td>
</tr>
<tr>
<td>4</td>
<td>NO PIN</td>
</tr>
<tr>
<td>5</td>
<td>NO PIN</td>
</tr>
<tr>
<td>6</td>
<td>CATHODE - dp</td>
</tr>
<tr>
<td>7</td>
<td>CATHODE - e</td>
</tr>
<tr>
<td>8</td>
<td>CATHODE - d</td>
</tr>
<tr>
<td>9</td>
<td>NO CONN,</td>
</tr>
<tr>
<td>10</td>
<td>CATHODE - c</td>
</tr>
<tr>
<td>11</td>
<td>CATHODE - g</td>
</tr>
<tr>
<td>12</td>
<td>NO PIN</td>
</tr>
<tr>
<td>13</td>
<td>CATHODE - b</td>
</tr>
</tbody>
</table>

NOTES:
1. Dimensions in millimeters and (inches).
2. All unreflected dimensions are for reference only.
3. Reflected modes:
4. Unused dip position.
5. See Internal Circuit Diagram.
Maximum Ratings

Power Dissipation $T_A = 25^\circ C$ ........................................................................................................... 460 mW
Operating Temperature Range .......................................................................................................................... $-20^\circ C$ to $+85^\circ C$
Storage Temperature Range ................................................................................................................................. $-20^\circ C$ to $+85^\circ C$
Average Forward Current/Segment or Decimal Pt. $T_A = 25^\circ C$ ......................................................... 25 mA
Peak Forward Current/Segment or Decimal Pt. $T_A = 25^\circ C$ (Pulse Duration $\leq 500 \mu s$) .......... 150 mA
Reverse Voltage/Segment or Decimal Pt. ........................................................................................................... 6V
Maximum Solder Temperature 1.59 mm (1.16 in.) Below Seating Plane ($t \leq 3$ sec) [2] ............... 230°C

NOTES:
1. Derate from 35°C at 0.3 mW/°C per segment or decimal point.
2. Clean only in Freon TE, Freon TF, Isopropanol, Ethanol, Genesolv DI-15 or DE-15, or water.

Electrical/Optical Characteristics at $T_A = 25^\circ C$

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment[1]</td>
<td>$I_v$</td>
<td>$I_{PEAK} = 100 \text{mA}$ (10%) Duty Cycle</td>
<td>200</td>
<td></td>
<td></td>
<td>$\mu$cd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_f = 20 \text{mA DC}$</td>
<td>100</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td></td>
<td>655</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Dominant Wavelength[2]</td>
<td>$\lambda_d$</td>
<td></td>
<td>639</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Forward Voltage/Segment or D.P.</td>
<td>$V_F$</td>
<td>$I_f = 20 \text{mA}$</td>
<td>1.6</td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Current/Segment or D.P.</td>
<td>$I_R$</td>
<td>$V_R = 6 \text{V}$</td>
<td>10</td>
<td></td>
<td></td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Rise and Fall Time[3]</td>
<td>$t_v, t_f$</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage</td>
<td>$\Delta V_F/^\circ C$</td>
<td></td>
<td>-2.0</td>
<td></td>
<td></td>
<td>mV/°C</td>
</tr>
<tr>
<td>Temperature Coefficient of Luminous Intensity</td>
<td>$\Delta I_v/^\circ C$</td>
<td></td>
<td>-1.0</td>
<td></td>
<td></td>
<td>%/°C</td>
</tr>
</tbody>
</table>

NOTES:
1. The digits are categorized for luminous intensity with the intensity category designated by a letter located on the right hand side of the package.
2. Dominant wavelength, $\lambda_d$, is derived from the C.I.E. Chromaticity diagram and represents that single wavelength which is perceived by the eye.
3. Time for a 10%-90% change of light intensity for step change in current.

Figure 1. Normalized Angular Distribution of Luminous Intensity.

Figure 2. Forward Current versus Forward Voltage.

Figure 3. Relative Efficiency (Luminous Intensity per Unit Current) versus Peak Current per Segment.
The common anode 5082-7730 series devices are arrays of eight discrete light emitting diodes, which are optically magnified to form seven individual segments plus a decimal point. As depicted in Figure 4, character encoding on the 7730 and the 7731 can be performed by commercially available BCD-7 segment decoder/driver circuits. Through the use of strobing techniques, only one decoder/driver is required to drive a display containing up to 16 characters as outlined in Figure 6. When each character in the display is illuminated in sequence, at a minimum of 100 times per second, flicker-free characters are formed. Under average current drive conditions of 10mA/segment, the display is easily readable to distances of ten feet and will retain good contrast under relatively high ambient lighting conditions.

The 5082-7730 series devices are constructed utilizing a lead frame in a standard DIP package. The individual packages may be close-packed at 10.16mm (.4 in.) centers on a PC board. Also, the larger character height allows other character spacing options when desired. The lead frame has an integral seating plane which will hold the package approximately 1.52mm (.060 in.) above the PC board during standard soldering and flux removal operation. To optimize device performance, new materials are used that are limited to certain solvent materials for flux removal. It is recommended that only Freon TF, Freon TE, (for Freons, up to 2 min. max. at boiling temp.), Isopropanol, Ethanol, Genesolv DI-15, Genesolv DE-15, or water be used for cleaning operations. To improve display contrast, the entire front surface of the display, except for emitting areas, is finished in a uniform flat black. Additional filters may be incorporated, if desired, to further lower the ambient reflectance and improve display contrast. See Hewlett Packard Application Note 964 for further information regarding the contrast enhancement.

Figure 4. Direct Drive Circuit for the 5082-7730/7731 Common Anode Display.

Figure 5. Internal Circuit Diagram.

Figure 6. General Strobe Drive Scheme for Common Anode (5082-7730/7731) Displays.
Polarity and Overflow Indicator–5082-7732

ABSOLUTE MAXIMUM RATINGS

Power Dissipation \( T_A = 25^\circ C \) .......................................................... \( 345\, \text{mW} \)
Operating Temperature Range ........................................... \(-20^\circ C \) to \(+85^\circ C\)
Storage Temperature Range ........................................... \(-20^\circ C \) to \(+85^\circ C\)
Average Forward Current/Segment or Decimal Point \( T_A = 25^\circ C \) .................. \( 25\, \text{mA} \)
Peak Forward Current/Segment or Decimal Point \( T_A = 25^\circ C \) (Pulse Duration \( \leq 500\, \mu\text{s} \)) .................. \( 150\, \text{mA} \)
Reverse Voltage Segment or Decimal Point .................. \( 6\, \text{V} \)
Reverse Voltage Segment a-b or d ...................................... \( 12\, \text{V} \)
Maximum Solder Temperature \( 1.59\, \text{mm (1.16 in.) Below Seating Plane (t \leq 3\, \text{sec})} \) \( 230^\circ C \)

NOTES:
1. Derate from \( 35^\circ C \) at \( 0.3\, \text{mA/}^\circ C \) per segment or decimal point.
2. Clean only in Freon TE, Freon TF, Isopropanol, Ethanol, Genesolv DI-15 or DE-15, or water.

ELECTRICAL/OPTICAL CHARACTERISTICS AT \( 25^\circ C \)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment ( ^{[1]} )</td>
<td>( \mu I_{\text{AVE}} )</td>
<td>( I_{\text{PEAK}} = 100, \text{mA} ) ( 10% ) Duty Cycle</td>
<td>200</td>
<td></td>
<td></td>
<td>( \mu\text{cd} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 20, \text{mA} )</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( \lambda_{\text{PEAK}} )</td>
<td></td>
<td>655</td>
<td></td>
<td></td>
<td>( \text{nm} )</td>
</tr>
<tr>
<td>Forward Voltage, Segments a-b or d</td>
<td>( V_F )</td>
<td>( I_F = 20, \text{mA} )</td>
<td>3.2</td>
<td>4.0</td>
<td></td>
<td>( \text{V} )</td>
</tr>
<tr>
<td>Forward Voltage, Segments c or dp</td>
<td>( V_F )</td>
<td>( I_F = 20, \text{mA} )</td>
<td>1.6</td>
<td>2.0</td>
<td></td>
<td>( \text{V} )</td>
</tr>
<tr>
<td>Reverse Current, Segments a-b or d</td>
<td>( I_R )</td>
<td>( V_R = 12, \text{V} )</td>
<td>10</td>
<td></td>
<td></td>
<td>( \mu\text{A} )</td>
</tr>
<tr>
<td>Reverse Current, Segments c or dp</td>
<td>( I_R )</td>
<td>( V_R = 6, \text{V} )</td>
<td>10</td>
<td></td>
<td></td>
<td>( \mu\text{A} )</td>
</tr>
<tr>
<td>Rise and Fall Time ( ^{[2]} )</td>
<td>( t_r )</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>( \text{ns} )</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage Segments a-b or d</td>
<td>( \Delta V_F /^\circ C )</td>
<td></td>
<td>-4.0</td>
<td></td>
<td></td>
<td>( \text{mV/}^\circ C )</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage Segments c or dp</td>
<td>( \Delta V_F /^\circ C )</td>
<td></td>
<td>-2.0</td>
<td></td>
<td></td>
<td>( \text{mV/}^\circ C )</td>
</tr>
<tr>
<td>Temperature Coefficient of Luminous Intensity</td>
<td>( \Delta I_{\text{P}} /^\circ C )</td>
<td></td>
<td>-1.0</td>
<td></td>
<td></td>
<td>%/^\circ C</td>
</tr>
</tbody>
</table>

NOTES:  
1. The digits are categorized for luminous intensity with the intensity categories designated by a letter located on the right hand side of the package.
2. Time for a 10%-90% change of light intensity for step change in current.

PACKAGE DIMENSIONS – 5082-7732

PIN NO. | FUNCTION
---|---
1 | Anode c, d
2 | No Pin
3 | No Pin
4 | Internal Connection \( ^{[3]} \)
5 | No Pin
6 | No Pin
7 | Cathode d
8 | Cathode c
9 | Cathode dp
10 | Cathode a-b
11 | Internal Connection \( ^{[3]} \)
12 | No Pin
13 | No Pin
14 | Anode a-b, dp

NOTES:
1. Dimensions in millimeters and inches.
2. All unmarked dimensions are for reference only.
3. See Internal Circuit Diagram.
Features

- **COMMON CATHODE**
- **RIGHT HAND DP**
- **EXCELLENT CHARACTER APPEARANCE**
  - Continuous Uniform Segments
  - Wide Viewing Angle
  - High Contrast
- **IC COMPATIBLE**
- **STANDARD 0.3” DIP LEAD CONFIGURATION**
  - PC Board or Standard Socket Mountable
- **CATEGORIZED FOR LUMINOUS INTENSITY**
  - Assures Uniformity of Light Output from Unit to Unit within a Single Category

Description

The HP 5082-7740 is a common cathode LED numeric display with a right hand decimal point. The large 7.62mm (0.3”) high character size generates a bright, continuously uniform 7 segment display. Designed for viewing distances of up to 10 feet, this single digit display has been human engineered to provide a high contrast ratio and wide viewing angle.

The 5082-7740 utilizes a standard 7.62mm (.3”) dual-in-line package configuration that allows for quick mounting on PC boards or in standard IC sockets. Requiring a forward voltage of only 1.6V, the display is inherently IC compatible allowing for easy integration into electronic calculators, credit card verifiers, TVs, radios, and digital clocks.
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment(^{(1)})</td>
<td>(I_{\text{AVE}})</td>
<td>(I_{\text{PEAK}}=100,\text{mA}) 10% Duty Cycle</td>
<td>50</td>
<td>200</td>
<td>350</td>
<td>(\mu\text{cd})</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>(\lambda_{\text{PEAK}})</td>
<td>(I_{\text{F}}=20,\text{mA DC})</td>
<td>655</td>
<td>nm</td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Dominant Wavelength(^{(2)})</td>
<td>(\lambda_{d})</td>
<td>(I_{\text{F}}=100,\text{mA})</td>
<td>639</td>
<td>nm</td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Forward Voltage/Segment or D.P. (^{(3)})</td>
<td>(V_{F})</td>
<td>(V_{R}=6,\text{V})</td>
<td>2.0</td>
<td>2.3</td>
<td></td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Reverse Current/Segment or D.P. (^{(3)})</td>
<td>(I_{R})</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Rise and Fall Time(^{(3)})</td>
<td>(t_{r}, t_{f})</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage</td>
<td>(\Delta V_{F}/\degree\text{C})</td>
<td></td>
<td>-2.0</td>
<td></td>
<td></td>
<td>(\text{mV} / \degree\text{C})</td>
</tr>
<tr>
<td>Temperature Coefficient of Luminous Intensity</td>
<td>(\Delta I_{\text{AVE}}/\degree\text{C})</td>
<td></td>
<td>-1.0</td>
<td></td>
<td></td>
<td>% / \degree\text{C}</td>
</tr>
</tbody>
</table>

NOTES:
1. Derate from 35°\(^{\circ}\) at .3mA/°C per segment or D.P.
2. Clean only in Freon TF, Isopropanol, Ethanol, Freon TE, Genesolv DI-15, Genesolv DE-15, or water.

Electrical/Optical Characteristics at \(T_{A}=25\,\degree\text{C}\)

NOTE:
1. The digits are categorized for luminous intensity such that the variation from digit to digit within a category is not discernible to the eye. Intensity categories are designated by a letter located on the right hand side of the package.
2. Dominant wavelength, \(\lambda_{d}\), is derived from the C.I.E. Chromaticity diagram and represents that single wavelength which is perceived by the eye.
3. Time for a 10%-90% change of light intensity for step change in current.

Figure 1. Normalized Angular Distribution of Luminous Intensity.

Figure 2. Forward Current versus Forward Voltage.

Figure 3. Relative Efficiency (Luminous Intensity per Unit Current) versus Peak Current per Segment.
Features

- **5082-7750**
  - Common Anode
  - Left Hand D.P.

- **5082-7751**
  - Common Anode
  - Right Hand D.P.

- **5082-7756**
  - Polarity and Overflow Indicator
  - Universal Pinout
  - Right Hand D.P.

- **5082-7760**
  - Common Cathode
  - Right Hand D.P.

- **LARGE DIGIT**
  - Viewing Up to 6 Meters (19.7 Feet)

- **EXCELLENT CHARACTER APPEARANCE**
  - Continuous Uniform Segments
  - Wide Viewing Angle
  - High Contrast

- **IC COMPATIBLE**

- **STANDARD 7.62mm (.3 in.) DIP LEAD CONFIGURATION**
  - PC Board or Standard Socket Mountable

- **CATEGORIZED FOR LUMINOUS INTENSITY**
  - Assures Uniformity of Light Output from Unit to Unit within a Single Category

Description

The 5082-7750/7760 series are large 10.92mm (.43 in.) GaAsP LED seven segment displays. Designed for viewing distances up to 6 meters (19.7 feet), these single digit displays provide a high contrast ratio and a wide viewing angle.

These devices utilize a standard 7.62mm (.3 in.) dual-inline package configuration that permits mounting on PC boards or in standard IC sockets. Requiring a low forward voltage, these displays are inherently IC compatible, allowing for easy integration into electronic instrumentation, point of sale terminals, TVs, radios, and digital clocks.

Devices

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Package Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7750</td>
<td>Common Anode Left Hand Decimal</td>
<td>A</td>
</tr>
<tr>
<td>-7751</td>
<td>Common Anode Right Hand Decimal</td>
<td>B</td>
</tr>
<tr>
<td>-7756</td>
<td>Universal Overflow ±1 Right Hand Decimal</td>
<td>C</td>
</tr>
<tr>
<td>-7760</td>
<td>Common Cathode Right Hand Decimal</td>
<td>D</td>
</tr>
</tbody>
</table>

Note: Universal pinout brings the anode and cathode of each segment’s LED out to separate pins. See internal diagram C.
Package Dimensions

**Internal Circuit Diagram**

**Absolute Maximum Ratings**

- DC Power Dissipation Per Segment or D.P.\(^{(1)}\) (\(T_A=25^\circ\)C) ........................................ 42mW
- Operating Temperature Range .................................. -20° C to +85°C
- Storage Temperature Range ...................................... -20° C to +85°C
- Peak Forward Current Per Segment or D.P.\(^{(3)}\) (\(T_A=25^\circ\)C) ........................................ 150mA
- DC Forward Current Per Segment or D.P.\(^{(1,2)}\) (\(T_A=25^\circ\)C) ........................................ 25mA
- Reverse Voltage Per Segment or D.P. ........................................ 6.0V
- Lead Soldering Temperature ........................................ 230°C for 3 Sec [1.59mm (1/16 inch) below seating plane\(^{(4)}\)]

Notes: 1. See power derating curve (Fig.2). 2. Derate average current from 50°C at 0.43mA/°C per segment. 3. See Maximum Tolerable Segment Peak Current vs. Pulse Duration curve, (Fig. 1). 4. Clean only in water, isopropanol, ethanol, Freon TF or TE (or equivalent) and Genesolv Di-150 or DE-15 (or equivalent).
Electrical/Optical Characteristics at \( T_A = 25^\circ C \)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment (^{(2,4)})</td>
<td>( I_V )</td>
<td>( I_{\text{PEAK}} = 100, mA )</td>
<td>( I_F = 20, mA )</td>
<td>350</td>
<td>( \mu \text{cd} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.5% Duty Cycle</td>
<td></td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( \lambda_{\text{PEAK}} )</td>
<td></td>
<td></td>
<td>655</td>
<td></td>
<td>( \text{nm} )</td>
</tr>
<tr>
<td>Dominant Wavelength (^{(2)})</td>
<td>( \lambda_d )</td>
<td></td>
<td></td>
<td>645</td>
<td></td>
<td>( \text{nm} )</td>
</tr>
<tr>
<td>Forward Voltage, any Segment or D.P.</td>
<td>( V_F )</td>
<td>( I_F = 20, mA )</td>
<td></td>
<td>1.6</td>
<td>2.0</td>
<td>( \text{V} )</td>
</tr>
<tr>
<td>Reverse Current, any Segment or D.P.</td>
<td>( I_R )</td>
<td>( V_R = 6, V )</td>
<td></td>
<td>10</td>
<td></td>
<td>( \mu \text{A} )</td>
</tr>
<tr>
<td>Rise and Fall Time (^{(3)})</td>
<td>( t_{\text{R,F}} )</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td>( \text{ns} )</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage</td>
<td>( \Delta V_F / \circ C )</td>
<td></td>
<td></td>
<td>-2.0</td>
<td></td>
<td>( \text{mV} / \circ C )</td>
</tr>
<tr>
<td>Temperature Coefficient of Luminous Intensity</td>
<td>( \Delta I_V / \circ C )</td>
<td></td>
<td></td>
<td>-1.0</td>
<td></td>
<td>( % / \circ C )</td>
</tr>
</tbody>
</table>

Notes:
1. The digits are categorized for luminous intensity with the intensity category designated by a letter located on the right hand side of the package.
2. The dominant wavelength, \( \lambda_d \), is derived from the CIE Chromaticity Diagram and is that single wavelength which defines the color of the device.
3. Time for a 10\% - 90\% change of light intensity for step change in current.
4. Temperature coefficient of luminous intensity \( I_V / \circ C \) is determined by the formula: \( I_V = I_{V_{25}} \circ C (0.982)^{(T_A - 25 \circ C)} \)

### Operational Considerations

#### ELECTRICAL

The 5082-7750/7760 series display is composed of eight light emitting diodes optically magnified to form seven individual segments and decimal point.

The diodes are made of GaAsP (Gallium Arsenide Phosphide) junction on a GaAs substrate. Diode turn-on voltage is approximately 1.55 volts and typical forward diode resistance is 5 ohms. For strobing at peak currents a user should take this forward resistance into account.

Typical forward voltage may be scaled from Figure 4 or calculated from the following formula:
\[
V_F = 1.55V + (50 \times I_{\text{PEAK}})
\]

Figure 1 relates refresh rate, \( f \), and pulse duration, \( t_p \), to a ratio which defines the maximum desirable operating peak current as a function of derated dc current, \( I_{\text{PEAK}} / I_{\text{DC MAX}} \). To most effectively utilize Figure 1, perform the following steps:

1. Determine desired duty factor.
   - Example: Four digit display, duty factor = 1/4.
2. Determine desired refresh rate, \( f \). Use duty factor to calculate pulse duration, \( t_p \).
   - Note: \( t_p = \text{Duty Factor} \times f \times 1\, \text{kHz} \)
   - Example: \( f = 1\, \text{kHz} \), \( t_p = 250 \, \mu \text{sec} \).
3. Enter Figure 1 at the calculated \( t_p \). Move vertically to the refresh rate line and then record the corresponding value of \( I_{\text{PEAK}} / I_{\text{DC MAX}} \).
   - Example: At \( t_p = 250 \, \mu \text{sec} \), \( f = 1\, \text{kHz} \), \( I_{\text{PEAK}} / I_{\text{DC MAX}} = 3.0 \).
4. From Figure 2, determine the value for \( I_{\text{DC MAX}} \).
   - Note: \( I_{\text{DC MAX}} \) is derated above \( T_A = 50^\circ C \).
   - Example: At \( T_A = 70^\circ C \), \( I_{\text{DC MAX}} = 16.4\, mA \).
5. Calculate \( I_{\text{PEAK}} \) from \( I_{\text{PEAK}} / I_{\text{DC MAX}} \) ratio and calculate \( I_{\text{AVG}} \) from \( I_{\text{PEAK}} \) and duty factor.
   - Example: \( I_{\text{PEAK}} = (3.0) (16.4\, mA) = 49.2\, mA \) peak
   - \( I_{\text{AVG}} = (1/4) (49.2\, mA) = 12.3\, mA \) average.

The above calculations determine the maximum tolerable strobing conditions. Operation at a reduced peak current or duty factor is suggested to help insure even more reliable operation.

Refresh rates of 1kHz or faster provide the most efficient operation resulting in the maximum possible time average luminous intensity.

This display may be operated at various peak currents (see Figure 3). Light output for a selected peak current may be calculated from the 20mA value using the following formula:
\[
i_V = (I_{V_{20mA}}) \eta_{\text{PEAK}} \frac{I_{\text{AVG}}}{20\, mA}
\]

Where:
- \( I_V \) = Luminous Intensity at desired \( I_{\text{AVG}} \)
- \( I_{V_{20mA}} \) = Luminous Intensity at \( I_F = 20\, mA \)
- \( I_{\text{AVG}} \) = Average Forward Current per segment = \( (I_{\text{PEAK}} \times \text{Duty Factor}) \)
- \( \eta_{\text{PEAK}} \) = Relative Efficiency Factor at Peak

Operating Forward Current from Figure 3.

#### CONTRAST ENHANCEMENT

The 5082-7750/7760 series display may be effectively filtered using one of the following filter products: Homalite H 100-1605; Panelgraphic Ruby Red 60 or Dark Red 63; Plexiglas 2423; 3M Brand Light Control Film for daylight viewing.

#### MECHANICAL

The 5082-7750/7760 series devices are constructed utilizing a lead frame in a standard DIP package. The individual packages may be close-packed on 12.7mm (.5 in.) centers on a PC board. Also, the larger character height allows other character spacing options when desired. The lead frame has an integral seating plane which will hold the package approximately 1.52mm (.060 in.) above the PC board during standard soldering and flux removal operation. To optimize device performance, new materials are used that are limited to certain solvent materials for flux removal. It is recommended that only mixtures of Freon and alcohol be used for post solder vapor cleaning processes, with an immersion time in the vapors up to two minutes maximum. Suggested products are Freon TF, Freon TE, Genesolv DI-15 and Genesolv DE-15. Isoproponal, Ethanol or water may also be used for cleaning operations.
OPERATION IN THIS REGION REQUIRES TEMPERATURE DERATING OF IoCMAX.

Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration.

Figure 2. Maximum Allowable DC Current and DC Power Dissipation per Segment as a Function of Ambient Temperature.

Figure 3. Relative Efficiency (Luminous Intensity per Unit Current) versus Peak Current per Segment.

Figure 4. Forward Current versus Forward Voltage.

Figure 5. Normalized Angular Distribution of Luminous Intensity.
Features

- **ULTRA LOW POWER**
  Excellent Readability at Only 500 μA
  Average per Segment

- **CONSTRUCTED FOR STROBED OPERATION**
  Minimizes Lead Connections

- **STANDARD DIP PACKAGE**
  End Stackable
  Integral Red Contrast Filter
  Rugged Construction

- **CATEGORIZED FOR LUMINOUS INTENSITY**
  Assures Uniformity of Light Output from Unit to Unit within a Single Category

- **IC COMPATIBLE**

Description

The HP 5082-7400 series are 2.79mm (.11"), seven segment GaAsP numeric indicators packaged in 3, 4, and 5 digit end-stackable clusters. An integral magnification technique increases the luminous intensity, thereby making ultra-low power consumption possible. Options include either the standard lower right hand decimal point or a centered decimal point for increased legibility in multi-cluster applications.

Applications include hand-held calculators, portable instruments, digital thermometers, or any other product requiring low power, low cost, minimum space, and long lifetime indicators.

Device Selection Guide

<table>
<thead>
<tr>
<th>Digits per Cluster</th>
<th>Configuration</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Center Decimal Point</td>
</tr>
<tr>
<td>3 (right)</td>
<td><img src="image" alt="3 digits right" /></td>
<td>5082-7402</td>
</tr>
<tr>
<td>3 (left)</td>
<td><img src="image" alt="3 digits left" /></td>
<td>5082-7403</td>
</tr>
<tr>
<td>4</td>
<td><img src="image" alt="4 digits" /></td>
<td>5082-7404</td>
</tr>
<tr>
<td>5</td>
<td><img src="image" alt="5 digits" /></td>
<td>5082-7406</td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current per Segment (Duration &lt; 1 msec)</td>
<td>$I_{PEAK}$</td>
<td>110</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Average Current per Segment</td>
<td>$I_{AVG}$</td>
<td>5</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation per Digit [1]</td>
<td>$P_D$</td>
<td>80</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>$T_A$</td>
<td>-40</td>
<td>75</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_S$</td>
<td>-40</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>$V_R$</td>
<td>5</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

NOTES: 1. At 25°C; derate 1 mW/°C above 25°C ambient.  2. See Mechanical Section for recommended flux removal solvents.

Electrical/Optical Characteristics at $T_A = 25°C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment or dp [3]</td>
<td>$I_V$</td>
<td>$I_{AVG} = 1 mA$ (duty cycle = 10%)</td>
<td>5</td>
<td>20</td>
<td></td>
<td>μcd</td>
</tr>
<tr>
<td>(Time Averaged)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or dp</td>
<td>$V_F$</td>
<td>$I_F = 10 mA$</td>
<td>1.6</td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Current/Segment or dp</td>
<td>$I_R$</td>
<td>$V_R = 5 V$</td>
<td>100</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Rise and Fall Time [4]</td>
<td>$t_r$, $t_f$</td>
<td>10</td>
<td></td>
<td>ns</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES: 3. The digits are categorized for luminous intensity. Intensity categories are designated by a letter located on the back side of the package. 4. Time for a 10%-90% change of light intensity for step change in current.

---

Figure 1. Forward Current vs. Forward Voltage.

Figure 2. Typical Time Averaged Luminous Intensity per Segment (Digit Average) vs. Average Current per Segment.

Figure 3. Relative Luminous Intensity vs. Case Temperature at Fixed Current Level.

Figure 4. Relative Luminous Efficiency vs. Peak Current per Segment.
NOTES: 1. Dimensions in millimeters and (inches).
2. Tolerances on all dimensions are ±0.038mm (±.015 in.) unless otherwise noted.

Package Description

Figure 5. 5082-7402/-7403/-7404/-7412/-7413/-7414

Figure 6. 5082-7405/7415

Magnified Character Font Description

Figure 7. Center Decimal Point Configuration

Figure 8. Right Decimal Point Configuration

Device Pin Description

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>5082-7402/7412 FUNCTION</th>
<th>5082-7403/7413 FUNCTION</th>
<th>5082-7404/7414 FUNCTION</th>
<th>5082-7405/7415 FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>CATHODE 1</td>
<td>CATHODE 1</td>
<td>CATHODE 1</td>
</tr>
<tr>
<td>2</td>
<td>ANODE e</td>
<td>ANODE e</td>
<td>ANODE e</td>
<td>ANODE e</td>
</tr>
<tr>
<td>3</td>
<td>ANODE c</td>
<td>ANODE c</td>
<td>ANODE c</td>
<td>ANODE c</td>
</tr>
<tr>
<td>4</td>
<td>CATHODE 3</td>
<td>CATHODE 3</td>
<td>CATHODE 3</td>
<td>CATHODE 3</td>
</tr>
<tr>
<td>5</td>
<td>ANODE dp</td>
<td>ANODE dp</td>
<td>ANODE dp</td>
<td>ANODE dp</td>
</tr>
<tr>
<td>6</td>
<td>CATHODE 4</td>
<td>N/C</td>
<td>CATHODE 4</td>
<td>ANODE d</td>
</tr>
<tr>
<td>7</td>
<td>ANODE g</td>
<td>ANODE g</td>
<td>ANODE g</td>
<td>CATHODE 5</td>
</tr>
<tr>
<td>8</td>
<td>ANODE d</td>
<td>ANODE d</td>
<td>ANODE d</td>
<td>ANODE g</td>
</tr>
<tr>
<td>9</td>
<td>ANODE f</td>
<td>ANODE f</td>
<td>ANODE f</td>
<td>CATHODE 4</td>
</tr>
<tr>
<td>10</td>
<td>CATHODE 2</td>
<td>CATHODE 2</td>
<td>CATHODE 2</td>
<td>ANODE f</td>
</tr>
<tr>
<td>11</td>
<td>ANODE b</td>
<td>ANODE b</td>
<td>ANODE b</td>
<td>(See Note 1)</td>
</tr>
<tr>
<td>12</td>
<td>ANODE a</td>
<td>ANODE a</td>
<td>ANODE a</td>
<td>ANODE b</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td>CATHODE 2</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>ANODE a</td>
</tr>
</tbody>
</table>

Note 1. Leave Pin 11 unconnected.
Electrical

Character encoding can be performed by commercially available BCD-7 segment decoder/driver circuits. Through the use of a strobing technique, only one decoder/driver is required for each display. In addition, the number of interconnection lines between the display and the drive circuitry is minimized to $8 + N$, where $N$ is the number of characters in the display.

Each of the segments on the display is "addressable" on two sets of lines — the "character enable" lines and the "segment enable" lines. Displays are wired so that all of the cathodes of all segments comprising one character are wired together to a single character enable line. Similarly, the anodes of each of like segments (e.g., all of the decimal points, all of the center line anodes, etc.) are wired to a single line. Therefore, a single digit in the cluster can be illuminated by connecting the appropriate character enable line, with the appropriate segment enable lines for the character being displayed. When each character in the display is illuminated in sequence, at a minimum of 100 times a second, flicker free characters are formed.

The decimal point in the 7412, 7413, 7414, and 7415 displays is located at the lower right of the digit for conventional driving schemes.

The 7402, 7403, 7404 and 7405 displays contain a centrally located decimal point which is activated in place of a digit. In long registers, this technique of setting off the decimal point significantly improves the display's readability. With respect to timing, the decimal point is treated as a separate character with its own unique time frame.

A detailed discussion of display circuits and drive techniques appears in Application Note 937.

Mechanical

The 5082-7400 series package is a standard 12 or 14 pin DIP consisting of a plastic encapsulated lead frame with integral molded lenses. It is designed for plugging into DIP sockets or soldering into PC boards. The lead frame construction allows use of standard DIP insertion tools and techniques. Alignment problems are simplified due to the clustering of digits in a single package. The shoulders of the lead frame pins are intentionally raised above the bottom of the package to allow tilt mounting of up to 20° from the PC board.

To improve display contrast, the plastic incorporates a red dye that absorbs strongly at all visible wavelengths except the 655 nm emitted by the LED. In addition, the lead frames are selectively darkened to reduce reflectance. An additional filter, such as Plexiglass 2423, Panelgraphic60 or 63, and Homalite 100-1600, will further lower the ambient reflectance and improve display contrast.

The devices can be soldered for up to 5 seconds at a maximum solder temperature of 230°C (1/16” below the seating plane). The plastic encapsulant used in these displays may be damaged by some solvents commonly used for flux removal. It is recommended that only Freon TE, Freon TE-35, Freon TF, Isopropanol, or soap and water be used for cleaning operations.

![Figure 9. Block Diagram for Calculator Display Using Lower Right Hand Decimal Point.](image1)

![Figure 10. Block Diagram for Display Using Center Decimal Point.](image2)
Features

- MOS COMPATIBLE
  Can be Driven Directly from many MOS Circuits

- LOW POWER
  Excellent Readability at Only 250 µA per Segment

- CONSTRUCTED FOR STROBED OPERATION
  Minimizes Lead Connections

- STANDARD DIP PACKAGE
  End Stackable
  Integral Red Contrast Filter
  Rugged Construction

- CATEGORIZED FOR LUMINOUS INTENSITY
  Assures Uniformity of Light Output from Unit to Unit within a Single Category

Description

The HP 5082-7430 series displays are 2.79mm (.11 inch), seven segment GaAsP numeric indicators packaged in 2 or 3 digit end-stackable clusters on 200 mil centers. An integral magnification technique increases the luminous intensity, thereby making ultra-low power consumption possible. These clusters have the standard lower right hand decimal points. Applications include hand-held calculators, portable instruments, digital thermometers, or any other product requiring low power, low cost, minimum space, and long lifetime indicators.

Device Selection Guide

<table>
<thead>
<tr>
<th>Digits per Cluster</th>
<th>Configuration</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(right)</td>
<td></td>
<td>5082-7432</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>5082-7433</td>
</tr>
</tbody>
</table>
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current per Segment or dp (Duration &lt; 500µs)</td>
<td>$I_{\text{PEAK}}$</td>
<td>50</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Average Current per Segment or dp</td>
<td>$I_{\text{AVG}}$</td>
<td>5</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation per Digit</td>
<td>$P_D$</td>
<td>80</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>$T_A$</td>
<td>-40</td>
<td>75</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_S$</td>
<td>-40</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>$V_R$</td>
<td>5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Solder Temperature 1/16&quot; below seating plane (t ≤ 3 sec.)</td>
<td></td>
<td></td>
<td>230</td>
<td>°C</td>
</tr>
</tbody>
</table>

**NOTES:** 1. Derate linearly @ 1 mW/°C above 25°C ambient.  2. See Mechanical section for recommended flux removal solvents.

### Electrical/Optical Characteristics at $T_A=25°C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment or dp</td>
<td>$I_V$</td>
<td>$I_{\text{AVG}} = 500µA$ (duty cycle = 10%)</td>
<td>10</td>
<td>40</td>
<td></td>
<td>µcd</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{\text{PEAK}}$</td>
<td></td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or dp</td>
<td>$V_F$</td>
<td>$I_F = 5$ mA</td>
<td>1.56</td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Current/Segment or dp</td>
<td>$I_R$</td>
<td>$V_R = 5$ V</td>
<td>100</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Rise and Fall Time</td>
<td>$t_{r, f}$</td>
<td></td>
<td>10</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:** 3. The digits are categorized for luminous intensity. Intensity categories are designated by a letter located on the back side of the package.  4. Time for a 10%-90% change of light intensity for step change in current.

---

**Figure 1.** Peak Forward Current vs. Peak Forward Voltage

**Figure 2.** Typical Time Averaged Luminous Intensity per Segment vs. Average Current per Segment

**Figure 3.** Relative Luminous Intensity vs. Ambient Temperature at Fixed Current Level

**Figure 4.** Relative Luminous Efficiency vs. Peak Current per Segment
Package Description

Figure 5.

Magnified Character Font Description

Figure 6.

Device Pin Description

<table>
<thead>
<tr>
<th>PIN NUMBER</th>
<th>5082-7432 FUNCTION</th>
<th>5082-7433 FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>CATHODE 1</td>
</tr>
<tr>
<td>2</td>
<td>ANODE e</td>
<td>ANODE e</td>
</tr>
<tr>
<td>3</td>
<td>ANODE d</td>
<td>ANODE d</td>
</tr>
<tr>
<td>4</td>
<td>CATHODE 2</td>
<td>CATHODE 2</td>
</tr>
<tr>
<td>5</td>
<td>ANODE c</td>
<td>ANODE c</td>
</tr>
<tr>
<td>6</td>
<td>ANODE dp</td>
<td>ANODE dp</td>
</tr>
<tr>
<td>7</td>
<td>CATHODE 3</td>
<td>CATHODE 3</td>
</tr>
<tr>
<td>8</td>
<td>ANODE b</td>
<td>ANODE b</td>
</tr>
<tr>
<td>9</td>
<td>ANODE g</td>
<td>ANODE g</td>
</tr>
<tr>
<td>10</td>
<td>ANODE a</td>
<td>ANODE a</td>
</tr>
<tr>
<td>11</td>
<td>ANODE f</td>
<td>ANODE f</td>
</tr>
<tr>
<td>12</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>
Electrical/Optical

The 5082-7430 series devices utilize a monolithic GaAsP chip of 8 common cathode devices for each display digit. The segment anodes of each digit are interconnected, forming an 8 by N line array, where N is the number of characters in the display. Each chip is positioned under an integrally molded lens giving a magnified character height of 2.79mm (0.11) inches. Satisfactory viewing will be realized within an angle of approximately ±20° from the center-line of the digit.

To improve display contrast, the plastic encapsulant contains a red dye to reduce the reflected ambient light. An additional filter, such as Plexiglass 2423, Panelgraphic 60 or 63, and Homalite 100-1600, will further lower the ambient reflectance and improve display contrast.

Character encoding on the 5082-7430 series devices is performed by standard 7 segment decoder/driver circuits. Through the use of strobing techniques only one decoder/driver is required for very long multidigit displays.

A discussion of display circuits and drive techniques appears in Application Note 946.

Mechanical

The 5082-7430 series package is a standard 12 Pin DIP consisting of a plastic encapsulated lead frame with integrally molded lenses. It is designed for plugging into DIP sockets or soldering into PC boards. Alignment problems are simplified due to the clustering of digits in a single package.

The devices can be soldered for up to 3 seconds at a maximum solder temperature of 230°C (1/16” below the seating plane). The plastic encapsulant used in these displays may be damaged by some solvents commonly used for flux removal. It is recommended that only Freon TE, Freon TE-35, Freon TF, Isopropanol, or soap and water be used for cleaning operations.
Features

- MOS COMPATIBLE
  Can be driven directly from MOS circuits.

- LOW POWER
  Excellent readability at only 250μA average per segment.

- UNIFORM ALIGNMENT
  Excellent alignment is assured by design.

- MATCHED BRIGHTNESS
  Uniformity of light output from digit to digit on a single PC Board.

- AVAILABLE IN 50.8mm (2.0 inch) AND 60.325mm (2.375 inch) BOARD LENGTHS

Description

The HP 5082-7440 series displays are 2.67mm (.105") high, seven segment GaAsP Numeric Indicators mounted in an eight or nine digit configuration on a P.C. Board. These special parts, designed specifically for calculators, have right hand decimal points and are mounted on 5.08mm (200 mil) centers. The plastic lens magnifies the digits and includes an integral protective bezel. Applications are primarily portable, hand-held calculators and other products requiring low power, low cost and long lifetime indicators which occupy a minimum of space.

Device Selection Guide

<table>
<thead>
<tr>
<th>Digits Per PC Board</th>
<th>Configuration</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>![Digits 8]</td>
<td>5082-7440</td>
</tr>
<tr>
<td></td>
<td>(Figure 5)</td>
<td>5082-7448</td>
</tr>
<tr>
<td>9</td>
<td>![Digits 9]</td>
<td>5082-7441</td>
</tr>
<tr>
<td></td>
<td>(Figure 5)</td>
<td>5082-7449</td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current per Segment or dp (Duration &lt; 500\mu s)</td>
<td>I_{PEAK}</td>
<td>50</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>Average Current per Segment or dp [1]</td>
<td>I_{AVG}</td>
<td>3</td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation per Digit</td>
<td>P_D</td>
<td>50</td>
<td>50</td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>T_A</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_S</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>V_R</td>
<td>5</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Solder Temperature at connector edge (t&lt;3 sec.) [2]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES: 1. Derate linearly @ 0.1mA/°C above 60°C ambient. 2. See Mechanical section for recommended soldering techniques and flux removal solvents.

Electrical/Optical Characteristics at T_A=25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment or dp</td>
<td>I_V</td>
<td>I_{AVG} = 500\mu A</td>
<td>9</td>
<td>40</td>
<td></td>
<td>\mu cd</td>
</tr>
<tr>
<td>(I_{PK} = 5, mA, duty cycle = 10%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>\lambda_{peak}</td>
<td></td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or dp [3]</td>
<td>V_F</td>
<td>I_F = 5 mA</td>
<td>1.55</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

NOTES: 3. See Figure 7 for test circuit. 4. Operation at Peak Currents of less than 3.5mA is not recommended.

---

**Figure 1.** Peak Forward Current vs. Peak Forward Voltage

**Figure 2.** Typical Time Averaged Luminous Intensity per Segment vs. Average Current per Segment

**Figure 3.** Relative Luminous Intensity vs. Ambient Temperature at Fixed Current Level

**Figure 4.** Relative Luminous Efficiency vs. Peak Current per Segment
Package Description

Figure 5.

Magnified Character Font Description

DEVICES
5082-7440
5082-7441
5082-7448
5082-7449

Note: All dimensions in millimeters and inches.

Figure 6.

Table 1.

Device Pin Description

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5082-7440</td>
<td>5082-7441</td>
<td>5082-7448</td>
<td>5082-7449</td>
</tr>
<tr>
<td></td>
<td>Function</td>
<td>Function</td>
<td>Function</td>
<td>Function</td>
</tr>
<tr>
<td>1</td>
<td>N/C</td>
<td>Dlg. 1 Cathode</td>
<td>Dlg. 2 Cathode</td>
<td>Dlg. 3 Cathode</td>
</tr>
<tr>
<td>2</td>
<td>Seg. c Anode</td>
<td>Seg. c Anode</td>
<td>Dlg. 2 Cathode</td>
<td>Seg. a Anode</td>
</tr>
<tr>
<td>3</td>
<td>Dlg. 2 Cathode</td>
<td>Dlg. 2 Cathode</td>
<td>Dlg. 3 Cathode</td>
<td>Dlg. 4 Cathode</td>
</tr>
<tr>
<td>5</td>
<td>Dlg. 3 Cathode</td>
<td>Dlg. 3 Cathode</td>
<td>Dlg. 3 Cathode</td>
<td>Dlg. 4 Cathode</td>
</tr>
<tr>
<td>6</td>
<td>Seg. a Anode</td>
<td>Seg. a Anode</td>
<td>Seg. a Anode</td>
<td>Seg. a Anode</td>
</tr>
<tr>
<td>7</td>
<td>Dlg. 4 Cathode</td>
<td>Dlg. 4 Cathode</td>
<td>Dlg. 4 Cathode</td>
<td>Dlg. 4 Cathode</td>
</tr>
<tr>
<td>8</td>
<td>Seg. e Anode</td>
<td>Seg. e Anode</td>
<td>Seg. e Anode</td>
<td>Seg. e Anode</td>
</tr>
<tr>
<td>9</td>
<td>Dlg. 5 Cathode</td>
<td>Dlg. 5 Cathode</td>
<td>Dlg. 5 Cathode</td>
<td>Dlg. 5 Cathode</td>
</tr>
</tbody>
</table>
Electrical/Optical

The HP 5082-7440 series devices utilize a monolithic GaAsP chip containing 7 segments and a decimal point for each display digit. The segments of each digit are interconnected, forming an 8 by N line array, where N is the number of characters in the display. Each chip is positioned under a separate element of a plastic magnifying lens, producing a magnified character height of 0.105" (2.67mm). Satisfactory viewing will be realized within an angle of approximately ±20° from the centerline of the digit. The secondary lens magnifier will increase character height from 2.67mm (0.105") to 3.33mm (0.131") and reduce viewing angle in the vertical plane only from ±20° to approximatively ±18°.

Figure 7. Circuit Diagram used for Testing the Luminous Intensity of the HP 5082-7440

Mechanical

The 5082-7440 series devices are constructed on a standard printed circuit board substrate. A separately molded plastic lens containing 9 individual magnifying elements is attached to the PC board over the digits. The device may be mounted either by use of pins which may be soldered into the plate through holes at the connector edge of the board or by insertion into a standard PC board connector.

The devices may be soldered for up to 3 seconds per tab at a maximum soldering temperature of 230°C. Heat should be applied only to the edge connector tab areas of the PC board. Heating other areas of the board to temperatures in excess of 85°C can result in permanent damage to the display. It is recommended that a rosin core wire solder or a low temperature deactivating flux and solid core wire solder be used in soldering operations.

Special Cleaning Instructions

For bulk cleaning after a flow solder operation, the following process is recommended: Wash display in clean liquid Freon TP-35 or Freon TE-35 solvent for a time period up to 2 minutes maximum. Air dry for a sufficient length of time to allow solvent to evaporate from beneath display lens. Maintain solvent temperature below 30°C (86°F). Methanol, isopropanol, or ethanol may be used for hand cleaning at room temperature. Water may be used for hand cleaning if it is not permitted to collect under display lens. Solvent vapor cleaning at elevated temperatures is not recommended as such processes will damage display lens. Ketones, esters, aromatic and chlorinated hydrocarbon solvents will also damage display lens. Alcohol base active rosin flux mixtures should be prevented from coming in contact with display lens.

These devices are constructed on a silver plated printed circuit board. To prevent the formation of a tarnish (Ag2S) which could impair solderability, the boards should be stored in the unopened shipping packages until they are used. Further information on the storage, handling and cleaning of silver-plated components is contained in Hewlett-Packard Application Bulletin No. 3.
Features

- **MOS COMPATIBLE**
  Can be driven directly from most MOS circuits.

- **LOW POWER**
  Excellent readability at only 250μA average per segment.

- **UNIFORM ALIGNMENT**
  Excellent Alignment is assured by design.

- **MATCHED BRIGHTNESS**
  Uniformity of light output from digit to digit on a single PC board.

- **14-DIGIT AVAILABLE IN TWO DIGIT HEIGHTS [mm (inches)]**
  [2.54(.100) AND 2.84(.112)]

- **12-DIGIT DISPLAYS AVAILABLE IN TWO PINOUTS.**

Description

The HP 5082-7442, 7444, 7445, and 7447 are seven segment GaAsP Numeric indicators mounted in 12 or 14 digit configurations on a P.C. board. These special parts designed specifically for scientific and business calculators have right hand decimal points and are mounted on 175 mil (4.45mm) centers in the 12 digit configurations and 150 mil (3.81mm) centers in the 14 digit configurations. The plastic lens magnifies the digits and includes an integral protective bezel.

Applications are primarily portable, hand held calculators and other products requiring low power, low cost, and long lifetime indicators which occupy a minimum of space.

Device Selection Guide

<table>
<thead>
<tr>
<th>Digits Per PC Board</th>
<th>Digit Height mm (inches)</th>
<th>Configuration</th>
<th>Package</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>2.54 (.100)</td>
<td></td>
<td>Figure 4</td>
<td>7442 and 7445</td>
</tr>
<tr>
<td>14</td>
<td>2.54 (.100)</td>
<td></td>
<td>Figure 5</td>
<td>7444</td>
</tr>
<tr>
<td>14</td>
<td>2.84 (.112)</td>
<td></td>
<td>Figure 5</td>
<td>7447</td>
</tr>
</tbody>
</table>

*5082-7447 is a 5082-7444 with a slide-in cylindrical lens to provide added magnification.*
### Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current per Segment or dp (Duration &lt;500μs)</td>
<td>I_{PEAK}</td>
<td>50</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Average Current per Segment or dp(^{(1)})</td>
<td>I_{AVG}</td>
<td>3</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation per Digit</td>
<td>P_{D}</td>
<td>50</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>T_{A}</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_{S}</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>V_{R}</td>
<td>5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Solder Temperature at connector edge (t ≤3 sec.)(^{(2)})</td>
<td></td>
<td>230</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Derate linearly at 0.1mA/°C above 60°C ambient.
2. See Mechanical section for recommended soldering techniques and flux removal solvents.

### Electrical/Optical Characteristics at \(T_A=25°C\)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>7442/7445</td>
<td>Luminous intensity/ Segment or dp(^{(3)}) (Digit Average)</td>
<td>I_{V}</td>
<td>5mA Peak 1/12 Duty Cycle</td>
<td>7</td>
<td>35</td>
<td></td>
<td>μcd</td>
</tr>
<tr>
<td>7444/7447</td>
<td>Peak Wavelength</td>
<td>\lambda_{PEAK}</td>
<td>5mA Peak 1/14 Duty Cycle</td>
<td>7</td>
<td>35</td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>7442/7445</td>
<td>Forward Voltage/ Segment or dp</td>
<td>V_{F}</td>
<td>I_{F} = 5mA</td>
<td>1.55</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

**NOTE:** 3. Operation at Peak Currents of less than 3.5mA is not recommended.

### Electrical/Optical

The HP 5082-7442, 7444, 7445 and 7447 devices utilize a monolithic GaAsP chip containing 7 segments and a decimal point for each display digit. The segments of each digit are interconnected, forming an 8 by N line array, where N is the number of digits in the display. Each chip is positioned under a separate element of a plastic magnifying lens, producing a magnified character. Satisfactory viewing will be realized within an angle of approximately ±20° from the centerline of the digit. A filter, such as plexiglass 2423, Panelgraphic 60 or 63, and Homalite 100-1600, will lower the ambient reflectance and improve display contrast. Digit encoding of these devices is performed by standard 7 segment decoder driver circuits.

These devices are tested for digit-to-digit luminous intensity matching. This test is performed with a power supply of 5V and component values selected to supply 5mA \(I_{PEAK}\) at \(V_F = 1.55V\). If the device is to be driven from \(V_{CC}\) potentials of less than 3.5 volts, it is recommended that the factory be contacted.
Mechanical Specifications

The 5082-7442, 7444, 7445 and 7447 devices are constructed on a silver plated printed circuit board substrate. A molded plastic lens array is attached to the PCB over the digits to provide magnification.

These devices may be mounted using any one of several different techniques. The most straightforward is the use of standard PC board edge connectors. A less expensive approach can be implemented through the use of stamped or etched metal mounting clips such as those available from Burndy (Series LED-B) or JAV Manufacturing (Series 1255). Some of these devices will also serve as an integral display support. A third approach would be the use of a row of wire stakes which would first be soldered to the PC mother-board and the display board then inserted over the wire stakes and soldered in place.

The devices may be soldered for up to 3 seconds per tab at a maximum soldering temperature of 230°C. Heat should be applied only to the edge connector tab areas of the PC board. Heating other areas of the board to temperatures in excess of 85°C can result in permanent damage to the lens. It is recommended that a rosin core wire solder or a low temperature deactivating flux and solid core wire solder be used in soldering operations. A solder containing approximately 2% silver (Sn 62) will enhance solderability by preventing leaching of the plated silver off the PC board into the solder solution.

Device Pin Description

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-7442</td>
<td></td>
<td>5082-7444</td>
<td></td>
</tr>
<tr>
<td>5082-7447</td>
<td></td>
<td>5082-7445</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cathode - Digit 1</td>
<td>2</td>
<td>Cathode - Digit 2</td>
</tr>
<tr>
<td>2</td>
<td>Cathode - Digit 2</td>
<td>3</td>
<td>Cathode - Digit 3</td>
</tr>
<tr>
<td>3</td>
<td>Cathode - Digit 3</td>
<td>4</td>
<td>Anode - Segment c</td>
</tr>
<tr>
<td>4</td>
<td>Anode - Segment c</td>
<td>5</td>
<td>Cathode - Digit 4</td>
</tr>
<tr>
<td>5</td>
<td>Cathode - Digit 4</td>
<td>6</td>
<td>Anode - DP</td>
</tr>
<tr>
<td>6</td>
<td>Anode - DP</td>
<td>7</td>
<td>Cathode - Digit 5</td>
</tr>
<tr>
<td>7</td>
<td>Cathode - Digit 5</td>
<td>8</td>
<td>Anode - Segment a</td>
</tr>
<tr>
<td>8</td>
<td>Anode - Segment a</td>
<td>9</td>
<td>Cathode - Digit 6</td>
</tr>
<tr>
<td>9</td>
<td>Cathode - Digit 6</td>
<td>10</td>
<td>Anode - Segment e</td>
</tr>
<tr>
<td>10</td>
<td>Anode - Segment e</td>
<td>11</td>
<td>Cathode + Digit 7</td>
</tr>
<tr>
<td>11</td>
<td>Cathode + Digit 7</td>
<td>12</td>
<td>Anode - Segment d</td>
</tr>
<tr>
<td>12</td>
<td>Anode - Segment d</td>
<td>13</td>
<td>Cathode - Digit 8</td>
</tr>
<tr>
<td>13</td>
<td>Cathode - Digit 8</td>
<td>14</td>
<td>Anode - Segment g</td>
</tr>
<tr>
<td>14</td>
<td>Anode - Segment g</td>
<td>15</td>
<td>Cathode - Digit 9</td>
</tr>
<tr>
<td>15</td>
<td>Cathode - Digit 9</td>
<td>16</td>
<td>Anode - Segment b</td>
</tr>
<tr>
<td>16</td>
<td>Anode - Segment b</td>
<td>17</td>
<td>Cathode - Digit 10</td>
</tr>
<tr>
<td>17</td>
<td>Cathode - Digit 10</td>
<td>18</td>
<td>Anode - Segment f</td>
</tr>
<tr>
<td>18</td>
<td>Anode - Segment f</td>
<td>19</td>
<td>Cathode - Digit 11</td>
</tr>
<tr>
<td>19</td>
<td>Cathode - Digit 11</td>
<td>20</td>
<td>Cathode - Digit 12</td>
</tr>
<tr>
<td>20</td>
<td>Cathode - Digit 12</td>
<td>21</td>
<td>Cathode - Digit 13</td>
</tr>
<tr>
<td>21</td>
<td>Cathode - Digit 13</td>
<td>22</td>
<td>Cathode - Digit 14</td>
</tr>
<tr>
<td>22</td>
<td>Cathode - Digit 14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Special Cleaning Instructions

For bulk cleaning after a flow solder operation, the following process is recommended. Wash display in clean liquid Freon TP - 35 or Freon TE - 35 solvent for a time period up to 2 minutes maximum. Air dry for a sufficient length of time to allow solvent to evaporate from beneath display lens. Maintain solvent temperature below 30°C (86°F). Methanol, isopropanol, or ethanol may be used for cleaning at room temperature. Soap and water solutions may be utilized for removing water-soluble fluxes from the contact area but must not be allowed to collect under the display lens.

Solvent vapor cleaning at elevated temperatures is not recommended as such processes will damage display lens. Ketones, esters, aromatic and chlorinated hydrocarbon solvents will also damage display lens. Alcohol base active rosin flux mixtures should be prevented from coming in contact with display lens.

These devices are constructed on a silver plated printed circuit board. To prevent the formation of a tarnish (Ag,S) which could impair solderability, the boards should be stored in the unopened shipping packages until they are used. Further information on the storage, handling and cleaning of silver-plated components is contained in Hewlett-Packard Application Bulletin No. 3.
Package Dimensions

NOTES:
1. ALL DIMENSIONS IN MILLIMETERS AND (INCHES).
2. TOLERANCES ON ALL DIMENSIONS ARE ±0.38 (.015) UNLESS OTHERWISE SPECIFIED.
Features

- MOS COMPATIBLE
  Can be driven directly from MOS circuits.

- LOW POWER
  Excellent readability at only 250μA average per segment.

- UNIFORM ALIGNMENT
  Excellent alignment is assured by design.

- MATCHED BRIGHTNESS
  Uniformity of light output from digit to digit on a single PC Board.

- STATE OF THE ART LENS DESIGN
  Assures the best possible character height, viewing angle, off-axis distortion tradeoff.

Description

The HP 5082-7240 series displays are 2.59mm (.102") high, seven segment GaAsP Numeric Indicators mounted in an eight or nine digit configuration on a P. C. Board. These special parts, designed specifically for calculators, have right hand decimal points and are mounted on 5.08mm (200 mil) centers. The plastic lens over the digits has a magnifier and a protective bezel built-in. A secondary magnifying lens, available on special request, can be added to the primary lens for additional character enlargement.

Applications are primarily portable, hand-held calculators and other products requiring low power, low cost and long lifetime indicators which occupy a minimum of space.

Device Selection Guide

<table>
<thead>
<tr>
<th>Digits Per PC Board</th>
<th>Configuration</th>
<th>Device</th>
<th>Package</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8.8.8.8.8.8.8.8.8</td>
<td>(Figure 5)</td>
<td>5082-7240</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8.8.8.8.8.8.8.8.8</td>
<td>(Figure 5)</td>
<td>5082-7241</td>
<td></td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current per Segment or dp (Duration &lt; 500μs)</td>
<td>I_{PEAK}</td>
<td>50</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Average Current per Segment or dp[^1]</td>
<td>I_{AVG}</td>
<td>3</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation per Digit</td>
<td>P_D</td>
<td>50</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>T_A</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_S</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>V_R</td>
<td>5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Solder Temperature at connector edge (t≤3 sec.)[^2]</td>
<td></td>
<td>230</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: 1. Derate linearly @ 0.1mA/°C above 60°C ambient. 2. See Mechanical section for recommended soldering techniques and flux removal solvents.

Electrical/Optical Characteristics at T_A = 25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminous Intensity/Segment or dp</td>
<td>I_L</td>
<td>I_{AVG} = 500μA (I_{PK} = 5mA, duty cycle ~ 10%)</td>
<td>12.5</td>
<td>50</td>
<td>μcd</td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>λ_{Peak}</td>
<td></td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Forward Voltage/Segment or dp[^3]</td>
<td>V_F</td>
<td>I_F = 5mA</td>
<td>1.6</td>
<td></td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: 3. See Figure 7 for test circuit.
### Package Description

**Figure 5.**

### Magnified Character Font Description

**DEVICES**

**5082-7240**

**5082-7241**

**Note:** All dimensions in millimeters and inches.

**Figure 6.**

### Device Pin Description

<table>
<thead>
<tr>
<th>Pin No.</th>
<th><strong>5082-7240</strong> Function</th>
<th><strong>5082-7241</strong> Function</th>
<th>Pin No.</th>
<th><strong>5082-7240</strong> Function</th>
<th><strong>5082-7241</strong> Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOTE 4</td>
<td>Dig. 1 Cathode</td>
<td>10</td>
<td>Seg. d Anode</td>
<td>Dig. 6 Cathode</td>
</tr>
<tr>
<td>2</td>
<td>Seg. c Anode</td>
<td>Seg. c Anode</td>
<td>11</td>
<td>Dig. 6 Cathode</td>
<td>Seg. d Anode</td>
</tr>
<tr>
<td>3</td>
<td>Dig. 2 Cathode</td>
<td>Dig. 2 Cathode</td>
<td>12</td>
<td>Seg. g Anode</td>
<td>Dig. 7 Cathode</td>
</tr>
<tr>
<td>4</td>
<td>d.p. Anode</td>
<td>d.p. Anode</td>
<td>13</td>
<td>Seg. g Anode</td>
<td>Dig. 7 Cathode</td>
</tr>
<tr>
<td>5</td>
<td>Dig. 3 Cathode</td>
<td>Dig. 3 Cathode</td>
<td>14</td>
<td>Seg. b Anode</td>
<td>Seg. b Anode</td>
</tr>
<tr>
<td>6</td>
<td>Seg. a Anode</td>
<td>Seg. a Anode</td>
<td>15</td>
<td>Dig. 8 Cathode</td>
<td>Dig. 8 Cathode</td>
</tr>
<tr>
<td>7</td>
<td>Dig. 4 Cathode</td>
<td>Dig. 4 Cathode</td>
<td>16</td>
<td>Seg. f Anode</td>
<td>Seg. f Anode</td>
</tr>
<tr>
<td>8</td>
<td>Seg. e Anode</td>
<td>Seg. e Anode</td>
<td>17</td>
<td>Dig. 9 Cathode</td>
<td>Dig. 9 Cathode</td>
</tr>
<tr>
<td>9</td>
<td>Dig. 5 Cathode</td>
<td>Dig. 5 Cathode</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 4:** Leave pin 1 unconnected on the 5082-7240.
Electrical/Optical

The HP 5082-7240 series devices utilize a monolithic GaAsP chip containing 7 segments and a decimal point for each display digit. The segments of each digit are interconnected, forming an 8 by N line array, where N is the number of characters in the display. Each chip is positioned under a separate element of a plastic magnifying lens, producing a magnified character height of 2.59mm (0.102”). Satisfactory viewing will be realized within an angle of approximately ±20° from the centerline of the digit. A secondary lens magnifier that will increase character height from 2.59mm (.102”) to 3.56mm (.140”) is available as a special product. Character encoding of the 7240 series devices is performed by standard 7 segment decoder driver circuits.

The 5082-7240 series devices are tested for digit to digit luminous intensity matching using the circuit depicted in Figure 7. Component values are chosen to give an I_F of 5mA per segment at a segment V_F of 1.6 volts. This test method is preferred in order to provide the best possible simulation of the end product drive circuit, thereby insuring excellent digit to digit matching. If the device is to be driven from V_CC potentials of less than 3.5 volts, it is recommended that the factory be contacted.

Mechanical

The 5082-7240 series devices are constructed on a standard printed circuit board substrate. A separately molded plastic lens bar containing 9 individual magnifying elements is attached to the PC board over the digits. The device may be mounted either by use of pins which may be soldered into the plate through holes at the connector edge of the board or by insertion into a standard PC board connector.

The devices may be soldered for up to 3 seconds per tab at a maximum soldering temperature of 230°C. Heat should be applied only to the edge connector tab areas of the PC board. Heating other areas of the board to temperatures in excess of 85°C can result in permanent damage to the display. It is recommended that a rosin core wire solder or a low temperature deactivating flux and solid core wire solder be used in soldering operations.

Special Cleaning Instructions

For bulk cleaning after a flow solder operation, the following process is recommended: Wash display in clean liquid Freon TP-35 or Freon TE-35 solvent for a time period up to 2 minutes maximum. Air dry for a sufficient length of time to allow solvent to evaporate from beneath display lens. Maintain solvent temperature below 30°C (86°F). Methanol, isopropanol, or ethanol may be used for hand cleaning at room temperature. Water may be used for hand cleaning if it is not permitted to collect under display lens.

Solvent vapor cleaning at elevated temperatures is not recommended as such processes will damage display lens. Ketones, esters, aromatic and chlorinated hydrocarbon solvents will also damage display lens. Alcohol base active rosin flux mixtures should be prevented from coming in contact with display lens.

Figure 7. Circuit Diagram used for Testing the Luminous Intensity of the HP 5082-7240
**Features**

- NUMERIC 5082-7300/-7302
  - 0-9, Test State, Minus Sign, Blank States
  - Decimal Point
  - 7300 Right Hand D.P.
  - 7302 Left Hand D.P.

- HEXADECIMAL 5082-7340
  - 0-9, A-F, Base 16 Operation
  - Blanking Control, Conserves Power
  - Hexadecimal Operation
  - 7340 Right Hand D.P.
  - 7342 Left Hand D.P.

- DTL/TTL COMPATIBLE
- INCLUDES DECODER/DRIVER WITH 5 BIT MEMORY
  - 8421 Positive Logic Input
- 4 x 7 DOT MATRIX ARRAY
  - Shaped Character, Excellent Readibility
- STANDARD .600 INCH x .400 INCH DUAL-IN-LINE PACKAGE INCLUDING CONTRAST FILTER
- CATEGORIZED FOR LUMINOUS INTENSITY
  - Assures Uniformity of Light Output from Unit to Unit within a Single Category

**Description**

The HP 5082-7300 series solid state numeric and hexadecimal indicators with on-board decoder/driver and memory provide a reliable, low-cost method for displaying digital information. The 5082-7300 numeric indicator decodes positive 8421 BCD logic inputs into characters 0-9, a "-" sign, a test pattern, and four blanks in the invalid BCD states. The unit employs a right-hand decimal point. Typical applications include point-of-sale terminals, instrumentation, and computer systems.

The 5082-7302 is the same as the 5082-7300, except that the decimal point is located on the left-hand side of the digit.

The 5082-7340 hexadecimal indicator decodes positive 8421 logic inputs into 16 states, 0-9 and A-F. In place of the decimal point an input is provided for blanking the display (all LED's off), without losing the contents of the memory. Applications include terminals and computer systems using the base-16 character set.

The 5082-7304 is a (± 1.) overrange character, including decimal point, used in instrumentation applications.

**Package Dimensions**

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>5082-7300</th>
<th>5082-7340</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN</td>
<td>Numeric</td>
<td>Hexadecimal</td>
</tr>
<tr>
<td>1</td>
<td>Input 2</td>
<td>Input 2</td>
</tr>
<tr>
<td>2</td>
<td>Input 4</td>
<td>Input 4</td>
</tr>
<tr>
<td>3</td>
<td>Input 8</td>
<td>Input 8</td>
</tr>
<tr>
<td>4</td>
<td>Decimal</td>
<td>Blanking</td>
</tr>
<tr>
<td>5</td>
<td>control</td>
<td>enable</td>
</tr>
<tr>
<td>6</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>( V_{CC} )</td>
<td>( V_{CC} )</td>
</tr>
<tr>
<td>8</td>
<td>Input 1</td>
<td>Input 1</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Dimensions in millimeters and (inches).
2. Unless otherwise specified, the tolerance is ±.38mm (±.015").
3. Vertical digit center line is ±.51mm (±.02") from vertical package center line.
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature, ambient</td>
<td>$T_S$</td>
<td>-40</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature, case</td>
<td>$T_C$</td>
<td>-20</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>$V_{CC}$, Pin potential to ground pin</td>
<td>$V_{CC}$</td>
<td>-0.5</td>
<td>7.0</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to input logic pins and decimal point [1]</td>
<td>$V_I$</td>
<td>-0.5</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to latch enable</td>
<td>$V_E$</td>
<td>-0.5</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to blanking control [2]</td>
<td>$V_B$</td>
<td>-0.5</td>
<td>5.5</td>
<td>V</td>
</tr>
</tbody>
</table>

**Notes:**
1. Decimal point applies only to 7300/7302.
2. Applies only to 7340.

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min</th>
<th>Nom</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Low Level Input Voltage</td>
<td>$V_{IL}$</td>
<td>0</td>
<td>0.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>High Level Input Voltage</td>
<td>$V_{IH}$</td>
<td>2.0</td>
<td>5.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Latch enable voltage-data being entered</td>
<td>$V_{EL}$</td>
<td>0</td>
<td>0.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Latch enable voltage-data not being entered</td>
<td>$V_{EH}$</td>
<td>2.0</td>
<td>5.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Blanking control voltage-display not blanked [1]</td>
<td>$V_{BL}$</td>
<td>0</td>
<td>0.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Blanking control voltage-display blanked [1]</td>
<td>$V_{BH}$</td>
<td>3.5</td>
<td>5.25</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
1. Applies only to 7340.

### Electrical/Optical Characteristics ($T_C = -20°C$ to +85°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>$V_{CC}$</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply current</td>
<td>$I_{CC}$</td>
<td>5.5V</td>
<td>$V_{CC} = 5.5V$</td>
<td>94</td>
<td>170</td>
<td>220</td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_T$</td>
<td>470[1]</td>
<td>$V_{CC} = 5.5V$</td>
<td>935</td>
<td>120</td>
<td>165</td>
<td>mW</td>
</tr>
<tr>
<td>Luminous Intensity per LED (Digit average) [3][6]</td>
<td>$I_V$</td>
<td>32</td>
<td>$V_{CC} = 5.0V$, $T_C = 25°C$</td>
<td>70</td>
<td>120</td>
<td>200</td>
<td>μA</td>
</tr>
<tr>
<td>Enable Pulse Width</td>
<td>$t_W$</td>
<td>50</td>
<td>$V_{IL} = 0.4V$, $V_{EH} = 2.4V$</td>
<td>50</td>
<td>120</td>
<td>200</td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held before positive transition of enable line</td>
<td>$t_{SETUP}$</td>
<td>120</td>
<td>$V_{CC} = 5.0V$, $V_{EL} = 0.4V$</td>
<td>120</td>
<td>200</td>
<td>400</td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held after positive transition of enable line</td>
<td>$t_{HOLD}$</td>
<td>50</td>
<td>$V_{IH} = 2.4V$, $T_C = 25°C$</td>
<td>50</td>
<td>120</td>
<td>200</td>
<td>nsec</td>
</tr>
<tr>
<td>Blanking control current “L” state [4]</td>
<td>$I_{BL}$</td>
<td>200</td>
<td>$V_{CC} = 5.5V$, $V_{BH} = 0.8V$</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>μA</td>
</tr>
<tr>
<td>Blanking control current “H” state [4]</td>
<td>$I_{BH}$</td>
<td>2.0</td>
<td>$V_{CC} = 5.5V$, $V_{BH} = 4.5V$</td>
<td>2.0</td>
<td>4.0</td>
<td>6.0</td>
<td>mA</td>
</tr>
<tr>
<td>Logic and latch enable currents “L” state</td>
<td>$I_{IL}$</td>
<td>-1.6</td>
<td>$V_{CC} = 5.5V$, $V_I = 0.4V$</td>
<td>-1.6</td>
<td>1.6</td>
<td>3.2</td>
<td>mA</td>
</tr>
<tr>
<td>Logic and latch enable currents “H” state</td>
<td>$I_{IH}$</td>
<td>+250</td>
<td>$V_{CC} = 5.5V$, $V_I = 2.4V$</td>
<td>+250</td>
<td>250</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td>655</td>
<td>$T_C = 25°C$</td>
<td>655</td>
<td>1500</td>
<td>2500</td>
<td>nm</td>
</tr>
<tr>
<td>Spectral halfwidth</td>
<td>$\Delta \lambda$</td>
<td>30</td>
<td>$T_C = 25°C$</td>
<td>30</td>
<td>150</td>
<td>300</td>
<td>nm</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>0.8</td>
<td></td>
<td>0.8</td>
<td>1.0</td>
<td>2.0</td>
<td>g</td>
</tr>
</tbody>
</table>

**Notes:**
1. $V_{CC} = 5.0V$ with statistical average number of LED's lit.
2. Worst case condition excluding test state on 5082-7300/-7302.
3. The digits are categorized for luminous intensity such that the variation from digit to digit within a category is not discernible to the eye. Intensity categories are designated by a letter located on the reverse side of the package contiguous with the Hewlett-Packard logo marking.
4. Applies only to 7340.
5. $I_V$ as a function of temperature, $I_V(T)$, may be calculated from the relationship: $I_V(T) = I_V(25°C)(0.986)[(T_C - 25°C)]$; $I_V(T)$ = Luminous intensity at any particular case temperature; $I_V(25°C)$ = Luminous intensity at $T_C = 25°C$; $T_C$ = Case temperature at which luminous intensity is to be calculated.
TRUTH TABLE FOR 5082-7300 SERIES DEVICES

NOTES:
1. The blanking control input, B, pertains to the 5082-7340 Hexadecimal indicator only.
2. The decimal point input pertains to the 5082-7300 and -7302 Numeric Indicators only.
3. H = logic 'High'; L = logic 'Low'; x = 'don't care'.

---

Figure 1. Block Diagram of 5082-7300 Series Logic.

Figure 2. Typical Blanking Control Current Vs. Voltage for 5082-7340 Only.

Figure 3. Typical Blanking Control Input Current Vs. Temperature, 5082-7340.

Figure 4. Typical Latch Enable Input Current Vs. Voltage for the 5082-7300 Series Devices.

Figure 5. Typical Logic and Decimal Point Input Current Vs. Voltage for the 5082-7300 Series Devices. Decimal Point Applies to 5082-7300 Only.

Figure 6. Timing Diagram of 5082-7300 Series Logic.
SOLID STATE OVER RANGE CHARACTER

For display applications requiring a ±, 1, or decimal point designation, the 5082-7304 over range character is available. This display module comes in the same package as the 5082-7300 series numeric indicator and is completely compatible with it.

Package Dimensions

NOTES: 1. Dimensions in inches and (millimeters).
2. Unless otherwise specified, the tolerance on all dimensions is ±.015 inches, (±.38 mm) 5082–7304

TRUTH TABLE FOR 5082-7304

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>H</td>
</tr>
<tr>
<td>=</td>
<td>L</td>
</tr>
<tr>
<td>Decimal Point</td>
<td>X</td>
</tr>
<tr>
<td>Blank</td>
<td>L</td>
</tr>
</tbody>
</table>

NOTES: L: Line switching transistor in Fig. 7 cutoff.
H: Line switching transistor in Fig. 7 saturated.
X: 'don’t care’

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SYMBOL</th>
<th>MIN</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature, ambient</td>
<td>Tₑₑ</td>
<td>-40</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature, case</td>
<td>Tᵣᵣ</td>
<td>-20</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>Forward current, each LED</td>
<td>Iₑₑ</td>
<td>10</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Reverse voltage, each LED</td>
<td>Vᵣᵣ</td>
<td>4</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MIN</th>
<th>NOM</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vᵧᵧ</td>
<td>4.5</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Iₑₑ</td>
<td>5.0</td>
<td>10</td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>

NOTE:
LED current must be externally limited. Refer to figure 7 for recommended resistor values.

Electrical/Optical Characteristics (Tᵣᵣ = -20°C TO +85°C, UNLESS OTHERWISE SPECIFIED)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Voltage per LED</td>
<td>Vₑₑ</td>
<td>Iₑₑ = 10 mA</td>
<td>1.6</td>
<td>2.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power dissipation</td>
<td>Pₑₑ</td>
<td>Iₑₑ = 10 mA</td>
<td>250</td>
<td>320</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Luminous Intensity per LED (digit average)</td>
<td>lₑₑ</td>
<td>Iₑₑ = 6 mA, Tᵣᵣ = 25°C</td>
<td>32</td>
<td>70</td>
<td>μcd</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>λᵣᵣ</td>
<td>Tᵣᵣ = 25°C</td>
<td>665</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectral halfwidth</td>
<td>Δλ₁/₂</td>
<td>Tᵣᵣ = 25°C</td>
<td>30</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td>0.8</td>
<td>gm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Features
• CERAMIC/GLASS PACKAGE
• ADDED RELIABILITY
• NUMERIC 5082-7356/-7357
  0-9, Test State, Minus Sign, Blank States
  Decimal Point
  7356 Right Hand D.P.
  7357 Left Hand D.P.
• HEXADECIMAL 5082-7359
  0-9, A-F, Base 16 Operation
  Blanking Control, Conserves Power
  No Decimal Point
• TTL COMPATIBLE
• INCLUDES DECODER/DRIVER WITH 5 BIT MEMORY
  8421 Positive Logic Input and Decimal Point
• 4 x 7 DOT MATRIX ARRAY
  Shaped Character, Excellent Readability
• STANDARD DUAL-IN-LINE PACKAGE
  15.2mm x 10.2mm (.6 inch x .4 inch)
• CATEGORIZED FOR LUMINOUS INTENSITY
  Assures Uniformity of Light Output from Unit to Unit within a Single Category

Description
The HP 5082-7350 series solid state numeric and hexadecimal indicators with on-board decoder/driver and memory provide 7.4mm (0.29 inch) displays for use in adverse industrial environments.

The 5082-7356 numeric indicator decodes positive 8421 BCD logic inputs into characters 0-9, a "—" sign, a test pattern, and four blanks in the invalid BCD states. The unit employs a right-hand decimal point. Typical applications include control systems, instrumentation, communication systems and transportation equipment.

The 5082-7357 is the same as the 5082-7356 except that the decimal point is located on the left-hand side of the digit.

The 5082-7359 hexadecimal indicator decodes positive 8421 logic inputs into 16 states, 0-9 and A-F. In place of the decimal point an input is provided for blanking the display (all LED's off), without losing the contents of the memory. Applications include terminals and computer systems using the base-16 character set.

A companion overrange display with right hand decimal point (±1.) is available upon request from the Optoelectronics Division of Hewlett-Packard.

Package Dimensions

![Package Dimension Diagram]
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature, ambient</td>
<td>$T_S$</td>
<td>$-65$</td>
<td>$+125$</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature, ambient ($^{	ext{1,2}}$)</td>
<td>$T_A$</td>
<td>$-55$</td>
<td>$+100$</td>
<td>°C</td>
</tr>
<tr>
<td>Supply voltage ($^{	ext{3}}$)</td>
<td>$V_{CC}$</td>
<td>$-0.5$</td>
<td>$+7.0$</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to input logic, dp and enable pins</td>
<td>$V_L, V_{IPE}, V_E$</td>
<td>$-0.5$</td>
<td>$+7.0$</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to blanking input ($^{	ext{7}}$)</td>
<td>$V_B$</td>
<td>$-0.6$</td>
<td>$V_{CC}$</td>
<td>V</td>
</tr>
<tr>
<td>Maximum solder temperature at 1.59mm (.062 inch) below seating plane, $t \leq 5$ seconds</td>
<td></td>
<td></td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

Notes:
1. Nominal thermal resistance of a display mounted in a socket which is soldered into a printed circuit board: $\theta_{JA}=500 \, \text{°C/W}$; $\theta_{JC}=150 \, \text{°C/W}$. 2. $\theta_{JA}$ of a mounted display should not exceed 35° ClW for operation up to $T_A=+100 \, \text{°C}$. 3. Voltage values are with respect to device ground, pin 6. 4. All typical values at $V_{CC}=5.0 \, \text{Volts}, T_A=25 \, \text{°C}$. 5. These displays are categorized for luminous intensity with the intensity category designated by a letter located on the back of the display contiguous with the Hewlett-Packard logo marking. 6. The luminous intensity at a specific ambient temperature, $I_v(T_A)$, may be calculated from this relationship: $I_v(T_A)=I_v(25 \, \text{°C})(0.985)^{(T_A-25 \, \text{°C})}$. 7. Applies only to 7359. 8. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature, ambient</td>
<td>$T_A$</td>
<td>0</td>
<td></td>
<td>$+70$</td>
<td>°C</td>
</tr>
<tr>
<td>Enable Pulse Width</td>
<td>$t_{PW}$</td>
<td>100</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held before positive transition of enable line</td>
<td>$t_{RSET}$</td>
<td>50</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held after positive transition of enable line</td>
<td>$t_{HOLD}$</td>
<td>50</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Enable pulse rise time</td>
<td>$t_{RRI}$</td>
<td>200</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
</tbody>
</table>

### Electrical/Optical Characteristics ($T_A = 0 \, \text{°C}$ to $+70 \, \text{°C}$, unless otherwise specified)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ. ($^{	ext{4}}$)</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Current</td>
<td>$I_{DC}$</td>
<td>$V_{CC}$=5.5V (Numeral)</td>
<td></td>
<td>112</td>
<td>170</td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_T$</td>
<td>5 and dp lighted</td>
<td></td>
<td>560</td>
<td>935</td>
<td>mW</td>
</tr>
<tr>
<td>Luminous intensity per LED (Digit average) ($^{	ext{4,5}}$)</td>
<td>$I$</td>
<td>$V_{CC}$=5.0V, $T_A=25 , \text{°C}$</td>
<td></td>
<td>40</td>
<td>85</td>
<td>$\mu$cd</td>
</tr>
<tr>
<td>Logic low-level input voltage</td>
<td>$V_{IL}$</td>
<td></td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic high-level input voltage</td>
<td>$V_{IH}$</td>
<td></td>
<td></td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Enable low-voltage; data being entered</td>
<td>$V_{IL}$</td>
<td>$V_{CC}$=4.5V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enable high-voltage; data not being entered</td>
<td>$V_{EH}$</td>
<td></td>
<td></td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanking low-voltage; display not blanked ($^{	ext{7}}$)</td>
<td>$V_{BIL}$</td>
<td></td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanking high-voltage; display blanked ($^{	ext{7}}$)</td>
<td>$V_{BHI}$</td>
<td></td>
<td></td>
<td>3.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanking low-level input current ($^{	ext{7}}$)</td>
<td>$I_{BL}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=0.8V</td>
<td></td>
<td></td>
<td>50</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Blanking high-level input current ($^{	ext{7}}$)</td>
<td>$I_{BH}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=4.5V</td>
<td></td>
<td></td>
<td>1.0</td>
<td>mA</td>
</tr>
<tr>
<td>Logic low-level input current</td>
<td>$I_{IL}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=0.4V</td>
<td></td>
<td></td>
<td>-1.6</td>
<td>mA</td>
</tr>
<tr>
<td>Logic high-level input current</td>
<td>$I_{IH}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=2.4V</td>
<td></td>
<td></td>
<td>100</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Enable low-level input current</td>
<td>$I_{EL}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=0.4V</td>
<td></td>
<td></td>
<td>-1.6</td>
<td>mA</td>
</tr>
<tr>
<td>Enable high-level input current</td>
<td>$I_{EH}$</td>
<td>$V_{CC}$=5.5V, $V_{IH}$=2.4V</td>
<td></td>
<td></td>
<td>130</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td>$T_A=25 , \text{°C}$</td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Dominant Wavelength ($^{	ext{6}}$)</td>
<td>$\lambda_d$</td>
<td>$T_A=25 , \text{°C}$</td>
<td>640</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td>gm</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. Nominal thermal resistance of a display mounted in a socket which is soldered into a printed circuit board: $\theta_{JA}=500 \, \text{°C/W}$; $\theta_{JC}=150 \, \text{°C/W}$. 2. $\theta_{JA}$ of a mounted display should not exceed 35° ClW for operation up to $T_A=+100 \, \text{°C}$. 3. Voltage values are with respect to device ground, pin 6. 4. All typical values at $V_{CC}=5.0 \, \text{Volts}, T_A=25 \, \text{°C}$. 5. These displays are categorized for luminous intensity with the intensity category designated by a letter located on the back of the display contiguous with the Hewlett-Packard logo marking. 6. The luminous intensity at a specific ambient temperature, $I_v(T_A)$, may be calculated from this relationship: $I_v(T_A)=I_v(25 \, \text{°C})(0.985)^{(T_A-25 \, \text{°C})}$. 7. Applies only to 7359. 8. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
Figure 1. Timing Diagram of 5082-7350 Series Logic.

Figure 2. Block Diagram of 5082-7350 Series Logic.

Notes:
1. H = Logic High; L = Logic Low. With the enable input at logic high changes in BCD input logic levels have no effect upon display memory or displayed character.
2. The decimal point input, DP, pertains only to the 5082-7356 and 5082-7357 displays.
3. The blanking control input, B, pertains only to the 5082-7359 hexadecimal display. Blanking input has no effect upon display memory.

Figure 3. Typical Blanking Control Current vs. Voltage for 5082-7359.

Figure 4. Typical Blanking Control Input Current vs. Ambient Temperature for 5082-7359.

Figure 5. Typical Latch Enable Input Current vs. Voltage.

TRUTH TABLE

<table>
<thead>
<tr>
<th>BCD DATA(1)</th>
<th>5082-7356/7357</th>
<th>5082-7359</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xg</td>
<td>X2</td>
<td>X3</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Notes:
1. H = Logic High; L = Logic Low. With the enable input at logic high changes in BCD input logic levels have no effect upon display memory or displayed character.
2. The decimal point input, DP, pertains only to the 5082-7356 and 5082-7357 displays.
3. The blanking control input, B, pertains only to the 5082-7359 hexadecimal display. Blanking input has no effect upon display memory.
**Operational Considerations**

**ELECTRICAL**

The 5082-7350 series devices use a modified 4 x 7 dot matrix of light emitting diodes (LED's) to display decimal/hexadecimal numeric information. The LED's are driven by constant current drivers. BCD information is accepted by the display memory when the enable line is at logic low and the data is latched when the enable is at logic high. To avoid the latching of erroneous information, the enable pulse rise time should not exceed 200 nanoseconds. Using the enable pulse width and data setup and hold times listed in the Recommended Operating Conditions allows data to be clocked into an array of displays at a 10MHz rate.

The blanking control input on the 5082-7395 display blanks (turns off) the displayed hexadecimal information without disturbing the contents of display memory. The display is blanked at a minimum threshold level of 3.5 volts. This may be easily achieved by using an open collector TTL gate and a pull-up resistor. For example, (1/6) 7416 hexinverter buffer/driver and a 120 ohm pull-up resistor will provide sufficient drive to blank twelve displays. The size of the blanking pull-up resistor may be calculated from the following formula, where N is the number of digits:

\[ R_{\text{blank}} = \frac{(V_{CC} - 3.5V)}{[N \times (1.0mA)]} \]

The decimal point input is active low true and this data is latched into the display memory in the same fashion as is the BCD data. The decimal point LED is driven by the onboard IC.

**MECHANICAL**

These hermetic displays are designed for use in adverse industrial environments.

These displays may be mounted by soldering directly to a printed circuit board or inserted into a socket. The lead-to-lead pin spacing is 2.54mm (0.100 inch) and the lead row spacing is 15.24mm (0.600 inch). These displays may be end stacked with 2.54mm (0.100 inch) spacing between outside pins of adjacent displays. Sockets such as Augat 324-AG20 (3 digits) or Augat 508-AG80 (one digit, right angle mounting) may be used.

The primary thermal path for power dissipation is through the device leads. Therefore, to insure reliable operation up to an ambient temperature of +100°C, it is important to maintain a case-to-ambient thermal resistance of less than 35°C/watt as measured on top of display pin 3.

Post solder cleaning may be accomplished using water, Freon/alcohol mixtures formulated for vapor cleaning processing (up to 2 minutes in vapors at boiling) or Freon/alcohol mixtures formulated for room temperature cleaning. Suggested solvents: Freon TF, Freon TE, Genesolv DI-15, Genesolv DE-15.

**CONTRAST ENHANCEMENT**

The 5082-7350 displays have been designed to provide the maximum possible ON/OFF contrast when placed behind an appropriate contrast enhancement filter. Some suggested filters are Panelgraphic Ruby Red 60 and Dark Red 63, SGL Homalite H100-1605, 3M Light Control Film and Polaroid HRCP Red Circular Polarizing Filter. For further information see Hewlett-Packard Application Note 964.
Features

- **1.5 INCH HIGH CHARACTER**
  Readable From 60 Feet
- **ON-BOARD DECODER/DRIVER**
  8421 Positive Logic Input
  DTL-TTL Compatible
- **5 x 7 DOT MATRIX**
  Shaped Character For Excellent Readability
- **SINGLE PLANE CONSTRUCTION**
  Wide Viewing Angle
- **EDGE MOUNTING IN STANDARD PC BOARD CONNECTORS (.156" Centers)**
- **RELIABLE, RUGGED, LONG OPERATING LIFE**

Description

The HP 5082-7500 is a 38.1mm (1.5 in.) numeric indicator utilizing discrete red light emitting diodes arranged in a 5 x 7 dot matrix. Inclusion of the decoder/driver permits direct addressing by the standard BCD code.

The large size and high efficiency light emitters permit viewing distances up to 60 feet. The single plane of light emitters permits wide viewing angles and low mounting space requirements. Applications include equipment for scales, process control and medical measurement, and other data systems requiring ease of readability at a distance.

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature, Ambient</td>
<td>TS</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>TA</td>
<td>-20</td>
<td>70</td>
<td>°C</td>
</tr>
<tr>
<td>Logic Supply Voltage [1]</td>
<td>VCC</td>
<td>-0.5</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage [1, 2]</td>
<td>VLED</td>
<td>-0.5</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>Voltage Applied to BCD [1, 2]</td>
<td>V1</td>
<td>-0.5</td>
<td>5.25</td>
<td>V</td>
</tr>
</tbody>
</table>

[1] Voltage values are with respect to ground pin.
[2] V1 or VLED not to exceed VCC by more than 0.5V at any time.

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Supply Voltage</td>
<td>VCC</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage, Display ON [1]</td>
<td>VLED</td>
<td>4.5</td>
<td>5.0</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage, Display OFF [2]</td>
<td>VLED</td>
<td>-0.5</td>
<td>0</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature, Ambient</td>
<td>TA</td>
<td>-20</td>
<td>25</td>
<td>70</td>
<td>°C</td>
</tr>
</tbody>
</table>

[1] All selected LEDs remain uniformly lit.
Electrical/Optical Characteristics (TA = -20°C to 70°C, Unless Noted)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Voltage, &quot;L&quot; State</td>
<td>VIL</td>
<td>VCC = 4.5V</td>
<td>0</td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic Voltage, &quot;H&quot; State</td>
<td>VIH</td>
<td>VCC = 5.5V</td>
<td>2.0</td>
<td>5.25</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic Supply Current</td>
<td>ICC</td>
<td>VCC = 5.5V</td>
<td>37</td>
<td>65</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>LED Supply Current</td>
<td>ILED</td>
<td>VCC = 5.5V, VLED = 5.25V</td>
<td></td>
<td></td>
<td>250</td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>PD</td>
<td>VCC = 5.5V, VLED = 5.25V</td>
<td>1.4</td>
<td>2.8</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>Luminous Intensity per LED</td>
<td>I</td>
<td>VCC = 5.0V, VLED = 5.0V</td>
<td>0.8</td>
<td>1.25</td>
<td></td>
<td>mcd</td>
</tr>
<tr>
<td>Logic Current, &quot;L&quot; State</td>
<td>IL</td>
<td>VCC = 5.5V, VLED = 0.4V</td>
<td></td>
<td>-1.6</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Logic Current, &quot;H&quot; State</td>
<td>IH</td>
<td>VCC = 5.5V, VLED = 2.4V</td>
<td>+100</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Decimal Point Current</td>
<td>IDP</td>
<td>VCC = 5.5V, VLED = 5.25V</td>
<td></td>
<td>-25</td>
<td>-35</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>λPEAK</td>
<td></td>
<td>655</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Spectral Halfwidth</td>
<td>Δλ½</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td>gm</td>
</tr>
</tbody>
</table>

[1] VCC = 5.0V, VLED = 5.0V with statistical average number of LEDs lit, TA = 25°C.
[2] VCC = 5.0V, VLED = 5.0V, TA = 25°C.
[3] Pin 2 is connected to the decimal point LED thru a 120Ω series current limiting resistor. This pin should be connected to ground thru a NPN switching transistor.

Truth Table

<table>
<thead>
<tr>
<th>Character</th>
<th>X8</th>
<th>X4</th>
<th>X2</th>
<th>X1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>1</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>3</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>4</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>6</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>7</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>9</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>BLANK</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>BLANK</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>BLANK</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>BLANK</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>BLANK</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>D.P. ON</td>
<td>D.P. (IN) = L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.P. OFF</td>
<td>D.P. (IN) = H</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Typical BCD logic input current vs. input voltage.

Figure 2. Typical decimal point input current as a function of dp input voltage.

Figure 3. Typical ILED as a function of VLED.

Figure 4. Typical luminous intensity per LED (digit average) as a function of VLED.
Features

- **RUGGED, SHOCK RESISTANT, HERMETIC**
- **DESIGNED TO MEET MIL STANDARDS**
- **INCLUDES DECODER/DRIVER**
  - BCD Inputs
- **TTL/DTL COMPATIBLE**
- **CONTROLLABLE LIGHT OUTPUT**
- **5 x 7 LED MATRIX CHARACTER**

Description

The HP 5082-7010 solid state numeric indicator with built-in decoder/driver provides a hermetically tested 6.8mm (0.27 in.) display for use in military or adverse industrial environments. Typical applications include ground, airborne and shipboard equipment, fire control systems, medical instruments, and space flight systems.

The 5082-7010 is a modified 5x7 matrix display that indicates the numerals 0-9 when presented with a BCD code. The BCD code is negative logic with blanks displayed for invalid codes. A left-hand decimal point is included which must be externally current limited.

The 5082-7011 is a companion plus/minus sign in the same hermetically tested package. Plus/minus indications require only that voltage be applied to two input pins.

Both displays allow luminous intensity to be varied by changing the DC drive voltage or by pulse duration modulation of the LED voltage.

Package Dimensions

<table>
<thead>
<tr>
<th>PIN FUNCTION</th>
<th>PIN FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Input 1</td>
<td>5 Input 4</td>
</tr>
<tr>
<td>2 Vcc</td>
<td>6 Ground</td>
</tr>
<tr>
<td>3 Vdd</td>
<td>7 Vcc</td>
</tr>
<tr>
<td>4 Input 8</td>
<td>8 Input 2</td>
</tr>
</tbody>
</table>

**Notes:**
1. Unless otherwise specified, the tolerance on all dimensions is ±0.38 mm (±0.015 inches).
2. All dimensions in millimeters and (inches).
3. The package and mounting pins are tin plated Kovar.
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature, Ambient</td>
<td>$T_S$</td>
<td>$-65$</td>
<td>$+100$</td>
<td>$^\circ$C</td>
</tr>
<tr>
<td>Operating Temperature, Case</td>
<td>$T_C$</td>
<td>$-55$</td>
<td>$+95$</td>
<td>$^\circ$C</td>
</tr>
<tr>
<td>Logic Supply Voltage to Ground</td>
<td>$V_{CC}$</td>
<td>$-0.5$</td>
<td>$+7.0$</td>
<td>V</td>
</tr>
<tr>
<td>Logic Input Voltage</td>
<td>$V_I$</td>
<td>$-0.5$</td>
<td>$+5.5$</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage to Ground</td>
<td>$V_{LED}$</td>
<td>$-0.5$</td>
<td>$+5.5$</td>
<td>V</td>
</tr>
<tr>
<td>Decimal Point Current</td>
<td>$I_{DP}$</td>
<td>$-10$</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

Note: 1. Above $T_C = 65^\circ$C derate $V_{LED}$ per derating curve in Figure 10.

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Supply Voltage</td>
<td>$V_{CC}$</td>
<td>$4.5$</td>
<td>$5.0$</td>
<td>$5.5$</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage, Display Off</td>
<td>$V_{LED}$</td>
<td>$-0.5$</td>
<td></td>
<td>$+1.0$</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage, Display On</td>
<td>$V_{LED}$</td>
<td>$3.0$</td>
<td></td>
<td>$5.5$</td>
<td>V</td>
</tr>
<tr>
<td>Decimal Point Current, “H” State</td>
<td>$I_{DP}$</td>
<td>$0$</td>
<td></td>
<td>$-10.0$, $-1.0$</td>
<td>mA</td>
</tr>
<tr>
<td>Logic Input Voltage, “H” State</td>
<td>$V_{IH}$</td>
<td>$2.0$</td>
<td></td>
<td>$5.5$</td>
<td>V</td>
</tr>
<tr>
<td>Logic Input Voltage, “L” State</td>
<td>$V_{IL}$</td>
<td>$0$</td>
<td></td>
<td>$0.8$</td>
<td>V</td>
</tr>
</tbody>
</table>

Note: 2. Decimal point current must be externally current limited. See application information.

Electrical/Optical Characteristics

Case Temperature, $T_C = 0^\circ$C to $70^\circ$C, unless otherwise specified

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.[4]</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Supply Current</td>
<td>$I_{CC}$</td>
<td>$V_{CC} = 5.5V$</td>
<td>45</td>
<td>75</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>LED Supply Current</td>
<td>$I_{LED}$</td>
<td>$V_{LED}$</td>
<td>5.5V</td>
<td>5.5V</td>
<td>255</td>
<td>350</td>
</tr>
<tr>
<td>LED Supply Current, “H” State (ea. input)</td>
<td>$I_{IH}$</td>
<td>$V_{CC} = 5.5V$, $V_{IH} = 2.4V$</td>
<td></td>
<td>100</td>
<td></td>
<td>$\mu$A</td>
</tr>
<tr>
<td>LED Supply Current, “L” State (ea. input)</td>
<td>$I_{IL}$</td>
<td>$V_{CC} = 5.5V$, $V_{IL} = 0.4V$</td>
<td></td>
<td>$-1.6$</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Decimal Point Voltage Drop</td>
<td>$V_{LED} - V_{DP}$</td>
<td>$I_{DP} = -10mA$</td>
<td>1.6</td>
<td>2.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_T$</td>
<td>$V_{CC}$</td>
<td>$5.5V$</td>
<td>1.7</td>
<td>2.3</td>
<td>W</td>
</tr>
<tr>
<td>Luminous Intensity per LED (digit avg.)</td>
<td>$I_{L}$</td>
<td>$V_{LED}$</td>
<td>$T_C$</td>
<td></td>
<td></td>
<td>$\mu$cd</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{peak}$</td>
<td></td>
<td></td>
<td></td>
<td>655</td>
<td>nm</td>
</tr>
<tr>
<td>Spectral Halfwidth</td>
<td>$\Delta \lambda_{SP}$</td>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td>nm</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.9</td>
<td>gram</td>
</tr>
</tbody>
</table>

Notes: 3. With numeral 8 displayed.
4. All typical values at $T_C = 25^\circ$C.
5. $T_C = 0^\circ$C to $85^\circ$C for $V_{LED} = 5.5V$.

Truth Table

<table>
<thead>
<tr>
<th>Character X8</th>
<th>Logic</th>
<th>X4</th>
<th>X2</th>
<th>X1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>1</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>4</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>6</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>7</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>8</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

$V_{IL} = 0.0$ to $0.8V$
$V_{IH} = 2.0$ to $5.5V$
Figure 1. Equivalent input circuit of the 5082-7010 decoder. Note: Display metal case is isolated from ground pin #6.

Figure 2. Equivalent circuit of the 5082-7010 as seen from LED and decimal point drive lines.

Figure 3. Equivalent circuit of 5082-7011 plus/minus sign. All resistors 345Ω typical. Note: Display metal case is isolated from ground pin #6.

Figure 4. Input current as a function of input voltage, each input.

Figure 5. Logic "H" input current as a function of case temperature, each input.

Figure 6. Logic "L" input current as a function of case temperature, each input.
Figure 7. LED supply current as a function of LED supply voltage.

Figure 8. Luminous intensity per LED (digit average) as a function of LED supply voltage.

Figure 9. Maximum power derating as a function of case temperature.

Figure 10. LED voltage derating as a function of case temperature.

Figure 11. Relative luminous intensity as a function of case temperature at fixed current level.

Figure 12. LED voltage derating as a function of ambient temperature, display soldered into P.C. board without heat sink.
Solid State Plus/Minus Sign 5082-7011

For display applications requiring ± designation, the 5082-7011 solid state plus/minus sign is available. This display module comes in the same package as the 5082-7010 numeric indicator and is completely compatible with it. Plus or minus information can be indicated by supplying voltage to one (minus sign) or two (plus sign) input leads. A third lead is provided for the ground connection. Luminous intensity is controlled by changing the LED drive voltage. Each LED has its own built-in 345Ω (nominal) current limiting resistor. Therefore, no external current limiting is required for voltages at 5.5V or lower. Like the numeric indicator, the -7011 plus/minus sign is TTL/DTL compatible.

Electrical/Optical Characteristics
Case Temperature, $T_C = 0°C$ to $70°C$, unless otherwise specified

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ. $^{[1]}$</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Supply Current</td>
<td>$I_{LED}$</td>
<td>$V_{LED} = 5.5V$</td>
<td>105</td>
<td>150</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_T$</td>
<td>$V_{LED} = 5.5V$</td>
<td>0.6</td>
<td>0.9</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Luminous Intensity per LED (Digit Avg.)</td>
<td>$I_L^{[2]}$</td>
<td>$V_{LED} = 5.5V$</td>
<td>60</td>
<td>115</td>
<td>μcd</td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{peak}$</td>
<td>$V_{LED} = 4.2V$</td>
<td>40</td>
<td>80</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Spectral Halfwidth</td>
<td>$\Delta\lambda$</td>
<td>$V_{LED} = 3.5V$</td>
<td>50</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td>4.9</td>
<td></td>
<td>gram</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. All typical values at $T_C = 25°C$
2. At $T_C = 25°C$

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature, Ambient</td>
<td>$T_S$</td>
<td>-65</td>
<td>+100</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Temperature, Case</td>
<td>$T_C$</td>
<td>-55</td>
<td>+95</td>
<td>°C</td>
</tr>
<tr>
<td>Plus, Plus/Minus Input Potential to Ground</td>
<td>$V_{LED}$</td>
<td>-0.5</td>
<td>5.5</td>
<td>V</td>
</tr>
</tbody>
</table>

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Supply Voltage, Display Off</td>
<td>$V_{LED}$</td>
<td>-0.5</td>
<td>0</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td>LED Supply Voltage, Display On</td>
<td>$V_{LED}$</td>
<td>3.0</td>
<td>4.2</td>
<td>5.5</td>
<td>V</td>
</tr>
</tbody>
</table>
Applications

Decimal Point Limiting Resistor
The decimal point of the 5082-7010 display requires an external current limiting resistor, between pin 2 and ground. Recommended resistor value is 220Ω, 1/4 watt.

Mounting
The 5082-7010 and 5082-7011 displays are packaged with two rows of 4 contact pins each in a DIP configuration with a row center line spacing of 0.890 inches. Normal mounting is directly onto a printed circuit board. If desired, these displays may be socket mounted using contact strip connectors such as Augat's 325-AG1 or AMP 583773-1 or 583774-1.

Heat Sink Operation
Optimum display case operating temperature for the 5082-7010 and 7011 displays is $T_C=0°C$ to $70°C$ as measured on back surface. Maintaining the display case operating temperature within this range may be achieved by mounting the display on an appropriate heat sink or metal core printed circuit board. Thermal conducting compound such as Wakefield 120 or Dow Corning 340 can be used between display and heat sink. See figure 10 for $V_{LED}$ derating vs. display case temperature.

Operation Without Heat Sink
These displays may also be operated without the use of a heat sink. The thermal resistance from case to ambient for these displays when soldered into a printed circuit board is nominally $\theta_{CA}=30°C/W$. See figure 12 for $V_{LED}$ derating vs. ambient temperature.

Cleaning
Post solder cleaning may be accomplished using water, Freon/alcohol mixtures formulated for vapor cleaning processing (up to 2 minutes in vapors at boiling) or Freon/alcohol mixtures formulated for room temperature cleaning. Suggested solvents: Freon TF, Freon TE, Genesolv DI-15, Genesolv DE-15.
Features

- PERFORMANCE GUARANTEED OVER TEMPERATURE
- HERMETICITY GUARANTEED
- TXV SCREENING AVAILABLE
- GOLD PLATED LEADS
- HIGH TEMPERATURE STABILIZED
- NUMERIC
  5082-7391 Right Hand D.P.
  5082-7392 Left Hand D.P.
- HEXADECIMAL
  5082-7395
- TTL COMPATIBLE
- DECODER/DRIVER WITH 5 BIT MEMORY
- 4 x 7 DOT MATRIX ARRAY
  Shaped Character, Excellent Readability
- STANDARD DUAL-IN-LINE PACKAGE
- CATEGORIZED FOR LUMINOUS INTENSITY
  Assures Uniformity of Light Output from Unit to Unit within a Single Category

Description

The HP 5082-7390 series solid state numeric and hexadecimal indicators with on-board decoder/driver and memory are hermetically tested 7.4mm (0.29 inch) displays for use in military and aerospace applications.

The 5082-7391 numeric indicator decodes positive 8421 BCD logic inputs into characters 0-9, a "-" sign, a test pattern, and four blanks in the invalid BCD states. The unit employs a right-hand decimal point. Typical applications include control systems, instrumentation, communication systems and transportation equipment.

The 5082-7392 is the same as the 5082-7391 except that the decimal point is located on the left-hand side of the digit.

The 5082-7395 hexadecimal indicator decodes positive 8421 logic inputs into 16 states, 0-9 and A-F. In place of the decimal point an input is provided for blanking the display (all LED's off), without losing the contents of the memory. Applications include terminals and computer systems using the base-16 character set.

A companion overrange display with right hand decimal point (+1) is available upon request from the Opto-electronics Division of Hewlett-Packard.

Package Dimensions

NOTES:
1. Dimensions in millimeters and (inches).
2. Unless otherwise specified the tolerance on all dimensions is ±0.015 (±0.005/16). Vertical digit center line is ±0.025 (±0.001/32) from vertical package center line.
3. Lead material is gold plated copper alloy.
## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature, ambient</td>
<td>$T_s$</td>
<td>-65</td>
<td>+125</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature, ambient ($^{(1)}$)</td>
<td>$T_A$</td>
<td>-55</td>
<td>+100</td>
<td>°C</td>
</tr>
<tr>
<td>Supply voltage ($^{(3)}$)</td>
<td>$V_{CC}$</td>
<td>-0.5</td>
<td>+7.0</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to input logic, dp and enable pins</td>
<td>$V_L,V_{DE},V_E$</td>
<td>-0.5</td>
<td>+7.0</td>
<td>V</td>
</tr>
<tr>
<td>Voltage applied to blanking input ($^{(3)}$)</td>
<td>$V_B$</td>
<td>-0.5</td>
<td>$V_{CC}$</td>
<td>V</td>
</tr>
<tr>
<td>Maximum solder temperature at 1.59mm (.062 inch) below seating plane; $t \leq 5$ seconds</td>
<td></td>
<td>260</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

## Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature, ambient ($^{(1)}$)</td>
<td>$T_A$</td>
<td>-55</td>
<td></td>
<td>+100</td>
<td>°C</td>
</tr>
<tr>
<td>Enable Pulse Width</td>
<td>$t_E$</td>
<td>100</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held before positive transition of enable line</td>
<td>$t_{SELUP}$</td>
<td>50</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Time data must be held after positive transition of enable line</td>
<td>$t_{HOLD}$</td>
<td>50</td>
<td></td>
<td></td>
<td>nsec</td>
</tr>
<tr>
<td>Enable pulse rise time</td>
<td>$t_{PHR}$</td>
<td></td>
<td></td>
<td>200</td>
<td>nsec</td>
</tr>
</tbody>
</table>

## Electrical/Optical Characteristics ($T_A = -55°C$ to +100°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ. ($^{(4)}$)</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Current</td>
<td>$I_{CC}$</td>
<td>$V_{CC}=5.5V$ (Numerical)</td>
<td>112</td>
<td>170</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_T$</td>
<td>5 and dp lighted</td>
<td>560</td>
<td>935</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Luminous intensity per LED (Digit average) ($^{(5)}$)</td>
<td>$I_L$</td>
<td>$V_{CC}=5.0V, T_A=25°C$</td>
<td>40</td>
<td>85</td>
<td></td>
<td>μcd</td>
</tr>
<tr>
<td>Logic low-level input voltage</td>
<td>$V_{EL}$</td>
<td>$V_{CC}=4.5V$</td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic high-level input voltage</td>
<td>$V_{EH}$</td>
<td>$V_{CC}=4.5V$</td>
<td></td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Enable low-voltage; data being entered</td>
<td>$V_{EL}$</td>
<td>$V_{CC}=4.5V$</td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Enable high-voltage; data not being entered</td>
<td>$V_{EH}$</td>
<td>$V_{CC}=4.5V$</td>
<td></td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanking low-voltage; display not blanked</td>
<td>$I_{B}$</td>
<td>$V_{CC}=5.5V, V_{BL}=0.8V$</td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanked high-voltage; display blanked ($^{(7)}$)</td>
<td>$I_{BH}$</td>
<td>$V_{CC}=5.5V, V_{BH}=0.4V$</td>
<td></td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Blanked low-level input current ($^{(7)}$)</td>
<td>$I_{BL}$</td>
<td>$V_{CC}=5.5V, V_{BL}=0.8V$</td>
<td></td>
<td>50</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Blanked high-level input current ($^{(7)}$)</td>
<td>$I_{BH}$</td>
<td>$V_{CC}=5.5V, V_{BH}=0.4V$</td>
<td></td>
<td>1.0</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Logic low-level input current</td>
<td>$I_{IL}$</td>
<td>$V_{CC}=5.5V, V_{IL}=0.4V$</td>
<td></td>
<td>-1.6</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Logic high-level input current</td>
<td>$I_{IH}$</td>
<td>$V_{CC}=5.5V, V_{IH}=2.4V$</td>
<td></td>
<td>+100</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Enable low-level input current</td>
<td>$I_{EL}$</td>
<td>$V_{CC}=5.5V, V_{EL}=0.4V$</td>
<td></td>
<td>-1.6</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Enable high-level input current</td>
<td>$I_{EH}$</td>
<td>$V_{CC}=5.5V, V_{EH}=2.4V$</td>
<td></td>
<td>+130</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td>$T_A=25°C$</td>
<td>655</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Dominant Wavelength ($^{(9)}$)</td>
<td>$\lambda_d$</td>
<td>$T_A=25°C$</td>
<td>640</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td>gm</td>
<td></td>
</tr>
<tr>
<td>Leak Rate</td>
<td></td>
<td>$5 \times 10^{-7}$</td>
<td></td>
<td></td>
<td>cc/sec</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Nominal thermal resistance of a display mounted in a socket which is soldered into a printed circuit board: $\theta_{JA}=50°C/W$; $\theta_{JC}=15°C/W$.
2. $\theta_{JA}$ of a mounted display should not exceed 35°C/W for operation up to $T_A=+100°C$.
3. Voltage values are with respect to device ground, pin 6.
4. All typical values at $V_{CC}=5.0$ Volts; $T_A=25°C$.
5. These displays are categorized for luminous intensity with the intensity category designated by a letter located on the back of the display contiguous with the Hewlett-Packard logo marking.
6. The luminous intensity at a specific ambient temperature, $I_v(T_A)$, may be calculated from this relationship: $I_v(T_A)=I_v(25°C)(0.985)^{(T_A-25°C)}$.
7. Applies only to 7395.
8. The dominant wavelength, $\lambda_d$, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
Figure 1. Timing Diagram of 5082-7390 Series Logic.

Figure 2. Block Diagram of 5082-7390 Series Logic.

Notes:
1. H = Logic High; L = Logic Low. With the enable input at logic high changes in BCD input logic levels have no effect upon display memory or displayed character.
2. The decimal point input, DP, pertains only to the 5082-7391 and 5082-7392 displays.
3. The blanking control input, B, pertains only to the 5082-7395 hexadecimal display. Blanking input has no effect upon display memory.

Figure 3. Typical Blanking Control Current vs. Voltage for 5082-7395.

Figure 4. Typical Blanking Control Input Current vs. Ambient Temperature for 5082-7395.

Figure 5. Typical Latch Enable Input Current vs. Voltage.
Operational Considerations

ELECTRICAL

The 5082-7390 series devices use a modified 4 x 7 dot matrix of light emitting diodes (LED's) to display decimal/hexadecimal numeric information. The LED's are driven by constant current drivers. BCD information is accepted by the display memory when the enable line is at logic low and the data is latched when the enable is at logic high. To avoid the latching of erroneous information, the enable pulse rise time should not exceed 200 nanoseconds. Using the enable pulse width and data setup and hold times listed in the Recommended Operating Conditions allows data to be clocked into an array of displays at a 10MHz rate.

The blanking control input on the 5082-7395 display blanks (turns off) the displayed hexadecimal information without disturbing the contents of display memory. The display is blanked at a minimum threshold level of 3.5 volts. This may be easily achieved by using an open collector TTL gate and a pull-up resistor. For example, (1/6) 7416 hexinverter buffer/driver and a 120 ohm pull-up resistor will provide sufficient drive to blank twelve displays. The size of the blanking pull-up resistor may be calculated from the following formula, where N is the number of digits:

\[ R_{\text{blank}} = \frac{(V_{\text{CC}} - 3.5V)}{[N (1.0mA)]} \]

The decimal point input is active low true and this data is latched into the display memory in the same fashion as is the BCD data. The decimal point LED is driven by the onboard IC.

MECHANICAL

5082-7390 series displays are hermetically tested for use in environments which require a high reliability device. These displays are designed and tested to meet a helium leak rate of 5 x 10^-7 cc/sec and a standard dye penetrant gross leak test.

These displays may be mounted by soldering directly to a printed circuit board or inserted into a socket. The lead-to-lead pin spacing is 2.54mm (0.100 inch) and the lead row spacing is 15.24mm (0.600 inch). These displays may be end stacked with 2.54mm (0.100 inch) spacing between outside pins of adjacent displays. Sockets such as Augat 324-AG2D (3 digits) or Augat 508-AG8D (one digit, right angle mounting) may be used.

The primary thermal path for power dissipation is through the device leads. Therefore, to insure reliable operation up to an ambient temperature of +100°C, it is important to maintain a case-to-ambient thermal resistance of less than 35°C/watt as measured on top of display pin 3.

Post solder cleaning may be accomplished using water, Freon/alcohol mixtures formulated for vapor cleaning processing (up to 2 minutes in vapors at boiling) or Freon/alcohol mixtures formulated for room temperature cleaning. Suggested solvents: Freon TF, Freon TE, Genesolv DI-15, Genesolv DE-15.

PRECONDITIONING

5082-7390 series displays are 100% preconditioned by 24 hour storage at 125°C.

CONTRAST ENHANCEMENT

The 5082-7390 displays have been designed to provide the maximum possible ON/OFF contrast when placed behind an appropriate contrast enhancement filter. Some suggested filters are Panelgraphic Ruby Red 60 and Dark Red 63, SGL Homalite H100-1605, 3M Light Control Film and Polaroid HRC Polarizing Filter. For further information see Hewlett-Packard Application Note 964.
High Reliability Test Program

Hewlett-Packard provides standard high reliability test programs, patterned after MIL-M-38510 in order to facilitate the use of HP products in military programs.

HP offers two levels of high reliability testing:

The TXV prefix identifies a part which has been preconditioned and screened per Table 1.

The TXVB prefix identifies a part which has been preconditioned and screened per Table 1, and comes from a lot which has been subjected to the Group B tests described in Table 2.

Table 1. TXV Preconditioning and Screening — 100%.

<table>
<thead>
<tr>
<th>Examination or Test</th>
<th>MIL-STD-883 Methods</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internal Visual Inspection</td>
<td>HPA Procedure 72-Q352</td>
<td>Per Electrical/Optical Characteristics.</td>
</tr>
<tr>
<td>2. Electrical Test: hv, lcc, ln, lt, ltc, n, ln, ltc, n, ln</td>
<td>1008</td>
<td>125°C, 168 hours.</td>
</tr>
<tr>
<td>3. High Temperature Storage</td>
<td>1010</td>
<td>-65°C to +125°C, 10 cycles.</td>
</tr>
<tr>
<td>4. Temperature Cycling</td>
<td>2001</td>
<td>Condition A, limit pressure to 25psi for 1 hour.</td>
</tr>
<tr>
<td>5. Acceleration</td>
<td>1014</td>
<td>Condition D, 40psi for 1 hour.</td>
</tr>
<tr>
<td>6. Helium Leak Test</td>
<td>1014</td>
<td>$T_s = -25^\circ C$, t=168 hours, at $V_{CC}=5.5V$ and cycling through logic at 1 character per sec.</td>
</tr>
<tr>
<td>7. Gross Leak Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Electrical Test: Same as Step 2</td>
<td>1015</td>
<td></td>
</tr>
<tr>
<td>9. Burn-in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Electrical Test as in Step 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART NUMBER SYSTEM</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Product</td>
<td>TXV-7391</td>
<td>TXVB-7391</td>
</tr>
<tr>
<td>With TXV Screening</td>
<td>TXV-7392</td>
<td>TXVB-7392</td>
</tr>
<tr>
<td>With TXV Screening Plus Group B</td>
<td>TXV-7395</td>
<td>TXVB-7395</td>
</tr>
</tbody>
</table>

Table 2. Group B.

<table>
<thead>
<tr>
<th>Examination or Test</th>
<th>Method</th>
<th>MIL-STD-883 Condition</th>
<th>LTPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subgroup 1: Physical Dimensions</td>
<td>2008</td>
<td>Package Dimensions per Product Outline Drawing.</td>
<td>20</td>
</tr>
<tr>
<td>Subgroup 2: Solderability</td>
<td>2003</td>
<td>Immersion within 0.062” of seating plane 260°C, t=5 sec., omit aging.</td>
<td>15</td>
</tr>
<tr>
<td>Temperature Cycling</td>
<td>1010</td>
<td>10 cycles -65°C to +125°C</td>
<td></td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>1011</td>
<td>Test Condition A</td>
<td></td>
</tr>
<tr>
<td>Hermetic Seal</td>
<td>1014</td>
<td>Condition A, limit pressure to 25psi for 1 hour, and Condition D, 40psi for 1 hour.</td>
<td>15</td>
</tr>
<tr>
<td>Moisture Resistance</td>
<td>1004</td>
<td>Omit initial conditioning.</td>
<td></td>
</tr>
<tr>
<td>End Points: Electrical Test</td>
<td></td>
<td>Same as Step 2, Table 1.</td>
<td></td>
</tr>
<tr>
<td>Subgroup 3: Shock -- Non-operating</td>
<td>2002</td>
<td>1500 G, t=0.5ms, 5 blows in each orientation X1, Y1, Z1.</td>
<td>15</td>
</tr>
<tr>
<td>Vibration Variable Frequency</td>
<td>2007</td>
<td>Non-operating.</td>
<td></td>
</tr>
<tr>
<td>Constant Acceleration</td>
<td>2001</td>
<td>2,000 G, Y1 orientation.</td>
<td></td>
</tr>
<tr>
<td>End Points: Electrical Test</td>
<td>1014</td>
<td>Same as Step 2, Table 1.</td>
<td></td>
</tr>
<tr>
<td>Subgroup 4: Terminal Strength</td>
<td>2004</td>
<td>Test Condition B2</td>
<td></td>
</tr>
<tr>
<td>End Points: Hermetic Seal</td>
<td>1014</td>
<td>Condition A, limit pressure to 25psi for 1 hour, and Condition D, 40psi for 1 hour.</td>
<td>15</td>
</tr>
<tr>
<td>Subgroup 5: Salt Atmosphere</td>
<td>1009</td>
<td>Test Condition A</td>
<td></td>
</tr>
<tr>
<td>Subgroup 6: High Temperature Life</td>
<td>1008</td>
<td>$T_s = 125^\circ C$, non-operating, t=1000 hours.</td>
<td>$\lambda=7$</td>
</tr>
<tr>
<td>End Points: Electrical Test</td>
<td></td>
<td>Same as Step 2, Table 1.</td>
<td></td>
</tr>
<tr>
<td>Subgroup 7: Steady State Operating Life</td>
<td>1005</td>
<td>$T_s = -25^\circ C$, t=1000 hours, at $V_{CC}=5.5V$ and cycling through logic at 1 character per second.</td>
<td>$\lambda=5$</td>
</tr>
<tr>
<td>End Points: Electrical Test</td>
<td></td>
<td>Same as Step 2, Table 1.</td>
<td></td>
</tr>
</tbody>
</table>
Features

- RUGGED, SHOCK RESISTANT, HERMETIC
- DESIGNED TO MEET MIL STANDARDS
- INCLUDES DECODER/DRIVER — BCD INPUTS
- TTL/DTL COMPATIBLE
- CONTROLLABLE LIGHT OUTPUT
- 5 x 7 LED MATRIX CHARACTER

Description

The HP 5082-7001 triple digit solid state numeric indicator with built-in decoder/driver provides a hermetically tested 6.8mm (0.27 in.) display for use in military or adverse industrial environments. Typical applications include ground, air-borne, and shipboard equipment, fire control systems, medical instruments, and space flight systems.

The 5082-7001 is a modified 5 x 7 matrix display that indicates the numerals 0-9 when presented with a BCD code. The BCD code is negative logic with blanks displayed for invalid codes. A left-hand decimal point is included which must be externally current limited.

The 5082-7010 is a single digit version of the 5082-7001 solid state numeric indicator. The 5082-7011 is a companion plus/minus sign in the same single digit hermetically tested package used for the 5082-7010. Plus/minus indications require only that voltage be applied to two input pins.

All three displays allow luminous intensity to be varied by changing the DC drive voltage or by pulse duration modulation of the LED voltage.

Electrical / Optical Specifications

The 5082-7010/11 data sheet lists the electrical/optical specifications for the 5082-7001 and 5082-7010/11 displays.

Package Dimensions

![Package Dimensions Diagram]

Notes:
1. Unless otherwise specified, the tolerance on all dimensions is ±0.38mm (±0.015 in.).
2. All dimensions in millimeters and inches.
3. The 5082-7010/11 data sheet gives the package dimensions and pin-out function table for these displays.
Features

- **5 x 7 LED MATRIX CHARACTER**
  Human Factors Engineered
- **BRIGHTNESS CONTROLLABLE**
- **IC COMPATIBLE**
- **SMALL SIZE**
  Standard 15.24mm (.600 inch) Dual In-Line Package; 6.9mm (.27 inch) Character Height
- **WIDE VIEWING ANGLE**
- **RUGGED, SHOCK RESISTANT**
  Hermetically Sealed
  Designed to Meet MIL Standards
- **LONG OPERATING LIFE**

Description

The Hewlett-Packard 5082-7100 Series is an X-Y addressable, 5 x 7 LED Matrix capable of displaying the full alphanumeric character set. This alphanumeric indicator series is available in 3, 4, or 5 character end-stackable clusters. The clusters permit compact presentation of information, ease of character alignment, minimum number of interconnections, and compatibility with multiplexing driving schemes. Alphanumeric applications include computer terminals, calculators, military equipment and space flight readouts.

The 5082-7100 is a three character cluster.
The 5082-7101 is a four character cluster.
The 5082-7102 is a five character cluster.

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current Per LED (Duration &lt; 1 ms)</td>
<td>I_{PEAK}</td>
<td>100</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Average Current Per LED</td>
<td>I_{AVG}</td>
<td>10</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation Per Character (All diodes lit)</td>
<td>P_{D}</td>
<td>700</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature, Case</td>
<td>T_{C}</td>
<td>-55</td>
<td>95</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_{S}</td>
<td>-55</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Reverse Voltage Per LED</td>
<td>V_{R}</td>
<td>4</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Note 1: At 25°C Case Temperature; derate 8.5mW/°C above 25°C.
Electrical / Optical Characteristics at $T_C=25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Luminous Intensity Per LED (Character Average) @ Pulse Current of 100mA/LED</td>
<td>$I_F$ (PEAK)</td>
<td>1.0</td>
<td>2.2</td>
<td></td>
<td>mcd</td>
</tr>
<tr>
<td>Reverse Current Per LED @ $V_R = 4V$</td>
<td>$I_R$</td>
<td>10</td>
<td></td>
<td></td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Peak Forward Voltage @ Pulse Current of 50mA/LED</td>
<td>$V_F$</td>
<td>1.7</td>
<td>2.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>$\lambda_{PEAK}$</td>
<td>655</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Spectral Line Halfwidth</td>
<td>$\Delta\lambda_{1/2}$</td>
<td>30</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Rise and Fall Times</td>
<td>$t_r, t_f$</td>
<td>10</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

Note 1. Time for a 10% - 90% change of light intensity for step change in current.

Figure 1. Forward Current-Voltage Characteristic.

Figure 2. Relative Luminous Intensity vs. Case Temperature at Fixed Current Level.

Figure 3. Typical Time Average Luminous Intensity per LED vs. Average Current per LED.

Figure 4. Typical Relative Luminous Efficiency vs. Peak Current per LED.
Package Dimensions and Pin Configurations

Device Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anode G</td>
<td>12</td>
<td>Anode B</td>
<td>1</td>
<td>N/C</td>
<td>15</td>
<td>Anode C</td>
</tr>
<tr>
<td>2</td>
<td>1c</td>
<td>13</td>
<td>3d</td>
<td>2</td>
<td>1c</td>
<td>16</td>
<td>4c</td>
</tr>
<tr>
<td>3</td>
<td>1d</td>
<td>14</td>
<td>3b</td>
<td>3</td>
<td>1e</td>
<td>17</td>
<td>4a</td>
</tr>
<tr>
<td>4</td>
<td>Anode F</td>
<td>15</td>
<td>Anode A</td>
<td>4</td>
<td>Anode G</td>
<td>18</td>
<td>Anode B</td>
</tr>
<tr>
<td>5</td>
<td>Anode E</td>
<td>16</td>
<td>2e</td>
<td>5</td>
<td>2b</td>
<td>19</td>
<td>3e</td>
</tr>
<tr>
<td>6</td>
<td>2b</td>
<td>17</td>
<td>2c</td>
<td>6</td>
<td>2d</td>
<td>20</td>
<td>3o</td>
</tr>
<tr>
<td>7</td>
<td>2d</td>
<td>18</td>
<td>2a</td>
<td>7</td>
<td>Anode D</td>
<td>21</td>
<td>3s</td>
</tr>
<tr>
<td>8</td>
<td>Anode C</td>
<td>19</td>
<td>Anode D</td>
<td>8</td>
<td>Anode E</td>
<td>22</td>
<td>2e</td>
</tr>
<tr>
<td>9</td>
<td>3a</td>
<td>20</td>
<td>1e</td>
<td>9</td>
<td>3c</td>
<td>23</td>
<td>2c</td>
</tr>
<tr>
<td>10</td>
<td>3c</td>
<td>21</td>
<td>1b</td>
<td>10</td>
<td>3d</td>
<td>24</td>
<td>2e</td>
</tr>
<tr>
<td>11</td>
<td>3e</td>
<td>22</td>
<td>1a</td>
<td>11</td>
<td>Anode F</td>
<td>25</td>
<td>Anode A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>4b</td>
<td>26</td>
<td>1d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13</td>
<td>4d</td>
<td>27</td>
<td>1b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
<td>4e</td>
<td>28</td>
<td>1a</td>
</tr>
<tr>
<td>15</td>
<td>Anode G</td>
<td>29</td>
<td>Anode A</td>
<td>16</td>
<td>5b</td>
<td>34</td>
<td>1d</td>
</tr>
<tr>
<td>17</td>
<td>5d</td>
<td>35</td>
<td>1b</td>
<td>18</td>
<td>N/C</td>
<td>36</td>
<td>1a</td>
</tr>
</tbody>
</table>

Notes:
1. Dimensions are in millimeters and (inch).
2. Unless otherwise specified, the tolerance on all dimensions is ±0.001 mm ( ±0.0001 in).
3. Character size 0.9 x 0.9 mm ( 0.27 x 0.27 in.).
Operating Considerations

ELECTRICAL

The 5 x 7 matrix of LED's, which make up each character, are X-Y addressable. This allows for a simple addressing, decoding and driving scheme between the display module and customer furnished logic.

There are three main advantages to the use of this type of X-Y addressable array:

1. It is an elementary addressing scheme and provides the least number of interconnection pins for the number of diodes addressed. Thus, it offers maximum flexibility toward integrating the display into particular applications.

2. This method of addressing offers the advantage of sharing the Read-Only-Memory character generator among several display elements. One character generating ROM can be shared over 25 or more 5 x 7 dot matrix characters with substantial cost savings.

3. In many cases equipments will already have a portion of the required decoder/driver (timing and clock circuitry plus buffer storage) logic circuitry available for the display.

To form alphanumeric characters a method called “scanning” or “strobing” is used. Information is addressed to the display by selecting one row of diodes at a time, energizing the appropriate diodes in that row and then proceeding to the next row. After all rows have been excited one at a time, the process is repeated. By scanning through all rows at least 100 times a second, a flicker free character can be produced. When information moves sequentially from row to row of the display (top to bottom) this is row scanning, as illustrated in Figure 5. Information can also be moved from column to column (left to right across the display) in a column scanning mode. For most applications (5 or more characters to share the same ROM) it is more economical to use row scanning.

A much more detailed description of general scanning techniques along with specific circuit recommendations is contained in HP Application Note 931.

MECHANICAL/THERMAL MOUNTING

The solid state display typically operates with 200mW power dissipation per character. However, if the operating conditions are such that the power dissipation exceeds the derated maximum allowable value, the device should be heat sunk. The usual mounting technique combines mechanical support and thermal heat sinking in a common structure. A metal strap or bar can be mounted behind the display using silicone grease to insure good thermal control. A well-designed heat sink can limit the case temperature to within 10°C of ambient.

![Figure 5. Row Scanning Block Diagram.](image)
Features

- **FOUR CHARACTER SIZES, COMMON CATHODE**
  - 53 mil, 80 mil, 100 mil, 120 mil.
- **DISCRETE AND MONOLITHIC COLON CHIPS**
- **AVERAGE LUMINOUS INTENSITY AND DISTRIBUTION SPECIFIED FOR EACH WAFER**
- **100% ELECTRICALLY TESTED AND VISUALLY INSPECTED**
- **LOW POWER**
  - MOS Compatible
- **CONTINUOUS SEGMENTS**
  - Excellent Aesthetic Appearance

Description

The HP 5082-7800 series are common cathode monolithic chips, specifically designed for hybrid applications. Chips are available in seven segment, nine segment and one digit fonts. Colons are available in discrete or monolithic form. All chips are made of GaAsP material and are suitable for die attach and wire bonding to appropriate substrates. Chips are 100% visually inspected to HP standard criteria.

Packaging

Hewlett Packard offers chips packaged on vinyl film or in waffle packages. The recommended vinyl film allows ease of handling wafers, maintains the orientation of adjacent dice, and optimizes digit-to-digit luminous intensity matching.

Device Selection Guide

<table>
<thead>
<tr>
<th>Character Height</th>
<th>Font</th>
<th>Chip Size</th>
<th>Tilt Angle Degrees</th>
<th>Stroke Width mm (mil)</th>
<th>Minimum Bonding Pad Size</th>
<th>Vinyl Film P/N 5082-</th>
<th>Waffle Pack P/N 5082-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.35 mm (53 mil)</td>
<td>7 segment</td>
<td>1.50 x 1.35 mm (59 x 53 mil)</td>
<td>6 (Typical)</td>
<td>0.084 (3.3)</td>
<td>0.15 x 0.18 mm (6 x 7 mil)</td>
<td>7811</td>
<td>7821</td>
</tr>
<tr>
<td>2.03 mm (80 mil)</td>
<td>7 segment</td>
<td>2.24 x 1.42 mm (88 x 56 mil)</td>
<td>5 (Typical)</td>
<td>0.127 (5)</td>
<td>0.15 x 0.18 mm (6 x 7 mil)</td>
<td>7832</td>
<td>7842</td>
</tr>
<tr>
<td>2.54 mm (100 mil)</td>
<td>7 segment</td>
<td>2.72 x 1.91 mm (107 x 75 mil)</td>
<td>5</td>
<td>0.114 (4.5)</td>
<td>0.18 x 0.23 mm (7 x 9 mil)</td>
<td>7851</td>
<td>7861</td>
</tr>
<tr>
<td>2.54 mm (100 mil)</td>
<td>9 segment</td>
<td>2.72 x 1.91 mm (107 x 75 mil)</td>
<td>5</td>
<td>0.114 (4.5)</td>
<td>0.18 x 0.23 mm (7 x 9 mil)</td>
<td>7852</td>
<td>7862</td>
</tr>
<tr>
<td>2.54 mm (100 mil)</td>
<td>1 or colon</td>
<td>2.72 x 0.89 mm (107 x 35 mil)</td>
<td>5</td>
<td>0.114 (4.5)</td>
<td>0.18 x 0.23 mm (7 x 9 mil)</td>
<td>7853</td>
<td>7863</td>
</tr>
<tr>
<td>3.05 mm (120 mil)</td>
<td>7 segment</td>
<td>3.25 x 2.34 mm (128 x 92 mil)</td>
<td>5</td>
<td>0.102 (4)</td>
<td>0.20 x 0.30 mm (8 x 12 mil)</td>
<td>7871</td>
<td>7881</td>
</tr>
<tr>
<td>0.28 mm (011 mil)</td>
<td>decimal point or colon</td>
<td>0.38 x 0.38 mm (15 x 15 mil)</td>
<td>—</td>
<td>—</td>
<td>0.12 mm (4.8 mil) diameter</td>
<td>7890*</td>
<td>7892*</td>
</tr>
</tbody>
</table>

*Standard packaging is a vial (P/N 5082-7893).
Device Dimensions

Absolute Maximum Ratings

Storage Temperature Range \(^{(1)}\) \(-40^\circ\text{C} \text{ to } +125^\circ\text{C}\)
Reverse Voltage \(^{(1)}\) \(5V\)
Assembly Temperature (Duration \(\leq 5\) min.) \(420^\circ\text{C}\)
Operating Junction Temperature \(125^\circ\text{C}\)

<table>
<thead>
<tr>
<th>Description</th>
<th>1.35 mm (53 mil)</th>
<th>2.03 mm (80 mil)</th>
<th>2.54 mm (100 mil)</th>
<th>3.05 (120 mil)</th>
<th>0.28 mm (11 mil)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Forward Current/Segment (pulse duration (\leq 500) (\mu)sec.)</td>
<td>50</td>
<td>100</td>
<td>25</td>
<td>25</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Average Forward Current/Segment</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Wire Bonder Force</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>95</td>
<td>gm</td>
</tr>
</tbody>
</table>

Note 1. Rating applies to chip only.

Electrical/Optical Characteristics at \(T_A = 25^\circ\text{C}\)

Common Specifications for All Devices

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_R), Reverse Current/Segment</td>
<td>100 (\mu)A max. at (V_R = 5V)</td>
</tr>
<tr>
<td>(\lambda_{\text{PEAK}}), Peak Wavelength</td>
<td>655 nm (typical)</td>
</tr>
<tr>
<td>(\lambda_d), Dominant Wavelength (^{(1)})</td>
<td>640 nm (typical)</td>
</tr>
<tr>
<td>(\theta_{JC}), Chip Thermal Resistance (Junction to back contact)</td>
<td>85(^{\circ}) C/W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 mil and 53 mil</td>
<td>85(^{\circ}) C/W</td>
</tr>
<tr>
<td>80 mil, 100 mil and 120 mil</td>
<td>45(^{\circ}) C/W</td>
</tr>
</tbody>
</table>
### 5082-7811/21

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Luminous Intensity/Segment (Digit Average)</td>
<td>50</td>
<td>70</td>
<td>—</td>
<td>$\mu$cd</td>
<td>$I_F = 5mA$ DC</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Segment to Segment Intensity Ratio (Within Each Digit)</td>
<td>—</td>
<td>1.2:1</td>
<td>1.7:1</td>
<td></td>
<td>$I_F = 5mA$ DC</td>
<td></td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Luminous Intensity Normalized Standard Deviation (Digit to Digit)</td>
<td>—</td>
<td>0.10</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage/Segment</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td>$I_F = 5mA$ DC</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Notes
1. Dominant wavelength, $\lambda_d$, is derived from the C.I.E. chromaticity diagram and represents that single wavelength which defines the color of the device.
2. $I_v$ is the mean value and $\sigma$ is the standard deviation of the wafer luminous intensity.

### 5082-7832/42

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Luminous Intensity/Segment (Digit Average)</td>
<td>80</td>
<td>150</td>
<td>—</td>
<td>$\mu$cd</td>
<td>$I_F = 10mA$ DC</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Segment to Segment Intensity Ratio (Within Each Digit)</td>
<td>—</td>
<td>1.2:1</td>
<td>1.7:1</td>
<td></td>
<td>$I_F = 10mA$ DC</td>
<td></td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Luminous Intensity Normalized Standard Deviation (Digit to Digit)</td>
<td>—</td>
<td>0.10</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage/Segment</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td>$I_F = 10mA$ DC</td>
<td>1</td>
</tr>
</tbody>
</table>

### 5082-7851/61, -7852/62, -7853/63

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Luminous Intensity/Segment (Digit Average)</td>
<td>60</td>
<td>85</td>
<td>—</td>
<td>$\mu$cd</td>
<td>$I_F = 6mA$ DC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Segment to Segment Intensity Ratio (Within Each Digit)</td>
<td>—</td>
<td>1.2:1</td>
<td>1.7:1</td>
<td></td>
<td>$I_F = 6mA$ DC</td>
<td></td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Luminous Intensity Normalized Standard Deviation (Digit to Digit)</td>
<td>—</td>
<td>0.10</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage/Segment</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td>$I_F = 6mA$ DC</td>
<td>1</td>
</tr>
</tbody>
</table>

### 5082-7871/81

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Luminous Intensity/Segment (Digit Average)</td>
<td>60</td>
<td>85</td>
<td>—</td>
<td>$\mu$cd</td>
<td>$I_F = 6mA$ DC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Segment to Segment Intensity Ratio (Within Each Digit)</td>
<td>—</td>
<td>1.2:1</td>
<td>1.7:1</td>
<td></td>
<td>$I_F = 6mA$ DC</td>
<td></td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Luminous Intensity Normalized Standard Deviation (Digit to Digit)</td>
<td>—</td>
<td>0.10</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage/Segment</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td>$I_F = 6mA$ DC</td>
<td>1</td>
</tr>
</tbody>
</table>

### 5082-7890/92/93

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_v$</td>
<td>Luminous Intensity (Wafer Average)</td>
<td>45</td>
<td>80</td>
<td>140</td>
<td>$\mu$cd</td>
<td>$I_F = 6mA$ DC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Luminous Intensity Normalized Standard Deviation</td>
<td>—</td>
<td>0.10</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td>$I_F = 6mA$ DC</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: 1. Dominant wavelength, $\lambda_d$, is derived from the C.I.E. chromaticity diagram and represents that single wavelength which defines the color of the device. 2. $I_v$ is the mean value and $\sigma$ is the standard deviation of the wafer luminous intensity.
Typical Characteristic Curves

![Figure 1. Peak Forward Current vs. Peak Forward Voltage.](image)

![Figure 2. Relative Luminous Efficiency (Luminous Intensity per Unit Current) vs. Peak Current per Segment.](image)

![Figure 3. Relative Luminous Efficiency (Luminous Intensity per Unit Current) vs. Peak Current per Segment.](image)

Strobing Considerations

The time average luminous intensity at $T_A = 25^\circ C$ may be calculated for any specific drive condition from the following formula:

$$I_v \text{ time avg} = \left[ \frac{I_{av}}{I_{DC \ spec}} \right] \left[ \eta_1 \text{ PEAK} \right] \left[ I_{V \ spec} \right]$$

Where:

- $I_{av}$ = average operating current
- $I_{DC \ spec}$ = data sheet current at which $I_{V \ spec}$ is measured
- $I_{V \ spec}$ = data sheet luminous intensity at $I_{DC \ spec}$
- $\eta_1 \text{ PEAK}$ = relative luminous efficiency at peak operating current (See Figures 2 and 3).

The luminous intensity at any chip operating temperature may be calculated using the following formula:

$$I_v = (I_v \ at \ 25^\circ C) \times (0.982) \times (T_A - 25^\circ C)$$

Assembly Information

The cathode metallization (chip back contact) is a gold/germanium alloy and the anode bonding pads are aluminum. Conductive silver epoxy for die attach is preferred. If eutectic die attach is used, gold/germanium preforms are recommended. Gold wire of .025 mm (1 mil) or .038 mm (1.5 mil) diameter should be used for lead bonding. The .025 mm diameter wire is recommended for the .28 mm (11 mil) decimal point die. The substrate temperature should be in the range of 275-330$^\circ C$ and the bonder capillary temperature should be set between 100$^\circ C$ and 350$^\circ C$. Ultrasonic wire bonding may be used also.

For more detailed assembly information, refer to Hewlett-Packard Application Bulletin No. 8.

Visual Inspection

All chips are 100% visually inspected to HP specification. A copy of the visual inspection specification is available on request.

Recommended Incoming Inspection Procedures

Hewlett-Packard guarantees all visual parameters. Customers should perform incoming inspection to the same levels. It is important that these chips be handled carefully. Excessive or rough handling of chips can cause scratched or broken units. All shipments must be accepted or rejected on a lot basis. Samples should be selected and tested for the visual specifications to the recommended AQL level. Before a lot will be authorized for return, the inspected units should be returned to Hewlett-Packard for our verification. Returns cannot be accepted after the entire lot has been removed from its shipping container.
Isolators

Selection Guide ........................................ 116

☐ High Speed Isolators

☐ High Reliability Isolators

☐ Low Input Current/High Gain Isolators
### High Speed Isolators

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Application[1]</th>
<th>Typical Data Rates</th>
<th>Current Transfer Ratio</th>
<th>Specified Input Current</th>
<th>Input To Output Insulation</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-4350</td>
<td>High Speed Transistor Output Isolator</td>
<td>Line Receiver, Analog Circuits, TTL/CMOS, TTL/LTTL, Ground Isolation</td>
<td>1M bit/s</td>
<td>7% Min.</td>
<td>16mA</td>
<td>3000Vdc[4]</td>
<td>117</td>
</tr>
<tr>
<td>5082-4351</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-4352</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5082-4354</td>
<td>Dual 5082-4350</td>
<td>Line Receiver, Analog Circuits, TTL/CMOS, TTL/LTTL, Ground Isolation</td>
<td>1M bit/s</td>
<td>7% Min.</td>
<td>16mA</td>
<td>3000Vdc[4]</td>
<td>121</td>
</tr>
<tr>
<td>5082-4355</td>
<td>Dual 5082-4351</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### High Reliability Isolators

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Application[1]</th>
<th>Typical Data Rates</th>
<th>Current Transfer Ratio</th>
<th>Specified Input Current</th>
<th>Input To Output Insulation</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-4365[2]</td>
<td>Dual Channel Hermetically Sealed Optically Coupled Logic Gate, TX - Screened, TXB - Screened with Group B Data</td>
<td>Line Receiver, Ground Isolation for High Reliability Systems</td>
<td>10M bit/s</td>
<td>400% Typ.</td>
<td>10mA</td>
<td>1500Vdc</td>
<td>133</td>
</tr>
</tbody>
</table>

### Low Input Current/High Gain Isolators

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Application[1]</th>
<th>Typical Data Rates</th>
<th>Current Transfer Ratio</th>
<th>Specified Input Current</th>
<th>Input To Output Insulation</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5082-4371[2]</td>
<td>Low Input Current, High Gain, (V_{CC} = 18V) Max.</td>
<td>Line Receiver, Ultra Low Current Ground Isolation, CMOS/LTTL, CMOS/TTL, CMOS/CMOS</td>
<td>400% Min.</td>
<td>0.5mA</td>
<td></td>
<td>3000Vdc[4]</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. For further information ask for Application Notes 939, 948, 951-1, 951-2 and 947. (See pages 146 and 147.)
2. Performance guaranteed over complete operational temperature range.
3. The 5082-4352 Current Transfer Ratio Specification is guaranteed to be 15% minimum and 22% maximum.
4. Recognized under the component recognition program of Underwriters Laboratories Inc. (File No. E55361).
Features

- **HIGH SPEED:** 1 Mbit/s
- **TTL COMPATIBLE**
- **RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITERS LABORATORIES, INC. (FILE NO. E55361)**
- **HIGH COMMON MODE TRANSIENT IMMUNITY:** 1000V~/s
- **3000Vdc INSULATION VOLTAGE**
- **2 MHz BANDWIDTH**
- **OPEN COLLECTOR OUTPUT**

Description

The 5082-4350 series isolators use a light emitting diode and an integrated photon detector to provide 3000V dc electrical insulation between input and output. Separate connection for the photodiode bias and output transistor collector improve the speed up to a hundred times that of a conventional phototransistor isolator by reducing the base-collector capacitance.

The 5082-4350 is suitable for use in TTL/CMOS, TTL/LL TTL or wide bandwidth analog applications. Current transfer ratio (CTR) for the -4350 is 7% minimum at $I_F = 16$ mA.

The 5082-4351 is suitable for high speed TTL/TTTL applications. A standard 16 mA TTL sink current through the input LED will provide enough output current for 1 TTL load and a 5.6 kΩ pull-up resistor. CTR of the -4351 is 15% minimum at $I_F = 16$ mA.

The 5082-4352 is suitable for use in applications where matched or known CTR is desired. CTR is 15 to 22% at $I_F = 16$ mA.

Applications

- **Line Receivers** — High common mode transient immunity (>1000V/~s) allows use of low cost twisted pair cable instead of coax.
- **High Speed Logic Ground Isolation** — TTL/TTTL, TTL/LL TTL, TTL/CMOS, TTL/LSTTL.
- **Replace Slow Phototransistor Isolators** — Pins 2-7 of the -4350 series conform to pins 1-6 of 6 pin phototransistor isolators. Pin 8 can be tied to any available bias voltage of 1.5V to 15V for high speed operation.
- **Replace Pulse Transformers** — Save board space and weight.
- **Analog Signal Ground Isolation** — Integrated photon detector provides improved linearity over phototransistor type.

Absolute Maximum Ratings

- **Storage Temperature** .............. -55°C to +125°C
- **Operating Temperature** .............. -55°C to 100°C
- **Lead Solder Temperature** .............. 260°C for 10Sec (1/16" below seating plane)
- **Average Input Current — $I_F$** .............. 25mA[1]
- **Peak Input Current — $I_F$** .............. 50mA[2]
- **(50% duty cycle, 1 ms pulse width)**
- **Peak Transient Input Current — $I_F$** .............. 1.0A (<1μsec pulse width, 300pps)
- **Reverse Input Voltage — $V_R$ (Pin 3-2)** .............. 5V
- **Input Power Dissipation** .............. 45mW[3]
- **Average Output Current — $I_O$ (Pin 6)** .............. 8mA
- **Peak Output Current** .............. 16mA
- **Emitter-Base Reverse Voltage (Pin 5-7)** .............. 5V
- **Supply and Output Voltage — $V_{CC}$ (Pin 8-5), $V_O$ (Pin 6-5)**
- **.............. -0.5V to 15V**
- **Base Current — $I_B$ (Pin 7)** .............. 5mA
- **Output Power Dissipation** .............. 100mW[4]

See notes, following page.
### Electrical Specifications \( (T_A = 25°C) \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device 5082</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Transfer Ratio</td>
<td>CTR</td>
<td>4350</td>
<td>7</td>
<td>18</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4351</td>
<td>15</td>
<td>22</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4352</td>
<td>15</td>
<td>22</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic Low Output Voltage</td>
<td>V_{OL}</td>
<td>4350</td>
<td>0.1</td>
<td>0.4</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4351</td>
<td>0.1</td>
<td>0.4</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4352</td>
<td>0.1</td>
<td>0.4</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic High Output Current</td>
<td>I_{OH}</td>
<td>4350</td>
<td>3</td>
<td>500</td>
<td>nA</td>
<td></td>
<td>(I_F = 0mA, V_O = V_{CC} = 5.5V)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4351</td>
<td>100</td>
<td></td>
<td>µA</td>
<td></td>
<td>(I_F = 0mA, V_O = V_{CC} = 15V)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4352</td>
<td>16</td>
<td></td>
<td>µA</td>
<td></td>
<td>(I_F = 16mA, V_O = Open, V_{CC} = 15V)</td>
</tr>
<tr>
<td>Logic Low Supply Current</td>
<td>I_{CL}</td>
<td>4350</td>
<td>0.02</td>
<td>1</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4351</td>
<td>0.02</td>
<td>1</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4352</td>
<td>0.02</td>
<td>1</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>V_F</td>
<td>4350</td>
<td>1.5</td>
<td>1.7</td>
<td>V</td>
<td></td>
<td>(I_F = 16mA)</td>
</tr>
<tr>
<td>Temperature Coefficient of</td>
<td>(\Delta V_F)</td>
<td>4350</td>
<td>-1.8</td>
<td></td>
<td>mV/°C</td>
<td></td>
<td>(I_F = 16mA)</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>(\Delta T_A)</td>
<td>4350</td>
<td>5</td>
<td></td>
<td>V</td>
<td></td>
<td>(I_R = 10mA)</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C_I</td>
<td>4350</td>
<td>40</td>
<td></td>
<td>pF</td>
<td>(f = 1MHz, V_F = 0)</td>
<td></td>
</tr>
<tr>
<td>Input - Output Insulation</td>
<td>C_{I-O}</td>
<td>4350</td>
<td>1.0</td>
<td></td>
<td>µA</td>
<td>(45% Relative Humidity, t=5 sec)</td>
<td></td>
</tr>
<tr>
<td>Leakage Current</td>
<td>I_{I-O}</td>
<td>4350</td>
<td>10^{12}</td>
<td></td>
<td>Ω</td>
<td>(V_I-O = 500V)dc</td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>R_{I-O}</td>
<td>4350</td>
<td>0.6</td>
<td></td>
<td>pF</td>
<td>(f = 1MHz)</td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>C_{I-O}</td>
<td>4350</td>
<td>0.6</td>
<td></td>
<td>pF</td>
<td>(f = 1MHz)</td>
<td></td>
</tr>
<tr>
<td>Transistor DC Current Gain</td>
<td>h_{FE}</td>
<td>4350</td>
<td>150</td>
<td></td>
<td></td>
<td>(V_O = 5V, I_O = 3mA)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Derate linearly above 70°C free-air temperature at a rate of 0.1mA/°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1.6mA/°C.
3. Derate linearly above 70°C free-air temperature at a rate of 1.6mA/°C.
4. Derate linearly above 70°C free-air temperature at a rate of 2.0mA/°C.
5. CURRENT TRANSFER RATIO is defined as the ratio of output collector current, \(I_O\), to the forward LED input current, \(I_F\), times 100%.
6. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
7. Common mode transient immunity in Logic High level is the maximum tolerable (positive) \(dV_{CM}/dt\) on the leading edge of the common mode pulse signal, \(V_{CM}\), to assure that the output will remain in a Logic High state (i.e., \(V_O > 2.0V\)). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) \(dV_{CM}/dt\) on the trailing edge of the common mode pulse signal, \(V_{CM}\), to assure that the output will remain in a Logic Low state (i.e., \(V_O < 0.8V\)).
8. The 1.9kΩ load represents 1 TTL unit load of 1.6mA and a 5.6kΩ pull-up resistor.
9. The 4.1kΩ load represents 1 LTTI unit load of 0.18mA and a 5.6kΩ pull-up resistor.
10. The frequency at which the ac output voltage is 3 dB below the low frequency asymptote.

### Switching Specifications \( (T_A = 25°C) \)

\(V_{CC} = 5V, I_F = 16mA\) UNLESS OTHERWISE SPECIFIED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device 5082</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay</td>
<td>1PHL</td>
<td>4350</td>
<td>0.5</td>
<td>1.5</td>
<td>µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time To Logic Low at Output</td>
<td>1PLH</td>
<td>4351, 4352</td>
<td>0.2</td>
<td>0.8</td>
<td>µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propagation Delay</td>
<td>2PHL</td>
<td>4350</td>
<td>0.4</td>
<td>1.5</td>
<td>µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time To Logic High at Output</td>
<td>2PLH</td>
<td>4351, 4352</td>
<td>0.3</td>
<td>0.8</td>
<td>µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity in Logic High Level Output</td>
<td>CMH</td>
<td>4350</td>
<td>&gt;1000</td>
<td></td>
<td>V/µs</td>
<td>(I_F = 0mA, V_{CM} = 10Vp-p, R_I = 4.1kΩ)</td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity in Logic Low Level Output</td>
<td>CML</td>
<td>4350</td>
<td>&lt;-1000</td>
<td></td>
<td>V/µs</td>
<td>(V_{CM} = 10Vp-p, R_I = 4.1kΩ)</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>8B</td>
<td>4350</td>
<td>2</td>
<td></td>
<td>MHz</td>
<td>(R_I = 100Ω)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Derate linearly above 70°C free-air temperature at a rate of 0.1mA/°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1.6mA/°C.
3. Derate linearly above 70°C free-air temperature at a rate of 1.6mA/°C.
4. Derate linearly above 70°C free-air temperature at a rate of 2.0mA/°C.
5. CURRENT TRANSFER RATIO is defined as the ratio of output collector current, \(I_O\), to the forward LED input current, \(I_F\), times 100%.
6. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
7. Common mode transient immunity in Logic High level is the maximum tolerable (positive) \(dV_{CM}/dt\) on the leading edge of the common mode pulse signal, \(V_{CM}\), to assure that the output will remain in a Logic High state (i.e., \(V_O > 2.0V\)). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) \(dV_{CM}/dt\) on the trailing edge of the common mode pulse signal, \(V_{CM}\), to assure that the output will remain in a Logic Low state (i.e., \(V_O < 0.8V\)).
8. The 1.9kΩ load represents 1 TTL unit load of 1.6mA and a 5.6kΩ pull-up resistor.
9. The 4.1kΩ load represents 1 LTTI unit load of 0.18mA and a 5.6kΩ pull-up resistor.
10. The frequency at which the ac output voltage is 3 dB below the low frequency asymptote.
Figure 1. DC and Pulsed Transfer Characteristics.

Figure 2. Current Transfer Ratio vs. Input Current.

Figure 3. Input Current vs. Forward Voltage.

Figure 4. Output Current vs. Input Current.

Figure 5. Propagation Delay vs. Temperature.

Figure 6. Logic High Output Current vs. Temperature.
Figure 7. Small-Signal Current Transfer Ratio vs. Quiescent Input Current.

Figure 8. Frequency Response.

Figure 9. Switching Test Circuit.

Figure 10. Test Circuit for Transient Immunity and Typical Waveforms.
Features

- **HIGH SPEED:** 1 Mbit/s
- **TTL COMPATIBLE**
- **HIGH COMMON MODE TRANSIENT IMMUNITY:** >1000V/μs
- **HIGH DENSITY PACKAGING**
- **3000Vdc INSULATION VOLTAGE**
- **3 MHz BANDWIDTH**
- **OPEN COLLECTOR OUTPUTS**
- **RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITERS LABORATORIES, INC. (FILE NO. E55361)**

Description

The 5082-4354/55 dual isolators contain a pair of light emitting diodes and integrated photon detectors with 3000V dc electrical insulation between input and output. Separate connection for the photodiode bias and output transistor collectors improve the speed up to a hundred times that of a conventional phototransistor isolator by reducing the base-collector capacitance.

The 5082-4354 is suitable for use in TTL/CMOS, TTL/LTTL or wide bandwidth analog applications. Current transfer ratio (CTR) for the -4354 is 7% minimum at $I_F = 16$ mA. The 5082-4355 is suitable for high speed TTL/LTTL applications. A standard 16 mA TTL sink current through the input LED will provide enough output current for 1 TTL load and a 5.6kΩ pull-up resistor. CTR of the -4355 is 15% minimum at $I_F = 16$ mA.

Applications

- **Line Receivers** — High common mode transient immunity (>1000V/μs) allows use of low cost twisted pair cable instead of coax.
- **High Speed Logic Ground Isolation** — TTL/LTTL, TTL/CMOS, TTL/LSTTL.
- **Replace Pulse Transformers** — Save board space and weight.
- **Analog Signal Ground Isolation** — Integrated photon detector provides improved linearity over phototransistor type.
- **Polarity Sensing**.
- **Isolated Analog Amplifier** — Dual channel packaging enhances thermal tracking.

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-55°C to +125°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +100°C</td>
</tr>
<tr>
<td>Lead Solder Temperature</td>
<td>260°C for 10Sec (1/16&quot; below seating plane)</td>
</tr>
<tr>
<td>Average Input Current — $I_F$ (each channel)</td>
<td>25mA[1]</td>
</tr>
<tr>
<td>Peak Input Current — $I_F$ (each channel)</td>
<td>50mA[2] (50% duty cycle, 1 ms pulse width)</td>
</tr>
<tr>
<td>Peak Transient Input Current — $I_F$ (each channel)</td>
<td>1.0 A (&lt;1μsec pulse width, 300pps)</td>
</tr>
<tr>
<td>Reverse Input Voltage — $V_R$ (each channel)</td>
<td>5V</td>
</tr>
<tr>
<td>Input Power Dissipation (each channel)</td>
<td>45mW[3]</td>
</tr>
<tr>
<td>Average Output Current — $I_O$ (each channel)</td>
<td>8mA</td>
</tr>
<tr>
<td>Peak Output Current — $I_O$ (each channel)</td>
<td>16mA</td>
</tr>
<tr>
<td>Supply and Output Voltage — $V_{CC}$ (Pin 8-5), $V_O$ (Pin 7,6-5)</td>
<td>-0.5V to 15V</td>
</tr>
<tr>
<td>Output Power Dissipation (each channel)</td>
<td>35mW[4]</td>
</tr>
</tbody>
</table>

See notes, page 2.
### Electrical Specifications AT $T_A = 25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Fig.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Transfer Ratio</td>
<td>CTR</td>
<td>4354</td>
<td>7</td>
<td>18</td>
<td></td>
<td>%</td>
<td>$I_F = 16mA, V_O = 0.4V, V_CC = 4.5V$</td>
<td>2</td>
<td>5, 6</td>
</tr>
<tr>
<td>Logic Low</td>
<td>VOL</td>
<td>4354</td>
<td>0.1</td>
<td>0.4</td>
<td></td>
<td>V</td>
<td>$I_P = 16mA, I_O = 1.1mA, V_CC = 4.5V$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td></td>
<td>4355</td>
<td>0.1</td>
<td>0.4</td>
<td></td>
<td>V</td>
<td>$I_P = 16mA, I_O = 2.4mA, V_CC = 4.5V$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Logic High</td>
<td>IOH</td>
<td></td>
<td>3</td>
<td></td>
<td>500</td>
<td>nA</td>
<td>$I_F = 0mA, V_O = V_CC = 5.5V$</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Output Current</td>
<td>IOH</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>$\mu A$</td>
<td>$I_F = 0mA, V_O = V_CC = 15V$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Logic Low</td>
<td>ICCL</td>
<td></td>
<td>32</td>
<td></td>
<td></td>
<td>$\mu A$</td>
<td>$I_{F1} = I_{F2} = 16mA, V_{O1} = V_{O2} = Open, V_{CC} = 15V$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Supply Current</td>
<td>ICCH</td>
<td></td>
<td>0.05</td>
<td>2</td>
<td></td>
<td>$\mu A$</td>
<td>$I_{F1} = I_{F2} = 0mA, V_{O1} = V_{O2} = Open, V_{CC} = 15V$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>$V_F$</td>
<td></td>
<td>1.5</td>
<td>1.7</td>
<td></td>
<td>V</td>
<td>$I_F = 16mA$</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage</td>
<td>$\Delta V_F$</td>
<td>$T_A$</td>
<td>-1.8</td>
<td></td>
<td>mV/$^\circ C$</td>
<td>$I_F = 16mA$</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Reverse Voltage</td>
<td>$V_R$</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td>V</td>
<td>$I_F = 10mA$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>$C_O$</td>
<td></td>
<td>40</td>
<td></td>
<td></td>
<td>$\mu F$</td>
<td>$f = 1$ MHz, $V_F = 0$</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Output - Input Insulation Leakage Current</td>
<td>$I_{I-O}$</td>
<td>1.0</td>
<td>$\mu A$</td>
<td>46% Relative Humidity, $t = 5$ sec</td>
<td>$V_{IO} = 3000Vdc$</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>$R_{I-O}$</td>
<td>1012</td>
<td>$\Omega$</td>
<td>$V_{I-O} = 500Vdc$</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>$C_{I-O}$</td>
<td>0.6</td>
<td>$\mu F$</td>
<td>$f = 1$ MHz</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Voltage (Input-Input)</td>
<td>$V_{I-I}$</td>
<td>1500</td>
<td>$V$</td>
<td>45% Relative Humidity</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Input)</td>
<td>$R_{I-I}$</td>
<td>1011</td>
<td>$\Omega$</td>
<td>$V_{I-I} = 500Vdc$</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Input)</td>
<td>$C_{I-I}$</td>
<td>0.25</td>
<td>$\mu F$</td>
<td>$f = 1$ MHz</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Derate linearly above 70°C free-air temperature at a rate of 0.8m$A/$°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1.0m$A/$°C.
3. Derate linearly above 70°C free-air temperature at a rate of 0.9m$A/$°C.
4. Derate linearly above 70°C free-air temperature at a rate of 1.0m$A/$°C.
5. Each channel.
6. CURRENT TRANSFER RATIO is defined as the ratio of output collector current, $I_O$, to the forward LED input current, $I_F$, times 100%.
7. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
8. Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.
9. Common mode transient immunity in Logic High level is the maximum tolerable (positive) $dV_{CM}/dt$ on the leading edge of the common mode pulse signal $V_{CM}$, to assure that the output will remain in a Logic High state (i.e., $V_H > 2.0V$). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) $dV_{CM}/dt$ on the trailing edge of the common mode pulse signal $V_{CM}$, to assure that the output will remain in a Logic Low state (i.e., $V_L < 0.8V$).
10. The 1.9$k\Omega$ load represents 1 TTL unit load of 1.6mA and the 5.6$k\Omega$ pull-up resistor.
11. The 4.1$k\Omega$ load represents 1 LTL unit load of 0.18mA and 5.6$k\Omega$ pull-up resistor.
12. The frequency at which the ac output voltage is 3dB below the low frequency asymptote.

### Switching Specifications AT $T_A = 25^\circ C$, $V_{CC} = 5V$, $I_F = 16mA$, UNLESS OTHERWISE SPECIFIED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Fig.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay Time To Logic Low at Output</td>
<td>TPRLH</td>
<td>4354</td>
<td>0.3</td>
<td>1.5</td>
<td>micros</td>
<td>$R_L = 4.1k\Omega$</td>
<td>5, 9</td>
<td>10, 11</td>
<td></td>
</tr>
<tr>
<td>Propagation Delay Time To Logic High at Output</td>
<td>TPRLH</td>
<td>4354</td>
<td>0.3</td>
<td>1.5</td>
<td>micros</td>
<td>$R_L = 4.1k\Omega$</td>
<td>5, 9</td>
<td>10, 11</td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic High Level Output</td>
<td>CMH</td>
<td>4354</td>
<td>&gt;1000</td>
<td>V/micros</td>
<td>$I_F = 0mA, R_L = 4.1k\Omega, V_{CM} = 10V_{PP}$</td>
<td>10</td>
<td>9, 10, 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic Low Level Output</td>
<td>CMH</td>
<td>4354</td>
<td>&gt;1000</td>
<td>V/micros</td>
<td>$I_F = 0mA, R_L = 1.9k\Omega, V_{CM} = 10V_{PP}$</td>
<td>10</td>
<td>9, 10, 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>BW</td>
<td></td>
<td>3</td>
<td></td>
<td>MHz</td>
<td>$R_L = 1000\Omega$</td>
<td>8</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. DC and Pulsed Transfer Characteristics.

Figure 2. Current Transfer Ratio vs. Input Current.

Figure 3. Input Current vs. Forward Voltage.

Figure 4. Output Current vs. Input Current.

Figure 5. Propagation Delay vs. Temperature.

Figure 6. Logic High Output Current vs. Temperature.
Figure 7. Small-Signal Current Transfer Ratio vs. Quiescent Input Current.

Figure 8. Frequency Response.

Figure 9. Switching Test Circuit.

Figure 10. Test Circuit for Transient Immunity and Typical Waveforms.
Features
- DTL/TTL COMPATIBLE: 5V SUPPLY
- ULTRA HIGH SPEED
- LOW INPUT CURRENT REQUIRED: 5mA
- HIGH COMMON MODE REJECTION
- GUARANTEED PERFORMANCE OVER TEMPERATURE
- RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITERS LABORATORIES, INC. (FILE NO. E55361)
- 3000V dc INSULATION VOLTAGE

Description/Applications
The 5082-4360 consists of a GaAsP photon emitting diode and a unique integrated detector. The photons are collected in the detector by a photodiode and then amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. The circuit is temperature, current and voltage compensated.

This unique isolator design provides maximum DC and AC circuit isolation between input and output while achieving DTL/TTL circuit compatibility. The isolator operational parameters are guaranteed from 0°C to 70°C, such that a minimum input current of 5mA will sink an eight gate fan-out (13mA) at the output with 5 volt Vcc applied to the detector. This isolation and coupling is achieved with a typical propagation delay of 45nsec. The enable input provides gating of the detector with input sinking and sourcing requirements compatible with DTL/TTL interfacing and a propagation delay of 25 nsec typical.

The 5082-4360 can be used in high speed digital interfacing applications where common mode signals must be rejected, such as for a line receiver and digital programming of floating power supplies, motors, and other machine control systems. The elimination of ground loops can be accomplished between system interfaces such as a computer and a peripheral memory.

The open collector output provides capability for bussing, OR'ing and strobing.

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current, Low Level Each Channel</td>
<td>IFL</td>
<td>0</td>
<td>250</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Input Current, High Level Each Channel</td>
<td>IFL</td>
<td>5</td>
<td>7.5</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>High Level Enable Voltage</td>
<td>VEE</td>
<td>2.0</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Low Level Enable Voltage (Output High)</td>
<td>VEL</td>
<td>0</td>
<td>0.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply Voltage, Output</td>
<td>VCC</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Fan Out (TTL Load)</td>
<td>N</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>TA</td>
<td>0</td>
<td>25</td>
<td>70</td>
<td>°C</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

Storage Temperature .................................. −55°C to +125°C
Operating Temperature ................................ 0°C to +70°C
Lead Solder Temperature ............................ 260°C for 10 Sec.
Peak Forward Input Current ................................ 20mA (≤ 1 msec Duration)
Average Forward Input Current ........................ 10mA
Reverse Input Voltage .................................. 5V
Enable Input Voltage ...................................... 5.5V
(Not to exceed VCC by more than 500mV)
Supply Voltage - VCC ................................. 7V (1 Minute Maximum)
Output Current - IO ..................................... 50mA
Output Collector Power Dissipation ................... 85mW
Output Voltage - VO ...................................... 7V
## Electrical Characteristics

**OVER RECOMMENDED TEMPERATURE (TA = 0°C -70°C) UNLESS OTHERWISE NOTED**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Output Current</td>
<td>I\text{OH}</td>
<td>50</td>
<td>250</td>
<td>µA</td>
<td></td>
<td>V\text{CC}=5.5V, V\text{O}=5.5V, I\text{F} = 250µA, V\text{EH}=2.0V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Low Level Output Voltage</td>
<td>V\text{OL}</td>
<td>0.5</td>
<td>0.6</td>
<td>V</td>
<td></td>
<td>V\text{CC}=5.5V, I\text{F}=5mA, V\text{EH}=2.0V I\text{OL} (Sinking) = 13mA</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>High Level Enable Current</td>
<td>I\text{EH}</td>
<td>-1.0</td>
<td></td>
<td>mA</td>
<td></td>
<td>V\text{CC}=5.5V, V\text{EH}=2.0V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level Enable Current</td>
<td>I\text{EL}</td>
<td>-1.6</td>
<td>2.0</td>
<td>mA</td>
<td></td>
<td>V\text{CC}=5.5V, V\text{EL}=0.5V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Level Supply Current</td>
<td>I\text{CH}</td>
<td>7</td>
<td>15</td>
<td>mA</td>
<td></td>
<td>V\text{CC}=5.5V, I\text{F}=0 V\text{EL}=0.5V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level Supply</td>
<td>I\text{CL}</td>
<td>13</td>
<td>18</td>
<td>mA</td>
<td></td>
<td>V\text{CC}=5.5V, I\text{F}=10mA V\text{EL}=0.5V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input-Output Insulation Leakage Current</td>
<td>I\text{L-O}</td>
<td>1.0</td>
<td></td>
<td>µA</td>
<td>Relative Humidity=45% T\text{A}=25°C t=5sec, V\text{L-O} = 3000Vdc</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>R\text{L-O}</td>
<td>1012</td>
<td></td>
<td>Ω</td>
<td>V\text{L-O}=500V, T\text{A}=25°C</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>C\text{L-O}</td>
<td>0.6</td>
<td></td>
<td>pF</td>
<td>f=1MHz, T\text{A}=25°C</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>V\text{F}</td>
<td>1.5</td>
<td>1.75</td>
<td>V</td>
<td>I\text{F}=10mA, T\text{A}=25°C</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Input Reverse Breakdown Voltage</td>
<td>B\text{VR}</td>
<td>5</td>
<td></td>
<td>V</td>
<td>I\text{R}=10µA, T\text{A}=25°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C\text{IN}</td>
<td>40</td>
<td></td>
<td>pF</td>
<td>V\text{F}=0, f=1MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Transfer Ratio</td>
<td>C\text{TR}</td>
<td>600</td>
<td></td>
<td>%</td>
<td>I\text{F}=5.0mA, R\text{L}=100Ω</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

*All typical values are at V\text{CC} = 5V, T\text{A} = 25°C*

## Switching Characteristics at T\text{A}=25°C, V\text{CC} = 5V

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay Time to High Output Level</td>
<td>t\text{PLH}</td>
<td>45</td>
<td>75</td>
<td>ns</td>
<td></td>
<td>R\text{L}=350Ω, C\text{L}=15pF, I\text{F}=7.5mA</td>
<td>7,9</td>
<td>1</td>
</tr>
<tr>
<td>Propagation Delay Time to Low Output Level</td>
<td>t\text{PHL}</td>
<td>45</td>
<td>75</td>
<td>ns</td>
<td></td>
<td>R\text{L}=350Ω, C\text{L}=15pF, I\text{F}=7.5mA</td>
<td>7,9</td>
<td>2</td>
</tr>
<tr>
<td>Output Rise-Fall Time (10-90%)</td>
<td>t\text{IN}, t\text{FF}</td>
<td>25</td>
<td></td>
<td>ns</td>
<td></td>
<td>R\text{L}=350Ω, C\text{L}=15pF, I\text{F}=7.5mA</td>
<td>7,9</td>
<td>2</td>
</tr>
<tr>
<td>Propagation Delay Time of Enable from V\text{EH} to V\text{EL}</td>
<td>t\text{EIH}</td>
<td>25</td>
<td></td>
<td>ns</td>
<td></td>
<td>R\text{L}=350Ω, C\text{L}=15pF, I\text{F}=7.5mA, V\text{EH}=3.0V, V\text{EL}=0.5V</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Propagation Delay Time of Enable from V\text{EL} to V\text{EH}</td>
<td>t\text{EHL}</td>
<td>15</td>
<td></td>
<td>ns</td>
<td></td>
<td>R\text{L}=350Ω, C\text{L}=15pF, I\text{F}=7.5mA, V\text{EH}=3.0V, V\text{EL}=0.5V</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic High Output Level</td>
<td>\text{CMH}</td>
<td>50</td>
<td></td>
<td>v/µs</td>
<td></td>
<td>V\text{CM}=10V, R\text{L}=350Ω, \text{V}_{\text{O(min)}}=2V, I\text{F}=0mA</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic Low Output Level</td>
<td>\text{CML}</td>
<td>150</td>
<td></td>
<td>v/µs</td>
<td></td>
<td>V\text{CM}=10V, R\text{L}=350Ω, \text{V}_{\text{O(max)}}=0.8V, I\text{F}=5mA</td>
<td>11</td>
<td>6</td>
</tr>
</tbody>
</table>
Operating Procedures and Definitions

Logic Convention. The 5082-4360 is defined in terms of positive logic.

Bypassing. A ceramic capacitor (.01 to .1μF) should be connected from pin 8 to pin 5. Its purpose is to stabilize the operation of the high gain linear amplifier. Failure to provide the bypassing may impair the switching properties. The total lead length between capacitor and isolator should not exceed 20mm.

Polarities. All voltages are referenced to network ground (pin 5). Current flowing toward a terminal is considered positive.

Enable Input. No external pull-up required for a logic (1), i.e., can be open circuit.

NOTES:
1. The $t_{PLH}$ propagation delay is measured from the 3.75mA point on the trailing edge of the input pulse to the 1.5V point on the trailing edge of the output pulse.
2. The $t_{PHL}$ propagation delay is measured from the 3.75mA point on the input pulse to the 1.5V point on the leading edge of the output pulse.
3. The $t_{EHL}$ enable propagation delay is measured from the 1.5V point on the trailing edge of the input pulse to the 1.5V point on the leading edge of the output pulse.
4. The $t_{ELH}$ enable propagation delay is measured from the 1.5V point on the leading edge of the input pulse to the 1.5V point on the leading edge of the output pulse.
5. Device considered a two terminal device: pins 2 and 3 shorted together, and pins 5, 6, 7, and 8 shorted together.
6. Common mode transient immunity in Logic High level is the maximum tolerable (positive) $dV_{CM}/dt$ on the leading edge of the common mode pulse, $V_{CM}$, to assure that the output will remain in a Logic High state (i.e., $V_o>2.0V$). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) $dV_{CM}/dt$ on the trailing edge of the common mode pulse signal, $V_{CM}$, to assure that the output will remain in a Logic Low state (i.e., $V_o<0.8V$).
7. DC Current Transfer Ratio is defined as the ratio of the output collector current to the forward bias input current times 100%.
8. At 10mA $V_F$ decreases with increasing temperature at the rate of 1.6mV/°C.
Figure 7. Test Circuit for tpHL and tPLH.

Figure 8. Test Circuit for tELH and tEHL.

Figure 9. Propagation Delay, tpHL and tPLH vs. Pulse Input Current, IFH.

Figure 10. Response Delay Between TTL Gates.

Figure 11. Test Circuit for Transient Immunity and Typical Waveforms.
Features

- HIGH DENSITY PACKAGING
- DTL/TTL COMPATIBLE: 5V SUPPLY
- ULTRA HIGH SPEED
- LOW INPUT CURRENT REQUIRED: 5mA
- HIGH COMMON MODE REJECTION
- GUARANTEED PERFORMANCE OVER TEMPERATURE
- RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITERS LABORATORIES, INC. (FILE NO. E55361)
- 3000Vdc INSULATION VOLTAGE

Description/Applications

The 5082-4364 consists of a pair of inverting optically isolated gates each with a GaAsP photon emitting diode and a unique integrated detector. The photons are collected in the detector by a photodiode and then amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. Each circuit is temperature, current and voltage compensated.

This unique dual isolator design provides maximum DC and AC circuit isolation between each input and output while achieving DTL/TTL circuit compatibility. The isolator operational parameters are guaranteed from 0°C to 70°C, such that a minimum input current of 5 mA in each channel will sink an eight gate fan-out (13 mA) at the output with 5 volt VCC applied to the detector. This isolation and coupling is achieved with a typical propagation delay of 50 nsec.

The 5082-4364 can be used in high speed digital interface applications where common mode signals must be rejected such as for a line receiver and digital programming of floating power supplies, motors, and other machine control systems. The elimination of ground loops can be accomplished between system interfaces such as a computer and a peripheral memory.

The open collector output provides capability for bussing, OR’ing, and strobing. In all applications, the dual channel configuration allows for high density packaging, increased convenience and more usable board space.

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current, Low Level (Each Channel)</td>
<td>IFL</td>
<td>0</td>
<td>250</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Input Current, High Level (Each Channel)</td>
<td>IFH</td>
<td>5</td>
<td>7.5</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Supply Voltage, Output (VCC)</td>
<td>VCC</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Fan Out (TTL Load) (Each Channel)</td>
<td>N</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature (TA)</td>
<td>0</td>
<td>25</td>
<td>70</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

- Storage Temperature: -55°C to +125°C
- Operating Temperature: 0°C to +70°C
- Lead Solder Temperature: 260°C for 10 Sec.
- Peak Forward Input Current (each channel): 20 mA (≤ 1 msec Duration)
- Average Forward Input Current (each channel): 10 mA
- Reverse Input Voltage (each channel): 5V
- Supply Voltage - VCC: 7V (1 Minute Maximum)
- Output Current - IO (each channel): 16 mA
- Output Voltage - VO (each channel): 7V
### Electrical Characteristics

OVER RECOMMENDED TEMPERATURE ($T_A = 0^\circ C - 70^\circ C$) UNLESS OTHERWISE NOTED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Output Current</td>
<td>$I_{OH}$</td>
<td>50</td>
<td>250</td>
<td>50</td>
<td>$\mu A$</td>
<td>$V_{CC} = 5.5V, V_O = 5.5V, I_F = 250\mu A$</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Low Level Output Voltage</td>
<td>$V_{OL}$</td>
<td>0.5</td>
<td>0.6</td>
<td>50</td>
<td>$V$</td>
<td>$V_{CC} = 5.5V, I_F = 5mA, I_{OL} (Sinking) = 13mA$</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>High Level Supply Current</td>
<td>$I_{CCH}$</td>
<td>14</td>
<td>30</td>
<td>14</td>
<td>mA</td>
<td>$V_{CC} = 5.5V, I_F = 0, Each Channel</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Low Level Supply</td>
<td>$I_{CCL}$</td>
<td>26</td>
<td>36</td>
<td>26</td>
<td>mA</td>
<td>$V_{CC} = 5.5V, I_F = 10mA, Each Channel</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Input - Output Insulation Leakage Current</td>
<td>$I_{I-O}$</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>$\mu A$</td>
<td>Relative Humidity = 45%, $T_A = 25^\circ C$, $t = 5$ sec, $V_{I-O} = 3000Vdc$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>$R_{I-O}$</td>
<td>10^12</td>
<td>10^12</td>
<td>10^12</td>
<td>$\Omega$</td>
<td>$V_{I-O} = 500V, T_A = 25^\circ C$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>$C_{I-O}$</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>pF</td>
<td>$f = 1MHz, T_A = 25^\circ C$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>$V_F$</td>
<td>1.5</td>
<td>1.75</td>
<td>1.75</td>
<td>V</td>
<td>$I_F = 10mA, T_A = 25^\circ C$</td>
<td>4</td>
<td>7.3</td>
</tr>
<tr>
<td>Input Reverse Breakdown Voltage</td>
<td>$BV_R$</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>V</td>
<td>$I_R = 10\mu A, T_A = 25^\circ C$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>$C_{In}$</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>pF</td>
<td>$V_F = 0, f = 1MHz$</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Insulation Voltage (Input-Output)</td>
<td>$V_{I-I}$</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>V</td>
<td>Relative Humidity = 45%</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Input)</td>
<td>$R_{I-I}$</td>
<td>10^12</td>
<td>10^12</td>
<td>10^12</td>
<td>$\Omega$</td>
<td>$V_{I(I-2)} = 500V$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Input)</td>
<td>$C_{I-I}$</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>pF</td>
<td>$f = 1MHz$</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Current Transfer Ratio</td>
<td>CTR</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>%</td>
<td>$I_F = 5.0mA, R_L = 100\Omega$</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

*All typical values are at $V_{CC} = 5V, T_A = 25^\circ C$*

### Switching Characteristics at $T_A = 25^\circ C, V_{CC} = 5V$

EACH CHANNEL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay Time to High Output Level</td>
<td>$t_{PLH}$</td>
<td>55</td>
<td>75</td>
<td>55</td>
<td>ns</td>
<td>$R_L = 350 \Omega, C_L = 15pF, I_F = 7.5mA$</td>
<td>5,6</td>
<td>1</td>
</tr>
<tr>
<td>Propagation Delay Time to Low Output Level</td>
<td>$t_{PHL}$</td>
<td>40</td>
<td>75</td>
<td>40</td>
<td>ns</td>
<td>$R_L = 350 \Omega, C_L = 15pF, I_F = 7.5mA$</td>
<td>5,6</td>
<td>2</td>
</tr>
<tr>
<td>Output Rise-Fall Time (10-90%)</td>
<td>$t_r, t_f$</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>ns</td>
<td>$R_L = 350 \Omega, C_L = 15pF, I_F = 7.5mA$</td>
<td>5,6</td>
<td>3</td>
</tr>
<tr>
<td>Common Mode Transient Immunity at High Output Level</td>
<td>$CM_{H}$</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>$V/\mu s$</td>
<td>$V_{CM} = 10V_{p-p}, R_L = 350 \Omega, V_O (min.) = 2V, I_F = 0mA$</td>
<td>9,8</td>
<td>5</td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Low Output Level</td>
<td>$CM_{L}$</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>$V/\mu s$</td>
<td>$V_{CM} = 10V_{p-p}, R_L = 350 \Omega, V_O (max.) = 0.8V, I_F = 7.5mA$</td>
<td>8,5</td>
<td>5</td>
</tr>
</tbody>
</table>

**NOTE:** It is essential that a bypass capacitor (.01µF to 0.1µF, ceramic) be connected from pin 8 to pin 5. Total lead length between both ends of the capacitor and the isolator pins should not exceed 20mm. Failure to provide the bypass may impair the switching properties.
NOTES:
1. The tPLH propagation delay is measured from the 3.75 mA point on the trailing edge of the input pulse to the 1.5V point on the trailing edge of the output pulse.
2. The tPHL propagation delay is measured from the 3.75 mA point on the leading edge of the input pulse to the 1.5V point on the leading edge of the output pulse.
3. Each channel.
4. Measured between pins 1, 2, 3, and 4 shorted together, and pins 5, 6, 7, and 8 shorted together.
5. Common mode transient immunity in Logic High level is the maximum tolerable (positive) dVCM/dt on the leading edge of the common mode pulse, VCM, to assure that the output will remain in a Logic High state (i.e., V0>2.0V). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dVCM/dt on the trailing edge of the common mode pulse signal, VCM, to assure that the output will remain in a Logic Low state (i.e., V0<0.8V).
6. DC Current Transfer Ratio is defined as the ratio of the output collector current to the forward bias input current times 100%.
7. At 10mA VF decreases with increasing temperature at the rate of 1.9mV/°C.
8. Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

NOTE: Dashed characteristics indicate pulsed operation.

Figure 2. Isolator Transfer Characteristics.

Figure 3. Input-Output Characteristics.

Figure 4. Input Diode Forward Characteristic
* $C_L$ is approximately 15 pF, which includes probe and stray wiring capacitance.

**Figure 5. Test Circuit for $t_{PHL}$ and $t_{PLH}$.**

**Figure 6. Propagation Delay, $t_{PHL}$ and $t_{PLH}$ vs. Pulse Input Current, $I_{FH}$.**

**Figure 7. Response Delay Between TTL Gates.**

**Figure 8. Test Circuit for Transient Immunity and Typical Waveforms.**
**Features**

- HERMETICALLY SEALED
- HIGH SPEED
- PERFORMANCE GUARANTEED OVER -55°C TO +125°C AMBIENT TEMPERATURE RANGE
- HIGH RELIABILITY SCREENING PROGRAM AVAILABLE
- TTL COMPATIBLE INPUT AND OUTPUT
- HIGH COMMON MODE REJECTION
- DUAL-IN-LINE PACKAGE
- 1500Vdc INSULATION VOLTAGE
- DUAL CHANNEL
- EIA REGISTRATION

**Applications**

- Logic Ground Isolation
- Line Receiver
- Computer - Peripheral Interface
- High Density Packaging
- High Reliability Systems

**Description**

The 5082-4365 consists of a pair of inverting optically isolated gates, each with a light emitting diode and a unique high gain integrated photon detector in a hermetically sealed ceramic package. The output of the detector is an open collector Schottky clamped transistor.

This unique dual isolator design provides maximum DC and AC circuit isolation between each input and output while achieving TTL circuit compatibility. The isolator operational parameters are guaranteed from -55°C to +125°C, such that a minimum input current of 10 mA in each channel will sink a six gate fanout (10 mA) at the output with 4.5 to 5.5 V V_{CC} applied to the detector. This isolation and coupling is achieved with a typical propagation delay of 55 nsec.

**Recommended Operating Conditions**

<table>
<thead>
<tr>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current, Low Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each Channel</td>
<td>I_{FL}</td>
<td>0</td>
<td>250</td>
<td>µA</td>
</tr>
<tr>
<td>Input Current, High Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each Channel</td>
<td>I_{FH}</td>
<td>10</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>V_{CC}</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Fan Out (TTL Load)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each Channel</td>
<td>N</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>T_{A}</td>
<td>-55</td>
<td>25</td>
<td>125</td>
</tr>
</tbody>
</table>

**Absolute Maximum Ratings**

- Storage Temperature: -65°C to +150°C
- Operating Temperature: -55°C to +125°C
- Lead Solder Temperature: 260°C for 10 Sec.
- Peak Forward Input Current (each channel): 40 mA (≤1 msec Duration)
- Average Input Forward Current (each channel): 20 mA
- Reverse Input Voltage (each channel): 5V
- Supply Voltage - V_{CC}: 7V
- Output Current - I_{O} (each channel): 25 mA
- Output Power Dissipation (each channel): 40 mW
- Output Voltage - V_{O} (each channel): 7V
### TABLE II, GROUP A

**Electrical Characteristics**

OVER RECOMMENDED TEMPERATURE (\(T_A = -55^\circ C\) TO \(+125^\circ C\)) UNLESS OTHERWISE NOTED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.*</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Output Current</td>
<td>(I_{OH})</td>
<td>1</td>
<td>250</td>
<td>(\mu A)</td>
<td>(V_{CC} = 5.5V, V_O = 5.5V, I_F = 250\mu A)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level Output Voltage</td>
<td>(V_{OL})</td>
<td>0.5</td>
<td>0.6</td>
<td>(V)</td>
<td>(V_{CC} = 5.5V, I_F = 10mA, I_{OL} (Sinking) = 10mA)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Level Supply Current</td>
<td>(I_{CC})</td>
<td>18</td>
<td>28</td>
<td>(mA)</td>
<td>(V_{CC} = 5.5V, I_F = 0) Each Channel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level Supply Current</td>
<td>(I_{CC})</td>
<td>26</td>
<td>36</td>
<td>(mA)</td>
<td>(V_{CC} = 5.5V, I_F = 20mA) Each Channel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>(V_F)</td>
<td>1.5</td>
<td>1.75</td>
<td>(V)</td>
<td>(I_F = 20mA, T_A = 25^\circ C)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Reverse Breakdown Voltage</td>
<td>(B_{VR})</td>
<td>5</td>
<td></td>
<td>(V)</td>
<td>(I_R = 10\mu A, T_A = 25^\circ C)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>(C_{in})</td>
<td>60</td>
<td></td>
<td>(pF)</td>
<td>(V_F = 0, f = 1MHz)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Diode Temperature Coefficient</td>
<td>(\Delta V_T)</td>
<td>-1.9</td>
<td></td>
<td>(mV/^\circ C)</td>
<td>(I_F = 20mA)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input - Output Insulation Leakage Current</td>
<td>(I_{I-O})</td>
<td>1.0</td>
<td>(\mu A)</td>
<td>(V_{I-O} = 1500Vdc, Relative Humidity = 45%) (T_A = 25^\circ C, t = 5sec)</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>(R_{I-O})</td>
<td>(10^2)</td>
<td>(\Omega)</td>
<td>(V_{I-O} = 500V)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>(C_{I-O})</td>
<td>1.7</td>
<td>(pF)</td>
<td>(f = 1MHz)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Voltage (Input-Input)</td>
<td>(V_{I-I})</td>
<td>1500</td>
<td>(V_{dc})</td>
<td>Relative Humidity = 45%</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Input)</td>
<td>(R_{I-I})</td>
<td>(10^2)</td>
<td>(\Omega)</td>
<td>(V_{I-I} = 500V)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Input)</td>
<td>(C_{I-I})</td>
<td>0.55</td>
<td>(pF)</td>
<td>(f = 1MHz)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. Each channel.
2. Measured between pins 1 through 8 shorted together and pins 9 through 16 shorted together.
3. Measured between pins 1 and 2 or 5 and 6 shorted together, and pins 3 through 16 shorted together.
4. Measured between pins 1 and 2 shorted together, and pins 3 through 16 shorted together.
5. The \(I_{OH}\) propagation delay is measured from the \(6.5mA\) point on the trailing edge of the input pulse to the \(1.5V\) point on the trailing edge of the output pulse.
6. The \(I_{OH}\) propagation delay is measured from the \(6.5mA\) point on the leading edge of the input pulse to the \(1.5V\) point on the leading edge of the output pulse.
7. \(CMH\) is the max. tolerable common mode transient to assure that the output will remain in a high logic state (i.e., \(V_O > 2.0V\)).
8. \(CM_L\) is the max. tolerable common mode transient to assure that the output will remain in a low logic state (i.e., \(V_O < 0.8V\)).
9. It is essential that a bypass capacitor (.01 to .1pF, ceramic) be connected from pin 10 to pin 15. Total lead length between both ends of the capacitor and the isolator pins should not exceed 20mm.

### TABLE III

**Switching Characteristics** AT \(T_A = 25^\circ C\), \(V_{CC} = 5V\) EACH CHANNEL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Figure</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay Time to High Output Level</td>
<td>(t_{PHL})</td>
<td>65</td>
<td>90</td>
<td>(ns)</td>
<td>(R_L = 510\Omega, C_L = 15pF, I_F = 13mA)</td>
<td>2.3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Propagation Delay Time to Low Output Level</td>
<td>(t_{PHL})</td>
<td>55</td>
<td>90</td>
<td>(ns)</td>
<td>(R_L = 510\Omega, C_L = 15pF, I_F = 13mA)</td>
<td>2.3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Output Rise-Fall Time (10-90%)</td>
<td>(t_r, t_f)</td>
<td>25</td>
<td></td>
<td>(ns)</td>
<td>(R_L = 510\Omega, C_L = 15pF, I_F = 13mA)</td>
<td>2.3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity at High Output Level</td>
<td>(CMH)</td>
<td>250</td>
<td>(V/\mu s)</td>
<td>(V_{CM} = 10V (peak), V_G (min.) = 2V, R_L = 510\Omega, I_F = 0mA)</td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Low Output Level</td>
<td>(CM_L)</td>
<td>-750</td>
<td>(V/\mu s)</td>
<td>(V_{CM} = 10V (peak), V_G (max.) = 0.8V, R_L = 510\Omega, I_F = 10mA)</td>
<td>6</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

6. The \(t_{PHL}\) propagation delay is measured from the \(6.5mA\) point on the leading edge of the input pulse to the \(1.5V\) point on the leading edge of the output pulse.
7. \(CMH\) is the max. tolerable common mode transient to assure that the output will remain in a high logic state (i.e., \(V_O > 2.0V\)).
8. \(CM_L\) is the max. tolerable common mode transient to assure that the output will remain in a low logic state (i.e., \(V_O < 0.8V\)).
9. It is essential that a bypass capacitor (.01 to .1pF, ceramic) be connected from pin 10 to pin 15. Total lead length between both ends of the capacitor and the isolator pins should not exceed 20mm.
Figure 1. Input Diode Forward Characteristic

Figure 2. Test Circuit for t_{PHL} and t_{PLH}

Figure 3. Propagation Delay, t_{PHL} and t_{PLH} vs. Pulse Input Current, I_{FH}

Figure 4. Input-Output Characteristics

Figure 5. Propagation Delay vs. Temperature

Figure 6. Typical Common Mode Rejection Characteristics/Circuit
Wewlett Packard provides standard high reliability test programs, patterned after MIL-M-38510 in order to facilitate the use of HP products in military programs.

HP offers two levels of high reliability testing:
- The TX prefix identifies a part which has been preconditioned and screened per Table IV.
- The TXB prefix identifies a part which has been preconditioned and screened per Table IV, and comes from a lot which has been subjected to the Group B tests detailed in Table V.

<p>| TABLE IV  TX Preconditioning and Screening — 100% |</p>
<table>
<thead>
<tr>
<th>Examination or Test</th>
<th>MIL-STD-883 Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-Cap Visual Inspection</td>
<td>HP Procedure 72-4063, 4</td>
</tr>
<tr>
<td>2. Electrical Test: Group A, Table II, 100%, $T_A = 25^\circ C$</td>
<td>1008</td>
</tr>
<tr>
<td>3. High Temperature Storage</td>
<td>168 hrs. @ 150$^\circ C$</td>
</tr>
<tr>
<td>4. Temperature Cycling</td>
<td>-65$^\circ C$ to +150$^\circ C$</td>
</tr>
<tr>
<td>5. Acceleration</td>
<td>2001</td>
</tr>
<tr>
<td>6. Helium Leak Test</td>
<td>Cond. A</td>
</tr>
<tr>
<td>7. Gross Leak Test</td>
<td>Cond. C, Step 1</td>
</tr>
<tr>
<td>8. Electrical Test: read $V_{OL}$ per Table II, $T_A = 25^\circ C$</td>
<td>1015</td>
</tr>
<tr>
<td>9. Burn-in, $V_{CC} = 5.5V, I_F = 13mA, I_O = 28mA$</td>
<td>186 hrs. @ $T_A = 25^\circ C$</td>
</tr>
<tr>
<td>10. Electrical Test: Group A*, Table II</td>
<td>Max. $\Delta V_{OL} = \pm 20%$</td>
</tr>
<tr>
<td>11. Evaluate drift</td>
<td></td>
</tr>
</tbody>
</table>

*aMin/Max guaranteed parameters only.

<p>| TABLE V, GROUP B |</p>
<table>
<thead>
<tr>
<th>Examination or Test</th>
<th>MIL-STD-883 Condition</th>
<th>LTPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subgroup 1 Physical Dimensions</td>
<td>2008</td>
<td>See Product Outline Drawing</td>
</tr>
<tr>
<td>Subgroup 2 Solderability</td>
<td>2003</td>
<td>Immersion within 0.10&quot; of body, 8 terminations</td>
</tr>
<tr>
<td>Subgroup 3 Temperature Cycling</td>
<td>1010</td>
<td>Test Condition B</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>1011</td>
<td>Test Condition A, 5 cycles</td>
</tr>
<tr>
<td>Hermetic Seal, Fine Leak</td>
<td>1014</td>
<td>Test Condition A</td>
</tr>
<tr>
<td>Hermetic Seal, Gross Leak</td>
<td>1014</td>
<td>Test Condition C, Step 1</td>
</tr>
<tr>
<td>End Points: Group A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 4 Shock, non-operating</td>
<td>2002</td>
<td>1500 G, $\tau = 0.5 ms, 5$ blows in each orientation $X_1, \ Y_1, \ Y_2$</td>
</tr>
<tr>
<td>Constant Acceleration</td>
<td>2001</td>
<td>20KG, $Y_1$</td>
</tr>
<tr>
<td>End Points: Same as Subgroup 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 5 Terminal Strength, tension</td>
<td>2004</td>
<td>Test Condition A, 1 lb., 16 sec.</td>
</tr>
<tr>
<td>Subgroup 6 High Temperature Life</td>
<td>1008</td>
<td>$T_A = 125^\circ C$, non-operating</td>
</tr>
<tr>
<td>End Points: p, Step 10, Table IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 7 Steady State Operating Life</td>
<td>1005</td>
<td>$V_{CC} = 5.5V, I_F = 13mA, I_O = 25mA, T_A = 25^\circ C$</td>
</tr>
<tr>
<td>End Points: Same as Subgroup 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

136
Features

- HIGH CURRENT TRANSFER RATIO — 800% TYPICAL
- LOW INPUT CURRENT REQUIREMENT — 0.5mA
- TTL COMPATIBLE OUTPUT — 0.1V VoL
- 3000 Vdc INSULATION VOLTAGE
- HIGH COMMON MODE REJECTION — 500V/µs
- PERFORMANCE GUARANTEED OVER TEMPERATURE 0°C to 70°C
- BASE ACCESS ALLOWS GAIN BANDWIDTH ADJUSTMENT
- HIGH OUTPUT CURRENT — 60mA
- DC TO 1M bit/s OPERATION
- RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITERS LABORATORIES, INC. (FILE NO. E55361)

Description

The 5082-4370 series isolators use a Light Emitting Diode and an integrated high gain photon detector to provide 3000V dc electrical insulation, 500V/µs common mode transient immunity and extremely high current transfer ratio between input and output. Separate pins for the photodiode and output stage result in TTL compatible saturation voltages and high speed operation. Where desired the Vcc and Vo terminals may be tied together to achieve conventional photodarlington operation. A base access terminal allows a gain bandwidth adjustment to be made.

The 5082-4371 is suitable for use in CMOS, LTTL or other low power applications. A 400% minimum current transfer ratio is guaranteed over a 0-70°C operating range for only 0.5mA of LED current.

The 5082-4370 is suitable for use mainly in TTL applications. Current Transfer Ratio is 300% minimum over 0-70°C for an LED current of 1.6mA [1 TTL unit load (U.L.)]. A 300% minimum CTR enables operation with 1 U.L. in, 1 U.L. out with a 2.2 kΩ pull-up resistor.

Applications

- Ground Isolate Most Logic Families — TTL/TTL, CMOS/TTL, CMOS/CMOS, LTTL/TTL, CMOS/LTTL
- Low Input Current Line Receiver — Long Line or Partyline
- EIA RS-232C Line Receiver
- Telephone Ring Detector
- 117 V ac Line Voltage Status Indicator — Low Input Power Dissipation
- Low Power Systems — Ground Isolation

Absolute Maximum Ratings

Storage Temperature ............... -55°C to +125°C
Operating Temperature ............. 0°C to +70°C
Lead Solder Temperature .......... 260°C for 10 Sec (1/16” below seating plane)
Average Input Current — I_F .......... 20mA [1]
Peak Input Current — I_F ........... 40mA (50% duty cycle, 1 ms pulse width)
Peak Transient Input Current — I_F .......... 1.0A (<1 µsec pulse width, 300pps)
Reverse Input Voltage — V_R .......... 5V
Input Power Dissipation ............. 35mW [2]
Output Current — I_O (Pin 6) ....... 60mA [3]
Emitter-Base Reverse Voltage (Pin 5-7) ...... 0.5V
Supply and Output Voltage — V_CC (Pin 8-5), V_O (Pin 6-5) ....... -0.5 to 7V
5082-4370 .................. -0.5 to 18V
5082-4371 .................. 100mW [4]

See notes, page 2.
## Electrical Specifications

**OVER RECOMMENDED TEMPERATURE (T_A = 0°C to 70°C), UNLESS OTHERWISE SPECIFIED**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device 5082-</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Fig.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Transfer Ratio</td>
<td>CTR</td>
<td>4371</td>
<td>400</td>
<td>800</td>
<td>900</td>
<td>%</td>
<td>IF = 0.5 mA, V_O = 0.4 V, V_CC = 4.5 V</td>
<td>5, 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4370</td>
<td>300</td>
<td>600</td>
<td>700</td>
<td>%</td>
<td>IF = 1.6 mA, V_O = 0.4 V, V_CC = 4.5 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic Low Output Voltage</td>
<td>VOL</td>
<td>4371</td>
<td>0.1</td>
<td>0.4</td>
<td>0.4</td>
<td>V</td>
<td>IF = 1.6 mA, I_O = 6.4 mA, V_CC = 4.5 V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4370</td>
<td>0.1</td>
<td>0.4</td>
<td>0.4</td>
<td>V</td>
<td>IF = 1.6 mA, I_O = 4.8 mA, V_CC = 4.5 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic High Output Current</td>
<td>I_OH</td>
<td>4371</td>
<td>0.06</td>
<td>100</td>
<td>250</td>
<td>mA</td>
<td>IF = 0 mA, V_O = V_CC = 18 V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4370</td>
<td>0.1</td>
<td>250</td>
<td>500</td>
<td>mA</td>
<td>IF = 0 mA, V_O = V_CC = 7 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic Low Supply Current</td>
<td>I_CCL</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td>mA</td>
<td>IF = 1.6 mA, V_O = Open, V_CC = 5 V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Logic High Supply Current</td>
<td>I_CCH</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>nA</td>
<td>IF = 0 mA, V_O = Open, V_CC = 5 V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Input Forward Voltage</td>
<td>V_F</td>
<td>1.4</td>
<td>1.7</td>
<td></td>
<td></td>
<td>V</td>
<td>IF = 1.6 mA, T_A = 25°C</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient of Forward Voltage</td>
<td>ΔVF / ΔTA</td>
<td>0</td>
<td>-1.8</td>
<td></td>
<td></td>
<td>mV/°C</td>
<td>IF = 1.6 mA.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C_I</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td>pF</td>
<td>f = 1 MHz, Vp = 0.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Input - Output Insulation Leakage Current</td>
<td>I_L</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td>μA</td>
<td>48% Relative Humidity, T_A = 25°C</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Resistance (Input-Output)</td>
<td>R_L</td>
<td>10&lt;sup&gt;-1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td>Ω</td>
<td>V_L = 500 Vdc</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Capacitance (Input-Output)</td>
<td>C_I</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
<td>pF</td>
<td>f = 1 MHz.</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

*All typicals at T_A = 25°C and V_CC = 5V, unless otherwise noted.

## Switching Specifications

**AT T_A = 25°C**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Device 5082-</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Conditions</th>
<th>Fig.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Delay Time, To Logic Low at Output</td>
<td>τ_PHL</td>
<td>4371</td>
<td>5</td>
<td>25</td>
<td>1</td>
<td>μs</td>
<td>IF = 0.5 mA, R_L = 4.7 kΩ</td>
<td>6</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4370</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>μs</td>
<td>IF = 1.6 mA, R_L = 2.2 kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propagation Delay Time, To Logic High at Output</td>
<td>τ_PHL</td>
<td>4371</td>
<td>5</td>
<td>60</td>
<td>7</td>
<td>μs</td>
<td>IF = 0.5 mA, R_L = 4.7 kΩ</td>
<td>6</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4370</td>
<td>4</td>
<td>35</td>
<td>5</td>
<td>μs</td>
<td>IF = 1.6 mA, R_L = 2.2 kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic High Level Output</td>
<td>CM_H</td>
<td>&gt;500</td>
<td></td>
<td></td>
<td></td>
<td>V/μs</td>
<td>IF = 0 mA, R_L = 2.2 kΩ, V_CM = 10 Vp-p</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Common Mode Transient Immunity at Logic Low Level Output</td>
<td>CM_L</td>
<td>&lt;500</td>
<td></td>
<td></td>
<td></td>
<td>V/μs</td>
<td>IF = 1.6 mA, R_L = 2.2 kΩ, V_CM = 10 Vp-p</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Derate linearly above 50°C free-air temperature at a rate of 0.4 mA/°C.
2. Derate linearly above 50°C free-air temperature at a rate of 0.7 mA/°C.
3. Derate linearly above 25°C free-air temperature at a rate of 0.7 mA/°C.
4. Derate linearly above 25°C free-air temperature at a rate of 2.0 mA/°C.
5. DC CURRENT TRANSFER RATIO is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.
6. Pin 7 Open.
7. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
8. Use of a resistor between pin 5 and 7 will decrease gain and delay time. See Application Note 951-1 for more details.
9. Common mode transient immunity in Logic High level is the maximum tolerable (positive) dV_CM/dt on the leading edge of the common mode pulse, V_CM, to assure that the output will remain in a Logic High state (i.e., V_O > 0.8V). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dV_CM/dt on the trailing edge of the common mode pulse signal, V_CM, to assure that the output will remain in a Logic Low state (i.e., V_O < 0.8V).
Figure 1. 5082-4371 DC Transfer Characteristics.

Figure 2. 5082-4370 DC Transfer Characteristics.

Figure 3. Current Transfer Ratio vs. Forward Current.

Figure 4. Input Diode Forward Current vs. Forward Voltage.

Figure 5. 5082-4371 Output Current vs. Input Diode Forward Current.

Figure 6. 5082-4370 Output Current vs. Input Diode Forward Current.
Figure 7. Propagation Delay vs. Temperature.

Figure 8. Non Saturated Rise and Fall Times vs. Load Resistance.

Figure 9. Switching Test Circuit.

Figure 10. Test Circuit for Transient Immunity and Typical Waveforms.
Photodetectors (PIN Photodiodes)

Features
- High Speed: 1ns Speed of Response
- Wide Dynamic Range: dc to 1 GHz
- Low Noise

Benefits
- Allows Detection of Fast Light Sources, e.g., Lasers
- Applicable to Many Different Light Sources

Applications
- Detection of IR Radiation
- Card Readers
- Tape Readers
- Isolators

(For further information ask for Application Note 915. See page 146.)
Features
- HIGH SENSITIVITY (NEP < -108 dBm)
- WIDE DYNAMIC RANGE (1% LINEARITY OVER 100 dB)
- BROAD SPECTRAL RESPONSE
- HIGH SPEED (Tr, Tf < 1ns)
- STABILITY SUITABLE FOR PHOTOMETRY/RADIOMETRY
- HIGH RELIABILITY
- FLOATING, SHIELDED CONSTRUCTION
- LOW CAPACITANCE
- LOW NOISE

Description
The HP silicon planar PIN photodiodes are ultra-fast light detectors for visible and near infrared radiation. Their response to blue and violet is unusually good for low dark current silicon photodiodes.

These devices are suitable for applications such as high speed tachometry, optical distance measurement, star tracking, densitometry, radiometry, and fiber-optic termination.

The speed of response of these detectors is less than one nanosecond. Laser pulses shorter than 0.1 nanosecond may be observed. The frequency response extends from dc to 1 GHz.

The low dark current of these planar diodes enables detection of very low light levels. The quantum detection efficiency is constant over ten decades of light intensity, providing a wide dynamic range.

Package Dimensions

The 5082-4203, -4204, and -4207 are packaged on a standard TO-18 header with a flat glass window cap. For versatility of circuit connection, they are electrically insulated from the header. The light sensitive area of the 5082-4203 and -4204 is 0.508mm (0.020 inch) in diameter and is located 1.905mm (0.075 inch) behind the window. The light sensitive area of the 5082-4207 is 1.016mm (0.040 inch) in diameter and is also located 1.905mm (0.075 inch) behind the window.

The 5082-4205 is in a low capacitance Kovar and ceramic package of very small dimensions, with a hemispherical glass lens.

The 5082-4220 is packaged on a TO-46 header with the 0.508mm(0.020 inch) diameter sensitive area located 2.540mm (0.100 inch) behind a flat glass window.
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>-4203</th>
<th>-4204</th>
<th>-4205</th>
<th>-4207</th>
<th>-4220</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_MAX Power Dissipation</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>nW</td>
</tr>
<tr>
<td>Peak Reverse Voltage</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>volts</td>
</tr>
<tr>
<td>Steady Reverse Voltage</td>
<td>50</td>
<td>20</td>
<td>50</td>
<td>20</td>
<td>50</td>
<td>volts</td>
</tr>
</tbody>
</table>

Electrical/Optical Characteristics at T_A = 25°C

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RA</td>
<td>Axial Incidence</td>
<td>1.0</td>
<td></td>
<td>1.5*</td>
<td>1.0</td>
<td></td>
<td>1.5*</td>
<td>1.0</td>
<td></td>
<td>1.5*</td>
<td>1.0</td>
<td></td>
<td>1.5*</td>
<td>1.0</td>
<td></td>
<td>1.5*</td>
<td>mA/cm²</td>
</tr>
<tr>
<td>A</td>
<td>Active Area</td>
<td>2 x 10⁻³</td>
<td></td>
<td>3 x 10⁻³</td>
<td>2 x 10⁻³</td>
<td></td>
<td>3 x 10⁻³</td>
<td>2 x 10⁻³</td>
<td></td>
<td>3 x 10⁻³</td>
<td>2 x 10⁻³</td>
<td></td>
<td>3 x 10⁻³</td>
<td>2 x 10⁻³</td>
<td></td>
<td>3 x 10⁻³</td>
<td>cm²</td>
</tr>
<tr>
<td>R</td>
<td>Responsivity</td>
<td>5</td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td>5</td>
<td>μA</td>
</tr>
<tr>
<td>I_D</td>
<td>Dark Current</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
<td>nA</td>
</tr>
<tr>
<td>NEP</td>
<td>Noise Equivalent Power</td>
<td>5.3 x 10⁻¹⁴</td>
<td></td>
<td>2.8 x 10⁻¹⁴</td>
<td>5.3 x 10⁻¹⁴</td>
<td></td>
<td>2.8 x 10⁻¹⁴</td>
<td>5.3 x 10⁻¹⁴</td>
<td></td>
<td>2.8 x 10⁻¹⁴</td>
<td>5.3 x 10⁻¹⁴</td>
<td></td>
<td>2.8 x 10⁻¹⁴</td>
<td>5.3 x 10⁻¹⁴</td>
<td></td>
<td>2.8 x 10⁻¹⁴</td>
<td>5.3 x 10⁻¹⁴</td>
</tr>
<tr>
<td>D*</td>
<td>Detectivity</td>
<td>8.7 x 10⁻¹⁰</td>
<td></td>
<td>2.8 x 10⁻¹⁰</td>
<td>8.7 x 10⁻¹⁰</td>
<td></td>
<td>2.8 x 10⁻¹⁰</td>
<td>8.7 x 10⁻¹⁰</td>
<td></td>
<td>2.8 x 10⁻¹⁰</td>
<td>8.7 x 10⁻¹⁰</td>
<td></td>
<td>2.8 x 10⁻¹⁰</td>
<td>8.7 x 10⁻¹⁰</td>
<td></td>
<td>2.8 x 10⁻¹⁰</td>
<td>8.7 x 10⁻¹⁰</td>
</tr>
<tr>
<td>C_J</td>
<td>Junction Capacitance</td>
<td>1.5</td>
<td></td>
<td>0.7</td>
<td>1.5</td>
<td></td>
<td>0.7</td>
<td>1.5</td>
<td></td>
<td>0.7</td>
<td>1.5</td>
<td></td>
<td>0.7</td>
<td>1.5</td>
<td></td>
<td>0.7</td>
<td>pF</td>
</tr>
<tr>
<td>C_P</td>
<td>Package Capacitance</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>t_r, t_f</td>
<td>Rise, Fall Time</td>
<td>300</td>
<td></td>
<td>1</td>
<td>300</td>
<td></td>
<td>1</td>
<td>300</td>
<td></td>
<td>1</td>
<td>300</td>
<td></td>
<td>1</td>
<td>300</td>
<td></td>
<td>1</td>
<td>ns</td>
</tr>
<tr>
<td>B_S</td>
<td>Series Resistance</td>
<td>50</td>
<td></td>
<td>50</td>
<td>50</td>
<td></td>
<td>50</td>
<td>50</td>
<td></td>
<td>50</td>
<td>50</td>
<td></td>
<td>50</td>
<td>50</td>
<td></td>
<td>50</td>
<td>Ω</td>
</tr>
</tbody>
</table>

NOTES:

1. Peak Pulse Power
   When exposing the diode to high level incidence, the following photocurrent limits must be observed:
   \[ \frac{P_{\text{MAX}} - P_0}{E_C} \]
   and in addition:
   \[ I_P(\text{avg}) < \frac{1000 \text{ A}}{t (\mu\text{s})} \text{ or } I_P < 500 \text{ mA} \text{ or } I_P(\text{PEAK}) < \frac{I_P (\text{avg})}{f \times t} \]
   whichever of the above three conditions is least.
   \[ I_P(\text{PEAK}) \]
   - photocurrent (A)
   \[ E_C \]
   - supply voltage (V)
   \[ t \]
   - pulse duration (μs)
   \[ f \]
   - pulse repetition rate (MHz)
   \[ P_{\text{MAX}} \]
   - max dissipation (W)

Power dissipation limits apply to the sum of both the optical power input to the device and the electrical power input from flow of photocurrent when reverse voltage is applied.

2. Exceeding the Peak Reverse Voltage will cause permanent damage to the diode. Forward current is harmless to the diode, within the power dissipation limit. For optimum performance, the diode should be reversed biased with \( E_C \) between 5 and 20 volts.

3. Exceeding the Steady Reverse Voltage may impair the low-noise properties of the photodiodes, an effect which is noticeable only if operation is diode-noise limited (see Figure 8).

4. The 5082-4205 has a lens with approximately 2.5x magnification; the actual junction area is \( 0.5 \times 10^{-3} \text{ cm}^2 \), corresponding to a diameter of 0.25mm (0.010`). Specification includes lens effect.

5. At any particular wavelength and for the flux in a small spot falling entirely within the active area, responsivity is the ratio of incremental photodiode current to the incremental flux producing it. It is related to quantum efficiency, \( \eta_q \) in electrons per photon by:
   \[ R = \eta_q \left( \frac{\lambda}{1240} \right) \]
   where \( \lambda \) is the wavelength in nanometers. Thus, at 770nm, a responsivity of 0.5 A/W corresponds to a quantum efficiency of 0.81 (or 81%) electrons per photon.

6. At -10V for the 5082-4204, -4205, and -4207; at -25V for the 5082-4203 and -4220.

7. For \( (\lambda, f, \Delta f) = (770\text{nm}, 100\text{Hz}, 6\text{Hz}) \) where \( f \) is the frequency for a spot noise measurement and \( \Delta f \) is the noise bandwidth, NEP is the optical flux required for unity signal/noise ratio normalized for bandwidth. Thus:
   \[ \text{NEP} = \frac{I_N}{\sqrt{\Delta f} \sqrt{\Delta f}} \]
   where \( I_N \) is the bandwidth-normalized noise current computed from the shot noise formula:
   \[ I_N = \sqrt{2}I_D = 17.9 \times 10^{-15} \sqrt{I_D (\text{A/Hz})} \]
   where \( I_D \) is in nA.

   \[ \text{Detecitivity} \ D^* = \sqrt{A \text{ cm} \sqrt{\text{Hz}}} \]
   for \( A \) in cm².

8. For \( (\lambda, f, \Delta f) = (770\text{nm}, 100\text{Hz}, 6\text{Hz}) \) and \( \text{NEP} \) is the optical flux required for unity signal/noise ratio normalized for bandwidth.

9. At -10V for the 5082-4204, -4205, -4207, -4220; at -25V for the 5082-4203.

10. Between diode cathode lead and case - does not apply to 5082-4206, -4220.

11. With 50Ω load.

12. With 50Ω load and -20V bias.
Figure 1. Spectral Response.

Figure 2. Relative Directional Sensitivity of the PIN Photodiodes.

Figure 3. Typical Output Characteristics at $\lambda = 900\text{nm}$.

Figure 4. Dark Current at $-10\text{V}$ Bias vs. Temperature.

Figure 5. Typical Capacitance Variation With Applied Voltage.

Figure 6. Noise vs. Load Resistance.

Figure 7. Photodiode Cut-Off Frequency vs. Load Resistance ($C = 2\text{pF}$).

Figure 8. Noise Equivalent Power vs. Load Resistance.

$$I_S = \text{Signal current} = 0.5\mu\text{A}/\mu\text{W} \times P \text{ input}$$

$$I_N = \text{Shot noise current}$$

$<1.2 \times 10^{-14}\text{ amps/Hz}^{1/2} (5082-4204)$

$<4 \times 10^{-14}\text{ amps/Hz}^{1/2} (6082-4207)$

$$I_D = \text{Dark current}$$

$<600 \times 10^{-12}\text{ amps at } -10\text{ V dc (5082-4204)}$

$<2500 \times 10^{-12}\text{ amps at } -10\text{ V dc (5082-4207)}$

$$R_p = 10^{11}\Omega$$

$$R_S = <50\Omega$$
Application Information

NOISE FREE PROPERTIES

The noise current of the PIN diodes is negligible. This is a direct result of the exceptionally low leakage current, in accordance with the shot noise formula $I_N = (2qI_p\Delta f)^{1/2}$. Since the leakage current does not exceed 600 picoamps for the 5082-4204 at a reverse bias of 10 volts, shot noise current is less than $1.4 \times 10^{-14}$ amp Hz$^{-1/2}$ at this voltage.

Excess noise is also very low, appearing only at frequencies below 10 Hz, and varying approximately as 1/f. When the output of the diode is observed in a load, thermal noise of the load resistance $(R_L)$ is $1.28 \times 10^{-10} (R_L)^{1/2} x (\Delta f)^{1/2}$ at 25°C, and far exceeds the diode shot noise for load resistance less than 100 megohms (see Figure 6). Thus in high frequency operation where low values of load resistance are required for high cut-off frequency, all PIN photodiodes contribute virtually no noise to the system (see Figures 6 and 7).

HIGH SPEED PROPERTIES

Ultra-fast operation is possible because the HP PIN photodiodes are capable of a response time less than one nanosecond. A significant advantage of this device is that the speed of response is exhibited at relatively low reverse bias (~10 to 20 volts).

OFF-AXIS INCIDENCE RESPONSE

Response of the photodiodes to a uniform field of radiant incidence $E_x$, parallel to the polar axis is given by $I = (RA) \times E_x$ for 770nm. The response from a field not parallel to the axis can be found by multiplying $(RA)$ by a normalizing factor obtained from the radiation pattern at the angle of operation. For example, the multiplying factor for the 5082-4207 with incidence $E_x$ at an angle of 40° from the polar axis is 0.8. If $E_x = 1\text{mW/cm}^2$, then $I_p = k x (RA) x E_x^2$. $I_p = 0.8 \times 4.0 \times 1 = 3.2 \mu\text{amps}$.

SPECTRAL RESPONSE

To obtain the response at a wavelength other than 770nm, the relative spectral response must be considered. Referring to the spectral response curve, Figure 1, obtain response, $X$, at the wavelength desired. Then the ratio of the response at the desired wavelength to response at 770nm is given by:

$$\text{RATIO} = \frac{X}{0.5}$$

Multiplying this ratio by the incidence response at 770nm gives the incidence response at the desired wavelength.

ULTRAVIOLET RESPONSE

Under reverse bias, a region around the outside edge of the nominal active area becomes responsive. The width of this annular ring is approximately 25μm (0.001 inch) at -20V, and expands with higher reverse voltage. Responsivity in this edge region is higher than in the interior, particularly at shorter wavelengths; at 400nm the interior, responsivity is 0.1 A/W while edge responsivity is 0.35 A/W. At wavelengths shorter than 400nm, attenuation by the glass window affects response adversely; hence UV detection is improved by removal of the glass or substitution of a sapphire window (available on special order). Speed of response for edge incidence is $t_e, t_f \approx 300\text{ns}$.

5082-4205 MOUNTING RECOMMENDATIONS

a. The 5082-4205 is intended to be soldered to a printed circuit board having a thickness of from 0.51 to 1.52mm (0.02 to 0.06 inch).

b. Soldering temperature should be controlled so that at no time does the case temperature approach 280°C. The lowest solder melting point in the device is 280°C (gold-tin eutectic). If this temperature is approached, the solder will soften, and the lens may fall off. Lead-tin solder is recommended for mounting the package, and should be applied with a small soldering iron, for the shortest possible time, to avoid the temperature approaching 280°C.

c. Contact to the lens end should be made by soldering to one or both of the tabs provided. Care should be exercised to prevent solder from coming in contact with the lens.

d. If printed circuit board mounting is not convenient, wire leads may be soldering or welded to the devices using the precautions noted above.

LINEAR OPERATION

Having an equivalent circuit as shown in Figure 9, operation of the photodiode is most linear when operated with a current amplifier as shown in Figure 10.

![Figure 10. Linear Operation.](image)

Lowest noise is obtained with $E_x = 0$, but higher speed and wider dynamic range are obtained if $5 < E_x < 20$ volts. The amplifier should have as high an input resistance as possible to permit high loop gain. If the photodiode is reversed, bias should also be reversed.

LOGARITHMIC OPERATION

If the photodiode is operated at zero bias with a very high impedance amplifier, the output voltage will be:

$$V_{OUT} = \left(1 + \frac{R_2}{R_1}\right) \frac{kT}{q} \ln \left(1 + \frac{I_p}{I_s}\right)$$

where $I_s = I_F \left(\frac{e^{qV/kT} - 1}{kT}\right)^{-1}$ at $I_F < 0.1\text{mA}$

using a circuit as shown in Figure 11.

![Figure 11. Logarithmic Operation.](image)

Output voltage, $V_{OUT}$, is positive as the photocurrent, $I_p$, flows back through the photodiode making the anode positive.
APPLICATION NOTE 931
Solid State Alphanumeric Display...Decoder/Driver Circuitry
Hewlett-Packard offers a series of solid state displays capable of producing multiple alphanumeric characters utilizing 5 x 7 dot arrays of GaAsP light emitting diodes (LED's). These 5 x 7 dot arrays exhibit clear, easily read characters. In addition, each array is X-Y addressable to allow for a simple addressing, decoding, and driving scheme between the display module and external logic. Methods of addressing, decoding and driving information to such an X-Y addressable matrix are covered in detail in this application note. The note starts with a general definition of the scanning or strobing technique used for this simplified addressing and then proceeds to describe horizontal and vertical strobing. Finally, a detailed circuit description is given for a practical vertical strobing application.

APPLICATION NOTE 934
5082-7300 Series Solid State Display Installation Techniques
The 5082-7300 series Numeric/Hexadecimal Indicators are an excellent solution to most standard display problems in commercial, industrial and military applications. The unit integrates the display character and associated drive electronics in a single package. This advantage allows for space, pin and labor cost reductions, at the same time improving overall reliability.

The information presented in this note describes general methods of incorporating the 7300 into varied applications.

APPLICATION NOTE 937
Monolithic Seven Segment LED Display Installation Techniques
The Hewlett-Packard series of small endstackable monolithic GaAsP displays are designed for strobing, a drive method that allows time sharing of the character generator among the digits in a display.

This Application Note begins with an explanation of the strobing technique, followed by a discussion of the uses and advantages of the right hand and center decimal point products.

Several circuits are given for typical applications. Finally, a discussion of interfacing to various data forms is presented along with comments on mounting the displays.

APPLICATION NOTE 939
High Speed Optically Coupled Isolators
Often designers are faced with the problem of providing circuit isolation in order to prevent ground loops and common mode signals. Typical devices for doing this have been relays, transformers and line receivers. However, both relays and transformers are low speed devices, incompatible with modern logic circuits. Line receiver circuits are fast enough, but are limited to a common mode voltage of 3 volts. In addition, they do not protect very well against ground loop signals. Now, Optically Coupled Isolators are available which solve most isolation problems.

This Application Note contains a description of Hewlett-Packard's high speed isolators, and discusses their applications in digital and analog systems.

APPLICATION NOTE 941
5082-7700 Series Seven Segment LED Display Applications
The HP 5082-7700 series of LED displays are available in both common anode and common cathode configurations. These single digit displays have been engineered to provide a high contrast ratio and a wide viewing angle.

This Application Note begins with DC drive techniques and circuits. Next is an explanation of the strobe drive technique and the resultant increase in device efficiency. This is followed by general strobing circuits and some typical applications such as clocks, calculators and counters.

Finally, information is presented on general operating conditions, including intensity uniformity, light output control as a function of ambient light, contrast enhancement and device mounting.

APPLICATION NOTE 945
Photometry of RED LEDs
Nearly all LEDs are used either as discrete indicator lamps or as elements of a segmented or dot-matrix display. As such, they are viewed directly by human viewers, so the primary criteria for determining their performance is the judgment of a viewer. Equipment for measuring LED light output should, therefore, simulate human vision.

This Application Note will provide answers to these questions:
1. What to measure (definitions of terms)
2. How to measure it (apparatus arrangement)
3. Whose equipment to use (criteria for selection)

APPLICATION NOTE 946
5082-7430 Series Monolithic Seven Segment Displays
The HP 5082-7430 series solid state displays are common cathode, 2 and 3 digit clusters capable of displaying numeric and selected alphabetic data. These GaAsP displays employ an integral magnification technique to increase both the character size and the luminous intensity of each monolithic digit. The resultant 2.79mm (0.11") high character is viewable at distances of up to 5 feet when operated at as little as 0.5mW per segment.
These displays are designed for strobed operation. In strobing, the decoder is timeshared among the digits in the display, which are illuminated one at a time.

Typical applications, such as an Electronic Stopwatch, a battery operated Event Counter and a Four Function Calculator are discussed in this note.

APPLICATION NOTE 947
Digital Data Transmission Using Optically Coupled Isolators

Optically coupled isolators make ideal line receivers for digital data transmission applications. They are especially useful for elimination of common mode interference between two isolated data transmission systems. This application note describes design considerations and circuit techniques with special emphasis on selection of line drivers, transmission lines, and line receiver termination for optimum data rate and common mode rejection. Both resistive and active terminations are described in detail. Specific techniques are described for multiplexing applications, and for common mode rejection and data rate enhancement.

APPLICATION NOTE 948
Performance of the 5082-4350/51/60 Series of Isolators in Short to Moderate Length Digital Data Transmission Systems

Optically coupled isolators (opto-isolators) can function as excellent alternatives to integrated circuit line receivers in digital data transmission applications. Their major advantages consist of superior common-mode noise rejection and true ground isolation between the two subsystems.

This application note describes the basic design elements of a data transmission link and presents examples of systems that will be useful at distances that range from 1 ft. to 300 ft. and have a moderate overall cost.

APPLICATION BULLETINS

APPLICATION BULLETIN 1
Construction and Performance of High Efficiency Red, Yellow and Green LED Materials

The high luminous efficiency of Hewlett-Packard’s High Efficiency Red, Yellow and Green lamps and displays is made possible by a new kind of light emitting material utilizing a GaP transparent substrate. This application bulletin discusses the construction and performance of this material as compared to standard red GaAsP and red GaP materials.

APPLICATION BULLETIN 2
New Operating Curves for 5082-7600 Series Displays

The 5082-7600 series data sheets contain operating curves to assist the designer in determining the limits within which the display may be reliably operated. A description of each curve is presented along with a design example illustrating their use.

APPLICATION BULLETIN 3
Soldering Hewlett-Packard Silver Plated Lead Frame LED Devices

Many of Hewlett-Packard’s commercial LED devices use a silver plated lead frame. Soldering to a silver lead frame provides a reliable electrical and mechanical connection and is no more complicated than soldering to a gold lead frame. Some suggestions on how to handle and solder silver plated lead frame devices are presented.

APPLICATION BULLETIN 4
Detection and Indication of Segment Failures in Seven Segment LED Displays

The occurrence of a segment failure in certain applications of 7 segment displays can have serious consequences if a resultant erroneous message is read by the viewer. This application bulletin discusses three techniques for detecting open segment lines and presenting this information to the viewer.

APPLICATION BULLETIN 8
Assembly and Handling Techniques for Monolithic Display Chips

Die attach, lead bonding and intensity matching of LED display chips present special problems for the manufacturers of hybrid modules. This application bulletin discusses some of the basic considerations for handling of gallium arsenide phosphide materials.
<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>City</th>
<th>Zip</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALABAMA</td>
<td>Hall-Mark Electronics 4739 Commercial Dr.</td>
<td>Huntsville</td>
<td>35805</td>
<td>(205) 837-8700</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 4126 Pleasantdale Rd.</td>
<td>Atlanta</td>
<td>30340</td>
<td>(404) 449-9170</td>
</tr>
<tr>
<td></td>
<td>MISSOURI Hall-Mark Electronics 13789 Rider Trail</td>
<td>Earth City</td>
<td>63045</td>
<td>(314) 291-5350</td>
</tr>
<tr>
<td>ARIZONA</td>
<td>Liberty Electronics 3130 N. 27th Avenue</td>
<td>Phoenix</td>
<td>85017</td>
<td>(602) 257-1272</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Hall-Mark Electronics 180 Cossen</td>
<td>Elk Grove Village</td>
<td>60007</td>
<td>(312) 437-6800</td>
</tr>
<tr>
<td></td>
<td>MISSOURI Schweber Electronics 1275 Brummel Avenue</td>
<td>Elk Grove Village</td>
<td>60007</td>
<td>(312) 593-2740</td>
</tr>
<tr>
<td>CALIFORNIA</td>
<td>Schweber Electronics 3000 Redhill Avenue</td>
<td>Costa Mesa</td>
<td>92626</td>
<td>(714) 556-3880</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Hall-Mark Electronics 6653 Amberton Drive</td>
<td>Baltimore</td>
<td>21227</td>
<td>(301) 265-8500</td>
</tr>
<tr>
<td></td>
<td>MISSOURI Schweber Electronics 5640 Fisher Lane</td>
<td>Rockville</td>
<td>20852</td>
<td>(301) 881-3300</td>
</tr>
<tr>
<td>COLORADO</td>
<td>Elmar Electronics 2288 Charleston Road</td>
<td>Mt. View</td>
<td>94040</td>
<td>(415) 961-3611</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Hall-Mark Electronics 9006 Rosehill Road</td>
<td>Lenexa</td>
<td>66215</td>
<td>(913) 888-4747</td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td>Schweber Electronics Finance Drive</td>
<td>Commerce Industrial Park</td>
<td>Danbury</td>
<td>06810</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Hall-Mark Electronics 6921 Penn Avenue, So.</td>
<td>Troy</td>
<td>48084</td>
<td>(313) 583-9242</td>
</tr>
<tr>
<td>MARYLAND</td>
<td>Wilshire Electronics 2 Townline Circle</td>
<td>Rochester</td>
<td>14623</td>
<td>(716) 461-4000</td>
</tr>
<tr>
<td>MEASSACHUSETTS</td>
<td>Wilshire Electronics One Wilshire Road</td>
<td>Burlington</td>
<td>01803</td>
<td>(617) 272-8200</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 213 Third Avenue</td>
<td>Waltham</td>
<td>02154</td>
<td>(617) 890-8484</td>
</tr>
<tr>
<td>MICHIGAN</td>
<td>Wilshire Electronics 1302 W. McNab Road</td>
<td>Ft. Lauderdale</td>
<td>33309</td>
<td>(305) 971-9280</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 86 Executive Drive</td>
<td>Troy</td>
<td>48084</td>
<td>(313) 583-9242</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
<td>Hall-Mark Electronics 3000 Industrial Dr.</td>
<td>Raleigh</td>
<td>27609</td>
<td>(919) 832-4465</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 1855 New Highway (Unit B)</td>
<td>Farmingdale</td>
<td>11735</td>
<td>(516) 293-5775</td>
</tr>
<tr>
<td>NEW JERSEY</td>
<td>Wilshire Electronics 617 Main Street</td>
<td>Johnson City</td>
<td>13790</td>
<td>(607) 797-1236</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 2288 Charleston Road</td>
<td>Mt. View</td>
<td>94040</td>
<td>(415) 961-3611</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>Wilshire Electronics 124 Maryland Street</td>
<td>Elmhurst</td>
<td>60126</td>
<td>(716) 890-8484</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 2830 No. 29th Terrace</td>
<td>Hollywood</td>
<td>33020</td>
<td>(305) 927-0511</td>
</tr>
<tr>
<td>OHIO</td>
<td>Wilshire Electronics 7233 Lake Ellenor Dr.</td>
<td>Orlando</td>
<td>32809</td>
<td>(305) 855-4020</td>
</tr>
<tr>
<td></td>
<td>GEORGIA Schweber Electronics 9201 Penn Avenue, So. Suite 10</td>
<td>Bloomington</td>
<td>55431</td>
<td>(612) 884-9056</td>
</tr>
<tr>
<td></td>
<td>MISSOURI Schweber Electronics 7402 Washington Avenue, So. Eden Prairie, Minn.</td>
<td>55343</td>
<td>(612) 941-5280</td>
<td></td>
</tr>
</tbody>
</table>
OKLAHOMA
Hall-Mark Electronics
4846 So. 83rd E. Avenue
Tulsa 74145
(918) 835-8458

PENNSYLVANIA
Schweber Electronics
101 Rock Road
Horsham 19044
(609) 964-4496
(215) 441-0600

TEXAS
Hall-Mark Electronics
458 Pike Road
Huntingdon Valley 19001
(215) 355-7300

AUSTRALIA
C.W. Tyree Semiconductors Pty. Ltd.
10-16 Charles Street
Redfern N.S.W. 2016

BELGIUM
Diode Belgium
Rue Picard 202 Picardstratt
1020 Bruxelles - Brussels
Tel: 02 28 51 08

CANADA
Schweber Electronics
2724 Rena Road
Mississauga, Ontario, L4T3J9
(416) 768-9050

ENGLAND
Celdis, Ltd.
37-39 Loverock Road
Reading, Berks
Tel: 0118 38 57 16

FINLAND
Field OY
Veneentekijantie 18
00210 Helsinki 21

FRANCE
S.C.A.I.B. S.A.
15-17 Avenue De Segur
Paris VII
Tel: 555 1720

GERMANY
EBV Elektronik
8 Munich 2
Augustenstrasse 79
Tel: (0811) 524340/48

ITALY
Celdis Italiana
via Luigi Barzini 20
I-20125 Milano

NETHERLANDS
B.V. Diode
Hollandstraat 22
Utrecht
Tel: (030) 884214

SWEDEN
Interelko A.B.
Sandvargavagen 50
122 33 Enskede
Tel: (08) 492505

SWITZERLAND
Baerlocher A.G.
Corporation for Electronic Products
Föhrbuckstrasse 110
8005 Zurich