GaAlAs Plastic Infrared Emitting Diodes
Types OP290, OP291, OP292 Series

Features
- Wide irradiance pattern
- Significantly higher power output than GaAs at equivalent drive currents
- T-1 3/4 package style
- UL recognized, File No. S2047

Description
The OP290, OP291, and OP292 are gallium aluminum arsenide infrared emitting diodes molded in IR transmissive plastic packages. The OP290 is specified under pulse conditions to 1.5 amps and can be used up to 5 amps. The OP291 is specified under pulse conditions to 100 mA and is intended for use as low cost plastic replacements for TO-46 hermetic units. The OP292 is specified under pulse conditions to 20 mA and is intended for use in low current applications. The wavelength is centered at 890 nm and closely matches the spectral response of silicon phototransistors. Each of these unit types is categorized into three ranges of aperture power output. They are also completely characterized for ease of system design. Silver-copper lead frames offer excellent thermal characteristics.

Absolute Maximum Ratings (\(T_A = 25^\circ\) C unless otherwise noted)
- Reverse Voltage OP290: 5.0 V
- OP291: 2.0 V
- OP292: 5.0 V
- Continuous Forward Current
  - OP290: 150 mA
  - OP291: 5 A
  - OP292: 100 mA
- Peak Forward Current
  - OP290 (25 \(\mu\)s pulse width): 5.0 A
  - OP291 (100 \(\mu\)s pulse width): 2.0 A
  - OP292 (100 \(\mu\)s pulse width): 1.00 A
- Maximum Duty Cycle OP290 (25 \(\mu\)s pulse width, @ 5 A): 1.25% (2)
- Storage and Operating Temperature Range: -40\(^\circ\) C to +100\(^\circ\) C
- Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron]: 260\(^\circ\) C (3)
- Power Dissipation, Free Air: 333 mW (4)
- Power Dissipation, Board Mounted: 533 mW (5)
- Power Dissipation, Full Heat Sink: 1.11 W (6)

Notes:
1. Derate linearly 1.67 mA/\(^\circ\) C above 25\(^\circ\) C (Free-Air). When used with heat sink (See Note 5) derate linearly 2.07 mA/\(^\circ\) C above 65\(^\circ\) C (Normal use).
2. Refer to graph of Maximum Peak Pulse Current vs. Pulse Width.
3. RMA flux is recommended. Duration can be extended to 10 sec max. when soldering Max. 20 grams force may be applied to the leads when flow soldering.
4. Measured in Free-Air. Derate linearly 3.33 mW/\(^\circ\) C above 25\(^\circ\) C.
5. Mounted on 1/16" (1.6 mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35 mm) below flange of device. Derate linearly 5.33 mW/\(^\circ\) C above 62.5\(^\circ\) C.
6. Immersed in silicone fluid to simulate infinite heat sink. Derate linearly 11.1 mW/\(^\circ\) C above 95\(^\circ\) C.
7. Measurement is taken at the end of a single 100 \(\mu\)s pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
8. \(E_{\text{RAPT}}\) is a measurement of the average aperture radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.500" (12.7 mm) from the measurement surface. \(E_{\text{RAPT}}\) is not necessarily uniform within the measured area.
9. Typical total Power Out (\(P_o\)) @ \(I_F = 20\) mA pulsed all units is 3.6 mW, @ \(I_F = 100\) mA is 19 mW, and @ \(I_F = 1.5\) A is 240 mW.
10. Measured at the end of a 10 msec. voltage soak.
11. This dimension is held to within \(\pm 0.005^\prime\) on the flange edge and may vary \(\pm 0.020^\prime\) in the area of the leads.
12. Cathode lead is 0.070" nom shorter than anode lead.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (972) 323-2200 Fax (972) 323-2396
# Types OP290, OP291, OP292 Series

**Electrical Characteristics** ($T_A = 25^\circ$ C unless otherwise noted)

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<th>SYMBOL</th>
<th>PARAMETER</th>
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<th>MAX</th>
<th>UNITS</th>
<th>TEST CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{o(\text{APT})}$</td>
<td>Apertured Radiant Incidence</td>
<td>OP290C</td>
<td>150</td>
<td>300</td>
<td>mW/cm$^2$</td>
<td>$I_f = 1.50$ A$^7$(8)$^9$(9)</td>
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<tr>
<td></td>
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<td>OP290B</td>
<td>180</td>
<td></td>
<td>mW/cm$^2$</td>
<td>$I_f = 1.50$ A$^7$(8)$^9$(9)</td>
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<td>OP290A</td>
<td>210</td>
<td></td>
<td>mW/cm$^2$</td>
<td>$I_f = 1.50$ A$^7$(8)$^9$(9)</td>
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<tr>
<td></td>
<td></td>
<td>OP291C</td>
<td>10</td>
<td>26</td>
<td>mW/cm$^2$</td>
<td>$I_f = 100$ mA$^7$(8)$^9$(9)</td>
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<td>OP291B</td>
<td>13</td>
<td></td>
<td>mW/cm$^2$</td>
<td>$I_f = 100$ mA$^7$(8)$^9$(9)</td>
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<td>OP291A</td>
<td>16</td>
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<td>mW/cm$^2$</td>
<td>$I_f = 100$ mA$^7$(8)$^9$(9)</td>
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<tr>
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<td>OP292C</td>
<td>1.7</td>
<td>4.4</td>
<td>mW/cm$^2$</td>
<td>$I_f = 20$ mA$^7$(8)$^9$(9)</td>
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<td></td>
<td></td>
<td>OP292B</td>
<td>2.2</td>
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<td>mW/cm$^2$</td>
<td>$I_f = 20$ mA$^7$(8)$^9$(9)</td>
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<td>OP292A</td>
<td>2.7</td>
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<td>mW/cm$^2$</td>
<td>$I_f = 20$ mA$^7$(8)$^9$(9)</td>
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<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>OP290</td>
<td>4.00</td>
<td>V</td>
<td>$I_f = 1.50$ A$^7$</td>
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<tr>
<td></td>
<td></td>
<td>OP291</td>
<td>2.00</td>
<td>V</td>
<td>$I_f = 100$ mA$^7$</td>
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<tr>
<td></td>
<td></td>
<td>OP292</td>
<td>1.75</td>
<td>V</td>
<td>$I_f = 20$ mA$^7$</td>
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<tr>
<td>$I_R$</td>
<td>Reverse Current</td>
<td>OP290/OP292</td>
<td>10</td>
<td>$V_R = 5$ V$^{(10)}$</td>
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<td>OP291</td>
<td>100</td>
<td>$\mu$A</td>
<td>$V_R = 2$ V$^{(10)}$</td>
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<tr>
<td>$\lambda_p$</td>
<td>Wavelength at Peak Emission</td>
<td>OP290/OP292</td>
<td>890</td>
<td>nm</td>
<td>$I_f = 10$ mA</td>
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<tr>
<td>$B$</td>
<td>Spectral Bandwidth Between Half Power Points</td>
<td>OP290/OP292</td>
<td>80</td>
<td>nm</td>
<td>$I_f = 10$ mA</td>
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<tr>
<td>$\Delta \lambda_p / \Delta T$</td>
<td>Spectral Shift with Temperature</td>
<td>OP290/OP292</td>
<td>0.18</td>
<td>nm$^2$/C</td>
<td>$I_f$ = Constant</td>
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<tr>
<td>$\theta_{\text{HP}}$</td>
<td>Emission Angle at Half Power Points</td>
<td>OP290/OP292</td>
<td>50</td>
<td>Deg</td>
<td>$I_f = 20$ mA</td>
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<tr>
<td>$t_R$</td>
<td>Output Rise Time</td>
<td>OP290/OP292</td>
<td>500</td>
<td>ns</td>
<td>$I_f = 100$ mA, $\text{PW} = 10$ $\mu$s, D.C. = 10%</td>
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<tr>
<td>$t_T$</td>
<td>Output Fall Time</td>
<td>OP290/OP292</td>
<td>250</td>
<td>ns</td>
<td>$I_f = 100$ mA, $\text{PW} = 10$ $\mu$s, D.C. = 10%</td>
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</tbody>
</table>

## Typical Performance Curves

### Forward Voltage vs. Ambient Temperature

- **Test Conditions:**
  - Pulse Width = 100 $\mu$s
  - Duty Cycle = 0.1%
  - $T_A = T_s$

### Forward Voltage vs. Forward Current

- **Test Conditions:**
  - $T_A = T_s = 25^\circ$ C
  - PW = 100 $\mu$s
  - Single pulse measured at end of pulse

### Rise and Fall Times vs. Forward Current

- **Test Conditions:**
  - $T_A = T_s = 25^\circ$ C
  - PW = 100 $\mu$s, DC = 0.1%

## Thermal Parameters

<table>
<thead>
<tr>
<th>Type Units</th>
<th>$R_{THJA}$ (C/W)</th>
<th>$C_{TH}$ (10$^{-5}$ W/cm$^2$C)</th>
<th>$T_{TH}$ (10$^{-2}$ s)</th>
<th>$K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Free Air(1)</td>
<td>300</td>
<td>188</td>
<td>90</td>
<td>1.42</td>
</tr>
</tbody>
</table>

Refer to Application Bulletin 105 for use of these constants.

## Notes to Thermal Parameters

1. Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.
2. Unit mounted in double sided printed circuit board = 0.250 inches 16.35 mml below plastic. The land areas are 0.080 inches square. This simulates normal use.
3. Unit immersed in circulating silicone fluid holding $T_{CASE} = 25^\circ$ C. This simulates an infinite heat sink.
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Typical Performance Curves

Percent Change in Radiant Intensity vs. Time

- Test Conditions:
  - $I_f = 1$ A, $P_W = 100$ $\mu$W, 10 PPS
  - $T_A = 25$°C
  - Mounted in Socket

- Table: 1 K Hrs.
  - $20$ mA 1.8%
  - $50$ mA 1.8%
  - $100$ mA 2.4%
  - $250$ mA 7.1%
  - $1$ Amp 0.6%

- Projected $I_f = 250$ mA DC

Spectral Response and Emission vs. Wavelength

- Test Conditions (LED):
  - $T_A = T_j = 25$°C
  - $I_f = 100$ mA, DC = 0.1%
  - $P_W = 100$ $\mu$W
  - Peak Wavelength = $\lambda_p$

(A) XSTR
816 ± 30 nm
(B) LED GaAlAs
650 ± 20 nm
(C) LED GaAs
550 ± 15 nm

Power Dissipation vs. Ambient Temperature

- Notes (Dissipating):
  - (A) Free air 3.33 mW/°C
  - (B) Normal 5.33 mW/°C
  - (C) Infinite heat sink 11.1 mW/°C

Shift in Peak Wavelength vs. Junction Temperature

Coupling Characteristics of OP291/OP593 and OP296/OP598

- Test Conditions:
  - OP291 - $I_f = 100$ mA, $P_W = 100$ $\mu$W, Duty Cycle = 0.1%
  - OP598 - $V_{CE} = 5$ V
  - $R_i = 1$ k$\Omega$
  - $T_A = 25$°C
  - Shaded area represents normal production spread

Coupling Characteristics of OP295/OP599 and OP290/OP593

- Test Conditions:
  - OP295 - $I_f = 1.5$ A, $P_W = 100$ $\mu$W, Duty Cycle = 0.1%
  - OP593 - $V_{CE} = 5$ V
  - $R_i = 1$ k$\Omega$
  - $T_A = 25$°C
  - Shaded area represents normal production spread

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