

# HCPL-814

## AC Input Phototransistor Optocoupler High Density Mounting Type



### Data Sheet



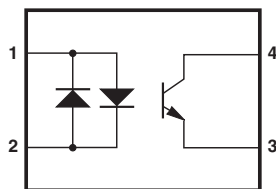
#### Description

The HCPL-814 contains a phototransistor, optically coupled to two light emitting diodes connected inverse parallel. It can operate directly by AC input current. It is packaged in a 4-pin DIP package and available in wide-lead spacing option and lead bend SMD option. Input-output isolation voltage is 5000 V<sub>rms</sub>. Response time,  $t_r$ , is typically 4  $\mu$ s and minimum CTR is 20% at input current of  $\pm 1$  mA.

#### Applications

- Detecting or monitoring AC signals
- AC line/digital logic isolation
- Programmable logic controllers
- AC/DC – input modules

#### Functional Diagram



- |                   |              |
|-------------------|--------------|
| 1. ANODE, CATHODE | 3. EMITTER   |
| 2. CATHODE, ANODE | 4. COLLECTOR |

#### Features

- AC input response
- High input-output isolation voltage ( $V_{iso} = 5,000 V_{rms}$ )
- Low collector dark current ( $I_{CEO}$ : max.  $10^{-7}$  A at  $V_{CE} = 20$  V)
- Current transfer ratio (CTR: min. 20% at  $I_F = \pm 1$  mA,  $V_{CE} = 5$  V)
- Response time ( $t_r$ : typ. 4  $\mu$ s at  $V_{CE} = 2$  V,  $I_C = 2$  mA,  $R_L = 100 \Omega$ )
- Compact dual-in-line package
- UL approved
- CSA approved
- IEC/EN/DIN EN 60747-5-2 approved
- Options available:
  - Leads with 0.4" (10.16 mm) spacing (W00)
  - Leads bend for surface mounting (300)
  - Tape and reel for SMD (500)
  - IEC/EN/DIN EN 60747-5-2 approvals (060)

**CAUTION:** It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.

## Ordering Information

HCPL-814 is UL Recognized with 5000 Vrms for 1 minute per UL1577 and is approved under CSA Component Acceptance Notice #5, File CA 88324.

| Part Number | RoHS Compliant Option    |                          | Package       | Surface Mount | Gull Wing | Tape & Reel | IEC/EN/DIN EN 60747-5-2 | Quantity          |
|-------------|--------------------------|--------------------------|---------------|---------------|-----------|-------------|-------------------------|-------------------|
|             | Rank '0'<br>20%<CTR<300% | Rank 'A'<br>50%<CTR<150% |               |               |           |             |                         |                   |
| HCPL-814    | -000E                    | -00AE                    | 300 mil DIP-4 |               |           |             |                         | 100 pcs per tube  |
|             | -300E                    | -30AE                    | 300 mil DIP-4 | X             | X         |             |                         | 100 pcs per tube  |
|             | -500E                    | -50AE                    | 300 mil DIP-4 | X             | X         | X           |                         | 1000 pcs per reel |
|             | -060E                    | -06AE                    | 300 mil DIP-4 |               |           |             | X                       | 100 pcs per tube  |
|             | -360E                    | -36AE                    | 300 mil DIP-4 | X             | X         |             | X                       | 100 pcs per tube  |
|             | -560E                    | -56AE                    | 300 mil DIP-4 | X             | X         | X           | X                       | 1000 pcs per reel |
|             | -W00E                    | -W0AE                    | 400 mil DIP-4 |               |           |             |                         | 100 pcs per tube  |
|             | -W60E                    | -W6AE                    | 400 mil DIP-4 |               |           |             | X                       | 100 pcs per tube  |

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

Example 1:

HCPL-814-360E to order product of 300 mil DIP-4 AC Gull Wing Surface Mount package in Tube packaging with 20%<CTR<300%, IEC/EN/DIN EN 60767-5-2 Safety Approval and RoHS compliant.

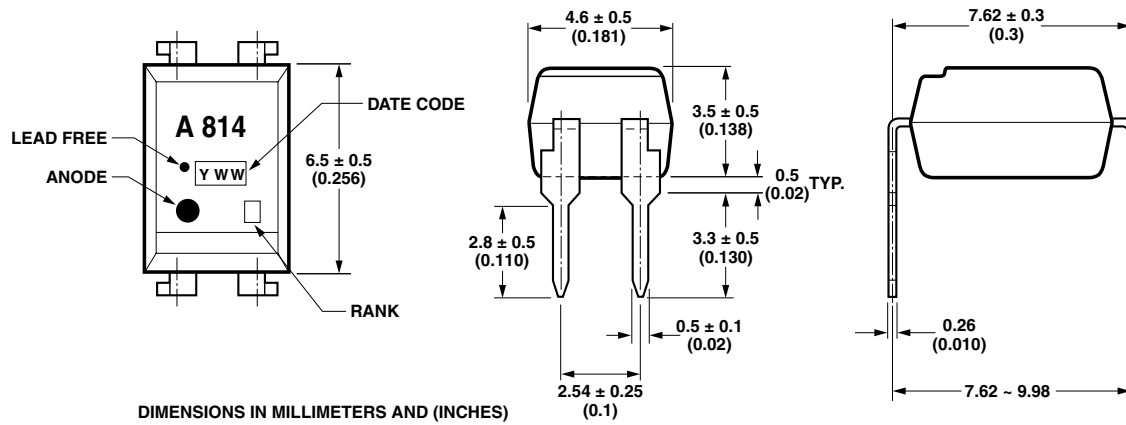
Example 2:

HCPL-814-50AE to order product of 300 mil DIP-4 AC Gull Wing Surface Mount package in Tape and Reel packaging with 50%<CTR<150% and RoHS compliant.

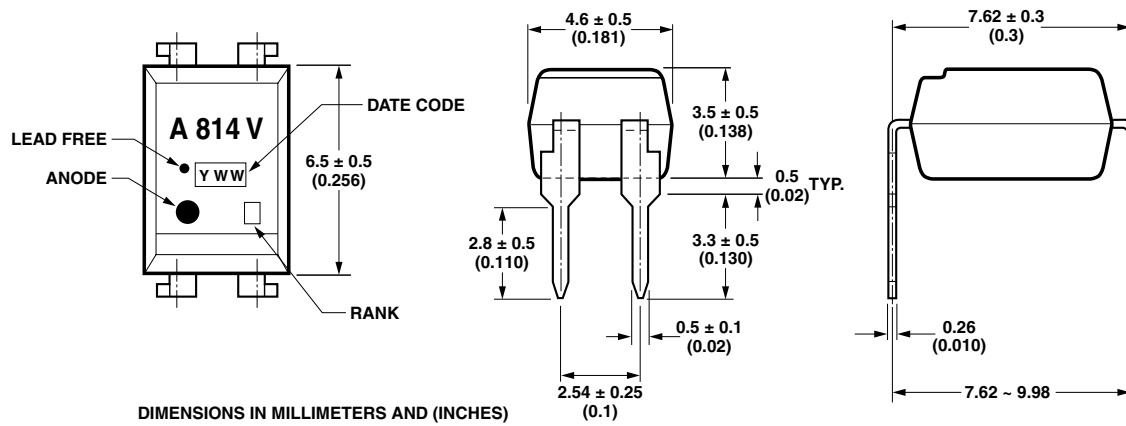
Option datasheets are available. Contact your Avago sales representative or authorized distributor for information.

## Package Outline Drawings

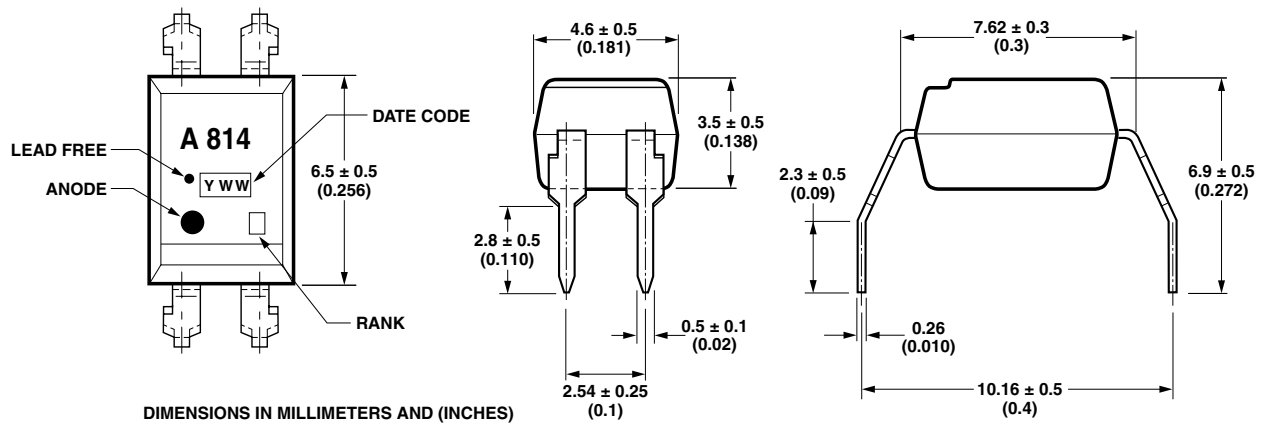
### HCPL-814-000E



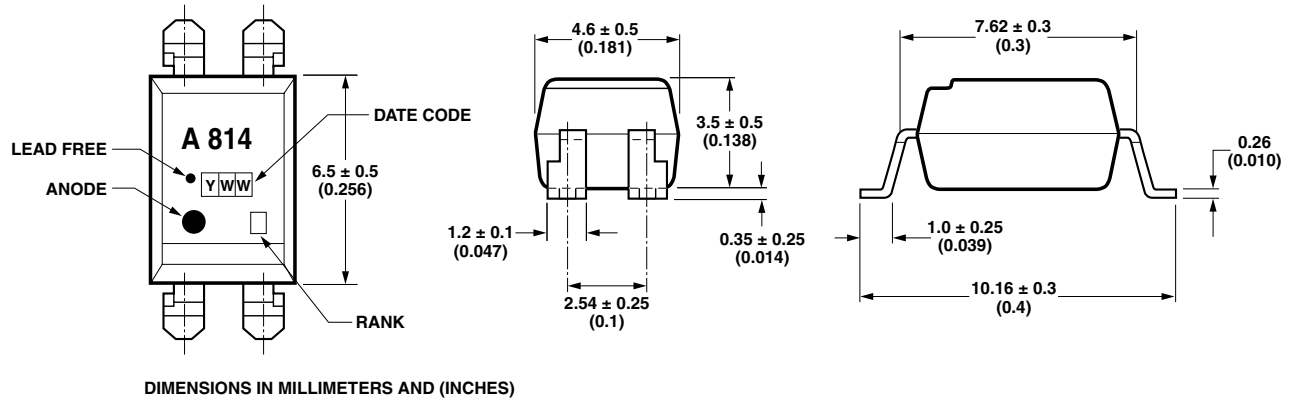
### HCPL-814-060E



### HCPL-814-W00E

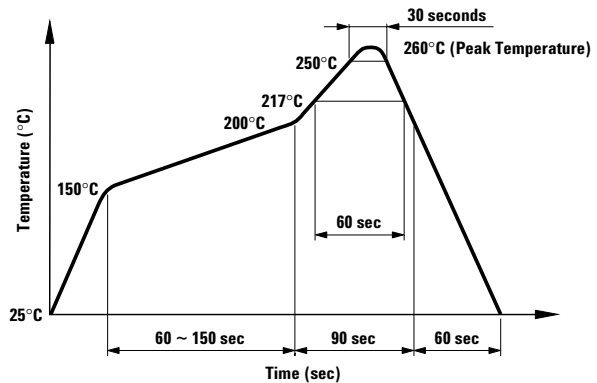


## HCPL-814-300E



### Solder Reflow Temperature Profile

- One-time soldering reflow is recommended within the condition of temperature and time profile shown at right.
- When using another soldering method such as infrared ray lamp, the temperature may rise partially in the mold of the device. Keep the temperature on the package of the device within the condition of (1) above.



Note: Non-halide flux should be used.

### Absolute Maximum Ratings

| Parameters                                                             | Symbol    | Min. | Max. | Units     |
|------------------------------------------------------------------------|-----------|------|------|-----------|
| Storage Temperature                                                    | $T_S$     | -55  | 125  | °C        |
| Ambient Operating Temperature                                          | $T_A$     | -30  | 100  | °C        |
| Lead Solder Temperature for 10s<br>(1.6 mm below seating plane)        | $T_{sol}$ |      | 260  | °C        |
| Average Forward Current                                                | $I_F$     |      | ±50  | mA        |
| Input Power Dissipation                                                | $P_I$     |      | 70   | mW        |
| Collector Current                                                      | $I_C$     |      | 50   | mA        |
| Collector-Emitter Voltage                                              | $V_{CEO}$ |      | 35   | V         |
| Emitter-Collector Voltage                                              | $V_{ECO}$ |      | 6    | V         |
| Collector Power Dissipation                                            | $P_C$     |      | 150  | mW        |
| Total Power Dissipation                                                | $P_{tot}$ |      | 200  | mW        |
| Isolation Voltage<br>(AC for 1 minute, R.H. = 40 ~ 60%) <sup>[1]</sup> | $V_{iso}$ |      | 5000 | $V_{rms}$ |

## Electrical Specifications ( $T_A = 25^\circ\text{C}$ )

| Parameter                             | Symbol        | Min.               | Typ.               | Max. | Units         | Test Conditions                                                                     |
|---------------------------------------|---------------|--------------------|--------------------|------|---------------|-------------------------------------------------------------------------------------|
| Forward Voltage                       | $V_F$         | —                  | 1.2                | 1.4  | V             | $I_F = \pm 20\text{ mA}$                                                            |
| Terminal Capacitance                  | $C_t$         | —                  | 50                 | 250  | pF            | $V = 0, f = 1\text{ kHz}$                                                           |
| Collector Dark Current                | $I_{CE0}$     | —                  | —                  | 100  | nA            | $V_{CE} = 20\text{ V}, I_F = 0$                                                     |
| Collector-Emitter Breakdown Voltage   | $BV_{CEO}$    | 35                 | —                  | —    | V             | $I_C = 0.1\text{ mA}, I_F = 0$                                                      |
| Emitter-Collector Breakdown Voltage   | $BV_{ECO}$    | 6                  | —                  | —    | V             | $I_E = 10\text{ }\mu\text{A}, I_F = 0$                                              |
| Collector Current                     | $I_C$         | 0.2                | —                  | 3    | mA            | $I_F = \pm 1\text{ mA},$                                                            |
| Current Transfer Ratio <sup>[2]</sup> | CTR           | 20                 | —                  | 300  | %             | $V_{CE} = 5\text{ V}$                                                               |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ | —                  | 0.1                | 0.2  | V             | $I_F = \pm 20\text{ mA}, I_C = 1\text{ mA}$                                         |
| Isolation Resistance                  | $R_{iso}$     | $5 \times 10^{10}$ | $1 \times 10^{11}$ | —    | $\Omega$      | DC 500 V<br>40 ~ 60% R.H.                                                           |
| Floating Capacitance                  | $C_f$         | —                  | 0.6                | 1    | pF            | $V = 0, f = 1\text{ MHz}$                                                           |
| Cut-off Frequency                     | $f_c$         | 15                 | 80                 | —    | kHz           | $V_{CE} = 5\text{ V}, I_C = 2\text{ mA}$<br>$R_L = 100\text{ }\Omega, -3\text{ dB}$ |
| Response Time (Rise)                  | $t_r$         | —                  | 4                  | 18   | $\mu\text{s}$ | $V_{CE} = 2\text{ V}, I_C = 2\text{ mA},$                                           |
| Response Time (Fall)                  | $t_f$         | —                  | 3                  | 18   | $\mu\text{s}$ | $R_L = 100\text{ }\Omega$                                                           |

| Rank Mark | CTR (%)  | Conditions                                         |
|-----------|----------|----------------------------------------------------|
| A         | 50 ~ 150 | $I_F = \pm 1\text{ mA},$                           |
| No Mark   | 20 ~ 300 | $V_{CE} = 5\text{ V},$<br>$T_A = 25^\circ\text{C}$ |

### Notes:

1. Isolation voltage shall be measured using the following method:

- Short between anode and cathode on the primary side and between collector and emitter on the secondary side.
- The isolation voltage tester with zero-cross circuit shall be used.
- The waveform of applied voltage shall be a sine wave.

2.  $CTR = \frac{I_C}{I_F} \times 100\%$

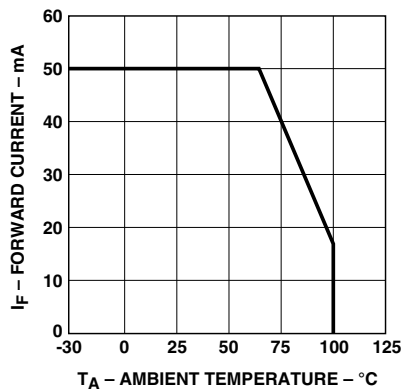


Figure 1. Forward current vs. temperature.

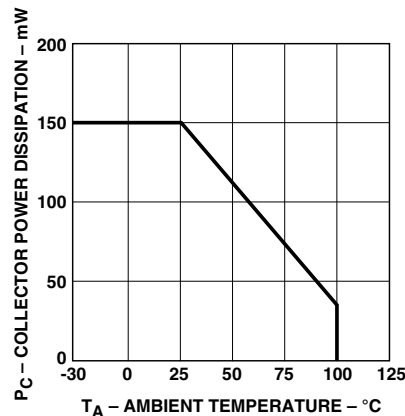


Figure 2. Collector power dissipation vs. temperature.

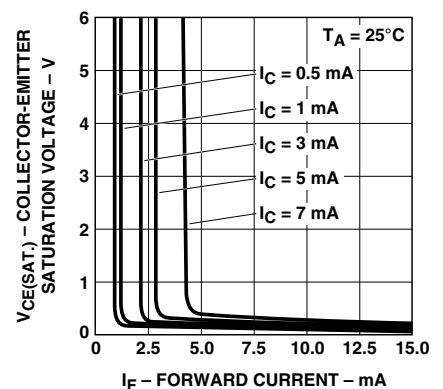


Figure 3. Collector-emitter saturation voltage vs. forward current.

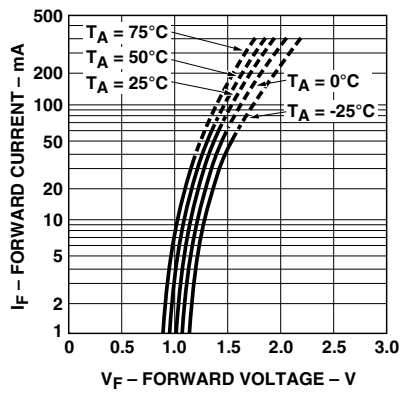


Figure 4. Forward current vs. forward voltage.

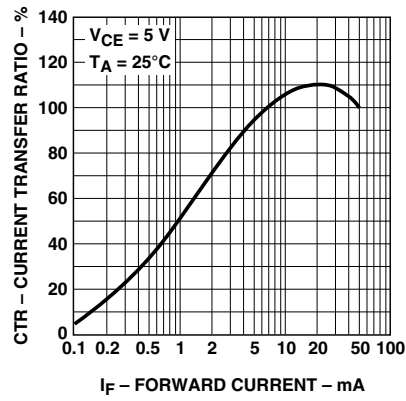


Figure 5. Current transfer ratio vs. forward current.

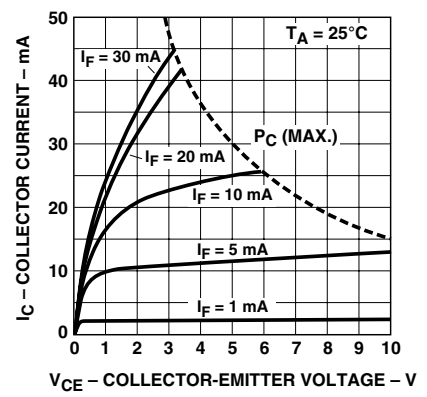


Figure 6. Collector current vs. collector-emitter voltage.

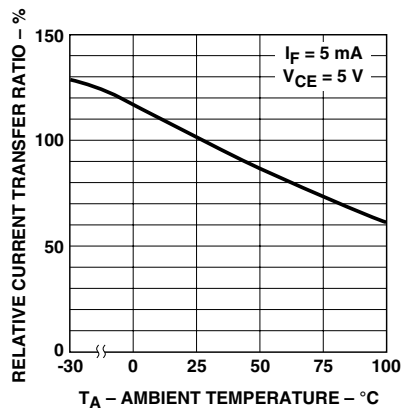


Figure 7. Relative current transfer ratio vs. temperature.

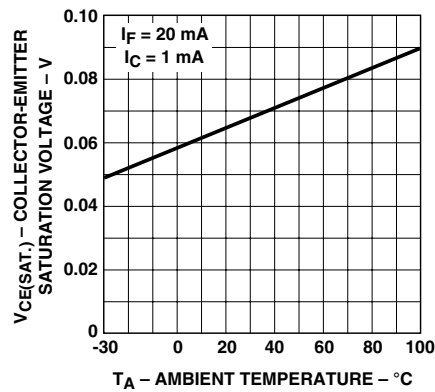


Figure 8. Collector-emitter saturation voltage vs. temperature.

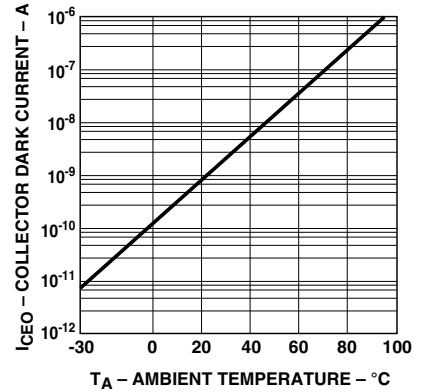


Figure 9. Collector dark current vs. temperature.

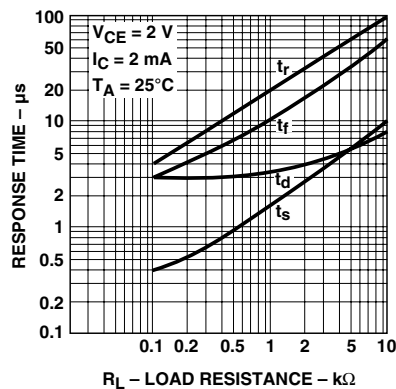


Figure 10. Response time vs. load resistance.

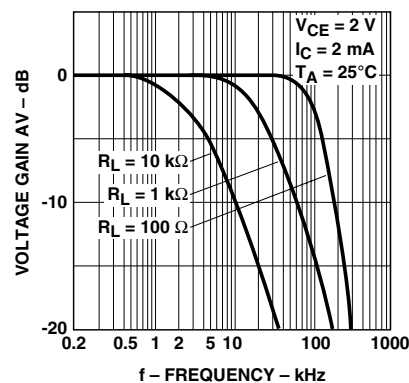


Figure 11. Frequency response.

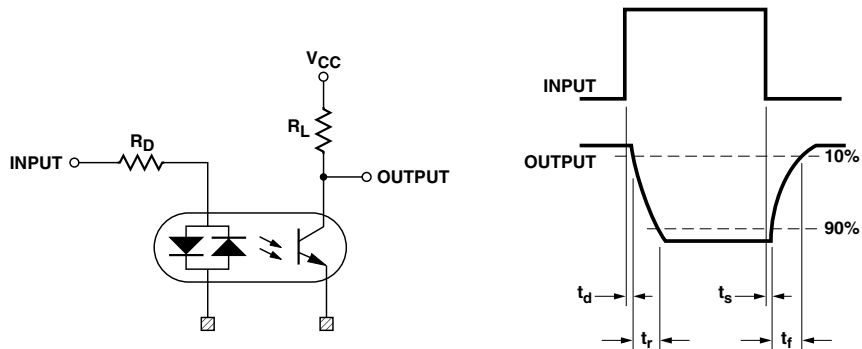


Figure 12. Test circuit for response time.

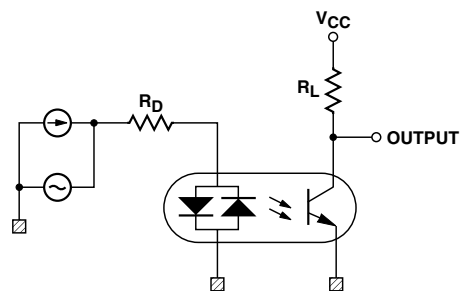


Figure 13. Test circuit for frequency response.

For product information and a complete list of distributors, please go to our website: [www.avagotech.com](http://www.avagotech.com)

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