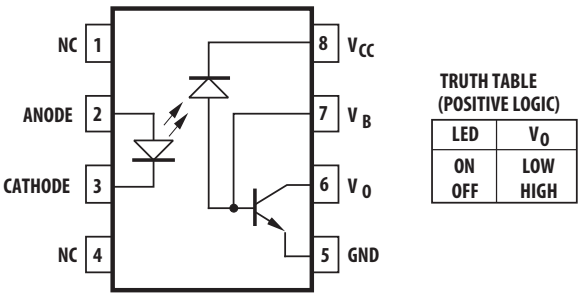
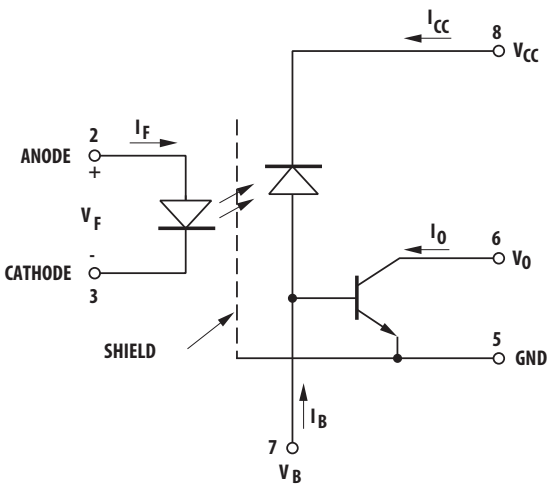


Functional Diagram



Schematic



Truth Table (Positive Logic)

| LED | V <sub>O</sub> |
|-----|----------------|
| ON  | LOW            |
| OFF | HIGH           |

A 0.1-μF bypass capacitor must be connected between pins 5 and 8.

Selection Guide

| Minimum CMR  |                     |                            | 8-Pin DIP (300 Mil)    |                                   | Small Outline SO-8     |                                   | Widebody (400 Mil)     |
|--------------|---------------------|----------------------------|------------------------|-----------------------------------|------------------------|-----------------------------------|------------------------|
| dV/dT (V/μs) | V <sub>CM</sub> (V) | Current Transfer Ratio (%) | Single Channel Package | Dual Channel Package <sup>a</sup> | Single Channel Package | Dual Channel Package <sup>a</sup> | Single Channel Package |
| 1000         | 10                  | 7                          | 6N135                  | HCPL-2530                         | HCPL-0500              | HCPL-0530                         | HCNW135                |
|              |                     | 19                         | 6N136                  | HCPL-2531                         | HCPL-0501              | HCPL-0531                         | HCNE136                |
|              |                     | 15                         | HCPL-2502              |                                   |                        |                                   |                        |

a. Technical data for these products are on separate Broadcom publications.

## Ordering Information

6N135, 6N136, HCPL-2502, HCPL-0500, HCPL-0501 are UL Recognized with 3750 V<sub>rms</sub> for 1 minute per UL1577.

HCNW135 and HCNW136 are UL Recognized with 5000 V<sub>rms</sub> for 1 minute per UL1577. All these devices are approved under CSA Component Acceptance Notice #5, File CA 88324.

| Part Number | Option         |                    | Package                | Surface Mount | Gull Wing | Tape and Reel | UL 3750 V <sub>rms</sub> / 1 Minute Rating | UL 5000 V <sub>rms</sub> / 1 Minute Rating | IEC/EN/DIN EN 60747-5-5 | Quantity      |
|-------------|----------------|--------------------|------------------------|---------------|-----------|---------------|--------------------------------------------|--------------------------------------------|-------------------------|---------------|
|             | RoHS Compliant | Non RoHS Compliant |                        |               |           |               |                                            |                                            |                         |               |
| 6N135       | -000E          | No option          | 300mil DIP-8           |               |           |               | X                                          |                                            |                         | 50 per tube   |
| 6N136       | -300E          | #300               |                        | X             | X         |               | X                                          |                                            |                         | 50 per tube   |
| HCPL-2502   | -500E          | #500               |                        | X             | X         | X             | X                                          |                                            |                         | 1000 per reel |
|             | -020E          | #020               |                        |               |           |               |                                            | X                                          |                         | 50 per tube   |
|             | -320E          | #320               |                        | X             | X         |               |                                            | X                                          |                         | 50 per tube   |
|             | -520E          | #520               |                        | X             | X         | X             |                                            | X                                          |                         | 1000 per reel |
|             | -060E          | #060               |                        |               |           |               | X                                          |                                            | X                       | 50 per tube   |
|             | -360E          | #360               |                        | X             | X         |               | X                                          |                                            | X                       | 50 per tube   |
|             | -560E          | #560               |                        | X             | X         | X             | X                                          |                                            | X                       | 1000 per reel |
| HCPL-0500   | -000E          | No option          | SO-8                   | X             |           |               | X                                          |                                            |                         | 100 per tube  |
| HCPL-0501   | -500E          | #500               |                        | X             |           | X             | X                                          |                                            |                         | 1500 per reel |
|             | -060E          | #060               |                        | X             |           |               | X                                          |                                            | X                       | 100 per tube  |
|             | -560E          | #560               |                        | X             |           | X             | X                                          |                                            | X                       | 1500 per reel |
| HCNW135     | -000E          | No option          | 400 mil Widebody DIP-8 |               |           |               |                                            | X                                          | X                       | 42 per tube   |
| HCNW136     | -300E          | #300               |                        | X             | X         |               |                                            | X                                          | X                       | 42 per tube   |
|             | -500E          | #500               |                        | X             | X         | X             |                                            | X                                          | X                       | 750 per reel  |

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-2502-560E to order product of 300 mil DIP Gull Wing Surface Mount package in Tape and Reel packaging with IEC/EN/DIN EN 60747-5-5 Safety Approval in RoHS compliant.

### Example 2:

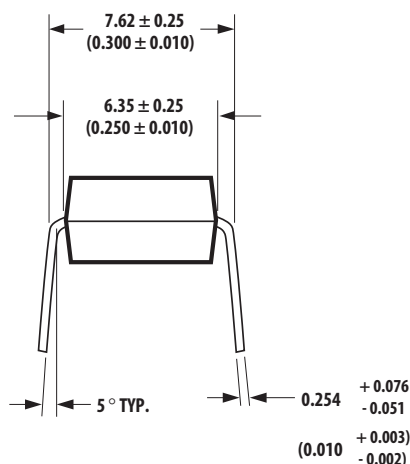
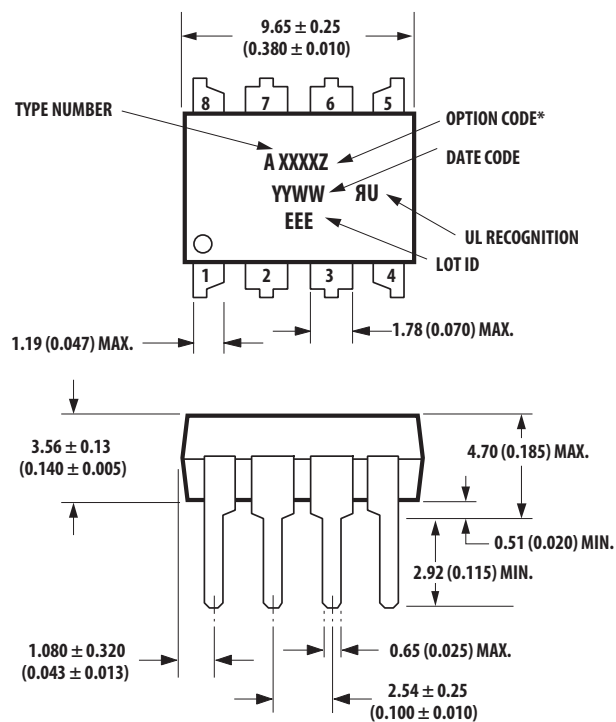
HCPL-2502 to order product of 300 mil DIP package in tube packaging and non RoHS compliant.

Optional data sheets are available. Contact your Broadcom® sales representative or authorized distributor for information.

**NOTE:** The notation '#XXX' is used for existing products, while (new) products launched since 15th July 2001 and RoHS compliant option will use '-XXxE'.

# Package Outline Drawings

## 8-Pin DIP Package (6N135/6, HCPL-2502)



DIMENSIONS IN MILLIMETERS AND (INCHES).

\*MARKING CODE LETTER FOR OPTION NUMBERS

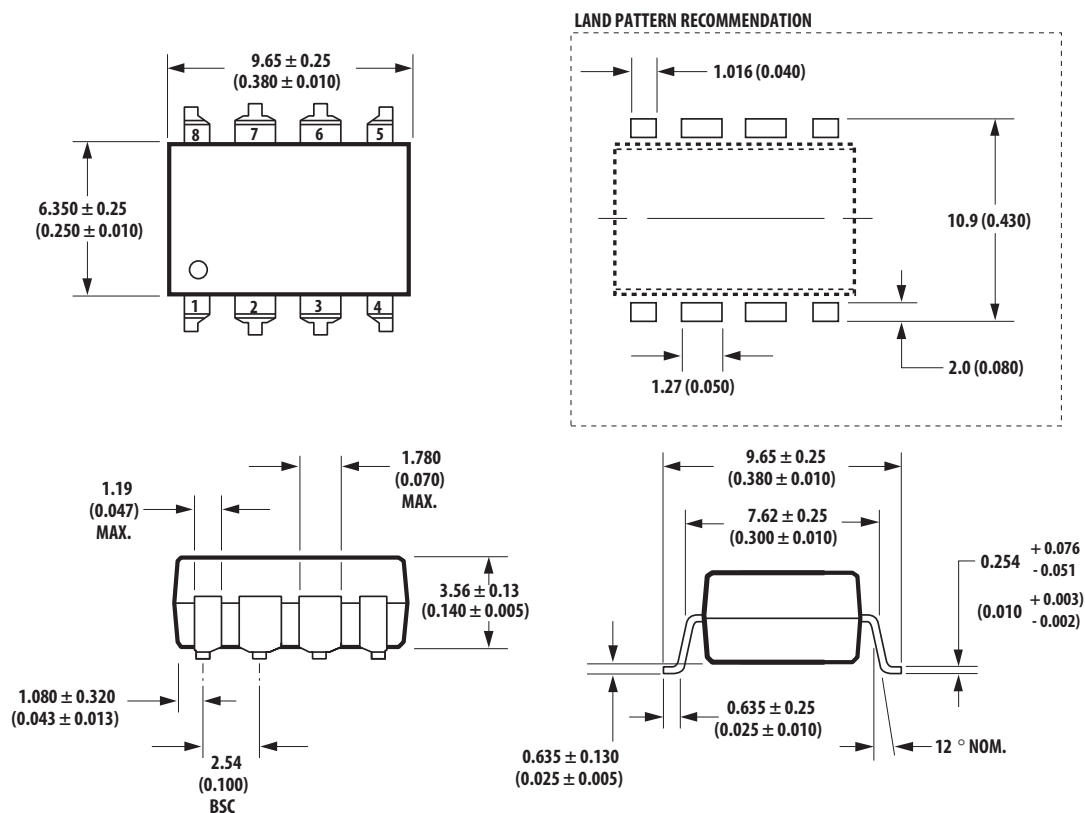
"L" = OPTION 020

"V" = OPTION 060

OPTION NUMBERS 300 AND 500 NOT MARKED.

NOTE: FLOATING LEAD PROTRUSION IS 0.25 mm (10 mils) MAX.

## 8-Pin DIP Package with Gull Wing Surface Mount Option 300 (6N135/6)

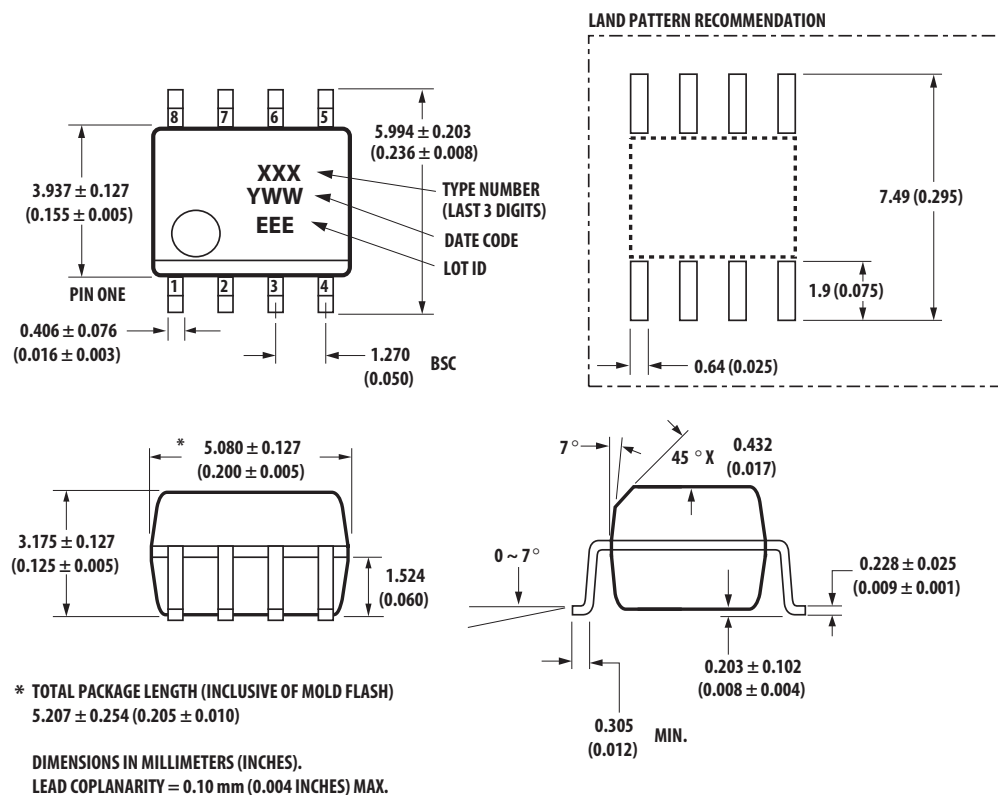


DIMENSIONS IN MILLIMETERS (INCHES).

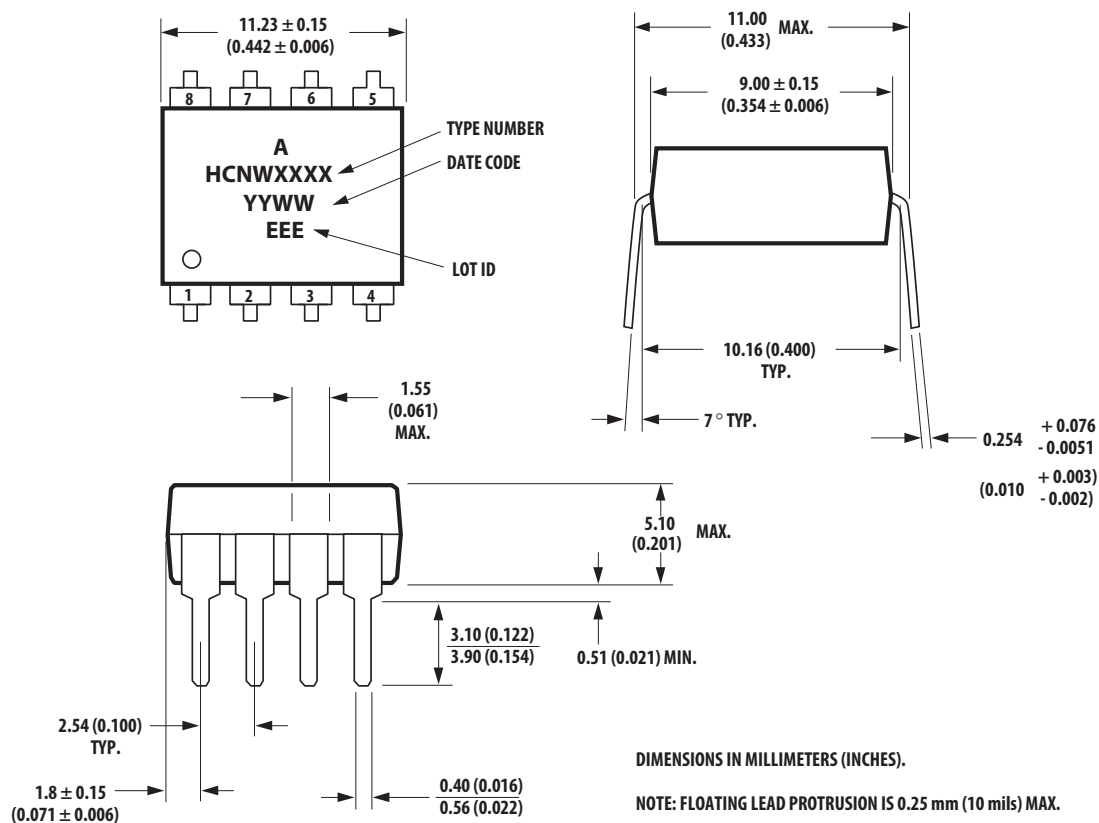
LEAD COPLANARITY =  $0.10$  mm ( $0.004$  INCHES).

NOTE: FLOATING LEAD PROTRUSION IS  $0.25$  mm (10 mils) MAX.

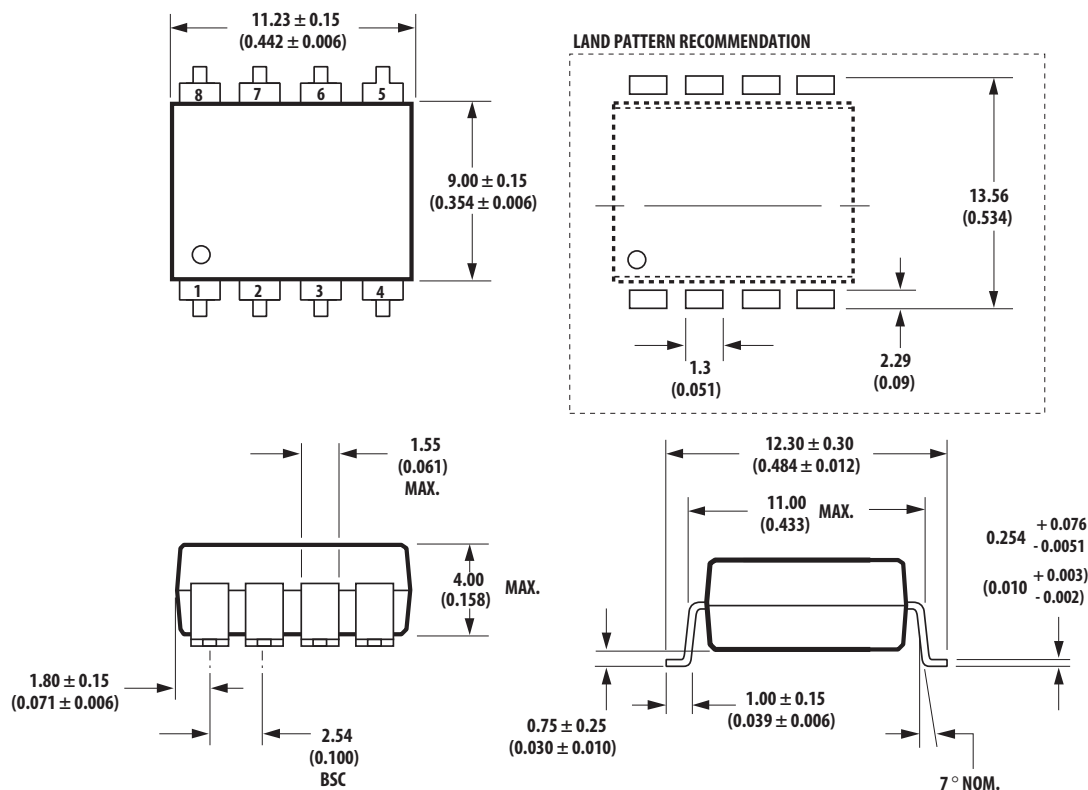
## Small Outline SO-8 Package (HCPL-0500/1)



## 8-Pin Widebody DIP Package (HCNW135/6)



## 8-Pin Widebody DIP Package with Gull Wing Surface Mount Option 300 (HCNW135/6)



DIMENSIONS IN MILLIMETERS (INCHES).

LEAD COPLANARITY = 0.10 mm (0.004 INCHES).

NOTE: FLOATING LEAD PROTRUSION IS 0.25 mm (10 mils) MAX.

## Solder Reflow Profile

Recommended reflow conditions are as per JEDEC Standard, J-STD-020 (latest revision). Non-halide flux should be used.

## Regulatory Information

The devices contained in this data sheet have been approved by the following organizations:

|                         |                                                                     |
|-------------------------|---------------------------------------------------------------------|
| UL                      | Approval under UL 1577, Component Recognition Program, File E55361. |
| CSA                     | Approval under CSA Component Acceptance Notice #5, File CA 88324.   |
| IEC/EN/DIN EN 60747-5-5 | (HCNW and Option 060/360/560 only)                                  |

## Insulation and Safety Related Specifications

| Parameter                                            | Symbol | 8-Pin DIP<br>(300 Mil)<br>Value | SO-8 Value | Widebody<br>(400 Mil)<br>Value | Units | Conditions                                                                                                                                                |
|------------------------------------------------------|--------|---------------------------------|------------|--------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimum External Air Gap<br>(External Clearance)     | L(101) | 7.1                             | 4.9        | 9.6                            | mm    | Measured from input terminals to output terminals, shortest distance through air.                                                                         |
| Minimum External Tracking<br>(External Creepage)     | L(102) | 7.4                             | 4.8        | 10.0                           | mm    | Measured from input terminals to output terminals, shortest distance path along body..                                                                    |
| Minimum Internal Plastic Gap<br>(Internal Clearance) |        | 0.08                            | 0.08       | 1.0                            | mm    | Through insulation distance conductor to conductor, usually the direct distance between the photoemitter and photodetector inside the optocoupler cavity. |
| Minimum Internal Tracking<br>(Internal Creepage)     |        | N/A                             | N/A        | 4.0                            | mm    | Measured from input terminals to output terminals, along internal cavity.                                                                                 |
| Tracking Resistance<br>(Comparative Tracking Index)  | CTI    | 200                             | 200        | 200                            | V     | DIN IEC 112/VDE 0303 Part 1                                                                                                                               |
| Isolation Group                                      |        | IIIa                            | IIIa       | IIIa                           |       | Material Group<br>(DIN VDE 0110, 1/89, Table 1)                                                                                                           |

Option 300 – Surface mount classification is Class A in accordance with CECC 00802.

## IEC/EN/DIN EN 60747-5-5 Insulation Characteristics<sup>a</sup> (Option 060 Only)

| Description                                                                                                                                                                                        | Symbol                                     | 8-Pin DIP                  | SO-8                        | Units                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------|-----------------------------|-------------------------|
| Installation Classification per DIN VDE 0110/39, Table 1<br>for rated mains voltage $\leq 150 V_{rms}$<br>for rated mains voltage $\leq 300 V_{rms}$<br>for rated mains voltage $\leq 600 V_{rms}$ |                                            | I – IV<br>I – IV<br>I – IV | I – IV<br>I – IV<br>I – III |                         |
| Climatic Classification                                                                                                                                                                            |                                            | 0/70/21                    | 0/70/21                     |                         |
| Pollution Degree (DIN VDE 0110/39)                                                                                                                                                                 |                                            | 2                          | 2                           |                         |
| Maximum Working Insulation Voltage                                                                                                                                                                 | $V_{IORM}$                                 | 630                        | 567                         | $V_{peak}$              |
| Input to Output Test Voltage, Method b <sup>a</sup><br>$V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test with $t_m = 1s$ , Partial Discharge $< 5 pC$                                        | $V_{PR}$                                   | 1181                       | 1063                        | $V_{peak}$              |
| Input to Output Test Voltage, Method a <sup>a</sup><br>$V_{IORM} \times 1.6 = V_{PR}$ , Type and Sample Test, $t_m = 10s$ , Partial Discharge $< 5 pC$                                             | $V_{PR}$                                   | 1008                       | 907                         | $V_{peak}$              |
| Highest Allowable Overvoltage <sup>a</sup> (Transient Overvoltage $t_{ini} = 60s$ )                                                                                                                | $V_{IOTM}$                                 | 8000                       | 6000                        | $V_{peak}$              |
| Safety-limiting values – Maximum Values Allowed in the Event of a Failure<br>Case Temperature<br>Input Current<br>Output Power                                                                     | $T_S$<br>$I_{S, INPUT}$<br>$P_{S, OUTPUT}$ | 175<br>230<br>600          | 150<br>150<br>600           | $^{\circ}C$<br>mA<br>mW |
| Insulation Resistance at $T_S$ , $V_{IO} = 500V$                                                                                                                                                   | $R_S$                                      | $\geq 10^9$                | $\geq 10^9$                 | $\Omega$                |

a. Refer to the front of the optocoupler section of the current catalog, under Product Safety Regulations section IEC/EN/DIN EN 60747-5-5, for a detailed description.

**NOTE:** Isolation characteristics are guaranteed only within the safety maximum ratings, which must be ensured by protective circuits in the application.

## IEC/EN/DIN EN 60747-5-5 Insulation Characteristics<sup>a</sup> (HCNW135/6 Option 060 Only)

| Description                                                                                                                                                                                                                                       | Symbol                                     | Characteristic                        | Units                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------|-------------------------|
| Installation Classification per DIN VDE 0110/39, Table 1<br>for rated mains voltage $\leq 150 V_{rms}$<br>for rated mains voltage $\leq 300 V_{rms}$<br>for rated mains voltage $\leq 600 V_{rms}$<br>for rated mains voltage $\leq 1000 V_{rms}$ |                                            | I – IV<br>I – IV<br>I – IV<br>I – III |                         |
| Climatic Classification                                                                                                                                                                                                                           |                                            | 0/70/21                               |                         |
| Pollution Degree (DIN VDE 0110/39)                                                                                                                                                                                                                |                                            | 2                                     |                         |
| Maximum Working Insulation Voltage                                                                                                                                                                                                                | $V_{IORM}$                                 | 1414                                  | $V_{peak}$              |
| Input to Output Test Voltage, Method b <sup>a</sup><br>$V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test with $t_m = 1s$ , Partial Discharge $< 5 pC$                                                                                       | $V_{PR}$                                   | 2651                                  | $V_{peak}$              |
| Input to Output Test Voltage, Method a <sup>a</sup><br>$V_{IORM} \times 1.6 = V_{PR}$ , Type and Sample Test, $t_m = 10s$ , Partial Discharge $< 5 pC$                                                                                            | $V_{PR}$                                   | 2262                                  | $V_{peak}$              |
| Highest Allowable Overvoltage <sup>a</sup> (Transient Overvoltage $t_{ini} = 60s$ )                                                                                                                                                               | $V_{IOTM}$                                 | 8000                                  | $V_{peak}$              |
| Safety-limiting values – Maximum Values Allowed in the Event of a Failure<br>Case Temperature<br>Input Current<br>Output Power                                                                                                                    | $T_S$<br>$I_{S, INPUT}$<br>$P_{S, OUTPUT}$ | 150<br>400<br>700                     | $^{\circ}C$<br>mA<br>mW |
| Insulation Resistance at $T_S$ , $V_{IO} = 500V$                                                                                                                                                                                                  | $R_S$                                      | $\geq 10^9$                           | $\Omega$                |

a. Refer to the front of the optocoupler section of the current catalog, under Product Safety Regulations section IEC/EN/DIN EN 60747-5-5, for a detailed description.

**NOTE:** Isolation characteristics are guaranteed only within the safety maximum ratings, which must be ensured by protective circuits in the application.

## Absolute Maximum Rating

| Parameter                                                                                                                  | Symbol         | Device              | Min.                                         | Max. | Units | Note |
|----------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|----------------------------------------------|------|-------|------|
| Storage Temperature <sup>a</sup>                                                                                           | $T_S$          |                     | -55                                          | 125  | °C    |      |
| Operating Temperature <sup>a</sup>                                                                                         | $T_A$          | 8-Pin DIP SO-8      | -55                                          | 100  | °C    |      |
|                                                                                                                            |                | Widebody            | -55                                          | 85   |       |      |
| Average Forward Input Current <sup>a</sup>                                                                                 | $I_{F(AVG)}$   |                     | —                                            | 25   | mA    | b    |
| Peak Forward Input Current <sup>a</sup><br>(50% duty cycle, 1-ms pulse width)                                              | $I_{F(PEAK)}$  | 8-Pin DIP SO-8      | —                                            | 50   | mA    | c    |
| 50% duty cycle, 1 ms pulse width                                                                                           |                | Widebody            | —                                            | 40   |       |      |
| Peak Transient Input Current <sup>a</sup> (1-μs pulse width, 300 pps)                                                      | $I_{F(TRANS)}$ | 8-Pin DIP SO-8      | —                                            | 1    | A     |      |
|                                                                                                                            |                | Widebody            | —                                            | 0.1  |       |      |
| Reverse LED Input Voltage <sup>a</sup> (Pin 3-2)                                                                           | $V_R$          | 8-Pin DIP SO-8      | —                                            | 5    | V     |      |
|                                                                                                                            |                | Widebody            | —                                            | 3    |       |      |
| Input Power Dissipation <sup>a</sup>                                                                                       | $P_{IN}$       | 8-Pin DIP SO-8      | —                                            | 45   | mW    | d    |
|                                                                                                                            |                | Widebody            | —                                            | 40   |       |      |
| Average Output Current <sup>a</sup> (Pin 6)                                                                                | $I_{O(AVG)}$   |                     | —                                            | 8    | mA    |      |
| Peak Output Current <sup>a</sup>                                                                                           | $I_{O(PEAK)}$  |                     | —                                            | 16   | mA    |      |
| Emitter-Base Reverse Voltage <sup>a</sup> (Pin 5-7)                                                                        | $V_{EBR}$      |                     | —                                            | 5    | V     |      |
| Supply Voltage (Pin 8-5)                                                                                                   | $V_{CC}$       |                     | -0.5                                         | 30   | V     |      |
| Output Voltage (Pin 6-5)                                                                                                   | $V_O$          |                     | -0.5                                         | 20   | V     |      |
| Supply Voltage <sup>a</sup> (Pin 8-5)                                                                                      | $V_{CC}$       |                     | -0.5                                         | 15   | V     |      |
| Output Voltage <sup>a</sup> (Pin 6-5)                                                                                      | $V_O$          |                     | -0.5                                         | 15   | V     |      |
| Base Current <sup>a</sup> (Pin 7)                                                                                          | $I_B$          |                     | —                                            | 5    | mA    |      |
| Output Power Dissipation <sup>a</sup>                                                                                      | $P_O$          |                     | —                                            | 100  | mW    | e    |
| Lead Solder Temperature <sup>a</sup> (Through-Hole Parts Only)<br>1.6 mm below seating plane, 10s up to seating plane, 10s | $T_{LS}$       | 8-Pin DIP           | —                                            | 260  | °C    |      |
|                                                                                                                            |                | Widebody            |                                              | 260  | °C    |      |
| Reflow Temperature Profile                                                                                                 | $T_{RP}$       | SO-8 and Option 300 | See <a href="#">Package Outline Drawings</a> |      |       |      |

a. Data has been registered with JEDEC for the 6N135/6N136.

b. Derate linearly above 70°C free-air temperature at a rate of 0.8 mA/°C (8-Pin DIP). Derate linearly above 85°C free-air temperature at a rate of 0.5 mA/°C (SO-8).

c. Derate linearly above 70°C free-air temperature at a rate of 1.6 mA/°C (8-Pin DIP). Derate linearly above 85°C free-air temperature at a rate of 1.0 mA/°C (SO-8).

d. Derate linearly above 70°C free-air temperature at a rate of 0.9 mW/°C (8-Pin DIP). Derate linearly above 85°C free-air temperature at a rate of 1.1 mW/°C (SO-8).

e. Derate linearly above 70°C free-air temperature at a rate of 2.0 mW/°C (8-Pin DIP). Derate linearly above 85°C free-air temperature at a rate of 2.3 mW/°C (SO-8).

## Electrical Specifications (DC)

Over recommended operating temperature ( $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ) and unless otherwise specified. See note.

| Parameter                                  | Symbol                           | Device                            | Min. | Typ. <sup>a</sup> | Max. | Units | Test Conditions                                                      |                                                 |                                                   | Figure  | Note |
|--------------------------------------------|----------------------------------|-----------------------------------|------|-------------------|------|-------|----------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------|---------|------|
| Current Transfer Ratio                     | CTR <sup>b</sup>                 | 6N135                             | 7    | 18                | 50   | %     | T <sub>A</sub> = 25°C                                                | V <sub>O</sub> = 0.4V                           | I <sub>F</sub> = 16 mA,<br>V <sub>CC</sub> = 4.5V | 1, 2, 4 | c, d |
|                                            |                                  | HCPL-0500<br>HCNW135              | 5    | 19                | —    |       |                                                                      | V <sub>O</sub> = 0.5V                           |                                                   |         |      |
|                                            |                                  | HCPL-2502                         | 15   |                   | 22   |       | T <sub>A</sub> = 25°C                                                | V <sub>O</sub> = 0.4V                           |                                                   |         |      |
|                                            |                                  |                                   | 15   | 25                | —    |       |                                                                      | V <sub>O</sub> = 0.5V                           |                                                   |         |      |
|                                            |                                  | 6N136<br>HCPL-0501<br>HCNW136     | 19   | 24                | 50   |       | T <sub>A</sub> = 25°C                                                | V <sub>O</sub> = 0.4V                           |                                                   |         |      |
|                                            |                                  |                                   | 15   | 25                | —    |       |                                                                      | V <sub>O</sub> = 0.5V                           |                                                   |         |      |
| Logic Low Output Voltage                   | V <sub>OL</sub>                  | 6N135                             | —    | 0.1               | 0.4  | V     | T <sub>A</sub> = 25°C                                                | I <sub>O</sub> = 1.1 mA                         | I <sub>F</sub> = 16 mA,<br>V <sub>CC</sub> = 4.5V |         |      |
|                                            |                                  | HCPL-0500<br>HCNW135              | —    | 0.1               | 0.5  |       |                                                                      | I <sub>O</sub> = 0.8 mA                         |                                                   |         |      |
|                                            |                                  | 6N136                             | —    | 0.1               | 0.4  |       | T <sub>A</sub> = 25°C                                                | I <sub>O</sub> = 3.0 mA                         |                                                   |         |      |
|                                            |                                  | HCPL-2502<br>HCPL-0501<br>HCNW136 | —    | 0.1               | 0.5  |       |                                                                      | I <sub>O</sub> = 2.4 mA                         |                                                   |         |      |
| Logic High Output Current                  | I <sub>OH</sub> <sup>b</sup>     |                                   | —    | 0.003             | 0.5  | μA    | T <sub>A</sub> = 25°C                                                | V <sub>O</sub> = V <sub>CC</sub> = 5.5V         | I <sub>F</sub> = 0 mA                             | 7       |      |
|                                            |                                  |                                   | —    | 0.01              | 1    |       | T <sub>A</sub> = 25°C                                                | V <sub>O</sub> = V <sub>CC</sub> = 15V          |                                                   |         |      |
|                                            |                                  |                                   | —    | —                 | 50   |       |                                                                      | V <sub>O</sub> = V <sub>CC</sub> = 15V          |                                                   |         |      |
| Logic Low Supply Current                   | I <sub>CCL</sub>                 |                                   | —    | 50                | 200  | μA    | I <sub>F</sub> = 16 mA, V <sub>O</sub> = Open, V <sub>CC</sub> = 15V |                                                 |                                                   |         |      |
| Logic High Supply Current                  | I <sub>CCH</sub> <sup>b</sup>    |                                   | —    | 0.02              | 1    | μA    | T <sub>A</sub> = 25°C                                                | I <sub>F</sub> = 0 mA,<br>V <sub>O</sub> = Open |                                                   |         |      |
|                                            |                                  |                                   | —    | —                 | 2    |       |                                                                      | V <sub>CC</sub> = 15V                           |                                                   |         |      |
| Input Forward Voltage                      | V <sub>F</sub> <sup>b</sup>      | 8-Pin DIP                         | —    | 1.5               | 1.7  | V     | T <sub>A</sub> = 25°C                                                | I <sub>F</sub> = 16 mA                          |                                                   | 3       |      |
|                                            |                                  | SO-8                              | —    | —                 | 1.8  |       |                                                                      |                                                 |                                                   |         |      |
|                                            |                                  | Widebody                          | 1.45 | 1.68              | 1.85 |       | T <sub>A</sub> = 25°C                                                | I <sub>F</sub> = 16 mA                          |                                                   |         |      |
|                                            |                                  |                                   | 1.35 | —                 | 1.95 |       |                                                                      |                                                 |                                                   |         |      |
| Input Reverse Breakdown Voltage            | BV <sub>R</sub> <sup>b</sup>     | 8-Pin DIP                         | 5    | —                 | —    | V     | I <sub>R</sub> = 10 μA                                               |                                                 |                                                   |         |      |
|                                            |                                  | SO-8                              |      |                   |      |       |                                                                      |                                                 |                                                   |         |      |
|                                            |                                  | Widebody                          | 3    | —                 | —    |       | I <sub>R</sub> = 100 μA                                              |                                                 |                                                   |         |      |
| Temperature Coefficient of Forward Voltage | ΔV <sub>F</sub> /ΔT <sub>A</sub> | 8-Pin DIP                         | —    | −1.6              |      | mV/°C | I <sub>F</sub> = 16 mA                                               |                                                 |                                                   |         |      |
|                                            |                                  | SO-8                              |      |                   |      |       |                                                                      |                                                 |                                                   |         |      |
|                                            |                                  | Widebody                          | —    | −1.9              |      |       |                                                                      |                                                 |                                                   |         |      |
| Input Capacitance                          | C <sub>IN</sub>                  | 8-Pin DIP                         | —    | 60                | —    | pF    | f = 1 MHz, V <sub>F</sub> = 0V                                       |                                                 |                                                   |         |      |
|                                            |                                  | SO-8                              |      |                   |      |       |                                                                      |                                                 |                                                   |         |      |
|                                            |                                  | Widebody                          | —    | 90                | —    |       |                                                                      |                                                 |                                                   |         |      |

| Parameter                  | Symbol   | Device    | Min. | Typ. <sup>a</sup> | Max. | Units | Test Conditions                     | Figure | Note |
|----------------------------|----------|-----------|------|-------------------|------|-------|-------------------------------------|--------|------|
| Transistor DC Current Gain | $h_{FE}$ | 8-Pin DIP | —    | 150               | —    |       | $V_O = 5V, I_O = 3\text{ mA}$       |        |      |
|                            |          | Widebody  | —    | 180               | —    |       | $V_O = 5V, I_O = 3\text{ mA}$       |        |      |
|                            |          |           | —    | 160               | —    |       | $V_O = 0.4V, I_B = 20\text{ }\mu A$ |        |      |

a. All typicals at  $T_A = 25^\circ\text{C}$ .

b. For JEDEC registered parts.

c. CURRENT TRANSFER RATIO in percent is defined as the ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100.

d. The JEDEC registration for the 6N136 specifies a minimum CTR of 15%. Avago guarantees a minimum CTR of 19%.

**NOTE:** Use of a 0.1- $\mu\text{f}$  bypass capacitor connected between pins 5 and 8 is recommended.

## Switching Specifications (AC)

Over recommended temperature ( $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ),  $V_{CC} = 5\text{V}$ ,  $I_F = 16\text{ mA}$  unless otherwise specified.

| Parameter                                                          | Symbol             | Device                                | Min. | Typ. <sup>a</sup> | Max. | Units                   | Test Conditions            |                                                                                                                      | Figure   | Note    |
|--------------------------------------------------------------------|--------------------|---------------------------------------|------|-------------------|------|-------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------|----------|---------|
| Propagation Delay<br>Time to Logic Low at<br>Output                | $t_{\text{PHL}}^b$ | 6N135                                 | —    | 0.2               | 1.5  | $\mu\text{s}$           | $T_A = 25^\circ\text{C}$   | $R_L = 4.1\text{ k}\Omega$                                                                                           | 5, 6, 11 | c, d    |
|                                                                    |                    | HCPL-0500                             |      |                   |      |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | HCNW135                               |      |                   |      |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | 6N136                                 | —    | 0.2               | 0.8  |                         | $T_A = 25^\circ\text{C}$   | $R_L = 1.9\text{ k}\Omega$                                                                                           |          |         |
| Propagation Delay<br>Time to Logic High at<br>Output               | $t_{\text{PLH}}^b$ | 6N135                                 | —    | 1.3               | 1.5  | $\mu\text{s}$           | $T_A = 25^\circ\text{C}$   | $R_L = 4.1\text{ k}\Omega$                                                                                           | 5, 6, 11 | c, d    |
|                                                                    |                    | HCPL-0500                             | —    | —                 | 2.0  |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | HCNW135                               |      |                   |      |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | 6N136                                 | —    | 0.6               | 0.8  |                         | $T_A = 25^\circ\text{C}$   | $R_L = 1.9\text{ k}\Omega$                                                                                           |          |         |
| Common Mode<br>Transient Immunity at<br>Logic High Level<br>Output | $ CM_H $           | 6N135                                 | 1    | —                 | —    | $\text{kV}/\mu\text{s}$ | $R_L = 4.1\text{ k}\Omega$ | $I_F = 0\text{ mA}$ ,<br>$T_A = 25^\circ\text{C}$ ,<br>$V_{CM} = 10\text{ V}_{\text{p-p}}$ ,<br>$C_L = 15\text{ pF}$ | 12       | c, d, e |
|                                                                    |                    | HCPL-0500                             | —    | 1                 | —    |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | HCNW135                               |      |                   |      |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | 6N136                                 | 1    | —                 | —    |                         | $R_L = 1.9\text{ k}\Omega$ |                                                                                                                      |          |         |
| Common Mode<br>Transient Immunity at<br>Logic Low Level<br>Output  | $ CM_L $           | 6N135                                 | 1    | —                 | —    | $\text{kV}/\mu\text{s}$ | $R_L = 4.1\text{ k}\Omega$ | $I_F = 16\text{ mA}$ ,<br>$T_A = 25^\circ\text{C}$ ,<br>$C_L = 15\text{ pF}$                                         | 12       | c, d, e |
|                                                                    |                    | HCPL-0500                             | —    | 1                 | —    |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | HCNW135                               |      |                   |      |                         |                            |                                                                                                                      |          |         |
|                                                                    |                    | 6N136                                 | 1    | —                 | —    |                         | $R_L = 1.9\text{ k}\Omega$ |                                                                                                                      |          |         |
| Bandwidth                                                          | BW                 | 6N135/6                               | —    | 9                 | —    | MHz                     | See Test<br>Circuit        |                                                                                                                      | 8, 10    | f       |
|                                                                    |                    | HCPL-2502<br>HCPL-0500/1<br>HCNW135/6 | —    | 11                | —    |                         |                            |                                                                                                                      |          |         |

a. All typicals at  $T_A = 25^\circ\text{C}$ .

b. For JEDEC registered parts.

c. The  $1.9\text{ k}\Omega$  load represents 1 TTL unit load of  $1.6\text{ mA}$  and the  $5.6\text{ k}\Omega$  pull-up resistor.

d. The  $4.1\text{ k}\Omega$  load represents 1 LSTTL unit load of  $0.36\text{ mA}$  and  $6.1\text{ k}\Omega$  pull-up resistor.

e. Common mode transient immunity in a 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 (that is,  $V_O > 2.0\text{V}$ ). Common mode transient immunity in a 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 (that is,  $V_O < 0.8\text{ V}$ ).

f. The frequency at which the ac output voltage is 3 dB below its mid-frequency value.

## Package Characteristics

Over recommended temperature ( $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ) unless otherwise specified.

| Parameter                                             | Sym.      | Device                 | Min.      | Typ. <sup>a</sup> | Max. | Units         | Test Conditions                                                        | Figure | Note    |
|-------------------------------------------------------|-----------|------------------------|-----------|-------------------|------|---------------|------------------------------------------------------------------------|--------|---------|
| Input-Output Momentary Withstand Voltage <sup>b</sup> | $V_{ISO}$ | 8-Pin DIP SO-8         | 3750      | —                 | —    | $V_{rms}$     | RH < 50%, $t = 1$ min., $T_A = 25^\circ\text{C}$                       |        | c, d    |
|                                                       |           | Widebody               | 5000      | —                 | —    |               |                                                                        |        | c, e    |
|                                                       |           | 8-Pin DIP (Option 020) | 5000      | —                 | —    |               |                                                                        |        | c, e, f |
|                                                       | $I_{I-O}$ | 8-Pin DIP              | —         | —                 | 1    | $\mu\text{A}$ | 45% RH, $t = 5\text{s}$ , $V_{I-O} = 3$ kVdc, $T_A = 25^\circ\text{C}$ |        | c, g    |
| Input-Output Resistance                               | $R_{I-O}$ | 8-Pin DIP SO-8         | —         | $10^{12}$         | —    | $\Omega$      | $V_{I-O} = 500$ Vdc                                                    |        | c       |
|                                                       |           | Widebody               | $10^{12}$ | $10^{13}$         | —    |               | $T_A = 25^\circ\text{C}$                                               |        |         |
|                                                       |           |                        | $10^{11}$ | —                 | —    |               | $T_A = 100^\circ\text{C}$                                              |        |         |
| Input-Output Capacitance                              | $C_{I-O}$ | 8-Pin DIP SO-8         | —         | 0.6               | —    | pF            | $f = 1$ MHz                                                            |        | c       |
|                                                       |           | Widebody               | —         | 0.5               | 0.6  |               |                                                                        |        |         |

a. All typicals at  $T_A = 25^\circ\text{C}$ .

b. The Input-Output Momentary Withstand Voltage is a dielectric voltage rating that should not be interpreted as an input-output continuous voltage rating. For the continuous voltage rating refer to the IEC/EN/DIN EN 60747-5-5 Insulation Related Characteristics Table (if applicable), your equipment level safety specification or Avago Application Note 1074, *Optocoupler Input-Output Endurance Voltage*, publication number 5963-2203E.

c. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.

d. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage  $\geq 4500 V_{rms}$  for 1 second (leakage detection current limit,  $I_{I-O} \leq 5 \mu\text{A}$ ). This test is performed before the 100% Production test shown in the IEC/EN/DIN EN 60747-5-5 Insulation Related Characteristics Table if applicable.

e. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage  $\geq 6000 V_{rms}$  for 1 second (leakage detection current limit,  $I_{I-O} \leq 5 \mu\text{A}$ ). This test is performed before the 100% Production test shown in the IEC/EN/DIN EN 60747-5-5 Insulation Related Characteristics Table if applicable.

f. Refer to the Option 020 data sheet for more information.

g. This rating is equally validated by an equivalent ac proof test.

Figure 1: DC and Pulsed Transfer Characteristics

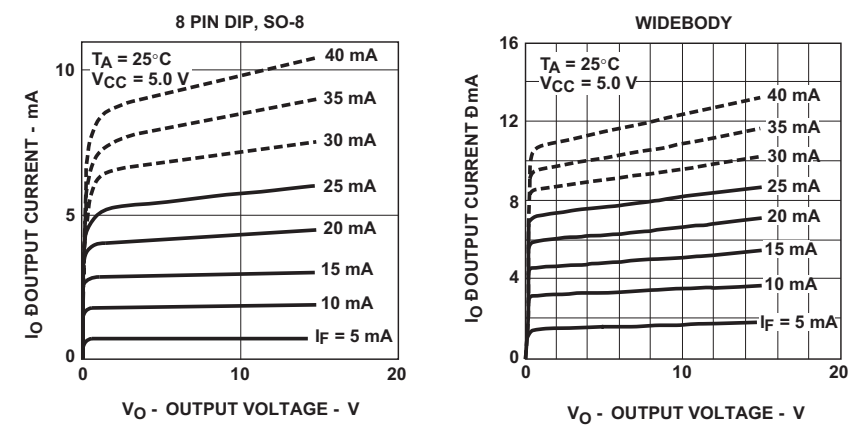


Figure 2: Current Transfer Ratio vs. Input Current

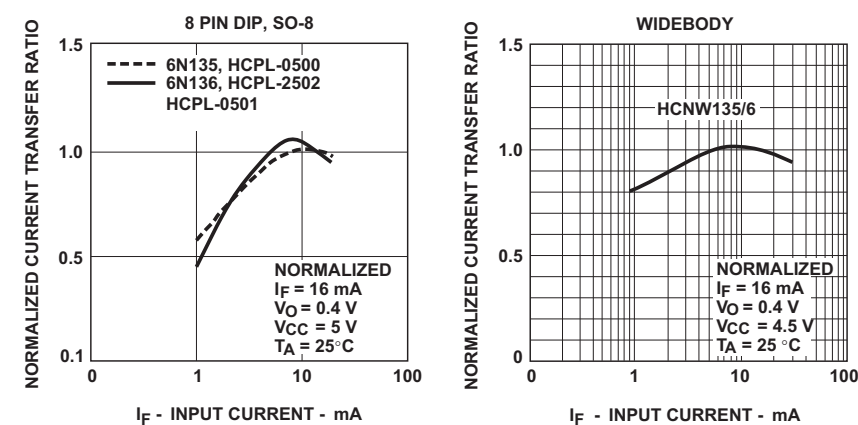


Figure 3: Input Current vs. Forward Voltage

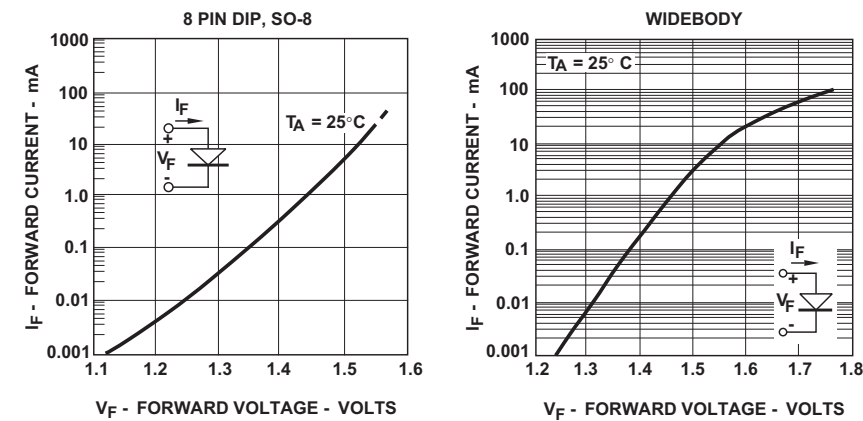


Figure 4: Current Transfer Ratio vs. Temperature

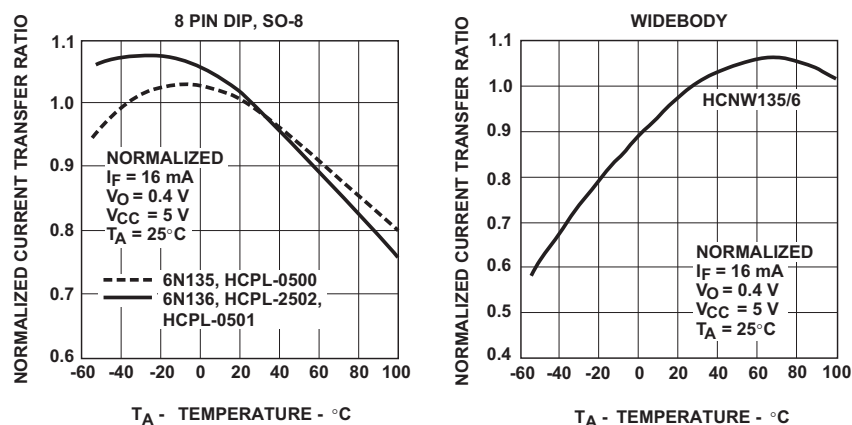


Figure 5: Propagation Delay vs. Temperature

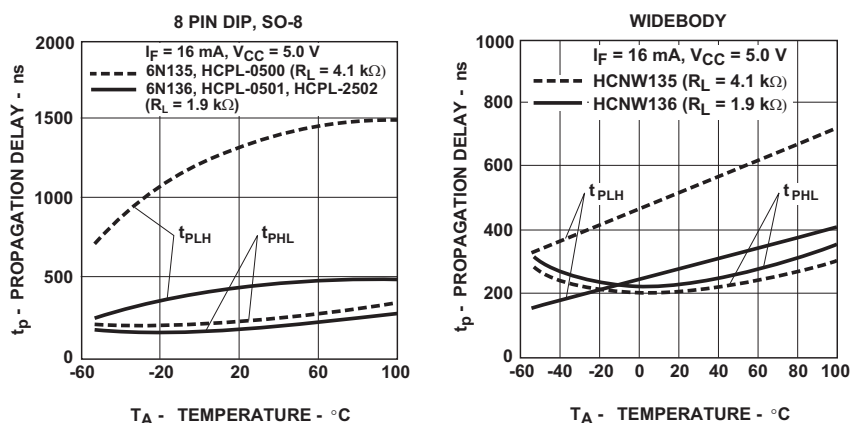


Figure 6: Propagation Delay Time vs. Load Resistance

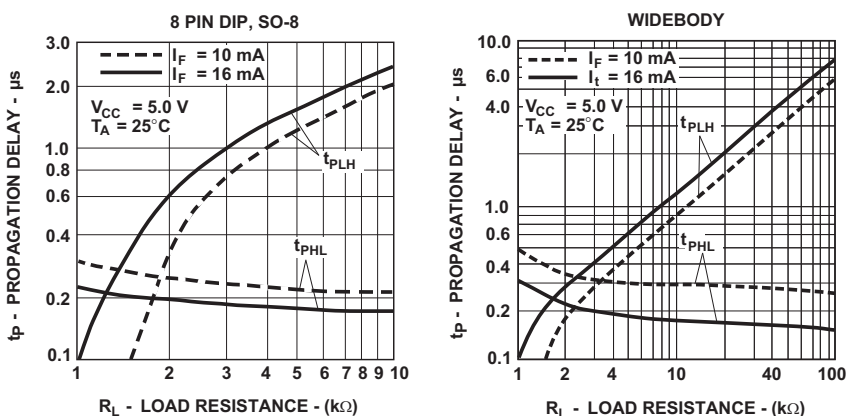


Figure 7: Logic High Output Current vs. Temperature

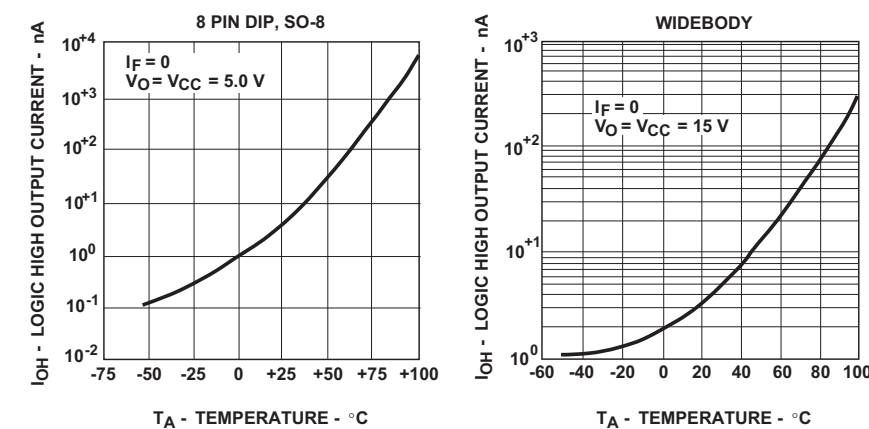


Figure 8: Small-Signal Current Transfer Ratio vs. Quiescent Input Current

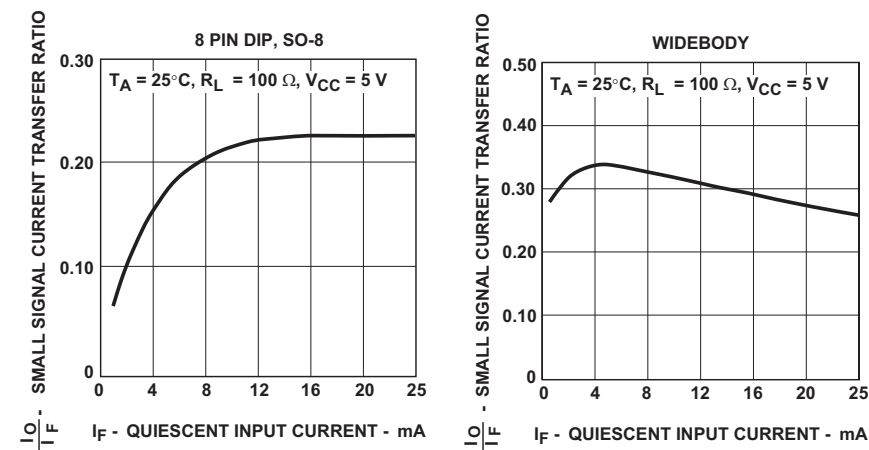


Figure 9: Thermal Derating Curve, Dependence of Safety Limiting Value with Case Temperature per IEC/EN/DIN EN 60747-5-5

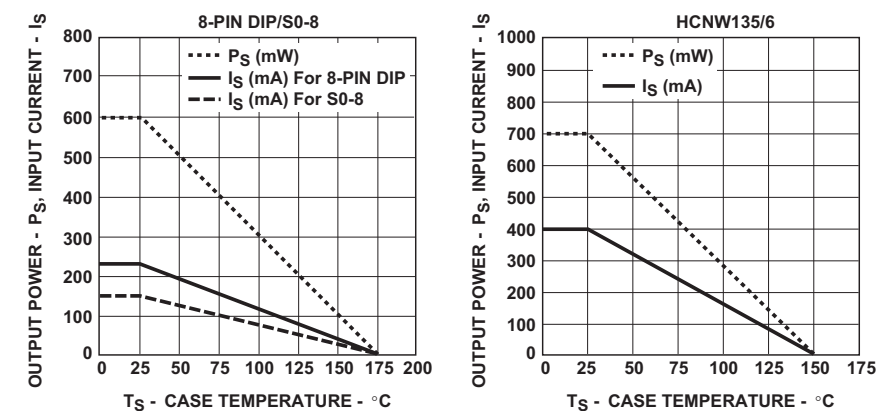


Figure 10: Frequency Response

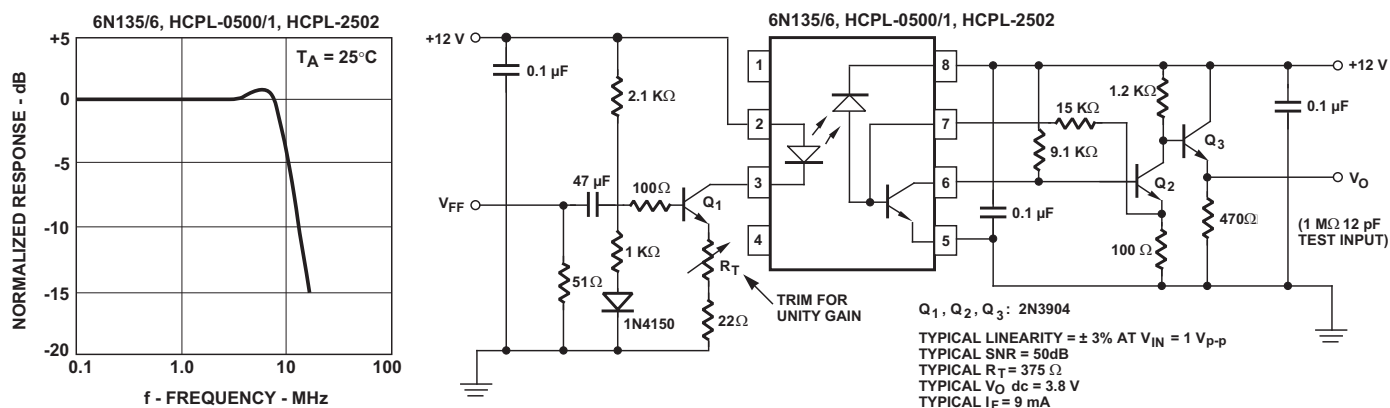


Figure 11: Switching Test Current

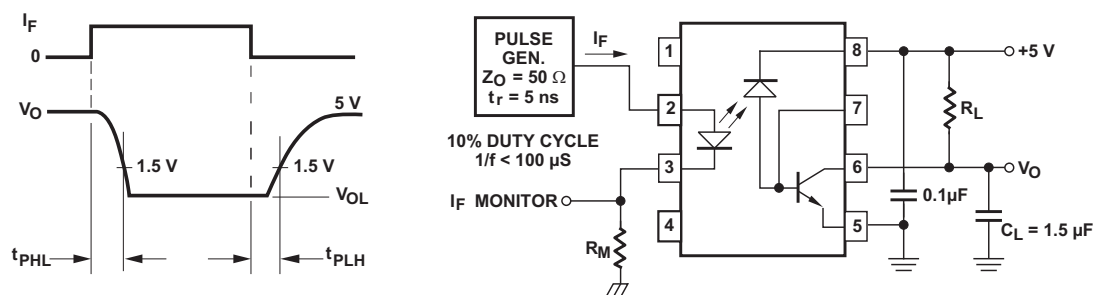
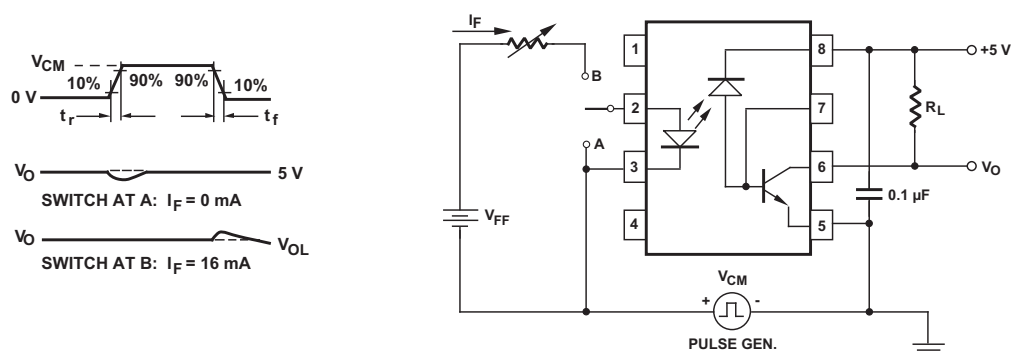


Figure 12: Test Circuit for Transient Immunity and Typical Waveforms



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