

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

DESCRIPTION

The HCPL-4502/HCPL-2503, 6N135/6 and HCPL-2530/HCPL-2531 optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor.

A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers by reducing the base-collector capacitance of the input transistor.

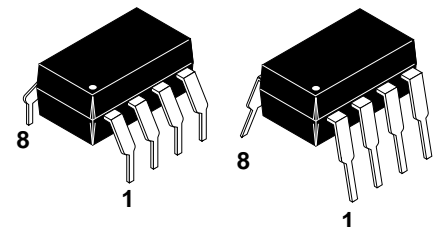
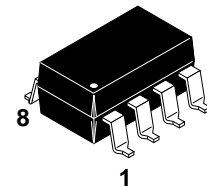
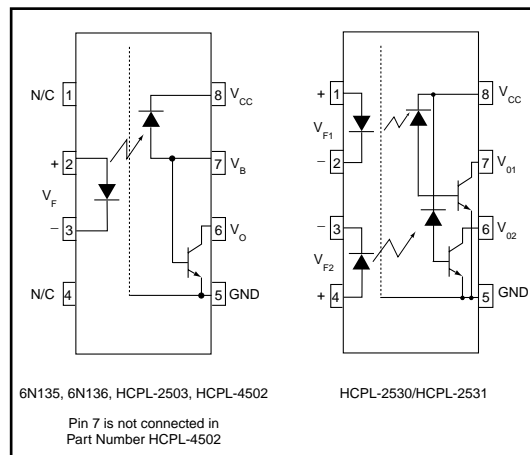
An internal noise shield provides superior common mode rejection of 10kV/μs. An improved package allows superior insulation permitting a 480 V working voltage compared to industry standard of 220 V.

FEATURES

- High speed-1 MBit/s
- Superior CMR-10 kV/μs
- Dual-Channel
HCPL-2530/HCPL-2531
- Double working voltage-480V RMS
- CTR guaranteed 0-70°C
- U.L. recognized (File # E90700)

APPLICATIONS

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

| Parameter | Symbol | Value | Units |
|--|------------------------|----------------|-------|
| Storage Temperature | T _{STG} | -55 to +125 | °C |
| Operating Temperature | T _{OPR} | -55 to +100 | °C |
| Lead Solder Temperature | T _{SOL} | 260 for 10 sec | °C |
| EMITTER | | | |
| DC/Average Forward Input Current | I _F (avg) | 25 | mA |
| Peak Forward Input Current (50% duty cycle, 1 ms P.W.) | I _F (pk) | 50 | mA |
| Peak Transient Input Current - (≤ 1 μs P.W., 300 pps) | I _F (trans) | 1.0 | A |
| Reverse Input Voltage | V _R | 5 | V |
| Input Power Dissipation | P _D | 100 | mW |
| | | 45 | mW |
| DETECTOR | | | |
| Average Output Current | I _O (avg) | 8 | mA |
| Peak Output Current | I _O (pk) | 16 | mA |
| Emitter-Base Reverse Voltage | V _{EBR} | 5 | V |
| Supply Voltage | V _{CC} | -0.5 to 30 | V |
| Output Voltage | V _O | -0.5 to 20 | V |
| Base Current | I _B | 5 | mA |
| Output power dissipation | P _D | 100 | mW |
| | | 35 | mW |

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

| ELECTRICAL CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified) | | | | | | | |
|---|--|-----------------------------|--|-----|-------|-----|----------------------|
| INDIVIDUAL COMPONENT CHARACTERISTICS | | | | | | | |
| Parameter | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
| EMITTER | | | | | | | |
| Input Forward Voltage | ($I_F = 16$ mA, $T_A = 25^\circ\text{C}$) | V_F | | | 1.45 | 1.7 | V |
| | ($I_F = 16$ mA) | | | | | 1.8 | |
| Input Reverse Breakdown Voltage | ($I_R = 10$ μA) | B_{VR} | | 5.0 | | | V |
| Temperature coefficient of forward voltage | ($I_F = 16$ mA) | $(\Delta V_F / \Delta T_A)$ | | | -1.6 | | mV/ $^\circ\text{C}$ |
| DETECTOR | | | | | | | |
| Logic high output current | ($I_F = 0$ mA, $V_O = V_{CC} = 5.5$ V) ($T_A = 25^\circ\text{C}$) | I_{OH} | All | | 0.001 | 0.5 | μA |
| | ($I_F = 0$ mA, $V_O = V_{CC} = 15$ V) ($T_A = 25^\circ\text{C}$) | | 6N135 6N136 HCPL-4502 HCPL-2503 | | 0.005 | 1 | |
| | ($I_F = 0$ mA, $V_O = V_{CC} = 15$ V) | | All | | | 50 | |
| | | | | | | | |
| Logic low supply current | ($I_F = 16$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V) | I_{CCL} | 6N135 6N136 HCPL-4502 HCPL-2503 | | 120 | 200 | μA |
| | ($I_{F1} = I_{F2} = 16$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V) | | HCPL-2530 HCPL-2531 | | 200 | 400 | |
| Logic high supply current | ($I_F = 0$ mA, $V_O = \text{Open}$, $V_{CC} = 15$ V) ($T_A = 25^\circ\text{C}$) | I_{CCH} | 6N135 6N136 HCPL-4502 HCPL-2503 | | | 1 | μA |
| | ($I_F = 0$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V) | | 6N135 6N136 HCPL-4502 HCPL-2503 | | | 2 | |
| | ($I_F = 0$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V) | | HCPL-2530 HCPL-2531 | | 0.02 | 4 | |

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

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

| TRANSFER CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified) | | | | | | | | | |
|---|--|--------|--|---|---------------------------------|-----|------|-----|---|
| Parameter | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit | | |
| COUPLED Current transfer ratio (Note 5) | $(I_F = 16 \text{ mA}, V_O = 0.4 \text{ V})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$ | CTR | 6N135 HCPL-2530 | 7 | 18 | 50 | % | | |
| | | | 6N136 HCPL-4502 HCPL-2531 | 19 | 27 | 50 | % | | |
| | | | HCPL-2503 | 12 | 27 | | % | | |
| | | | 6N135 HCPL-2530 | 5 | 21 | | % | | |
| | $(I_F = 16 \text{ mA}, V_O = 0.5 \text{ V})$ $(V_{CC} = 4.5 \text{ V})$ | | 6N136 HCPL-4502 HCPL-2531 | 15 | 30 | | % | | |
| | | | HCPL-2503 | 9 | 30 | | % | | |
| | | | Logic low output voltage output voltage | $(I_F = 16 \text{ mA}, I_O = 1.1 \text{ mA})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$ | 6N135 HCPL-2530 | | 0.18 | 0.4 | V |
| | | | | | 6N136 HCPL-4502 HCPL-2503 | | 0.18 | 0.5 | |
| $(I_F = 16 \text{ mA}, I_O = 3 \text{ mA})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$ | HCPL-2531 | | | 0.25 | 0.4 | | | | |
| $(I_F = 16 \text{ mA}, I_O = 0.8 \text{ mA})$ $(V_{CC} = 4.5 \text{ V})$ | 6N135 HCPL-2530 | | | | 0.5 | | | | |
| $(I_F = 16 \text{ mA}, I_O = 2.4 \text{ mA})$ $(V_{CC} = 4.5 \text{ V})$ | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | | | 0.5 | | | | |

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

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

SWITCHING CHARACTERISTICS ($T_A = 0$ to 70°C unless otherwise specified., $V_{CC} = 5\text{ V}$)

| Parameter | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
|---|---|-----------|--|-----|--------|-----|------------------------|
| Propagation delay time to logic low | $T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7) | T_{PHL} | 6N135 HCPL-2530 | | 0.45 | 1.5 | μs |
| | $(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) $T_A = 25^\circ\text{C}$ | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | 0.45 | 0.8 | μs |
| | $(R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7) | | 6N135 HCPL-2530 | | | 2.0 | μs |
| | $(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | | 1.0 | μs |
| Propagation delay time to logic high | $T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7) | T_{PLH} | 6N135 HCPL-2530 | | 0.5 | 1.5 | μs |
| | $(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) $T_A = 25^\circ\text{C}$ | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | 0.3 | 0.8 | μs |
| | $(R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7) | | 6N135 HCPL-2530 | | | 2.0 | μs |
| | $(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | | 1.0 | μs |
| Common mode transient immunity at logic high | $(I_F = 0\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$, $R_L = 4.1\text{ k}\Omega$) (Note 8) (Fig. 8) $T_A = 25^\circ\text{C}$ | $ CM_H $ | 6N135 HCPL-2530 | | 10,000 | | $\text{V}/\mu\text{s}$ |
| | $(I_F = 0\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$) $T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$) (Note 8) (Fig. 8) | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | 10,000 | | $\text{V}/\mu\text{s}$ |
| Common mode transient immunity at logic low | $(I_F = 16\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$, $R_L = 4.1\text{ k}\Omega$) (Note 8) (Fig. 8) $T_A = 25^\circ\text{C}$ | $ CM_L $ | 6N135 HCPL-2530 | | 10,000 | | $\text{V}/\mu\text{s}$ |
| | $(I_F = 16\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$) $(R_L = 1.9\text{ k}\Omega)$ (Note 8) (Fig. 8) | | 6N136 HCPL-4502 HCPL-2503 HCPL-2531 | | 10,000 | | $\text{V}/\mu\text{s}$ |

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

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

| ISOLATION CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified) | | | | | | |
|--|---|-----------|------|-----------|-----|---------------|
| Characteristics | Test Conditions | Symbol | Min | Typ** | Max | Unit |
| Input-output insulation leakage current | (Relative humidity = 45%) ($T_A = 25^\circ\text{C}$, $t = 5$ s) ($V_{I-O} = 3000$ VDC) (Note 9) | I_{I-O} | | | 1.0 | μA |
| Withstand insulation test voltage | ($RH \leq 50\%$, $T_A = 25^\circ\text{C}$) (Note 9) ($t = 1$ min.) | V_{ISO} | 2500 | | | V_{RMS} |
| Resistance (input to output) | (Note 9) ($V_{I-O} = 500$ VDC) | R_{I-O} | | 10^{12} | | Ω |
| Capacitance (input to output) | (Note 9) ($f = 1$ MHz) | C_{I-O} | | 0.6 | | pF |
| DC Current gain | ($I_O = 3$ mA, $V_O = 5$ V) | HFE | | 150 | | |
| Input-Input Insulation leakage current | ($RH \leq 45\%$, $V_{I-I} = 500$ VDC) (Note 10) $t = 5$ s, (HCPL-2530/2531 only) | I_{I-I} | | 0.005 | | μA |
| Input-Input Resistance | ($V_{I-I} = 500$ VDC) (Note 10) (HCPL-2530/2531 only) | R_{I-I} | | 10^{11} | | Ω |
| Input-Input Capacitance | ($f = 1$ MHz) (Note 10) (HCPL-2530/2531 only) | C_{I-I} | | 0.03 | | pF |

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

NOTES

- Derate linearly above 70°C free-air temperature at a rate of 0.8 mA/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 1.6 mA/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 0.9 mW/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 2.0 mW/ $^\circ\text{C}$.
- Current Transfer Ratio is defined as a ratio of output collector current, I_O , to the forward LED input current, I_F , times 100%.
- The 4.1 k Ω load represents 1 LSTTL unit load of 0.36 mA and 6.1 k Ω pull-up resistor.
- The 1.9 k Ω load represents 1 TTL unit load of 1.6 mA and 5.6 k Ω pull-up resistor.
- 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., $V_O > 2.0$ V). 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., $V_O < 0.8$ V).
- Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.
- Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

Fig. 1 Normalized CTR vs. Forward Current

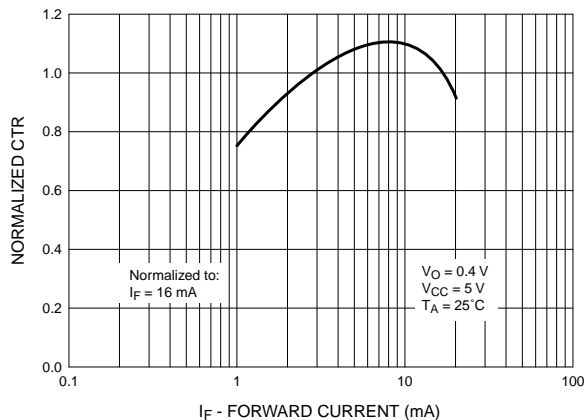


Fig. 2 Normalized CTR vs. Temperature

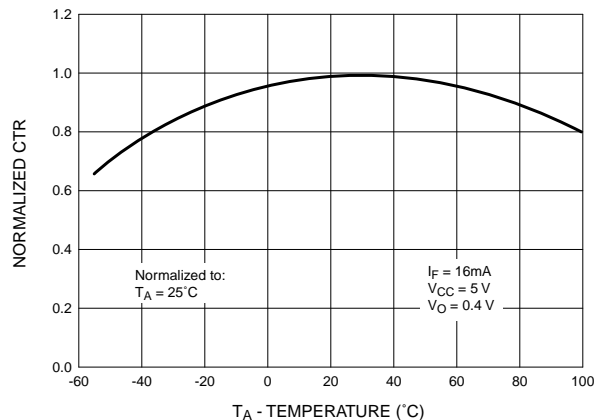


Fig. 3 Output Current vs. Output Voltage

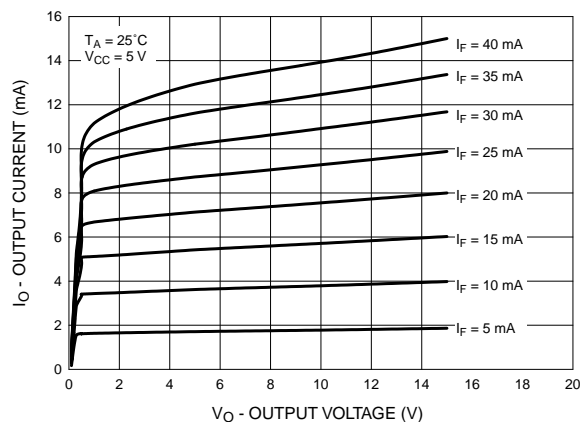


Fig. 4 Logic High Output Current vs. Temperature

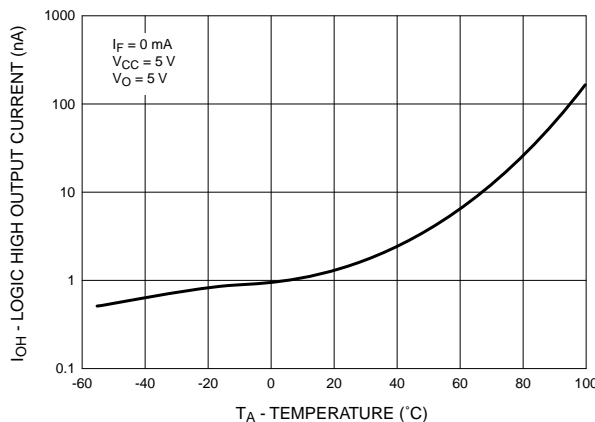


Fig. 5 Propagation Delay vs. Temperature

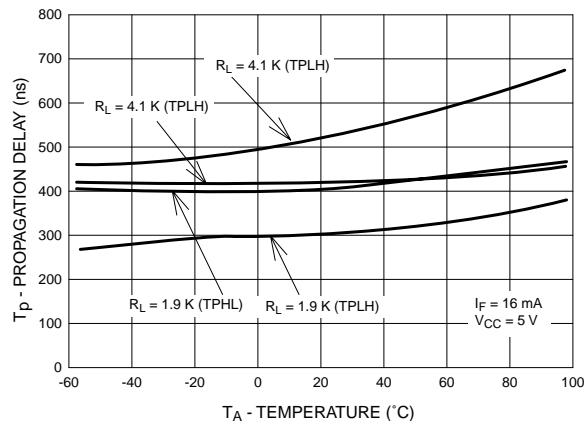
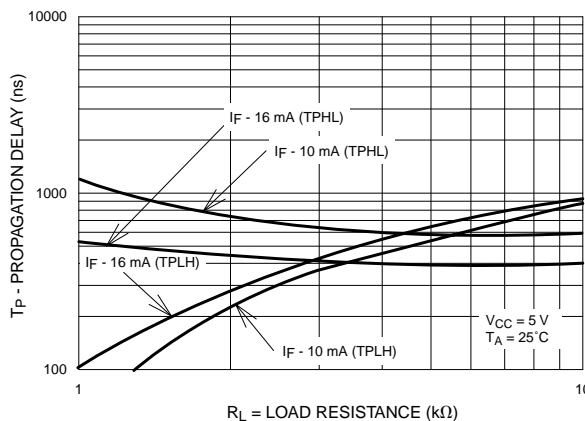
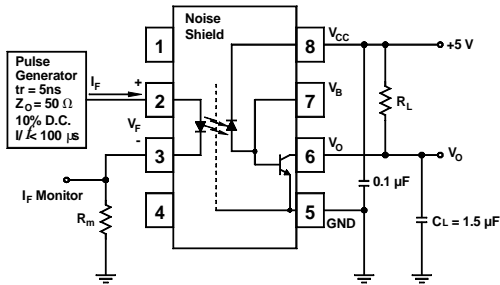


Fig. 6 Propagation Delay vs. Load Resistance

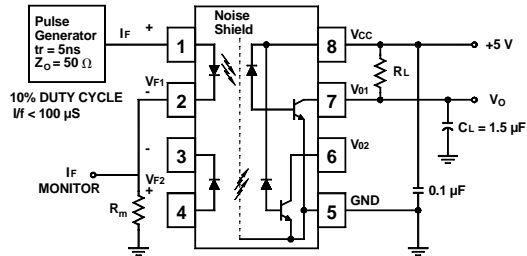


SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531



Test Circuit for 6N135, 6N136, HCPL-2503 and HCPL-4502



Test Circuit for HCPL-2530 and HCPL-2531

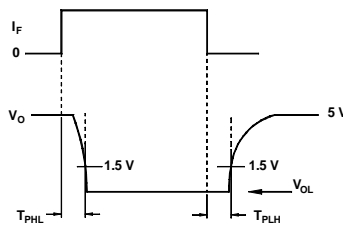
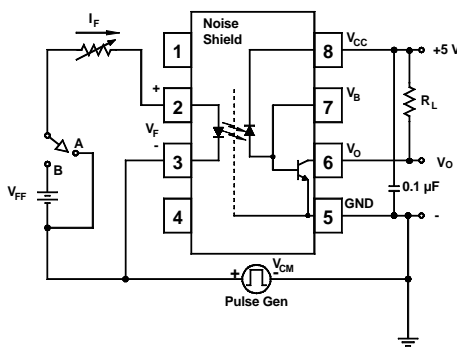
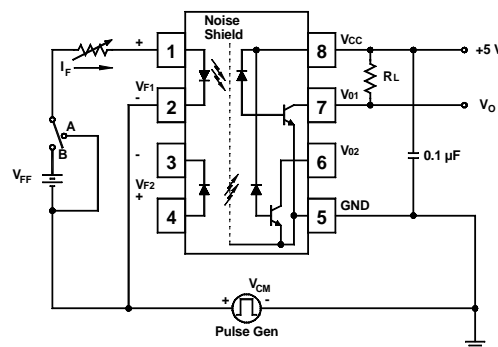


Fig. 7 Switching Time Test Circuit



Test Circuit for 6N135, 6N136, HCPL-2503 and HCPL-4502



Test Circuit for HCPL-2530 and HCPL-2531

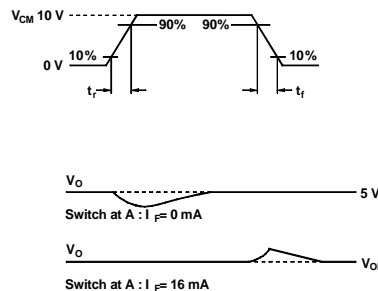
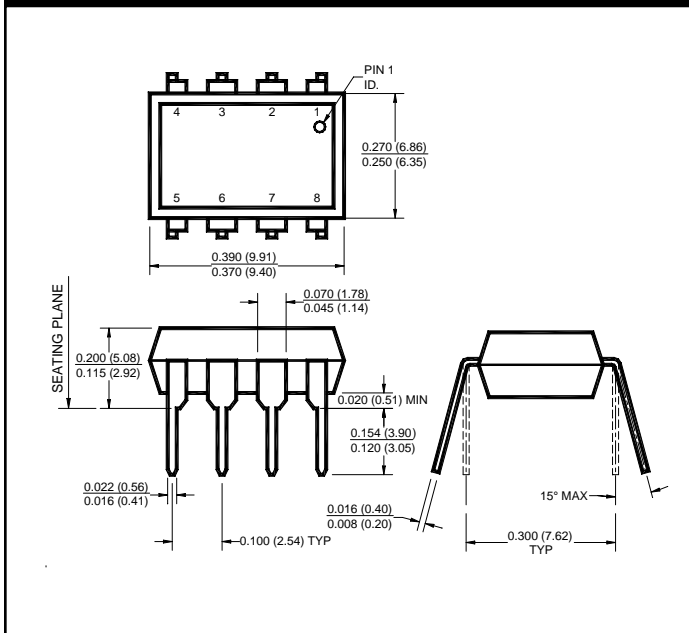


Fig. 8 Common Mode Immunity Test Circuit

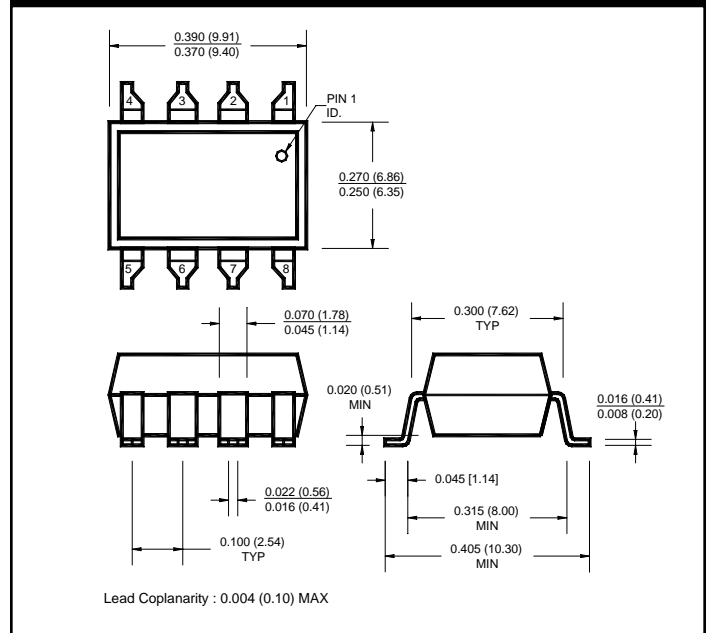
SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

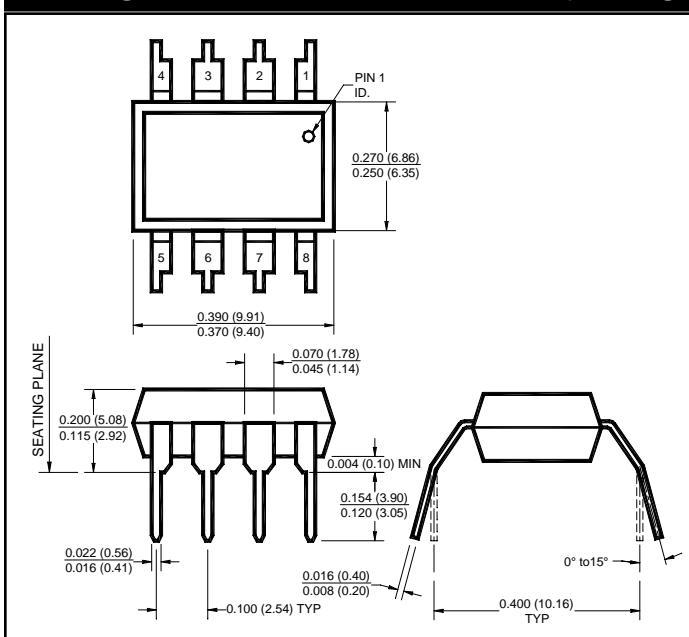
Package Dimensions (Through Hole)



Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



NOTE

All dimensions are in inches (millimeters)

www.qtopto.com

Call QT Optoelectronics for more information or the phone number of your nearest distributor.

United States 800-533-6786 • France 33 [0] 1.45.18.78.78 • Germany 49 [0] 89/96.30.51 • United Kingdom 44 [0] 1296 394499 • Asia/Pacific 603-7352417

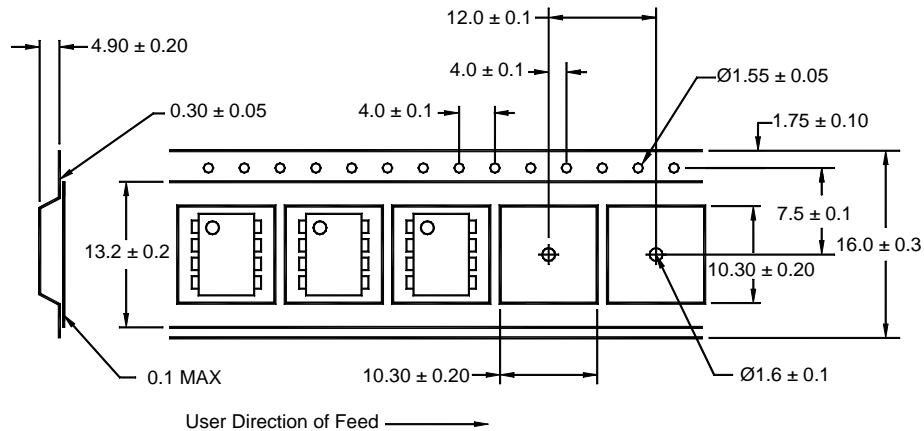
SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

ORDERING INFORMATION

| Option | Order Entry Identifier | Description |
|--------|------------------------|------------------------------------|
| R2 | .R2 | Opto Plus Reliability Conditioning |
| S | .S | Surface Mount Lead Bend |
| SD | .SD | Surface Mount; Tape and reel |
| SDL | .SDL | Surface Mount; Tape and reel |
| W | .W | 0.4" Lead Spacing |

QT Carrier Tape Specifications ("D" Taping Orientation)



Corporate Headquarters

QT Optoelectronics
 610 North Mary Avenue
 Sunnyvale, CA 94086
 (408) 720-1440 Phone
 (408) 720-0848 Fax

European Sales

QT Optoelectronics
 "Le Levant"
 2, rue du Nouveau Bercy
 F-94277-CHARENTON-LE PONT Cedex
 FRANCE
 33 [0] 1.45.18.78.78 Phone
 33 [0] 1.43.75.77.57 Fax

North American Sales

QT Optoelectronics
 16775 Addison Rd., Suite 200
 Addison, TX 75001
 (972) 447-1300 Phone
 (972) 447-0784 Fax

Asia/Pacific Sales

QT Optoelectronics
 B613, 6th Floor
 East Wing, Wisma Tractors
 Jalan SS16/1, Subang Jaya
 47500 Petaling Jaya
 Selangor Darul Eshan, Malaysia
 603/735-2417 Phone
 603/736-3382 Fax

European Sales

Quality Technologies Deutschland GmbH
 Max-Huber-Strasse 8
 D-85737 Ismaning, Germany
 49 [0] 89/96.30.51 Phone
 49 [0] 89/96.54.74 Fax

European Sales

Quality Technologies (U.K) Ltd.
 10, Prebendal Court, Oxford Road
 Aylesbury, Buckinghamshire
 HP19-3EY United Kingdom
 44 [0] 1296/30.44.99 Phone
 44 [0] 1296/39.24.32 Fax

www.qtopto.com

Call QT Optoelectronics for more information or the phone number of your nearest distributor.

United States 800-533-6786 • France 33 [0] 1.45.18.78.78 • Germany 49 [0] 89/96.30.51 • United Kingdom 44 [0] 1296 394499 • Asia/Pacific 603-7352417