



March 2014

# Single-Channel: 6N135M, 6N136M, HCPL4503M Dual-Channel: HCPL2530M, HCPL2531M High Speed Transistor Optocouplers

## Features

- High Speed –1 MBit/s
- Superior CMR – 10 kV/μs
- Dual-Channel: HCPL2530M, HCPL2531M
- CTR Guaranteed 0°C to 70°C
- U.L. Recognized (File # E90700, Vol. 2)
- DIN EN/IEC60747-5-5
  - Ordering Option 'V', e.g., 6N135VM
- 5,000 V<sub>RMS</sub> (1 Minute) Isolation Rating
- Superior CMR of 15,000 V/μs Minimum (HCPL4503M)
- No Base Connection for Improved Noise Immunity (HCPL4503M)

## Applications

- Line Receivers
- Pulse Transformer Replacement
- Output Interface to CMOS-LSTTL-TTL
- Wide-Bandwidth Analog Coupling

## Description

The HCPL4503M, 6N135M, 6N136M, HCPL2530M, and HCPL2531M 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.

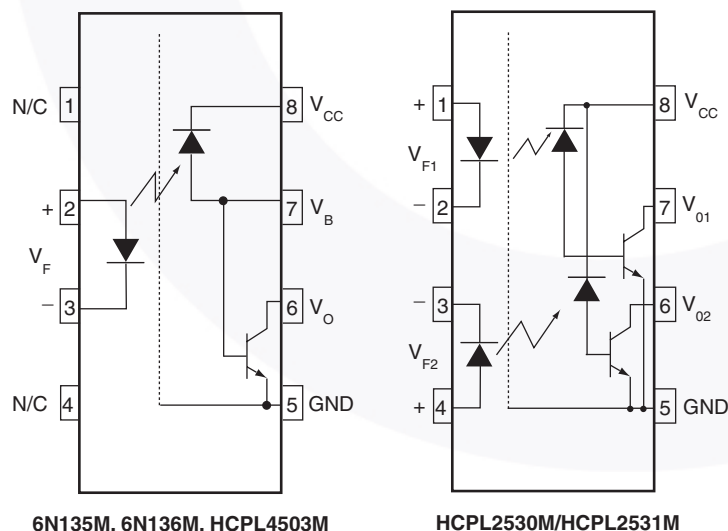
The HCPL4503M has no internal connection to the phototransistor base for improved noise immunity.

An internal noise shield provides superior common mode rejection of up to 50,000 V/μs.

## Related Resources

- [www.fairchildsemi.com/products/opto/](http://www.fairchildsemi.com/products/opto/)
- [www.fairchildsemi.com/pf/HC/HCPL0500.html](http://www.fairchildsemi.com/pf/HC/HCPL0500.html)
- [www.fairchildsemi.com/pf/FO/FODM452.html](http://www.fairchildsemi.com/pf/FO/FODM452.html)
- [www.fairchildsemi.com/pf/FO/FOD050L.html](http://www.fairchildsemi.com/pf/FO/FOD050L.html)

## Schematics



Pin 7 is not connected in the HCPL4503M

Figure 1. Schematics

## Package Outlines

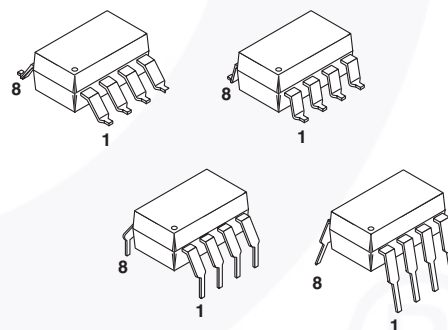


Figure 2. Package Outlines

## Safety and Insulation Ratings for 8-Pin DIP White

As per DIN EN/IEC 60747-5-5. This optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

| Symbol                | Parameter                                                                                                                                                      | Min.            | Typ.      | Max. | Unit              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|------|-------------------|
|                       | Installation Classifications per DIN VDE 0110/1.89 Table 1                                                                                                     |                 |           |      |                   |
|                       | For Rated Mains Voltage < 150 V <sub>RMS</sub>                                                                                                                 |                 | I–IV      |      |                   |
|                       | For Rated Mains Voltage < 300 V <sub>RMS</sub>                                                                                                                 |                 | I–IV      |      |                   |
|                       | For Rated Mains Voltage < 450 V <sub>RMS</sub>                                                                                                                 |                 | I–III     |      |                   |
|                       | For Rated Mains Voltage < 600 V <sub>RMS</sub>                                                                                                                 |                 | I–III     |      |                   |
|                       | Climatic Classification                                                                                                                                        |                 | 40/100/21 |      |                   |
|                       | Pollution Degree (DIN VDE 0110/1.89)                                                                                                                           |                 | 2         |      |                   |
| CTI                   | Comparative Tracking Index                                                                                                                                     | 175             |           |      |                   |
| V <sub>PR</sub>       | Input to Output Test Voltage, Method b, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC | 1,669           |           |      |                   |
|                       | Input to Output Test Voltage, Method a, V <sub>IORM</sub> × 1.5 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 60 s, Partial Discharge < 5 pC  | 1,335           |           |      |                   |
| V <sub>IORM</sub>     | Max Working Insulation Voltage                                                                                                                                 | 890             |           |      | V <sub>PEAK</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over Voltage                                                                                                                                 | 6,000           |           |      | V <sub>PEAK</sub> |
|                       | External Creepage                                                                                                                                              | 8.0             |           |      | mm                |
|                       | External Clearance                                                                                                                                             | 7.4             |           |      | mm                |
|                       | External Clearance (for Option T, 0.4" Lead Spacing)                                                                                                           | 10.16           |           |      | mm                |
|                       | Insulation Thickness                                                                                                                                           | 0.5             |           |      | mm                |
| T <sub>S</sub>        | Safety Limit Values, Maximum Values Allowed in the Event of a Failure                                                                                          |                 |           |      |                   |
|                       | Case Temperature                                                                                                                                               | 150             |           |      | °C                |
| I <sub>S,INPUT</sub>  | Input Current                                                                                                                                                  | 200             |           |      | mA                |
| P <sub>S,OUTPUT</sub> | Output Power (Duty Factor ≤ 2.7%)                                                                                                                              | 300             |           |      | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V                                                                                              | 10 <sup>9</sup> |           |      | Ω                 |

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

| Symbol                 | Parameter                                                    | Condition                     | Value        | Units |
|------------------------|--------------------------------------------------------------|-------------------------------|--------------|-------|
| T <sub>STG</sub>       | Storage Temperature                                          |                               | -40 to +125  | °C    |
| T <sub>OPR</sub>       | Operating Temperature                                        |                               | -40 to +100  | °C    |
| T <sub>SOL</sub>       | Lead Solder Temperature                                      |                               | 260 for 10 s | °C    |
| EMITTER                |                                                              |                               |              |       |
| I <sub>F</sub> (avg)   | DC/Average Forward Input Current Each Channel <sup>(1)</sup> |                               | 25           | mA    |
| I <sub>F</sub> (pk)    | Peak Forward Input Current Each Channel <sup>(2)</sup>       | 50% Duty Cycle, 1 ms P.W.     | 50           | mA    |
| I <sub>F</sub> (trans) | Peak Transient Input Current Each Channel                    | ≤ 1 μs P.W., 300 pps          | 1.0          | A     |
| V <sub>R</sub>         | Reverse Input Voltage Each Channel                           |                               | 5            | V     |
| P <sub>D</sub>         | Input Power Dissipation Each Channel <sup>(3)</sup>          | 6N135M, 6N136M, and HCPL4503M | 45           | mW    |
|                        |                                                              | HCPL2530M and HCPL2531M       |              |       |
| DETECTOR               |                                                              |                               |              |       |
| I <sub>O</sub> (avg)   | Average Output Current Each Channel                          |                               | 8            | mA    |
| I <sub>O</sub> (pk)    | Peak Output Current Each Channel                             |                               | 16           | mA    |
| V <sub>EBR</sub>       | Emitter-Base Reverse Voltage                                 | 6N135M and 6N136M             | 5            | V     |
| V <sub>CC</sub>        | Supply Voltage                                               |                               | -0.5 to 30   | V     |
| V <sub>O</sub>         | Output Voltage                                               |                               | -0.5 to 20   | V     |
| I <sub>B</sub>         | Base Current                                                 | 6N135M and 6N136M             | 5            | mA    |
| PD                     | Output Power Dissipation Each Channel <sup>(4)</sup>         | 6N135M, 6N136M, and HCPL4503M | 100          | mW    |
|                        |                                                              | HCPL2530M and HCPL2531M       | 35           | mW    |

### Notes:

1. Derate linearly above  $70^\circ\text{C}$  free-air temperature at a rate of  $0.8 \text{ mA}/^\circ\text{C}$ .
2. Derate linearly above  $70^\circ\text{C}$  free-air temperature at a rate of  $1.6 \text{ mA}/^\circ\text{C}$ .
3. Derate linearly above  $70^\circ\text{C}$  free-air temperature at a rate of  $0.9 \text{ mW}/^\circ\text{C}$ .
4. Derate linearly above  $70^\circ\text{C}$  free-air temperature at a rate of  $2.0 \text{ mW}/^\circ\text{C}$ .

## Electrical Characteristics

$T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  unless otherwise specified. Typical value is measured at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5.0\text{ V}$ .

### Individual Component Characteristics

| Symbol                  | Parameter                                  | Test Conditions                                                                               | Device                        | Min. | Typ.   | Max. | Unit                 |
|-------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------|------|--------|------|----------------------|
| <b>EMITTER</b>          |                                            |                                                                                               |                               |      |        |      |                      |
| $V_F$                   | Input Forward Voltage                      | $I_F = 16\text{ mA}$ , $T_A = 25^\circ\text{C}$                                               | All                           |      | 1.45   | 1.7  | V                    |
|                         |                                            | $I_F = 16\text{ mA}$                                                                          | All                           |      |        | 1.8  |                      |
| $B_{VR}$                | Input Reverse Breakdown Voltage            | $I_R = 10\text{ }\mu\text{A}$                                                                 | All                           | 5.0  | 21     |      | V                    |
| $\Delta V_F/\Delta T_A$ | Temperature Coefficient of Forward Voltage | $I_F = 16\text{ mA}$                                                                          | All                           |      | -1.7   |      | mV/ $^\circ\text{C}$ |
| <b>DETECTOR</b>         |                                            |                                                                                               |                               |      |        |      |                      |
| $I_{OH}$                | Logic High Output Current                  | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 5.5\text{ V}$ , $T_A = 25^\circ\text{C}$                | All                           |      | 0.0007 | 0.5  | $\mu\text{A}$        |
|                         |                                            | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$ , $T_A = 25^\circ\text{C}$                 | 6N135M<br>6N136M<br>HCPL4503M |      | 0.0019 | 1    |                      |
|                         |                                            | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$                                            | All                           |      |        | 50   |                      |
| $I_{CCL}$               | Logic Low Supply Current                   | $I_F = 16\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{ V}$                           | 6N135M<br>6N136M<br>HCPL4503M |      | 163    | 200  | $\mu\text{A}$        |
|                         |                                            | $I_{F1} = I_{F2} = 16\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{ V}$               | HCPL2530M<br>HCPL2531M        |      |        | 400  |                      |
| $I_{CCH}$               | Logic High Supply Current                  | $I_F = 0\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{ V}$ , $T_A = 25^\circ\text{C}$ | 6N135M<br>6N136M<br>HCPL4503M |      | 0.0002 | 1    | $\mu\text{A}$        |
|                         |                                            | $I_F = 0\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{ V}$                            | 6N135M<br>6N136M<br>HCPL4503M |      | 0.0004 | 2    |                      |
|                         |                                            | $I_F = 0\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{ V}$                            | HCPL2530M<br>HCPL2531M        |      |        | 4    |                      |

## Electrical Characteristics (Continued)

$T_A = 0$  to  $70^\circ\text{C}$  unless otherwise specified. Typical value is measured at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5.0\text{ V}$ .

### Transfer Characteristics

| Symbol         | Parameter                             | Test Conditions                                                                                      | Device                                      | Min. | Typ. | Max. | Unit |
|----------------|---------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------|------|------|------|------|
| <b>COUPLED</b> |                                       |                                                                                                      |                                             |      |      |      |      |
| CTR            | Current Transfer Ratio <sup>(5)</sup> | $I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ ,<br>$V_{CC} = 4.5\text{ V}$ , $T_A = 25^\circ\text{C}$  | 6N135M                                      | 7    | 38   | 50   | %    |
|                |                                       |                                                                                                      | HCPL2530M                                   |      |      |      |      |
|                |                                       |                                                                                                      | 6N136M<br>HCPL4503M                         | 19   | 38   | 50   | %    |
|                |                                       |                                                                                                      | HCPL2531M                                   |      |      |      |      |
|                |                                       | $I_F = 16\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$                                                    | $V_{OL} = 0.4\text{ V}$ 6N135M              | 5    |      |      | %    |
|                |                                       |                                                                                                      | $V_{OL} = 0.5\text{ V}$ HCPL2530M           |      |      |      |      |
|                |                                       |                                                                                                      | $V_{OL} = 0.4\text{ V}$ 6N136M<br>HCPL4503M | 15   |      |      | %    |
|                |                                       |                                                                                                      | $V_{OL} = 0.5\text{ V}$ HCPL2531M           |      |      |      |      |
| $V_{OL}$       | Logic LOW Output Voltage              | $I_F = 16\text{ mA}$ , $I_O = 1.1\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$ , $T_A = 25^\circ\text{C}$ | 6N135M                                      |      | 0.12 | 0.4  | V    |
|                |                                       |                                                                                                      | HCPL2530M                                   |      |      | 0.5  |      |
|                |                                       | $I_F = 16\text{ mA}$ , $I_O = 3\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$ , $T_A = 25^\circ\text{C}$   | 6N136M<br>HCPL4503M                         |      | 0.20 | 0.4  |      |
|                |                                       |                                                                                                      | HCPL2531M                                   |      |      | 0.5  |      |
|                |                                       | $I_F = 16\text{ mA}$ , $I_O = 0.8\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$                            | 6N135M                                      |      | 0.11 | 0.5  |      |
|                |                                       |                                                                                                      | HCPL2530M                                   |      |      |      |      |
|                |                                       | $I_F = 16\text{ mA}$ , $I_O = 2.4\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$                            | HCPL4503M                                   |      | 0.18 | 0.5  |      |
|                |                                       |                                                                                                      | HCPL2531M                                   |      |      |      |      |

#### Note:

5. Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.

## Electrical Characteristics (Continued)

$T_A = 0$  to  $70^\circ\text{C}$  unless otherwise specified. Typical values are measured at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5\text{V}$ .

### Switching Characteristics ( $V_{CC} = 5\text{V}$ )

| Symbol     | Parameter                                             | Test Conditions                                                                                                                       | Device              | Min.   | Typ.   | Max. | Unit                   |
|------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|------|------------------------|
| $t_{PHL}$  | Propagation Delay<br>Time to Logic LOW                | $T_A = 25^\circ\text{C}$ , $R_L = 4.1\text{ k}\Omega$ ,<br>$I_F = 16\text{ mA}^{(6)}$ (Figure 15)                                     | 6N135M              |        | 0.23   | 1.5  | $\mu\text{s}$          |
|            |                                                       |                                                                                                                                       | HCPL2530M           |        |        |      |                        |
|            |                                                       | $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ,<br>$T_A = 25^\circ\text{C}^{(7)}$ (Figure 15)                                     | 6N136M              |        | 0.25   | 0.8  | $\mu\text{s}$          |
|            |                                                       |                                                                                                                                       | HCPL2531M           |        |        |      |                        |
|            |                                                       | $R_L = 4.1\text{ k}\Omega$ , $I_F = 16\text{ mA}^{(6)}$<br>(Figure 15)                                                                | 6N135M<br>HCPL2530M |        |        | 2.0  | $\mu\text{s}$          |
| $t_{PLH}$  | Propagation Delay<br>Time to Logic HIGH               | $T_A = 25^\circ\text{C}$ , ( $R_L = 4.1\text{ k}\Omega$ ,<br>$I_F = 16\text{ mA}^{(6)}$ ) (Figure 15)                                 | 6N135M              |        | 0.45   | 1.5  | $\mu\text{s}$          |
|            |                                                       |                                                                                                                                       | HCPL2530M           |        |        |      |                        |
|            |                                                       | $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}^{(7)}$ ,<br>$T_A = 25^\circ\text{C}$ (Figure 15)                                     | 6N136M              |        | 0.26   | 0.8  | $\mu\text{s}$          |
|            |                                                       |                                                                                                                                       | HCPL2531M           |        |        |      |                        |
|            |                                                       | $R_L = 4.1\text{ k}\Omega$ , $I_F = 16\text{ mA}^{(6)}$<br>(Figure 15)                                                                | 6N135M<br>HCPL2530M |        |        | 2.0  | $\mu\text{s}$          |
| $ICM_{HI}$ | Common Mode<br>Transient<br>Immunity at<br>Logic High | $I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ ,<br>$R_L = 4.1\text{ k}\Omega$ , $T_A = 25^\circ\text{C}^{(8)}$<br>(Figure 16)    | 6N135M<br>HCPL2530M |        | 10,000 |      | $\text{V}/\mu\text{s}$ |
|            |                                                       | $I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega$ , $T_A = 25^\circ\text{C}^{(8)}$<br>(Figure 16)    | 6N136M<br>HCPL2531M |        | 10,000 |      | $\text{V}/\mu\text{s}$ |
|            |                                                       | $I_F = 0\text{ mA}$ , $V_{CM} = 1,500\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega$ , $T_A = 25^\circ\text{C}^{(8)}$<br>(Figure 16) | HCPL4503M           | 15,000 | 50,000 |      |                        |
| $ICM_{LI}$ | Common Mode<br>Transient<br>Immunity at<br>Logic Low  | $I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ ,<br>$R_L = 4.1\text{ k}\Omega$ , $T_A = 25^\circ\text{C}^{(8)}$<br>(Figure 16)   | 6N135M<br>HCPL2530M |        | 10,000 |      | $\text{V}/\mu\text{s}$ |
|            |                                                       | $I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega^{(8)}$ (Figure 16)                                 | 6N136M<br>HCPL2531M |        | 10,000 |      | $\text{V}/\mu\text{s}$ |
|            |                                                       | $I_F = 0\text{ mA}$ , $V_{CM} = 1,500\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega$ , $T_A = 25^\circ\text{C}^{(8)}$<br>(Figure 16) | HCPL4503M           | 15,000 | 50,000 |      |                        |

#### Notes:

- 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.
- The  $1.9\text{ k}\Omega$  load represents 1 TTL unit load of  $1.6\text{ mA}$  and  $5.6\text{ k}\Omega$  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.,  $V_O > 2.0\text{ V}$ ). 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.,  $V_O < 0.8\text{ V}$ ).

## Electrical Characteristics (Continued)

$T_A = 0$  to  $70^\circ\text{C}$  unless otherwise specified. Typical values are measured at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5\text{ V}$ .

### Isolation Characteristics

| Symbol    | Characteristics                        | Test Conditions                                                                                                                                     | Min.  | Typ.      | Max. | Unit      |
|-----------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|------|-----------|
| $V_{ISO}$ | Withstand Insulation Test Voltage      | $RH \leq 50\%$ , $T_A = 25^\circ\text{C}$ , $I_{I-O} \leq 10\text{ }\mu\text{A}$ ,<br>$t = 1\text{ minute}$ , $f = 50\text{ Hz}$ <sup>(9)(11)</sup> | 5,000 |           |      | $V_{RMS}$ |
| $R_{I-O}$ | Resistance (Input to Output)           | $V_{I-O} = 500\text{ VDC}$ <sup>(9)</sup>                                                                                                           |       | $10^{11}$ |      | $\Omega$  |
| $C_{I-O}$ | Capacitance (Input to Output)          | $f = 1\text{ MHz}$ , $V_{I-O} = 0\text{ V}$ <sup>(9)</sup>                                                                                          |       | 1         |      | pF        |
| $I_{I-I}$ | Input-Input Insulation Leakage Current | $RH \leq 45\%$ , $V_{I-I} = 500\text{ VDC}$ <sup>(10)</sup><br>$t = 5\text{ s}$ , (HCPL2530M/2531M only)                                            |       | $< 1$     |      | nA        |
| $R_{I-I}$ | Input-Input Resistance                 | $V_{I-I} = 500\text{ VDC}$ <sup>(10)</sup><br>(HCPL2530M/2531M only)                                                                                |       | $10^{12}$ |      | $\Omega$  |
| $C_{I-I}$ | Input-Input Capacitance                | $f = 1\text{ MHz}$ <sup>(10)</sup><br>(HCPL2530M/2531M only)                                                                                        |       | 0.2       |      | pF        |

#### Notes:

9. 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.
10. Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.
11. 5,000  $V_{RMS}$  for 1 minute duration is equivalent to 6,000  $V_{RMS}$  for 1 second duration.

## Typical Performance Curves

For single-channel devices; 6N135M, 6N136M, and HCPL4503M.

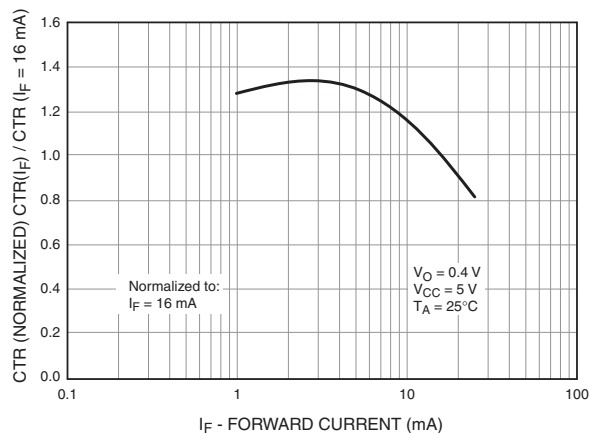


Figure 3. Normalized CTR vs. Forward Current

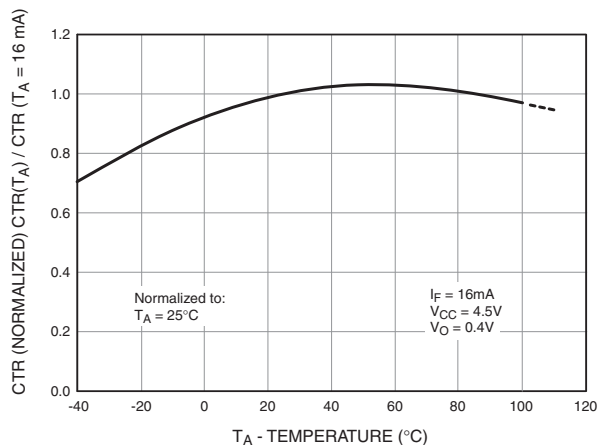


Figure 4. Normalized CTR vs. Temperature

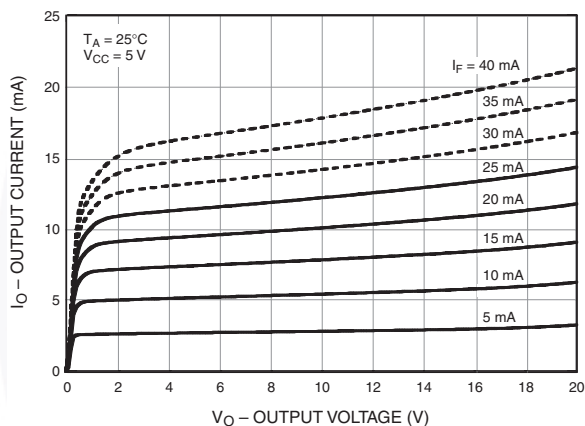


Figure 5. Output Current vs. Output Voltage

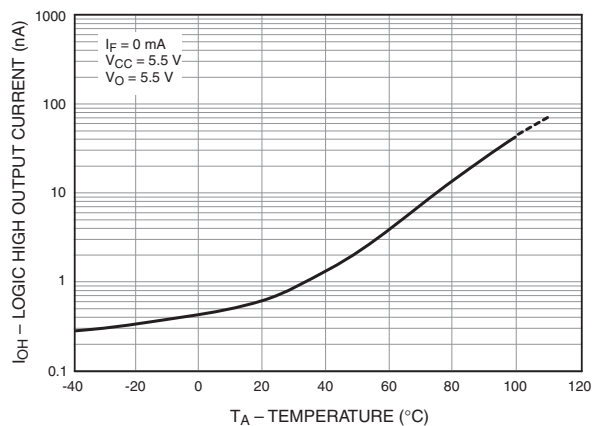


Figure 6. Logic High Output Current vs. Temperature

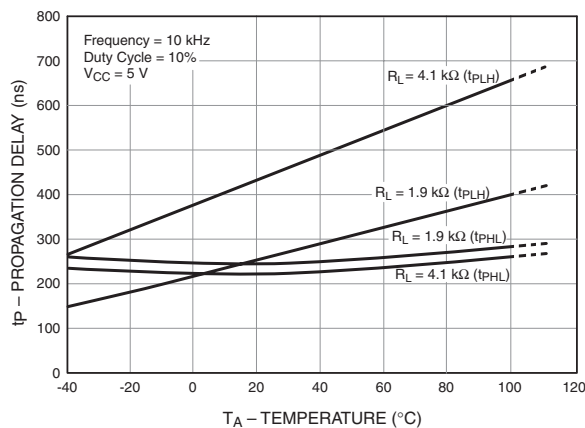


Figure 7. Propagation Delay vs. Temperature

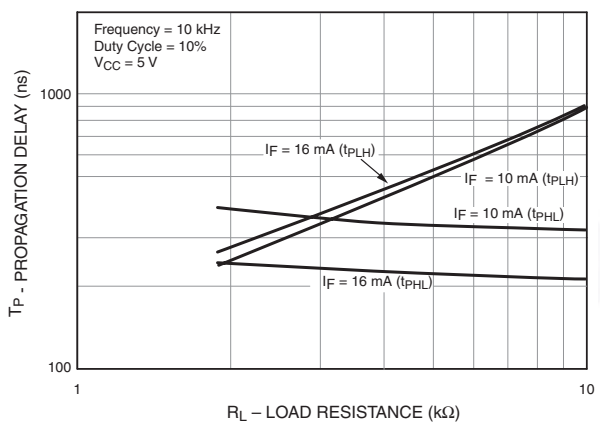


Figure 8. Propagation Delay vs. Load Resistance

## Typical Performance Curves (Continued)

For dual-channel devices; HCPL2530M and HCPL2531M.

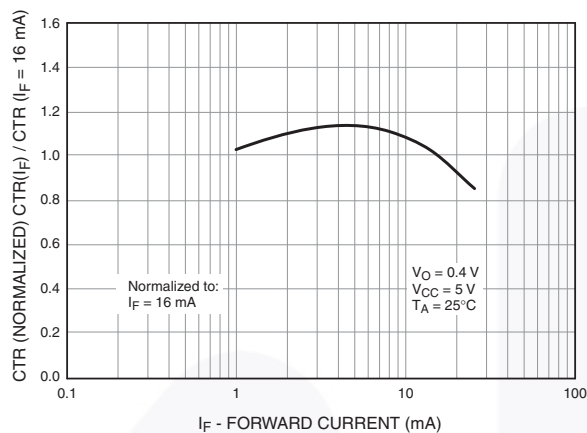


Figure 9. Normalized CTR vs. Forward Current

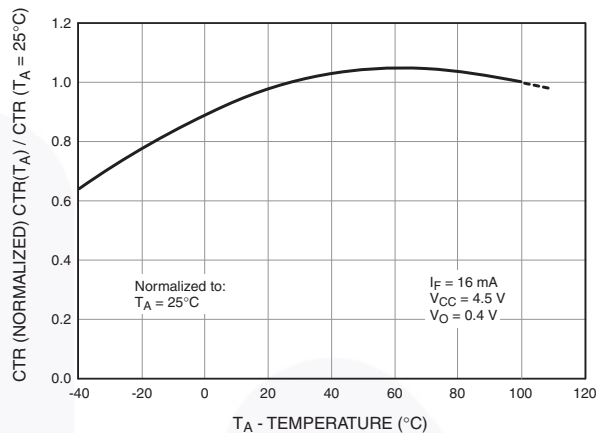


Figure 10. Normalized CTR vs. Temperature

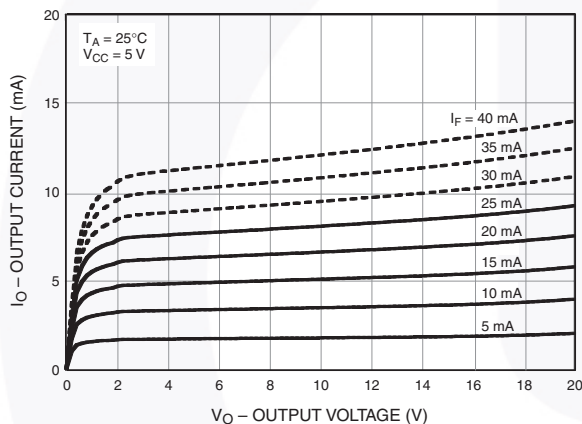


Figure 11. Output Current vs. Output Voltage

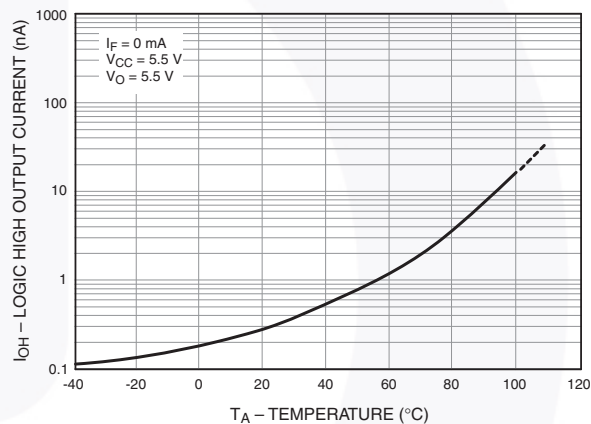


Figure 12. Logic High Output Current vs. Temperature

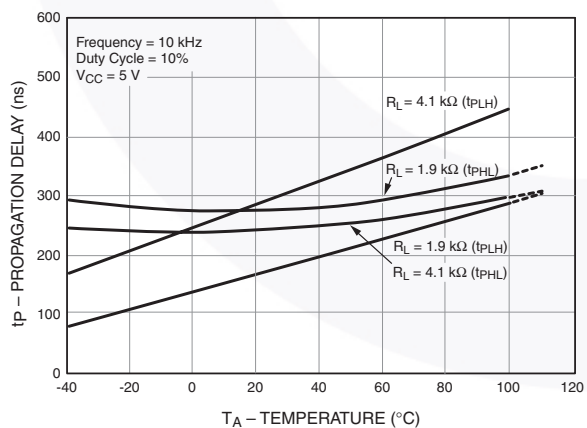


Figure 13. Propagation Delay vs. Temperature

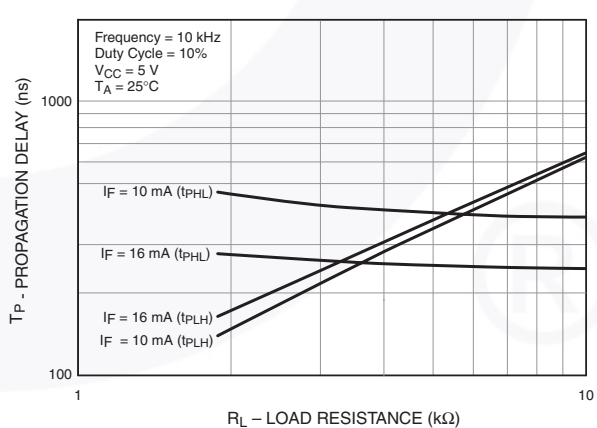
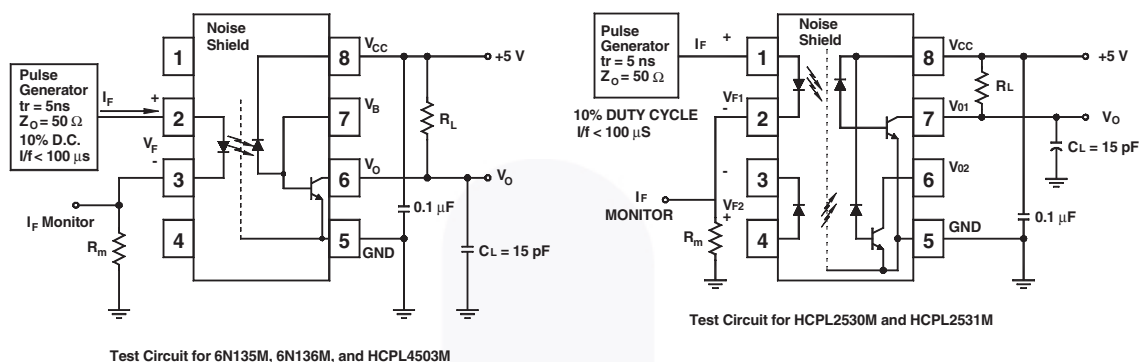


Figure 14. Propagation Delay vs. Load Resistance

## Test Circuits



Test Circuit for 6N135M, 6N136M, and HCPL4503M

Test Circuit for HCPL2530M and HCPL2531M

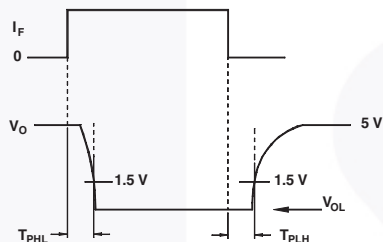
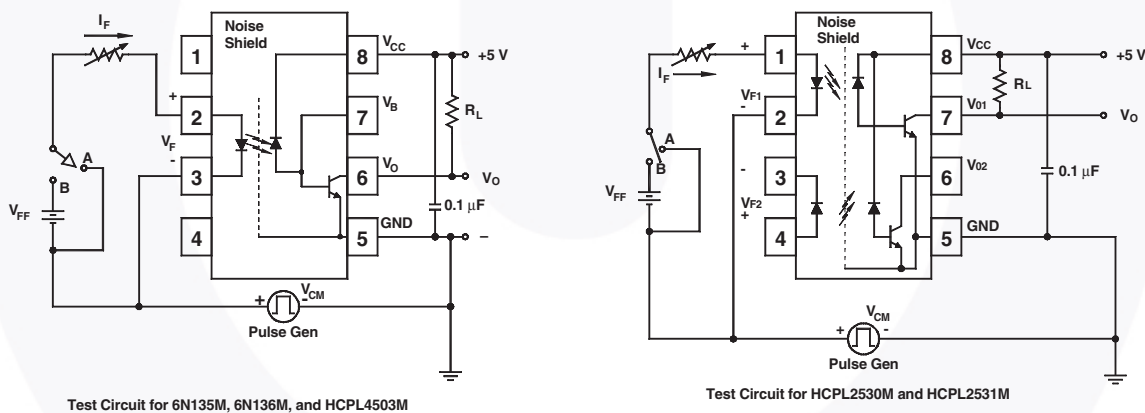


Figure 15. Switching Time Test Circuit



Test Circuit for 6N135M, 6N136M, and HCPL4503M

Test Circuit for HCPL2530M and HCPL2531M

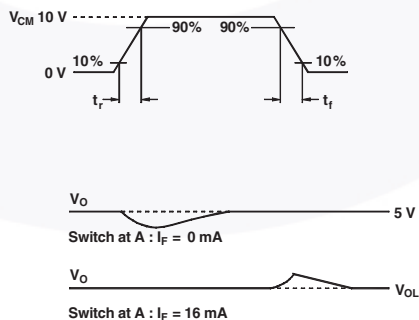
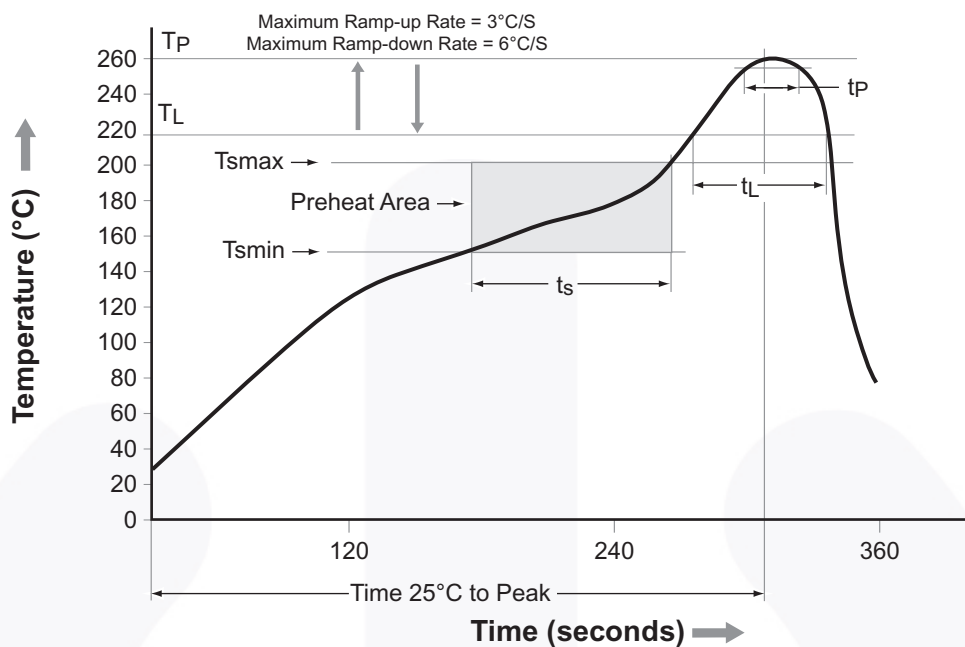


Figure 16. Common Mode Immunity Test Circuit

## Reflow Profile



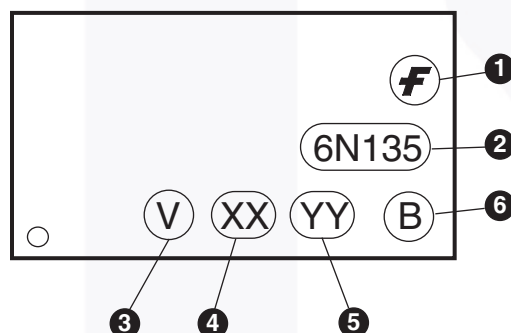
| Profile Feature                                                       | Pb-Free Assembly Profile |
|-----------------------------------------------------------------------|--------------------------|
| Temperature Min. (T <sub>smin</sub> )                                 | 150°C                    |
| Temperature Max. (T <sub>smax</sub> )                                 | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> ) | 60 to 120 s              |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )                      | 3°C/second maximum       |
| Liquidous Temperature (T <sub>L</sub> )                               | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )             | 60 to 150 s              |
| Peak Body Package Temperature                                         | 260°C +0°C / -5°C        |
| Time (t <sub>P</sub> ) within 5°C of 260°C                            | 30 s                     |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                    | 6°C/s maximum            |
| Time 25°C to Peak Temperature                                         | 8 minutes maximum        |

Figure 17. Relow Profile

## Ordering Information

| Part Number | Package                                                   | Packing Method                       |
|-------------|-----------------------------------------------------------|--------------------------------------|
| 6N135M      | DIP 8-Pin                                                 | Tube (50 units per tube)             |
| 6N135SM     | SMT 8-Pin (Lead Bend)                                     | Tube (50 units per tube)             |
| 6N135SDM    | SMT 8-Pin (Lead Bend)                                     | Tape and Reel (1,000 units per reel) |
| 6N135VM     | DIP 8-Pin, DIN EN/IEC 60747-5-5 option                    | Tube (50 units per tube)             |
| 6N135SVM    | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-5 option        | Tube (50 units per tube)             |
| 6N135SDVM   | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-5 option        | Tape and Reel (1,000 units per reel) |
| 6N135TVM    | DIP 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-5 option | Tube (50 units per tube)             |
| 6N135TSVM   | SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-5 option | Tube (50 units per tube)             |
| 6N135TSR2VM | SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-5 option | Tape and Reel (700 units per reel)   |

## Marking Information

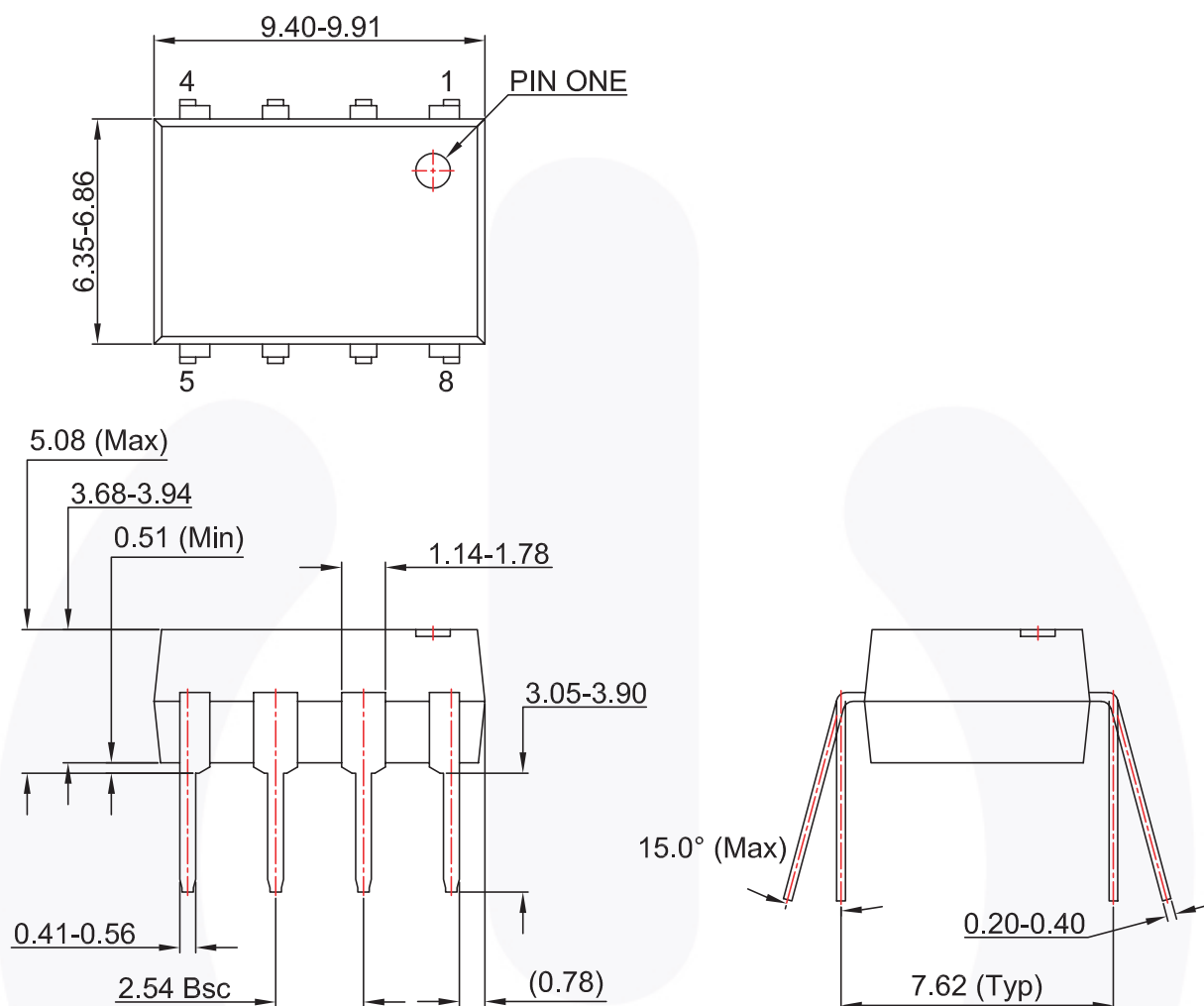


| Definitions      |                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------|
| 1                | Fairchild logo                                                                                          |
| 2 <sup>(1)</sup> | Device number                                                                                           |
| 3                | DIN EN/IEC60747-5-5 mark (Note: Only appears on parts ordered with this option – See order entry table) |
| 4                | Two-digit year code, e.g., '08'                                                                         |
| 5                | Two-digit work week ranging from '01' to '53'                                                           |
| 6                | Assembly package code                                                                                   |

### Notes:

- 'HCPL' devices are marked with only the numeric characters (for example, HCPL4503M is marked as '4503').
- The 'M' suffix is an ordering identifier only. It is used to indicate the white package version. The 'M' does not appear in the top mark.

## Package Dimensions



### NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N08GREV6.

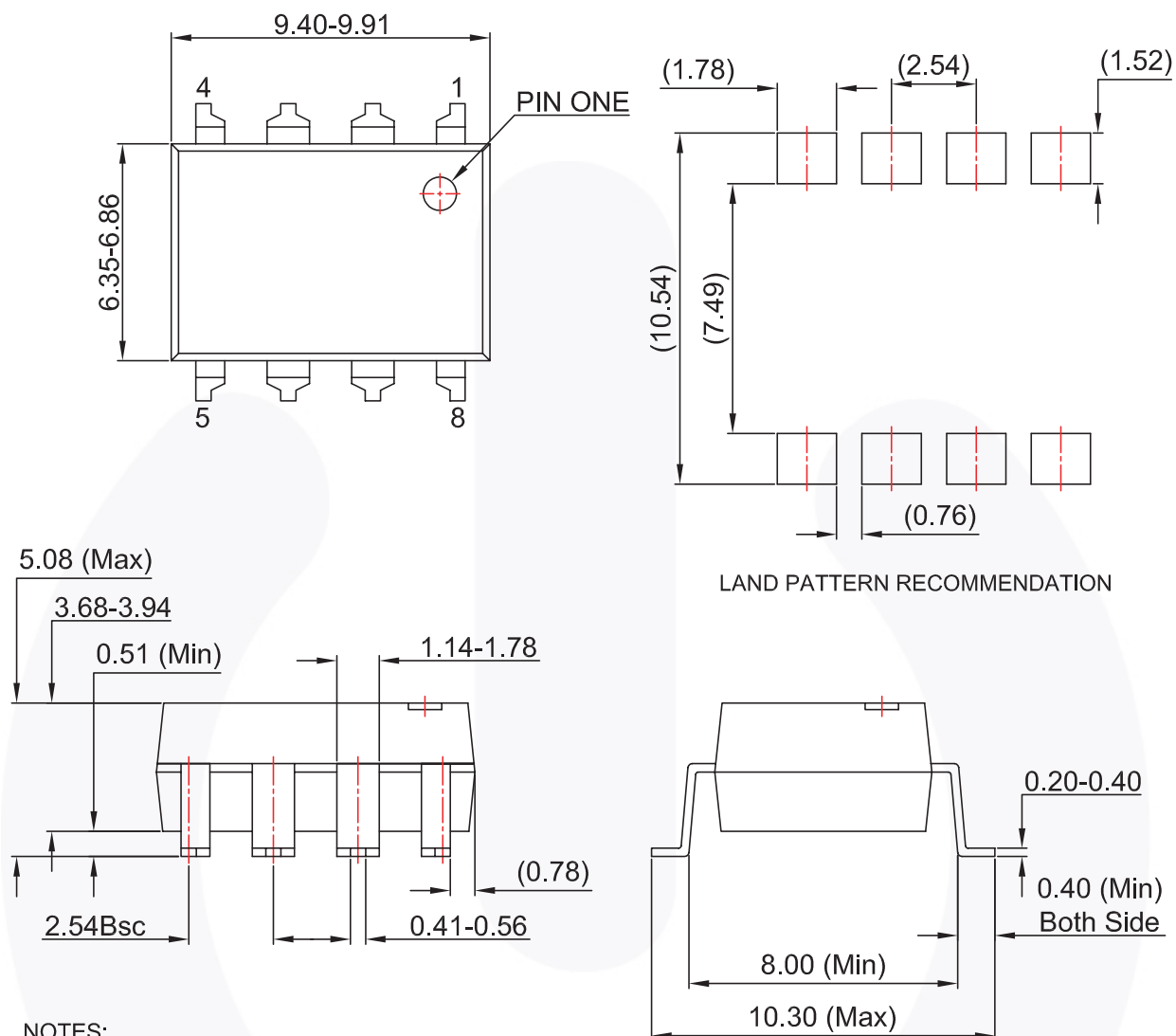
**Figure 18. 8-Pin DIP Through Hole**

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## Package Dimensions (Continued)



### NOTES:

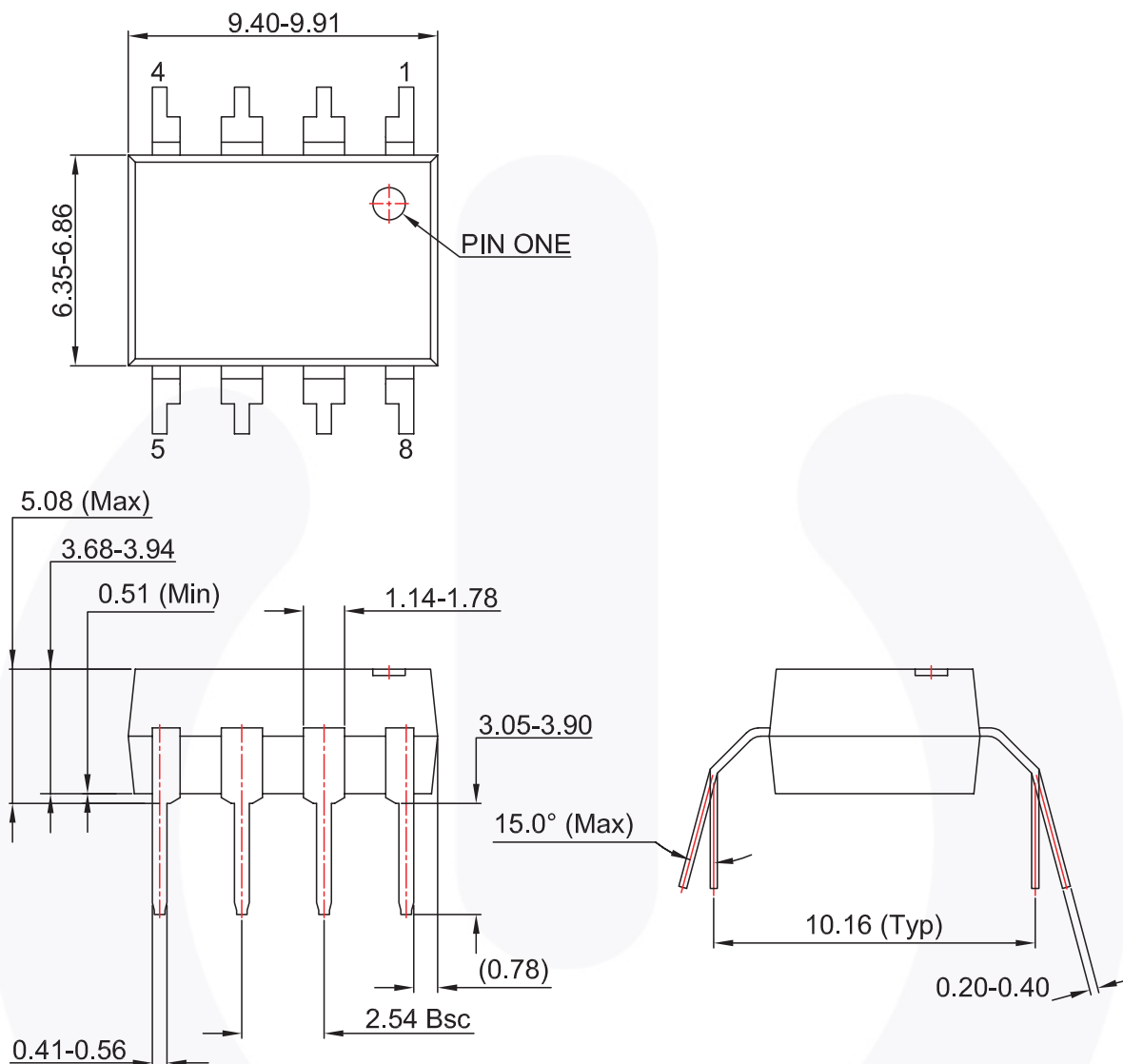
- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N08HREV6.

**Figure 19. 8-Pin DIP Surface Mount (Option S)**

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## Package Dimensions (Continued)



### NOTES:

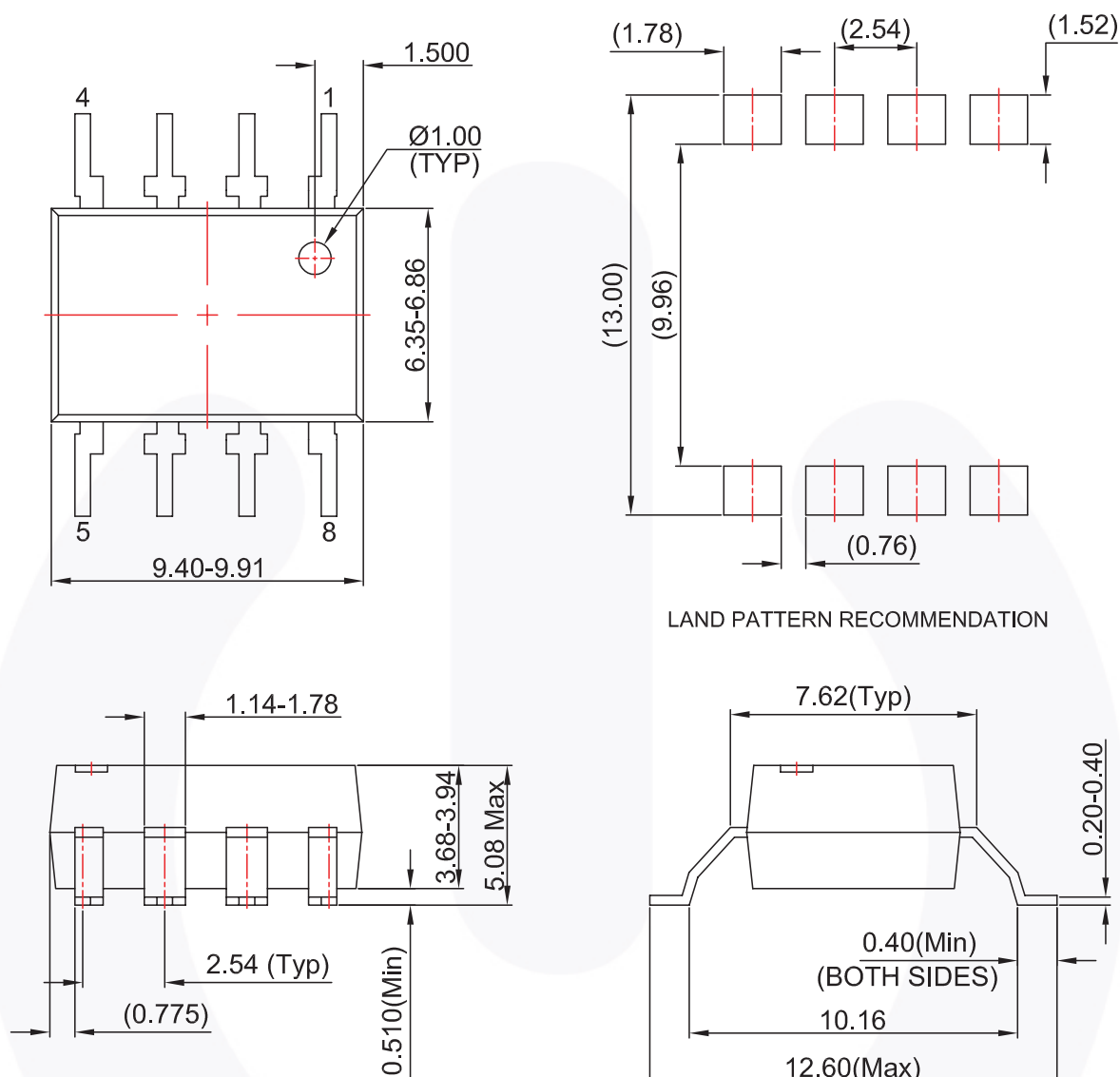
- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
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**Figure 20. 8-Pin DIP Through Hole 0.4" Lead Spacing (Option T)**

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## Package Dimensions (Continued)



### NOTES:

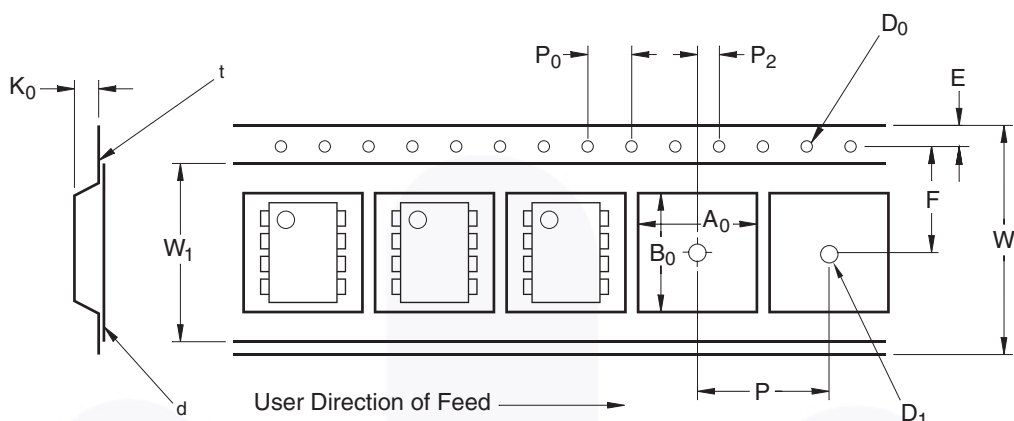
- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N08L.

**Figure 21. 8-Pin DIP Surface Mount 0.4" Lead Spacing (Option TS)**

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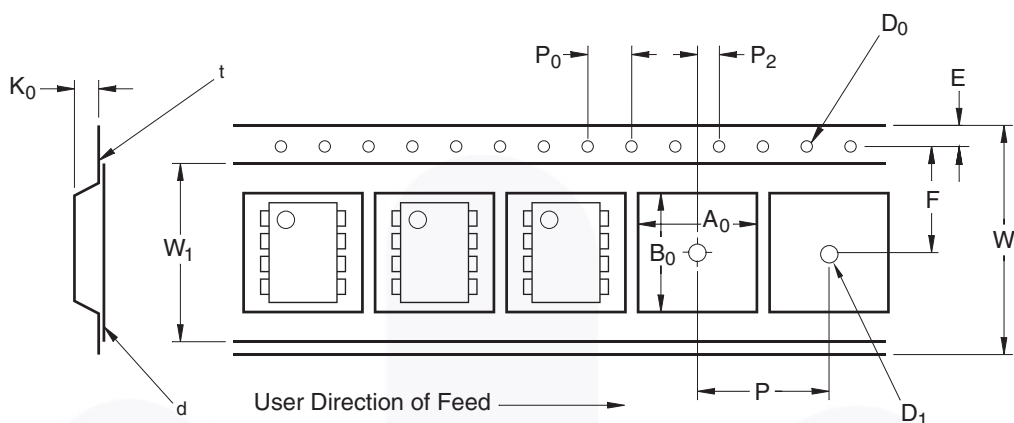
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
<http://www.fairchildsemi.com/dwg/N0/N08L.pdf>

## Carrier Tape Specifications (Option SD)



| Symbol         | Description                        | Dimension in mm |
|----------------|------------------------------------|-----------------|
| W              | Tape Width                         | 16.0 ± 0.3      |
| t              | Tape Thickness                     | 0.30 ± 0.05     |
| P <sub>0</sub> | Sprocket Hole Pitch                | 4.0 ± 0.1       |
| D <sub>0</sub> | Sprocket Hole Diameter             | 1.55 ± 0.05     |
| E              | Sprocket Hole Location             | 1.75 ± 0.10     |
| F              | Pocket Location                    | 7.5 ± 0.1       |
| P <sub>2</sub> |                                    | 2.0 ± 0.1       |
| P              | Pocket Pitch                       | 12.0 ± 0.1      |
| A <sub>0</sub> | Pocket Dimensions                  | 10.30 ± 0.20    |
| B <sub>0</sub> |                                    | 10.30 ± 0.20    |
| K <sub>0</sub> |                                    | 4.90 ± 0.20     |
| W <sub>1</sub> | Cover Tape Width                   | 13.2 ± 0.2      |
| d              | Cover Tape Thickness               | 0.1 Maximum     |
|                | Maximum Component Rotation or Tilt | 10°             |
| R              | Minimum Bending Radius             | 30              |

## Carrier Tape Specifications (Option TSR2)



| Symbol         | Description                        | Dimension in mm |
|----------------|------------------------------------|-----------------|
| W              | Tape Width                         | 24.0 ± 0.3      |
| t              | Tape Thickness                     | 0.40 ± 0.1      |
| P <sub>0</sub> | Sprocket Hole Pitch                | 4.0 ± 0.1       |
| D <sub>0</sub> | Sprocket Hole Diameter             | 1.55 ± 0.05     |
| E              | Sprocket Hole Location             | 1.75 ± 0.10     |
| F              | Pocket Location                    | 11.5 ± 0.1      |
| P <sub>2</sub> |                                    | 2.0 ± 0.1       |
| P              | Pocket Pitch                       | 16.0 ± 0.1      |
| A <sub>0</sub> | Pocket Dimensions                  | 12.80 ± 0.1     |
| B <sub>0</sub> |                                    | 10.35 ± 0.1     |
| K <sub>0</sub> |                                    | 5.7 ± 0.1       |
| W <sub>1</sub> | Cover Tape Width                   | 21.0 ± 0.1      |
| d              | Cover Tape Thickness               | 0.1 Maximum     |
|                | Maximum Component Rotation or Tilt | 10°             |
| R              | Minimum Bending Radius             | 30              |



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