

## H11L1M, H11L2M, H11L3M 6-Pin DIP Optocoupler

### Features

- High Data Rate, 1 MHz Typical (NRZ)
- Free from Latch-up and Oscillation Throughout Voltage and Temperature Ranges
- Microprocessor Compatible Drive
- Logic Compatible Output Sinks 16 mA at 0.4 V Maximum
- Guaranteed On/Off Threshold Hysteresis
- Wide Supply Voltage Capability, Compatible with All Popular Logic Systems
- Underwriters Laboratory (UL) Recognized — File #E90700, Volume 2
- VDE Recognized — File #102497 — Add Option V (e.g., H11L1MV)

### Applications

- Logic-to-Logic Isolator
- Programmable Current Level Sensor
- Line Receiver—Eliminate Noise and Transient Problems
- AC to TTL Conversion—Square Wave Shaping
- Digital Programming of Power Supplies
- Interfaces Computers with Peripherals

### Schematic

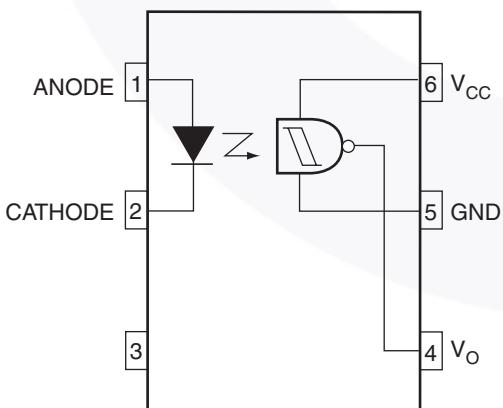


Figure 1. Schematic

### Description

The H11LXM series has a high-speed integrated circuit detector optically coupled to a gallium-arsenide infrared emitting diode. The output incorporates a Schmitt trigger, which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open-collector output for maximum application flexibility.

### Package Outlines

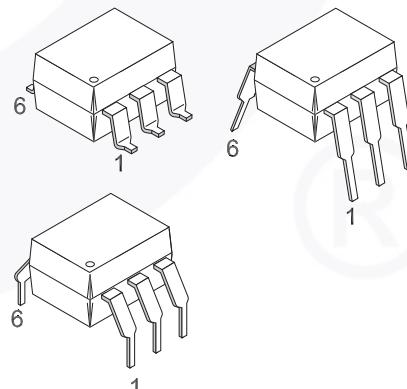


Figure 2. Package Outlines

### Truth Table

| Input | Output |
|-------|--------|
| H     | L      |
| L     | H      |

## 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              | Parameters  | Value              | Units                |
|---------------------|---|--------------------|----------------------|
| <b>Total Device</b> |   |                    |                      |
| $T_{STG}$           | Storage Temperature   | -40 to +150        | $^\circ\text{C}$     |
| $T_{OPR}$           | Operating Temperature   | -40 to +85         | $^\circ\text{C}$     |
| $T_{SOL}$           | Lead Solder Temperature   | 260 for 10 seconds | $^\circ\text{C}$     |
| $P_D$               | Total Device Power Dissipation at $25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | 250                | mW                   |
|                     |   | 2.94               | mW/ $^\circ\text{C}$ |
| <b>Emitter</b>      |   |                    |                      |
| $I_F$               | Continuous Forward Current  | 30                 | mA                   |
| $V_R$               | Reverse Voltage   | 6                  | V                    |
| $I_F(\text{pk})$    | Forward Current – Peak (1 $\mu\text{s}$ pulse, 300 pps)                                 | 100                | mA                   |
| $P_D$               | LED Power Dissipation   | 60                 | mW                   |
| <b>Detector</b>     |   |                    |                      |
| $P_D$               | Detector Power Dissipation  | 150                | mW                   |
| $V_O$               | $V_{45}$ Allowed Range  | 0 to 16            | V                    |
| $V_{CC}$            | $V_{65}$ Allowed Range  | 3 to 16            | V                    |
| $I_O$               | $I_4$ Output Current  | 50                 | mA                   |

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

| Symbol               | Parameters              | Test Conditions                        | Device | Min. | Typ. | Max. | Units         |
|----------------------|-------------------------|--|--------|------|------|------|---------------|
| <b>Emitter</b>       |                         |  |        |      |      |      |               |
| $V_F$                | Input Forward Voltage   | $I_F = 10 \text{ mA}$                  | All    |      | 1.2  | 1.5  | V             |
|                      |                         | $I_F = 0.3 \text{ mA}$                 |        | 0.75 | 1.0  |      |               |
| $I_R$                | Reverse Current         | $V_R = 3 \text{ V}$                    | All    |      |      | 10   | $\mu\text{A}$ |
| $C_J$                | Capacitance             | $V = 0, f = 1.0 \text{ MHz}$           | All    |      |      | 100  | $\text{pF}$   |
| <b>Detector</b>      |                         |  |        |      |      |      |               |
| $V_{CC}$             | Operating Voltage Range |  | All    | 3    |      | 15   | V             |
| $I_{CC(\text{off})}$ | Supply Current          | $I_F = 0, V_{CC} = 5 \text{ V}$        | All    |      | 1.6  | 5.0  | mA            |
| $I_{OH}$             | Output Current, High    | $I_F = 0, V_{CC} = V_O = 15 \text{ V}$ | All    |      |      | 100  | $\mu\text{A}$ |

### Transfer Characteristics

| Symbol                                     | Parameter                                | Test Conditions  | Device | Min. | Typ. | Max. | Units         |
|--|--|--|--------|------|------|------|---------------|
| <b>DC Characteristics</b>                  |  |  |        |      |      |      |               |
| $I_{CC(\text{on})}$                        | Supply Current                           | $I_F = 10 \text{ mA}, V_{CC} = 5 \text{ V}$  | All    |      | 1.6  | 5.0  | mA            |
| $V_{OL}$                                   | Output Voltage, Low                      | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}, I_F = I_{F(\text{on})} \text{ max.}$            | All    |      | 0.2  | 0.4  | V             |
| $I_{F(\text{on})}$                         | Turn-On Threshold Current <sup>(1)</sup> | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}$   | H11L1M |      |      | 1.6  | mA            |
|  |  |  | H11L2M |      |      | 10.0 |               |
|  |  |  | H11L3M |      |      | 5.0  |               |
| $I_{F(\text{off})}$                        | Turn-Off Threshold Current               | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}$   | All    | 0.3  | 1.0  |      | mA            |
| $I_{F(\text{off})}/I_{F(\text{on})}$       | Hysteresis Ratio                         | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}$   | All    | 0.50 | 0.75 | 0.90 |               |
| <b>AC Characteristics, Switching Speed</b> |  |  |        |      |      |      |               |
| $t_{on}$                                   | Turn-On Time                             | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$ | All    |      | 1.0  | 4.0  | $\mu\text{s}$ |
| $t_f$                                      | Fall Time                                | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$ | All    |      | 0.1  |      | $\mu\text{s}$ |
| $t_{off}$                                  | Turn-Off Time                            | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$ | All    |      | 1.2  | 4.0  | $\mu\text{s}$ |
| $t_r$                                      | Rise Time                                | $R_L = 270 \Omega, V_{CC} = 5 \text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$ | All    |      | 0.1  |      | $\mu\text{s}$ |
|  | Data Rate                                |  | All    |      | 1.0  |      | MHz           |

### Isolation Characteristics

| Symbol    | Parameter                      | Test Conditions                            | Min.      | Typ. | Max. | Units                    |
|-----------|--------------------------------|--|-----------|------|------|--------------------------|
| $V_{ISO}$ | Input-Output Isolation Voltage | $t = 1 \text{ Second}$                     | 7500      |      |      | $\text{V}_{\text{PEAK}}$ |
| $C_{ISO}$ | Isolation Capacitance          | $V_{I-O} = 0 \text{ V}, f = 1 \text{ MHz}$ |           | 0.4  | 0.6  | $\text{pF}$              |
| $R_{ISO}$ | Isolation Resistance           | $V_{I-O} = \pm 500 \text{ VDC}$            | $10^{11}$ |      |      | $\Omega$                 |

#### Note:

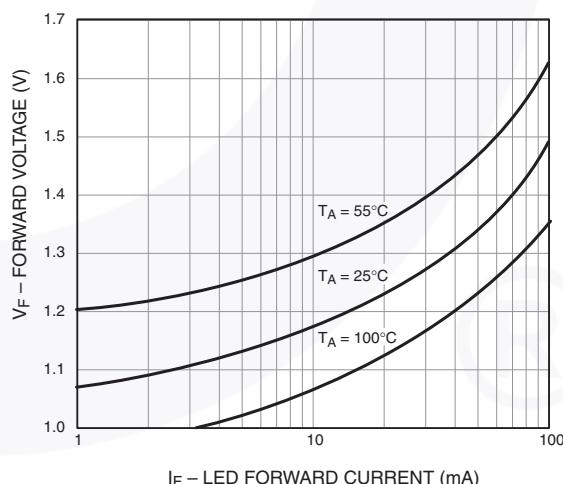
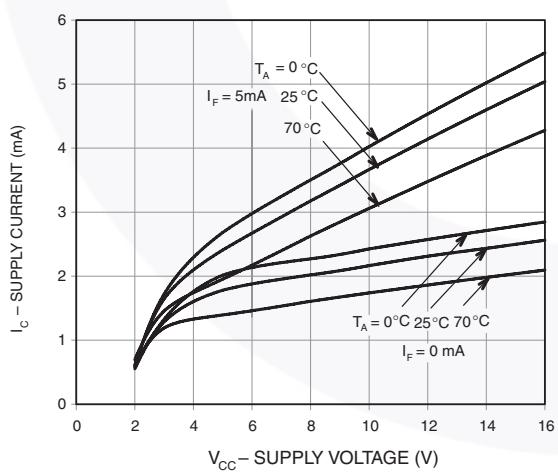
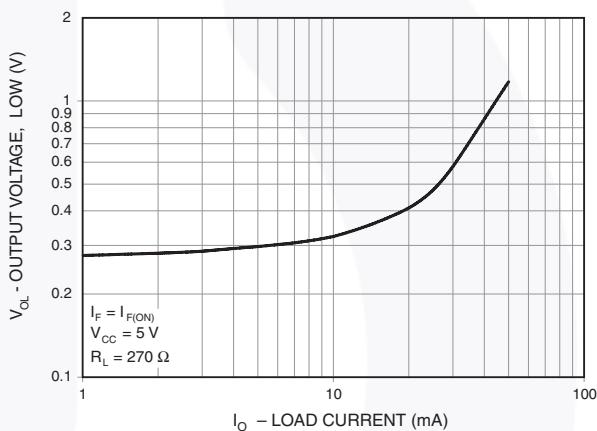
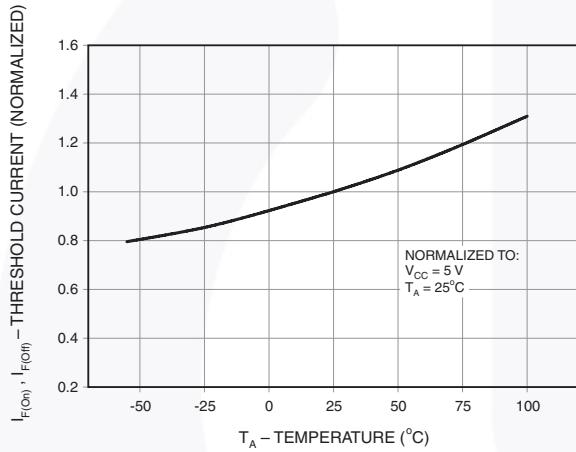
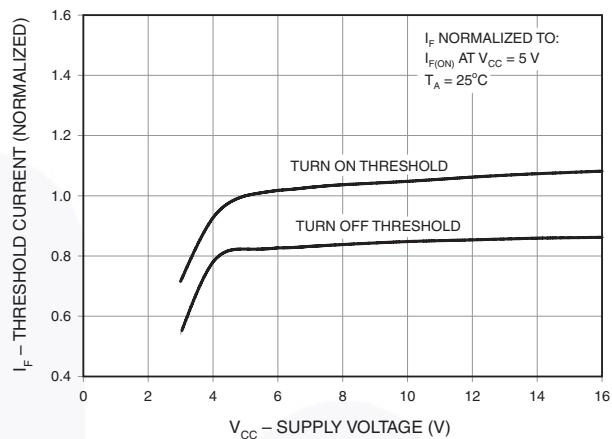
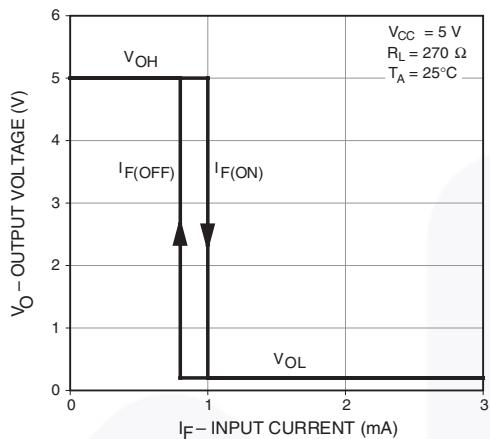
1. Maximum  $I_{F(\text{ON})}$  is the maximum current required to trigger the output. For example, a 1.6 mA maximum trigger current would require the LED to be driven at a current greater than 1.6 mA to guarantee the device turns on. A 10% guard band is recommended to account for degradation of the LED over its lifetime. The maximum allowable LED drive current is 60 mA.

## Safety and Insulation Ratings

As per IEC 60747-5-2, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings is ensured by means of protective circuits.

| Symbol     | Parameter   | Min.   | Typ.      | Max. | Unit       |
|------------|---|--------|-----------|------|------------|
|            | Installation Classifications per DIN VDE 0110/1.89<br>see Table 1   |        |           |      |            |
|            | For Rated Main Voltage < 150 Vrms   |        | I-IV      |      |            |
|            | For Rated Main Voltage < 300 Vrms   |        | I-IV      |      |            |
|            | Climatic Classification   |        | 55/100/21 |      |            |
|            | Pollution Degree (DIN VDE 0110/1.89)  |        | 2         |      |            |
| CTI        | Comparative Tracking Index  | 175    |           |      |            |
| $V_{PR}$   | Input to Output Test Voltage, Method b,<br>$V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test<br>with $t_m = 1$ Second, Partial Discharge < 5 pC | 1594   |           |      | $V_{peak}$ |
|            | Input to Output Test Voltage, Method a,<br>$V_{IORM} \times 1.5 = V_{PR}$ , Type and Sample Test<br>with $t_m = 60$ Seconds, Partial Discharge < 5 pC | 1275   |           |      | $V_{peak}$ |
| $V_{IORM}$ | Maximum Working Insulation Voltage  | 850    |           |      | $V_{peak}$ |
| $V_{IOTM}$ | Highest Allowable Over Voltage  | 6000   |           |      | $V_{peak}$ |
|            | External Creepage   | 7      |           |      | mm         |
|            | External Clearance  | 7      |           |      | mm         |
|            | Insulation Thickness  | 0.5    |           |      | mm         |
| $R_{IO}$   | Insulation Resistance at $T_s$ , $V_{IO} = 500$ V   | $10^9$ |           |      | $\Omega$   |

## Typical Performance Curves



Typical Performance Curves (Continued)

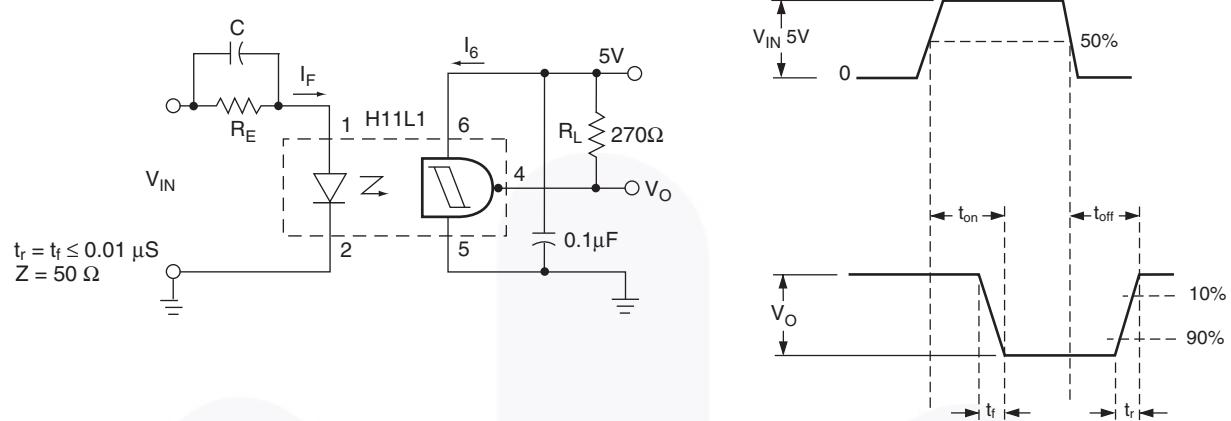


Figure 9. Switching Test Circuit and Waveforms

Reflow Profile

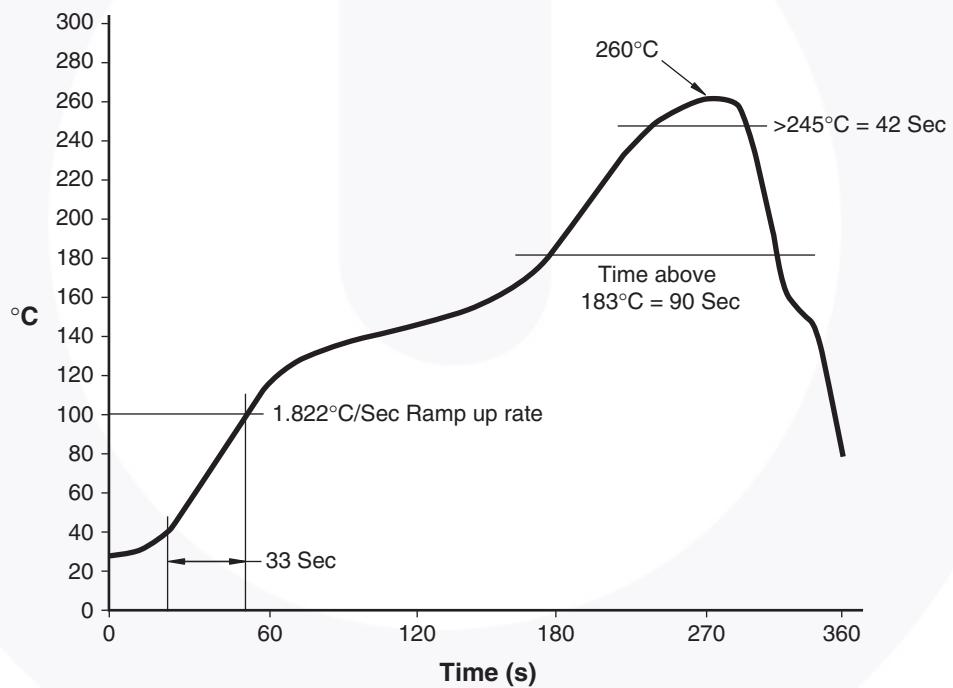
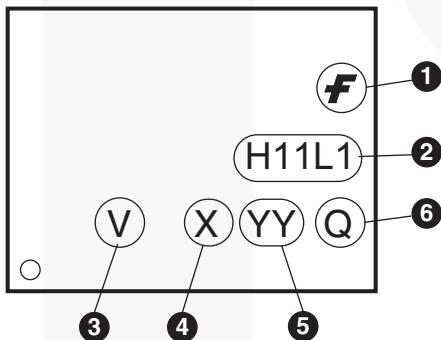


Figure 10. Reflow Profile

## Ordering Information

| Option    | Order Entry Identifier<br>(Example) | Description                            |
|-----------|-------------------------------------|--|
| No option | H11L1M                              | Standard Through Hole Device           |
| S         | H11L1SM                             | Surface Mount Lead Bend                |
| SR2       | H11L1SR2M                           | Surface Mount; Tape and Reel           |
| T         | H11L1TM                             | 0.4" Lead Spacing                      |
| V         | H11L1VM                             | VDE 0884                               |
| TV        | H11L1TVM                            | VDE 0884, 0.4" Lead Spacing            |
| SV        | H11L1SVM                            | VDE 0884, Surface Mount                |
| SR2V      | H11L1SR2VM                          | VDE 0884, Surface Mount, Tape and Reel |

## Marking Information

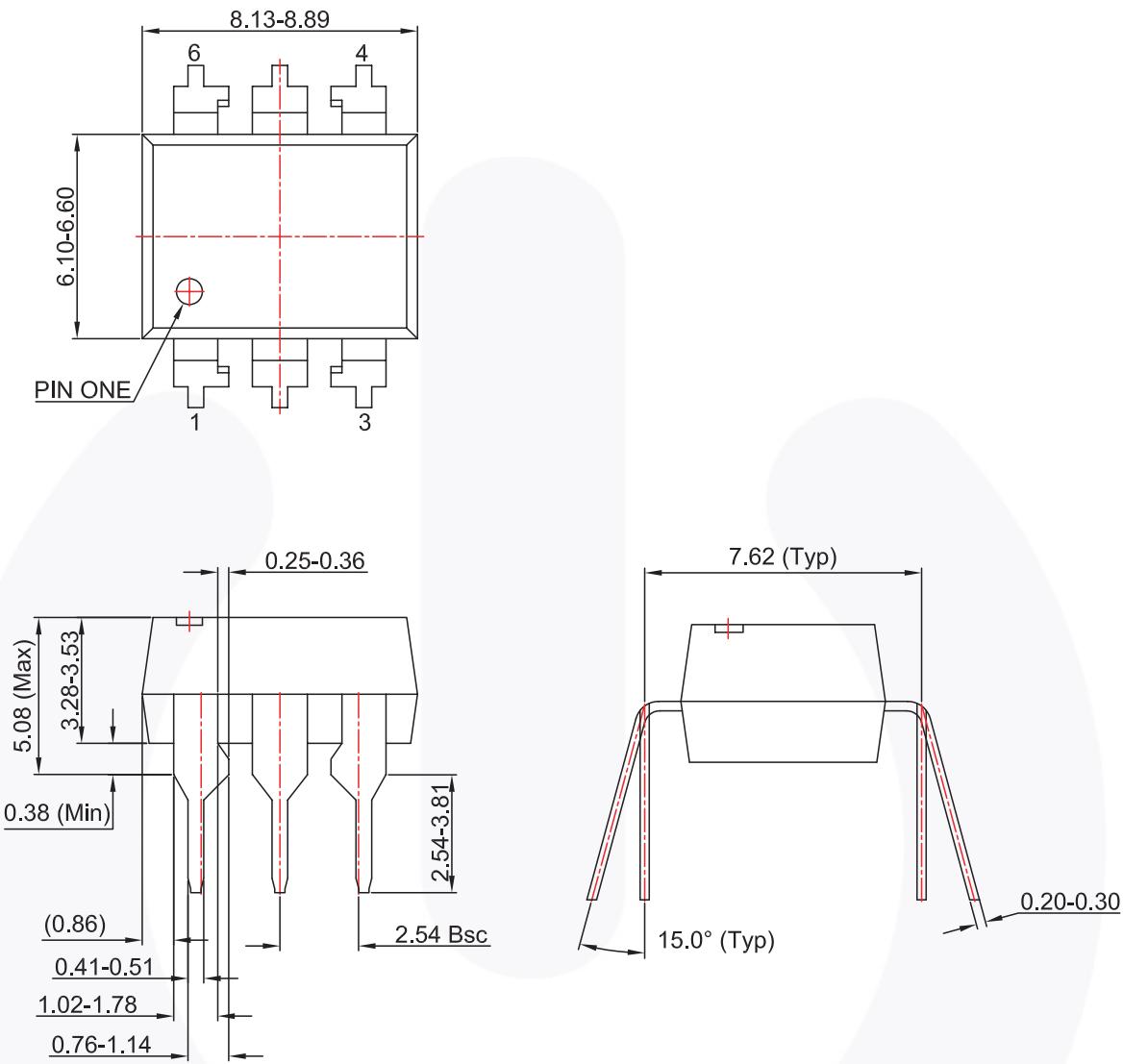


### Definitions

|   |  |
|---|--|
| 1 | Fairchild logo   |
| 2 | Device number  |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One-digit year code, e.g., '3'   |
| 5 | Two-digit work week ranging from '01' to '53'  |
| 6 | Assembly package code  |

\*Note – Parts that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in portrait format.

## Package Dimensions



### NOTES:

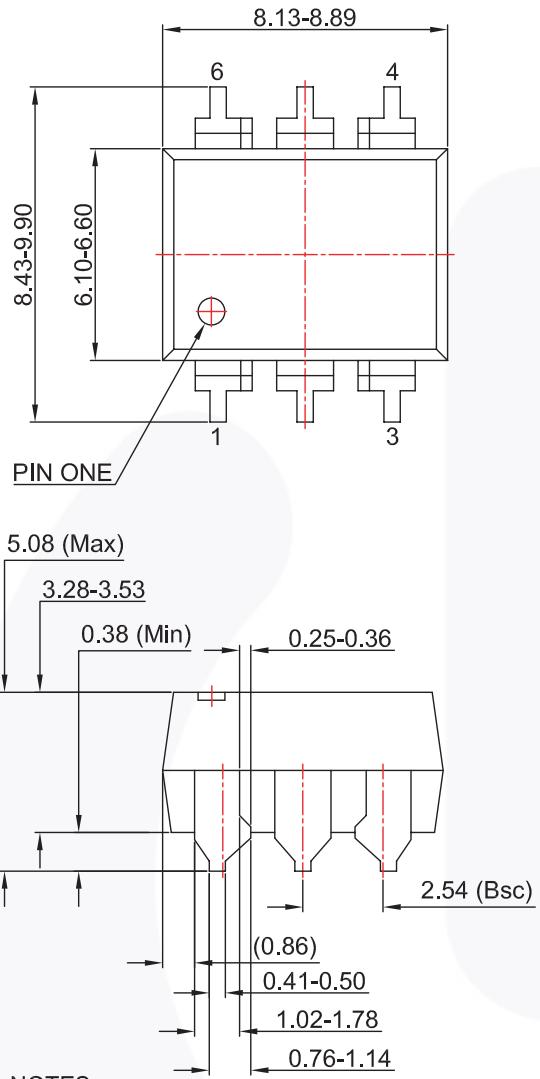
- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N06BREV3.

Figure 11. 6-pin DIP Through Hole

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**Package Dimensions (Continued)**



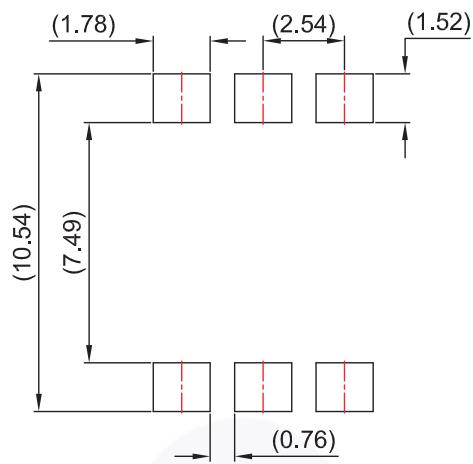
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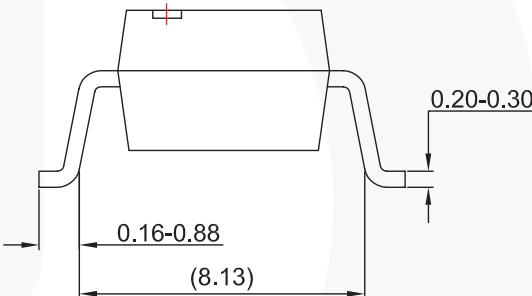
**Figure 12. 6-pin DIP Surface Mount**

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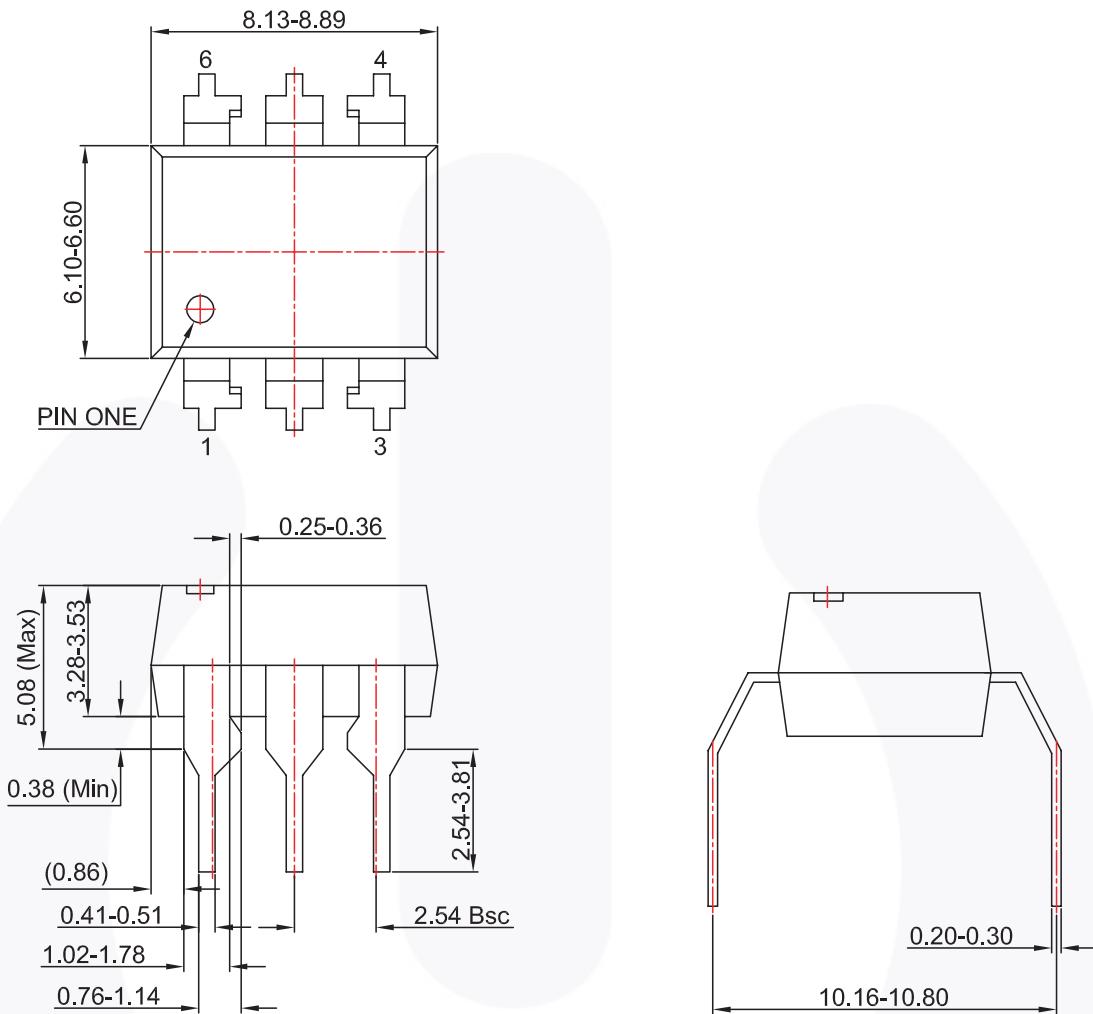
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LAND PATTERN RECOMMENDATION



**Package Dimensions (Continued)**



**NOTES:**

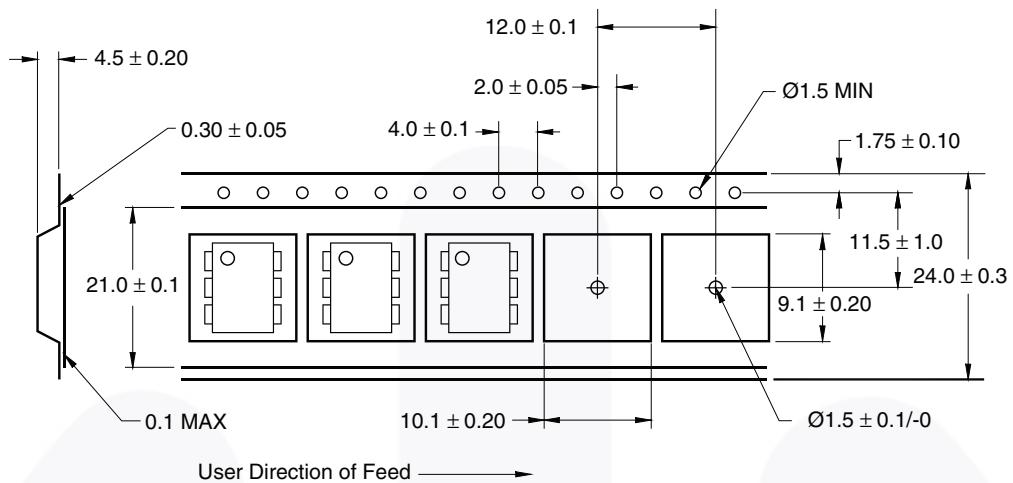
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**Figure 13. 6-pin DIP 0.4" Lead Spacing**

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## Tape Dimensions



**Note:**

All dimensions are in millimeters.

**Figure 14. Tape Dimensions**



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