

# 6-Pin DIP Schmitt Trigger Output Optocoupler

## H11L1M, H11L2M, H11L3M

### 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.

### 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
- Safety and Regulatory Approvals:
  - ◆ UL1577, 4,170 VAC<sub>RMS</sub> for 1 Minute
  - ◆ DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

### 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



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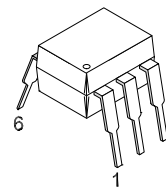
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### SCHEMATIC

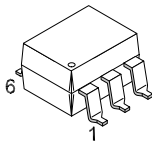


### Truth Table

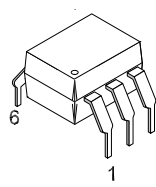
| Input | Output |
|-------|--------|
| H     | L      |
| L     | H      |



**PDIP6  
CASE 646BX**



**PDIP6  
CASE 646BY**



**PDIP6  
CASE 646BZ**

### MARKING DIAGRAM



- H11L1 = Specific Device Code
- V = DIN EN/IEC40747-5-5 Option
- Y = Year Code
- WW = Work Week
- Q = Assembly Package Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# H11L1M, H11L2M, H11L3M

## SAFETY AND INSULATION RATINGS

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.

| Parameter   |                        | Characteristics |
|---|------------------------|-----------------|
| Installation Classifications per DIN VDE 0110/1.89 Table 1, For For Rated Mains Voltage | < 150 V <sub>RMS</sub> | I-IV            |
|   | < 300 V <sub>RMS</sub> | I-IV            |
| Climatic Classification   |                        | 55/100/21       |
| Pollution Degree (DIN VDE 0110/1.89)  |                        | 2               |
| Comparative Tracking Index  |                        | 175             |

| Symbol                | Parameter  | Value            | Units             |
|-----------------------|--|------------------|-------------------|
| V <sub>PR</sub>       | Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC  | 1360             | V <sub>peak</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 | 1594             | V <sub>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage   | 850              | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage   | 6000             | V <sub>peak</sub> |
|                       | External Creepage  | ≥7               | mm                |
|                       | External Clearance   | ≥7               | mm                |
|                       | External Clearance (for Option TV, 0.4" Lead Spacing)  | ≥10              | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)   | ≥0.5             | mm                |
| T <sub>S</sub>        | Case Temperature (Note 1)  | 175              | °C                |
| I <sub>S,INPUT</sub>  | Input Current (Note 1)   | 350              | mA                |
| P <sub>S,OUTPUT</sub> | Output Power (Note 1)  | 800              | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)   | >10 <sup>9</sup> | Ω                 |

1. Safety limit values – maximum values allowed in the event of a failure.

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameters | Value | Units |
|--------|------------|-------|-------|
|--------|------------|-------|-------|

### TOTAL DEVICE

|                  |   |                    |       |
|------------------|---|--------------------|-------|
| T <sub>STG</sub> | Storage Temperature   | -40 to +125        | °C    |
| T <sub>OPR</sub> | Operating Temperature                                       | -40 to +85         | °C    |
| T <sub>J</sub>   | Junction Temperature  | -40 to +125        | °C    |
| T <sub>SOL</sub> | Lead Solder Temperature                                     | 260 for 10 seconds | °C    |
| P <sub>D</sub>   | Total Device Power Dissipation at 25°C<br>Derate Above 25°C | 250                | mW    |
|                  |   | 2.94               | mW/°C |

### EMITTER

|                    |  |     |    |
|--------------------|--|-----|----|
| I <sub>F</sub>     | Continuous Forward Current                   | 30  | mA |
| V <sub>R</sub>     | Reverse Voltage                              | 6   | V  |
| I <sub>F(pk)</sub> | Forward Current – Peak (1 μs pulse, 300 pps) | 100 | mA |
| P <sub>D</sub>     | LED Power Dissipation                        | 60  | mW |

### DETECTOR

|                 |                               |         |    |
|-----------------|-------------------------------|---------|----|
| P <sub>D</sub>  | Detector Power Dissipation    | 150     | mW |
| V <sub>O</sub>  | V <sub>45</sub> Allowed Range | 0 to 16 | V  |
| V <sub>CC</sub> | V <sub>65</sub> Allowed Range | 3 to 16 | V  |
| I <sub>O</sub>  | I <sub>4</sub> Output Current | 50      | mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

# H11L1M, H11L2M, H11L3M

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Device | Min | Typ | Max | Units |
|--------|-----------|-----------------|--------|-----|-----|-----|-------|
|--------|-----------|-----------------|--------|-----|-----|-----|-------|

### INDIVIDUAL COMPONENT CHARACTERISTICS

#### Emitter

|       |                       |                             |     |      |     |     |               |
|-------|-----------------------|-----------------------------|-----|------|-----|-----|---------------|
| $V_F$ | 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 | pF            |

#### Detector

|                      |                         |                                       |     |   |     |     |               |
|----------------------|-------------------------|---------------------------------------|-----|---|-----|-----|---------------|
| $V_{CC}$             | 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

#### DC Characteristics

|                                      |                                    |  |        |      |      |      |    |
|--------------------------------------|------------------------------------|--|--------|------|------|------|----|
| $I_{CC(\text{on})}$                  | 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 (Note 2) | $R_L = 270\ \Omega, V_{CC} = 5\text{ V}$                                     | 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 |    |

#### AC Characteristics, Switching Speed

|                  |               |  |     |  |     |     |               |
|------------------|---------------|--|-----|--|-----|-----|---------------|
| $t_{\text{on}}$  | 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     |  | All |  | 0.1 |     |               |
| $t_{\text{off}}$ | Turn-Off Time |  | All |  | 1.2 | 4.0 |               |
| $t_r$            | Rise Time     |  | All |  | 0.1 |     |               |
|                  | Data Rate     |  | All |  | 1.0 |     | MHz           |

### ISOLATION CHARACTERISTICS

|                  |                                |   |           |  |     |     |                       |
|------------------|--------------------------------|---|-----------|--|-----|-----|-----------------------|
| $V_{\text{ISO}}$ | Input-Output Isolation Voltage | $t = 1\text{ Minute}$   | 4170      |  |     |     | $V_{AC_{\text{RMS}}}$ |
| $C_{\text{ISO}}$ | Isolation Capacitance          | $V_{\text{I-O}} = 0\text{ V}, f = 1\text{ MHz}$               |           |  | 0.4 | 0.6 | pF                    |
| $R_{\text{ISO}}$ | Isolation Resistance           | $V_{\text{I-O}} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$ | $10^{11}$ |  |     |     | $\Omega$              |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. 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 30 mA.

# H11L1M, H11L2M, H11L3M

## TYPICAL PERFORMANCE CURVES



Figure 1. Transfer Characteristics



Figure 2. Threshold Current vs. Supply Voltage

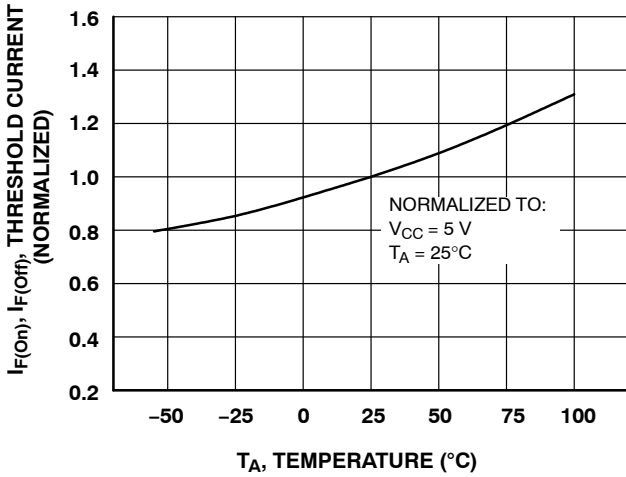


Figure 3. Threshold Current vs. Supply Temperature



Figure 4. Output Voltage, Low vs. Load Current

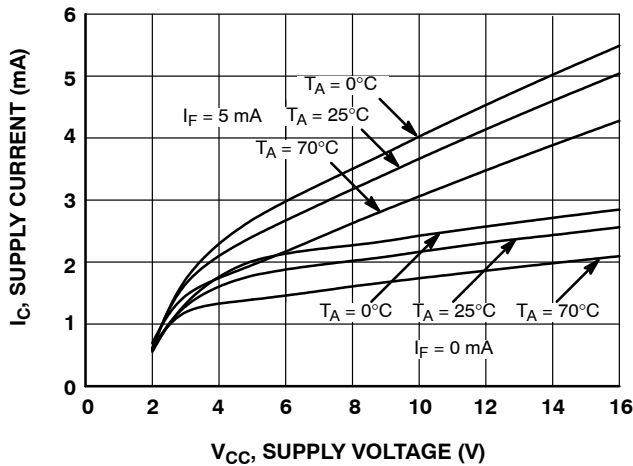


Figure 5. Supply Current vs. Supply Voltage



Figure 6. LED Forward Voltage vs. Forward Current

# H11L1M, H11L2M, H11L3M

## TYPICAL PERFORMANCE CURVES (continued)

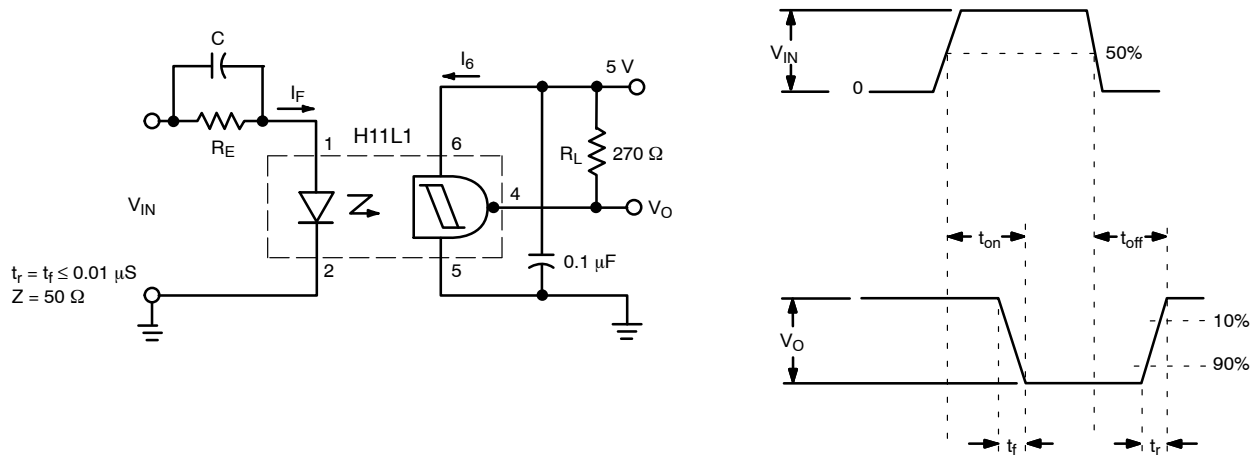


Figure 7. Switching Test Circuit and Waveforms

## REFLOW PROFILE

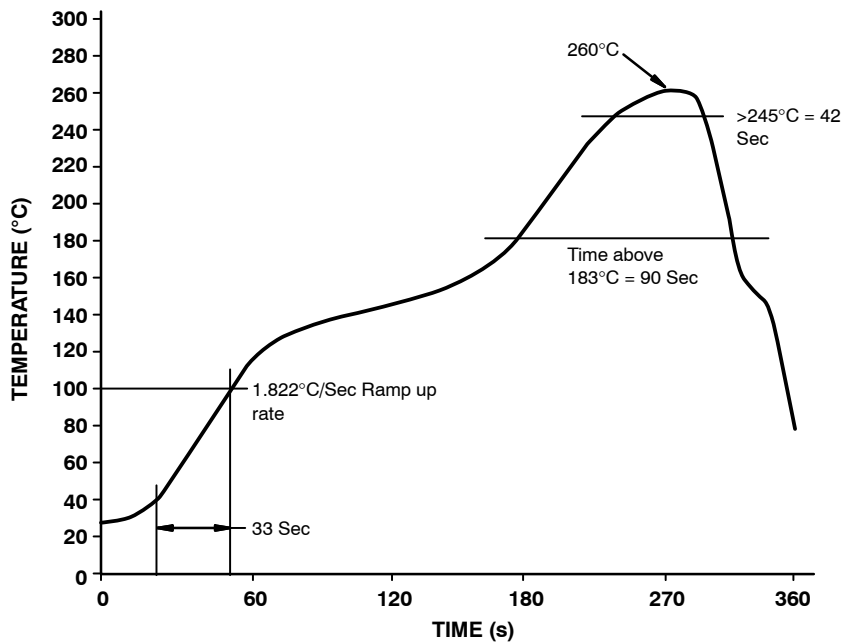


Figure 8. Reflow Profile

## PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Package  | Shipping†              |
|-------------|--|------------------------|
| H11L1M      | DIP 6-Pin  | 50 Units/Tube          |
| H11L1SM     | SMT 6-Pin (Lead Bend)                                    | 50 Units/Tube          |
| H11L1SR2M   | SMT 6-Pin (Lead Bend)                                    | 1000 Units/Tape & Reel |
| H11L1VM     | DIP 6-Pin, DIN EN/IEC60747-5-5 Option                    | 50 Units/Tube          |
| H11L1SVM    | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | 50 Units/Tube          |
| H11L1SR2VM  | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | 1000 Units/Tape & Reel |
| H11L1TVM    | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option | 50 Units/Tube          |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

3. The product orderable part number system listed in this table also applies to the H11L2M and H11L3M product families.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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CASE 646BX  
ISSUE O

DATE 31 JUL 2016



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

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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### PDIP6 8.51x6.35, 2.54P

#### CASE 646BY

#### ISSUE A

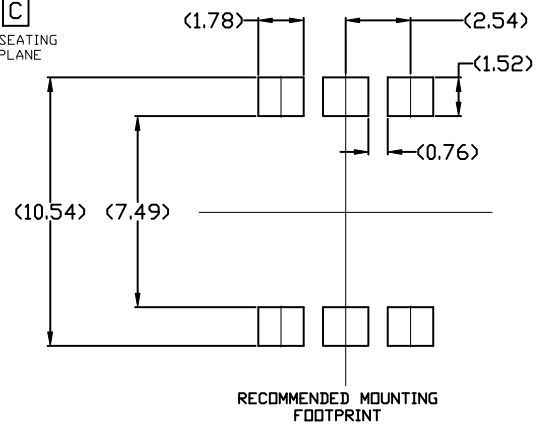
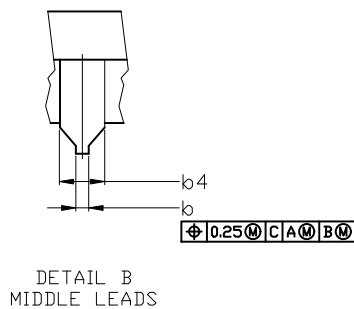
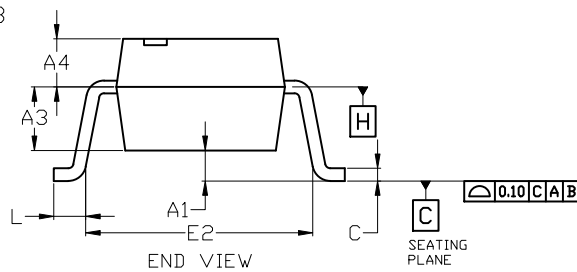
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**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS ARE LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | ---         | ---  | 4.80 |
| A1  | 0.38        | ---  | ---  |
| A2  | 3.28        | 3.40 | 3.53 |
| A3  | 2.49 REF    |      |      |
| A4  | 1.89 REF    |      |      |
| b   | 0.41        | 0.46 | 0.51 |
| b1  | 0.76        | 0.92 | 1.14 |
| b2  | 0.25        | 0.28 | 0.36 |
| b3  | 1.02        | 1.40 | 1.78 |
| b4  | 1.778 REF   |      |      |
| c   | 0.20        | 0.25 | 0.30 |
| D   | 8.13        | 8.51 | 8.89 |
| D1  | 0.86 REF    |      |      |
| E   | 6.10        | 6.35 | 6.60 |
| E1  | 8.43        | 9.17 | 9.90 |
| E2  | 8.13 REF    |      |      |
| e   | 2.54 BSC    |      |      |
| L   | 0.16        | 0.52 | 0.88 |



For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

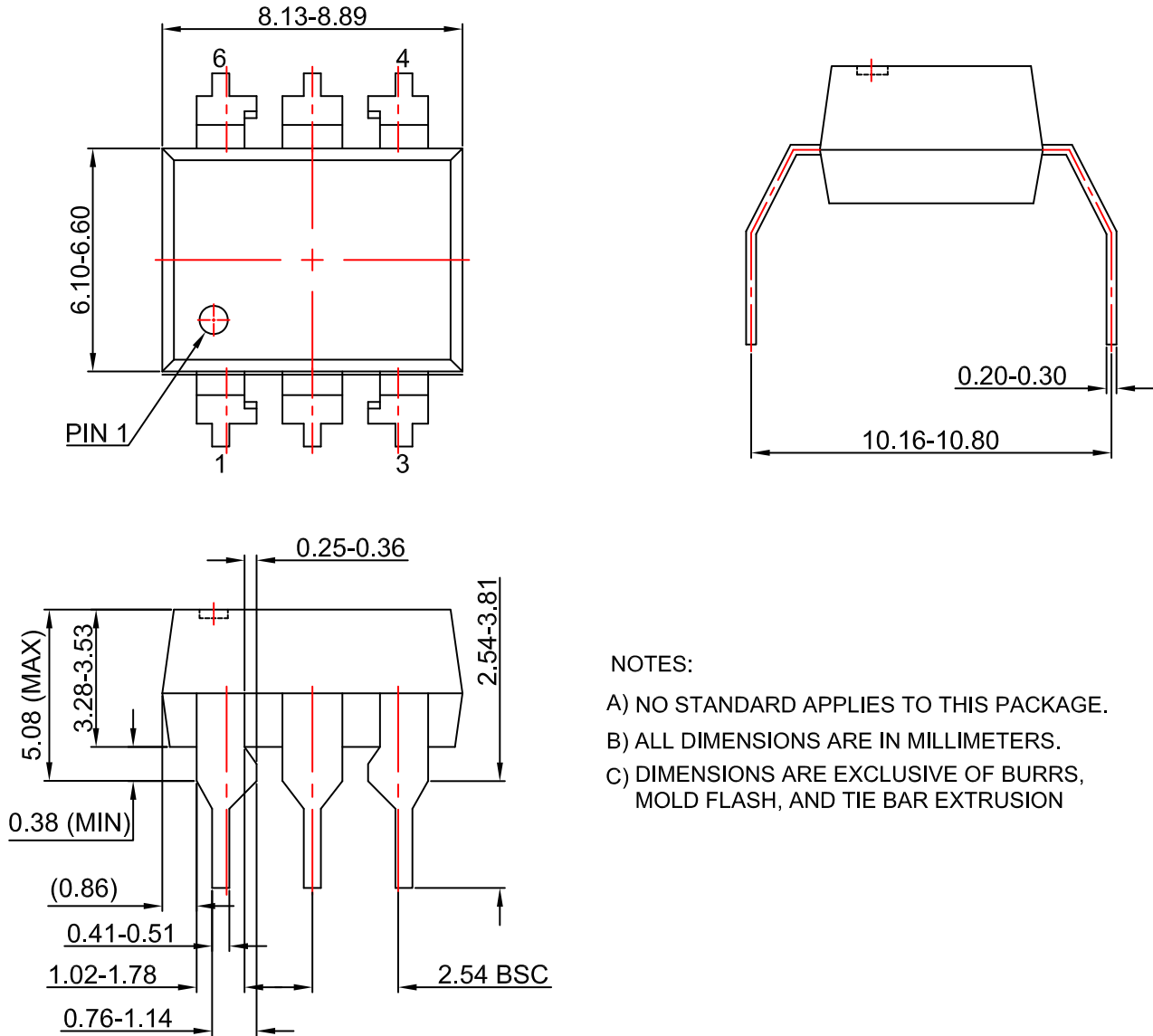
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**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

PDIP6 8.51x6.35, 2.54P  
CASE 646BZ  
ISSUE O

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