

# 6-Pin DIP Schmitt Trigger Output Optocoupler

## H11N1M

The H11N1M has a high-speed integrated circuit detector optically coupled to an aluminium gallium arsenide (AlGaAs) 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.

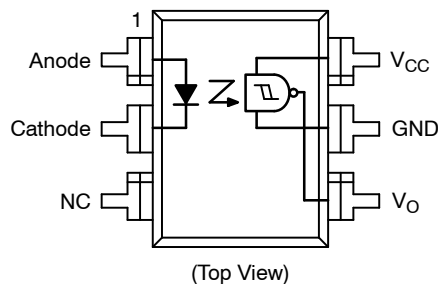
### Features

- High Data Rate, 5 MHz Typical (NRZ)
- Free from Latch-up and Oscillation Throughout Voltage and Temperature Ranges
- Microprocessor Compatible Drive
- Logic Compatible Output Sinks 16 mA at 0.5 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

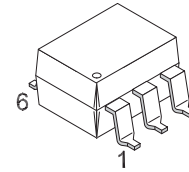
- Logic-to-Logic Isolator
- Programmable Current Level Sensor
- Line Receiver – Eliminate Noise and Transient Problems
- AC to TTL Conversion – Square Wave Shaping
- Interfaces Computers with Peripherals
- Isolated Power MOS Driver for Power Supplies

### SCHEMATIC

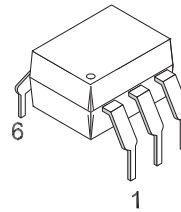


### Truth Table

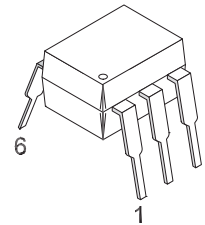
| Input | Output |
|-------|--------|
| H     | L      |
| L     | H      |



PDIP6  
CASE 646BY

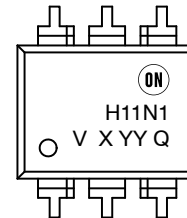


PDIP6  
CASE 646BZ



PDIP6  
CASE 646BX

### MARKING DIAGRAM



- H11N1 = Device Code  
 V = DIN EN/IEC60747-5-5 Option  
 (only appears on component ordered with this option)  
 X = One-Digit Year Code, e.g., "6"  
 YY = Digit Work Week, Ranging from "01" to "53"  
 Q = Assembly Package Code

### ORDERING INFORMATION

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

# H11N1M

**Table 1. 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 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             | Unit              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| 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                                                                                                                                 | 6,000             | 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.

**Table 2. ABSOLUTE MAXIMUM RATINGS** T<sub>A</sub> = 25°C unless otherwise specified.

| Symbol | Parameter | 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 | 210                | mW    |
|                  | Derate above 25°C                      | 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.

# H11N1M

**Table 3. ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol               | Parameter               | Test Conditions                                 | Min  | Typ  | Max | Units         |
|----------------------|-------------------------|-------------------------------------------------|------|------|-----|---------------|
| <b>EMITTER</b>       |                         |                                                 |      |      |     |               |
| $V_F$                | Input Forward Voltage   | $I_F = 10\text{ mA}$                            |      | 1.4  | 2.0 | V             |
|                      |                         | $I_F = 0.3\text{ mA}$                           | 0.75 | 1.25 |     |               |
| $I_R$                | Reverse Current         | $V_R = 5\text{ V}$                              |      |      | 10  | $\mu\text{A}$ |
| $C_J$                | Capacitance             | $V = 0\text{ V}, f = 1.0\text{ MHz}$            |      |      | 100 | pF            |
| <b>DETECTOR</b>      |                         |                                                 |      |      |     |               |
| $V_{CC}$             | Operating Voltage Range |                                                 | 4    |      | 15  | V             |
| $I_{CC(\text{off})}$ | Supply Current          | $I_F = 0\text{ mA}, V_{CC} = 5\text{ V}$        |      | 6    | 10  | mA            |
| $I_{OH}$             | Output Current, High    | $I_F = 0\text{ mA}, V_{CC} = V_O = 15\text{ V}$ |      |      | 100 | $\mu\text{A}$ |

**Table 4. TRANSFER CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol                                 | Parameter                  | Test Conditions                                                                 | Min  | Typ | Max  | Units |
|----------------------------------------|----------------------------|---------------------------------------------------------------------------------|------|-----|------|-------|
| $I_{CC(\text{on})}$                    | Supply Current             | $I_F = 10\text{ mA}, V_{CC} = 5\text{ V}$                                       |      | 6.5 | 10.0 | mA    |
| $V_{OL}$                               | Output Voltage, Low        | $R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}\text{ Maximum}$ |      |     | 0.5  | V     |
| $I_{F(\text{on})}$                     | Turn-On Threshold Current  | $R_L = 270\ \Omega, V_{CC} = 5\text{ V}$ (Note 2)                               | 0.8  |     | 3.2  | mA    |
| $I_{F(\text{off})}$                    | Turn-Off Threshold Current | $R_L = 270\ \Omega, V_{CC} = 5\text{ V}$                                        | 0.3  |     |      | mA    |
| $I_{F(\text{off})} / I_{F(\text{on})}$ | Hysteresis Ratio           | $R_L = 270\ \Omega, V_{CC} = 5\text{ V}$                                        | 0.65 |     | 0.95 |       |

**Table 5. SWITCHING SPEED**

| Symbol    | AC Characteristics | Test Conditions                                                                   | Min | Typ | Max | Units |
|-----------|--------------------|-----------------------------------------------------------------------------------|-----|-----|-----|-------|
| $t_{on}$  | Turn-On Time       | $C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = (\text{Note 3}), \text{Figure 7}$ |     | 100 | 330 | ns    |
| $t_r$     | Rise Time          | $C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = (\text{Note 3}), \text{Figure 7}$ |     | 7.5 |     | ns    |
| $t_{off}$ | Turn-Off Time      | $C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = (\text{Note 3}), \text{Figure 7}$ |     | 150 | 330 | ns    |
| $t_f$     | Fall Time          | $C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = (\text{Note 3}), \text{Figure 7}$ |     | 12  |     | ns    |
|           | Data Rate          |                                                                                   |     | 5   |     | MHz   |

**Table 6. ISOLATION CHARACTERISTICS**

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

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.

- Maximum  $I_{F(\text{on})}$  is the maximum current required to trigger the output. For example, a 3.2 mA maximum trigger current would require the LED to be driven at a current greater than 3.2 mA to guarantee the device will turn 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.
- H11N1:  $R_E = 910\ \Omega$

## TYPICAL CHARACTERISTICS

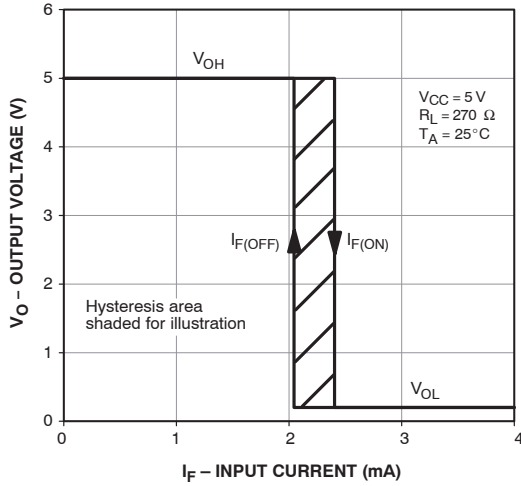


Figure 1. Transfer Characteristics

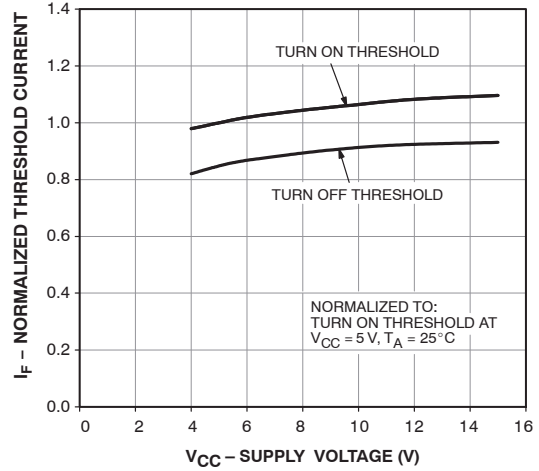


Figure 2. Threshold Current vs. Supply Voltage

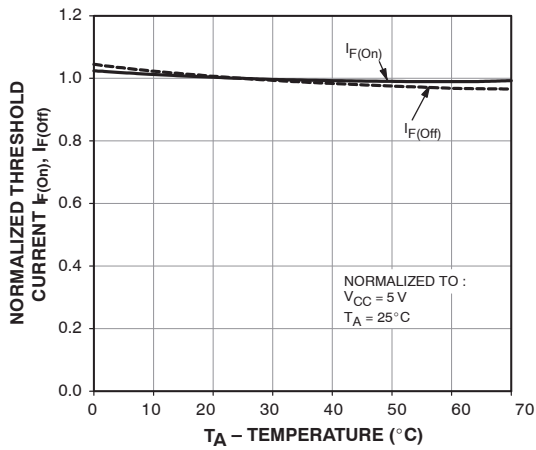


Figure 3. Threshold Current vs. Temperature

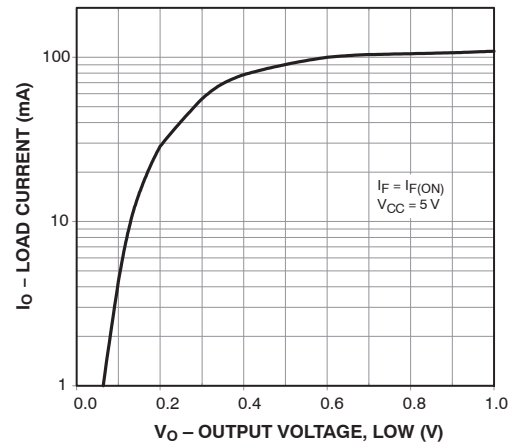


Figure 4. Load Current vs. Output Voltage

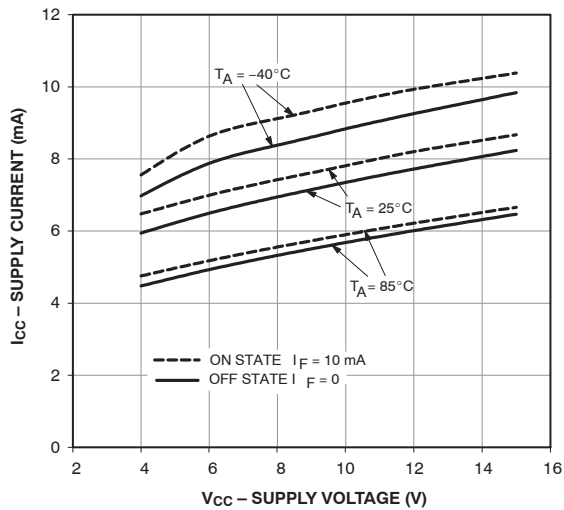


Figure 5. Supply Current vs. Supply Voltage

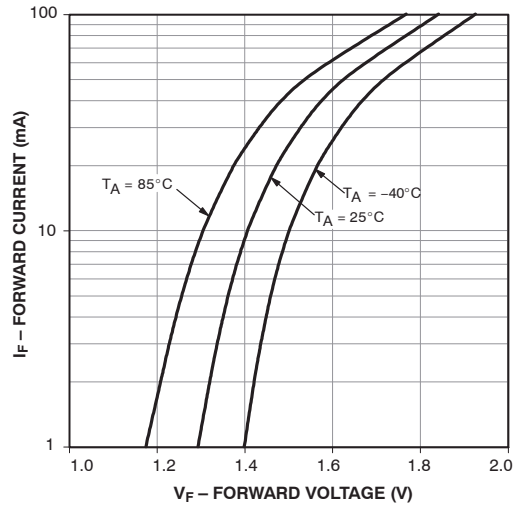


Figure 6. LED Forward Current vs. Forward Voltage

# H11N1M

## TEST CIRCUIT

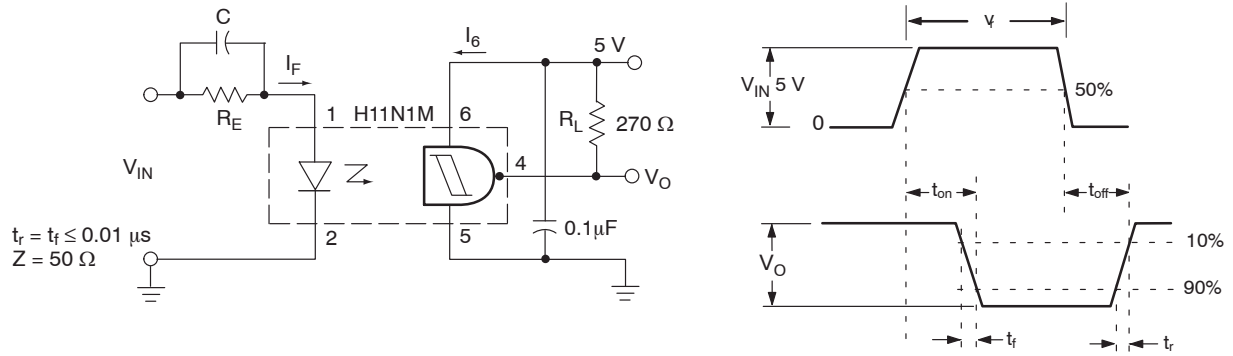


Figure 7. Switching Test Circuit and Waveforms

## REFLOW PROFILE

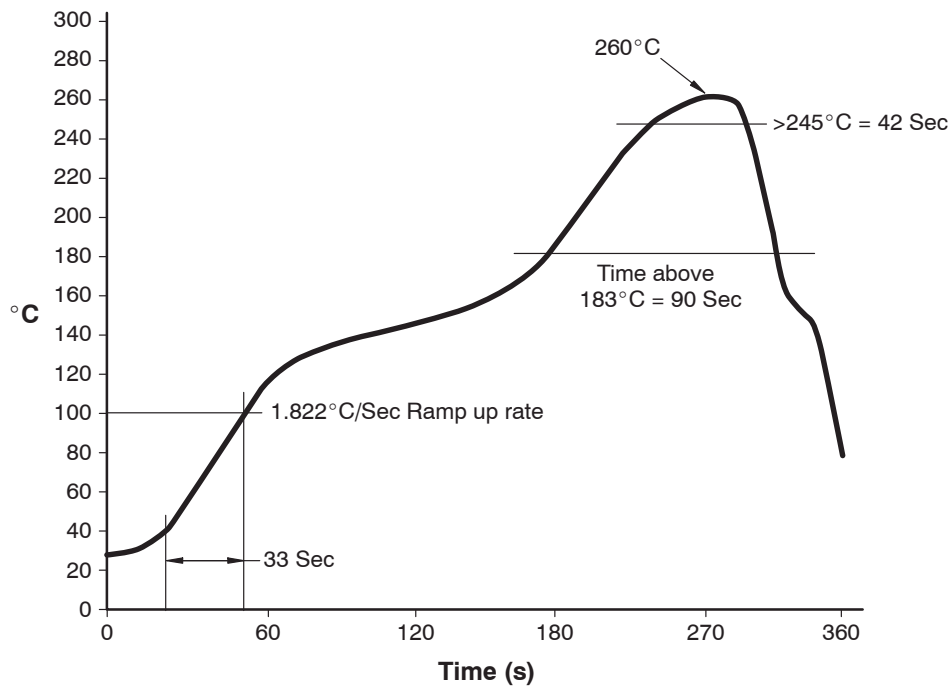


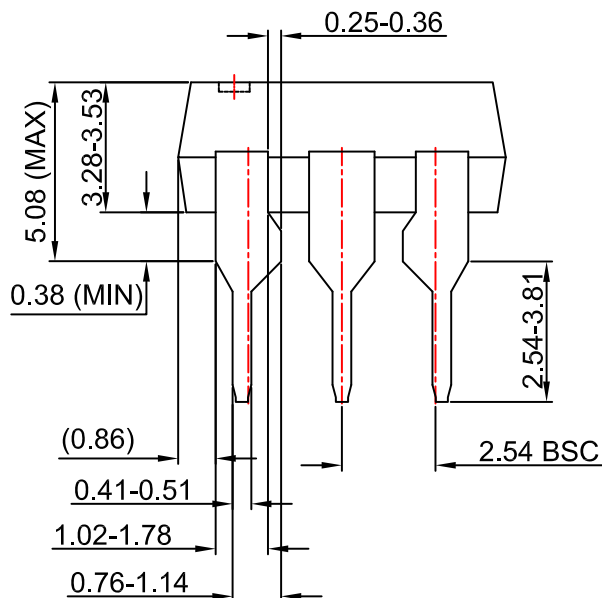
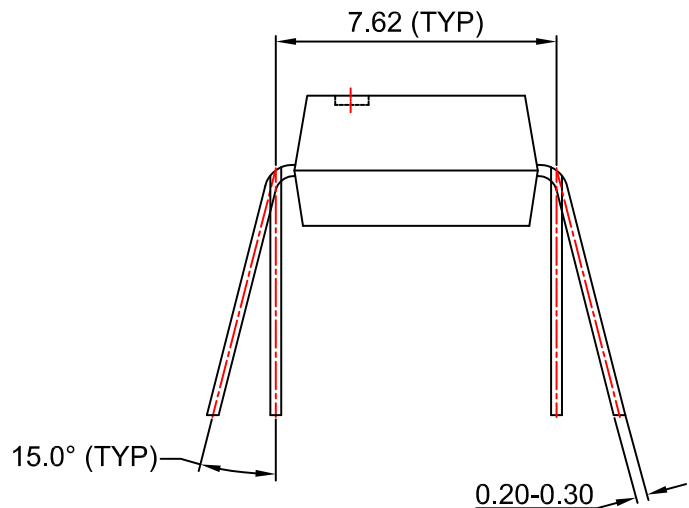
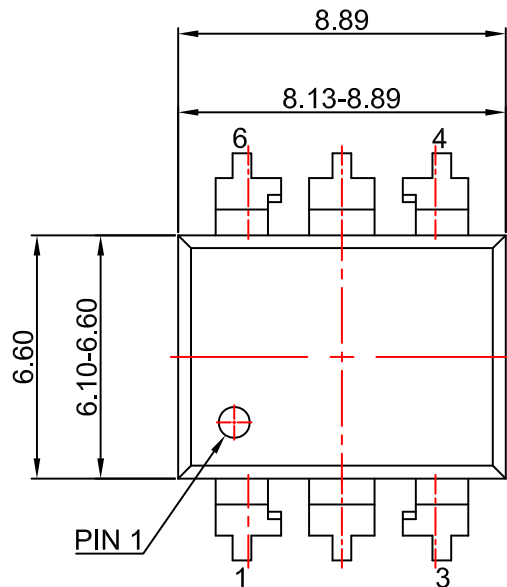
Figure 8. Reflow Profile

## ORDERING INFORMATION

| Part Number | Package                                                  | Packing Method             |
|-------------|----------------------------------------------------------|----------------------------|
| H11N1M      | DIP 6-Pin                                                | Tube (50 Units)            |
| H11N1SM     | SMT 6-Pin (Lead Bend)                                    | Tube (50 Units)            |
| H11N1SR2M   | SMT 6-Pin (Lead Bend)                                    | Tape and Reel (1000 Units) |
| H11N1VM     | DIP 6-Pin, DIN EN/IEC60747-5-5 Option                    | Tube (50 Units)            |
| H11N1SVM    | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tube (50 Units)            |
| H11N1SR2VM  | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tape and Reel (1000 Units) |
| H11N1TVM    | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option | Tube (50 Units)            |

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

DATE 31 JUL 2016



**NOTES:**

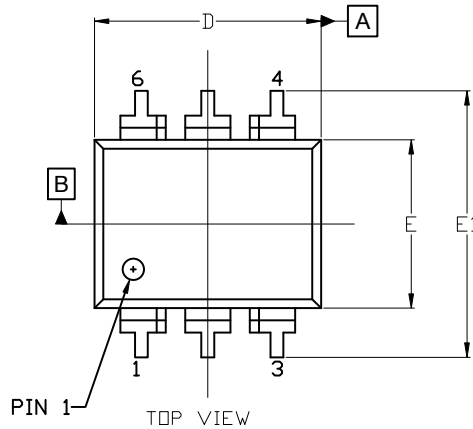
- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
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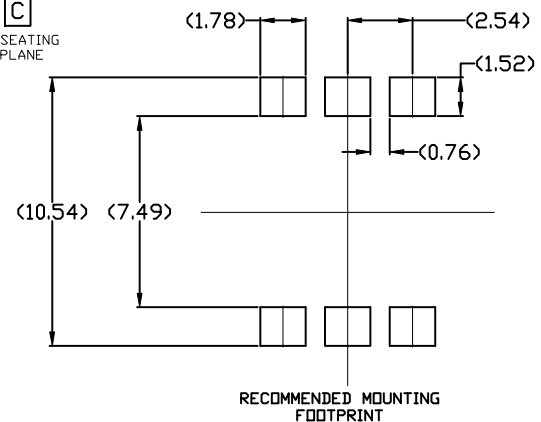
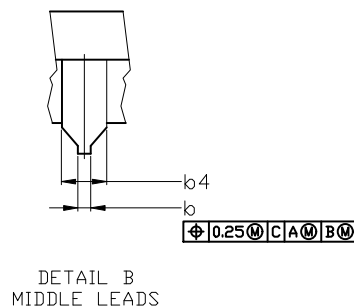
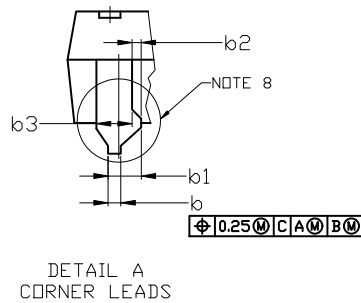
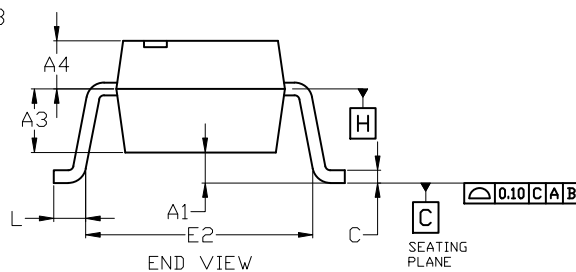
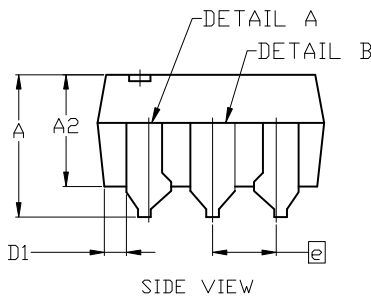
**PDIP6 8.51x6.35, 2.54P**  
**CASE 646BY**  
**ISSUE A**

DATE 15 JUL 2019


**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 IS 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 |



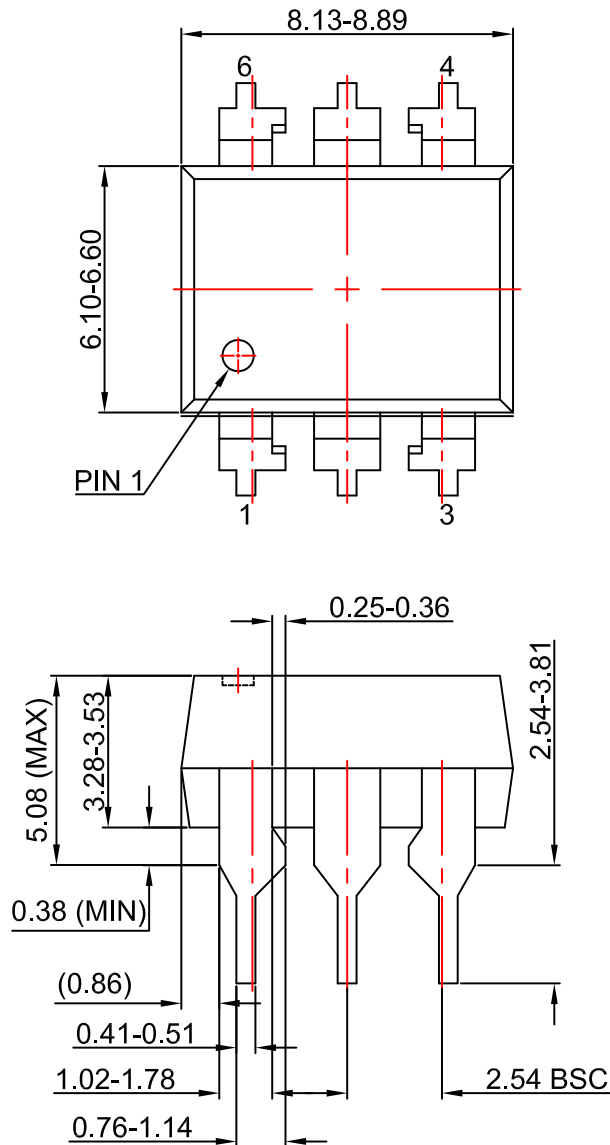
- For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

|                         |                               |                                                                                                                                                                                     |
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CASE 646BZ  
ISSUE O

DATE 31 JUL 2016



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