# H11N1M

# 6-Pin DIP Schmitt Trigger Output Optocoupler

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.

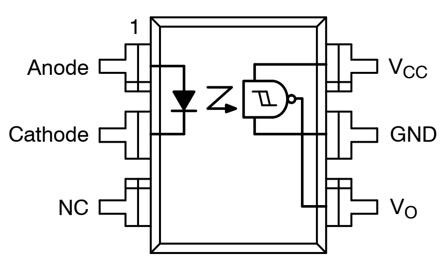
### Features

- 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 $VAC_{RMS}$ 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**




(Top View)

**Truth Table**

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

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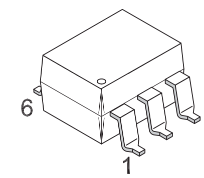
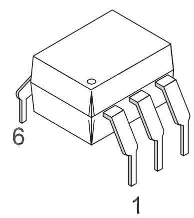
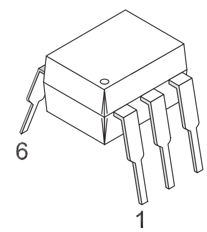



**PDIP6**
**CASE 646BY**

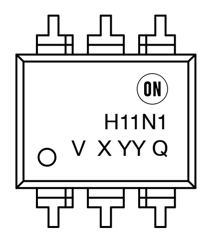



**PDIP6**
**CASE 646BZ**




**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.

**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 $V_{RMS}$ | I–IV |
| | < 300 $V_{RMS}$ | I–IV |
| Climatic Classification | | 55/100/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{PR}$ | Input−to−Output Test Voltage, Method A, $V_{IORM}$ x 1.6 = $V_{PR}$, Type and Sample Test with $t_m$ = 10 s, Partial Discharge < 5 pC | 1360 | $V_{peak}$ |
| | Input−to−Output Test Voltage, Method B, $V_{IORM}$ x 1.875 = $V_{PR}$, 100% Production Test with $t_m$ = 1 s, Partial Discharge < 5 pC | 1594 | $V_{peak}$ |
| $V_{IORM}$ | Maximum Working Insulation Voltage | 850 | $V_{peak}$ |
| $V_{IOTM}$ | Highest Allowable Over−Voltage | 6,000 | $V_{peak}$ |
| | 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 |
| $T_S$ | Case Temperature (Note 1) | 175 | °C |
| $I_{S,INPUT}$ | Input Current (Note 1) | 350 | mA |
| $P_{S,OUTPUT}$ | Output Power (Note 1) | 800 | mW |
| $R_{IO}$ | Insulation Resistance at $T_S$, $V_{IO}$ = 500 V (Note 1) | > $10^9$ | Ω |

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

**Table 2. ABSOLUTE MAXIMUM RATINGS** $T_A$ = 25°C unless otherwise specified.

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| **TOTAL DEVICE** | | | |
| $T_{STG}$ | Storage Temperature | −40 to +125 | °C |
| $T_{OPR}$ | Operating Temperature | −40 to +85 | °C |
| $T_J$ | Junction Temperature | −40 to +125 | °C |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 seconds | °C |
| $P_D$ | Total Device Power Dissipation at 25°C | 210 | mW |
| | Derate above 25°C | 2.94 | mW/°C |
| **EMITTER** | | | |
| $I_F$ | Continuous Forward Current | 30 | mA |
| $V_R$ | Reverse Voltage | 6 | V |
| $I_F$(pk) | Forward Current − Peak (1 μs pulse, 300 pps) | 100 | mA |
| $P_D$ | LED Power Dissipation | 60 | mW |
| **DETECTOR** | | | |
| $P_D$ | 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 |

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.

**Table 3. ELECTRICAL CHARACTERISTICS** $T_A$ = 25°C unless otherwise specified

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

**Table 4. TRANSFER CHARACTERISTICS** $T_A$ = 25°C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $I_{CC(on)}$ | Supply Current | $I_F$ = 10 mA, $V_{CC}$ = 5 V | | 6.5 | 10.0 | mA |
| $V_{OL}$ | Output Voltage, Low | $R_L$ = 270 Ω, $V_{CC}$ = 5 V, $I_F$ = $I_{F(on)}$ Maximum | | | 0.5 | V |
| $I_{F(on)}$ | Turn−On Threshold Current | $R_L$ = 270 Ω, $V_{CC}$ = 5 V (Note 2) | 0.8 | | 3.2 | mA |
| $I_{F(off)}$ | Turn−Off Threshold Current | $R_L$ = 270 Ω, $V_{CC}$ = 5 V | 0.3 | | | mA |
| $I_{F(off)}$ / $I_{F(on)}$ | Hysteresis Ratio | $R_L$ = 270 Ω, $V_{CC}$ = 5 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 pF, $t_P$ = 1 μs, $R_E$ = (Note 3), Figure 7 | | 100 | 330 | ns |
| $t_r$ | Rise Time | C = 120 pF, $t_P$ = 1 μs, $R_E$ = (Note 3), Figure 7 | | 7.5 | | ns |
| $t_{off}$ | Turn−Off Time | C = 120 pF, $t_P$ = 1 μs, $R_E$ = (Note 3), Figure 7 | | 150 | 330 | ns |
| $t_f$ | Fall Time | C = 120 pF, $t_P$ = 1 μs, $R_E$ = (Note 3), 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 Minute | 4170 | | | $VAC_{RMS}$ |
| $C_{ISO}$ | Isolation Capacitance | $V_{I-O}$ = 0 V, f = 1 MHz | | 0.4 | 0.6 | pF |
| $R_{ISO}$ | Isolation Resistance | $V_{I-O}$ = ±500 VDC, $T_A$ = 25°C | $10^{11}$ | | | Ω |

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 $I_{F(on)}$ 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.
3. H11N1: $R_E$ = 910 Ω

## TYPICAL CHARACTERISTICS

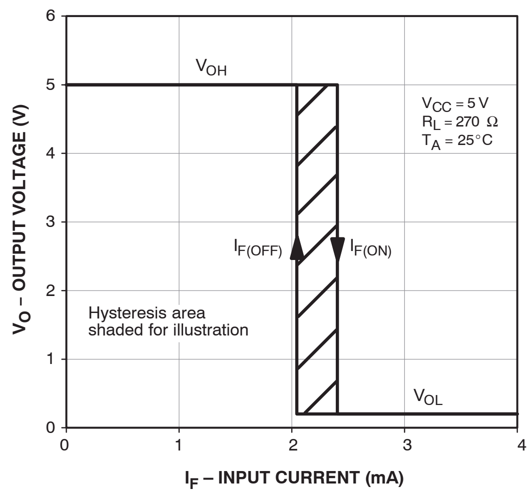



**Figure 1. Transfer Characteristics**

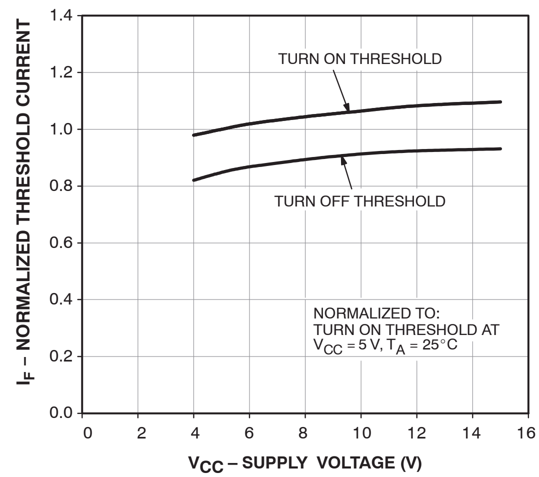



**Figure 2. Threshold Current vs. Supply Voltage**

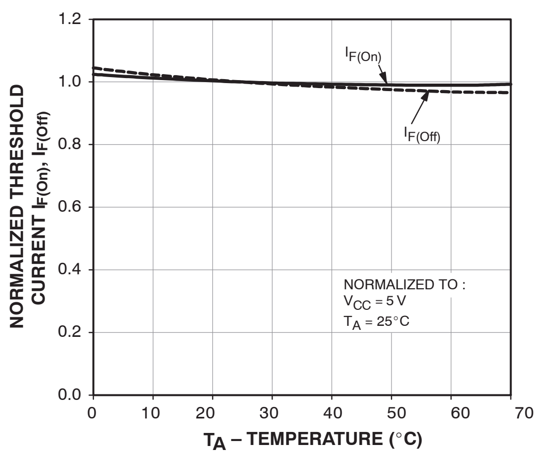



**Figure 3. Threshold Current vs. Temperature**

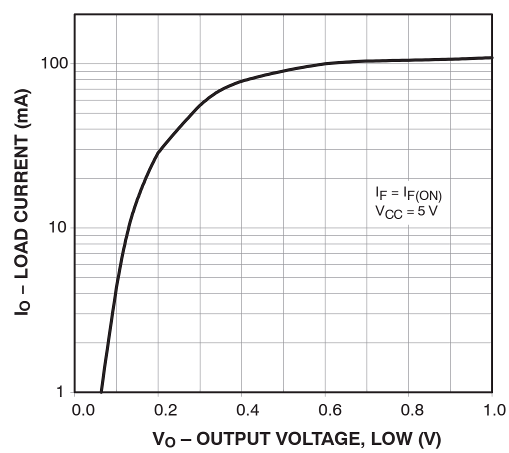



**Figure 4. Load Current vs. Output Voltage**

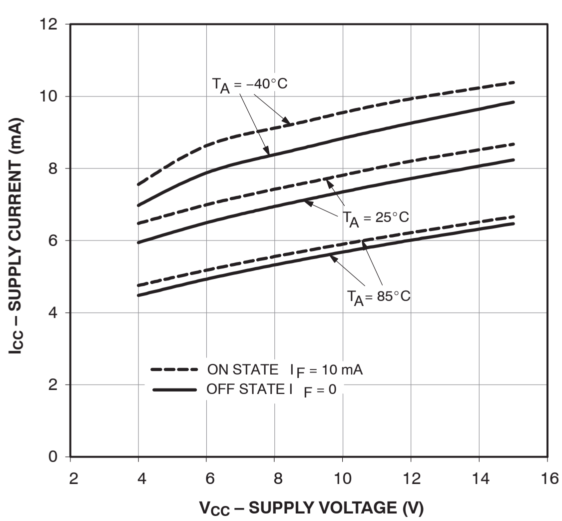



**Figure 5. Supply Current vs. Supply Voltage**

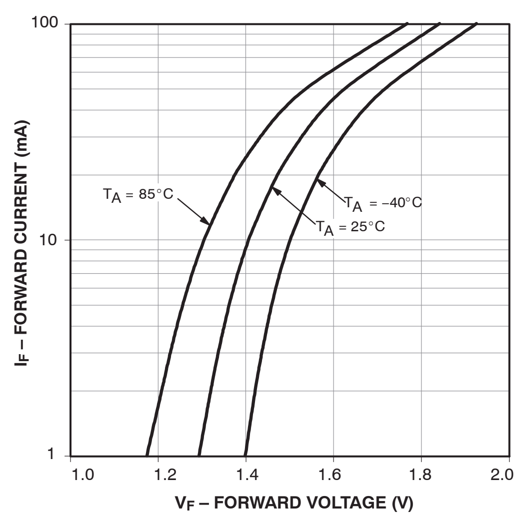



**Figure 6. LED Forward Current vs. Forward Voltage**

## TEST CIRCUIT

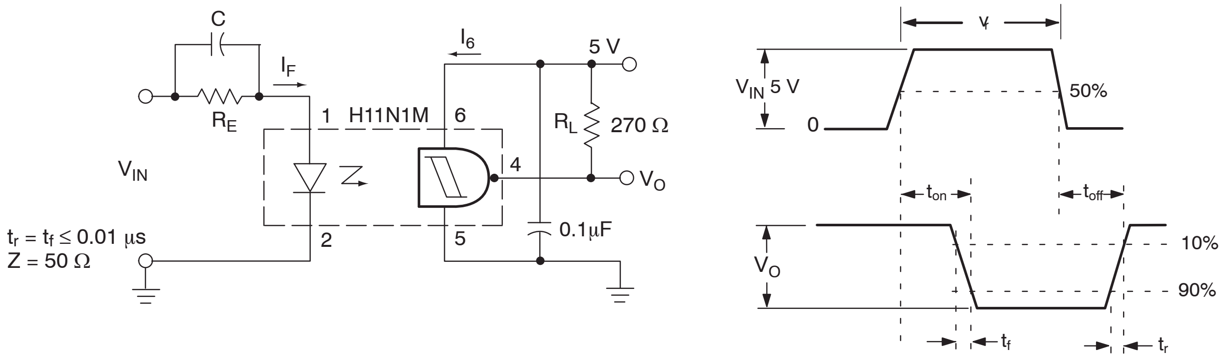



**Figure 7. Switching Test Circuit and Waveforms**

## REFLOW PROFILE

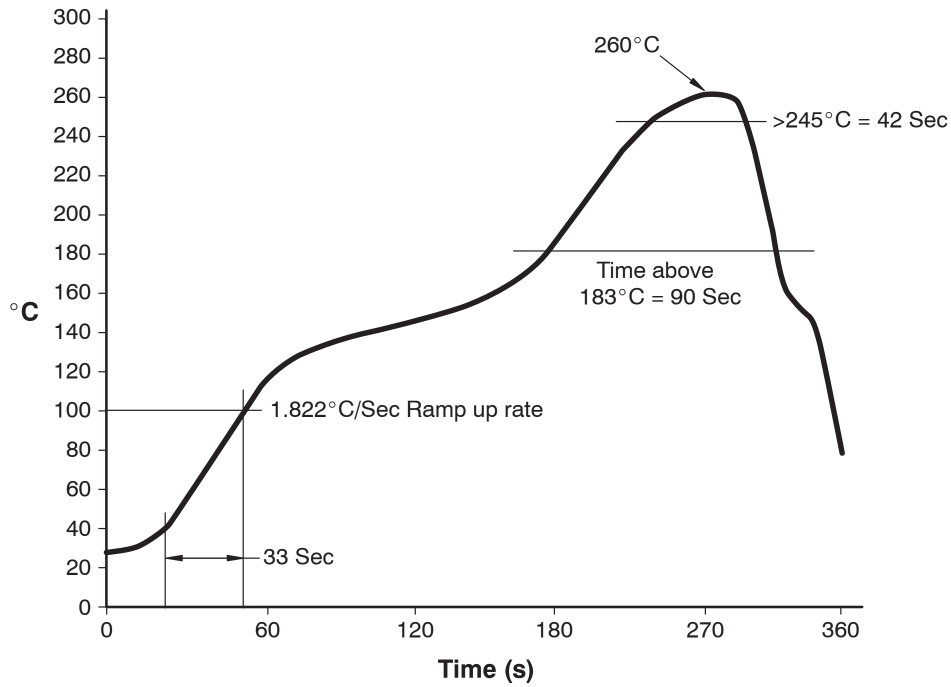


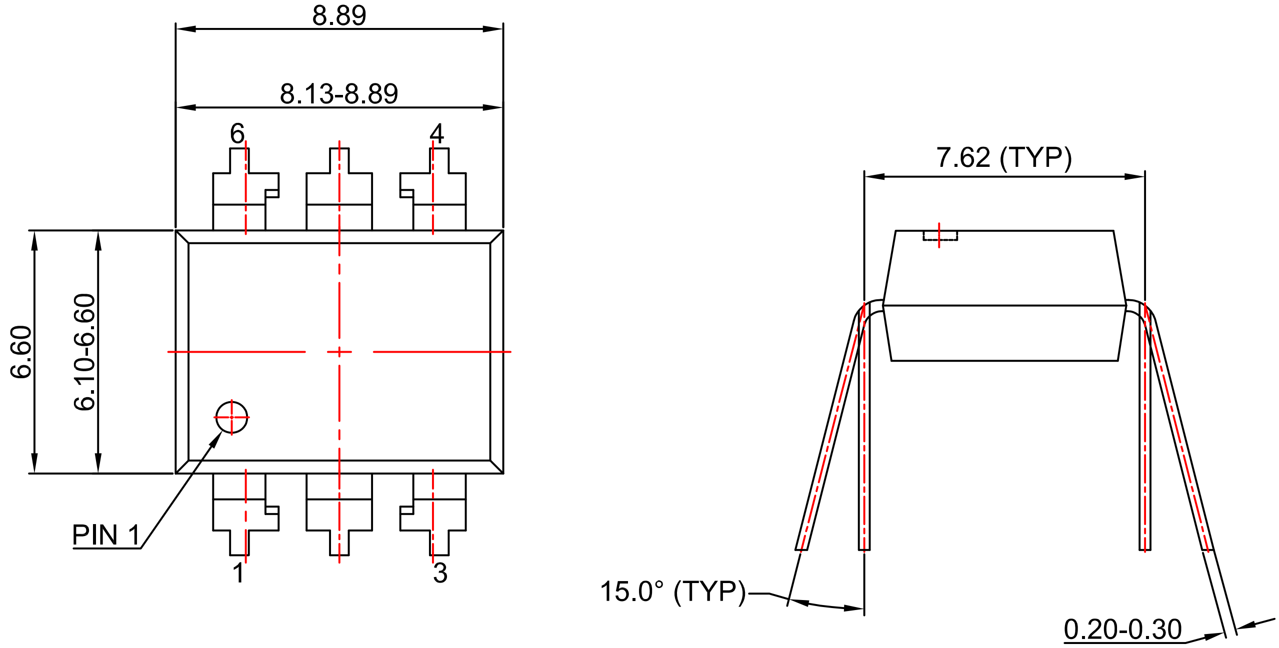

**Figure 8. Reflow Profile**

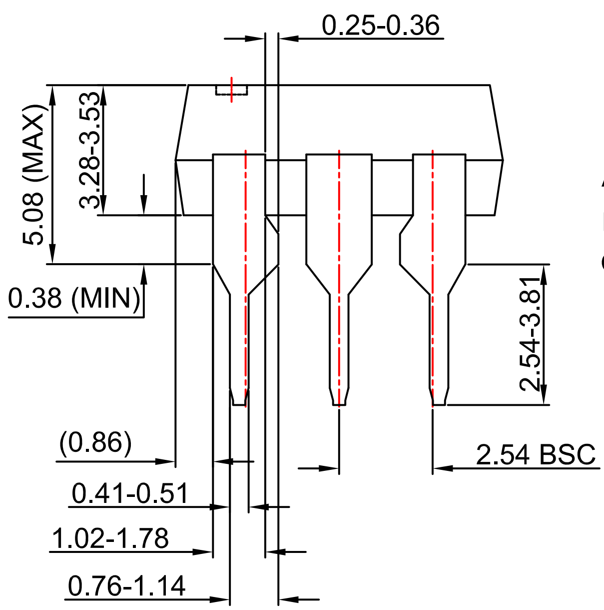
### ORDERING INFORMATION

| 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) |

## PACKAGE DIMENSIONS

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




NOTES:

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B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

## PACKAGE DIMENSIONS

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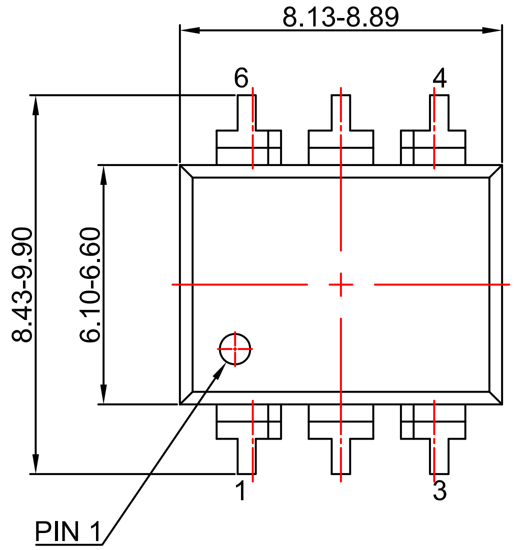
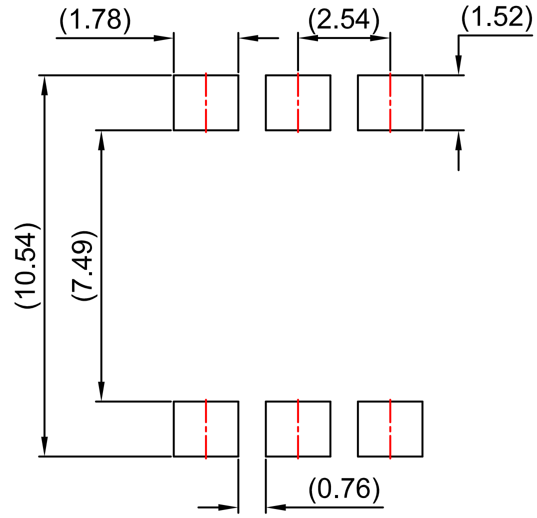
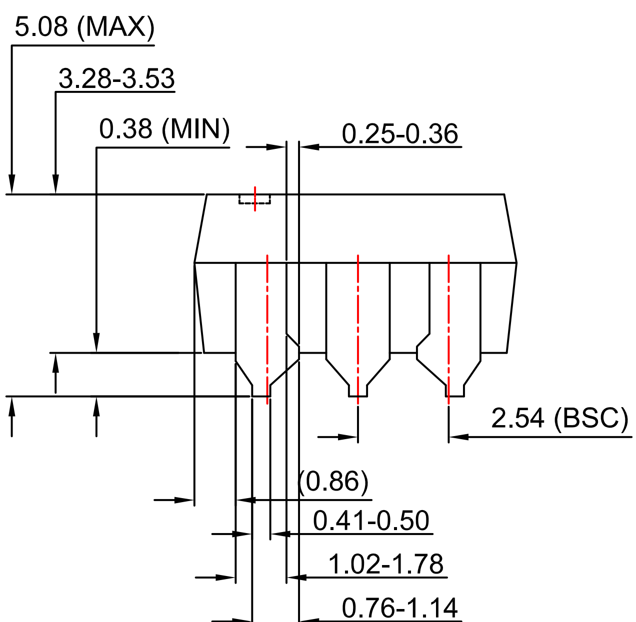
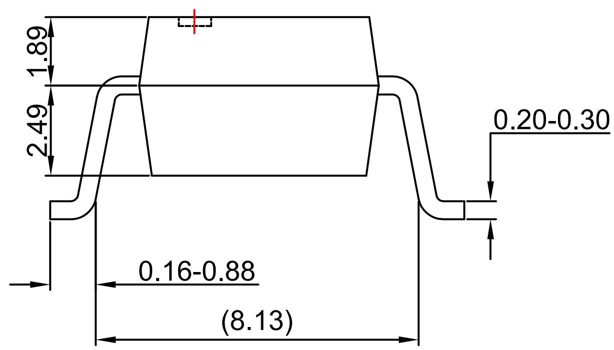
CASE 646BY
ISSUE O




LAND PATTERN RECOMMENDATION

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## PACKAGE DIMENSIONS

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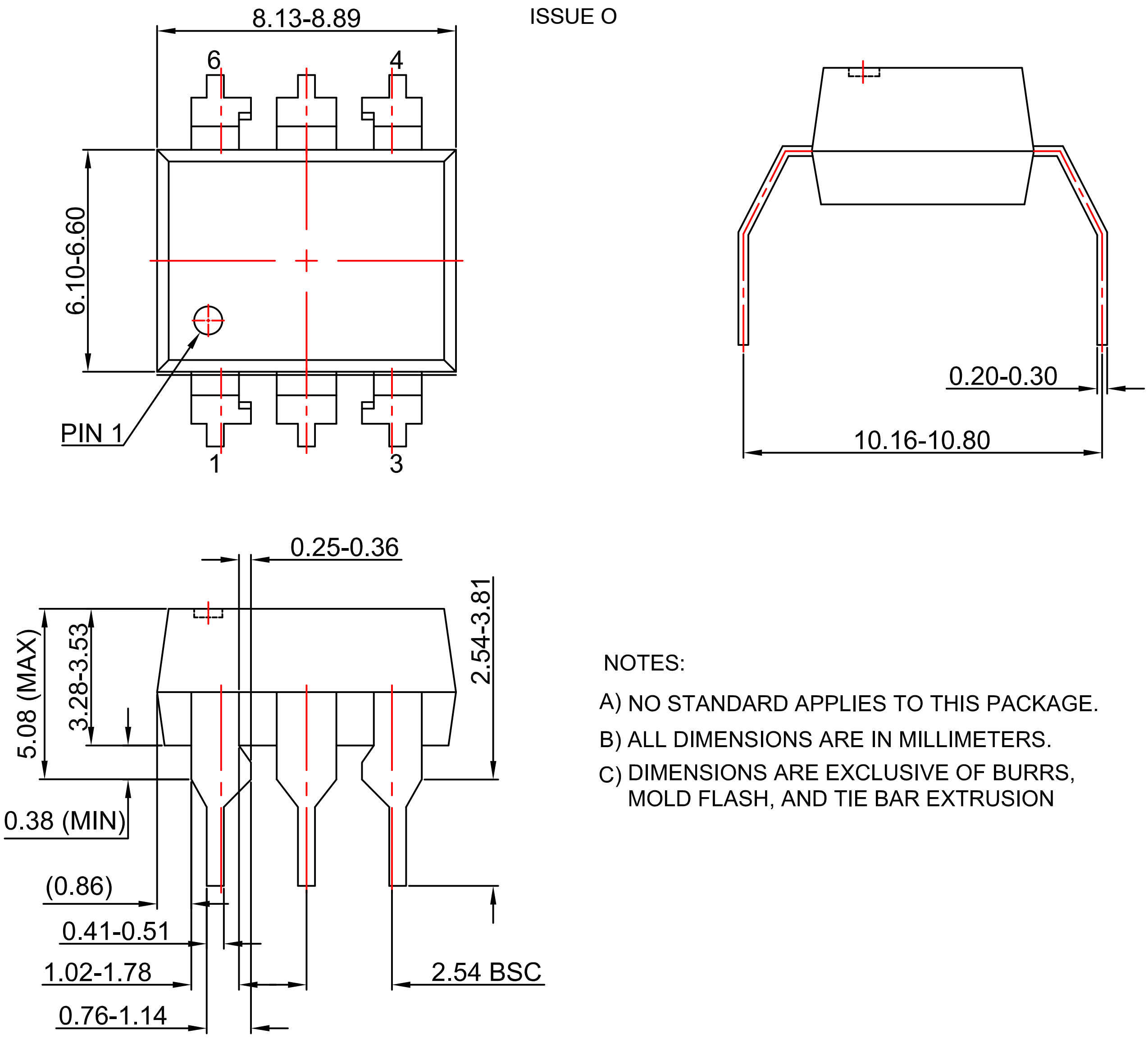
CASE 646BZ
ISSUE O

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