



October 2014

H11N1M, H11N2M, H11N3M — 6-Pin DIP Schmitt Trigger Output Optocoupler

# H11N1M, H11N2M, H11N3M 6-Pin DIP Schmitt Trigger Output Optocoupler

## 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

## Description

The H11NXM series 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.

## Schematic

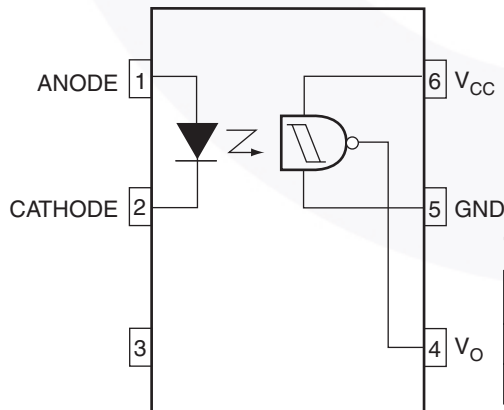


Figure 1. Schematic

### Truth Table

Input	Output
H	L
L	H

## Package Outlines

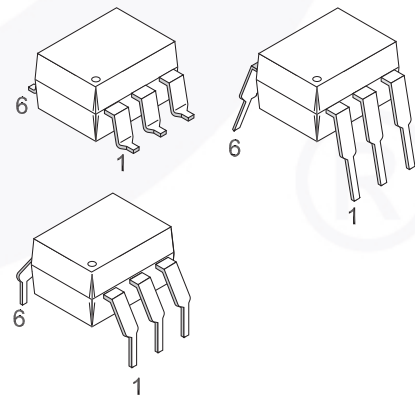


Figure 2. Package Outlines

## 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	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 <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	350	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	800	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

**Note:**

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

## 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>			
$T_{\text{STG}}$	Storage Temperature	-40 to +125	$^\circ\text{C}$
$T_{\text{OPR}}$	Operating Temperature	-40 to +85	$^\circ\text{C}$
$T_J$	Junction Temperature	-40 to +125	$^\circ\text{C}$
$T_{\text{SOL}}$	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation at $25^\circ\text{C}$	210	mW
	Derate Above $25^\circ\text{C}$	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
$V_{\text{CC}}$	$V_{65}$ 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		1.4	2.0	V
		$I_F = 0.3 \text{ mA}$		0.75	1.25		
$I_R$	Reverse Current	$V_R = 5 \text{ V}$	All			10	$\mu\text{A}$
$C_J$	Capacitance	$V = 0, f = 1.0 \text{ MHz}$	All			100	pF
<b>Detector</b>							
$V_{\text{CC}}$	Operating Voltage Range		All	4		15	V
$I_{\text{CC(off)}}$	Supply Current	$I_F = 0, V_{\text{CC}} = 5 \text{ V}$	All		6	10	mA
$I_{\text{OH}}$	Output Current, High	$I_F = 0, V_{\text{CC}} = V_O = 15 \text{ V}$	All			100	$\mu\text{A}$

**Electrical Characteristics** (Continued) $T_A = 25^\circ\text{C}$  unless otherwise specified.**Transfer Characteristics**

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Units
$I_{CC(on)}$	Supply Current	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}$	All		6.5	10.0	mA
$V_{OL}$	Output Voltage, Low	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(on)}\text{ Maximum}$	All			0.5	V
$I_{F(on)}$	Turn-On Threshold Current	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}^{(2)}$	H11N1M	0.8		3.2	mA
			H11N2M	2.3		5.0	
			H11N3M	4.1		10.0	
$I_{F(off)}$	Turn-Off Threshold Current	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.3			mA
$I_{F(off)} / I_{F(on)}$	Hysteresis Ratio	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.65		0.95	

**Switching Speed**

Symbol	AC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Units
$t_{on}$	Turn-On Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$ , Figure 9	All		100	330	ns
$t_r$	Rise Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$ , Figure 9	All		7.5		ns
$t_{off}$	Turn-Off Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$ , Figure 9	All		150	330	ns
$t_f$	Fall Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$ , Figure 9	All		12		ns
	Data Rate		All		5		MHz

**Isolation Characteristics**

Symbol	Parameters	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	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

**Notes:**

- 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.
- H11N1:  $R_E = 910\ \Omega$ , H11N2:  $R_E = 560\ \Omega$ , H11N3:  $R_E = 240\ \Omega$

Typical Performance Curves

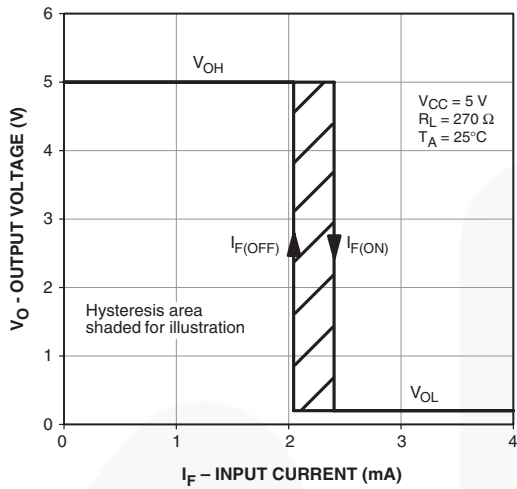


Figure 3. Transfer Characteristics

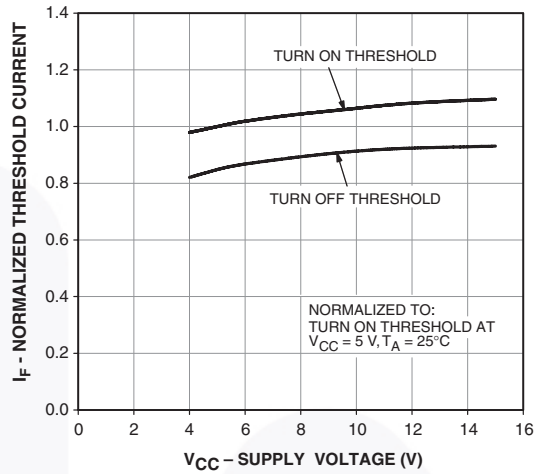


Figure 4. Threshold Current vs. Supply Voltage

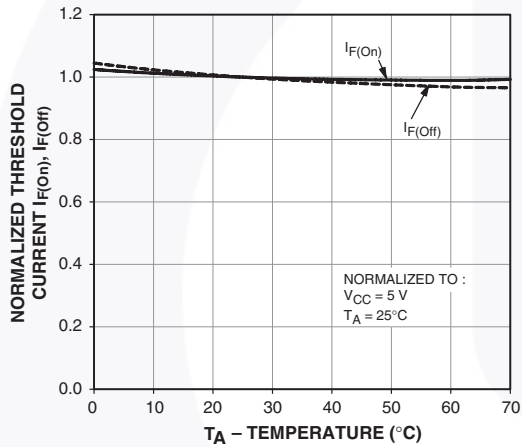


Figure 5. Threshold Current vs. Temperature

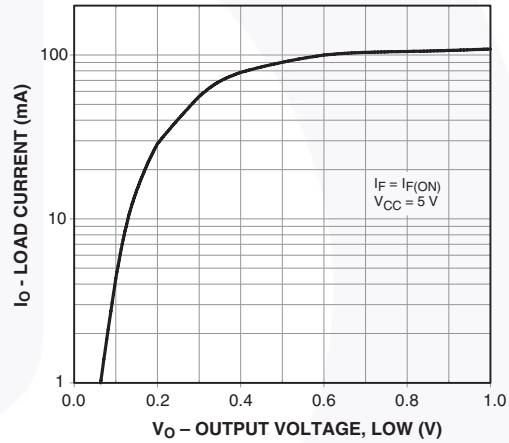


Figure 6. Load Current vs. Output Voltage

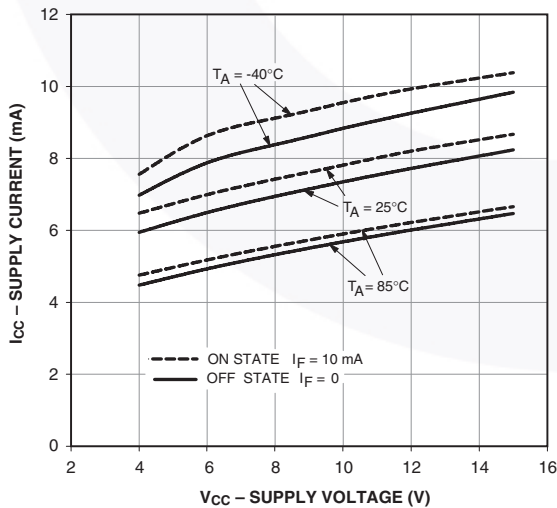


Figure 7. Supply Current vs. Supply Voltage

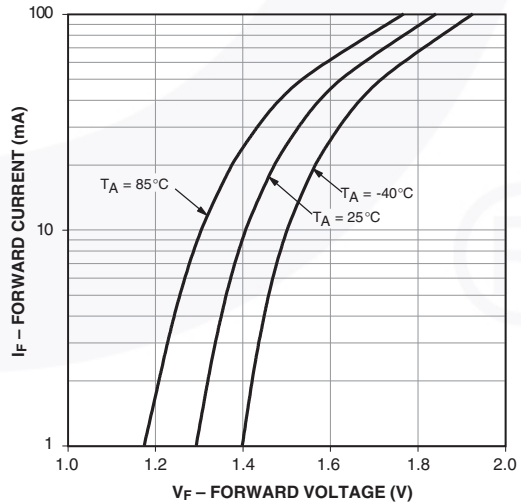


Figure 8. LED Forward Current vs. Forward Voltage

### Switching Test Circuit and Waveforms

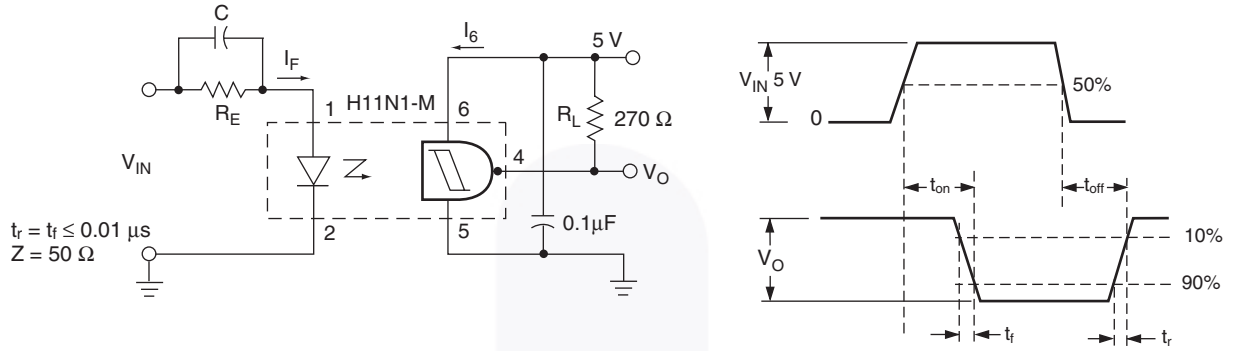


Figure 9. Switching Test Circuit and Waveforms

### Reflow Profile

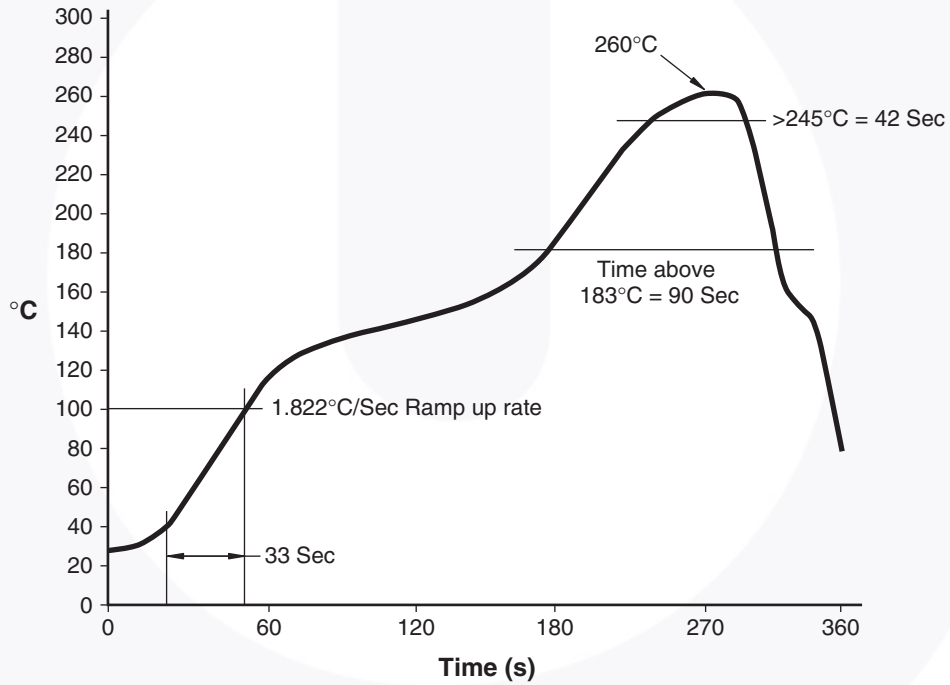


Figure 10. Reflow Profile

## 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)

**Note:**

4. The product orderable part number system listed in this table also applies to the H11N2M and H11N3M product families.

## Marking Information

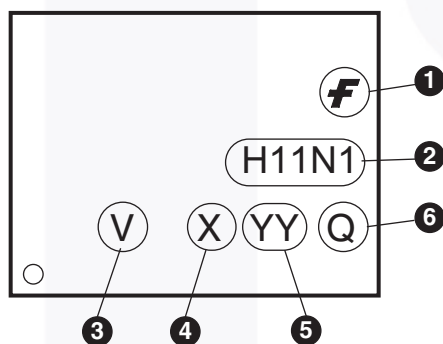
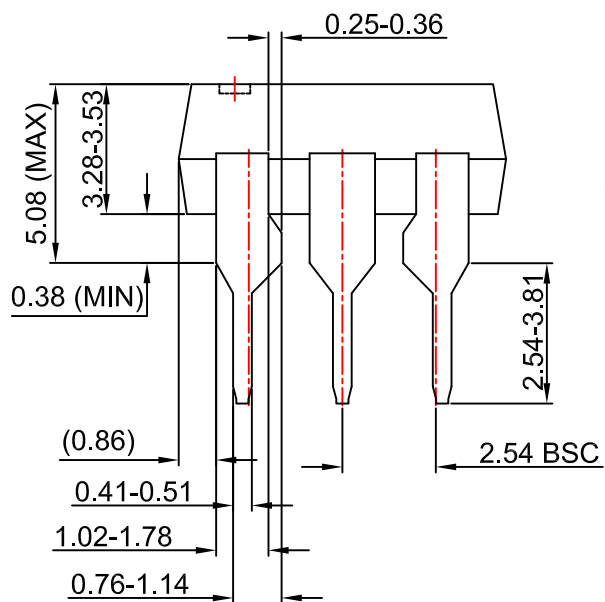
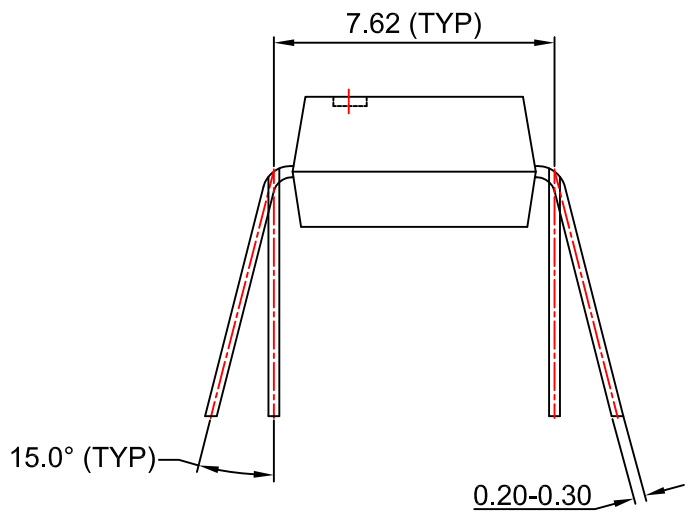
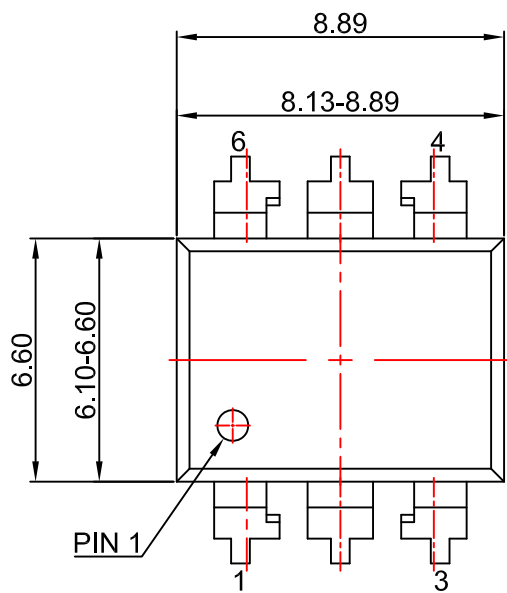


Figure 11. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code

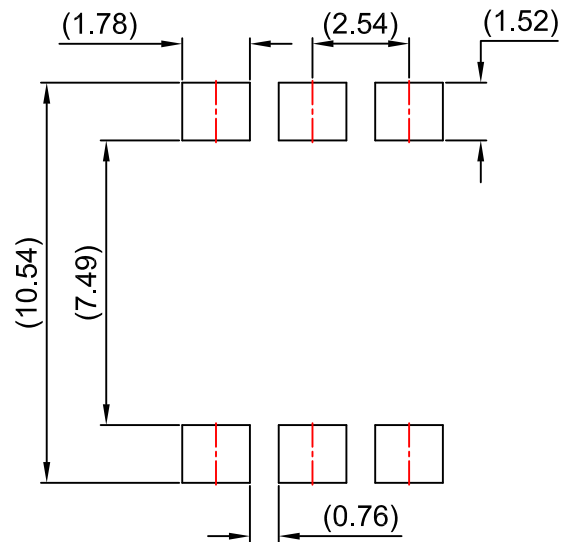
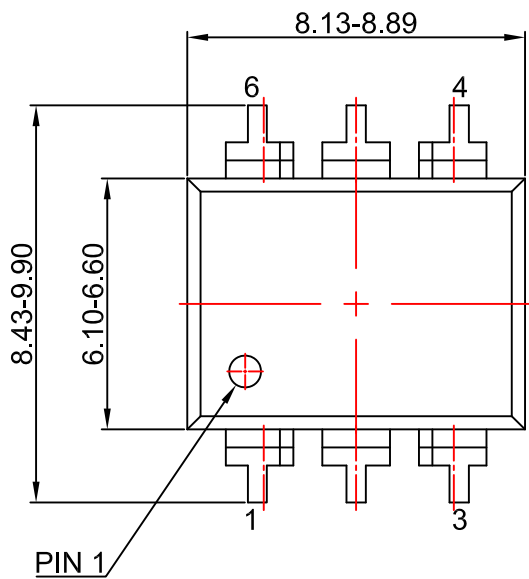


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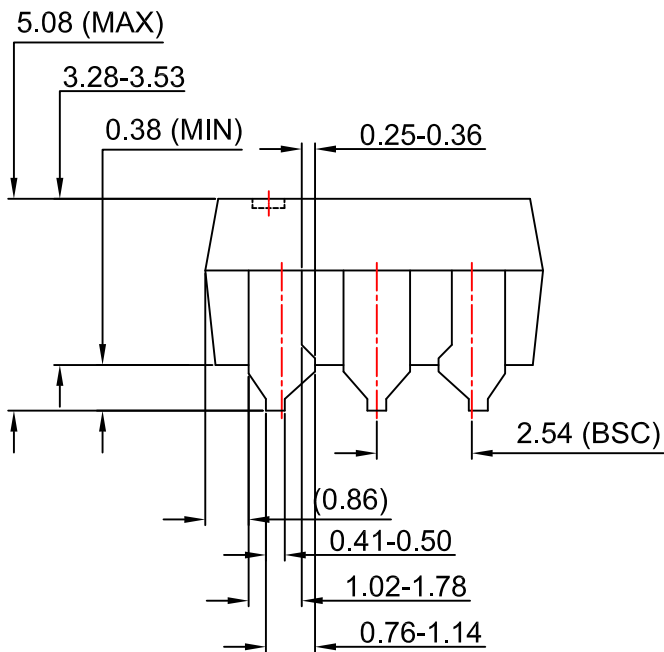
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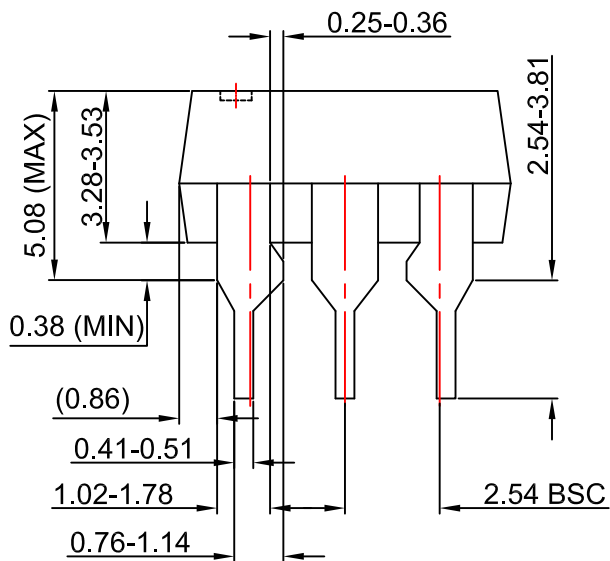
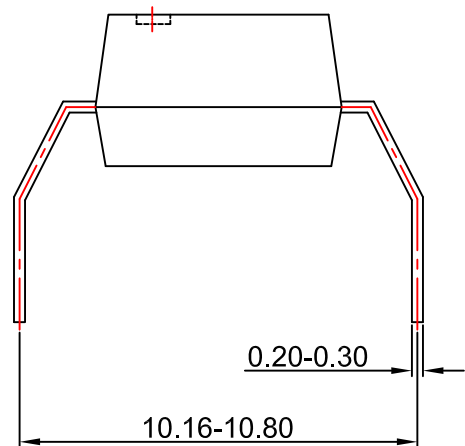
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| ESBC™                    | MicroPak2™                                     | STEALTH™                              | UniFET™          |
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