

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.

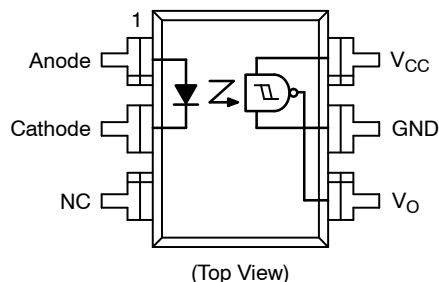
Features

- 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_{RMS} for 1 Minute
 - ♦ DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Applications

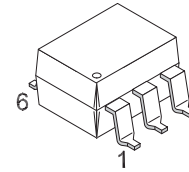
- Logic-to-Logic Isolator
- Programmable Current Level Sensor
- Line Receiver – Eliminate Noise and Transient Problems
- AC to TTL Conversion – Square Wave Shaping
- Interfaces Computers with Peripherals
- Isolated Power MOS Driver for Power Supplies

SCHEMATIC

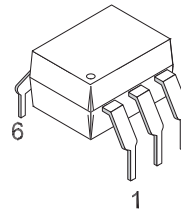


Truth Table

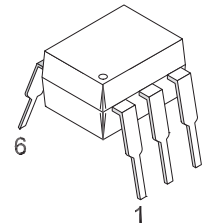
Input	Output
H	L
L	H



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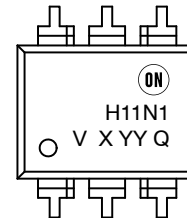


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MARKING DIAGRAM



- 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 _{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} × 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} × 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
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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.

H11N1M

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
EMITTER						
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	μA
C_J	Capacitance	$V = 0\text{ V}, f = 1.0\text{ MHz}$			100	pF
DETECTOR						
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	μA

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_{ACRMS}
C_{ISO}	Isolation Capacitance	$V_{\text{I-O}} = 0\text{ V}, f = 1\text{ MHz}$		0.4	0.6	pF
R_{ISO}	Isolation Resistance	$V_{\text{I-O}} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	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.

- 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

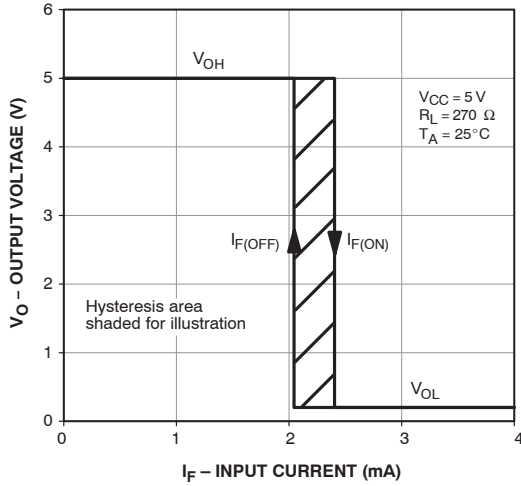


Figure 1. Transfer Characteristics

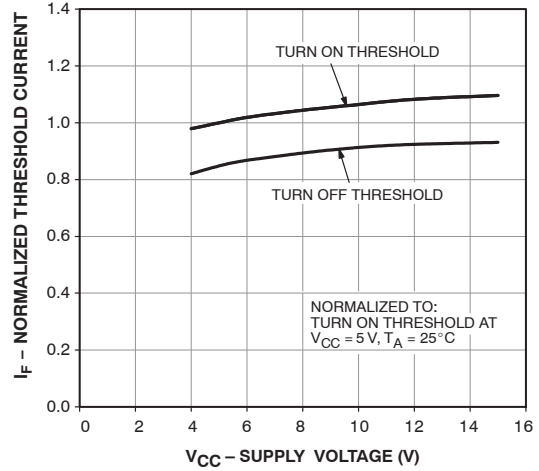


Figure 2. Threshold Current vs. Supply Voltage

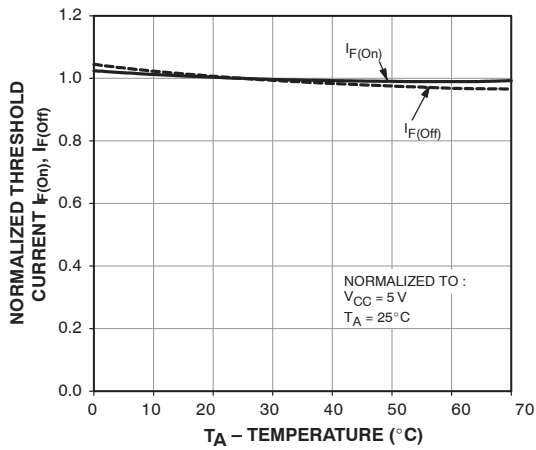


Figure 3. Threshold Current vs. Temperature

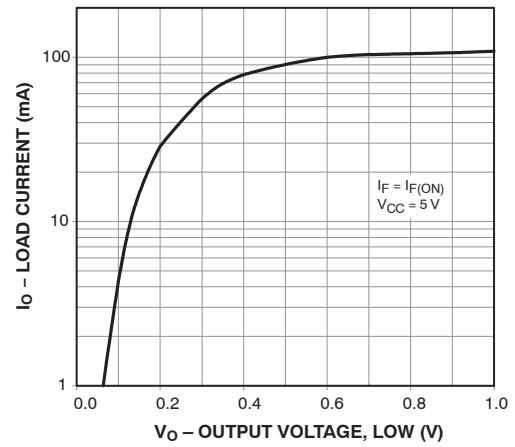


Figure 4. Load Current vs. Output Voltage

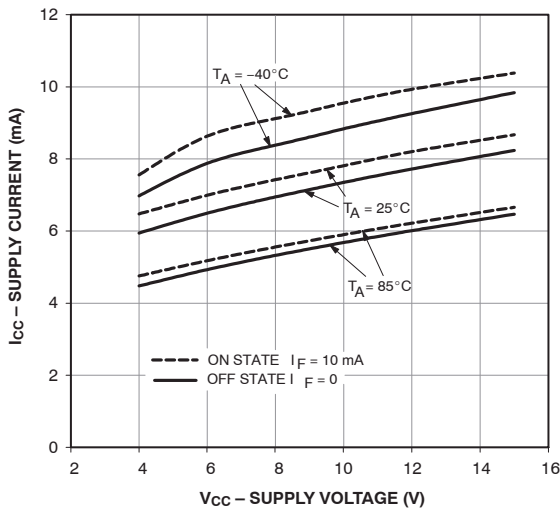


Figure 5. Supply Current vs. Supply Voltage

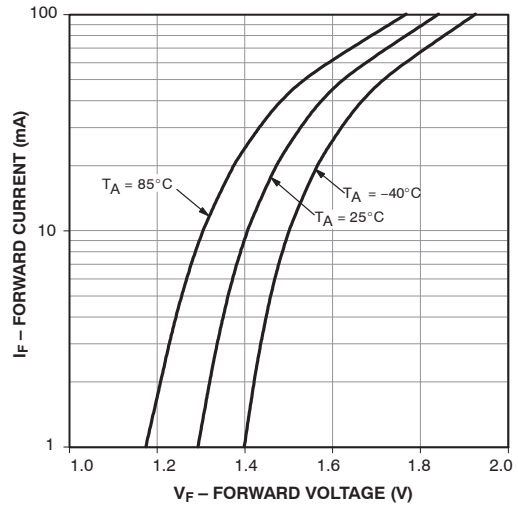


Figure 6. LED Forward Current vs. Forward Voltage

H11N1M

TEST CIRCUIT

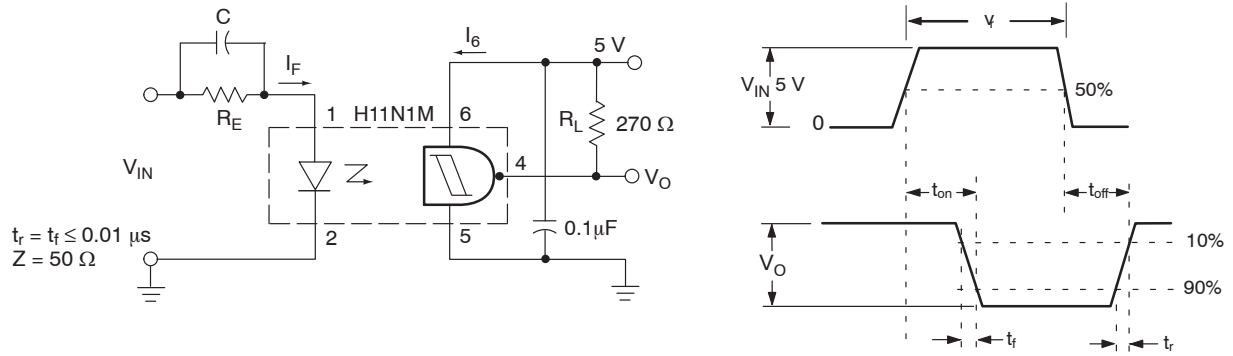


Figure 7. Switching Test Circuit and Waveforms

REFLOW PROFILE

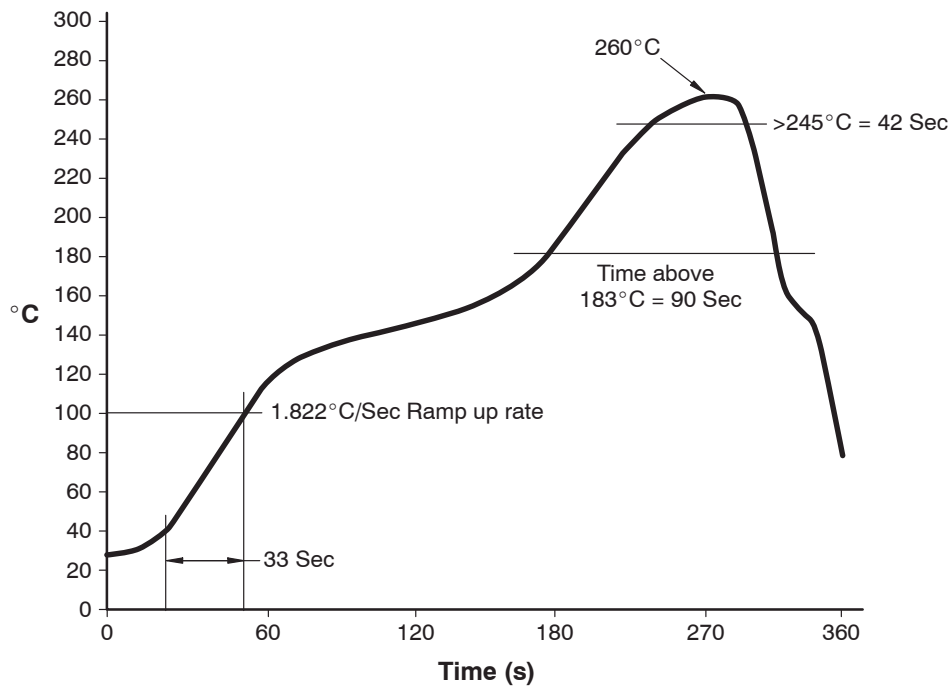


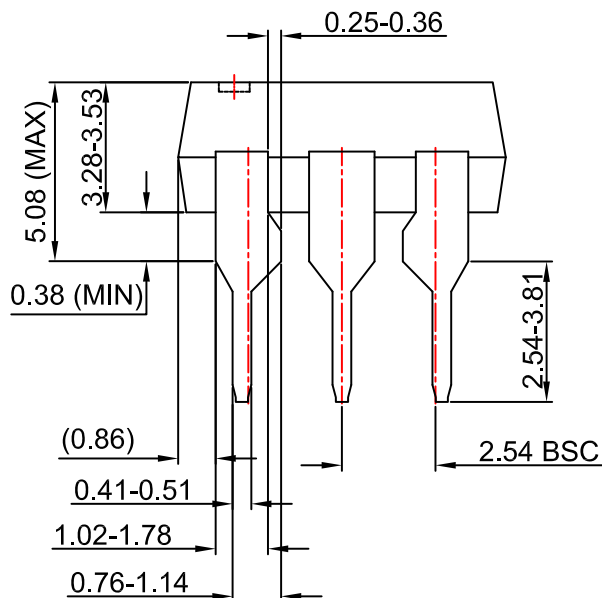
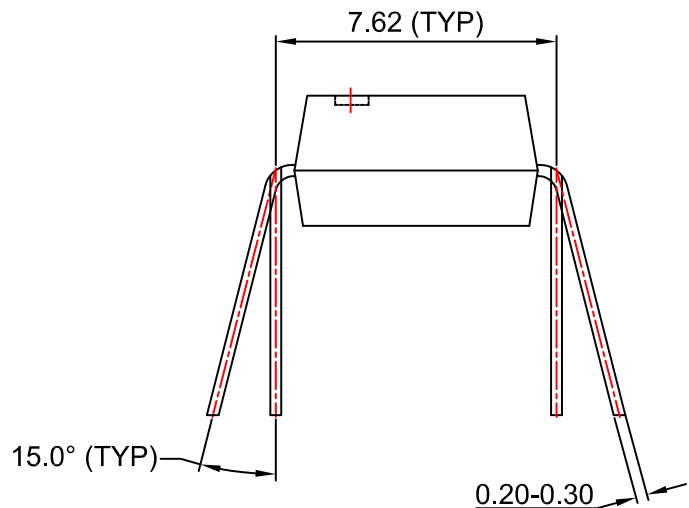
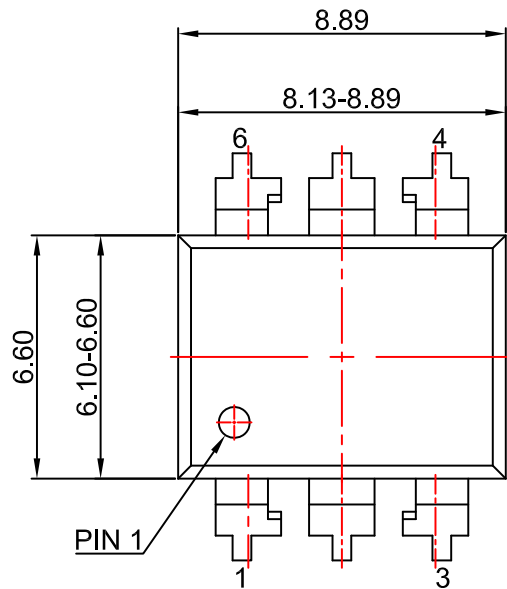
Figure 8. Reflow Profile

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)

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NOTES:

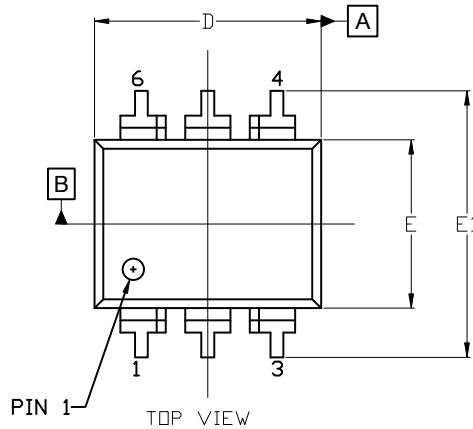
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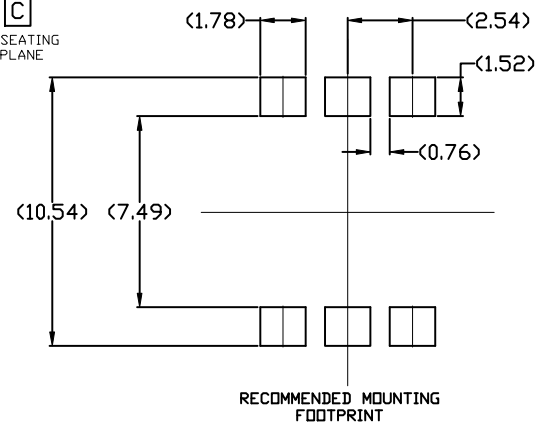
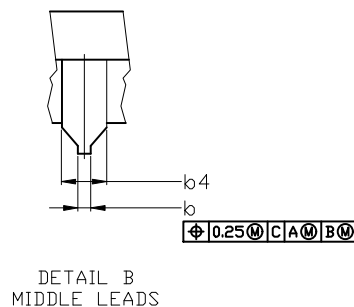
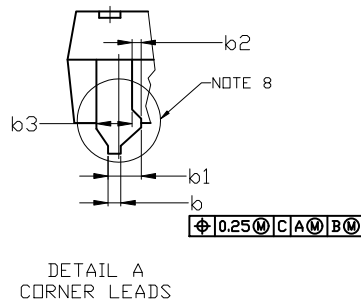
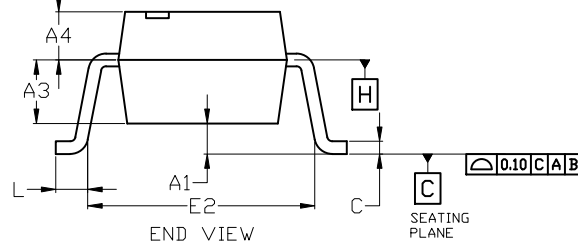
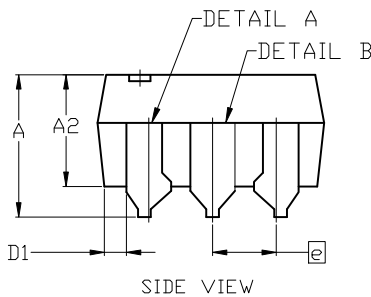
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NOTES:

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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



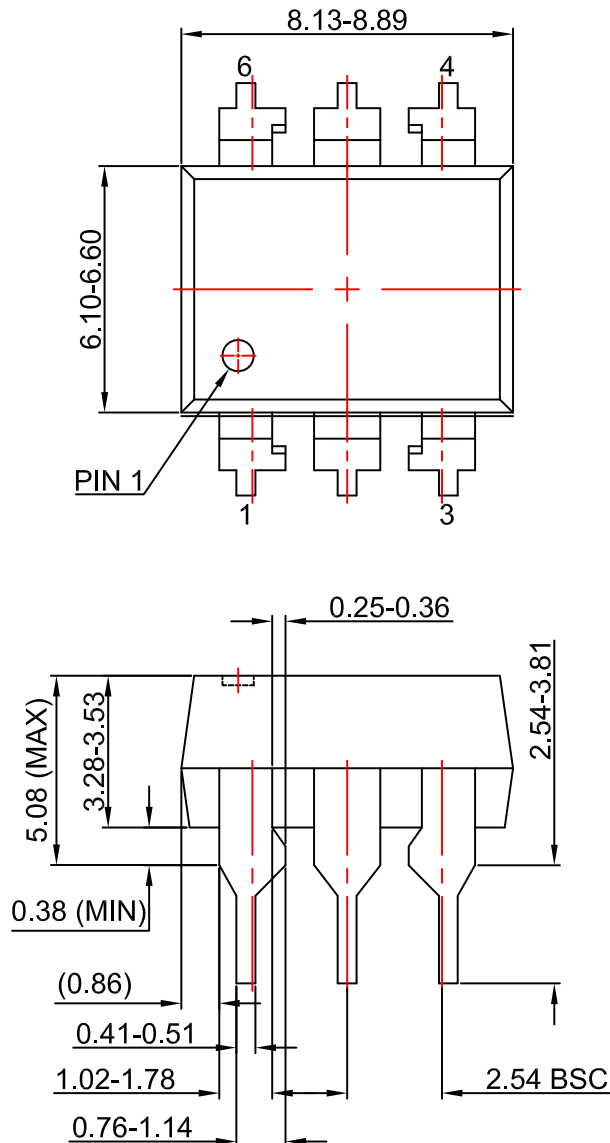
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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