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April 2015

H11AG1M
6-Pin DIP Phototransistor Optocoupler

Features

- High-Efficiency Low-Degradation Liquid Epitaxial IRED
- Logic Level Compatible, Input and Output Currents, with CMOS and LS/TTL
- High DC Current Transfer Ratio at Low Input Currents (as low as 200 µA)
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Applications

- CMOS Driven Solid State Reliability
- Telephone Ring Detector
- Digital Logic Isolation

Description

The H11AG1M device consists of a Gallium-Aluminum-Arsenide IRED emitting diode coupled with a silicon phototransistor in a dual in-line package. This device provides the unique feature of high current transfer ratio at both low output voltage and low input current. This makes it ideal for use in low-power logic circuits, telecommunications equipment and portable electronics isolation applications.

Schematic

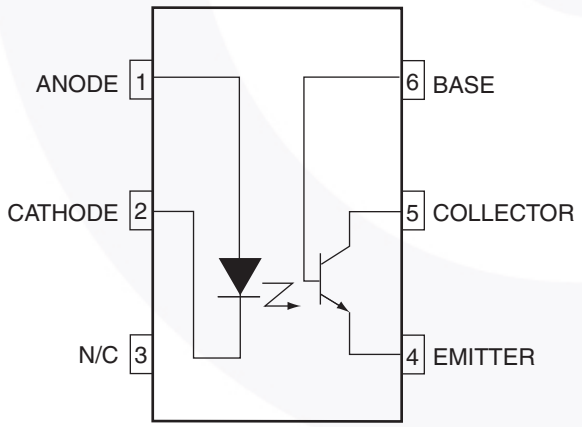


Figure 1. Schematic

Package Outlines

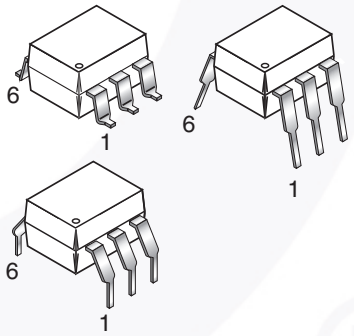


Figure 2. Package Outlines

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_{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	6000	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(1)	175	°C
$I_{S,INPUT}$	Input Current(1)	350	mA
$P_{S,OUTPUT}$	Output Power(1)	800	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V(1)	> 10^9	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.

Symbol	Parameters	Value	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ 25°C (LED plus detector)	225	mW
	Derate Linearly From 25°C	3.5	mW/°C
EMITTER			
I_F	Continuous Forward Current	50	mA
V_R	Reverse Voltage	6	V
$I_F(pk)$	Forward Current – Peak (1 µs pulse, 300 pps)	3.0	A
P_D	LED Power Dissipation @ 25°C	75	mW
	Derate Linearly From 25°C	1.0	mW/°C
DETECTOR			
I_C	Continuous Collector Current	50	mA
P_D	Detector Power Dissipation @ 25°C	150	mW
	Derate Linearly From 25°C	2.0	mW/°C

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
EMITTER						
V_F	Input Forward Voltage	I_F = 1 mA		1.25	1.50	V
I_R	Reverse Leakage Current	V_R = 5 V, T_A = 25°C			10	µA
C_J	Capacitance	V = 0, f = 1.0 MHz			100	pF
DETECTOR						
BV_{CEO}	Breakdown Voltage, Collector-to-Emitter	I_C = 1.0 mA, I_F = 0	30			V
BV_{CBO}	Breakdown Voltage, Collector-to-Base	I_C = 100 µA, I_F = 0	70			V
BV_{ECO}	Breakdown Voltage, Emitter-to-Collector	I_C = 100 µA, I_F = 0	7			V
I_{CEO}	Leakage Current, Collector-to-Emitter	V_{CE} = 10 V, I_F = 0		5	10	µA
C_{CE}	Capacitance	V_{CE} = 10 V, f = 1 MHz		10		pF

Transfer Characteristics

Symbol	Characteristics	Test Conditions	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS						
CTR	Current Transfer Ratio	I_F = 1 mA, V_{CE} = 5 V	300			%
		I_F = 1 mA, V_{CE} = 0.6 V	100			%
		I_F = 0.2 mA, V_{CE} = 1.5 V	100			%
$V_{CE(SAT)}$	Saturation Voltage	I_F = 2.0 mA, I_C = 0.5 mA			0.40	V
AC CHARACTERISTICS (Non-Saturated Switching Times)						
t_{on}	Turn-On Time	R_L = 100 Ω, I_F = 1 mA, V_{CC} = 5 V		5		µs
t_{off}	Turn-Off Time	R_L = 100 Ω, I_F = 1 mA, V_{CC} = 5 V		5		µs

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	t = 1 Minute	4170			VAC_{RMS}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, f = 1 MHz		0.2		pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}			Ω

Typical Performance Curves

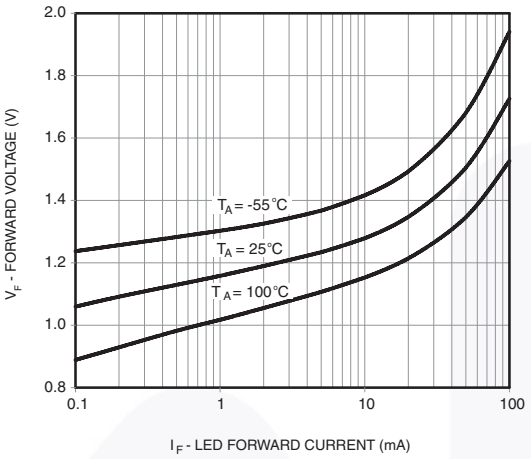


Figure 3. LED Forward Voltage vs. Forward Current

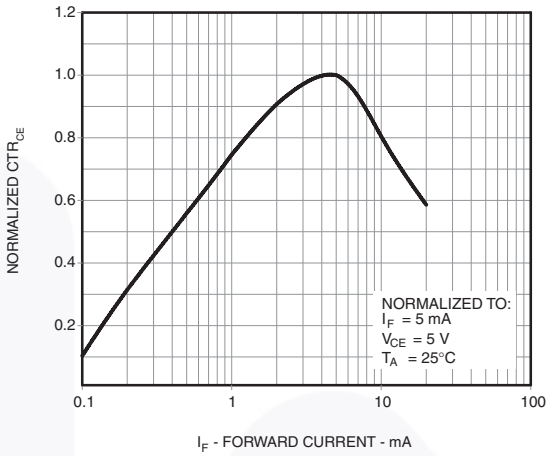


Figure 4. Normalized Current Transfer Ratio vs. Forward Current

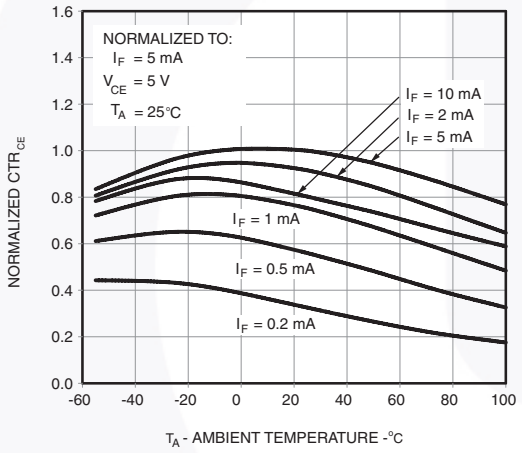


Figure 5. Normalized CTR vs. Temperature

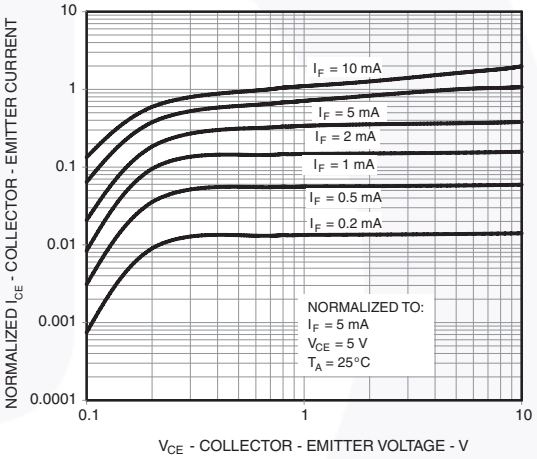


Figure 6. Normalized Collector vs. Collector-Emitter Voltage

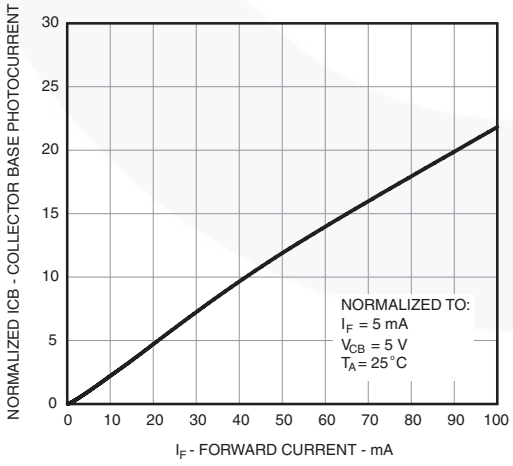


Figure 7. Normalized Collector-Base Photocurrent Ratio vs. Forward Current

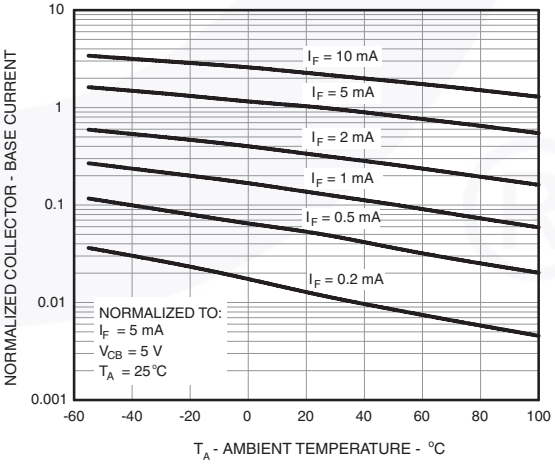


Figure 8. Normalized Collector-Base Current vs. Temperature

Typical Performance Curves (Continued)

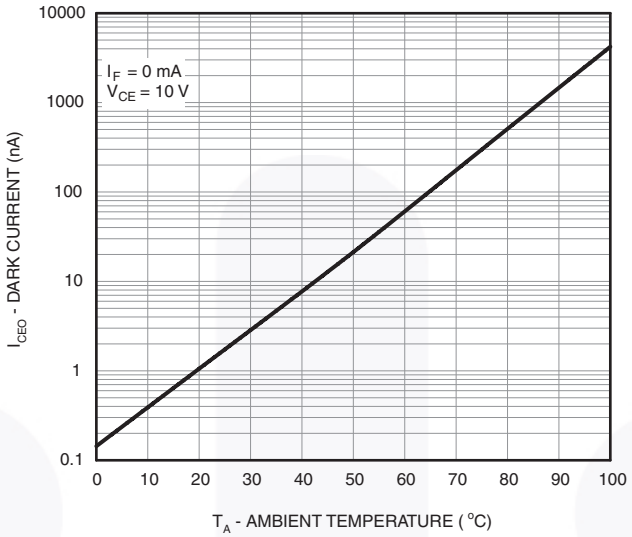
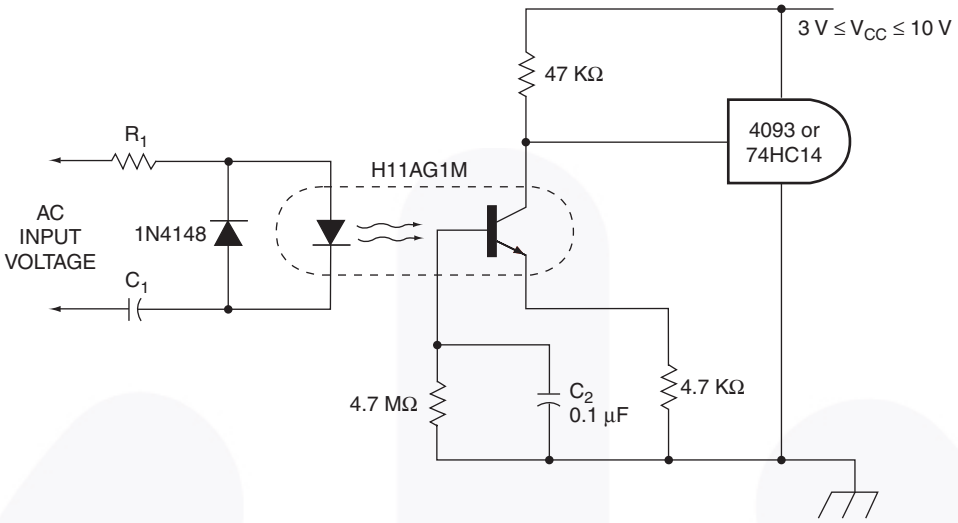


Figure 9. Collector-Emitter Dark Current vs. Ambient Temperature

Typical Application



Input	R1	C1	Z
40-90 VAC_{RMS} 20 Hz	75 KΩ 1/10 W	0.1 µF 100 V	109 KΩ
95-135 VAC_{RMS} 60 Hz	180 KΩ 1/10 W	12 nF 200 V	285 KΩ
200-280 VAC_{RMS} 50/60 Hz	390 KΩ 1/4 W	6.80 nF 400 V	550 KΩ

DC component of input voltage is ignored due to C1

The H11AG1M uses less input power than the neon bulb traditionally used to monitor telephone and line voltages. Additionally. response time can be tailored to ignore telephone dial tap, switching transients and other undesired signals by modifying the value of C2. The high impedance to line voltage also can simply board layout spacing requirements.

Figure 10. Telephone Ring Detector / A.C. Line CMOS Input Isolator

Reflow Profile

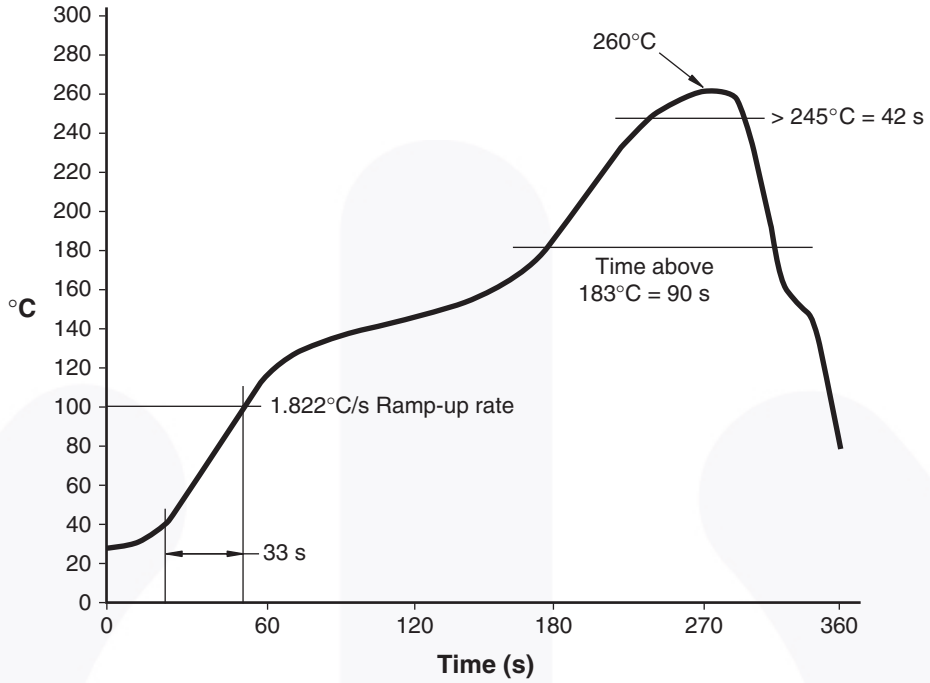


Figure 11. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
H11AG1M	DIP 6-Pin	Tube (50 Units)
H11AG1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11AG1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11AG1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AG1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AG1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11AG1TVM	DIP 6-Pin, 0.4” Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Marking Information

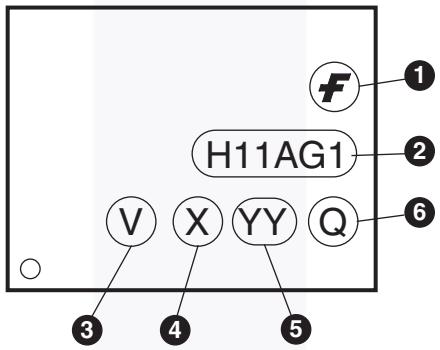
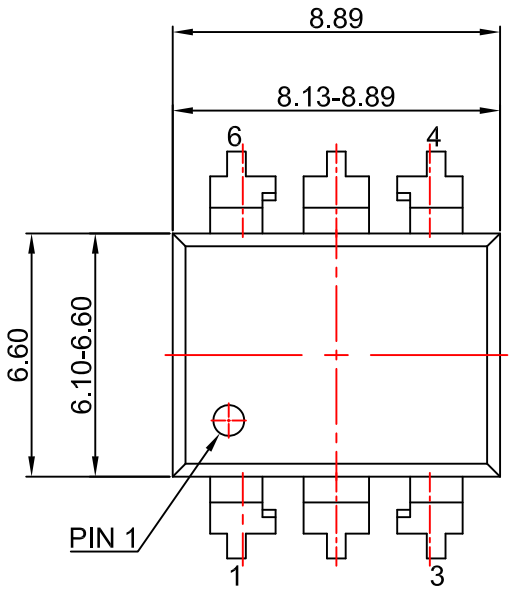
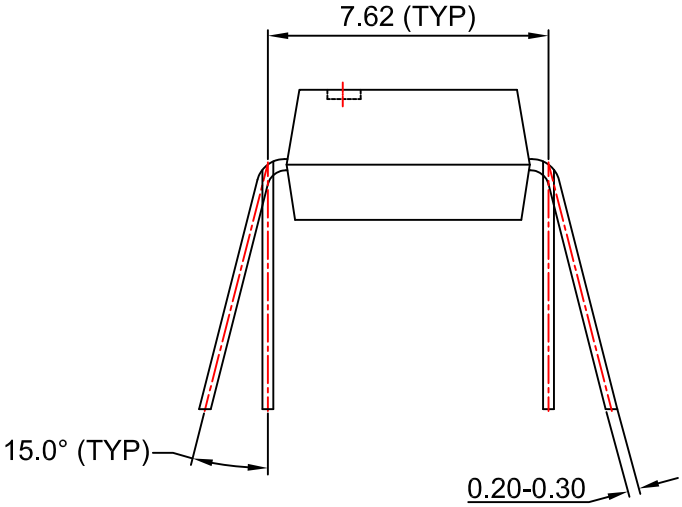


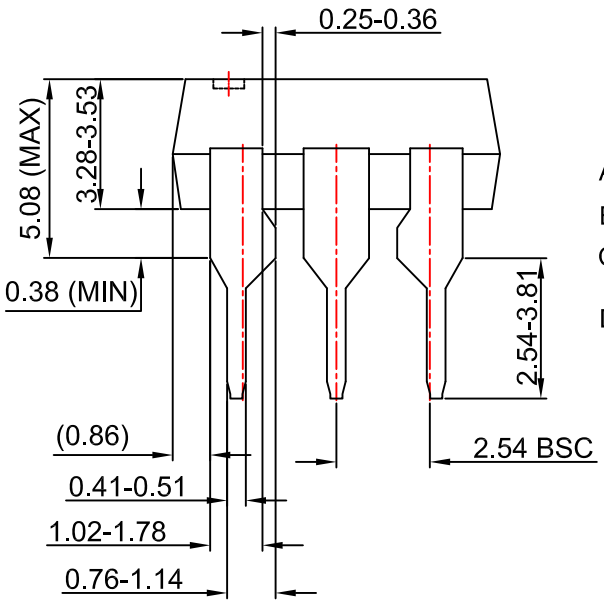
Figure 12. Top Mark

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., “5”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code







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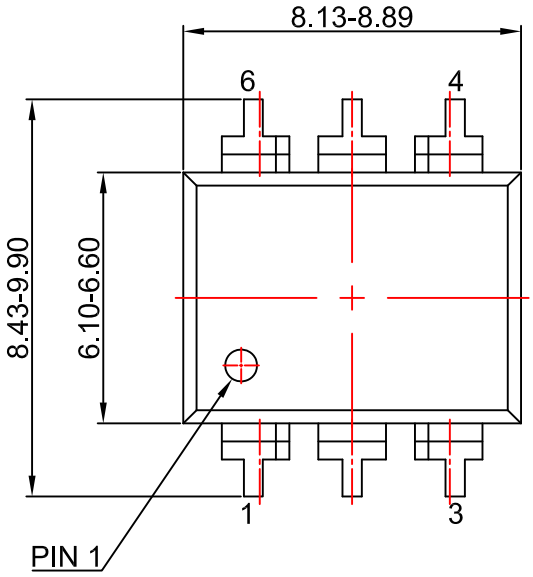
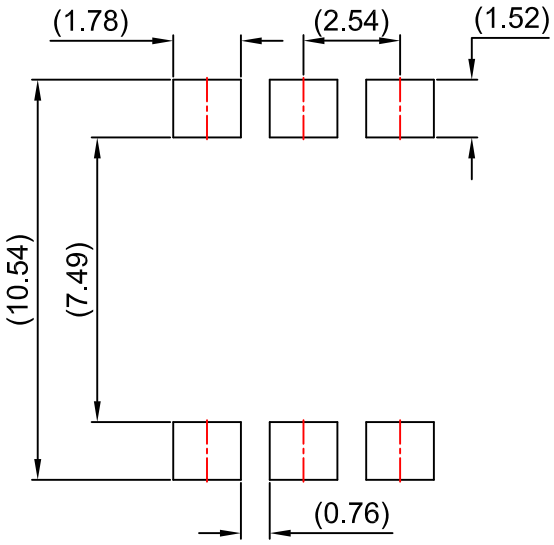
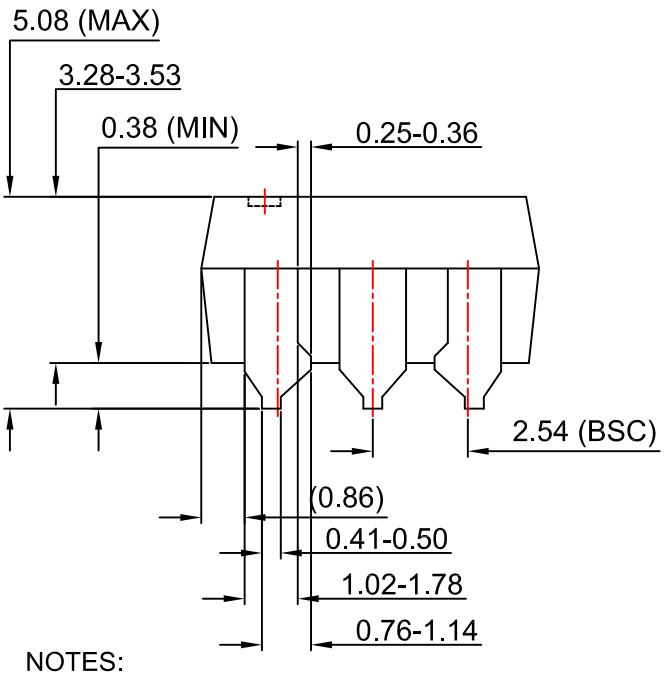
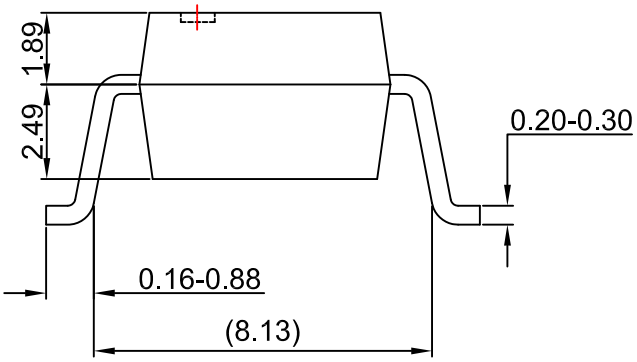




LAND PATTERN RECOMMENDATION





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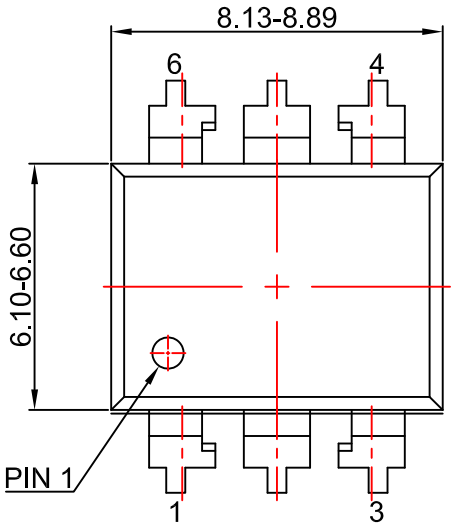

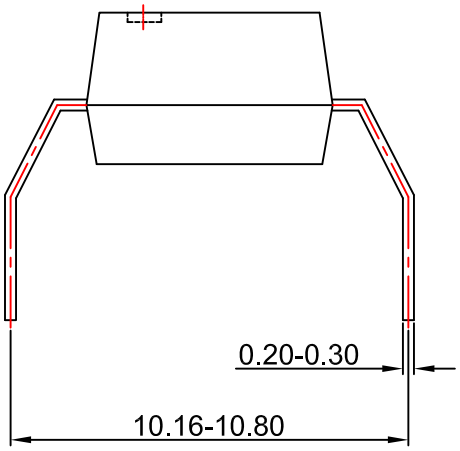

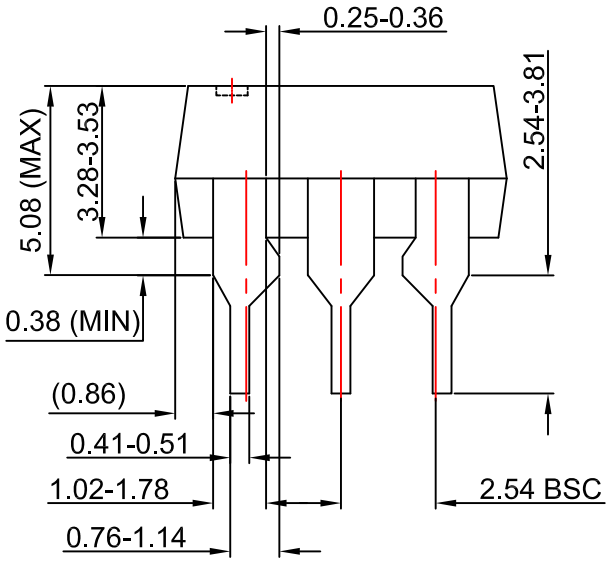

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