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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  $\mu$ A)
- 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

- 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

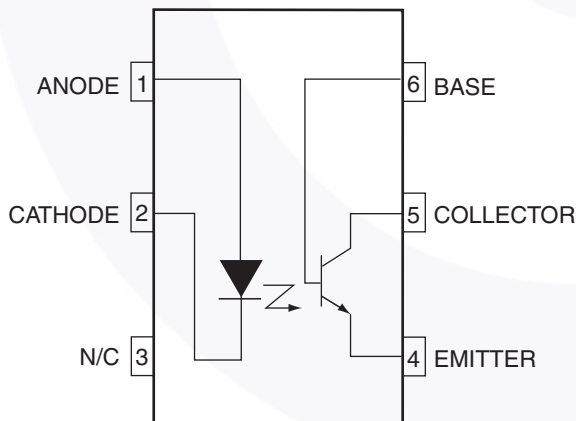


Figure 1. Schematic

### Package Outlines

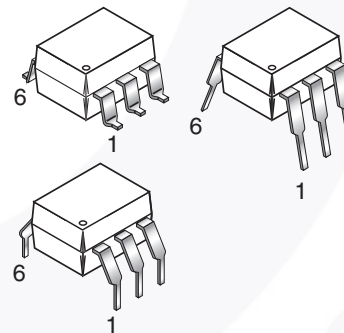


Figure 2. Package Outlines



## 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 <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.

Symbol	Parameters	Value	Unit
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +125	°C
$T_{OPR}$	Operating Temperature	-40 to +100	°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 @ 25°C (LED plus detector)	225	mW
	Derate Linearly From 25°C	3.5	mW/°C
<b>EMITTER</b>			
$I_F$	Continuous Forward Current	50	mA
$V_R$	Reverse Voltage	6	V
$I_F(pk)$	Forward Current – Peak (1 $\mu$ s pulse, 300 pps)	3.0	A
$P_D$	LED Power Dissipation @ 25°C	75	mW
	Derate Linearly From 25°C	1.0	mW/°C
<b>DETECTOR</b>			
$I_C$	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

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

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

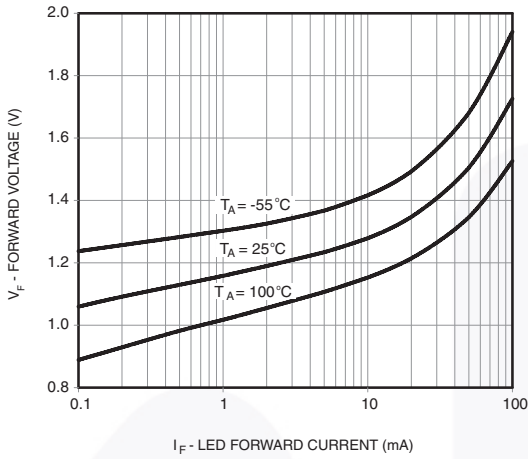
### Transfer Characteristics

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

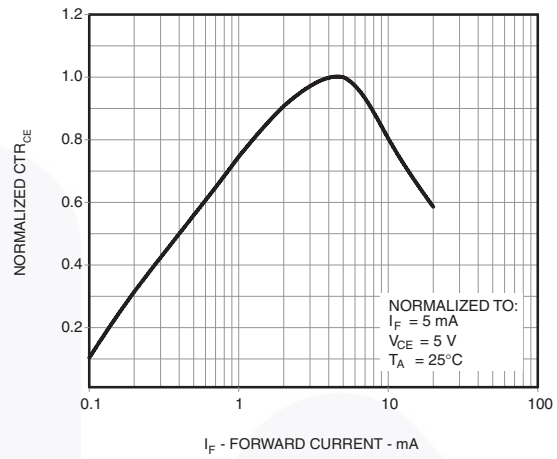
### Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC(RMS)}$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
$R_{ISO}$	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

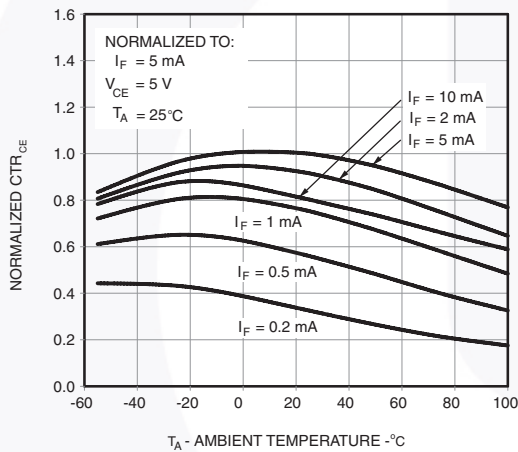
### Typical Performance Curves



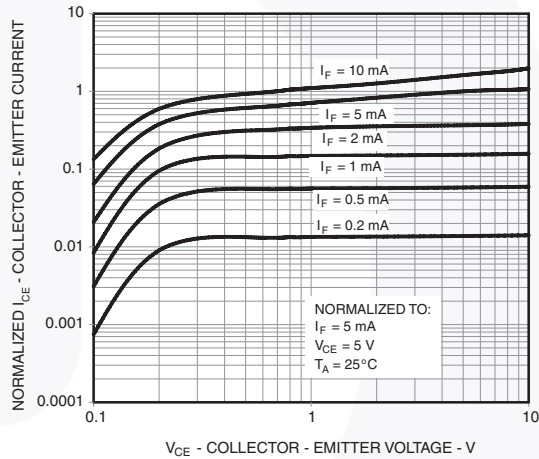
**Figure 3. LED Forward Voltage vs. Forward Current**



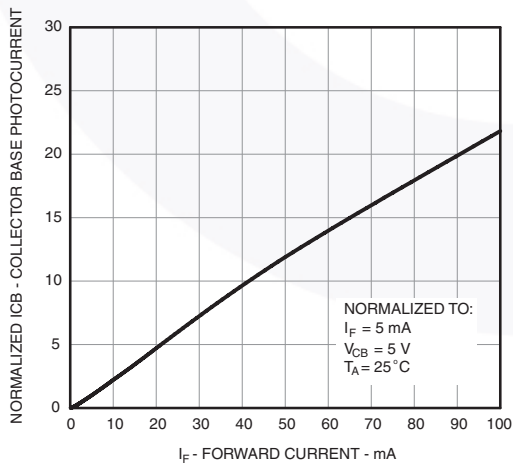
**Figure 4. Normalized Current Transfer Ratio vs. Forward Current**



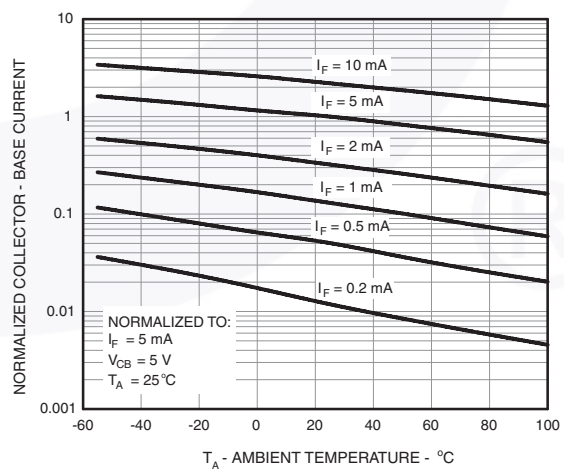
**Figure 5. Normalized CTR vs. Temperature**



**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)

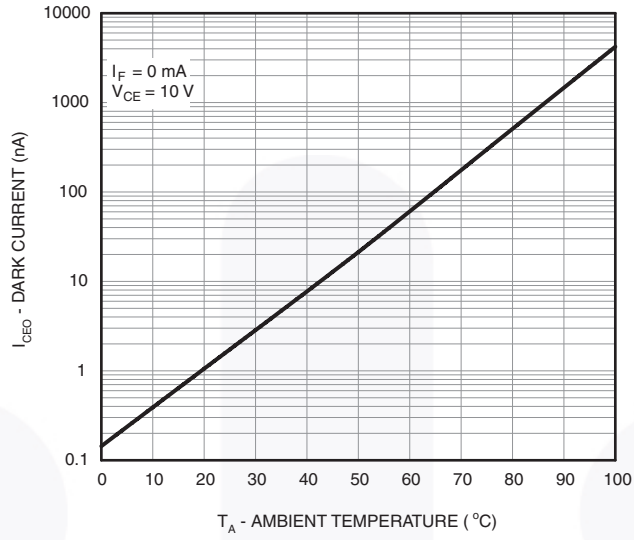
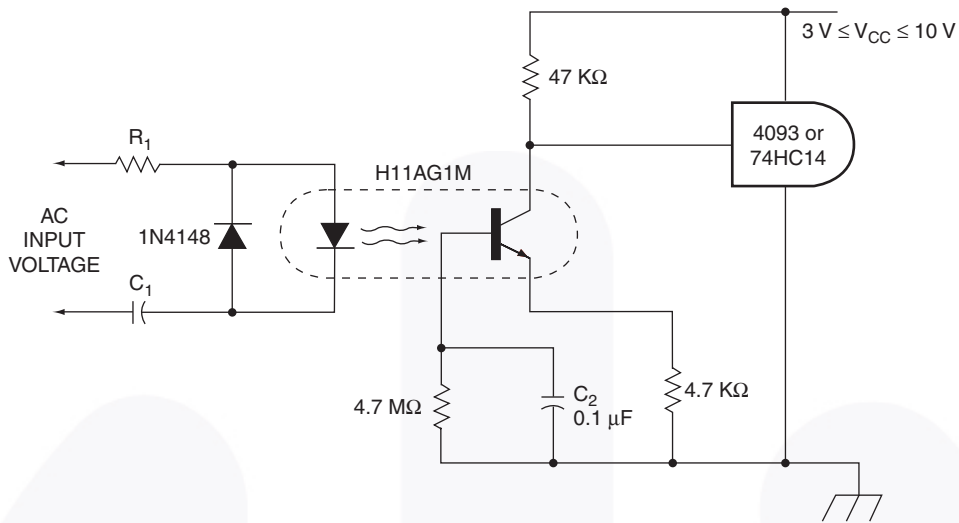


Figure 9. Collector-Emitter Dark Current vs. Ambient Temperature



Typical Application



Input	R1	C1	Z
40-90 VAC <sub>RMS</sub> 20 Hz	75 KΩ 1/10 W	0.1 μF 100 V	109 KΩ
95-135 VAC <sub>RMS</sub> 60 Hz	180 KΩ 1/10 W	12 nF 200 V	285 KΩ
200-280 VAC <sub>RMS</sub> 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

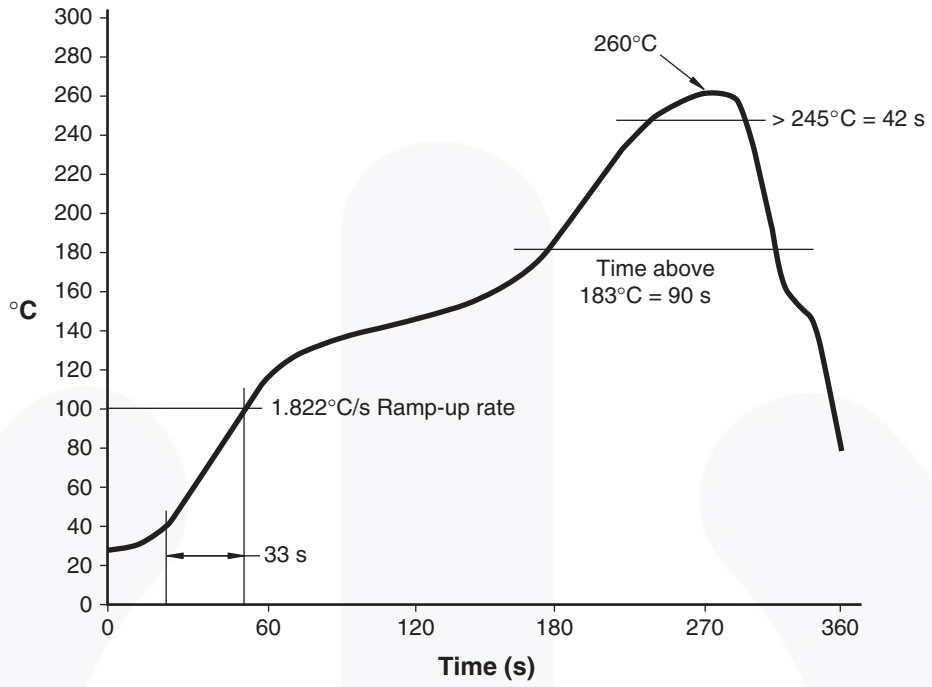


Figure 11. Reflow Profile

### 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

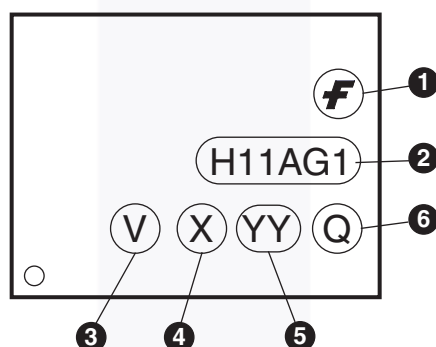
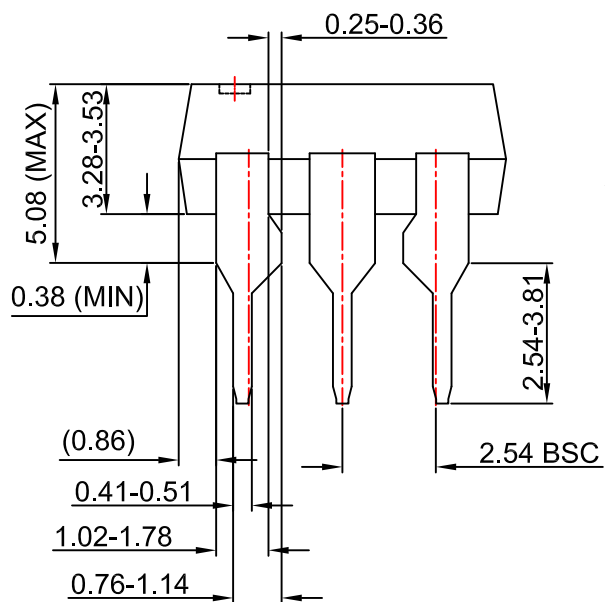
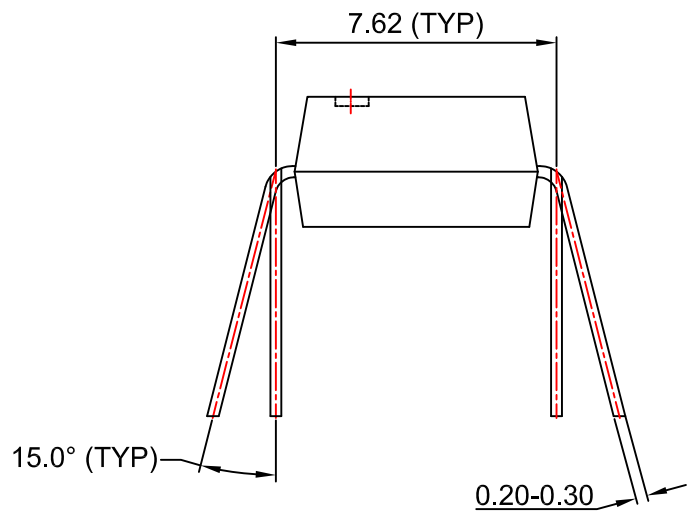
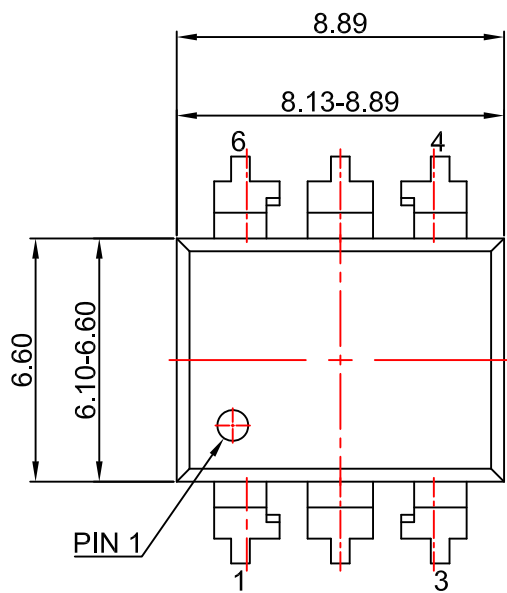


Figure 12. Top Mark

Table 1. Top Mark Definitions

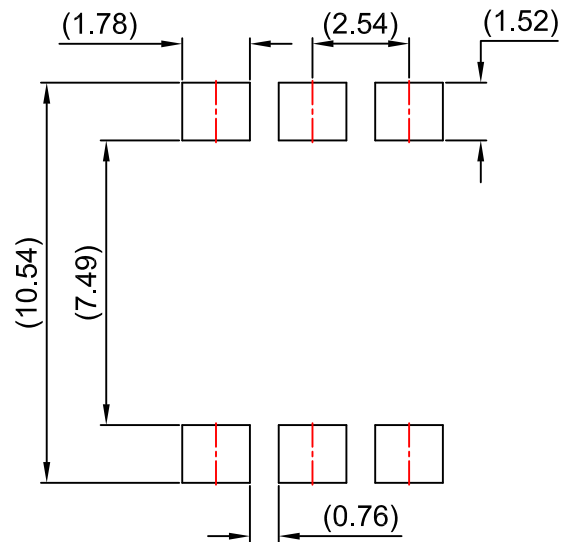
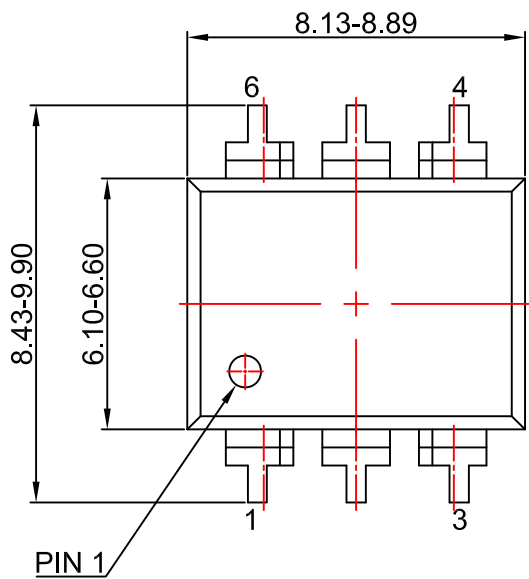
1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



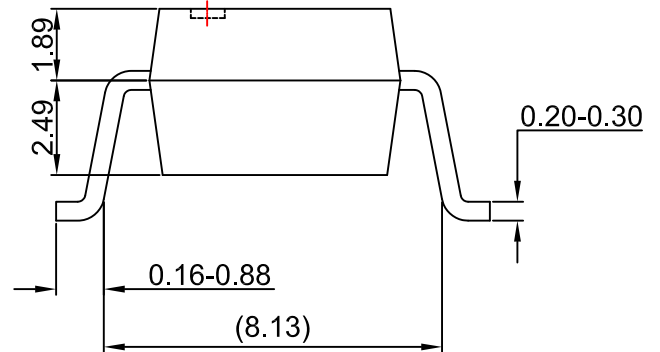
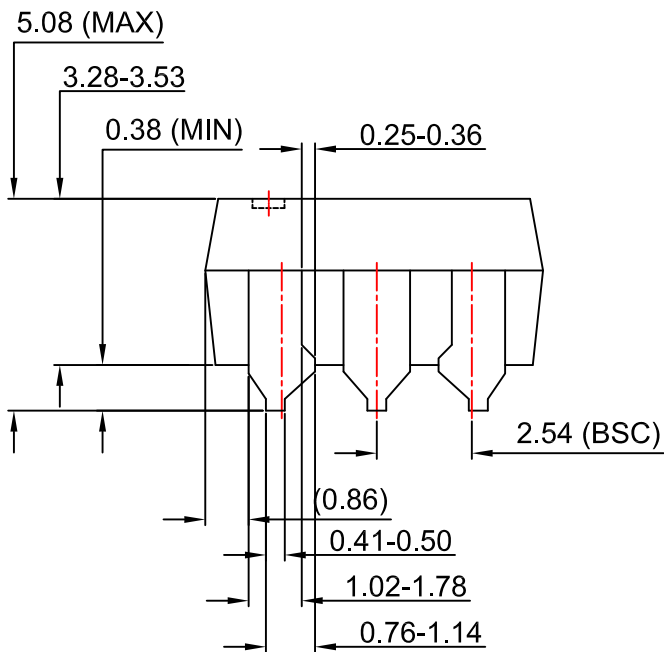
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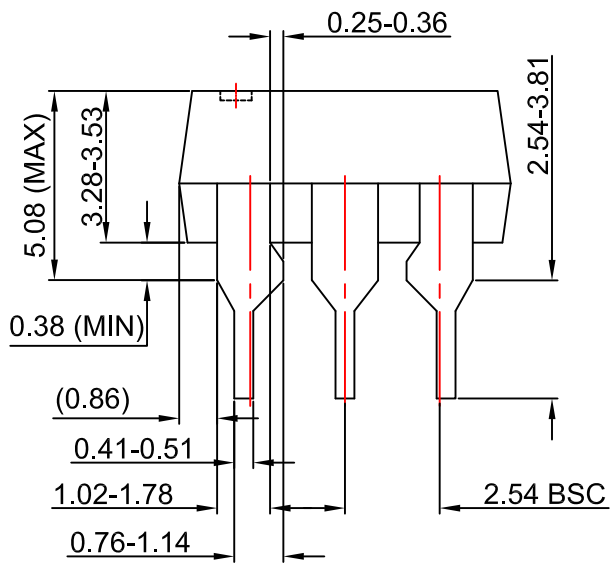
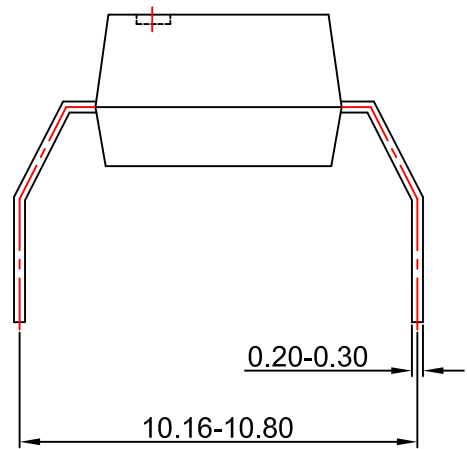
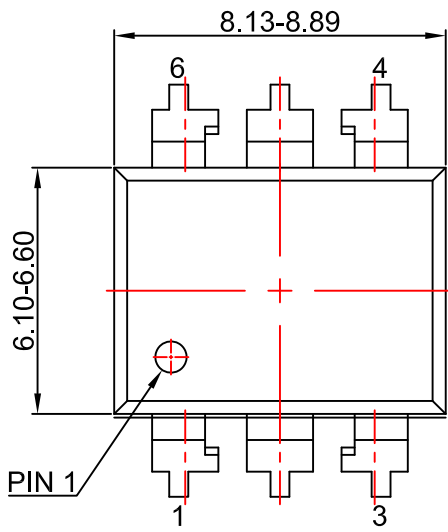


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