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July 2015

MOC3010M, MOC3011M, MOC3012M, MOC3020M, MOC3021M, MOC3022M, MOC3023M 6-Pin DIP Random-Phase Triac Driver Output Optocoupler (250/400 Volt Peak)

Features

- Excellent I_{FT} Stability—IR Emitting Diode Has Low Degradation
- Peak Blocking Voltage
  – 250 V, MOC301XM
  – 400 V, MOC302XM
- Safety and Regulatory Approvals
  – UL1577, 4,170 VAC_{RMS} for 1 Minute
  – DIN EN/IEC60747-5-5

Applications

- Industrial Controls
- Solenoid/Valve Controls
- Traffic Lights
- Static AC Power Switch
- Vending Machines
- Incandescent Lamp Dimmers
- Solid State Relay
- Motor Control
- Lamp Ballasts

Description

The MOC301XM and MOC302XM series are optically isolated triac driver devices. These devices contain a GaAs infrared emitting diode and a light activated silicon bilateral switch, which functions like a triac. They are designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115 V_{AC} operations.

Schematic

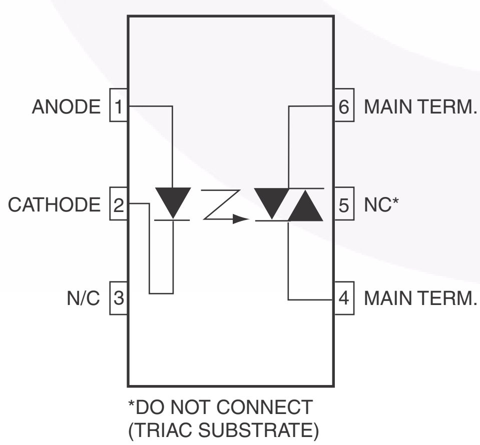


Figure 1. Schematic

Package Outlines

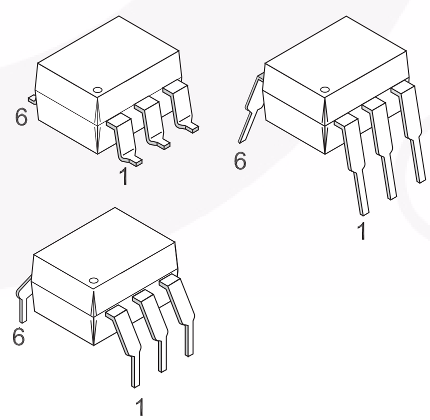


Figure 2. Package Outlines

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		40/85/21
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	1275	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
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V	> 10^9	Ω

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°C unless otherwise specified.

Symbol	Parameters	Device	Value	Unit
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +85	°C
T_J	Junction Temperature Range	All	-40 to +100	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
P_D	Total Device Power Dissipation at 25°C Ambient	All	330	mW
	Derate Above 25°C		4.4	mW/°C
EMITTER				
I_F	Continuous Forward Current	All	60	mA
V_R	Reverse Voltage	All	3	V
P_D	Total Power Dissipation at 25°C Ambient	All	100	mW
	Derate Above 25°C		1.33	mW/°C
DETECTOR				
V_{DRM}	Off-State Output Terminal Voltage	MOC3010M MOC3011M MOC3012M	250	V
		MOC3020M MOC3021M MOC3022M MOC3023M	400	
I_{TSM}	Peak Repetitive Surge Current (PW = 100 µs, 120 pps)	All	1	A
P_D	Total Power Dissipation at 25°C Ambient	All	300	mW
	Derate Above 25°C		4	mW/°C

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V_F	Input Forward Voltage	I_F = 10 mA	All		1.15	1.50	V
I_R	Reverse Leakage Current	V_R = 3 V, T_A = 25°C	All		0.01	100	µA
DETECTOR							
I_{DRM}	Peak Blocking Current, Either Direction	Rated V_{DRM}, I_F = 0[1]	All		10	100	nA
V_{TM}	Peak On-State Voltage, Either Direction	I_{TM} = 100 mA peak, I_F = 0	All		1.8	3.0	V

Transfer Characteristics

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
I_{FT}	LED Trigger Current	Voltage = 3 V[2]	MOC3020M			30	mA
			MOC3010M			15	
			MOC3021M				
			MOC3011M			10	
			MOC3022M				
			MOC3012M			5	
			MOC3023M				
I_H	Holding Current, Either Direction		All		100		µA

Isolation Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage[3]	t = 1 Minute	All	4170			VAC_{RMS}

Notes:

1. Test voltage must be applied within dv/dt rating.
2. All devices are guaranteed to trigger at an I_F value less than or equal to max I_{FT}. Therefore, recommended operating I_F lies between max I_{FT} (30 mA for MOC3020M, 15 mA for MOC3010M and MOC3021M, 10 mA for MOC3011M and MOC3022M, 5 mA for MOC3012M and MOC3023M) and absolute maximum I_F (60 mA).
3. Isolation voltage, V_{ISO}, is an internal device dielectric breakdown rating. For this test, pins 1 and 2 are common, and pins 4, 5 and 6 are common.

Typical Performance Curves

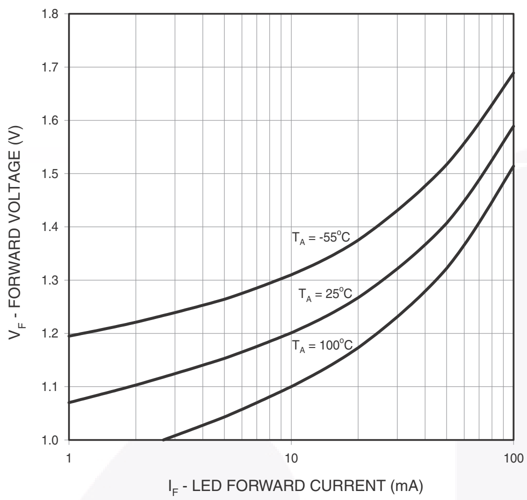


Figure 3. LED Forward Voltage vs. Forward Current

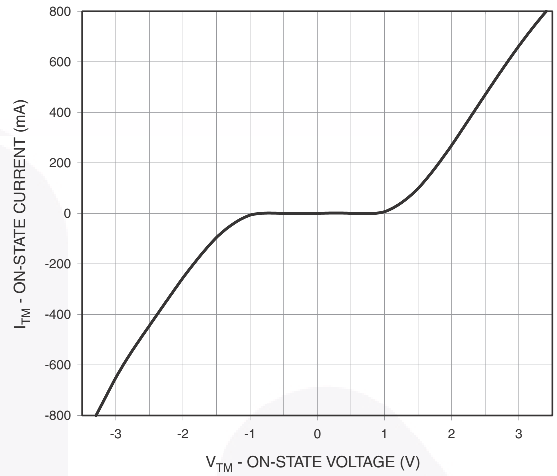


Figure 4. On-State Characteristics

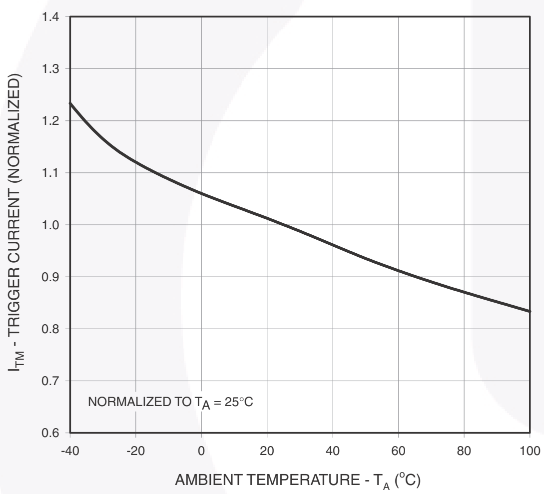


Figure 5. Trigger Current vs. Ambient Temperature

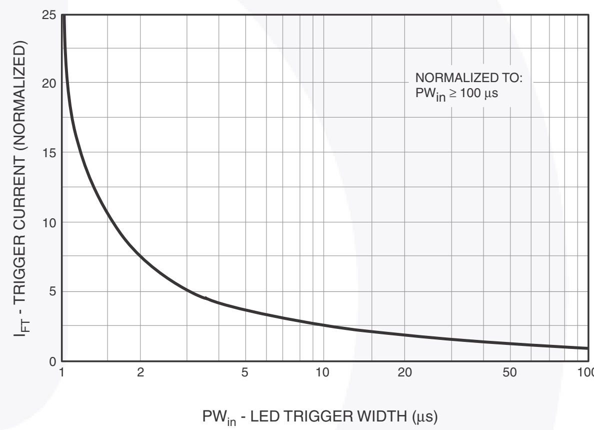


Figure 6. LED Current Required to Trigger vs. LED Pulse Width

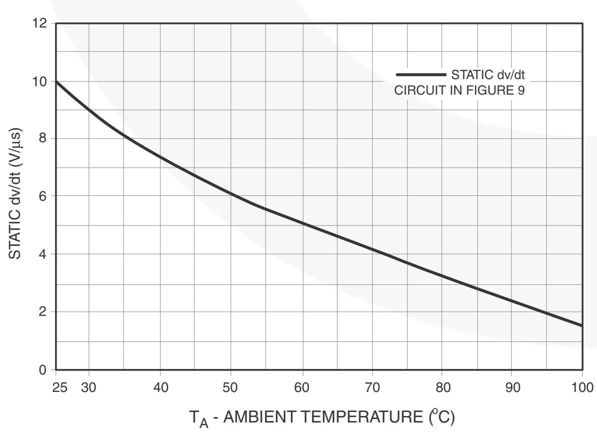


Figure 7. dv/dt vs. Temperature

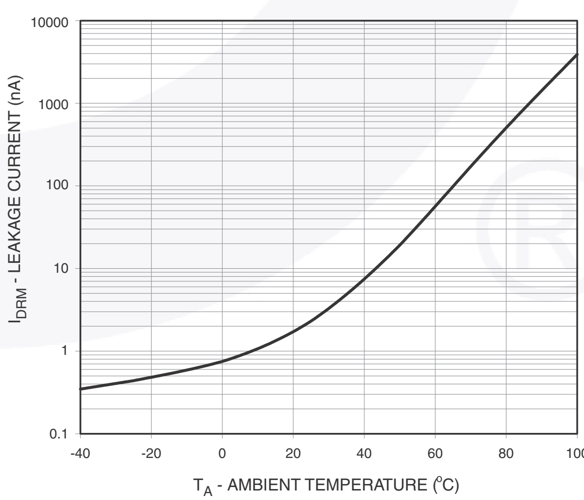
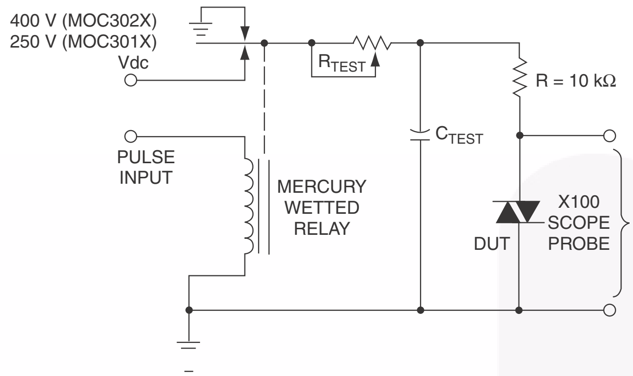
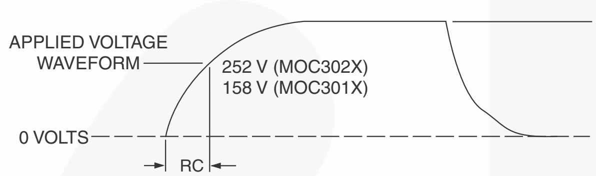


Figure 8. Leakage Current, I_{DRM} vs. Temperature



1. The mercury wetted relay provides a high speed repeated pulse to the D.U.T.
2. 100x scope probes are used, to allow high speeds and voltages.
3. The worst-case condition for static dv/dt is established by triggering the DUT with a normal LED input current, then removing the current. The variable R_{TEST} allows the dv/dt to be gradually increased until the DUT continues to trigger in response to the applied voltage pulse, even after the LED current has been removed. The dv/dt is then decreased until the DUT stops triggering. τ_{RC} is measured at this point and recorded.



$$dv/dt = \frac{0.63\, V_{max}}{RC} = \frac{252}{RC}\ \text{(MOC302X)}$$

$$= \frac{158}{RC}\ \text{(MOC301X)}$$

Note:
This optoisolator should not be used to drive a load directly. It is intended to be a trigger device only.

Figure 9. Static dv/dt Test Circuit

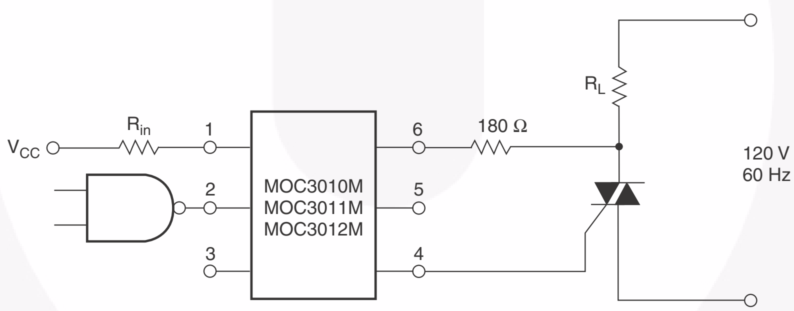


Figure 10. Resistive Load

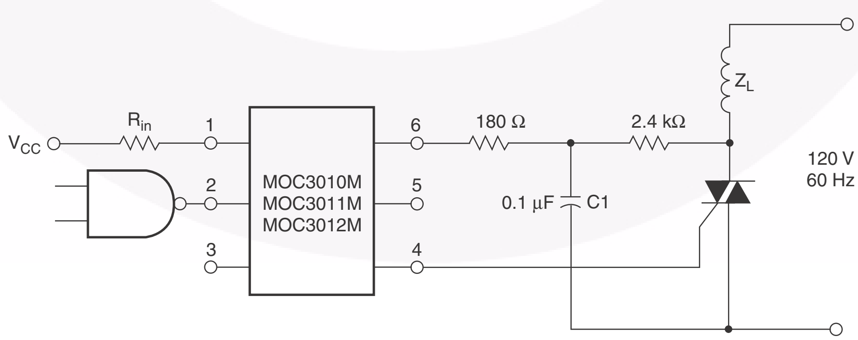


Figure 11. Inductive Load with Sensitive Gate Triac ($I_{GT} \leq 15$ mA)

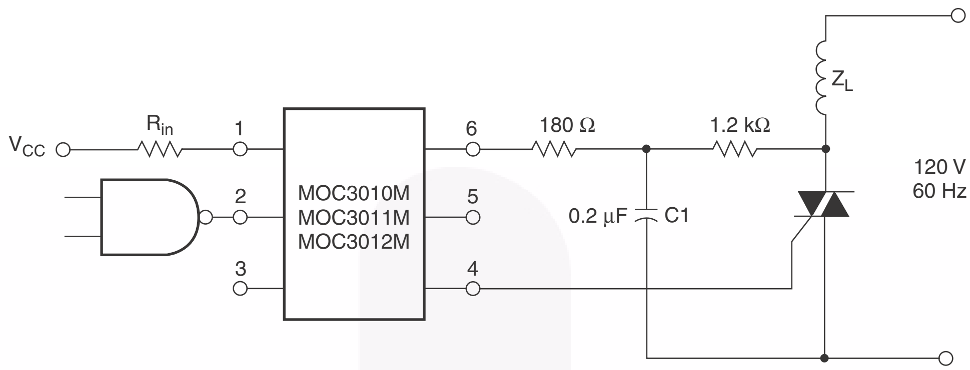
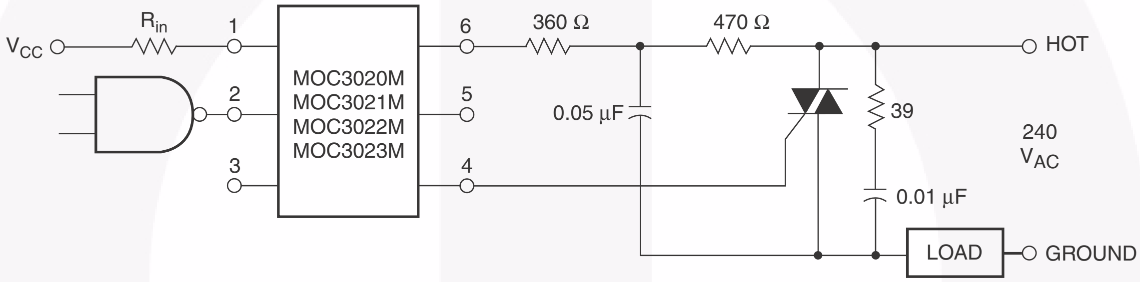


Figure 12. Inductive Load with sensitive Gate Triac ($I_{GT} \leq 15$ mA)



In this circuit the "hot" side of the line is switched and the load connected to the cold or ground side.

The 39 Ω resistor and 0.01 μF capacitor are for snubbing of the triac, and the 470 Ω resistor and 0.05 μF capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular and load used.

Figure 13. Typical Application Circuit

Reflow Profile

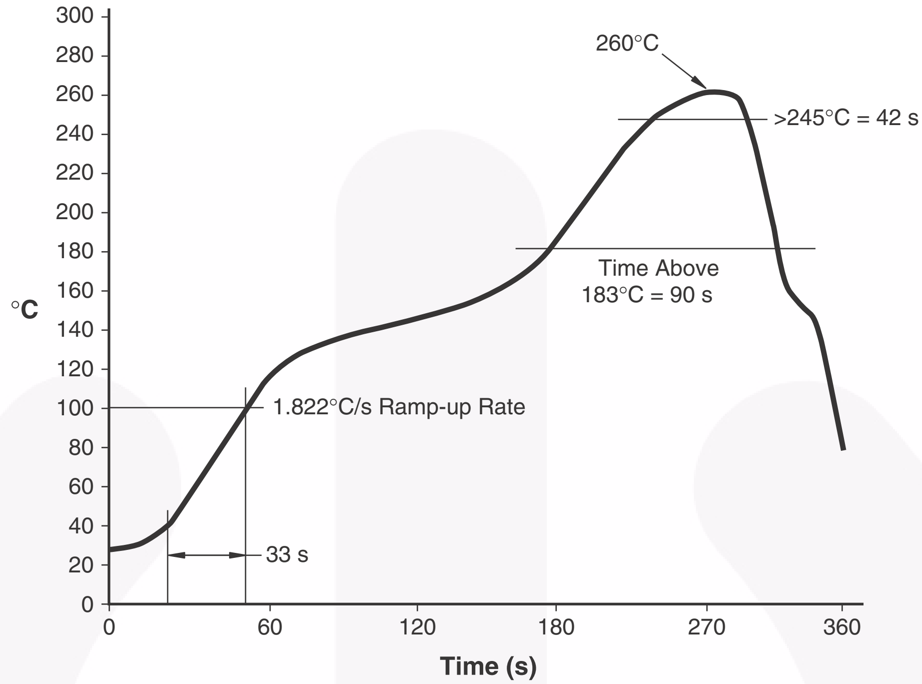


Figure 14. Reflow Profile

Ordering Information[4]

Part Number	Package	Packing Method
MOC3010M	DIP 6-Pin	Tube (50 Units)
MOC3010SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MOC3010SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MOC3010VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3010SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3010SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MOC3010TVM	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 MOC3011M, MOC3012M, MOC3020M, MOC3021M, MOC3022M, and MOC3023M product families.

Marking Information

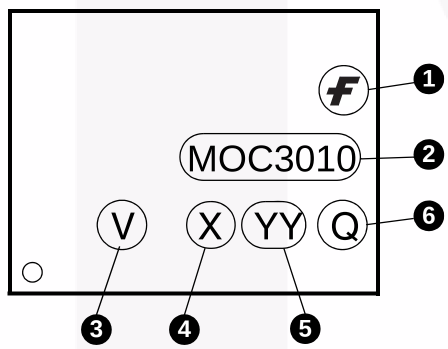
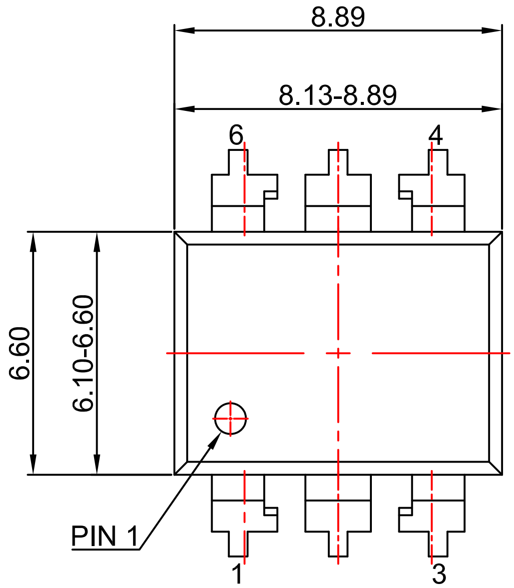
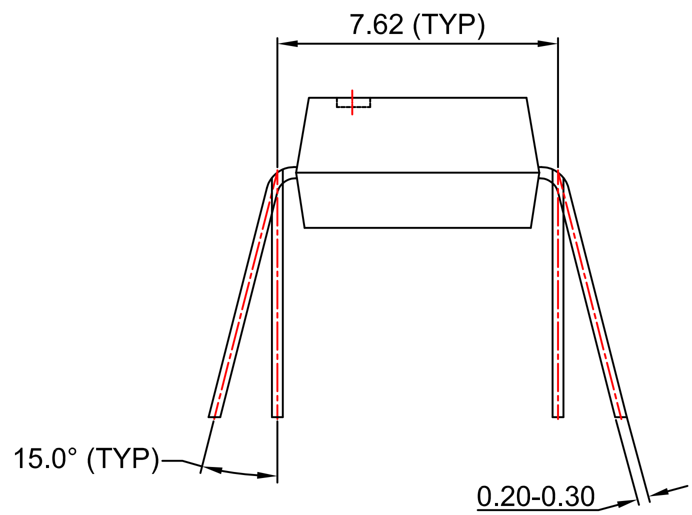
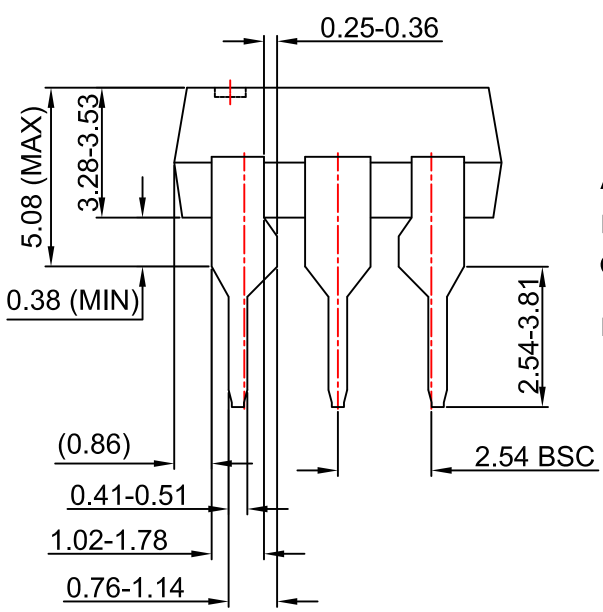


Figure 15. Top Mark

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	Two-Digit Work Week, Ranging from ‘01’ to ‘53’
6	Assembly Package Code







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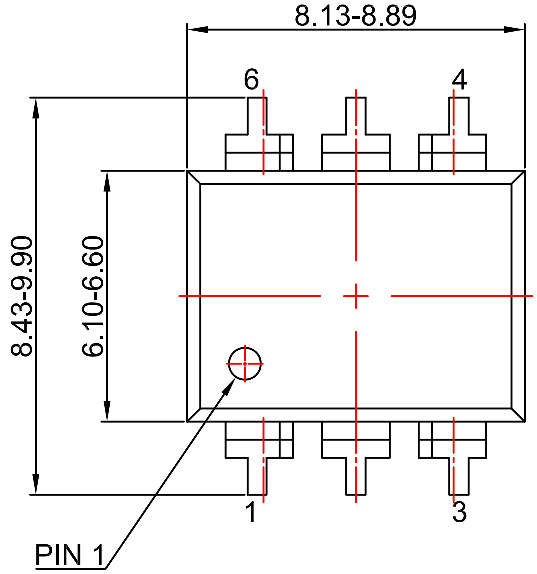
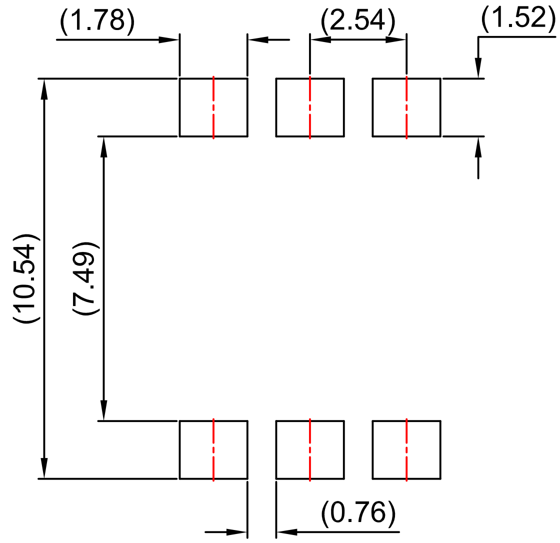
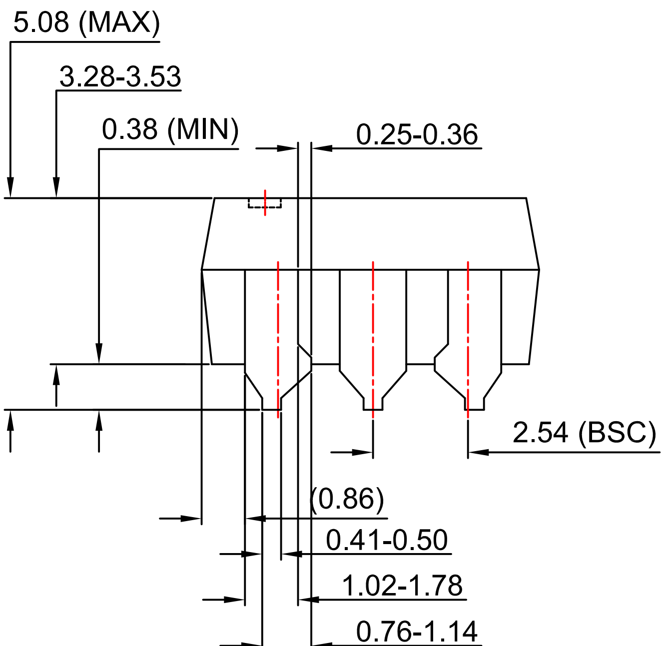
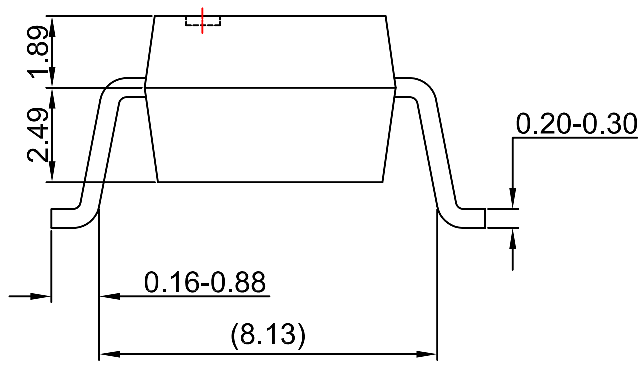




LAND PATTERN RECOMMENDATION





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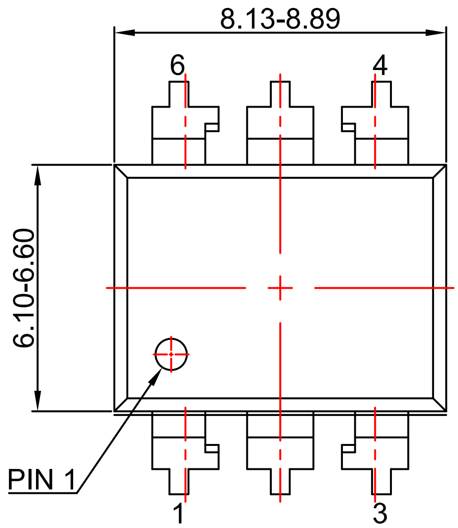

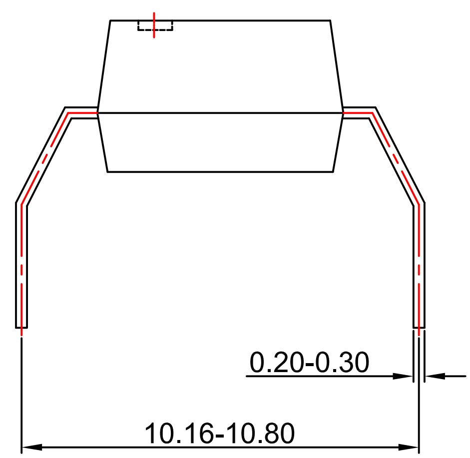

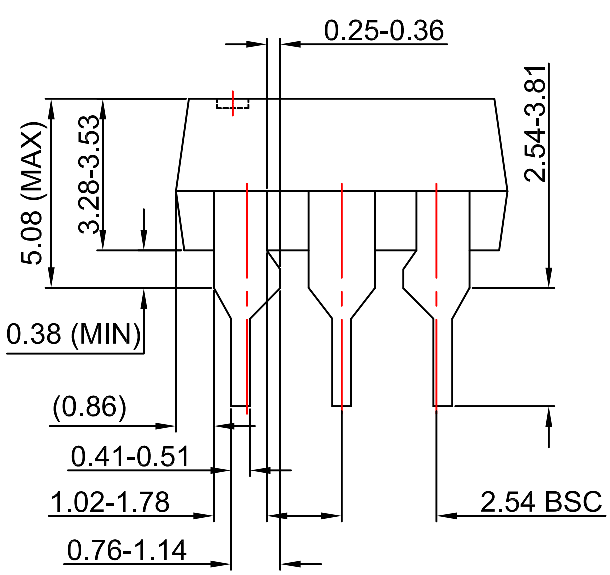

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