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September 2015

MOC3061M, MOC3062M, MOC3063M, MOC3162M, MOC3163M
6-Pin DIP Zero-Cross Triac Driver Optocoupler (600 Volt Peak)

Features

- Simplifies Logic Control of 115/240 VAC Power
- Zero Voltage Crossing to Minimize Conducted and Radiated Line Noise
- 600 V Peak Blocking Voltage
- Superior Static dv/dt
  - 600 V/µs (MOC306xM)
  - 1000 V/µs (MOC316xM)
- Safety and Regulatory Approvals
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN EN/IEC60747-5-5

Applications

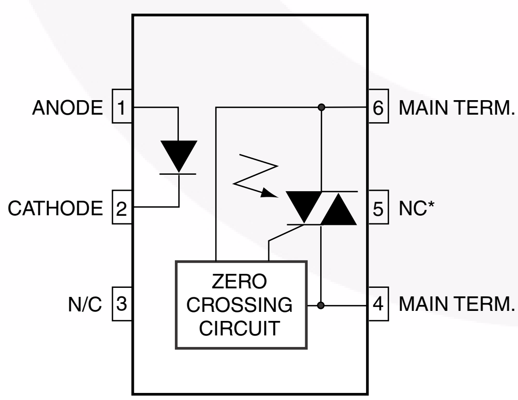
- Solenoid/Valve Controls
- Static Power Switches
- Temperature Controls
- AC Motor Starters
- Lighting Controls
- AC Motor Drives
- E.M. Contactors
- Solid State Relays

Description

The MOC306XM and MOC316XM devices consist of a GaAs infrared emitting diode optically coupled to a monolithic silicon detector performing the function of a zero voltage crossing bilateral triac driver.

They are designed for use with a triac in the interface of logic systems to equipment powered from 115/240 VAC lines, such as solid-state relays, industrial controls, motors, solenoids and consumer appliances, etc.

Schematic



*DO NOT CONNECT
(TRIAC SUBSTRATE)

Figure 1. Schematic

Package Outlines

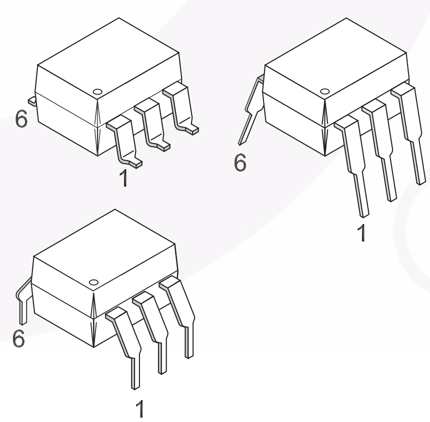


Figure 2. Package Outlines

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	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
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	250	mW
	Derate Above 25°C		2.94	mW/°C
EMITTER				
I_F	Continuous Forward Current	All	60	mA
V_R	Reverse Voltage	All	6	V
P_D	Total Power Dissipation at 25°C Ambient	All	120	mW
	Derate Above 25°C		1.41	mW/°C
DETECTOR				
V_{DRM}	Off-State Output Terminal Voltage	All	600	V
I_{TSM}	Peak Non-Repetitive Surge Current (Single Cycle 60 Hz Sine Wave)	All	1	A
P_D	Total Power Dissipation at 25°C Ambient	All	150	mW
	Derate Above 25°C		1.76	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 = 30 mA	All		1.3	1.5	V
I_R	Reverse Leakage Current	V_R = 6 V	All		0.005	100	µA
DETECTOR							
I_{DRM1}	Peak Blocking Current, Either Direction	V_{DRM} = 600 V, I_F = 0(1)	MOC306XM		10	500	nA
			MOC316XM		10	100	
dv/dt	Critical Rate of Rise of Off-State Voltage	I_F = 0 (Figure 11)(2)	MOC306XM	600	1500		V/µs
			MOC316XM	1000			

Transfer Characteristics

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
I_{FT}	LED Trigger Current (Rated I_{FT})	Main Terminal Voltage = 3 V(3)	MOC3061M			15	mA
			MOC3062M MOC3162M			10	
			MOC3063M MOC3163M			5	
V_{TM}	Peak On-State Voltage, Either Direction	I_{TM} = 100 mA peak, I_F = rated I_{FT}	All		1.8	3.0	V
I_H	Holding Current, Either Direction		All		500		µA

Zero Crossing Characteristics

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
V_{INH}	Inhibit Voltage (MT1-MT2 voltage above which device will not trigger)	I_F = rated I_{FT}	MOC3061M MOC3062M MOC3063M		12	20	V
			MOC3162M MOC3163M		12	15	
I_{DRM2}	Leakage in Inhibited State	I_F = rated $I_{FT,\ DRM}$ = 600 V, off-state	All			2	mA

Isolation Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage(4)	f = 60 Hz, t = 1 Minute	4170			VAC_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V_{DC}		10^{11}		Ω
C_{ISO}	Isolation Capacitance	V = 0 V, f = 1 MHz		0.2		pF

Notes:

1. Test voltage must be applied within dv/dt rating.
2. This is static dv/dt. See Figure 11 for test circuit. Commutating dv/dt is a function of the load-driving thyristor(s) only.
3. 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} (15 mA for MOC3061M, 10 mA for MOC3062M and MOC3162M, 5 mA for MOC3063M and MOC3163M) and absolute maximum I_F (60 mA).
4. 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

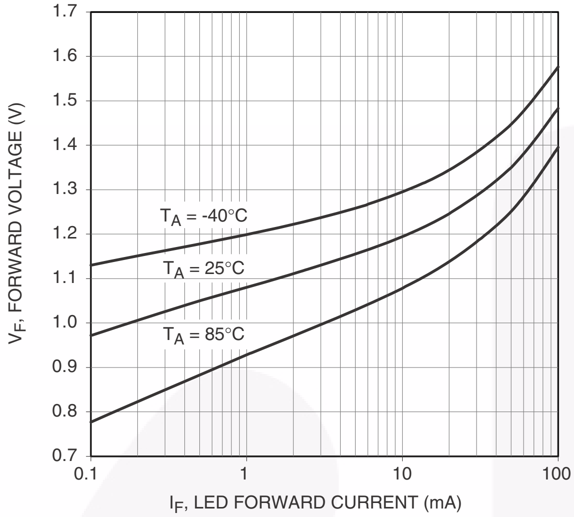


Figure 3. LED Forward Voltage vs. Forward Current

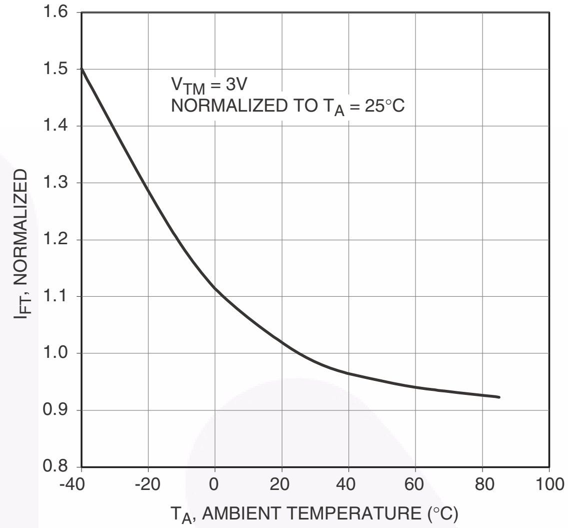


Figure 4. Trigger Current Vs. Temperature

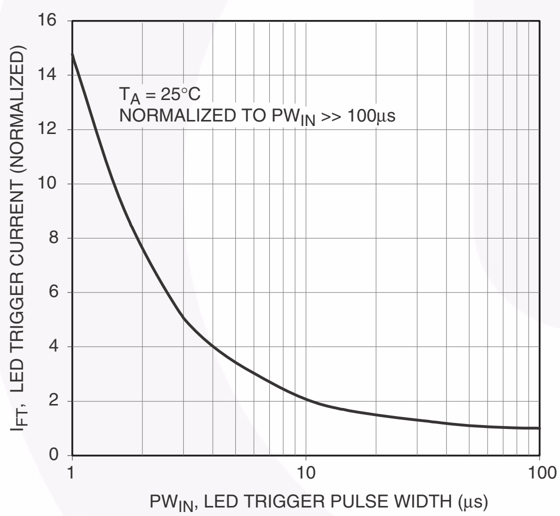


Figure 5. LED Current Required to Trigger vs. LED Pulse Width

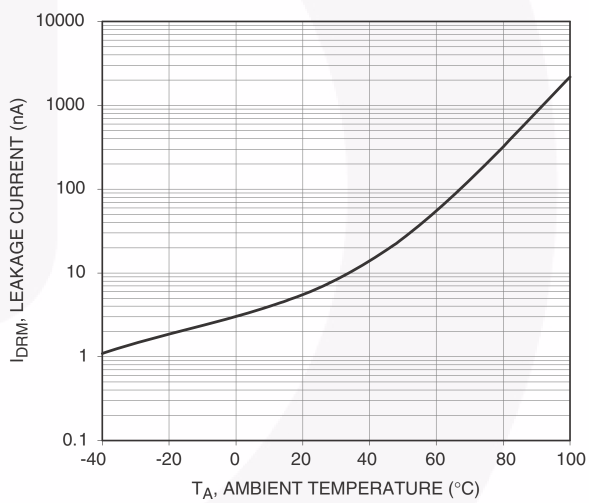


Figure 6. Leakage Current, I_{DRM} vs. Temperature

Typical Performance Curves (Continued)

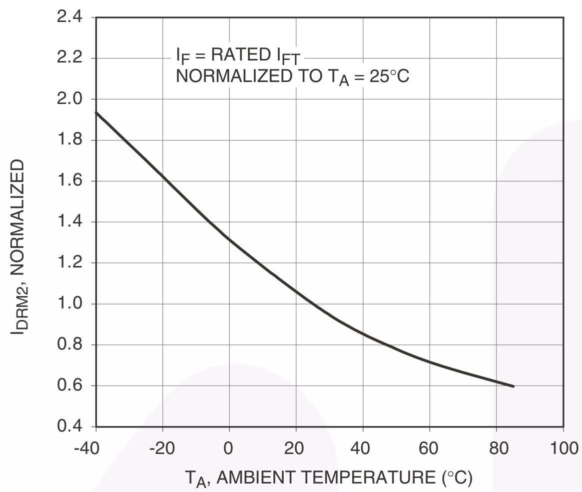


Figure 7. I_{DRM2}, Leakage in Inhibit State vs. Temperature

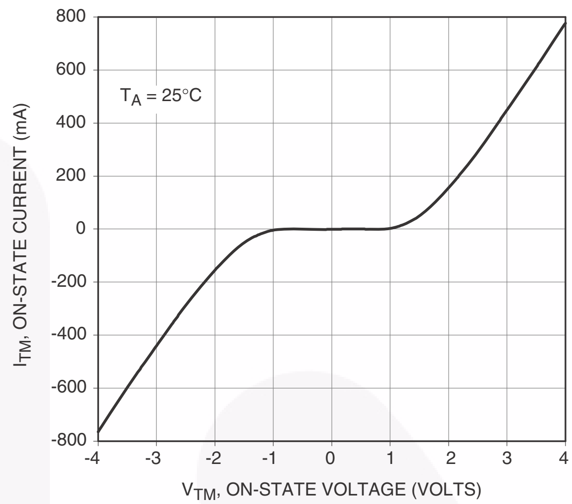


Figure 8. On-State Characteristics

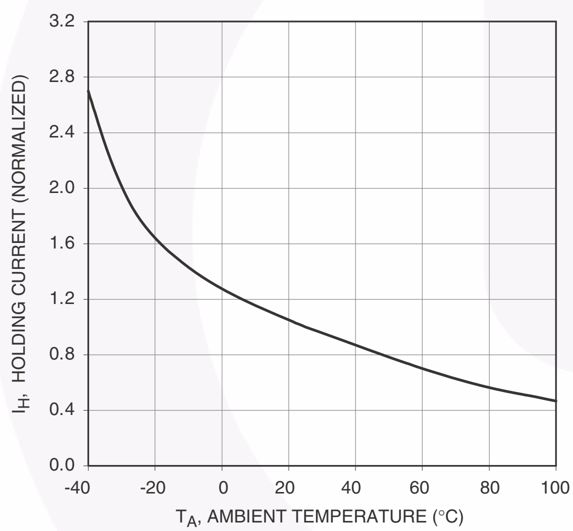


Figure 9. I_H, Holding Current vs. Temperature

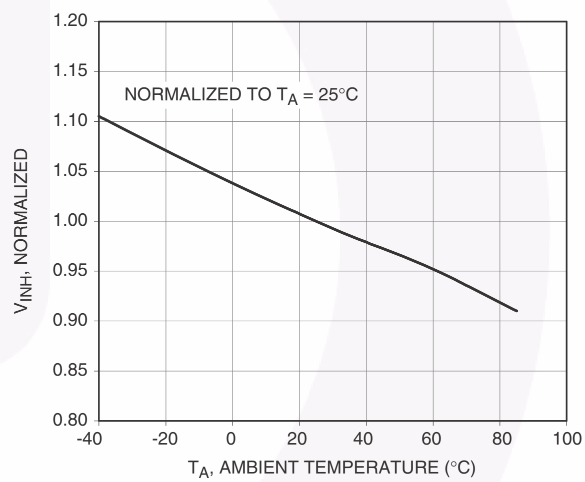
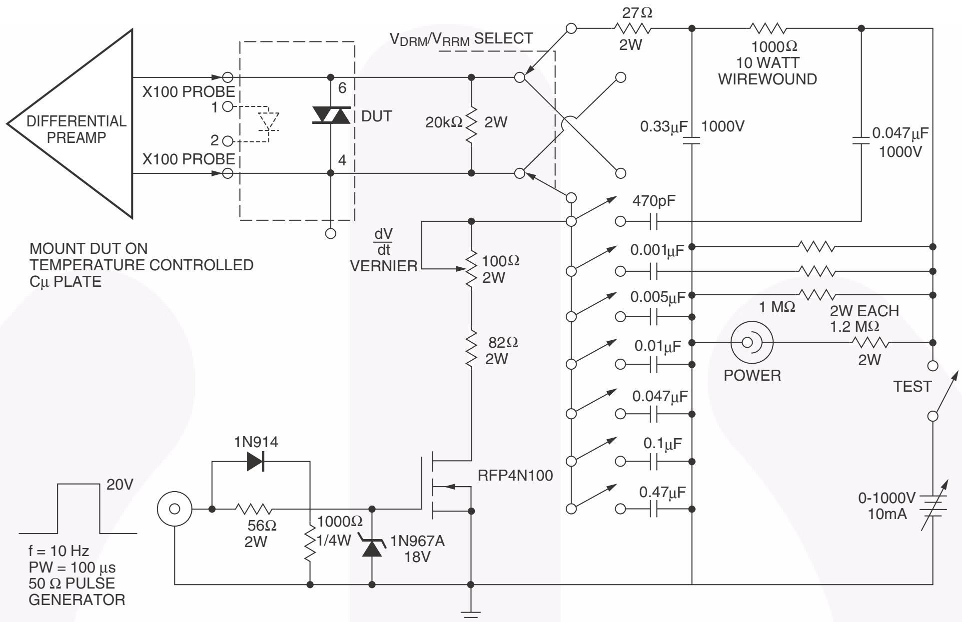


Figure 10. Inhibit Voltage vs. Temperature

1. 100x scope probes are used, to allow high speeds and voltages.
2. The worst-case condition for static dv/dt is established by triggering the D.U.T. with a normal LED input current, then removing the current. The variable vernier resistor combined with various capacitor combinations allows the dv/dt to be gradually increased until the D.U.T. 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 D.U.T. stops triggering. t_{RC} is measured at this point and recorded.



ALL COMPONENTS ARE NON-INDUCTIVE UNLESS SHOWN

Figure 11. Circuit for Static $\frac{dV}{dt}$ Measurement of Power Thyristors

Basic Applications

Typical circuit for use when hot line switching is required. In this circuit the "hot" side of the line is switched and the load connected to the cold or neutral side. The load may be connected to either the neutral or hot line.

R_{in} is calculated so that I_F is equal to the rated I_{FT} of the part, 15mA for the MOC3061M, 10mA for the MOC3062M, or 5mA for the MOC3063M. The 39Ω resistor and 0.01μF capacitor are for snubbing of the triac and is often, but not always, necessary depending upon the particular triac and load used.

Suggested method of firing two, back-to-back SCR's with a Fairchild triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 330Ω.

Note:

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

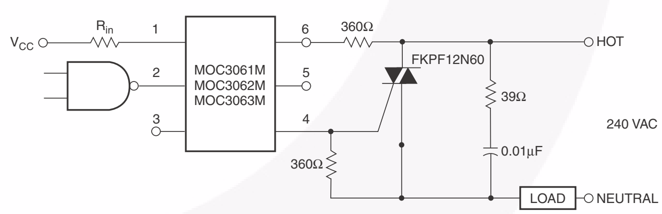


Figure 12. Hot-Line Switching Application Circuit

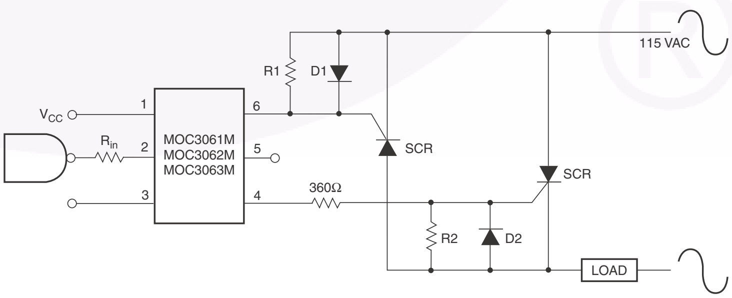
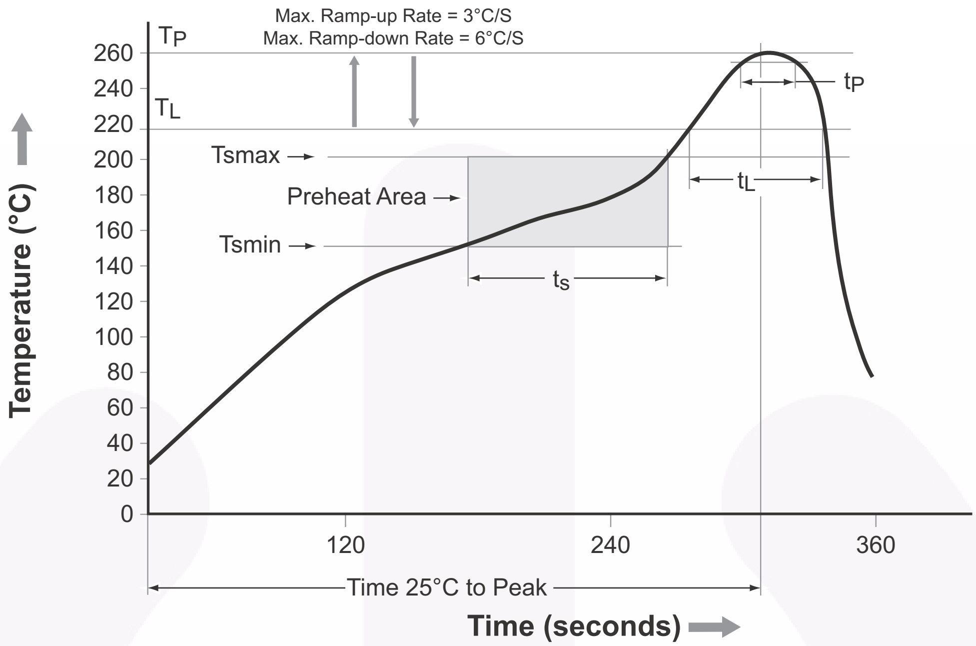


Figure 13. Inverse-Parallel SCR Driver Circuit

Reflow Profile



Profile Freature	Pb-Free Assembly Profile
Temperature Minimum (Tsmin)	150°C
Temperature Maximum (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60 seconds to 120 seconds
Ramp-up Rate (T_L to T_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60 seconds to 150 seconds
Peak Body Package Temperature	260°C +0°C / –5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum

Figure 14. Reflow Profile

Ordering Information[5]

Part Number	Package	Packing Method
MOC3061M	DIP 6-Pin	Tube (50 Units)
MOC3061SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MOC3061SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MOC3061VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3061SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3061SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MOC3061TVM	DIP 6-Pin, 0.4” Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

5. The product orderable part number system listed in this table also applies to the MOC3062M, MOC3063M, MOC3162M, and MOC3163M product families.

Marking Information

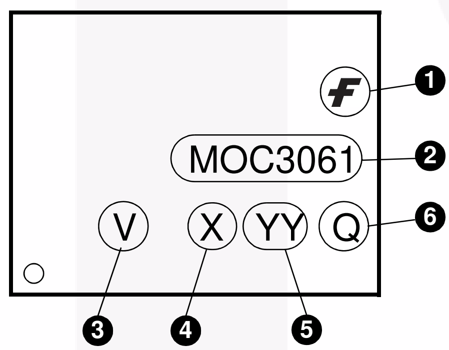
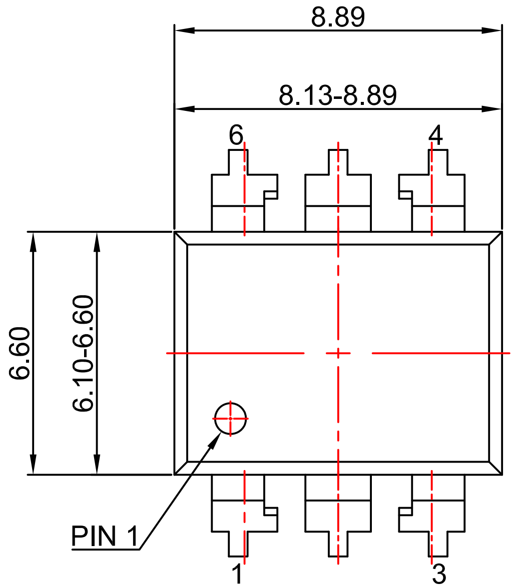
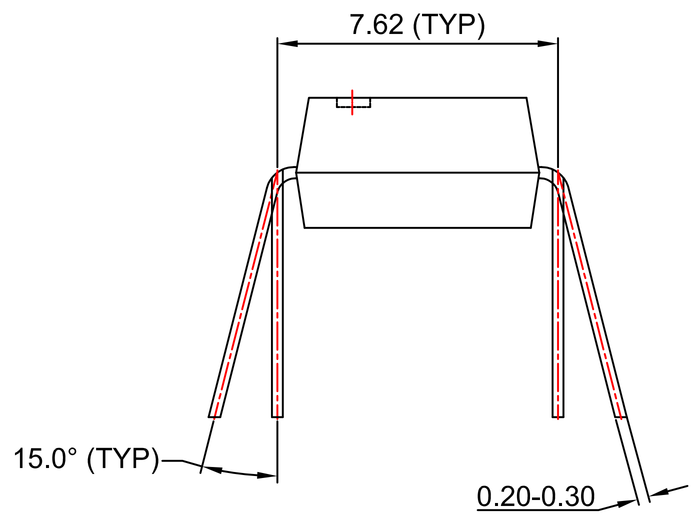
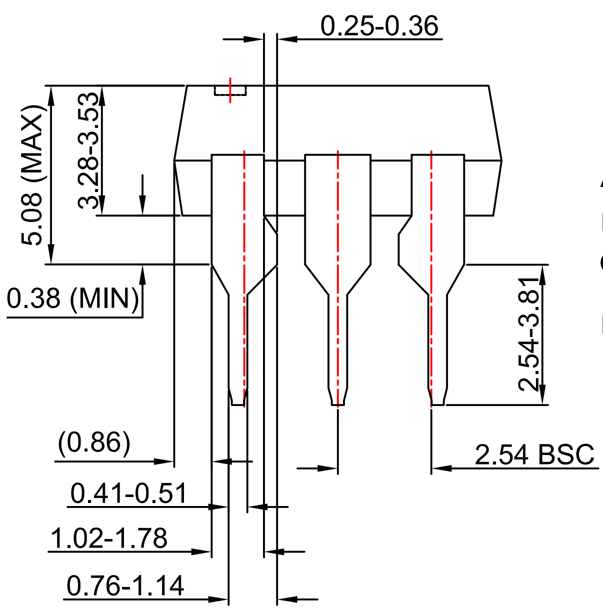


Figure 15. Top Mark

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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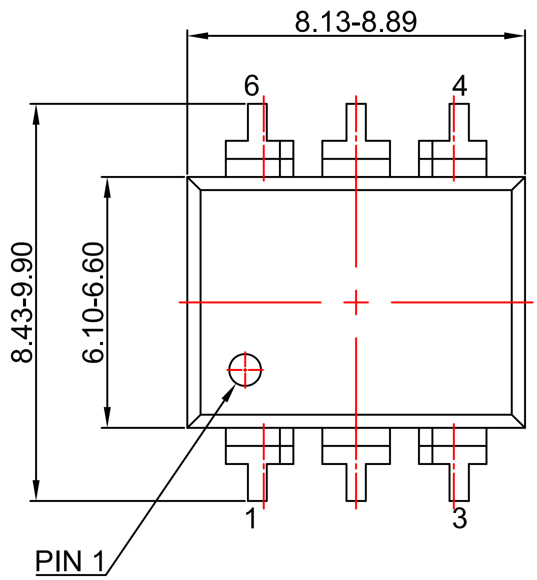
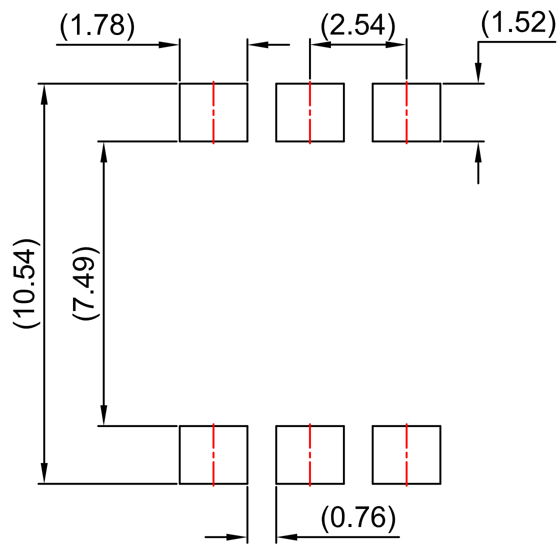
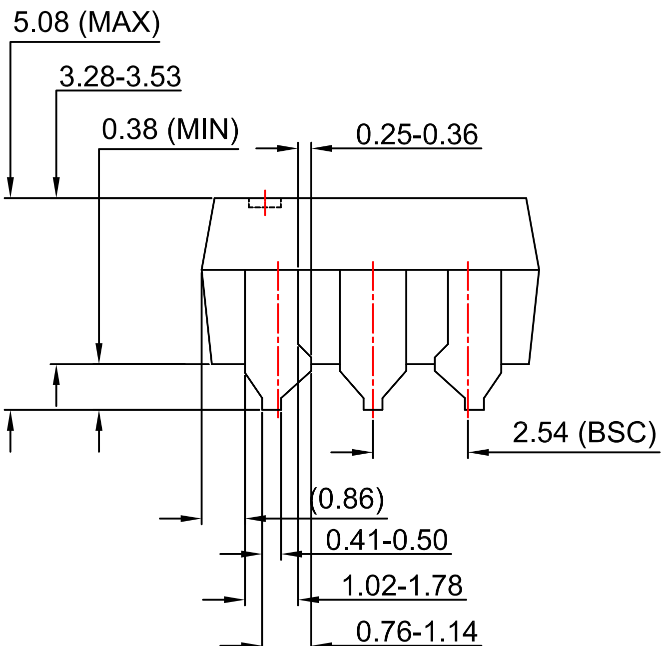
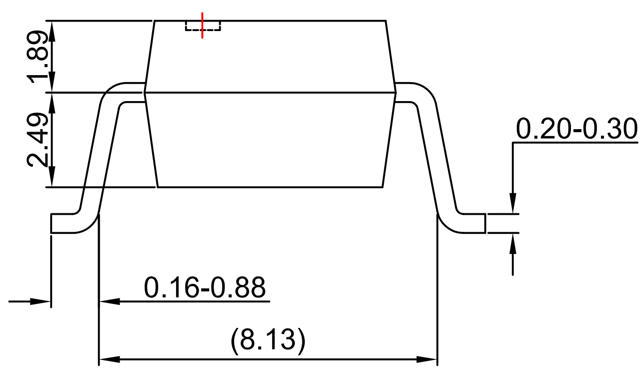




LAND PATTERN RECOMMENDATION





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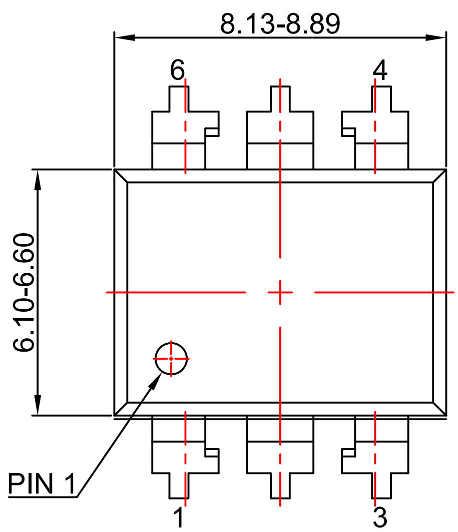

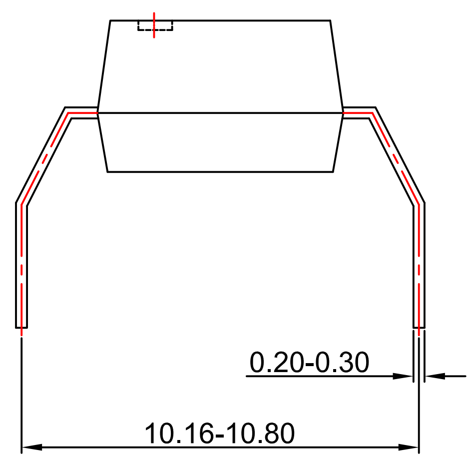

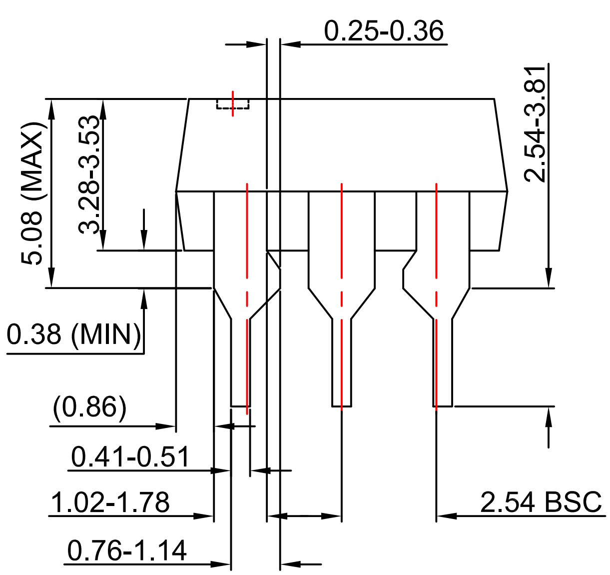

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