FAIRCHILD SEMICONDUCTOR®

March 2014

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

Features

- Excellent I_{FT} Stability—IR Emitting Diode Has Low Degradation
- High Isolation Voltage—Minimum 5300 $V_{AC(RMS)}$
- Underwriters Laboratory (UL) Recognized—File #E90700
- Peak Blocking Voltage
  - 250 V, MOC301XM
  - 400 V, MOC302XM
- VDE Recognized (File #94766)
  - Ordering Option V (e.g., MOC3023VM)

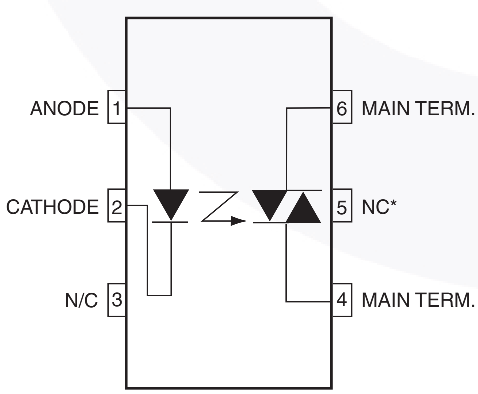
Description

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.

Applications

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

Schematic



*DO NOT CONNECT (TRIAC SUBSTRATE)

Figure 1. Schematic

Package Outlines

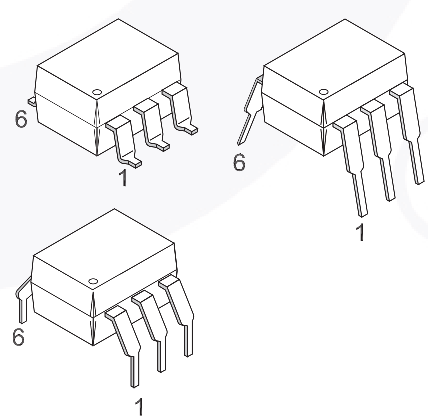


Figure 2. Package Outlines

Safety and Insulation Ratings

As per DIN EN/IEC60747-5-2. This optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings is ensured by means of protective circuits.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 see Table 1 For Rated Mains Voltage < 150 V_{RMS}		I–IV		
	For Rated Mains Voltage < 300 V_{RMS}		I–IV		
	Climatic Classification		40/85/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V_{PR}	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			
	Input to Output Test Voltage, Method a, V_{IORM} x 1.5 = V_{PR}, Type and Sample Test with t_m = 60 s, Partial Discharge < 5 pC	1275			
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 T, 0.4” Lead Spacing)	10.16			mm
	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	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +85	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
T_J	Junction Temperature Range	All	-40 to +100	°C
V_{ISO}	Isolation Surge Voltage[1] (Peak AC Voltage, 60 Hz, 1 Second Duration)	All	7500	Vac(pk)
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/1M/2M	250	V
		MOC3020M/1M/2M/3M	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

Note:

1. Isolation surge 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.

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

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

Notes:

2. Test voltage must be applied within dv/dt rating.
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} (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).

Typical Performance Curves

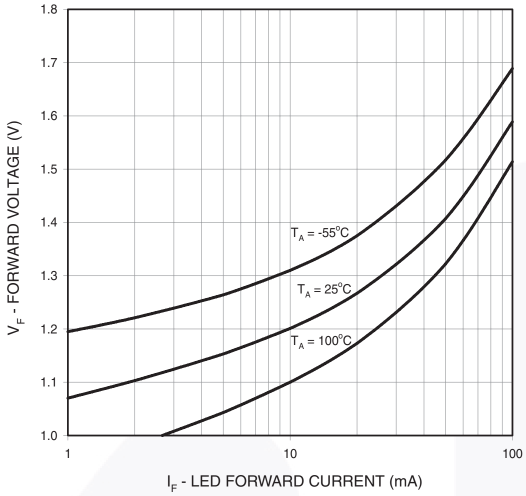


Figure 3. LED Forward Voltage vs. Forward Current

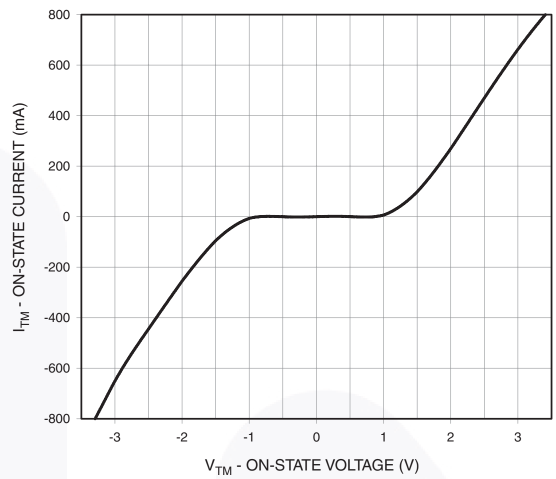


Figure 4. On-State Characteristics

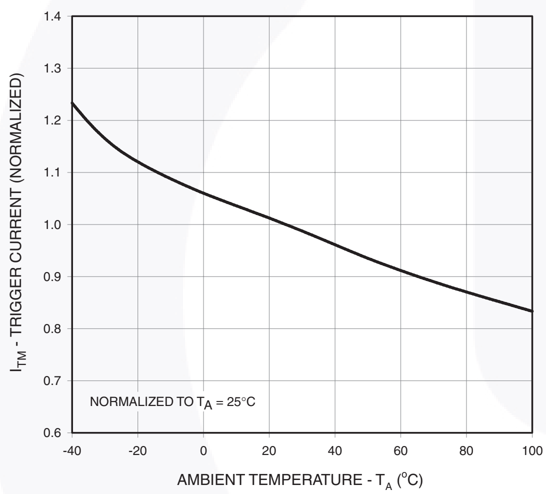


Figure 5. Trigger Current vs. Ambient Temperature

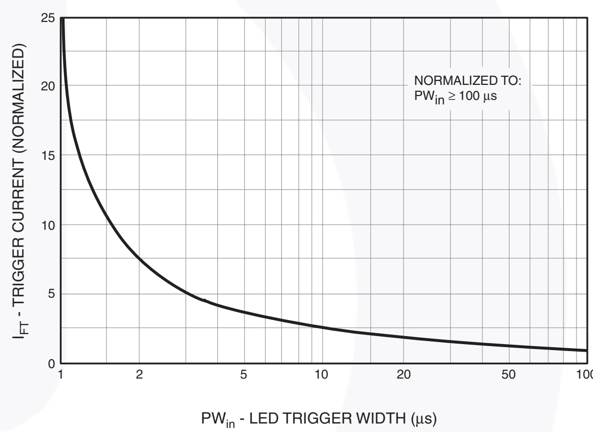


Figure 6. LED Current Required to Trigger vs. LED Pulse Width

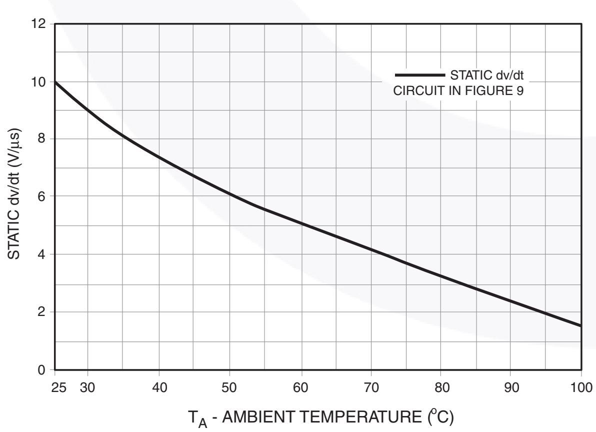


Figure 7. dv/dt vs. Temperature

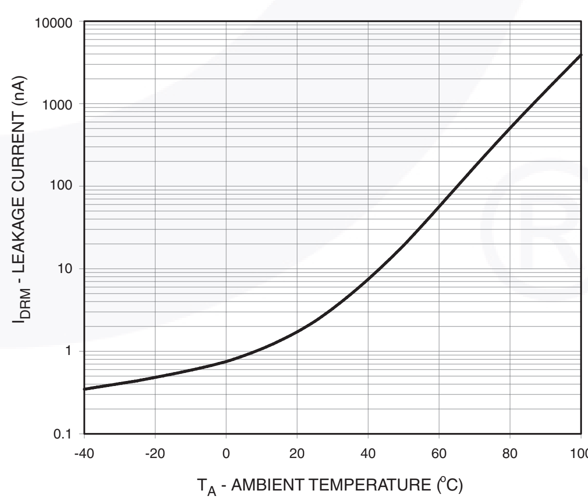
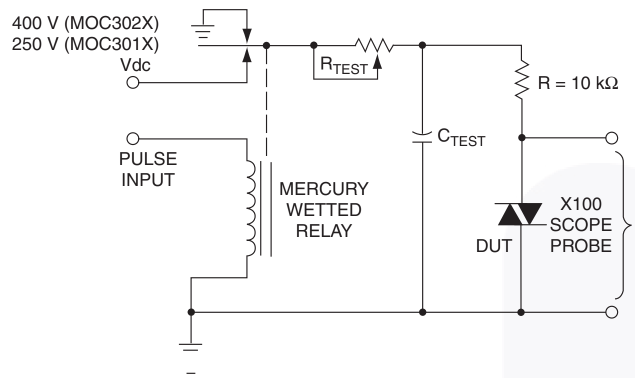
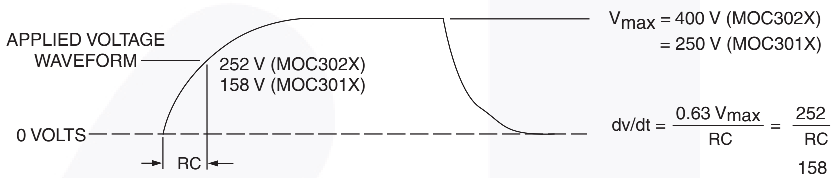


Figure 8. Leakage Current, I_{DRM} vs. Temperature



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

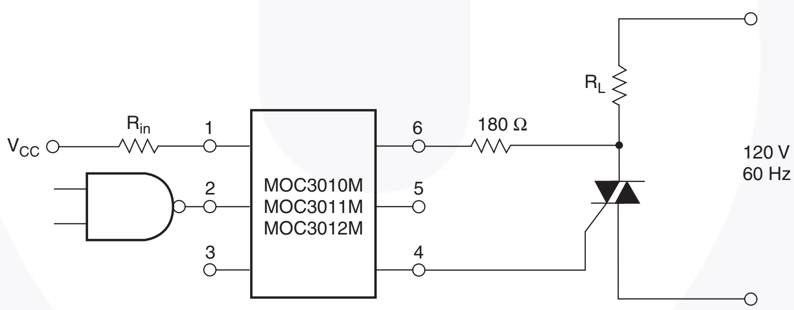


Figure 10. Resistive Load

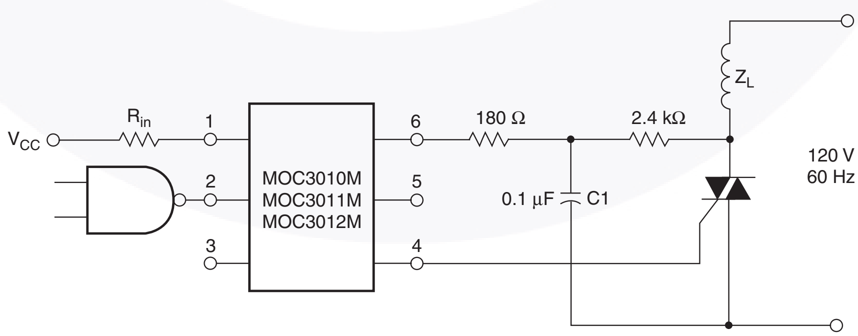


Figure 11. Inductive Load with Sensitive Gate Triac ($I_{GT} \leq 15$ mA)

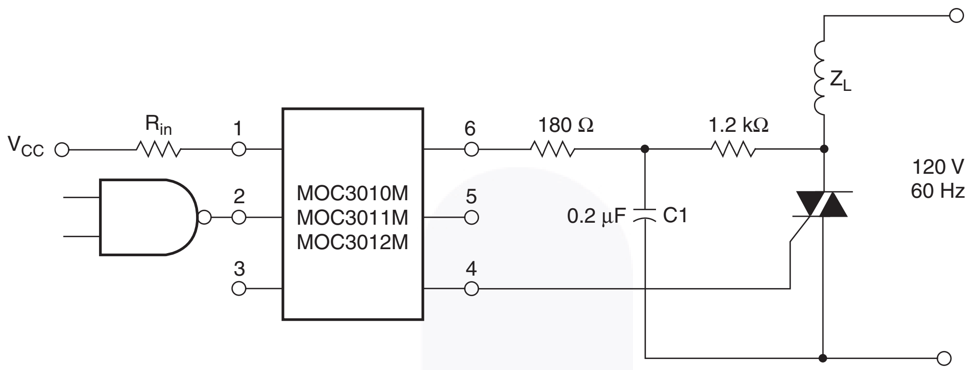
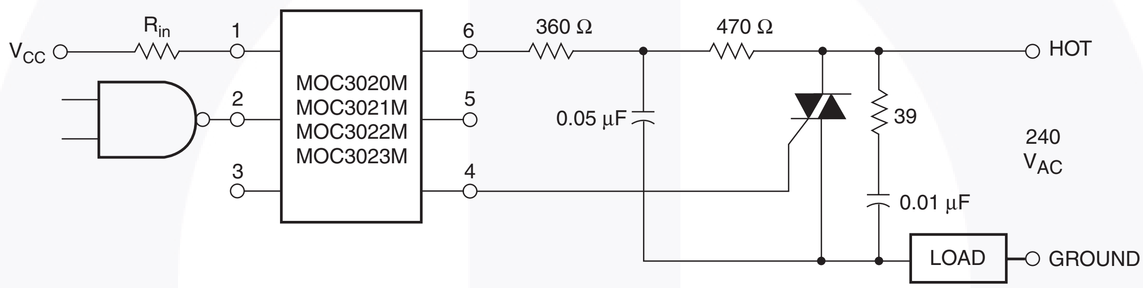


Figure 12. Inductive Load with sensitive Gate Triact (IGT ≤ 15 mA)



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

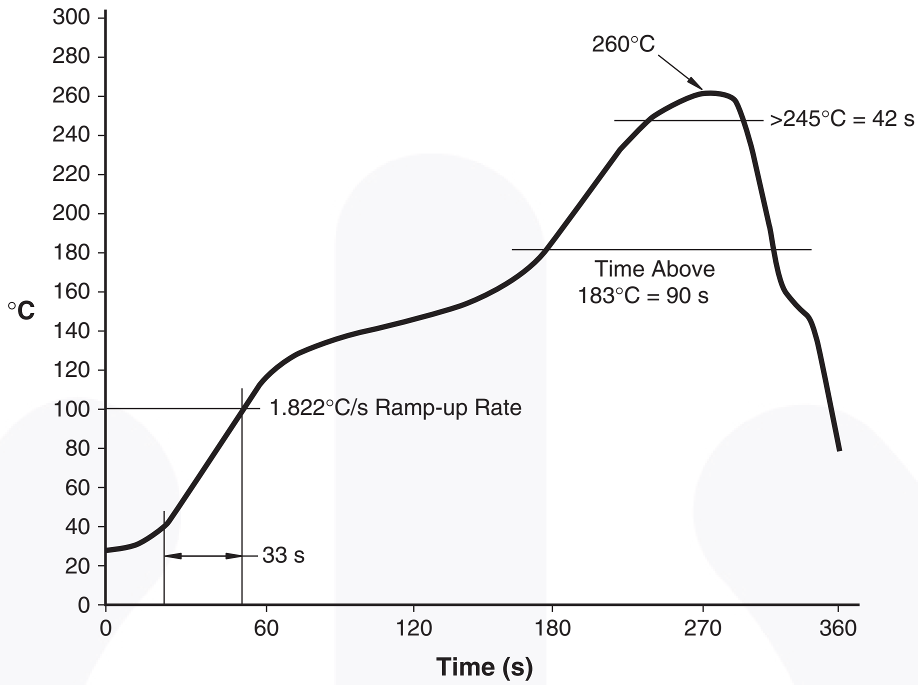
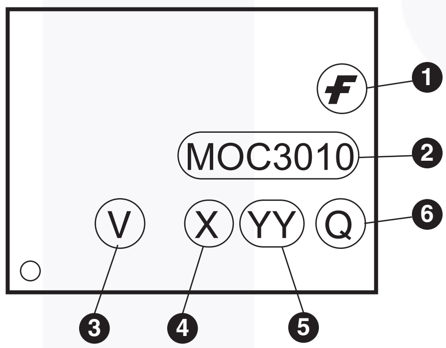


Figure 14. Relow Profile

Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	MOC3010M	Standard Through Hole Device
S	MOC3010SM	Surface Mount Lead Bend
SR2	MOC3010SR2M	Surface Mount; Tape and Reel
T	MOC3010TM	0.4" Lead Spacing
V	MOC3010VM	VDE 0884
TV	MOC3010TVM	VDE 0884, 0.4" Lead Spacing
SV	MOC3010SVM	VDE 0884, Surface Mount
SR2V	MOC3010SR2VM	VDE 0884, Surface Mount, Tape and Reel

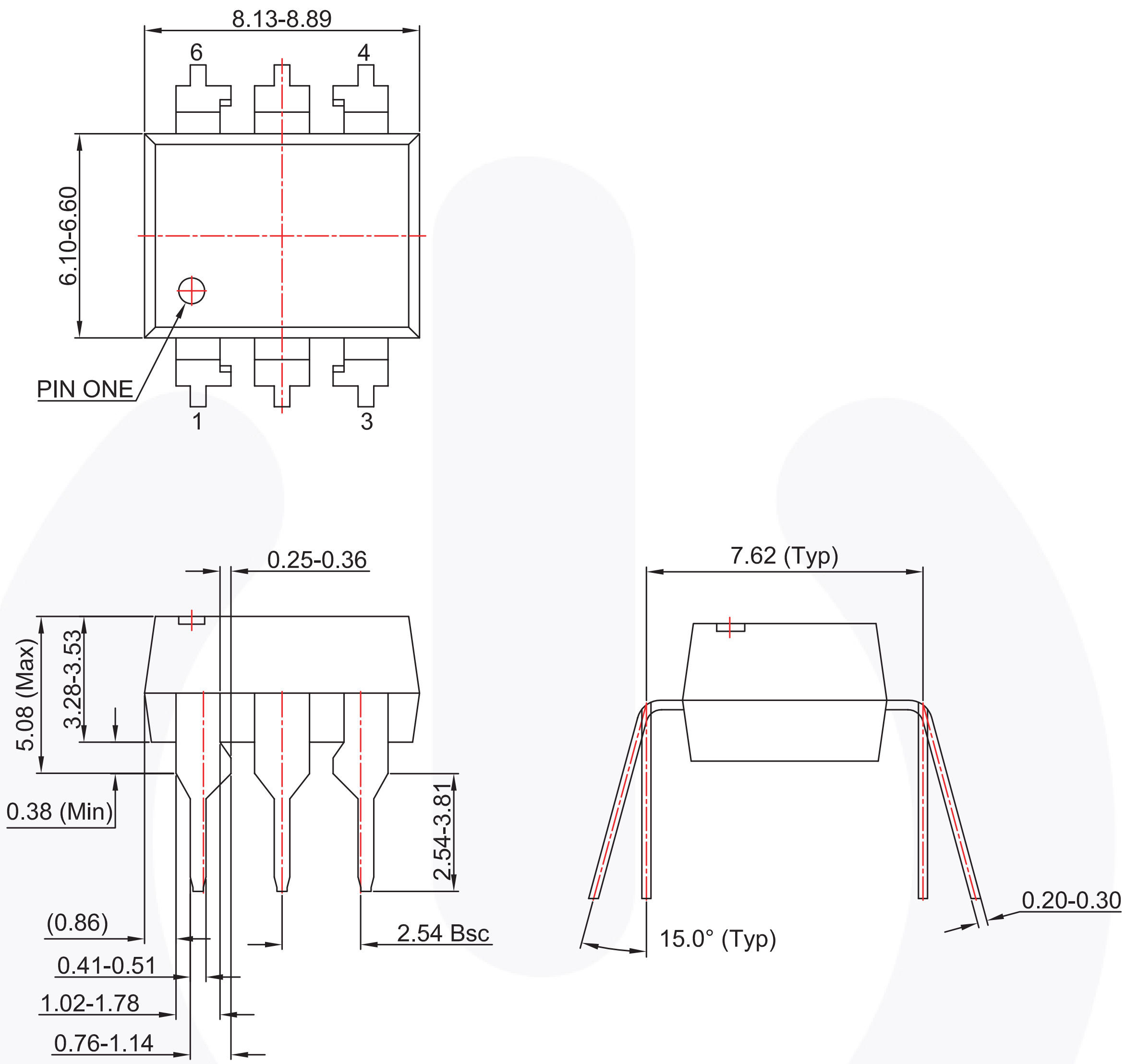
Marking Information



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One-digit year code, e.g., ‘3’
5	Two-digit work week, ranging from ‘01’ to ‘53’
6	Assembly package code

*Note – Parts that do not have the ‘V’ option (see definition 3 above) that are marked with date code ‘325’ or earlier are marked in portrait format.

Package Dimensions



NOTES:

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B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION: MKT-N06BREV3.

Figure 15. 6-Pin DIP Through Hole

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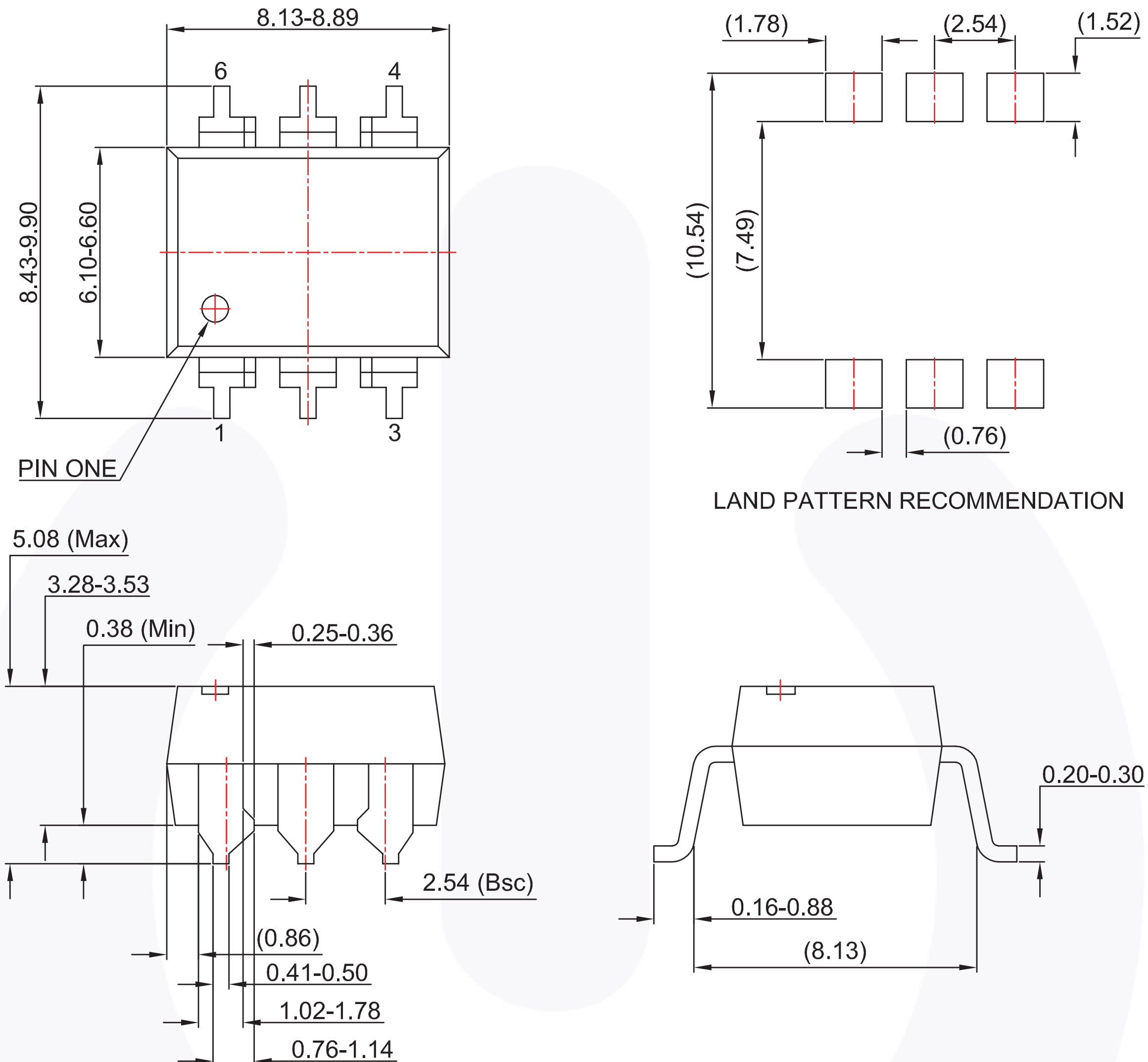
Package Dimensions (Continued)



NOTES:

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C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION : MKT-N06CREV3.

Figure 16. 6-Pin DIP Surface Mount

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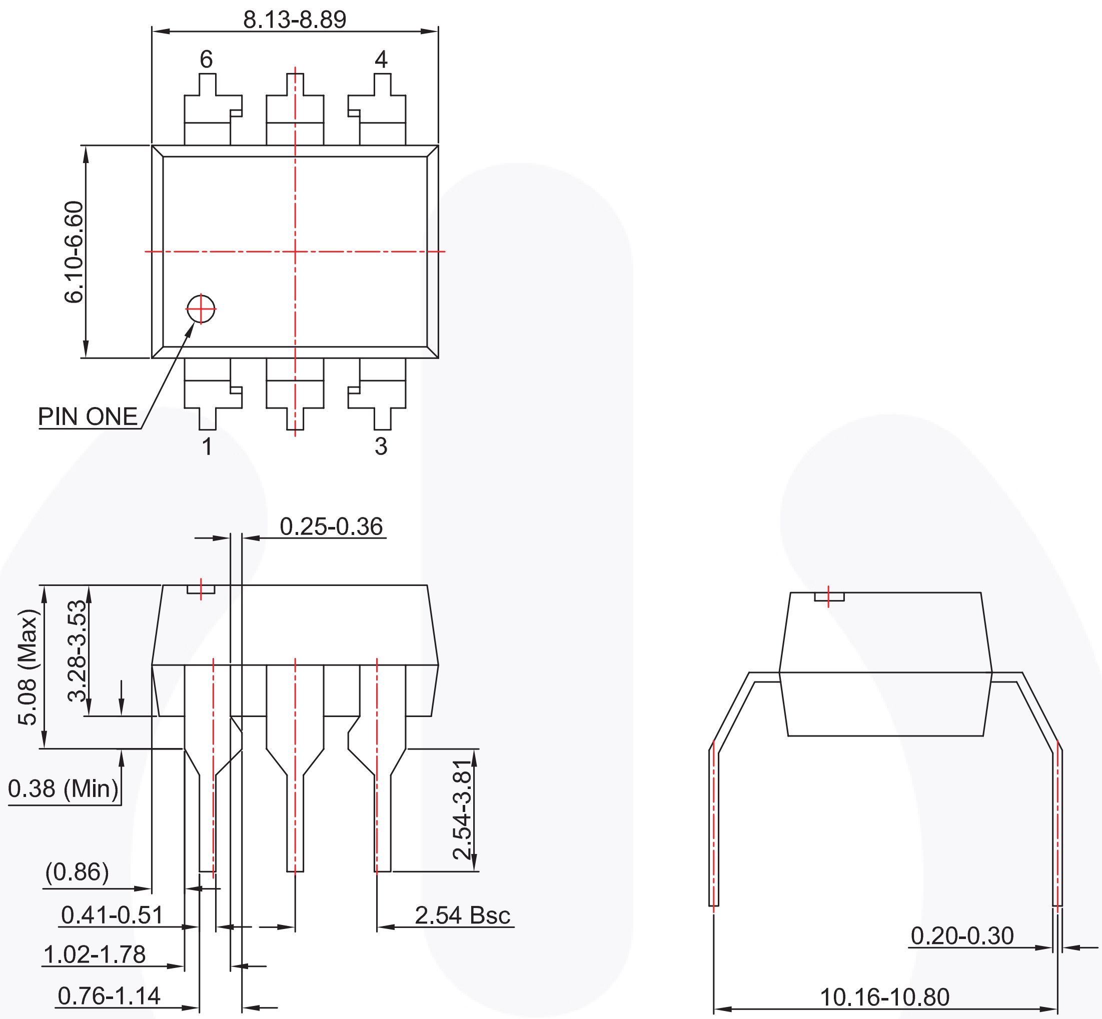
Package Dimensions (Continued)



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C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION: MKT-N06DREV3.

Figure 17. 6-Pin DIP 0.4" Lead Spacing

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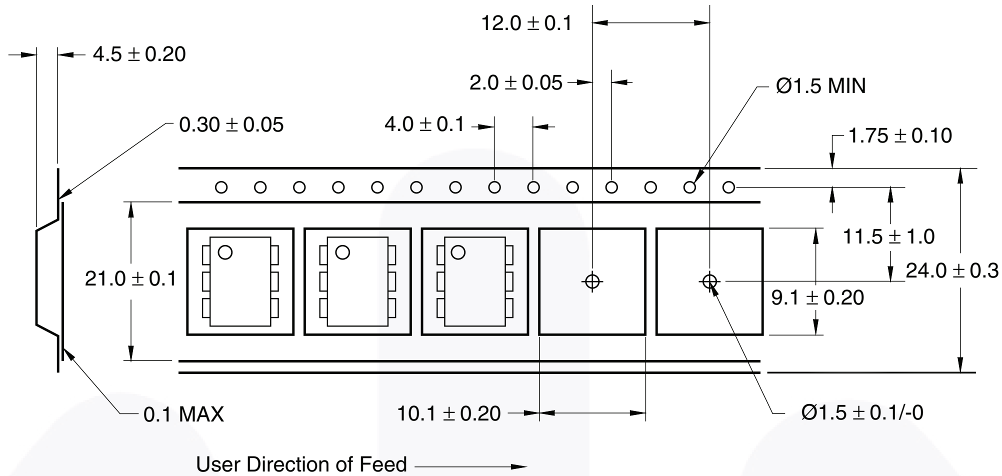
Carrier Tape Specification



Note:
All dimensions are in millimeters.

Figure 18. Carrier Tape Specification

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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