FAIRCHILD SEMICONDUCTOR®

May 2013

TIL111M, TIL117M, MOC8100M
General Purpose 6-Pin Phototransistor Optocouplers

Features

- UL Recognized (File # E90700)
- VDE Recognized (File #102497 for white package)
  - Add Option V (e.g., TIL111VM)

Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Appliance Sensor Systems
- Industrial Controls

General Description

The MOC8100M, TIL111M, and TIL117M optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

Schematic

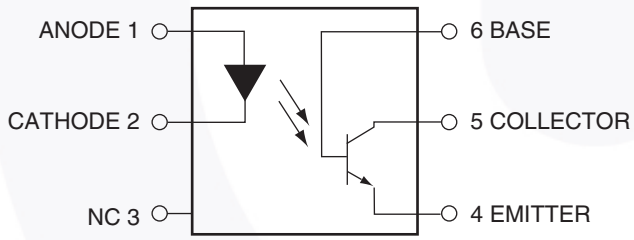


Figure 1. Schematic

Package Outlines

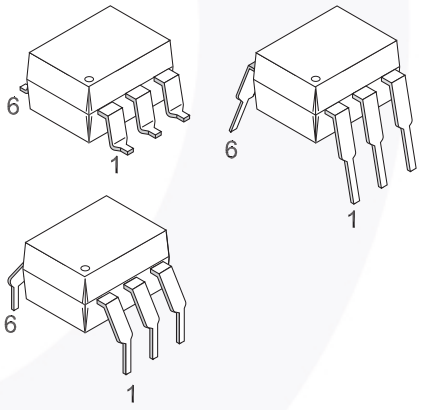


Figure 2. Package Outlines

Safety and Insulation Ratings

As per IEC60747-5-2. 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.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For Rated Mains Voltage < 150 V_{RMS}		I–IV		
	For Rated Mains Voltage < 300 V_{RMS}		I–IV		
	Climatic Classification		55/100/21		
	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
	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.

Symbol	Parameter	Device	Value	Units
Total Device				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +100	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 sec	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	All	250	mW
	Derate Above 25°C		2.94	mW/°C
Emitter				
I_F	DC/Average Forward Input Current	All	60	mA
V_R	Reverse Input Voltage	TIL111M	3	V
		MOC8100M, TIL117M	6	
I_F(pk)	Forward Current – Peak (300 µs, 2% Duty Cycle)	All	3	A
P_D	LED Power Dissipation @ T_A = 25°C	All	120	mW
	Derate Above 25°C		1.41	mW/°C
Detector				
V_{CEO}	Collector-Emitter Voltage	All	30	V
V_{CBO}	Collector-Base Voltage	All	70	V
V_{ECO}	Emitter-Collector Voltage	TIL111M, TIL117M	7	V
V_{EBO}	Emitter-Base Voltage	All	7	
P_D	Detector Power Dissipation @ T_A = 25°C	All	150	mW
	Derate Above 25°C		1.76	mW/°C

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameter	Test Conditions		Device	Min.	Typ.*	Max.	Unit
Emitter								
V_F	Input Forward Voltage	I_F = 16 mA	T_A = 25°C	TIL111M		1.2	1.4	V
		I_F = 10 mA for MOC8100M, I_F = 16 mA for TIL117M	T_A = 0°C to 70°C	MOC8100M, TIL117M		1.2	1.4	
			T_A = -55°C			1.32		
			T_A = +100°C			1.10		
I_R	Reverse Leakage Current	V_R = 3.0 V		TIL111M, TIL117M		0.001	10	µA
		V_R = 6.0 V		MOC8100M		0.001	10	µA
Detector								
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 1.0 mA, I_F = 0		All	30	100		V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10 µA, I_F = 0		All	70	120		V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_F = 0		All	7	10		V
BV_{ECO}	Emitter-Collector Breakdown Voltage	I_F = 100 µA, I_F = 0		TIL111M, TIL117M	7	10		V
I_{CEO}	Collector-Emitter Dark Current	V_{CE} = 10 V, I_F = 0		TIL111M, TIL117M		1	50	nA
		V_{CE} = 5 V, T_A = 25°C		MOC8100M		0.5	25	nA
		V_{CE} = 30 V, I_F = 0, T_A = 70°C		TIL117M, MOC8100M		0.2	50	µA
I_{CBO}	Collector-Base Dark Current	V_{CB} = 10 V		TIL111M, TIL117M			20	nA
I_{CBO}		V_{CB} = 5 V		MOC8100M			10	nA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz		All		8		pF

*All Typical values at T_A = 25°C

Electrical Characteristics (Continued)

T_A = 25°C unless otherwise specified.

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min	Typ*	Max	Unit
DC Characteristics							
CTR_{CE}	Current Transfer Ratio, Collector to Emitter	I_F = 10 mA, V_{CE} = 10 V	TIL117M	50			%
		I_F = 1 mA, V_{CE} = 5 V	MOC8100M	50			%
		I_F = 1 mA, V_{CE} = 5 V, T_A = 0°C to +70°C		30			
$I_{C(ON)}$	On-State Collector Current (Phototransistor Operation)	I_F = 16 mA, V_{CE} = 0.4 V	TIL111M	2			mA
	On-State Collector Current (Photodiode Operation)	I_F = 16 mA, V_{CB} = 0.4 V		7			µA
$V_{CE\ (SAT)}$	Collector-Emitter Saturation Voltage	I_C = 500 µA, I_F = 10 mA	TIL117M			0.4	V
		I_C = 2 mA, I_F = 16 mA	TIL111M			0.4	
		I_C = 100 µA, I_F = 1 mA	MOC8100M			0.5	
AC Characteristics							
t_{ON}	Turn-On Time	I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Fig. 13)	MOC8100M			20	µs
			TIL117M			10	
t_{OFF}	Turn-Off Time		MOC8100M			20	µs
			TIL117M			10	
t_r	Rise Time		MOC8100M		2		µs
t_f	Fall Time		TIL117M		2		
t_r	Rise Time (Phototransistor Operation)	$I_{C(ON)}$ = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Fig. 13)	TIL111M			10	µs
t_f	Fall Time (Phototransistor Operation)						

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	f = 60 Hz, t = 1 s	7500			$V_{AC(PK)}$
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V_{DC}	10^{11}			Ω
C_{ISO}	Isolation Capacitance	V_{I-O} = 0, f = 1 MHz		0.2		pF

*All Typical values at T_A = 25°C.

Typical Performance Characteristics

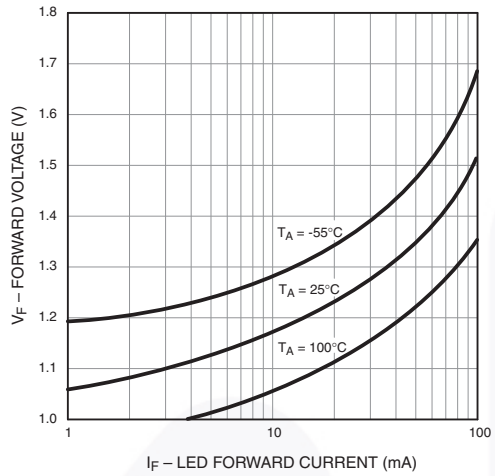


Figure 3. LED Forward Voltage vs. Forward Current

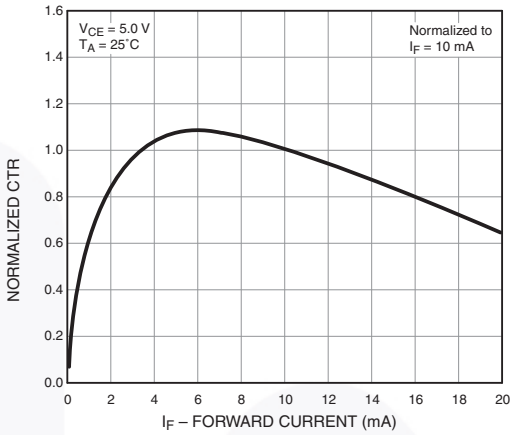


Figure 4. Normalized CTR vs. Forward Current

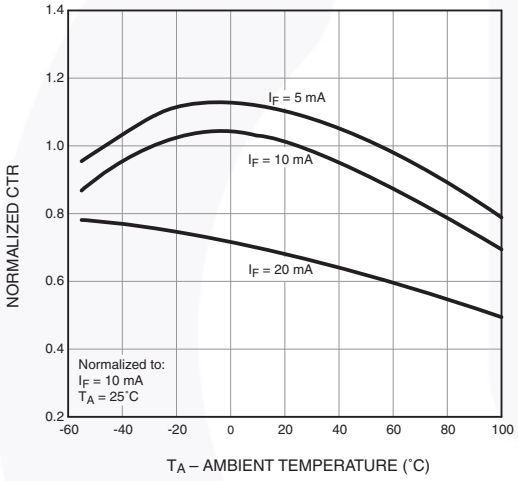


Figure 5. Normalized CTR vs. Ambient Temperature

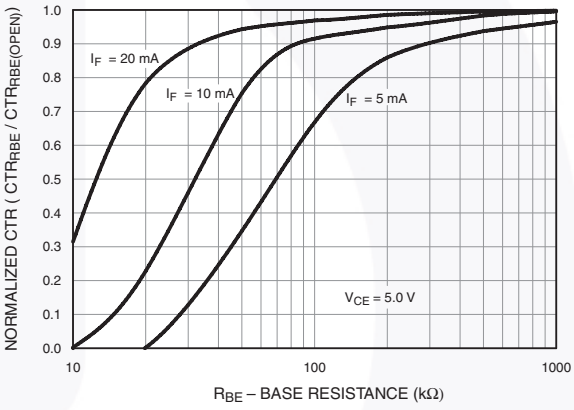


Figure 6. CTR vs. RBE (Unsaturated)

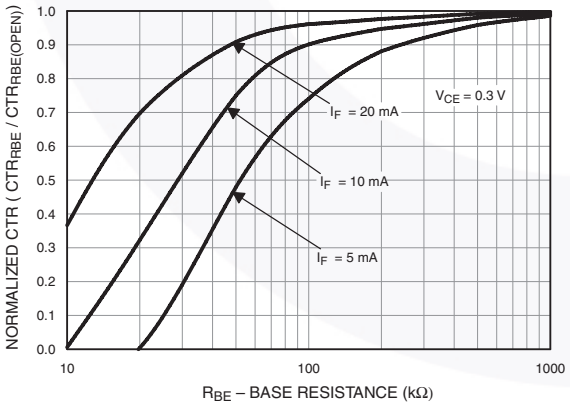


Figure 7. CTR vs. RBE (Saturated)

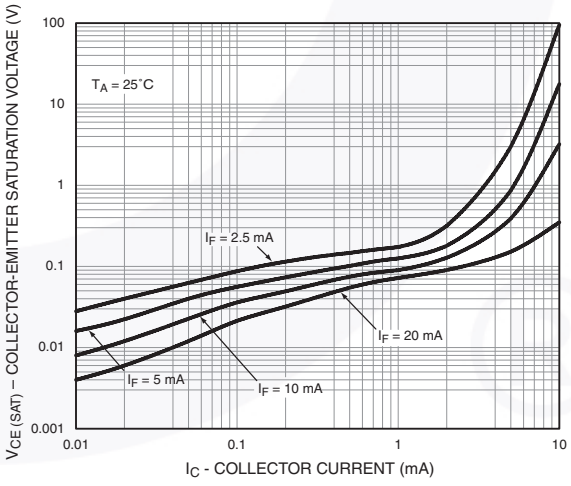


Figure 8. Collector-Emitter Saturation Voltage vs Collector Current

Typical Performance Characteristics (Continued)

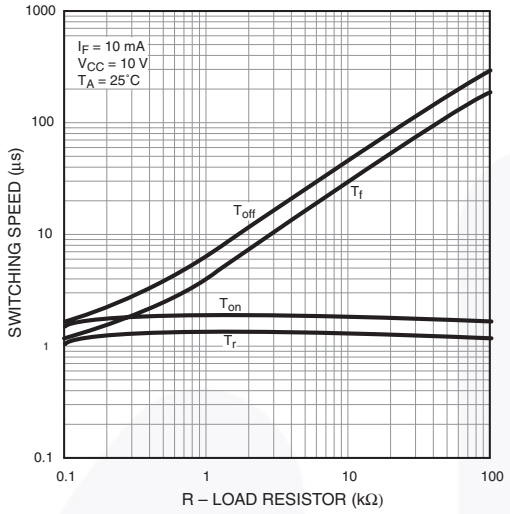


Figure 9. Switching Speed vs. Load Resistor

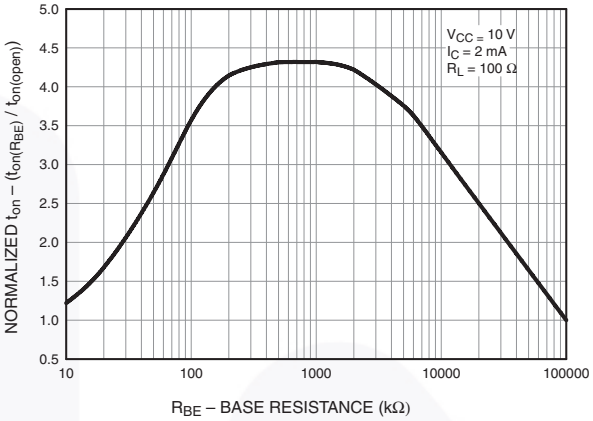


Figure 10. Normalized t_{on} vs. R_{BE}

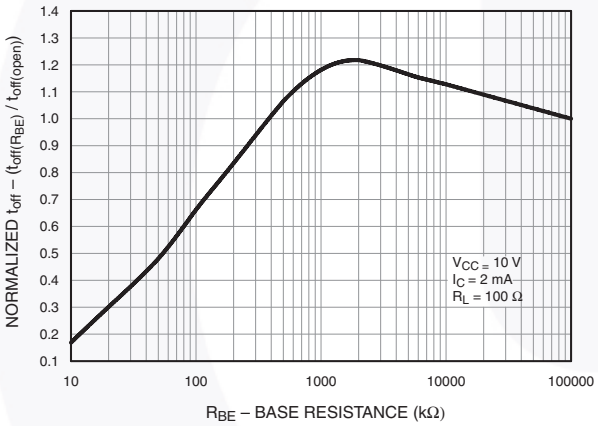


Figure 11. Normalized t_{off} vs. R_{BE}

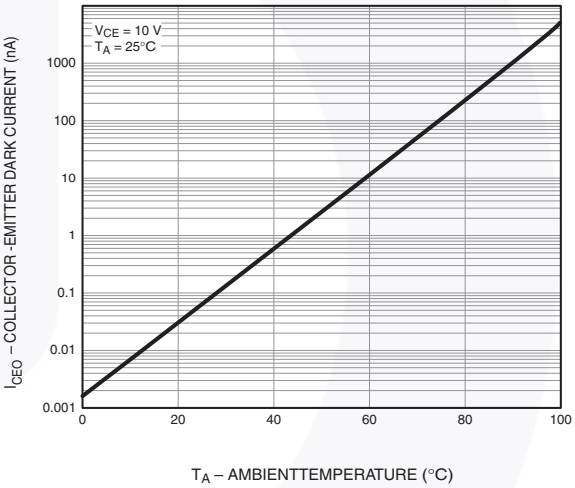
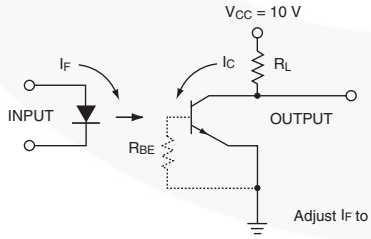


Figure 12. Dark Current vs. Ambient Temperature

TEST CIRCUIT



WAVEFORMS

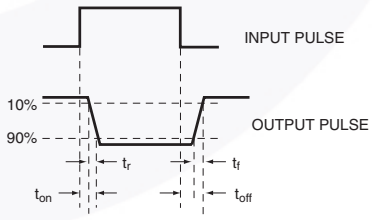


Figure 13. Switching Time Test Circuit and Waveforms

Reflow Profile

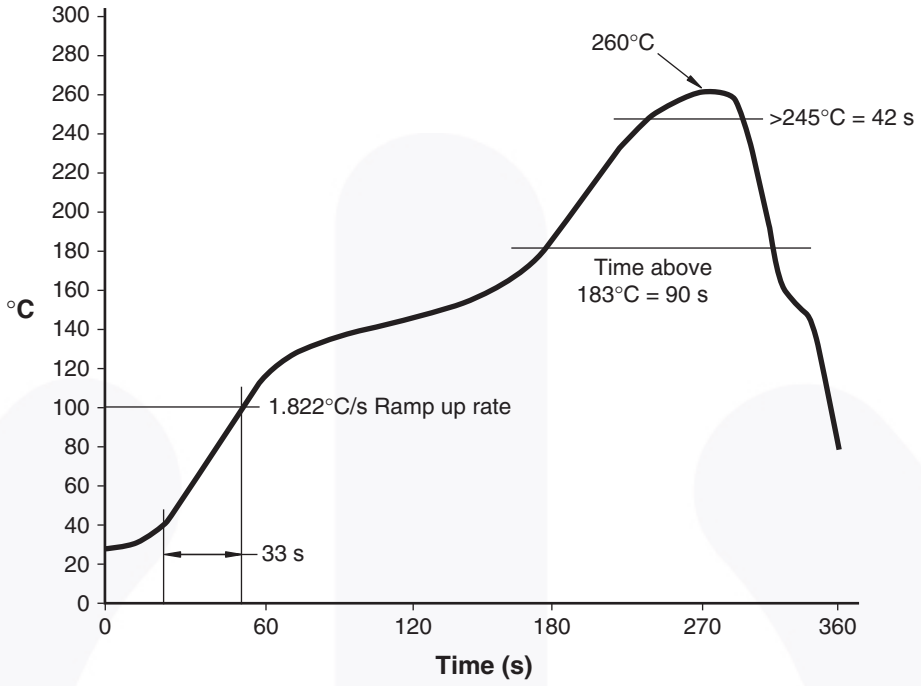
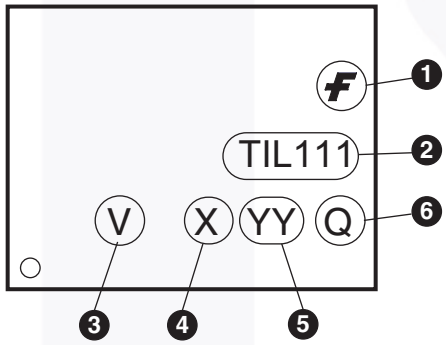


Figure 14. Reflow Profile

Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	TIL111M	Standard Through-Hole Device
S	TIL111SM	Surface Mount Lead Bend
SR2	TIL111SR2M	Surface Mount; Tape and Reel
T	TIL111TM	0.4" Lead Spacing
V	TIL111VM	VDE 0884
TV	TIL111TVM	VDE 0884, 0.4" Lead Spacing
SV	TIL111SVM	VDE 0884, Surface Mount
SR2V	TIL111SR2VM	VDE 0884, Surface Mount, Tape and Reel

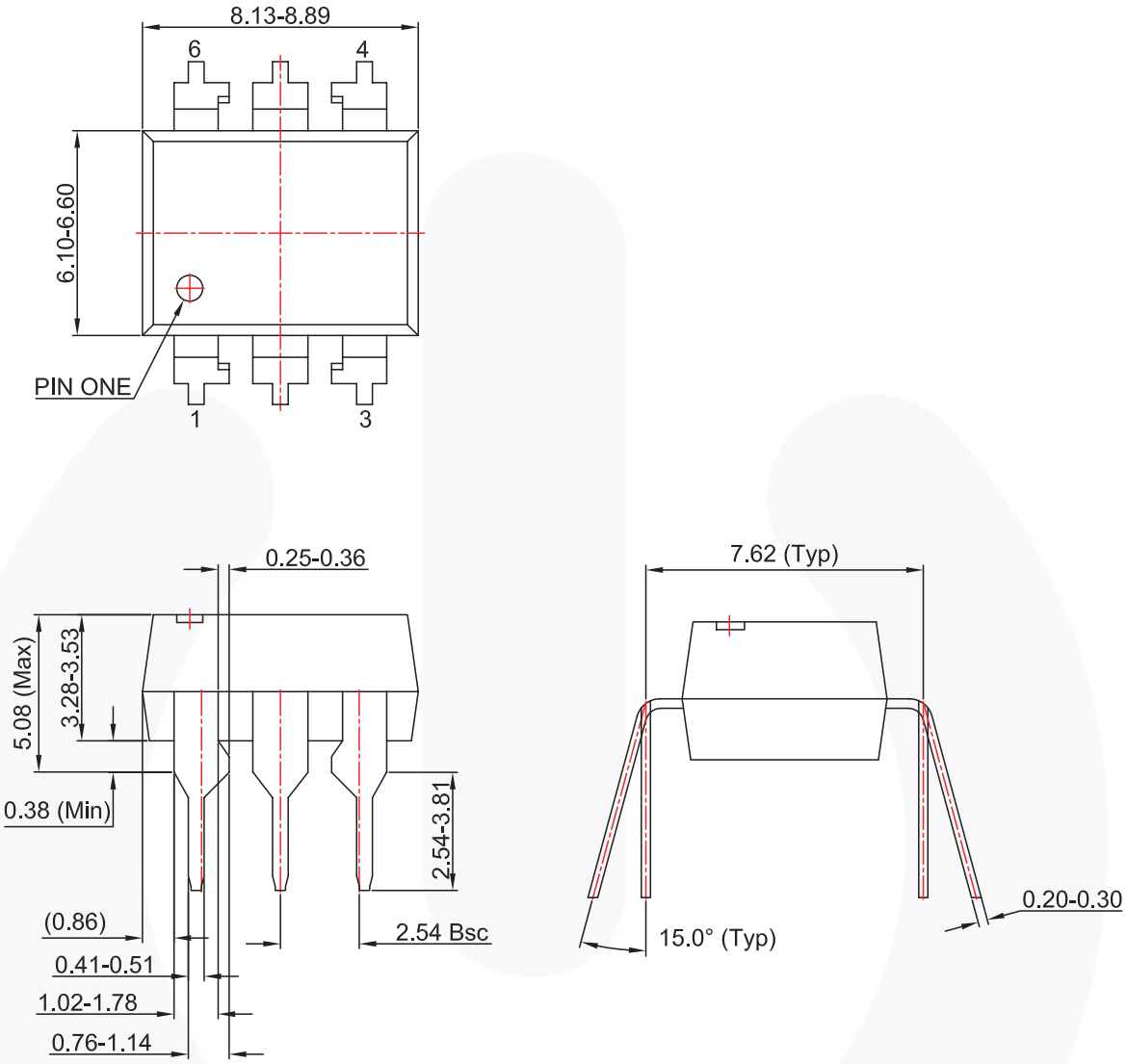
Marking Information



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:

A) NO STANDARD APPLIES TO THIS PACKAGE.

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)

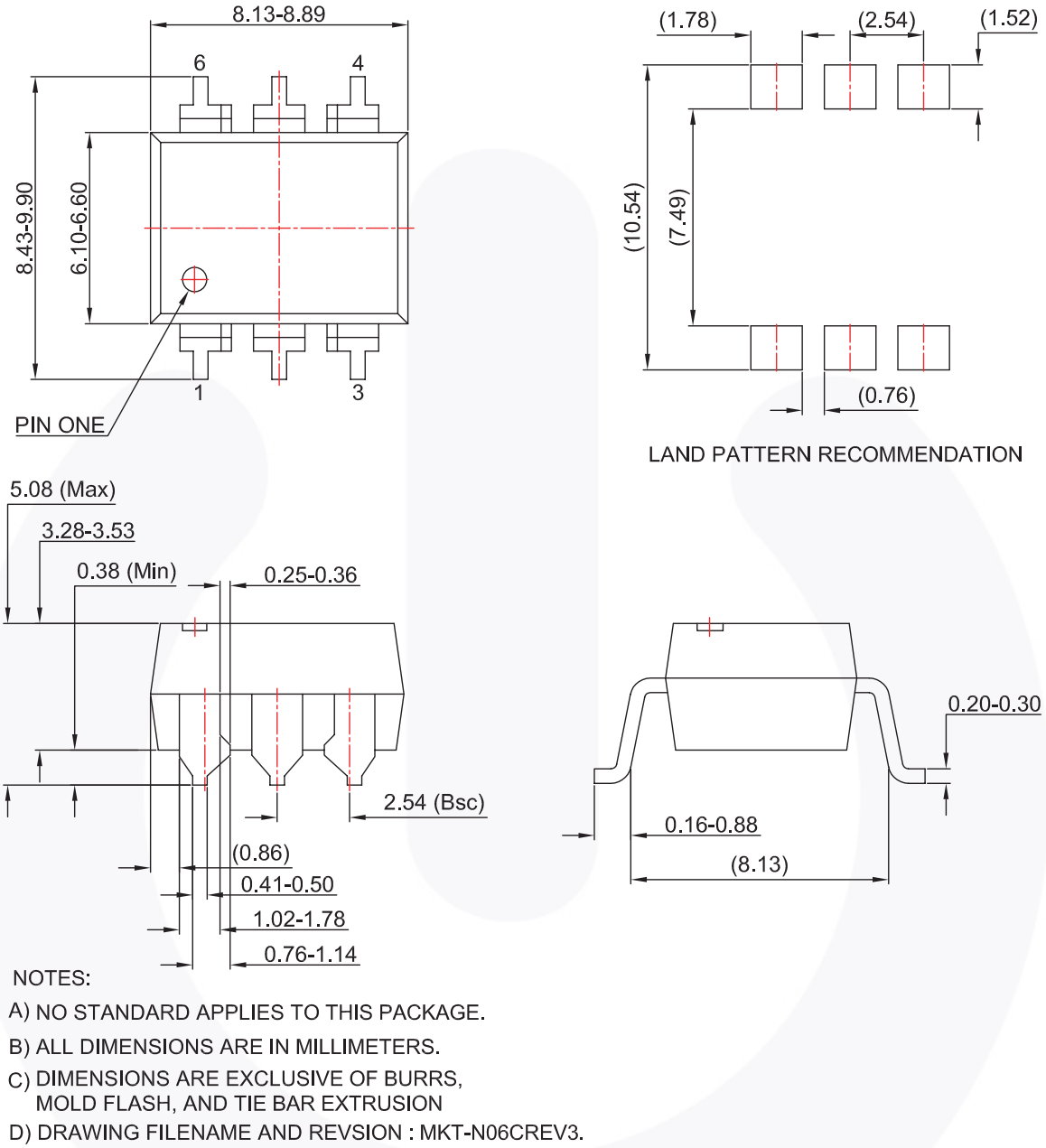

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Figure 16. 6-Pin DIP Surface Mount

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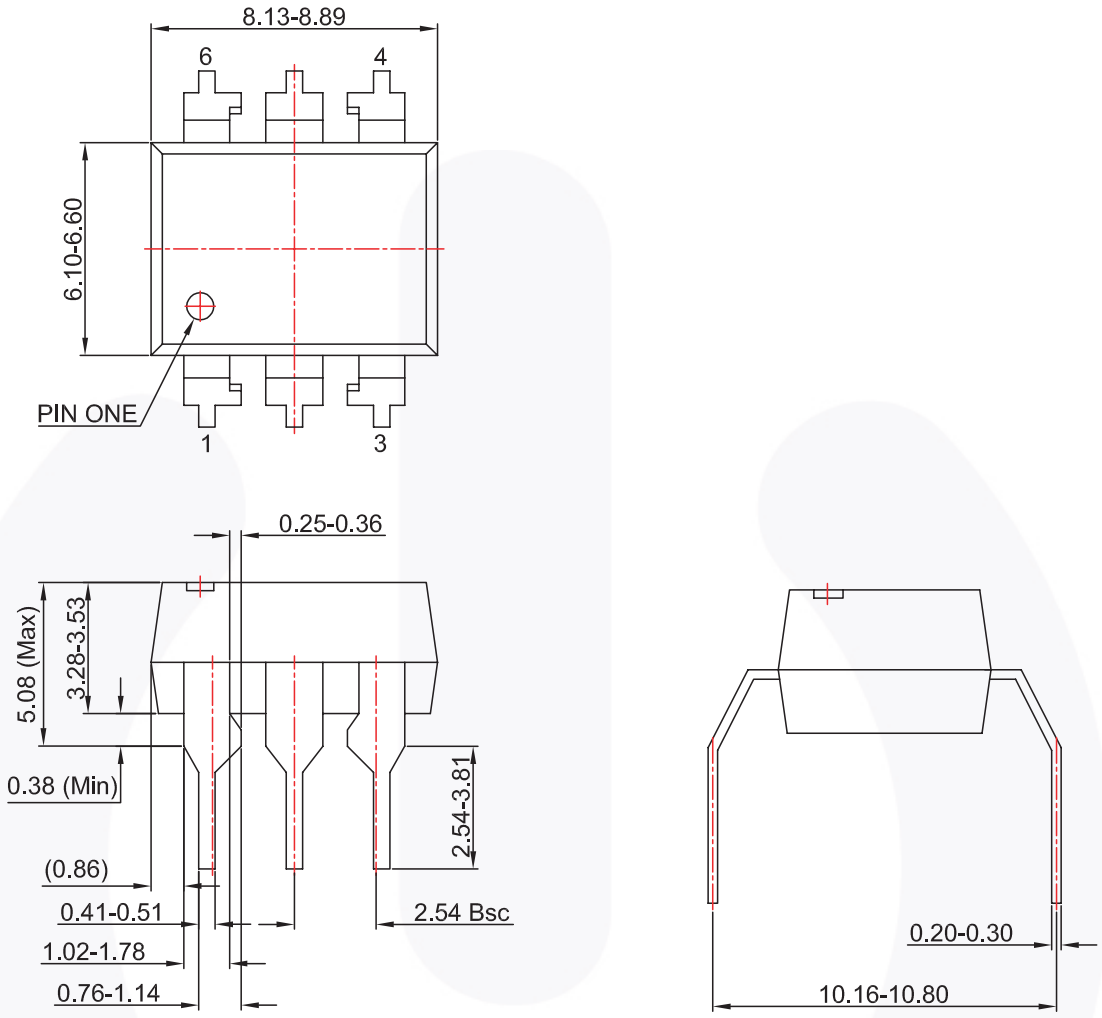
Package Dimensions (Continued)



NOTES:

A) NO STANDARD APPLIES TO THIS PACKAGE.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

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

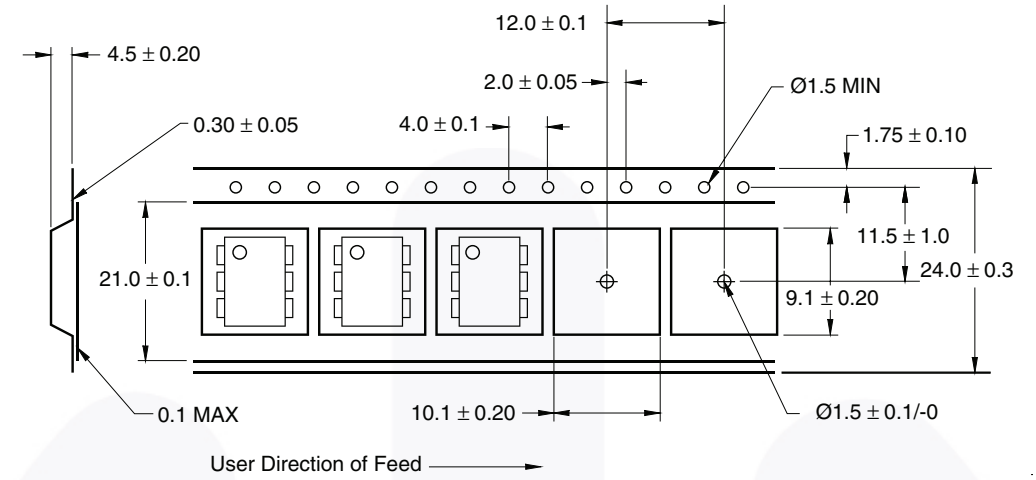

Figure 18. Carrier Tape Specification

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PRODUCT STATUS DEFINITIONS

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.

Rev. I64

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