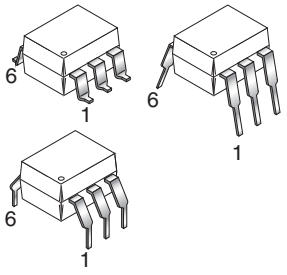
FAIRCHILD
SEMICONDUCTOR®

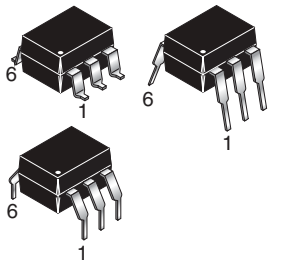
GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLERS

TIL111 **TIL111-M** **TIL117-M** **MOC8100-M**

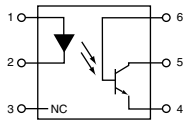
WHITE PACKAGE (-M SUFFIX)



BLACK PACKAGE (NO -M SUFFIX)



SCHEMATIC



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

DESCRIPTION

The MOC8100, TIL111 and TIL117 optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

FEATURES

- The TIL111 is also available in both black and white packages by specifying -M suffix, e.g. TIL111-M for the white package and no suffix for the black package.
- UL recognized (File # E90700)
- VDE recognized (File # 94766); (File #102497 for white package)
  - Add option V for white package (e.g., TIL111V-M)
  - Add option 300 for black package (e.g., TIL111.300)

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

Parameter	Device	Symbol	Value	Units
TOTAL DEVICE				
Storage Temperature	All	T_{STG}	-55 to +150	°C
Operating Temperature	All	T_{OPR}	-55 to +100	°C
Lead Solder Temperature	All	T_{SOL}	260 for 10 sec	°C
Total Device Power Dissipation @ T_A = 25°C	All	P_D	250	mW
Derate above 25°C			3.3 (non-M) 2.94 (-M)	mW/°C
EMITTER				
DC/Average Forward Input Current	All	I_F	100 (non-M), 60 (-M)	mA
Reverse Input Voltage	TIL111/TIL111-M	V_R	3	V
	MOC8100-M/TIL117-M		6	
Forward Current - Peak (300µs, 2% Duty Cycle)	All	I_F(pk)	3	A
LED Power Dissipation @ T_A = 25 °C	All	P_D	150 (non-M), 120 (-M)	mW
Derate above 25°C			2.0 (non-M), 1.41 (-M)	mW/°C
DETECTOR				
Collector-Emitter Voltage	All	V_{CEO}	30	V
Collector-Base Voltage	All	V_{CBO}	70	V
Emitter-Collector Voltage	TIL111-M/TIL117-M	V_{ECO}	7	V
Emitter-Base Voltage	All	V_{EBO}	7	
Detector Power Dissipation @ T_A = 25 °C	All	P_D	150	mW
Derate above 25°C			2.0 (non-M), 1.76 (-M)	mW/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameter	Test Conditions	Device	Symbol	Min	Typ*	Max	Unit
EMITTER							
Input Forward Voltage	(I_F = 16 mA) (T_A = 25°C)	TIL111/TIL111-M	V_F		1.2	1.4	V
	(I_F = 10 mA; for MOC8100-M) (T_A = 0-70°C)	MOC8100-M/ TIL117-M			1.2	1.4	
	(I_F = 10 mA; for MOC8100-M) (T_A = -55°C)				1.32		
	(I_F = 16 mA; for TIL117-M) (T_A = +100°C)				1.10		
Reverse Leakage Current	(V_R = 3.0 V)	TIL111/TIL111-M/ TIL117-M	I_R		0.001	10	µA
	(V_R = 6.0V)	MOC8100-M			0.001	10	µA
DETECTOR							
Collector-Emitter Breakdown Voltage	(I_C = 1.0 mA, I_F = 0)	All	BV_{CEO}	30	100		V
Collector-Base Breakdown Voltage	(I_C = 10 µA, I_F = 0)	All	BV_{CBO}	70	120		V
Emitter-Base Breakdown Voltage	(I_E = 10 µA, I_F = 0)	All	BV_{EBO}	7	10		V
Emitter-Collector Breakdown Voltage	(I_F = 100µA, I_F = 0)	TIL111-M TIL117-M	BV_{ECO}	7	10		V
Collector-Emitter Dark Current	(V_{CE} = 10 V, I_F = 0)	TIL111/TIL111-M/ TIL117-M	I_{CEO}		1	50	nA
	(V_{CE} = 5V, T_A = 25°C)	MOC8100-M	I_{CEO}		0.5	25	nA
	(V_{CE} = 30 V, I_F = 0, T_A = 70°C)	TIL117-M/ MOC8100-M	I_{CEO}		0.2	50	µA
Collector-Base Dark Current	(V_{CB} = 10 V)	TIL111/TIL111-M/ TIL117-M	I_{CBO}			20	nA
	(V_{CB} = 5 V)	MOC8100-M	I_{CBO}			10	nA
Capacitance	(V_{CE} = 0 V, f = 1 MHz)	All	C_{CE}		8		pF

ISOLATION CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Min	Typ*	Max	Units
Input-Output Isolation Voltage	(Non '-M', Black Package) (f = 60 Hz, t = 1 min)	V_{ISO}	5300			Vac(rms)
	('-M', White Package) (f = 60 Hz, t = 1 sec)		7500			Vac(pk)
Isolation Resistance	(V_{I-O} = 500 VDC)	R_{ISO}	10^{11}			Ω
Isolation Capacitance	(V_{I-O} = 0, f = 1 MHz)	C_{ISO}			2	pF

Note
* Typical values at T_A = 25°C unless otherwise noted

TRANSFER CHARACTERISTICS (T_A = 25°C Unless otherwise specified.)

DC Characteristic	Test Conditions	Symbol	Device	Min	Typ*	Max	Unit
Current Transfer Ratio, Collector to Emitter	(I_F = 10 mA, V_{CE} = 10 V)	CTR_{CE}	TIL117-M	50			%
	(I_F = 1 mA, V_{CE} = 5 V)		MOC8100-M	50			%
	(I_F = 1 mA, V_{CE} = 5 V, T_A = 0 to +70°C)			30			
On-State Collector Current (Phototransistor Operation)	(I_F = 16 mA, V_{CE} = 0.4 V)	$I_{C(ON)}$	TIL111 TIL111-M	2			mA
On-State Collector Current (Photodiode Operation)	(I_F = 16 mA, V_{CB} = 0.4V)			7			µA
Collector-Emitter Saturation Voltage	(I_C = 500 µA, I_F = 10 mA)	$V_{CE\ (SAT)}$	TIL117-M			0.4	V
	(I_C = 2 mA, I_F = 16 mA)		TIL111 TIL111-M			0.4	
	(I_C = 100 µA, I_F = 1 mA)		MOC8100-M			0.5	
AC Characteristic							
Turn-On Time	(I_C = 2 mA, V_{CC} = 10 V, R_L = 100Ω) (Fig. 20)	T_{ON}	MOC8100-M			20	µs
			TIL117-M			10	
Turn-Off Time		T_{OFF}	MOC8100-M			20	µs
			TIL117-M			10	
Rise Time		t_r	MOC8100-M TIL117-M		2		µs
Fall Time		t_f			2		
Rise Time (Phototransistor Operation)	($I_{C(ON)}$ = 2 mA, V_{CC} = 10 V, R_L = 100Ω) (Fig. 20)	t_r	TIL111 TIL111-M			10	µs
Fall Time (Phototransistor Operation)		t_f					

* Typical values at T_A = 25°C

TYPICAL PERFORMANCE CURVES

Fig. 1 LED Forward Voltage vs. Forward Current (Black Package)

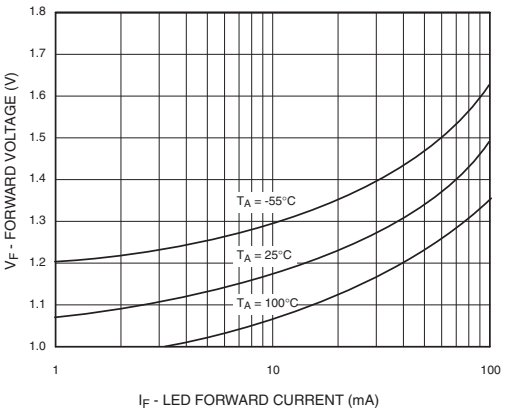


Fig. 2 LED Forward Voltage vs. Forward Current (White Package)

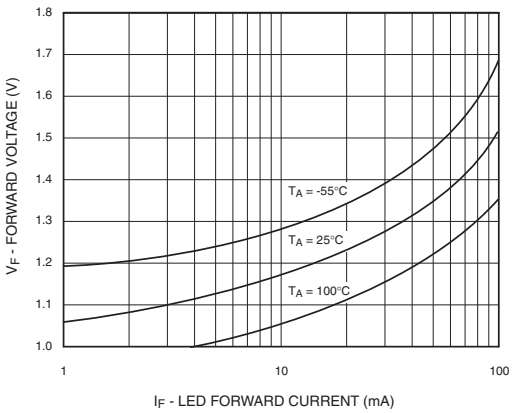


Fig.3 Normalized CTR vs. Forward Current (Black Package)

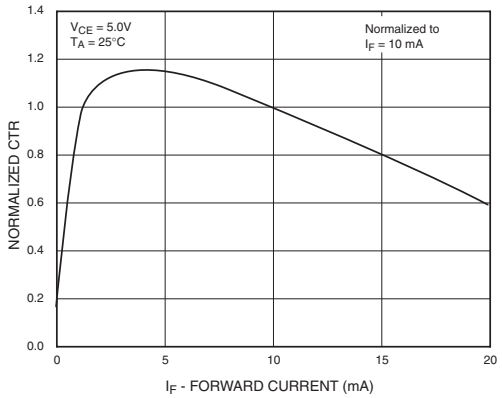


Fig.4 Normalized CTR vs. Forward Current (White Package)

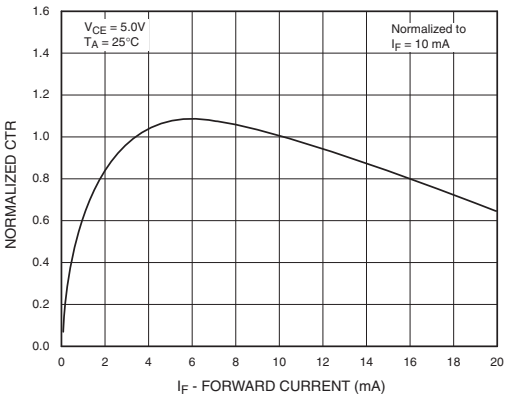


Fig. 5 Normalized CTR vs. Ambient Temperature (Black Package)

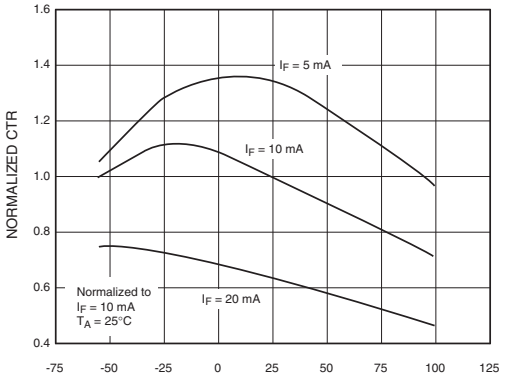


Fig. 6 Normalized CTR vs. Ambient Temperature (White Package)

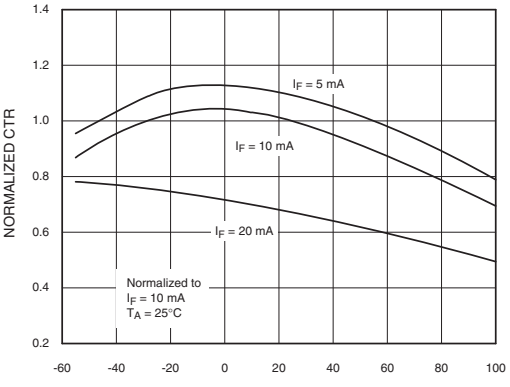


Fig. 7 CTR vs. RBE (Unsaturated) (Black Package)

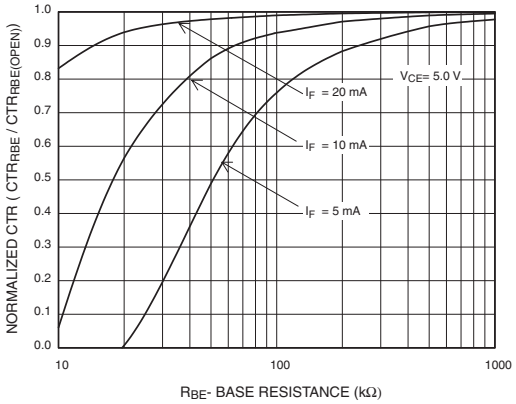


Fig. 8 CTR vs. RBE (Unsaturated) (White Package)

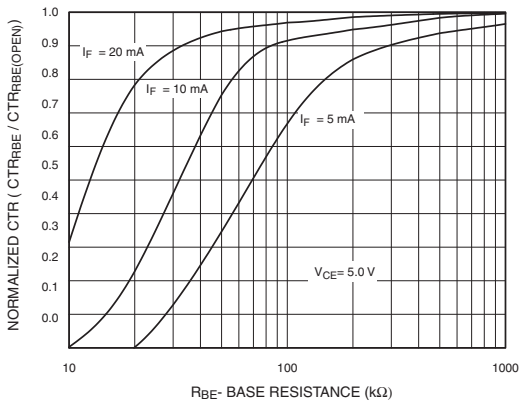


Fig. 9 CTR vs. RBE (Saturated) (Black Package)

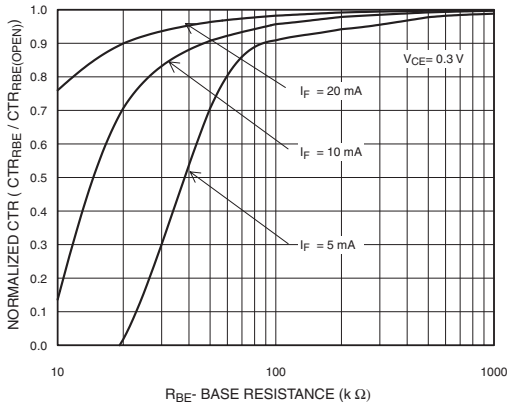


Fig. 10 CTR vs. RBE (Saturated) (White Package)

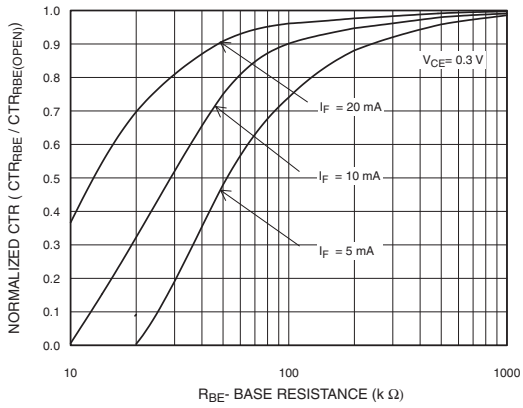


Fig. 11 Collector-Emitter Saturation Voltage vs Collector Current (Black Package)

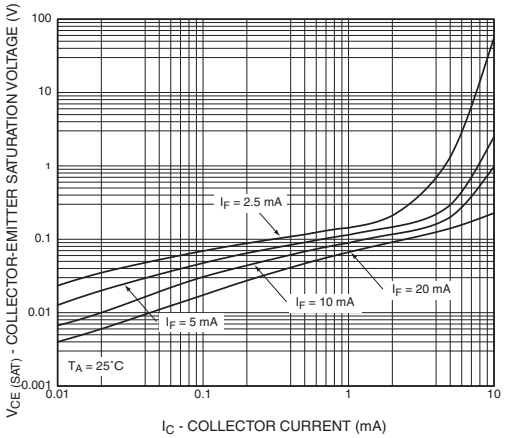


Fig. 12 Collector-Emitter Saturation Voltage vs Collector Current (White Package)

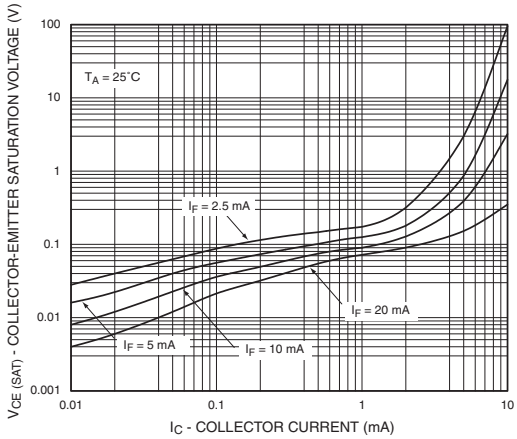


Fig. 13 Switching Speed vs. Load Resistor (Black Package)

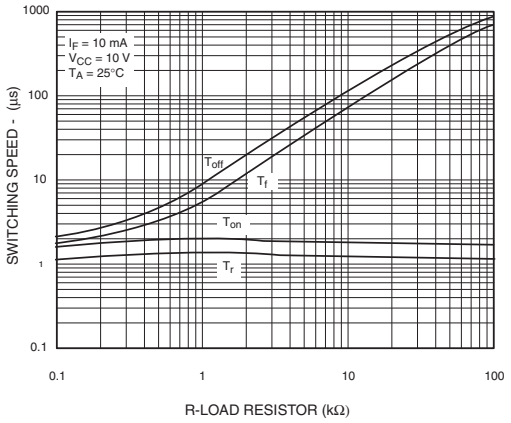


Fig. 14 Switching Speed vs. Load Resistor (White Package)

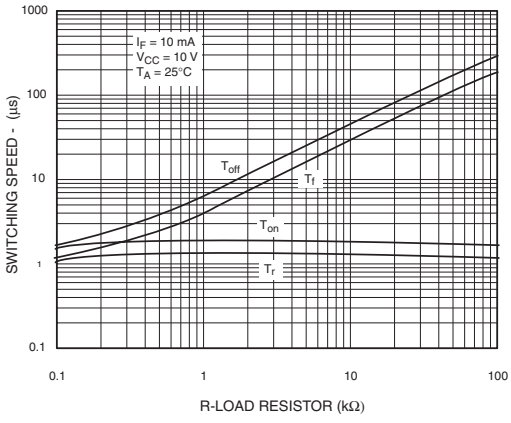


Fig. 15 Normalized t_{on} vs. R_{BE} (Black Package)

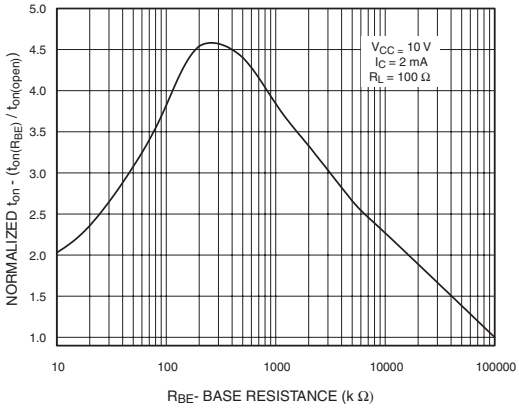


Fig. 16 Normalized t_{on} vs. R_{BE} (White Package)

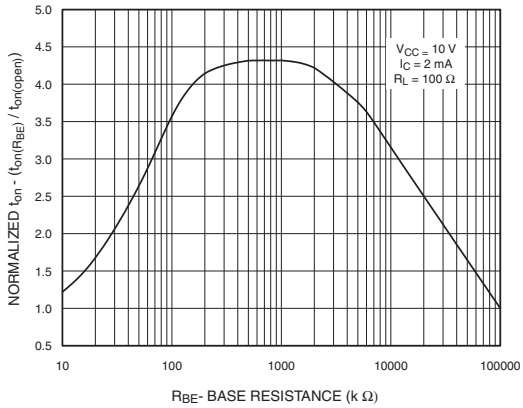


Fig. 17 Normalized t_{off} vs. R_{BE} (Black Package)

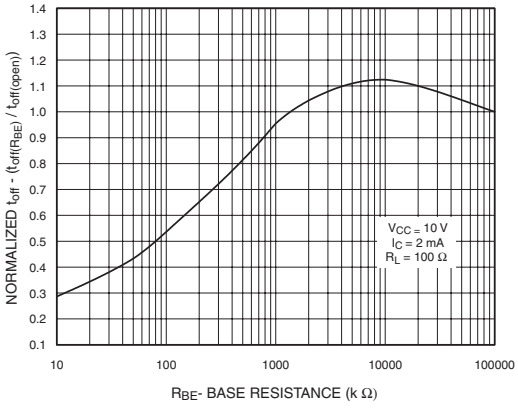


Fig. 18 Normalized t_{off} vs. R_{BE} (White Package)

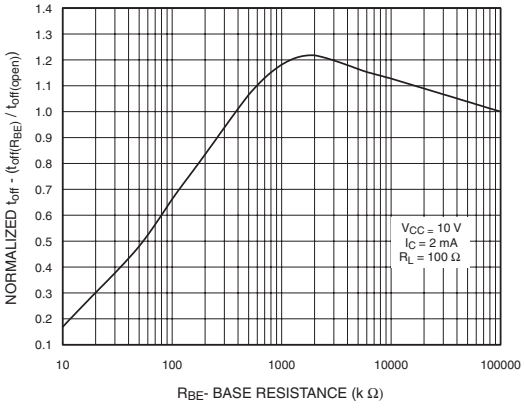
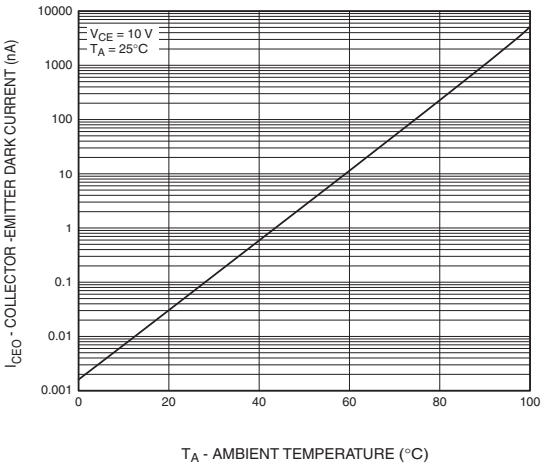


Fig. 19 Dark Current vs. Ambient Temperature



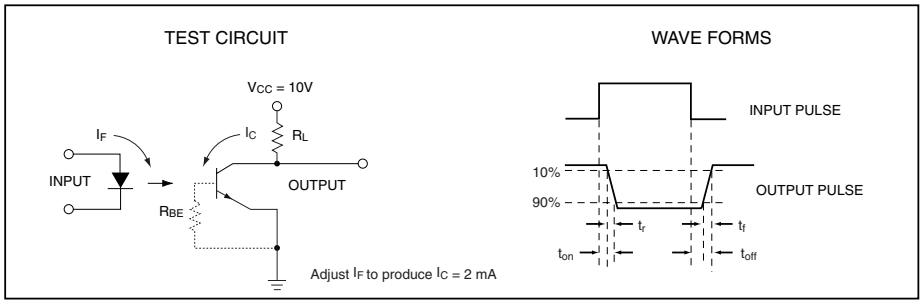
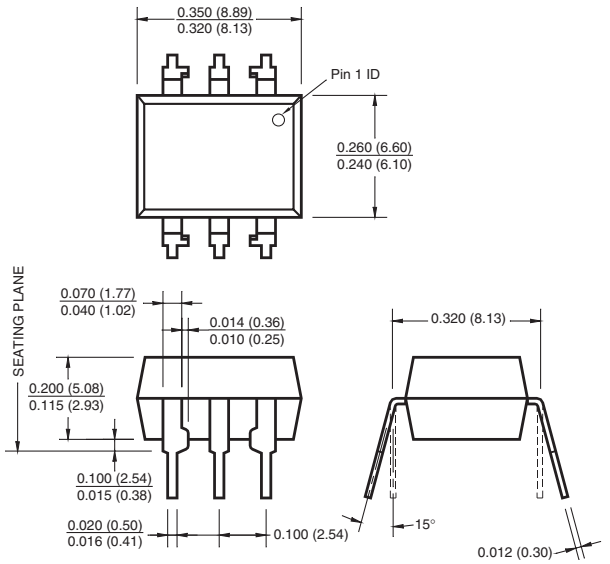


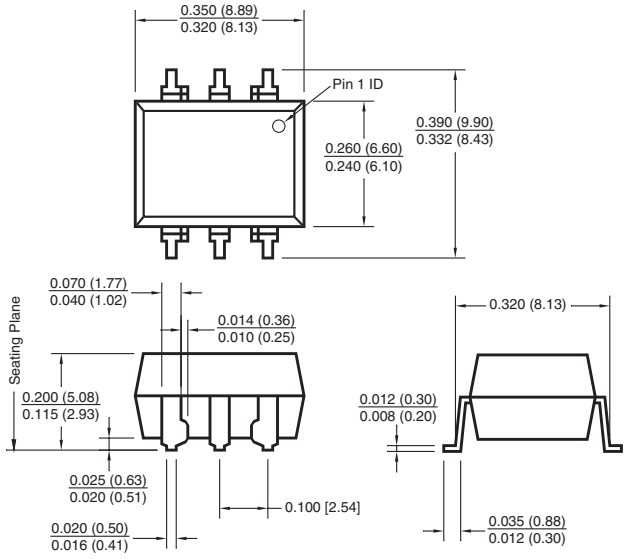
Figure 20. Switching Time Test Circuit and Waveforms

White Package (-M Suffix)

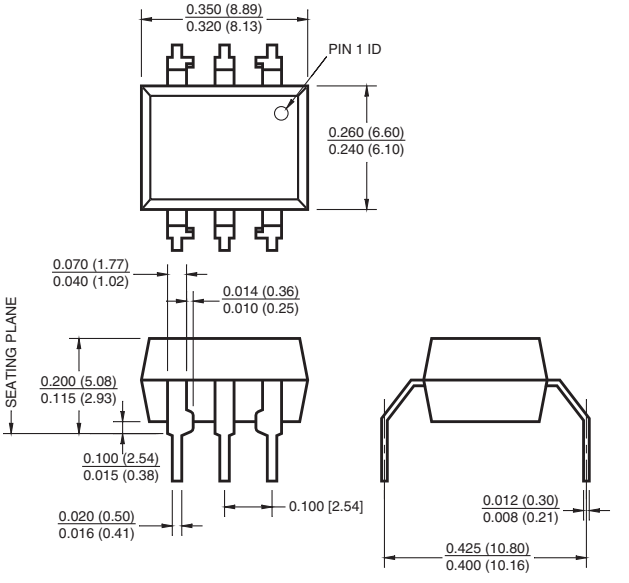
Package Dimensions (Through Hole)



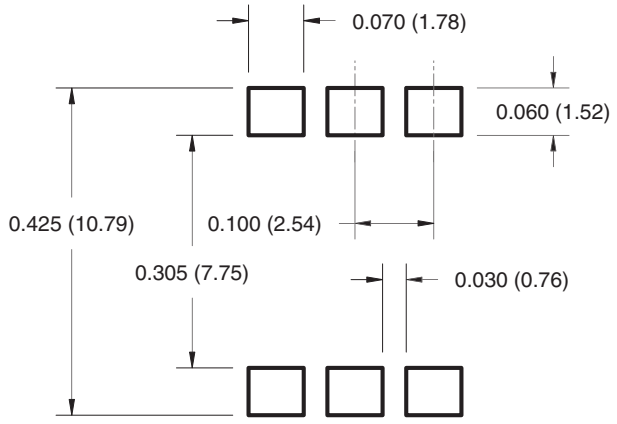
Package Dimensions (Surface Mount)



Package Dimensions (0.4” Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform

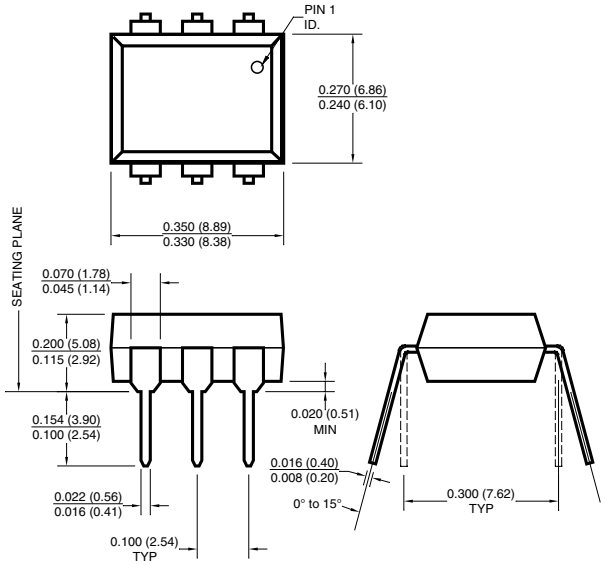


NOTE

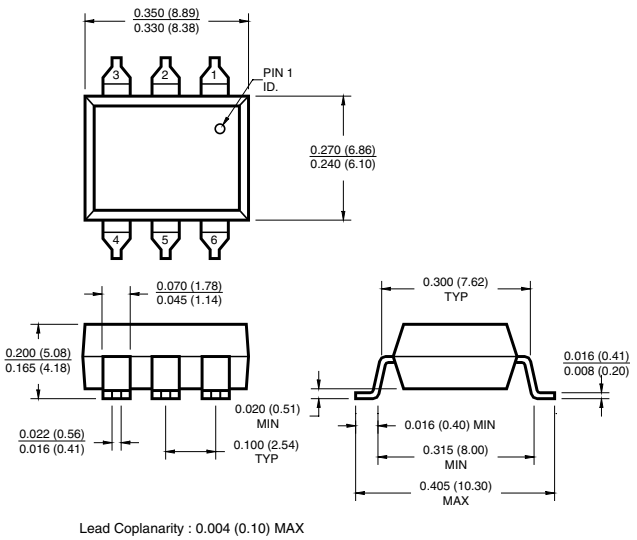
All dimensions are in inches (millimeters)

Black Package (No -M Suffix)

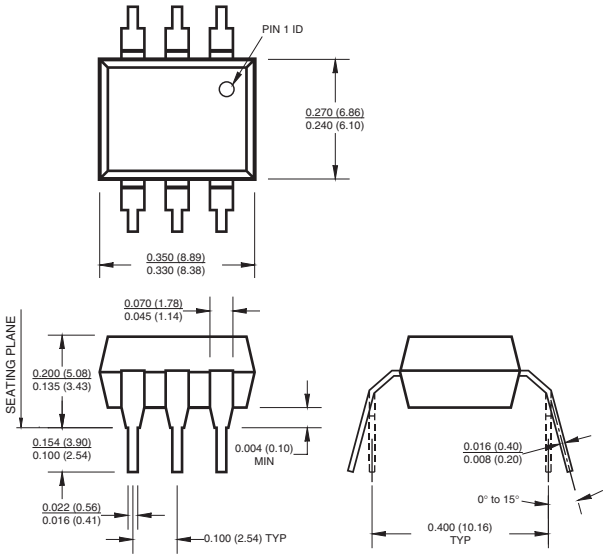
Package Dimensions (Through Hole)



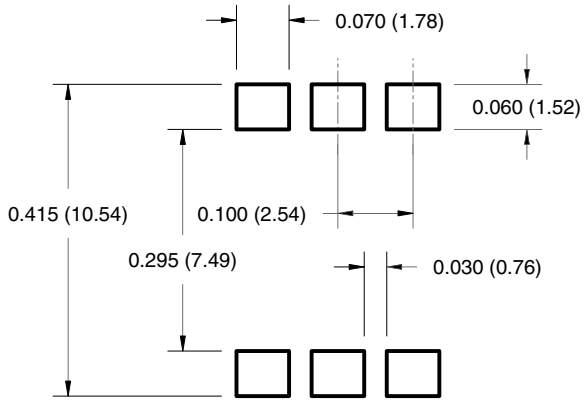
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform

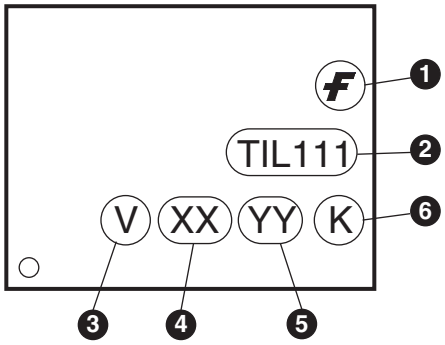


NOTE
All dimensions are in inches (millimeters)

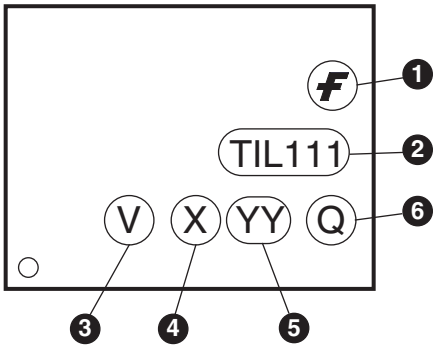
ORDERING INFORMATION

Order Entry Identifier		
Black Package (No Suffix)	**White Package (-M Suffix)**	**Option**
.S	S	Surface Mount Lead Bend
.SD	SR2	Surface Mount; Tape and reel
.W	T	0.4" Lead Spacing
.300	V	VDE 0884
.300W	TV	VDE 0884, 0.4" Lead Spacing
.3S	SV	VDE 0884, Surface Mount
.3SD	SR2V	VDE 0884, Surface Mount, Tape & Reel

MARKING INFORMATION



Black Package, No Suffix

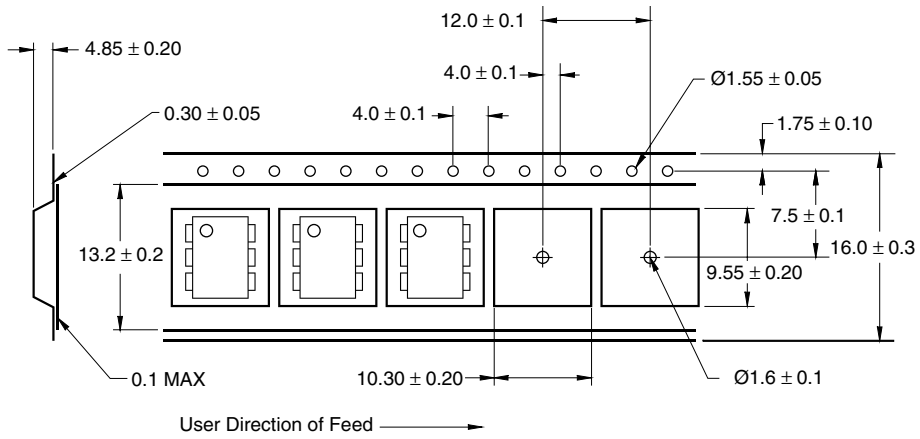


White Package, -M Suffix

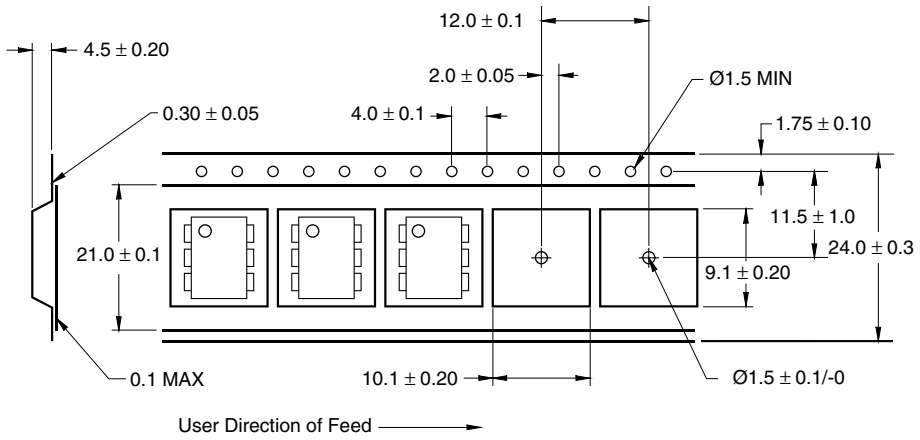
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One or two digit year code • Two digits for black package parts, e.g., '03' • One digit for white package parts, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

*Note – Parts built in the white package (M suffix) that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in the portrait format.

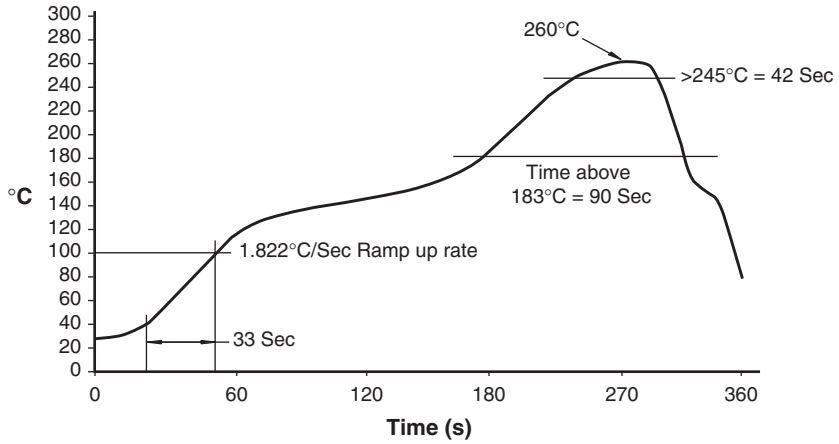
Carrier Tape Specifications (Black Package, No Suffix)



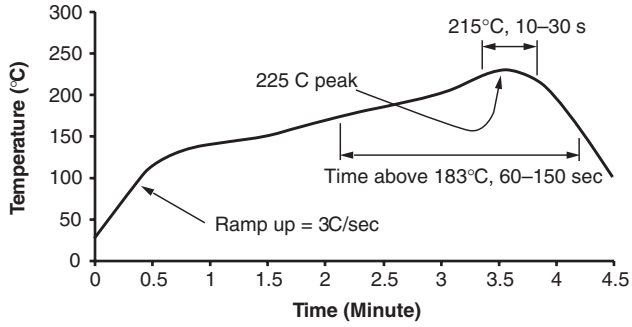
Carrier Tape Specifications (White Package, -M Suffix)



Reflow Profile (White Package, -M Suffix)



Reflow Profile (Black Package, No Suffix)



- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60–150 seconds
- One time soldering reflow is recommended

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