



**THE DATASHEET OF
TIL111TVM**



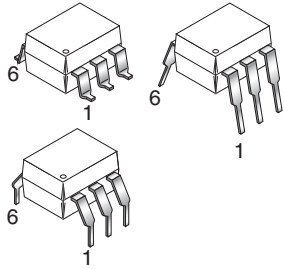
TIL111

TIL111-M

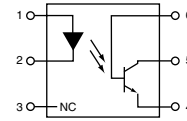
TIL117-M

MOC8100-M

WHITE PACKAGE (-M SUFFIX)

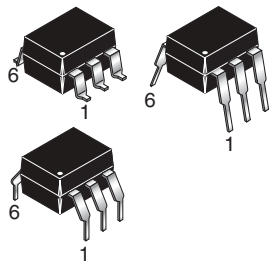


SCHEMATIC



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

BLACK PACKAGE (NO -M SUFFIX)



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

TIL111

TIL111-M

TIL117-M

MOC8100-M

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Device	Symbol	Value	Units
TOTAL DEVICE				
Storage Temperature	All	T_{STG}	-55 to +150	$^\circ\text{C}$
Operating Temperature	All	T_{OPR}	-55 to +100	$^\circ\text{C}$
Lead Solder Temperature	All	T_{SOL}	260 for 10 sec	$^\circ\text{C}$
Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	All	P_D	250	mW
			3.3 (non-M), 2.94 (-M)	mW/ $^\circ\text{C}$
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 (300 μs , 2% Duty Cycle)	All	$I_F(pk)$	3	A
LED Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	All	P_D	150 (non-M), 120 (-M)	mW
			2.0 (non-M), 1.41 (-M)	mW/ $^\circ\text{C}$
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 @ $T_A = 25^\circ\text{C}$ Derate above 25°C	All	P_D	150	mW
			2.0 (non-M), 1.76 (-M)	mW/ $^\circ\text{C}$

TIL111

TIL111-M

TIL117-M

MOC8100-M

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

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

ISOLATION CHARACTERISTICS

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

Note

* Typical values at $T_A = 25^\circ\text{C}$ unless otherwise noted

TIL111

TIL111-M

TIL117-M

MOC8100-M

TRANSFER CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)								
DC Characteristic	Test Conditions	Symbol	Device	Min	Typ*	Max	Unit	
Current Transfer Ratio, Collector to Emitter	($I_F = 10\text{ mA}$, $V_{CE} = 10\text{ V}$)	CTR_{CE}	TIL117-M	50			%	
	($I_F = 1\text{ mA}$, $V_{CE} = 5\text{ V}$)		MOC8100-M	50			%	
	($I_F = 1\text{ mA}$, $V_{CE} = 5\text{ V}$, $T_A = 0\text{ to }+70^\circ\text{C}$)			30				
On-State Collector Current (Phototransistor Operation)	($I_F = 16\text{ mA}$, $V_{CE} = 0.4\text{ V}$)	$I_{C(ON)}$	TIL111	2			mA	
On-State Collector Current (Photodiode Operation)	($I_F = 16\text{ mA}$, $V_{CB} = 0.4\text{ V}$)		TIL111-M	7			μA	
Collector-Emitter Saturation Voltage	($I_C = 500\text{ }\mu\text{A}$, $I_F = 10\text{ mA}$)	$V_{CE(SAT)}$	TIL117-M			0.4	V	
	($I_C = 2\text{ mA}$, $I_F = 16\text{ mA}$)		TIL111			0.4		
	($I_C = 100\text{ }\mu\text{A}$, $I_F = 1\text{ mA}$)		MOC8100-M			0.5		
AC Characteristic	($I_C = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\Omega$) (Fig. 20)	T_{ON}	MOC8100-M			20	μs	
Turn-On Time			TIL117-M			10		
Turn-Off Time		T_{OFF}	MOC8100-M			20	μs	
			TIL117-M			10		
Rise Time		t_r	MOC8100-M		2		μs	
Fall Time			TIL117-M		2			
Rise Time (Phototransistor Operation)		($I_{C(ON)} = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\Omega$) (Fig. 20)	t_r	TIL111			10	μs
Fall Time (Phototransistor Operation)								

* Typical values at $T_A = 25^\circ\text{C}$

TIL111

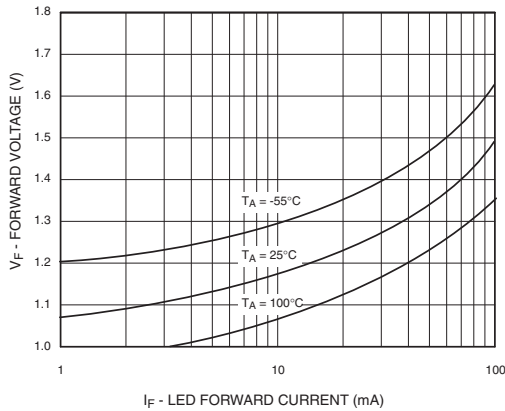
TIL111-M

TIL117-M

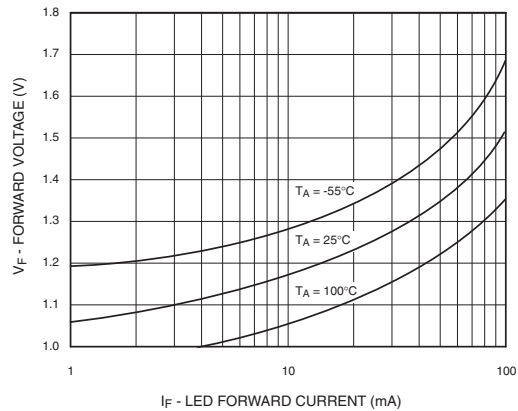
MOC8100-M

TYPICAL PERFORMANCE CURVES

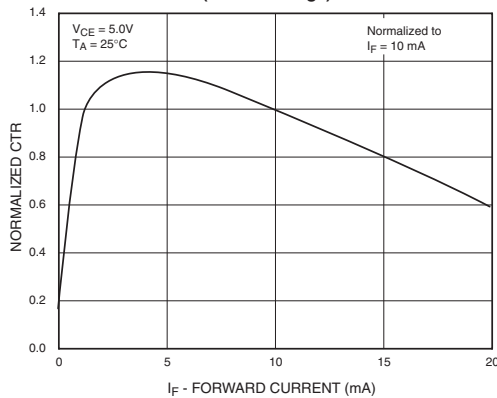
**Fig. 1 LED Forward Voltage vs. Forward Current
(Black Package)**



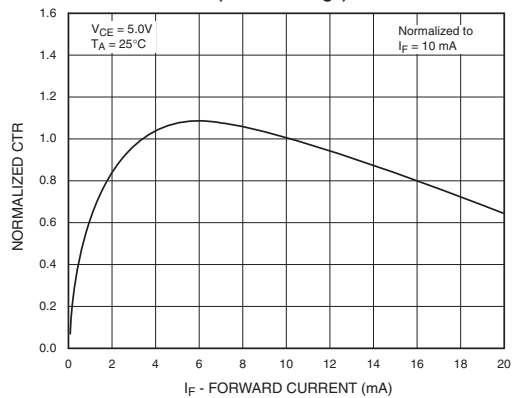
**Fig. 2 LED Forward Voltage vs. Forward Current
(White Package)**



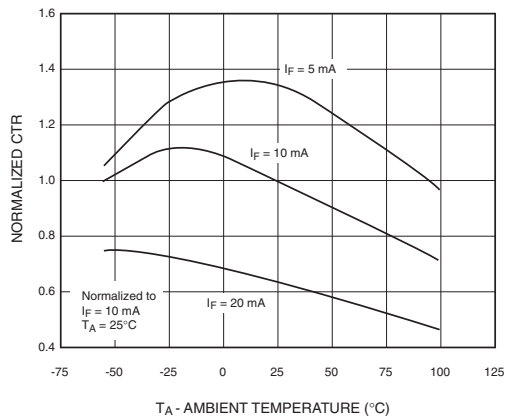
**Fig.3 Normalized CTR vs. Forward Current
(Black Package)**



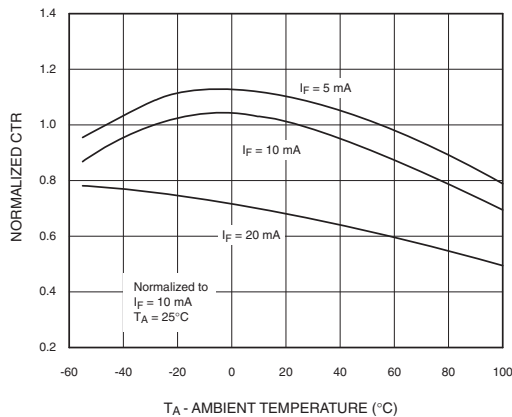
**Fig.4 Normalized CTR vs. Forward Current
(White Package)**



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



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



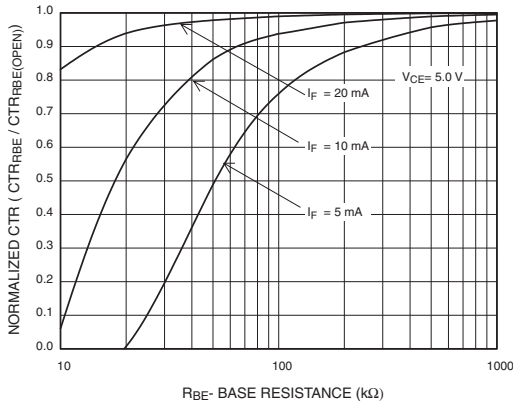
TIL111

TIL111-M

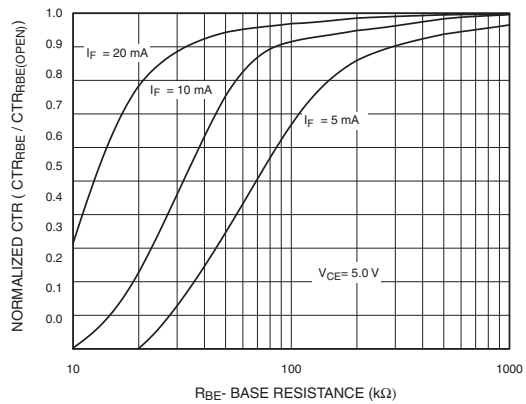
TIL117-M

MOC8100-M

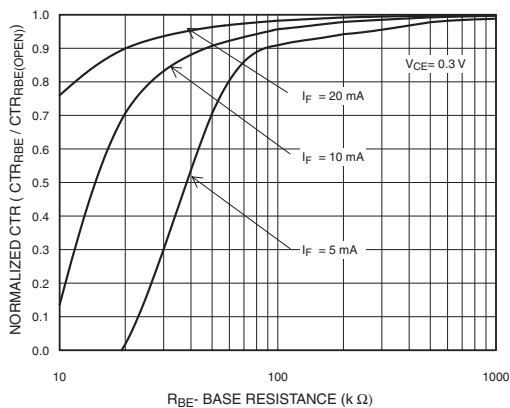
**Fig. 7 CTR vs. R_{BE} (Unsaturated)
(Black Package)**



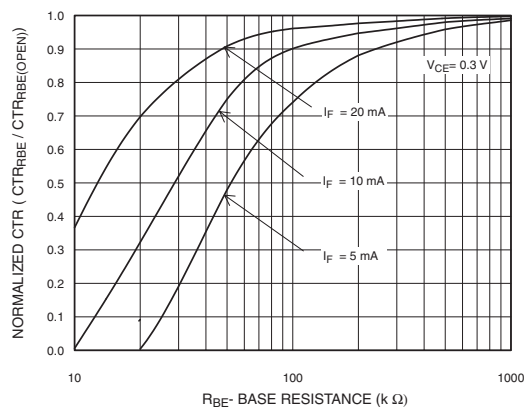
**Fig. 8 CTR vs. R_{BE} (Unsaturated)
(White Package)**



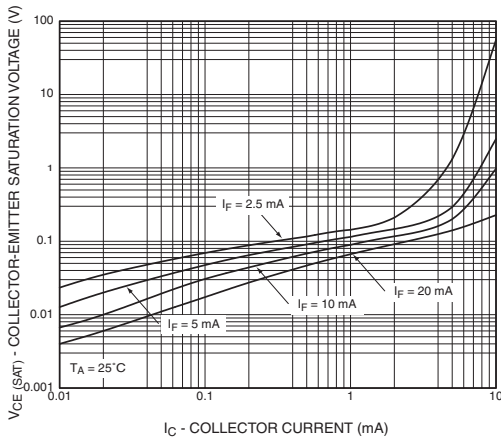
**Fig. 9 CTR vs. R_{BE} (Saturated)
(Black Package)**



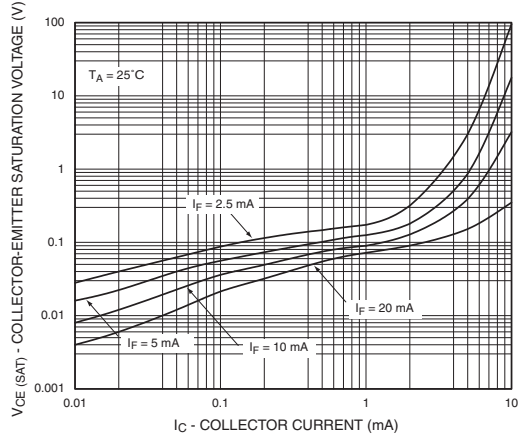
**Fig. 10 CTR vs. R_{BE} (Saturated)
(White Package)**



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



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



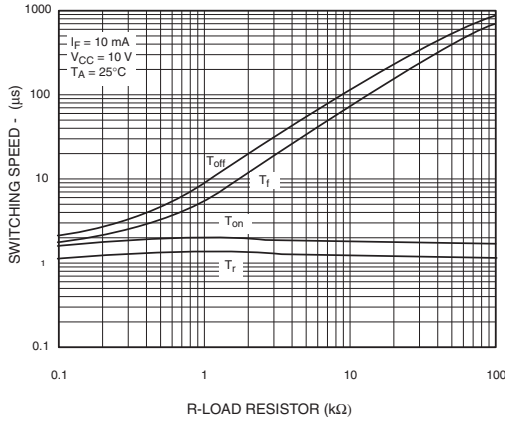
TIL111

TIL111-M

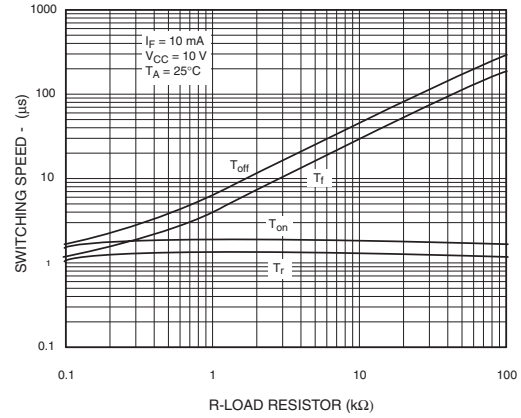
TIL117-M

MOC8100-M

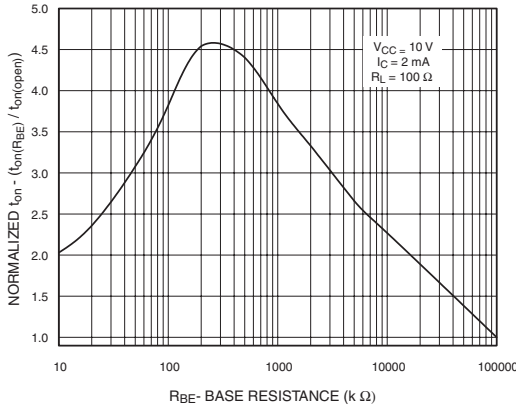
**Fig. 13 Switching Speed vs. Load Resistor
(Black Package)**



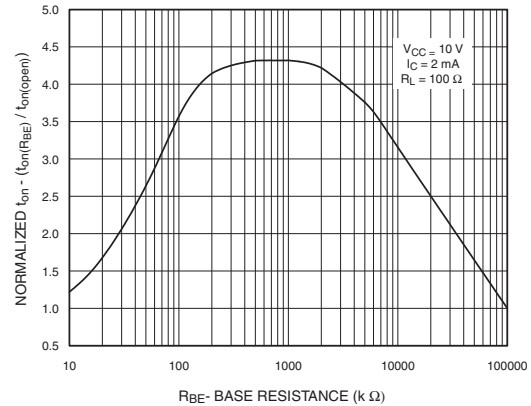
**Fig. 14 Switching Speed vs. Load Resistor
(White Package)**



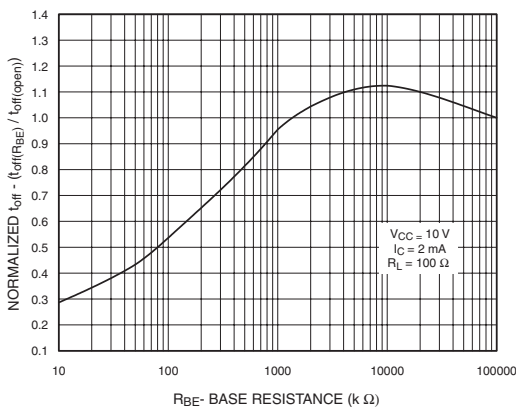
**Fig. 15 Normalized t_{on} vs. R_{BE}
(Black Package)**



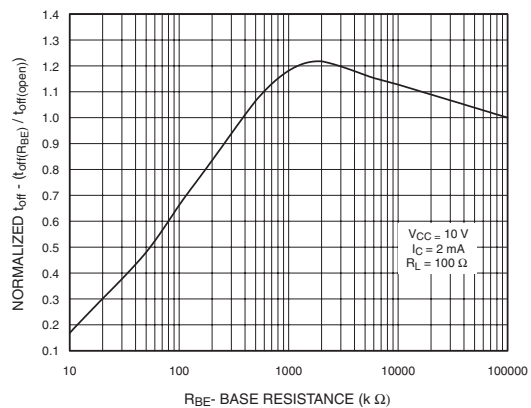
**Fig. 16 Normalized t_{on} vs. R_{BE}
(White Package)**



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



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



TIL111

TIL111-M

TIL117-M

MOC8100-M

Fig. 19 Dark Current vs. Ambient Temperature

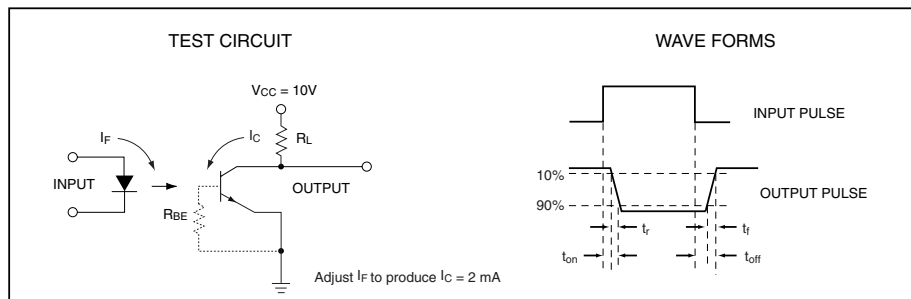
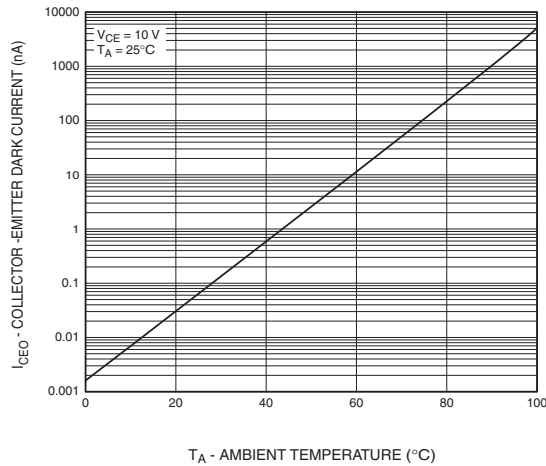


Figure 20. Switching Time Test Circuit and Waveforms

TIL111

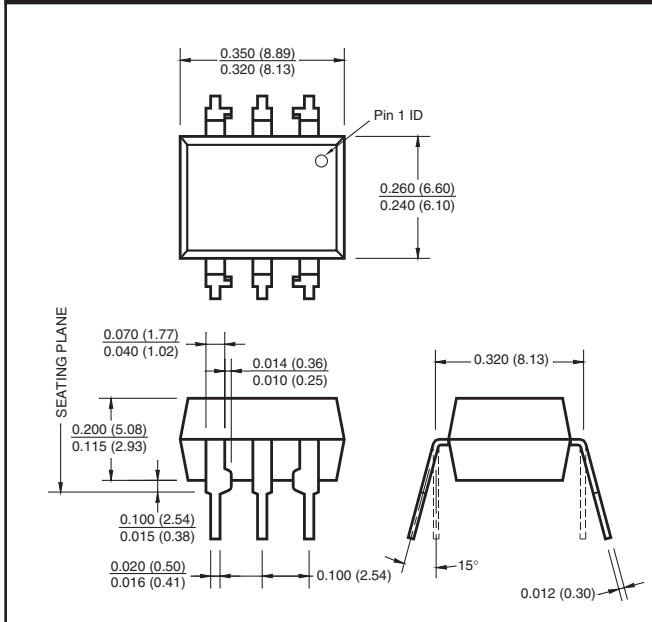
TIL111-M

TIL117-M

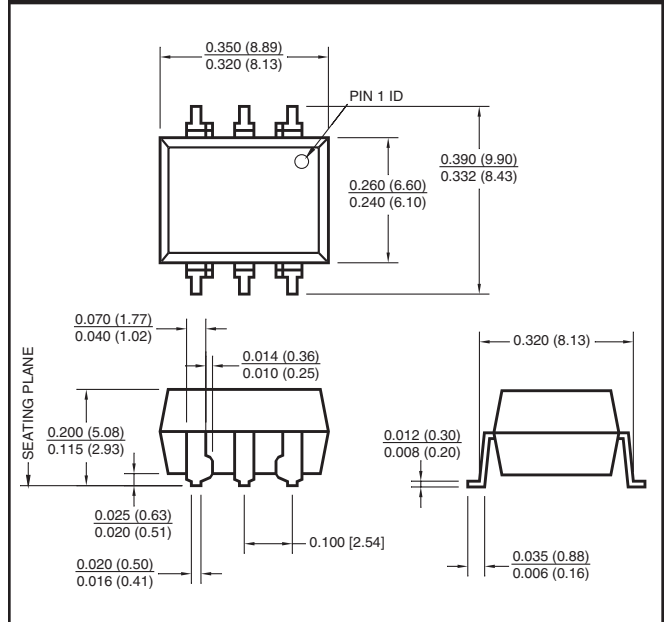
MOC8100-M

White Package (-M Suffix)

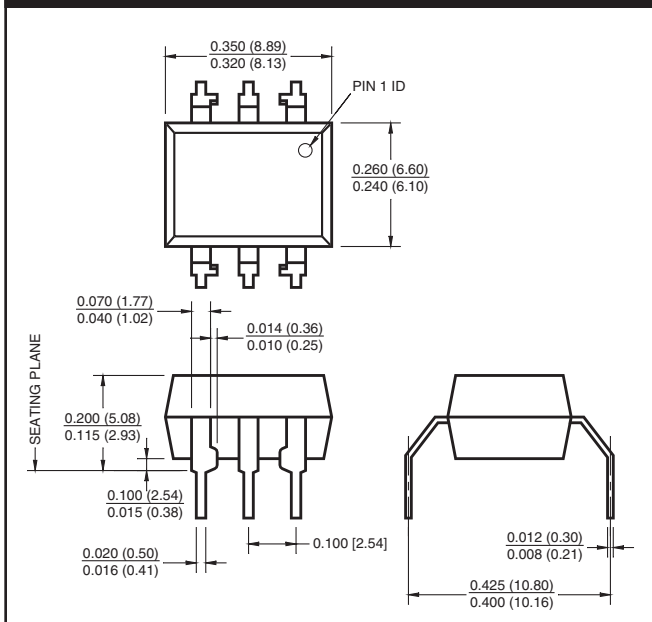
Package Dimensions (Through Hole)



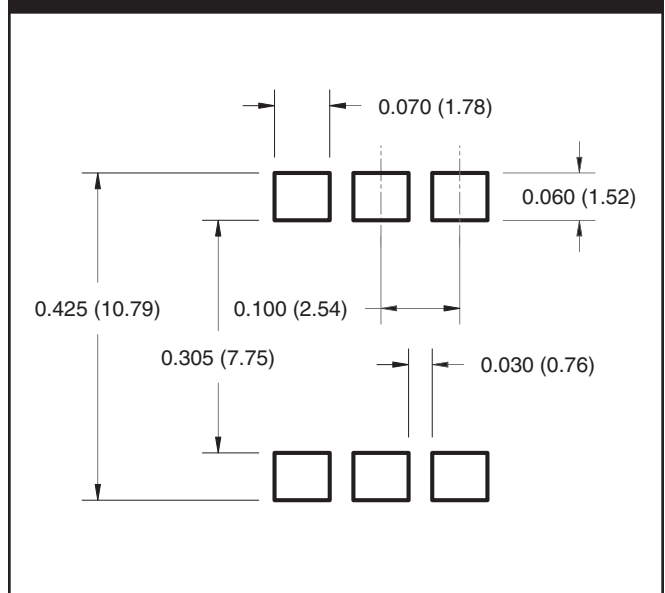
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE
All dimensions are in inches (millimeters)

TIL111

TIL111-M

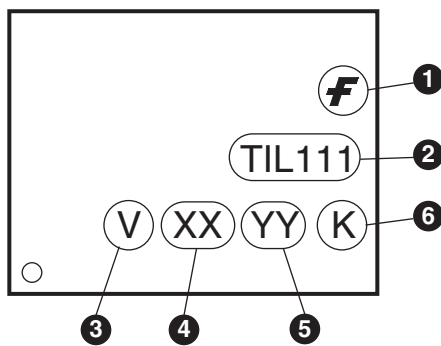
TIL117-M

MOC8100-M

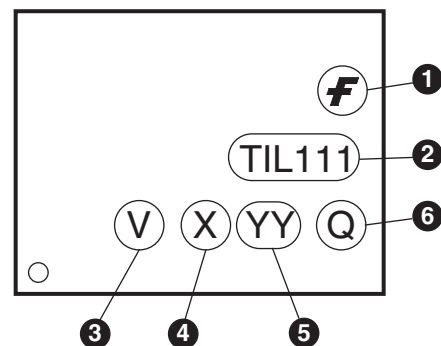
ORDERING INFORMATION

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.

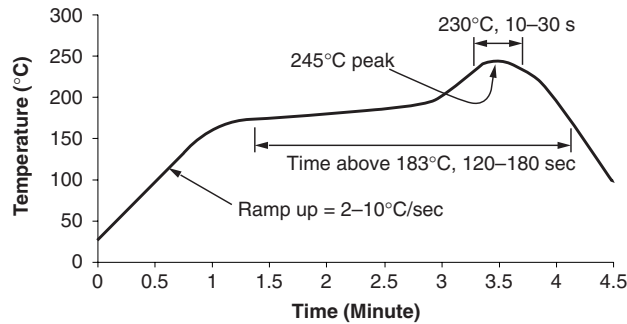
TIL111

TIL111-M

TIL117-M

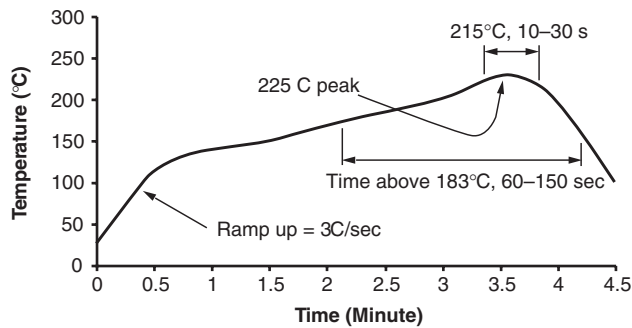
MOC8100-M

Reflow Profile (White Package, -M Suffix)



- Peak reflow temperature: 245°C (package surface temperature)
- Time of temperature higher than 183°C for 120-180 seconds
- One time soldering reflow is recommended

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

TIL111

TIL111-M

TIL117-M

MOC8100-M

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