



**THE DATASHEET OF
TIL111SM**



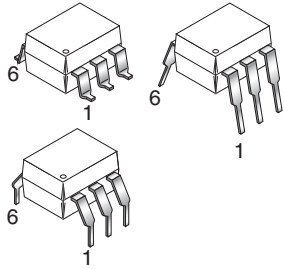
TIL111

TIL111-M

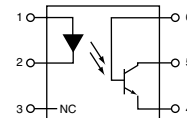
TIL117-M

MOC8100-M

WHITE PACKAGE (-M SUFFIX)

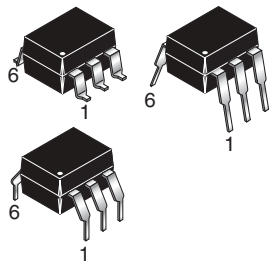


SCHEMATIC



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 | $I_F(\text{pk})$ | 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

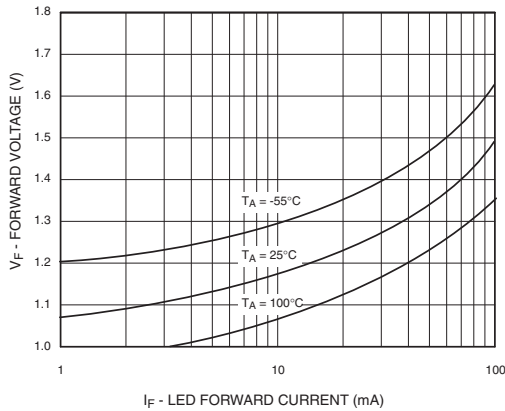
TIL111-M

TIL117-M

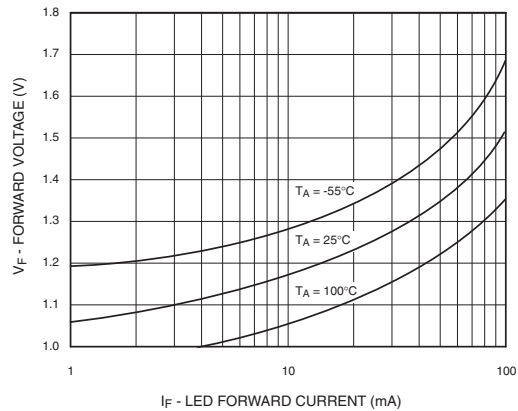
MOC8100-M

TYPICAL PERFORMANCE CURVES

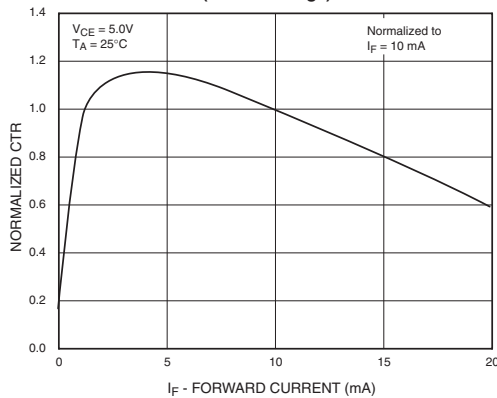
**Fig. 1 LED Forward Voltage vs. Forward Current
(Black Package)**



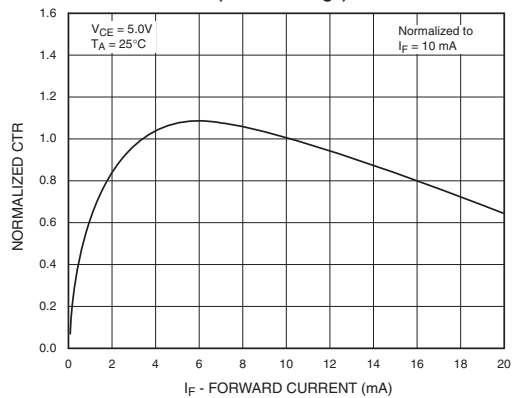
**Fig. 2 LED Forward Voltage vs. Forward Current
(White Package)**



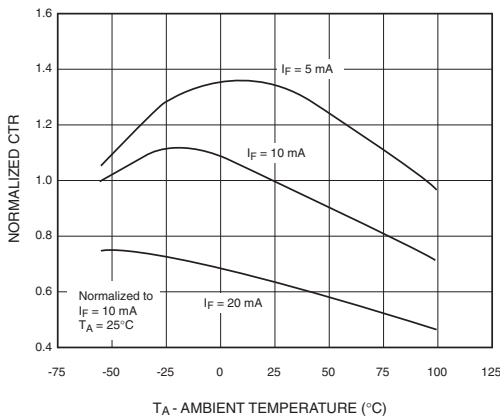
**Fig.3 Normalized CTR vs. Forward Current
(Black Package)**



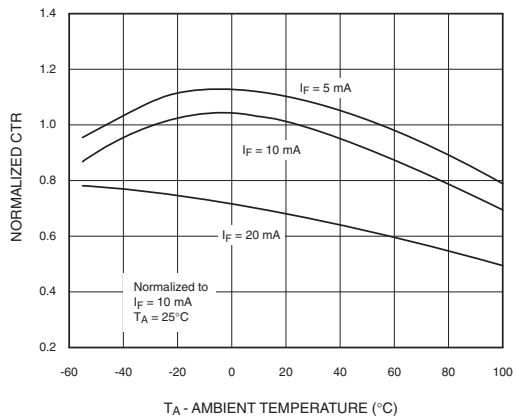
**Fig.4 Normalized CTR vs. Forward Current
(White Package)**



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



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



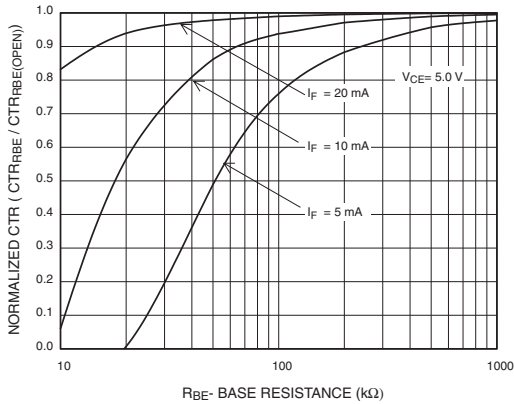
TIL111

TIL111-M

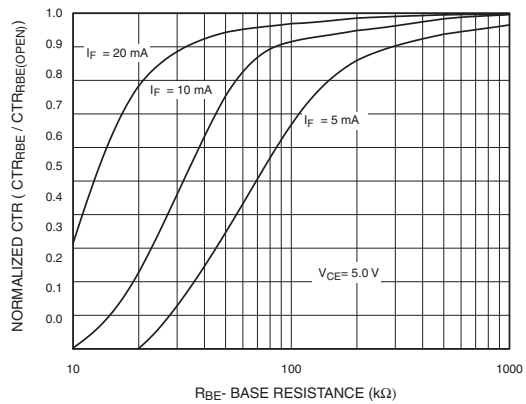
TIL117-M

MOC8100-M

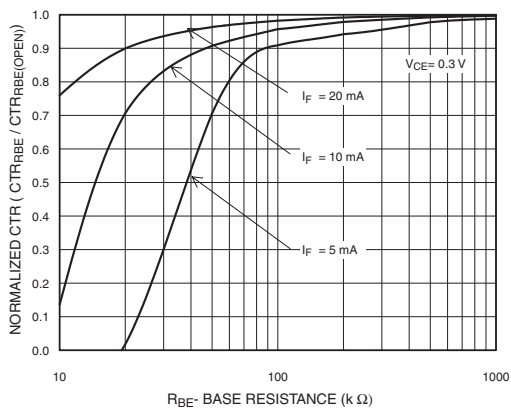
**Fig. 7 CTR vs. RBE (Unsaturated)
(Black Package)**



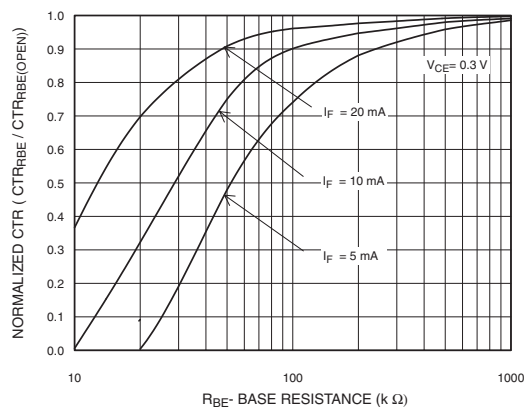
**Fig. 8 CTR vs. RBE (Unsaturated)
(White Package)**



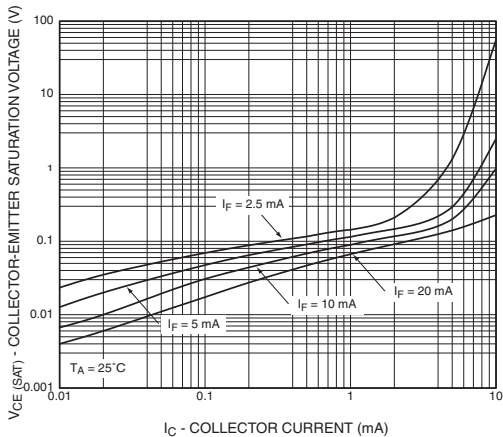
**Fig. 9 CTR vs. RBE (Saturated)
(Black Package)**



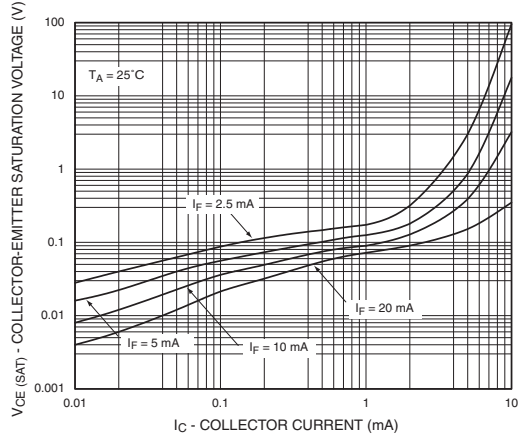
**Fig. 10 CTR vs. RBE (Saturated)
(White Package)**



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



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



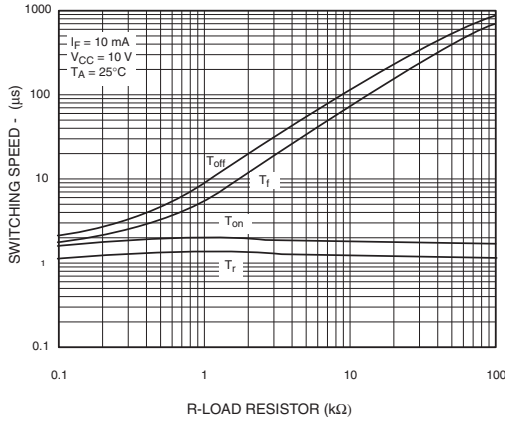
TIL111

TIL111-M

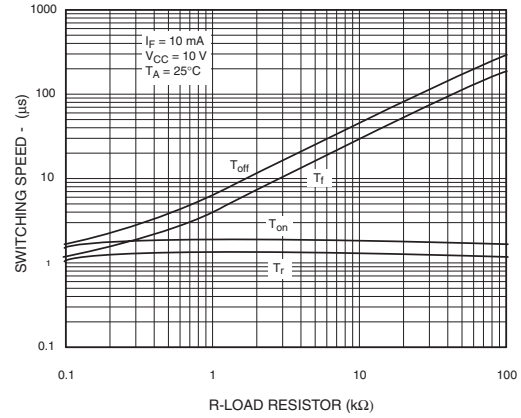
TIL117-M

MOC8100-M

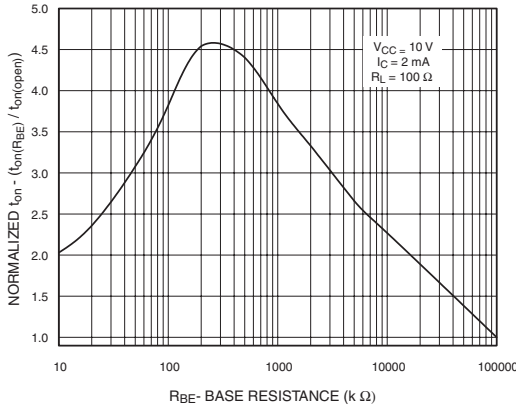
**Fig. 13 Switching Speed vs. Load Resistor
(Black Package)**



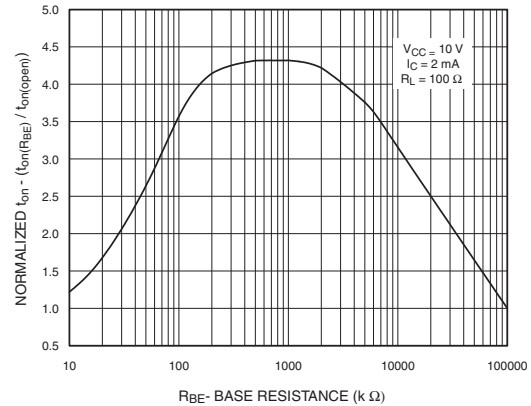
**Fig. 14 Switching Speed vs. Load Resistor
(White Package)**



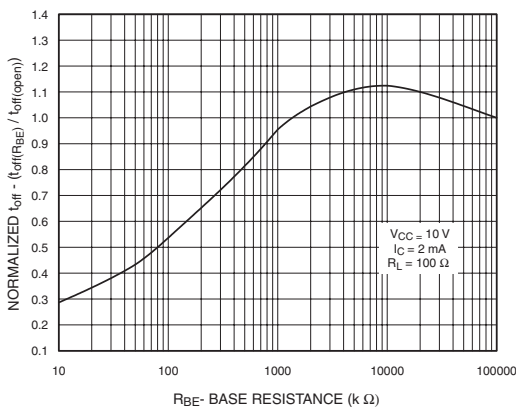
**Fig. 15 Normalized t_{on} vs. R_{BE}
(Black Package)**



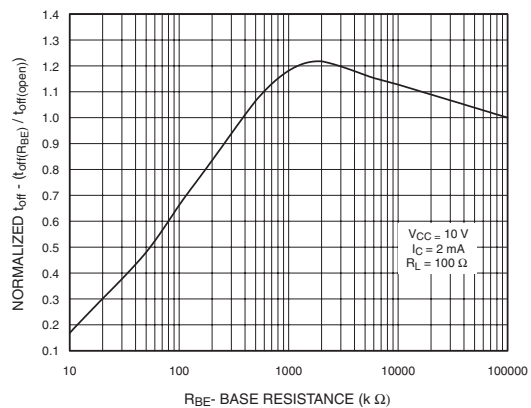
**Fig. 16 Normalized t_{on} vs. R_{BE}
(White Package)**



**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

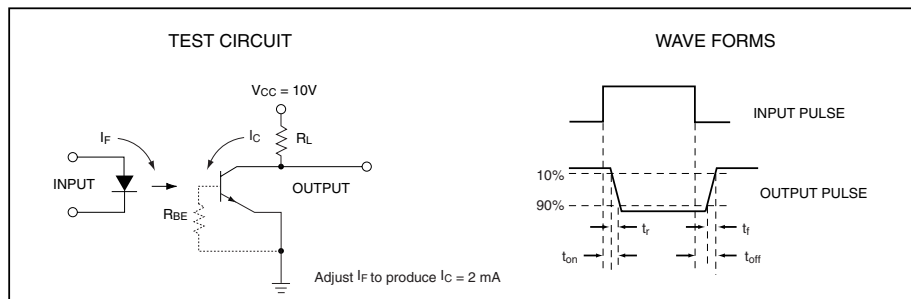
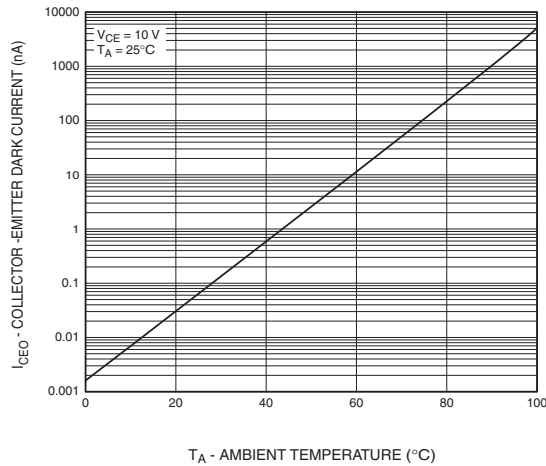


Figure 20. Switching Time Test Circuit and Waveforms

TIL111

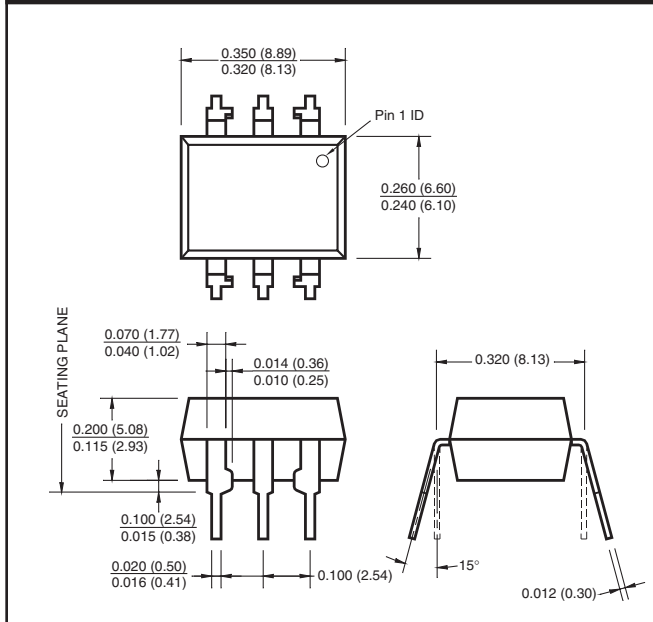
TIL111-M

TIL117-M

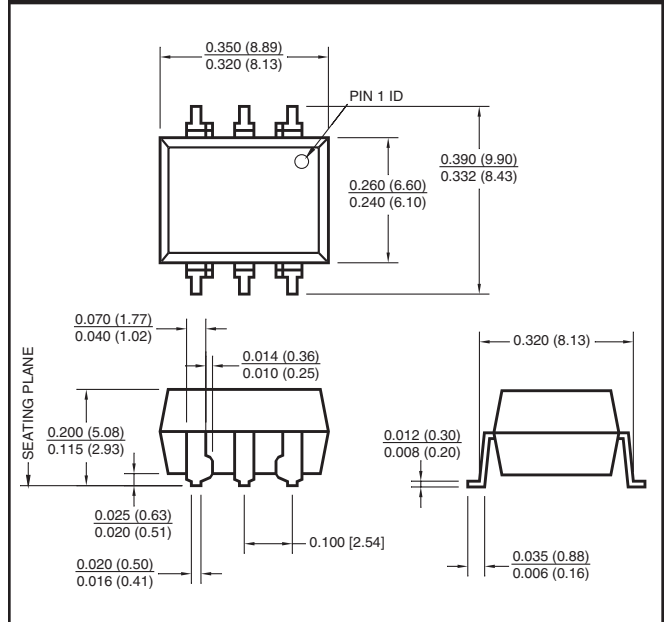
MOC8100-M

White Package (-M Suffix)

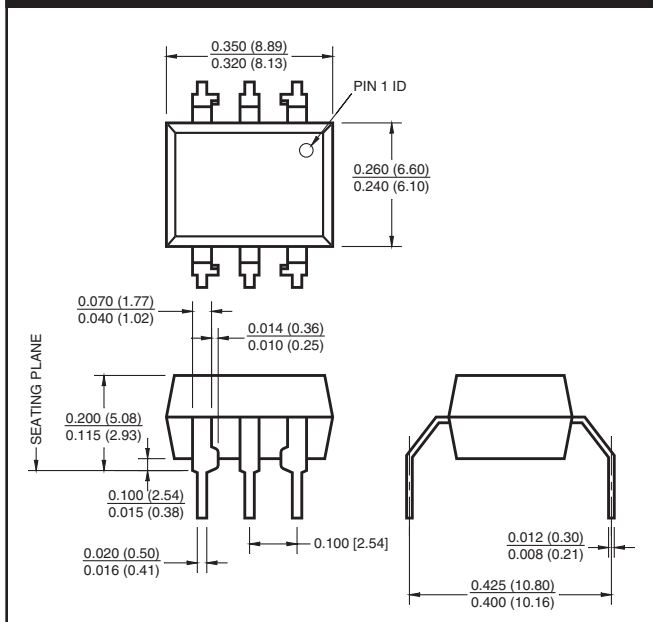
Package Dimensions (Through Hole)



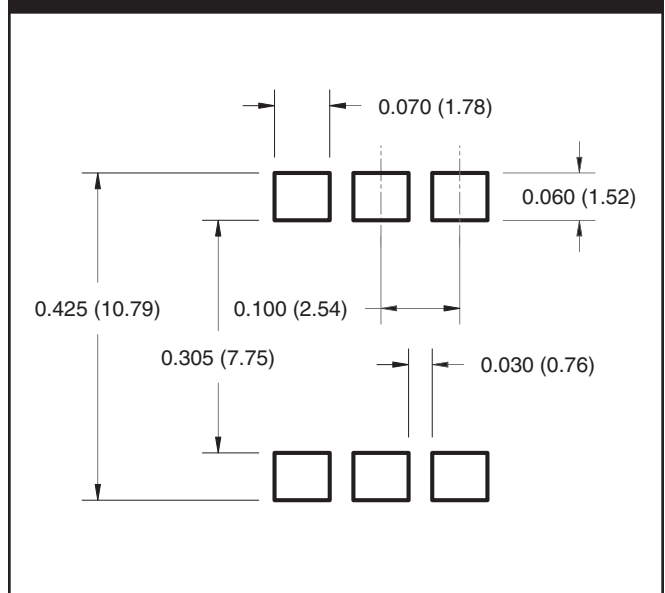
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE

All dimensions are in inches (millimeters)

TIL111

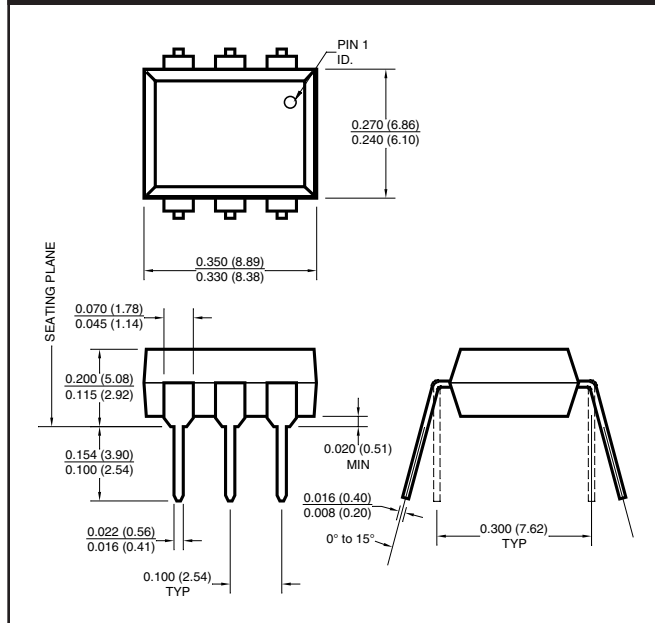
TIL111-M

TIL117-M

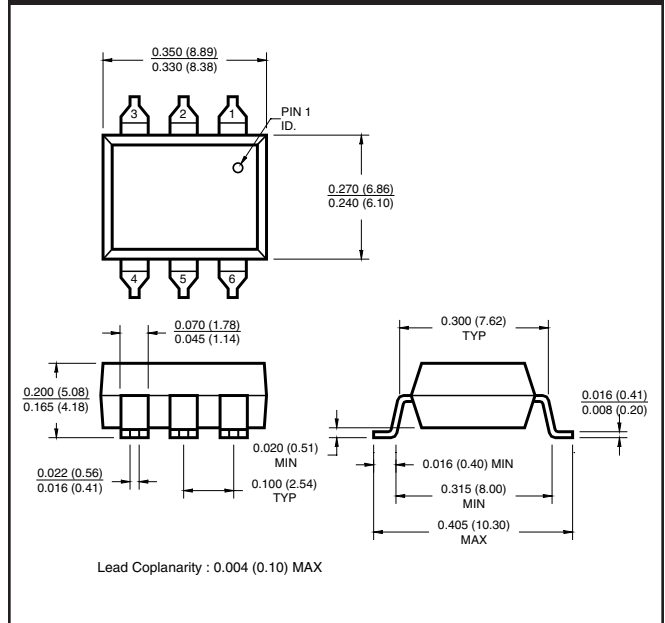
MOC8100-M

Black Package (No -M Suffix)

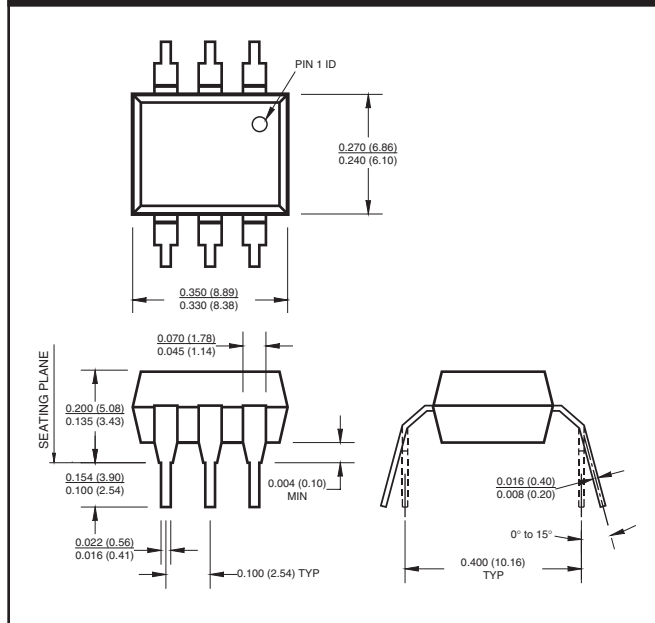
Package Dimensions (Through Hole)



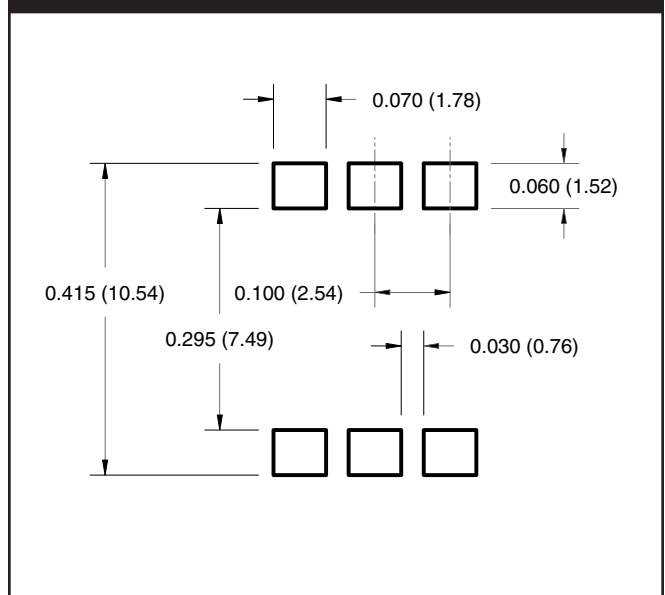
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE

All dimensions are in inches (millimeters)

TIL111

TIL111-M

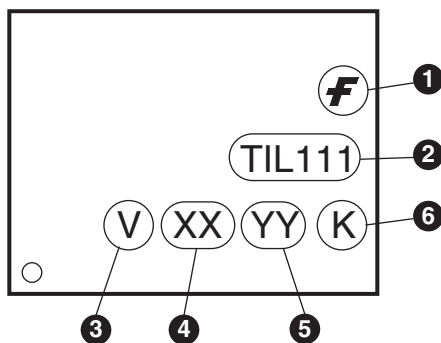
TIL117-M

MOC8100-M

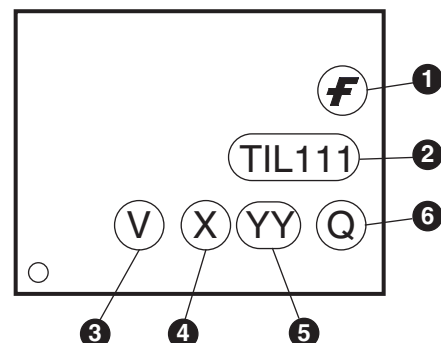
ORDERING INFORMATION

| 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.

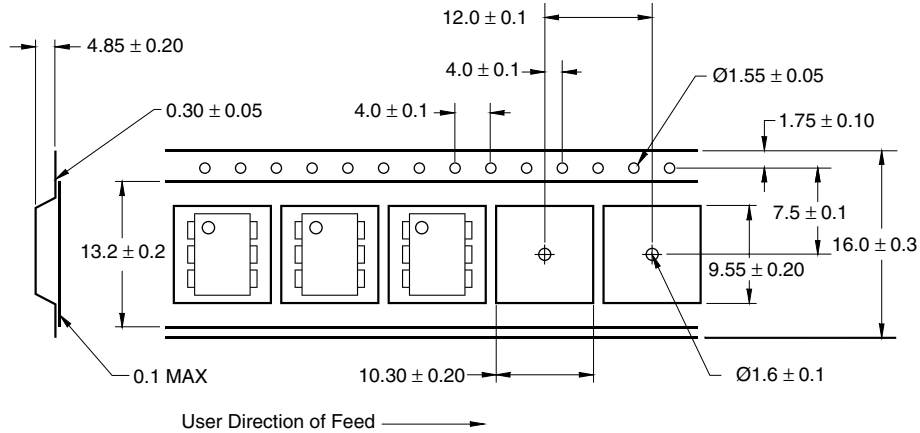
TIL111

TIL111-M

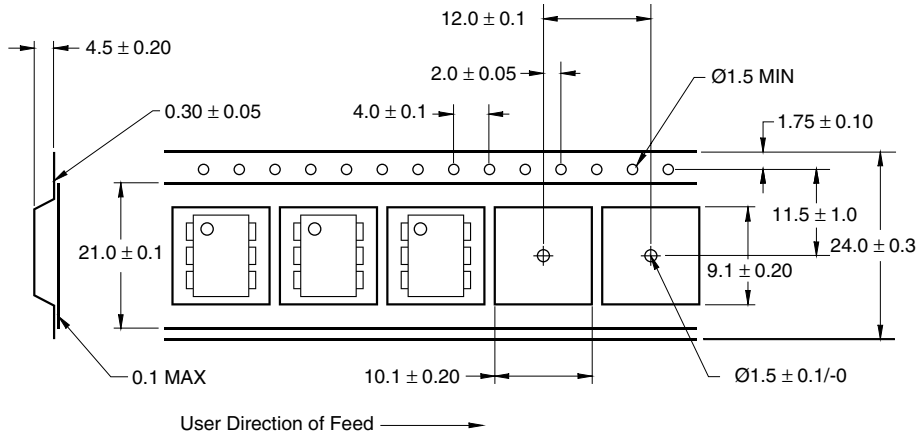
TIL117-M

MOC8100-M

Carrier Tape Specifications (Black Package, No Suffix)



Carrier Tape Specifications (White Package, -M Suffix)



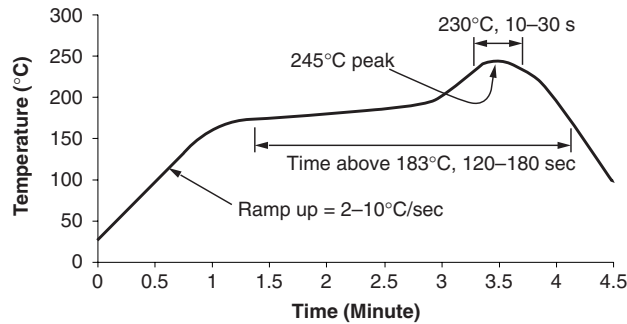
TIL111

TIL111-M

TIL117-M

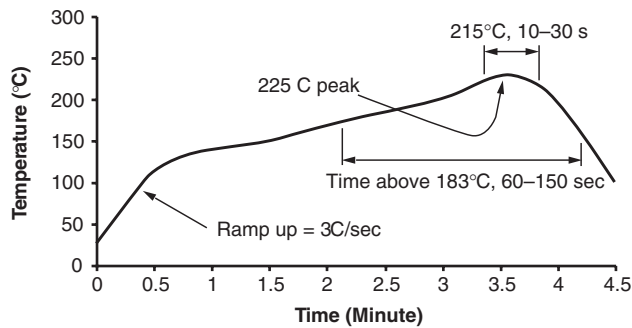
MOC8100-M

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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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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-  Excess Inventory Management