

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)

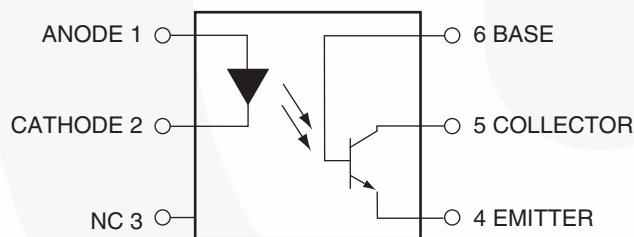
Applications

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

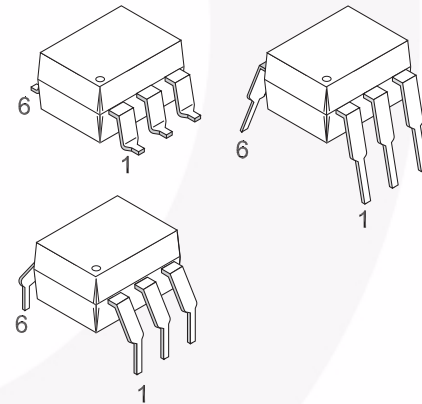
General Description

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



Package Outlines



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 Derate above 25°C	All	250	mW
			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 (300µs, 2% Duty Cycle)	All	3	A
P _D	LED Power Dissipation @ T _A = 25 °C Derate above 25°C	All	120	mW
			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 Derate above 25°C	All	150	mW
			1.76	mW/°C

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise specified.)**Individual Component Characteristics**

Symbol	Parameter	Test Conditions		Device	Min.	Typ.*	Max.	Unit
EMITTER								
V _F	Input Forward Voltage	I _F = 16mA	T _A = 25°C	TIL111M		1.2	1.4	V
		I _F = 10mA for MOC8100M, I _F = 16mA; for TIL117M	T _A = 0°C–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 = 3.0V		TIL111M, TIL117M		0.001	10	μA
		V _R = 6.0V		MOC8100M		0.001	10	μA
DETECTOR								
BV _{CEO}	Collector-Emitter Breakdown Voltage	I _C = 1.0mA, I _F = 0		All	30	100		V
BV _{CBO}	Collector-Base Breakdown Voltage	I _C = 10μA, I _F = 0		All	70	120		V
BV _{EBO}	Emitter-Base Breakdown Voltage	I _E = 10μA, I _F = 0		All	7	10		V
BV _{ECO}	Emitter-Collector Breakdown Voltage	I _F = 100μA, I _F = 0		TIL111M, TIL117M	7	10		V
I _{CEO}	Collector-Emitter Dark Current	V _{CE} = 10V, I _F = 0		TIL111M, TIL117M		1	50	nA
		V _{CE} = 5V, T _A = 25°C		MOC8100M		0.5	25	nA
		V _{CE} = 30V, I _F = 0, T _A = 70°C		TIL117M, MOC8100M		0.2	50	μA
I _{CBO}	Collector-Base Dark Current	V _{CB} = 10V		TIL111M, TIL117M			20	nA
I _{CBO}		V _{CB} = 5V		MOC8100M			10	nA
C _{CE}	Capacitance	V _{CE} = 0V, f = 1MHz		All		8		pF

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

Electrical Characteristics (Continued) ($T_A = 25^\circ\text{C}$ 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 = 10mA, V _{CE} = 10V	TIL117M	50			%
		I _F = 1mA, V _{CE} = 5V	MOC8100M	50			%
		I _F = 1mA, V _{CE} = 5V, T _A = 0°C to +70°C		30			
I _{C(ON)}	On-State Collector Current (Phototransistor Operation)	I _F = 16mA, V _{CE} = 0.4V	TIL111M	2			mA
	On-State Collector Current (Photodiode Operation)	I _F = 16mA, V _{CB} = 0.4V		7			µA
V _{CE (SAT)}	Collector-Emitter Saturation Voltage	I _C = 500µA, I _F = 10mA	TIL117M			0.4	V
		I _C = 2mA, I _F = 16mA	TIL111M			0.4	
		I _C = 100µA, I _F = 1mA	MOC8100M			0.5	
AC CHARACTERISTICS							
T _{ON}	Turn-On Time	I _C = 2mA, V _{CC} = 10V, R _L = 100Ω (Fig. 11)	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)} = 2mA, V _{CC} = 10V, R _L = 100Ω (Fig. 11)	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	$f = 60\text{Hz}$, $t = 1\text{ sec.}$	7500			$V_{\text{AC(rms)}}$
R_{ISO}	Isolation Resistance	$V_{\text{I-O}} = 500\text{ VDC}$	10^{11}			Ω
C_{ISO}	Isolation Capacitance	$V_{\text{I-O}} = 0$, $f = 1\text{MHz}$		0.2		pF

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

Safety and Insulation Ratings

As per IEC 60747-5-2, 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 Main Voltage < 150Vrms		I-IV		
	For Rated Main voltage < 300Vrms		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, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ sec, Partial Discharge < 5pC	1594			V_{peak}
	Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$, Type and Sample Test with $t_m = 60$ sec, Partial Discharge < 5pC	1275			V_{peak}
V_{IORM}	Max. 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
RIO	Insulation Resistance at T_s , $V_{IO} = 500V$	10^9			Ω

Typical Performance Characteristics

Fig. 1 LED Forward Voltage vs. Forward Current

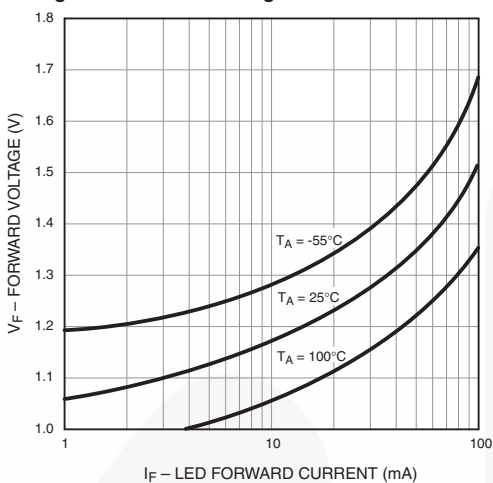


Fig. 2 Normalized CTR vs. Forward Current

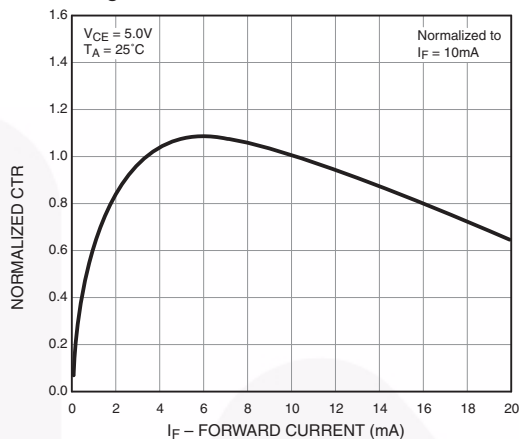


Fig. 3 Normalized CTR vs. Ambient Temperature

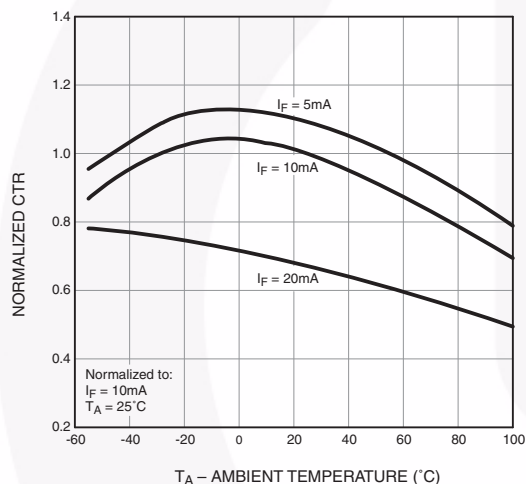


Fig. 4 CTR vs. RBE (Unsaturated)

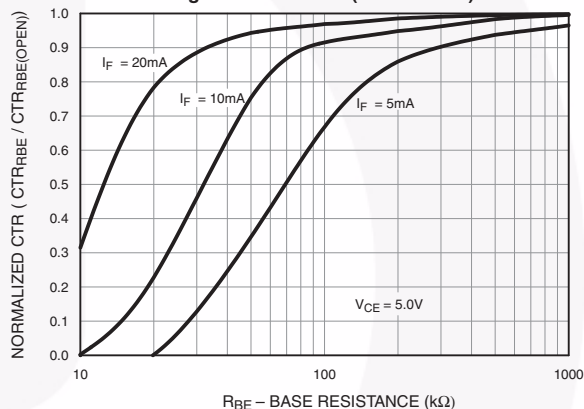


Fig. 5 CTR vs. RBE (Saturated)

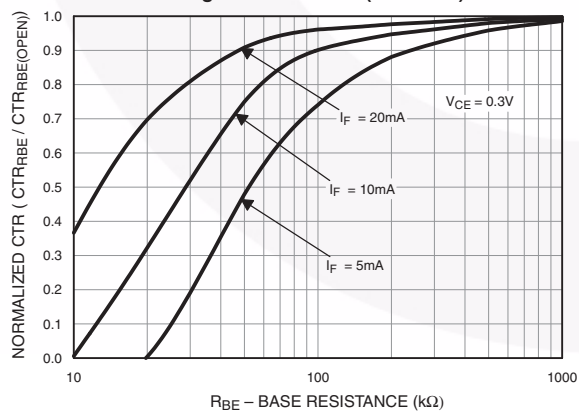
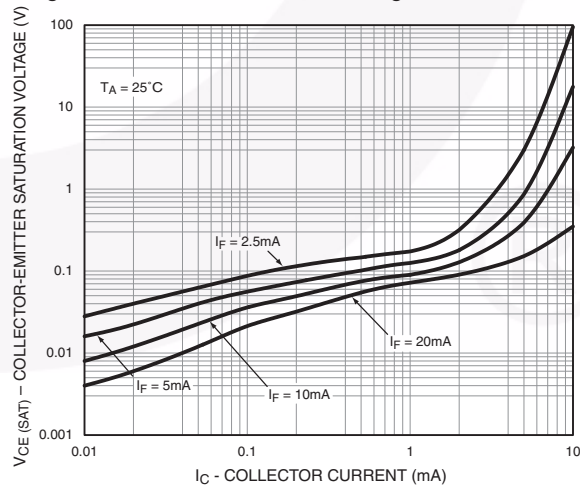


Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current



Typical Performance Characteristics (Continued)

Fig. 7 Switching Speed vs. Load Resistor

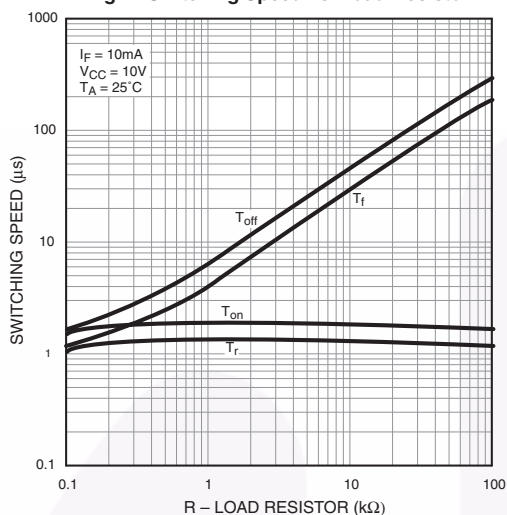


Fig. 8 Normalized t_{on} vs. R_{BE}

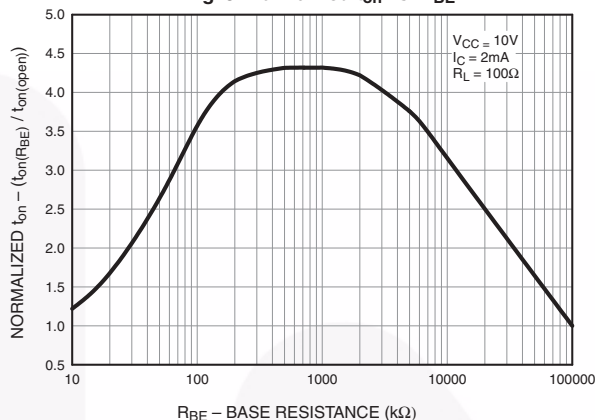


Fig. 9 Normalized t_{off} vs. R_{BE}

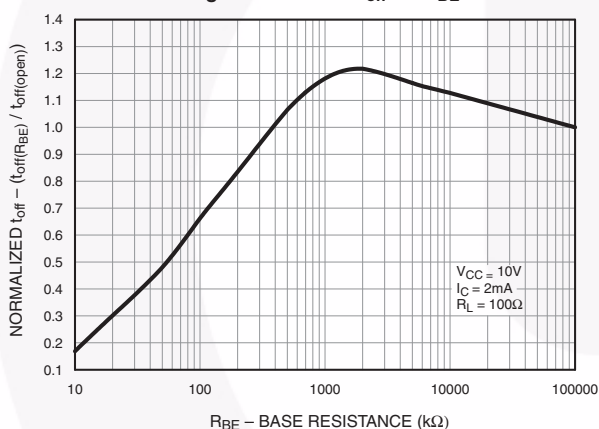
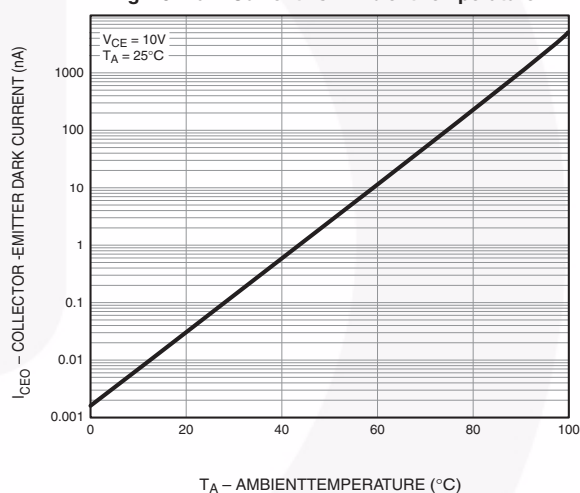
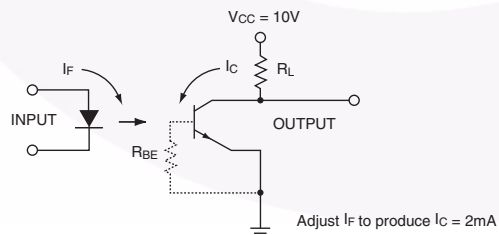


Fig. 10 Dark Current vs. Ambient Temperature



TEST CIRCUIT



WAVEFORMS

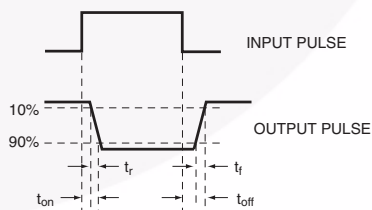
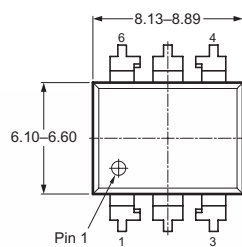


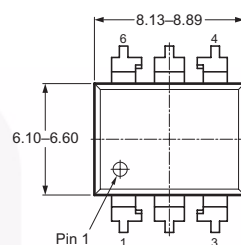
Figure 11. Switching Time Test Circuit and Waveforms

Package Dimensions

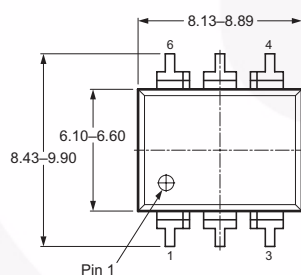
Through Hole



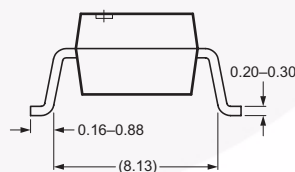
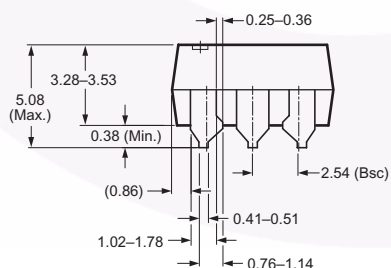
0.4" Lead Spacing



Surface Mount



Recommended Pad Layout

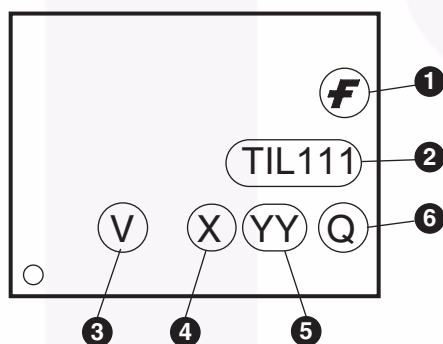


Note:
All dimensions in mm.

Ordering Information

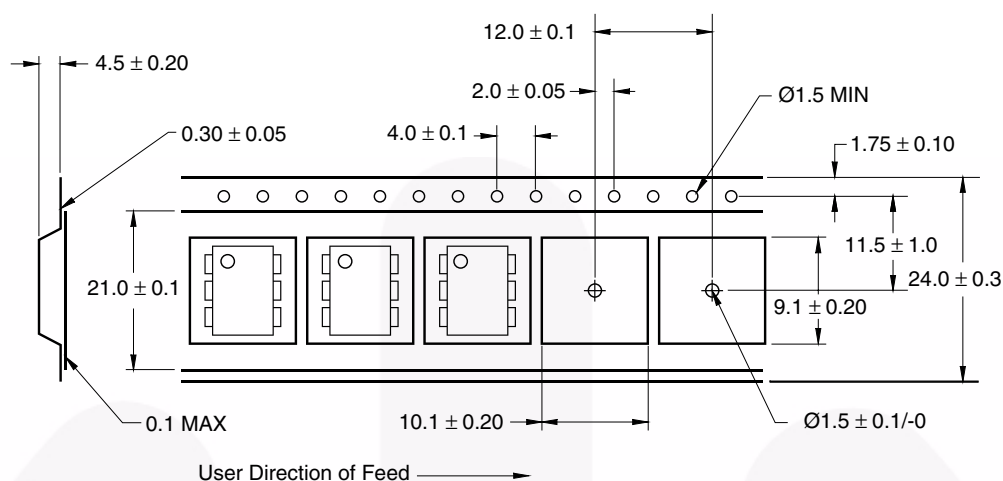
Option	Order Entry Identifier (Example)	Description
No option	TIL111M	Standard Through Hole Device
S	TIL111SM	Surface Mount Lead Bend
SR2	TIL111SR2M	Surface Mount; Tape and Reel
T	TIL111TM	0.4" Lead Spacing
V	TIL111VM	VDE 0884
TV	TIL111TVM	VDE 0884, 0.4" Lead Spacing
SV	TIL111SVM	VDE 0884, Surface Mount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

Marking Information

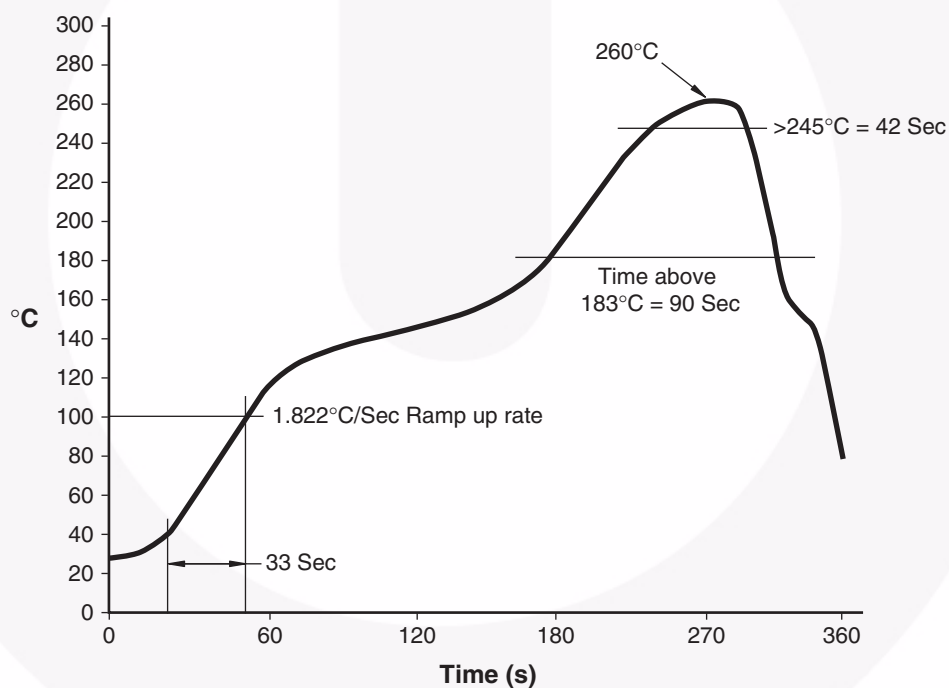


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

*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.



Reflow Profile





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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.
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Rev. I40