

4N29M, 4N30M, 4N32M, 4N33M, H11B1M, TIL113M General Purpose 6-Pin Photodarlington Optocoupler

Features

- High sensitivity to low input drive current
- Meets or exceeds all JEDEC Registered Specifications
- UL, C-UL approved
- VDE 0884 approval available as a test option
– add option V (e.g., 4N29VM)

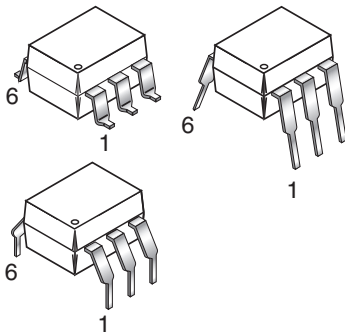
Applications

- Low power logic circuits
- Telecommunications equipment
- Portable electronics
- Solid state relays
- Interfacing coupling systems of different potentials and impedances

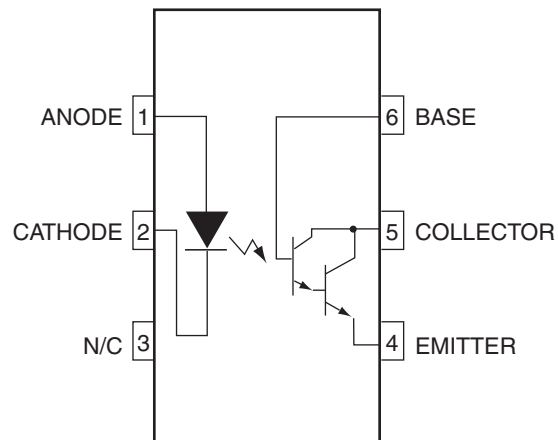
Description

The 4N29M, 4N30M, 4N32M, 4N33M, H11B1M and TIL113M have a gallium arsenide infrared emitter optically coupled to a silicon planar photodarlington.

Packages



Schematic



Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

Symbol	Parameter	Value	Units
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +150	$^\circ\text{C}$
T_{OPR}	Operating Temperature	-40 to +100	$^\circ\text{C}$
T_{SOL}	Lead Solder Temperature (Wave)	260 for 10 sec	$^\circ\text{C}$
P_D	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	250	mW
	Derate above 25°C	3.3	mW/ $^\circ\text{C}$
EMITTER			
I_F	Continuous Forward Current	80	mA
V_R	Reverse Voltage	3	V
$I_F(\text{pk})$	Forward Current – Peak (300 μs , 2% Duty Cycle)	3.0	A
P_D	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate above 25°C	2.0	mW/ $^\circ\text{C}$
DETECTOR			
BV_{CEO}	Collector-Emitter Breakdown Voltage	30	V
BV_{CBO}	Collector-Base Breakdown Voltage	30	V
BV_{ECO}	Emitter-Collector Breakdown Voltage	5	V
P_D	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate above 25°C	2.0	mW/ $^\circ\text{C}$
I_C	Continuous Collector Current	150	mA

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*	$I_F = 10\text{mA}$	4NXXM		1.2	1.5	V
			H11B1M, TIL113M	0.8	1.2	1.5	
I_R	Reverse Leakage Current*	$V_R = 3.0\text{V}$	4NXXM		0.001	100	μA
		$V_R = 6.0\text{V}$	H11B1M, TIL113M		0.001	10	
C	Capacitance*	$V_F = 0\text{V}, f = 1.0\text{MHz}$	All		150		pF
DETECTOR							
BV_{CEO}	Collector-Emitter Breakdown Voltage*	$I_C = 1.0\text{mA}, I_B = 0$	4NXXM, TIL113M	30	60		V
			H11B1M	25	60		
BV_{CBO}	Collector-Base Breakdown Voltage*	$I_C = 100\mu\text{A}, I_E = 0$	All	30	100		V
BV_{ECO}	Emitter-Collector Breakdown Voltage*	$I_E = 100\mu\text{A}, I_B = 0$	4NXXM	5.0	10		V
			H11B1M, TIL113M	7	10		
I_{CEO}	Collector-Emitter Dark Current*	$V_{CE} = 10\text{V}, \text{Base Open}$	All		1	100	nA

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS							
$I_{C(CTR)}$	Collector Output Current*(1, 2)	$I_F = 10\text{mA}, V_{CE} = 10\text{V}, I_B = 0$	4N32M, 4N33M	50 (500)			mA (%)
			4N29M, 4N30M	10 (100)			
		$I_F = 1\text{mA}, V_{CE} = 5\text{V}$	H11B1M	5 (500)			
		$I_F = 10\text{mA}, V_{CE} = 1\text{V}$	TIL113M	30 (300)			
$V_{CE(SAT)}$	Saturation Voltage*(2)	$I_F = 8\text{mA}, I_C = 2.0\text{mA}$	4NXXM			1.0	V
			TIL113M			1.25	
		$I_F = 1\text{mA}, I_C = 1\text{mA}$	H11B1M			1.0	
AC CHARACTERISTICS							
t_{on}	Turn-on Time	$I_F = 200\text{mA}, I_C = 50\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$	4NXXM, TIL113M			5.0	μs
		$I_F = 10\text{mA}, V_{CE} = 10\text{V}, R_L = 100\Omega$	H11B1M		25		
t_{off}	Turn-off Time	$I_F = 200\text{mA}, I_C = 50\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$	4N32M, 4N33M, TIL113M			100	μs
			4N29M, 4N30M			40	
		$I_F = 10\text{mA}, V_{CE} = 10\text{V}, R_L = 100\Omega$	H11B1M		18		
BW	Bandwidth(3, 4)				30		kHz

Electrical Characteristics ($T_A = 25^\circ\text{C}$ Unless otherwise specified.) (Continued)**Isolation Characteristics**

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.	Max.	Units
V_{ISO}	Input-Output Isolation Voltage ⁽⁵⁾	$I_{I-O} \leq 1\mu\text{A}$, V_{rms} , $t = 1\text{sec.}$	All	7500			Vac(peak)
		VDC	4N32M*	2500			V
		VDC	4N33M*	1500			
R_{ISO}	Isolation Resistance ⁽⁵⁾	$V_{I-O} = 500\text{VDC}$	All	10^{11}			Ω
C_{ISO}	Isolation Capacitance ⁽⁵⁾	$V_{I-O} = \emptyset$, $f = 1\text{MHz}$	All		0.8		pF

Notes:

* Indicates JEDEC registered data.

1. The current transfer ratio (I_C/I_F) is the ratio of the detector collector current to the LED input current.
2. Pulse test: pulse width = $300\mu\text{s}$, duty cycle $\leq 2.0\%$.
3. I_F adjusted to $I_C = 2.0\text{mA}$ and $I_C = 0.7\text{mA rms}$.
4. The frequency at which I_C is 3dB down from the 1kHz value.
5. For this test, LED pins 1 and 2 are common, and phototransistor pins 4, 5 and 6 are common.

Typical Performance Curves

Fig. 1 LED Forward Voltage vs. Forward Current

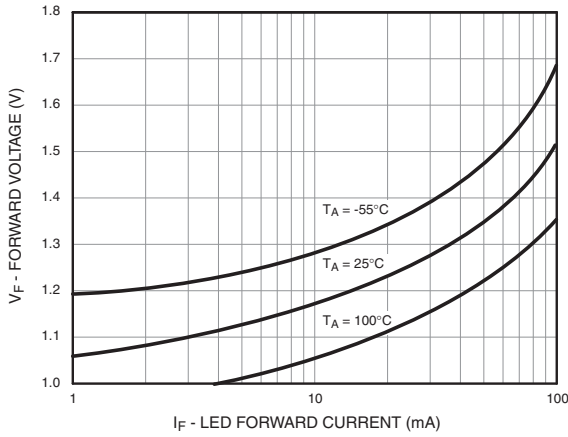


Fig. 2 Normalized CTR vs. Forward Current

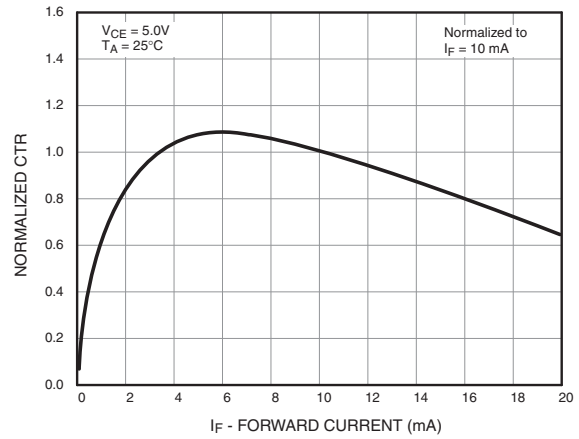


Fig. 3 Normalized CTR vs. Ambient Temperature

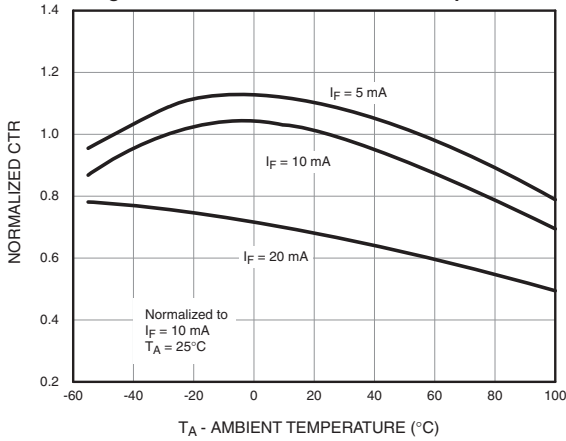


Fig. 4 CTR vs. RBE (Unsaturated)

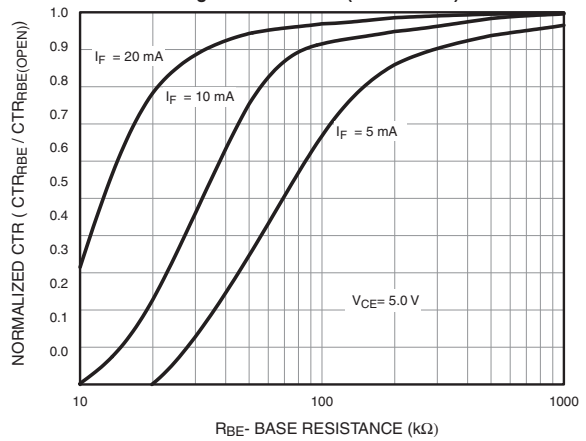


Fig. 5 CTR vs. RBE (Saturated)

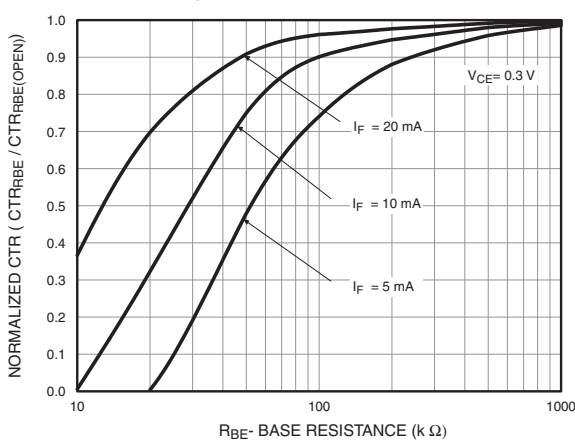
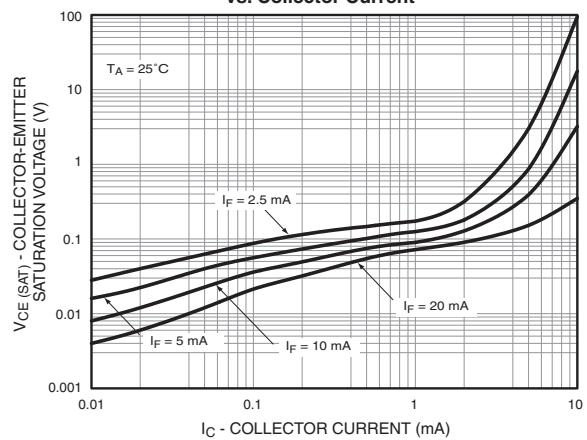


Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current



Typical Performance Curves (Continued)

Fig. 7 Switching Speed vs. Load Resistor

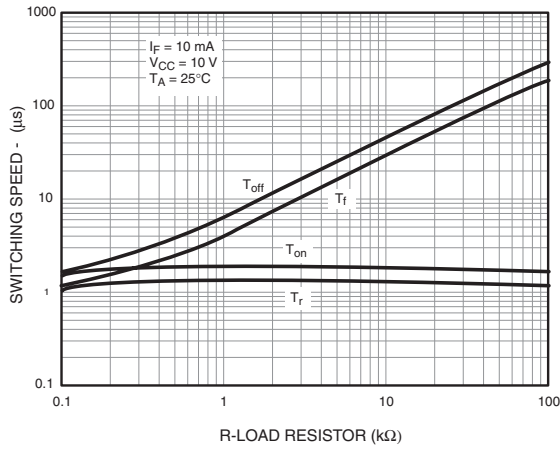


Fig. 8 Normalized t_{on} vs. R_{BE}

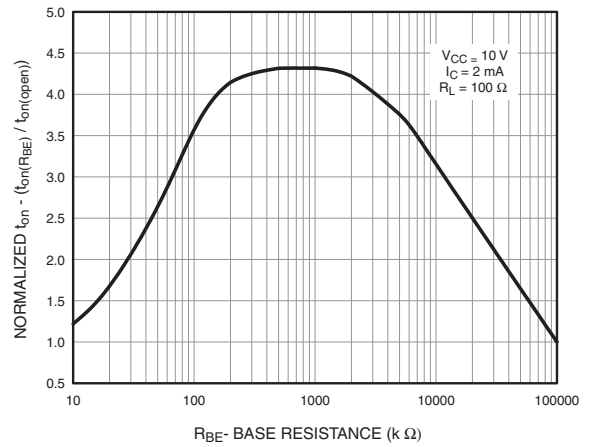


Fig. 9 Normalized t_{off} vs. R_{BE}

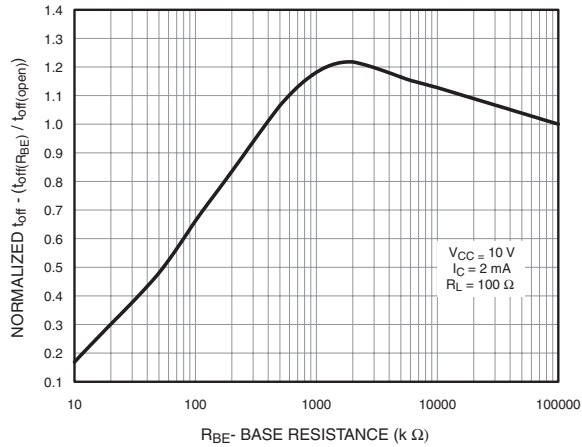
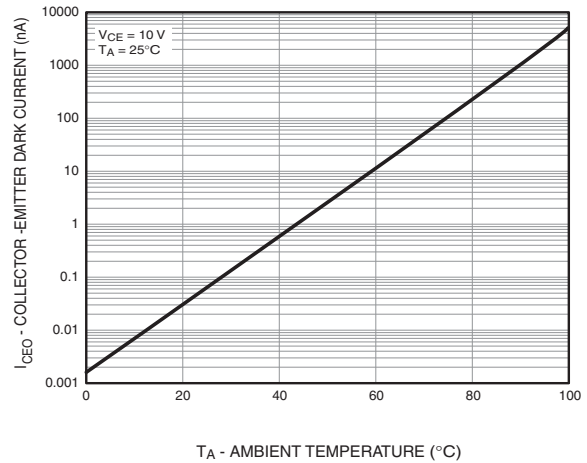
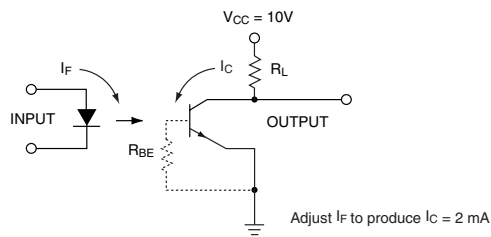


Fig. 10 Dark Current vs. Ambient Temperature



TEST CIRCUIT



WAVE FORMS

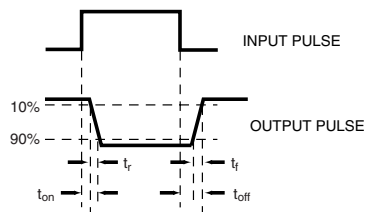
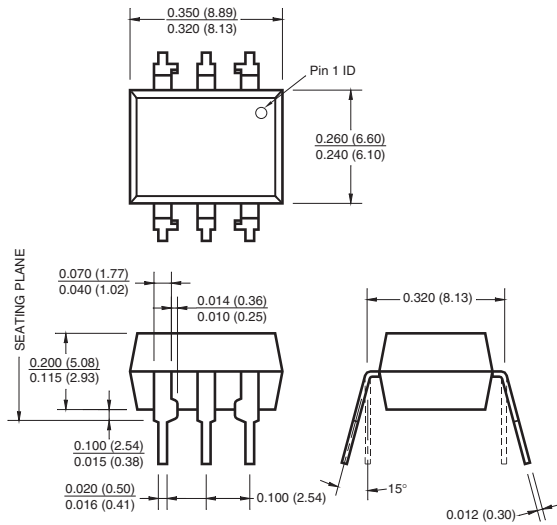


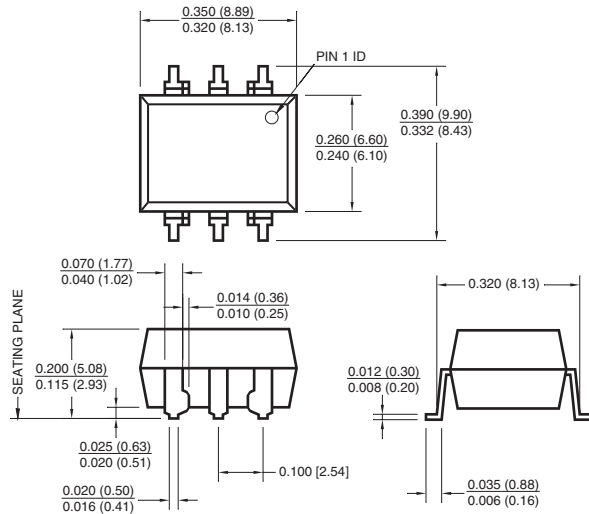
Figure 11. Switching Time Test Circuit and Waveforms

Package Dimensions

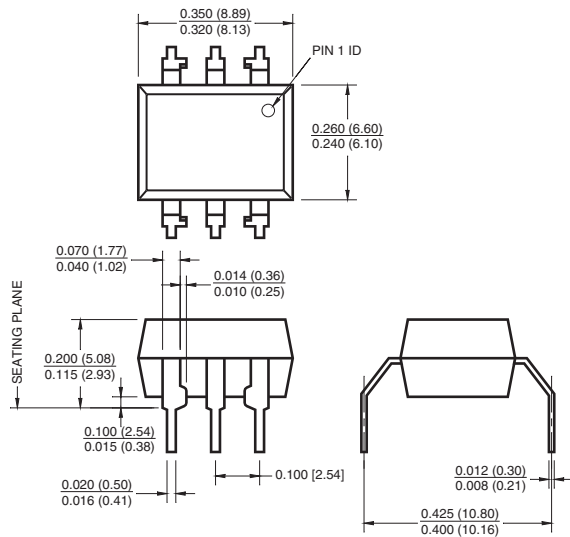
Through Hole



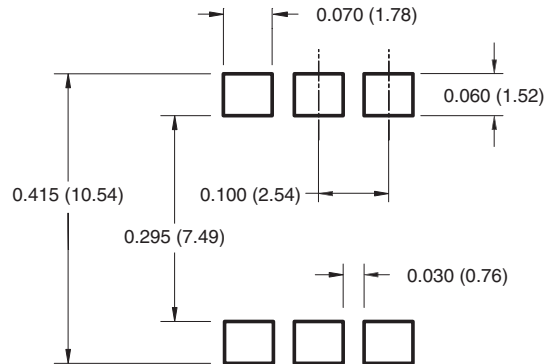
Surface Mount



0.4" Lead Spacing



Recommended Pay Layout for Surface Mount Leadform



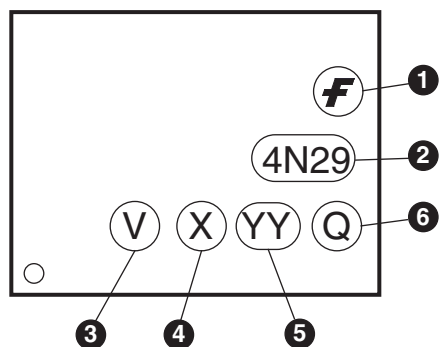
Note:

All dimensions are in inches (millimeters).

Ordering Information

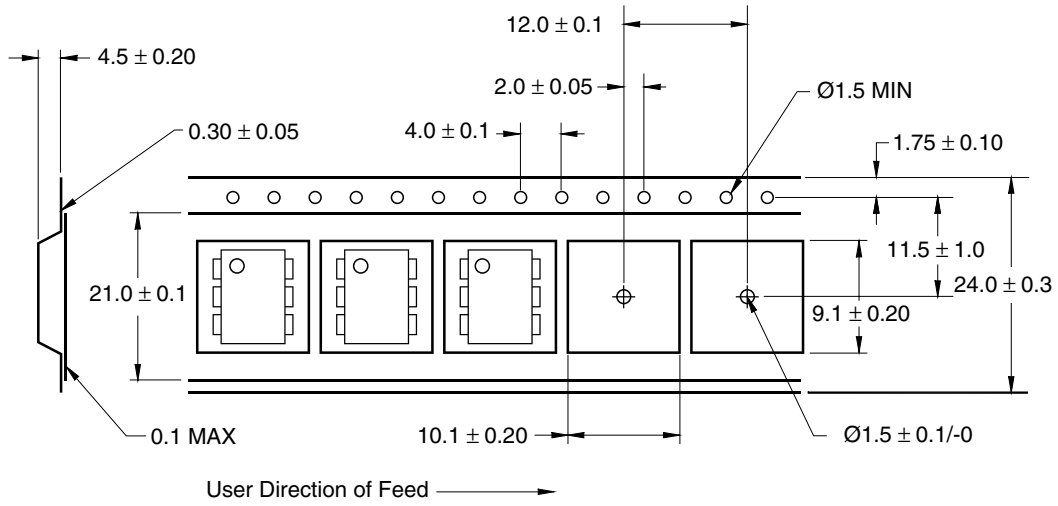
Suffix	Example	Option
No Suffix	4N32M	Standard Through Hole Device
S	4N32SM	Surface Mount Lead Bend
SR2	4N32SR2M	Surface Mount; Tape and reel
T	4N32TM	0.4" Lead Spacing
V	4N32VM	VDE 0884
TV	4N32TVM	VDE 0884, 0.4" Lead Spacing
SV	4N32SVM	VDE 0884, Surface Mount
SR2V	4N32SR2VM	VDE 0884, Surface Mount, Tape & 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

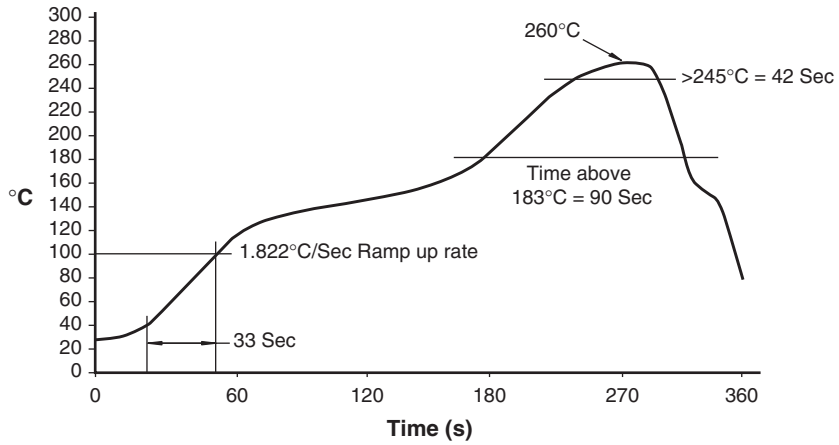
Tape Dimensions



Note:

All dimensions are in millimeters.


Reflow Soldering Profile





TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE ^x	HiSeC TM	Power-SPM TM	TinyBuck TM
Across the board. Around the world. TM	<i>i-Lo</i> TM	PowerTrench [®]	TinyLogic [®]
ActiveArray TM	ImpliedDisconnect TM	Programmable Active Droop TM	TINYOPTO TM
Bottomless TM	IntelliMAX TM	QFET [®]	TinyPower TM
Build it Now TM	ISOPLANAR TM	QS TM	TinyWire TM
CoolFET TM	MICROCOUPLER TM	QT Optoelectronics TM	TruTranslation TM
CorePLUS TM	MicroPak TM	Quiet Series TM	μSerDes TM
CROSSVOLT TM	MICROWIRE TM	RapidConfigure TM	UHC [®]
CTL TM	Motion-SPM TM	RapidConnect TM	UniFET TM
Current Transfer Logic TM	MSX TM	ScalarPump TM	VCX TM
DOME TM	MSXPro TM	SMART START TM	Wire TM
E ² C MOS TM	OCX TM	SPM [®]	
EcoSPARK [®]	OCXPro TM	STEALTH TM	
EnSigna TM	OPTOLOGIC [®]	SuperFET TM	
FACT Quiet Series TM	OPTOPLANAR [®]	SuperSOT TM -3	
FACT [®]	PACMAN TM	SuperSOT TM -6	
FAST [®]	PDP-SPM TM	SuperSOT TM -8	
FASTr TM	POP TM	SyncFET TM	
FPS TM	Power220 [®]	TCM TM	
FRFET [®]	Power247 [®]	The Power Franchise [®]	
GlobalOptoisolator TM	PowerEdge TM	 TM	
GTO TM	PowerSaver TM	TinyBoost TM	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
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.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. I27