

# 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)

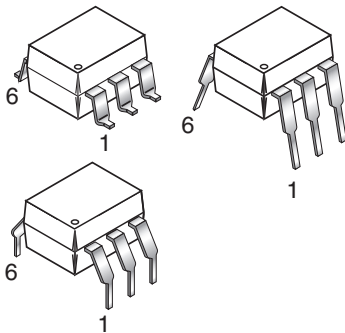
## Applications

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

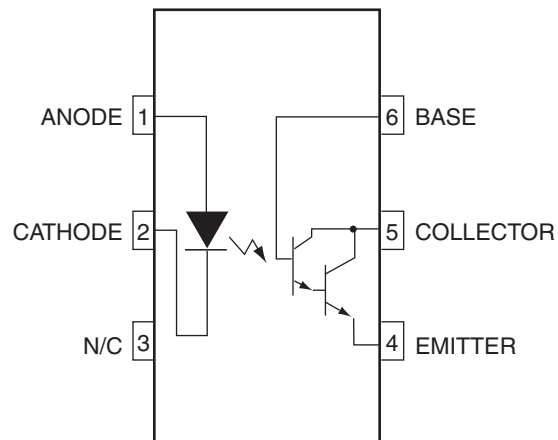
## Description

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
<b>TOTAL DEVICE</b>			
$T_{STG}$	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 $25^\circ\text{C}$	3.3	mW/ $^\circ\text{C}$
<b>EMITTER</b>			
$I_F$	Continuous Forward Current	80	mA
$V_R$	Reverse Voltage	3	V
$I_F(\text{pk})$	Forward Current – Peak (300 $\mu\text{s}$ , 2% Duty Cycle)	3.0	A
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate above $25^\circ\text{C}$	2.0	mW/ $^\circ\text{C}$
<b>DETECTOR</b>			
$BV_{CEO}$	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 $25^\circ\text{C}$	2.0	mW/ $^\circ\text{C}$
$I_C$	Continuous Collector Current	150	mA

## Electrical Characteristics (T<sub>A</sub> = 25°C Unless otherwise specified.)

### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
<b>EMITTER</b>							
V <sub>F</sub>	Input Forward Voltage*	I <sub>F</sub> = 10mA	4NXXM		1.2	1.5	V
			H11B1M, TIL113M	0.8	1.2	1.5	
I <sub>R</sub>	Reverse Leakage Current*	V <sub>R</sub> = 3.0V	4NXXM		0.001	100	μA
		V <sub>R</sub> = 6.0V	H11B1M, TIL113M		0.001	10	
C	Capacitance*	V <sub>F</sub> = 0V, f = 1.0MHz	All		150		pF
<b>DETECTOR</b>							
BV <sub>CEO</sub>	Collector-Emitter Breakdown Voltage*	I <sub>C</sub> = 1.0mA, I <sub>B</sub> = 0	4NXXM, TIL113M	30	60		V
			H11B1M	25	60		
BV <sub>CBO</sub>	Collector-Base Breakdown Voltage*	I <sub>C</sub> = 100μA, I <sub>E</sub> = 0	All	30	100		V
BV <sub>ECO</sub>	Emitter-Collector Breakdown Voltage*	I <sub>E</sub> = 100μA, I <sub>B</sub> = 0	4NXXM	5.0	10		V
			H11B1M, TIL113M	7	10		
I <sub>CEO</sub>	Collector-Emitter Dark Current*	V <sub>CE</sub> = 10V, Base Open	All		1	100	nA

### Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
<b>DC CHARACTERISTICS</b>							
I <sub>C(CTR)</sub>	Collector Output Current*(1, 2)	I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V, I <sub>B</sub> = 0	4N32M, 4N33M	50 (500)			mA (%)
			4N29M, 4N30M	10 (100)			
		I <sub>F</sub> = 1mA, V <sub>CE</sub> = 5V	H11B1M	5 (500)			
		I <sub>F</sub> = 10mA, V <sub>CE</sub> = 1V	TIL113M	30 (300)			
V <sub>CE(SAT)</sub>	Saturation Voltage*(2)	I <sub>F</sub> = 8mA, I <sub>C</sub> = 2.0mA	4NXXM			1.0	V
			TIL113M			1.25	
		I <sub>F</sub> = 1mA, I <sub>C</sub> = 1mA	H11B1M			1.0	
<b>AC CHARACTERISTICS</b>							
t <sub>on</sub>	Turn-on Time	I <sub>F</sub> = 200mA, I <sub>C</sub> = 50mA, V <sub>CC</sub> = 10V, R <sub>L</sub> = 100Ω	4NXXM, TIL113M			5.0	μS
		I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V, R <sub>L</sub> = 100Ω	H11B1M		25		
t <sub>off</sub>	Turn-off Time	I <sub>F</sub> = 200mA, I <sub>C</sub> = 50mA, V <sub>CC</sub> = 10V, R <sub>L</sub> = 100Ω	4N32M, 4N33M, TIL113M			100	μS
			4N29M, 4N30M			40	
		I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V, R <sub>L</sub> = 100Ω	H11B1M		18		
BW	Bandwidth <sup>(3, 4)</sup>				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 <sup>(5)</sup>	$I_{I-O} \leq 1\mu\text{A}$ , $V_{rms}$ , $t = 1\text{sec.}$	All	7500			Vac(peak)
		VDC	4N32M*	2500			V
		VDC	4N33M*	1500			
$R_{ISO}$	Isolation Resistance <sup>(5)</sup>	$V_{I-O} = 500\text{VDC}$	All	$10^{11}$			$\Omega$
$C_{ISO}$	Isolation Capacitance <sup>(5)</sup>	$V_{I-O} = \emptyset$ , $f = 1\text{MHz}$	All		0.8		pF

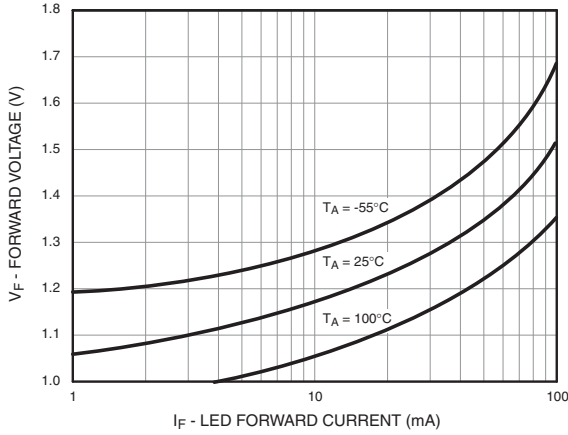
**Notes:**

\* Indicates JEDEC registered data.

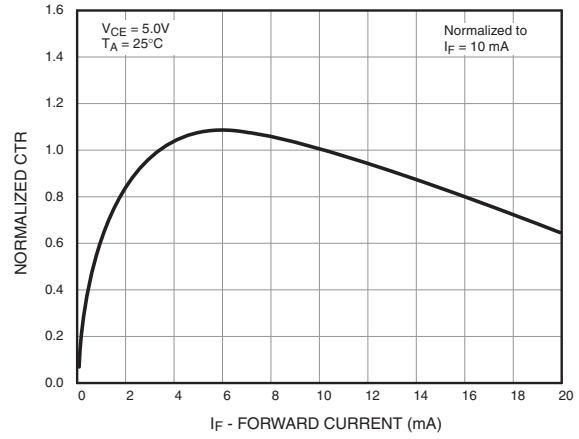
1. The current transfer ratio ( $I_C/I_F$ ) is the ratio of the detector collector current to the LED input current.
2. Pulse test: pulse width =  $300\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .
3.  $I_F$  adjusted to  $I_C = 2.0\text{mA}$  and  $I_C = 0.7\text{mA rms}$ .
4. The frequency at which  $I_C$  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

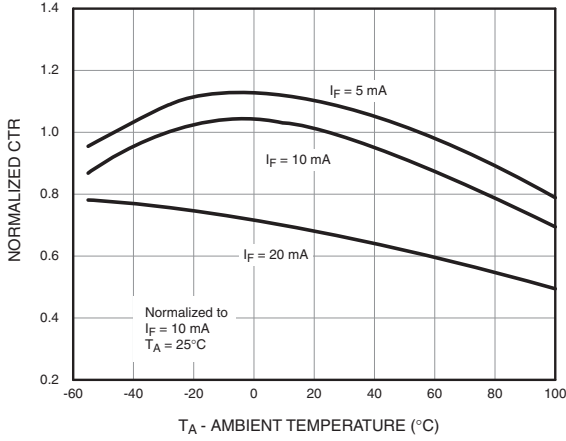
**Fig. 1 LED Forward Voltage vs. Forward Current**



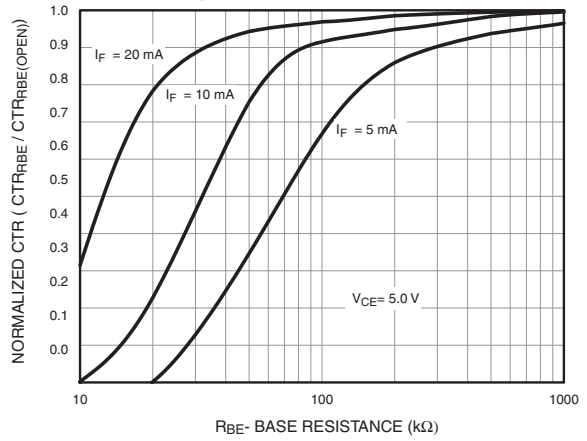
**Fig. 2 Normalized CTR vs. Forward Current**



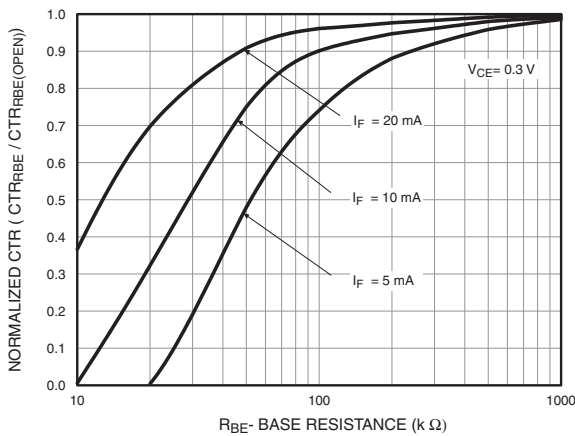
**Fig. 3 Normalized CTR vs. Ambient Temperature**



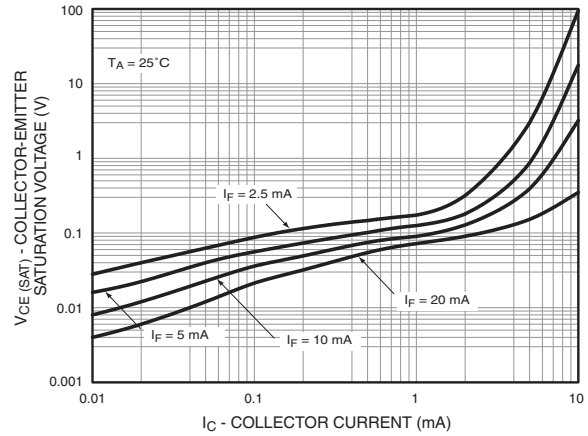
**Fig. 4 CTR vs. RBE (Unsaturated)**



**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

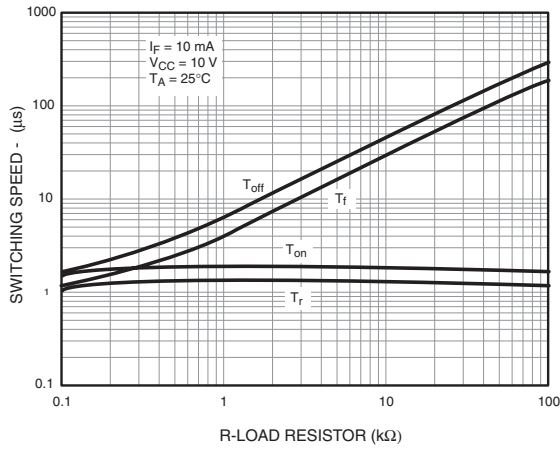


Fig. 8 Normalized  $t_{on}$  vs.  $R_{BE}$

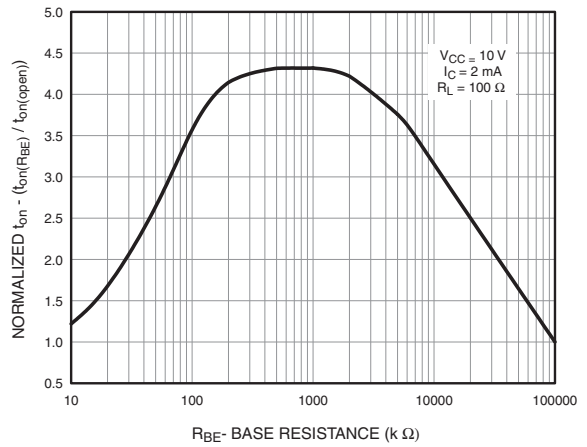


Fig. 9 Normalized  $t_{off}$  vs.  $R_{BE}$

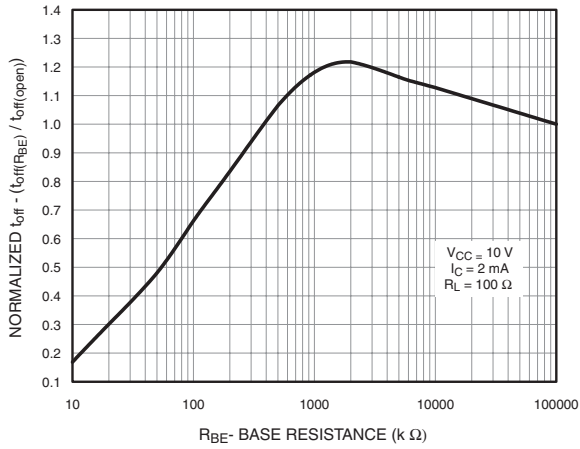
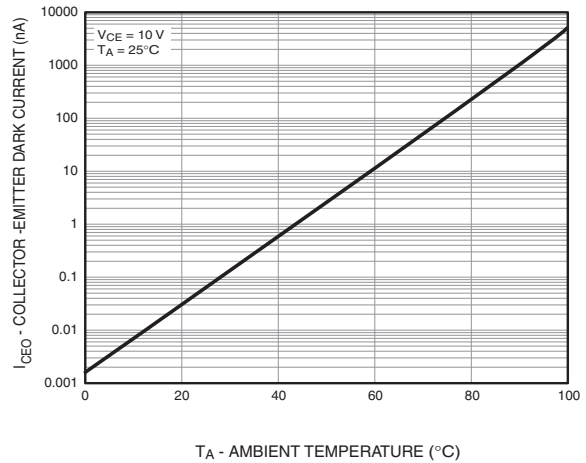
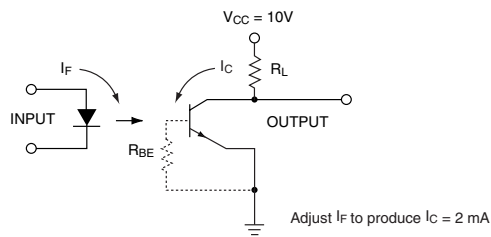


Fig. 10 Dark Current vs. Ambient Temperature



TEST CIRCUIT



WAVE FORMS

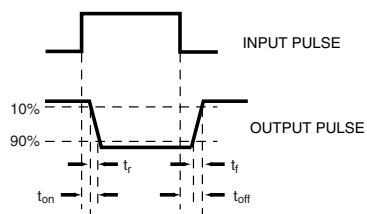
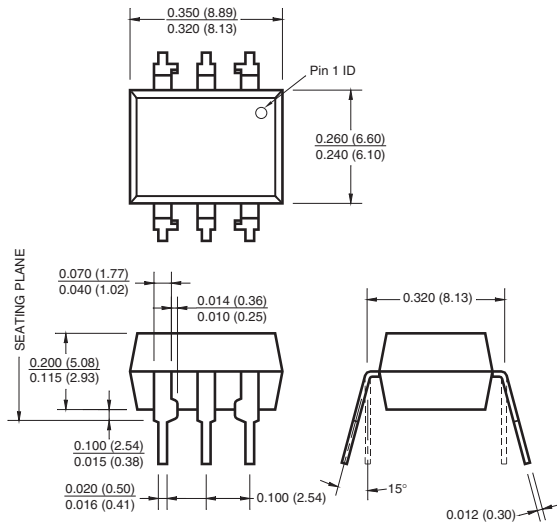


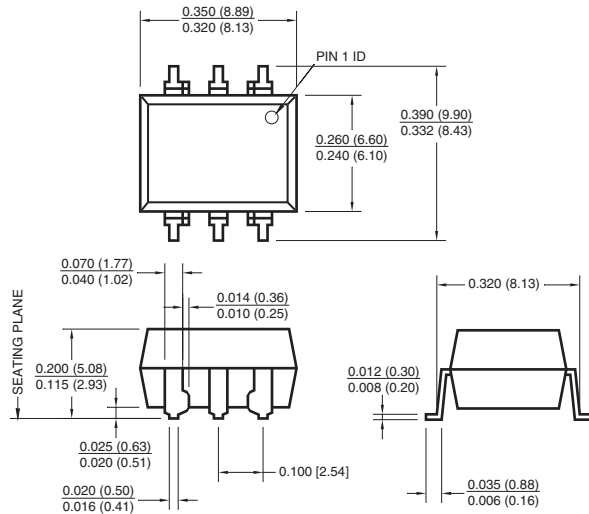
Figure 11. Switching Time Test Circuit and Waveforms

## Package Dimensions

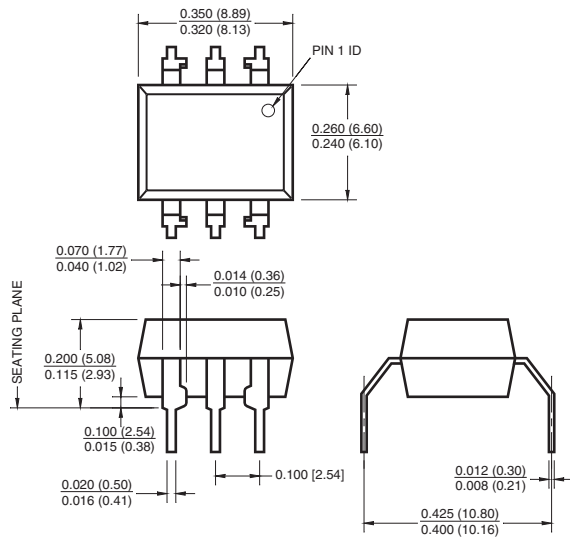
### Through Hole



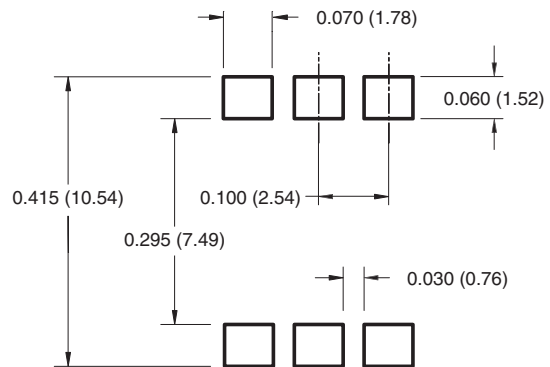
### Surface Mount



### 0.4" Lead Spacing



### Recommended Pay Layout for Surface Mount Leadform



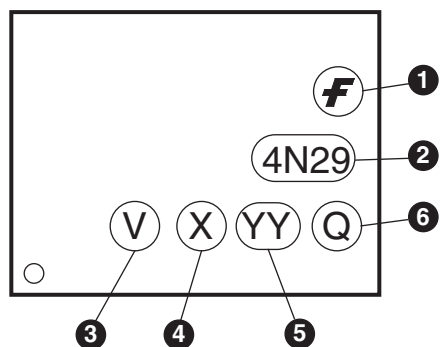
**Note:**

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

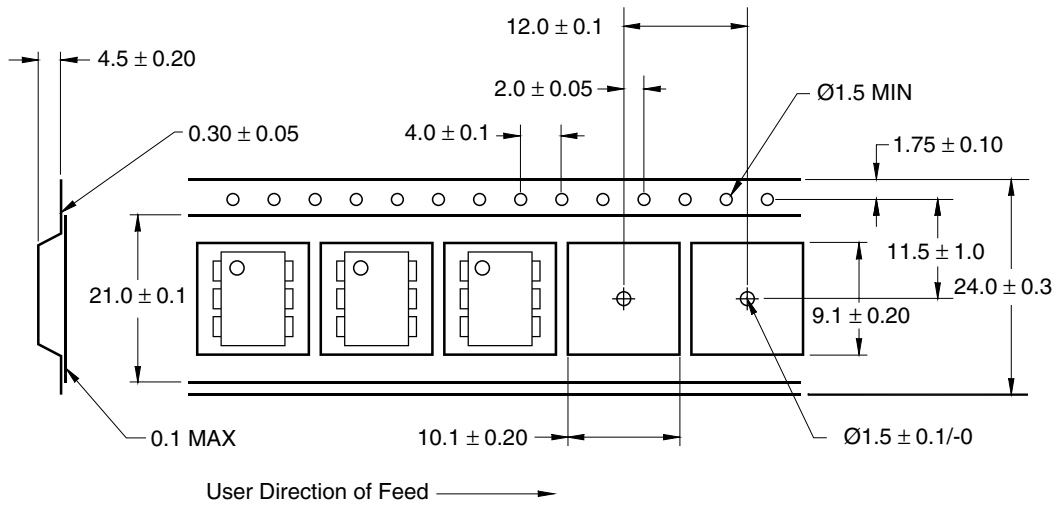
## Marking Information



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



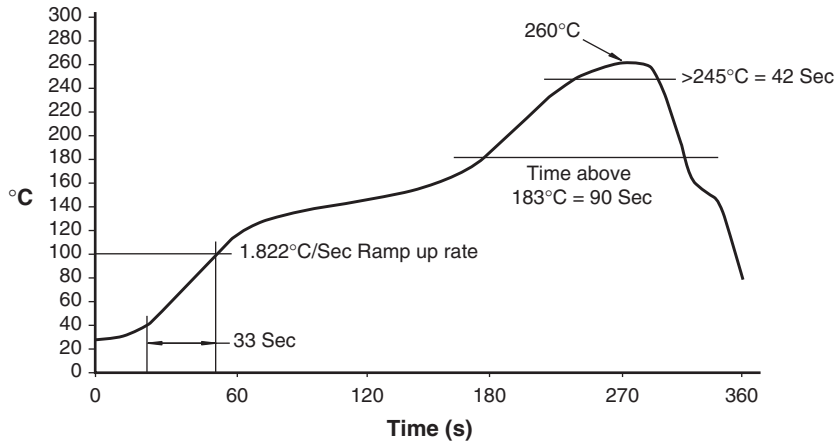
### Tape Dimensions



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

## 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:

- 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.
- 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