FAIRCHILD SEMICONDUCTOR®

September 2009

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, File #E90700, Volume 2
- IEC 60747-5-2 approved (ordering option V)

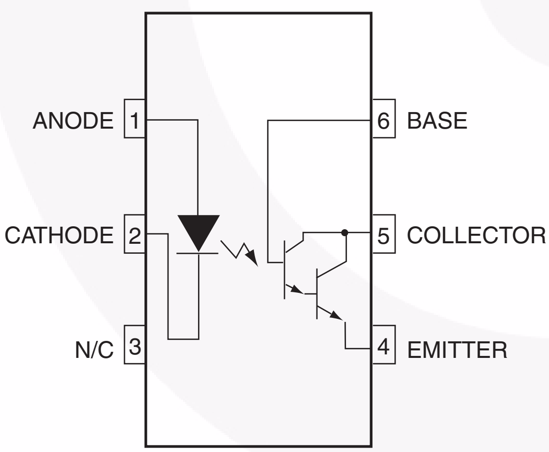
Applications

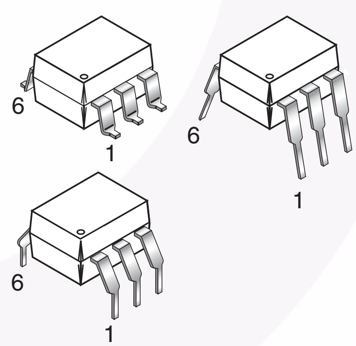
- Low power logic circuits
- Telecommunications equipment
- Portable electronics
- Solid state relays
- Interfacing coupling systems of different potentials and impedances

Description

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

Schematic





Absolute Maximum Ratings (T_A = 25°C unless otherwise specified.)

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	Value	Units
TOTAL DEVICE			
T_{STG}	Storage Temperature	-50 to +150	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_{SOL}	Lead Solder Temperature (Wave)	260 for 10 sec	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	250	mW
	Derate above 25°C	3.3	mW/°C
EMITTER			
I_F	Continuous Forward Current	80	mA
V_R	Reverse Voltage	3	V
I_F(pk)	Forward Current – Peak (300µs, 2% Duty Cycle)	3.0	A
P_D	LED Power Dissipation @ T_A = 25°C	150	mW
	Derate above 25°C	2.0	mW/°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°C	150	mW
	Derate above 25°C	2.0	mW/°C
I_C	Continuous Collector Current	150	mA

Electrical Characteristics (T_A = 25°C Unless otherwise specified.)

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V_F	Input Forward Voltage*	I_F = 10mA	4NXXM		1.2	1.5	V
			H11B1M, TIL113M	0.8	1.2	1.5	
I_R	Reverse Leakage Current*	V_R = 3.0V	4NXXM		0.001	100	µA
		V_R = 6.0V	H11B1M, TIL113M		0.001	10	
C	Capacitance*	V_F = 0V, f = 1.0MHz	All		150		pF
DETECTOR							
BV_{CEO}	Collector-Emitter Breakdown Voltage*	I_C = 1.0mA, I_B = 0	4NXXM, TIL113M	30	60		V
			H11B1M	25	60		
BV_{CBO}	Collector-Base Breakdown Voltage*	I_C = 100µA, I_E = 0	All	30	100		V
BV_{ECO}	Emitter-Collector Breakdown Voltage*	I_E = 100µA, I_B = 0	4NXXM	5.0	10		V
			H11B1M, TIL113M	7	10		
I_{CEO}	Collector-Emitter Dark Current*	V_{CE} = 10V, 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 = 10mA, V_{CE} = 10V, I_B = 0	4N32M, 4N33M	50 (500)			mA (%)
			4N29M, 4N30M	10 (100)			
		I_F = 1mA, V_{CE} = 5V	H11B1M	5 (500)			
		I_F = 10mA, V_{CE} = 1V	TIL113M	30 (300)			
$V_{CE(SAT)}$	Saturation Voltage*(2)	I_F = 8mA, I_C = 2.0mA	4NXXM			1.0	V
			TIL113M			1.25	
		I_F = 1mA, I_C = 1mA	H11B1M			1.0	
AC CHARACTERISTICS							
t_{on}	Turn-on Time	I_F = 200mA, I_C = 50mA, V_{CC} = 10V, R_L = 100Ω	4NXXM, TIL113M			5.0	µs
		I_F = 10mA, V_{CE} = 10V, R_L = 100Ω	H11B1M		25		
t_{off}	Turn-off Time	I_F = 200mA, I_C = 50mA, V_{CC} = 10V, R_L = 100Ω	4N32M, 4N33M, TIL113M			100	µs
			4N29M, 4N30M			40	
		I_F = 10mA, V_{CE} = 10V, R_L = 100Ω	H11B1M		18		
BW	Bandwidth(3, 4)				30		kHz

Electrical Characteristics (T_A = 25°C Unless otherwise specified.) (Continued)

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.	Max.	Units
V_{ISO}	Input-Output Isolation Voltage(5)	f = 60Hz, t = 1 sec.	All	7500			V_{AC}PEAK
		VDC	4N32M*	2500			V
		VDC	4N33M*	1500			
R_{ISO}	Isolation Resistance(5)	V_{I-O} = 500VDC	All	10^{11}			Ω
C_{ISO}	Isolation Capacitance(5)	V_{I-O} = Ø, f = 1MHz	All		0.8		pF

* Indicates JEDEC registered data.

Notes:

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 = 300µs, duty cycle ≤ 2.0% .
3. I_F adjusted to I_C = 2.0mA and I_C = 0.7mA 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.

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} x 1.875 = V_{PR}, 100% Production Test with tm = 1 sec, Partial Discharge < 5pC	1594			V_{peak}
	Input to Output Test Voltage, Method a, V_{IORM} x 1.5 = V_{PR}, Type and Sample Test with tm = 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 Ts, V_{IO} = 500V	10^9			Ω

Typical Performance Curves

Fig. 1 LED Forward Voltage vs. Forward Current

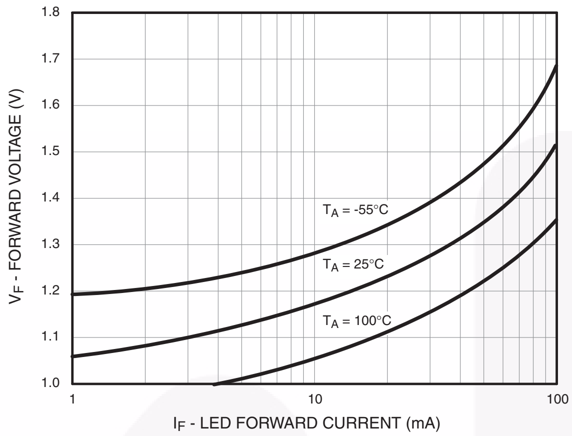


Fig. 2 Normalized CTR vs. Forward Current

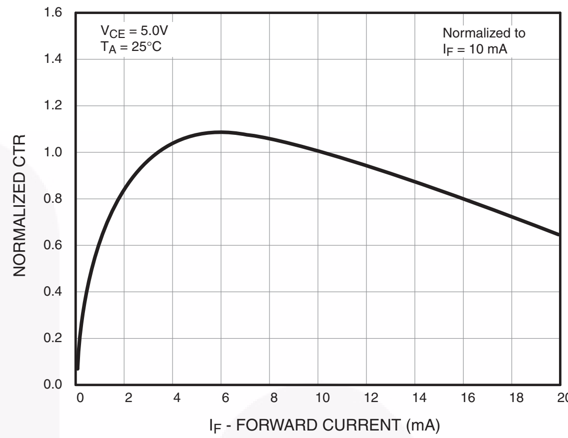


Fig. 3 Normalized CTR vs. Ambient Temperature

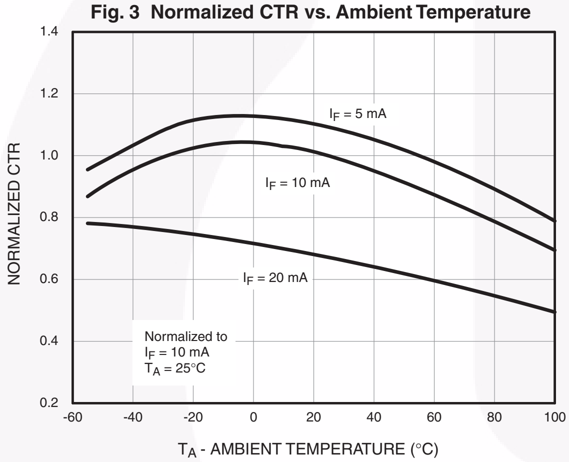


Fig. 4 CTR vs. RBE (Unsaturated)

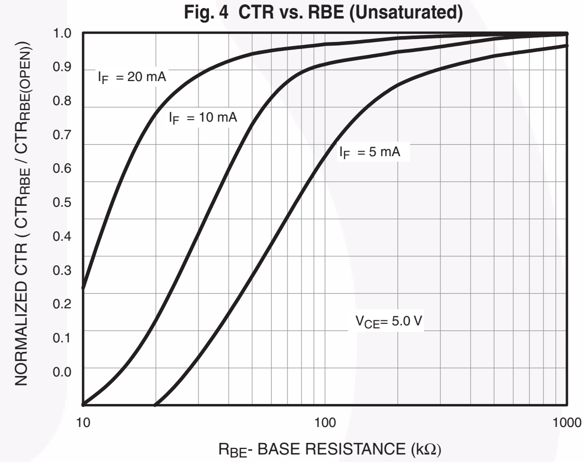


Fig. 5 CTR vs. RBE (Saturated)

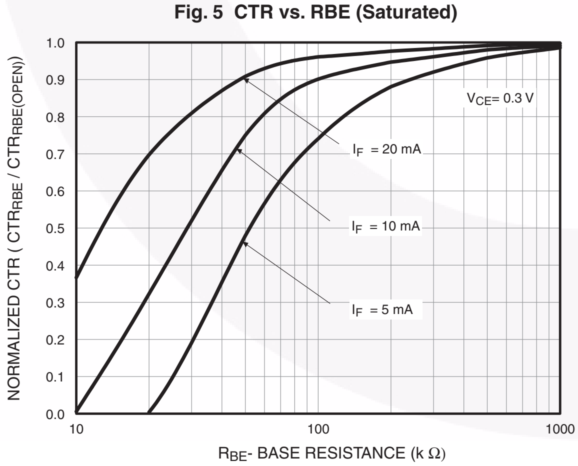
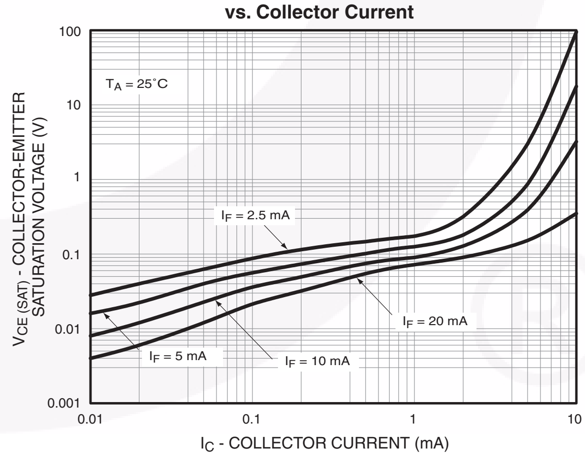


Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current



Typical Performance Curves (Continued)

Fig. 7 Switching Speed vs. Load Resistor

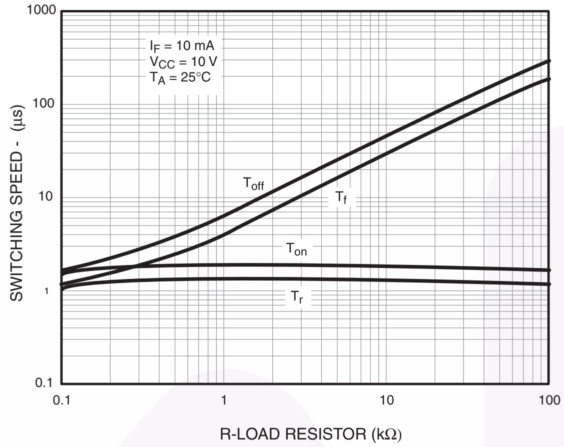


Fig. 8 Normalized t_{on} vs. R_{BE}

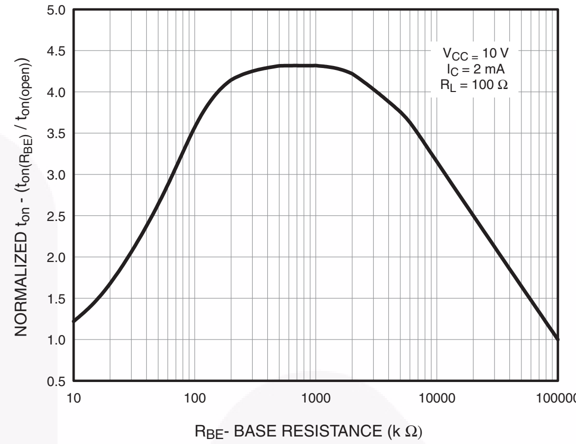


Fig. 9 Normalized t_{off} vs. R_{BE}

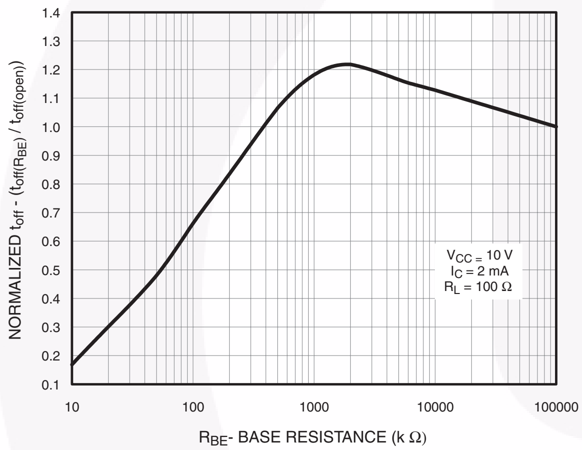
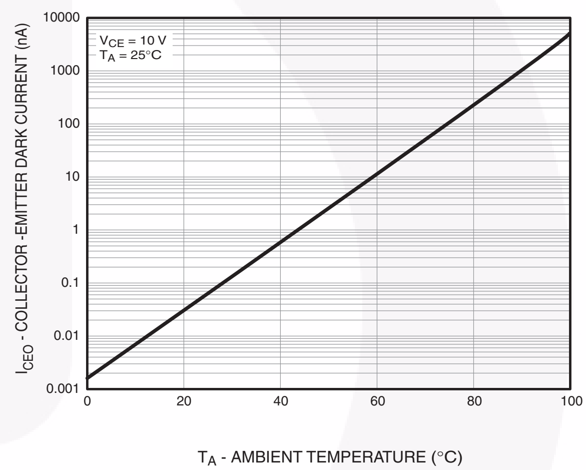


Fig. 10 Dark Current vs. Ambient Temperature



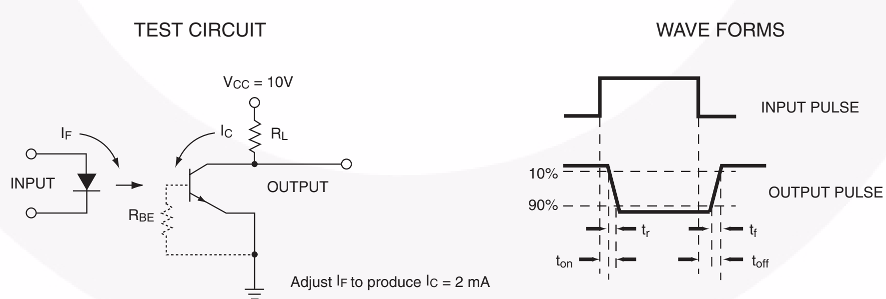
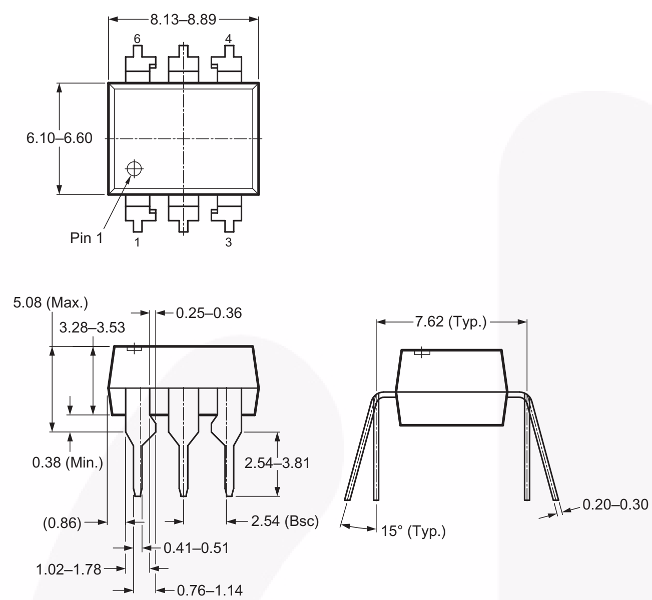


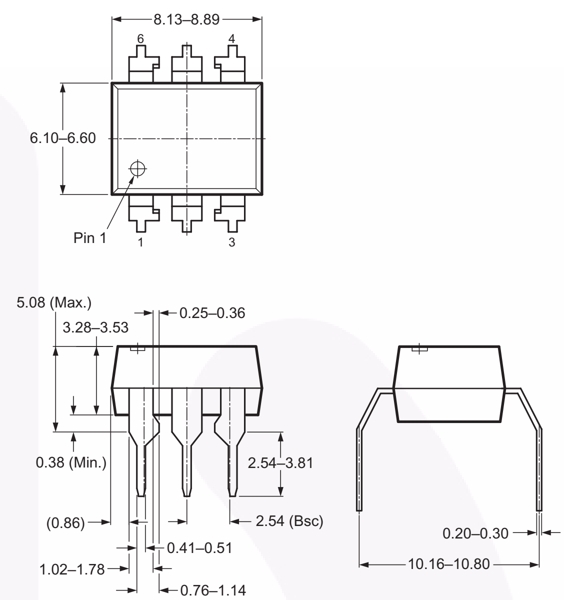
Figure 11. Switching Time Test Circuit and Waveforms

Package Dimensions

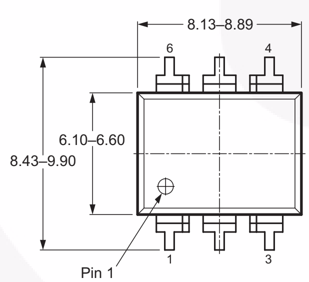
Through Hole

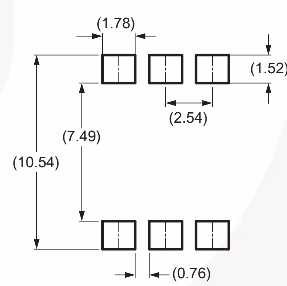


0.4" Lead Spacing

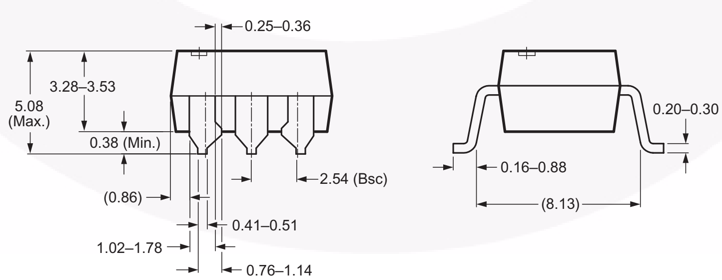


Surface Mount





Rcommended Pad Layout

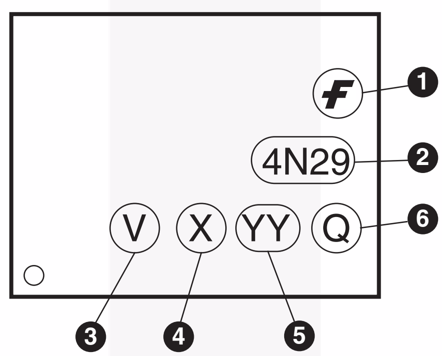


Note:
All dimensions in mm.

Ordering Information

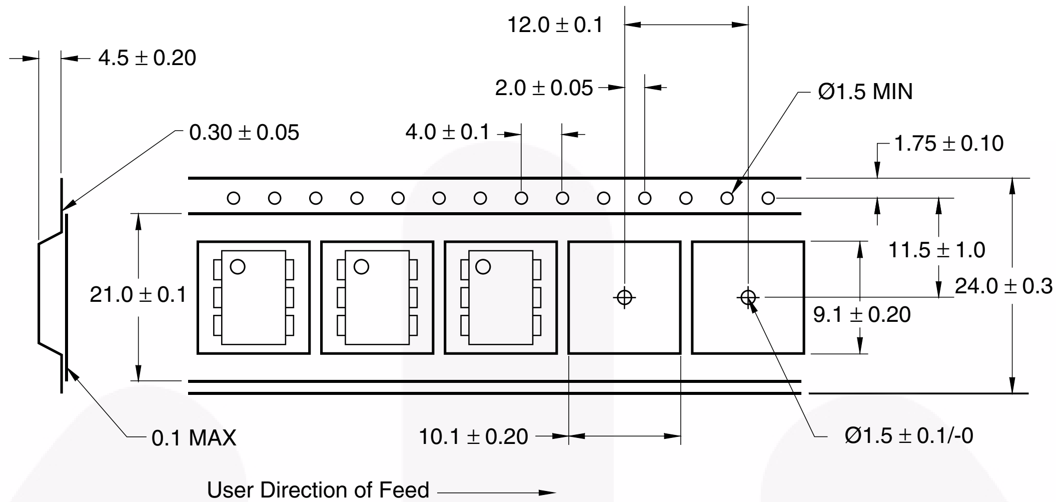
Suffix	Example	Option
No Suffix	4N32M	Standard Through Hole Device (50 units per tube)
S	4N32SM	Surface Mount Lead Bend
SR2	4N32SR2M	Surface Mount; Tape and Reel (1,000 units per reel)
T	4N32TM	0.4" Lead Spacing
V	4N32VM	VDE 0884
TV	4N32TVM	VDE 0884, 0.4" Lead Spacing
SV	4N32SVM	VDE 0884, Surface Mount
SR2V	4N32SR2VM	VDE 0884, Surface Mount, Tape & Reel (1,000 units per reel)

Marking Information



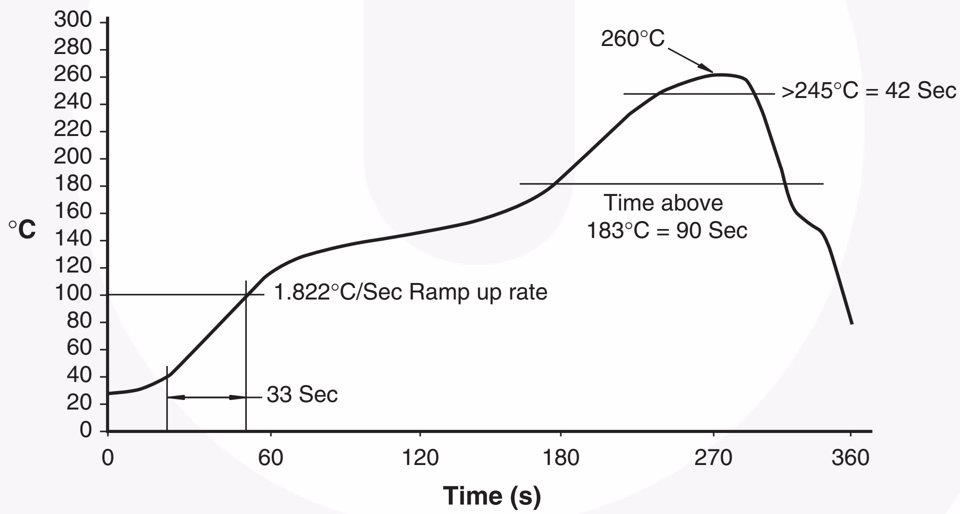
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

Tape Dimensions



Note:
All dimensions are in millimeters.

Reflow Soldering Profile



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