FAIRCHILD SEMICONDUCTOR®

September 2009

H11N1M, H11N2M, H11N3M
6-Pin DIP High Speed Logic Optocouplers

Features

- High data rate, 5MHz typical (NRZ)
- Free from latch up and oscilliation throughout voltage and temperature ranges.
- Microprocessor compatible drive
- Logic compatible output sinks 16mA at 0.5V maximum
- Guaranteed on/off threshold hysteresis
- Wide supply voltage capability, compatible with all popular logic systems
- High common mode transient immunity, 2000V/μs minimum
- Fast switching t_r = 7.5ns typical, t_f = 12ns typical
- Underwriter Laboratory (UL) recognized—file #E90700
- VDE recognized—File#102497 – Add option V (e.g., H11N1VM)

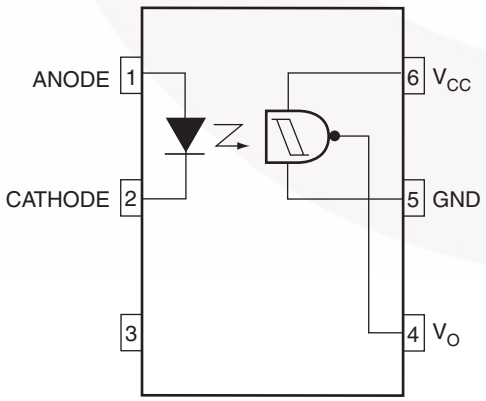
Applications

- Logic to logic isolator
- Programmable current level sensor
- Line receiver—eliminate noise and transient problems
- A.C. to TTL conversion—square wave shaping
- Interfaces computers with peripherals
- Isolated power MOS driver for power supplies

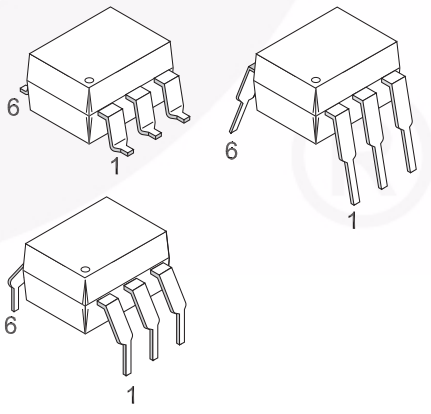
Description

The H11NXM series has a high speed integrated circuit detector optically coupled to an AlGaAs infrared emitting diode. The output incorporates a Schmitt trigger, which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open collector output for maximum application flexibility.

Schematic



Package Outlines



Truth Table

Input	Output
H	L
L	H

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	Parameters	Value	Units
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +150	°C
T_{OPR}	Operating Temperature	-40 to +85	°C
T_{SOL}	Lead Solder Temperature	260 for 10 sec	°C
P_D	Total Device Power Dissipation @ 25°C	250	mW
	Derate Above 25°C	2.94	mW/°C
EMITTER			
I_F	Continuous Forward Current	30	mA
V_R	Reverse Voltage	6	V
I_F(pk)	Forward Current – Peak (1µs pulse, 300 pps)	1.0	A
P_D	LED Power Dissipation 25°C Ambient	120	mW
	Derate Linearly From 25°C	1.41	mW/°C
DETECTOR			
P_D	Detector Power Dissipation @ 25°C	150	mW
	Derate Linearly from 25°C	1.76	mW/°C
V_O	V_{45} Allowed Range	0 to 16	V
V_{CC}	V_{65} Allowed Range	0 to 16	V
I_O	I_4 Output Current	50	mA

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

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.*	Max.	Units
EMITTER							
V_F	Input Forward Voltage	I_F = 10mA	All		1.4	2	V
		I_F = 0.3mA		0.75	1.25		
I_R	Reverse Current	V_R = 5V	All			10	µA
C_J	Capacitance	V = 0, f = 1.0MHz	All			100	pF
DETECTOR							
V_{CC}	Operating Voltage Range		All	4		15	V
$I_{CC(off)}$	Supply Current	I_F = 0, V_{CC} = 5V	All		6	10	mA
I_{OH}	Output Current, High	I_F = 0.3mA, V_{CC} = V_O = 15V	All			100	µA

Transfer Characteristics

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
$I_{CC(on)}$	Supply Current	I_F = 10mA, V_{CC} = 5V	All		6.5	10	mA
V_{OL}	Output Voltage, Low	R_L=270Ω,V_{CC}=5V, I_F = $I_{F(on)}$ max.	All			0.5	V
$I_{F(on)}$	Turn-On Threshold Current	R_L=270Ω, V_{CC} = 5V(1)	H11N1M	0.8		3.2	mA
			H11N2M	2.3		5	
			H11N3M	4.1		10	
$I_{F(off)}$	Turn-Off Threshold Current	R_L = 270Ω, V_{CC} = 5V	All	0.3			mA
$I_{F(off)}$ / $I_{F(on)}$	Hysteresis Ratio	R_L = 270Ω, V_{CC} = 5V	All	0.65		0.95	

Switching Speed

Symbol	AC Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
t_{PHL}	Propagation Delay Time HIGH-to-LOW	C = 120pF, t_P = 1µs, R_E = (2), Figure 1	All		100	330	ns
t_r	Rise Time	C = 120pF, t_P = 1µs, R_E = (2), Figure 1	All		7.5		ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH	C = 120pF, t_P = 1µs, R_E = (2), Figure 1	All		150	330	ns
t_f	Fall Time	C = 120pF, t_P = 1µs, R_E = (2), Figure 1	All		12		ns
	Data Rate		All		5		MHz

Isolation Characteristics

Symbol	Parameters	Test Conditions	Min.	Typ.*	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	f = 60 Hz, t =1 sec.	7500			V_{PEAK}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0V, f = 1 MHz		0.4	0.6	pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC	10^{11}			Ω

*Typical values at T_A = 25°C

Notes:

1. Maximum $I_{F(ON)}$ is the maximum current required to trigger the output. For example, a 3.2mA maximum trigger current would require the LED to be driven at a current greater than 3.2mA to guarantee the device will turn on. A 10% guard band is recommended to account for degradation of the LED over its lifetime. The maximum allowable LED drive current is 30mA.
2. H11N1: R_E = 910Ω, H11N2: R_E = 560Ω, H11N3: R_E = 240Ω

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

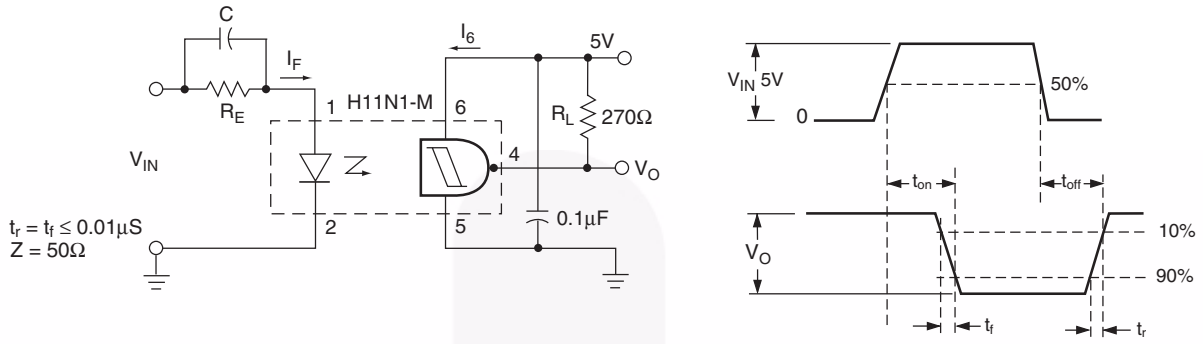


Figure 1. Switching Test Circuit and Waveforms

Figure 2. Transfer Characteristics

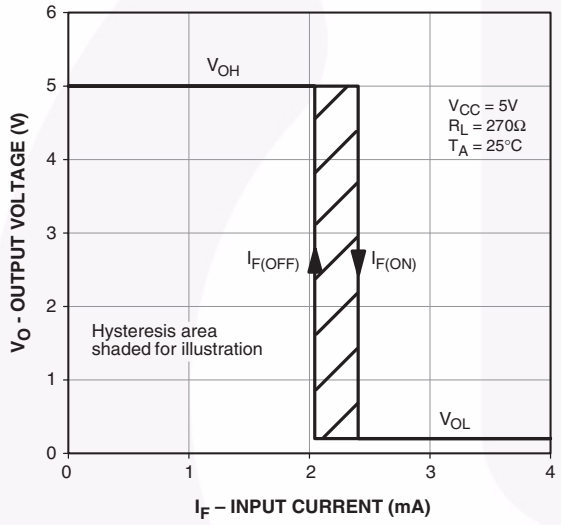


Figure 3. Threshold Current vs. Supply Voltage

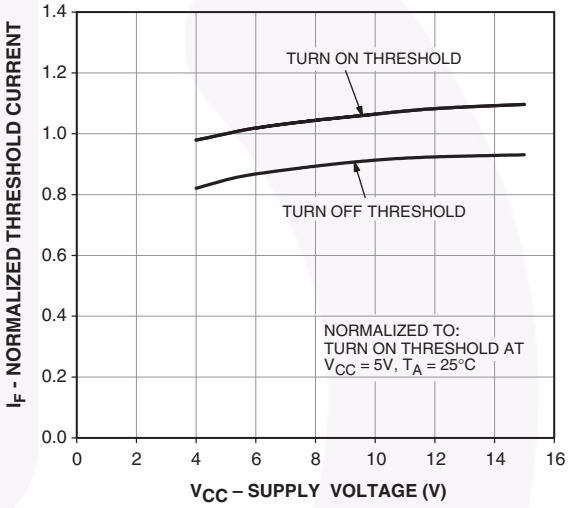


Figure 4. Threshold Current vs. Temperature

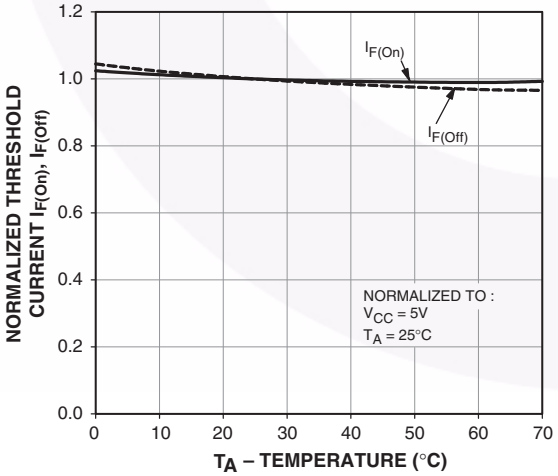
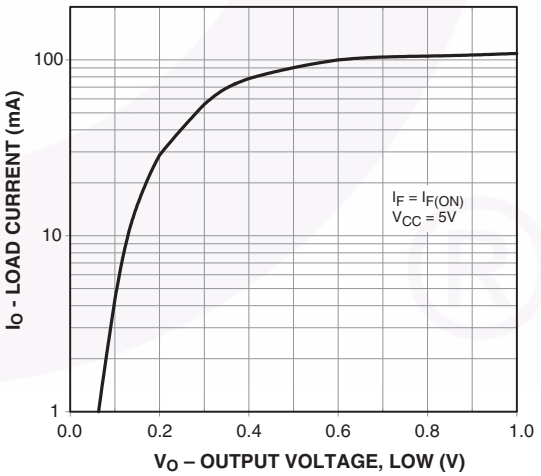


Figure 5. Load Current vs. Output Voltage



Typical Performance Curves (Continued)

Figure 6. Supply Current vs. Supply Voltage

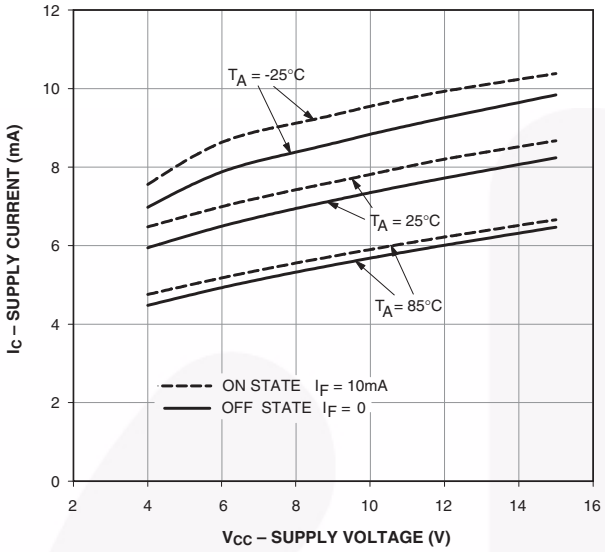
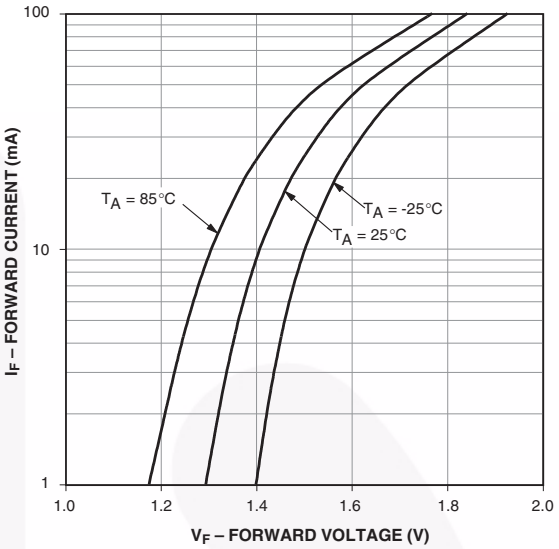
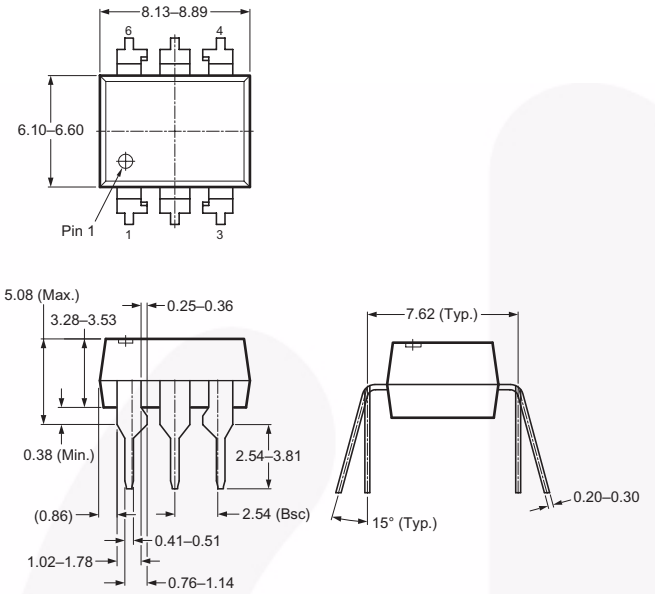


Figure 7. LED Forward Voltage vs. Forward Current

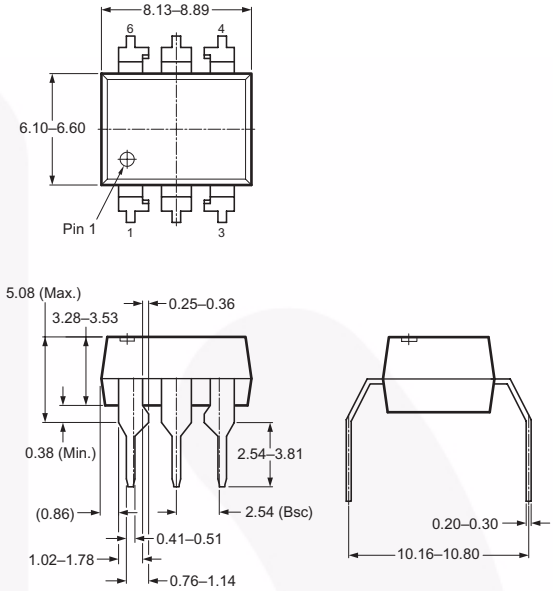


Package Dimensions

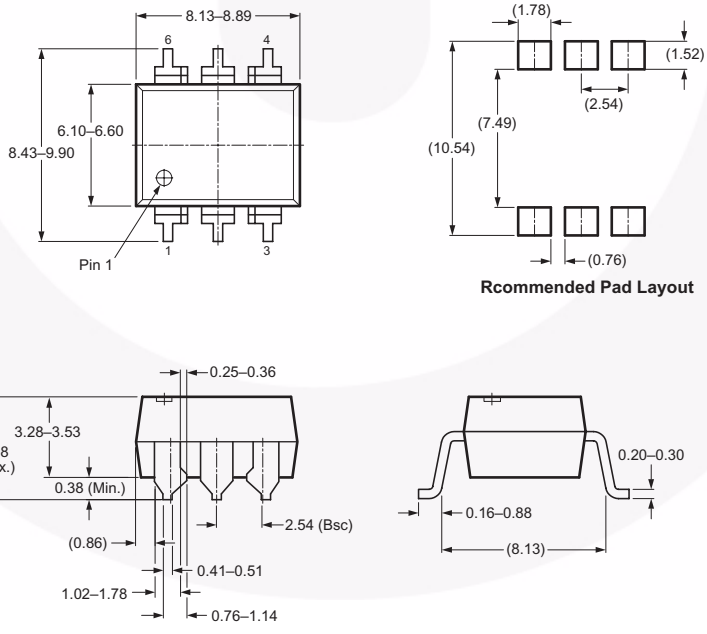
Through Hole



0.4" Lead Spacing



Surface Mount

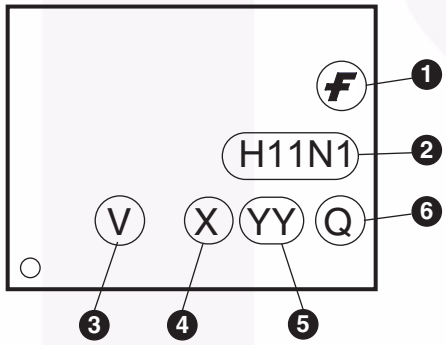


Note:
All dimensions in mm.

Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	H11N1M	Standard Through Hole Device
S	H11N1SM	Surface Mount Lead Bend
SR2	H11N1SR2M	Surface Mount; Tape and Reel
T	H11N1TM	0.4" Lead Spacing
V	H11N1VM	VDE 0884
TV	H11N1TVM	VDE 0884, 0.4" Lead Spacing
SV	H11N1SVM	VDE 0884, Surface Mount
SR2V	H11N1SR2VM	VDE 0884, Surface Mount, Tape and Reel

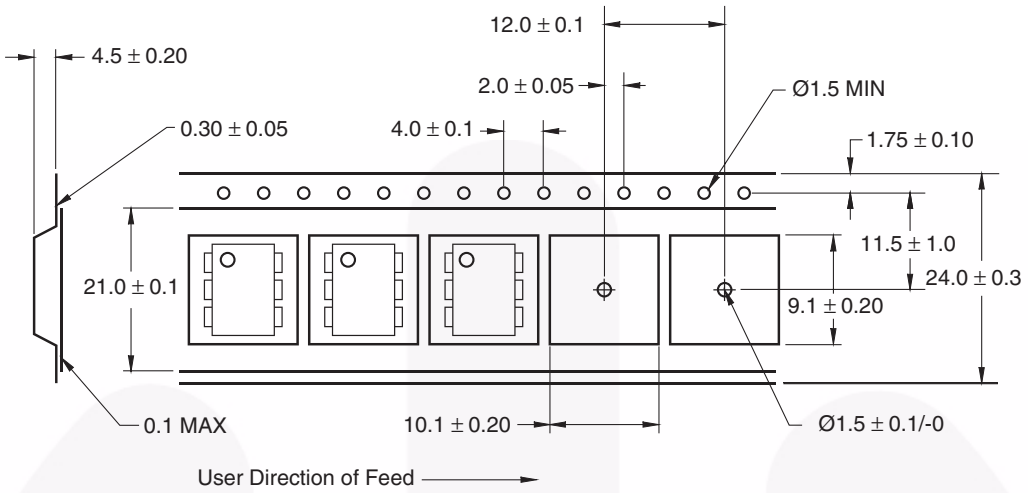
Marking Information



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., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

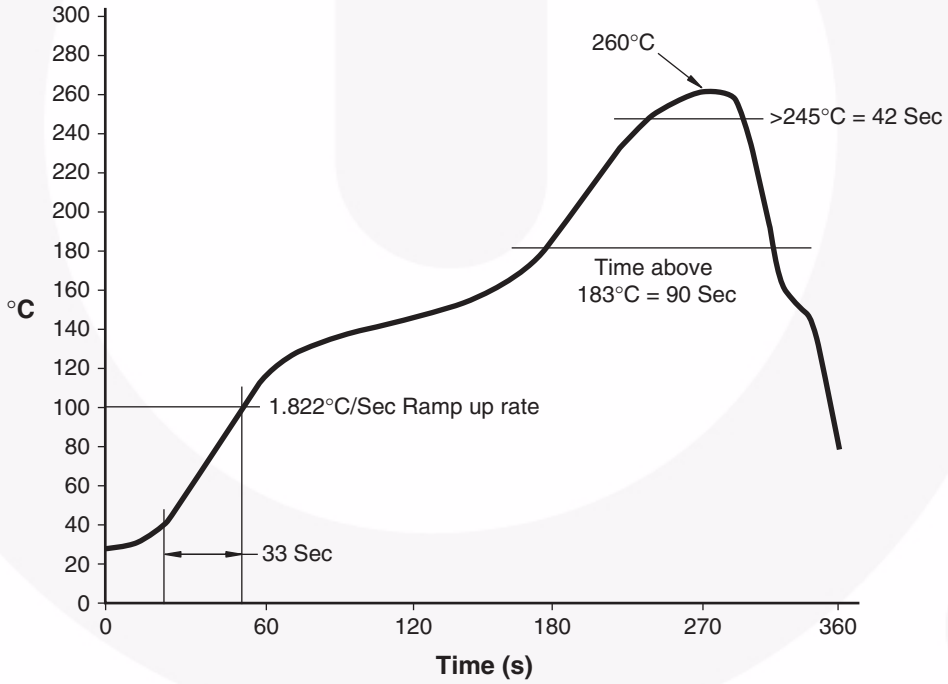
*Note – Parts that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in portrait format.

Tape Dimensions



Note:
All dimensions are in millimeters.

Reflow Soldering 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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