

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

## Features

- High data rate, 5MHz typical (NRZ)
- Free from latch up and oscillation 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/ $\mu$ s minimum
- Fast switching  $t_r = 7.5\text{ns}$  typical,  $t_f = 12\text{ns}$  typical
- Underwriter Laboratory (UL) recognized—file #E90700
- VDE recognized—File#102497 – Add option V (e.g., H11N1VM)

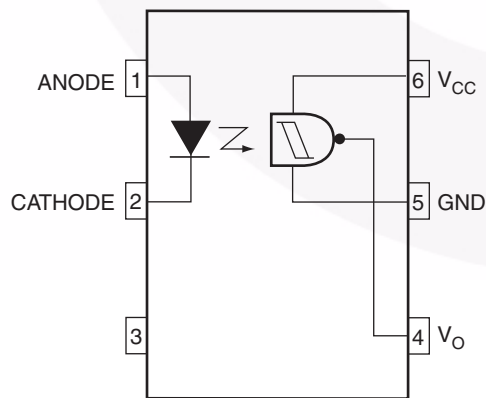
## Applications

- 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

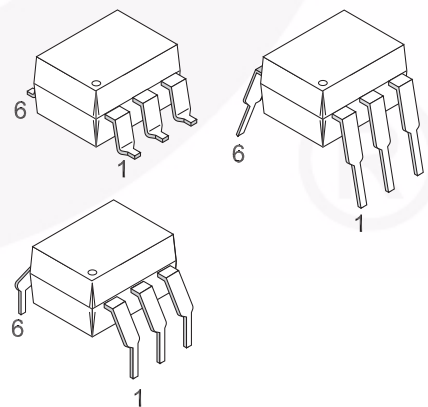
## Description

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** ( $T_A = 25^\circ\text{C}$  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
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	-40 to +85	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature	260 for 10 sec	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation @ $25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	250	mW
		2.94	$\text{mW}/^\circ\text{C}$
<b>EMITTER</b>			
$I_F$	Continuous Forward Current	30	mA
$V_R$	Reverse Voltage	6	V
$I_{F(pk)}$	Forward Current – Peak (1 $\mu\text{s}$ pulse, 300 pps)	1.0	A
$P_D$	LED Power Dissipation $25^\circ\text{C}$ Ambient Derate Linearly From $25^\circ\text{C}$	120	mW
		1.41	$\text{mW}/^\circ\text{C}$
<b>DETECTOR</b>			
$P_D$	Detector Power Dissipation @ $25^\circ\text{C}$ Derate Linearly from $25^\circ\text{C}$	150	mW
		1.76	$\text{mW}/^\circ\text{C}$
$V_O$	$V_{45}$ 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** ( $T_A = 25^\circ\text{C}$  unless otherwise specified.)**Individual Component Characteristics**

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

**Transfer Characteristics**

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
$I_{CC(\text{on})}$	Supply Current	$I_F = 10\text{mA}, V_{CC} = 5\text{V}$	All		6.5	10	mA
$V_{OL}$	Output Voltage, Low	$R_L = 270\Omega, V_{CC} = 5\text{V}, I_F = I_{F(\text{on})} \text{ max.}$	All			0.5	V
$I_{F(\text{on})}$	Turn-On Threshold Current	$R_L = 270\Omega, V_{CC} = 5\text{V}^{(1)}$	H11N1M	0.8		3.2	mA
			H11N2M	2.3		5	
			H11N3M	4.1		10	
$I_{F(\text{off})}$	Turn-Off Threshold Current	$R_L = 270\Omega, V_{CC} = 5\text{V}$	All	0.3			mA
$I_{F(\text{off})} / I_{F(\text{on})}$	Hysteresis Ratio	$R_L = 270\Omega, V_{CC} = 5\text{V}$	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	$C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$	All		100	330	ns
$t_r$	Rise Time	$C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$	All		7.5		ns
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH	$C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$	All		150	330	ns
$t_f$	Fall Time	$C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$	All		12		ns
	Data Rate		All		5		MHz

**Isolation Characteristics**

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

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

- Maximum  $I_{F(\text{ON})}$  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.
- H11N1:  $R_E = 910\Omega$ , H11N2:  $R_E = 560\Omega$ , H11N3:  $R_E = 240\Omega$

## 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 $T_s$ , $V_{IO} = 500V$	$10^9$			$\Omega$

### Typical Performance Curves

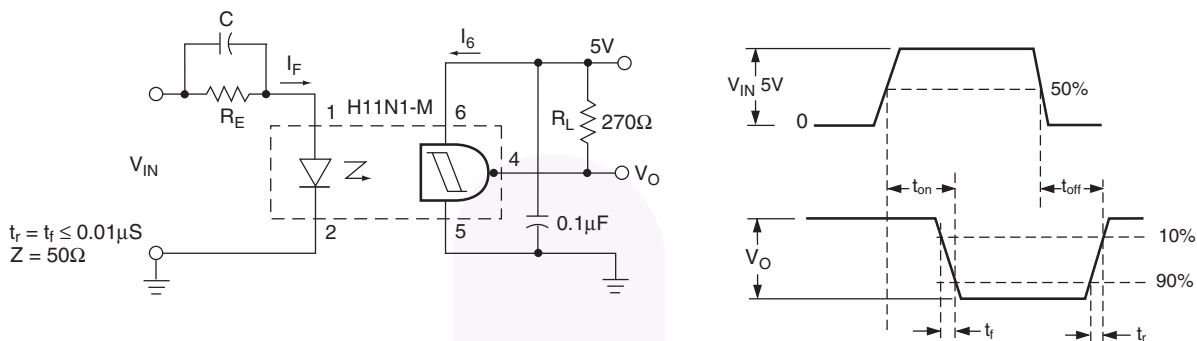


Figure 1. Switching Test Circuit and Waveforms

Figure 2. Transfer Characteristics

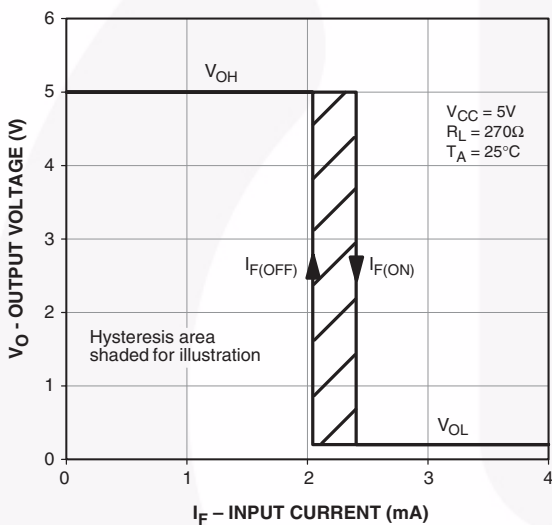


Figure 3. Threshold Current vs. Supply Voltage

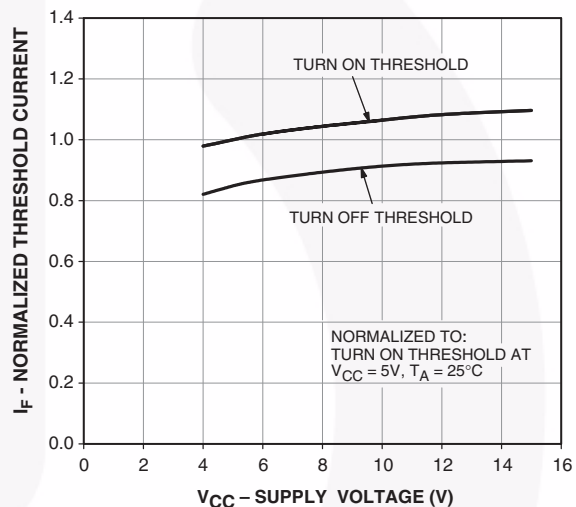


Figure 4. Threshold Current vs. Temperature

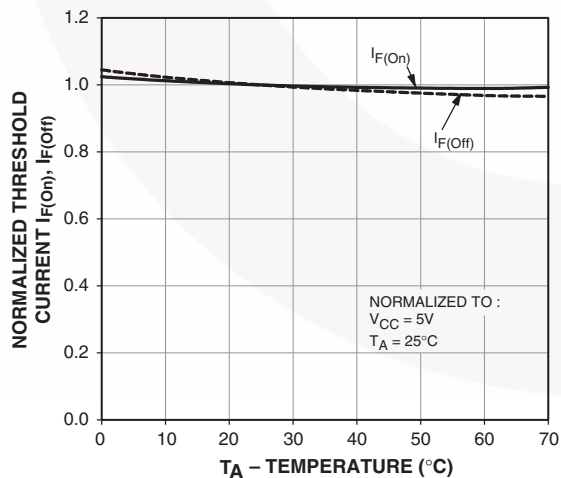
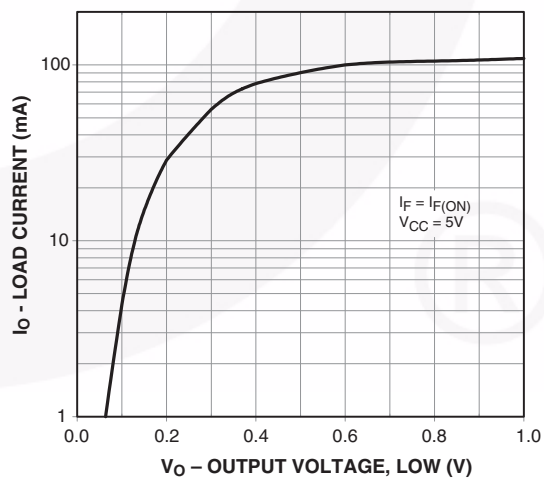


Figure 5. Load Current vs. Output Voltage



Typical Performance Curves (Continued)

Figure 6. Supply Current vs. Supply Voltage

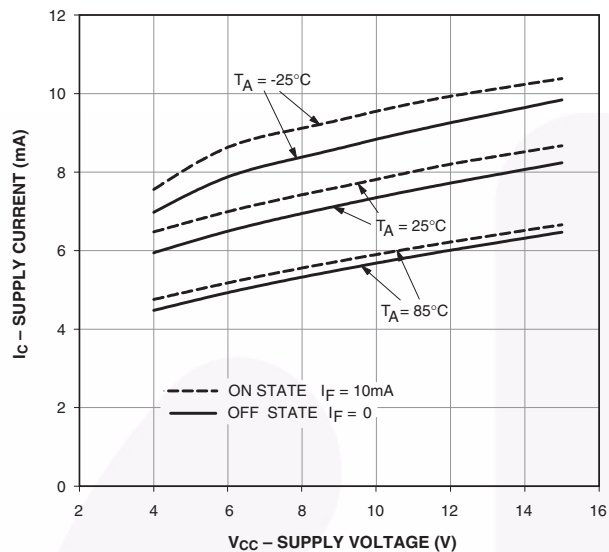
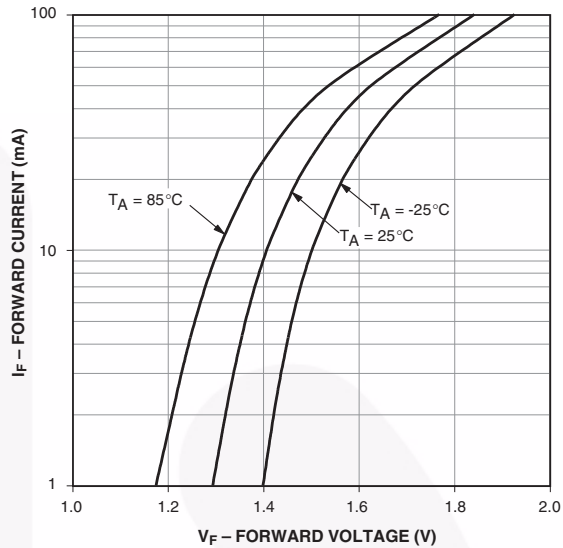
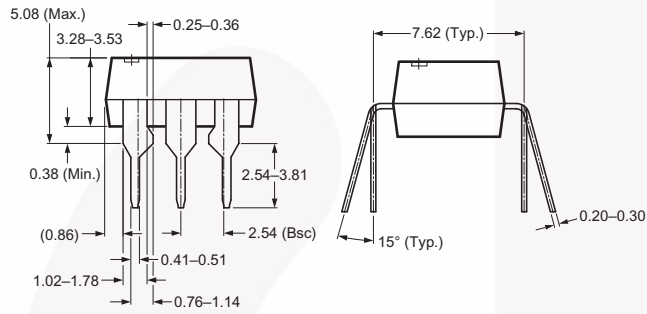
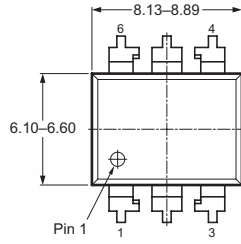


Figure 7. LED Forward Voltage vs. Forward Current

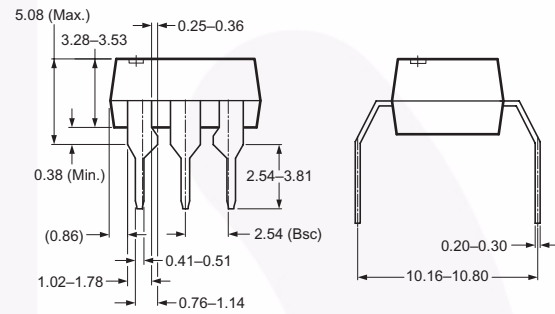
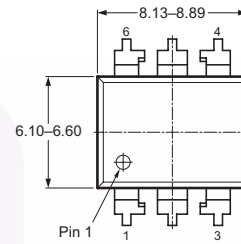


## Package Dimensions

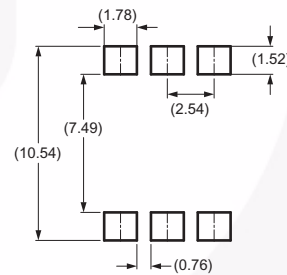
### Through Hole



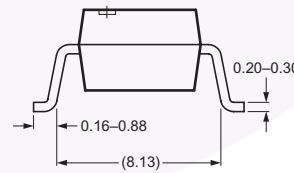
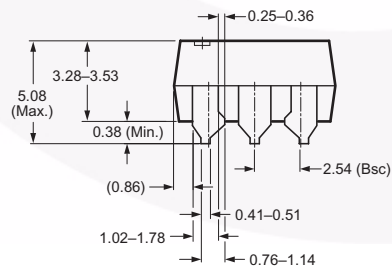
### 0.4" Lead Spacing



### Surface Mount



Recommended Pad Layout

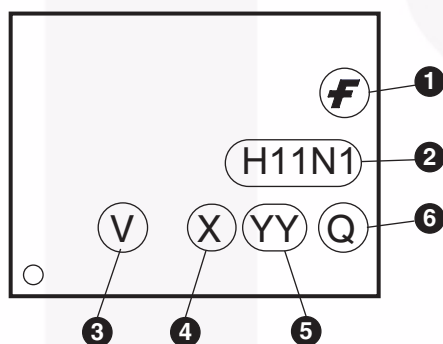


**Note:**  
All dimensions in mm.

## 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

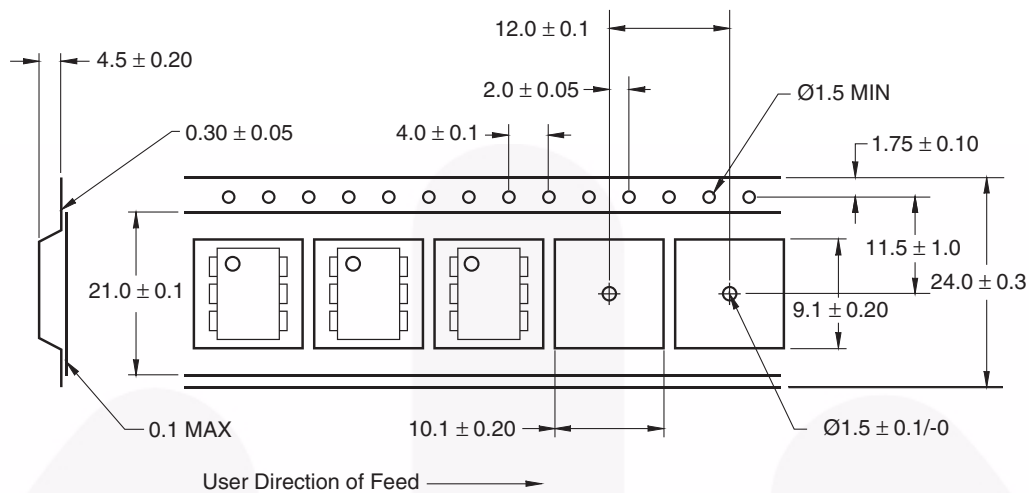


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

\*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.



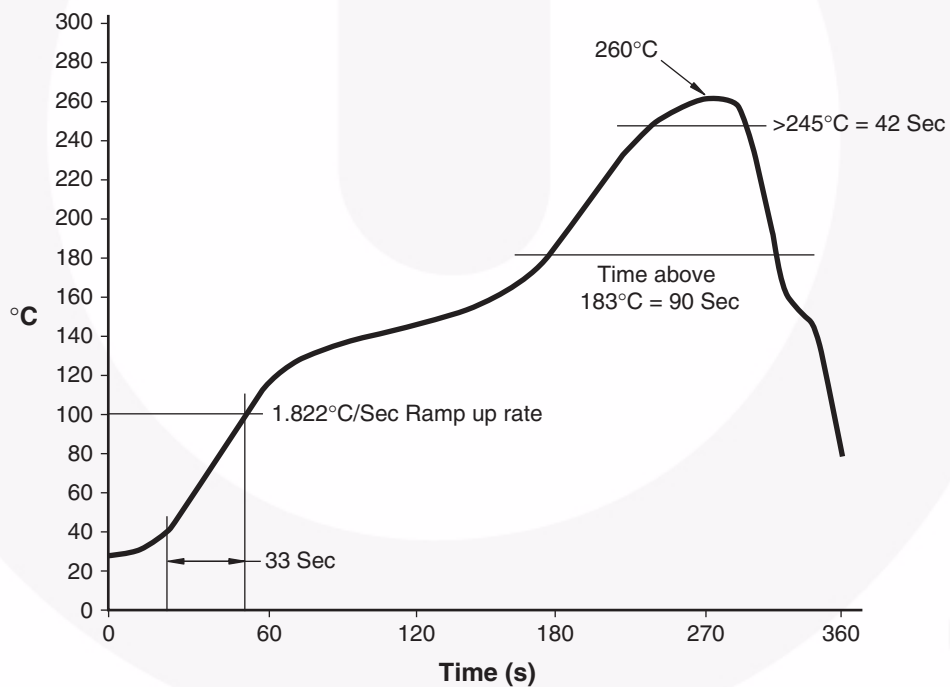
### Tape Dimensions



**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.
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