

## 4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M, H11A1M, H11A2M, H11A3M, H11A4M, H11A5M General Purpose 6-Pin Phototransistor Optocouplers

### Features

- UL recognized (File # E90700, Volume 2)
- VDE recognized (File # 102497)
  - Add option V (e.g., 4N25VM)

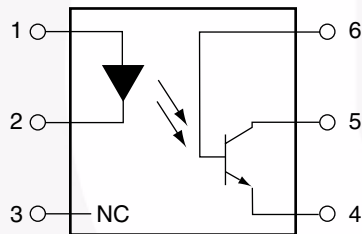
### Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

### Description

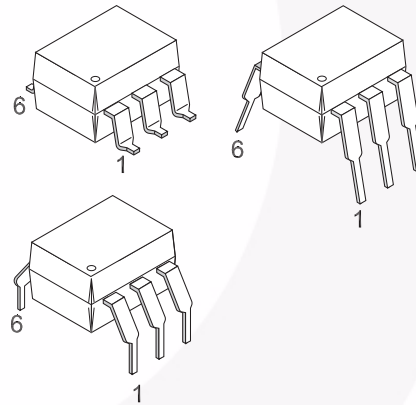
The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

### Schematic



- PIN 1. ANODE  
2. CATHODE  
3. NO CONNECTION  
4. EMITTER  
5. COLLECTOR  
6. BASE

### Package Outlines



**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	Parameter	Value	Units
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	-40 to +100	$^\circ\text{C}$
$T_{SOL}$	Wave solder temperature (see page 8 for reflow solder profile)	260 for 10 sec	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	250	mW
		2.94	
<b>EMITTER</b>			
$I_F$	DC/Average Forward Input Current	60	mA
$V_R$	Reverse Input Voltage	6	V
$I_{F(pk)}$	Forward Current – Peak (300 $\mu\text{s}$ , 2% Duty Cycle)	3	A
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	120	mW
		1.41	mW/ $^\circ\text{C}$
<b>DETECTOR</b>			
$V_{CEO}$	Collector-Emitter Voltage	30	V
$V_{CBO}$	Collector-Base Voltage	70	V
$V_{ECO}$	Emitter-Collector Voltage	7	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	150	mW
		1.76	mW/ $^\circ\text{C}$

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)**Individual Component Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 10\text{mA}$		1.18	1.50	V
$I_R$	Reverse Leakage Current	$V_R = 6.0\text{V}$		0.001	10	$\mu\text{A}$
<b>DETECTOR</b>						
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1.0\text{mA}$ , $I_F = 0$	30	100		V
$BV_{CBO}$	Collector-Base Breakdown Voltage	$I_C = 100\mu\text{A}$ , $I_F = 0$	70	120		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\mu\text{A}$ , $I_F = 0$	7	10		V
$I_{CEO}$	Collector-Emitter Dark Current	$V_{CE} = 10\text{V}$ , $I_F = 0$		1	50	nA
$I_{CBO}$	Collector-Base Dark Current	$V_{CB} = 10\text{V}$			20	nA
$C_{CE}$	Capacitance	$V_{CE} = 0\text{V}$ , $f = 1\text{MHz}$		8		pF

**Isolation Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
$V_{ISO}$	Input-Output Isolation Voltage	$f = 60\text{Hz}$ , $t = 1\text{sec}$	7500			Vac(pk)
$R_{ISO}$	Isolation Resistance	$V_{I-O} = 500\text{VDC}$	$10^{11}$			$\Omega$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = \&$ , $f = 1\text{MHz}$		0.2	2	pF

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

**Electrical Characteristics** (Continued) ( $T_A = 25^\circ\text{C}$  unless otherwise specified)**Transfer Characteristics**

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
<b>DC CHARACTERISTICS</b>							
CTR	Current Transfer Ratio, Collector to Emitter	$I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$	4N35M, 4N36M, 4N37M	100			%
			H11A1M	50			
			H11A5M	30			
			4N25M, 4N26M H11A2M, H11A3M	20			
			4N27M, 4N28M H11A4M	10			
		$I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$ , $T_A = -55^\circ\text{C}$	4N35M, 4N36M, 4N37M	40			
		$I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$ , $T_A = +100^\circ\text{C}$	4N35M, 4N36M, 4N37M	40			
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$I_C = 2\text{mA}$ , $I_F = 50\text{mA}$	4N25M, 4N26M, 4N27M, 4N28M,			0.5	V
		$I_C = 0.5\text{mA}$ , $I_F = 10\text{mA}$	4N35M, 4N36M, 4N37M			0.3	
			H11A1M, H11A2M, H11A3M, H11A4M, H11A5M			0.4	
<b>AC CHARACTERISTICS</b>							
$T_{ON}$	Non-Saturated Turn-on Time	$I_F = 10\text{mA}$ , $V_{CC} = 10\text{V}$ , $R_L = 100\Omega$ (Fig. 11)	4N25M, 4N26M, 4N27M, 4N28M, H11A1M, H11A2M, H11A3M, H11A4, H11A5M		2		$\mu\text{s}$
		$I_C = 2\text{mA}$ , $V_{CC} = 10\text{V}$ , $R_L = 100\Omega$ (Fig. 11)	4N35M, 4N36M, 4N37M		2	10	$\mu\text{s}$
$T_{OFF}$	Turn-off Time	$I_F = 10\text{mA}$ , $V_{CC} = 10\text{V}$ , $R_L = 100\Omega$ (Fig. 11)	4N25M, 4N26M, 4N27M, 4N28M, H11A1M, H11A2M, H11A3M, H11A4M, H11A5M		2		$\mu\text{s}$
		$I_C = 2\text{mA}$ , $V_{CC} = 10\text{V}$ , $R_L = 100\Omega$ (Fig. 11)	4N35M, 4N36M, 4N37M		2	10	

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

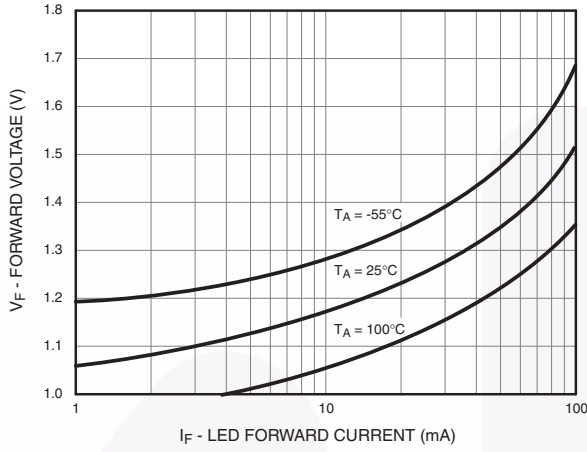
## Safety and Insulation Ratings

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.

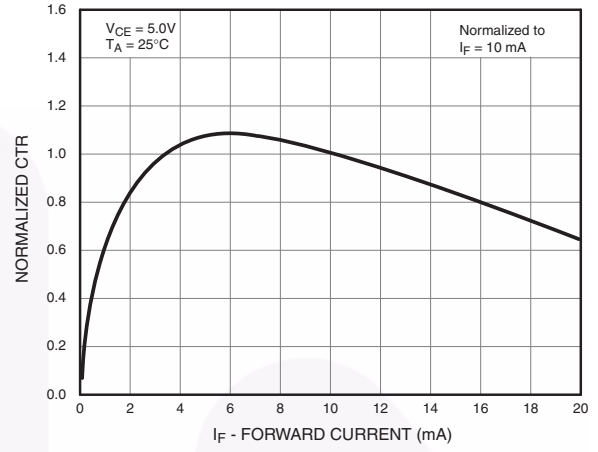
Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For Rated Main Voltage < 150Vrms		I-IV		
	For Rated Main voltage < 300Vrms		I-IV		
	Climatic Classification		55/100/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
$V_{PR}$	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

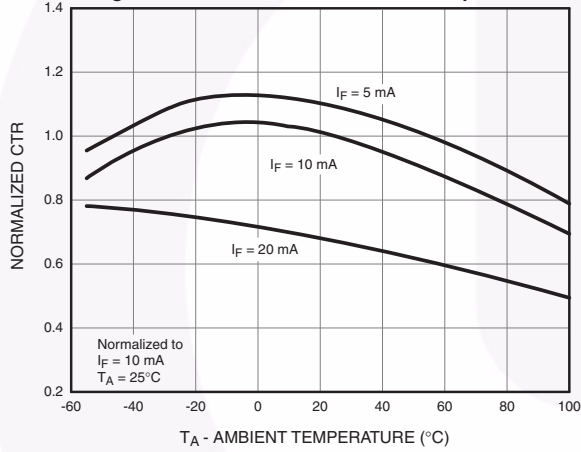
**Fig. 1 LED Forward Voltage vs. Forward Current**



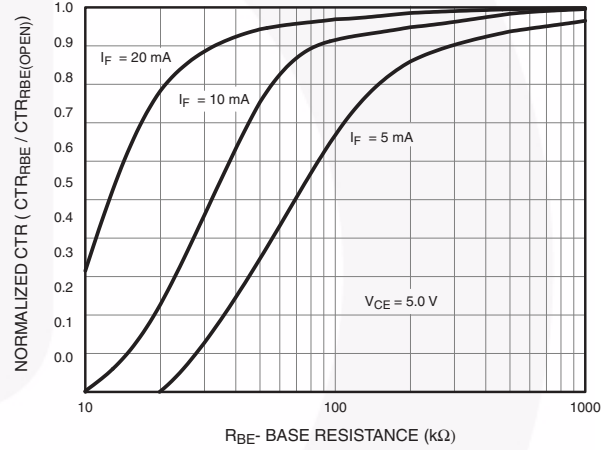
**Fig. 2 Normalized CTR vs. Forward Current**



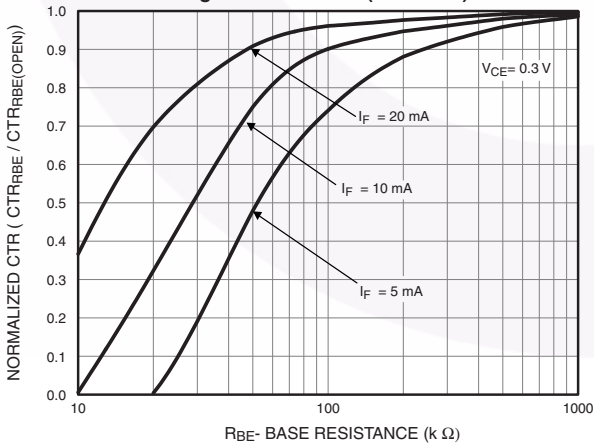
**Fig. 3 Normalized CTR vs. Ambient Temperature**



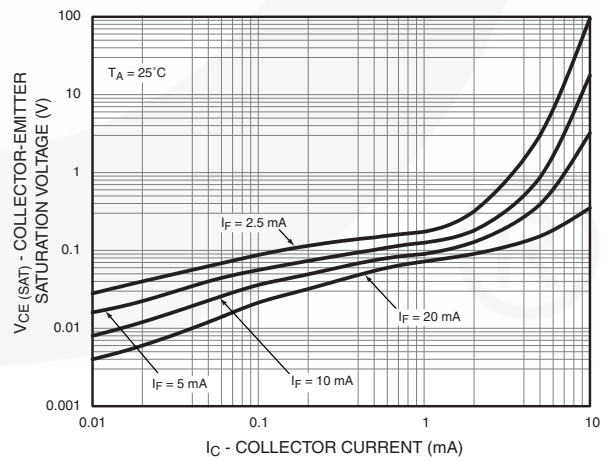
**Fig. 4 CTR vs. RBE (Unsaturated)**



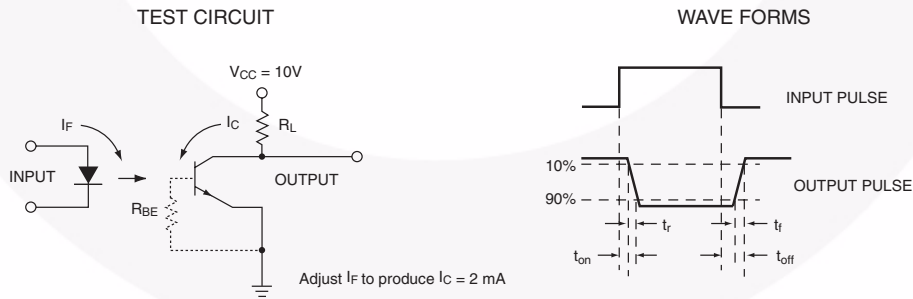
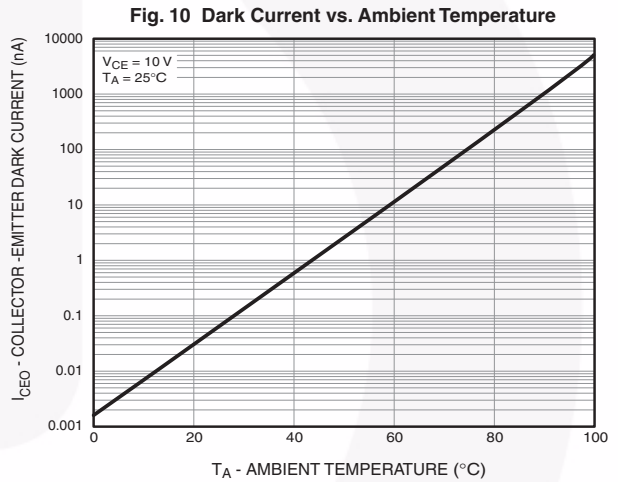
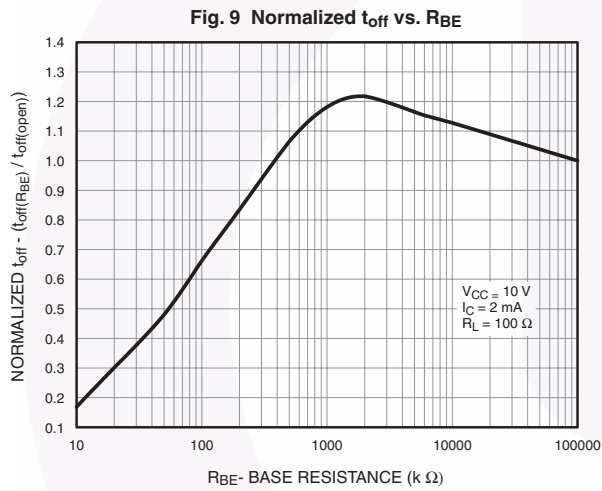
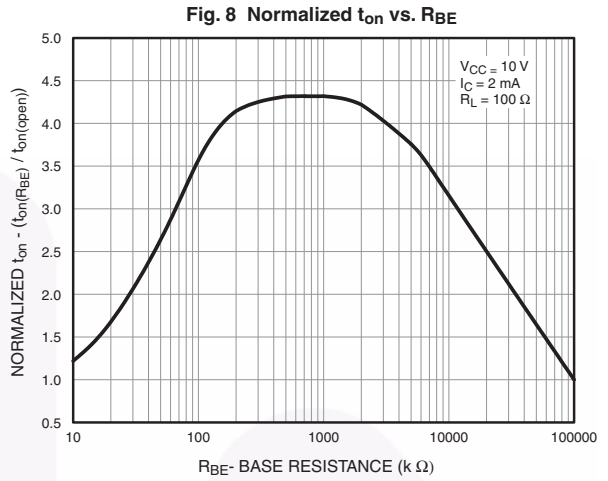
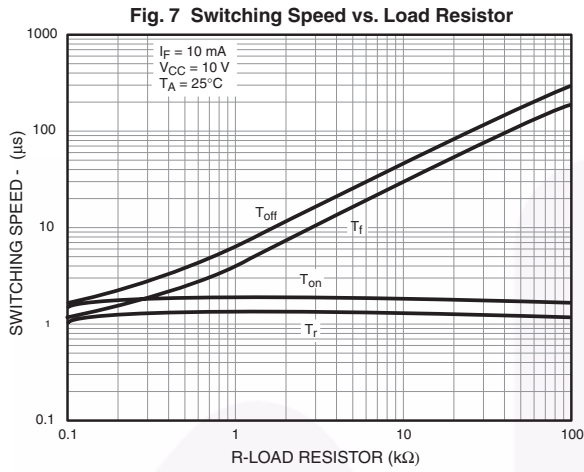
**Fig. 5 CTR vs. RBE (Saturated)**



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



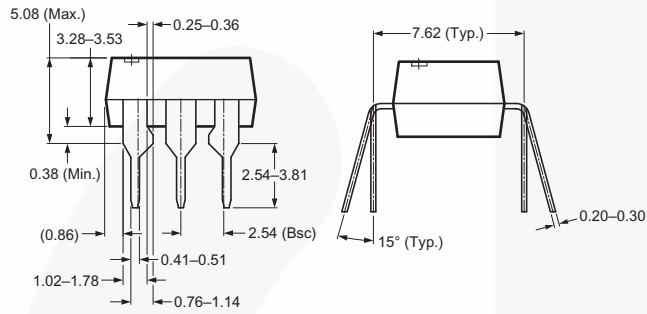
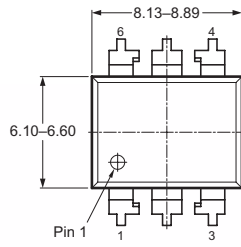
## Typical Performance Curves (Continued)



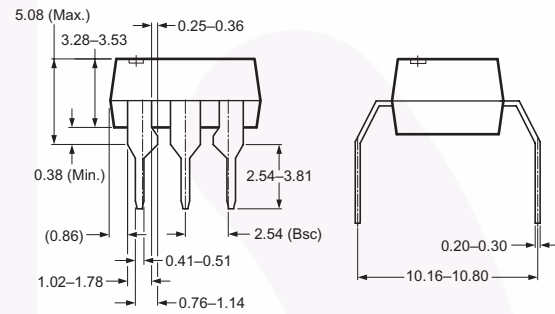
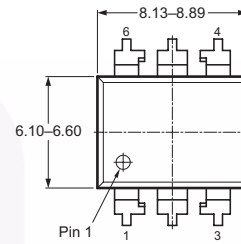
**Figure 11. Switching Time Test Circuit and Waveforms**

## Package Dimensions

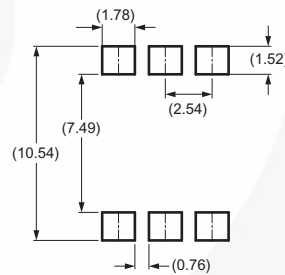
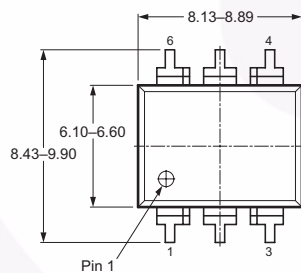
### Through Hole



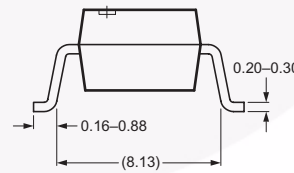
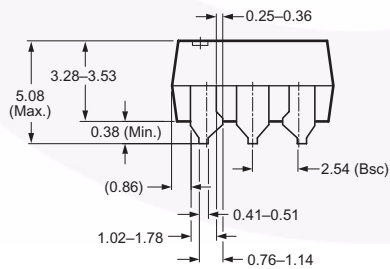
### 0.4" Lead Spacing



### Surface Mount



Recommended Pad Layout

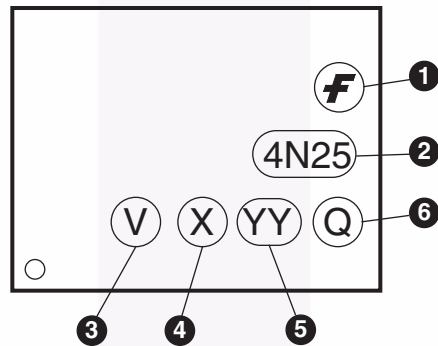


**Note:**  
All dimensions in mm.

## Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	4N25M	Standard Through Hole Device
S	4N25SM	Surface Mount Lead Bend
SR2	4N25SR2M	Surface Mount; Tape and Reel
T	4N25TM	0.4" Lead Spacing
V	4N25VM	VDE 0884
TV	4N25TVM	VDE 0884, 0.4" Lead Spacing
SV	4N25SVM	VDE 0884, Surface Mount
SR2V	4N25SR2VM	VDE 0884, Surface Mount, Tape and Reel

## Marking Information

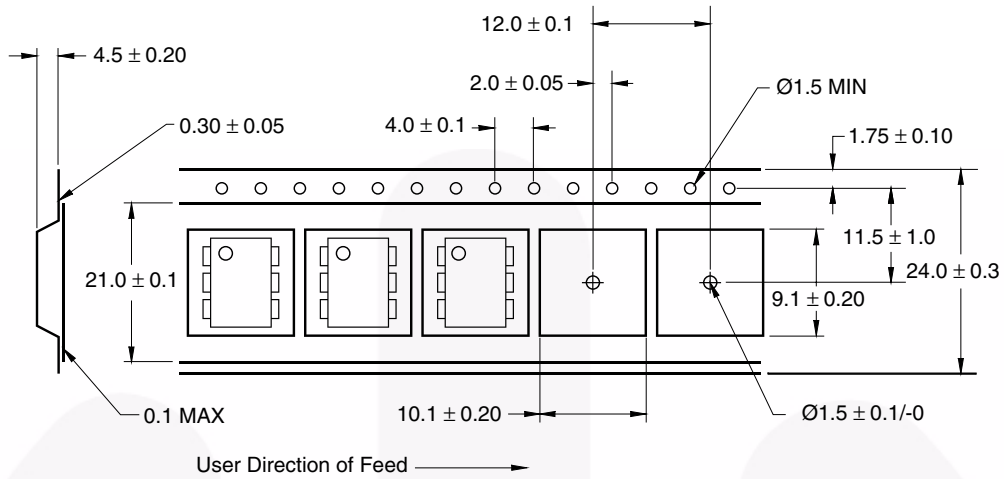


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

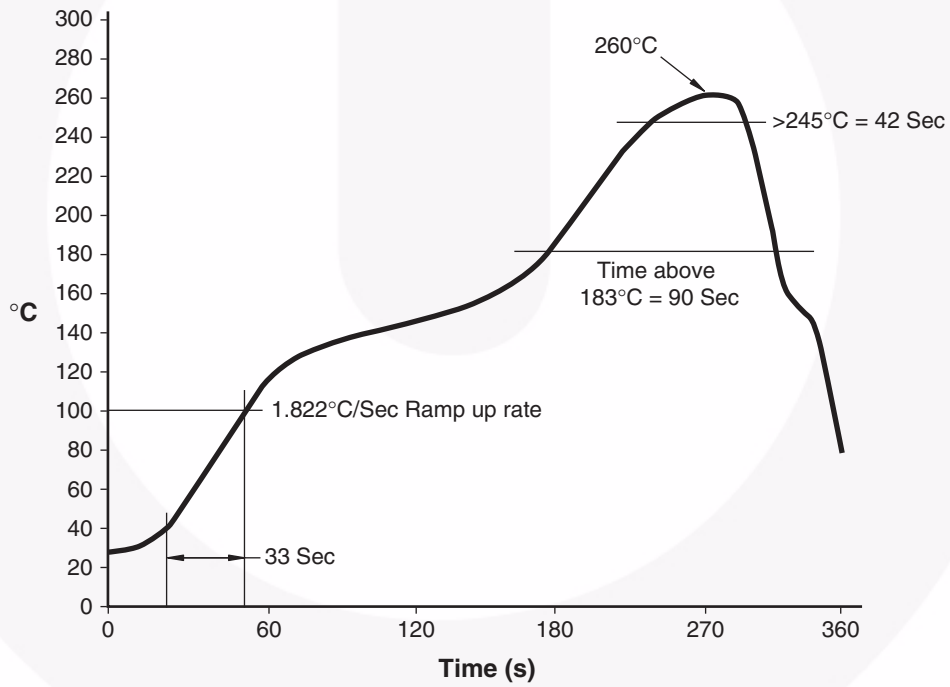
\*Note – Parts that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in portrait format.



### Carrier Tape Specification







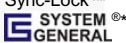
### Reflow Profile





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**PRODUCT STATUS DEFINITIONS**

**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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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