

# H11AA1-M, H11AA2-M, H11AA3-M, H11AA4-M AC Input/Phototransistor Optocouplers

## Features

- Bi-polar emitter input
- Built-in reverse polarity input protection
- Underwriters Laboratory (UL) recognized File #E90700, Volume 2
- VDE approved File #102497 (ordering option 'V')

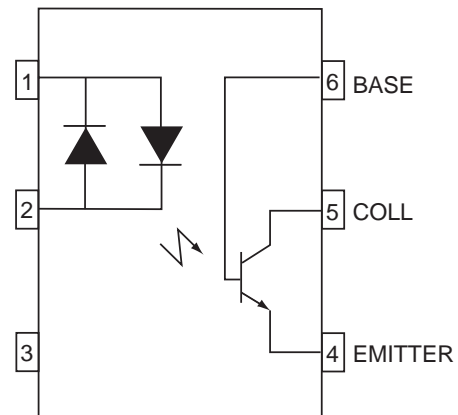
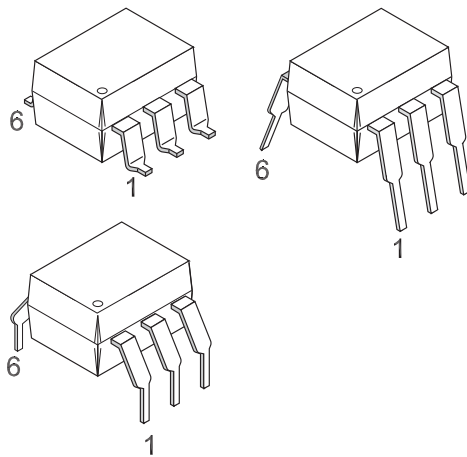
## Applications

- AC line monitor
- Unknown polarity DC sensor
- Telephone line interface

## Description

The H11AAX-M series consists of two gallium-arsenide infrared emitting diodes connected in inverse parallel driving a single silicon phototransistor output.

## Package and Schematic



**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified)

Symbol	Parameter	Device	Value	Units
<b>TOTAL DEVICE</b>				
$T_{STG}$	Storage Temperature	All	-40 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	All	-40 to +100	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature	All	260 for 10 sec	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation Derate Linearly From $25^\circ\text{C}$	All	250	mW
			2.94	mW/ $^\circ\text{C}$
<b>EMITTER</b>				
$I_F$	Continuous Forward Current	All	60	mA
$I_F(\text{pk})$	Forward Current – Peak (1 $\mu\text{s}$ pulse, 300 pps)	All	$\pm 1.0$	A
$P_D$	LED Power Dissipation Derate Linearly From $25^\circ\text{C}$	All	120	mW
			1.41	mW/ $^\circ\text{C}$
<b>DETECTOR</b>				
$I_C$	Continuous Collector Current	All	50	mA
$P_D$	Detector Power Dissipation Derate linearity from $25^\circ\text{C}$	All	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	Device	Min.	Typ.*	Max.	Unit
<b>EMITTER</b>							
$V_F$	Input Forward Voltage	$I_F = \pm 10\text{mA}$	All		1.17	1.5	V
$C_J$	Capacitance	$V_F = 0\text{V}$ , $f = 1.0\text{MHz}$	All		80		pF
<b>DETECTOR</b>							
$BV_{CEO}$	Breakdown Voltage Collector to Emitter	$I_C = 1.0\text{mA}$ , $I_F = 0$	All	30	100		V
$BV_{CBO}$	Collector to Base	$I_C = 100\mu\text{A}$ , $I_F = 0$	All	70	120		V
$BV_{EBO}$	Emitter to Base	$I_E = 100\mu\text{A}$ , $I_F = 0$	All	5	10		V
$BV_{ECO}$	Emitter to Collector	$I_E = 100\mu\text{A}$ , $I_F = 0$	All	7	10		V
$I_{CEO}$	Leakage Current Collector to Emitter	$V_{CE} = 10\text{V}$ , $I_F = 0$	H11AA1,3,4(-M)		1	50	nA
			H11AA2-M		1	200	
$C_{CE}$	Capacitance Collector to Emitter	$V_{CE} = 0$ , $f = 1\text{MHz}$	All		10		pF
$C_{CB}$	Collector to Base	$V_{CB} = 0$ , $f = 1\text{MHz}$	All		80		pF
$C_{EB}$	Emitter to Base	$V_{EB} = 0$ , $f = 1\text{MHz}$	All		15		pF

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

**Transfer Characteristics** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
CTR <sub>CE</sub>	Current Transfer Ratio, Collector to Emitter	$I_F = \pm 10\text{mA}$ , $V_{CE} = 10\text{V}$	H11AA4-M	100			%
			H11AA3-M	50			
			H11AA1-M	20			
			H11AA2-M	10			
	Current Transfer Ratio, Symmetry	$I_F = \pm 10\text{mA}$ , $V_{CE} = 10\text{V}$ (Figure 11)	All	.33		3.0	
V <sub>CE(SAT)</sub>	Saturation Voltage, Collector to Emitter	$I_F = \pm 10\text{mA}$ , $I_{CE} = 0.5\text{mA}$	All			.40	V

**Isolation Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
C <sub>I-O</sub>	Package Capacitance Input/Output	$V_{I-O} = 0$ , $f = 1\text{MHz}$		0.7		pF
V <sub>ISO</sub>	Isolation Voltage	$f = 60\text{ Hz}$ , $t = 1\text{ sec.}$	7500			Vac(pk)
R <sub>ISO</sub>	Isolation Resistance	$V_{I-O} = 500\text{ VDC}$	$10^{11}$			$\Omega$

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

## Typical Performance Characteristics

Fig. 1 Input Voltage vs. Input Current

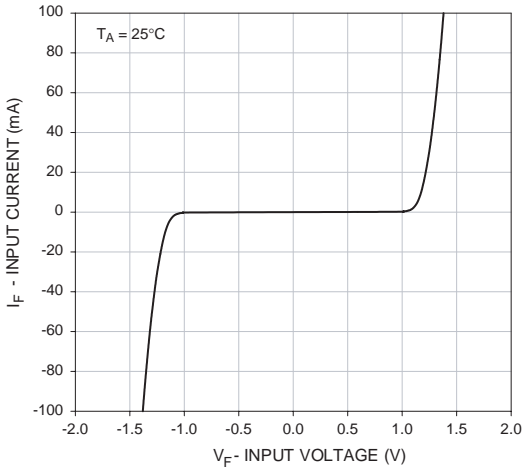


Fig. 2 Normalized CTR vs. Forward Current

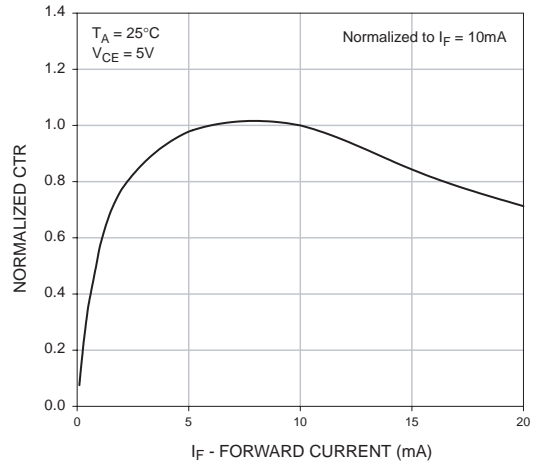


Fig. 3 Normalized CTR vs. Ambient Temperature

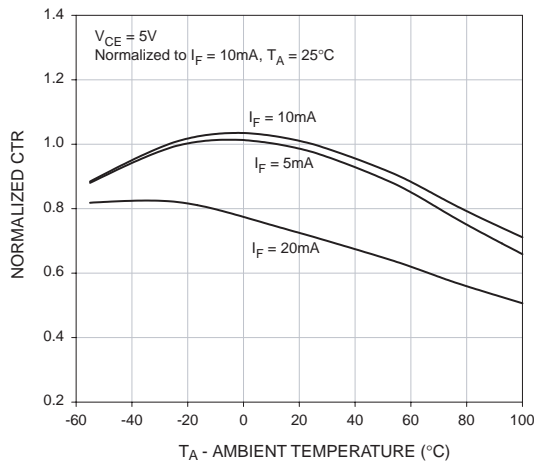


Fig. 4 CTR vs. RBE (Unsaturated)

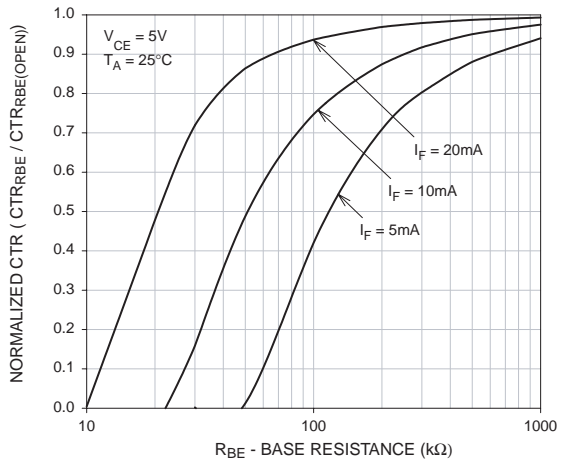


Fig. 5 CTR vs. RBE (Saturated)

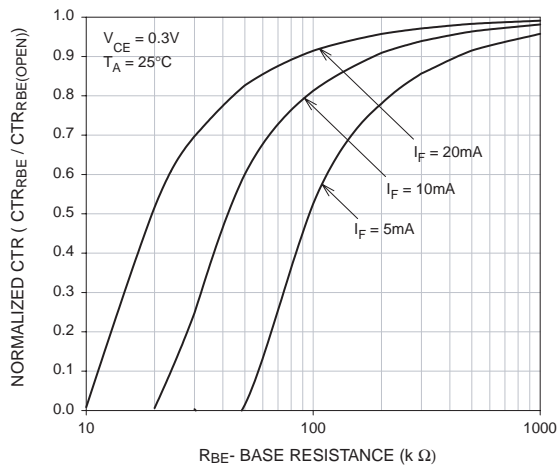
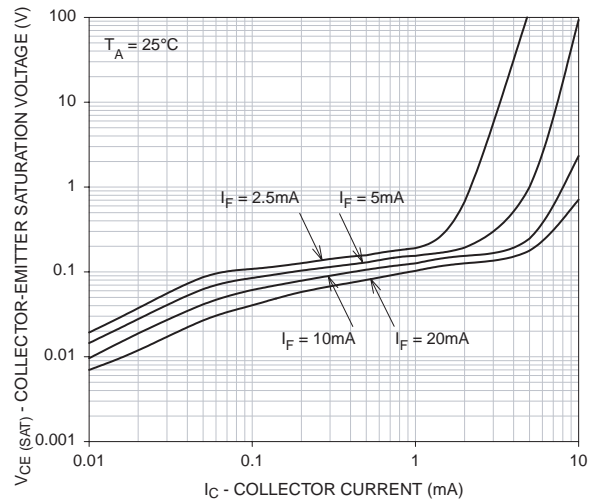


Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current



Typical Performance Characteristics (Continued)

Fig. 7 Switching Speed vs. Load Resistor

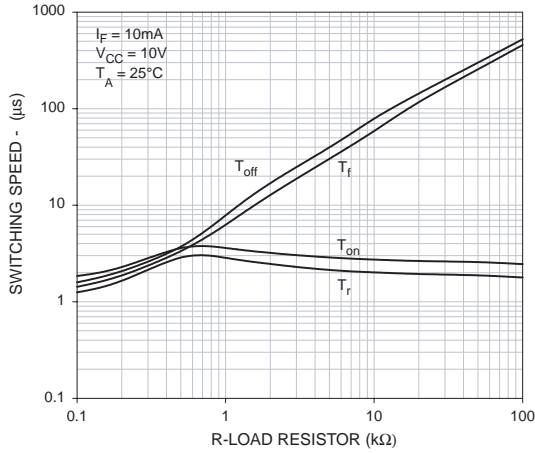


Fig. 8 Normalized  $t_{on}$  vs.  $R_{BE}$

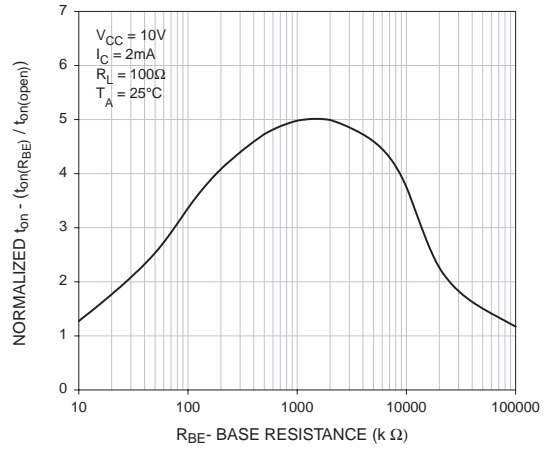


Fig. 9 Normalized  $t_{off}$  vs.  $R_{BE}$

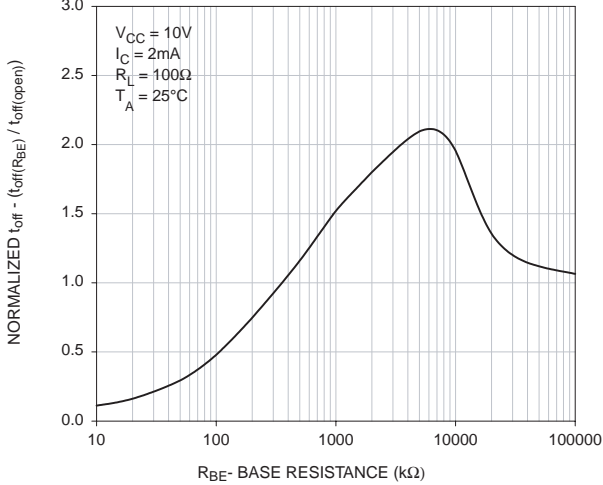


Fig. 10 Dark Current vs. Ambient Temperature

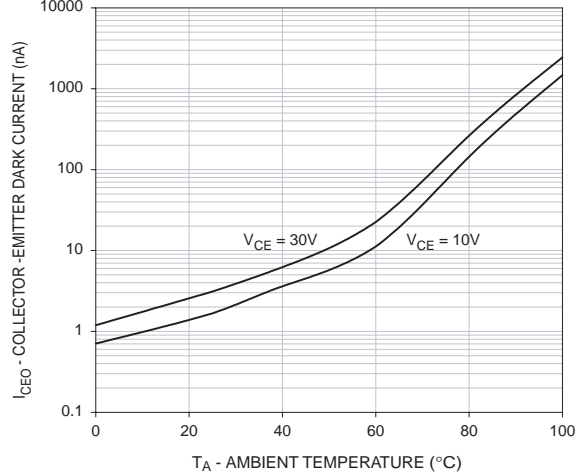
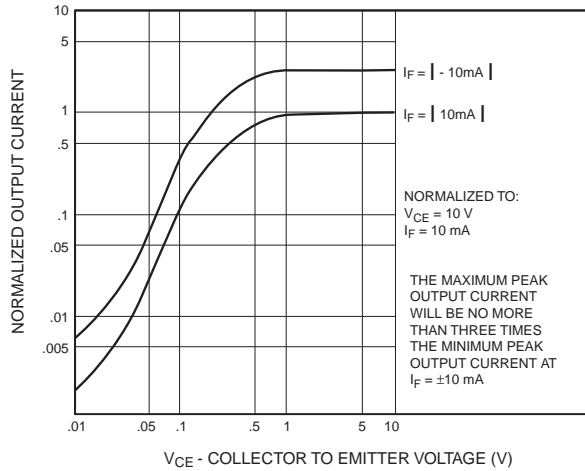
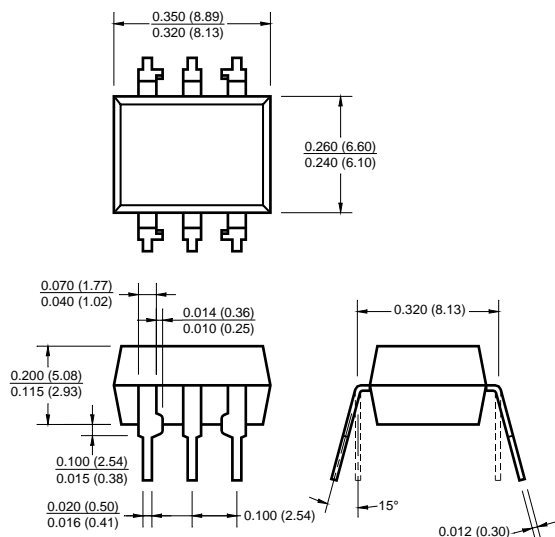


Fig. 11 Output Symmetry Characteristics

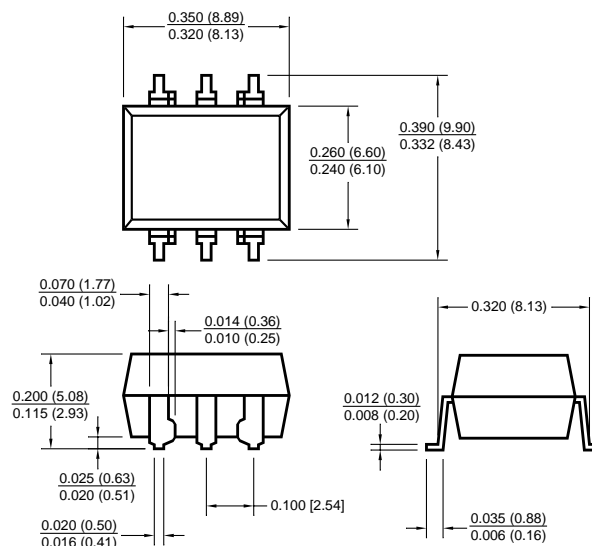


## Mechanical Dimensions

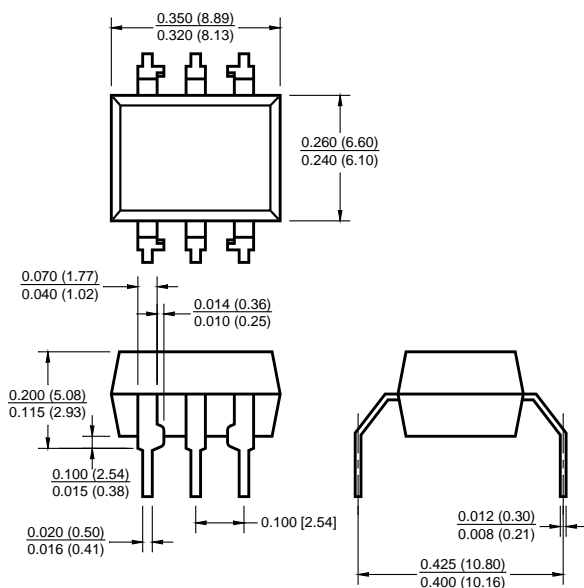
### Package Dimensions (Through Hole)



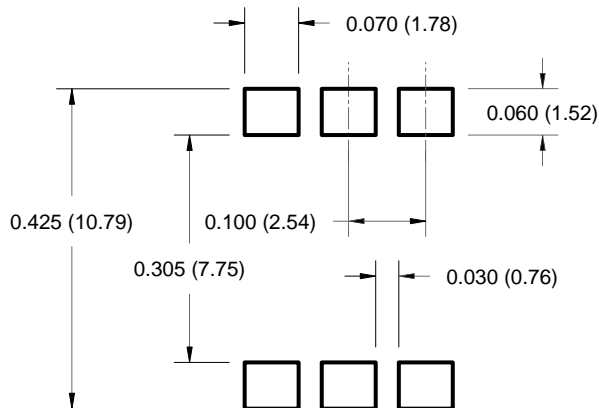
### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



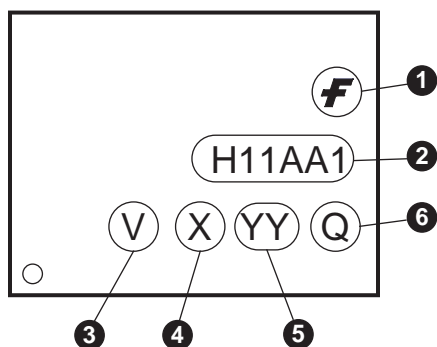
**Note:**

All dimensions are in inches (millimeters).

### Ordering Information

Option/Order Entry Identifier	Description
S	Surface Mount Lead Bend
SR2	Surface Mount; Tape and Reel
T	0.4" Lead Spacing
V	VDE 0884
TV	VDE 0884, 0.4" Lead Spacing
SV	VDE 0884, Surface Mount
SR2V	VDE 0884, Surface Mount, Tape & Reel

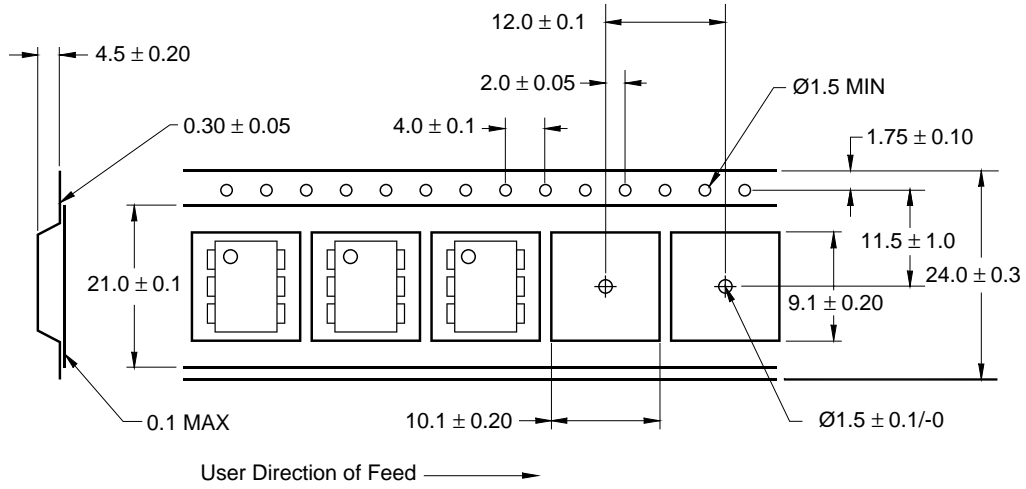
### Marking Information



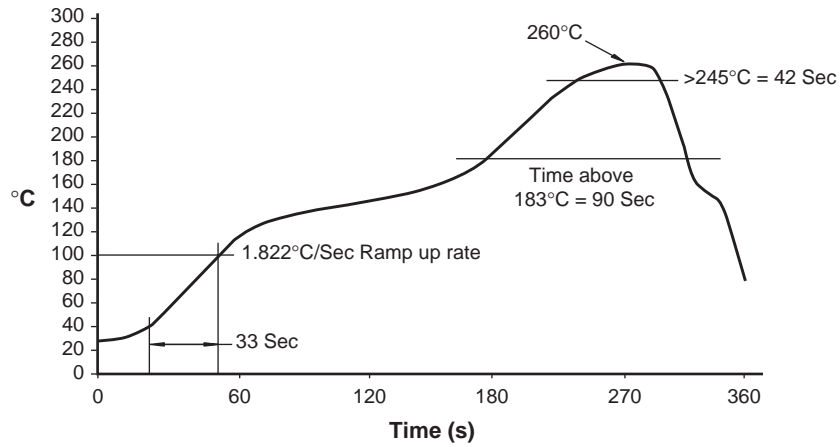
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

\*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.

### Carrier Tape Specifications



### Reflow Profile (White Package, -M Suffix)





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EnSigna <sup>TM</sup>	LittleFET <sup>TM</sup>	PowerTrench <sup>®</sup>	TCM <sup>TM</sup>	
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## 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, and 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.
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