FAIRCHILD SEMICONDUCTOR®

September 2009

H11AA1M, H11AA2M, H11AA3M, H11AA4M
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')

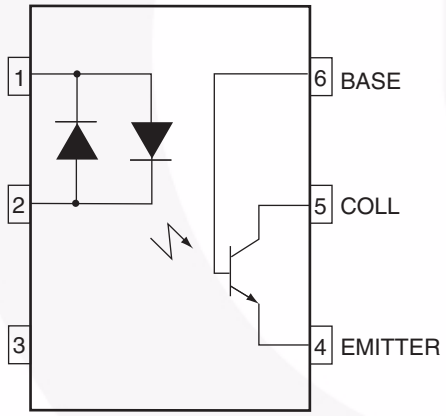
Applications

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

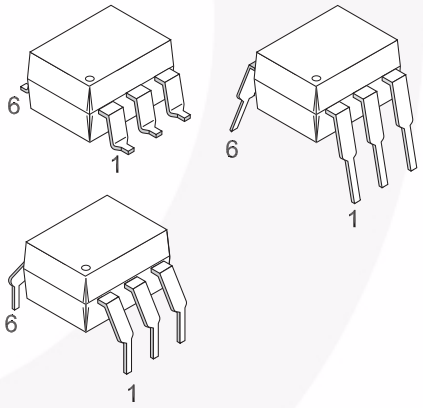
Description

The H11AAXM series consists of two gallium-arsenide infrared emitting diodes connected in inverse parallel driving a single silicon phototransistor output.

Schematic



Package Outlines



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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	Device	Value	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +100	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 sec	°C
P_D	Total Device Power Dissipation	All	250	mW
	Derate Linearly From 25°C		2.94	mW/°C
EMITTER				
I_F	Continuous Forward Current	All	60	mA
I_F(pk)	Forward Current – Peak (1µs pulse, 300 pps)	All	±1.0	A
P_D	LED Power Dissipation	All	120	mW
	Derate Linearly From 25°C		1.41	mW/°C
DETECTOR				
I_C	Continuous Collector Current	All	50	mA
P_D	Detector Power Dissipation	All	150	mW
	Derate linearity from 25°C		1.76	mW/°C

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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	All		1.17	1.5	V
C_J	Capacitance	V_F = 0 V, f = 1.0MHz	All		80		pF
DETECTOR							
BV_{CEO}	Breakdown Voltage Collector to Emitter	I_C = 1.0mA, I_F = 0	All	30	100		V
BV_{CBO}	Collector to Base	I_C = 100µA, I_F = 0	All	70	120		V
BV_{EBO}	Emitter to Base	I_E = 100µA, I_F = 0	All	5	10		V
BV_{ECO}	Emitter to Collector	I_E = 100µA, I_F = 0	All	7	10		V
I_{CEO}	Leakage Current Collector to Emitter	V_{CE} = 10 V, I_F = 0	H11AA1M H11AA3M H11AA4M		1	50	nA
			H11AA2M		1	200	
C_{CE}	Capacitance Collector to Emitter	V_{CE} = 0, f = 1MHz	All		10		pF
C_{CB}	Collector to Base	V_{CB} = 0, f = 1MHz	All		80		pF
C_{EB}	Emitter to Base	V_{EB} = 0, f = 1MHz	All		15		pF

*Typical values at T_A = 25°C

Transfer Characteristics

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
CTR_{CE}	Current Transfer Ratio, Collector to Emitter	I_F = ±10mA, V_{CE} = 10V	H11AA4M	100			%
			H11AA3M	50			
			H11AA1M	20			
			H11AA2M	10			
	Current Transfer Ratio, Symmetry	I_F = ±10mA, V_{CE} = 10V (Figure 11)	All	.33		3.0	
$V_{CE(SAT)}$	Saturation Voltage, Collector to Emitter	I_F = ±10mA, I_{CE} = 0.5mA	All			.40	V

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
C_{I-O}	Package Capacitance Input/Output	V_{I-O} = 0, f = 1MHz		0.7		pF
V_{ISO}	Isolation Voltage	f = 60Hz, t = 1 sec.	7500			Vac(pk)
R_{ISO}	Isolation Resistance	V_{I-O} = 500 VDC	10^{11}			Ω

*Typical values at T_A = 25°C

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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 Characteristics

Fig. 1 Input Voltage vs. Input Current

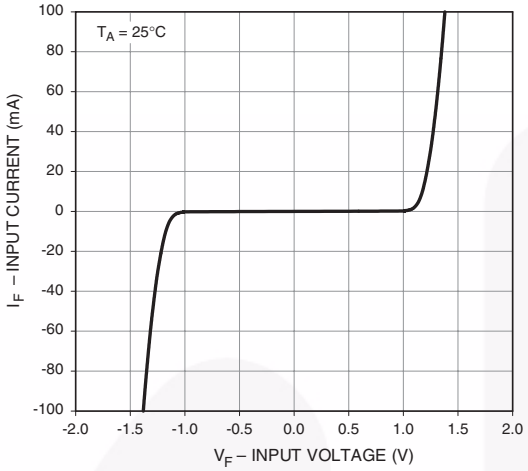


Fig. 2 Normalized CTR vs. Forward Current

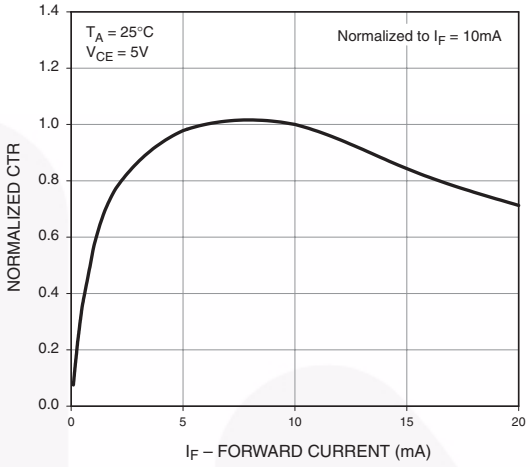


Fig. 3 Normalized CTR vs. Ambient Temperature

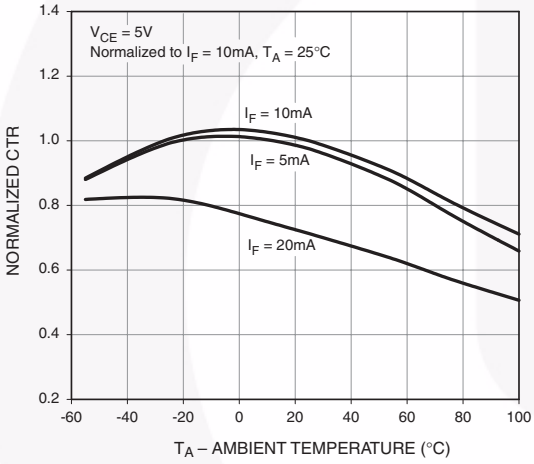


Fig. 4 CTR vs. RBE (Unsaturated)

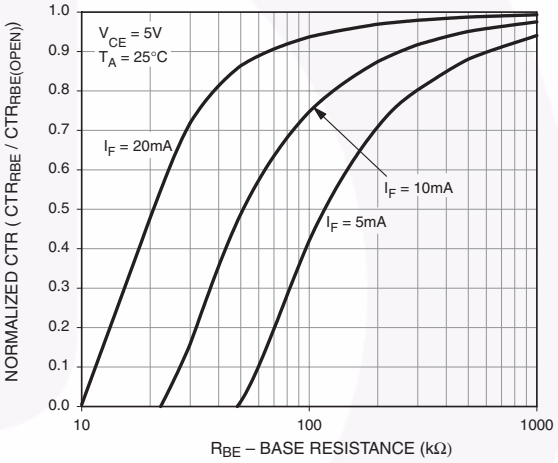


Fig. 5 CTR vs. RBE (Saturated)

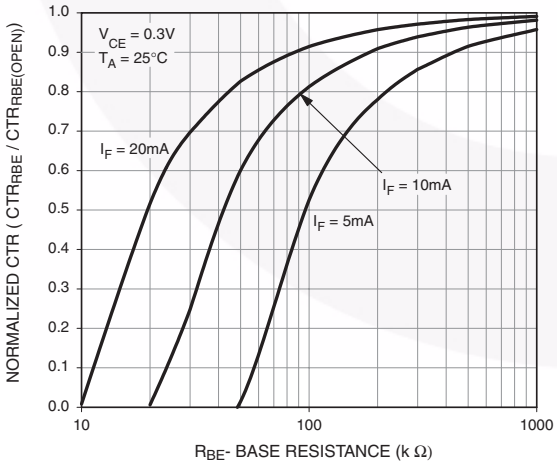
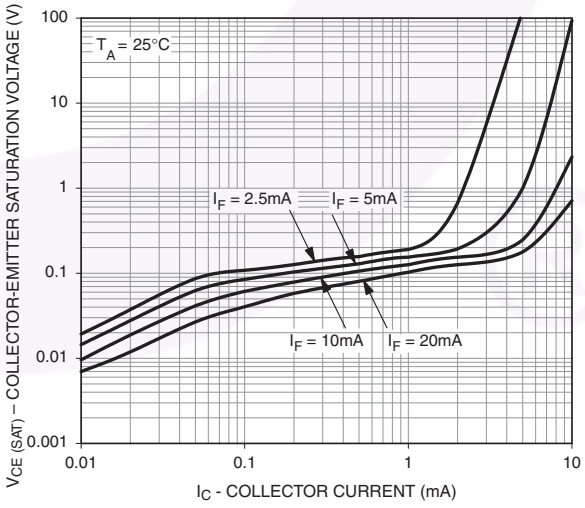


Fig. 6 Collector-Emitter Saturation Voltage vs Collector Current



Typical Performance Characteristics (Continued)

Fig. 7 Switching Speed vs. Load Resistor

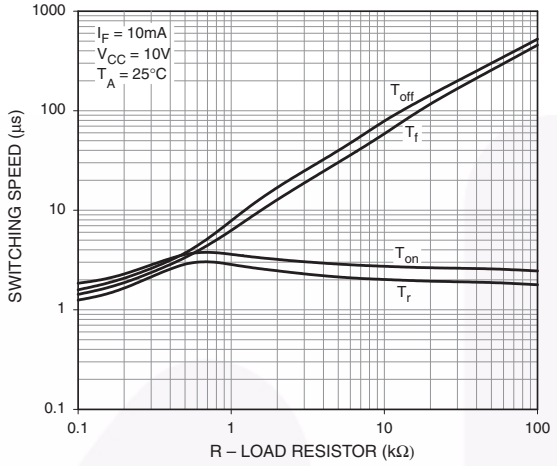


Fig. 8 Normalized t_{on} vs. R_{BE}

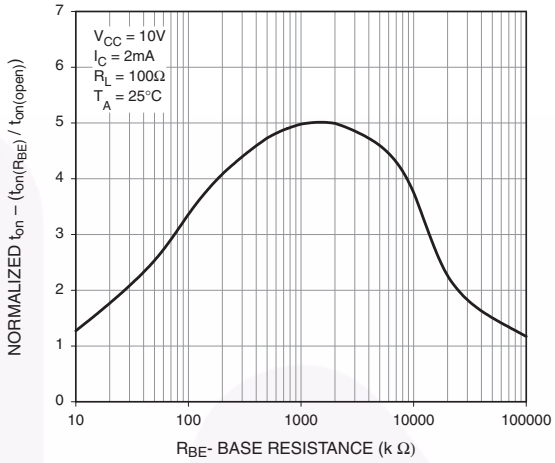


Fig. 9 Normalized t_{off} vs. R_{BE}

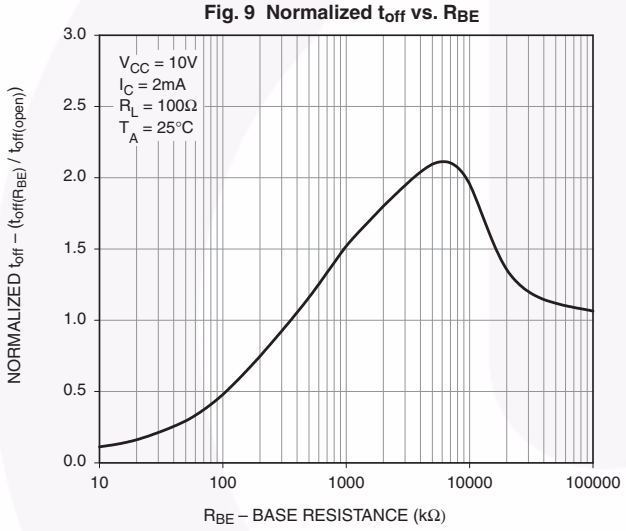


Fig. 10 Dark Current vs. Ambient Temperature

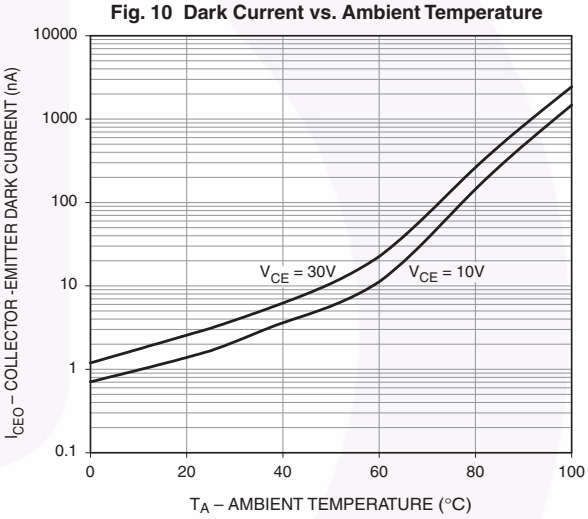
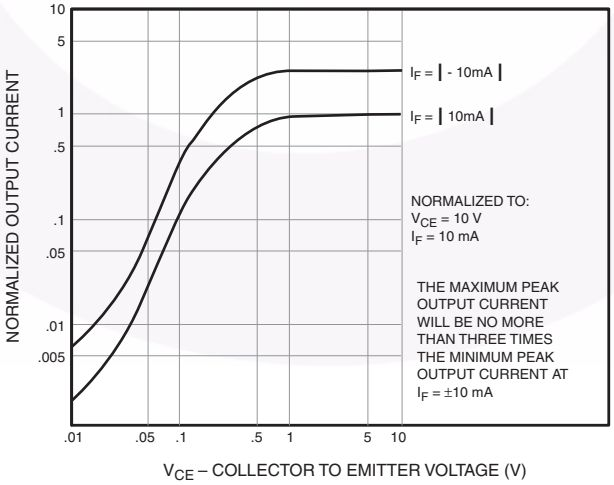
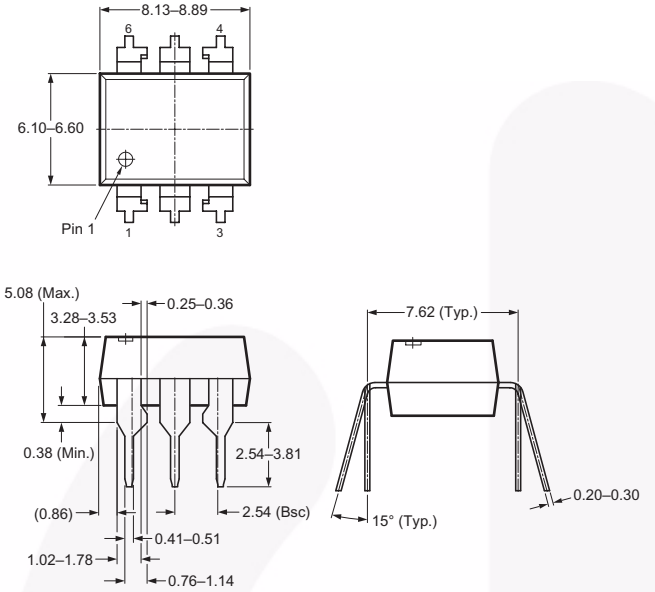


Fig. 11 Output Symmetry Characteristics

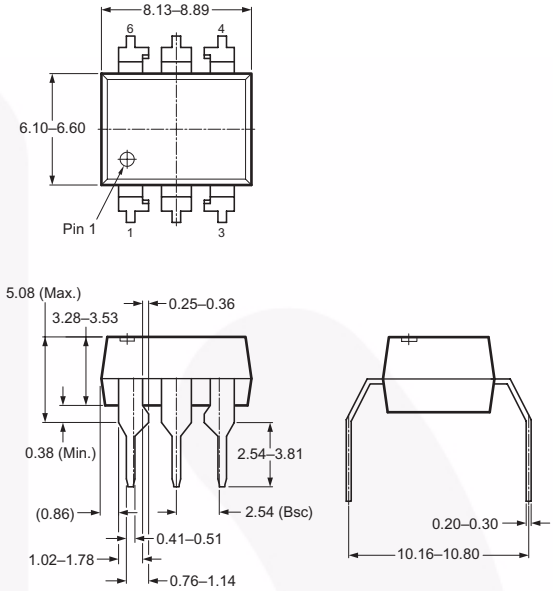


Package Dimensions

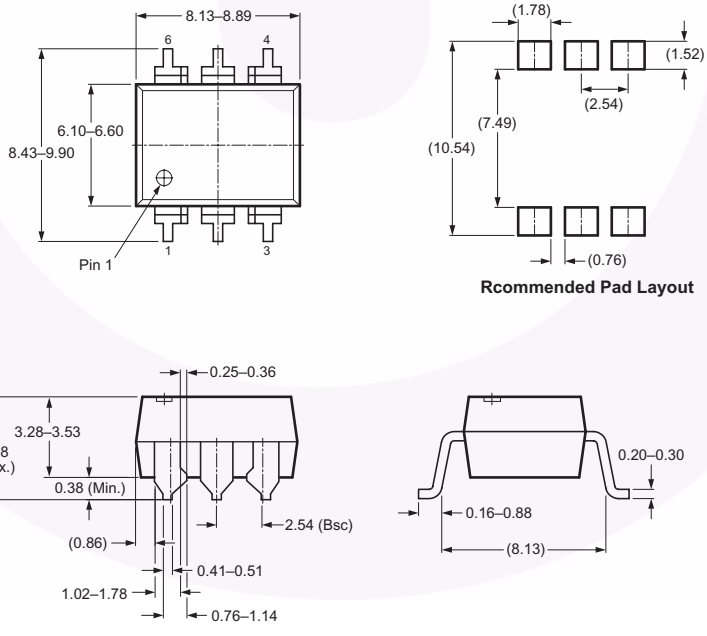
Through Hole



0.4" Lead Spacing



Surface Mount

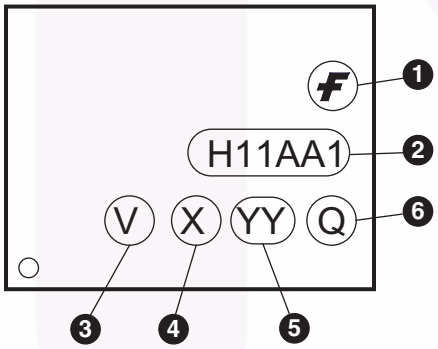


Note:
All dimensions in mm.

Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	H11AA1M	Standard Through Hole Device
S	H11AA1SM	Surface Mount Lead Bend
SR2	H11AA1SR2M	Surface Mount; Tape and Reel
T	H11AA1TM	0.4" Lead Spacing
V	H11AA1VM	VDE 0884
TV	H11AA1TVM	VDE 0884, 0.4" Lead Spacing
SV	H11AA1SVM	VDE 0884, Surface Mount
SR2V	H11AA1SR2VM	VDE 0884, Surface Mount, Tape and Reel

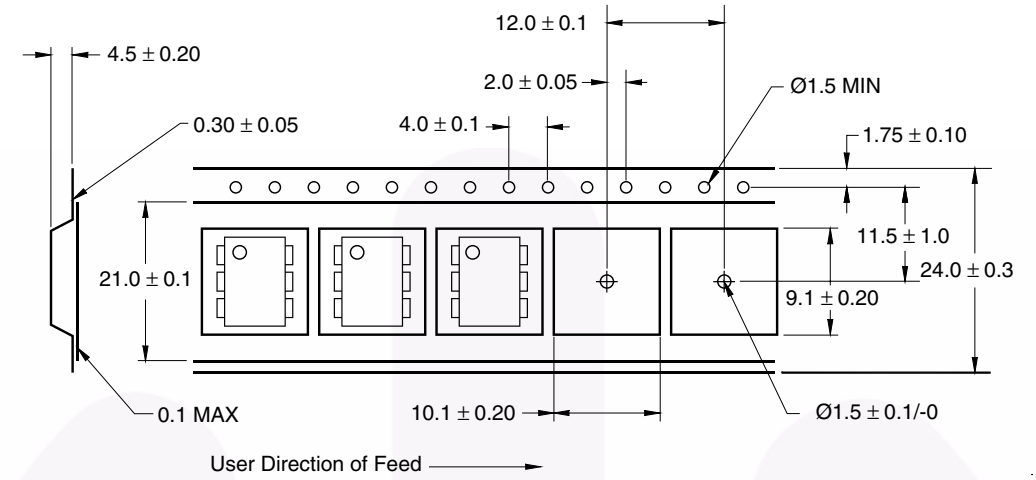
Marking Information



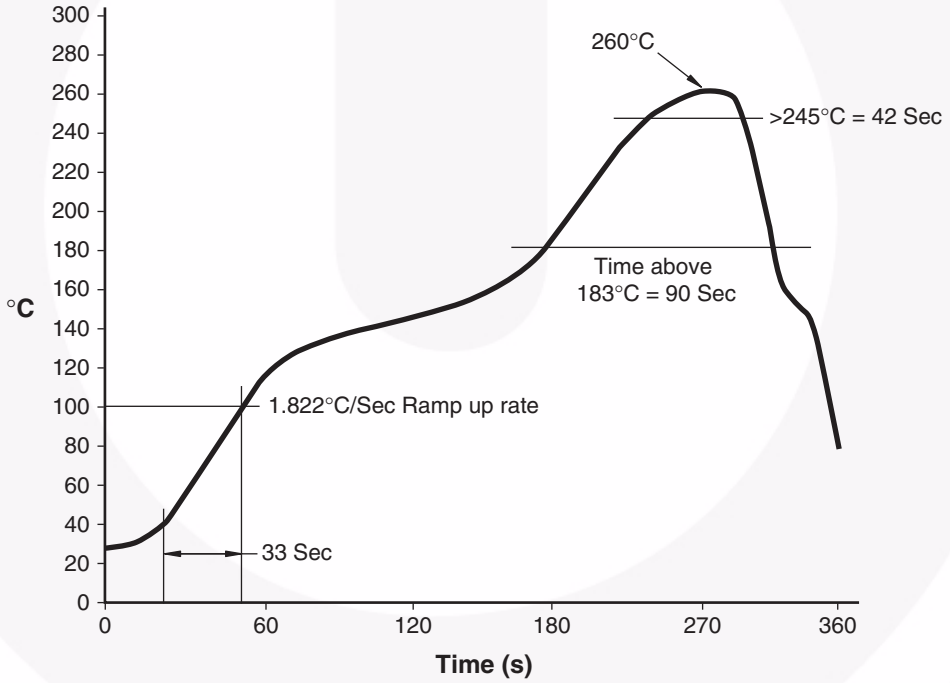
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., ‘3’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

*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.

Carrier Tape Specification



Reflow 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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