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FAIRCHILD SEMICONDUCTOR®

December 2009

HSR312, HSR312L, HSR412, HSR412L
Photovoltaic Solid-State Relay Optocouplers

Features

- 4,000 VRMS Isolation
- Wide operating voltage range
- 250V (HSR312, HSR312L)
- 400V (HSR412, HSR412L)
- Solid-State Reliability
- Bounce-Free Operation
- 4000V ESD Rating (HBM)
- UL and CSA approved

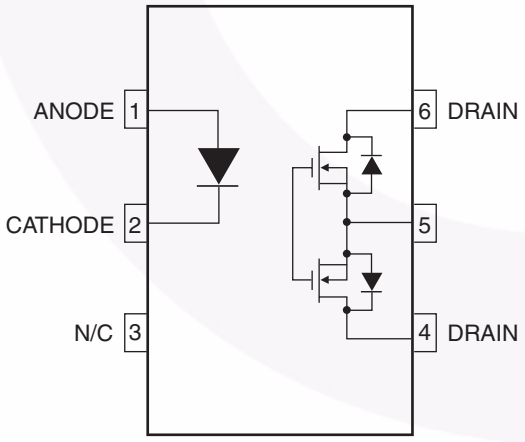
Description

The HSR312 and HSR412 devices consist of a AlGaAs infrared emitting diode optically coupled to a power MOSFET detector which is driven by a photovoltaic generator. The devices are housed in a 6-pin dual-in-line package. The HSR312L and HSR412L employ an active current limit circuitry enabling the device to withstand current surge transients.

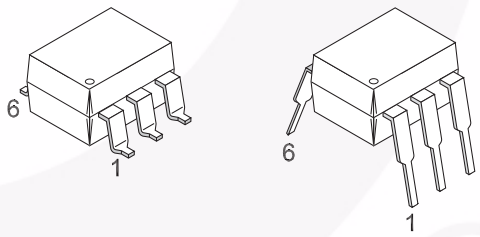
Applications

- On/Off Hook Switch
- Replacement for Mechanical Relays
- Dial Out Relay
- Ring Injection Relay
- General Switching
- Ground Start

Schematic



Package Outlines



Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

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	Device	Value	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +100	°C
T_{OPR}	Operating Temperature	All	-40 to +85	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 sec	°C
V_{ISO}	Isolation Surge Voltage	All	4000	Vac(RMS)
C_{IO}	Maximum Input/Output Capacitance	All	1.0	pF
R_{IO}	Maximum Input/Output Resistance	All	10^{12}	Ω

Electrical Characteristics (T_A = -40°C to +85°C unless otherwise specified)

Input Characteristics

Symbol	Parameters/ Test Conditions	Connection	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
$I_{F(ON)}$	Control Current	Series or Parallel	Max.	2.0	2.0	3.0	3.0	mA
$I_{F(OFF)}$	Control Current for Off-State Resistance (T_A = 25°C)	Series or Parallel	Min.	0.4	0.4	0.4	0.4	mA
I_F	Control Current Range	Series or Parallel	Min.	2.0	2.0	3.0	3.0	mA
			Max.	25	25	25	25	
V_R	Reverse Voltage	Series or Parallel	Min.	7	7	7	7	V
V_F	Forward Voltage (I_F = 10mA)	Series or Parallel	Max.	1.6	1.6	1.6	1.6	V

Output Characteristics

Symbol	Parameters/ Test Conditions	Connection	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
V_{OPR}	Operating Voltage Range	Series or Parallel	Max.	250	250	400	400	V_{DC} or $V_{AC(PEAK)}$
I_L	Load Current T_A = +40°C, 5mA control (see Fig. 1 & 2)	Series	Max.	190	170	140	120	mA
		Parallel	Max.	320	300	210	200	
R_{ON}	On-State Resistance T_A = 25°C, 50mA pulsed load, 5mA control	Series	Max.	10	15	27	35	Ω
		Parallel	Max.	3	4.25	7	9	
	Off-State Leakage Current T_A = 25°C, ±250V for HSR312/L, ±400V for HSR412/L	Series or Parallel	Max.	1.0	1.0	1.0	1.0	µA
I_{LMT}	Current Limit T_A = +25°C, 5mA control	Series	Min.	N/A	190	N/A	130	mA
			Max.	N/A	300	N/A	220	
		Parallel	Min.	N/A	330	N/A	260	
			Max.	N/A	560	N/A	440	
T_{ON}	Turn-On Time T_A = +25°C for 50mA, 100VDC load, 5mA control	Series or Parallel	Max.	3.0	3.0	2.0	2.0	mS
T_{OFF}	Turn-Off Time T_A = +25°C for 50mA, 100VDC load, 5mA control	Series or Parallel	Max.	0.5	0.5	0.5	0.5	mS
	Thermal Offset Voltage 5mA control	Series or Parallel	Max.	N/A	N/A	0.5	0.5	mV
C_O	Output Capacitance $50V_{DC}$	Series	Max.	50	50	12	12	pF

Isolation Characteristics

Symbol	Characteristics	Test Conditions	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
V_{ISO}	Input-Output Isolation Voltage	$I_{I-O} \leq 2$ µA	Max	4000	4000	4000	4000	V

Typical Performance Curves

Figure 1. Forward Current vs. Forward Voltage

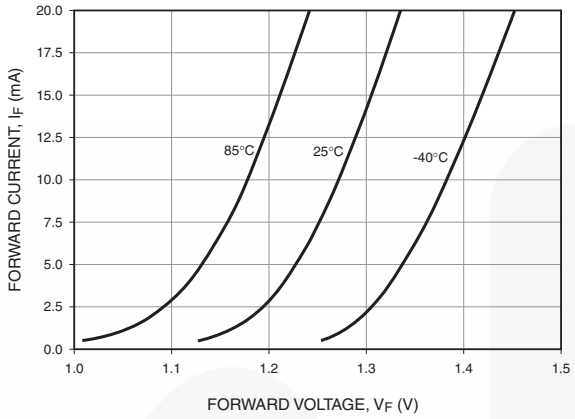


Figure 2. Normalized on Resistance vs. Ambient Temperature

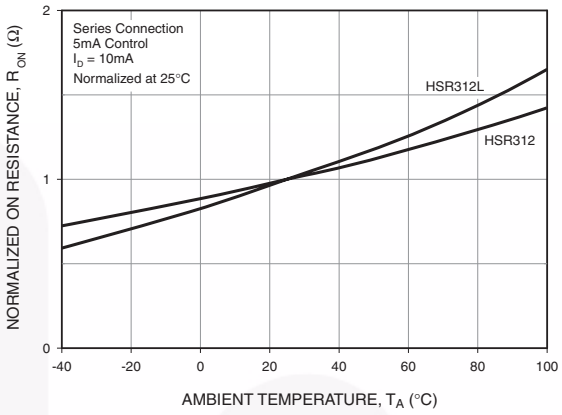


Figure 3. Normalized on Resistance vs. Ambient Temperature

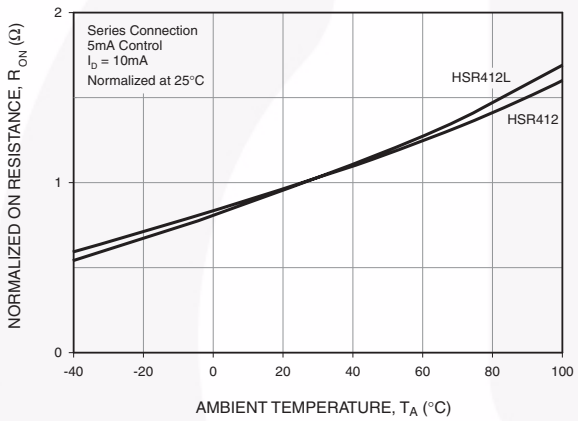


Figure 4. Load Current vs. Voltage Drop

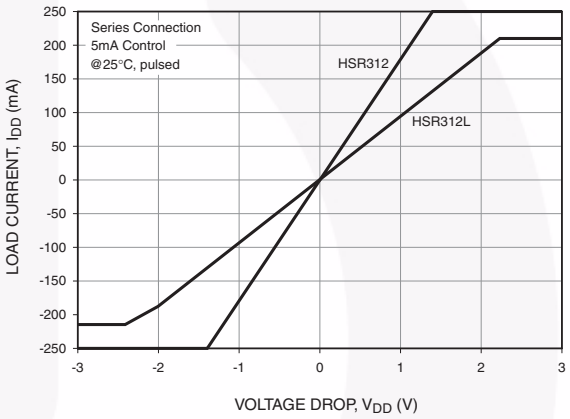


Figure 5. Load Current vs. Voltage Drop

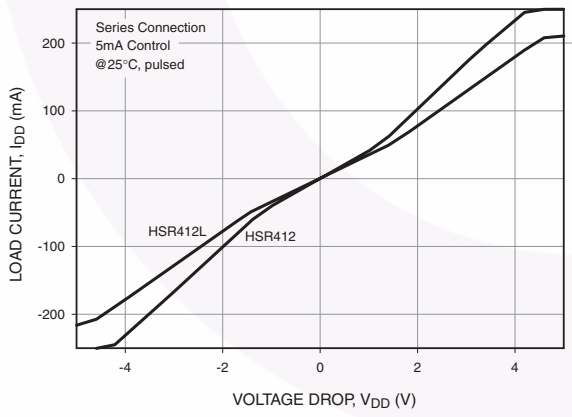
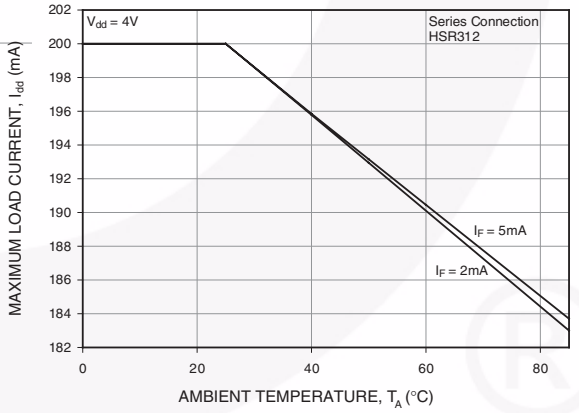


Figure 6. Maximum Load Current Vs Ambient Temperature



Typical Performance Curves (Continued)

Figure 7. Maximum Load Current Vs Ambient Temperature

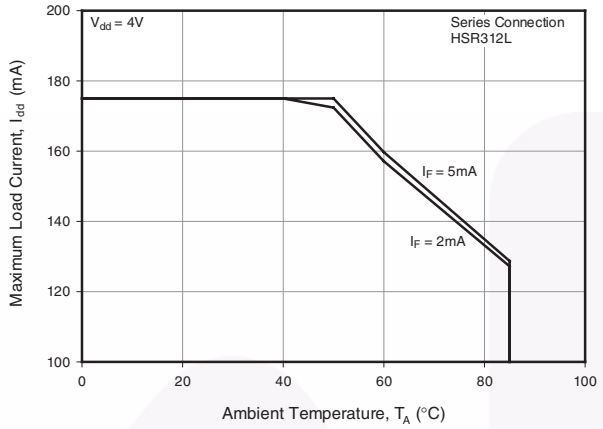


Figure 8. Maximum Load Current Vs Ambient Temperature

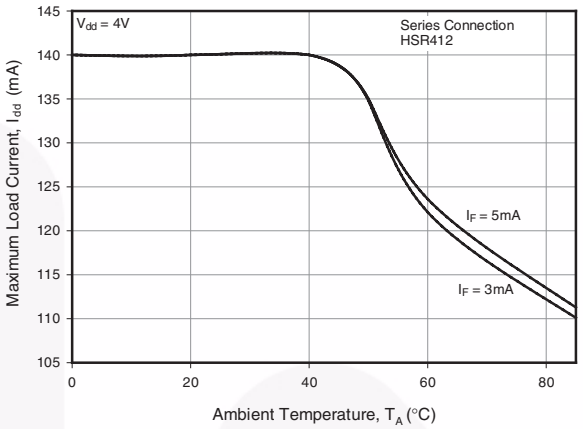


Figure 9. Maximum Load Current Vs Ambient Temperature

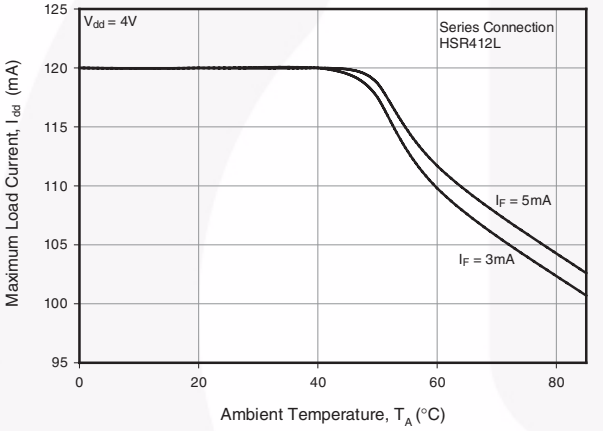


Figure 10. Off State Current vs. Ambient Temperature

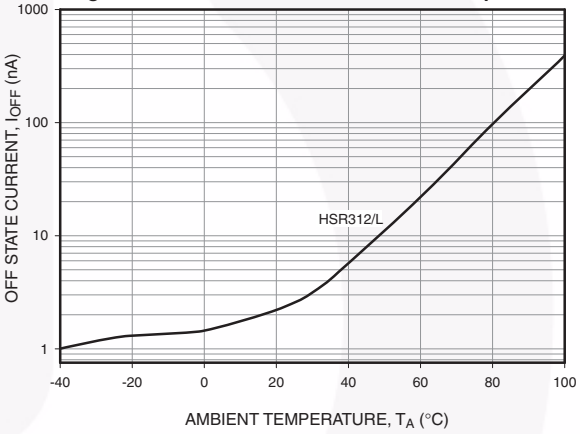


Figure 11. Off State Current vs. Ambient Temperature

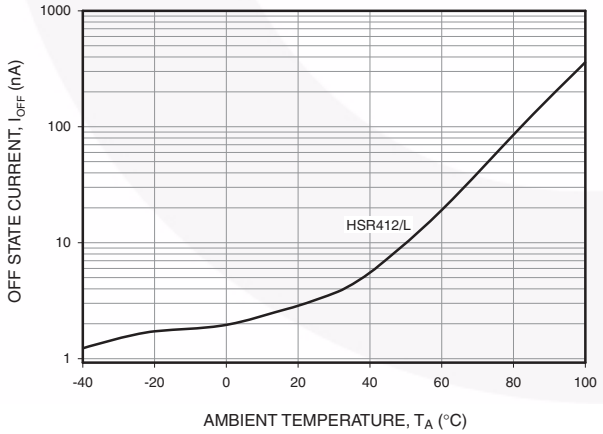
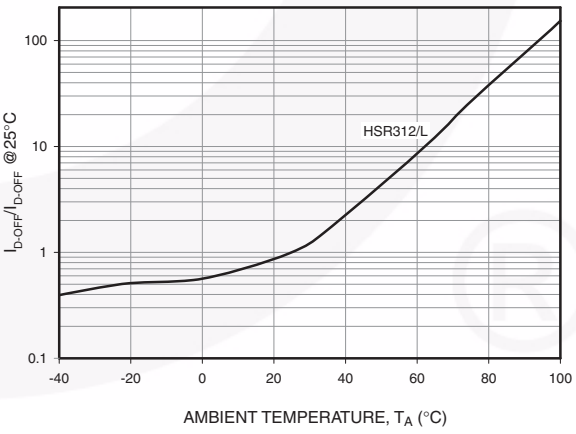
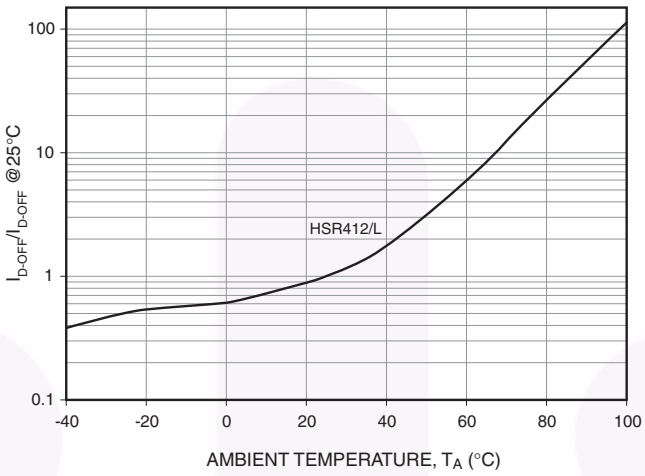


Figure 12. Normalized Off State Leakage vs. Ambient Temperature

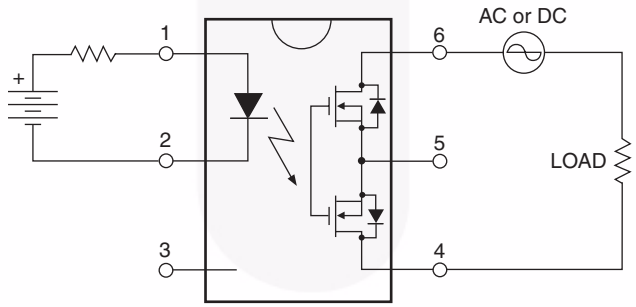


Typical Performance Curves (Continued)

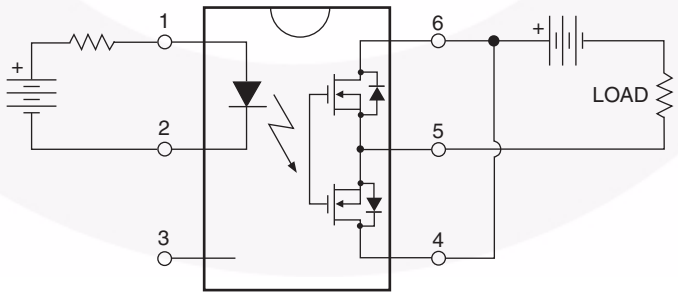
Figure 13. Normalized Off State Leakage vs. Ambient Temperature



Series Connection

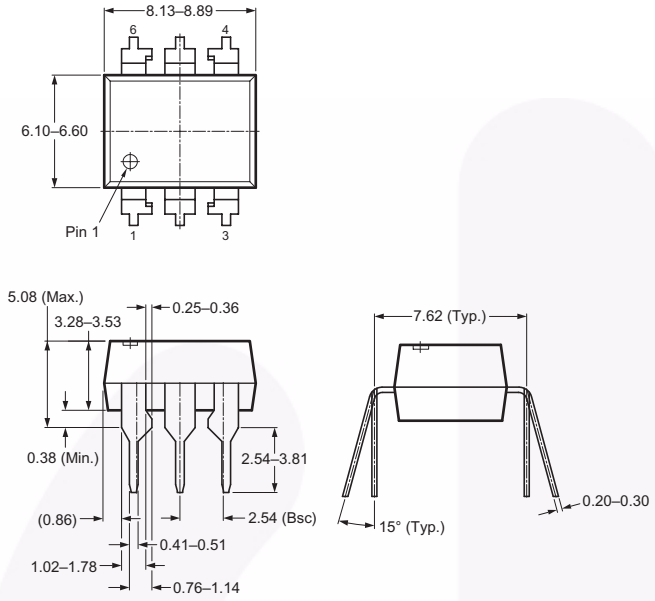


Parallel Connection

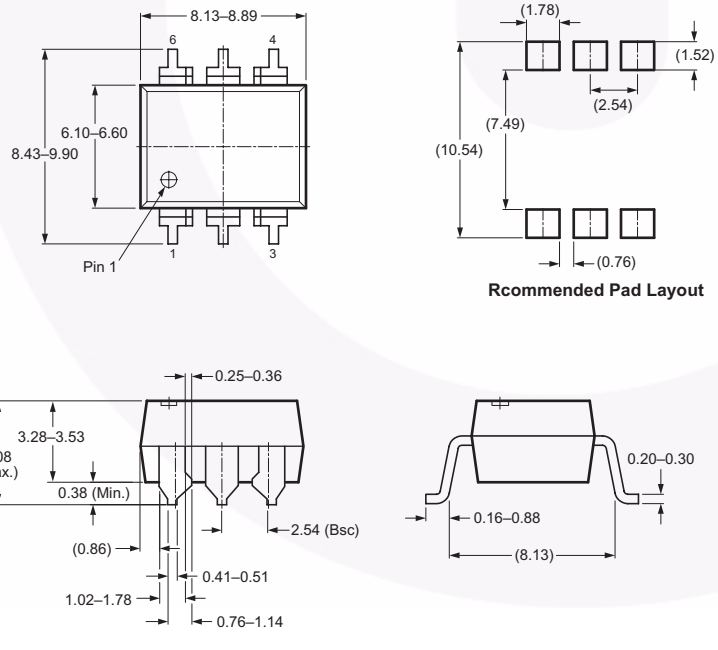


Package Dimensions

Through Hole



Surface Mount

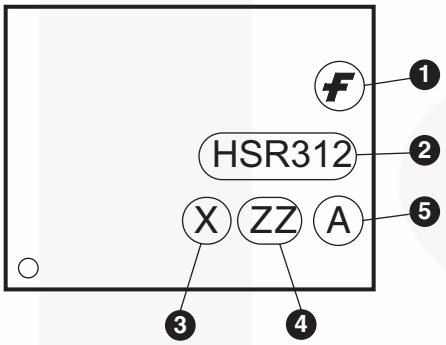


Note:
All dimensions in mm.

Ordering Information

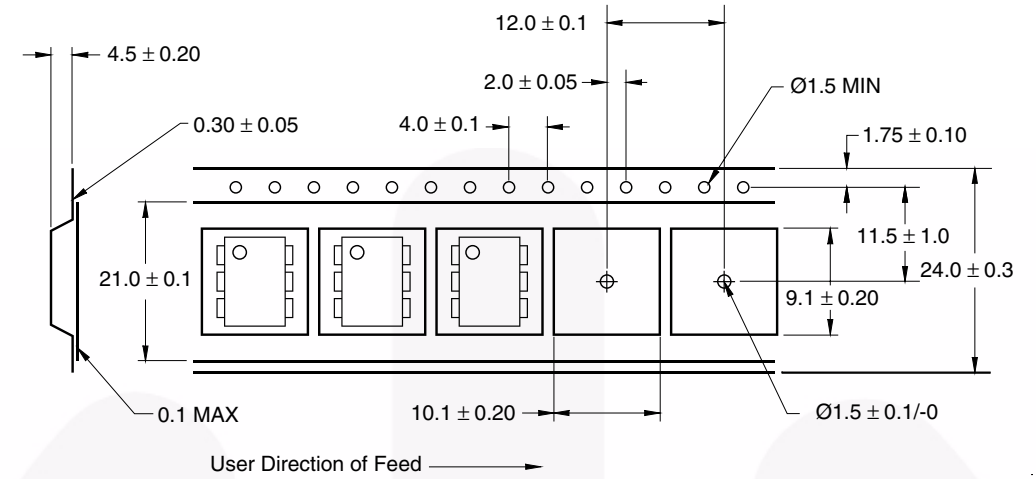
Option	Order Entry Identifier (Example)	Description
No option	HSR312	Standard Through Hole Device
S	HSR312S	Surface Mount Lead Bend
SR2	HSR312SR2	Surface Mount; Tape and Reel

Marking Information

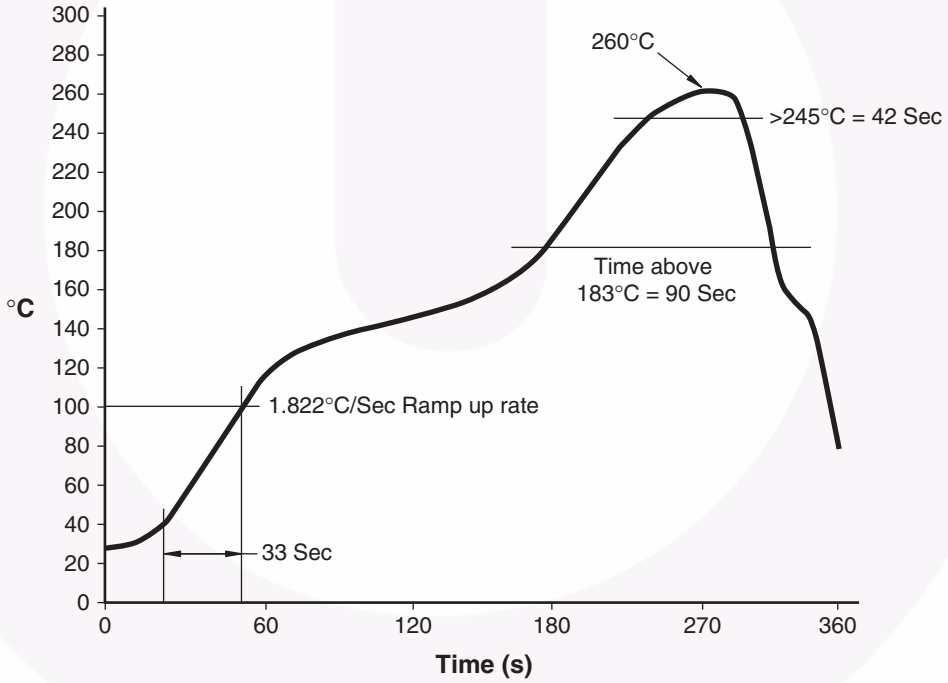


Definitions	
1	Fairchild logo
2	Device number
3	One digit year code, e.g., ‘3’
4	Two digit work week ranging from ‘01’ to ‘53’
5	Assembly package code

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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