FAIRCHILD SEMICONDUCTOR®

September 2009

H11F1M, H11F2M, H11F3M
Photo FET Optocouplers

Features

As a remote variable resistor:
- ≤ 100Ω to ≥ 300MΩ
- ≤ 15pF shunt capacitance
- ≥ 100GΩ I/O isolation resistance

As an analog switch:
- Extremely low offset voltage
- 60 $V_{pk\text{-}pk}$ signal capability
- No charge injection or latch-up
- t_{on}, t_{off} ≤ 15µS
- UL recognized (File #E90700)

Applications

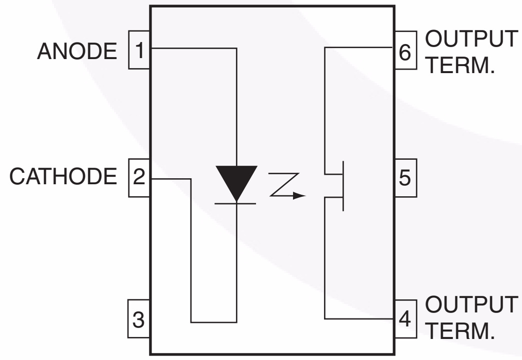
As a remote variable resistor:
- Isolated variable attenuator
- Automatic gain control
- Active filter fine tuning/band switching

As an analog switch:
- Isolated sample and hold circuit
- Multiplexed, optically isolated A/D conversion

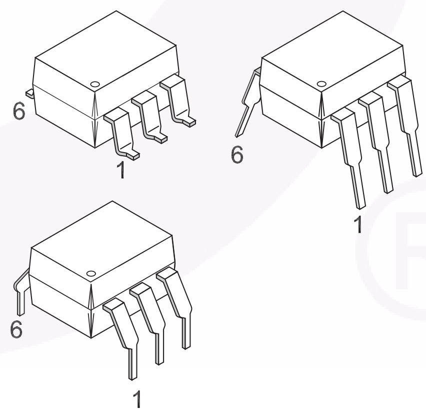
General Description

The H11FXM series consists of a Gallium-Aluminum-Arsenide IRED emitting diode coupled to a symmetrical bilateral silicon photo-detector. The detector is electrically isolated from the input and performs like an ideal isolated FET designed for distortion-free control of low level AC and DC analog signals. The H11FXM series devices are mounted in dual in-line packages.

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
EMITTER				
I_F	Continuous Forward Current	All	60	mA
V_R	Reverse Voltage	All	5	V
$I_{F(pk)}$	Forward Current – Peak (10µs pulse, 1% duty cycle)	All	1	A
P_D	LED Power Dissipation 25°C Ambient	All	100	mW
	Derate Linearly from 25°C		1.33	mW/°C
DETECTOR				
P_D	Detector Power Dissipation @ 25°C	All	300	mW
	Derate linearly from 25°C		4.0	mW/°C
BV_{4-6}	Breakdown Voltage (either polarity)	H11F1M, H11F2M	±30	V
		H11F3M	±15	V
I_{4-6}	Continuous Detector Current (either polarity)	All	±100	mA

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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 = 16mA	All		1.3	1.75	V
I_R	Reverse Leakage Current	V_R = 5V	All			10	µA
C_J	Capacitance	V = 0 V, f = 1.0MHz	All		50		pF
OUTPUT DETECTOR							
BV_{4-6}	Breakdown Voltage Either Polarity	I_{4-6} = 10µA, I_F = 0	H11F1M, H11F2M	30			V
			H11F3M	15			
I_{4-6}	Off-State Dark Current	V_{4-6} = 15 V, I_F = 0	All			50	nA
		V_{4-6} = 15 V, I_F = 0, T_A = 100°C	All			50	µA
R_{4-6}	Off-State Resistance	V_{4-6} = 15 V, I_F = 0	All	300			MΩ
C_{4-6}	Capacitance	V_{4-6} = 15 V, I_F = 0, f = 1MHz	All			15	pF

Transfer Characteristics

Symbol	Characteristics	Test Conditions	Device	Min	Typ*	Max	Units
DC CHARACTERISTICS							
R_{4-6}	On-State Resistance	I_F = 16mA, I_{4-6} = 100µA	H11F1M			200	Ω
			H11F2M			330	
			H11F3M			470	
R_{6-4}	On-State Resistance	I_F = 16mA, I_{6-4} = 100µA	H11F1M			200	Ω
			H11F2M			330	
			H11F3M			470	
	Resistance, non-linearity and assymetry	I_F = 16mA, I_{4-6} = 25µA RMS, f = 1kHz	All		2		%
AC CHARACTERISTICS							
t_{on}	Turn-On Time	R_L = 50Ω, I_F = 16mA, V_{4-6} = 5V	All			25	µs
t_{off}	Turn-Off Time	R_L = 50Ω, I_F = 16mA, V_{4-6} = 5V	All			25	µs

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.*	Max.	Units
V_{ISO}	Isolation Voltage	f = 60Hz, t = 1 sec.	All	7500			V_{AC}PEAK
R_{ISO}	Isolation Resistance	V_{I-O} = 500 VDC	All	10^{11}			Ω
C_{ISO}	Isolation Capacitance	f = 1MHz	All		0.2		pF

*All 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

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Typical Performance Curves

Figure 1. Resistance vs. Input Current

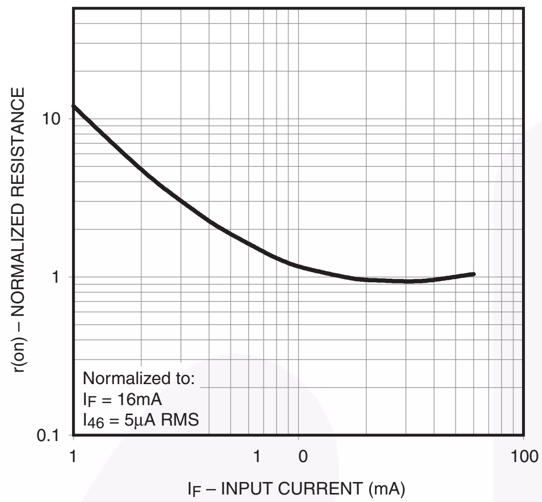


Figure 2. Output Characteristics

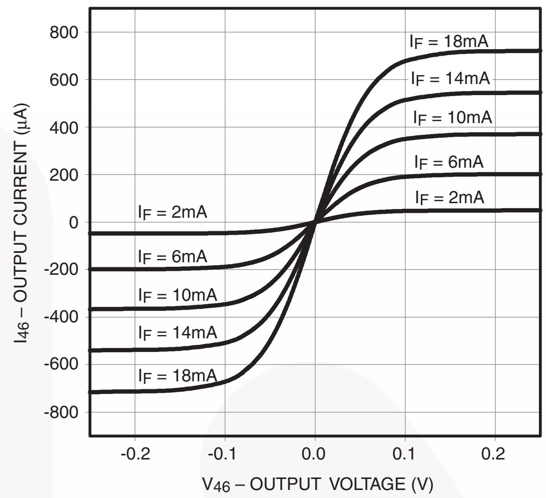


Figure 3. LED Forward Voltage vs. Forward Current

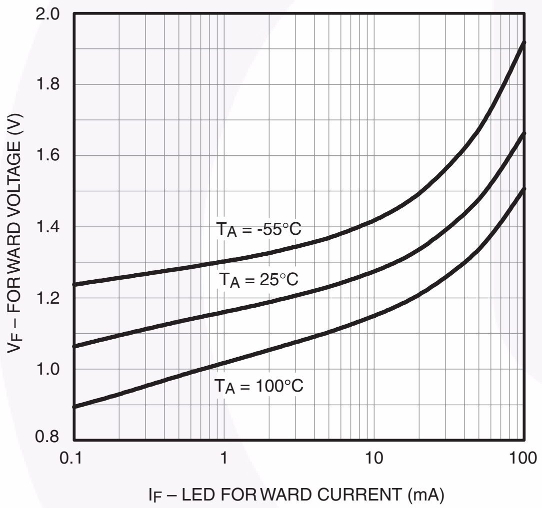


Figure 4. Off-state Current vs. Ambient Temperature

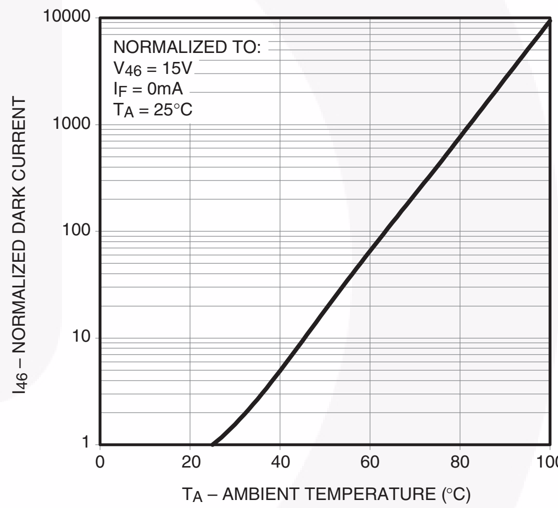
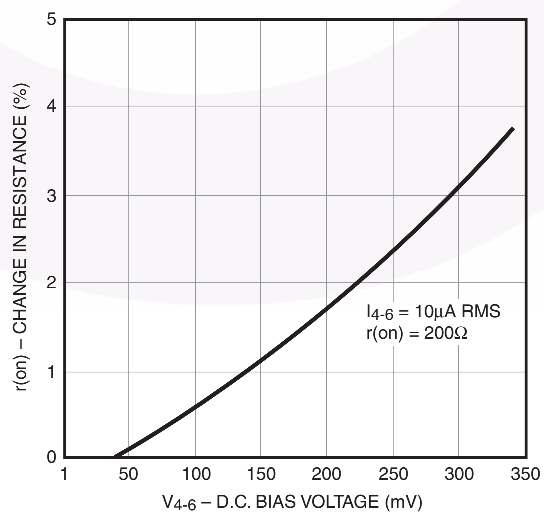


Figure 5. Resistive Non-Linearity vs. D.C. Bias



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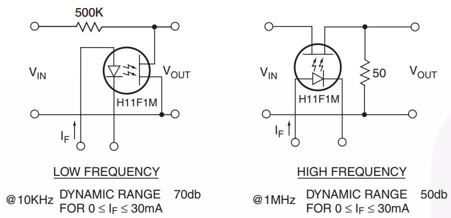
Typical Applications

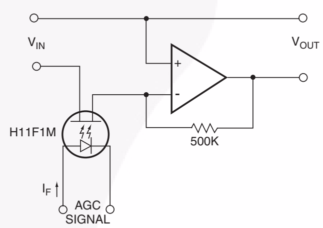
As a Variable Resistor

ISOLATED VARIABLE ATTENUATORS



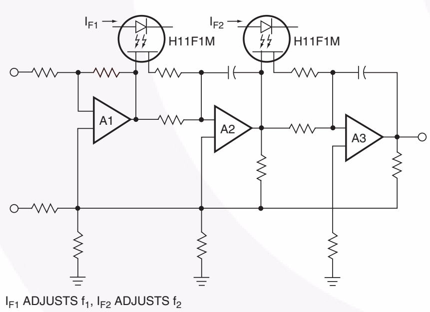
Distortion free attenuation of low level A.C. signals is accomplished by varying the IRED current, I_F Note the wide dynamic range and absence of coupling capacitors; D.C. level shifting or parasitic feedback to the controlling function.

AUTOMATIC GAIN CONTROL



This simple circuit provides over 70db of stable gain control for an AGC signal range of from 0 to 30mA. This basic circuit can be used to provide programmable fade and attack for electronic music.

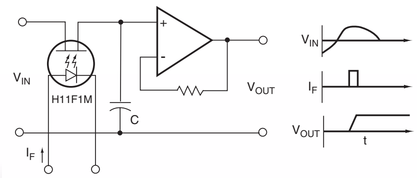
ACTIVE FILTER FINE TUNING/BAND SWITCHING



The linearity of resistance and the low offset voltage of the H11FXM allows the remote tuning or band-switching of active filters without switching glitches or distortion. This schematic illustrates the concept, with current to the H11F1M IRED's controlling the filter's transfer characteristic.

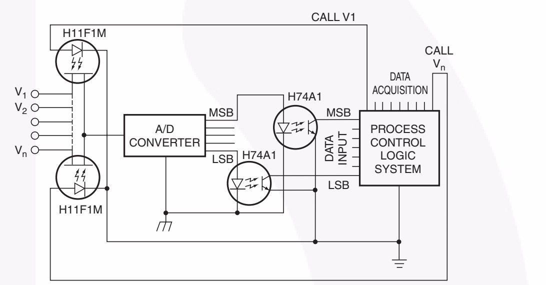
As an Analog Signal Switch

ISOLATED SAMPLE AND HOLD CIRCUIT



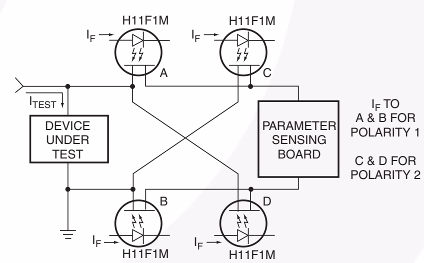
Accuracy and range are improved over conventional FET switches because the H11FXM has no charge injection from the control signal. The H11FXM also provides switching of either polarity input signal up to 30V magnitude.

MULTIPLEXED, OPTICALLY-ISOLATED A/D CONVERSION



The optical isolation, linearity and low offset voltage of the H11FXM allows the remote multiplexing of low level analog signals from such transducers as thermocouplers, Hall effect devices, strain gauges, etc. to a single A/D converter.

TEST EQUIPMENT - KELVIN CONTACT POLARITY



In many test equipment designs the auto polarity function uses reed relay contacts to switch the Kelvin Contact polarity. These reeds are normally one of the highest maintenance cost items due to sticking contacts and mechanical problems. The totally solid-State H11FXM eliminates these troubles while providing faster switching.

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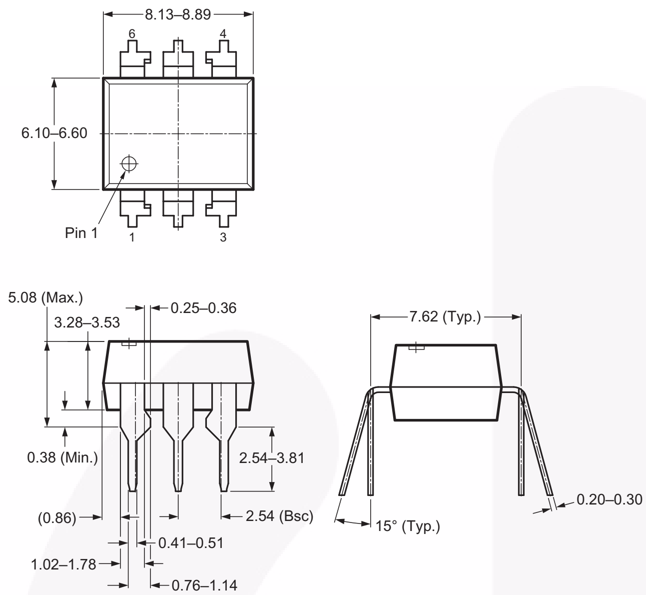
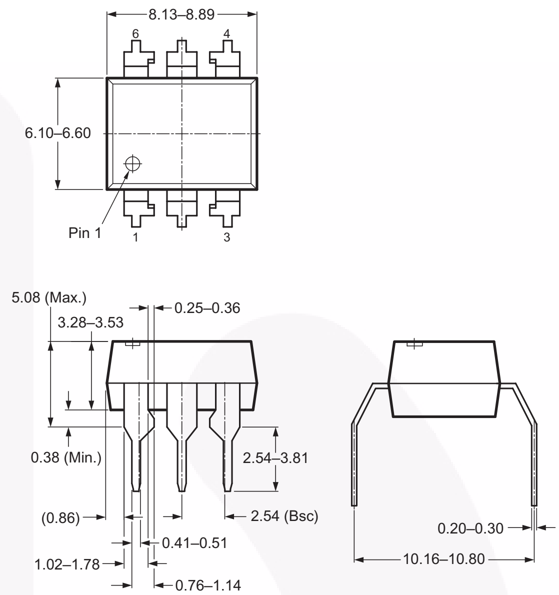
Package Dimensions

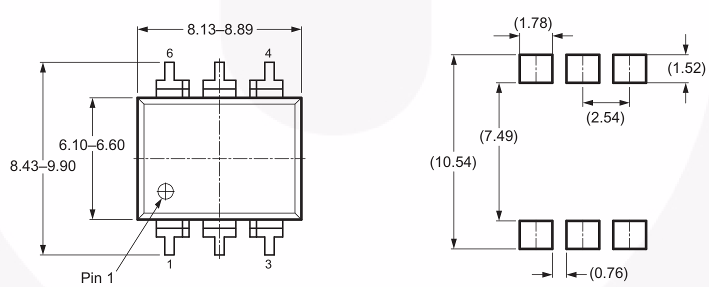
Through Hole



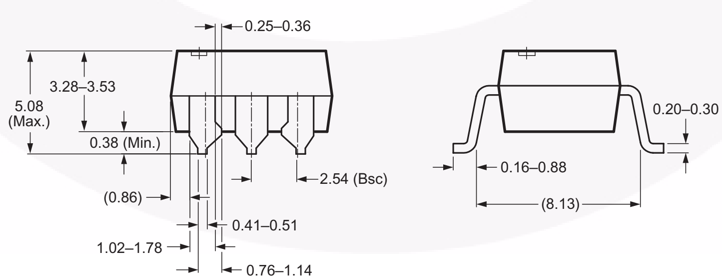
0.4" Lead Spacing



Surface Mount



Rcommended Pad Layout



Note:
All dimensions in mm.

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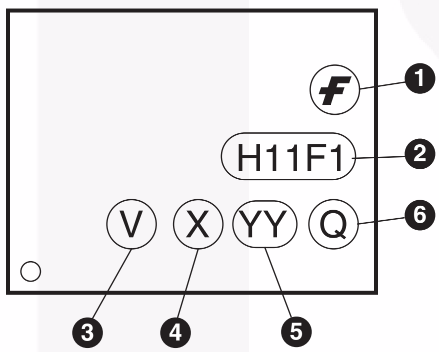
Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	H11F1M	Standard Through Hole Device
S	H11F1SM	Surface Mount Lead Bend
SR2	H11F1SR2M	Surface Mount; Tape and Reel
V	H11F1VM	IEC60747-5-2 approval
TV	H11F1TVM	IEC60747-5-2 approval, 0.4" Lead Spacing
SV	H11F1SVM	IEC60747-5-2 approval, Surface Mount
SR2V	H11F1SR2VM	IEC60747-5-2 approval, 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

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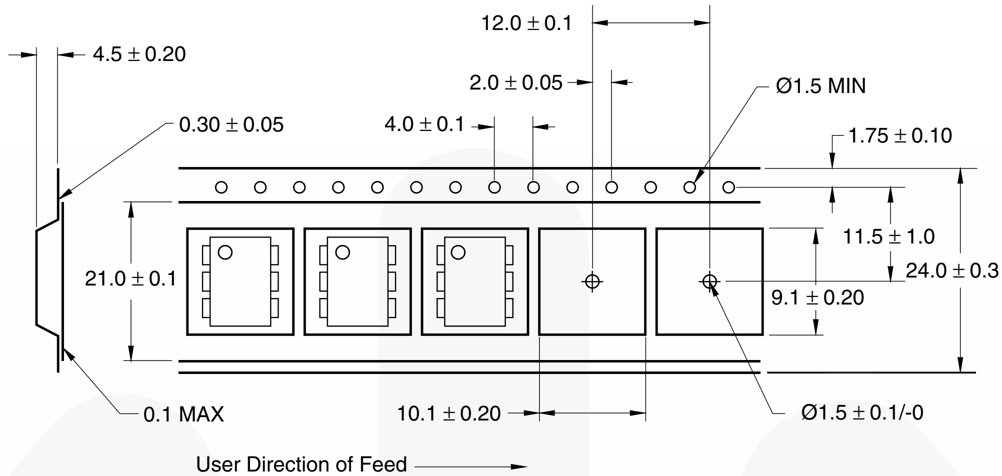
Carrier Tape Specification



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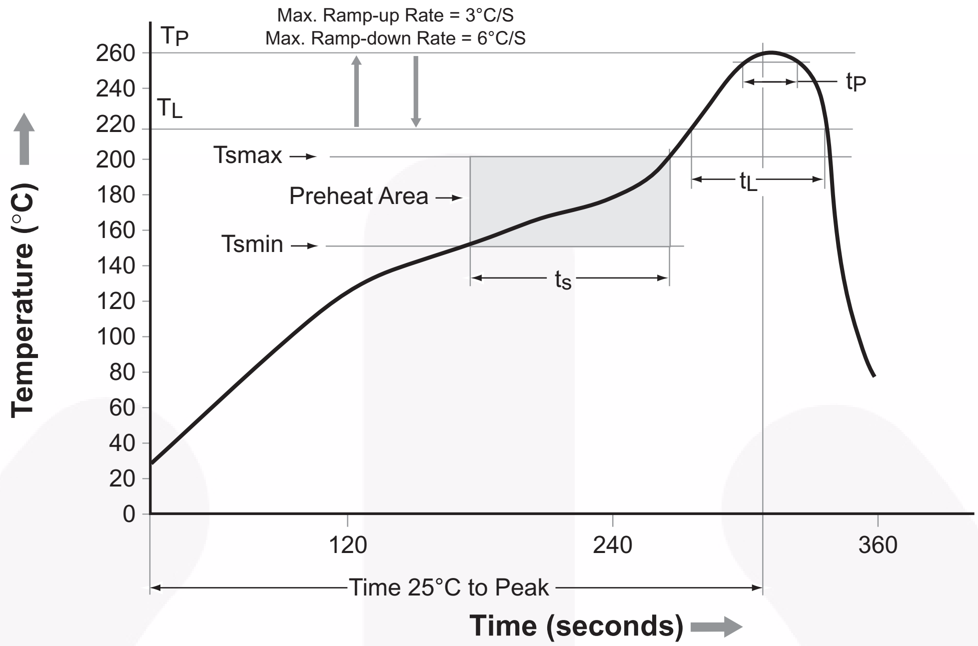
Reflow Profile



Profile Freature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60–120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second max.
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / –5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

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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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