



## SFH615A



### DESCRIPTION

The SFH615A series of optically coupled isolators each consists of an infrared light emitting diode and an NPN silicon photo transistor in a space efficient Dual In Line Plastic Package.

### FEATURES

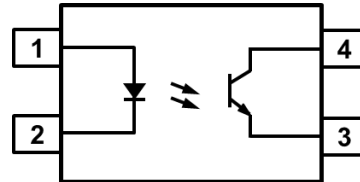
- AC Isolation Voltage 5300V<sub>RMS</sub>
- Low Input Current I<sub>F</sub> 1mA
- High Current Transfer Ratios
- Wide Operating Temperature Range -55°C to +110°C
- Lead Free and RoHS Compliant
- UL File E91231 Package Code "EE"
- VDE Approval Certificate No. 40028086

### APPLICATIONS

- Computer Terminals
- Industrial System Controllers
- Measuring Instruments

### ORDER INFORMATION

- Add X after PN for VDE Approval
- Add G after PN for 10mm lead spacing
- Add SM after PN for Surface Mount
- Add SMT&R after PN for Surface Mount Tape & Reel



- 1 Anode
- 2 Cathode
- 3 Emitter
- 4 Collector

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

#### Input

Forward Current	50mA
Reverse Voltage	6V
Power dissipation	70mW

#### Output

Collector to Emitter Voltage V <sub>CEO</sub>	70V
Emitter to Collector Voltage V <sub>ECO</sub>	6V
Collector Current	50mA
Power Dissipation	150mW

#### Total Package

Isolation Voltage	5300V <sub>RMS</sub>
Total Power Dissipation	200mW
Operating Temperature	-55 to 110°C
Storage Temperature	-55 to 125°C
Junction Temperature	125°C
Lead Soldering Temperature (10s)	260°C

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## SFH615A

### ELECTRICAL CHARACTERISTICS (Ambient Temperature = 25°C unless otherwise specified)

#### INPUT

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward Voltage	$V_F$	$I_F = 20\text{mA}$		1.2	1.4	V
Reverse Leakage	$I_R$	$V_R = 4\text{V}$			10	$\mu\text{A}$
Terminal Capacitance	$C_t$	$V = 0\text{V}, f = 1\text{kHz}$		30	250	pF

#### OUTPUT

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector–Emitter Breakdown Voltage	$BV_{CEO}$	$I_C = 0.1\text{mA}, I_F = 0\text{mA}$	70			V
Emitter–Collector Breakdown Voltage	$BV_{ECO}$	$I_E = 10\mu\text{A}, I_F = 0\text{mA}$	6			V
Collector–Emitter Dark Current	$I_{CEO}$	$V_{CE} = 20\text{V}, I_F = 0\text{mA}$			100	nA

#### COUPLED

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit	
Current Transfer Ratio	CTR	$I_F = 10\text{mA}, V_{CE} = 5\text{V}$	SFH615A-1	40		80	%
			SFH615A-2	63		125	
			SFH615A-3	100		200	
			SFH615A-4	160		320	
		$I_F = 1\text{mA}, V_{CE} = 5\text{V}$	SFH615A-1	13			
			SFH615A-2	22			
			SFH615A-3	34			
			SFH615A-4	56			
Collector–Emitter Saturation Voltage	$V_{CE(\text{sat})}$	$I_F = 20\text{mA}, I_C = 1\text{mA}$		0.1	0.2	V	
Floating Capacitance	$C_f$	$V = 0\text{V}, f = 1\text{MHz}$		0.6	1	pF	
Cut-Off Frequency	$f_c$	$V_{CE} = 5\text{V}, I_C = 2\text{mA}$ $R_L = 100\Omega$ -3dB		80		kHz	

## SFH615A

### ELECTRICAL CHARACTERISTICS (Ambient Temperature = 25°C unless otherwise specified)

#### SWITCHING

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
<b>NON-SATURATED</b>						
Turn-ON Time	$t_{ON}$	$V_{CC} = 5V,$ $I_F = 10mA,$ $R_L = 75\Omega$		3.0		$\mu s$
Rise Time	$t_r$			2.0		
Turn-OFF Time	$t_{OFF}$			2.3		
Fall Time	$t_f$			2.0		
Cut-off Frequency	$f_{CO}$			250		kHz
<b>SATURATED</b> $V_{CC} = 5V, R_L = 1k\Omega, V_{CE(sat)} \leq 0.4V$						
Turn-ON Time	$t_{ON}$	$I_F = 20mA$ SFH615A-1 $I_F = 10mA$ SFH615A-2 $I_F = 10mA$ SFH615A-3 $I_F = 5mA$ SFH615A-4		3.0 4.2 4.2 6.0		$\mu s$
Rise Time	$t_r$	$I_F = 20mA$ SFH615A-1 $I_F = 10mA$ SFH615A-2 $I_F = 10mA$ SFH615A-3 $I_F = 5mA$ SFH615A-4		2.0 3.0 3.0 4.6		
Turn-OFF Time	$t_{OFF}$	$I_F = 20mA$ SFH615A-1 $I_F = 10mA$ SFH615A-2 $I_F = 10mA$ SFH615A-3 $I_F = 5mA$ SFH615A-4		18 23 23 25		
Fall Time	$t_f$	$I_F = 20mA$ SFH615A-1 $I_F = 10mA$ SFH615A-2 $I_F = 10mA$ SFH615A-3 $I_F = 5mA$ SFH615A-4		11 14 14 15		

#### ISOLATION

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Input to Output Isolation Voltage	$V_{ISO}$	AC 1 minute, RH = 40% to 60% Note 1	5300			$V_{RMS}$
Input to Output Isolation Resistance	$R_{ISO}$	$V_{IO} = 500V$ , RH = 40% to 60% Note 1	$5 \times 10^{10}$	$1 \times 10^{11}$		$\Omega$

Note 1 : Measure with input leads shorted together and output leads shorted together.

# SFH615A

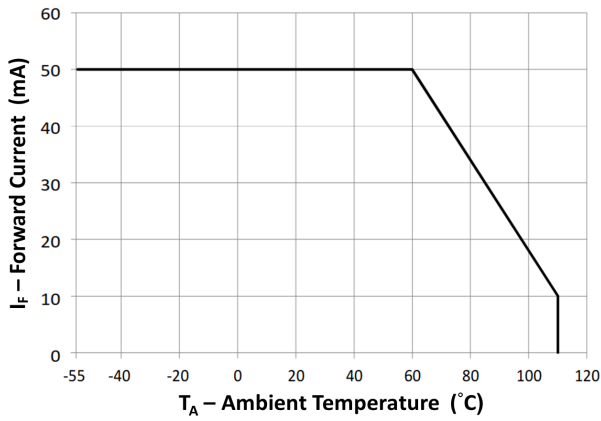


Fig 1 Forward Current vs Ambient Temperature

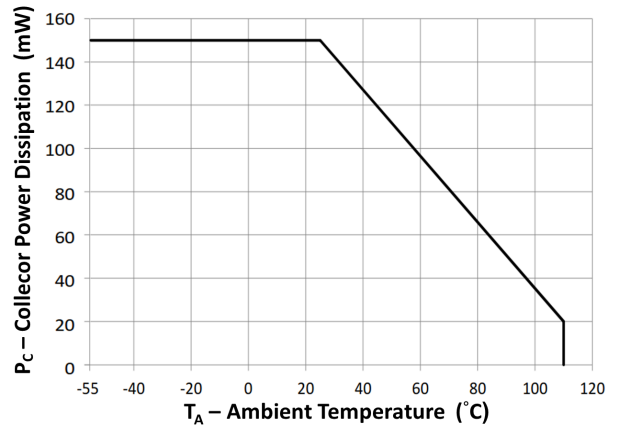


Fig 2 Collector Power Dissipation vs Ambient Temperature

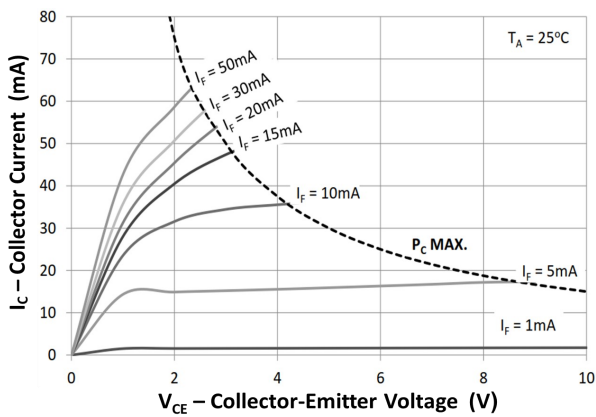


Fig 3 Collector Current vs Collector-Emitter Voltage

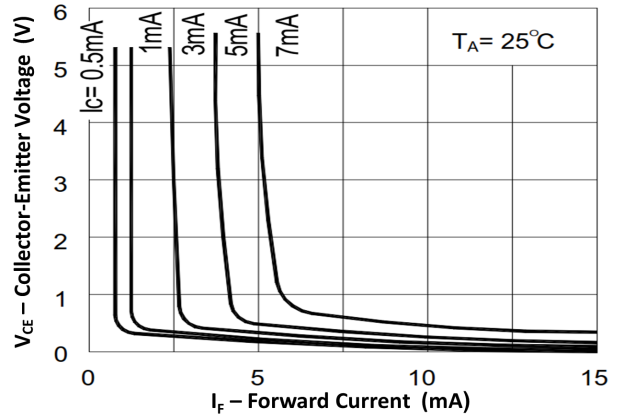


Fig 4 Collector-Emitter Voltage vs Forward Current

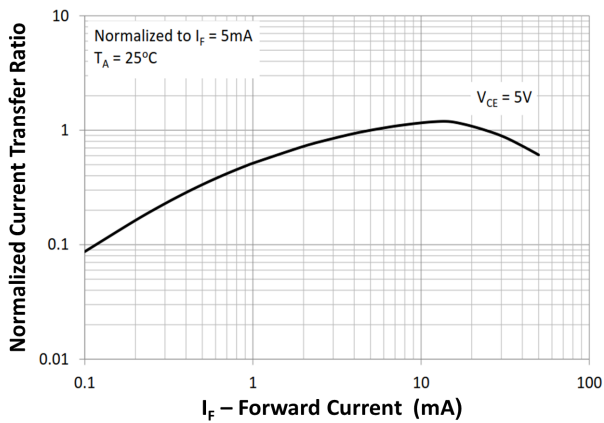


Fig 5 Normalized Current Transfer Ratio vs Forward Current

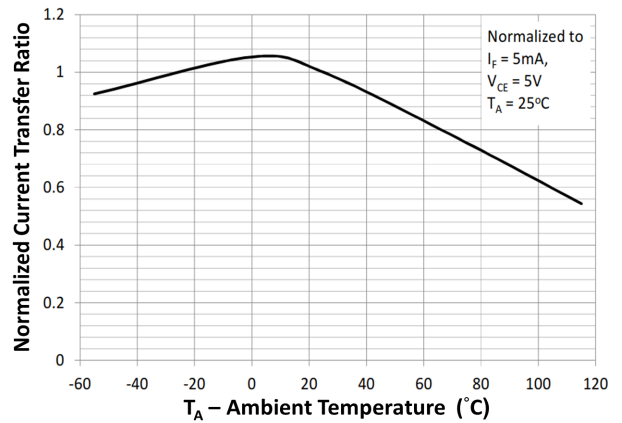
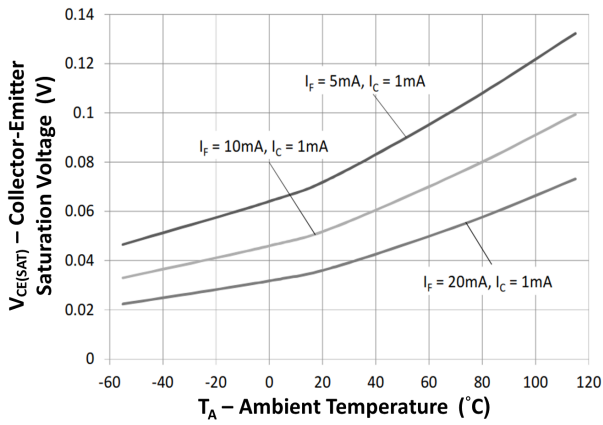
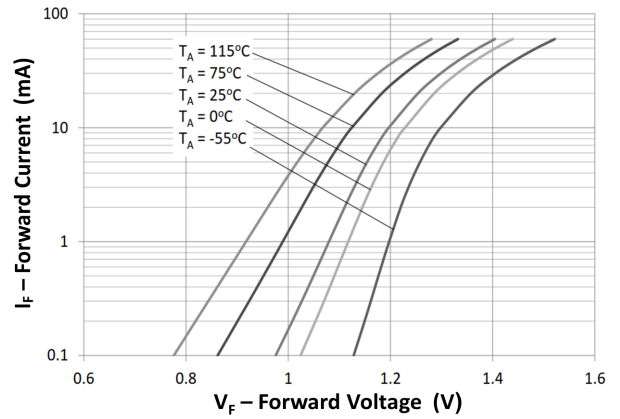


Fig 6 Normalized Current Transfer Ratio vs Ambient Temperature

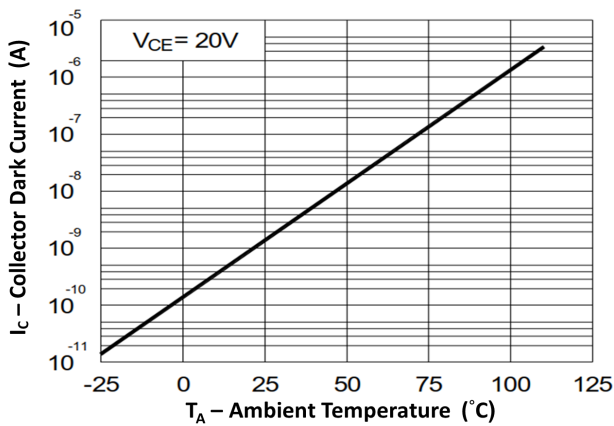
# SFH615A



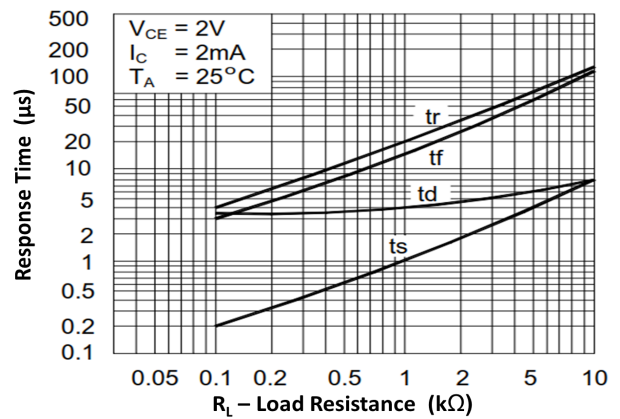
**Fig 7 Collector-Emitter Saturation Voltage vs Ambient Temperature**



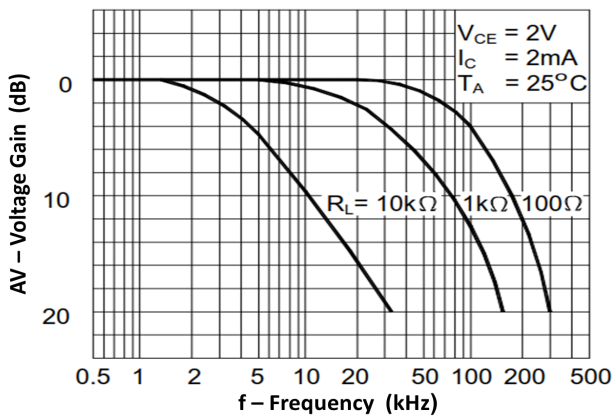
**Fig 8 Forward Current vs Forward Voltage**



**Fig 9 Collector Dark Current vs Ambient Temperature**

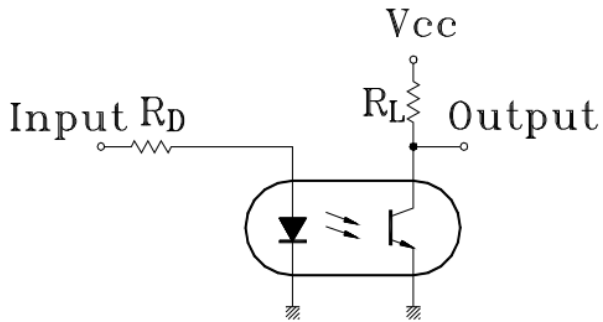


**Fig 10 Response Time vs Load Resistance**

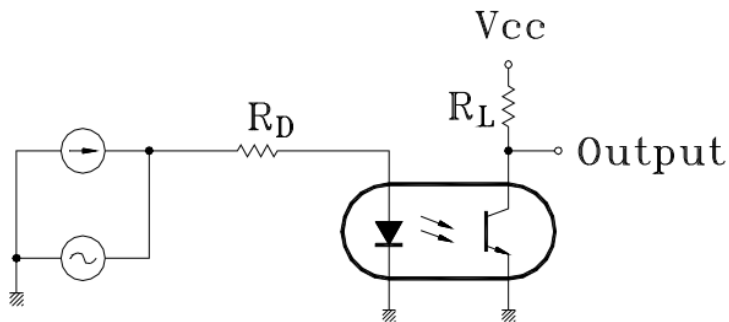
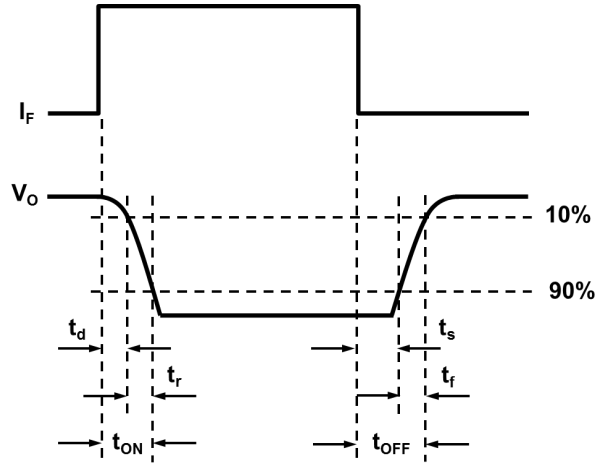


**Fig 11 Frequency Response**

## SFH615A



**Response Time Test Circuit and Waveform**



**Frequency Response Test Circuit**

## SFH615A

### ORDER INFORMATION

SFH615A (UL Approval)			
After PN	PN	Description	Packing quantity
None	SFH615A-1, SFH615A-2, SFH615A-3, SFH615A-4	Standard DIP4	100 pcs per tube
G	SFH615A-1G, SFH615A-2G, SFH615A-3G, SFH615A-4G	10mm Lead Spacing	100 pcs per tube
SM	SFH615A-1SM, SFH615A-2SM, SFH615A-3SM, SFH615A-4SM	Surface Mount	100 pcs per tube
SMT&R	SFH615A-1SMT&R, SFH615A-2SMT&R, SFH615A-3SMT&R, SFH615A-4SMT&R	Surface Mount Tape & Reel	1000 pcs per reel

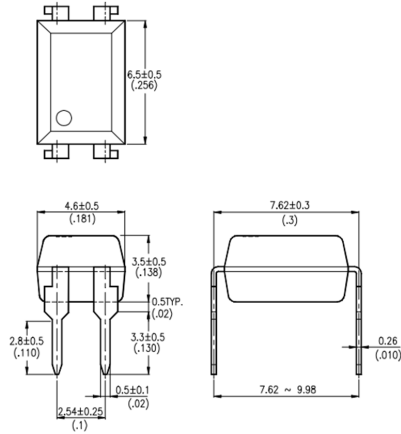
SFH615A (UL and VDE Approvals)			
After PN	PN	Description	Packing quantity
None	SFH615A-1X, SFH615A-2X, SFH615A-3X, SFH615A-4X	Standard DIP8	100 pcs per tube
G	SFH615A-1XG, SFH615A-2XG, SFH615A-3XG, SFH615A-4XG	10mm Lead Spacing	100 pcs per tube
SM	SFH615A-1XSM, SFH615A-2XSM, SFH615A-3XSM, SFH615A-4XSM	Surface Mount	100 pcs per tube
SMT&R	SFH615A-1XSMT&R, SFH615A-2XSMT&R, SFH615A-3XSMT&R, SFH615A-4XSMT&R	Surface Mount Tape & Reel	1000 pcs per reel

# SFH615A

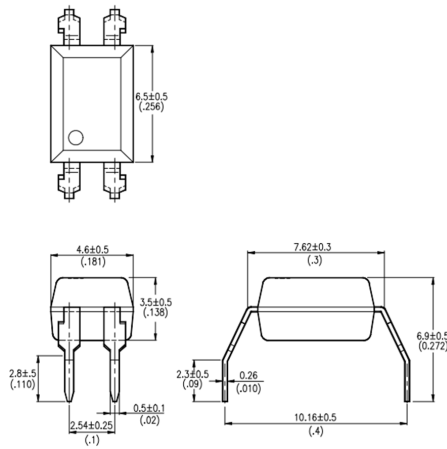
## PACKAGE DIMENSIONS in mm (inch)

### DIP

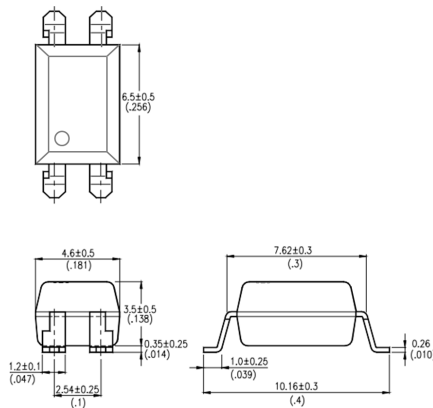
**SFH615**



**SFH615G**



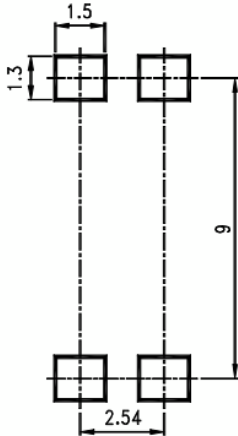
**SFH615SM**



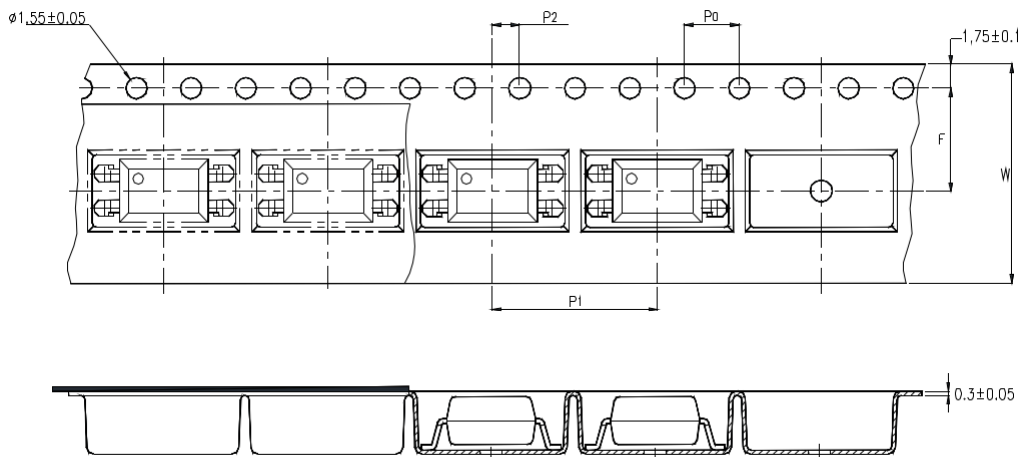


## SFH615A

### RECOMMENDED PAD LAYOUT FOR SMD (mm)



### TAPE AND REEL PACKAGING

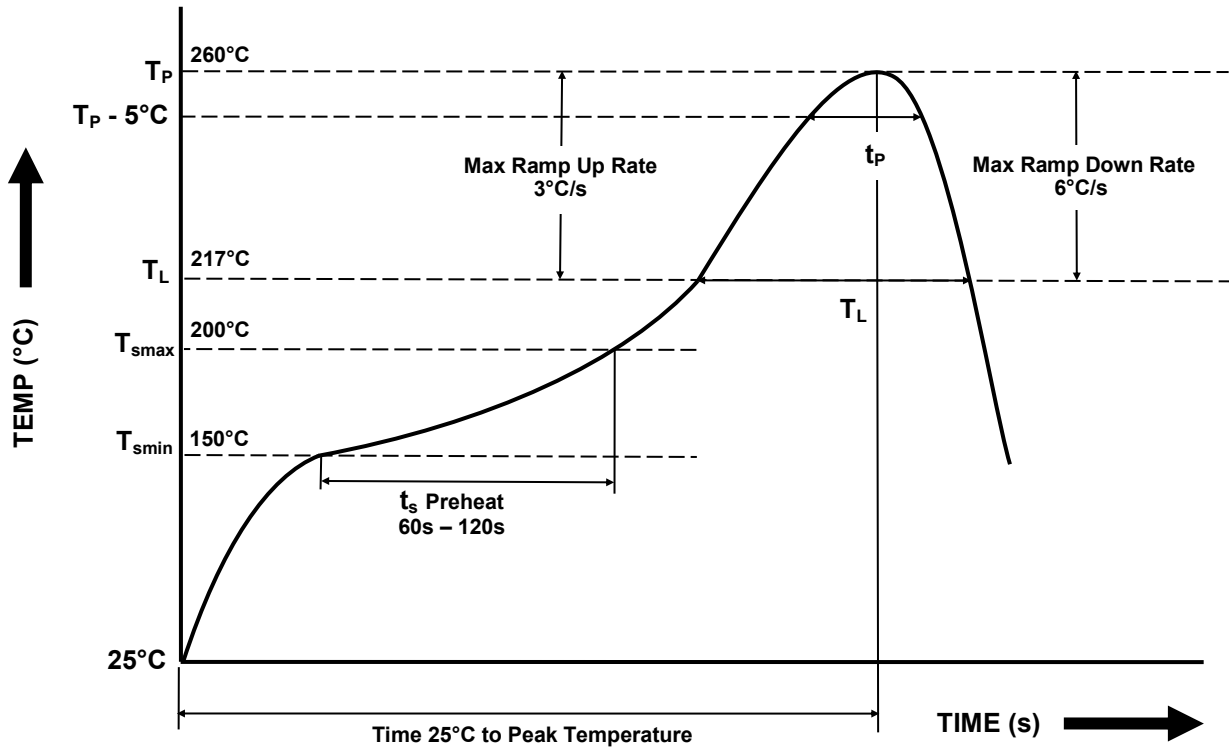


Description	Symbol	Dimension mm (inch)
Tape Width	W	16 ± 0.3 (0.63)
Pitch of Sprocket Holes	P <sub>0</sub>	4 ± 0.1 (0.15)
Distance of Compartment to Sprocket Holes	F	7.5 ± 0.1 (0.295)
	P <sub>2</sub>	2 ± 0.1 (0.079)
Distance of Compartment to Compartment	P <sub>1</sub>	12 ± 0.1 (0.472)



**SFH615A**

**IR REFLOW SOLDERING TEMPERATURE PROFILE FOR SMD**  
**One Time Reflow Soldering is Recommended.**  
**Do not immerse device body in solder paste.**



Profile Details	Conditions
<b>Preheat</b> - Min Temperature ( $T_{SMIN}$ ) - Max Temperature ( $T_{SMAX}$ ) - Time $T_{SMIN}$ to $T_{SMAX}$ ( $t_s$ )	150°C 200°C 60s - 120s
<b>Soldering Zone</b> - Peak Temperature ( $T_P$ ) - Time at Peak Temperature - Liquidous Temperature ( $T_L$ ) - Time within 5°C of Actual Peak Temperature ( $T_P - 5^\circ C$ ) - Time maintained above $T_L$ ( $t_L$ ) - Ramp Up Rate ( $T_L$ to $T_P$ ) - Ramp Down Rate ( $T_P$ to $T_L$ )	260°C 10s max 217°C 30s max 60s - 100s 3°C/s max 6°C/s max
Average Ramp Up Rate ( $T_{smax}$ to $T_P$ )	3°C/s max
Time 25°C to Peak Temperature	8 minutes max



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