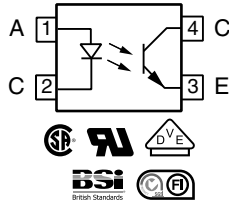
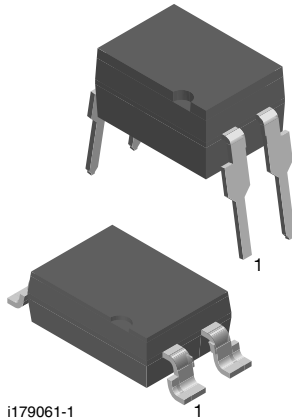


# Optocoupler, Phototransistor Output, Low Input Current



## FEATURES

- Good CTR linearity depending on forward current
- Low CTR degradation
- High collector emitter voltage,  $V_{CE0} = 55\text{ V}$
- Isolation test voltage,  $5300\text{ V}_{RMS}$
- Low coupling capacitance
- End stackable, 0.100" (2.54 mm) spacing
- High common mode transient immunity
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines

## AGENCY APPROVALS

The safety application model number covering all products in this datasheet is SFH618A. This model number should be used when consulting safety agency documents.

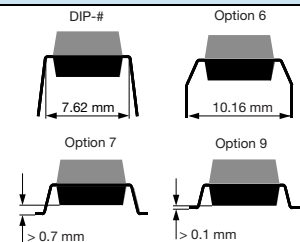
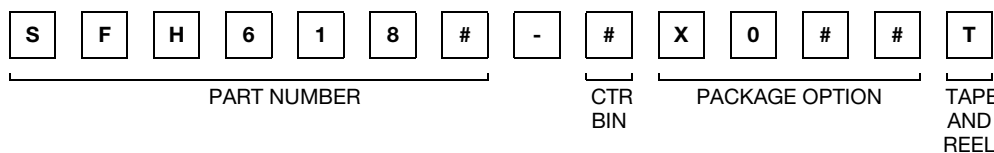
- UL1577, file no. E52744 system code H or J, double protection
- CSA 93751
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI IEC 60950; IEC 60065
- FIMKO

## DESCRIPTION

The SFH618A (DIP) and SFH6186 (SMD) feature a high current transfer ratio, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 or SMD package.

The coupling devices are designed for signal transmission between two electrically separated circuits. The couplers are end-stackable with 2.54 mm lead spacing. Creepage and clearance distances of > 8 mm achieved with option 6.

## ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CTR (%)			
	1 mA			
<b>UL, CUL</b>	<b>63 to 125</b>	<b>100 to 200</b>	<b>160 to 320</b>	<b>250 to 500</b>
DIP-4	SFH618A-2	SFH618A-3	SFH618A-4	SFH618A-5
DIP-4, 400 mil, option 6	-	SFH618A-3X006	-	-
SMD-4, option 7	-	-	-	SFH618A-5X007T <sup>(1)</sup>
SMD-4, option 9	SFH6186-2T <sup>(1)</sup>	SFH6186-3T <sup>(1)</sup> , SFH6186-3T1 <sup>(2)</sup> , SFH6186-3X002T <sup>(1)</sup>	SFH6186-4T <sup>(1)</sup>	SFH6186-5T <sup>(1)</sup> , SFH6186-5T1 <sup>(2)</sup>
<b>VDE, UL, CUL</b>	<b>63 to 125</b>	<b>100 to 200</b>	<b>160 to 320</b>	<b>250 to 500</b>
DIP-4	-	SFH618A-3X001	SFH618A-4X001	-
DIP-4, 400 mil, option 6	-	SFH618A-3X016	SFH618A-4X016	SFH618A-5X016
SMD-4, option 7	-	SFH618A-3X017T <sup>(1)</sup>	-	SFH618A-5X017T <sup>(1)</sup>
SMD-4, option 9	-	SFH6186-3X001T <sup>(1)</sup>	SFH6186-4X001T	SFH6186-5X001T <sup>(1)</sup>

## Notes

- Additional options may be possible, please contact sales office
- <sup>(1)</sup> Also available in tubes, do not put T to the end
- <sup>(2)</sup> Product is rotated 90° in tape and reel cavity



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	6	V
Power dissipation		P <sub>diss</sub>	70	mW
Forward current		I <sub>F</sub>	60	mA
<b>OUTPUT</b>				
Collector emitter voltage		V <sub>CEO</sub>	55	V
Emitter collector voltage		V <sub>ECO</sub>	7	V
Collector current		I <sub>C</sub>	50	mA
	t <sub>p</sub> ≤ 1 ms	I <sub>C</sub>	100	mA
Power dissipation		P <sub>diss</sub>	150	mW
<b>COUPLER</b>				
Storage temperature range		T <sub>stg</sub>	-55 to +150	°C
Ambient temperature range		T <sub>amb</sub>	-55 to +100	°C
Junction temperature		T <sub>j</sub>	125	°C
Soldering temperature (1)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	T <sub>sld</sub>	260	°C

Notes

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.
- (1) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

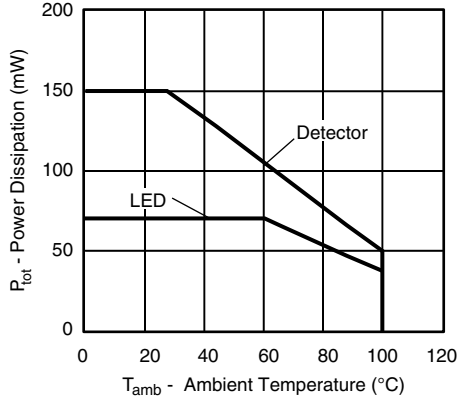


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature



<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	$I_F = 5\text{ mA}$		$V_F$		1.1	1.5	V
Reverse current	$V_R = 6\text{ V}$		$I_R$		0.01	10	$\mu\text{A}$
Capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$		$C_O$		25		pF
Thermal resistance			$R_{thja}$		1070		K/W
<b>OUTPUT</b>							
Collector emitter leakage current	$V_{CE} = 10\text{ V}$		$I_{CEO}$		10	200	nA
Collector emitter capacitance	$V_{CE} = 5\text{ V}, f = 1\text{ MHz}$		$C_{CE}$		7		pF
Thermal resistance			$R_{thja}$		500		K/W
<b>COUPLER</b>							
Collector emitter saturation voltage	$I_C = 0.32\text{ mA}, I_F = 1\text{ mA}$	SFH618A-2	$V_{CEsat}$		0.25	0.4	V
		SFH6186-2	$V_{CEsat}$		0.25	0.4	V
	$I_C = 0.5\text{ mA}, I_F = 1\text{ mA}$	SFH618A-3	$V_{CEsat}$		0.25	0.4	V
		SFH6186-3	$V_{CEsat}$		0.25	0.4	V
	$I_C = 0.8\text{ mA}, I_F = 1\text{ mA}$	SFH618A-4	$V_{CEsat}$		0.25	0.4	V
		SFH6186-4	$V_{CEsat}$		0.25	0.4	V
	$I_C = 1.25\text{ mA}, I_F = 1\text{ mA}$	SFH618A-5	$V_{CEsat}$		0.25	0.4	V
		SFH6186-5	$V_{CEsat}$		0.25	0.4	V
Coupling capacitance			$C_C$		0.25		pF

**Note**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$I_F = 1\text{ mA}, V_{CE} = 0.5\text{ V}$	SFH618A-2	CTR	63		125	%
		SFH6186-2	CTR	63		125	%
	$I_F = 0.5\text{ mA}, V_{CE} = 1.5\text{ V}$	SFH618A-2	CTR	32	75		%
		SFH6186-2	CTR	32	75		%
	$I_F = 1\text{ mA}, V_{CE} = 0.5\text{ V}$	SFH618A-3	CTR	100		200	%
		SFH6186-3	CTR	100		200	%
	$I_F = 0.5\text{ mA}, V_{CE} = 1.5\text{ V}$	SFH618A-3	CTR	50	120		%
		SFH6186-3	CTR	50	120		%
	$I_F = 1\text{ mA}, V_{CE} = 0.5\text{ V}$	SFH618A-4	CTR	160		320	%
		SFH6186-4	CTR	160		320	%
	$I_F = 0.5\text{ mA}, V_{CE} = 1.5\text{ V}$	SFH618A-4	CTR	80	200		%
		SFH6186-4	CTR	80	200		%
	$I_F = 1\text{ mA}, V_{CE} = 0.5\text{ V}$	SFH618A-5	CTR	250		500	%
		SFH6186-5	CTR	250		500	%
	$I_F = 0.5\text{ mA}, V_{CE} = 1.5\text{ V}$	SFH618A-5	CTR	125	300		%
		SFH6186-5	CTR	125	300		%

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Turn on time	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_{on}$		6		$\mu\text{s}$	
Rise time	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_r$		3.5		$\mu\text{s}$	
Turn off time	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_{off}$		5.5		$\mu\text{s}$	
Fall time	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_f$		5		$\mu\text{s}$	

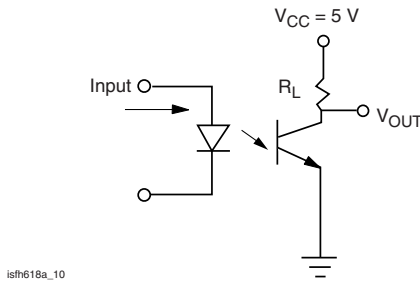


Fig. 2 - Test Circuit

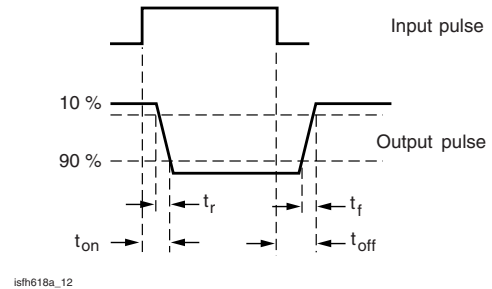


Fig. 3 - Test Circuit and Waveforms

SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55/115/21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V <sub>ISO</sub>	4470	V <sub>RMS</sub>
Tested withstanding isolation voltage	According to UL1577, t = 1 s	V <sub>ISO</sub>	5300	V <sub>RMS</sub>
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V <sub>IOTM</sub>	8000	V <sub>peak</sub>
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V <sub>IORM</sub>	890	V <sub>peak</sub>
Isolation resistance	T <sub>amb</sub> = 25 °C, V <sub>IO</sub> = 500 V	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
	T <sub>amb</sub> = 100 °C, V <sub>IO</sub> = 500 V	R <sub>IO</sub>	≥ 10 <sup>11</sup>	Ω
Output safety power		P <sub>SO</sub>	700	mW
Input safety current		I <sub>SI</sub>	400	mA
Input safety temperature		T <sub>S</sub>	175	°C
Creepage distance	DIP-4		≥ 7	mm
Clearance distance	DIP-4		≥ 7	mm
Creepage distance	DIP-4, 400 mil, option 6		≥ 8	mm
Clearance distance	DIP-4, 400 mil, option 6		≥ 8	mm
Creepage distance	SMD-4, option 7 and option 9		≥ 7	mm
Clearance distance	SMD-4, option 7 and option 9		≥ 7	mm
Insulation thickness		DTI	≥ 0.4	mm

**Note**

- As per DIN EN 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

**TYPICAL CHARACTERISTICS** (T<sub>amb</sub> = 25 °C, unless otherwise specified)

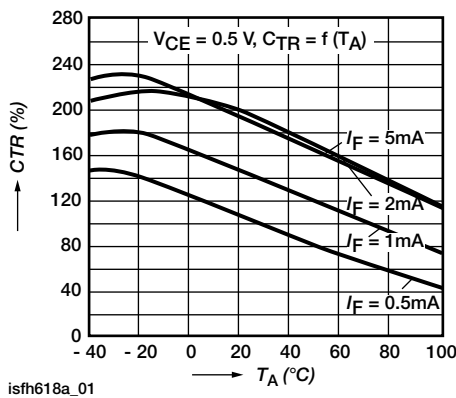


Fig. 4 - Current Transfer Ratio (typ.)

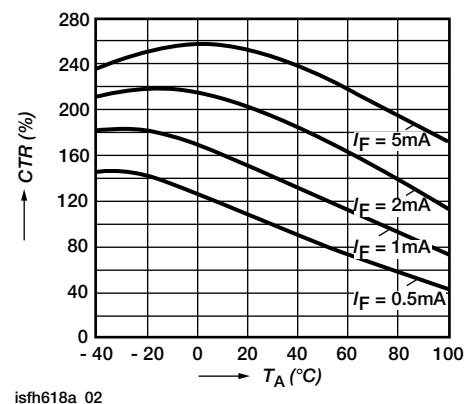


Fig. 5 - Current Transfer Ratio (typ.)

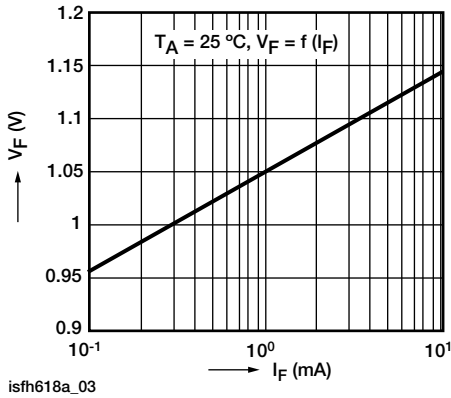


Fig. 6 - Diode Forward Voltage (typ.)

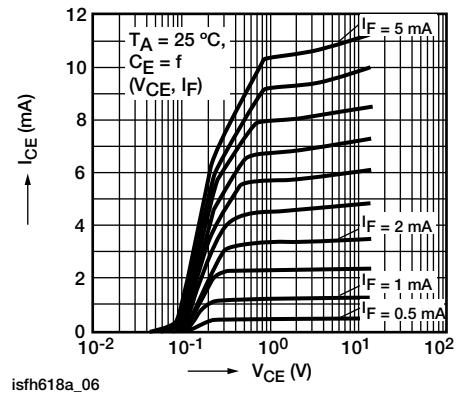


Fig. 9 - Output Characteristics

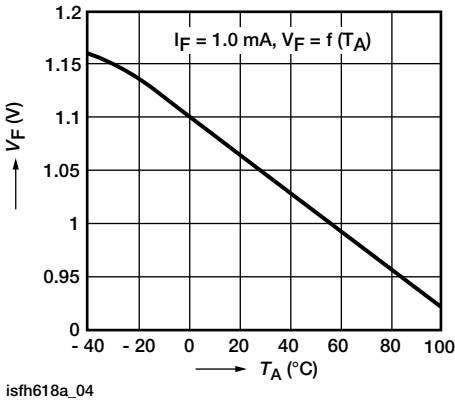


Fig. 7 - Diode Forward Voltage (typ.)

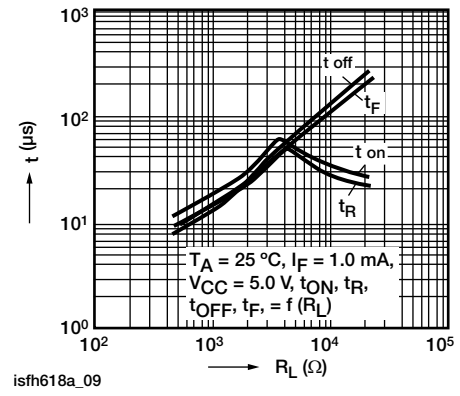


Fig. 10 - Switching Times (typ.)

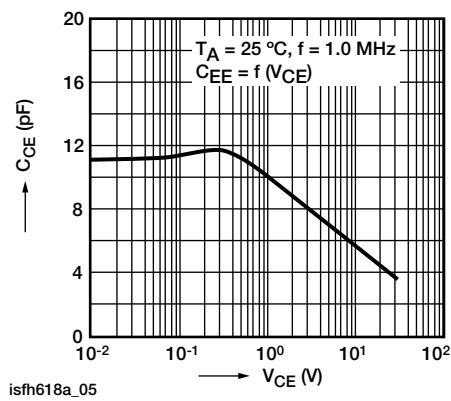
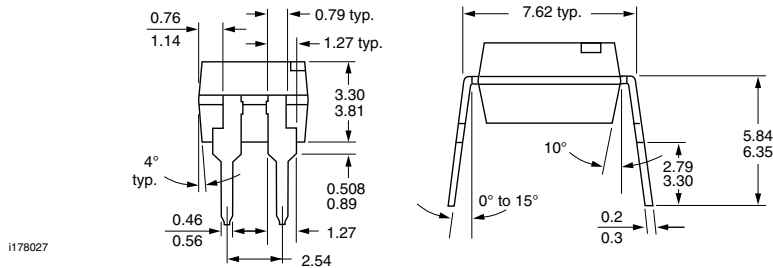
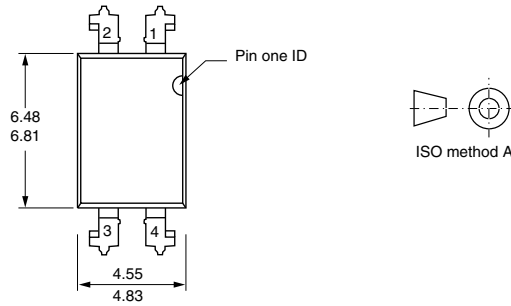


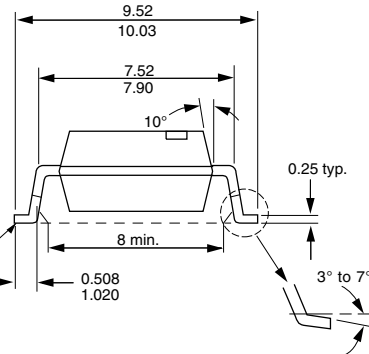
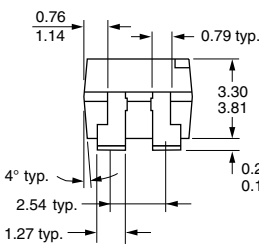
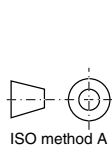
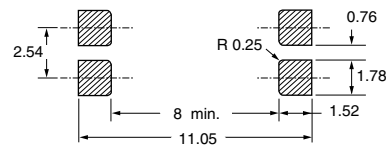
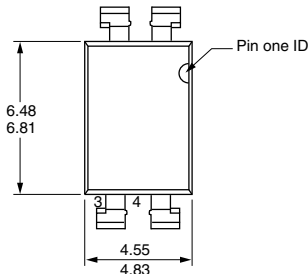
Fig. 8 - Transistor Capacitance



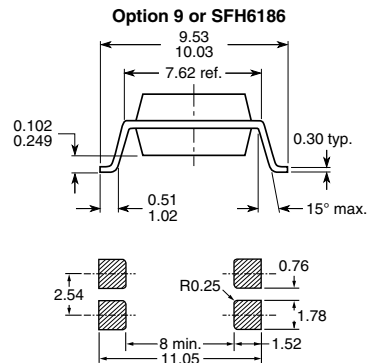
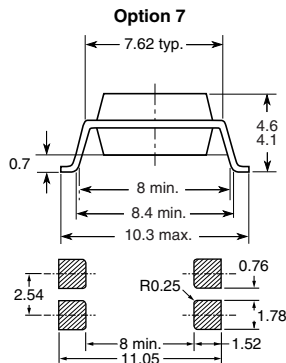
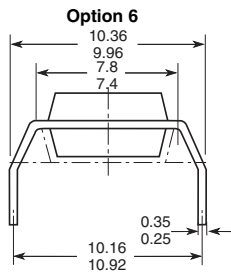
### PACKAGE DIMENSIONS in millimeters



SMD

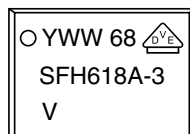


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### PACKAGE MARKING (example)



**SOLDER PROFILES**

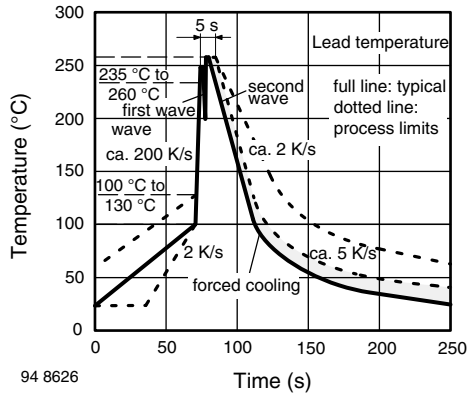


Fig. 11 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

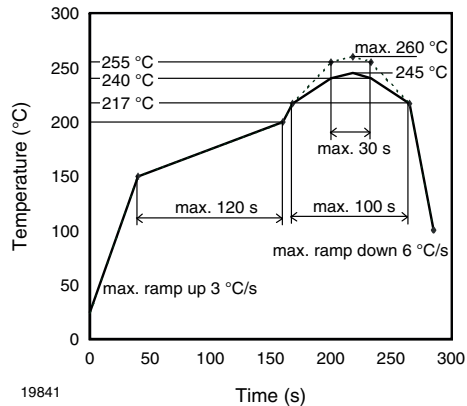


Fig. 12 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices



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