



**THE DATASHEET OF
SFH601-4X009T**



Optocoupler, Phototransistor Output, With Base Connection



23030



FEATURES

- Isolation test voltage, 5000 V_{RMS}
- Low coupling capacitance
- High common mode transient immunity
- Storage temperature, -55 ° to +150 °C
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

APPLICATIONS

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

AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\) available with option 1](#)
- [CQC](#)

DESIGN SUPPORT TOOLS AVAILABLE



DESCRIPTION

The SFH601 has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-6 package.

It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling device is designed for signal transmission between two electrically separated circuits.

ORDERING INFORMATION											
S	F	H	6	0	1	-	#	X	0	#	#
PART NUMBER							CTR BIN	PACKAGE OPTION			TAPE AND REEL
AGENCY CERTIFIED/PACKAGE		CTR (%)									
UL, cUL, CQC		40 to 80	63 to 125	100 to 200	160 to 320						
DIP-6		SFH601-1	SFH601-2	SFH601-3	-						
SMD-6, option 7				SFH601-3X007T	SFH601-4X007T						
SMD-6, option 9		-	-	SFH601-3X009	-						
VDE, UL, cUL, CQC		40 to 80	63 to 125	100 to 200	160 to 320						
DIP-6, 400 mil, option 6		-	SFH601-2X016	SFH601-3X016	-						
SMD-6, option 7		-	-	SFH601-3X017T	-						

Note

- Additional options may be possible, please contact sales office

ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	60	mA
Total power dissipation		P_{diss}	100	mW
OUTPUT				
Collector emitter voltage		V_{CEO}	100	V
Emitter base voltage		V_{EBO}	7	V
Collector current		I_C	50	mA
Power dissipation		P_{diss}	150	mW
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	$^{\circ}\text{C}$
Ambient temperature range		T_{amb}	-55 to +100	$^{\circ}\text{C}$
Soldering temperature	$t = 10\text{ s}$	T_{sld}	260	$^{\circ}\text{C}$

Note

- 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

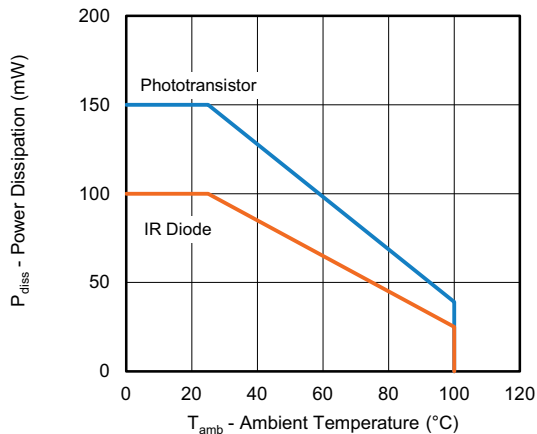


Fig. 1 - Power Dissipation vs. Ambient Temperature

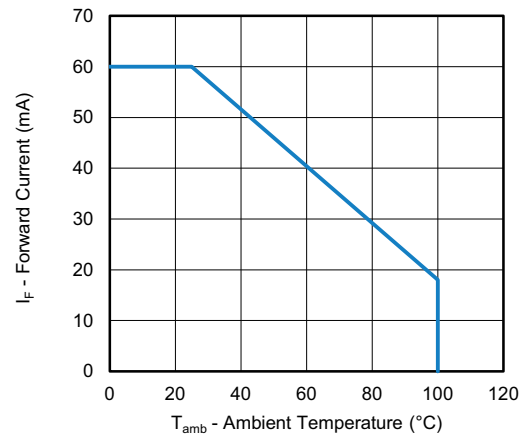


Fig. 2 - Maximum Forward Current vs. Ambient Temperature

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Forward voltage	$I_F = 60\text{ mA}$	V_F	-	1.45	1.65	V
Breakdown voltage	$I_R = 10\text{ }\mu\text{A}$	V_{BR}	6	-	-	V
Reverse current	$V_R = 6\text{ V}$	I_R	-	0.01	10	μA
Capacitance	$V_F = 0\text{ V}$, $f = 1\text{ kHz}$	C_I	-	-	100	pF
OUTPUT						
Collector emitter leakage current	$V_{CE} = 10\text{ V}$	I_{CEO}	-	2	50	nA
COUPLER						
Collector emitter saturation voltage	$I_F = 10\text{ mA}$, $I_C = 2.5\text{ mA}$	V_{CEsat}	-	0.125	0.4	V
Coupling capacitance	$V_{I-O} = 0$, $f = 1\text{ MHz}$	C_{IO}	-	0.6	-	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

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
I_C/I_F	$I_F = 10 \text{ mA}, V_{CE} = 5 \text{ V}$	SFH601-1	CTR	40	-	80	%
		SFH601-2	CTR	63	-	125	%
		SFH601-3	CTR	100	-	200	%
		SFH601-4	CTR	160	-	320	%

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$	t_{on}	-	3	-	μs
Turn-off time	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$	t_{off}	-	3	-	μs



Fig. 3 - Test Circuit for Switching Characteristics

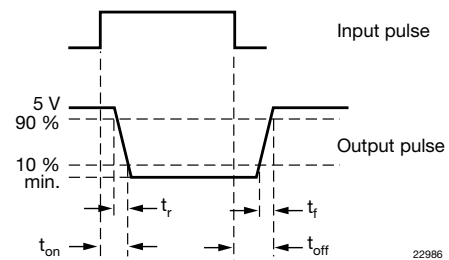


Fig. 4 - Parameter and Limit Definition

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, $t = 1 \text{ min}$	V_{ISO}	5000	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	8000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	890	V_{peak}
Isolation resistance	$T_{amb} = 25 \text{ }^\circ\text{C}, V_{IO} = 500 \text{ V}$	R_{IO}	$\geq 10^{12}$	Ω
	$T_{amb} = 100 \text{ }^\circ\text{C}, V_{IO} = 500 \text{ V}$	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	700	mW
Input safety current		I_{SI}	400	mA
Input safety temperature		T_{SI}	175	$^\circ\text{C}$
Creepage distance	DIP-6, SMD-6		≥ 7	mm
Clearance distance			≥ 7	mm
Creepage distance	DIP-6, 400 mil		≥ 8	mm
Clearance distance			≥ 8	mm
Insulation thickness		DTI	≥ 0.4	mm

Note

- As per IEC 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 ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

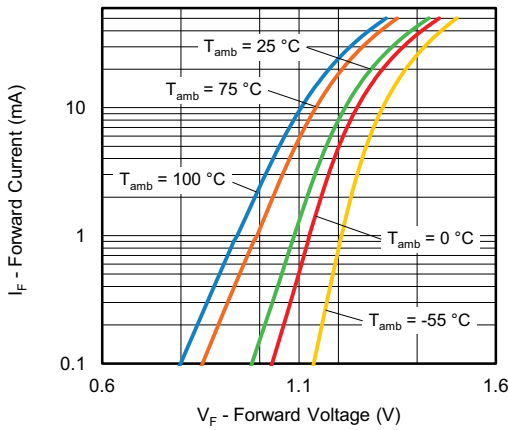


Fig. 5 - Forward Current vs. Forward Voltage

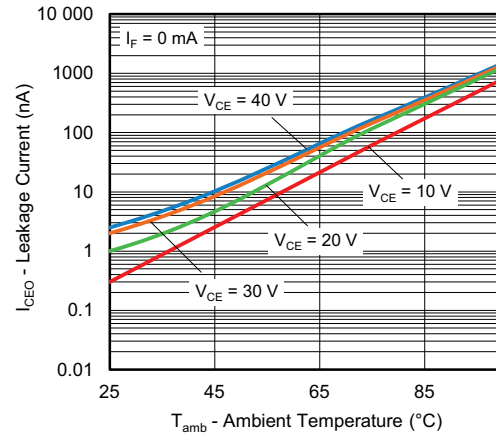


Fig. 8 - Leakage Current vs. Ambient Temperature

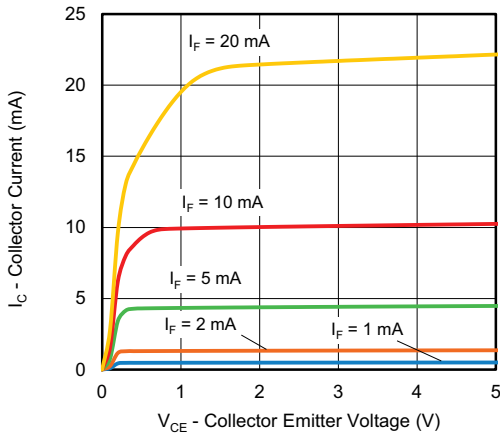


Fig. 6 - Collector Current vs. Collector Emitter Voltage (non-saturated)

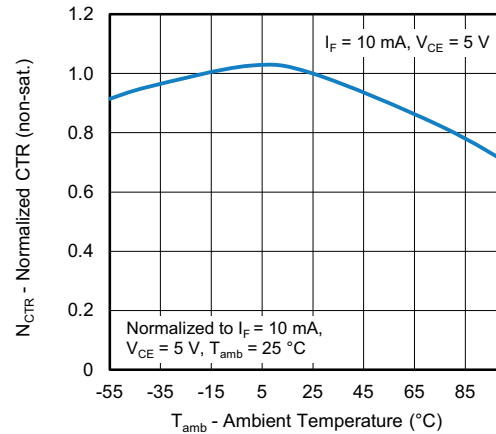


Fig. 9 - Normalized CTR vs. Ambient Temperature (non-saturated)

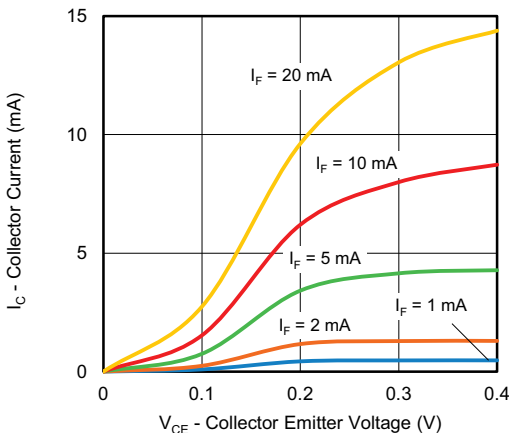


Fig. 7 - Collector Current vs. Collector Emitter Voltage (saturated)

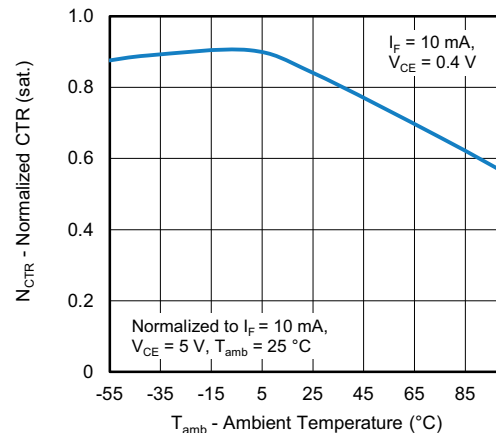


Fig. 10 - Normalized CTR vs. Ambient Temperature (saturated)

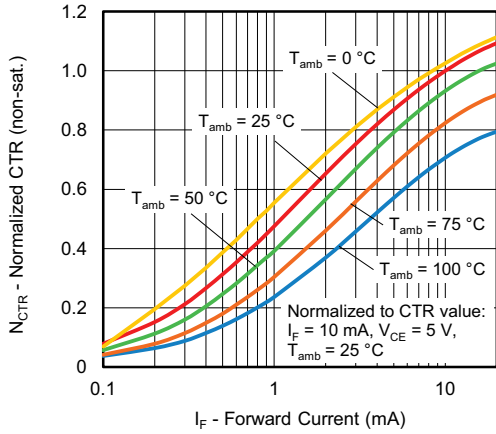


Fig. 11 - Normalized CTR vs. Forward Current (non-saturated)

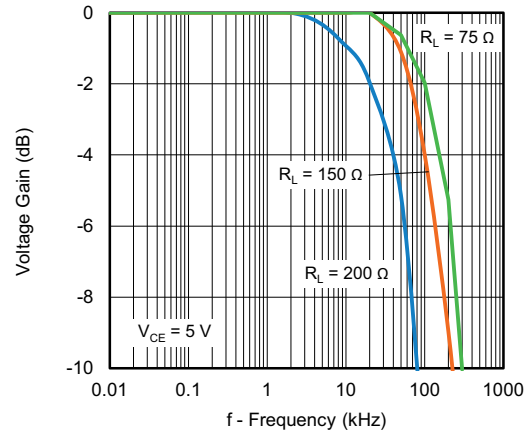


Fig. 13 - Voltage Gain vs. Frequency

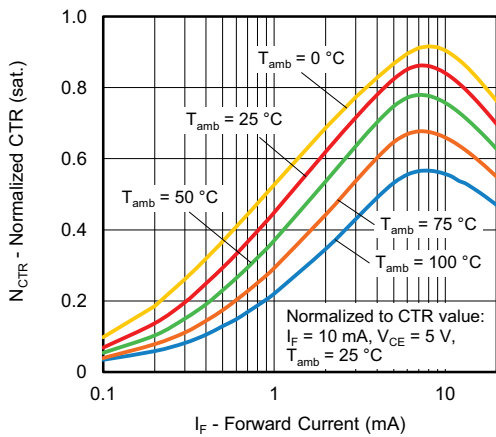


Fig. 12 - Normalized CTR vs. Forward Current (saturated)

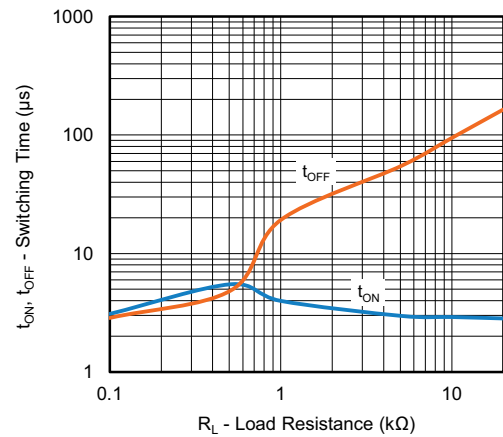
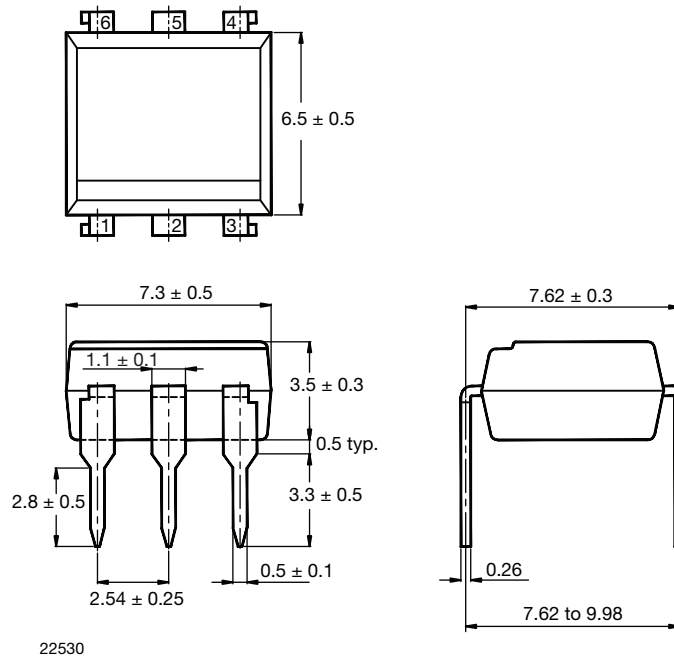


Fig. 14 - Switching Time vs. Load Resistance

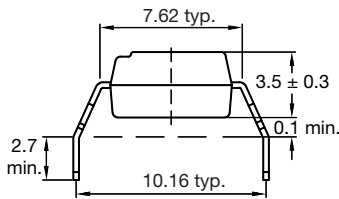
PACKAGE DIMENSIONS in millimeters

6 Pin Package



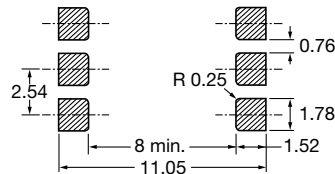
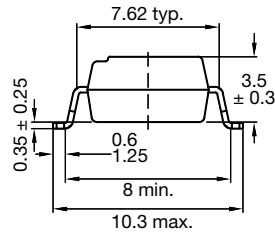
22530

Option 6

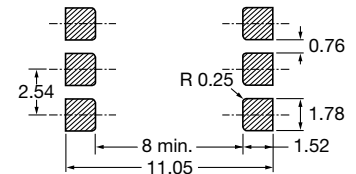
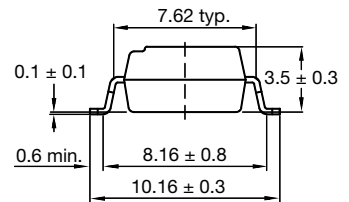


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Option 7



Option 9



PACKAGE MARKING

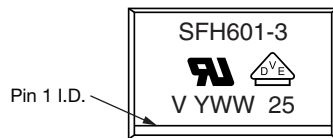


Fig. 15 - Example of SFH601

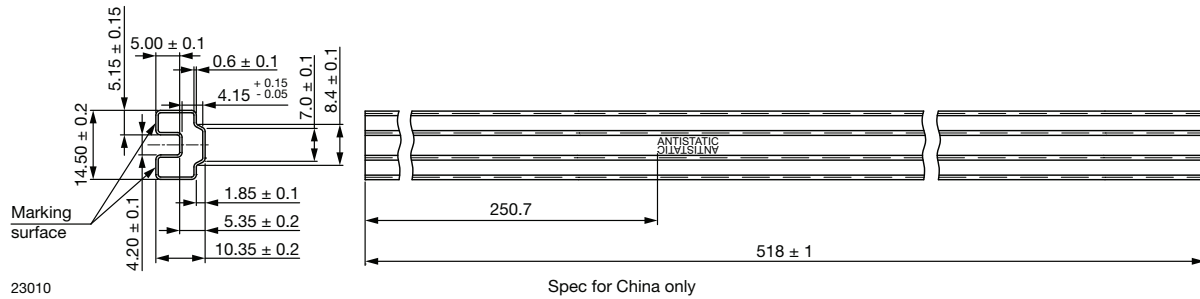
Notes

- "YWW" is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking

PACKAGING INFORMATION (in millimeters)

DEVICES PER TUBE			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-6	50	40	2000
DIP-6, option 6	50	40	2000
SMD-6, option 9	50	40	2000

DIP-6



Spec for China only

Fig. 16 - DIP-6

SMD-6

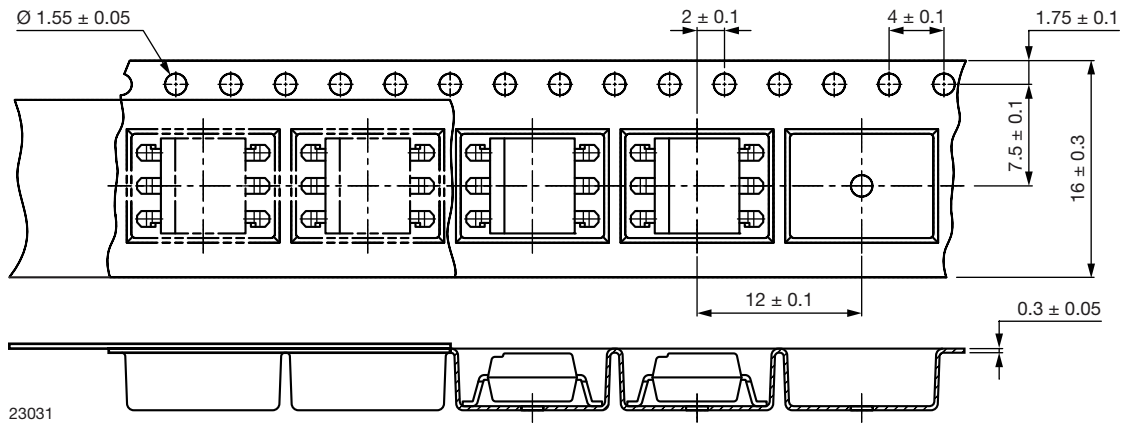


Fig. 17 - SMD-6

Reel



Fig. 18 - Tape and Reel Shipping Medium

SOLDER PROFILES

IR Reflow Soldering (JEDEC® J-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

PROFILE ITEM	CONDITIONS
Preheat	
- Temperature minimum ($T_{S \text{ min.}}$)	150 °C
- Temperature maximum ($T_{S \text{ max.}}$)	200 °C
- Time (min. to max.) (t_s)	90 s ± 30 s
Soldering zone	
- Temperature (T_L)	217 °C
- Time (t_L)	60 s
Peak temperature (T_p)	260 °C
Ramp-up rate	3 °C/s max.
Ramp-down rate	3 °C/s to 6 °C/s

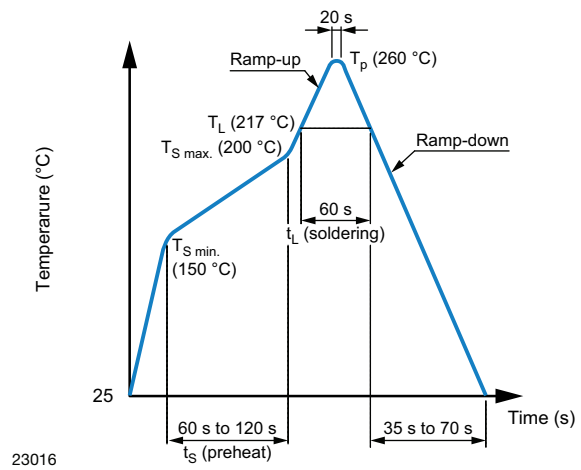


Fig. 19



Wave Soldering (JEDEC JESD22-A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s

Hand Soldering by Soldering Iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.



Fig. 20

23017



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