
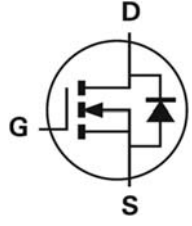
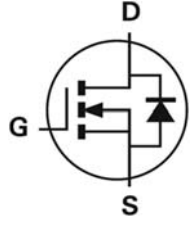


V_{DSS} , 60V $R_{DS(ON)}$, 13m Ω (max.) @ $V_{GS}=10V$ $R_{DS(ON)}$, 16m Ω (max.) @ $V_{GS}=4.5V$ I_D , 49A	TO-251D 	
	D 	

Description	Features
The SG60N10SI uses advanced Trench technology and designs to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.	<ul style="list-style-type: none"> • Low On-Resistance • Low Input Capacitance • Low Miller Charge • Low Input / Output Leakage • Pb-free lead plating; RoHS compliant
	Applications
	<ul style="list-style-type: none"> • Motor / Body Load Control • Automotive Systems • Load Switch • DC-DC converters and Off-line UPS

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG60N10SI	Halogen-Free	TO-251D	SI	Tube	75

Absolute Maximum Ratings ($T_A=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	$T_C=25^{\circ}C$	49
		$T_C=100^{\circ}C$	31
Drain Current-Pulsed ^{Note 1}	I_{DM}	100	A
Avalanche Current	I_{AS}	30	A
Avalanche Energy, L=0.1mH	E_{AS}	45	mJ
Maximum Power Dissipation	P_D	$T_C=25^{\circ}C$	52.1
		$T_C=100^{\circ}C$	20.8
Storage Temperature Range	T_{STG}	-55 to +150	$^{\circ}C$
Operating Junction Temperature Range	T_J	-55 to +150	$^{\circ}C$

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	Steady State	-	-	62	$^{\circ}C/W$
Maximum Junction-to-Case	$R_{\theta JC}$	Steady State	-	-	2.4	$^{\circ}C/W$

Electrical Characteristics (T_J=25°C unless otherwise noted)

OFF CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _{DS} =250μA	60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =48V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _{DS} =250μA	1.2	-	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _{DS} =14A	-	-	13	mΩ
Drain-Source On-State Resistance		V _{GS} =4.5V, I _{DS} =7A	-	-	16	mΩ
Forward Transconductance ^{Note 1}	g _{fs}	V _{DS} =10V, I _D =15A	-	11	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C _{iss}	V _{DS} =30V, V _{GS} =0V, f=1MHz	-	2037	-	pF
Output Capacitance	C _{oss}		-	160	-	
Reverse Transfer Capacitance	C _{rss}		-	78	-	
Gate Resistance	R _g	V _{GS} =0V, V _{DS} =0V, f=1MHz	-	0.6	-	Ω

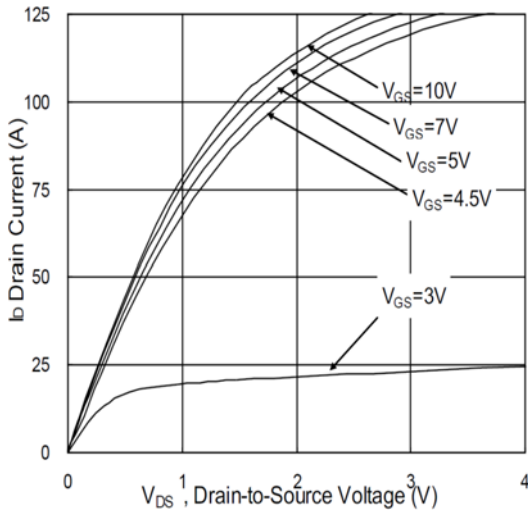
SWITCHING CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	T _{d(on)}	V _{DD} =15V, I _D =15A, V _{GS} =10V, R _g =6Ω	-	9.3	-	ns
Rise Time	t _r		-	27.4	-	
Turn-Off Delay Time	T _{d(off)}		-	43.9	-	
Fall Time	t _f		-	10.6	-	
Total Gate Charge	Q _g	V _{DS} =30V, I _{DS} =15A, V _{GS} =10V	-	38	-	nC
Gate to Source Gate Charge	Q _{gs}		-	5.7	-	
Gate to Drain "Miller" Charge	Q _{gd}		-	8.5	-	

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Body-Diode Continuous Current	I _S	V _G =V _D =0V, Force Current	-	-	49	A
Pulsed Source Current	I _{SM}	V _G =V _D =0V, Force Current	-	-	100	A
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =15A	-	-	1.2	V

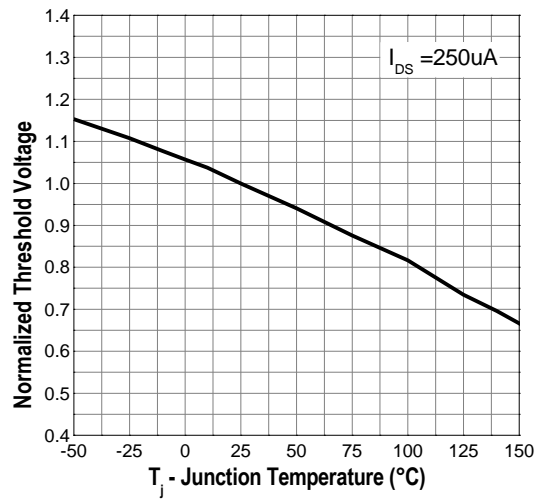
- Notes:**
- Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
 - R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{θJC} is guaranteed by design while R_{θJA} is determined by the user's board design. R_{θJA} shown below for single device operation on FR-4 in still air.

Typical Operating Characteristics

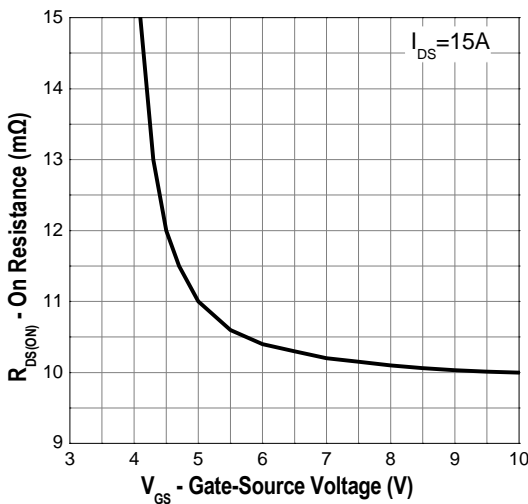
Output Characteristics



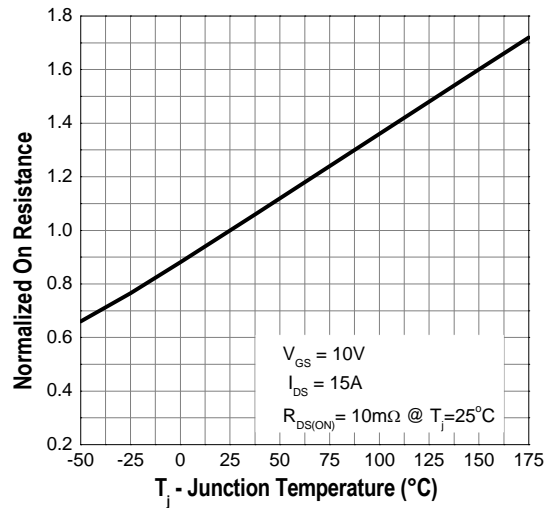
Gate Threshold Voltage



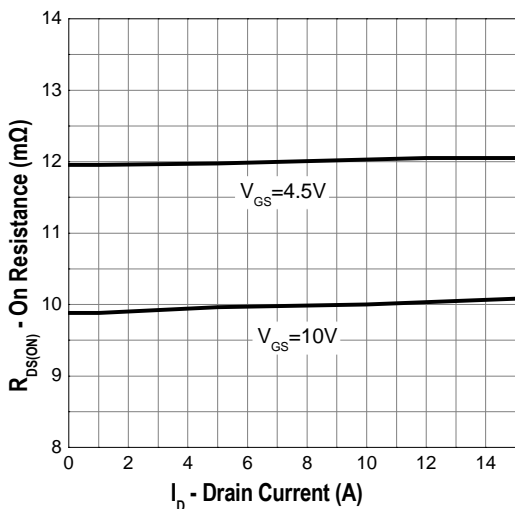
Gate-Source On Resistance



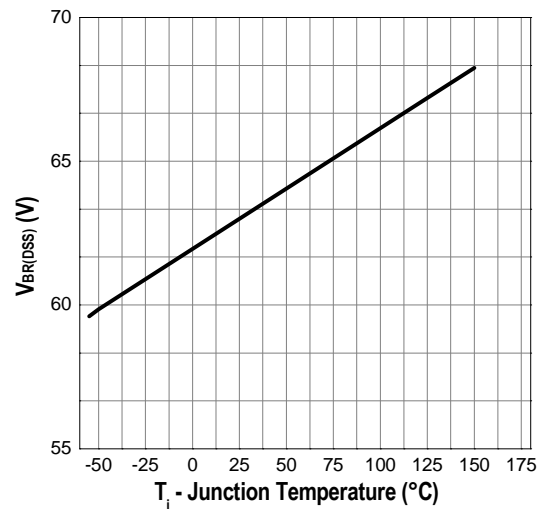
Drain-Source On Resistance



Drain-Source On Resistance

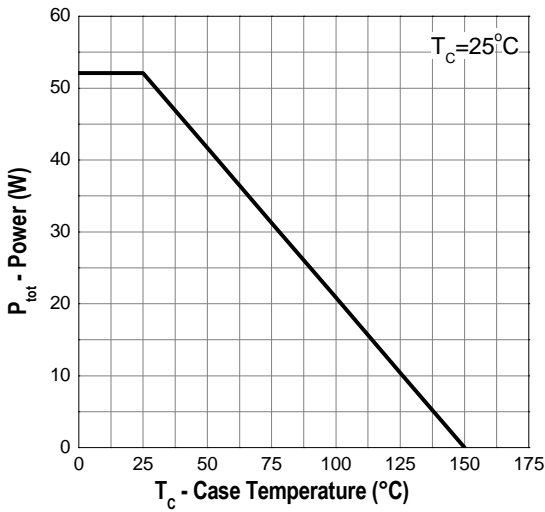


Drain-source Breakdown Voltage

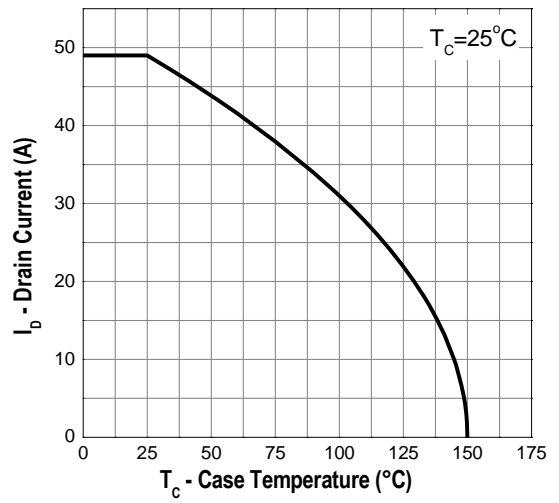


Typical Operating Characteristics (Cont.)

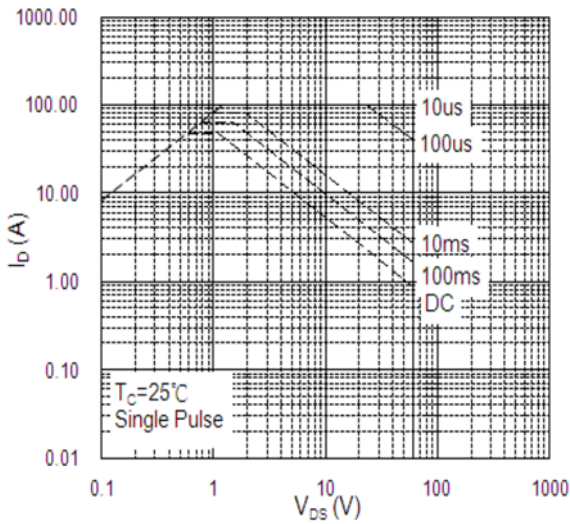
Power Dissipation



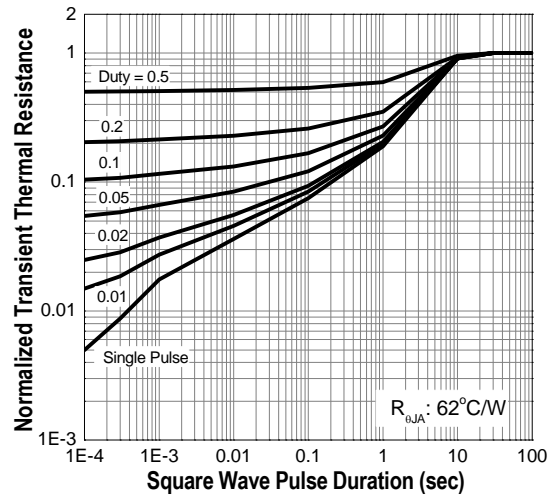
Drain Current



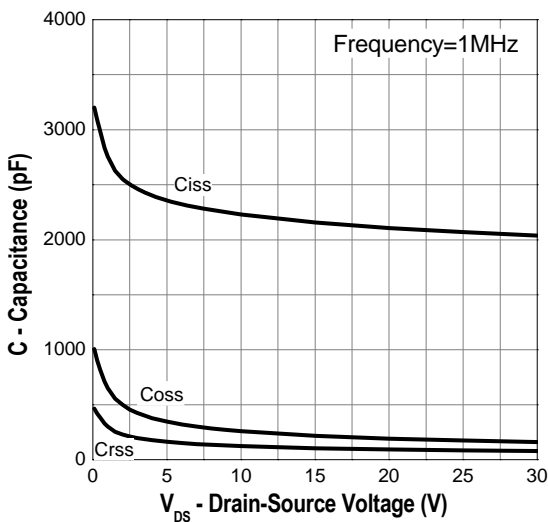
Safe Operation Area



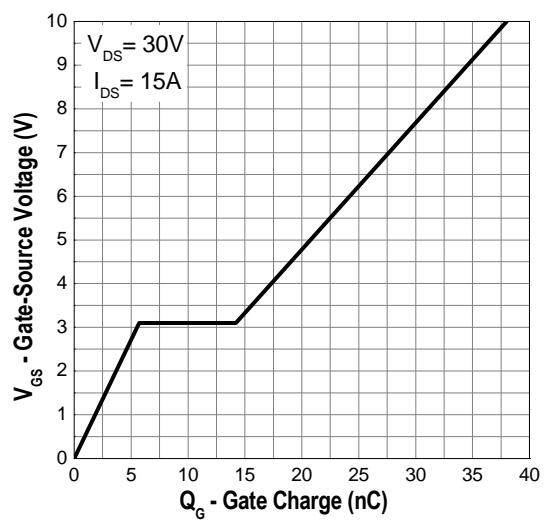
Transient Thermal Impedance



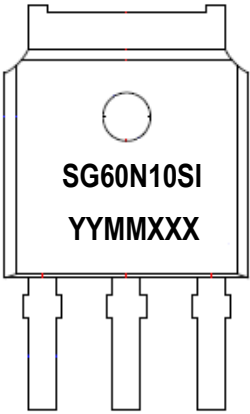
Capacitance



Gate Charge

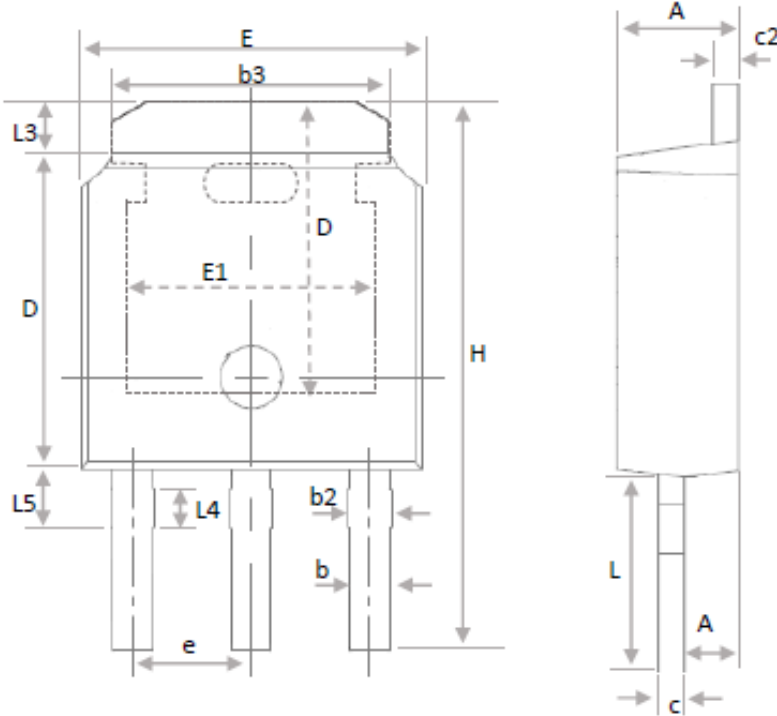


Marking Information

TO-251D (SI)	Marking Rule
<p>Laser Marking</p>  <p>Diagram</p>	<p><u>Line 1</u> : Device SG60N10SI</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month Code XXX : Serial Number</p>

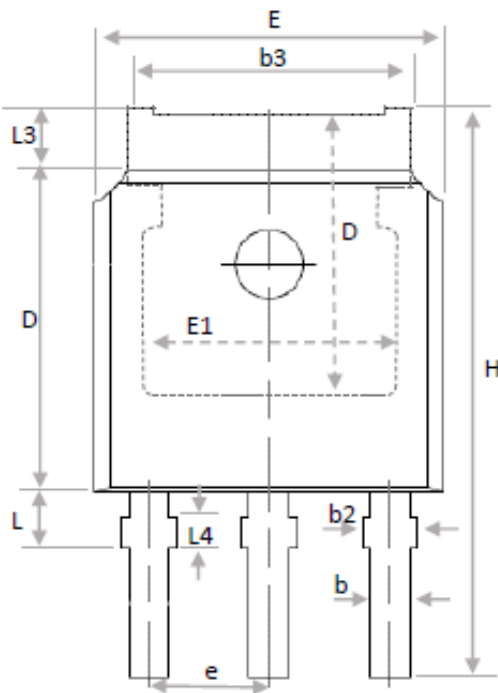
Package of Dimension

G-TYPE



Symbol	Min	Nor	Max
E	6.40	6.57	6.731
L	3.35	3.50	3.65
L3	0.89	1.08	1.27
L4	0.698 Ref.		
L5	0.900	1.063	1.226
D	6.00	6.11	6.223
H	10.240	10.690	11.140
b	0.64	0.76	0.88
b2	0.72	0.93	1.14
b3	5.13	-	-
e	2.19	2.29	2.39
A	2.200	2.290	2.380
A1	0.89	1.02	1.15
c	0.46	0.53	0.60
c2	0.46	0.53	0.60
D1	5.10	-	-
E1	4.40	-	-

P-TYPE

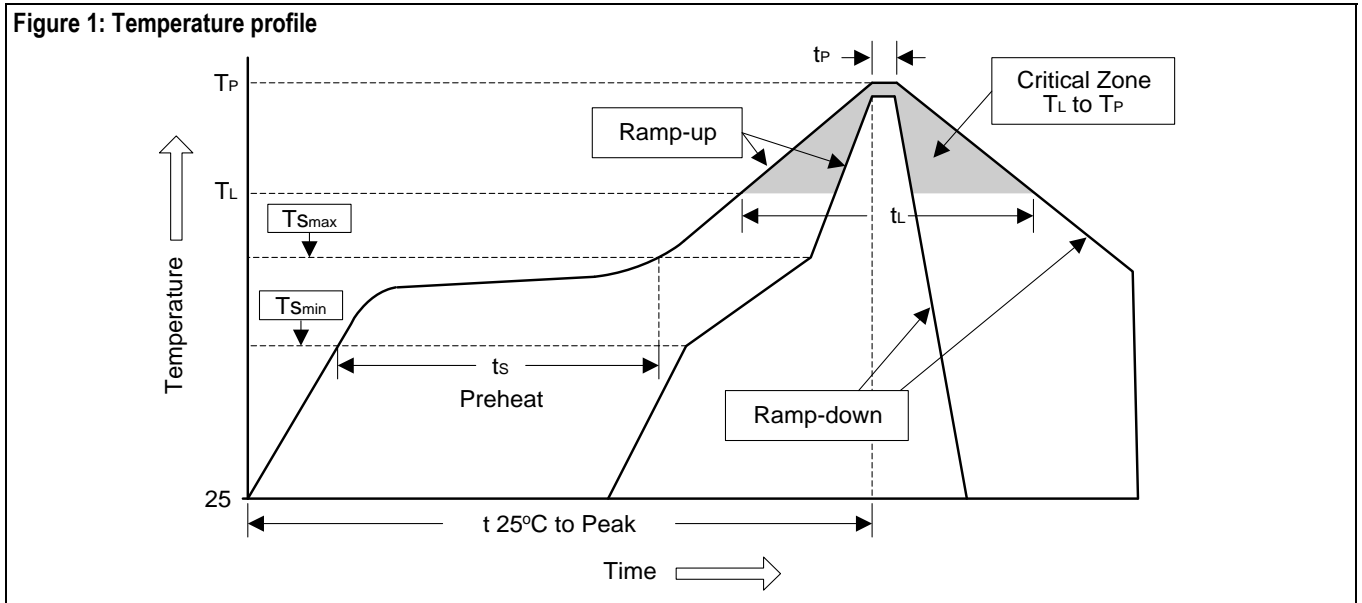


1. All dimension are in millimeters.
2. Dimension does not include burrs and mold flash/protrusions.

Soldering Methods for Silicongear's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{Smin})	100°C	150°C
- Temperature Max (T_{Smax})	150°C	200°C
- Time (min to max) (t_s)	60 to 120 sec	60 to 180 sec
T_{Smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60 to 150 sec	60 to 150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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