

$V_{DS}$ , 30V $R_{DS(ON)}$ , 18m $\Omega$ (max.) @ $V_{GS}=10V$ $R_{DS(ON)}$ , 28m $\Omega$ (max.) @ $V_{GS}=4.5V$ $I_D$ , 28A	<b>PDFN 3.3x3.3-8L</b>		

Description	Features
The SGN3013E 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"> <li>• Low On-Resistance</li> <li>• Low Input Capacitance</li> <li>• Low Miller Charge</li> <li>• Low Input / Output Leakage</li> <li>• Pb-free lead plating; RoHS compliant</li> </ul>
	<b>Applications</b> <ul style="list-style-type: none"> <li>• Lithium-Ion Secondary Batteries</li> <li>• Notebook PCs</li> <li>• Load Switch</li> <li>• DC-DC converters and Off-line UPS</li> </ul>

### Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SGN3013E	Halogen-Free	PDFN 3.3x3.3-8L	E	Tape & Reel	5,000

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

Parameter	Symbol	Value	Unit	
Drain-Source Voltage	$V_{DS}$	30	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V	
Drain Current-Continuous	$I_D$	$T_C=25^\circ\text{C}$	28	A
		$T_C=100^\circ\text{C}$	18	A
		$T_A=25^\circ\text{C}$	8	A
		$T_A=70^\circ\text{C}$	6	A
Drain Current-Pulsed <small>Note 1</small>	$I_{DM}$	60	A	
Avalanche Current	$I_{AS}$	22	A	
Avalanche Energy, $L=0.1\text{mH}$	$E_{AS}$	24.2	mJ	
Maximum Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	20.8	W
		$T_C=100^\circ\text{C}$	8.3	W
		$T_A=25^\circ\text{C}$	1.7	W
		$T_A=70^\circ\text{C}$	1.1	W
Operating Junction Temperature Range	$T_J$ $T_{STG}$	-55 to +150	$^\circ\text{C}$	

### Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	Steady State	-	-	75	$^\circ\text{C/W}$
Maximum Junction-to-Case	$R_{\theta JC}$	Steady State	-	-	6	$^\circ\text{C/W}$

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

OFF CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	30	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.2	-	2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>DS</sub> =10A	-	-	18	mΩ
Drain-Source On-State Resistance		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =5A	-	-	28	mΩ
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =1A	-	4	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	-	560	-	pF
Output Capacitance	C <sub>oss</sub>		-	79	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	63	-	
Gate Resistance	R <sub>g</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	-	2	-	Ω

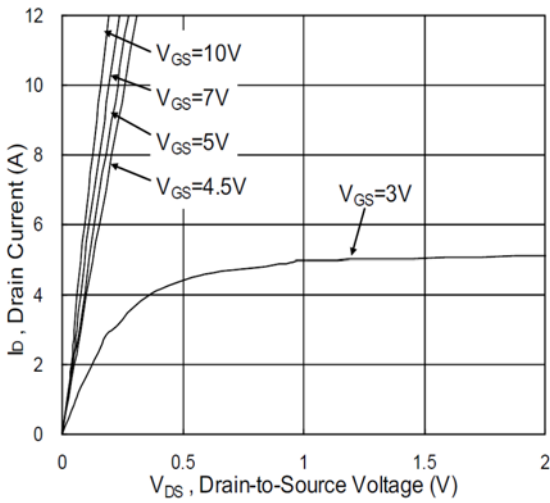
SWITCHING CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>DD</sub> =15V, I <sub>D</sub> =5A, V <sub>GS</sub> =10V, R <sub>GEN</sub> =3.3Ω	-	4	-	ns
Rise Time	t <sub>r</sub>		-	9.6	-	
Turn-Off Delay Time	T <sub>d(off)</sub>		-	15.1	-	
Fall Time	t <sub>f</sub>		-	5.9	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	-	7.2	-	nC
Gate to Source Gate Charge	Q <sub>gs</sub>		-	1.4	-	
Gate to Drain "Miller" Charge	Q <sub>gd</sub>		-	2.2	-	

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Body-Diode Continuous Current	I <sub>S</sub>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	-	-	28	A
Pulsed Source Current	I <sub>SM</sub>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	-	-	60	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A	-	0.8	1.2	V

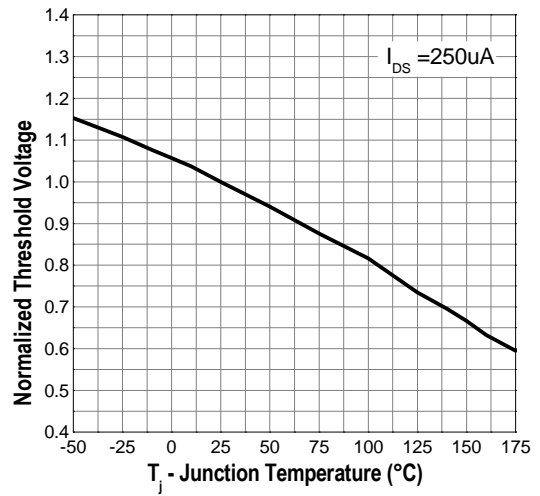
- Notes:**
1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
  2. R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R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

Typical Operating Characteristics

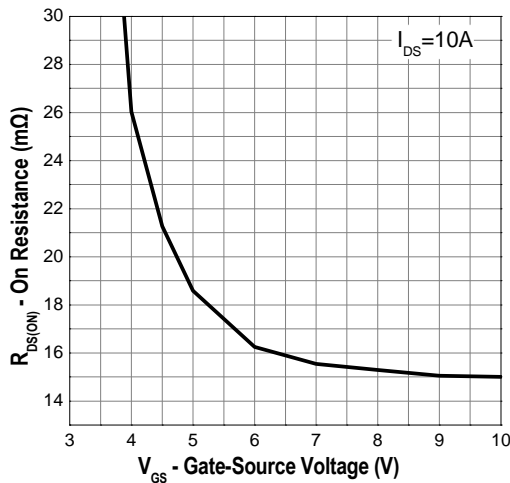
Output Characteristics



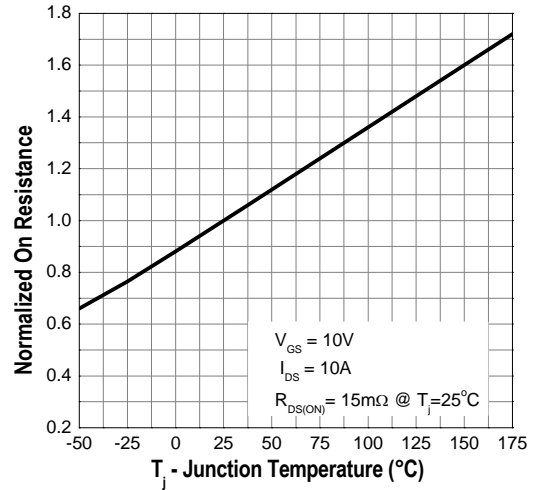
Gate Threshold Voltage



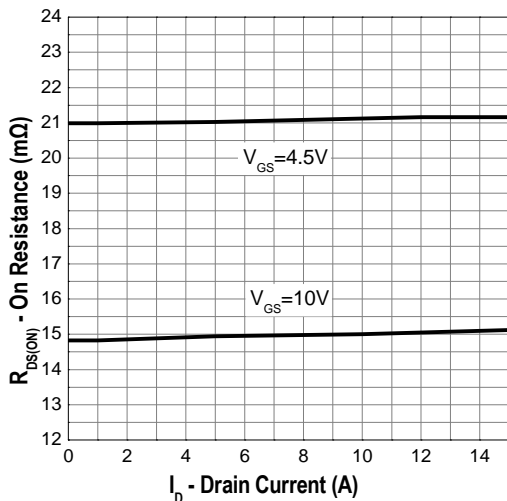
Gate-Source On Resistance



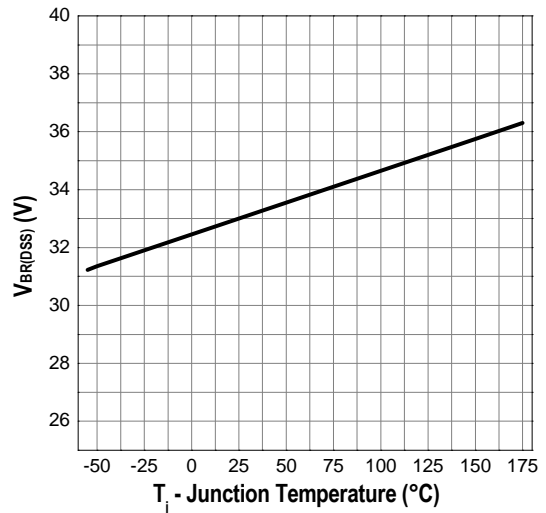
Drain-Source On Resistance



Drain-Source On Resistance

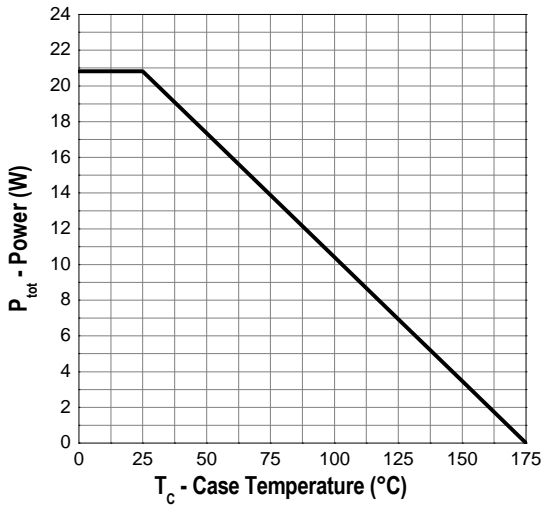


Drain-source Breakdown Voltage

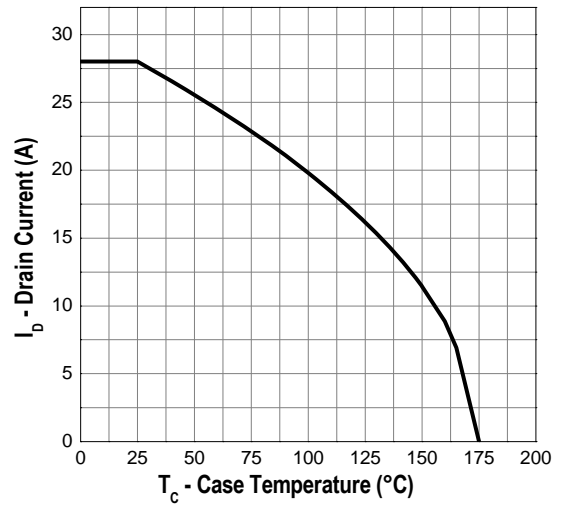


Typical Operating Characteristics (Cont.)

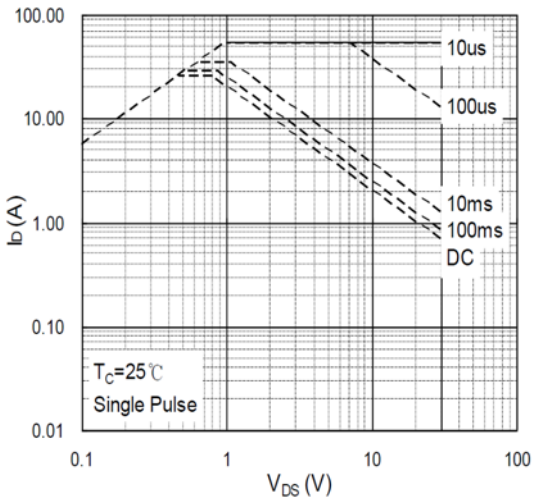
Power Dissipation



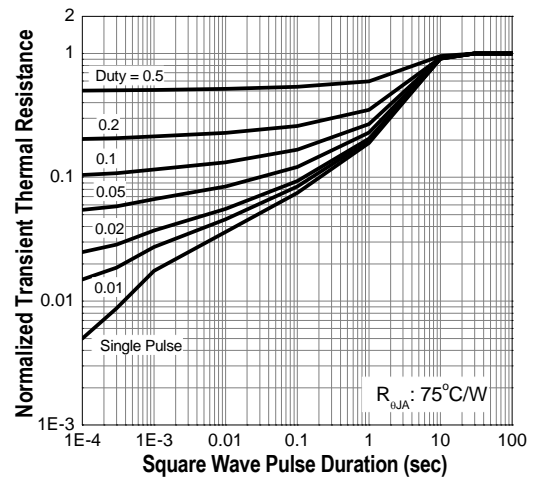
Drain Current



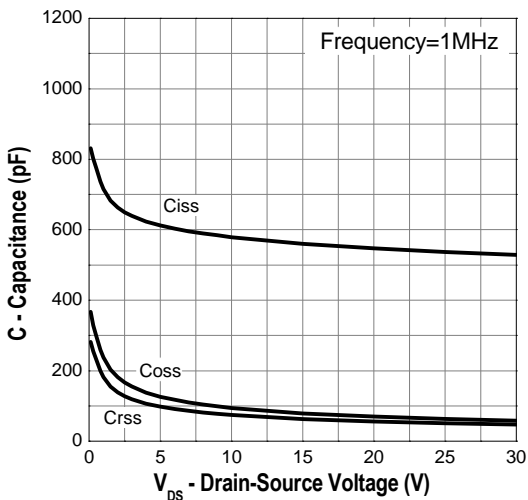
Safe Operation Area



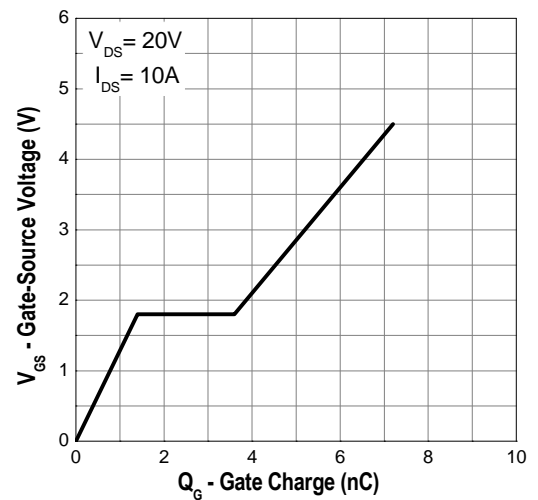
Transient Thermal Impedance




Capacitance



Gate Charge



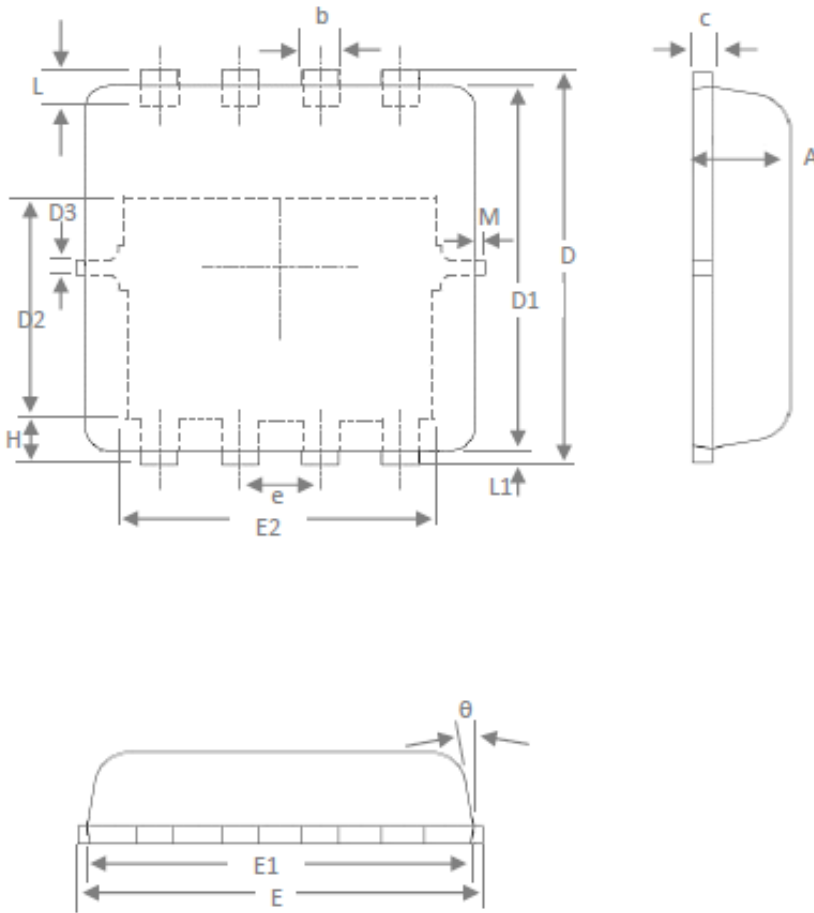
## Marking Information

PDFN 3.3x3.3-8L (E)	Marking Rule
<p>Laser Marking</p> 	<p><u>Line 1</u> : Device N3013E</p> <p><u>Line 2</u> : Date Code YMMXXX</p> <p>Y : Year Code MM : Month Code XXX : Serial Number</p> <p>Year Code Description As Below</p>

## Year Code Description

Year Code	Year	
0	2010	2020
1	2011	2021
2	2012	2022
3	2013	2023
4	2014	2024
5	2015	2025
6	2016	2026
7	2017	2027
8	2018	2028
9	2019	2029

**Package of Dimension**



Symbol	Min	Nor	Max
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.78	1.88	1.98
D3	-	0.13	-
E	3.00	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
θ	-	10°	12°
M	-	-	0.15

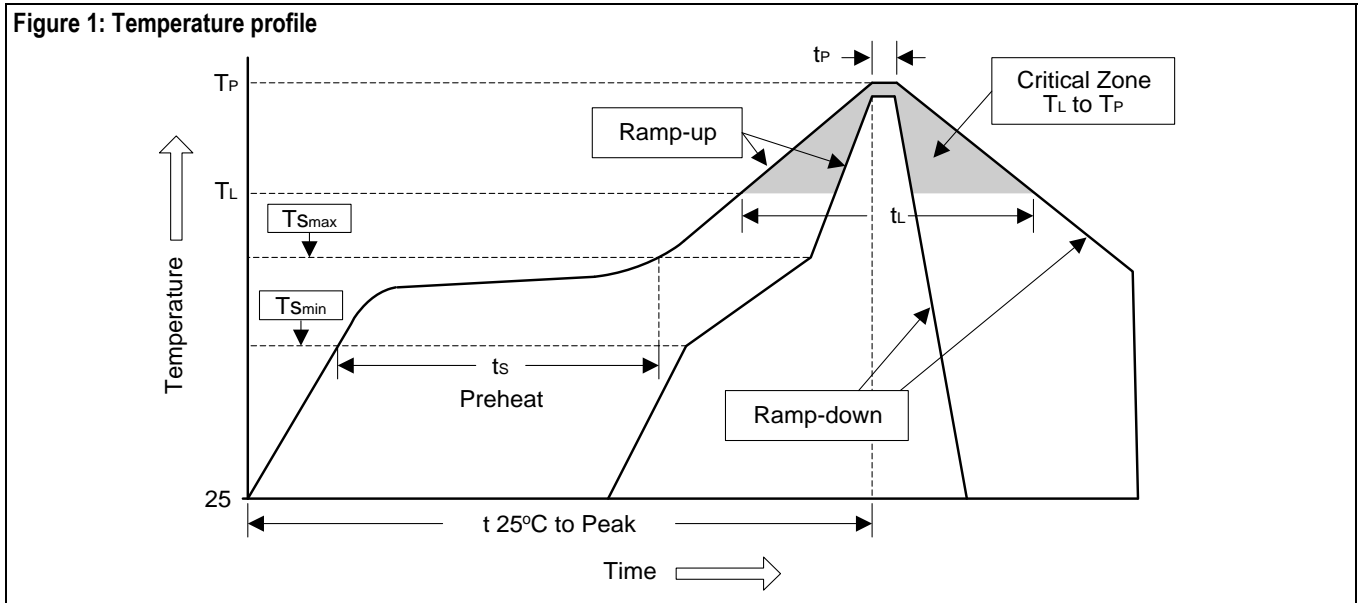
**Note:**

1. All Dimension Are In mm.
2. Package Body Sizes Exclude Mold Flash, Protrusion Or Gate Burrs.  
Mold Flash, Protrusion Or Gate Burrs Shall Not Exceed 0.10 mm Per Side.
3. Package Body Sizes Determined At The Outermost Extremes Of The Plastic Body  
Exclusive Of Mold Flash, Tie Bar Burrs, Gate Burrs And Interlead Flash,  
But Including Any Mismatch Between The Top And Bottom Of The Plastic Body.

## 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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