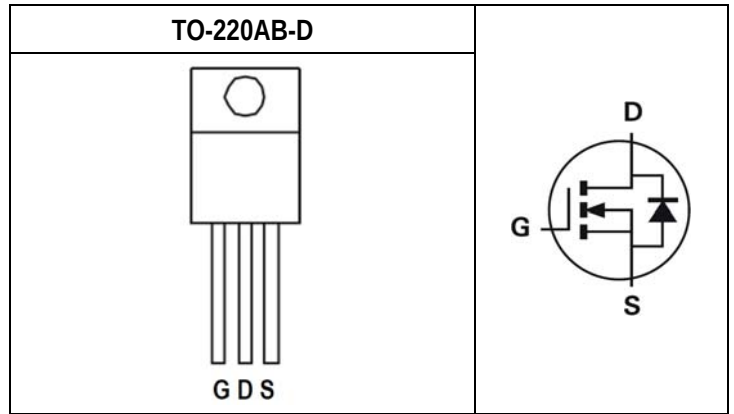


Key Performance Parameters		
Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(ON) \text{ max. } V_{GS}=10V}$	3	mΩ
I_D	84	A
Q_g	67.7	nC
Q_{gd}	21.1	nC
Q_{SW}	28.8	nC
$Q_{g(sync)}$	46.6	nC



Features	Application
- Optimized for synchronous rectification - Low Input Capacitance - Low Switching Charge - Low Miller Capacitance - Fully Characterized Capacitance and Avalanche - Pb-free lead plating; RoHS compliant	- Battery powered circuits - BLDC Motor drive applications - Half-bridge and full-bridge topologies - Synchronous rectifier applications - Resonant mode power supplies

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
DG60N05HPB	Halogen-Free	TO-220AB-D	PB	Tube	50

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

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	V
Drain Current-Continuous ^{Note 4}	$T_C=25^\circ\text{C}$	I_D	84	A
	$T_C=100^\circ\text{C}$		84	A
Drain Current-Pulsed ^{Note 1}	$T_C=25^\circ\text{C}$	I_{DM}	262	A
Avalanche Current		I_{AR}	43	A
Single Pulse Avalanche Energy ^{Note 3}		E_{AS}	92	mJ
Maximum Power Dissipation	$T_C=25^\circ\text{C}$	P_{tot}	223	W
Operating and Storage Temperature Range		T_J	150	$^\circ\text{C}$

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance, Junction-to-Ambient ^{Note 2}	$R_{\theta JA}$	Steady State	-	45.3	-	$^\circ\text{C/W}$
Thermal resistance, Junction-to-Case	$R_{\theta JC}$	Steady State	-	0.56	-	$^\circ\text{C/W}$

Notes:

- Pulse Test: Pulse Width $\leq 10\text{ms}$, Duty Cycle $\leq 1\%$.
- $R_{\theta JA}$ 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. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 in still air.
- Starting $T_J=25^\circ\text{C}$, $L=0.1\text{mH}$, $V_G=10\text{V}$, Rated $V_{DS}=60\text{V}$ N-CH
- The maximum current rating is package limited.

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

STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_{DS}=250\mu A$	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=48V, V_{GS}=0V, T_J=25^\circ C$	-	-	10	μA
		$V_{DS}=48V, V_{GS}=0V, T_J=125^\circ C$	-	-	100	μA
Gate-Body Leakage	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA

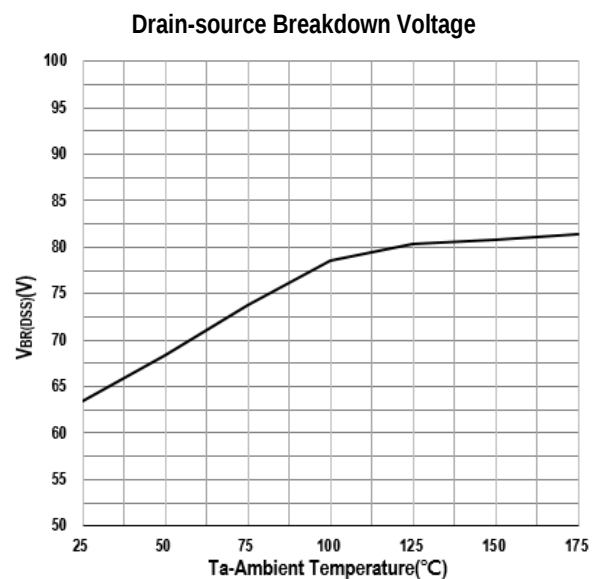
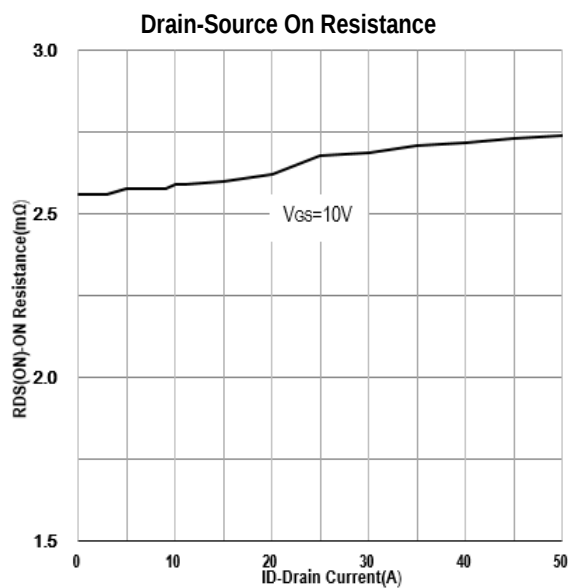
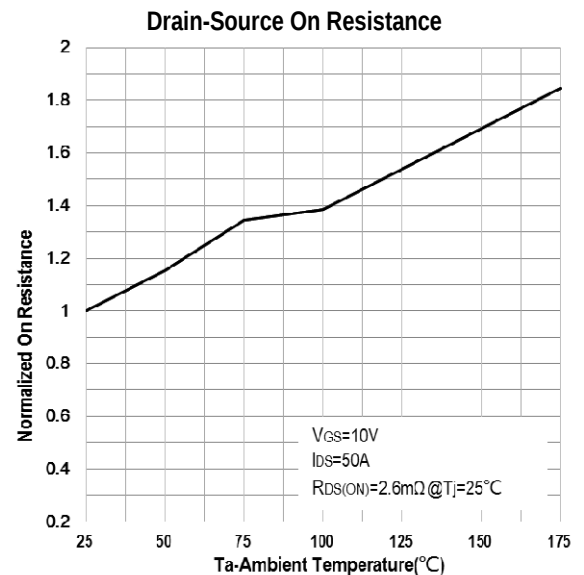
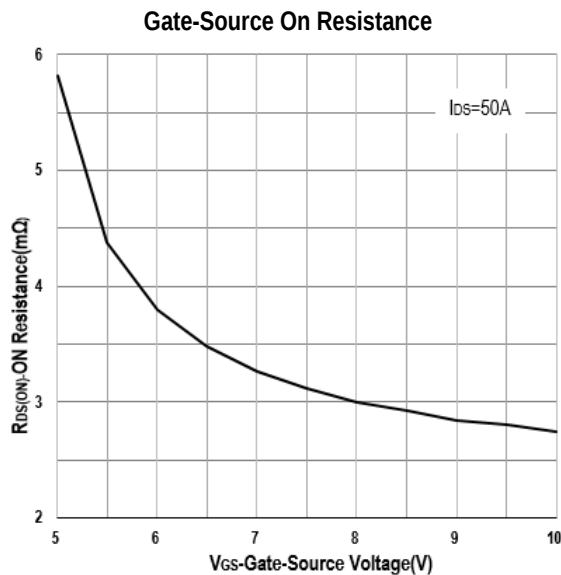
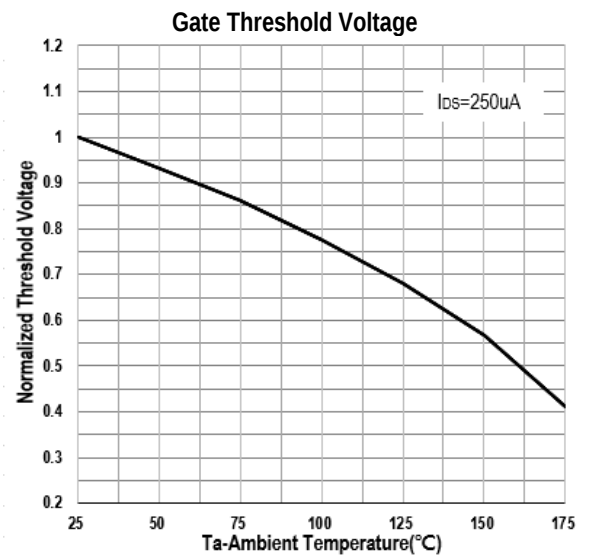
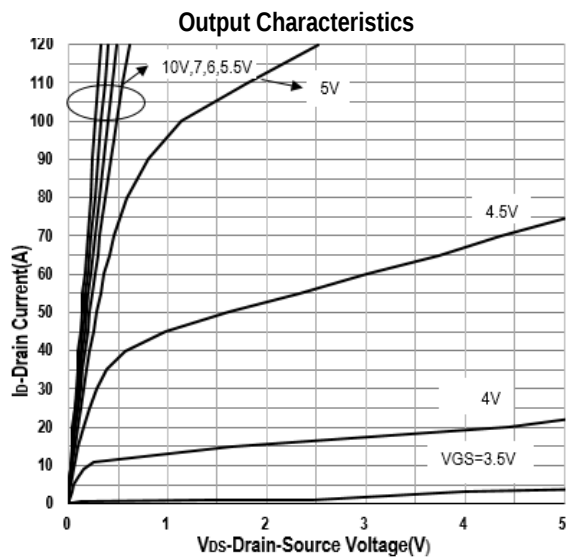
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	2	2.6	3.4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_{DS}=50A$	-	-	3.0	m Ω
Gate Resistance	R_g	$V_{GS}=0V, V_{DS}=0V, f=1MHz$	-	0.9	2	Ω
Forward Transconductance	g_{fs}	$V_{DS}=5V, I_{DS}=20A$	-	14	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	$V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	3762	-	pF
Output Capacitance	C_{oss}		-	1867	-	pF
Reverse Transfer Capacitance	C_{rss}		-	126	-	pF
Turn-On Delay Time	$T_{d(on)}$	$V_{DS}=30V, V_{GS}=10V, I_{DS}=50A, R_{GEN}=4.7\Omega$	-	15.4	-	ns
Rise Time	t_r		-	85.6	-	ns
Turn-Off Delay Time	$T_{d(off)}$		-	45.9	-	ns
Fall Time	t_f		-	111.8	-	ns

GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q_{gs}	$V_{DD}=30V, I_D=50A$	-	18.1	-	nC
Gate charge at threshold	$Q_{g(th)}$	$V_{DD}=30V, I_D=50A$	-	10.2	-	nC
Gate to Drain Charge	Q_{gd}	$V_{DD}=30V, I_D=50A$	-	21.1	-	nC
Switching charge	Q_{SW}	$V_{DD}=30V, I_D=50A$	-	28.8	-	nC
Gate charge total	Q_g	$V_{DD}=30V, I_D=50A, V_{GS}=0 \text{ to } 10V$	-	67.7	-	nC
Gate plateau voltage	$V_{plateau}$	$V_{DD}=30V, I_D=50A$	-	4.7	-	V
Gate charge total, sync. FET ($Q_g - Q_{gd}$)	$Q_{g(sync)}$	$V_{DS}=0.1V$	-	46.6	-	nC

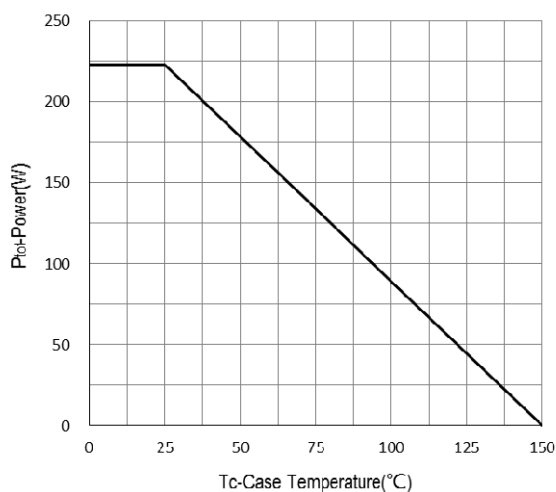
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_F=50A$	-	-	1.3	V
Body Diode Reverse Recovery Time	t_{rr}	$V_{DD}=30V, I_F=50A, di/dt=100A/\mu s$	-	49.0	-	ns
		$V_{DD}=30V, I_F=50A, di/dt=200A/\mu s$	-	41.8	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}	$V_{DD}=30V, I_F=50A, di/dt=100A/\mu s$	-	50.1	-	nC
		$V_{DD}=30V, I_F=50A, di/dt=200A/\mu s$	-	84.5	-	nC
Reverse Recovery Current	I_{RRM}	$V_{DD}=30V, I_F=50A, di/dt=100A/\mu s$	-	1.8	-	A
		$V_{DD}=30V, I_F=50A, di/dt=200A/\mu s$	-	3.4	-	A

Typical Operating Characteristics

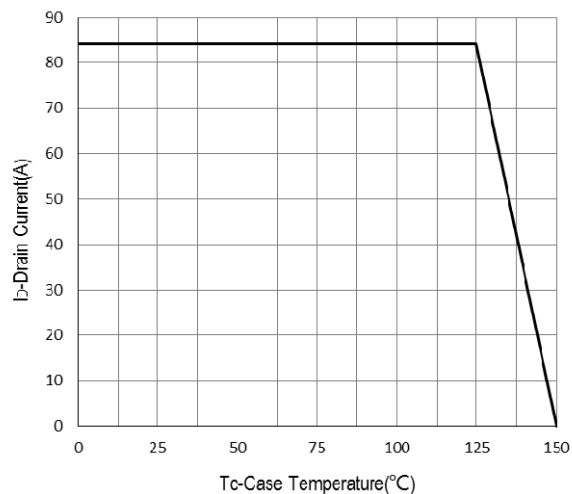


Typical Operating Characteristics (Cont.)

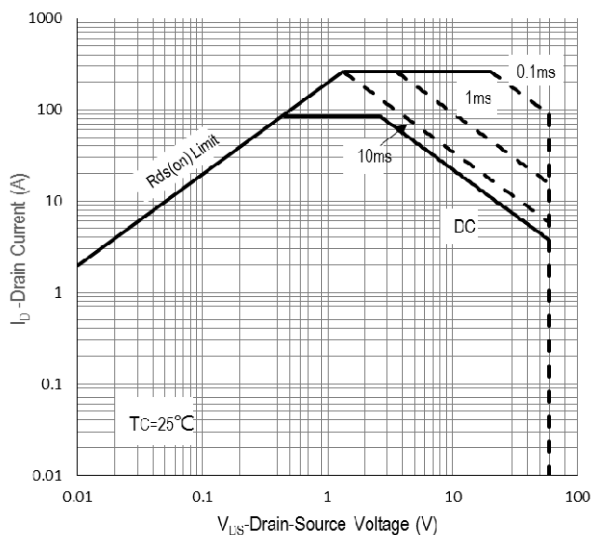
Power Dissipation



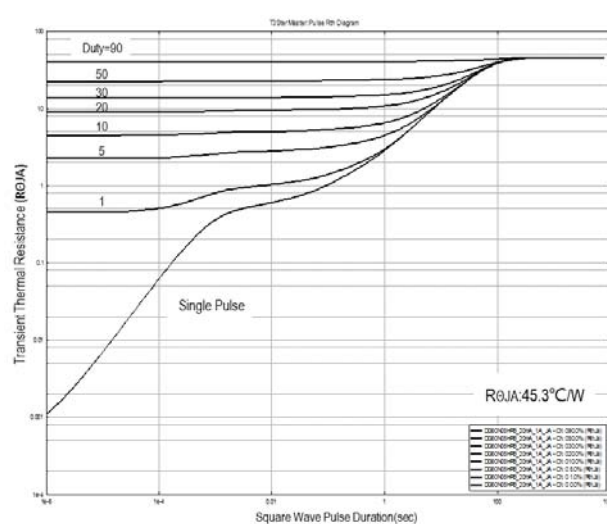
Drain Current



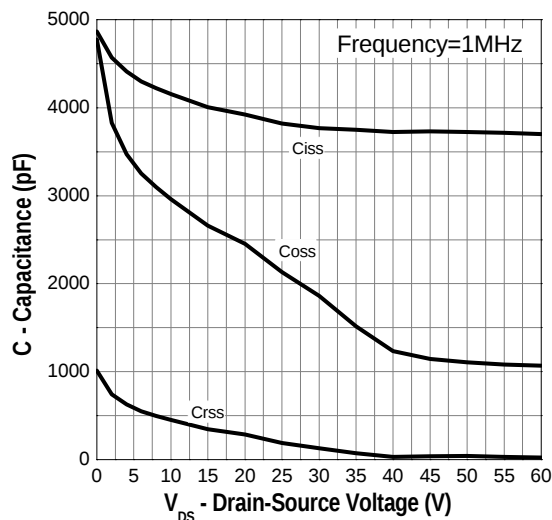
Safe Operation Area



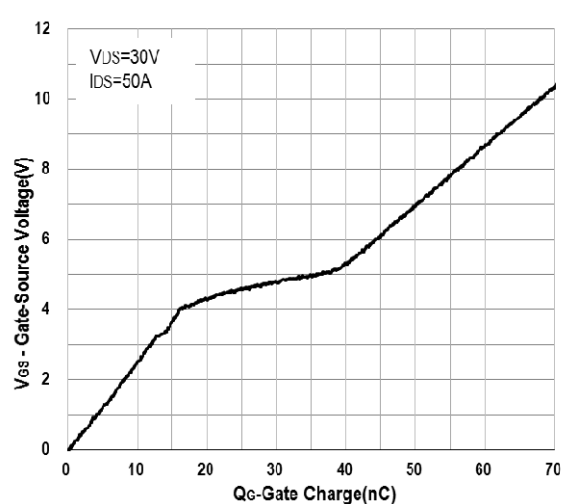
Transient Thermal Impedance



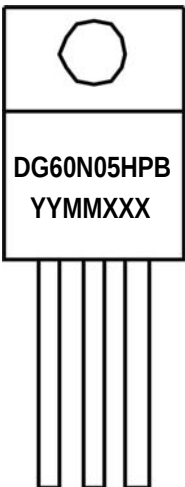
Capacitance



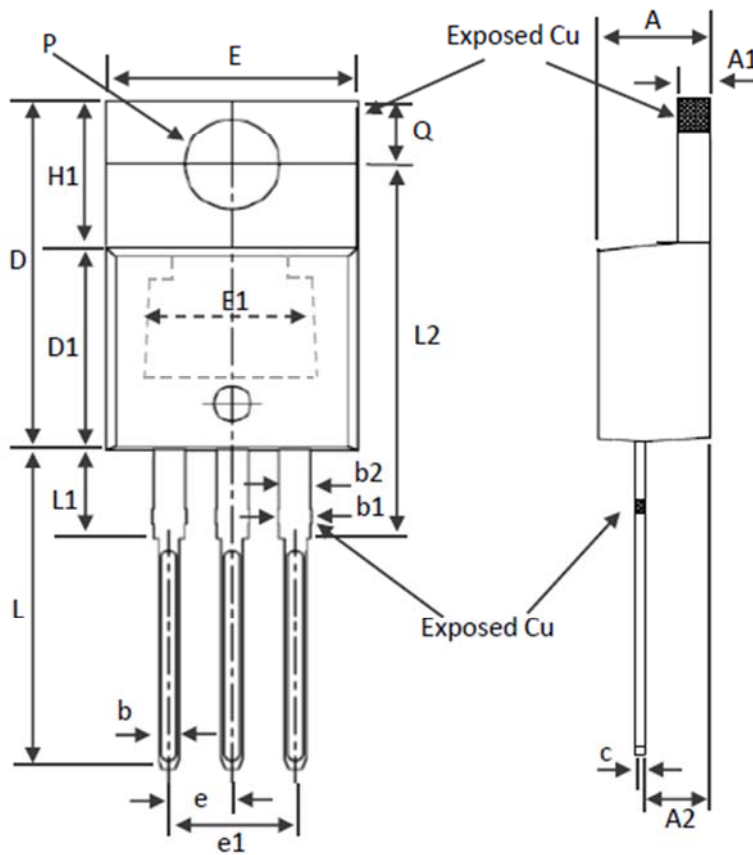
Gate Charge



Marking Information

TO-220AB-D (PB)	Marking Rule
Laser Marking 	<u>Line 1</u> : Device Name DG60N05HPB <u>Line 2</u> : Date Code YYMMXXX YY : Year Code MM : Month XXX : Serial Number

Package of Dimension



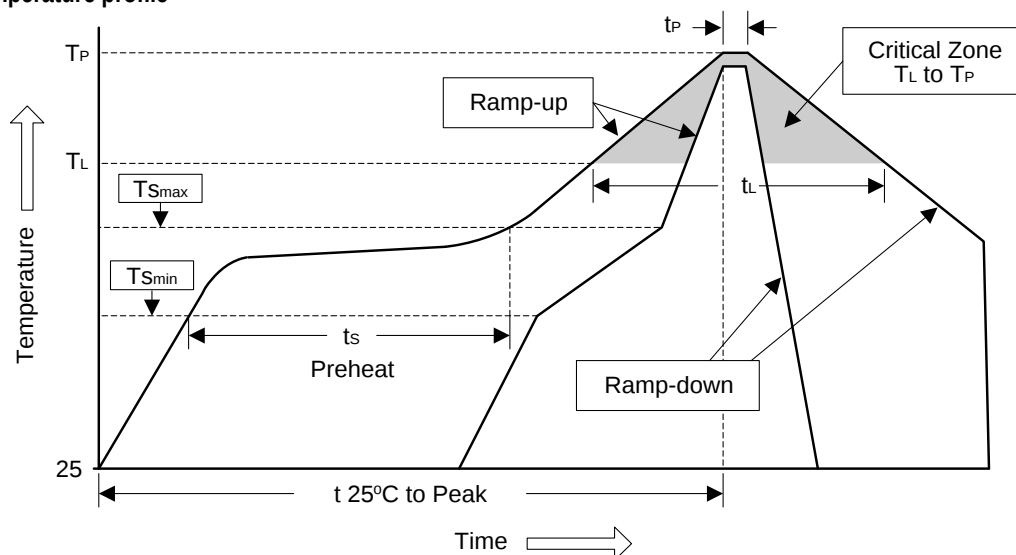
Symbol	Min	Nor	Max
A	3.56	4.57	4.82
A1	0.51	1.27	1.39
A2	2.04	2.67	2.92
b	0.39	0.81	1.01
b1	1.15	1.37	1.82
b2	1.15	1.27	1.77
D	14.22	15.00	16.51
D1	8.39	8.70	9.01
D2	11.45	11.94	12.87
E	9.66	10.11	10.66
E1	6.86	7.00	8.89
e	2.54 Ref.		
e1	5.08 Ref.		
H1	5.85	6.30	6.85
L	12.70	13.60	14.73
L1	-	3.75	6.35
L2	15.80	16.00	16.20
P	3.54	3.87	4.08
Q	2.54	2.74	3.42

1. All dimension are in millimeters.
2. Dimension dose 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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