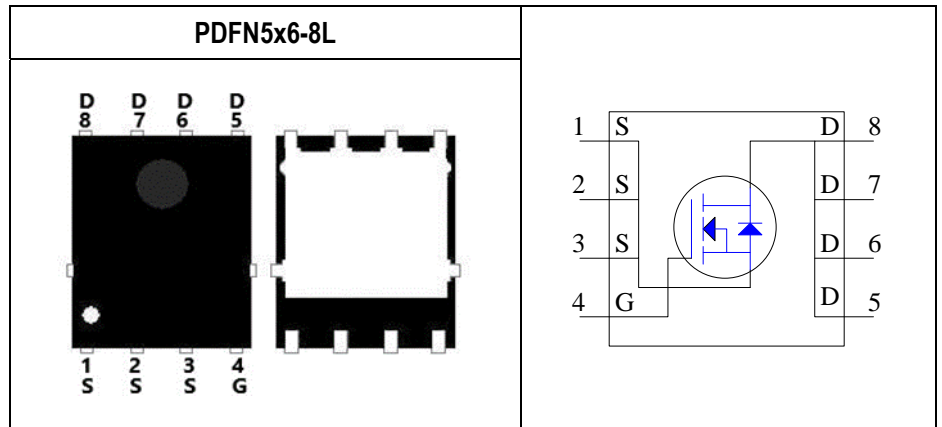


Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(ON) max. V_{GS}=10V}$	10	mΩ
$R_{DS(ON) max. V_{GS}=4.5V}$	16	mΩ
I_D	44.8	A
$Q_{g 10V}$	14.6	nC
Q_{gd}	3.1	nC
Q_{SW}	4.8	nC



Features	Application
<ul style="list-style-type: none"> Low On-Resistance $R_{DS(on)}$ Low Input Capacitance Low Gate Charge Fully Characterized Capacitance and Avalanche Pb-free lead plating; RoHS compliant 	<ul style="list-style-type: none"> MOSFET for synchronous rectification in SMPS High Speed Power Switching With Logic Level Driving capacity DC-DC converter AC-DC adaptor

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
DG60N12Q	Halogen-Free	PDFN5x6-8L	Q	Tape & Reel	2,500

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 1}	I_D	$T_C=25^\circ\text{C}$	44.8
		$T_C=100^\circ\text{C}$	28.3
Drain Current-Continuous ^{Note 2}	I_D	$T_A=25^\circ\text{C}$	12
		$T_A=70^\circ\text{C}$	9.6
Drain Current-Pulsed ^{Note 3}	I_{DM}	90	A
Avalanche Current	I_{AR}	15.6	A
Single Pulse Avalanche Energy ^{Note 4}	E_{AS}	12.1	mJ
Maximum Power Dissipation	P_D	$T_C=25^\circ\text{C}$	30.1
		$T_C=100^\circ\text{C}$	12
		$T_A=25^\circ\text{C}$	2.17
		$T_A=70^\circ\text{C}$	1.39
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance, Junction-Case ^{Note 5}	$R_{\theta JC}$	Steady State	-	-	4.15	$^\circ\text{C/W}$
Thermal resistance, Junction-Ambient ^{Note 5}	$R_{\theta JA}$	Steady State	-	-	57.39	$^\circ\text{C/W}$

Notes:

- Limited by silicon chip capability and $R_{\theta JC}$ junction-to-case thermal resistance.
- The maximum current rating is limited by package and $R_{\theta JA}$ junction-to-ambient thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width $\leq 100\mu\text{s}$, Duty $\leq 2\%$)
- Limited by T_{Jmax} , starting $T_J=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_g=25\Omega$, $I_D=15.6\text{A}$, $V_{GS}=10\text{V}$.
- The value of thermal resistance is measured with the single device mounted on 1 inch² FR-4 PCB with 2 oz. copper under a still air environment temperature is 25 $^\circ\text{C}$ based on JEDEC standard JESD51-14 and JESD51-2a. Thermal resistance obtained depends on the user's specific board design and given application.

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}	$V_{DS}=60V, V_{GS}=0V$	-	-	1	μA
		$V_{DS}=60V, V_{GS}=0V, T_J=125^\circ C$	-	-	100	μA
Gate-Body Leakage	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA

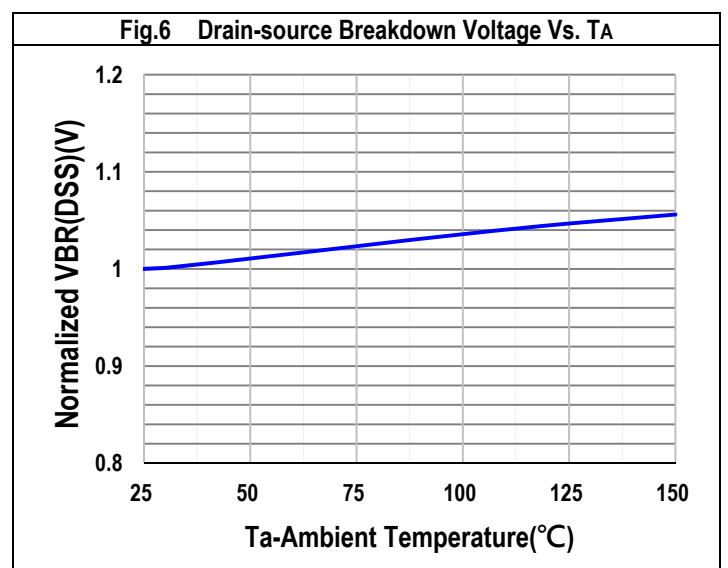
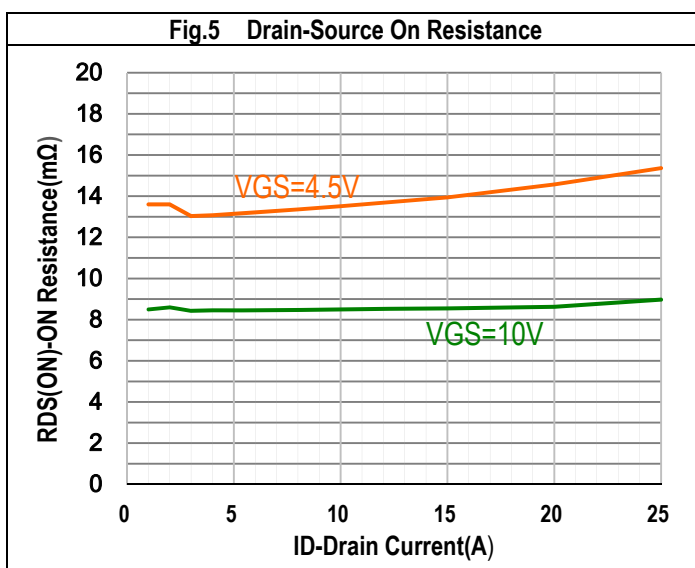
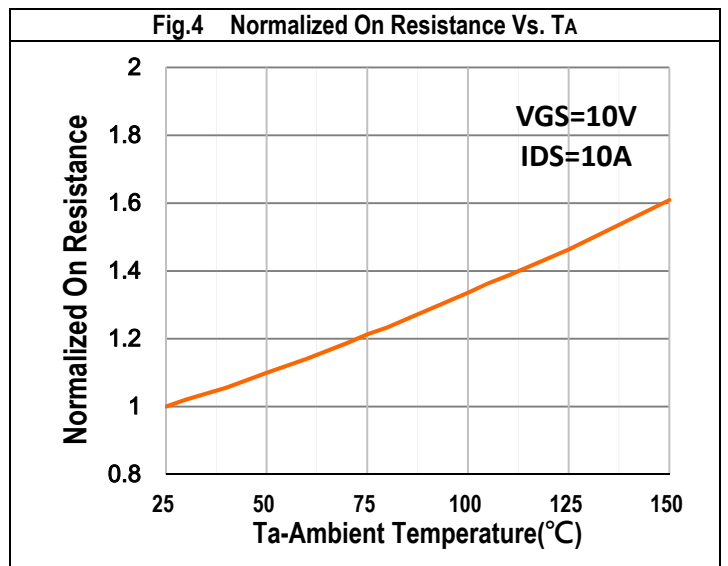
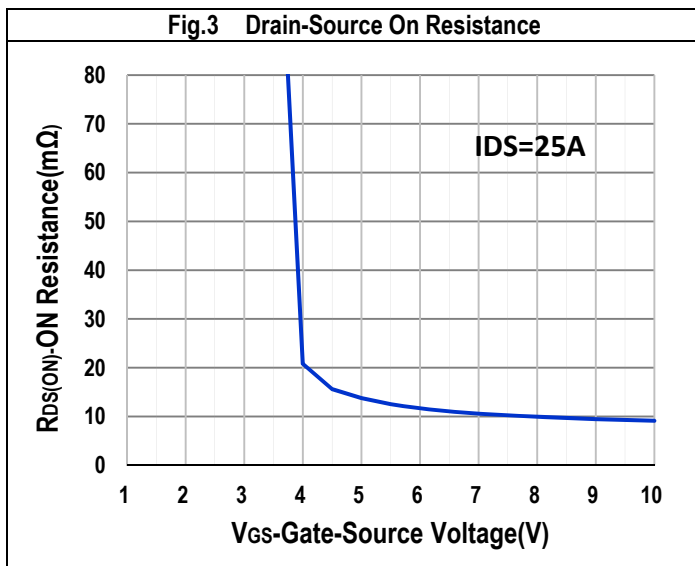
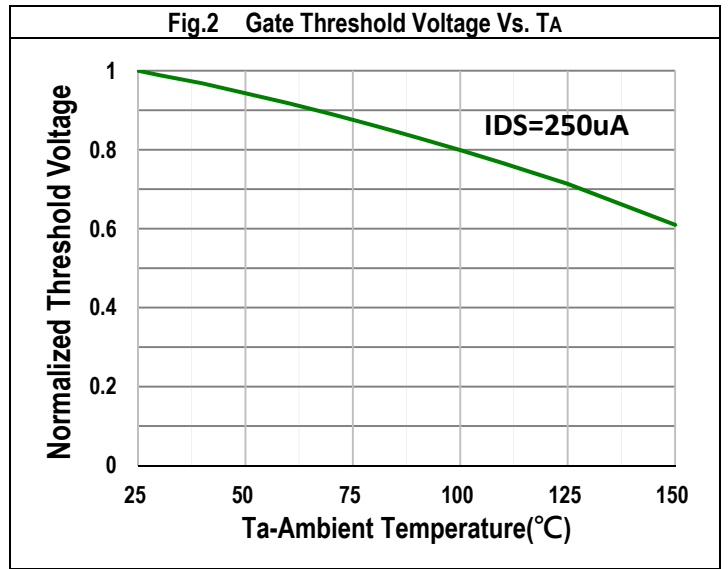
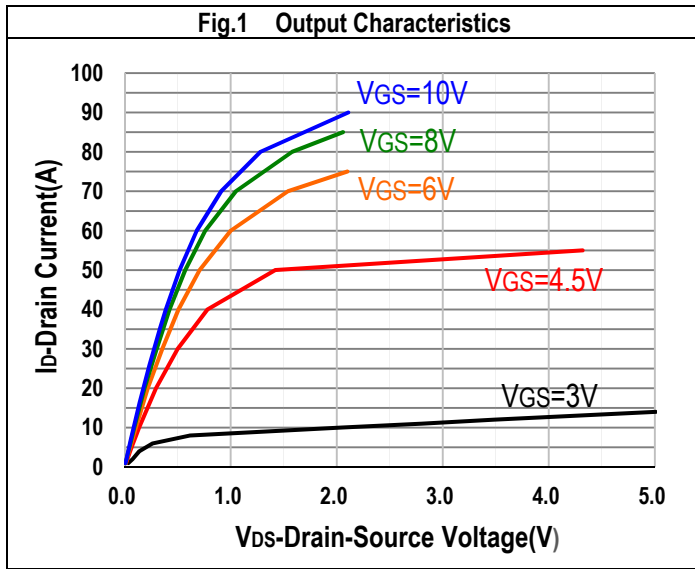
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1.4	1.7	2.1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_{DS}=10A$	-	8.6	10	m Ω
		$V_{GS}=4.5V, I_{DS}=10A$	-	13.6	16	m Ω
Gate Resistance	R_g	$V_{GS}=0V, V_{DS}=0V, f=1MHz$	-	1.9	-	Ω
Forward Transconductance	g_{fs}	$V_{DS}=5V, I_{DS}=5A$	-	19	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	822	-	pF
Output Capacitance	C_{oss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	297	-	pF
Reverse Transfer Capacitance	C_{rss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	43	-	pF
Turn-On Delay Time	$T_{d(on)}$	$V_{DS}=30V, V_{GS}=10V, I_{DS}=20A, R_{GEN}=3\Omega$	-	4	-	nS
Rise Time	t_r	$V_{DS}=30V, V_{GS}=10V, I_{DS}=20A, R_{GEN}=3\Omega$	-	62.7	-	nS
Turn-Off Delay Time	$T_{d(off)}$	$V_{DS}=30V, V_{GS}=10V, I_{DS}=20A, R_{GEN}=3\Omega$	-	21.5	-	nS
Fall Time	t_f	$V_{DS}=30V, V_{GS}=10V, I_{DS}=20A, R_{GEN}=3\Omega$	-	8.9	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q_{gs}	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	3.7	-	nC
Gate charge at threshold	$Q_{g(th)}$	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	1.6	-	nC
Gate to Drain Charge	Q_{gd}	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	3.1	-	nC
Switching charge	Q_{SW}	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	4.8	-	nC
Gate charge total	$Q_{g 10V}$	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	14.6	-	nC
	$Q_{g 4.5V}$	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 4.5V	-	7.3	-	nC
Gate plateau voltage	$V_{plateau}$	$V_{DD}=30V, I_D=20A, V_{GS}=0$ to 10V	-	3.7	-	V
Gate charge total, sync. FET ($Q_g - Q_{gd}$)	$Q_{g(sync)}$	$V_{DS}=0.1V, V_{GS}=0$ to 10V	-	11.5	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Body Diode continuous forward current	I_S	$T_C=25^\circ C$	-	-	44.8	A
Body Diode pulse current	I_{SM}	$T_C=25^\circ C$	-	-	90	A
Body Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=1A$	-	0.68	1	V
Body Diode Reverse Recovery Time	t_{rr}	$V_{DD}=30V, I_F=20A, di/dt=100A/\mu s$	-	22.2	-	nS
		$V_{DD}=30V, I_F=20A, di/dt=200A/\mu s$	-	19.1	-	nS
Body Diode Reverse Recovery Charge	Q_{rr}	$V_{DD}=30V, I_F=20A, di/dt=100A/\mu s$	-	9.5	-	nC
		$V_{DD}=30V, I_F=20A, di/dt=200A/\mu s$	-	18.4	-	nC

Typical Operating Characteristics



Typical Operating Characteristics (Cont.)

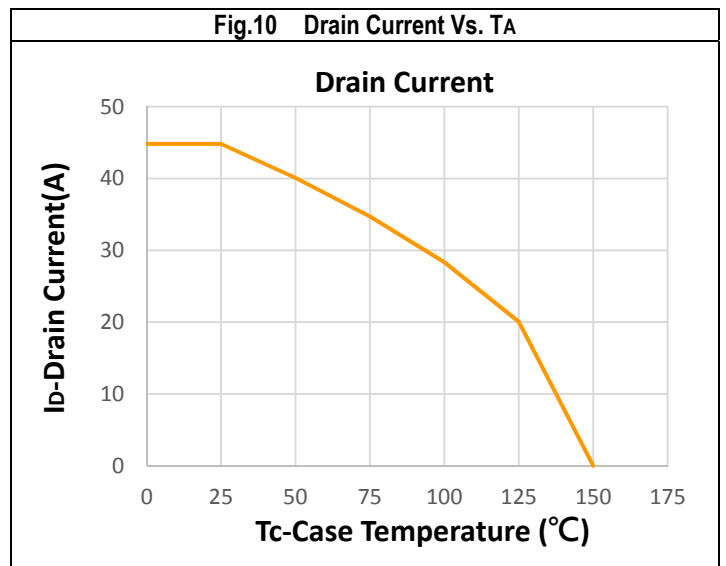
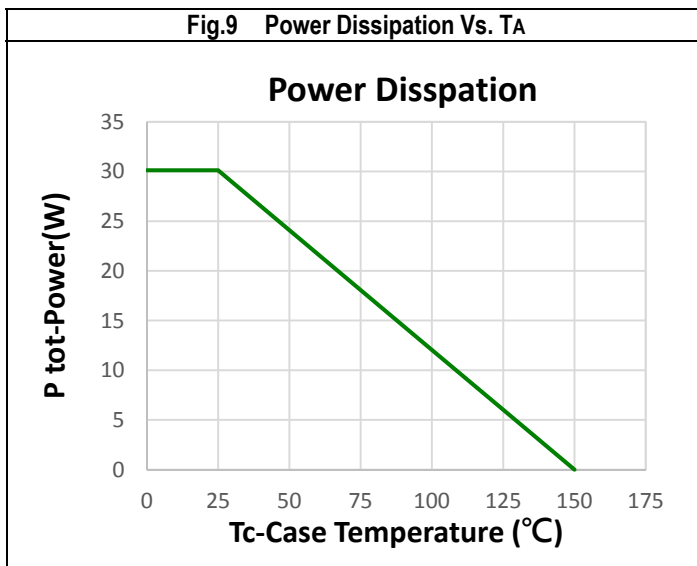
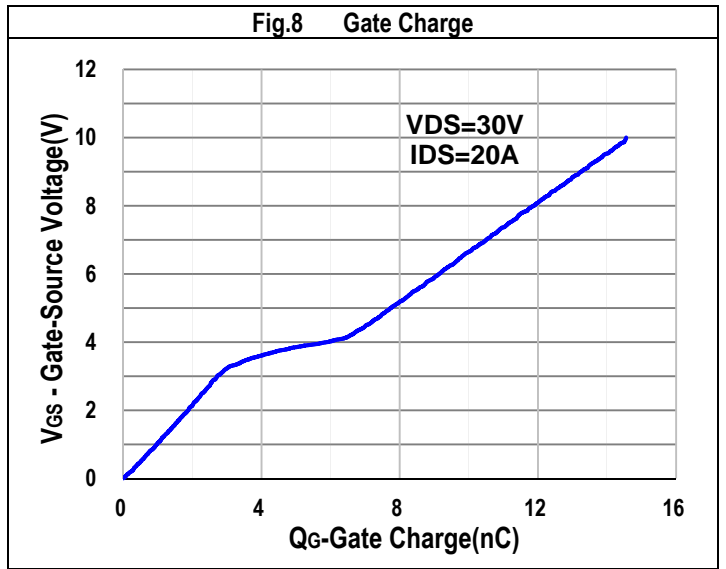
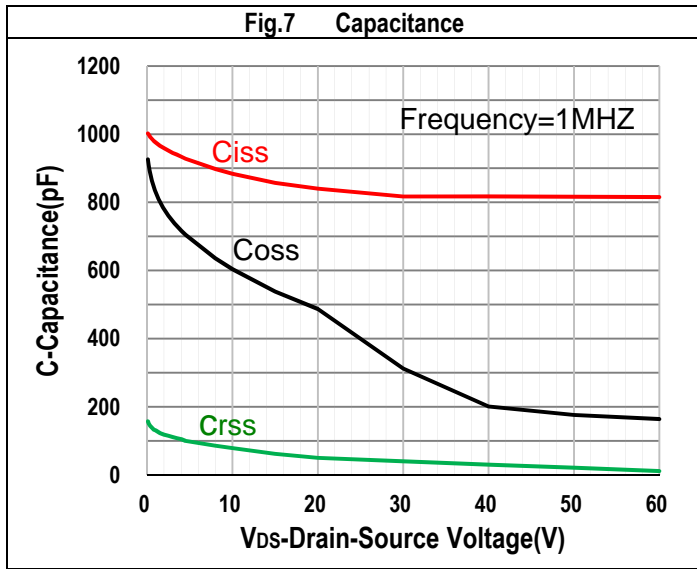


Fig.11 Safe Operation Area

Safe Operating Area

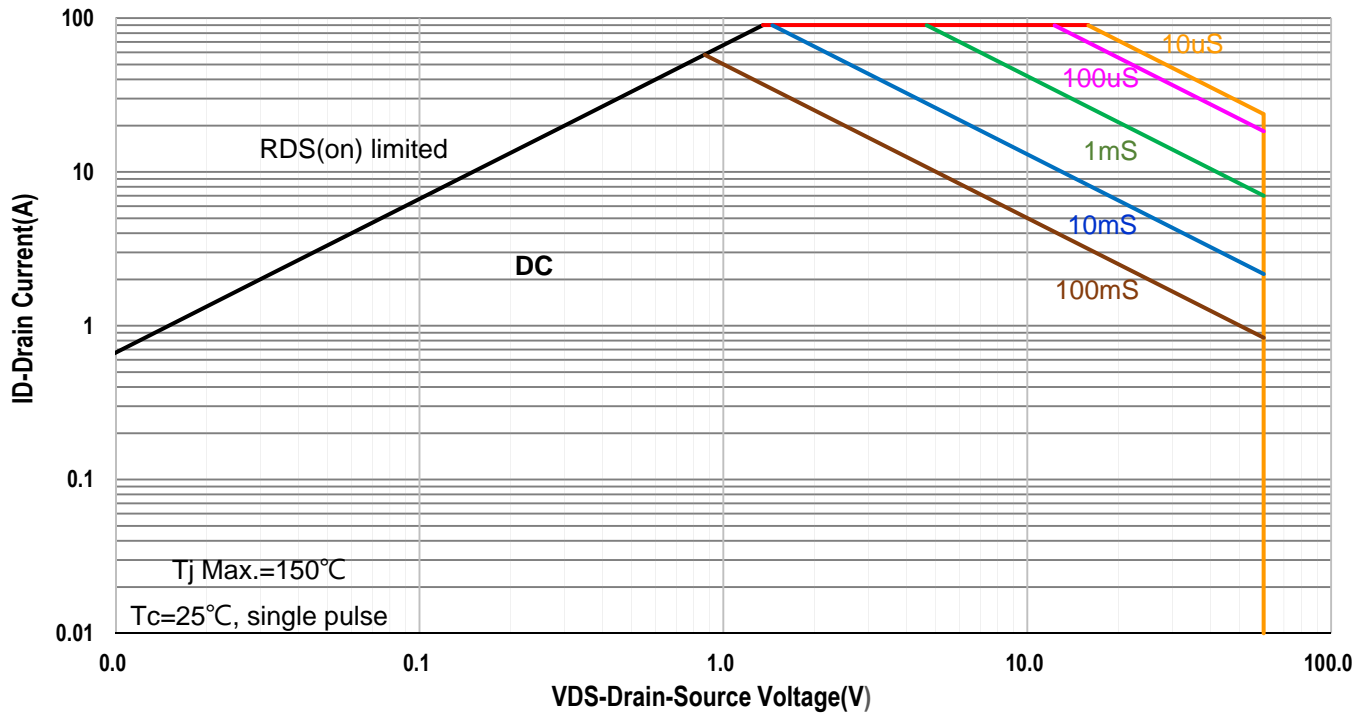
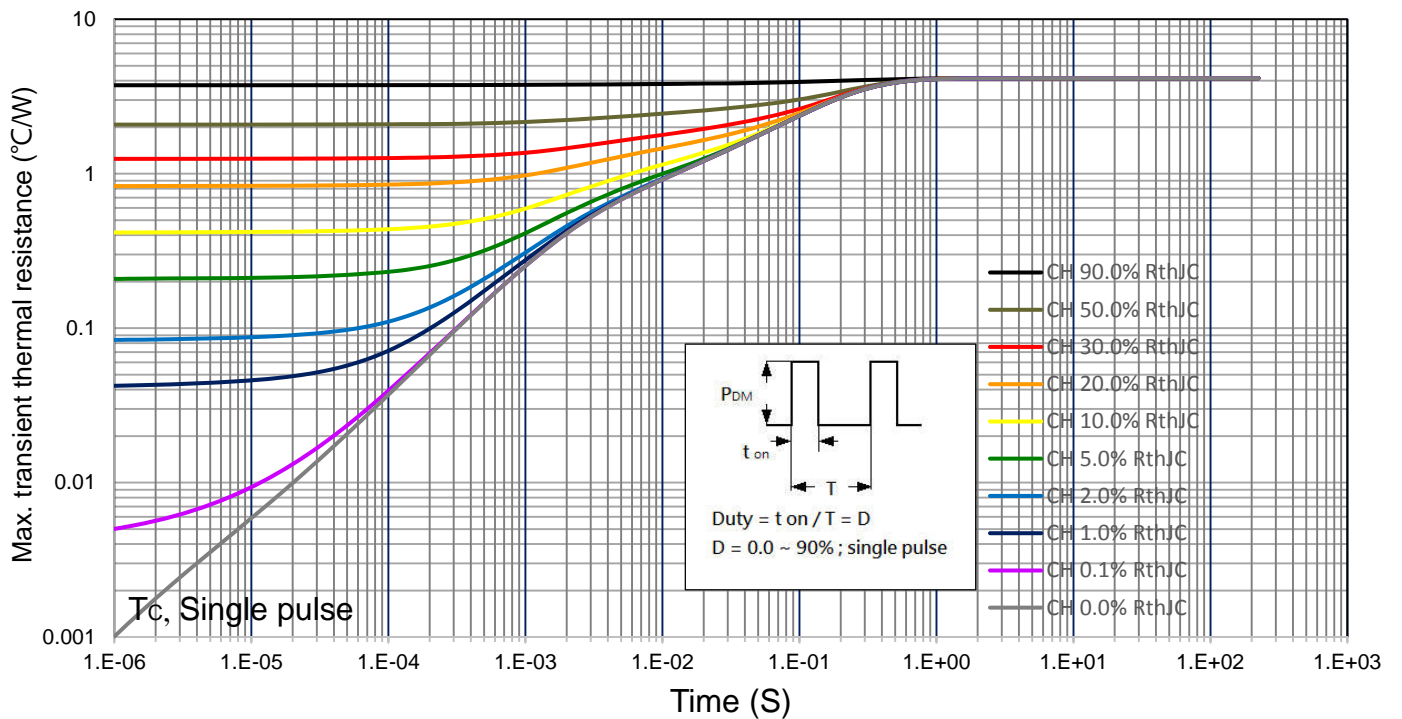
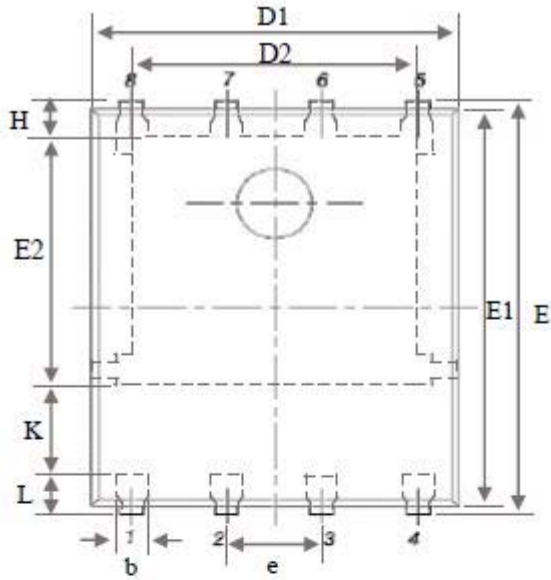


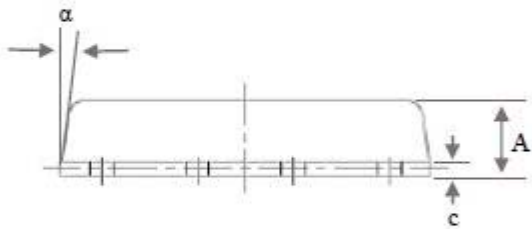
Fig.12 Transient Thermal Impedance




Package of Dimension



Symbol	Min	Nor	Max
A	0.90	1.04	1.17
b	0.33	0.42	0.51
C	0.06	0.20	0.35
D1	4.80	5.10	5.40
D2	3.61	3.96	4.31
E	5.90	6.03	6.15
E1	5.65	5.75	5.85
E2	3.30	3.54	3.78
e	1.27 BSC		
H	0.38	0.50	0.61
L	0.38	0.55	0.71
L1	0.05	0.15	0.25



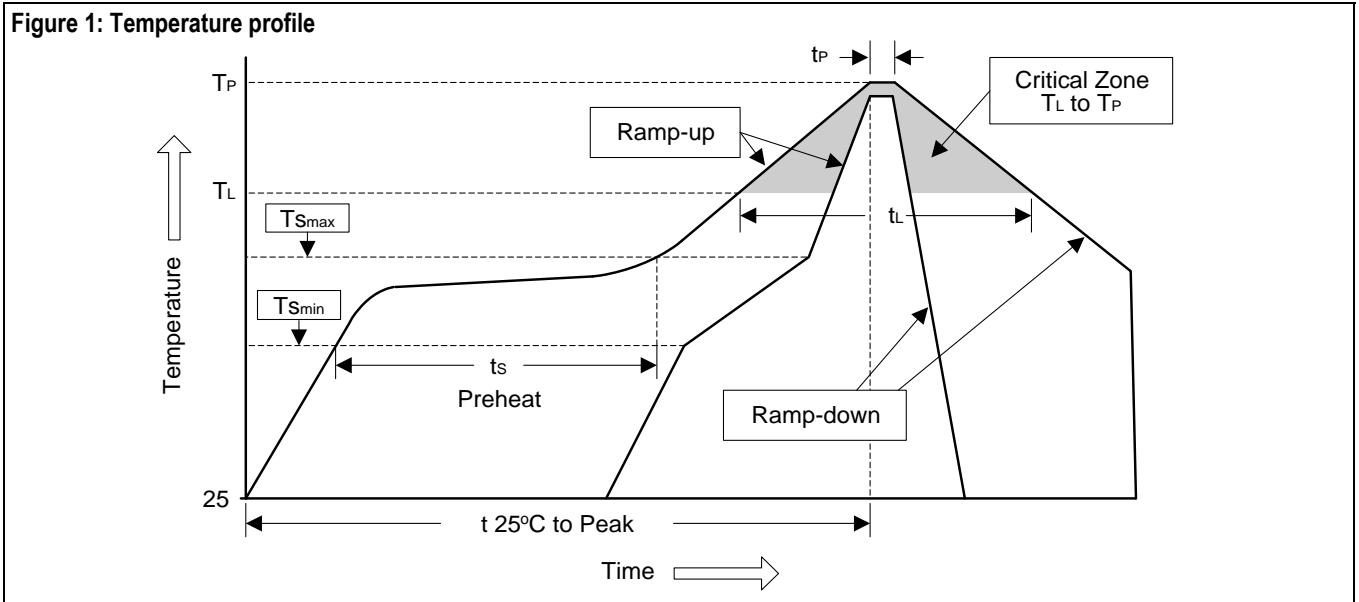
Marking Information

PDFN 5x6-8L (Q)	Marking Rule
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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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Revision History

Document Revision History			
Device	Date	Revision	Description (major change from last revision)
DG60N12Q	Feb-15-2023	03	<ul style="list-style-type: none">- Update symbol- I_D、P_D、I_S、I_{SM} parameter revision- Update $R_{\theta JC}$、$R_{\theta JA}$ parameter- Update typical operating characteristic diagrams Fig. 09 ~ 12- Added package dimensions section.- Added revision history section.