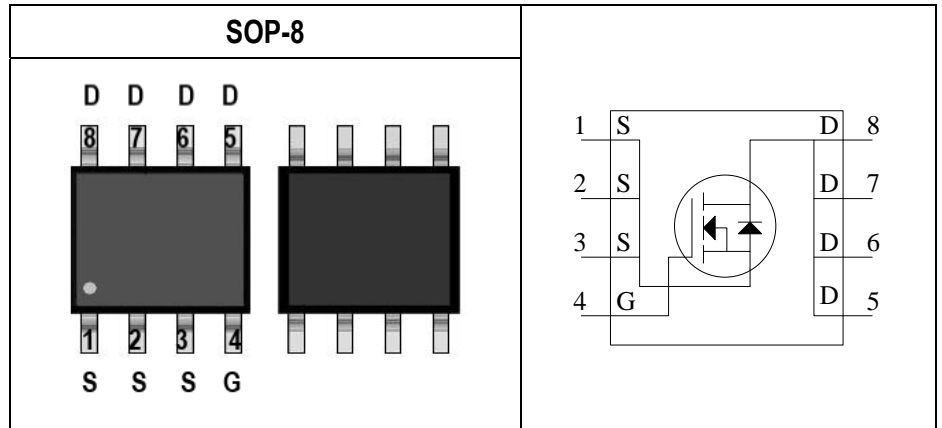


Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(ON) max. V_{GS}=10V}$	10	m Ω
$R_{DS(ON) max. V_{GS}=4.5V}$	16	m Ω
I_D	34	A
$Q_{g 10V}$	16	nC
Q_{gd}	3.6	nC
Q_{SW}	5.3	nC



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"> AC to DC adaptor DC to DC Converter Motor Driving Application Switch Mode Power Supply MOSFET for synchronous rectification in SMPS

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
DG60N12S	Halogen-Free	SOP-8	S	Tape & Reel	3,000

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	$T_C=25^\circ\text{C}$	34 A
		$T_C=100^\circ\text{C}$	21.5 A
Drain Current-Continuous ^{Note 2}	I_D	$T_A=25^\circ\text{C}$	13.5 A
		$T_A=70^\circ\text{C}$	10.8 A
Drain Current-Pulsed ^{Note 3}	I_{DM}	60	A
Avalanche Current	I_{AR}	14.2	A
Single Pulse Avalanche Energy ^{Note 4}	E_{AS}	10	mJ
Maximum Power Dissipation	P_D	$T_C=25^\circ\text{C}$	20.3 W
		$T_C=100^\circ\text{C}$	8.1 W
		$T_A=25^\circ\text{C}$	3.2 W
		$T_A=70^\circ\text{C}$	2.0 W
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	-	-	6.15	$^\circ\text{C/W}$
Thermal resistance, Junction-Ambient ^{Note 5}	$R_{\theta JA}$	Steady State	-	-	39.14	$^\circ\text{C/W}$

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 $T_J=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_g=25\Omega$, $I_D=14.2\text{A}$, $V_{GS}=10\text{V}$.
- 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°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

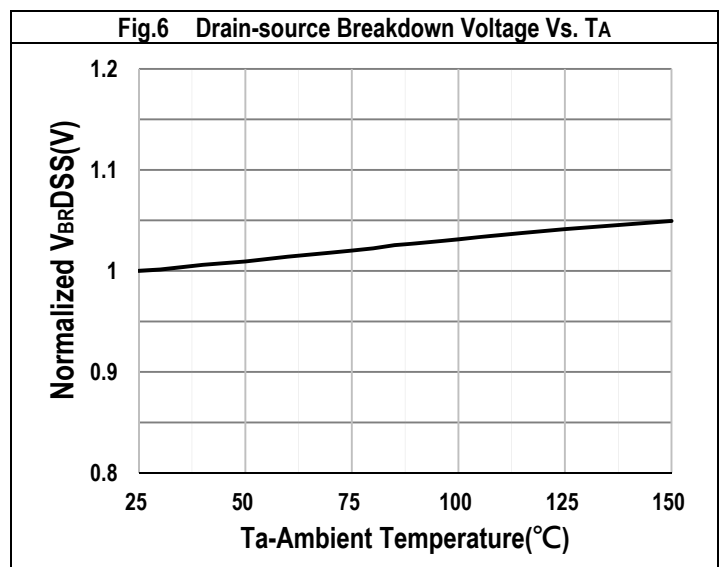
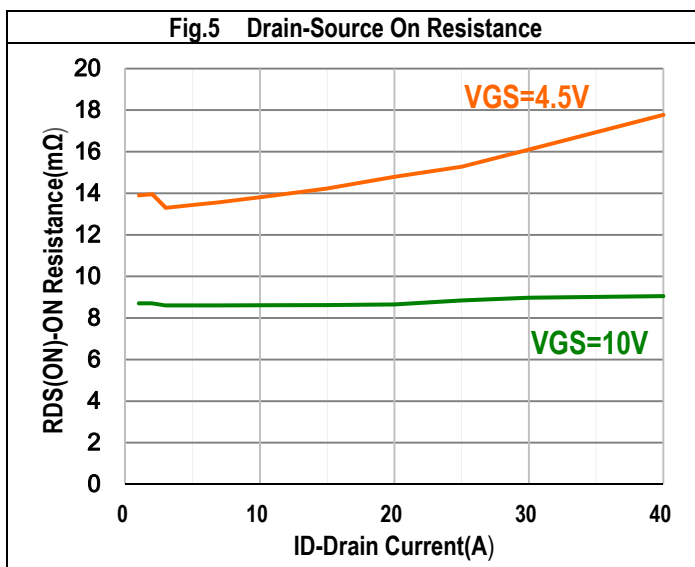
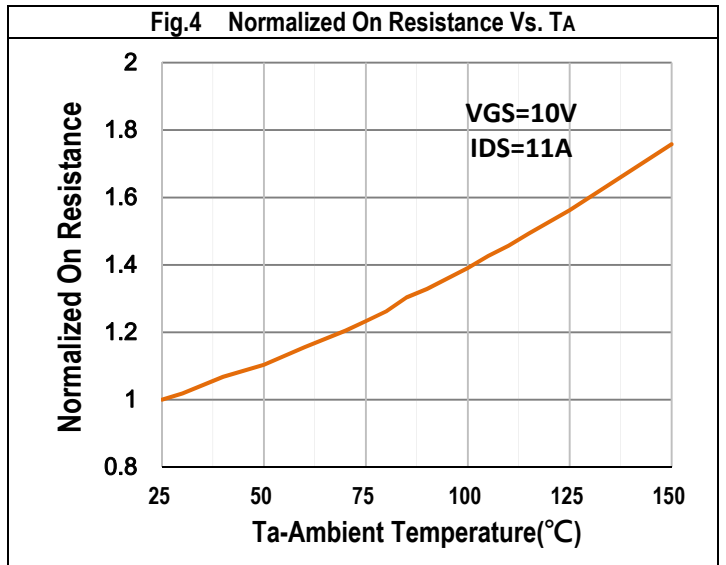
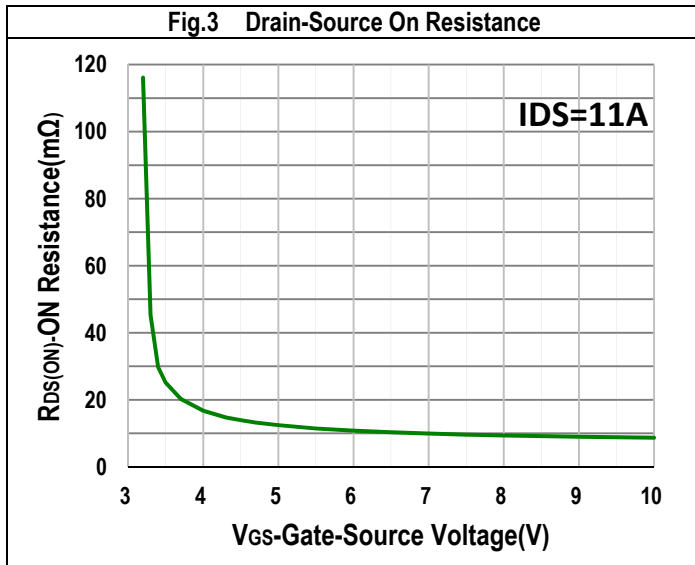
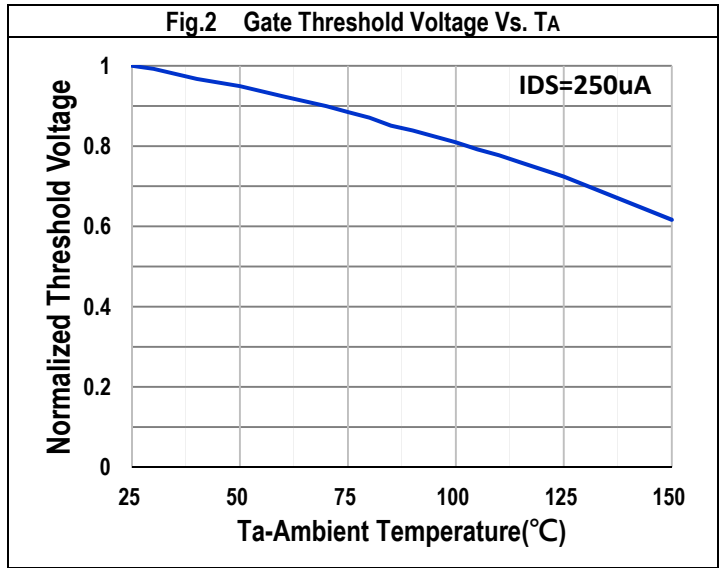
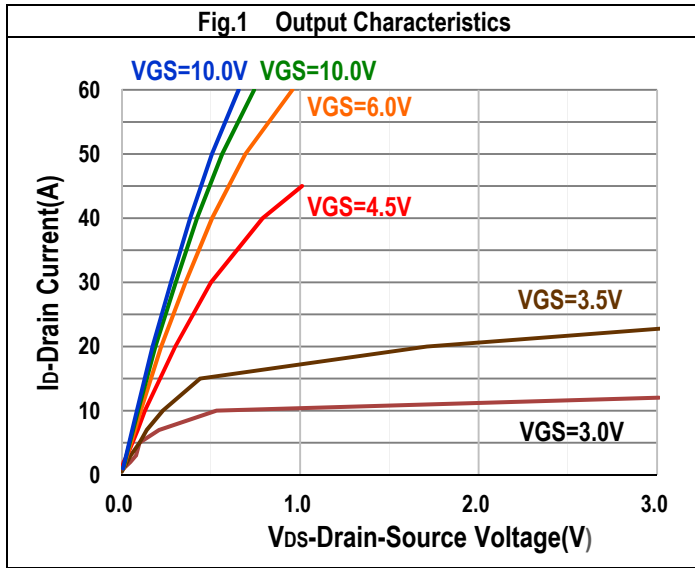
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1.3	1.7	2.1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_{DS}=20A$	-	8.8	10	m Ω
		$V_{GS}=4.5V, I_{DS}=10A$	-	13.8	16	m Ω
Gate Resistance	R_g	$V_{GS}=0V, V_{DS}=0V, f=1MHz$	-	1.5	-	Ω
Forward Transconductance	g_{fs}	$V_{DS}=5V, I_{DS}=11A$	-	10	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	842	-	pF
Output Capacitance	C_{oss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	273	-	pF
Reverse Transfer Capacitance	C_{rss}	$V_{DD}=60V, V_{DS}=30V, V_{GS}=0V, f=1MHz$	-	33	-	pF
Turn-On Delay Time	$T_{d(on)}$	$V_{DS}=30V, V_{GS}=10V, I_{DS}=12A, R_{GEN}=3\Omega$	-	8.5	-	nS
Rise Time	t_r	$V_{DS}=30V, V_{GS}=10V, I_{DS}=12A, R_{GEN}=3\Omega$	-	44.1	-	nS
Turn-Off Delay Time	$T_{d(off)}$	$V_{DS}=30V, V_{GS}=10V, I_{DS}=12A, R_{GEN}=3\Omega$	-	17.7	-	nS
Fall Time	t_f	$V_{DS}=30V, V_{GS}=10V, I_{DS}=12A, R_{GEN}=3\Omega$	-	23.7	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q_{gs}	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	3.4	-	nC
Gate charge at threshold	$Q_{g(th)}$	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	1.6	-	nC
Gate to Drain Charge	Q_{gd}	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	3.6	-	nC
Switching charge	Q_{sw}	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	5.3	-	nC
Gate charge total	$Q_{g 10V}$	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	16	-	nC
	$Q_{g 4.5V}$	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 4.5V$	-	7.9	-	nC
Gate plateau voltage	$V_{plateau}$	$V_{DD}=30V, I_D=11A, V_{GS}=0 \text{ to } 10V$	-	3.6	-	V
Gate charge total, sync. FET ($Q_g - Q_{gd}$)	$Q_{g(sync)}$	$V_{DS}=0.1V, V_{GS}=0 \text{ to } 10V$	-	12.4	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Body Diode continuous forward current	I_S	$T_C=25^\circ C$	-	-	34	A
Body Diode pulse current	I_{SM}	$T_C=25^\circ C$	-	-	60	A
Body Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=1A$	-	0.7	1.0	V
Body Diode Reverse Recovery Time	t_{rr}	$V_{DD}=30V, I_F=11A, di/dt=100A/\mu s$	-	24	-	nS
		$V_{DD}=30V, I_F=11A, di/dt=200A/\mu s$	-	20.6	-	nS
Body Diode Reverse Recovery Charge	Q_{rr}	$V_{DD}=30V, I_F=11A, di/dt=100A/\mu s$	-	10.9	-	nC
		$V_{DD}=30V, I_F=11A, di/dt=200A/\mu s$	-	20.8	-	nC

Typical Operating Characteristics



Typical Operating Characteristics (Cont.)

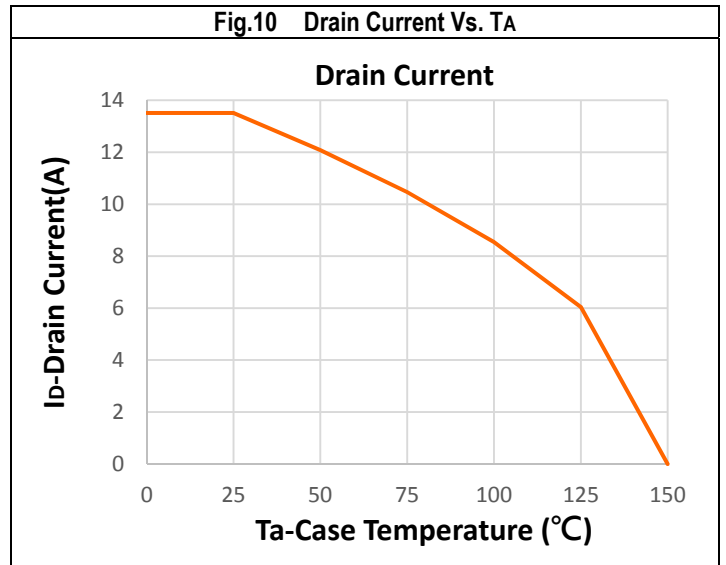
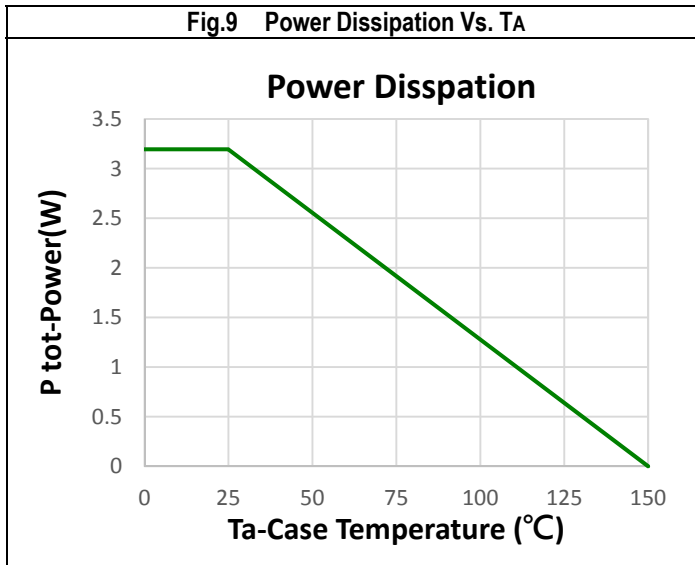
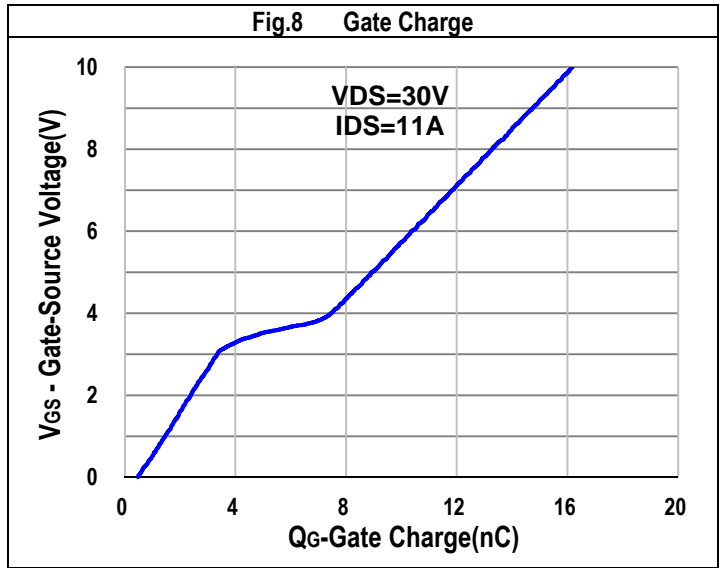
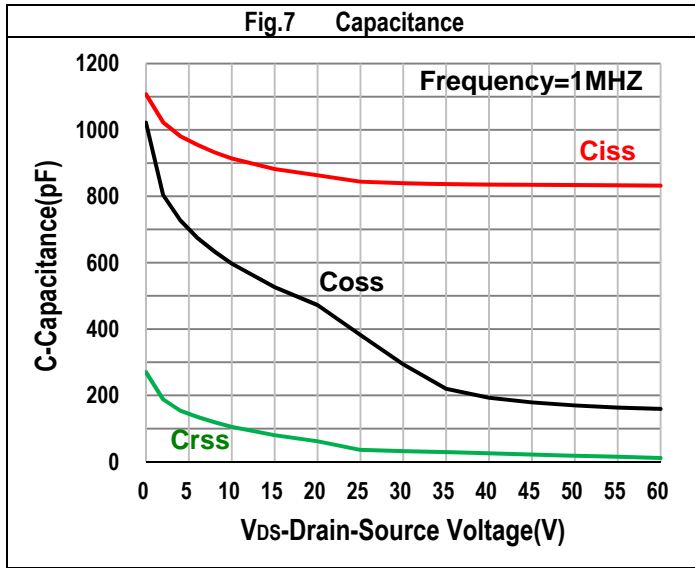


Fig.11 Safe Operation Area

Safe Operating Area

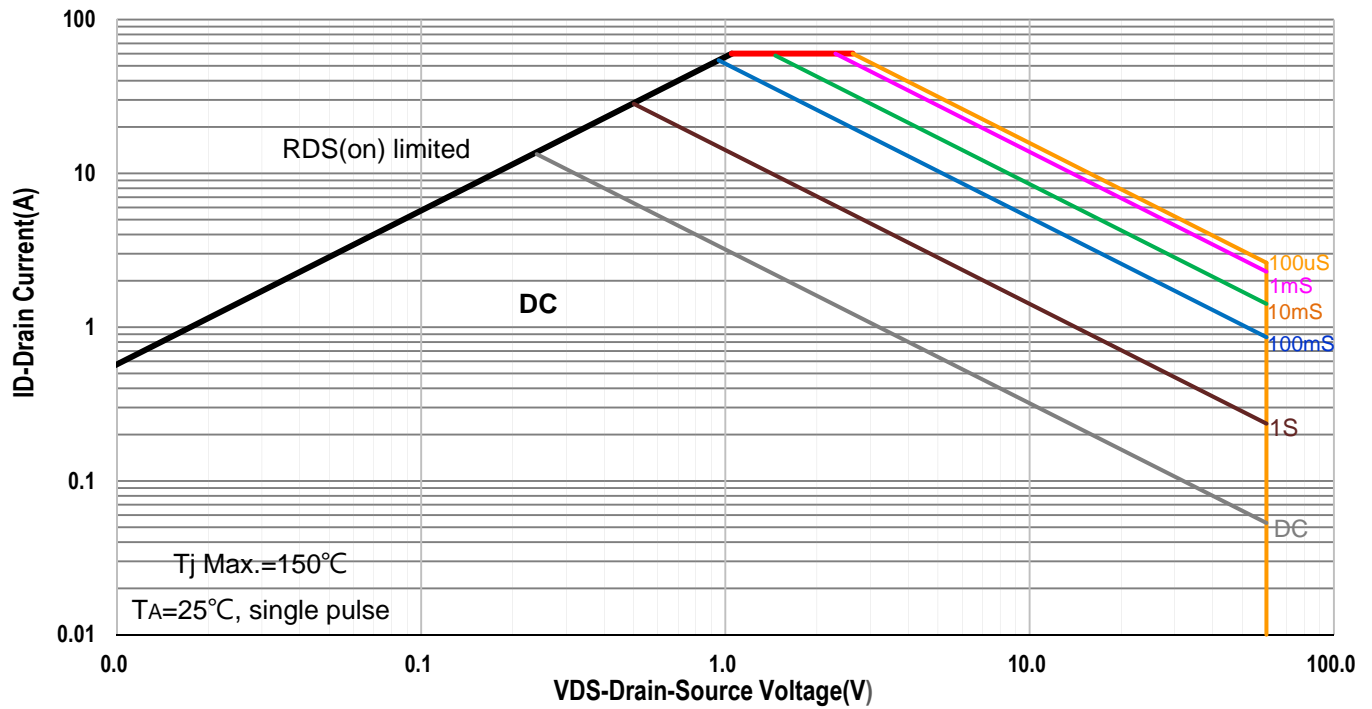
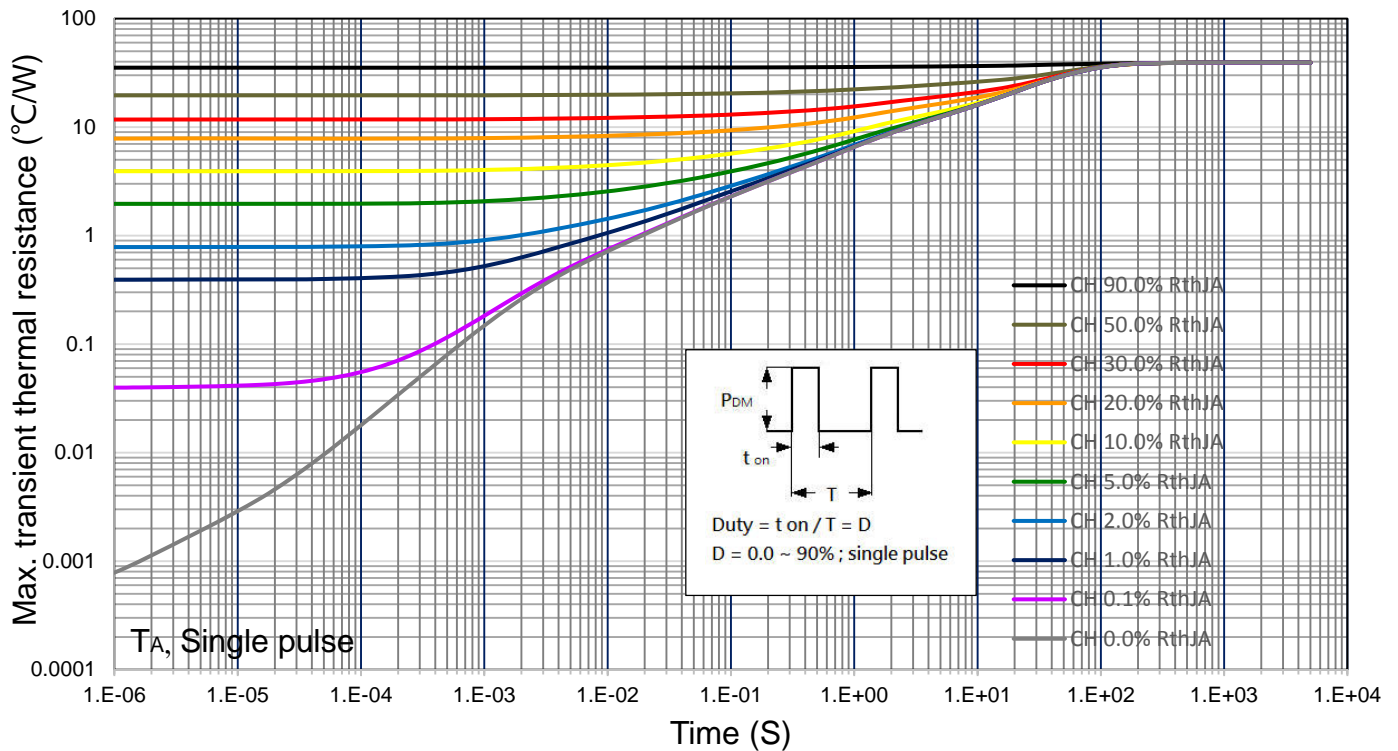
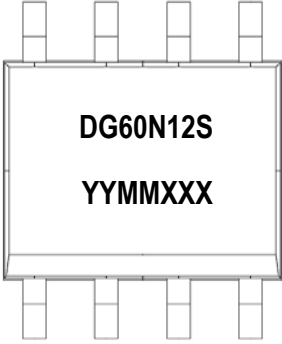


Fig.12 Transient Thermal Impedance



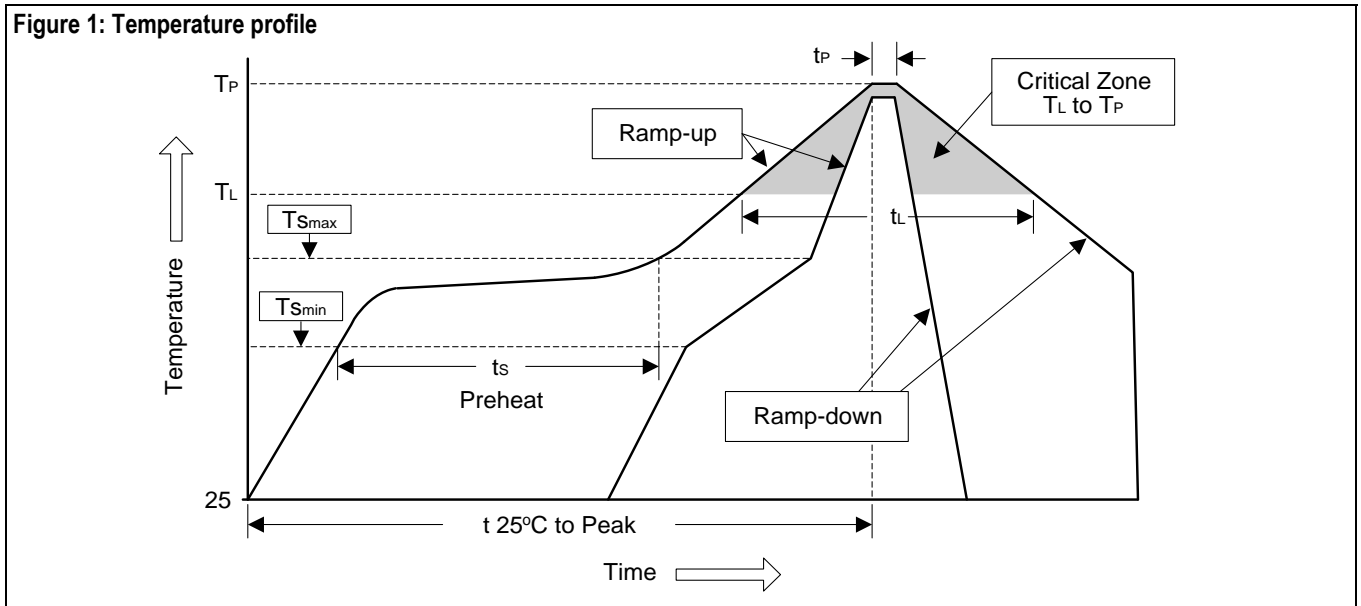
Marking Information

SOP-8(S)	Marking Rule
<p data-bbox="140 342 308 376">Laser Marking</p> 	<p data-bbox="826 342 1011 376"><u>Line 1</u> : Device</p> <p data-bbox="826 389 963 423">DG60N12S</p> <p data-bbox="826 477 1058 510"><u>Line 2</u> : Date Code</p> <p data-bbox="826 524 963 557">YYMMXXX</p> <p data-bbox="826 611 1021 645">YY : Year Code</p> <p data-bbox="826 658 1046 692">MM : Month Code</p> <p data-bbox="826 705 1082 739">XXX : Serial Number</p>

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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