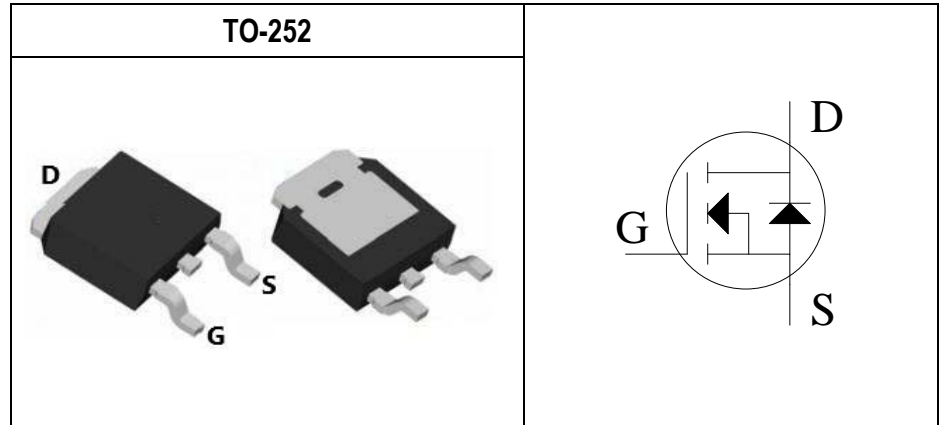


Parameter	Value	Unit
V_{DSS}	60	V
$R_{DS(ON) max. V_{GS}=10V}$	9	m Ω
$R_{DS(ON) max. V_{GS}=4.5V}$	14.4	m Ω
I_D	68	A
$Q_{g 10V}$	17.2	nC
Q_{gd}	4.2	nC
Q_{SW}	6.2	nC



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"> Load Switch 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
DG60N12D	Halogen-Free	TO-252	D	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	$T_C=25^\circ\text{C}$	68
		$T_C=100^\circ\text{C}$	43
Drain Current-Continuous ^{Note 2}	I_D	$T_A=25^\circ\text{C}$	13.4
		$T_A=70^\circ\text{C}$	10.7
Drain Current-Pulsed ^{Note 3}	I_{DM}	136	A
Avalanche Current	I_{AR}	12.3	A
Single Pulse Avalanche Energy ^{Note 4}	E_{AS}	7.5	mJ
Maximum Power Dissipation	P_D	$T_C=25^\circ\text{C}$	69
		$T_C=100^\circ\text{C}$	27.6
		$T_A=25^\circ\text{C}$	2.7
		$T_A=70^\circ\text{C}$	1.7
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	-	-	1.81	$^\circ\text{C/W}$
Thermal resistance, Junction-Ambient ^{Note 5}	$R_{\theta JA}$	Steady State	-	-	46.34	$^\circ\text{C/W}$

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 $T_J=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_g=25\Omega$, $I_D=12.3\text{A}$, $V_{GS}=10\text{V}$.
- The value of thermal resistance is measured with the single device put on cooling plate under a still air environment temperature is 25 degree 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} =250μA	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°C	-	-	100	μA
Gate-Body Leakage	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA

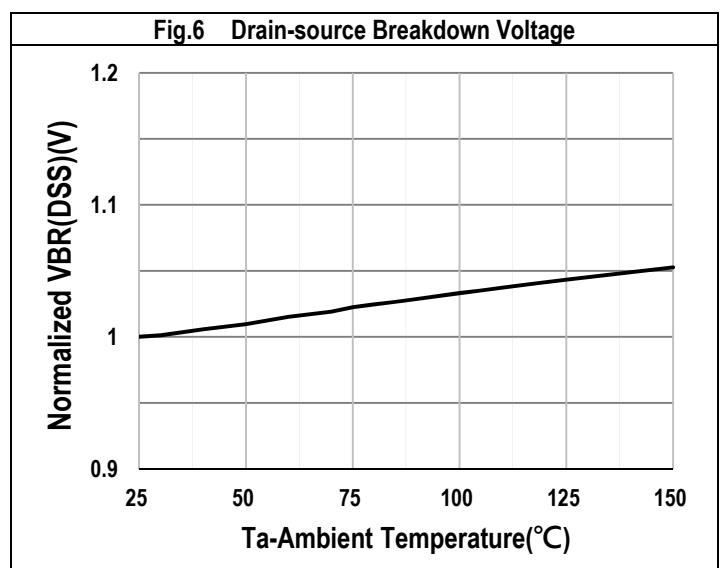
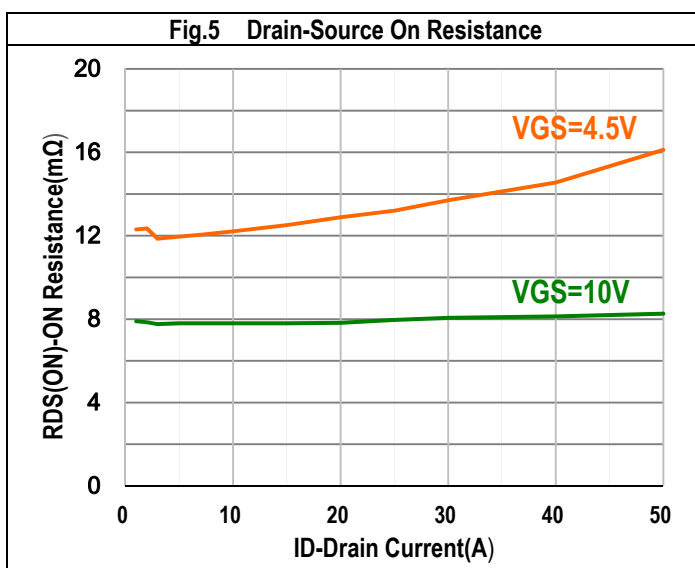
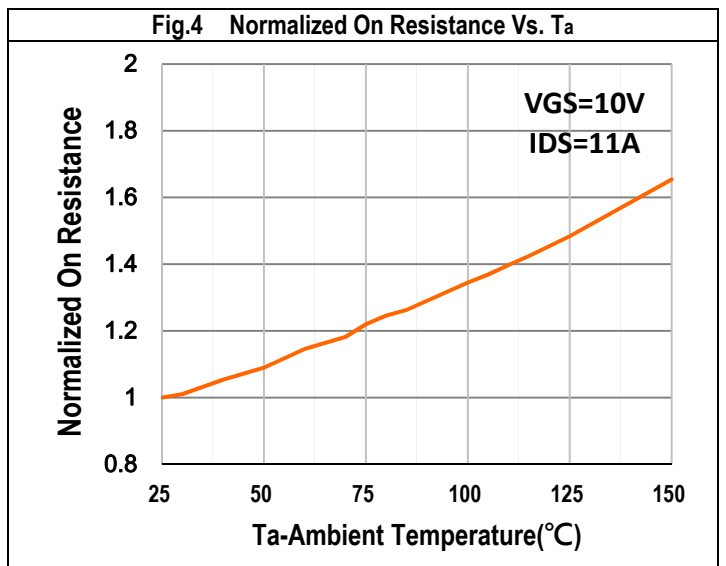
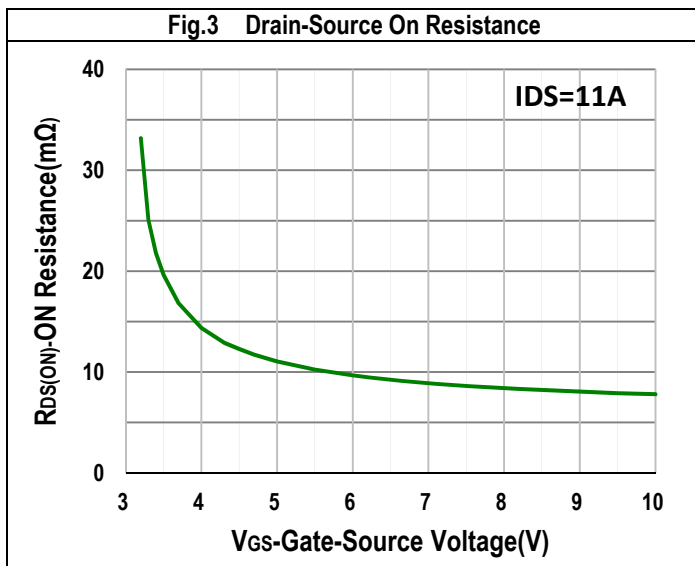
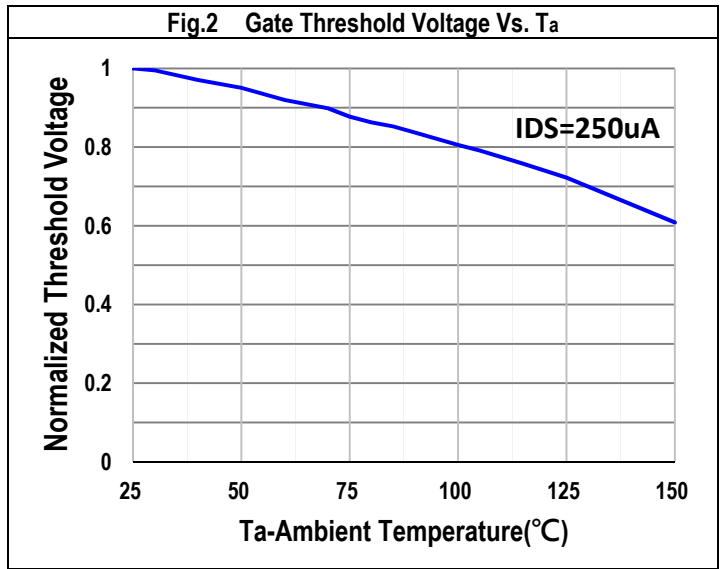
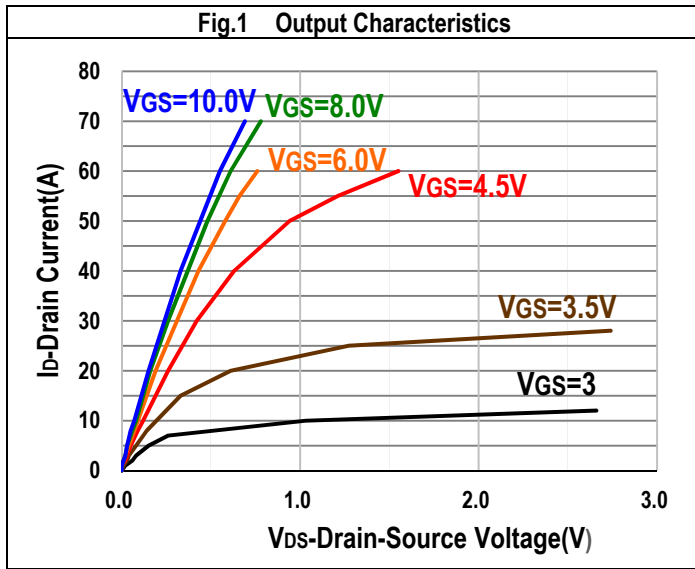
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _{DS} =250μA	1.3	1.7	2.1	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _{DS} =20A	-	7.9	9	mΩ
		V _{GS} =4.5V, I _{DS} =10A	-	12.5	14.4	mΩ
Gate Resistance	R _g	V _{GS} =0V, V _{DS} =0V, f=1MHz	-	1.5	-	Ω
Forward Transconductance	g _{fs}	V _{DS} =5V, I _{DS} =11A	-	15	-	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	-	854	-	pF
Output Capacitance	C _{oss}	V _{DD} =60V, V _{DS} =30V, V _{GS} =0V, f=1MHz	-	294	-	pF
Reverse Transfer Capacitance	C _{rss}	V _{DD} =60V, V _{DS} =30V, V _{GS} =0V, f=1MHz	-	35	-	pF
Turn-On Delay Time	T _{d(on)}	V _{DS} =30V, V _{GS} =10V, I _{DS} =14A, R _{GEN} =3Ω	-	7.9	-	nS
Rise Time	t _r	V _{DS} =30V, V _{GS} =10V, I _{DS} =14A, R _{GEN} =3Ω	-	3.9	-	nS
Turn-Off Delay Time	T _{d(off)}	V _{DS} =30V, V _{GS} =10V, I _{DS} =14A, R _{GEN} =3Ω	-	21.7	-	nS
Fall Time	t _f	V _{DS} =30V, V _{GS} =10V, I _{DS} =14A, R _{GEN} =3Ω	-	5.3	-	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	-	3.6	-	nC
Gate charge at threshold	Q _{g(th)}	V _{DD} =30V, I _D =20A, V _{GS} =0 to 10V	-	1.7	-	nC
Gate to Drain Charge	Q _{gd}	V _{DD} =30V, I _D =20A, V _{GS} =0 to 10V	-	4.2	-	nC
Switching charge	Q _{sw}	V _{DD} =30V, I _D =20A, V _{GS} =0 to 10V	-	6.2	-	nC
Gate charge total	Q _{g 10V}	V _{DD} =30V, I _D =20A, V _{GS} =0 to 10V	-	17.2	-	nC
	Q _{g 4.5V}	V _{DD} =30V, I _D =20A, V _{GS} =0 to 4.5V	-	8.6	-	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	-	13	-	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°C	-	-	68	A
Body Diode pulse current	I _{SM}	T _C =25°C	-	-	136	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/μs	-	25.5	-	nS
		V _{DD} =30V, I _F =11A, di/dt=200A/μs	-	21.7	-	nS
Body Diode Reverse Recovery Charge	Q _{rr}	V _{DD} =30V, I _F =11A, di/dt=100A/μs	-	12.5	-	nC
		V _{DD} =30V, I _F =11A, di/dt=200A/μs	-	22.5	-	nC

Typical Operating Characteristics



Typical Operating Characteristics (Cont.)

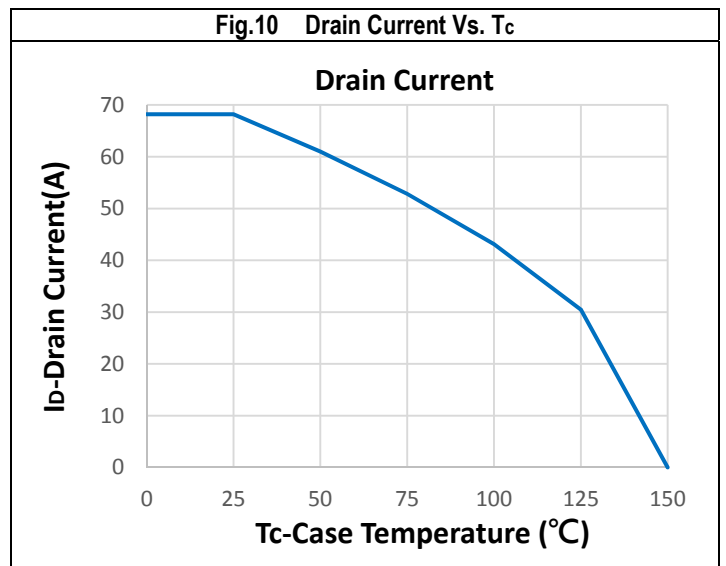
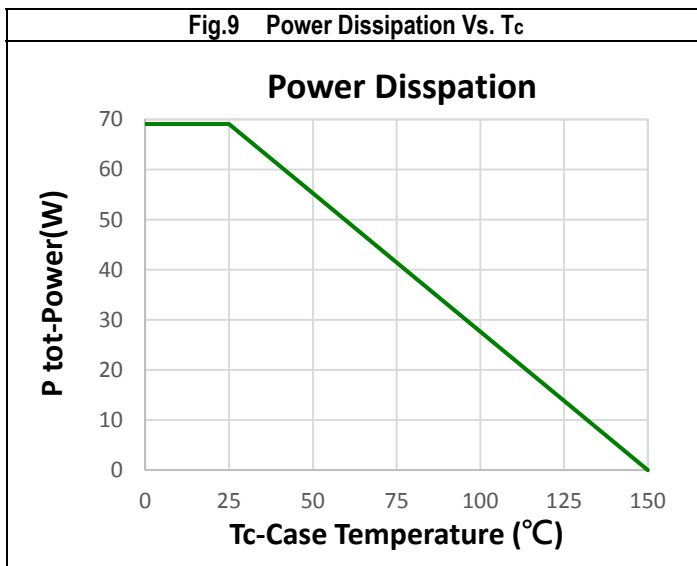
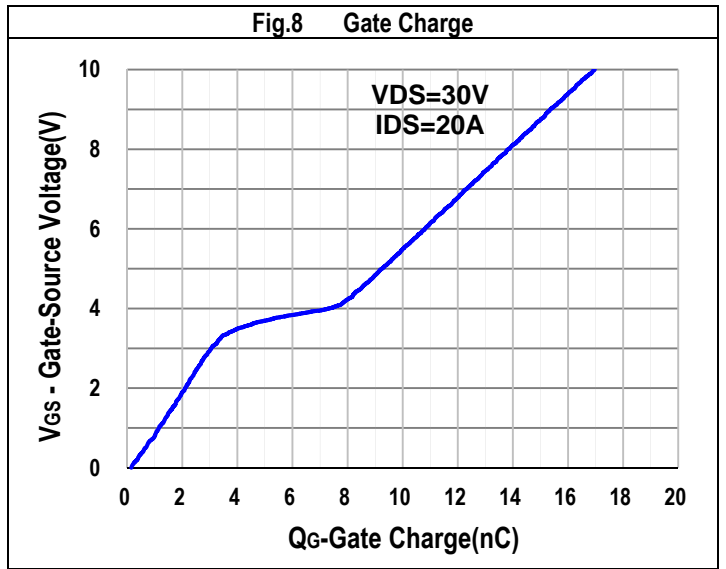
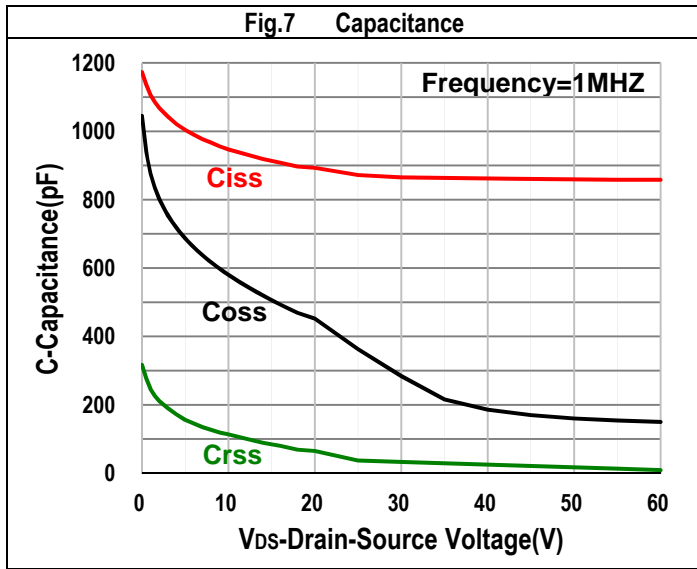


Fig.11 Safe Operation Area

Safe Operating Area

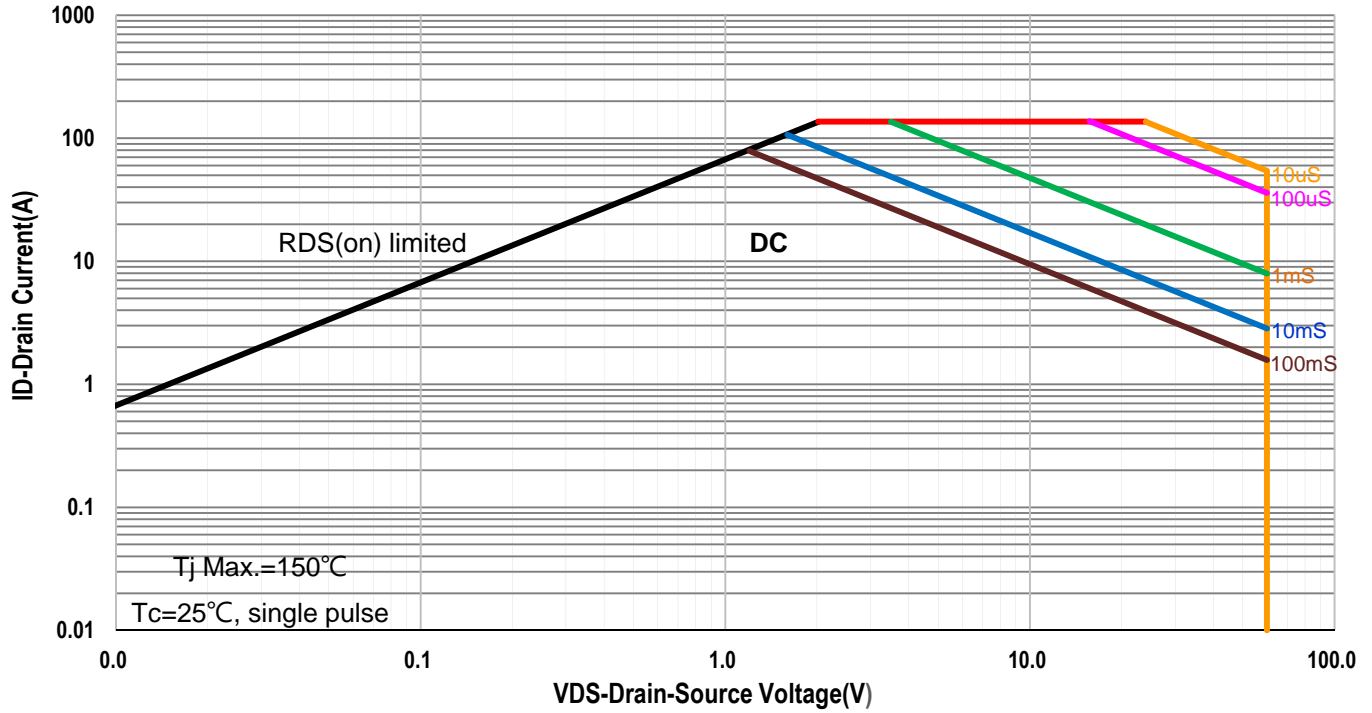
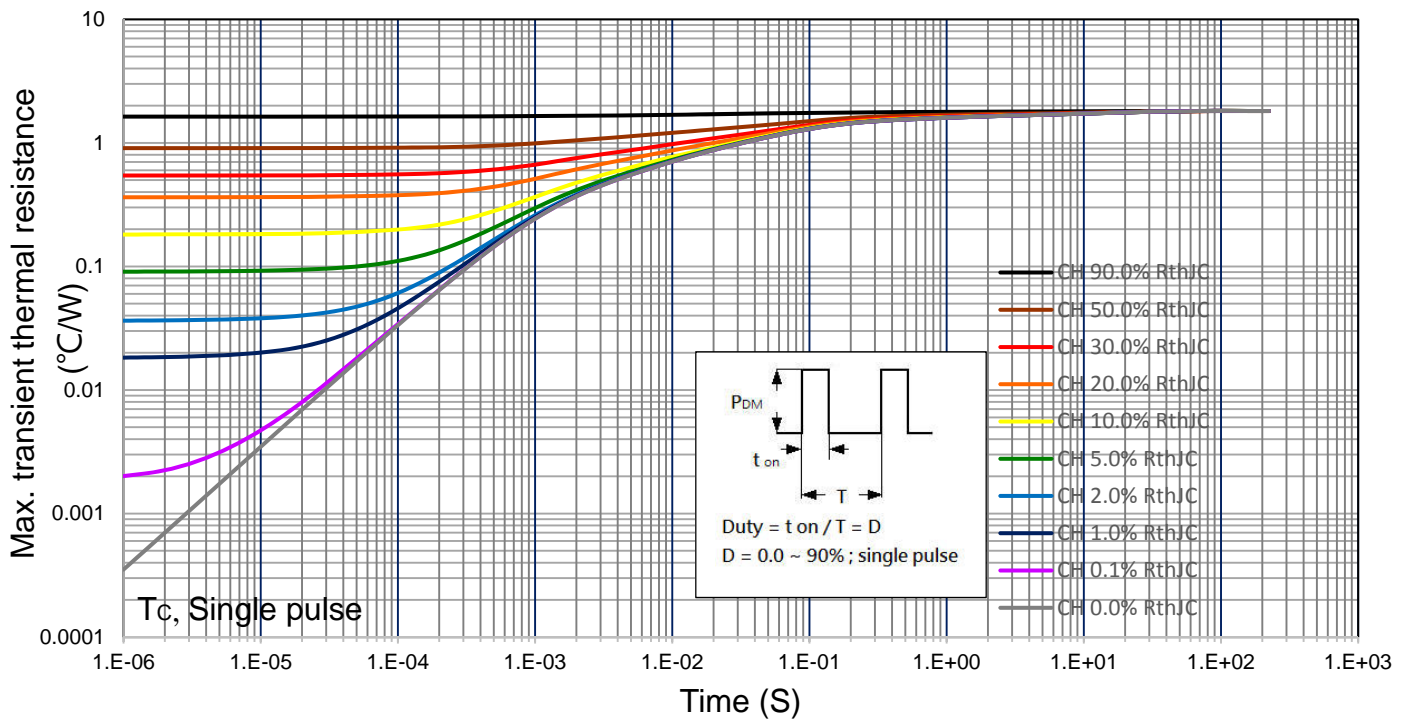
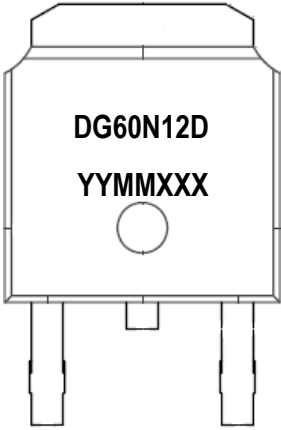


Fig.12 Transient Thermal Impedance



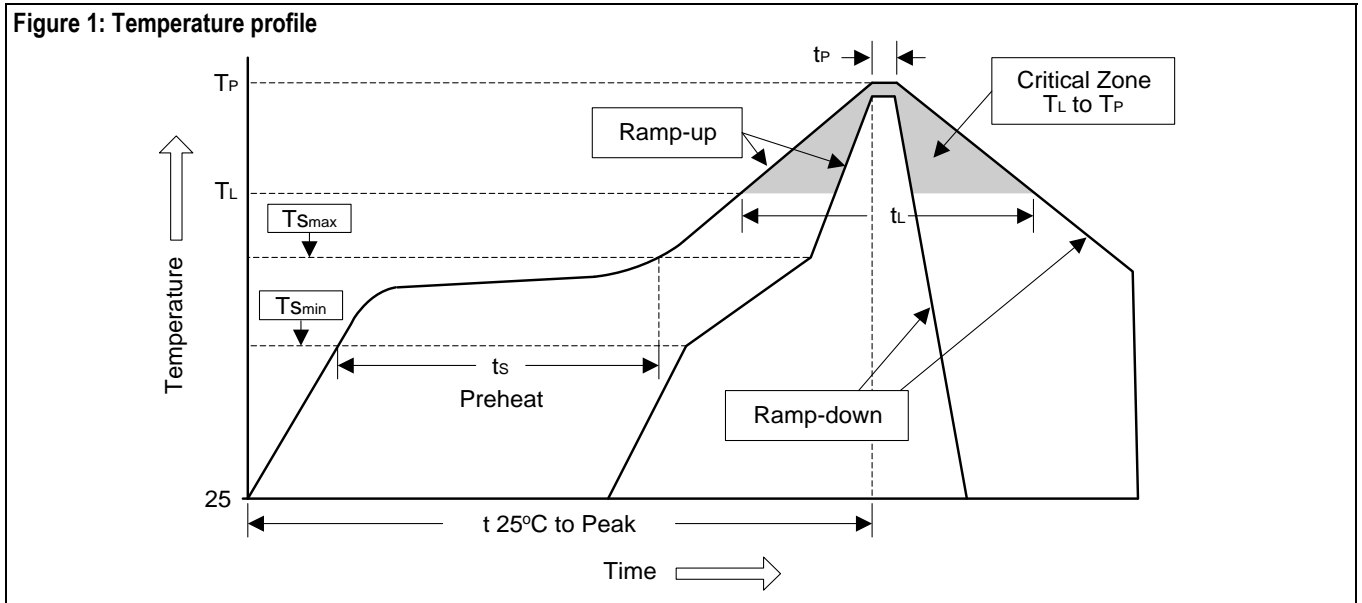
Marking Information

TO-252 (D)	Marking Rule
<p data-bbox="129 365 284 398">Laser Marking</p>  <p>The diagram shows a TO-252 (D) MOSFET package. The top surface is marked with the device identifier 'DG60N12D' and the date code 'YYMMXXX'. A small circular mark is located below the date code. The package has three leads extending from the bottom.</p>	<p data-bbox="805 365 976 398"><u>Line 1</u> : Device</p> <p data-bbox="805 405 932 439">DG60N12D</p> <p data-bbox="805 483 1018 517"><u>Line 2</u> : Date Code</p> <p data-bbox="805 524 932 557">YYMMXXX</p> <p data-bbox="805 602 986 636">YY : Year Code</p> <p data-bbox="805 642 1007 676">MM : Month Code</p> <p data-bbox="805 683 1038 716">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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