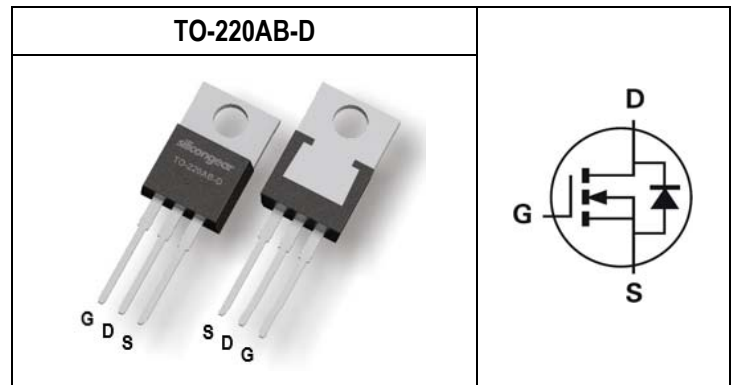


Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(ON) \text{ max. } V_{GS}=10V}$	2.7	m $\Omega$
$R_{DS(ON) \text{ max. } V_{GS}=4.5V}$	3.8	m $\Omega$
$I_D$	214	A
$Q_g$	99	nC
$Q_{gd}$	25.5	nC
$Q_{sw}$	33.6	nC



Features	Application
<ul style="list-style-type: none"> <li>Optimized for synchronous rectification Low Input Capacitance</li> <li>Low Switching Charge</li> <li>Low Miller Capacitance</li> <li>Fully Characterized Capacitance and Avalanche</li> <li>Pb-free lead plating; RoHS compliant</li> </ul>	<ul style="list-style-type: none"> <li>Battery powered circuits</li> <li>BLDC Motor drive applications</li> <li>Half-bridge and full-bridge topologies</li> <li>Synchronous rectifier applications</li> <li>Resonant mode power supplies</li> </ul>

## Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
DG60N11PB	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	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous <sup>Note 1</sup>	$I_D$	$T_C=25^\circ\text{C}$	214
		$T_C=100^\circ\text{C}$	135
Drain Current-Pulsed <sup>Note 2</sup>	$I_{DM}$	429	A
Avalanche Current	$I_{AR}$	58.8	A
Single Pulse Avalanche Energy <sup>Note 3</sup>	$E_{AS}$	173	mJ
Maximum Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	208
		$T_C=100^\circ\text{C}$	83
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-to-Ambient <sup>Note 4</sup>	$R_{\theta JA}$	Steady State	-	-	38.02	$^\circ\text{C/W}$
Thermal resistance, Junction-to-Case <sup>Note 4</sup>	$R_{\theta JC}$	Steady State	-	-	0.6	$^\circ\text{C/W}$

### Notes:

- Limited by silicon chip capability and junction temperature.
- 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  $T_J=25^\circ\text{C}$ ,  $L=0.1\text{mH}$ ,  $R_g=25\Omega$ ,  $I_D=58.8\text{A}$ ,  $V_{GS}=10\text{V}$ .
- $R_{\theta JA}$  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.

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

STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	-	-	1	μA
		V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C	-	-	100	μA
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA

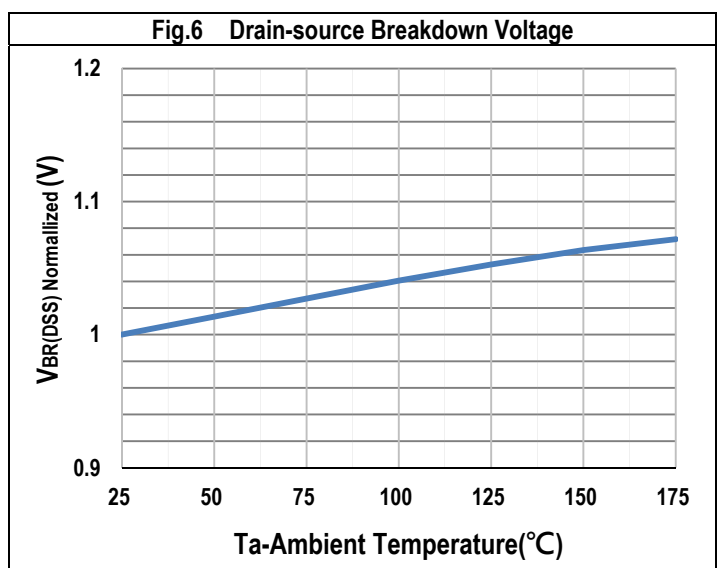
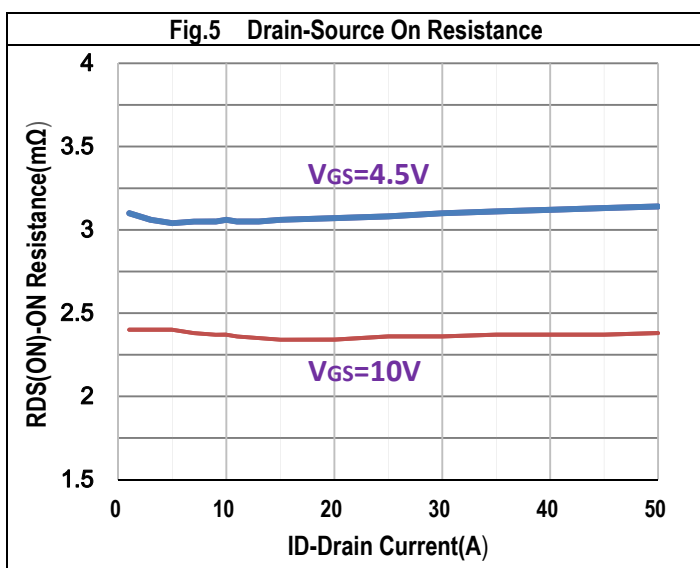
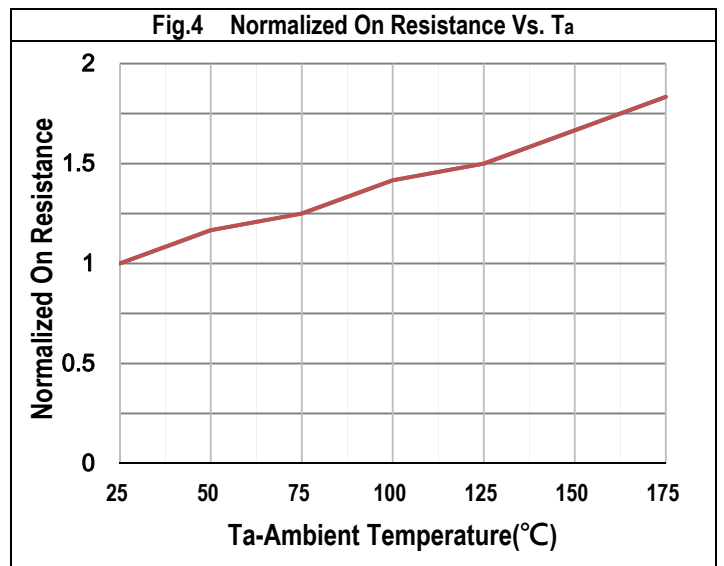
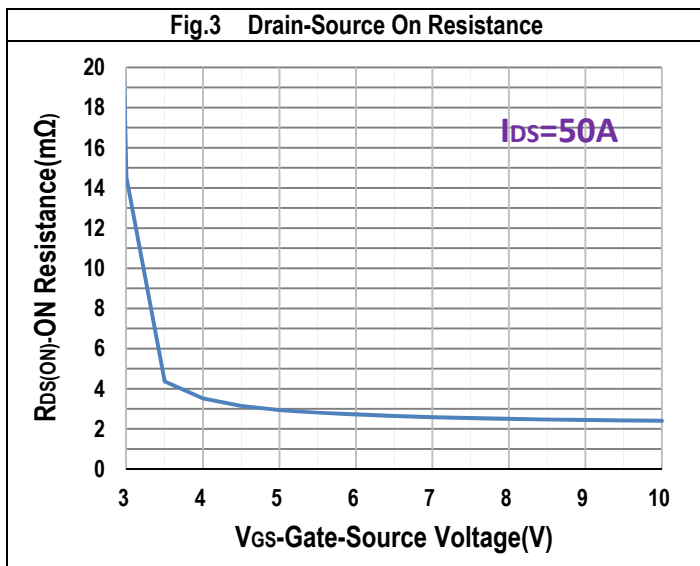
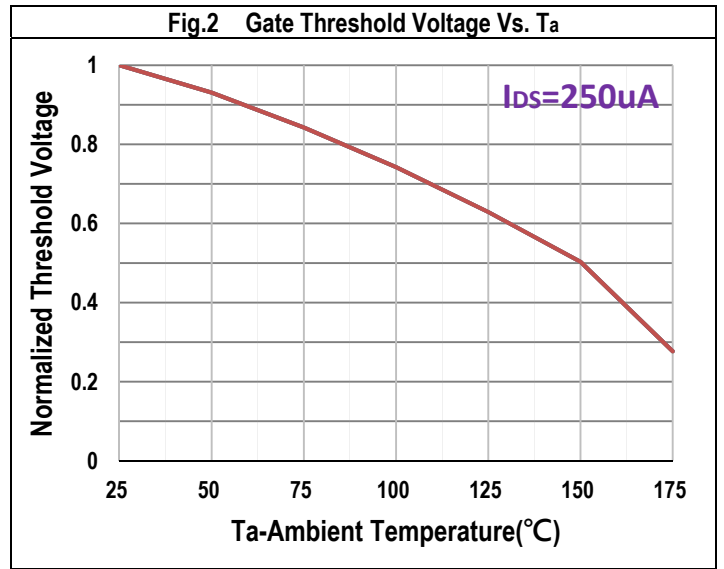
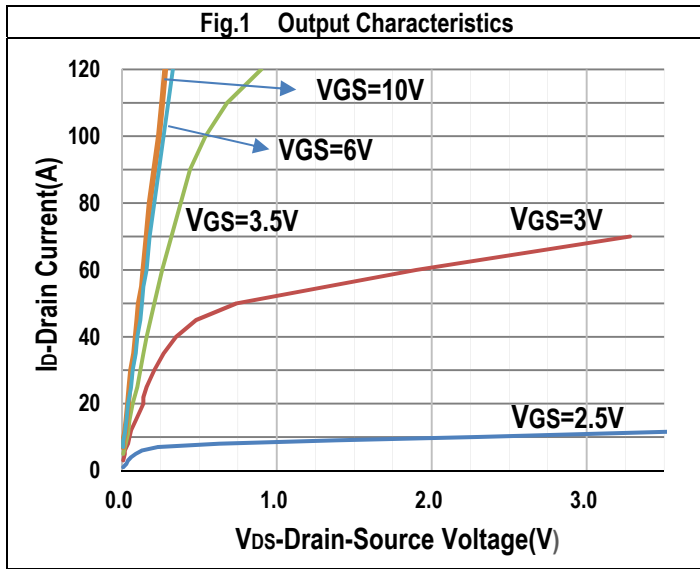
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.2	1.6	2.4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>DS</sub> =50A	-	2.3	2.7	mΩ
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>DS</sub> =20A	-	3.0	3.8	mΩ
Gate Resistance	R <sub>g</sub>	V <sub>GS</sub> =15mV, V <sub>DS</sub> =0V, f=1MHz	-	1.1	-	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =5V, I <sub>DS</sub> =20A	-	53	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz	-	5198	-	pF
Output Capacitance	C <sub>oss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz	-	1704	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz	-	76	-	pF
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =50A, R <sub>GEN</sub> =3Ω	-	28	-	ns
Rise Time	t <sub>r</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =50A, R <sub>GEN</sub> =3Ω	-	143	-	ns
Turn-Off Delay Time	T <sub>d(off)</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =50A, R <sub>GEN</sub> =3Ω	-	40	-	ns
Fall Time	t <sub>f</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =50A, R <sub>GEN</sub> =3Ω	-	167	-	ns

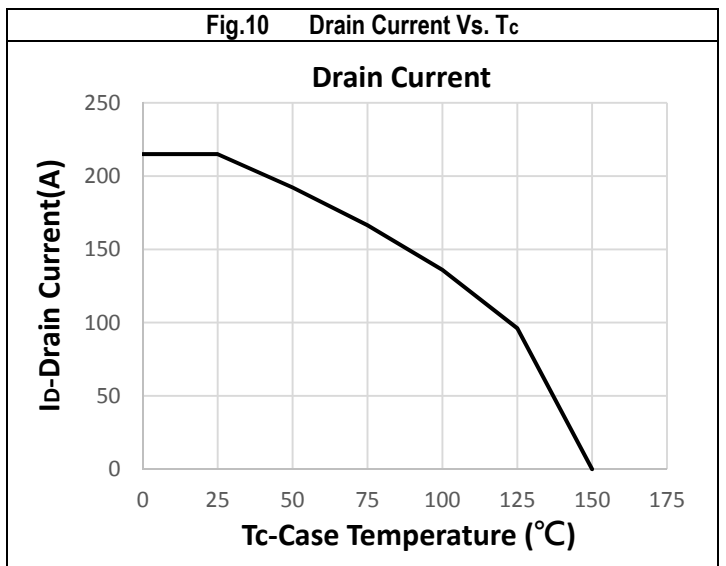
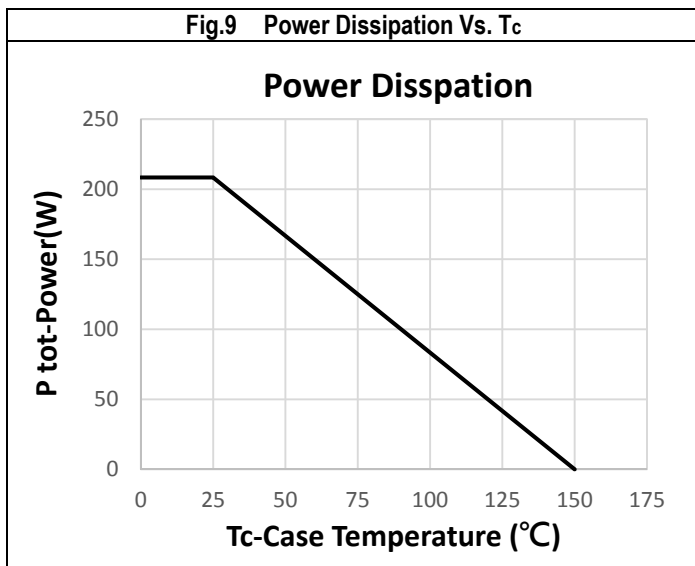
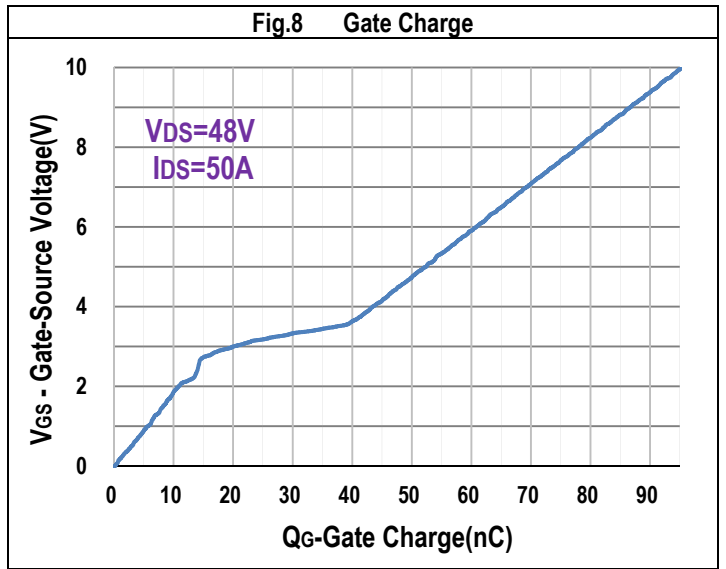
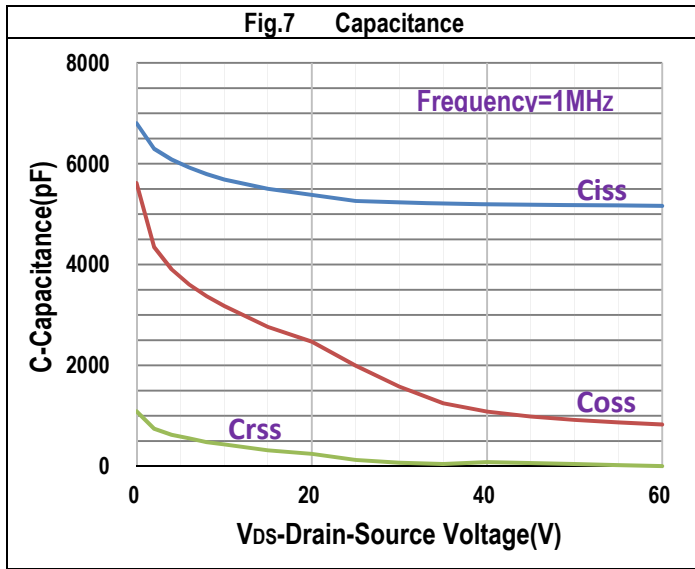
GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q <sub>gs</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	17.7	-	nC
Gate charge at threshold	Q <sub>g(th)</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	8.9	-	nC
Gate to Drain Charge	Q <sub>gd</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	25.5	-	nC
Switching charge	Q <sub>sw</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	33.6	-	nC
Gate charge total	Q <sub>g</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	99	-	nC
Gate charge total	Q <sub>g</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 4.5V	-	47	-	nC
Gate plateau voltage	V <sub>plateau</sub>	V <sub>DD</sub> =48V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	3.3	-	V
Gate charge total, sync. FET (Q <sub>g</sub> - Q <sub>gd</sub> )	Q <sub>g(sync)</sub>	V <sub>DS</sub> =0.1V, V <sub>GS</sub> =0 to 10V	-	73.5	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode continuous forward current (Body Diode)	I <sub>S</sub>	T <sub>C</sub> =25°C	-	-	214	A
Diode pulse current (Body Diode)	I <sub>SM</sub>	T <sub>C</sub> =25°C	-	-	429	A
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A	-	0.65	1	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	V <sub>DD</sub> =48V, I <sub>F</sub> =50A, di/dt=200A/μs	-	44	-	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	V <sub>DD</sub> =48V, I <sub>F</sub> =50A, di/dt=200A/μs	-	78	-	nC

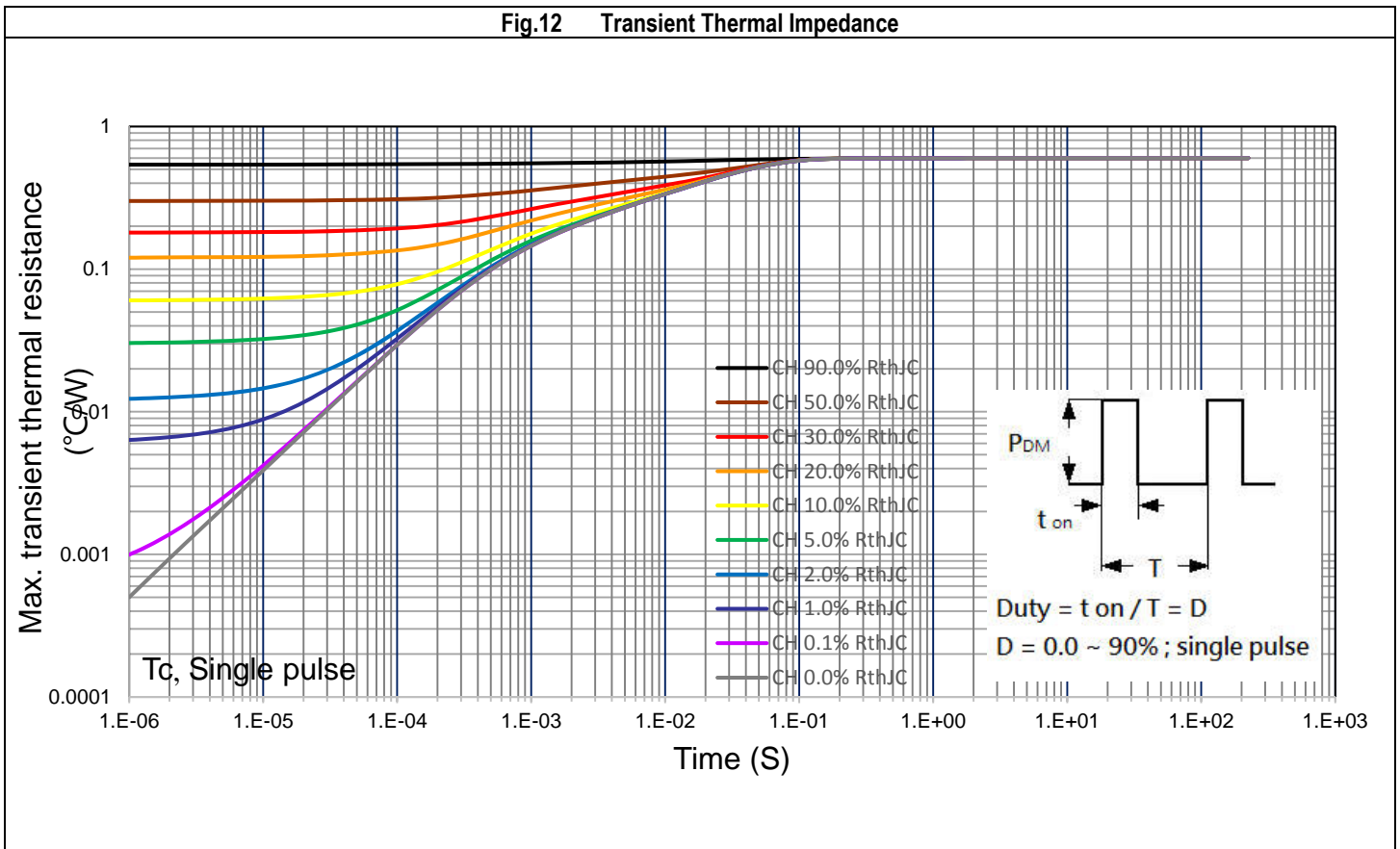
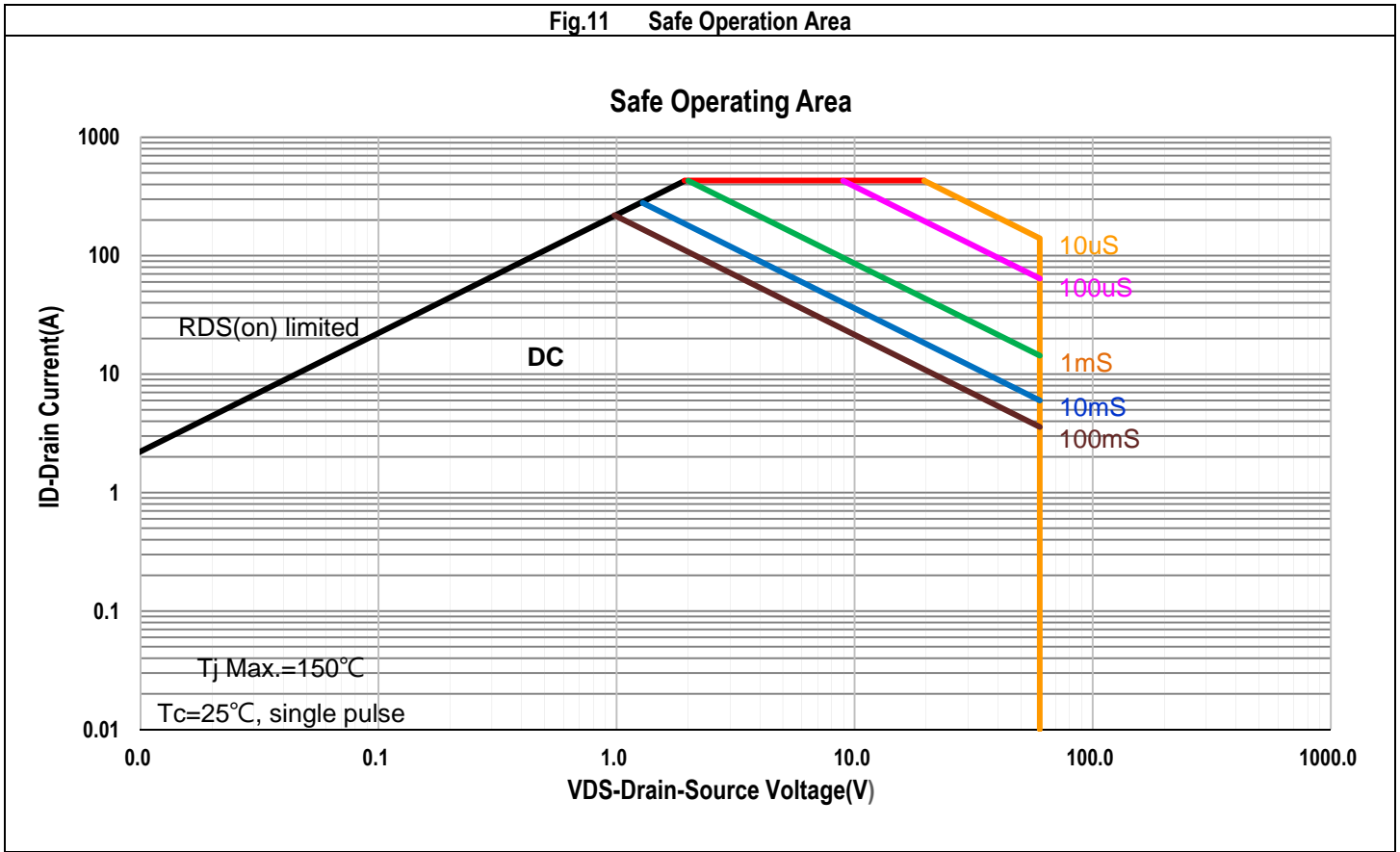
## Typical Operating Characteristics



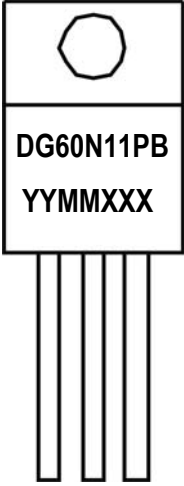
Typical Operating Characteristics (Cont.)



Typical Operating Characteristics (Cont.)



## Marking Information

TO-220AB-D (PB)	Marking Rule
<p data-bbox="92 367 256 398">Laser Marking</p>  <p data-bbox="389 920 488 949">Diagram</p>	<p data-bbox="815 367 1002 398"><u>Line 1</u> : Device</p> <p data-bbox="815 412 970 443">DG60N11PB</p> <p data-bbox="815 501 1046 533"><u>Line 2</u> : Date Code</p> <p data-bbox="815 546 951 577">YYMMXXX</p> <p data-bbox="815 636 1011 667">YY : Year Code</p> <p data-bbox="815 680 1035 712">MM : Month Code</p> <p data-bbox="815 725 1070 757">XXX : Serial Number</p>

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