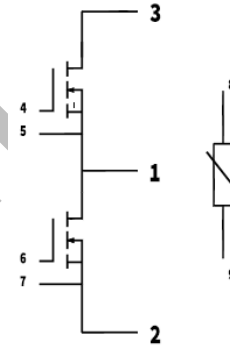


MSC120HF120T2LH

SiC MOSFET Module

Features:

- Ultra Low Loss
- High-Frequency Operation
- Zero Reverse Recovery Current from Diode
- Zero Turn-off Tail Current from MOSFET
- Normally-off, Fail-safe Device Operation
- Easy of Paralleling
- Copper Baseplate and Aluminum Nitride Insulator



Applications:

- Induction Heating
- DC/DC Converters
- Solar and Wind Inverters
- Line Regen Drives
- Battery Charge

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

Symbol	Description		Value	Units
V_{DSmax}	Drain-Source Voltage		1200	V
V_{GSmax}	Gate-Source Voltage	Absolute Maximum values	-10/+25	V
V_{GSop}	Gate-Source Voltage	Recommended Operational Values	-5/20	V
I_D	Continuous Drain Current	$V_{GS}=20\text{V}, T_C=25^\circ\text{C}$	193	A
		$V_{GS}=20\text{V}, T_C=90^\circ\text{C}$	138	A
$I_{D(pluse)}$	Pulsed Drain Current	Pulse width t_p limited by T_{jmax}	480	A
P_D	Power Dissipation	$T_C=25^\circ\text{C}, T_j=150^\circ\text{C}$	925	W

Electrical Characteristics of MOSFET ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain - Source Breakdown Voltage	$V_{GS}=0V, I_D=300\mu A$	1.2			V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = 10\text{ V}, I_D = 6\text{ mA}$	1.8	2.6		V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1.2\text{ kV}, V_{GS} = 0V$		80	300	μA
		$V_{DS} = 1.2\text{ kV}, V_{GS} = 0V,$ $T_J = 150^\circ\text{C}$		400	1500	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = 20\text{ V}, V_{DS} = 0V$		1	100	nA
$R_{DS(on)}$	On State Resistance	$V_{GS} = 20\text{ V}, I_{DS} = 120\text{ A}$		13	16	m Ω
		$V_{GS} = 20\text{ V}, I_{DS} = 120\text{ A},$ $T_J = 150^\circ\text{C}$		23	30	
g_{fs}	Transconductance	$V_{DS}= 20\text{ V}, I_{DS} = 120\text{ A}$		53.8		S
		$V_{DS}= 20\text{ V}, I_{DS} = 120\text{ A}, T_J=150^\circ\text{C}$		48.5		
C_{iss}	Input Capacitance			6.3		nF
C_{oss}	Output Capacitance	$V_{DS} = 1KV, f = 200\text{ kHz},$ $V_{AC} = 25\text{ mV}$		0.88		
C_{rss}	Reverse Transfer Capacitance			0.037		
E_{on}	Turn-On Switching Energy	$V_{DD} = 600\text{ V}, V_{GS} = -5V/+20V$ $I_D = 120\text{ A}, R_{G(ext)} = 2.5\ \Omega$		1.7		mJ
E_{off}	Turn-Off Switching Energy			0.4		
$R_{G(int)}$	Internal Gate Resistance	$f = 200\text{ kHz}, V_{AC} = 25\text{ mV}$		1.8		Ω
Q_{GS}	Gate-Source Charge	$V_{DD}= 800\text{ V}, V_{GS} = -5V/+20V,$ $I_D= 120\text{ A},$		97		nC
Q_{GD}	Gate-Drain Charge			118		
Q_G	Total Gate Charge			378		
$t_{d(on)}$	Turn-off delay time	$V_{DD} = 600V, V_{GS} = -5/+20V,$ $I_D = 120\text{ A}, R_{G(ext)} = 2.5\ \Omega,$		38		ns
t_r	Rise Time			34		
$t_{d(off)}$	Turn-off delay time			70		
t_f	Fall Time			22		
t_{SC}	Short Time	$V_{DD}=700V, V_{GS}=15V, T_J=100^\circ\text{C}$	5			μs
$R_{\theta JCM}$	MOSFET Thermal Resistance: Junction-To-Case			0.125	0.135	$^\circ\text{C/W}$

Electrical Characteristics of Body Diode ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	$I_F = 120\text{ A}, V_{GS} = 0$		1.5	1.8	V
		$I_F = 120\text{ A}, V_{GS} = 0, T_J = 150^\circ\text{C}$		1.9	2.4	
Q_C	Total Capacitive Charge	$I_{SD} = 120\text{ A}, V_{DS} = 600\text{ V}, T_J = 25^\circ\text{C}, di_{SD}/dt = 3\text{ kA}/\mu\text{s}, V_{GS} = -5\text{ V}$		1.1		μC
$R_{\theta JCD}$	Diode Thermal Resistance: Junction-To-Case			0.108	0.115	$^\circ\text{C}/\text{W}$
I_F	Continuous Diode Forward Current	$V_{GS} = -5\text{ V}, T_C = 25^\circ\text{C}$			305	A
		$V_{GS} = 5\text{ V}, T_C = 25^\circ\text{C}$			195	A

NTC-Thermistor Characteristic Values

R_{25}	$T_C = 25^\circ\text{C}$	5		$\text{k}\Omega$
$\Delta R/R$	$T_C = 100^\circ\text{C}, R_{100} = 481\Omega$		± 5	%
P_{25}	$T_C = 25^\circ\text{C}$	50		mW
$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$	3380		K
$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$	3440		K

Module

Symbol	Description	Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	$f = 50\text{ Hz}, 1\text{ minute}$	2500		V
L_{stray}	Stray Inductance	Measured between terminals 2 and 3		8.2	nH
T_J	Maximum Junction Temperature			150	$^\circ\text{C}$
T_{JOP}	Maximum Operating Junction Temperature Range	-40		150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-40		125	$^\circ\text{C}$
CTI	Comparative Tracking Index	200			
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)		0.03		$^\circ\text{C}/\text{W}$
M	Power Terminals Screw:M5	2.0		3.5	N·m
M	Mounting Screw:M6	3.0		5.0	N·m
G	Weight		290		g

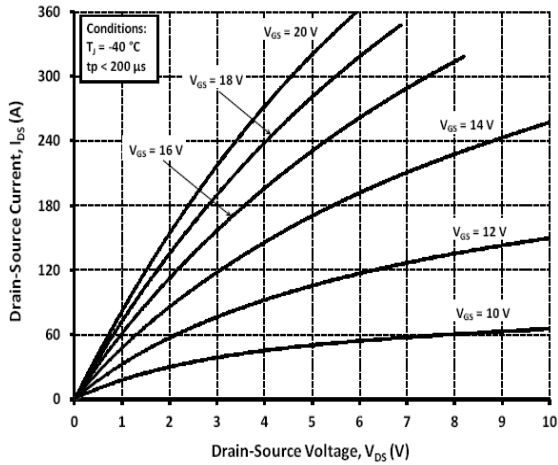


Fig.1 Output Characteristic $T_j = -40^\circ\text{C}$

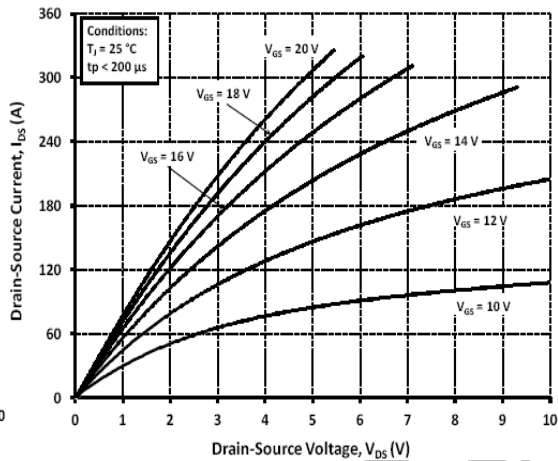


Fig.2 Output Characteristics $T_j = 25^\circ\text{C}$

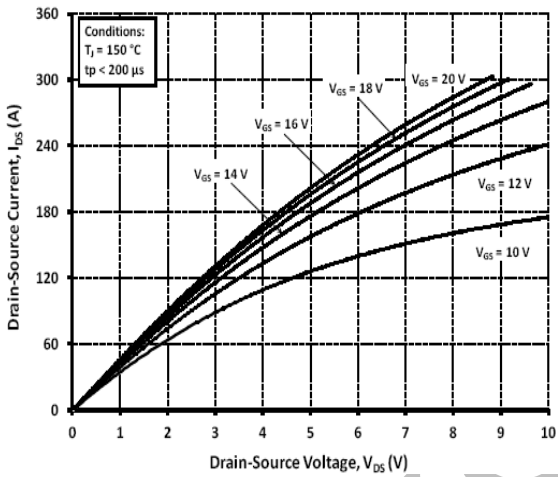


Fig.3 Output Characteristic $T_j = 150^\circ\text{C}$

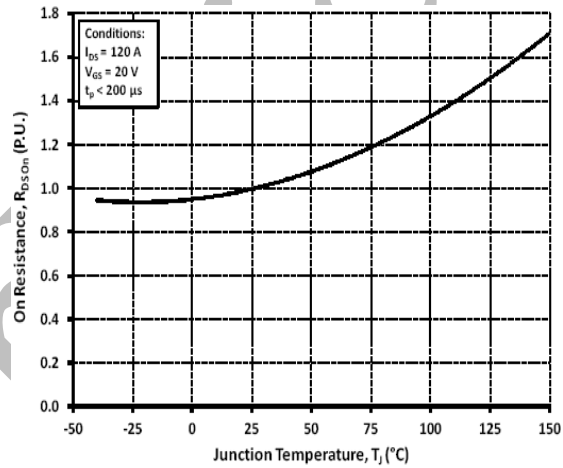


Fig.4 Normalized On-Resistance VS Temperature

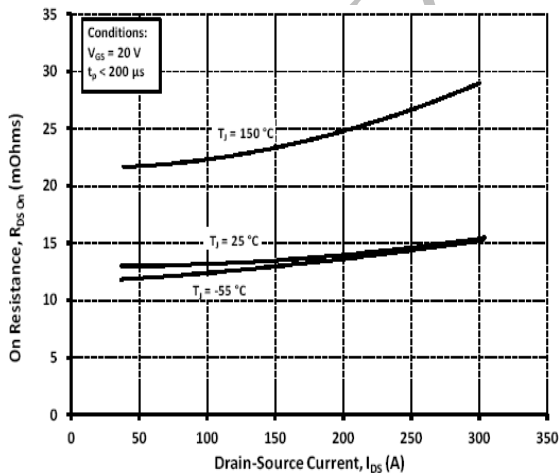


Fig.5 On-Resistance VS Drain Current For Various Temperatures

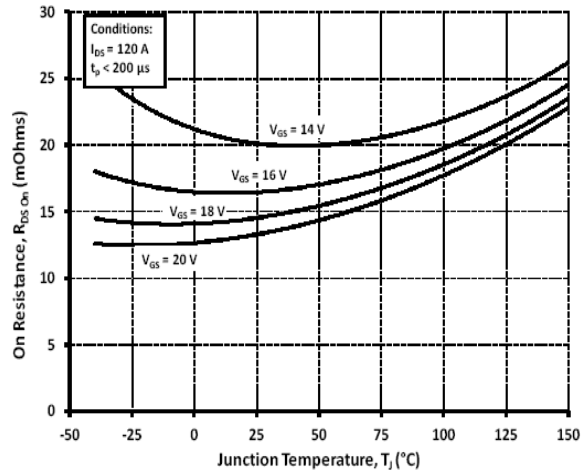


Fig.6 On-Resistance vs Temperatures For Various Gate-Source voltage

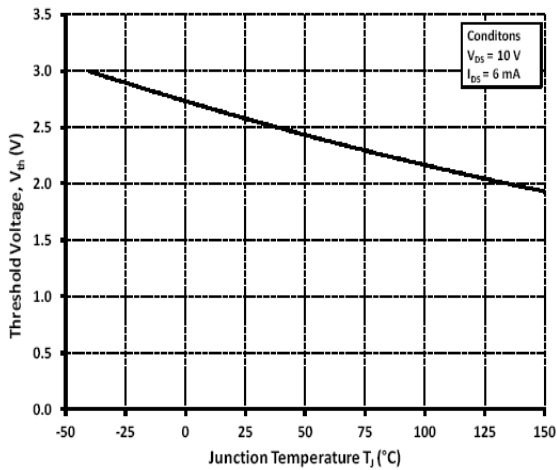


Fig.7 Threshold Voltage VS Temperature

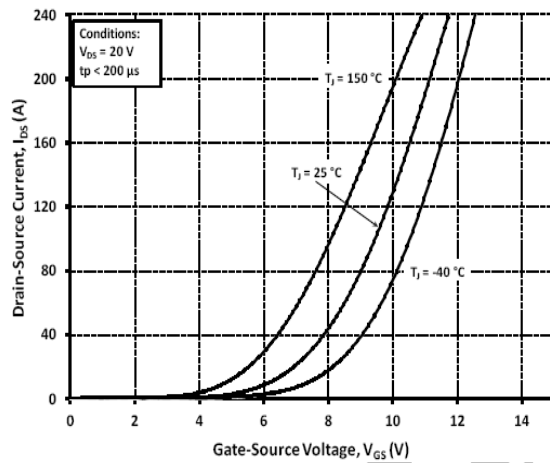


Fig.8 Transfer Characteristic for Various Junction Temperature

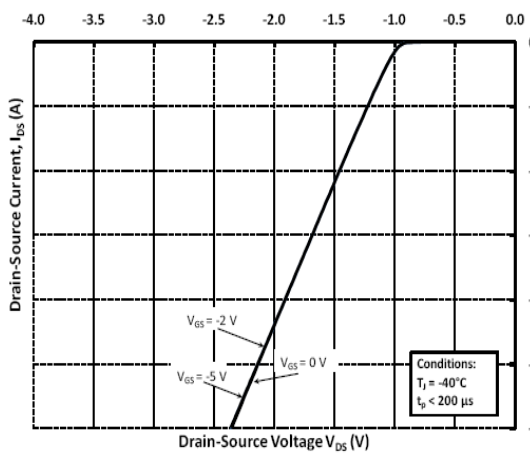


Fig.9 Diode Characteristic at -40°C

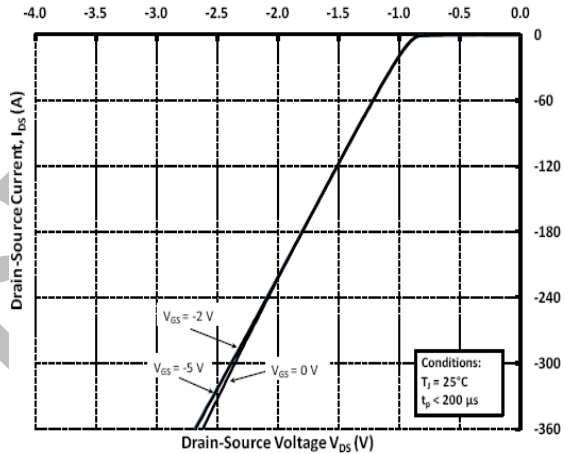


Fig.10 Diode Characteristic at 25°C

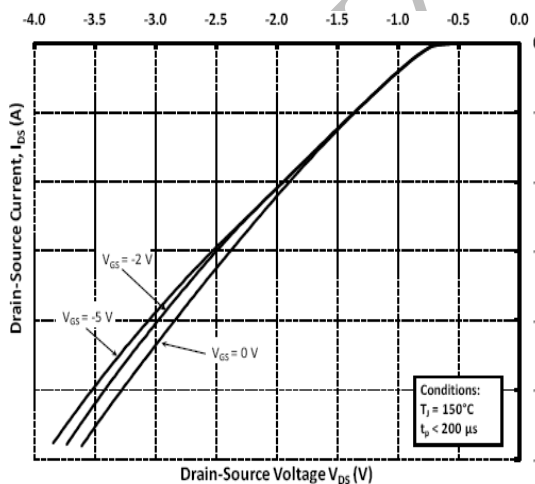


Fig.11 Diode Characteristic at 150°C

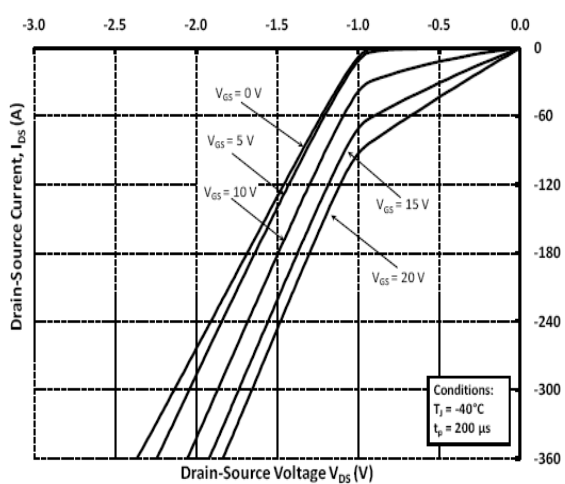


Fig.12 3rd Quadrant Characteristic at -40°C

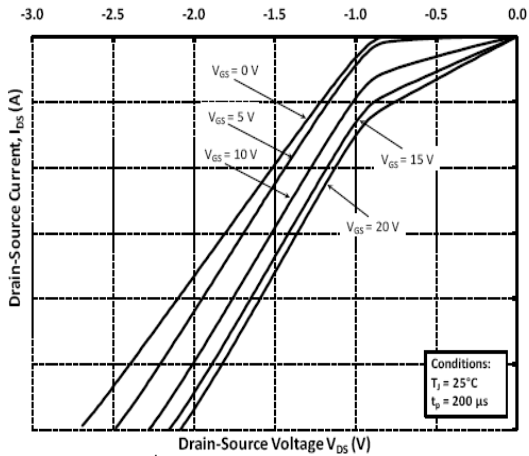


Fig. 13 3rd Quadrant Characteristic at 25°C

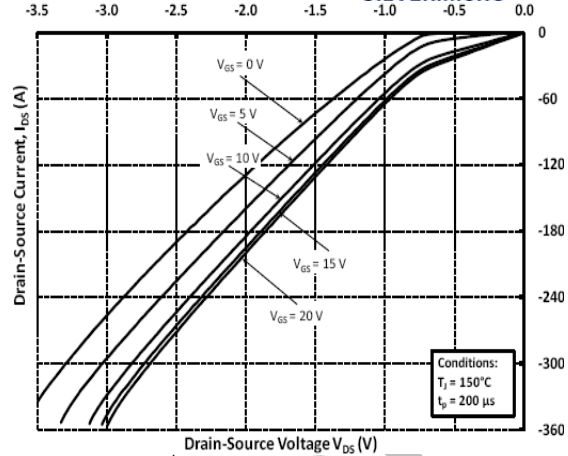


Fig. 14 3rd Quadrant Characteristic at 150°C

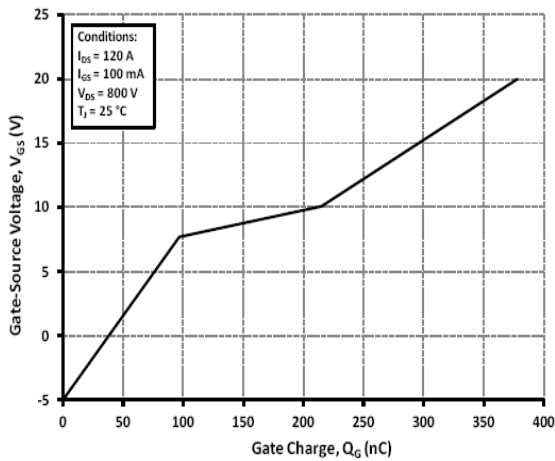


Fig. 15 Typical Gate Charge Characteristic

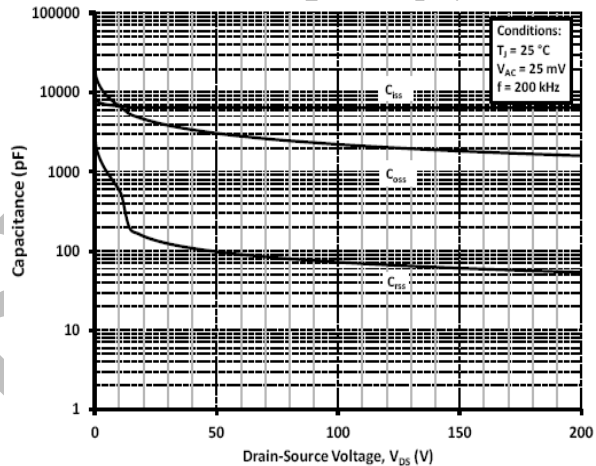


Fig. 16 Capacitances VS Drain-Source Voltage (0-200V)

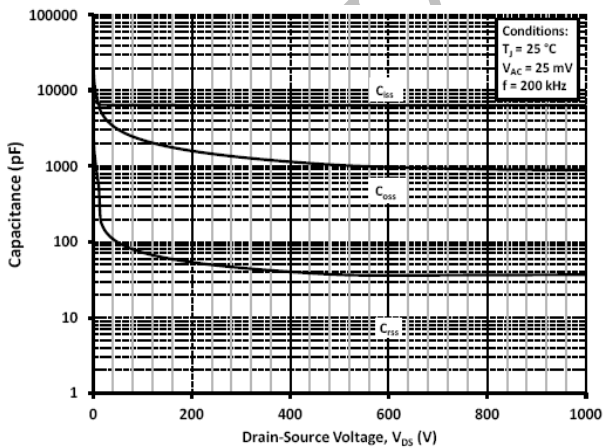


Fig. 17 Typical Capacitances VS Drain-Source Voltage (0-1KV)

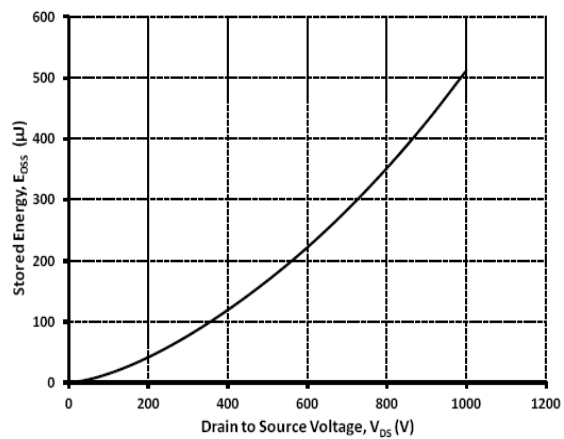


Fig. 18 Typical Output Capacitor Stored Energy

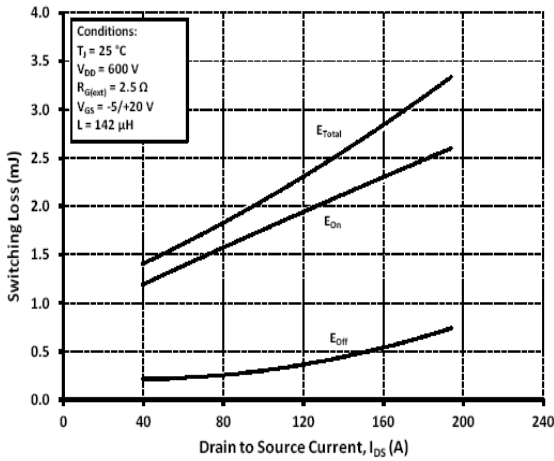


Fig.19 Inductive Switching Energy VS Drain Current For $V_{DS}=600\text{A}$, $R_G=2.5\ \Omega$

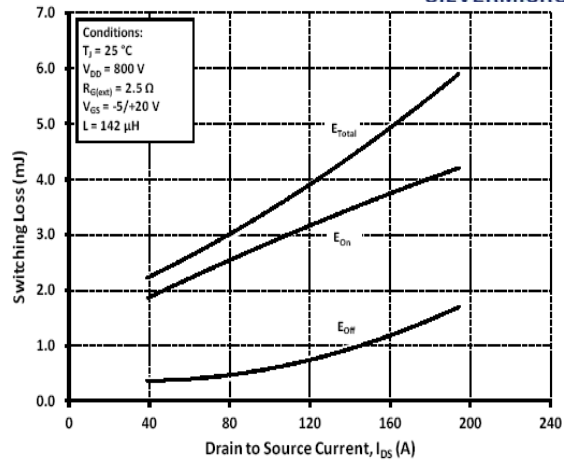


Fig.20 Inductive Switching Energy VS Drain Current For $V_{DS}=800\text{A}$, $R_G=2.5\ \Omega$

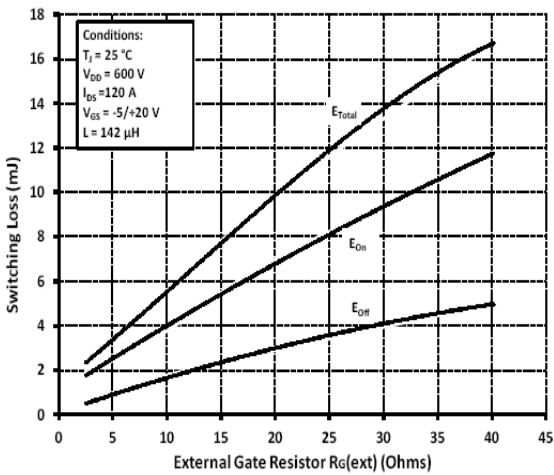


Fig.21 Inductive Switching Energy VS $R_{G(\text{ext})}$

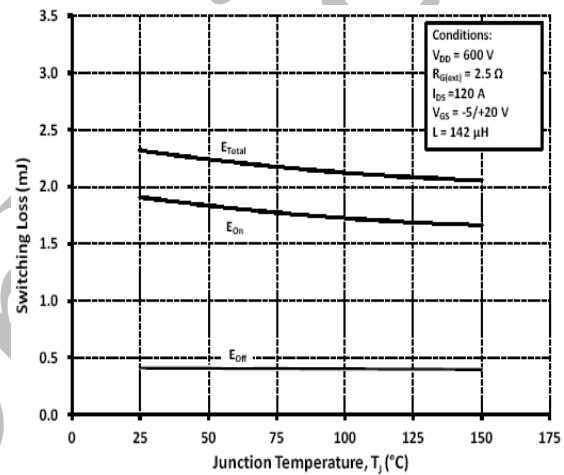


Fig.22 Inductive Switching Energy VS Temperature

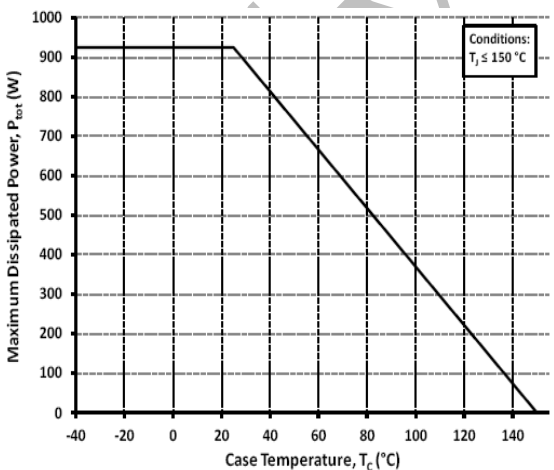


Fig.23 Maximum Power Dissipation (MOSFET) Derating VS Case Temperature

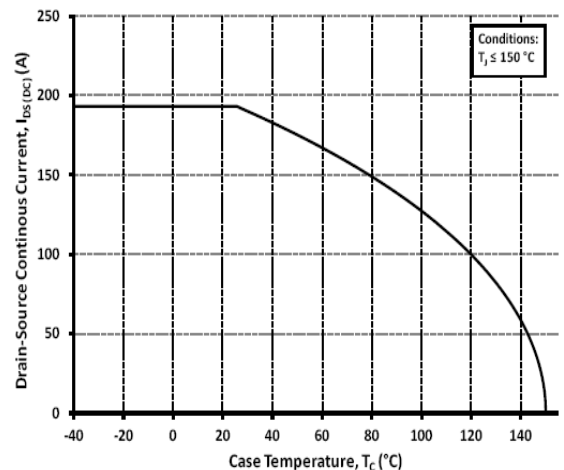


Fig.24 Continuous Drain Current Derating VS Case Temperature

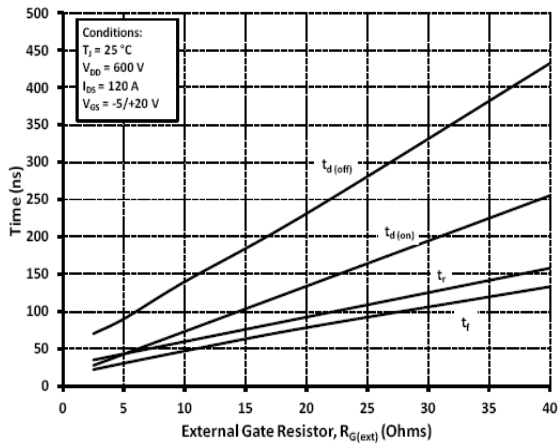


Fig.25 Timing VS $R_{G(ext)}$

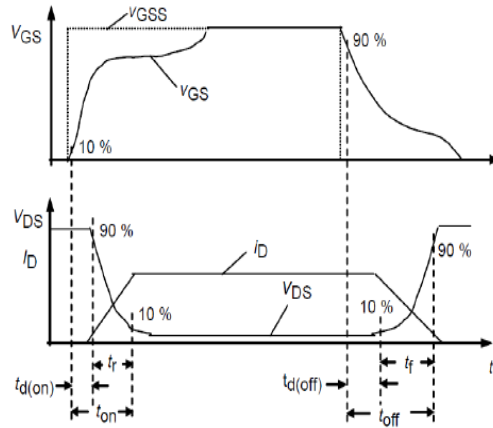


Fig.26 Resistive Switching Time Description

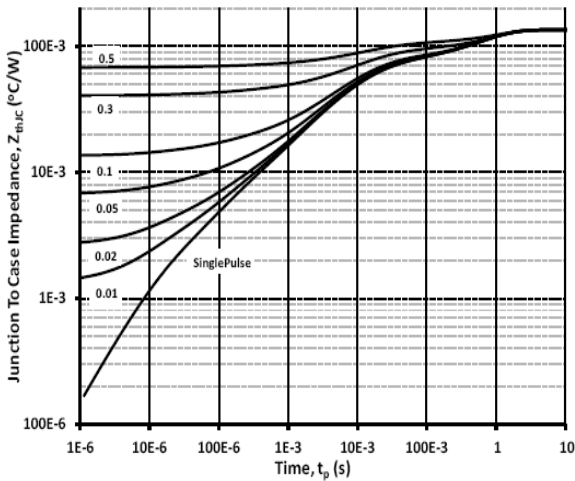


Fig.27 MOSFET Junction Case Thermal Impedance

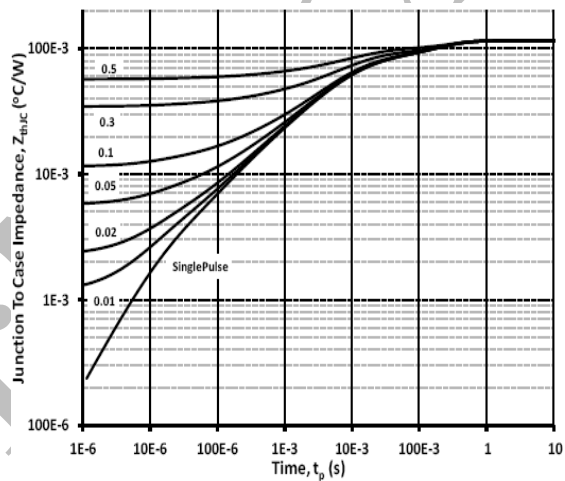


Fig.28 Diode Junction to Case Thermal Impedance

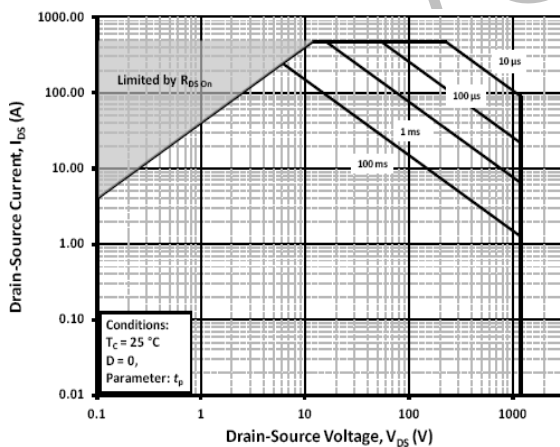


Fig.29 Maximum Power Dissipation (MOSFET) Derating Vs. Case Temperature

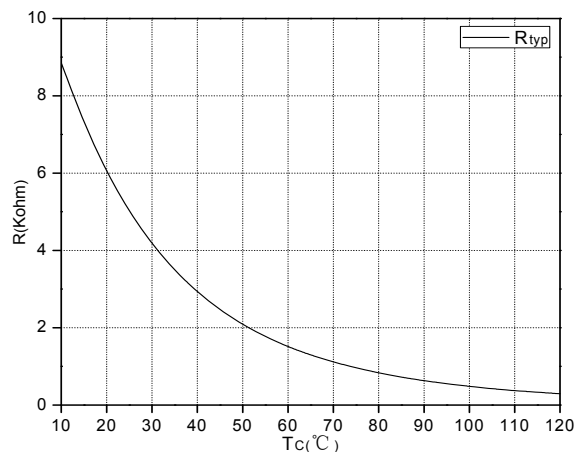
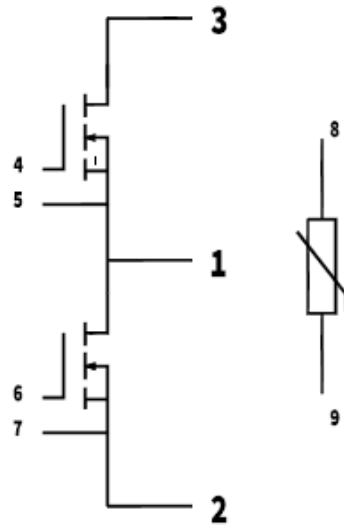
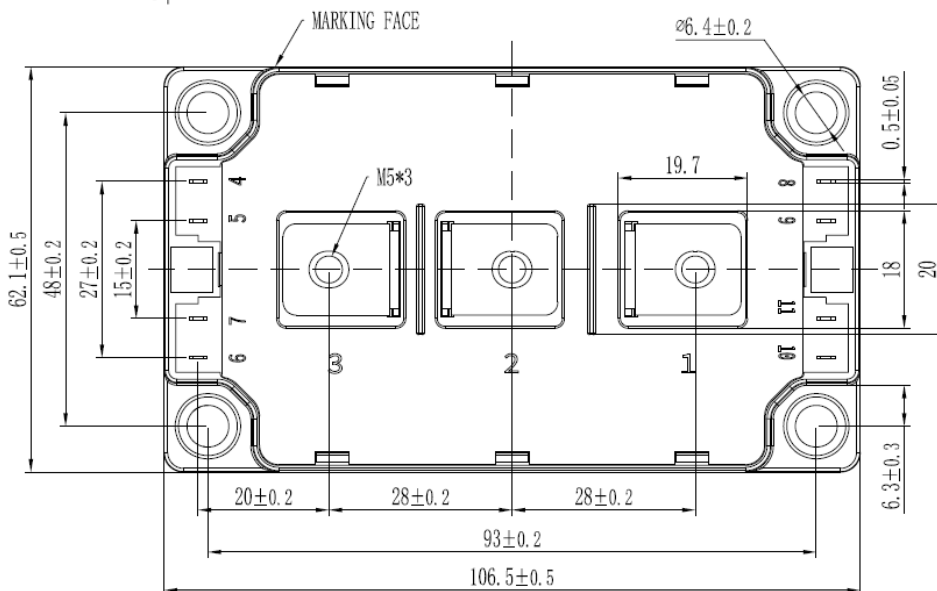
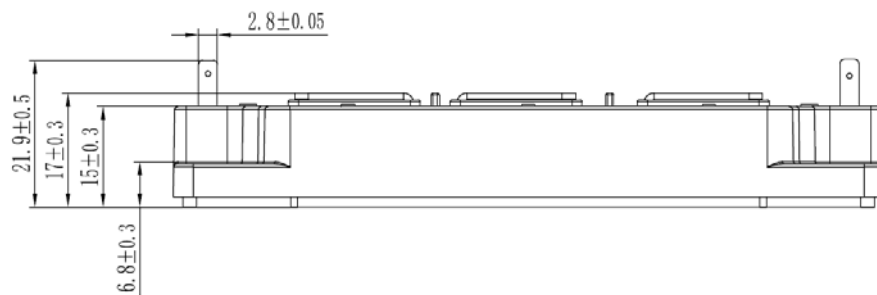


Fig.30 NTC Temperature Characteristics

Internal Circuit:



Package Outline (Unit: mm):





Date	Revision	Notes
12/27/2018	01	Initial Release
01/24/2019	02	Add t _{SC} & L _{Stray}

Announcement

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