

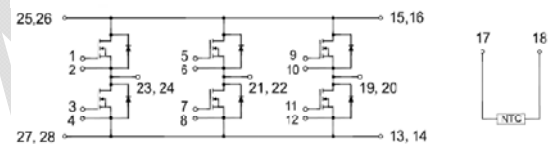
MSC20FF120T5H

SiC MOSFET Module

Preliminary Data

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:

- Solar Inverter
- 3-Phase PFC
- UPS and SMPS
- Regen Drives
- Motor Drive

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	$V_{GS}=20V, T_C=25^\circ\text{C}$	29.5	A
		$V_{GS}=20V, T_C=90^\circ\text{C}$	20	A
$I_{D(pluse)}$	Pulsed Drain Current	Pulse width t_p limited by T_{jmax}	80	A
P_D	Power Dissipation	$T_c=25^\circ\text{C}, T_j=150^\circ\text{C}$	167	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			KV
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.7	2.2		V
		$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}, T_J=150^{\circ}\text{C}$		1.6		
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1.2\text{ kV}, V_{GS} = 0V$		1	100	μA
		$V_{DS} = 1.2\text{ kV}, V_{GS} = 0V, T_J = 150^{\circ}\text{C}$		10	250	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = 20\text{ V}, V_{DS} = 0V$		1	250	nA
$R_{DS(on)}$	On State Resistance	$V_{GS} = 20\text{ V}, I_{DS} = 20\text{ A}$		80	98	m Ω
		$V_{GS} = 20\text{ V}, I_{DS} = 20\text{ A}, T_J = 150^{\circ}\text{C}$		145	208	
g_{fs}	Transconductance	$V_{DS}= 20\text{ V}, I_{DS} = 20\text{ A}$		9.8		S
		$V_{DS}= 20\text{ V}, I_{DS} = 20\text{ A}, T_J=150^{\circ}\text{C}$		8.5		
C_{iss}	Input Capacitance			900		nF
C_{oss}	Output Capacitance	$V_{DS} = 800V, f = 200\text{ kHz}, V_{AC} = 25\text{ mV}$		181		
C_{rss}	Reverse Transfer Capacitance			5.9		
E_{on}	Turn-On Switching Energy	$V_{DD} = 800\text{ V}, V_{GS} = -5V/+20V, I_D = 20\text{ A}, R_{G(ext)} = 2.5\ \Omega, \text{Load}=412\ \mu H, T_J=150^{\circ}\text{C}$		0.41		mJ
E_{off}	Turn-Off Switching Energy			0.07		
$R_{G(int)}$	Internal Gate Resistance	$f = 1\text{MHz}, V_{AC} = 25\text{ mV}$		3.8		Ω
Q_{GS}	Gate-Source Charge	$V_{DD}= 800\text{ V}, V_{GS} = -5V/+20V, I_D= 20\text{ A},$		16.1		nC
Q_{GD}	Gate-Drain Charge			20.7		
Q_G	Total Gate Charge			61.5		
$t_{d(on)}$	Turn-off delay time	$V_{DD} = 800V, V_{GS} = -5/+20V, I_D = 20\text{ A}, R_{G(ext)} = 2.5\ \Omega, \text{Timing relative to VDS}$		10		ns
t_r	Rise Time			14		
$t_{d(off)}$	Turn-off delay time			22.4		
t_f	Fall Time			53		
$R_{\theta JCM}$	Thermal Resistance Junction-To-Case for MOSFET			0.7	0.75	$^{\circ}\text{C/W}$

Free-Wheeling SiC Schottky Diode Characteristics (T_C=25°C unless otherwise specified)

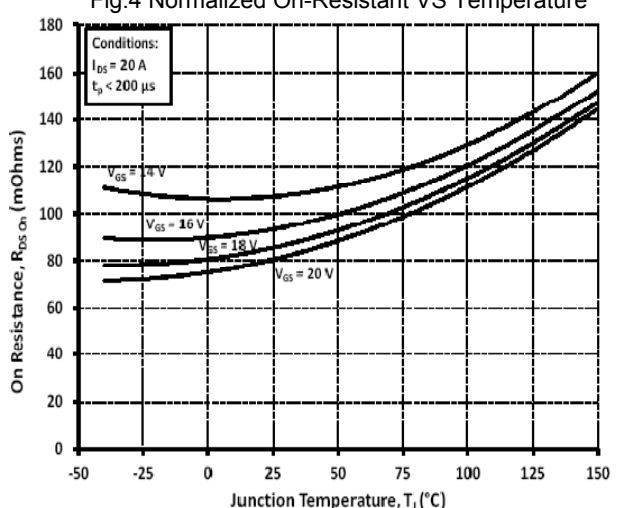
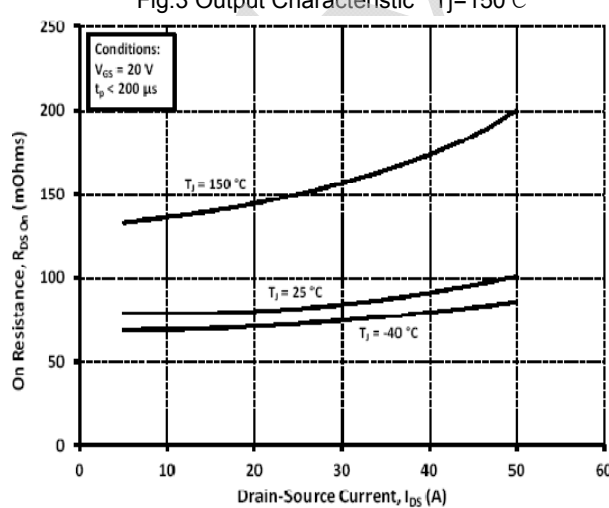
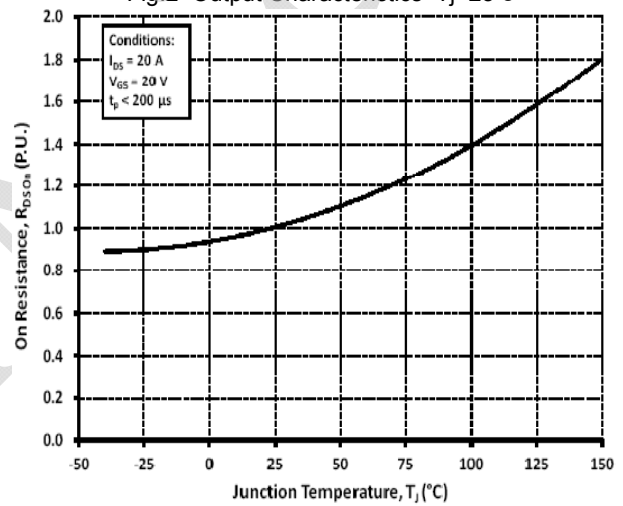
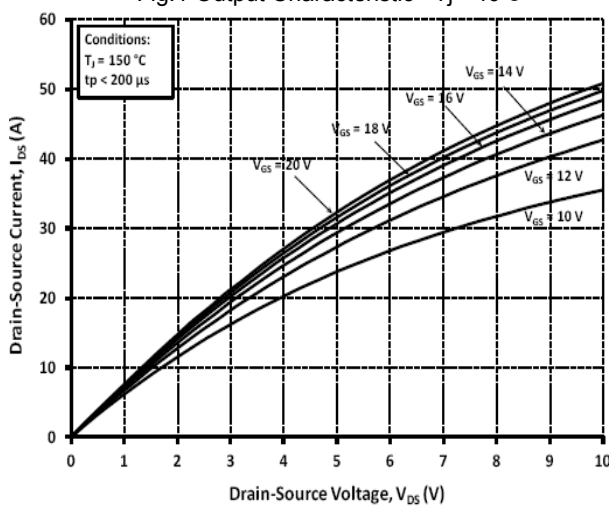
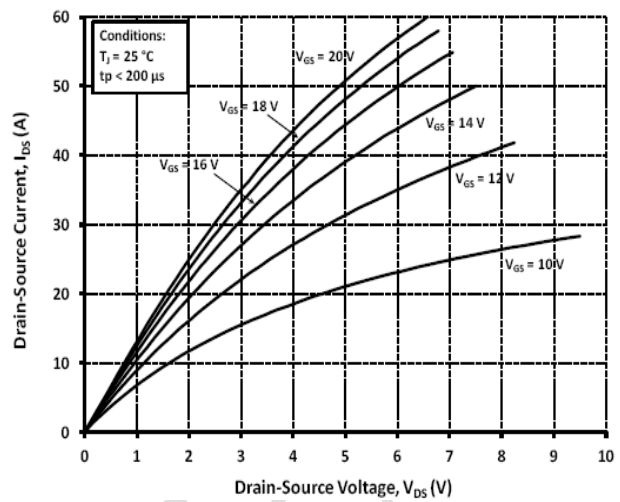
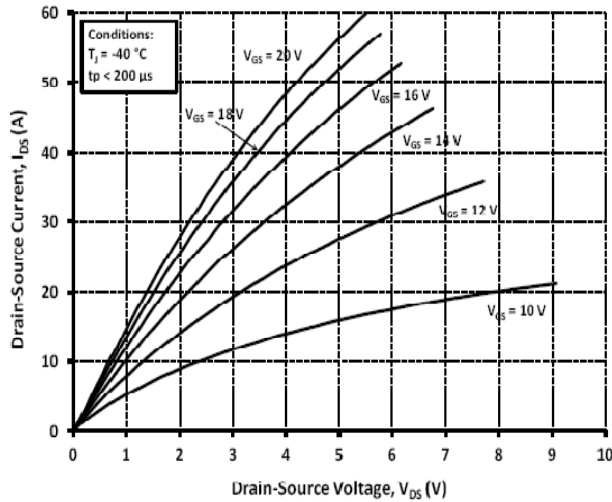
Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{SD}	Diode Forward Voltage	I _F = 20 A, V _{GS} = 0		1.5	1.7	V
		I _F = 20 A, V _{GS} = 0 T _J =150°C		1.8	2.3	
Q _C	Total Capacitive Charge	I _{SD} = 20A, V _{DS} = 800 V, T _J = 25°C, di _{SD} /dt = 1500A/μs, V _{GS} = -5 V		0.27		μC
R _{θJCD}	Thermal Resistance Junction-To-Case for Diode			0.8	0.85	°C/W
I _F	Continuous Diode Forward Current	V _{GS} = -5V, T _C =25°C			46	A
		V _{GS} = 5V, T _C =25°C			27	A

NTC Characteristics

Symbol	Conditions	Min	Typ	Max	Unit
R ₂₅	T _C =25°C		5		KΩ
Delta R/R	T _C =100°C.R ₁₀₀ =481 Ω			±5	%
P ₂₅	T _C =25°C			20	mW
B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$		3380		K
B _{25/80}	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$		3440		K

Module

Symbol	Description	Conditions	Min	Typ	Max	Unit
T _{Jmax}	Junction Temperature		-40		150	°C
T _C , T _{STG}	Case and Storage Temperature Range		-40		125	°C
Viso	Case Isolation Voltage	AC,50 HZ, 1 min	4.5			KV
L _{Stray}	Stray Inductance	Measured between terminals 2 and 3			30	nH
G	Weight			180		g
M	Mounting Torque	To heatsink and terminal			5	N·m
	Clearance Distance	Terminal to terminal			14.09	mm
	Creepage Distance	Terminal to terminal			14.11	mm
		Terminal to baseplate			17.46	mm



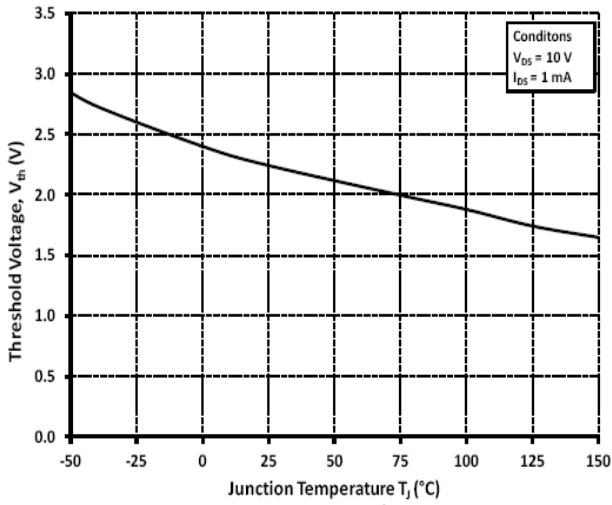


Fig. 7 Threshold Voltage VS Temperature

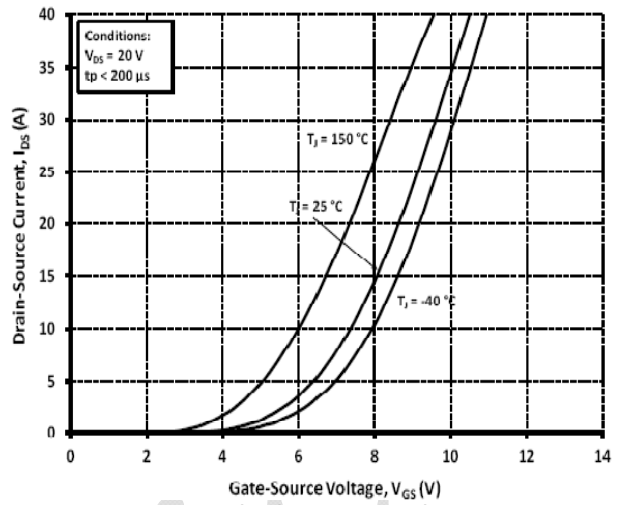


Fig. 8 Transfer Characteristic for Various Junction Temperature

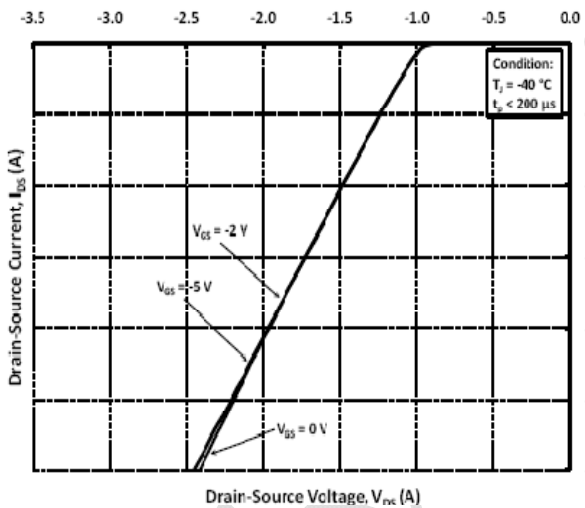


Fig. 9 Diode Characteristic at -40°C

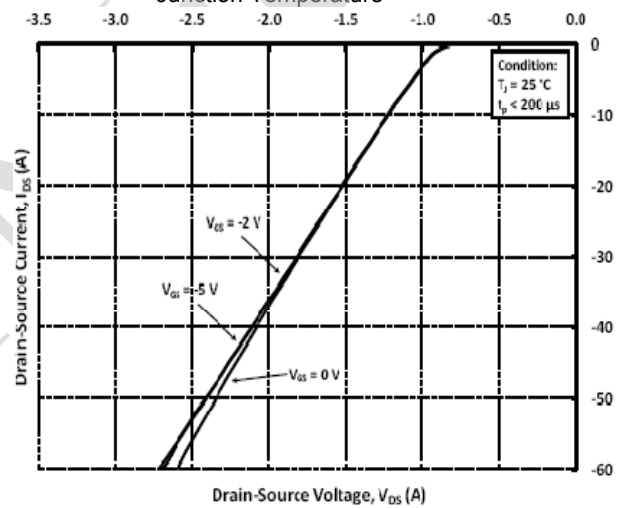


Fig. 10 Diode Characteristic at 25°C

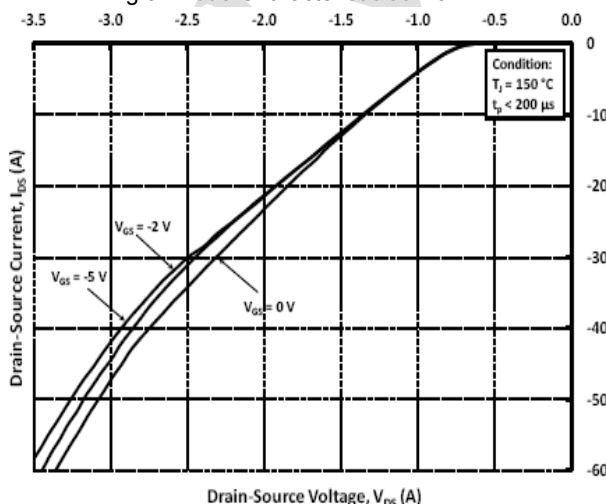


Fig. 11 Diode Characteristic at 150°C

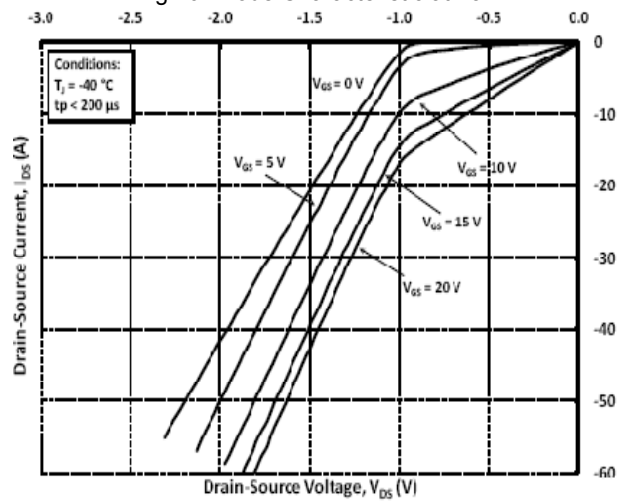


Fig. 12 3rd Quadrant Characteristic at -40°C

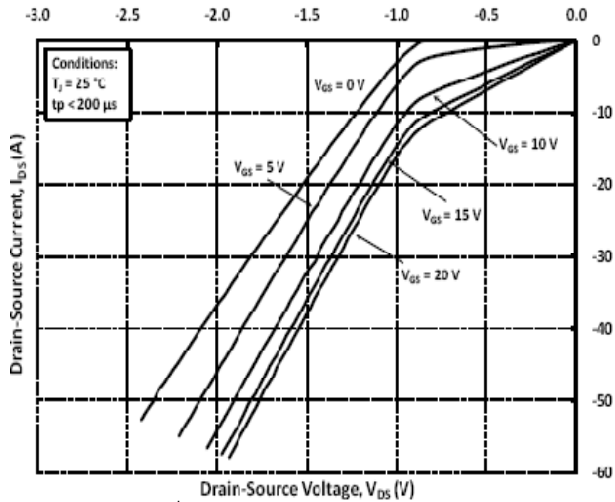


Fig. 13 3rd Quadrant Characteristic at 25°C

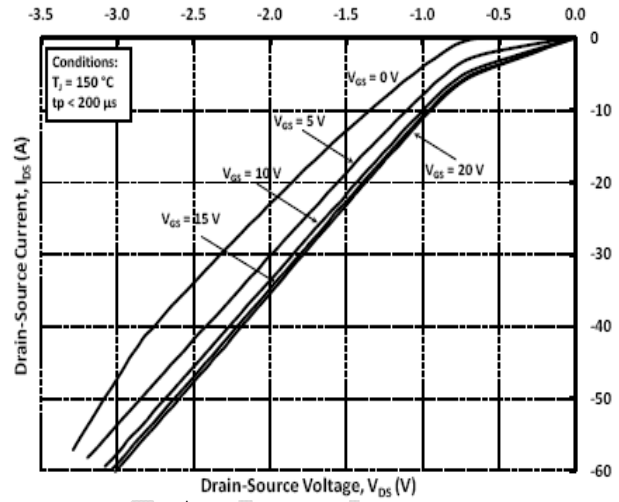


Fig. 14 3rd Quadrant Characteristic at 150°C

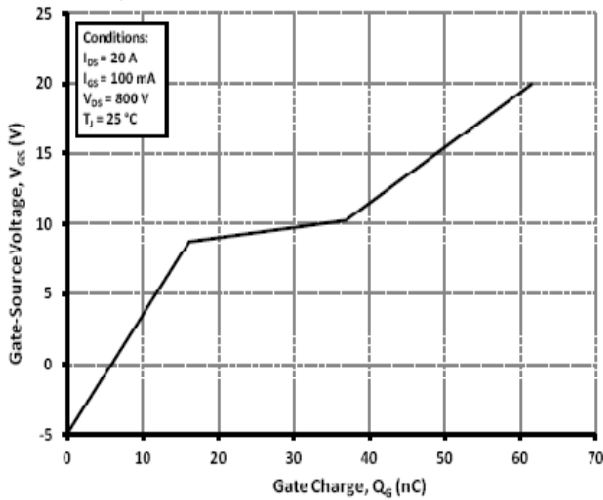


Fig. 15 Typical Gate Charge Characteristic

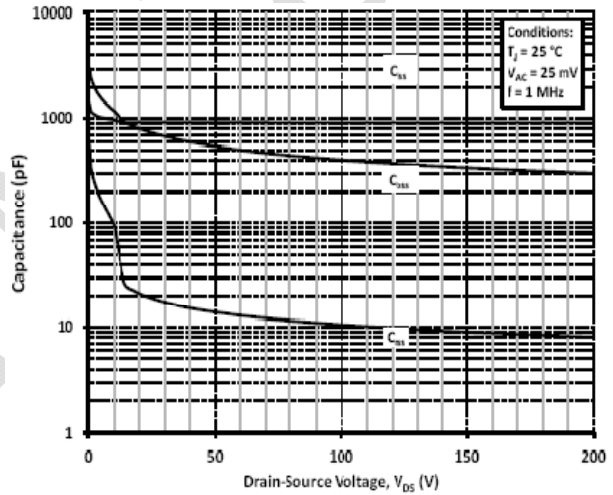


Fig. 16 Capacitances VS Drain-Source Voltage (0-200V)

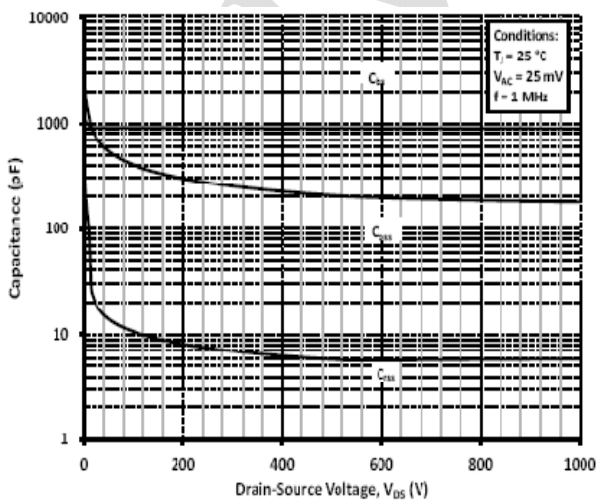


Fig. 17 Typical Capacitances VS Drain-Source Voltage (0-1KV)

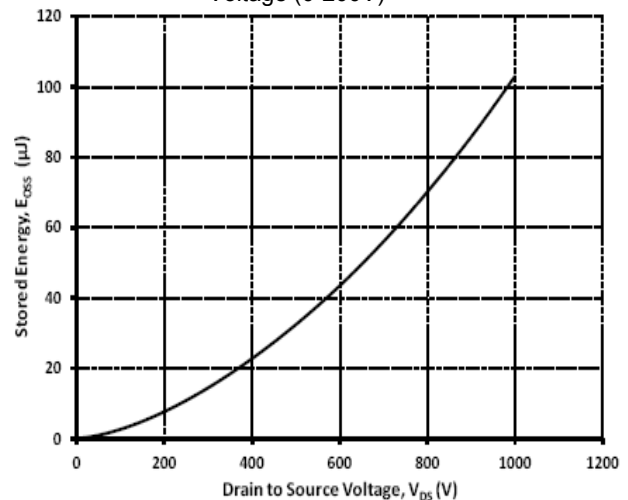


Fig. 18 Typical Output Capacitor Stored Energy

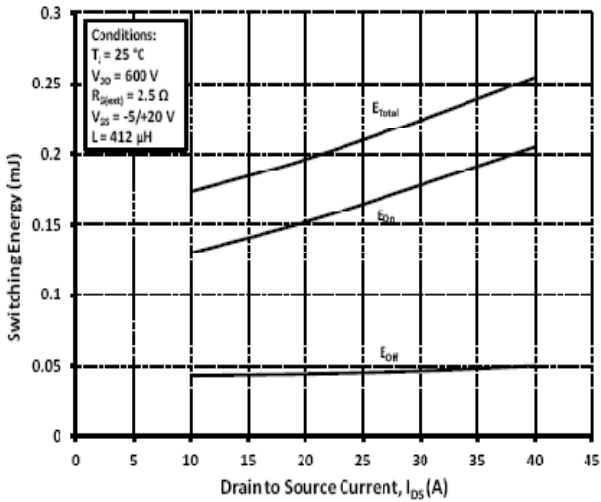


Fig.19 Inductive Switching Energy VS Drain Current For $V_{DS}=600\text{A}$

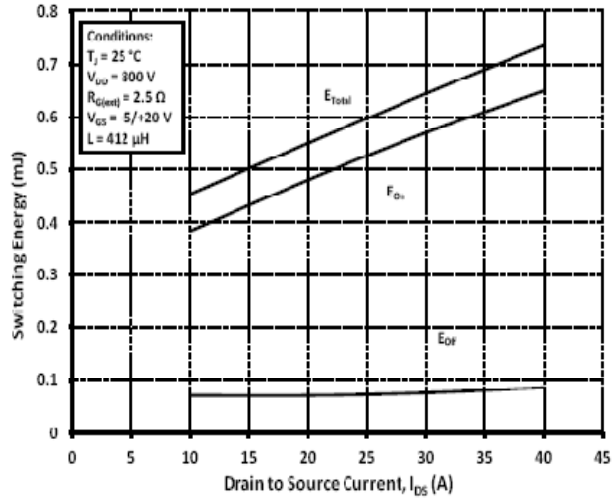


Fig.20 Inductive Switching Energy VS Drain Current For $V_{DS}=800\text{A}$

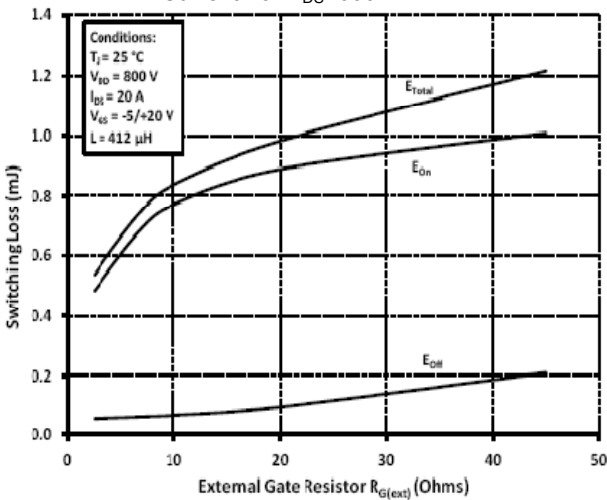


Fig.21 Inductive Switching Energy VS $R_{G(\text{ext})}$

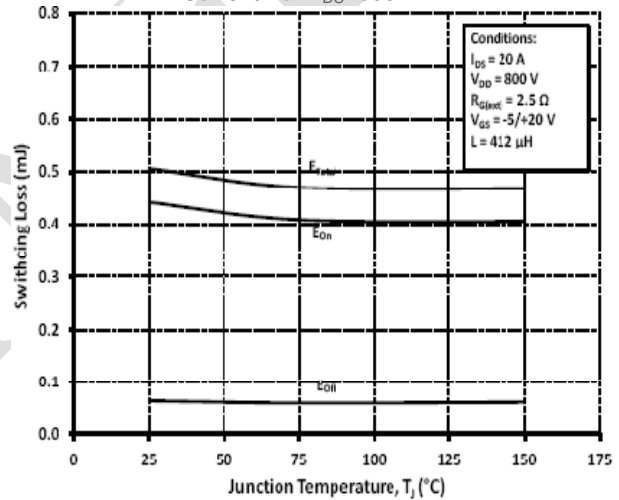


Fig.22 Inductive Switching Energy VS Temperature

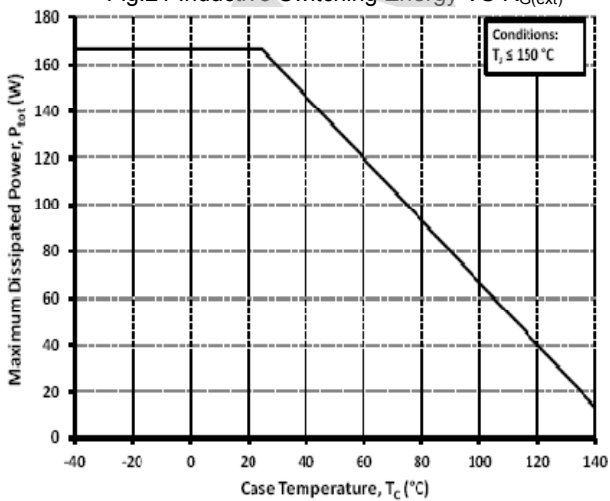


Fig.23 Maximum Power Dissipation (MOSFET) Derating VS Case Temperature

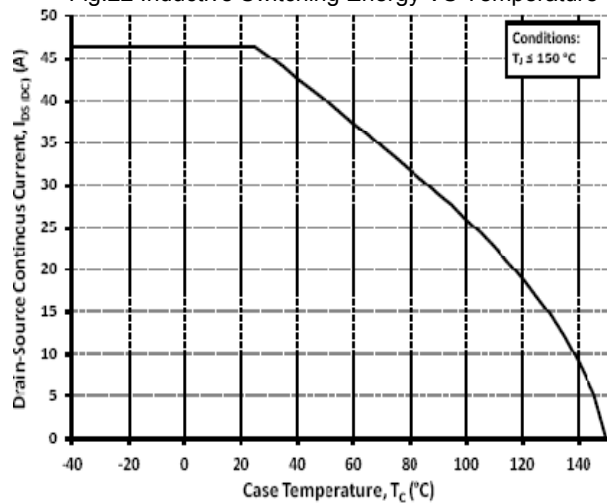


Fig.24 Continuous Drain Current Derating VS Case Temperature

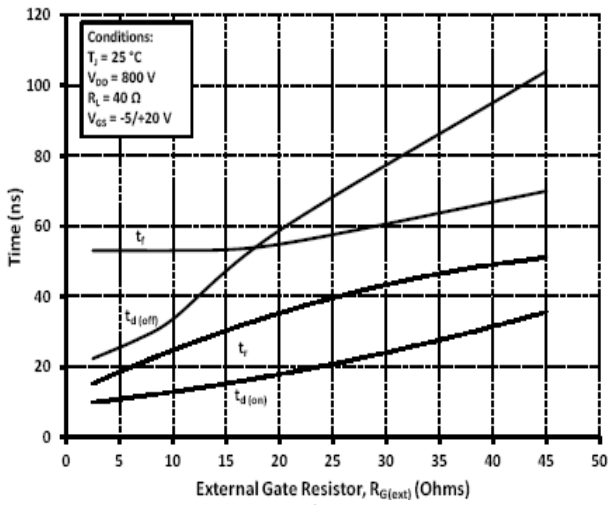


Fig.25 Timing VS $R_{G(ext)}$

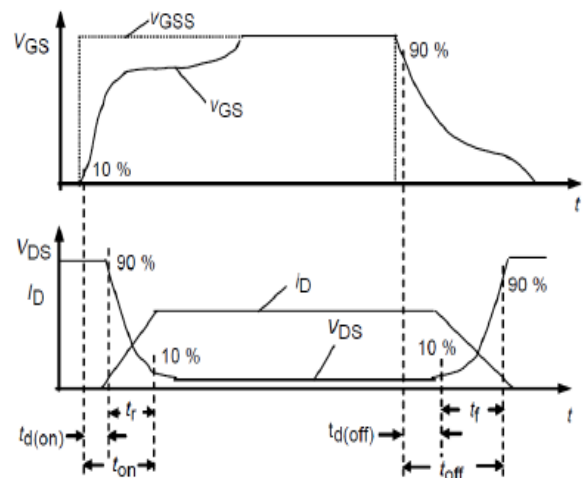


Fig.26 Resistive Switching Time Description

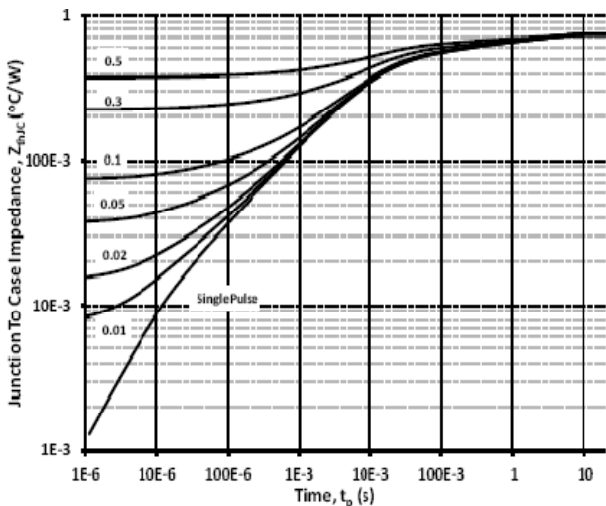


Fig.27 MOSFET Junction Case Thermal Impedance

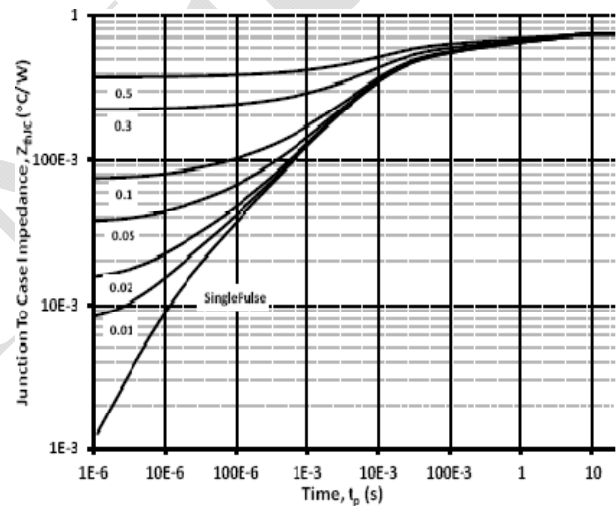


Fig.28 Diode Junction to Case Thermal Impedance

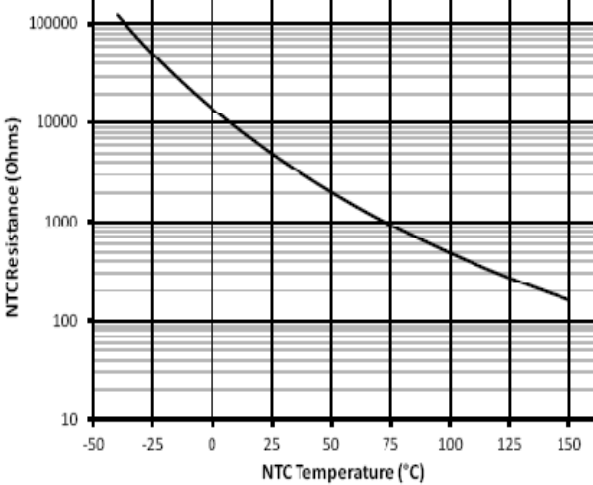


Fig.29 NTC Resistance VS NTC Temperature VS. Case Temperature

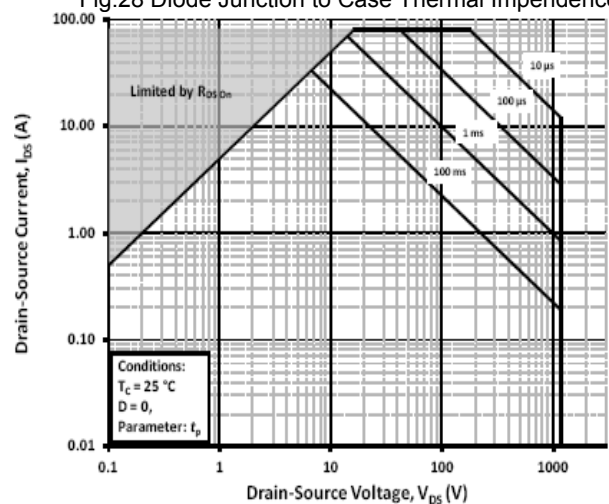


Fig.30 MOSFET Safe Operating Area

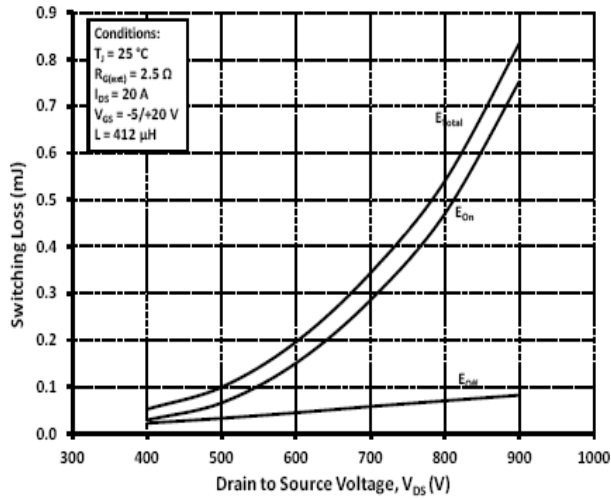
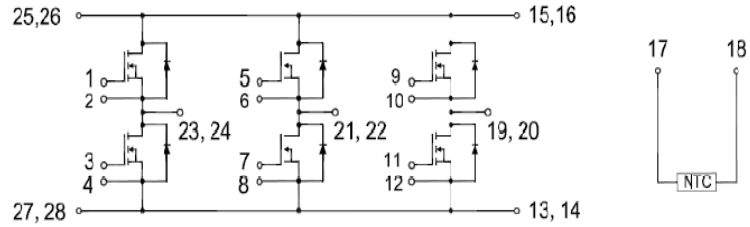


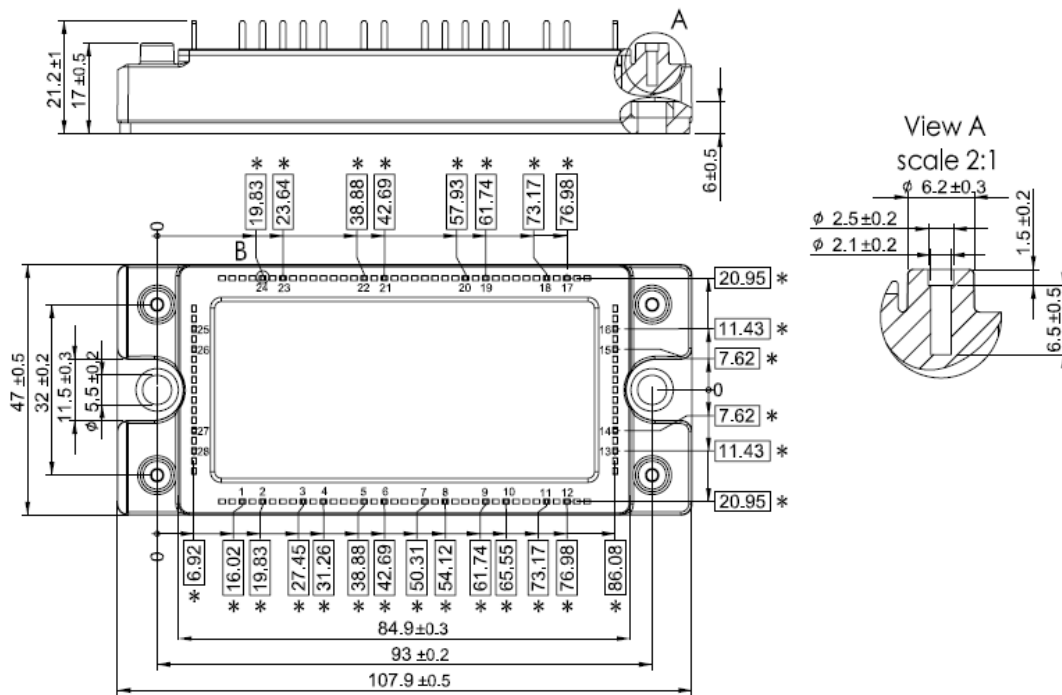
Fig.31 Inductive Switching Energy VS. V_{DS}

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Internal Circuit



Package Outline (Unit: mm):





Announcement

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