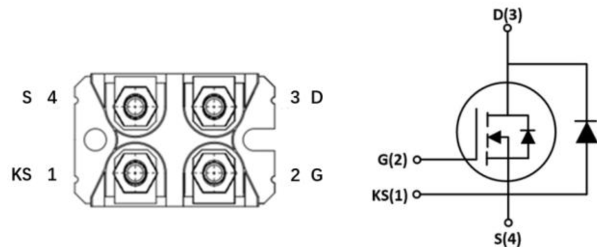
IVST12017MA1L – 1200V 17mΩ MOSFET + 40A SBD SiC Module

Features

- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- High operating junction temperature capability
- Integrated silicon carbide diode
- Kelvin gate input easing driver circuit design
- Freewheeling diode with zero reverse recovery

Package



Part Number	Package
IVST12017MA1L	SOT 227

Applications

- Introduction heating and welding
- Battery charger
- Photovoltaic inverter
- High frequency DC-DC converter

Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
SiC MOSFET					
V_{DS}	Drain-Source voltage	1200	V	V_{GS}=0V, I_D=100μA	
V_{GSmax} (DC)	Maximum DC voltage	-5 to 22	V	Static (DC)	
V_{GSmax} (Spike)	Maximum spike voltage	-10 to 25	V	<1% duty cycle, and pulse width<200ns	
V_{GSon}	Recommended turn-on voltage	20±0.5	V		
V_{GSoff}	Recommended turn-off voltage	-3.5 to -2	V		
I_D	Drain current (continuous)	121	A	V_{GS}=20V, T_C=25°C	Fig. 21
		85	A	V_{GS}=20V, T_C=100°C	
I_{DM}	Drain current (pulsed)	302	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	464	W	T_C=25°C	Fig. 22
T_{stg}	Storage temperature range	-55 to 175	°C		
T_J	Operating junction temperature	-55 to 175	°C		
SiC SBD					
V_{RRM}	Reverse voltage (repetitive peak)	1200	V		
V_{DC}	DC blocking voltage	1200	V		
I_F	Forward current (continuous)	86	A	T_C=25°C	
		40	A	T_C=136°C	
I_{FSM}	Surge non-repetitive forward current	260	A	sine halfwave @Tc=25°C tp=10ms	
I_{FRM}	Surge repetitive forward current	220	A	sine halfwave @Tamb=25°	

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				C tp=10ms, Freq=0.1Hz, 100cycles	

Electrical Characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		5	100	μA	V_{DS}=1200V, V_{GS}=0V	
I_{GSS}	Gate leakage current			±100	nA	V_{DS}=0V, V_{GS}=-5~20V	
V_{TH}	Gate threshold voltage	1.8	3.2	5	V	V_{GS}=V_{DS}, I_D=18mA	Fig. 8, 9
			2.4			V_{GS}=V_{DS}, I_D=18mA @ T_C=175°C	
R_{ON}	Static drain-source on-resistance		17	21	mΩ	V_{GS}=20V, I_D=60A @T_J=25°C	Fig. 4, 5, 6, 7
			31.4		mΩ	V_{GS}=20V, I_D=60A @T_J=175°C	
C_{iss}	Input capacitance		5730		pF	V_{DS}=800V, V_{GS}=0V, f=100kHz, V_{AC}=25mV	Fig. 16
C_{oss}	Output capacitance		417		pF		
C_{rss}	Reverse transfer capacitance		29.6		pF		
E_{oss}	C_{oss} stored energy		168		μJ		Fig. 17
Q_g	Total gate charge		280		nC	V_{DS}=800V, I_D=60A, V_{GS}=-5 to 20V	Fig. 18
Q_{gs}	Gate-source charge		96		nC		
Q_{gd}	Gate-drain charge		76		nC		
R_g	Gate input resistance		1.55		Ω	f=1MHz	
E_{ON}	Turn-on switching energy		1291		μJ	V_{DS}=800V, I_D=60A, V_{GS}=-3.6 to 20V, $R_{G(ext)}$=3.3Ω, L=200μH	Fig. 19, 20
E_{OFF}	Turn-off switching energy		743.8		μJ		
$t_{d(on)}$	Turn-on delay time		19.2		ns		
t_r	Rise time		45.6				
$t_{d(off)}$	Turn-off delay time		59.6				
t_f	Fall time		28.8				
SiC SBD							
V_F	Forward Voltage		1.48	1.80	V	I_F = 40 A T_J=25°C	Fig. 25
			2.30	3.00		I_F = 40 A T_J=175°C	
I_R	Reverse Current		10	300	μA	V_R = 1200 V T_J=25°C	Fig. 26
			60	1000		V_R = 1200 V T_J=175°C	
t_{rr}	Reverse recovery time		26.2		ns	V_{DS}=800V, di/dt=3050A/μs, V_{GS}=-3.6 to 20V, $R_{G(ext)}$=5.1Ω, L=200μH, T_J=25℃	
Q_{rr}	Reverse recovery charge		430.1		nC		
I_{RRM}	Peak reverse recovery current		29.6		A		

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Reverse Diode Characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
V_{SD}	Diode forward voltage		3.5		V	I_{SD}=30A, V_{GS}=0V	Fig. 10, 11, 12
			3.2		V	I_{SD}=30A, V_{GS}=0V, T_J=175°C	
t_{rr}	Reverse recovery time		22.8		ns	V_{GS}=-3.5V/+20V, I_{SD}=60A, V_R=800V, $R_{G(ext)}$=7.5Ω, di/dt=3050A/us, L=200μH	
Q_{rr}	Reverse recovery charge		418		nC		
I_{RRM}	Peak reverse recovery current		31.6		A		

Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.323	°C/W	Per MOSFET Fig. 23
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.427	°C/W	Per SBD

Module Characteristics

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{ISOL}	Isolation voltage	RMS, f=50/60Hz, t=10sec, I_{ISOL}≤1mA *	3.0			kV
T_{STG}	Storage temperature		-40		150	℃
M	Terminal connection torque	Screw M4	1.1		1.5	N·m
	Mounting torque	Screw M4	1.1		1.5	N·m
G	Weight of module			27		g
	Creepage distance	Terminal to heatsink		10.61		mm
		Terminal to terminal		10.37		mm
	Clearance distance	Terminal to heatsink		6.7		mm
		Terminal to terminal		4.05		mm

*: 1. Isolation voltages are between terminals and baseplate.

2. All terminals are connected together during the test.

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Typical Performance (curves)

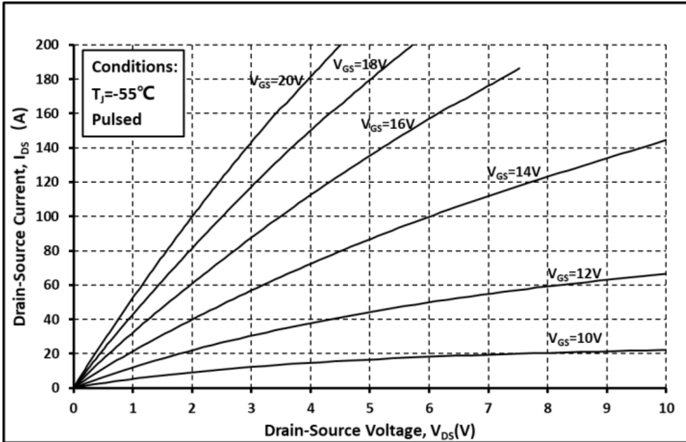

Fig. 1 Output Curve @ T_J=-55°C

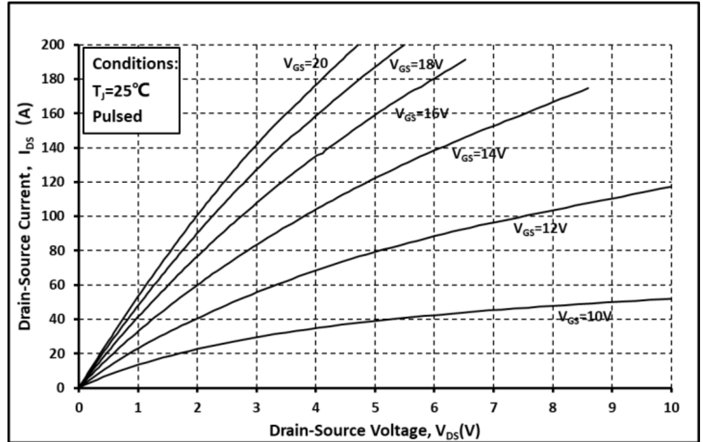

Fig. 2 Output Curve @ T_J=25°C

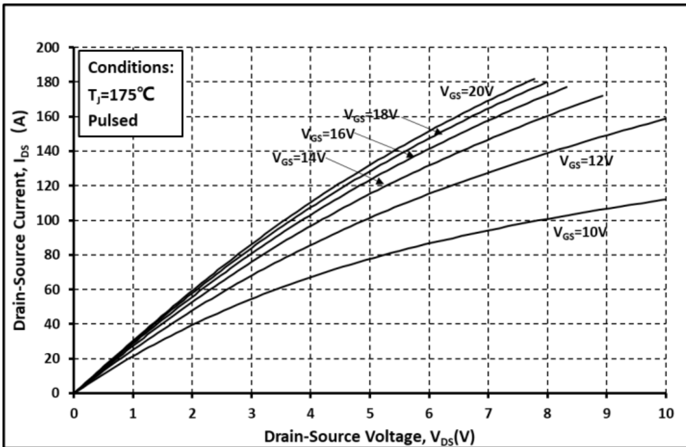

Fig. 3 Output Curve @ T_J=175°C

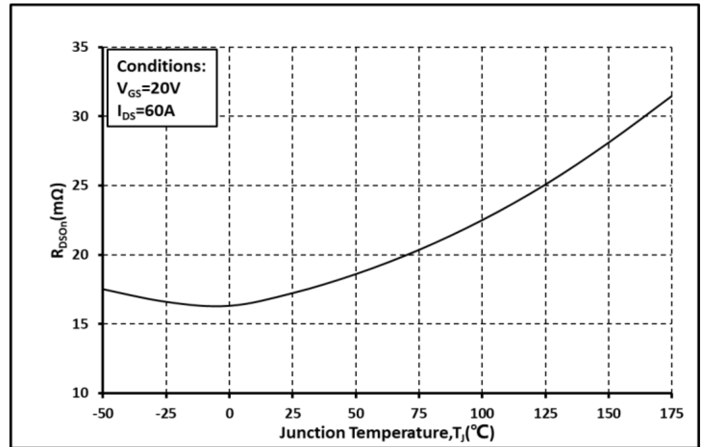

Fig. 4 Ron vs. Temperature

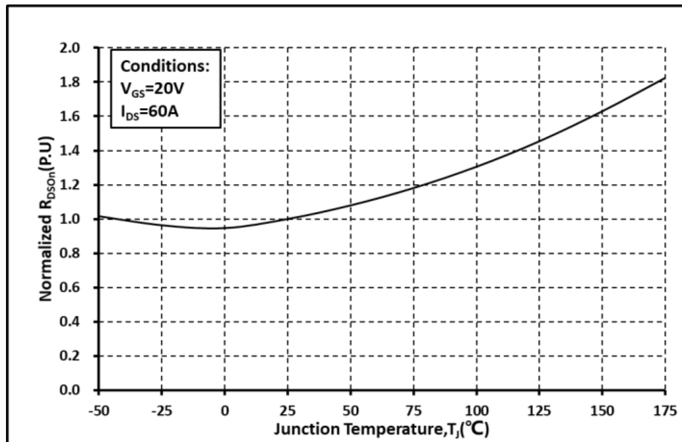

Fig. 5 Normalized Ron vs. Temperature

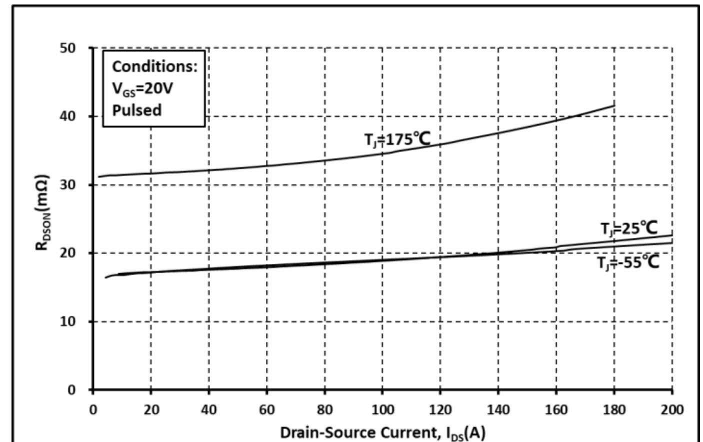

Fig. 6 Ron vs. I_{DS} @ Various Temperature

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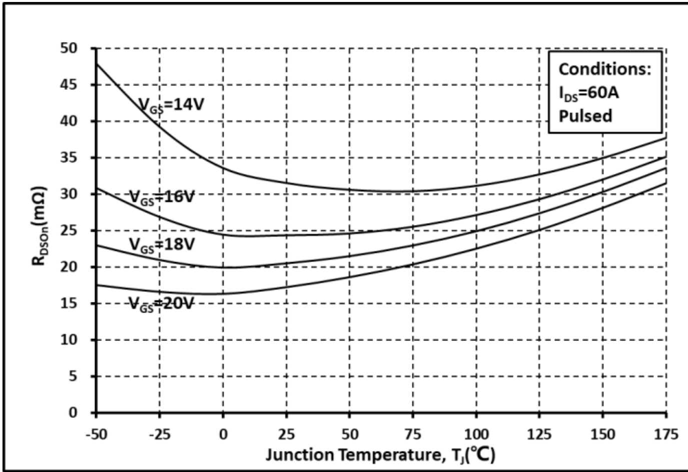

Fig. 7 Ron vs. Temperature @ Various V_{GS}

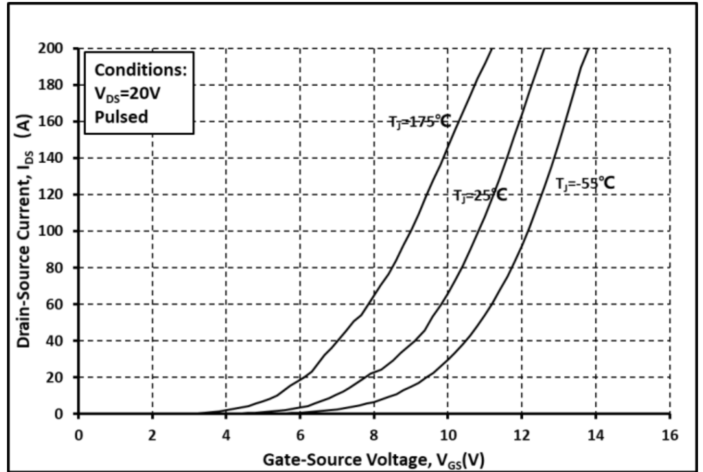

Fig. 8 Transfer Curves @ Various Temperature

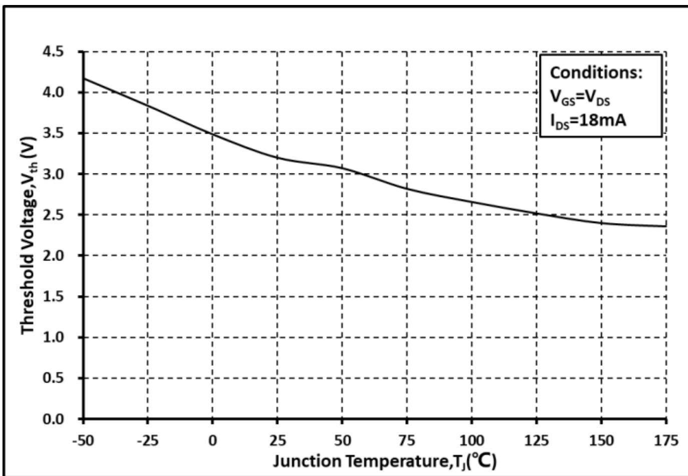

Fig. 9 Threshold Voltage vs. Temperature

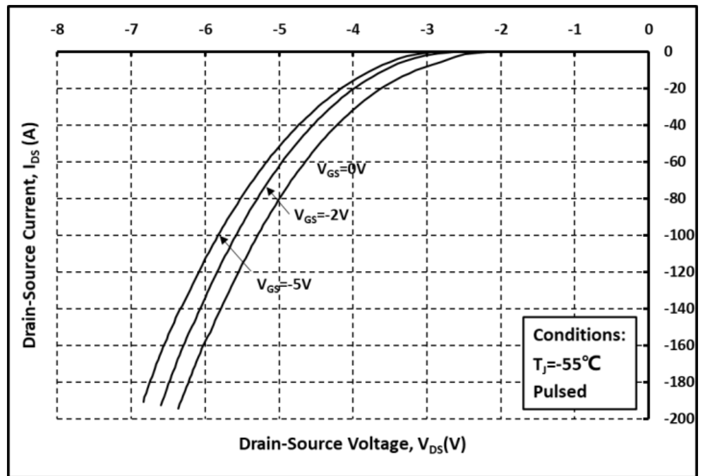

Fig. 10 Body Diode curves @ T_J=-55°C

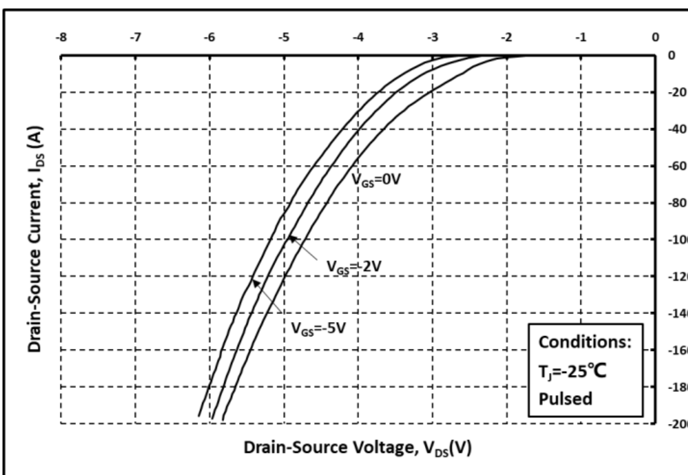

Fig. 11 Body Diode curves @ T_J=25°C

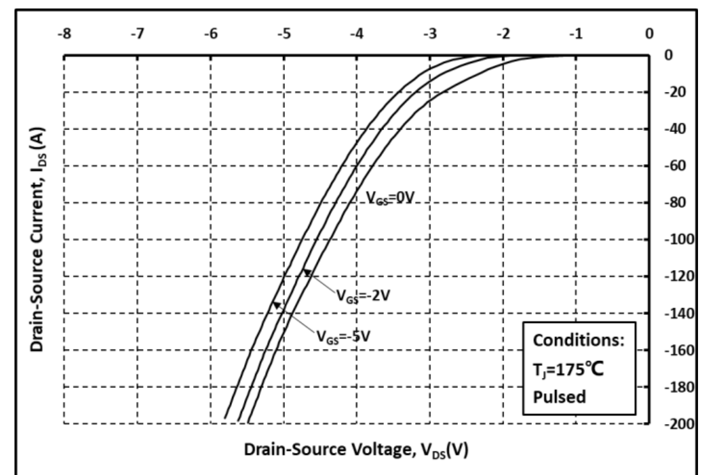

Fig. 12 Body Diode curves @ T_J=175°C

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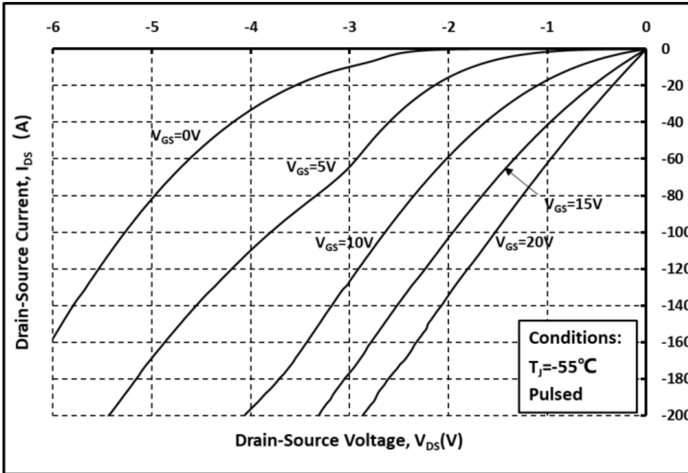

Fig. 13 3rd Quadrant curves @ T_J=-55°C

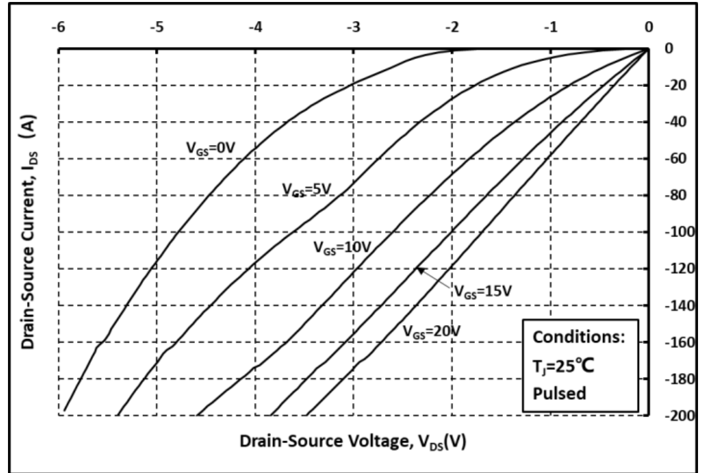

Fig. 14 3rd Quadrant curves @ T_J=25°C

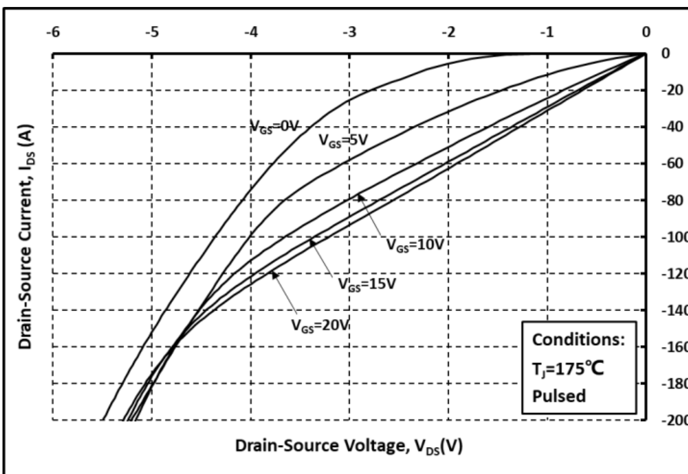

Fig. 15 3rd Quadrant curves @ T_J=175°C

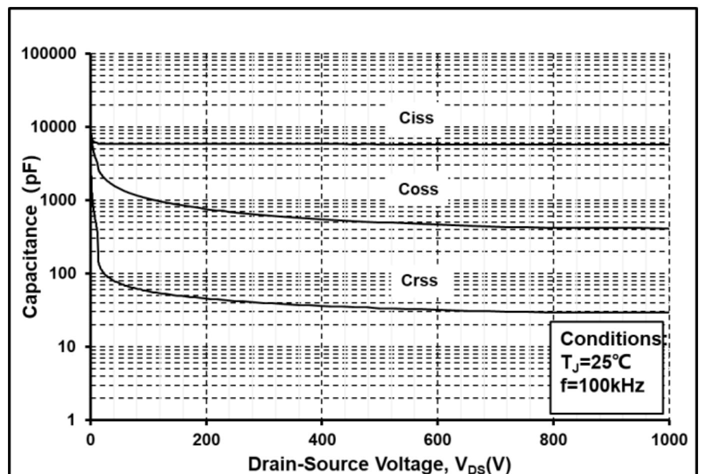

Fig. 16 Capacitance vs. V_{DS}

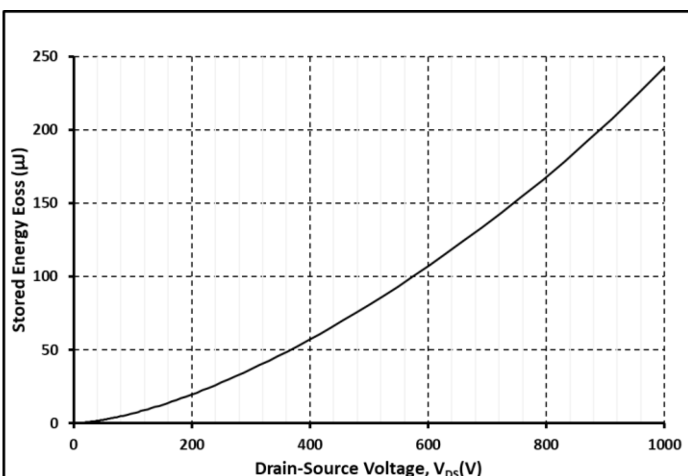

Fig. 17 Output Capacitor Stored Energy

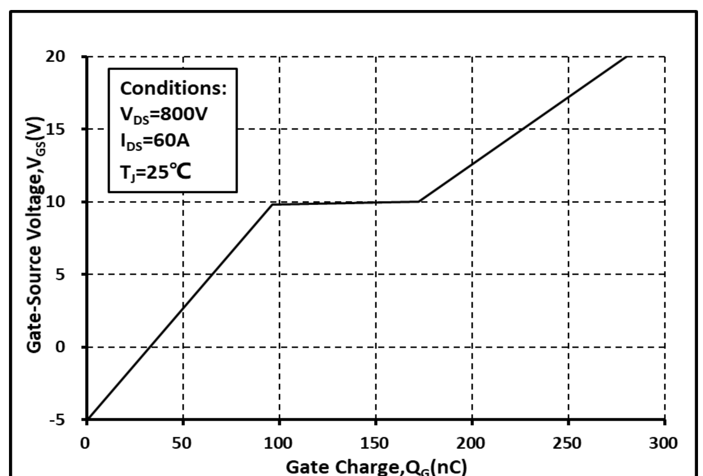

Fig. 18 Gate Charge Characteristics

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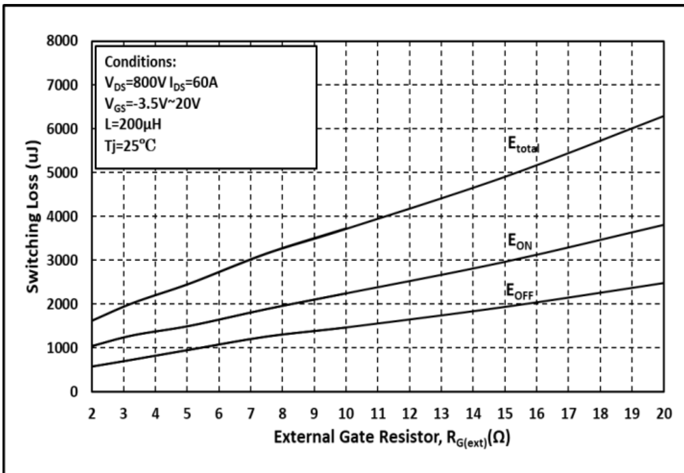

Fig. 19 Switching Energy vs. $R_{G(ext)}$

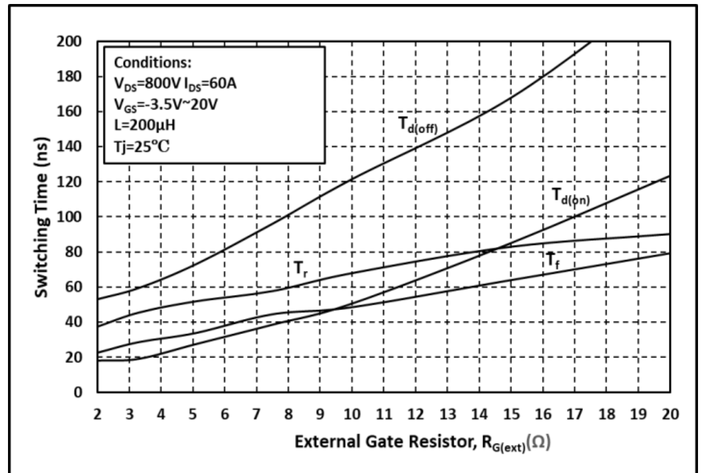

Fig. 20 Switching Times vs. $R_{G(ext)}$

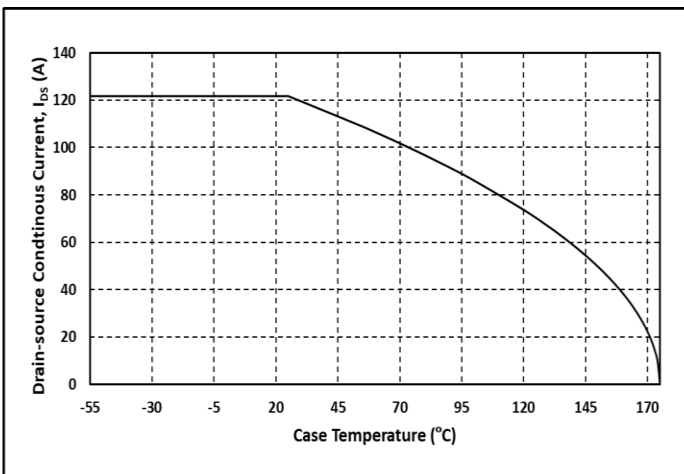

Fig. 21 Continuous Drain Current vs. Case Temperature

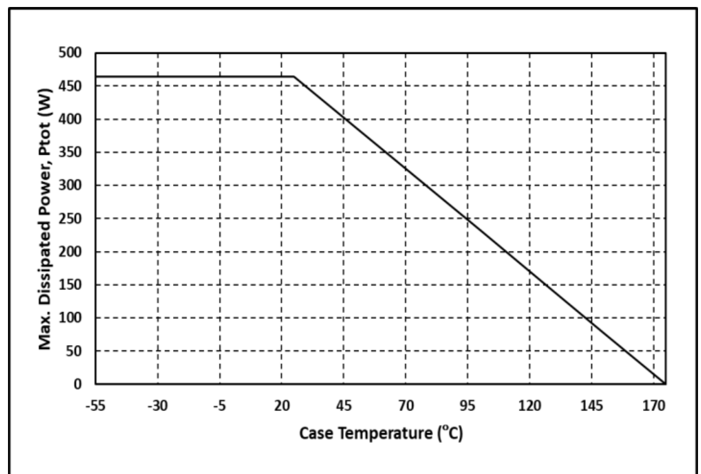

Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

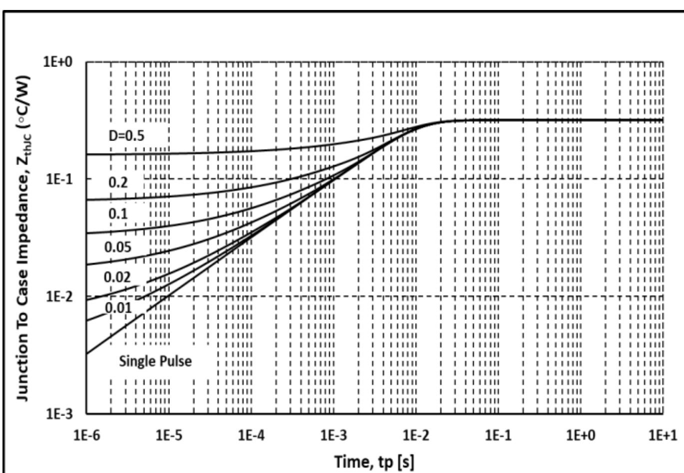

Fig. 23 Thermal impedance （MOSFET）

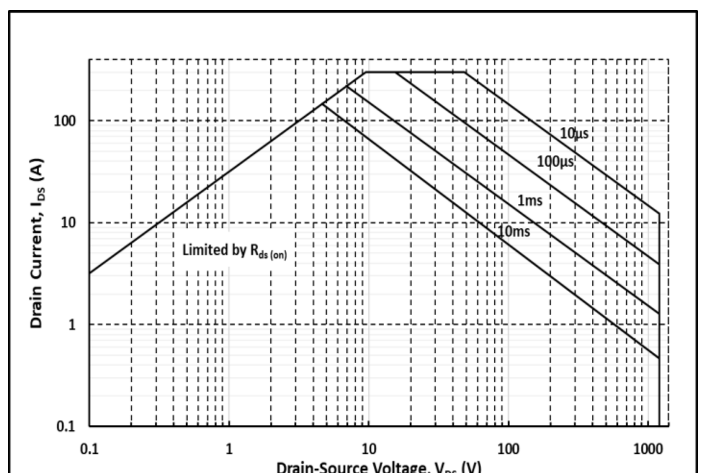

Fig. 24 Safe Operating Area

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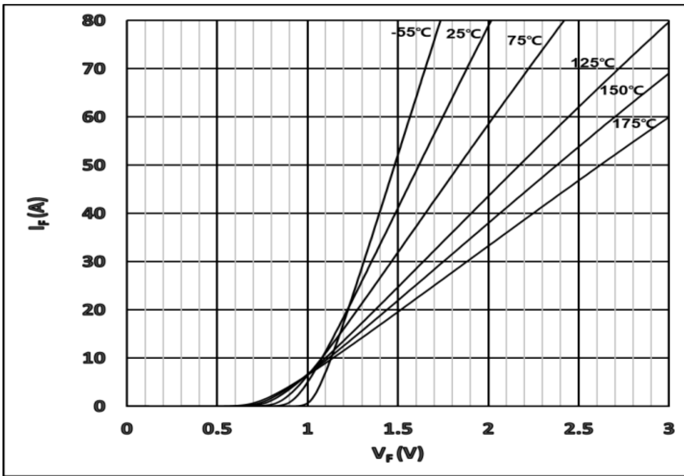

Fig. 25 Typical Forward Characteristics

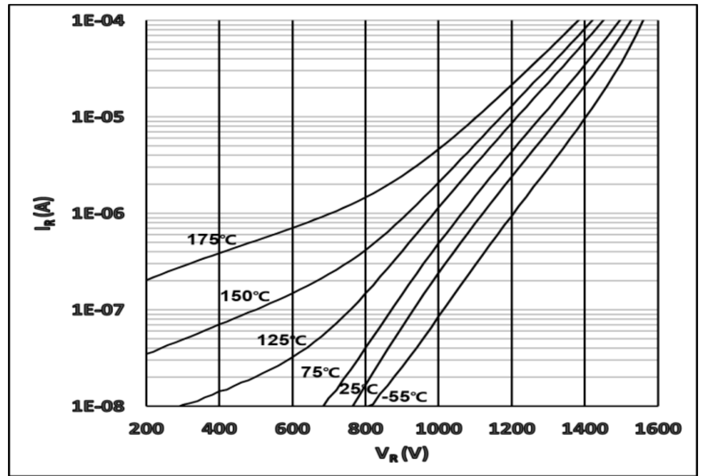

Fig. 26 Typical Reverse Characteristics

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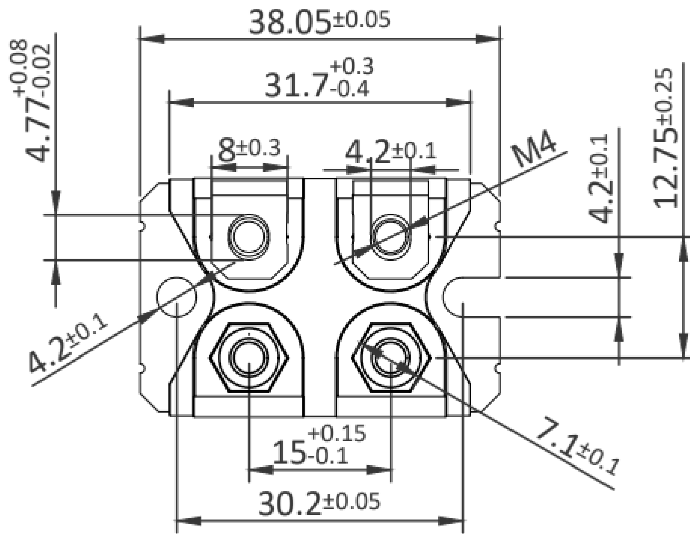
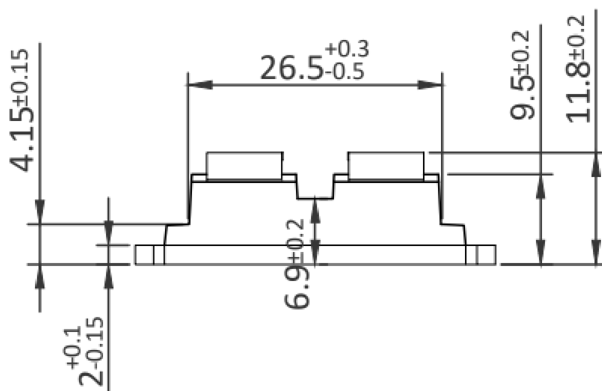
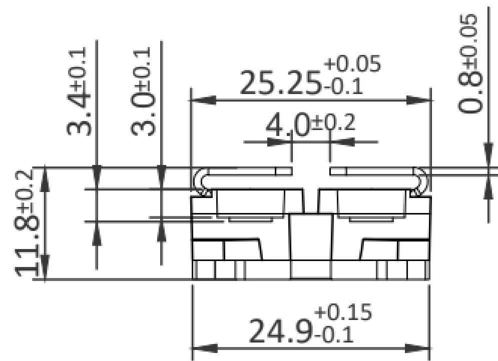
Package Dimensions







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