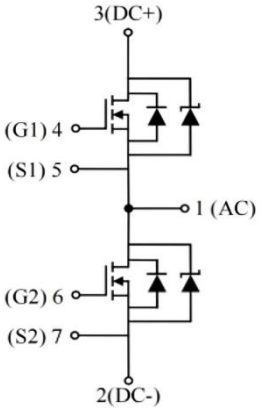
Half-Bridge Module with Sic MOSFET & SBD

V_{DS}=1200V, I_D=500A, R_{DS}(on)= 2.2mΩ



Features:

- Ultra-Low Loss
- Low Inductive Design
- Zero Reverse Recovery
- Standard 62mm Package
- High Frequency Operation
- Ultra-low Thermal Resistance
- SiC MOSFET with Antiparallel SBD



Applications:

- HF Resonant
- Solar and Wind
- Renewable Energy
- Converters/Inverters
- High Temperature Applications

Maximum ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain-Source Voltage	1200	V	
V_{GSmax}	Gate-Source Voltage	-10/+22	V	Absolute maximum values
V_{GSop}	Gate-Source Voltage	-4/+18	V	Recommended operational values
I_D	Continuous Drain Current (MOSFET)	700	A	V_{GS}=18V, T_C=25°C,T_J=175°C
	Continuous Drain Current (MOSFET)	500		V_{GS}=18V, T_C=90°C, T_J≤175°C
$I_{F(SBD)}$	DC source-Drain Current(Schottky diode)	500	A	V_{GS}= -4V, T_C=90°C, T_J≤175°C
$I_{D(pulse)}$	Pulsed Drain Current	1000	A	Pulse width tp limited by T_{Jmax}
P_D	Power Dissipation	2200	W	T_C=25°C, T_J≤175°C
T_J,T_{STG}	Case and Storage Temperature Range	-40 ~ +175	°C	
$T_{J\ max}$	Junction Temperature	175	°C	

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{DSS}	Drain Source Blocking Voltage	V_{GS}=0V,I_D=600μA	1200			V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=162mA	2.0	2.9	4.0	V
		V_{DS}=V_{GS}, I_{DS}=162mA,T_J=150℃		2.2		V
		V_{DS}=V_{GS}, I_{DS}=162mA,T_J=175℃		2.1		V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V,V_{GS}=0V		6	300	μA
		V_{DS}=1200V,V_{GS}=0V,T_J=175℃		-	-	μA
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=+18V,V_{DS}=0V		6	1200	nA
I_{GSS-}	Gate-Source Leakage Current	V_{GS}=-4V,V_{DS}=0V	-1200			nA
$R_{DS(on)}$	On State Resistance	V_{GS}=18V,I_{DS}=500A,T_J=25℃		2.2	2.8	mΩ
		V_{GS}=18V,I_{DS}=500A,T_J=150℃		4.0		
		V_{GS}=18V,I_{DS}=500A,T_J=175℃		4.5		
g_{fs}	Transconductance	V_{DS}=20V,I_{DS}=500A		390		S
		V_{DS}=20V,I_{DS}=500A,T_J=175℃		336		
Q_{GS}	Gate-Source Charge	V_{DD}=1000V,V_{GS}=-4V/+18V, I_D=500A		360		nC
Q_{GD}	Gate-Drain Charge			588		
Q_G	Total Gate Charge			1480		
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=1000V, f=100kHz,V_{AC}=25mV		31.2n		F
C_{oss}	Output Capacitance			1.3n		
C_{rss}	Reverse Transfer Capacitance			110p		
$R_{G(int)}$	Internal Gate Resistance	V_{GS}=0V,f=100kHz		1.2		Ω

(continued)SiC MOSFET Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
E_{on}	Turn-On Energy T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 11.78 10.78 10.71 10.58		mJ	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.5Ω Load=15μH
E_{off}	Turn-Off Energy T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 2.77 2.66 2.66 2.65		mJ	V_{DD}=600V,V_{GS}=4V/+18V I_D=500A,$R_{G(on)}$=0.0Ω Load=15μH
$t_{d(on)}$	Turn-on delay time T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 109 101 98 96		ns	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.5Ω Load=15μH

t_r	Rise Time T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 39 38 38 36		ns	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.5Ω Load=15μH
$t_{d(of)}$	Turn-off delay time T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 171 184 187 188		ns	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.0Ω Load=15μH
t_f	Fall Time T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 28 30 29 28		ns	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.0Ω Load=15μH

Diode electrical characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{DC}	DC Blocking Voltage	1200			V	T_J=25℃
V_{RRM}	Repetitive Peak Reverse Voltage	1200			V	T_J=25℃
V_{RSM}	Surge Peak Reverse Voltage	1200			V	T_J=25℃
$I_{F(SBD)}$	Continuous DC Forward Current		500		A	T_C=90℃,T_J≤175℃
I_{FRM}	Repetitive Peak Forward Current		1000		A	Pulse Width tp Limited by T_{Jmax}
I_{FSM}	Surge Non-repetitive Forward Current		2500		A	T_J=25℃,tp=10ms,Half Sine Pulse
V_F	Diode Forward Voltage (Schottky Diode)		1.59		V	I_F=500A,T_J=25℃,V_{GS}=-4V
			2.20			I_F=500A,T_J=150°℃,V_{GS}=-4V
			2.29			I_F=500A,T_J=175℃,V_{GS}=-4V
I_R	Reverse Current		6	900	μA	V_R=1200V,T_J=25℃
			70			V_R=1200V,T_J=175℃
C	Total Capacitive		17.8		nF	V_R=1V,f=100kHz
			1588		pF	V_R=400V,f=100kHz
			1166		pF	V_R=800V,f=100kHz
Q_C	Total Capacitive Charge		1580		nC	V_R=800V
T_{RR}	Reverse Recovery Time T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 29 39 43 46		ns	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.5Ω, $R_{G(off)}$=0.0Ω Load=15μH
Q_{RR}	Reverse Recovery Charge T_J=25℃ T_J=125℃ T=150℃ T_J=175℃		 3.25 3.48 3.63 3.50		μC	

I_{RRM}	Peak Reverse Recovery Current T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 180 196 200 204		A	V_{DD}=600V,V_{GS}=-4V/+18V I_D=500A,$R_{G(on)}$=0.5Ω, $R_{G(off)}$=0.0Ω Load=15μH
E_{RR}	Reverse Recovery Energy T_J=25℃ T_J=125℃ T_J=150℃ T_J=175℃		 1.26 1.28 1.34 1.27		mJ	

Thermal characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{thjc\ MOS}$	Juction-to-Case Thermal Resistance for MOSFET	Per SiC MOSFET			0.068	K/W
$R_{thjc\ SBD}$	Juction-to-Case Thermal Resistance for Schottky Diode	Per SiC Schottky Diode			-	K/W

Module physical characteristics

Symbol	Parameter	Test Conditions	Typ.	Unit
	Material of Module Base plate		Cu	
	Internal Isolation		AMB	
L_{stray}	Stray Inductance	Measured Between Terminals Input and Output	13	nH
R_{3-1}	Lead Resistance,High-Side	T_C=25℃,I_D=500A,Terminal-Die	0.55	mΩ
R_{1-2}	Lead Resistance,Low-Side	T_C=25℃,I_D=500A,Terminal-Die	0.75	mΩ
V_{isol}	Isolation Test Voltage	RMS, f=50Hz, t=1min	4.0	kV
T_{stg}	Storage Temperature		-40 to 125	℃
da	Clearance	Terminal to Terminal	11.0	mm
		Terminal to Heat sink	23.0	mm
ds	Cree page	Terminal to Terminal	23.0	mm
		Terminal to Heat sink	29.0	mm
M_S	Mounting Torque of Screws	Base plate To Heat sink,Screw M6	3.0~6.0	N·m
M_T	Mounting Torque of Screws	To Terminals,Screw M6	2.5~5.0	N·m
G	Weight		340	g
CTI	Comparative Tracking Index		>400	

Characteristics diagrams

Figure 1. Output Characteristics T_J=175℃

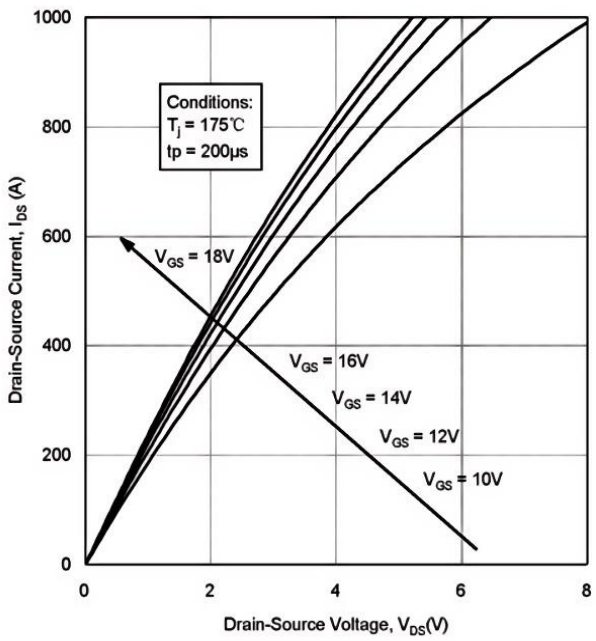


Figure 2. Output Characteristics vs. Temperature

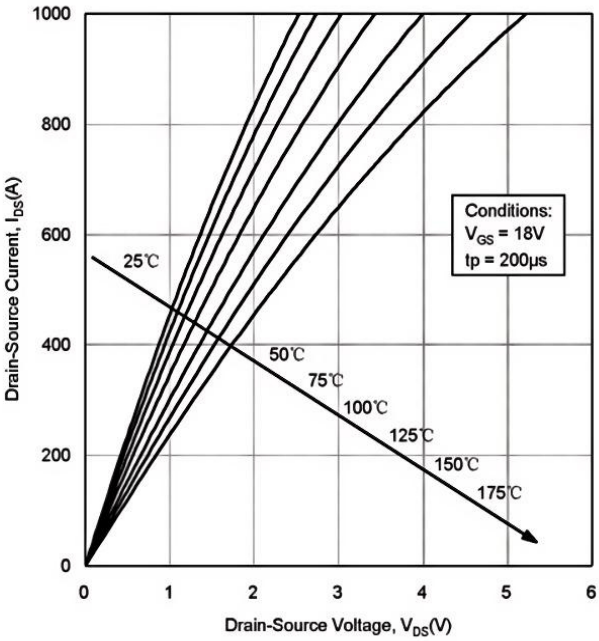


Figure 3. Transfer Characteristics

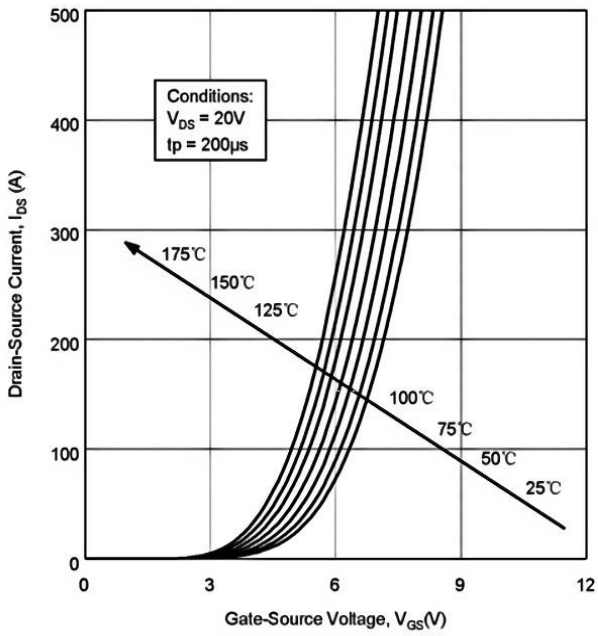


Figure 4. Normalized On-Resistance vs. Junction Temperature

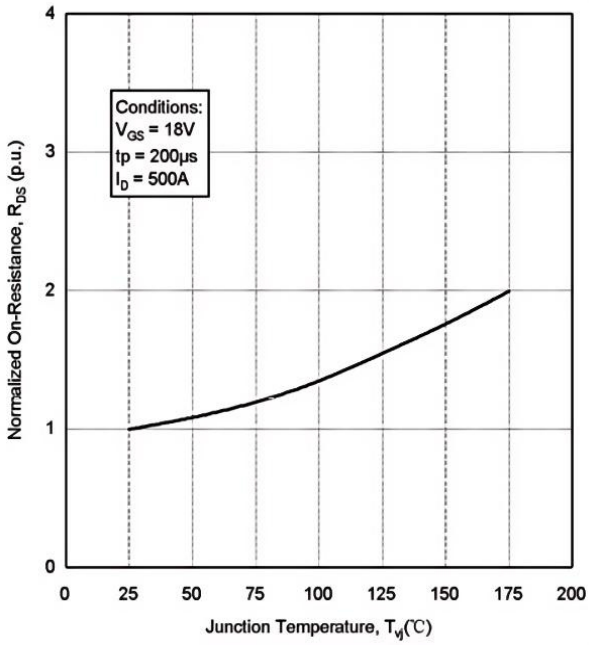


Figure 5. Gate Charge Characteristics

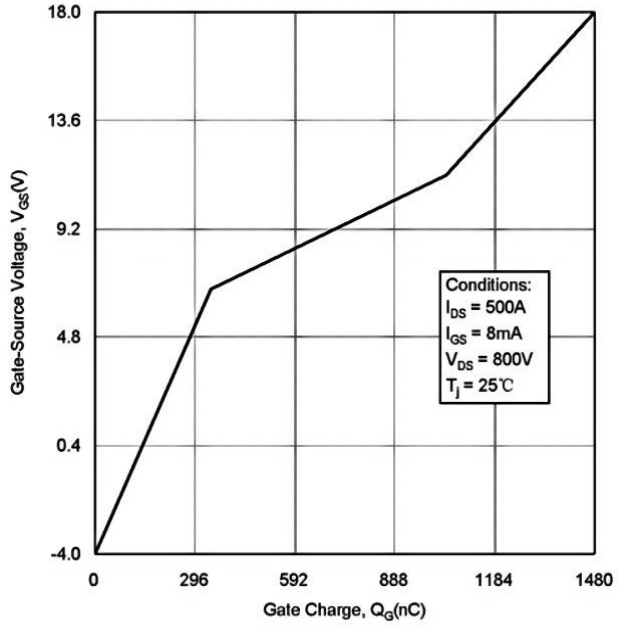


Figure 6. Threshold Voltage Temperature Junction

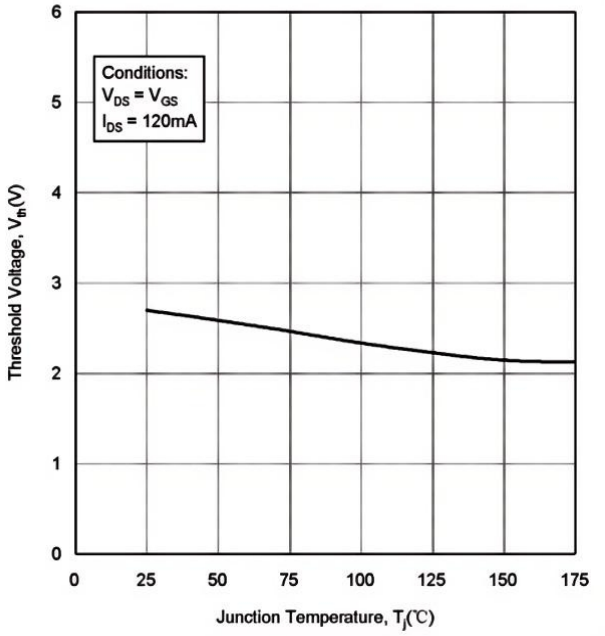


Figure 7. Capacitance vs Drain-Source Voltage（0-800V）

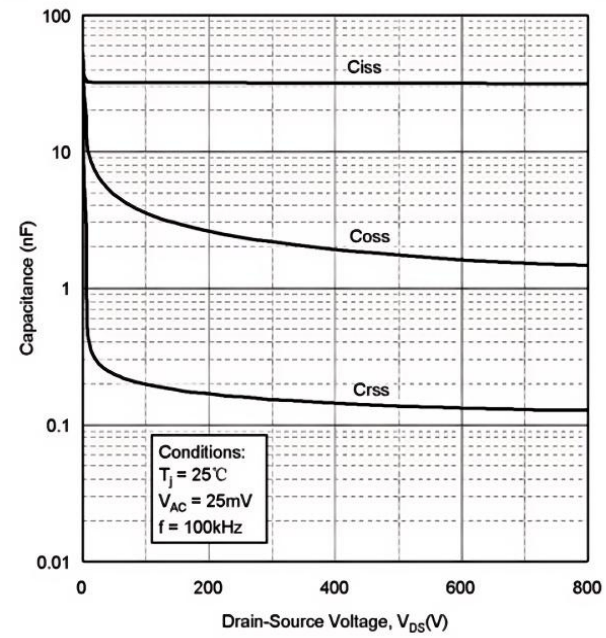


Figure 8. Source Drain Output Characteristics

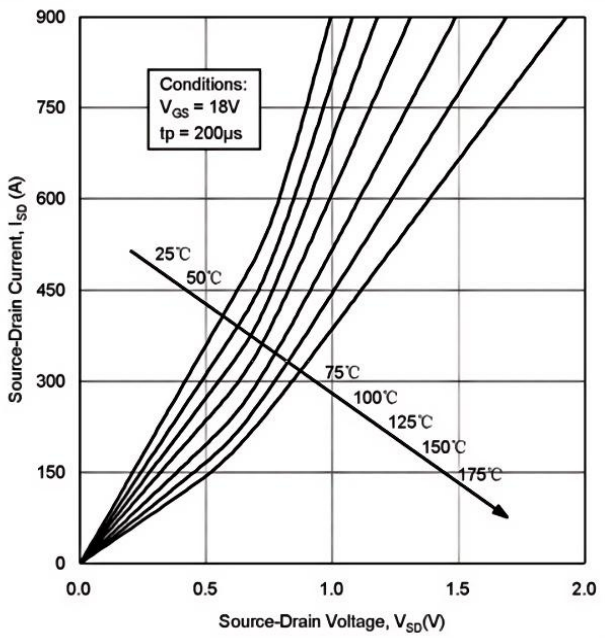


Figure 9. 3rd Quadrant Characteristic vs. Junction Temperature at VGs=-4V (Diode)

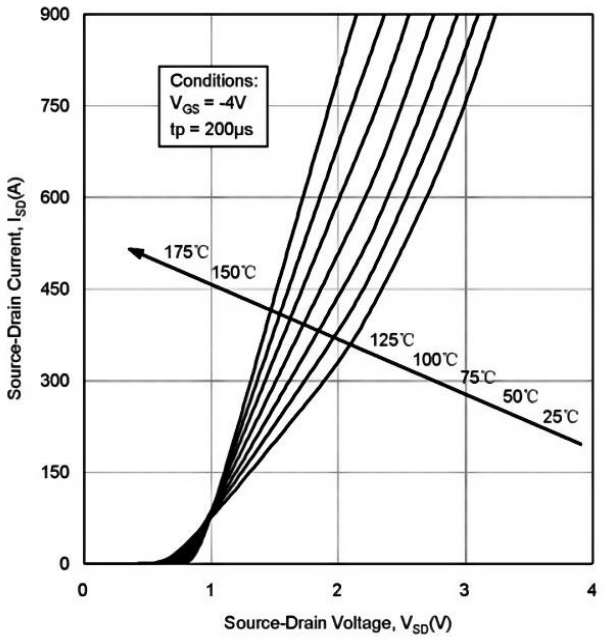


Figure 10. Temperature MOSFET Switching Energy vs. Junction

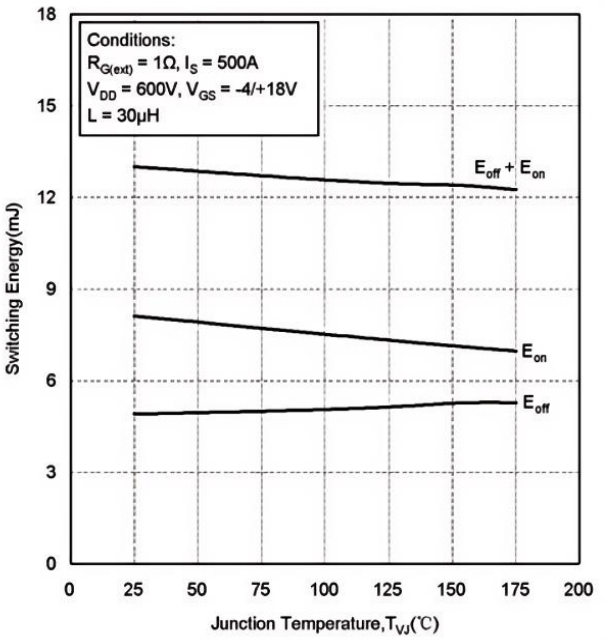


Figure 11. Inductive Switching Energy vs. Drain Current (T_J=150℃,T_J=175℃)

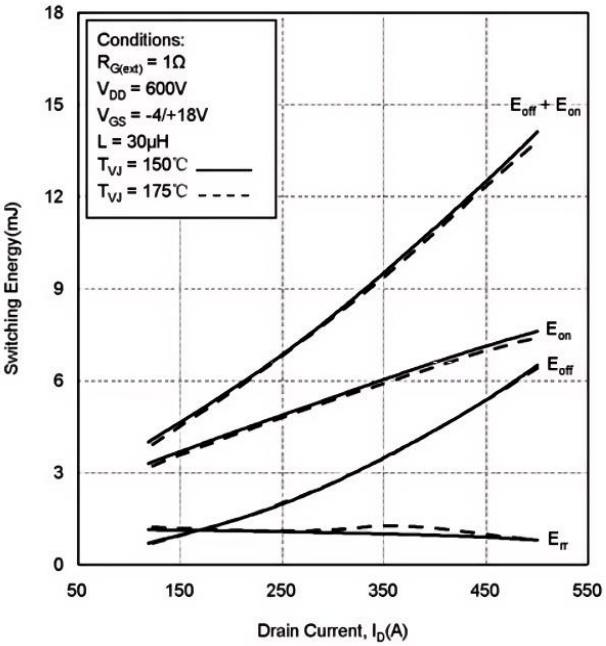


Figure 12. Inductive Switching Energy Vs. RG(ext) (T_J=150℃,T_J=175℃)

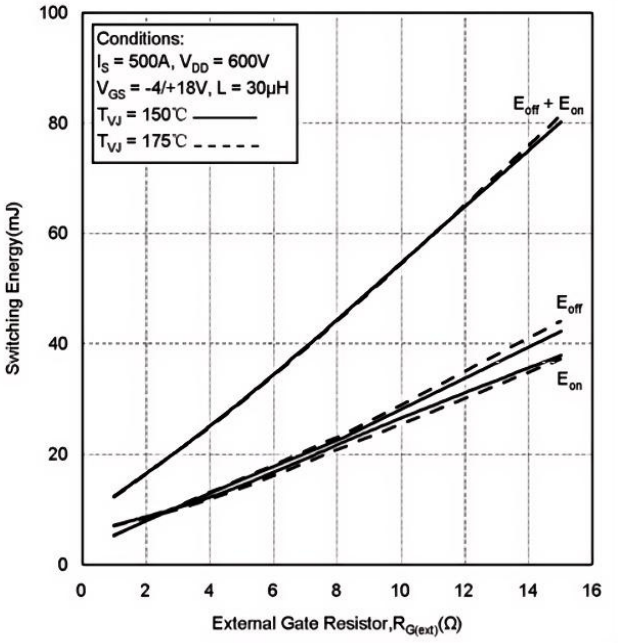


Figure 13. Reverse Recovery Energy Vs. Junction Temperature

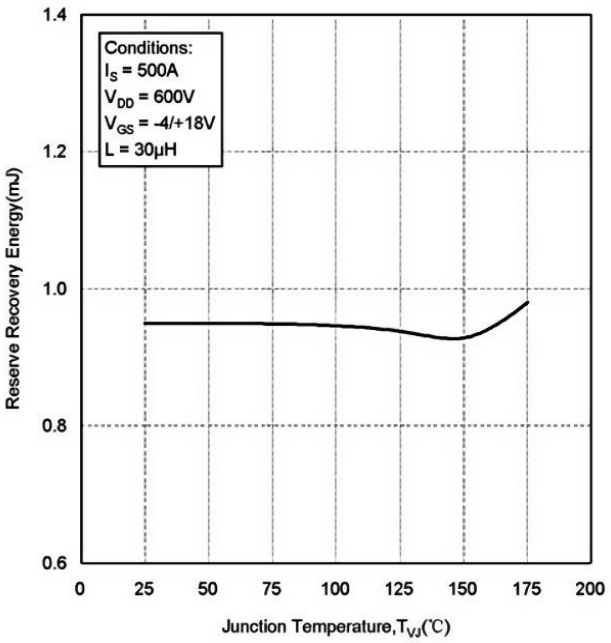


Figure 14. Reverse Recovery Energy vs. External Gate Resistance

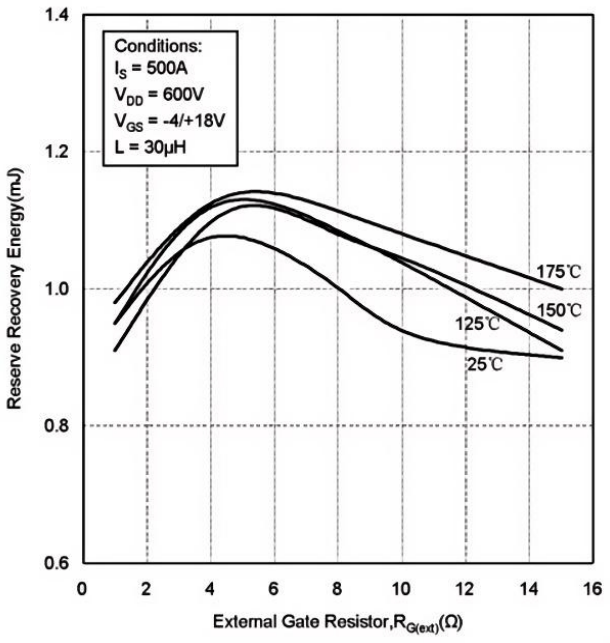


Figure 15. MOSFET Junction to Case Transient Thermal Impedance, Zthjc (K/W)

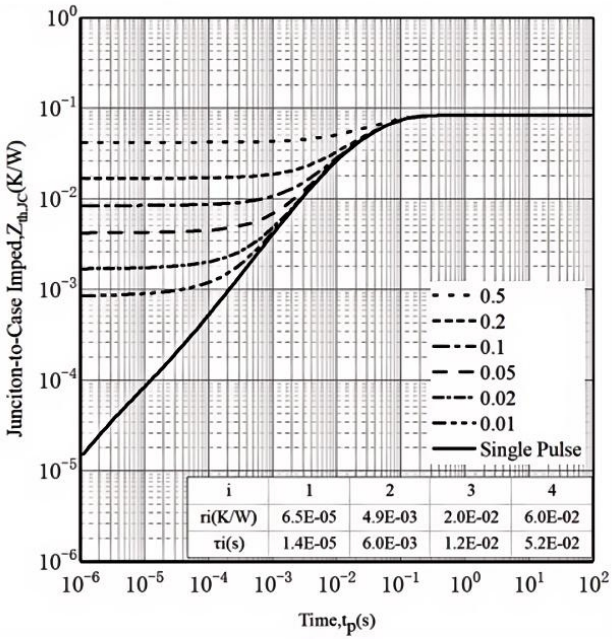


Figure 16. Example of acceptable Vgs waveform

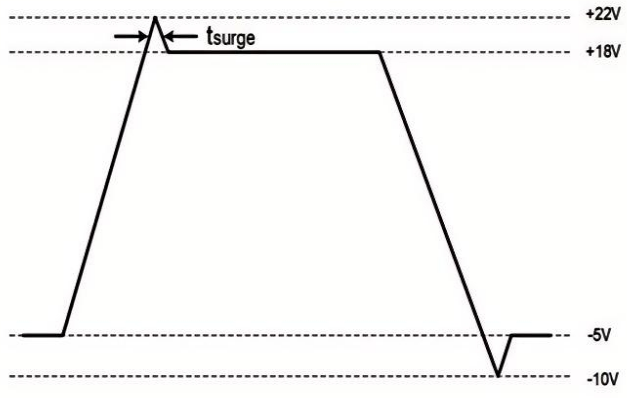


Figure 17. Wavelength for Switching Test

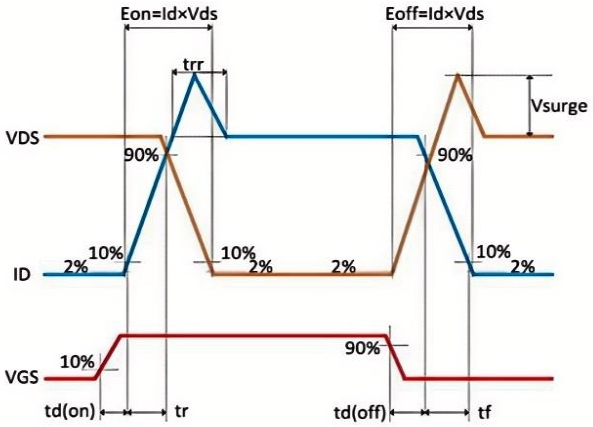
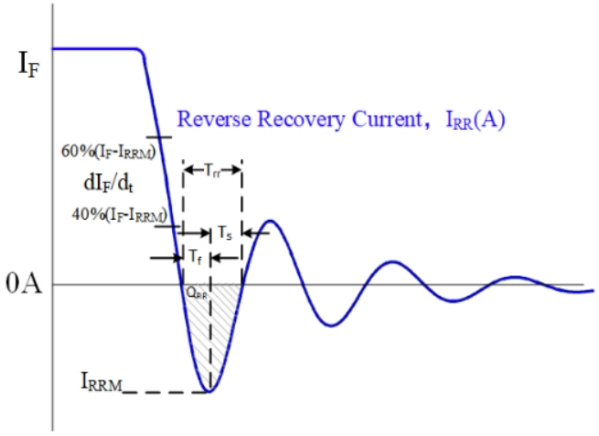
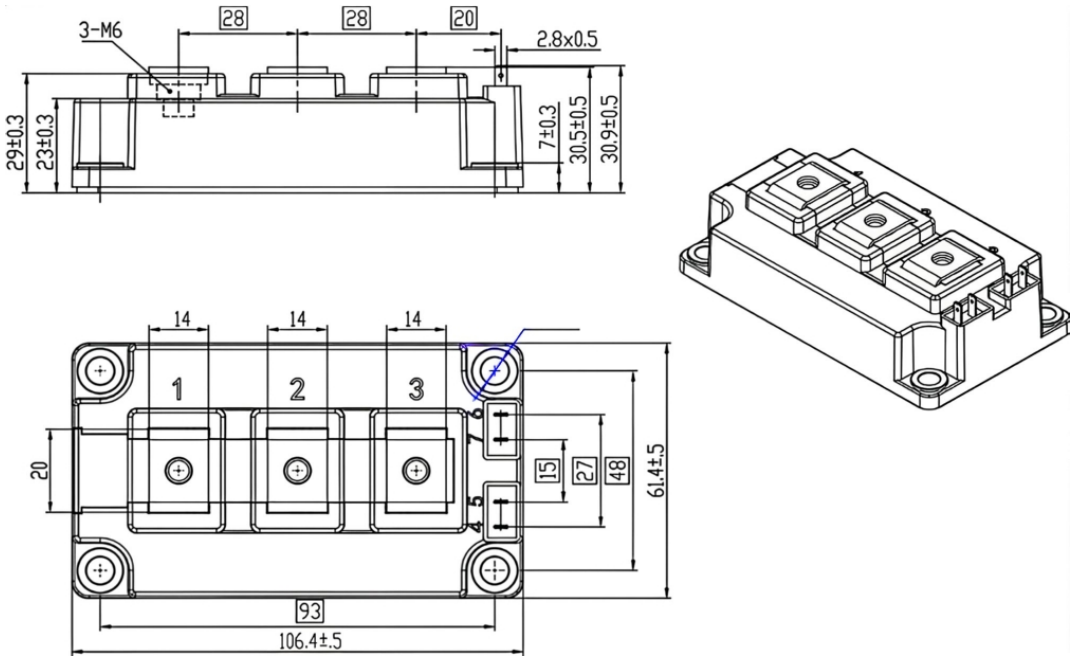


Figure 18. Reverse Recovery Definitions



Package outlines (62mm)



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