

Features

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant

Benefits

- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements

Applications

- Switch mode power supplies
- Renewable energy
- On Board Charger
- High voltage DC/DC converters

Package Pin Definitions

- Pin1- Gate
- Pin2- Drain
- Pin3- Power Source

SiC MOSFET

$$V_{DS} = 1200 \text{ V}$$

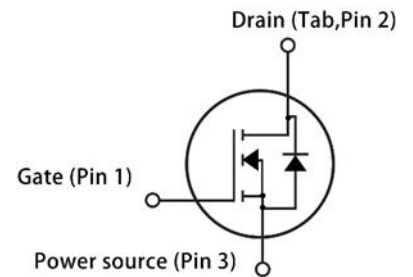
$$I_D (T_C=25^\circ\text{C}) = 140\text{A}$$

$$R_{DS(on).typ} = 16 \text{ m}\Omega @ V_{GS}=15 \text{ V}$$



1 2 3
G D S

TO-247-3



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

Symbol	Parameter	Test conditions	Value	Unit	Note
V_{DSmax}	Drain-Source Voltage	$V_{GS} = 0V, I_D = 100\mu A$	1200	V	
V_{GSmax}	Gate-Source voltage	AC ($f > 1\text{ Hz}$)	-10/+25	V	
V_{GSop}	Recommend Gate-Source Voltage	Static	-4/+15 -4/+18	V	
I_D	Continuous Drain current	$V_{GS} = 15V, T_C = 25^{\circ}\text{C}$ $V_{GS} = 18V, T_C = 25^{\circ}\text{C}$	140	A	Fig. 14
		$V_{GS} = 15V, T_C = 100^{\circ}\text{C}$ $V_{GS} = 18V, T_C = 100^{\circ}\text{C}$	99		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with t_p limited by T_{jmax}	243	A	
P_D	Power Dissipation	$T_C = 25^{\circ}\text{C}, T_J = 175^{\circ}\text{C}$	577	W	Fig. 16
T_j	Operating junction temperature		-55~175	$^{\circ}\text{C}$	
T_{stg}	Storage temperature		-55~175	$^{\circ}\text{C}$	
	TO-247 mounting torque	M3 Screw	0.7	Nm	

Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		0.26		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

Electrical Characteristics $T_j=25^{\circ}\text{C}$ unless otherwise specified

Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	$V_{GS} = 0V, I_D = 100\mu A$	1200			V	
$V_{GS(th)}$	Gate Threshold voltage	$V_{GS} = V_{DS}, I_D = 25mA$		2.9		V	Fig. 9
		$V_{GS} = V_{DS}, I_D = 25mA, T_j=175^{\circ}\text{C}$		2.0			
I_{GSS}	Gate-Source Leakage current	$V_{GS} = 15V, V_{DS} = 0V$			250	nA	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200V, V_{GS} = 0V, T_j = 25^{\circ}\text{C}$		1	50	μA	
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS} = 15V, I_D = 75A$ $V_{GS} = 18V, I_D = 75A$		16 14	24	m Ω	Fig. 3, 4, 5
		$V_{GS} = 15V, I_D = 75A, T_j = 175^{\circ}\text{C}$ $V_{GS} = 18V, I_D = 75A, T_j = 175^{\circ}\text{C}$		26 25			
g_{fs}	Transconductance	$V_{DS} = 15V, I_D = 75A$		63		S	Fig. 6
		$V_{DS} = 15V, I_D = 75A, T_j = 175^{\circ}\text{C}$		58			

Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
Q_{GS}	Gate to Source Charge	$V_{DS} = 800V$ $I_D = 75A$ $V_{GS} = -4V/15V$		113		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			49			
Q_G	Total Gate Charge			221			

AC Characteristics ($T_j=25^{\circ}C$ unless otherwise specified)

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 1000V$ $f = 100\text{ KHz}$ $V_{AC} = 25mV$		5636		pF	Fig. 13
C_{oss}	Output Capacitance			182		pF	
C_{rss}	Reverse Transfer Capacitance			13		pF	
$R_{G(int)}$	Internal Gate Resistance	$f=1\text{ MHz}, V_{AC} = 25mV$		1.3		Ω	

Reverse Diode Characteristics ($T_J=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	$V_{GS} = -4\text{V}, I_{SD} = 37.5\text{A}$		4.0		V	Fig. 7,8
		$V_{GS} = -4\text{V}, I_{SD} = 37.5\text{A}, T_J = 175^\circ\text{C}$		3.5			
I_S	Continuous Diode Forward Current	$V_{GS} = -4\text{V}, T_C = 25^\circ\text{C}$		129		A	
$I_{S, pulse}$	Diode pulse Current	$V_{GS} = -4\text{V}$, pulse width t_p limited by T_{Jmax}		243		A	
t_{rr}	Reverse Recovery Time	$V_{GS} = -4\text{V}, I_{SD} = 75\text{A}, V_R = 800\text{V}$ $\text{dif/dt} = 3500\text{A/us}$		32		nS	
Q_{rr}	Reverse Recovery Charge			472		nC	
I_{rm}	Peak Reverse Recovery Current			18		A	

Switching Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 800\text{V}$ $V_{GS} = -4/+15\text{V}$ $I_D = 75\text{A}, R_{G(ext)} = 5\Omega$ $L = 200\mu\text{H}$		15		nS	Fig.22
t_r	Rise Time			81		nS	
$t_{d(off)}$	Turn-Off Delay Time			37		nS	
t_f	Fall Time			14		nS	
E_{on}	Turn-On Energy			2845		μJ	Fig.20
E_{off}	Turn-Off Energy			770		μJ	
E_{tot}	Total switching energy			3615		μJ	

Typical Performance

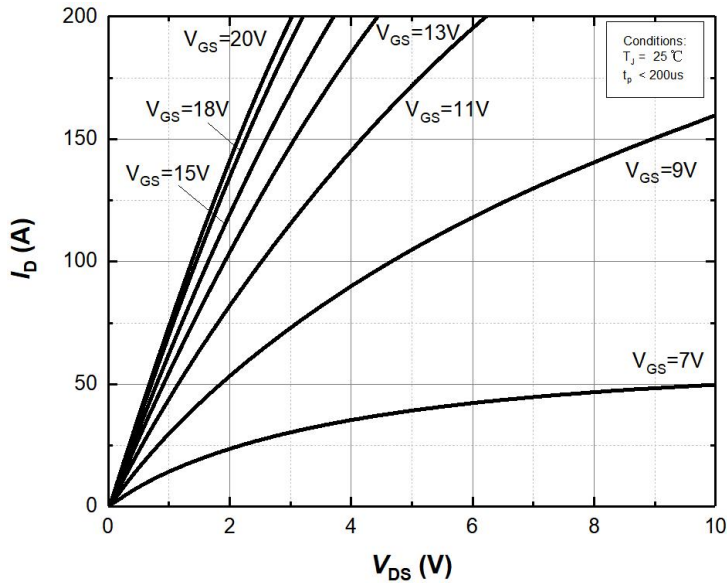


Figure 1. Output characteristics at $T_j=25^\circ\text{C}$

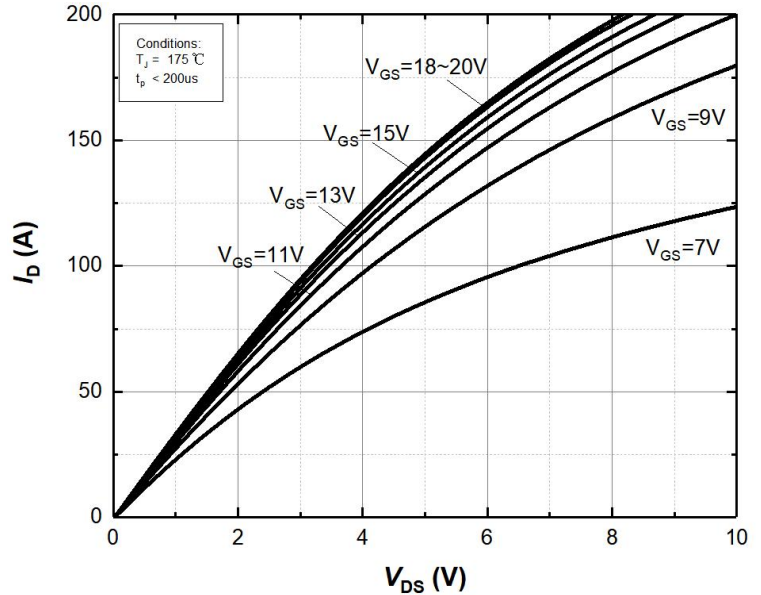


Figure 2. Output characteristics at $T_j=175^\circ\text{C}$

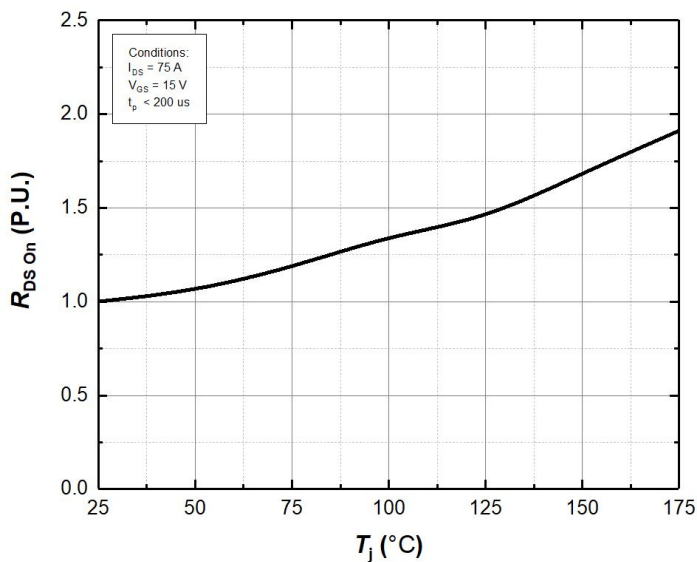


Figure 3. Normalized On-Resistance vs. Temperature

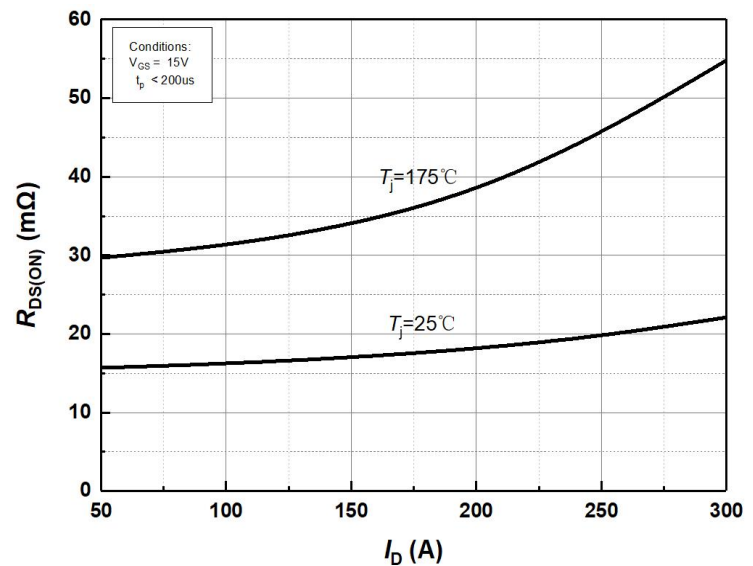


Figure 4. On-Resistance vs. Drain current for Various Temperature

Typical Performance

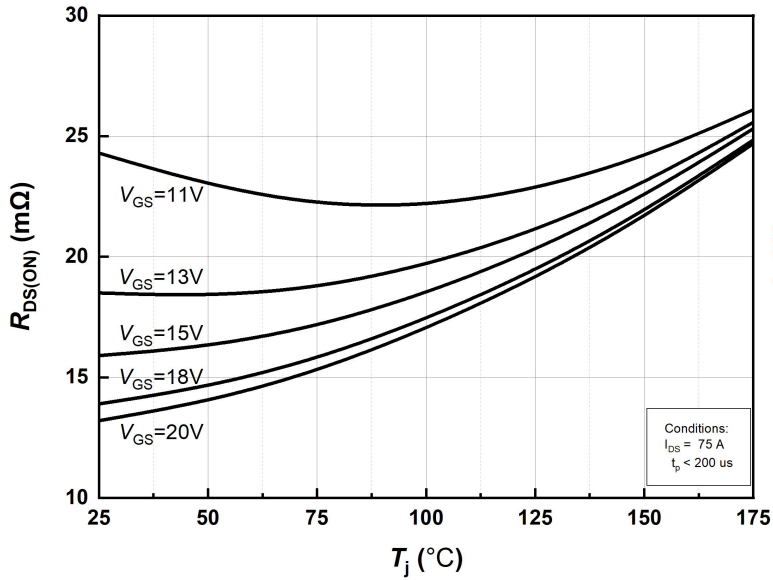


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

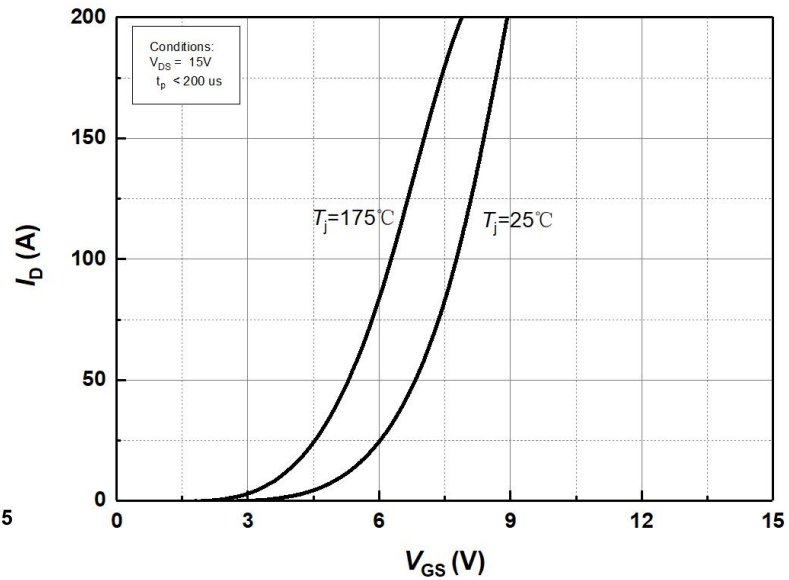


Figure 6. Transfer Characteristics for Various Junction Temperatures

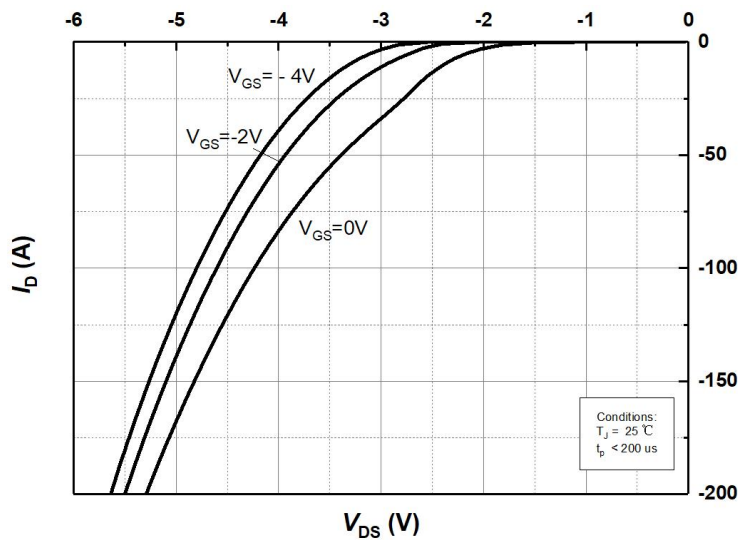


Figure 7. Body Diode Characteristics at $T_j=25^{\circ}\text{C}$

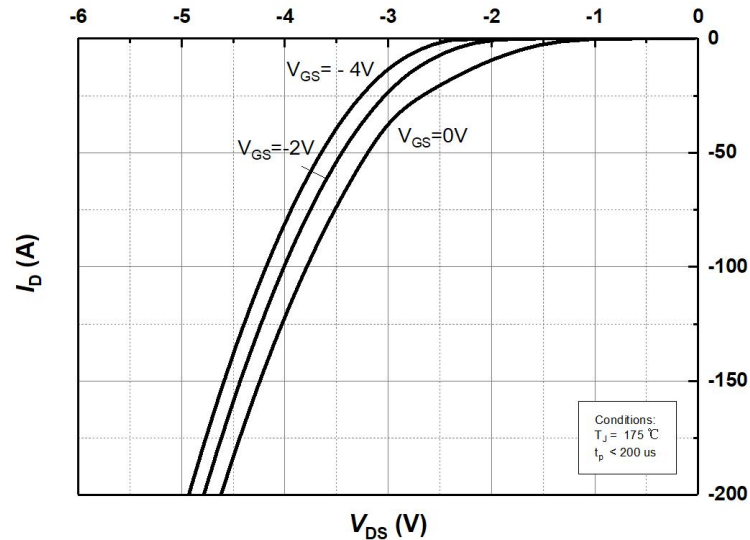


Figure 8. Body Diode Characteristics at $T_j=175^{\circ}\text{C}$

Typical Performance

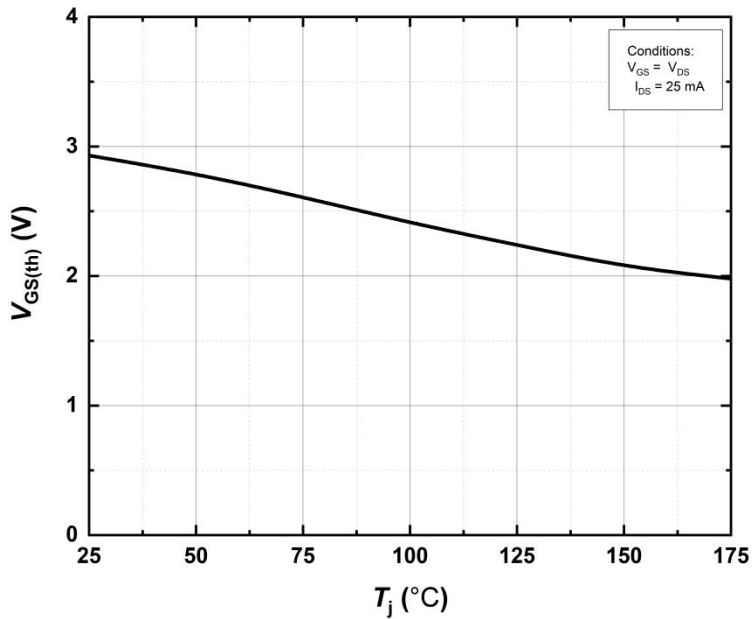


Figure 9. Threshold Voltage vs. Temperature

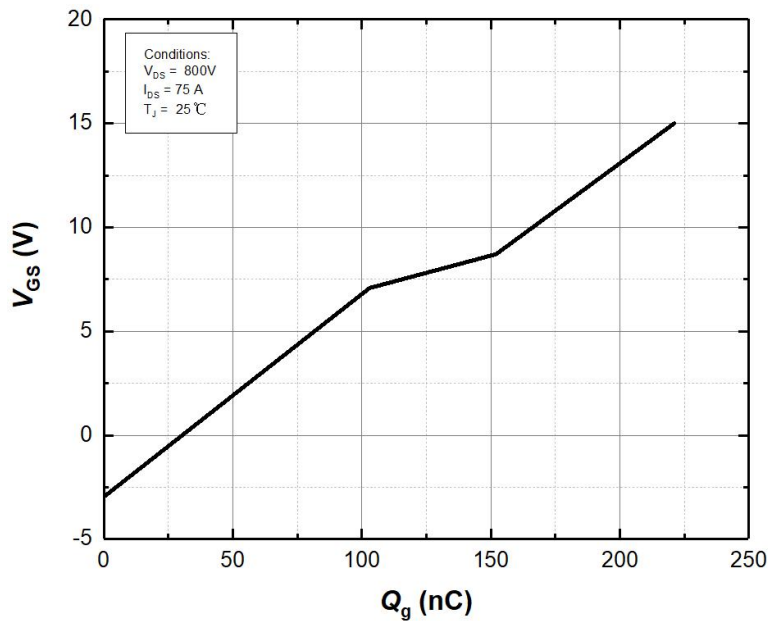


Figure 10 Gate Charge Characteristics

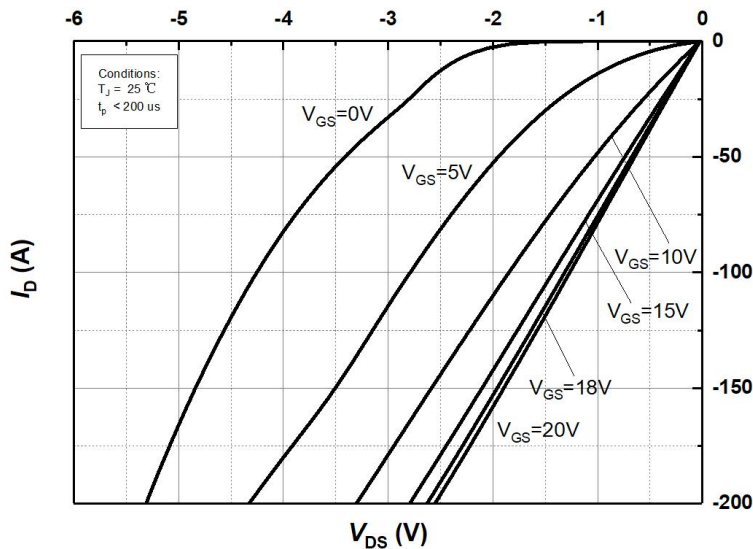


Figure 11. 3rd Quadrant Characteristic at $T_j=25^{\circ}\text{C}$

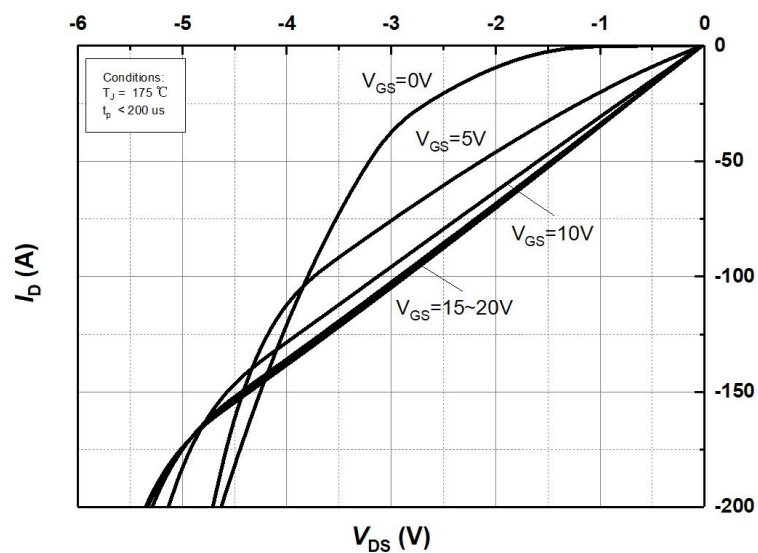


Figure 12. 3rd Quadrant Characteristic at $T_j=175^{\circ}\text{C}$

Typical Performance

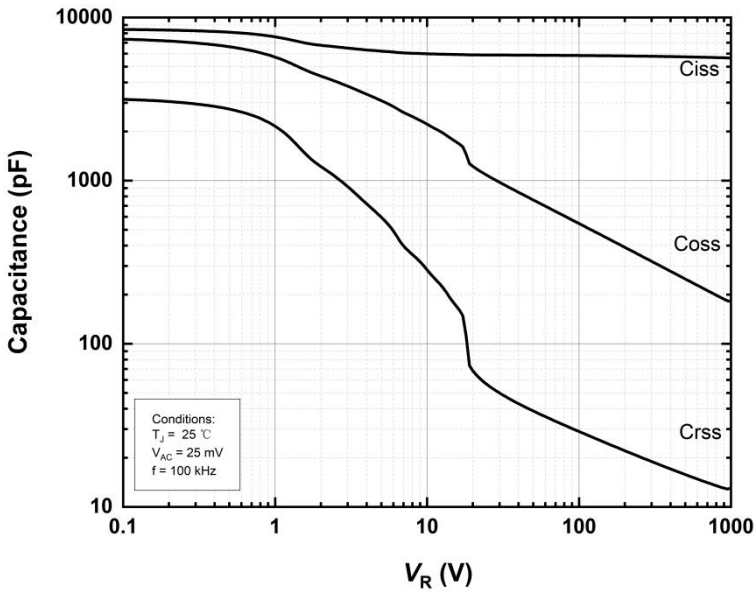


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 1000V)

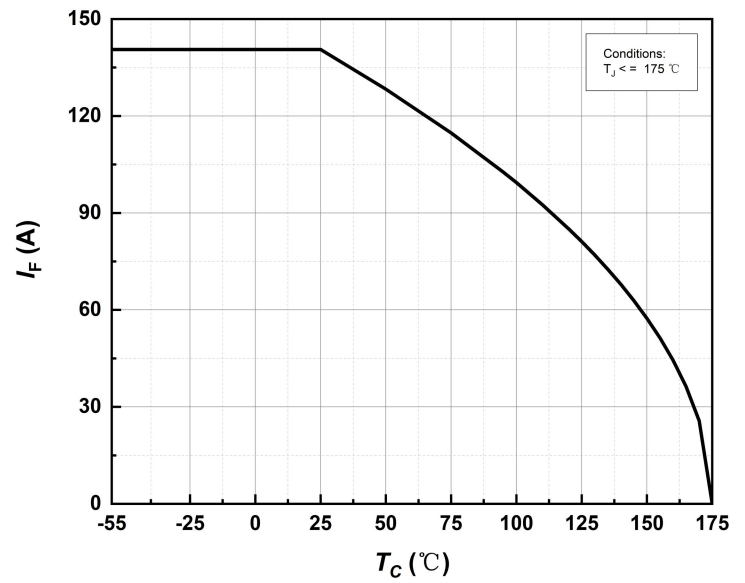


Figure 14. Continuous Drain Current Derating vs Case Temperature

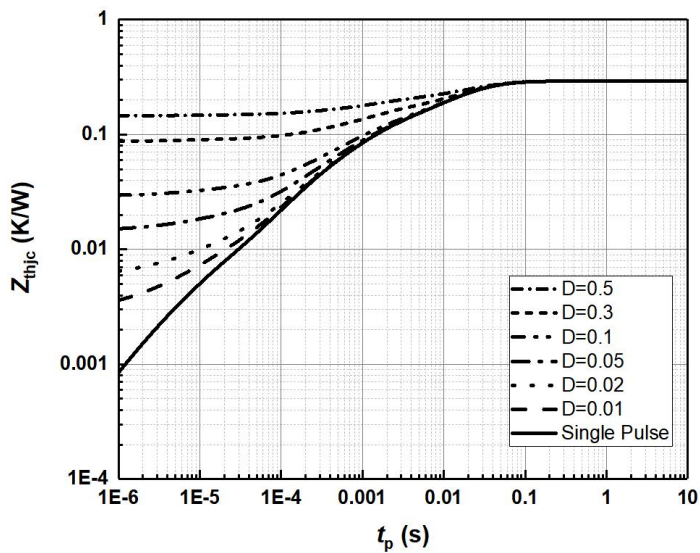


Figure 15. Transient Thermal Impedance (Junction – Case)

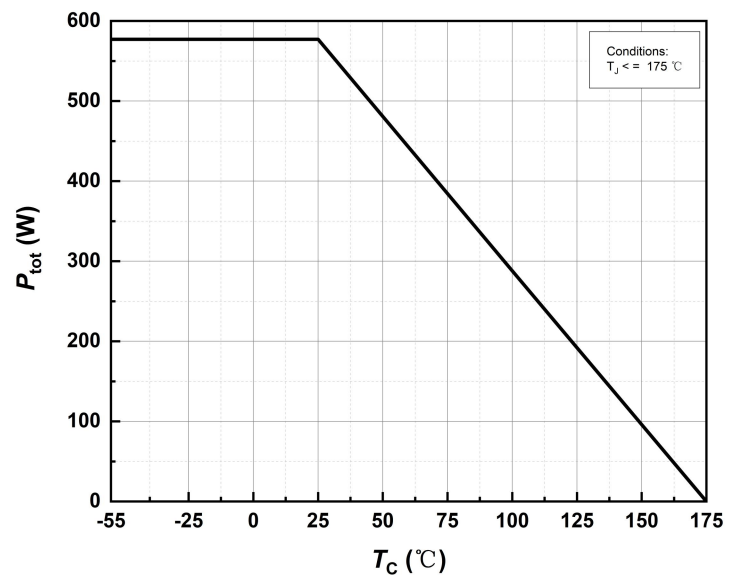


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

Typical Performance

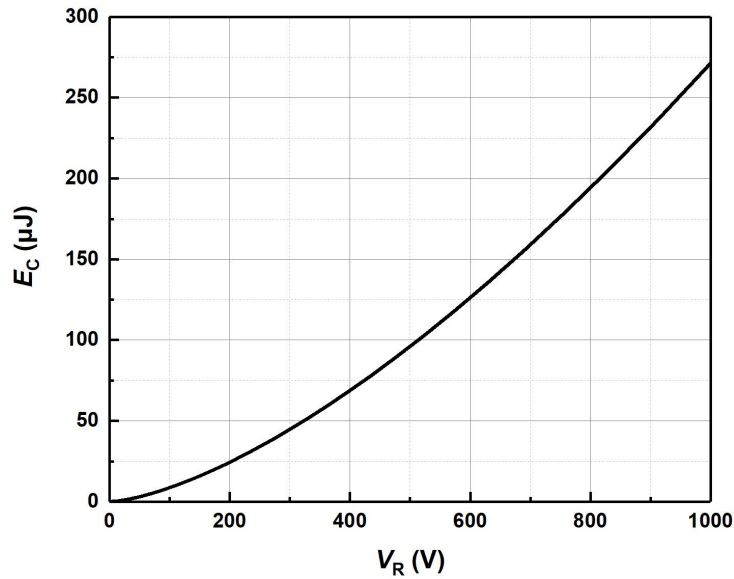


Figure 17. Output Capacitor Stored Energy

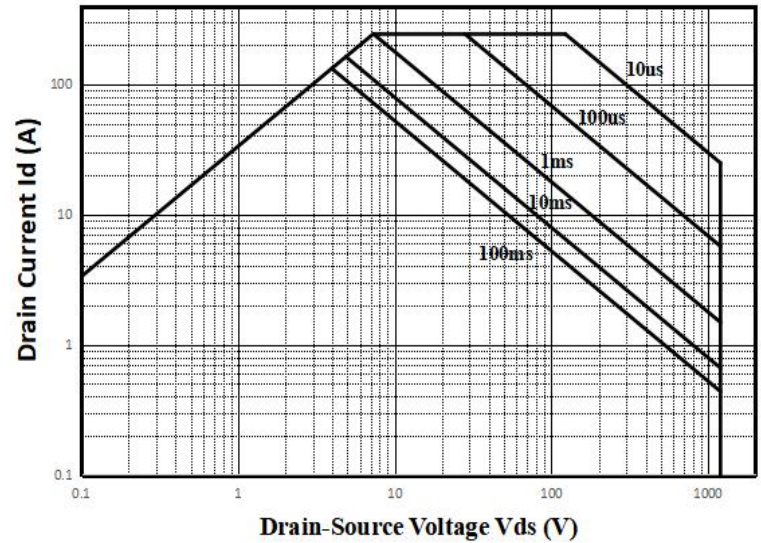


Figure 18. Safe Operating Area

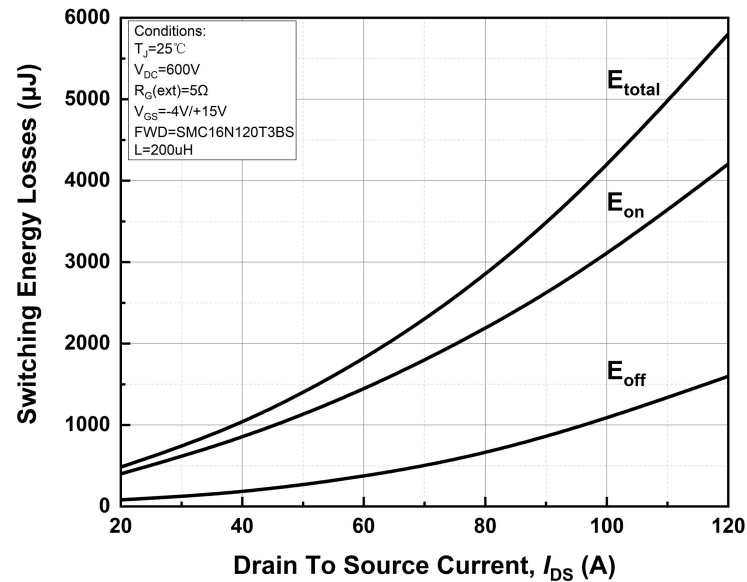


Figure 19. Clamped Inductive Switching Energy vs. Drain Current($V_{DD} = 600\text{V}$)

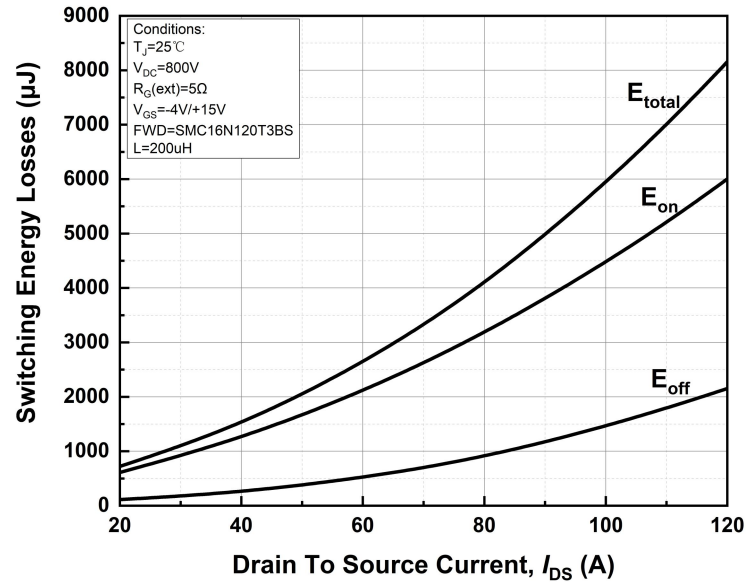


Figure 20. Clamped Inductive Switching Energy vs. Drain Current($V_{DD} = 800\text{V}$)

Typical Performance

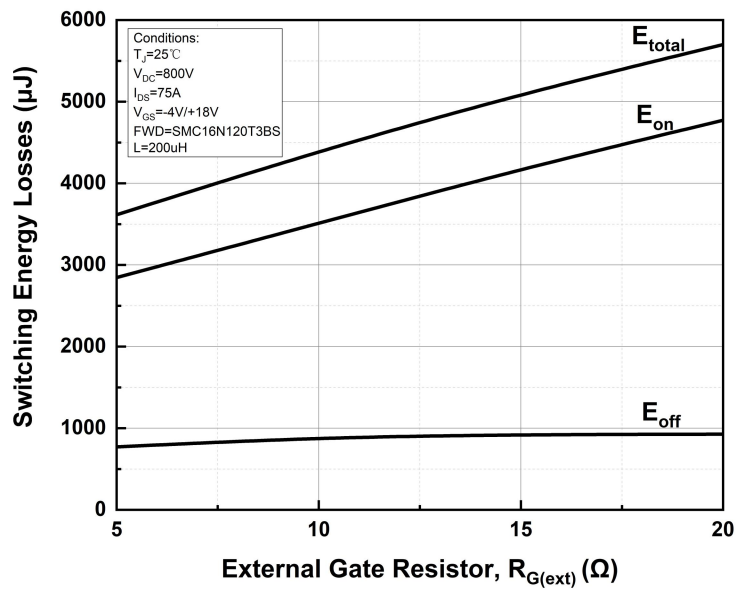


Figure 21. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$

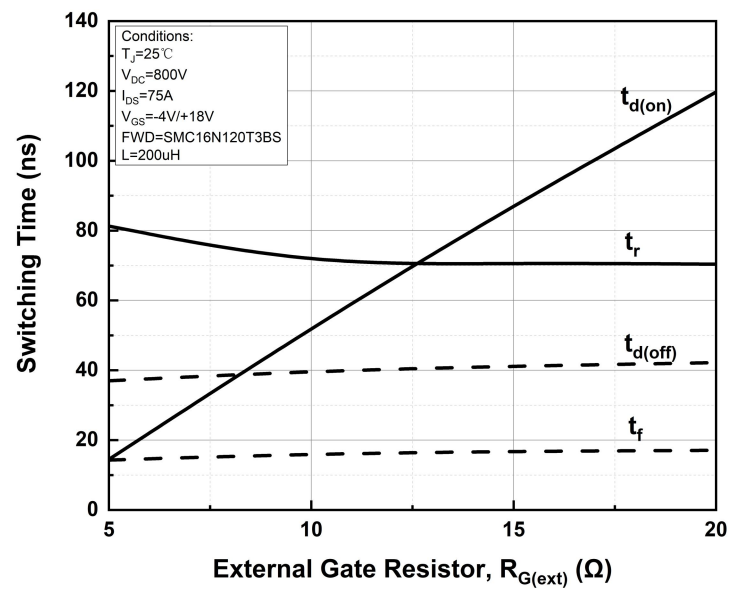
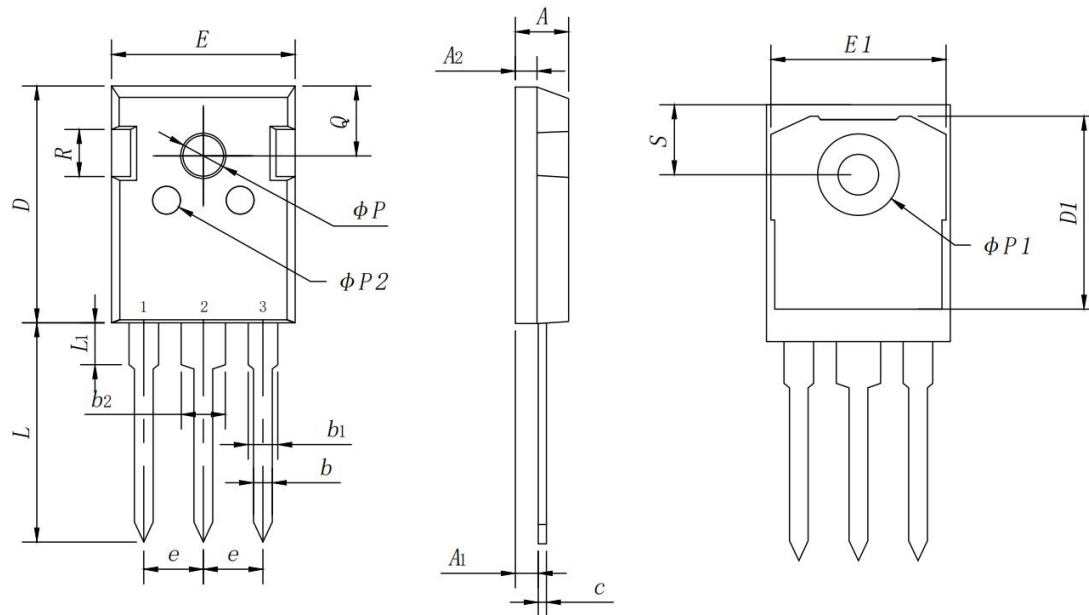


Figure 22. Switching Times vs. $R_{G(\text{ext})}$

Package Dimensions



SYMBOLS	DIMENSION IN MM		
	MIN	NOM	MAX
A	4.70	5.00	5.30
A_1	2.24	2.41	2.58
A_2	1.80	2.00	2.20
b	1.00	1.20	1.40
b_1	1.60	2.10	2.60
b_2	2.60	3.10	3.60
c	0.40	0.60	0.80
D	20.0	21.00	22.0
$D1$	15.24	16.24	17.24
E	15.50	15.75	16.01
$E1$	13.77	14.02	14.27
e	5.20	5.44	5.72
L	19.70	19.95	20.20
L_1	3.85	4.15	4.45
ϕP	3.55	3.60	3.65
$\phi P1$	7.14	7.19	7.24
$\phi P2$	2.35	2.40	2.45
Q	5.89	6.15	6.40
R	4.30	4.60	4.90
S	6.04	6.17	6.30