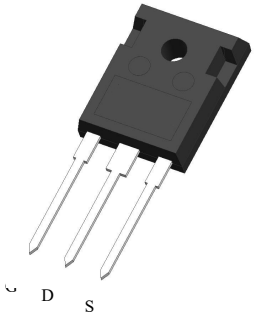
TPMW280N120C1P

SiC Power MOSFET

General Description

Topdiode 14A 1200V SiC MOSFET is an ultrahigh performance power SiC MOSFET,designed for high frequency applications where high efficiency and high reliability are required. The wide band gap material allows the design of a SiC MOSFET structure with low leakage current and conduction losses.

Package TO-247-3



Features

High Blocking Voltage with Low On-Resistance

High Speed Switching with Low Capacitance

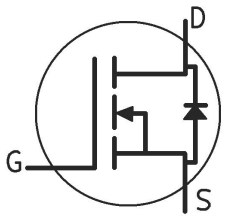
Easy to Parallel and Simple to Drive

Avalanche Ruggedness

Resistant to Latch-Up

Halogen Free, RoHS Compliant

Equivalent Schematic



Applications

LED Lighting Power Supplies

High Voltage DC/DC Converters

Industrial Power Supplies

HVAC

Summary

Symbol	Value
V_{DS}	1200V
$R_{DS(on)}$	280mΩ
I_D@25°C	14A
$Q_{G(typ.)}$	31.3nC

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

Symbol	Parameter	Test Conditions	Value	Unit
V_{DSmax}	Drain-Source Voltage	V_{GS}=0V, I_D=100μA	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°C	14	A
		V_{GS}=20V, T_C=100°C	8.7	A
$I_{D(pulse)}$	Pulsed Drain Current	Pulse Width t_p Limited by T_{Jmax}	27	A
P_D	Power Dissipation	T_C=25°C,T_J=150°C	69.4	W
T_J ,T_{stg}	Operating Junction and Storage Temperature		-55 to +150	°C
T_L	Solder Temperature	1.6mm (0.063”) from Case for 10s	260	°C
M_d	Mounting Torque	M3 or 6-32 Screw	1	Nm
			8.8	lbf-in

Reverse Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	V_{GS}= -5V, I_{SD}=3A		4.0		V
		V_{GS}= -5V, I_{SD}=3A, T_J=150°C		3.8		V
I_S	Continuous Diode Forward Current	T_C=25°C		14		A
t_{rr}	Reverse Recover Time	V_{GS}=-5V,I_{SD}=6A V_R=800V dI_F/dt =1840 A/μs		6.1		ns
Q_{rr}	Reverse Recovery Charge			13.4		nC
I_{rrm}	Peak Reverse Recovery Current			5.4		A

Note (1): When using SiC Body Diode the maximum recommended V_{GS} = -5V

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Thermal Resistance from Junction to Case		1.54	1.8	°C/W
R_{thJA}	Thermal Resistance from Junction to Ambient			40	°C/W

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=100μA	1200			V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=1.25mA	2.0	3.3	4.0	V
		V_{DS}=V_{GS}, I_D=1.25mA, T_J=150℃		2.4		V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V, V_{GS}=0V		2	100	μA
I_{GSS}	Gate-Source Leakage Current	V_{DS}=0V, V_{GS}=20V			250	nA
$R_{DS(on)}$	Drain-Source On-State Resistance	V_{GS}=20V, I_D=6A		280	330	mΩ
		V_{GS}=20V, I_D=6A,T_J=150℃		370		mΩ
g_{fs}	Trans Conductance	V_{DS}= 20 V, I_{DS}= 6 A		2.3		S
		V_{DS}= 20 V, I_{DS}= 6 A, T_J = 150 °C		2.6		S
C_{iss}	Input Capacitance	V_{GS}=0V V_{DS}=1000V f=1 MHz V_{AC}=25mV		442		pF
C_{oss}	Output Capacitance			22		pF
C_{rss}	Reverse Transfer Capacitance			6.5		pF
E_{oss}	C_{oss} Stored Energy			12.6		μJ
E_{ON}	Turn-On Switching Energy	V_{DD}=800V, V_{GS}=-5V/20V, I_D=6A, $R_{G(ext)}$=2.0Ω, L= 500μH		161.5		μJ
E_{OFF}	Turn-Off Switching Energy			17.85		μJ
$t_{d(on)}$	Turn-On Delay Time			3.5		ns
t_r	Rise Time			19.1		ns
$t_{d(off)}$	Turn-Off Delay Time			12.5		ns
t_f	Fall Time			26.5		ns
$R_{G(int)}$	Internal Gate Resistance	f=1MHz, V_{AC}=25mV, ESR of C_{ISS}		2		Ω
Q_{GS}	Gate to Source Charge	V_{DS}=800V ,V_{GS}=-5V/20V I_D=6A		8.6		nC
Q_{GD}	Gate to Drain Charge			13.6		nC
Q_G	Total Gate Charge			31.3		nC

Typical Performance

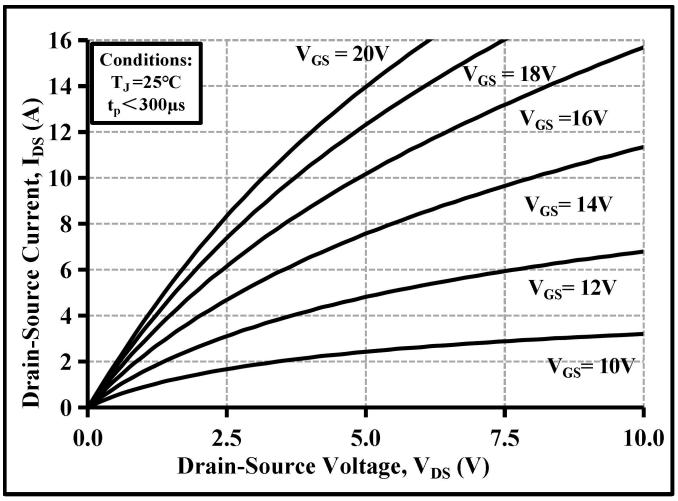


Figure 1: Output Characteristics T_J =25°C

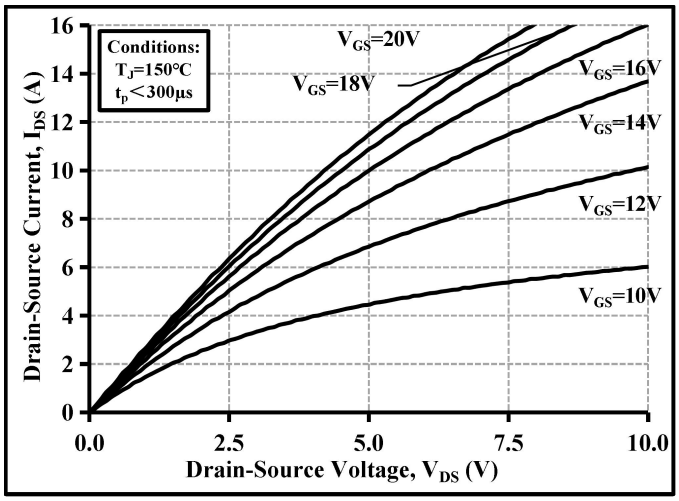


Figure 2: Output Characteristics T_J = 150°C

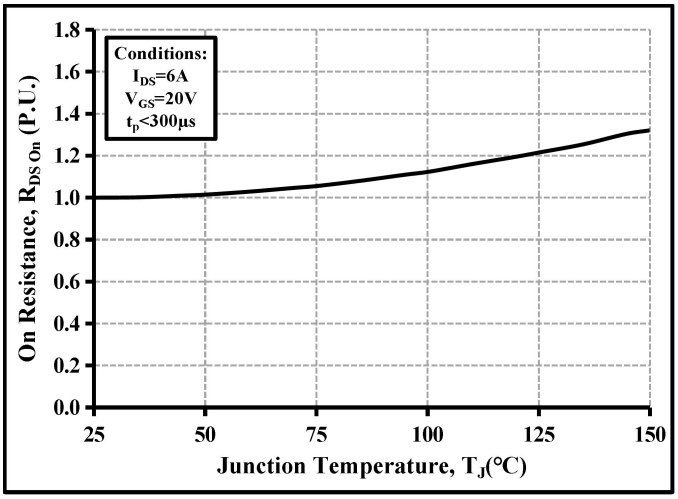


Figure 3: Normalized On-Resistance vs Temperature

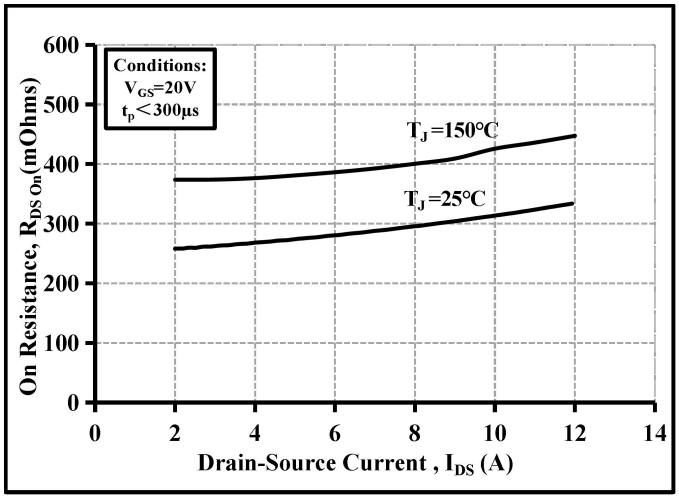


Figure 4: On-Resistance vs Drain Current For Various Temperatures

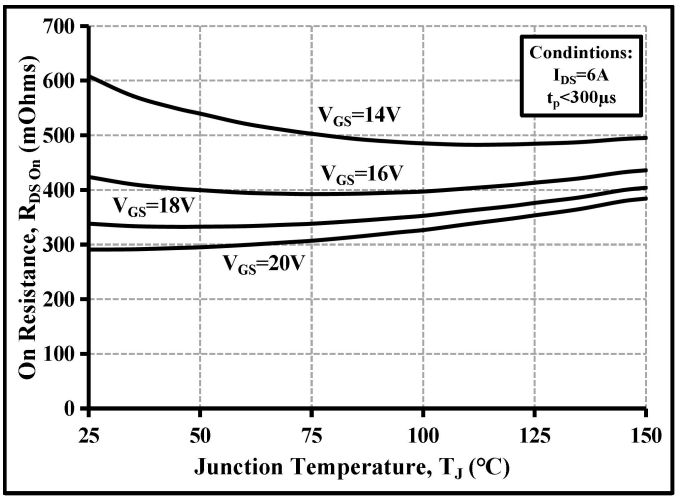


Figure 5: On-Resistance vs Temperature For Various Gate Voltage

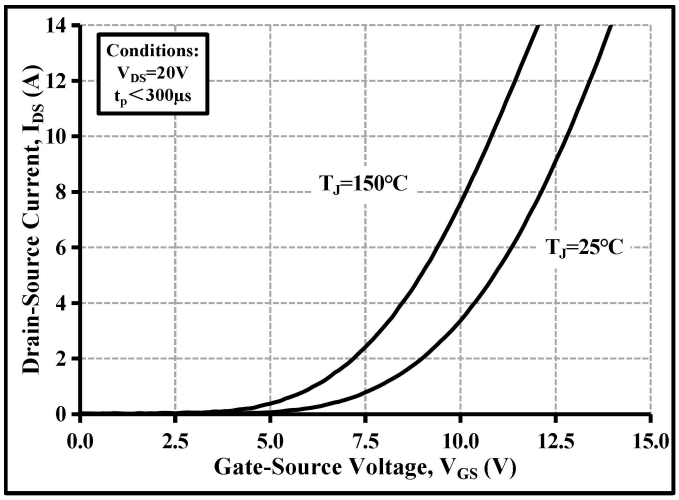


Figure 6: Transfer Characteristic for Various Junction Temperatures

Typical Performance

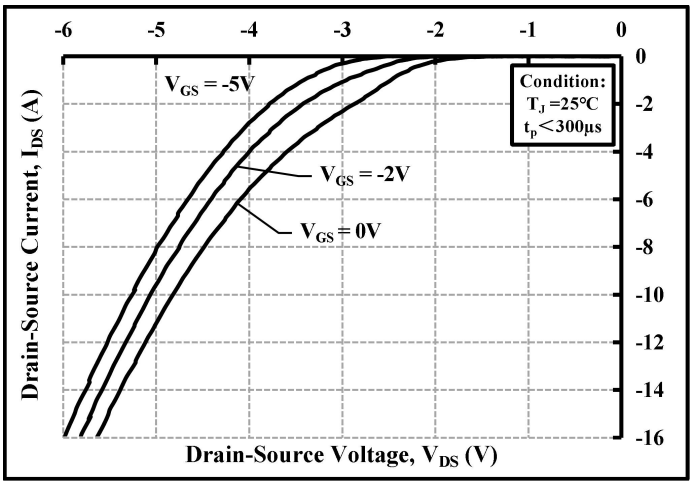


Figure 7: Body Diode Characteristic at 25℃

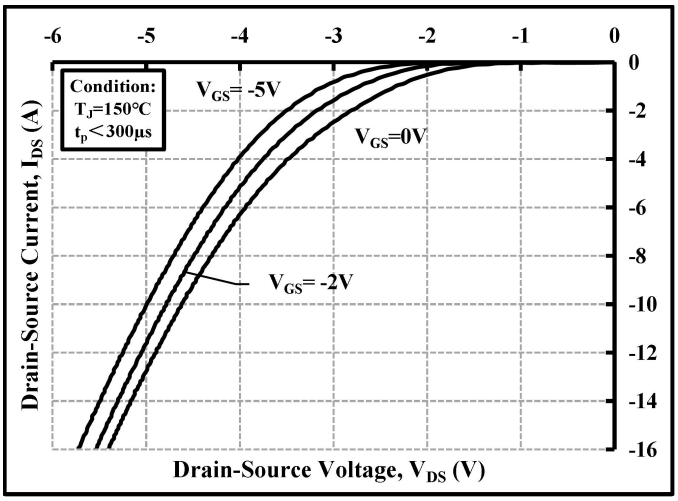


Figure 8: Body Diode Characteristic at 150℃

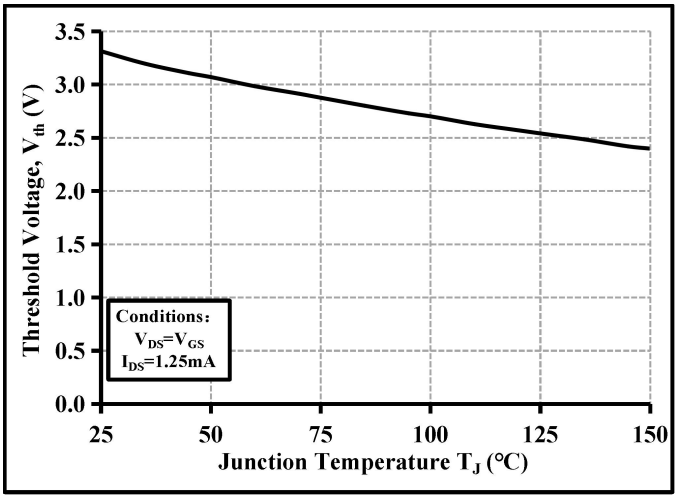


Figure 9: Threshold Voltage vs Temperature

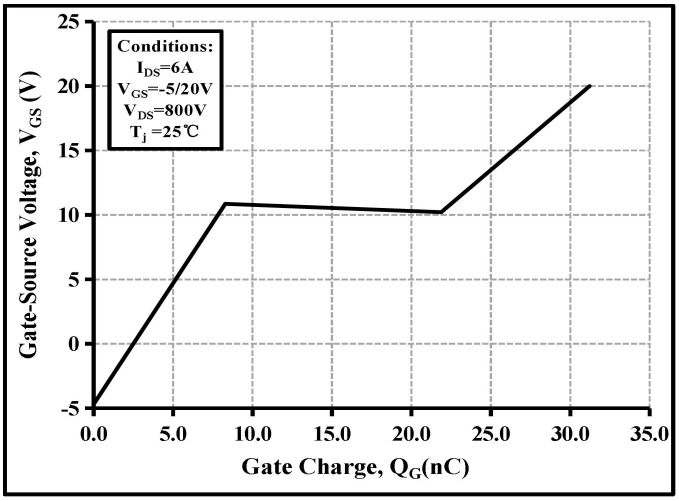


Figure 10: Gate Charge Characteristics

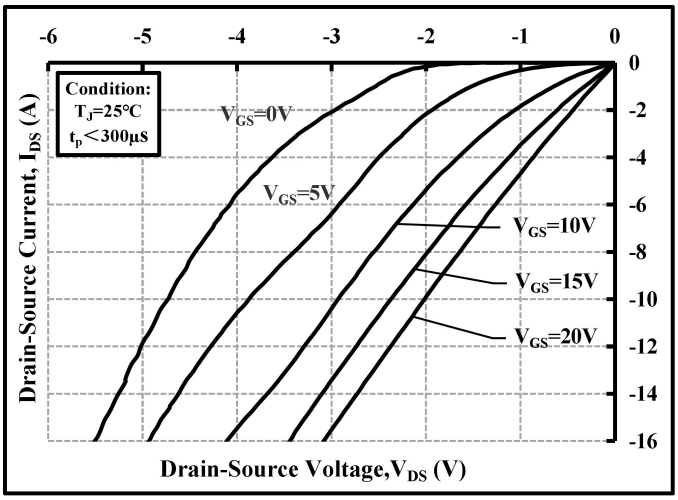


Figure 11: 3rd Quadrant Characteristic at 25℃

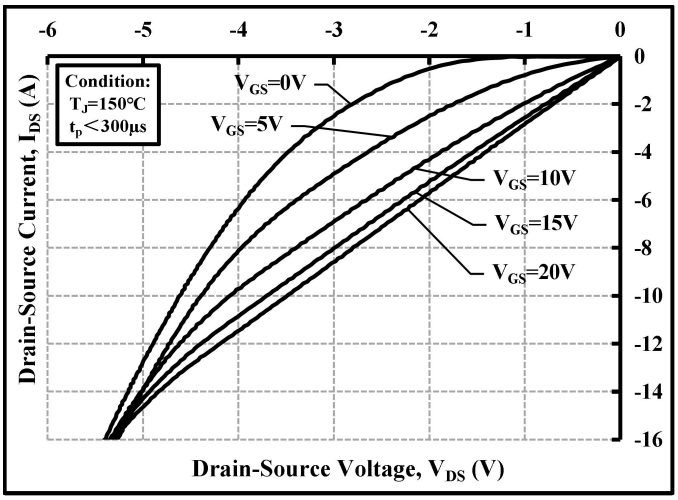


Figure 12: 3rd Quadrant Characteristic at 150℃

Typical Performance

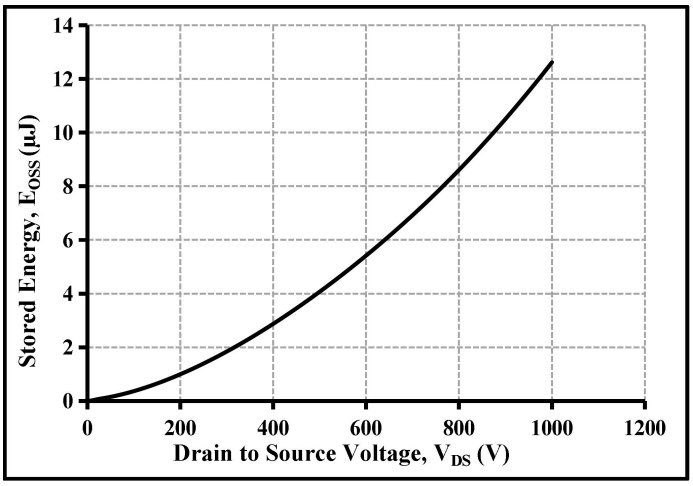


Figure 13: Output Capacitor Stored Energy

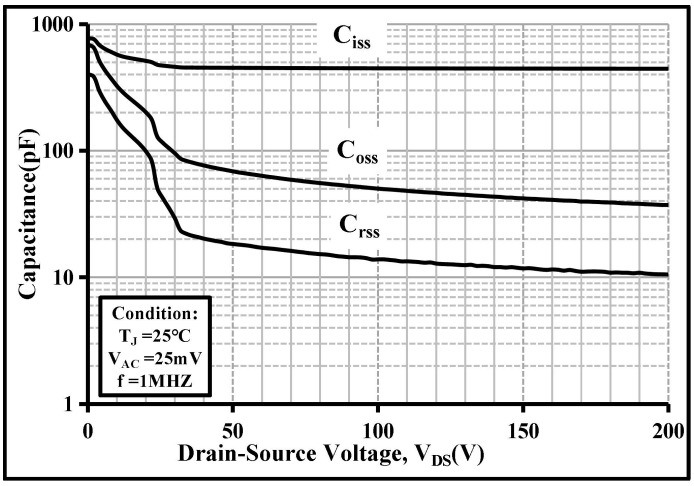


Figure 14: Capacitance vs Drain-Source Voltage (0-200 V)

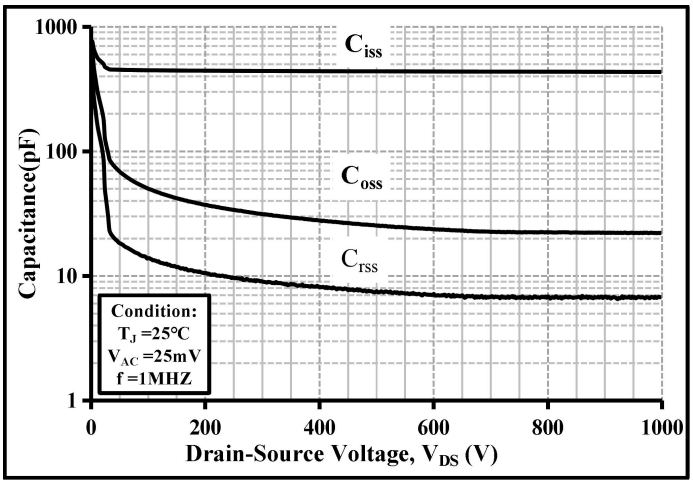


Figure 15: Capacitance vs Drain-Source Voltage (0-1000 V)

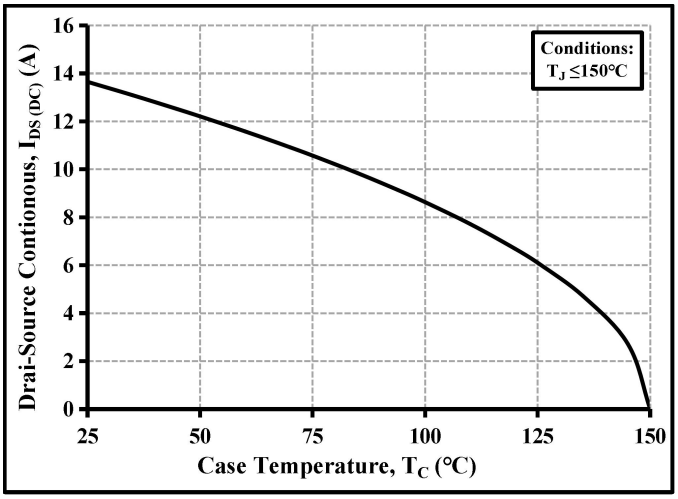


Figure 19: Continuous Drain Current Derating vs Case Temperature

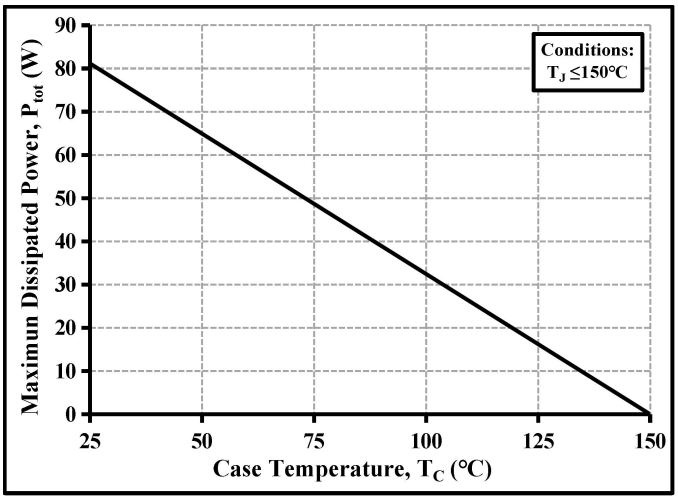


Figure 20: Maximum Power Dissipation Derating vs Case Temperature

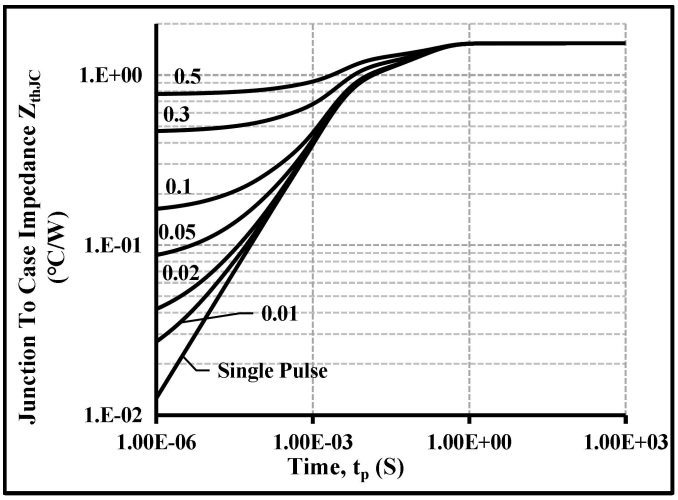


Figure 21: Transient Thermal Impedance (Junction - Case)

Typical Performance

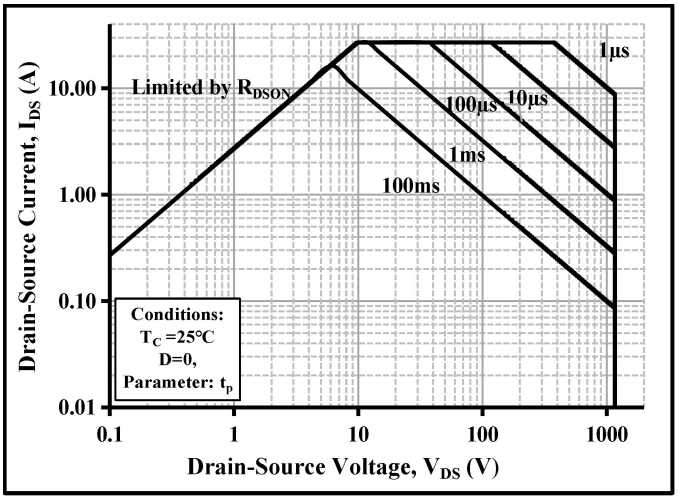


Figure 22: Safe Operating Area

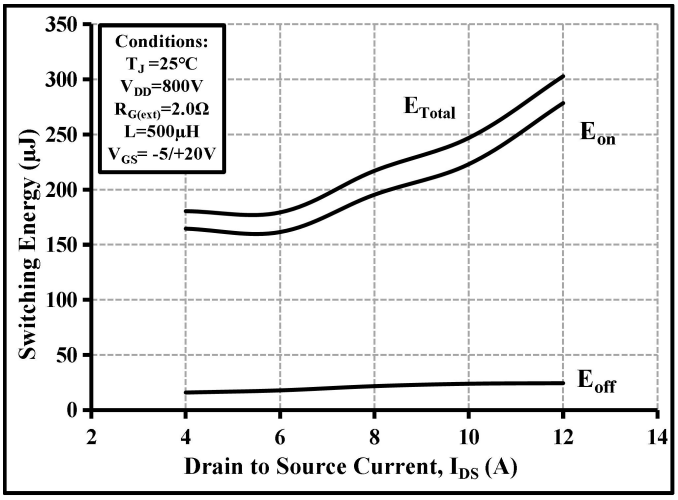


Figure 23: Clamped Inductive Switching Energy vs Drain Current

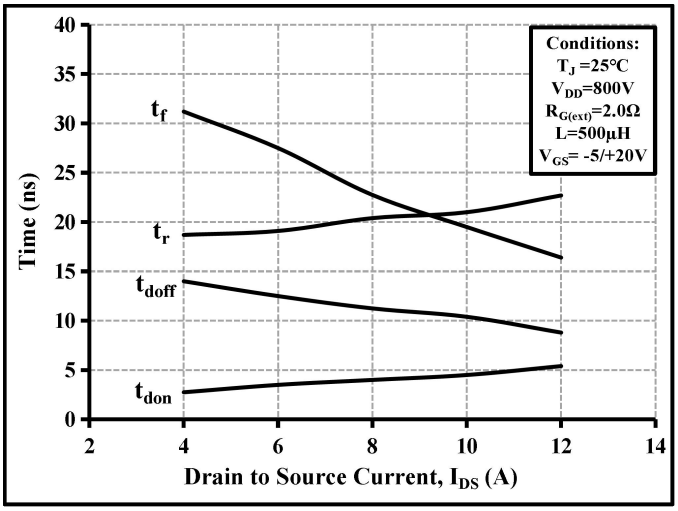


Figure 24: Switching Times vs Drain Current

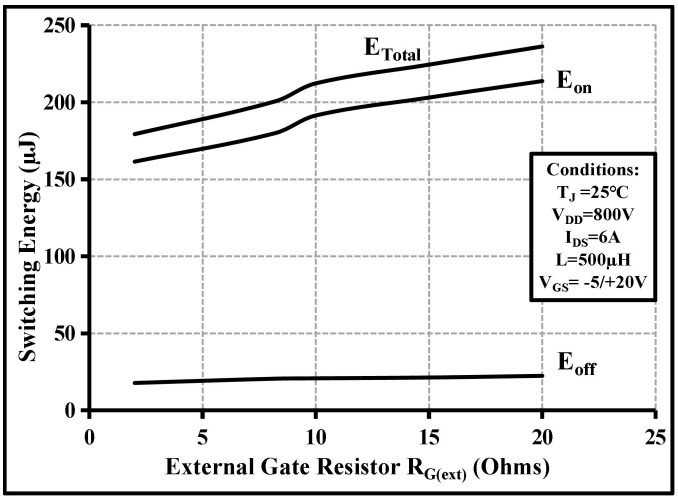


Figure 25: Clamped Inductive Switching Energy vs $R_{G(ext)}$

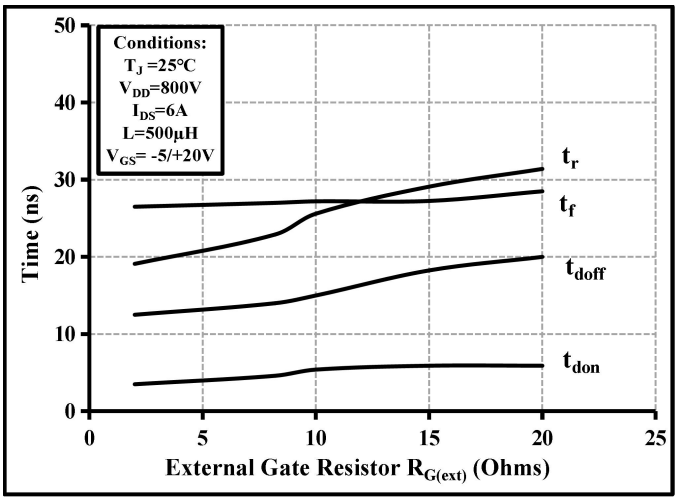
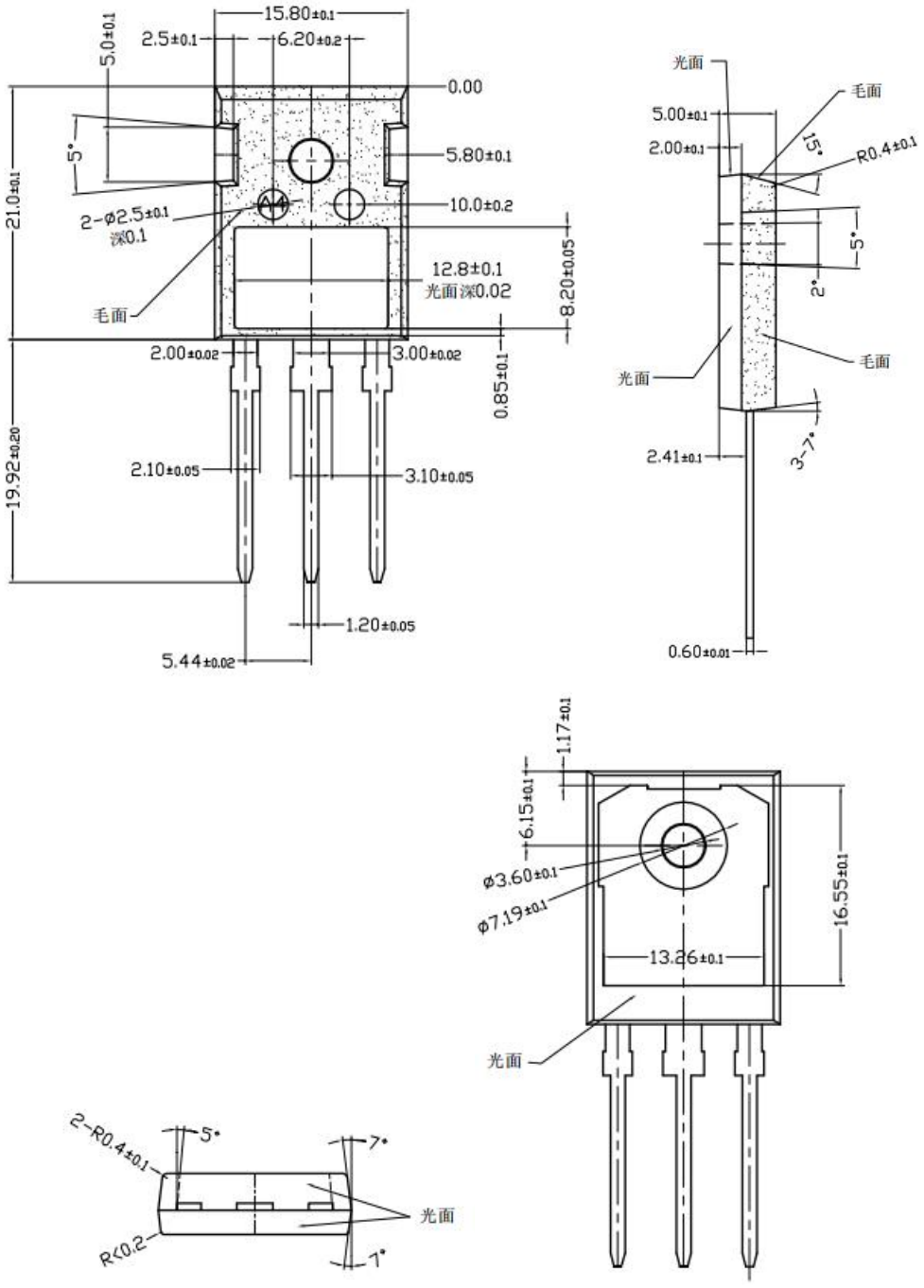


Figure 26: Switching Times vs $R_{G(ext)}$

Package Dimensions

TO-247-3



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