

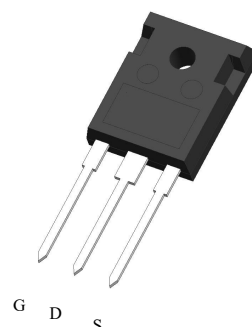
TPMW40N120C1P

SiC Power MOSFET

General Description

Topdiode 56A 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

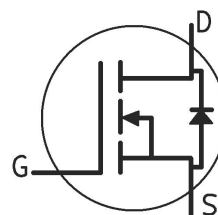
Easy to Parallel and Simple to Drive

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

TPMW40N120C1P Summary

Symbol	Value
V_{DS}	1200V
$R_{DS(on)}$	40m Ω
$I_D@25^{\circ}C$	56A
$Q_G(yp.)$	196nC

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

Symbol	Parameter	Test Conditions	Value	Unit
V_{DSmax}	Drain-Source Voltage	$V_{GS}=0V, I_D=100\mu A$	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	$V_{GS}=20V, T_C=25^{\circ}\text{C}$	56	A
		$V_{GS}=20V, T_C=100^{\circ}\text{C}$	40	A
$I_{D(pulse)}$	Pulsed Drain Current	Pulse Width t_p Limited by T_{Jmax}	112	A
P_D	Power Dissipation	$T_C=25^{\circ}\text{C}, T_J=175^{\circ}\text{C}$	194	W
T_J, T_{stg}	Operating Junction and Storage Temperature		-55 to +175	$^{\circ}\text{C}$
T_L	Solder Temperature	1.6mm (0.063") from Case for 10s	260	$^{\circ}\text{C}$
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	$V_{GS} = -5V, I_{SD}=20A$		4.0		V
		$V_{GS} = -5V, I_{SD}=20A, T_J=175^{\circ}\text{C}$		3.5		V
I_S	Continuous Diode Forward Current	$T_C=25^{\circ}\text{C}$		56		A
t_{rr}	Reverse Recover Time	$V_{GS}=-5V, I_{SD}=30A$ $V_R=800V$ $dI_F/dt = 2100 \text{ A}/\mu s$		23.2		ns
Q_{rr}	Reverse Recovery Charge			240		nC
I_{rrm}	Peak Reverse Recovery Current			17.8		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		0.77		$^{\circ}\text{C}/\text{W}$

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=100\mu A$	1200			V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=9mA$	2.0	3.2	4.0	V
		$V_{DS}=V_{GS}, I_D=9mA, T_J=175^\circ C$		2.1		V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=1200V, V_{GS}=0V$		7	100	μA
I_{GSS}	Gate-Source Leakage Current	$V_{DS}=0V, V_{GS}=20V$			250	nA
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=20V, I_D=20A$		40	55	$m\Omega$
		$V_{GS}=20V, I_D=20A, T_J=175^\circ C$		61		$m\Omega$
g_{fs}	Trans Conductance	$V_{DS}=20V, I_{DS}=20A$		9.3		S
		$V_{DS}=20V, I_{DS}=20A, T_J=175^\circ C$		9.8		S
C_{iss}	Input Capacitance	$V_{GS}=0V$		3120		pF
C_{oss}	Output Capacitance	$V_{DS}=1000V$		144		pF
C_{rss}	Reverse Transfer Capacitance	$f=1MHz$		27.1		pF
E_{oss}	C_{oss} Stored Energy	$V_{AC}=25mV$		79.7		μJ
E_{ON}	Turn-On Switching Energy	$V_{DD}=800V, V_{GS}=-5V/20V, I_D=30A, R_{G(ext)}=2.0\Omega, L=250\mu H$		876.9		μJ
E_{OFF}	Turn-Off Switching Energy			62.5		μJ
$t_{d(on)}$	Turn-On Delay Time			11.5		ns
t_r	Rise Time			34		ns
$t_{d(off)}$	Turn-Off Delay Time			42.5		ns
t_f	Fall Time			17.5		ns
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz, V_{AC}=25mV, ESR \text{ of } C_{iss}$		3.1		Ω
Q_{GS}	Gate to Source Charge	$V_{DS}=800V, V_{GS}=-5V/20V, I_D=30A$		44.7		nC
Q_{GD}	Gate to Drain Charge			87.8		nC
Q_G	Total Gate Charge			196		nC

Typical Performance

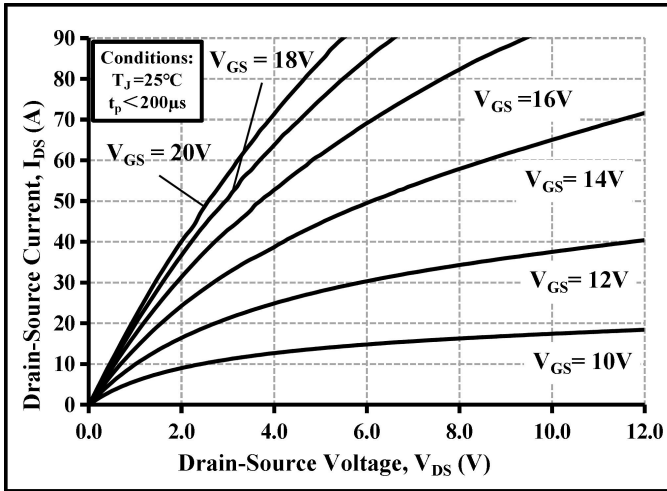


Figure 1: Output Characteristics $T_J = 25^\circ\text{C}$

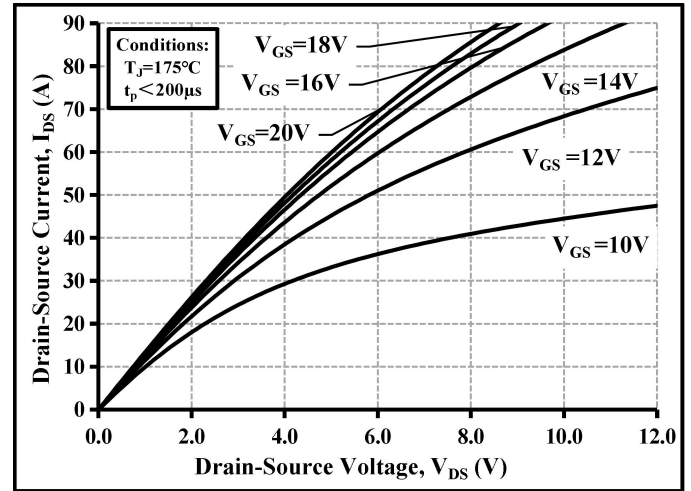


Figure 2: Output Characteristics $T_J = 175^\circ\text{C}$

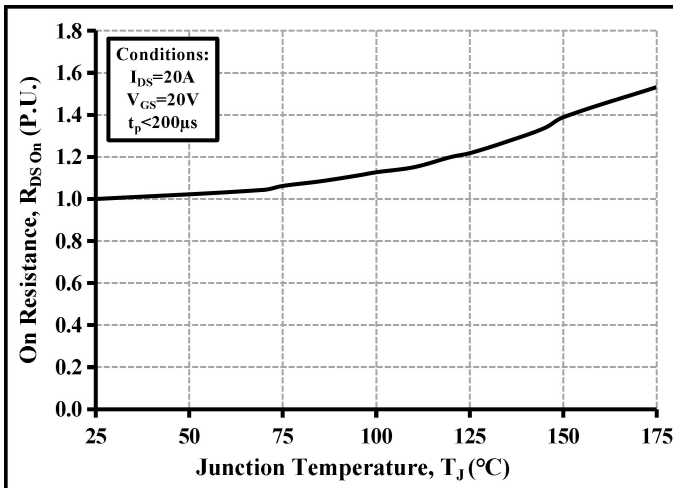


Figure 3: Normalized On-Resistance vs Temperature

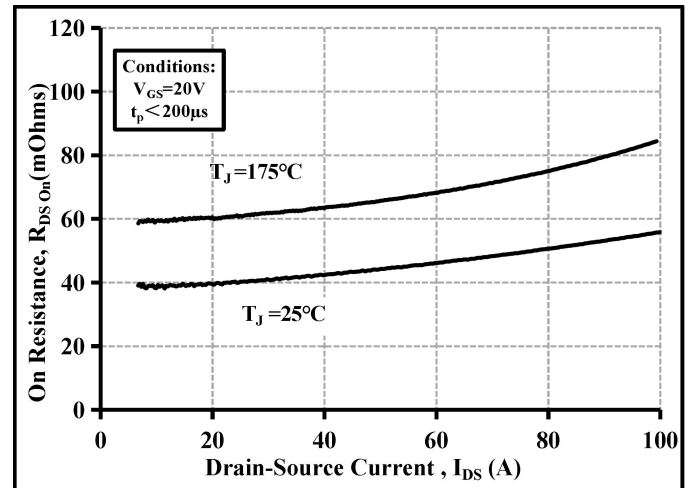


Figure 4: On-Resistance vs Drain Current For Various Temperatures

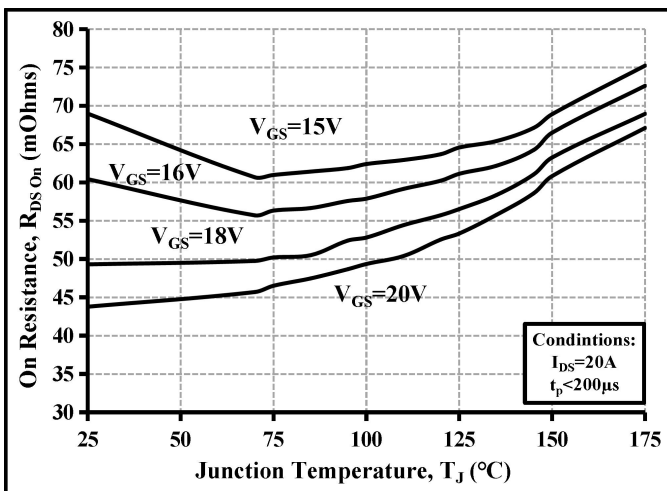


Figure 5: On-Resistance vs Temperature For Various Gate Voltage

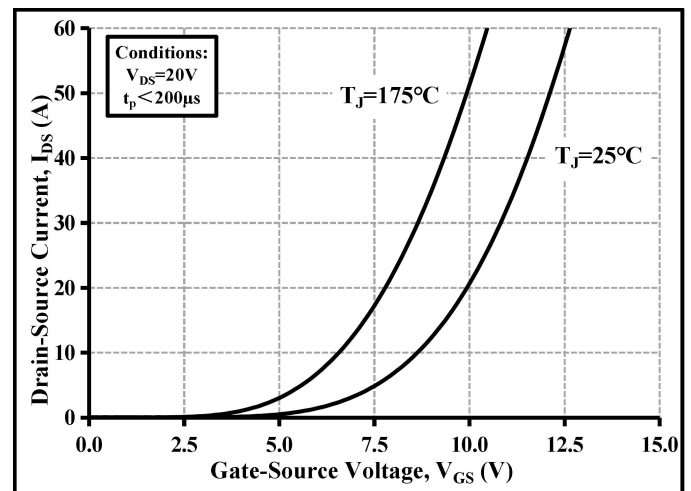


Figure 6: Transfer Characteristic for Various Junction Temperatures

Typical Performance

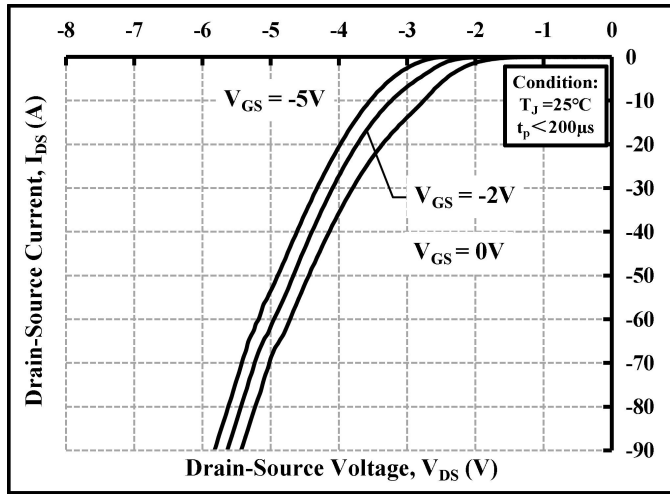


Figure 7: Body Diode Characteristic at 25°C

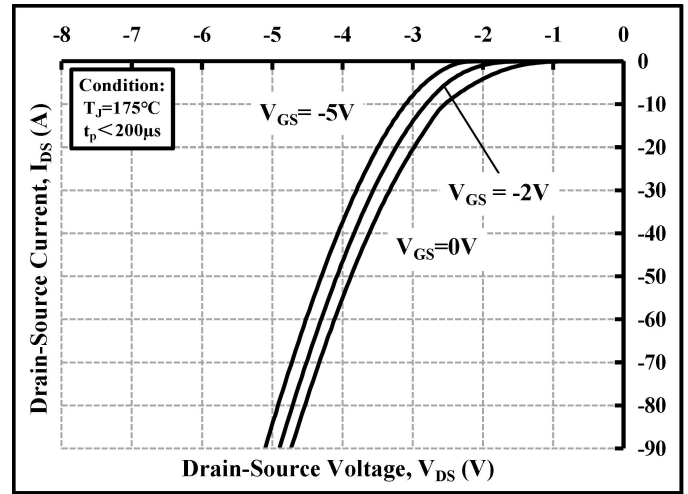


Figure 8: Body Diode Characteristic at 175°C

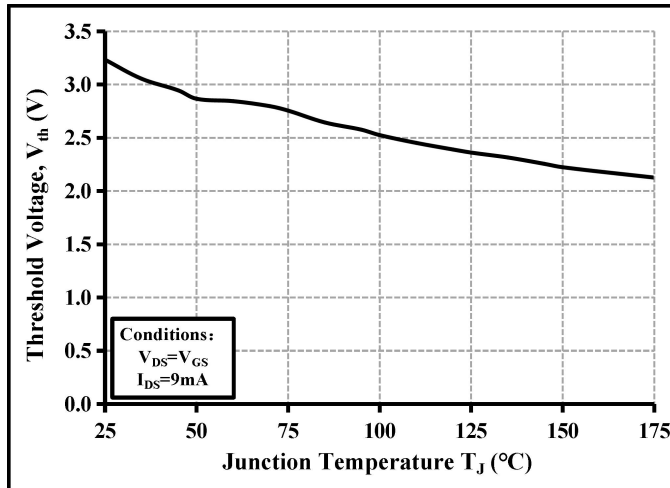


Figure 9: Threshold Voltage vs Temperature

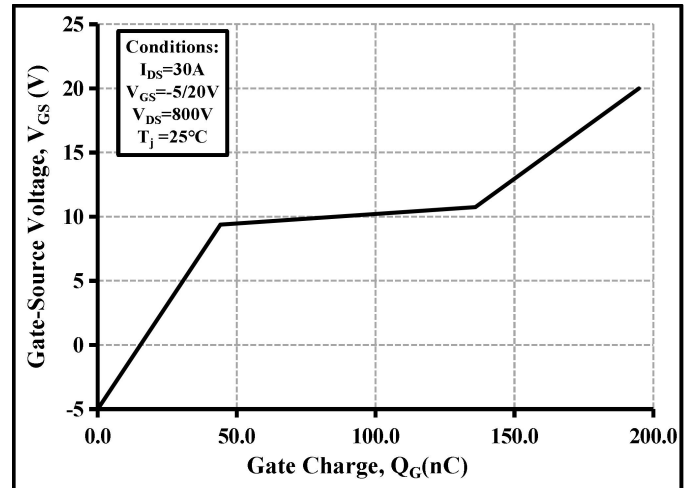


Figure 10: Gate Charge Characteristics

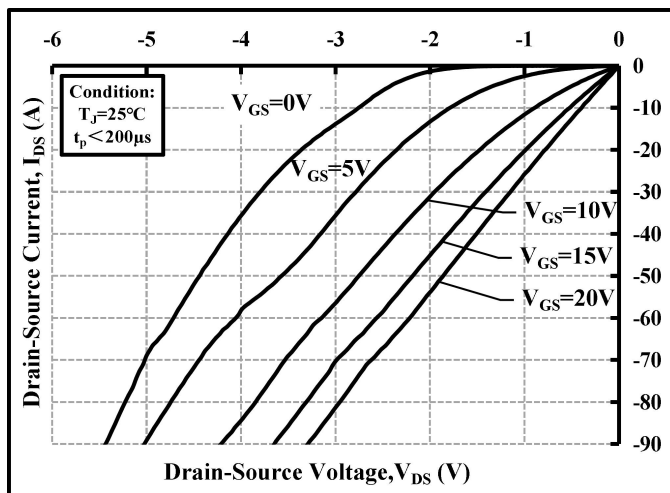


Figure 11: 3rd Quadrant Characteristic at 25°C

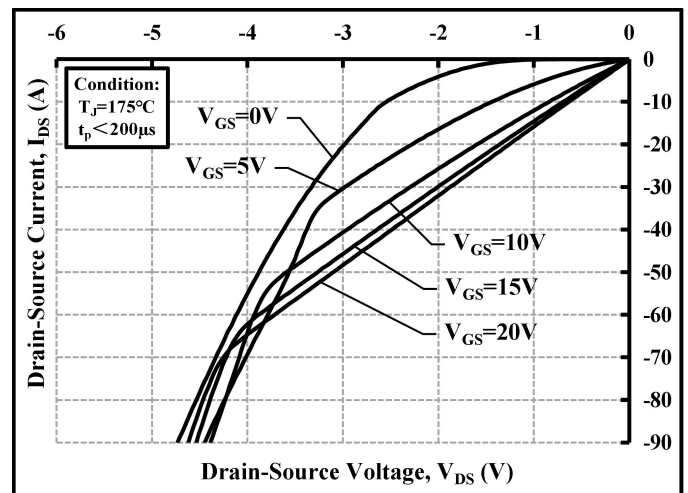


Figure 12: 3rd Quadrant Characteristic at 175°C

Typical Performance

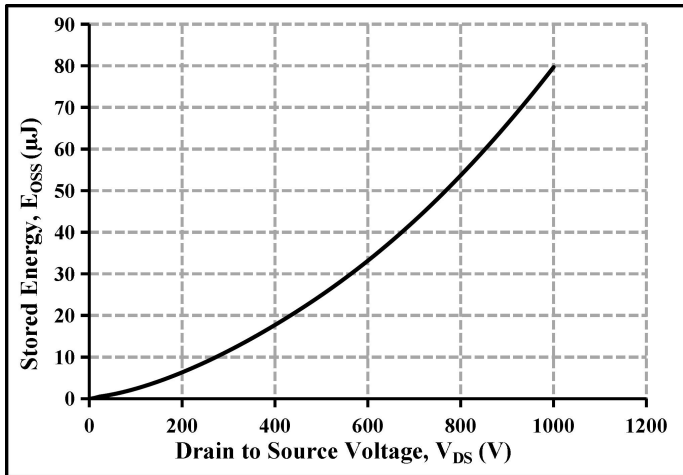


Figure 13: Output Capacitor Stored Energy

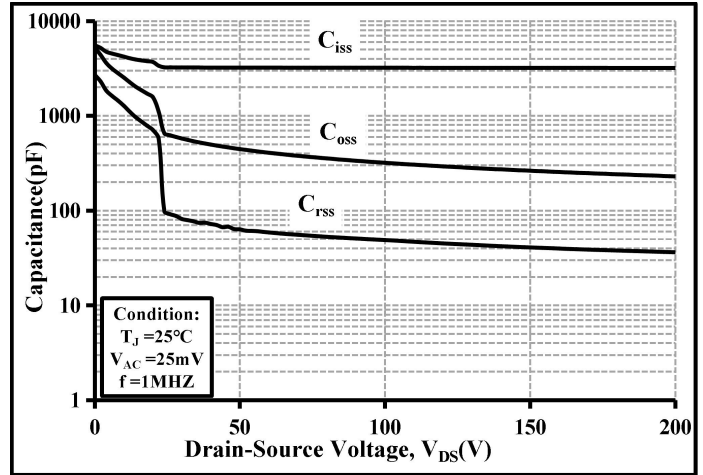


Figure 14: Capacitance vs Drain-Source Voltage (0-200 V)

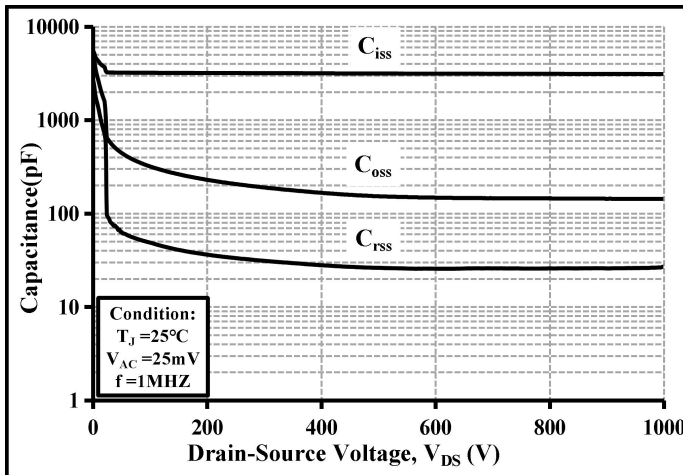


Figure 15: Capacitance vs Drain-Source Voltage (0-1000 V)

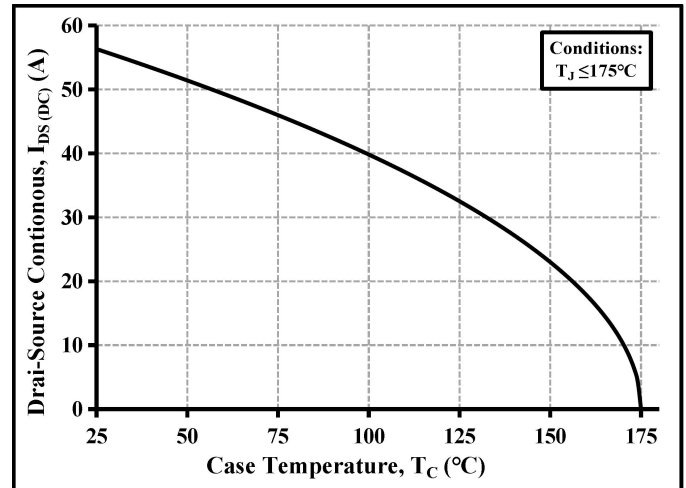


Figure 19: Continuous Drain Current Derating vs Case Temperature

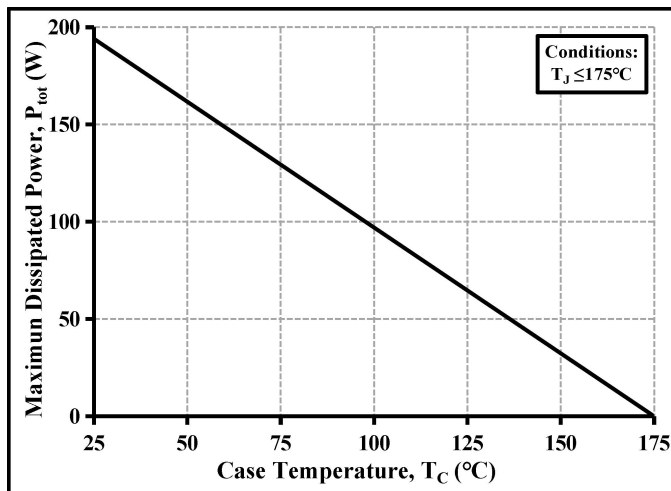


Figure 20: Maximum Power Dissipation Derating vs Case Temperature

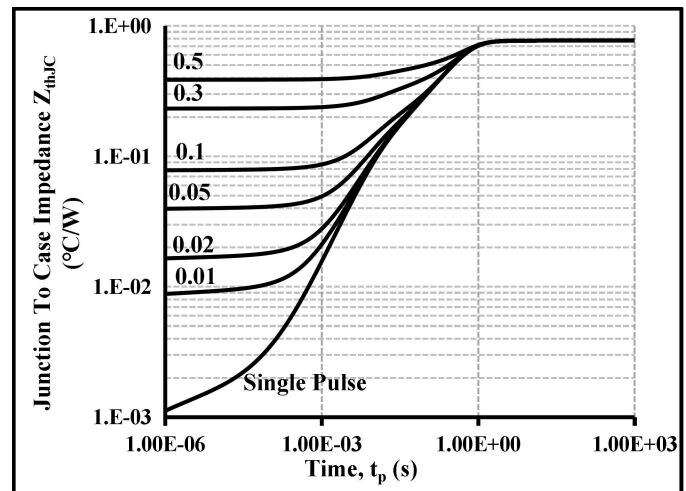


Figure 21: Transient Thermal Impedance (Junction - Case)

Typical Performance

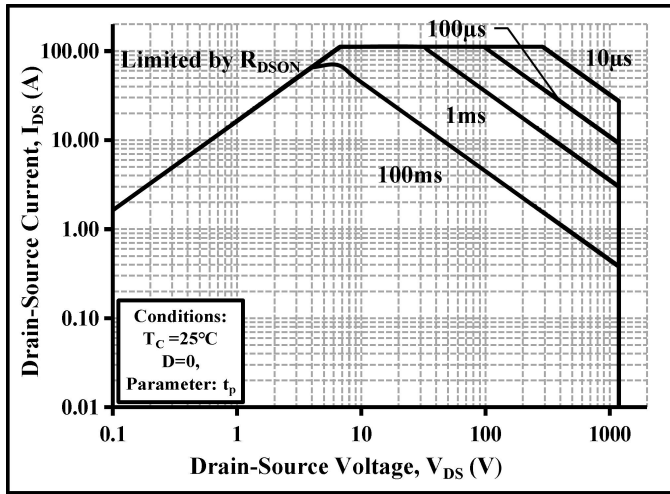


Figure 22: Safe Operating Area

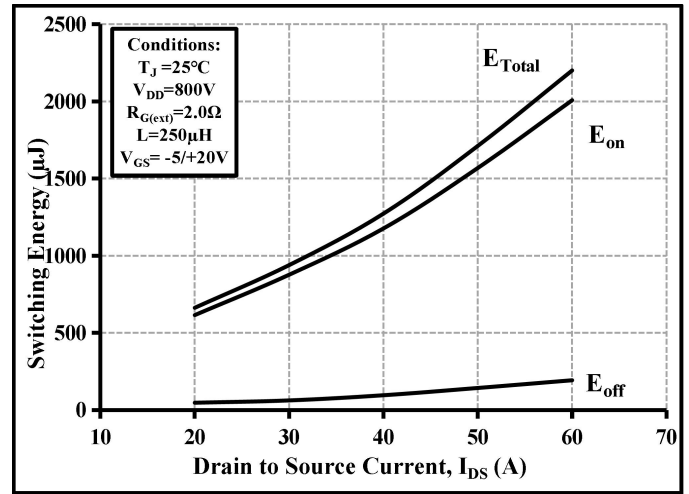


Figure 23: Clamped Inductive Switching Energy vs Drain Current

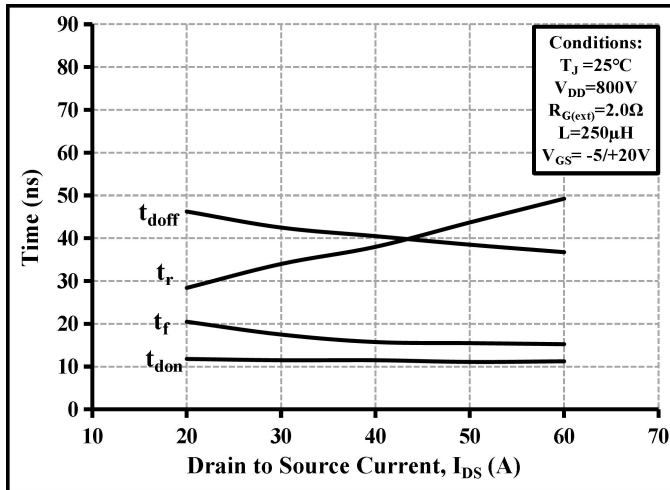


Figure 24: Switching Times vs Drain Current

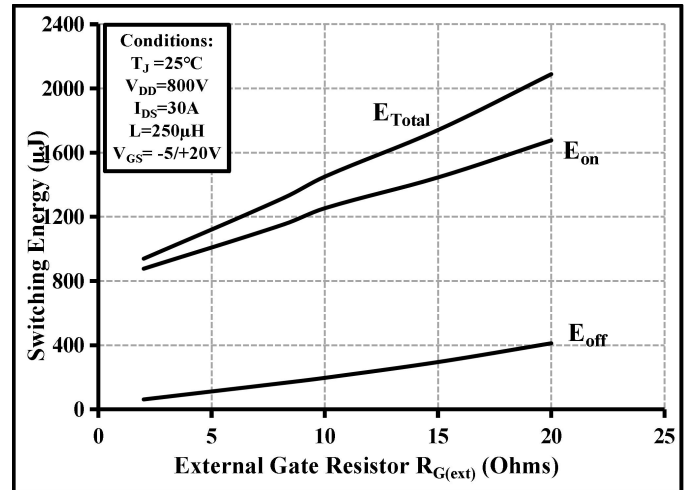


Figure 25: Clamped Inductive Switching Energy vs $R_{G(ext)}$

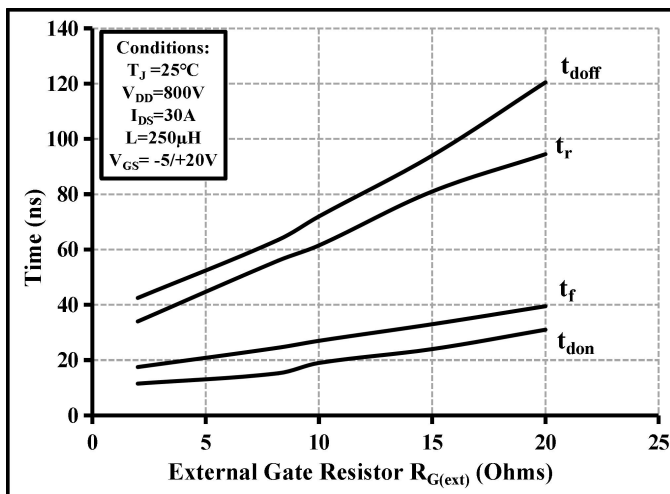
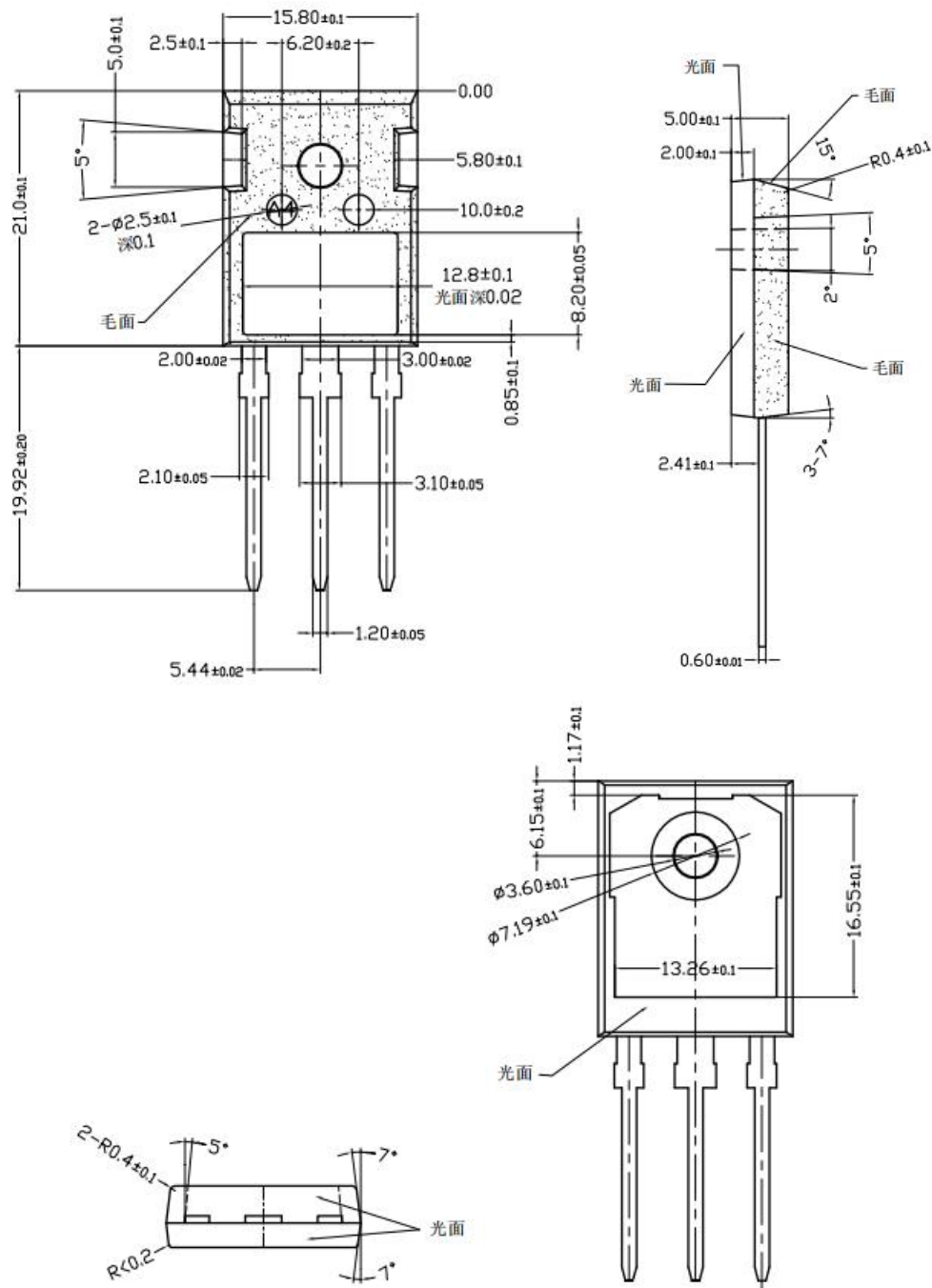


Figure 26: Switching Times vs $R_{G(ext)}$

Package Dimensions

TO-247-3

UNIT:mm