芯干线科技
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宽禁带功率半导体专家

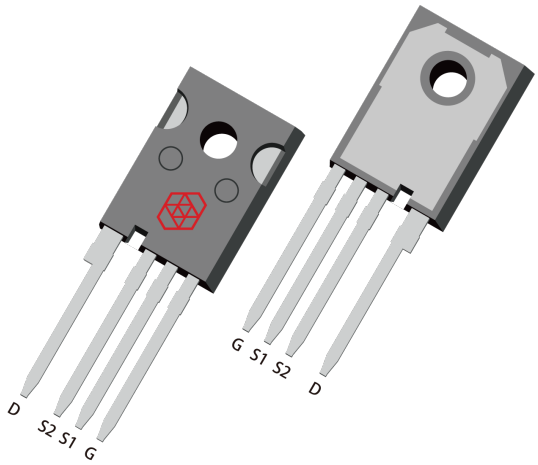
X2M120040T4B

N-channel 1200V SiC Power MOSFET

Features

V_{DS}	$R_{DS(on)}$	Ic@25°C
1200V	40mΩ	64A

- 2nd Generation SiC MOSFET Technology
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Fast Intrinsic Diode with Low Reverse Recovery



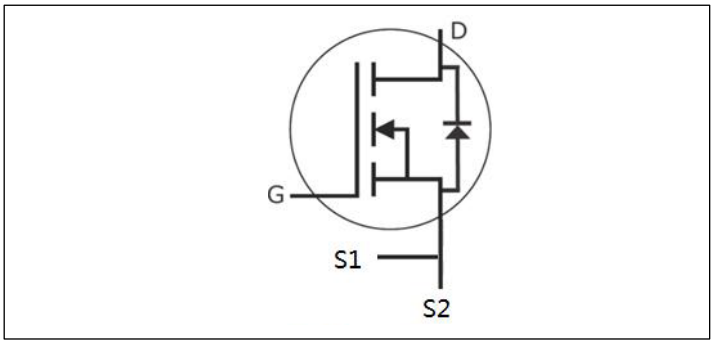
Applications

- EV Charging
- Solar PV Inverters
- DC/DC Converters
- Server Power Supplies
- UPS

Description

Package pin definition

- Pin D: Drain
- Pin G: Gate
- Pin S1: Driver Source
- Pin S2: Power Source



Type	Package	Qty
X2M120040T4B	TO-247-4	30

1.MOSFET

Absolute Max. Ratings (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain-Source Voltage	1200	V	VGS=0V ID=100μA
V_{GSmax}	Gate-Source Voltage	-8/+22	V	Absolute maximum values
V_{GSop}	Gate-Source Voltage	-4/+18	V	Recommended operational values
I_D	Continuous Drain Current	64	A	V_{GS}=18V, T_c=25℃
		45		V_{GS}=18V, T_c=100℃
$I_{DS(pluse)}$	pulsed collector current, t_p limited by T_{Jmax}	160	A	Pulse width t_p limited by T_{Jmax}
P_D	Power dissipation	298	W	T_c=25℃, T_J=175℃

Electrical Characteristics (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{(BR)DSS}$①	Drain-Source Breakdown voltage	1200			V	V_{GS}=0V I_D=100μA
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.6	V	V_{DS}=V_{GS} I_D=15mA
			2.0			V_{DS}=V_{GS} I_D=15mA T_J=175℃
I_{DSS}	Zero Gate Voltage Drain Current			100	μA	V_{DS}=1200V V_{GS}=0V
$I_{GSS(-)}$	Gate-Source Leakage Current			250	nA	V_{DS}=0V V_{GS}=22V
$I_{GSS(+)}$	Gate-Source Leakage Current			250		V_{DS}=0V V_{GS}=-8V
$R_{DS(on)}$	Drain-Source On-State Resistance		40	60	mΩ	V_{GS}=18V I_D=30A
			74			V_{GS}=18V I_D=30A T_J=175℃

(table continues……)

MOSFET

gfs	Transconductance		5.8		s	V_{GS}=18V I_D=30A
C_{iss}	Input Capacitance		2107		pF	V_{GS}=0V V_{DS}=0 to 1000V F=1MHz
C_{oss}	Output Capacitance		102			
C_{rss}	Reverse Transfer Capacitance		12.5			
E_{ON}	Turn-On Switching Energy		405		μJ	V_{DS}=800V,V_{GS}=-4/18V, I_D= 30A, Rg = 2.5Ω , L=135uH
E_{OFF}	Turn-Off Switching Energy		80			
$t_{d(on)}$	Turn-On Delay Time		14		ns	
t_r	Rise Time		20			
$t_{d(off)}$	Turn-Off Delay Time		34			
t_f	Fall time		10			
$R_{G(int)}$	Internal Gate Resistance		3.3		Ω	F=1MHz
Q_{gs}	Gate to Source Charge		23		nC	V_{DS}=800V I_D=30A V_{GS}=-4/18V
Q_{gd}	Gate to Drain Charge		36			
Q_g	Total Gate Charge		95			

Thermal Characteristics (Typical)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.5	/	°C/W	
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient	/	40		

Note: ①The recommended Maximum Voltage is less than 1300V 。

2.Diode

Absolute Max. Ratings (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions
I_S	Continuous Diode Forward Current		50	A	V_{GS}=-4V T_C=25℃
$I_{S,\ pulse}$	Diode pulse Current		100	A	V_{GS}=-4V

Electrical Characteristics (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions
VSD	Diode Forward Voltage	3.9		V	V_{GS}=-4V I_{SD}=8A T_J=25℃
		3.2			V_{GS}=-4V I_{SD}=8A T_J=175℃
t_{rr}	Reverse Recover Time	16		ns	V_{GS}=-4V I_D=30A V_R=400V di/dt=4000A/us T_J=175℃
Q_{rr}	Reverse Recovery Charge	270		nC	
I_{rrm}	Peak Reverse Recovery Current	30		A	

3. Characteristics Diagrams

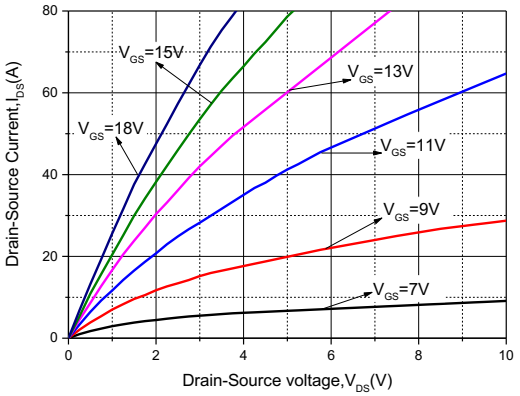


Figure 1.Output Characteristics T_J=25°C

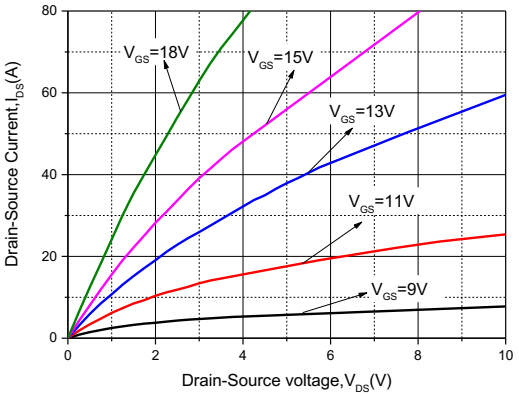


Figure 2.Output Characteristics T_J=-40°C

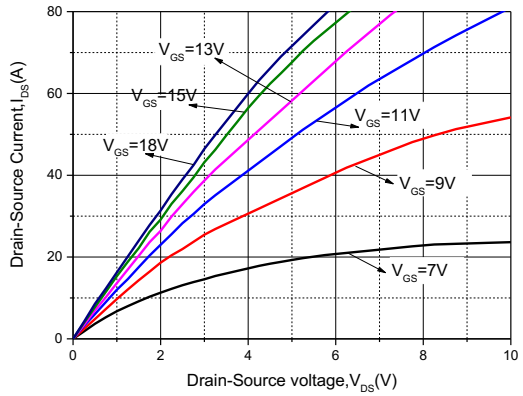


Figure 3.Output Characteristics T_J=150°C

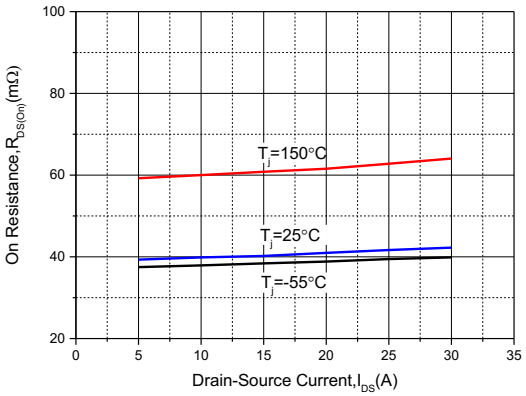


Figure 4.On-resistance vs.Drain Current For Various Temperature

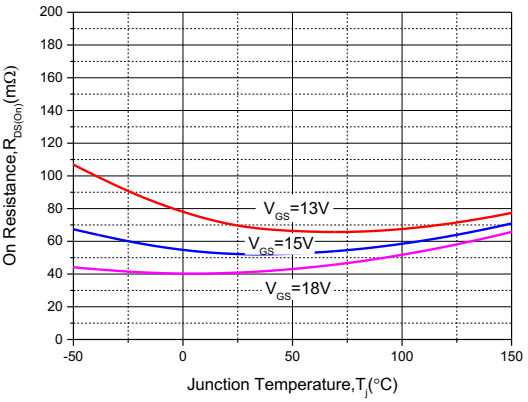


Figure 5.On-resistance vs.Temperature For Various Gate Voltage

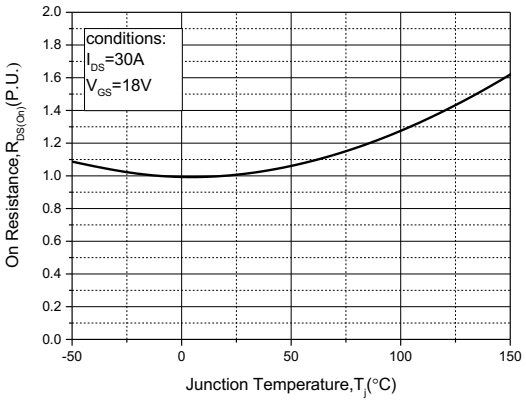


Figure 6.Normalized On-Resistance vs.Temperature

Characteristics Diagrams

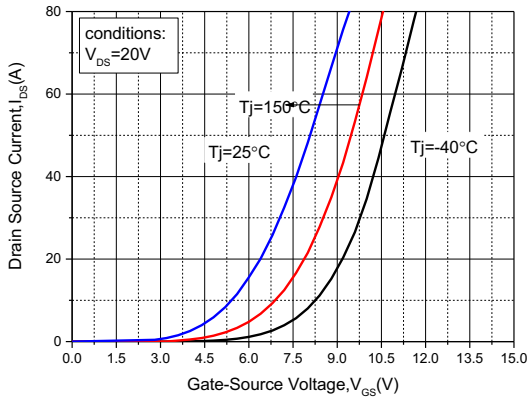


Figure 7.Transfer Characteristic for Vrious Junction Temperature

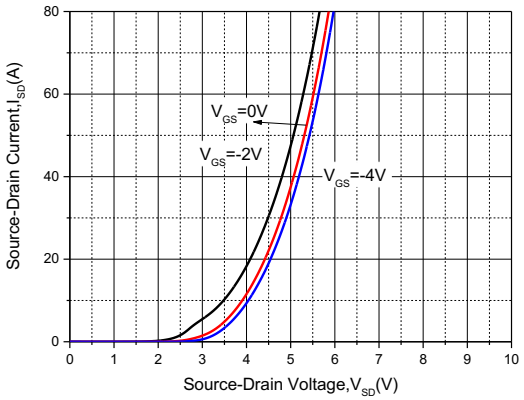


Figure 8.Body Diode Characteristic @-55°C

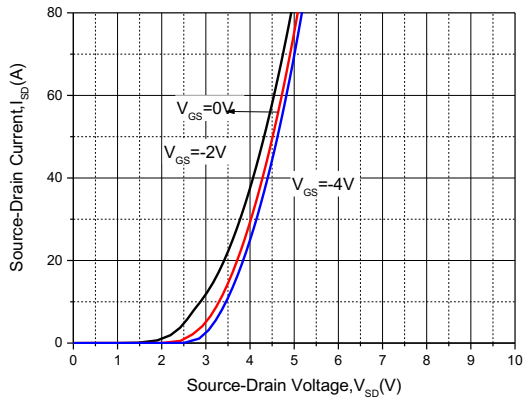


Figure 9.Body Diode Characteristic @25°C

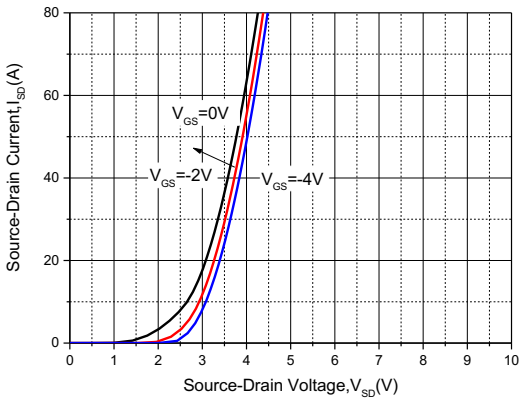


Figure 10.Body Diode Characteristic @175°C

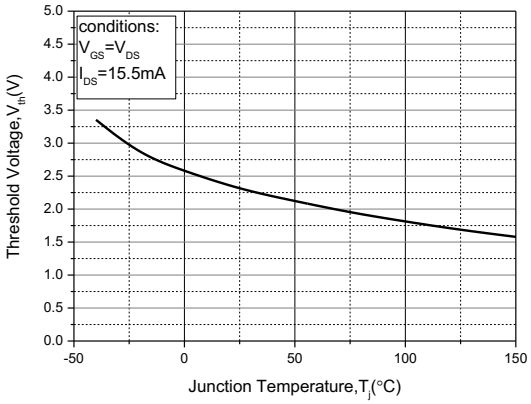


Figure 11.Threshold Voltage vs.Temperature

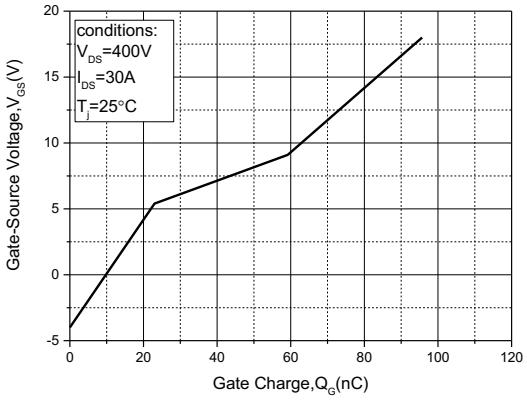


Figure 12.Gate Charge Characteristics

Characteristics Diagrams

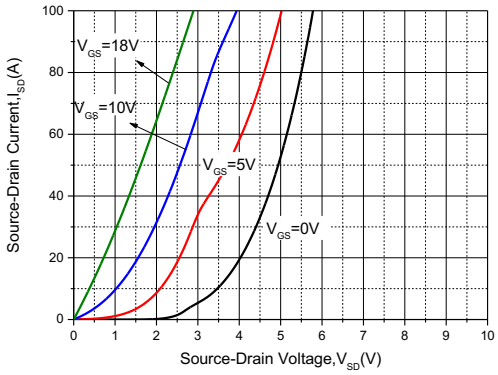


Figure 13.3rd Quadrant Characteristic @-55°C

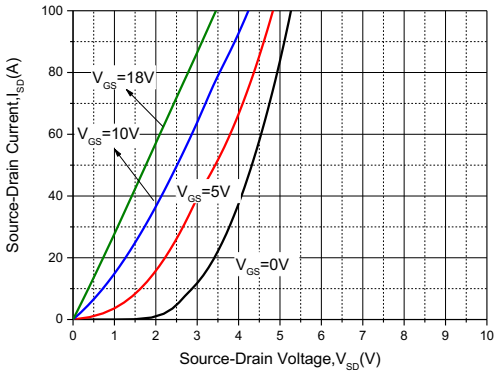


Figure 14.3rd Quadrant Characteristic @25°C

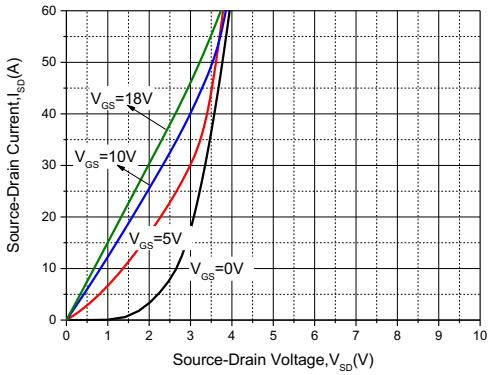


Figure 15.3rd Quadrant Characteristic @175°C

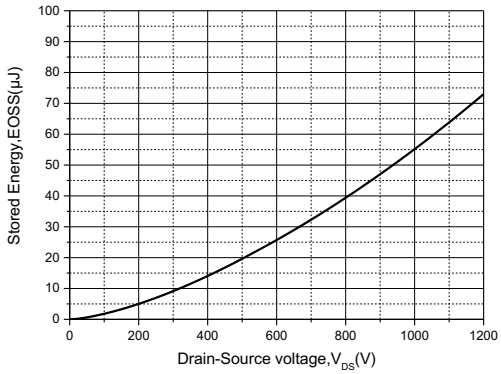


Figure 16.Output Capactor Stored Energy

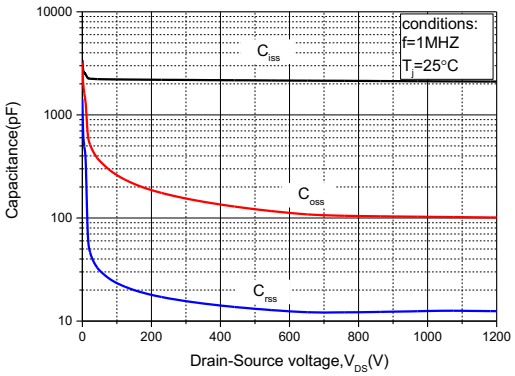


Figure 17.Capacitances vs.Drain-Source Voltage(0-650V)

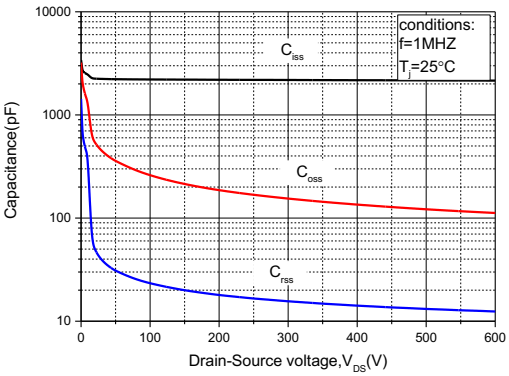


Figure 18.Capacitances vs.Drain-Source Voltage(0-200V)

Characteristics Diagrams

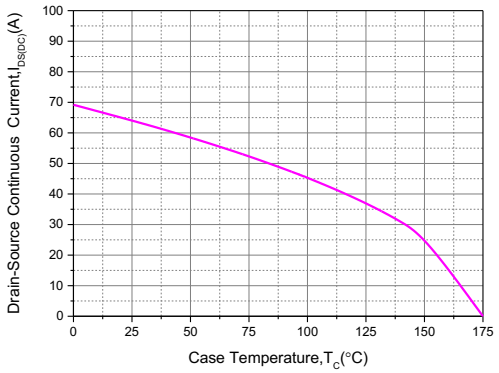


Figure 19.Continuous Drain Current Derating vs. Case Temperature

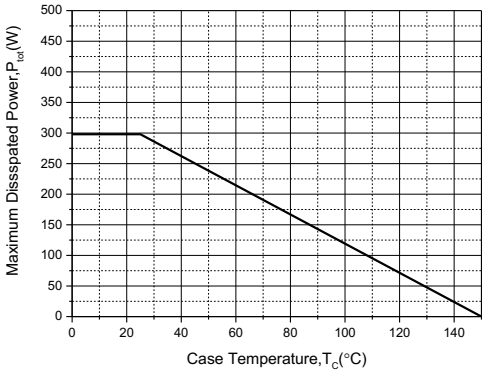


Figure 20.Maximum Power Dissipation Derating vs. Case Temperature

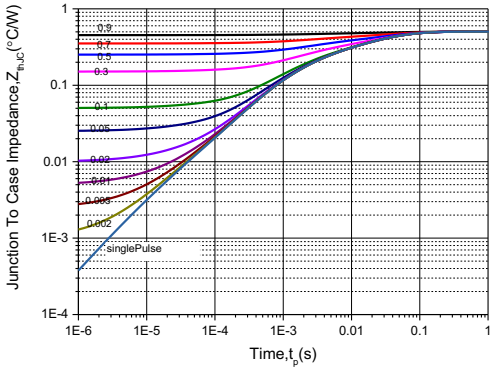


Figure 21.Transient Thermal Impedance(Junction-Case)

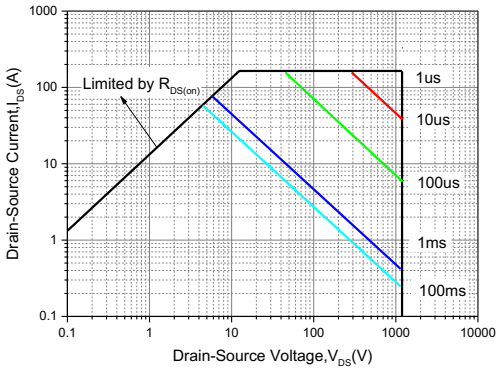


Figure 22.Safe Operating Area

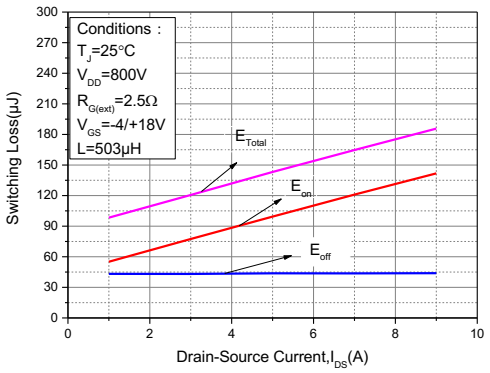


Figure 23.Clampled Inductive Switching Energy vs. Drain Current@25°C

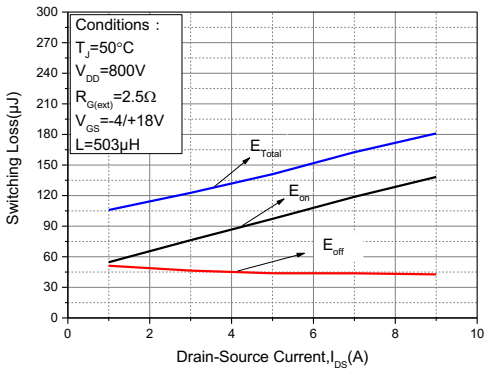


Figure 24.Clampled Inductive Switching Energy vs. Drain Current@50°C

Characteristics Diagrams

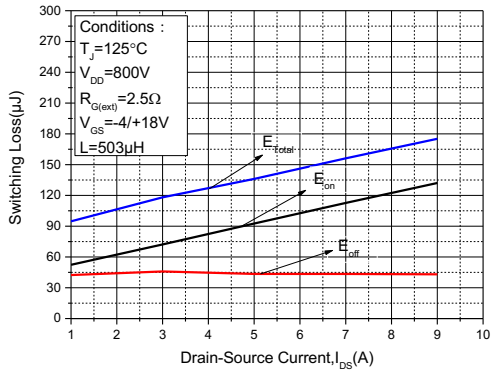


Figure 25.Clampled Inductive Switching Energy vs. Drain Current@125°C

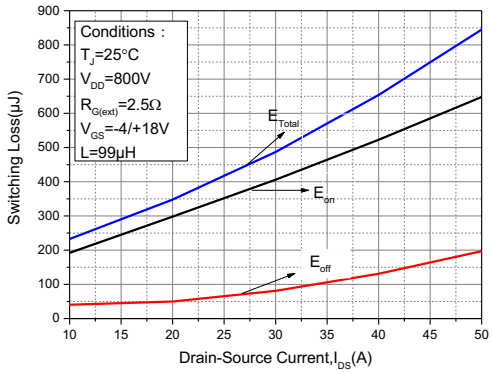


Figure 26.Clampled Inductive Switching Energy vs. Drain Current@25°C

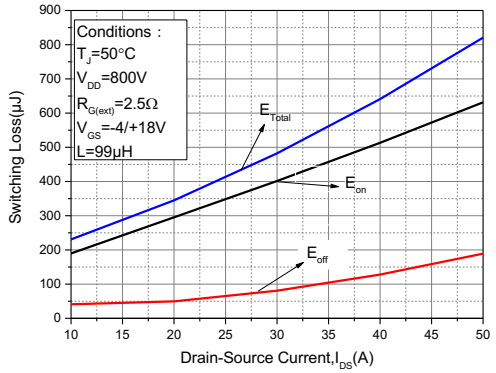


Figure 27.Clampled Inductive Switching Energy vs. Drain Current@50°C

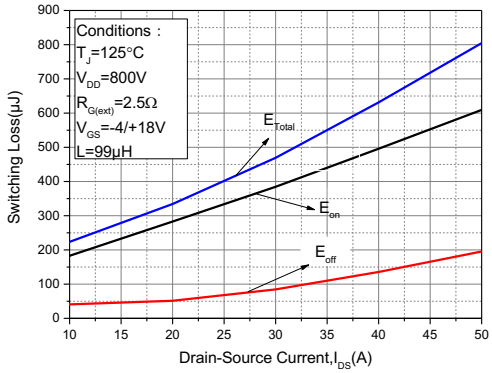


Figure 28.Clampled Inductive Switching Energy vs. Drain Current@125°C

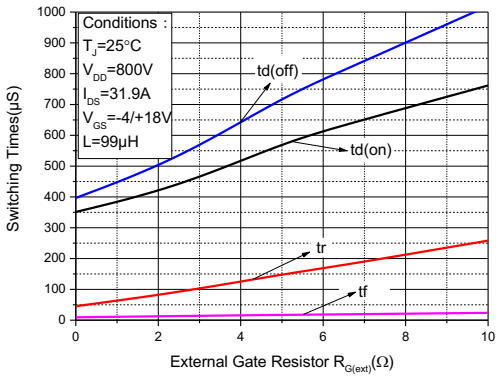


Figure 29.Clampled Inductive Switching Energy vs. $RG_{(ext)}$

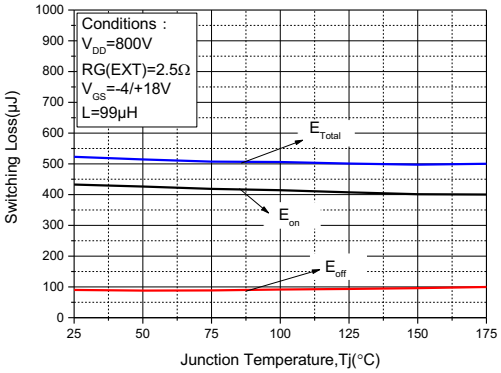
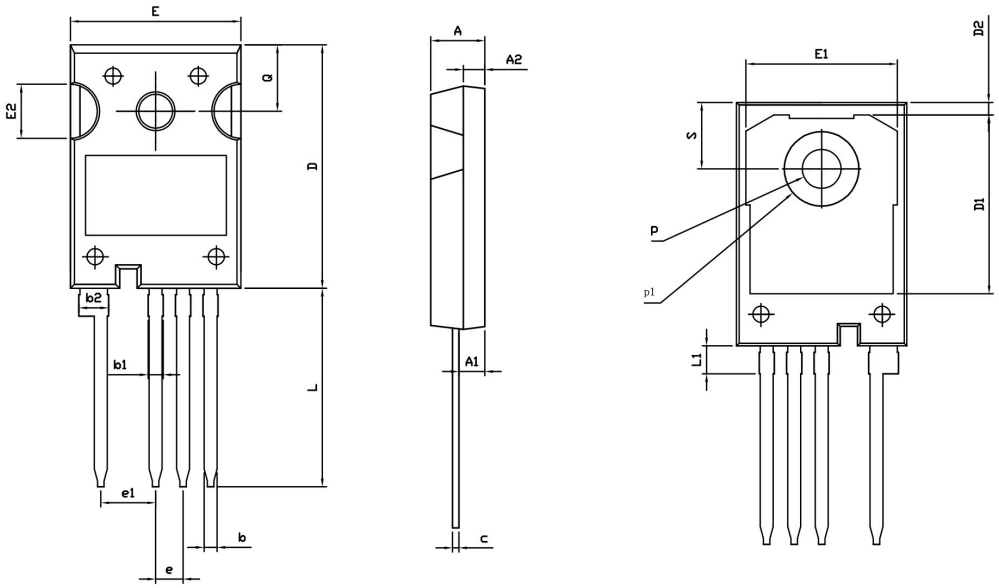


Figure 30.Clampled Inductive Switching Energy vs. Temperature

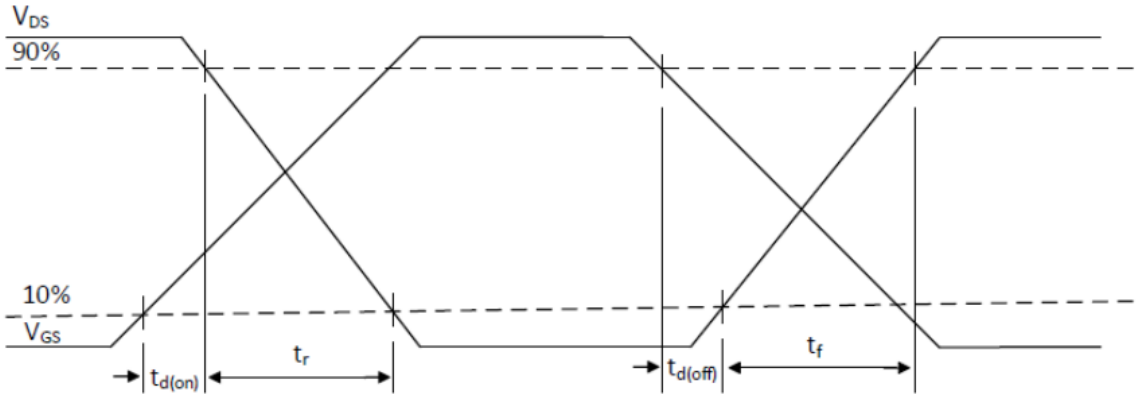
4.Package Dimensions

Package TO-247-4



	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.25	2.40	2.45
A2	1.85	2.00	2.15
b	1.05	1.20	1.35
b1	1.00	1.30	1.60
b2	2.35	2.65	2.95
c	0.50	0.60	0.70
D	22.34	22.54	22.74
D1	16.00	16.50	17.00
D2	0.97	1.17	1.37
e	2.34	2.54	2.74
e1	4.88	5.08	5.28
E	15.60	15.80	16.00
E1	13.50	14.00	14.50
E2	4.80	5.00	5.20
L	18.08	18.38	18.68
L1	2.38	2.58	2.78
p	3.50	3.60	3.70
p1	6.60	6.80	7.00
Q	6.00	6.15	6.30
S	6.00	6.15	6.30

5.Testing Conditions



Switching Time Waveform

Revision History

Document revision	Date	Description of changes
1.0	2022.8	Target datasheet
2.0	2023.3.8	First design vision datasheet
3.0	2023.9.18	Second design vision datasheet

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