

JX4S0040R120M

1200V, 60A, 45mΩ, N-Channel, Silicon Carbide MOSFET



Product Data Sheet

JX-3T04-19A A/2

General Description

The JX-MT3 series SiC MOSFET in TO-247-3 package ensures stable high-temperature operation for power-dense and energy-critical systems, enabling compact designs with reduced EMI.

Features

- 3rd Generation SiC MOSFET Technology
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to parallel and Simple to Drive
- RoHS Compliant, Halogen Free



Applications

- EV Charging
- High Voltage DC/DC Converters
- Switch Mode Power Supplies
- Power Factor Correction Modules

Ordering Informations

Order Number / Marking	JX4S0040R120M
Package Type	TO-247-3
Packing Method	Tube

Key Parameters

Symbol	Parameter	Values			Unit	Test Conditions
Absolute maximum rating						
V _{DS}	Drain-Source Voltage	1200			V	T _C =25°C
I _b	Drain Current (Continuous)	60			A	T _C =25°C
P _b	Power Dissipation	395			W	T _C =25OC
T _J	Junction Temperature	175			OC	
Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics						
R _{DS(on)}	Static Drain-Source on Resistance	-	45	52	mΩ	V _{GS} =18V; I _D =20A; T _J =25°C
Dynamic characteristics						
Q _G	Total Gate Charge	-	125	-	nC	V _{DS} =800V; V _{GS} =-5/+18V; I _D =20A; T _J =25°C
Q _{GD}	Gate-Drain Charge	-	33	-		
Source-drain diode						
Q _{rr}	Reverse Recovery Charge	-	32	-	nC	V _{GS} =0V; I _F =20A; V _R =800V; di/dt=900A/μs; T _J =175°C

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

Symbol	Parameter	Values	Unit
V_{DS}	Drain-Source Voltage	1200	V
I_b	Drain Current (Continuous; $T_c=25^{\circ}\text{C}$)	60	A
	Drain Current (Continuous; $T_c=100^{\circ}\text{C}$)	48	A
I_{DM}	Drain Current (Pulsed)	100	A
V_{GS}	Gate-Source Voltage	-10/+22V	V
P_D	Power Dissipation ($T_c=25^{\circ}\text{C}$)	395	W
T_J, T_{stg}	Junction and Storage Temperature Range	-55 to +175	$^{\circ}\text{C}$

MOSFET Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics (at T _J =25°C unless otherwise specified)						
BV _{DS}	Drain-Source Breakdown Voltage	1200	-	-	V	I _b =250μA; V _{GS} =0V
I _{DSS}	Zero Gate Voltage Drain Current	-	-	100	μA	V _{DS} = 1200V; V _{GS} =0V
I _{GSS}	Gate-Body Leakage Current	-	-	250	nA	V _{GS} =-10 to 20V; V _{DS} =0V
V _{GS(th)}	Gate Threshold Voltage	2	3	4	V	V _{DS} =V _{GS} ; I _b =20mA
V _{GS(on)}	Recommended Turn-on Voltage	-	18	-	V	Static
V _{GS(off)}	Recommended Turn-off Voltage	-	-5	-		
R _{DS(on)}	Static Drain-Source on Resistance	-	45	52	mΩ	V _{GS} = 18V; I _b =20A
		-	81	-		V _{GS} = 18V; I _b =20A; T _J = 175oC
Dynamic characteristics (at T _J =25°C unless otherwise specified)						
C _{iss}	Input Capacitance	-	2565	-	pF	V _{DS} = 1000V; f= 1MHz; V _{AC} =25mV
C _{oss}	Output Capacitance	-	109	-		
C _{rss}	Reverse Transfer Capacitance	-	4	-		
g _{fs}	Transconductance	-	24	-	S	V _{DS} =20V; I _D =20A
E _{oss}	Coss Stored Energy	-	63	-	μJ	V _{DS} = 1000V; f= 1MHz
E _{on}	Turn-on Energy (Body Diode)	-	1.41	-	mJ	V _{DS} =800V; V _{GS} =-5/+18V; I _D =20A; L= 150μH; R _{G(ext)} =2.5Ω; T _J = 175oC
E _{off}	Turn-off Energy (Body Diode)	-	1.12	-		
Q _G	Total Gate Charge	-	125	-	nC	V _{DS} =800V; V _{GS} =-5/+18V; I _D =20A
Q _{GS}	Gate-Source Charge	-	32	-		
Q _{GD}	Gate-Drain Charge	-	33	-		
R _{G(int)}	Internal Gate Resistance	-	4.2	-	Ω	f=1MHz; V _{AC} =25mV
t _{d(on)}	Turn-on Delay Time	-	20	-	ns	V _{DS} =800V; V _{GS} =-5/+18V; I _D =20A; R _{G(ext)} =2.5Ω; Load= 150μH
t _r	Rise Time	-	21	-		
t _{d(off)}	Turn-off Delay Time	-	50	-		
t _f	Fall Time	-	20	-		

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{SD}	Diode Forward Voltage	-	4.0	6	V	$V_{GS}=0V$; $I_F=20A$
		-	3.5	6		$V_{GS}=0V$; $I_F=20A$; $T_J=175^{\circ}\text{C}$
I_S	Continuous Diode Forward Current	-	55	-	A	$V_{GS}=0V$; $T_C=25^{\circ}\text{C}$
T_{rr}	Reverse Recovery Time	-	38	-	ns	$V_{GS}=-5V$; $I_F=20A$; $V_R=800V$; $di/dt=900A/\mu s$; $T_J=175^{\circ}\text{C}$
Q_{rr}	Reverse Recovery Charge	-	32	-	nC	
I_{rrm}	Peak Reverse Recovery Current	-	3	-	A	

Thermal Characteristics

Symbol	Parameter	Value.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.38	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^{\circ}\text{C/W}$

The values are based on Junction-to-Case Thermal Impedance measured with the device mounted to a large heat sink, assuming a maximum junction temperature of $T_{J(max)}=175^{\circ}\text{C}$.

Typical Performance

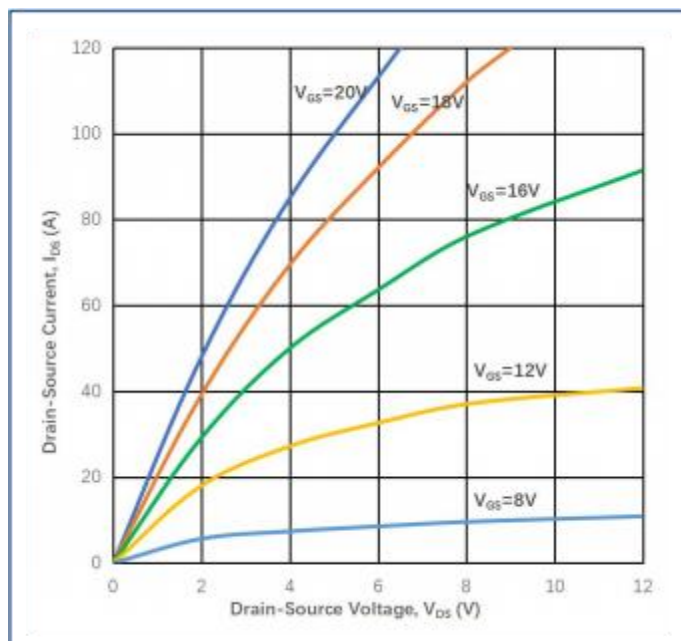


Figure 1

Output Characteristics ($T_J = 25^\circ\text{C}$)

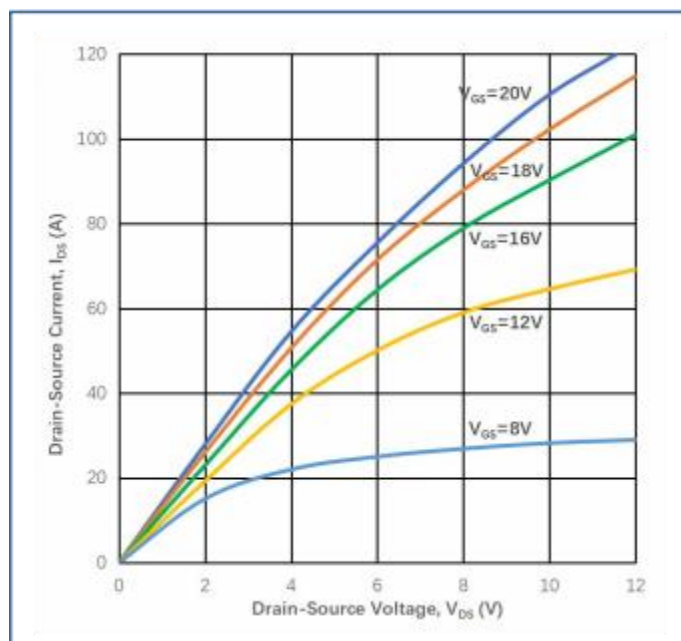


Figure 2

Output Characteristics ($T_J = 175^\circ\text{C}$)

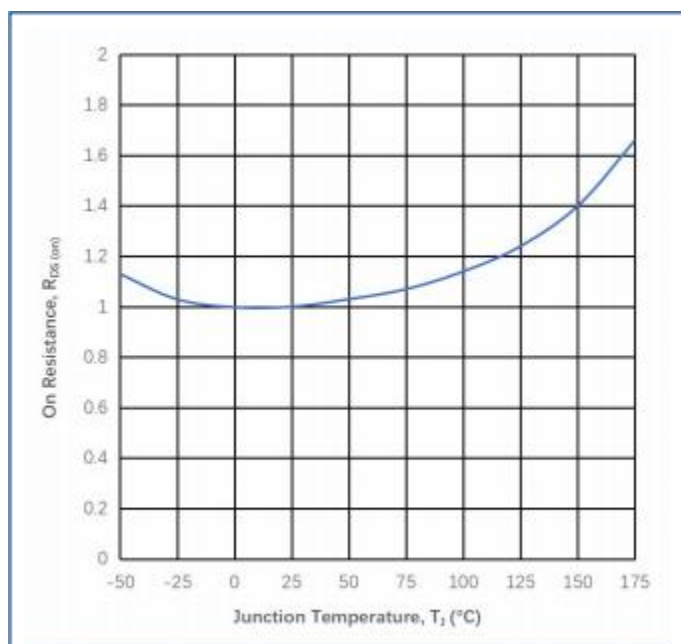


Figure 3

Normalized On-Resistance vs. Temperature

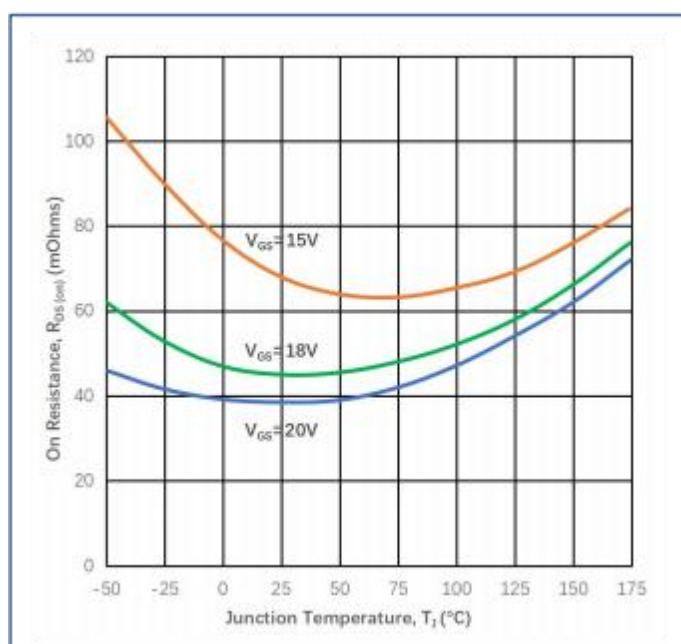


Figure 4

On-Resistance vs. Temperature

Typical Performance

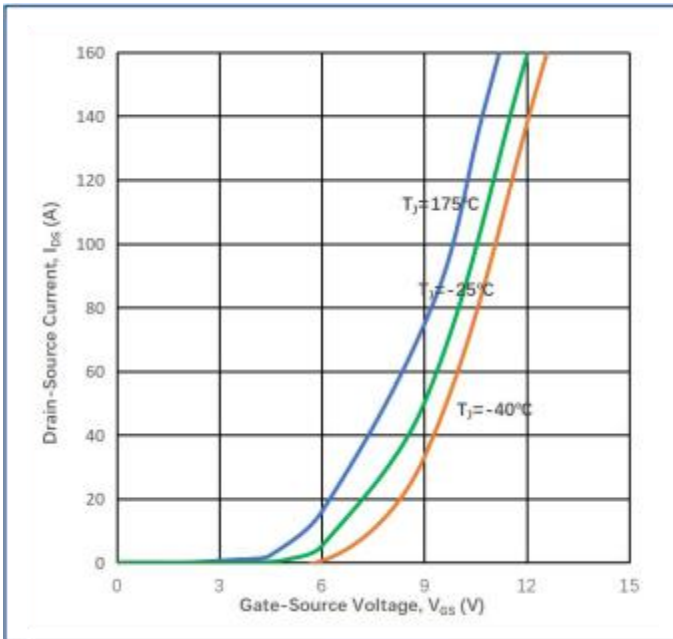


Figure 5
Transfer Characteristic

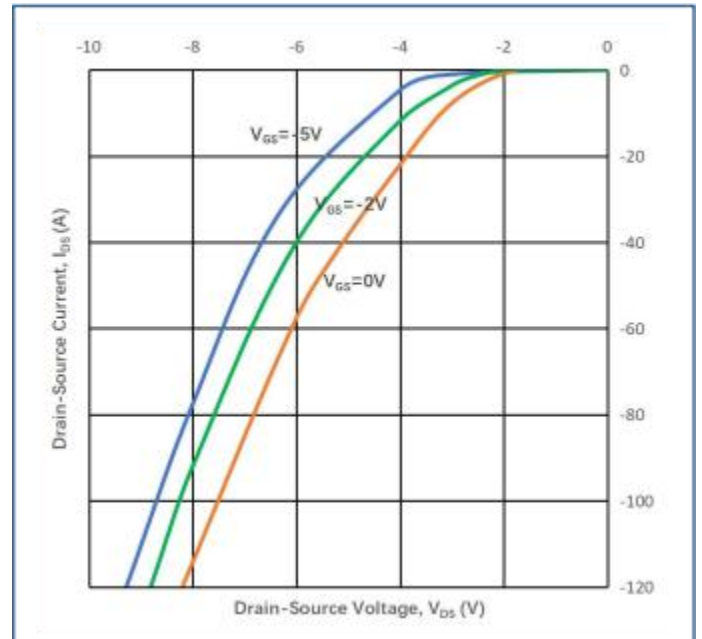


Figure 6
Body Diode Characteristic at 25°C

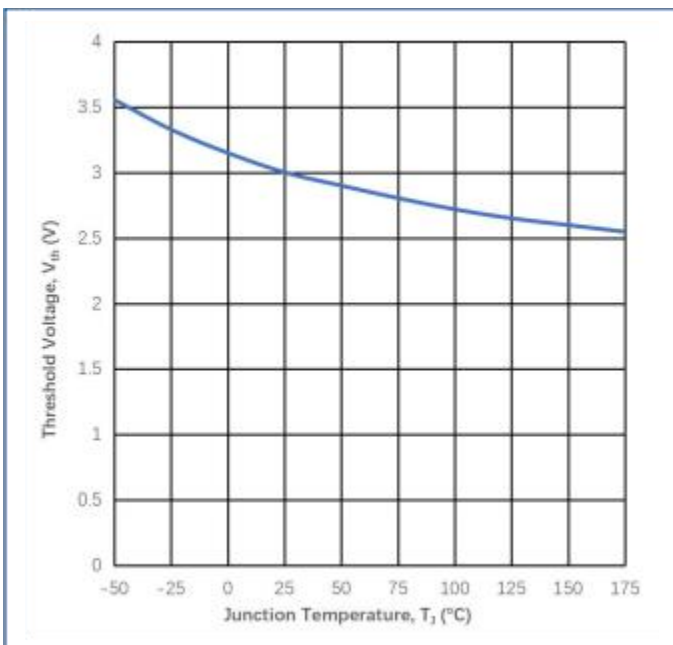


Figure 7
Threshold Voltage vs. Temperature

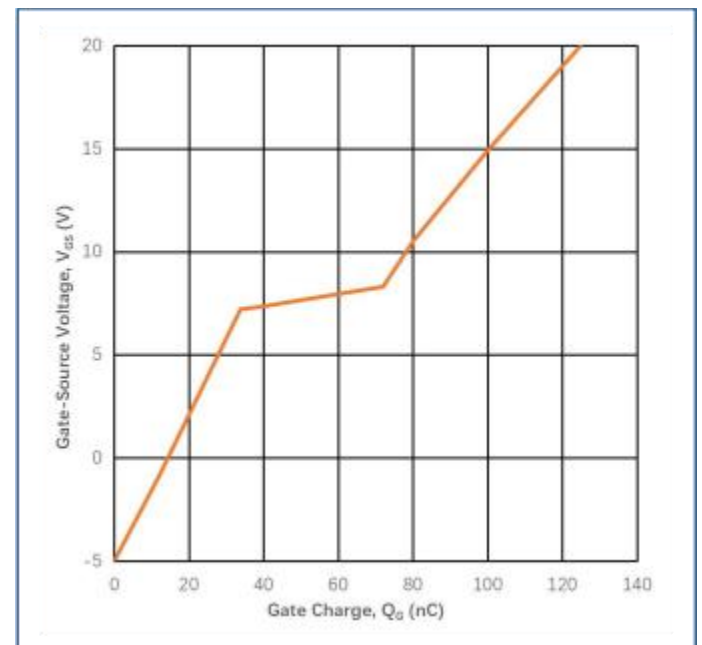


Figure 8
Gate Charge Characteristics

Typical Performance

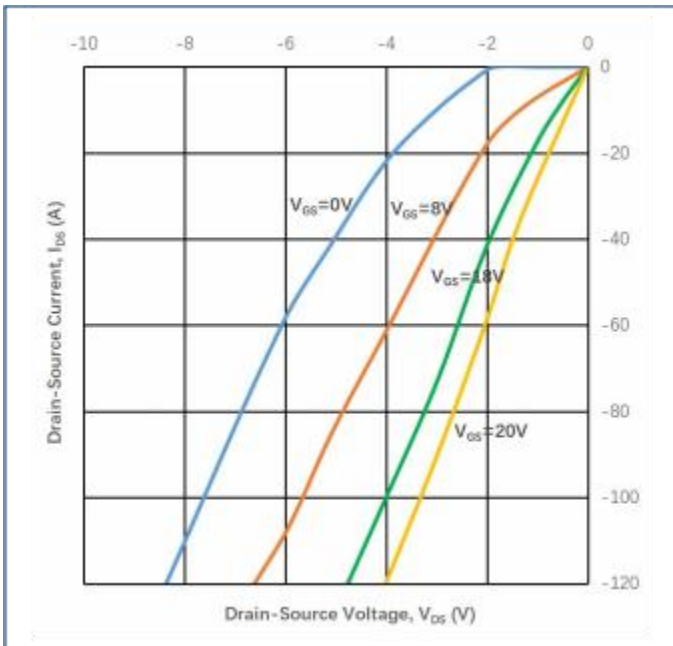


Figure 9

3rd Quadrant Characteristic at 25°C

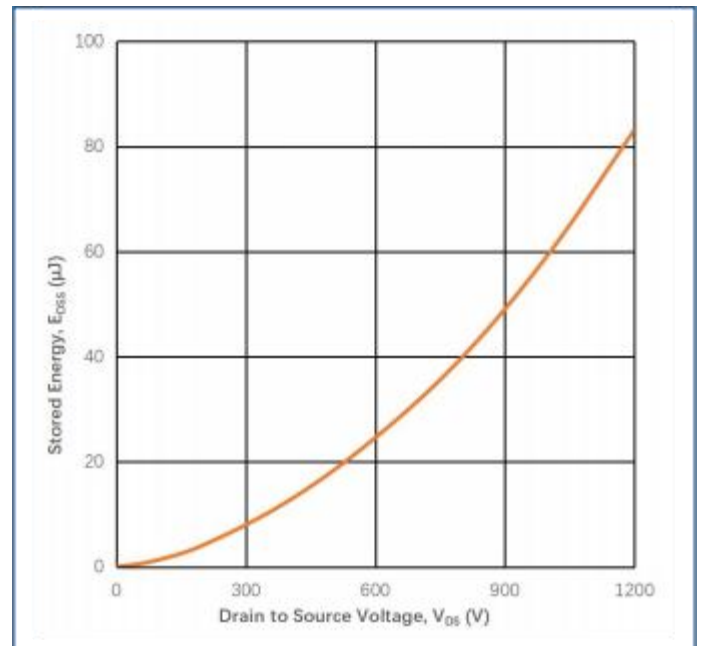


Figure 10

Output Capacitor Stored Energy

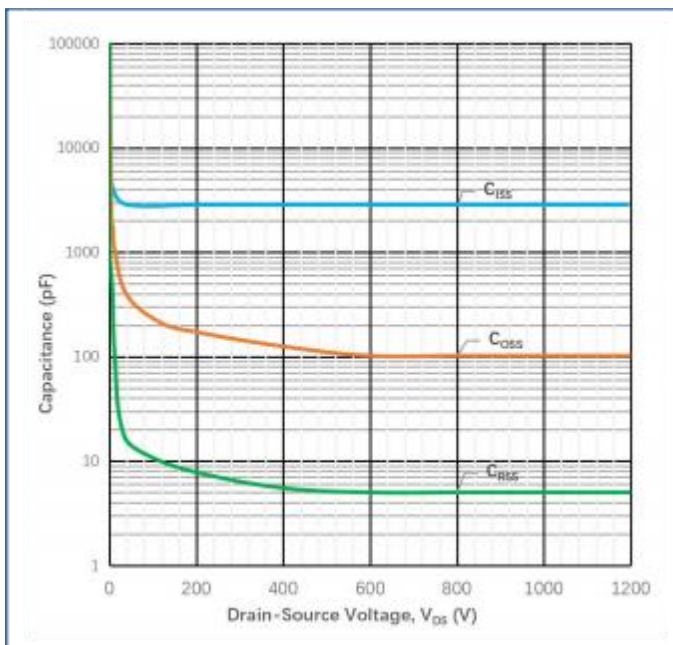


Figure 11

Capacitances vs. Drain-Source

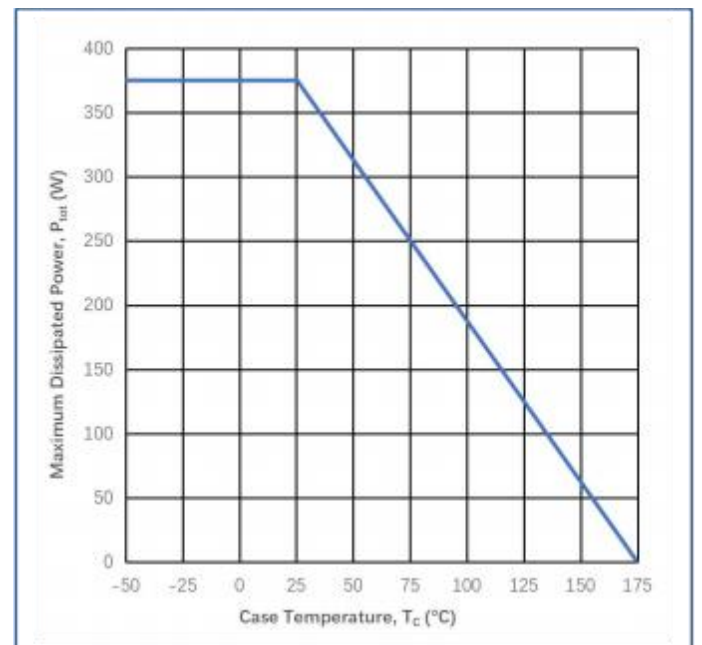


Figure 12

Max Power Dissipation Derating vs T_C

Typical Performance

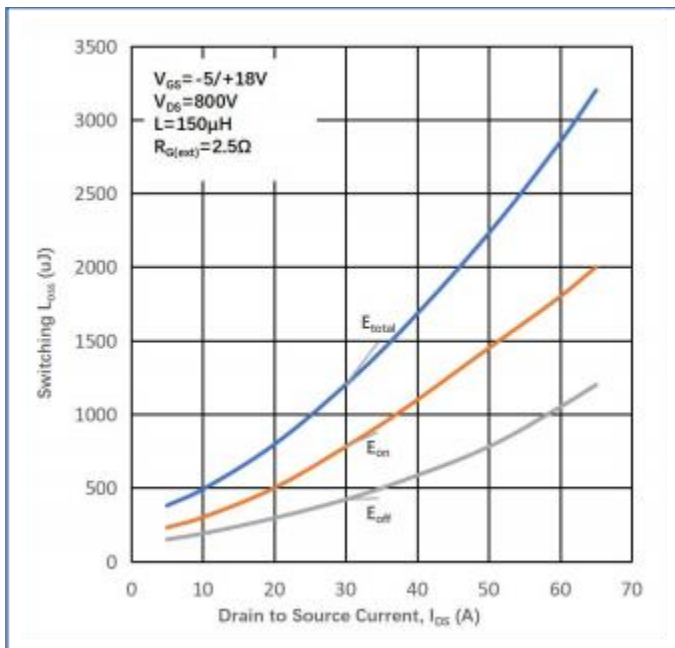


Figure 13

Switching Energy vs. Drain Current

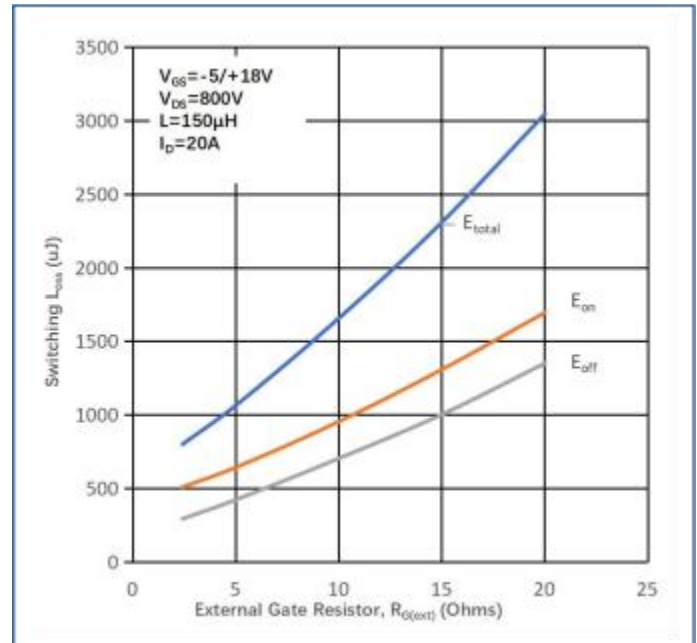


Figure 14

Switching Energy vs. $R_{G(ext)}$

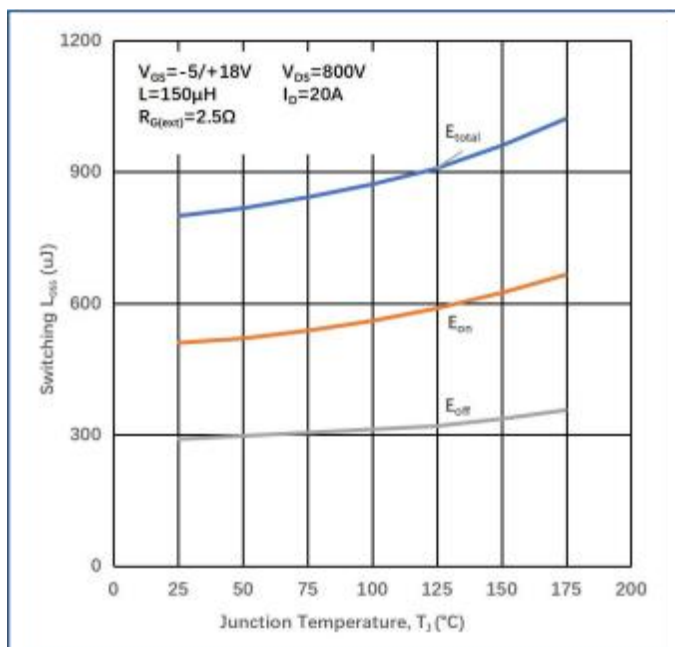


Figure 15

Switching Energy vs. Temperature

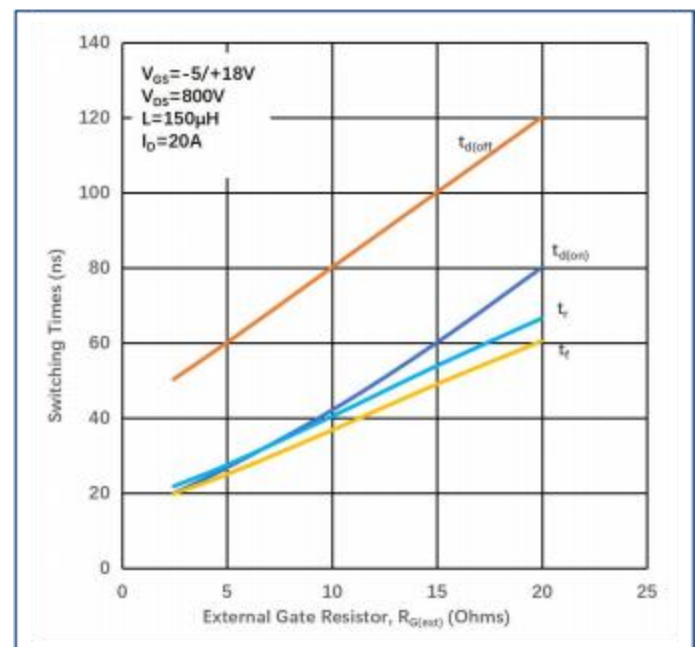


Figure 16

Switching Times vs. $R_{G(ext)}$

Typical Performance

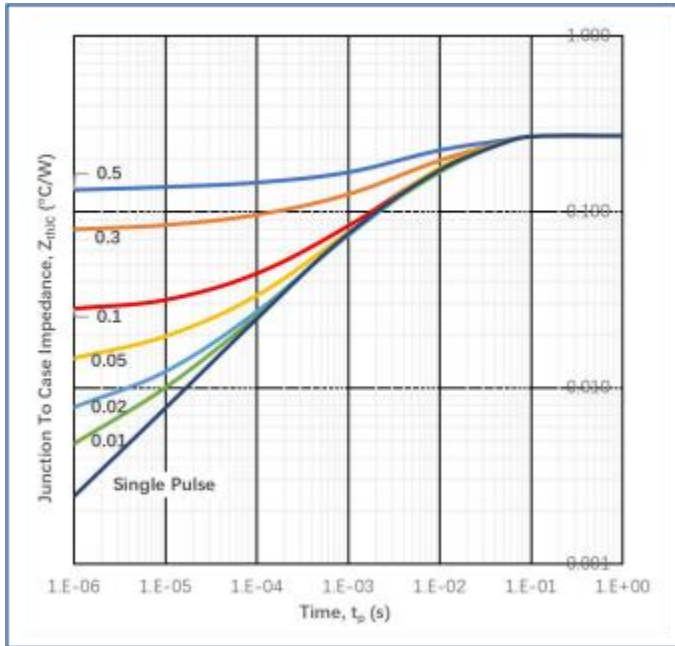


Figure 17

Transient Thermal Impedance

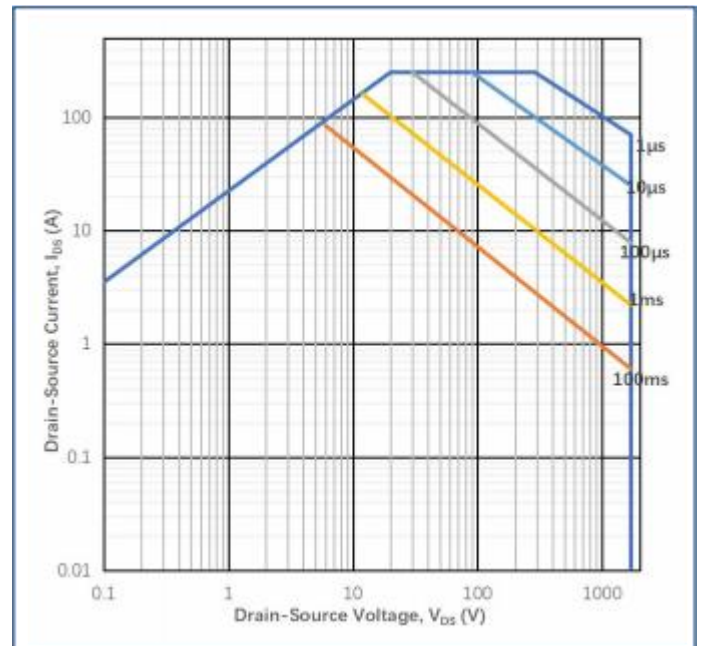
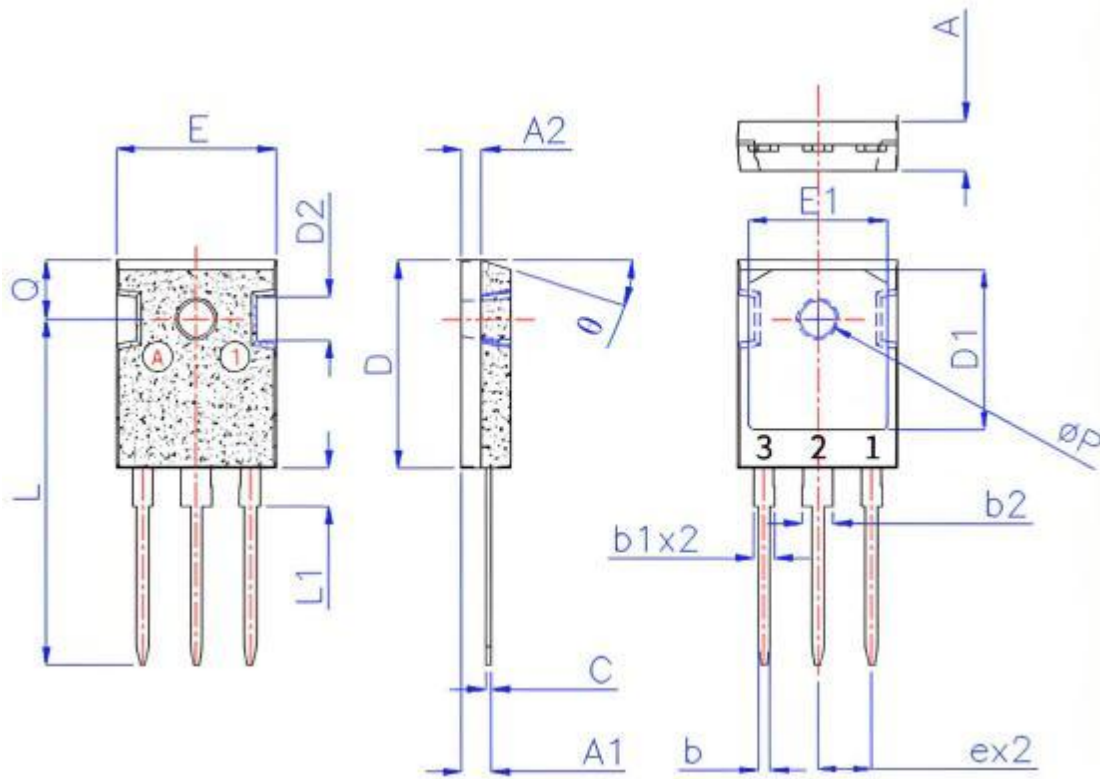


Figure 18

Safe Operating Area

Package Dimensions (mm)

Package Type: TO-247-3



Symbol	Millimeters			Inches		
	Min.	Type.	Max.	Min.	Type.	Max.
A	4.80	5.00	5.20	0.189	0.197	0.205
A1	2.85	3.00	3.15	0.112	0.118	0.124
b	1.16	1.22	1.27	0.046	0.048	0.050
b1	2.03	2.06	2.10	0.080	0.081	0.083
b2	3.03	3.06	3.10	0.119	0.120	0.122
C	0.55	0.60	0.65	0.022	0.024	0.026
D	20.80	21.00	21.20	0.819	0.827	0.835
D1	15.94	16.24	16.54	0.628	0.639	0.651
D2	4.30 BSC			0.169 BSC		
e	5.44 BSC			0.214 BSC		
E	15.95	16.15	16.35	0.628	0.636	0.644
E1	13.82	14.02	14.26	0.544	0.552	0.561
L	34.65	35.05	35.45	1.364	1.380	1.396
L1	-	-	3.86	-	-	0.152
Q	5.85	5.95	6.05	0.230	0.234	0.238
øP	3.45	3.60	3.75	0.136	0.142	0.148

Pin	Symbol	Description
1	G	Gate
2	D	Drain
3	S	Source
mb	D	mounting base; connected to drain

Note:

1. All metal surfaces are Sn plated (matte), except area of cut.
2. Burr or mold flash size (0.5 mm) is not included in the dimensions.

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Contact Info

Tel: +86 755-21059554

Web: <http://www.junxinsemi.com/>

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