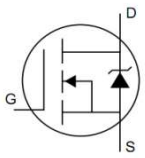
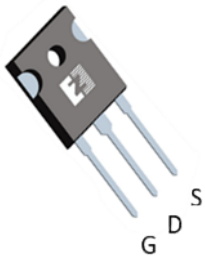
General Description

This silicon carbide Power MOSFET device has been developed using ZMJ's advanced 1st generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and very high switching operations. It improves application performance in frequency, energy efficiency, system size and weight reduction.

Product Summary



V_{DS}= 1200V
$R_{DS(ON)}$ = 20mΩ
I_D= 84A



TO-247-3

Features

- ■High Blocking Voltage
- ■High Speed Switching With Low Capacitances
- ■Low $R_{DS(ON)}$ to Minimize Conductive Loss
- ■Low Gate Charge For Fast Switching
- ■Low Thermal Resistance
- ■100% Avalanche Tested
- ■AEC-Q101 Qualified

Application

- ■Motor Drives
- ■On Board Charger
- ■DC-DC
- ■Auxiliary Drives

Ordering Information:

Part NO.	ZMCA020R120C3
Marking	ZMC020R120
Packing Information	Bulk Tube
Basic Ordering Unit (pcs)	400

Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		1200	V
Gate-Source Voltage	V_{GS}	Transient Voltage	-10V/25V	V
	V_{GS}	Static Voltage	-10V/24V	V
Recommended turn on gate voltage	$V_{GS(on)}$		15 to 18V	V
Recommended turn off gate voltage	$V_{GS(off)}$		-4V to 0V	V
Continuous Drain Current	I_D	T_C=25℃	84	A
	I_D	T_C=75℃	69	A
	I_D	T_C=100℃	59	A

Pulsed Drain Current ①	I_{DM}	Pulsed; $t_p \leq 10$ μs; $T_{mb} = 25$ °C;	336	A
Total Power Dissipation	P_D	T_C=25℃	375	W
Total Power Dissipation	P_D	T_A=25℃	3.8	W
Operating Junction Temperature	T_J		-55 to +175	℃
Storage Temperature	T_{STG}		-55 to +175	℃
Single Pulse Avalanche Energy	E_{AS}	L=0.5mH, V_{GS}=18V, R_g=25Ω	1225	mJ
ESD Level (HBM)			Class2	

• Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction - Case	R_{thJC}	-	-	0.4	°C/W
Thermal Resistance, Junction-Ambient	R_{thJA}①	-	-	40	°C/W
Soldering Temperature(total time<10s)	Tsold	-	-	260	°C

• Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA	1200	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =5mA	2	2.9	4	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V,V_{DS}=1200V	-	-	10	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=-10V, V_{DS} =0V	-	-	-100	nA
		V_{GS}=25V, V_{DS} =0V	-	-	100	nA
Static Drain-Source On Resistance	$R_{DS(on)}$	T_j=25°C,V_{GS}=18V,I_D=60A	-	20	26	mΩ
		T_j=175°C,V_{GS}=18V,I_D=60A	-	47	-	mΩ
		Tj=25°C,V_{GS}=15V,I_D=60A	-	26	-	mΩ
Forward Transconductance	g_{fs}	V_{DS} =20V,I_{SD} =60A	-	27	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =-4V, I_{SD} =60A	-	3.8	5	V

• Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	f = 100KHz, V_{DS}=800V	-	4840	-	pF
Output Capacitance	C_{oss}		-	190	-	
Reverse Transfer Capacitance	C_{rss}		-	8	-	
Output Charge	Q_{oss}	f = 100KHz,V_{GS}=0V, V_{DS}=0V to 800V	-	266	-	nC
Coss Stored Energy	E_{oss}		-	72	-	uJ
Gate Risistance	R_g	f = 1MHz	-	1.9		Ω
Total Gate Charge	Q_g	V_{DD} = 800V, I_D = 60A, V_{GS} = -4V/18V	-	186	-	nC
Gate - Source Charge	Q_{gs}		-	65	-	
Gate - Drain Charge	Q_{gd}		-	76	-	

Turn-ON Delay Time	$t_{D(on)}$	V_{GS}=-4V/18V,V_{DS}=800V, R_G =1Ω, I_D =60A	-	20	-	ns
Turn-ON Rise Time	t_r		-	8	-	ns
Turn-Off Delay Time	$t_{D(off)}$		-	45	-	ns
Turn-Off Fall Time	t_f		-	20	-	ns
Turn-On Energy	E_{on}		-	465	-	uJ
Turn-Off Energy	E_{off}		-	138	-	uJ
Reverse Recovery Time	t_{rr}	V_{DD}=800V, dI_S/dt = 100A/us, I_S=60A	-	21	-	ns
Reverse Recovery Peak Current	I_{rrm}		-	15	-	A
Reverse Recovery Charge	Q_{rr}		-	198	-	nC

• Characteristics Diagrams

Fig.1 Gate-Charge Characteristics

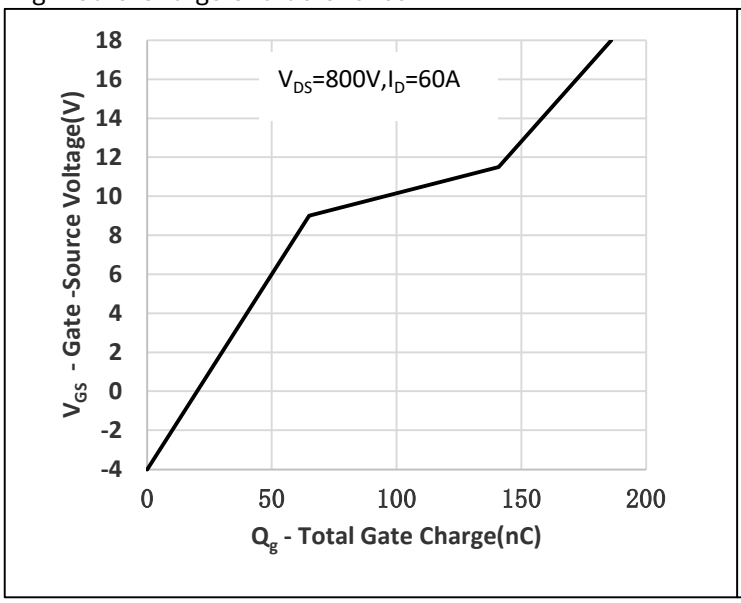


Fig.2 Capacitance Characteristics

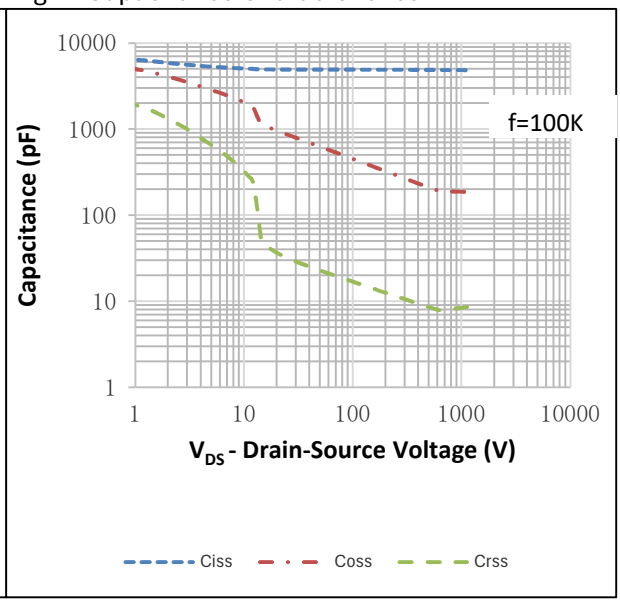


Fig.3 Power Dissipation

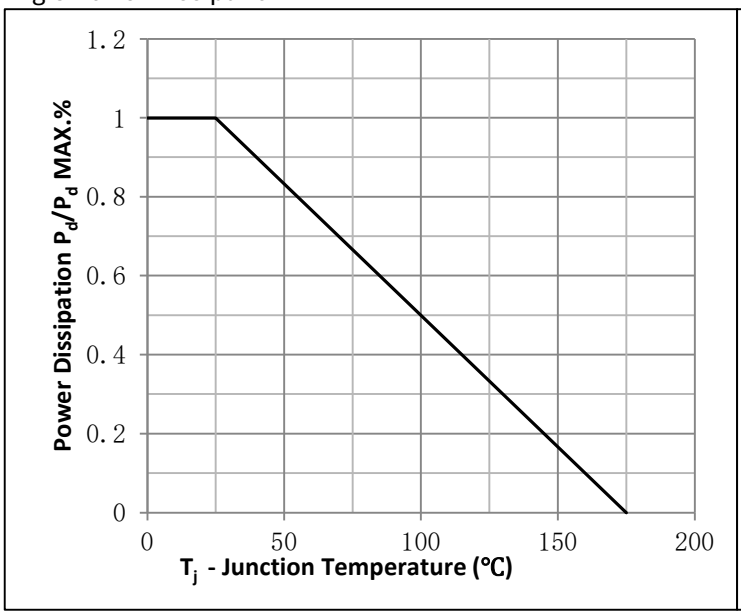


Fig.4 Typical Output Characteristics

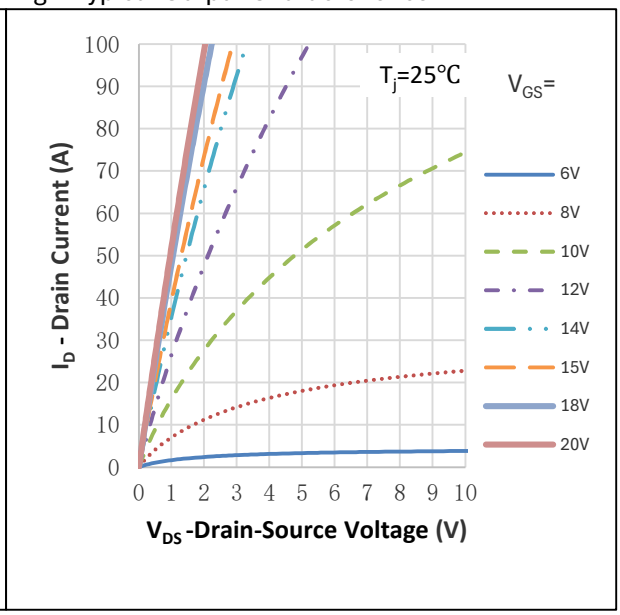


Fig.5 Threshold Voltage vs. Junction Temperature

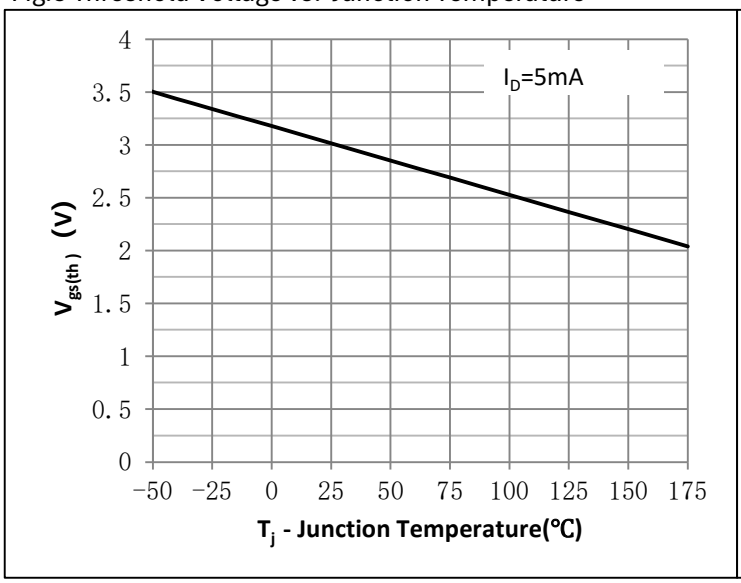


Fig.6 On-Resistance vs. Drain Current

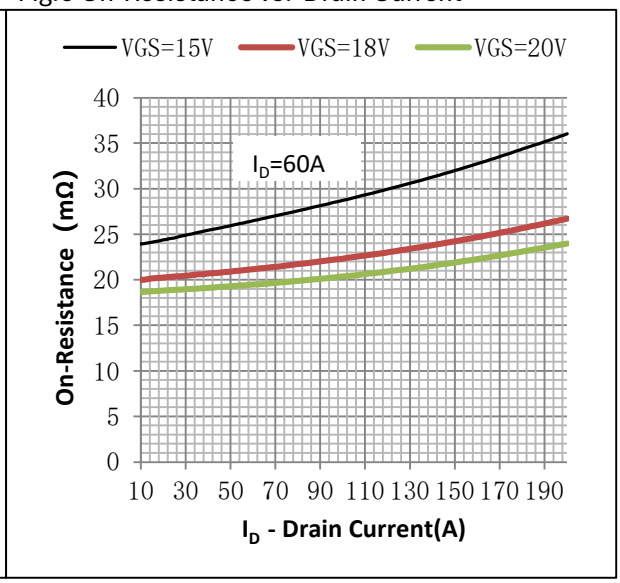


Fig.7 On-Resistance vs. Gate Source Voltage

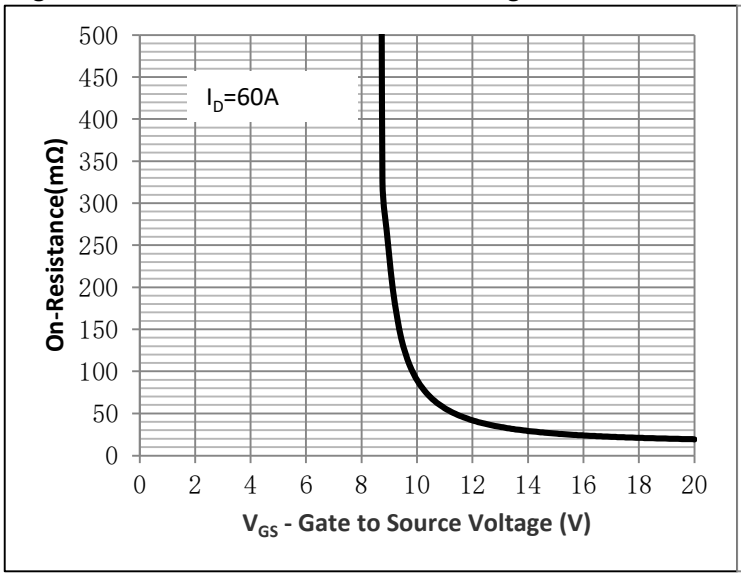


Fig.8 On-Resistance vs. Junction Temperature

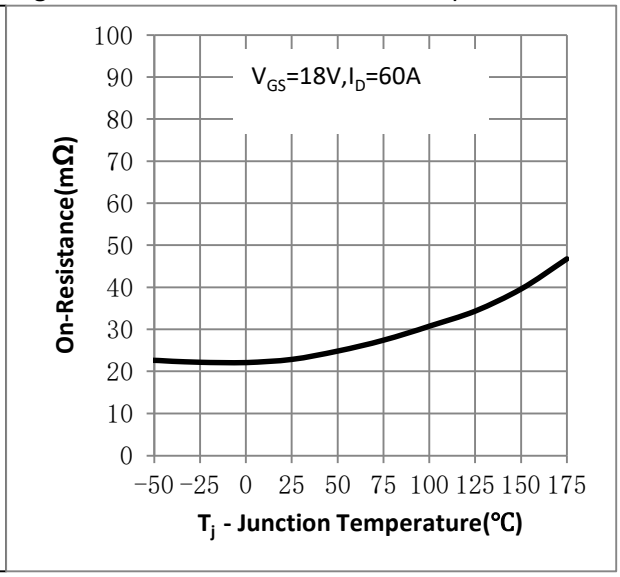


Figure 9. Diode Forward Voltage vs. Current

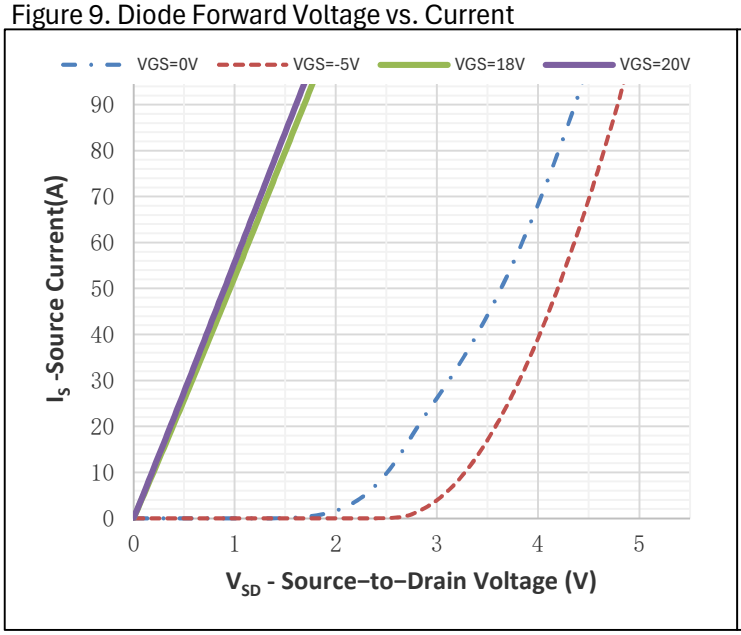


Figure 10. Transfer Characteristics

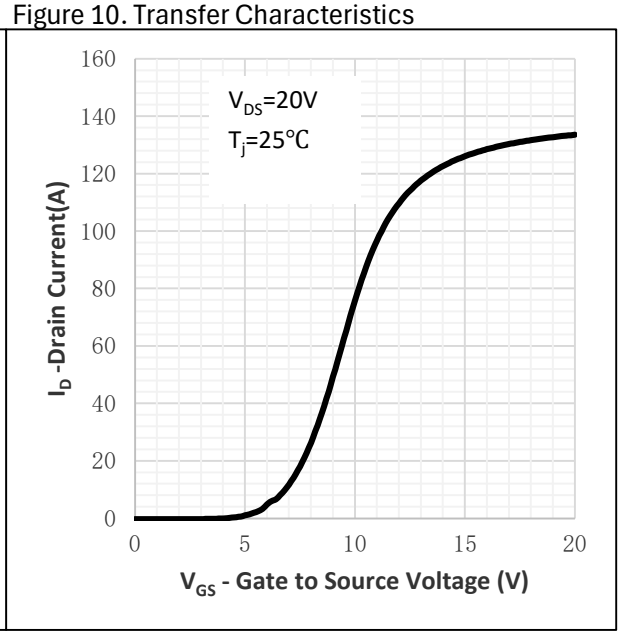


Fig.11 SOA Maximum Safe Operating Area

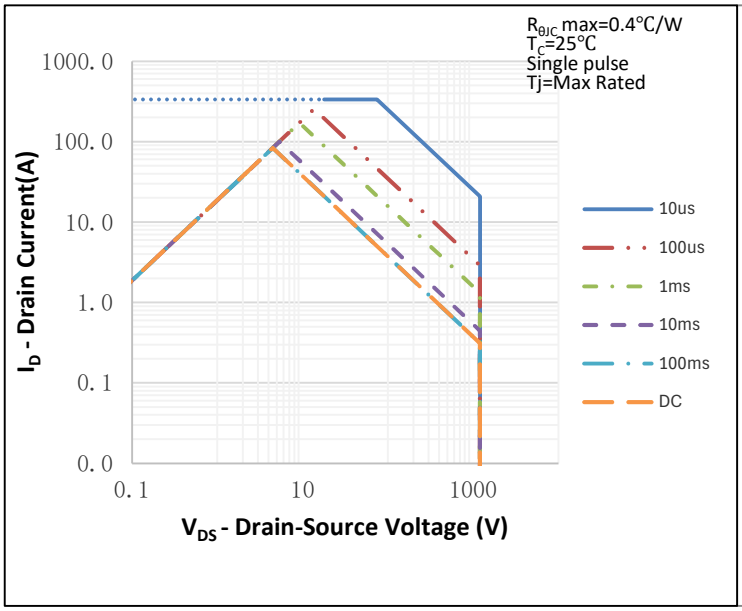


Fig.12 I_D vs. Junction Temperature②

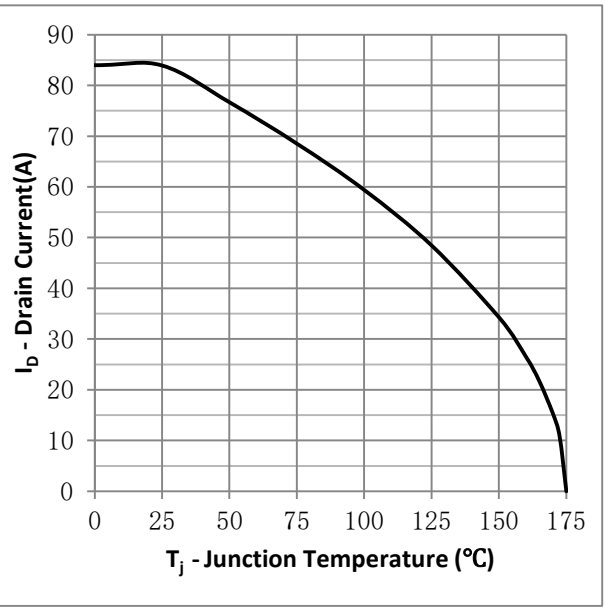


Fig.13 Output Capacitor Stored Energy

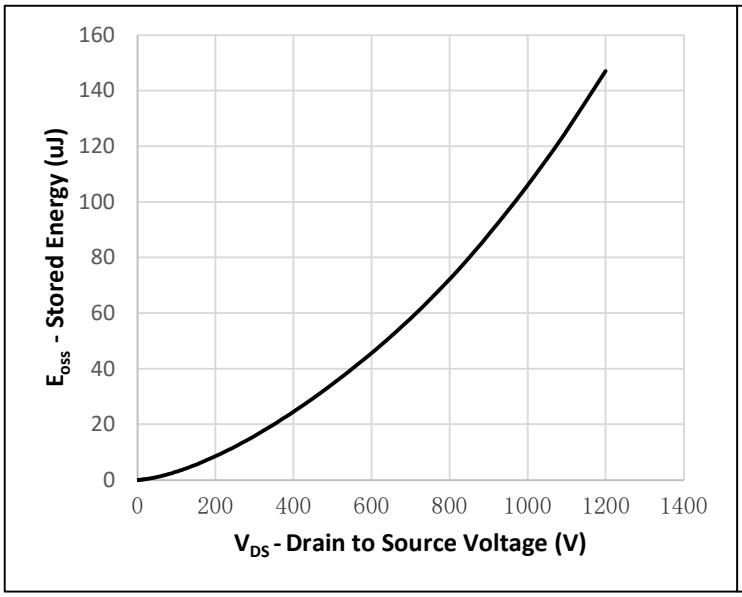
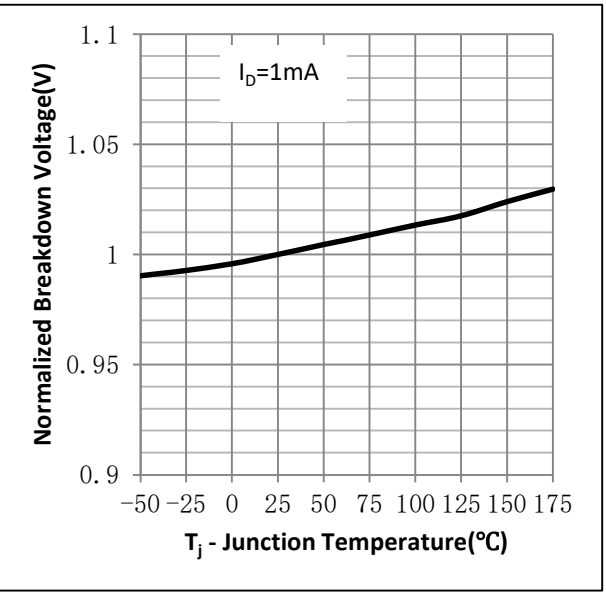
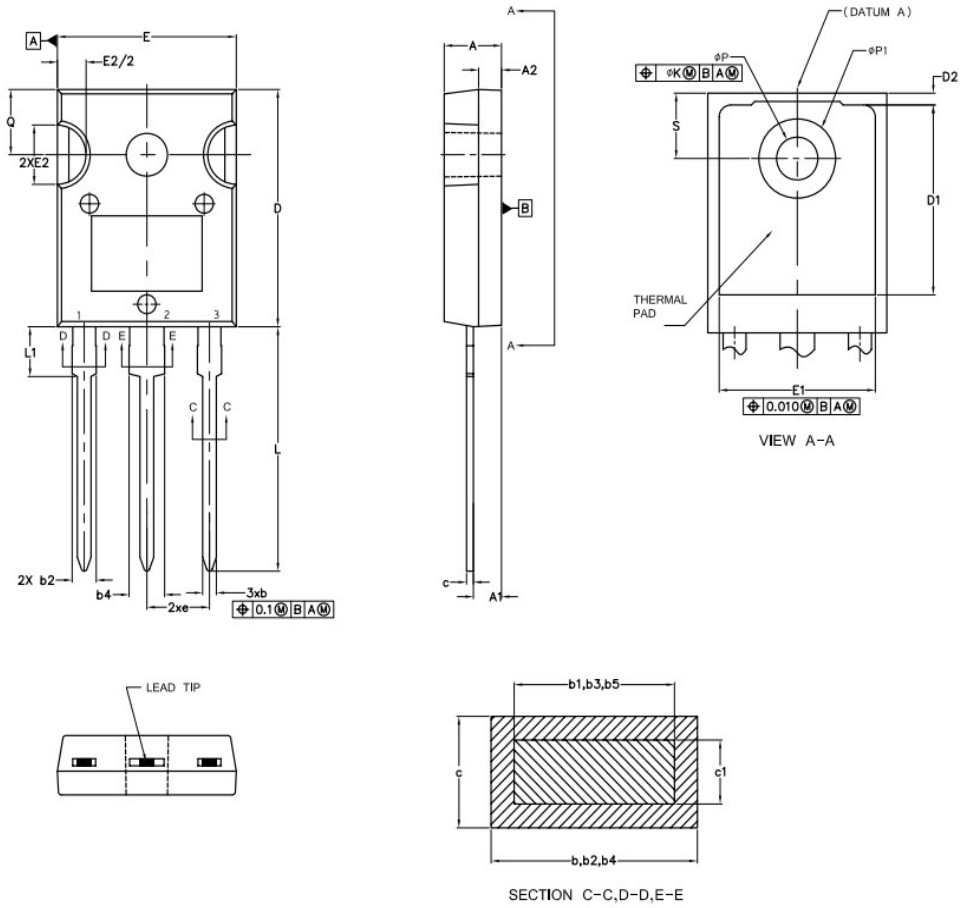


Fig.14 Normalized Breakdown Voltage vs. Junction Temperature



●TO-247-3 Package Outline



SYMBOLS	DIMENSIONS			
	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A	4.83	5.13	0.190	0.20
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.65	2.39	0.065	0.094
b3	1.65	2.34	0.065	0.092
b4	2.59	3.43	0.102	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.89	0.015	0.035
c1	0.38	0.84	0.015	0.033
D	19.71	20.70	0.776	0.815
D1	13.08	——	0.515	——
D2	0.51	1.35	0.020	0.053
E	15.29	15.87	0.602	0.625
E1	13.46	——	0.530	——
E2	4.52	5.49	0.178	0.216
e	5.46BSC		0.215BSC	
L	19.57	21.00	0.780	0.827
L1	3.71	4.29	0.146	0.169
øP	3.56	3.66	0.140	0.144
øP1	——	7.39	——	0.291
Q	5.31	5.69	0.209	0.224
S	5.51BSC		0.217BSC	

Note:

① The value of RθJA is measured with the device in a still environment with TA=25°C

②Practically the current will be limited by PCB, thermal design and operating temperature. V_{GS}=18V.

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Revision History:

Version	Date	Change
A	2024/11/26	New