

• General Description

This silicon carbide Power MOSFET device has been developed using ZMJ's advanced 2nd 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.

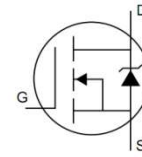
• Features

- 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

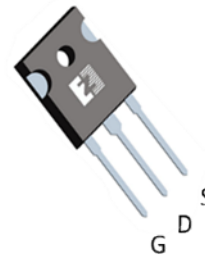
• Application

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

• Product Summary



$V_{DS} = 1200V$
 $R_{DS(ON)} = 53m\Omega$
 $I_D = 35A$



TO-247-3



• Ordering Information:

Part NO.	ZMCA060R120C3
Marking	ZMC060R120
Packing Information	BULK TUBE
Basic Ordering Unit (pcs)	400

• Absolute Maximum Ratings ($T_C=25^\circ C$)

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	$T_C=25^\circ C$	35	A
	I_D	$T_C=75^\circ C$	28	A
	I_D	$T_C=100^\circ C$	24	A

Pulsed Drain Current ^①	I_{DM}	Pulsed; $t_p \leq 10 \mu s$; $T_{mb} = 25^\circ C$;	140	A
Total Power Dissipation	P_D	$T_C = 25^\circ C$	197	W
Total Power Dissipation	P_D	$T_A = 25^\circ C$	3.8	W
Operating Junction Temperature	T_J		-55 to +175	$^\circ C$
Storage Temperature	T_{STG}		-55 to +175	$^\circ C$
Single Pulse Avalanche Energy	E_{AS}	$L=0.5mH, V_{GS}=18V, R_g=25\Omega$	361	mJ
ESD Level (HBM)			Class2	

• Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction - Case	R_{thJC}	-	-	0.76	$^\circ C/W$
Thermal Resistance, Junction-Ambient	$R_{thJA\oplus}$	-	-	40	$^\circ C/W$
Soldering Temperature(total time<10s)	T_{sold}	-	-	260	$^\circ C$

• Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	1200	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 5mA$	2	2.8	4	V
Drain-Source Leakage Current	I_{DSS}	$V_{GS} = 0V, V_{DS} = 1200V$	-	-	10	μA
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	$R_{DS(on)}$	$T_J = 25^\circ C, V_{GS} = 18V, I_D = 20A$	-	53	65	m Ω
		$T_J = 175^\circ C, V_{GS} = 18V, I_D = 20A$	-	110	-	m Ω
		$T_J = 25^\circ C, V_{GS} = 15V, I_D = 20A$	-	63	-	m Ω
Forward Transconductance	g_{fs}	$V_{DS} = 10V, I_{SD} = 20A$	-	8.5	-	S
Diode Forward Voltage	V_{FSD}	$V_{GS} = -4V, I_{SD} = 20A$	-	4.3	5	V

• Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	$f = 100KHz, V_{DS} = 800V$	-	1521	-	pF
Output Capacitance	C_{oss}		-	67	-	
Reverse Transfer Capacitance	C_{rss}		-	5	-	
Output Charge	Q_{oss}	$f = 100KHz, V_{GS} = 0V, V_{DS} = 0V \text{ to } 800V$	-	92	-	nC
Coss Stored Energy	E_{oss}		-	25	-	μJ
Gate Resistance	R_g	$f = 1MHz$	-	1.7	-	Ω
Total Gate Charge	Q_g	$V_{DD} = 800V, I_D = 20A, V_{GS} = -4V/18V$	-	68	-	nC
Gate - Source Charge	Q_{gs}		-	19	-	
Gate - Drain Charge	Q_{gd}		-	28	-	

Turn-ON Delay Time	$t_{D(on)}$	$V_{GS}=-4V/18V, V_{DS}=800V,$ $R_G=10\Omega, I_D=20A,$ $L=505\mu H$	-	13	-	ns
Turn-ON Rise Time	t_r		-	4.2	-	ns
Turn-Off Delay Time	$t_{D(off)}$		-	34	-	ns
Turn-Off Fall Time	t_f		-	15	-	ns
Turn-On Energy	E_{on}		-	580	-	μJ
Turn-Off Energy	E_{off}		-	156	-	μJ
Reverse Recovery Time	t_{rr}	$V_{DD}=800V, di_S/dt =$ $600A/\mu s, I_S=20A$	-	24	-	ns
Reverse Recovery Peak Current	I_{rrm}		-	5.5	-	A
Reverse Recovery Charge	Q_{rr}		-	74	-	nC

● Characteristics Diagrams

Fig.1 Gate-Charge Characteristics

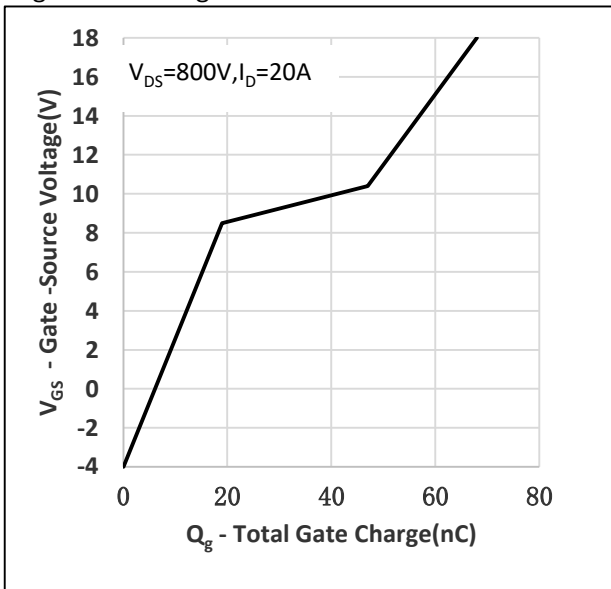


Fig.2 Capacitance Characteristics

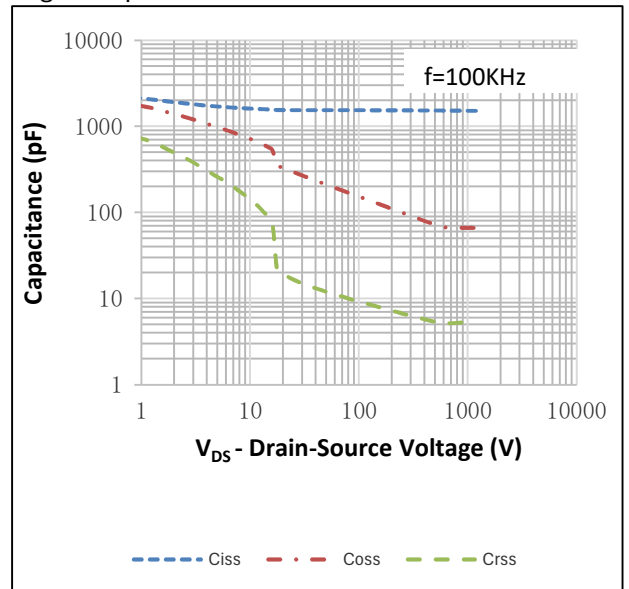


Fig.3 Power Dissipation

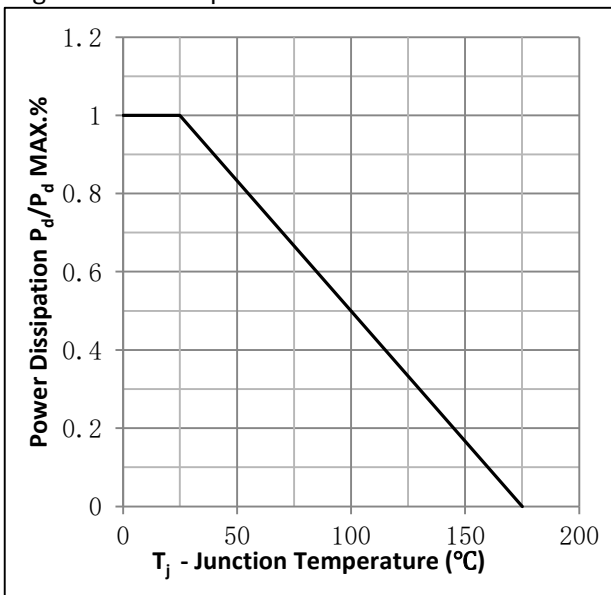


Fig.4 Typical Output Characteristics

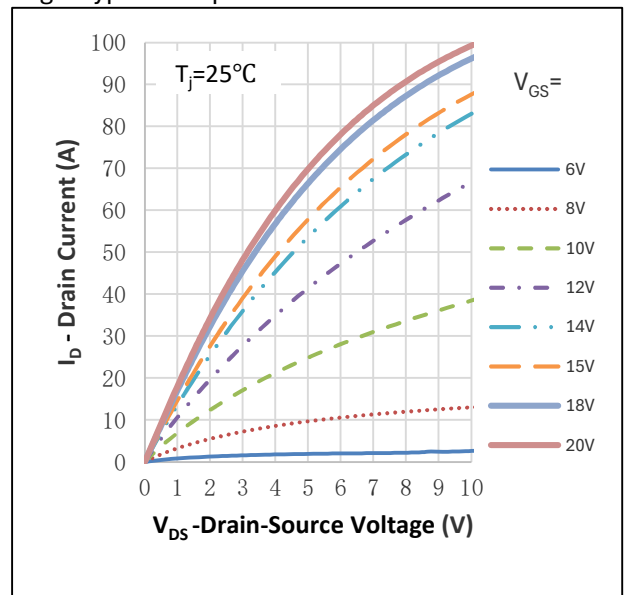


Fig.5 Threshold Voltage vs. Junction Temperature

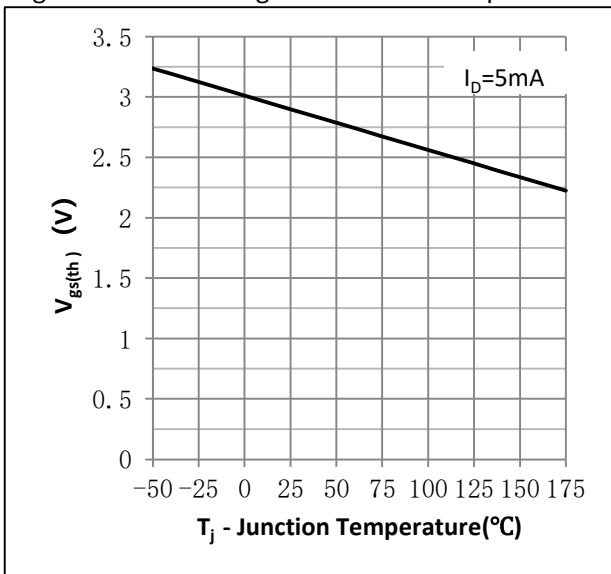


Fig.6 On-Resistance vs. Drain Current

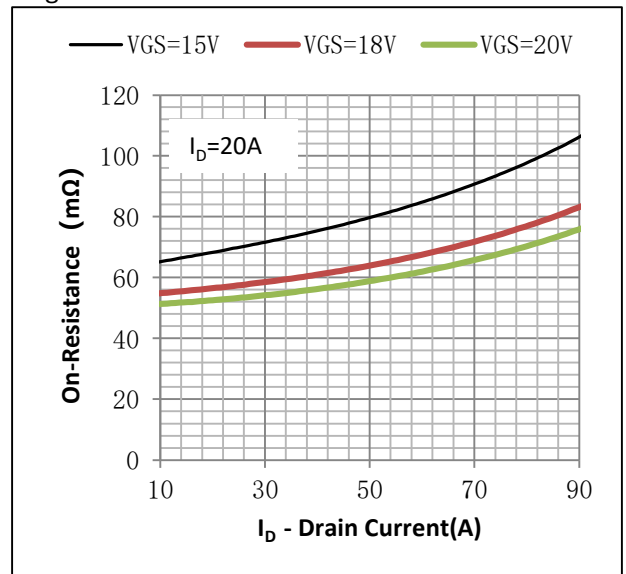


Fig.7 On-Resistance vs. Gate Source Voltage

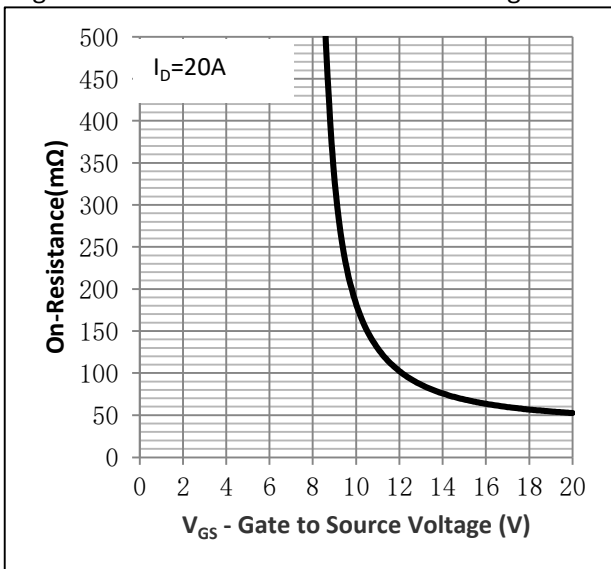


Fig.8 On-Resistance vs. Junction Temperature

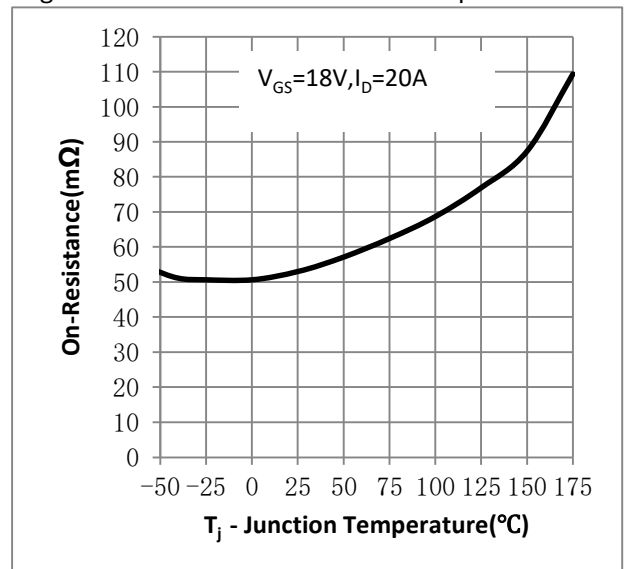


Figure 9. Diode Forward Voltage vs. Current

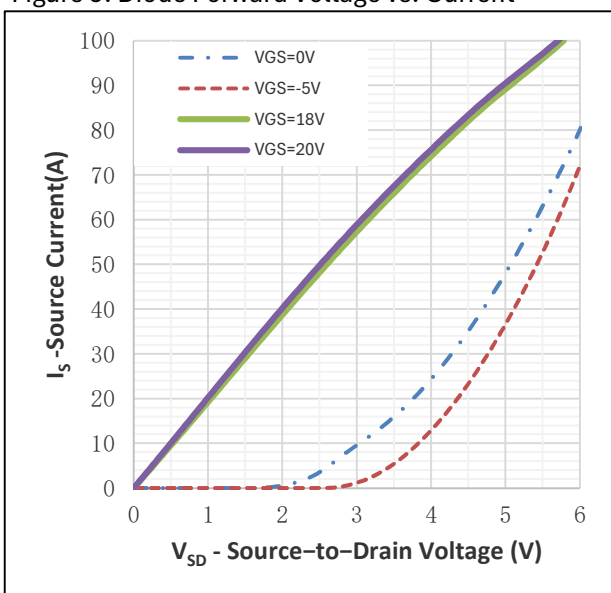


Figure 10. Transfer Characteristics

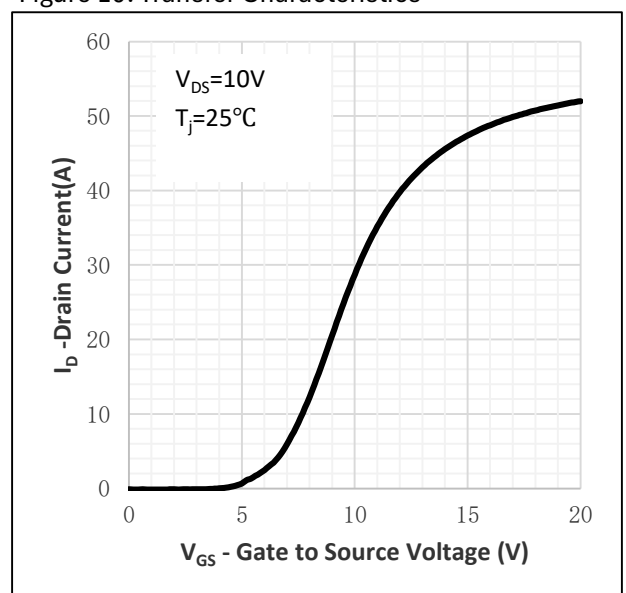


Fig.11 SOA Maximum Safe Operating Area

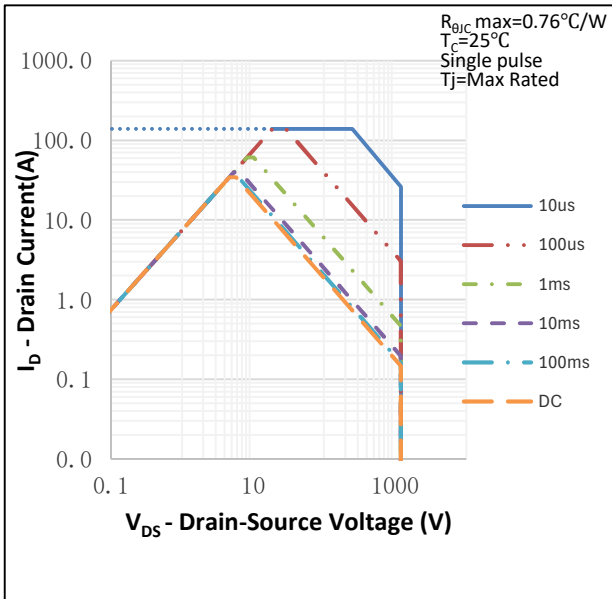


Fig.12 I_D vs. Junction Temperature

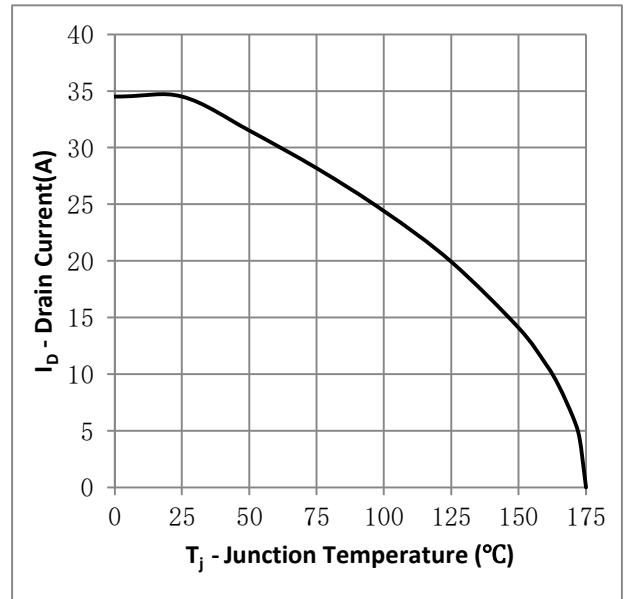


Fig.13 Output Capacitor Stored Energy

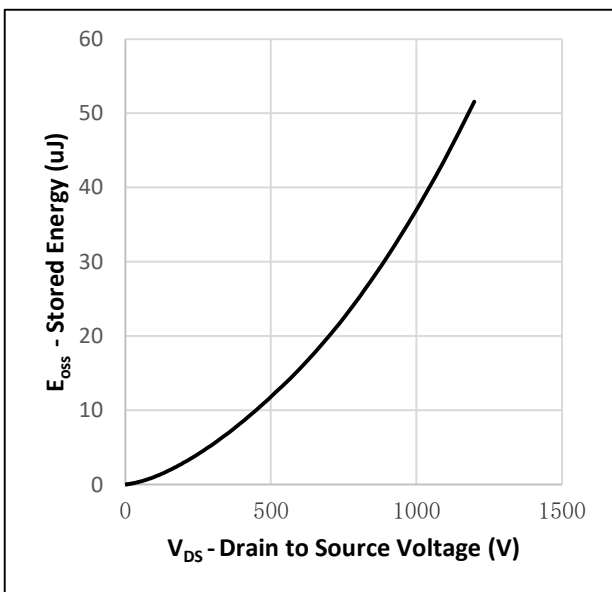
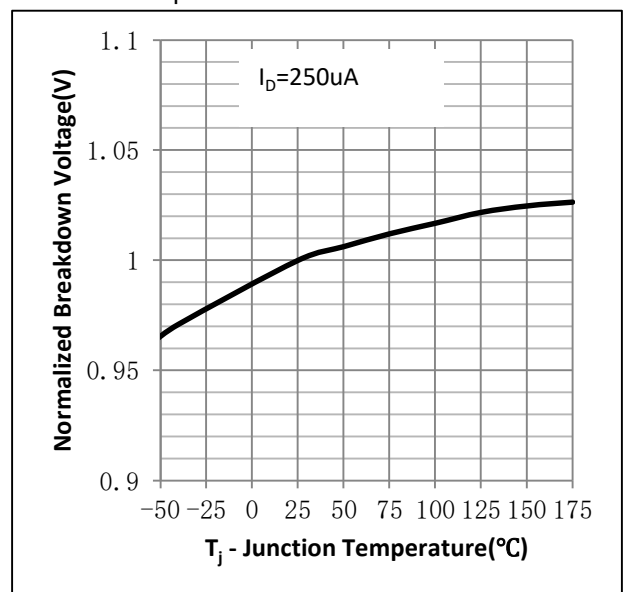
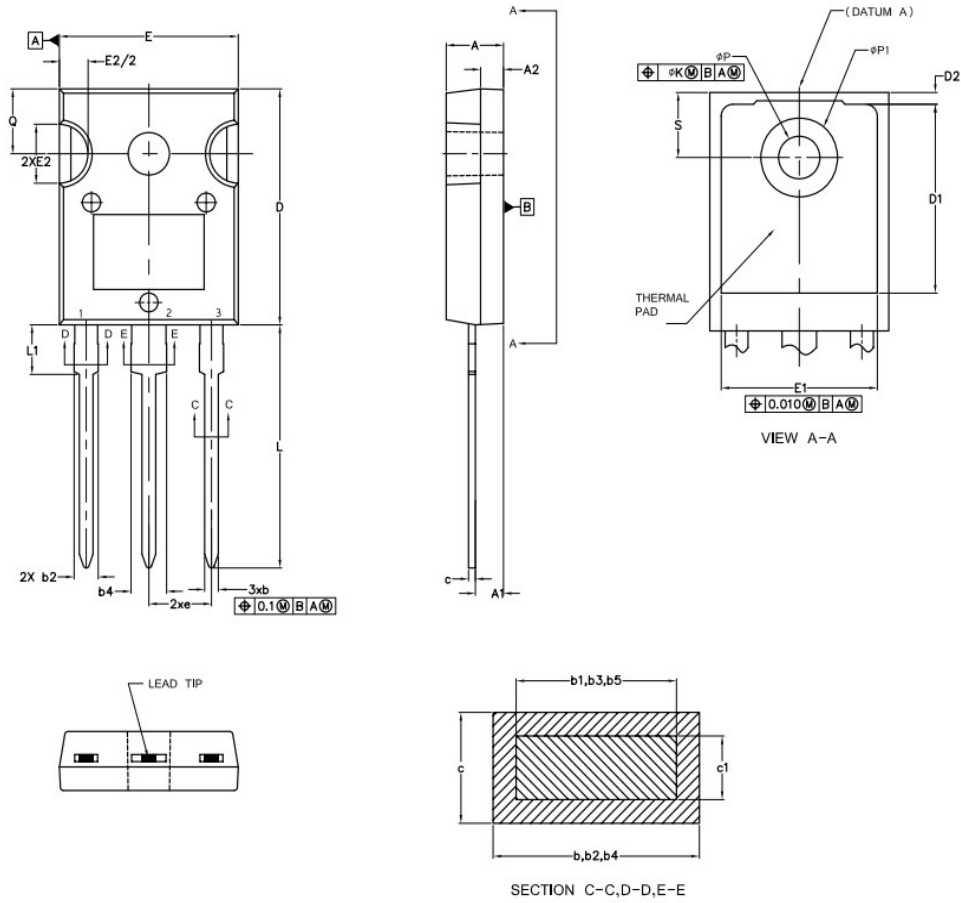


Fig.14 Normalized Breakdown Voltage vs. Junction Temperature



•TO-247-3 Package Outline



DIMENSIONS	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
ϕP	3.56	3.66	0.140	0.144
$\phi P1$	—	7.39	—	0.291
Q	5.31	5.69	0.209	0.224
S	5.51BSC		0.217BSC	

Note:

- ① The value of $R\theta JA$ is measured with the device in a still environment with $T_A=25^\circ C$
- ② Practically 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
B	2025/2/27	Correct basic order quantity