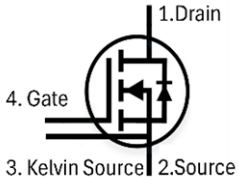
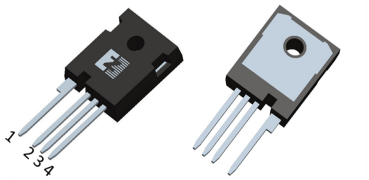
General Description

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}= 2000V
$R_{DS(ON)}$ = 57mΩ
I_D= 33A



TO-247-4

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.	ZMCA060R200C4
Marking	ZMC060R200
Packing Information	BULK TUBE
Basic Ordering Unit (pcs)	600

Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		2000	V
Gate-Source Voltage	V_{GS}	Transient Voltage	-10V/23V	V
	V_{GS}	Static Voltage	-10V/20V	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℃	33	A
	I_D	T_C=75℃	27	A
	I_D	T_C=100℃	23	A

Pulsed Drain Current ①	I_{DM}	Pulsed; $t_p \leq 10$ μs; $T_{mb} = 25$ °C;	132	A
Total Power Dissipation	P_D	T_C=25℃	300	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	1042	mJ
ESD Level (HBM)			Class2	

• Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction - Case	R_{thJC}	-	-	0.5	°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	2000	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =5mA	3	3.8	5	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V,V_{DS}=2000V	-	-	10	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=-10V, V_{DS} =0V	-	-	-100	nA
		V_{GS}=20V, V_{DS} =0V	-	-	100	nA
Static Drain-Source On Resistance	$R_{DS(on)}$	T_j=25°C,V_{GS}=18V,I_D=20A	-	57	70	mΩ
		T_j=175°C,V_{GS}=18V,I_D=20A	-	110	-	mΩ
		T_j=25°C,V_{GS}=15V,I_D=20A	-	77	-	mΩ
Forward Transconductance	g_{fs}	V_{DS} =10V,I_{SD} =10A	-	5	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =-4V, I_{SD} =20A	-	3.8	5	V

• Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Capacitance	C_{iss}	f = 100KHz, V_{DS}=1200V	-	2218	-	pF
Output Capacitance	C_{oss}		-	74	-	
Reverse Transfer Capacitance	C_{rss}		-	1.8	-	
Output Charge	Q_{oss}	f = 100KHz,V_{GS}=0V, V_{DS}=0V to 1200V	-	173	-	nC
Coss Stored Energy	E_{oss}		-	70	-	uJ
Gate Risistance	R_g	f = 1MHz	-	1.9	-	Ω
Total Gate Charge	Q_g	V_{DD} = 1200V, I_D = 20A, V_{GS} = -4V/18V	-	96	-	nC
Gate - Source Charge	Q_{gs}		-	32	-	
Gate - Drain Charge	Q_{gd}		-	38	-	

Turn-ON Delay Time	$t_{D(on)}$	V_{GS}=-4V/18V,V_{DS}=1200V, R_G =10Ω, I_D =20A, L=505uH	-	19	-	ns
Turn-ON Rise Time	t_r		-	10	-	ns
Turn-Off Delay Time	$t_{D(off)}$		-	41	-	ns
Turn-Off Fall Time	t_f		-	14	-	ns
Turn-On Energy	E_{on}		-	1010	-	uJ
Turn-Off Energy	E_{off}		-	182	-	uJ
Reverse Recovery Time	t_{rr}	V_{DD}=1200V, dI_S/dt = 600A/us, I_S=20A	-	80	-	ns
Reverse Recovery Peak Current	I_{rrm}		-	16	-	A
Reverse Recovery Charge	Q_{rr}		-	570	-	nC

• Characteristics Diagrams

Fig.1 Gate-Charge Characteristics

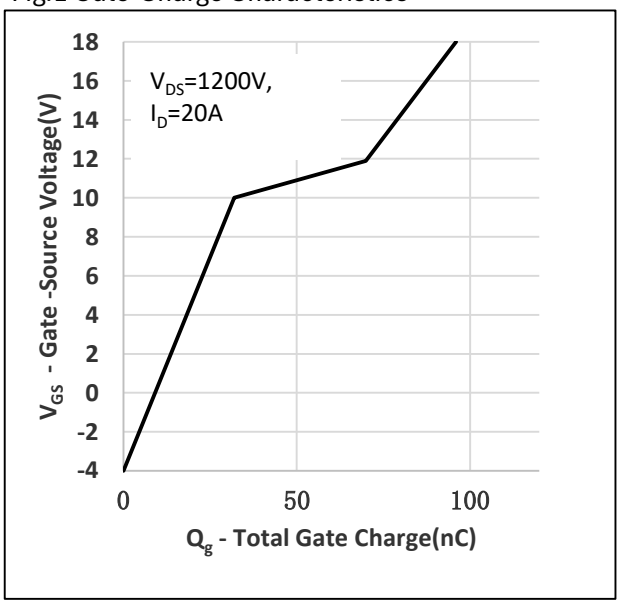


Fig.2 Capacitance Characteristics

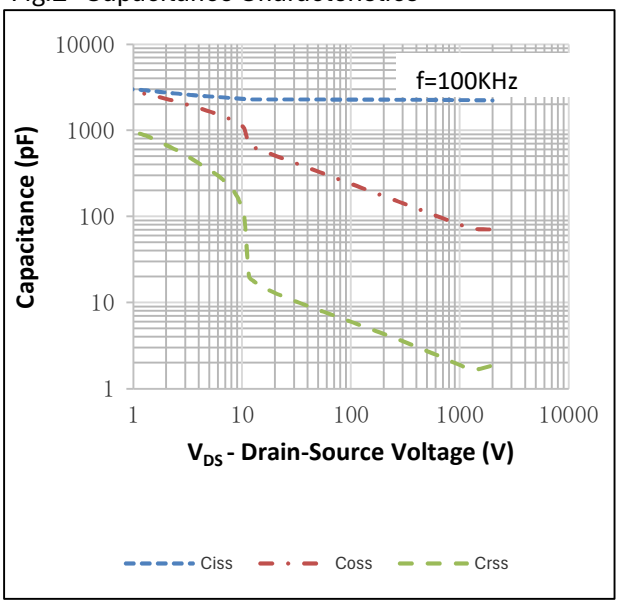


Fig.3 Power Dissipation

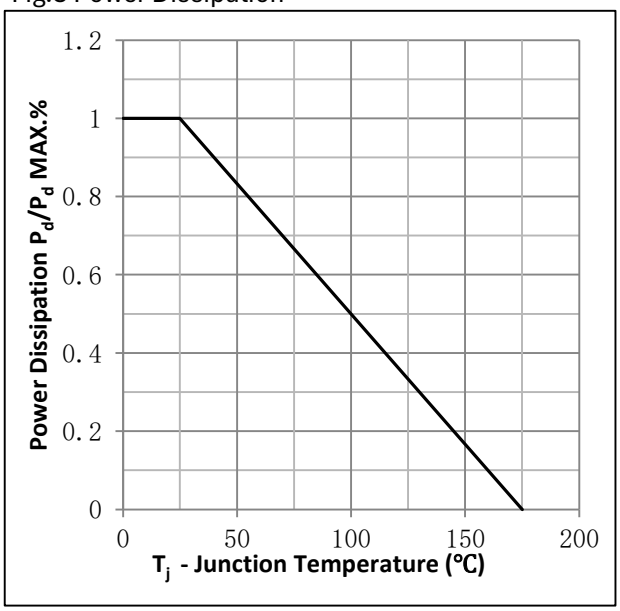


Fig.4 Typical Output Characteristics

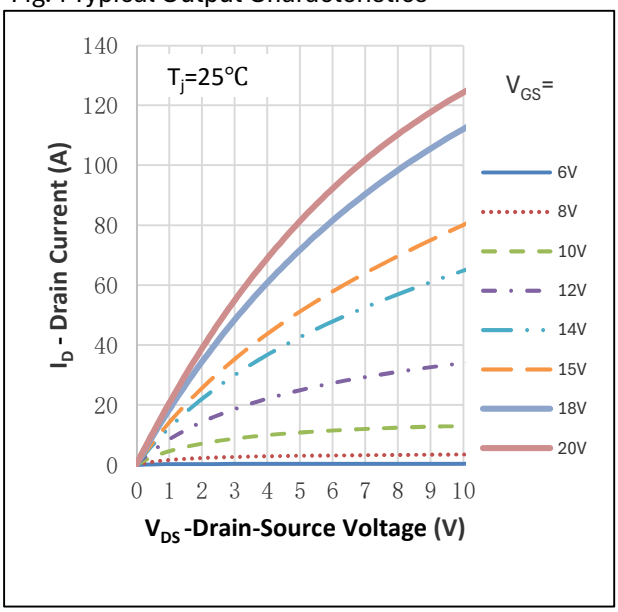


Fig.5 Threshold Voltage vs. Junction Temperature

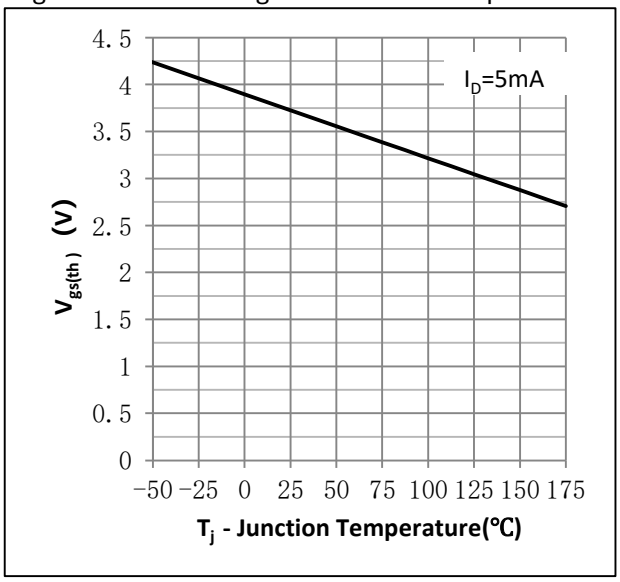


Fig.6 On-Resistance vs. Drain Current

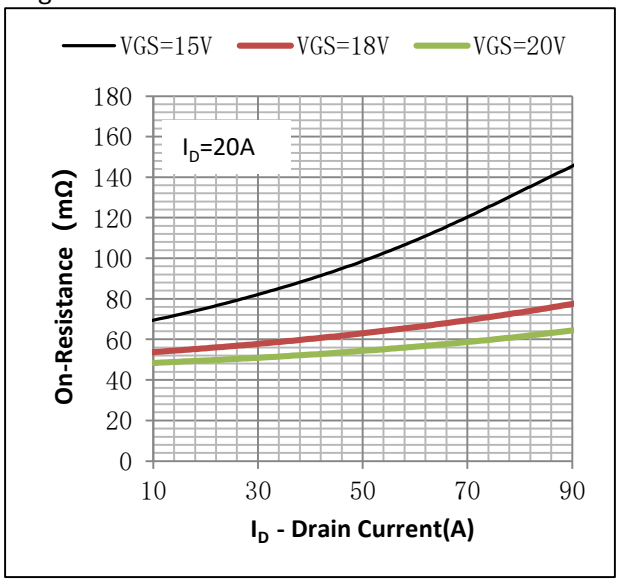


Fig.7 On-Resistance vs. Gate Source Voltage

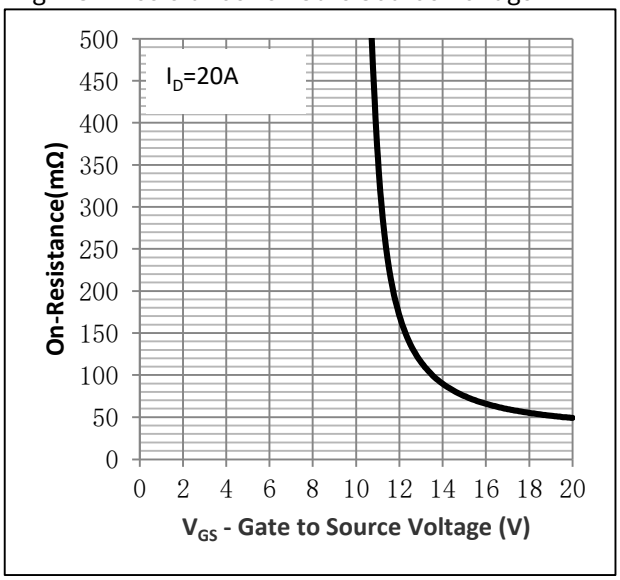


Fig.8 On-Resistance vs. Junction Temperature

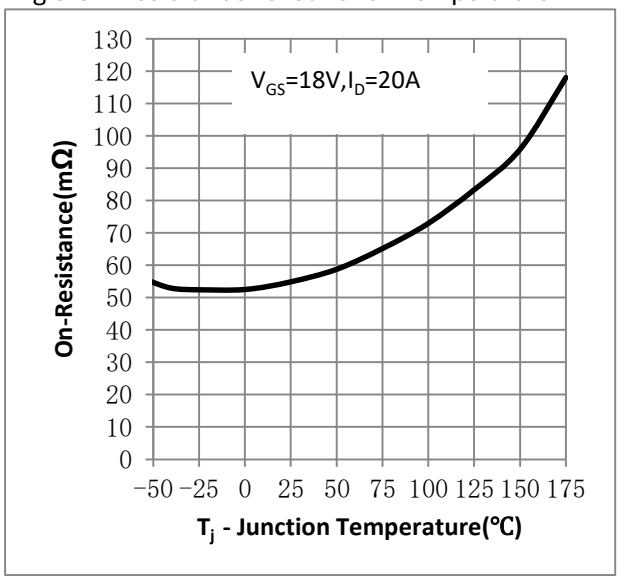


Figure 9. Diode Forward Voltage vs. Current

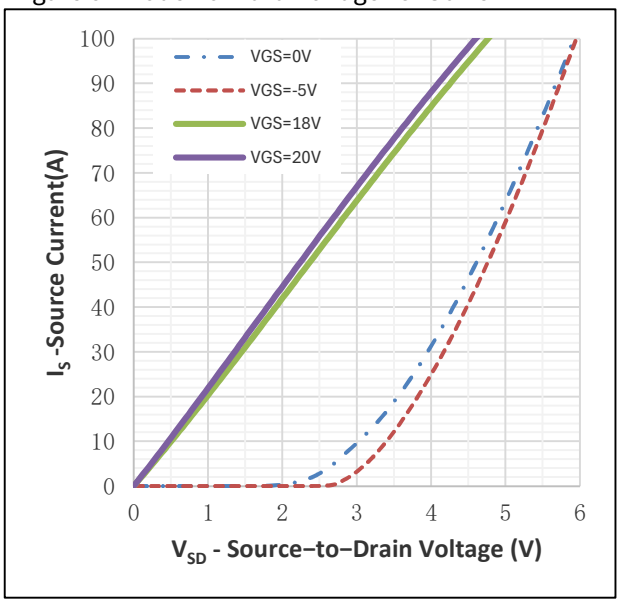


Figure 10. Transfer Characteristics

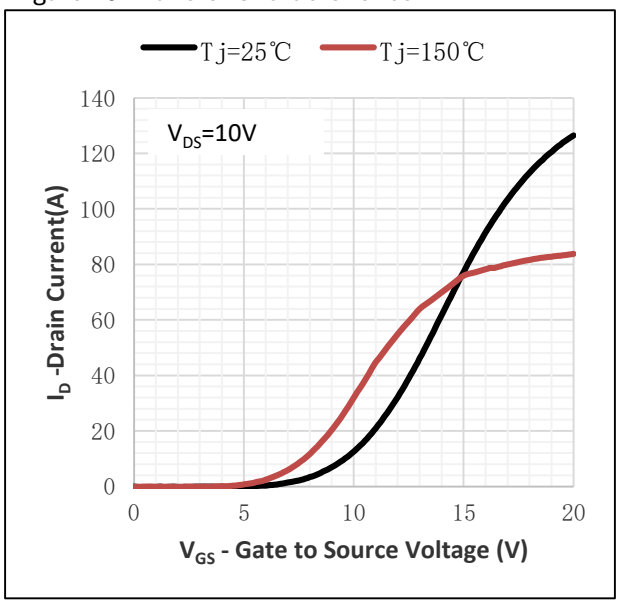


Fig.11 SOA Maximum Safe Operating Area

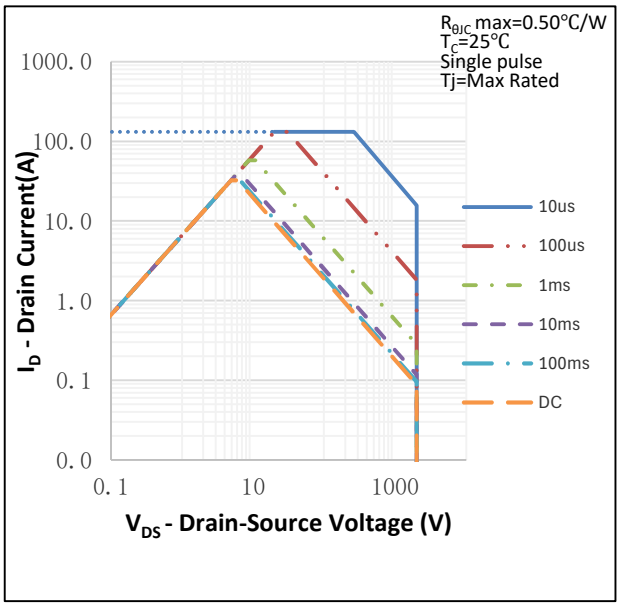


Fig.12 I_D vs. Junction Temperature②

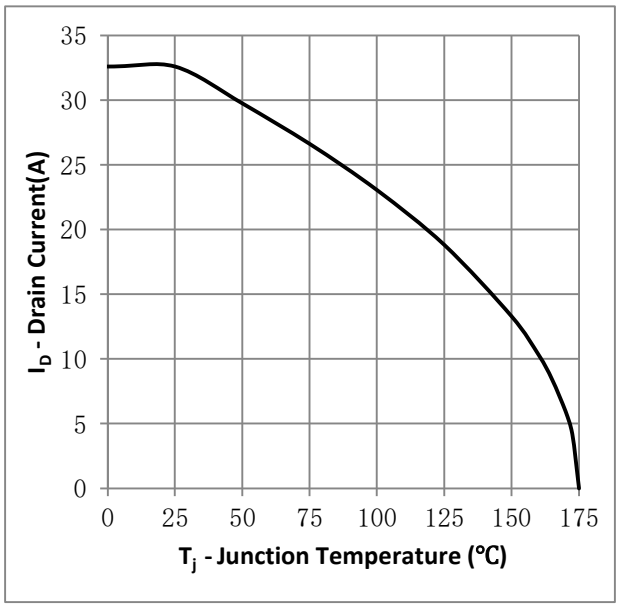


Fig.13 Output Capacitor Stored Energy

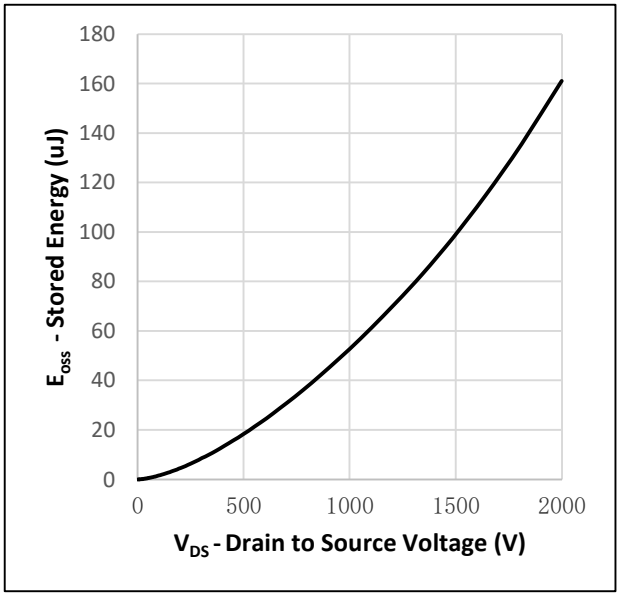
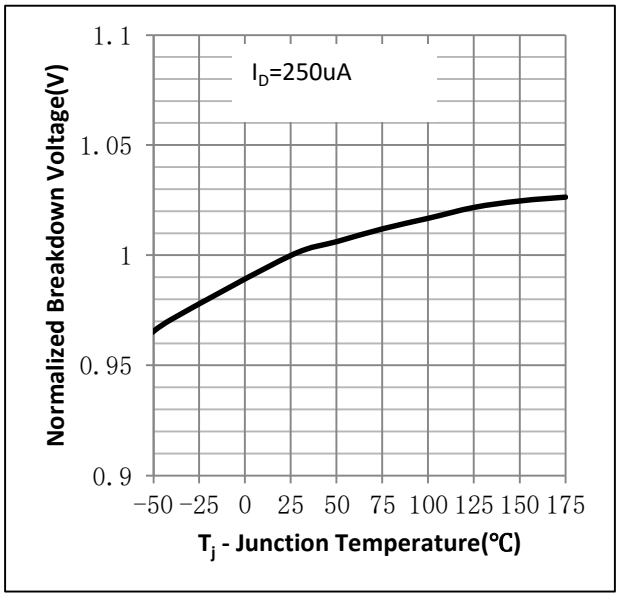
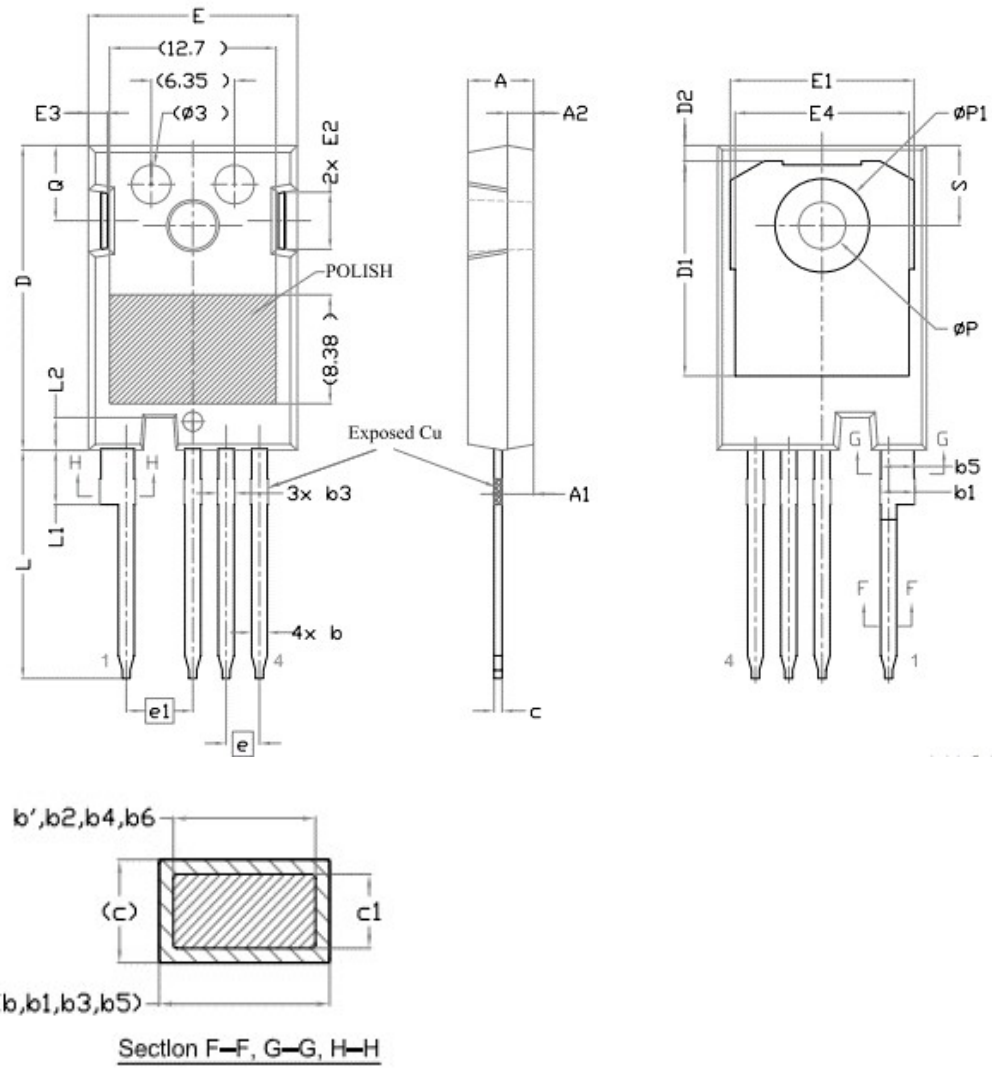


Fig.14 Normalized Breakdown Voltage vs. Junction Temperature



●TO-247-4 Package Outline



Section F–F, G–G, H–H

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

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	2024/11/6	New