

1200V N-Channel SiC MOSFET Module

● General Description

This silicon carbide Power MOSFET device has been developed using ZMJ’s advanced 2<sup>nd</sup> 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.

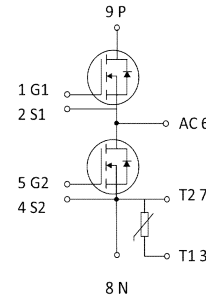
● Features

- 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

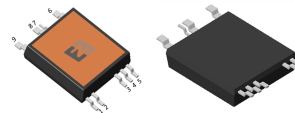
● Application

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

● Product Summary



$V_{DS} = 1200V$   
 $R_{DS(ON)} = 53m\Omega$   
 $I_D = 31A$



HSOP9



● Ordering Information:

Part NO.	ZMCA060R120H9
Marking	ZMC060R120
Packing Information	REEL TAPE
Basic Ordering Unit (pcs)	200

● 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	$I_D$	$T_C=25^\circ C$	31	A
	$I_D$	$T_C=100^\circ C$	22	A
	$I_D$	$T_C=150^\circ C$	12	A

Pulsed Drain Current <sup>①</sup>	$I_{DM}$	Pulsed; $t_p \leq 10 \mu s$ ; $T_{mb} = 25^\circ C$ ;	124	A
Total Power Dissipation	$P_D$	$T_C = 25^\circ C$	125	W
Total Power Dissipation	$P_D$	$T_A = 25^\circ C$	6.0	W
Operating Junction Temperature	$T_J$		-55 to +175	$^\circ C$
Storage Temperature	$T_{STG}$		-55 to +175	$^\circ C$
Single Pulse Avalanche Energy	$E_{AS}$	$L = 0.5mH, V_{GS} = 18V, R_g = 25\Omega$	342	mJ
ESD Level (HBM)	Class2			

### • Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction - Case	$R_{thJC}$	-	-	1.2	$^\circ C/W$
Thermal Resistance, Junction-Ambient	$R_{thJA} \textcircled{\text{D}}$	-	-	25	$^\circ C/W$
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	$\mu A$
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	$R_{DS(on)}$	$T_j = 25^\circ C, V_{GS} = 18V, I_D = 18A$	-	53	65	m $\Omega$
		$T_j = 175^\circ C, V_{GS} = 18V, I_D = 18A$	-	110	-	m $\Omega$
		$T_j = 25^\circ C, V_{GS} = 15V, I_D = 18A$	-	63	-	m $\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 10V, I_{SD} = 18A$	-	8.5	-	S
Diode Forward Voltage	$V_{FSD}$	$V_{GS} = -4V, I_{SD} = 18A$	-	4.3	5	V

### • Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Capacitance	$C_{iss}$	$f = 100KHz, V_{DS} = 800V$	-	1690	-	pF
Output Capacitance	$C_{oss}$		-	67	-	
Reverse Transfer Capacitance	$C_{riss}$		-	3	-	
Output Charge	$Q_{oss}$	$f = 100KHz, V_{GS} = 0V, V_{DS} = 0V \text{ to } 800V$	-	91	-	nC
Coss Stored Energy	$E_{oss}$		-	25	-	$\mu J$
Gate Resistance	$R_g$	$f = 1MHz$	-	1.7	-	$\Omega$
Total Gate Charge	$Q_g$	$V_{DD} = 800V, I_D = 18A, V_{GS} = -4V/18V$	-	69	-	nC
Gate - Source Charge	$Q_{gs}$		-	23	-	
Gate - Drain Charge	$Q_{gd}$		-	26	-	

Turn-ON Delay Time	$t_{D(on)}$	VGS=-4V/18V, VDS=800V, RG_ON =33Ω, RG_OFF =40Ω, ID =18A, L=100uH	-	9.1	-	ns
Turn-ON Rise Time	$t_r$		-	22	-	ns
Turn-Off Delay Time	$t_{D(off)}$		-	236	-	ns
Turn-Off Fall Time	$t_f$		-	107	-	ns
Turn-On Energy	$E_{on}$		-	0.89	-	mJ
Turn-Off Energy	$E_{off}$		-	0.18	-	mJ
Reverse Recovery Time	$t_{rr}$	VDD=800V, dIS/dt = 650A/us, IS=18A	-	132	-	ns
Reverse Recovery Peak Current	$I_{rrm}$		-	20	-	A
Reverse Recovery Charge	$Q_{rr}$		-	1.5	-	uC

**●NTC Characteristic**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Rated Resistance	$R_{25}$	$T_{NTC}=25^{\circ}C$	-	5	-	kΩ
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC}=100^{\circ}C, R_{100}=479\Omega$	-5	-	5	%
Power Dissipation	$P_{25}$	$T_{NTC}=25^{\circ}C$	-	-	125	mW
B-value	$B_{25/85}$	$R2 = R_{25} \exp[B_{25/85}(1/T2 - 1/(298.15 K))]$	-	3480	-	K

Characteristics Diagrams

Fig.1 Gate-Charge Characteristics

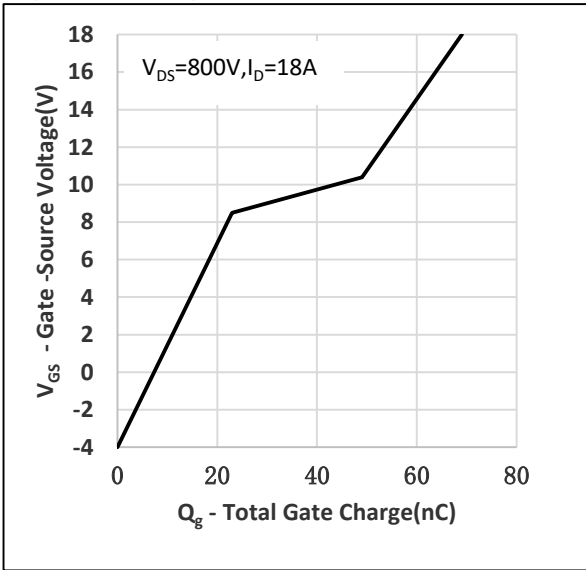


Fig.2 Capacitance Characteristics

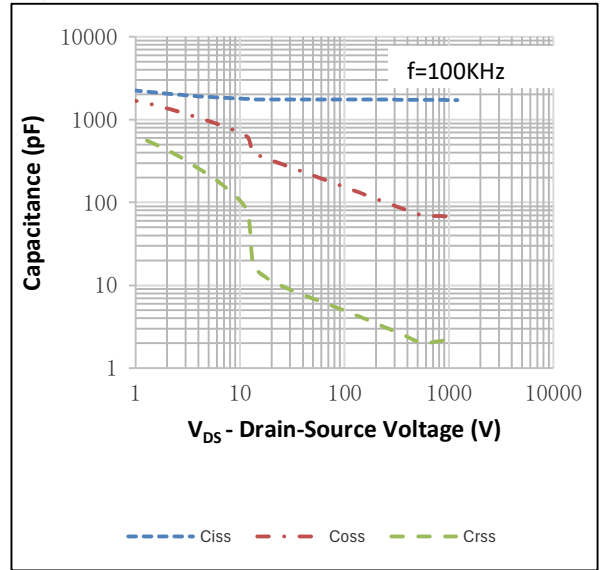


Fig.3 Power Dissipation

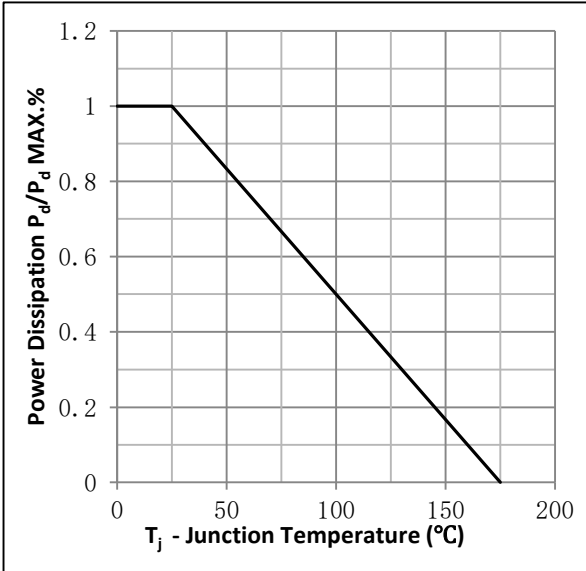


Fig.4 Typical Output Characteristics

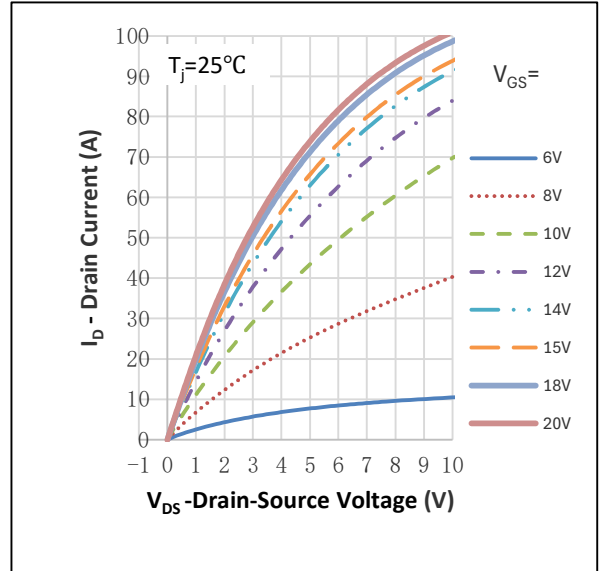


Fig.5 Threshold Voltage vs. Junction Temperature

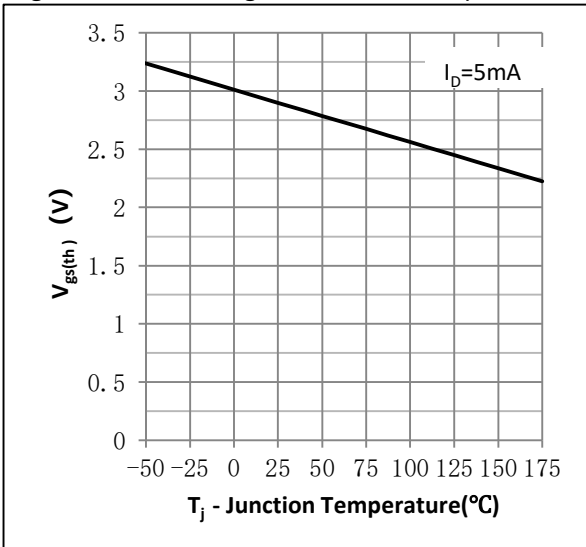
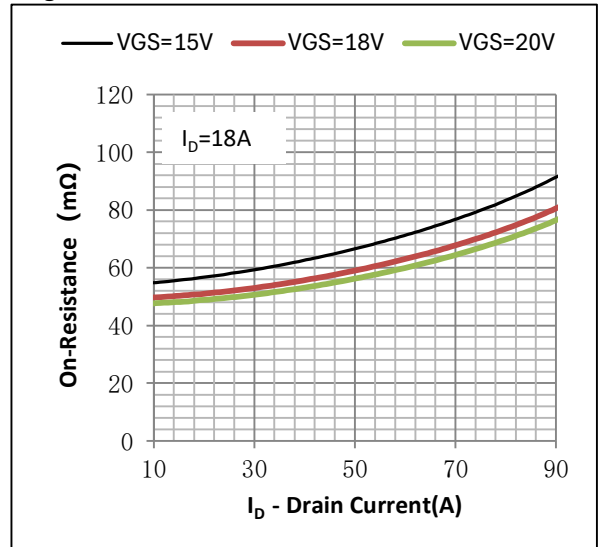


Fig.6 On-Resistance vs. Drain Current



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Fig.7 On-Resistance vs. Gate Source Voltage

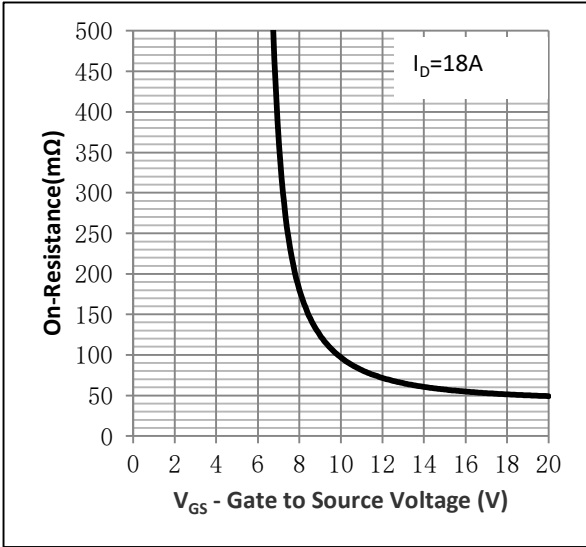


Fig.8 On-Resistance vs. Junction Temperature

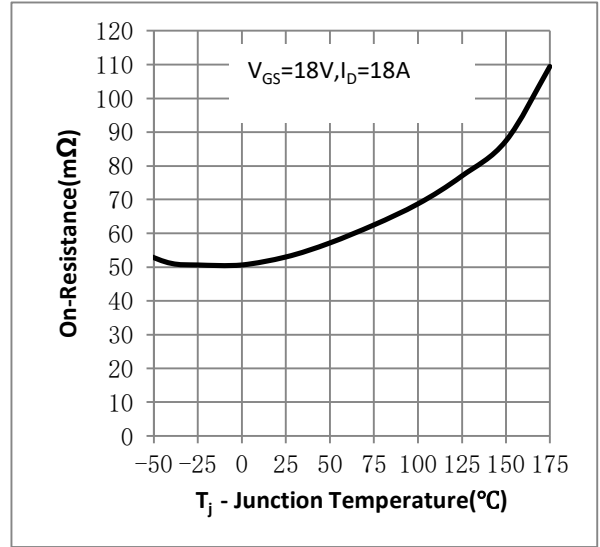


Figure 9. Diode Forward Voltage vs. Current

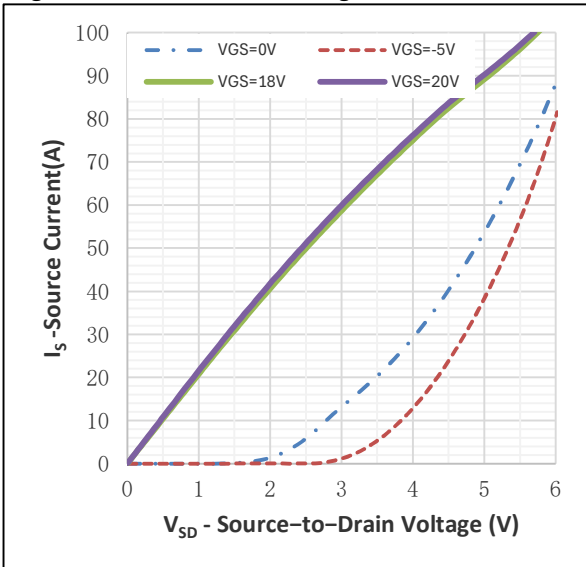


Figure 10. Transfer Characteristics

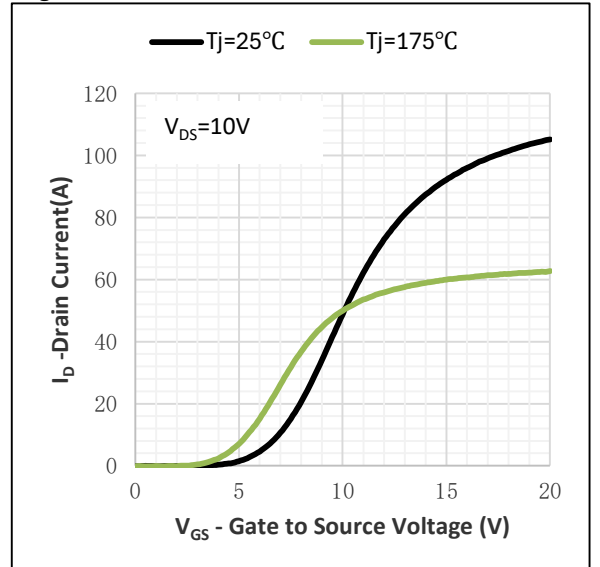


Fig.11 SOA Maximum Safe Operating Area

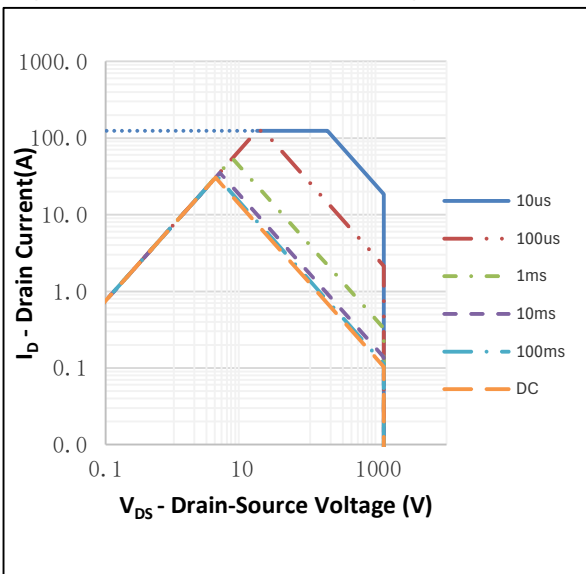


Fig.12 Id vs. Junction Temperature②

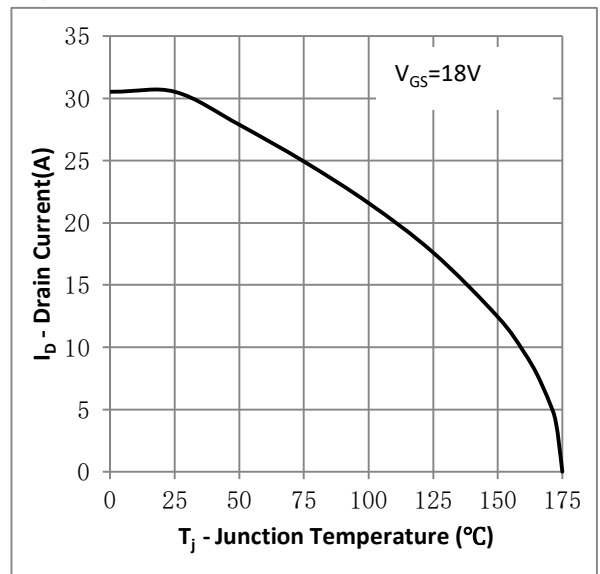


Fig.13 Output Capacitor Stored Energy

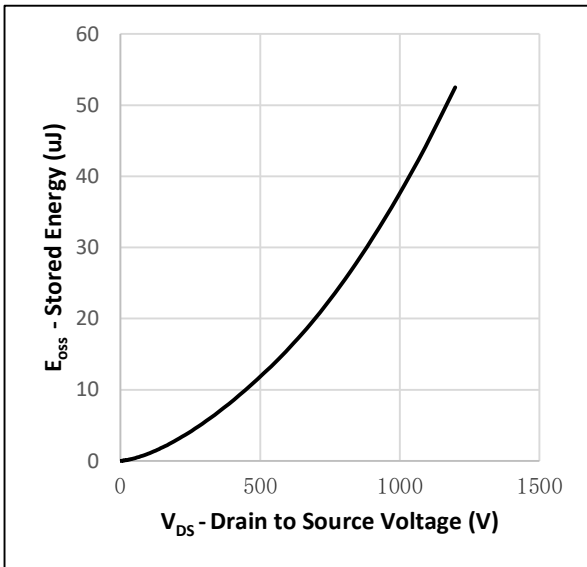
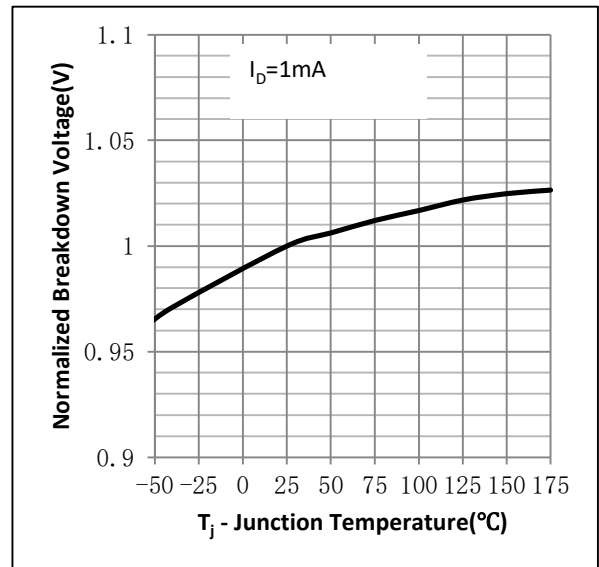
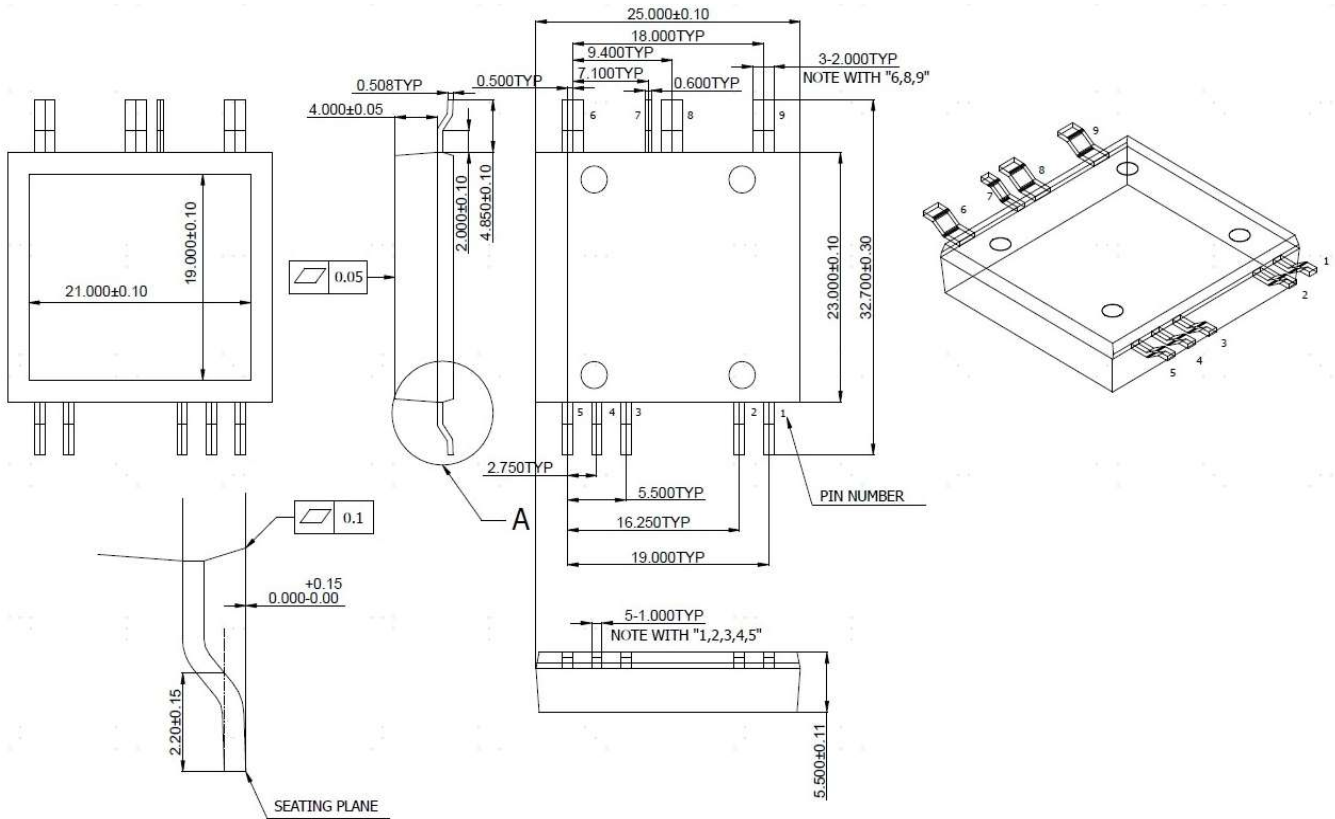


Fig.14 Normalized Breakdown Voltage vs. Junction Temperature



●HSOP9 Package Outline



DETAIL:"A"  
4:1

**Note:**

- ① The value of  $R\theta_{JA}$  is measured with the device in a still air environment with  $T_A=25^{\circ}\text{C}$
- ② Practically the current will be limited by PCB, thermal design and operating temperature.  $V_{GS}=18\text{V}$ .

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**Revision History:**

Version	Date	Change
A	2025/5/16	New