

• General Description

It combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . It suitable for automotive application.

• Features

- AEC-Q101 Qualified
- Low  $R_{DS(ON)}$  to minimize conductive loss
- Low Gate Charge for fast switching
- Low Thermal resistance

• Application

- BLDC Motor driver
- DC-DC
- Battery protection

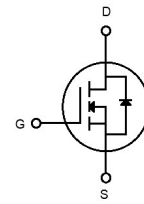
• Ordering Information:

Part NO.	ZMSA011N04HB6
Marking	ZMS011N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	800

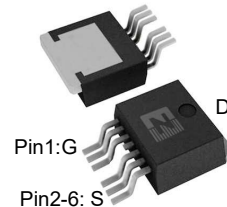
• Absolute Maximum Ratings ( $T_C=25^{\circ}C$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		40	V
Gate-Source Voltage <sup>①</sup>	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^{\circ}C$	155	A
	$I_D$	$T_C=75^{\circ}C$	155	A
	$I_D$	$T_C=100^{\circ}C$	155	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu s$ ; $T_{mb} = 25^{\circ}C$ ;	465	A
Total Power Dissipation	$P_D$	$T_C=25^{\circ}C$	188	W
Total Power Dissipation	$P_D$	$T_A=25^{\circ}C$	5.0	W
Operating Junction Temperature	$T_J$		-55 to +175	$^{\circ}C$
Storage Temperature	$T_{STG}$		-55 to +175	$^{\circ}C$
Single Pulse Avalanche Energy	$E_{AS}$	$L=0.1mH, V_{GS}=10V, R_g=25\Omega,$	320	mJ
		$L=0.5mH, V_{GS}=10V, R_g=25\Omega,$	460	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = 40V$   
 $R_{DS(ON)} = 1.4m\Omega$   
 $I_D = 155A$



Pin1: G  
 Pin2-6: S  
 TO-263-6



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	0.8	°C/W
Thermal resistance, junction-ambient <sup>②</sup>	$R_{thJA}$		-	30	°C/W
Soldering temperature	$T_{sold}$		-	260	°C

**•Electronic Characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	40			V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\mu A$	2.0	2.7	4.0	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{GS} = 0V, V_{DS} = 40V$			1.0	$\mu A$
Gate- Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 40A$		1.4	1.6	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5V, I_{SD} = 20A$		30		s
Diode Forward Voltage	$V_{FSD}$	$V_{GS} = 0V, I_{SD} = 40A$			1.3	V

**•Dynamic characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	$C_{iss}$	$f = 1MHz, V_{DS} = 25V$	-	5430	7059	pF
Output capacitance	$C_{oss}$		-	1520	1976	
Reverse transfer capacitance	$C_{rss}$		-	84	109	
Gate Resistance	$R_g$	$f = 1MHz$	-	1.6	2.9	$\Omega$
Total gate charge	$Q_g$	$V_{DD} = 15V,$ $I_D = 20A,$ $V_{GS} = 10V$	-	87	122	nC
Gate - Source charge	$Q_{gs}$		-	21	29	
Gate - Drain charge	$Q_{gd}$		-	19	27	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = 10V, V_{DS} = 15V,$ $R_G = 3.3\Omega, I_D = 20A$	-	15	23	ns
Turn-ON Rise time	$t_r$		-	10	15	ns
Turn-Off Delay time	$t_{D(off)}$		-	26	39	ns
Turn-Off Fall time	$t_f$		-	17	26	ns
Reverse Recovery Time	$t_{RR}$	$V_{DD} = 20V, di_S/dt =$ $100A/\mu s, I_S = 50A$	-	65	85	ns
Reverse Recovery Charge	$Q_{RR}$		-	95	124	nC

Fig.1 Gate-Charge Characteristics

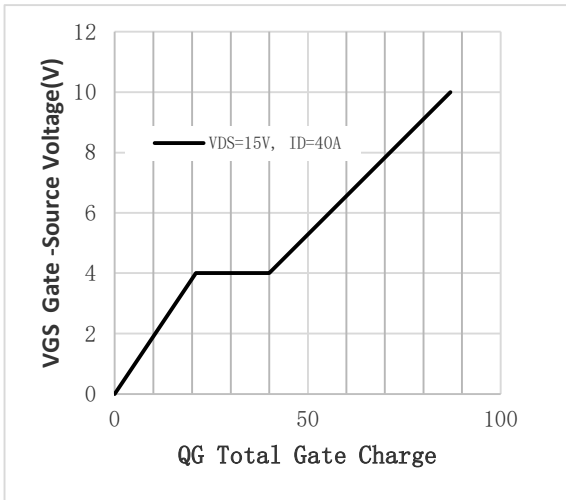


Fig.2 Capacitance Characteristics

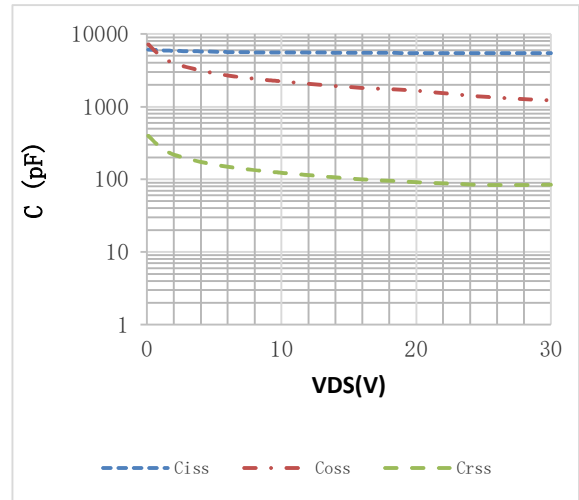


Fig.3 Power Dissipation

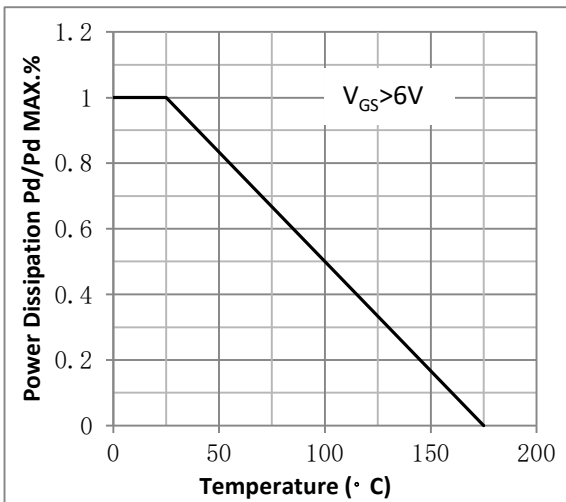


Fig.4 Typical output Characteristics

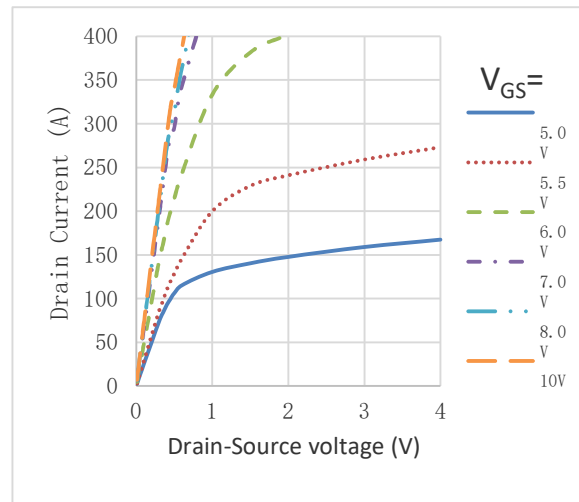


Fig.5 Threshold Voltage V.S Junction Temperature

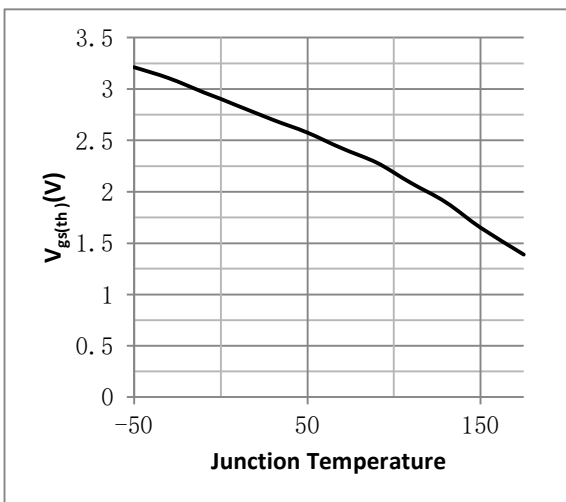


Fig.6 Resistance V.S Drain Current

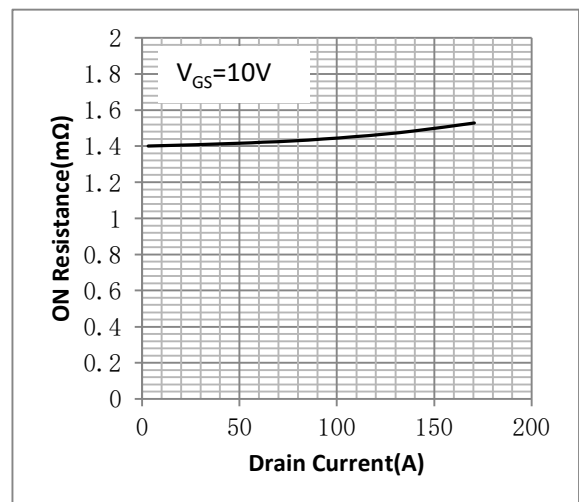


Fig.7 On-Resistance VS Gate Source Voltage

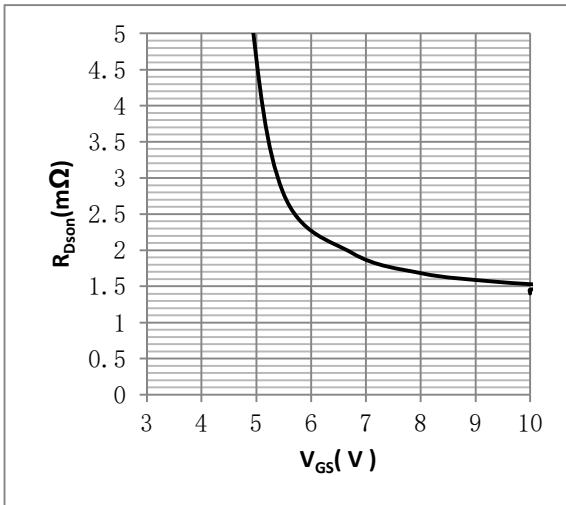


Fig.8 On-Resistance V.S Junction Temperature

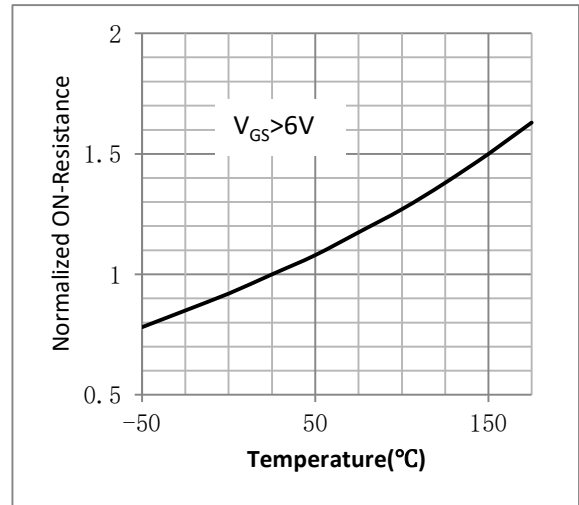


Figure 9. Diode Forward Voltage vs. Current

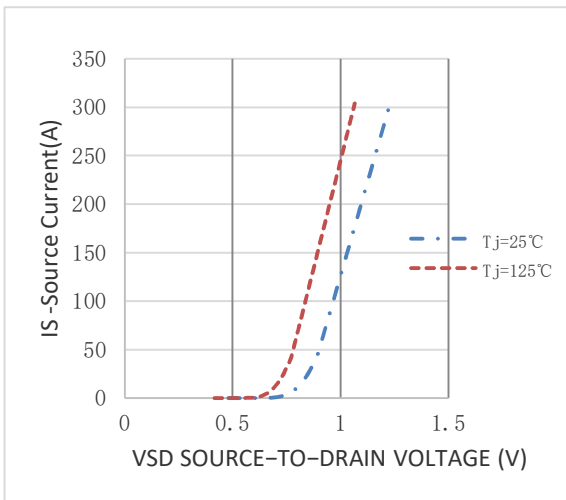


Figure 10. Transfer Characteristics

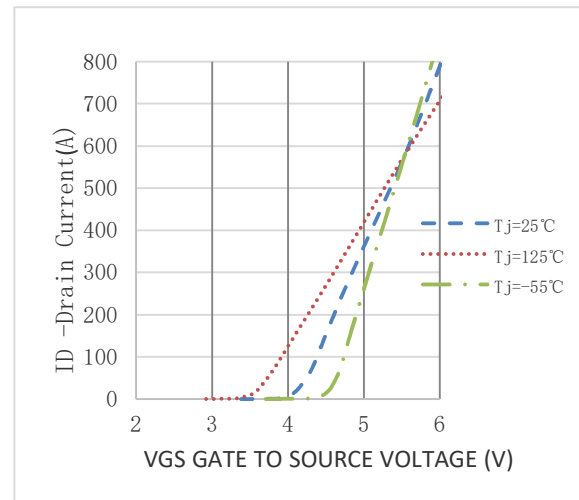


Fig.11 Safe Operating Area

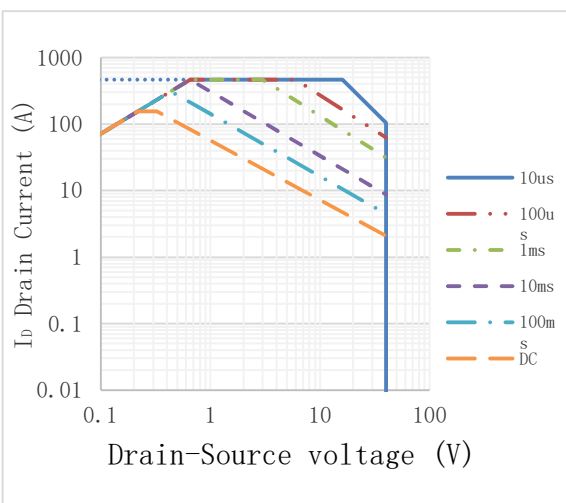
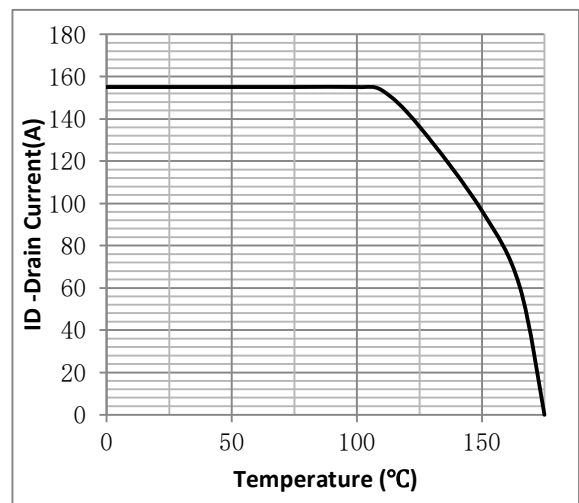
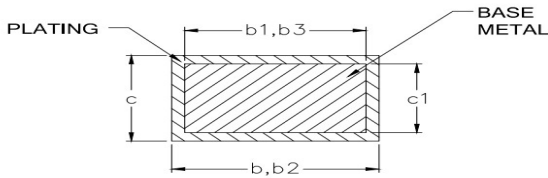
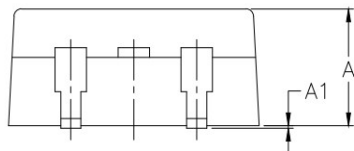
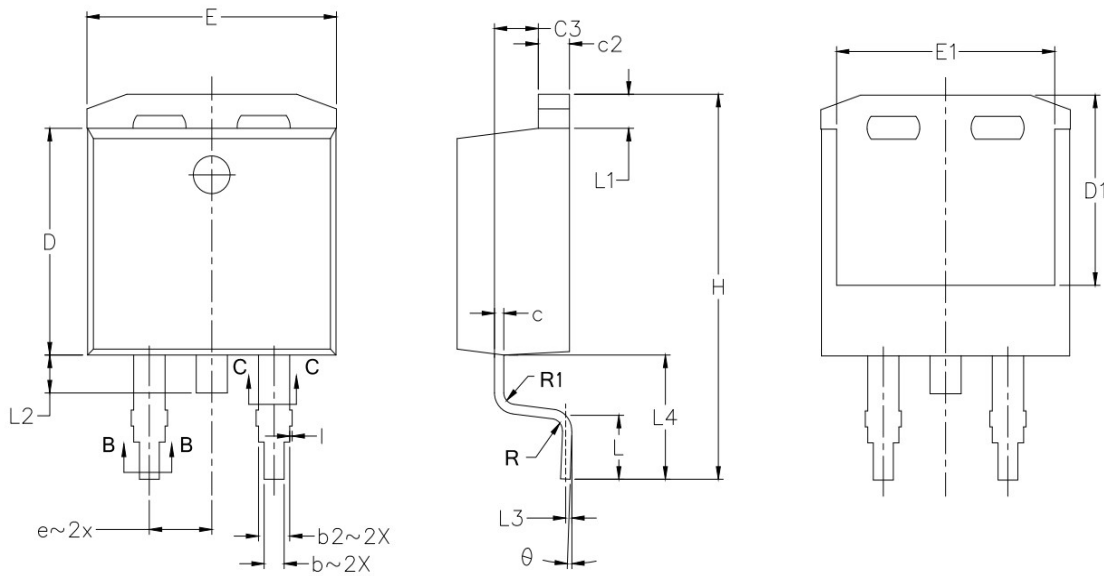


Fig.12 ID vs. Case Temperature<sup>③</sup>



•TO-263-6 Package Outline



SYMBOLS	COMMON			
	MM		INCH	
	MIN.	MAX.	MIN.	MAX.
A	4.064	4.826	0.160	0.190
A1	0.000	0.254	0.000	0.010
b	0.508	0.991	0.020	0.039
b1	0.508	0.889	0.020	0.035
b2	1.143	1.778	0.045	0.070
b3	1.143	1.727	0.045	0.068
c	0.381	0.737	0.015	0.029
c1	0.381	0.584	0.015	0.023
c2	1.143	1.651	0.045	0.065
D	8.382	9.652	0.330	0.380
D1	6.858	—	0.270	—
E	9.652	10.668	0.380	0.420
E1	6.223	—	0.245	—
e	2.540 BSC.		0.100 BSC.	
H	14.605	15.875	0.575	0.625
L	1.778	2.794	0.070	0.110
L1	—	1.676	—	0.066
L2	—	1.778	—	0.070
L3	0.254 BSC		0.010 BSC	
L4	4.780	5.280	0.188	0.208
R	0.460 TYP		0.018 TYP	
R1	0.460 TYP		0.018 TYP	
θ	0°	8°	0°	8°
C3	1.68	1.88	0.0661	0.0740
I	-	0.100	-	0.0039

NOTES:  
 1.Dimension D & E Does Not Include Mold Flash  
 2.Dimension b2 Does Not Include Protrusions

**Note:**

- ① Pulse :  $V_{GS}=+20V/-20V$ , Duty cycle=50%,  $T_j=175^{\circ}C$ ,  $t=1000$  hours; For DC , the following test conditions can be passed:  $V_{GS}=+20V/-10V$ ,  $T_j=175^{\circ}C$ ,  $t=1000$  hours;
- ② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ③ Practically the current will be limited by PCB, thermal design and operating temperature.  $V_{GS}=10V$ .

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## Revision History

Version	Date	Change
A	2022.6.6	
B	2022.9.5	1.Add Reach, HF figure, 2.ID modify
C	2022.11.14	1.Add Dynamic characteristics max limit 2.Add details of dimension drawing
D	2022.12.20	1.Modified id curve , junction temperature change to case
E	2024.11.27	Update RDSON typical value