

• General Description

It combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . It is 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
- Load Switch

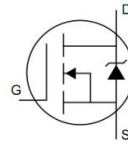
• Ordering Information:

Part NO.	ZMSA011N06HP
Marking	ZMS011N06H
Packing Information	Tube
Basic ordering unit (pcs)	1000

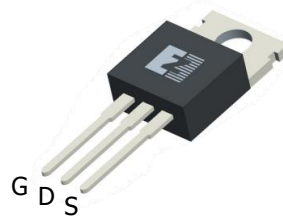
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		60	V
Gate-Source Voltage <sup>①</sup>	$V_{GS}$		±20	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	140	A
	$I_D$	$T_C=75^\circ\text{C}$	140	A
	$I_D$	$T_C=100^\circ\text{C}$	134	A
Pulsed Drain Current <sup>①</sup>	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	560	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	179	W
Total Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	2.0	W
Operating Junction Temperature	$T_J$		-55 to +175	°C
Storage Temperature	$T_{STG}$		-55 to +175	°C
Single Pulse Avalanche Energy	$E_{AS}$	$L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	270	mJ
		$L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	621	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = 60\text{V}$   
 $R_{DS(ON)} = 1.4\text{m}\Omega$   
 $I_D = 140\text{A}$



TO-220



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	0.7	°C/W
Thermal resistance, junction-ambient	$R_{thJA}$		-	62	°C/W
Soldering temperature (total time<10s)	$T_{sold}$		-	260	°C

**•Electronic Characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	60			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	$I_{DSS}$	$V_{GS} = 0V, V_{DS} = 60V$			1.0	$\mu A$
Gate- Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 30A$		1.4	1.9	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5V, I_{SD} = 20A$		45		S
Diode Forward Voltage	$V_{FSD}$	$V_{GS} = 0V, I_{SD} = 30A$			1.3	V

**•Dynamic characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	$C_{iss}$	$f = 1MHz, V_{DS} = 25V$	-	8000	-	pF
Output capacitance	$C_{oss}$		-	3200	-	
Reverse transfer capacitance	$C_{rss}$		-	160	-	
Gate Resistance	$R_g$	$f = 1MHz$	-	1.6		$\Omega$
Total gate charge	$Q_g$	$V_{DD} = 15V, I_D = 20A, V_{GS} = 10V$	-	142	-	nC
Gate - Source charge	$Q_{gs}$		-	42	-	
Gate - Drain charge	$Q_{gd}$		-	29	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = 10V, V_{DS} = 15V, R_G = 3.3\Omega, I_D = 20A$	-	30	-	ns
Turn-ON Rise time	$t_r$		-	12	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	65	-	ns
Turn-Off Fall time	$t_f$		-	14	-	ns
Reverse Recovery Time	$t_{RR}$		$V_{DD} = 20V, di_S/dt = 100A/\mu s, I_S = 50A$	-	72	-
Reverse Recovery Charge	$Q_{RR}$		-	98	-	nC

Fig.1 Gate-Charge Characteristics

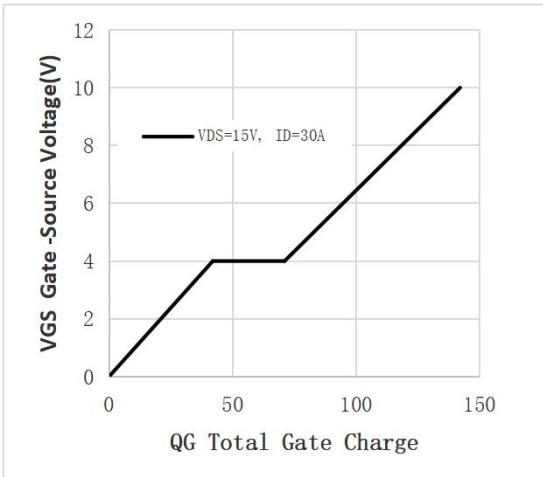


Fig.2 Capacitance Characteristics

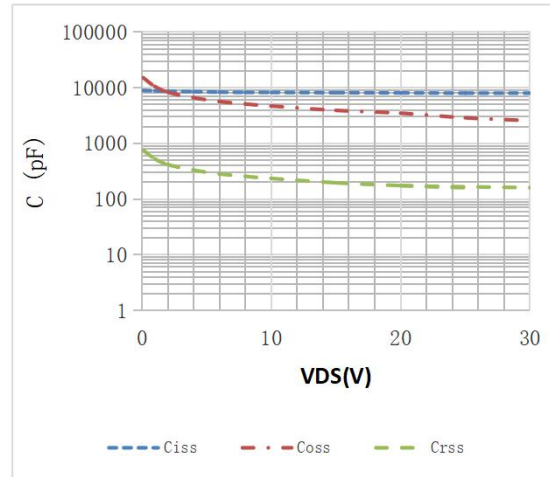


Fig.3 Power Dissipation

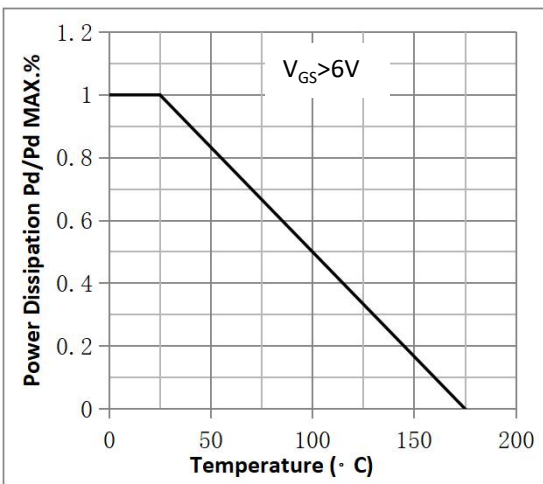


Fig.4 Typical output Characteristics

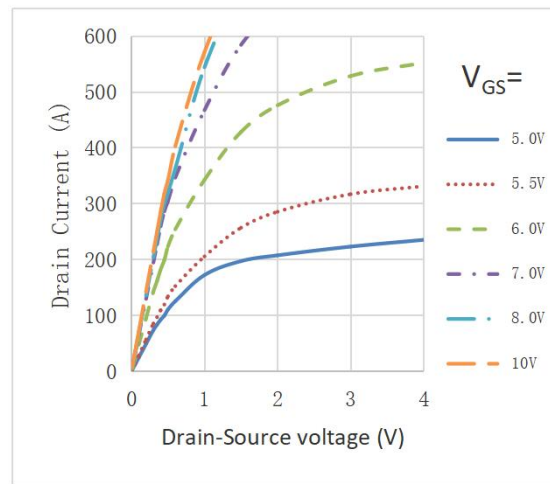


Fig.5 Threshold Voltage V.S Junction Temperature

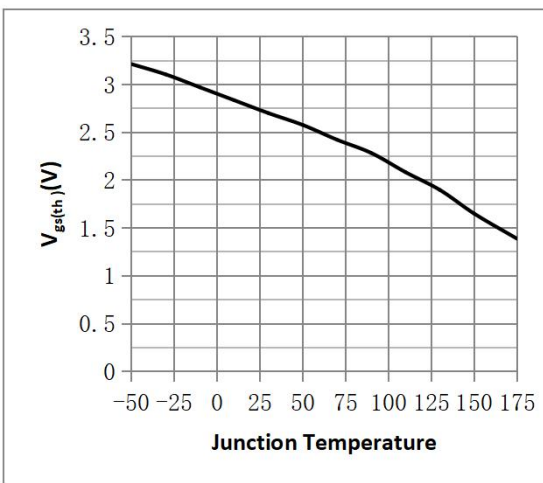


Fig.6 Resistance V.S Drain Current

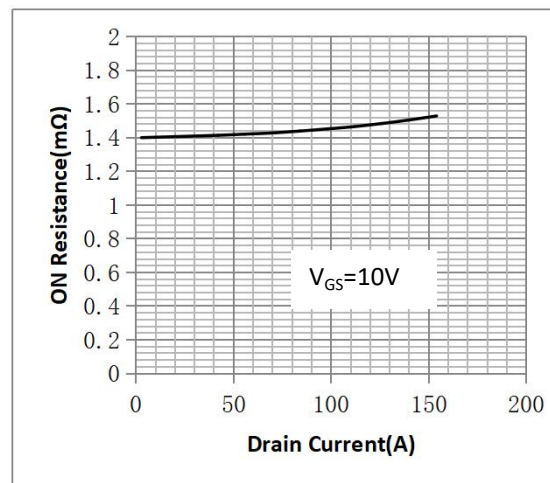


Fig.7 On-Resistance VS Gate Source Voltage

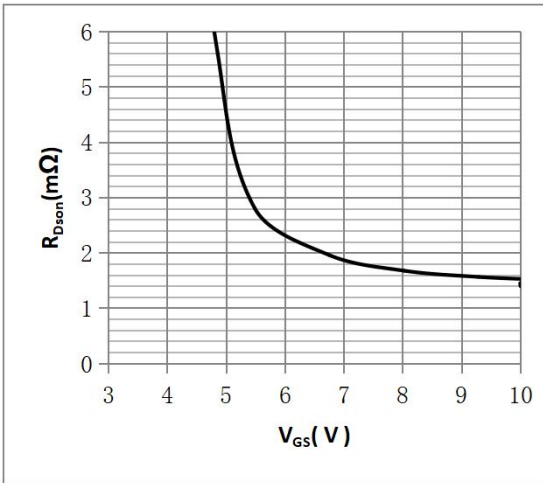


Fig.8 On-Resistance V.S Junction Temperature

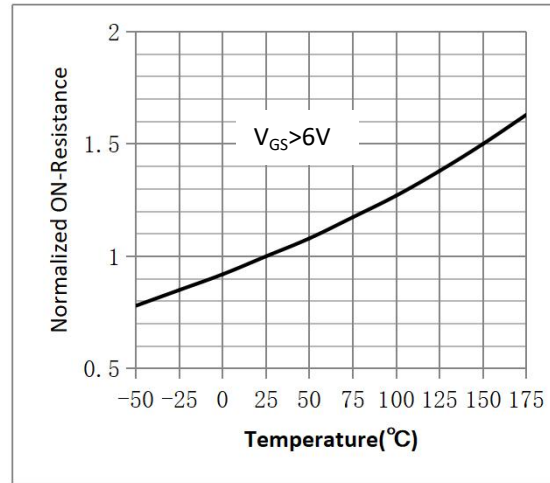


Figure 9. Diode Forward Voltage vs. Current

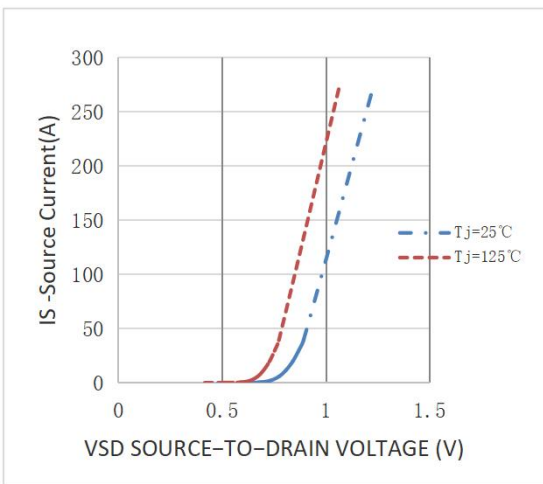


Figure 10. Transfer Characteristics

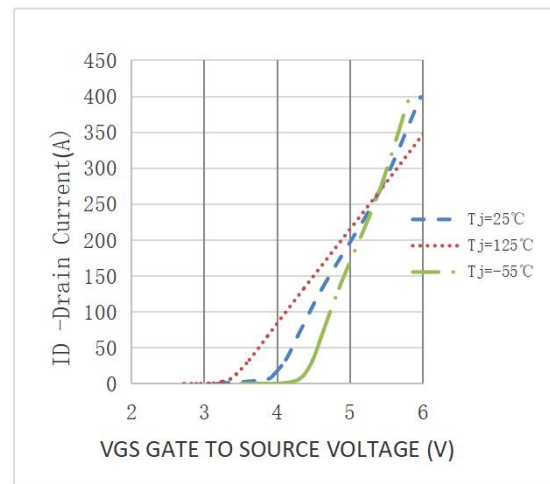


Fig.11 Safe Operating Area

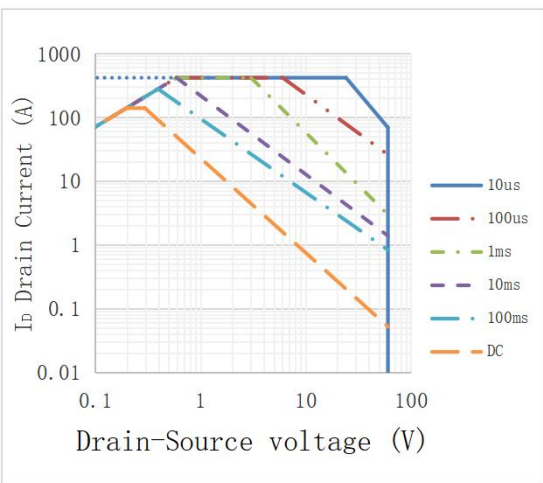
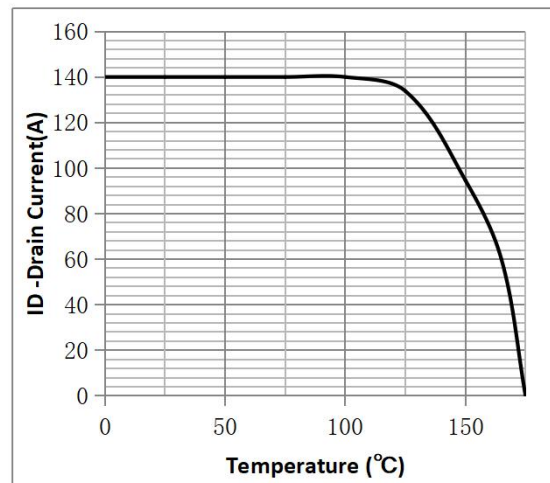
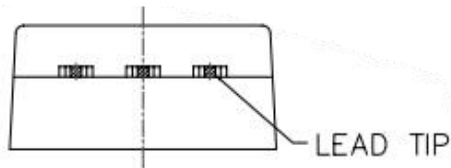
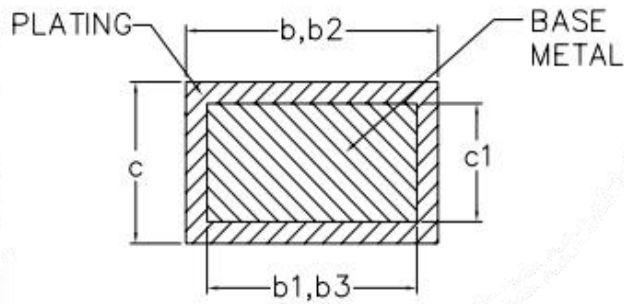
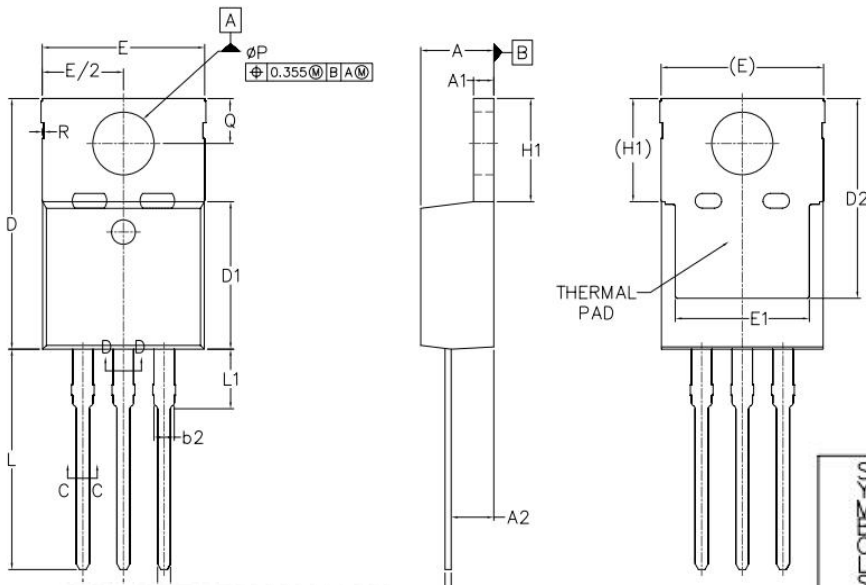


Fig.12 ID vs. Junction Temperature<sup>②</sup>



•TO-220 Package Outline



SYMBOLS	COMMON	
	MM	
	MIN.	MAX.
A	3.556	4.826
A1	0.508	1.397
A2	2.032	2.921
b	0.381	1.016
b1	0.381	0.965
b2	1.143	1.778
b3	1.143	1.727
c	0.356	0.610
c1	0.356	0.559
D	14.224	16.510
D1	8.382	9.017
D2	12.042	12.878
E	9.652	10.668
E1	6.858	8.890
e	2.540 BSC.	
H1	5.842	6.858
L	12.700	14.732
L1	3.560	4.060
∅P	3.810	3.860
Q	2.540	3.048
R	0.127 BSC	

**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 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	2022.4.6	New
B	2022.10.21	1.Fig.1~Fig11 modify 2.Idm corrected 3.Add Reach,HF figure 4.add "It is suitable for automotive application." 5.modify as "total time<10s)"
C	2023.12.22	Correct Package Outline Dimension