

• General Description

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

• Features

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

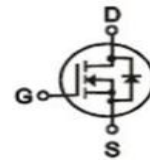
• Application

- BLDC Motor driver
- DC-DC
- Battery protection

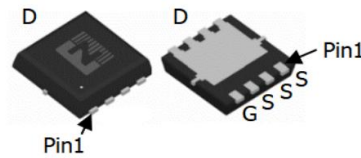
• Ordering Information:

Part NO.	ZMSA012N04HNC
Marking	ZMS012N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

• Product Summary



$V_{DS} = 40V$   
 $R_{DS(ON)} = 1.2m\Omega$   
 $I_D = 236A$



DFN5\*6



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

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-Source Voltage	$V_{DS}$	$25^\circ C \leq T_J \leq 175^\circ C$	40		V
Gate-Source Voltage	$V_{GS}$	Pulsed <sup>①</sup>	-20	20	V
Continuous Drain Current	$I_D$	$T_C=25^\circ C$		236	A
	$I_D$	$T_C=75^\circ C$		236	A
	$I_D$	$T_C=100^\circ C$		210	A
Pulsed Drain Current <sup>①</sup>	$I_{DM}$	Pulsed; $t_p \leq 10 \mu s$ ; $T_{mb} = 25^\circ C$ ;		944	A
Total Power Dissipation	$P_D$	$T_C=25^\circ C$		136	W
Total Power Dissipation	$P_D$	$T_A=25^\circ C$		3.8	W
Operating Junction Temperature	$T_J$		-55	175	$^\circ C$
Storage Temperature	$T_{STG}$		-55	175	$^\circ C$
Single Pulse Avalanche Energy	$E_{AS}$	$L=0.1mH, V_{GS}=10V, R_g=25\Omega,$		210	mJ
ESD Level (HBM)			CLASS 2		

**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	RthJC		-	1.1	°C/W
Thermal resistance, junction-ambient	RthJA <sup>②</sup>		-	40	°C/W
Soldering temperature	Tsold		-	260	°C

**•Electronic Characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250uA	40			V
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250uA	2	2.7	4	V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 40V			1	uA
Gate- Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			100	nA
Static Drain-source On Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 40A		1.2	1.6	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>GS</sub> = 5V, I <sub>SD</sub> = 20A		15		s
Diode Forward Voltage	V <sub>FSD</sub>	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 40A			1.3	V

**•Dynamic characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V <sub>DS</sub> = 25V	-	2912	-	pF
Output capacitance	Coss		-	806	-	
Reverse transfer capacitance	Crss		-	60	-	
Gate Resistance	Rg	f = 1MHz	-	1.6		Ω
Total gate charge	Qg	V <sub>DD</sub> = 15V, I <sub>D</sub> = 20A, V <sub>GS</sub> = 10V	-	49	-	nC
Gate - Source charge	Qgs		-	9.5	-	
Gate - Drain charge	Qgd		-	11	-	
Turn-ON Delay time	t <sub>D(on)</sub>	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 15V, R <sub>G</sub> = 3.3Ω, I <sub>D</sub> = 20A	-	10	-	ns
Turn-ON Rise time	t <sub>r</sub>		-	9	-	ns
Turn-Off Delay time	t <sub>D(off)</sub>		-	16	-	ns
Turn-Off Fall time	t <sub>f</sub>		-	12	-	ns
Reverse Recovery Time	t <sub>RR</sub>	V <sub>DD</sub> = 20V, di <sub>S</sub> /dt = 100A/s, I <sub>S</sub> = 50A	-	52	-	ns
Reverse Recovery Charge	Q <sub>RR</sub>		-	61	-	nC

Fig.1 Gate-Charge Characteristics

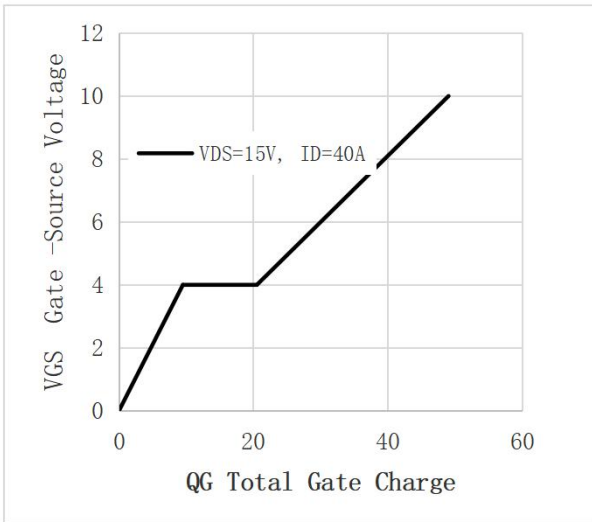


Fig.2 Capacitance Characteristics

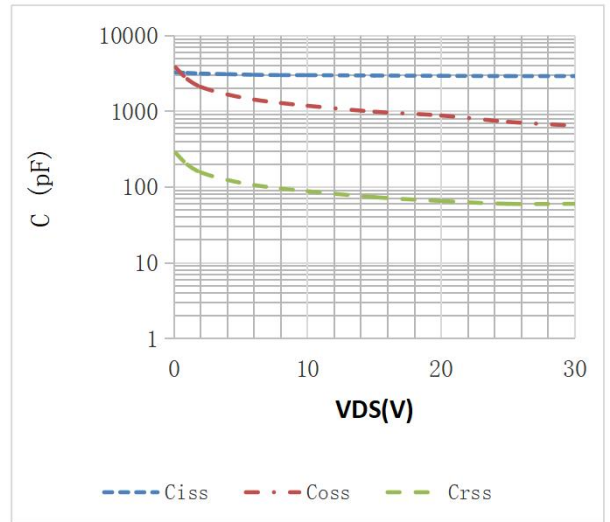


Fig.3 Power Dissipation

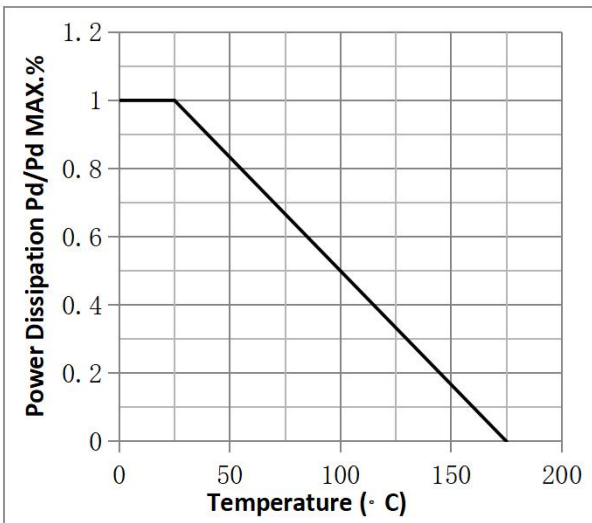


Fig.4 Typical output Characteristics

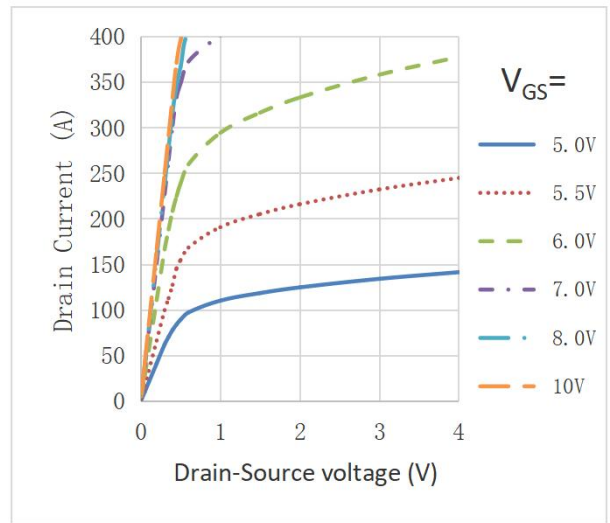


Fig.5 Threshold Voltage V.S Junction Temperature

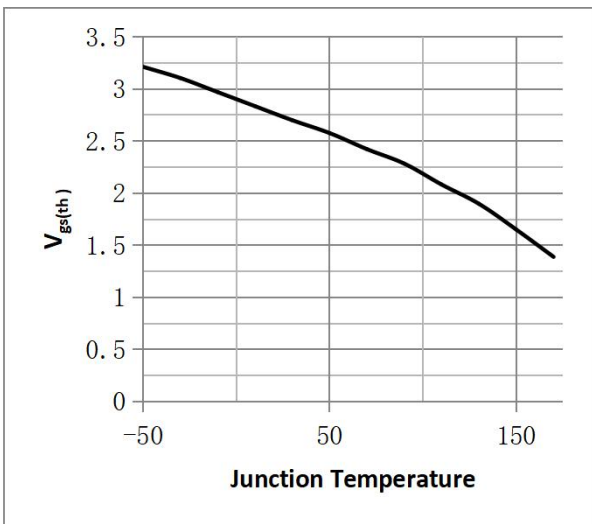


Fig.6 Resistance V.S Drain Current

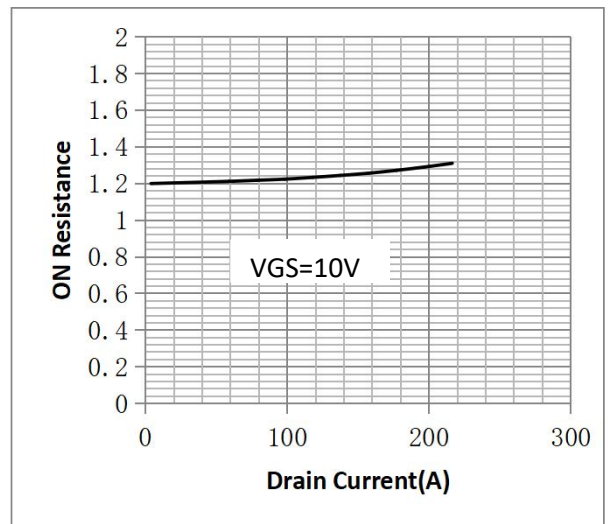


Fig.7 On-Resistance VS Gate Source Voltage

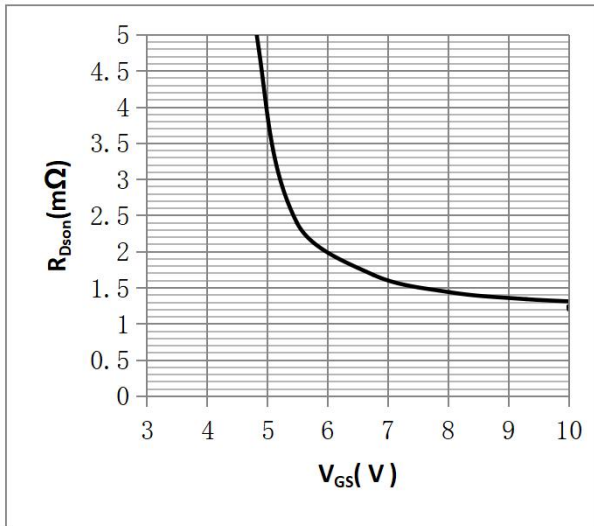


Fig.8 On-Resistance V.S Junction Temperature

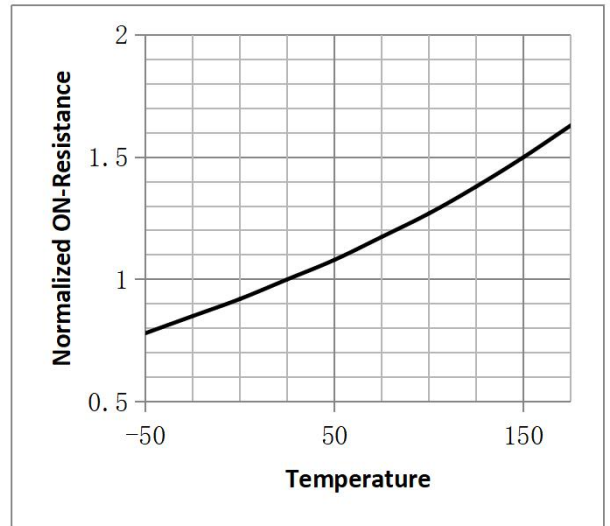


Figure 9. Diode Forward Voltage vs. Current

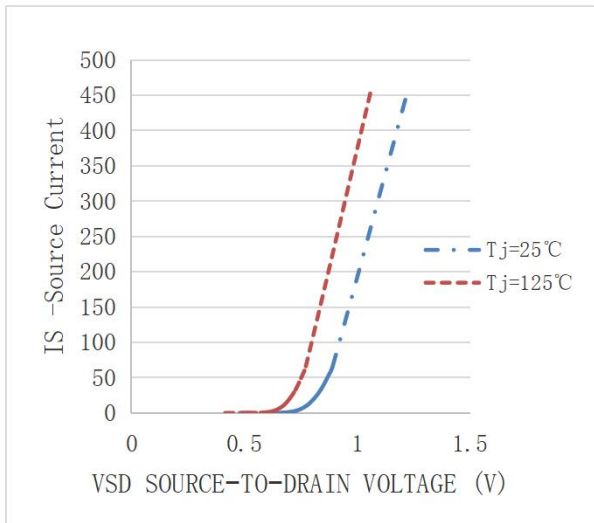


Figure 10. Transfer Characteristics

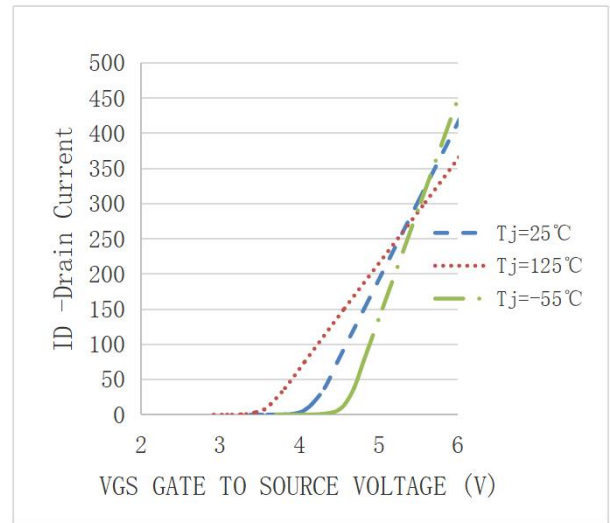


Fig.11 SOA Maximum Safe Operating Area

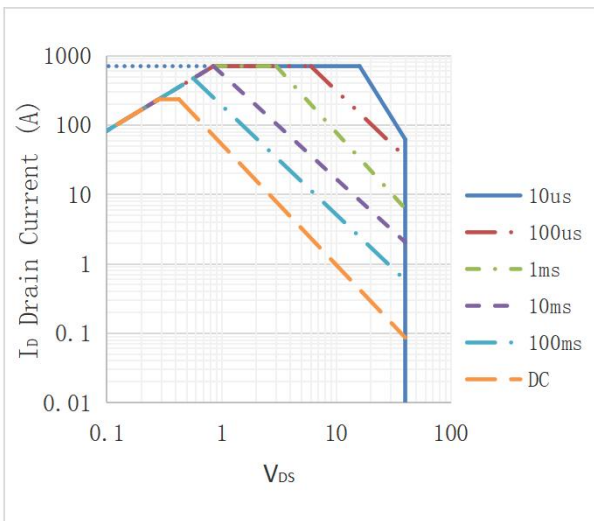
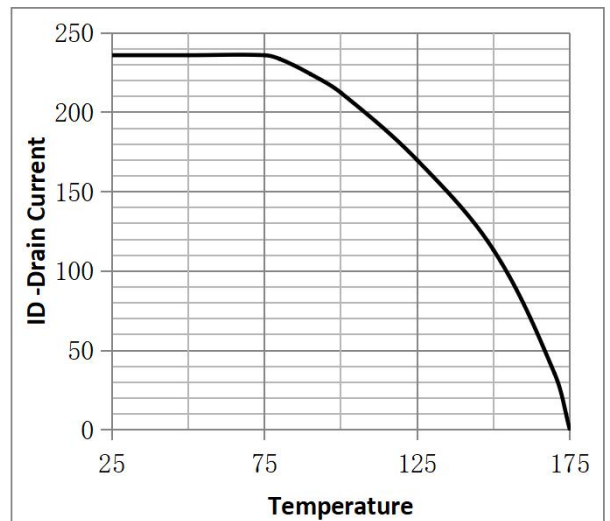
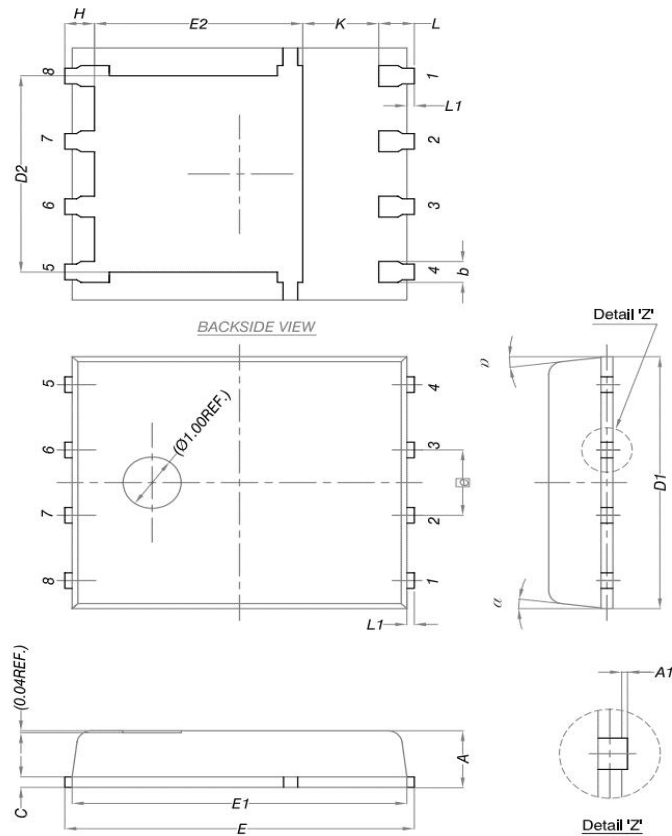


Fig.12 ID vs. Junction Temperature



•DFN5\*6 Package Outline



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0	-	0.05
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
α	0°	-	12°

**Note:**

- ① Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ , Accumulation time  $\leq 50$  hours; For DC , the following test conditions can be passed: VGS=+20V/-10V, Tj=175°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;

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