

• 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
- Battery protection

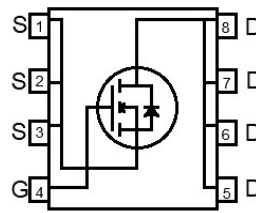
• Ordering Information:

Part NO.	ZMSA090N04M
Marking	090N04
Packing Information	REEL TAPE
Basic ordering unit (pcs)	5000

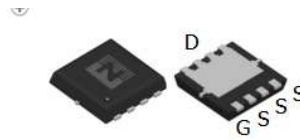
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

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	$I_D$	$T_C=25^\circ\text{C}$	46	A
	$I_D$	$T_C=75^\circ\text{C}$	38	A
	$I_D$	$T_C=100^\circ\text{C}$	33	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	184	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	34	W
Total Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	3.0	W
Operating Junction Temperature	$T_J$		-55 to +175	$^\circ\text{C}$
Storage Temperature	$T_{STG}$		-55 to +175	$^\circ\text{C}$
Single Pulse Avalanche Energy	$E_{AS}$	$L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	21	mJ
		$L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	38	mJ
ESD Level (HBM)	CLASS 1B			

• Product Summary



$V_{DS} = 40\text{V}$   
 $R_{DS(ON)} = 6.2\text{m}\Omega$   
 $I_D = 46\text{A}$



DFN3\*3



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$	-	-	4.4	°C/W
Thermal resistance, junction-ambient	$R_{thJA}^{②}$	-	-	50	°C/W
Soldering temperature (total time<10s)	$T_{sold}$	-	-	260	°C

**•Electronic Characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.2	1.8	2.5	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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=14A$	-	6.2	8	$m\Omega$
		$V_{GS}=4.5V, I_D=10A$	-	10	12.5	$m\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_{SD}=5A$	-	17	-	S
Diode Forward Voltage	$V_{FSD}$	$V_{GS}=0V, I_{SD}=14A$	-	-	1.3	V

**•Dynamic characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	$C_{iss}$	$f=1MHz, V_{DS}=25V$	-	693	-	pF
Output capacitance	$C_{oss}$		-	265	-	
Reverse transfer capacitance	$C_{rss}$		-	29	-	
Gate Resistance	$R_g$	$f=1MHz$	-	2.7	-	$\Omega$
Total gate charge	$Q_g$	$V_{DD}=15V, I_D=20A, V_{GS}=10V$	-	14	-	nC
Gate - Source charge	$Q_{gs}$		-	2.2	-	
Gate - Drain charge	$Q_{gd}$		-	4	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$	-	4	-	ns
Turn-ON Rise time	$t_r$		-	2.5	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	9	-	ns
Turn-Off Fall time	$t_f$		-	4	-	ns
Reverse Recovery Time	$t_{RR}$	$V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=50A$	-	31	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	26	-	nC

Fig.1 Gate-Charge Characteristics

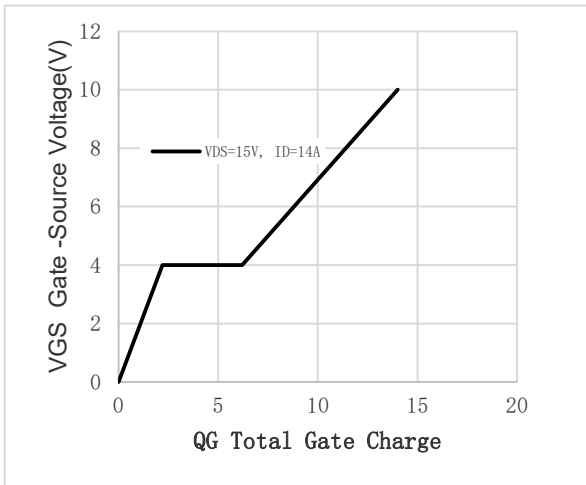


Fig.2 Capacitance Characteristics

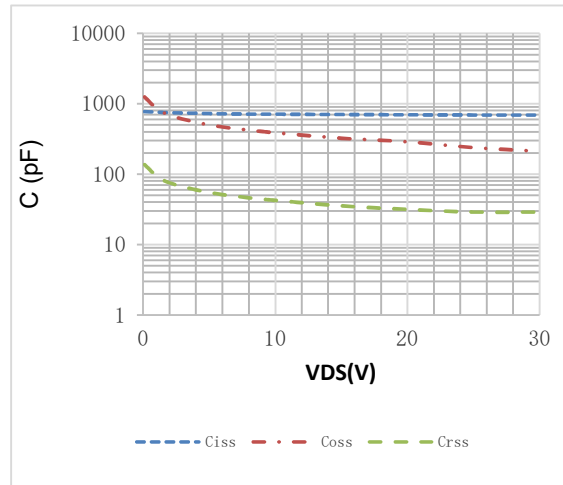


Fig.3 Power Dissipation

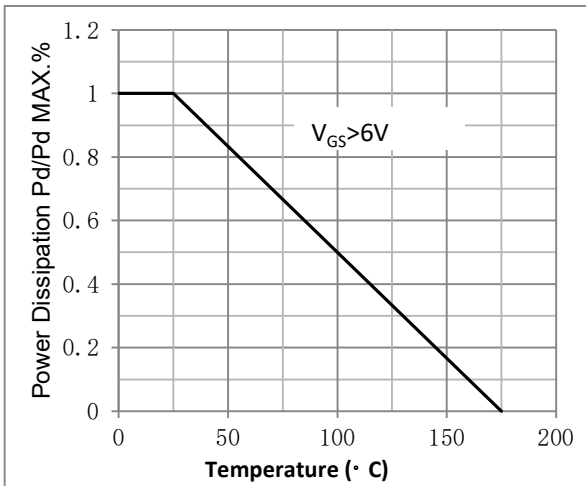


Fig.4 Typical output Characteristics

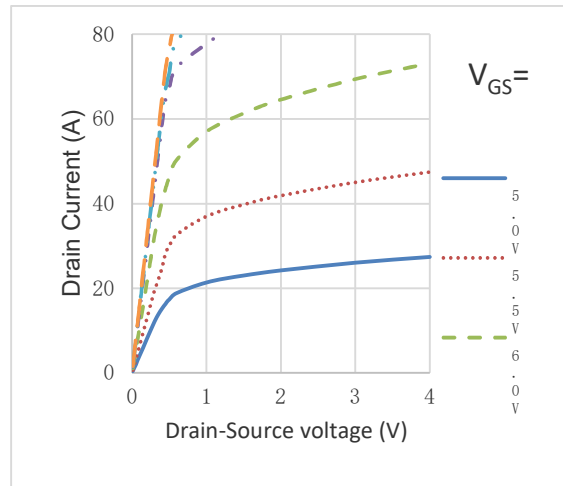


Fig.5 Threshold Voltage V.S Junction Temperature

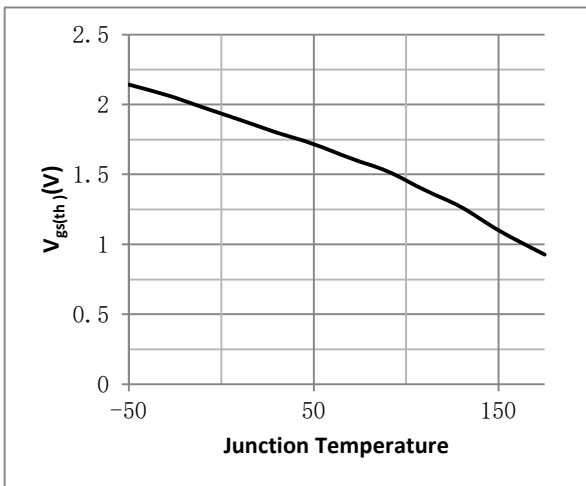


Fig.6 Resistance V.S Drain Current

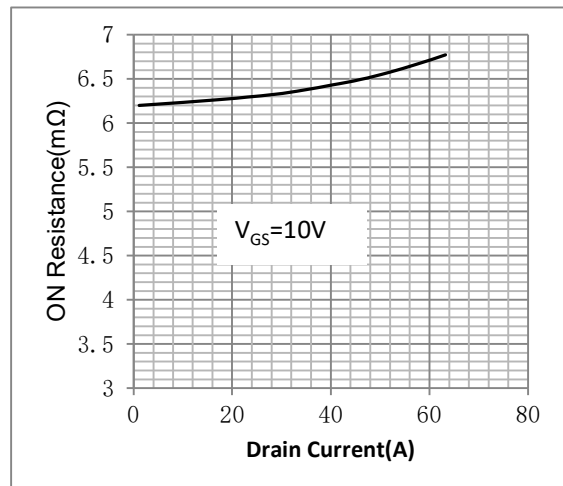


Fig.7 On-Resistance VS Gate Source Voltage

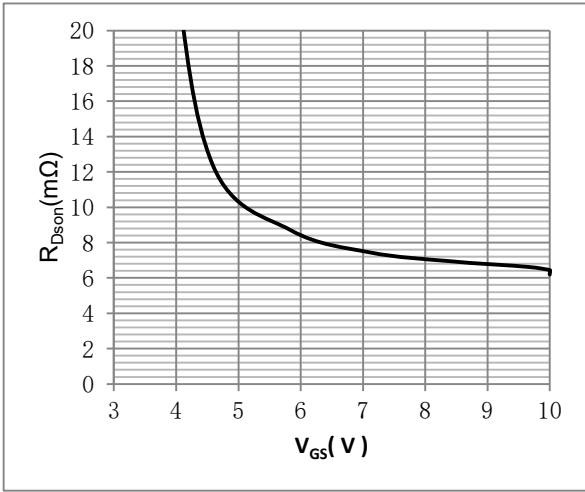


Fig.8 On-Resistance V.S Junction Temperature

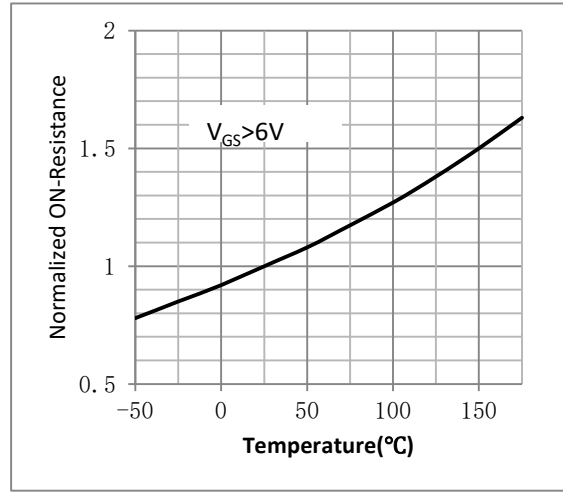


Figure 9. Diode Forward Voltage vs. Current

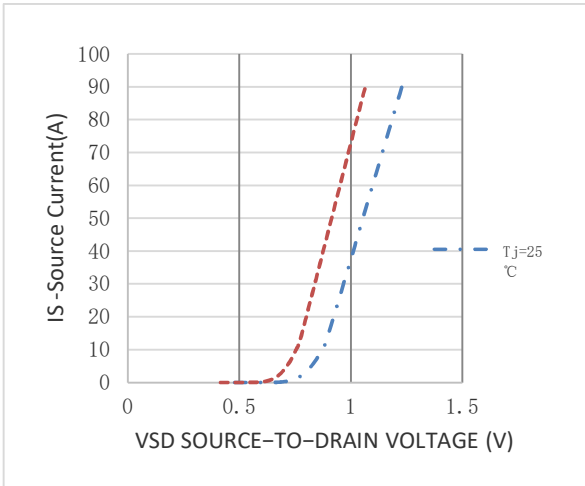


Figure 10. Transfer Characteristics

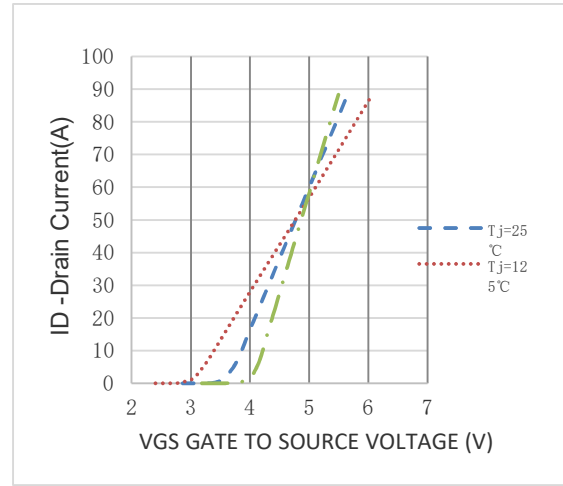


Fig.11 Safe Operating Area

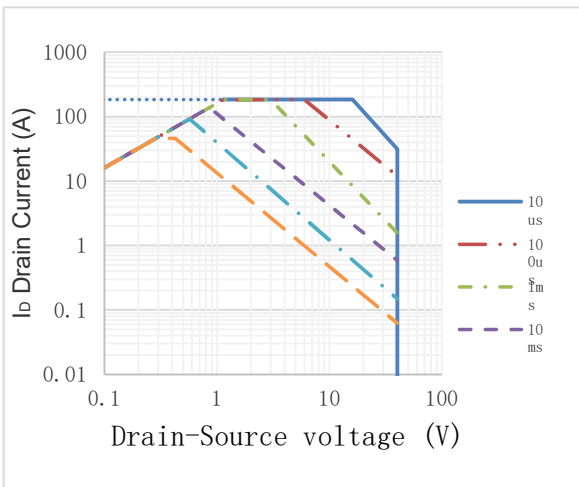
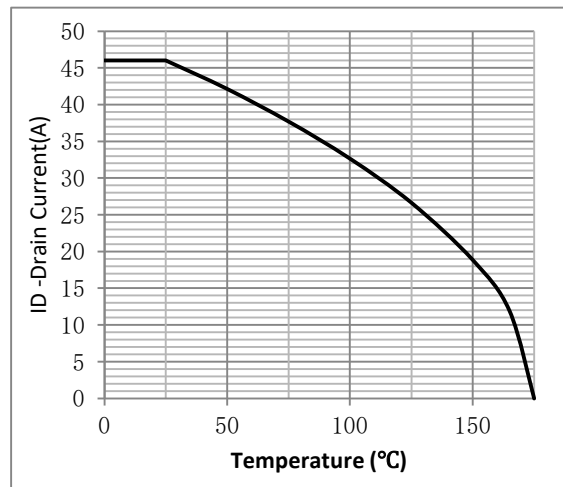
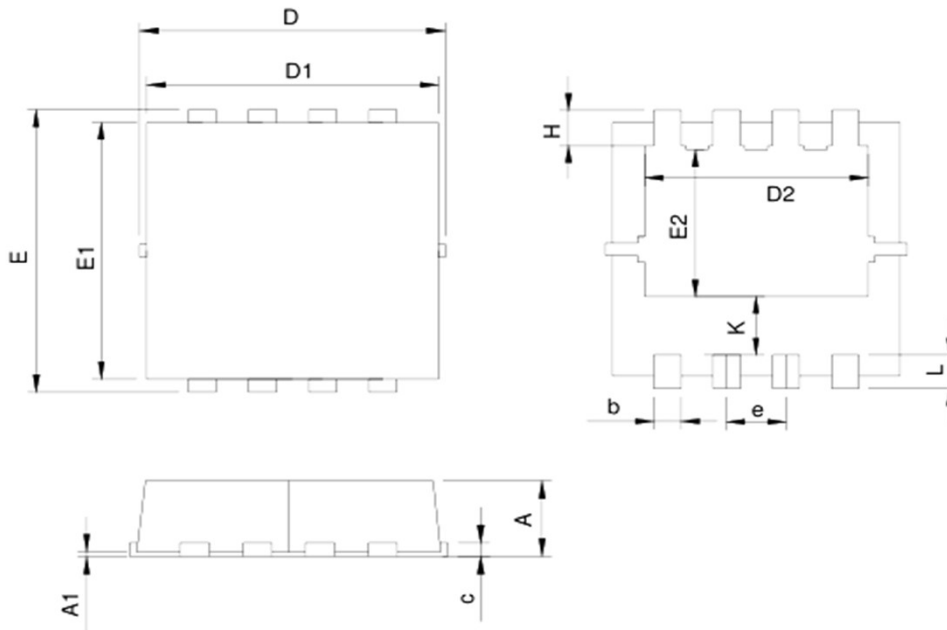


Fig.12 ID vs. Junction Temperature<sup>③</sup>

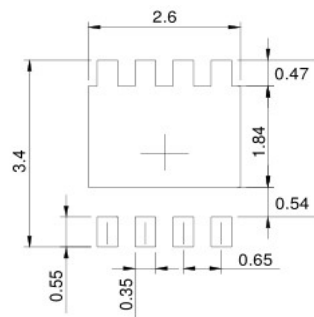


•DFN3\*3 Package Outline



SYMBOL	DFN3.3x3.3-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.70	1.00	0.028	0.039
A1	0.00	0.05	0.000	0.002
b	0.25	0.35	0.010	0.014
c	0.14	0.20	0.006	0.008
D	3.10	3.50	0.122	0.138
D1	3.05	3.25	0.120	0.128
D2	2.35	2.55	0.093	0.100
E	3.10	3.50	0.122	0.138
E1	2.90	3.10	0.114	0.122
E2	1.64	1.84	0.065	0.072
e	0.65 BSC		0.026 BSC	
H	0.32	0.52	0.013	0.020
K	0.59	0.79	0.023	0.031
L	0.25	0.55	0.010	0.022

RECOMMENDED LAND PATTERN



UNIT: mm

**Note:**

- ① Pulse : VGS=+20V/-20V, Duty cycle=50%, Tj=175°C, t=1000 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;
- ③ Practically the current will be limited by PCB, thermal design and operating temperature. V<sub>GS</sub>=10V.

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## Revision History

Version	Date	Change
A	2024.2.16	New
B	2024.12.23	Add RDSON@4.5V specification