

40V N-Channel Power SpeedFET

• 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
- Load Switch

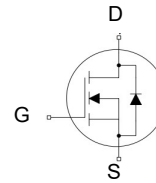
• Ordering Information:

Part NO.	ZMSA005N04HR
Marking	ZMS005N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	2000

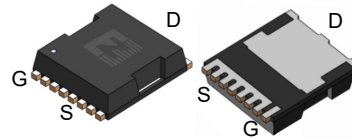
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

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	$I_D$	$T_C=25^\circ\text{C}$	390	A
	$I_D$	$T_C=75^\circ\text{C}$	390	A
	$I_D$	$T_C=100^\circ\text{C}$	345	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	1560	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	375	W
Total Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	4.2	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	$E_{AS}$	$L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	756	mJ
		$L=0.3\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	1210	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = 40\text{V}$   
 $R_{DS(ON)} = 0.52\text{m}\Omega$   
 $I_D = 390\text{A}$



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**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	0.4	°C/W
Thermal resistance, junction-ambient	$R_{thJA}^{②}$		-	36	°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	2.7	4	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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 40A$		0.52	0.65	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5V, I_{SD} = 10A$		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	$C_{iss}$	$f = 1MHz, V_{DS} = 25V$	-	10620	-	pF
Output capacitance	$C_{oss}$		-	2810	-	
Reverse transfer capacitance	$C_{rss}$		-	115	-	
Gate Resistance	$R_g$	$f = 1MHz$	-	1.6		$\Omega$
Total gate charge	$Q_g$	$V_{DD} = 15V, I_D = 20A, V_{GS} = 10V$	-	155	-	nC
Gate - Source charge	$Q_{gs}$		-	35	-	
Gate - Drain charge	$Q_{gd}$		-	32	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = 10V, V_{DS} = 15V, R_G = 3.3\Omega, I_D = 20A$	-	65	-	ns
Turn-ON Rise time	$t_r$		-	31	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	85	-	ns
Turn-Off Fall time	$t_f$		-	78	-	ns
Reverse Recovery Time	$t_{RR}$	$V_{DD} = 20V, dI_S/dt = 100A/\mu s, I_S = 50A$	-	97	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	135	-	nC

Fig.1 Gate-Charge Characteristics

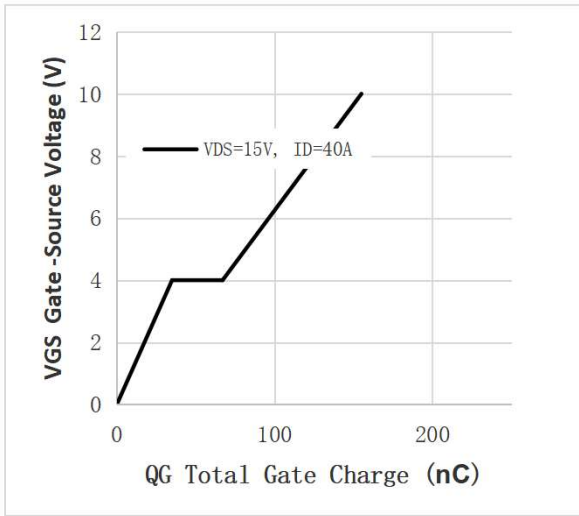


Fig.2 Capacitance Characteristics

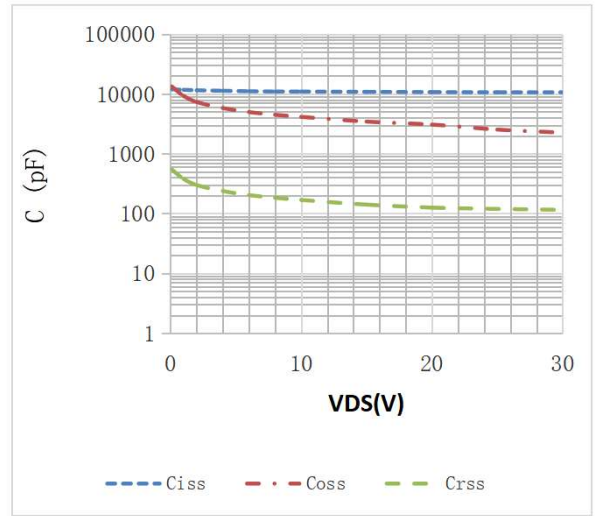


Fig.3 Power Dissipation

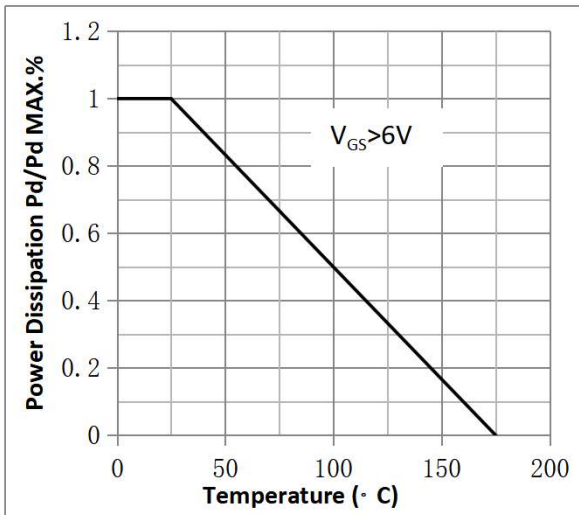


Fig.4 Typical output Characteristics

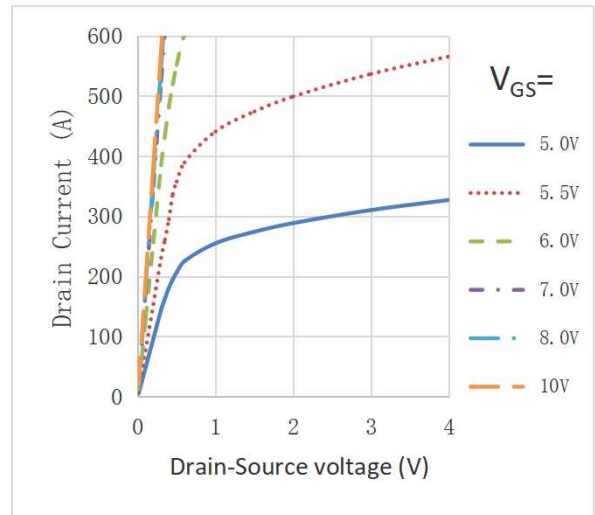


Fig.5 Threshold Voltage V.S Junction Temperature

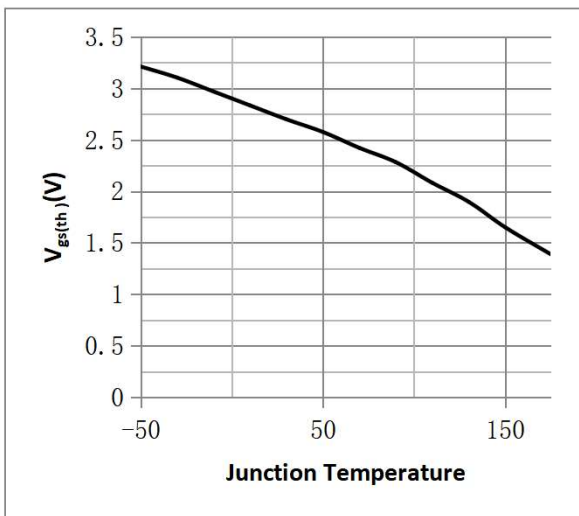


Fig.6 Resistance V.S Drain Current

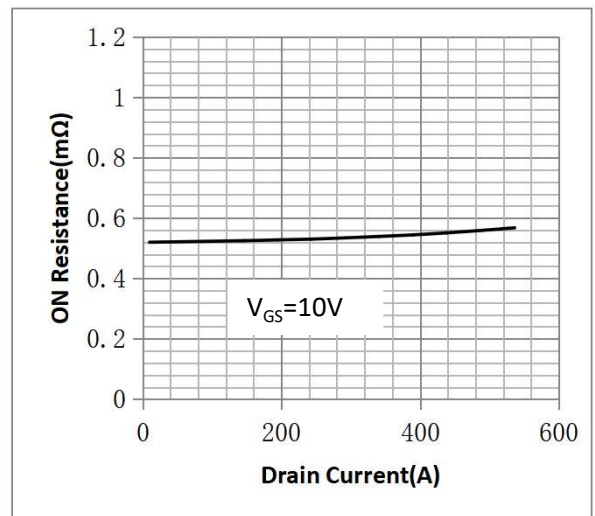


Fig.7 On-Resistance VS Gate Source Voltage

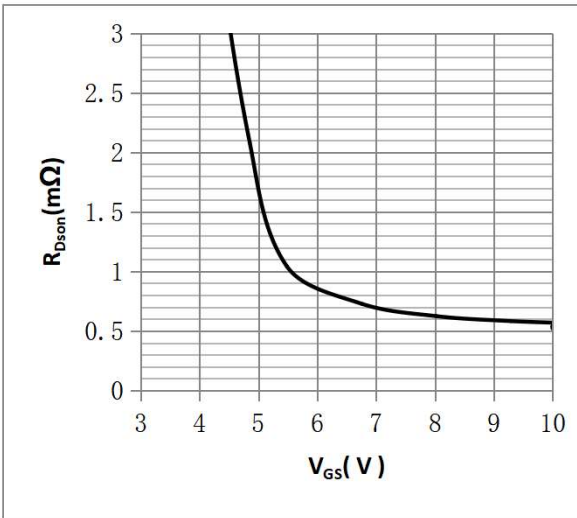


Fig.8 On-Resistance V.S Junction Temperature

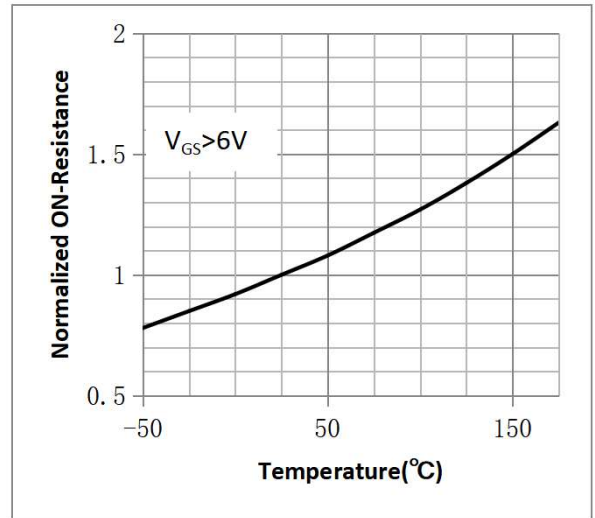


Figure 9. Diode Forward Voltage vs. Current

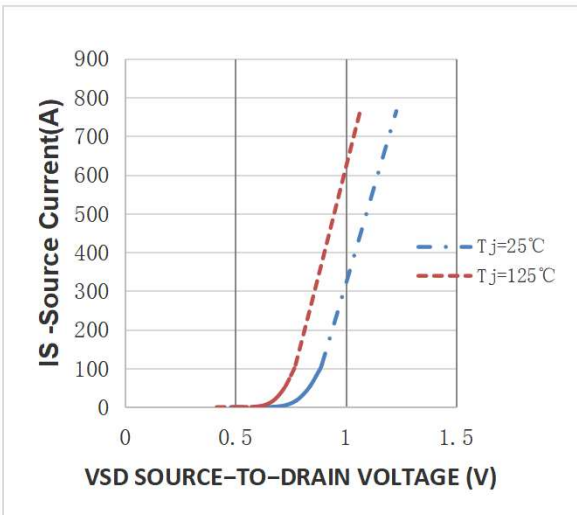


Figure 10. Transfer Characteristics

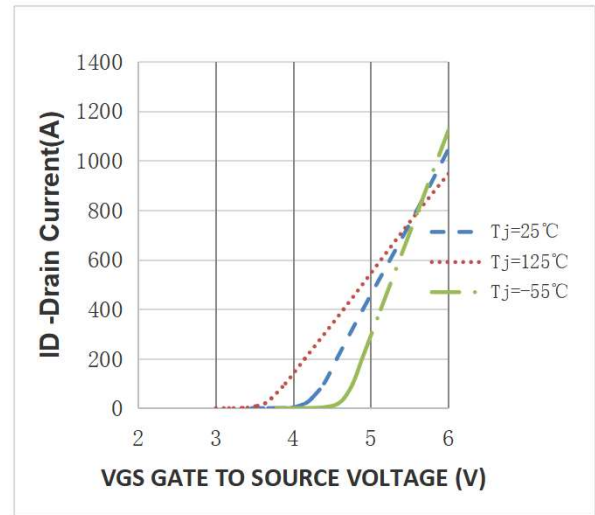


Fig.11 Safe Operating Area

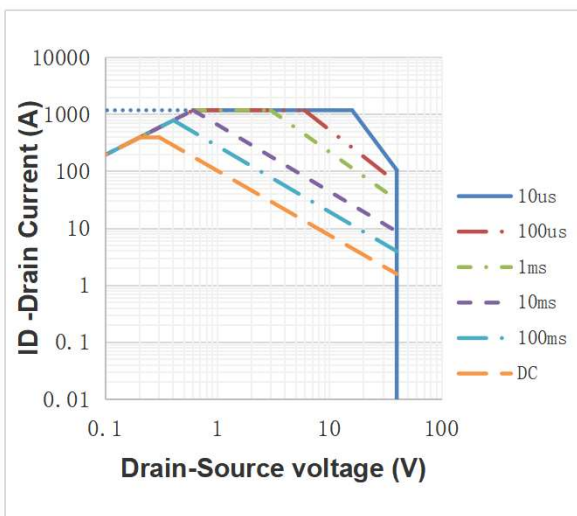
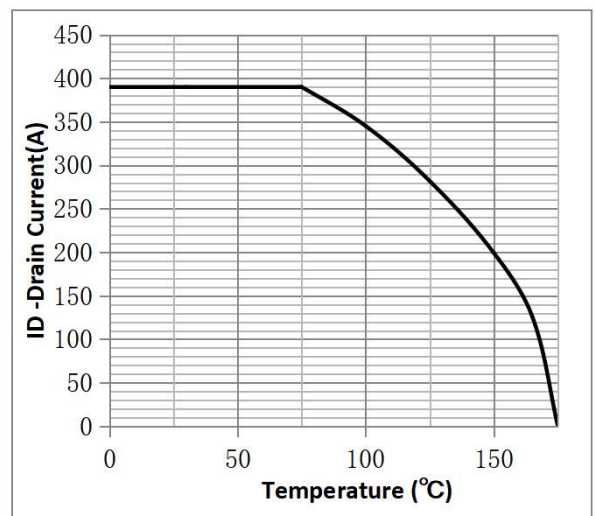
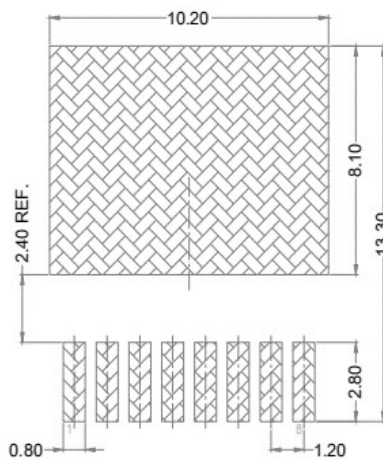
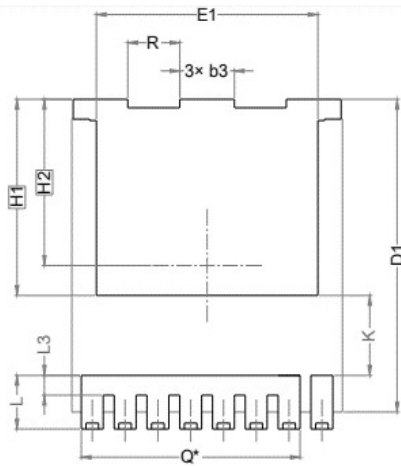
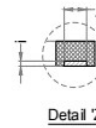
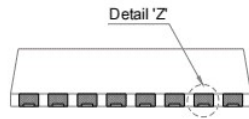
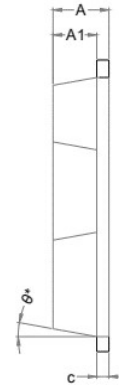
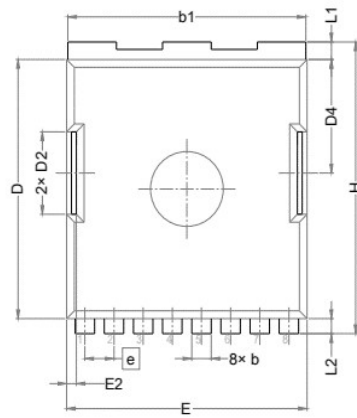


Fig.12 ID vs. Junction Temperature<sup>③</sup>



•TOLL Package Outline



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b3	1.90	2.00	2.10
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	8.00	8.10	8.20
E2	0.30	0.40	0.50
e	1.20 BSC		
H	11.58	11.68	11.78
H1	6.95 BSC		
H2	5.89 BSC		
i	0.10 REF.		
j	0.46 REF.		
K	2.80 REF.		
L	1.60	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.60	0.70	0.80
N	8		
Q	6.80 REF.		
R	1.80	1.90	2.00
θ	10° REF.		

**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. VGS=10V.

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## Revision History

Version	Date	Change
A	2022.1.15	new
B	2022.9.10	1.Add Reach, HF figure 2.ID curve modify
C	2023.1.6	1. Correct Dynamic characteristics 2. correct symbol figure 3. modified ID, EAS
C1	2023.3.30	Correct marking mistake
D	2023.12.18	Correct SOA
E	2024.11.6	RDSon modified.