

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

- 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

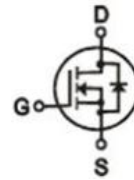
• Ordering Information:

Part NO.	ZMS005N04HR
Marking	ZMS005N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	2000

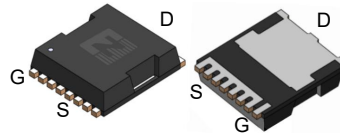
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		40	V
Gate-Source Voltage	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$ (silicon limited)	445	A
	$I_D$	$T_C=25^\circ\text{C}$ (package limited)	360	A
	$I_D$	$T_C=100^\circ\text{C}$	282	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	1780	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	313	W
Total Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	3.5	W
Operating Junction Temperature	$T_J$		-55 to +150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$		-55 to +150	$^\circ\text{C}$
Single Pulse Avalanche Energy	$E_{AS}$	L=0.1mH, VGS=10V, Rg=25 $\Omega$ ,	756	mJ
		L=0.5mH, VGS=10V, Rg=25 $\Omega$ ,	1210	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = 40\text{V}$   
 $R_{DS(ON)} = 0.5\text{m}\Omega$   
 $I_D = 360\text{A}$



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**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	RthJC		-	0.4	°C/W
Thermal resistance, junction-ambient	RthJA <sup>①</sup>		-	36	°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			1.0	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		0.5	0.75	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>GS</sub> =5V, I <sub>SD</sub> = 10A		30		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	-	10620	-	pF
Output capacitance	Coss		-	2810	-	
Reverse transfer capacitance	Crss		-	115	-	
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	-	155	-	nC
Gate - Source charge	Qgs		-	35	-	
Gate - Drain charge	Qgd		-	32	-	
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	-	65	-	ns
Turn-ON Rise time	t <sub>r</sub>		-	31	-	ns
Turn-Off Delay time	t <sub>D(off)</sub>		-	85	-	ns
Turn-Off Fall time	t <sub>f</sub>		-	78	-	ns
Reverse Recovery Time	t <sub>RR</sub>	V <sub>DD</sub> =20V, dI <sub>S</sub> /dt = 100A/us, I <sub>S</sub> =50A	-	97	-	ns
Reverse Recovery Charge	Q <sub>RR</sub>		-	135	-	nC

Fig.1 Gate-Charge Characteristics

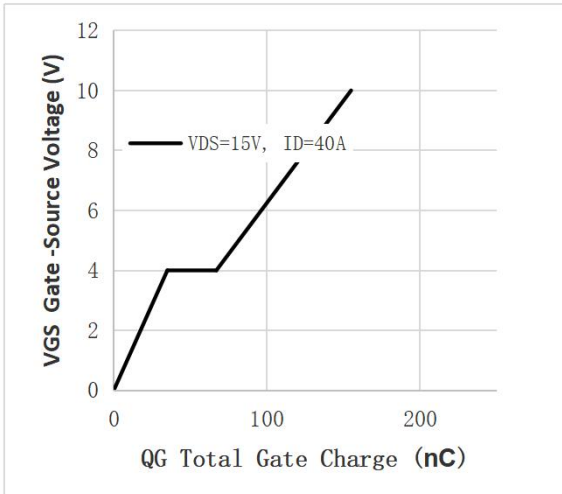


Fig.2 Capacitance Characteristics

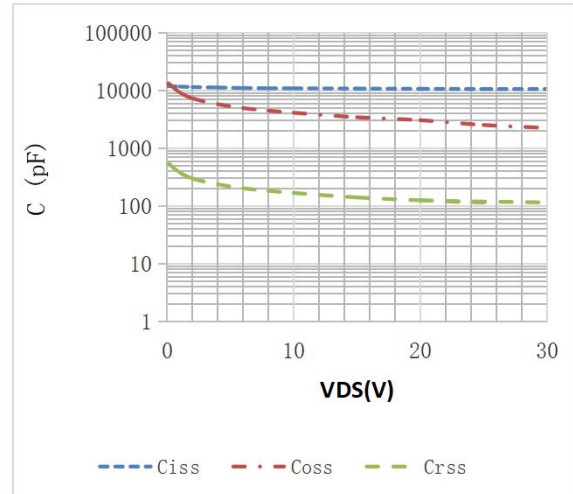


Fig.3 Power Dissipation

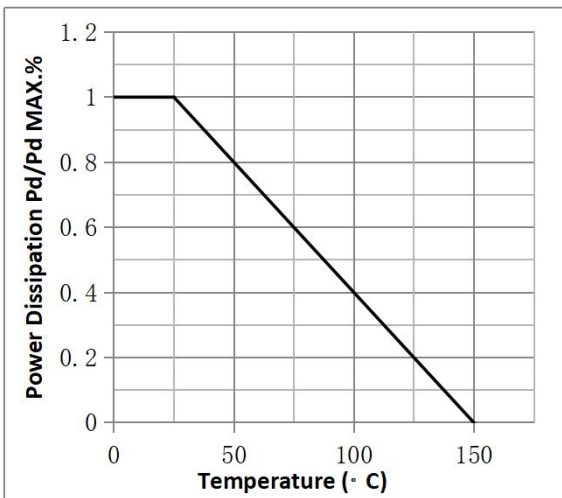


Fig.4 Typical output Characteristics

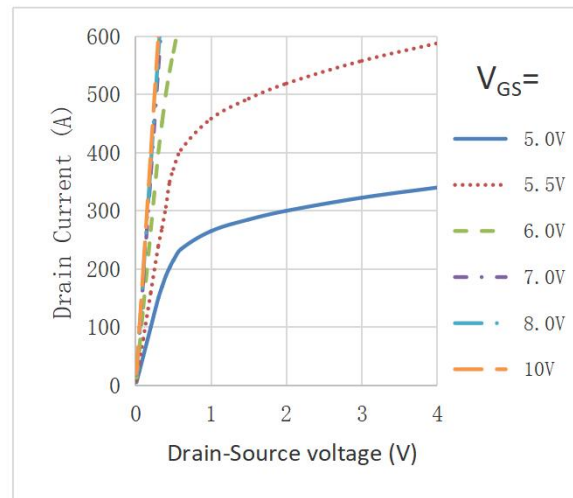


Fig.5 Threshold Voltage V.S Junction Temperature

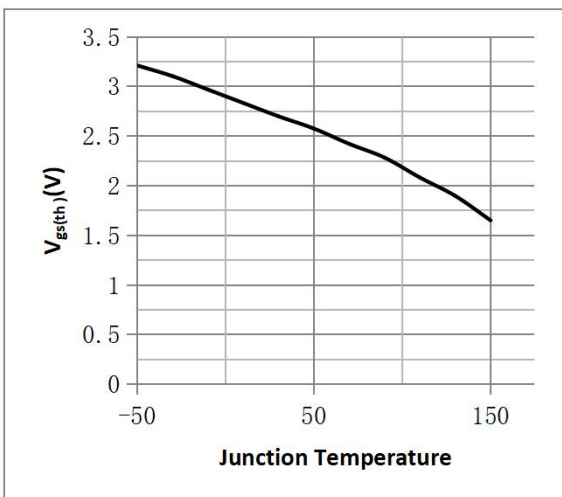


Fig.6 Resistance V.S Drain Current

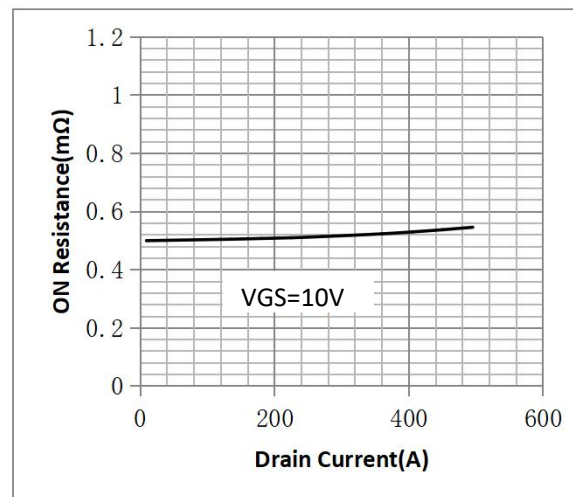


Fig.7 On-Resistance VS Gate Source Voltage

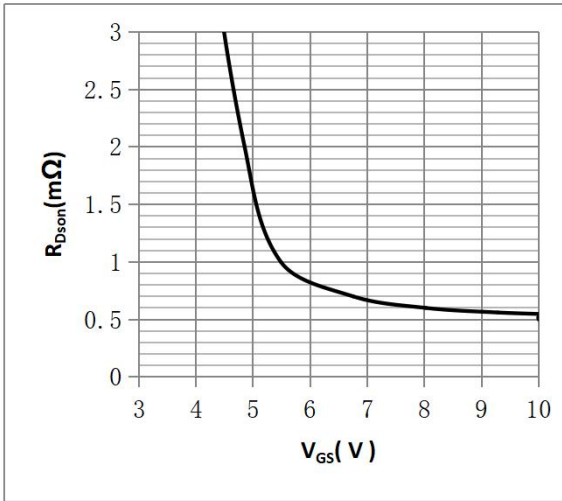


Fig.8 On-Resistance V.S Junction Temperature

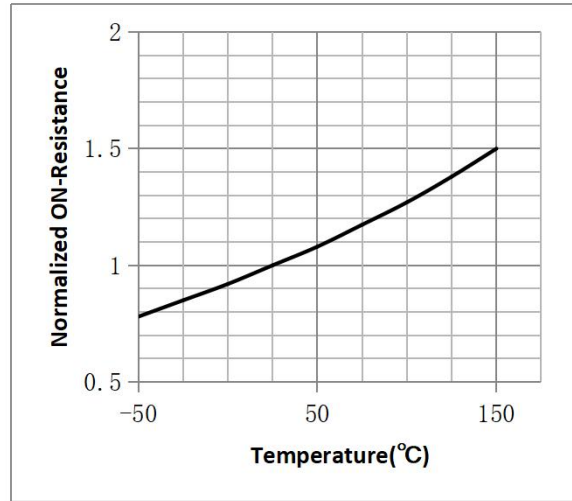


Figure 9. Diode Forward Voltage vs. Current

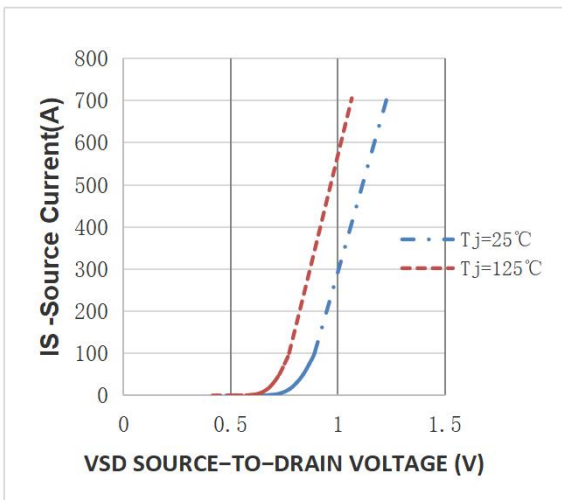


Figure 10. Transfer Characteristics

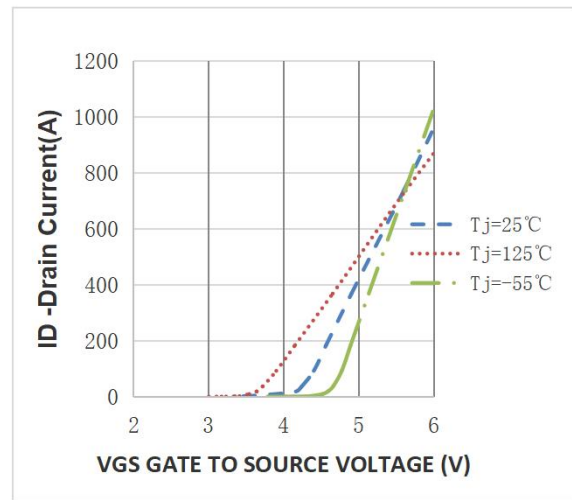


Fig.11 SOA Maximum Safe Operating Area

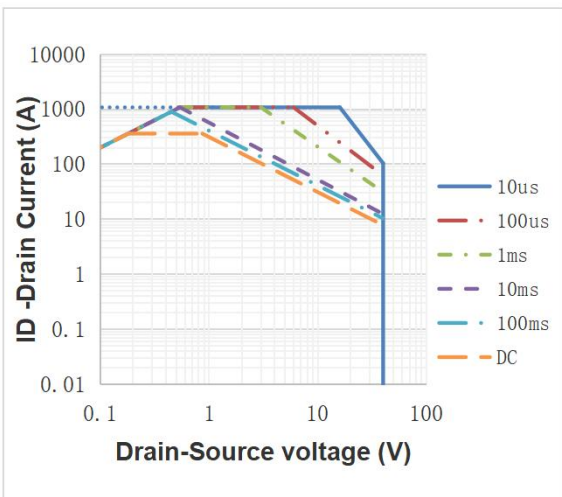
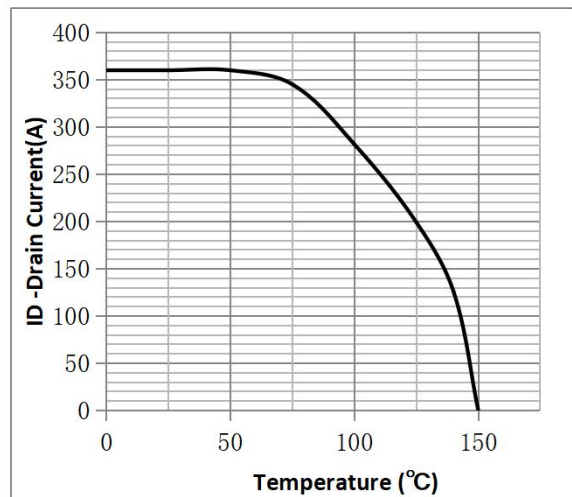
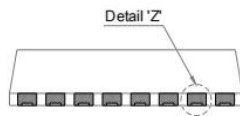
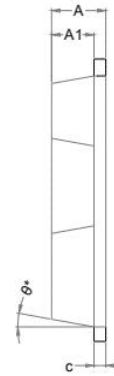
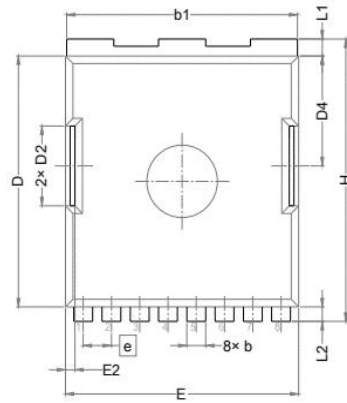


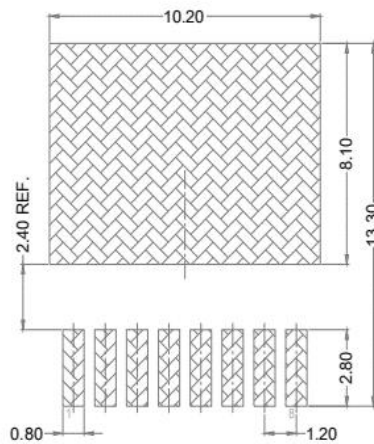
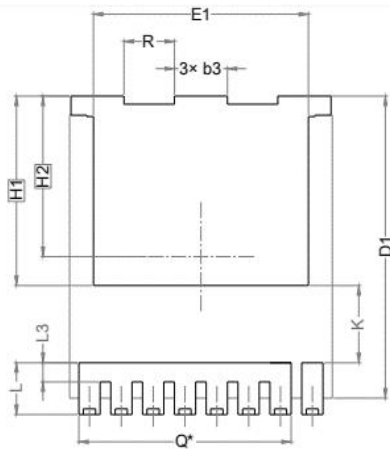
Fig.12 ID vs. Junction Temperature<sup>②</sup>



•TOLL Package Outline



Detail 'Z'



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 Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ② 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	2023.9.15	new