

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

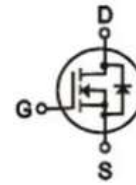
• Ordering Information:

Part NO.	ZMS005N04HB
Marking	ZMS005N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	800

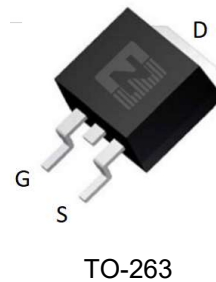
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$	$25^\circ\text{C} \leq T_j \leq 175^\circ\text{C}$	40	V
Gate-Source Voltage <sup>①</sup>	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	170	A
	$I_D$	$T_C=75^\circ\text{C}$	170	A
	$I_D$	$T_C=100^\circ\text{C}$	170	A
Pulsed Drain Current <sup>①</sup>	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	680	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	188	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
		$L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	1210	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = 40\text{V}$   
 $R_{DS(ON)} = 0.95\text{m}\Omega$   
 $I_D = 170\text{A}$



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	RthJC		-	0.8	°C/W
Thermal resistance, junction-ambient	RthJA <sup>②</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		0.95	1.2	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> = 40A, 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

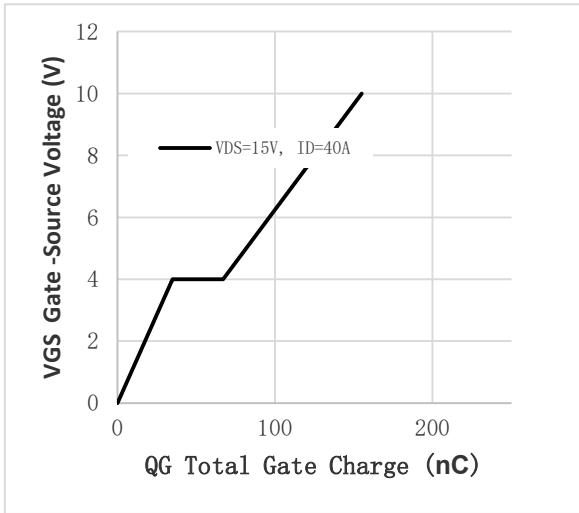


Fig.2 Capacitance Characteristics

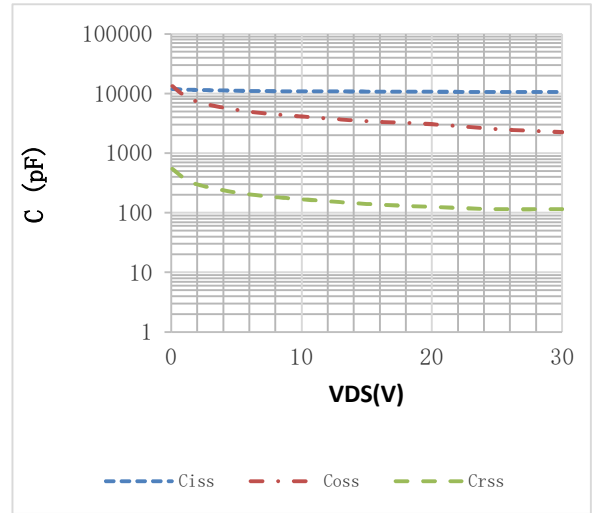


Fig.3 Power Dissipation

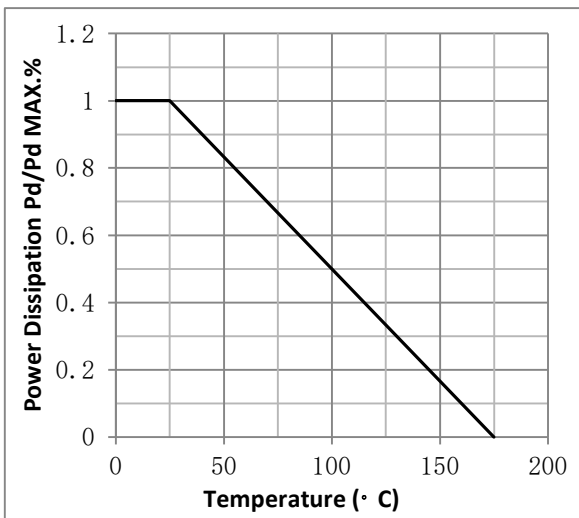


Fig.4 Typical output Characteristics

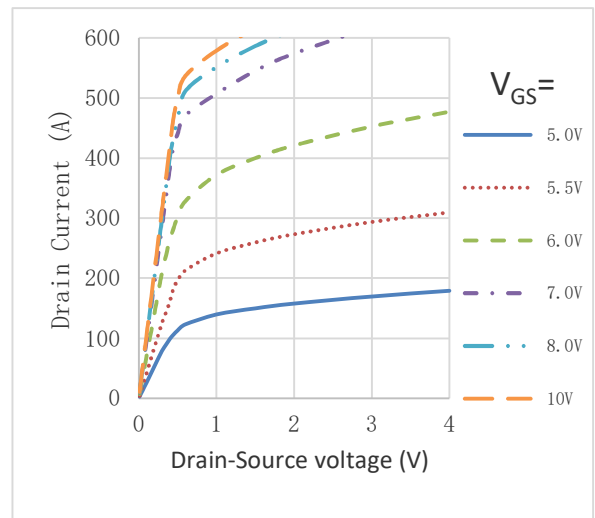


Fig.5 Threshold Voltage V.S Junction Temperature

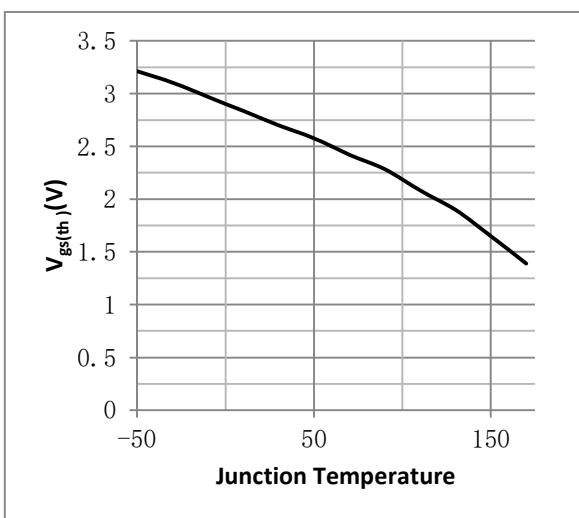


Fig.6 Resistance V.S Drain Current

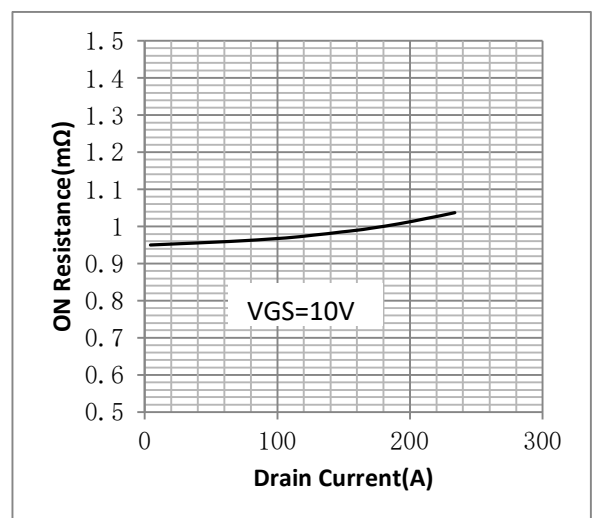


Fig.7 On-Resistance VS Gate Source Voltage

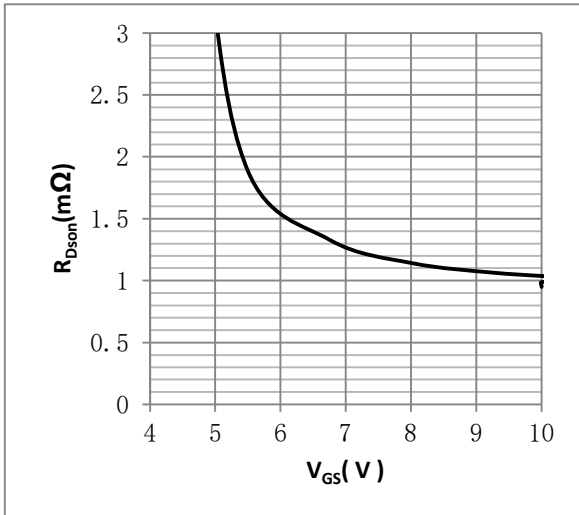


Fig.8 On-Resistance V.S Junction Temperature

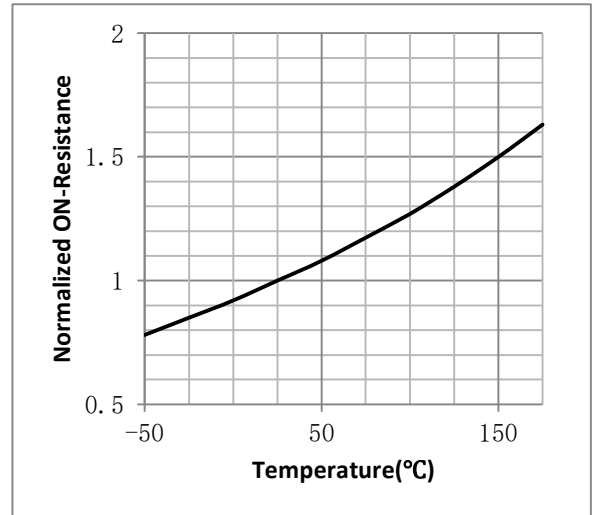


Figure 9. Diode Forward Voltage vs. Current

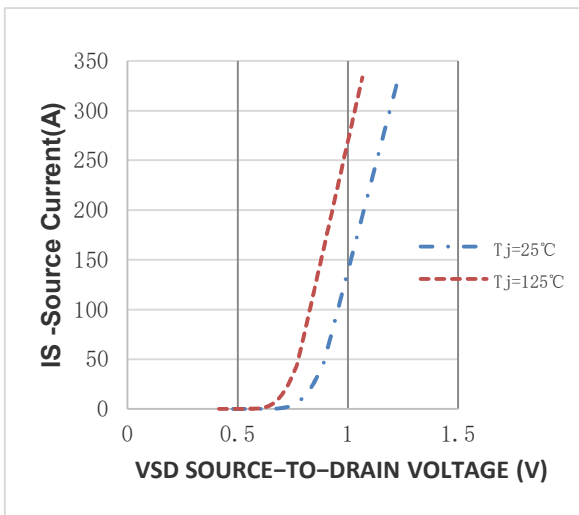


Figure 10. Transfer Characteristics

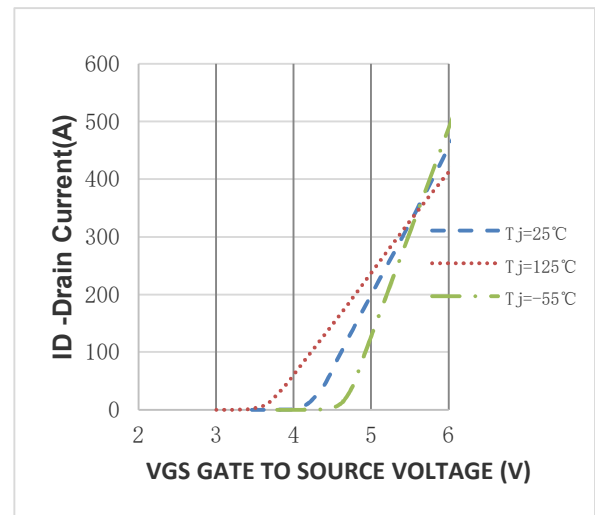


Fig.11 SOA Maximum Safe Operating Area

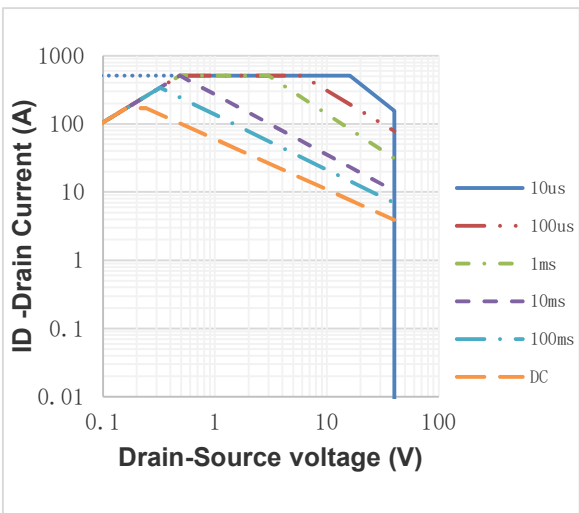
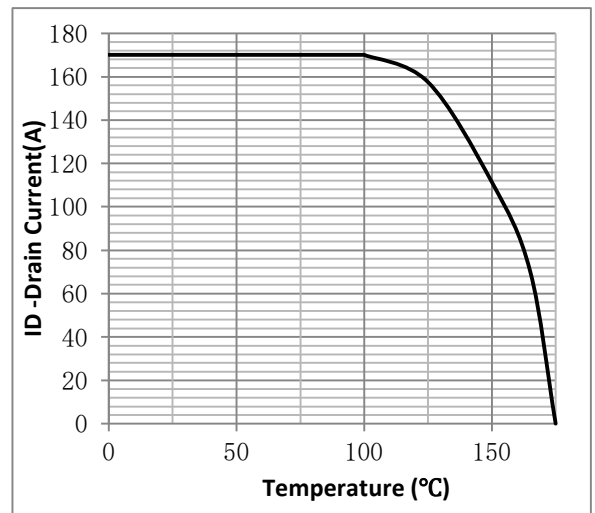
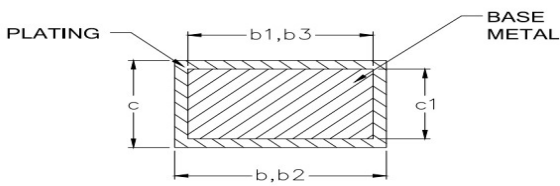
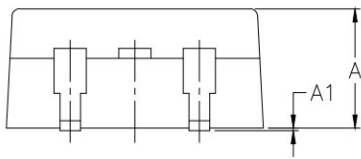
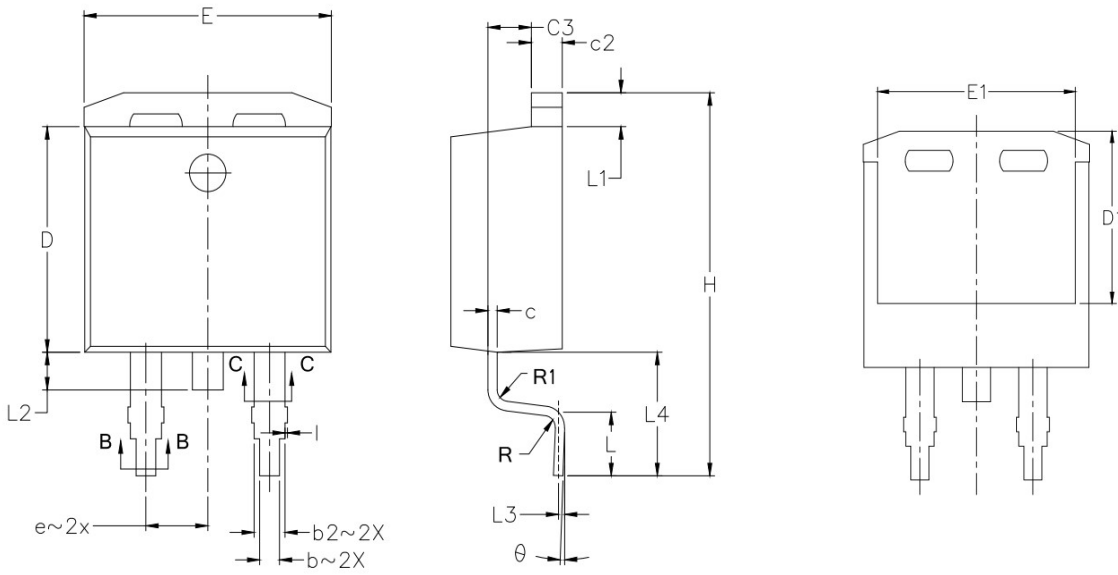


Fig.12 ID vs. Junction Temperature<sup>③</sup>



•TO-263 Package Outline



SYMBOLS	COMMON			
	MM		INCH	
	MIN.	MAX.	MIN.	MAX.
A	4.064	4.826	0.160	0.190
A1	0.000	0.254	0.000	0.010
b	0.508	0.991	0.020	0.039
b1	0.508	0.889	0.020	0.035
b2	1.143	1.778	0.045	0.070
b3	1.143	1.727	0.045	0.068
c	0.381	0.737	0.015	0.029
c1	0.381	0.584	0.015	0.023
c2	1.143	1.651	0.045	0.065
D	8.382	9.652	0.330	0.380
D1	6.858	—	0.270	—
E	9.652	10.668	0.380	0.420
E1	6.223	—	0.245	—
e	2.540 BSC.		0.100 BSC.	
H	14.605	15.875	0.575	0.625
L	1.778	2.794	0.070	0.110
L1	—	1.676	—	0.066
L2	—	1.778	—	0.070
L3	0.254 BSC		0.010 BSC	
L4	4.780	5.280	0.188	0.208
R	0.460 TYP		0.018 TYP	
R1	0.460 TYP		0.018 TYP	
θ	0°	8°	0°	8°
C3	1.68	1.88	0.0661	0.0740
I	-	0.100	-	0.0039

**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	2023.10.15	New
B	2024.5.11	Correct basic ordering unit