

60V 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
- Battery protection

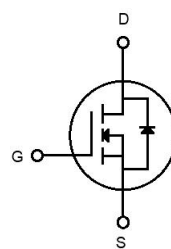
• **Ordering Information:**

Part NO.	ZMSA052N06B
Marking	ZMS052N06
Packing Information	REEL TAPE
Basic ordering unit (pcs)	800

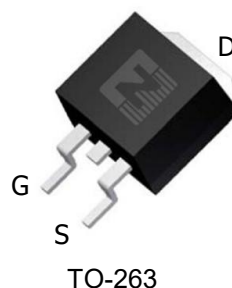
• **Absolute Maximum Ratings** ($T_C=25^{\circ}\text{C}$)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		60	V
Gate-Source Voltage ^①	V_{GS}		± 20	V
Continuous Drain Current	I_D	$T_C=25^{\circ}\text{C}$	80	A
	I_D	$T_C=75^{\circ}\text{C}$	66	A
	I_D	$T_C=100^{\circ}\text{C}$	57	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^{\circ}\text{C}$;	320	A
Total Power Dissipation	P_D	$T_C=25^{\circ}\text{C}$	88	W
Total Power Dissipation	P_D	$T_A=25^{\circ}\text{C}$	3.3	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}	$L=0.1\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	61	mJ
		$L=0.5\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	128	mJ
ESD Level (HBM)	CLASS 2			

• **Product Summary**



$V_{DS} = 60\text{V}$
 $R_{DS(ON)} = 5.2\text{m}\Omega$
 $I_D = 80\text{A}$



•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	1.7	°C/W
Thermal resistance, junction-ambient ^②	R_{thJA}		-	45	°C/W
Soldering temperature	T_{sold}		-	260	°C

•Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	60			V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.3	1.8	2.5	V
Drain-Source Leakage Current	I_{DSS}	$V_{GS}=0V, V_{DS}=60V$			1.0	μA
Gate- Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=12A$		5.2	6.5	m Ω
		$V_{GS}=4.5V, I_D=10A$		6.8	8.5	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_{SD}=10A$		16		S
Diode Forward Voltage	V_{FSD}	$V_{GS}=0V, I_{SD}=12A$			1.3	V

•Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1MHz, V_{DS}=25V$	-	1720	-	pF
Output capacitance	C_{oss}		-	960	-	
Reverse transfer capacitance	C_{rss}		-	91	-	
Gate Resistance	R_g	$f=1MHz$	-	1.4		Ω
Total gate charge	Q_g	$V_{DD}=15V, I_D=20A, V_{GS}=10V$	-	29	-	nC
	$Q_g(4.5V)$		-	14	-	
Gate - Source charge	Q_{gs}		-	4.4	-	
Gate - Drain charge	Q_{gd}		-	7.3	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$	-	16	-	ns
Turn-ON Rise time	t_r		-	17	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	28	-	ns
Turn-Off Fall time	t_f		-	15	-	ns
Reverse Recovery Time	t_{RR}	$V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=20A$	-	21	-	ns
Reverse Recovery Charge	Q_{RR}		-	20	-	nC

Fig.1 Gate-Charge Characteristics

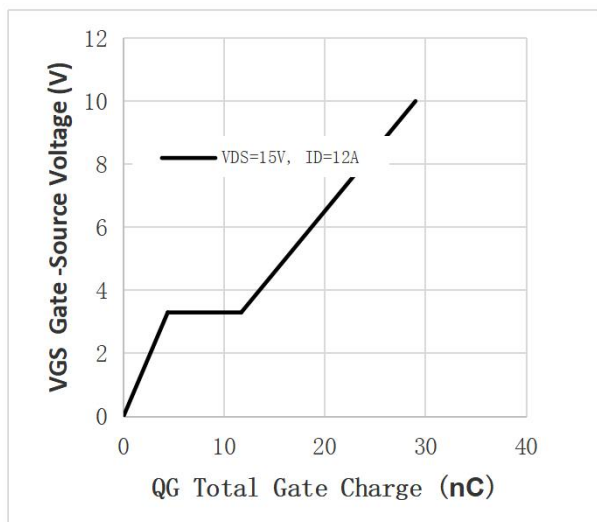


Fig.2 Capacitance Characteristics

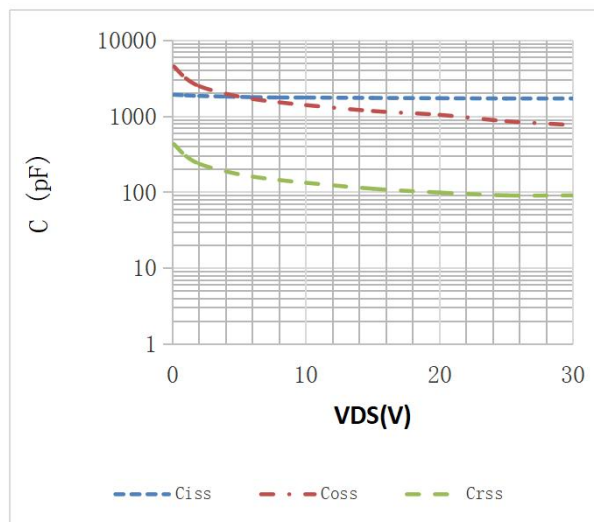


Fig.3 Power Dissipation

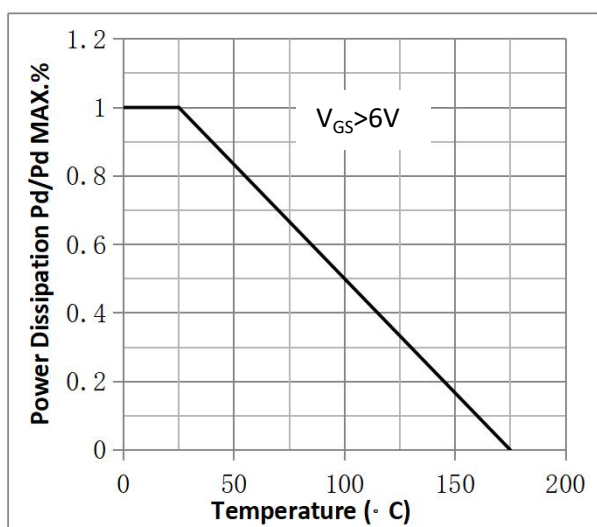


Fig.4 Typical output Characteristics

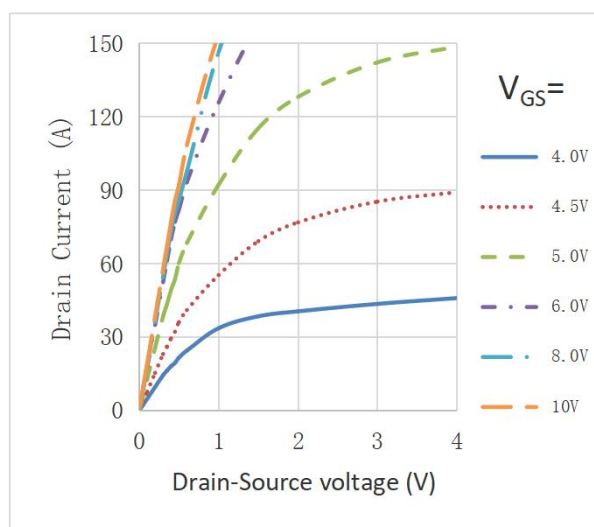


Fig.5 Threshold Voltage V.S Junction Temperature

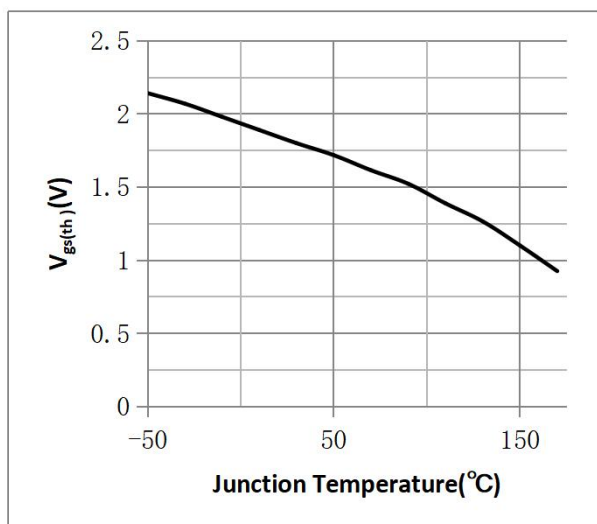


Fig.6 Resistance V.S Drain Current

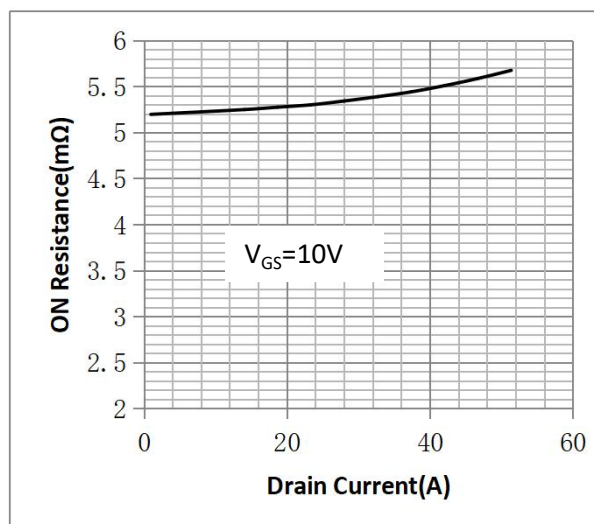


Fig.7 On-Resistance VS Gate Source Voltage

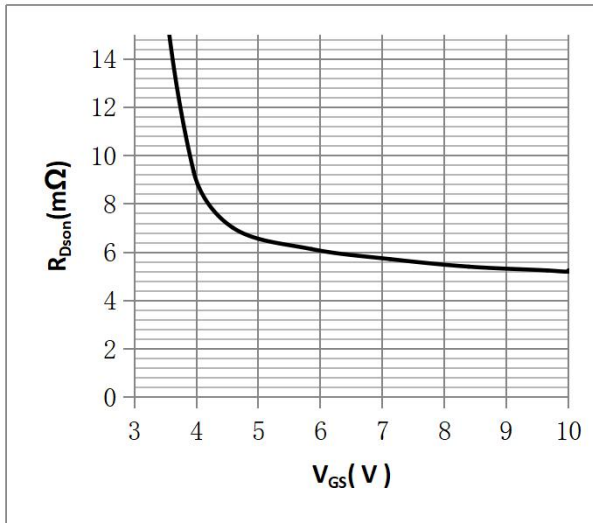


Fig.8 On-Resistance V.S Junction Temperature

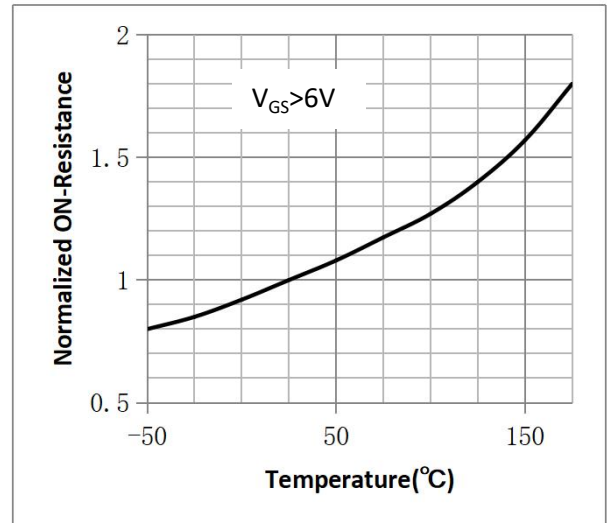


Figure 9. Diode Forward Voltage vs. Current

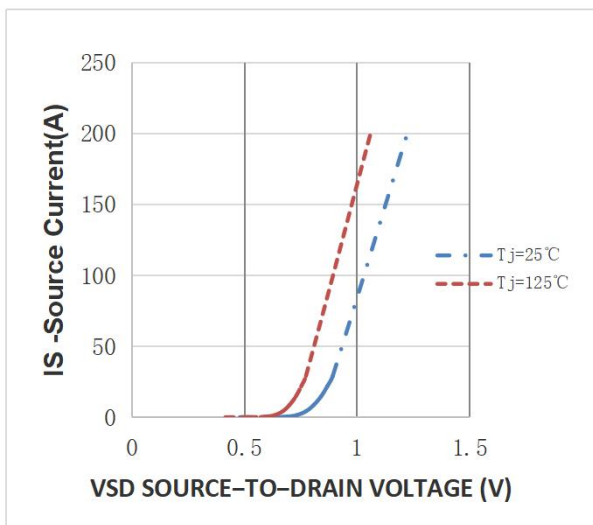


Figure 10. Transfer Characteristics

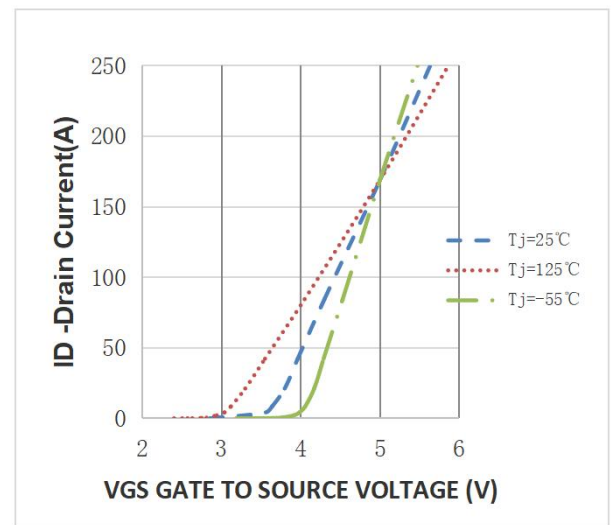


Fig.11 SOA Maximum Safe Operating Area

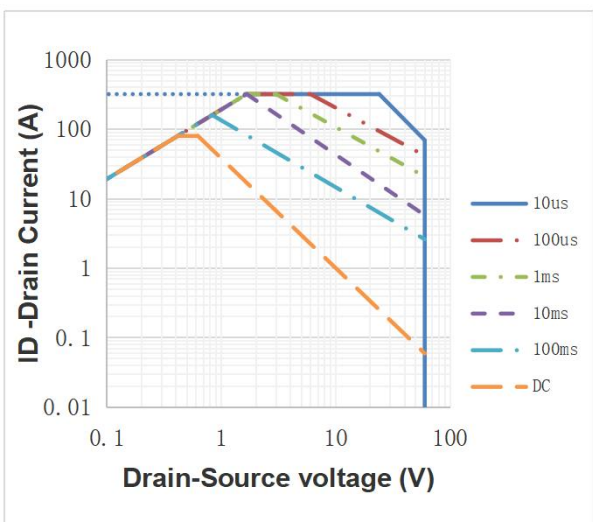
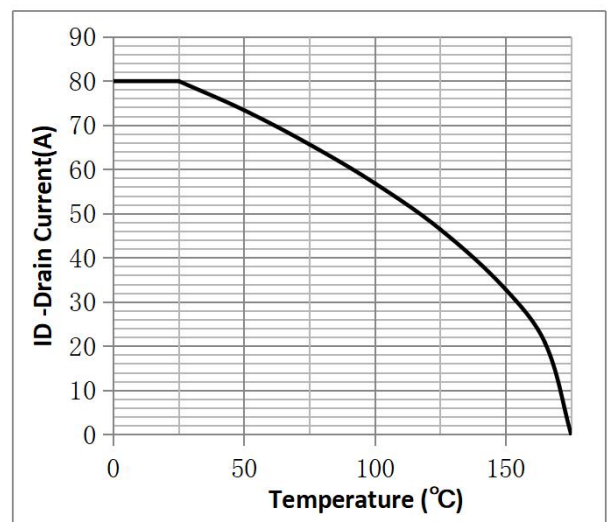
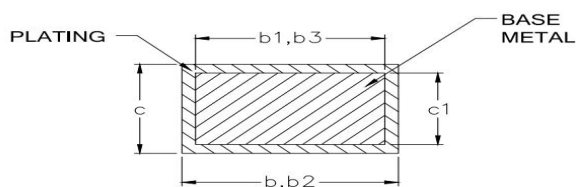
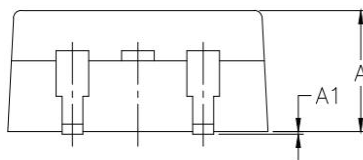
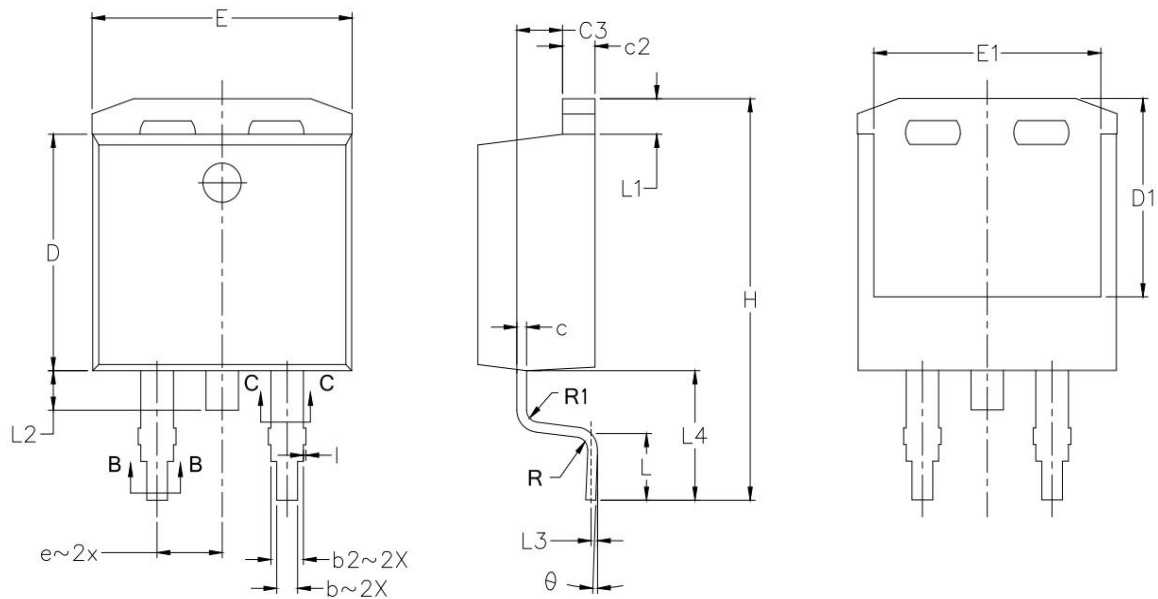


Fig.12 I_D vs. Junction Temperature^③



•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	
theta	0°	8°	0°	8°
C3	1.68	1.88	0.0661	0.0740
I	—	0.100	—	0.0039

Note:

- ① Pulse : $V_{GS}=+20V/-20V$, Duty cycle=50%, $T_j=175^{\circ}C$, $t=1000$ hours; For DC , the following test conditions can be passed: $V_{GS}=+20V/-10V$, $T_j=175^{\circ}C$, $t=1000$ 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. $V_{GS}=10V$.

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Revision History

Version	Date	Change
A	2021.5.10	
B	2022.9.7	1.Add Reach, HF figure, 2.ID modify