

**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**

- Low  $R_{DS(ON)}$  to minimize conductive loss
- Low Gate Charge for fast switching
- Low Thermal resistance

**• Application**

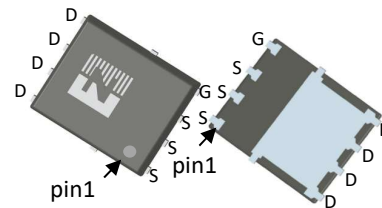
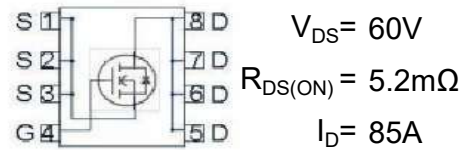
- BLDC Motor driver
- DC-DC
- Battery protection

**• Ordering Information:**

Part NO.	ZMS052N06N
Marking	ZMS052N06
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

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

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		60	V
Gate-Source Voltage	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	85	A
	$I_D$	$T_C=75^\circ\text{C}$	69	A
	$I_D$	$T_C=100^\circ\text{C}$	60	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	340	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	94	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**


DFN5\*6



### •Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	1.6	$^{\circ}C/W$
Thermal resistance, junction-ambient <sup>①</sup>	$R_{thJA}$		-	45	$^{\circ}C/W$
Soldering temperature	$T_{sold}$		-	260	$^{\circ}C$

### •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	$\mu A$
Gate- Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=12A$		5.2	6.5	$m\Omega$
		$V_{GS}=4.5V, I_D=10A$		6.8	8.5	$m\Omega$
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	-	$\mu F$
Output capacitance	$C_{oss}$		-	960	-	
Reverse transfer capacitance	$C_{rss}$		-	91	-	
Gate Resistance	$R_g$	$f=1MHz$	-	1.4		$\Omega$
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

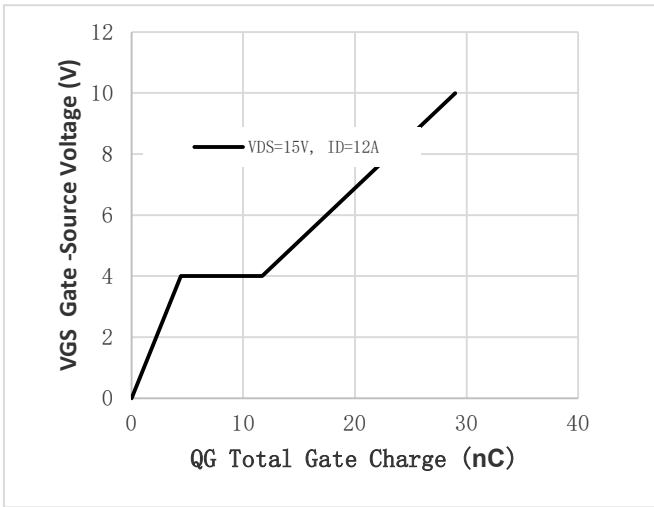


Fig.2 Capacitance Characteristics

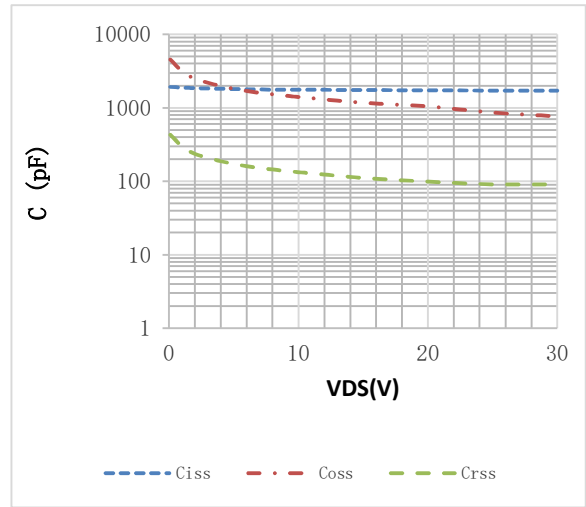


Fig.3 Power Dissipation

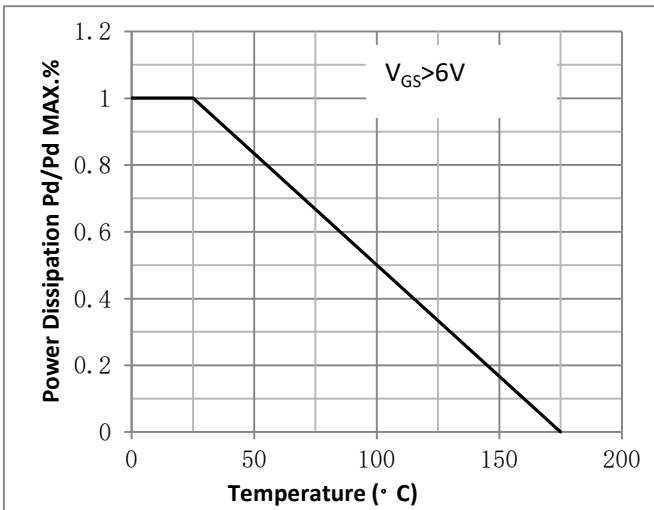


Fig.4 Typical output Characteristics

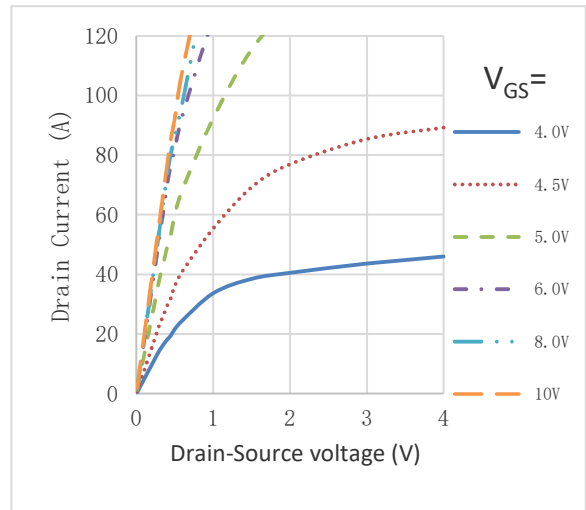


Fig.5 Threshold Voltage V.S Junction Temperature

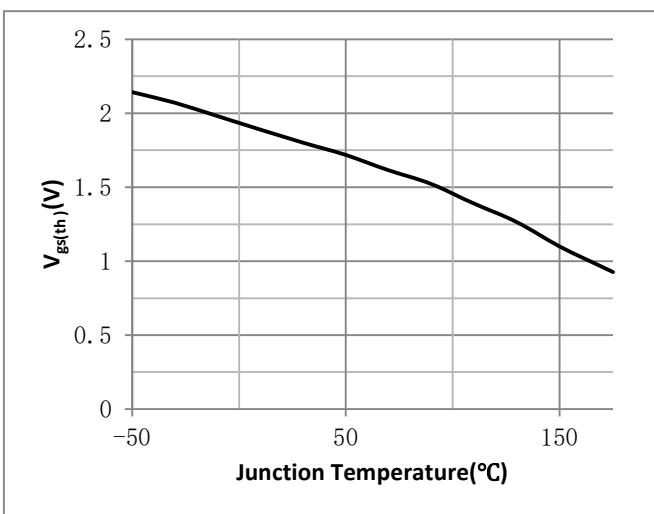


Fig.6 Resistance V.S Drain Current

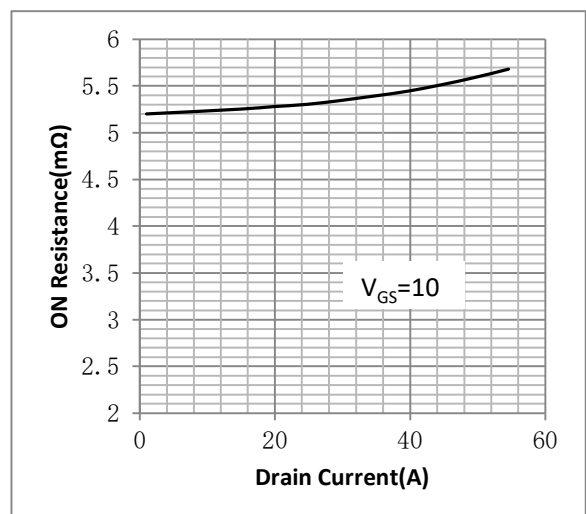


Fig.7 On-Resistance VS Gate Source Voltage

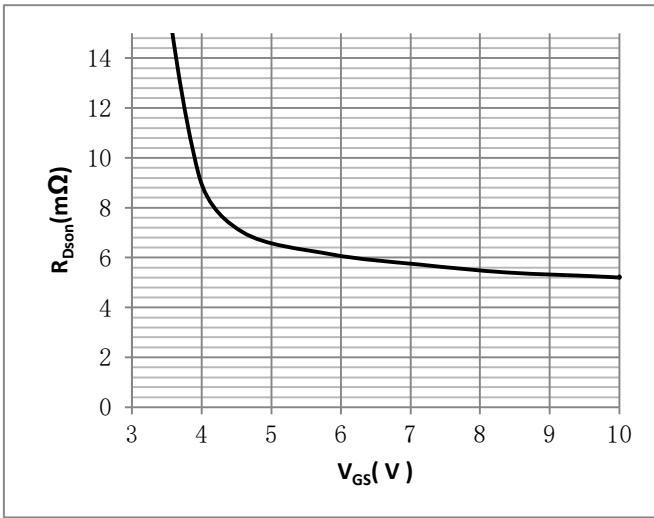


Fig.8 On-Resistance V.S Junction Temperature

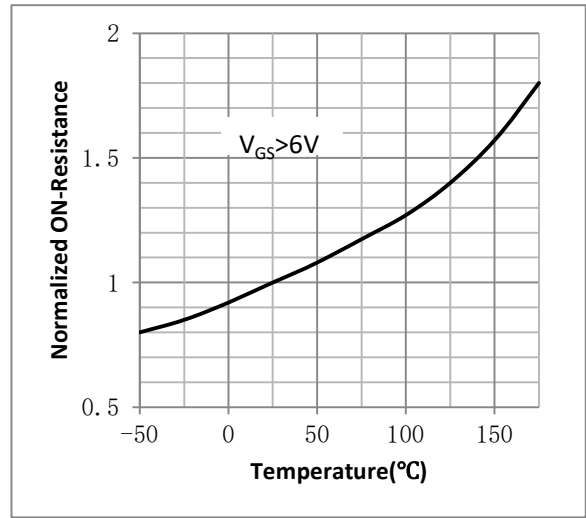


Figure 9. Diode Forward Voltage vs. Current

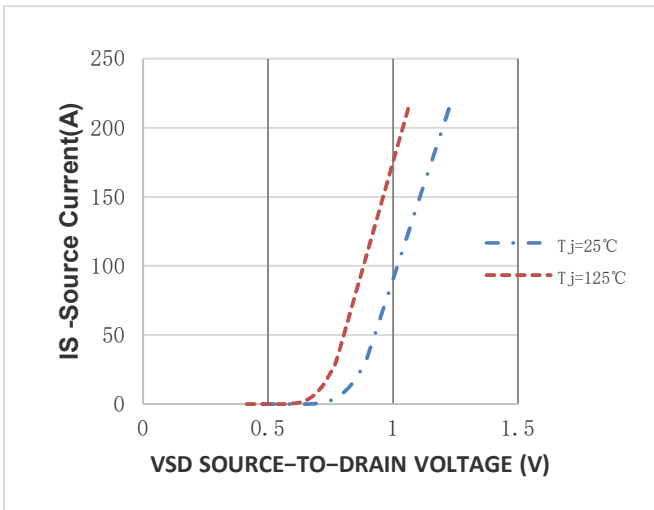


Figure 10. Transfer Characteristics

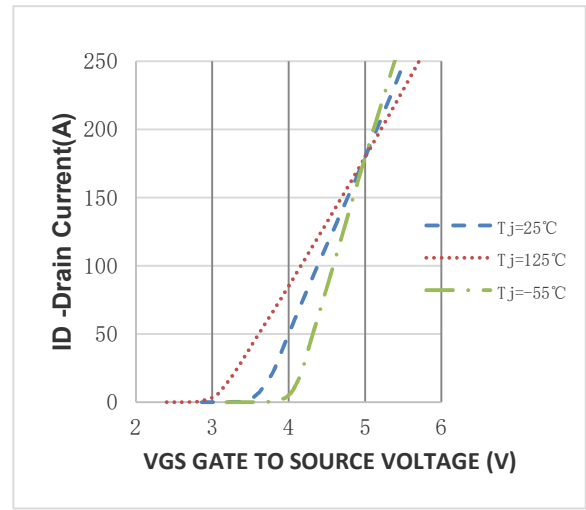


Fig.11 Safe Operating Area

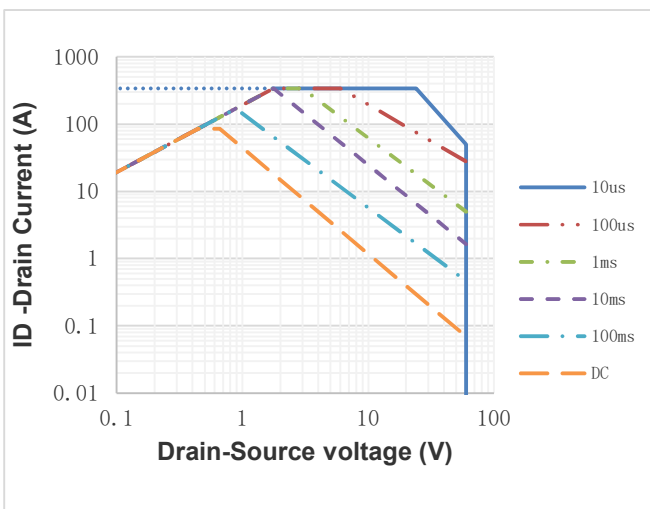
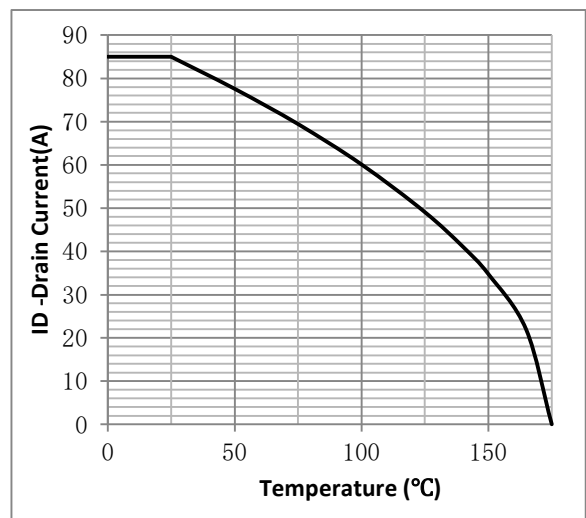
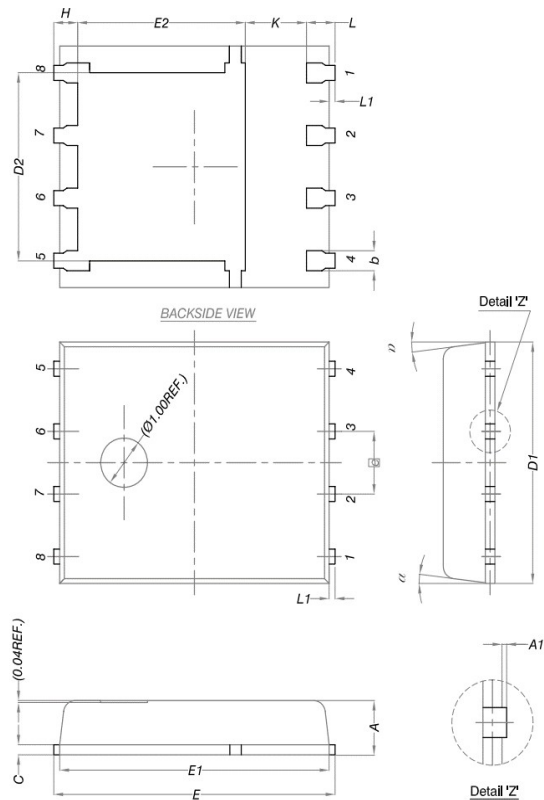


Fig.12 ID vs. Junction Temperature<sup>②</sup>



**•DFN5\*6 Package Outline**


DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0	-	0.05
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
$e$	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
$\alpha$	0°	-	12°

**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.  $V_{GS}=10V$ .

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## Revision History

Version	Date	Change
A	2019.1.10	
B	2022.1.7	1.Add Qg(4.5V)
C	2023.12.7	1.modified figure
D	2026.2.28	Update Tjmax to 175°C