

60V N-Channel Power MOSFET

• General Description

It combines 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

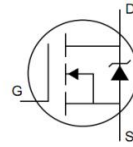
• Ordering Information:

Part NO.	ZMA500N06T
Marking	500N06
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

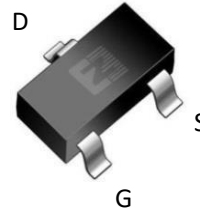
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		60	V
Gate-Source Voltage	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	3.4	A
	$I_D$	$T_C=75^\circ\text{C}$	2.7	A
	$I_D$	$T_C=100^\circ\text{C}$	2.2	A
Pulsed Drain Current	$I_{DM}$	Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	13.6	A
Total Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	2	W
Total Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	0.7	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	$E_{AS}$	$L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	5	mJ
		$L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,	10.5	mJ
ESD Level (HBM)	CLASS 1B			

• Product Summary



$V_{DS} = 60\text{V}$   
 $R_{DS(ON)} = 50\text{m}\Omega$   
 $I_D = 3.4\text{A}$



SOT-23-3



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	80	$^{\circ}C/W$
Thermal resistance, junction-ambient <sup>①</sup>	$R_{thJA}$		-	180	$^{\circ}C/W$
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	1.7	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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=5A$		50	65	$m\Omega$
		$V_{GS}=4.5V, I_D=3A$		70	90	$m\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_{SD}=10A$		5		S
Diode Forward Voltage	$V_{FSD}$	$V_{GS}=0V, I_{SD}=5A$			1.3	V

**•Dynamic characteristics**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Input capacitance	$C_{iss}$	$f=1MHz, V_{DS}=25V$	-	700	-	pF	
Output capacitance	$C_{oss}$		-	33	-		
Reverse transfer capacitance	$C_{rss}$		-	19	-		
Gate Resistance	$R_g$	$f=1MHz$	-	1		$\Omega$	
Total gate charge	$Q_g$	$V_{DD}=15V, I_D=20A, V_{GS}=10V$	-	11	-	nC	
	$Q_g(4.5v)$		-	5.5	-		
	Gate - Source charge		$Q_{gs}$	-	2.5		-
	Gate - Drain charge		$Q_{gd}$	-	1.5		-
Turn-ON Delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$	-	2	-	ns	
Turn-ON Rise time	$t_r$		-	3	-	ns	
Turn-Off Delay time	$t_{D(off)}$		-	10	-	ns	
Turn-Off Fall time	$t_f$		-	7	-	ns	
Reverse Recovery Time	$t_{RR}$	$V_{DD}=20V, di_S/dt=100A/\mu s, I_S=20A$	-	30	-	ns	
Reverse Recovery Charge	$Q_{RR}$		-	28	-	nC	

Fig.1 Gate-Charge Characteristics

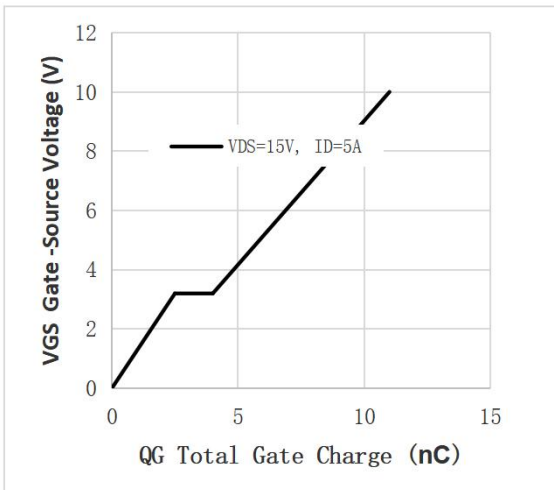


Fig.2 Capacitance Characteristics

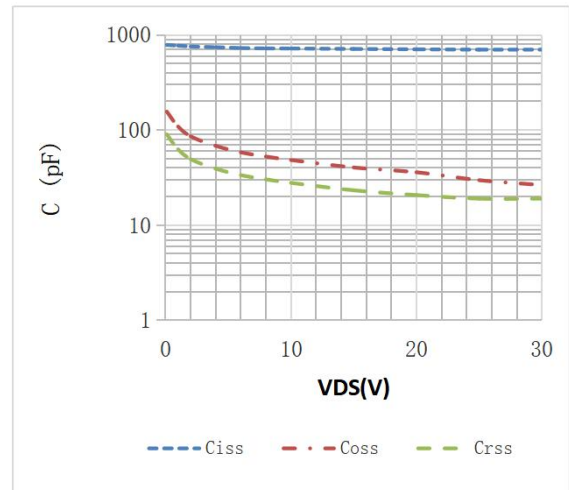


Fig.3 Power Dissipation

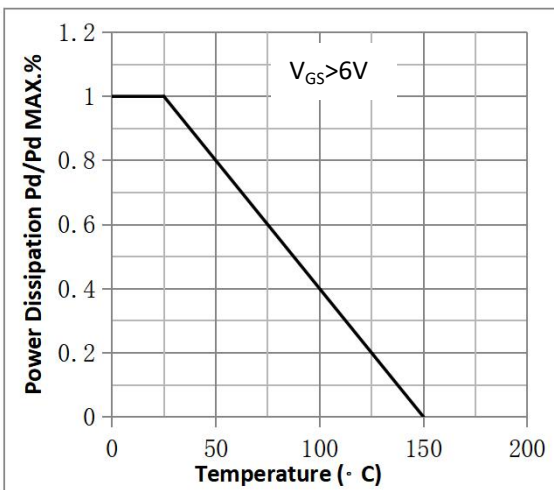


Fig.4 Typical output Characteristics

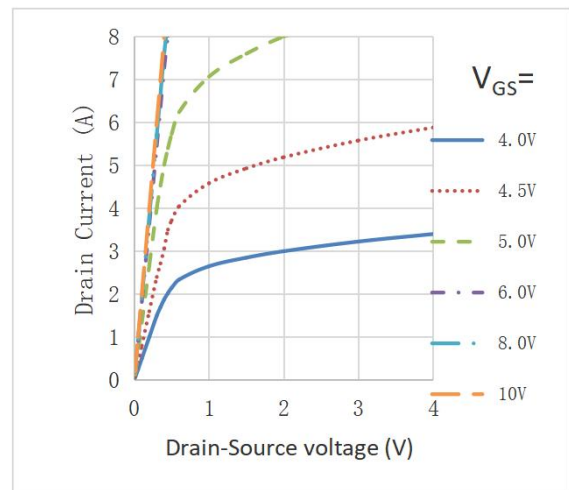


Fig.5 Threshold Voltage V.S Junction Temperature

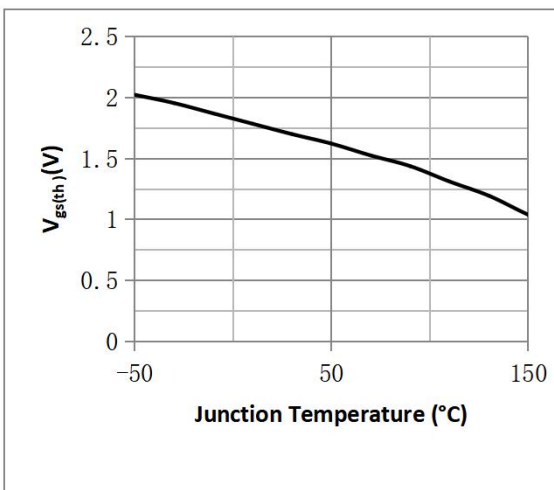


Fig.6 Resistance V.S Drain Current

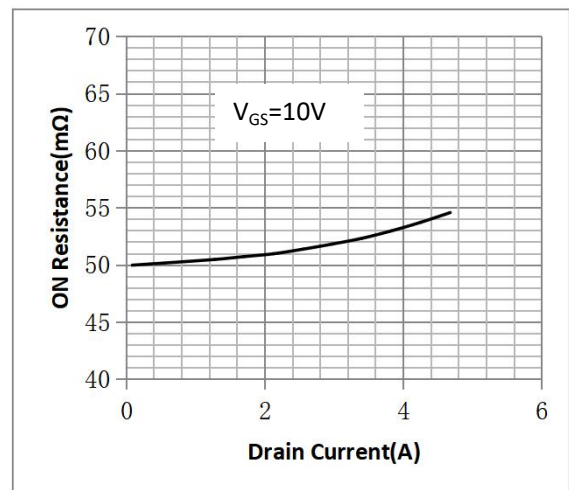


Fig.7 On-Resistance VS Gate Source Voltage

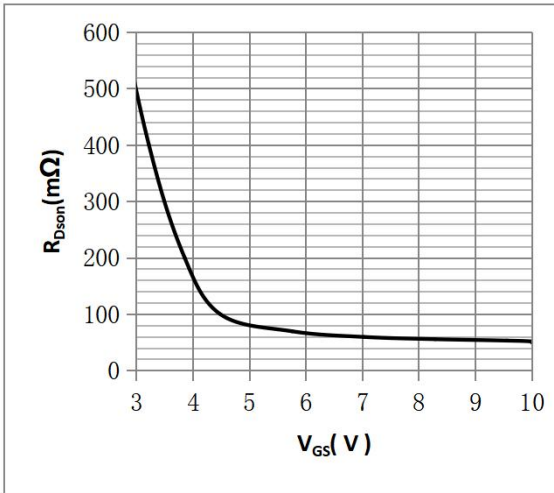


Fig.8 On-Resistance V.S Junction Temperature

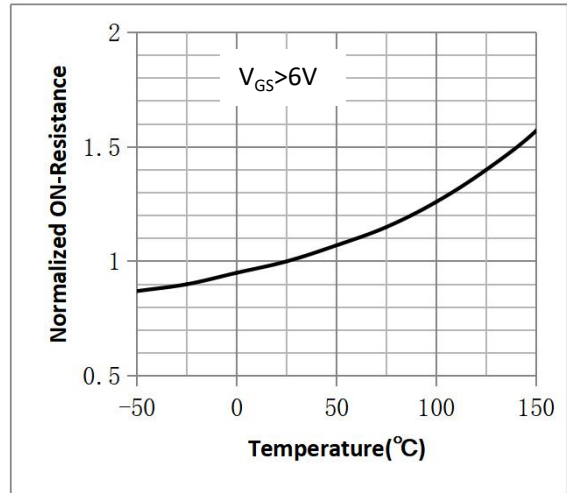


Figure 9. Diode Forward Voltage vs. Current

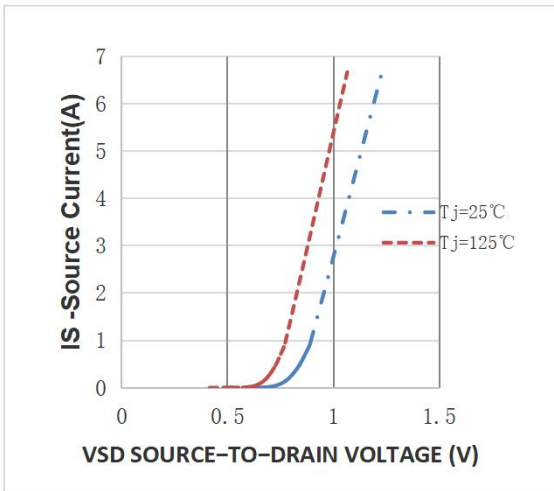


Figure 10. Transfer Characteristics

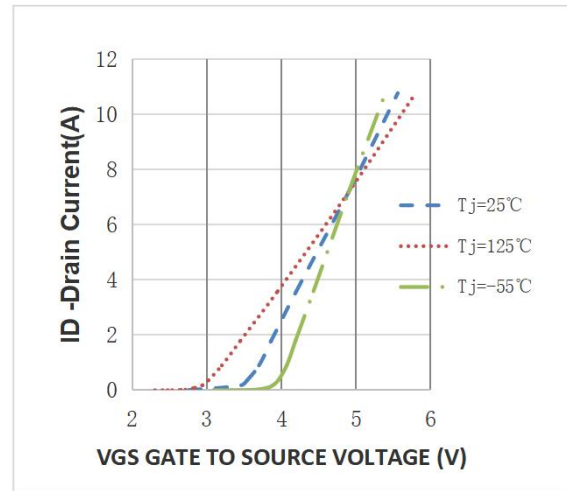


Fig.11 Safe Operating Area

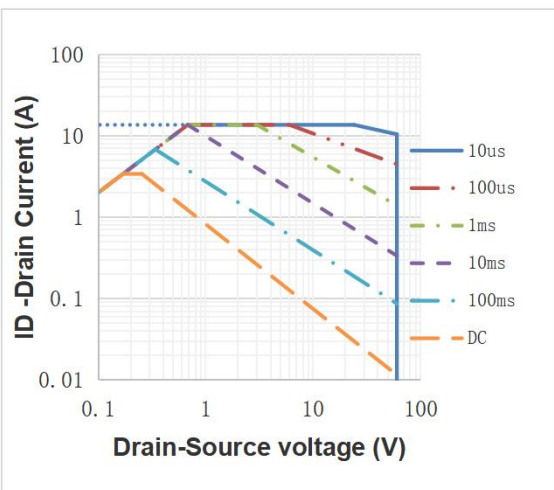
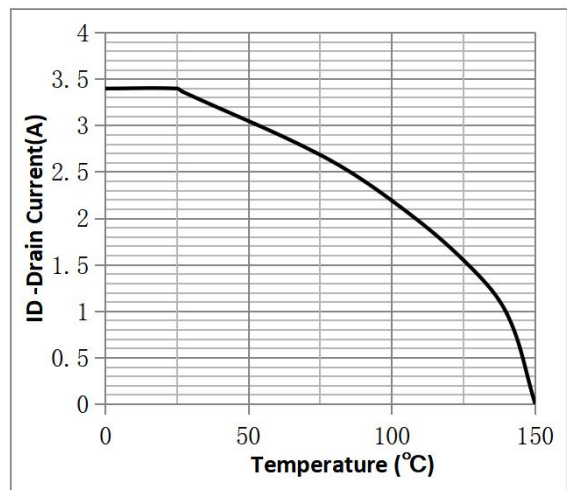
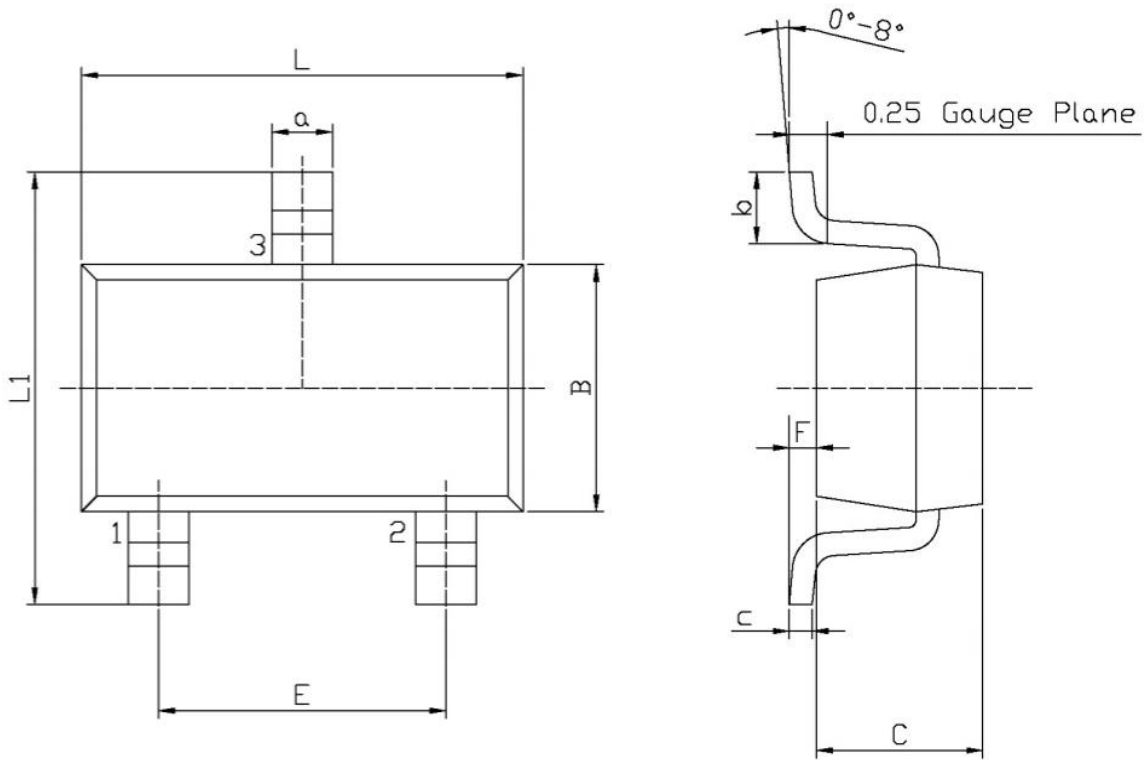


Fig.12 ID vs. Case Temperature<sup>②</sup>



●SOT-23-3 Package Outline



Unit: mm

Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
L	2.82	3.02	a	0.35	0.50
B	1.50	1.70	c	0.10	0.20
C	0.90	1.30	b	0.35	0.55
L1	2.60	3.00	F	0	0.15
E	1.80	2.00			

**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	2021.5.10	
B	2022.1.5	change the symbol figure
C	2022.9.10	1.Add Reach, HF figure, 2.ID modify
D	2022.12.20	ID & Curve modify