

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

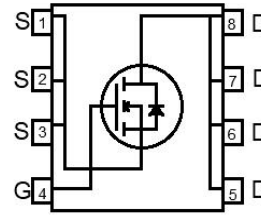
• Ordering Information:

Part NO.	ZMA280N06M
Marking	280N06
Packing Information	REEL TAPE
Basic ordering unit (pcs)	5000

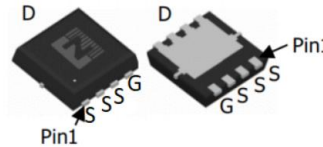
• Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

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	$T_C=25^\circ\text{C}$	20	A
	I_D	$T_C=75^\circ\text{C}$	17	A
	I_D	$T_C=100^\circ\text{C}$	15	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^\circ\text{C}$;	80	A
Total Power Dissipation	P_D	$T_C=25^\circ\text{C}$	33	W
Total Power Dissipation	P_D	$T_A=25^\circ\text{C}$	2.5	W
Operating Junction Temperature	T_J		-55 to +175	°C
Storage Temperature	T_{STG}		-55 to +175	°C
Single Pulse Avalanche Energy	E_{AS}	L=0.1mH, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	25	mJ
		L=0.5mH, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	53	mJ
ESD Level (HBM)	CLASS 1C			

• Product Summary



$V_{DS} = 60\text{V}$
 $R_{DS(ON)} = 28\text{m}\Omega$
 $I_D = 20\text{A}$



DFN3*3



•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	4.6	°C/W
Thermal resistance, junction-ambient ^②	R_{thJA}		-	60	°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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 12A$		28	34	m Ω
		$V_{GS} = 4.5V, I_D = 8A$		33	40	m Ω
Forward Transconductance	g_{FS}	$V_{DS} = 5V, I_{SD} = 10A$		12		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}	$f = 1MHz, V_{DS} = 25V$	-	1300	-	pF	
Output capacitance	C_{oss}		-	53	-		
Reverse transfer capacitance	C_{rss}		-	31	-		
Gate Resistance	R_g	$f = 1MHz$	-	1.4		Ω	
Total gate charge	Q_g	$V_{DD} = 15V, I_D = 20A, V_{GS} = 10V$	-	17	-	nC	
	$Q_g (4.5v)$		-	8	-		
	Gate - Source charge		Q_{gs}	-	4.1		-
	Gate - Drain charge		Q_{gd}	-	2.5		-
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = 10V, V_{DS} = 15V, R_G = 3.3\Omega, I_D = 20A$	-	9	-	ns	
Turn-ON Rise time	t_r		-	32	-	ns	
Turn-Off Delay time	$t_{D(off)}$		-	44	-	ns	
Turn-Off Fall time	t_f		-	30	-	ns	
Reverse Recovery Time	t_{RR}	$V_{DD} = 20V, di_S/dt = 100A/\mu s, I_S = 20A$	-	50	-	ns	
Reverse Recovery Charge	Q_{RR}		-	45	-	nC	

Fig.1 Gate-Charge Characteristics

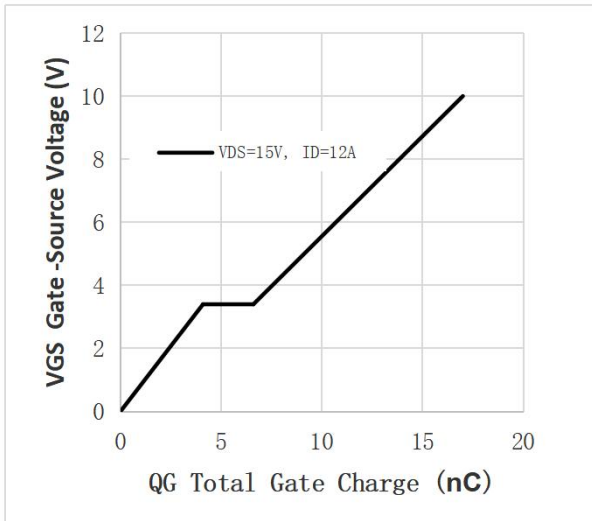


Fig.2 Capacitance Characteristics

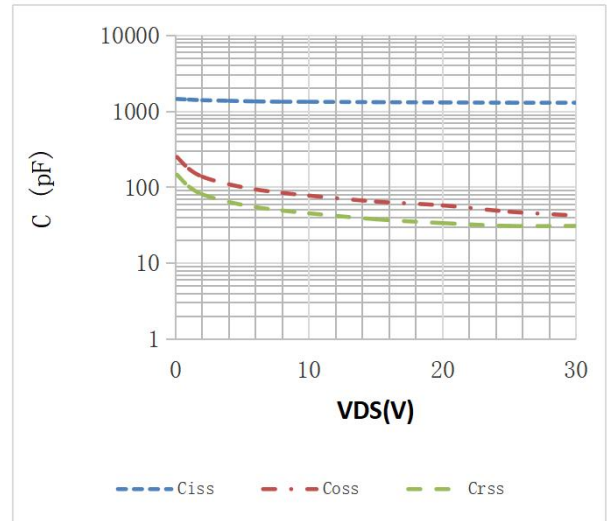


Fig.3 Power Dissipation

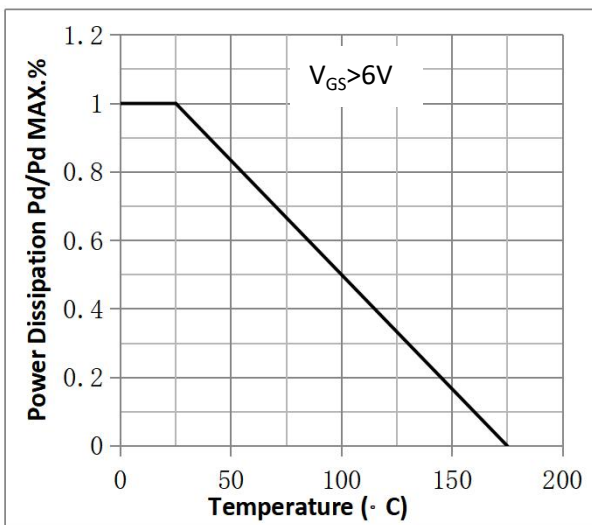


Fig.4 Typical output Characteristics

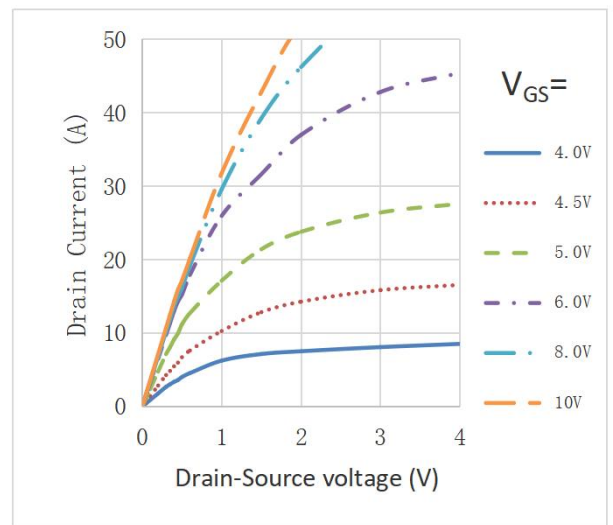


Fig.5 Threshold Voltage V.S Junction Temperature

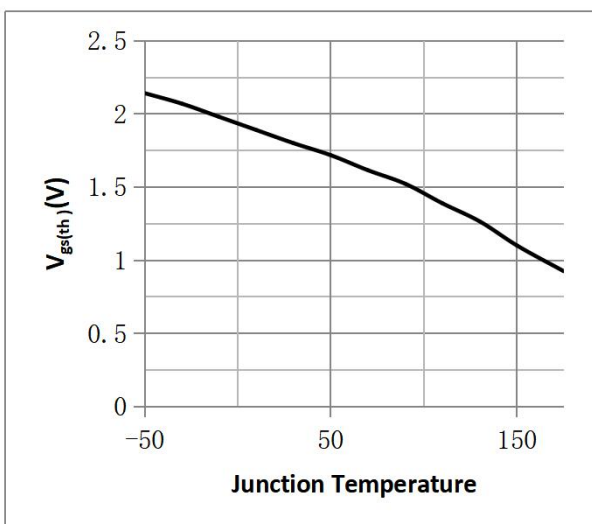


Fig.6 Resistance V.S Drain Current

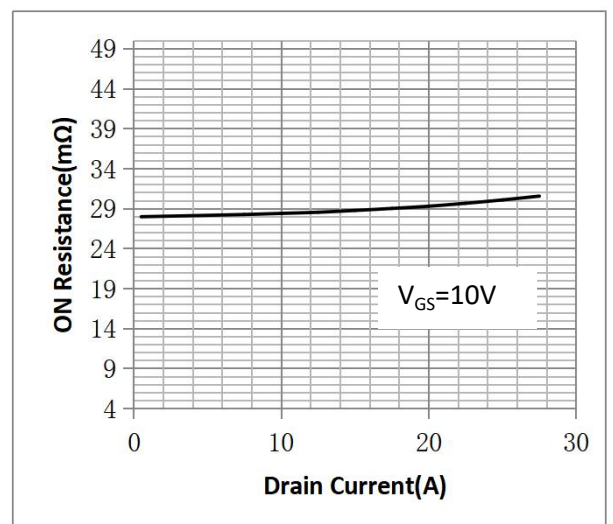


Fig.7 On-Resistance VS Gate Source Voltage

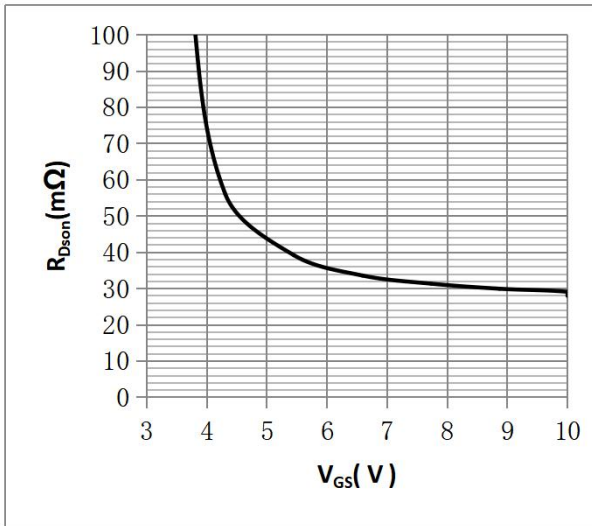


Fig.8 On-Resistance V.S Junction Temperature

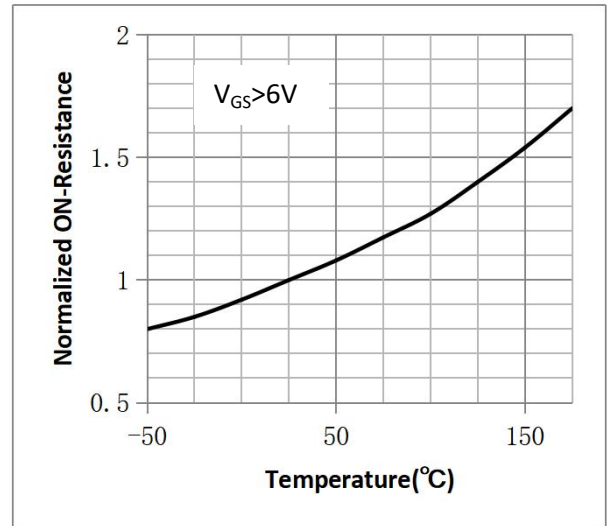


Figure 9. Diode Forward Voltage vs. Current

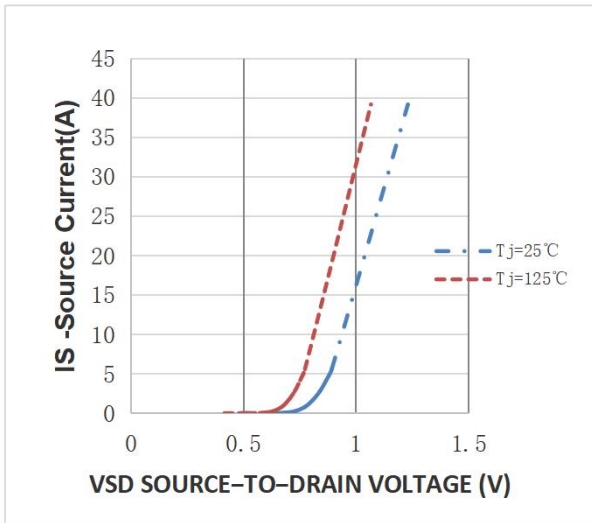


Figure 10. Transfer Characteristics

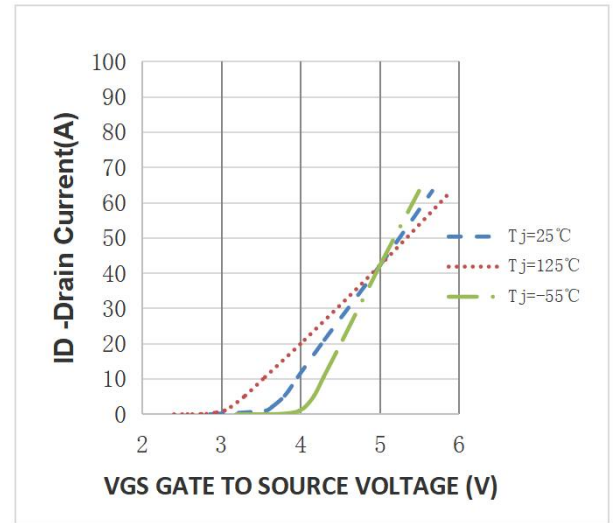


Fig.11 Safe Operating Area

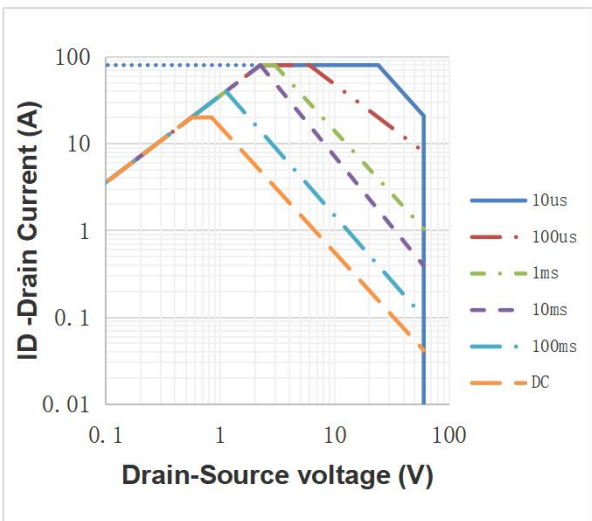
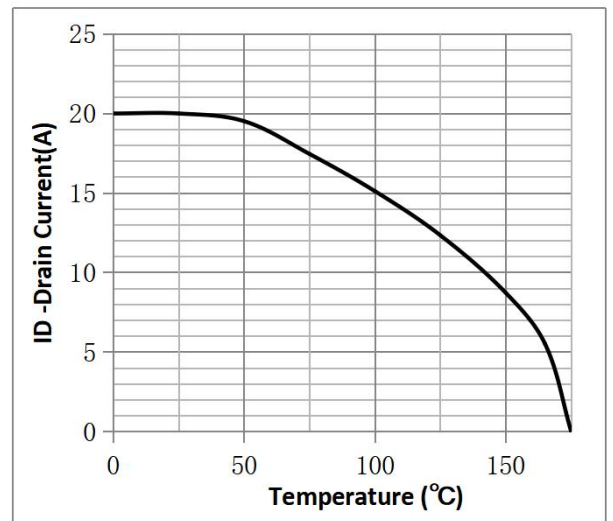
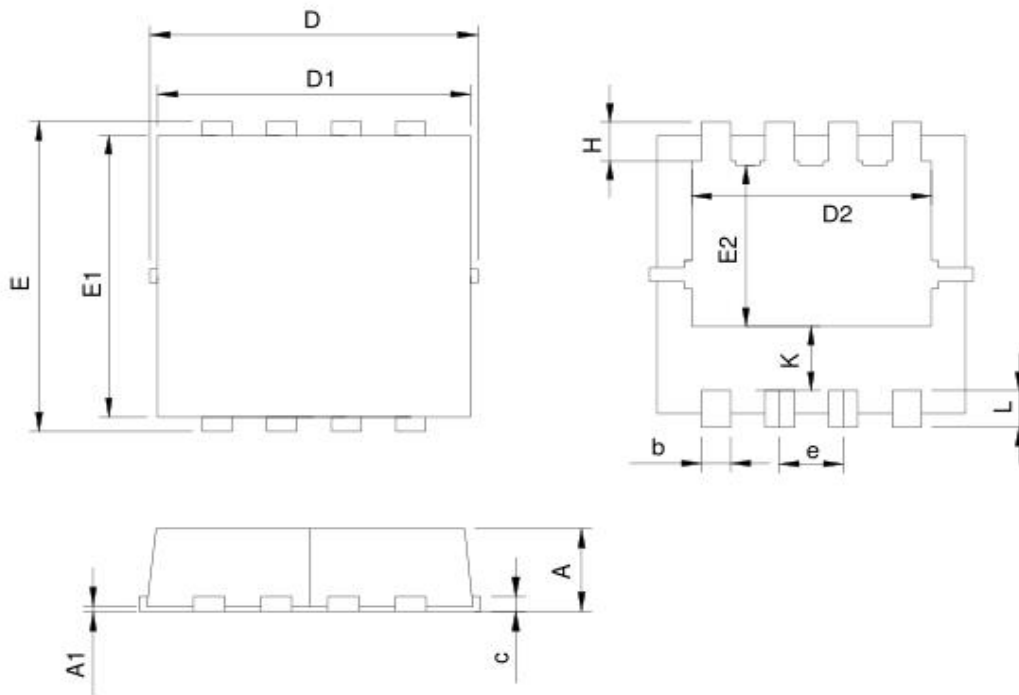


Fig.12 I_D vs. Case Temperature^③

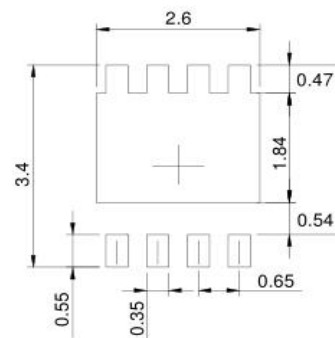


•DFN3*3 Package Outline



SYMBOL	DFN3.3x3.3-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.70	1.00	0.028	0.039
A1	0.00	0.05	0.000	0.002
b	0.25	0.35	0.010	0.014
c	0.14	0.20	0.006	0.008
D	3.10	3.50	0.122	0.138
D1	3.05	3.25	0.120	0.128
D2	2.35	2.55	0.093	0.100
E	3.10	3.50	0.122	0.138
E1	2.90	3.10	0.114	0.122
E2	1.64	1.84	0.065	0.072
e	0.65 BSC		0.026 BSC	
H	0.32	0.52	0.013	0.020
K	0.59	0.79	0.023	0.031
L	0.25	0.55	0.010	0.022

RECOMMENDED LAND PATTERN



UNIT: mm

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	2021.9.10	
B	2021.11.5	Add note1
C	2022.10.12	Reach,HF figure 3.ID Curve modify