

40V N-Channel Power MOSFET

• 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

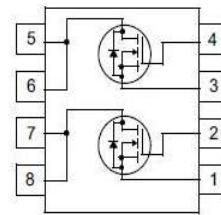
• Ordering Information:

Part NO.	ZMDA68412N
Marking	ZMD68412
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

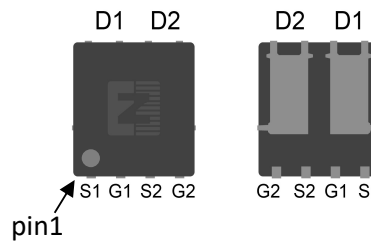
• Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		40	V
Gate-Source Voltage ^①	V_{GS}		± 20	V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	41	A
	I_D	$T_C=75^\circ\text{C}$	37	A
	I_D	$T_C=100^\circ\text{C}$	32	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^\circ\text{C}$;	164	A
Total Power Dissipation	P_D	$T_C=25^\circ\text{C}$	38	W
Total Power Dissipation	P_D	$T_A=25^\circ\text{C}$	3.0	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}	$L=0.1\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	25	mJ
		$L=0.5\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$,	47.5	mJ
ESD Level (HBM)	CLASS 1B			

• Product Summary



$V_{DS} = 40\text{V}$
 $R_{DS(ON)} = 7.4\text{m}\Omega$
 $I_D = 41\text{A}$



DFN5*6



•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	4	°C/W
Thermal resistance, junction-ambient ^②	R_{thJA}		-	50	°C/W
Soldering temperature	T_{sold}		-	260	°C

•Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	40			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}	$V_{GS} = 0V, V_{DS} = 40V$			1.0	μA
Gate- Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 14A$		7.4	9.2	m Ω
		$V_{GS} = 4.5V, I_D = 10A$		10	13	m Ω
Forward Transconductance	g_{FS}	$V_{DS} = 5V, I_{SD} = 5A$		8		S
Diode Forward Voltage	V_{FSD}	$V_{GS} = 0V, I_{SD} = 14A$			1.3	V

•Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Input capacitance	C_{iss}	$f = 1MHz, V_{DS} = 25V$	-	645	-	pF	
Output capacitance	C_{oss}		-	170	-		
Reverse transfer capacitance	C_{rss}		-	13	-		
Gate Resistance	R_g	$f = 1MHz$	-	1.6		Ω	
Total gate charge	Q_g	$V_{DD} = 15V, I_D = 20A, V_{GS} = 10V$	-	12	-	nC	
	$Q_g(4.5V)$		-	7	-		
	Gate - Source charge		Q_{gs}	-	2		-
	Gate - Drain charge		Q_{gd}	-	3.8		-
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = 10V, V_{DS} = 15V, R_G = 3.3\Omega, I_D = 20A$	-	4.5	-	ns	
Turn-ON Rise time	t_r		-	9	-	ns	
Turn-Off Delay time	$t_{D(off)}$		-	8	-	ns	
Turn-Off Fall time	t_f		-	3	-	ns	
Reverse Recovery Time	t_{RR}	$V_{DD} = 20V, di_s/dt = 100A/\mu s, I_S = 20A$	-	7.5	-	ns	
Reverse Recovery Charge	Q_{RR}		-	16	-	nC	

Fig.1 Gate-Charge Characteristics

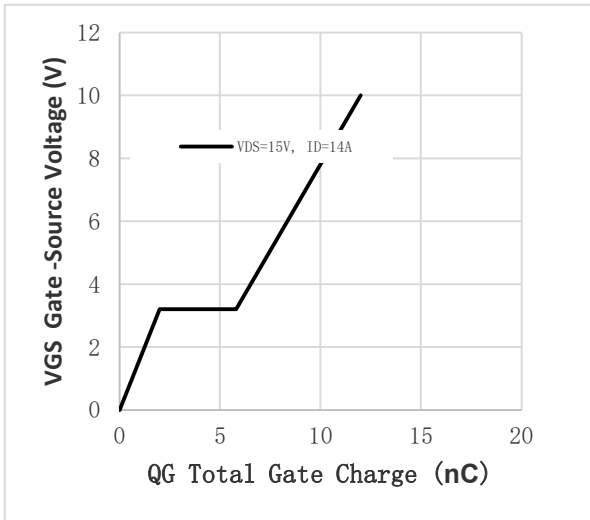


Fig.2 Capacitance Characteristics

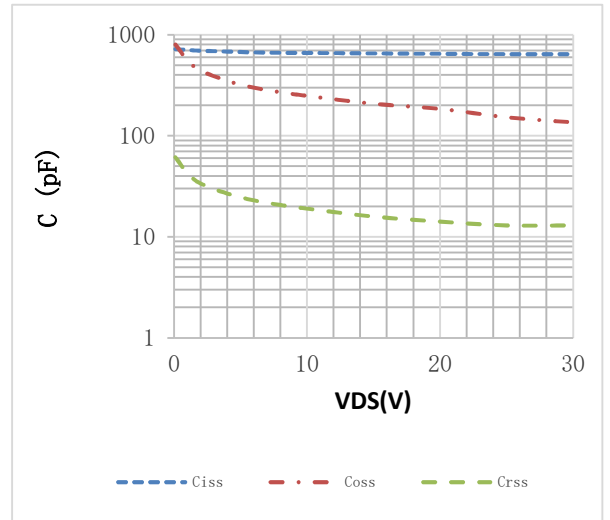


Fig.3 Power Dissipation

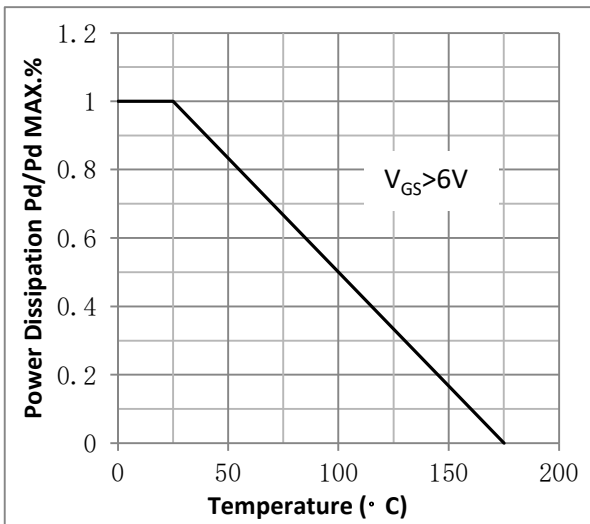


Fig.4 Typical output Characteristics

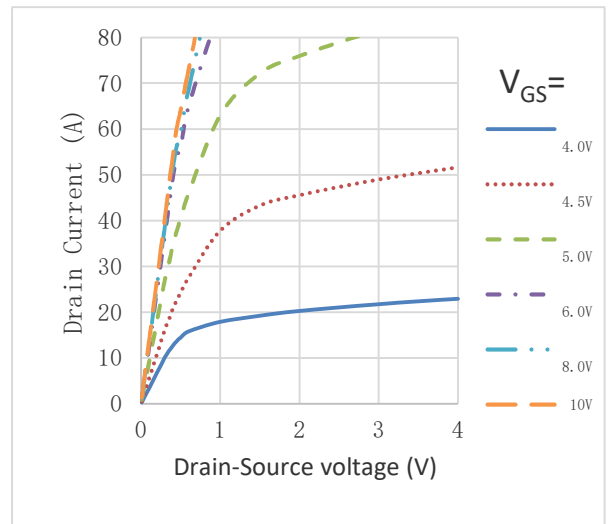


Fig.5 Threshold Voltage V.S Junction Temperature

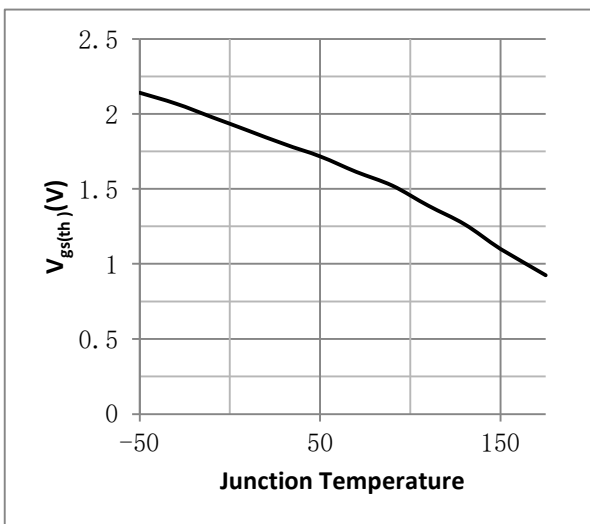


Fig.6 Resistance V.S Drain Current

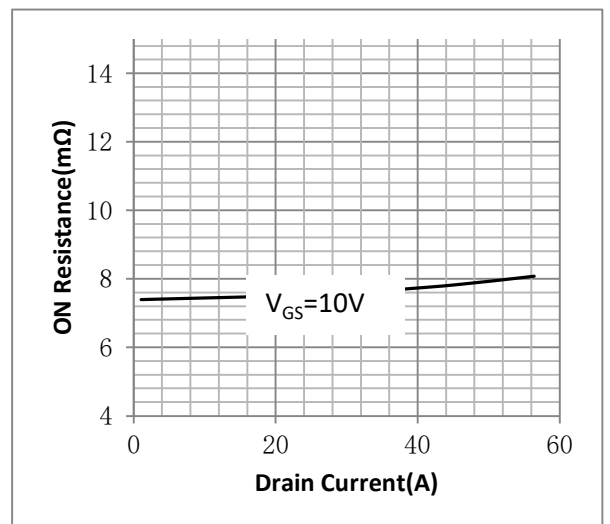


Fig.7 On-Resistance VS Gate Source Voltage

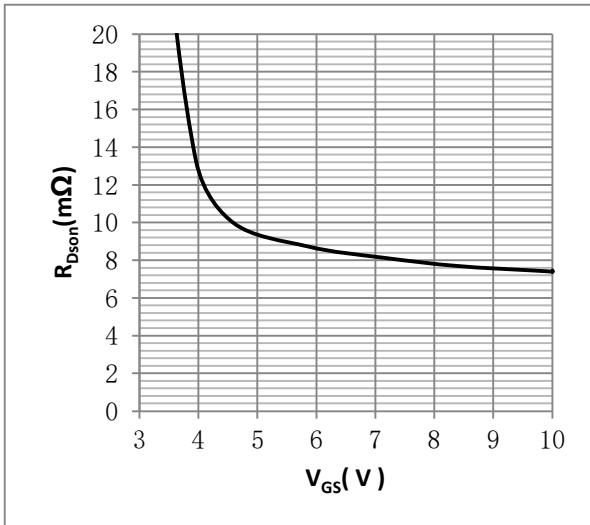


Fig.8 On-Resistance V.S Junction Temperature

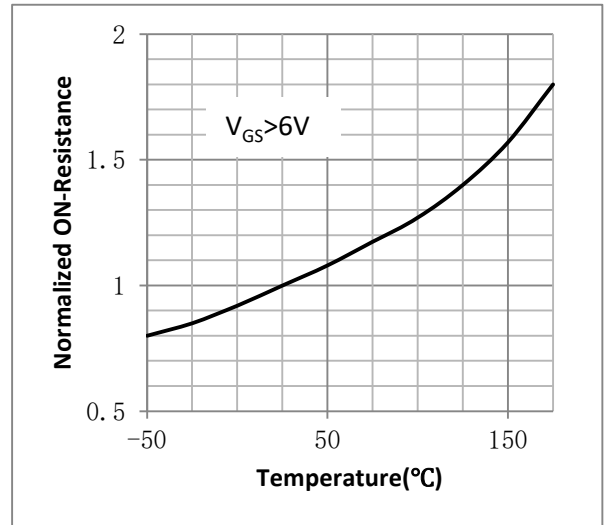


Figure 9. Diode Forward Voltage vs. Current

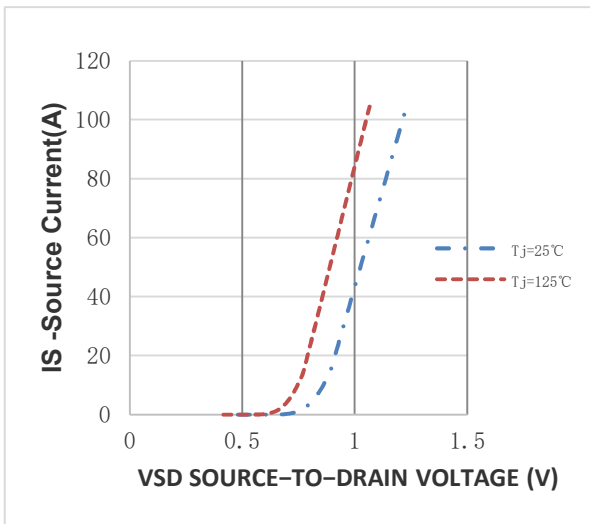


Figure 10. Transfer Characteristics

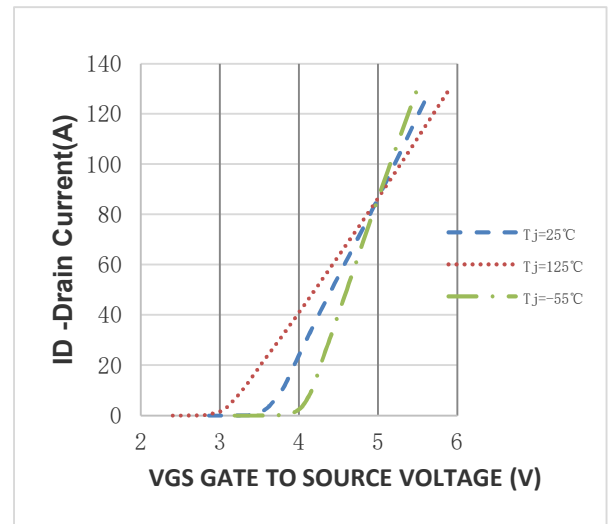


Fig.11 Safe Operating Area

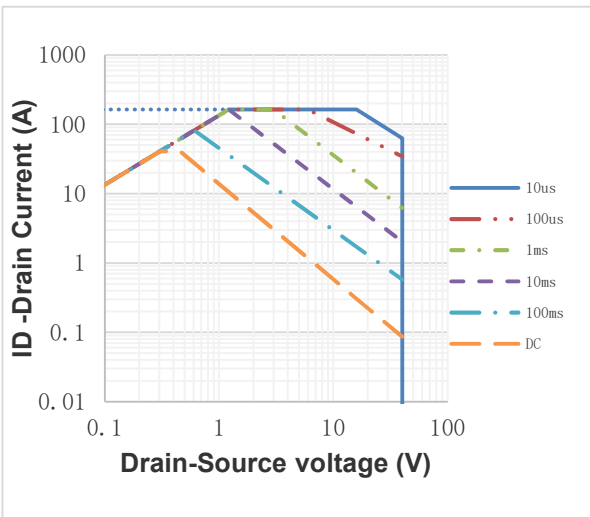
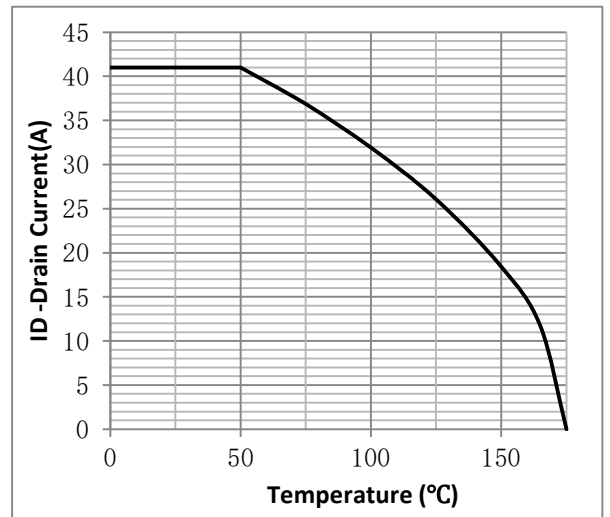
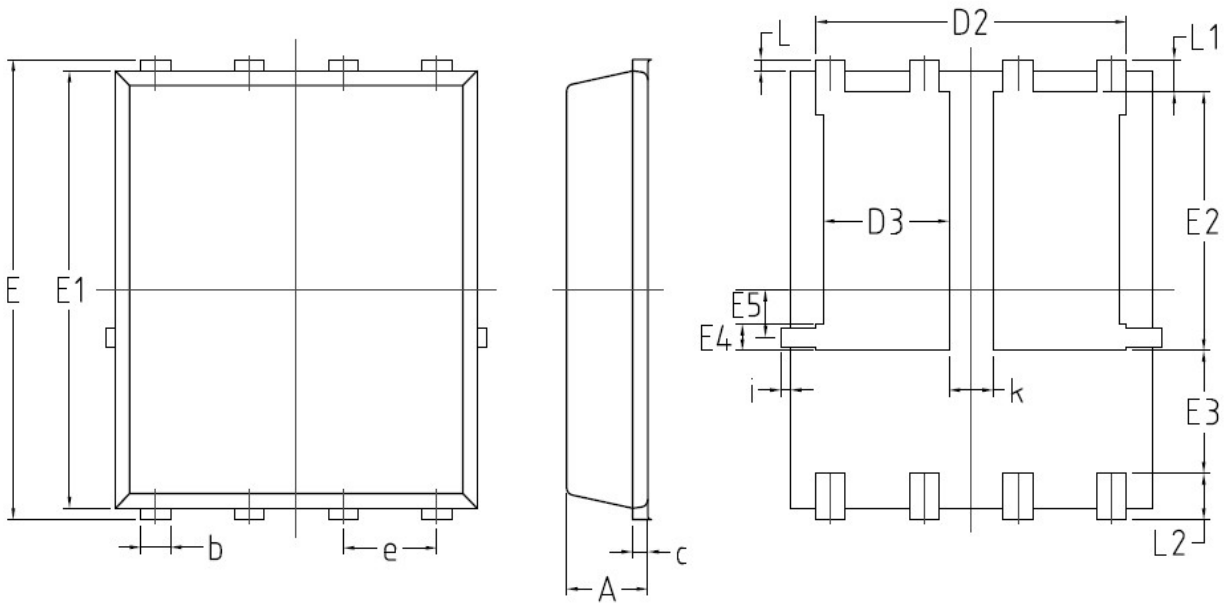


Fig.12 ID vs. Case Temperature^③



•DFN5*6 Package Outline



SYMBOL	COMMON			
	MM		INCH	
	MIN.	MAX.	MIN.	MAX.
A	1.03	1.17	0.0406	0.0461
b	0.34	0.48	0.0134	0.0189
c	0.203 BSC		0.0080 BSC	
D	4.80	5.40	0.1890	0.2126
D1	4.80	5.00	0.1890	0.1969
D2	4.11	4.31	0.1620	0.1700
D3	1.60	1.80	0.0629	0.0708
E	5.95	6.15	0.2343	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	3.30	3.50	0.1300	0.1378
E3	1.40	/	0.0551	/
E4	0.35 BSC		0.0138BSC	
E5	0.625 BSC		0.0246BSC	
e	1.27 BSC		0.05 BSC	
L	0.05	0.25	0.0019	0.0098
L1	0.38	0.50	0.0150	0.0197
L2	0.38	0.71	0.0150	0.0280
i	/	0.18	/	0.0070
k	0.5	0.7	0.0197	0.0276

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	2024.3.8	New
B	2024.11.6	RDSon modified.
C	2026.3.3	Correct POD,ESD level.