

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
- Half-Bridge - N-channel

• Application

- BLDC Motor driver
- DC-DC
- Battery protection

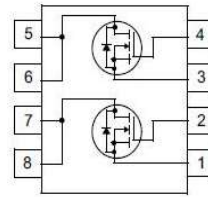
• Ordering Information:

Part NO.	ZMDA68412HN
Marking	ZMD68412H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

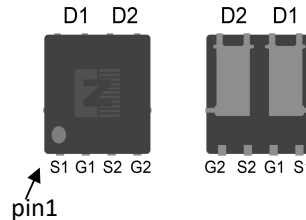
• Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS}$		40	V
Gate-Source Voltage <sup>①</sup>	$V_{GS}$		$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	45	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; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ;	180	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 1C			

• Product Summary



$V_{DS} = 40\text{V}$   
 $R_{DS(ON)} = 7.7\text{m}\Omega$   
 $I_D = 45\text{A}$



DFN5\*6



**•Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$		-	4	°C/W
Thermal resistance, junction-ambient <sup>②</sup>	$R_{thJA}$		-	50	°C/W
Soldering temperature	Tsold		-	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	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2	2.6	4	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{GS}=0V, V_{DS}=40V$			1.0	$\mu A$
Gate- Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=14A$		7.7	9	m $\Omega$
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	$C_{iss}$	$f=1MHz, V_{DS}=25V$	-	715	-	pF
Output capacitance	$C_{oss}$		-	265	-	
Reverse transfer capacitance	$C_{rss}$		-	75	-	
Gate Resistance	$R_g$	$f=1MHz$	-	4		$\Omega$
Total gate charge	$Q_g$	$V_{DD}=15V, I_D=14A, V_{GS}=10V$	-	8.7	-	nC
Gate - Source charge	$Q_{gs}$		-	1.2	-	
Gate - Drain charge	$Q_{gd}$		-	2.3	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=14A$	-	6	-	ns
Turn-ON Rise time	$t_r$		-	5	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	15	-	ns
Turn-Off Fall time	$t_f$		-	4	-	ns
Reverse Recovery Time	$t_{RR}$	$V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=14A$	-	31	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	44	-	nC

Fig.1 Gate-Charge Characteristics

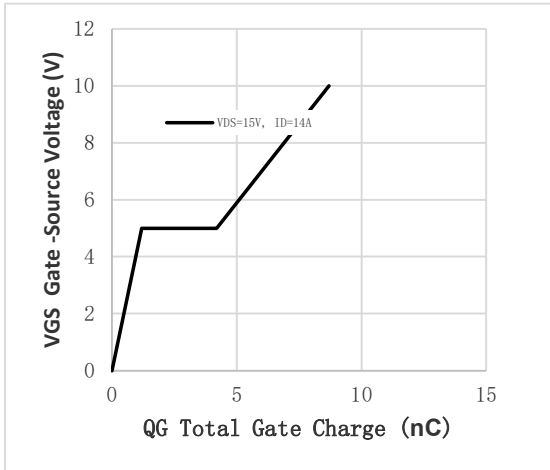


Fig.2 Capacitance Characteristics

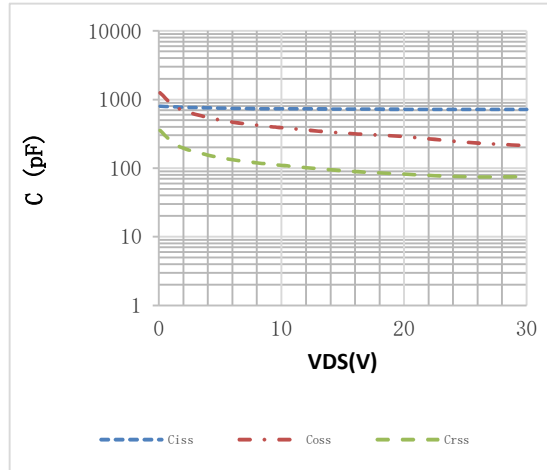


Fig.3 Power Dissipation

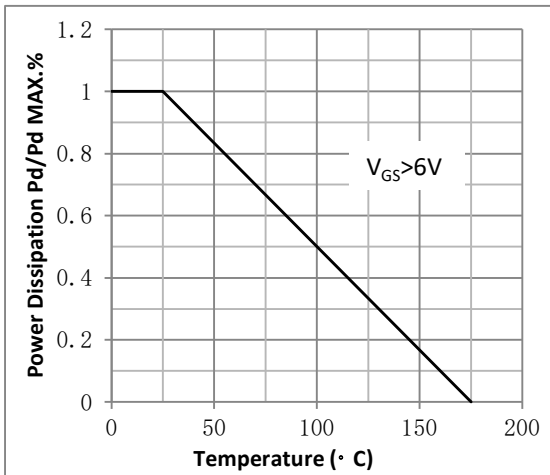


Fig.4 Typical output Characteristics

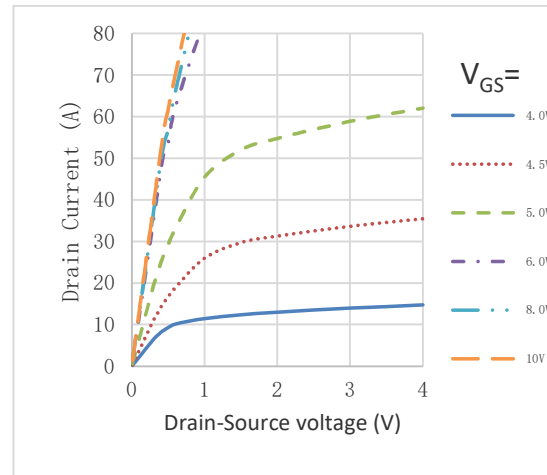


Fig.5 Threshold Voltage V.S Junction Temperature

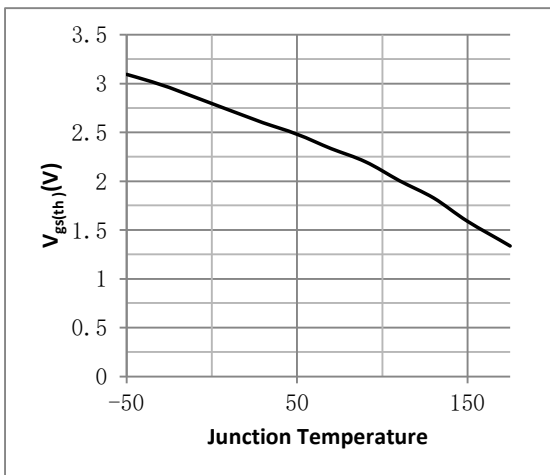


Fig.6 Resistance V.S Drain Current

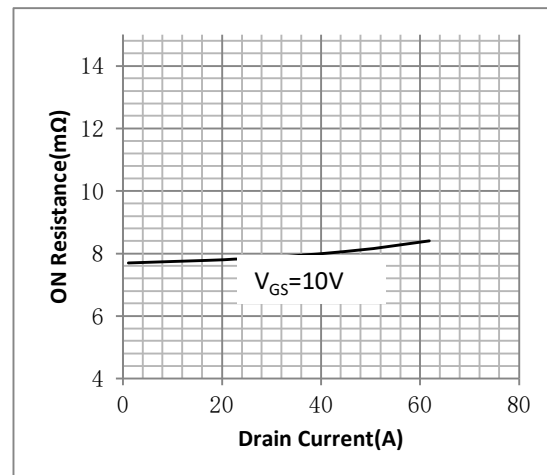


Fig.7 On-Resistance VS Gate Source Voltage

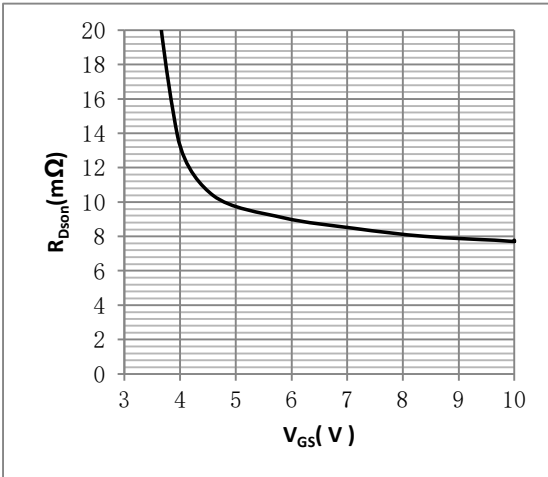


Fig.8 On-Resistance V.S Junction Temperature

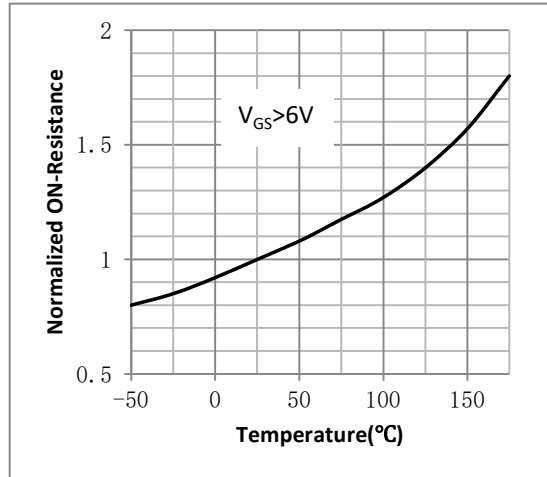


Figure 9. Diode Forward Voltage vs. Current

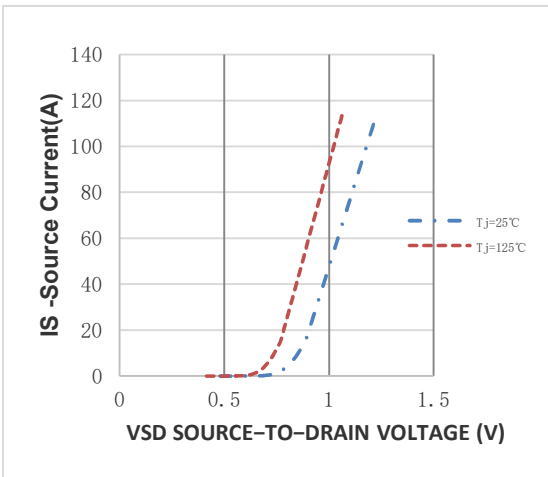


Figure 10. Transfer Characteristics

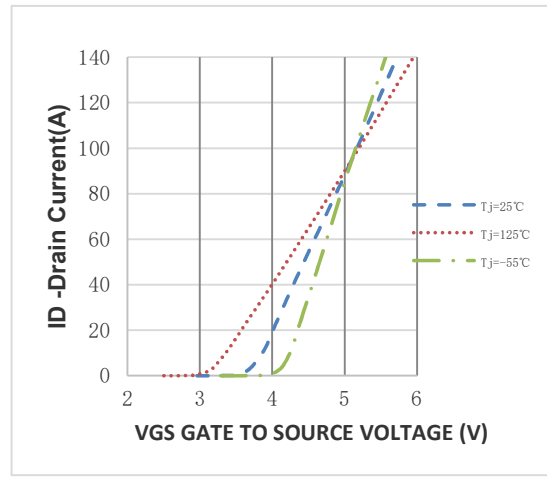


Fig.11 Safe Operating Area

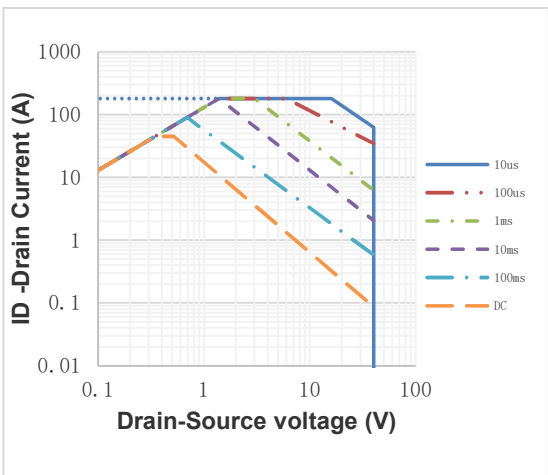
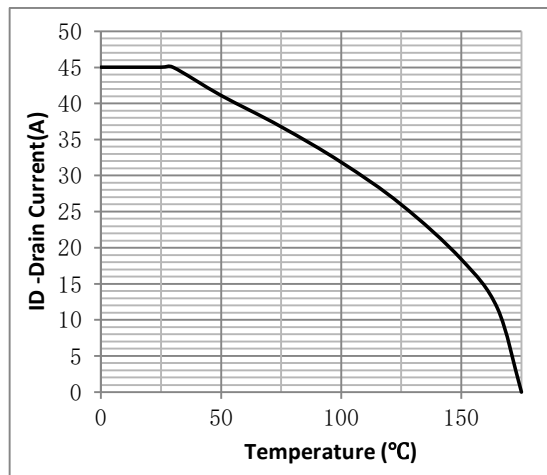
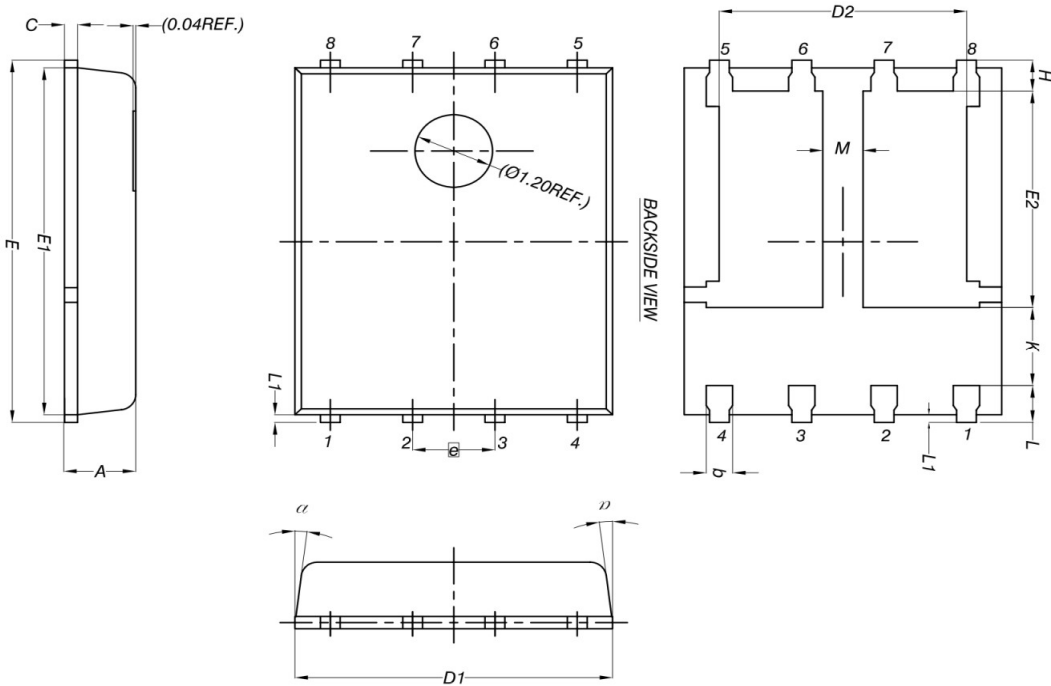


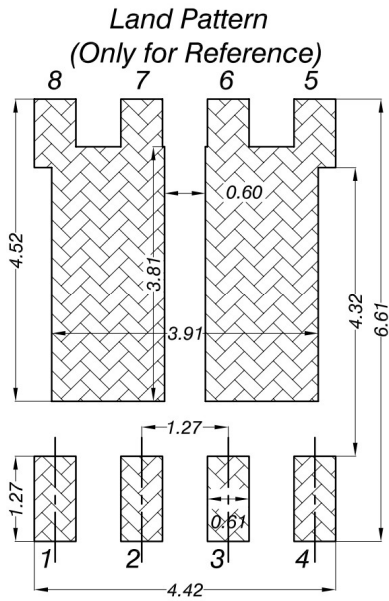
Fig.12 ID vs. Case Temperature<sup>③</sup>



•DFN5\*6 Package Outline



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
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
$\square$ 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
M	0.50	-	-
α	0°	-	12°



**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	2024.8.8	New
B	2025.10.11	Update ESD level.