

## General Description

It combines trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ .

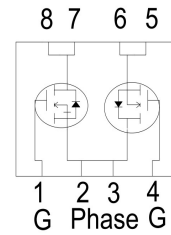
## Features

- AEC-Q101 Qualified
- Low  $R_{DS(ON)}$  to minimize conductive loss
- Low Gate Charge for fast switching
- Half-Bridge - N-channel

## Application

- BLDC Motor driver
- DC-DC

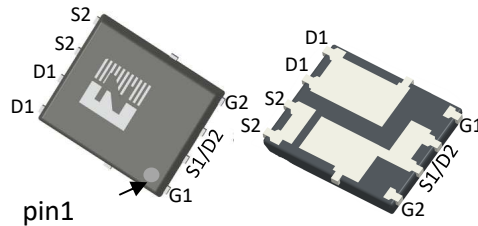
## Product Summary



$$V_{DS} = 40V$$

$$R_{DS(ON)} = 5.5m\Omega$$

$$I_D = 54A$$



DFN5\*6



## Ordering Information:

|                           |              |
|---------------------------|--------------|
| Part NO.                  | ZMDA68412HNB |
| Marking                   | ZMD68412H    |
| Packing Information       | REEL TAPE    |
| Basic ordering unit (pcs) | 3000         |

## Absolute Maximum Ratings ( $T_C=25^\circ C$ )

| 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         | $I_D$     | $T_C=25^\circ C$                                      | 54          | A          |
|                                  | $I_D$     | $T_C=75^\circ C$                                      | 45          | A          |
|                                  | $I_D$     | $T_C=100^\circ C$                                     | 39          | A          |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu s$ ; $T_{mb} = 25^\circ C$ ; | 216         | A          |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ C$                                      | 38          | W          |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ C$                                      | 3.3         | W          |
| Operating Junction Temperature   | $T_J$     |                                                       | -55 to +175 | $^\circ C$ |
| Storage Temperature              | $T_{STG}$ |                                                       | -55 to +175 | $^\circ C$ |
| Single Pulse Avalanche Energy    | $E_{AS}$  | $L=0.1mH$ , $V_{GS}=10V$ , $R_g=25\Omega$ ,           | 25          | mJ         |
|                                  |           | $L=0.5mH$ , $V_{GS}=10V$ , $R_g=25\Omega$ ,           | 40          | mJ         |
| ESD Level (HBM)                  |           | CLASS 1C                                              |             |            |

**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|------------|------|------|------|------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 4    | °C/W |
| Thermal resistance, junction-ambient <sup>②</sup> | $R_{thJA}$ |      | -    | 45   | °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    | 3    | 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 | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=14A$         |      | 5.5  | 6.1  | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=10A$       |      | 20   |      | 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            | $C_{iss}$    | $f=1MHz, V_{DS}=25V$                             | -    | 597  | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                  | -    | 205  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                  | -    | 10   | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                         | -    | 1.6  |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=15V, I_D=14A, V_{GS}=10V$                | -    | 6.7  | -    | nC       |
| Gate - Source charge         | $Q_{gs}$     |                                                  | -    | 1.3  | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                  | -    | 2.3  | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$ | -    | 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        | $t_{RR}$     | $V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=20A$        | -    | 31   | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                  | -    | 44   | -    | nC       |



Fig.1 Gate-Charge Characteristics

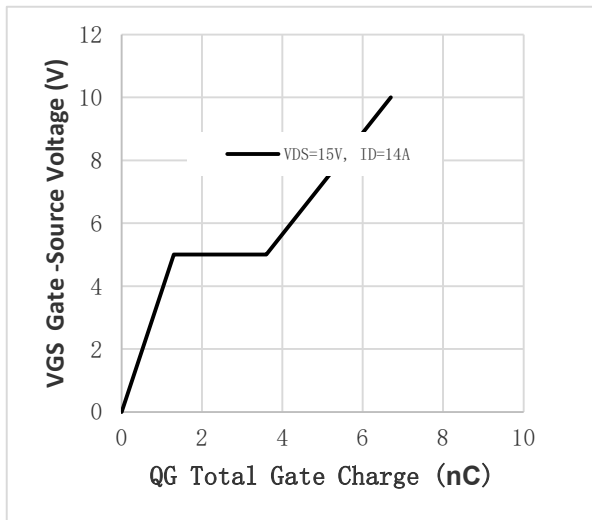


Fig.2 Capacitance Characteristics

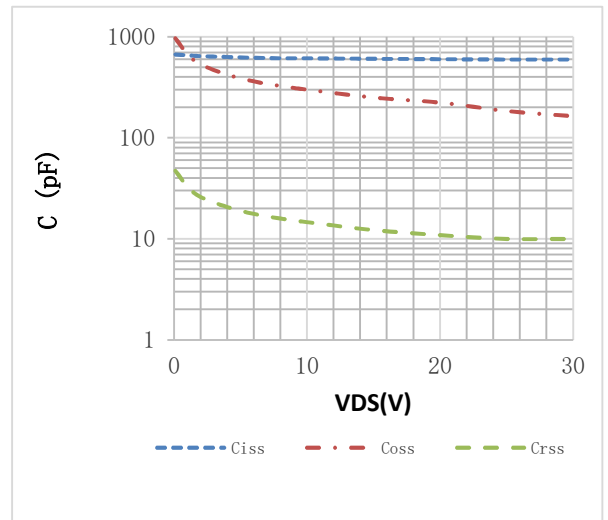


Fig.3 Power Dissipation

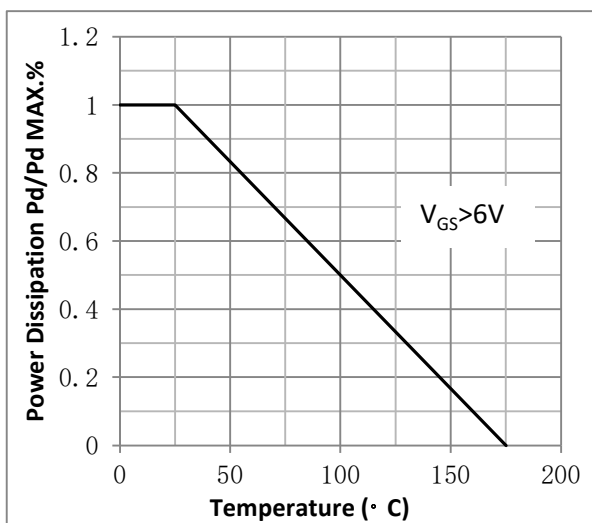


Fig.4 Typical output Characteristics

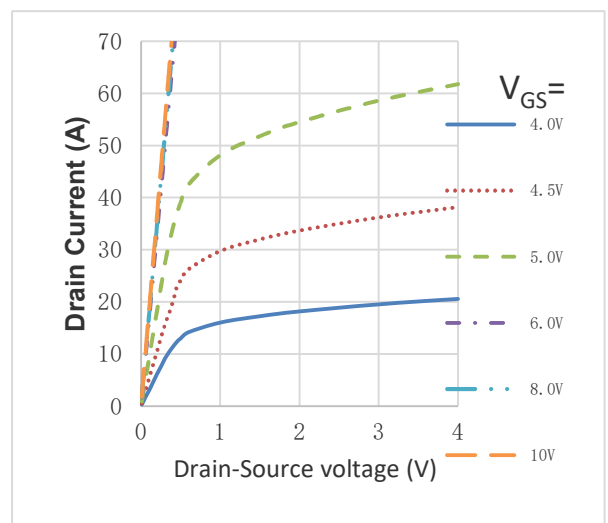


Fig.5 Threshold Voltage V.S Junction Temperature

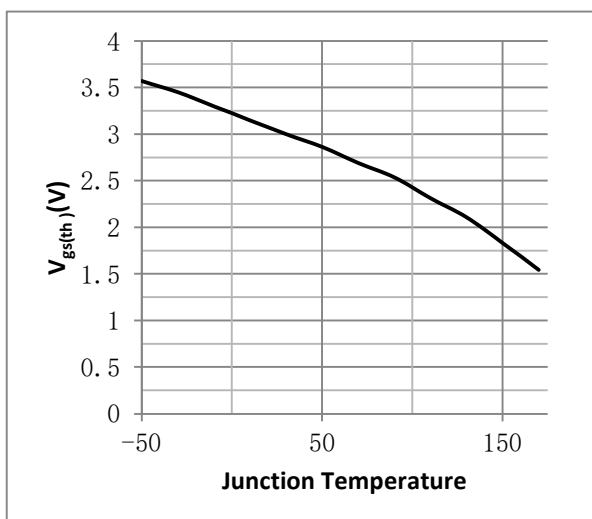


Fig.6 Resistance V.S Drain Current

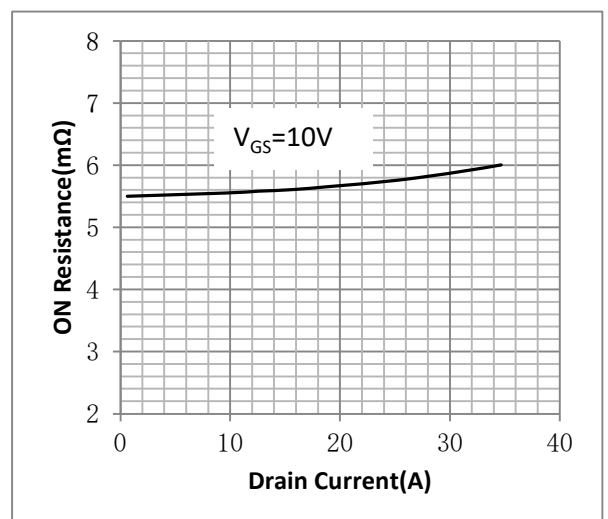


Fig.7 On-Resistance VS Gate Source Voltage

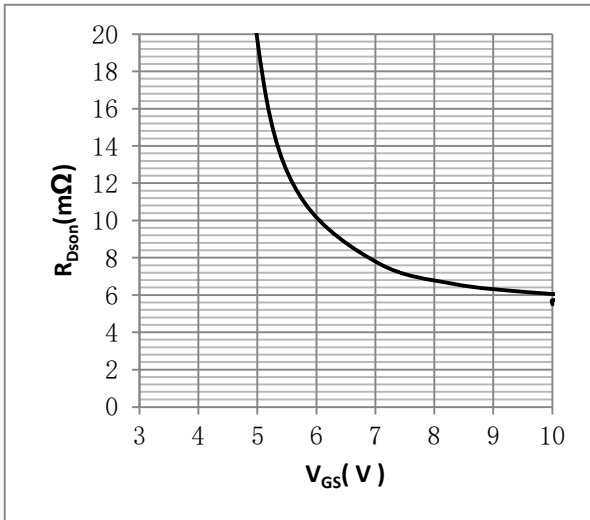


Fig.8 On-Resistance V.S Junction Temperature

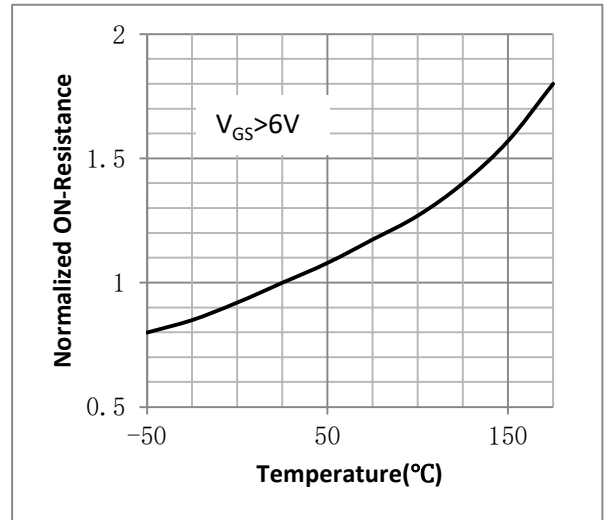


Figure 9. Diode Forward Voltage vs. Current

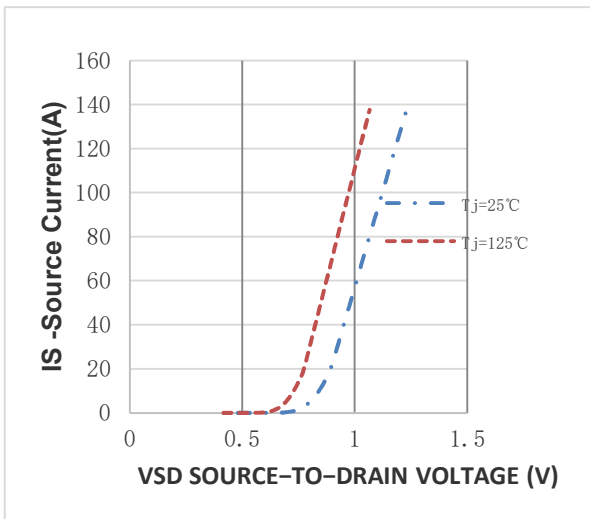


Figure 10. Transfer Characteristics

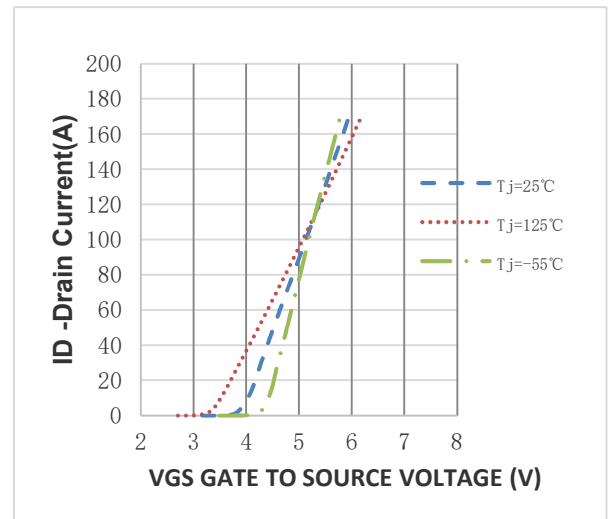


Fig.11 Safe Operating Area

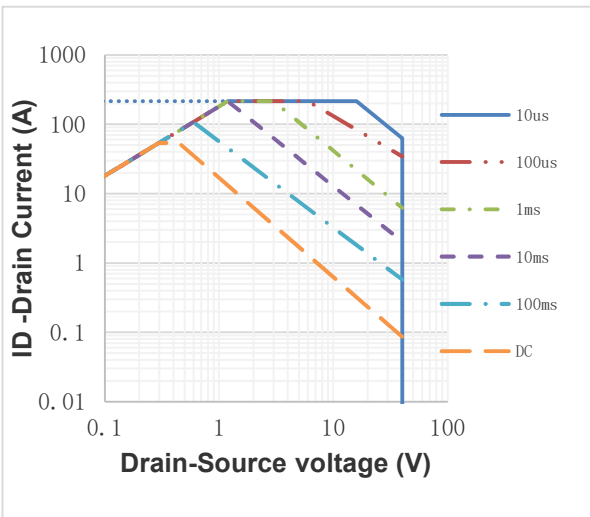
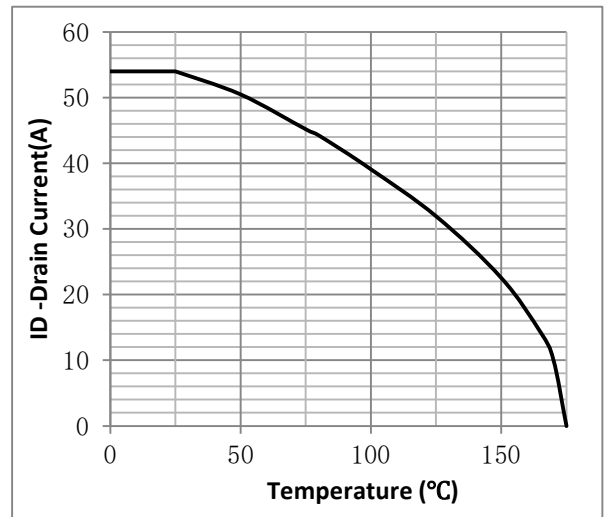
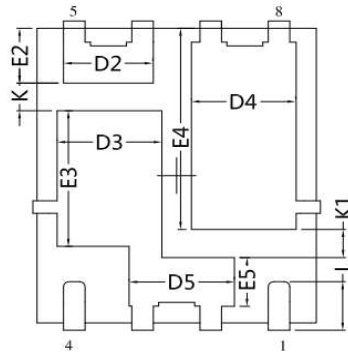
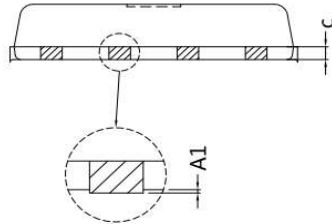
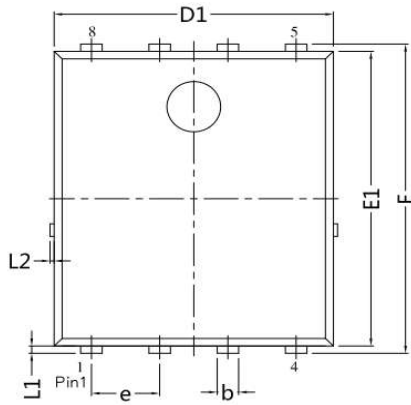


Fig.12 ID vs. Case Temperature<sup>③</sup>



•DFN5\*6 Package Outline



| DIM. | MILLIMETERS |      |      |
|------|-------------|------|------|
|      | MIN.        | NOM. | MAX. |
| A    | 1.00        | 1.10 | 1.20 |
| A1   | 0           | ---  | 0.05 |
| b    | 0.30        | 0.40 | 0.50 |
| c    | 0.20        | 0.25 | 0.30 |
| D1   | 5.10        | 5.20 | 5.30 |
| D2   | 1.52        | 1.67 | 1.82 |
| D3   | 1.78        | 1.95 | 2.10 |
| D4   | 1.78        | 1.95 | 2.10 |
| D5   | 1.81        | 1.96 | 2.11 |
| E    | 6.00        | 6.15 | 6.30 |
| E1   | 5.76        | 5.86 | 5.96 |
| E2   | 0.94        | 1.09 | 1.24 |
| E3   | 2.55        | 2.70 | 2.85 |
| E4   | 3.85        | 4.0  | 4.15 |
| E5   | 0.82        | 0.97 | 1.12 |
| e    | 1.27 BSC    |      |      |
| L    | 0.90        | 0.96 | 1.06 |
| L1   | 0.05        | 0.15 | 0.25 |
| L2   | 0.02        | 0.08 | 0.15 |
| K    | 0.55        | ---  | ---  |
| K1   | 0.56        | ---  | ---  |

**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       | 2024/9/4  | New                    |
| B       | 2024/9/12 | Modified ciss, Qg etc. |
| C       | 2025/9/27 | Update ESD level.      |
|         |           |                        |
|         |           |                        |
|         |           |                        |
|         |           |                        |
|         |           |                        |