

### General Description

It combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . It is suitable for automotive application.

### 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

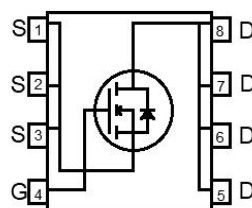
### Ordering Information:

|                           |              |
|---------------------------|--------------|
| Part NO.                  | ZMSA070N04HM |
| Marking                   | 070N04H      |
| 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             | $V_{DS}$  |                                                                   | 40          | V                |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                                   | $\pm 20$    | V                |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ\text{C}$                                            | 42          | A                |
|                                  | $I_D$     | $T_C=75^\circ\text{C}$                                            | 35          | A                |
|                                  | $I_D$     | $T_C=100^\circ\text{C}$                                           | 30          | A                |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ; | 168         | A                |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ\text{C}$                                            | 34          | W                |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ\text{C}$                                            | 2.5         | 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    | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 21          | mJ               |
|                                  |           | $L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 38          | mJ               |
| ESD Level (HBM)                  | CLASS 1C  |                                                                   |             |                  |

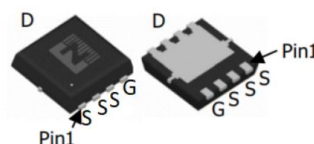
### Product Summary



$$V_{DS} = 40\text{V}$$

$$R_{DS(ON)} = 7\text{m}\Omega$$

$$I_D = 42\text{A}$$



DFN3\*3



**•Thermal resistance**

| Parameter                              | Symbol         | Min. | Typ. | Max. | Unit |
|----------------------------------------|----------------|------|------|------|------|
| Thermal resistance, junction - case    | $R_{thJC}$     |      | -    | 4.4  | °C/W |
| Thermal resistance, junction-ambient   | $R_{thJA}^{②}$ |      | -    | 60   | °C/W |
| Soldering temperature (total time<10s) | $T_{sold}$     |      | -    | 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            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 2.0  | 2.7  | 4.0  | 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    | 9    | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=4A$        |      | 9    |      | 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            | $C_{iss}$    | $f=1MHz, V_{DS}=25V$                             | -    | 908  | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                  | -    | 244  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                  | -    | 10   | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                         | -    | 1.2  |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=15V, I_D=20A, V_{GS}=10V$                | -    | 12   | -    | nC       |
| Gate - Source charge         | $Q_{gs}$     |                                                  | -    | 3    | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                  | -    | 5.3  | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$ | -    | 5    | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                  | -    | 7    | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                  | -    | 19   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                  | -    | 6    | -    | ns       |
| Reverse Recovery Time        | $t_{RR}$     | $V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=50A$        | -    | 24   | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                  | -    | 15   | -    | nC       |

Fig.1 Gate-Charge Characteristics

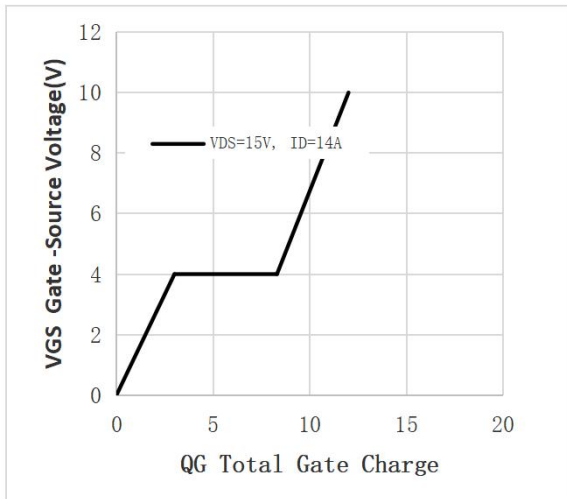


Fig.2 Capacitance Characteristics

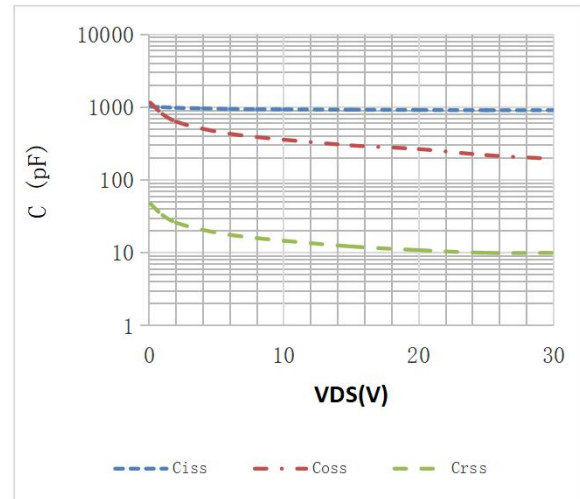


Fig.3 Power Dissipation

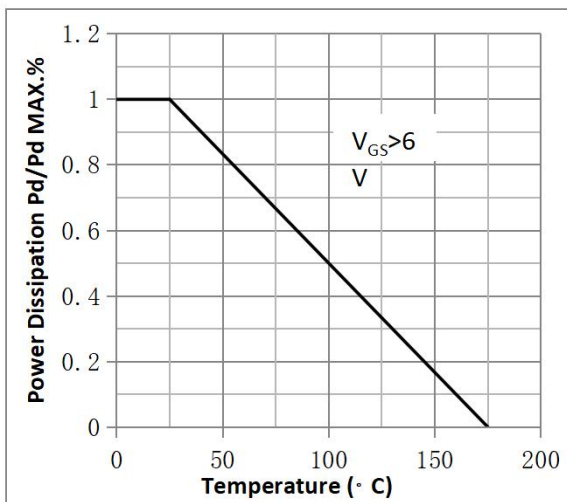


Fig.4 Typical output Characteristics

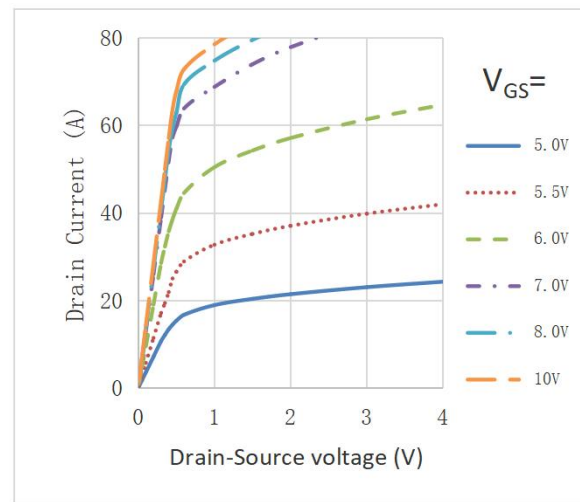


Fig.5 Threshold Voltage V.S Junction Temperature

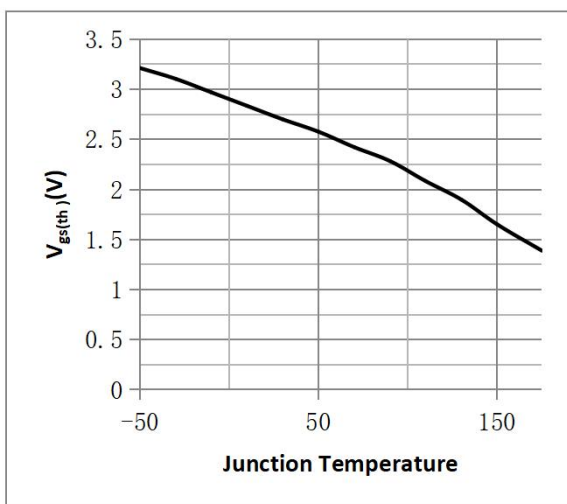


Fig.6 Resistance V.S Drain Current

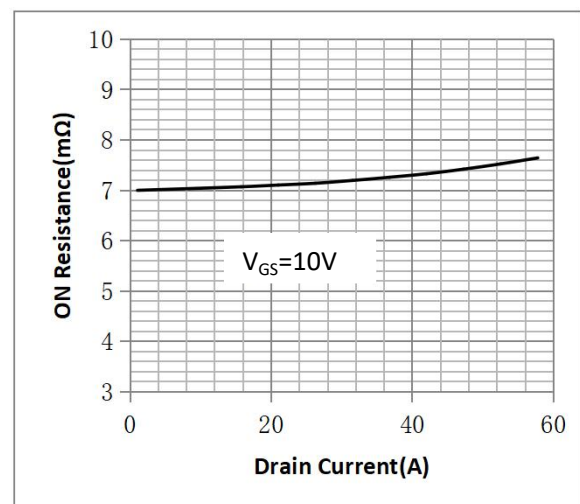


Fig.7 On-Resistance VS Gate Source Voltage

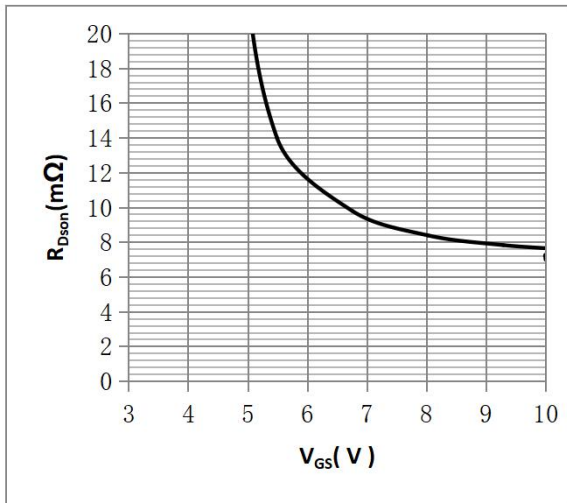


Fig.8 On-Resistance V.S Junction Temperature

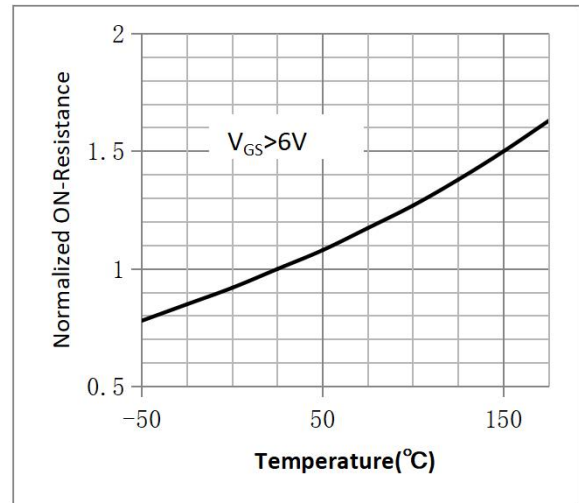


Figure 9. Diode Forward Voltage vs. Current

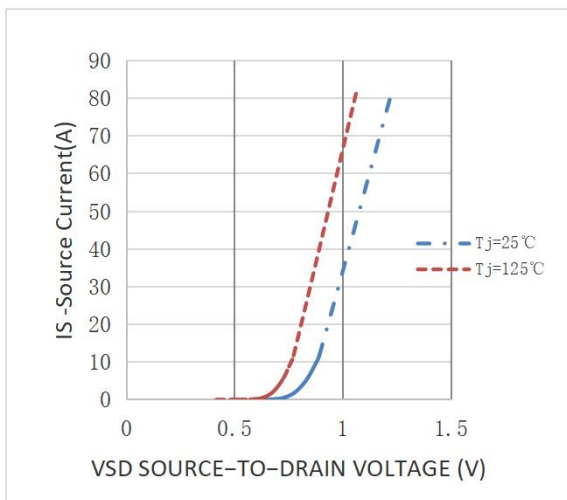


Figure 10. Transfer Characteristics

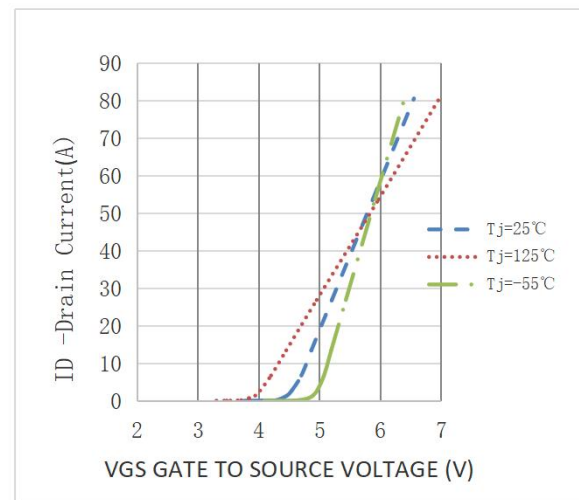


Fig.11 Safe Operating Area

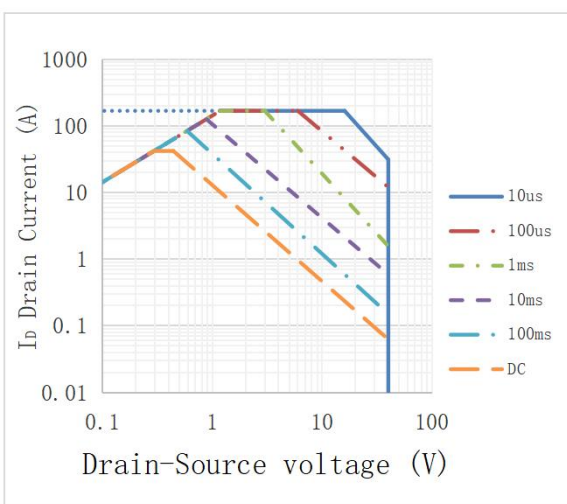
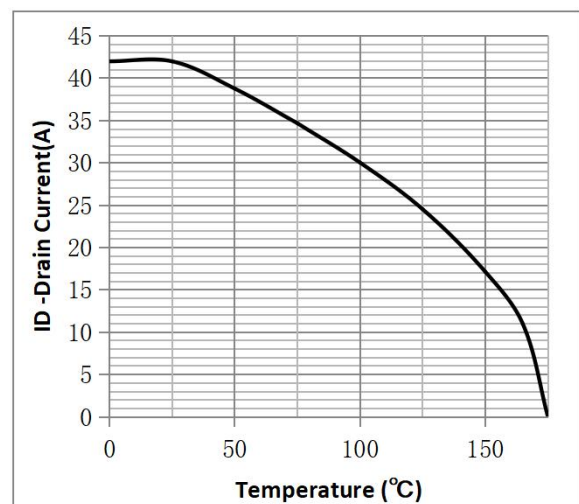
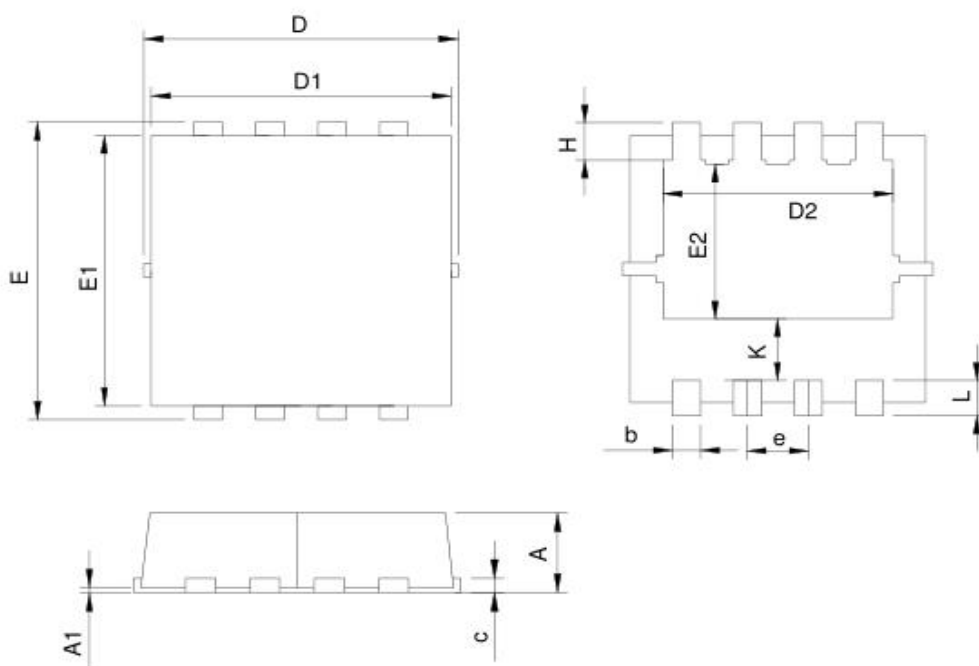


Fig.12  $I_D$  vs. Junction Temperature<sup>③</sup>

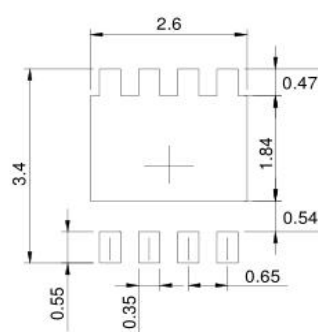


## ●DFN3\*3 Package Outline



| 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       | 2024.6.28 | New    |
|         |           |        |
|         |           |        |
|         |           |        |
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