

### 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.

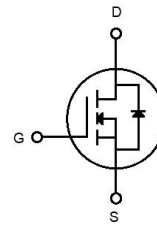
### Features

- 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
- Load Switch

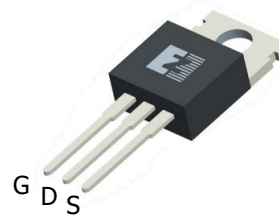
### Product Summary



$$V_{DS} = 150V$$

$$R_{DS(ON)} = 6.5m\Omega$$

$$I_D = 109A$$



TO-220



### Ordering Information:

|                           |              |
|---------------------------|--------------|
| Part NO.                  | ZMSA055N15HP |
| Marking                   | ZMS055N15H   |
| Packing Information       | Tube         |
| Basic ordering unit (pcs) | 1000         |

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

| Parameter                        | Symbol    | Conditions                                                        | Value       | Unit             |
|----------------------------------|-----------|-------------------------------------------------------------------|-------------|------------------|
| Drain-Source Voltage             | $V_{DS}$  |                                                                   | 150         | V                |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                                   | $\pm 20$    | V                |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ\text{C}$                                            | 109         | A                |
|                                  | $I_D$     | $T_C=75^\circ\text{C}$                                            | 89          | A                |
|                                  | $I_D$     | $T_C=100^\circ\text{C}$                                           | 77          | A                |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ; | 436         | A                |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ\text{C}$                                            | 214         | W                |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ\text{C}$                                            | 3.8         | 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    | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 390         | mJ               |
|                                  |           | $L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 702         | mJ               |
| ESD Level (HBM)                  | CLASS 2   |                                                                   |             |                  |

**•Thermal resistance**

| Parameter                              | Symbol         | Min. | Typ. | Max. | Unit |
|----------------------------------------|----------------|------|------|------|------|
| Thermal resistance, junction - case    | $R_{thJC}$     |      | -    | 0.7  | °C/W |
| Thermal resistance, junction-ambient   | $R_{thJA}^{②}$ |      | -    | 40   | °C/W |
| Soldering temperature (total time<10s) | $T_{sold}$     |      | -    | 260  | °C   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                     | Min. | Typ. | Max. | Unit       |
|-----------------------------------|--------------|-------------------------------|------|------|------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | 150  |      |      | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 2.0  | 3.3  | 4.0  | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=150V$      |      |      | 1.0  | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   |      |      | 100  | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=30A$         |      | 6.5  | 8.5  | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=20A$       |      | 45   |      | S          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=30A$       |      |      | 1.3  | V          |

**•Dynamic characteristics**

| Parameter                    | Symbol       | Condition                                        | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|--------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $f=1MHz, V_{DS}=25V$                             | -    | 6600 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                  | -    | 2750 | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                  | -    | 256  | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                         | -    | 1.2  |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=15V, I_D=20A, V_{GS}=10V$                | -    | 98   | -    | nC       |
| Gate - Source charge         | $Q_{gs}$     |                                                  | -    | 28   | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                  | -    | 25   | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$ | -    | 30   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                  | -    | 12   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                  | -    | 65   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                  | -    | 14   | -    | ns       |
| Reverse Recovery Time        | $t_{RR}$     | $V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=50A$        | -    | 72   | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                  | -    | 98   | -    | nC       |

Fig.1 Gate-Charge Characteristics

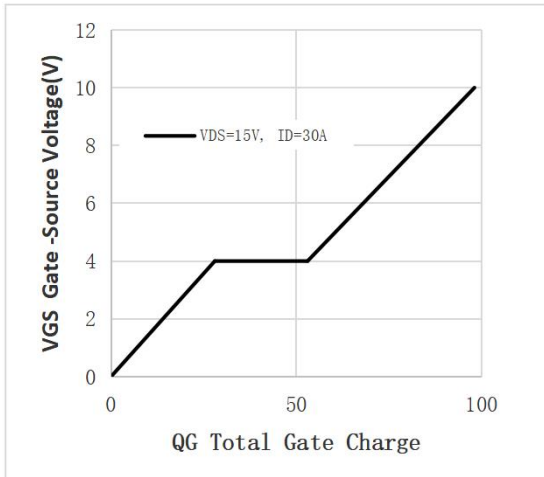


Fig.2 Capacitance Characteristics

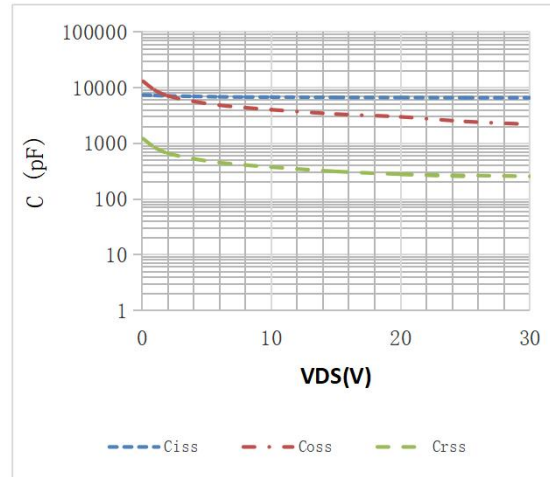


Fig.3 Power Dissipation

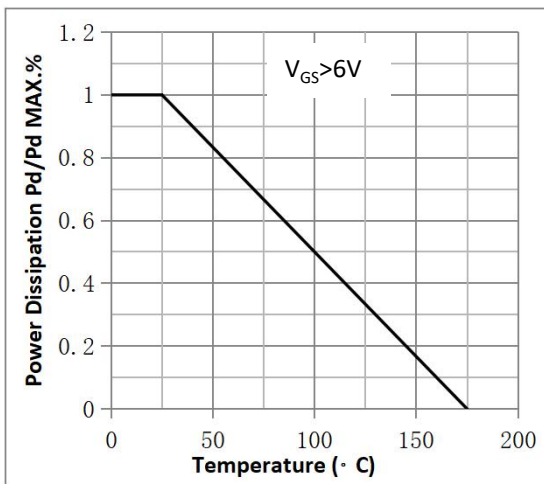


Fig.4 Typical output Characteristics

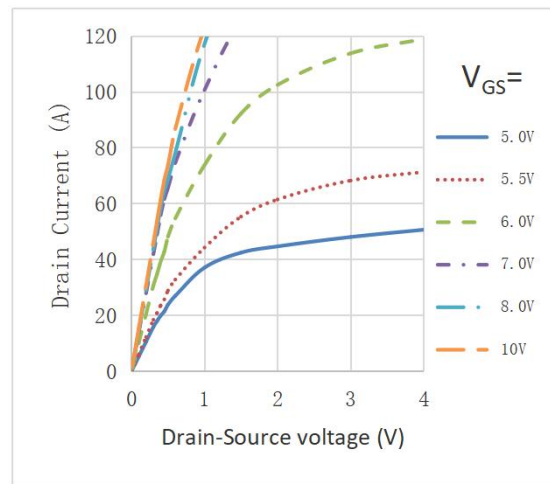


Fig.5 Threshold Voltage V.S Junction Temperature

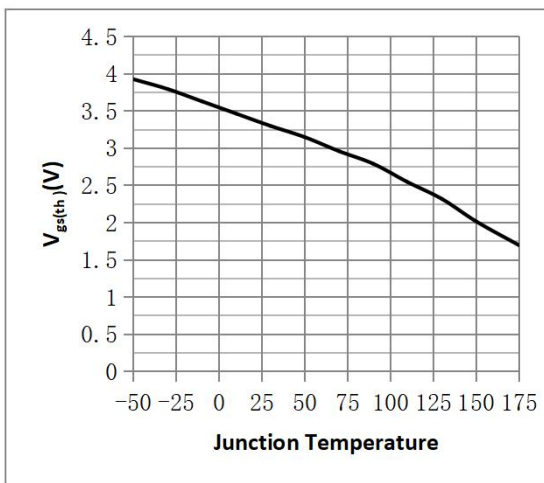


Fig.6 Resistance V.S Drain Current

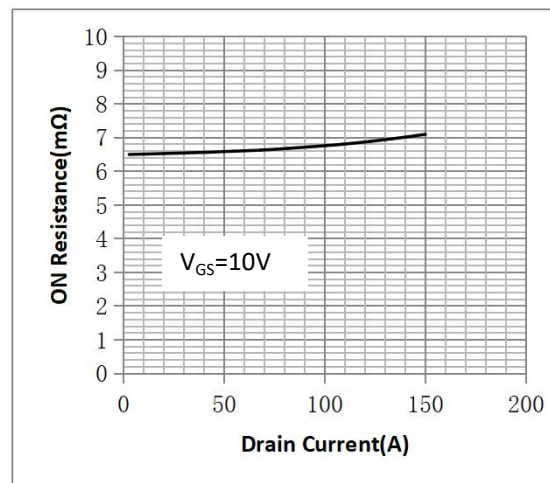


Fig.7 On-Resistance VS Gate Source Voltage

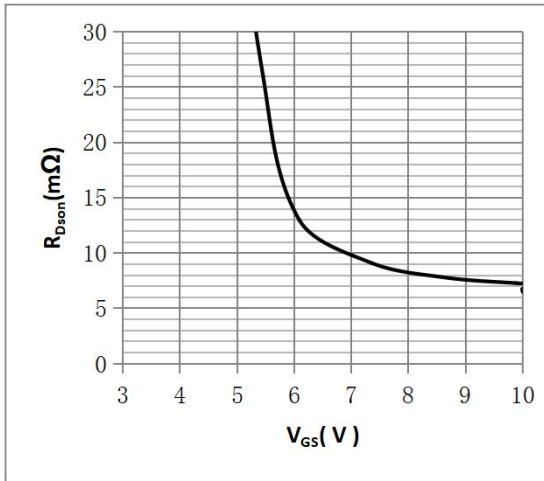


Fig.8 On-Resistance V.S Junction Temperature

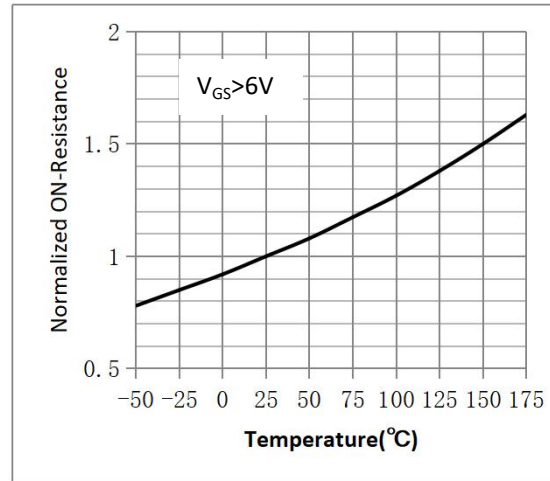


Figure 9. Diode Forward Voltage vs. Current

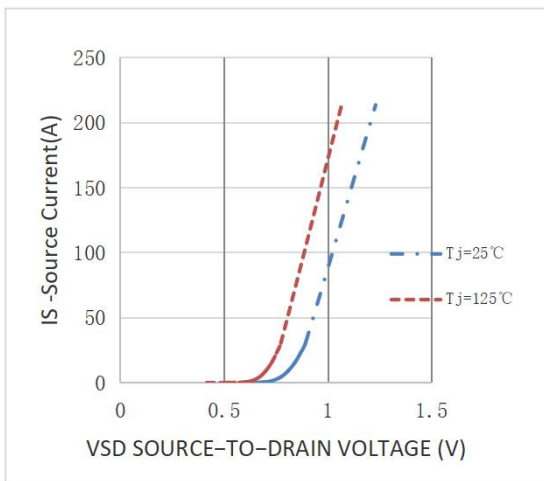


Figure 10. Transfer Characteristics

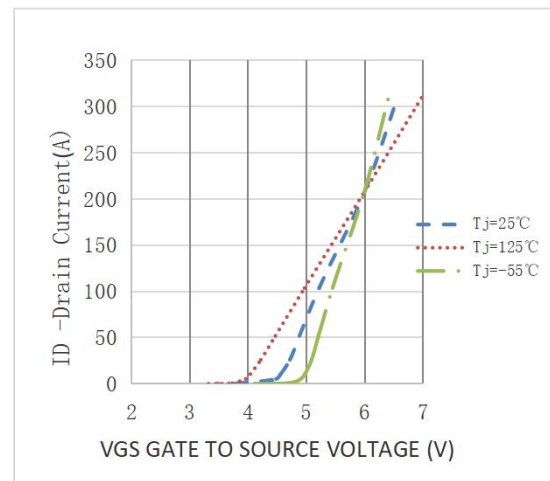


Fig.11 Safe Operating Area

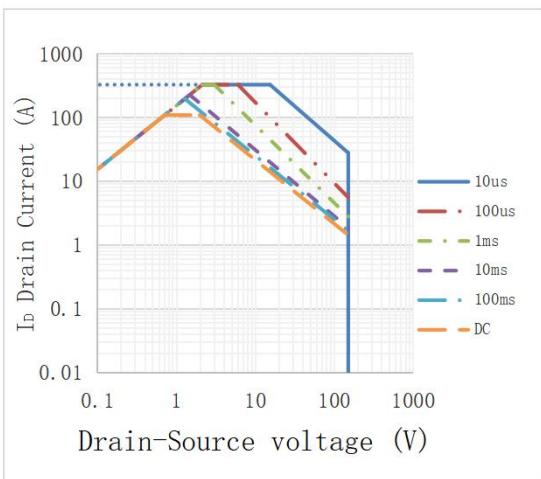
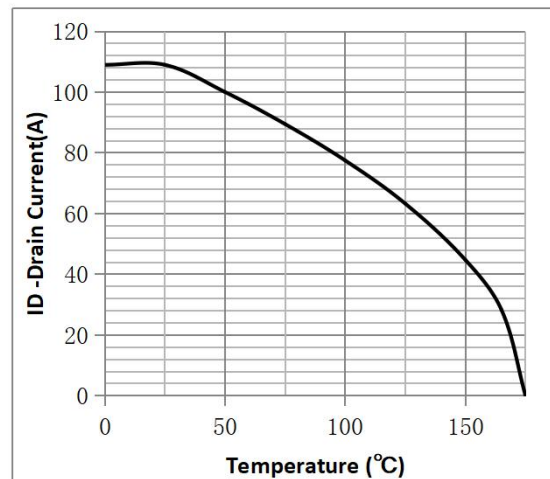
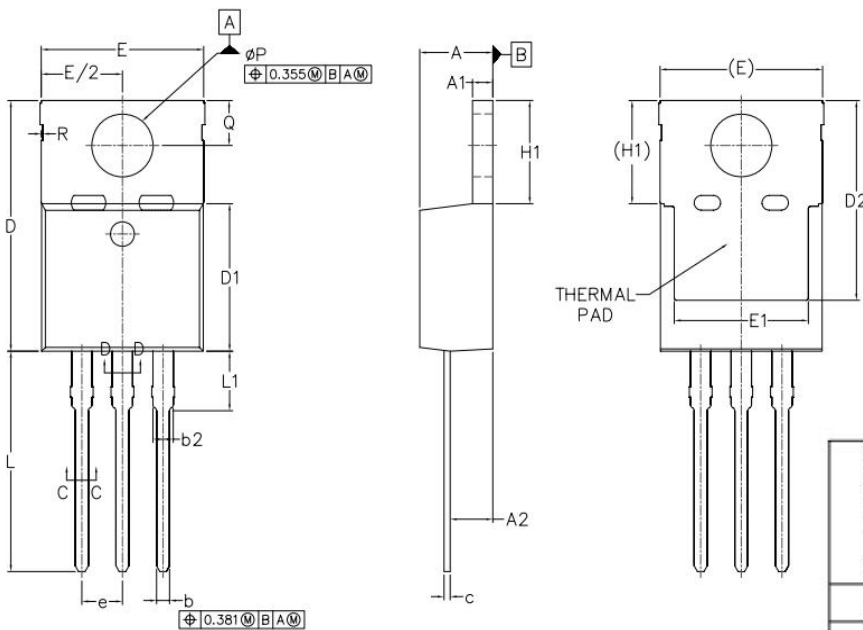


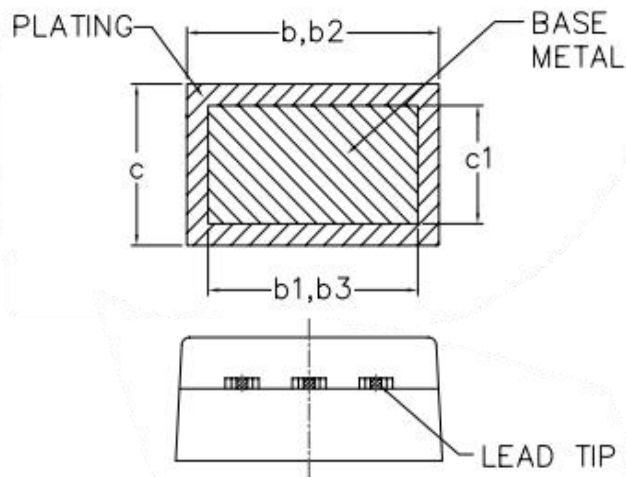
Fig.12 ID vs. Junction Temperature<sup>③</sup>



•TO-220 Package Outline



| SYMBOLS  | COMMON     |        |
|----------|------------|--------|
|          | MM         |        |
|          | MIN.       | MAX.   |
| A        | 3.556      | 4.826  |
| A1       | 0.508      | 1.397  |
| A2       | 2.032      | 2.921  |
| b        | 0.381      | 1.016  |
| b1       | 0.381      | 0.965  |
| b2       | 1.143      | 1.778  |
| b3       | 1.143      | 1.727  |
| c        | 0.356      | 0.610  |
| c1       | 0.356      | 0.559  |
| D        | 14.224     | 16.510 |
| D1       | 8.382      | 9.017  |
| D2       | 12.042     | 12.878 |
| E        | 9.652      | 10.668 |
| E1       | 6.858      | 8.890  |
| e        | 2.540 BSC. |        |
| H1       | 5.842      | 6.858  |
| L        | 12.700     | 14.732 |
| L1       | 3.560      | 4.060  |
| $\phi P$ | 3.810      | 3.860  |
| Q        | 2.540      | 3.048  |
| R        | 0.127 BSC  |        |



**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       | 2022.4.6   | New                                                                                                                                                  |
| B       | 2022.10.21 | 1.Fig.1~Fig11 modify 2.Idm corrected<br>3.Add Reach,HF figure 4.add "It is<br>suitable for automotive application."<br>5.modify as "total time<10s)" |
| C       | 2023.12.21 | Correct Pakage Outline Dimensiom                                                                                                                     |
|         |            |                                                                                                                                                      |
|         |            |                                                                                                                                                      |
|         |            |                                                                                                                                                      |
|         |            |                                                                                                                                                      |
|         |            |                                                                                                                                                      |