

### • General Description

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

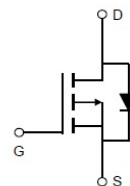
### • Features

- Low  $R_{DS(ON)}$  to minimize conductive loss
- Low Gate Charge for fast switching
- Low Thermal resistance

### • Application

- DC-DC
- Load Switch

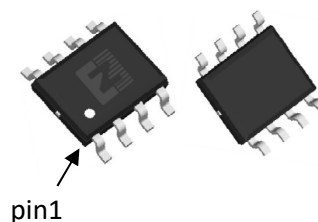
### • Product Summary



$$V_{DS} = -20V$$

$$R_{DS(ON)} = 50m\Omega$$

$$I_D = -6A$$



SOP-8



### • Ordering Information:

|                           |           |
|---------------------------|-----------|
| Part NO.                  | ZM500P02S |
| Marking                   | 500P02    |
| Packing Information       | REEL TAPE |
| Basic ordering unit (pcs) | 4000      |

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

| Parameter                        | Symbol    | Conditions                                                        | Value       | Unit             |
|----------------------------------|-----------|-------------------------------------------------------------------|-------------|------------------|
| Drain-Source Voltage             | $V_{DS}$  | $25^\circ\text{C} \leq T_J \leq 175^\circ\text{C}$                | -20         | V                |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                                   | $\pm 12$    | V                |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ\text{C}$                                            | -6          | A                |
|                                  | $I_D$     | $T_C=75^\circ\text{C}$                                            | -4.7        | A                |
|                                  | $I_D$     | $T_C=100^\circ\text{C}$                                           | -3.8        | A                |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ; | -24         | A                |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ\text{C}$                                            | 5           | W                |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ\text{C}$                                            | 0.7         | W                |
| Operating Junction Temperature   | $T_J$     |                                                                   | -55 to +150 | $^\circ\text{C}$ |
| Storage Temperature              | $T_{STG}$ |                                                                   | -55 to +150 | $^\circ\text{C}$ |
| Single Pulse Avalanche Energy    | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 1           | mJ               |
|                                  |           | $L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 2.1         | mJ               |
| ESD Level (HBM)                  | CLASS 2   |                                                                   |             |                  |

**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|------------|------|------|------|------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 25   | °C/W |
| Thermal resistance, junction-ambient <sup>②</sup> | $R_{thJA}$ |      | -    | 180  | °C/W |
| Soldering temperature (total time<10s)            | Tsold      |      | -    | 260  | °C   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                     | Min. | Typ. | Max. | Unit       |
|-----------------------------------|--------------|-------------------------------|------|------|------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | -20  |      |      | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | -0.3 | -0.6 | -1.2 | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=-20V$      |      |      | 1.0  | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 12V, V_{DS}=0V$   |      |      | 100  | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=-4A$         |      | 50   | 65   | m $\Omega$ |
|                                   |              | $V_{GS}=4.5V, I_D=-3A$        |      | 60   | 85   | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{GS}=-5V, I_{SD}=-3A$      |      | 15   |      | s          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=-4A$       |      |      | 1.3  | V          |

**•Dynamic characteristics**

| Parameter                    | Symbol    | Condition                           | Min. | Typ. | Max. | Unit     |
|------------------------------|-----------|-------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$ | $f=1MHz, V_{DS}=-25V$               | -    | 471  | -    | pF       |
| Output capacitance           | $C_{oss}$ |                                     | -    | 58   | -    |          |
| Reverse transfer capacitance | $C_{rss}$ |                                     | -    | 45   | -    |          |
| Gate Resistance              | $R_g$     | $f=1MHz$                            | -    | 8    |      | $\Omega$ |
| Total gate charge            | $Q_g$     | $V_{DD}=-15V, I_D=-4A, V_{GS}=-10V$ | -    | 13   | -    | nC       |
| Gate - Source charge         | $Q_{gs}$  |                                     | -    | 3.4  | -    |          |
| Gate - Drain charge          | $Q_{gd}$  |                                     | -    | 0.5  | -    |          |

Fig.1 Gate-Charge Characteristics

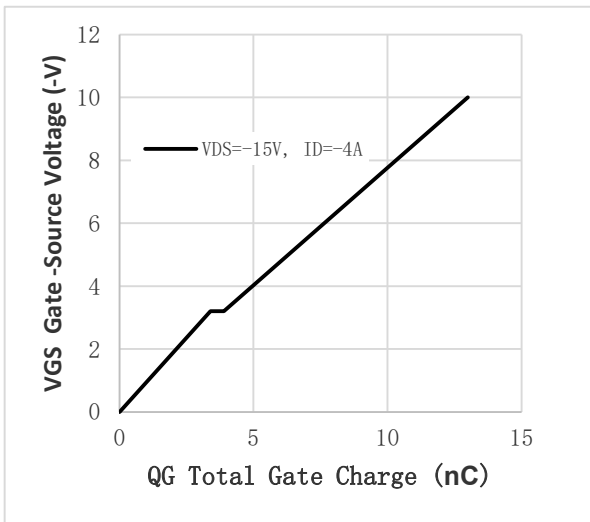


Fig.2 Capacitance Characteristics

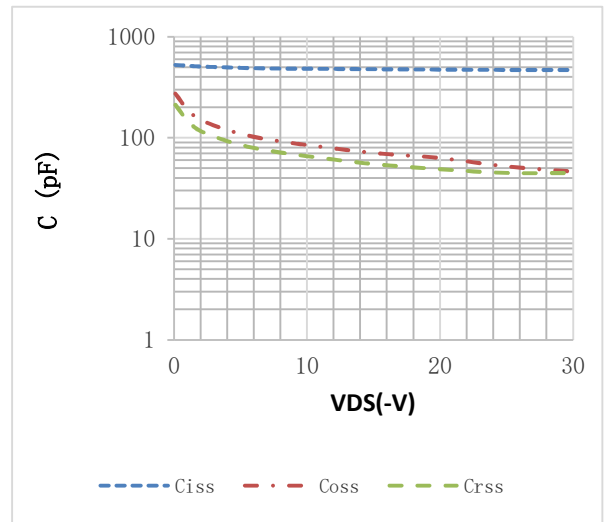


Fig.3 Power Dissipation

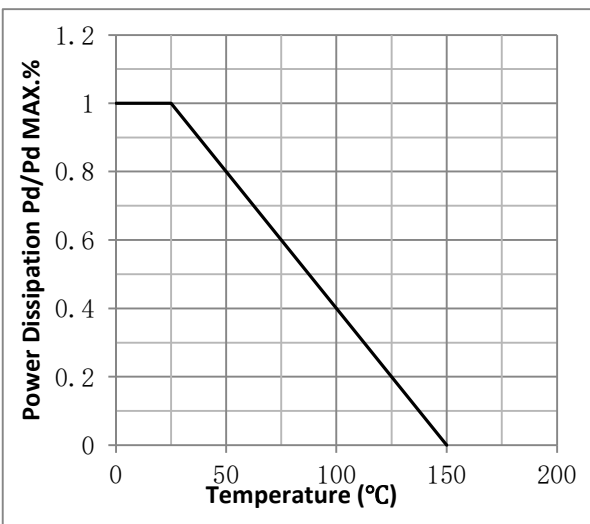


Fig.4 Typical output Characteristics

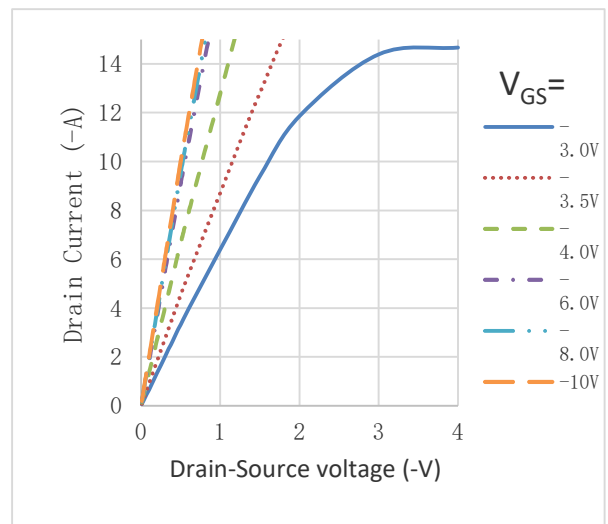


Fig.5 Threshold Voltage V.S Junction Temperature

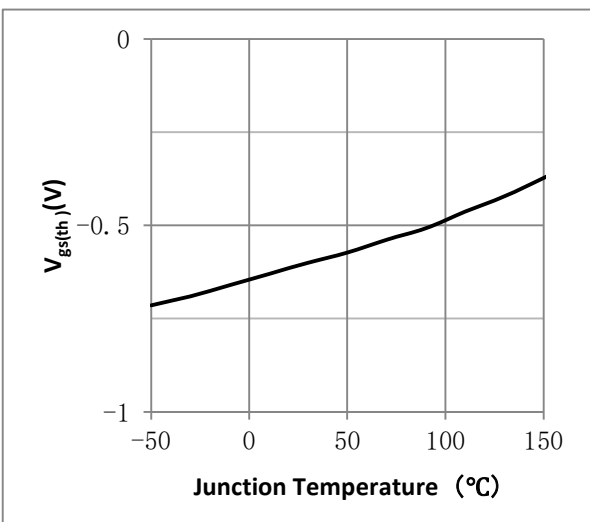


Fig.6 Resistance V.S Drain Current

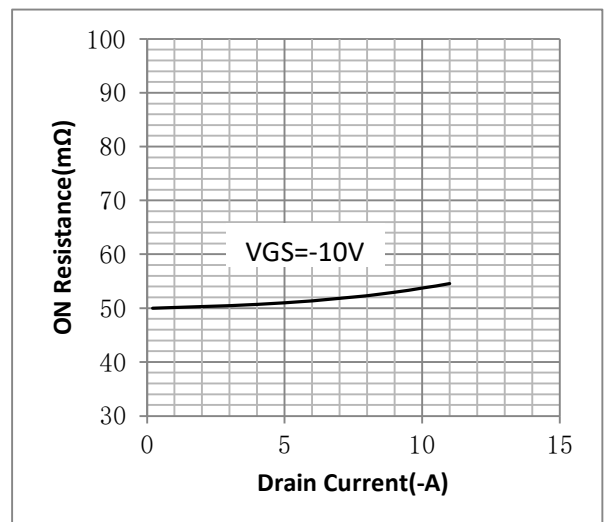


Fig.7 On-Resistance VS Gate Source Voltage

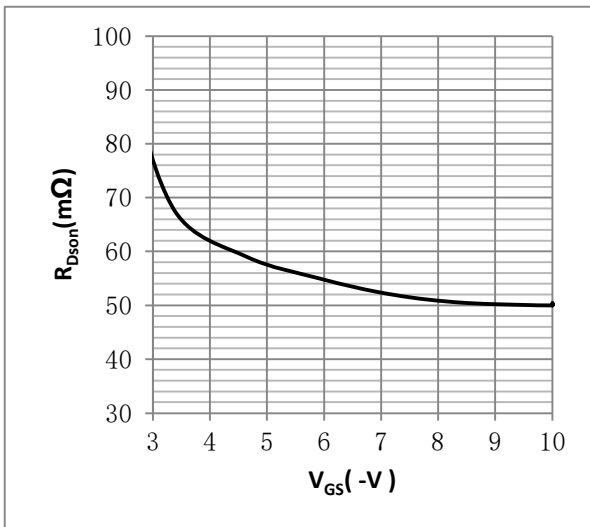


Fig.8 On-Resistance V.S Junction Temperature

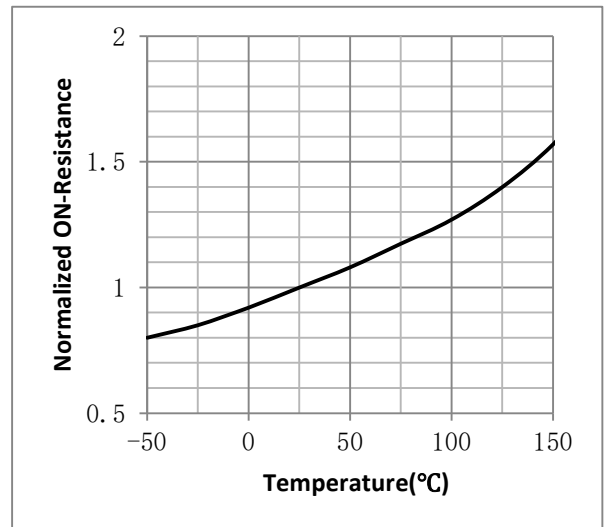


Figure 9. Diode Forward Voltage vs. Current

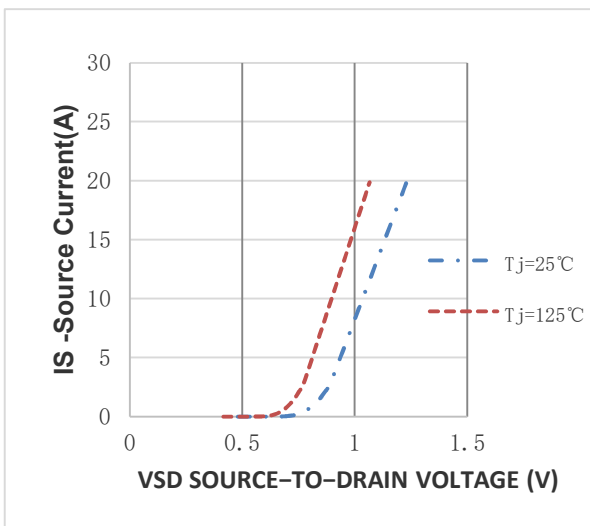


Figure 10. Transfer Characteristics

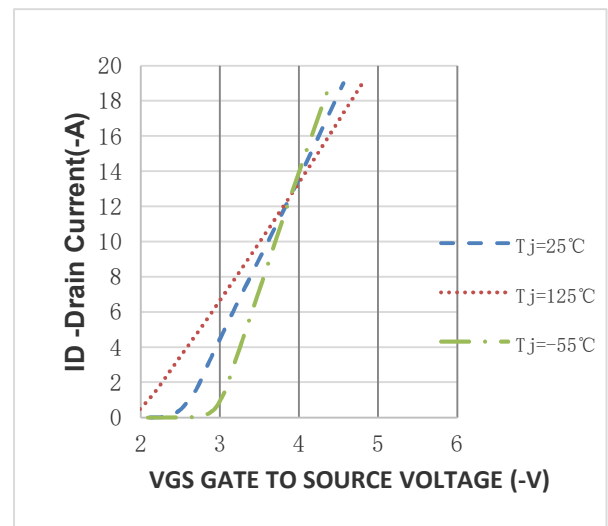


Fig.11 SOA Maximum Safe Operating Area

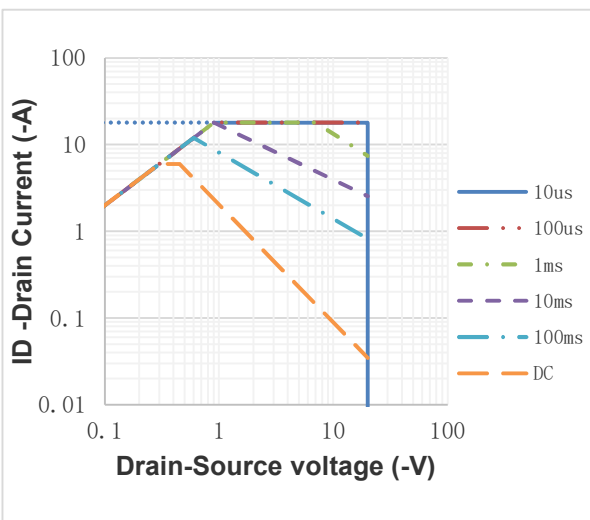
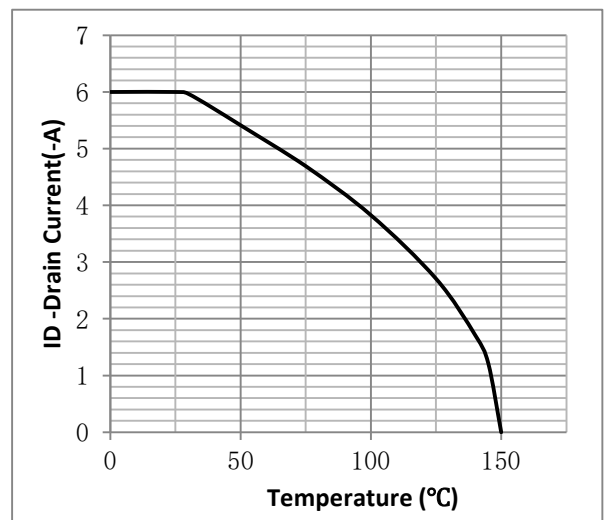


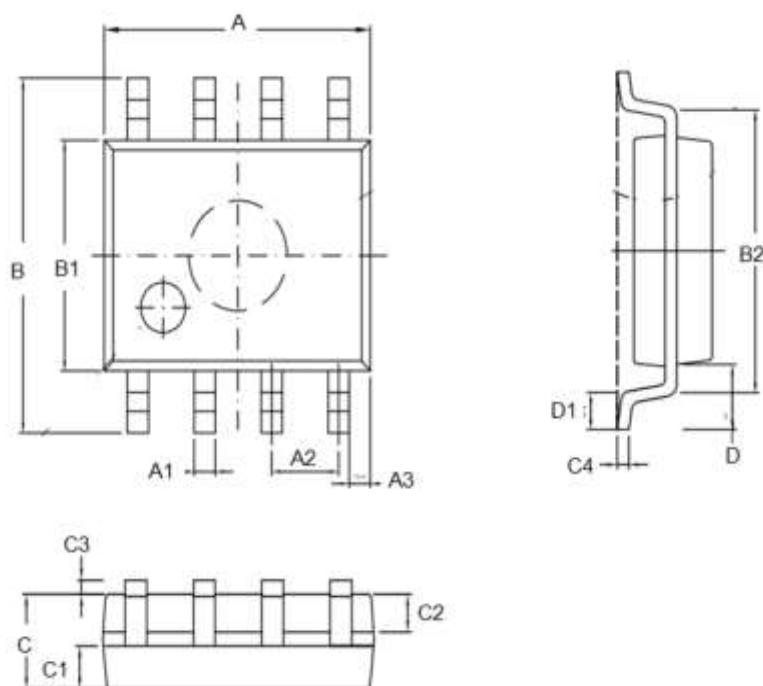
Fig.12  $I_D$  vs. Case Temperature<sup>③</sup>



•SOP-8 Package Outline

Unit: mm

| SYMBOL | min  | TYP  | max  | SYMBOL | min  |      | max  |
|--------|------|------|------|--------|------|------|------|
| A      | 4.80 |      | 5.00 | C      | 1.30 |      | 1.50 |
| A1     | 0.37 |      | 0.47 | C1     | 0.55 |      | 0.75 |
| A2     |      | 1.27 |      | C2     | 0.55 |      | 0.65 |
| A3     |      | 0.41 |      | C3     | 0.05 |      | 0.20 |
| B      | 5.80 |      | 6.20 | C4     | 0.19 | 0.20 | 0.23 |
| B1     | 3.80 |      | 4.00 | D      |      | 1.05 |      |
| B2     |      | 5.00 |      | D1     | 0.40 |      | 0.62 |



**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       | 2021. 2. 3  | New                            |
| B       | 2022. 9. 7  | 1. Add Reach, HF figure, 2. ID |
| C       | 2024. 5. 15 | Modify Fig1, 5, 8 and POD      |
|         |             |                                |
|         |             |                                |
|         |             |                                |
|         |             |                                |
|         |             |                                |