

### • General Description

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

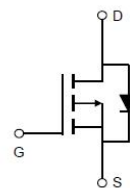
### • Features

- AEC-Q101 Qualified
- Low  $R_{DS(ON)}$  to minimize conductive loss
- High GOX reliability
- Low Thermal resistance

### • Application

- BLDC Motor driver
- DC-DC
- Load Switch

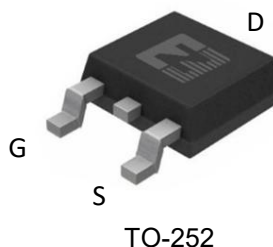
### • Product Summary



$$V_{DS} = -100V$$

$$R_{DS(ON)} = 200m\Omega$$

$$I_D = -8A$$



### • Ordering Information:

|                           |             |
|---------------------------|-------------|
| Part NO.                  | ZMA020KP10D |
| Marking                   | ZM020KP10   |
| Packing Information       | REEL TAPE   |
| Basic ordering unit (pcs) | 2500        |

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

| Parameter                        | Symbol    | Conditions                                                        | Value       | Unit             |
|----------------------------------|-----------|-------------------------------------------------------------------|-------------|------------------|
| Drain-Source Voltage             | $V_{DS}$  |                                                                   | -100        | V                |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                                   | $\pm 20$    | V                |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ\text{C}$                                            | -8          | A                |
|                                  | $I_D$     | $T_C=75^\circ\text{C}$                                            | -7          | A                |
|                                  | $I_D$     | $T_C=100^\circ\text{C}$                                           | -6          | 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          | $P_D$     | $T_C=25^\circ\text{C}$                                            | 68          | W                |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ\text{C}$                                            | 2.4         | 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    | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=-10\text{V}$ , $R_g=25\Omega$ ,        | 5           | mJ               |
|                                  |           | $L=0.5\text{mH}$ , $V_{GS}=-10\text{V}$ , $R_g=25\Omega$ ,        | 9.5         | mJ               |
| ESD Level (HBM)                  | CLASS 1C  |                                                                   |             |                  |

**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|------------|------|------|------|------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 2.2  | °C/W |
| Thermal resistance, junction-ambient <sup>②</sup> | $R_{thJA}$ |      | -    | 62   | °C/W |
| Soldering temperature                             | $T_{sold}$ |      | -    | 260  | °C   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                      | Min. | Typ. | Max. | Unit       |
|-----------------------------------|--------------|--------------------------------|------|------|------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=-250\mu A$     | -100 |      |      | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.3 | -1.8 | -2.5 | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=-100V$      |      |      | 1.0  | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$    |      |      | 100  | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-8A$         |      | 200  | 245  | m $\Omega$ |
|                                   |              | $V_{GS}=-4.5V, I_D=-6A$        |      | 220  | 265  | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=-5V, I_{SD}=-4A$       |      | 6    |      | s          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=-8A$        |      |      | 1.3  | V          |

**•Dynamic characteristics**

| Parameter                    | Symbol       | Condition                                               | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|---------------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $f = 1MHz, V_{DS}=-25V$                                 | -    | 1670 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                         | -    | 88   | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                         | -    | 49   | -    |          |
| Gate Resistance              | $R_g$        | $f = 1MHz$                                              | -    | 8    |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD} = -15V,$<br>$I_D = -8A,$<br>$V_{GS} = -10V$     | -    | 22.4 | -    | nC       |
|                              | $Q_g(-4.5v)$ |                                                         | -    | 10   | -    |          |
| Gate - Source charge         | $Q_{gs}$     |                                                         | -    | 4.2  | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                         | -    | 2.8  | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=-10V, V_{DS}=-15V,$<br>$R_G=3.3\Omega, I_D=-8A$ | -    | 17   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                         | -    | 62   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                         | -    | 45   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                         | -    | 46   | -    | ns       |

Fig.1 Gate-Charge Characteristics

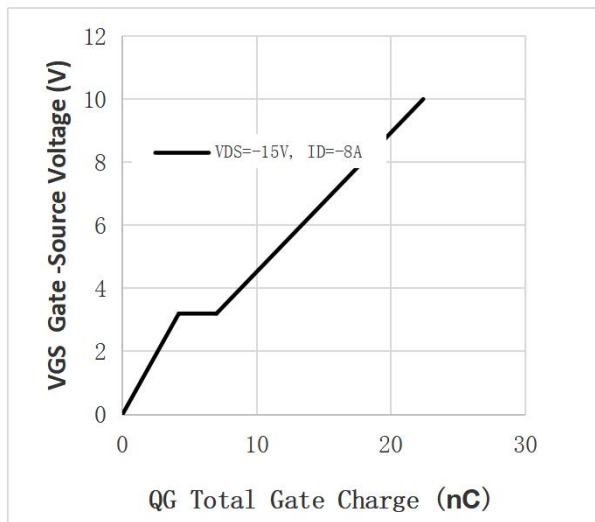


Fig.2 Capacitance Characteristics

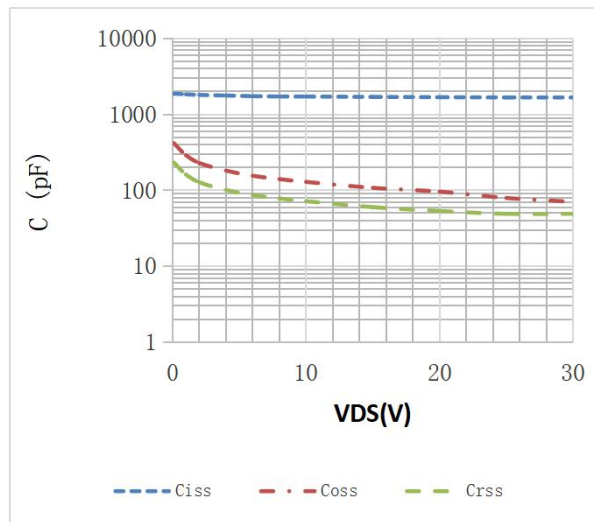


Fig.3 Power Dissipation

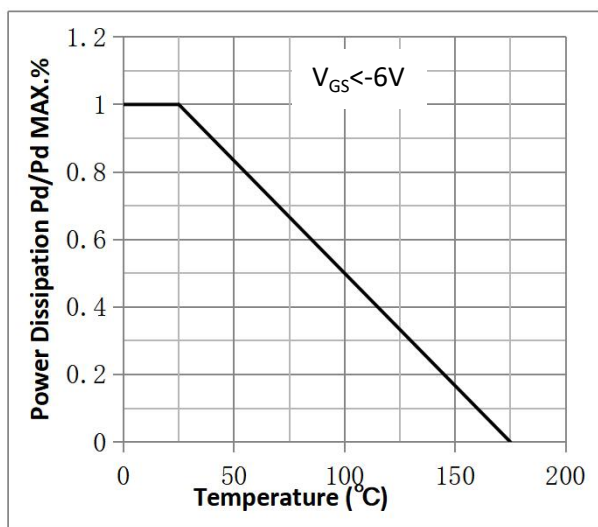


Fig.4 Typical output Characteristics

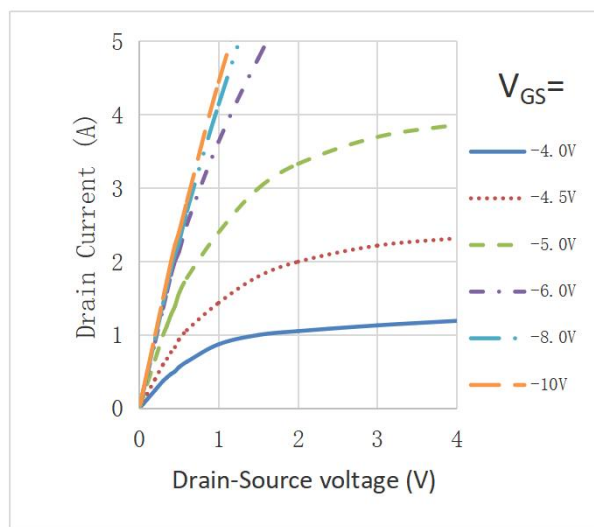


Fig.5 Threshold Voltage V.S Junction Temperature

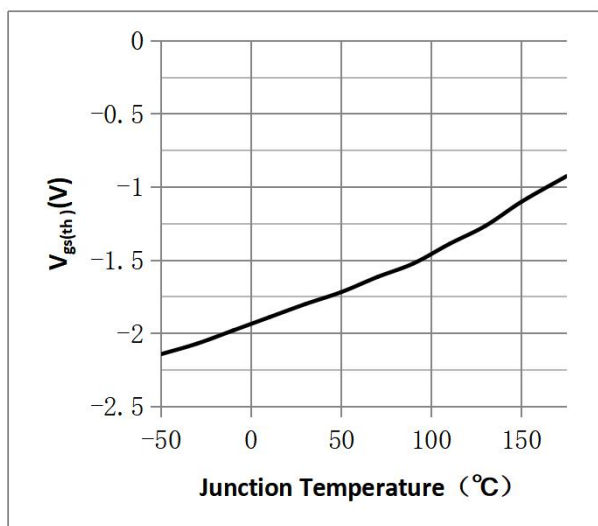


Fig.6 Resistance V.S Drain Current

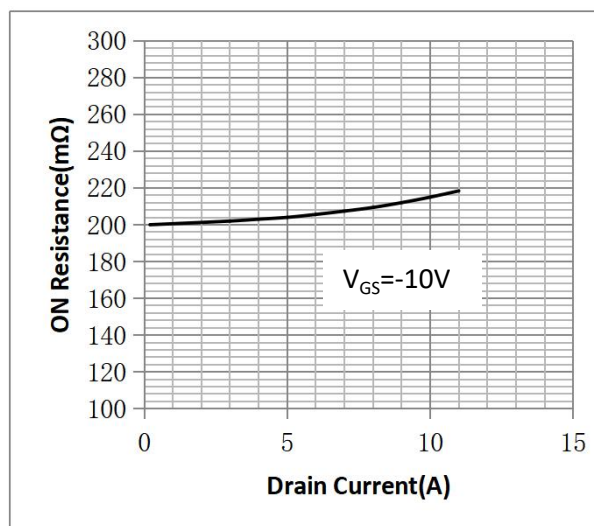


Fig.7 On-Resistance VS Gate Source Voltage

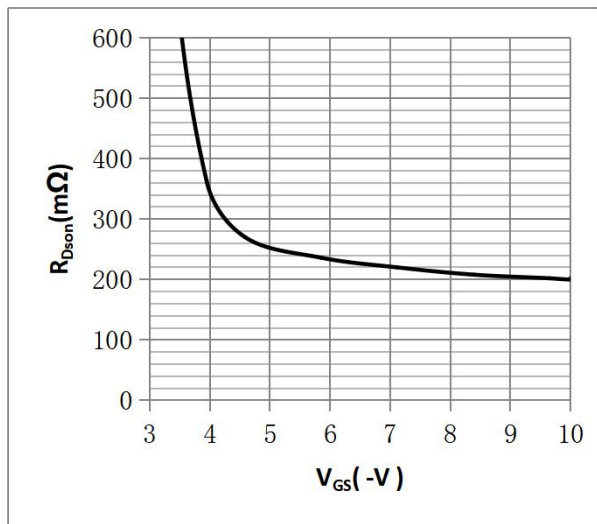


Fig.8 On-Resistance V.S Junction Temperature

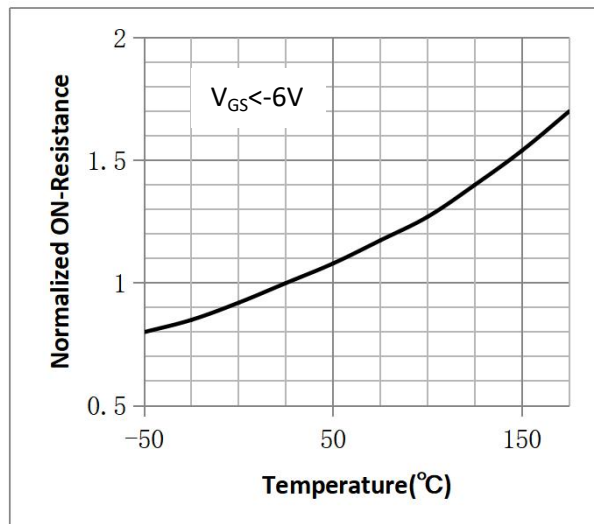


Figure 9. Diode Forward Voltage vs. Current

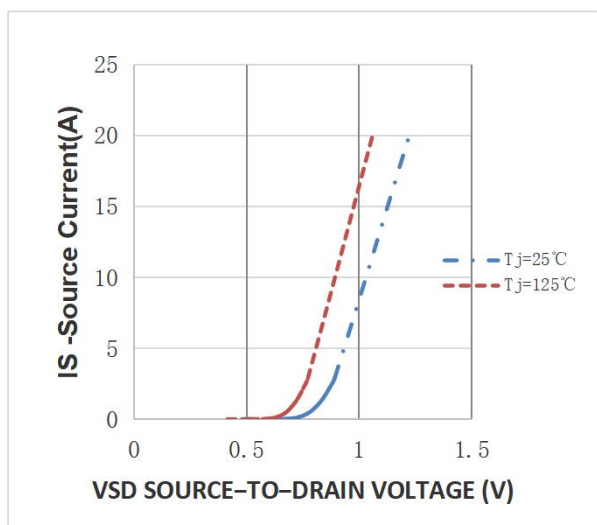


Figure 10. Transfer Characteristics

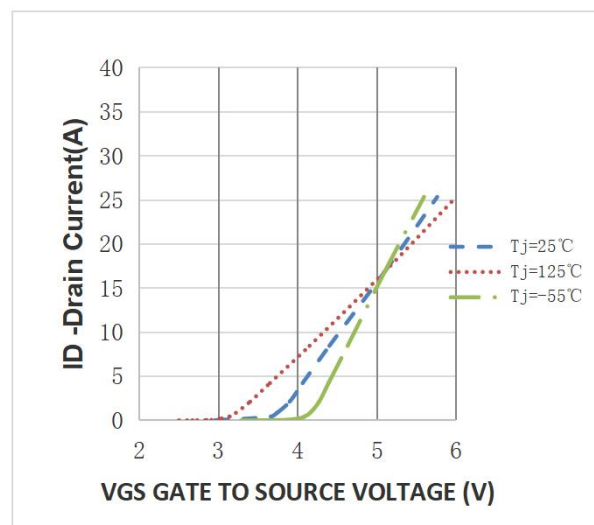


Fig.11 Safe Operating Area

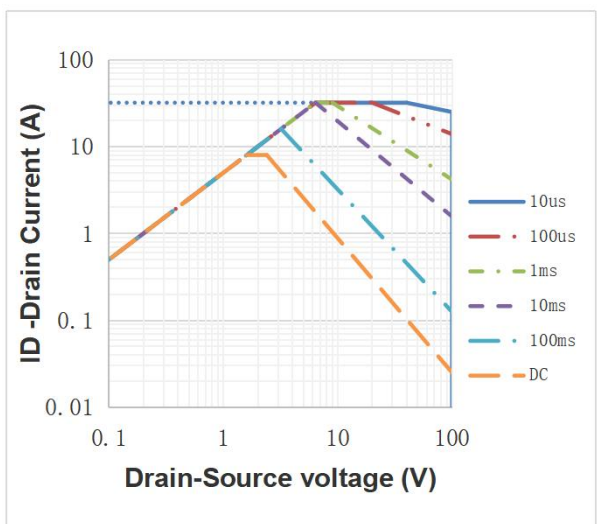
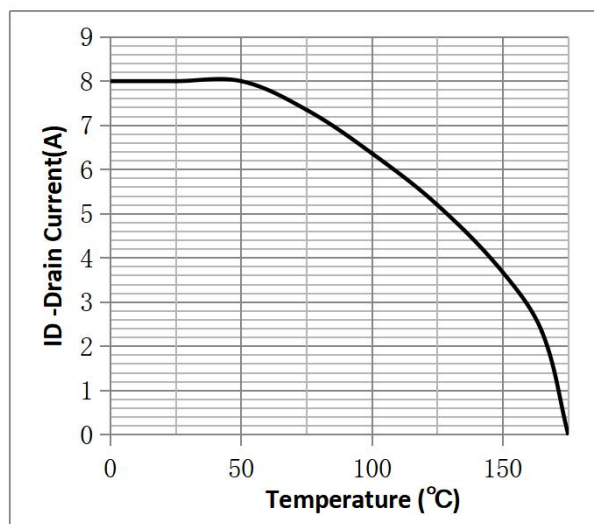
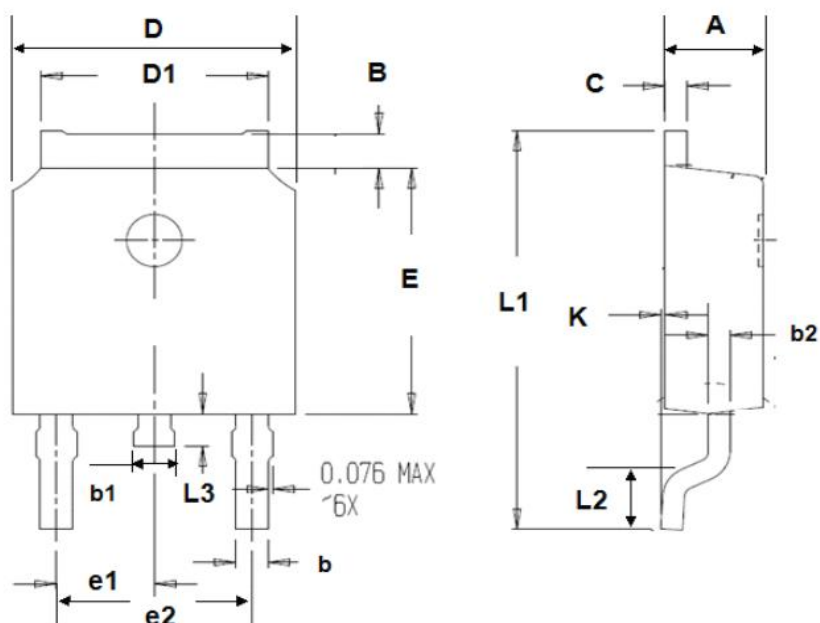


Fig.12 ID vs. Case Temperature<sup>③</sup>



•TO-252 Package Outline

| SYMBOL | min  | max   | SYMBOL | min  | max  |
|--------|------|-------|--------|------|------|
| A      | 2.10 | 2.50  | B      | 0.85 | 1.25 |
| b      | 0.50 | 0.90  | b1     | 0.50 | 0.90 |
| b2     | 0.45 | 0.70  | C      | 0.45 | 0.70 |
| D      | 6.30 | 6.75  | D1     | 5.10 | 5.50 |
| E      | 5.30 | 6.30  | e1     | 2.24 | 2.35 |
| L1     | 9.20 | 10.60 | e2     | 4.43 | 4.75 |
| L2     | 0.90 | 1.75  | L3     | 0.60 | 1.10 |
| K      | 0.00 | 0.23  |        |      |      |



**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       | 2021.8.12  | NEW                                                         |
| B       | 2021.9.7   | Add ESD LEVEL                                               |
| C       | 2022.9.23  | 1.Add Reach,HF figure 2.ID Curve<br>Modified 3.Rth modified |
| D       | 2023.11.30 | Correct Package Outline Dimension                           |
|         |            |                                                             |
|         |            |                                                             |
|         |            |                                                             |
|         |            |                                                             |