

**60V N-Channel Power MOSFET**

• **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
- Low Thermal resistance

• **Application**

- BLDC Motor driver
- DC-DC
- Load switch

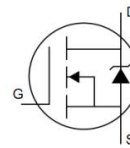
• **Ordering Information:**

|                           |            |
|---------------------------|------------|
| Part NO.                  | ZMA300N06E |
| Marking                   | 300N06     |
| Packing Information       | REEL TAPE  |
| Basic ordering unit (pcs) | 3000       |

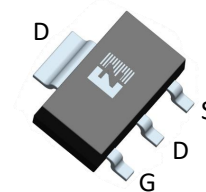
• **Absolute Maximum Ratings** ( $T_C=25^\circ\text{C}$ )

| Parameter                      | Symbol    | Conditions                                                        | Value       | Unit             |
|--------------------------------|-----------|-------------------------------------------------------------------|-------------|------------------|
| Drain-Source Voltage           | $V_{DS}$  |                                                                   | 60          | V                |
| Gate-Source Voltage            | $V_{GS}$  |                                                                   | $\pm 20$    | V                |
| Continuous Drain Current       | $I_D$     | $T_C=25^\circ\text{C}$                                            | 12          | A                |
|                                | $I_D$     | $T_C=75^\circ\text{C}$                                            | 10          | A                |
|                                | $I_D$     | $T_C=100^\circ\text{C}$                                           | 8           | A                |
| Pulsed Drain Current           | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ; | 48          | A                |
| Total Power Dissipation        | $P_D$     | $T_C=25^\circ\text{C}$                                            | 13          | W                |
| Total Power Dissipation        | $P_D$     | $T_A=25^\circ\text{C}$                                            | 1.3         | 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  | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 20          | mJ               |
|                                |           | $L=0.5\text{mH}$ , $V_{GS}=10\text{V}$ , $R_g=25\Omega$ ,         | 42          | mJ               |
| ESD Level (HBM)                | CLASS 1C  |                                                                   |             |                  |

• **Product Summary**



$V_{DS} = 60\text{V}$   
 $R_{DS(ON)} = 28\text{m}\Omega$   
 $I_D = 12\text{A}$



SOT-223



**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit          |
|---------------------------------------------------|------------|------|------|------|---------------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 10   | $^{\circ}C/W$ |
| Thermal resistance, junction-ambient <sup>①</sup> | $R_{thJA}$ |      | -    | 100  | $^{\circ}C/W$ |
| Soldering temperature                             | $T_{sold}$ |      | -    | 260  | $^{\circ}C$   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                     | Min. | Typ. | Max. | Unit      |
|-----------------------------------|--------------|-------------------------------|------|------|------|-----------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | 60   |      |      | V         |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.3  | 1.7  | 2.5  | V         |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=60V$       |      |      | 1.0  | $\mu A$   |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   |      |      | 100  | nA        |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=5A$          |      | 28   | 36   | $m\Omega$ |
|                                   |              | $V_{GS}=4.5V, I_D=3A$         |      | 33   | 43   | $m\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=10A$       |      | 5    |      | S         |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=5A$        |      |      | 1.3  | V         |

**•Dynamic characteristics**

| Parameter                    | Symbol       | Condition                                        | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|--------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $f=1MHz, V_{DS}=25V$                             | -    | 1300 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                  | -    | 53   | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                  | -    | 31   | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                         | -    | 1    |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=15V, I_D=20A, V_{GS}=10V$                | -    | 18   | -    | nC       |
|                              | $Q_g(4.5V)$  |                                                  | -    | 9    | -    |          |
| Gate - Source charge         | $Q_{gs}$     |                                                  | -    | 4    | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                  | -    | 2.5  | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$ | -    | 11   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                  | -    | 16   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                  | -    | 43   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                  | -    | 30   | -    | ns       |
| Reverse Recovery Time        | $t_{RR}$     | $V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=20A$        | -    | 46   | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                  | -    | 53   | -    | nC       |

Fig.1 Gate-Charge Characteristics

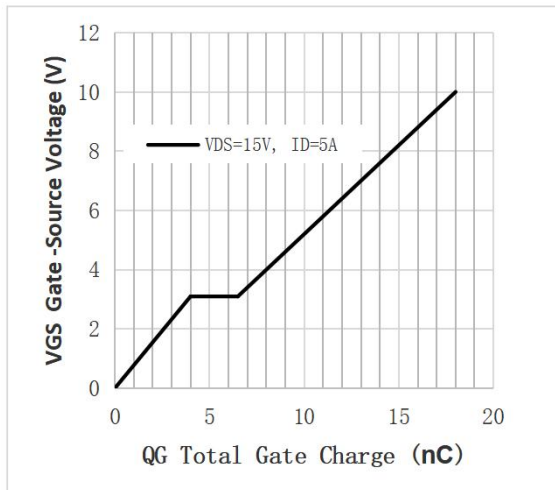


Fig.2 Capacitance Characteristics

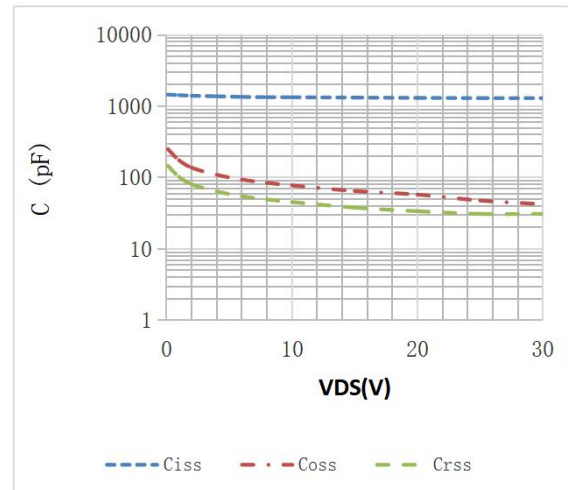


Fig.3 Power Dissipation

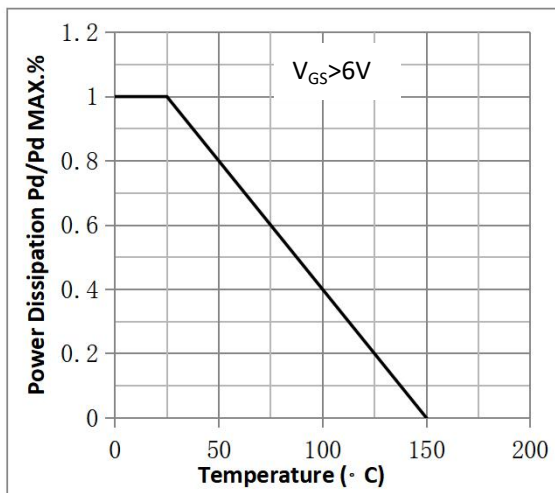


Fig.4 Typical output Characteristics

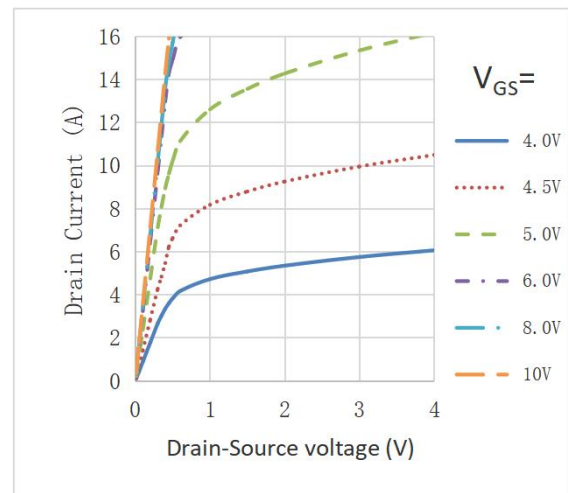


Fig.5 Threshold Voltage V.S Junction Temperature

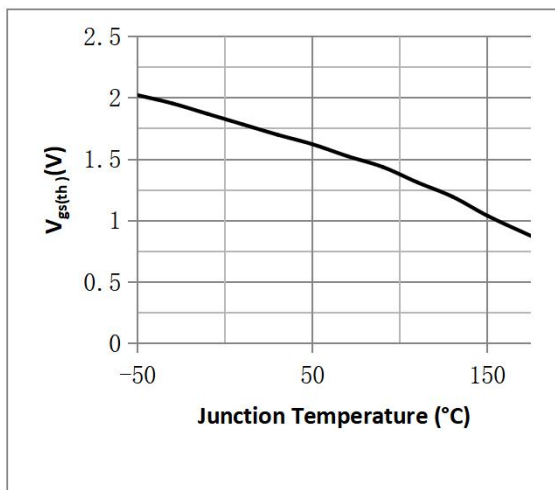


Fig.6 Resistance V.S Drain Current

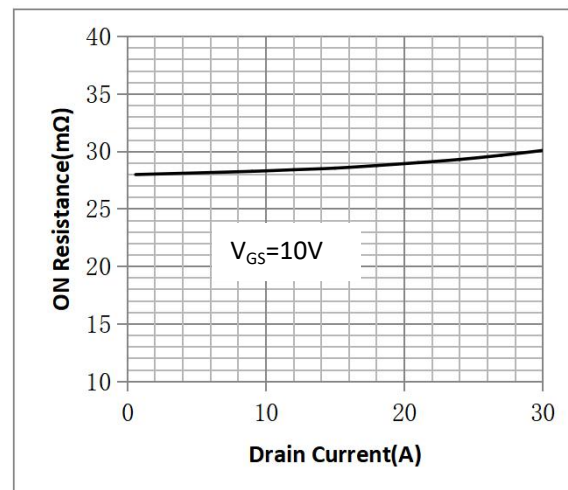


Fig.7 On-Resistance VS Gate Source Voltage

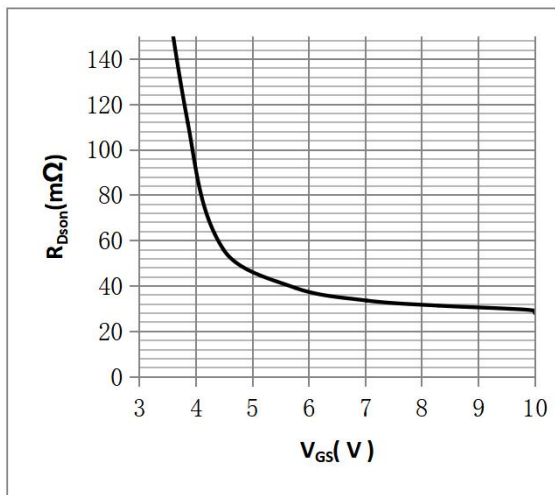


Fig.8 On-Resistance V.S Junction Temperature

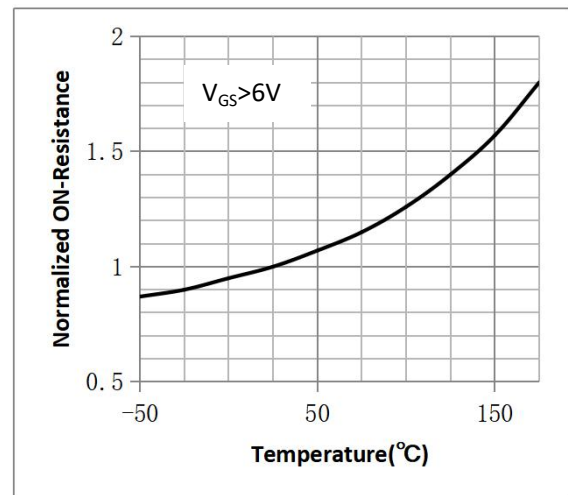


Figure 9. Diode Forward Voltage vs. Current

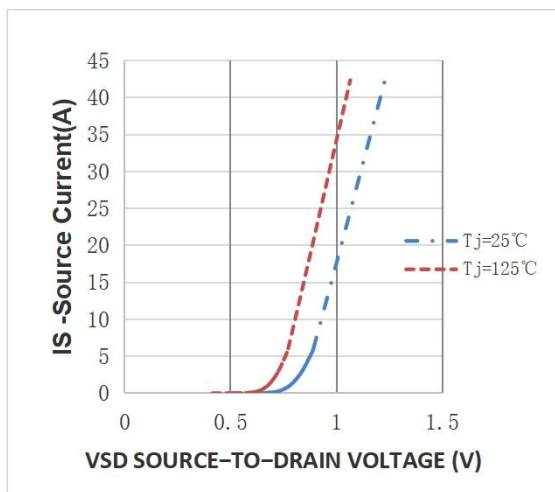


Figure 10. Transfer Characteristics

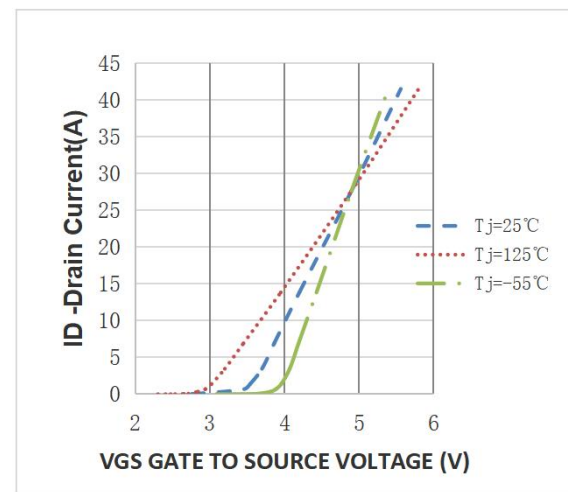


Fig.11 Safe Operating Area

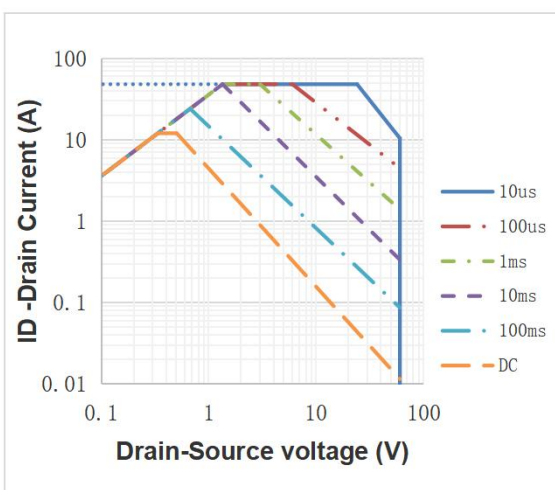
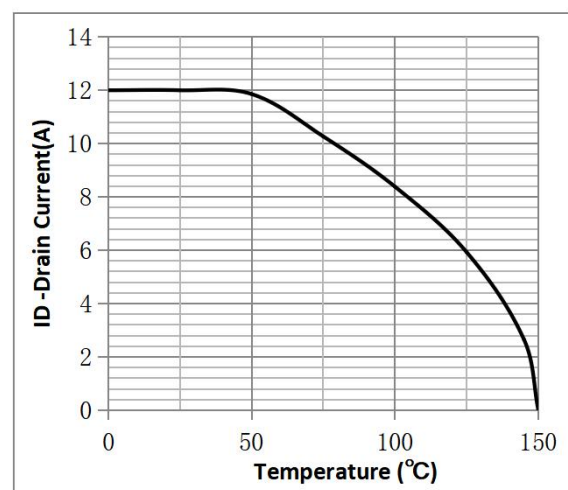
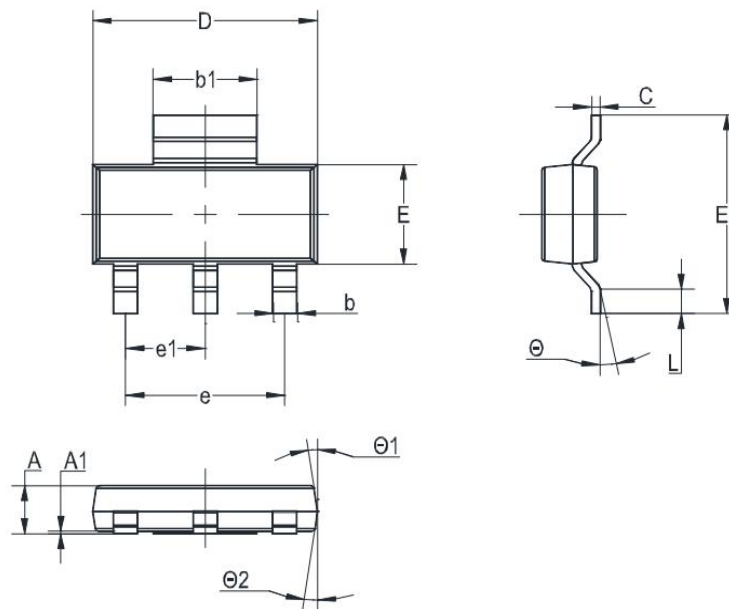


Fig.12 ID vs. Case Temperature<sup>②</sup>

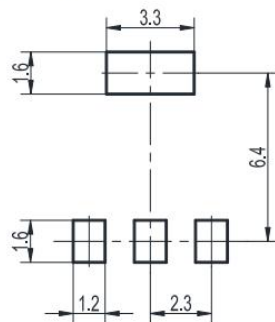


●SOT-223 Package Outline



| Unit | A          | A1         | b          | b1         | C            | D          | E          | E1         | e          | e1         | L          | Θ         | Θ1       | Θ2       |
|------|------------|------------|------------|------------|--------------|------------|------------|------------|------------|------------|------------|-----------|----------|----------|
| mm   | 1.8<br>1.5 | 0.1<br>MAX | 0.8<br>0.6 | 3.1<br>2.9 | 0.32<br>0.22 | 6.7<br>6.3 | 3.7<br>3.3 | 7.3<br>6.7 | 4.6<br>TYP | 2.3<br>TYP | 1.1<br>0.7 | 10°<br>0° | 7°<br>0° | 7°<br>0° |

**Recommended Soldering Footprint**



**Packing information**

| Package | Tape Width (mm) | Pitch   |               | Reel Size |      | Per Reel Packing Quantity |
|---------|-----------------|---------|---------------|-----------|------|---------------------------|
|         |                 | mm      | inch          | mm        | inch |                           |
| SOT-223 | 12              | 8 ± 0.1 | 0.315 ± 0.004 | 330       | 13   | 3,000                     |



**Note:**

- ① Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ② Practically the current will be limited by PCB, thermal design and operating temperature. VGS=10V.

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## Revision History

| Version | Date       | Change                            |
|---------|------------|-----------------------------------|
| A       | 2021.12.5  | NEW                               |
| B       | 2022.9.10  | 1.Add Reach,HF figure,2.ID modify |
| C       | 2022.12.10 | ID Curve modify                   |
|         |            |                                   |
|         |            |                                   |
|         |            |                                   |
|         |            |                                   |
|         |            |                                   |