

60V N-Channel Power MOSFET

• General Description

It combines 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

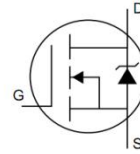
• Ordering Information:

| | |
|---------------------------|------------|
| Part NO. | ZMA098N06B |
| Marking | ZM098N06 |
| Packing Information | REEL TAPE |
| Basic ordering unit (pcs) | 800 |

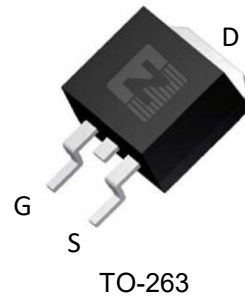
• Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Value | Unit |
|----------------------------------|-----------|---|-------------|------|
| Drain-Source Voltage | V_{DS} | | 60 | V |
| Gate-Source Voltage ^① | V_{GS} | | ±20 | V |
| Continuous Drain Current | I_D | $T_C=25^\circ\text{C}$ | 60 | A |
| | | $T_C=75^\circ\text{C}$ | 52 | A |
| | | $T_C=100^\circ\text{C}$ | 45 | A |
| Pulsed Drain Current | I_{DM} | Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^\circ\text{C}$; | 240 | A |
| Total Power Dissipation | P_D | $T_C=25^\circ\text{C}$ | 107 | W |
| Total Power Dissipation | P_D | $T_A=25^\circ\text{C}$ | 3.3 | W |
| Operating Junction Temperature | T_J | | -55 to +175 | °C |
| Storage Temperature | T_{STG} | | -55 to +175 | °C |
| Single Pulse Avalanche Energy | E_{AS} | L=0.1mH, $V_{GS}=10\text{V}$, $R_g=25\Omega$, | 76 | mJ |
| | | L=0.5mH, $V_{GS}=10\text{V}$, $R_g=25\Omega$, | 160 | mJ |
| ESD Level (HBM) | | | CLASS 2 | |

• Product Summary



$V_{DS} = 60\text{V}$
 $R_{DS(ON)} = 10\text{m}\Omega$
 $I_D = 60\text{A}$



•Thermal resistance

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|------------|------|------|------|------|
| Thermal resistance, junction - case | R_{thJC} | | - | 1.4 | °C/W |
| Thermal resistance, junction-ambient ^② | R_{thJA} | | - | 45 | °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} | $V_{GS} = 0V, I_D = 250\mu A$ | 60 | | | V |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$ | 1.4 | 1.7 | 2.5 | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{GS} = 0V, V_{DS} = 60V$ | | | 1.0 | μA |
| Gate- Source Leakage Current | I_{GSS} | $V_{GS} = \pm 20V, V_{DS} = 0V$ | | | 100 | nA |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS} = 10V, I_D = 24A$ | | 10 | 13 | m Ω |
| | | $V_{GS} = 4.5V, I_D = 12A$ | | 12 | 15 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS} = 5V, I_{SD} = 10A$ | | 14 | | S |
| Diode Forward Voltage | V_{FSD} | $V_{GS} = 0V, I_{SD} = 24A$ | | | 1.3 | V |

•Dynamic characteristics

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------|--------------|---|--|------|------|----------|
| Input capacitance | C_{iss} | $f = 1MHz, V_{DS} = 25V$ | - | 2750 | - | pF |
| Output capacitance | C_{oss} | | - | 185 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 135 | - | |
| Gate Resistance | R_g | $f = 1MHz$ | - | 1.9 | | Ω |
| Total gate charge | Q_g | $V_{DD} = 15V, I_D = 20A, V_{GS} = 10V$ | - | 30 | - | nC |
| | $Q_g (4.5v)$ | | - | 17 | - | |
| Gate - Source charge | Q_{gs} | | - | 8.4 | - | |
| Gate - Drain charge | Q_{gd} | | - | 5.8 | - | |
| Turn-ON Delay time | $t_{D(on)}$ | | $V_{GS} = 10V, V_{DS} = 15V, R_G = 3.3\Omega, I_D = 20A$ | - | 38 | |
| Turn-ON Rise time | t_r | - | | 231 | - | ns |
| Turn-Off Delay time | $t_{D(off)}$ | - | | 57 | - | ns |
| Turn-Off Fall time | t_f | - | | 31 | - | ns |
| Reverse Recovery Time | t_{RR} | $V_{DD} = 20V, dI_S/dt = 100A/\mu s, I_S = 20A$ | - | 108 | - | ns |
| Reverse Recovery Charge | Q_{RR} | | - | 253 | - | nC |

Fig.1 Gate-Charge Characteristics

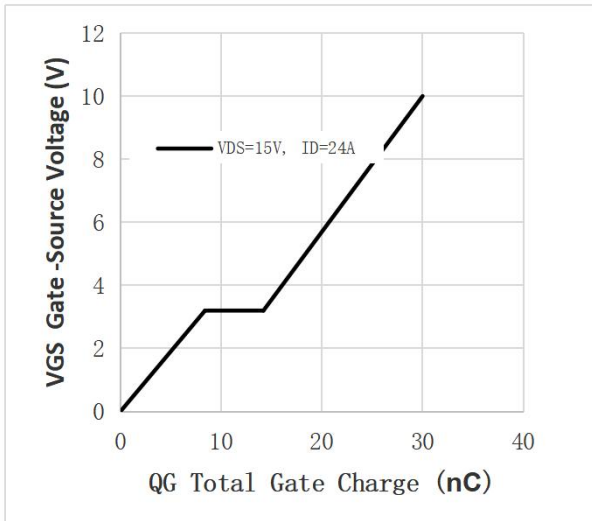


Fig.2 Capacitance Characteristics

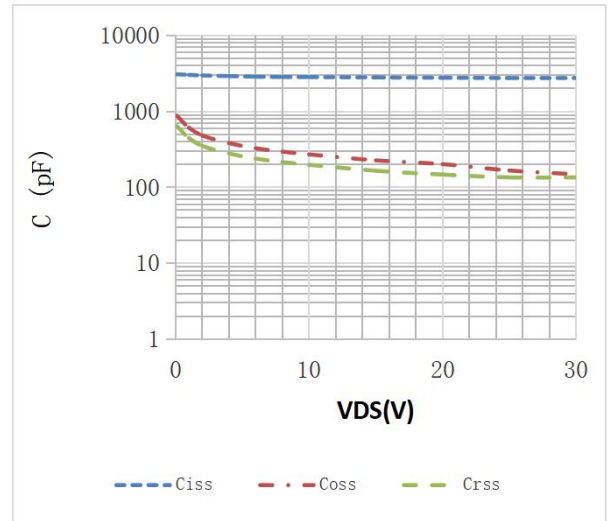


Fig.3 Power Dissipation

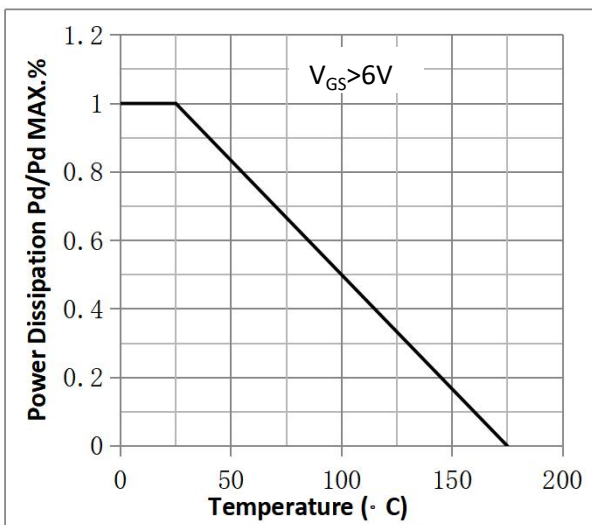


Fig.4 Typical output Characteristics

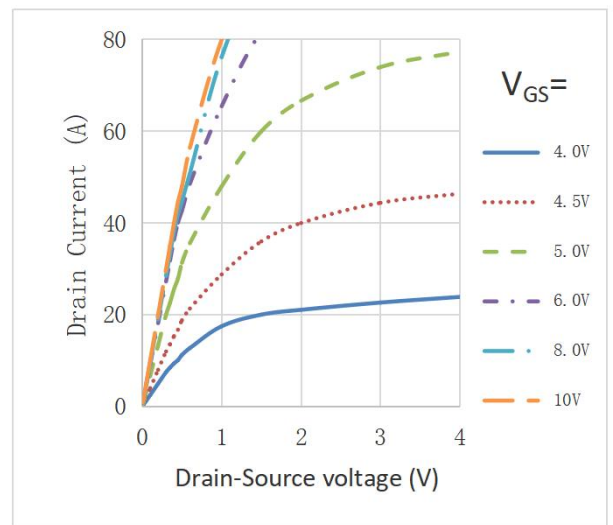


Fig.5 Threshold Voltage V.S Junction Temperature

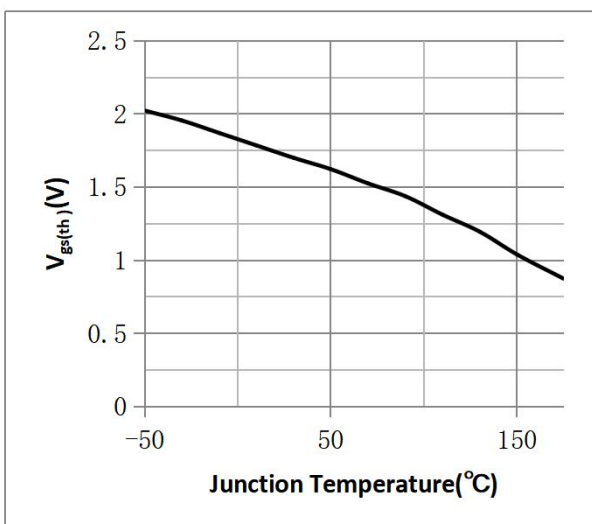


Fig.6 Resistance V.S Drain Current

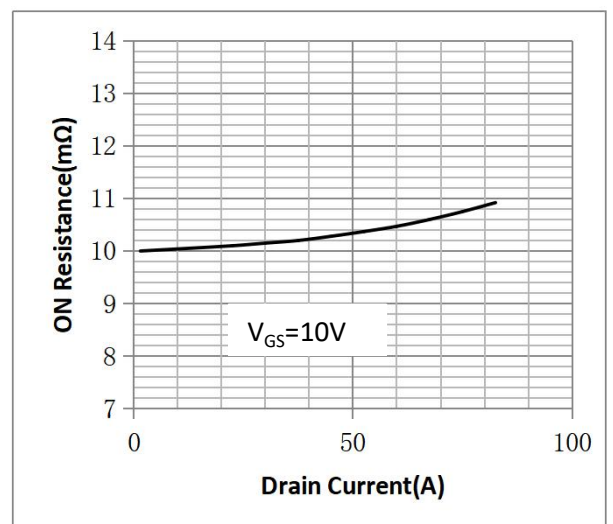


Fig.7 On-Resistance VS Gate Source Voltage

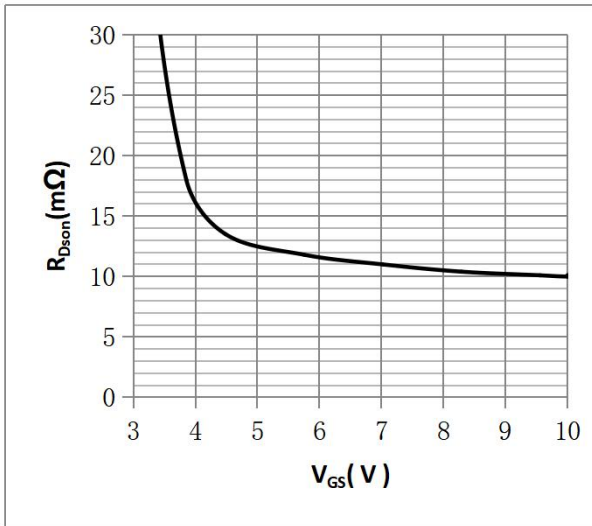


Fig.8 On-Resistance V.S Junction Temperature

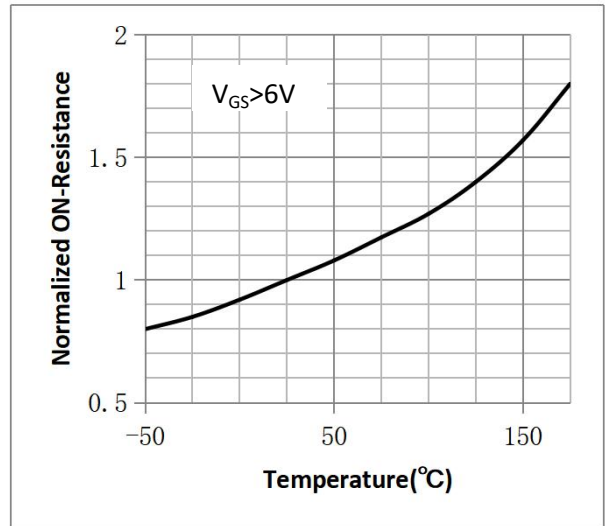


Figure 9. Diode Forward Voltage vs. Current

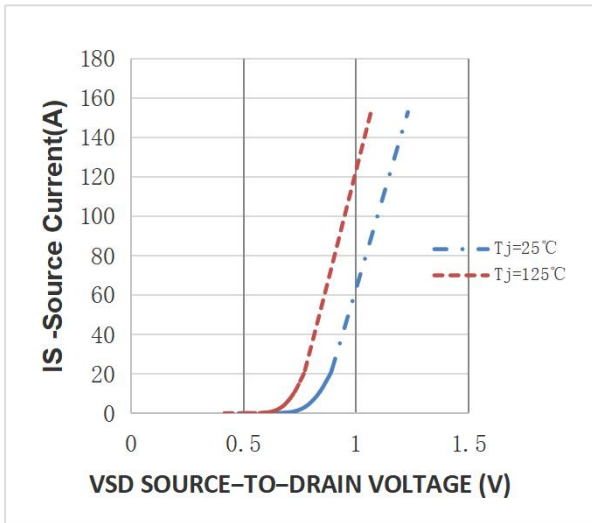


Figure 10. Transfer Characteristics

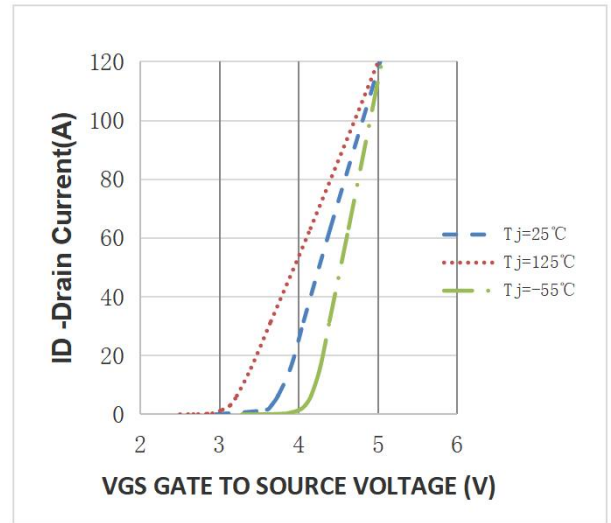


Fig.11 Safe Operating Area

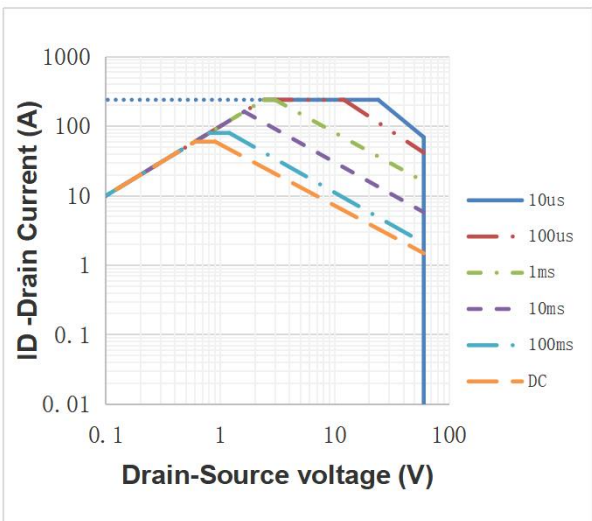
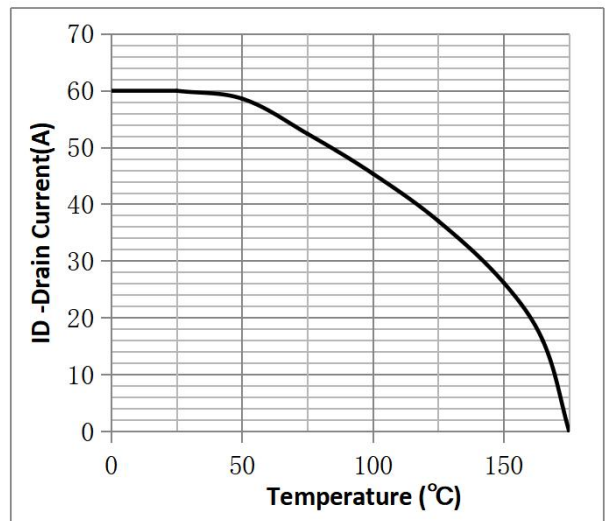
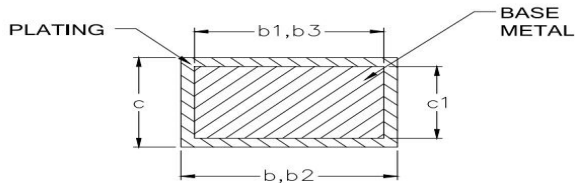
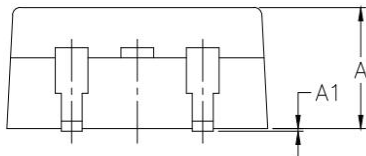
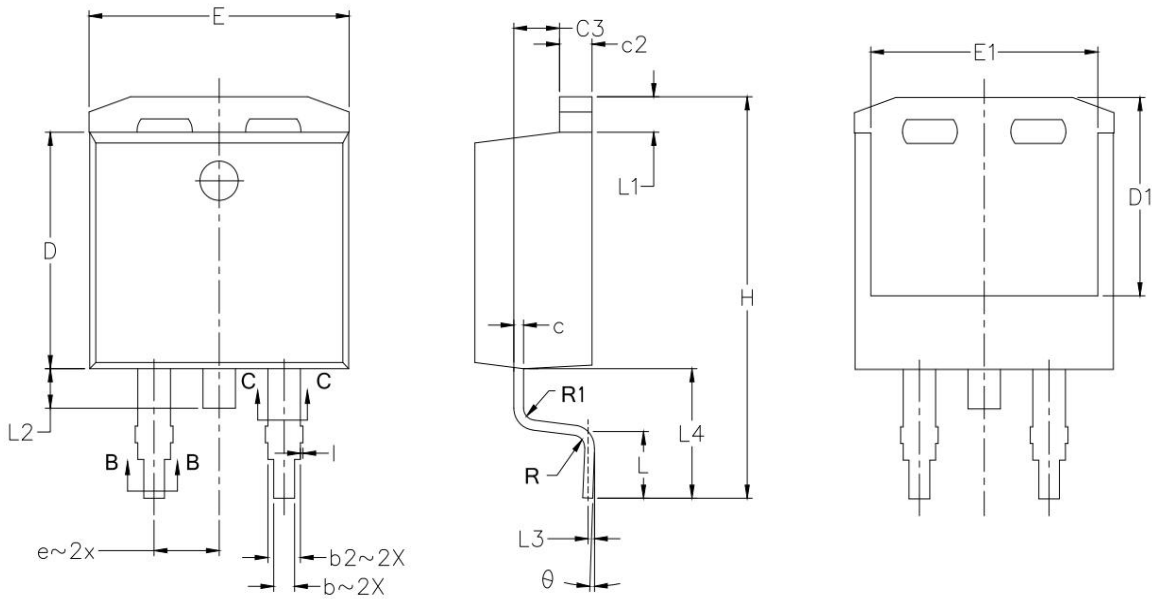


Fig.12 I_D vs. Case Temperature^③



•TO-263 Package Outline



NOTES:
 1.Dimension D & E Does Not Include Mold Flash
 2.Dimension b2 Does Not Include Protrusions

| SYMBOLS | COMMON | | | |
|---------|------------|--------|------------|--------|
| | MM | | INCH | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.064 | 4.826 | 0.160 | 0.190 |
| A1 | 0.000 | 0.254 | 0.000 | 0.010 |
| b | 0.508 | 0.991 | 0.020 | 0.039 |
| b1 | 0.508 | 0.889 | 0.020 | 0.035 |
| b2 | 1.143 | 1.778 | 0.045 | 0.070 |
| b3 | 1.143 | 1.727 | 0.045 | 0.068 |
| c | 0.381 | 0.737 | 0.015 | 0.029 |
| c1 | 0.381 | 0.584 | 0.015 | 0.023 |
| c2 | 1.143 | 1.651 | 0.045 | 0.065 |
| D | 8.382 | 9.652 | 0.330 | 0.380 |
| D1 | 6.858 | — | 0.270 | — |
| E | 9.652 | 10.668 | 0.380 | 0.420 |
| E1 | 6.223 | — | 0.245 | — |
| e | 2.540 BSC. | | 0.100 BSC. | |
| H | 14.605 | 15.875 | 0.575 | 0.625 |
| L | 1.778 | 2.794 | 0.070 | 0.110 |
| L1 | — | 1.676 | — | 0.066 |
| L2 | — | 1.778 | — | 0.070 |
| L3 | 0.254 BSC | | 0.010 BSC | |
| L4 | 4.780 | 5.280 | 0.188 | 0.208 |
| R | 0.460 TYP | | 0.018 TYP | |
| R1 | 0.460 TYP | | 0.018 TYP | |
| θ | 0° | 8° | 0° | 8° |
| C3 | 1.68 | 1.88 | 0.0661 | 0.0740 |
| I | — | 0.100 | — | 0.0039 |

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 | 2023.6.10 | NEW |
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