## • 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

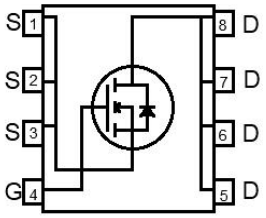
## •Application

■BLDC Motor driver

■DC-DC

■Battery protection

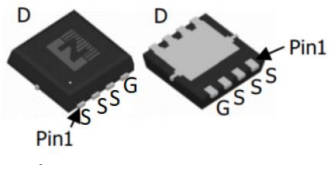
## • Product Summary




$V_{DS}$= 40V

$R_{DS(ON)}$ = 5.5mΩ

$I_D$= 45A




DFN3*3

## •Ordering Information:

| | |
|---|---|
| Part NO. | ZMA042N04M |
| Marking | 042N04 |
| Packing Information | REEL TAPE |
| Basic ordering unit (pcs) | 5000 |

## •Absolute Maximum Ratings ($T_C$=25℃)

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | | 40 | V |
| Gate-Source Voltage① | $V_{GS}$ | | ±20 | V |
| Continuous Drain Current | $I_D$ | $T_C$=25℃ | 45 | A |
| | $I_D$ | $T_C$=75℃ | 45 | A |
| | $I_D$ | $T_C$=100℃ | 43 | A |
| Pulsed Drain Current | $I_{DM}$ | Pulsed; $t_p$ ≤ 10 μs; $T_{mb}$ = 25 °C; | 180 | A |
| Total Power Dissipation | $P_D$ | $T_C$=25℃ | 56 | W |
| Total Power Dissipation | $P_D$ | $T_A$=25℃ | 2.5 | W |
| Operating Junction Temperature | $T_J$ | | -55 to +175 | ℃ |
| Storage Temperature | $T_{STG}$ | | -55 to +175 | ℃ |
| Single Pulse Avalanche Energy | $E_{AS}$ | L=0.1mH, $V_{GS}$=10V, Rg=25Ω, | 100 | mJ |
| | | L=0.5mH, $V_{GS}$=10V, Rg=25Ω, | 210 | mJ |
| ESD Level (HBM) | CLASS 2 | | | |

## ●Thermal resistance

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Thermal resistance, junction - case | $R_{thJC}$ | | - | 2.7 | °C/W |
| Thermal resistance, junction-ambient② | $R_{thJA}$ | | - | 60 | °C/W |
| Soldering temperature | Tsold | | - | 260 | °C |

## ●Electronic Characteristics

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ =0V, $I_D$ =250uA | 40 | | | V |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ =$V_{DS}$, $I_D$ =250uA | 1.3 | 1.8 | 2.5 | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{GS}$=0V, $V_{DS}$= 40V | | | 1.0 | uA |
| Gate- Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$ = 0V | | | 100 | nA |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$= 24A | | 5.5 | 7.0 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$= 12A | | 8.0 | 10 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ =5V, $I_{SD}$ = 10A | | 12 | | 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 | Ciss | f = 1MHz, $V_{DS}$=25V | - | 3300 | - | pF |
| Output capacitance | Coss | | - | 232 | - | |
| Reverse transfer capacitance | Crss | | - | 171 | - | |
| Gate Risistance | Rg | f = 1MHz | - | 1.4 | | Ω |
| Total gate charge | Qg | $V_{DD}$ = 15V, $I_D$ = 20A, $V_{GS}$ = 10V | - | 51 | - | nC |
| | Qg (4.5v) | | - | 24 | - | |
| Gate - Source charge | Qgs | | - | 9 | - | |
| Gate - Drain charge | Qgd | | - | 9.6 | - | |
| Turn-ON Delay time | $t_{D(on)}$ | $V_{GS}$=10V,$V_{DS}$=15V, $R_G$ =3.3Ω, $I_D$ =20A | - | 11 | - | ns |
| Turn-ON Rise time | $t_r$ | | - | 6 | - | ns |
| Turn-Off Delay time | $t_{D(off)}$ | | - | 34 | - | ns |
| Turn-Off Fall time | $t_f$ | | - | 10 | - | ns |
| Reverse Recovery Time | $t_{RR}$ | $V_{DD}$=20V, $dI_S/dt$ = 100A/us, $I_S$=20A | - | 20 | - | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | - | 14 | - | nC |

Fig.1 Gate-Charge Characteristics

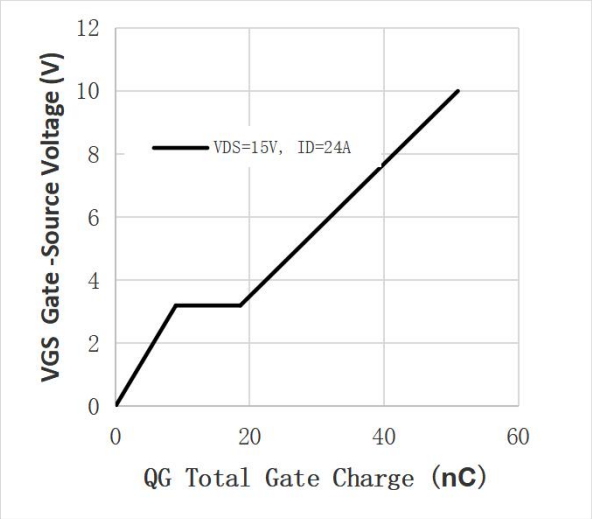



Fig.2 Capacitance Characteristics

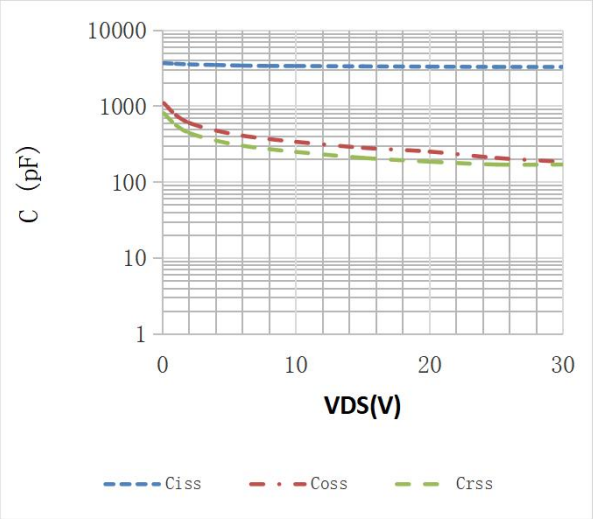



Fig.3 Power Dissipation

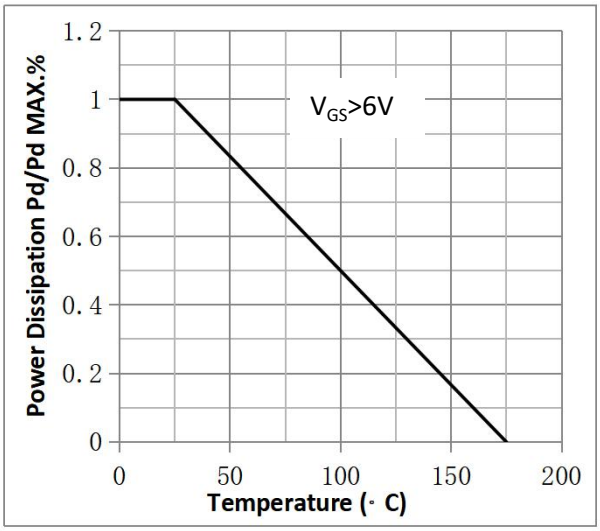



Fig.4 Typical output Characteristics

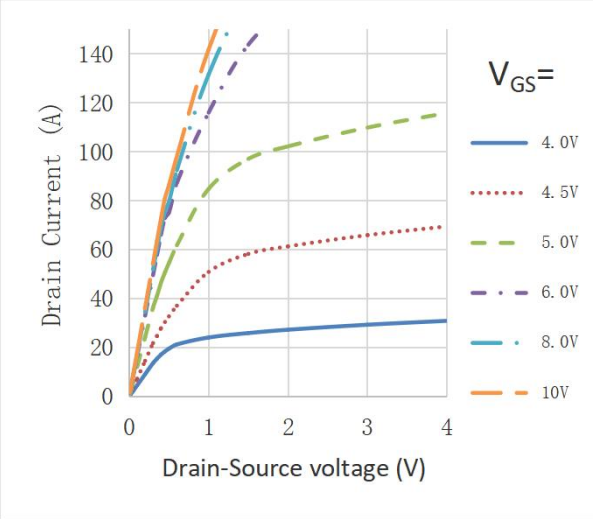



Fig.5 Threshold Voltage V.S Junction Temperature

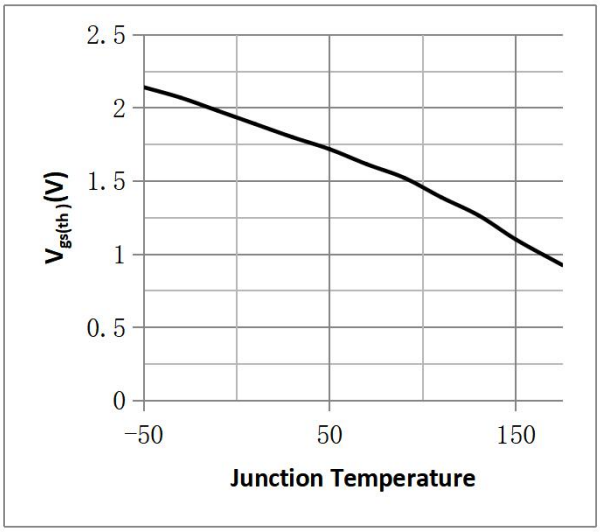



Fig.6 Resistance V.S Drain Current

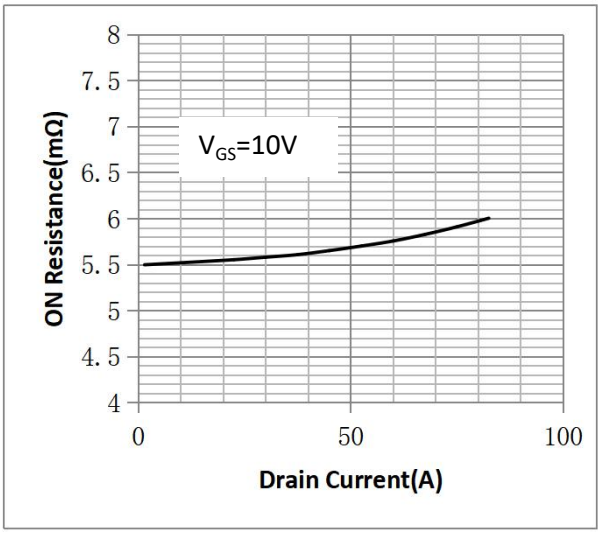


Fig.7 On-Resistance VS Gate Source Voltage

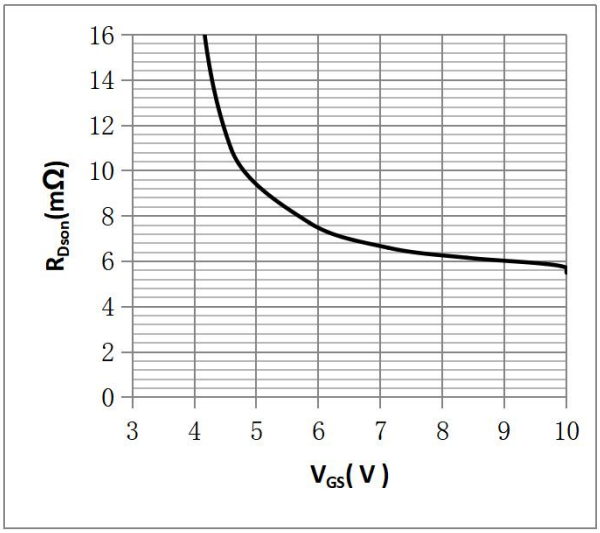



Fig.8 On-Resistance V.S Junction Temperature

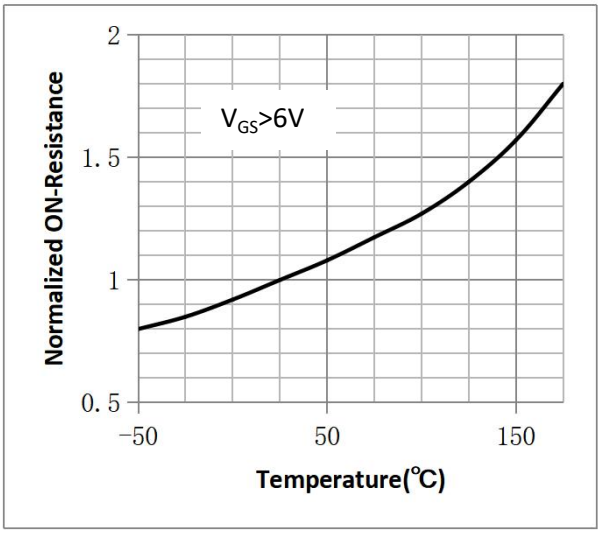



Figure 9. Diode Forward Voltage vs. Current

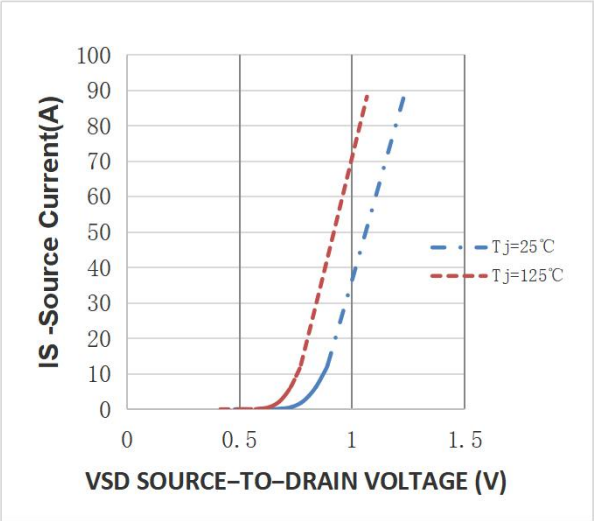



Figure 10. Transfer Characteristics

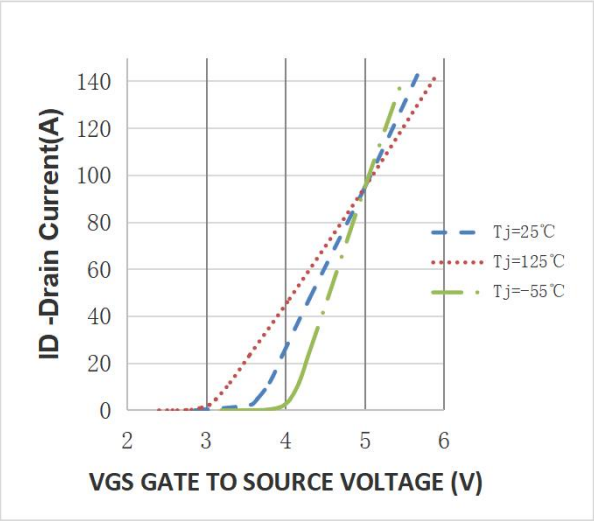



Fig.11 Safe Operating Area

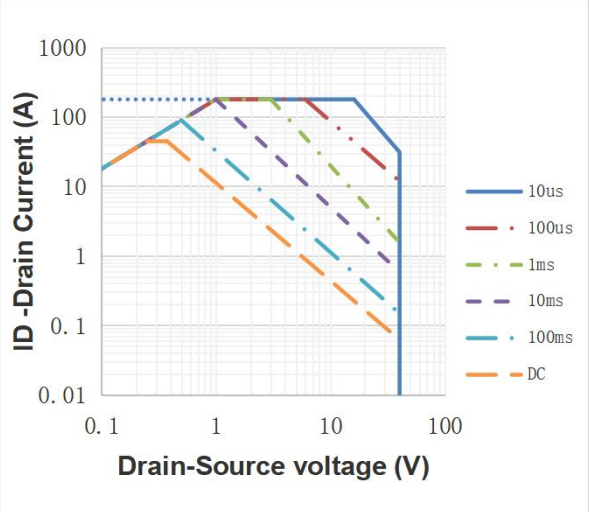
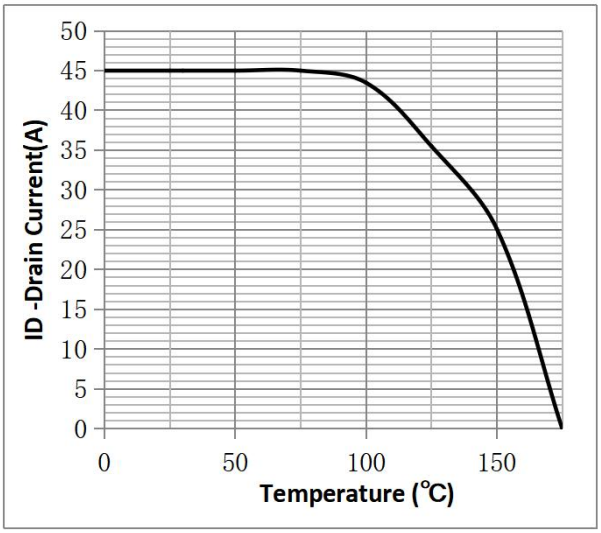
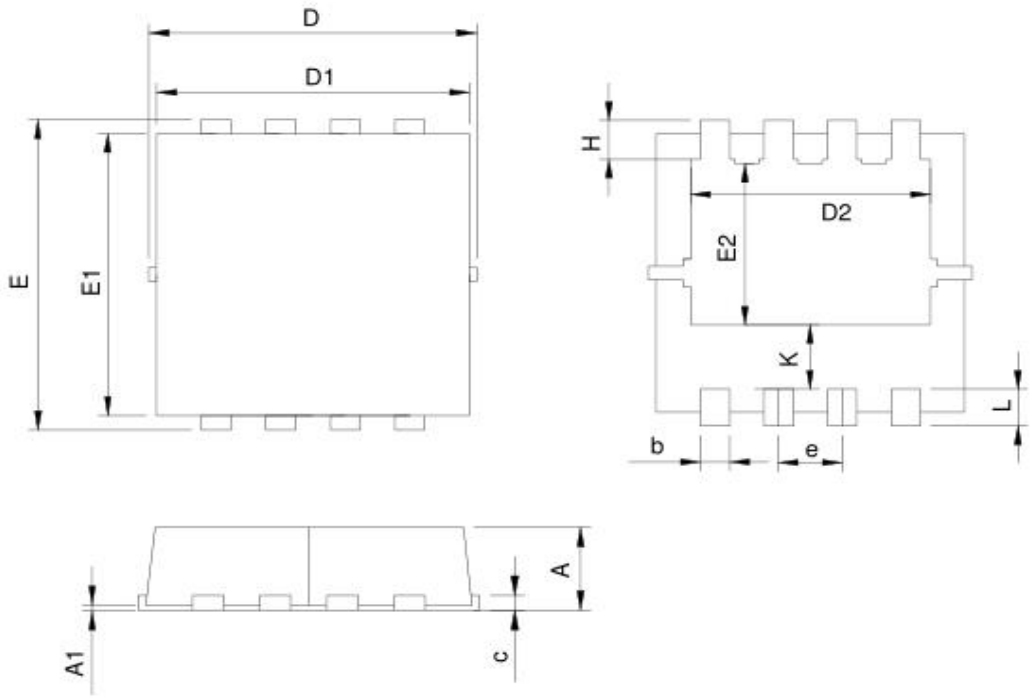



Fig.12 ID vs. Case Temperature③

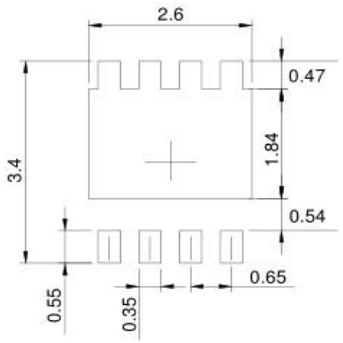


## ●DFN3*3 Package Outline




| SYMBOL | DFN3.3x3.3-8 | | | |
|---|---|---|---|---|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.70 | 1.00 | 0.028 | 0.039 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| b | 0.25 | 0.35 | 0.010 | 0.014 |
| c | 0.14 | 0.20 | 0.006 | 0.008 |
| D | 3.10 | 3.50 | 0.122 | 0.138 |
| D1 | 3.05 | 3.25 | 0.120 | 0.128 |
| D2 | 2.35 | 2.55 | 0.093 | 0.100 |
| E | 3.10 | 3.50 | 0.122 | 0.138 |
| E1 | 2.90 | 3.10 | 0.114 | 0.122 |
| E2 | 1.64 | 1.84 | 0.065 | 0.072 |
| e | 0.65 BSC | | 0.026 BSC | |
| H | 0.32 | 0.52 | 0.013 | 0.020 |
| K | 0.59 | 0.79 | 0.023 | 0.031 |
| L | 0.25 | 0.55 | 0.010 | 0.022 |

## RECOMMENDED LAND PATTERN




UNIT: mm

**Note:**

① Pulse : VGS=+20V/-20V, Duty cycle=50%,Tj=175℃, t=1000 hours; For DC， the following test conditions can be passed: VGS=+20V/-10V, Tj=175℃, t=1000 hours；

② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate；

③Practically 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 | 2021.7.10 | |
| B | 2022.9.5 | 1.Add Reach,HF figure,2.ID modify |
| | | |
| | | |
| | | |
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