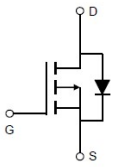
## • General Description

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

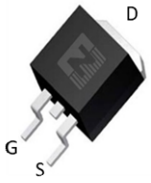
## • Product Summary




$V_{DS}$= -40V
$R_{DS(ON)}$ = 2.7mΩ
$I_D$= -328A

## • Features

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




TO-263

## •Application

■BLDC Motor driver
■DC-DC
■Load Switch

## •Ordering Information:

| | |
|---|---|
| Part NO. | ZMA025P04B |
| Marking | ZM025P04 |
| Packing Information | REEL TAPE |
| Basic ordering unit (pcs) | 800 |

## •Absolute Maximum Ratings ($T_C$=25°C,unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | | - | -40 | V |
| Gate-Source Voltage | $V_{GS}$ | | -20 | 20 | V |
| Continuous Drain Current | $I_D$ | VGS=-10V,$T_C$=25°C | - | -328 | A |
| | $I_D$ | VGS=-10V,$T_C$=75°C | - | -195 | A |
| | $I_D$ | VGS=-10V,$T_C$=100°C | - | -195 | A |
| Pulsed Drain Current | $I_{DM}$ | Pulsed; $t_p \leqslant$ 10 μs; $T_C$ = 25 °C; | - | -1312 | A |
| Total Power Dissipation | $P_D$ | $T_C$=25°C | - | 556 | W |
| Total Power Dissipation | $P_D$ | $T_A$=25°C | - | 2.4 | W |
| Operating Junction Temperature | $T_J$ | | -55 | 175 | ℃ |
| Storage Temperature | $T_{STG}$ | | -55 | 175 | ℃ |
| Single Pulse Avalanche Energy | $E_{AS}$ | L=0.1mH, $V_{GS}$=-10V, Rg=25Ω, | - | 490 | mJ |
| | | L=0.5mH, $V_{GS}$=-10V, Rg=25Ω, | - | 882 | mJ |
| ESD Level (HBM) | CLASS 2 | | | | |

## •Thermal resistance

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Thermal resistance, junction-case | $R_{thJC}$ | - | - | 0.27 | °C/W |
| Thermal resistance, junction-ambient① | $R_{thJA}$ | - | - | 62.5 | °C/W |
| Soldering temperature | Tsold | - | - | 260 | °C |

## •Electronic Characteristics (Tj=25°C,unless otherwise specified)

| 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 | -1.7 | -2.5 | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{GS}$=0V, $V_{DS}$=-40V,$T_j$=25℃ | - | - | 1.0 | uA |
| | | $V_{GS}$=0V, $V_{DS}$=-40V,$T_j$=175°C | - | - | 100 | 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, $I_D$=-15A,$T_j$=25°C | - | 2.7 | 3.2 | mΩ |
| | | $V_{GS}$=-10V, $I_D$=-15A,$T_j$=175°C | - | 4.7 | - | mΩ |
| | | $V_{GS}$=-4.5V,$I_D$=-10A,$T_j$=25°C | - | 4 | 4.8 | mΩ |
| | | $V_{GS}$=-4.5V,$I_D$=-10A,$T_j$=175°C | - | 6.4 | - | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ =-5V, $I_D$ = -5A | - | 29 | - | S |
| Diode Forward Voltage | $V_{FSD}$ | $V_{GS}$ =0V, $I_{SD}$ = -15A | - | - | -1.3 | V |

## •Dynamic characteristics (Tj=25°C,unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input capacitance | Ciss | f = 1MHz, $V_{DS}$=-20V,$V_{GS}$=0V | - | 13428 | - | pF |
| Output capacitance | Coss | | - | 1826 | - | |
| Reverse transfer capacitance | Crss | | - | 186 | - | |
| Gate Risistance | Rg | f = 1MHz,$V_{GS}$=0V | - | 7.1 | - | Ω |
| Total gate charge | Qg | $V_{DD}$ = -20V, $I_D$ = -15A, $V_{GS}$ = -10V | - | 262 | - | nC |
| | Qg (-4.5V) | | - | 126 | - | |
| Gate - Source charge | Qgs | | - | 47 | - | |
| Gate - Drain charge | Qgd | | - | 39 | - | |
| Turn-ON Delay time | $t_{D(on)}$ | $V_{GS}$=-10V, $V_{DS}$=-20V, $R_G$ =3.3Ω, $I_D$ =-15A | - | 17 | - | ns |
| Turn-ON Rise time | $t_r$ | | - | 81 | - | ns |
| Turn-Off Delay time | $t_{D(off)}$ | | - | 345 | - | ns |
| Turn-Off Fall time | $t_f$ | | - | 178 | - | ns |
| Reverse Recovery Time | $t_{rr}$ | $V_{DD}$=-20V, $dI_S/dt$ = 100A/us, $I_S$=-15A | - | 49 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 56 | - | nC |

Fig.1 Gate-source voltage as a function of gate charge;Typical values;Tj=25°C

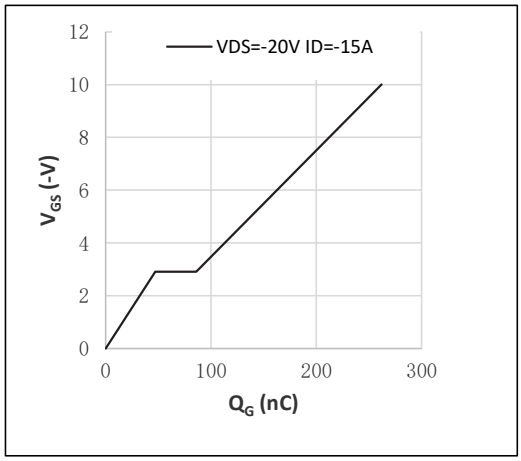



Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage;Typical values;Tj=25°C

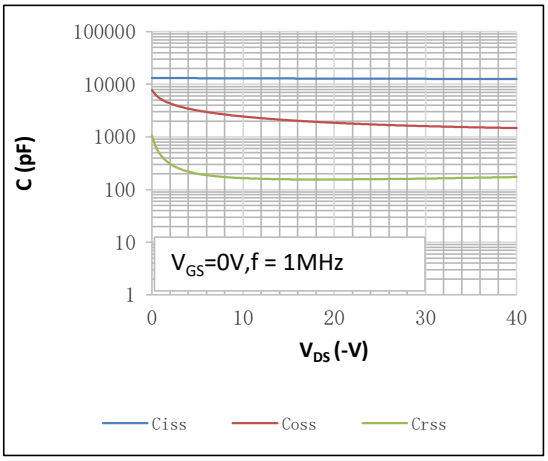



Fig.3 Output characteristics: drain current as a function of drain-source voltage;Typical values; Tj=25°C

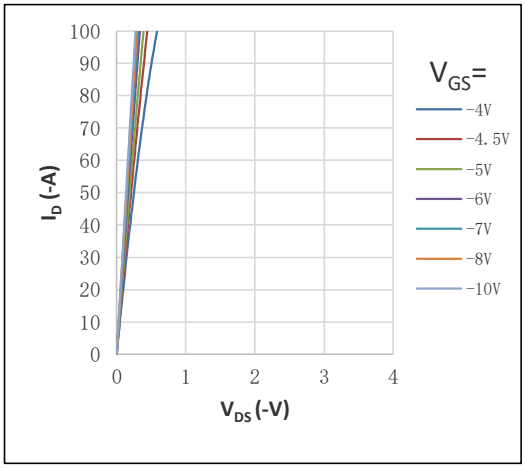



Fig.4 Output characteristics: drain current as a function of drain-source voltage;Typical values:Expanded curve;Tj=25°C

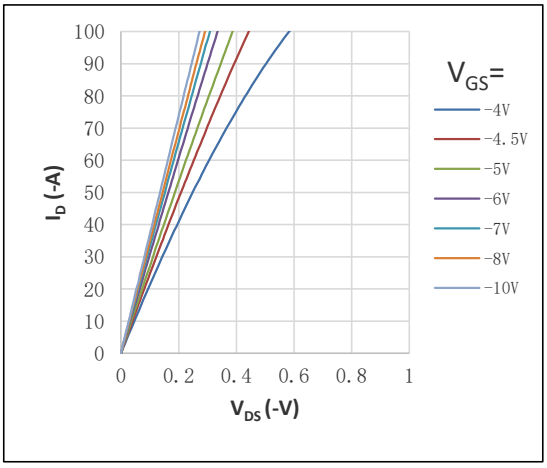



Fig.5 Gate-source threshold voltage as a function of junction temperature;Typical values

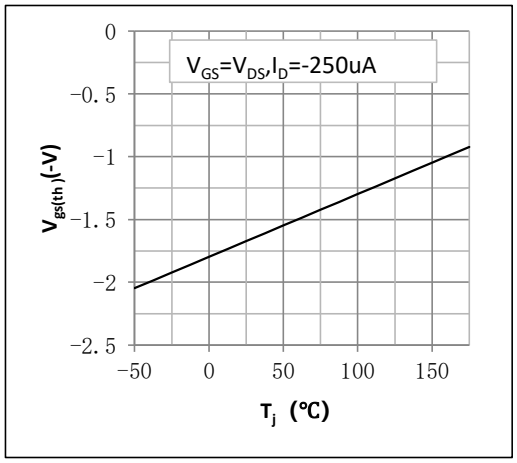



Fig.6 Drain-source on-state resistance as a function of drain current;Typical values;Tj=25 °C

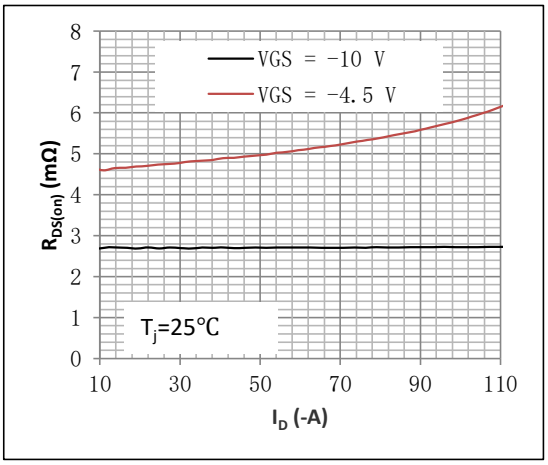


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

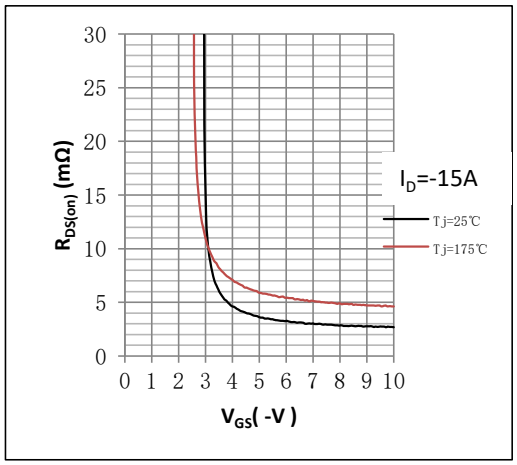



Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance=RDSon/RDSon(25 ℃)

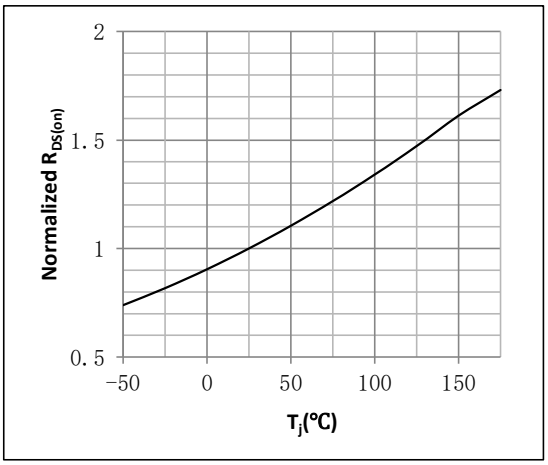



Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

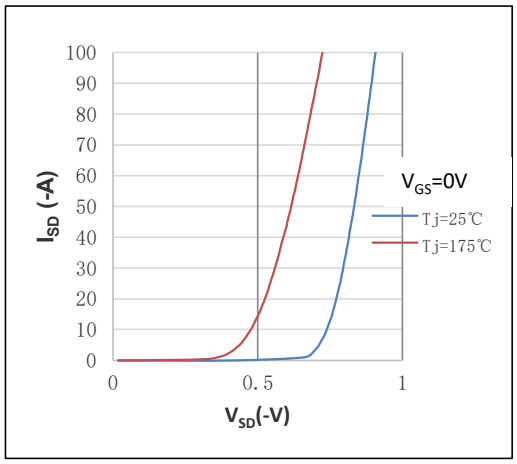



Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

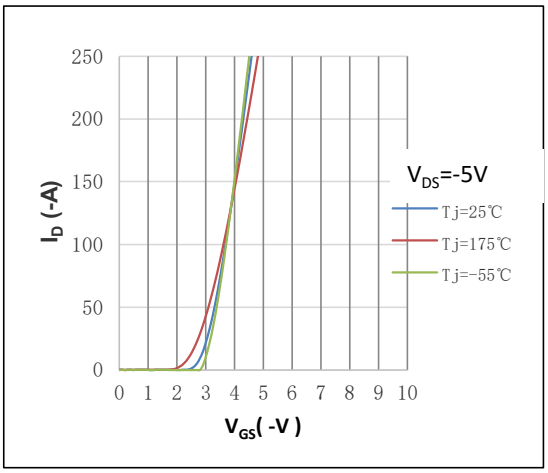



Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

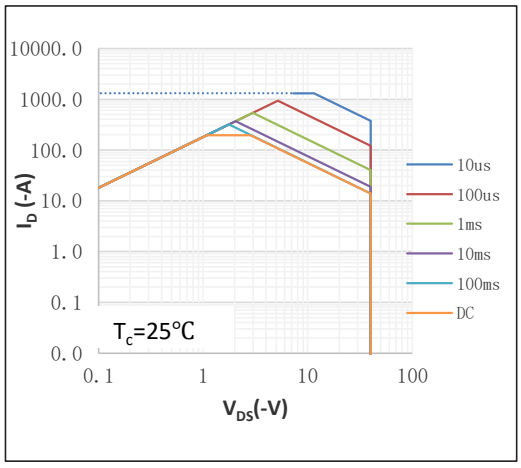



Fig.12 Continuous drain current as a function of case temperaturease③ ;Calculative values

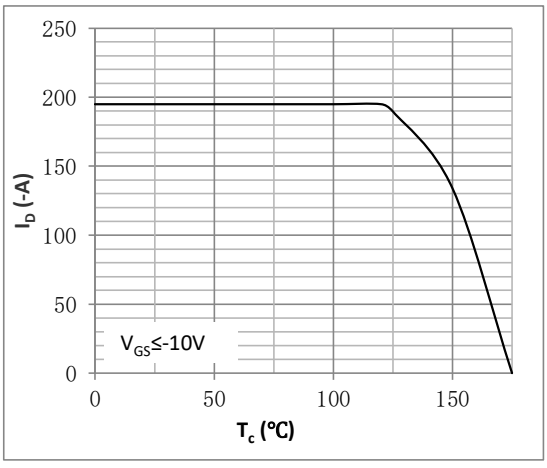


Fig.13 Drain-source breakdown voltage as a function of junction temperature;Typical values Normalized BVDSS=BVDSS/BVDSS(25°C)

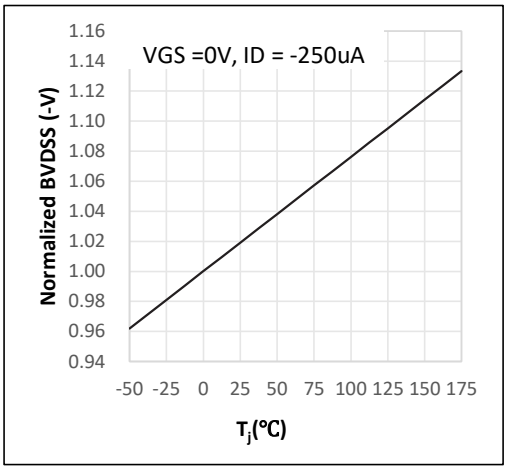



Fig.14 Normalized total power dissipation as a function of case temperature;Calculative values Normalized Power Dissipation= Pd/Pd(25°C)

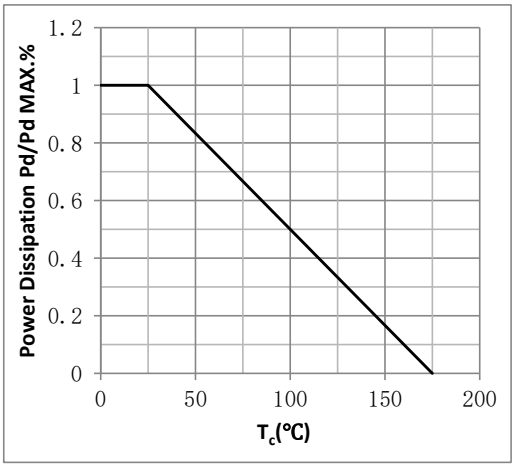
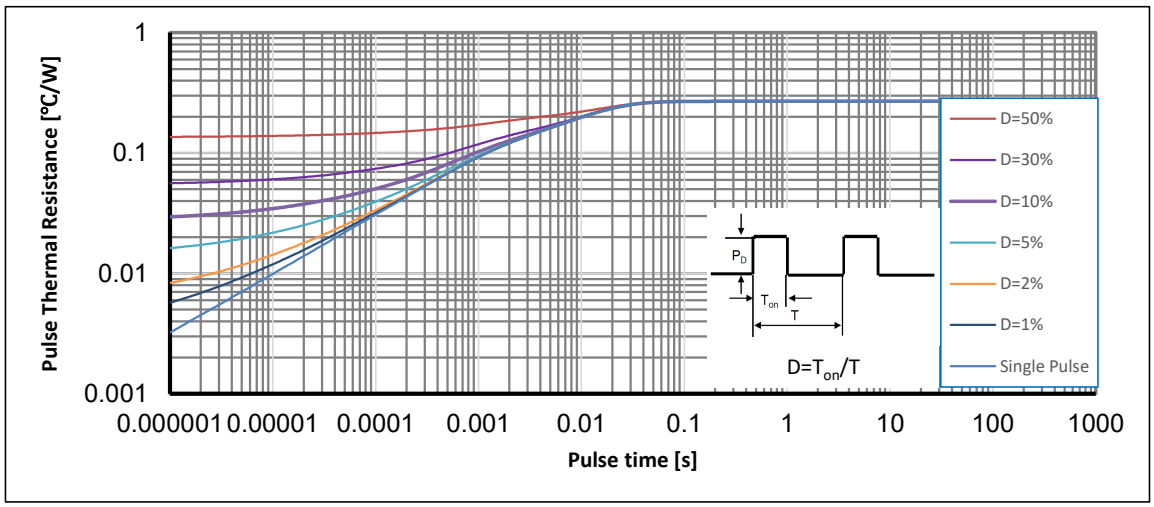
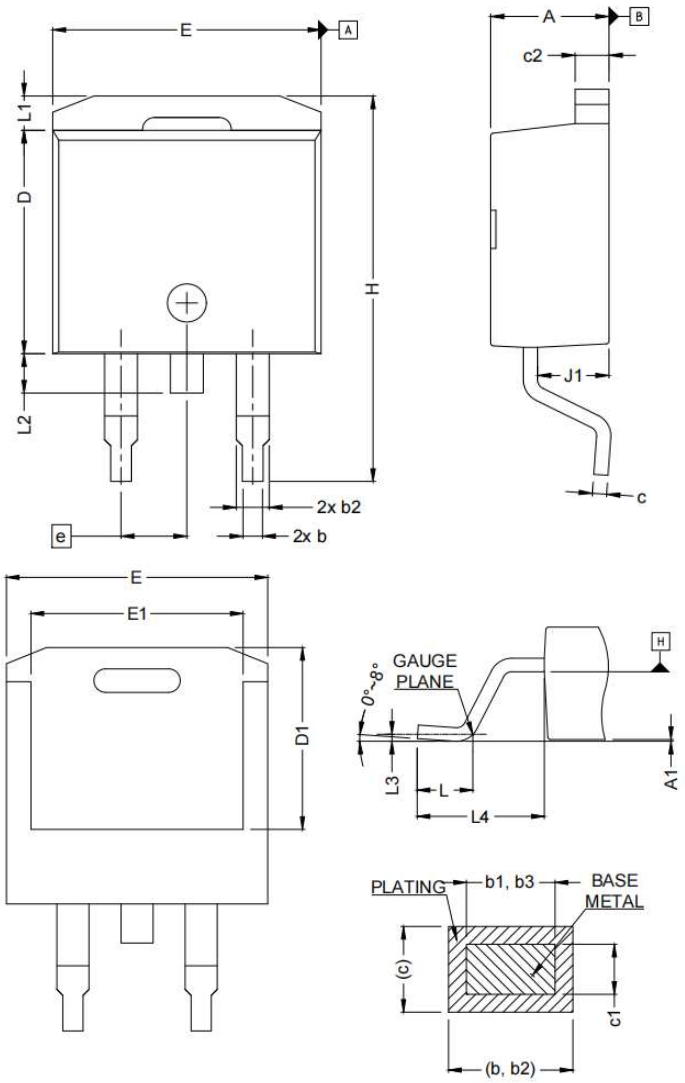



Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



## ●TO-263 Package Outline




NOTE
1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3.0 HEAT SINK SIDE FLASH IS MAX. 0.8mm.
4.0 RADIUS ON TERMINAL IS OPTIONAL.

| SYMBOL | MIN. | MAX. | SYMBOL | MIN. | MAX. |
|---|---|---|---|---|---|
| A | 4.36 | 4.56 | E | 10.15 | 10.55 |
| A1 | 0 | 0.25 | E1 | 8.10 | 8.70 |
| b | 0.70 | 0.90 | e | 2.54 BSC | |
| b1 | 0.51 | 0.89 | H | 15.00 | 15.60 |
| b2 | 1.17 | 1.37 | L | 1.90 | 2.50 |
| b3 | 1.17 | 1.37 | L1 | - | 1.65 |
| c | 0.38 | 0.69 | L2 | - | 1.78 |
| c1 | 0.38 | 0.53 | L3 | 0.25 TYP | |
| c2 | 1.19 | 1.34 | L4 | 4.78 | 5.28 |
| D | 8.60 | 9.00 | J1 | 2.56 | 2.96 |
| D1 | 6.90 | 7.50 | | | |

**Note:**

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

②Practically the current will be limited by PCB, thermal design and operating temperature. VGS=-10V.

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Revision History

| Version | Date | Change |
|---|---|---|
| A | 2025/2/18 | NEW |
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