

### • General Description

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

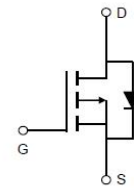
### • Features

- 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

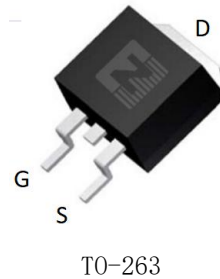
### • Product Summary



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

$$R_{DS(ON)} = 40m\Omega$$

$$I_D = -37A$$



### • Ordering Information:

|                           |            |
|---------------------------|------------|
| Part NO.                  | ZMA350P10B |
| Marking                   | ZM350P10   |
| 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             | $V_{DS}$  |                                                                   | -100        | V                |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                                   | $\pm 20$    | V                |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ\text{C}$                                            | -37         | A                |
|                                  | $I_D$     | $T_C=75^\circ\text{C}$                                            | -31         | A                |
|                                  | $I_D$     | $T_C=100^\circ\text{C}$                                           | -27         | A                |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$ ; | -148        | A                |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ\text{C}$                                            | 167         | W                |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ\text{C}$                                            | 5.0         | 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    | $E_{AS}$  | $L=0.1\text{mH}$ , $V_{GS}=-10\text{V}$ , $R_g=25\Omega$ ,        | 110         | mJ               |
|                                  |           | $L=0.5\text{mH}$ , $V_{GS}=-10\text{V}$ , $R_g=25\Omega$ ,        | 231         | mJ               |
| ESD Level (HBM)                  | CLASS 2   |                                                                   |             |                  |

**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|------------|------|------|------|------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 0.9  | °C/W |
| Thermal resistance, junction-ambient <sup>②</sup> | $R_{thJA}$ |      | -    | 30   | °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 | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-15A$        |      | 40   | 56   | m $\Omega$ |
|                                   |              | $V_{GS}=-4.5V, I_D=-8A$        |      | 52   | 70   | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=-5V, I_{SD}=-10A$      |      | 20   |      | S          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=-15A$       |      |      | 1.3  | V          |

**•Dynamic characteristics**

| Parameter                    | Symbol       | Condition                                           | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|-----------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $f=1MHz, V_{DS}=-25V$                               | -    | 4500 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                     | -    | 398  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                     | -    | 157  | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                            | -    | 4    |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=-15V, I_D=-10A, V_{GS}=-10V$                | -    | 124  | -    | nC       |
|                              | $Q_g(-4.5V)$ |                                                     | -    | 61   | -    |          |
| Gate - Source charge         | $Q_{gs}$     |                                                     | -    | 20   | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                     | -    | 29   | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=-10V, V_{DS}=-15V, R_G=3.3\Omega, I_D=-10A$ | -    | 26   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                     | -    | 89   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                     | -    | 96   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                     | -    | 67   | -    | ns       |
| Reverse Recovery Time        | $t_{RR}$     | $V_{DD}=-20V, dI_S/dt=100A/\mu s, I_S=-20A$         | -    | 205  | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                     | -    | 467  | -    | nC       |

Fig.1 Gate-Charge Characteristics

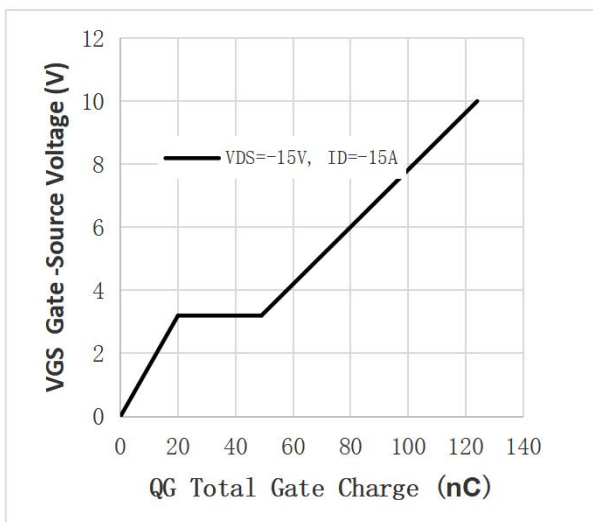


Fig.2 Capacitance Characteristics

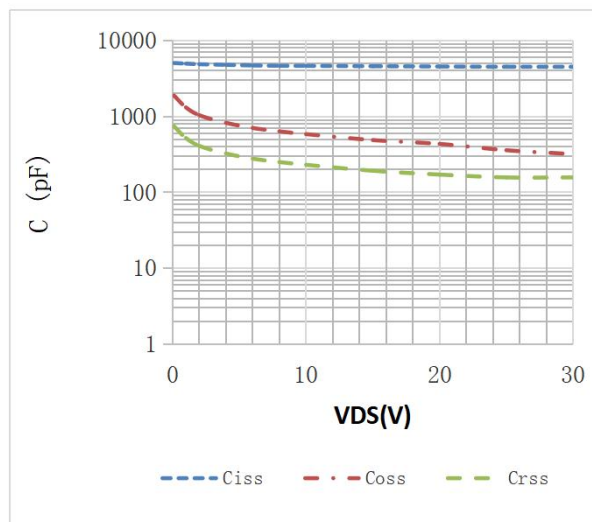


Fig.3 Power Dissipation

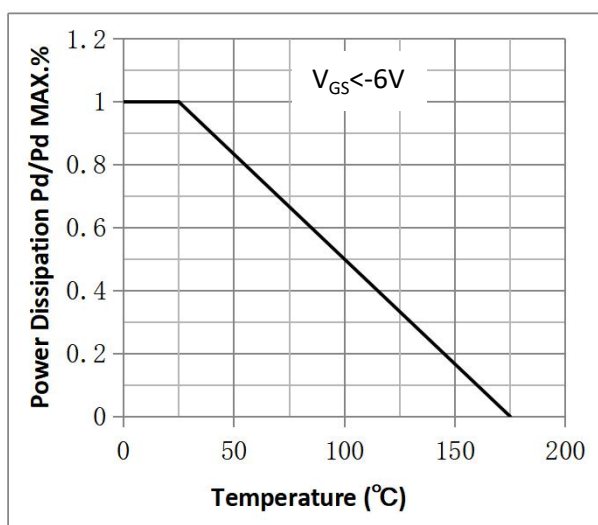


Fig.4 Typical output Characteristics

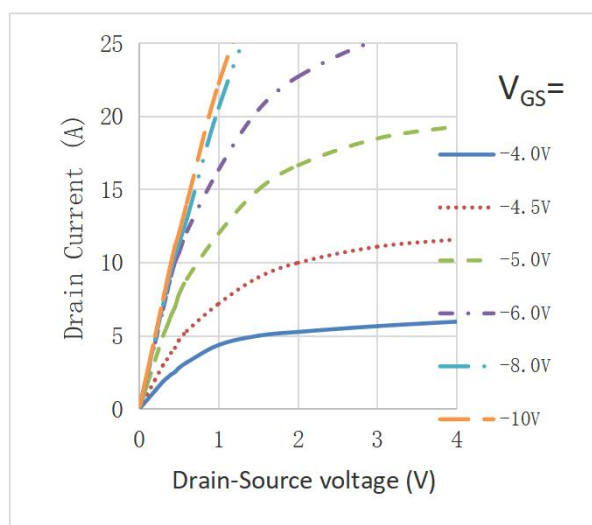


Fig.5 Threshold Voltage V.S Junction Temperature

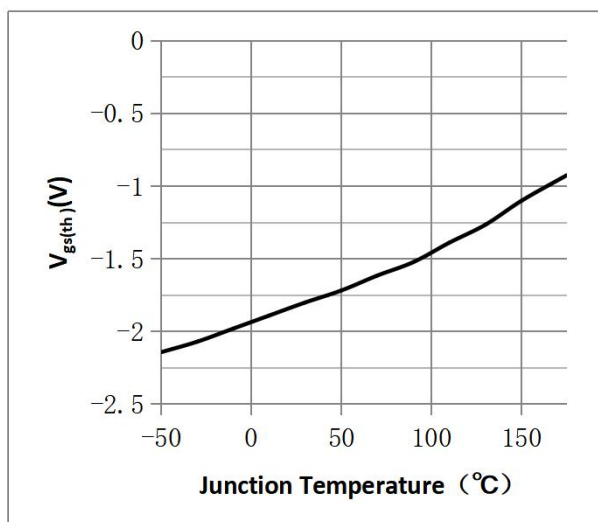


Fig.6 Resistance V.S Drain Current

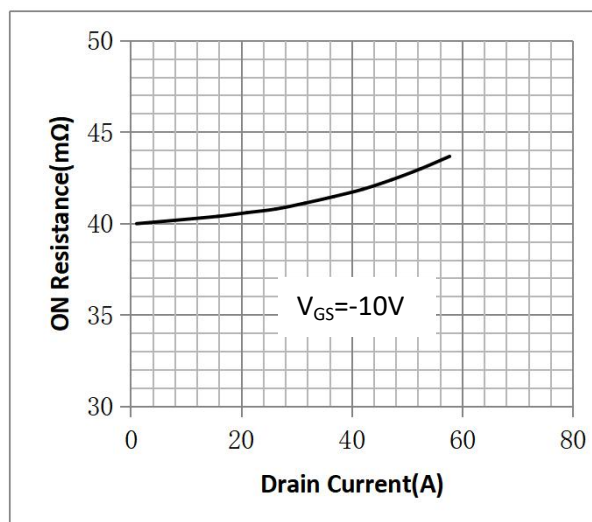


Fig.7 On-Resistance VS Gate Source Voltage

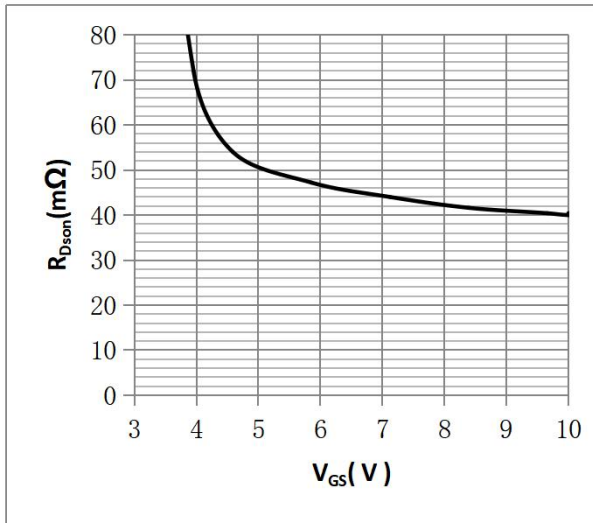


Fig.8 On-Resistance V.S Junction Temperature

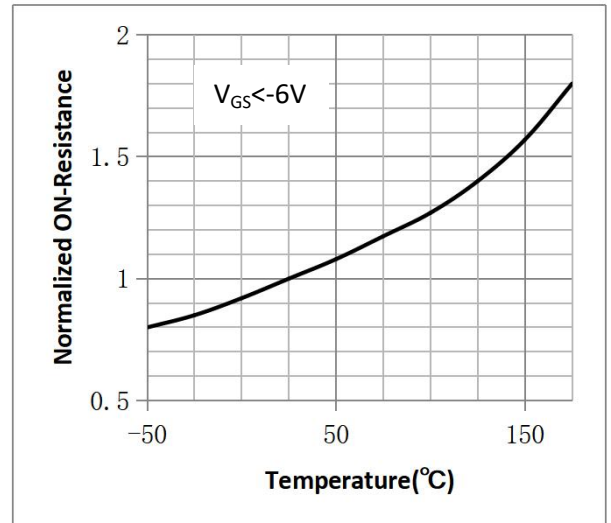


Figure 9. Diode Forward Voltage vs. Current

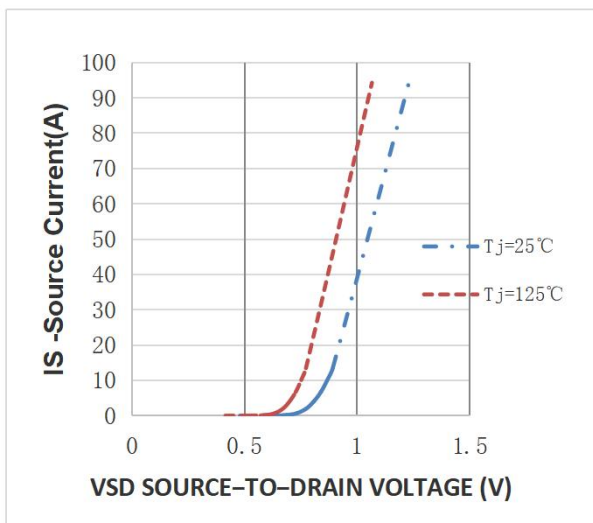


Figure 10. Transfer Characteristics

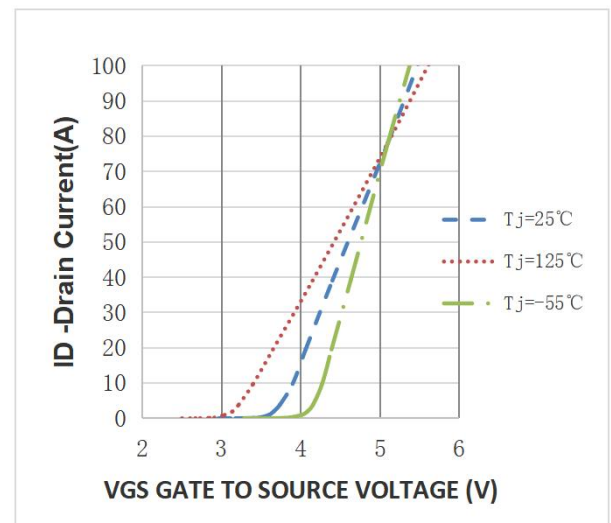


Fig.11 Safe Operating Area

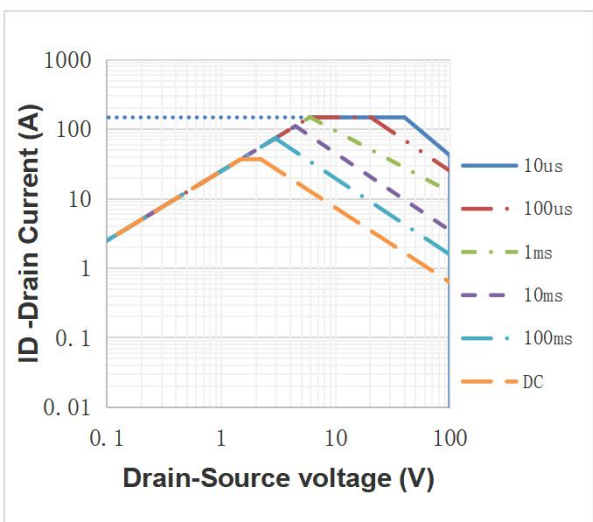
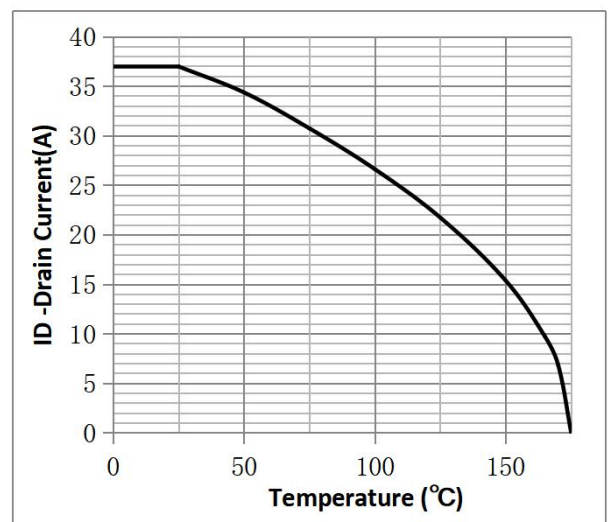
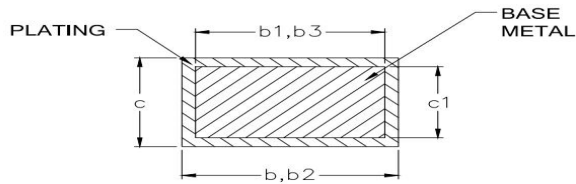
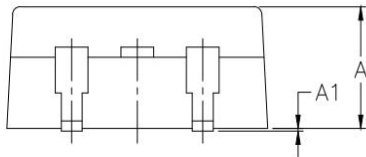
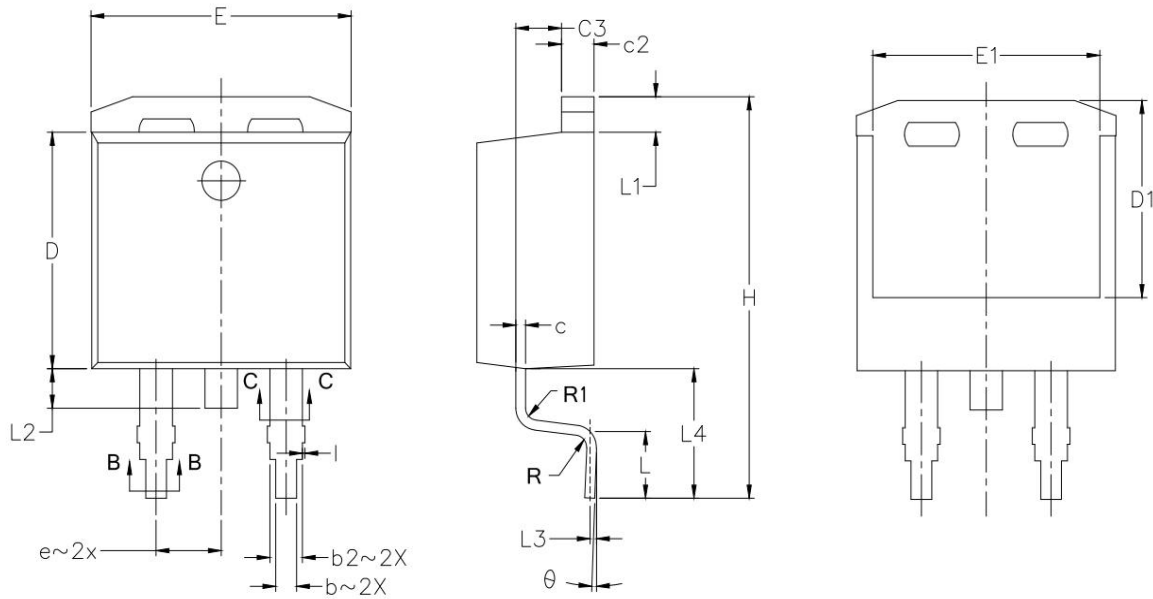


Fig.12 ID vs. Case Temperature<sup>③</sup>



•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       | 2021.12.3 | NEW                   |
| B       | 2022.9.7  | 1.Add Reach,HF figure |
|         |           |                       |
|         |           |                       |
|         |           |                       |
|         |           |                       |
|         |           |                       |
|         |           |                       |