

### General Description

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

### Features

- Fast Recovery Body Diode Embedded
- Low  $R_{DS(ON)}$  to Minimize Conductive Loss
- Low Gate Charge for Fast Switching
- Low Thermal Resistance

### Application

- Motor Driver
- DC-DC
- Battery Chargers

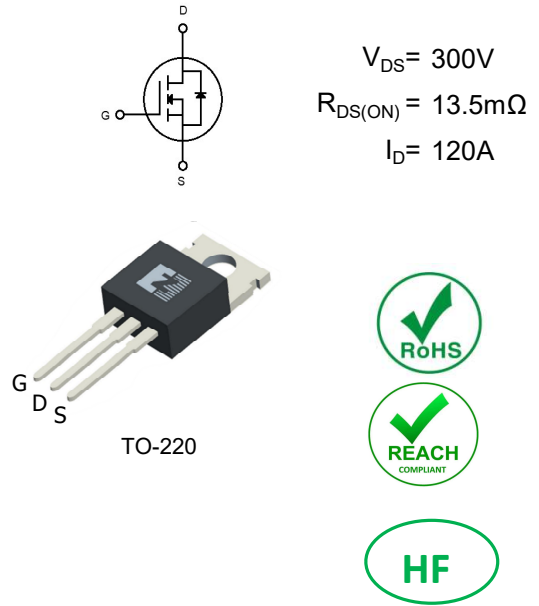
### Ordering Information:

|                           |             |
|---------------------------|-------------|
| Part NO.                  | ZMJ30R022FP |
| Marking                   | ZMJ30R022F  |
| Packing Information       | TUBE BULK   |
| Basic ordering unit (pcs) | 1000        |

### Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ , unless otherwise specified)

| Parameter                         | Symbol    | Conditions                                                 | Min. | Max. | Unit             |
|-----------------------------------|-----------|------------------------------------------------------------|------|------|------------------|
| Drain-Source Voltage              | $V_{DS}$  |                                                            | -    | 300  | V                |
| Gate-Source Voltage <sup>①</sup>  | $V_{GS}$  |                                                            | -20  | 20   | V                |
| Continuous Drain Current          | $I_D$     | $V_{GS}=10\text{V}, T_C=25^\circ\text{C}$                  | -    | 120  | A                |
|                                   | $I_D$     | $V_{GS}=10\text{V}, T_C=75^\circ\text{C}$                  | -    | 98   | A                |
|                                   | $I_D$     | $V_{GS}=10\text{V}, T_C=100^\circ\text{C}$                 | -    | 85   | A                |
| Pulsed Drain Current <sup>①</sup> | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu\text{s}; T_C = 25^\circ\text{C};$ | -    | 480  | A                |
| Total Power Dissipation           | $P_D$     | $T_C=25^\circ\text{C}$                                     | -    | 600  | W                |
| Total Power Dissipation           | $P_D$     | $T_A=25^\circ\text{C}$                                     | -    | 4.2  | W                |
| Operating Junction Temperature    | $T_J$     |                                                            | -55  | 175  | $^\circ\text{C}$ |
| Storage Temperature               | $T_{STG}$ |                                                            | -55  | 175  | $^\circ\text{C}$ |
| Single Pulse Avalanche Energy     | $E_{AS}$  | $L=10\text{mH}, V_{GS}=10\text{V}, R_g=25\Omega,$          | -    | 1280 | mJ               |
| ESD Level (HBM)                   | CLASS 2   |                                                            |      |      |                  |

### Product Summary



**•Thermal resistance**

| Parameter                            | Symbol         | Min. | Typ. | Max. | Unit |
|--------------------------------------|----------------|------|------|------|------|
| Thermal resistance, junction - case  | $R_{thJC}$     | -    | -    | 0.25 | °C/W |
| Thermal resistance, junction-ambient | $R_{thJA}^{②}$ | -    | -    | 36   | °C/W |
| Soldering temperature                | $T_{sold}$     | -    | -    | 260  | °C   |

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

| Parameter                         | Symbol       | Condition                                     | Min. | Typ. | Max. | Unit       |
|-----------------------------------|--------------|-----------------------------------------------|------|------|------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                     | 300  | -    | -    | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A, T_j=25^\circ C$ | 3    | 4    | 5    | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=300V, T_j=25^\circ C$      | -    | -    | 1    | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                   | -    | -    | 100  | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=40A, T_j=25^\circ C$         | -    | 13.5 | 16   | m $\Omega$ |
|                                   |              | $V_{GS}=10V, I_D=40A, T_j=175^\circ C$        | -    | 34   | -    | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=10A$                       | -    | 16   | -    | S          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=40A$                       | -    | -    | 1.3  | V          |

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

| Parameter                    | Symbol       | Condition                                         | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|---------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V, f=100KHz$                 | -    | 4505 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                   | -    | 2716 | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                   | -    | 6    | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                          | -    | 4.8  | -    | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=150V, I_D=40A, V_{GS}=10V$                | -    | 77   | -    | nC       |
| Gate - Source charge         | $Q_{gs}$     |                                                   | -    | 32   | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                   | -    | 27   | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=150V, R_G=3.3\Omega, I_D=40A$ | -    | 14   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                   | -    | 41   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                   | -    | 94   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                   | -    | 38   | -    | ns       |
| Reverse Recovery Time        | $t_{rr}$     | $V_{DD}=100V, dI_S/dt=100A/\mu s, I_S=25A$        | -    | 137  | -    | ns       |
| Reverse Recovery Charge      | $Q_{rr}$     |                                                   | -    | 400  | -    | nC       |

Fig.1 Gate-source voltage as a function of gate charge; Typical values;  $T_j=25^\circ\text{C}$

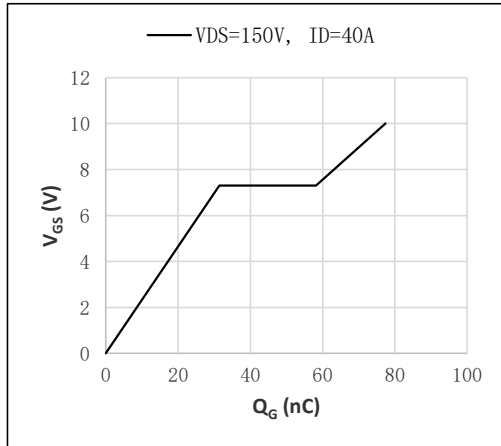


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values;  $T_j=25^\circ\text{C}$

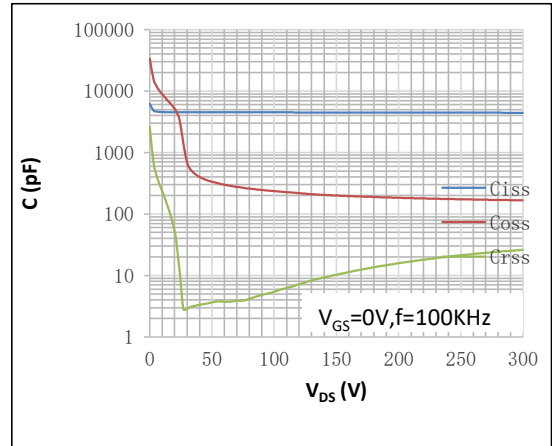


Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values;  $T_j=25^\circ\text{C}$

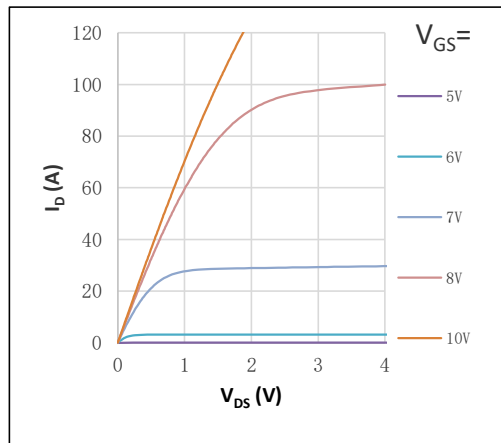


Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve;  $T_j=25^\circ\text{C}$

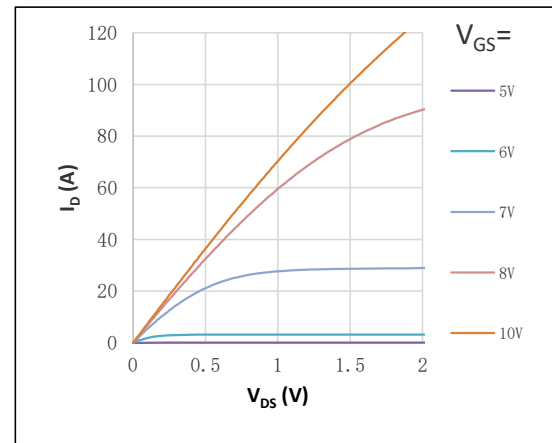


Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values

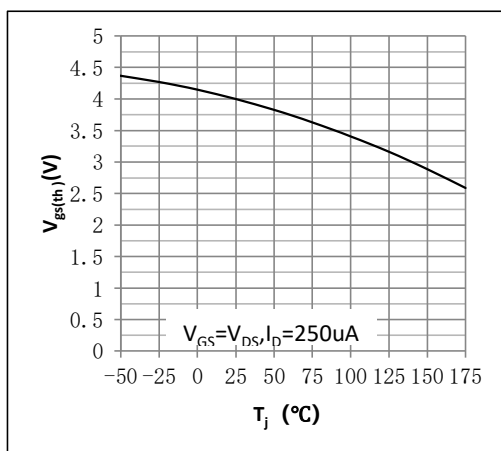


Fig.6 Drain-source on-state resistance as a function of drain current; Typical values;  $T_j=25^\circ\text{C}$

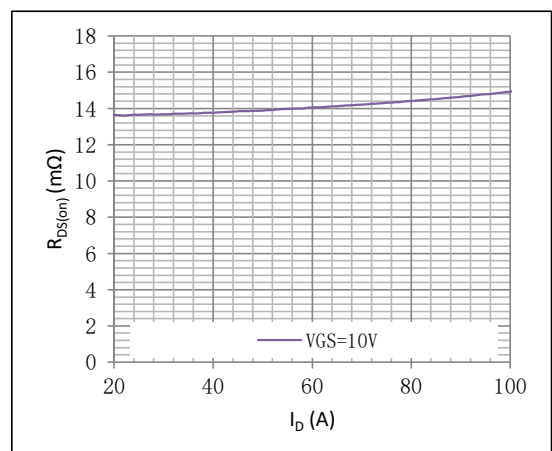


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

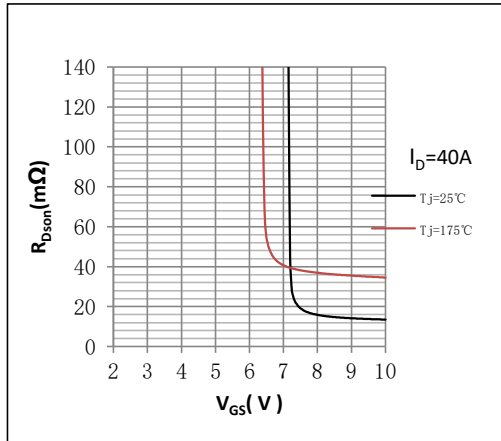


Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values  
Normalized On-Resistance= $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$

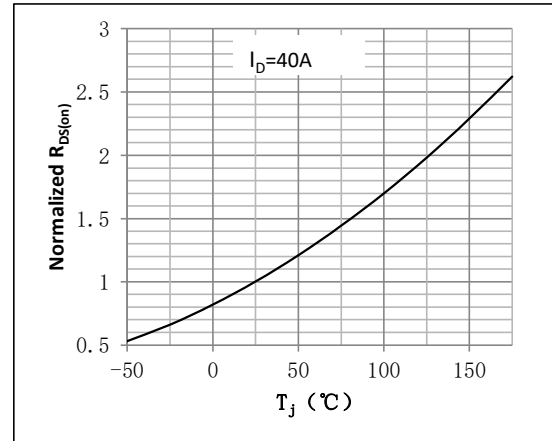


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

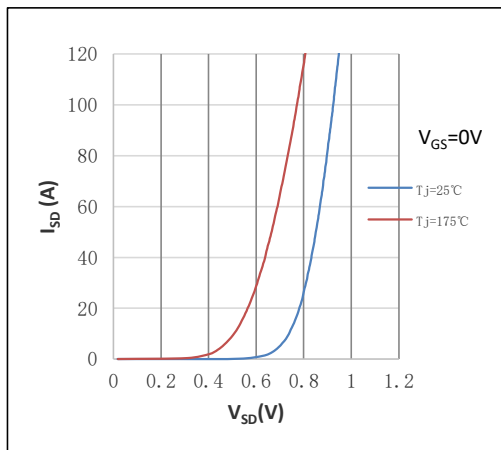


Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

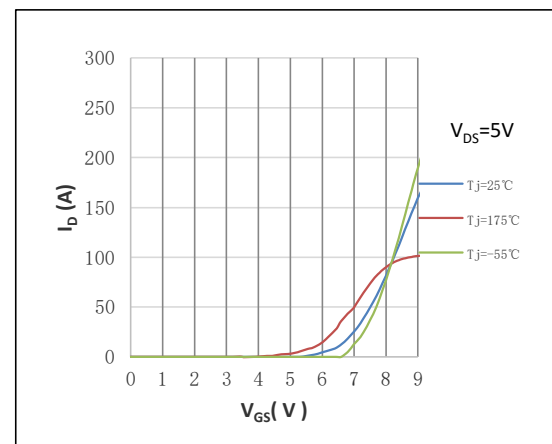


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

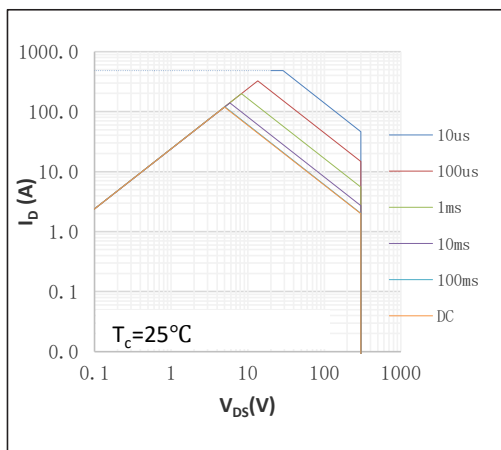


Fig.12 Continuous drain current as a function of case temperature<sup>®</sup>;Calculative values

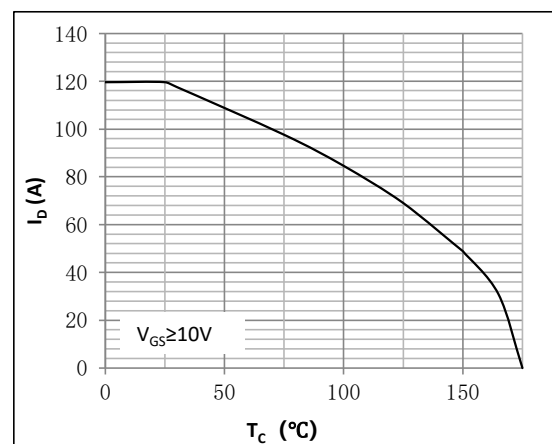


Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values  
Normalized BVDSS=BVDSS/BVDSS(25°C)

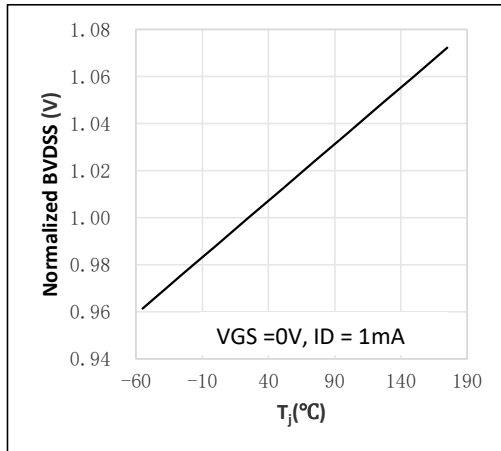


Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values  
Normalized Power Dissipation= $P_d/P_d(25^\circ C)$

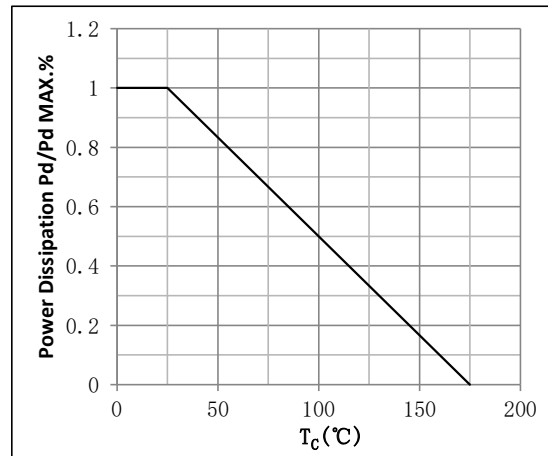
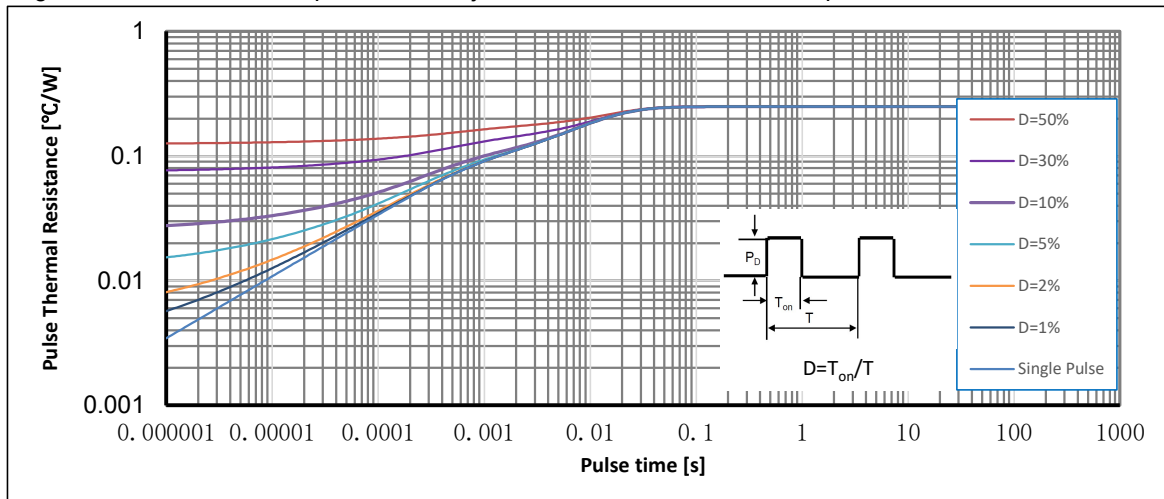
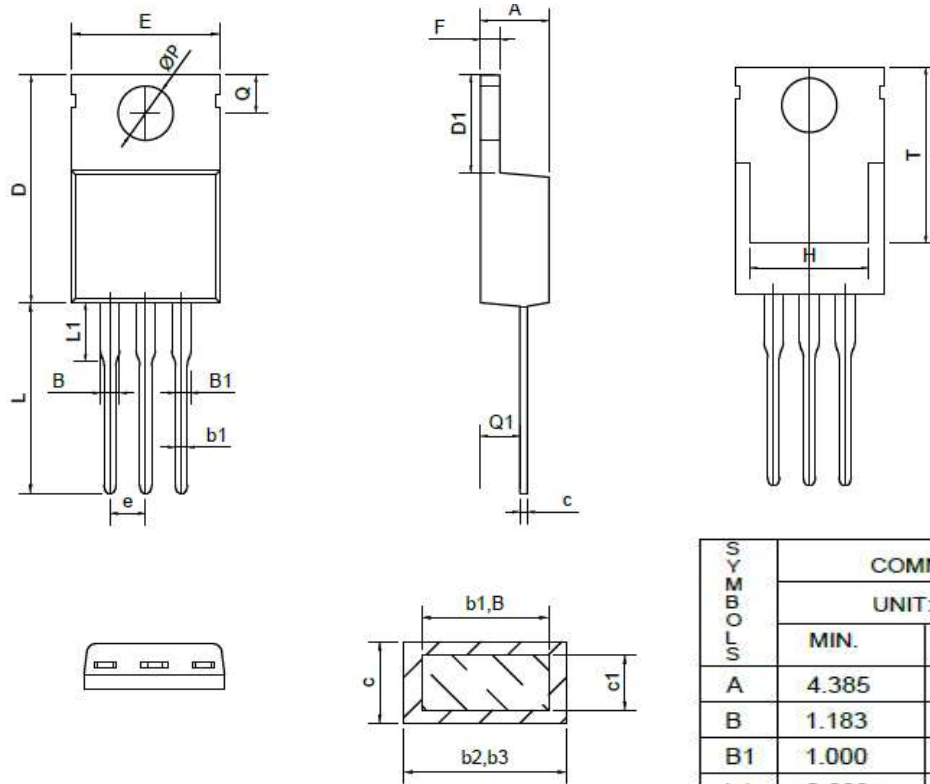


Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



•TO-220 Package Outline



| S<br>Y<br>M<br>B<br>O<br>L<br>S | COMMON   |        |
|---------------------------------|----------|--------|
|                                 | UNIT: mm |        |
|                                 | MIN.     | MAX.   |
| A                               | 4.385    | 4.685  |
| B                               | 1.183    | 1.478  |
| B1                              | 1.000    | 1.450  |
| b1                              | 0.688    | 1.016  |
| b2                              | 1.143    | 1.778  |
| b3                              | 1.143    | 1.727  |
| c                               | 0.456    | 0.610  |
| c1                              | 0.456    | 0.559  |
| D                               | 14.224   | 16.510 |
| D1                              | 5.842    | 6.858  |
| E                               | 9.685    | 10.385 |
| e                               | 2.540BSC |        |
| F                               | 1.200    | 1.400  |
| L                               | 12.600   | 14.732 |
| L1                              | 3.560    | 4.060  |
| Q                               | 2.500    | 3.048  |
| Q1                              | 2.032    | 2.921  |
| ØP                              | 3.600    | 3.900  |
| T                               | 12.042   | 12.878 |
| H                               | 6.858    | 8.890  |

**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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| A       | 2025/3/25 | New    |
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