

## N-Channel Trench Power MOSFET

### General Description

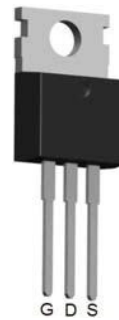
The PE01N85T is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged  $E_{AS}$  capability and ultra low  $R_{DS(ON)}$  is suitable for PWM, load switching especially for E-Bike controller applications.

### Features

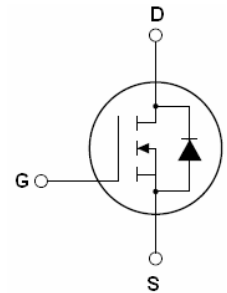
- $V_{DS}=100V$ ;  $I_D=85A$  @  $V_{GS}=10V$ ;  
 $R_{DS(ON)} < 10.5m\Omega$  @  $V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

### Application

- 72V E-Bike controller applications
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



To-220 Top View



Schematic Diagram

$$V_{DS} = 100V$$

$$I_D = 85A$$

$$R_{DS(ON)} = 8.7m\Omega$$

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| PE01N85T       | PE01N85T | TO-220         | -         | -          | -        |

Table 1. Absolute Maximum Ratings ( $T_A=25^\circ C$ )

| Symbol          | Parameter                                         | Value      | Unit       |
|-----------------|---------------------------------------------------|------------|------------|
| $V_{DS}$        | Drain-Source Voltage ( $V_{GS}=0V$ )              | 100        | V          |
| $V_{GS}$        | Gate-Source Voltage ( $V_{DS}=0V$ )               | $\pm 25$   | V          |
| $I_{D(DC)}$     | Drain Current (DC) at $T_c=25^\circ C$            | 85         | A          |
| $I_{D(DC)}$     | Drain Current (DC) at $T_c=100^\circ C$           | 60         | A          |
| $I_{DM(pluse)}$ | Drain Current-Continuous@ Current-Pulsed (Note 1) | 340        | A          |
| $P_D$           | Maximum Power Dissipation( $T_c=25^\circ C$ )     | 168        | W          |
| $E_{AS}$        | Single Pulse Avalanche Energy (Note 2)            | 576        | mJ         |
| $T_J, T_{STG}$  | Operating Junction and Storage Temperature Range  | -55 To 175 | $^\circ C$ |

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2. $E_{AS}$  condition: $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

**Table 2. Thermal Characteristic**

| Symbol          | Parameter                            | Value | Unit                 |
|-----------------|--------------------------------------|-------|----------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | 0.89  | $^{\circ}\text{C/W}$ |

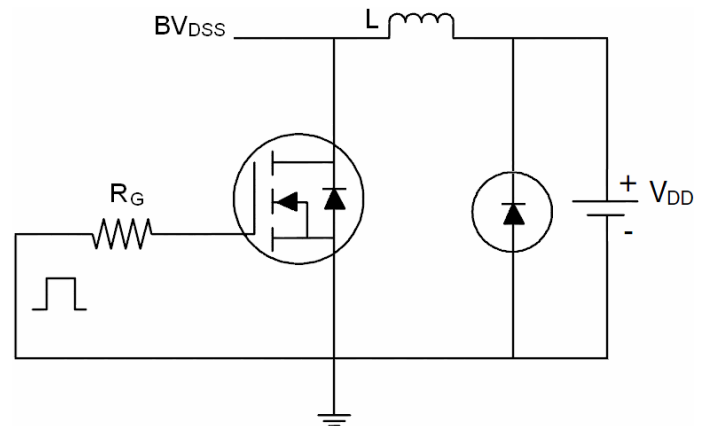
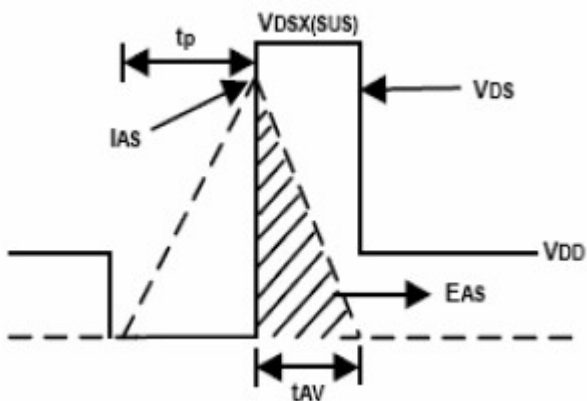
**Table 3. Electrical Characteristics (TA=25 $^{\circ}\text{C}$  unless otherwise noted)**

| Symbol                             | Parameter                                   | Conditions                                                                                                | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|------|------|------|
| On/Off States                      |                                             |                                                                                                           |     |      |      |      |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage              | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                                 | 100 |      |      | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current(Tc=25℃)     | V <sub>DS</sub> =100V,V <sub>GS</sub> =0V                                                                 |     |      | 1    | μA   |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current(Tc=125℃)    | V <sub>DS</sub> =100V,V <sub>GS</sub> =0V                                                                 |     |      | 10   | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current                   | V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V                                                                 |     |      | ±100 | nA   |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                      | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                                                   | 2   |      | 4    | V    |
| R <sub>DS(ON)</sub>                | Drain-Source On-State Resistance            | V <sub>GS</sub> =10V, I <sub>D</sub> =40A                                                                 |     | 8.7  | 10.5 | mΩ   |
| Dynamic Characteristics            |                                             |                                                                                                           |     |      |      |      |
| g <sub>FS</sub>                    | Forward Transconductance                    | V <sub>DS</sub> =10V,I <sub>D</sub> =15A                                                                  | 20  |      |      | S    |
| C <sub>iss</sub>                   | Input Capacitance                           | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V<br>f=1.0MHz                                                      |     | 7226 |      | PF   |
| C <sub>oss</sub>                   | Output Capacitance                          |                                                                                                           |     | 425  |      | PF   |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance                |                                                                                                           |     | 55   |      | PF   |
| Q <sub>g</sub>                     | Total Gate Charge                           | V <sub>DS</sub> =50V,I <sub>D</sub> =40A<br>V <sub>GS</sub> =10V                                          |     | 140  |      | nC   |
| Q <sub>gs</sub>                    | Gate-Source Charge                          |                                                                                                           |     | 27   |      | nC   |
| Q <sub>gd</sub>                    | Gate-Drain Charge                           |                                                                                                           |     | 38   |      | nC   |
| Switching Times                    |                                             |                                                                                                           |     |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time                          | V <sub>DD</sub> =65V,I <sub>D</sub> =40A,R <sub>L</sub> =15Ω<br>V <sub>GS</sub> =10V,R <sub>G</sub> =2.5Ω |     | 25   |      | nS   |
| t <sub>r</sub>                     | Turn-on Rise Time                           |                                                                                                           |     | 29   |      | nS   |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                         |                                                                                                           |     | 53   |      | nS   |
| t <sub>f</sub>                     | Turn-Off Fall Time                          |                                                                                                           |     | 63   |      | nS   |
| Source-Drain Diode Characteristics |                                             |                                                                                                           |     |      |      |      |
| I <sub>SD</sub>                    | Source-Drain Current(Body Diode)            |                                                                                                           |     | 85   |      | A    |
| I <sub>SDM</sub>                   | Pulsed Source-Drain Current(Body Diode)     |                                                                                                           |     | 340  |      | A    |
| V <sub>SD</sub>                    | Forward On Voltage <sup>(Note 1)</sup>      | T <sub>J</sub> =25℃,I <sub>SD</sub> =40A,V <sub>GS</sub> =0V                                              |     | 0.6  | 1    | V    |
| t <sub>rr</sub>                    | Reverse Recovery Time <sup>(Note 1)</sup>   | T <sub>J</sub> =25℃,I <sub>F</sub> =40A<br>di/dt=100A/μs                                                  |     | 95   |      | nS   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge <sup>(Note 1)</sup> |                                                                                                           |     | 189  |      | nC   |
| t <sub>on</sub>                    | Forward Turn-on Time                        | Intrinsic turn-on time is negligible(turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )             |     |      |      |      |

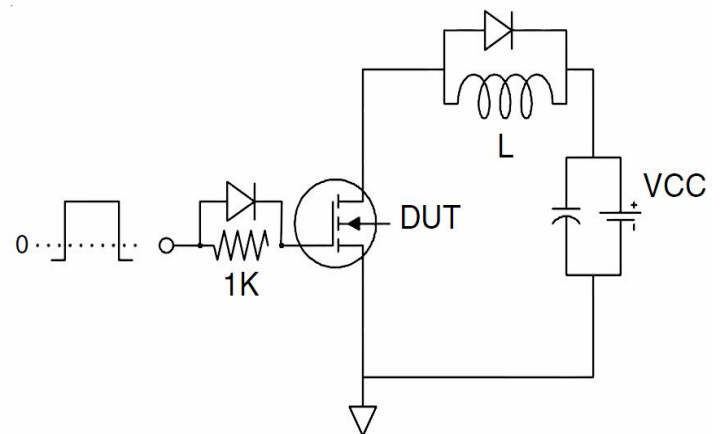
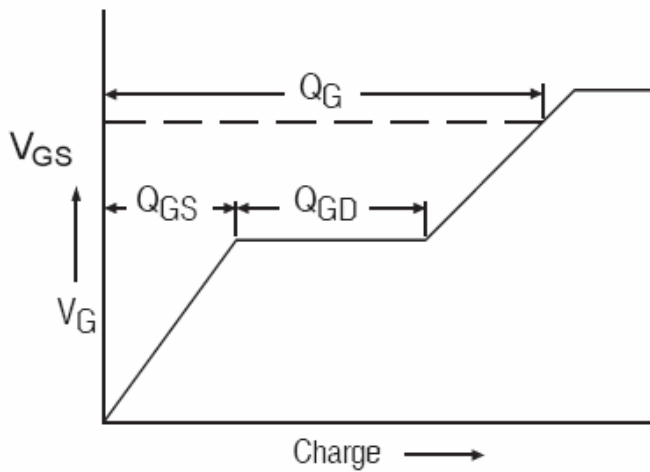
Notes 1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 1.5\%$ ,  $R_G=25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$

## Test Circuit

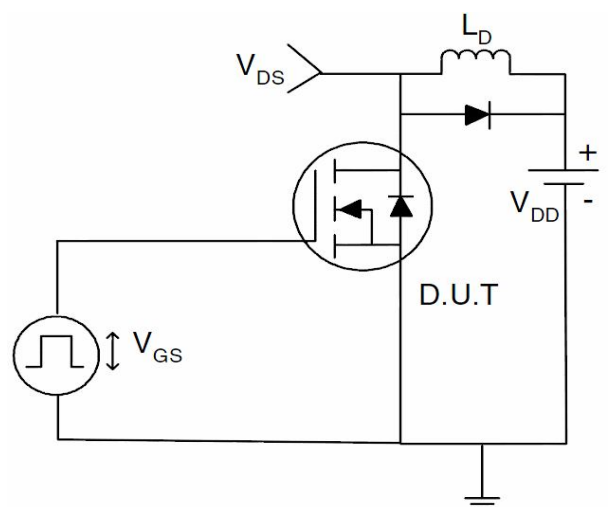
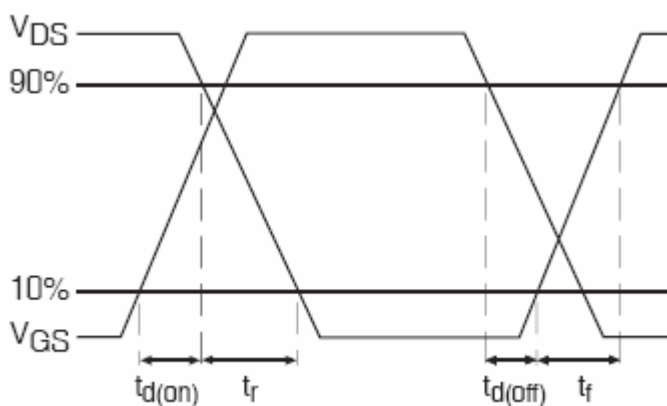
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit:



### 3) Switch Time Test Circuit:



# TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

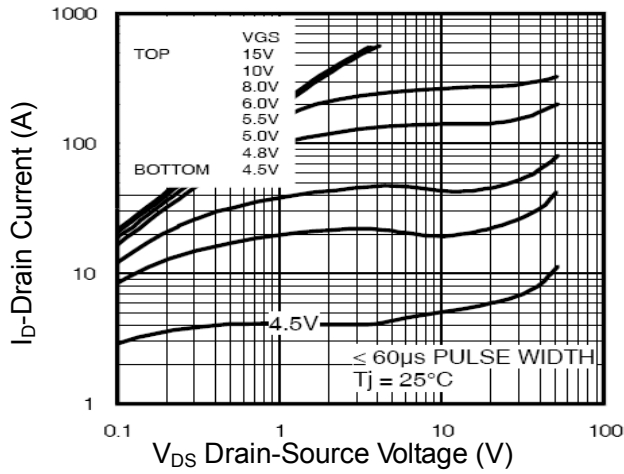


Figure2. Transfer Characteristics

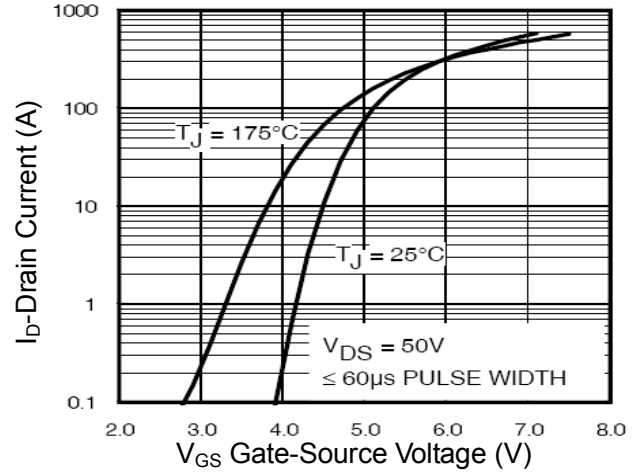


Figure3.  $R_{DS(ON)}$ - Drain Current

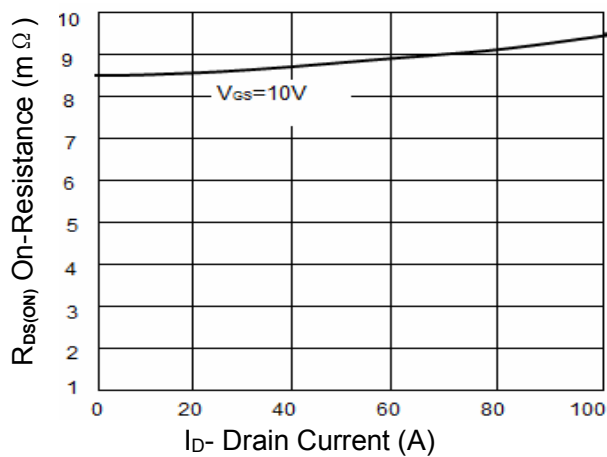


Figure4.  $R_{DS(ON)}$ - Junction Temperature

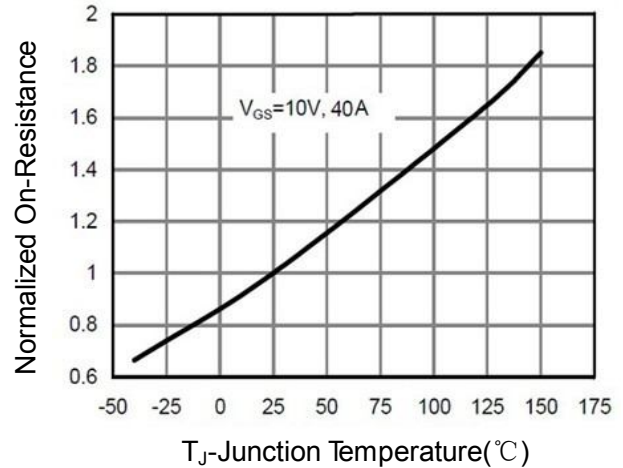


Figure5. Gate Charge

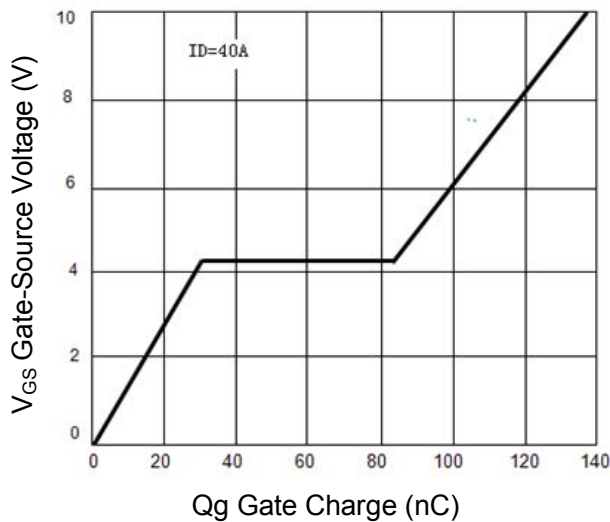


Figure6. Source- Drain Diode Forward

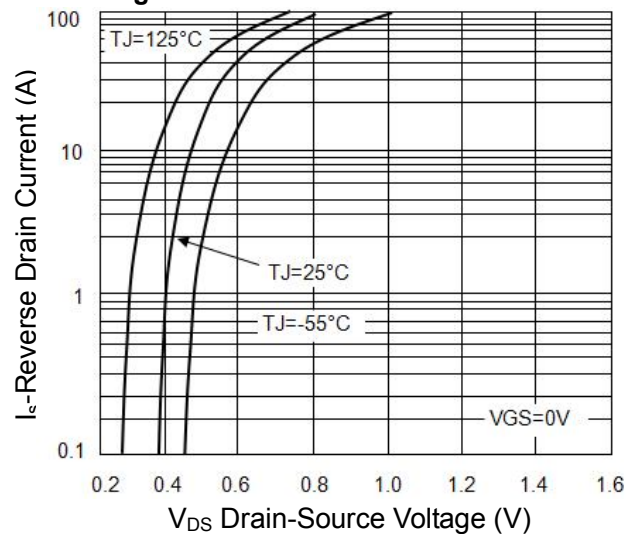


Figure7. Capacitance vs V<sub>DS</sub>

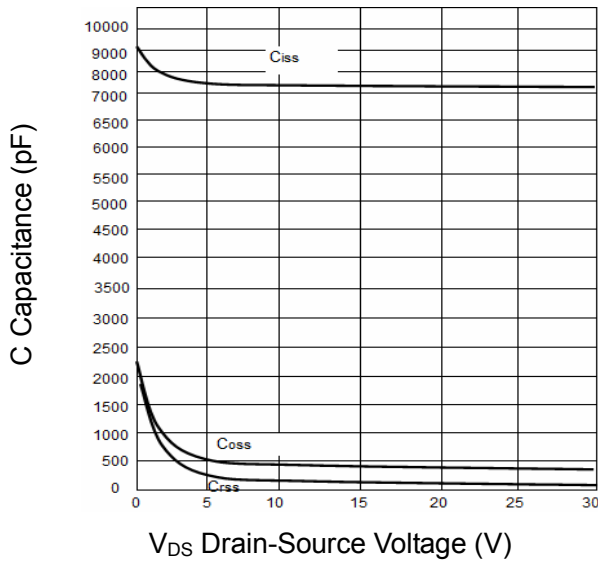


Figure8. Safe Operation Area

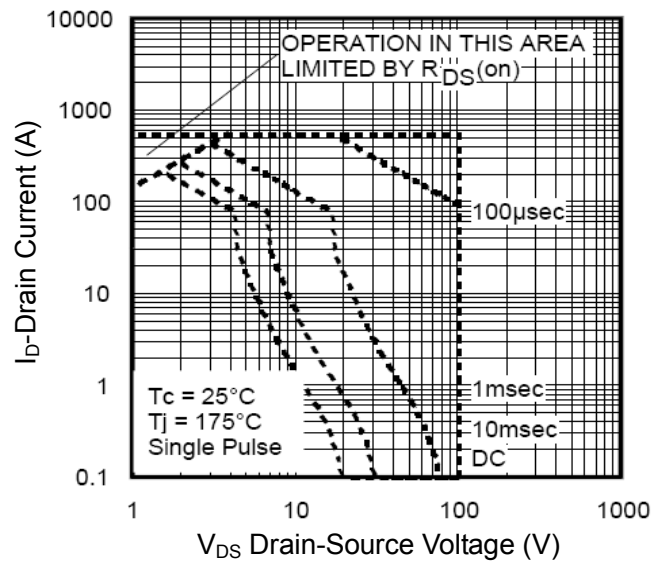


Figure9. BV<sub>DSS</sub> vs Junction Temperature

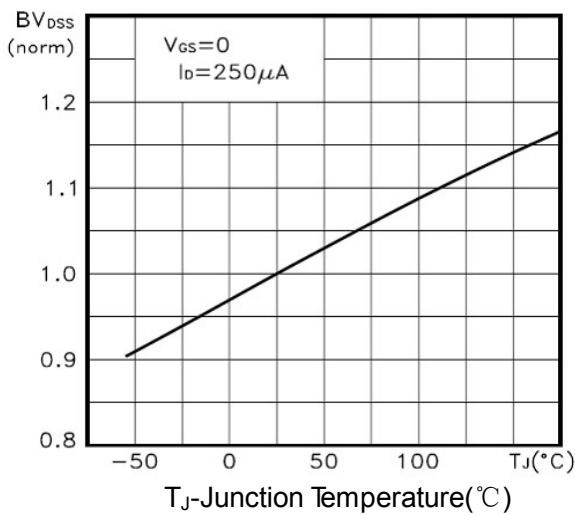


Figure10. V<sub>GS(th)</sub> vs Junction Temperature

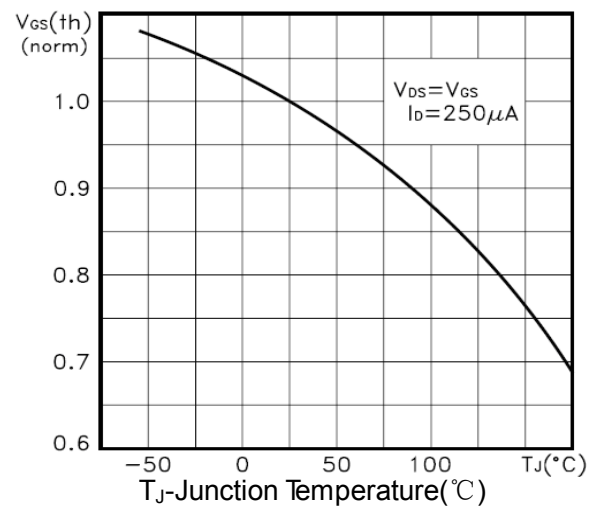
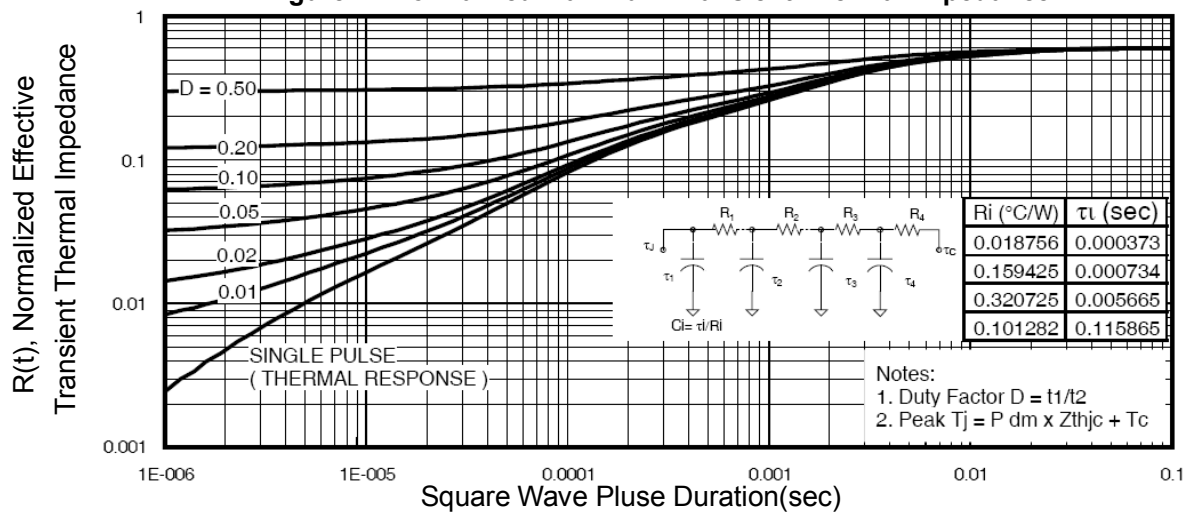
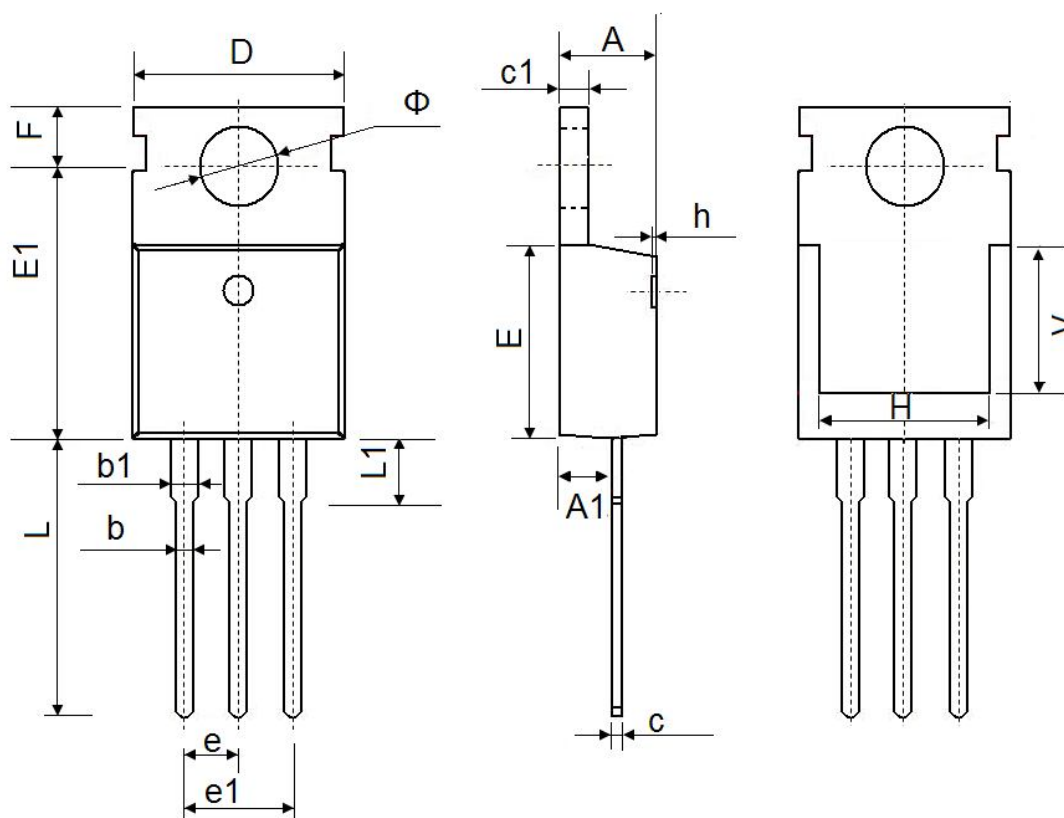


Figure11. Normalized Maximum Transient Thermal Impedance



# TO-220 Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max   |
| A      | 4.400                     | 4.600  | 0.173                | 0.181 |
| A1     | 2.250                     | 2.550  | 0.089                | 0.100 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.330                     | 0.650  | 0.013                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.910                     | 10.250 | 0.390                | 0.404 |
| E      | 8.9500                    | 9.750  | 0.352                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 2.650                     | 2.950  | 0.104                | 0.116 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.900                    | 13.400 | 0.508                | 0.528 |
| L1     | 2.850                     | 3.250  | 0.112                | 0.128 |
| V      | 7.500 REF.                |        | 0.295 REF.           |       |
| Φ      | 3.400                     | 3.800  | 0.134                | 0.150 |