

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP02525F uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

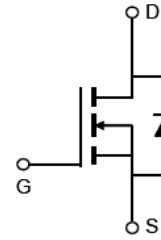
### General Features

- $V_{DS} = 250V, I_D = 25A$   
 $R_{DS(ON)} = 60m\Omega$  (typical) @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

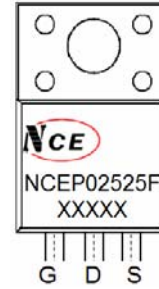
### Application

- LED backlighting
- Ideal for high-frequency switching and synchronous rectification

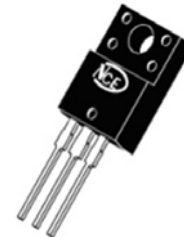
**100% UIS TESTED!**



Schematic diagram



Marking and pin assignment



TO-220F top view

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| NCEP02525F     | NCEP02525F | TO-220F        | -         | -          | -        |

### Absolute Maximum Ratings ( $T_A = 25^\circ C$ unless otherwise noted)

| Parameter   | Symbol             | Limit      | Unit          |
|---|--------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$           | 250        | V             |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$              | 25         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 17.5       | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 100        | A             |
| Maximum Power Dissipation                         | $P_D$              | 45         | W             |
| Derating factor                                   |                    | 0.3        | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 320        | mJ            |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

### Thermal Characteristic

|  |                 |     |              |
|--|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 3.3 | $^\circ C/W$ |
|--|-----------------|-----|--------------|

**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

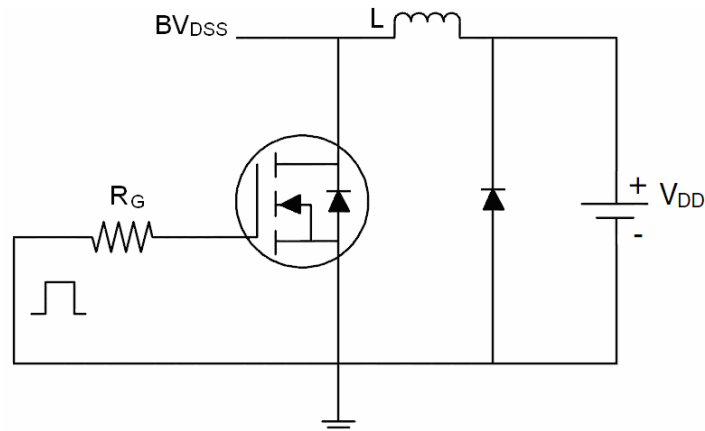
| Parameter                                 | Symbol       | Condition   | Min | Typ  | Max       | Unit       |
|---|--------------|---|-----|------|-----------|------------|
| <b>Off Characteristics</b>                |              |   |     |      |           |            |
| Drain-Source Breakdown Voltage            | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$   | 250 | -    | -         | V          |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS}=250V, V_{GS}=0V$  | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> (Note 3)        |              |   |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$   | 2.5 | 3.5  | 4.5       | V          |
| Drain-Source On-State Resistance          | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=20A$   | -   | 60   | 70        | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=5V, I_D=20A$  | 15  | -    | -         | S          |
| <b>Dynamic Characteristics</b> (Note 4)   |              |   |     |      |           |            |
| Input Capacitance                         | $C_{ISS}$    | $V_{DS}=125V, V_{GS}=0V,$<br>$F=1.0\text{MHz}$                                      | -   | 1600 |           | PF         |
| Output Capacitance                        | $C_{OSS}$    |   | -   | 92   |           | PF         |
| Reverse Transfer Capacitance              | $C_{RSS}$    |   | -   | 4.3  |           | PF         |
| <b>Switching Characteristics</b> (Note 4) |              |   |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=125V, R_L=7.5\Omega$<br>$V_{GS}=10V, R_G=3\Omega$                           | -   | 7    | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |   | -   | 9    | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |   | -   | 25   | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |   | -   | 5    | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=125V, I_D=20A,$<br>$V_{GS}=10V$   | -   | 24   | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |   | -   | 9.5  | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |   | -   | 5.6  | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |   |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=20A$  | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        |   | -   | -    | 25        | A          |
| Reverse Recovery Time                     | $t_{rr}$     | $T_J = 25^{\circ}\text{C}, I_F = I_S$<br>$di/dt = 100\text{A}/\mu\text{s}$ (Note 3) | -   | 45   | -         | nS         |
| Reverse Recovery Charge                   | $Q_{rr}$     |   | -   | 160  | -         | nC         |

**Notes:**

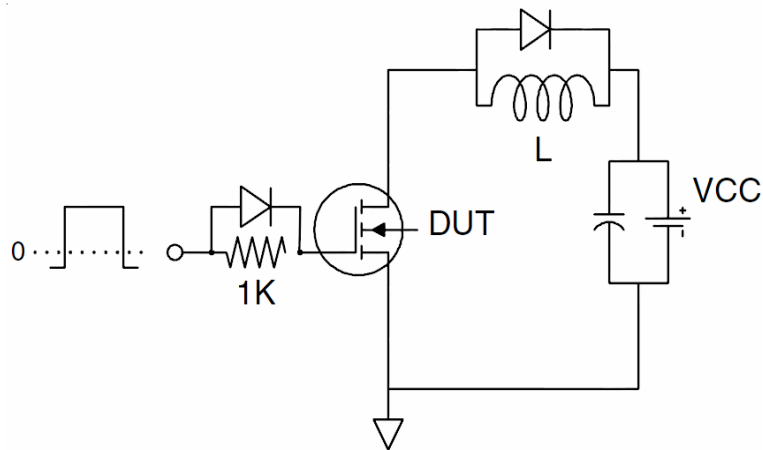
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

**Test Circuit**

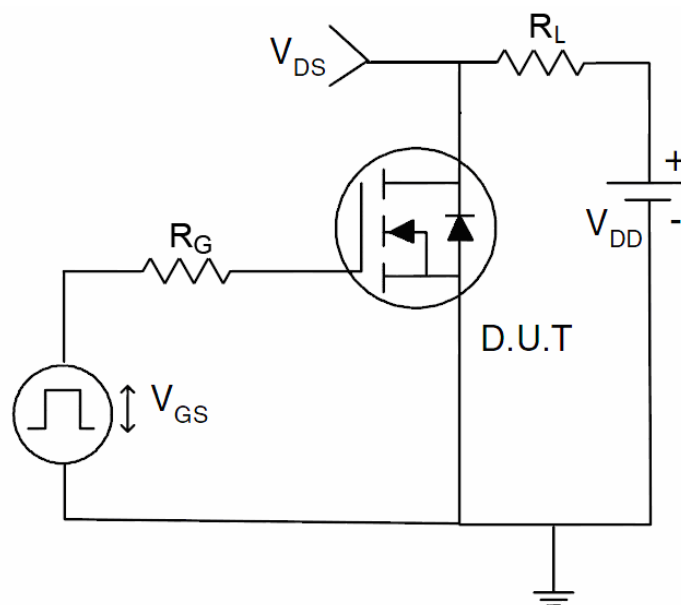
**1) E<sub>AS</sub> test Circuit**



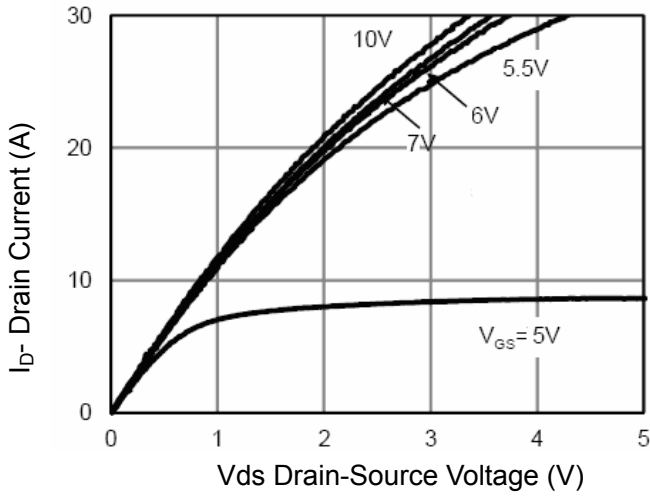
**2) Gate charge test Circuit**



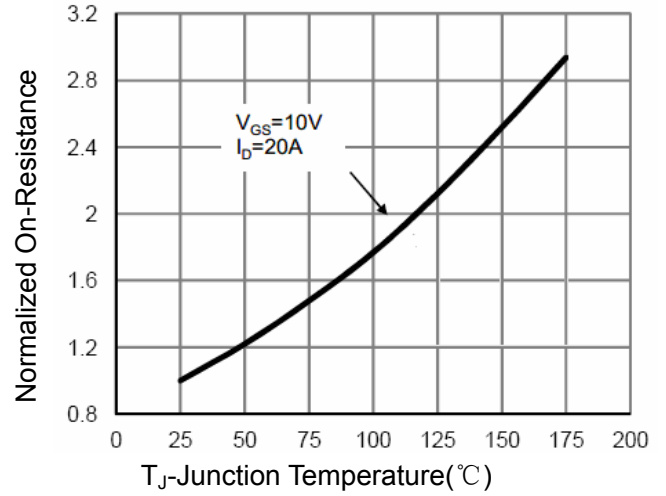
**3) Switch Time Test Circuit**



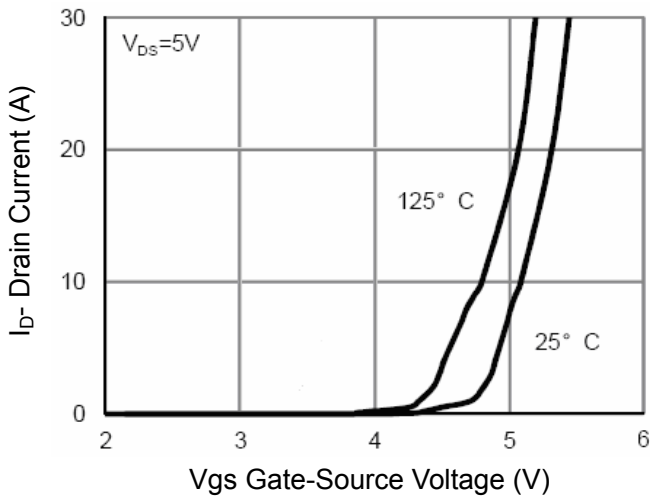
**Typical Electrical and Thermal Characteristics**



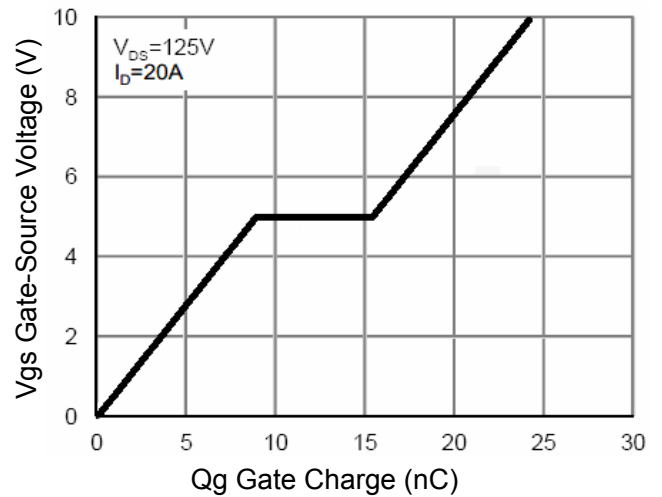
**Figure 1 Output Characteristics**



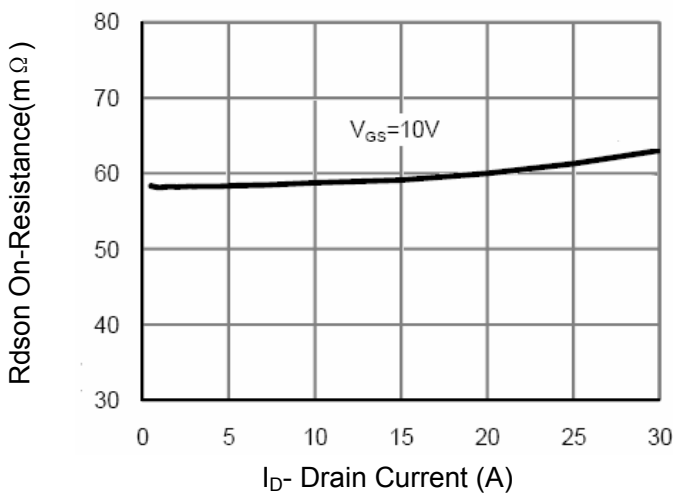
**Figure 4 Rds(on)-Junction Temperature**



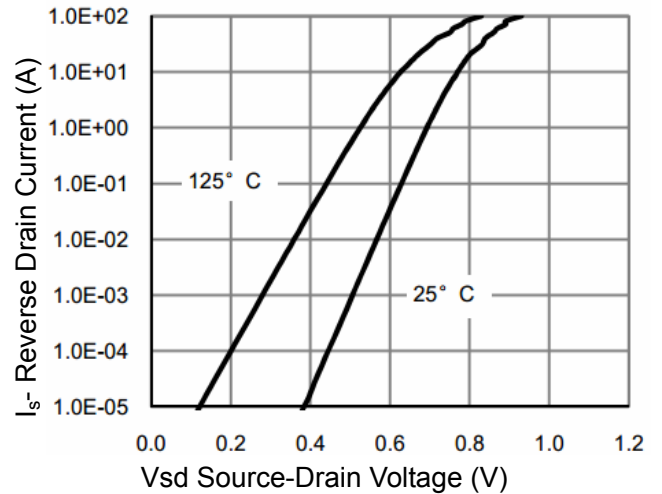
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3 Rds(on)- Drain Current**



**Figure 6 Source- Drain Diode Forward**

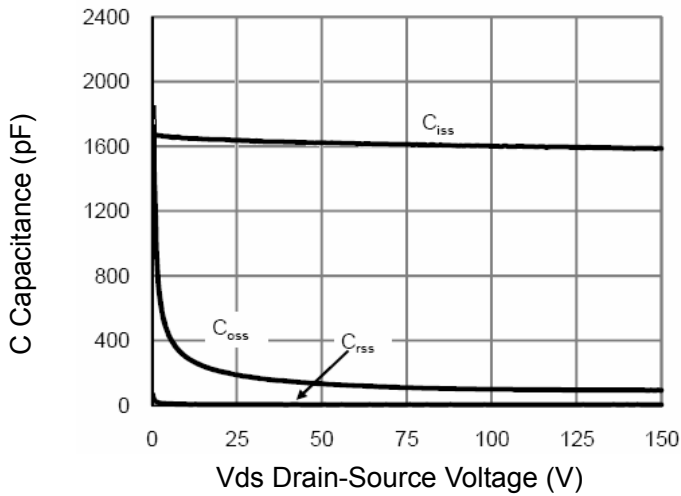


Figure 7 Capacitance vs Vds

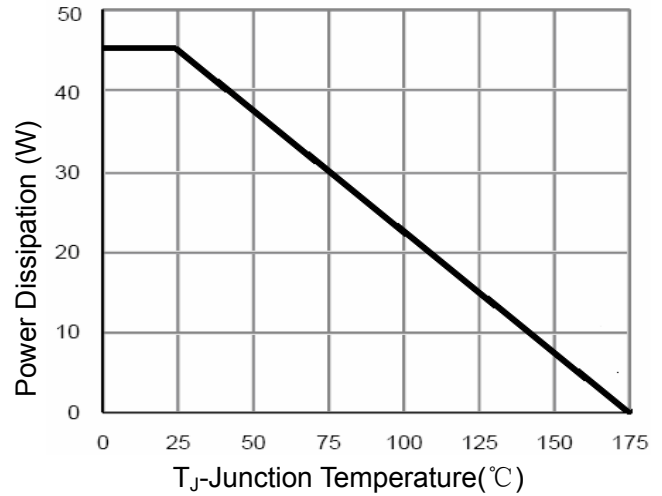


Figure 9 Power De-rating

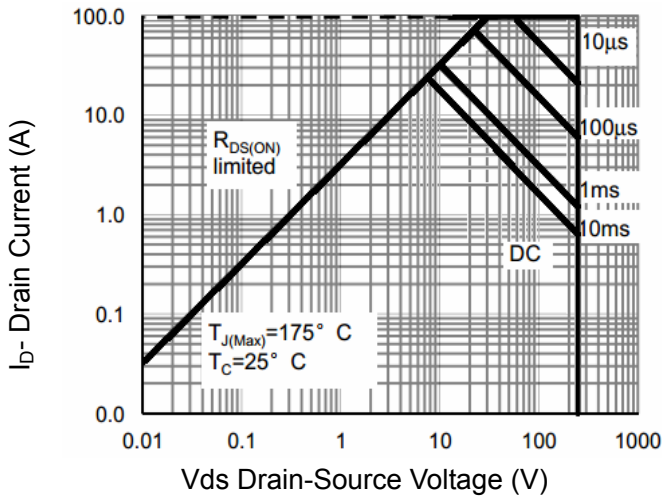


Figure 8 Safe Operation Area

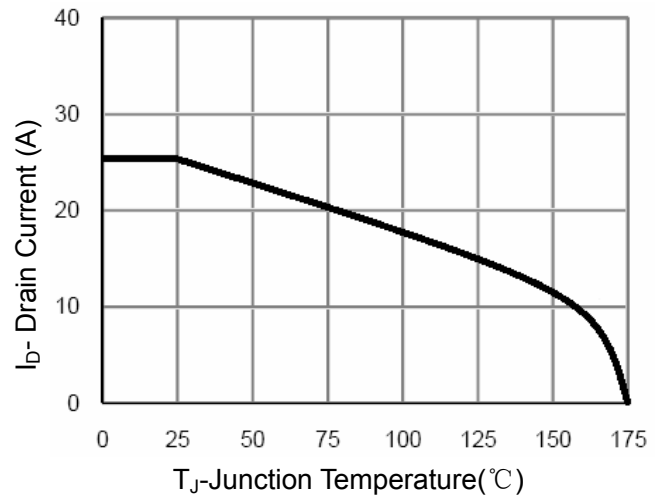


Figure 10 Current De-rating

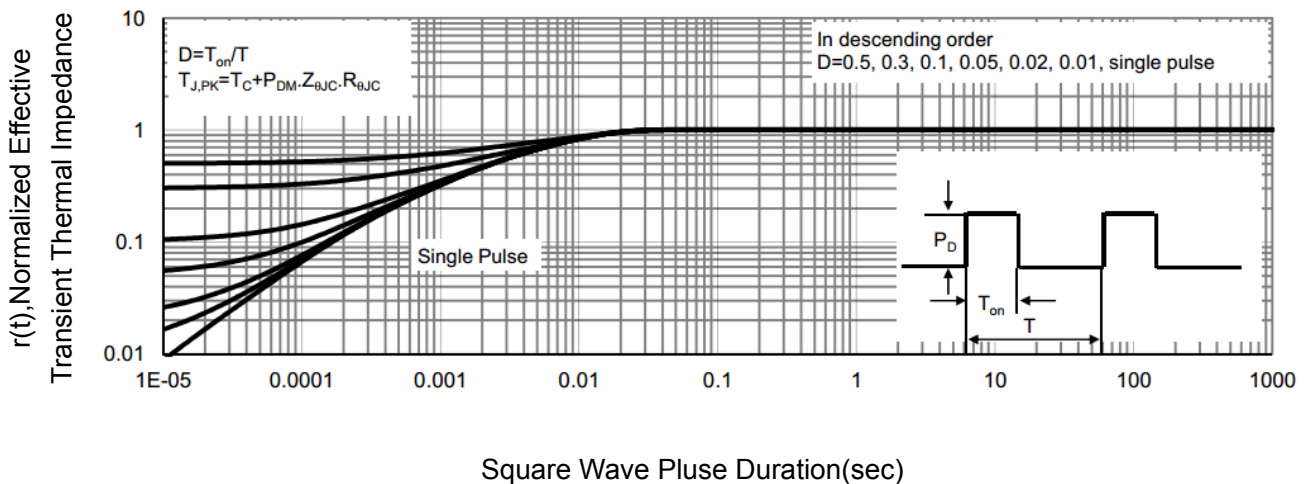
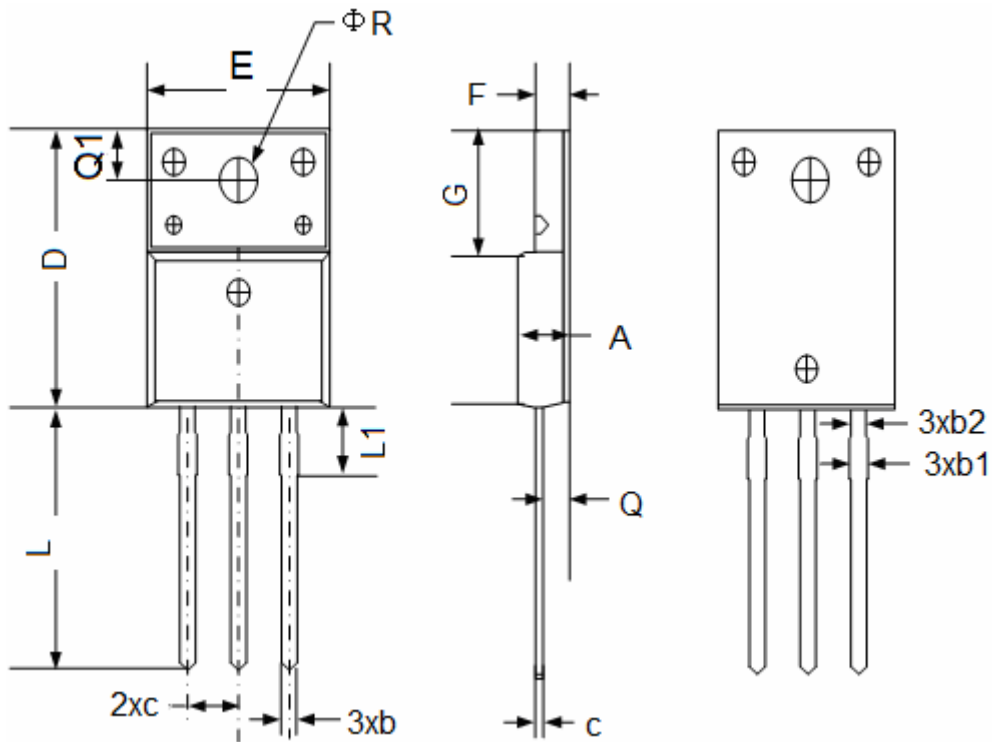


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220F Package Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |      |
|----------|---------------------------|-------|----------------------|------|
|          | Min.                      | Max.  | Min.                 | Max. |
| A        | 4.50                      | 4.83  | 0.18                 | 0.19 |
| b        | 0.70                      | 0.91  | 0.03                 | 0.04 |
| b1       | 1.20                      | 1.47  | 0.05                 | 0.06 |
| b2       | 1.10                      | 1.38  | 0.04                 | 0.05 |
| c        | 0.45                      | 0.63  | 0.02                 | 0.02 |
| D        | 15.67                     | 16.07 | 0.62                 | 0.63 |
| e        | 2.54 BSC                  |       | 0.10 BSC             |      |
| E        | 9.96                      | 10.36 | 0.39                 | 0.41 |
| F        | 2.34                      | 2.74  | 0.09                 | 0.11 |
| G        | 6.48                      | 6.90  | 0.26                 | 0.27 |
| L        | 12.68                     | 13.30 | 0.50                 | 0.52 |
| L1       | 3.13                      | 3.50  | 0.12                 | 0.14 |
| Q        | 2.56                      | 2.93  | 0.10                 | 0.12 |
| Q1       | 3.20                      | 3.40  | 0.13                 | 0.13 |
| $\Phi R$ | 3.08                      | 3.28  | 0.12                 | 0.13 |

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