

QIAOXIN N-Channel **Super Trench** Power MOSFET

Description

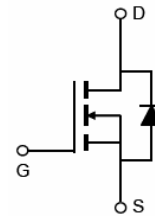
The VCRRP0225F uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification.

General Features

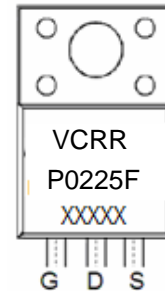
- $V_{DS} = 200V, I_D = 25A$
 $R_{DS(ON)} = 40m\Omega$ (typical) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

Application

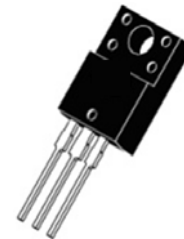
- LED backlighting
- Ideal for high-frequency switching and synchronous rectification



Schematic diagram



Marking and pin assignment



TO-220F top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package |
|----------------|--------|----------------|
| VCRRP0225F | | TO-220F |

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

| Parameter | Symbol | Limit | Unit |
|---|--------------------|------------|---------------|
| Drain-Source Voltage | V_{DS} | 200 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current-Continuous | I_D | 25 | A |
| Drain Current-Continuous($T_C = 100^\circ C$) | $I_D(100^\circ C)$ | 17.6 | 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 ^(Note 5) | 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 ^(Note 2) | $R_{\theta JC}$ | 3.3 | $^{\circ}C/W$ |
|--|-----------------|-----|---------------|

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

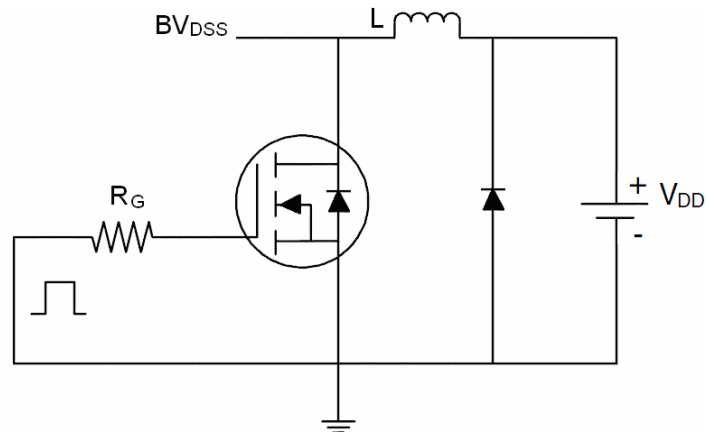
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|--|-----|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 200 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=200V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics ^(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 | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=20A$ | - | 40 | 50 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=5V, I_D=20A$ | 15 | - | - | S |
| Dynamic Characteristics ^(Note 4) | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=100V, V_{GS}=0V,$ $F=1.0MHz$ | - | 1635 | | PF |
| Output Capacitance | C_{OSS} | | - | 128 | | PF |
| Reverse Transfer Capacitance | C_{RSS} | | - | 3 | | PF |
| Switching Characteristics ^(Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=100V, R_L=7.5\Omega$ $V_{GS}=10V, R_G=3\Omega$ | - | 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 | $V_{DS}=100V, I_D=20A,$ $V_{GS}=10V$ | - | 25 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 10.6 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 6 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| 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} | $T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ ^(Note 3) | - | 45 | - | nS |
| Reverse Recovery Charge | Q_{rr} | | - | 160 | - | nC |

Notes:

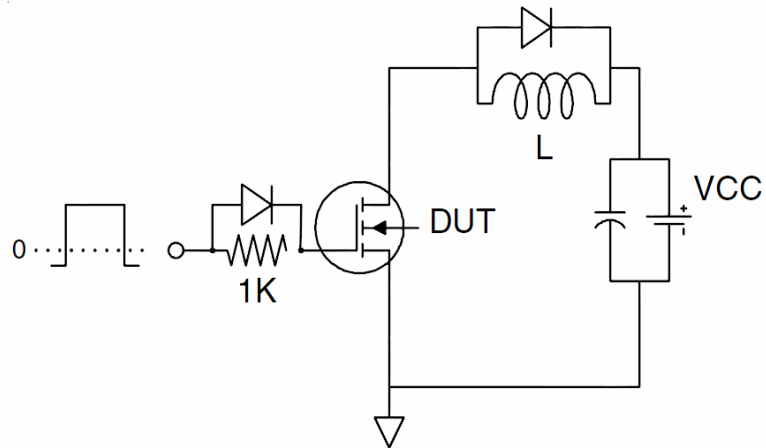
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V,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

Test Circuit

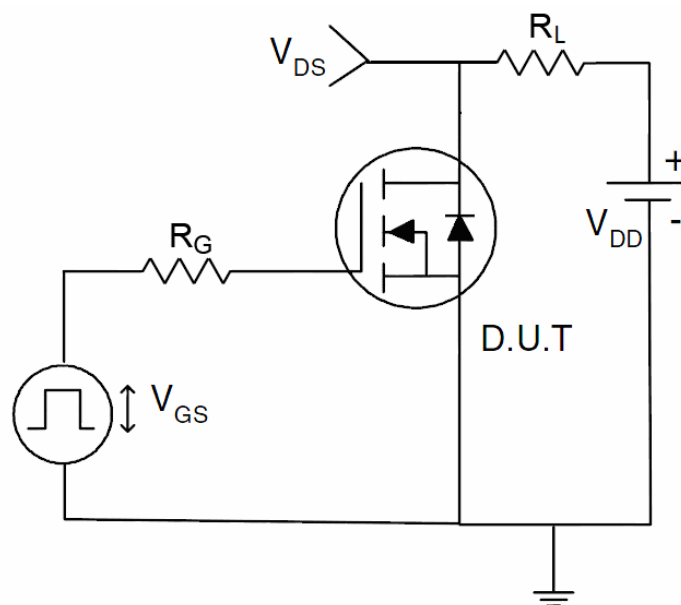
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics

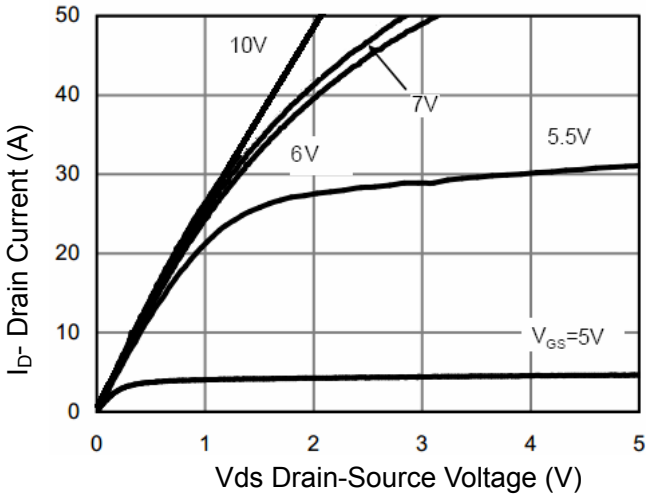


Figure 1 Output Characteristics

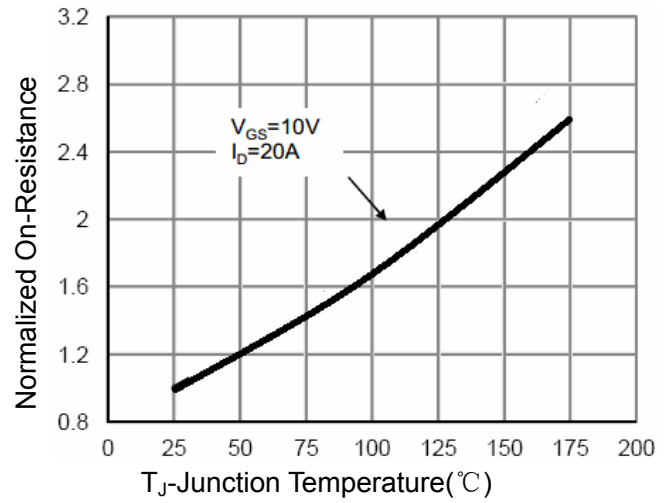


Figure 4 R_{dson} -Junction Temperature

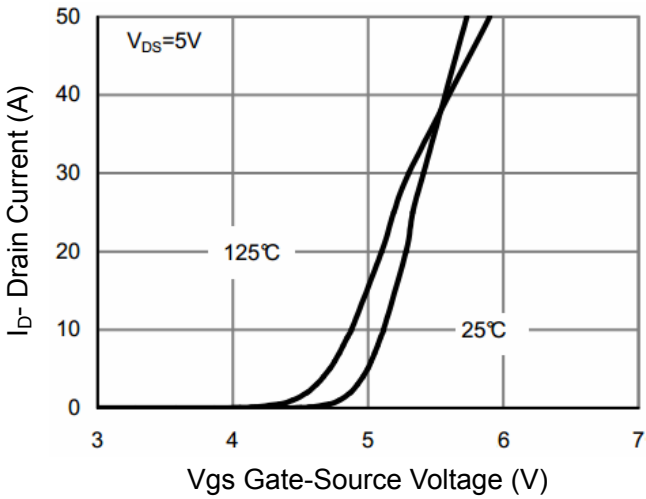


Figure 2 Transfer Characteristics

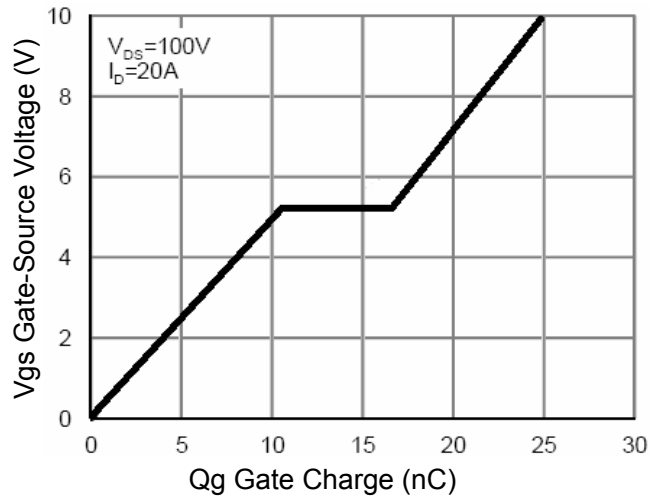


Figure 5 Gate Charge

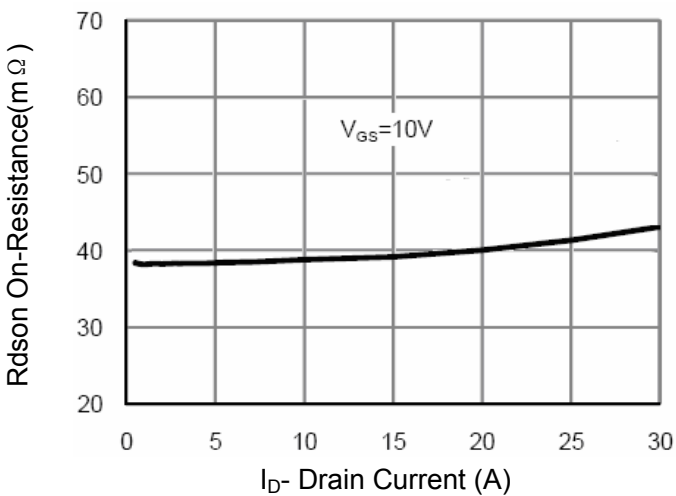


Figure 3 R_{dson} - Drain Current

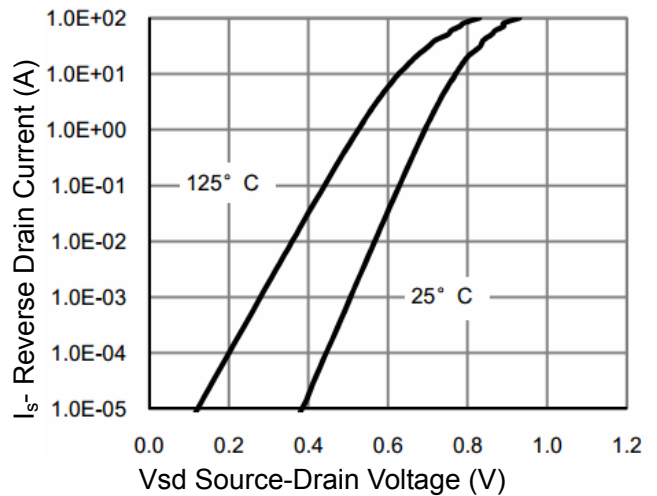


Figure 6 Source- Drain Diode Forward

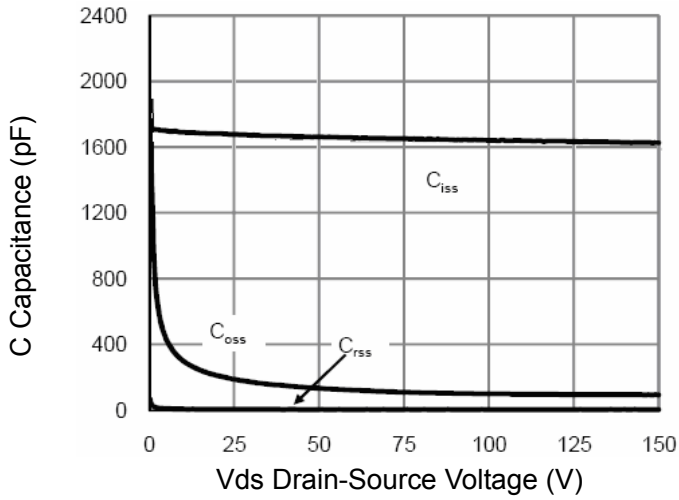


Figure 7 Capacitance vs Vds

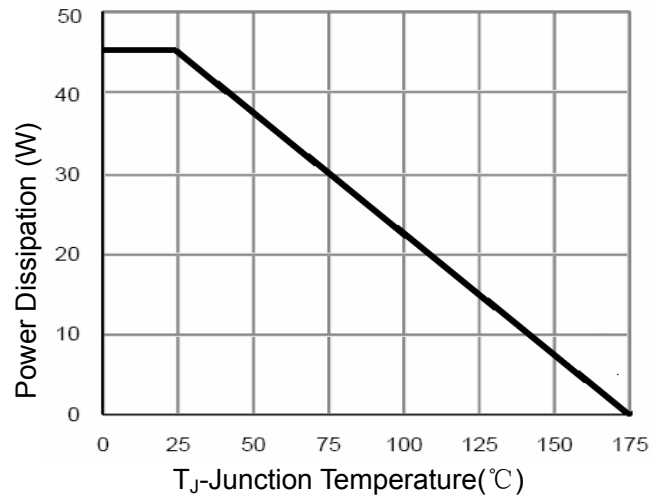


Figure 9 Power De-rating

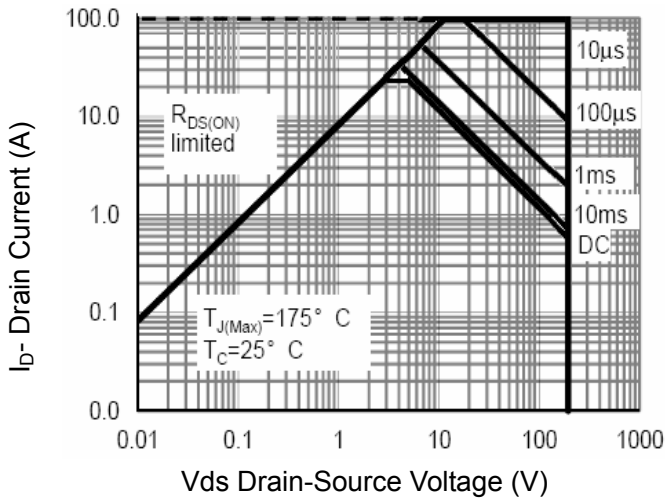


Figure 8 Safe Operation Area

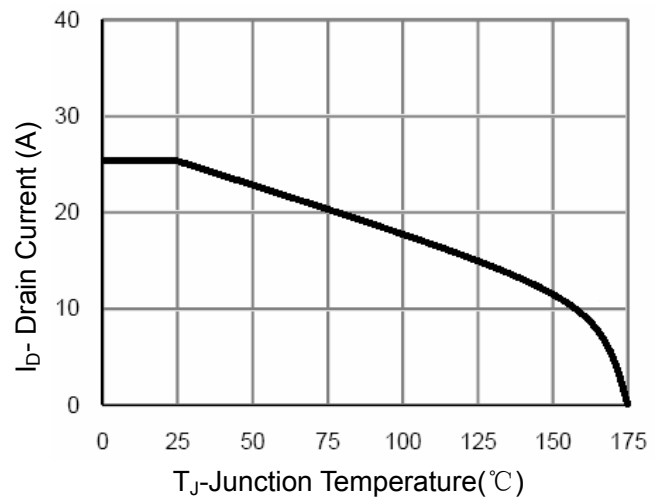


Figure 10 Current De-rating

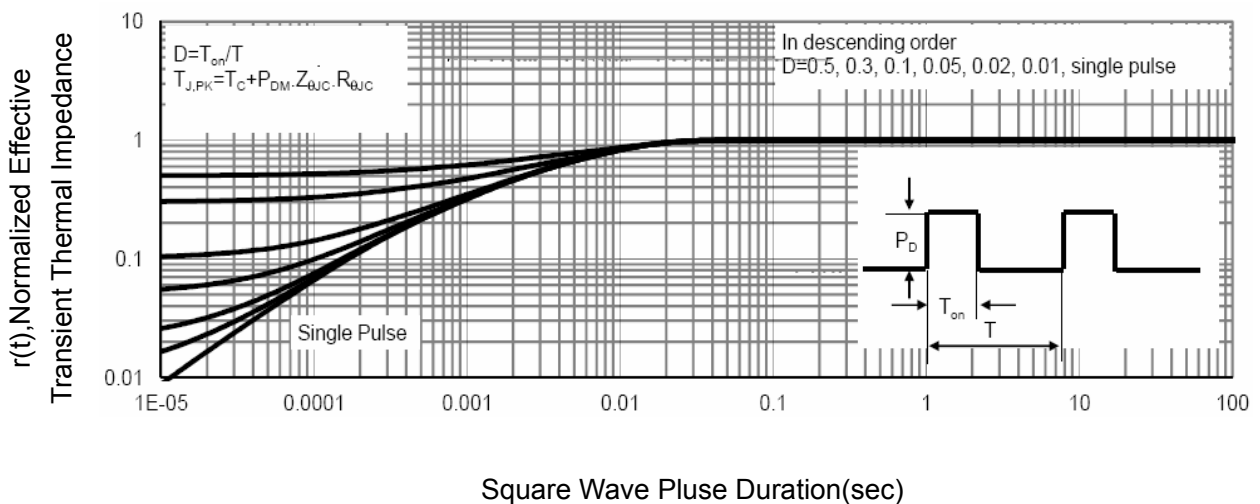
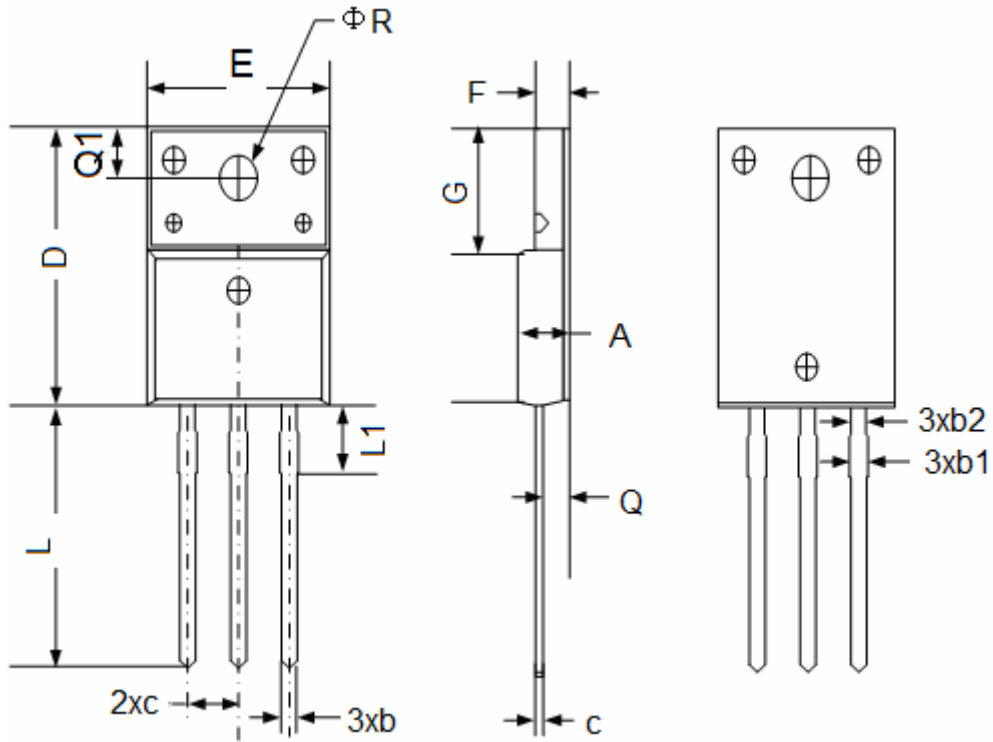


Figure 11 Normalized Maximum Transient Thermal Impedance

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 |
| ΦR | 3.08 | 3.28 | 0.12 | 0.13 |

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