

200V N-Ch Power MOSFET

Feature

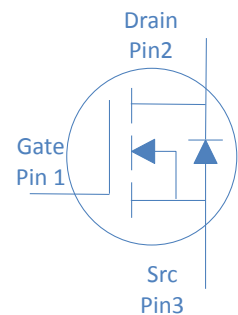
- ◇ High Speed Power Switching
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free

Application

- ◇ Synchronous Rectification in SMPS
- ◇ Hard Switching and High Speed Circuit
- ◇ Power Tools
- ◇ UPS
- ◇ Motor Control

| | | | |
|------------------|--------|-----|----|
| V_{DS} | | 200 | V |
| $R_{DS(on),typ}$ | TO-220 | 28 | mΩ |
| I_D | | 24 | A |

TO-220F



| Part Number | Package | Marking |
|-------------|---------|-----------|
| HGA320N20S | TO-220F | GA320N20S |

Absolute Maximum Ratings at $T_j=25^\circ\text{C}$ (unless otherwise specified)

| Parameter | Symbol | Conditions | Value | Unit |
|-----------------------------------|----------------|--|------------|------------------|
| Continuous Drain Current | I_D | $T_C=25^\circ\text{C}$ | 24 | A |
| | | $T_C=100^\circ\text{C}$ | 17 | |
| Drain to Source Voltage | V_{DS} | - | 200 | V |
| Gate to Source Voltage | V_{GS} | - | ± 20 | V |
| Pulsed Drain Current | I_{DM} | - | 150 | A |
| Avalanche Energy, Single Pulse | E_{AS} | $L=0.4\text{mH}, T_C=25^\circ\text{C}$ | 180 | mJ |
| Power Dissipation | P_D | $T_C=25^\circ\text{C}$ | 48 | W |
| Operating and Storage Temperature | T_J, T_{stg} | - | -55 to 175 | $^\circ\text{C}$ |

Absolute Maximum Ratings

| Parameter | Symbol | Max | Unit |
|-------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance Junction-Case | $R_{\theta JC}$ | 3.1 | $^\circ\text{C/W}$ |
| Thermal Resistance Junction-Ambient | $R_{\theta JA}$ | 50 | $^\circ\text{C/W}$ |

Electrical Characteristics at $T_j=25^\circ\text{C}$ (unless otherwise specified)

Static Characteristics

| Parameter | Symbol | Conditions | Value | | | Unit |
|-----------------------------------|---------------|---|-------|-----|-----------|-----------|
| | | | min | typ | max | |
| Drain to Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 200 | - | - | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 2 | 3 | 4 | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS}=0V, V_{DS}=200V, T_j=25^\circ\text{C}$ | - | - | 1 | μA |
| | | $V_{GS}=0V, V_{DS}=200V, T_j=100^\circ\text{C}$ | - | - | 100 | |
| Gate to Source Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| Drain to Source on Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=10A$ | - | 28 | 32 | $m\Omega$ |
| Transconductance | g_{fs} | $V_{DS}=5V, I_D=10A$ | - | 31 | - | S |
| Gate Resistance | R_G | $V_{GS}=0V, V_{DS}$ Open, $f=1\text{MHz}$ | - | 4.6 | - | Ω |

Dynamic Characteristics

| | | | | | | |
|-------------------------------|--------------|--|---|------|---|------|
| Input Capacitance | C_{iss} | $V_{GS}=0V, V_{DS}=100V, f=1\text{MHz}$ | - | 1598 | - | pF |
| Output Capacitance | C_{oss} | | - | 124 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 7.5 | - | |
| Total Gate Charge | Q_g | $V_{DD}=100V, I_D=10A, V_{GS}=10V$ | - | 19 | - | nC |
| Gate to Source Charge | Q_{gs} | | - | 7 | - | |
| Gate to Drain (Miller) Charge | Q_{gd} | | - | 2 | - | |
| Turn on Delay Time | $t_{d(on)}$ | $V_{DD}=100V, I_D=10A, V_{GS}=10V,$ $R_G=10\Omega,$ | - | 12 | - | ns |
| Rise time | t_r | | - | 17 | - | |
| Turn off Delay Time | $t_{d(off)}$ | | - | 23 | - | |
| Fall Time | t_f | | - | 10 | - | |

Reverse Diode Characteristics

| | | | | | | |
|-------------------------|----------|---|---|-----|-----|----|
| Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_F=10A$ | - | 0.9 | 1.2 | V |
| Reverse Recovery Time | t_{rr} | $V_R=100V, I_F=10A, di_F/dt=100A/\mu s$ | - | 90 | - | ns |
| Reverse Recovery Charge | Q_{rr} | | - | 306 | - | nC |

Fig 1. Typical Output Characteristics

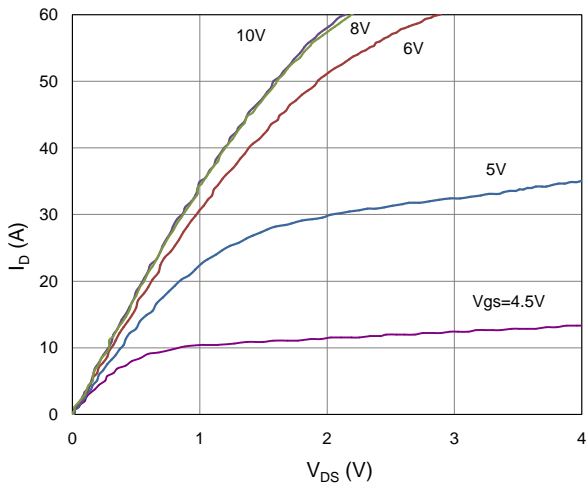


Figure 2. On-Resistance vs. Gate-Source Voltage

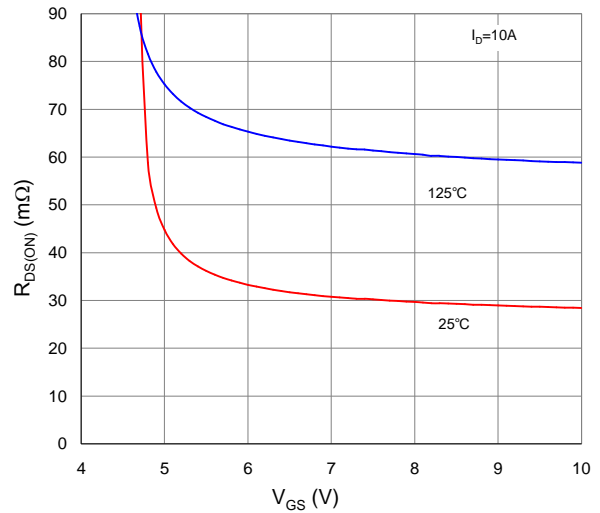


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

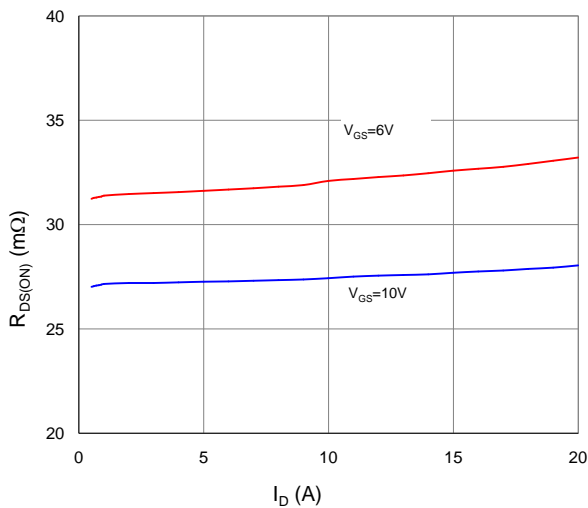


Figure 4. Normalized On-Resistance vs. Junction Temperature

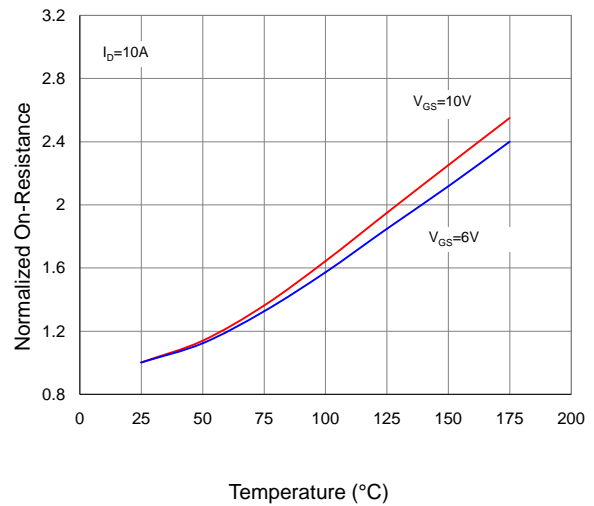


Figure 5. Typical Transfer Characteristics

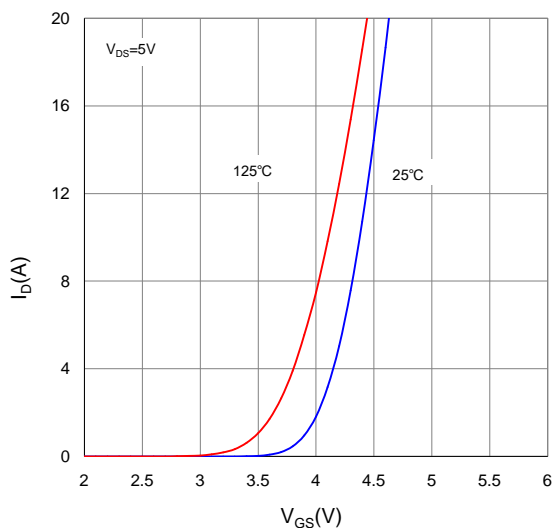


Figure 6. Typical Source-Drain Diode Forward Voltage

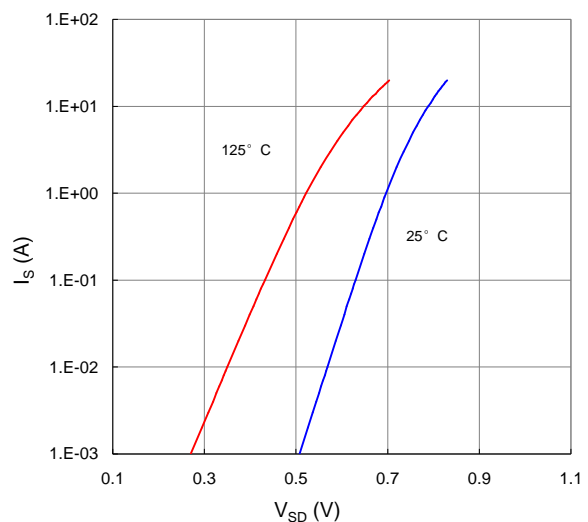


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

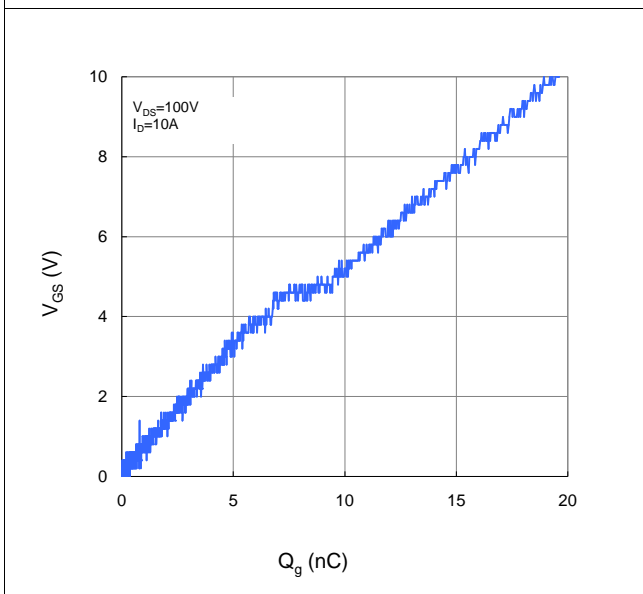


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

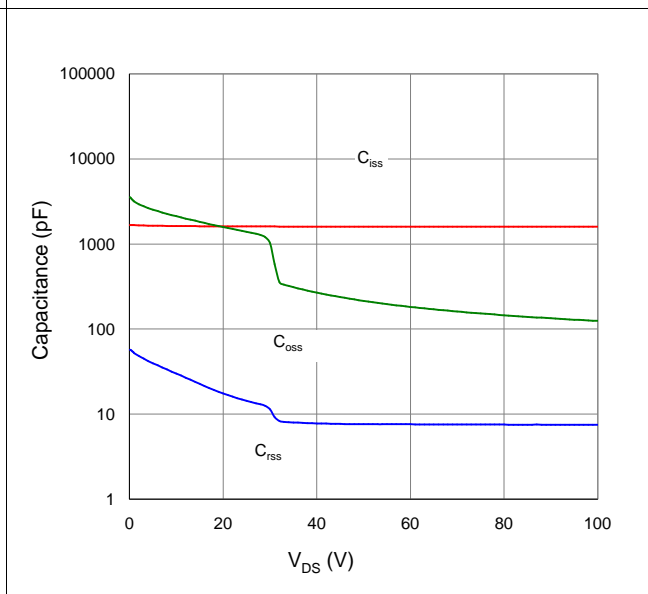


Figure 9. Maximum Safe Operating Area

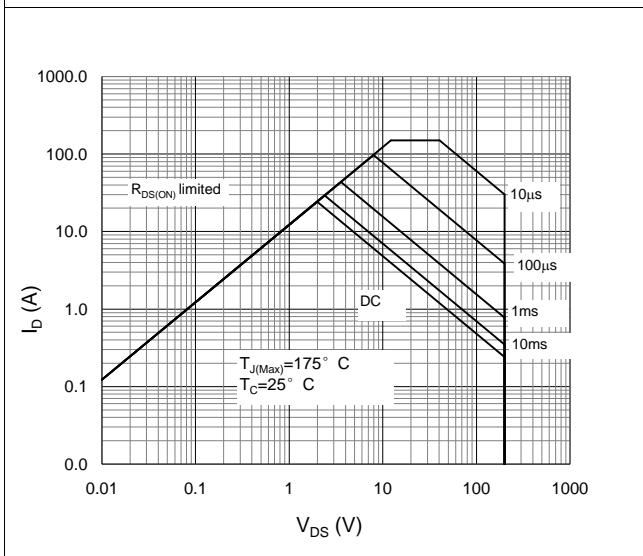


Figure 10. Maximum Drain Current vs. Case Temperature

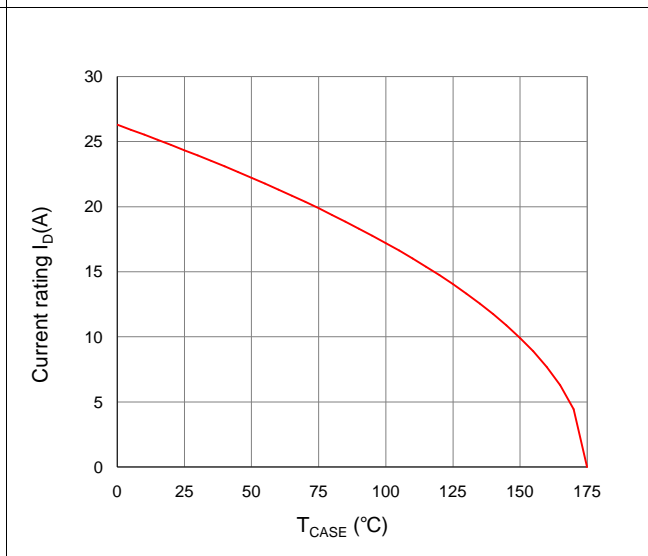
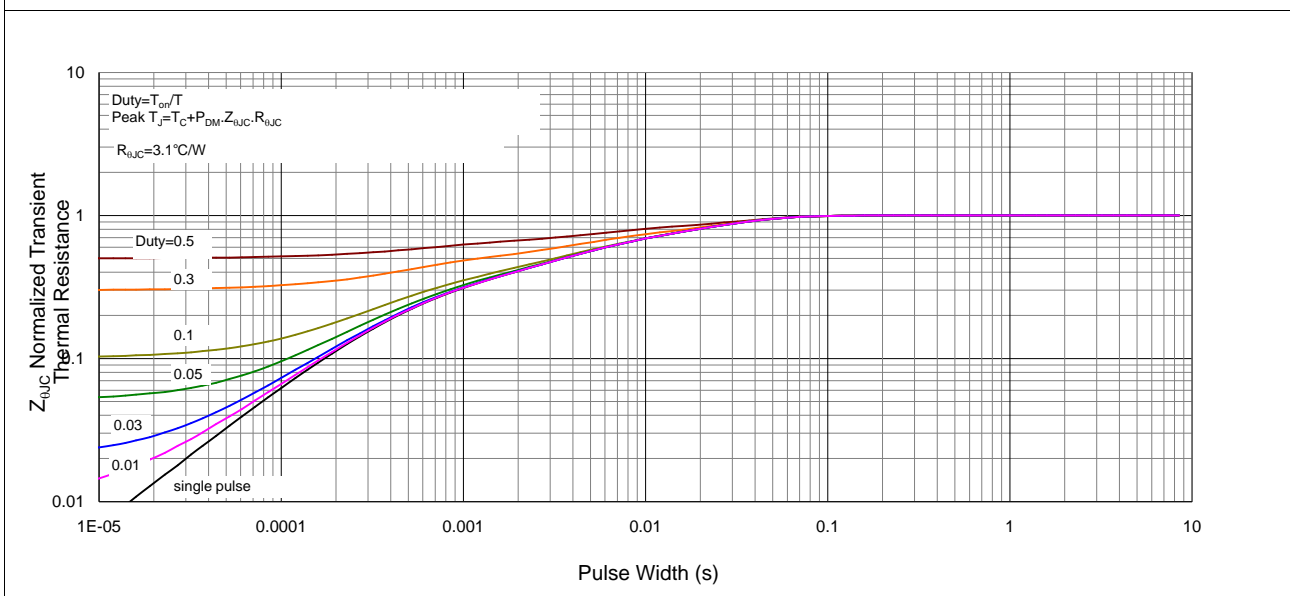
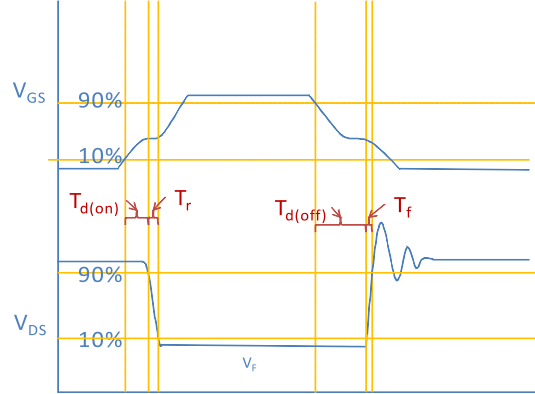
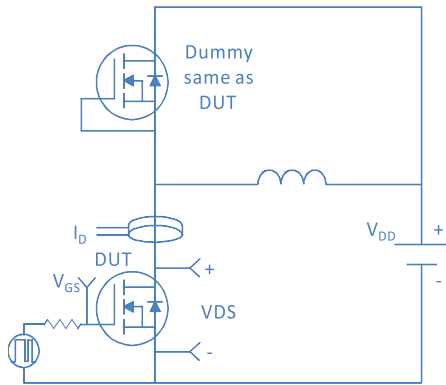


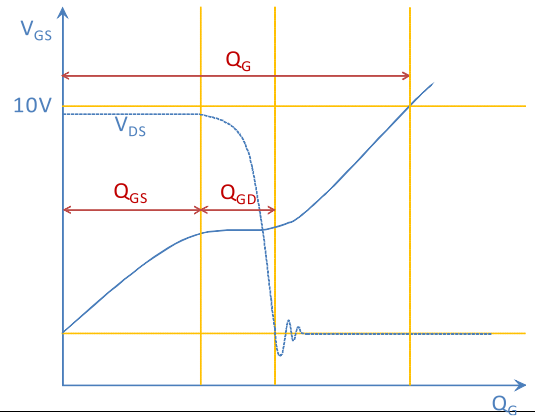
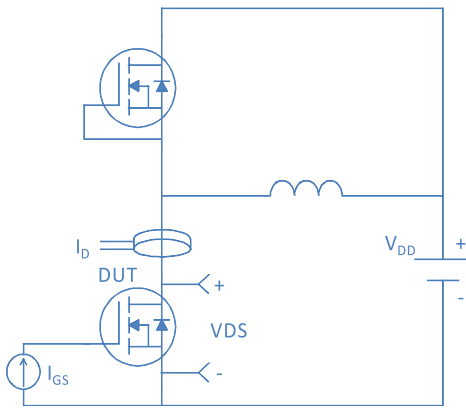
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



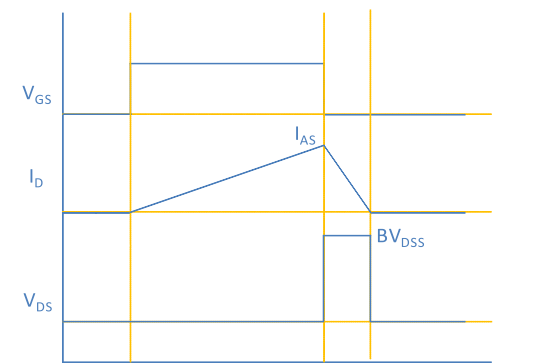
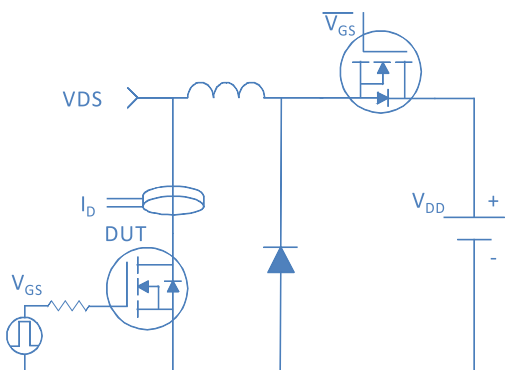
Inductive switching Test



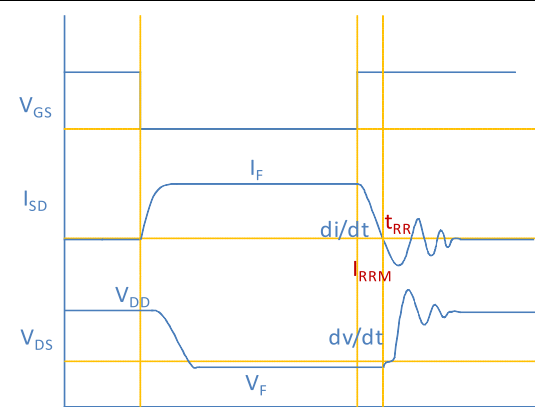
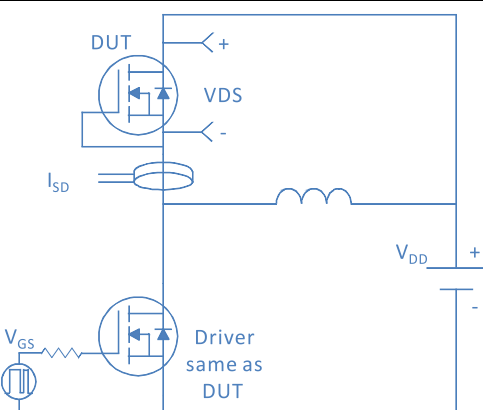
Gate Charge Test



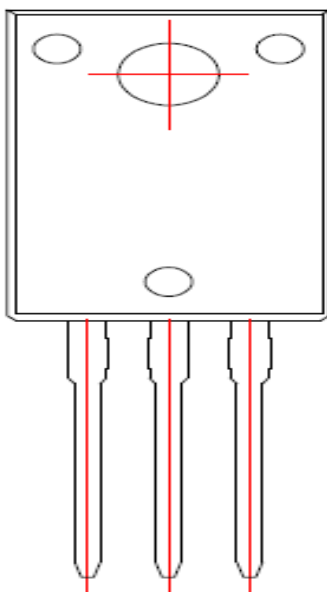
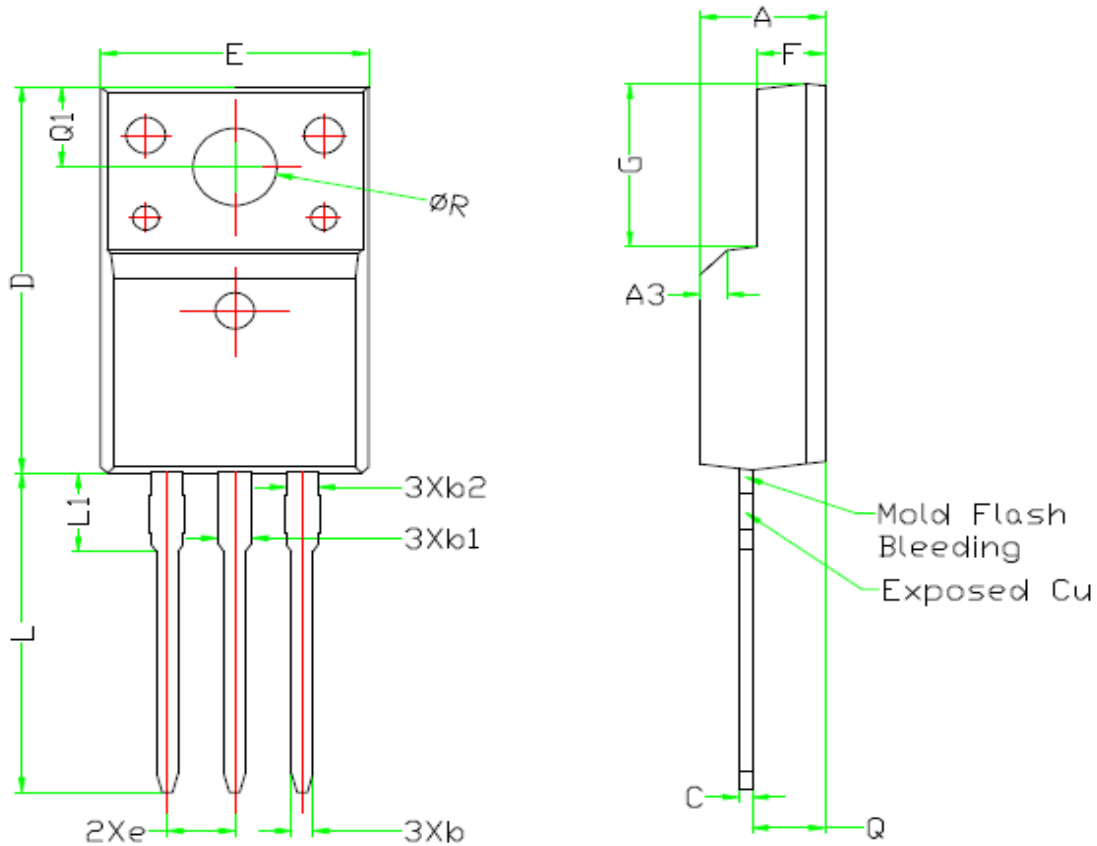
Uclamped Inductive Switching (UIS) Test



Diode Recovery Test



TO-220F, 3 leads



BOTTOM VIEW

| SYMBOL | DIMENSIONS | | |
|----------|------------|-------|-------|
| | Min. | Nom. | Max. |
| A | 4.60 | 4.70 | 4.80 |
| b | 0.70 | 0.80 | 0.91 |
| b1 | 1.20 | 1.30 | 1.47 |
| b2 | 1.10 | 1.20 | 1.30 |
| C | 0.45 | 0.50 | 0.63 |
| D | 15.80 | 15.87 | 15.87 |
| e | 2.54 | | |
| E | 10.00 | 10.10 | 10.30 |
| F | 2.44 | 2.54 | 2.64 |
| G | 6.50 | 6.70 | 6.90 |
| L | 12.90 | 13.10 | 13.30 |
| L1 | 3.13 | 3.23 | 3.33 |
| Q | 2.65 | 2.75 | 2.85 |
| Q1 | 3.20 | 3.30 | 3.40 |
| ϕR | 3.08 | 3.18 | 3.28 |

Note:

1. All Dimension Are In mm.
2. Package Body Sizes Exclude Mold Flash And Burrs
Mold Flash Should Be Less Than 6 Mil.