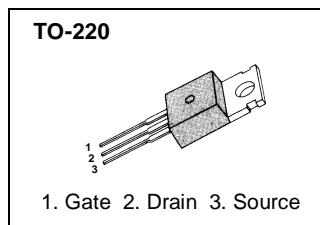


**FEATURES**

- Advanced New Design
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge: 5.0nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$ : 9.3Ω (Typ.)

$BV_{DSS} = 600V$   
 $R_{DS(ON)} = 11.5\Omega$   
 $I_D = 1.2A$



**ABSOLUTE MAXIMUM RATINGS**

| Symbol         | Characteristics   | Value       | Units     |
|----------------|---|-------------|-----------|
| $V_{DSS}$      | Drain-to-Source Voltage   | 600         | V         |
| $I_D$          | Continuous Drain Current ( $T_C = 25^\circ C$ )                         | 1.2         | A         |
|                | Continuous Drain Current ( $T_C = 100^\circ C$ )                        | 0.76        |           |
| $I_{DM}$       | Drain Current-Pulsed ①  | 4.8         | A         |
| $V_{GS}$       | Gate-to-Source Voltage  | $\pm 30$    | V         |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②  | 50          | mJ        |
| $I_{AR}$       | Avalanche Current ①   | 1.2         | A         |
| $E_{AR}$       | Repetitive Avalanche Energy ①   | 4.0         | mJ        |
| dv/dt          | Peak Diode Recovery dv/dt ③   | 4.5         | V/ns      |
| $P_D$          | Total Power Dissipation ( $T_C = 25^\circ C$ )                          | 40          | W<br>W/°C |
|                | Linear Derating Factor  | 0.32        |           |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | -55 to +150 | °C        |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300         |           |

**THERMAL RESISTANCE**

| Symbol          | Characteristics     | Typ. | Max. | Units |
|-----------------|---------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case    | -    | 3.13 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink        | 0.5  | -    |       |
| $R_{\theta JA}$ | Junction-to-Ambient | -    | 62.5 |       |

**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

| Symbol                 | Characteristics                         | Min. | Typ. | Max. | Units               | Test Conditions  |
|------------------------|---|------|------|------|---------------------|--|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 600  | –    | –    | V                   | $V_{GS}=0V, I_D=250\mu A$  |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | –    | 0.4  | –    | V/ $^\circ\text{C}$ | $I_D=250\mu A$ , <b>See Fig 7</b>  |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 3.0  | –    | 5.0  | V                   | $V_{DS}=5V, I_D=250\mu A$  |
| $I_{GSS}$              | Gate-Source Leakage, Forward            | –    | –    | 100  | nA                  | $V_{GS}=30V$   |
|                        | Gate-Source Leakage, Reverse            | –    | –    | –100 |                     | $V_{GS}= -30V$   |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | –    | –    | 10   | $\mu A$             | $V_{DS}=600V$  |
|                        |   | –    | –    | 100  |                     | $V_{DS}=480V, T_C=125^\circ\text{C}$   |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | –    | 9.3  | 11.5 | $\Omega$            | $V_{GS}=10V, I_D=0.6A$ ④   |
| $g_{fs}$               | Forward Transconductance                | –    | 0.9  | –    | S                   | $V_{DS}=50V, I_D=0.6A$ ④   |
| $C_{iss}$              | Input Capacitance                       | –    | 120  | 150  | pF                  | $V_{GS}=0V, V_{DS}=25V$<br>$f=1\text{MHz}$<br><b>See Fig 5</b>               |
| $C_{oss}$              | Output Capacitance                      | –    | 20   | 25   |                     |  |
| $C_{rss}$              | Reverse Transfer Capacitance            | –    | 3.0  | 4.0  |                     |  |
| $t_{d(on)}$            | Turn-On Delay Time                      | –    | 5    | 20   | ns                  | $V_{DD}=300V, I_D=1.2A$<br>$R_G=50\Omega$<br><b>See Fig 13</b> ④ ⑤           |
| $t_r$                  | Rise Time                               | –    | 25   | 60   |                     |  |
| $t_{d(off)}$           | Turn-Off Delay Time                     | –    | 7    | 25   |                     |  |
| $t_f$                  | Fall Time                               | –    | 25   | 60   |                     |  |
| $Q_g$                  | Total Gate Charge                       | –    | 5.0  | 6.0  | nC                  | $V_{DS}=480V, V_{GS}=10V$<br>$I_D=1.2A$<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | –    | 1.0  | –    |                     |  |
| $Q_{gd}$               | Gate-Drain (Miller) Charge              | –    | 2.6  | –    |                     |  |

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

| Symbol   | Characteristics           | Min. | Typ. | Max. | Units         | Test Conditions                               |
|----------|---------------------------|------|------|------|---------------|---|
| $I_S$    | Continuous Source Current | –    | –    | 1.2  | A             | Integral reverse pn-diode in the MOSFET       |
| $I_{SM}$ | Pulsed-Source Current ①   | –    | –    | 4.8  |               |   |
| $V_{SD}$ | Diode Forward Voltage ④   | –    | –    | 1.4  | V             | $T_J=25^\circ\text{C}, I_S=1.2A, V_{GS}=0V$   |
| $t_{rr}$ | Reverse Recovery Time     | –    | 160  | –    | ns            | $T_J=25^\circ\text{C}, I_F=1.2A, V_{DD}=480V$ |
| $Q_{rr}$ | Reverse Recovery Charge   | –    | 0.3  | –    | $\mu\text{C}$ | $di_F/dt=100A/\mu\text{s}$ ④                  |

**Notes:**

- ① Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- ②  $L=64\text{mH}, I_{AS}=1.2A, V_{DD}=50V, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq 1.2A, di/dt \leq 200A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

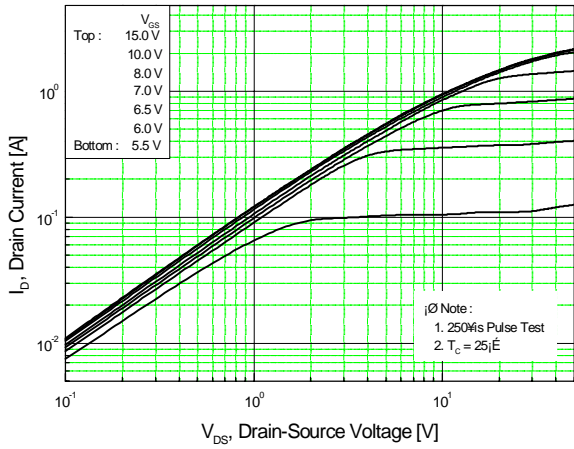


Fig 2. Transfer Characteristics

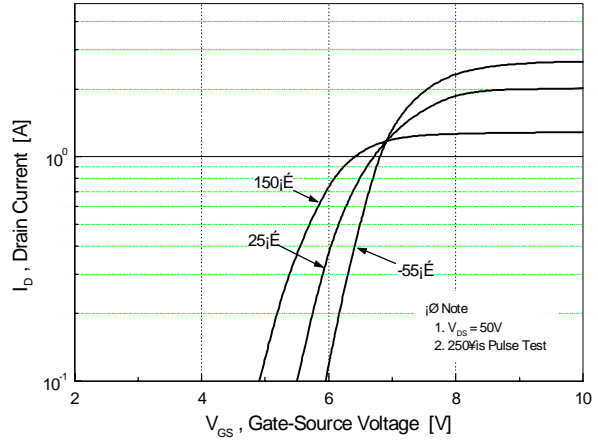


Fig 3. On-Resistance vs. Drain Current

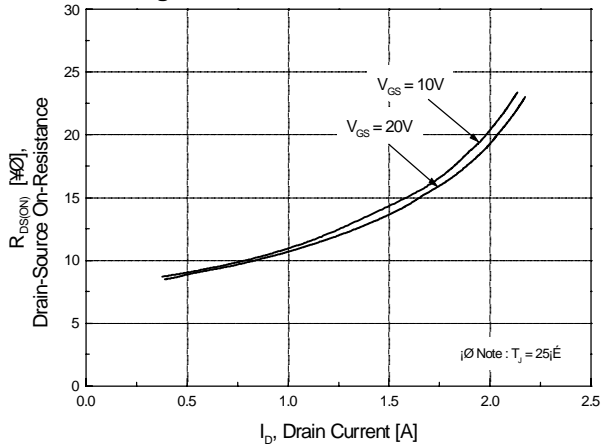


Fig 4. Source-Drain Diode Forward Voltage

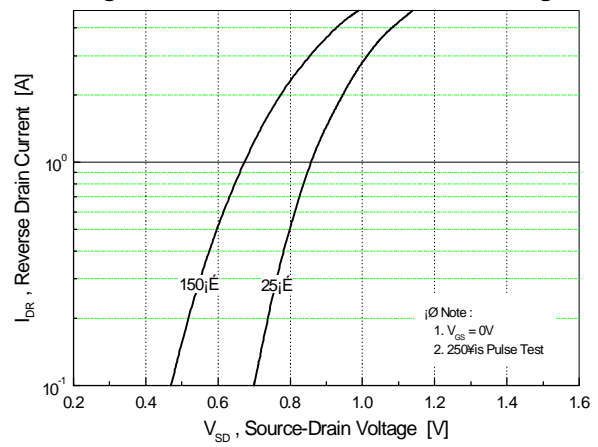


Fig 5. Capacitance vs. Drain-Source Voltage

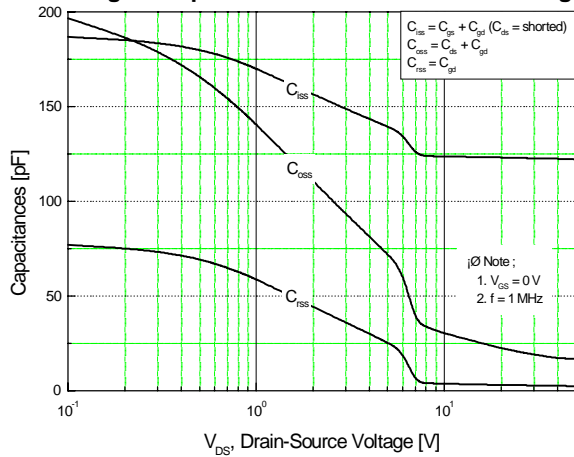


Fig 6. Gate Charge vs. Gate-Source Voltage

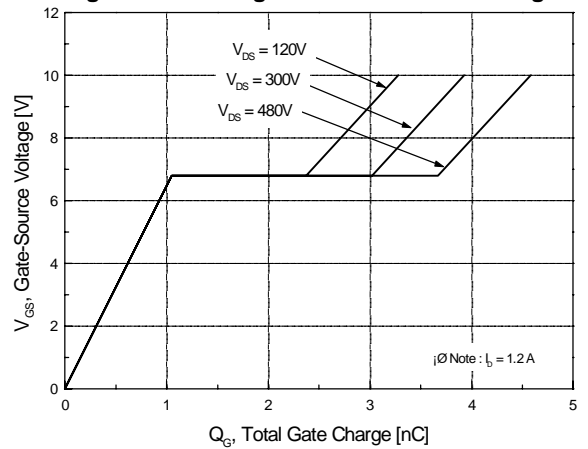


Fig 7. Breakdown Voltage vs. Temperature

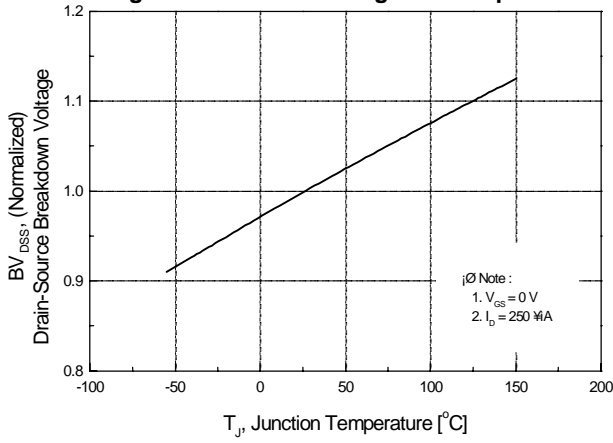


Fig 8. On-Resistance vs. Temperature

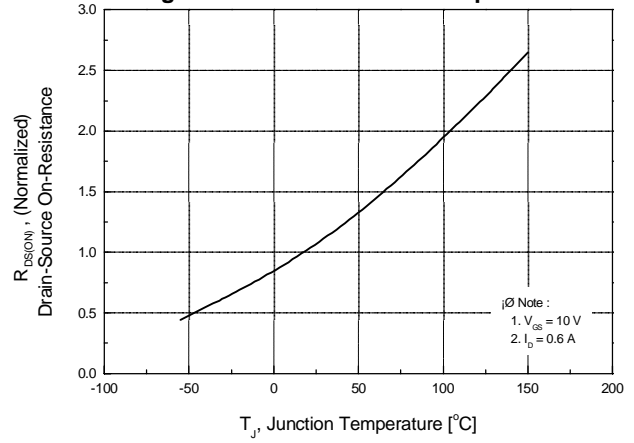


Fig 9. Max. Safe Operating Area

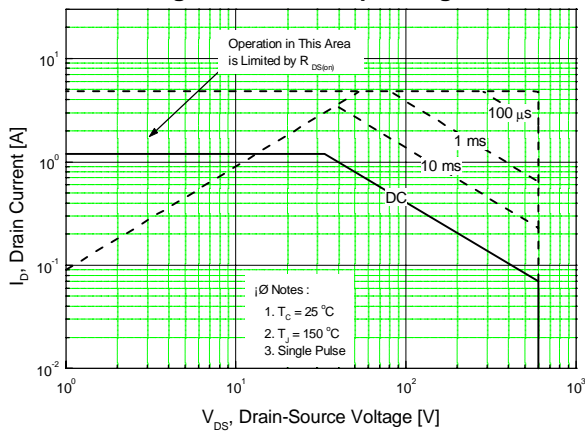


Fig 10. Max. Drain Current vs. Case Temperature

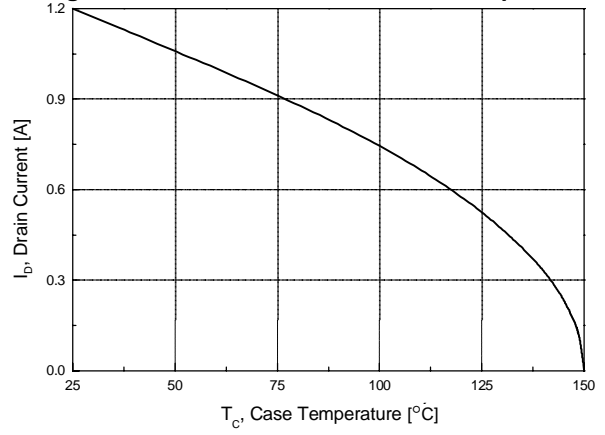


Fig 11. Thermal Response

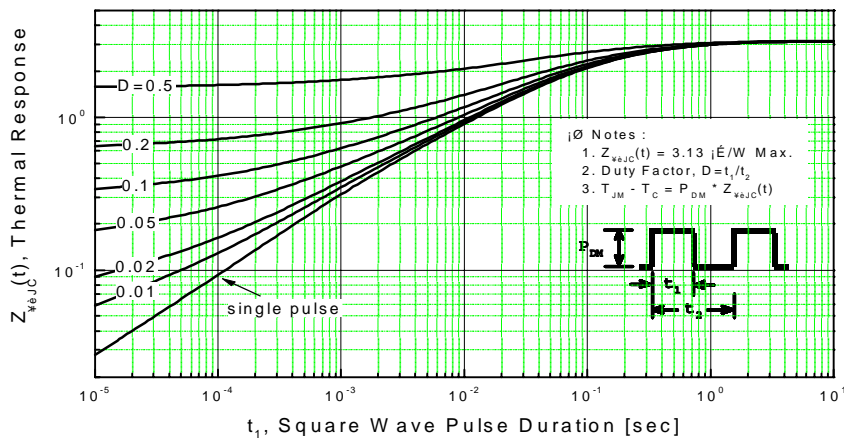


Fig 12. Gate Charge Test Circuit & Waveform

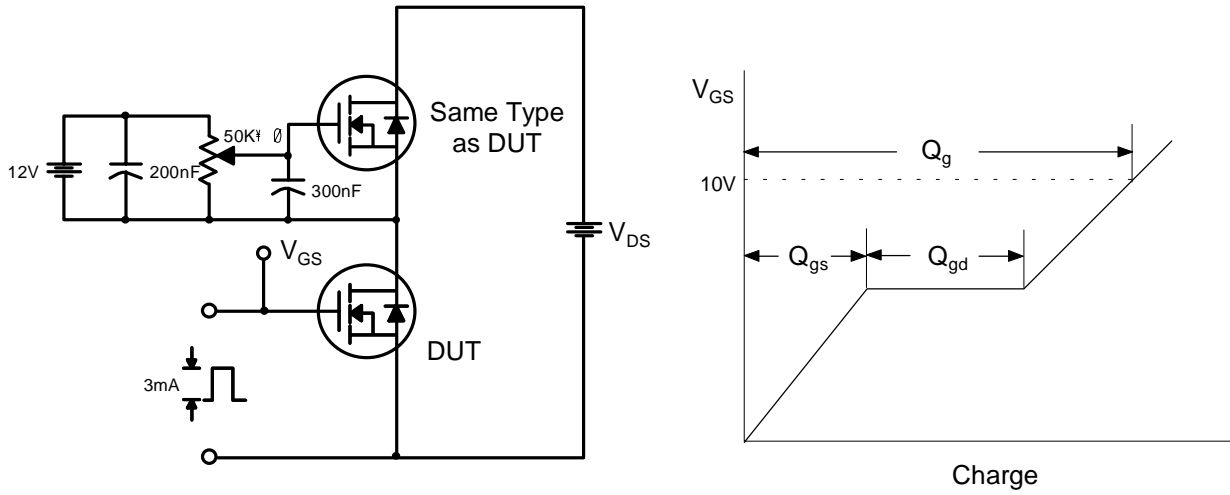


Fig 13. Resistive Switching Test Circuit & Waveforms

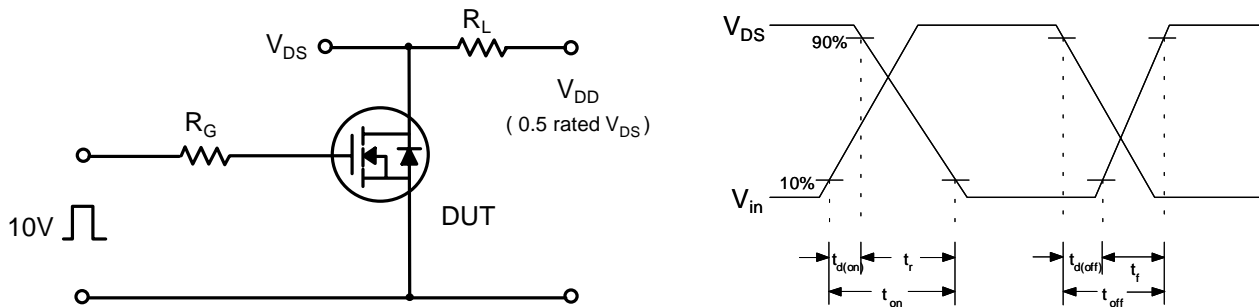


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

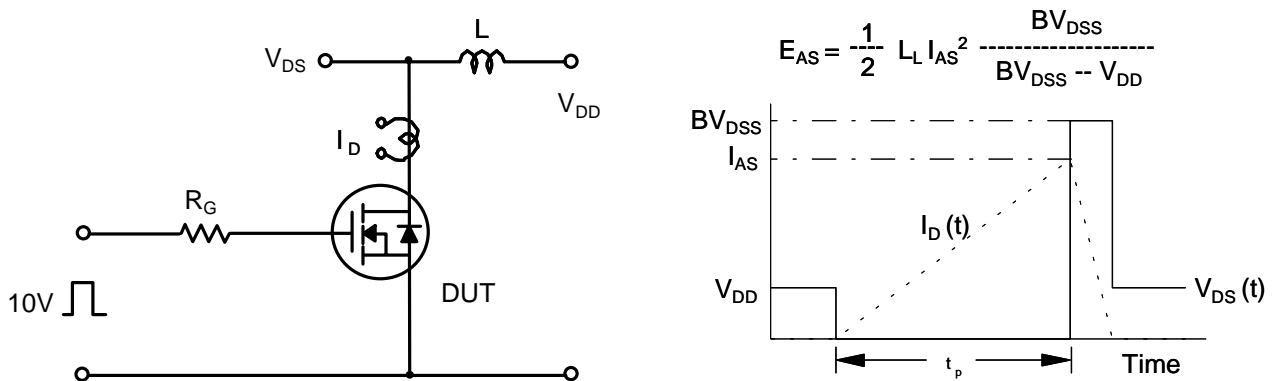
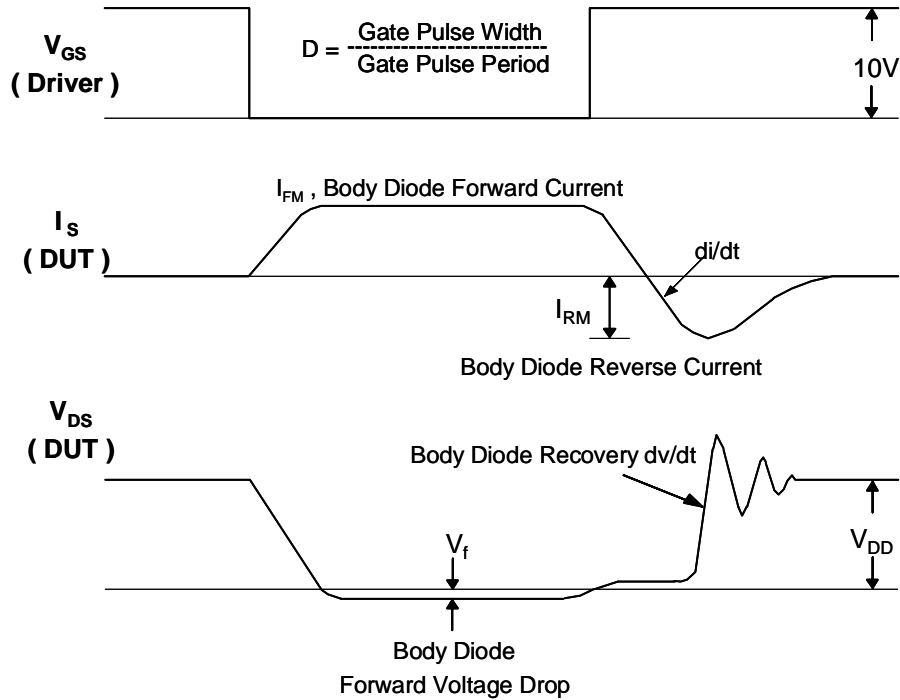
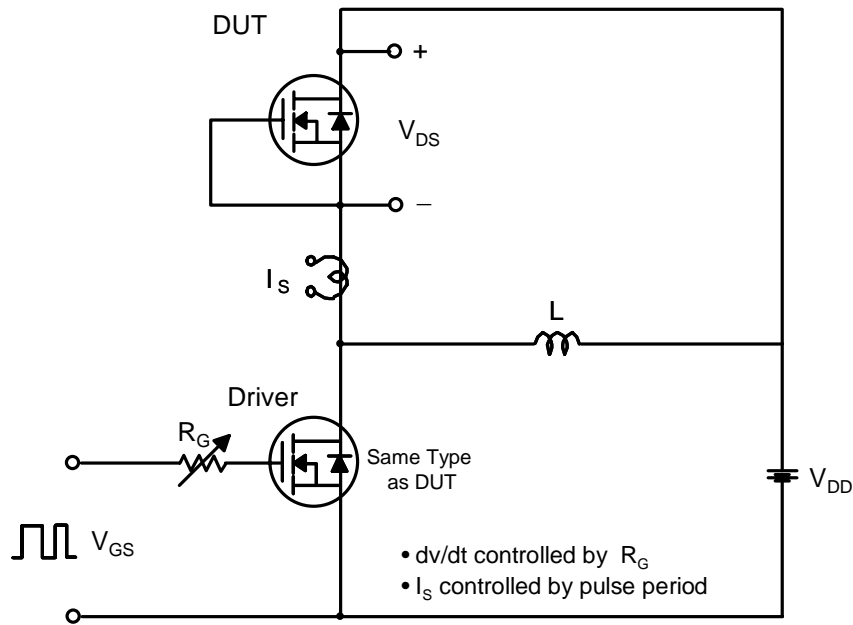
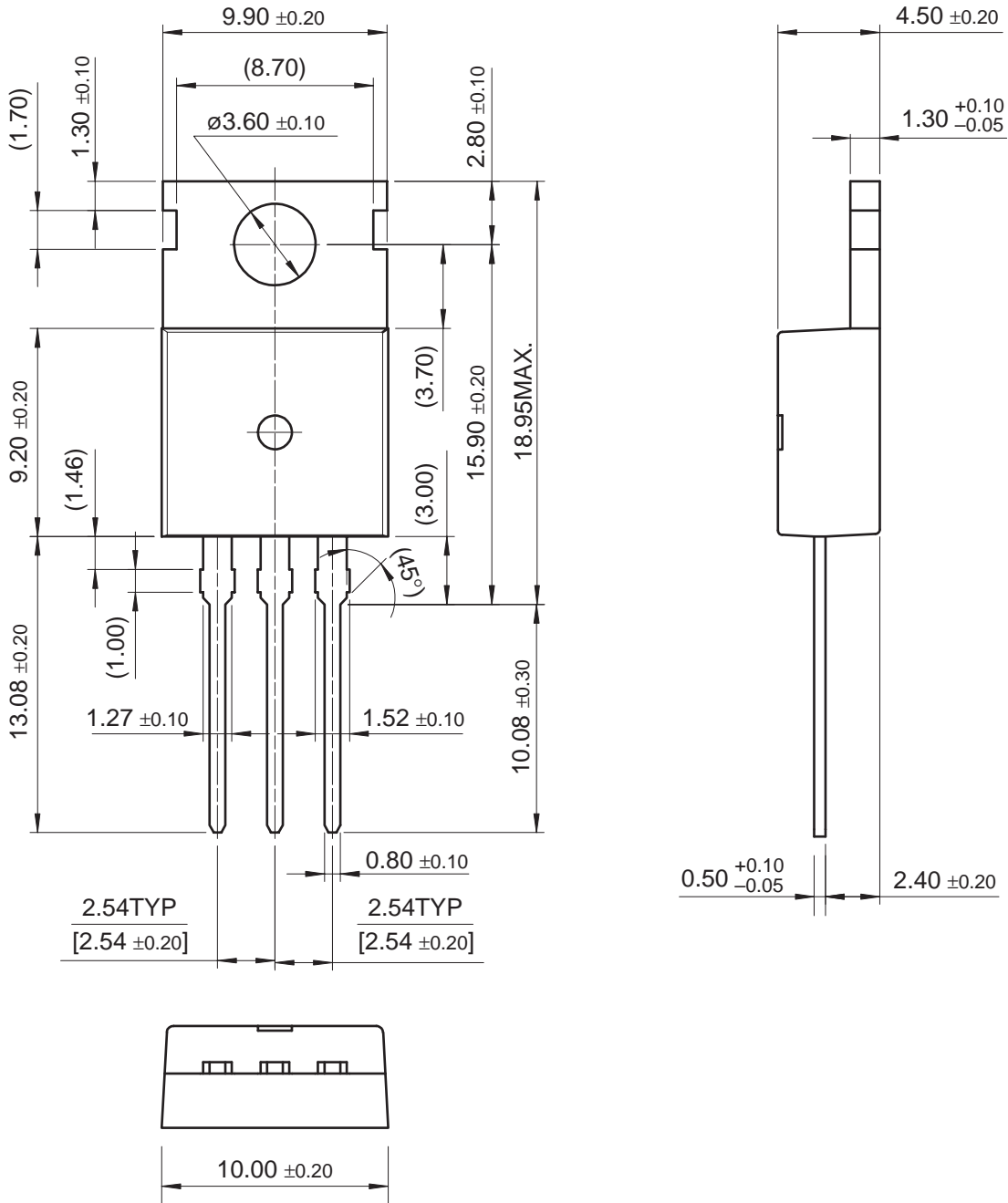


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220 Package Dimensions

TO-220 (FS PKG CODE AE)



Dimensions in Millimeters

September 1999, Rev B

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| FAST <sup>TM</sup>              | Quiet Series <sup>TM</sup> |                         |
| FAST <sub>r</sub> <sup>TM</sup> | SuperSOT <sup>TM</sup> -3  |                         |
| GTO <sup>TM</sup>               | SuperSOT <sup>TM</sup> -6  |                         |
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