

FCA36N60NF

N-Channel MOSFET, FRFET

600V, 36A, 95mΩ

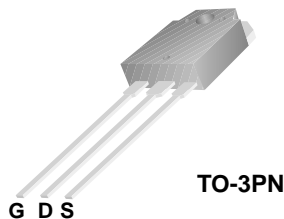
Features

- $R_{DS(on)} = 80m\Omega$ (Typ.) @ $V_{GS} = 10V, I_D = 18A$
- Ultra Low Gate Charge (Typ. $Q_g = 86nC$)
- Low Effective Output Capacitance
- 100% Avalanche Tested
- RoHS Compliant

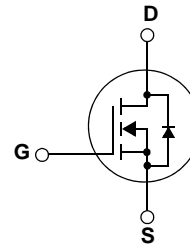
Description

The SupreMOS MOSFET, Fairchild's next generation of high voltage super-junction MOSFETs, employs a deep trench filling process that differentiates it from preceding multi-epi based technologies. By utilizing this advanced technology and precise process control, SupreMOS provides world class R_{sp} , superior switching performance and ruggedness.

This SupreMOS MOSFET fits the industry's AC-DC SMPS requirements for PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



TO-3PN



MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted*

| Symbol | Parameter | FCA36N60NF | Units |
|----------------|--|------------------------------------|------------|
| V_{DSS} | Drain to Source Voltage | 600 | V |
| V_{GSS} | Gate to Source Voltage | ± 30 | V |
| I_D | Drain Current | Continuous ($T_C = 25^\circ C$) | 34.9 |
| | | Continuous ($T_C = 100^\circ C$) | 22 |
| I_{DM} | Drain Current | Pulsed (Note 1) | 104.7 |
| E_{AS} | Single Pulsed Avalanche Energy | (Note 2) | 1800 |
| I_{AR} | Avalanche Current | | 12 |
| E_{AR} | Repetitive Avalanche Energy | | 3.12 |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 50 |
| | MOSFET dv/dt Ruggedness | | 100 |
| P_D | Power Dissipation | ($T_C = 25^\circ C$) | 312 |
| | | Derate above $25^\circ C$ | 2.6 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | $^\circ C$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | $^\circ C$ |

*Drain current limited by maximum junction temperature

Thermal Characteristics

| Symbol | Parameter | FCA36N60NF | Units |
|-----------------|---|------------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 0.40 | $^\circ C/W$ |
| $R_{\theta CS}$ | Thermal Resistance, Case to Heat Sink (Typical) | 0.24 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 40 | |

Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|------------|---------|-----------|------------|----------|
| FCA36N60NF | FCA36N60NF | TO-3PN | - | - | 30 |

Electrical Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|-----|------|-----------|---------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$ | 600 | - | - | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 1\text{mA}$, Referenced to 25°C | - | 0.60 | - | V/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$ $T_J = 125^\circ\text{C}$ | - | - | 10 | μA |
| I_{GSS} | Gate to Body Leakage Current | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$ | - | - | ± 100 | nA |

On Characteristics

| | | | | | | |
|--------------|--------------------------------------|---|-----|-----|-----|------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ | 3.0 | 3.7 | 5.0 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{V}, I_D = 18\text{A}$ | - | 80 | 95 | m Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 20\text{V}, I_D = 18\text{A}$ | - | 39 | - | S |

Dynamic Characteristics

| | | | | | | |
|---------------------|------------------------------------|--|---|------|------|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$ | - | 3191 | 4245 | pF |
| C_{oss} | Output Capacitance | | - | 145 | 195 | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 5 | 8 | pF |
| C_{oss} | Output Capacitance | $V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ | - | 81 | - | pF |
| $C_{oss\text{eff}}$ | Effective Output Capacitance | $V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$ | - | 338 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS} = 380\text{V}, I_D = 18\text{A},$ $V_{GS} = 10\text{V}$ (Note 4) | - | 86 | 112 | nC |
| Q_{gs} | Gate to Source Gate Charge | | - | 16 | - | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | - | 36 | - | nC |
| ESR | Equivalent Series Resistance (G-S) | Drain Open, $f=1\text{MHz}$ | - | 1.2 | - | Ω |

Switching Characteristics

| | | | | | | |
|--------------|---------------------|---|---|----|-----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 380\text{V}, I_D = 18\text{A}$ $R_G = 4.7\Omega$ (Note 4) | - | 27 | 64 | ns |
| t_r | Turn-On Rise Time | | - | 17 | 44 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 92 | 194 | ns |
| t_f | Turn-Off Fall Time | | - | 4 | 18 | ns |

Drain-Source Diode Characteristics

| | | | | | | |
|----------|--|---|---|-----|-----|---------------|
| I_S | Maximum Continuous Drain to Source Diode Forward Current | - | - | 36 | A | |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | - | - | 108 | A | |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS} = 0\text{V}, I_{SD} = 18\text{A}$ | - | - | 1.2 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0\text{V}, I_{SD} = 18\text{A}$ | - | 166 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $di_F/dt = 100\text{A}/\mu\text{s}$ | - | 1.3 | - | μC |

Notes:

- Repetitive Rating: Pulse width limited by maximum junction temperature
- $I_{AS} = 12\text{A}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
- $I_{SD} \leq 36\text{A}$, $di/dt \leq 1200\text{A}/\mu\text{s}$, $V_{DD} \leq 380\text{V}$, Starting $T_J = 25^\circ\text{C}$
- Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

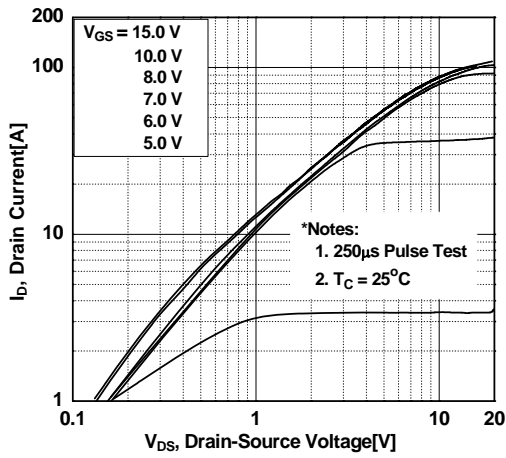


Figure 2. Transfer Characteristics

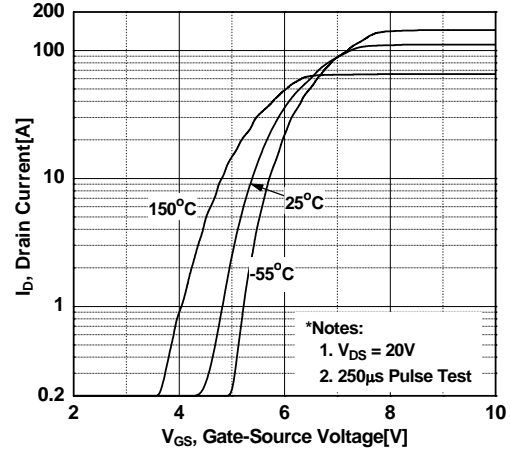


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

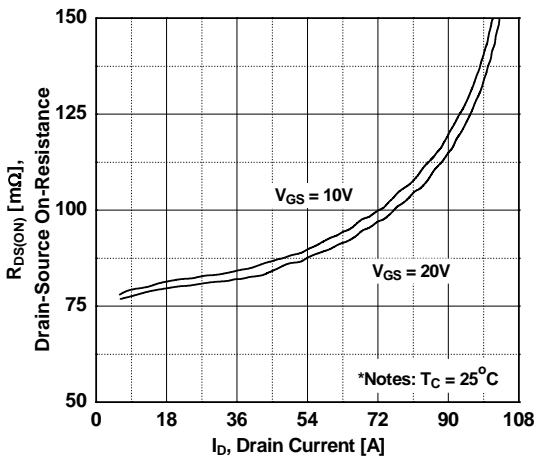


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

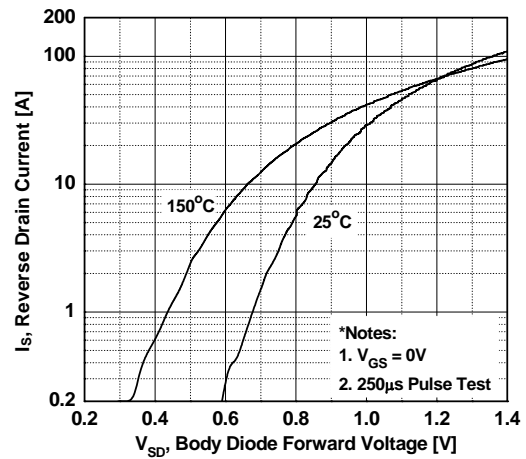


Figure 5. Capacitance Characteristics

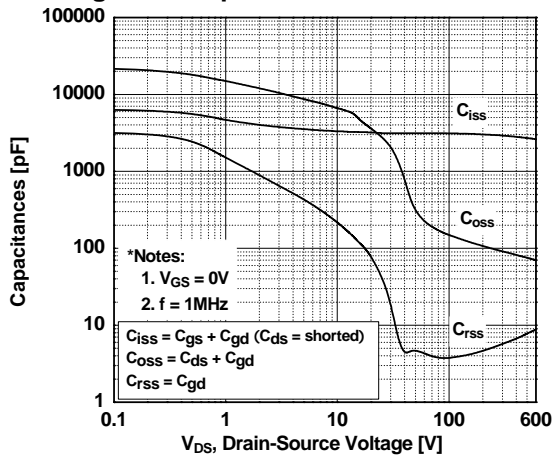
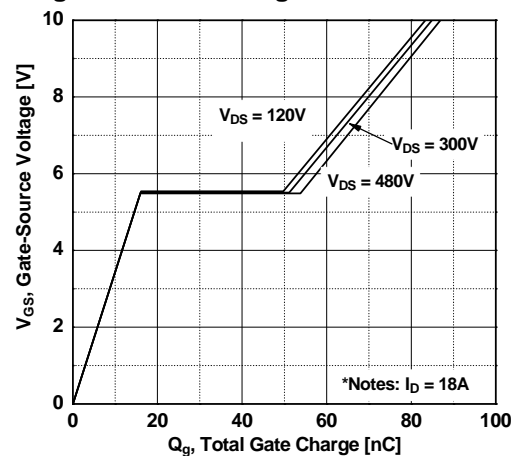


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

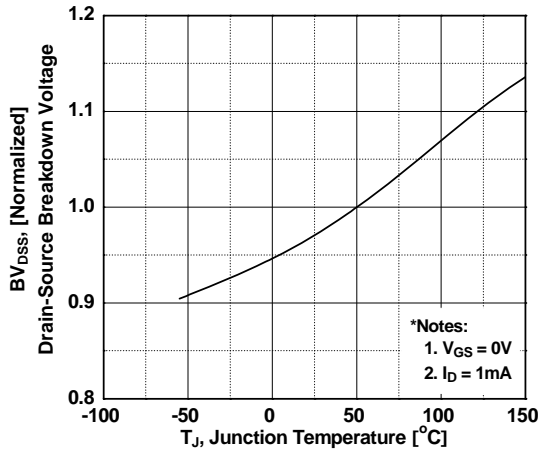


Figure 8. On-Resistance Variation vs. Temperature

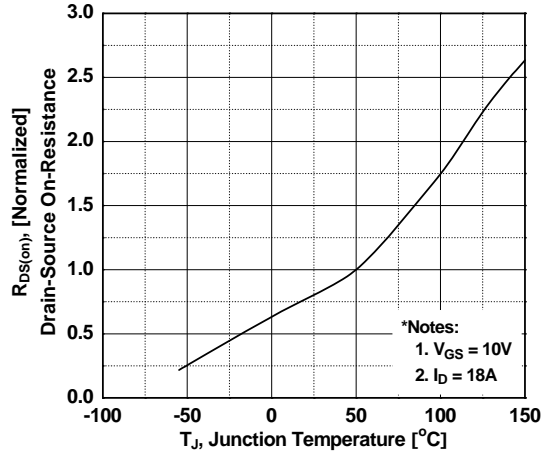


Figure 9. Maximum Safe Operating Area

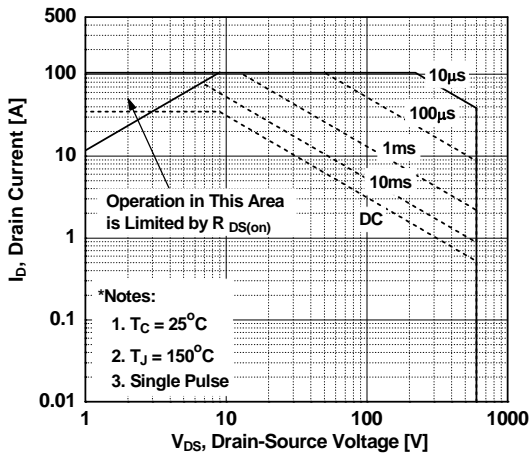


Figure 10. Maximum Drain Current vs. Case Temperature

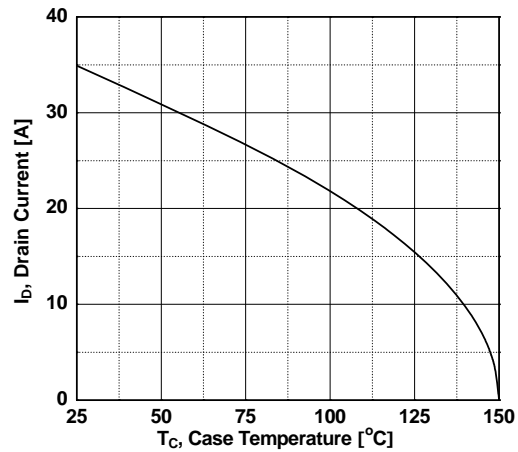
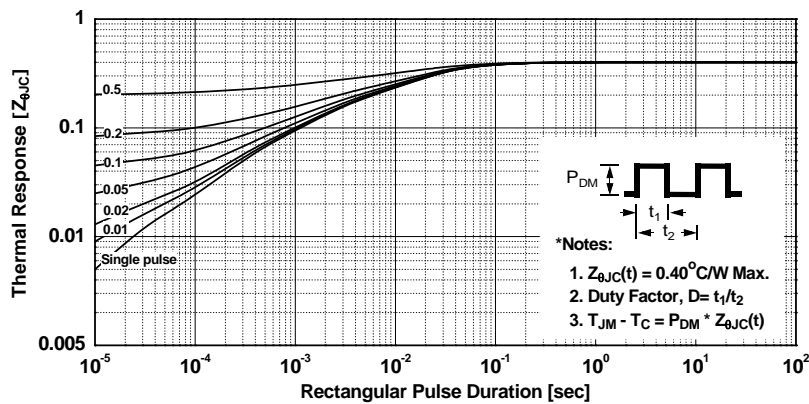
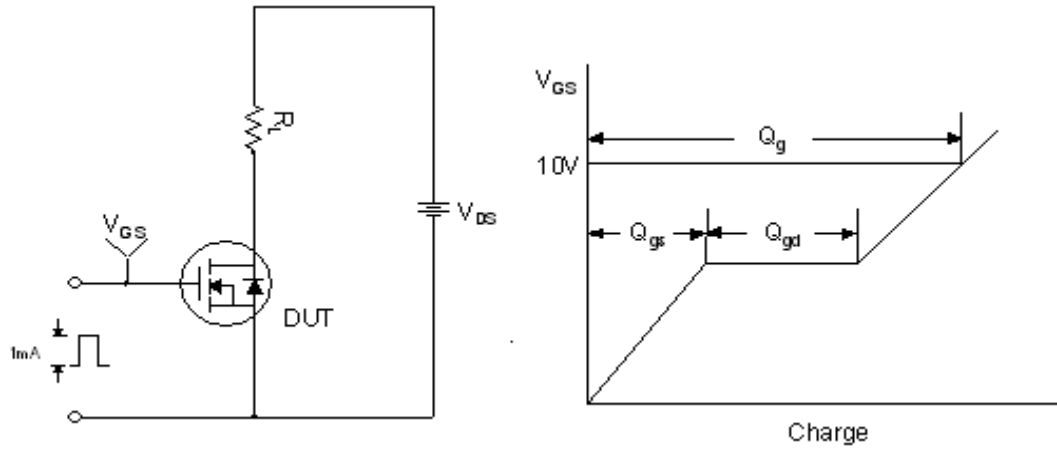


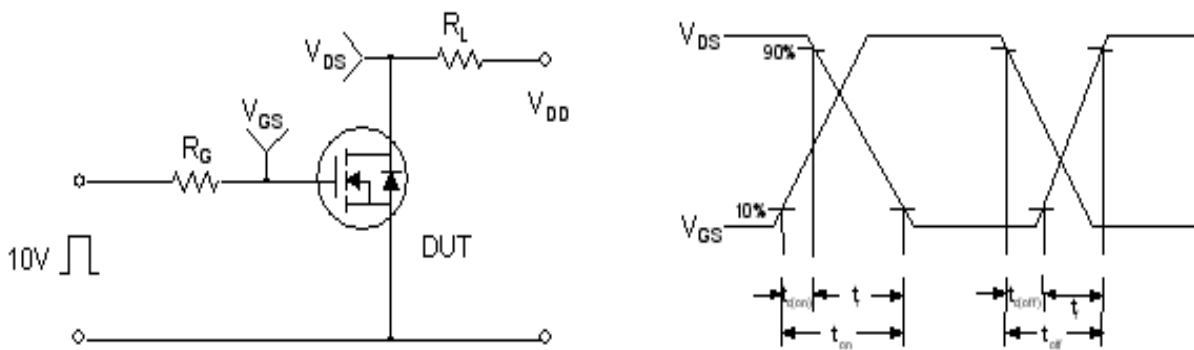
Figure 11. Transient Thermal Response Curve



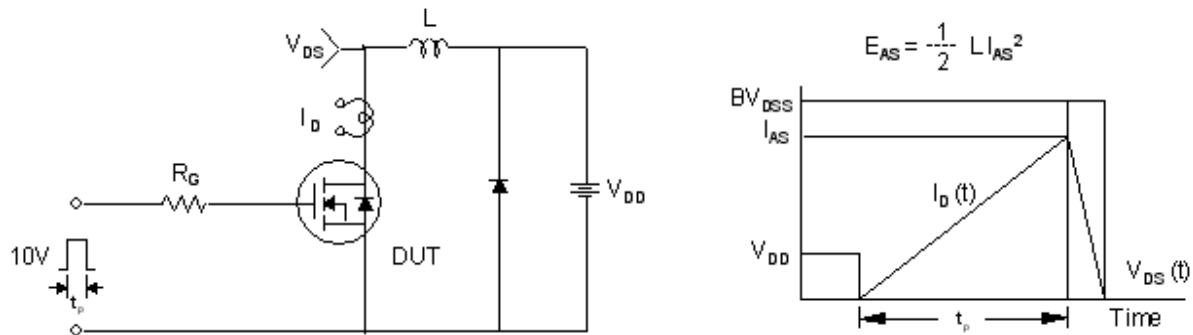
Gate Charge Test Circuit & Waveform



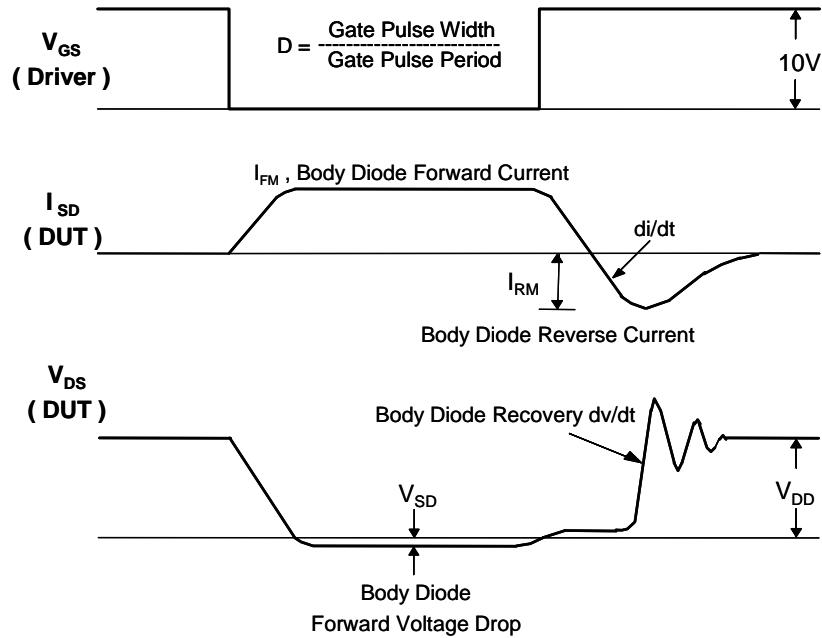
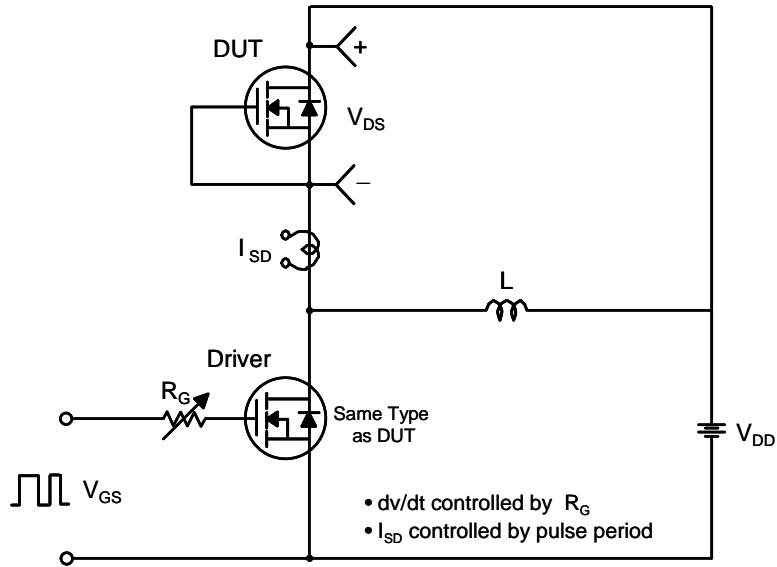
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

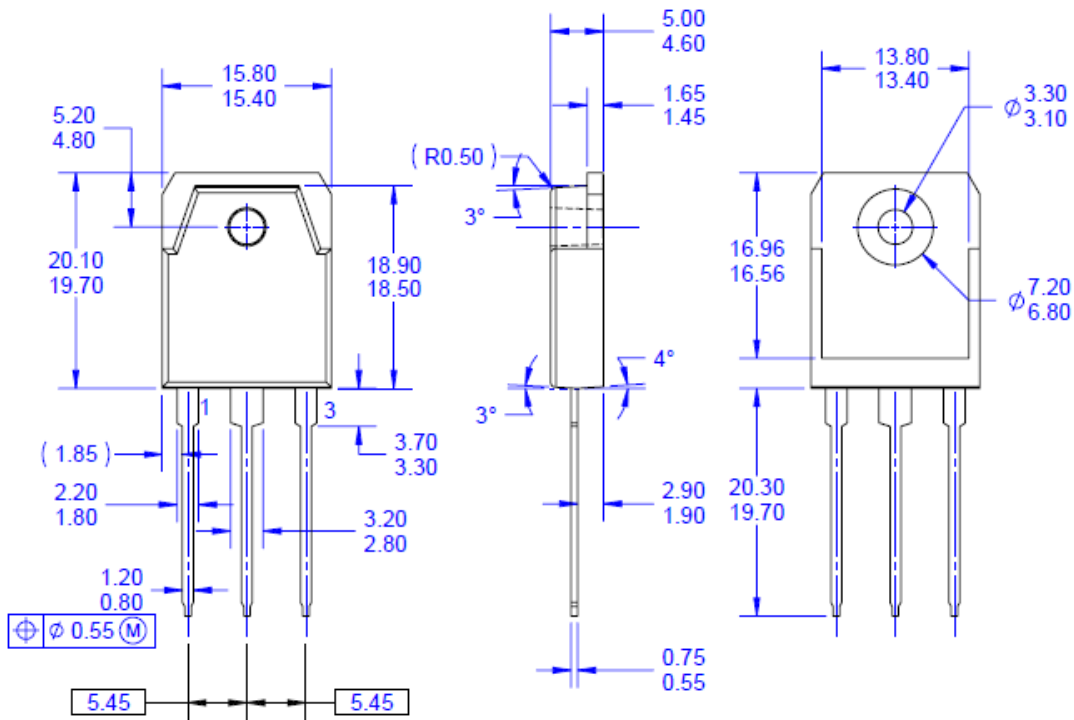


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-3PN



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