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FQA13N50C_F109

N-Channel QFET® MOSFET

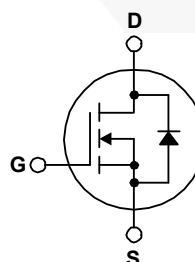
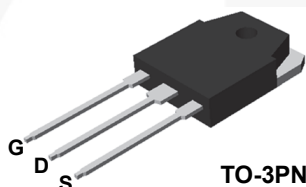
500 V, 13.5 A, 480 mΩ

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

Features

- 13.5 A, 500 V, $R_{DS(on)} = 480 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 6.75 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low C_{rss} (Typ. 20 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability



Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | FQA13N50C_F109 | Unit |
|----------------|---|----------------|---------------------|
| V_{DSS} | Drain-Source Voltage | 500 | V |
| I_D | Drain Current - Continuous ($T_C = 25^\circ\text{C}$) | 13.5 | A |
| | - Continuous ($T_C = 100^\circ\text{C}$) | 8.5 | A |
| I_{DM} | Drain Current - Pulsed (Note 1) | 54 | A |
| V_{GSS} | Gate-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 860 | mJ |
| I_{AR} | Avalanche Current (Note 1) | 13.5 | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 21.8 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) | 218 | W |
| | - Derate above 25°C | 1.56 | W/ $^\circ\text{C}$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds. | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | FQA13N50C_F109 | Unit |
|-----------------|---|----------------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max. | 0.58 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 40 | $^\circ\text{C/W}$ |

Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|----------------|-----------|---------|----------------|-----------|------------|----------|
| FQA13N50C_F109 | FQA13N50C | TO-3PN | Tube | N/A | N/A | 30 units |

Electrical Characteristics

$T_C = 25^\circ\text{C}$ unless otherwise noted.

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

Off Characteristics

| | | | | | | |
|--------------------------------|---|---|-----|-----|------|--------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 500 | -- | -- | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C | -- | 0.5 | -- | $V/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | -- | -- | 1 | μA |
| | | $V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$ | -- | -- | 10 | μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$ | -- | -- | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$ | -- | -- | -100 | nA |

On Characteristics

| | | | | | | |
|--------------|-----------------------------------|---|-----|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2.0 | -- | 4.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 6.75\text{ A}$ | -- | 0.39 | 0.48 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 40\text{ V}, I_D = 6.75\text{ A}$ | -- | 15 | -- | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|----|------|------|----|
| C_{iss} | Input Capacitance | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$ | -- | 1580 | 2055 | pF |
| C_{oss} | Output Capacitance | | -- | 180 | 235 | pF |
| C_{rss} | Reverse Transfer Capacitance | | -- | 20 | 25 | pF |

Switching Characteristics

| | | | | | | |
|--------------|---------------------|---|----|------|-----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 250\text{ V}, I_D = 13.5\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4) | -- | 25 | 60 | ns |
| t_r | Turn-On Rise Time | | -- | 100 | 210 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 130 | 270 | ns |
| t_f | Turn-Off Fall Time | | -- | 100 | 210 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 400\text{ V}, I_D = 13.5\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4) | -- | 43 | 56 | nC |
| Q_{gs} | Gate-Source Charge | | -- | 7.5 | -- | nC |
| Q_{gd} | Gate-Drain Charge | | -- | 18.5 | -- | nC |

Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | | |
|-----------------|---|--|----|-----|-----|----|
| I _S | Maximum Continuous Drain-Source Diode Forward Current | -- | -- | 13 | A | |
| I _{SM} | Maximum Pulsed Drain-Source Diode Forward Current | -- | -- | 52 | A | |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0 V, I _S = 13.5 A | -- | -- | 1.4 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _S = 13.5 A, dI _F / dt = 100 A/μs | -- | 410 | -- | ns |
| Q _{rr} | Reverse Recovery Charge | | -- | 4.5 | -- | μC |

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 5.6\text{ mH}$, $I_{AS} = 13.5\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 13.5\text{ A}$, $dI/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature

Typical Characteristics

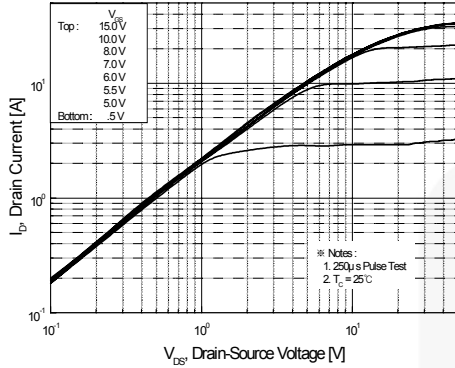


Figure 1. On-Region Characteristics

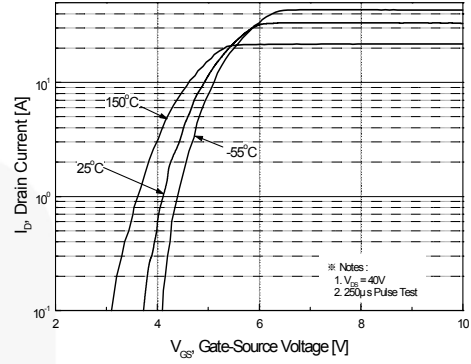


Figure 2. Transfer Characteristics

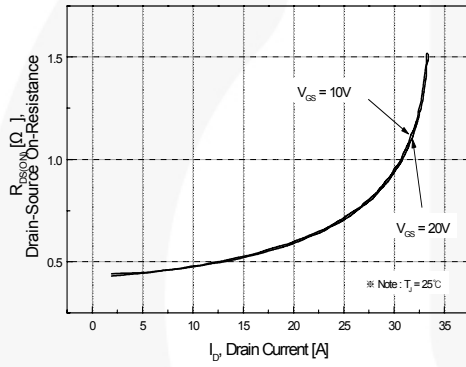


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

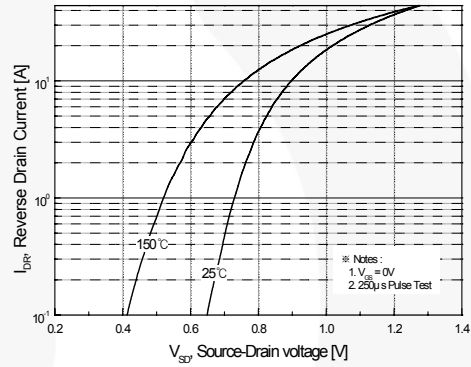


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

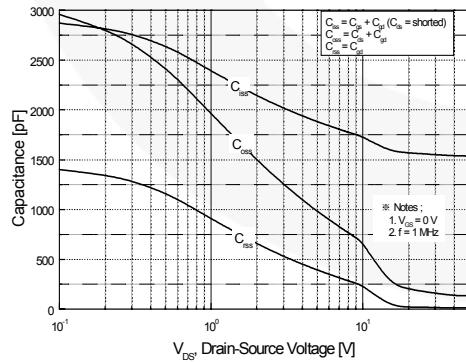


Figure 5. Capacitance Characteristics

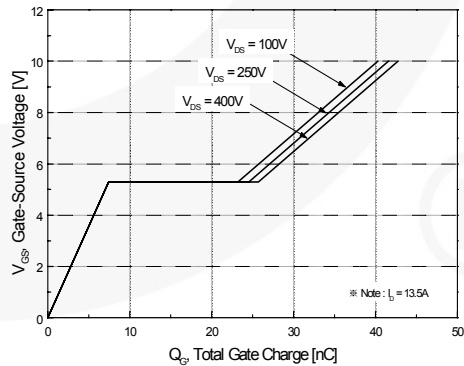


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

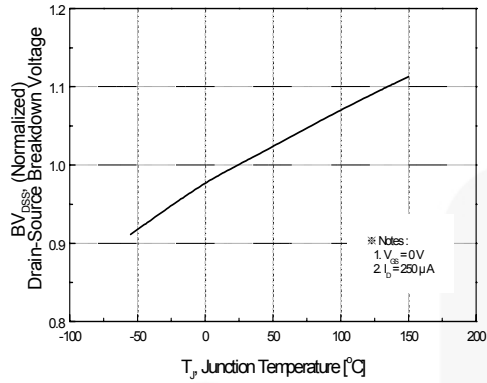


Figure 7. Breakdown Voltage Variation vs Temperature

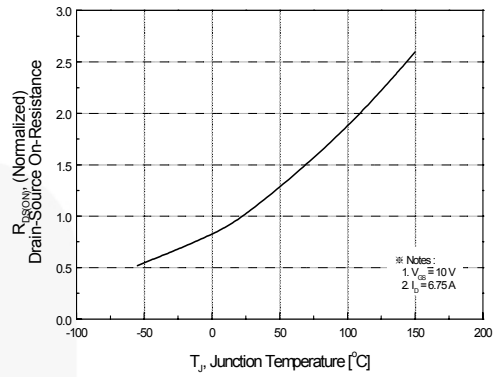


Figure 8. On-Resistance Variation vs Temperature

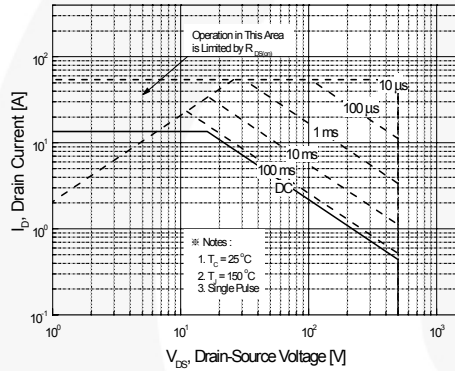


Figure 9. Maximum Safe Operating Area

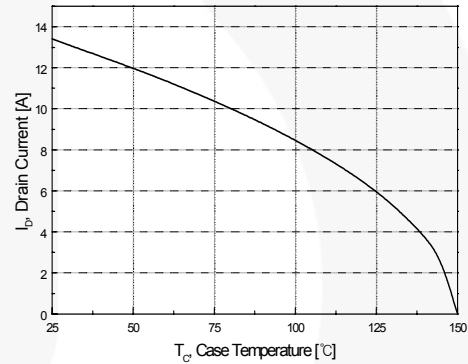


Figure 10. Maximum Drain Current vs Case Temperature

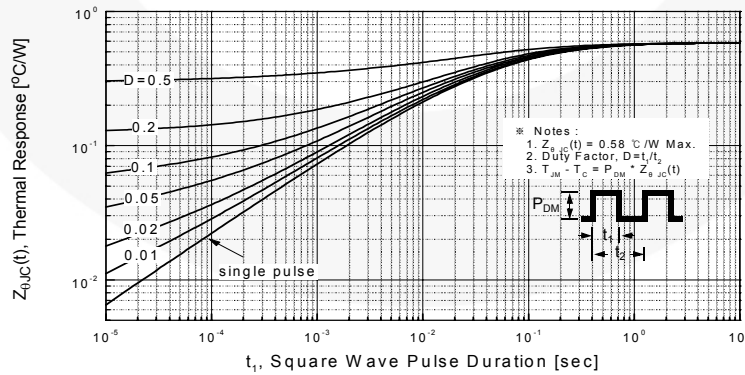


Figure 11. Transient Thermal Response Curve for FQA13N50C

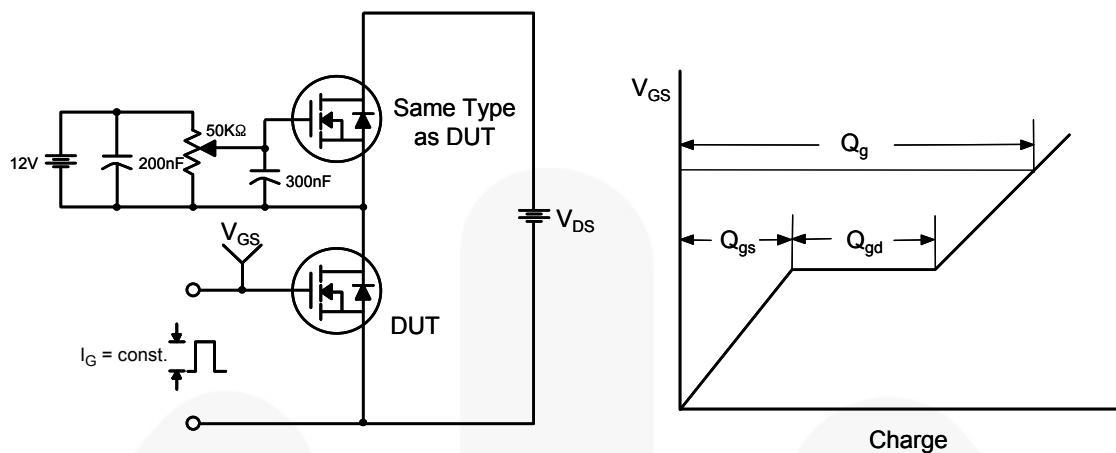


Figure 12. Gate Charge Test Circuit & Waveform

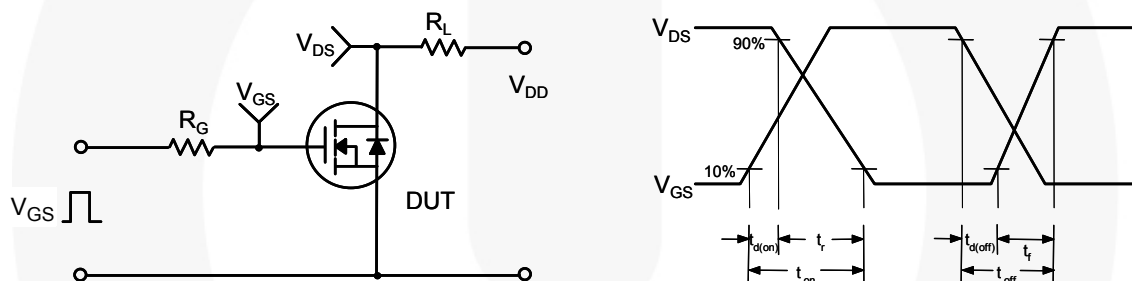


Figure 13. Resistive Switching Test Circuit & Waveforms

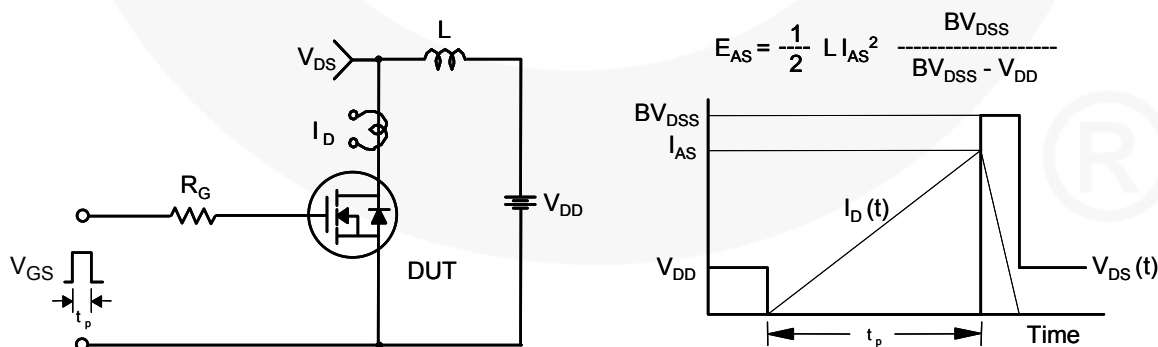
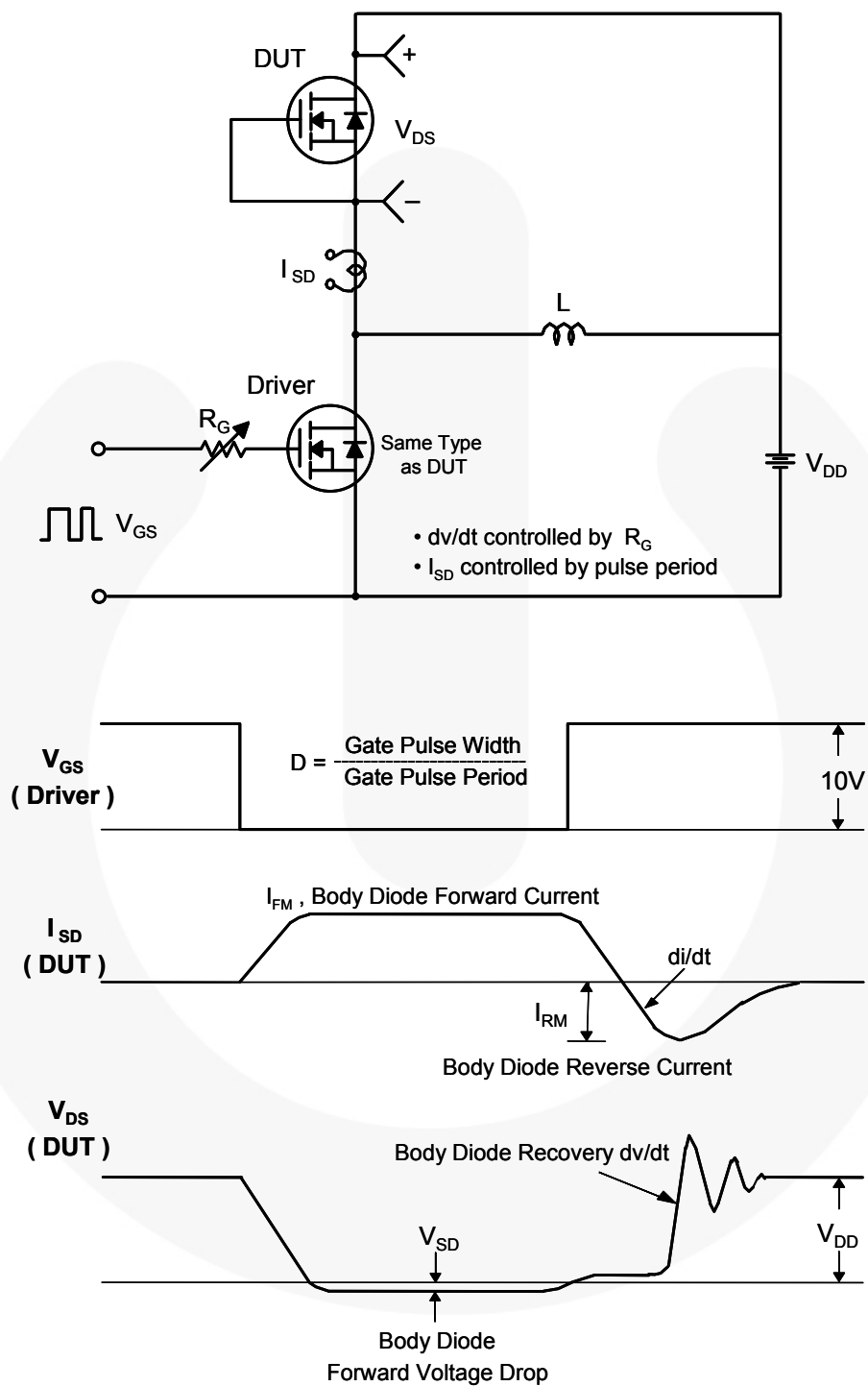
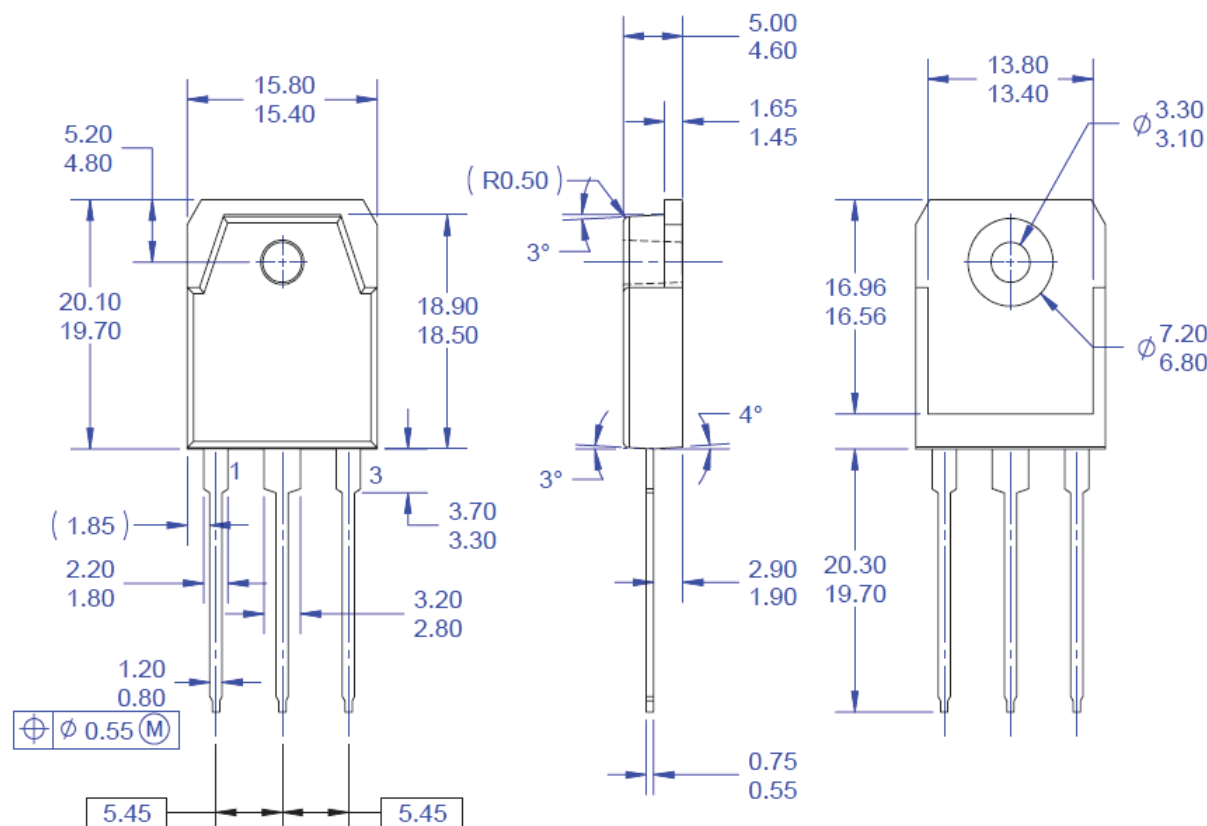


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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

Mechanical Dimensions



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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5
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- E) THIS PACKAGE IS INTENDED ONLY FOR TO3PN.
- F) DRAWING FILE NAME: TO3P03AREV4.

Figure 16. TO3, 3-Lead, Plastic, EIAJ SC-65

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