FAIRCHILD SEMICONDUCTOR™

September 2000

QFET™

# FQP6N80

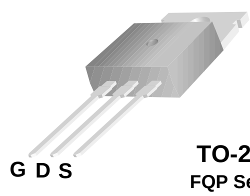
## 800V N-Channel MOSFET

### General Description

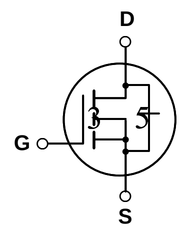
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply.

### Features

- 5.8A, 800V, $R_{DS(on)}$ = 1.95Ω @$V_{GS}$ = 10 V
- Low gate charge ( typical 31 nC)
- Low Crss ( typical 14 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability




**TO-220**
**FQP Series**




## Absolute Maximum Ratings

$T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | | FQP6N80 | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 800 | V |
| $I_D$ | Drain Current - Continuous ($T_C$ = 25°C) | | 5.8 | A |
| | - Continuous ($T_C$ = 100°C) | | 3.67 | A |
| $I_{DM}$ | Drain Current - Pulsed | (Note 1) | 23.2 | A |
| $V_{GSS}$ | Gate-Source Voltage | | ± 30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 680 | mJ |
| $I_{AR}$ | Avalanche Current | (Note 1) | 5.8 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | (Note 1) | 15.8 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 4.0 | V/ns |
| $P_D$ | Power Dissipation ($T_C$ = 25°C) | | 158 | W |
| | - Derate above 25°C | | 1.27 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | Typ | Max | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | -- | 0.79 | °C/W |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink | 0.5 | -- | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 62.5 | °C/W |

## Electrical Characteristics

$T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 800 | -- | -- | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | -- | 0.9 | -- | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 800 V, $V_{GS}$ = 0 V | -- | -- | 10 | µA |
| | | $V_{DS}$ = 640 V, $T_C$ = 125°C | -- | -- | 100 | µA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = 30 V, $V_{DS}$ = 0 V | -- | -- | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = -30 V, $V_{DS}$ = 0 V | -- | -- | -100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 3.0 | -- | 5.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 2.9 A | -- | 1.5 | 1.95 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 50 V, $I_D$ = 2.9 A (Note 4) | -- | 5.9 | -- | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | -- | 1150 | 1500 | pF |
| $C_{oss}$ | Output Capacitance | | -- | 125 | 160 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 14 | 18 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 400 V, $I_D$ = 5.8 A, $R_G$ = 25 Ω (Note 4, 5) | -- | 30 | 70 | ns |
| $t_r$ | Turn-On Rise Time | | -- | 70 | 150 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 65 | 140 | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 45 | 100 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 640 V, $I_D$ = 5.8 A, $V_{GS}$ = 10 V (Note 4, 5) | -- | 31 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 7.1 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 15 | -- | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 5.8 | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 23.2 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 5.8 A | -- | -- | 1.4 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_S$ = 5.8 A, $dI_F$ / dt = 100 A/µs (Note 4) | -- | 650 | -- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 5.7 | -- | µC |

**Notes:**
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 38mH, $I_{AS}$ = 5.8A, $V_{DD}$ = 50V, $R_G$ = 25 Ω, Starting $T_J$ = 25°C
3. $I_{SD}$ ≤ 5.8A, di/dt ≤ 200A/µs, $V_{DD}$ ≤ $BV_{DSS,}$ Starting $T_J$ = 25°C
4. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

## Typical Characteristics

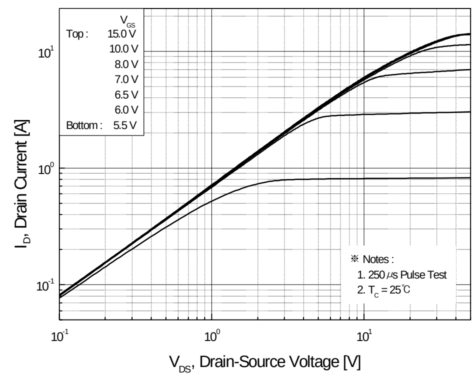



**Figure 1. On-Region Characteristics**

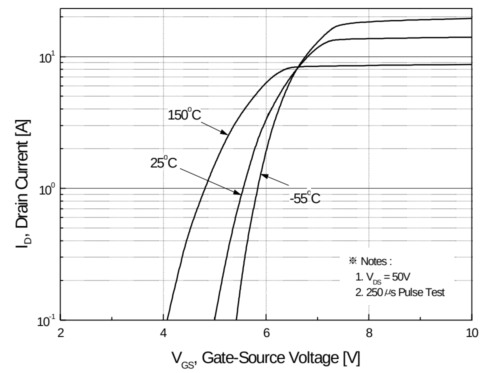



**Figure 2. Transfer Characteristics**

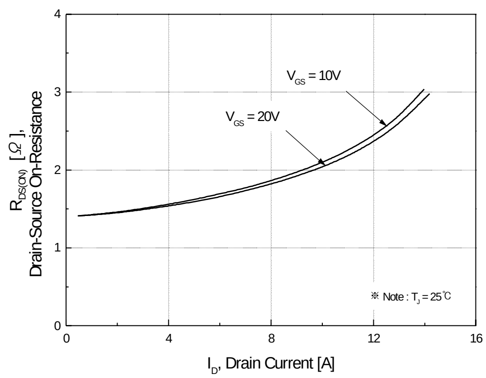



**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**

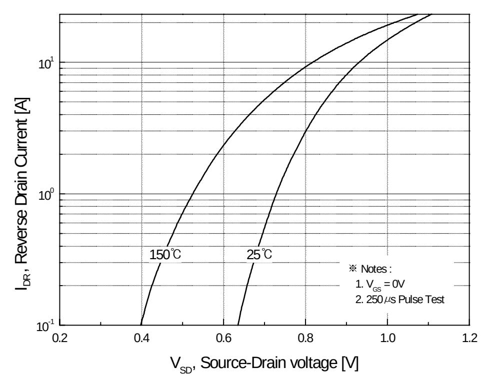



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

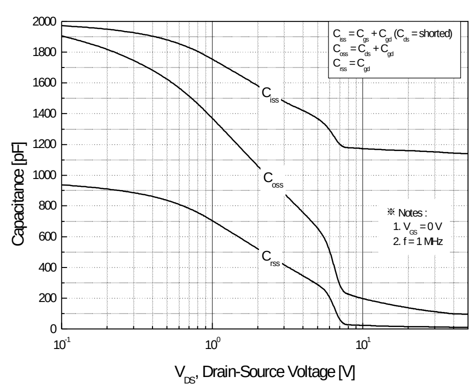



**Figure 5. Capacitance Characteristics**

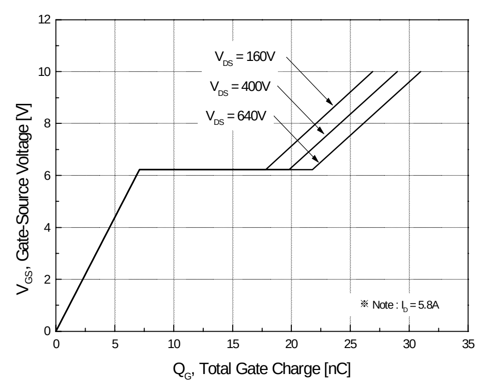



**Figure 6. Gate Charge Characteristics**

## Typical Characteristics (Continued)

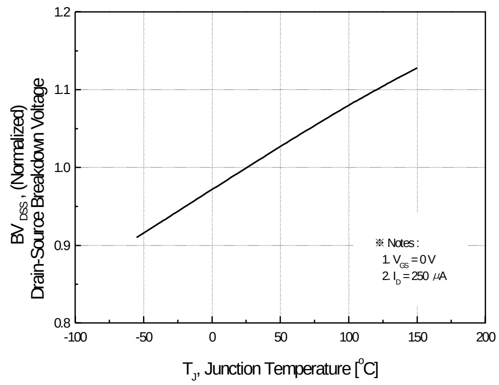



**Figure 7. Breakdown Voltage Variation vs Temperature**

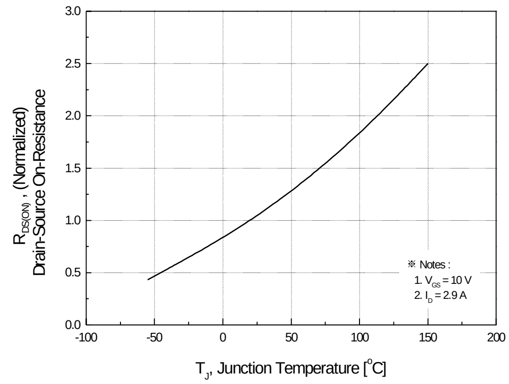



**Figure 8. On-Resistance Variation vs Temperature**

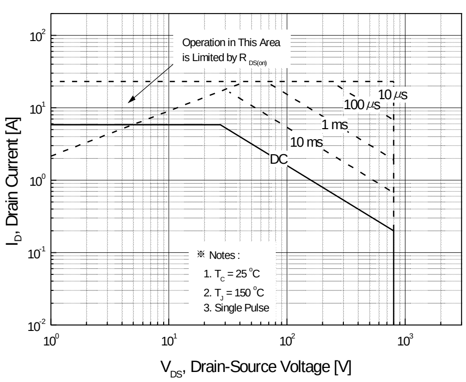



**Figure 9. Maximum Safe Operating Area**

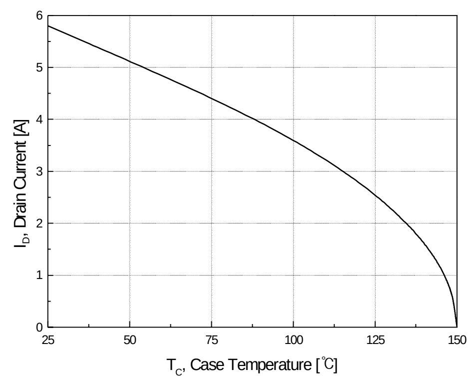



**Figure 10. Maximum Drain Current vs Case Temperature**

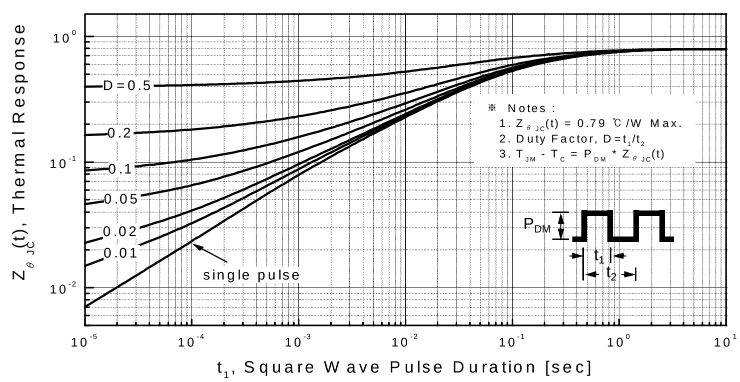
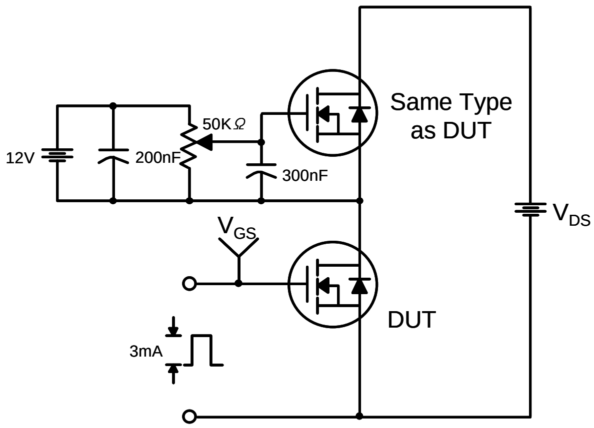
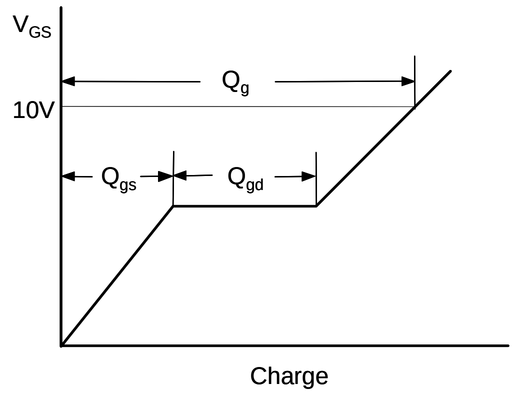


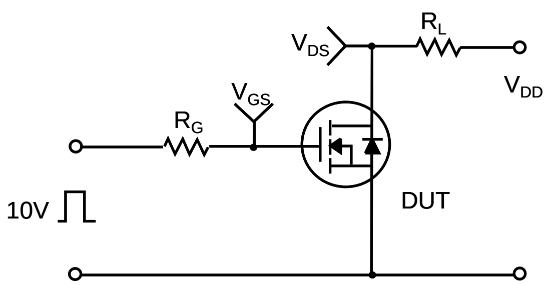

**Figure 11. Transient Thermal Response Curve**

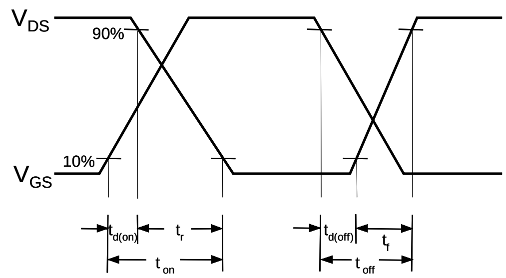
### Gate Charge Test Circuit & Waveform



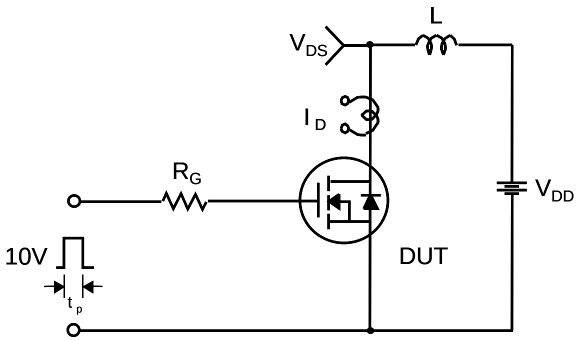




### Resistive Switching Test Circuit & Waveforms

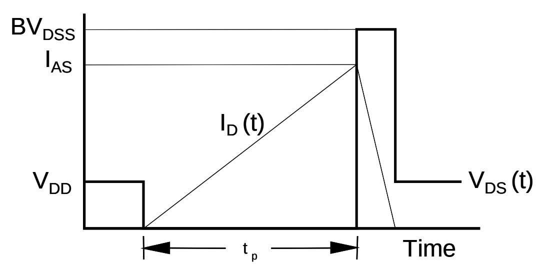


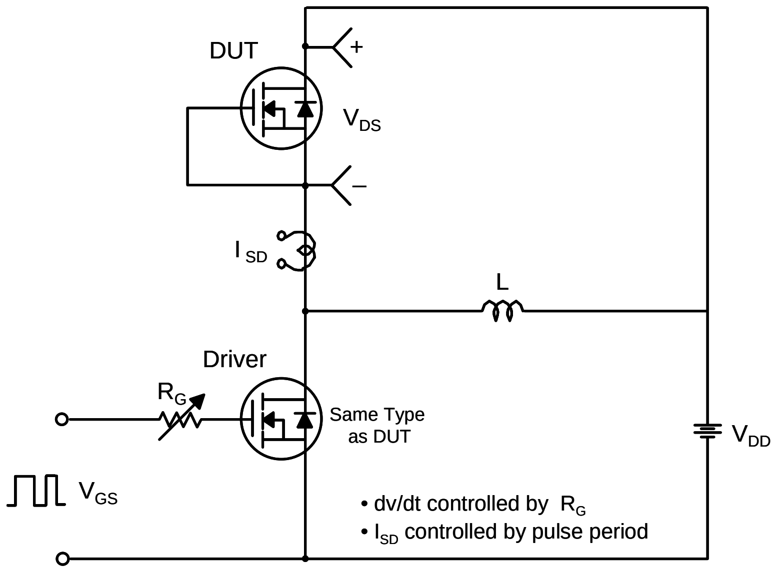

### Unclamped Inductive Switching Test Circuit & Waveforms

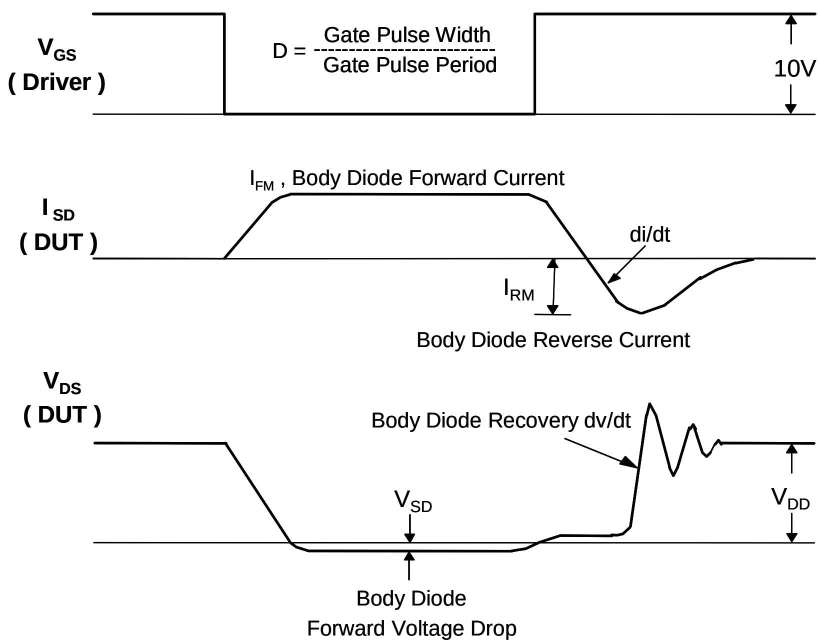



$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



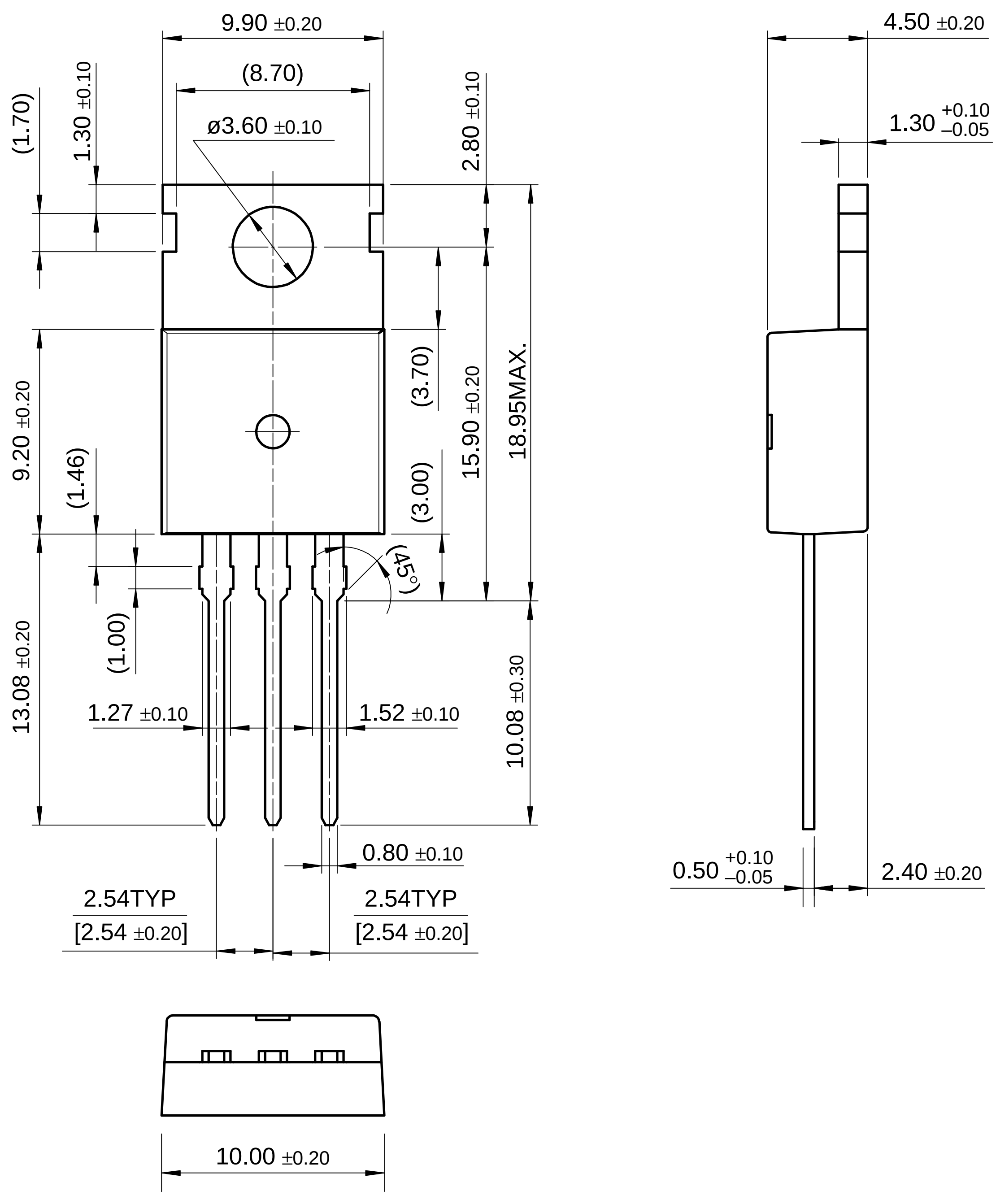
## Peak Diode Recovery dv/dt Test Circuit & Waveforms



## Package Dimensions

TO-220



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