

# FQA44N30

## 300V 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 switching DC/DC converters, switch mode power supply.

### Features

- 43.5A, 300V,  $R_{DS(on)} = 0.069\Omega$  @  $V_{GS} = 10$  V
- Low gate charge ( typical 120 nC)
- Low  $C_{rss}$  ( typical 75 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings

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

| Symbol         | Parameter   | FQA44N30    | Units               |
|----------------|---|-------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 300         | V                   |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )                       | 43.5        | A                   |
|                | - Continuous ( $T_C = 100^\circ\text{C}$ )                                    | 27.5        | A                   |
| $I_{DM}$       | Drain Current - Pulsed  | (Note 1)    | A                   |
| $V_{GSS}$      | Gate-Source Voltage   | $\pm 30$    | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy  | (Note 2)    | mJ                  |
| $I_{AR}$       | Avalanche Current   | (Note 1)    | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy   | (Note 1)    | mJ                  |
| $dv/dt$        | Peak Diode Recovery $dv/dt$   | (Note 3)    | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                                | 310         | W                   |
|                | - Derate above $25^\circ\text{C}$   | 2.5         | 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 purposes, 1/8" from case for 5 seconds | 300         | $^\circ\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                               | Typ  | Max | Units                     |
|-----------------|---|------|-----|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | --   | 0.4 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink        | 0.24 | --  | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | --   | 40  | $^\circ\text{C}/\text{W}$ |

## Electrical Characteristics

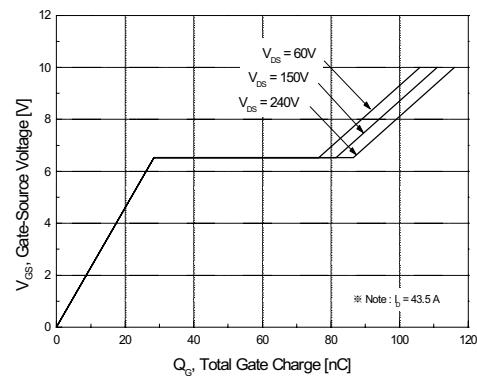
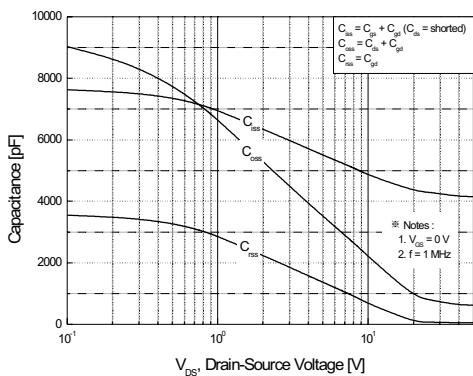
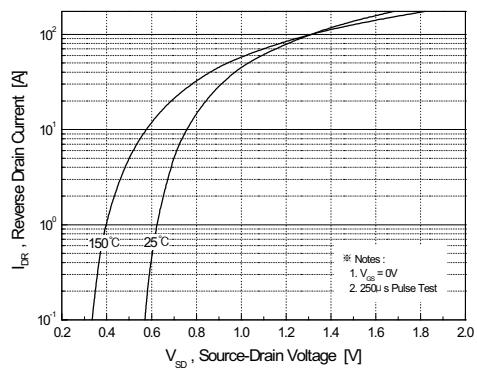
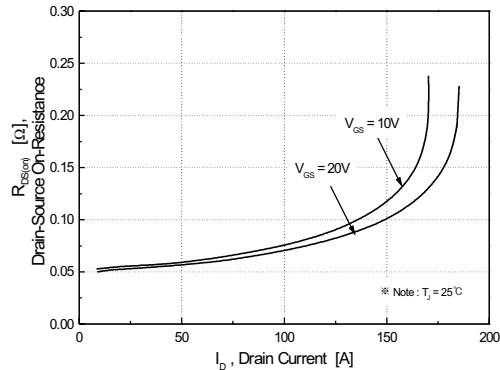
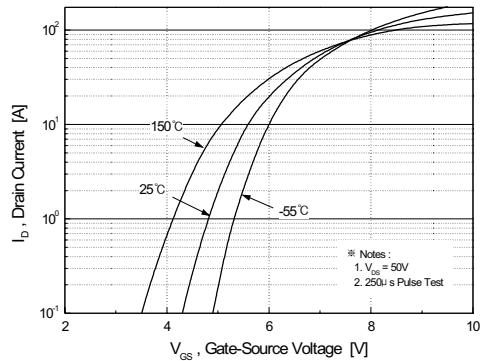
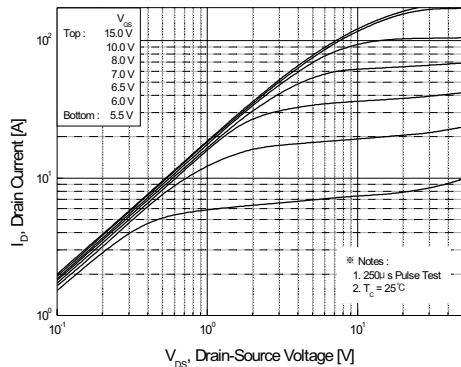
$T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol  | Parameter   | Test Conditions   | Min | Typ   | Max   | Units                     |
|---|---|---|-----|-------|-------|---------------------------|
| <b>Off Characteristics</b>                                    |   |   |     |       |       |                           |
| $BV_{DSS}$  | Drain-Source Breakdown Voltage                        | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$  | 300 | --    | --    | V                         |
| $\Delta BV_{DSS} / \Delta T_J$                                | Breakdown Voltage Temperature Coefficient             | $I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$                                    | --  | 0.32  | --    | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$   | Zero Gate Voltage Drain Current                       | $V_{DS} = 300 \text{ V}$ , $V_{GS} = 0 \text{ V}$   | --  | --    | 1     | $\mu\text{A}$             |
|   |   | $V_{DS} = 240 \text{ V}$ , $T_C = 125^\circ\text{C}$  | --  | --    | 10    | $\mu\text{A}$             |
| $I_{GSSF}$  | 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                        |
| <b>On Characteristics</b>                                     |   |   |     |       |       |                           |
| $V_{GS(\text{th})}$   | Gate Threshold Voltage                                | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$   | 3.0 | --    | 5.0   | V                         |
| $R_{DS(\text{on})}$   | Static Drain-Source On-Resistance                     | $V_{GS} = 10 \text{ V}$ , $I_D = 21.75 \text{ A}$   | --  | 0.055 | 0.069 | $\Omega$                  |
| $g_{FS}$  | Forward Transconductance                              | $V_{DS} = 50 \text{ V}$ , $I_D = 21.75 \text{ A}$ (Note 4)                                    | --  | 30    | --    | S                         |
| <b>Dynamic Characteristics</b>                                |   |   |     |       |       |                           |
| $C_{iss}$   | Input Capacitance                                     | $V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ ,<br>$f = 1.0 \text{ MHz}$                   | --  | 4300  | 5600  | pF                        |
| $C_{oss}$   | Output Capacitance                                    |   | --  | 810   | 1050  | pF                        |
| $C_{rss}$   | Reverse Transfer Capacitance                          |   | --  | 75    | 95    | pF                        |
| <b>Switching Characteristics</b>                              |   |   |     |       |       |                           |
| $t_{d(on)}$   | Turn-On Delay Time                                    | $V_{DD} = 150 \text{ V}$ , $I_D = 43.5 \text{ A}$ ,<br>$R_G = 25 \Omega$<br>(Note 4, 5)       | --  | 85    | 180   | ns                        |
| $t_r$   | Turn-On Rise Time                                     |   | --  | 470   | 950   | ns                        |
| $t_{d(off)}$  | Turn-Off Delay Time                                   |   | --  | 240   | 490   | ns                        |
| $t_f$   | Turn-Off Fall Time                                    |   | --  | 230   | 470   | ns                        |
| $Q_g$   | Total Gate Charge                                     | $V_{DS} = 240 \text{ V}$ , $I_D = 43.5 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$<br>(Note 4, 5) | --  | 120   | 150   | nC                        |
| $Q_{gs}$  | Gate-Source Charge                                    |   | --  | 29    | --    | nC                        |
| $Q_{gd}$  | Gate-Drain Charge                                     |   | --  | 58    | --    | nC                        |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |   |     |       |       |                           |
| $I_S$   | Maximum Continuous Drain-Source Diode Forward Current | --  | --  | 43.5  | --    | A                         |
| $I_{SM}$  | Maximum Pulsed Drain-Source Diode Forward Current     | --  | --  | 174   | --    | A                         |
| $V_{SD}$  | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0 \text{ V}$ , $I_S = 43.5 \text{ A}$   | --  | --    | 1.5   | V                         |
| $t_{rr}$  | Reverse Recovery Time                                 | $V_{GS} = 0 \text{ V}$ , $I_S = 43.5 \text{ A}$ ,<br>$dI_F / dt = 100 \text{ A}/\mu\text{s}$  | --  | 320   | --    | ns                        |
| $Q_{rr}$  | Reverse Recovery Charge                               |   | --  | 3.26  | --    | $\mu\text{C}$             |

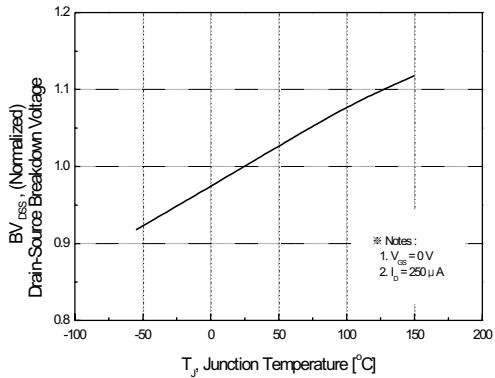
**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 1.5\text{mH}$ ,  $I_{AS} = 43.5\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25 \Omega$ . Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 43.5\text{A}$ ,  $dI/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ . Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

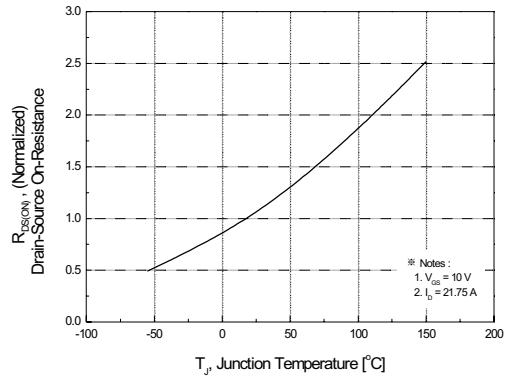
## Typical Characteristics



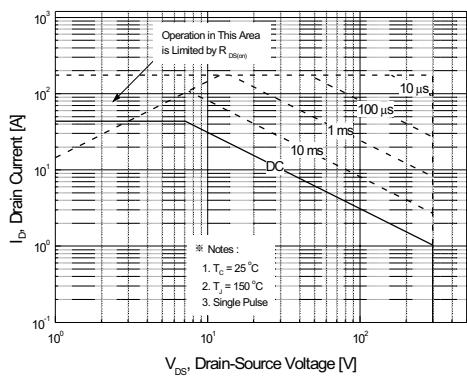
## Typical Characteristics (Continued)



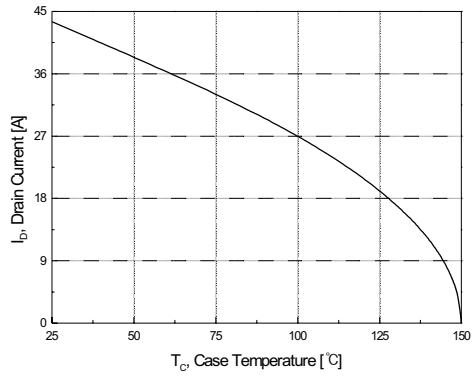
**Figure 7. Breakdown Voltage Variation vs. Temperature**



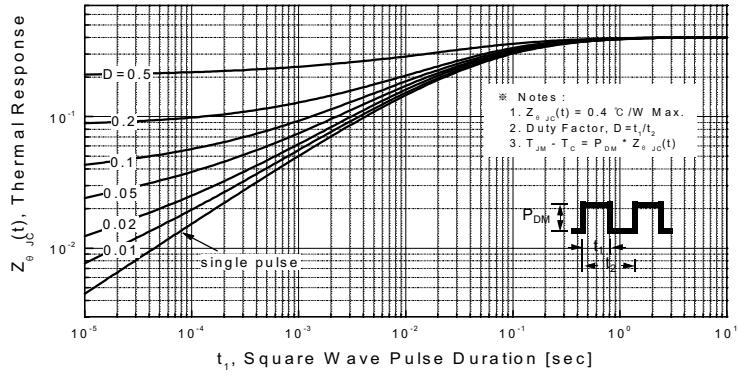
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

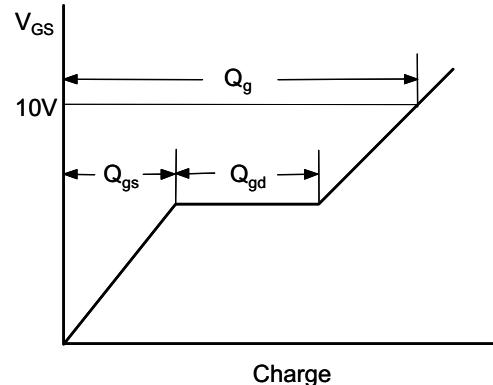
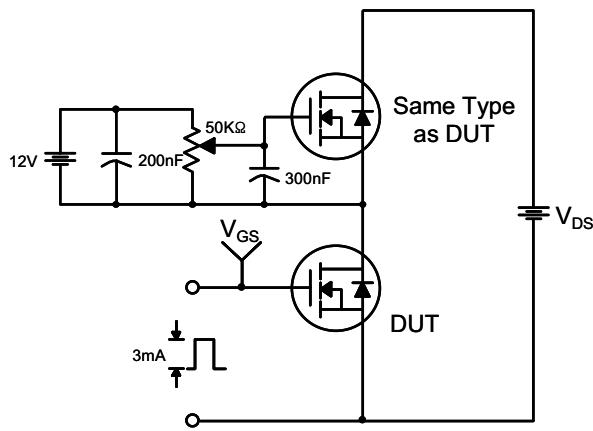


**Figure 10. Maximum Drain Current vs. Case Temperature**

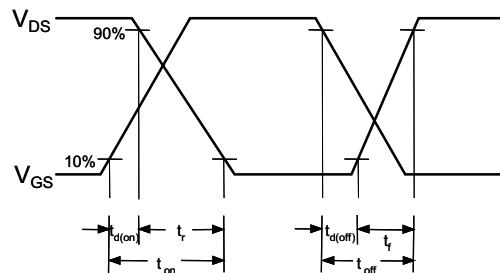
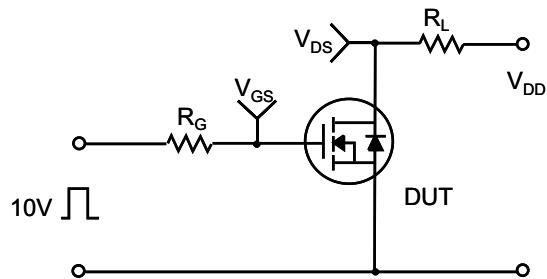


**Figure 11. Transient Thermal Response Curve**

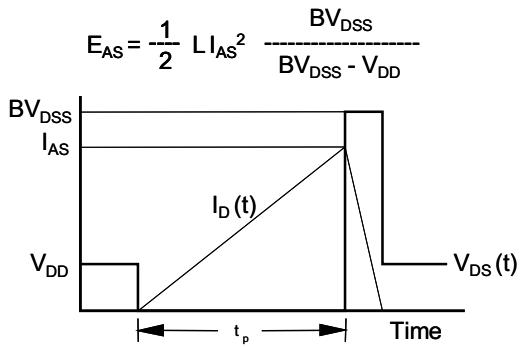
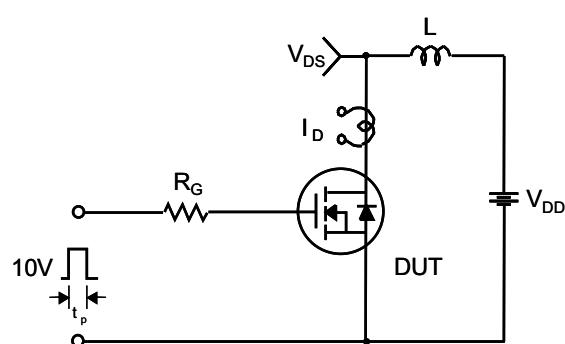
## Gate Charge Test Circuit &amp; Waveform



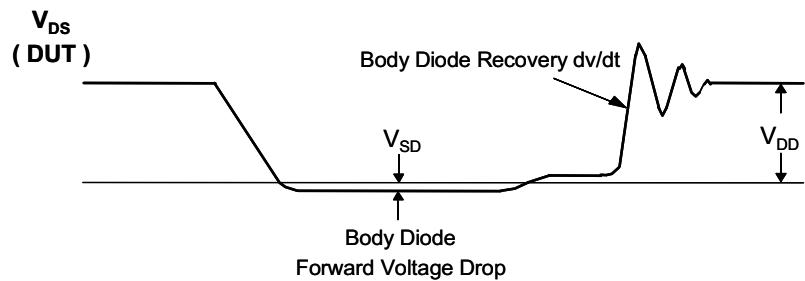
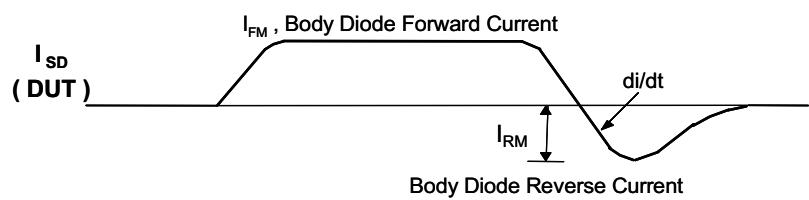
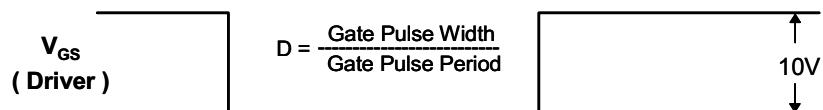
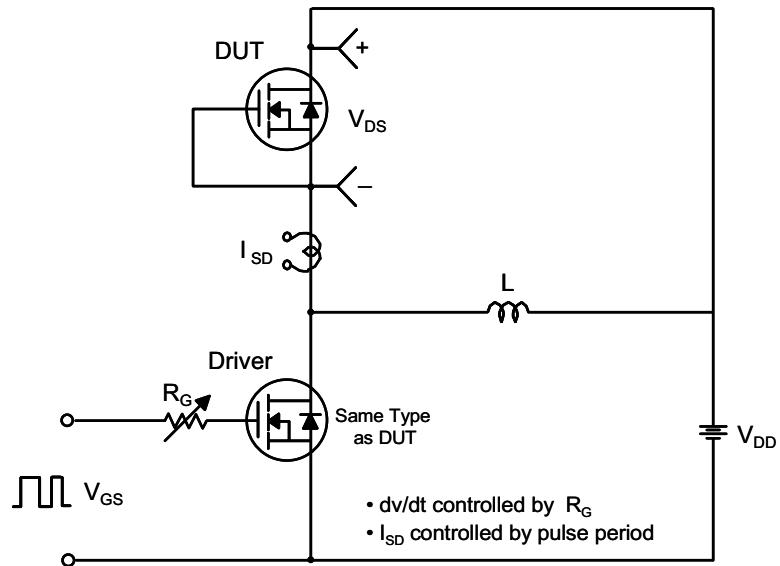
## Resistive Switching Test Circuit &amp; Waveforms



## Unclamped Inductive Switching Test Circuit &amp; Waveforms

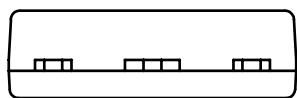
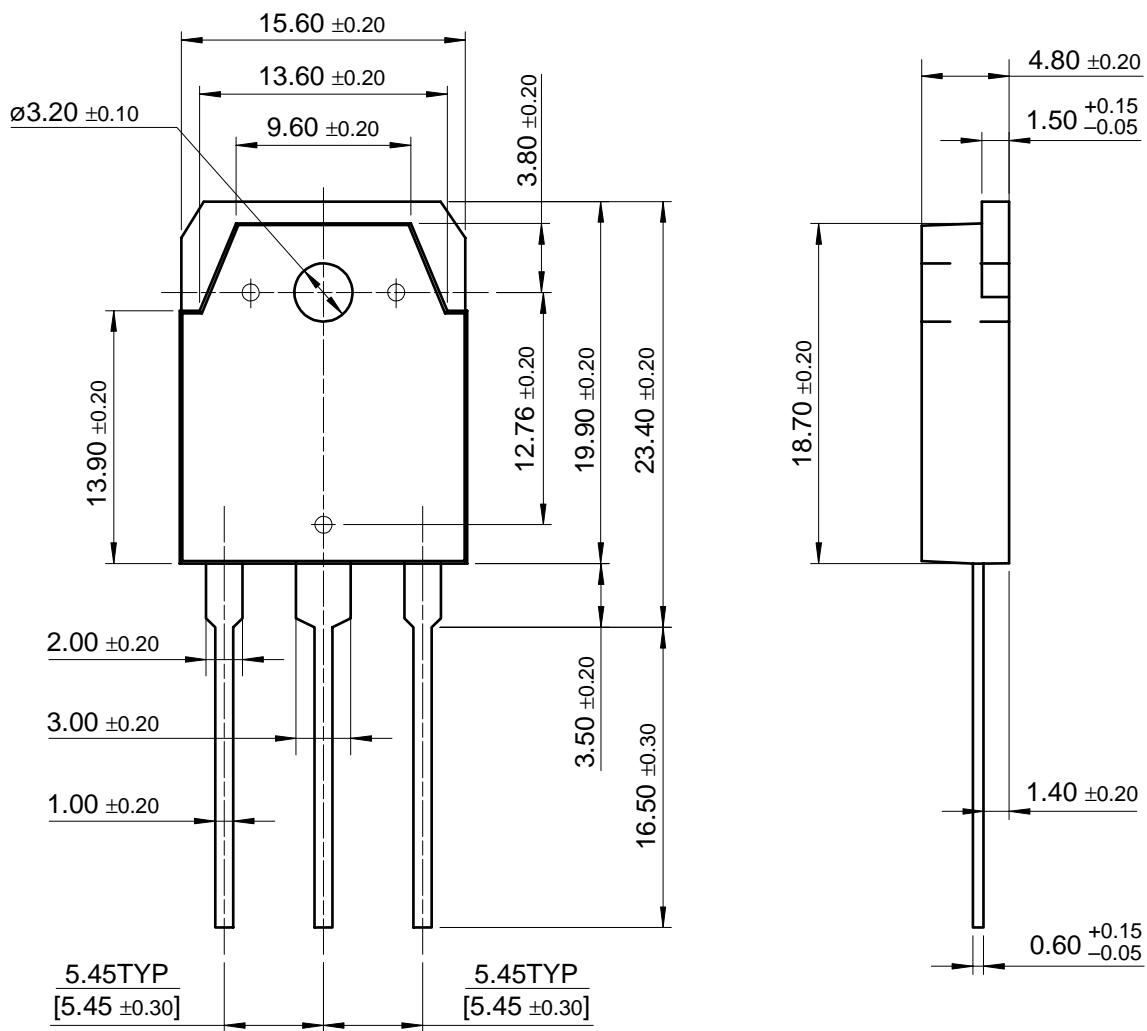


## Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms



## Package Dimensions

TO-3P



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