

# FQP45N15V2/FQPF45N15V2

## 150V N-Channel MOSFET

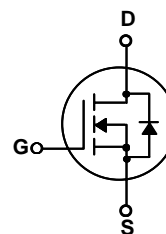
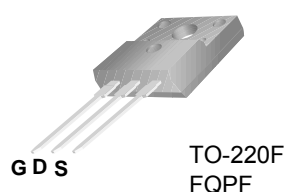
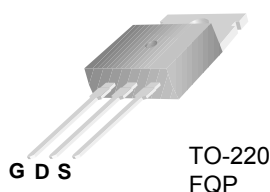
### General Description

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 DC to DC converters, synchronous rectification, and other applications lowest Rds(on) is required.

### Features

- 45A, 150V,  $R_{DS(on)} = 0.04\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 72 nC)
- Low Crss ( typical 135 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

| Symbol                            | Parameter   | FQP45N15V2  | FQPF45N15V2 | Units |
|-----------------------------------|---|-------------|-------------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage  | 150         |             | V     |
| I <sub>D</sub>                    | Drain Current - Continuous (T <sub>C</sub> = 25°C)<br>- Continuous (T <sub>C</sub> = 100°C) | 45          | 45 *        | A     |
|                                   |   | 31          | 31 *        | A     |
| I <sub>DM</sub>                   | Drain Current - Pulsed (Note 1)   | 180         | 180 *       | A     |
| V <sub>GSS</sub>                  | Gate-Source Voltage   | ± 30        |             | V     |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)   | 1124        |             | mJ    |
| I <sub>AR</sub>                   | Avalanche Current (Note 1)  | 45          |             | A     |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)  | 22          |             | mJ    |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)  | 4.5         |             | V/ns  |
| P <sub>D</sub>                    | Power Dissipation (T <sub>C</sub> = 25°C)<br>- Derate above 25°C                            | 220         | 66          | W     |
|                                   |   | 1.47        | 0.44        | W/°C  |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range   | -55 to +150 |             | °C    |
| T <sub>L</sub>                    | Maximum lead temperature for soldering purposes,<br>1/8" from case for 5 seconds            | 300         |             | °C    |

\* Drain current limited by maximum junction temperature

### Thermal Characteristics

| Symbol           | Parameter                               | FQP45N15V2 | FQPF45N15V2 | Units |
|------------------|---|------------|-------------|-------|
| R <sub>θJC</sub> | Thermal Resistance, Junction-to-Case    | 0.68       | 2.25        | °C/W  |
| R <sub>θCS</sub> | Thermal Resistance, Case-to-Sink Typ.   | 0.5        | --          | °C/W  |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | 62.5       | 62.5        | °C/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            | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$               | 150 | --   | --   | V                         |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | 0.21 | --   | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 150\text{ V}, V_{GS} = 0\text{ V}$                | --  | --   | 1    | $\mu\text{A}$             |
|                                |   | $V_{DS} = 120\text{ V}, T_C = 150^\circ\text{C}$            | --  | --   | 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                        |

### On Characteristics

|              |                                   |  |     |       |      |          |
|--------------|-----------------------------------|--|-----|-------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$            | 2.0 | --    | 4.0  | V        |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}$          | --  | 0.034 | 0.04 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = 40\text{ V}, I_D = 22.5\text{ A}$ (Note 4) | --  | 40    | --   | S        |

### Dynamic Characteristics

|           |                              |  |    |      |      |    |
|-----------|------------------------------|--|----|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 2330 | 3030 | pF |
| $C_{oss}$ | Output Capacitance           |  | -- | 510  | 670  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |  | -- | 135  | 176  | pF |

### Switching Characteristics

|              |                     |   |             |     |     |     |
|--------------|---------------------|---|-------------|-----|-----|-----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 75\text{ V}, I_D = 45\text{ A},$<br>$R_G = 25\ \Omega$      | --          | 22  | 54  | ns  |
| $t_r$        | Turn-On Rise Time   |   | --          | 232 | 474 | ns  |
| $t_{d(off)}$ | Turn-Off Delay Time |   | --          | 224 | 458 | ns  |
| $t_f$        | Turn-Off Fall Time  |   | (Note 4, 5) | --  | 246 | 502 |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 120\text{ V}, I_D = 45\text{ A},$<br>$V_{GS} = 10\text{ V}$ | --          | 72  | 94  | nC  |
| $Q_{gs}$     | Gate-Source Charge  |   | --          | 13  | --  | nC  |
| $Q_{gd}$     | Gate-Drain Charge   |   | (Note 4, 5) | --  | 31  | --  |

### Drain-Source Diode Characteristics and Maximum Ratings

|          |   |   |    |      |     |               |
|----------|---|---|----|------|-----|---------------|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current | --  | -- | 45   | A   |               |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current     | --  | -- | 180  | A   |               |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 45\text{ A}$        | -- | --   | 1.4 | V             |
| $t_{rr}$ | Reverse Recovery Time                                 | $V_{GS} = 0\text{ V}, I_S = 45\text{ A},$       | -- | 176  | --  | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                               | $di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4) | -- | 1.19 | --  | $\mu\text{C}$ |

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 0.74\text{ mH}, I_{AS} = 45\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 45\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , 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

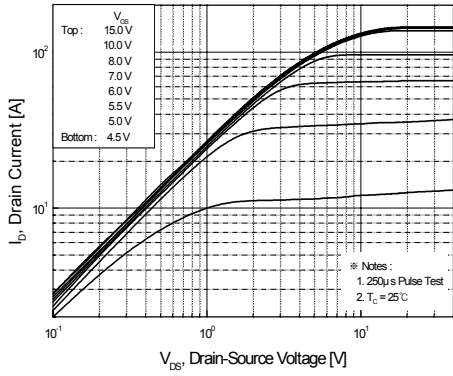


Figure 1. On-Region Characteristics

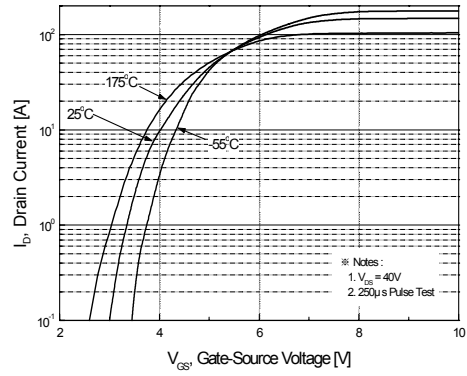


Figure 2. Transfer Characteristics

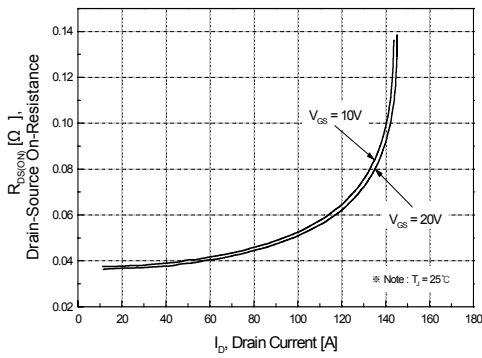


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

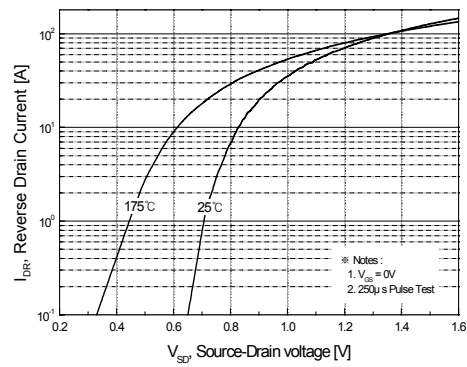


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

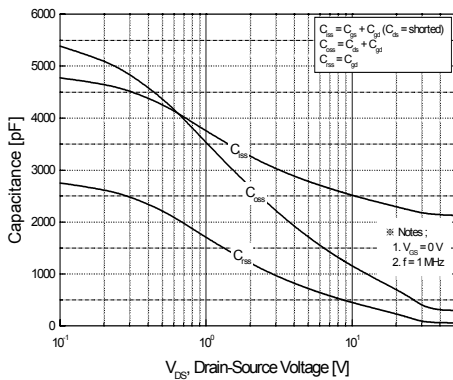


Figure 5. Capacitance Characteristics

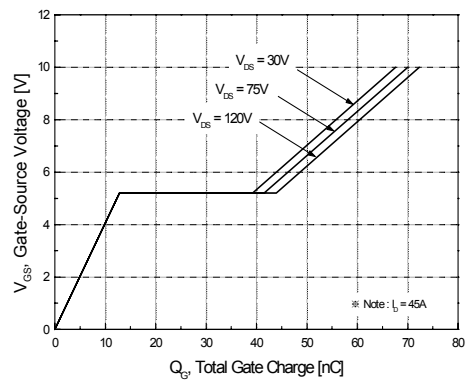
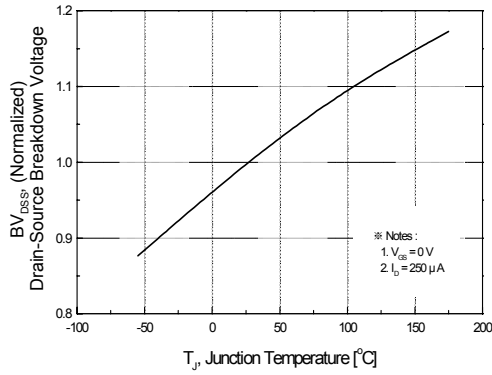
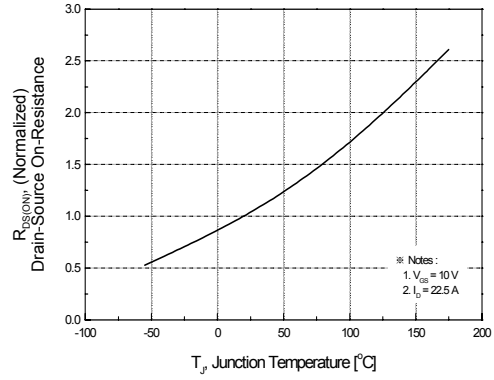


Figure 6. Gate Charge Characteristics

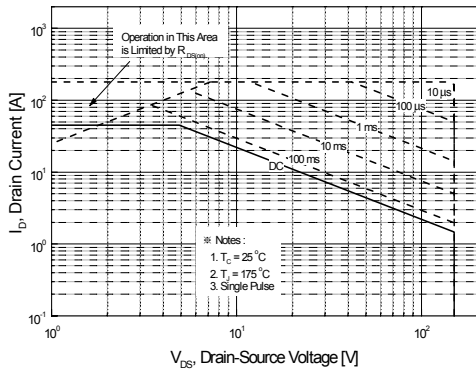
**Typical Characteristics** (Continued)



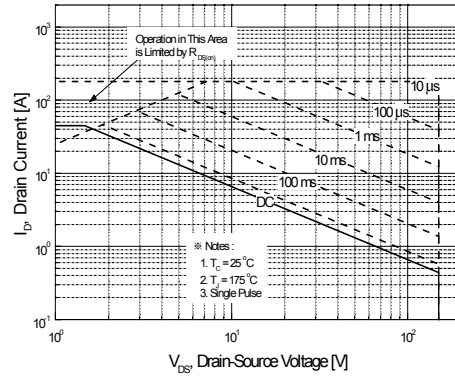
**Figure 7. Breakdown Voltage Variation vs Temperature**



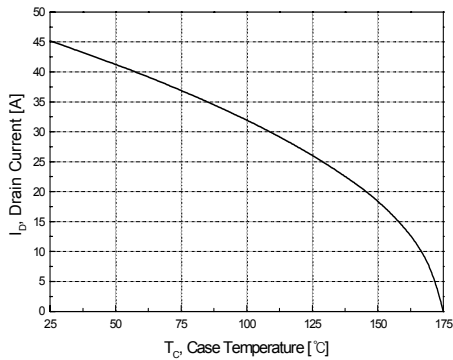
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP45N15V2**



**Figure 9-2. Maximum Safe Operating Area for FQP45N15V2**



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

Typical Characteristics (Continued)

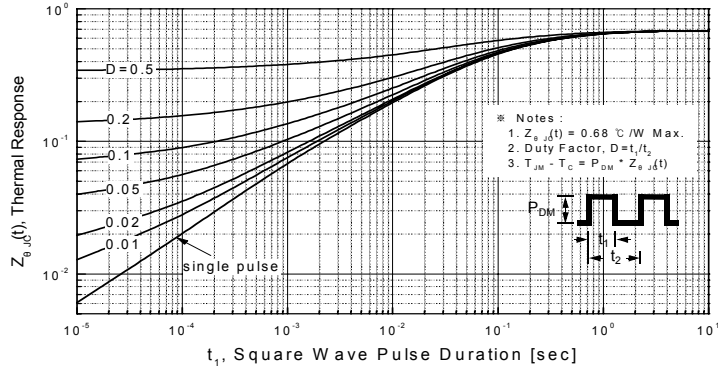


Figure 11. Transient Thermal Response Curve for FQP45N15V2

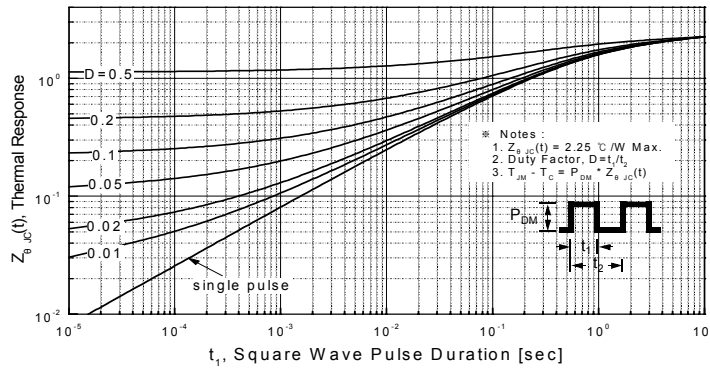
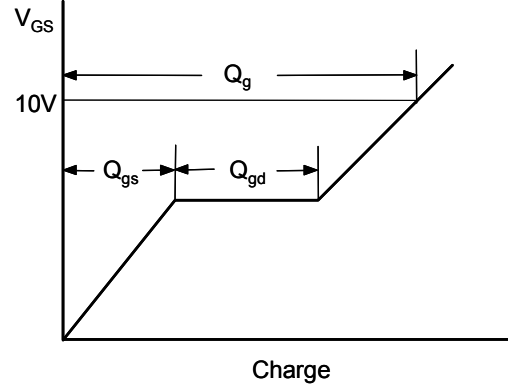
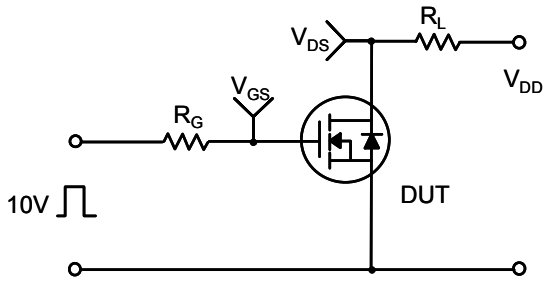


Figure 11-2. Transient Thermal Response Curve for FQPF45N15V2

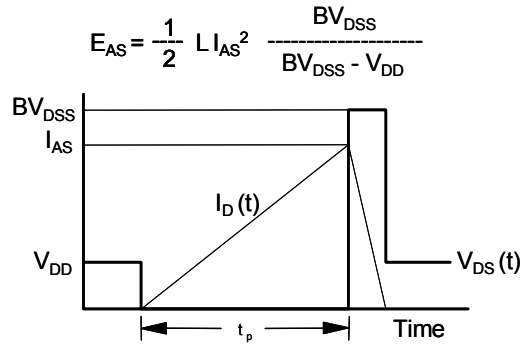
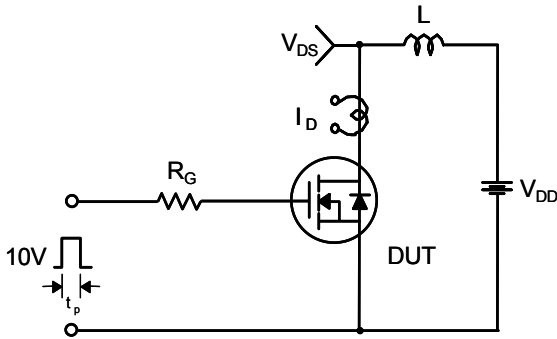
**Gate Charge Test Circuit & Waveform**



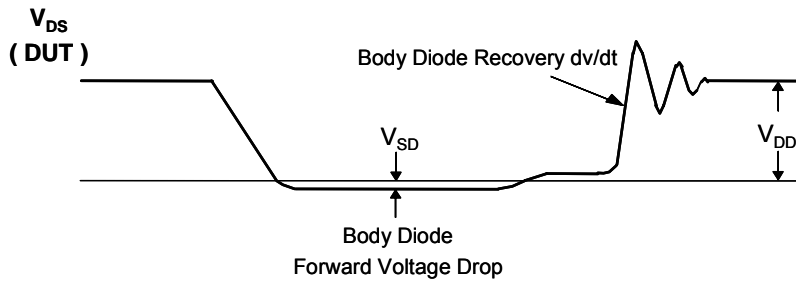
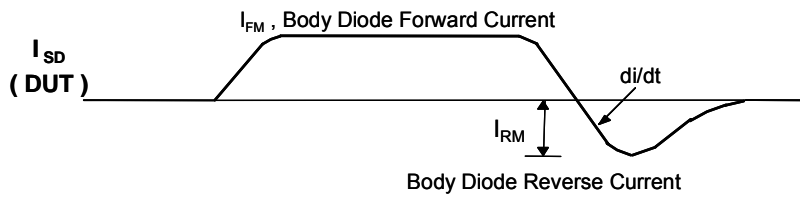
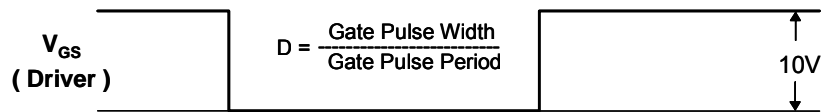
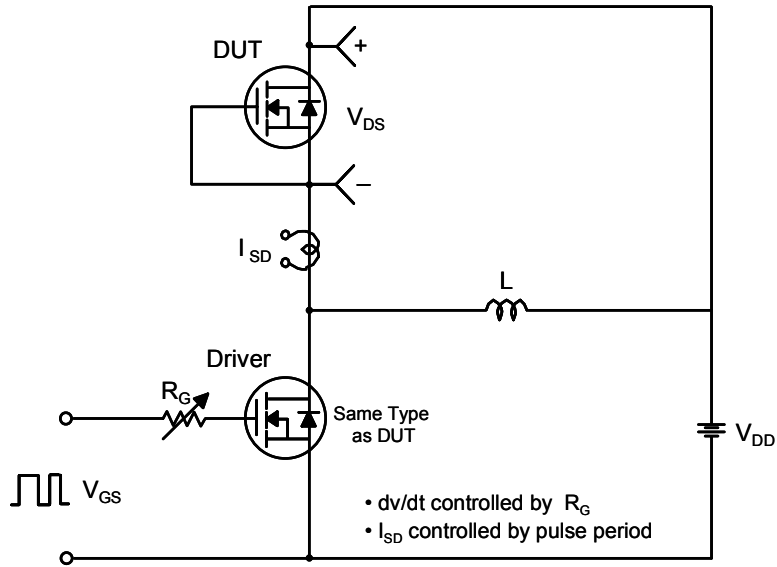
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

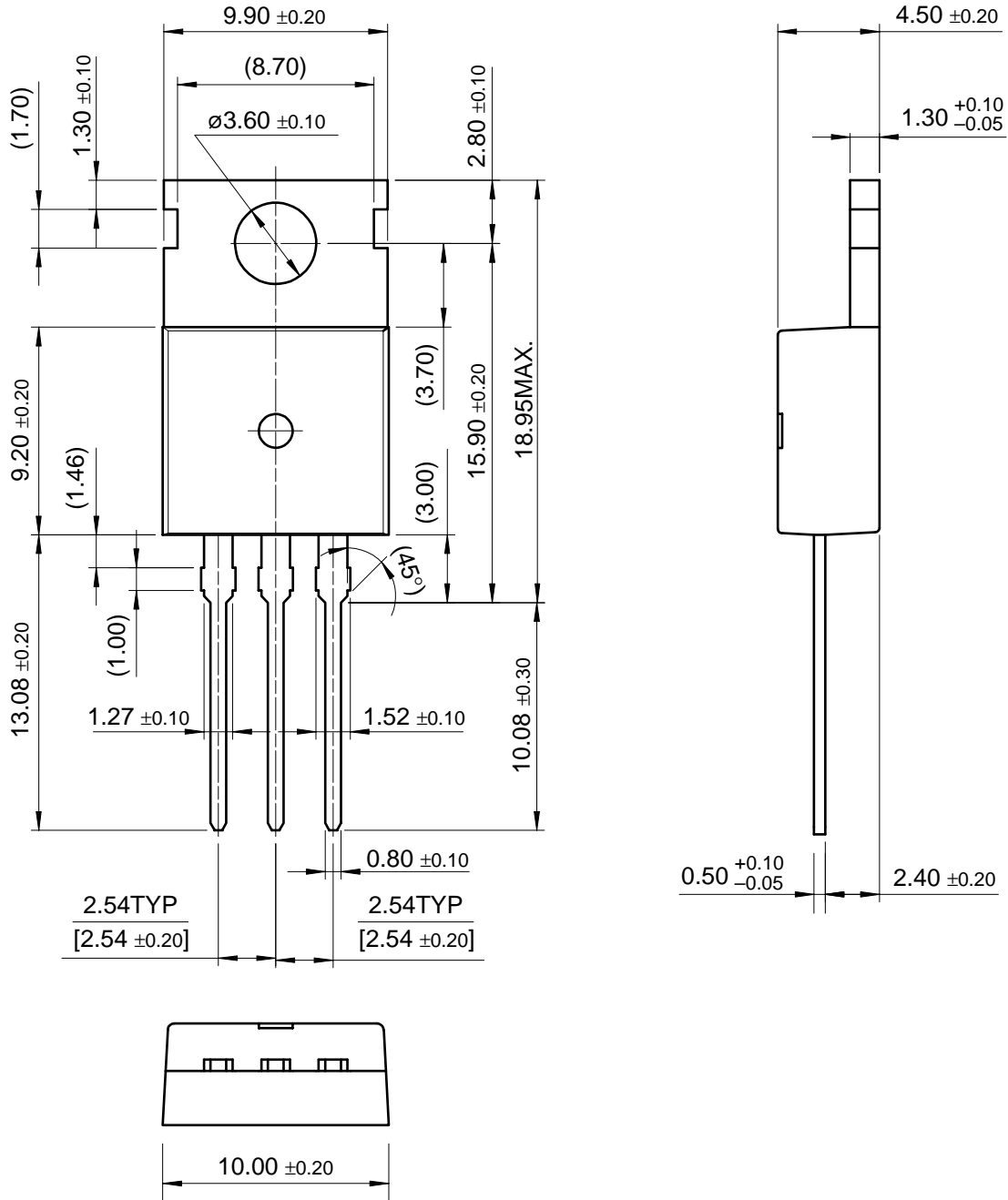


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-220



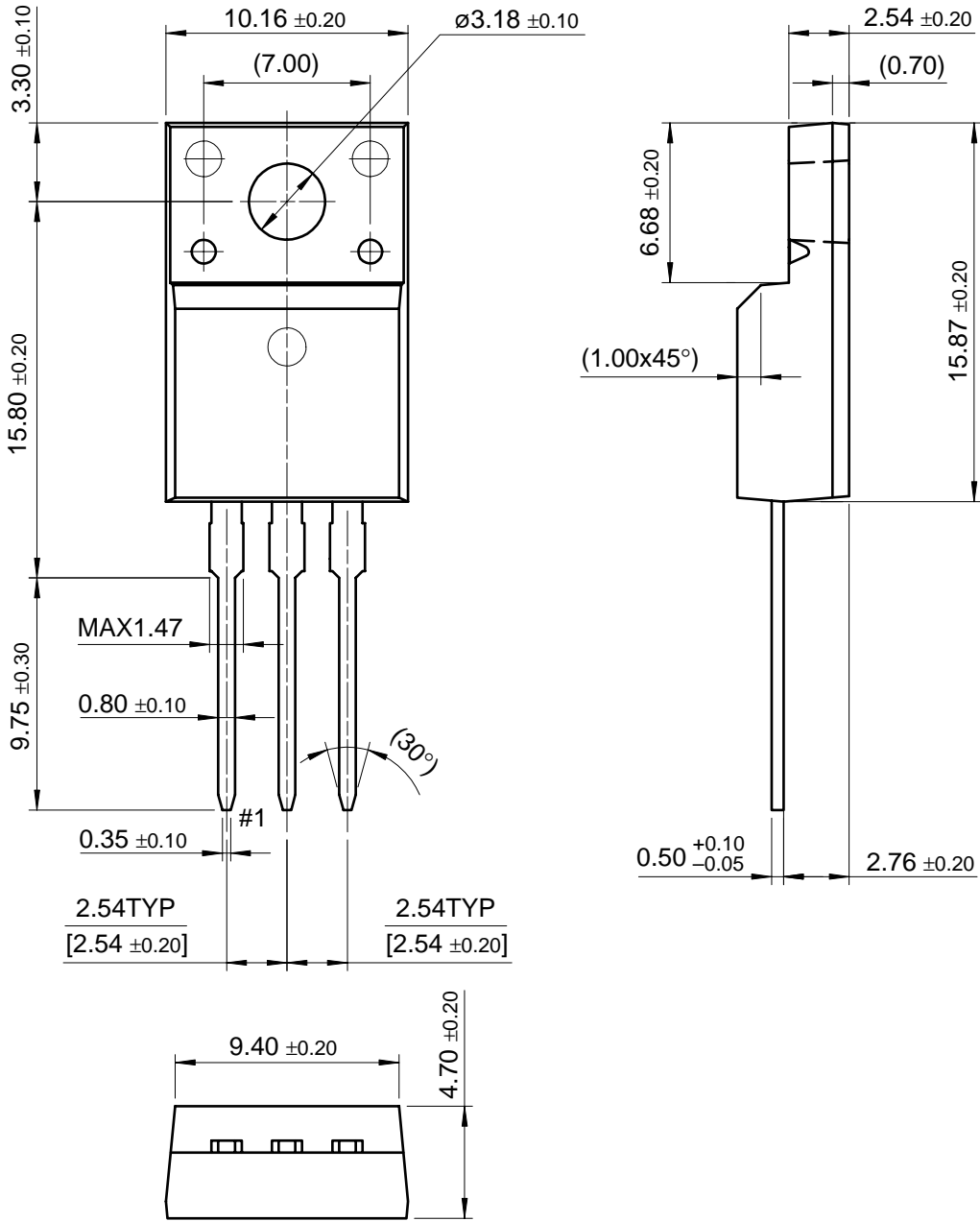
FQP45N15V2/FQP45N15V2

Dimensions in Millimeters



Package Dimensions (Continued)

TO-220F



FQP45N15V2/FQP45N15V2

Dimensions in Millimeters

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