



**QFET™**

# FQP3N80C/FQPF3N80C

800V N-Channel MOSFET

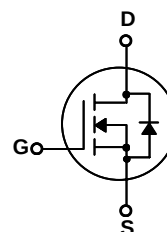
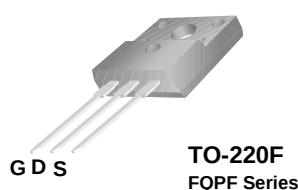
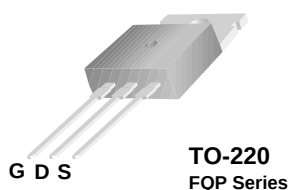
## General Description

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 supplies.

## Features

- 3.0A, 800V,  $R_{DS(on)} = 4.8\Omega$  @  $V_{GS} = 10V$
- Low gate charge ( typical 13 nC)
- Low  $C_{rss}$  ( typical 5.5 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



## Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter                                                                     | FQP3N80C    | FQPF3N80C | Units               |
|----------------|-------------------------------------------------------------------------------|-------------|-----------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage                                                          | 800         |           | V                   |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )                       | 3           | 3 *       | A                   |
|                | - Continuous ( $T_C = 100^\circ\text{C}$ )                                    | 1.9         | 1.9 *     | A                   |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)                                               | 12          | 12 *      | A                   |
| $V_{GSS}$      | Gate-Source Voltage                                                           | $\pm 30$    |           | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                       | 320         |           | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)                                                    | 3           |           | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)                                          | 10.7        |           | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)                                            | 4.5         |           | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                                | 107         | 39        | W                   |
|                | - Derate above $25^\circ\text{C}$                                             | 0.85        | 0.31      | 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         |           | $^\circ\text{C}$    |

\* Drain current limited by maximum junction temperature.

## Thermal Characteristics

| Symbol          | Parameter                               | FQP3N80C | FQPF3N80C | Units              |
|-----------------|-----------------------------------------|----------|-----------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 1.17     | 3.2       | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink Typ.   | 0.5      | --        | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5     | 62.5      | $^\circ\text{C/W}$ |

FQP3N80C/FQPF3N80C

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

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

**Off Characteristics**

|                                |                                           |                                                                   |     |    |      |                     |
|--------------------------------|-------------------------------------------|-------------------------------------------------------------------|-----|----|------|---------------------|
| $BV_{DSS}$                     | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$               | 800 | -- | --   | V                   |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | 1  | --   | V/ $^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$                      | --  | -- | 10   | $\mu\text{A}$       |
|                                |                                           | $V_{DS} = 640\text{ V}, T_C = 125^\circ\text{C}$                  | --  | -- | 100  | $\mu\text{A}$       |
| $I_{GSSF}$                     | 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            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$     | 3.0 | --  | 5.0 | V        |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}$          | --  | 4.0 | 4.8 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = 50\text{ V}, I_D = 1.5\text{ A}$ (Note 4) | --  | 3   | --  | S        |

**Dynamic Characteristics**

|           |                              |                                                                      |    |     |     |    |
|-----------|------------------------------|----------------------------------------------------------------------|----|-----|-----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 543 | 705 | pF |
| $C_{oss}$ | Output Capacitance           |                                                                      | -- | 54  | 70  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                      | -- | 5.5 | 7.5 | pF |

**Switching Characteristics**

|              |                     |                                                                                           |    |      |      |    |
|--------------|---------------------|-------------------------------------------------------------------------------------------|----|------|------|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 400\text{ V}, I_D = 3\text{ A},$<br>$R_G = 25\text{ }\Omega$<br><br>(Note 4, 5) | -- | 15   | 40   | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                           | -- | 43.5 | 95   | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                           | -- | 22.5 | 55   | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                           | -- | 32   | 75   | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 640\text{ V}, I_D = 3\text{ A},$<br>$V_{GS} = 10\text{ V}$<br><br>(Note 4, 5)   | -- | 13   | 16.5 | nC |
| $Q_{gs}$     | Gate-Source Charge  |                                                                                           | -- | 3.4  | --   | nC |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                                           | -- | 5.8  | --   | nC |

**Drain-Source Diode Characteristics and Maximum Ratings**

|                 |                                                       |                                                |    |     |     |    |
|-----------------|-------------------------------------------------------|------------------------------------------------|----|-----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current | --                                             | -- | 3.0 | A   |    |
| I <sub>SM</sub> | Maximum Pulsed Drain-Source Diode Forward Current     | --                                             | -- | 12  | A   |    |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 3.0 A  | -- | --  | 1.4 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 3.0 A, | -- | 642 | --  | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                               | dI <sub>F</sub> / dt = 100 A/μs (Note 4)       | -- | 4.0 | --  | μC |

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 67\text{ mH}, I_{AS} = 3.0\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 3\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , 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

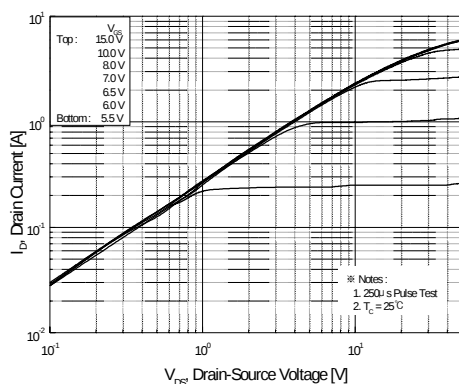


Figure 1. On-Region Characteristics

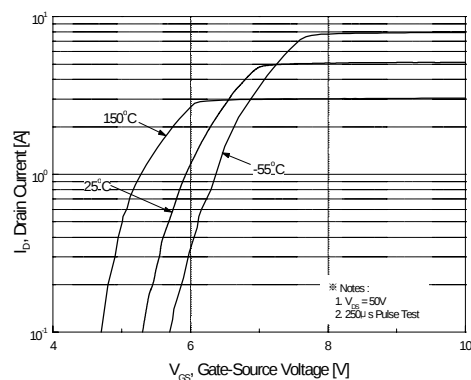


Figure 2. Transfer Characteristics

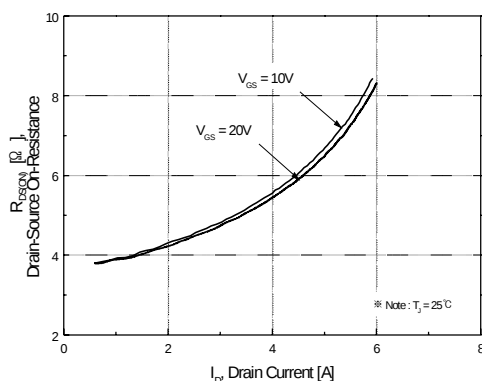


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

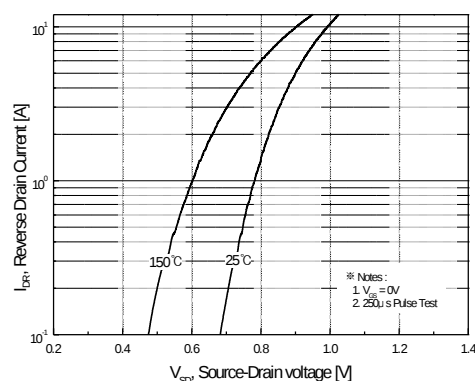


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

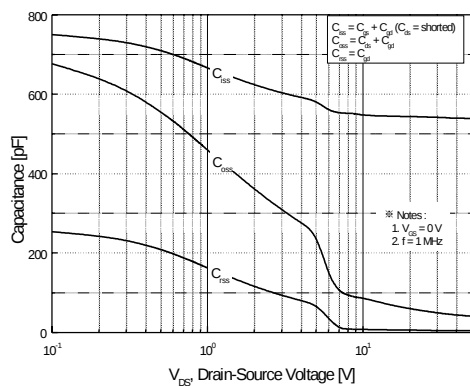


Figure 5. Capacitance Characteristics

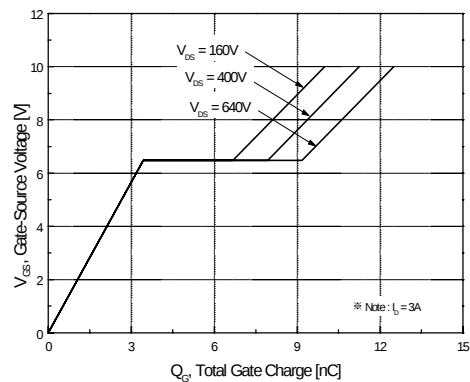


Figure 6. Gate Charge Characteristics

# Typical Characteristics (Continued)

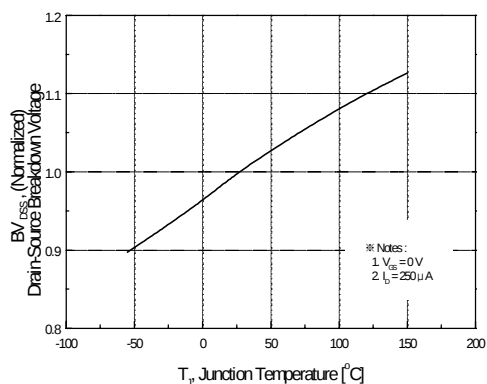


Figure 7. Breakdown Voltage Variation vs Temperature

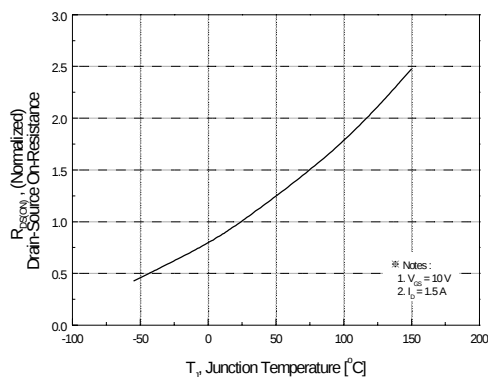


Figure 8. On-Resistance Variation vs Temperature

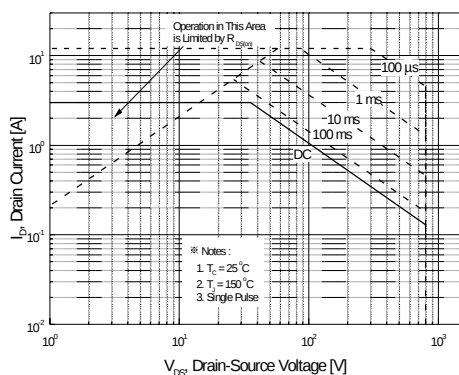


Figure 9-1. Maximum Safe Operating Area for FQP3N80C

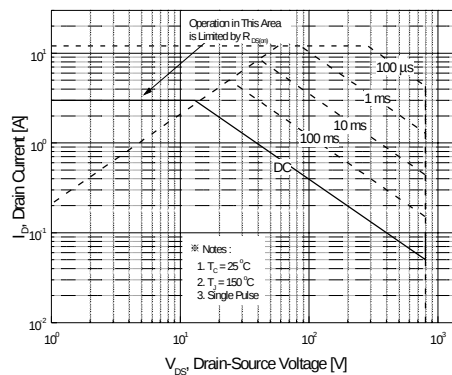


Figure 9-2. Maximum Safe Operating Area for FQPF3N80C

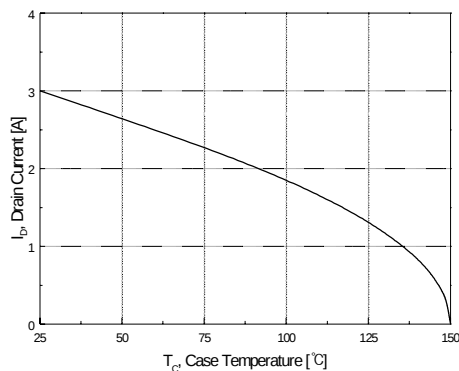


Figure 10. Maximum Drain Current vs Case Temperature

## Typical Characteristics (Continued)

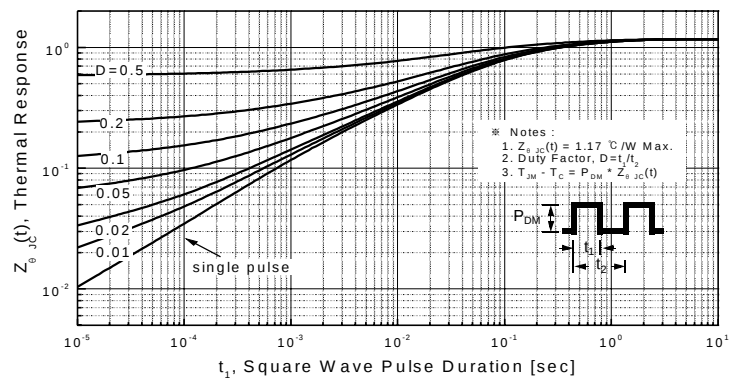


Figure 11-1. Transient Thermal Response Curve for FQP3N80C

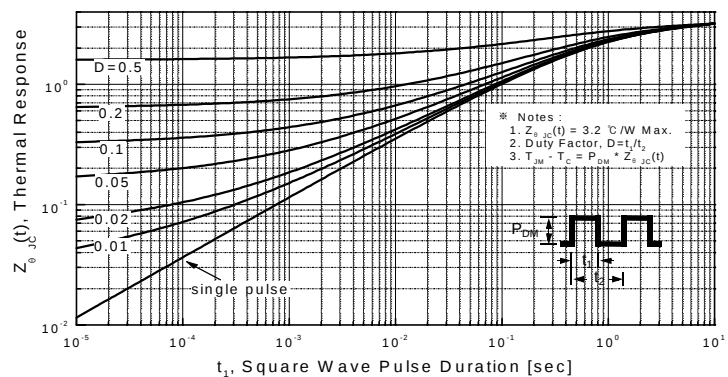
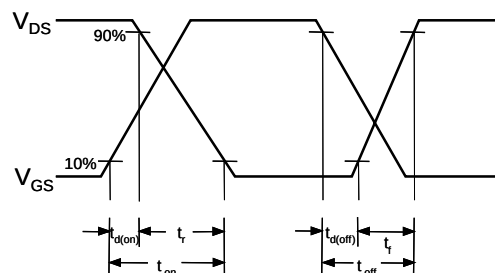


Figure 11-2. Transient Thermal Response Curve for FQPF3N80C

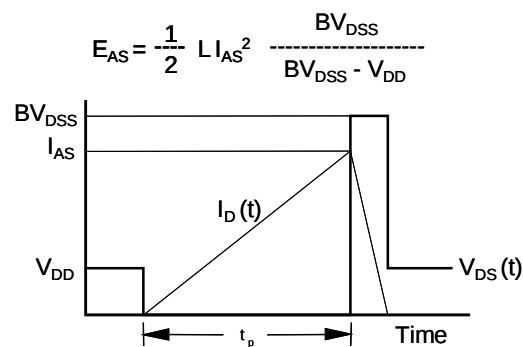
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



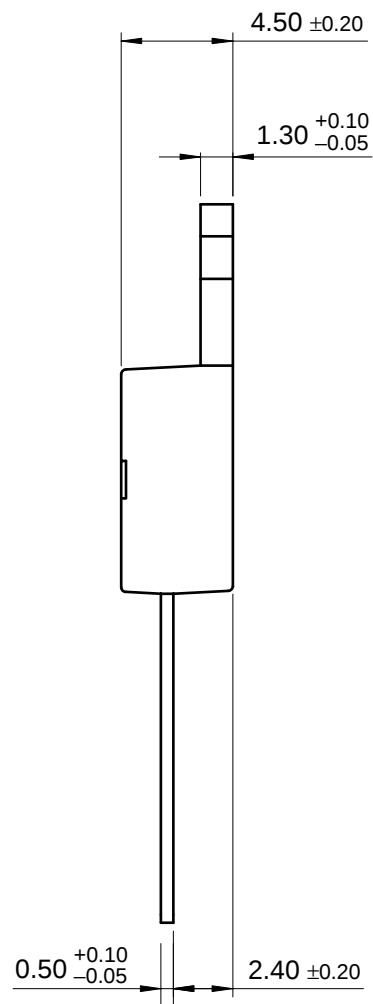
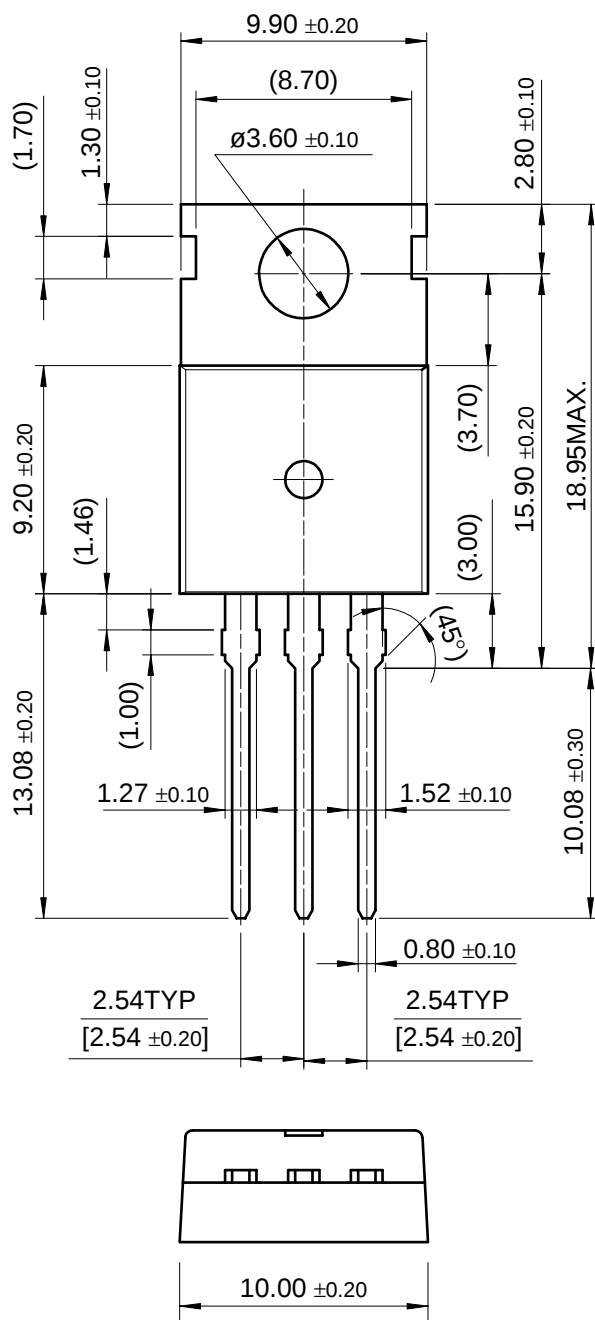
### Unclamped Inductive Switching Test Circuit & Waveforms





Package Dimensions

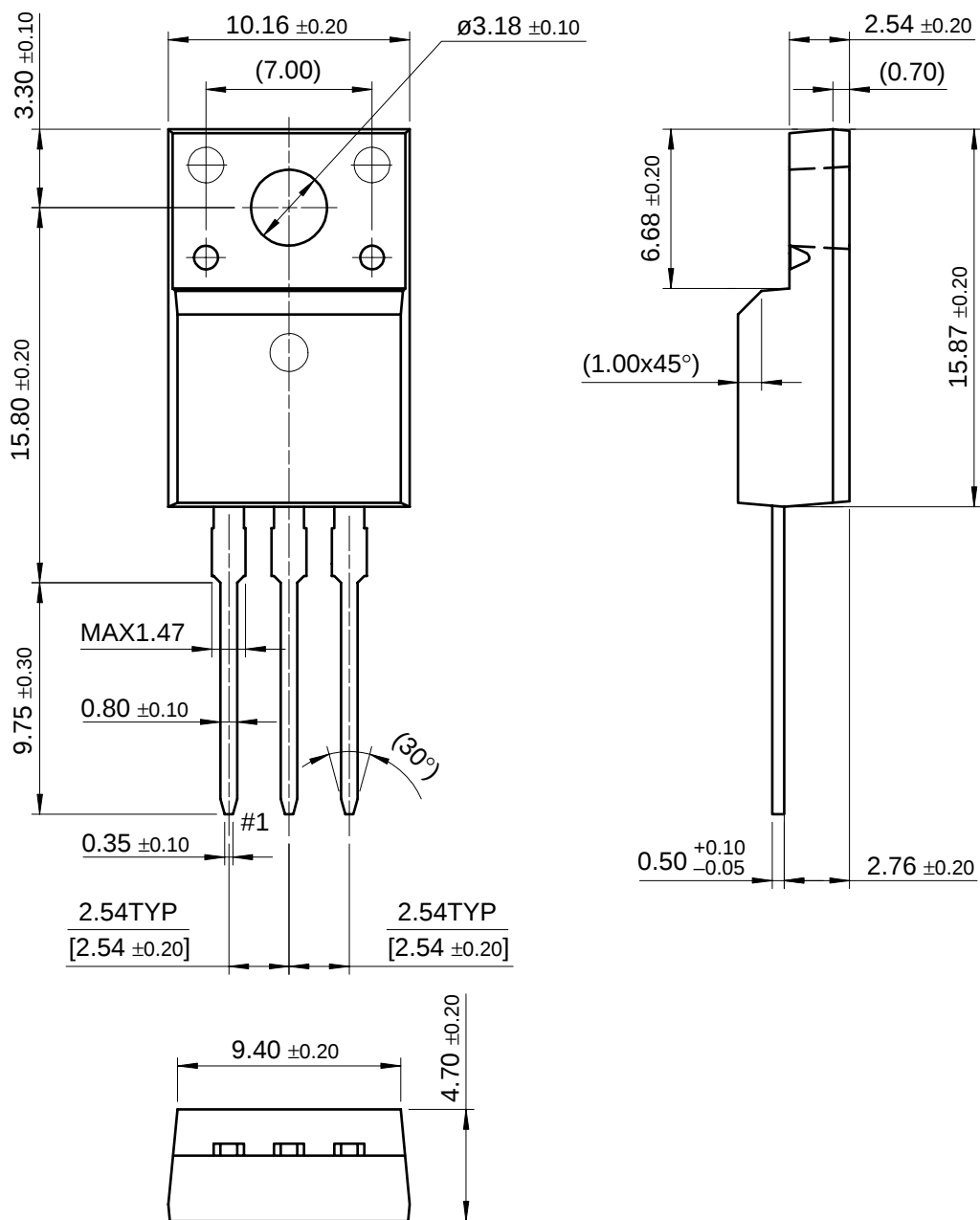
TO-220



Dimensions in Millimeters

Package Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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| EcoSPARK <sup>TM</sup>                            | GTO <sup>TM</sup>                | MSX <sup>TM</sup>               | QT Optoelectronics <sup>TM</sup> | TinyLogic <sup>®</sup>       |
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