

# FQP90N10V2/FQPF90N10V2

## 100V N-Channel MOSFET

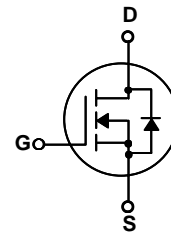
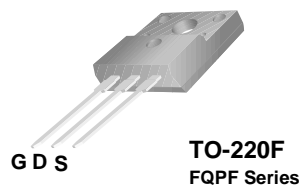
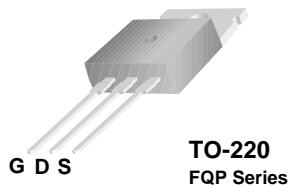
### General Description

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

- 90 A, 100V,  $R_{DS(on)} = 0.01\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 147 nC)
- Low Crss ( typical 300 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



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

Symbol	Parameter	FQP90N10V2	FQPF90N10V2	Units
V <sub>DSS</sub>	Drain-Source Voltage	100		V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	90	90 *	A
		68	68 *	A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	360	360 *	A
V <sub>GSS</sub>	Gate-Source Voltage	± 30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	2430		mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	90		A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	25		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) - Derate above 25°C	250	83	W
		1.67	0.55	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +175		°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		°C

\* Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	FQP90N10V2	FQPF90N10V2	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	0.6	1.8	°C/W
R <sub>θJS</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
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	100	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.1	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 80\text{ V}, T_C = 150^\circ\text{C}$	--	--	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	$V_{GS} = 10\text{ V}, I_D = 45\text{ A}$	--	8.5	10	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 45\text{ A}$ (Note 4)	--	72	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	4730	6150	pF
$C_{oss}$	Output Capacitance		--	1180	1530	pF
$C_{rss}$	Reverse Transfer Capacitance		--	300	390	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 90\text{ A},$ $R_G = 25\ \Omega$	--	52	114	ns	
$t_r$	Turn-On Rise Time		--	492	994	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	304	618	ns	
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	355	720	ns
$Q_g$	Total Gate Charge		$V_{DS} = 80\text{ V}, I_D = 90\text{ A},$ $V_{GS} = 10\text{ V}$	--	147	191	nC
$Q_{gs}$	Gate-Source Charge	(Note 4, 5)	--	28	--	nC	
$Q_{gd}$	Gate-Drain Charge		--	60	--	nC	

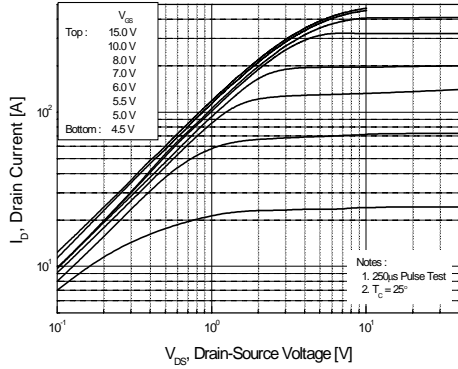
### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	90	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	360	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 90\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 90\text{ A},$	--	114	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	0.54	--	$\mu\text{C}$

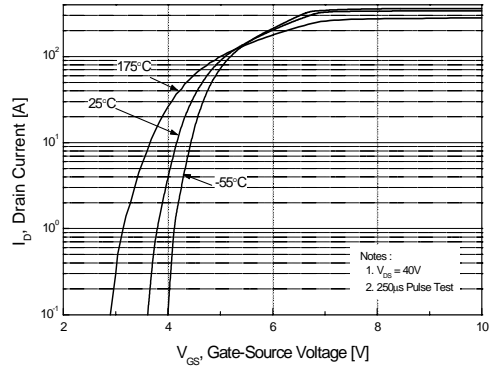
#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 0.3\text{ mH}, I_{AS} = 90\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 90\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , 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

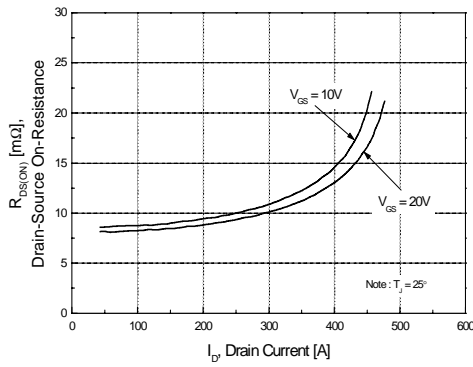
## Typical Characteristics



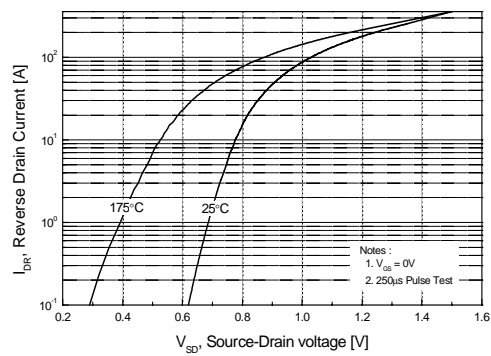
**Figure 1. On-Region Characteristics**



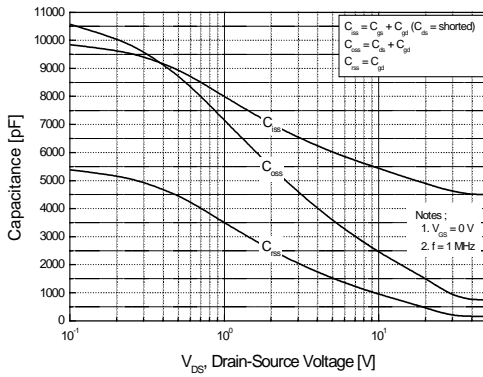
**Figure 2. Transfer Characteristics**



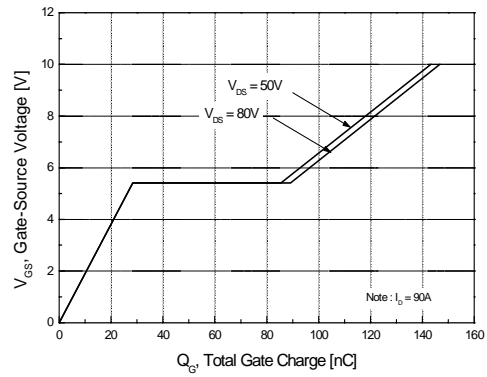
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



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

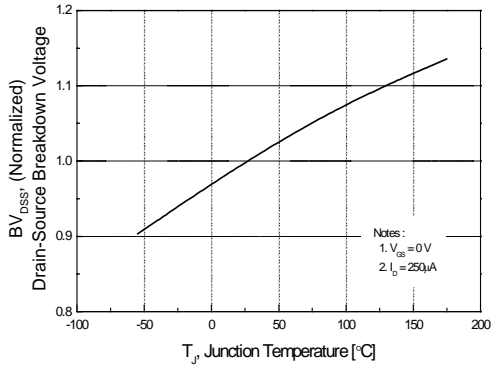


**Figure 5. Capacitance Characteristics**

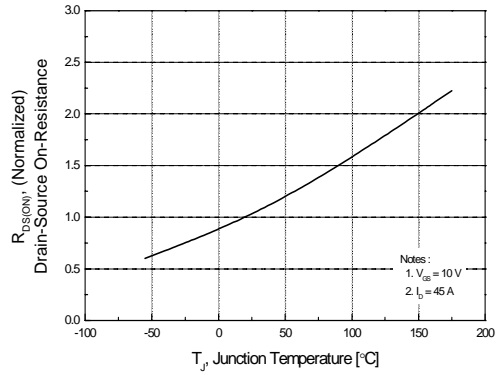


**Figure 6. Gate Charge Characteristics**

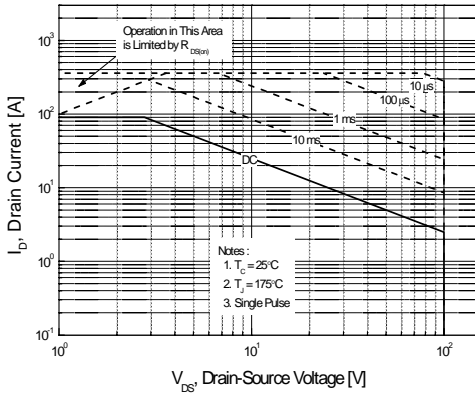
**Typical Characteristics** (Continued)



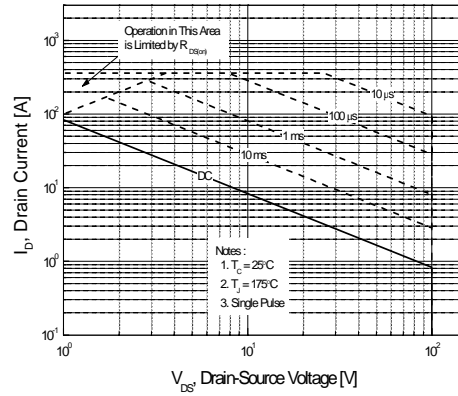
**Figure 7. Breakdown Voltage Variation vs Temperature**



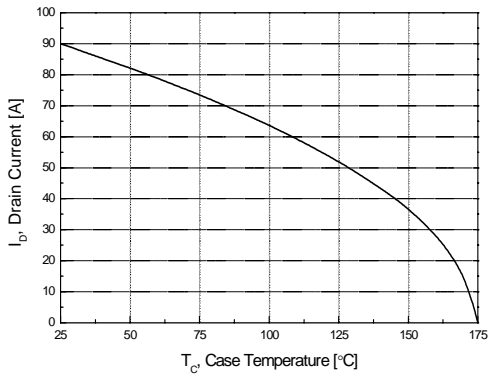
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP90N10V2**

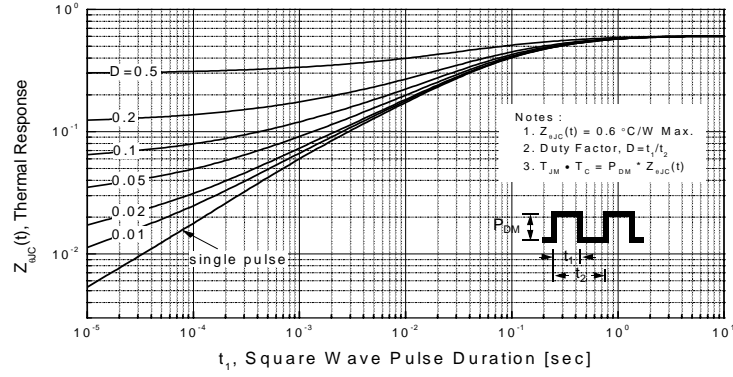


**Figure 9-2. Maximum Safe Operating Area for FQP90N10V2**

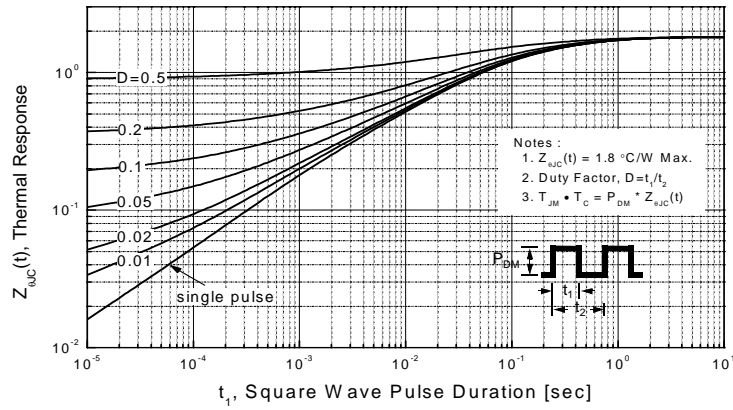


**Figure 10. Maximum Drain Current vs Case Temperature**

**Typical Characteristics** (Continued)

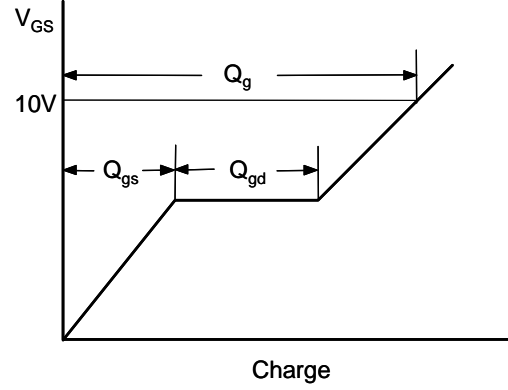
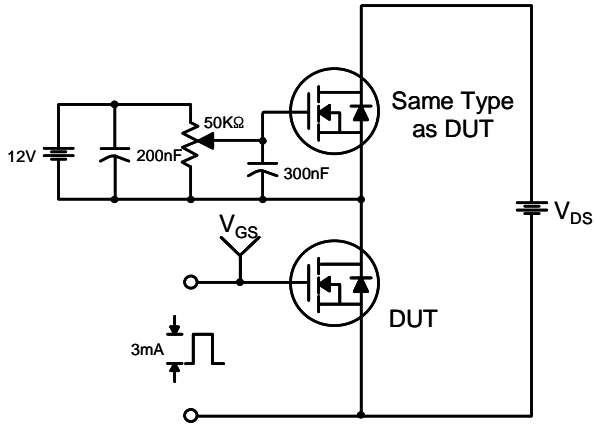


**Figure 11-1. Transient Thermal Response Curve for FQP90N10V2**

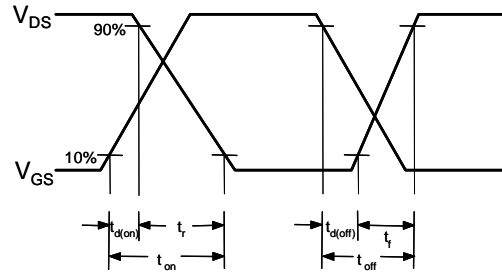
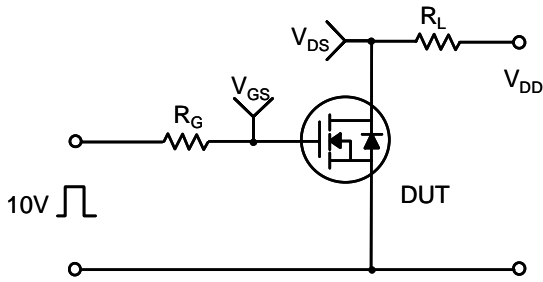


**Figure 11-2. Transient Thermal Response Curve for FQPF90N10V2**

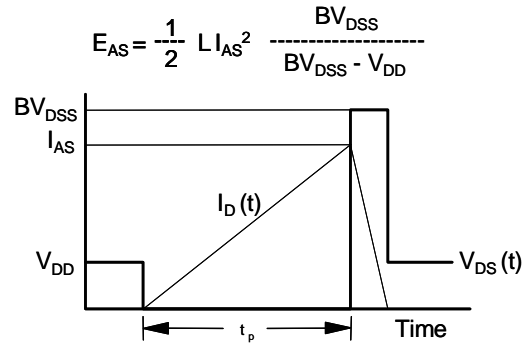
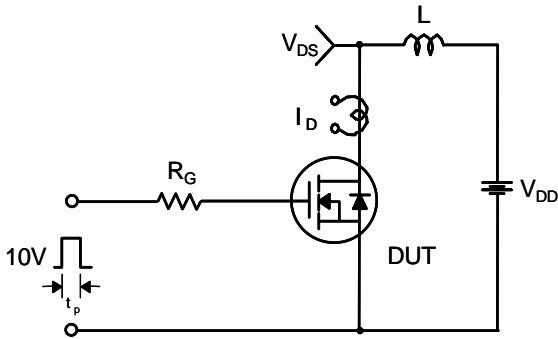
**Gate Charge Test Circuit & Waveform**



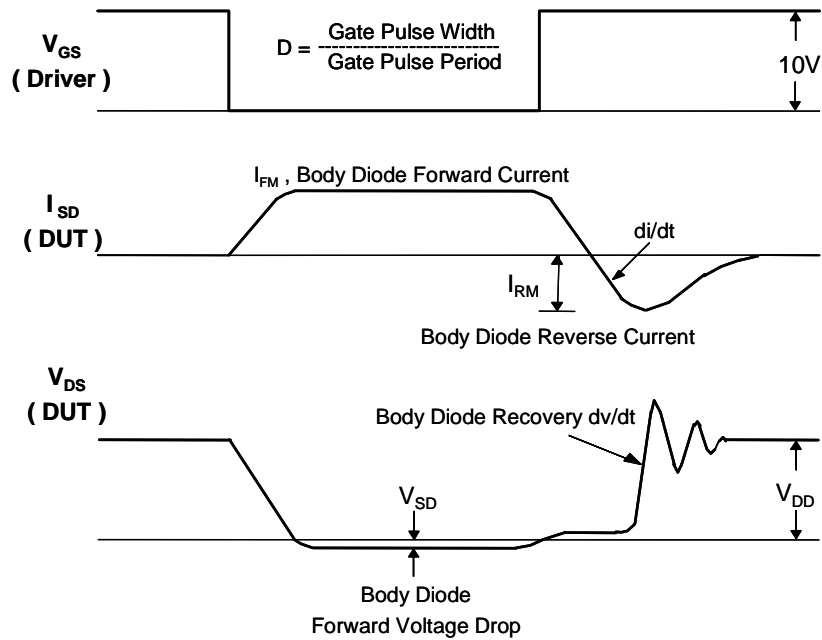
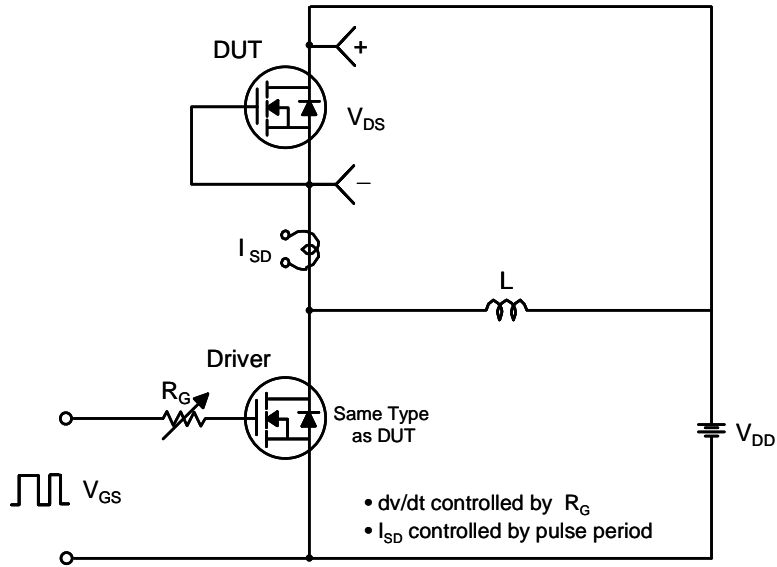
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

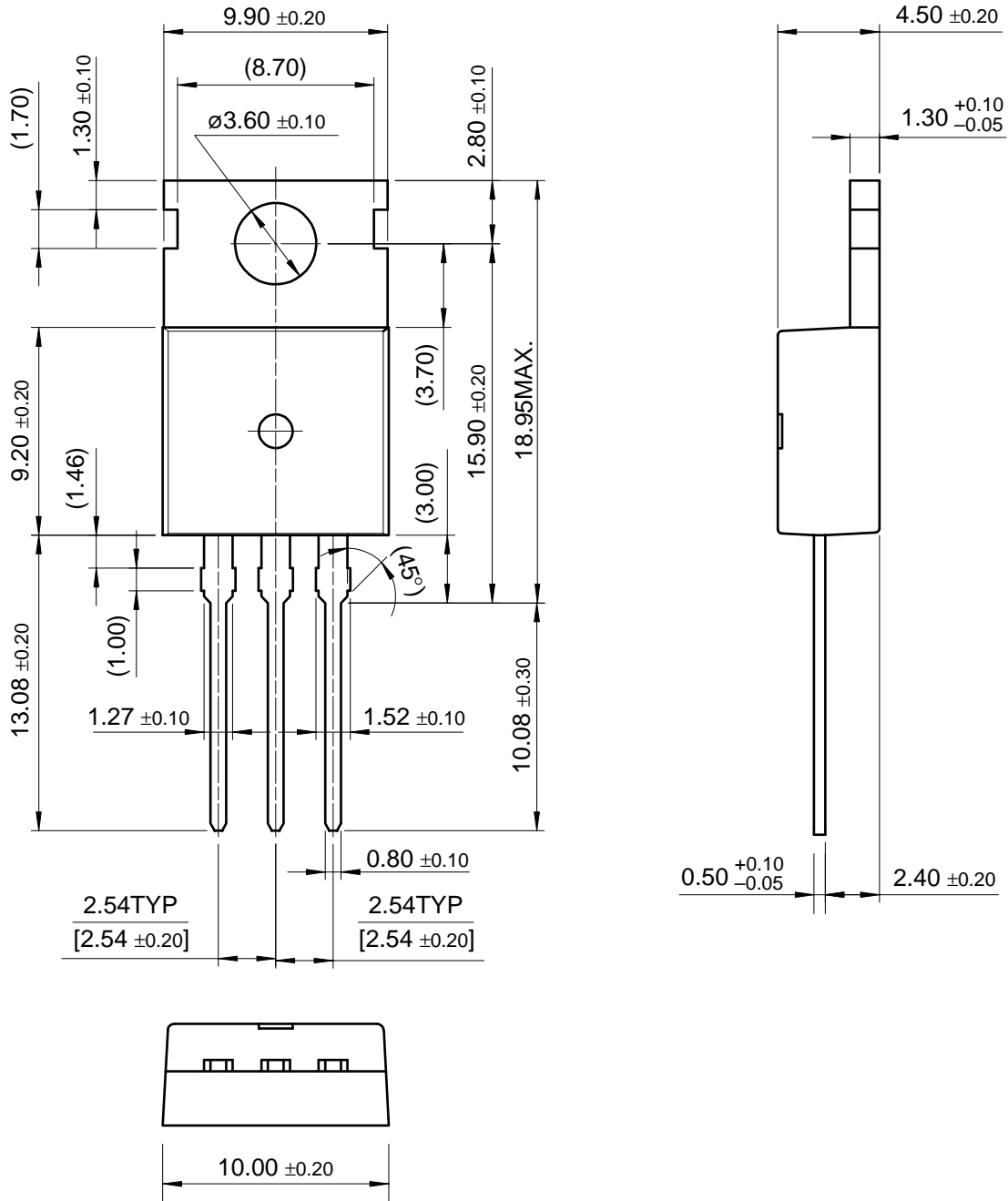


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-220



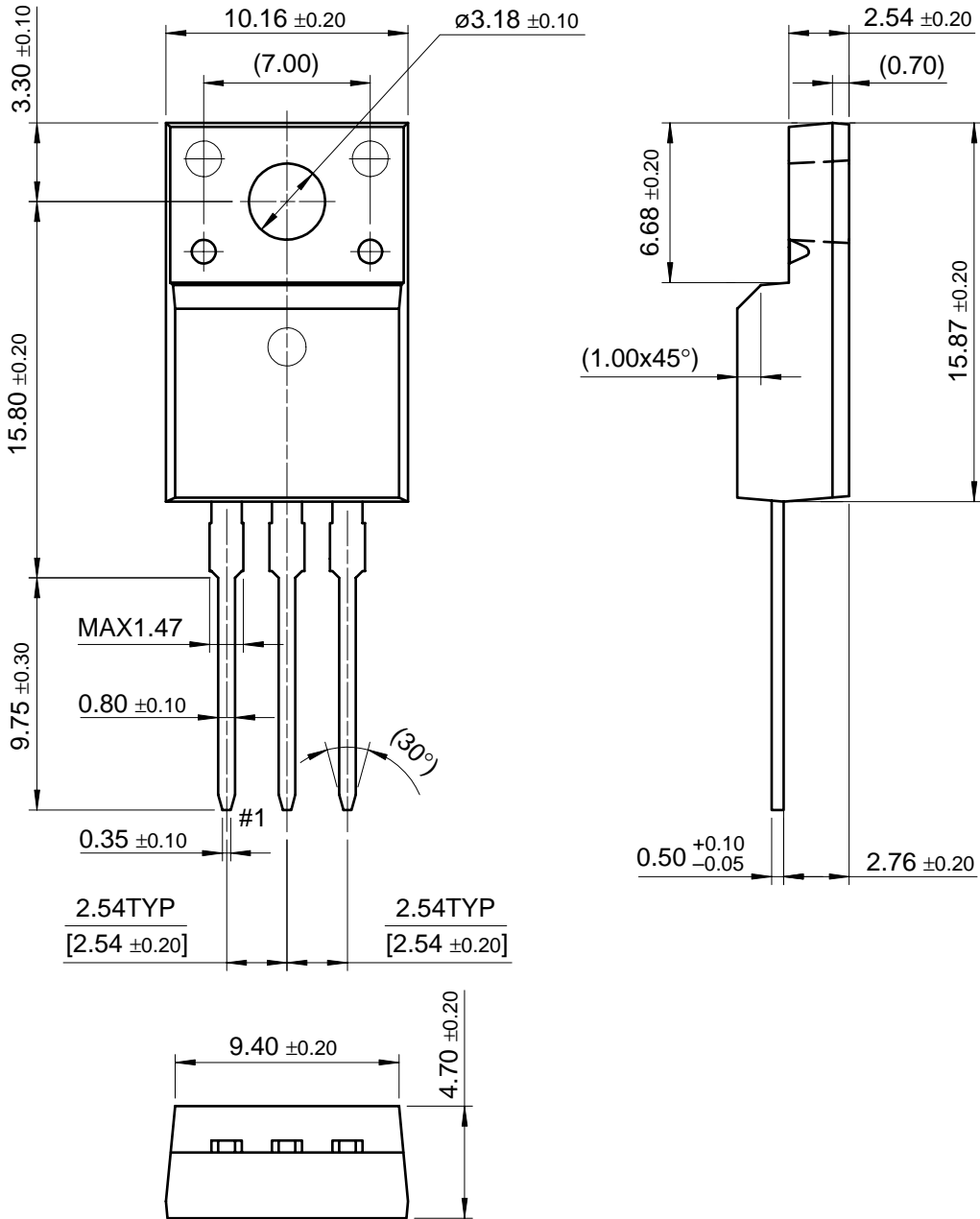
FQP90N10V2/FQP90N10V2

Dimensions in Millimeters



Package Dimensions (Continued)

TO-220F



Note: PKG backside isolation voltage : 4000V

Dimensions in Millimeters

FQP90N10V2/FQP90N10V2

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