



ON Semiconductor®

QFET®

FQP3N50C/FQPF3N50C 500V N-Channel MOSFET

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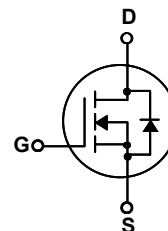
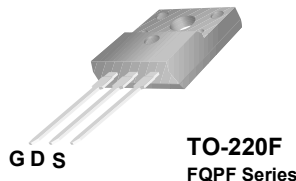
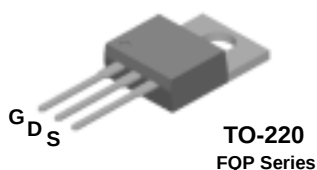
Features

- 3 A, 500 V, $R_{DS(on)} = 2.5 \Omega @ V_{GS} = 10 \text{ V}$
- Low gate charge (typical 10 nC)
- Low C_{rss} (typical 8.5 pF)
- Fast switching
- 100 % avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor'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 switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.



Absolute Maximum Ratings

Symbol	Parameter		FQP3N50C	FQPF3N50C	Units
V _{DSS}	Drain-Source Voltage		500		V
I _D	Drain Current	- Continuous (T _C = 25°C)	3	3 *	A
		- Continuous (T _C = 100°C)	1.8	1.8 *	A
I _{DM}	Drain Current - Pulsed (Note 1)		12	12 *	A
V _{GSS}	Gate-Source Voltage		± 30		V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		200		mJ
I _{AR}	Avalanche Current (Note 1)		3		A
E _{AR}	Repetitive Avalanche Energy (Note 1)		6.2		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P _D	Power Dissipation (T _C = 25°C)		62	25	W
	- Derate above 25°C		0.5	0.2	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

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP3N50C	FQPF3N50C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.0	4.9	$^\circ\text{C/W}$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP3N50C	FQP3N50C	TO-220	--	--	50
FQPF3N50C	FQPF3N50C	TO-220F	--	--	50

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	500	--	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.7	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 400 V, T _C = 125°C	--	--	10	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	2.0	--	4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 1.5 A	--	2.1	2.5	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 1.5 A (Note 4)	--	1.5	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	280	365	pF
C _{oss}	Output Capacitance		--	50	65	pF
C _{rss}	Reverse Transfer Capacitance		--	8.5	11	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V, I _D = 3 A, R _G = 25 Ω (Note 4, 5)	--	10	30	ns
t _r	Turn-On Rise Time		--	25	60	ns
t _{d(off)}	Turn-Off Delay Time		--	35	80	ns
t _f	Turn-Off Fall Time		--	25	60	ns
Q _g	Total Gate Charge	V _{DS} = 400 V, I _D = 3 A, V _{GS} = 10 V (Note 4, 5)	--	10	13	nC
Q _{gs}	Gate-Source Charge		--	1.5	--	nC
Q _{gd}	Gate-Drain Charge		--	5.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	3	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	12	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3 A, dI _F / dt = 100 A/μs (Note 4)	--	170	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.7	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 40mH, I_{AS} = 3A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 3A, 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 Performance Characteristics

Figure 1. On-Region Characteristics

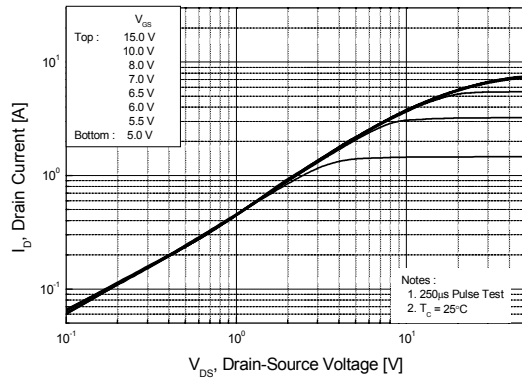


Figure 2. Transfer Characteristics

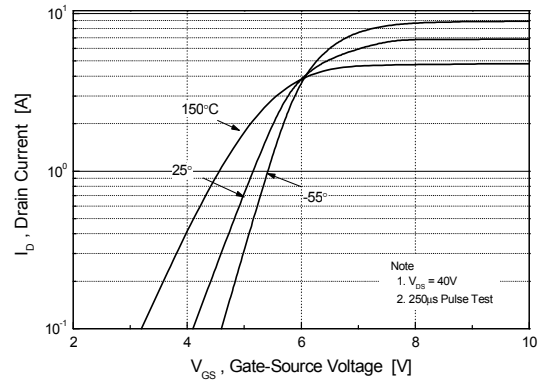


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

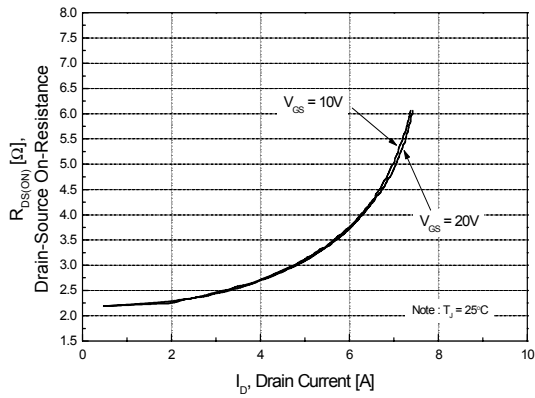


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

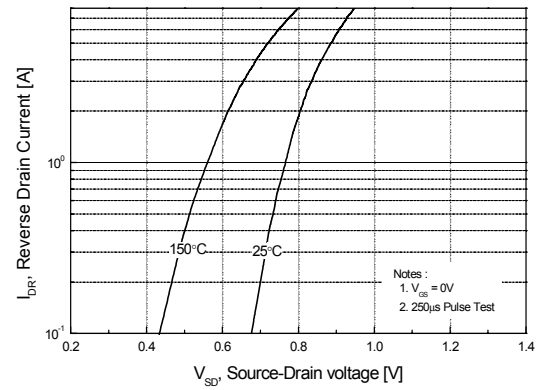


Figure 5. Capacitance Characteristics

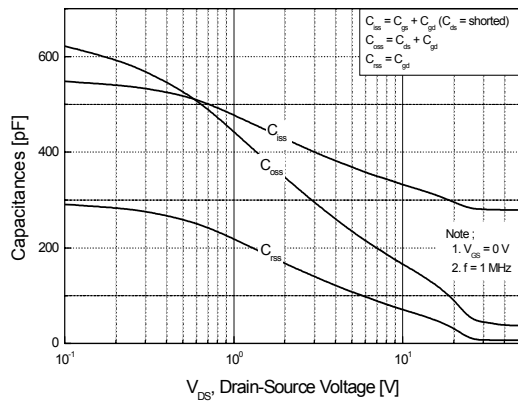
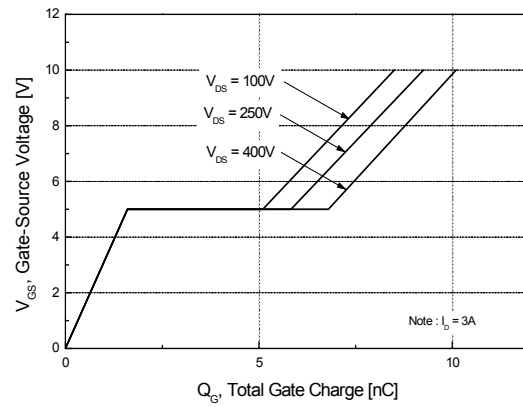


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

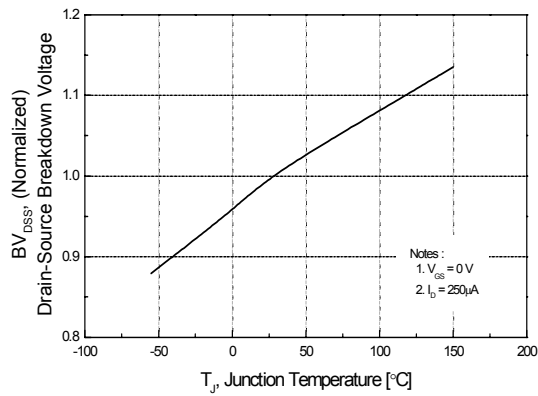


Figure 8. On-Resistance Variation vs. Temperature

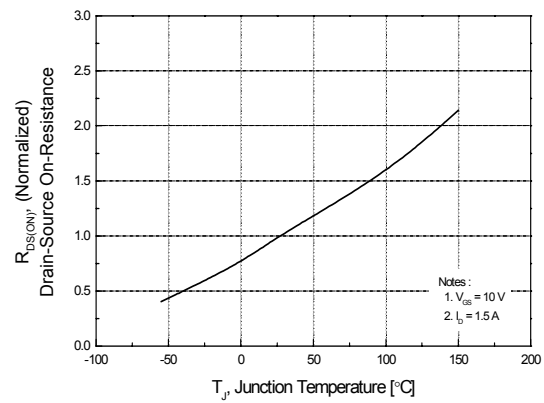


Figure 9-1. Maximum Safe Operating Area of FQP3N50C

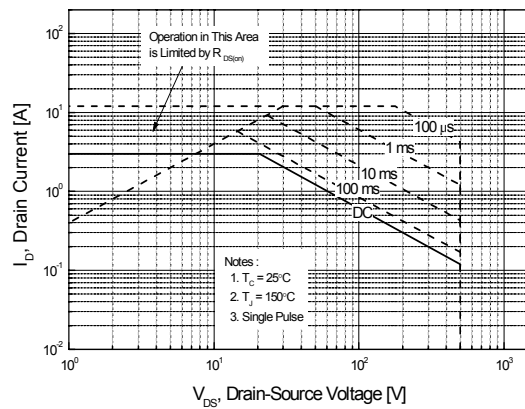


Figure 9-2. Maximum Safe Operating Area of FQPF3N50C

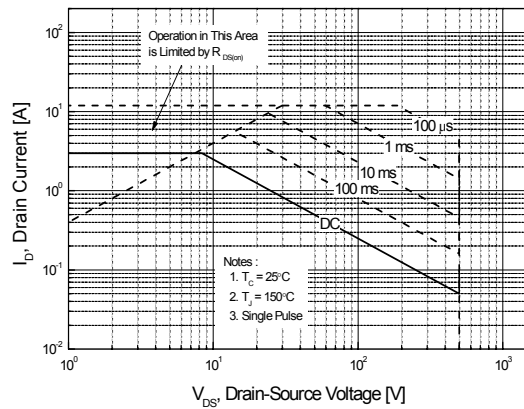
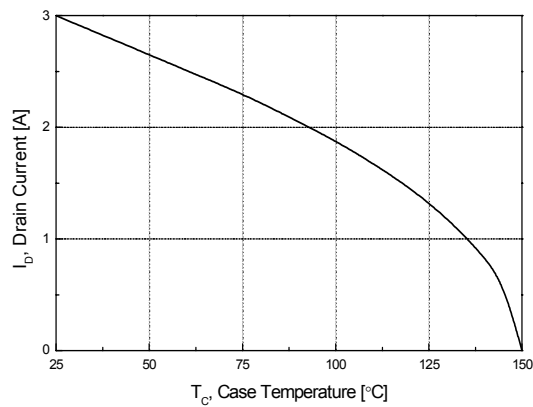


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. ransient Thermal Response Curve of FQP3N50C

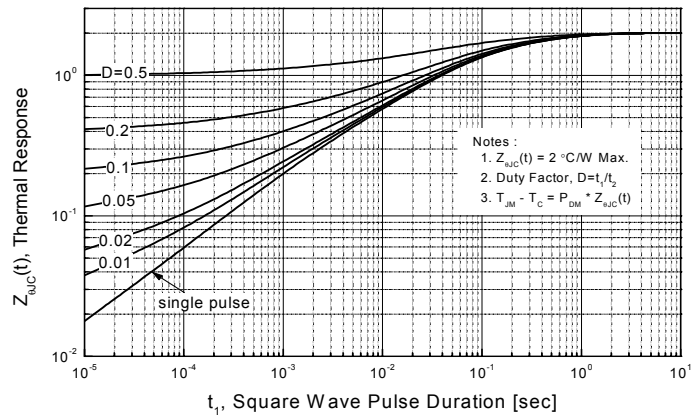
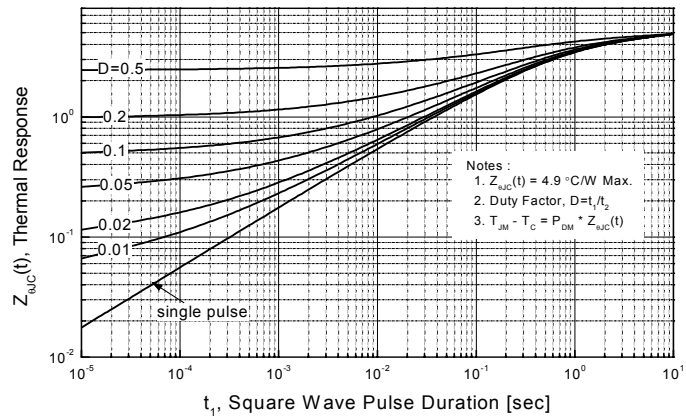
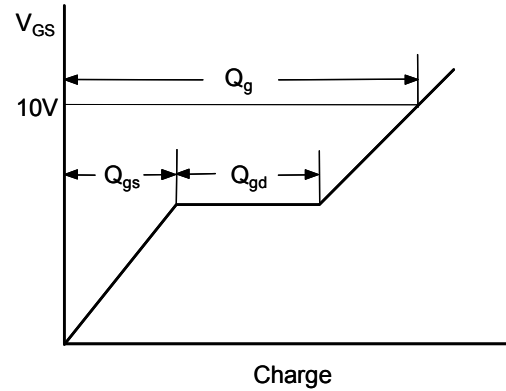
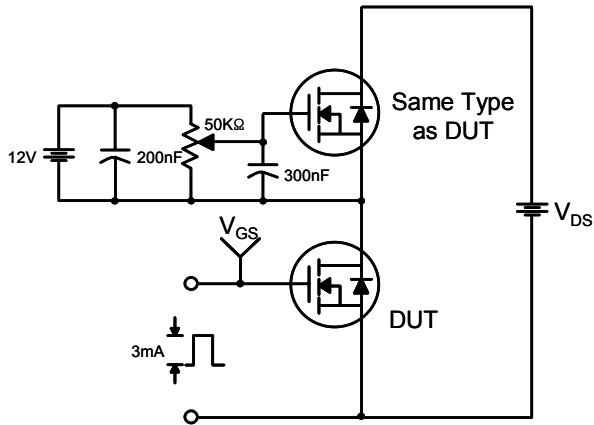


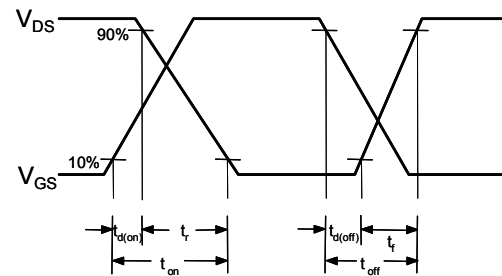
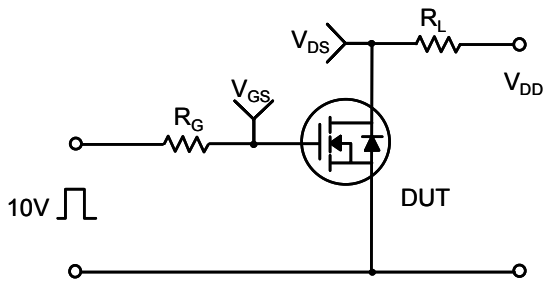
Figure 11-2. ransient Thermal Response Curve of FQPF3N50C



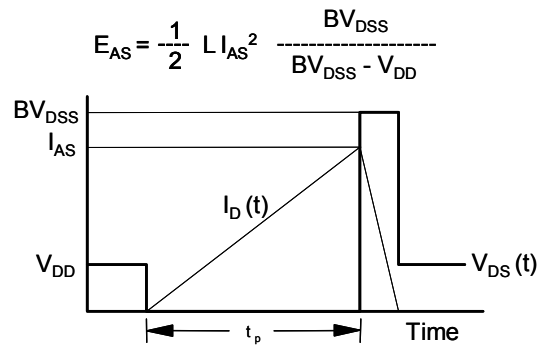
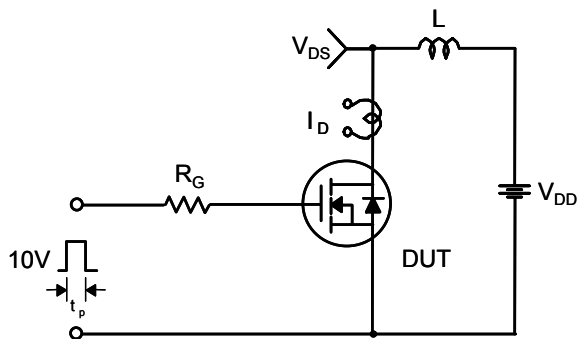
Gate Charge Test Circuit & Waveform



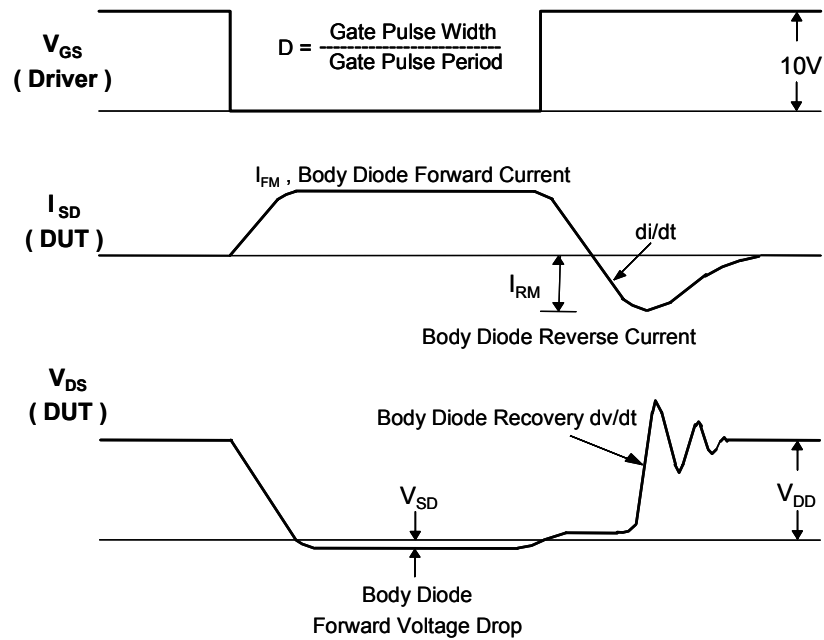
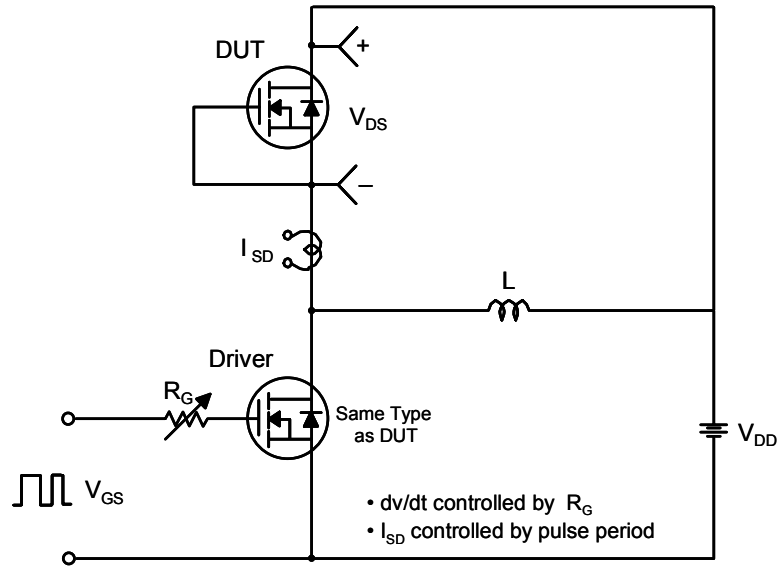
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

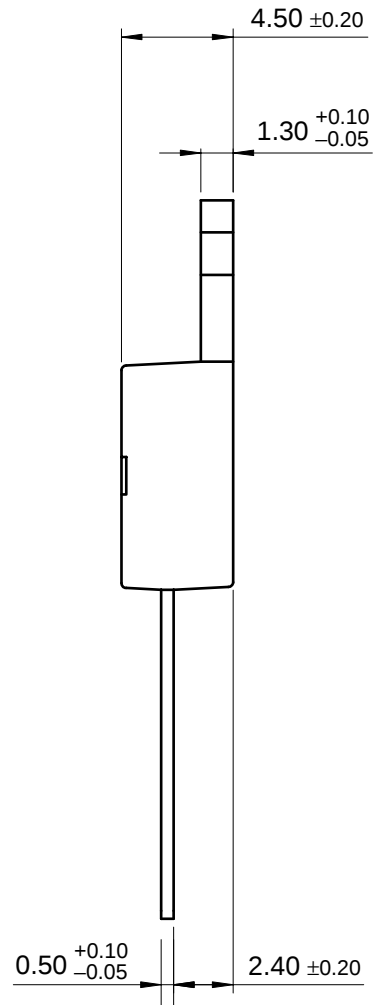
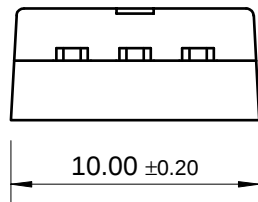
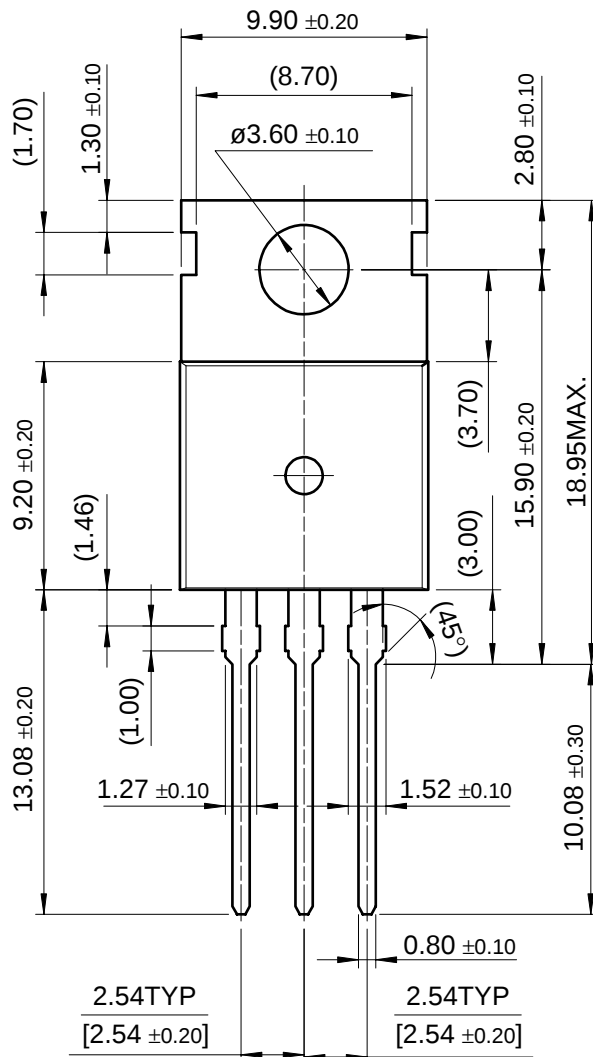


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

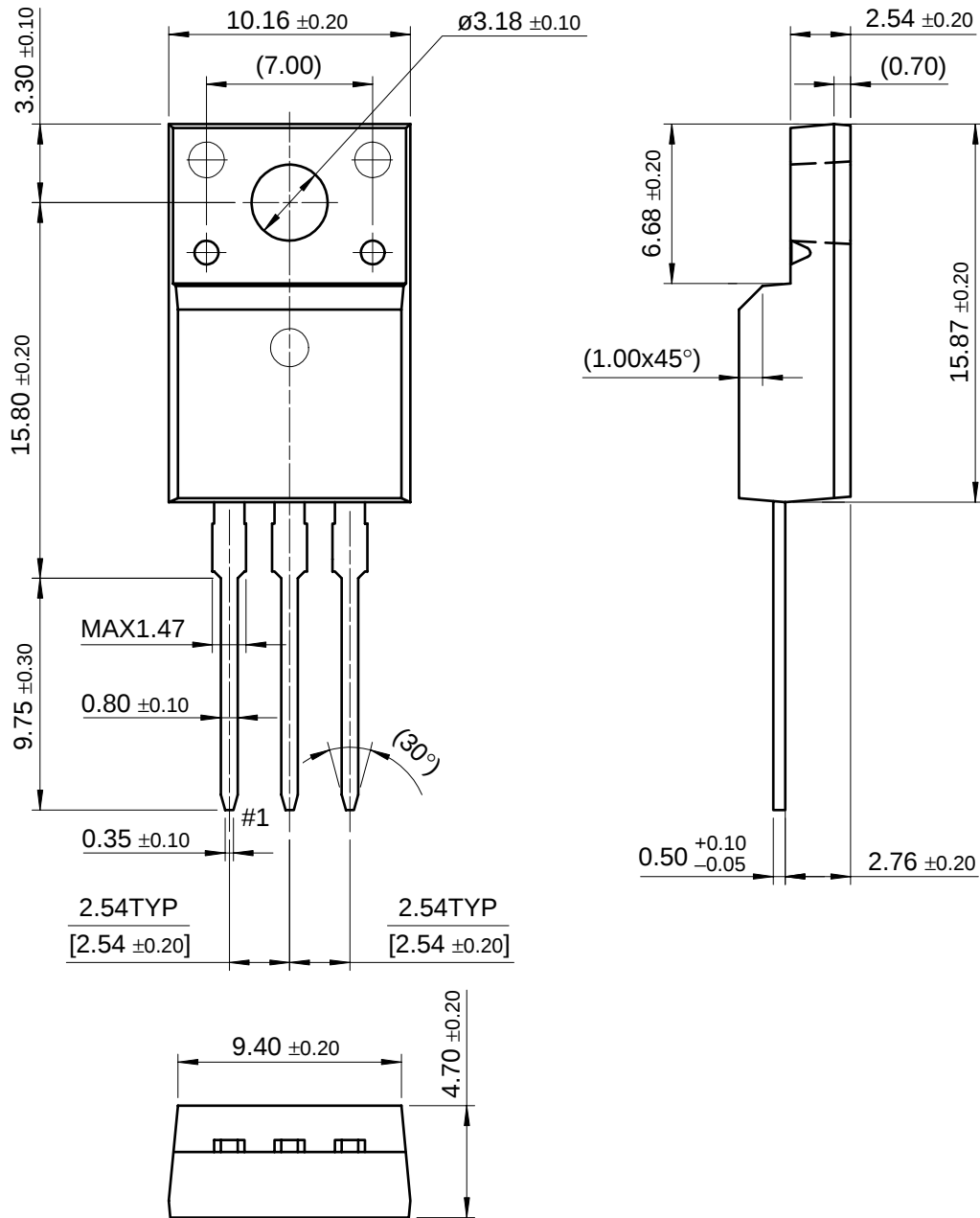
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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