

FQP11N40C/FQPF11N40C

400V N-Channel MOSFET

Features

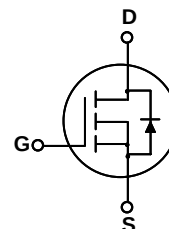
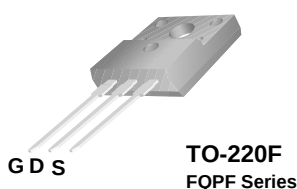
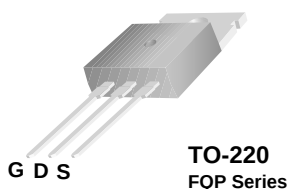
- 10.5 A, 400V, $R_{DS(on)} = 0.5 \Omega @ V_{GS} = 10 \text{ V}$
- Low gate charge (typical 28 nC)
- Low C_{rss} (typical 85pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



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 switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.



Absolute Maximum Ratings

Symbol	Parameter	FQP11N40C	FQPF11N40C	Units
V_{DSS}	Drain-Source Voltage	400		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	10.5	10.5 *	A
	- Continuous ($T_C = 100^\circ\text{C}$)	6.6	6.6 *	A
I_{DM}	Drain Current - Pulsed (Note 1)	42	42 *	A
V_{GSS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	360		mJ
I_{AR}	Avalanche Current (Note 1)	11		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	13.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	135	44	W
	- Derate above 25°C	1.07	0.35	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	FQP11N40C	FQPF11N40C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.93	2.86	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP11N40C	FQP11N40C	TO-220	--	--	50
FQPF11N40C	FQPF11N40C	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	400	--	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.54	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 400 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 320 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 = 5.25 A	--	0.43	0.53	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 5.25 A (Note 4)	--	7.1	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	840	1090	pF
C _{oss}	Output Capacitance		--	250	325	pF
C _{rss}	Reverse Transfer Capacitance		--	85	110	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 200 V, I _D = 10.5 A, R _G = 25 Ω (Note 4, 5)	--	14	40	ns
t _r	Turn-On Rise Time		--	89	190	ns
t _{d(off)}	Turn-Off Delay Time		--	81	170	ns
t _f	Turn-Off Fall Time		--	81	170	ns
Q _g	Total Gate Charge	V _{DS} = 320 V, I _D = 10.5 A, V _{GS} = 10 V (Note 4, 5)	--	28	35	nC
Q _{gs}	Gate-Source Charge		--	4	--	nC
Q _{gd}	Gate-Drain Charge		--	15	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	10.5	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	42	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 10.5 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 10.5 A, dI _F / dt = 100 A/μs (Note 4)	--	290	--	ns
Q _{rr}	Reverse Recovery Charge		--	2.4	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.7 mH, I_{AS} = 10.5A, V_{DD} = 50V, R_G = 25 Ω , Starting T_J = 25°C
3. I_{SD} $\leq$ 10.5A, di/dt $\leq$ 200A/ μ s, V_{DD} $\leq$ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width $\leq$ 300 μ s, Duty cycle $\leq$ 2%
5. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

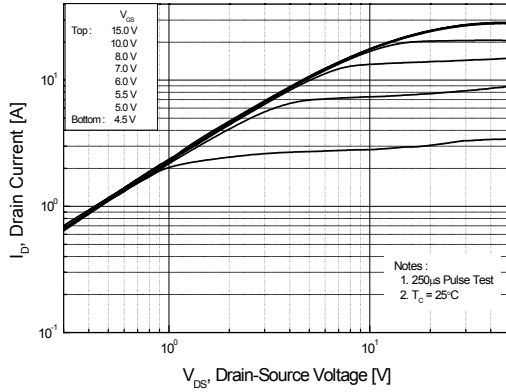


Figure 2. Transfer Characteristics

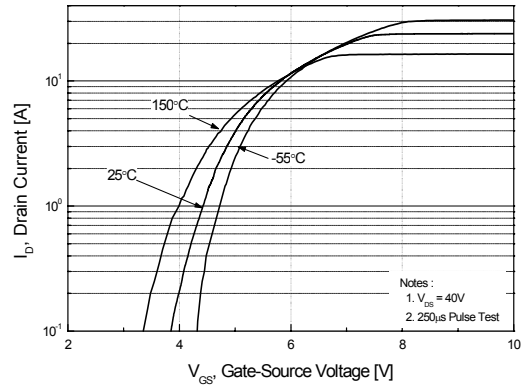


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

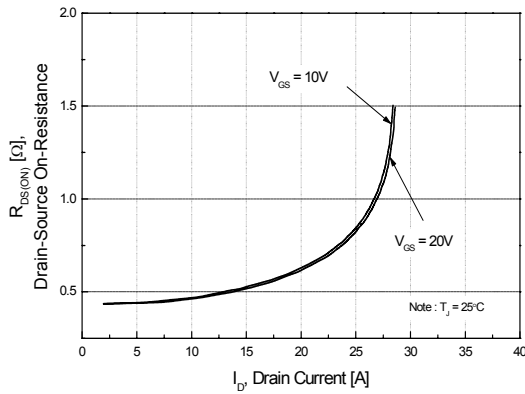


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

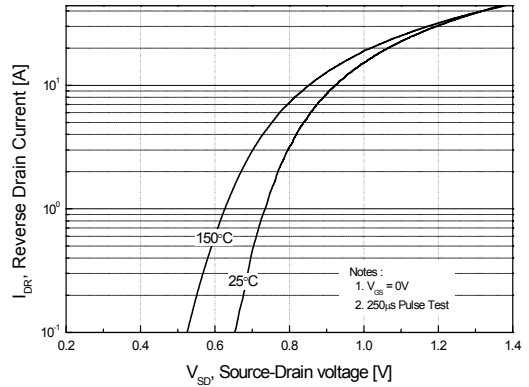


Figure 5. Capacitance Characteristics

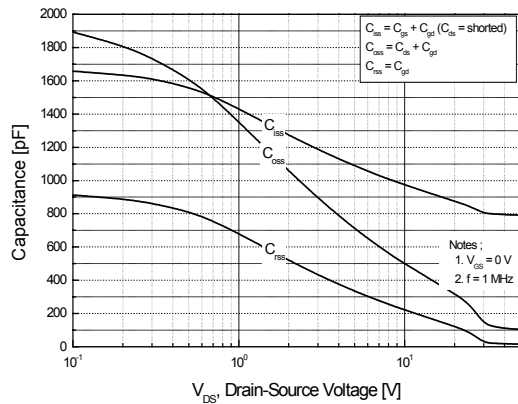
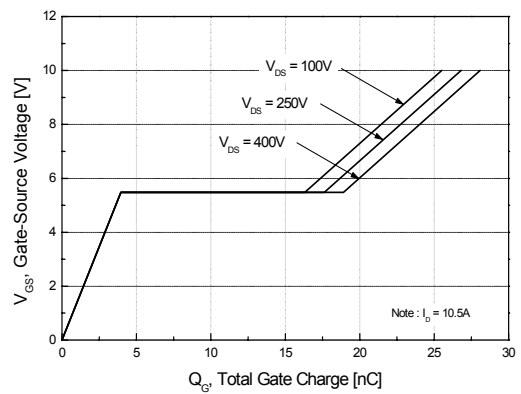


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

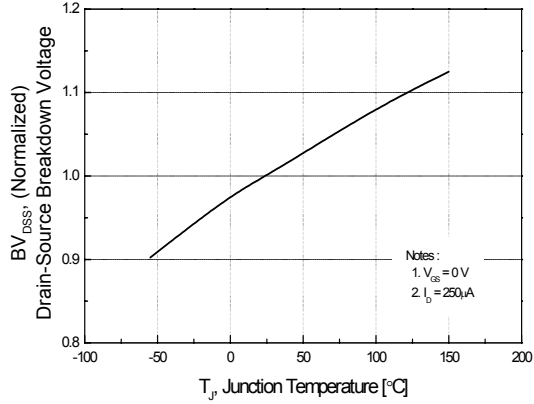


Figure 8. On-Resistance Variation vs. Temperature

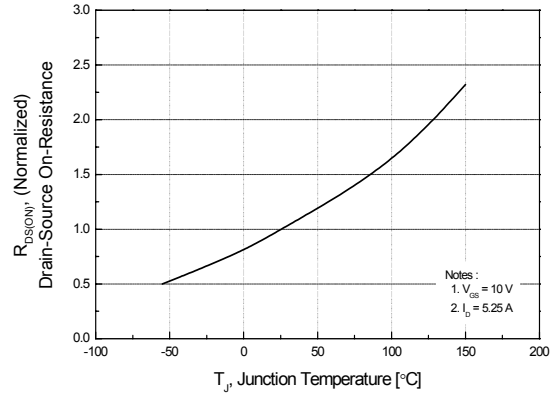


Figure 9-1. Maximum Safe Operating Area of FQP11N40C

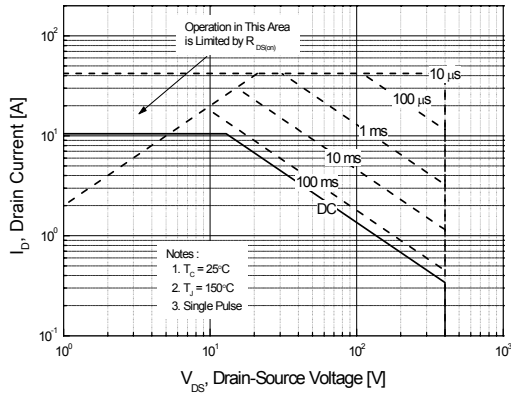


Figure 9-2. Maximum Safe Operating Area of FQPF11N40C

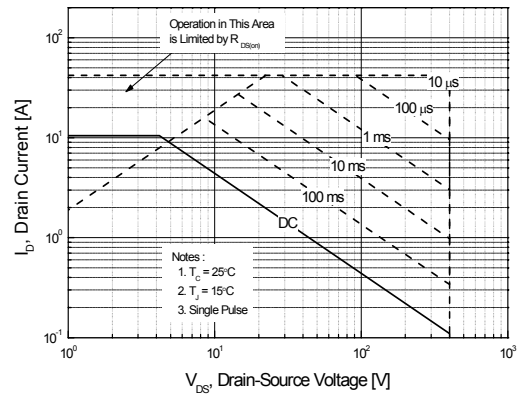
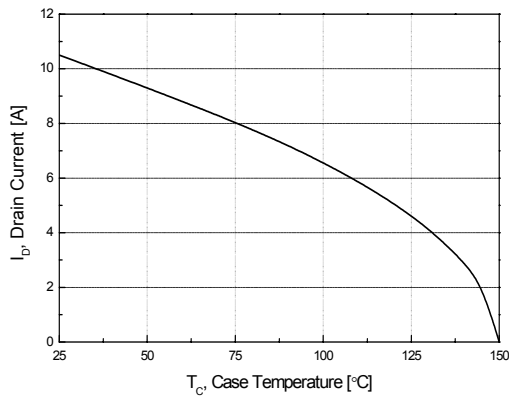


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. ransient Thermal Response Curve of FQP11N40C

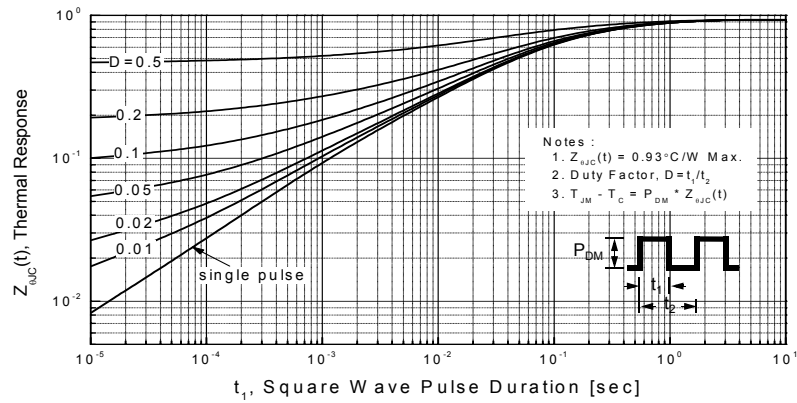
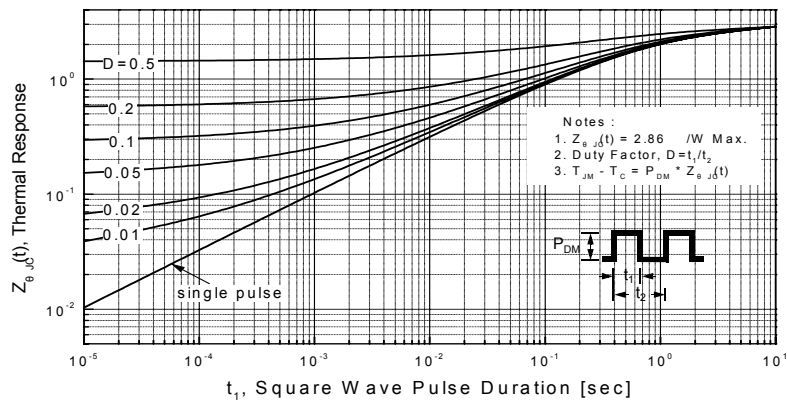
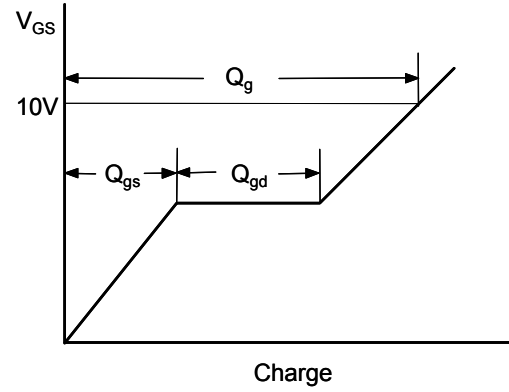
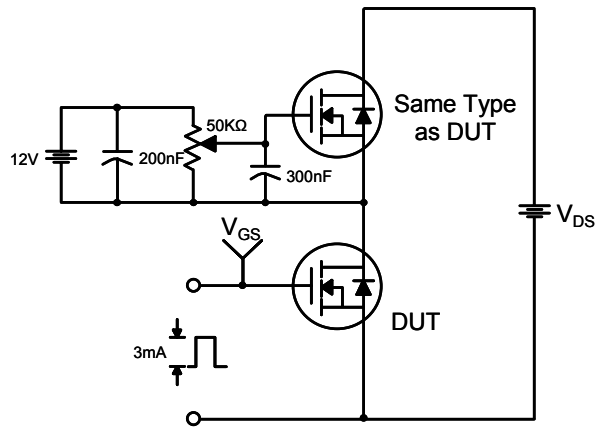


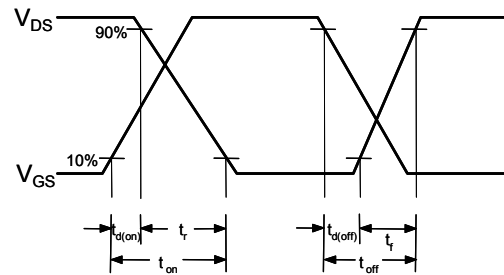
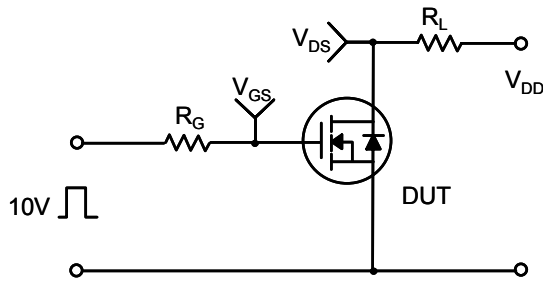
Figure 11-2. ransient Thermal Response Curve of FQPF11N40C



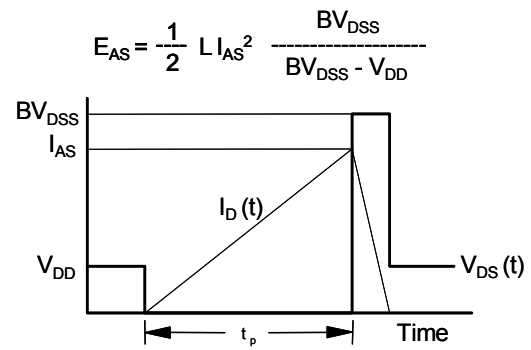
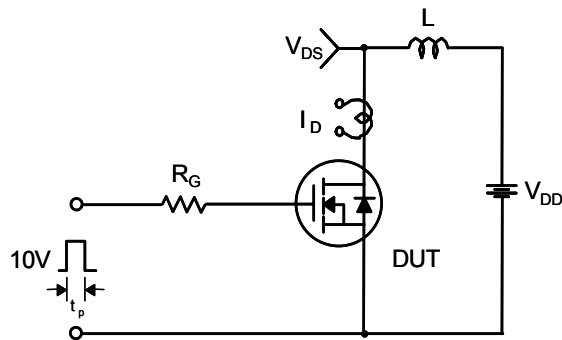
Gate Charge Test Circuit & Waveform



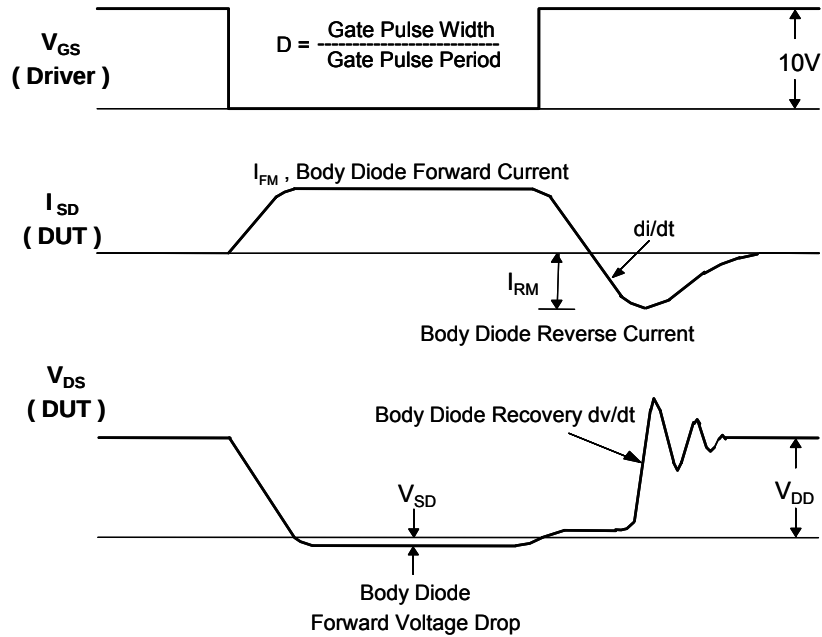
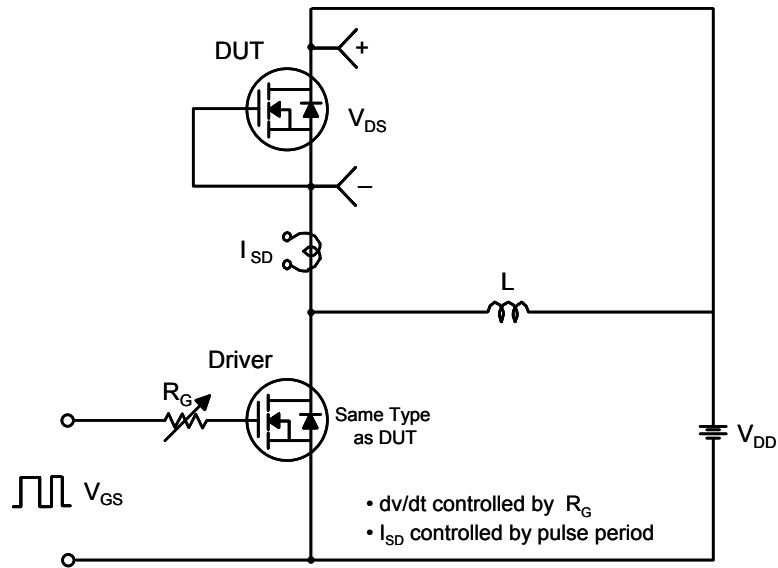
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

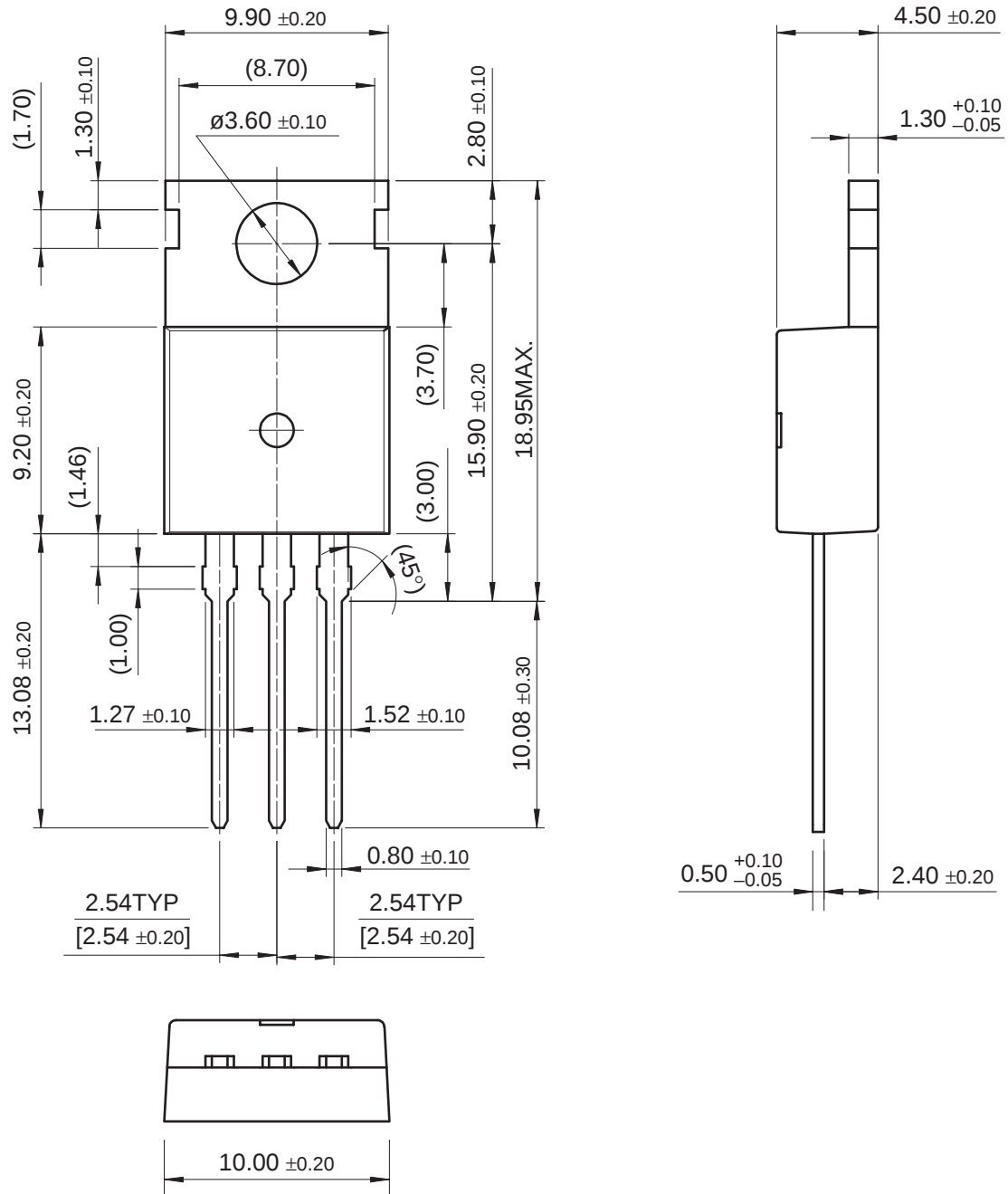


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

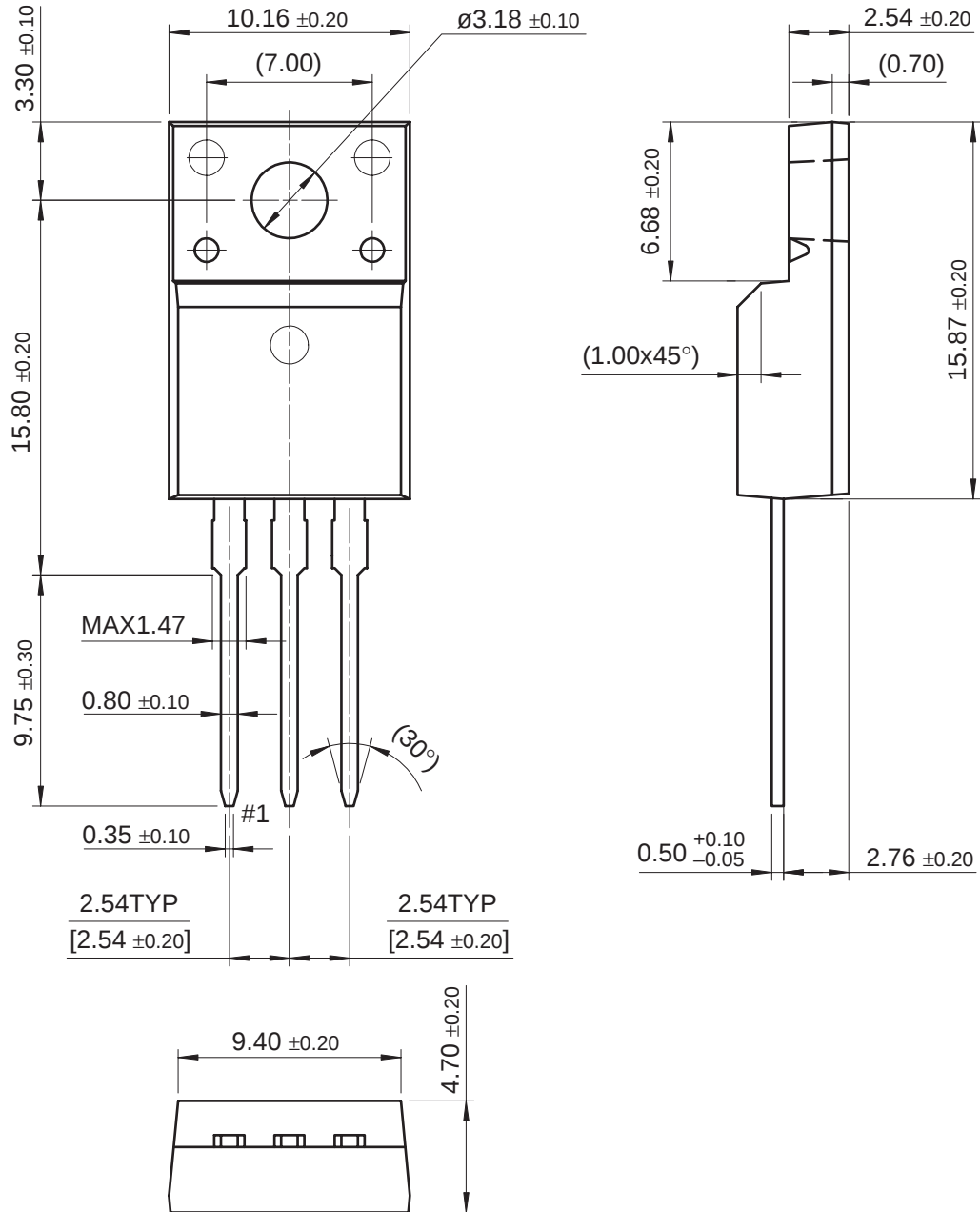
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters



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Rev. I34



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