

FQP6N40CF/FQPF6N40CF

400V N-Channel MOSFET

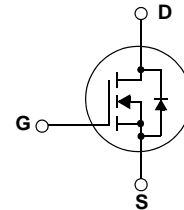
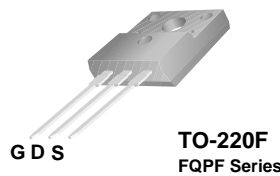
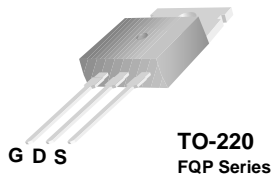
Features

- 6A, 400V, $R_{DS(on)} = 1.1 \Omega @ V_{GS} = 10 V$
- Low gate charge (typical 16nC)
- Low Crss (typical 15pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Fast recovery body diode (typical 70ns)

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, electronic lamp ballasts based on half bridge topology.



Absolute Maximum Ratings

Symbol	Parameter	FQP6N40CF	FQPF6N40CF	Units
V_{DSS}	Drain-Source Voltage	400		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ C$)	6	6*
		- Continuous ($T_C = 100^\circ C$)	3.6	3.6*
I_{DM}	Drain Current - Pulsed (Note 1)	24	24*	A
V_{GSS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	270		mJ
I_{AR}	Avalanche Current (Note 1)	6		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	73		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$)	73	38	W
		- Derate above $25^\circ C$	0.58	0.3
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ C$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ C$

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP6N40CF	FQPF6N40CF	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.71	3.31	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ C/W$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP6N40CF	FQP6N40CF	TO-220	-	-	50
FQPF6N40CF	FQPF6N40CF	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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	400	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.54	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 320\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
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	$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$	--	0.9	1.1	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 3\text{ A}$ (Note 4)	--	4.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	480	625	pF
C_{oss}	Output Capacitance		--	80	105	pF
C_{rss}	Reverse Transfer Capacitance		--	15	20	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 200\text{ V}, I_D = 6\text{ A}, R_G = 25\ \Omega$	--	13	35	ns
t_r	Turn-On Rise Time		--	65	140	ns
$t_{d(off)}$	Turn-Off Delay Time		--	21	55	ns
t_f	Turn-Off Fall Time		(Note 4, 5)	--	38	85
Q_g	Total Gate Charge	$V_{DS} = 320\text{ V}, I_D = 6\text{ A}, V_{GS} = 10\text{ V}$	--	16	20	nC
Q_{gs}	Gate-Source Charge		--	2.3	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4, 5)	--	8.2	--
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 6\text{ A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 6\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	--	70	--	ns
Q_{rr}	Reverse Recovery Charge	(Note 4)	--	0.12	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 13.7mH, $I_{AS} = 6\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 6\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, 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 Performance Characteristics

Figure 1. On-Region Characteristics

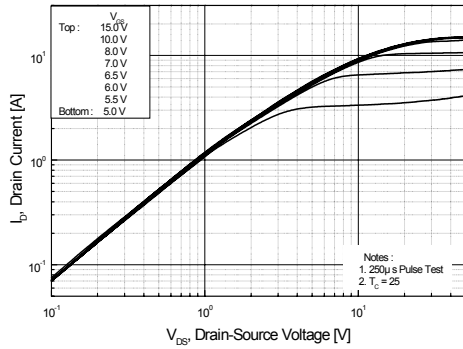


Figure 2. Transfer Characteristics

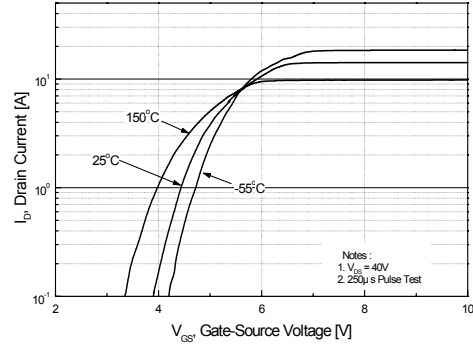


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

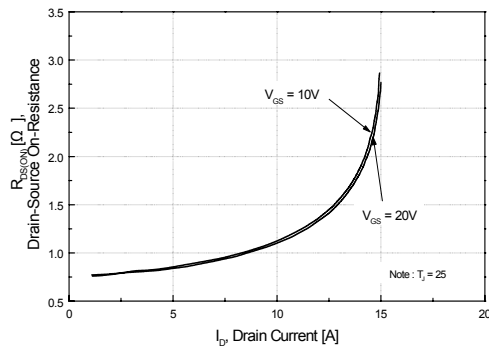


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

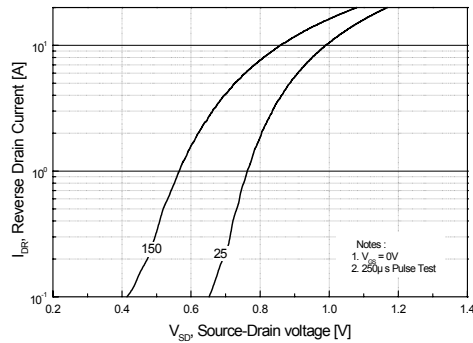


Figure 5. Capacitance Characteristics

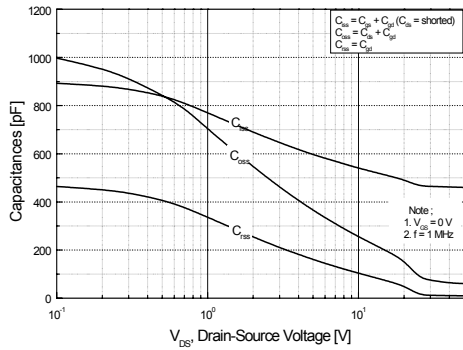
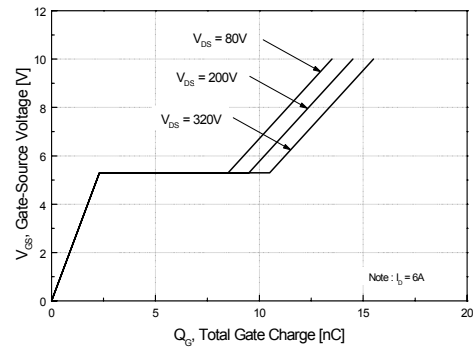


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

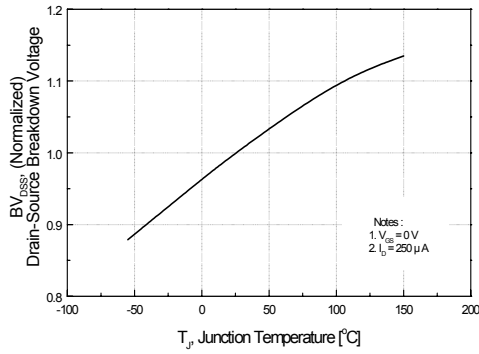


Figure 8. On-Resistance Variation vs. Temperature

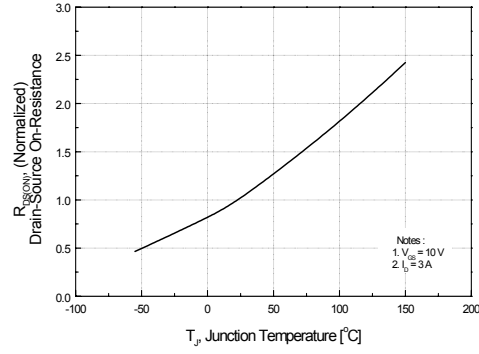


Figure 9-1. Maximum Safe Operating Area for FQP6N40CF

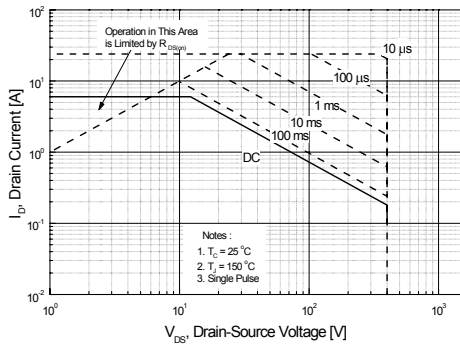


Figure 9-2. Maximum Safe Operating Area for FQPF6N40CF

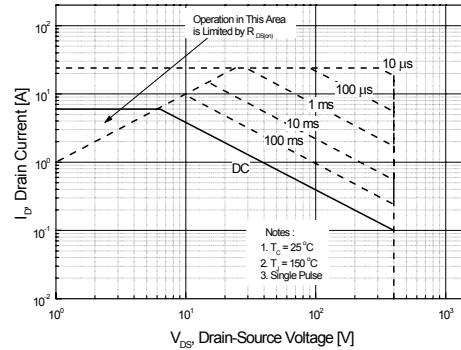
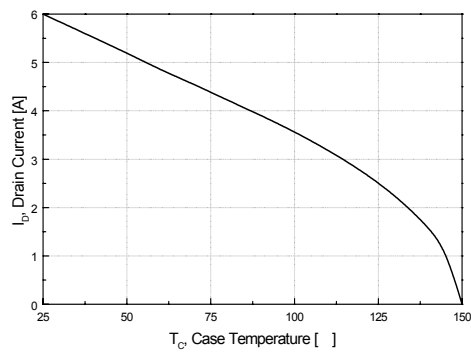


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FQP6N40CF

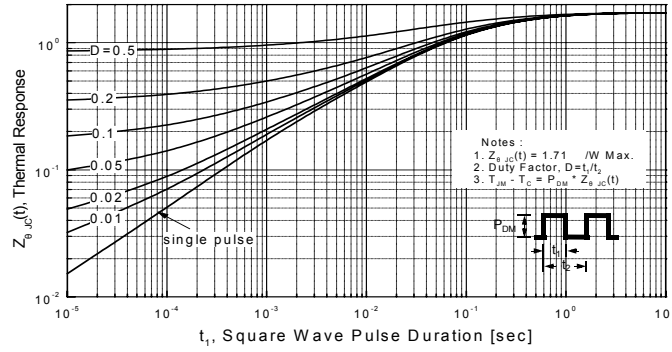
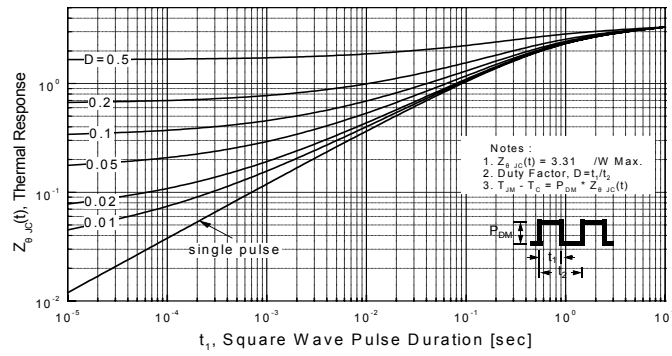
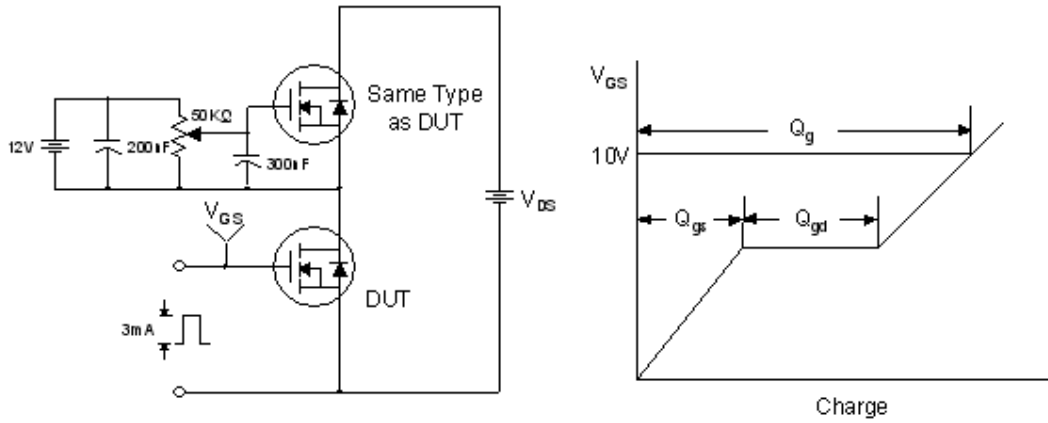


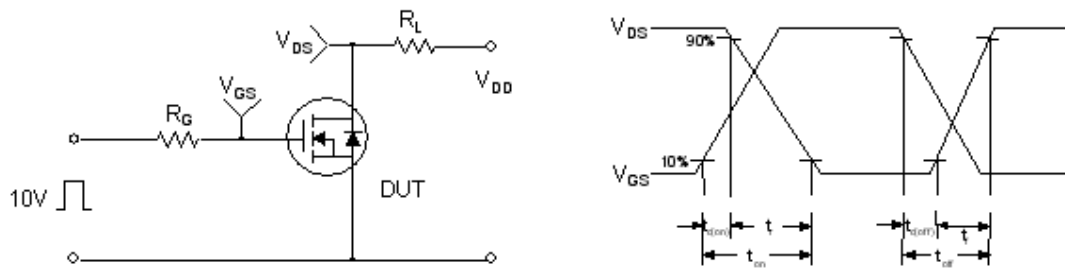
Figure 11-2. Transient Thermal Response Curve for FQPF6N40CF



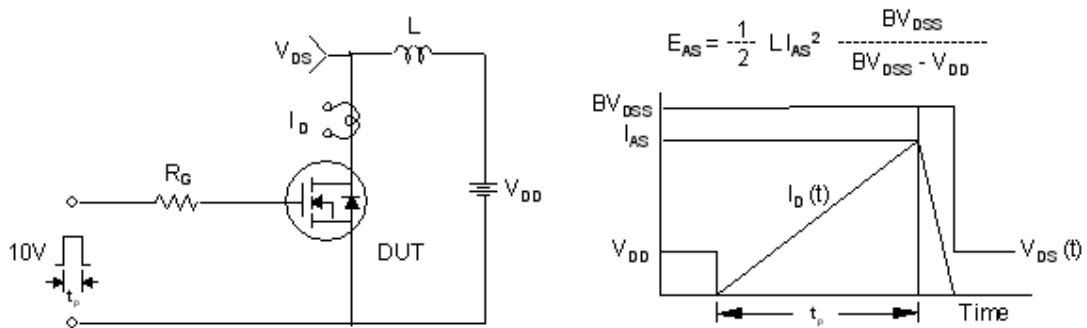
Gate Charge Test Circuit & Waveform



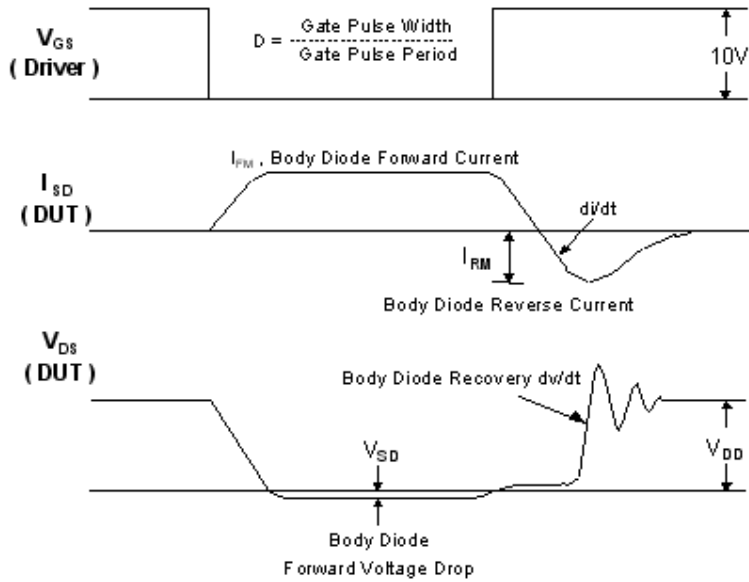
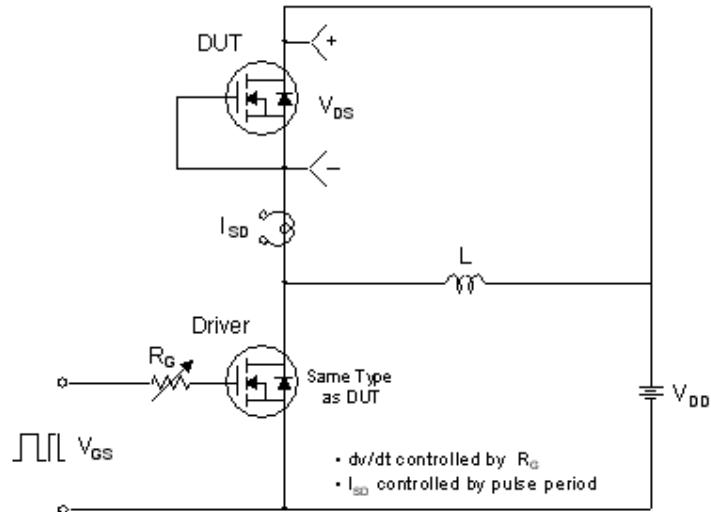
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

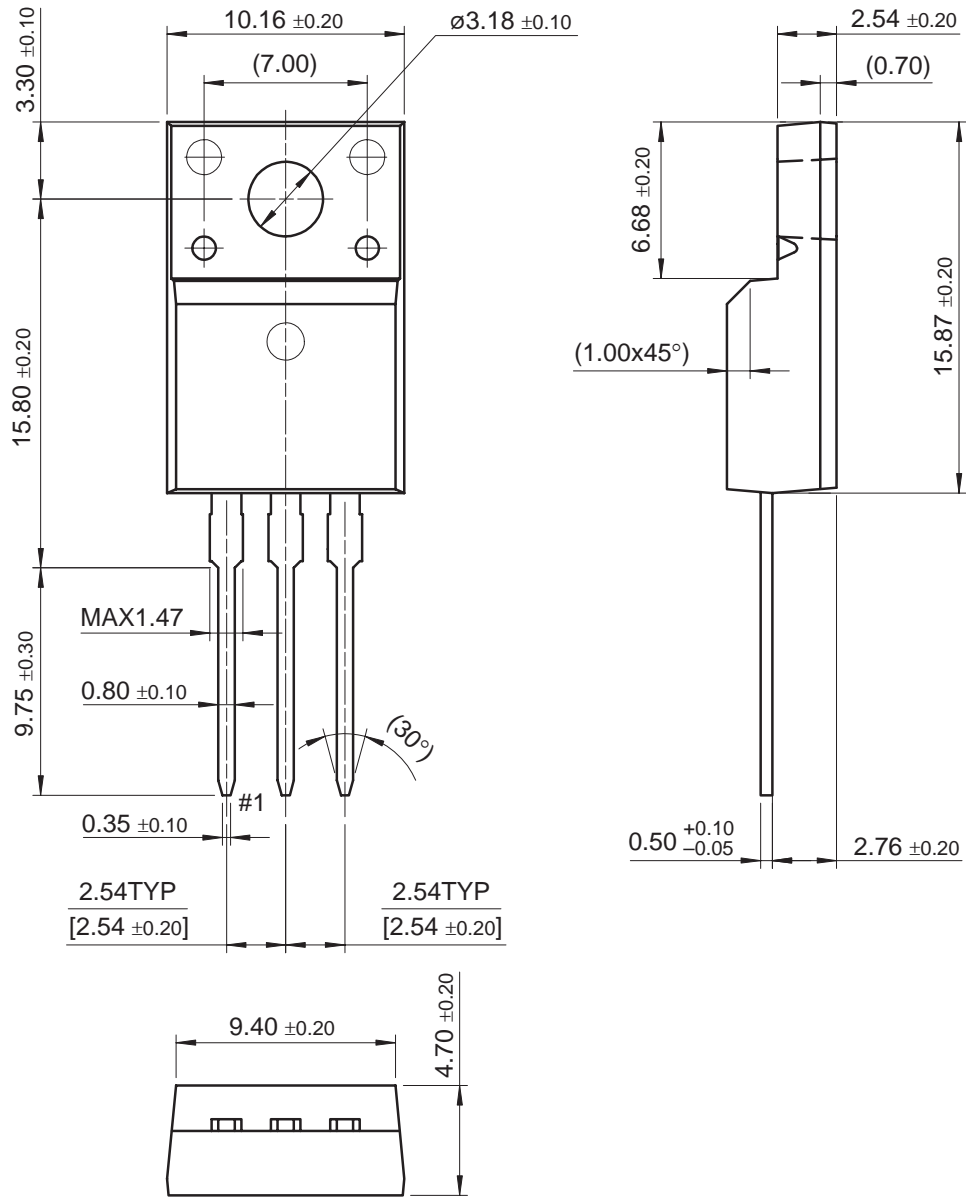


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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