

FQP6N40CF / FQPF6N40CF

N-Channel QFET FRFET MOSFET

400 V, 6.0 A, 1.1 Ω

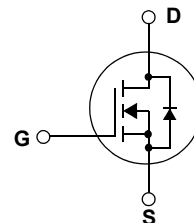
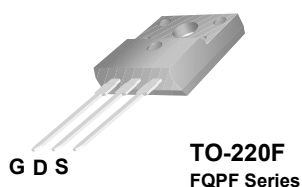
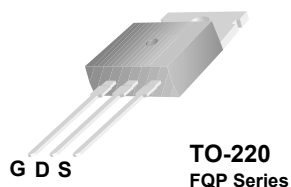


Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 6.0 A, 400 V, $R_{DS(on)} = 1.1 \Omega$ (Max) @ $V_{GS} = 10$ V, $I_D = 3.0$ A
- Low Gate Charge (Typ. 16 nC)
- Low C_{rss} (Typ. 15 pF)
- 100% Avalanche Tested



Absolute Maximum Ratings

Symbol	Parameter	FQP6N40CF	FQPF6N40CF	Unit
V_{DSS}	Drain-Source Voltage	400		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	6	6*
		- Continuous ($T_C = 100^\circ\text{C}$)	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)	20		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	73	38	W
		- Derate above 25°C	0.58	0.3
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	FQP6N40CF	FQPF6N40CF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.71	3.31	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

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.	Unit
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 = 3 A	--	0.9	1.1	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 3 A (Note 4)	--	4.7	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 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 V, I _D = 6 A, R _G = 25 Ω (Note 4, 5)	--	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		--	38	85	ns
Q _g	Total Gate Charge	V _{DS} = 320 V, I _D = 6 A, V _{GS} = 10 V (Note 4, 5)	--	16	20	nC
Q _{gs}	Gate-Source Charge		--	2.3	--	nC
Q _{gd}	Gate-Drain Charge		--	8.2	--	nC
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 V, I _S = 6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 6 A, di _F / dt = 100 A/μs (Note 4)	--	70	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.12	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 13.7mH, I_{AS} = 6A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 6A, 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

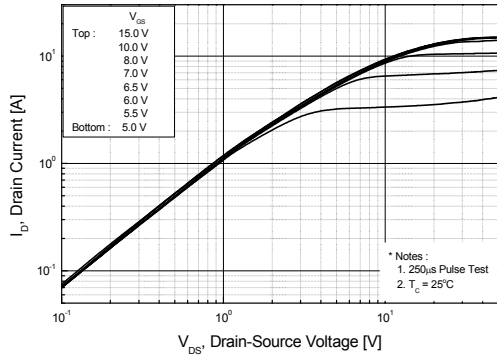


Figure 2. Transfer Characteristics

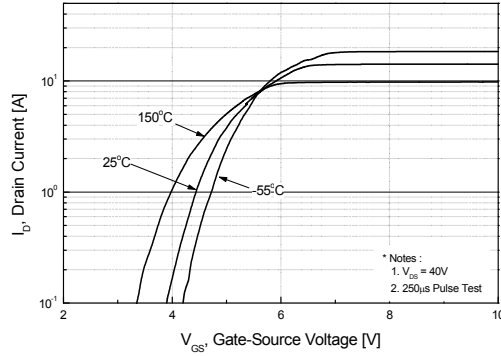


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

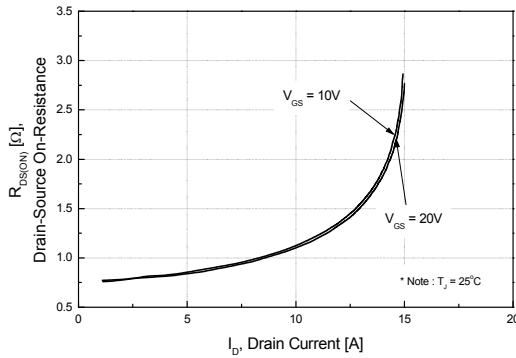


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

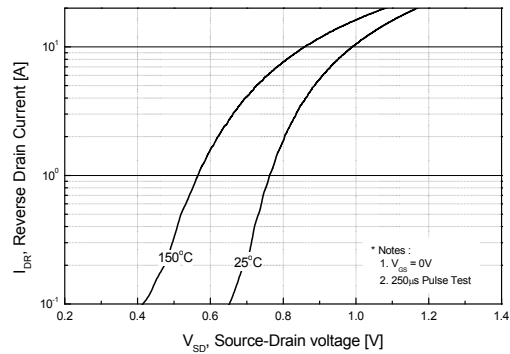


Figure 5. Capacitance Characteristics

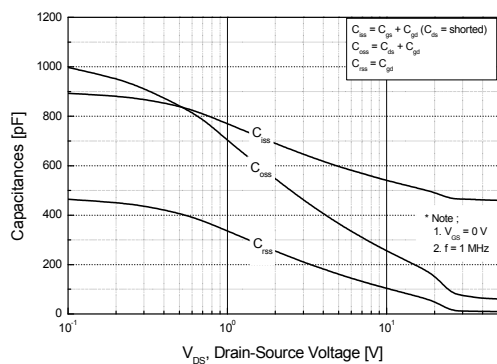
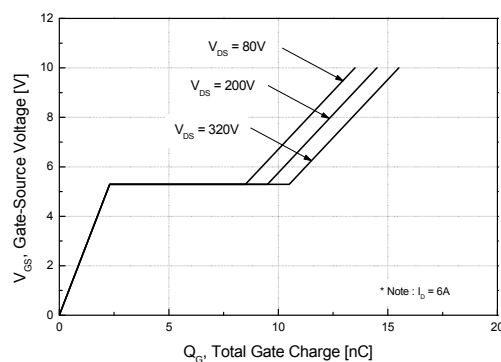


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

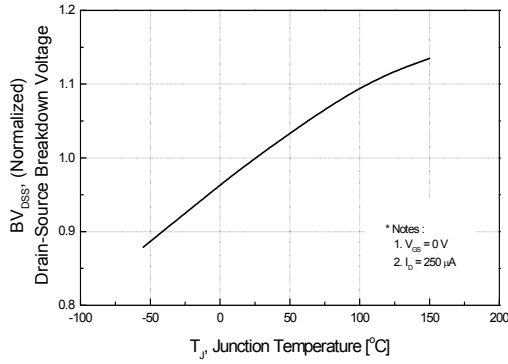


Figure 8. On-Resistance Variation vs. Temperature

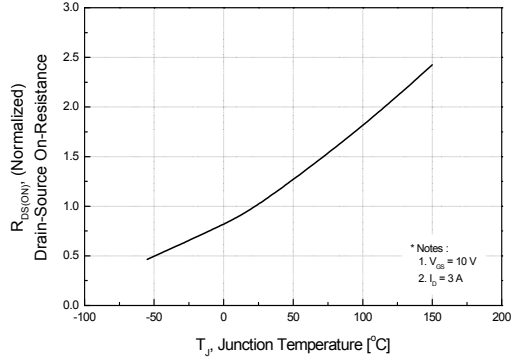


Figure 9-1. Maximum Safe Operating Area for FQP6N40CF

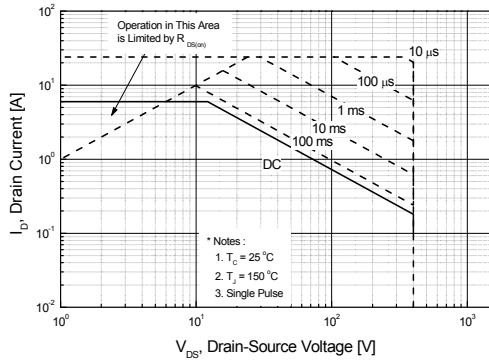


Figure 9-2. Maximum Safe Operating Area for FQPF6N40CF

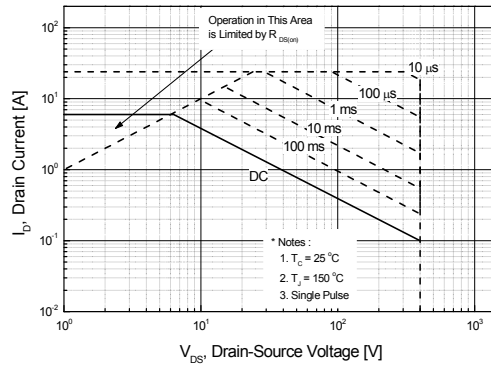
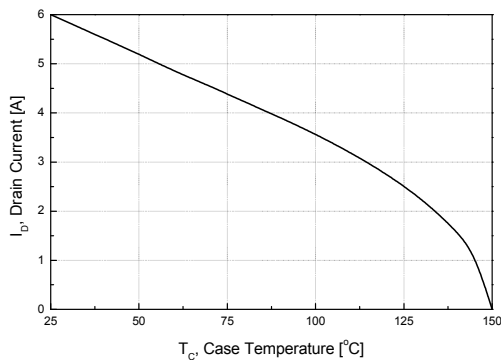


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. ransient Thermal Response Curve for FQP6N40CF

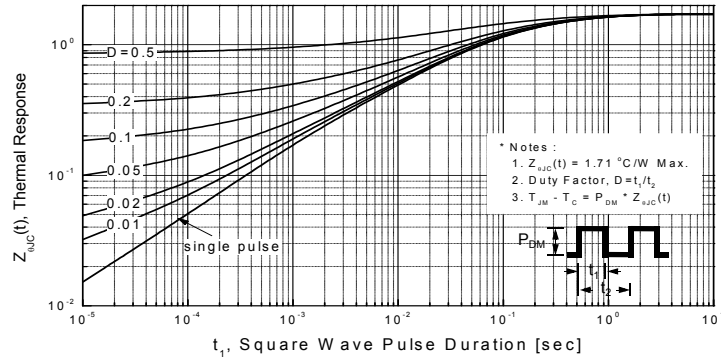
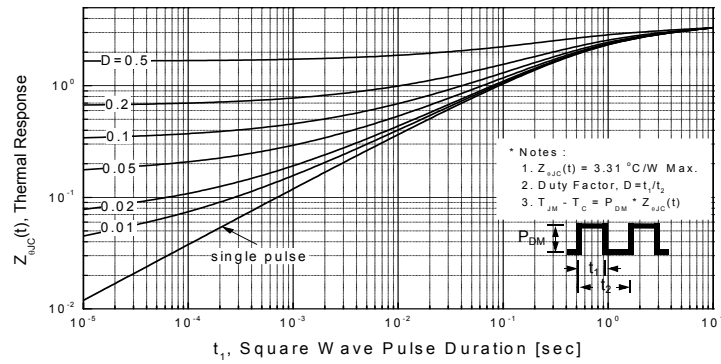
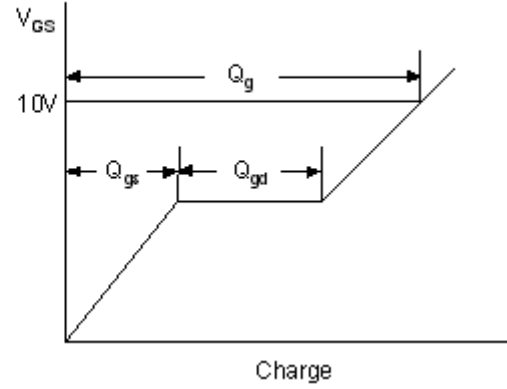
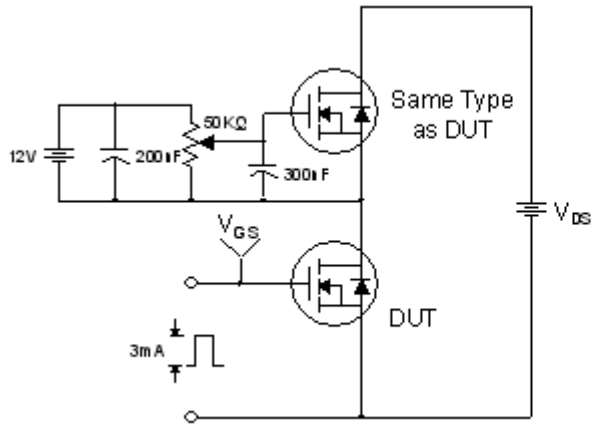


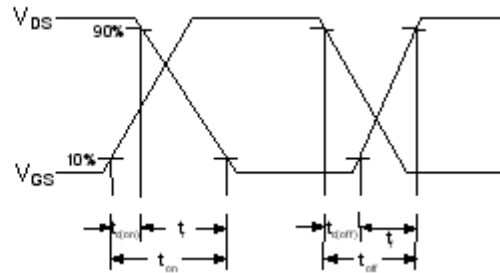
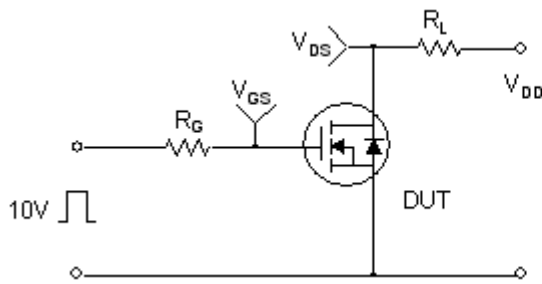
Figure 11-2. Transient Thermal Response Curve for FQPF6N40CF



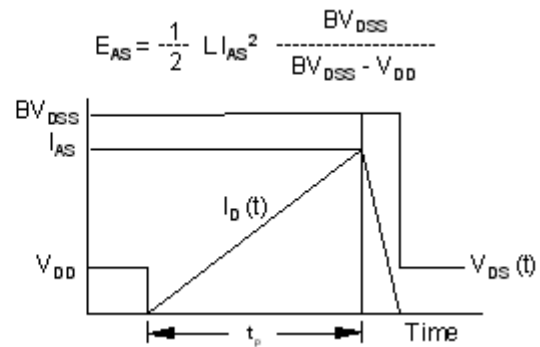
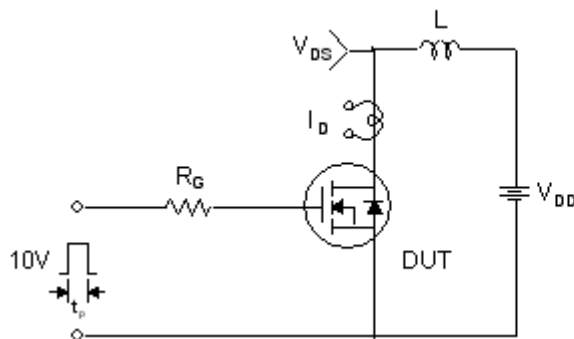
Gate Charge Test Circuit & Waveform



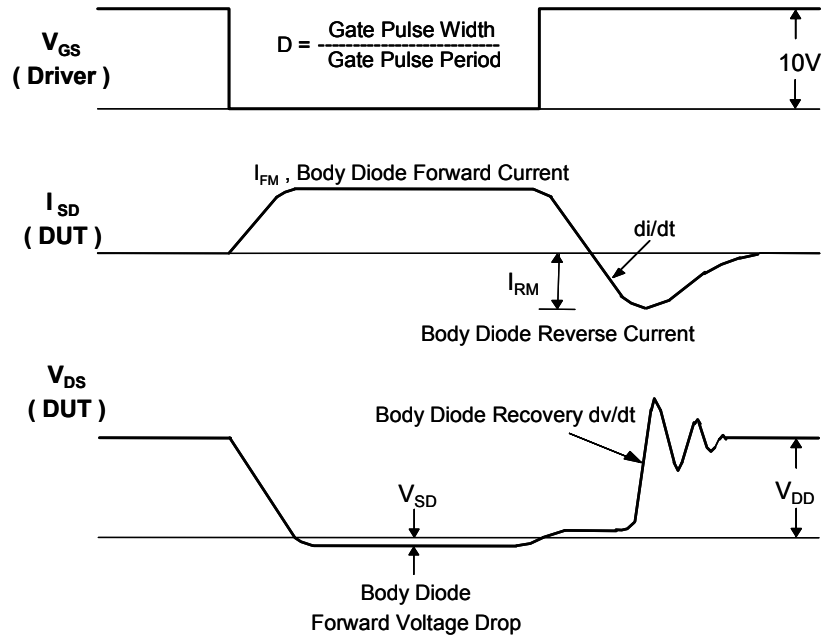
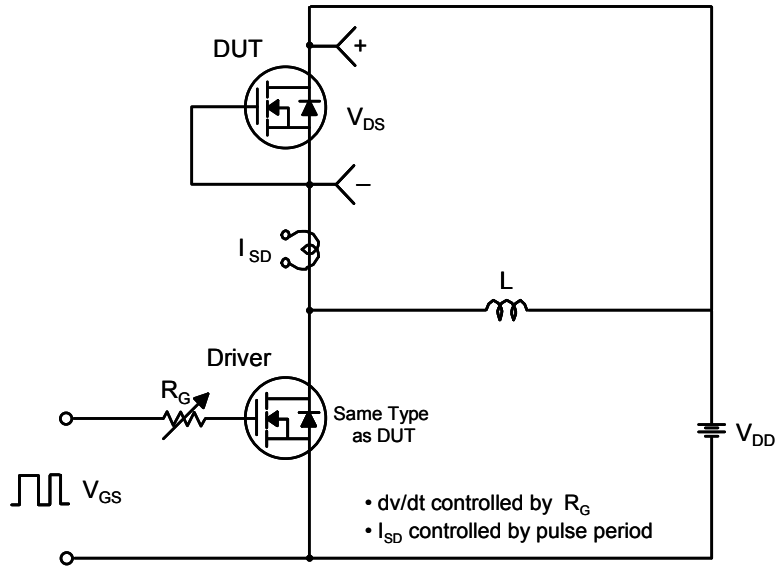
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

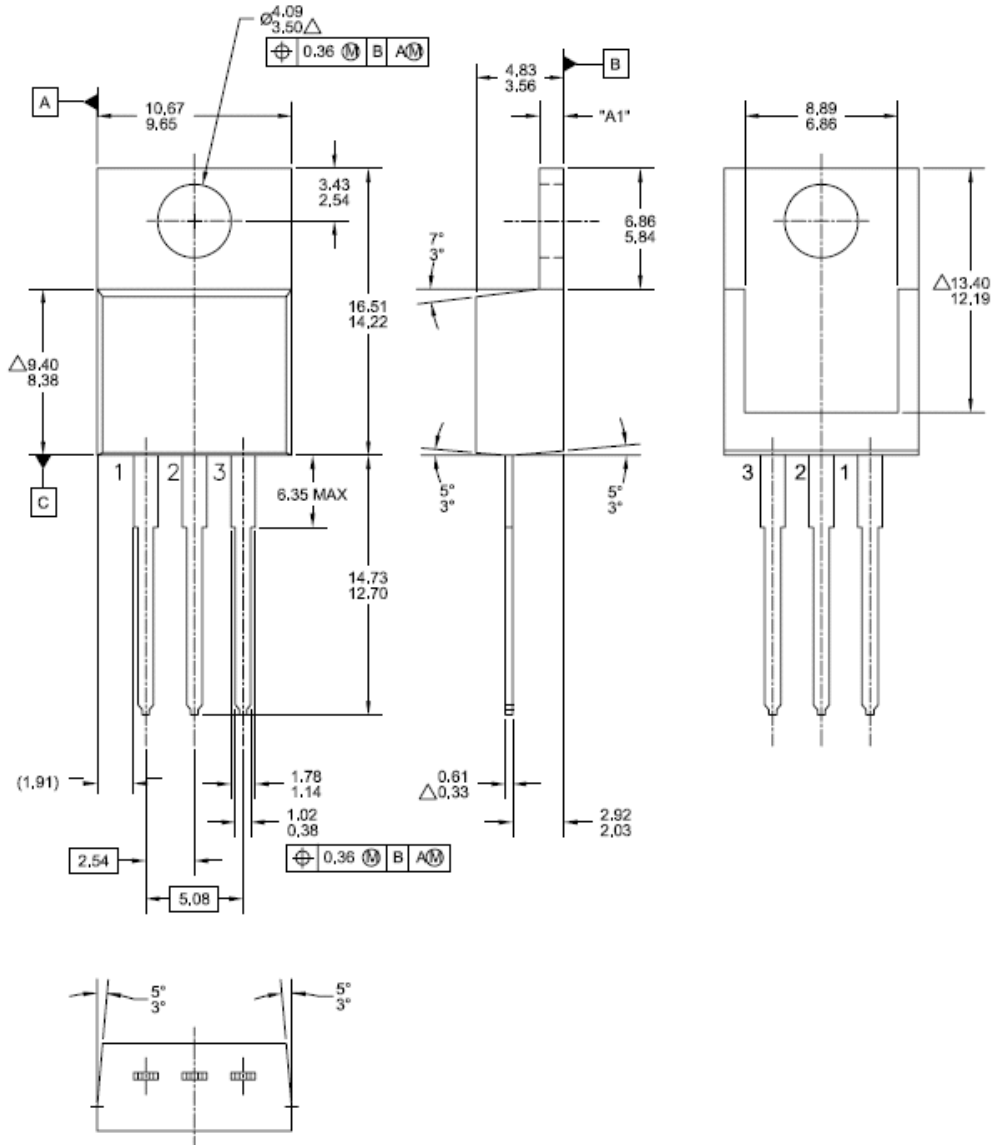


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

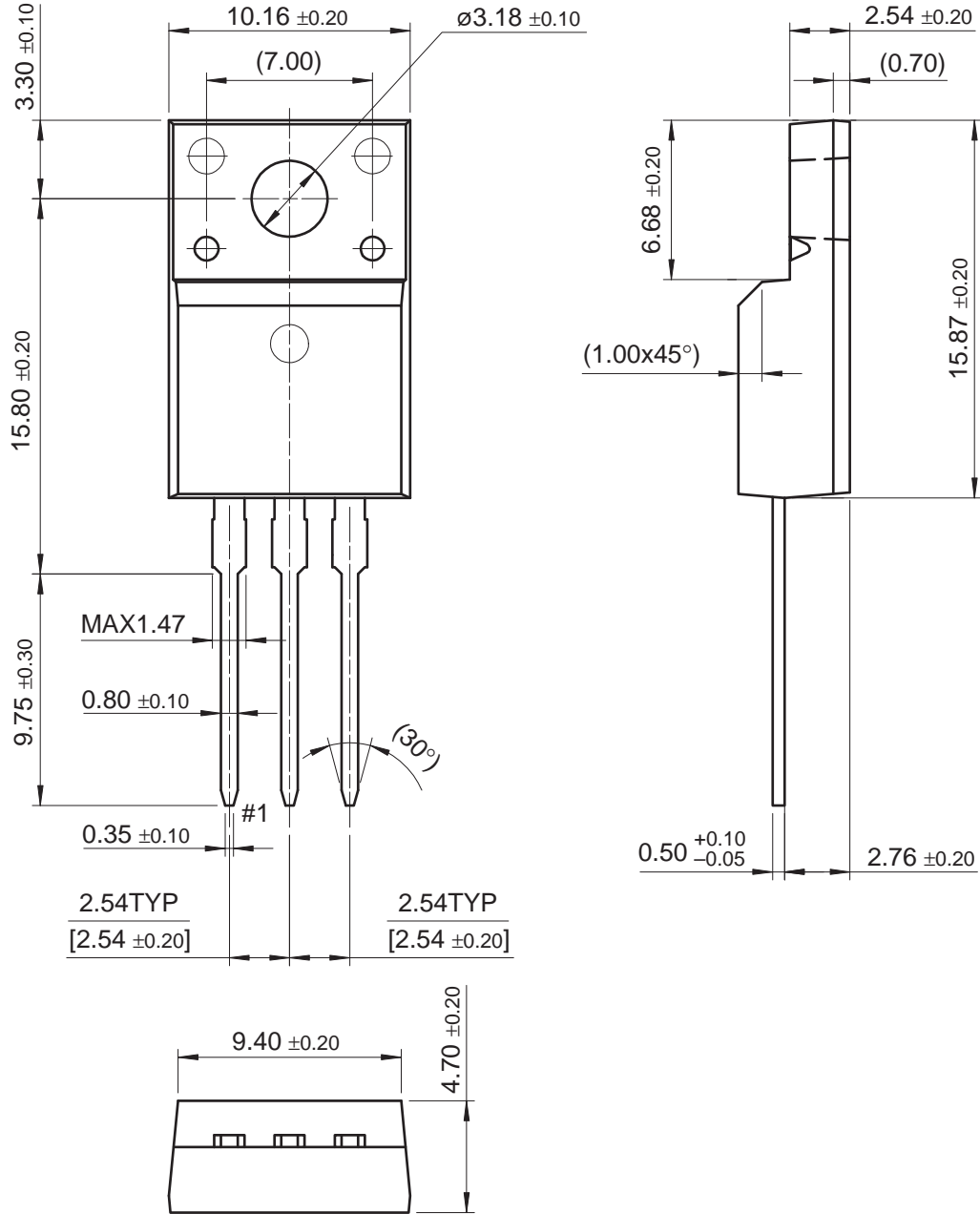
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters



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