

FQP13N50CF / FQPF13N50CF

N-Channel QFET® FRFET® MOSFET

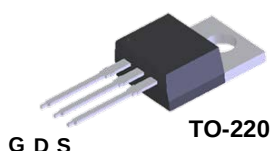
500 V, 13 A, 540 mΩ

Description

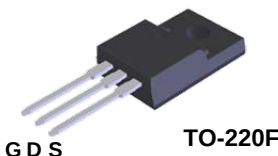
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength.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

Features

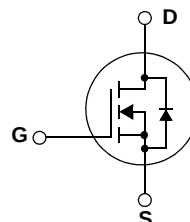
- 13 A, 500 V, $R_{DS(on)} = 540 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 6.5 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low C_{rss} (Typ. 20 pF)
- 100% Avalanche Tested
- Fast Recovery Body Diode (Typ. 100 ns)



TO-220



TO-220F



Absolute Maximum Ratings

Symbol	Parameter	FQP13N50CF	FQPF13N50CF	Unit
V_{DSS}	Drain-Source Voltage	500		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	13	13*	A
	- Continuous ($T_C = 100^\circ\text{C}$)	8	8*	A
I_{DM}	Drain Current - Pulsed (Note 1)	52	52*	A
V_{GSS}	Gate-Source voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	530		mJ
I_{AR}	Avalanche Current (Note 1)	13		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	19.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	195	48	W
	- Derate above 25°C	1.56	0.39	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 Purpose, 1/8" from Case for 5 Seconds	300		$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP13N50CF	FQPF13N50CF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.64	2.58	$^\circ\text{C/W}$
$R_{\theta JA}$	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
FQP13N50CF	FQP13N50CF	TO-220	-	-	50
FQPF13N50CF	FQPF13N50CF	TO-220F	-	-	50

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500V, V _{GS} = 0V	--	--	10	μA
		V _{DS} = 400V, T _C = 125°C	--	--	100	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.0	--	4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 6.5A	--	0.43	0.54	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 6.5A (Note 4)	--	15	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	1580	2055	pF
C _{oss}	Output Capacitance		--	180	235	pF
C _{rss}	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250V, I _D = 13A R _G = 25Ω (Note 4, 5)	--	25	60	ns
t _r	Turn-On Rise Time		--	100	210	ns
t _{d(off)}	Turn-Off Delay Time		--	130	270	ns
t _f	Turn-Off Fall Time		--	100	210	ns
Q _g	Total Gate Charge	V _{DS} = 400V, I _D = 13A V _{GS} = 10V (Note 4, 5)	--	43	56	nC
Q _{gs}	Gate-Source Charge		--	7.5	--	nC
Q _{gd}	Gate-Drain Charge		--	18.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	13	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	52	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 13A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 13A	--	100	160	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100A/μs (Note 4)	--	0.35	--	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 5.6mH, I_{AS} = 13A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 13A, 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 Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

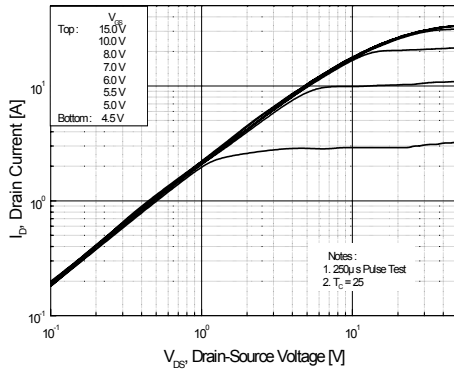


Figure 2. Transfer Characteristics

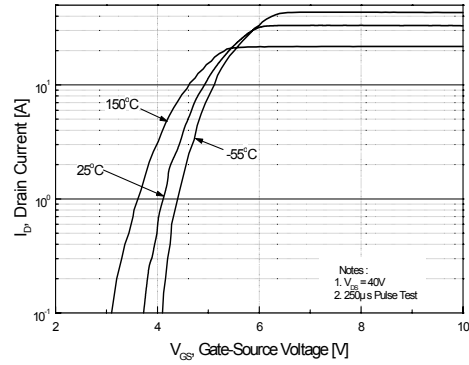


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

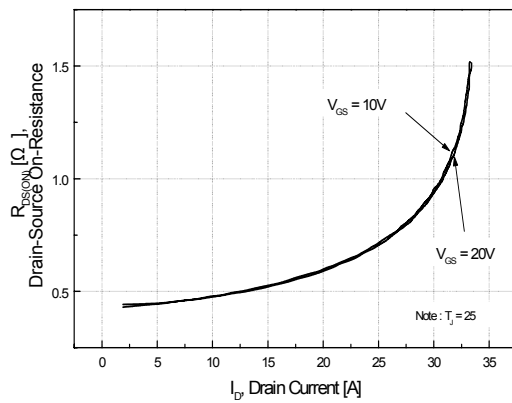


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

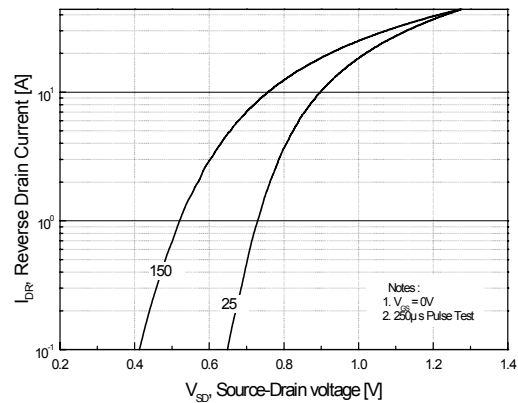


Figure 5. Capacitance Characteristics

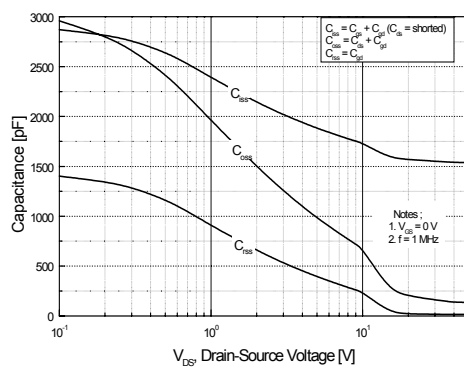
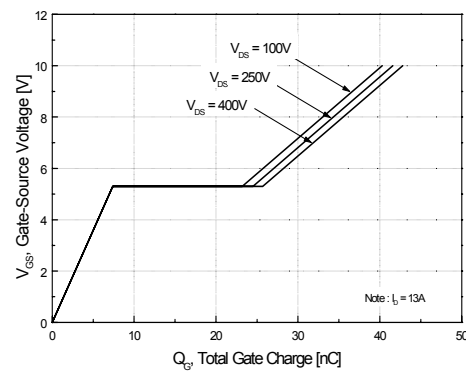


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

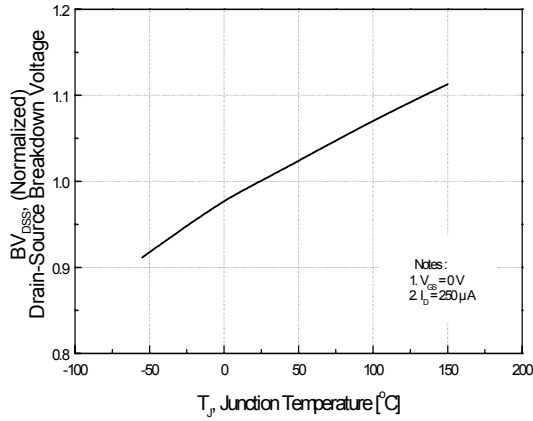


Figure 8. On-Resistance Variation vs. Temperature

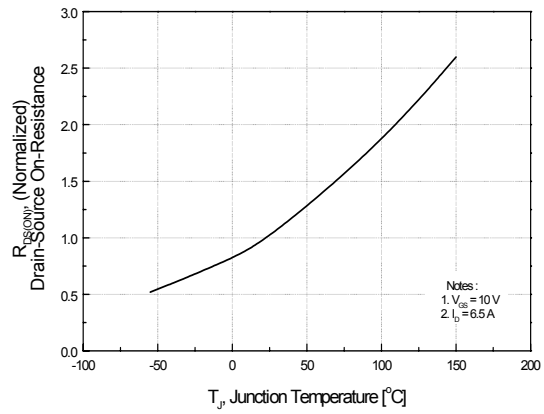


Figure 9-1. Maximum Safe Operating Area for FQP13N50CF

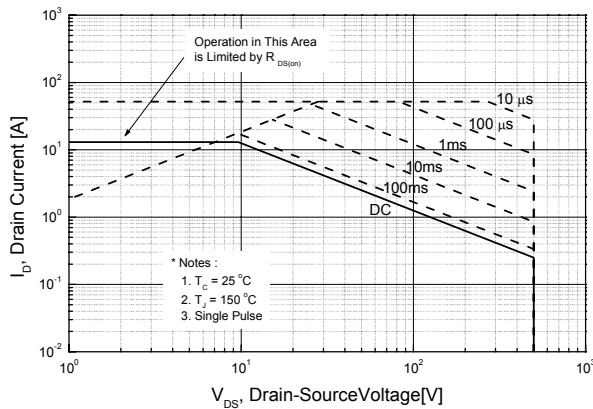


Figure 9-2. Maximum Safe Operating Area for FQPF13N50CF

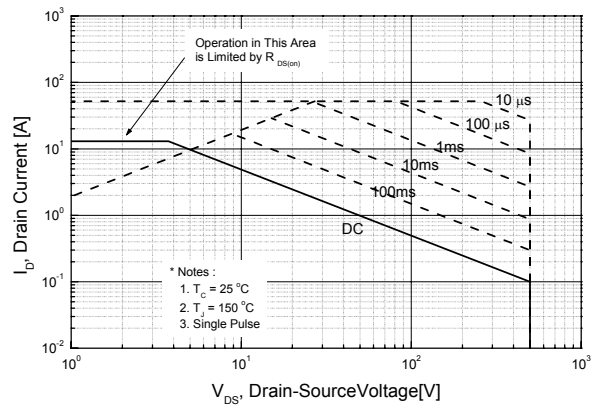
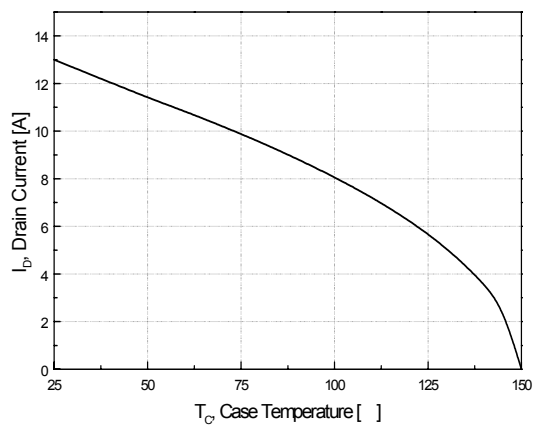


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FQP13N50CF

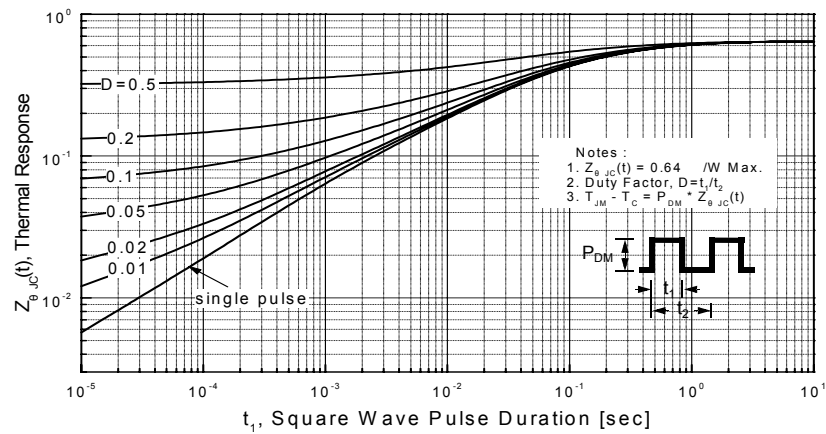
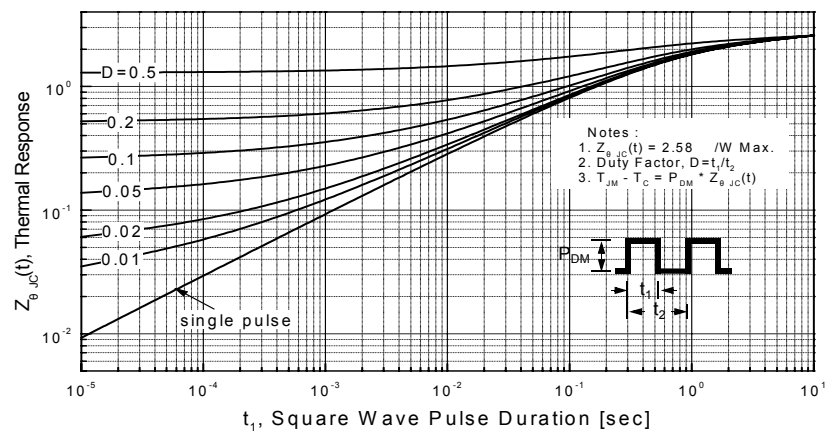
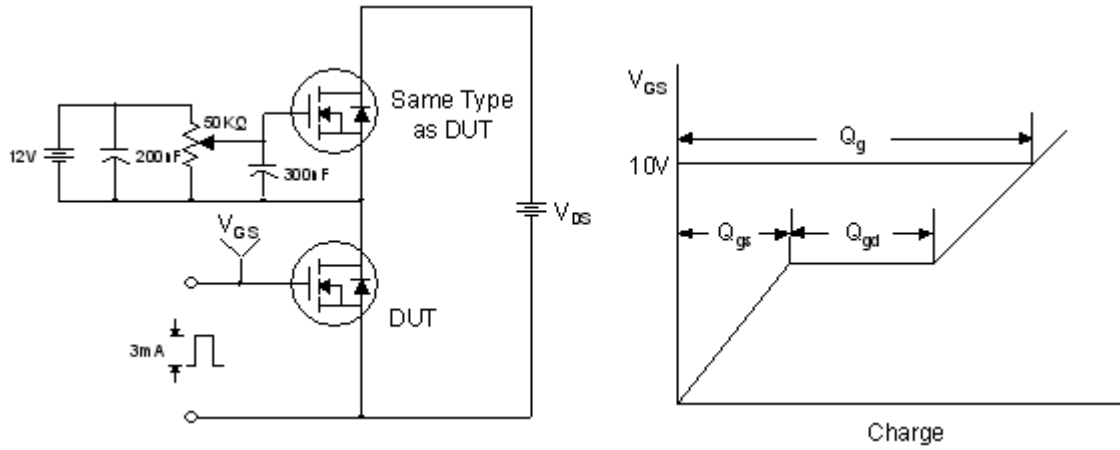


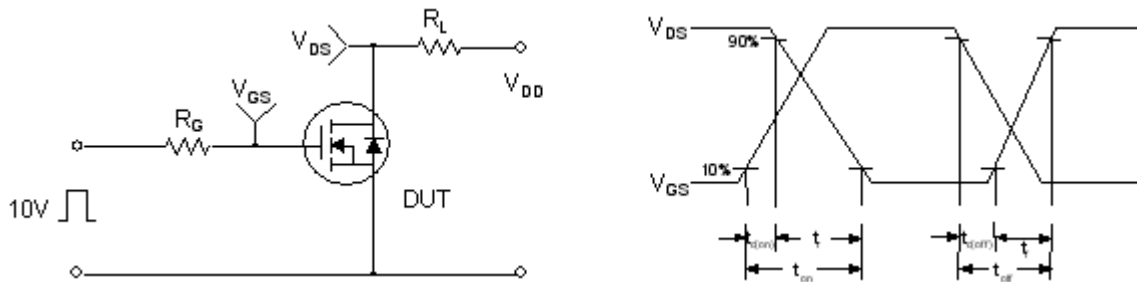
Figure 11-2. Transient Thermal Response Curve for FQPF13N50CF



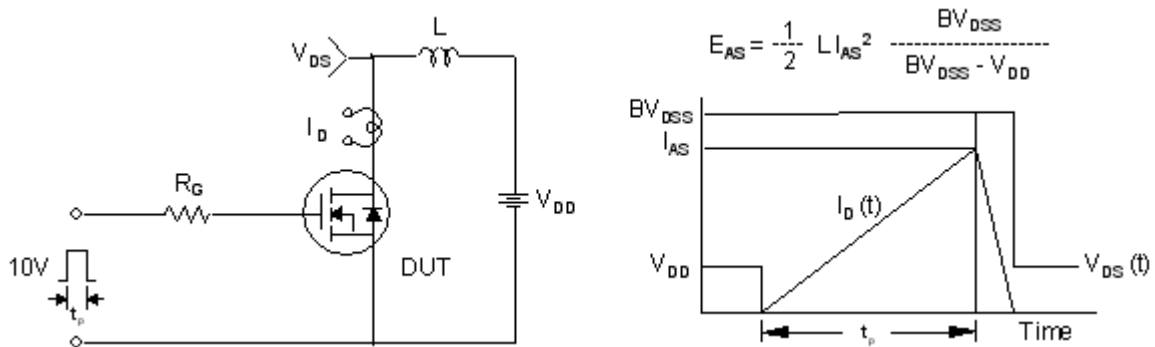
Gate Charge Test Circuit & Waveform



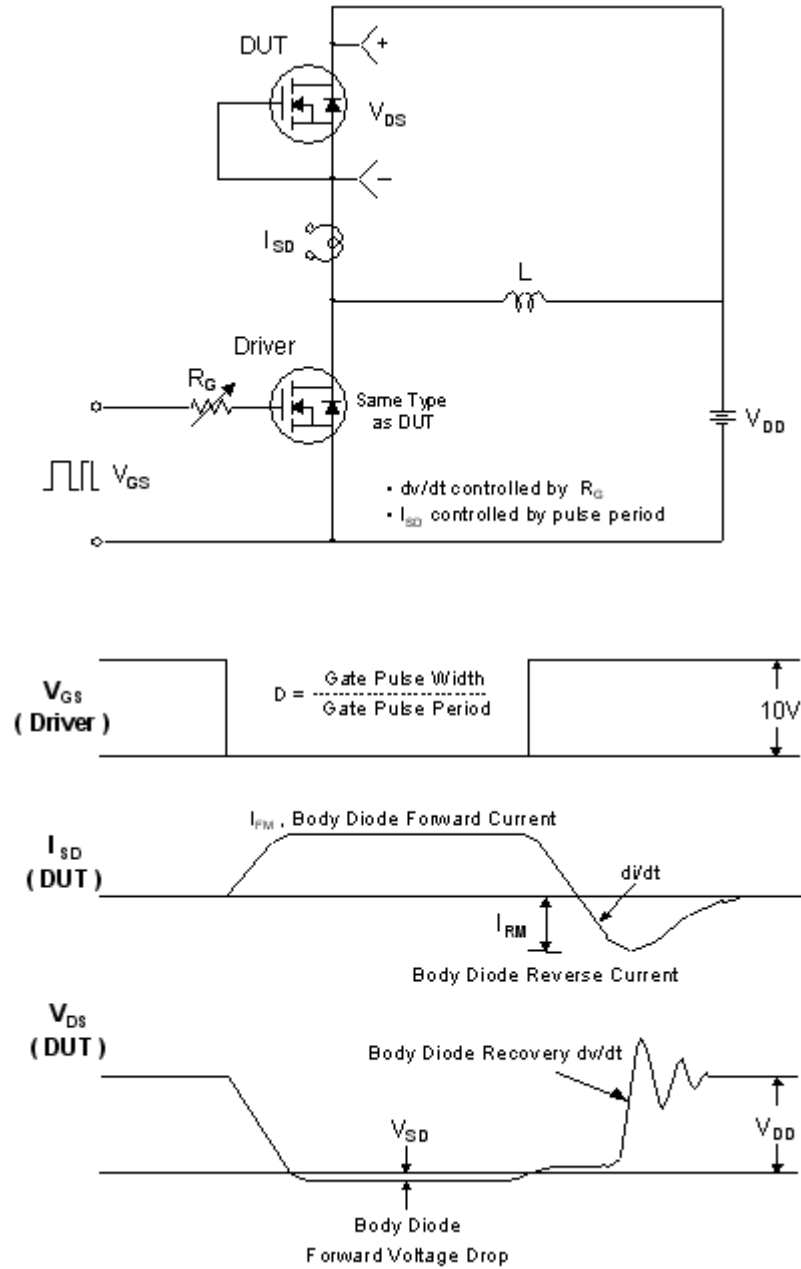
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

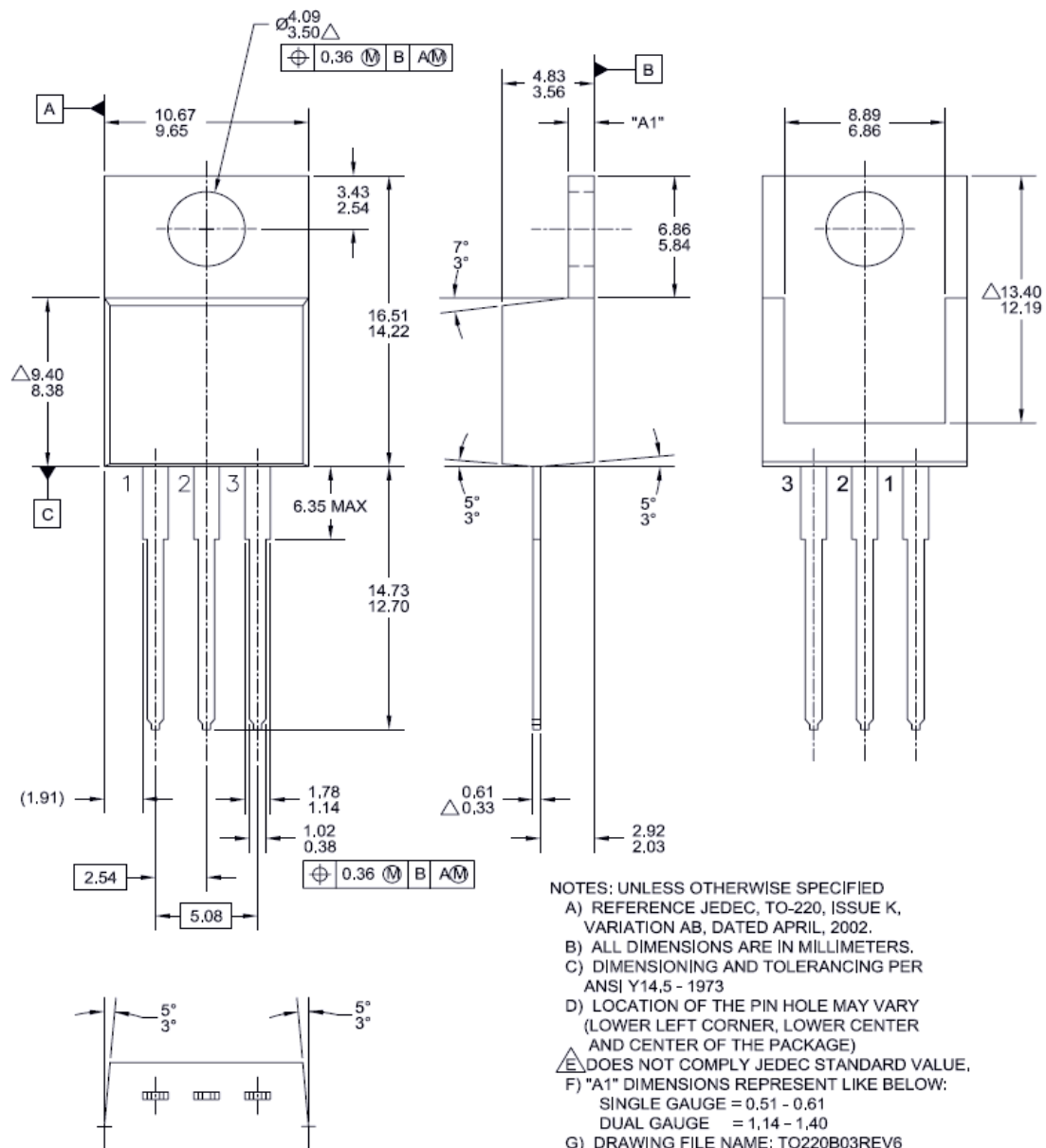


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

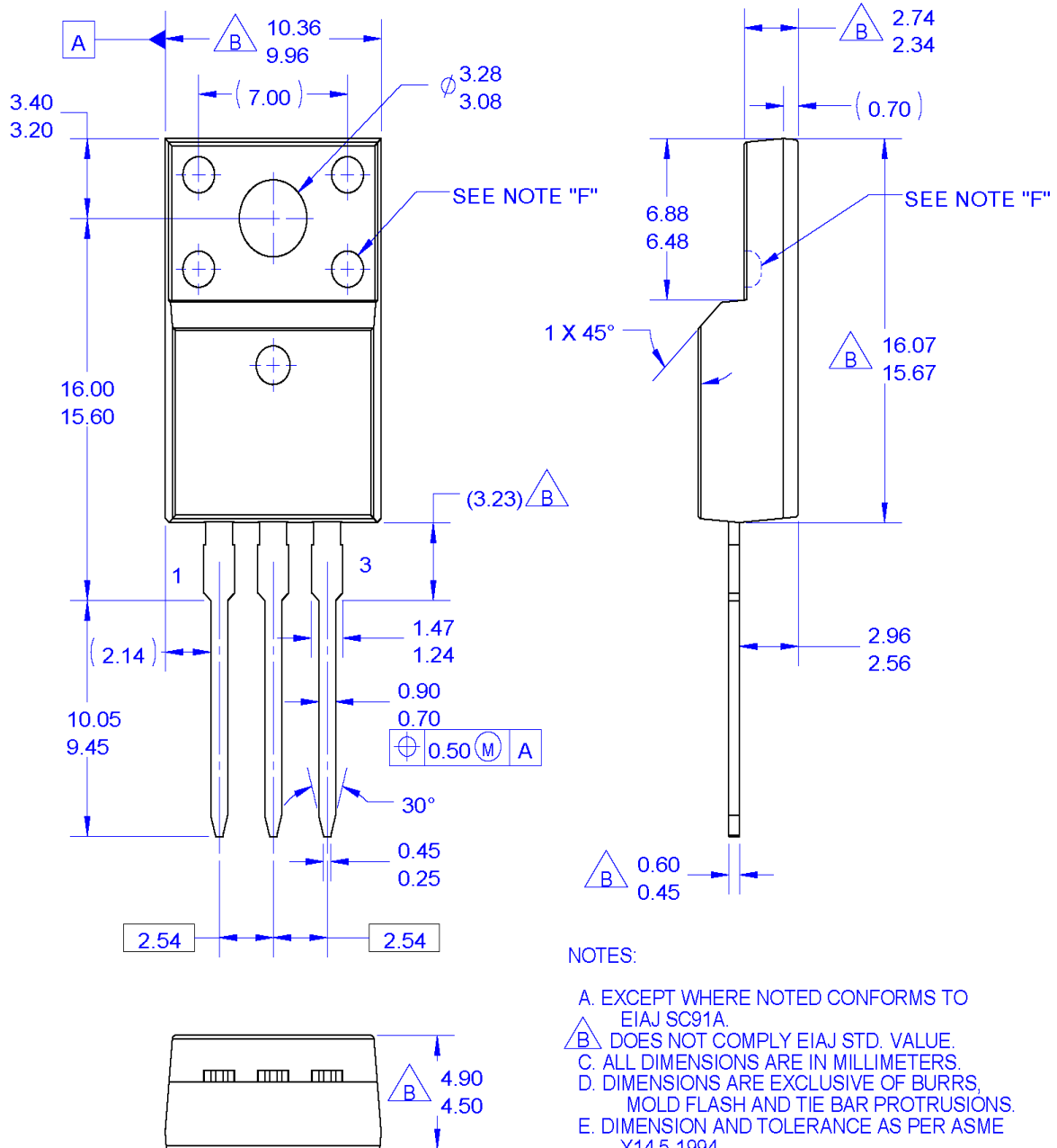
TO-220



Dimensions in Millimeters

Mechanical Dimensions

TO-220F



NOTES:

- EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- DOES NOT COMPLY EIAJ STD. VALUE.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- DRAWING FILE NAME: TO220M03REV3

Dimensions in Millimeters



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