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FAIRCHILD SEMICONDUCTOR®

December 2013

FQP9N90C / FQPF9N90C

N-Channel QFET® MOSFET

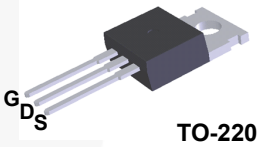
900 V, 8.0 A, 1.4 Ω

Description

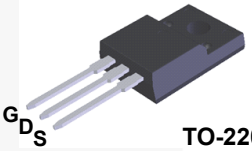
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength.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

Features

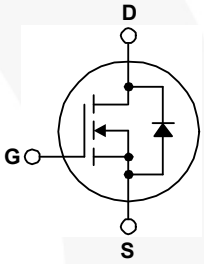
- 8 A, 900 V, $R_{DS(on)}$ = 1.4 Ω (Max.) @ V_{GS} = 10 V, I_D = 4 A
- Low Gate Charge (Typ. 45 nC)
- Low Crss (Typ. 14 pF)
- 100% Avalanche Tested



TO-220



TO-220F



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted.

Symbol	Parameter		FQP9N90C	FQPF9N90CT	Unit
V_{DSS}	Drain-Source Voltage		900		V
I_D	Drain Current - Continuous (T_C = 25°C)		8.0	8.0 *	A
	Drain Current - Continuous (T_C = 100°C)		2.8	2.8 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	32	32 *	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	900		mJ
I_{AR}	Avalanche Current	(Note 1)	8.0		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	20.5		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.0		V/ns
P_D	Power Dissipation (T_C = 25°C)		205	68	W
	- Derate above 25°C		1.64	0.54	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum lead temperature for soldering, 1/8" from case for 5 seconds		300		°C

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP9N90C	FQPF9N90CT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.61	1.85	°C/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ, Max.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP9N90C	FQP9N90C	TO-220	Tube	N/A	N/A	50 units
FQPF9N90CT	FQPF9N90CT	TO-220F	Tube	N/A	N/A	50 units

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	900	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.99	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 900 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 720 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	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 4 A	--	1.12	1.4	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 4 A	--	9.2	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2100	2730	pF
C_{oss}	Output Capacitance		--	175	230	pF
C_{rss}	Reverse Transfer Capacitance		--	14	18	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 450 V, I_D = 9.0A, R_G = 25 Ω (Note 4)	--	50	110	ns
t_r	Turn-On Rise Time		--	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	210	ns
t_f	Turn-Off Fall Time		--	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 9.0A, V_{GS} = 10 V (Note 4)	--	45	58	nC
Q_{gs}	Gate-Source Charge		--	13	--	nC
Q_{gd}	Gate-Drain Charge		--	18	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	8.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	32.0	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 8 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 9 A, dI_F / dt = 100 A/μs	--	550	--	ns
Q_{rr}	Reverse Recovery Charge		--	6.5	--	μC

Notes:
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 21 mH, I_{AS} = 9 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 9.0 A, di/dt ≤ 200 A/μs , V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.

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Typical Characteristics

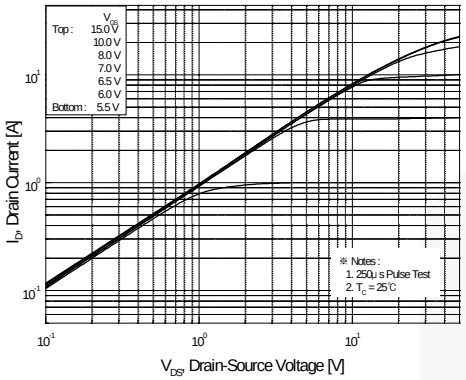


Figure 1. On-Region Characteristics

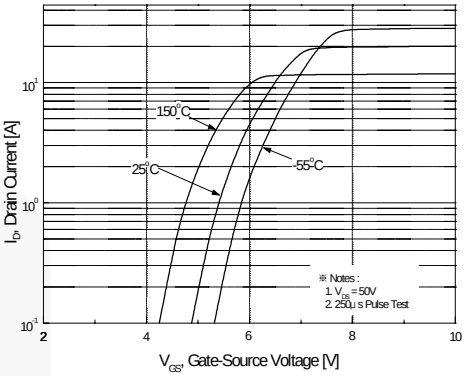


Figure 2. Transfer Characteristics

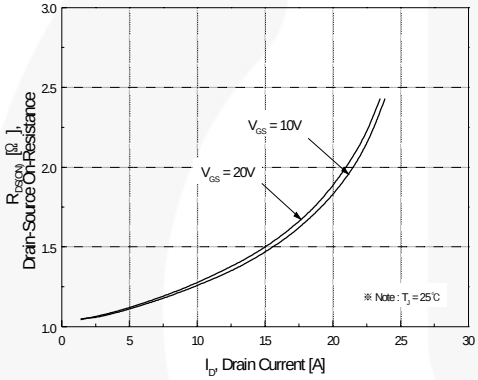


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

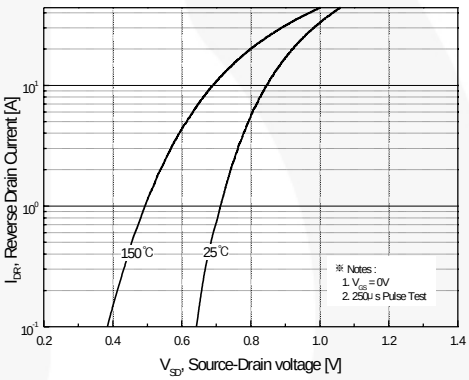


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

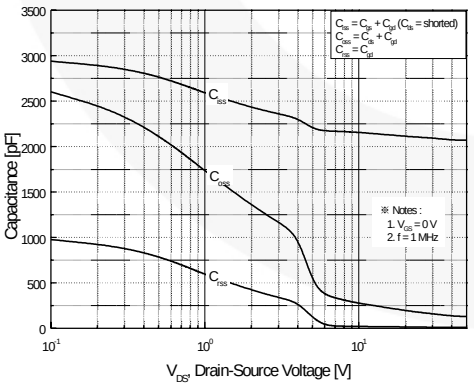


Figure 5. Capacitance Characteristics

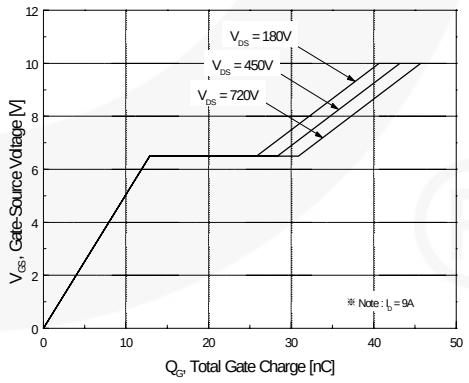


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

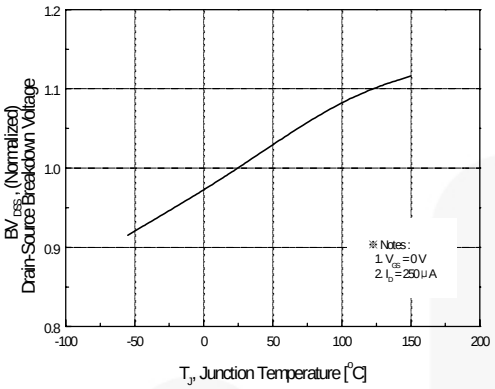


Figure 7. Breakdown Voltage Variation vs Temperature

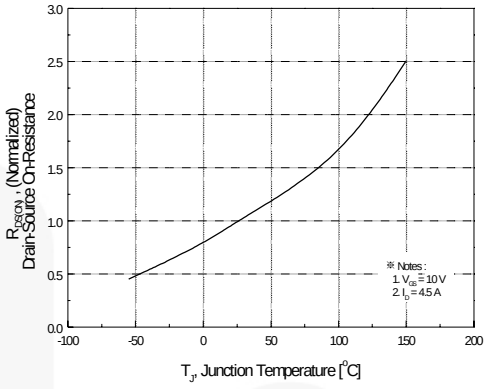


Figure 8. On-Resistance Variation vs Temperature

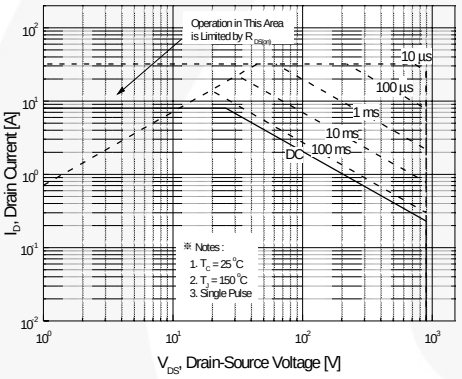


Figure 9-1. Maximum Safe Operating Area for FQP9N90C

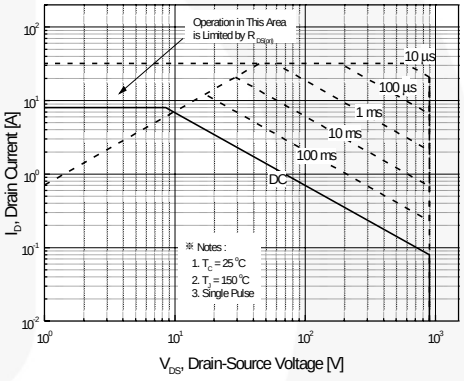


Figure 9-2. Maximum Safe Operating Area for FQPF9N90CT

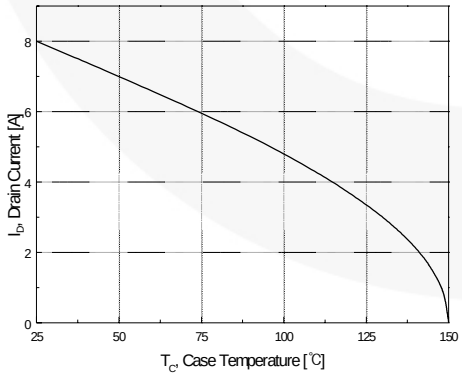


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

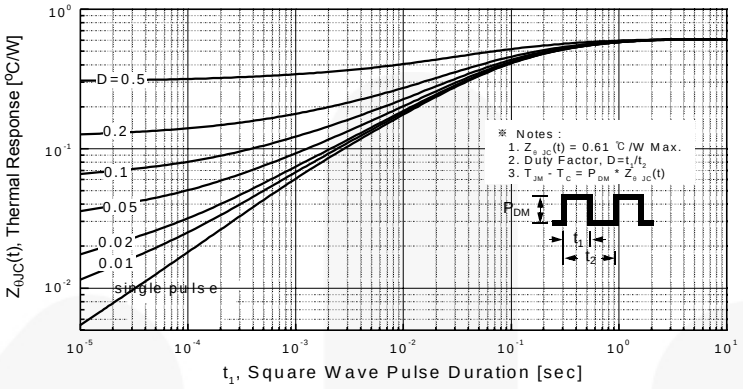


Figure 11-1. Transient Thermal Response Curve for FQP9N90C

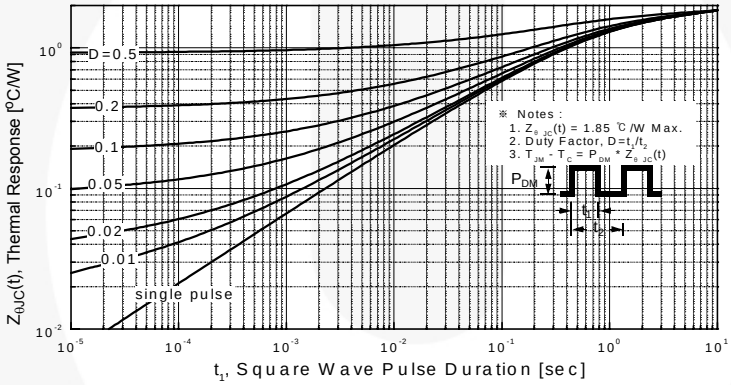


Figure 11-2. Transient Thermal Response Curve for FQPF9N90CT

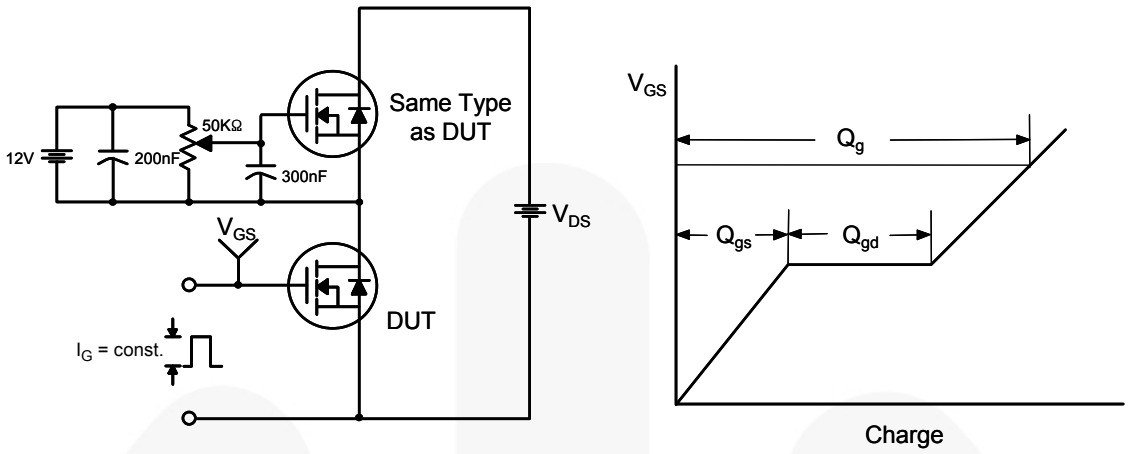


Figure 12. Gate Charge Test Circuit & Waveform

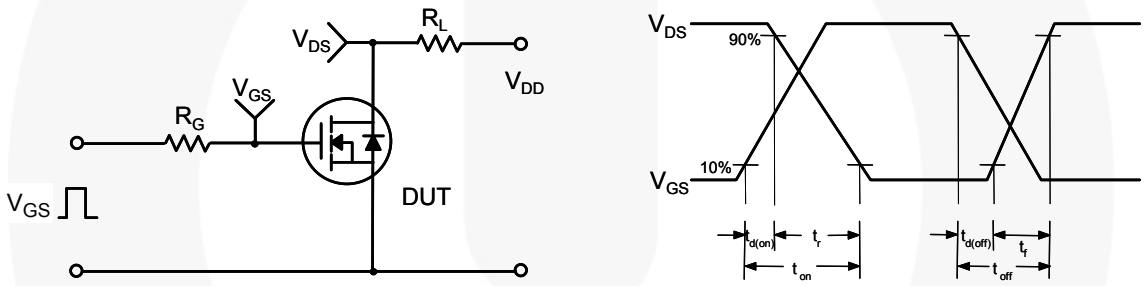


Figure 13. Resistive Switching Test Circuit & Waveforms

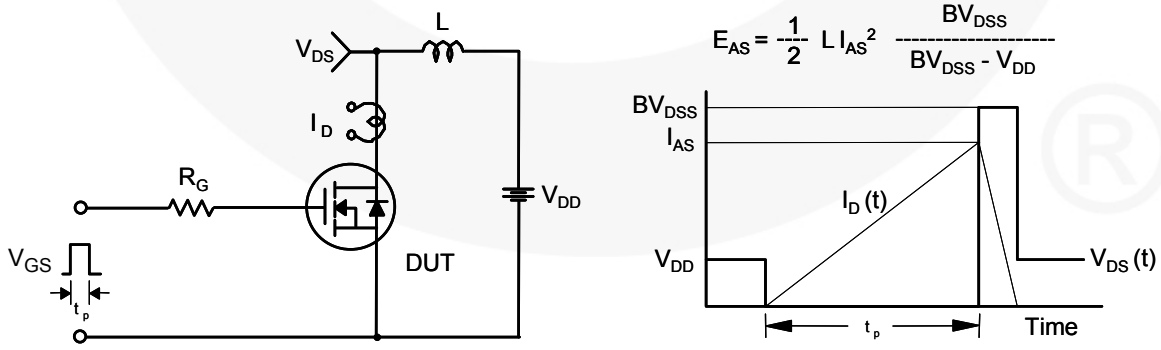


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

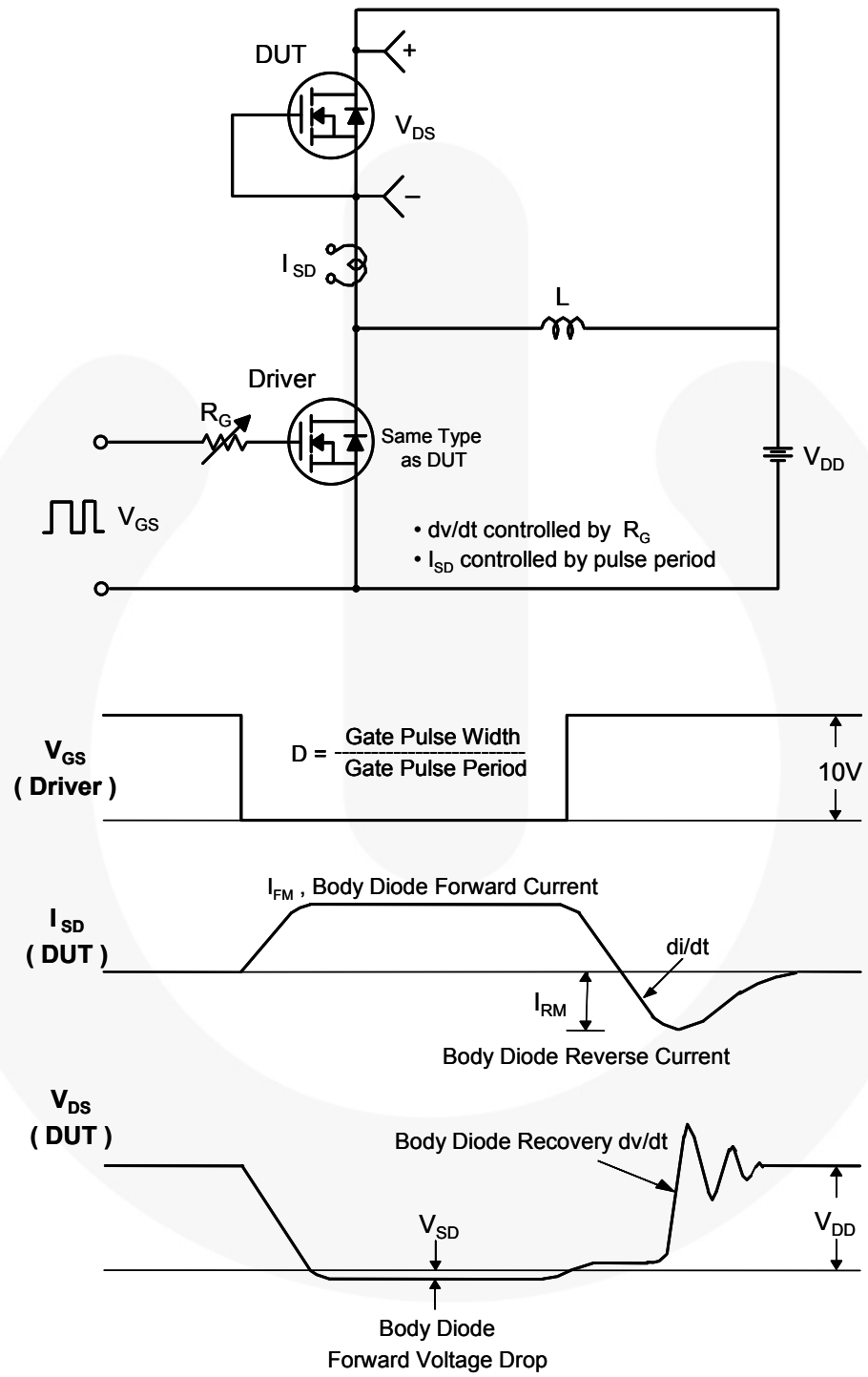


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

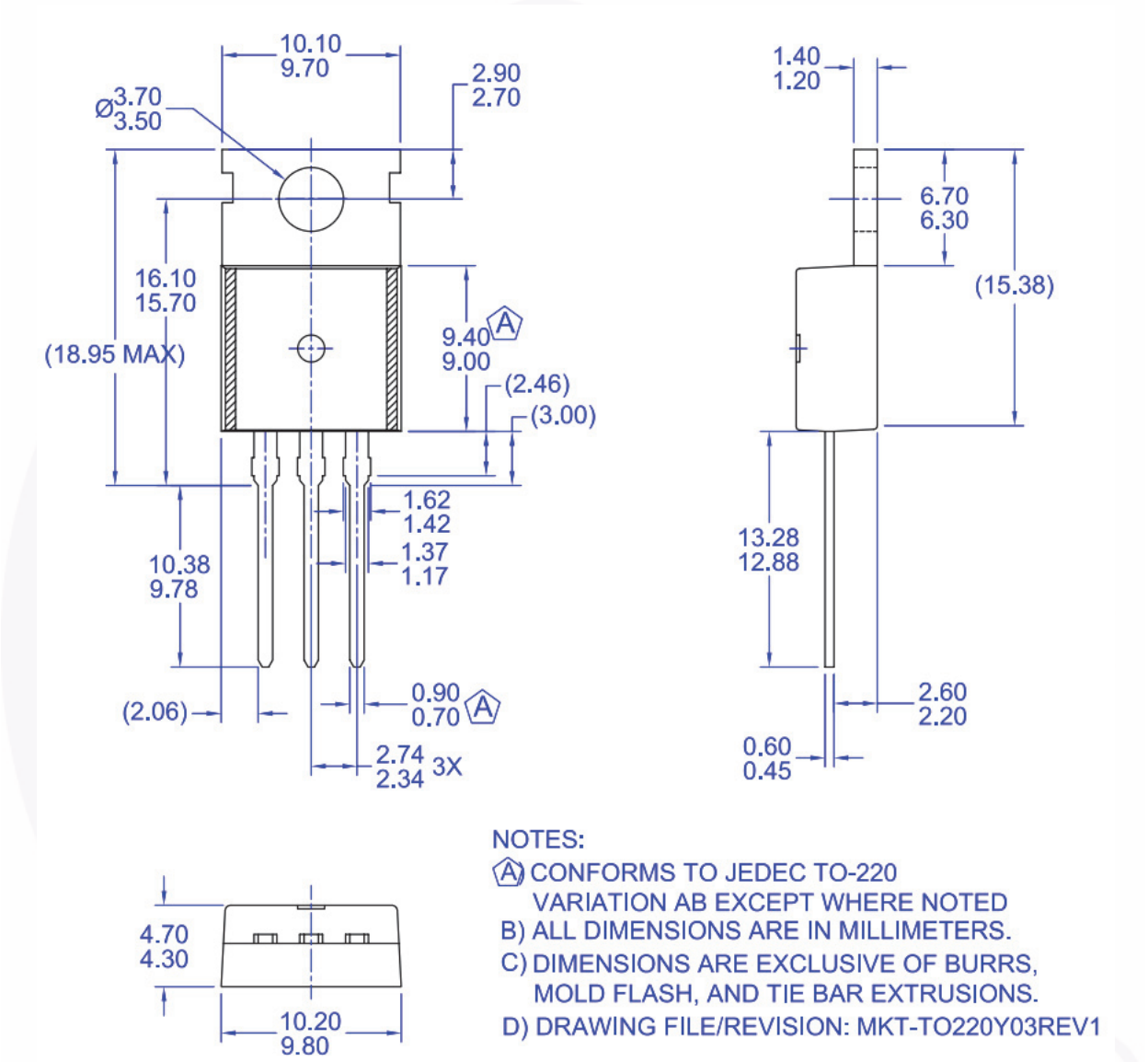


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

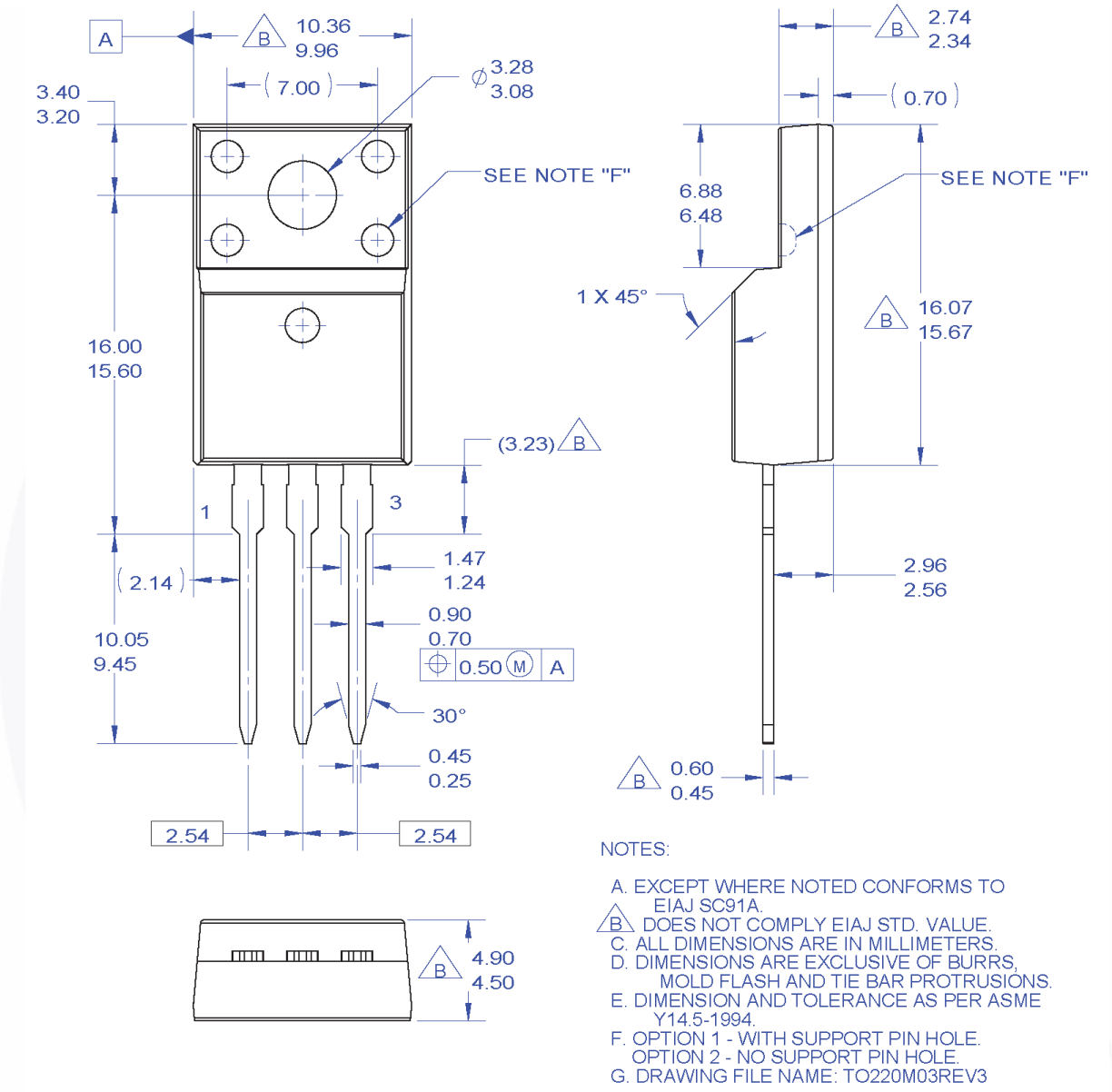


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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