ON Semiconductor®

FQP13N50C / FQPF13N50C

N-Channel QFET® MOSFET

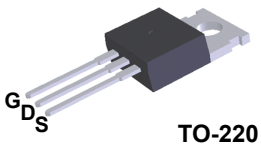
500 V, 13 A, 480 mΩ

Description

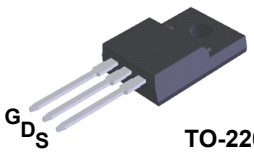
These N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse 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.

Features

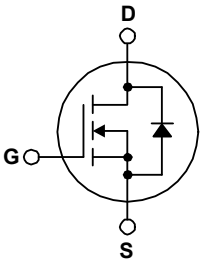
- 13 A, 500 V, $R_{DS(on)}$ = 480 mΩ (Max.) @ V_{GS} = 10 V, I_D = 6.5 A
- Low Gate Charge (Typ. 43 nC)
- Low Crss (Typ. 20 pF)
- 100% Avalanche Tested



TO-220



TO-220F



Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FQP13N50C	FQPF13N50C	Units
V_{DSS}	Drain-Source Voltage		500		V
I_D	Drain Current - Continuous (T_C = 25°C)		13	13 *	A
	- Continuous (T_C = 100°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)	860		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°C)		195	48	W
	- Derate above 25°C		1.56	0.39	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		°C

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP13N50C	FQPF13N50C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.64	2.58	°C/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

September-2017, Rev. 3

Publication Order Number:
FQP13N50C-F105/D

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP13N50C-F105	FQP13N50C	TO-220	Tube	N/A	N/A	50 units
FQPF13N50C-F105	FQPF13N50C	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics $T_C = 25^oC$ 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	500	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 400 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 = 6.5 A	--	0.39	0.48	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 6.5 A	--	15	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	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} = 250 V, I_D = 13 A, R_G = 25 Ω (Note 4)	--	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} = 400 V, I_D = 13 A, V_{GS} = 10 V (Note 4)	--	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} = 0 V, I_S = 13 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 13 A, dI_F / dt = 100 A/μs	--	410	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC

Notes:
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 6 mH, I_{AS} = 13 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 13 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.

Typical Characteristics

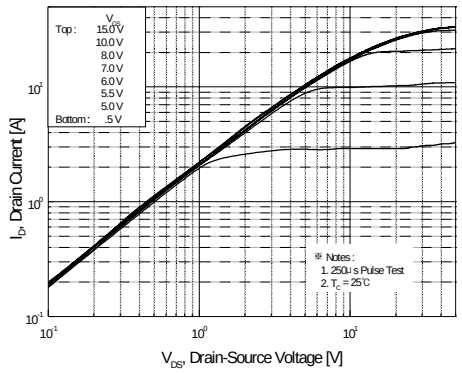


Figure 1. On-Region Characteristics

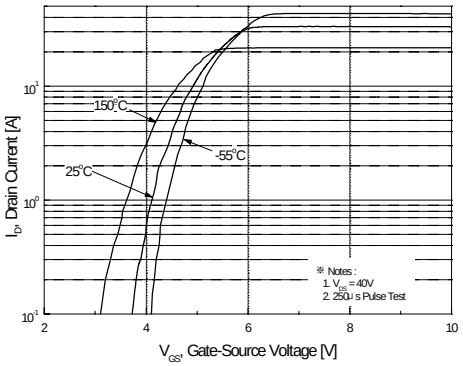


Figure 2. Transfer Characteristics

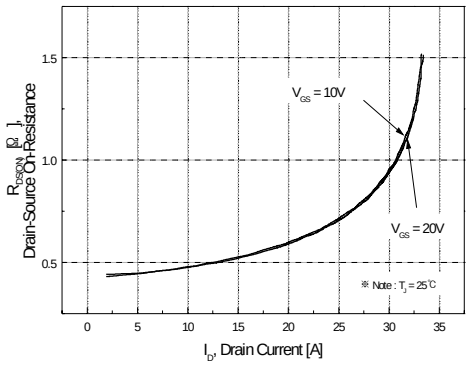


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

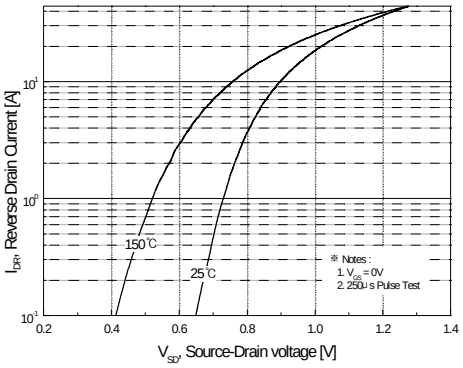


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

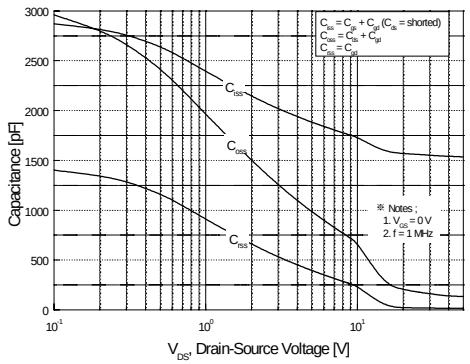


Figure 5. Capacitance Characteristics

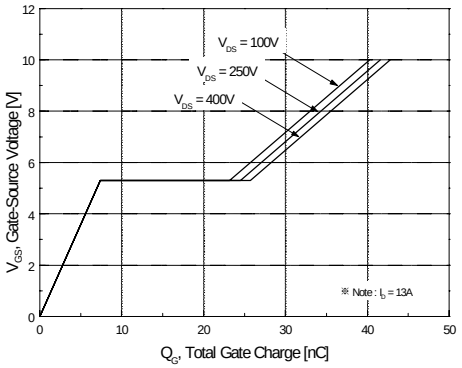


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

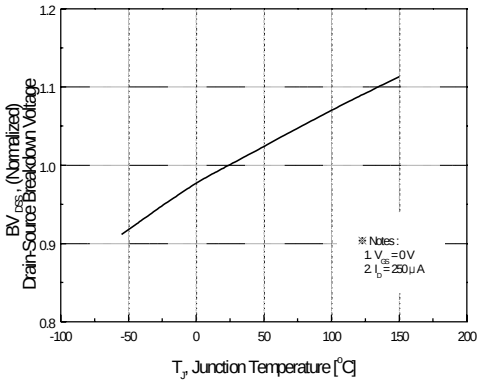


Figure 7. Breakdown Voltage Variation vs Temperature

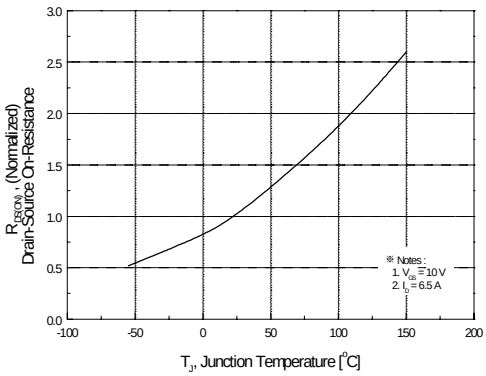


Figure 8. On-Resistance Variation vs Temperature

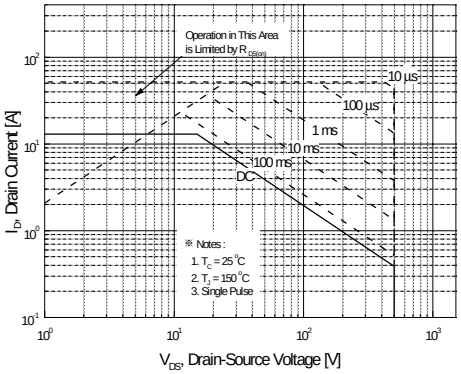


Figure 9-1. Maximum Safe Operating Area for FQP13N50C

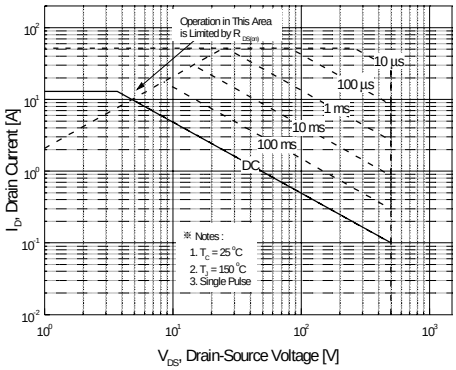


Figure 9-2. Maximum Safe Operating Area for FQPF13N50C

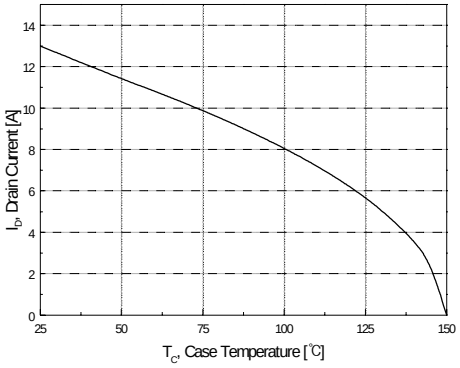


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

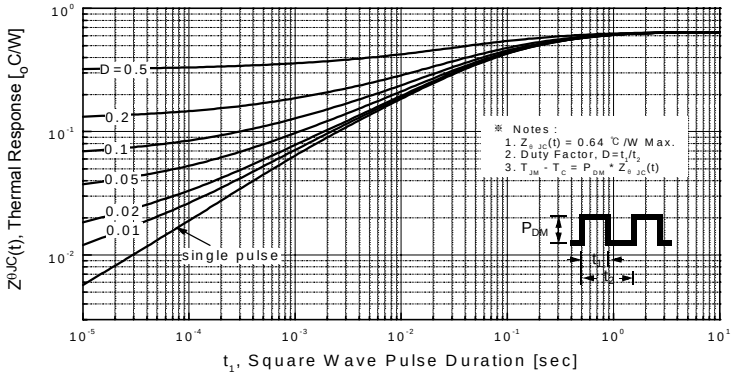


Figure 11-1. Transient Thermal Response Curve for FQP13N50C

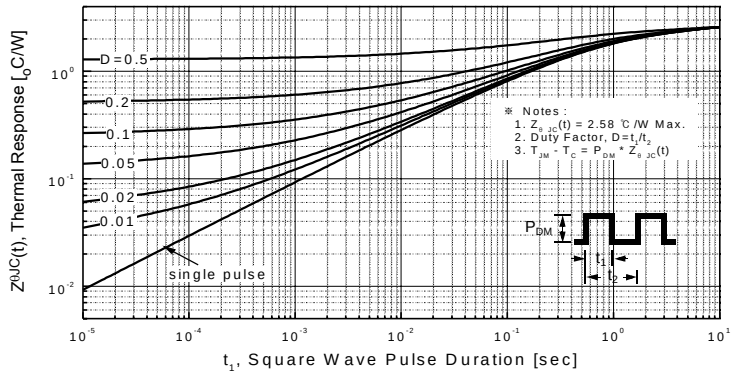


Figure 11-2. Transient Thermal Response Curve for FQPF13N50C

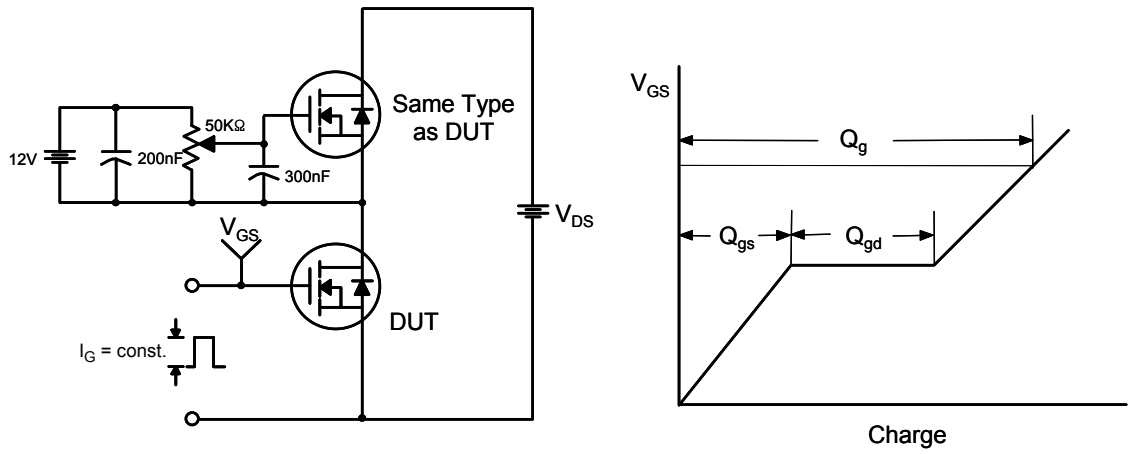


Figure 12. Gate Charge Test Circuit & Waveform

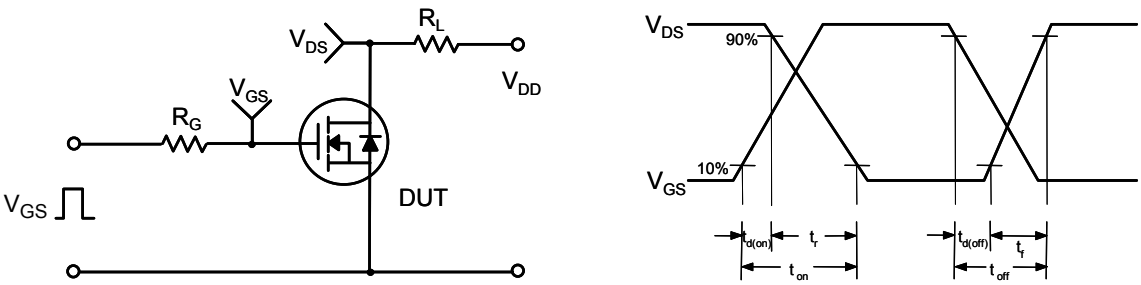


Figure 13. Resistive Switching Test Circuit & Waveforms

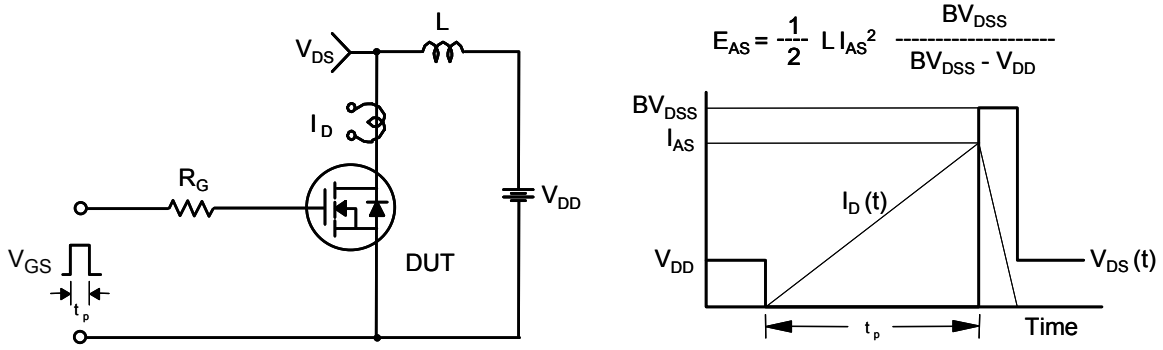


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

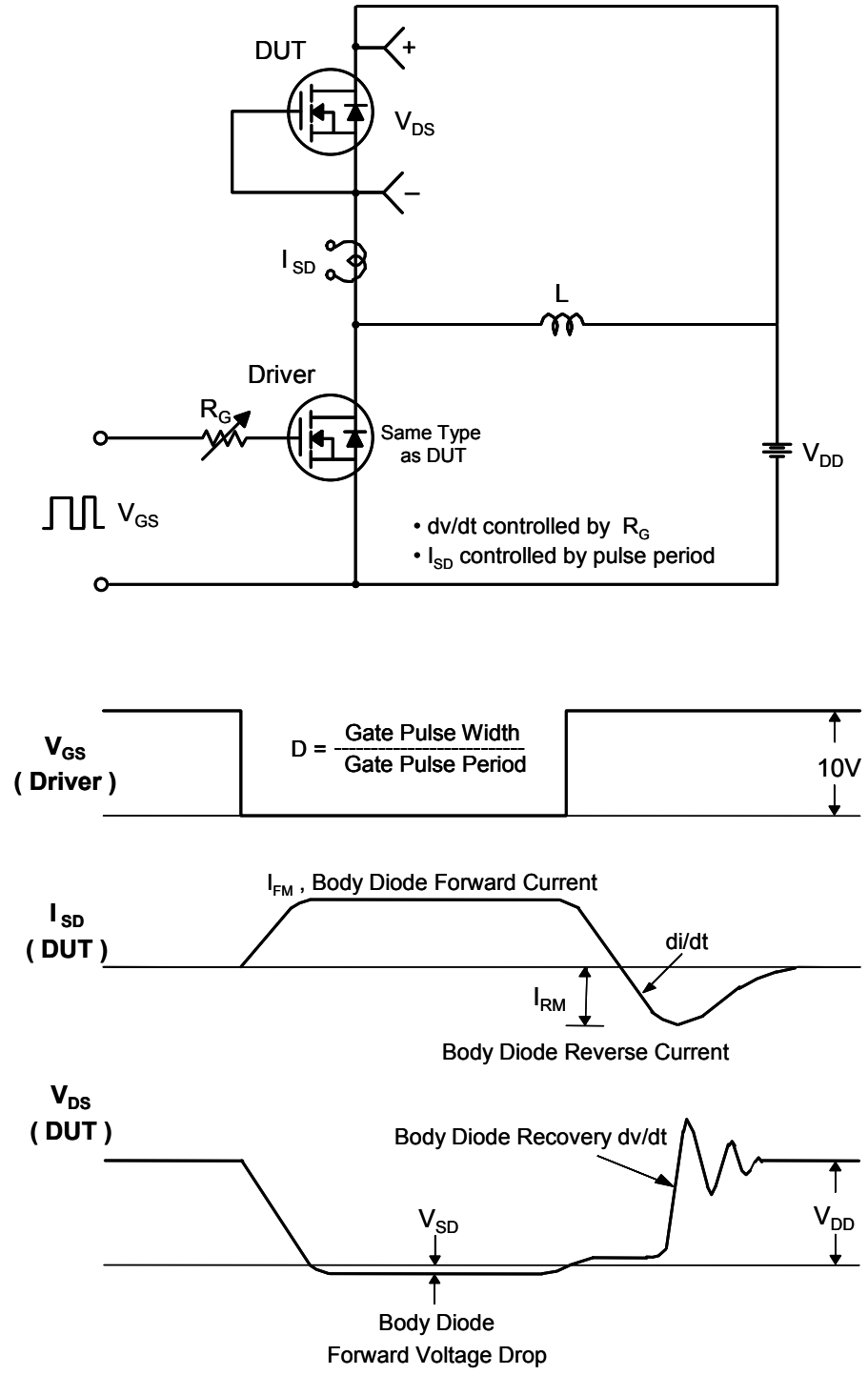


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

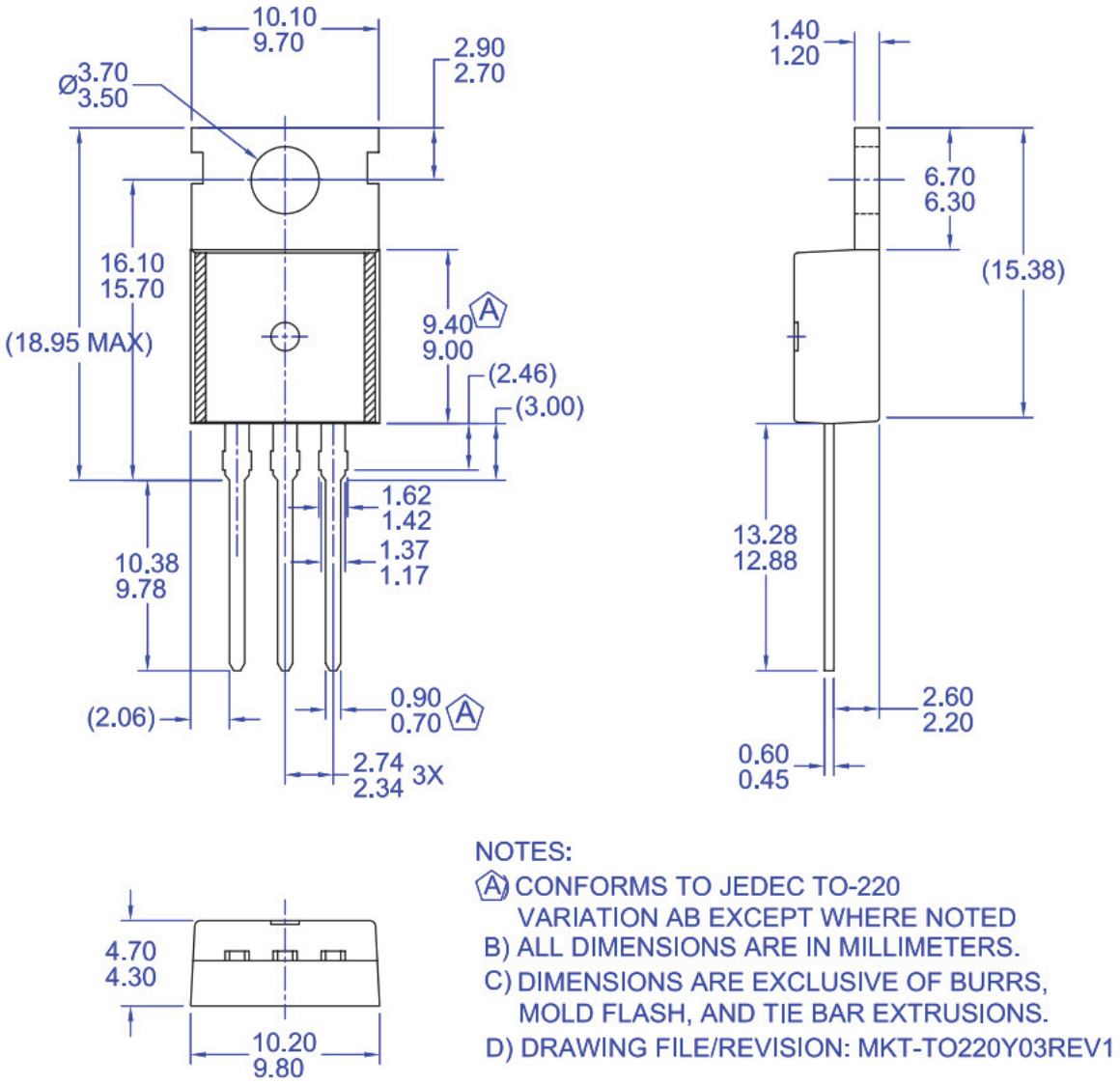


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

Package drawings are provided as a service to customers considering ON Semiconductor components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a ON Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of ON Semiconductor's worldwide terms and conditions, specif-ically the warranty therein, which covers ON Semiconductor products.

Mechanical Dimensions

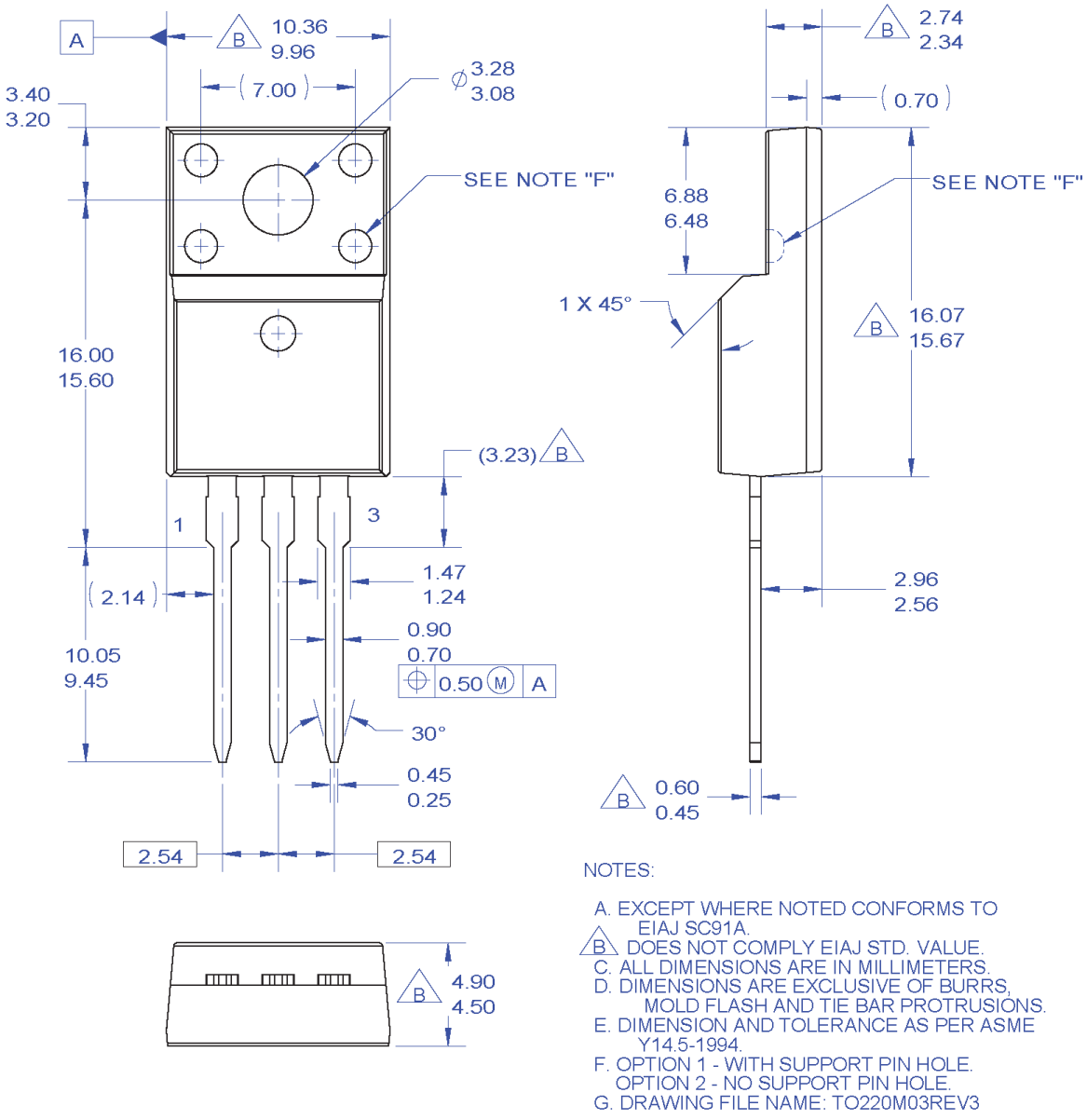


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

Package drawings are provided as a service to customers considering ON Semiconductor components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a ON Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of ON Semiconductor's worldwide terms and conditions, specif-ically the warranty therein, which covers ON Semiconductor products.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative