



ON Semiconductor®

FQP13N50C / FQPF13N50C

N-Channel QFET® MOSFET

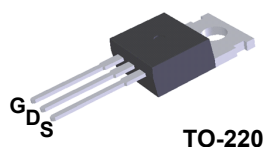
500 V, 13 A, 480 mΩ

Description

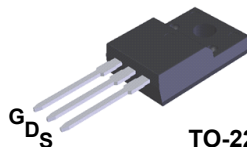
These N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse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

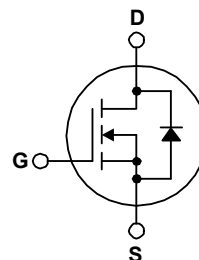
- 13 A, 500 V, $R_{DS(on)} = 480 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 6.5 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low C_{rss} (Typ. 20 pF)
- 100% Avalanche Tested



TO-220



TO-220F



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FQP13N50C	FQPF13N50C	Units
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)	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 ($T_C = 25^\circ\text{C}$)	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 purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

* 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	$^\circ\text{C}/\text{W}$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	$^\circ\text{C}/\text{W}$

FQP13N50C / FQPF13N50C — N-Channel QFET® MOSFET

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°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	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,	--	410	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs	--	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

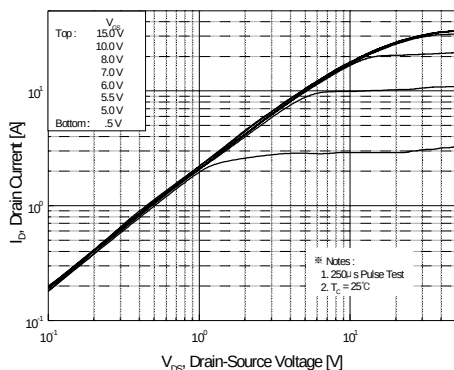


Figure 1. On-Region Characteristics

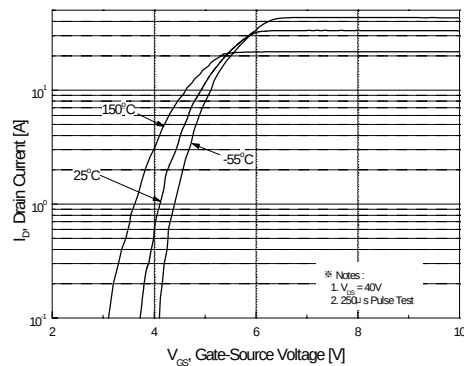


Figure 2. Transfer Characteristics

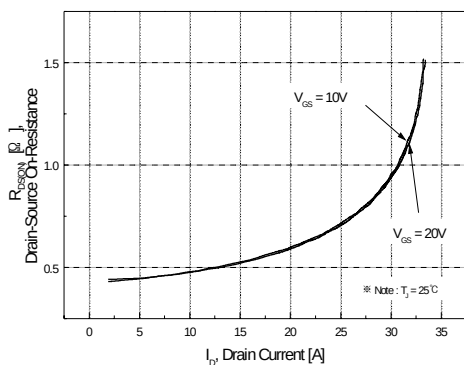


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

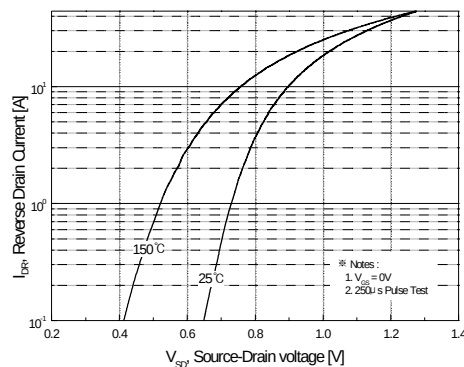


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

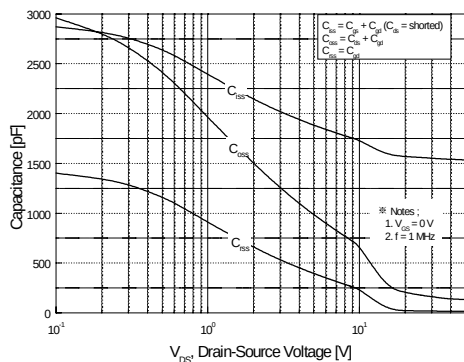


Figure 5. Capacitance Characteristics

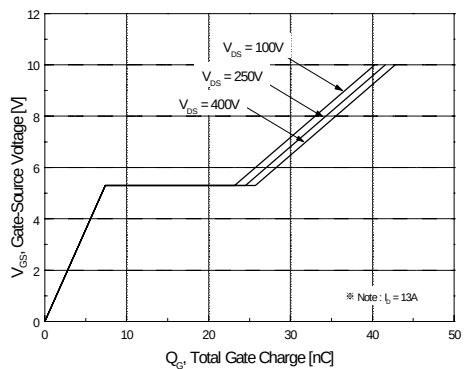


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

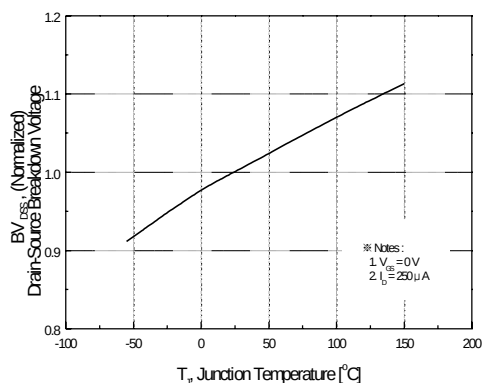


Figure 7. Breakdown Voltage Variation vs Temperature

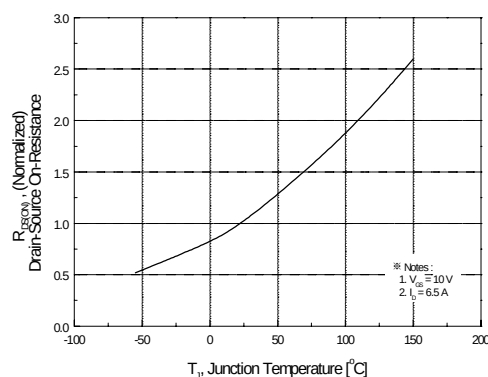


Figure 8. On-Resistance Variation vs Temperature

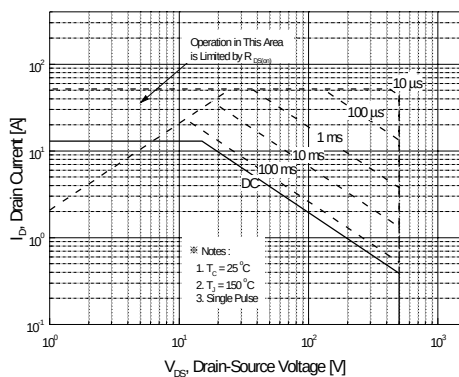


Figure 9-1. Maximum Safe Operating Area for FQP13N50C

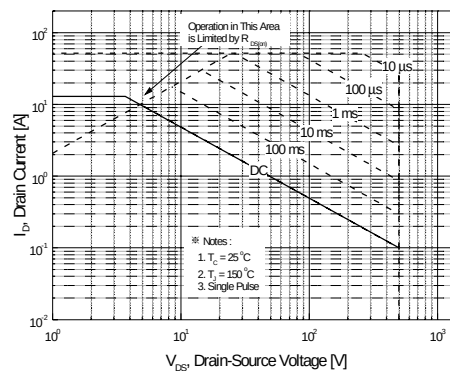


Figure 9-2. Maximum Safe Operating Area for FQPF13N50C

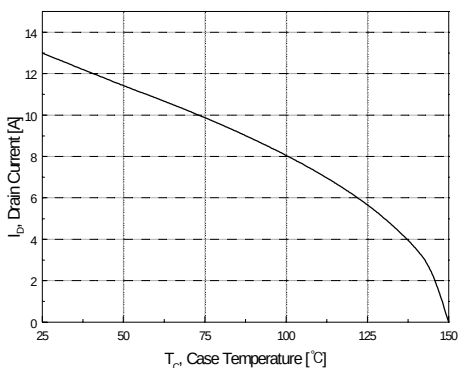


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

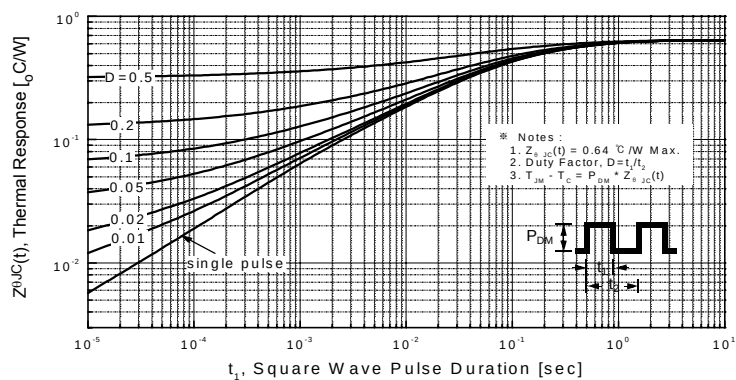


Figure 11-1. Transient Thermal Response Curve for FQP13N50C

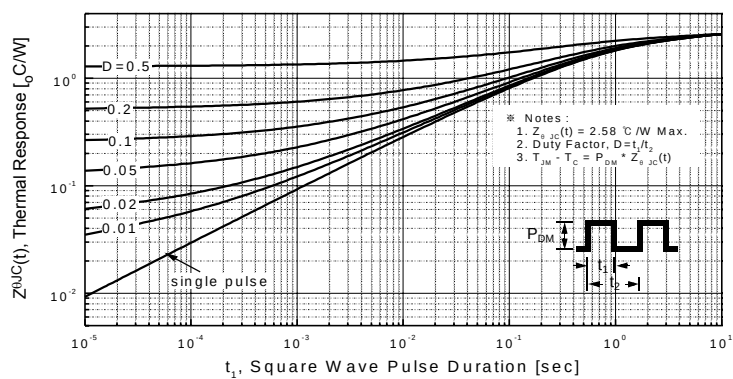


Figure 11-2. Transient Thermal Response Curve for FQPF13N50C

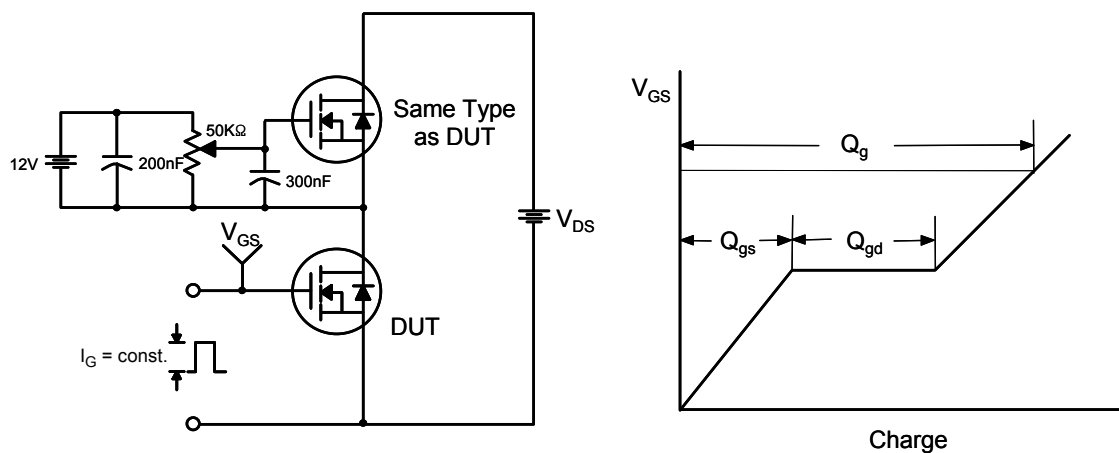


Figure 12. Gate Charge Test Circuit & Waveform

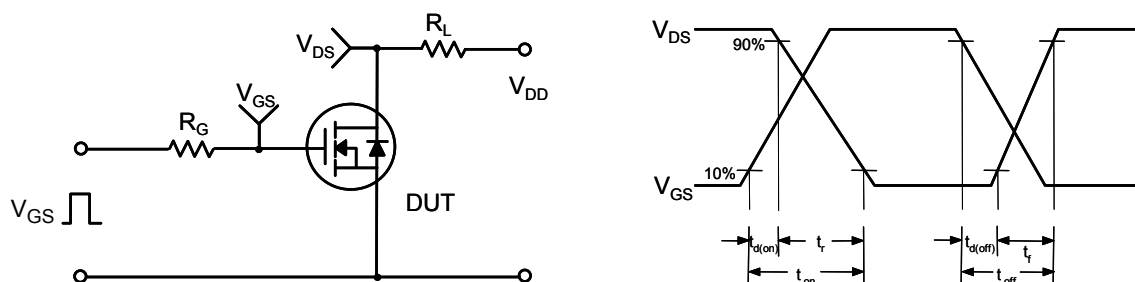


Figure 13. Resistive Switching Test Circuit & Waveforms

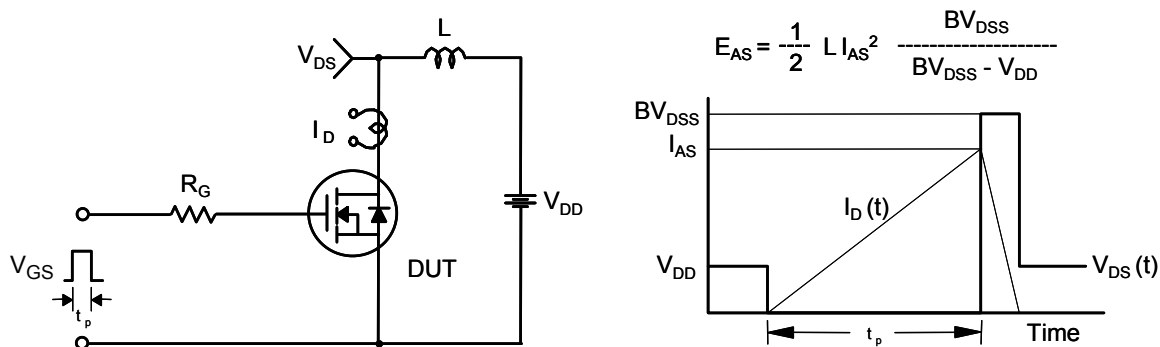


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

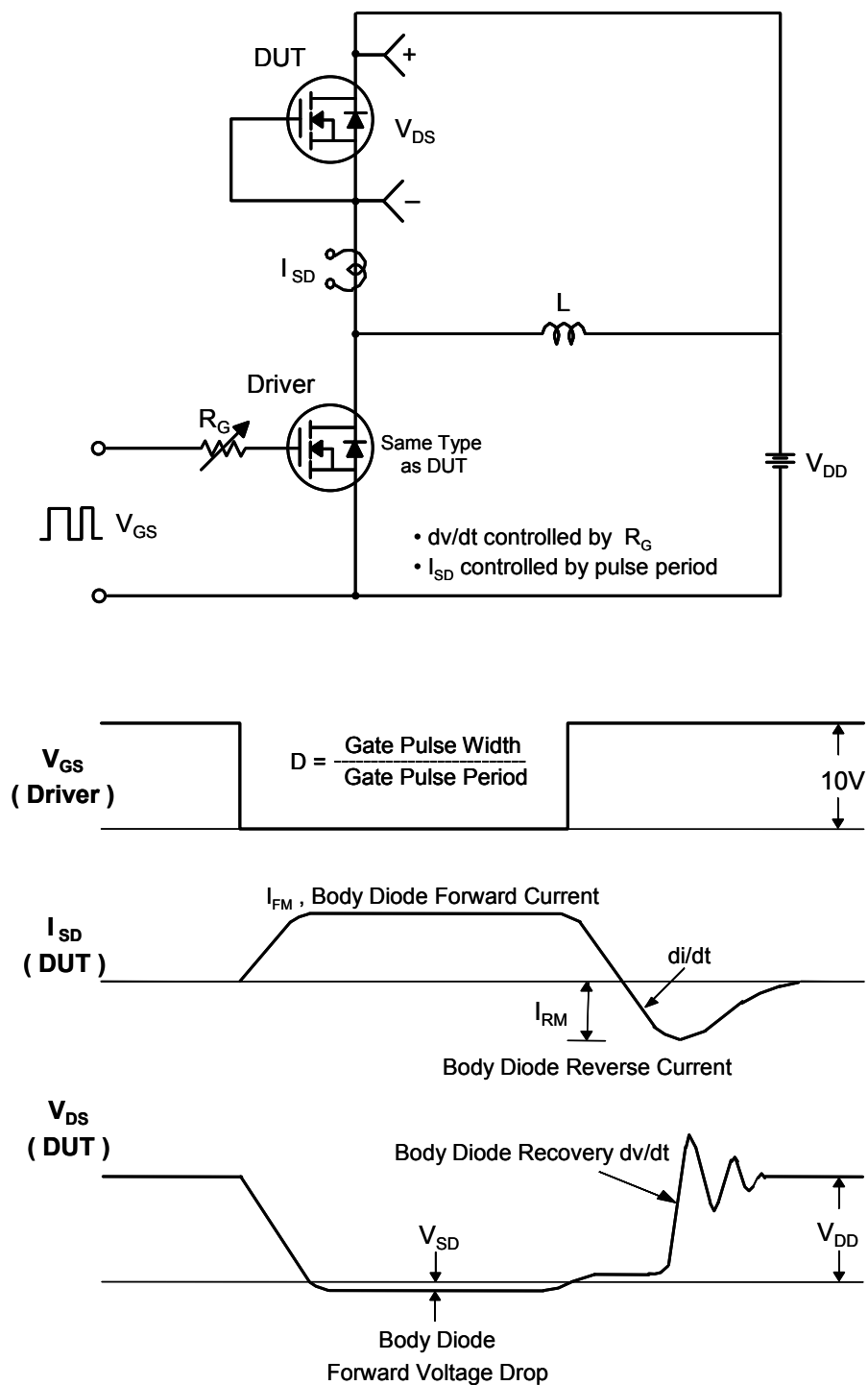


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

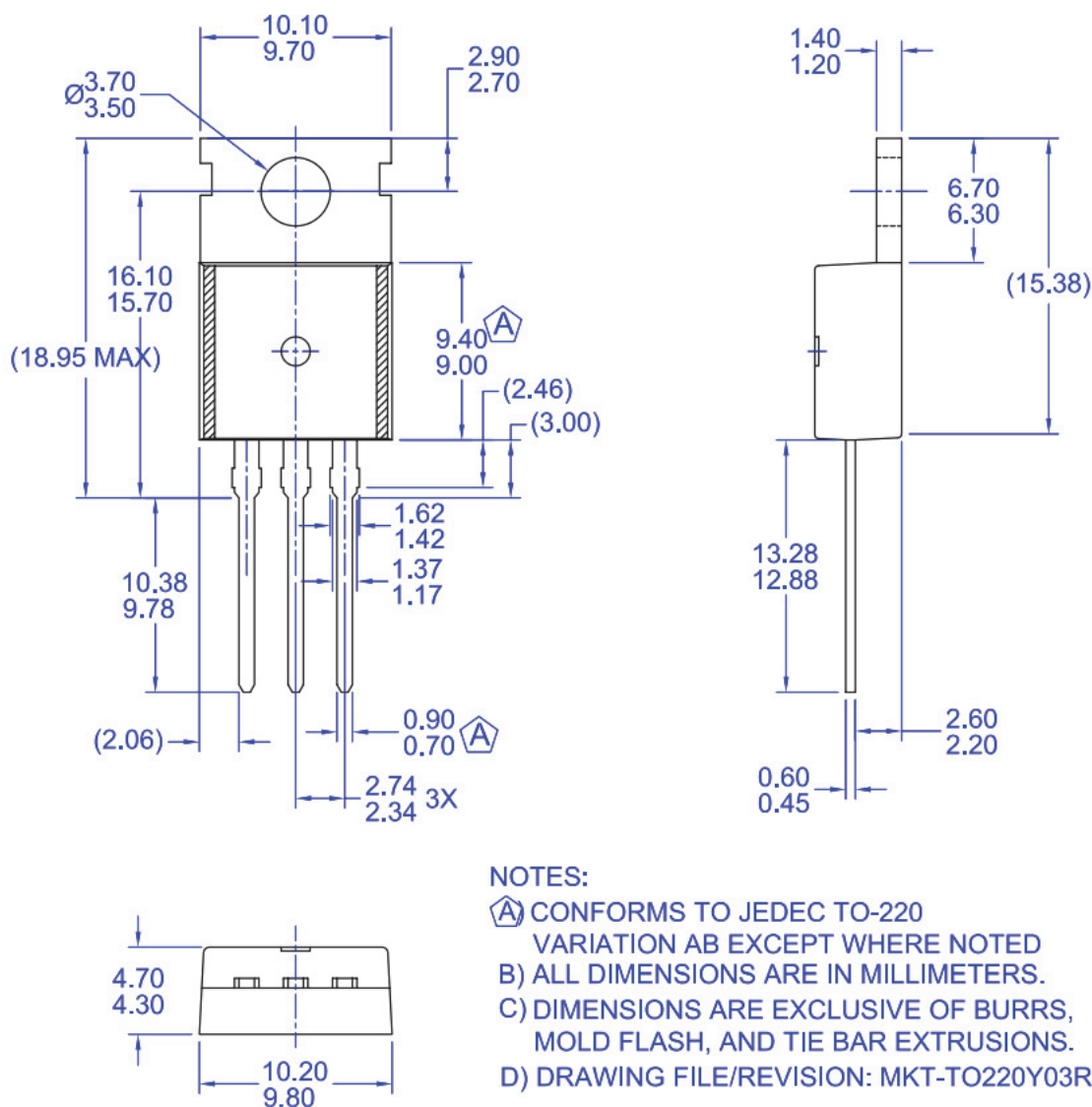


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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, specifically the warranty therein, which covers ON Semiconductor products.



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

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, specifically the warranty therein, which covers ON Semiconductor products.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

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