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FQP10N20C / FQPF10N20C

N-Channel QFET® MOSFET

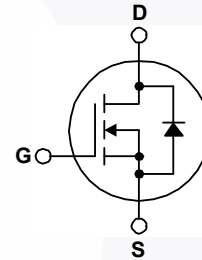
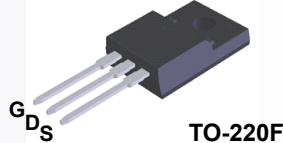
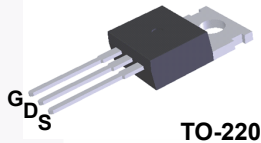
200 V, 9.5 A, 360 mΩ

Features

- 9.5 A, 200 V, $R_{DS(on)} = 360 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 4.75 \text{ A}$
- Low Gate Charge (Typ. 20 nC)
- Low Crss (Typ. 40.5 pF)
- 100% Avalanche Tested

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.



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

Symbol	Parameter	FQP10N20C	FQPF10N20C	Unit
V_{DSS}	Drain to Source Voltage	200		V
I_D	Drain Current	-Continuous ($T_C = 25^\circ\text{C}$)	9.5	9.5 *
		-Continuous ($T_C = 100^\circ\text{C}$)	6.0	6.0 *
I_{DM}	Drain Current - Pulsed (Note 1)	38	38 *	A
V_{GSS}	Gate to Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	210		mJ
I_{AR}	Avalanche Current (Note 1)	9.5		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	7.2		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C	72	38	W
		0.57	0.3	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	FQP10N20C	FQPF10N20C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	1.74	3.33	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	62.5	62.5	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP10N20C	FQP10N20C	TO-220	Tube	N/A	50 units
FQPF10N20C	FQPF10N20C	TO-220F	Tube	N/A	50 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	
Off Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.28	--	$\text{V}/^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	μA	
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	μA	
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA	
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA	
On Characteristics							
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4.75\text{ A}$	--	0.29	0.36	Ω	
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4.75\text{ A}$	--	5.5	--	S	
Dynamic Characteristics							
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	395	510	pF	
C_{oss}	Output Capacitance		--	97	125	pF	
C_{rss}	Reverse Transfer Capacitance		--	40.5	53	pF	
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 9.5\text{ A}, R_G = 25\ \Omega$	--	11	30	ns	
t_r	Turn-On Rise Time		--	92	190	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	--	70	150	ns
t_f	Turn-Off Fall Time		(Note 4)	--	72	160	ns
Q_g	Total Gate Charge	$V_{DS} = 160\text{ V}, I_D = 9.5\text{ A}, V_{GS} = 10\text{ V}$	--	20	26	nC	
Q_{gs}	Gate-Source Charge		(Note 4)	--	3.1	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	10.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings							
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.5	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	38	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A}$	--	--	1.5	V	
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}$	--	158	--	ns	
Q_{rr}	Reverse Recovery Charge		--	0.97	--	μC	

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. $L = 3.5\text{ mH}, I_{AS} = 9.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 9.5\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

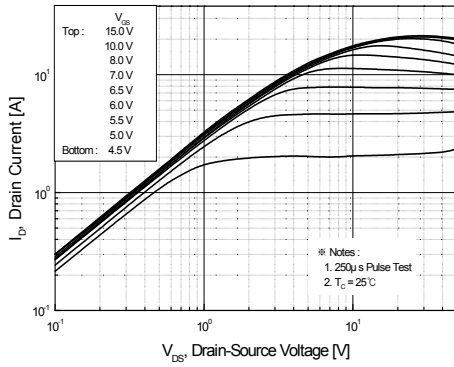


Figure 1. On-Region Characteristics

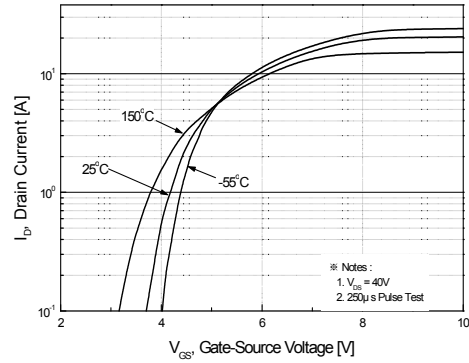


Figure 2. Transfer Characteristics

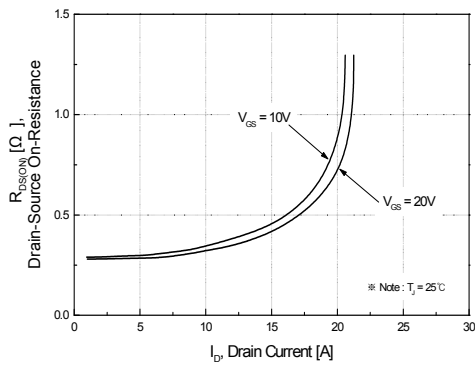


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

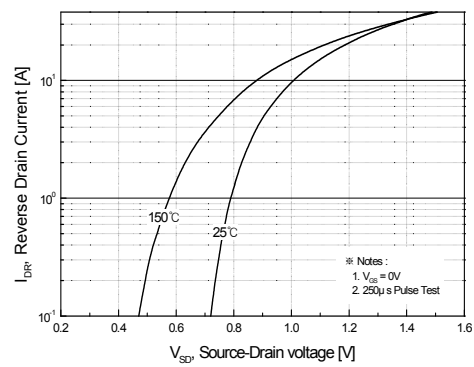


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

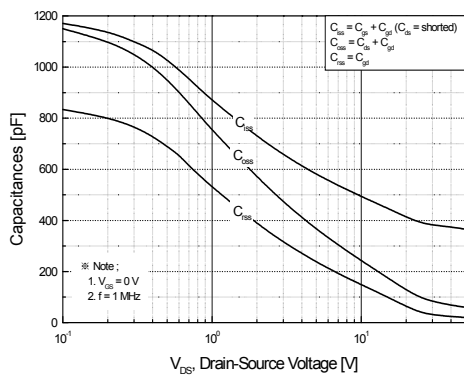


Figure 5. Capacitance Characteristics

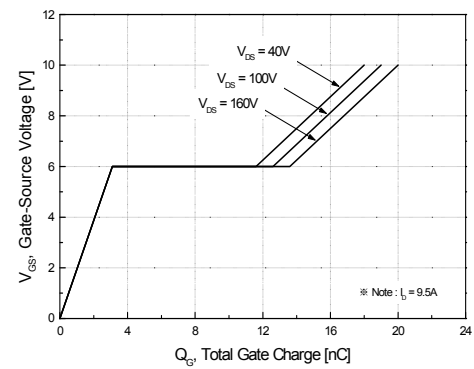


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

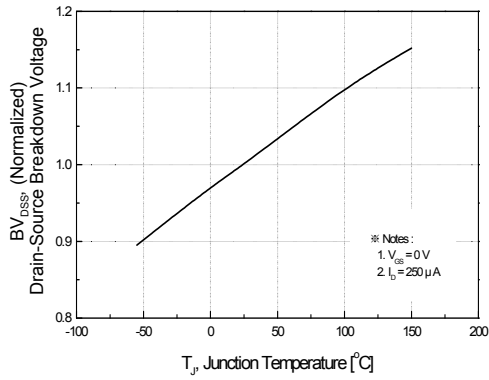


Figure 7. Breakdown Voltage Variation vs Temperature

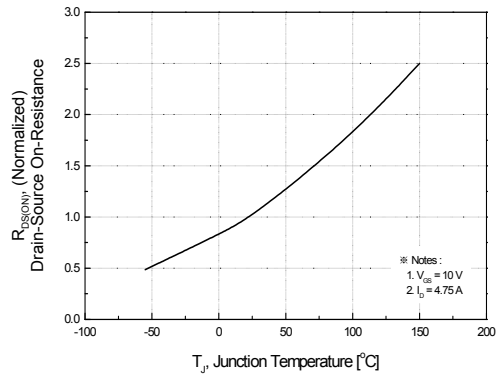


Figure 8. On-Resistance Variation vs Temperature

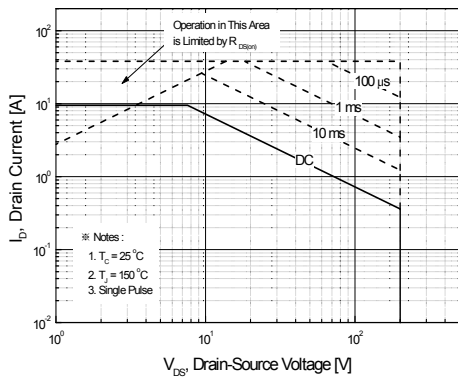


Figure 9-1. Maximum Safe Operating Area for FQP10N20C

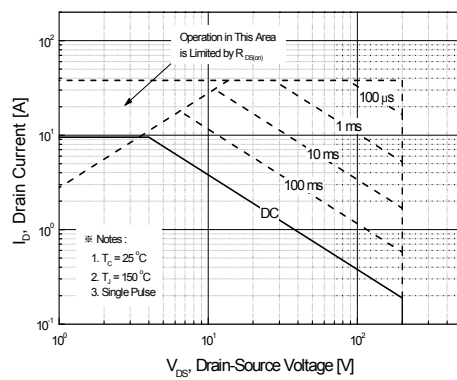


Figure 9-2. Maximum Safe Operating Area for FQPF10N20C

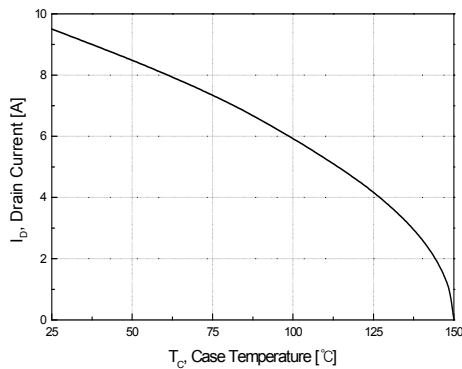


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

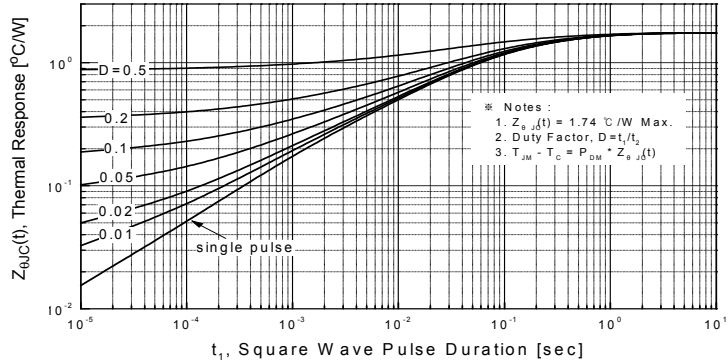


Figure 11-1. Transient Thermal Response Curve for FQP10N20C

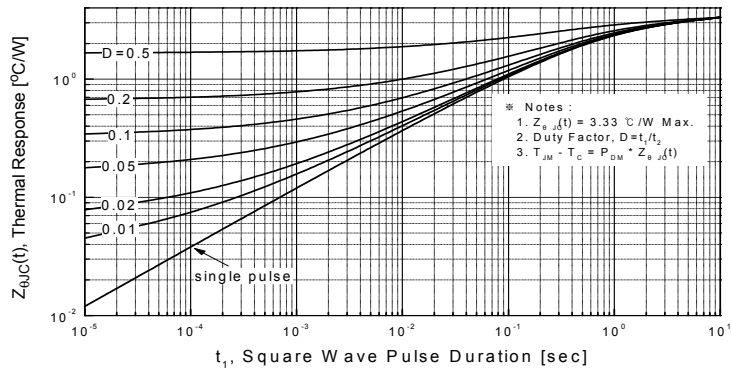


Figure 11-2. Transient Thermal Response Curve for FQPF10N20C

Figure 12. Gate Charge Test Circuit & Waveform

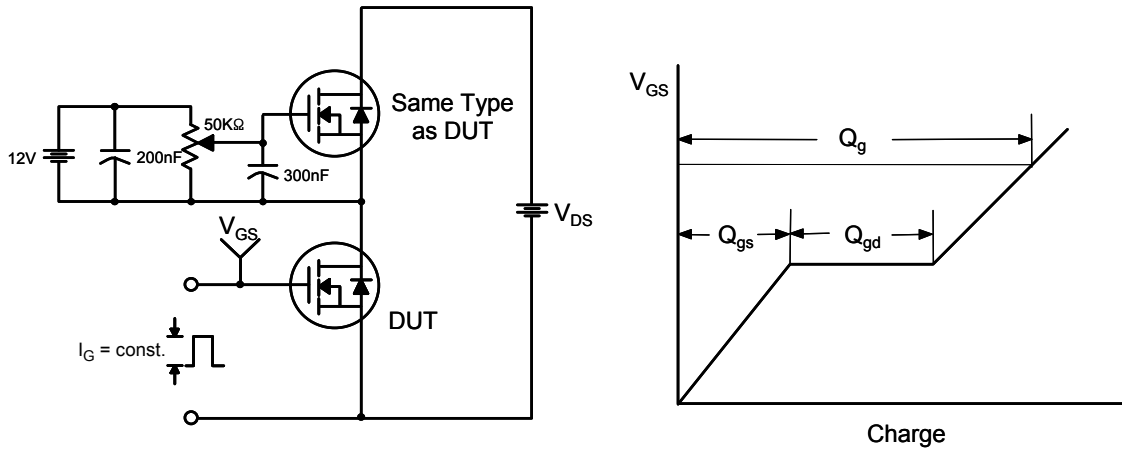


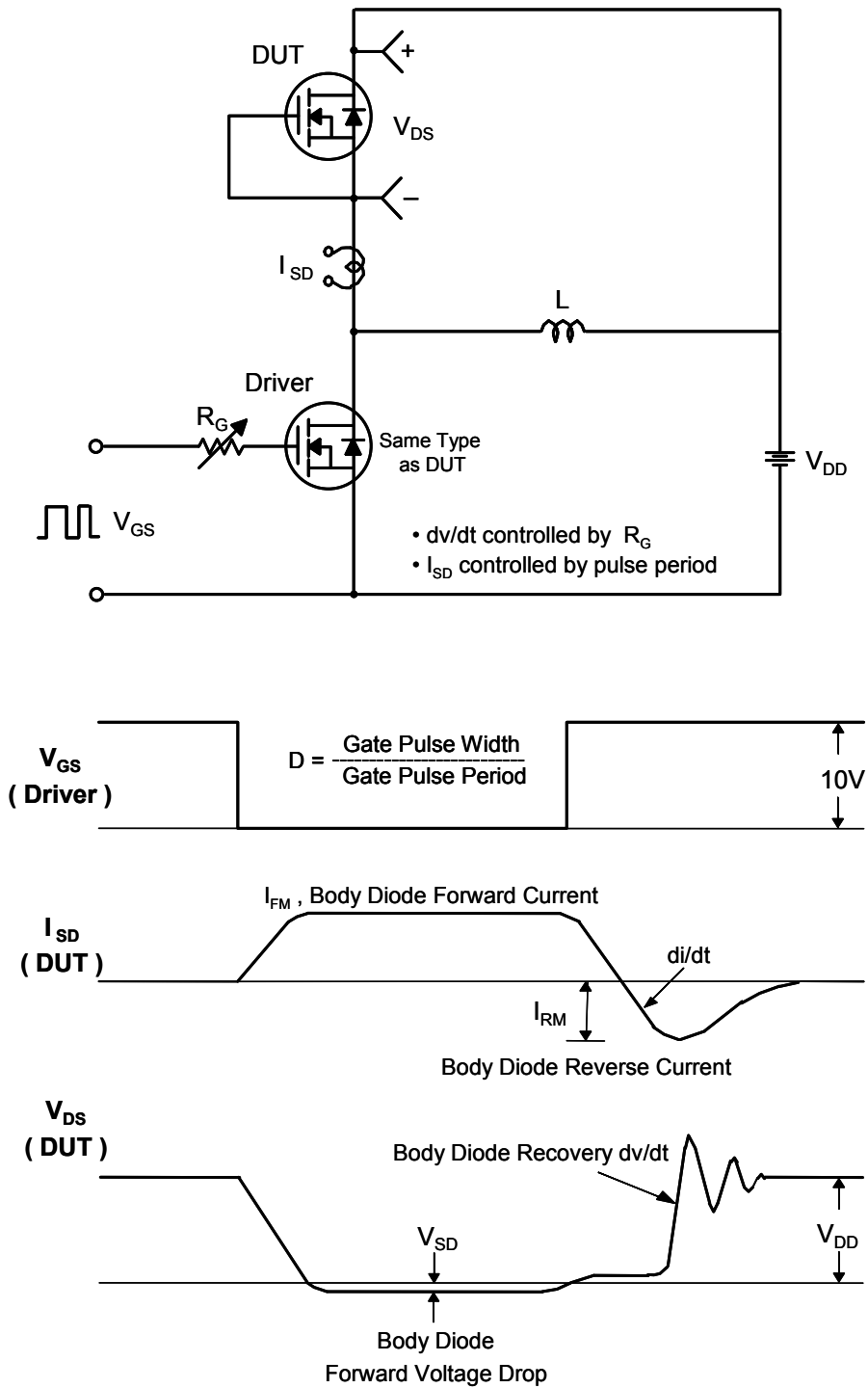
Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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



Mechanical Dimensions

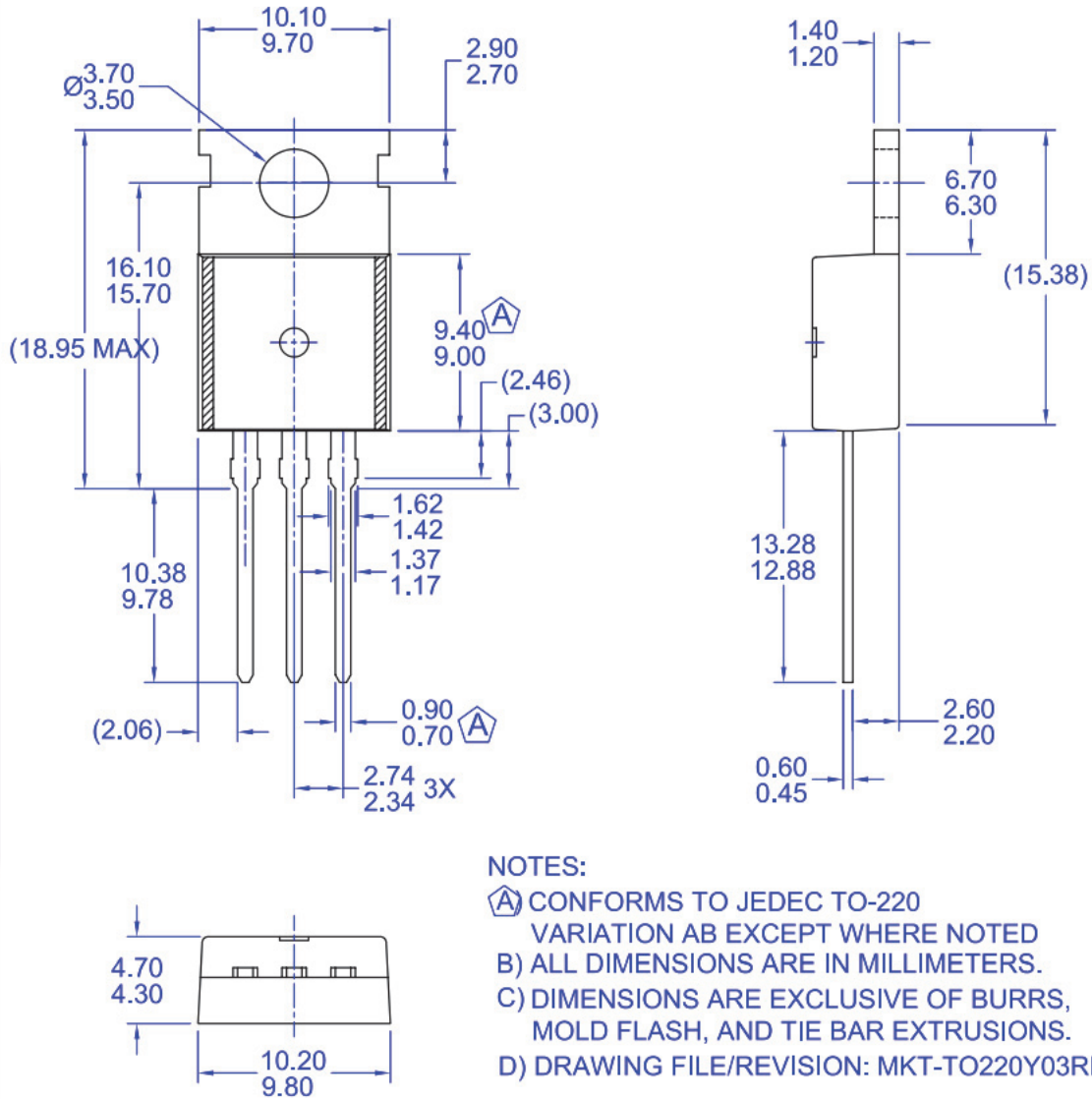


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions



NOTES:

- 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

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