

FQP4N20L

N-Channel QFET® MOSFET

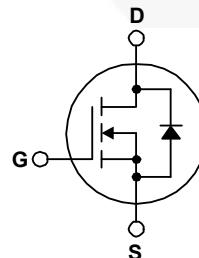
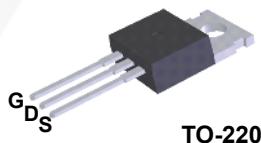
200 V, 3.8 A, 1.35 Ω

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation modes. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supplies, and motor control.

Features

- 3.8 A, 200 V, $R_{DS(on)} = 1.35 \Omega$ (Max.) @ $V_{GS} = 10$ V, $I_D = 1.9$ A
- Low Gate Charge (Typ. 4.0 nC)
- Low Crss (Typ. 6.0 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQP4N20L	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	3.8	A
	- Continuous ($T_C = 100^\circ\text{C}$)	2.4	A
I_{DM}	Drain Current - Pulsed (Note 1)	15.2	A
V_{GSS}	Gate-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	52	mJ
I_{AR}	Avalanche Current (Note 1)	3.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	45	W
	- Derate above 25°C	0.36	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	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQP4N20L	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.78	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP4N20L	FQP4N20L	TO-220	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}, I_D = 250 \mu\text{A}$	200	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C	--	0.16	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 200 \text{ V}, V_{\text{GS}} = 0 \text{ V}$	--	--	1	μA
		$V_{\text{DS}} = 160 \text{ V}, T_c = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 20 \text{ V}, V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -20 \text{ V}, V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA

On Characteristics

$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}, I_D = 250 \mu\text{A}$	1.0	--	2.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}, I_D = 1.9 \text{ A}$ $V_{\text{GS}} = 5 \text{ V}, I_D = 1.9 \text{ A}$	--	1.10 1.13	1.35 1.40	Ω
g_{FS}	Forward Transconductance	$V_{\text{DS}} = 25 \text{ V}, I_D = 1.9 \text{ A}$	--	3.2	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{\text{DS}} = 25 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1.0 \text{ MHz}$	--	240	310	pF
C_{oss}	Output Capacitance		--	36	45	pF
C_{rss}	Reverse Transfer Capacitance		--	6	8	pF

Switching Characteristics

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 100 \text{ V}, I_D = 3.8 \text{ A}, R_G = 25 \Omega$	--	7	25	ns
t_r	Turn-On Rise Time		--	70	150	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	15	40	ns
t_f	Turn-Off Fall Time		--	40	90	ns
Q_g	Total Gate Charge	$V_{\text{DS}} = 160 \text{ V}, I_D = 3.8 \text{ A}, V_{\text{GS}} = 5 \text{ V}$	--	4.0	5.2	nC
Q_{gs}	Gate-Source Charge		--	1.0	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	1.9	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.8	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	15.2	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}, I_S = 3.8 \text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}, I_S = 3.8 \text{ A}, dI_F / dt = 100 \text{ A}/\mu\text{s}$	--	90	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.25	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 5.4 \text{ mH}, I_{\text{AS}} = 3.8 \text{ A}, V_{\text{DD}} = 50 \text{ V}, R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{\text{SD}} \leq 3.8 \text{ A}, di/dt \leq 300 \text{ A}/\mu\text{s}, V_{\text{DD}} \leq BV_{\text{DSS}}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

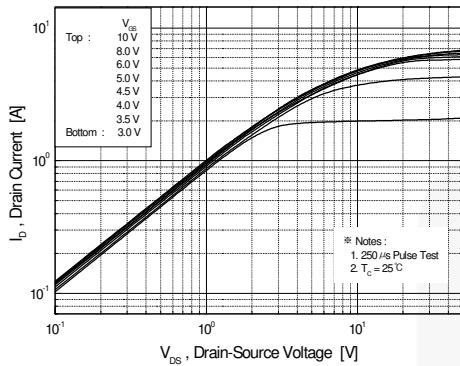


Figure 1. On-Region Characteristics

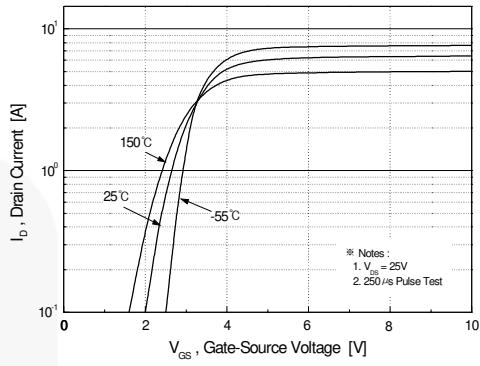
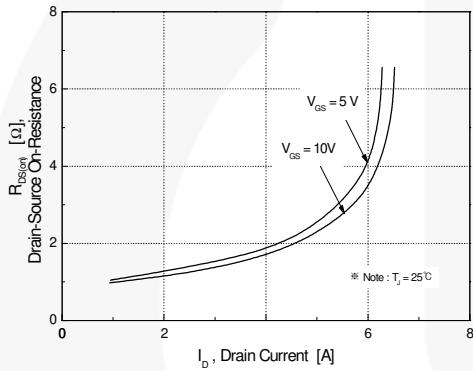
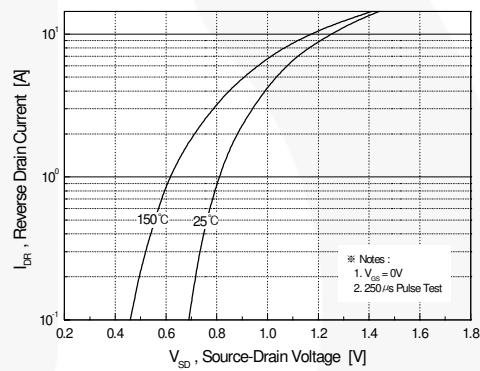


Figure 2. Transfer Characteristics



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



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

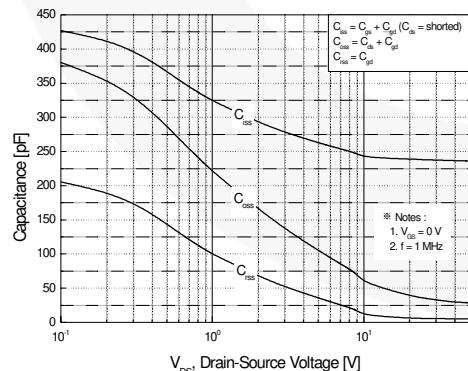


Figure 5. Capacitance Characteristics

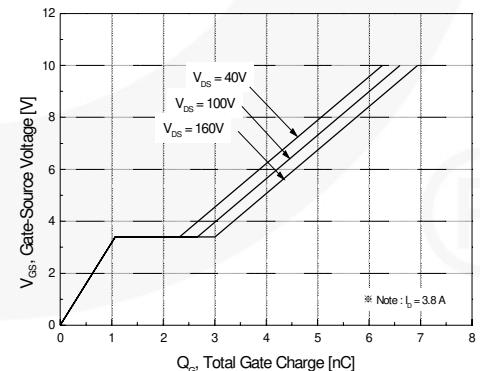


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

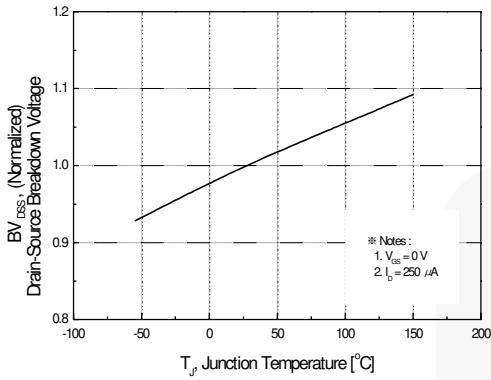


Figure 7. Breakdown Voltage Variation vs. Temperature

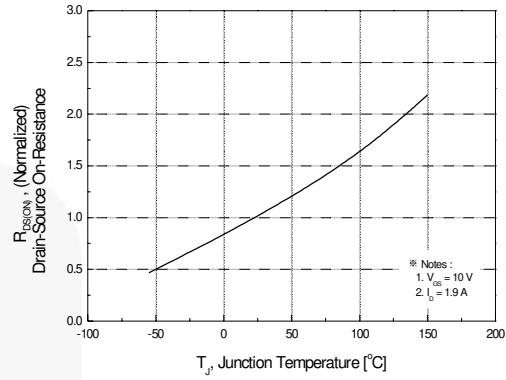


Figure 8. On-Resistance Variation vs. Temperature

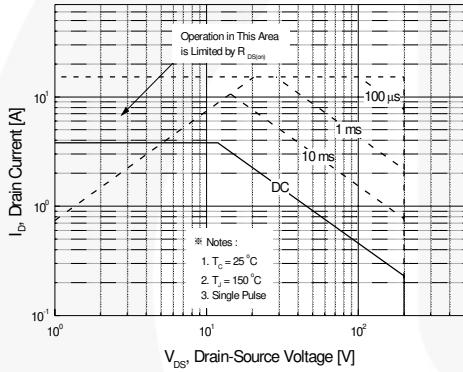


Figure 9. Maximum Safe Operating Area

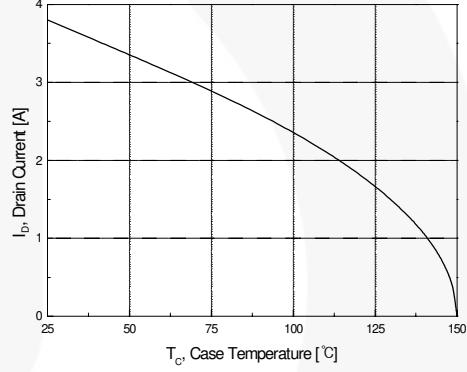


Figure 10. Maximum Drain Current vs. Case Temperature

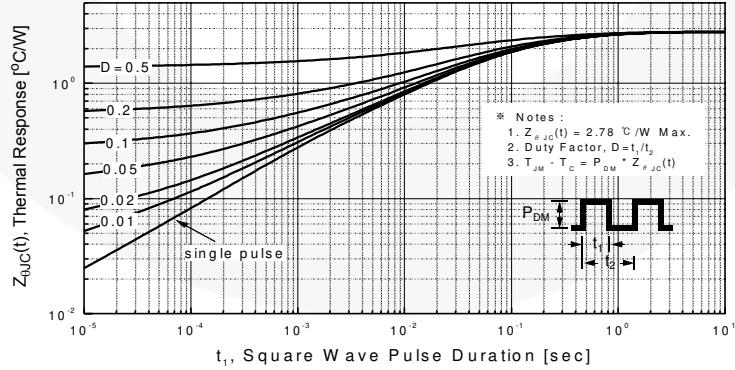


Figure 11. Transient Thermal Response Curve

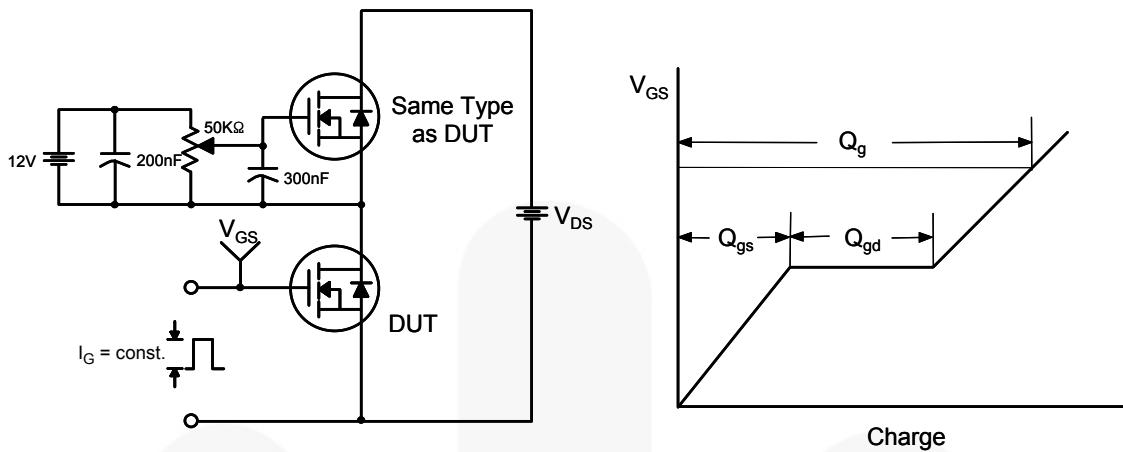


Figure 12. Gate Charge Test Circuit & Waveform

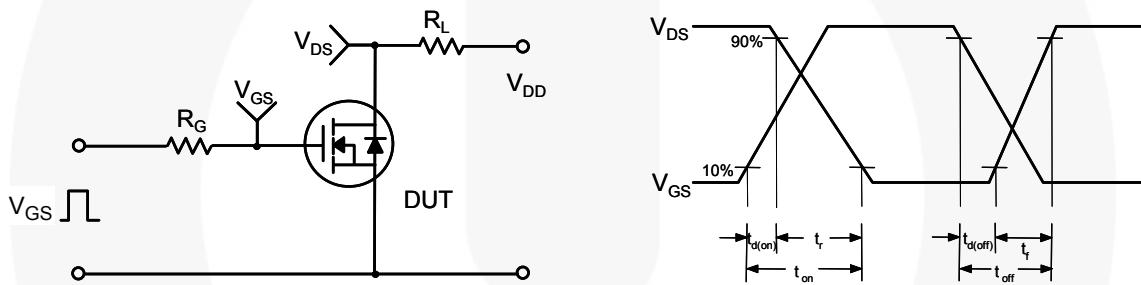


Figure 13. Resistive Switching Test Circuit & Waveforms

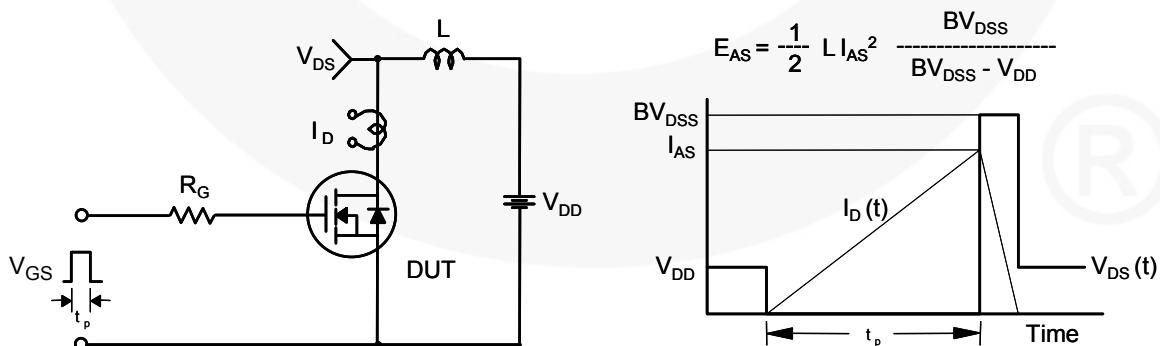


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

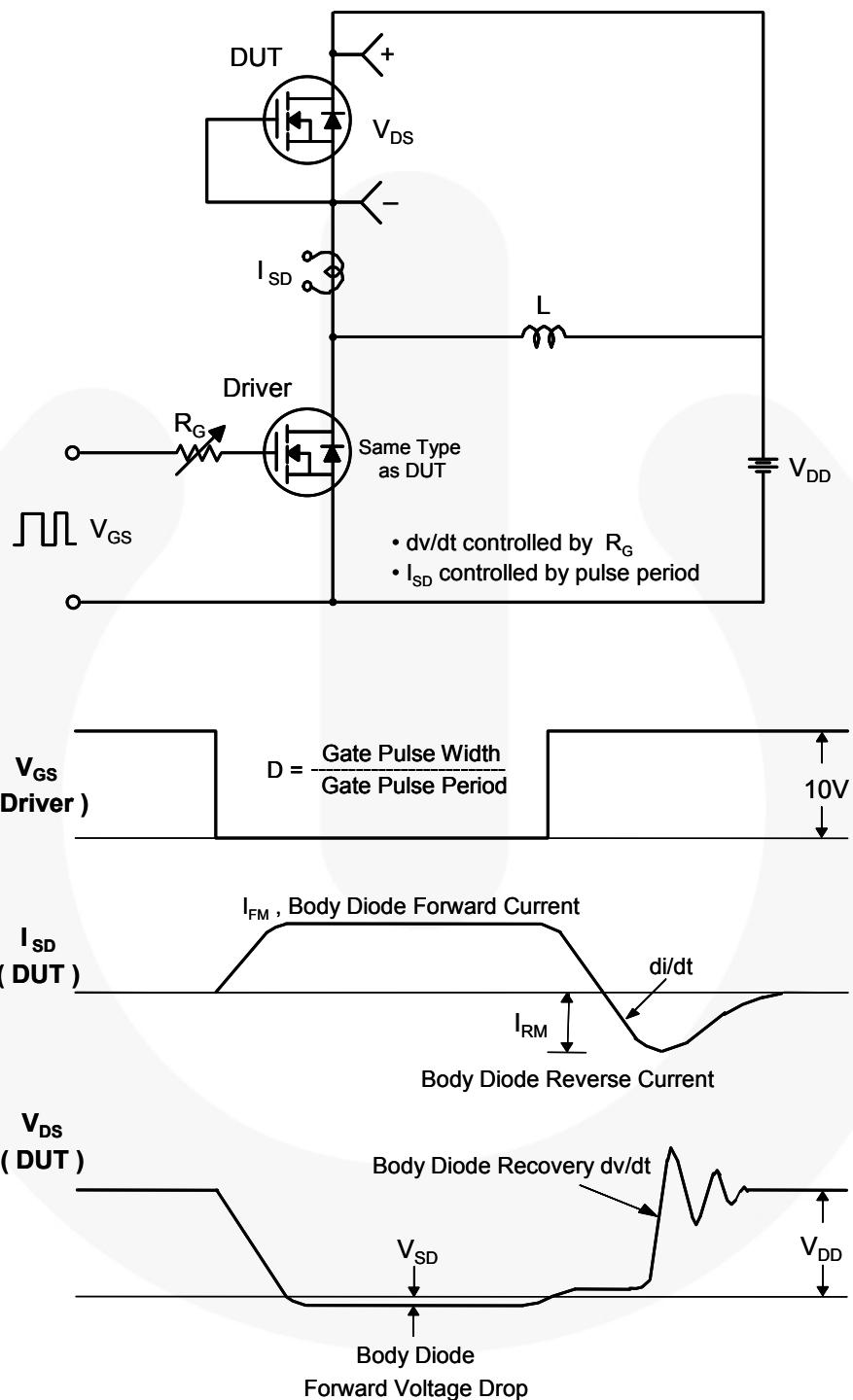


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

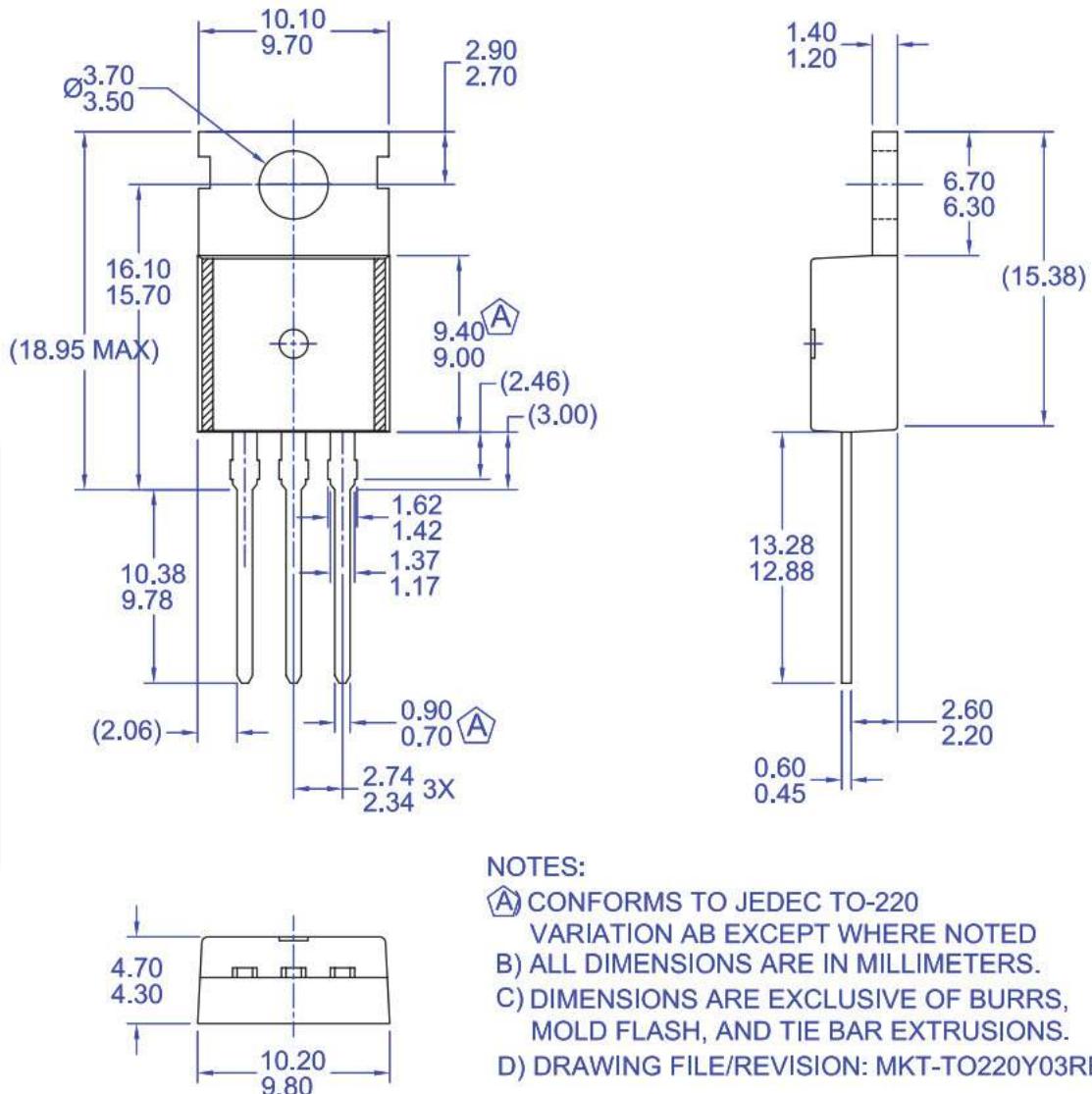


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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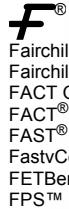
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