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FQP13N10

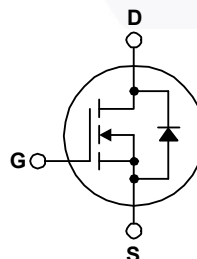
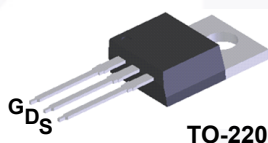
N-Channel QFET® MOSFET 100 V, 12.8 A, 180 mΩ

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, audio amplifier, DC motor control, and variable switching power applications.

Features

- 12.8 A, 100 V, $R_{DS(on)} = 180 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 6.4 \text{ A}$
- Low Gate Charge (Typ. 12 nC)
- Low C_{rss} (Typ. 20 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating



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

Symbol	Parameter	FQP13N10	Unit
V_{DSS}	Drain-Source Voltage	100	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	12.8	A
	- Continuous ($T_C = 100^\circ\text{C}$)	9.05	A
I_{DM}	Drain Current - Pulsed (Note 1)	51.2	A
V_{GSS}	Gate-Source Voltage	± 25	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	95	mJ
I_{AR}	Avalanche Current (Note 1)	12.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	6.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	65	W
	- Derate above 25°C	0.43	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQP13N10	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.31	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C}/\text{W}$

Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP13N10	FQP13N10	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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	100	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.09	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 80\text{ V}, T_C = 150^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 6.4\text{ A}$	--	0.142	0.18	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 6.4\text{ A}$	--	6.8	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	345	450	pF
C_{oss}	Output Capacitance		--	100	130	pF
C_{rss}	Reverse Transfer Capacitance		--	20	25	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 12.8\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4)	--	5	20	ns
t_r	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	20	50	ns
t_f	Turn-Off Fall Time		--	25	60	ns
Q_g	Total Gate Charge	$V_{DS} = 80\text{ V}, I_D = 12.8\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4)	--	12	16	nC
Q_{gs}	Gate-Source Charge		--	2.5	--	nC
Q_{gd}	Gate-Drain Charge		--	5.1	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	12.8	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	51.2	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 12.8 A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 12.8 A,	--	72	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs	--	0.17	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. $L = 0.87\text{ mH}, I_{AS} = 12.8\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 12.8\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially Independent of Operating Temperature.

Typical Characteristics

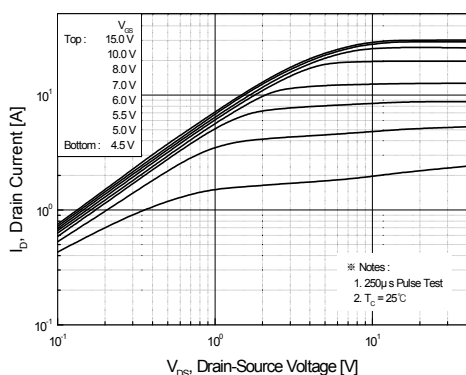


Figure 1. On-Region Characteristics

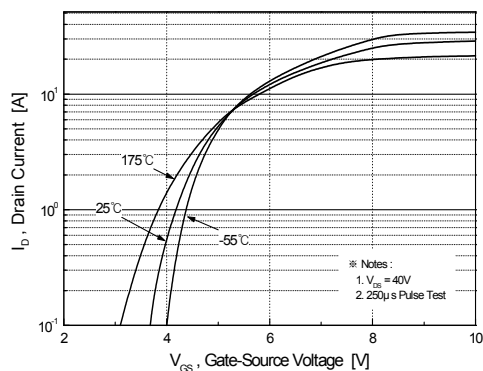


Figure 2. Transfer Characteristics

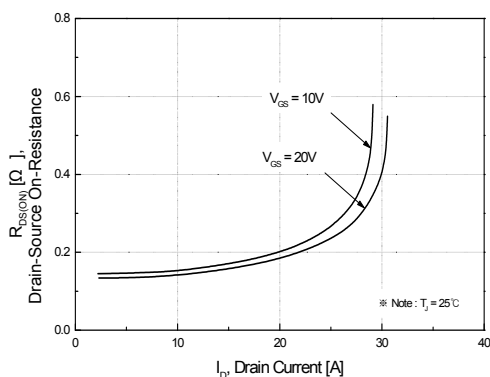


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

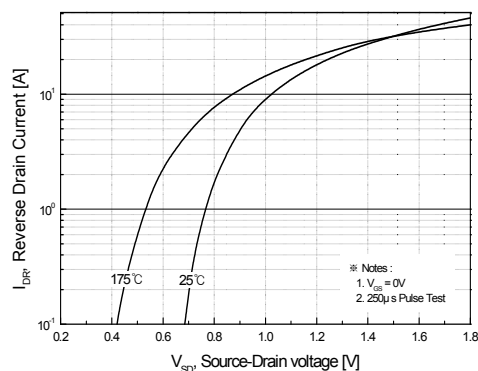


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

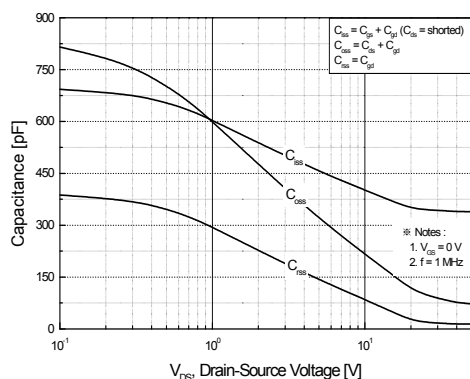


Figure 5. Capacitance Characteristics

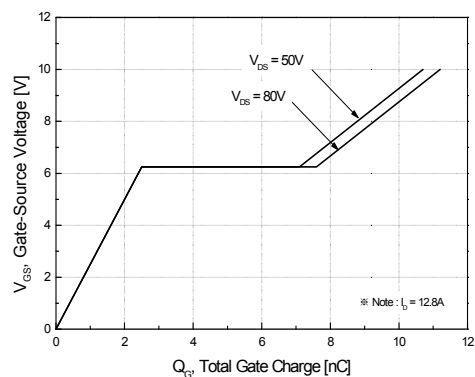


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

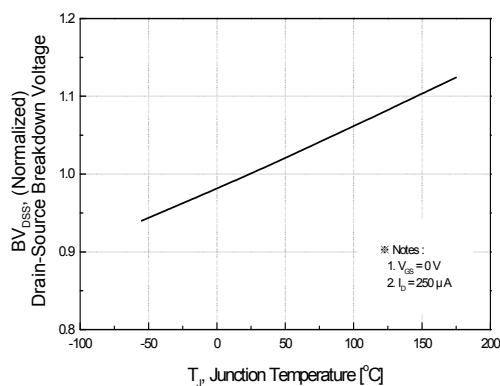


Figure 7. Breakdown Voltage Variation vs. Temperature

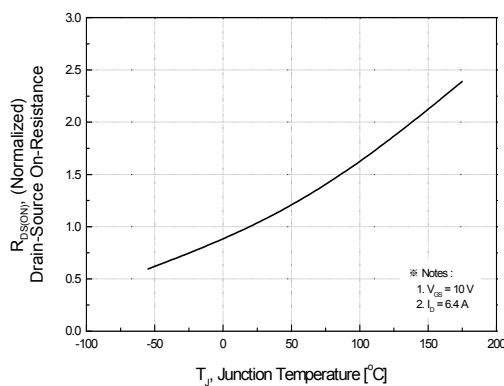


Figure 8. On-Resistance Variation vs. Temperature

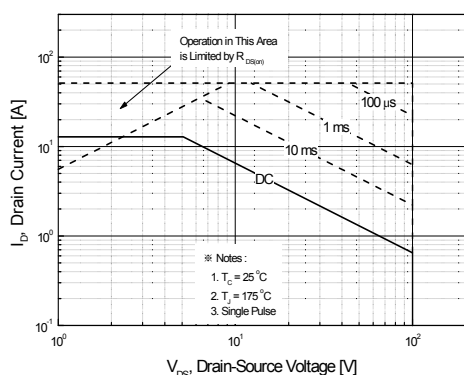


Figure 9. Maximum Safe Operating Area

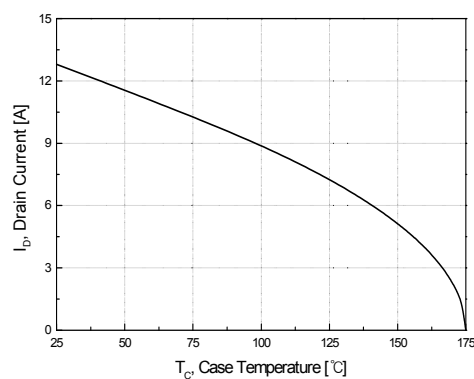


Figure 10. Maximum Drain Current vs. Case Temperature

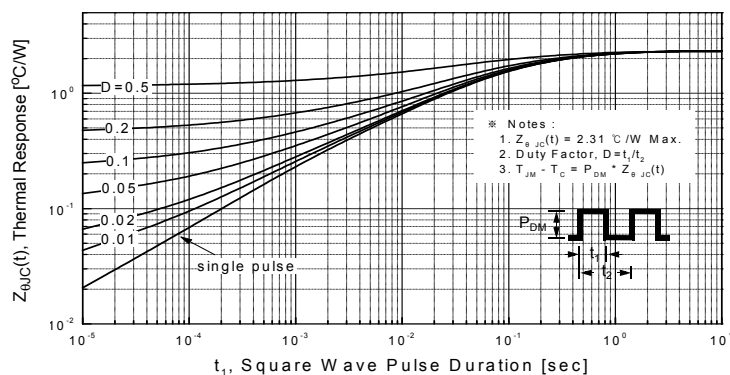


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

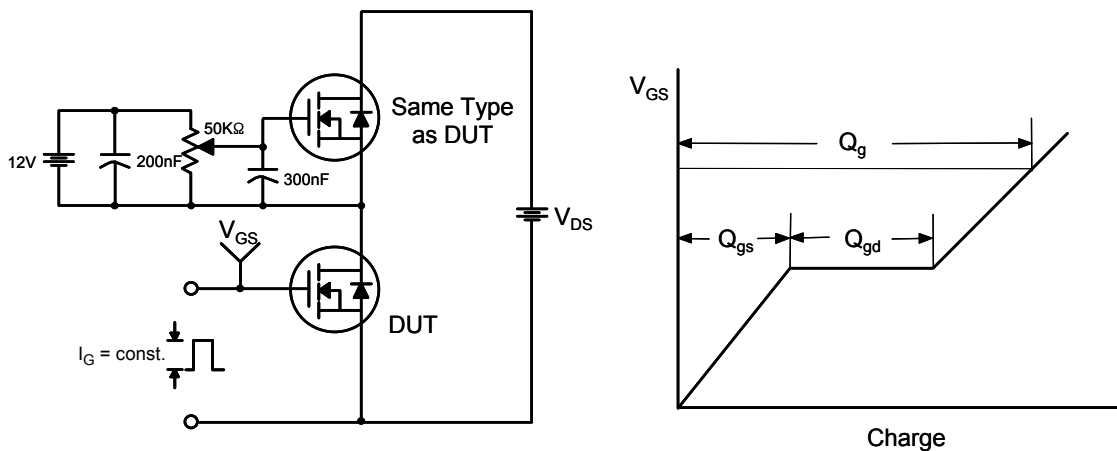


Figure 13. Resistive Switching Test Circuit & Waveforms

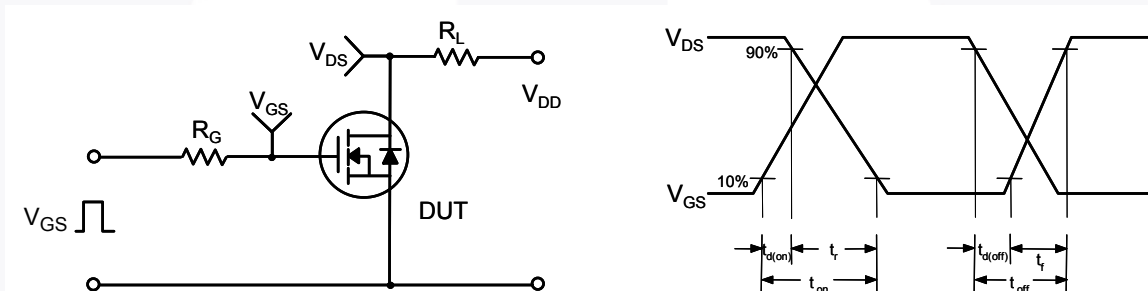
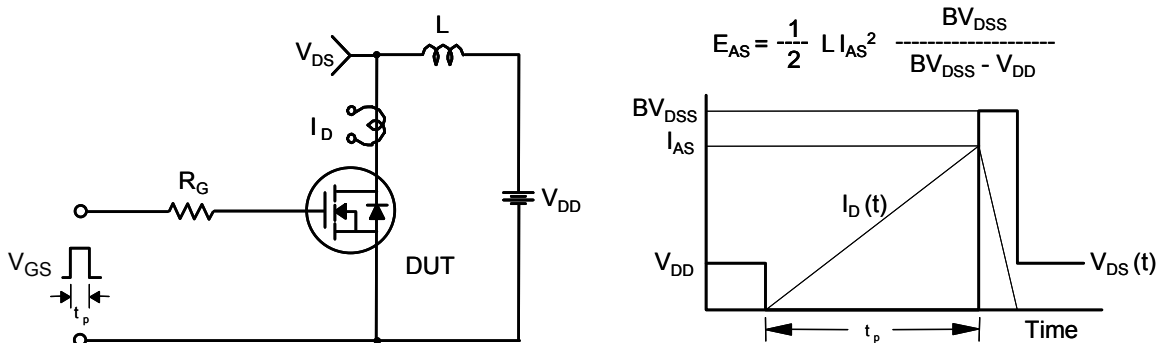


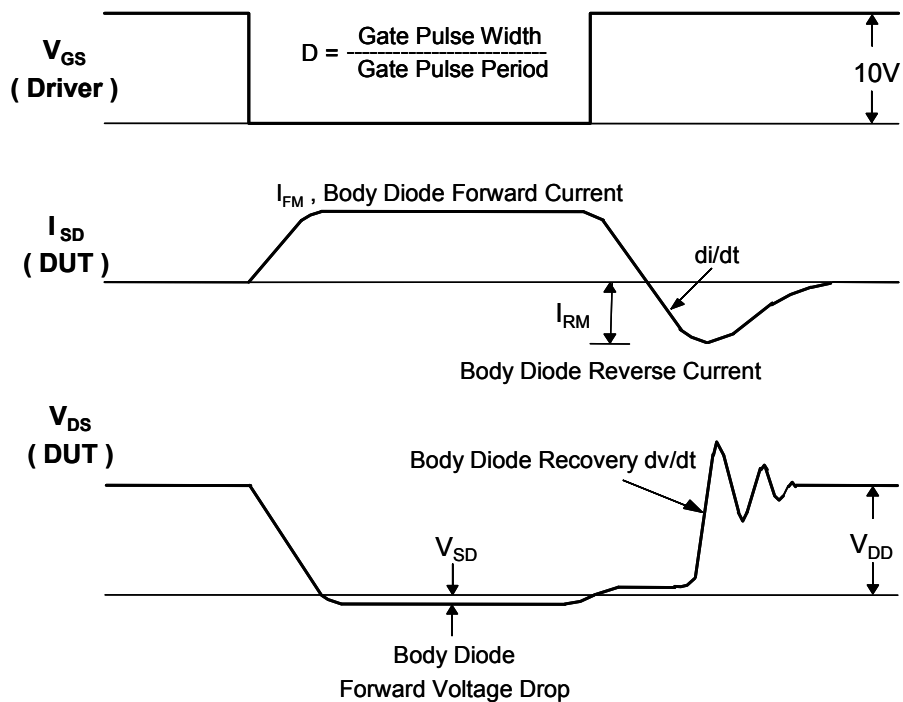
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



The top diagram shows a MOSFET switching circuit. A driver circuit, consisting of a pulse generator V_{GS} and a gate resistor R_G , is connected to the gate of the MOSFET. The MOSFET's source is grounded, and its drain is connected to a load resistor and a supply voltage V_{DD} . The MOSFET is labeled "Same Type as DUT". Key parameters are listed: dv/dt is controlled by R_G , and I_{SD} is controlled by the pulse period.

The middle waveform shows the gate voltage V_{GS} (Driver) as a square wave with a peak-to-peak amplitude of 10V. The duty cycle is defined as $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$.

The bottom waveform shows the drain current I_{SD} (DUT). During the "ON" state, it shows the body diode forward current I_{FM} . During the "OFF" state, it shows the body diode reverse current, characterized by a reverse recovery time t_{rr} and a reverse recovery current I_{RM} . The di/dt is indicated during the turn-off transition.



Mechanical Dimensions

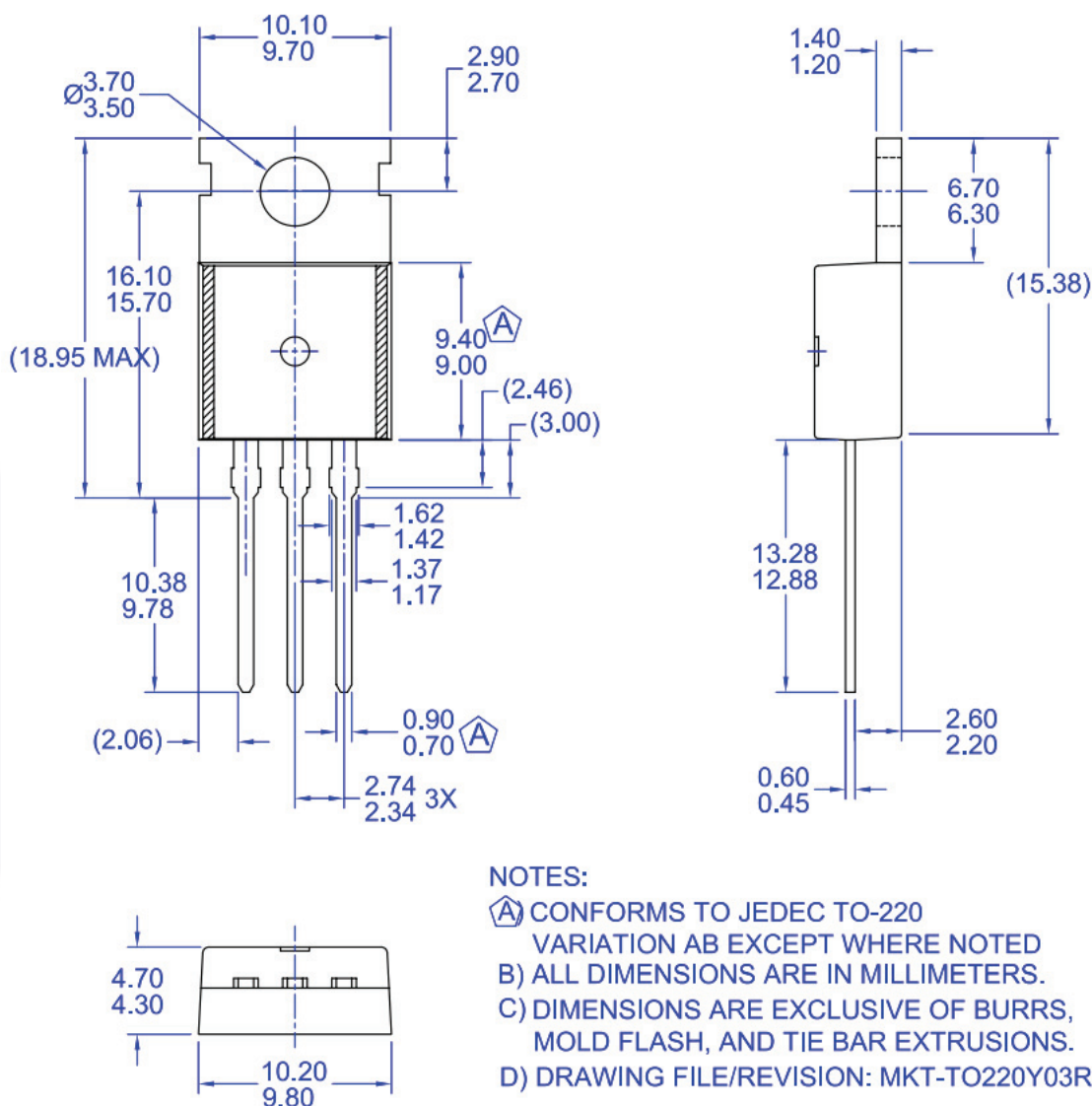


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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