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FQP6N40CF

N-Channel QFET® FRFET® MOSFET

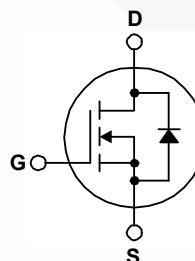
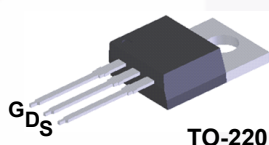
400 V, 6 A, 1.1 Ω

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.

Features

- 6 A, 400 V, $R_{DS(on)} = 1.1 \Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 3 \text{ A}$
- Low Gate Charge (Typ. 16 nC)
- Low C_{RSS} (Typ. 15 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQP6N40CF	Unit
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current		A
	- Continuous ($T_C = 25^\circ\text{C}$)	6	
	- Continuous ($T_C = 100^\circ\text{C}$)	3.6	
I_{DM}	Drain Current		A
	- Pulsed (Note 1)	24	
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	270	mJ
I_{AR}	Avalanche Current (Note 1)	6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	73	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	20	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	73	W
	- Derate above 25°C	0.58	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, 1/8" from case for 5 seconds.	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQP6N40CF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.71	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP6N40CF	FQP6N40CF	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
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	400	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.54	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 400 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 320 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 = 3 A	--	0.9	1.1	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 3 A	--	4.7	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	480	625	pF
C _{oss}	Output Capacitance		--	80	105	pF
C _{rss}	Reverse Transfer Capacitance		--	15	20	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 200 V, I _D = 6 A, R _G = 25 Ω	--	13	35	ns
t _r	Turn-On Rise Time		--	65	140	ns
t _{d(off)}	Turn-Off Delay Time		--	21	55	ns
t _f	Turn-Off Fall Time		(Note 4)	--	38	85
Q _g	Total Gate Charge	V _{DS} = 320 V, I _D = 6 A, V _{GS} = 10 V	--	16	20	nC
Q _{gs}	Gate-Source Charge		--	2.3	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4)	--	8.2	--
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 6 A, dI _F / dt = 100 A/μs	--	70	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.12	--	μC

Notes:

1. Repetitive rating : pulse width limited by maximum junction temperature.
2. $L = 13.7\text{ mH}$, $I_{AS} = 6\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 6\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

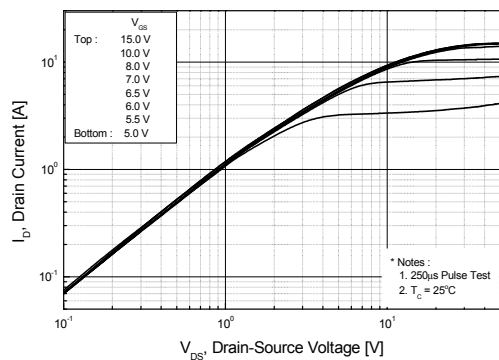


Figure 2. Transfer Characteristics

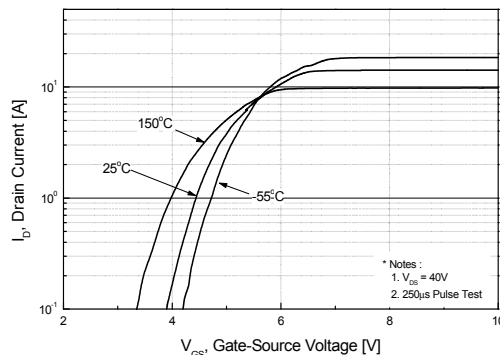


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

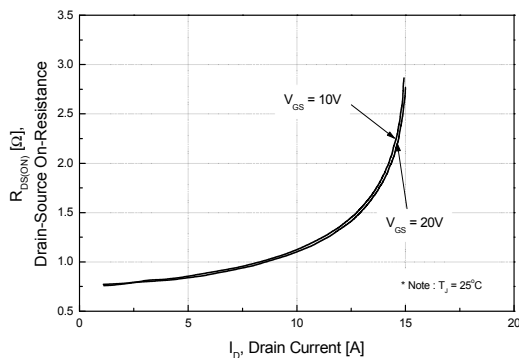


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

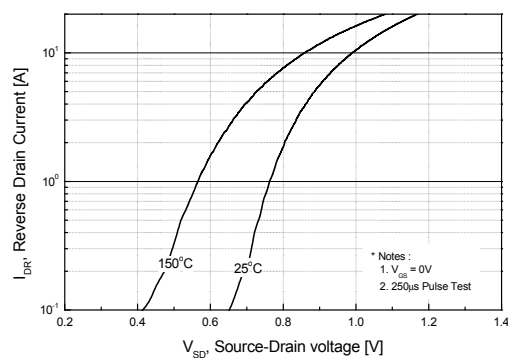


Figure 5. Capacitance Characteristics

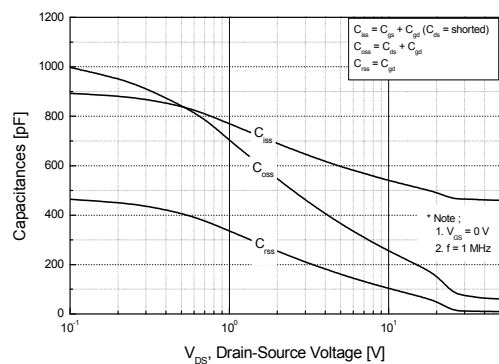
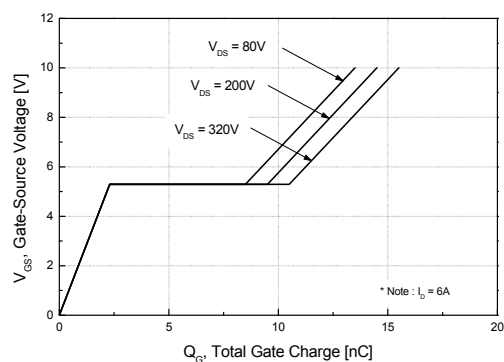


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

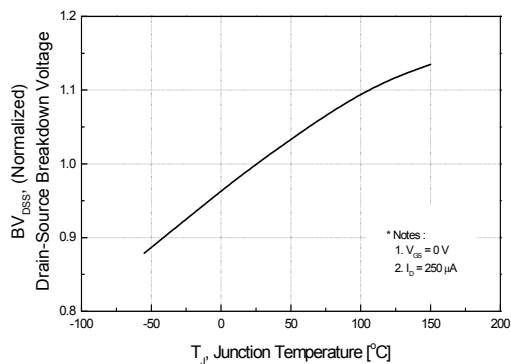


Figure 8. On-Resistance Variation vs. Temperature

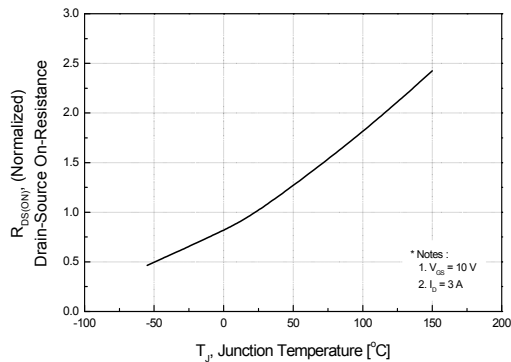


Figure 9. Maximum Safe Operating Area

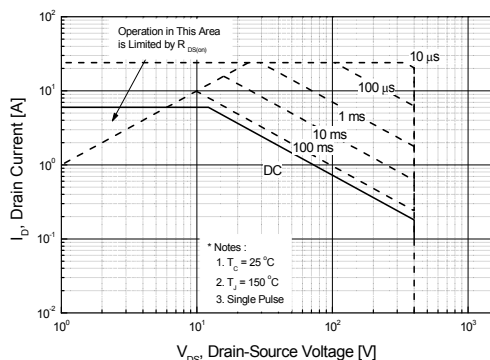


Figure 10. Maximum Drain Current vs. Case Temperature

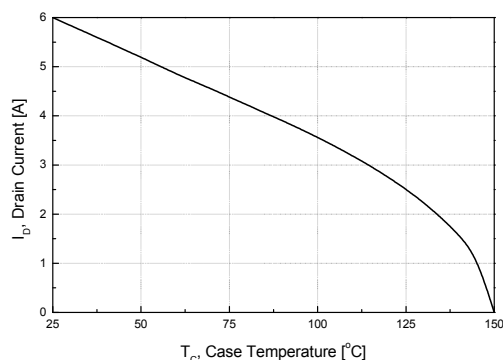
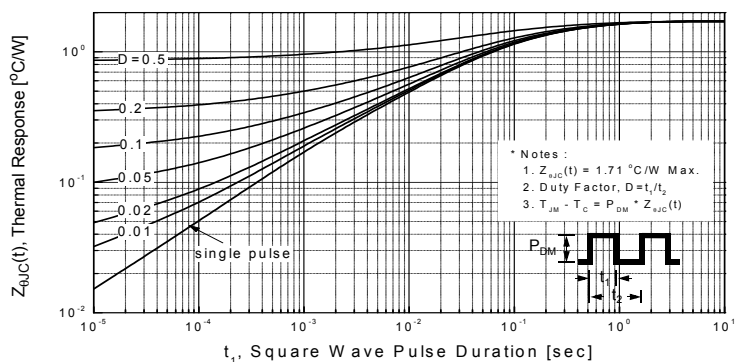


Figure 11. Transient Thermal Response Curve



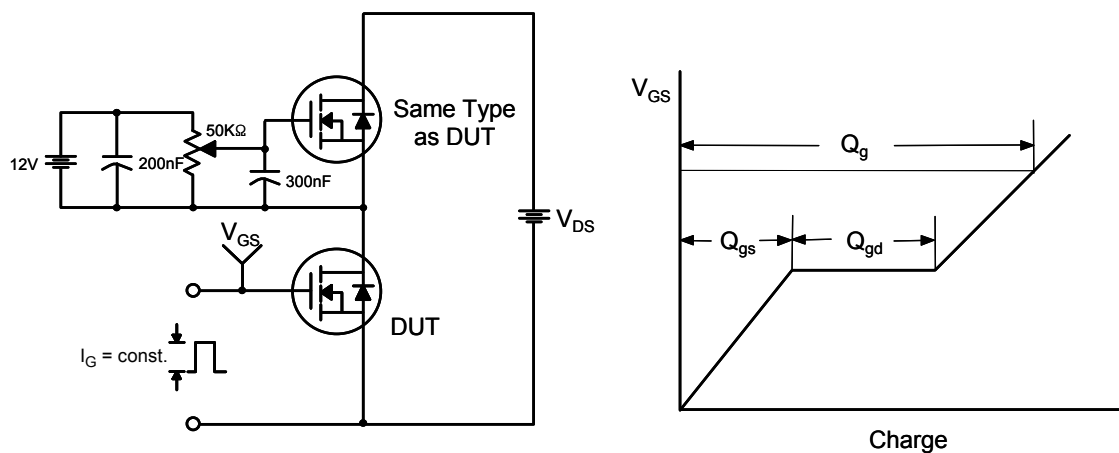


Figure 12. Gate Charge Test Circuit & Waveform

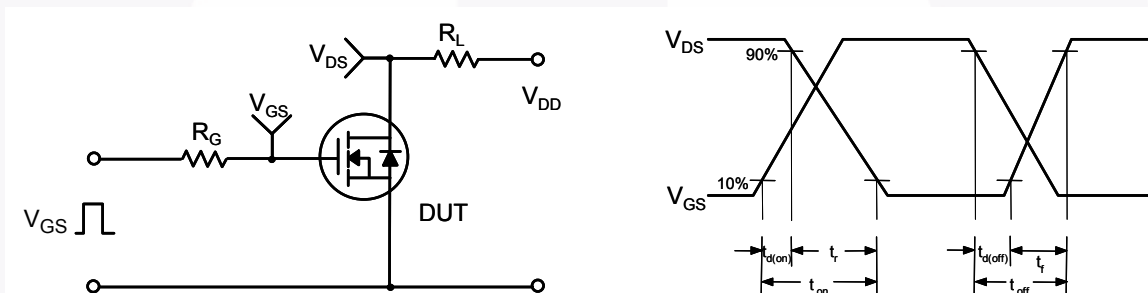


Figure 13. Resistive Switching Test Circuit & Waveforms

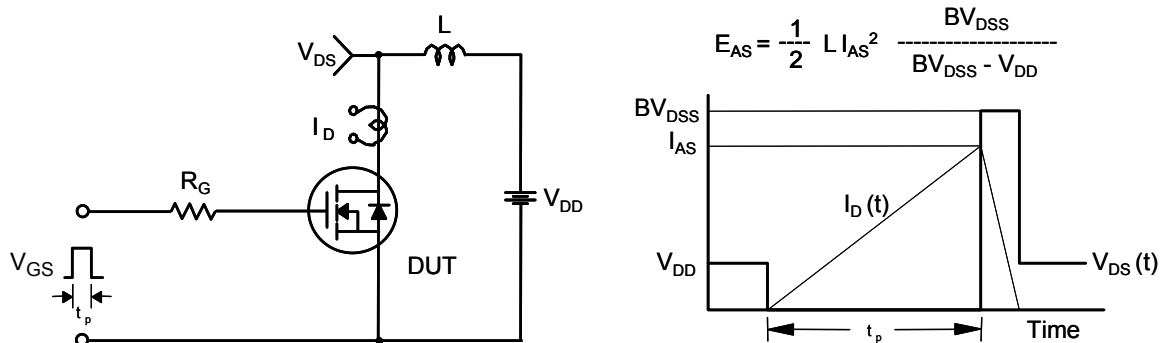


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

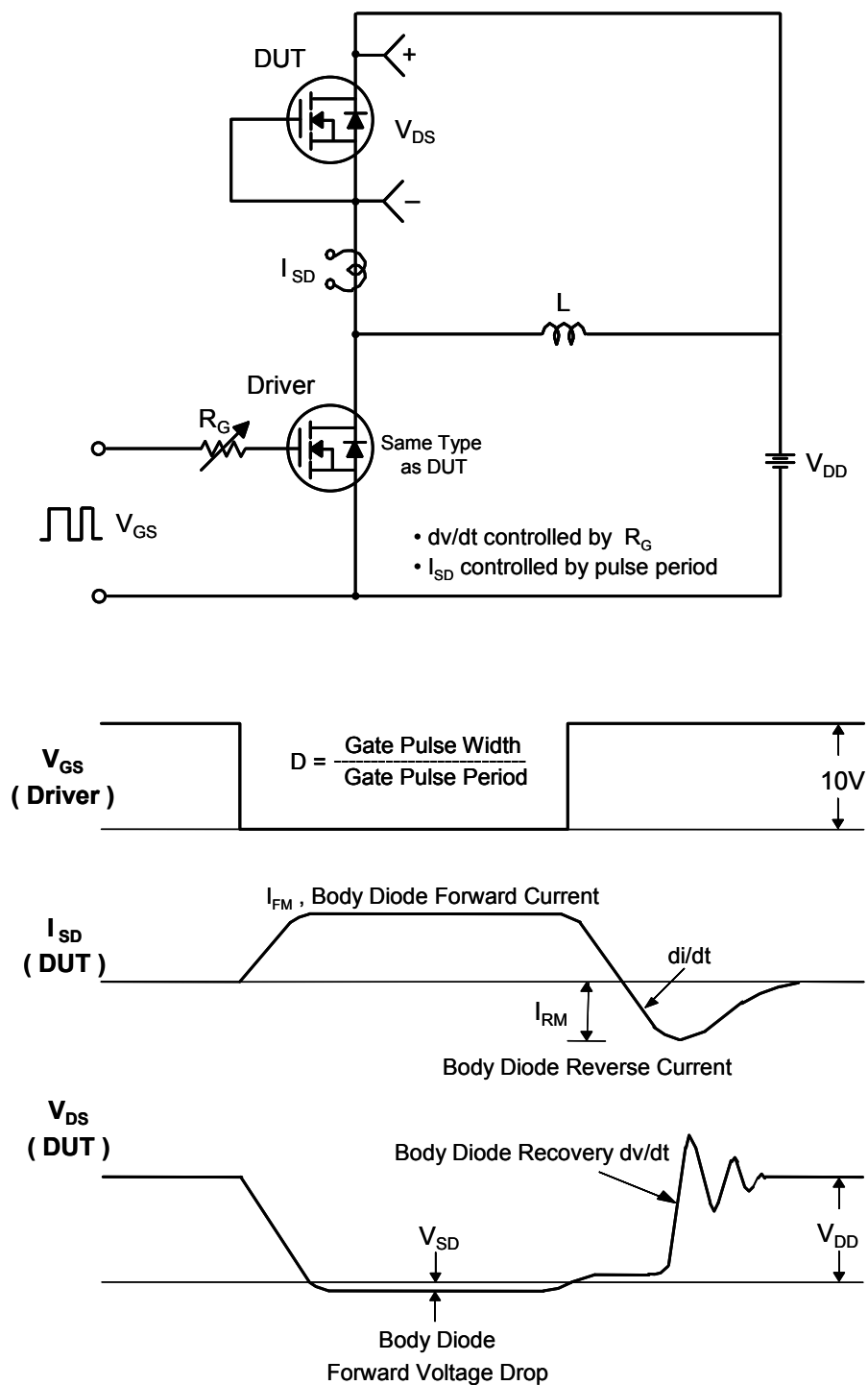


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

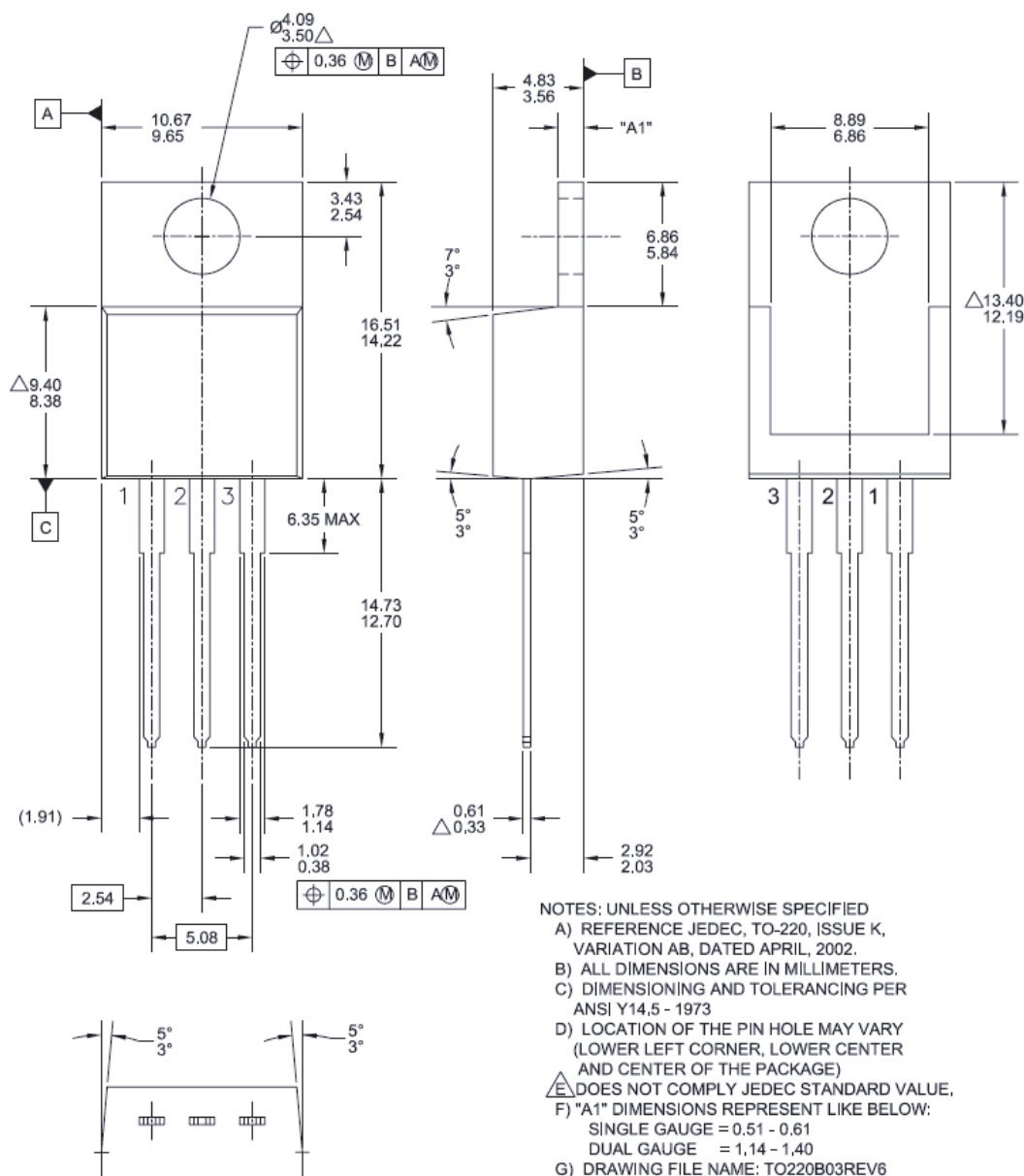


Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB

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