FAIRCHILD SEMICONDUCTOR®

QFET™

FQP5N60C/FQPF5N60C

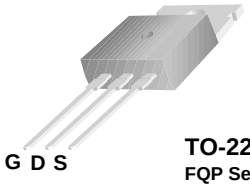
600V N-Channel MOSFET

General Description

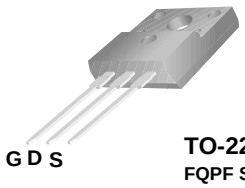
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in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

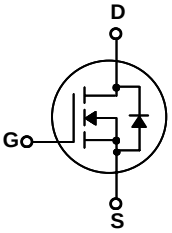
- 4.5A, 600V, $R_{DS(on)}$ = 2.5Ω @V_{GS} = 10 V
- Low gate charge (typical 15 nC)
- Low Crss (typical 6.5 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



TO-220
FQP Series



TO-220F
FQPF Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQP5N60C	FQPF5N60C	Units
V_{DSS}	Drain-Source Voltage		600		V
I_D	Drain Current - Continuous (T_C = 25°C)		4.5	4.5 *	A
	- Continuous (T_C = 100°C)		2.6	2.6 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	18	18 *	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	210		mJ
I_{AR}	Avalanche Current	(Note 1)	4.5		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	10		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25°C)		100	33	W
	- Derate above 25°C		0.8	0.26	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		°C

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FQP5N60C	FQPF5N60C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	3.79	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

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Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	600	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 480 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 = 2.25 A	--	2.0	2.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 2.25 A (Note 4)	--	4.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	515	670	pF
C_{oss}	Output Capacitance		--	55	72	pF
C_{rss}	Reverse Transfer Capacitance		--	6.5	8.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 4.5A, R_G = 25 Ω (Note 4, 5)	--	10	30	ns
t_r	Turn-On Rise Time		--	42	90	ns
$t_{d(off)}$	Turn-Off Delay Time		--	38	85	ns
t_f	Turn-Off Fall Time		--	46	100	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 4.5A, V_{GS} = 10 V (Note 4, 5)	--	15	19	nC
Q_{gs}	Gate-Source Charge		--	2.5	--	nC
Q_{gd}	Gate-Drain Charge		--	6.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	18	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 4.5 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 4.5 A, dI_F / dt = 100 A/μs (Note 4)	--	300	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.2	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 18.9mH, I_{AS} = 4.5 A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 4.5A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

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Typical Characteristics

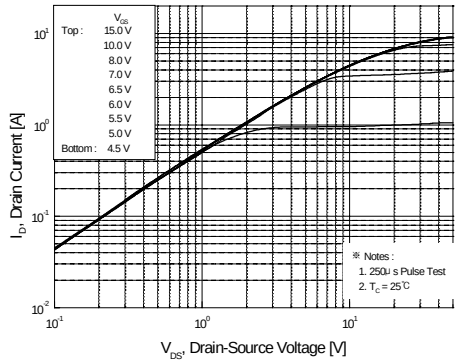


Figure 1. On-Region Characteristics

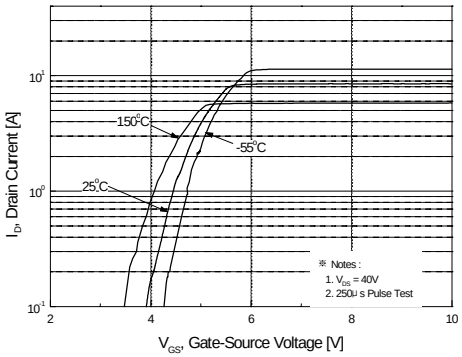


Figure 2. Transfer Characteristics

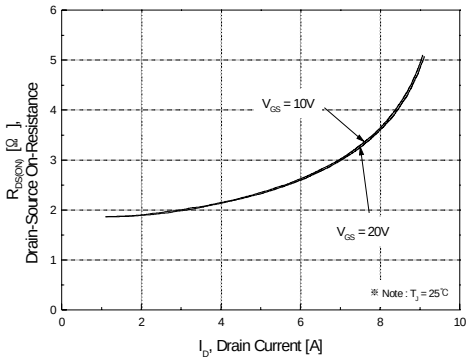


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

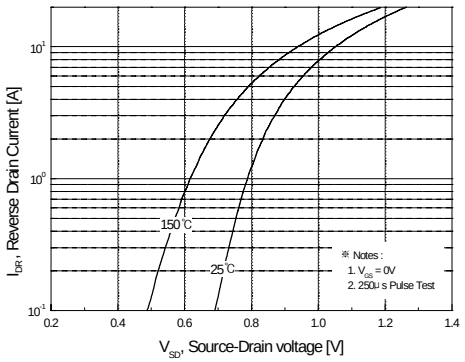


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

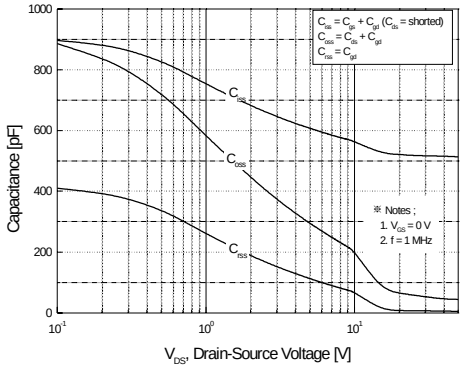


Figure 5. Capacitance Characteristics

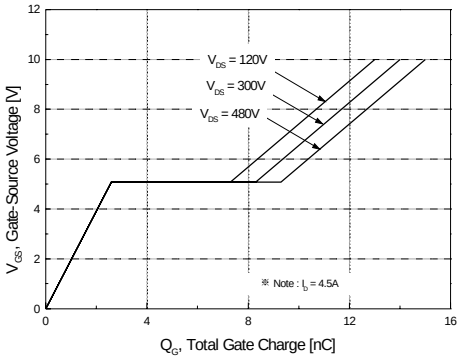


Figure 6. Gate Charge Characteristics

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Typical Characteristics (Continued)

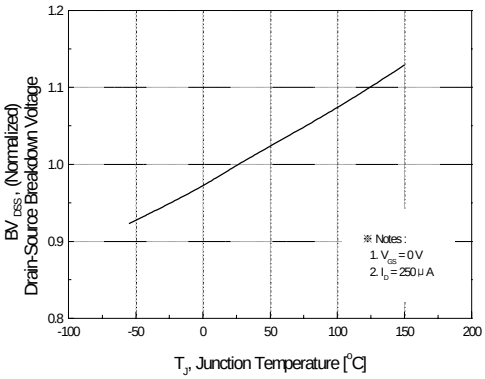


Figure 7. Breakdown Voltage Variation vs Temperature

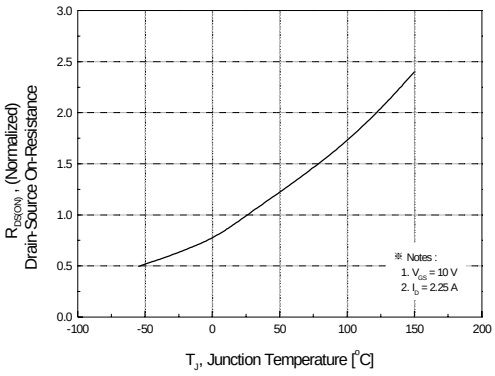


Figure 8. On-Resistance Variation vs Temperature

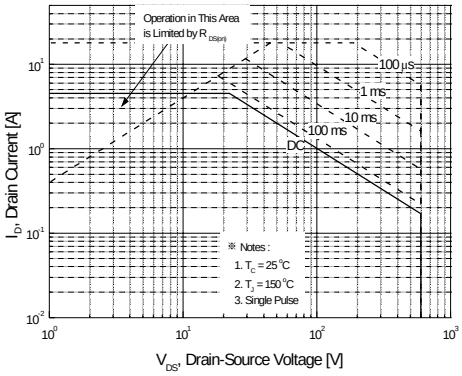


Figure 9-1. Maximum Safe Operating Area for FQP5N60C

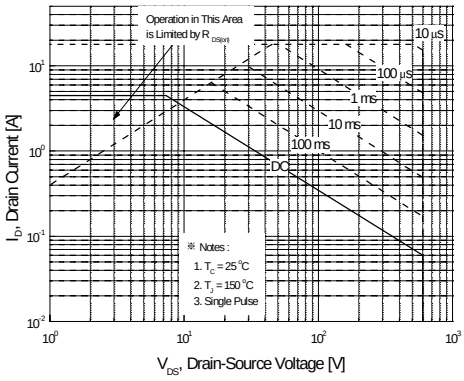


Figure 9-2. Maximum Safe Operating Area for FQPF5N60C

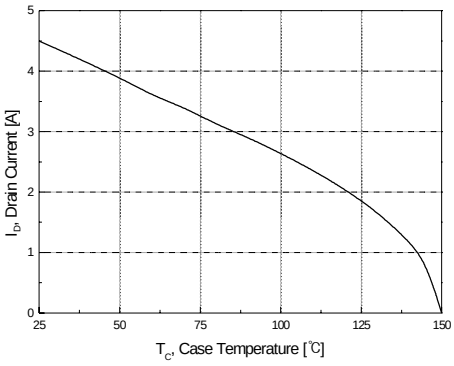


Figure 10. Maximum Drain Current vs Case Temperature

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Typical Characteristics (Continued)

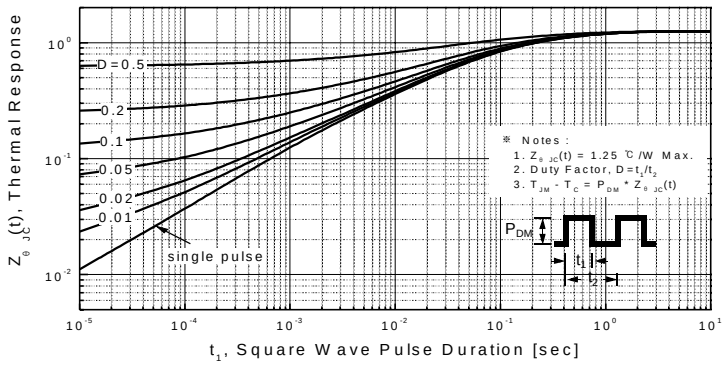


Figure 11-1. Transient Thermal Response Curve for FQP5N60C

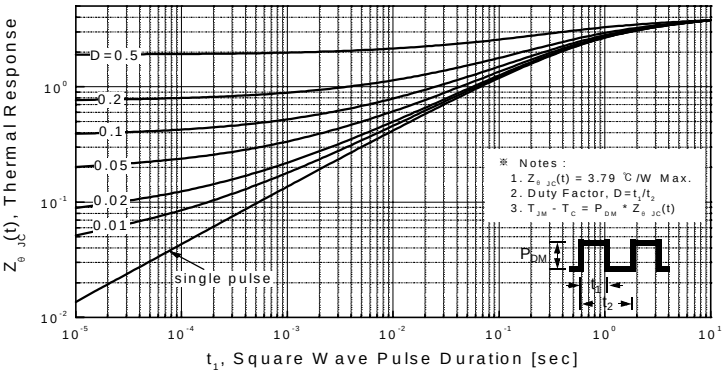
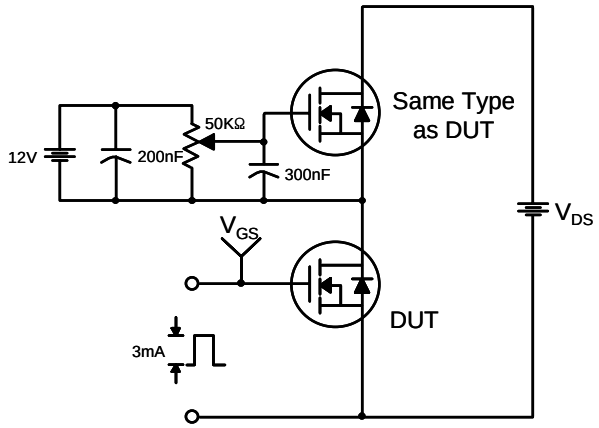
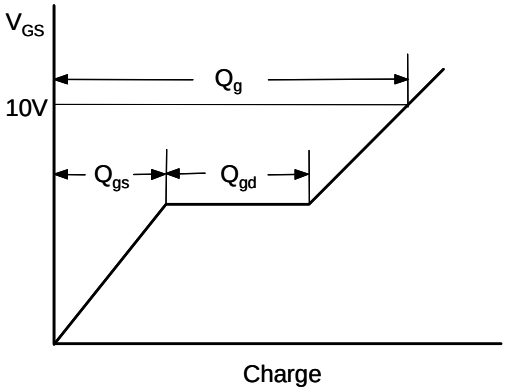


Figure 11-2. Transient Thermal Response Curve for FQPF5N60C

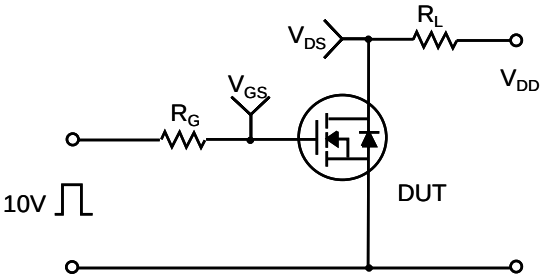
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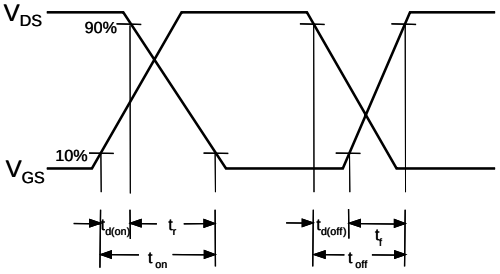
Gate Charge Test Circuit & Waveform



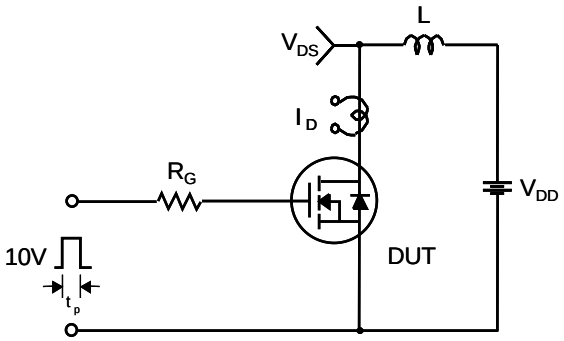


Resistive Switching Test Circuit & Waveforms

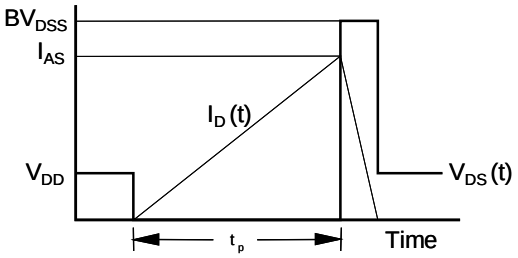




Unclamped Inductive Switching Test Circuit & Waveforms

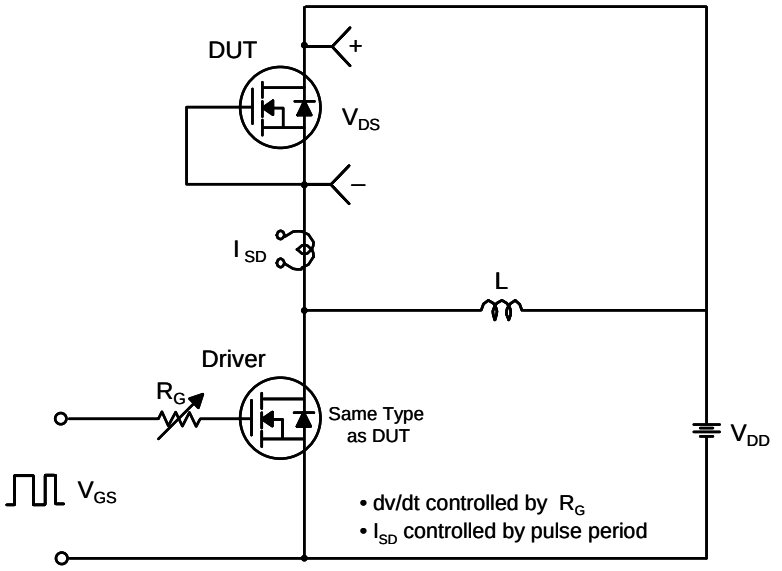


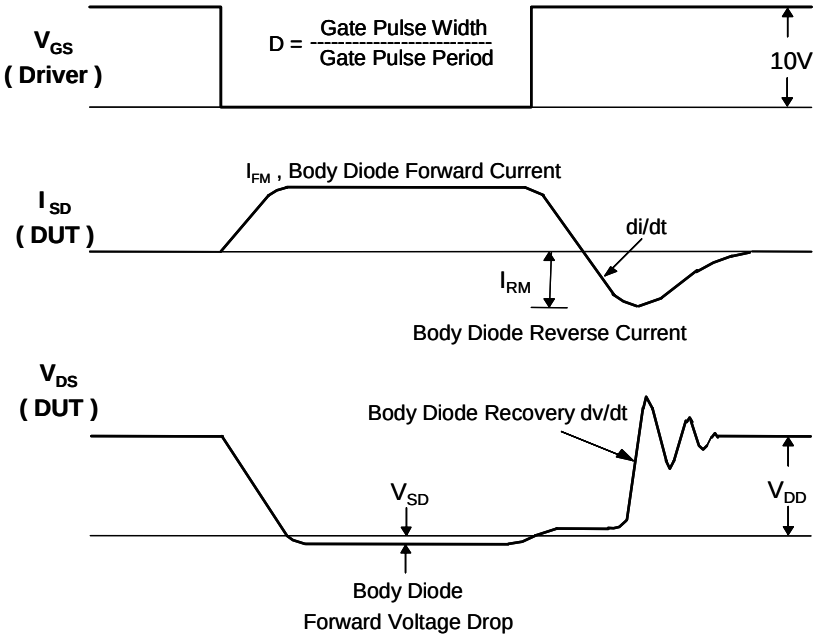
$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



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Peak Diode Recovery dv/dt Test Circuit & Waveforms

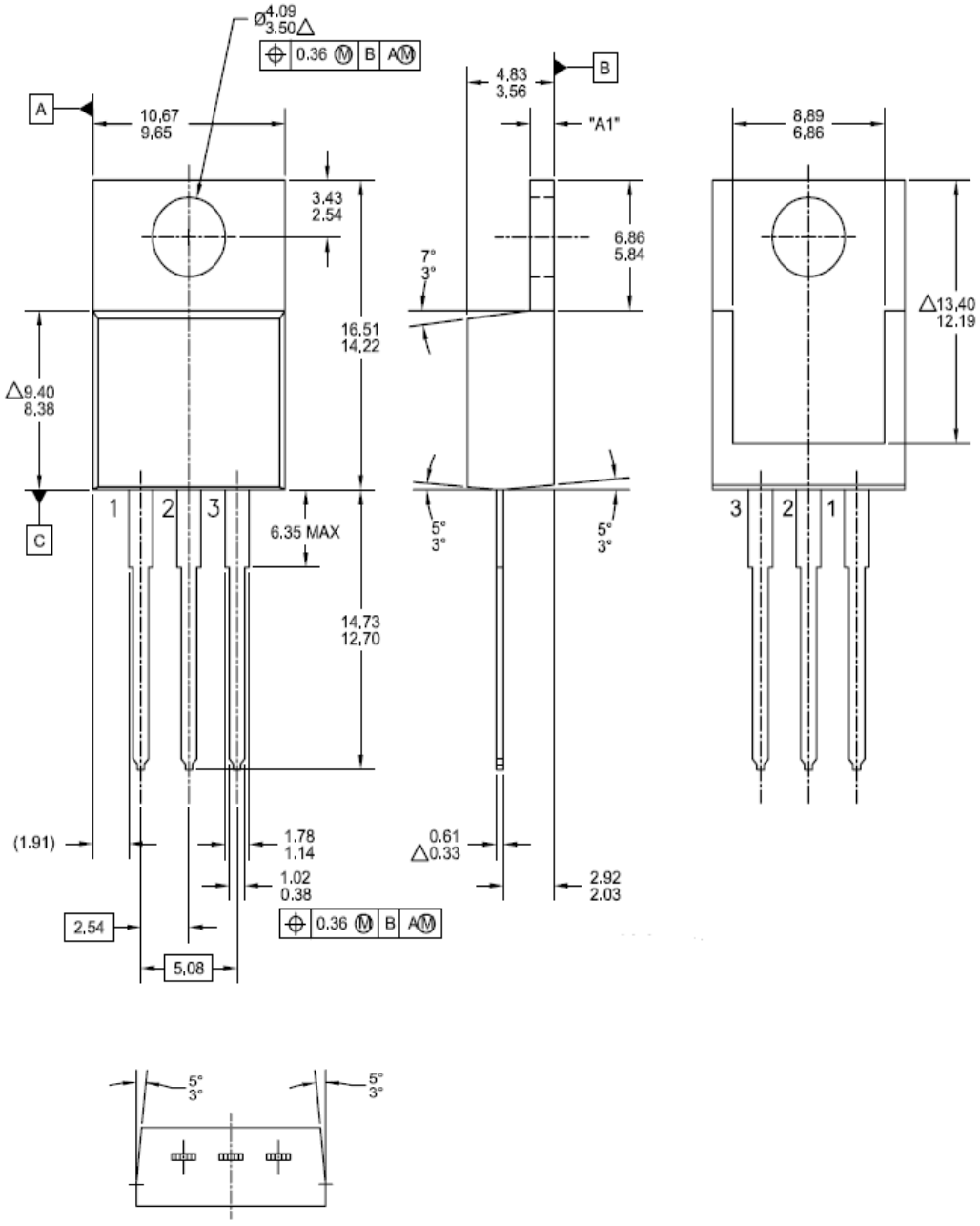




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Mechanical Dimensions

TO - 220

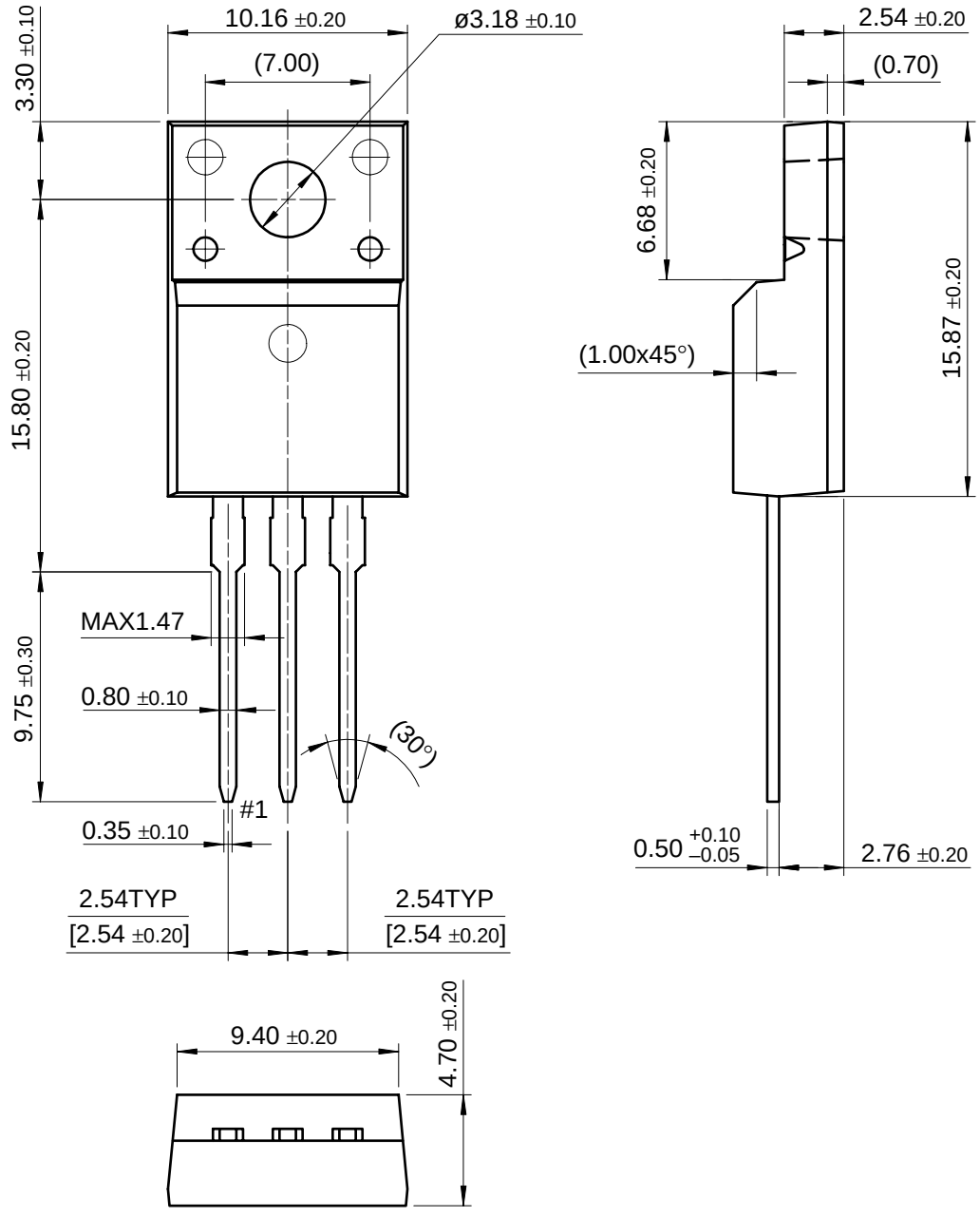


Dimensions in Millimeters

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Package Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

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