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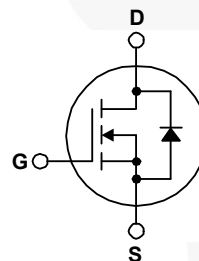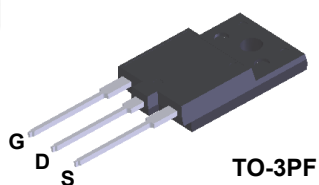# FQAF11N90C

N-Channel QFET® MOSFET

900 V, 7.0 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

- 7.0 A, 900 V, $R_{DS(on)}$ = 1.1 Ω (Max.) @ V_{GS} = 10 V, I_D = 3.5 A
- Low Gate Charge (Typ. 60 nC)
- Low Crss (Typ. 23 pF)
- 100% Avalanche Tested

TO-3PF

Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FQAF11N90C	Unit
V_{DSS}	Drain-Source Voltage		900	V
I_D	Drain Current - Continuous (T_C = 25°C)		7.0	A
	- Continuous (T_C = 100°C)		4.4	A
I_{DM}	Drain Current - Pulsed	(Note 1)	28.0	A
V_{GSS}	Gate-Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	960	mJ
I_{AR}	Avalanche Current	(Note 1)	7.0	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	12	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.0	V/ns
P_D	Power Dissipation (T_C = 25°C)		120	W
	- Derate above 25°C		0.96	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds.		300	°C

Thermal Characteristics

Symbol	Parameter	FQAF11N90C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.04	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQAF11N90C	FQAF11N90C	TO-3PF	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25°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	900	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	1.0	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 900 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 720 V, T_C = 125°C	--	--	100	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	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 3.5 A	--	0.91	1.1	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 3.5 A	--		--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2530	3290	pF
C_{oss}	Output Capacitance		--	215	280	pF
C_{rss}	Reverse Transfer Capacitance		--	23	30	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 450 V, I_D = 11.0 A, R_G = 25 Ω	--	60	130	ns
t_r	Turn-On Rise Time		--	130	270	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
t_f	Turn-Off Fall Time	(Note 4)	--	85	180	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 11.0 A, V_{GS} = 10 V	--	60	80	nC
Q_{gs}	Gate-Source Charge		--	13	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	25	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	28.0	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 7.0 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 11.0 A, dI_F / dt = 100 A/μs	--	1000	--	ns
Q_{rr}	Reverse Recovery Charge		--	17.0	--	μC

Notes:
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 37 mH, I_{AS} = 7.0 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C .
3. $I_{SD} \leq$ 11.0 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq BV_{DSS}$ starting T_J = 25°C.
4. Essentially independent of operating temperature.
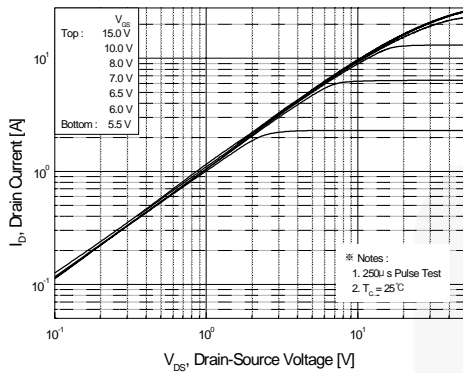
Typical Characteristics
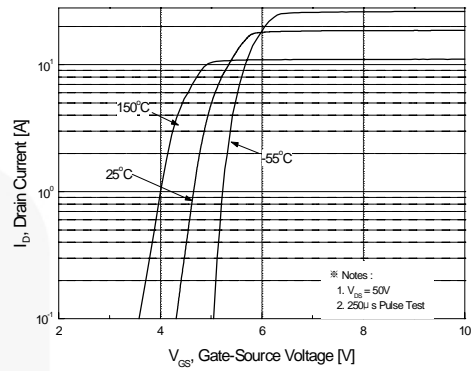
Figure 1. On-Region Characteristics

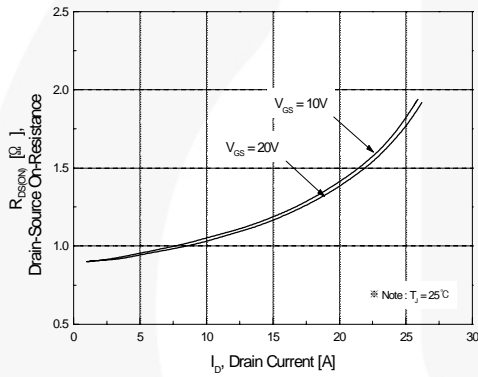**Figure 2. Transfer Characteristics**

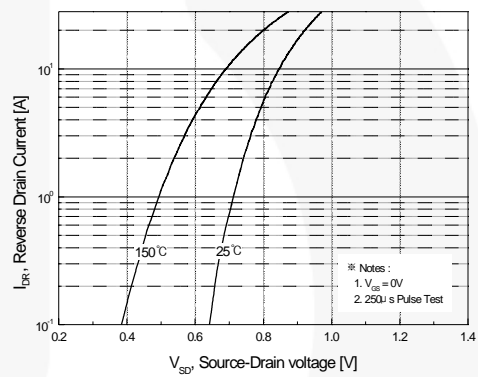**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**

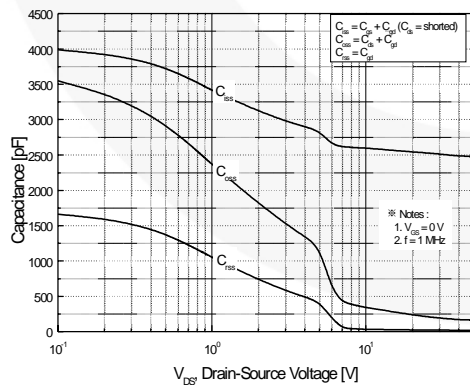**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**
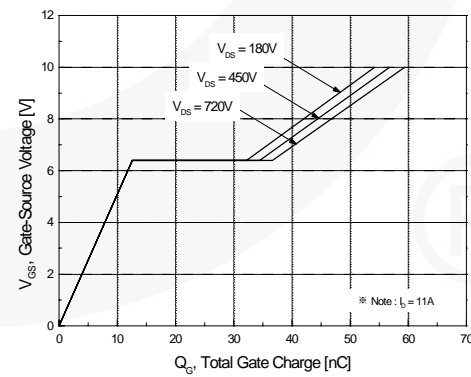

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
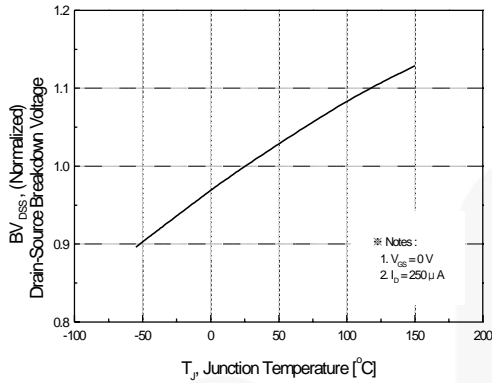
Typical Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation
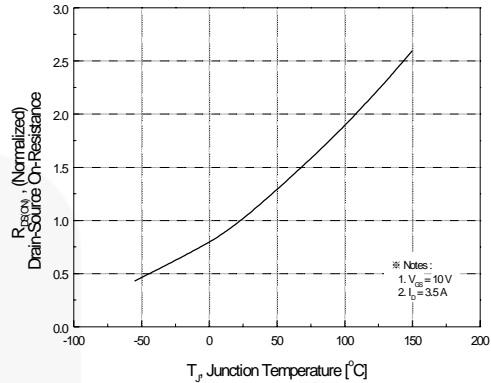vs Temperature**

**Figure 8. On-Resistance Variation
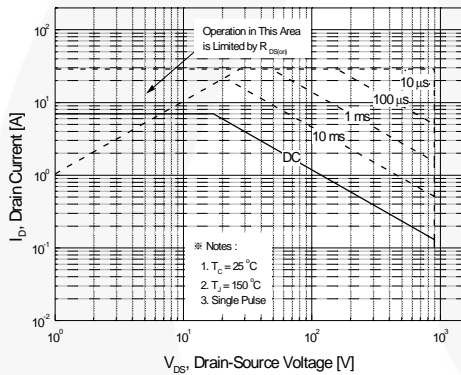vs Temperature**
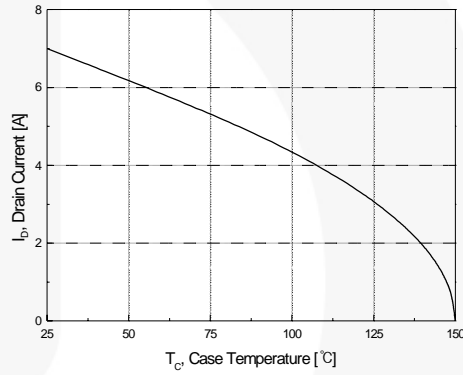

Figure 9. Maximum Safe Operating Area

**Figure 10. Maximum Drain Current
vs Case Temperature**
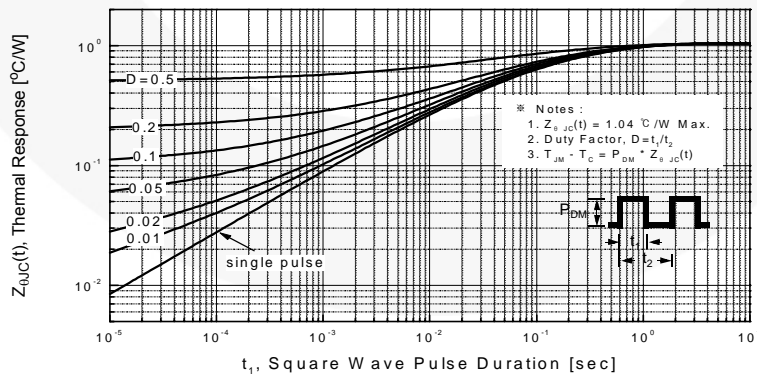
Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

Same Type as DUT

12V 200nF 50KΩ 300nF

V_{GS}

I_G = const.

DUT

V_{DS}

V_{GS}

Q_g

Q_{gs} Q_{gd}

Charge

Figure 12. Gate Charge Test Circuit & Waveform

V_{DS} R_L

V_{GS} V_{DD}

R_G

V_{GS}

DUT

V_{DS}

90%

V_{GS}

10%

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

t_{on} t_{off}
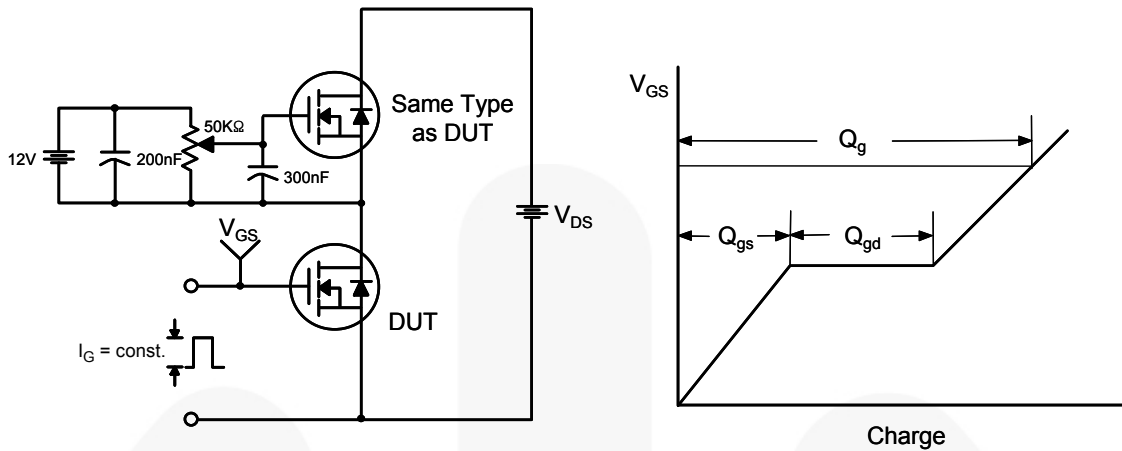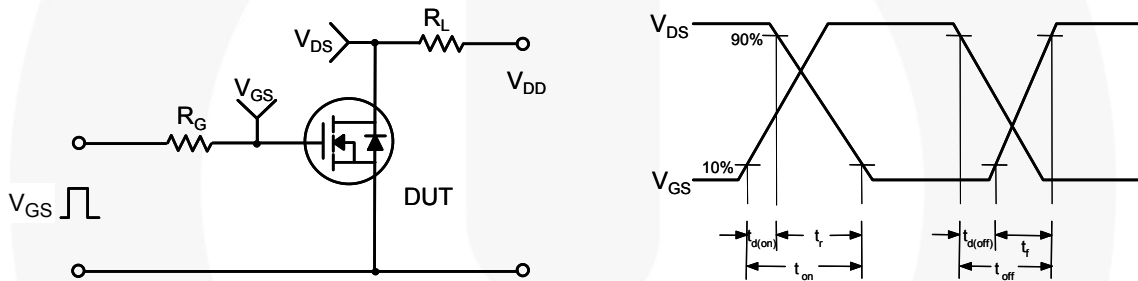
Figure 13. Resistive Switching Test Circuit & Waveforms

V_{DS} L

I_D

R_G

V_{DD}

V_{GS}

t_p

DUT

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

BV_{DSS}

I_{AS}

$I_D(t)$

V_{DD} $V_{DS}(t)$

t_p Time
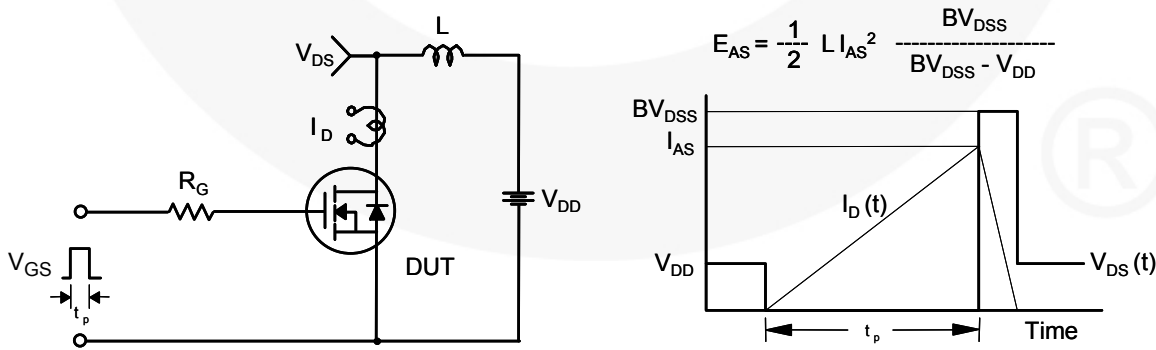
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by pulse period

V_{GS}
(Driver)

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop

Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms
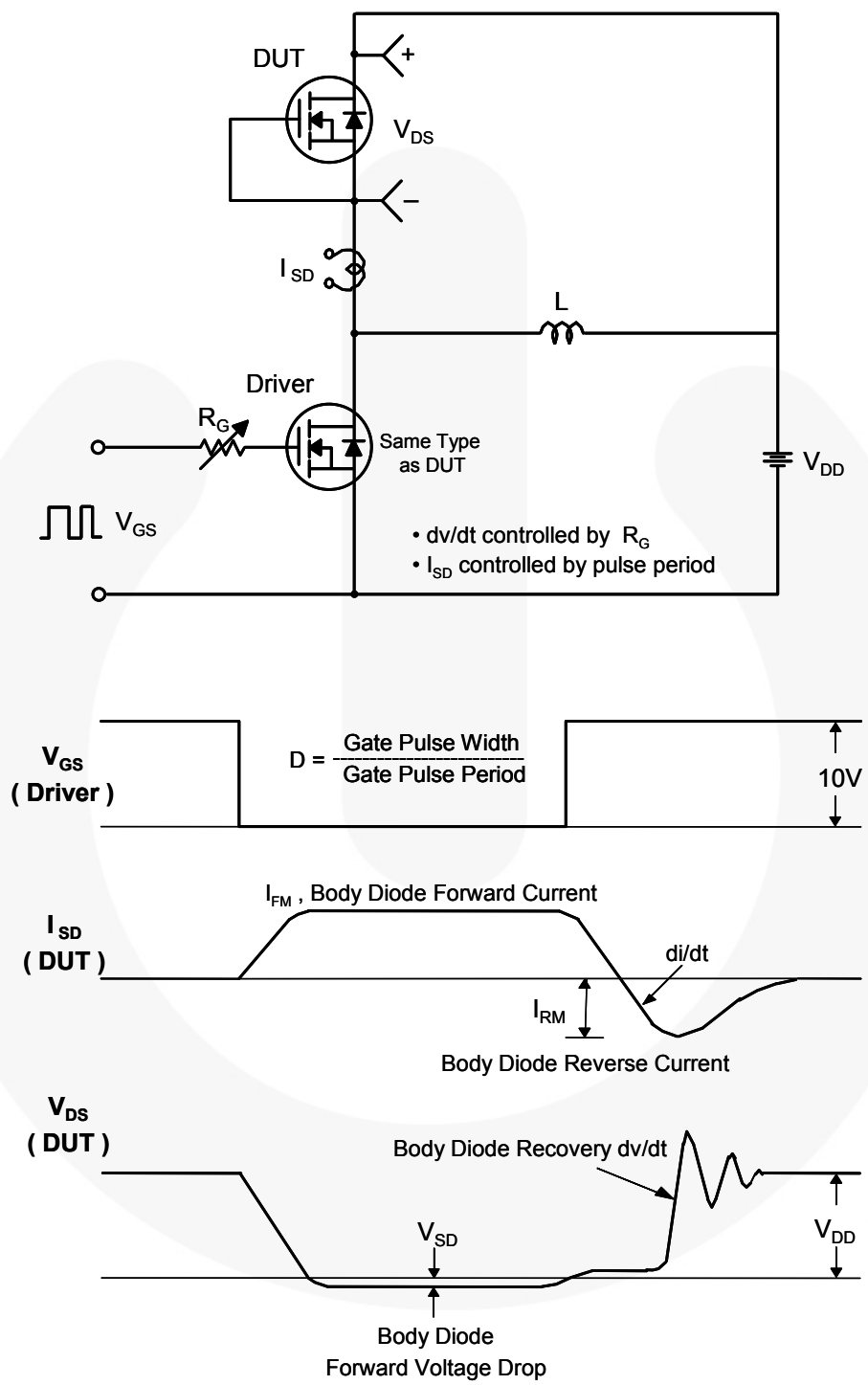
Mechanical Dimensions
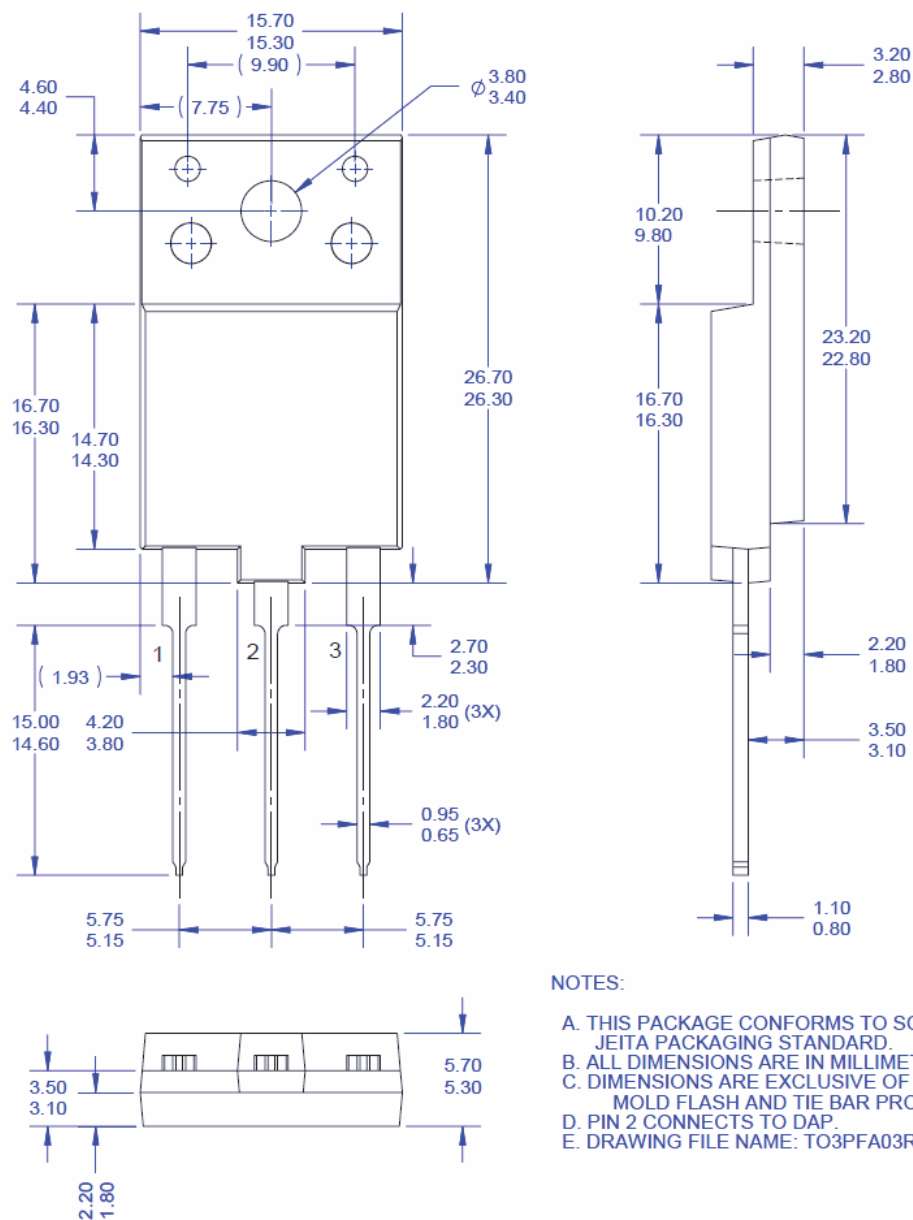
Figure 16. TO3PF, Molded, 3-Lead, Full Pack (AG)

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JEITA PACKAGING STANDARD.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS,
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D. PIN 2 CONNECTS TO DAP.
E. DRAWING FILE NAME: TO3PFA03REV1

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