April 2014

FQA9N90C_F109

N-Channel QFET® MOSFET

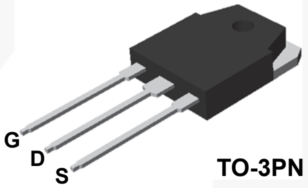
900 V, 9 A, 1.4 Ω

Features

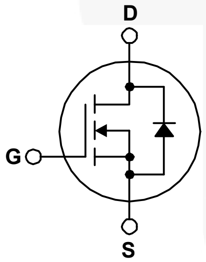
- 9 A, 900 V, $R_{DS(on)}$ = 1.4 Ω (Max.) @ V_{GS} = 10 V, I_D = 4.5 A
- Low Gate Charge (Typ. 45 nC)
- Low Crss . 14 pF)
- 100% Avalanche Tested
- RoHS compliant

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.



TO-3PN



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted.

Symbol	Parameter			FQA9N90C_F109	Unit
V_{DSS}	Drain-Source Voltage			900	V
I_D	Drain Current	- Continuous (T_C = 25°C)		9.0	A
		- Continuous (T_C = 100°C)		5.7	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	36	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	900	mJ
I_{AR}	Avalanche Current		(Note 1)	9.0	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	28	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.0	V/ns
P_D	Power Dissipation (T_C = 25°C)			280	W
		- Derate above 25°C		2.22	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

Thermal Characteristics

Symbol	Parameter	FQA9N90C_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.45	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	°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
FQA9N90C_F109	FQA9N90C	TO-3PN	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
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.99	--	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 = 4.5 A	--	1.12	1.4	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 4.5 A	--	9.2	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2100	2730	pF
C_{oss}	Output Capacitance		--	175	230	pF
C_{rss}	Reverse Transfer Capacitance		--	14	18	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 450 V, I_D = 11.0A, R_G = 25 Ω (Note 4)	--	50	110	ns
t_r	Turn-On Rise Time		--	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	210	ns
t_f	Turn-Off Fall Time		--	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 11.0A, V_{GS} = 10 V (Note 4)	--	45	58	nC
Q_{gs}	Gate-Source Charge		--	13	--	nC
Q_{gd}	Gate-Drain Charge		--	18	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	36	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S =9.0 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 9.0 A, dI_F / dt = 100 A/µs	--	550	--	ns
Q_{rr}	Reverse Recovery Charge		--	6.5	--	µC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 21 mH, I_{AS} = 9 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq 9$ A, di/dt ≤ 200 A/µs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

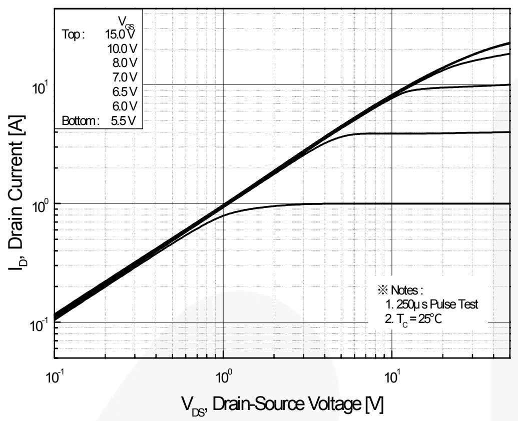


Figure 2. Transfer Characteristics

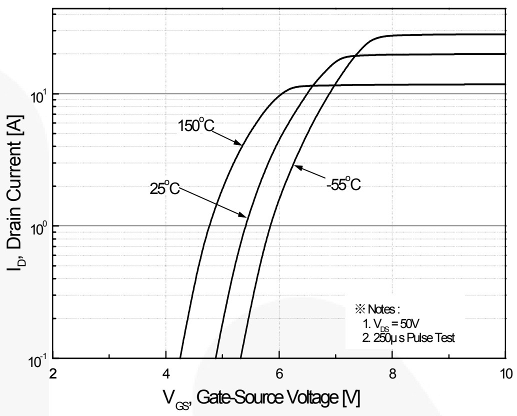


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

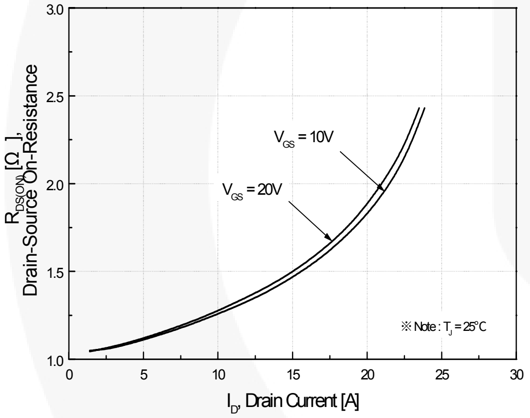


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

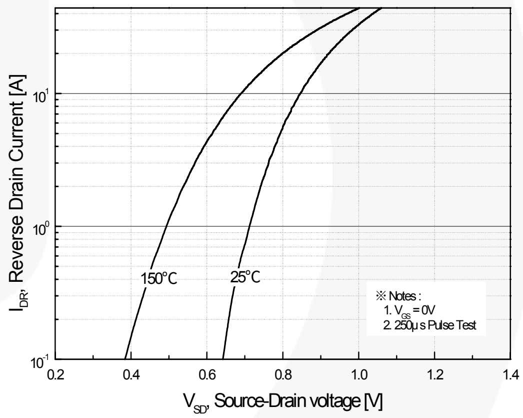


Figure 5. Capacitance Characteristics

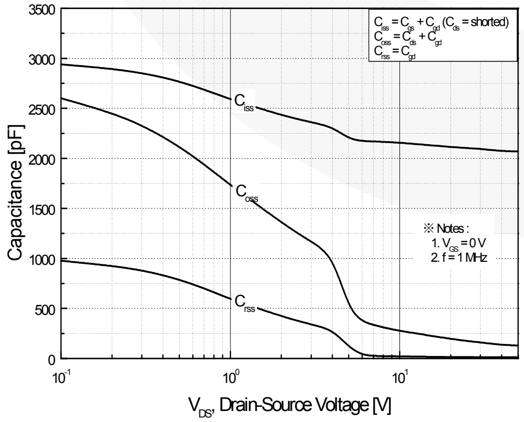
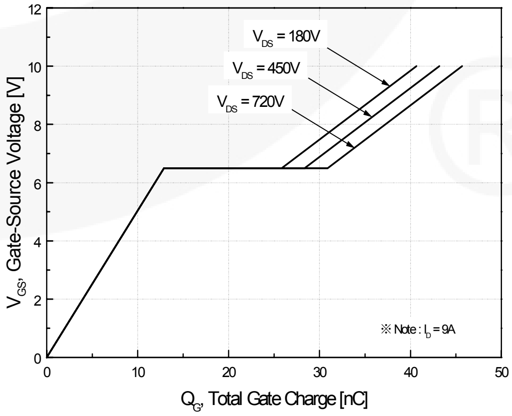


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

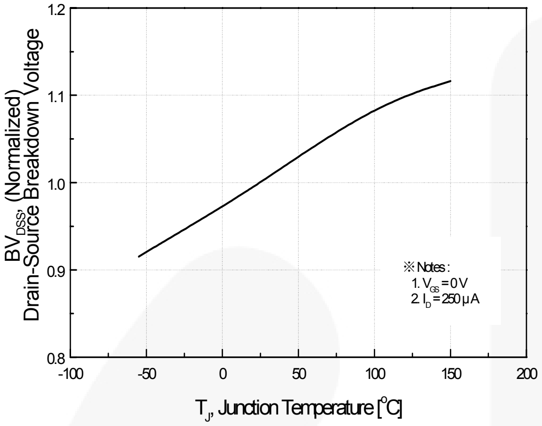


Figure 8. On-Resistance Variation vs. Temperature

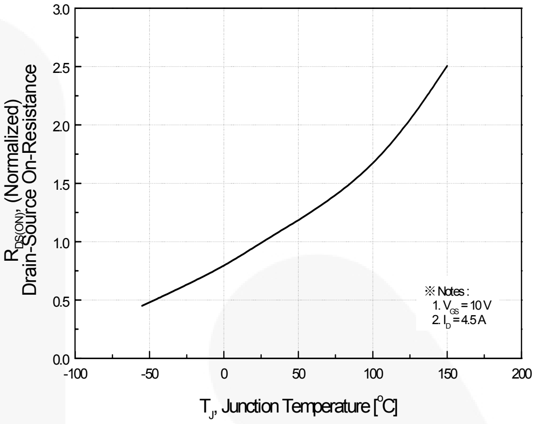


Figure 9. Maximum Safe Operating Area

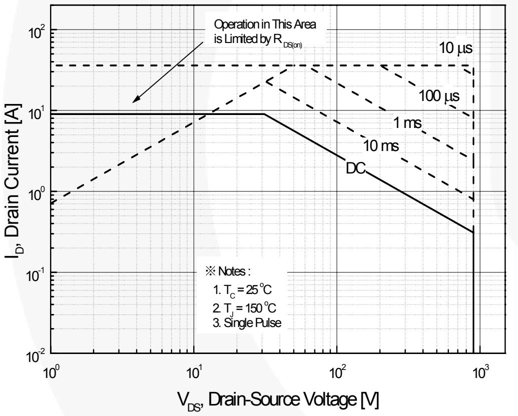


Figure 10. Maximum Drain Current vs. Case Temperature

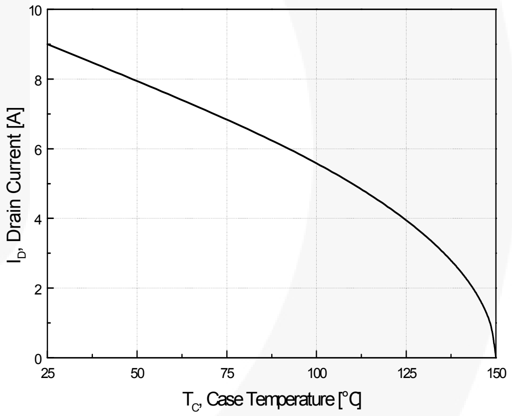
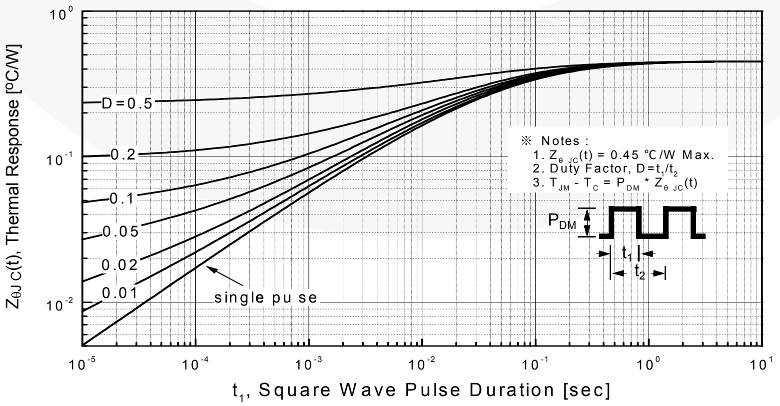


Figure 11. Transient Thermal Response Curve



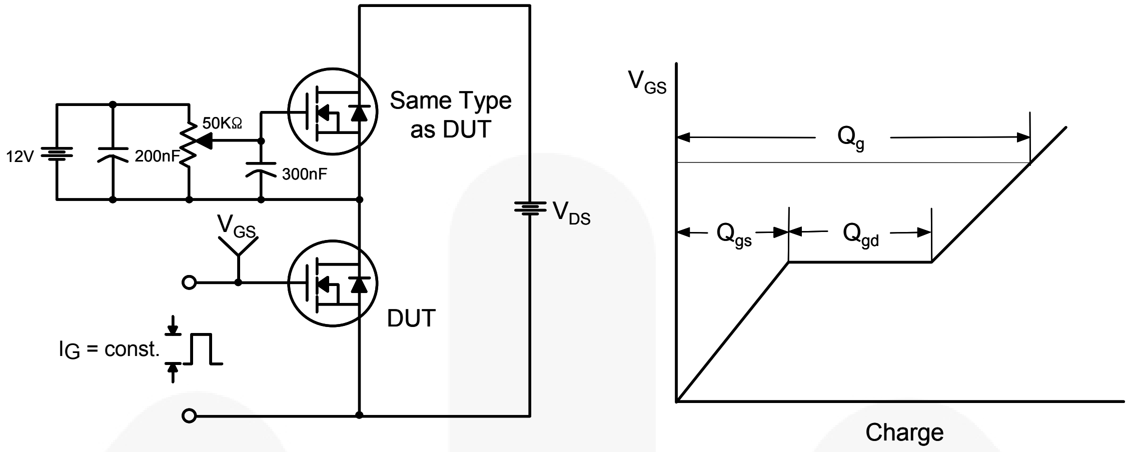


Figure 12. Gate Charge Test Circuit & Waveform

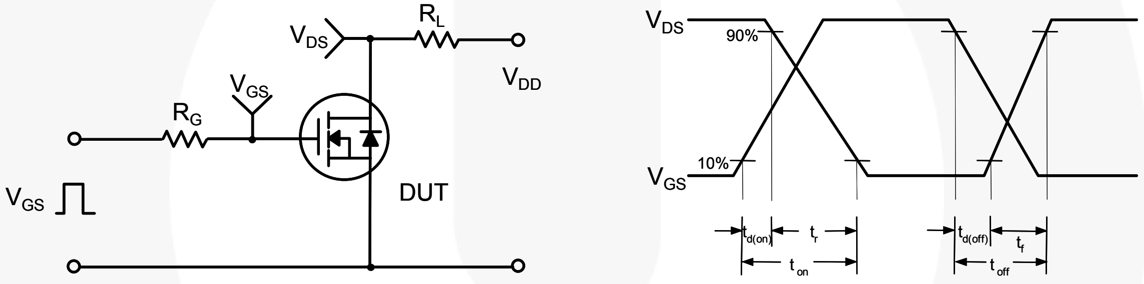
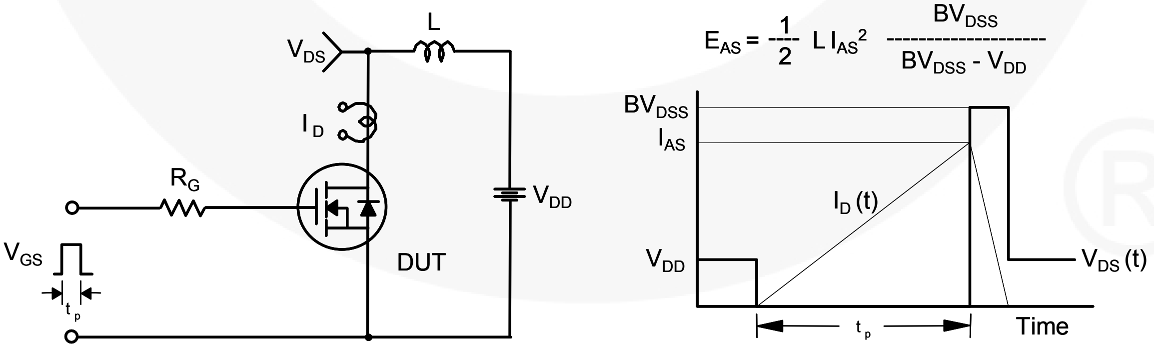


Figure 13. Resistive Switching Test Circuit & Waveforms



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

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

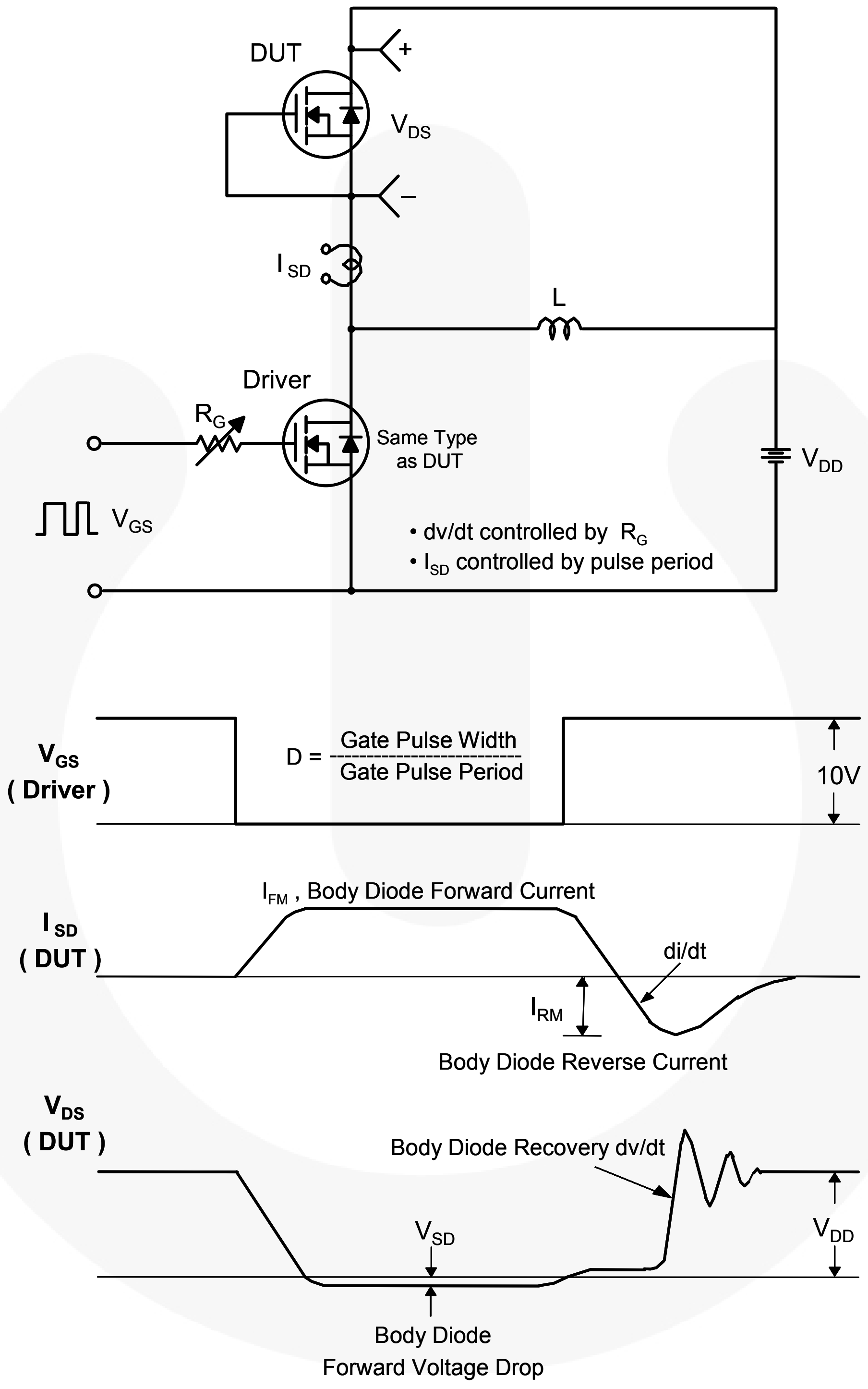


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

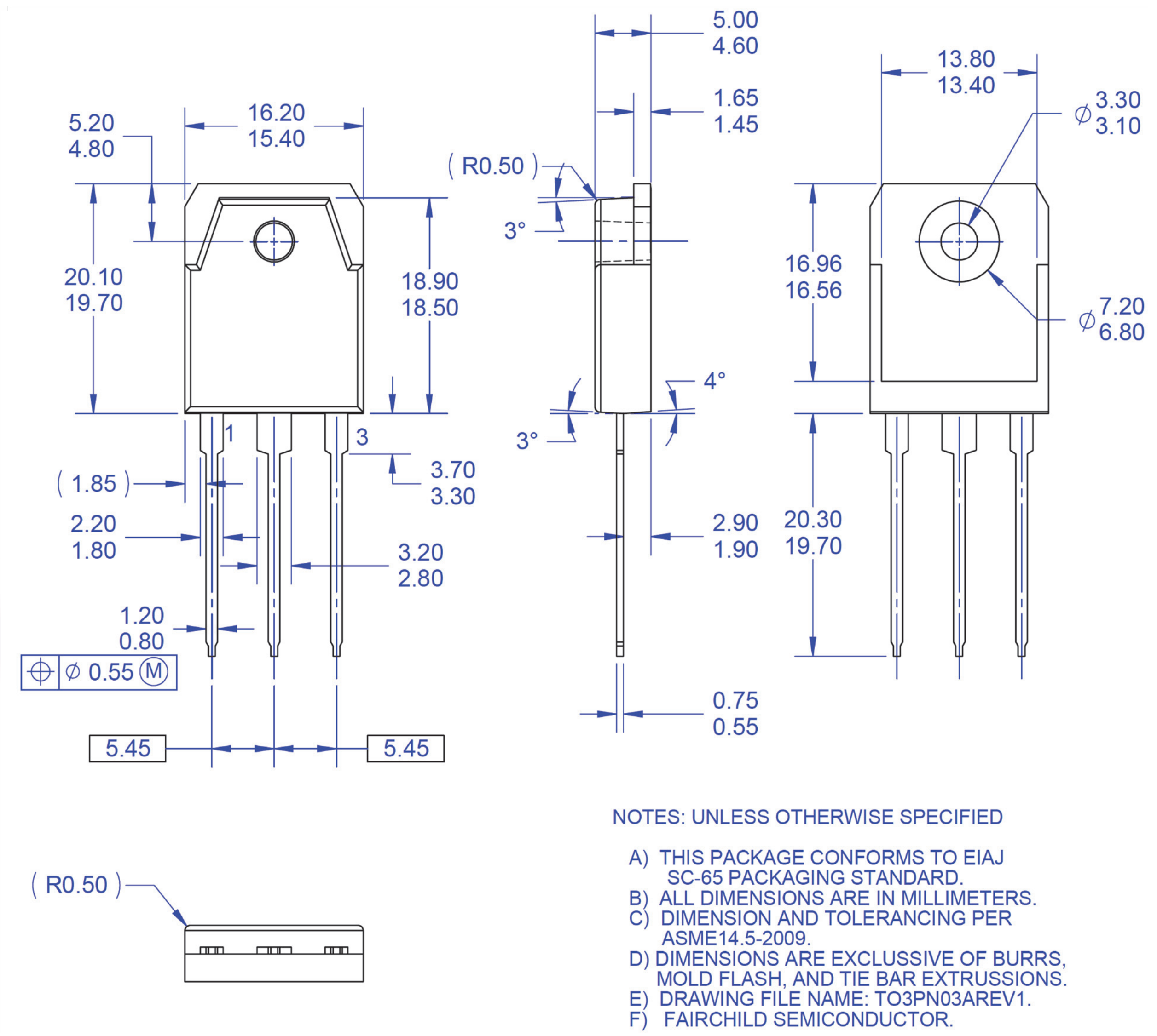


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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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