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FAIRCHILD

September 2017

FCA47N60 / FCA47N60_F109

N-Channel SuperFET® MOSFET

600 V, 47 A, 70 mΩ

Features

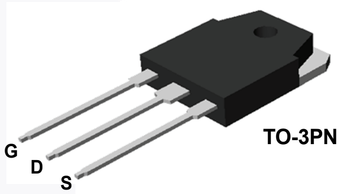
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 58 mΩ
- Ultra Low Gate Charge (Typ. Q_g= 210 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 420 pF)
- 100% Avalanche Tested

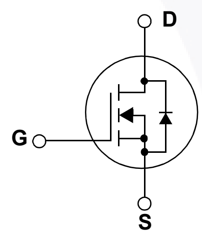
Application

- Solar Invertor
- AC-DC Power Supply

Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.





Absolute Maximum Ratings

Symbol	Parameter		FCA47N60	FCA47N60_F109	Unit
V_{DSS}	Drain-Source Voltage		600		V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	47 29.7		A A
I_{DM}	Drain Current	- Pulsed (Note 1)	141		A
V_{GSS}	Gate-Source voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	1800		mJ
I_{AR}	Avalanche Current	(Note 1)	47		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	41.7		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	417 3.33		W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300		°C

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	--	0.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	--	41.7	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCA47N60	FCA47N60	TO-3PN	-	-	30
FCA47N60	FCA47N60_F109	TO-3PN	-	-	30

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0 V, I_D = 250 μA, T_J = 150°C	--	650	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 47 A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V V_{DS} = 480 V, T_C = 125°C	-- --	-- --	1 10	μA 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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 23.5 A	--	0.058	0.07	
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 23.5 A	--	40	--	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	5900	8000	pF
C_{oss}	Output Capacitance		--	3200	4200	pF
C_{rss}	Reverse Transfer Capacitance		--	250	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	--	160	--	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	--	420	--	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 47 A R_G = 25 Ω (Note 4)	--	185	430	ns
t_r	Turn-On Rise Time		--	210	450	ns
$t_{d(off)}$	Turn-Off Delay Time		--	520	1100	ns
t_f	Turn-Off Fall Time		--	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 47 A V_{GS} = 10 V (Note 4)	--	210	270	nC
Q_{gs}	Gate-Source Charge		--	38	--	nC
Q_{gd}	Gate-Drain Charge		--	110	--	nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	47	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	141	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 47 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 47 A dI_F/dt =100 A/μs (Note 4)	--	590	--	ns
Q_{rr}	Reverse Recovery Charge		--	25	--	μC

Notes:

1. Repetitive Rating: Pulse-width limited by maximum junction temperature.
2. I_{AS} = 18 A, R_G = 25 Ω, starting T_J = 25°C
3. I_{SD} ≤ 47 A, di/dt ≤ 200 A/μs, V_{DD} = 380 V, starting T_J = 25°C
4. Essentially independent of operating temperature typical characteristics.

Typical Characteristics

Figure 1. On-Region Characteristics

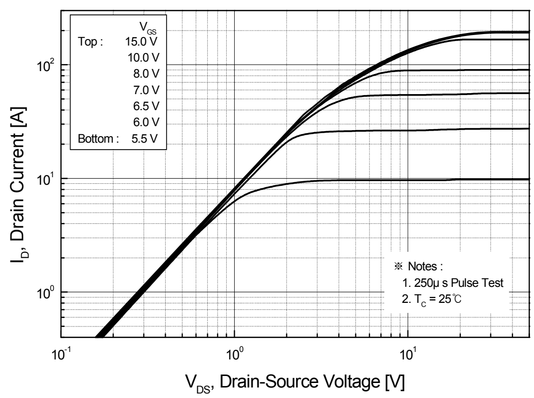


Figure 2. Transfer Characteristics

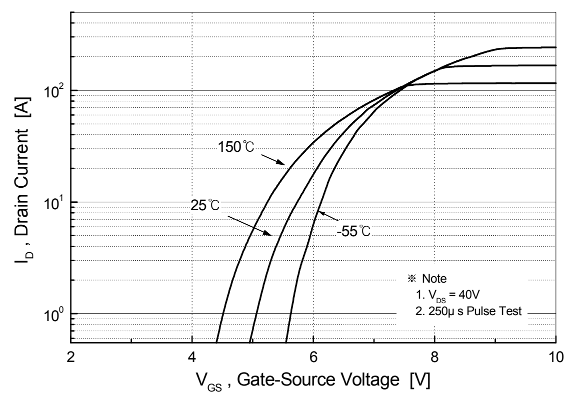


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

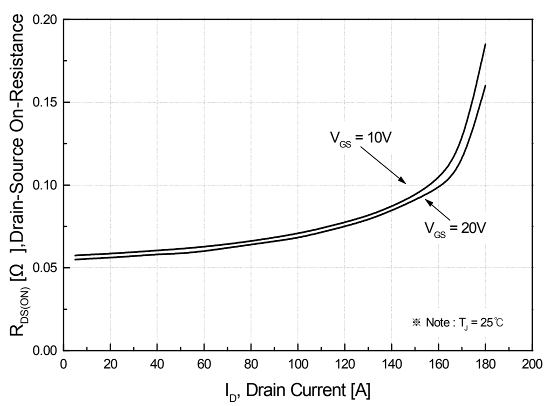


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

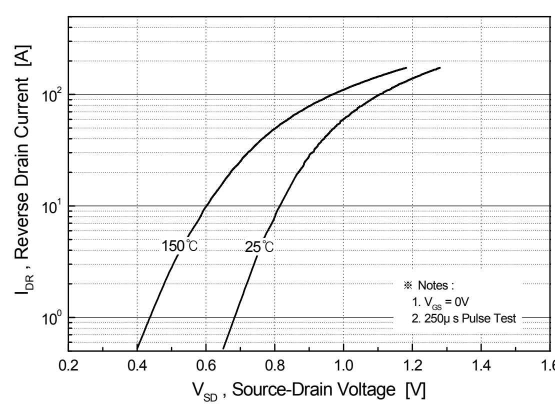


Figure 5. Capacitance Characteristics

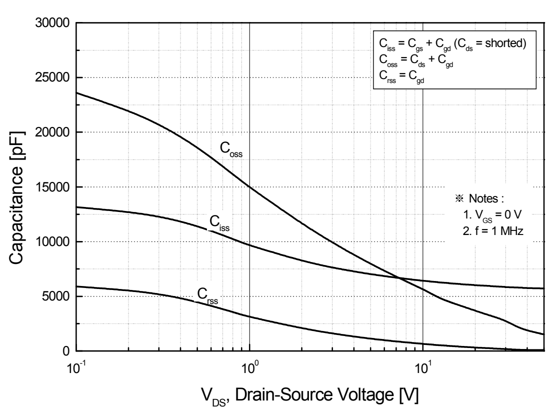
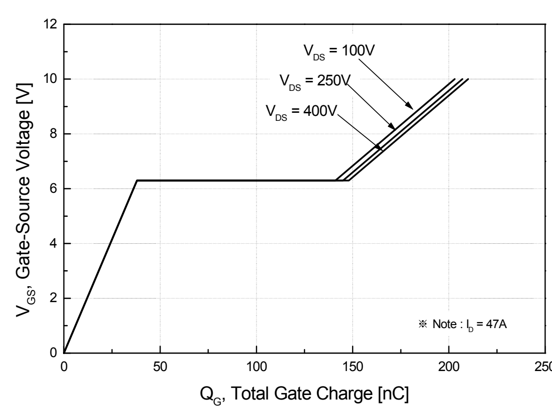


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

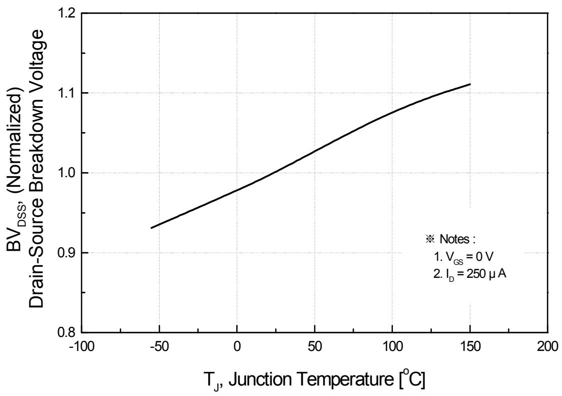


Figure 8. On-Resistance Variation vs. Temperature

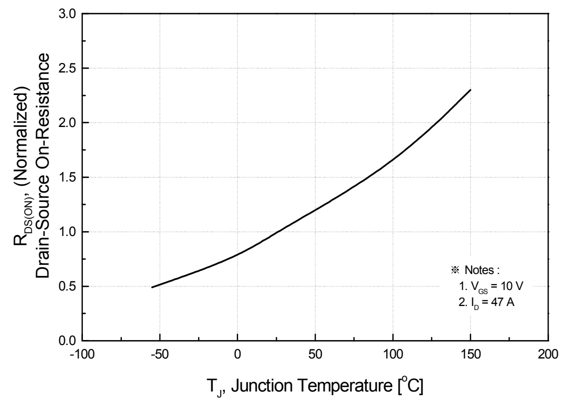


Figure 9. Safe Operating Area

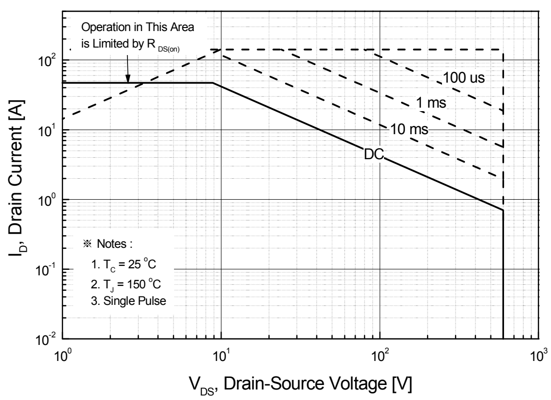


Figure 10. Maximum Drain Current vs. Case Temperature

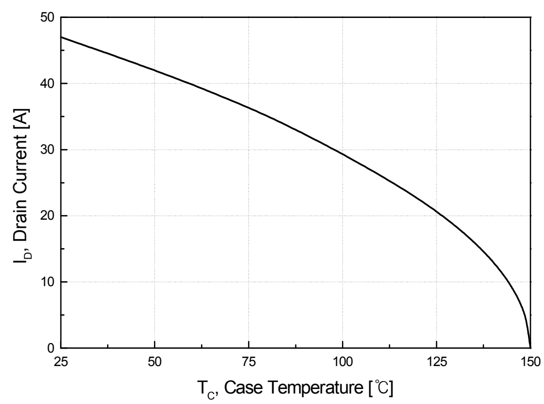


Figure 11. Transient Thermal Response Curve

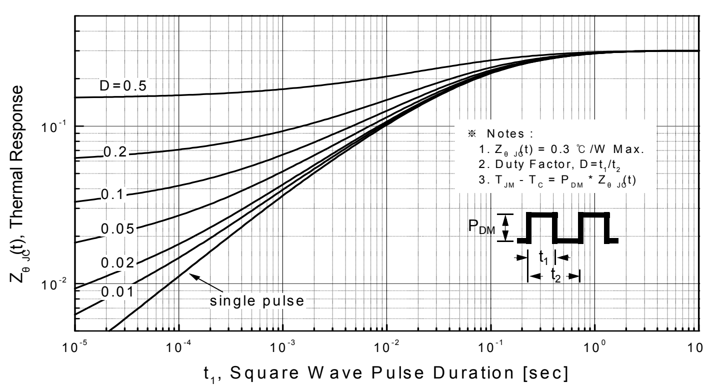


Figure 12. Gate Charge Test Circuit & Waveform

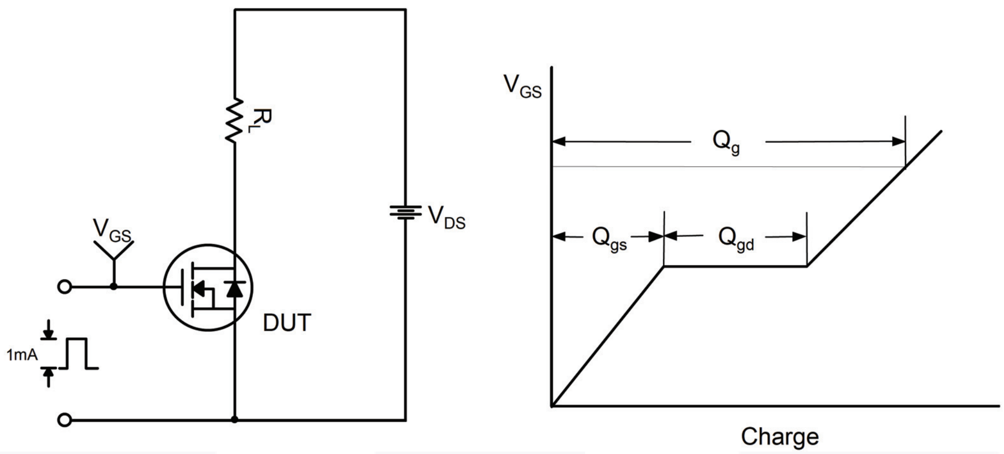


Figure 13. Resistive Switching Test Circuit & Waveforms

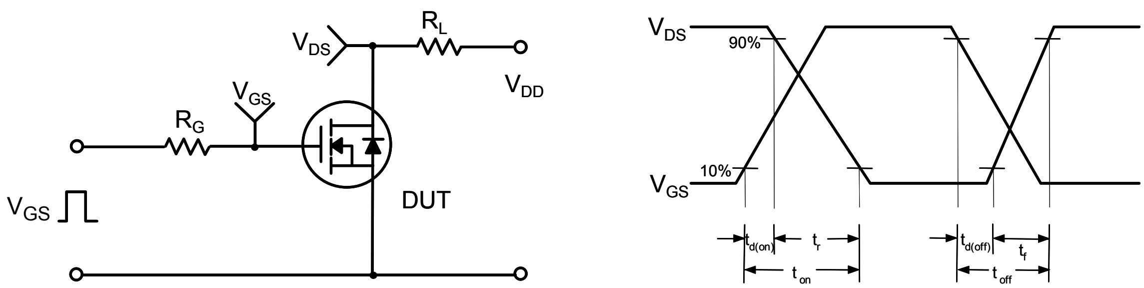


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

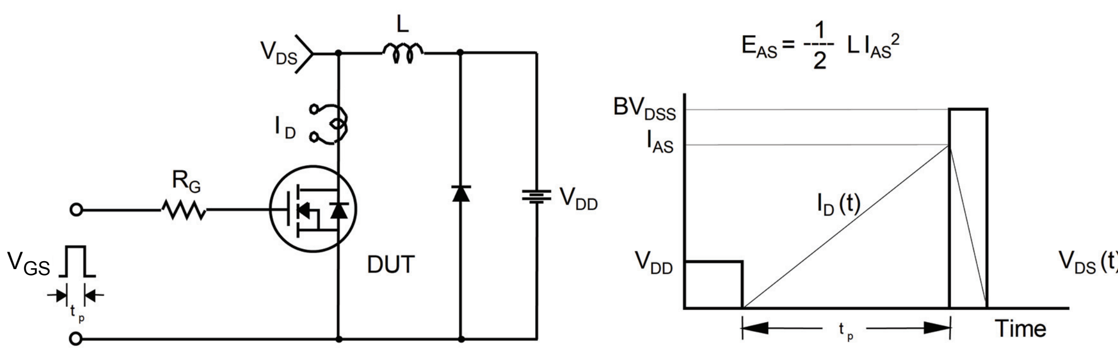
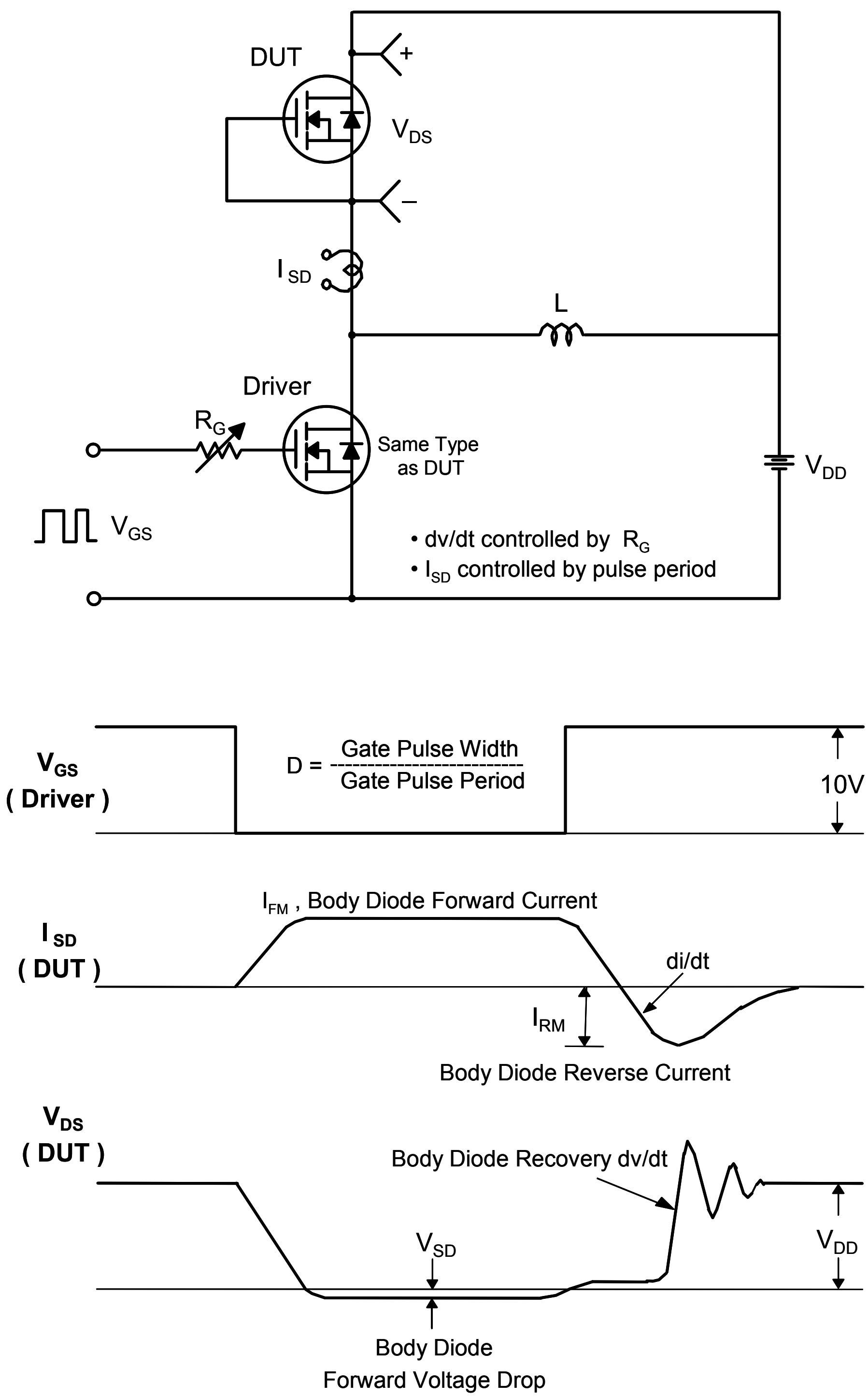


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

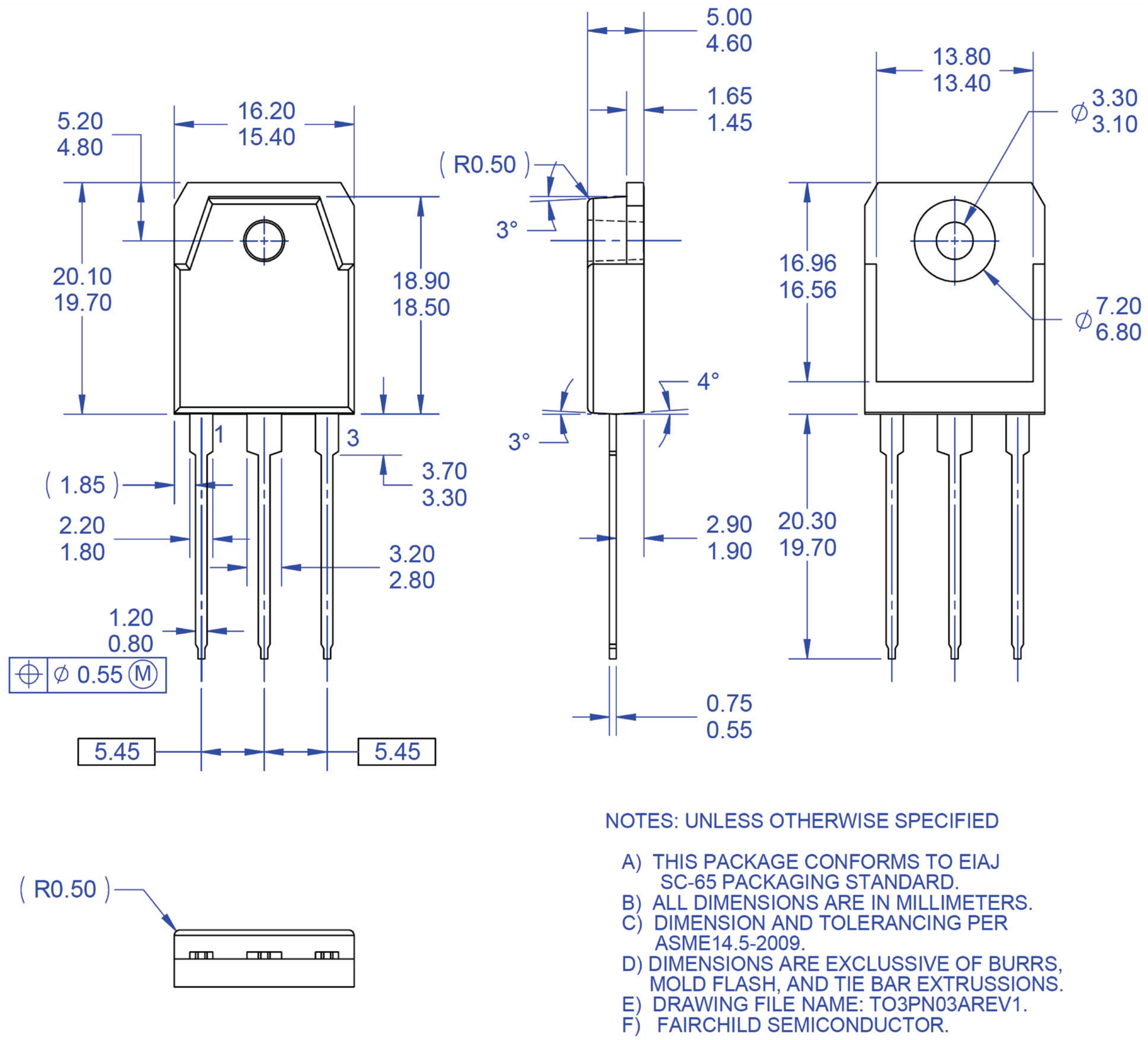


Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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Rev. I68