April 2014

FDA59N25

N-Channel UniFET™ MOSFET

250 V, 59 A, 49 mΩ

Features

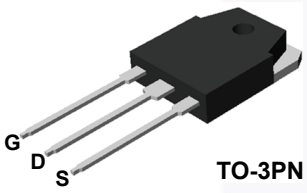
- $R_{DS(on)}$ = 49 mΩ (Max.) @ V_{GS} = 10 V, I_D = 29.5 A
- Low Gate Charge (Typ. 63 nC)
- Low C_{rss} (Typ. 70 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

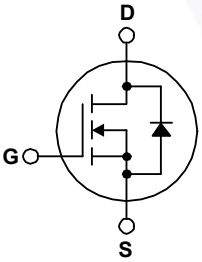
- PDP TV
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



TO-3PN



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

Symbol	Parameter			FDA59N25	Unit
V_{DSS}	Drain to Source Voltage			250	V
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage		(Note 1,2)	300	V
V_{GSS}	Gate to Source Voltage			±30	V
I_D	Drain Current	- Continuous (T_C = 25°C)		59	A
		- Continuous (T_C = 100°C)		35	
I_{DM}	Drain Current	- Pulsed	(Note 1)	236	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	1458	mJ
I_{AR}	Avalanche Current		(Note 1)	59	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	39.2	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)		392	W
		- Derate Above 25°C		3.2	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	FDA59N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.32	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA59N25	FDA59N25	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	250	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.25	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V V_{DS} = 200 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						
$V_{GS(th)}$	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 = 29.5 A	--	0.041	0.049	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 29.5 A	--	45	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	--	3090	4020	pF
C_{oss}	Output Capacitance		--	630	820	pF
C_{rss}	Reverse Transfer Capacitance		--	70	110	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 125 V, I_D = 59 A V_{GS} = 10 V, R_G = 25 Ω	--	70	150	ns
t_r	Turn-On Rise Time		--	480	970	ns
$t_{d(off)}$	Turn-Off Delay Time		--	90	190	ns
t_f	Turn-Off Fall Time	(Note 4)	--	170	350	ns
Q_g	Total Gate Charge	V_{DS} = 200 V, I_D = 59 A V_{GS} = 10 V	--	63	82	nC
Q_{gs}	Gate-Source Charge		--	18.5	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	30	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	59	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	236	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 59 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 59 A, dI_F/dt =100 A/μs	--	190	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.4	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 0.67 mH, I_{AS} = 59 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 59 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

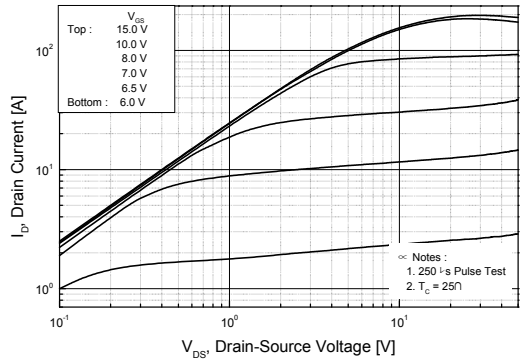


Figure 2. Transfer Characteristics

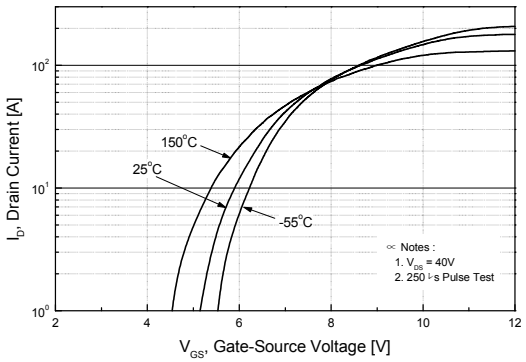


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

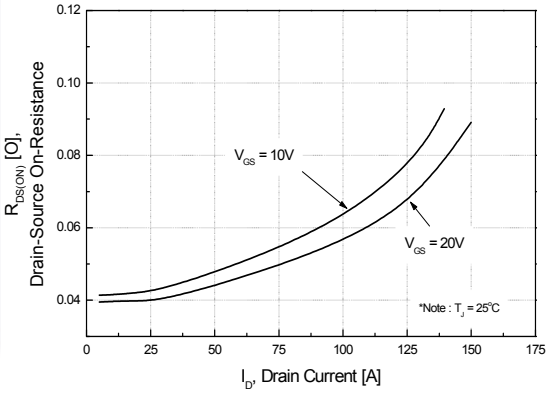


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

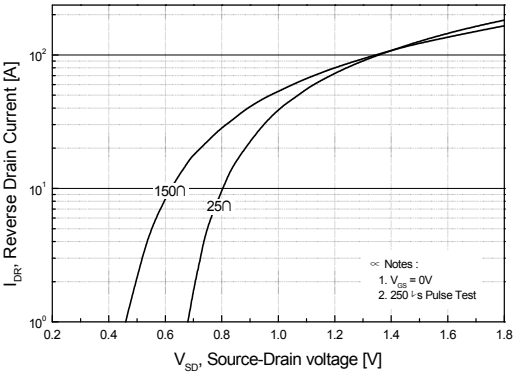


Figure 5. Capacitance Characteristics

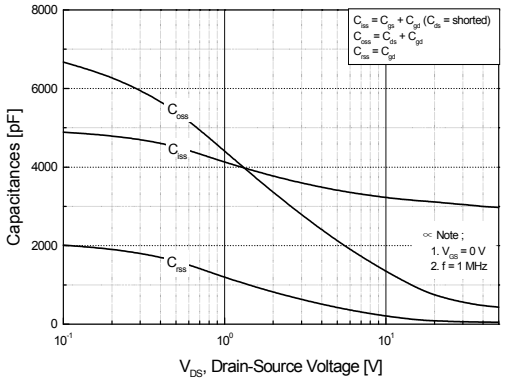
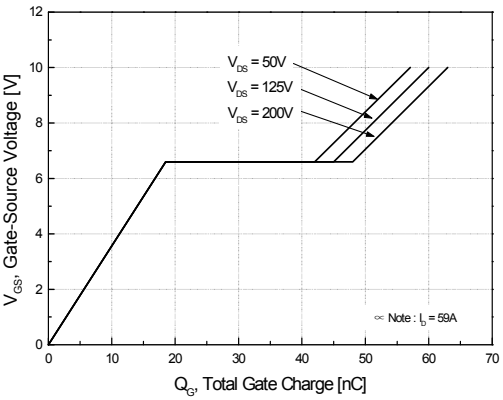


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

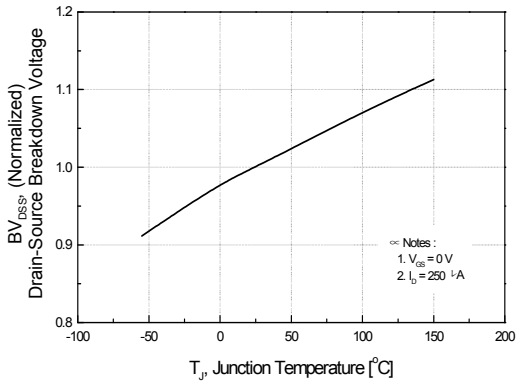


Figure 8. On-Resistance Variation vs. Temperature

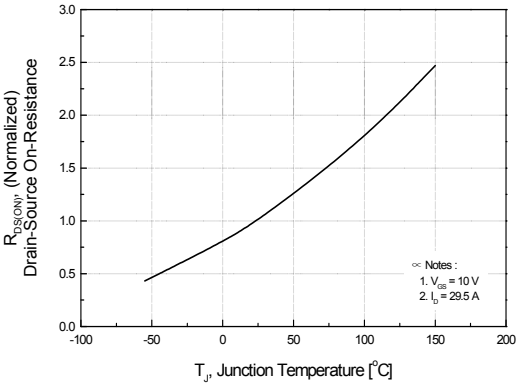


Figure 9. Maximum Safe Operating Area

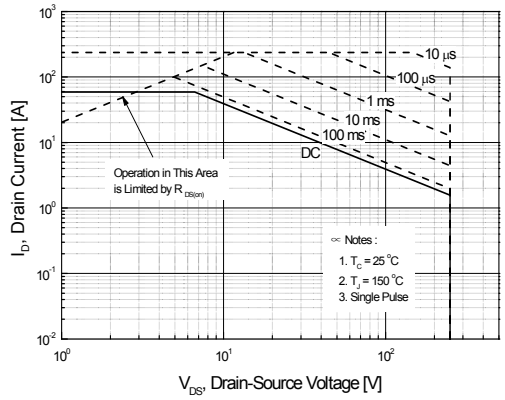


Figure 10. Maximum Drain Current vs. Case Temperature

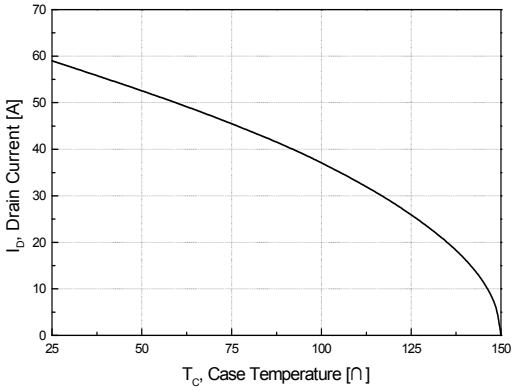
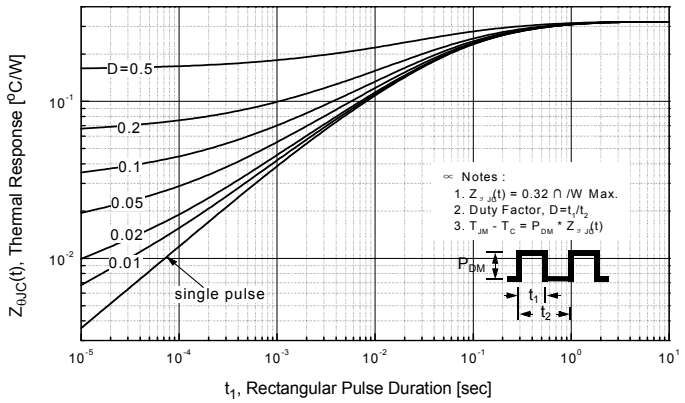


Figure 11. Transient Thermal Response Curve



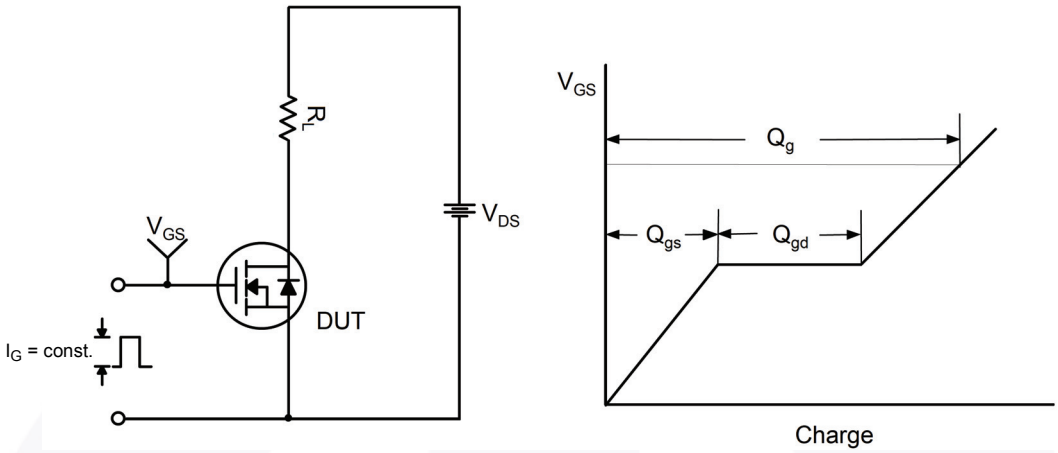


Figure 12. Gate Charge Test Circuit & Waveform

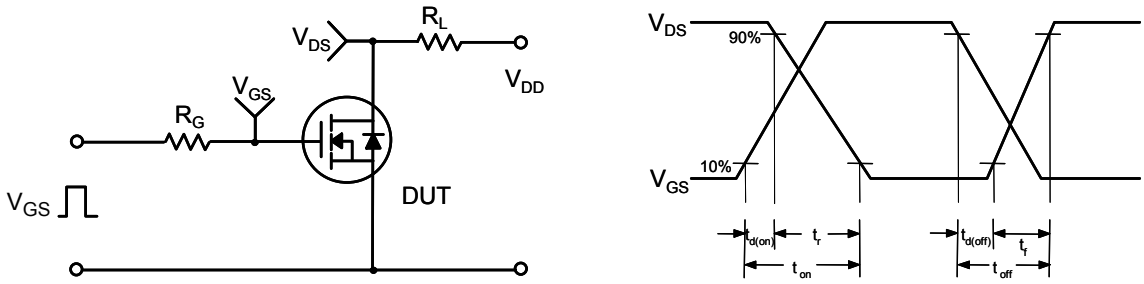


Figure 13. Resistive Switching Test Circuit & Waveforms

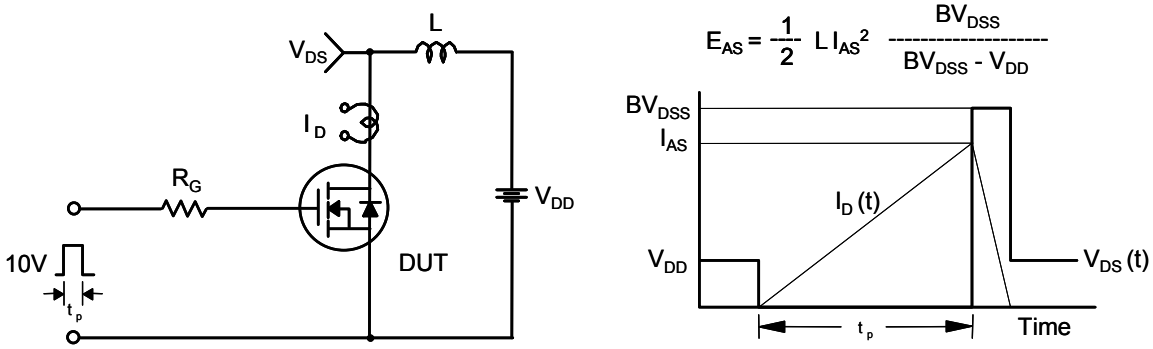


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

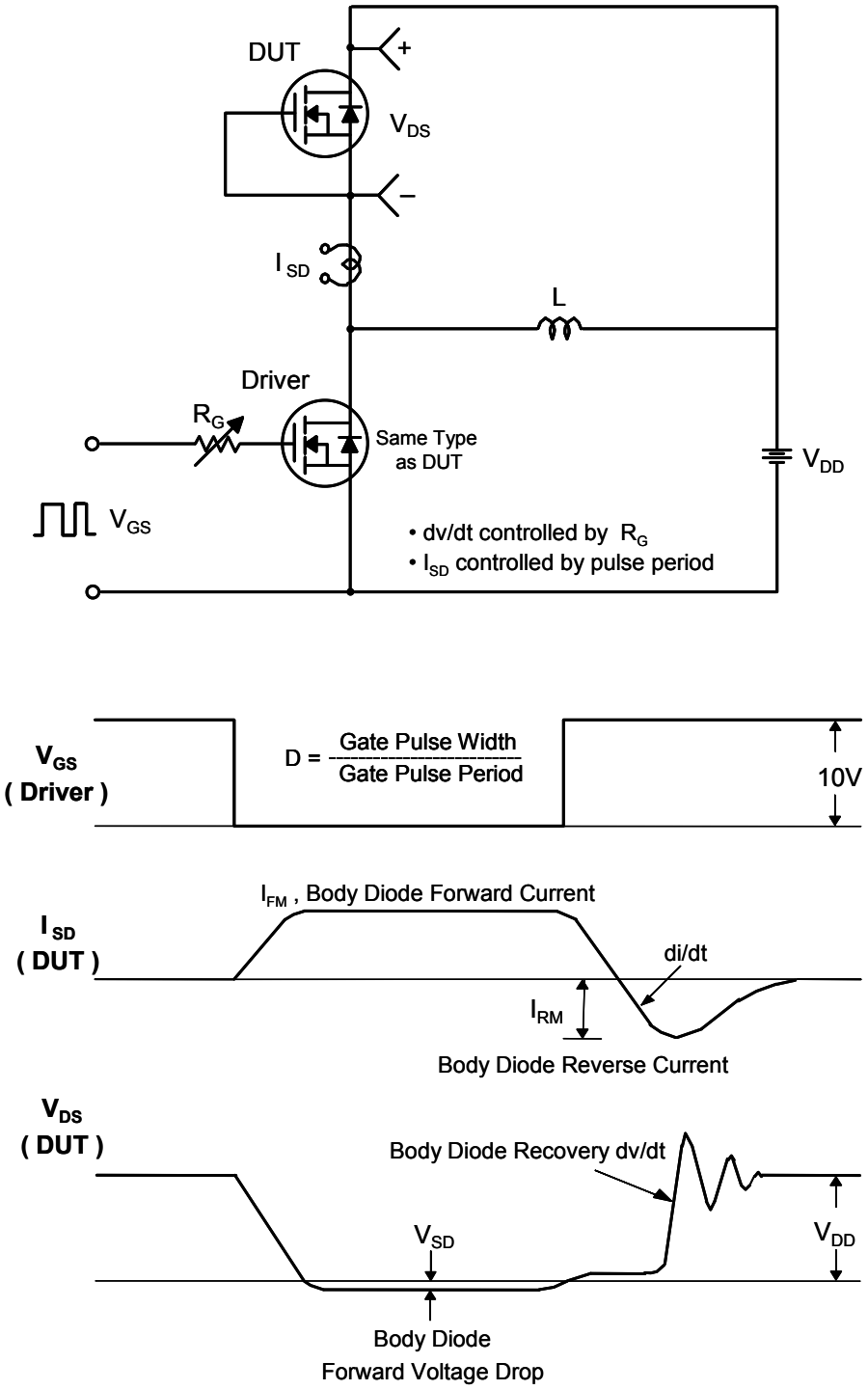


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

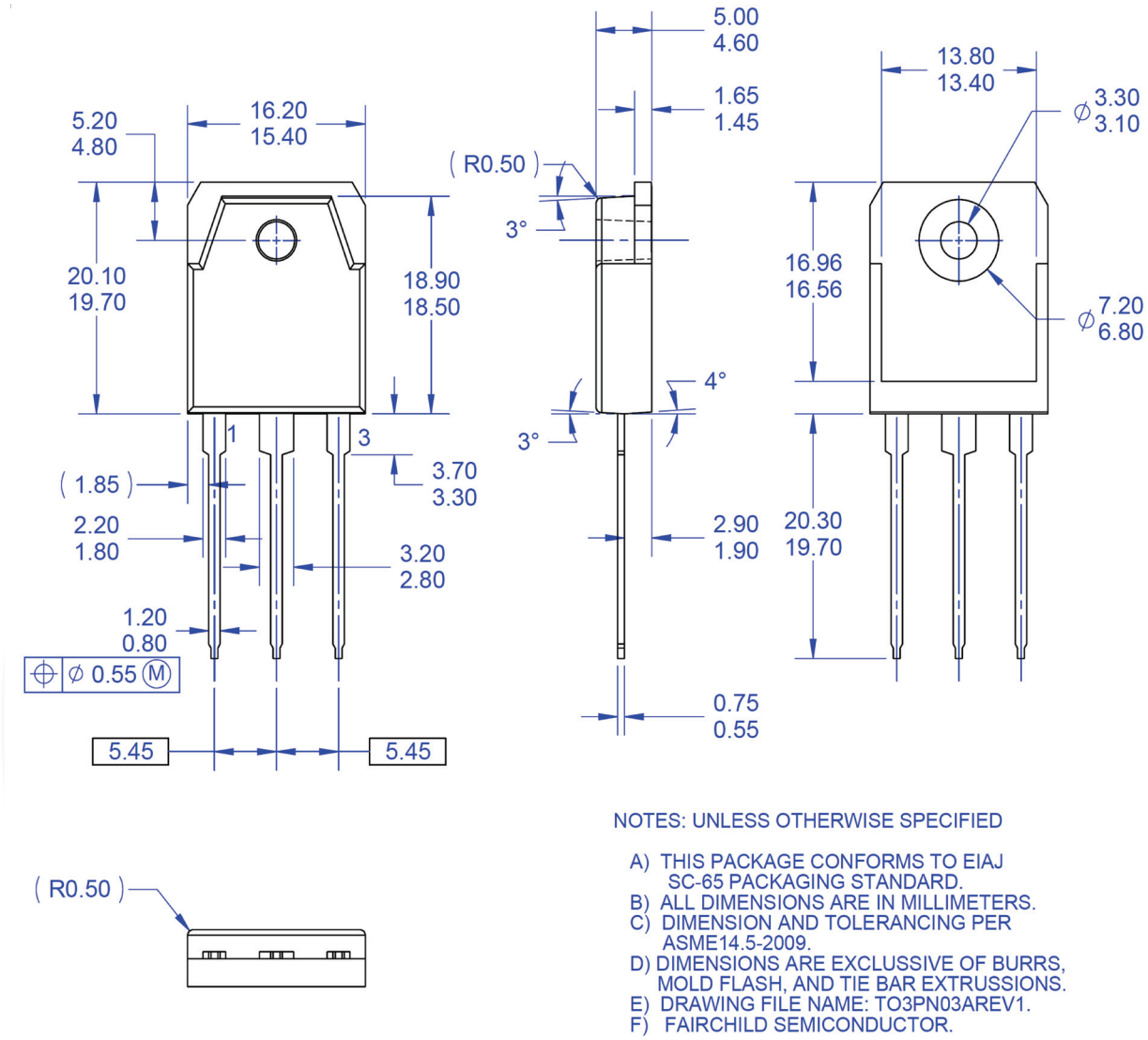


Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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