FAIRCHILD SEMICONDUCTOR®

March 2013

FCA20N60F

N-Channel SuperFET® FRFET® MOSFET

600 V, 47 A, 70 mΩ

Features

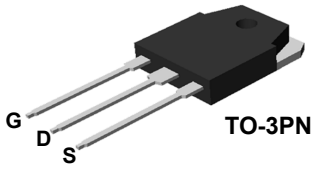
- 650 V @ T_J = 150°C
- Typ.$R_{DS(on)}$ = 150 mΩ
- Fast Recovery Type (Typ. T_{rr} = 160 ns)
- Ultra Low Gate Charge (Typ. Q_g = 75 nC)
- Low Effective Output Capacitance (Typ. C_{oss}.eff = 165 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

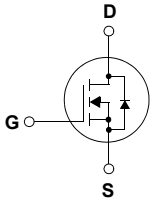
- LCD / LED / PDP TV
- Solar Inverter
- AC-DC Power Supply

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. SuperFET FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



TO-3PN



Absolute Maximum Ratings

Symbol	Parameter		FCA20N60F	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	20 12.5	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	60	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	690	mJ
I_{AR}	Avalanche Current	(Note 1)	20	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	20.8	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	208 1.67	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	FCA20N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.6	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	°C/W

* When mounted on the minimum pad size recommended (PCB Mount)

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Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCA20N60F	FCA20N60F	TO-3PN	--	--	30

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150°C	--	650	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DSS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0V, I_D = 20A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V V_{DS} = 480V, T_C = 125°C	-- --	-- --	10 100	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 10A	--	0.15	0.19	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 10A (Note 4)	--	17	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	2370	3080	pF
C_{oss}	Output Capacitance		--	1280	1665	pF
C_{rss}	Reverse Transfer Capacitance		--	95	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480V, V_{GS} = 0V, f = 1.0MHz	--	65	85	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 400V, V_{GS} = 0V	--	165	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300V, I_D = 20A, R_G = 25Ω	--	62	135	ns
t_r	Turn-On Rise Time		--	140	290	ns
$t_{d(off)}$	Turn-Off Delay Time		--	230	470	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	65	140	ns
Q_g	Total Gate Charge	V_{DS} = 480V, I_D = 20A, V_{GS} = 10V	--	75	98	nC
Q_{gs}	Gate-Source Charge		--	13.5	18	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	36	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 20A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 20A, dI_F/dt =100A/μs (Note 4)	--	160	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 10A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 20A, di/dt ≤ 1200A/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 Typical Characteristics

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

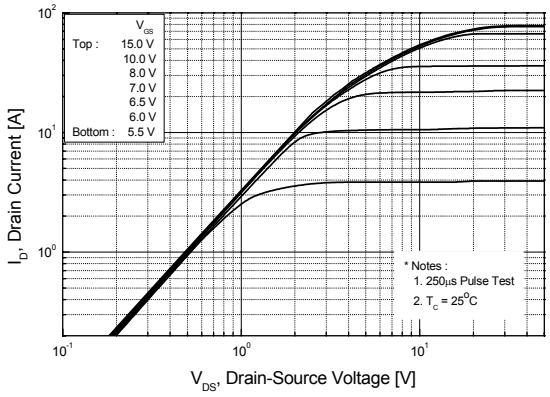


Figure 2. Transfer Characteristics

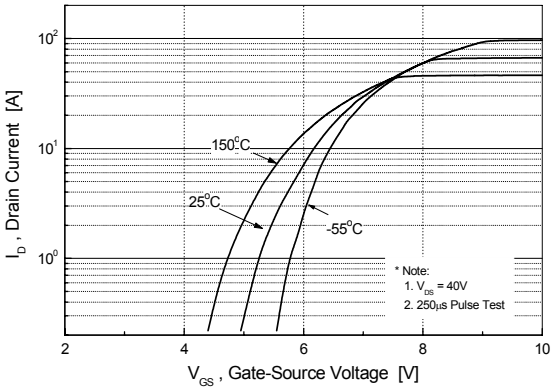


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

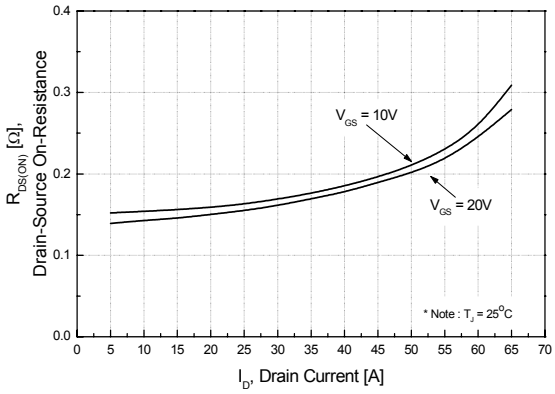


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

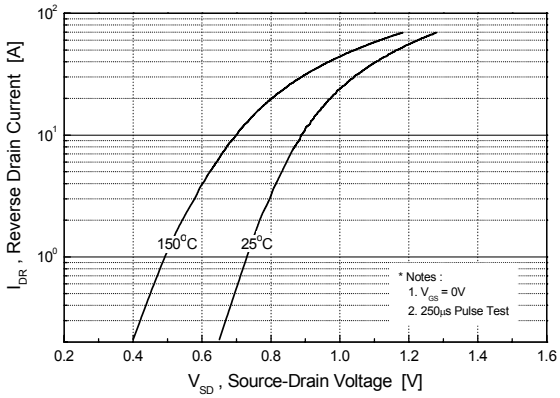


Figure 5. Capacitance Characteristics

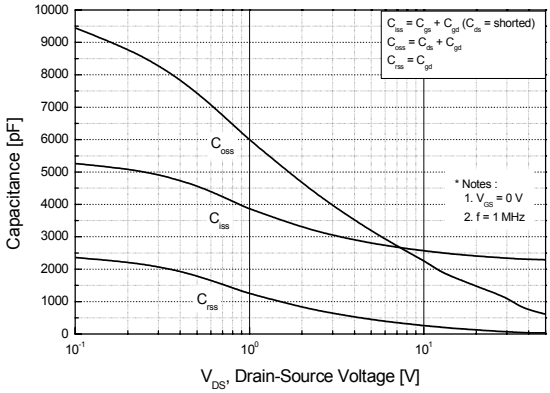
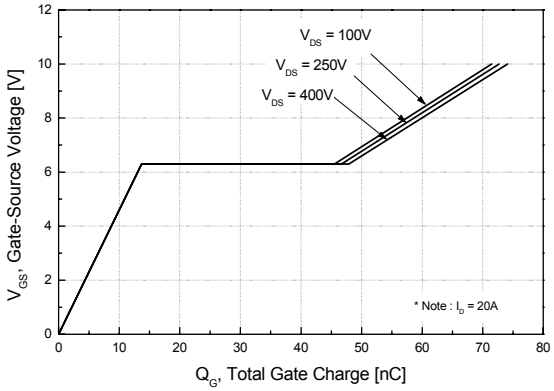


Figure 6. Gate Charge Characteristics



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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

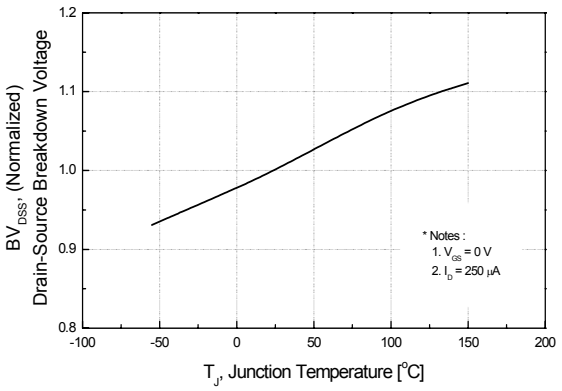


Figure 8. On-Resistance Variation vs. Temperature

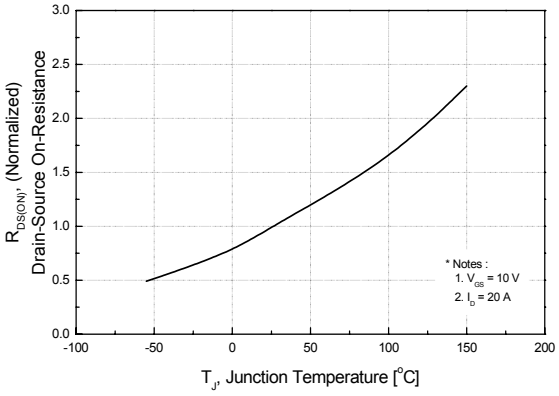


Figure 9-1. Maximum Safe Operating Area

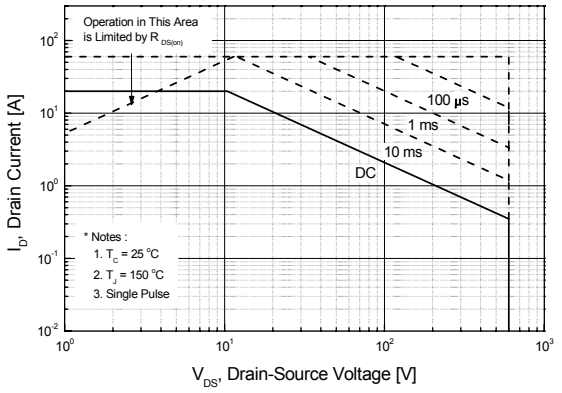


Figure 10. Maximum Drain Current vs. Case Temperature

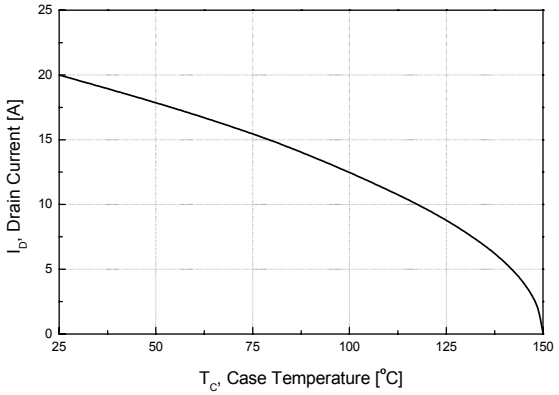
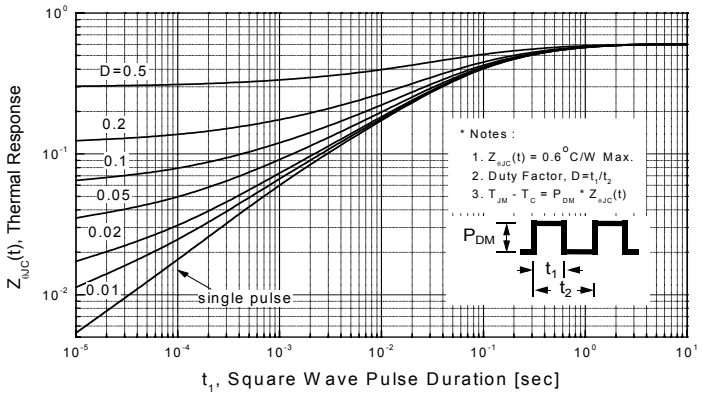


Figure 11. Transient Thermal Response Curve



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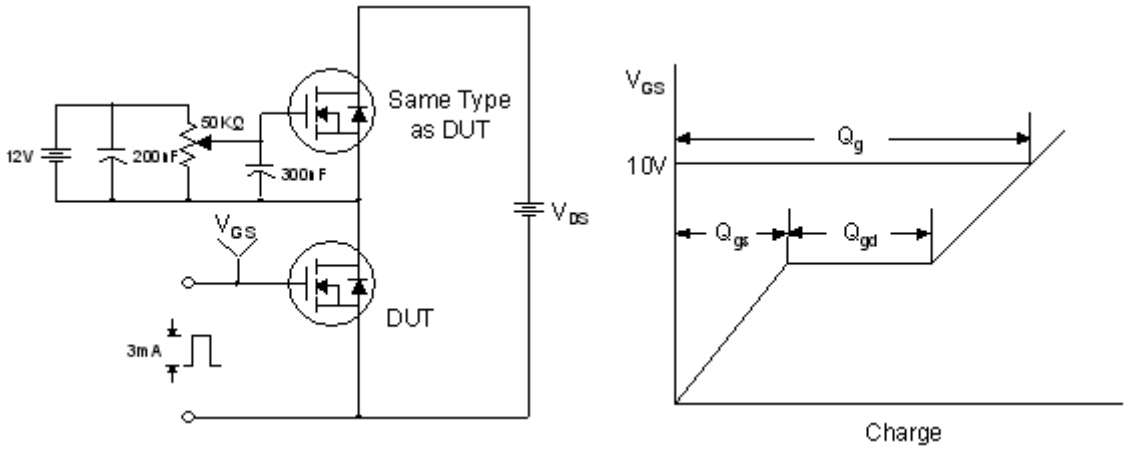
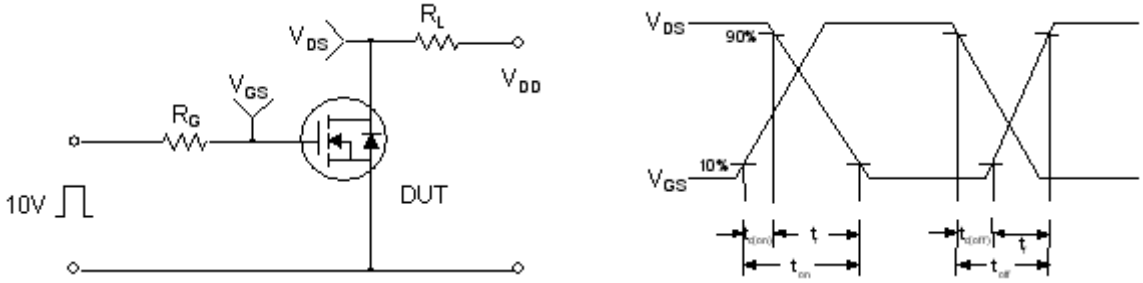
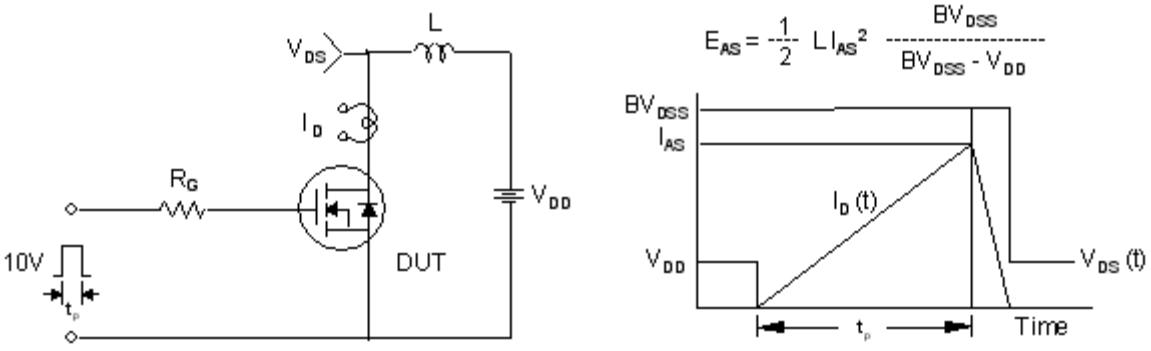
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



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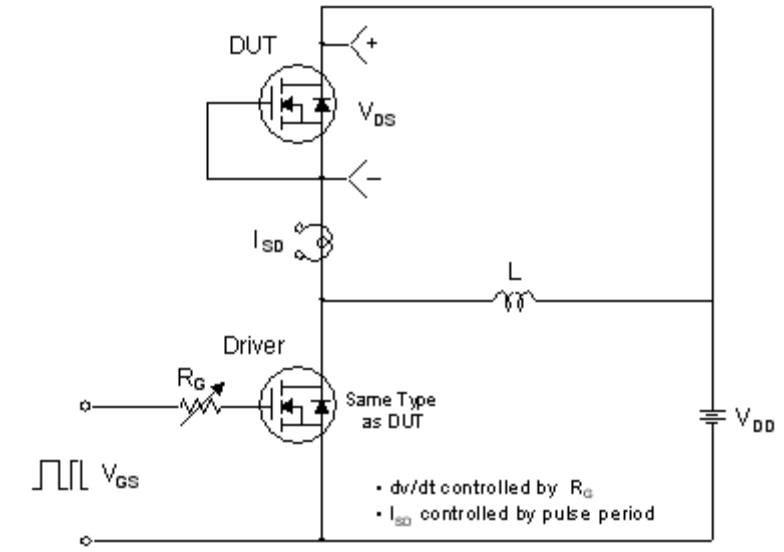
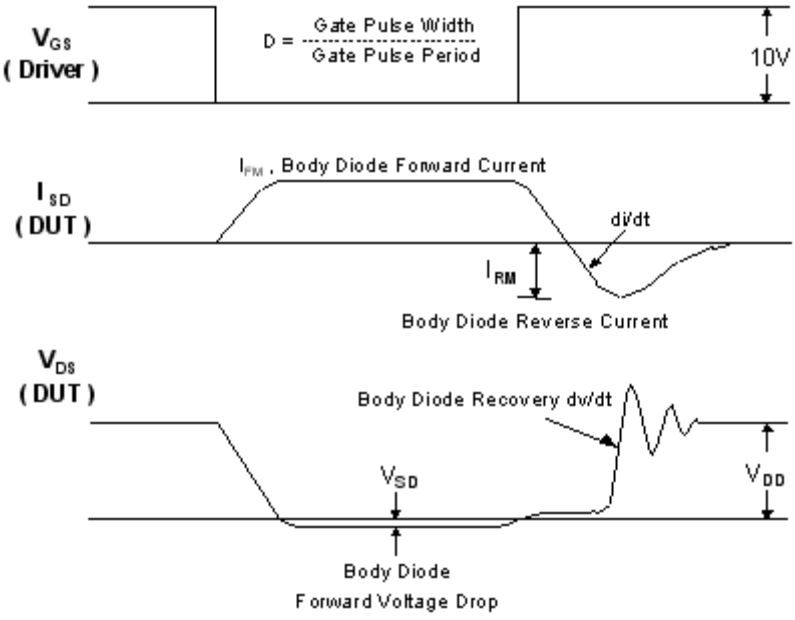
Peak Diode Recovery dv/dt Test Circuit & Waveforms





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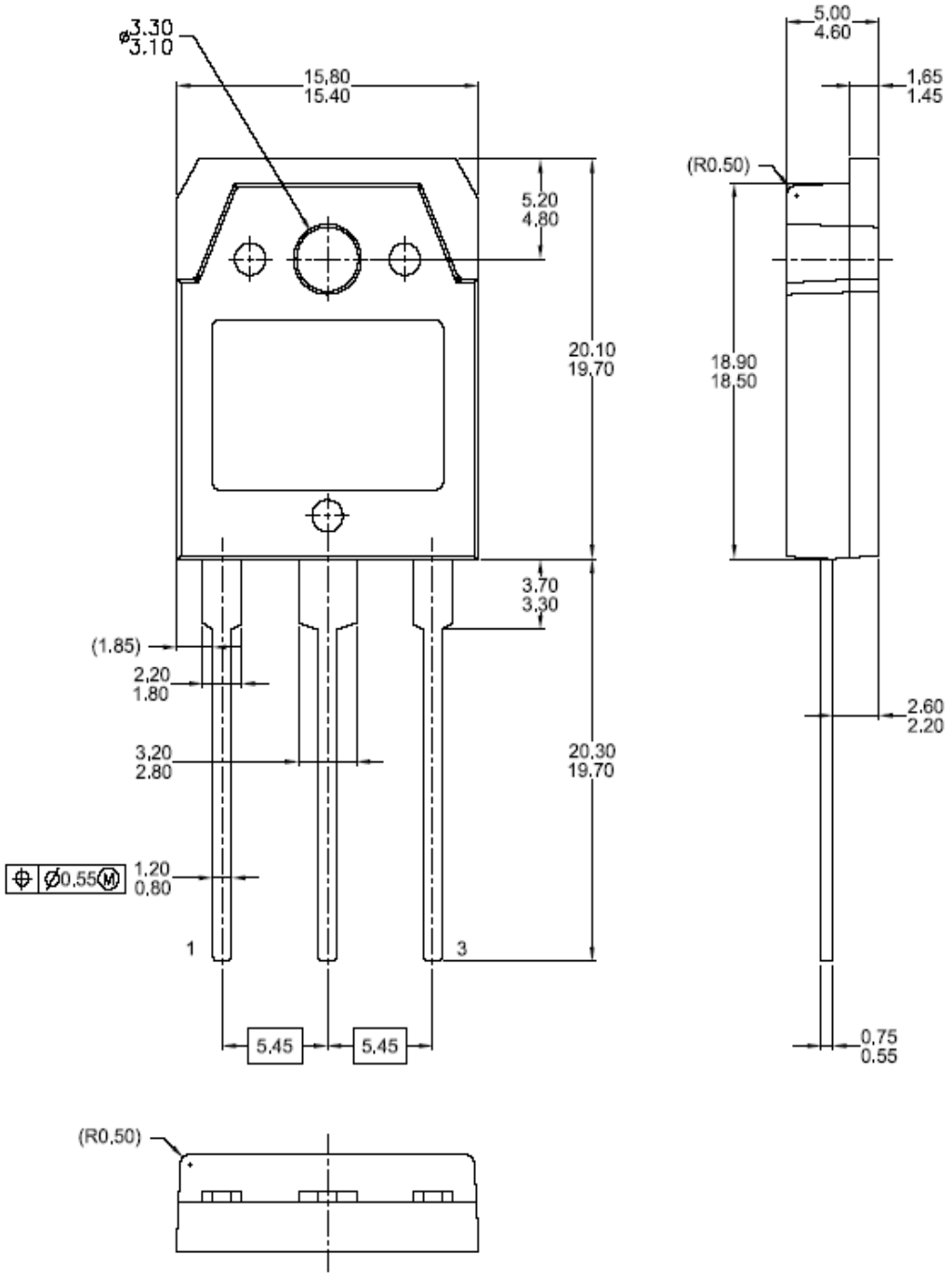
Mechanical Dimensions

TO-3PN



Dimensions in Millimeters

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