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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD

SEMICONDUCTOR®

January 2007

UniFET ™

FDA15N65

650V N-Channel MOSFET

Features

- 16A, 650V, $R_{DS(on)}$ = 0.44Ω @V_{GS} = 10 V
- Low gate charge (typical 48.5 nC)
- Low C_{rss} (typical 23.6 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.

TO-3PN
FDA Series

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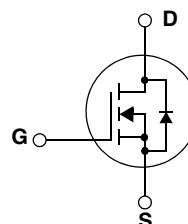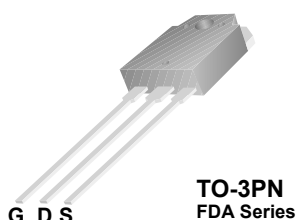
Absolute Maximum Ratings

Symbol	Parameter			FDA15N65	Unit
V_{DSS}	Drain-Source Voltage			650	V
I_D	Drain Current	- Continuous (T_C = 25°C)		16	A
		- Continuous (T_C = 100°C)		9.6	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	64	A
V_{GSS}	Gate-Source voltage			$\pm$ 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	637	mJ
I_{AR}	Avalanche Current		(Note 1)	16	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	26	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)		260	W
		- Derate above 25°C		2.1	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	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.48	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA15N65	FDA15N65	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		650	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250µA, Referenced to 25°C		--	0.65	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650V, V_{GS} = 0V V_{DS} = 520V, T_C = 125°C		-- --	-- --	1 10	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 = 8A		--	0.36	0.44	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 8A	(Note 4)	--	19.2	--	S
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz		--	2380	3095	pF
C_{oss}	Output Capacitance			--	295	385	pF
C_{rss}	Reverse Transfer Capacitance			--	23.6	35.5	pF
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 325V, I_D = 15A, R_G = 21.7Ω		--	65	140	ns
t_r	Turn-On Rise Time			--	125	260	ns
$t_{d(off)}$	Turn-Off Delay Time			--	105	220	ns
t_f	Turn-Off Fall Time		(Note 4, 5)	--	65	140	ns
Q_g	Total Gate Charge	V_{DS} = 520V, I_D = 15A, V_{GS} = 10V		--	48.5	63.0	nC
Q_{gs}	Gate-Source Charge			--	14.0	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4, 5)	--	21.2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings							
I_S	Maximum Continuous Drain-Source Diode Forward Current			--	--	16	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current			--	--	64	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 16A		--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 15A, dI_F/dt =100A/µs		--	496	--	ns
Q_{rr}	Reverse Recovery Charge		(Note 4)	--	5.69	--	µC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 4.6mH, I_{AS} = 16A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 16A, di/dt ≤ 200A/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

Typical Performance Characteristics
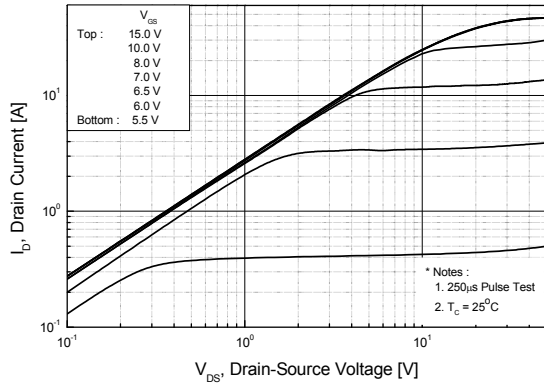
Figure 1. On-Region Characteristics

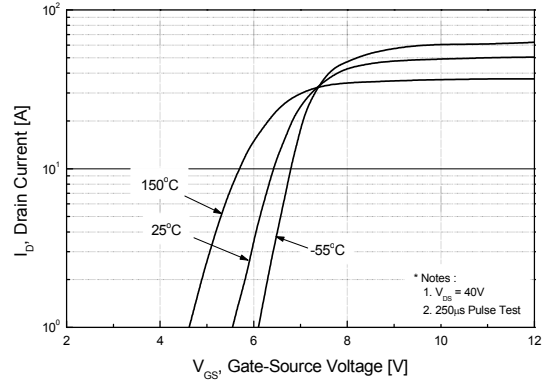### Figure 2. Transfer Characteristics

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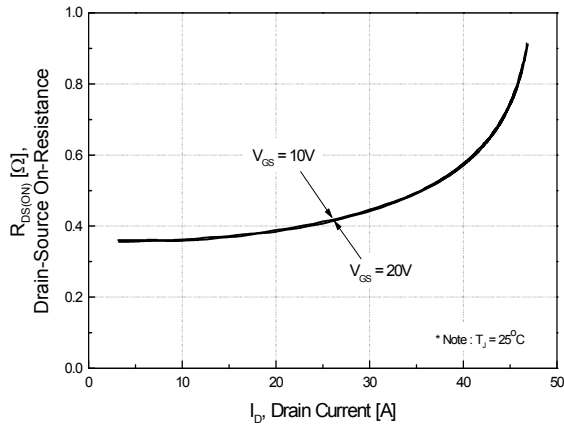

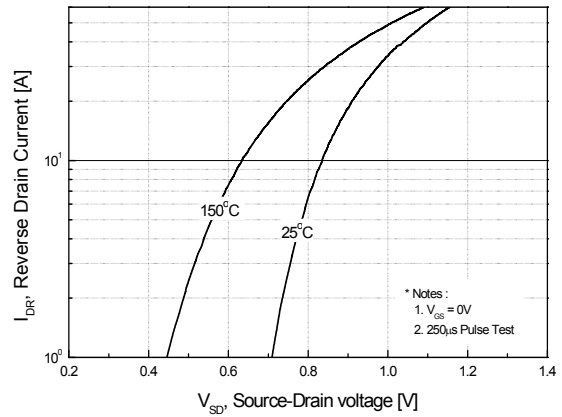### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue
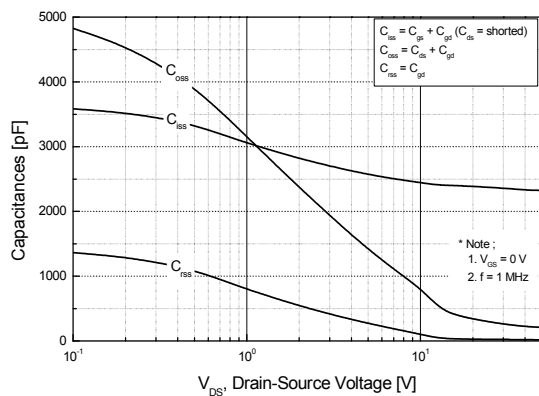

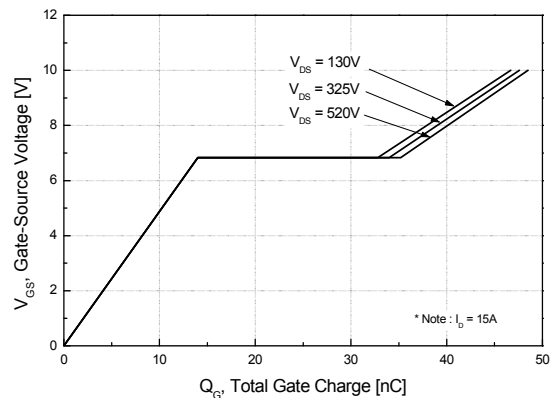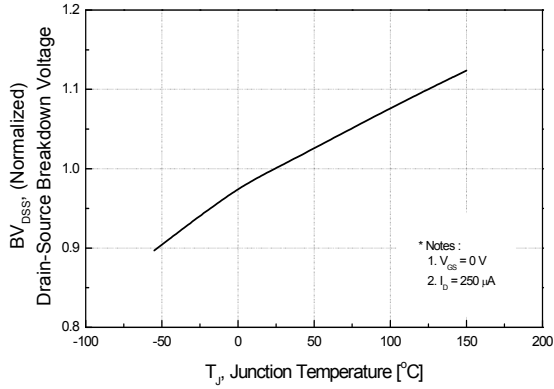### Figure 5. Capacitance Characteristics
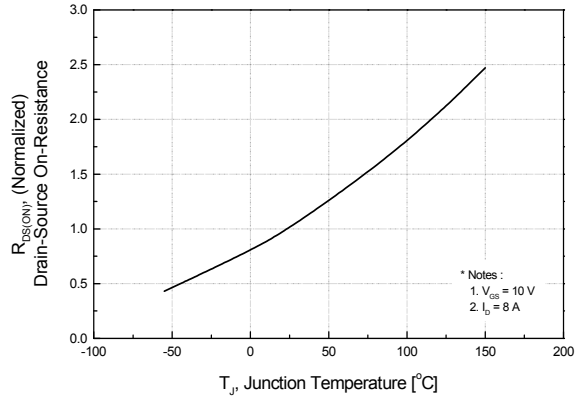

Figure 6. Gate Charge Characteristics
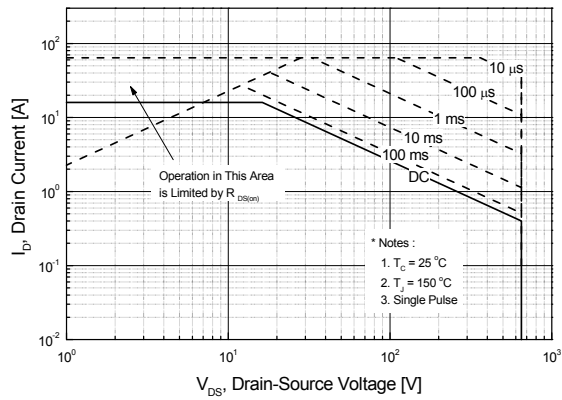
Typical Performance Characteristics (Continued)
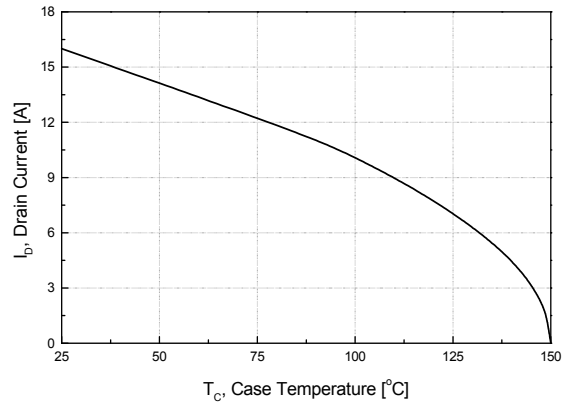
Figure 7. Breakdown Voltage Variation vs. Temperature

Figure 8. On-Resistance Variation vs. Temperature

Figure 9. Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

Figure 11. Transient Thermal Response Curve
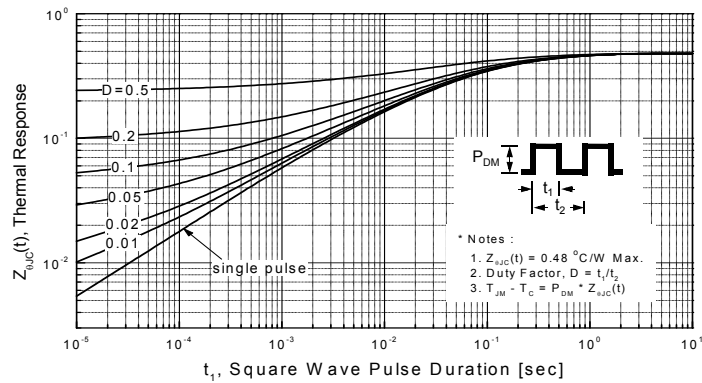
Gate Charge Test Circuit & Waveform
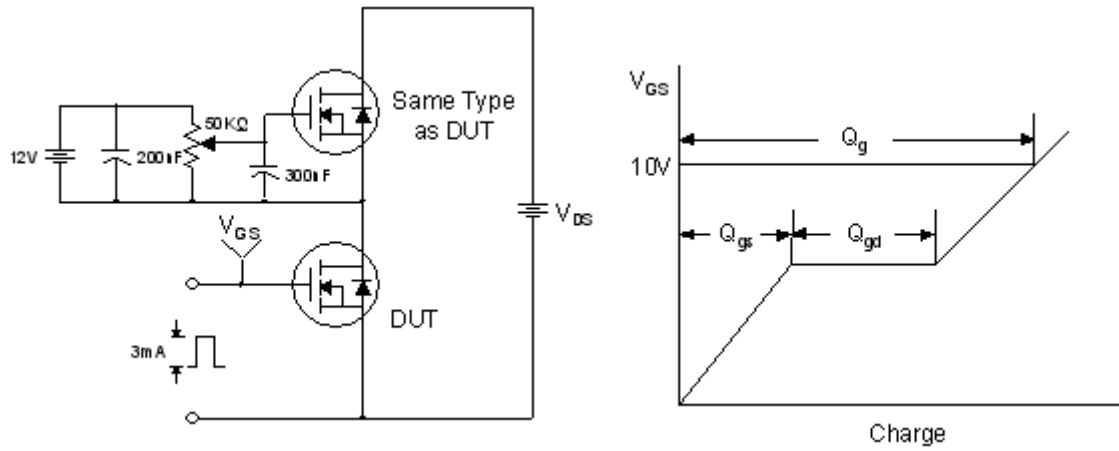
Resistive Switching Test Circuit & Waveforms
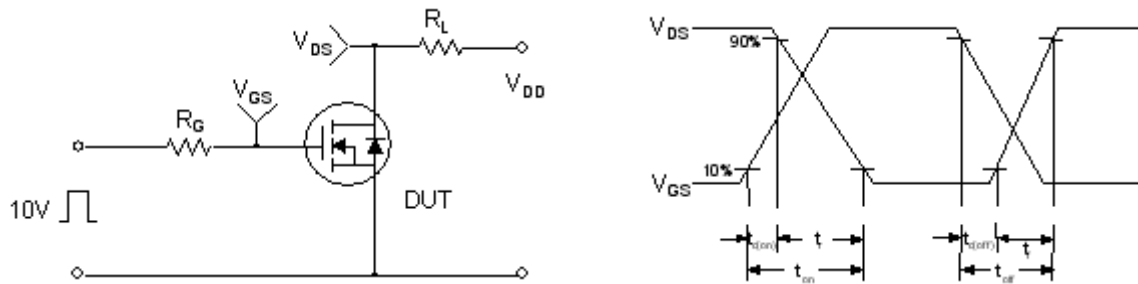
Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \ \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
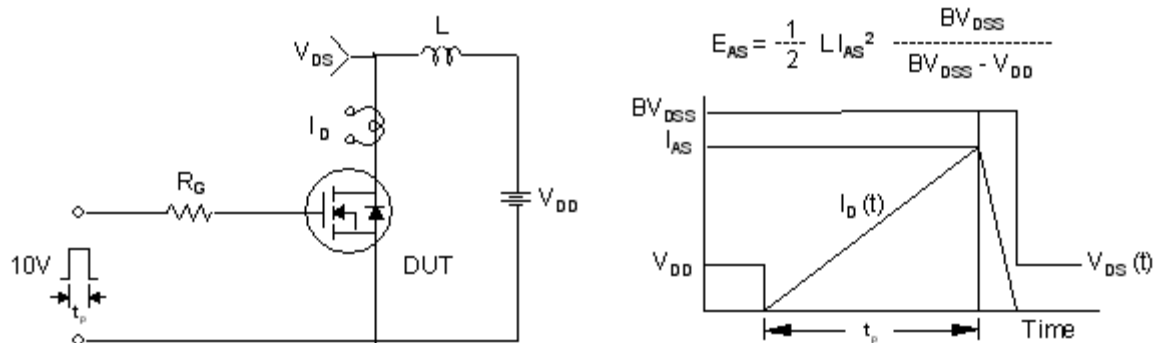
Peak Diode Recovery dv/dt Test Circuit & Waveforms

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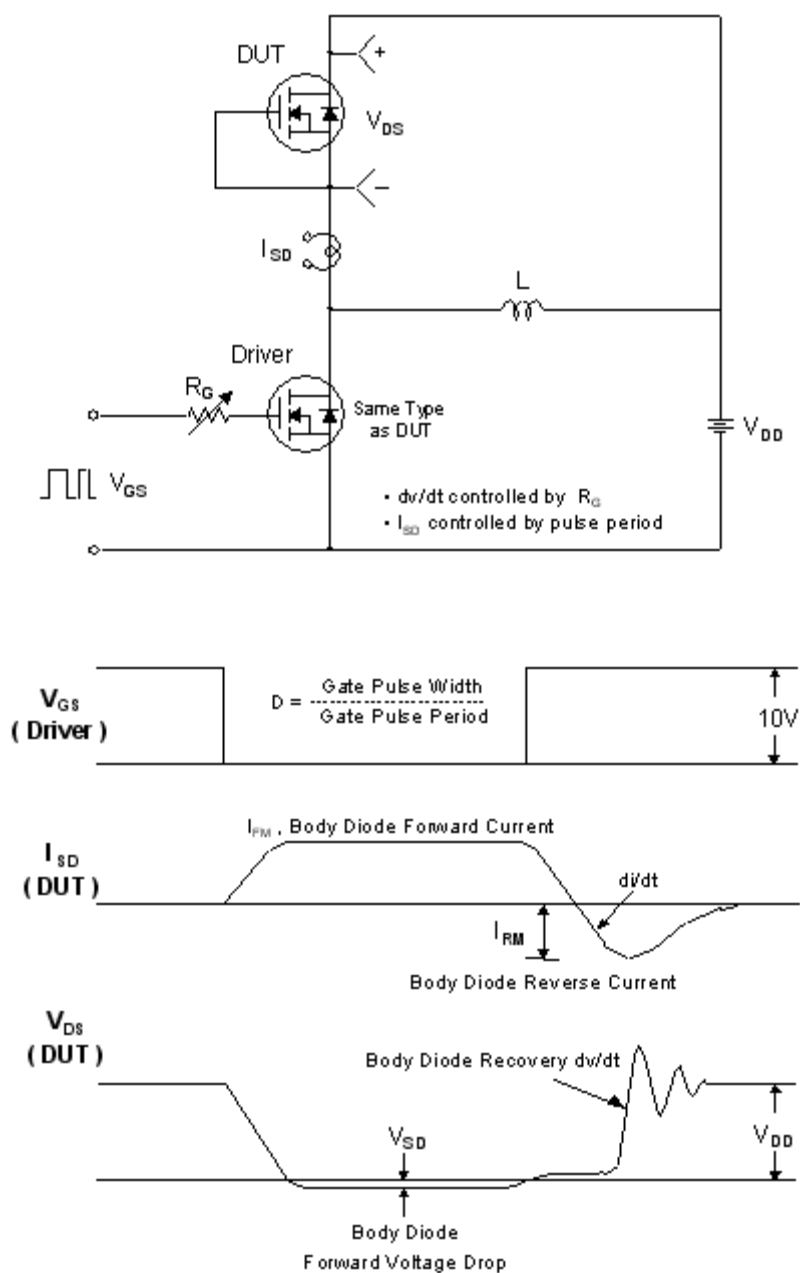
Mechanical Dimensions

TO-3PN
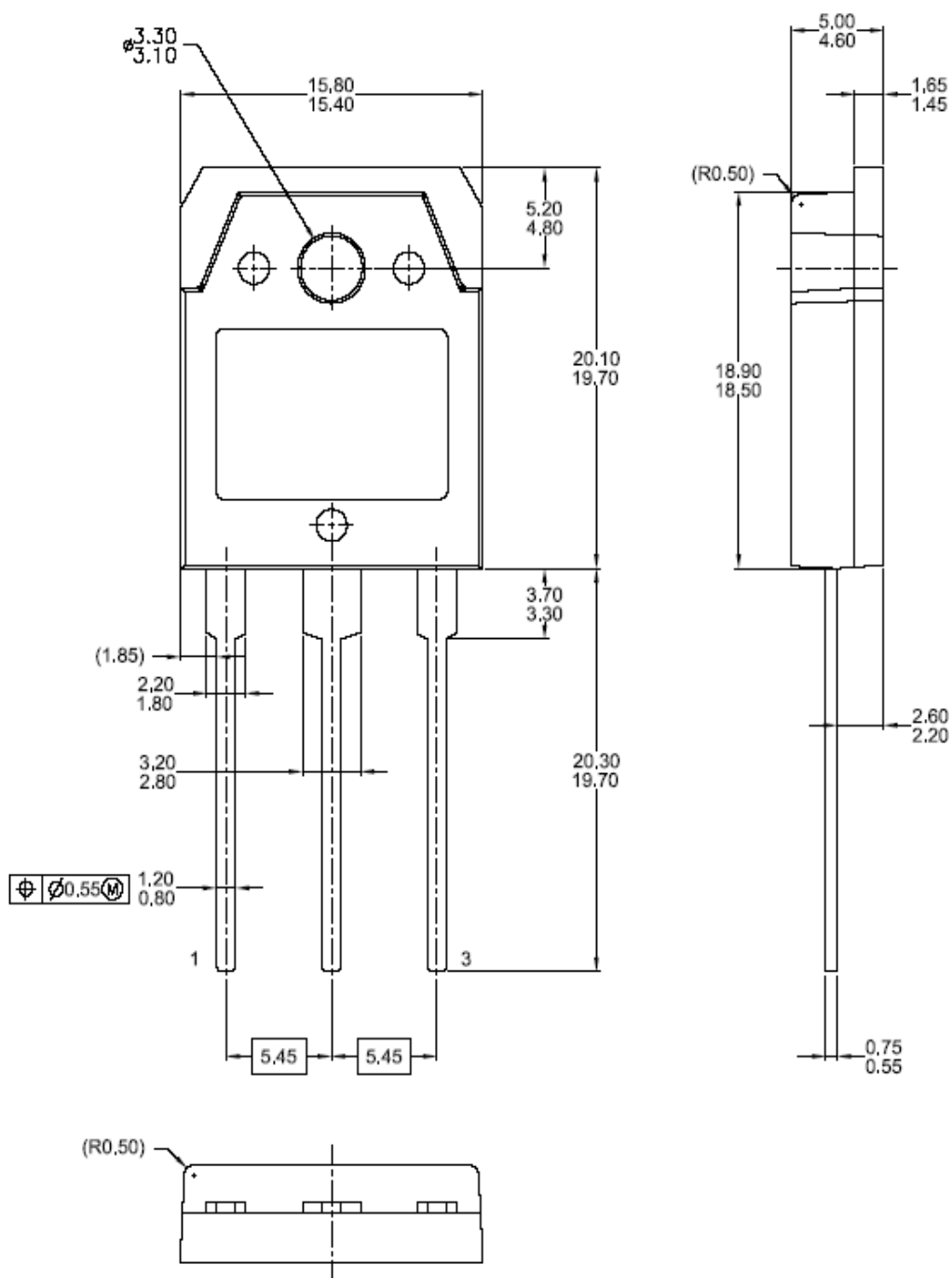
Dimensions in Millimeters

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Definition of Terms

Datasheet Identification	Product Status	Definition
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Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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