

# FCA22N60N

## N-Channel MOSFET

600V, 22A, 0.165Ω

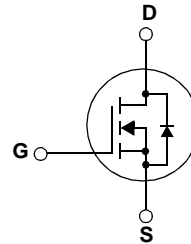
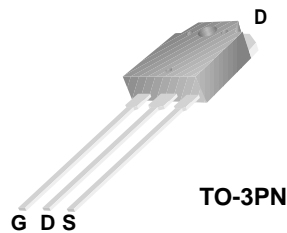
### Features

- $R_{DS(on)} = 0.140\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 11A$
- $BV_{DSS} > 650V$  @  $T_J = 150^\circ C$
- Ultra Low Gate Charge (Typ.  $Q_g = 45nC$ )
- Low Effective Output Capacitance
- 100% Avalanche Tested
- RoHS Compliant



### Description

The SupreMOS MOSFET, Fairchild's next generation of high voltage super-junction MOSFETs, employs a deep trench filling process that differentiates it from preceding multi-epi based technologies. By utilizing this advanced technology and precise process control, SupreMOS provides world class Rsp, superior switching performance and ruggedness. This SupreMOS MOSFET fits the industry's AC-DC SMPS requirements for PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



### MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted\*

Symbol	Parameter	FCA22N60N	Units
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	±30	V
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ C$ )	22
		Continuous ( $T_C = 100^\circ C$ )	13.8
$I_{DM}$	Drain Current	Pulsed (Note 1)	66
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	672
$I_{AR}$	Avalanche Current		7.3
$E_{AR}$	Repetitive Avalanche Energy		2.75
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20
	MOSFET dv/dt		100
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	205
		Derate above $25^\circ C$	1.64
$T_J, T_{STG}$	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

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FCA22N60N	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.61	°C/W
$R_{\theta JS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

**Package Marking and Ordering Information**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCA22N60N	FCA22N60N	TO-3PN	-	-	30

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_J = 150^\circ\text{C}$	650	-	-	
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{mA}$ , Referenced to $25^\circ\text{C}$	-	0.68	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480\text{V}, T_J = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 50\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	3	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 11\text{A}$	-	0.140	0.165	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 11\text{A}$	-	22	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1950	-	pF
$C_{oss}$	Output Capacitance		-	75.9	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	3	-	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	43.2	-	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	196.4	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 11\text{A},$ $V_{GS} = 10\text{V}$ (Note 4)	-	45	-	nC
$Q_{gs}$	Gate to Source Gate Charge		-	8.7	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	14.5	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open, $f = 1\text{MHz}$	-	1	-	$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 11\text{A}$ $R_G = 4.7\Omega$ (Note 4)	-	16.9	-	ns
$t_r$	Turn-On Rise Time		-	16.7	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	49	-	ns
$t_f$	Turn-Off Fall Time		-	4	-	ns

**Drain-Source Diode Characteristics**

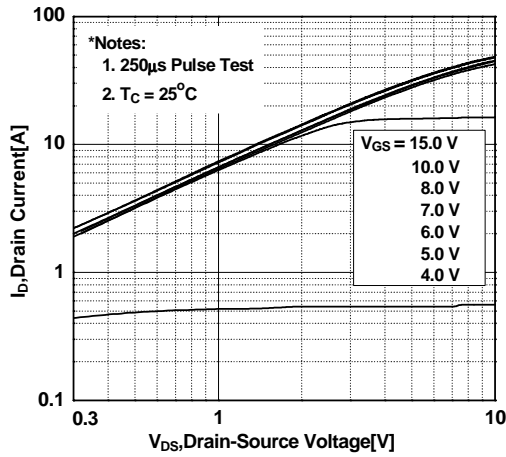
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	22	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	66	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 11\text{A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 11\text{A}$	-	350	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$	-	6	-	$\mu\text{C}$

**Notes:**

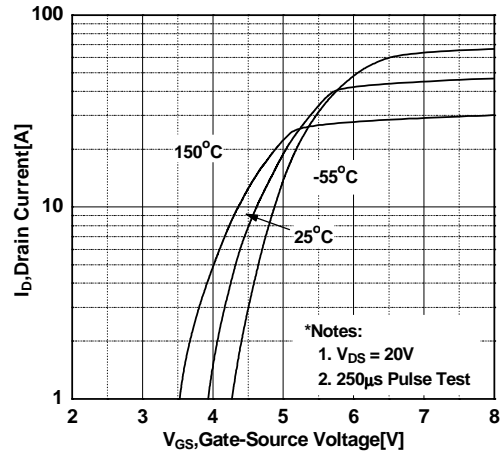
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 7.3\text{A}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 22\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq 380\text{V}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

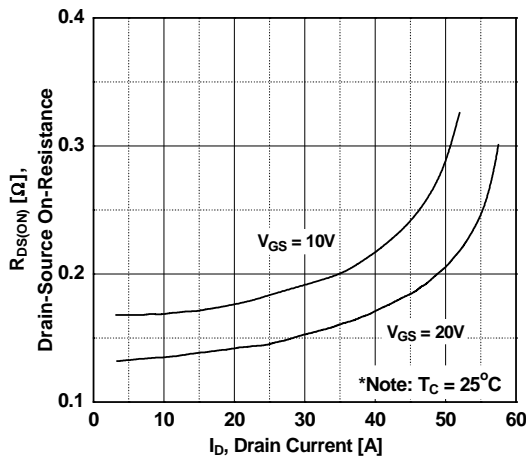
**Figure 1. On-Region Characteristics**



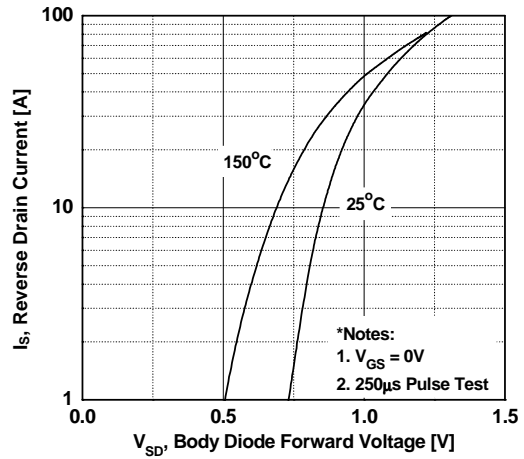
**Figure 2. Transfer Characteristics**



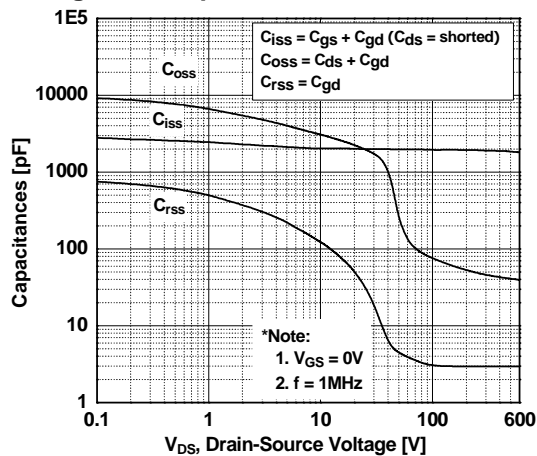
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



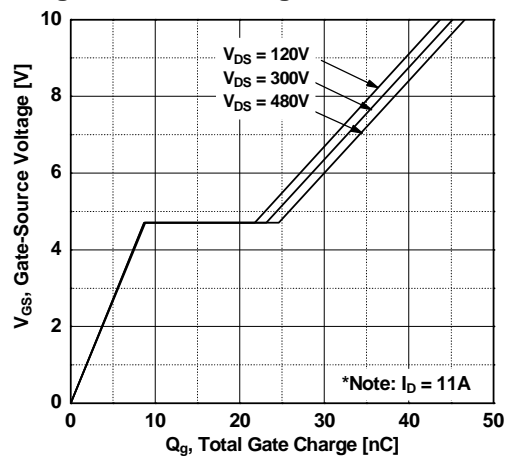
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

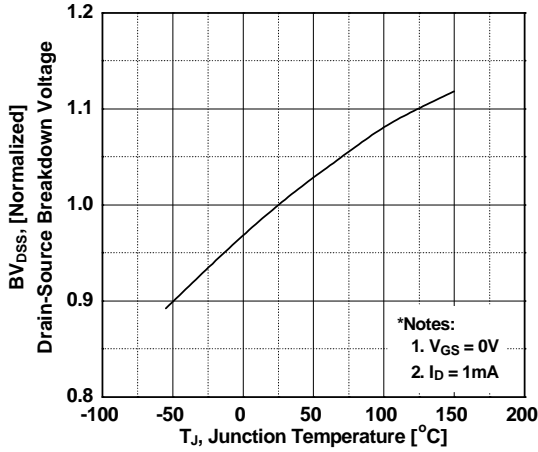


**Figure 6. Gate Charge Characteristics**

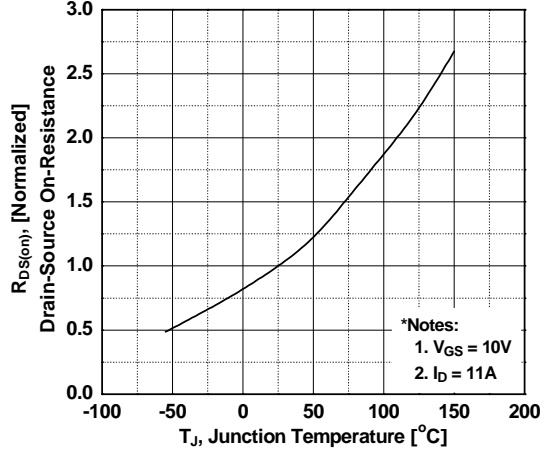


**Typical Performance Characteristics** (Continued)

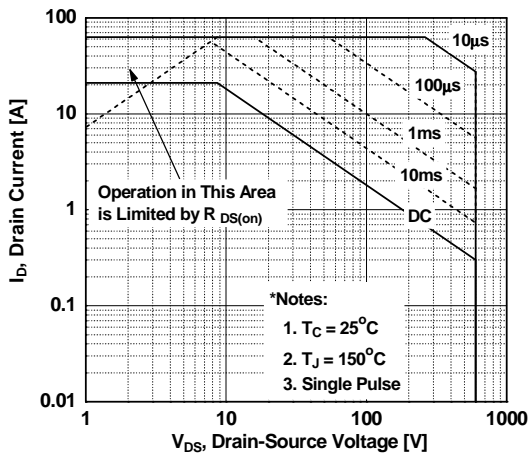
**Figure 7. Breakdown Voltage Variation vs. Temperature**



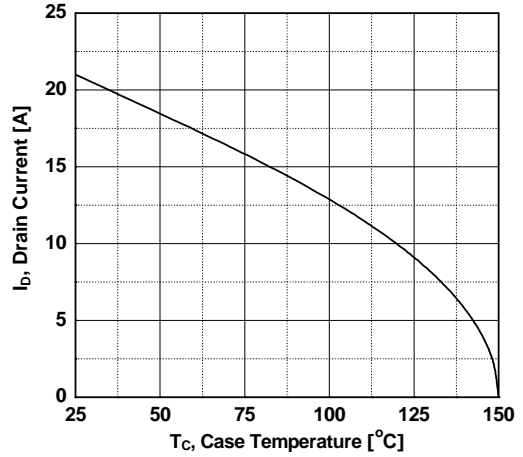
**Figure 8. On-Resistance Variation vs. Temperature**



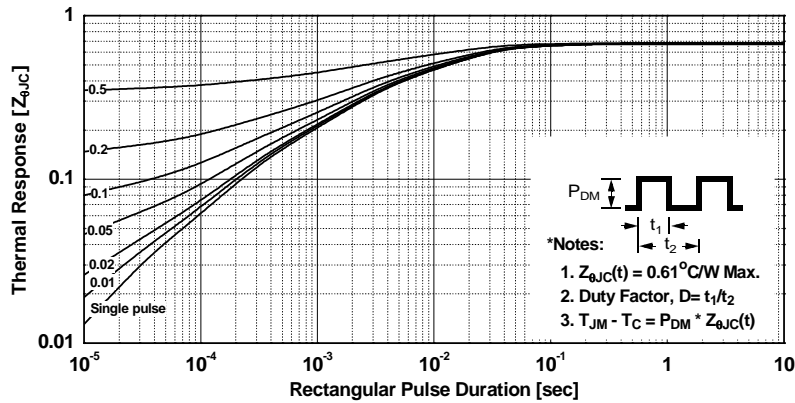
**Figure 9. Maximum Safe Operating Area**



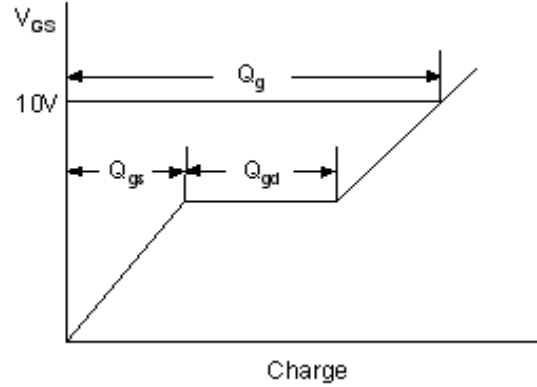
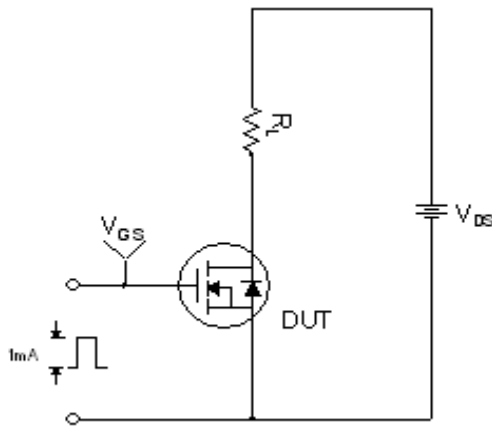
**Figure 10. Maximum Drain Current vs. Case Temperature**



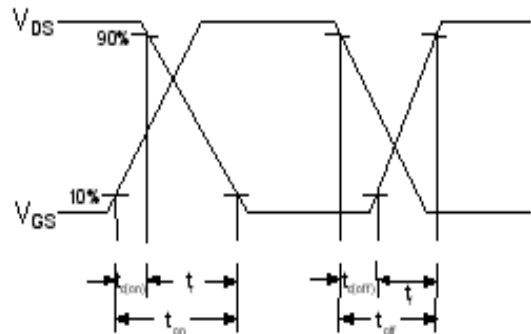
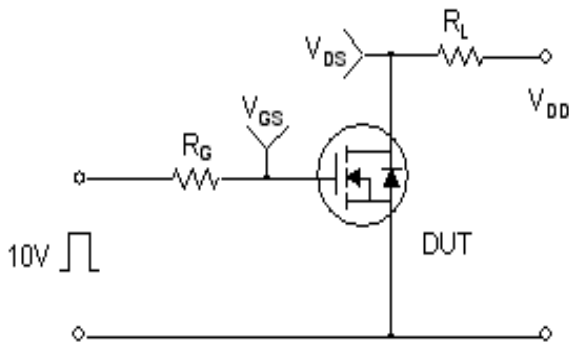
**Figure 11. Transient Thermal Response Curve**



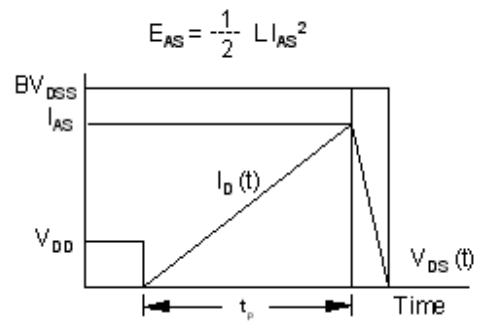
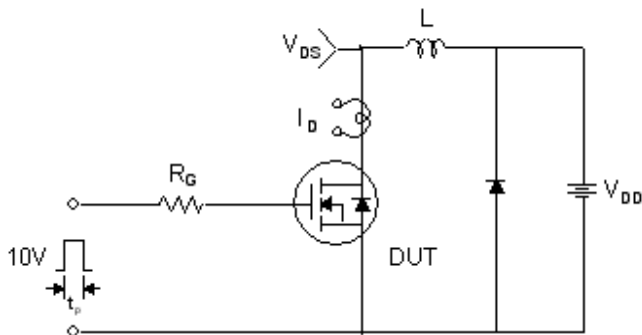
**Gate Charge Test Circuit & Waveform**



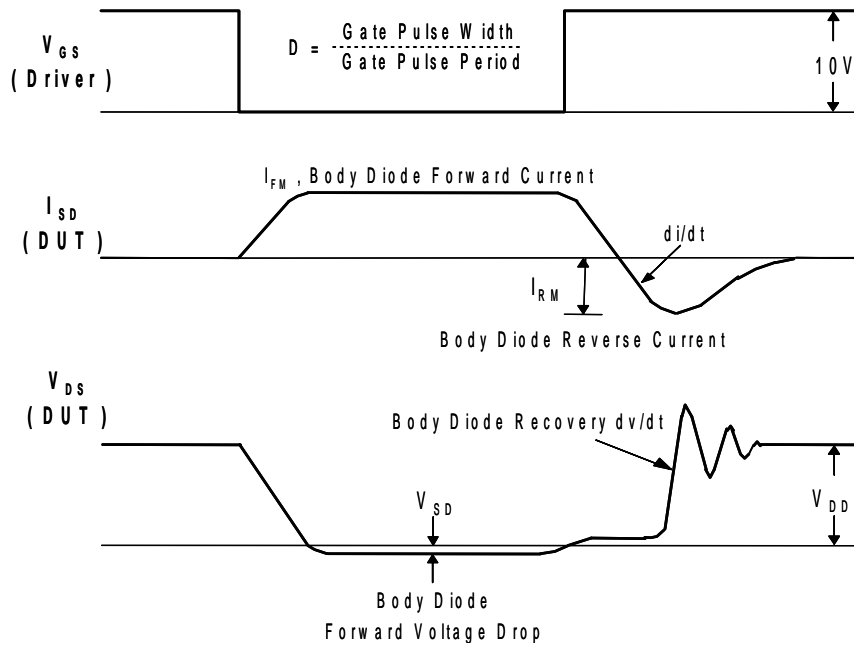
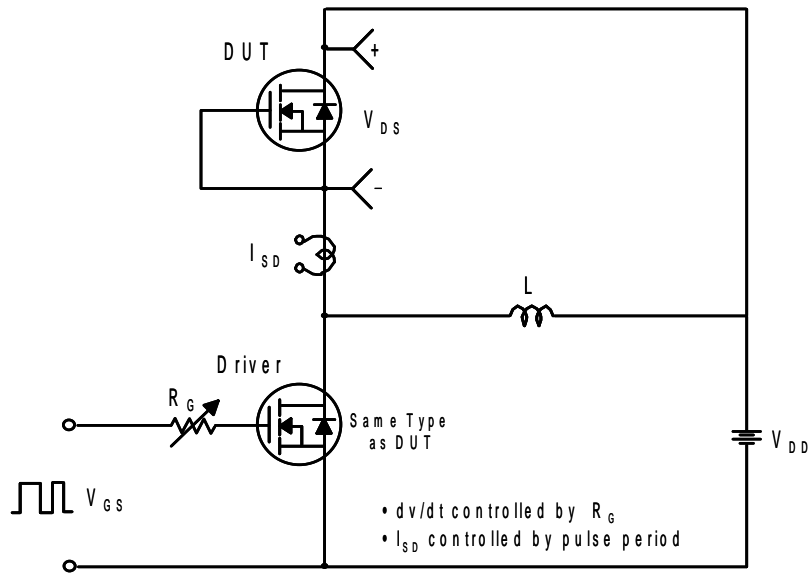
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

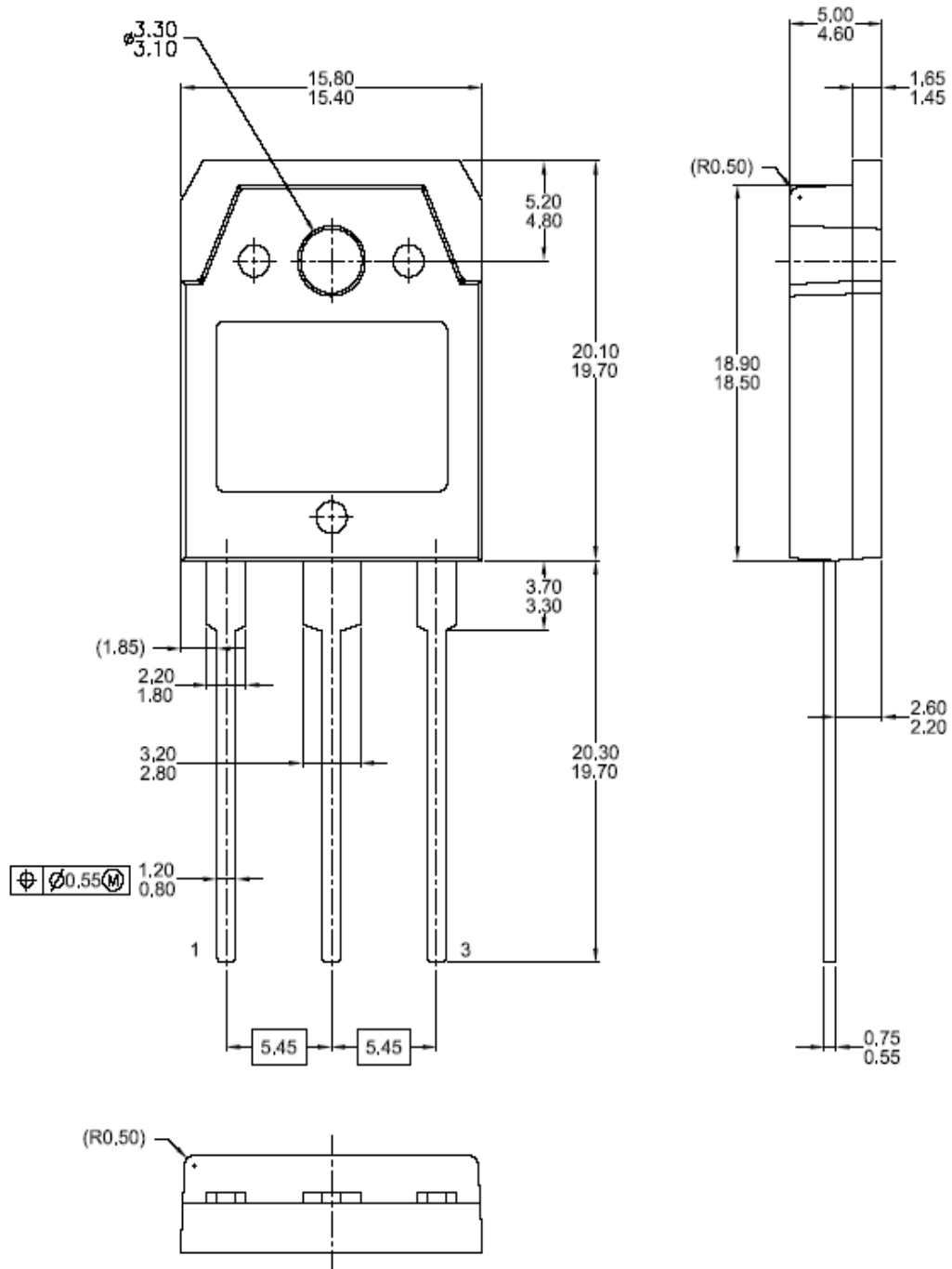


Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Mechanical Dimensions

## TO-3PN





Dimensions in Millimeters





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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
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Rev. I40