

**FCH47N60 / FCA47N60 / FCA47N60\_F109**

**600V N-Channel MOSFET**

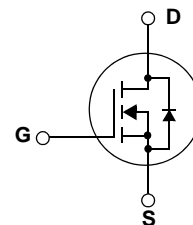
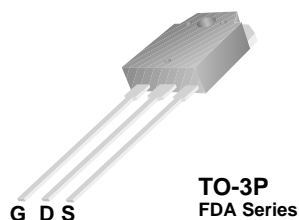
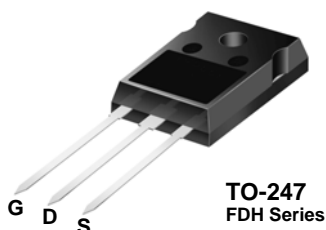
**Features**

- 650V @T<sub>J</sub> = 150°C
- Typ. R<sub>ds(on)</sub>=0.058Ω
- Ultra low gate charge (typ. Q<sub>g</sub>=210nC)
- Low effective output capacitance (typ. C<sub>oss,eff</sub>=420pF)
- 100% avalanche tested

**Description**

SuperFET™ is, Fairchild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



**Absolute Maximum Ratings**

Symbol	Parameter	FCH47N60	FCA47N60	Unit
V <sub>DSS</sub>	Drain-Source Voltage	600		V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	47 29.7		A A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	141		A
V <sub>GSS</sub>	Gate-Source voltage	± 30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	1800		mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	47		A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	41.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C) - Derate above 25°C	417 3.33		W W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		°C

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	--	0.3	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink	0.24	--	
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	--	41.7	°C/W

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH47N60	FCH47N60	TO-247	-	-	30
FCA47N60	FCA47N60	TO-3P	-	-	30
FCA47N60	FCA47N60_F109	TO-3PN	-	-	30

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

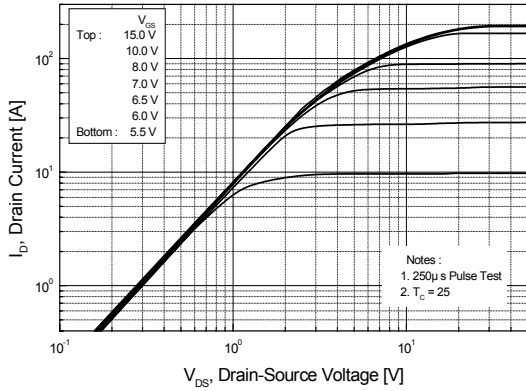
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}, T_J = 25^\circ\text{C}$	600	--	--	V
		$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}, T_J = 150^\circ\text{C}$	--	650	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.6	--	V/ $^\circ\text{C}$
BV <sub>DS</sub>	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 47\text{A}$	--	700	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 480\text{V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	$V_{GS} = 10\text{V}, I_D = 23.5\text{A}$	--	0.058	0.07	$\Omega$
g <sub>FS</sub>	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 23.5\text{A}$ (Note 4)	--	40	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$	--	5900	8000	pF
C <sub>oss</sub>	Output Capacitance		--	3200	4200	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	250	--	pF
C <sub>oss</sub>	Output Capacitance	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$	--	160	--	pF
C <sub>oss eff.</sub>	Effective Output Capacitance	$V_{DS} = 0\text{V to } 400\text{V}, V_{GS} = 0\text{V}$	--	420	--	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	$V_{DD} = 300\text{V}, I_D = 47\text{A}$ $R_G = 25\Omega$	--	185	430	ns
t <sub>r</sub>	Turn-On Rise Time		--	210	450	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	520	1100	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4, 5)	--	75	160
Q <sub>g</sub>	Total Gate Charge	$V_{DS} = 480\text{V}, I_D = 47\text{A}$ $V_{GS} = 10\text{V}$	--	210	270	nC
Q <sub>gs</sub>	Gate-Source Charge		--	38	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		(Note 4, 5)	--	110	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	47	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	141	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 47\text{A}$	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_S = 47\text{A}$ $di_F/dt = 100\text{A}/\mu\text{s}$ (Note 4)	--	590	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	25	--	$\mu\text{C}$

### NOTES:

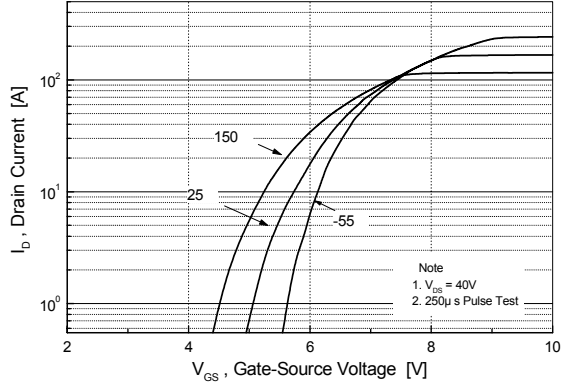
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 18\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 47\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

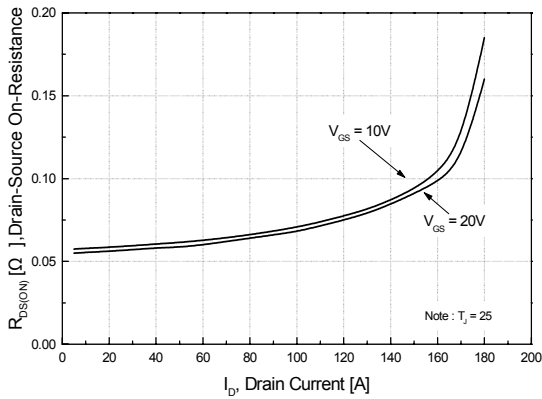
**Figure 1. On-Region Characteristics**



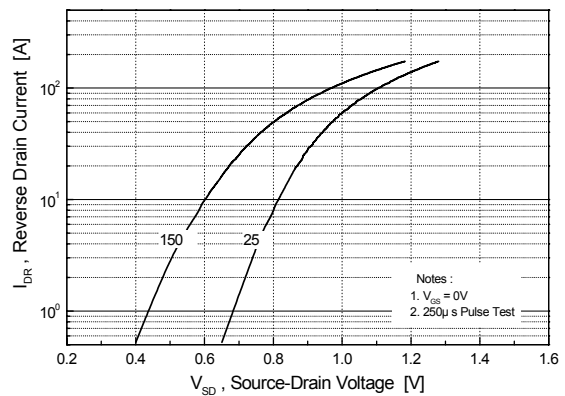
**Figure 2. Transfer Characteristics**



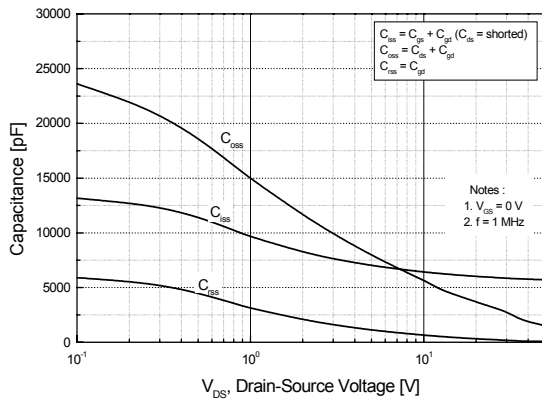
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



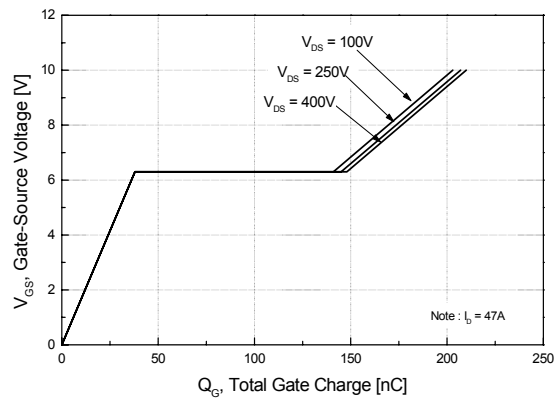
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

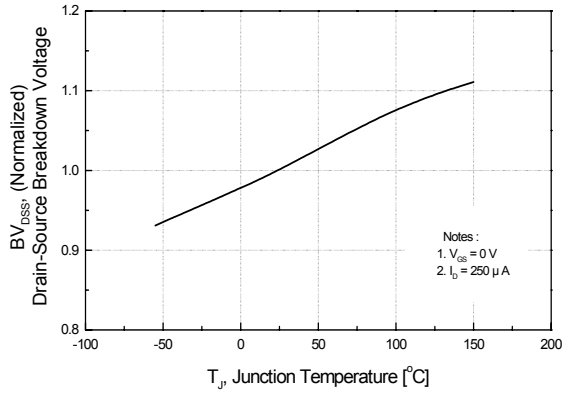


**Figure 6. Gate Charge Characteristics**

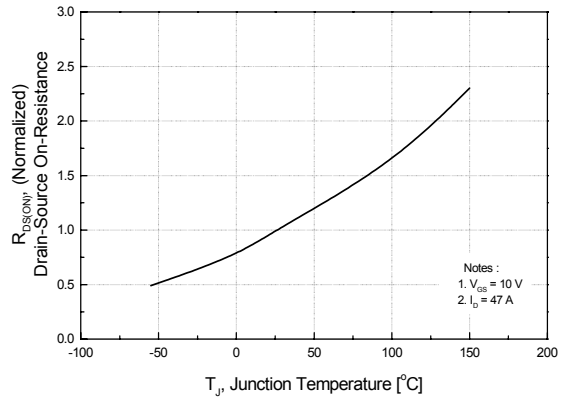


**Typical Performance Characteristics (Continued)**

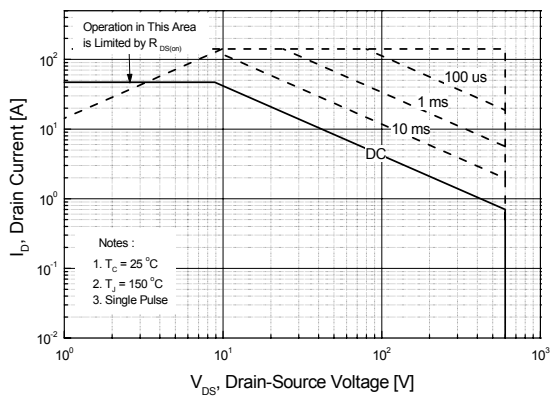
**Figure 7. Breakdown Voltage Variation vs. Temperature**



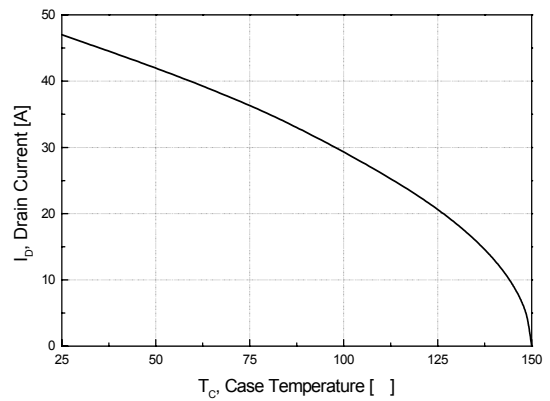
**Figure 8. On-Resistance Variation vs. Temperature**



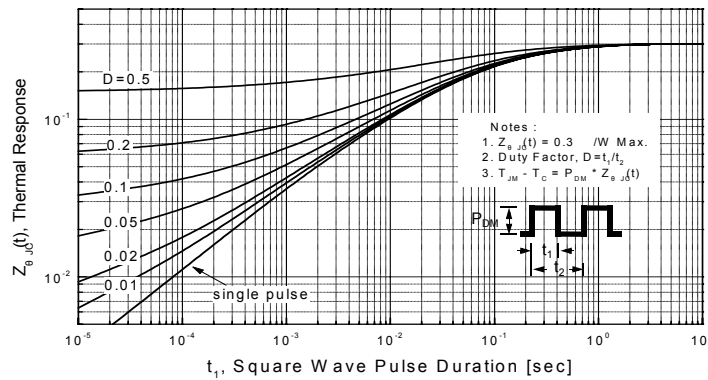
**Figure 9. Safe Operating Area**



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



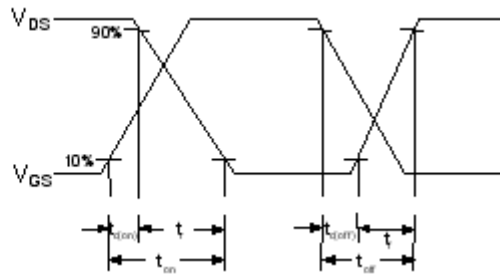
**Figure 10. Transient Thermal Response Curve**



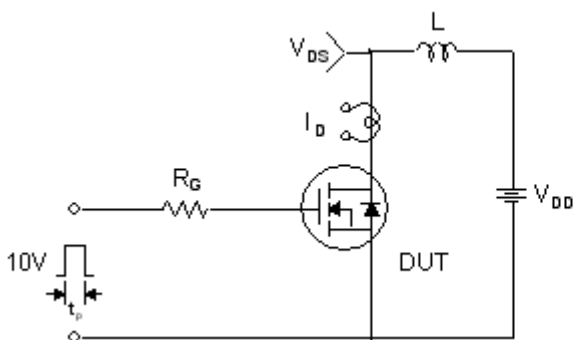
**Gate Charge Test Circuit & Waveform**



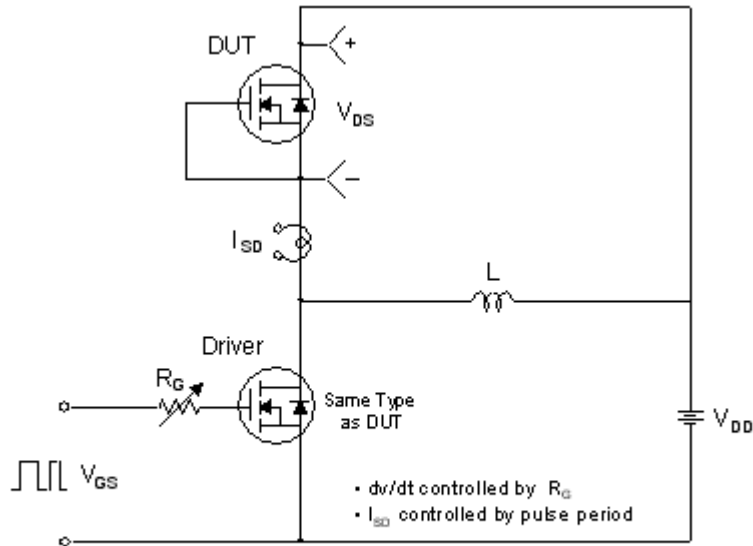
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

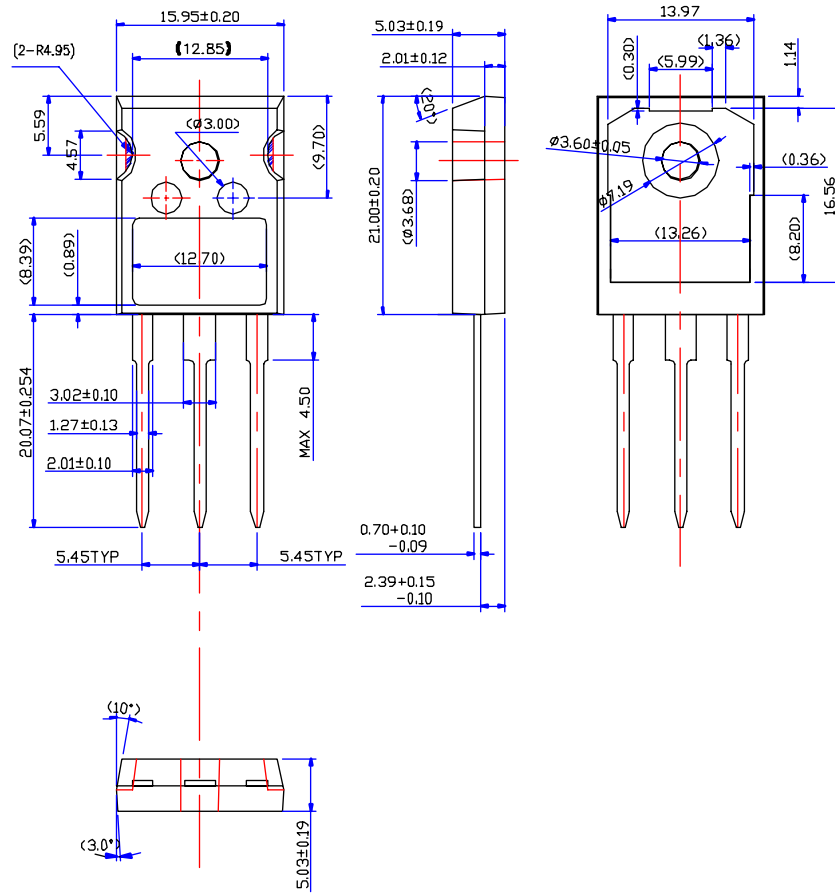


**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



# Mechanical Dimensions

## TO-247AD (FKS PKG CODE 001)

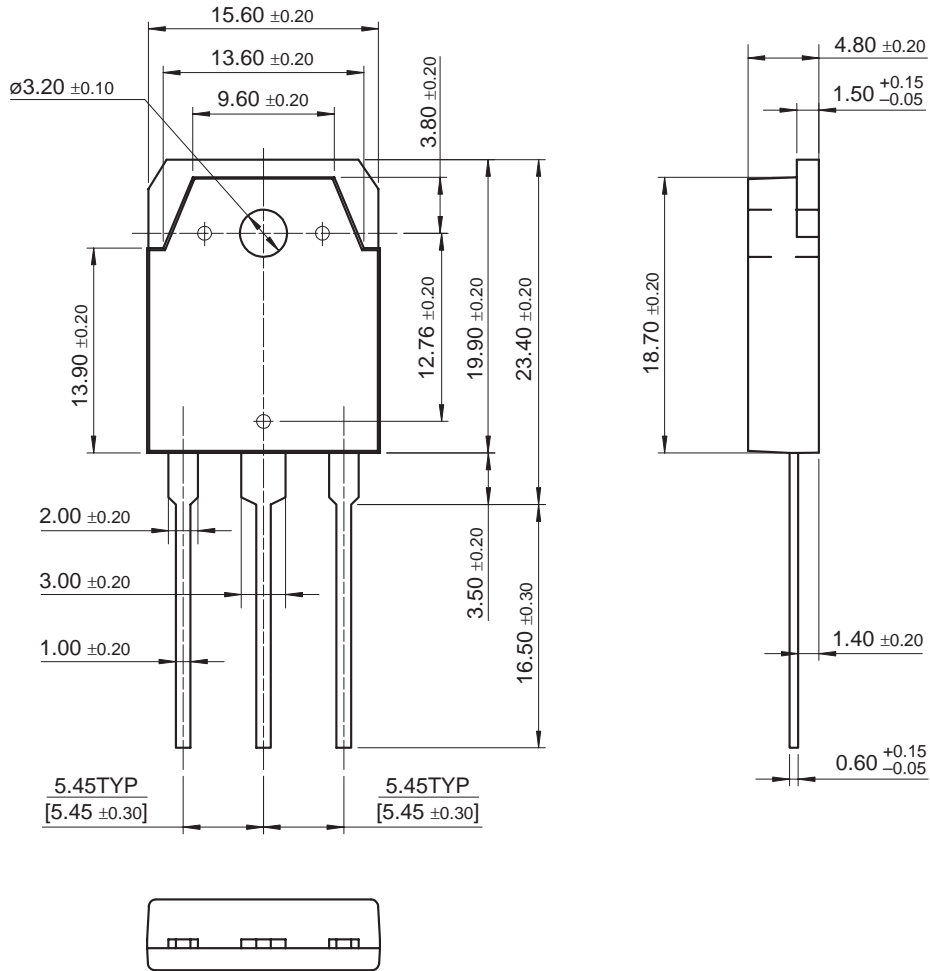


Dimensions in Millimeters

FCH47N60 / FCA47N60 / FCA47N60\_F109 600V N-Channel MOSFET

Mechanical Dimensions (Continued)

TO-3P

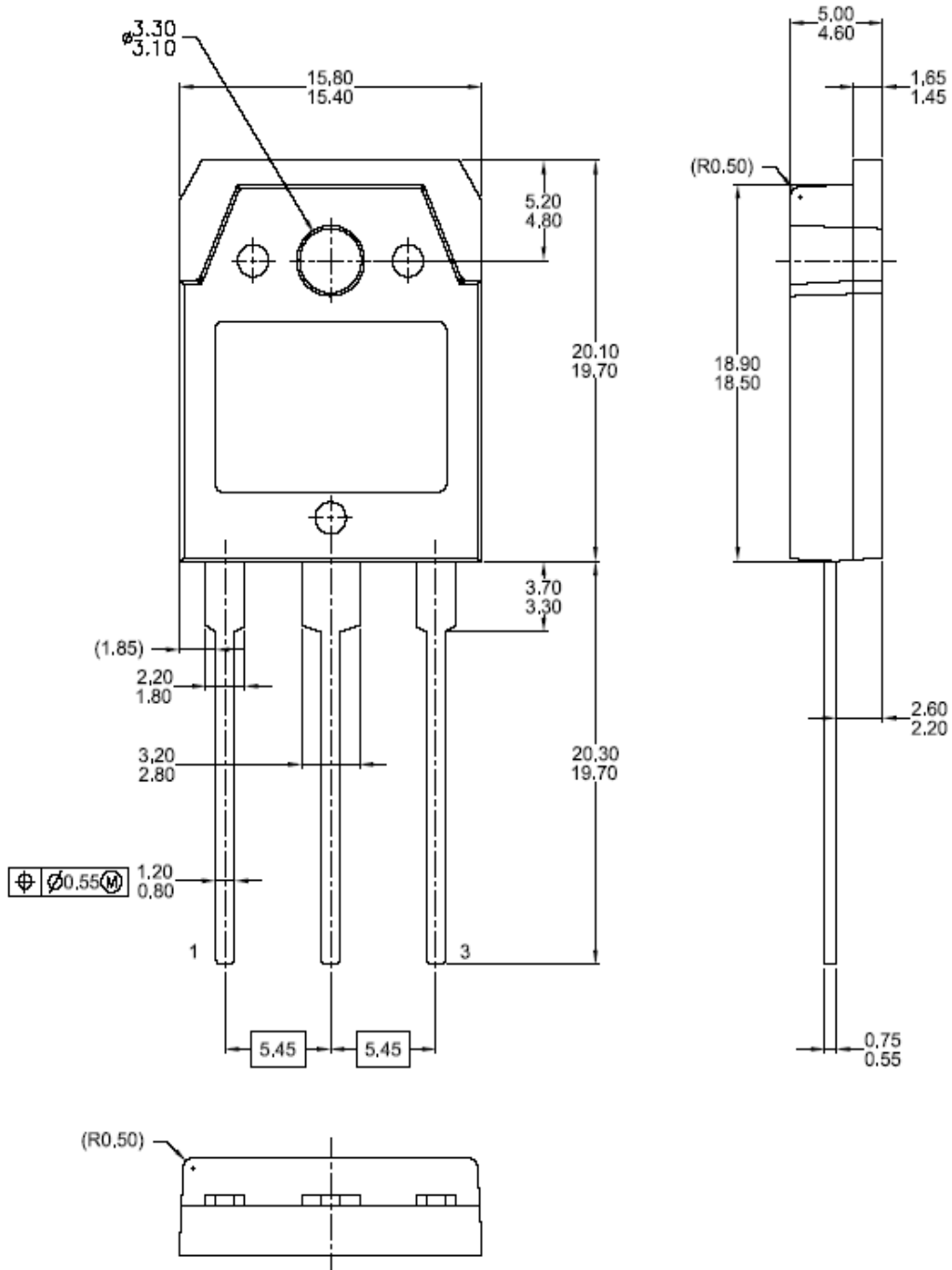


Dimensions in Millimeters



Mechanical Dimensions (Continued)


TO-3PN





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