

# FQP9N50C/FQPF9N50C

## 500V N-Channel MOSFET

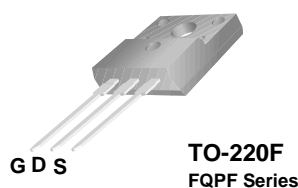
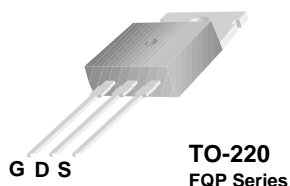
### General Description

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 efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

### Features

- 9 A, 500V,  $R_{DS(on)} = 0.8 \Omega @ V_{GS} = 10 V$
- Low gate charge ( typical 28 nC)
- Low Crss ( typical 24 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	FQP9N50C	FQPF9N50C	Units
$V_{DSS}$	Drain-Source Voltage	500		V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	9	9 *	A
		5.4	5.4 *	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	36	36 *	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	360		mJ
$I_{AR}$	Avalanche Current (Note 1)	9		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	13.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	135	44	W
		1.07	0.35	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FQP9N50C	FQPF9N50C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.93	2.86	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.57	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$	--	0.65	0.8	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4.5\text{ A}$ (Note 4)	--	6.5	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	790	1030	pF
$C_{oss}$	Output Capacitance		--	130	170	pF
$C_{riss}$	Reverse Transfer Capacitance		--	24	30	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 9\text{ A},$ $R_G = 25\ \Omega$	--	18	45	ns	
$t_r$	Turn-On Rise Time		--	65	140	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4, 5)	--	93	195	ns
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	64	125	ns
$Q_g$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 9\text{ A},$ $V_{GS} = 10\text{ V}$	--	28	35	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4, 5)	--	4	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4, 5)	--	15	--	nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	9	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	36	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 9\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 9\text{ A},$	--	335	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	2.95	--	$\mu\text{C}$

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 8\text{ mH}, I_{AS} = 9\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 9\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , 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

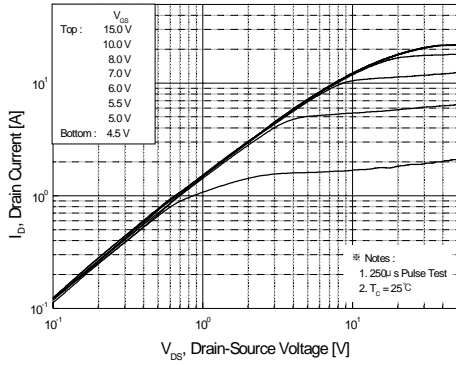


Figure 1. On-Region Characteristics

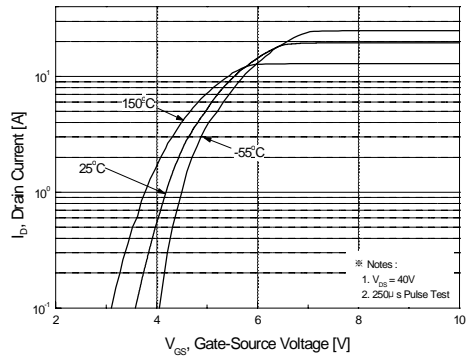


Figure 2. Transfer Characteristics

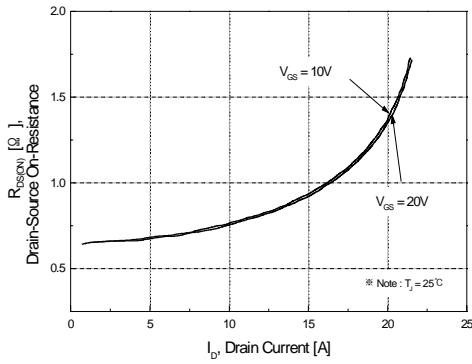


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

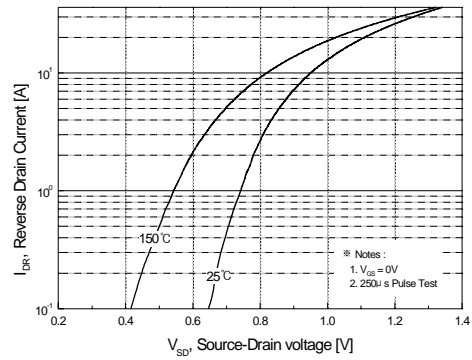


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

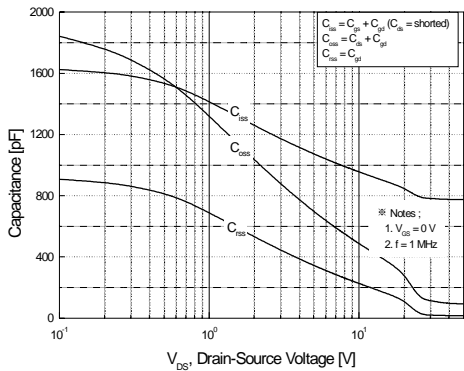


Figure 5. Capacitance Characteristics

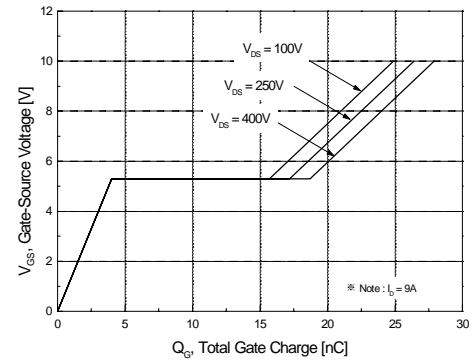
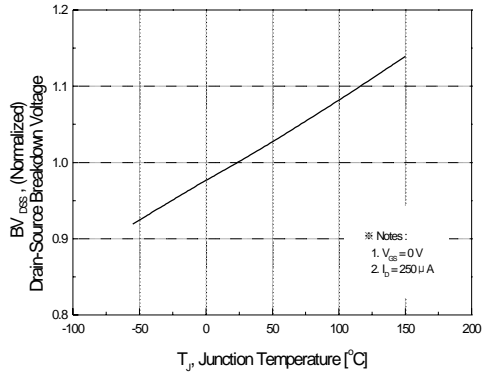
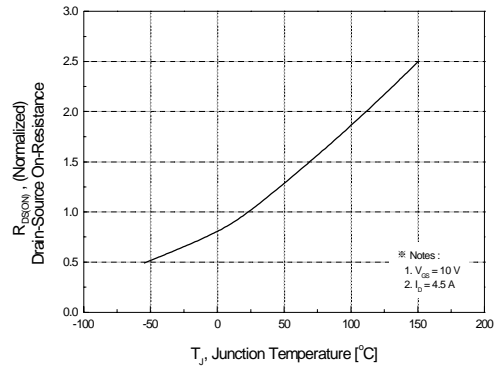


Figure 6. Gate Charge Characteristics

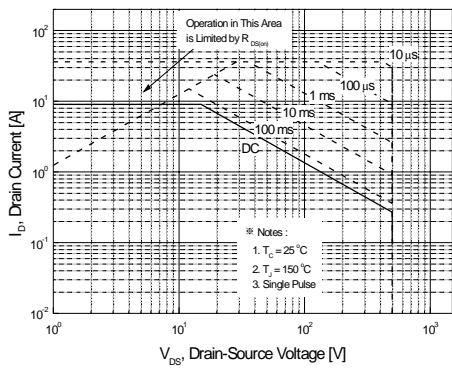
**Typical Characteristics** (Continued)



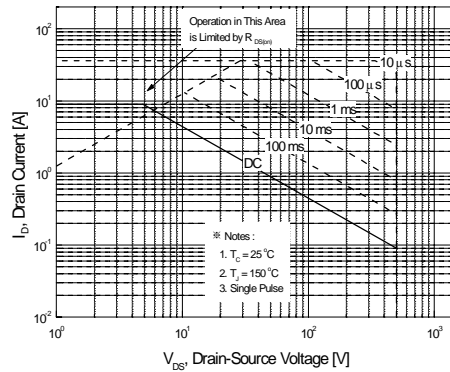
**Figure 7. Breakdown Voltage Variation vs Temperature**



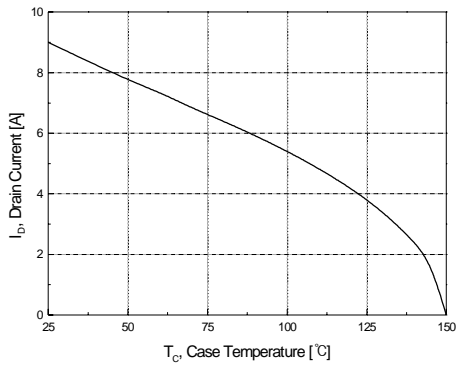
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP9N50C**



**Figure 9-2. Maximum Safe Operating Area for FQPF9N50C**



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

Typical Characteristics (Continued)

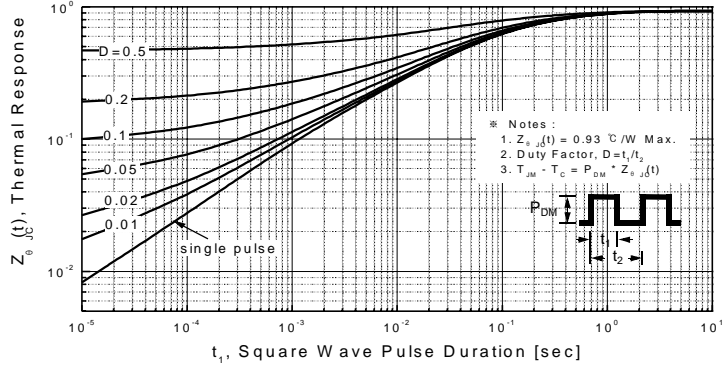


Figure 11-1. Transient Thermal Response Curve for FQP9N50C

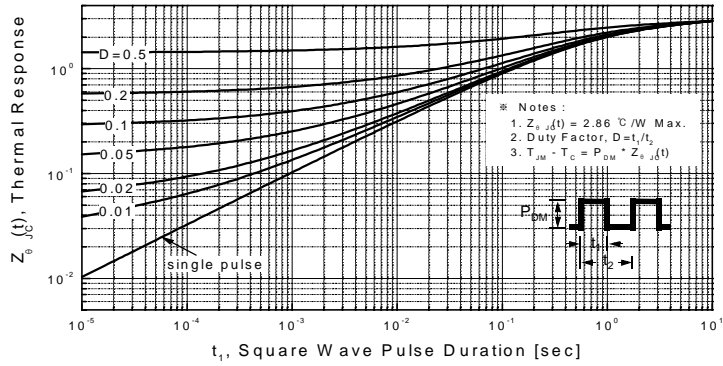


Figure 11-2. Transient Thermal Response Curve for FQPF9N50C

**Gate Charge Test Circuit & Waveform**



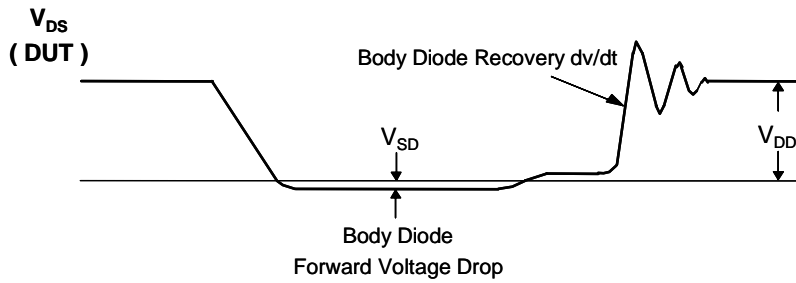
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

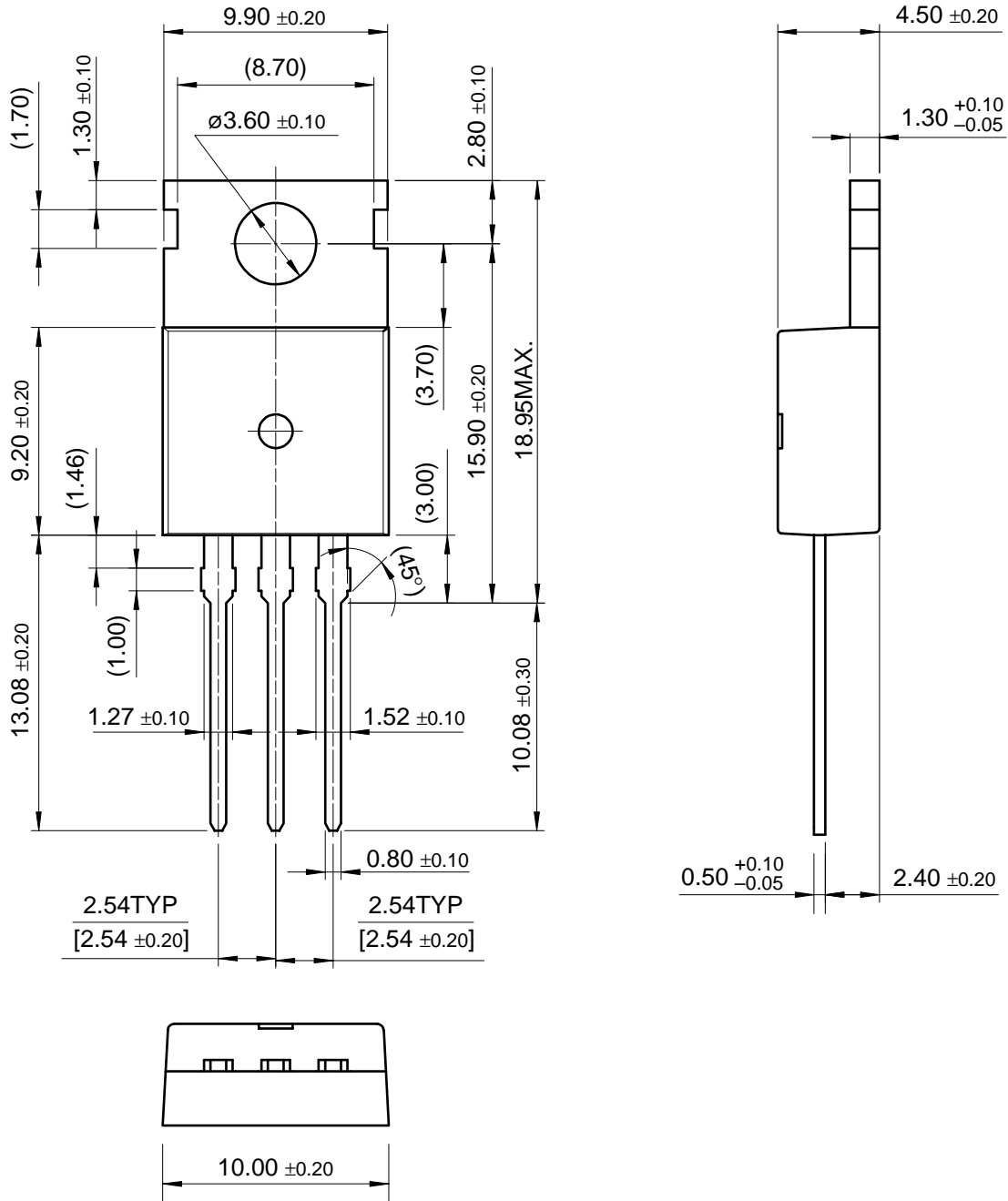


Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Package Dimensions

## TO-220



FQP9N50C/FQPF9N50C

Dimensions in Millimeters



Package Dimensions (Continued)

TO-220F



FQP9N50C/FQPF9N50C

Dimensions in Millimeters

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Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

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## FQPF9N50C

500V N-Channel Advance Q-FET C-Series

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### General description

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**Product status/pricing/packaging**

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Product	Product status	Pb-free Status	Pricing*	Package type	Leads	Packing method	Package Marking Convention**
FQPF9N50C	Full Production	 Full Production	\$1.10	<a href="#">TO-220F</a>	3	RAIL	Line 1: \$Y (Fairchild logo) &Z (Asm. Plant Code) &4 (4-Digit Date Code) Line 2: FQPF Line 3: 9N50C
FQPF9N50CT	Full Production	 Full Production	\$1.14	<a href="#">TO-220F</a>	3	RAIL	Line 1: \$Y (Fairchild logo) &Z (Asm. Plant Code) &4 (4-Digit Date Code)
FQPF9N50CYDTU	Preliminary		\$1.20	TO-220F	3	RAIL	Line 1: \$Y (Fairchild logo) &Z (Asm. Plant Code) &E&3 (3-Digit Date Code) Line 2: FQPF Line 3: 9N50C

\* Fairchild 1,000 piece Budgetary Pricing

\*\* A sample button will appear if the part is available through Fairchild's on-line samples program. If there is no sample button, please contact a [Fairchild distributor](#) to obtain samples



Indicates product with Pb-free second-level interconnect. For more information [click here](#).

Package marking information for product FQPF9N50C is available. [Click here for more information](#).

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### Models

Package & leads	Condition	Temperature range	Vcc range	Software version	Revision date
<b>PSPICE</b>					
TO-220F-3	<a href="#">Electrical/Thermal</a>	-55°C to 150°C	0V to 50V	OrCAD 10.3	Jul 27, 2007

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### Qualification Support

Click on a product for detailed qualification data

Product
<a href="#">FQPF9N50C</a>
<a href="#">FQPF9N50CT</a>
<a href="#">FQPF9N50CYDTU</a>

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