

# FCP7N60 / FCPF7N60

## N-Channel SuperFET® MOSFET

600 V, 7 A, 600 mΩ

### Features

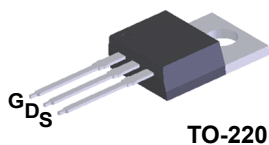
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 530\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 23\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 60\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Application

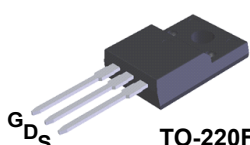
- LCD/LED/PDP TV
- Solar Inverter
- AC-DC Power Supply

### Description

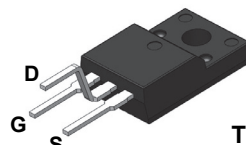
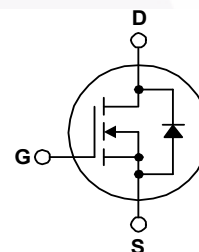
SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching 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.



TO-220



TO-220F


 TO-220F  
Y-formed


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

Symbol	Parameter		FCP7N60	FCPF7N60 / FCPF7N60YDTU	Unit
$V_{DSS}$	Drain-Source Voltage		600		V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	7	7*	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	4.4	4.4*	A
$I_{DM}$	Drain Current	- Pulsed (Note 1)	21	21*	A
$V_{GSS}$	Gate-Source voltage		$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	230		mJ
$I_{AR}$	Avalanche Current	(Note 1)	7		A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	8.3		mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	4.5		V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	83	31	W
		- Derate Above $25^\circ\text{C}$	0.67	0.25	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, 1/8" from Case for 5 Seconds		300		$^\circ\text{C}$

\*Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	FCP7N60	FCPF7N60 / FCPF7N60YDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.5	4.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP7N60	FCP7N60	TO220	Tube	N/A	N/A	50 units
FCPF7N60	FCPF7N60	TO220F	Tube	N/A	N/A	50 units
FCPF7N60YDTU	FCPF7N60	TO-220F (Y-formed)	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA, T <sub>J</sub> = 25°C	600	--	--	V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA, T <sub>J</sub> = 150°C	--	650	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
BV <sub>DS</sub>	Drain-Source Avalanche Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 7 A	--	700	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 480 V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.5 A	--	0.53	0.6	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 3.5 A	--	6	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz	--	710	920	pF
C <sub>oss</sub>	Output Capacitance		--	380	500	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	34	--	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> = 480 V, V <sub>GS</sub> = 0 V, f = 1 MHz	--	22	29	pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V	--	60	--	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 300 V, I <sub>D</sub> = 7 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω  (Note 4)	--	35	80	ns
t <sub>r</sub>	Turn-On Rise Time		--	55	120	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	75	160	ns
t <sub>f</sub>	Turn-Off Fall Time		--	32	75	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 480 V, I <sub>D</sub> = 7 A, V <sub>GS</sub> = 10 V  (Note 4)	--	23	30	nC
Q <sub>gs</sub>	Gate-Source Charge		--	4.2	5.5	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	11.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	21	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 7 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 7 A, dI <sub>F</sub> /dt =100 A/μs	--	360	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	4.5	--	μC

### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 3.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 7\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

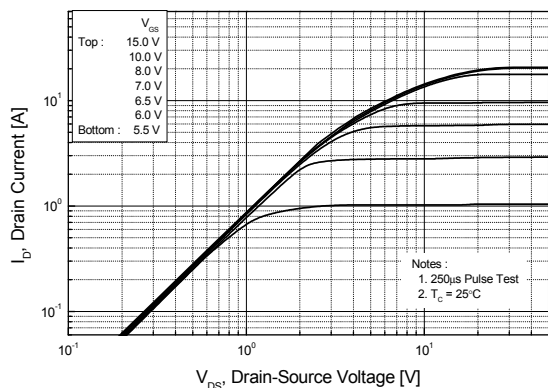


Figure 2. Transfer Characteristics

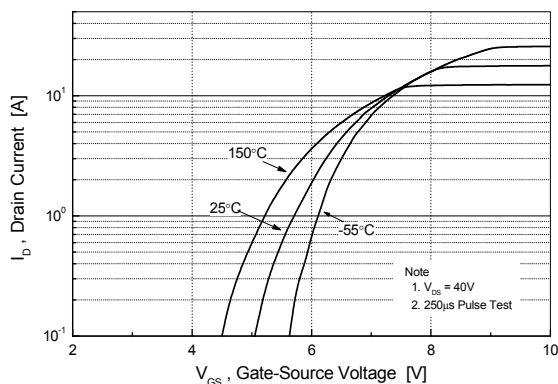


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

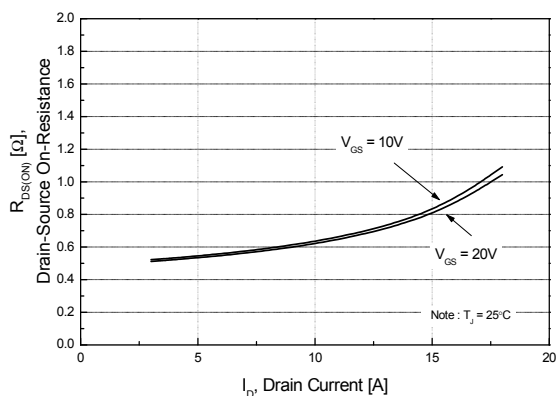


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

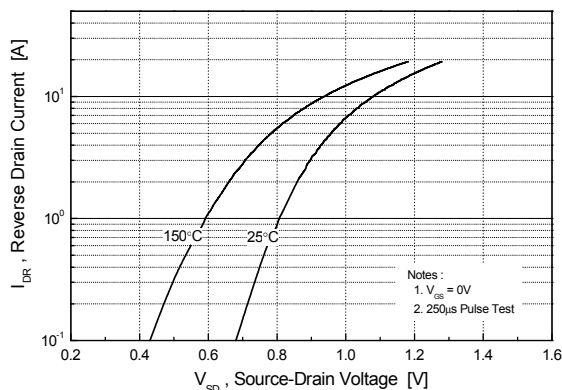


Figure 5. Capacitance Characteristics

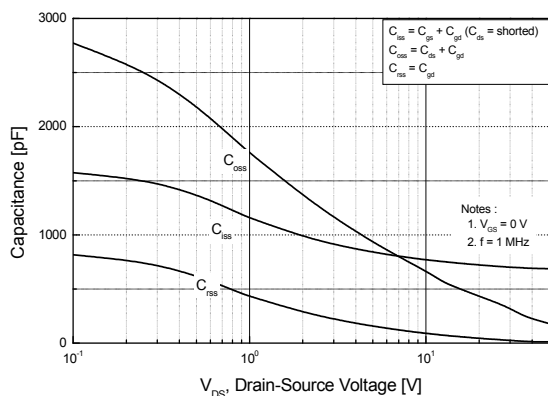
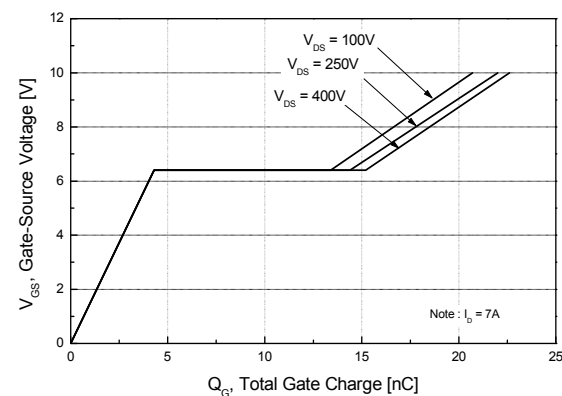
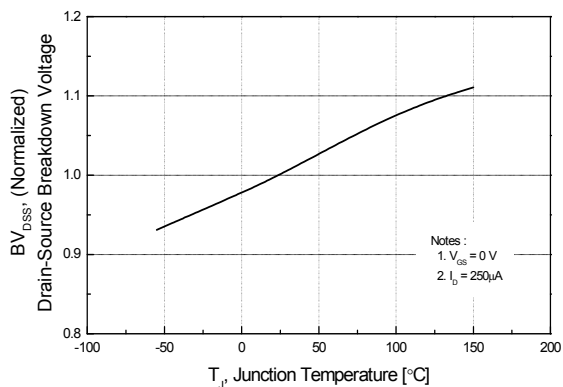


Figure 6. Gate Charge Characteristics

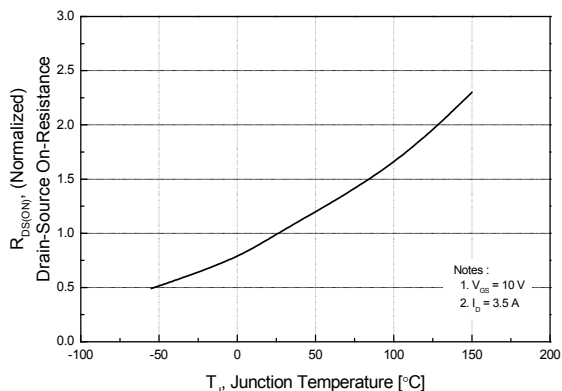


## Typical Performance Characteristics (Continued)

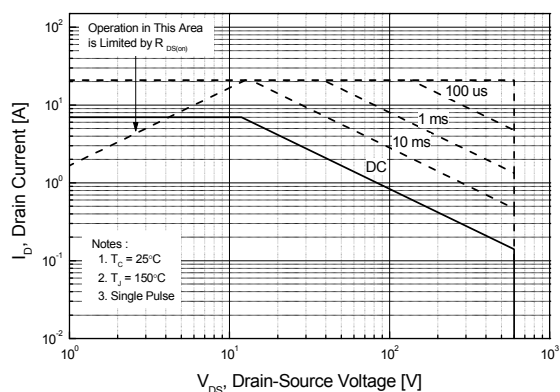
**Figure 7. Breakdown Voltage Variation vs. Temperature**



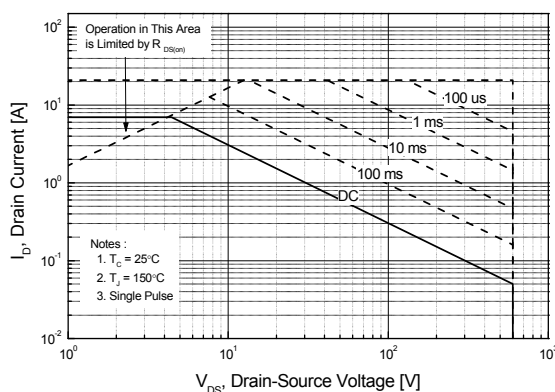
**Figure 8. On-Resistance Variation vs. Temperature**



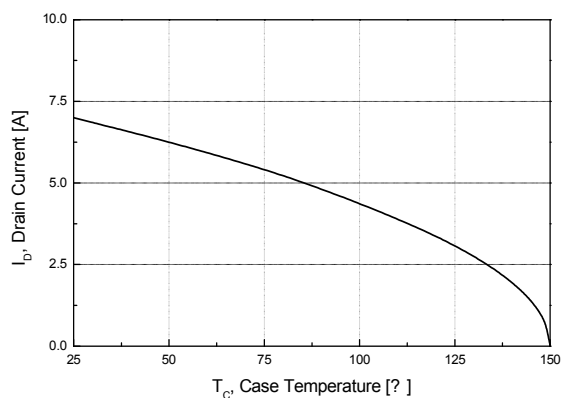
**Figure 9-1. Maximum Safe Operating Area for FCP7N60**



**Figure 9-2. Maximum Safe Operating Area for FCPF7N60**



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



# Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FCP7N60

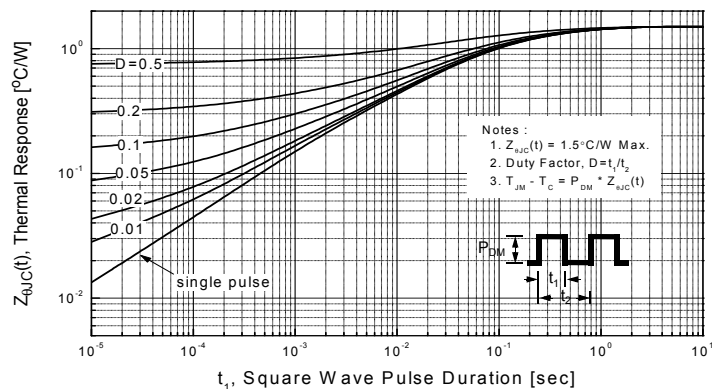
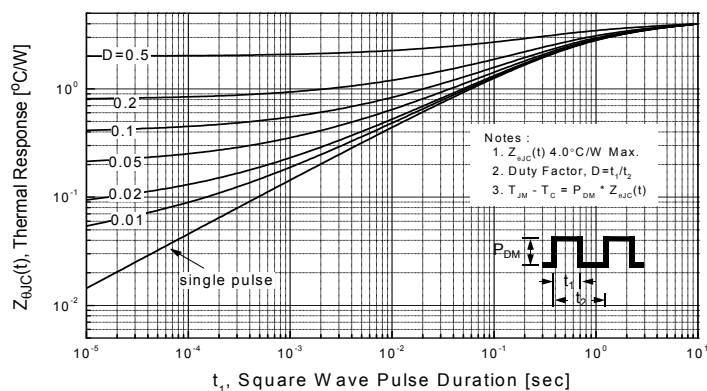


Figure 11-2. Transient Thermal Response Curve for FCPF7N60



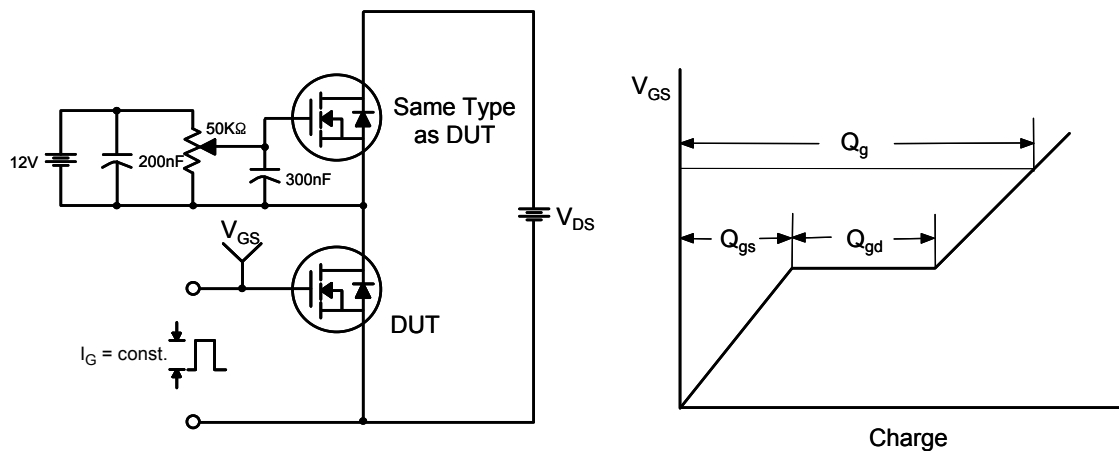


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

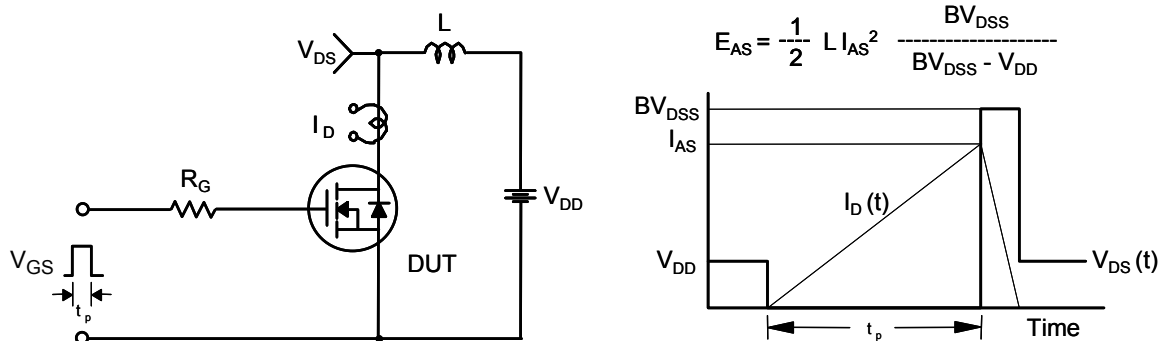


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms









# NOTES:

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:  
SINGLE GAUGE = 0.51 - 0.61  
DUAL GAUGE = 1.10 - 1.45
- G) DRAWING FILE NAME: TO220B03REV9
- H) PRESENCE IS SUPPLIER DEPENDENT
- I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.





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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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