

# FCH041N60F

## 600V N-Channel MOSFET, FRFET

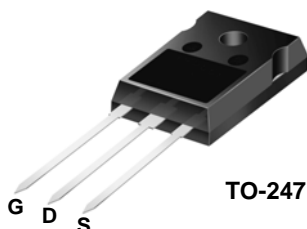
### Features

- $R_{DS(on)} = 36m\Omega$  (Typ)
- Ultra low gate charge (Typ.  $Q_g = 277nC$ )
- Low effective output capacitance
- 100% avalanche tested
- RoHS Compliant

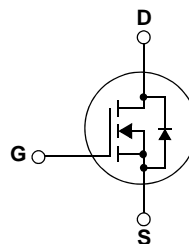
### Description

SuperFET®II 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®II is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



TO-247



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

Symbol	Parameter	FCH041N60F	Units
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	-DC	$\pm 20$
		-AC (f>1Hz)	30
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ C$ )	76
		-Continuous ( $T_C = 100^\circ C$ )	48.1
$I_{DM}$	Drain Current - Pulsed (Note 1)	228	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	2025	mJ
$I_{AR}$	Avalanche Current (Note 1)	15	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	5.95	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	50	
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ )	595	W
		- Derate above $25^\circ C$	4.76
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	FCH041N60F	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.21	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH041N60F	FCH041N60F	TO-247	-	-	30

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 10\text{mA}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 10\text{mA}, V_{GS} = 0\text{V}, T_J = 150^\circ\text{C}$	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.67	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 480\text{V}, T_C = 125^\circ\text{C}$	-	-	10	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 38\text{A}$	-	36	41	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 38\text{A}$ (Note 4)	-	64.5	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	10800	14365	pF
$C_{oss}$	Output Capacitance		-	324	430	pF
$C_{riss}$	Reverse Transfer Capacitance		-	4.5	-	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$	-	185	-	pF
$C_{oss \text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	748	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 38\text{A}$ $V_{GS} = 10\text{V}$	-	277	360	nC
$Q_{gs}$	Gate to Source Gate Charge		-	65.3	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	116	-
ESR	Equivalent Series Resistance	$f = 1\text{MHz}$	-	1	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 38\text{A}$ $R_{GEN} = 4.7\Omega$	-	63	136	ns
$t_r$	Turn-On Rise Time		-	66	142	ns
$t_{d(off)}$	Turn-Off Delay Time		-	244	498	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	53	116

### Drain-Source Diode Characteristics

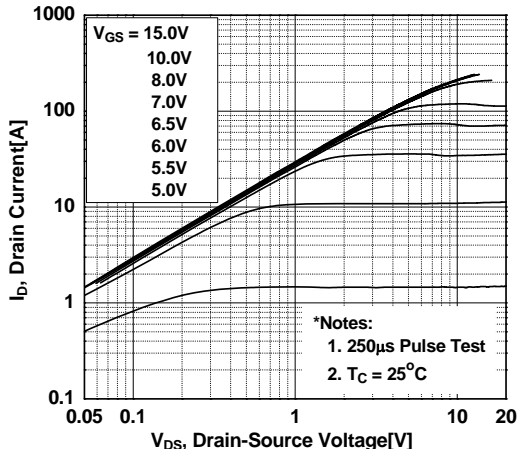
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	77	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	231	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 38\text{A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 38\text{A}$	-	190	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	1490	-	nC

#### Notes:

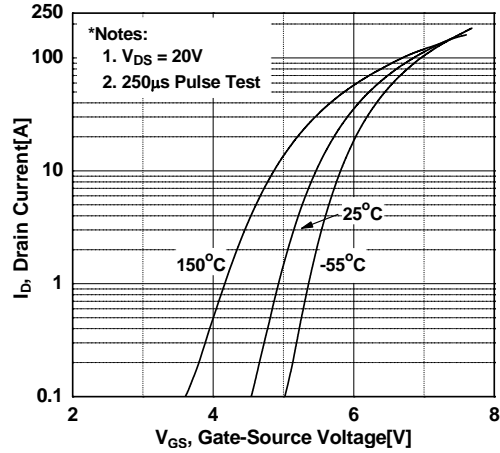
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 15\text{A}, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 38\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq 380\text{V}, \text{Starting } T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

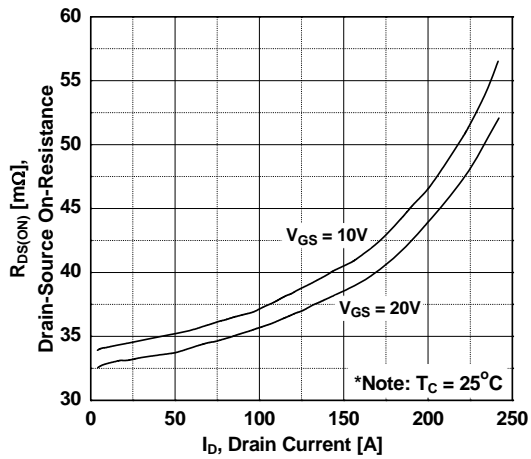
**Figure 1. On-Region Characteristics**



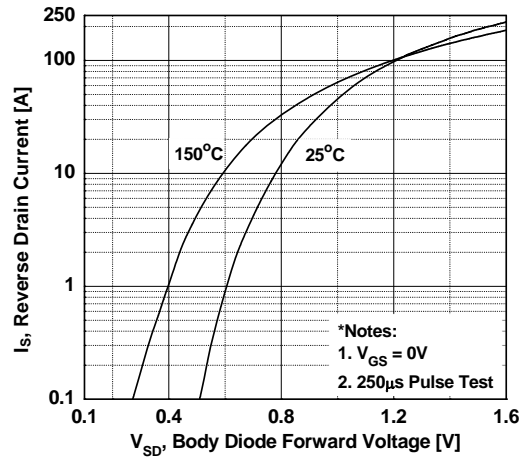
**Figure 2. Transfer Characteristics**



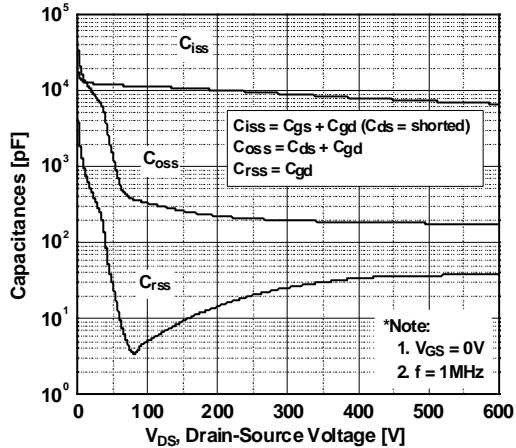
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



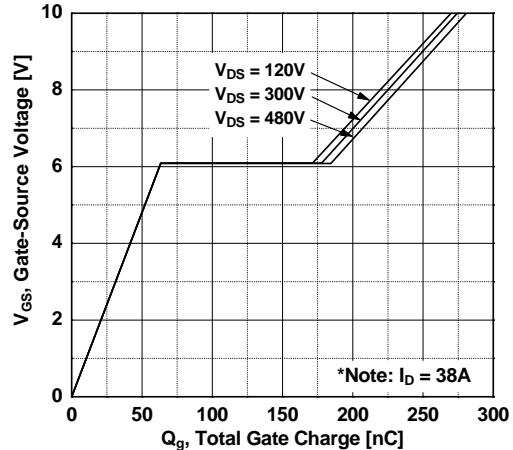
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

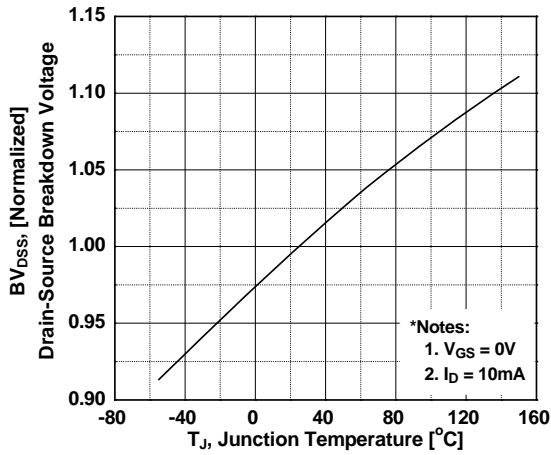


Figure 8. On-Resistance Variation vs. Temperature

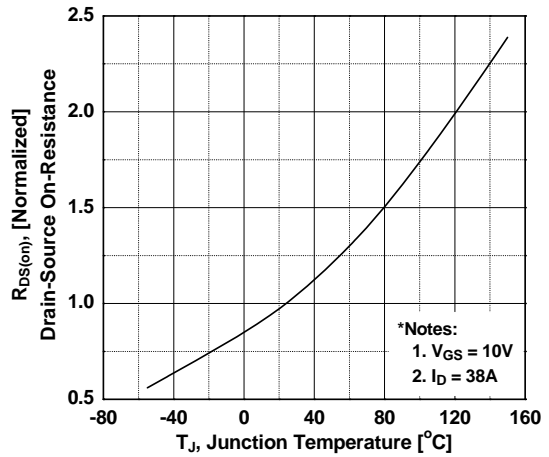


Figure 9. Maximum Safe Operating Area vs. Case Temperature

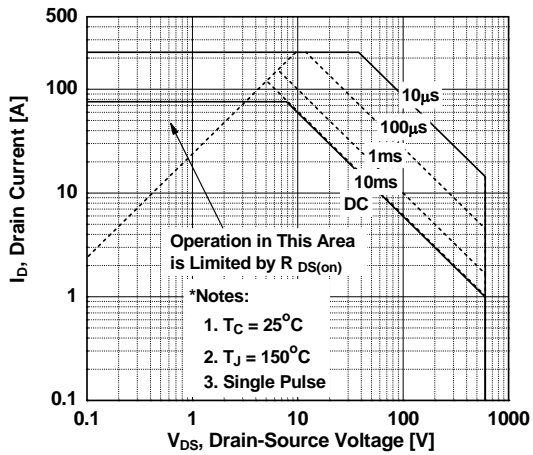


Figure 10. Maximum Drain Current

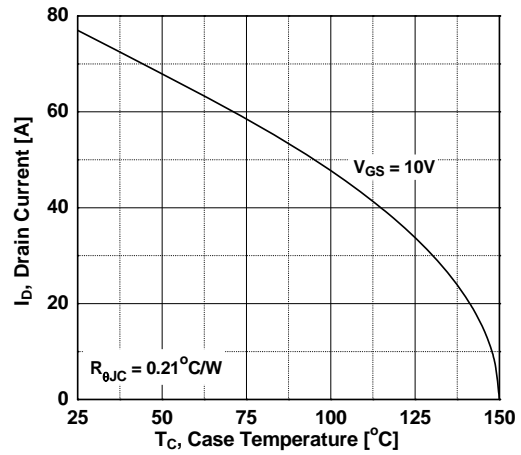
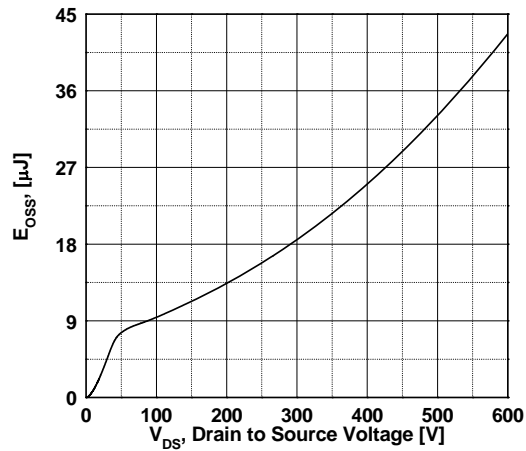
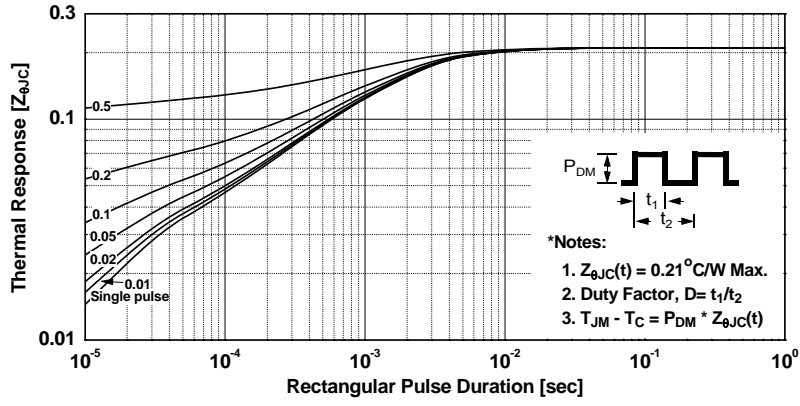


Figure 11. E\_oss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



**Gate Charge Test Circuit & Waveform**



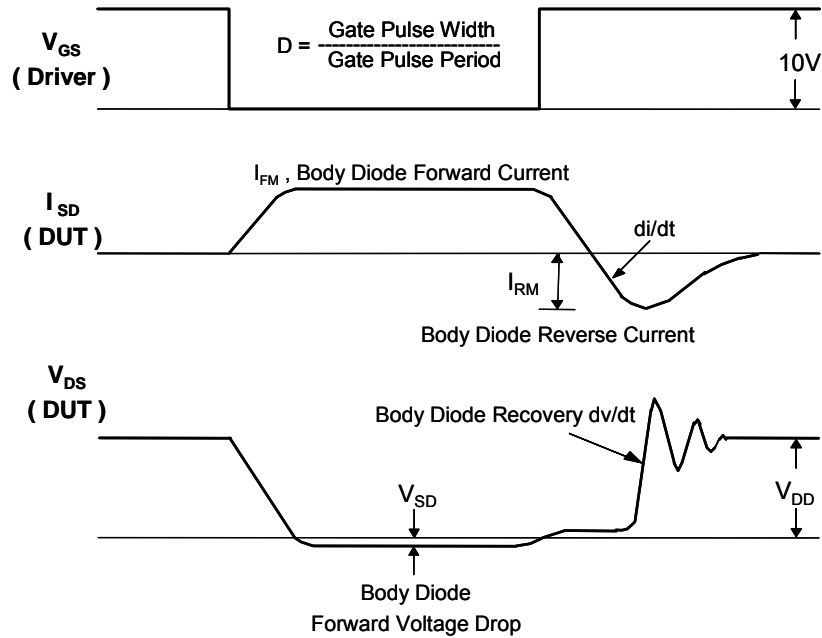
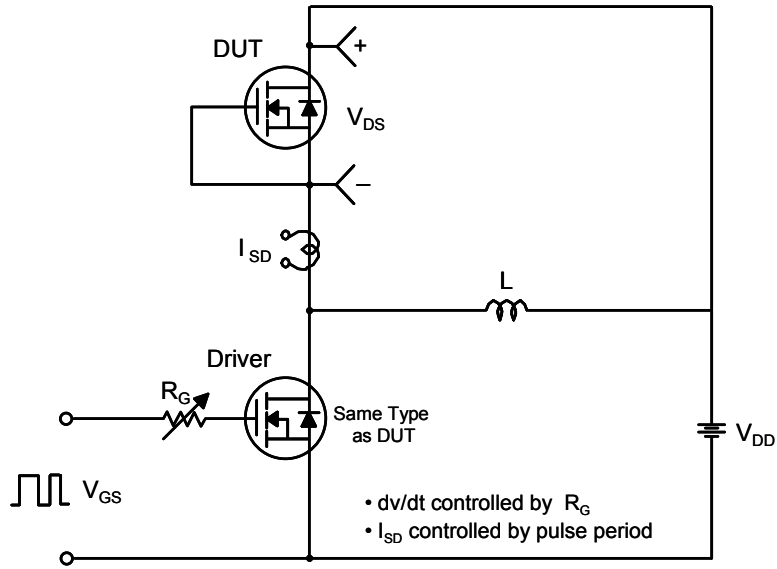
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

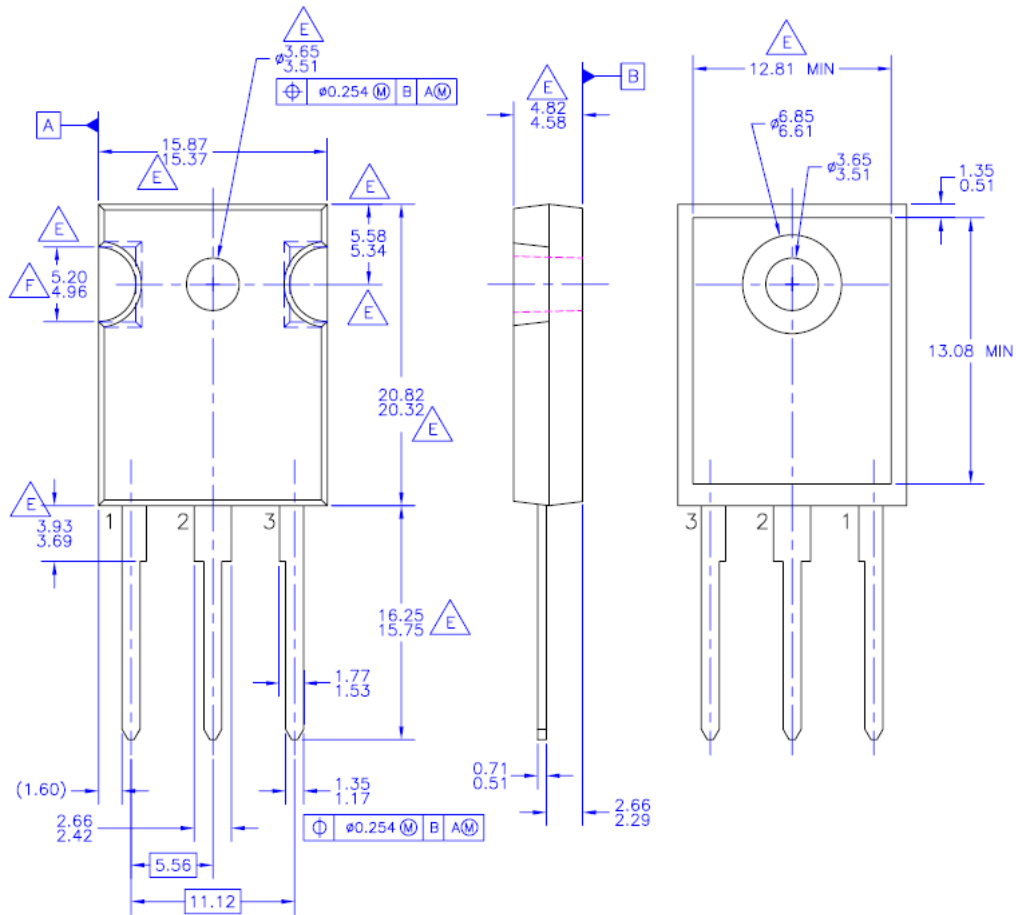


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-247**



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  - D. DRAWING CONFORMS TO ASME Y14.5 - 1994
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