

# FCH47N60

## N-Channel SuperFET® MOSFET

600 V, 47 A, 70 mΩ

### Features

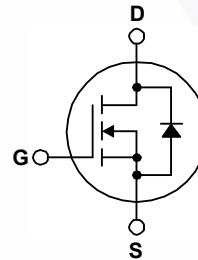
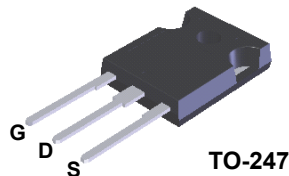
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 58\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 210\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 420\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Applications

- 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.



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

Symbol	Parameter	FCH47N60_F133	Unit
$V_{DSS}$	Drain to Source Voltage	600	V
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ\text{C}$ )	47
		Continuous ( $T_C = 100^\circ\text{C}$ )	29.7
$I_{DM}$	Drain Current	Pulsed (Note 1)	141
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	1800
$I_{AR}$	Avalanche Current	(Note 1)	47
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	41.7
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	4.5
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	417
		Derate Above $25^\circ\text{C}$	3.33
$T_J, T_{STG}$	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	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FCH47N60_F133	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	41.7	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH47N60_F133	FCH47N60	TO-247	Tube	N/A	N/A	30 units

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

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

$BV_{DSS}$	Drain-to-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_C = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_C = 150^\circ\text{C}$	-	650	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.6	-	$V/^\circ\text{C}$
$BV_{DS}$	Drain to Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 47\text{ A}$	-	700	-	V
$I_{DSS}$	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	
$I_{GSS}$	Gate-to-Body Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain-to-Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 23.5\text{ A}$	-	0.058	0.070	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 23.5\text{ A}$	-	40	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	5900	8000	pF
$C_{oss}$	Output Capacitance		-	3200	4200	pF
$C_{rss}$	Reverse Transfer Capacitance		-	250	-	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	160	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	420	-	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay	$V_{DD} = 300\text{ V}, I_D = 47\text{ A}, V_{GS} = 10\text{ V}, R_G = 25\ \Omega$	-	185	430	ns	
$t_r$	Turn-On Rise Time		-	210	450	ns	
$t_{d(off)}$	Turn-Off Delay		-	520	1100	ns	
$t_f$	Turn-Off Fall Time		(Note 4)	-	75	160	ns
$Q_{g(tot)}$	Total Gate Charge at 10 V		$V_{DS} = 480\text{ V}, I_D = 47\text{ A}, V_{GS} = 10\text{ V}$	-	210	270	nC
$Q_{gs}$	Gate to Source Gate Charge		(Note 4)	-	38	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	(Note 4)	-	110	-	nC	

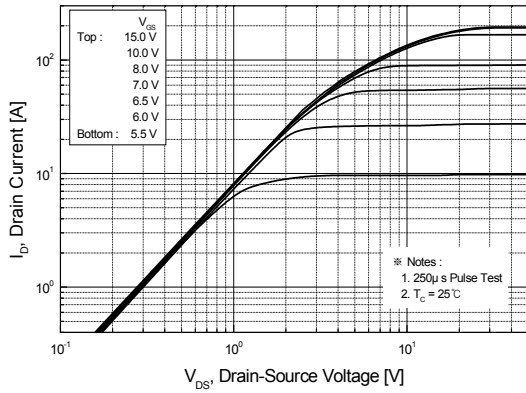
### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain-to-Source Diode Forward Current	-	-	47	A	
$I_{SM}$	Maximum Pulsed Drain-to-Source Diode Forward Current	-	-	141	A	
$V_{SD}$	Drain-to-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 47\text{ A}$	-	-	1.4	V
$t_{rr}$	Reverse-Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 47\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	-	590	-	ns
$Q_{rr}$	Reverse-Recovery Charge	$V_{GS} = 0\text{ V}, I_{SD} = 47\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	-	25	-	$\mu\text{C}$

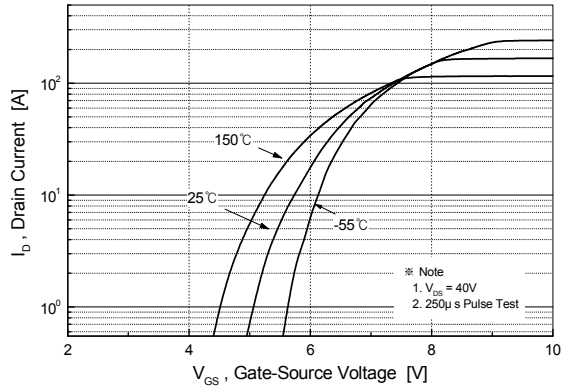
#### Notes:

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.  $I_{SD} \leq 48\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

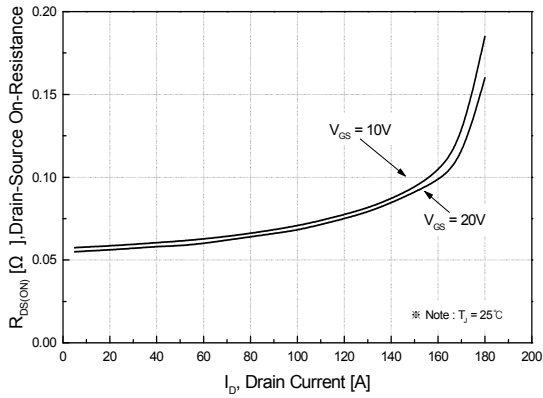
## Typical Performance Characteristics



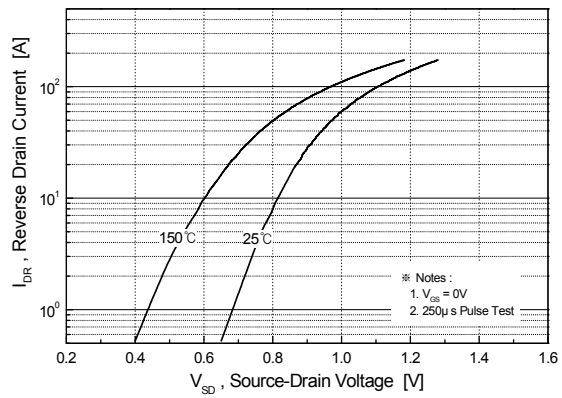
**Figure 1. On-Region Characteristics**



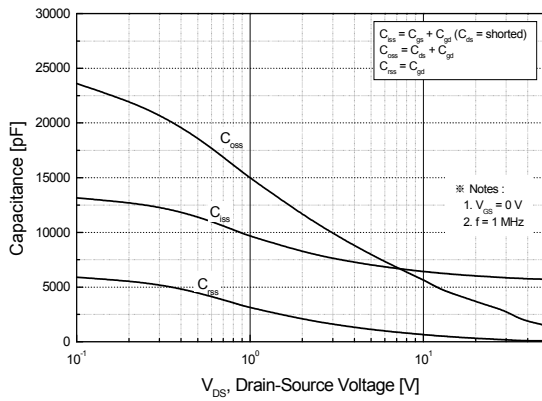
**Figure 2. Transfer Characteristics**



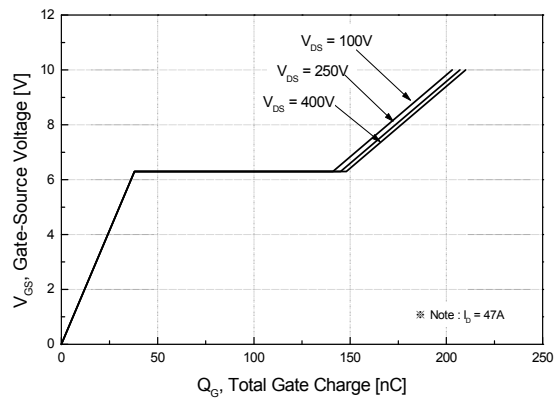
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



**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)

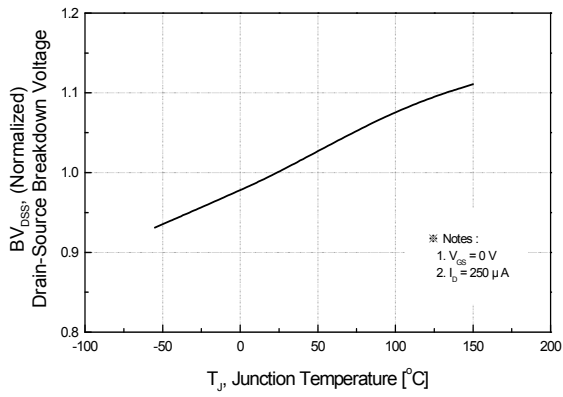


Figure 7. Breakdown Voltage Variation vs. Temperature

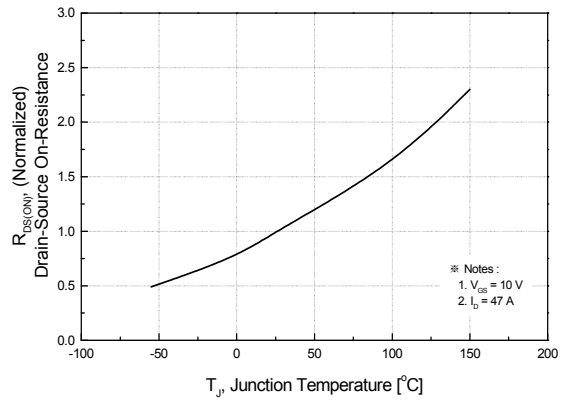


Figure 8. On-Resistance Variation vs. Temperature

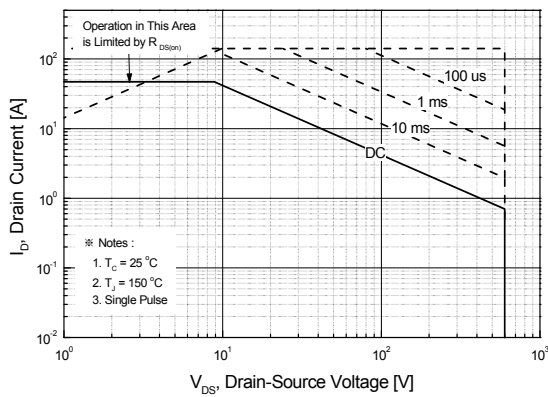


Figure 9. Safe Operating Area

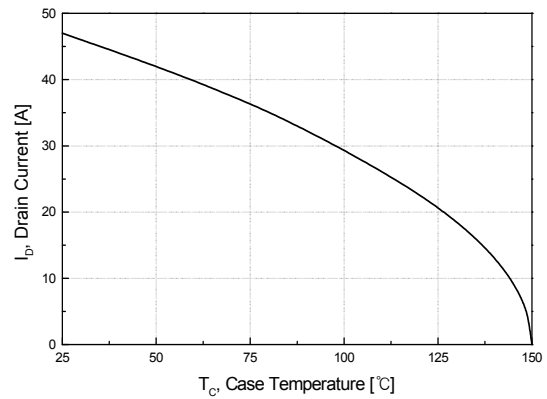


Figure 10. Maximum Drain Current vs. Case Temperature

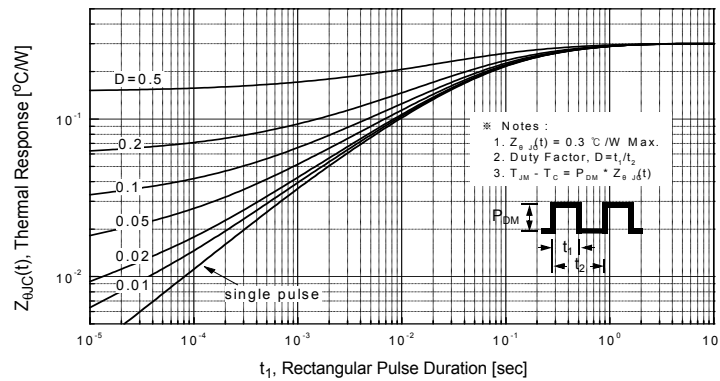
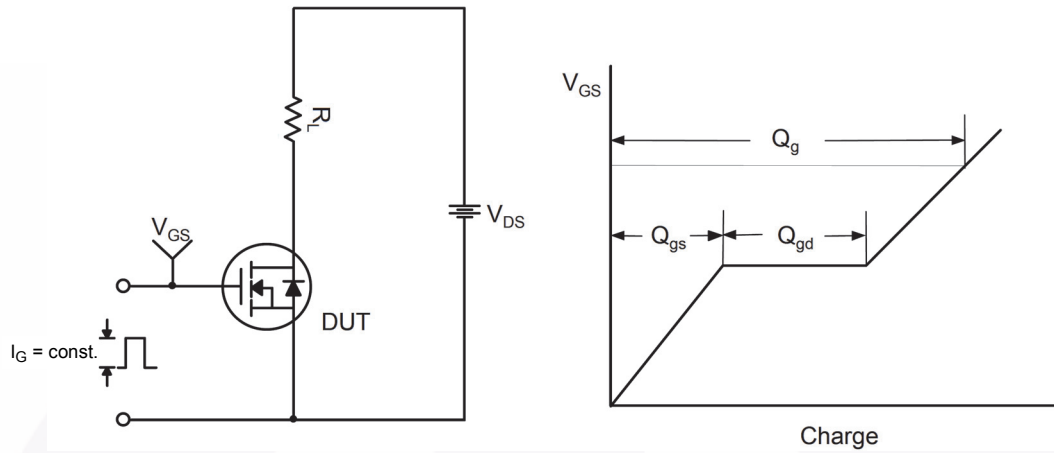


Figure 11. Transient Thermal Response Curve



**Figure 13. Gate Charge Test Circuit & Waveform**



**Figure 14. Resistive Switching Test Circuit & Waveforms**

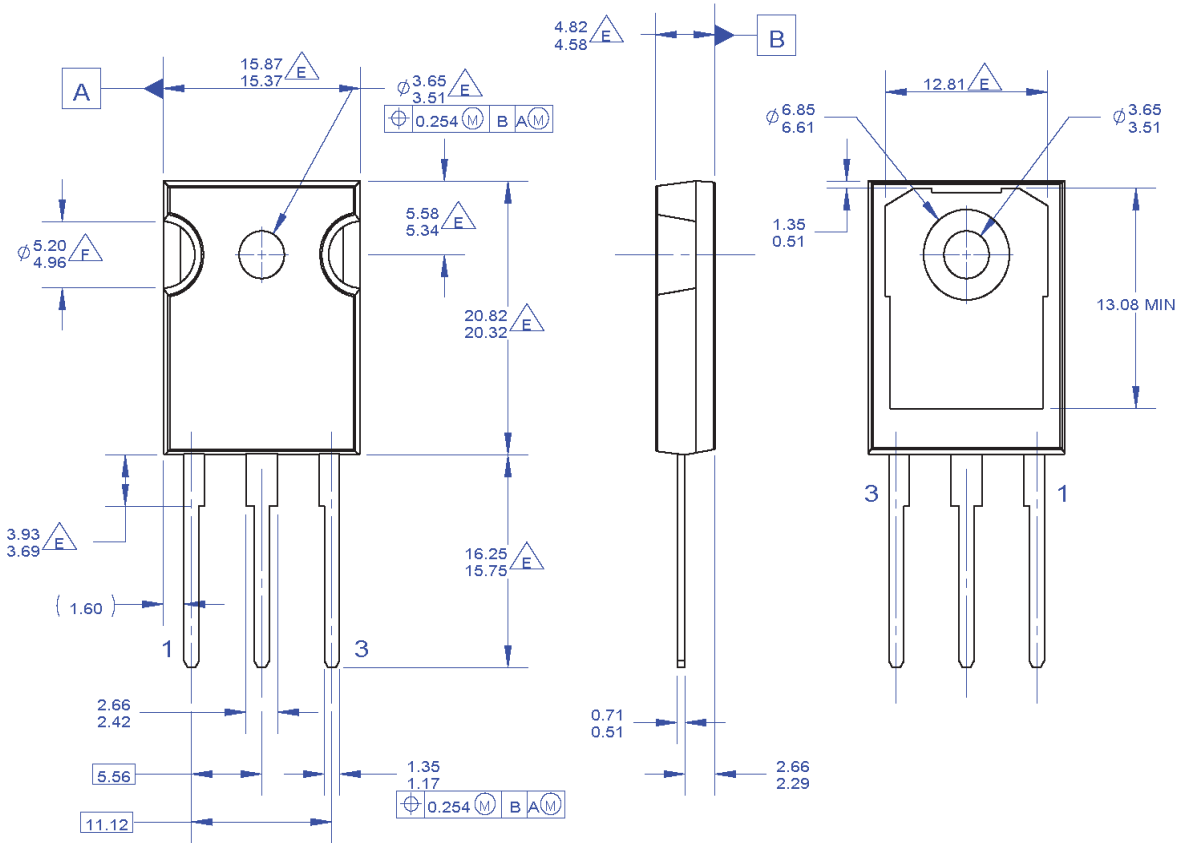


**Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms**



Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

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NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03\_REV03

**Figure 17. TO-247, Molded, 3-Lead, Jedec Variation AB**

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| AX-CAP®*                 | FRFET®                                          | <b>SYSTEM GENERAL</b> ®* |
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|                          | Programmable Active Droop™                      |                          |
|                          | QFET®                                           |                          |
|                          | QS™                                             |                          |
|                          | Quiet Series™                                   |                          |
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|                          | Saving our world, 1mW/W/kW at a time™           |                          |
|                          | SignalWise™                                     |                          |
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|                          | SPM®                                            |                          |
|                          | STEALTH™                                        |                          |
|                          | SuperFET®                                       |                          |
|                          | SuperSOT™-3                                     |                          |
|                          | SuperSOT™-6                                     |                          |
|                          | SuperSOT™-8                                     |                          |
|                          | SupreMOS®                                       |                          |
|                          | SyncFET™                                        |                          |

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