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May 2014

FCA35N60

N-Channel SuperFET[®] MOSFET

600 V, 35 A, 98 mΩ

Features

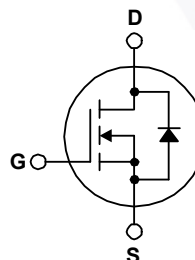
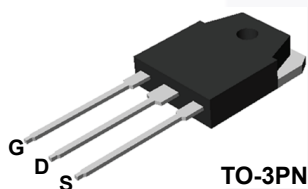
- 650V @ $T_J = 150^{\circ}\text{C}$
- Typ. $R_{DS(on)} = 79\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 139\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 340\text{ pF}$)
- 100% Avalanche Tested

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	FCA35N60	Unit
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate-Source voltage	± 30	V
I_D	Drain Current	- Continuous ($T_C = 25^{\circ}\text{C}$)	A
		- Continuous ($T_C = 100^{\circ}\text{C}$)	
I_{DM}	Drain Current	- Pulsed (Note 1)	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	mJ
I_{AR}	Avalanche Current	(Note 1)	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	V/ns
P_D	Power Dissipation	($T_C = 25^{\circ}\text{C}$)	W
		- Derate Above 25°C	$W/^{\circ}\text{C}$
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	$^{\circ}\text{C}$

Thermal Characteristics

Symbol	Parameter	FCA35N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.4	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	42	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCA35N60	FCA35N60	TO-3PN	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	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}, T_J = 150^\circ\text{C}$	-	650	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	-	0.6	-	V/ $^\circ\text{C}$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\ \text{V}, I_D = 16\ \text{A}$	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\ \text{V}, V_{GS} = 0\ \text{V}$	-	-	1	μA
		$V_{DS} = 480\ \text{V}, T_C = 125^\circ\text{C}$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30\ \text{V}, V_{DS} = 0\ \text{V}$	-	-	± 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	$V_{GS} = 10\ \text{V}, I_D = 17.5\ \text{A}$	-	0.079	0.098	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\ \text{V}, I_D = 17.5\ \text{A}$	-	28.8	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$	-	4990	6640	pF
C_{oss}	Output Capacitance		-	2380	3170	pF
C_{rss}	Reverse Transfer Capacitance		-	140	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 480\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$	-	113	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\ \text{V}$ to $480\ \text{V}, V_{GS} = 0\ \text{V}$	-	340	-	pF
Q_g	Total Gate Charge at 10V	$V_{DS} = 480\ \text{V}, I_D = 35\ \text{A}, V_{GS} = 10\ \text{V}$ (Note 4)	-	139	181	nC
Q_{gs}	Gate to Source Gate Charge		-	31	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	69	-	nC
ESR	Equivalent Series Resistance (G-S)	$f = 1\ \text{MHz}$	-	1.4	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\ \text{V}, I_D = 35\ \text{A}, V_{GS} = 10\ \text{V}, R_G = 4.7\ \Omega$ (Note 4)	-	34	78	ns
t_r	Turn-On Rise Time		-	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		-	105	220	ns
t_f	Turn-Off Fall Time		-	73	155	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current	-	-	35	A	
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	105	A	
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 35 A	-	-	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 35 A, dI _F /dt = 100 A/μs	-	614	-	ns
Q _{rr}	Reverse Recovery Charge		-	16.3	-	μC

Notes:

- 1: Repetitive rating; pulse-width limited by maximum junction temperature.
- 2: $I_{AS} = 17.5\ \text{A}, V_{DD} = 50\ \text{V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
- 3: $I_{SD} \leq 35\ \text{A}, di/dt \leq 200\ \text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
- 4: Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

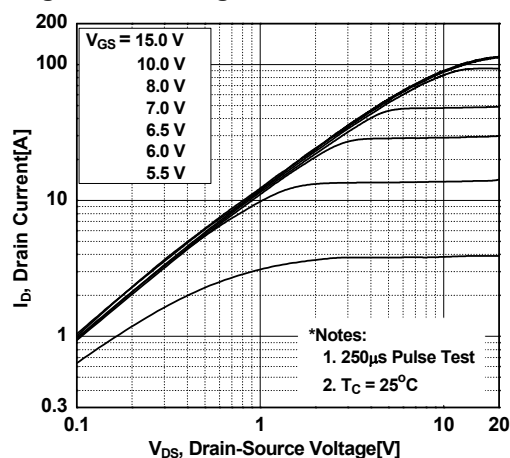


Figure 2. Transfer Characteristics

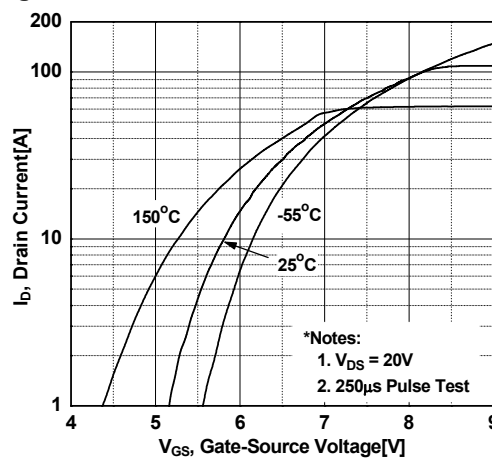


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

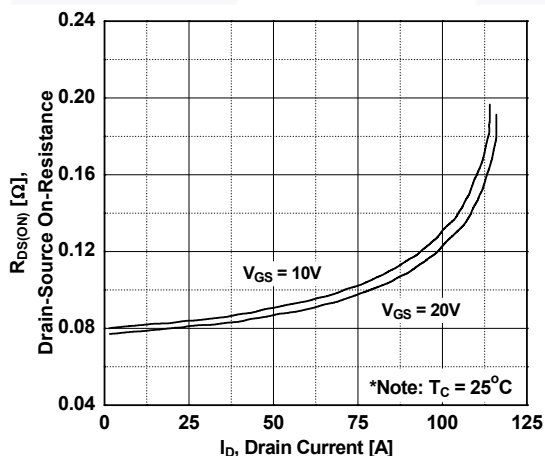


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

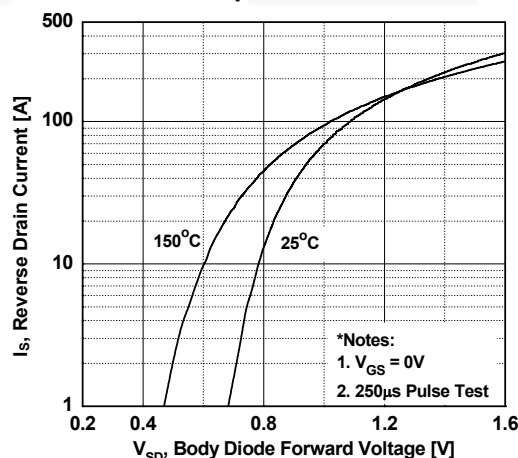


Figure 5. Capacitance Characteristics

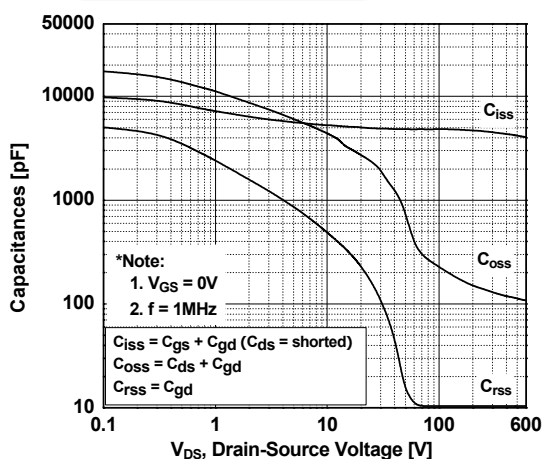
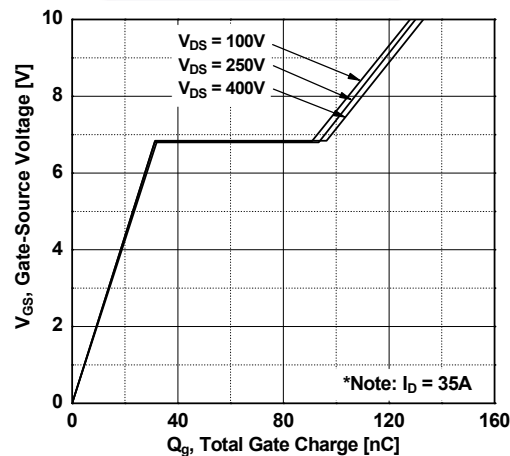


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

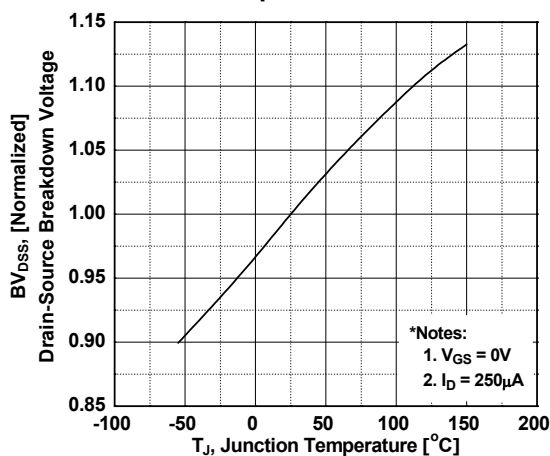


Figure 8. On-Resistance Variation vs. Temperature

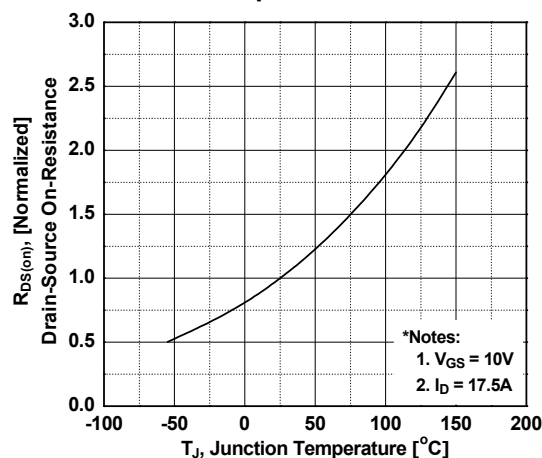


Figure 9. Maximum Safe Operating Area

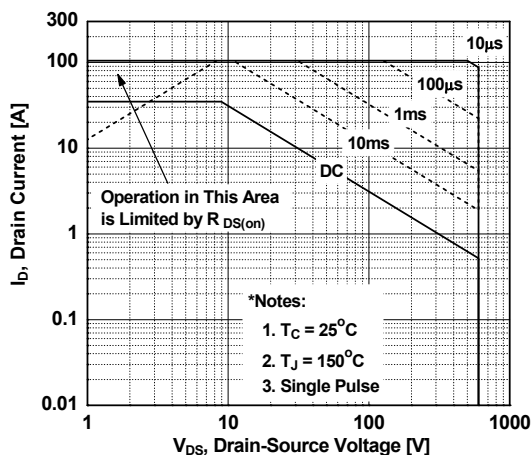


Figure 10. Maximum Drain Current vs. Case Temperature

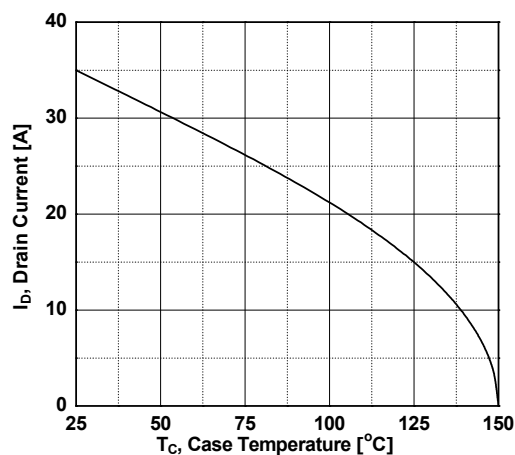
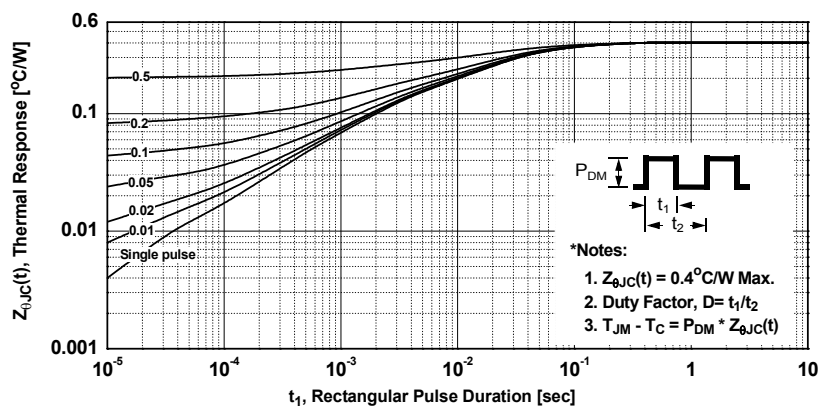


Figure 11. Transient Thermal Response Curve



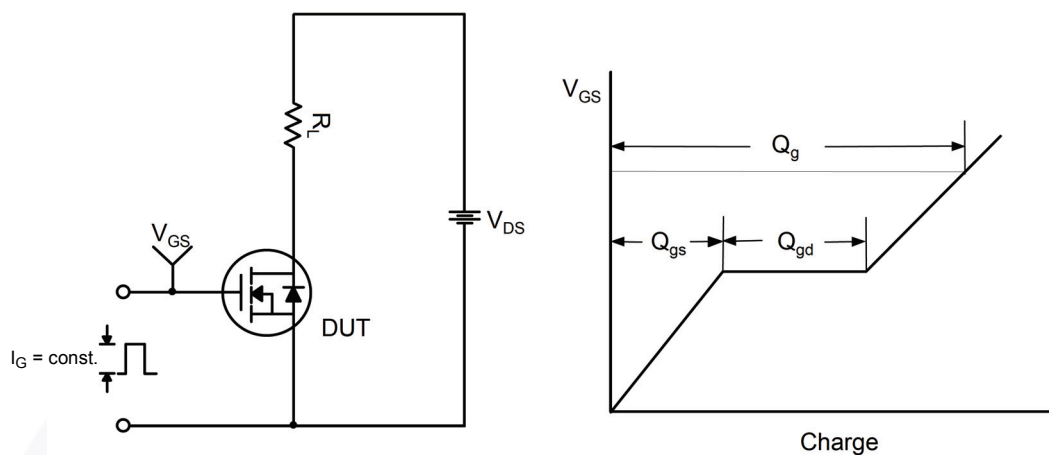


Figure 12. Gate Charge Test Circuit & Waveform

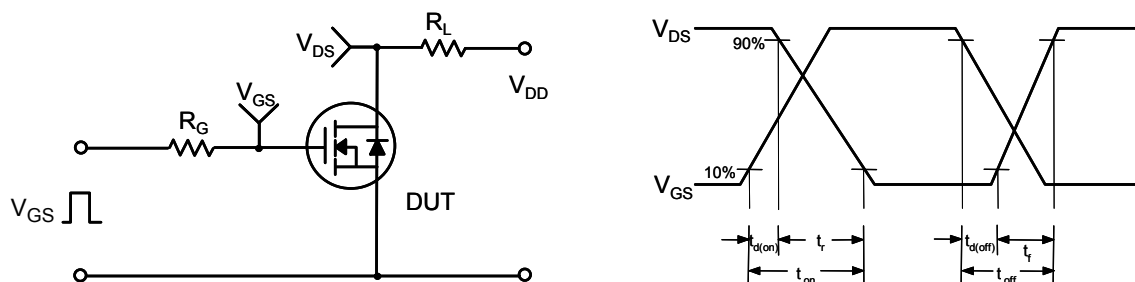


Figure 13. Resistive Switching Test Circuit & Waveforms

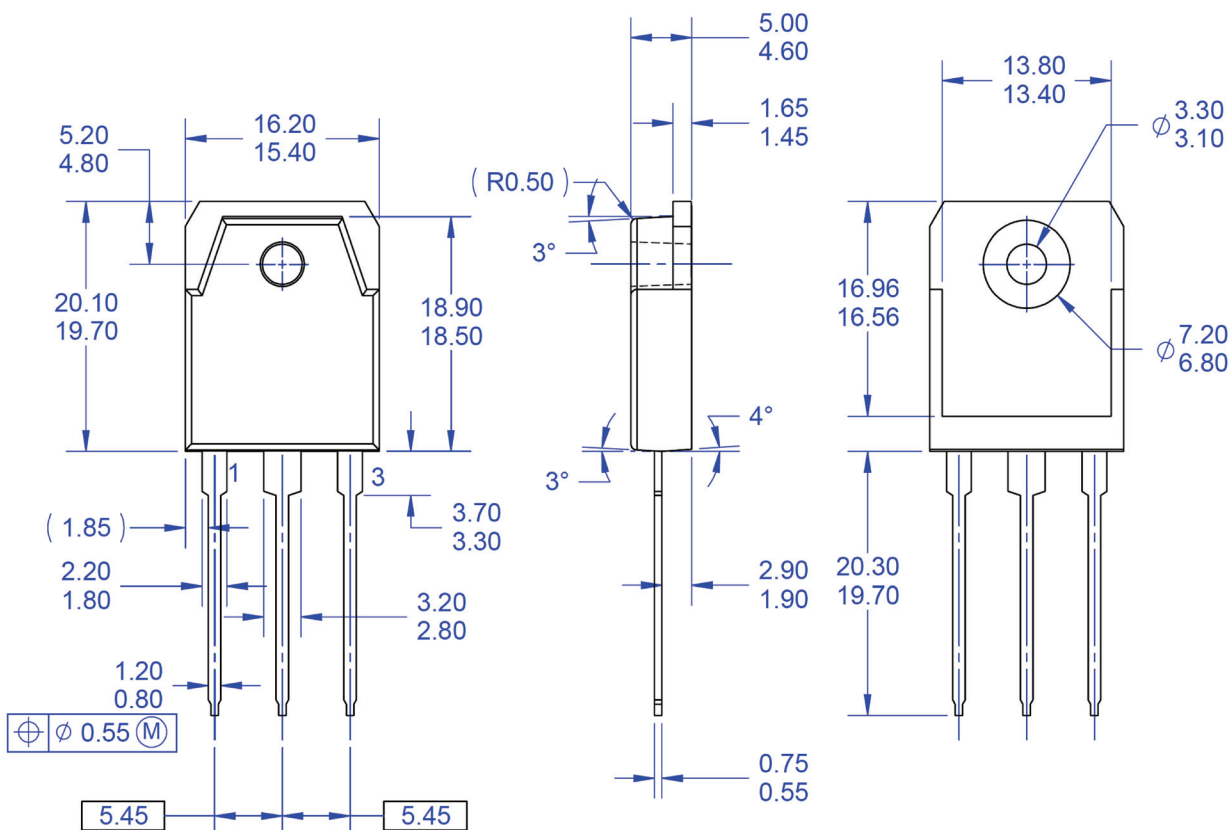


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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