

FAIRCHILD
SEMICONDUCTOR®

August 2009
SupreMOS™

FCP16N60N / FCPF16N60NT

N-Channel MOSFET

600V, 16A, 0.170Ω

Features

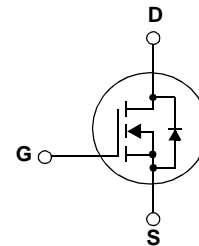
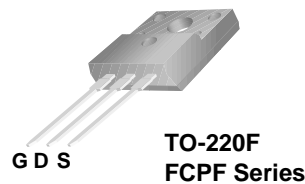
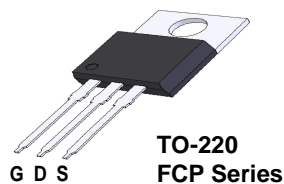
- $R_{DS(on)} = 0.17\Omega$ (Typ.) @ $V_{GS} = 10V$, $I_D = 8A$
- Ultra low gate charge (Typ. $Q_g = 40.2nC$)
- Low effective output capacitance
- 100% avalanche tested
- RoHS compliant



Description

The SupreMOS MOSFET, Fairchild's next generation of high voltage super-junction MOSFETs, employs a deep trench filling process that differentiates it from preceding multi-epi based technologies. By utilizing this advanced technology and precise process control, SupreMOS provides world class R_{sp} , superior switching performance and ruggedness.

This SupreMOS MOSFET fits the industry's AC-DC SMPS requirements for PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



FCP16N60N / FCPF16N60NT N-Channel MOSFET

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

Symbol	Parameter	FCP16N60N	FCPF16N60NT	Units
V_{DSS}	Drain to Source Voltage	600		V
V_{GSS}	Gate to Source Voltage	± 30		V
I_D	Drain Current	-Continuous ($T_C = 25^\circ C$)	16.0	16.0*
		-Continuous ($T_C = 100^\circ C$)	10.1	10.1*
I_{DM}	Drain Current	- Pulsed (Note 1)	48.0	48.0*
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)		355
I_{AR}	Avalanche Current			5.3
E_{AR}	Repetitive Avalanche Energy			1.34
dv/dt	MOSFET dv/dt Ruggedness			100
	Peak Diode Recovery dv/dt	(Note 3)		20
P_D	Power Dissipation	($T_C = 25^\circ C$)	134.4	35.7
		- Derate above $25^\circ C$	1.08	0.29
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCP16N60N	FCPF16N60NT	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.93	3.5	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.5	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCP16N60N	FCP16N60N	TO-220	-	-	50
FCPF16N60NT	FCPF16N60NT	TO-220F	-	-	50

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	$I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_C = 25^\circ\text{C}$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{mA}$, Referenced to 25°C	-	0.73	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	10	μA
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$	-	-	100	μA
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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 8\text{A}$	-	0.170	0.199	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 8\text{A}$	-	13	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1630	2170	pF
C_{oss}	Output Capacitance		-	70	95	pF
C_{rss}	Reverse Transfer Capacitance		-	5	10	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	40	60	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	176	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 8\text{A},$ $V_{GS} = 10\text{V}$ (Note 4)	-	40.2	52.3	nC
Q_{gs}	Gate to Source Gate Charge		-	6.7	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	12.9	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open	-	2.9	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 8\text{A}$ $R_G = 4.7\Omega$ (Note 4)	-	15.8	41.6	ns
t_r	Turn-On Rise Time		-	15.5	41.0	ns
$t_{d(off)}$	Turn-Off Delay Time		-	60.3	130.6	ns
t_f	Turn-Off Fall Time		-	20.2	50.4	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	16	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	48	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 8\text{A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 8\text{A}$	-	319	-	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	4.4	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 5.3\text{A}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 16\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} = 380\text{V}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

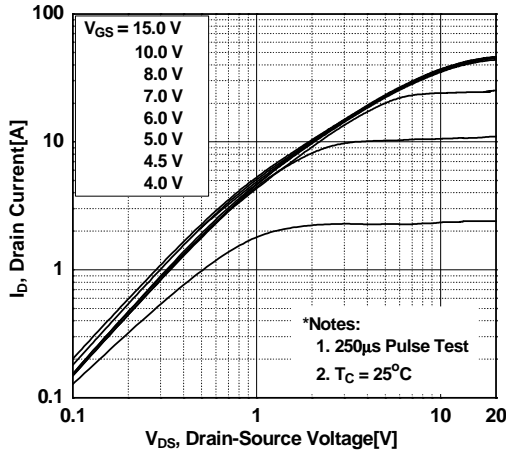


Figure 2. Transfer Characteristics

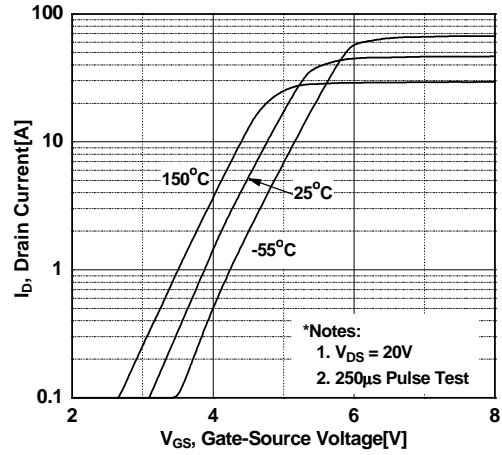


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

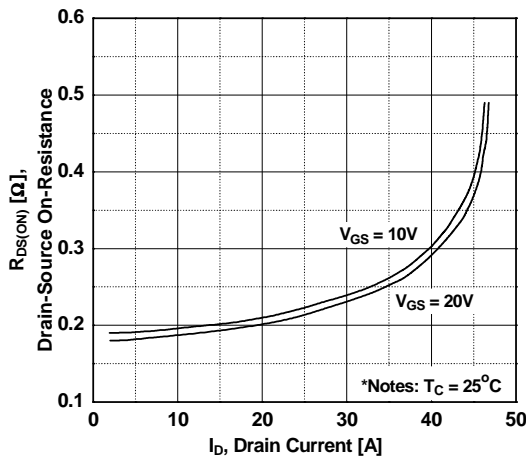


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

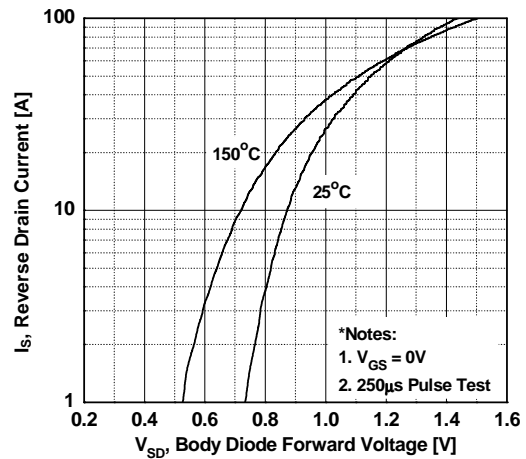


Figure 5. Capacitance Characteristics

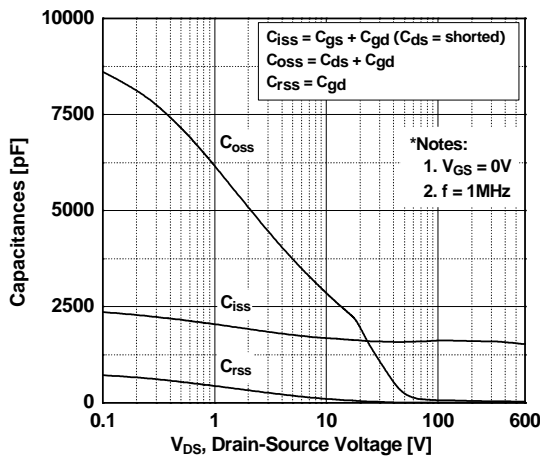
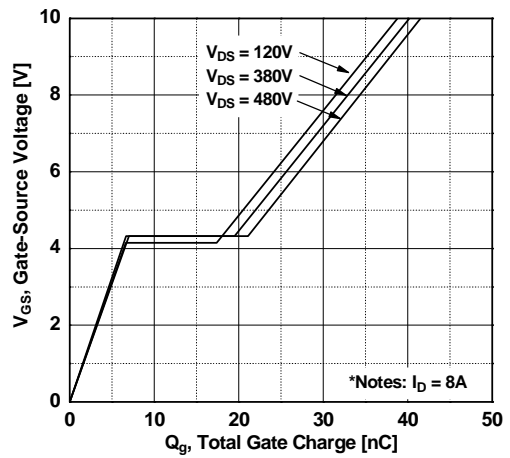


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

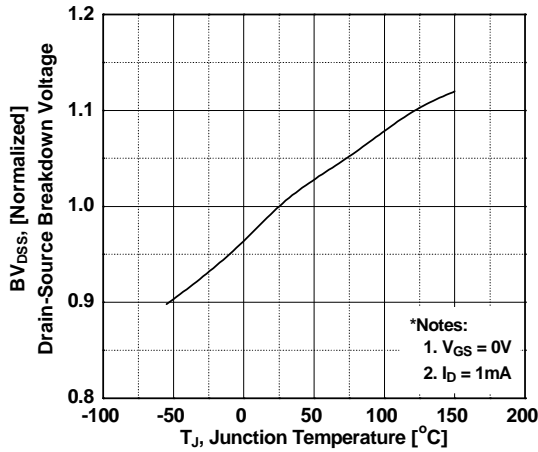


Figure 8. On-Resistance Variation vs. Temperature

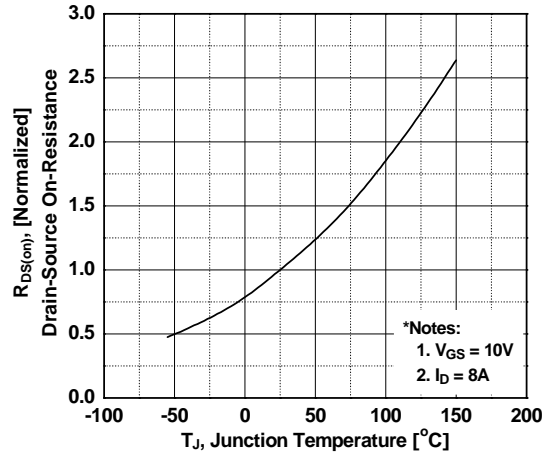


Figure 9. Maximum Safe Operating Area _ FCP16N60N

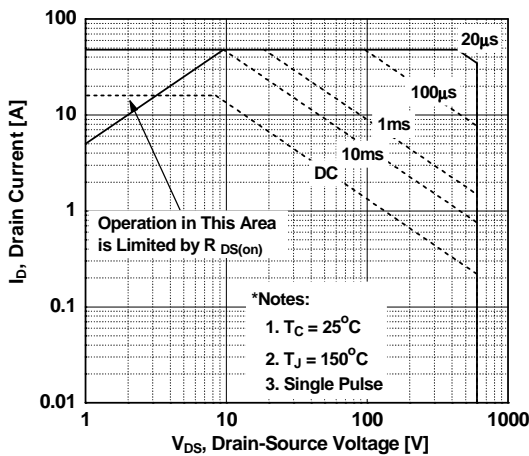


Figure 10. Maximum Safe Operating Area _ FCPF16N60NT

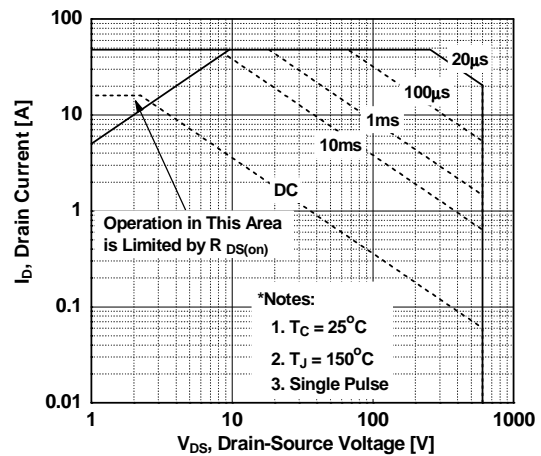
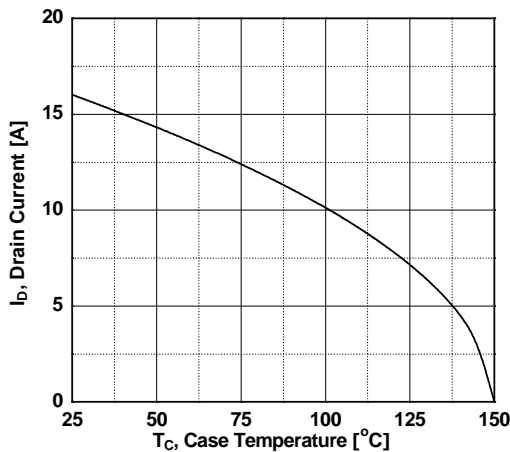


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve _ FCP16N60N

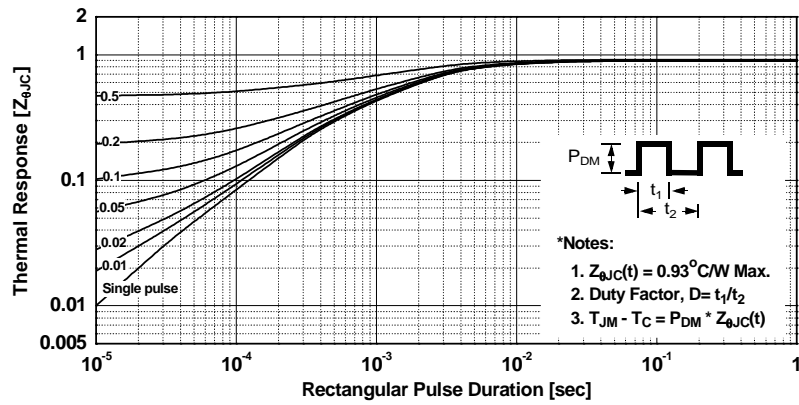
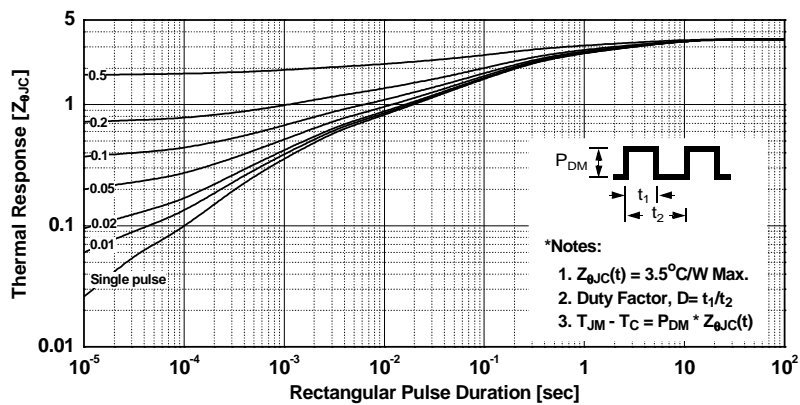
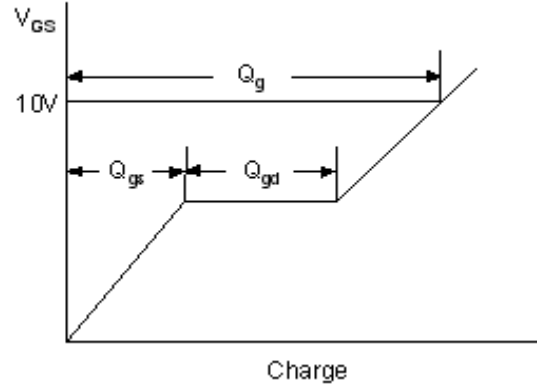
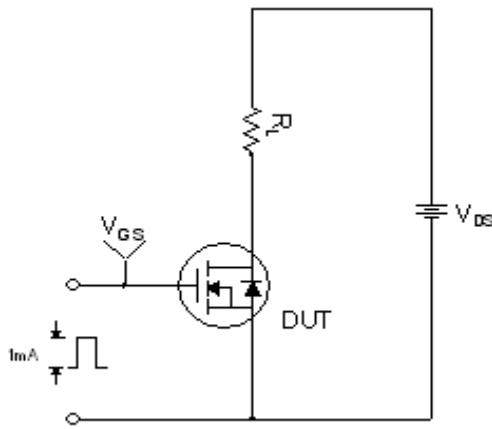


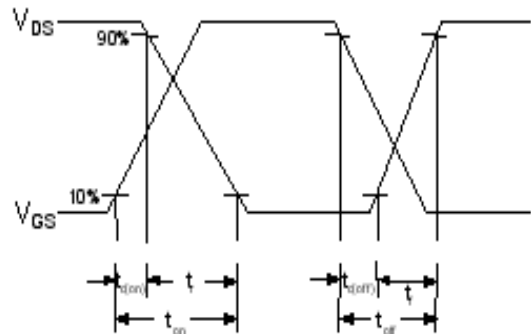
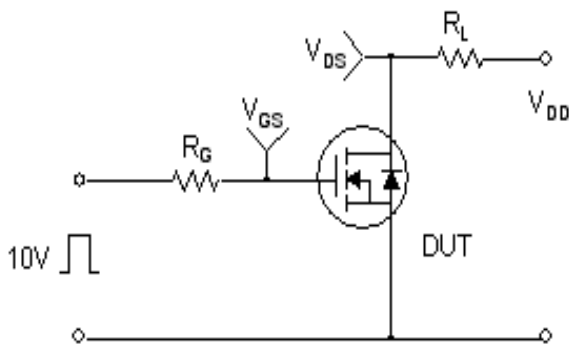
Figure 13. Transient Thermal Response Curve _ FCPF16N60NT



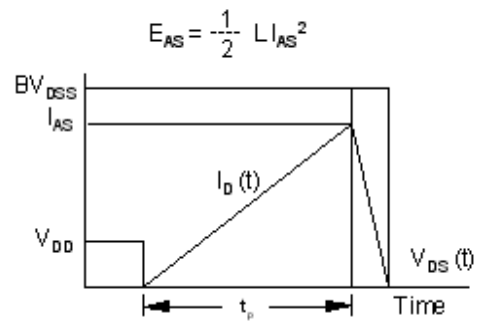
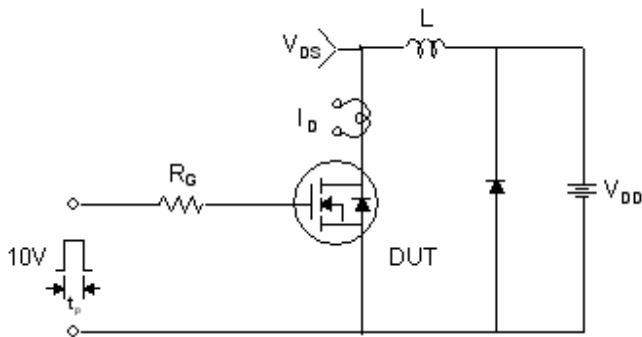
Gate Charge Test Circuit & Waveform



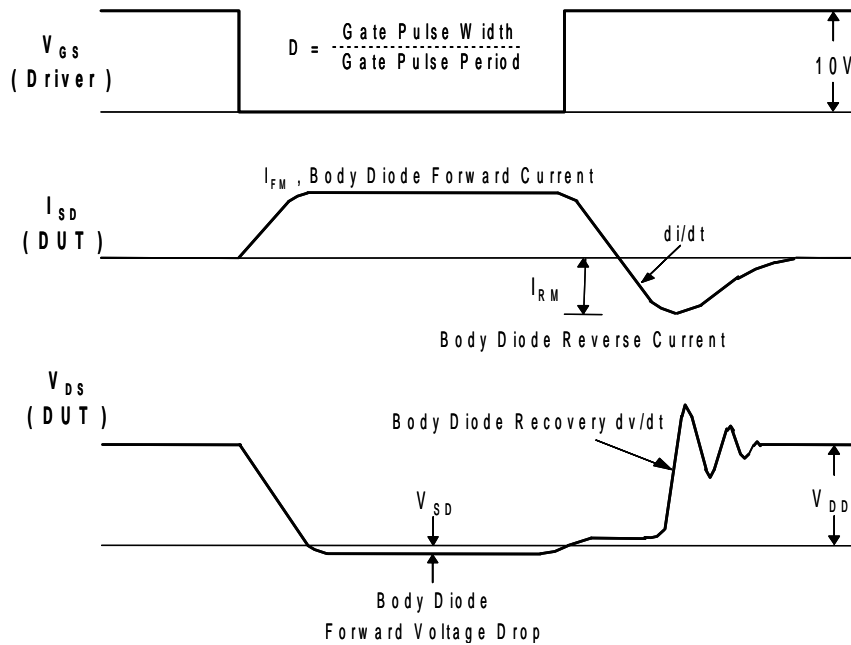
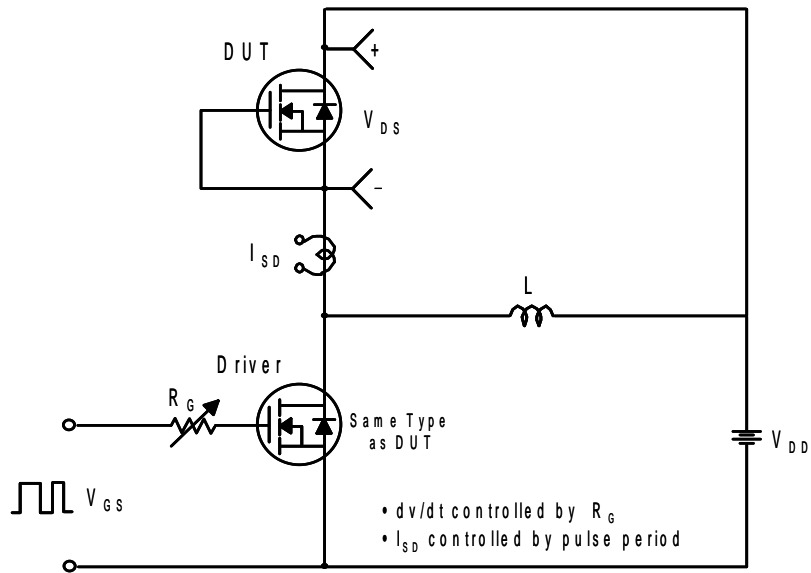
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

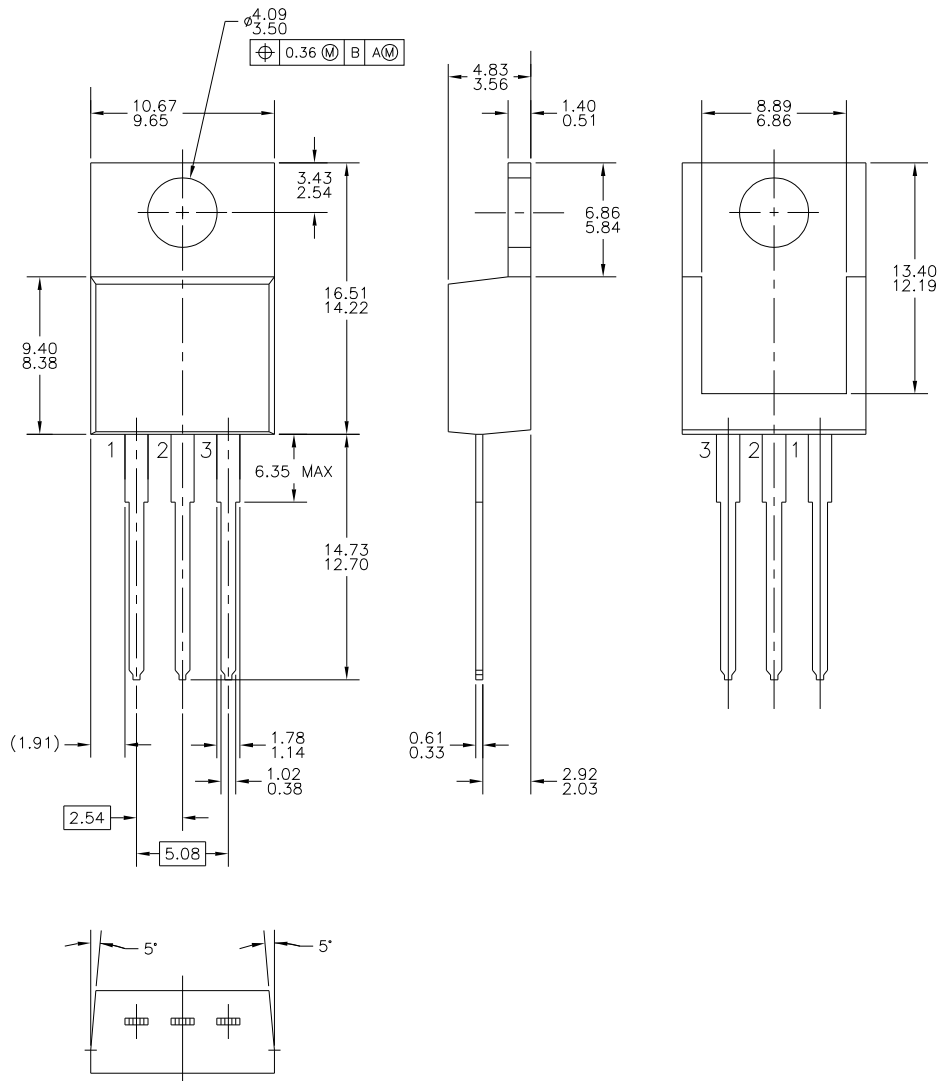


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-220

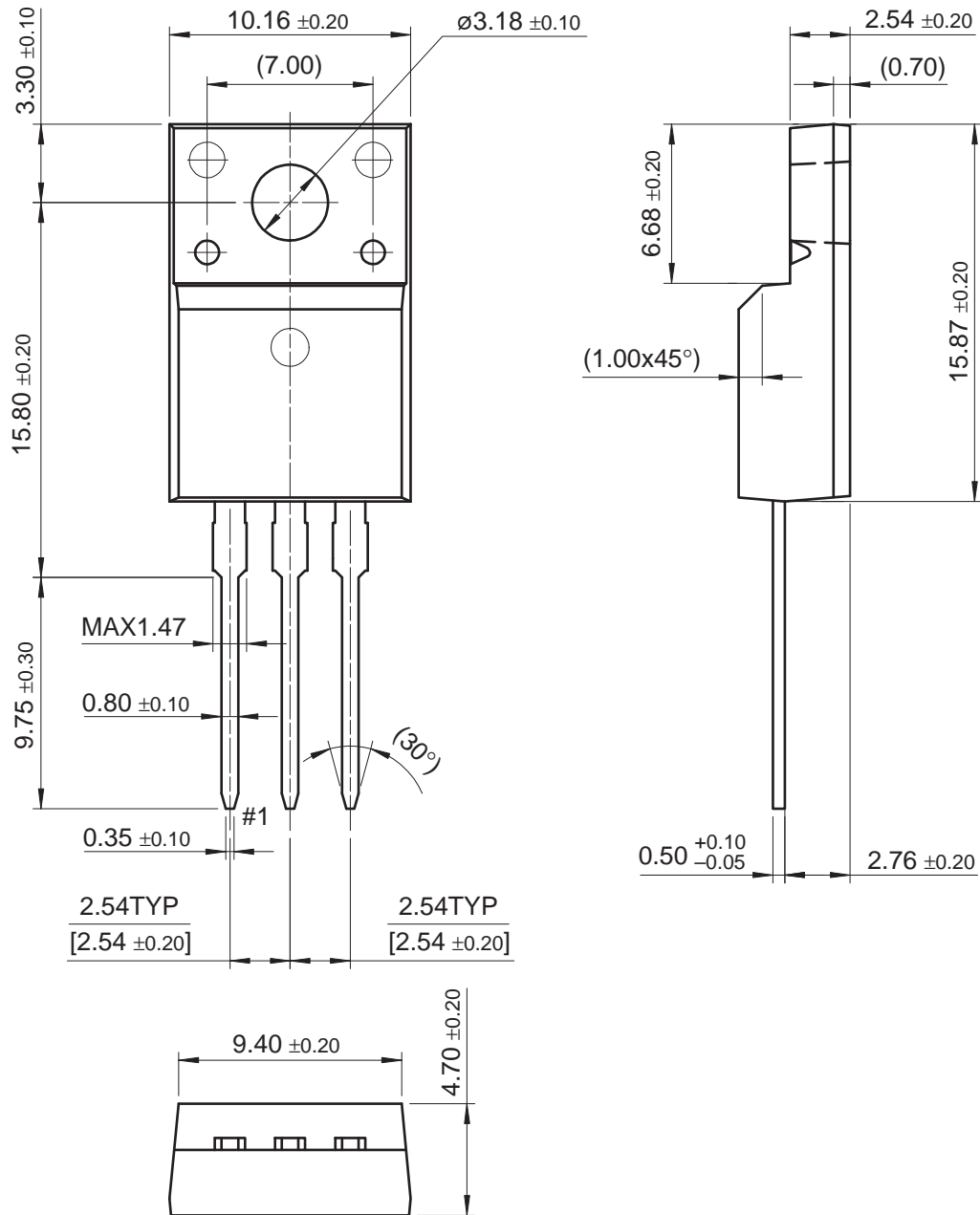


Dimensions in Millimeters

FCP16N60N / FCPF16N60NT N-Channel MOSFET

Mechanical Dimensions

TO-220F








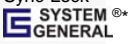
Dimensions in Millimeters

FCP16N60N / FCPF16N60NT N-Channel MOSFET



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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.
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