

# FCP11N60N / FCPF11N60NT

## N-Channel MOSFET

600V, 10.8A, 0.299Ω

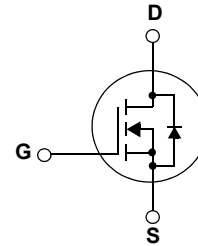
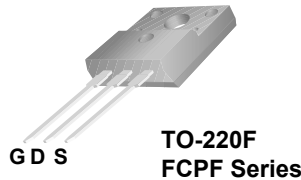
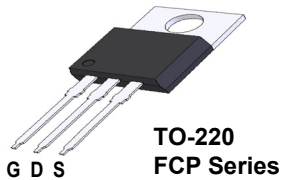
### Features

- $R_{DS(on)} = 0.255\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 5.4A$
- Ultra Low Gate Charge (Typ.  $Q_g = 27.4nC$ )
- 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.



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

Symbol	Parameter	FCP11N60N	FCPF11N60NT	Units
$V_{DSS}$	Drain to Source Voltage	600		V
$V_{GSS}$	Gate to Source Voltage	±30		V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ C$ )	10.8	10.8*
		-Continuous ( $T_C = 100^\circ C$ )	6.8	6.8*
$I_{DM}$	Drain Current	- Pulsed (Note 1)	32.4	32.4*
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	201.7		mJ
$I_{AR}$	Avalanche Current	3.7		A
$E_{AR}$	Repetitive Avalanche Energy	0.94		mJ
dv/dt	MOSFET dv/dt Ruggedness	100		V/ns
	Peak Diode Recovery dv/dt (Note 3)	20		V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	94.0	32.1
		- Derate above $25^\circ C$	0.75	0.26
$T_J, T_{STG}$	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		$^\circ C$

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FCP11N60N	FCPF11N60NT	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.33	3.9	$^\circ C/W$
$R_{\theta CS}$	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
FCP11N60N	FCP11N60N	TO-220	-	-	50
FCPF11N60NT	FCPF11N60NT	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	$I_D = 1\text{mA}, \text{Referenced to } 25^\circ\text{C}$	-	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	$\mu\text{A}$
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 5.4\text{A}$	-	0.255	0.299	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 5.4\text{A}$	-	13.5	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1130	1505	pF
$C_{oss}$	Output Capacitance		-	45	60	pF
$C_{rss}$	Reverse Transfer Capacitance		-	3	5	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	25	-	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	130	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 5.4\text{A},$ $V_{GS} = 10\text{V}$ (Note 4)	-	27.4	35.6	nC
$Q_{gs}$	Gate to Source Gate Charge		-	4.9	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	8.8	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open	-	2.0	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 5.4\text{A}$ $R_G = 4.7\Omega$ (Note 4)	-	13.6	37.2	ns
$t_r$	Turn-On Rise Time		-	9.1	28.2	ns
$t_{d(off)}$	Turn-Off Delay Time		-	42.0	94.0	ns
$t_f$	Turn-Off Fall Time		-	10.0	30.0	ns

### Drain-Source Diode Characteristics

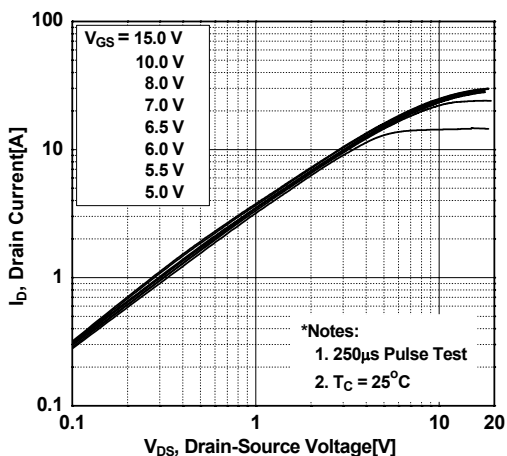
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	10.8	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	32.4	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 5.4\text{A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 5.4\text{A}$	-	268	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$	-	3.1	-	$\mu\text{C}$

#### Notes:

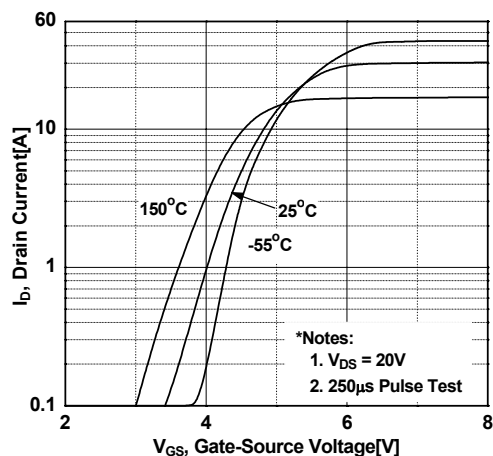
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 3.7\text{A}, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 10.8\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} = 380\text{V}, \text{Starting } T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

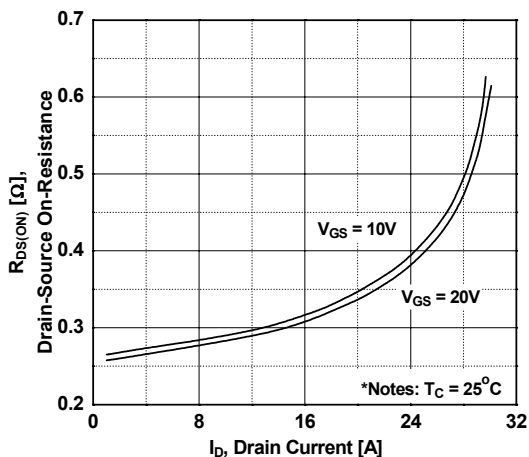
**Figure 1. On-Region Characteristics**



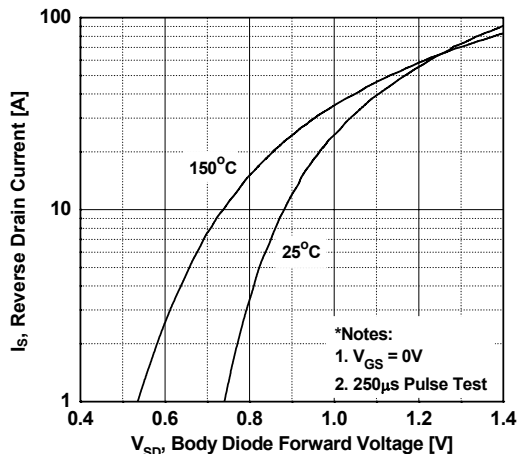
**Figure 2. Transfer Characteristics**



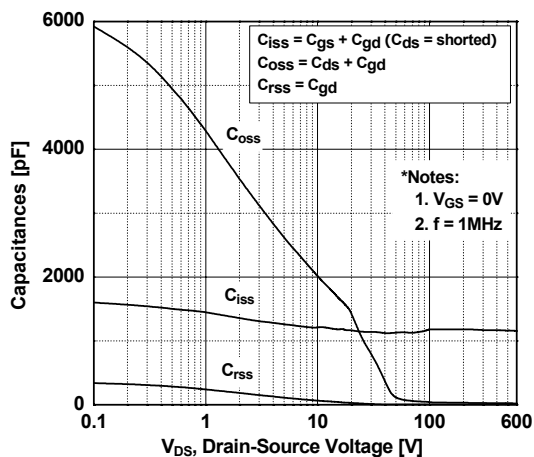
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



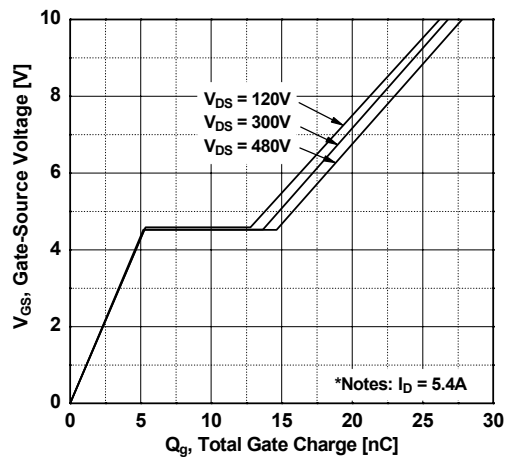
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

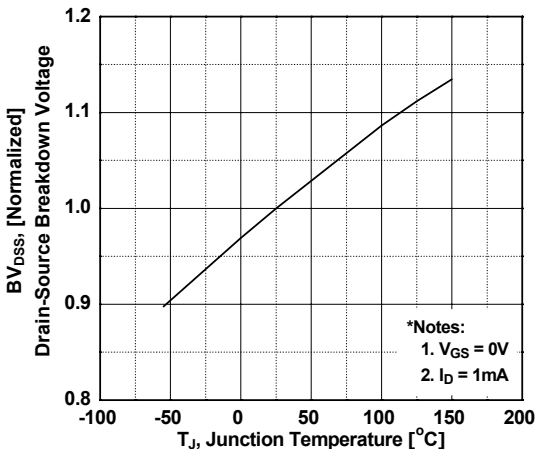


**Figure 6. Gate Charge Characteristics**

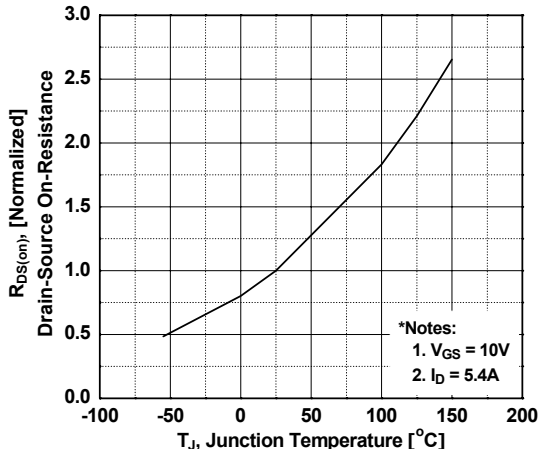


**Typical Performance Characteristics** (Continued)

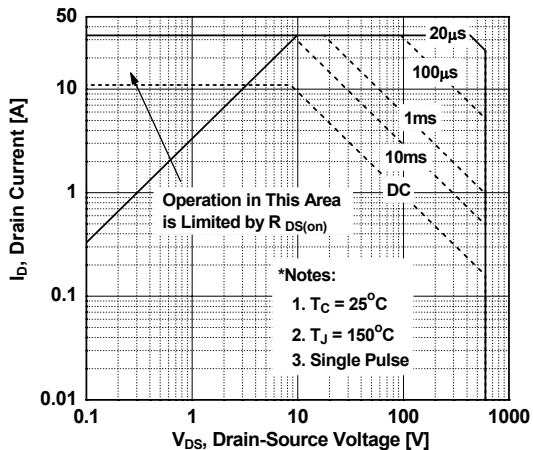
**Figure 7. Breakdown Voltage Variation vs. Temperature**



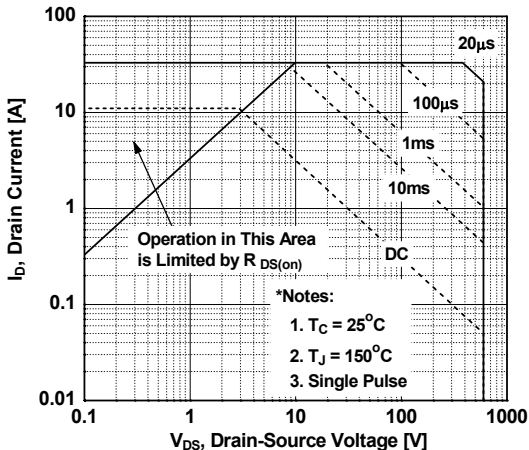
**Figure 8. On-Resistance Variation vs. Temperature**



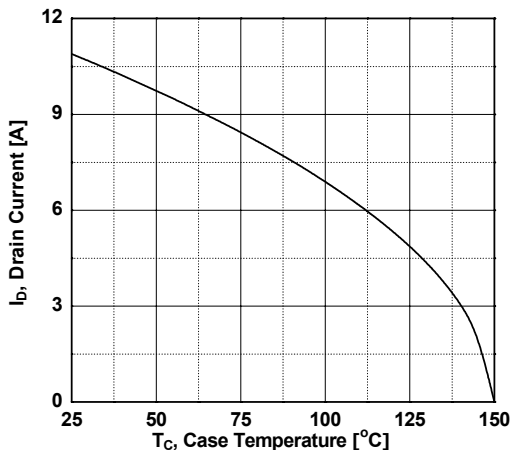
**Figure 9. Maximum Safe Operating Area \_ FCP11N60N**



**Figure 10. Maximum Safe Operating Area \_ FCPF11N60NT**



**Figure 11. Maximum Drain Current vs. Case Temperature**



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve \_ FCP11N60N

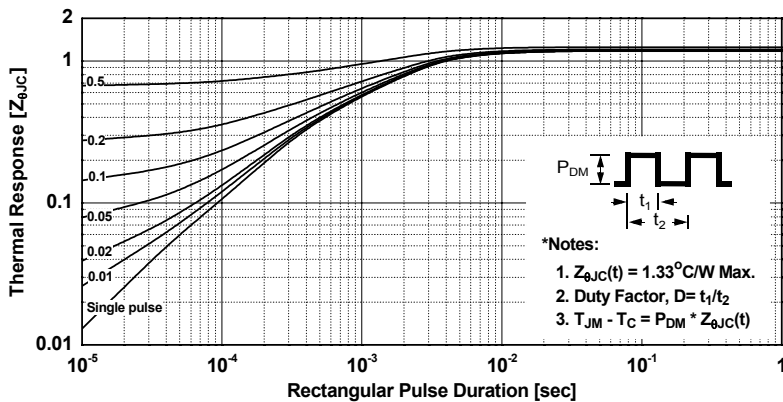
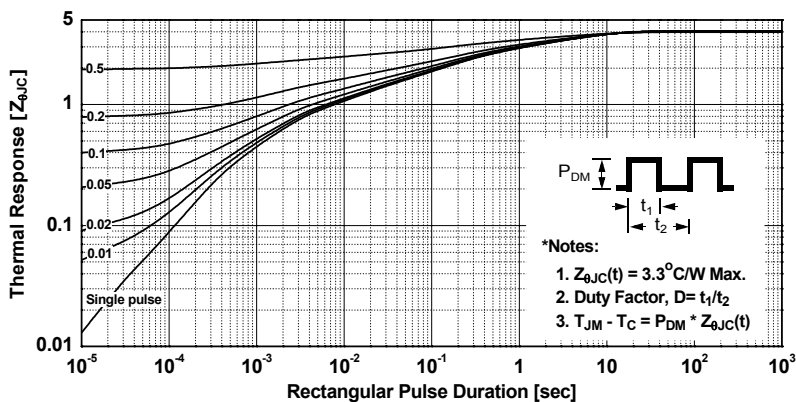
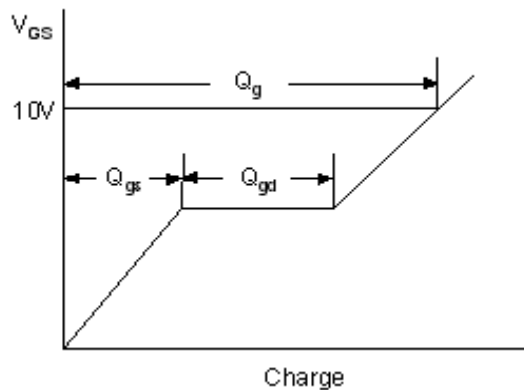
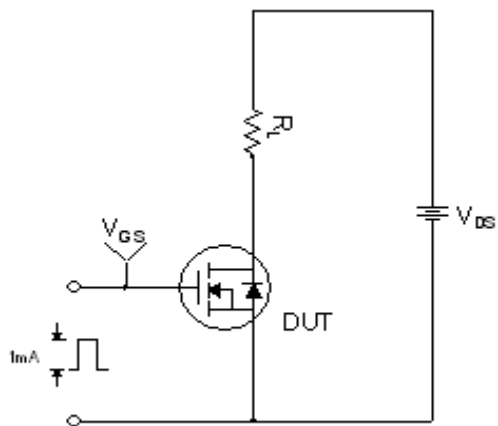


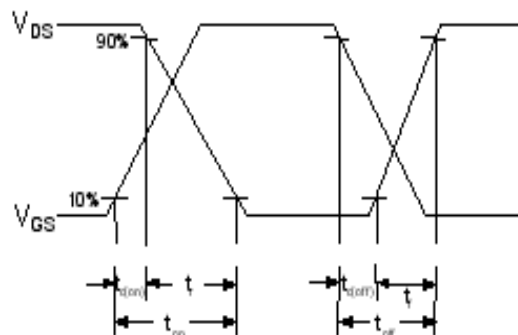
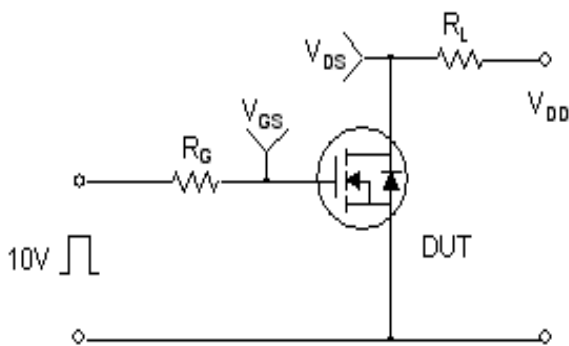
Figure 13. Transient Thermal Response Curve \_ FCPF11N60NT



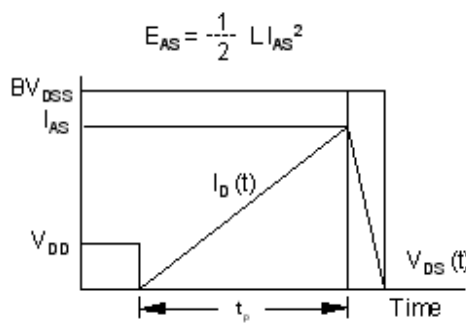
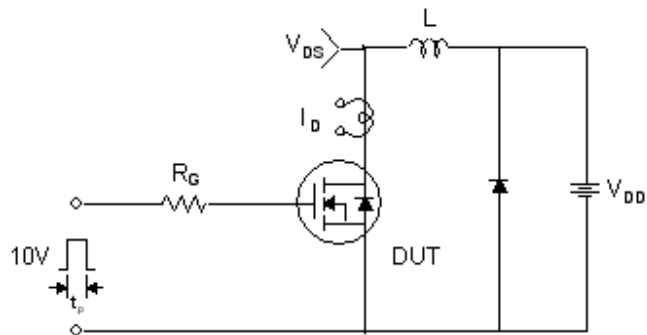
**Gate Charge Test Circuit & Waveform**



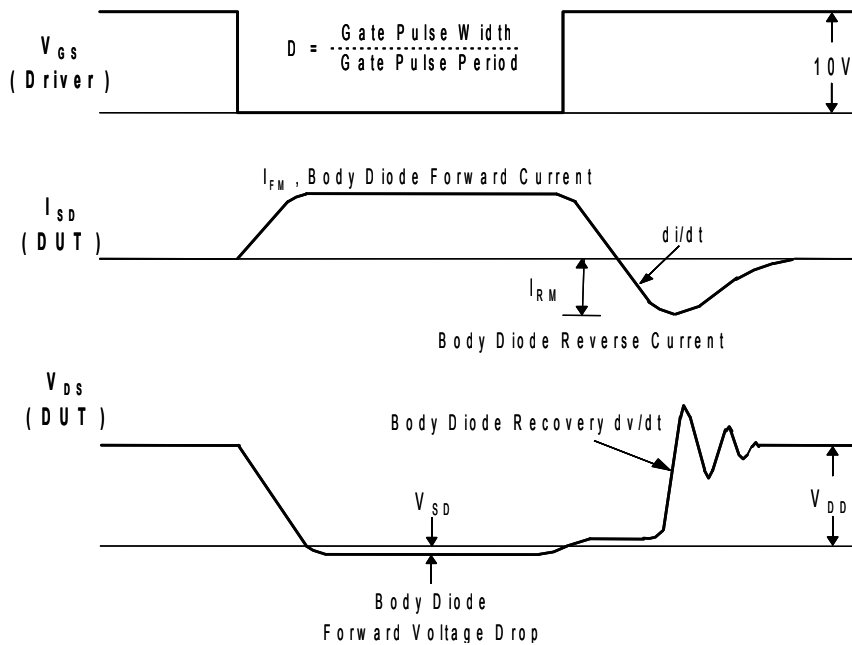
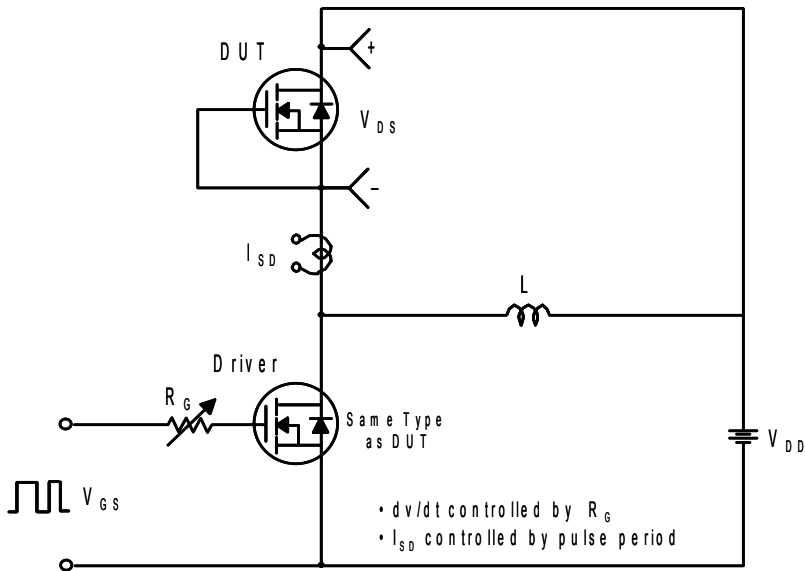
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

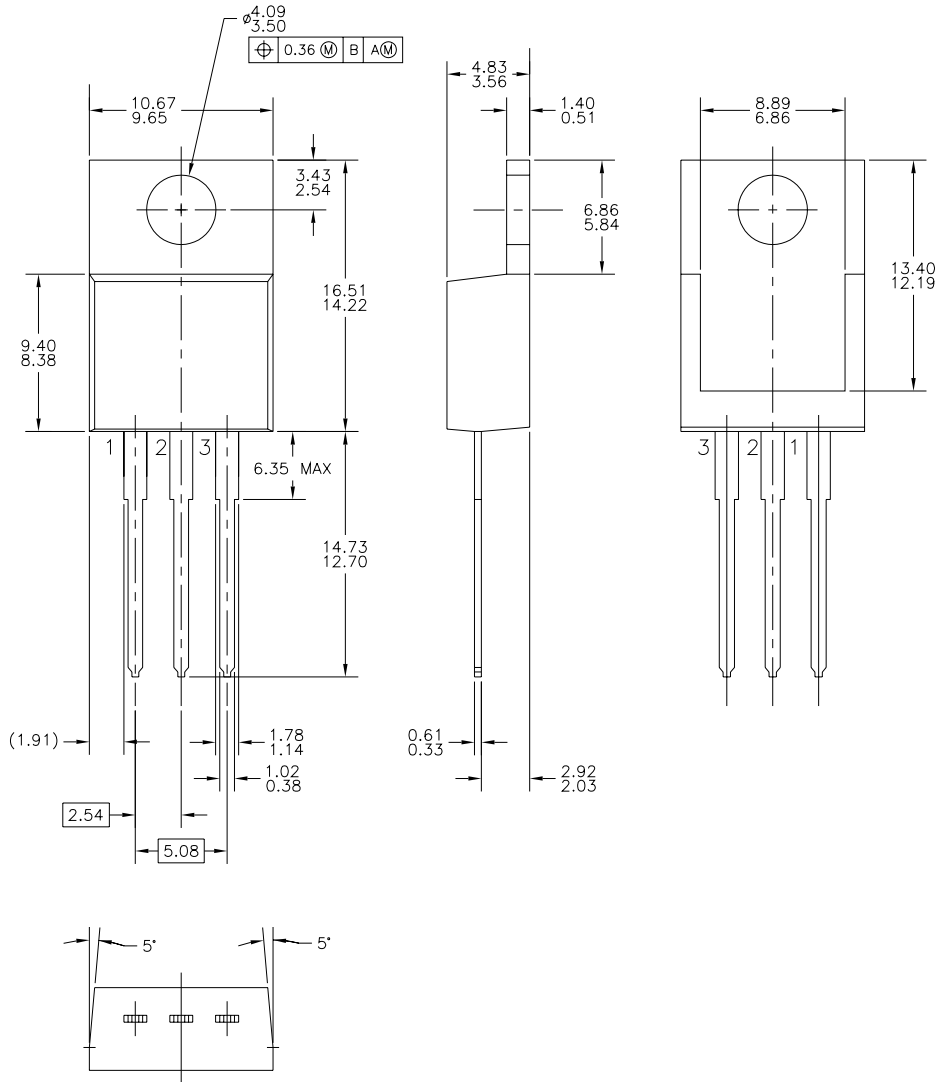


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-220

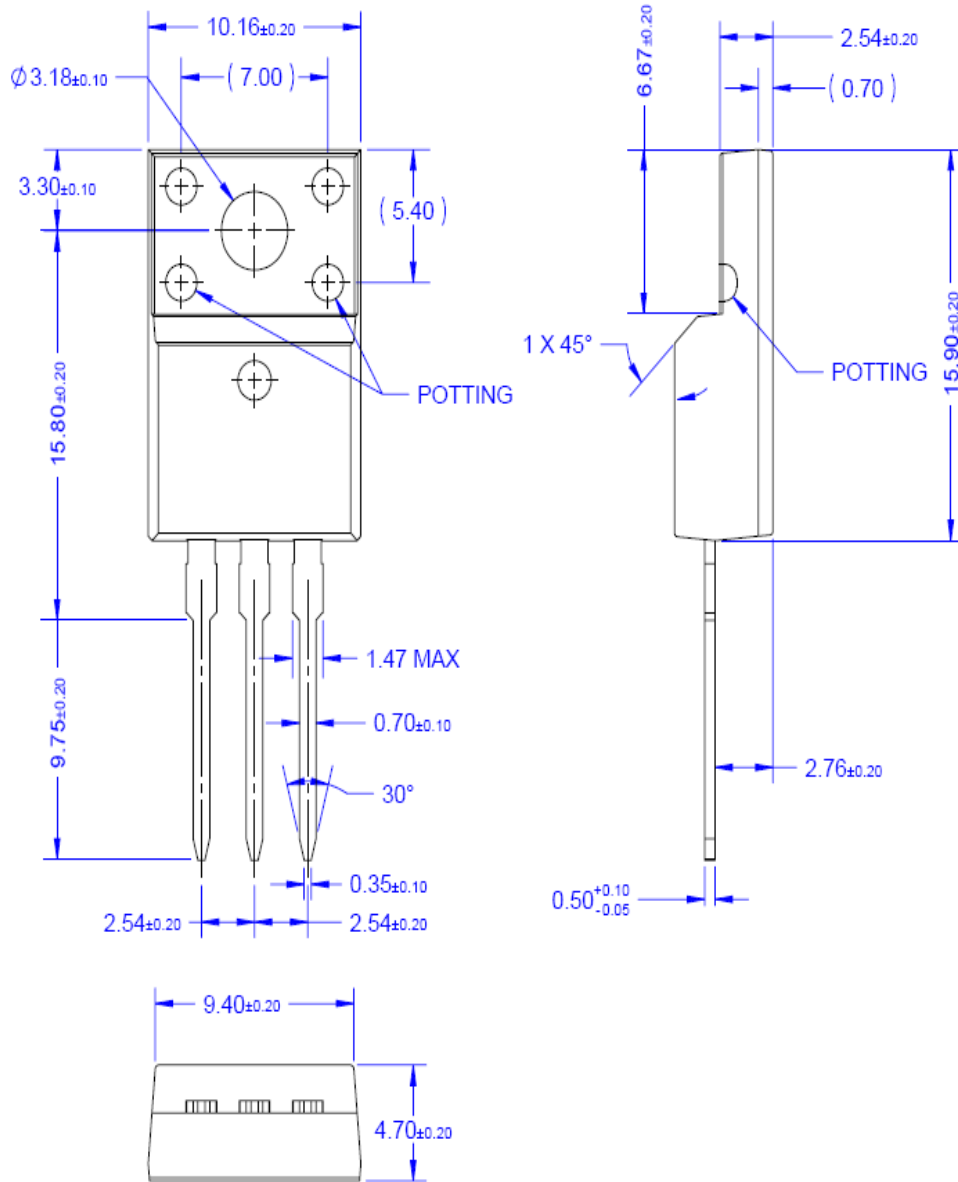


Dimensions in Millimeters



Mechanical Dimensions

TO-220F









Dimensions in Millimeters



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- |                                                                                      |                                                                                     |                                                                                      |                                                                                       |
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| AccuPower™                                                                           | FPS™                                                                                | PowerTrench®                                                                         | The Power Franchise®                                                                  |
| Auto-SPM™                                                                            | F-PFS™                                                                              | PowerXS™                                                                             | the power®                                                                            |
| Build it Now™                                                                        | FRFET®                                                                              | Programmable Active Droop™                                                           | franchise                                                                             |
| CorePLUS™                                                                            | Global Power ResourceSM                                                             | QFET®                                                                                | TinyBoost™                                                                            |
| CorePOWER™                                                                           | Green FPS™                                                                          | QS™                                                                                  | TinyBuck™                                                                             |
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| CTL™                                                                                 | Gmax™                                                                               | RapidConfigure™                                                                      | TinyLogic®                                                                            |
| Current Transfer Logic™                                                              | GTO™                                                                                |  ™  | TINYOPTO™                                                                             |
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| EfficientMax™                                                                        | ISOPLANAR™                                                                          | SmartMax™                                                                            | TinyPWM™                                                                              |
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|  ™  | MicroFET™                                                                           | STEALTH™                                                                             | TRUECURRENT™*                                                                         |
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| FACT Quiet Series™                                                                   | MotionMax™                                                                          | SuperSOT™-6                                                                          | Ultra FRFET™                                                                          |
| FACT®                                                                                | Motion-SPM™                                                                         | SuperSOT™-8                                                                          | UniFET™                                                                               |
| FAST®                                                                                | OPTOLOGIC®                                                                          | SupreMOS™                                                                            | VCX™                                                                                  |
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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.
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.
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Rev. I41