

FCP11N60N / FCPF11N60NT

N-Channel SupreMOS® MOSFET

600 V, 10.8 A, 299 mΩ

Features

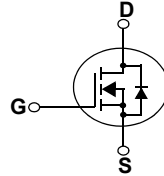
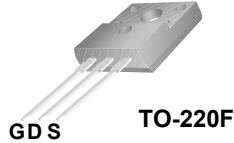
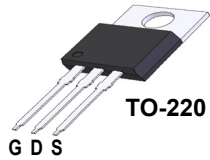
- $R_{DS(on)} = 255 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 5.4 \text{ A}$
- Ultra Low Gate Charge (Typ. $Q_g = 27.4 \text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss,eff} = 130 \text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Application

- LCD/LED/PDP TV
- Lighting
- Solar Inverter
- AC-DC Power Supply

Description

The SupreMOS® MOSFET is Fairchild Semiconductor®'s next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest Rsp on-resistance, superior switching performance and ruggedness. SupreMOS MOSFET is suitable for high frequency switching power converter 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	FCP11N60N	FCPF11N60NT	Unit
V_{DSS}	Drain to Source Voltage	600		V
V_{GSS}	Gate to Source Voltage	±30		V
I_D	Drain Current	-Continuous ($T_C = 25^\circ\text{C}$)	10.8	10.8*
		-Continuous ($T_C = 100^\circ\text{C}$)	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	($T_C = 25^\circ\text{C}$)	94.0	32.1
		- Derate above 25°C	0.75	0.26
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCP11N60N	FCPF11N60NT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.33	3.9	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	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.	Unit
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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	-	$V/^\circ\text{C}$
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	$V_{GS} = 10\text{ V}, I_D = 5.4\text{ A}$	-	0.255	0.299	Ω
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	-	Ω

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	-	μC

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

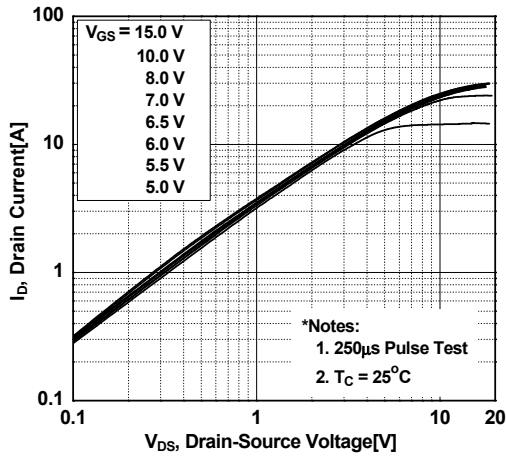


Figure 2. Transfer Characteristics

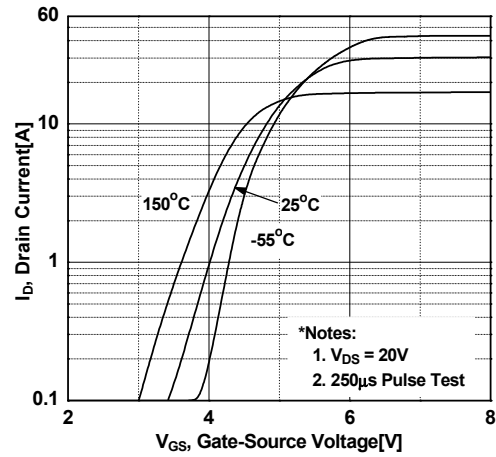


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

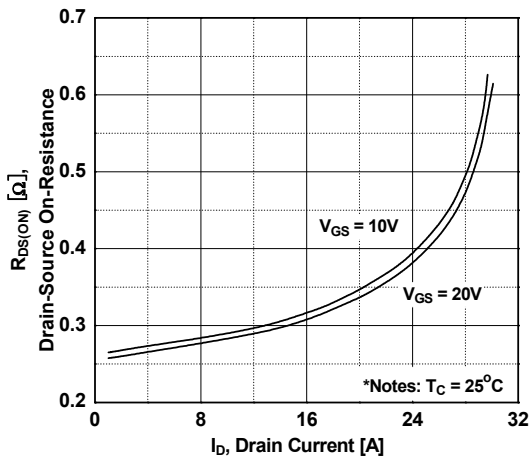


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

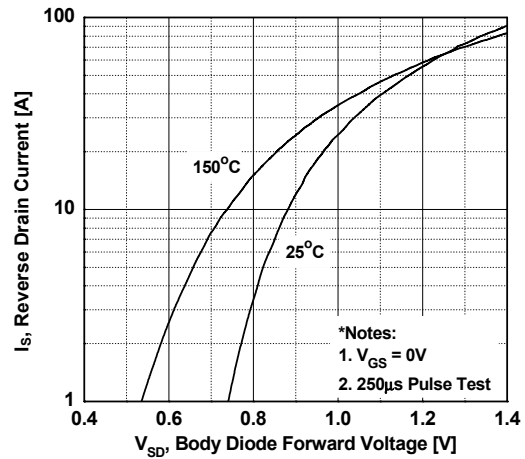


Figure 5. Capacitance Characteristics

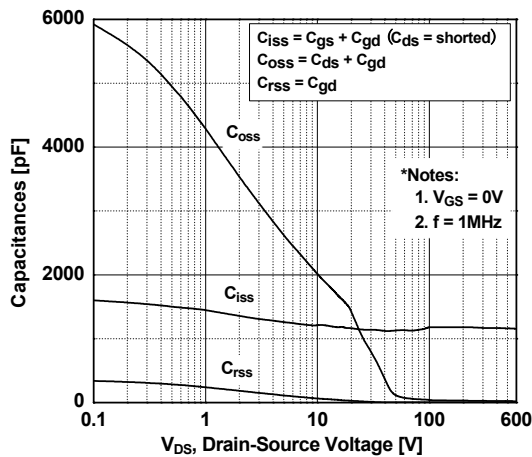
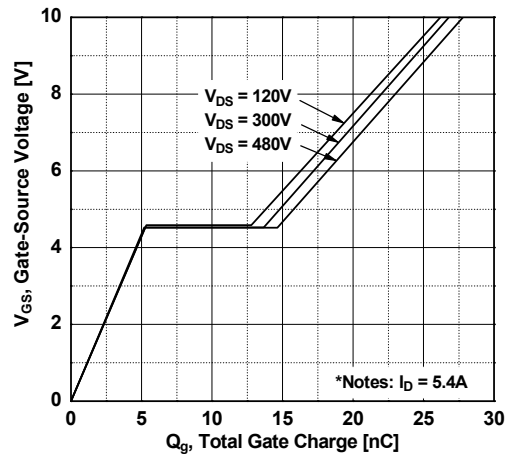


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

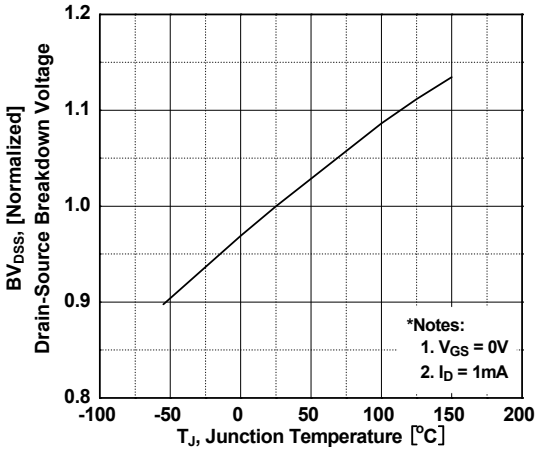


Figure 8. On-Resistance Variation vs. Temperature

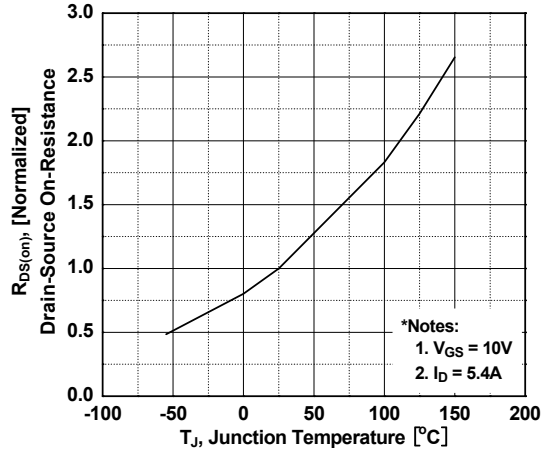


Figure 9. Maximum Safe Operating Area _FCP11N60N

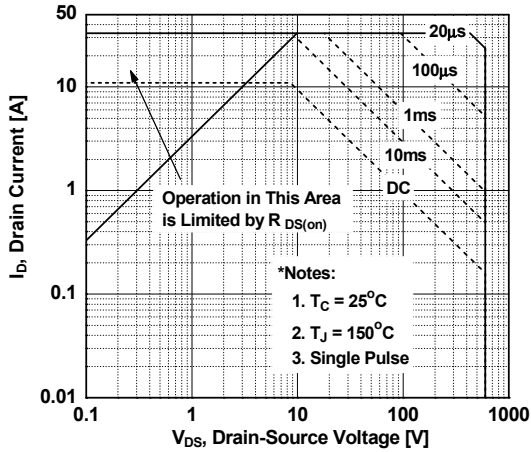


Figure 10. Maximum Safe Operating Area _FCPF11N60NT

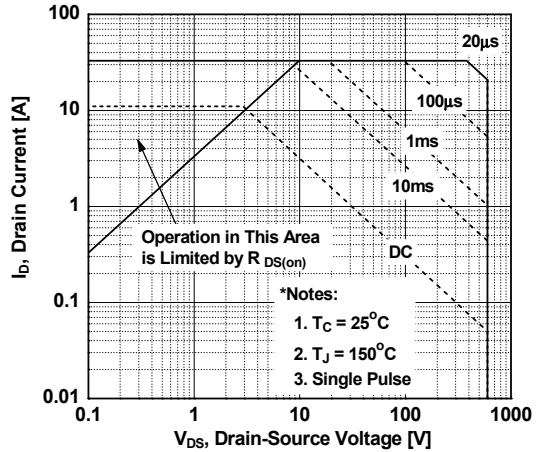
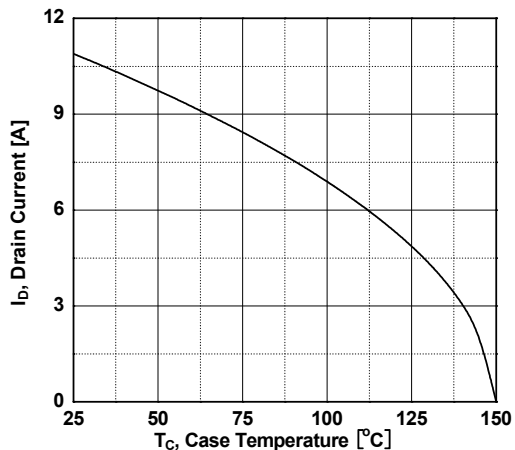


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve _ FCP11N60N

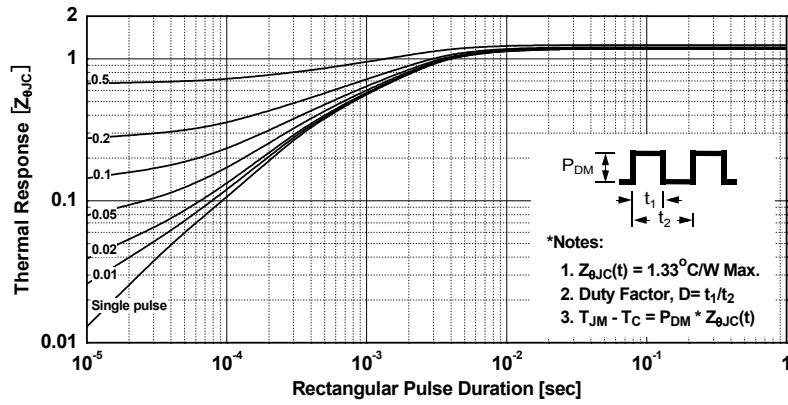
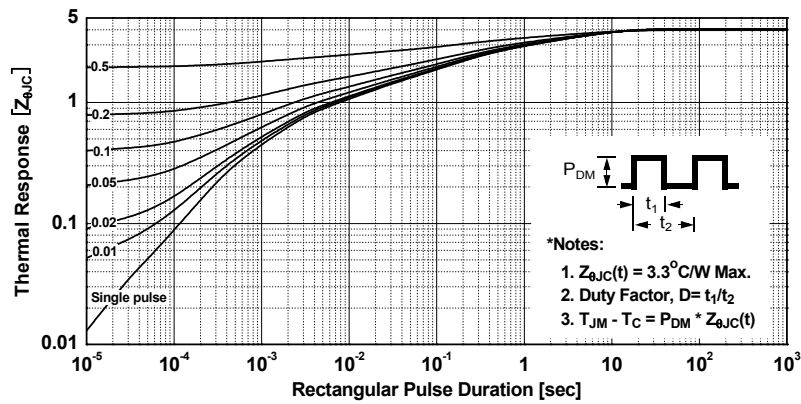
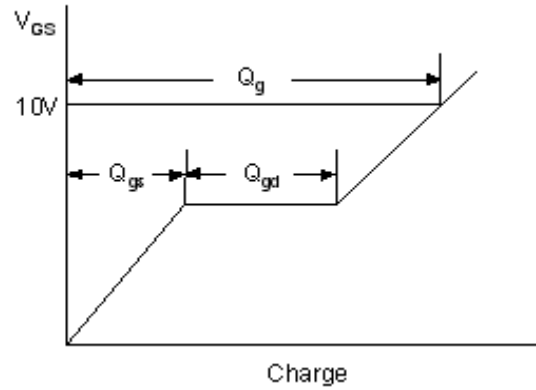
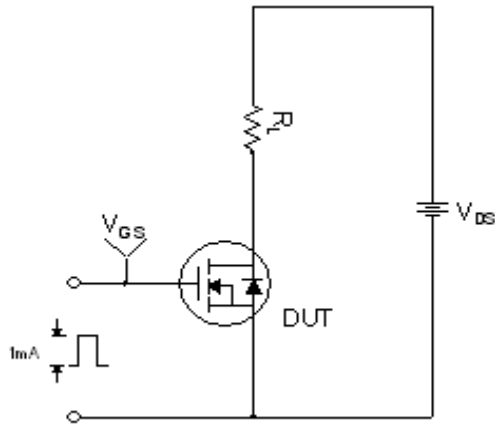


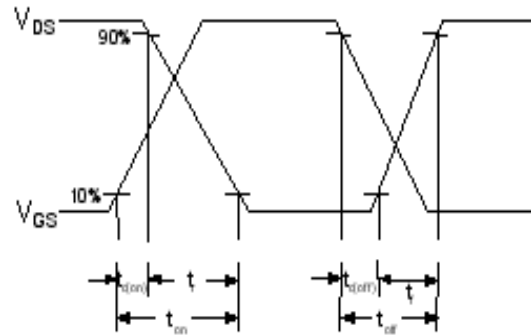
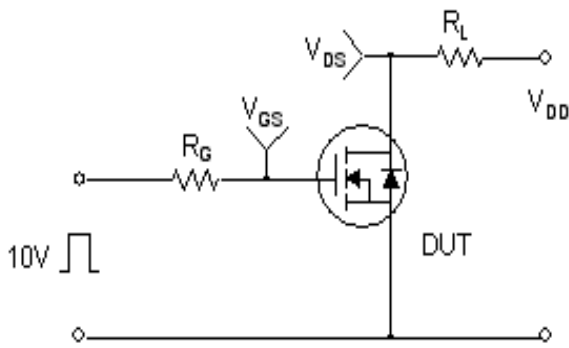
Figure 13. Transient Thermal Response Curve _ FCPF11N60NT



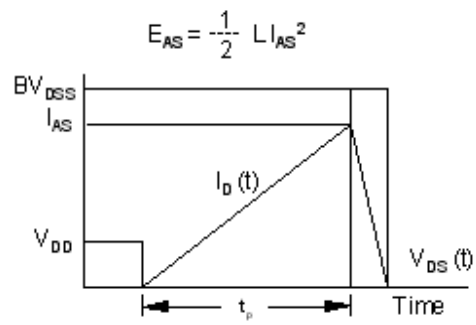
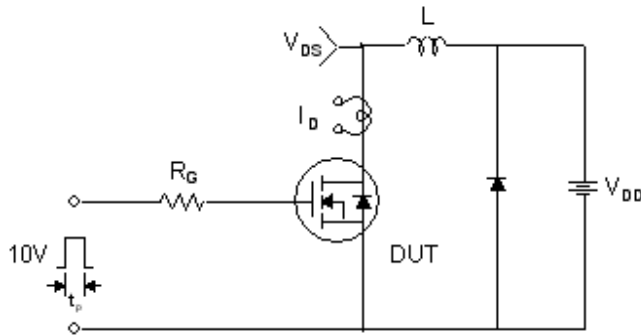
Gate Charge Test Circuit & Waveform



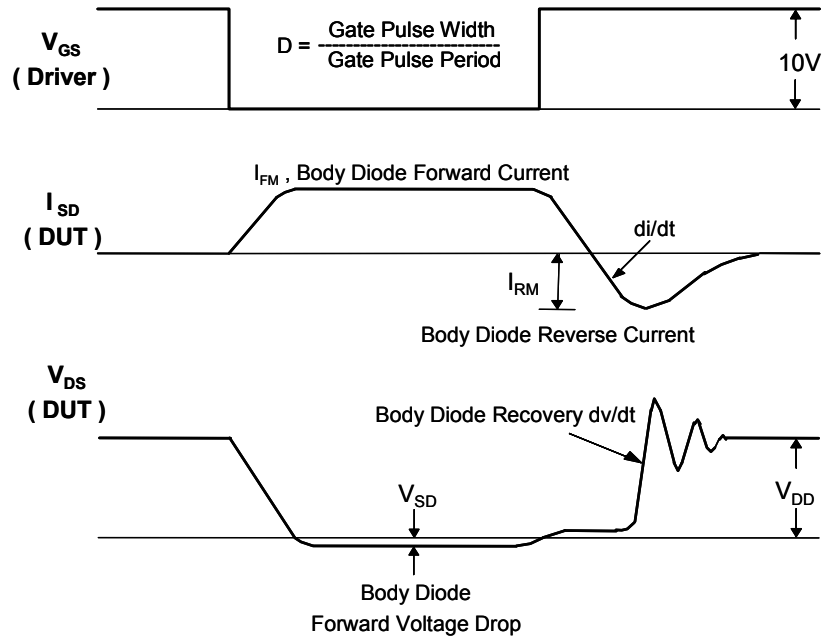
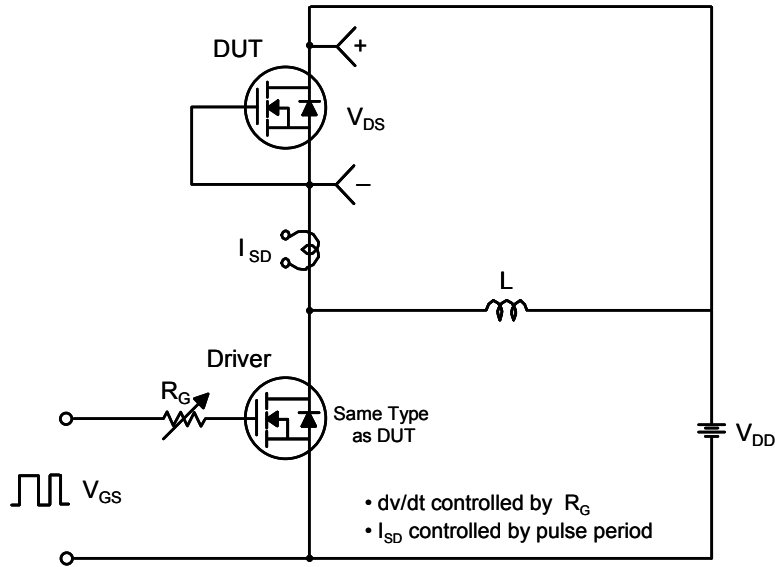
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

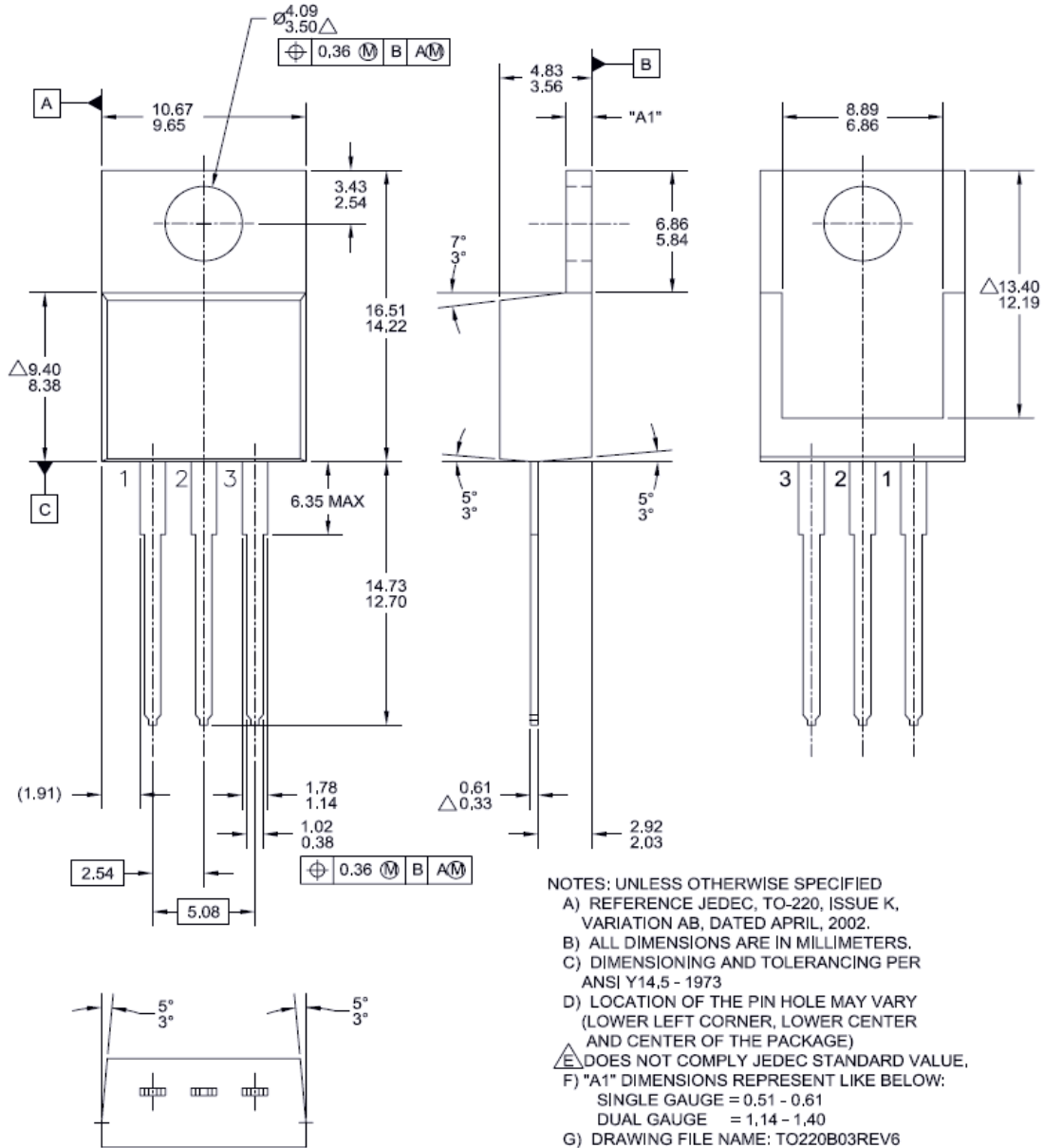


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-220




Dimensions in Millimeters



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| BitSiC™ | Global Power Resource SM | QFET® | TinyBuck™ |
| Build it Now™ | Green Bridge™ | QS™ | TinyCalc™ |
| CorePLUS™ | Green FPS™ | Quiet Series™ | TinyLogic® |
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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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