FAIRCHILD SEMICONDUCTOR®

March 2013

FCP13N60N / FCPF13N60NT

N-Channel SupreMOS® MOSFET

600 V, 13 A, 258 mΩ

Features

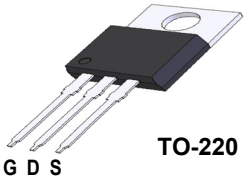
- $R_{DS(on)}$ = 244 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 6.5 A
- Ultra Low Gate Charge (Typ.Q_g = 30.4 nC)
- Low Effective Output Capacitance (Typ. C_{oss}.eff = 145 pF)
- 100% Avalanche Tested
- RoHS Compliant

Application

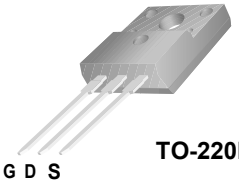
- LCD/LED/PDP TV
- Lighting
- Solar Inverter
- AC-DC Power Supply

Description

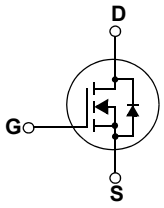
The SupreMOS® MOSFET is Fairchild Semiconductor®'s next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest Rsp on-resistance, superior 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.



TO-220



TO-220F



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FCP13N60N	FCPF13N60NT	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°C)		13	13*	A
		-Continuous (T_C = 100°C)		8.2	8.2*	
I_{DM}	Drain Current	- Pulsed	(Note 1)	39	39	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	235		mJ
I_{AR}	Avalanche Current			4.3		A
E_{AR}	Repetitive Avalanche Energy			1.16		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°C)		116	33.8	W
		- Derate above 25°C		0.93	0.27	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300		°C

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCP13N60N	FCPF13N60NT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.07	3.7	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Heak 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
FCP13N60N	FCP13N60N	TO-220	-	-	50
FCPF13N60NT	FCPF13N60NT	TO-220F	-	-	50

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0 V, $T_C = 25^oC$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25^oC	-	0.73	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480 V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 480 V, V_{GS} = 0 V, $T_C = 125^oC$	-	-	100	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 6.5 A	-	0.220	0.258	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 6.5 A	-	16.3	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	-	1325	1765	pF
C_{oss}	Output Capacitance		-	50	65	pF
C_{rss}	Reverse Transfer Capacitance		-	3	5	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	30	-	pF
C_{oss}eff	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	145	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 6.5 A, V_{GS} = 10 V (Note 4)	-	30.4	39.5	nC
Q_{gs}	Gate to Source Gate Charge		-	6.0	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	9.5	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open	-	2.8	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 6.5 A, R_G = 4.7 Ω (Note 4)	-	14.5	39	ns
t_r	Turn-On Rise Time		-	10.6	31.2	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	100	ns
t_f	Turn-Off Fall Time		-	9.8	29.6	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	13	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	39	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 6.5 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 6.5 A, dI_F/dt = 100 A/μs	-	287	-	ns
Q_{rr}	Reverse Recovery Charge		-	3.5	-	μC

Notes:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 4.3 A, R_G = 25 Ω, Starting $T_J = 25°C$
3. $I_{SD} \le 13$ A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, Starting $T_J = 25°C$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

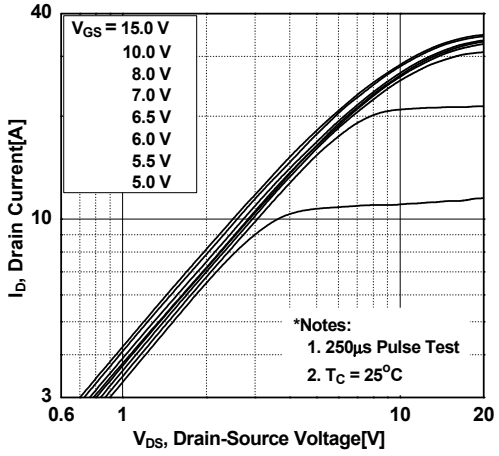


Figure 2. Transfer Characteristics

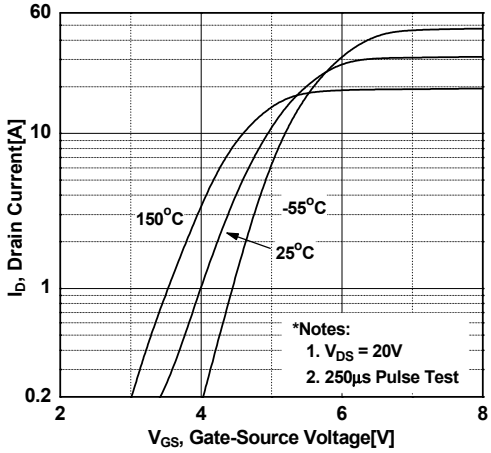


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

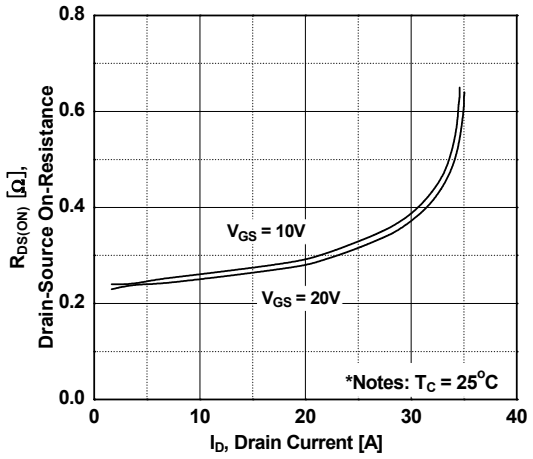


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

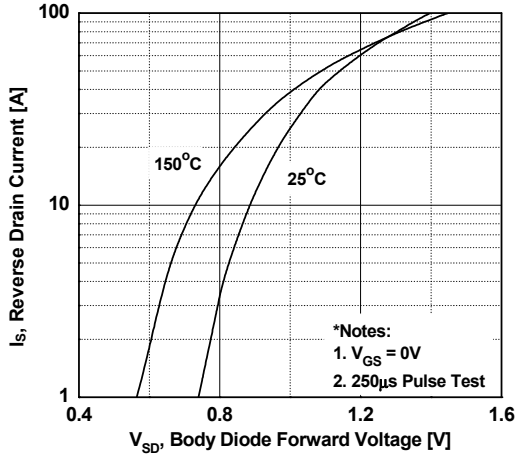


Figure 5. Capacitance Characteristics

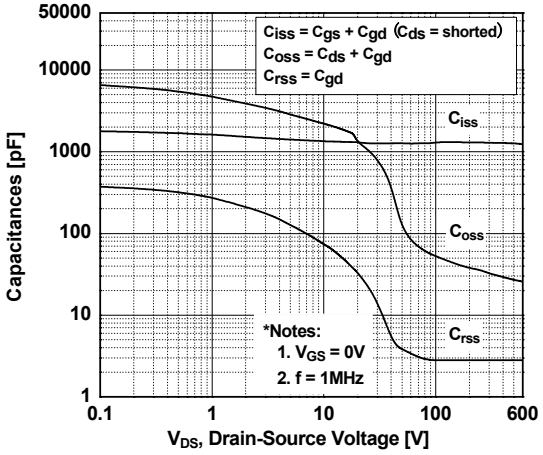
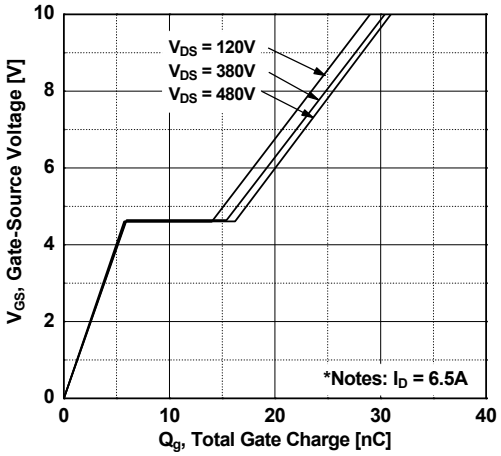


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

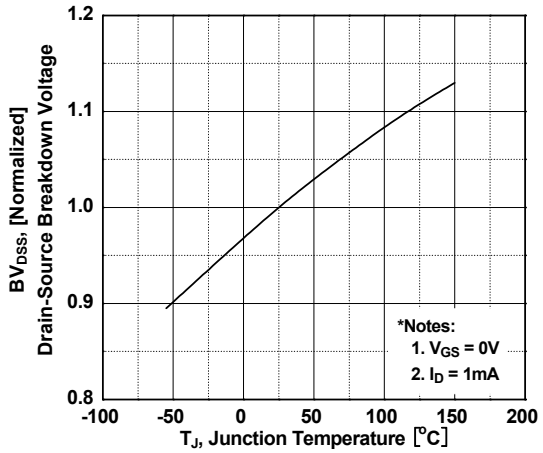


Figure 8. On-Resistance Variation vs. Temperature

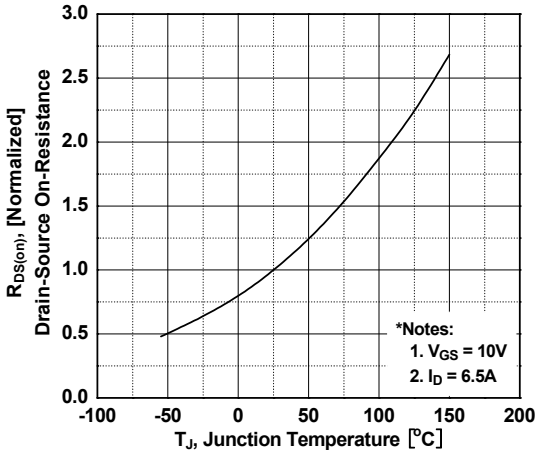


Figure 9. Maximum Safe Operating Area _ FCP13N60N

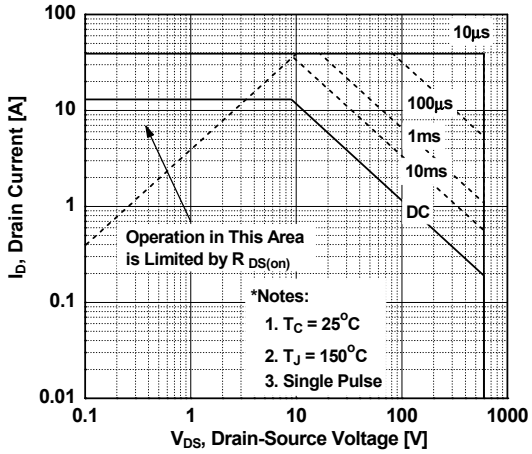


Figure 10. Maximum Safe Operating Area _ FCPF13N60NT

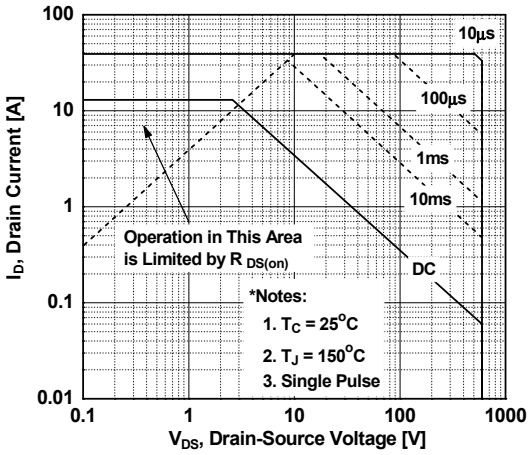
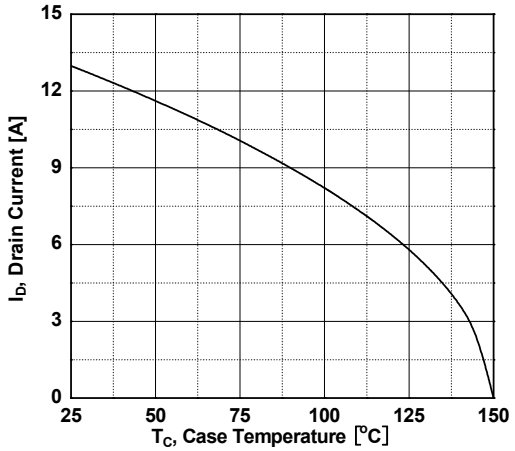


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve _ FCP13N60N

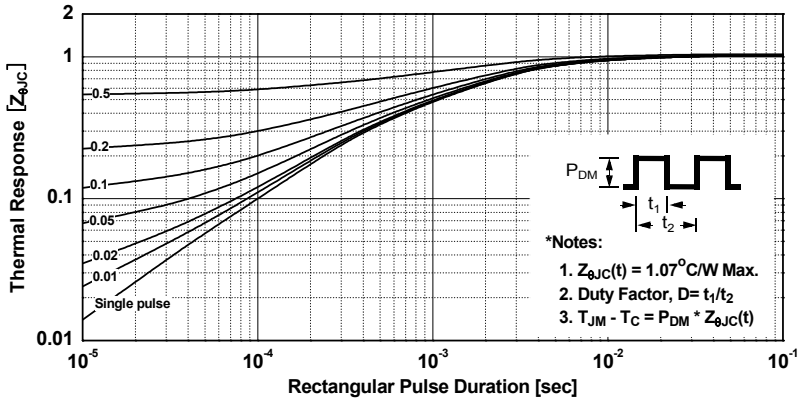
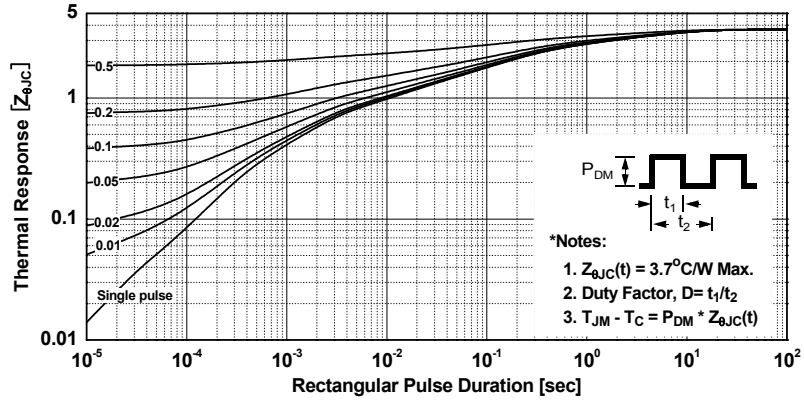
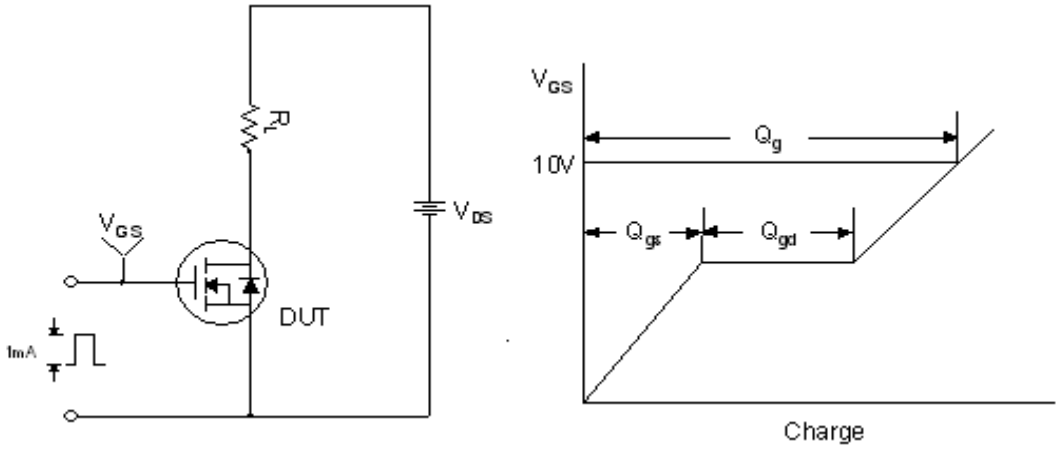


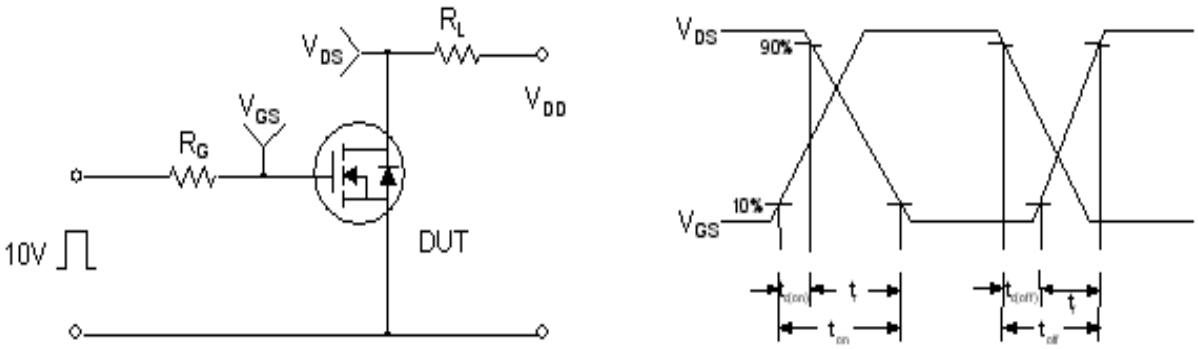
Figure 13. Transient Thermal Response Curve _ FCPF13N60NT



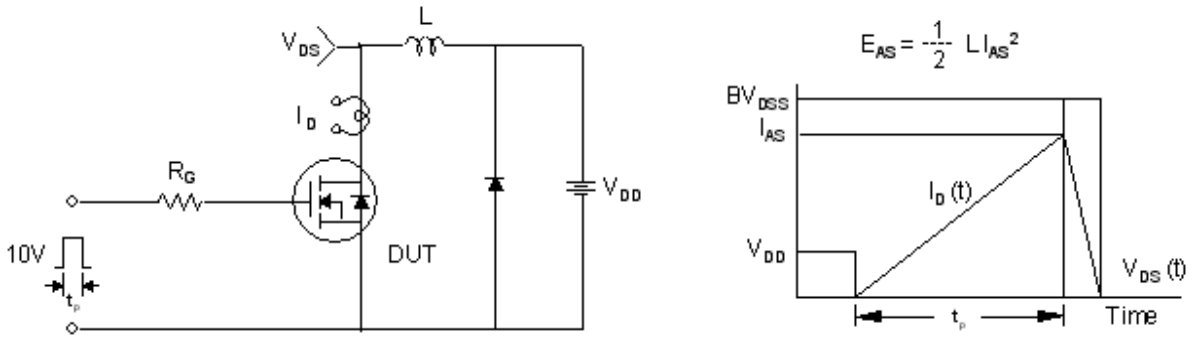
Gate Charge Test Circuit & Waveform



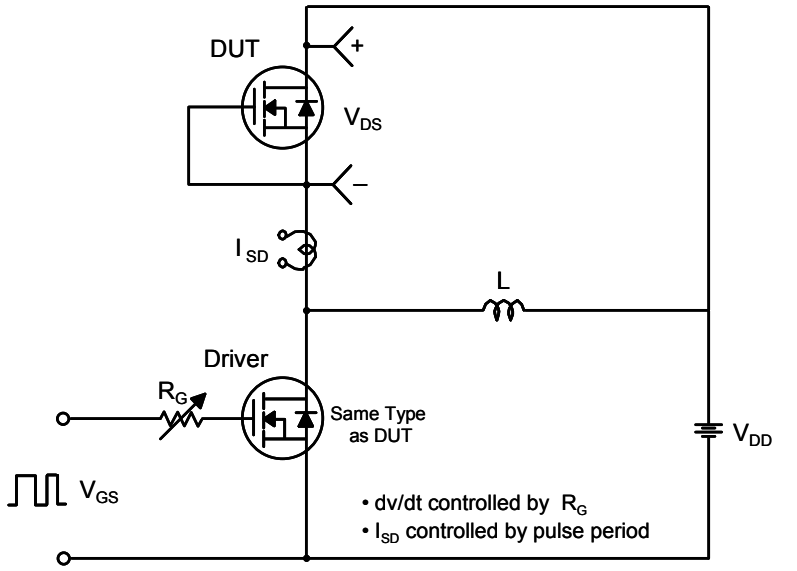
Resistive Switching Test Circuit & Waveforms

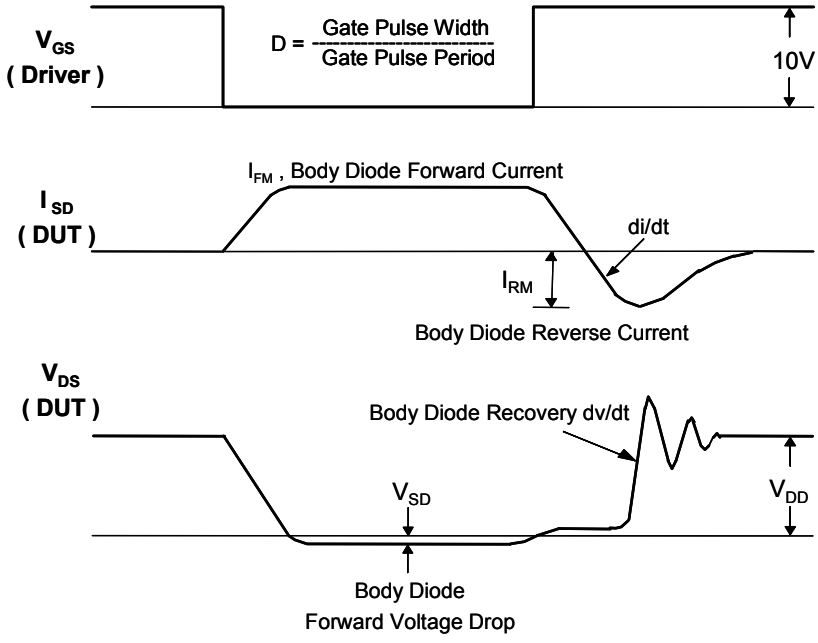


Unclamped Inductive Switching Test Circuit & Waveforms



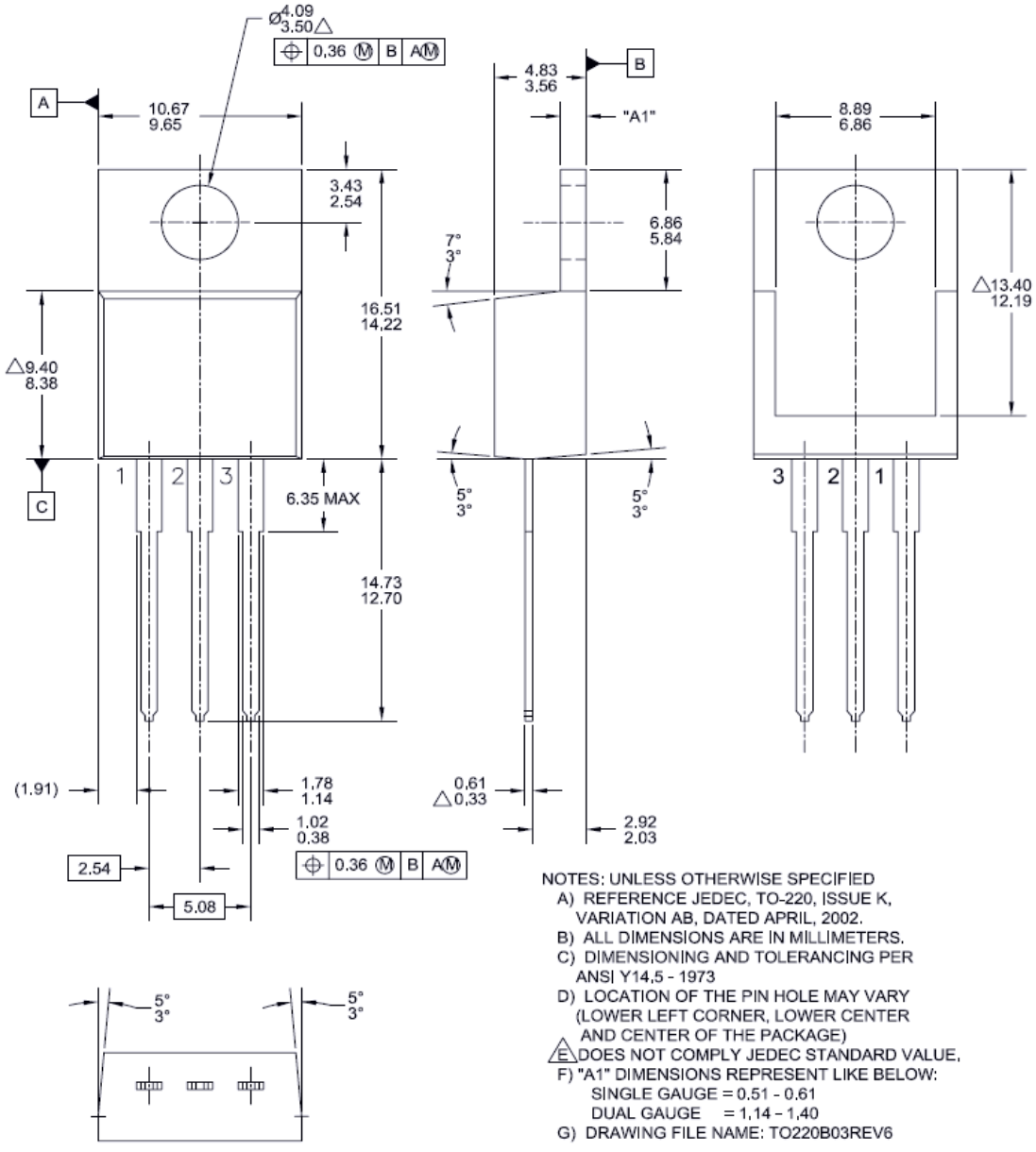
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-220

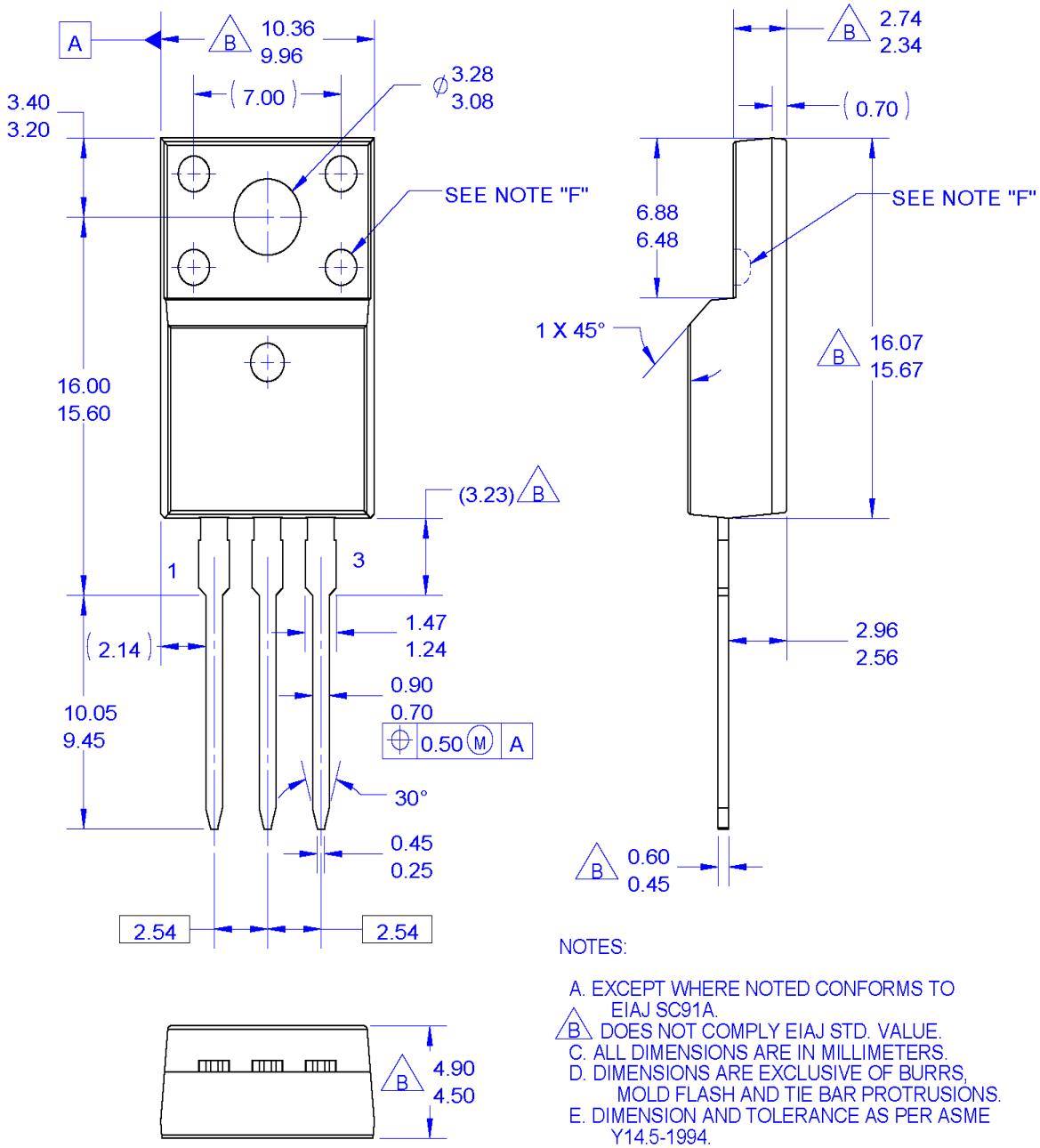


NOTES: UNLESS OTHERWISE SPECIFIED
A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973
D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
△E DOES NOT COMPLY JEDEC STANDARD VALUE,
F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1,14 – 1,40
G) DRAWING FILE NAME: TO220B03REV6

Dimensions in Millimeters

Mechanical Dimensions

TO-220F



NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
B DOES NOT COMPLY EIAJ STD. VALUE.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
G. DRAWING FILE NAME: TO220M03REV3

Dimensions in Millimeters

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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