

FCP600N60Z / FCPF600N60Z

N-Channel SuperFET® II MOSFET

600 V, 7.4 A, 600 mΩ

Features

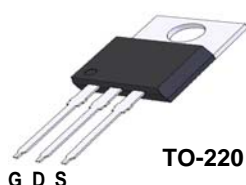
- 650 V @ $T_J = 150^\circ\text{C}$
- Max. $R_{DS(on)} = 600\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 20\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss,eff} = 74\text{ pF}$)
- 100% Avalanche Tested
- ESD Improved Capacity

Description

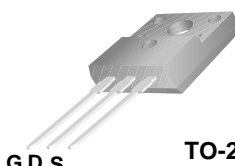
SuperFET® II MOSFET is Fairchild Semiconductor®'s first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is suitable for various AC/DC power conversion for system miniaturization and higher efficiency.

Applications

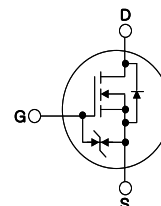
- LCD / LED / PDP TV and Monitor Lighting
- Solar Inverter
- AC-DC Power Supply



TO-220



TO-220F



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	FCP600N60Z	FCPF600N60Z	Unit
V_{DSS}	Drain to Source Voltage	600		V
V_{GSS}	Gate to Source Voltage	- DC	± 20	V
		- AC ($f > 1\text{ Hz}$)	± 30	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	7.4	A
		- Continuous ($T_C = 100^\circ\text{C}$)	4.7	A
I_{DM}	Drain Current	- Pulsed (Note 1)	22.2	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	135	mJ
I_{AR}	Avalanche Current	(Note 1)	1.5	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	0.89	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
	MOSFET dv/dt		100	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	89	W
		- Derate above 25°C	0.71	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 Purpose, 1/8" from Case for 5 Seconds	300		$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCP600N60Z	FCPF600N60Z	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	4.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCP600N60Z	FCP600N60Z	TO-220	-	-	50
FCPF600N60Z	FCPF600N60Z	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	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 150^\circ\text{C}$	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.67	-	V/ $^\circ\text{C}$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 7.4\text{ A}$	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 10	μA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 3.7\text{ A}$	-	0.51	0.6	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 3.7\text{ A}$	-	6.7	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	-	840	1120	pF
C_{oss}	Output Capacitance		-	630	840	pF
C_{rss}	Reverse Transfer Capacitance		-	30	45	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	16.5	-	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	-	74	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 3.7\text{ A}$ $V_{GS} = 10\text{ V}$ (Note 4)	-	20	26	nC
Q_{gs}	Gate to Source Gate Charge		-	3.4	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	7.5	-	nC
ESR	Equivalent Series Resistance	Drain open	-	2.89	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 3.7\text{ A}$ $V_{GS} = 10\text{ V}, R_G = 4.7\text{ }\Omega$ (Note 4)	-	13	36	ns
t_r	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	39	88	ns
t_f	Turn-Off Fall Time		-	9	28	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	7.4	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	22.2	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 3.7 A	-	-	1.2	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 3.7 A	-	200	-	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100 A/μs	-	2.3	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 1.5\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 3.7\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

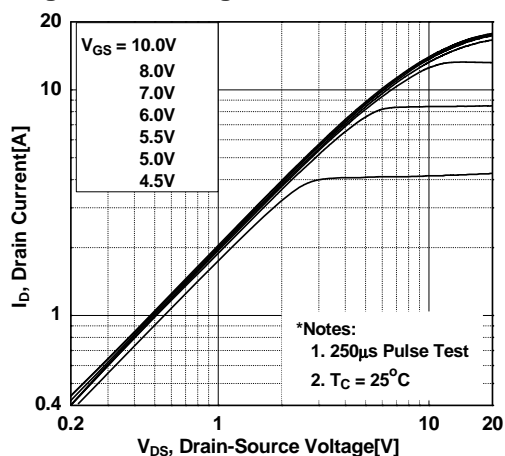


Figure 2. Transfer Characteristics

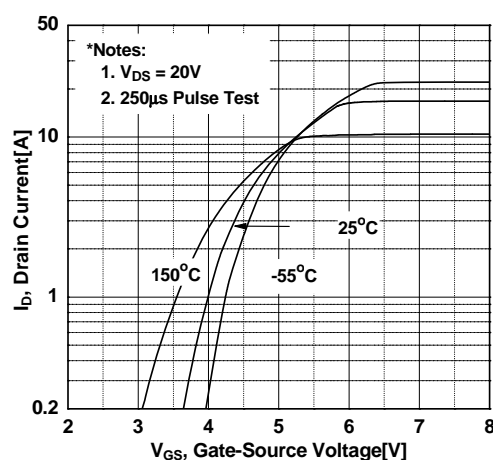


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

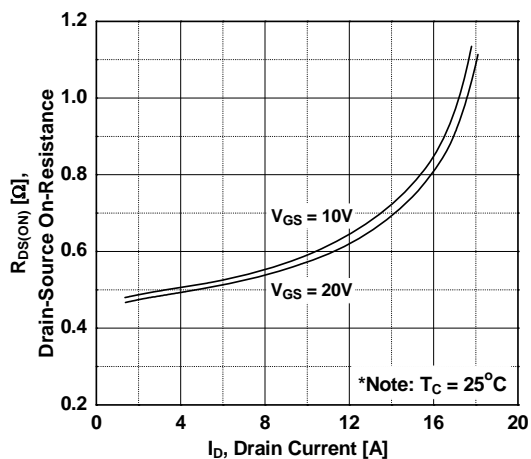


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

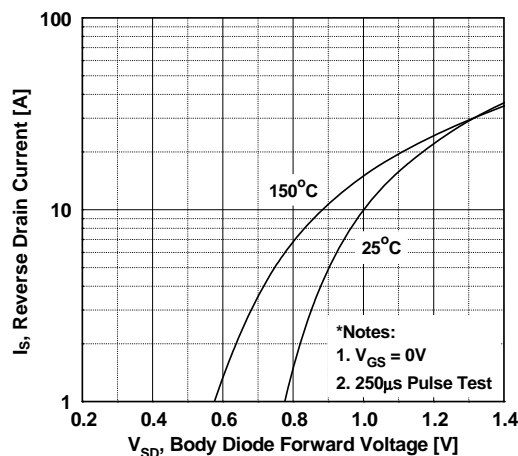


Figure 5. Capacitance Characteristics

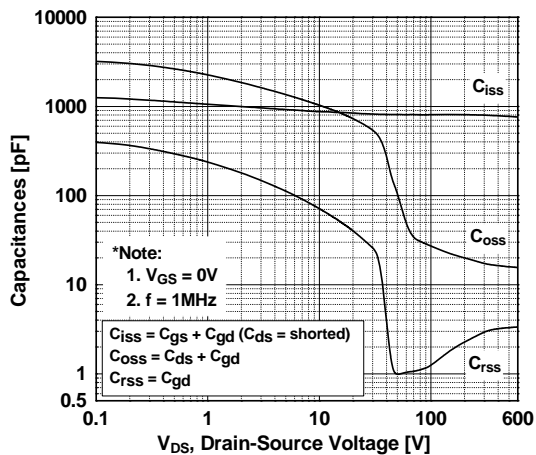
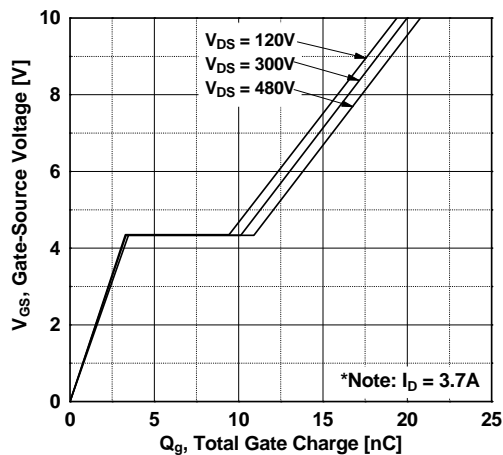


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

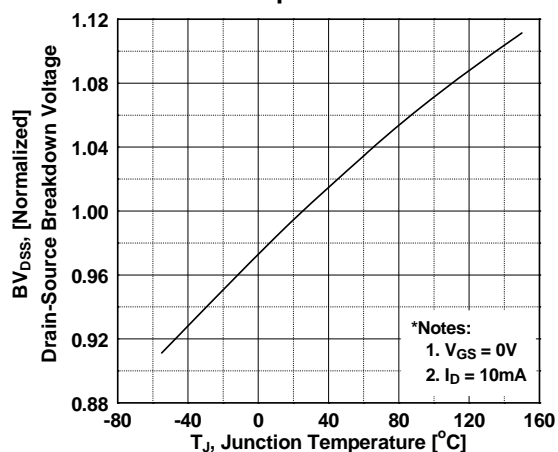


Figure 8. On-Resistance Variation vs. Temperature

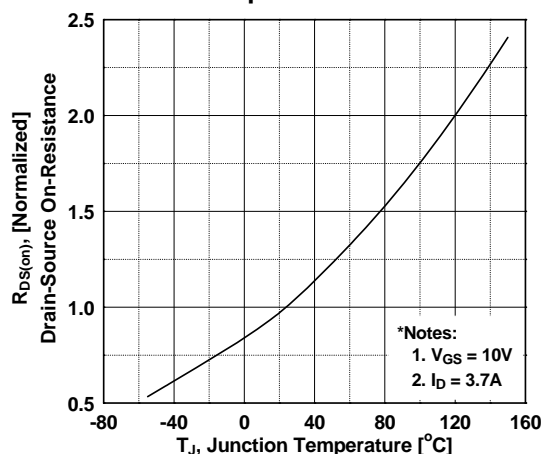


Figure 9. Maximum Safe Operating Area vs. Case Temperature - FCP600N60Z

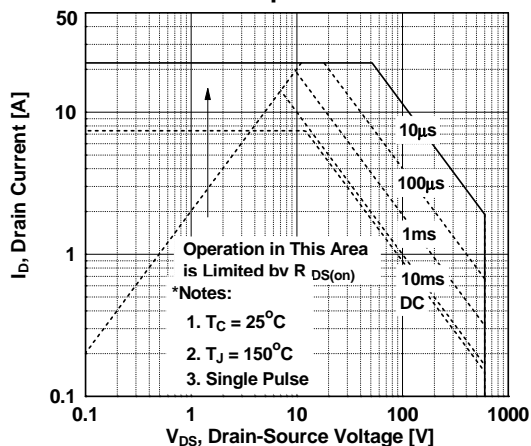


Figure 10. Maximum Safe Operating Area vs. Case Temperature - FCPF600N60Z

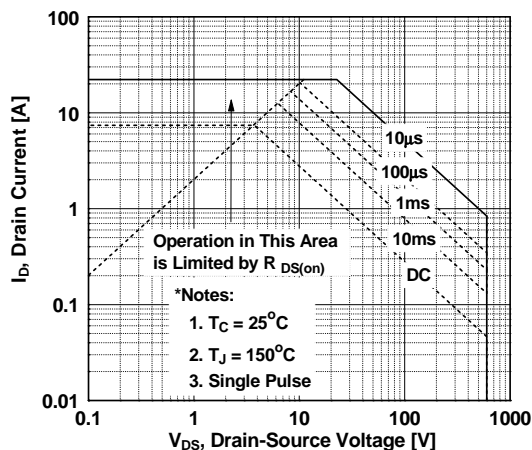


Figure 11. Maximum Drain Current

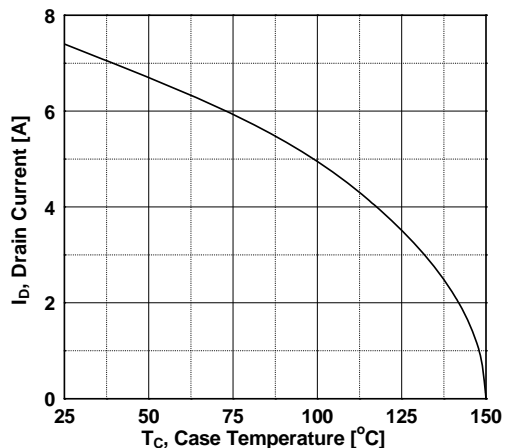
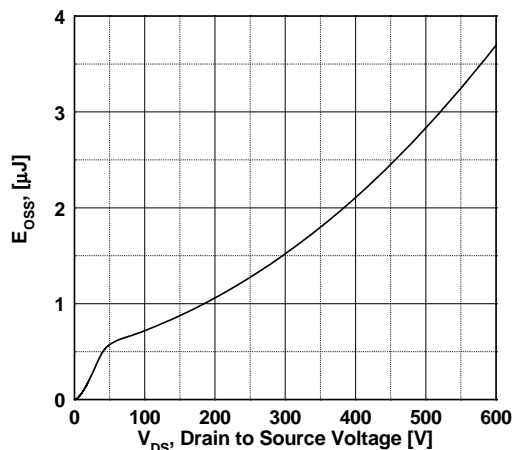


Figure 12. E_oss vs. Drain to Source Voltage Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve - FCP600N60Z

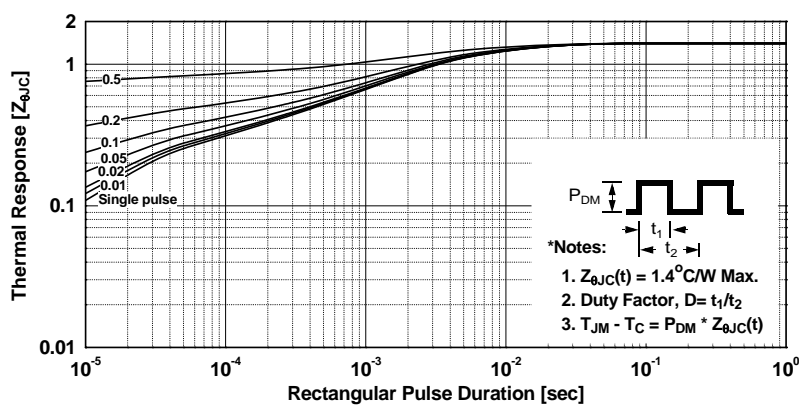
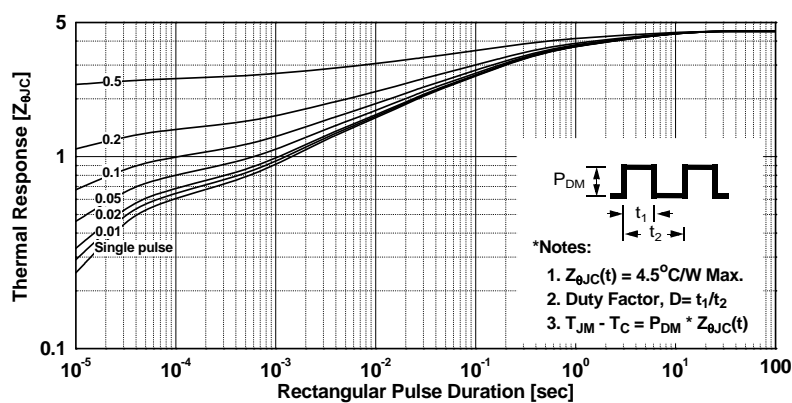
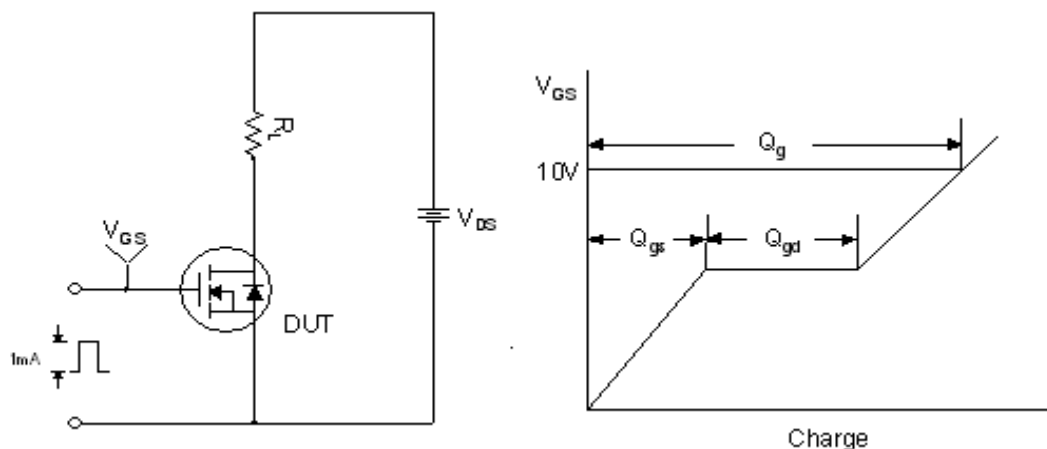


Figure 14. Transient Thermal Response Curve - FCPF600N60Z



Gate Charge Test Circuit & Waveform



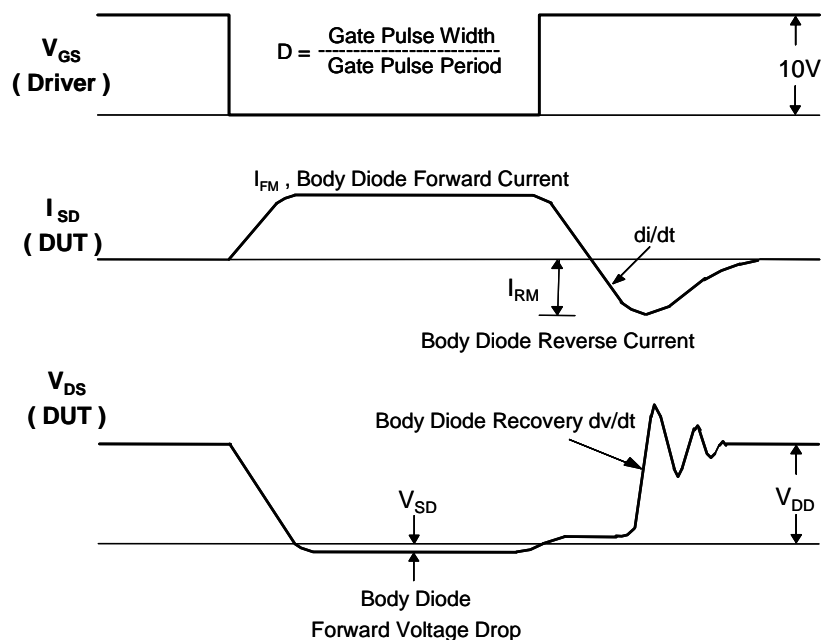
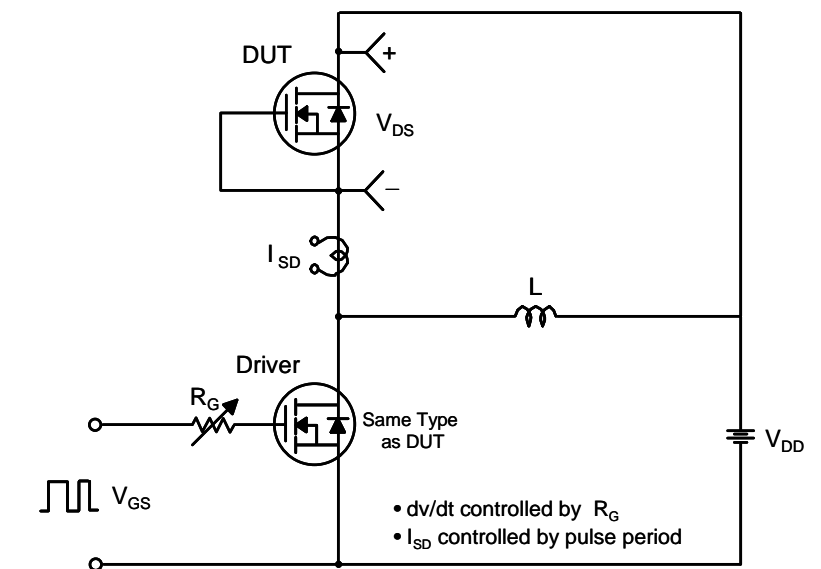
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

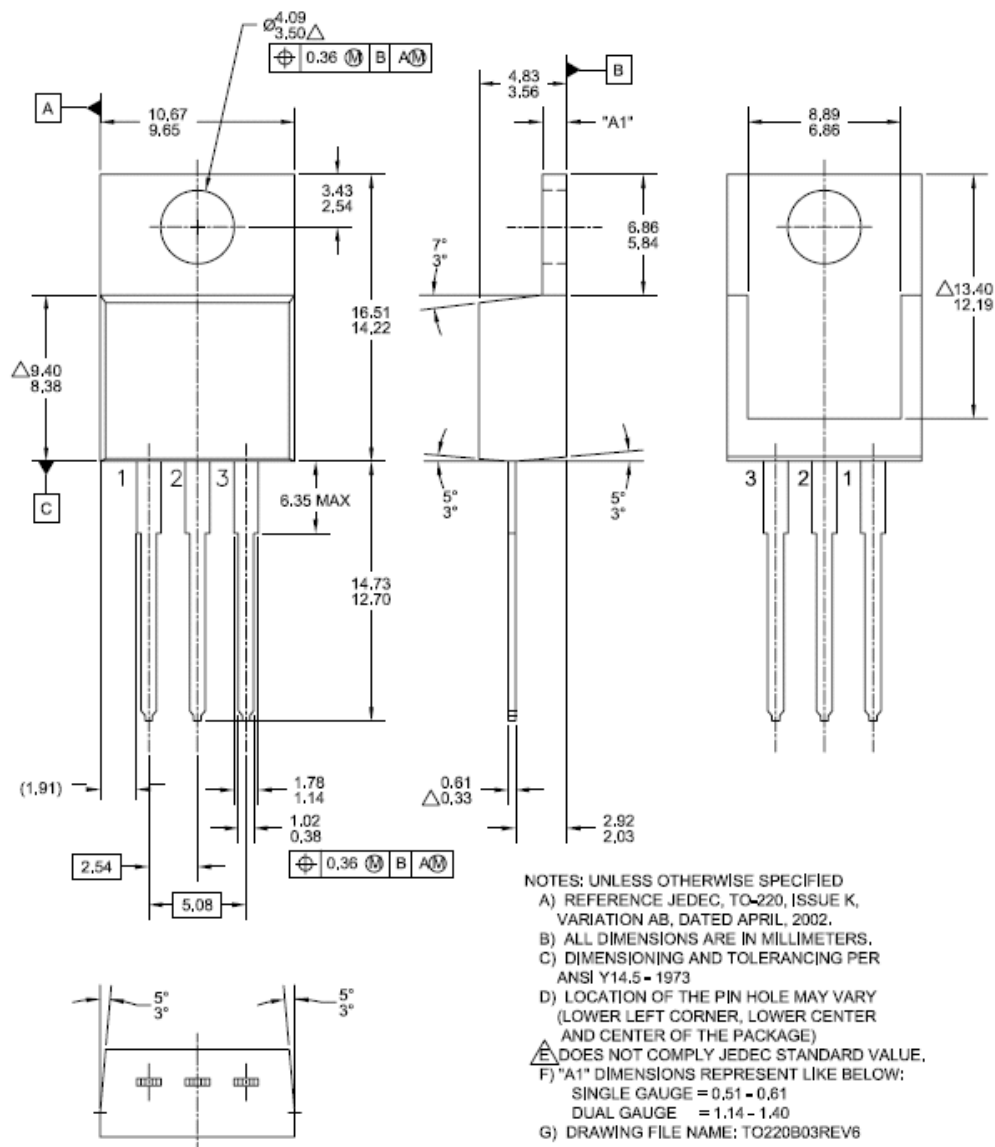


Peak Diode Recovery dv/dt Test Circuit & Waveforms



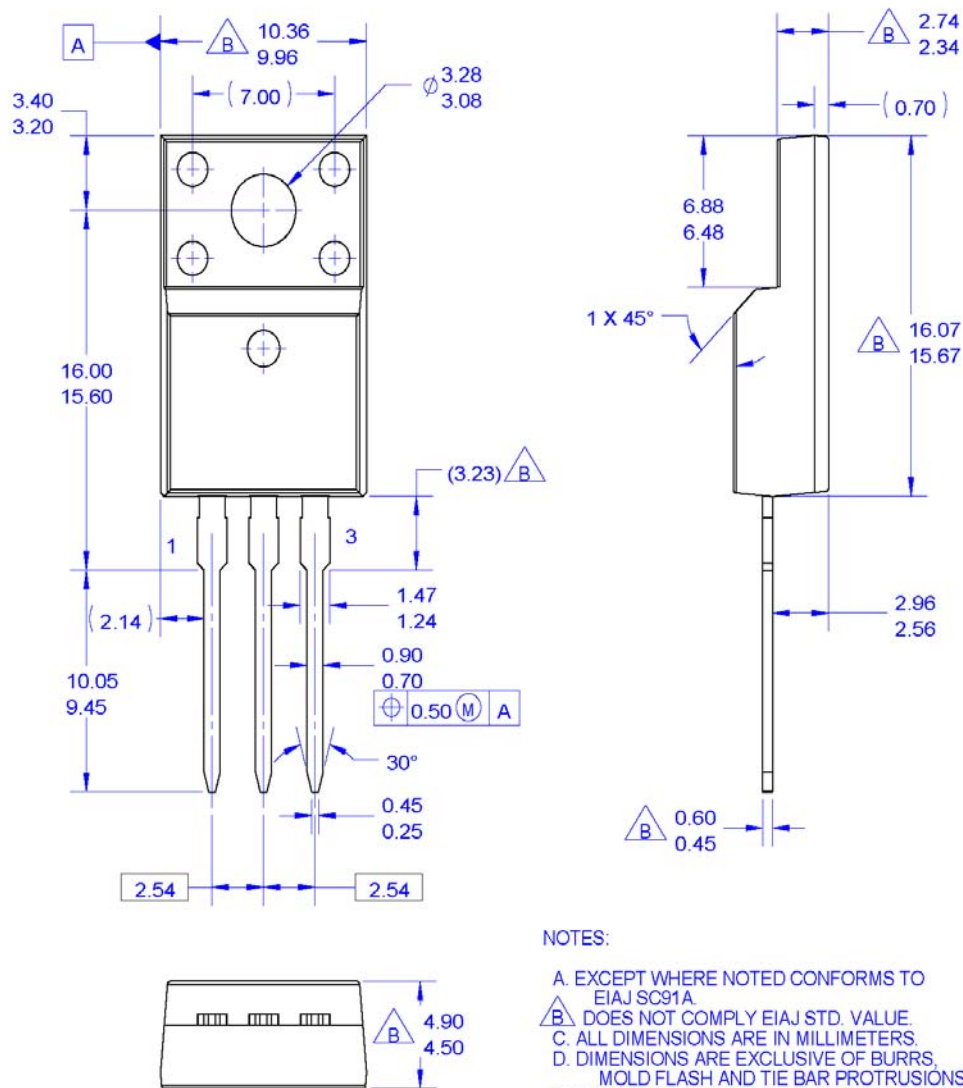
Mechanical Dimensions

TO-220AB



Package Dimensions

TO-220F (Retractable)



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. DRAWING FILE NAME: TO220M03REV3


* Front/Back Side Isolation Voltage : AC 2500V

Dimensions in Millimeters



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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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