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FCP9N60N / FCPF9N60NT

N-Channel SupreMOS® MOSFET

600 V, 9 A, 385 mΩ

Features

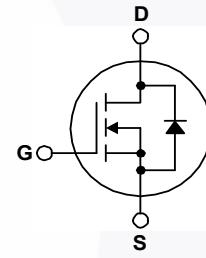
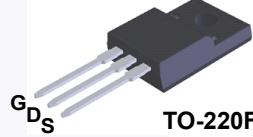
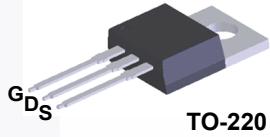
- $R_{DS(on)} = 330 \text{ mΩ}$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 4.5 \text{ A}$
- Ultra Low Gate Charge (Typ. $Q_g = 22 \text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(\text{eff.})} = 106 \text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

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 R_{sp} 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.



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

Symbol	Parameter		FCP9N60N	FCPF9N60NT	Unit	
V_{DSS}	Drain to Source Voltage		600		V	
V_{GSS}	Gate to Source Voltage		± 30		V	
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	9.0	9.0*	A	
		- Continuous ($T_C = 100^\circ\text{C}$)	5.7	5.7*		
I_{DM}	Drain Current	- Pulsed	(Note 1)	27	27*	
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	135		mJ
I_{AR}	Avalanche Current		(Note 1)	3		A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	0.83		mJ
dv/dt	MOSFET dv/dt		100		V/ns	
	Peak Diode Recovery dv/dt		(Note 3)	20		V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	83.3	29.8	W	
		- Derate Above 25°C	0.67	0.24		
T_J , T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C	
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300		°C	

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FCP9N60N	FCPF9N60NT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.5	4.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP9N60N	FCP9N60N	TO-220	Tube	N/A	N/A	50 units
FCPF9N60NT	FCPF9N60NT	TO-220F	Tube	N/A	N/A	50 units

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
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 1 \text{ mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.72	-	V°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	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.0	-	4.0	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 4.5 \text{ A}$	-	0.33	0.385	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40 \text{ V}, I_D = 4.5 \text{ A}$	-	7.5	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	930	1240	pF
C_{oss}	Output Capacitance	$V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	35	50	pF
C_{rss}	Reverse Transfer Capacitance	$V_{DS} = 380 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	2	4	pF
C_{oss}	Output Capacitance	$V_{DS} = 380 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	20	-	pF
$C_{\text{oss(eff.)}}$	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	106	-	pF
$Q_{\text{g(tot)}}$	Total Gate Charge at 10V	$V_{DS} = 380 \text{ V}, I_D = 4.5 \text{ A}, V_{GS} = 10 \text{ V}$	-	22.0	29	nC
Q_{gs}	Gate to Source Gate Charge	$V_{DS} = 380 \text{ V}, I_D = 4.5 \text{ A}, V_{GS} = 10 \text{ V}$	(Note 4)	4.1	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			7.1	-	nC
ESR	Equivalent Series Resistance (G-S)	$f = 1 \text{ MHz}$		2.9		Ω

Switching Characteristics

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{DD} = 380 \text{ V}, I_D = 4.5 \text{ A}, V_{GS} = 10 \text{ V}, R_G = 4.7 \Omega$	-	12.7	35.4	ns
t_r	Turn-On Rise Time	$V_{DD} = 380 \text{ V}, I_D = 4.5 \text{ A}, V_{GS} = 10 \text{ V}, R_G = 4.7 \Omega$	-	8.7	27.4	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		-	36.9	83.8	ns
t_f	Turn-Off Fall Time		(Note 4)	10.2	30.4	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	9.0	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	27	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 4.5 \text{ A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 4.5 \text{ A}, dI/dt = 100 \text{ A}/\mu\text{s}$	-	213	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.2	-	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 3 \text{ A}, R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 9 \text{ A}, dI/dt \leq 200 \text{ A}/\mu\text{s}, V_{DD} = 380 \text{ V}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

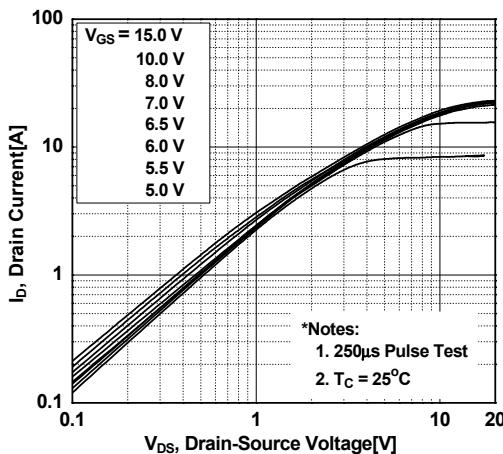


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

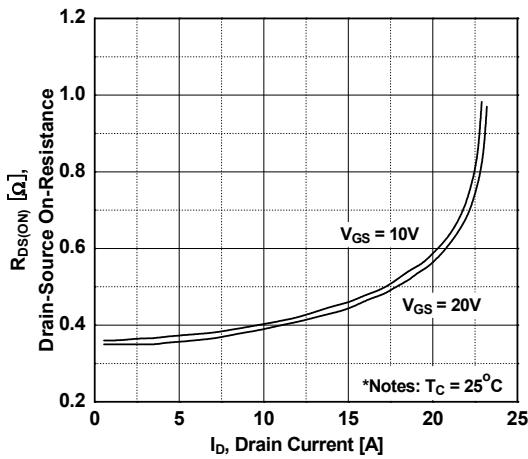


Figure 5. Capacitance Characteristics

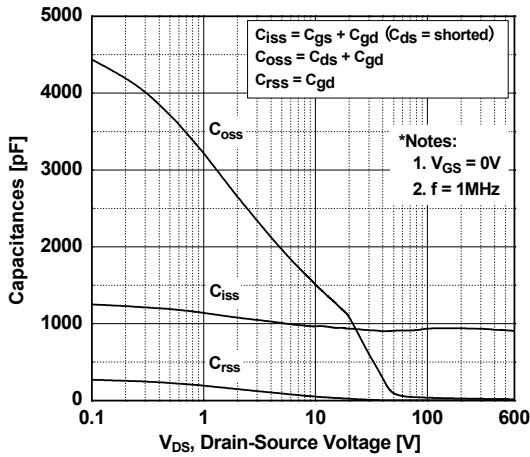


Figure 2. Transfer Characteristics

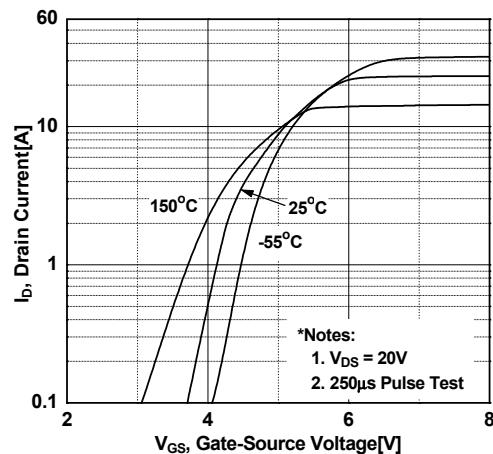


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

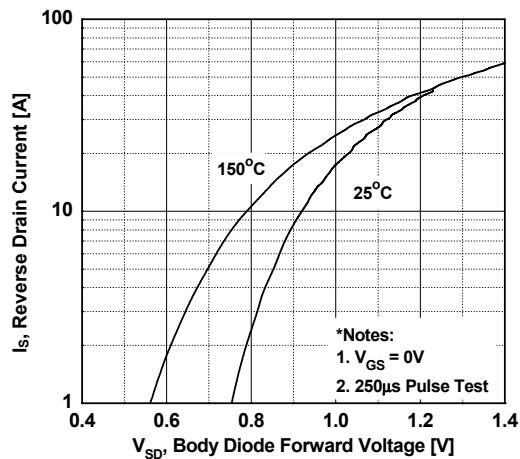
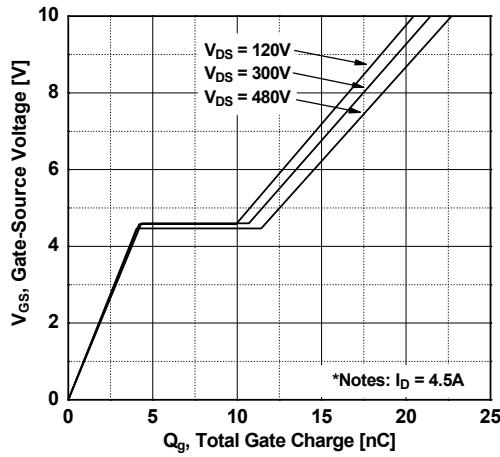


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

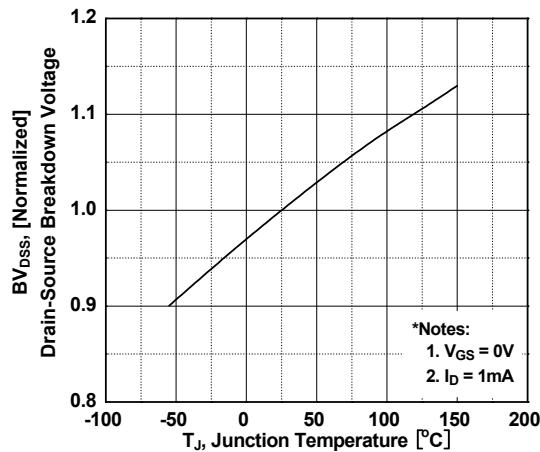


Figure 8. On-Resistance Variation vs. Temperature

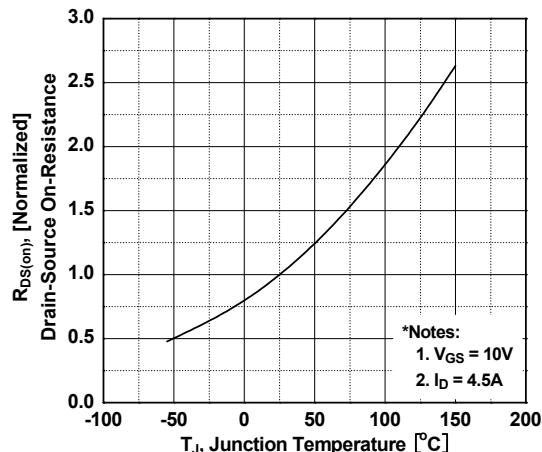


Figure 9. Maximum Safe Operating Area for FCPF9N60N

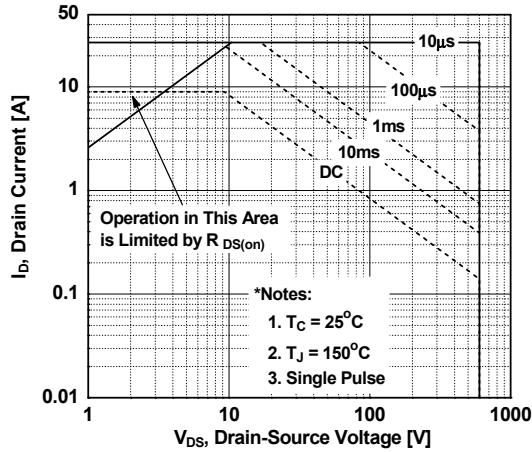


Figure 10. Maximum Safe Operating Area for FCPF9N60NT

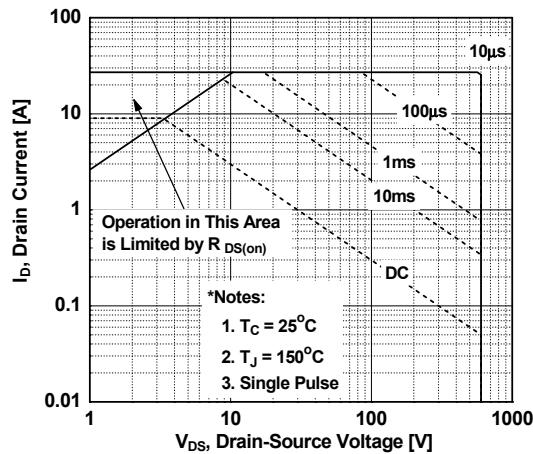
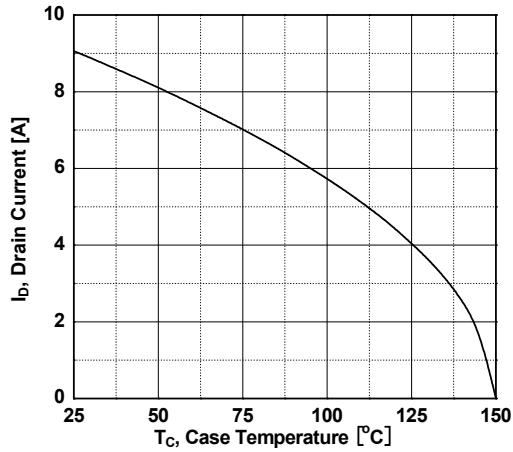


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve for FCP9N60N

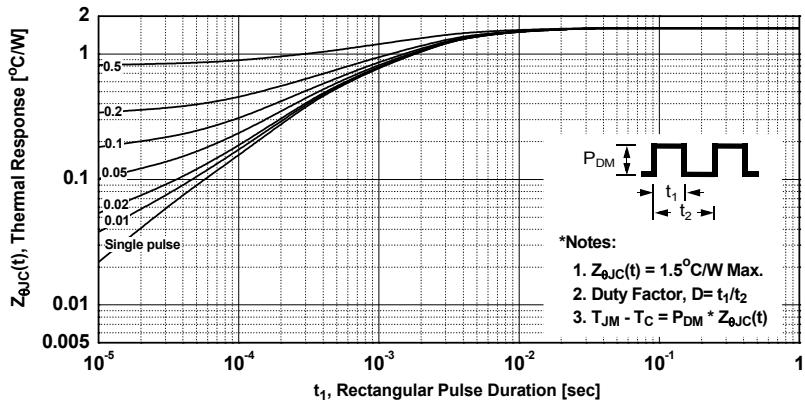
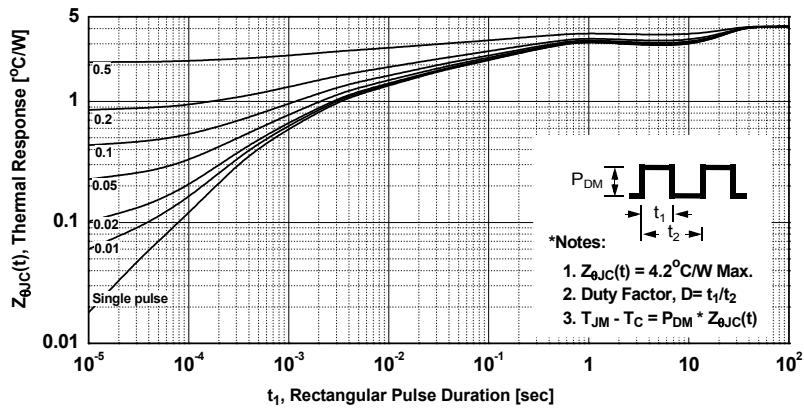


Figure 13. Transient Thermal Response Curve for FCPF9N60NT



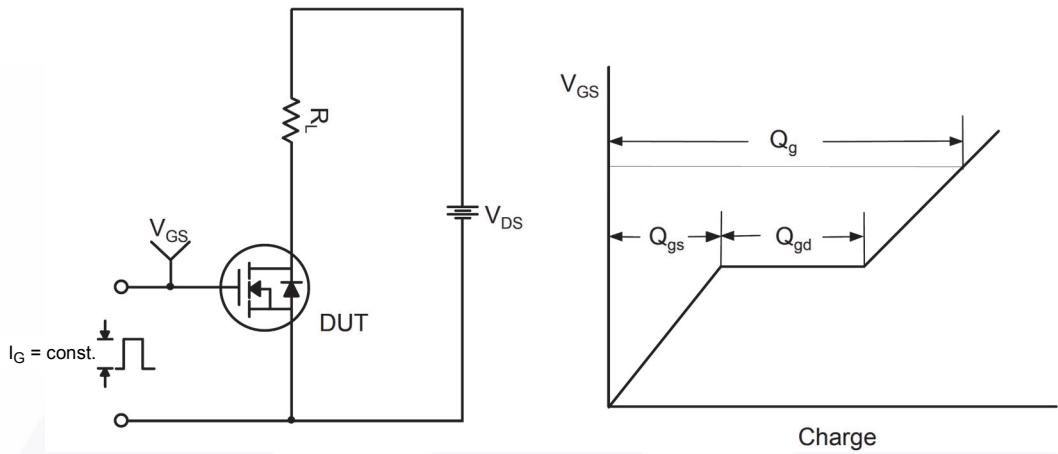


Figure 14. Gate Charge Test Circuit & Waveform

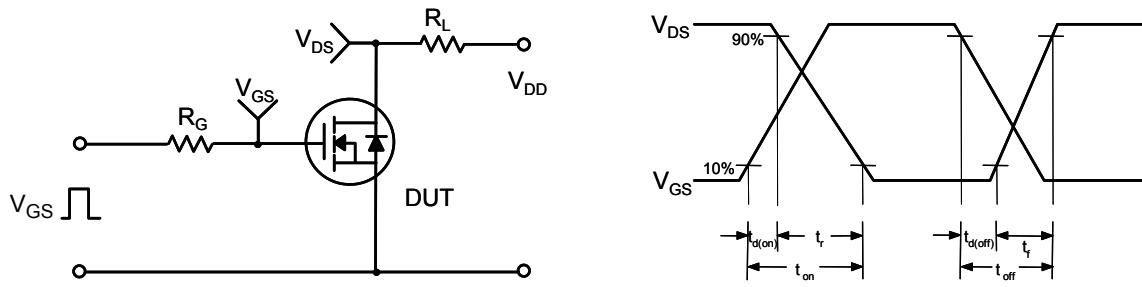


Figure 15. Resistive Switching Test Circuit & Waveforms

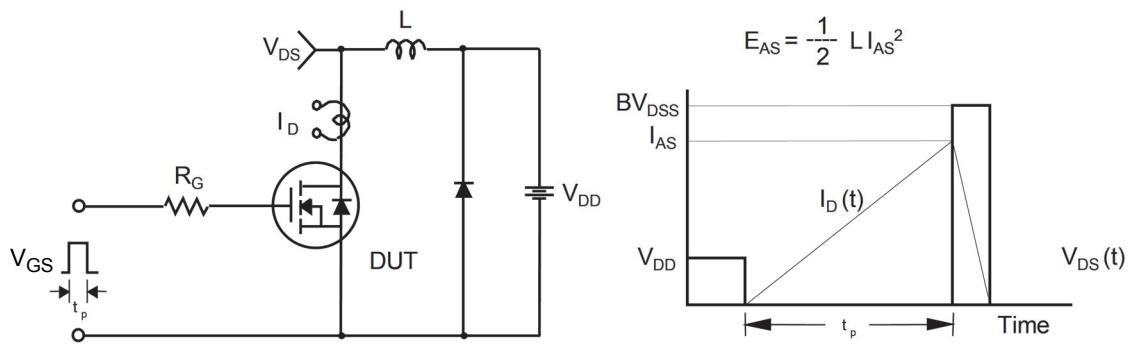


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

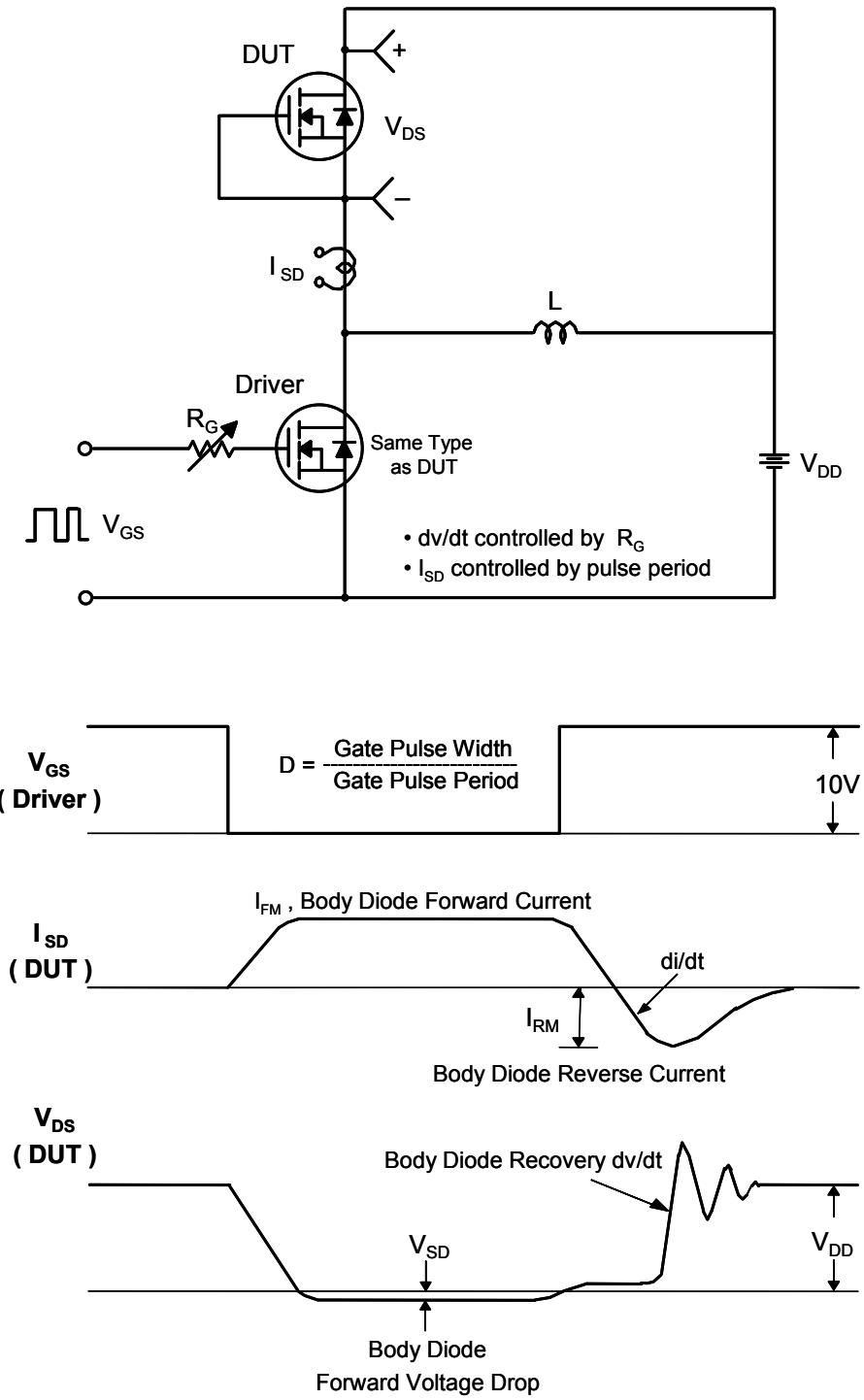


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

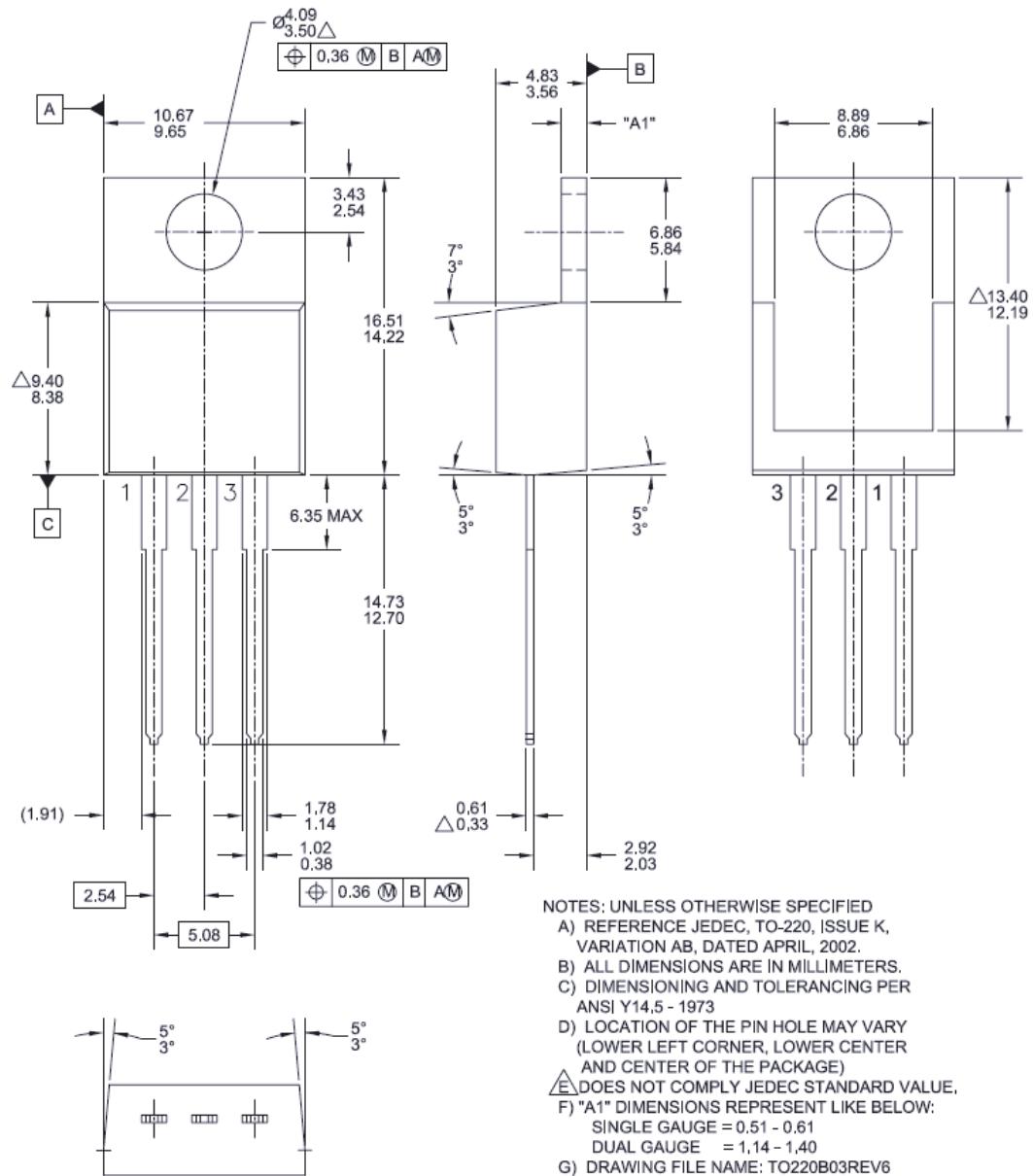


Figure 18. TO-220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

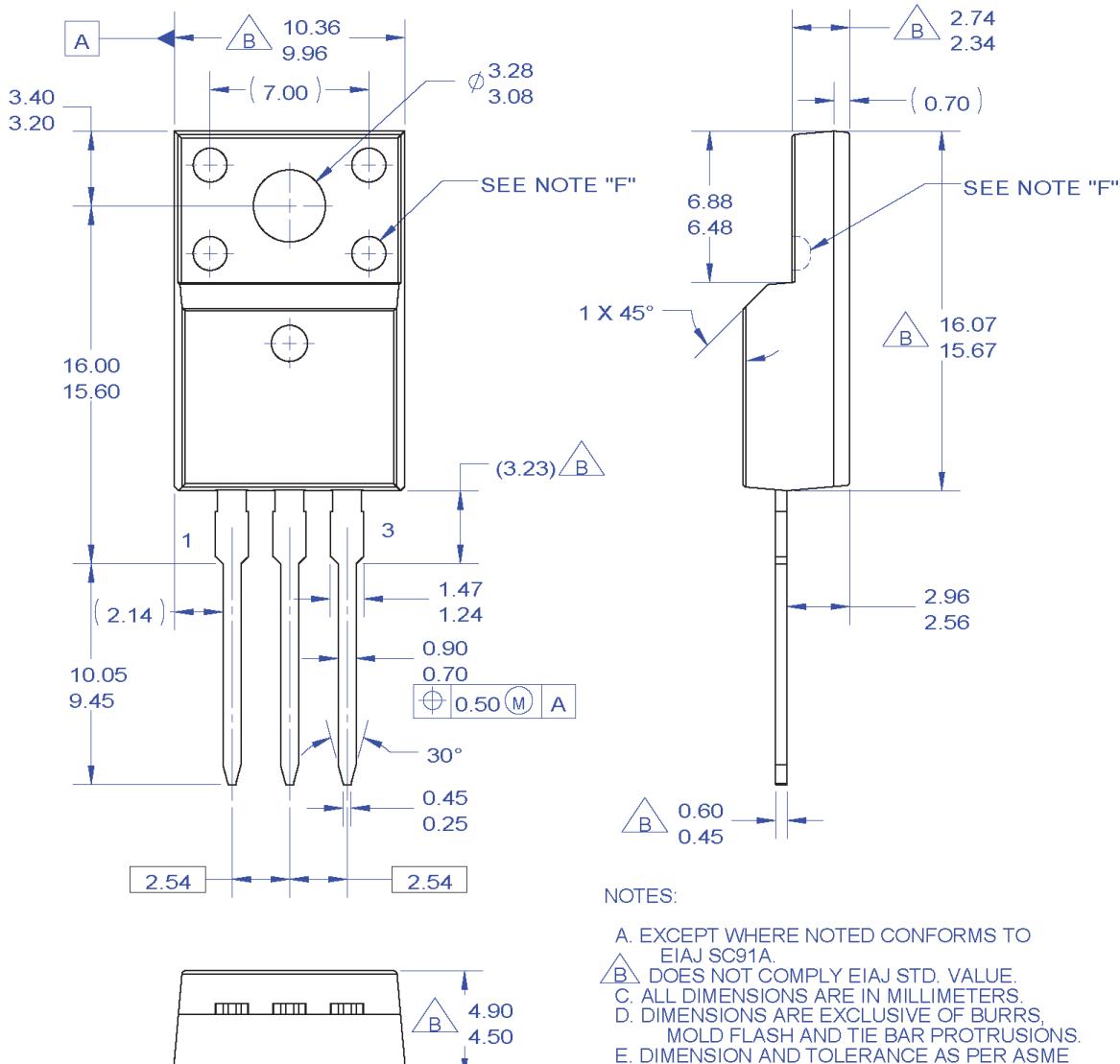


Figure 19. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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