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December 2014

FCPF400N60

N-Channel SuperFET® II MOSFET

600 V, 10 A, 400 mΩ

Features

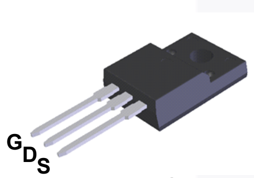
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 350 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 28 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 90 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

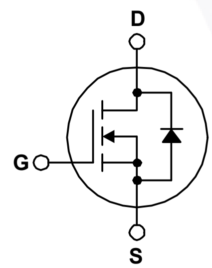
- LCD / LED / PDP TV Lighting
- Solar Inverter
- AC-DC Power Supply

Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



TO-220F



Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FCPF400N60	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	- DC	±20	V
		- AC (f > 1 Hz)	±30	
I_D	Drain Current	- Continuous (T_C = 25°C)	10*	A
		- Continuous (T_C = 100°C)	6.3*	
I_{DM}	Drain Current	- Pulsed (Note 1)	30*	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		211.6	mJ
I_{AR}	Avalanche Current (Note 1)		2.3	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		1.06	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
P_D	Power Dissipation	(T_C = 25°C)	31	W
		- Derate Above 25°C	0.25	W/°C
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	FCPF400N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	4.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCPF400N60	FCPF400N60	TO-220F	Tube	N/A	N/A	50 units

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	$V_{GS} = 0$ V, $I_D = 10$ mA, $T_J = 25°C$	600	-	-	V
		$V_{GS} = 0$ V, $I_D = 10$ mA, $T_J = 150°C$	650	-	-	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10$ mA, Referenced to 25^oC	-	0.67	-	$V/^oC$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 10$ A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600$ V, $V_{GS} = 0$ V	-	-	1	μA
		$V_{DS} = 480$ V, $T_C = 125^oC$	-	0.97	-	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20$ V, $V_{DS} = 0$ V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250$ μA	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10$ V, $I_D = 5$ A	-	0.35	0.40	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20$ V, $I_D = 5$ A	-	11	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, f = 1 MHz	-	1180	1580	pF
C_{oss}	Output Capacitance		-	860	1144	pF
C_{rss}	Reverse Transfer Capacitance		-	43	54	pF
C_{oss}	Output Capacitance	$V_{DS} = 380$ V, $V_{GS} = 0$ V, f = 1 MHz	-	22	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0$ V to 480 V, $V_{GS} = 0$ V	-	90	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380$ V, $I_D = 5$ A, $V_{GS} = 10$ V (Note 4)	-	28	38	nC
Q_{gs}	Gate to Source Gate Charge		-	5	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	10	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	1	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380$ V, $I_D = 5$ A, $V_{GS} = 10$ V, $R_G = 4.7$ Ω (Note 4)	-	13	37	ns
t_r	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	43	95	ns
t_f	Turn-Off Fall Time		-	6	21	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	10	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	30	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_{SD} = 5$ A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0$ V, $I_{SD} = 5$ A, $dI_F/dt = 100$ A/μs	-	240	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.7	-	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 2.3$ A, $V_{DD} = 50$ V, $R_G = 25$ Ω, starting $T_J = 25°C$.
3. $I_{SD} \le 5$ 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

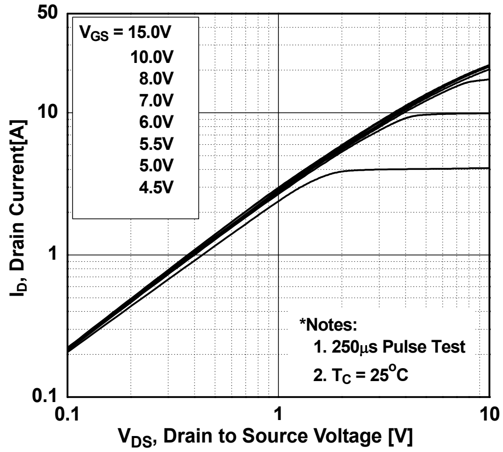


Figure 2. Transfer Characteristics

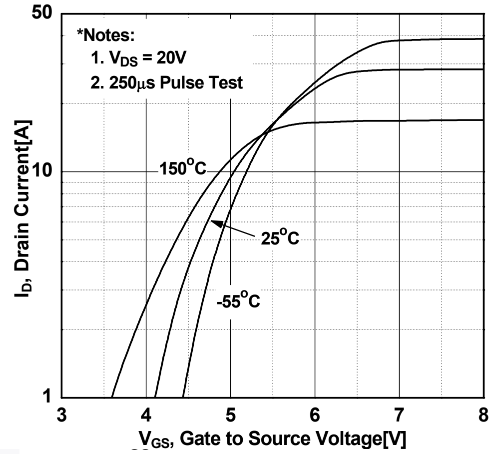


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

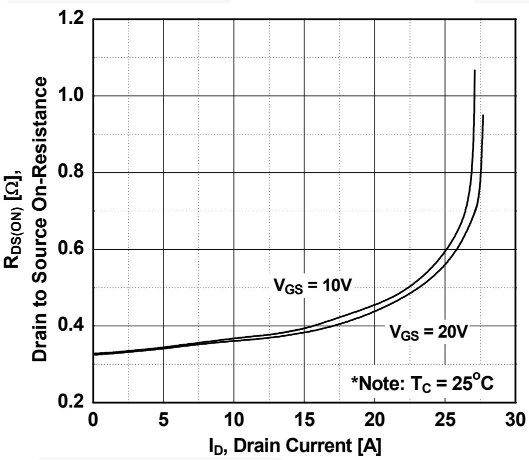


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

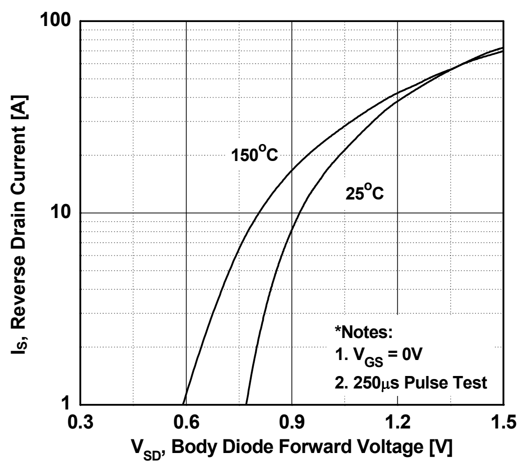


Figure 5. Capacitance Characteristics

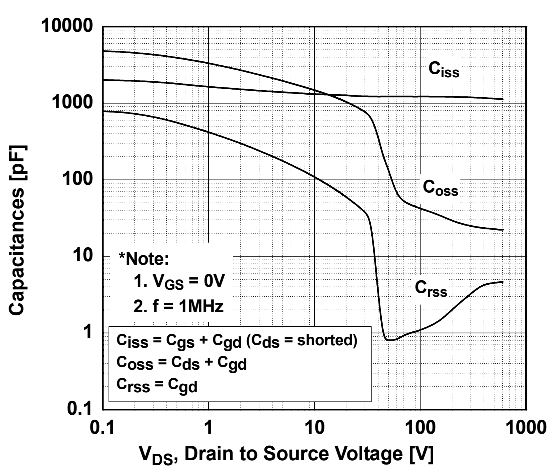
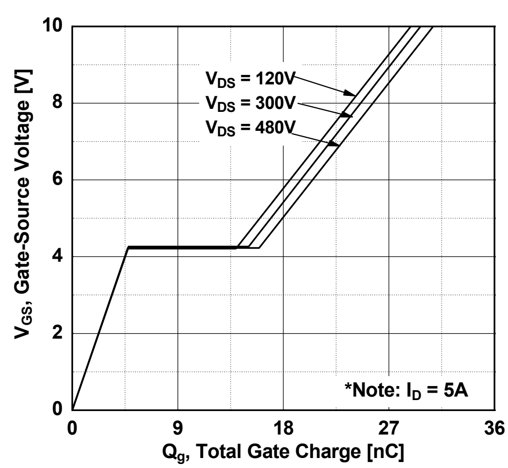


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

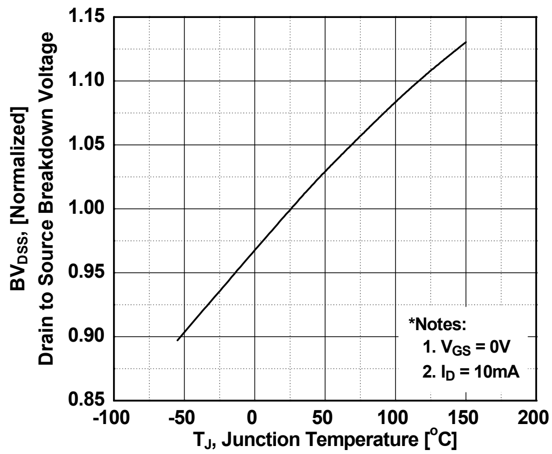


Figure 8. On-Resistance Variation vs. Temperature

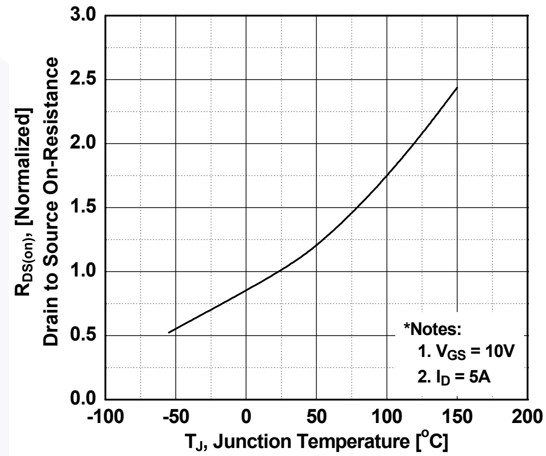


Figure 9. Maximum Safe Operating Area

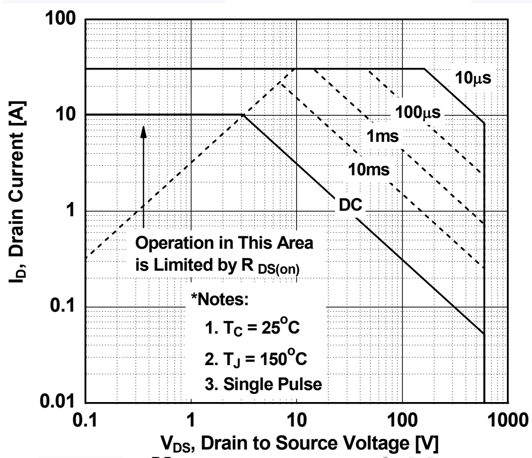


Figure 10. Maximum Drain Current vs. Case Temperature

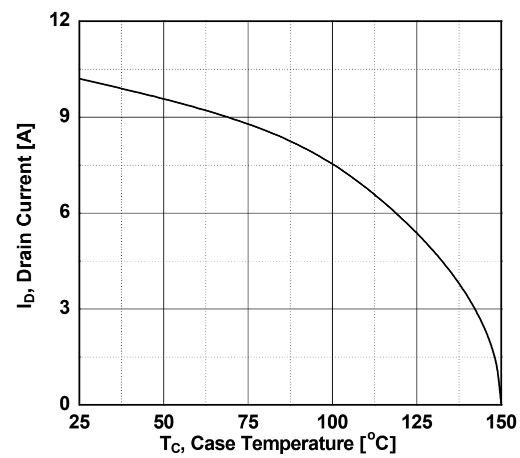
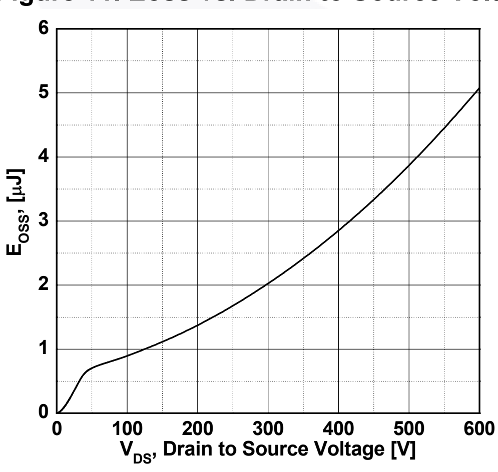
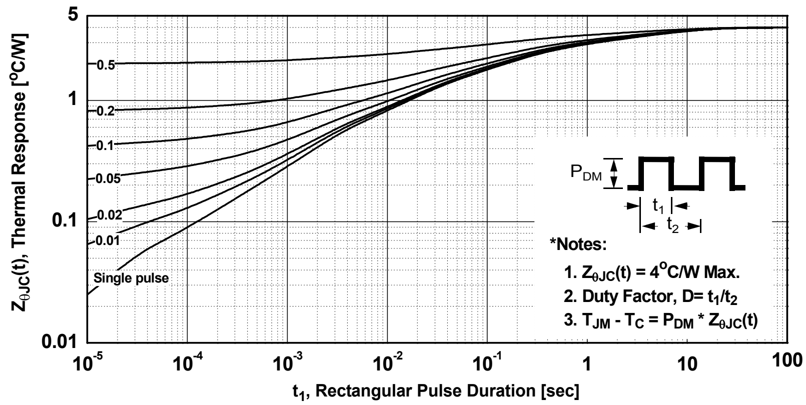


Figure 11. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



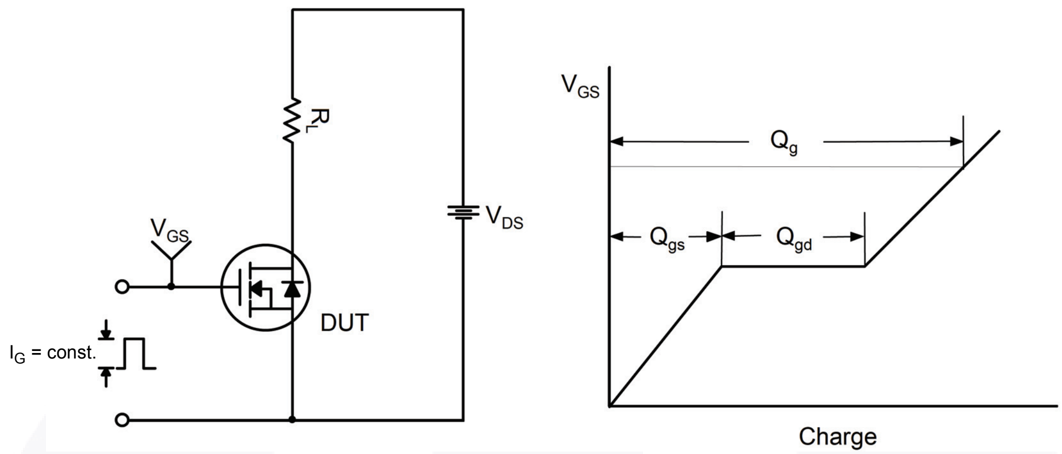


Figure 13. Gate Charge Test Circuit & Waveform

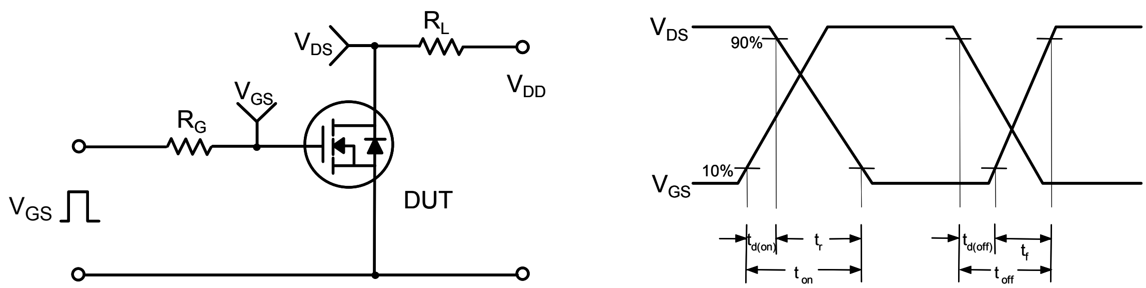


Figure 14. Resistive Switching Test Circuit & Waveforms

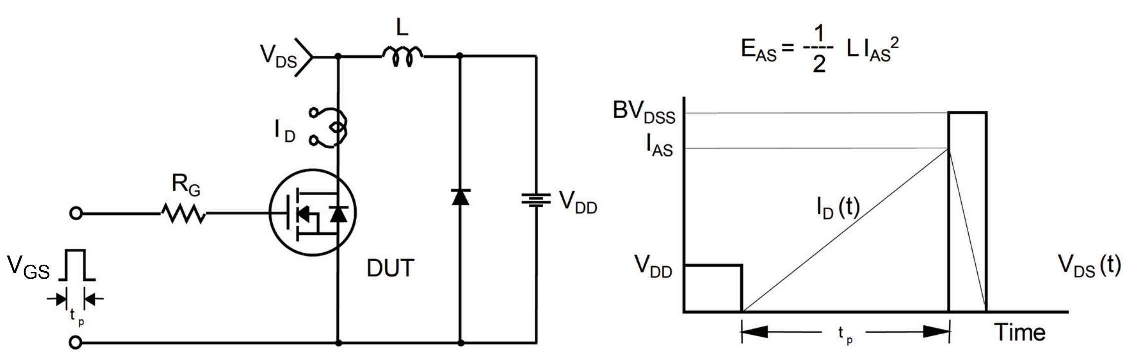


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

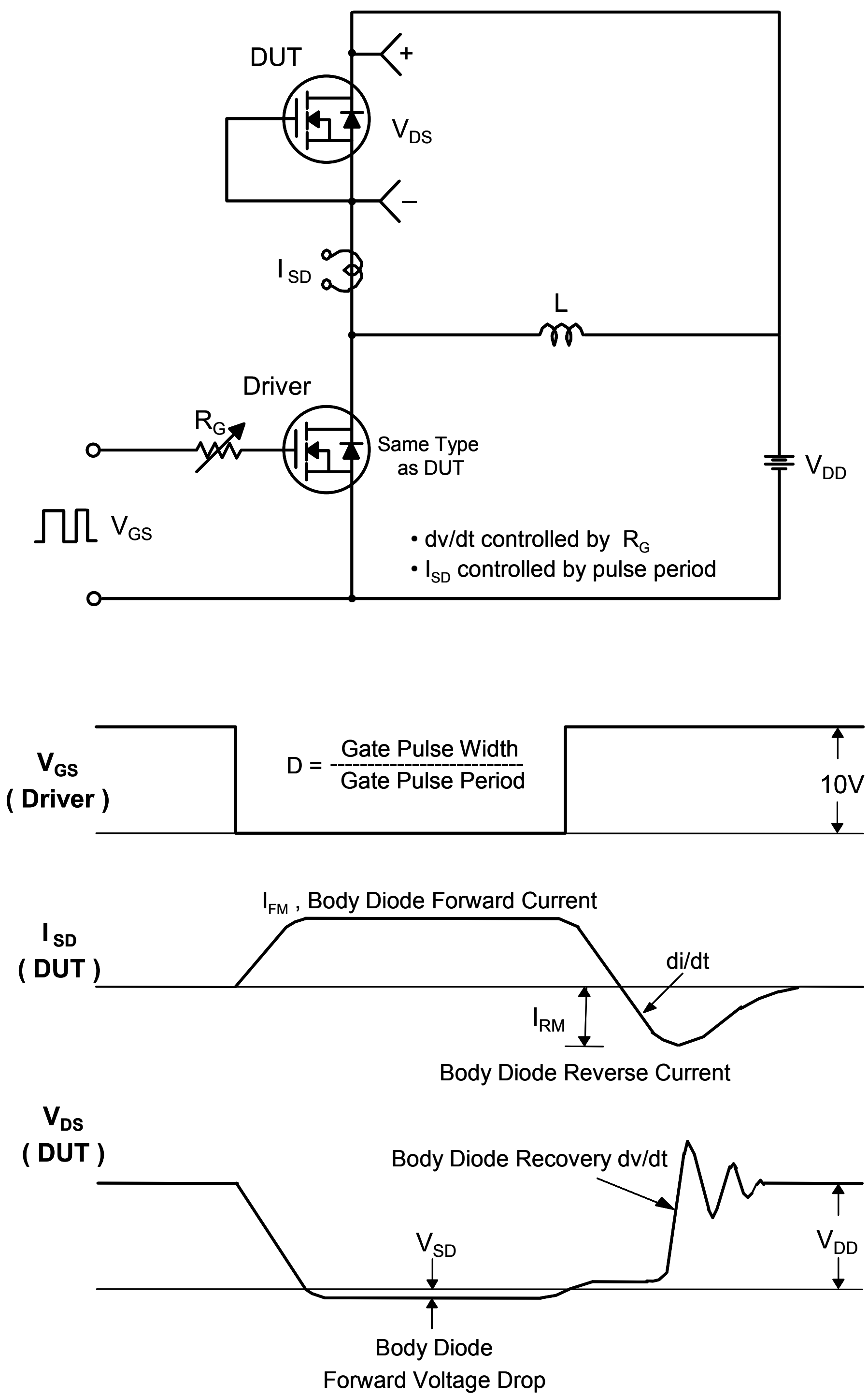


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

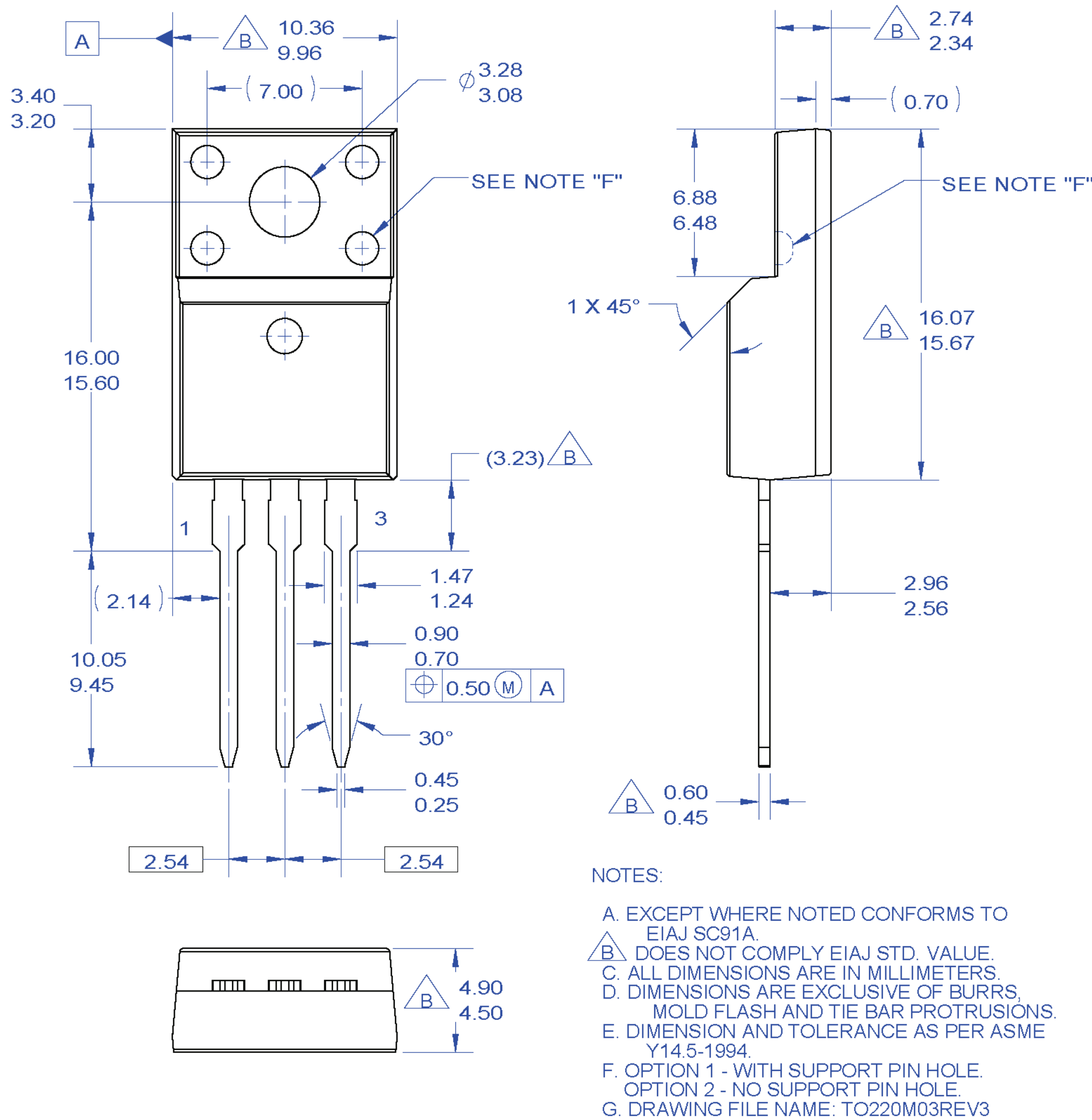


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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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.

Rev. I73

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