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FAIRCHILD SEMICONDUCTOR®

November 2013

FCB11N60

N-Channel SuperFET® MOSFET

600 V, 11 A, 380 mΩ

Features

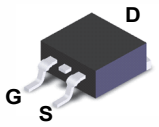
- 650V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 320 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 40 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 95 pF)
- 100% Avalanche Tested
- RoHS Compliant

Application

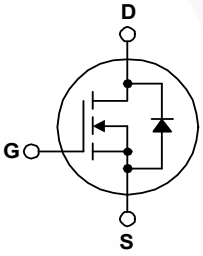
- Lighting
- Solar Inverter
- AC-DC Power Supply

Description

SuperFET® 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 technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



D^2-PAK



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

Symbol	Parameter		FCB11N60TM	Unit
V_{DSS}	Drain to Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C)	11	A
		- Continuous (T_C = 100°C)	7	
I_{DM}	Drain Current	- Pulsed (Note 1)	33	A
V_{GSS}	Gate to Source Voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		340	mJ
I_{AR}	Avalanche Current (Note 1)		11.0	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		12.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)	125	W
		- Derate Above 25°C	1.0	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

Thermal Characteristics

Symbol	Parameter	FCB11N60TM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (1 in^2 Pad of 2-oz Copper), Max.	40	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.	62.5	

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCB11N60TM	FCB11N60	D^2-PAK	Tape and Reel	330 mm	24 mm	800 units

Electrical Characteristics T_C = 25°C 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 = 250 µA, T_C = 25°C	600	-	-	V
		V_{GS} = 0 V, I_D = 250 µA, T_C = 150°C	-	650	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	-	0.6	-	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 11 A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_C = 125°C	-	-	10	
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	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 5.5 A	-	0.32	0.38	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 5.5 A	-	9.7	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	-	1148	1490	pF
C_{oss}	Output Capacitance		-	671	870	pF
C_{rss}	Reverse Transfer Capacitance		-	63	-	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1 MHz	-	35	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	95	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 11 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	-	34	80	ns
t_r	Turn-On Rise Time		-	98	205	ns
$t_{d(off)}$	Turn-Off Delay Time		-	119	250	ns
t_f	Turn-Off Fall Time		-	56	120	ns
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 480 V, I_D = 11 A, V_{GS} = 10 V (Note 4)	-	40	52	nC
Q_{gs}	Gate to Source Gate Charge		-	7.2	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	21	-	nC
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	11	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	33	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 11 A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 11 A, dI_F/dt = 100 A/µs	-	390	-	ns
Q_{rr}	Reverse Recovery Charge		-	5.7	-	µC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 5.51 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 11 A, di/dt ≤ 200 A/µs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

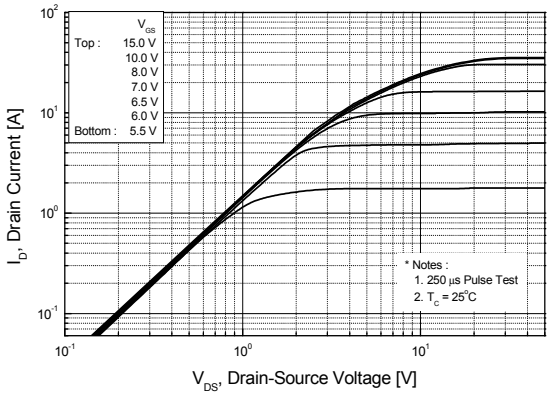


Figure 2. Transfer Characteristics

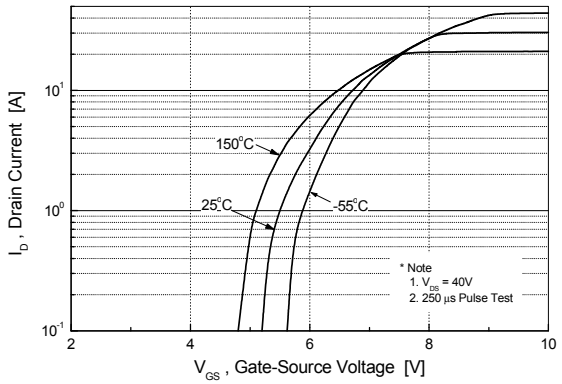


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

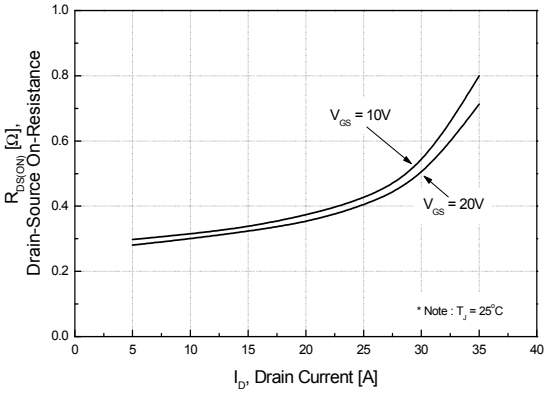


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

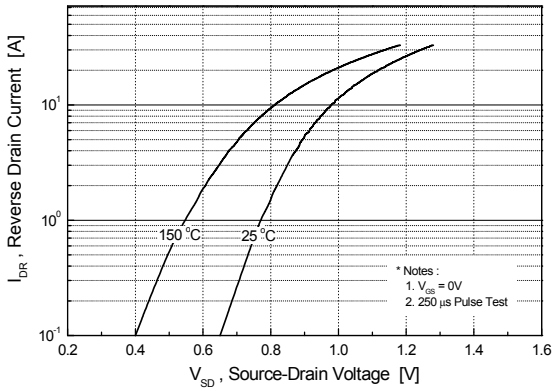


Figure 5. Capacitance Characteristics

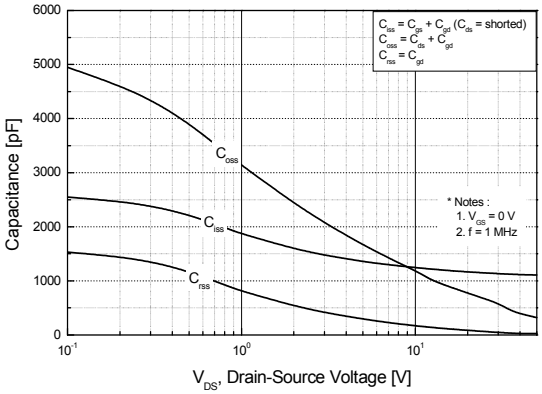
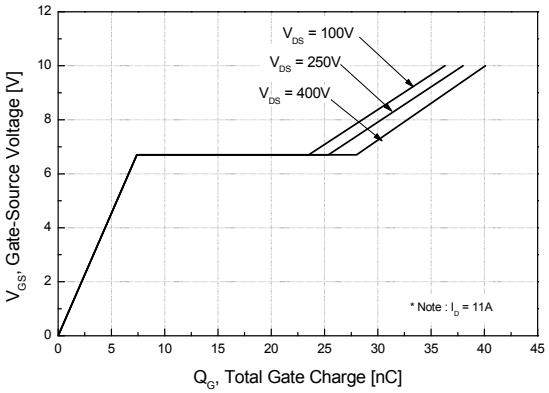


Figure 6. Gate Charge Characteristics



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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

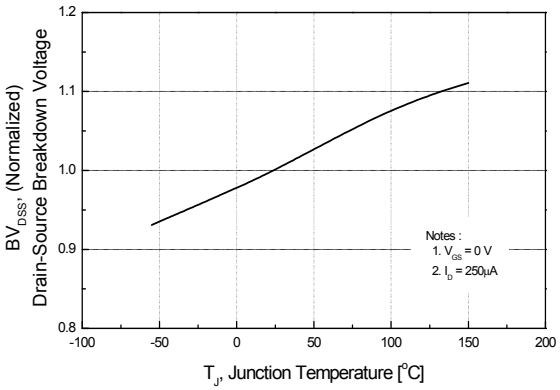


Figure 8. On-Resistance Variation vs. Temperature

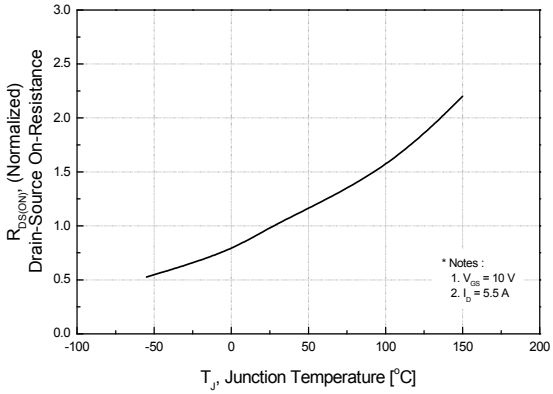


Figure 9. Maximum Safe Operating Area

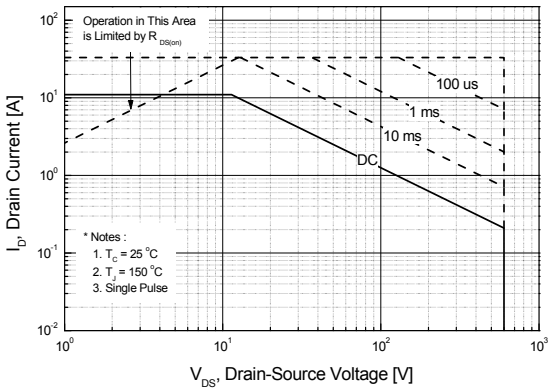


Figure 10. Maximum Drain Current vs. Case Temperature

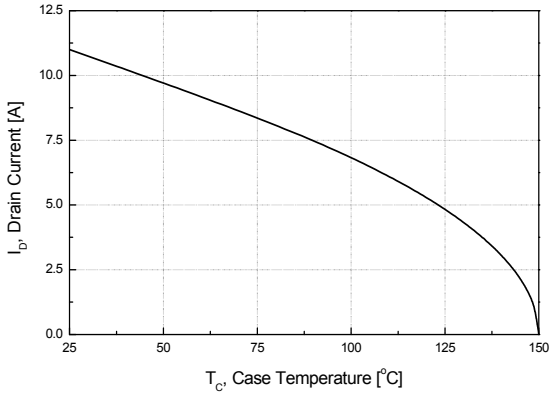
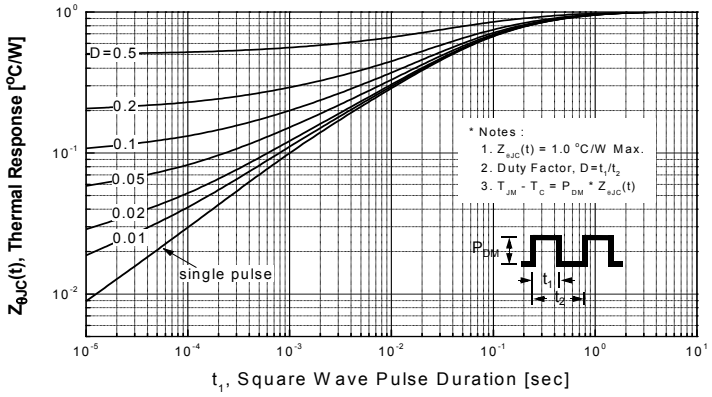


Figure 11. Transient Thermal Response Curve



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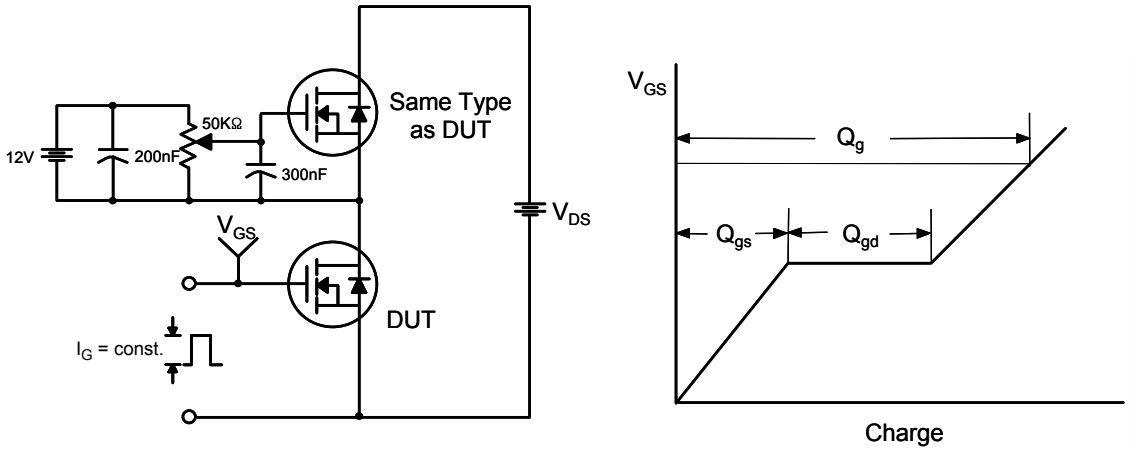


Figure 12. Gate Charge Test Circuit & Waveform

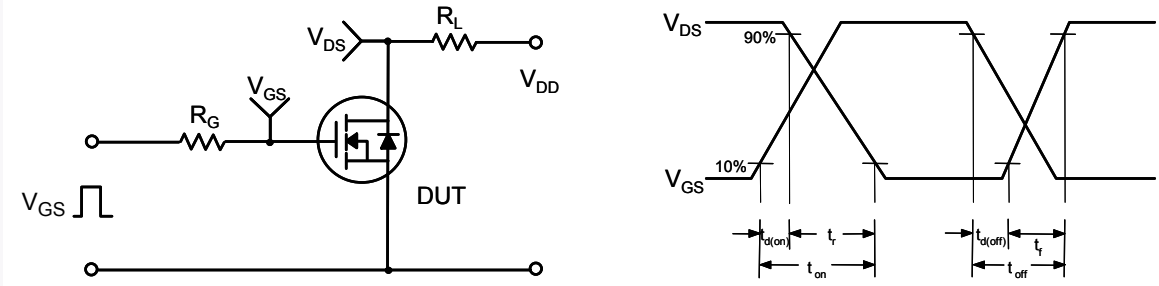


Figure 13. Resistive Switching Test Circuit & Waveforms

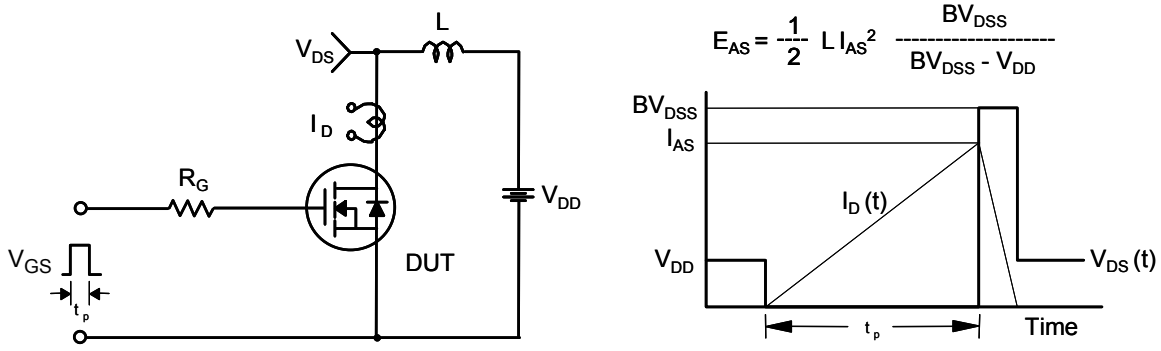


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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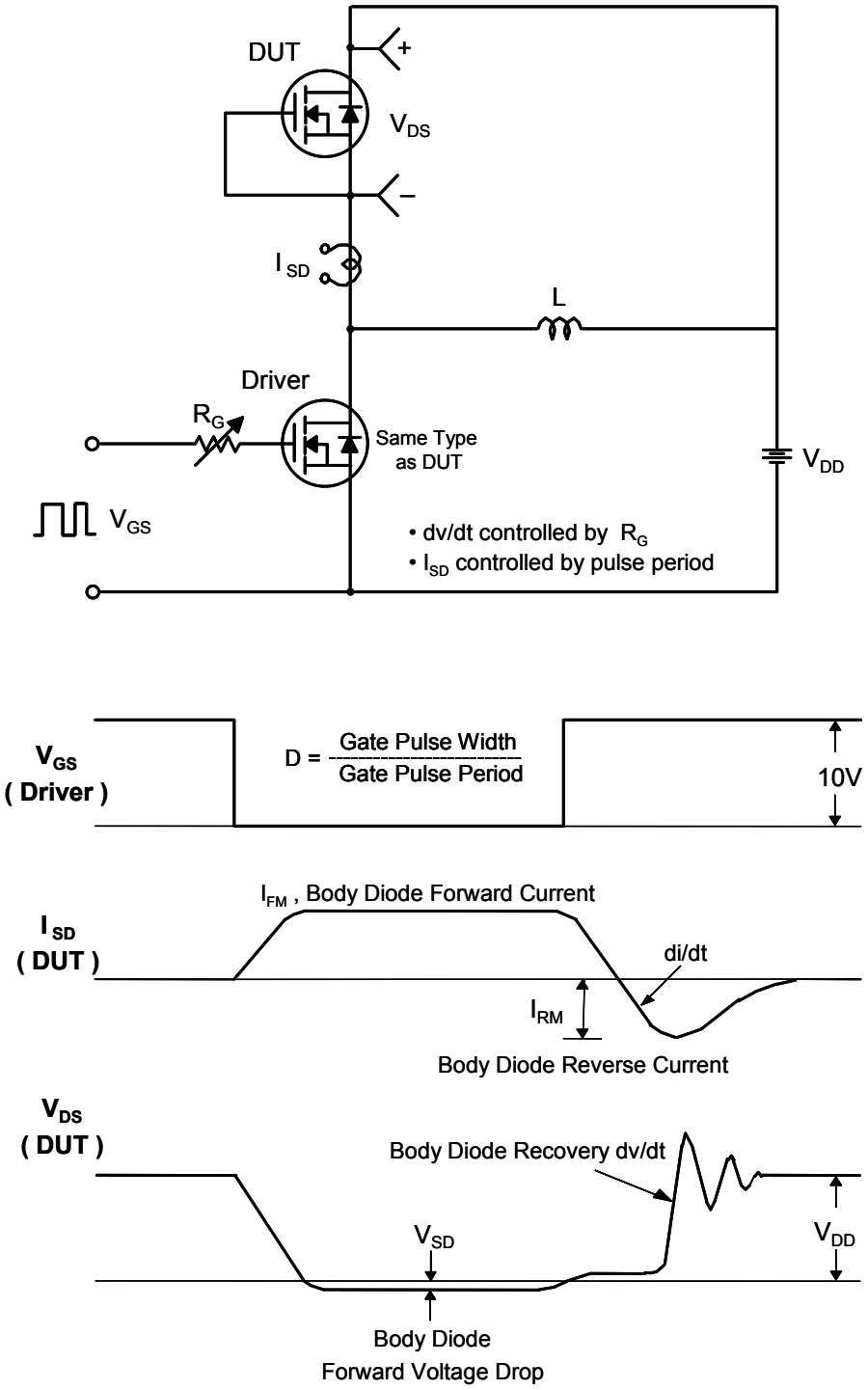


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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Mechanical Dimensions

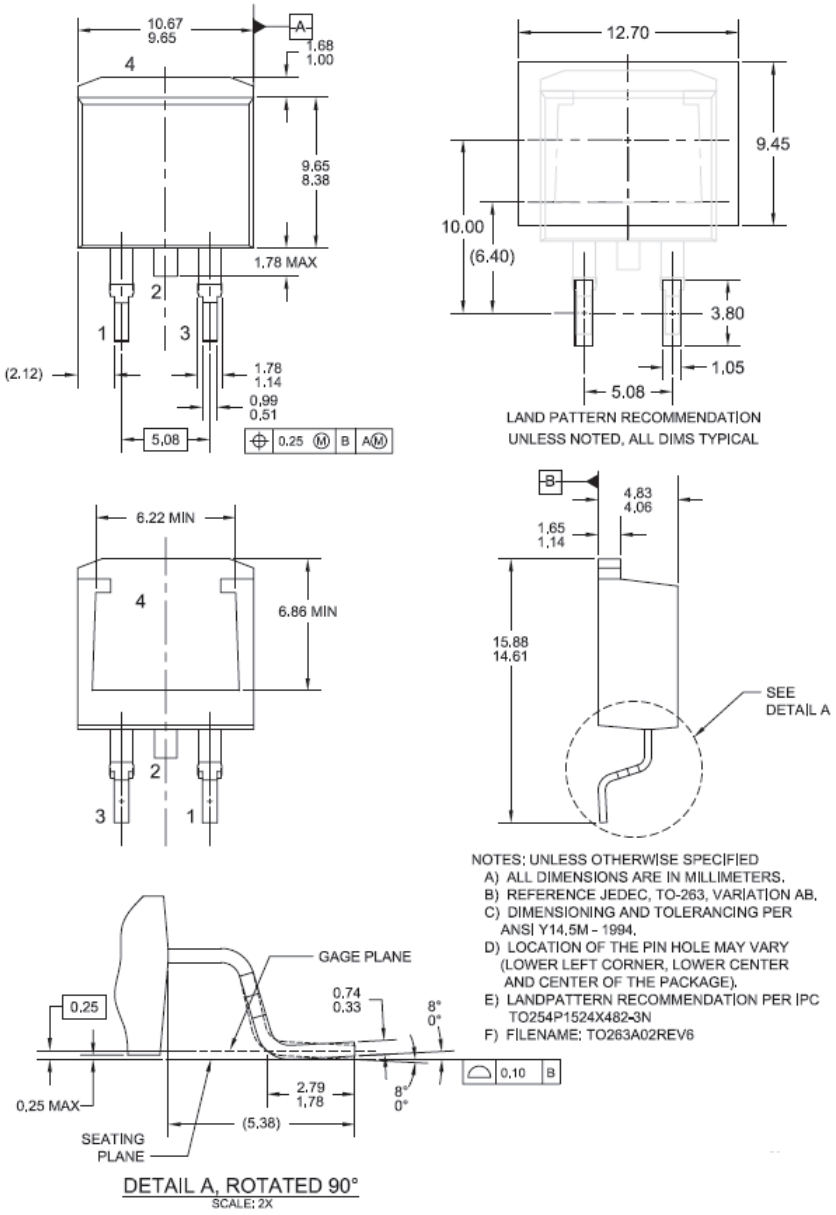


Figure 16. TO263 (D^2PAK), Molded, 2-Lead, Surface Mount

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