August 2014

FCD5N60 / FCU5N60

N-Channel SuperFET® MOSFET

600 V, 4.6 A, 950 mΩ

Features

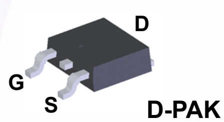
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 810 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 16 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 32 pF)
- 100% Avalanche Tested
- RoHS Compliant

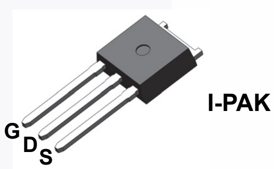
Application

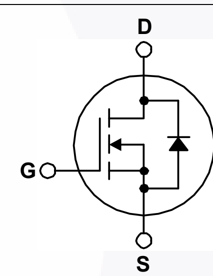
- LCD/LED TV and Monitor
- Lighting
- Solar Inverter
- AC-DC Power Supply

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.







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

Symbol	Parameter		FCD5N60TM FCD5N60TM_WS FCU5N60TU	Unit
V_{DSS}	Drain to Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C)	4.6	A
		- Continuous (T_C = 100°C)	2.9	
I_{DM}	Drain Current	- Pulsed (Note 1)	13.8	A
V_{GSS}	Gate to Source Voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		159	mJ
I_{AR}	Avalanche Current (Note 1)		4.6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		5.4	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)	54	W
		- Derate Above 25°C	0.43	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	FCD5N60TM FCD5N60TM_WS FCU5N60TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	83	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCD5N60TM	FCD5N60	D-PAK	Tape and Reel	330 mm	16 mm	2500 units
FCD5N60TM_WS	FCD5N60	D-PAK	Tape and Reel	330 mm	16 mm	2500 units
FCU5N60TU	FCU5N60	IPAK	Tube	N/A	N/A	75 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.6	-	V/°C
BV_{DS}	Drain to Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 4.6 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°C	-	-	10	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	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 = 2.3 A	-	0.81	0.95	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 2.3 A	-	3.8	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	470	600	pF
C_{oss}	Output Capacitance		-	250	320	pF
C_{rss}	Reverse Transfer Capacitance		-	22	-	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1 MHz	-	12	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	32	-	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 4.6 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	-	12	30	ns
t_r	Turn-On Rise Time		-	40	90	ns
$t_{d(off)}$	Turn-Off Delay Time		-	47	95	ns
t_f	Turn-Off Fall Time		-	22	55	ns
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 480 V, I_D = 4.6 A, V_{GS} = 10 V (Note 4)	-	16	-	nC
Q_{gs}	Gate to Source Gate Charge		-	2.8	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	7	-	nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	4.6	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	13.8	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 4.6 A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 4.6 A, dI_F/dt = 100 A/μs	-	295	-	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. $I_{SD} \leq$ 4.6 A, di/dt ≤ 200 A/μs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

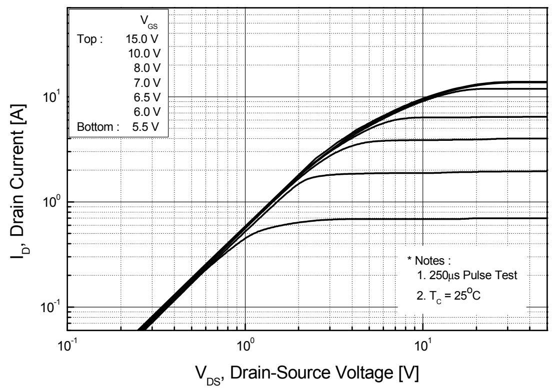


Figure 2. Transfer Characteristics

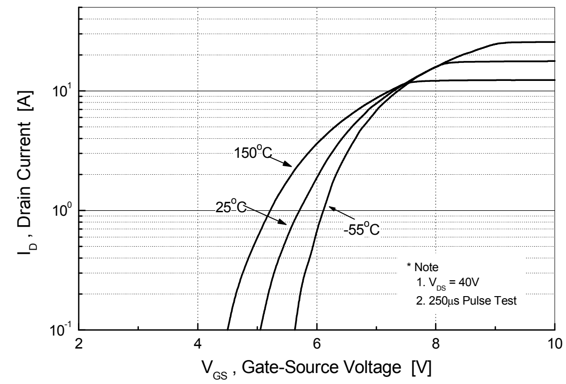


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

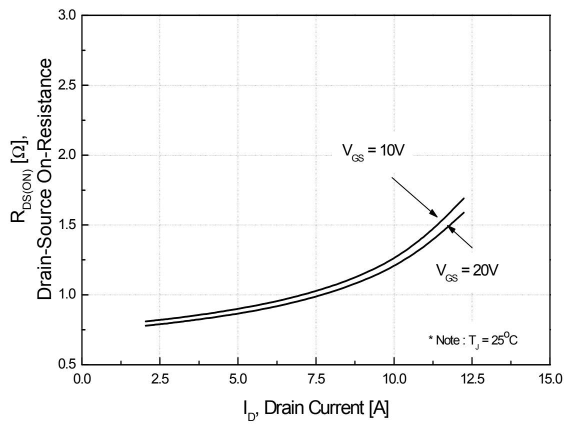


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

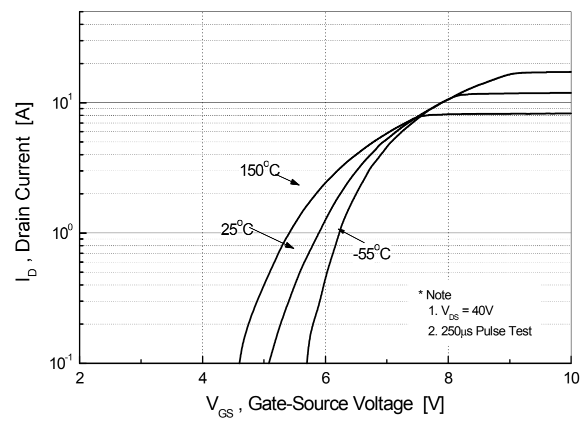


Figure 5. Capacitance Characteristics

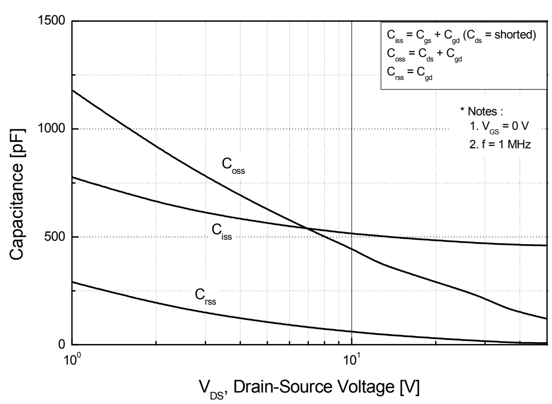
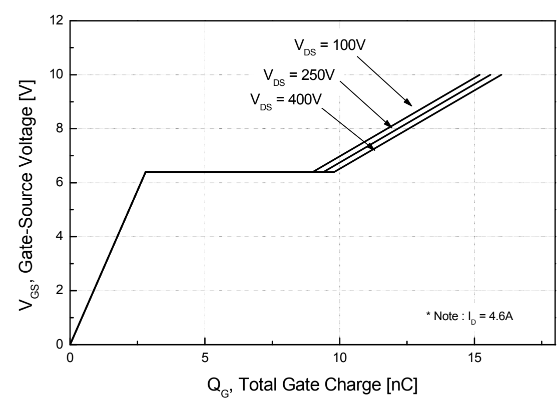


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

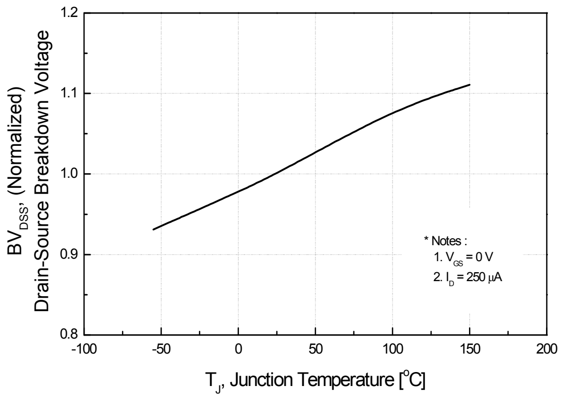


Figure 8. On-Resistance Variation vs. Temperature

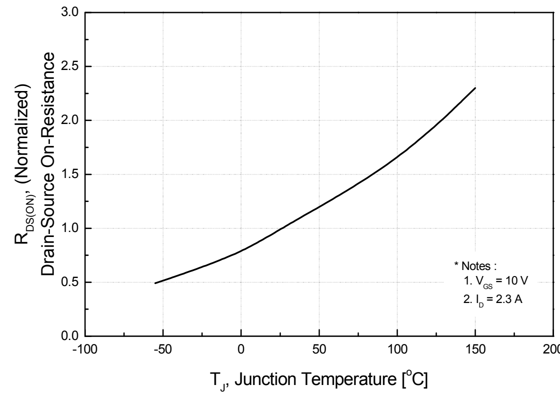


Figure 9. Maximum Safe Operating Area

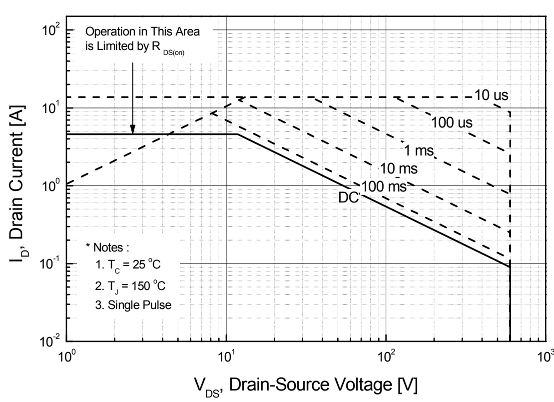


Figure 10. Maximum Drain Current vs. Case Temperature

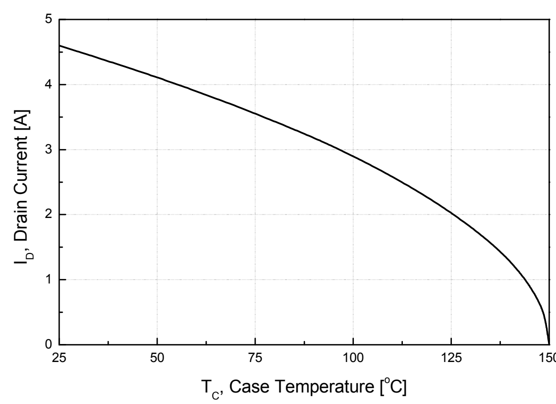
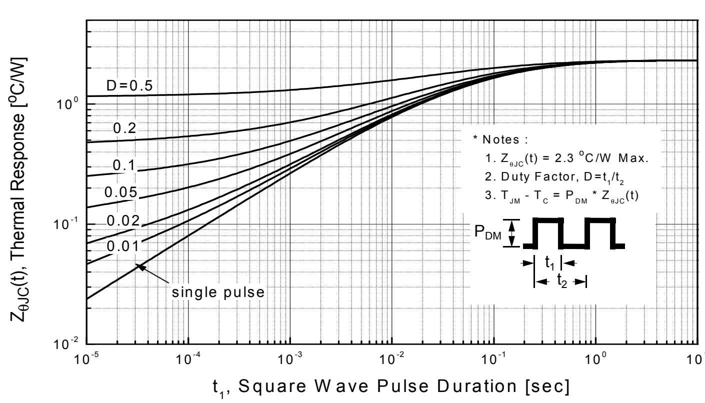


Figure 11. Transient Thermal Response Curve



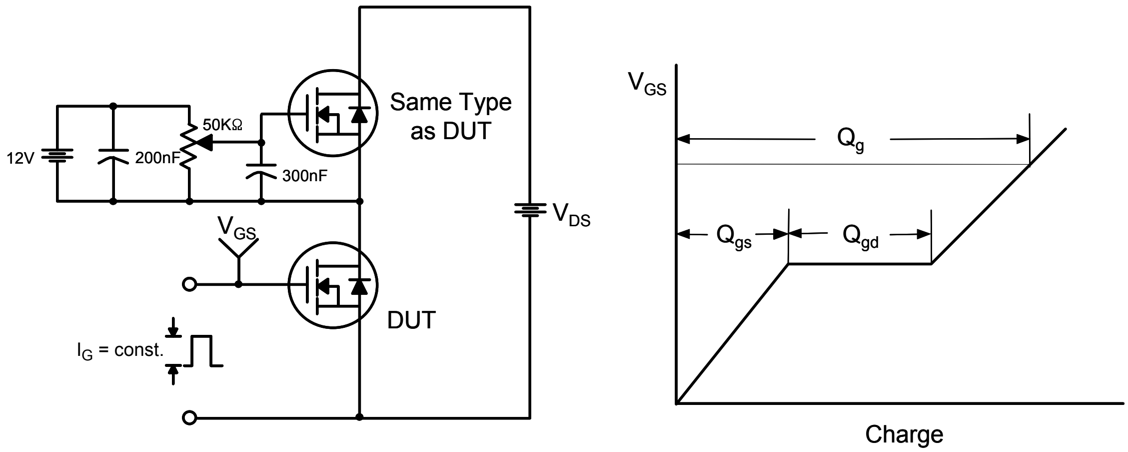


Figure 12. Gate Charge Test Circuit & Waveform

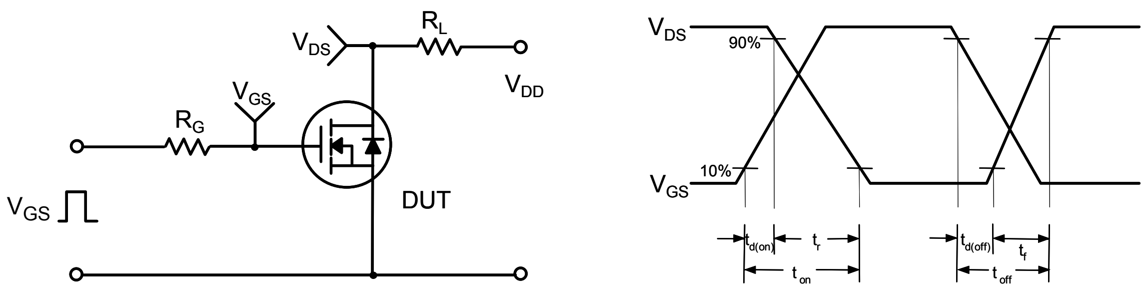


Figure 13. Resistive Switching Test Circuit & Waveforms

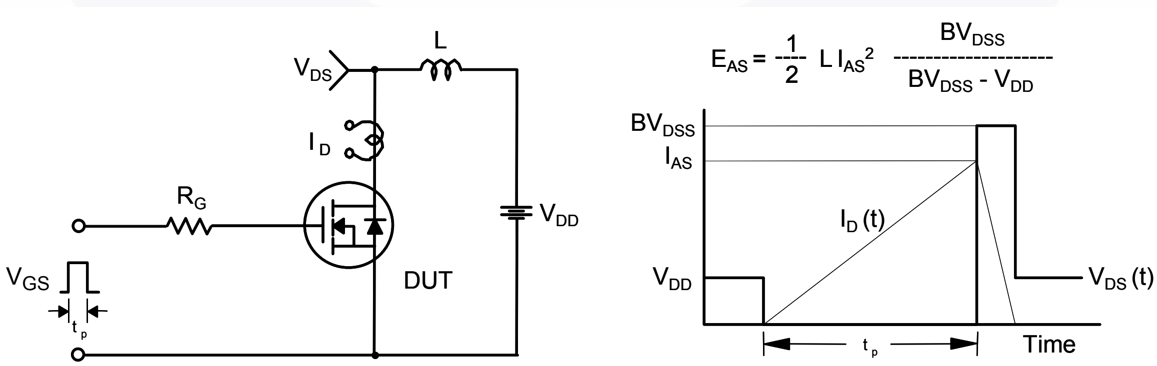


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

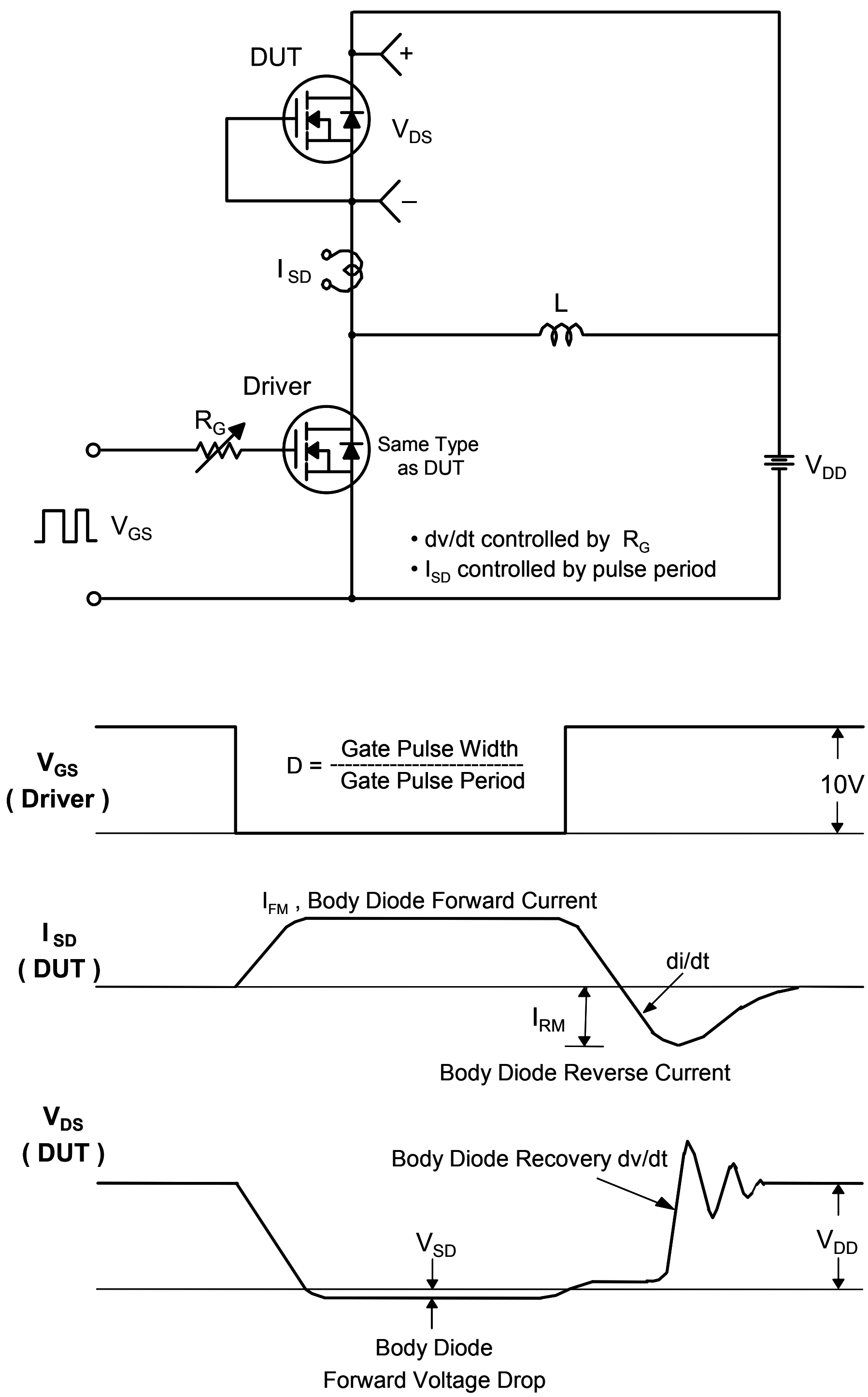


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

PUBLICATION ORDERING INFORMATION

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