

FCP22N60N / FCPF22N60NT

N-Channel SupreMOS® MOSFET

600 V, 22 A, 165 mΩ

Features

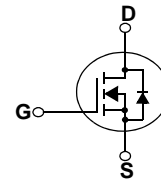
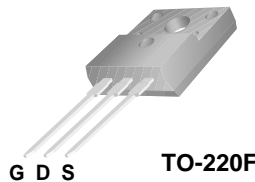
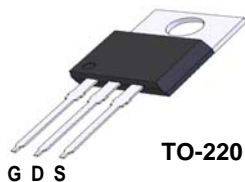
- $BV_{DSS} > 650V$ @ $T_J = 150^\circ C$
- $R_{DS(on)} = 140\ m\Omega$ (Typ.) @ $V_{GS} = 10\ V$, $I_D = 11\ A$
- Ultra Low Gate Charge (Typ. $Q_g = 45\ nC$)
- Low Effective Output Capacitance (Typ. $C_{oss,eff} = 196.4\ pF$)
- 100% Avalanche Tested
- RoHS Compliant

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.



MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted*

Symbol	Parameter	FCP22N60N	FCPF22N60NT	Unit
V_{DSS}	Drain to Source Voltage	600		V
V_{GSS}	Gate to Source Voltage	±45		V
I_D	Drain Current	Continuous ($T_C = 25^\circ C$)	22	22*
		Continuous ($T_C = 100^\circ C$)	13.8	13.8*
I_{DM}	Drain Current	Pulsed (Note 1)		A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)		672
I_{AR}	Avalanche Current			7.3
E_{AR}	Repetitive Avalanche Energy			2.75
dv/dt	Peak Diode Recovery dv/dt	(Note 3)		20
	MOSFET dv/dt			100
P_D	Power Dissipation	$(T_C = 25^\circ C)$		205
		Derate above $25^\circ C$		1.64
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCP22N60N	FCPF22N60NT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.61	3.2	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.5	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCP22N60N	FCP22N60N	TO-220	-	-	50
FCPF22N60NT	FCPF22N60NT	TO-220F	-	-	50

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}, T_J = 150^\circ\text{C}$	650	-	-	
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1 \text{ mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.68	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	-	10	μA
		$V_{DS} = 480 \text{ V}, T_J = 125^\circ\text{C}$	-	-	100	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 45 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.0	3	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 11 \text{ A}$	-	0.140	0.165	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_D = 11 \text{ A}$	-	22	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$	-	1950	-	pF
C_{oss}	Output Capacitance		-	75.9	-	pF
C_{rss}	Reverse Transfer Capacitance		-	3	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 380 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	43.2	-	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	196.4	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380 \text{ V}, I_D = 11 \text{ A},$ $V_{GS} = 10 \text{ V}$ (Note 4)	-	45	-	nC
Q_{gs}	Gate to Source Gate Charge		-	8.7	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	14.5	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open, $f=1 \text{ MHz}$	-	1	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380 \text{ V}, I_D = 11 \text{ A}$ $R_G = 4.7 \Omega$ (Note 4)	-	16.9	-	ns
t_r	Turn-On Rise Time		-	16.7	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	49	-	ns
t_f	Turn-Off Fall Time		-	4	-	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	22	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	66	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 11 \text{ A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 11 \text{ A}$ $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	350	-	ns
Q_{rr}	Reverse Recovery Charge		-	6	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 7.3 \text{ A}, R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 22 \text{ A}, di/dt \leq 200 \text{ A}/\mu\text{s}, V_{DD} \leq 380 \text{ V}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

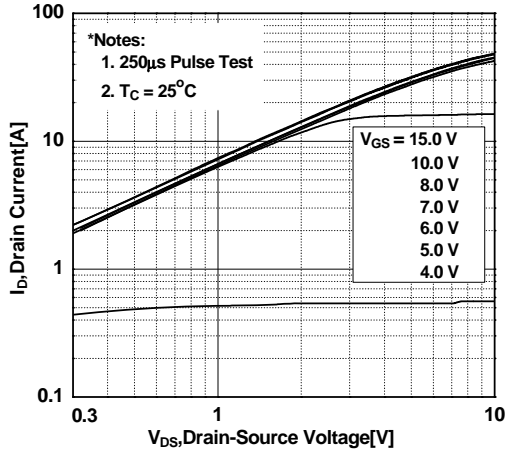


Figure 2. Transfer Characteristics

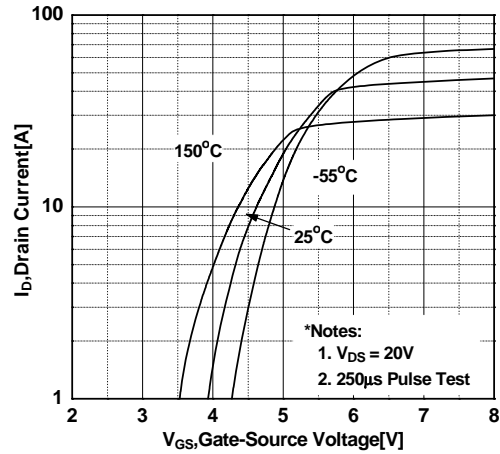


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

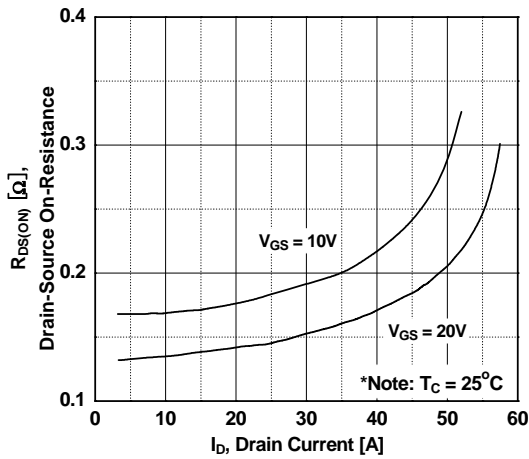


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

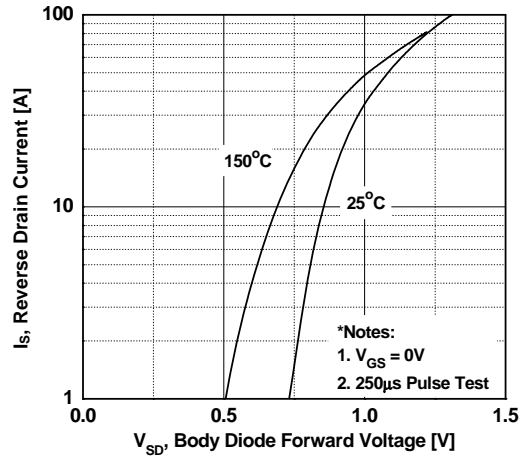


Figure 5. Capacitance Characteristics

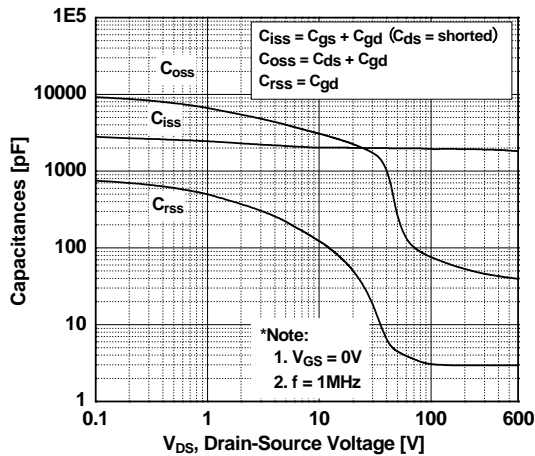
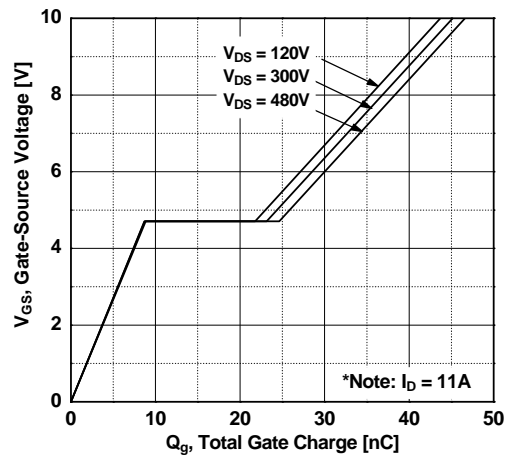


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

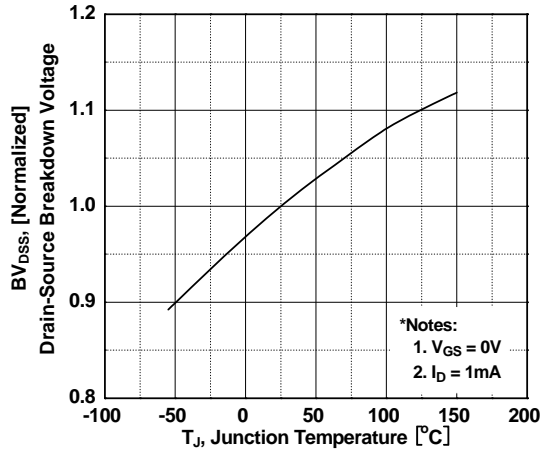


Figure 8. On-Resistance Variation vs. Temperature

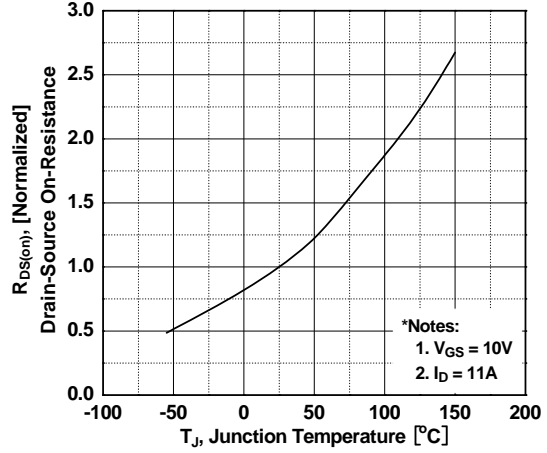


Figure 9. Maximum Safe Operating Area - FCP22N60N

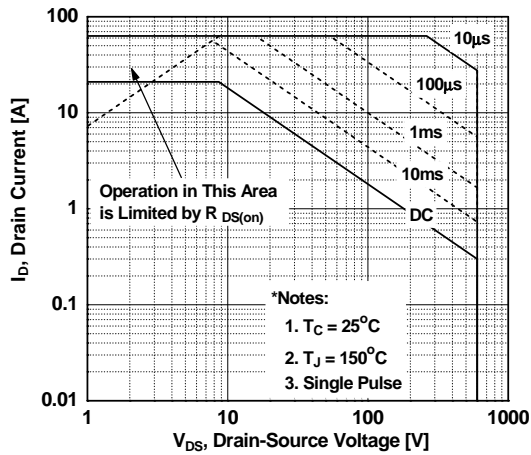


Figure 10. Maximum Safe Operating Area - FCPF22N60NT

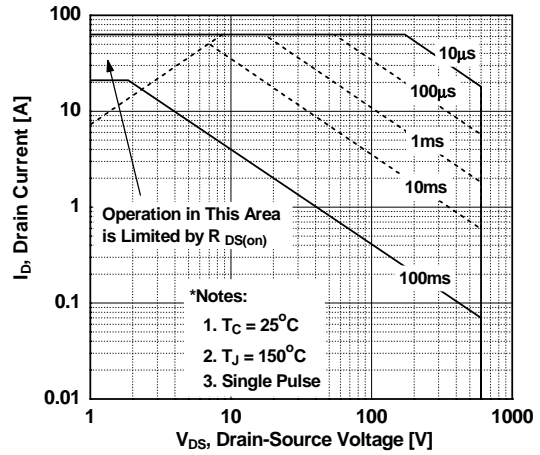
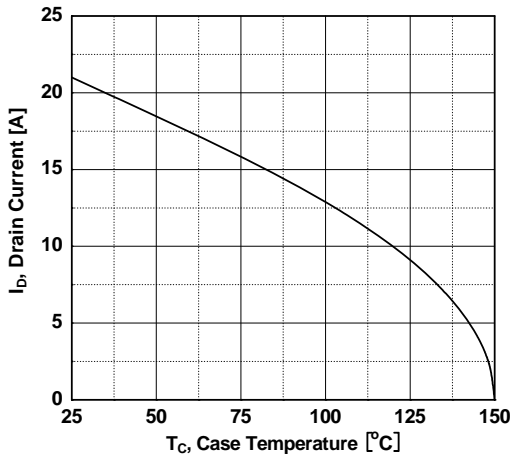


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics

Figure 12. Transient Thermal Response Curve - FCP22N60N

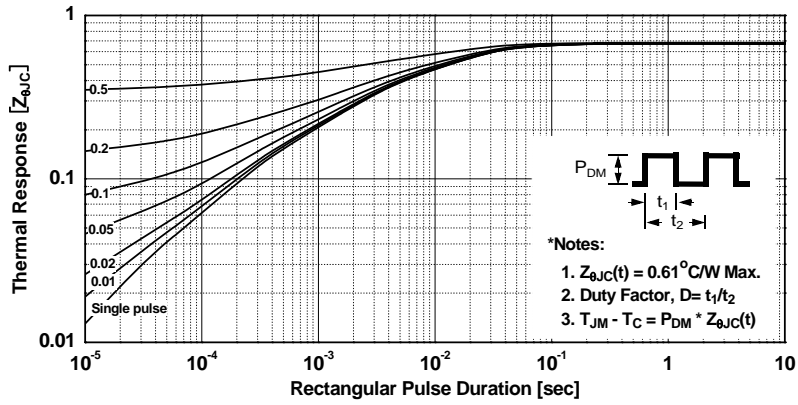
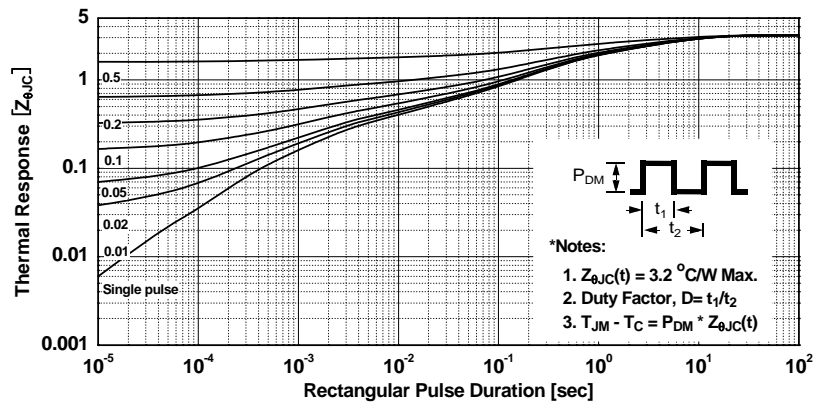
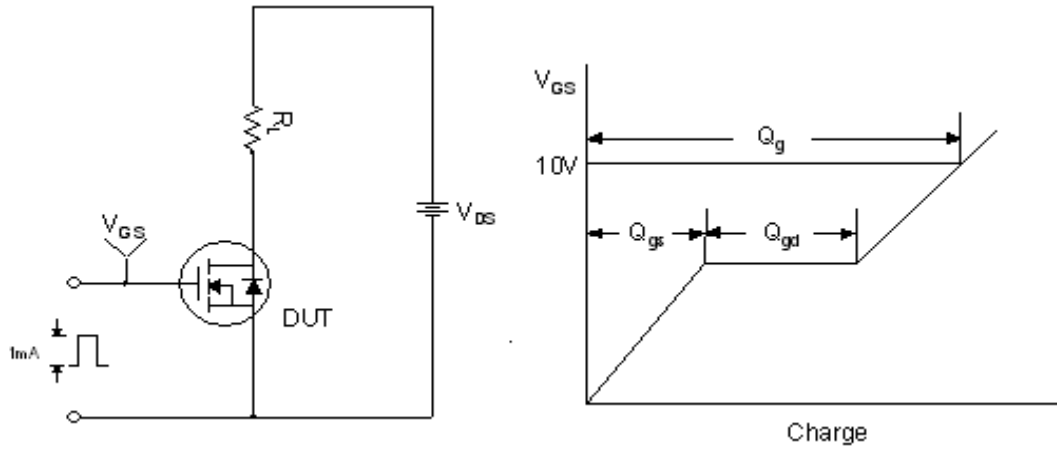


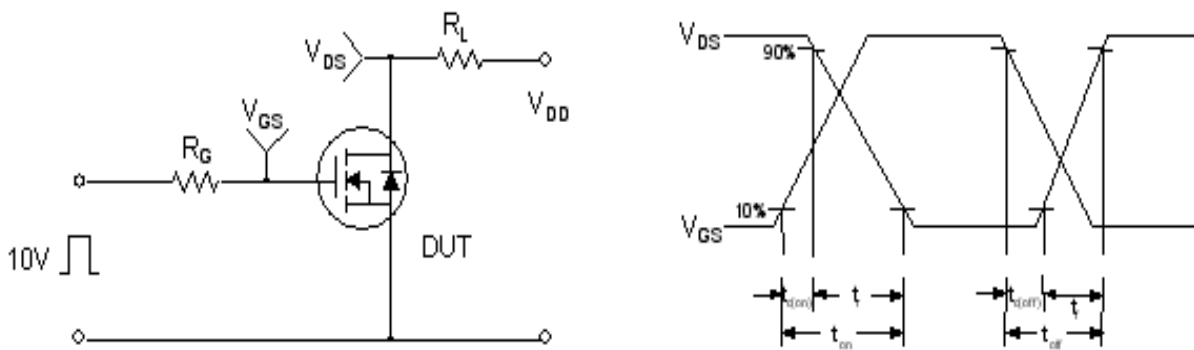
Figure 13. Transient Thermal Response Curve - FCPF22N60NT



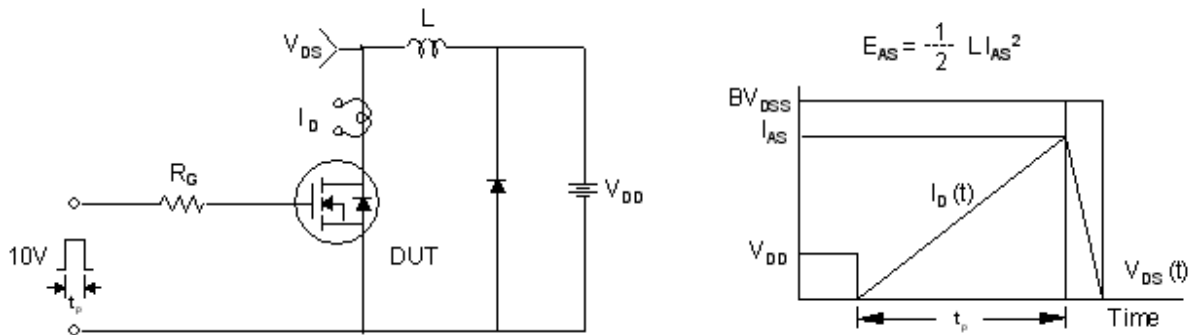
Gate Charge Test Circuit & Waveform



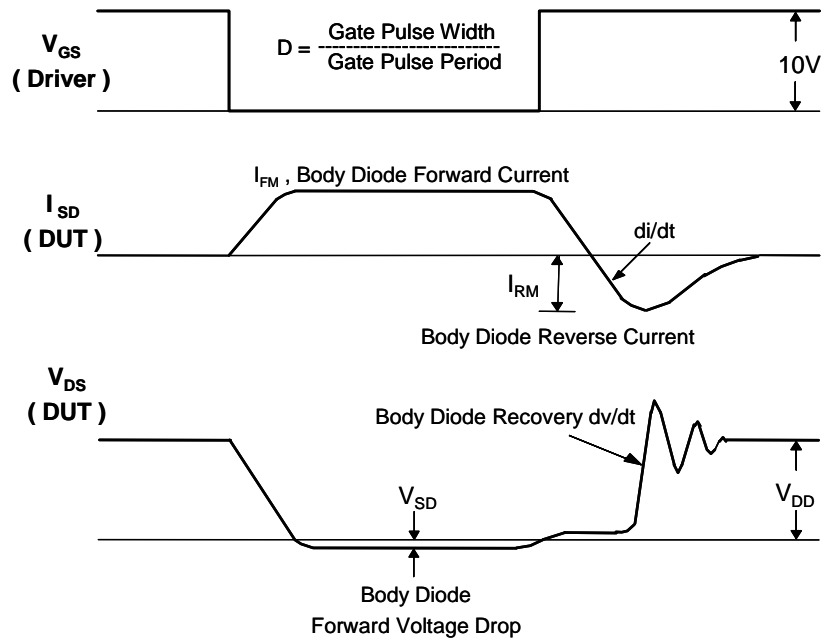
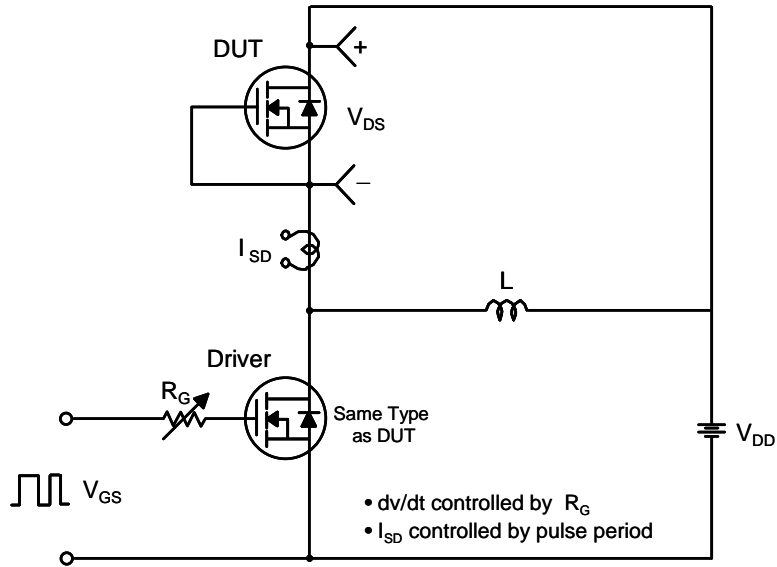
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms





Peak Diode Recovery dv/dt Test Circuit & Waveforms





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