



SKJ13N65

650V N-ch Multi-Epi Super-Junction MOSFET

General Features

- Proprietary New Super-Junction Technology
- $R_{DS(ON),typ.}=0.3\ \Omega @ V_{GS}=10V$
- Very low FOM $R_{DS(on)}$
- 100% avalanche tested

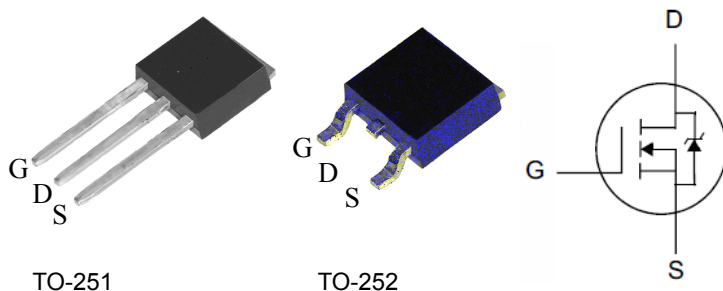
BV_{DSS}	$R_{DS(ON),typ.}$	I_D
650V	300m Ω	13A

Applications

- Switch Mode Power Supply(SMPS)
- Uninterruptible Power Supply(UPS)
- Power Factor Correction(PFC)

Ordering Information

Part Number	Package
SKJ13N65	TO-252
SKJ13N65T1	TO-251



Absolute Maximum Ratings

$T_C=25^{\circ}C$ unless otherwise specified

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-to-Source Voltage	650	V
V_{GSS}	Gate-to-Source Voltage	± 20	
I_D	Continuous Drain Current	13	A
I_{DM}	Pulsed Drain Current at $V_{GS}=10V$ (note1)	39	
E_{AS}	Single Pulse Avalanche Energy(note2)	280	mJ
P_D	Power Dissipation	101	W
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	$^{\circ}C$
$T_J \& T_{STG}$	Operating and Storage Temperature Range	-55 to 150	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	Max. Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.24	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	75	



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Electrical Characteristics

OFF Characteristics

$T_J = 25^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	650	--	--	V	$V_{GS}=0V, I_D=250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	--	--	10	μA	$V_{DS}=650V, V_{GS}=0V$
I_{GSS}	Gate-to-Source Leakage Current	--	--	+100	nA	$V_{GS}=+20V, V_{DS}=0V$
		--	--	-100		$V_{GS}=-20V, V_{DS}=0V$

ON Characteristics

$T_J = 25^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	0.30	0.32	Ω	$V_{GS}=10V, I_D=5.5A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.7	--	4.5	V	$V_{DS}=V_{GS}, I_D=250\mu A$

Dynamic Characteristics

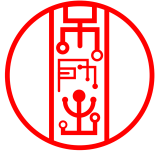
Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	534	--	pF	$V_{GS}=0V, V_{DS}=50V, f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance	--	26.7	--		
C_{oss}	Output Capacitance	--	45	--		
R_g	Gate resistance (Intrinsic)	--	8.9	--	Ω	$f=1.0MHz, \text{Open Drain}$
Q_g	Total Gate Charge	--	26.6	--	nC	$V_{DD}=520V, I_D=5A, V_{GS}=0 \text{ to } 10V$
Q_{gs}	Gate-to-Source Charge	--	6.0	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	13.1	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	11	--	ns	$V_{DD}=400V, I_D=5A, V_{GS}=10V, R_g=10\Omega$
t_{rise}	Rise Time	--	13	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	40	--		
t_{fall}	Fall Time	--	14	--		



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Source-Drain Body Diode Characteristics

$T_J=25^{\circ}\text{C}$ unless otherwise specified

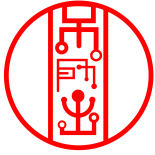
Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current ^[2]	--	--	13	A	Maximum Ratings
I_{SM}	Pulsed Source Current ^[2]	--	--	39		
V_{SD}	Diode Forward Voltage	--	0.9	1.1	V	$I_S=5\text{A}$, $V_{GS}=0\text{V}$
t_{rr}	Reverse Recovery Time	--	215	--	ns	$V_R=400\text{V}$, $V_{GS}=0\text{V}$ $I_F=5.0\text{A}$, $di/dt=100\text{A}/\mu\text{s}$
Q_{rr}	Reverse Recovery Charge	--	1.8	--	uC	

Note:

[1] Repetitive Rating: Pulse width limited by maximum junction temperature

[2] $I_{AS}=7.5\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

[3] Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 1\%$



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Typical Characteristics

Figure 1. Output Characteristics

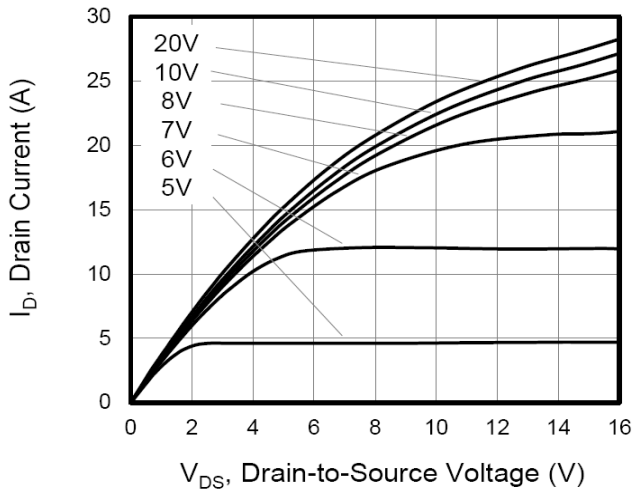


Figure 2. Transfer Characteristics

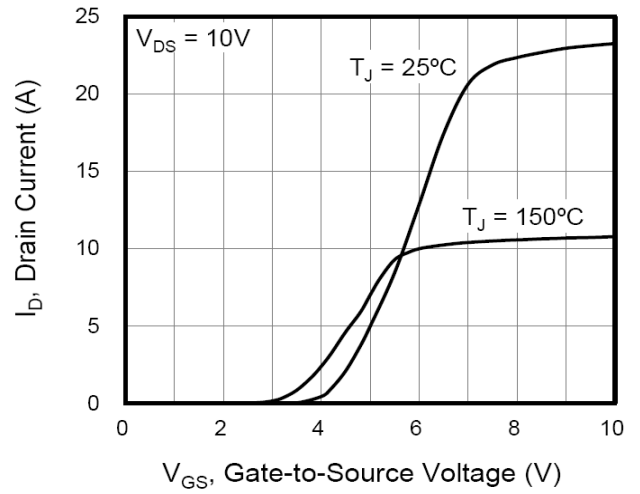


Figure 3. On-Resistance vs. Drain Current

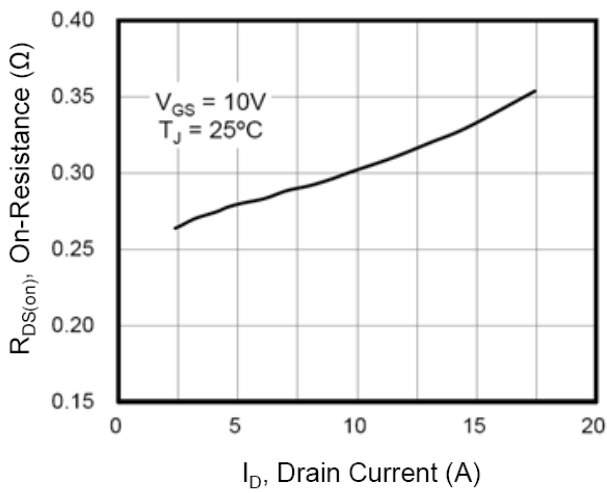


Figure 4. Capacitance

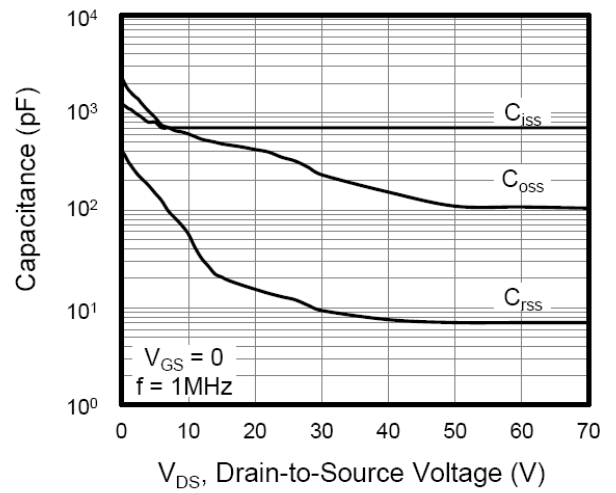


Figure 5. Gate Charge

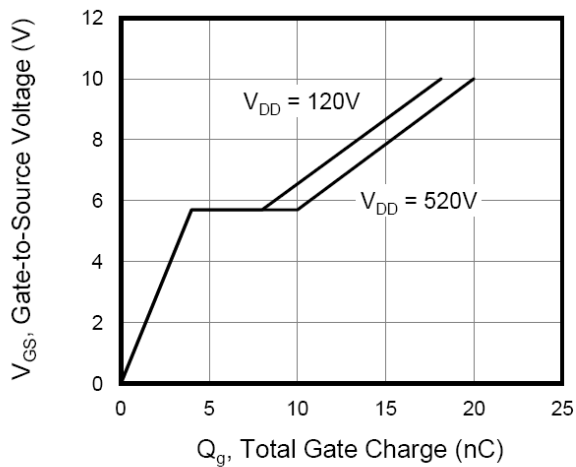
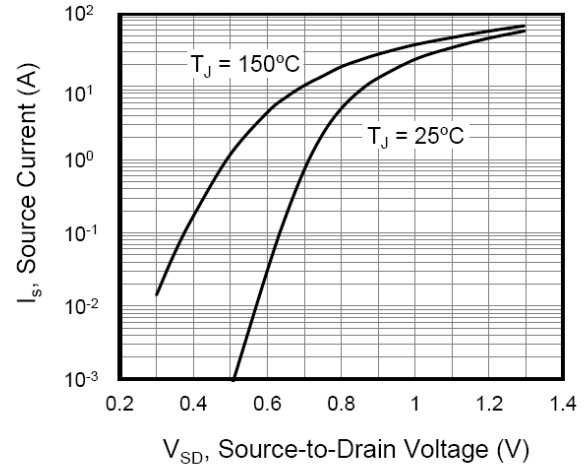
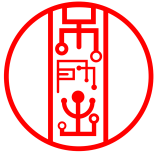


Figure 6. Body Diode Forward Voltage





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Typical Characteristics(Cont.)

Figure 7. On-Resistance vs. Junction Temperature

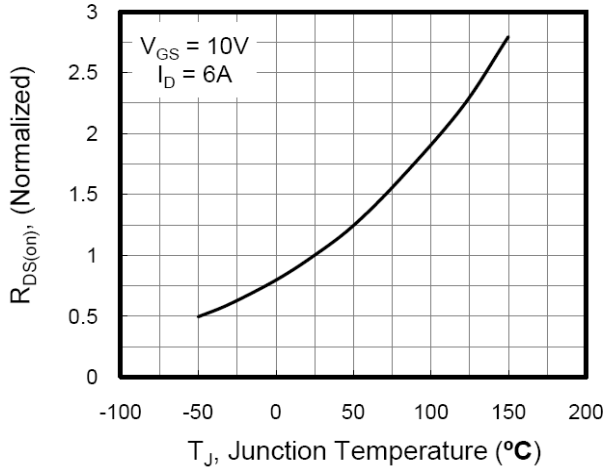


Figure 8. Threshold Voltage vs. Junction Temperature

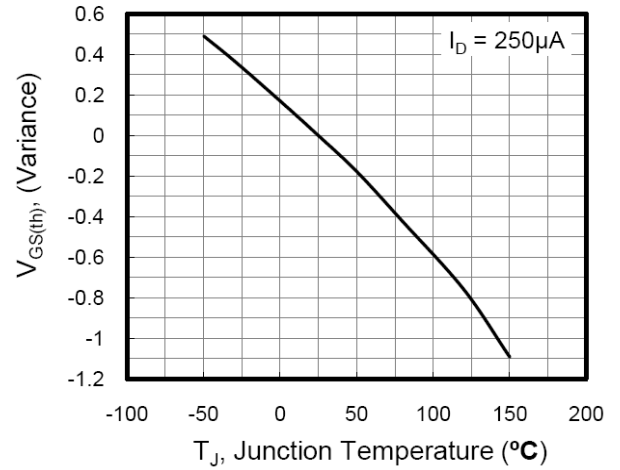


Figure 9. Transient Thermal Impedance

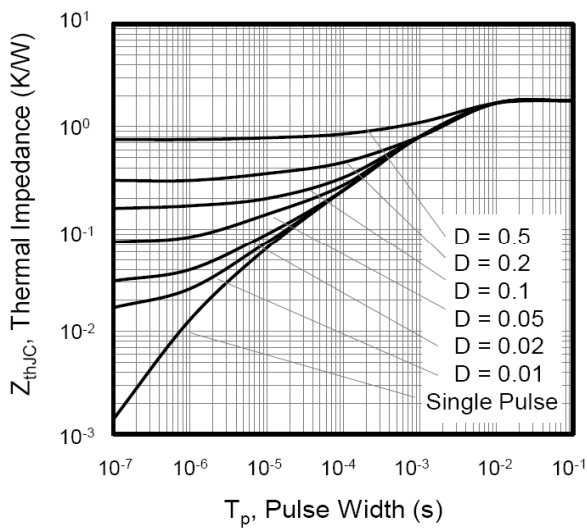


Figure 10. Transient Thermal Impedance

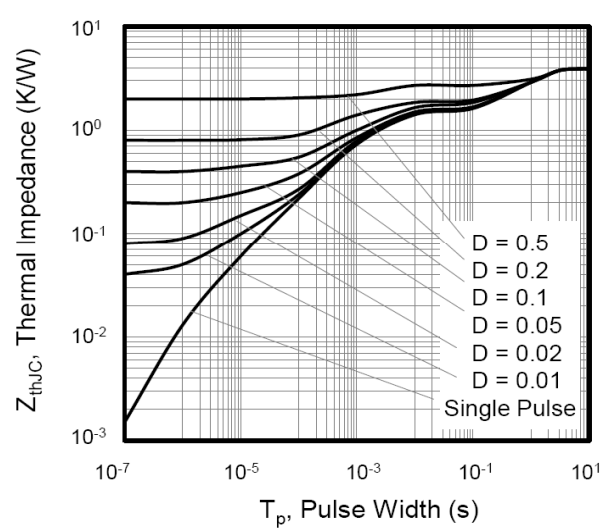


Figure 11. Safe operating area
Tc=25°C (Full PAK)

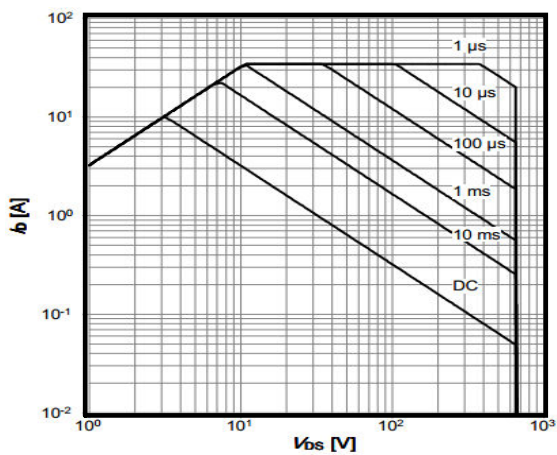
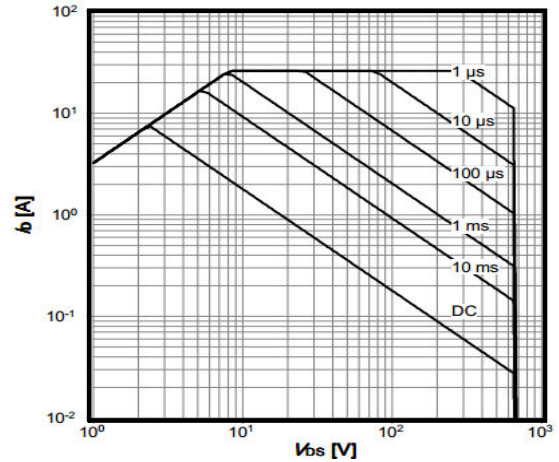
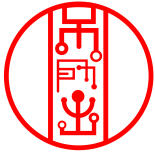


Figure 12. Safe operating area
Tc=80°C (Full PAK)





Test Circuits and Waveforms

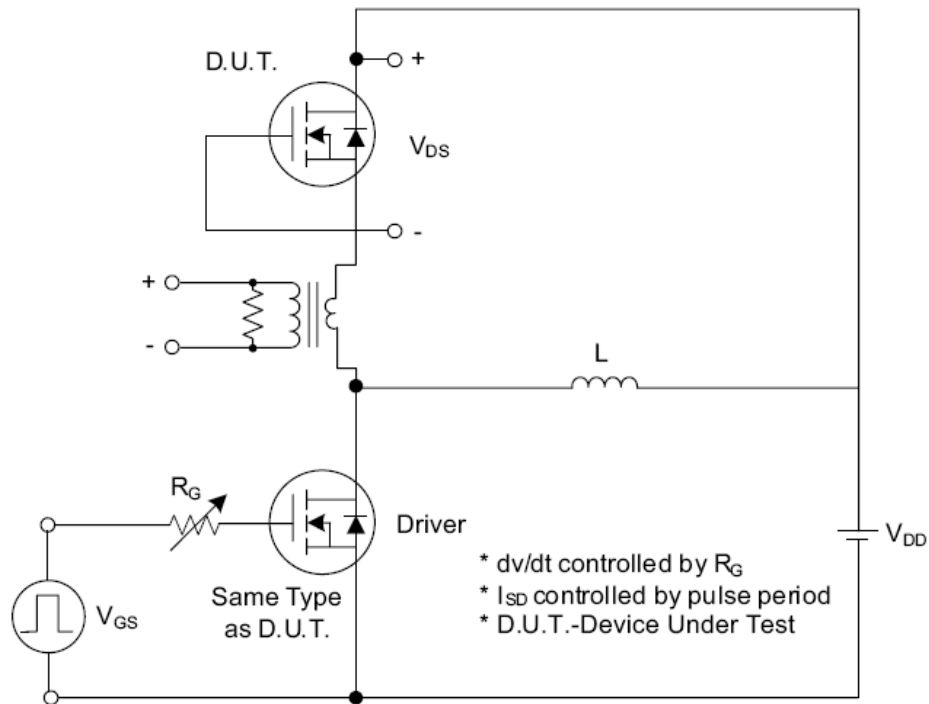


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

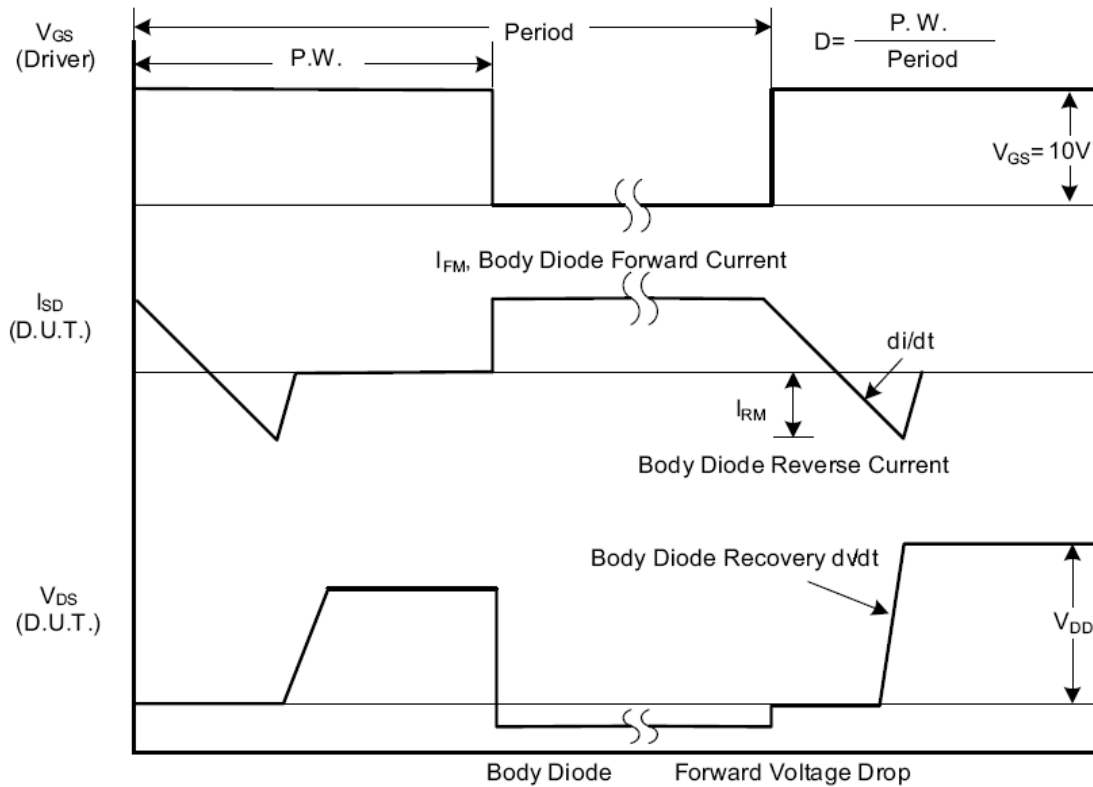
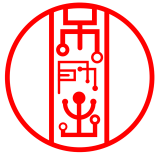


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms



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Test Circuits and Waveforms (Cont.)

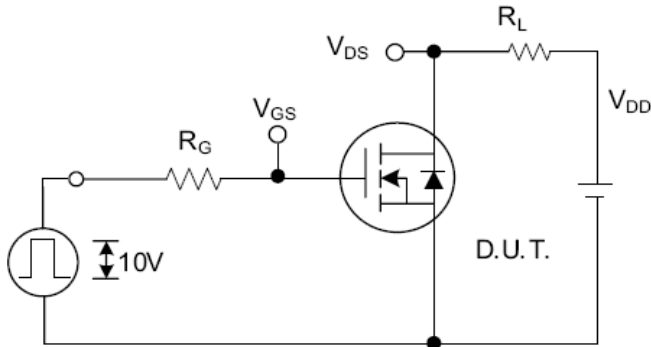


Fig. 2.1 Switching Test Circuit

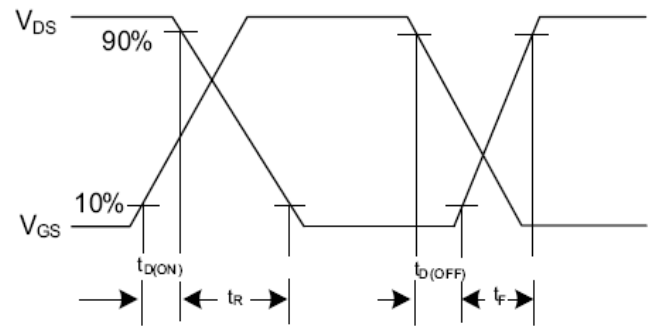


Fig. 2.2 Switching Waveforms

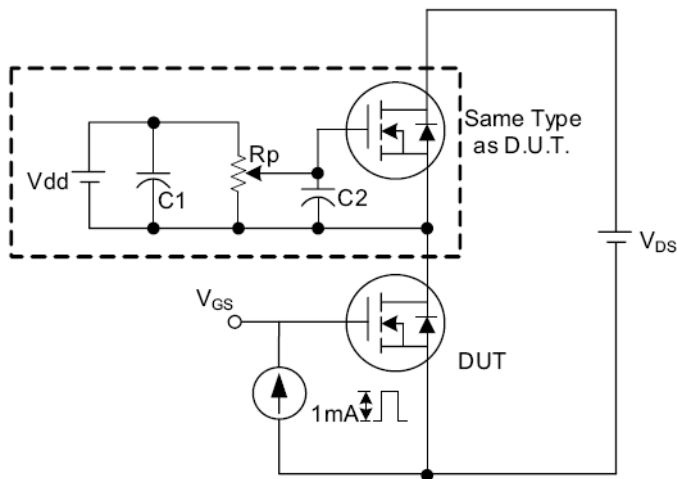


Fig. 3.1 Gate Charge Test Circuit

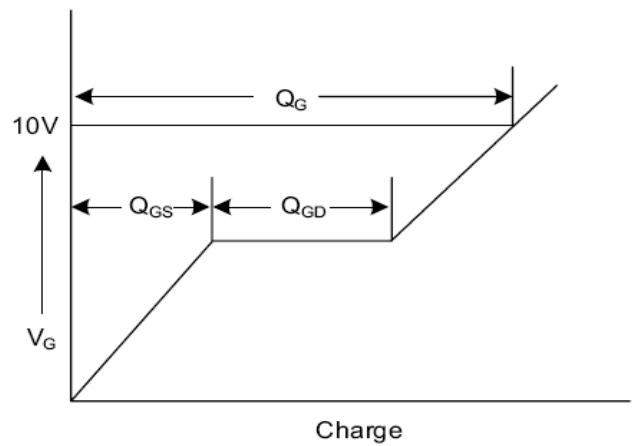


Fig. 3.2 Gate Charge Waveform

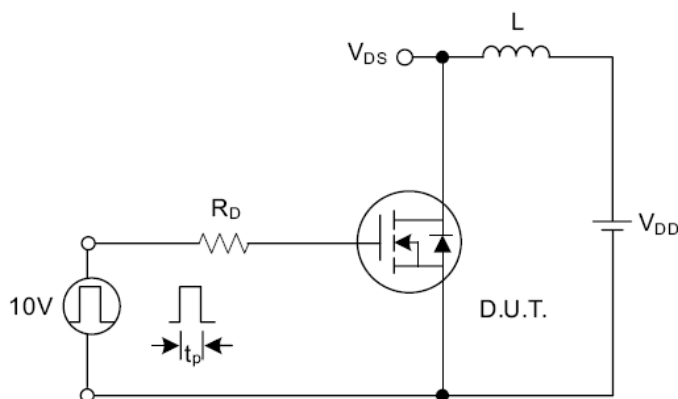


Fig. 4.1 Unclamped Inductive Switching Test Circuit

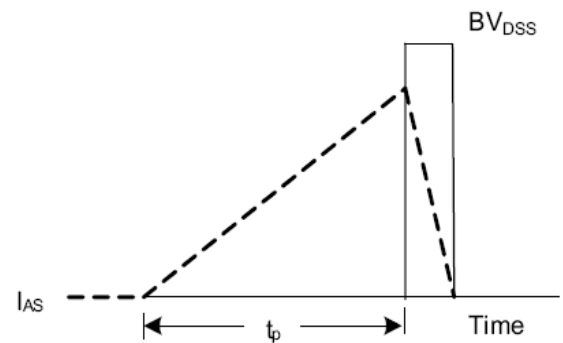


Fig. 4.2 Unclamped Inductive Switching Waveforms