



## 60V N-Channel MOSFET

Lead Free Package and Finish

### General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.}=13.5\text{ m}\Omega@V_{GS}=10\text{V}$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

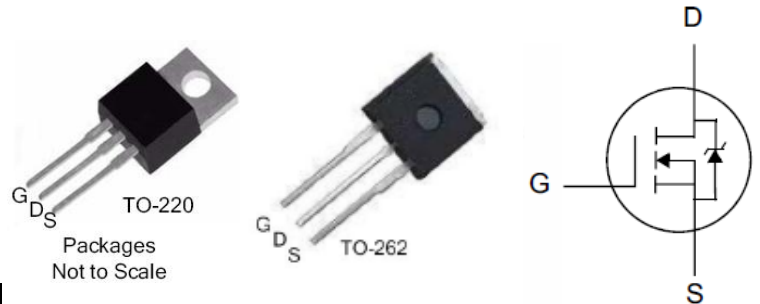
$BV_{DSS}$	$R_{DS(ON),typ.}$	$I_D$
60V	13.5m $\Omega$	55A

### Applications

- Automotive
- DC Motor Control
- Class D Amplifier

### Ordering Information

Part Number	Package	Brand
PTP16N06N	TO-220	
PTL16N06N	TO-262	



### Absolute Maximum Ratings

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

Symbol	Parameter	PTP16N06N	PTL16N06N	Unit
$V_{DSS}$	Drain-to-Source Voltage <sup>[1]</sup>	60		V
$V_{GSS}$	Gate-to-Source Voltage	$\pm 20$		
$I_D$	Continuous Drain Current	55		A
	Continuous Drain Current at $T_C=100^\circ\text{C}$	35		
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10\text{V}$ <sup>[2]</sup>	200		
$P_D$	Power Dissipation	85		W
	Derating Factor above $25^\circ\text{C}$	0.57		W/ $^\circ\text{C}$
$T_L$ $T_{PAK}$	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260		$^\circ\text{C}$
$T_J$ & $T_{STG}$	Operating and Storage Temperature Range	-55 to 175		

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

### Thermal Characteristics

Symbol	Parameter	PTP16N06N	PTL16N06N	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.75		$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62		



## 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	60	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	$\mu A$	$V_{DS}=60V, V_{GS}=0V$
		--	--	100		$V_{DS}=48V, V_{GS}=0V, T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Current	--	--	+1.0	$\mu A$	$V_{GS}=+20V, V_{DS}=0V$
		--	--	-1.0		$V_{GS}=-20V, V_{DS}=0V$

### 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	--	13.5	17	$m\Omega$	$V_{GS}=10V, I_D=20A^{[3]}$
$V_{GS(TH)}$	Gate Threshold Voltage	1.0	--	3.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$g_{FS}$	Forward Transconductance	18	--	--	S	$V_{DS}=5V, I_D=20A$

### Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$C_{iss}$	Input Capacitance	--	2.05	--	$nF$	$V_{GS}=0V, V_{DS}=30V, f=1.0MHz$
$C_{rss}$	Reverse Transfer Capacitance	--	0.12	--		
$C_{oss}$	Output Capacitance	--	0.16	--		
$Q_g$	Total Gate Charge	--	50	--	$nC$	$V_{DD}=30V, I_D=20A, V_{GS}=0 \text{ to } 10V$
$Q_{gs}$	Gate-to-Source Charge	--	6.0	--		
$Q_{gd}$	Gate-to-Drain (Miller) Charge	--	15	--		

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	7.5	--	$nS$	$V_{DD}=30V, I_D=20A, V_{GS}=10V, R_G=3.0\Omega$
$t_{rise}$	Rise Time	--	5.0	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	28	--		
$t_{fall}$	Fall Time	--	5.5	--		



## 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 <sup>[2]</sup>	--	--	55	A	Integral PN-diode in MOSFET
$I_{SM}$	Pulsed Source Current <sup>[2]</sup>	--	--	200		
$V_{SD}$	Diode Forward Voltage	--	--	1.5	V	$I_S=55\text{A}^{[3]}$ , $V_{GS}=0\text{V}$
trr	Reverse recovery time	--	30	--	ns	$V_{GS}=0\text{V}$ , $I_F=20\text{A}$ , $di_F/dt=100\text{A}/\mu\text{s}$
Qrr	Reverse recovery charge	--	40	--	nC	

### Note:

[1]  $T_J=+25^{\circ}\text{C}$  to  $+175^{\circ}\text{C}$  .

[2] Repetitive rating; pulse width limited by maximum junction temperature.

[3] Pulse width $\leq 380\mu\text{s}$ ; duty cycle $\leq 2\%$ .



## Typical Characteristics

Typical Electrical and Thermal Characteristics (Curves)

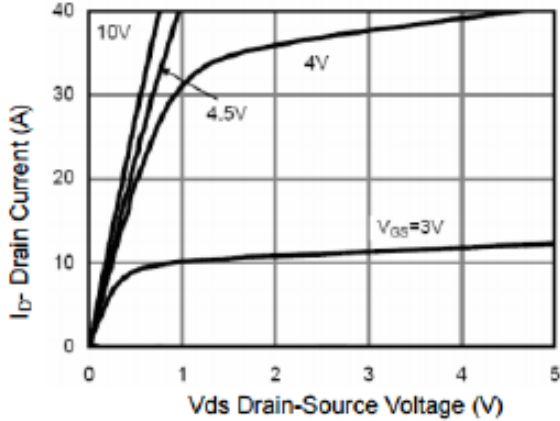


Figure 1 Output Characteristics

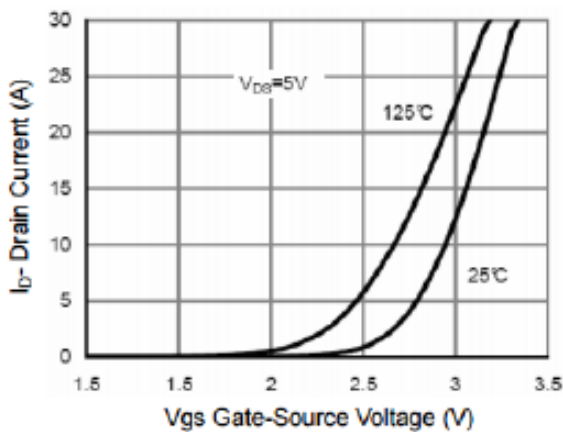


Figure 2 Transfer Characteristics

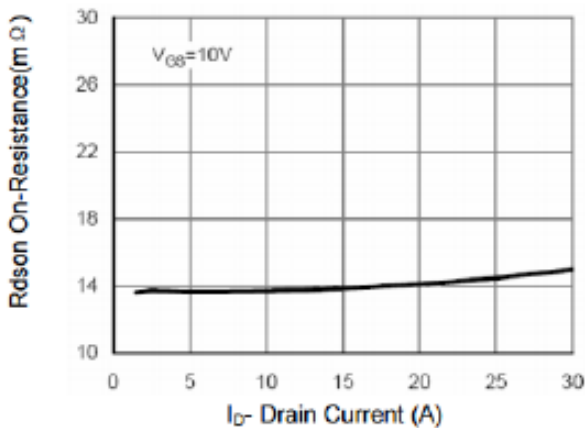


Figure 3  $R_{DS(on)}$ - Drain Current

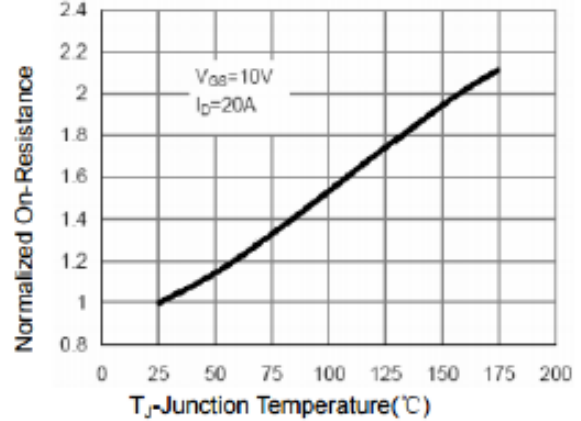


Figure 4  $R_{DS(on)}$ -Junction Temperature

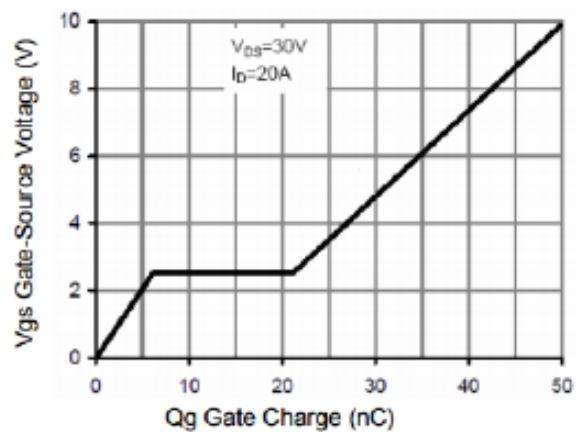


Figure 5 Gate Charge

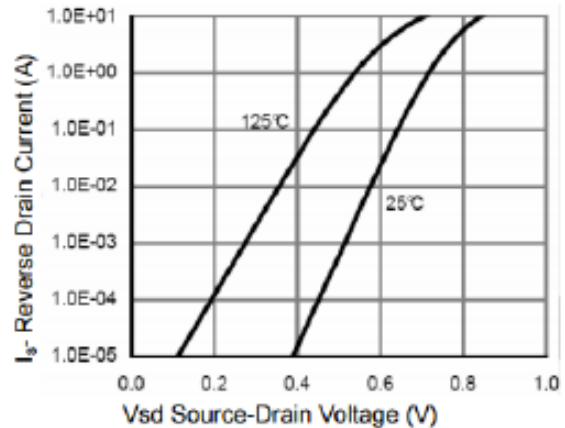


Figure 6 Source-Drain Diode Forward



### Typical Characteristics(Cont.)

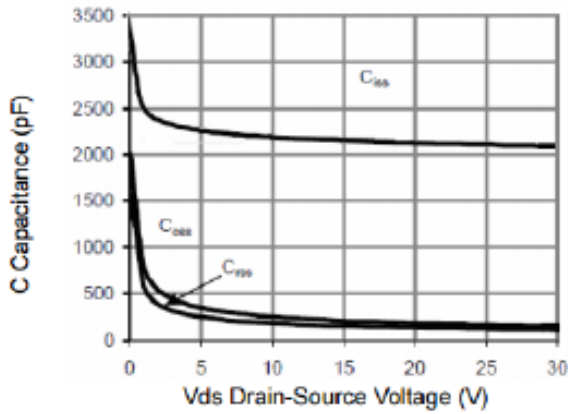


Figure 7 Capacitance vs Vds

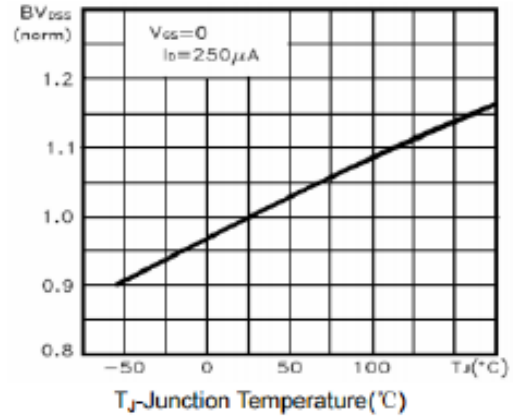


Figure 9  $BV_{DSS}$  vs Junction Temperature

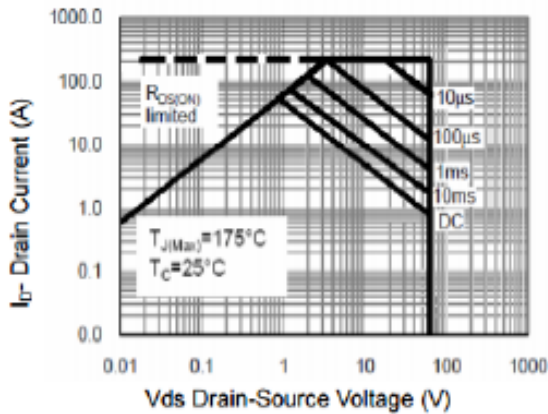


Figure 8 Safe Operation Area

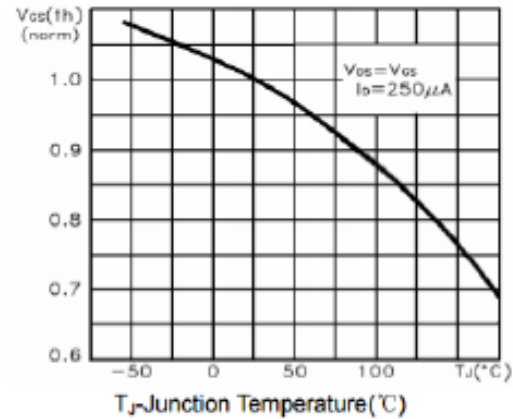


Figure 10  $V_{GS(th)}$  vs Junction Temperature

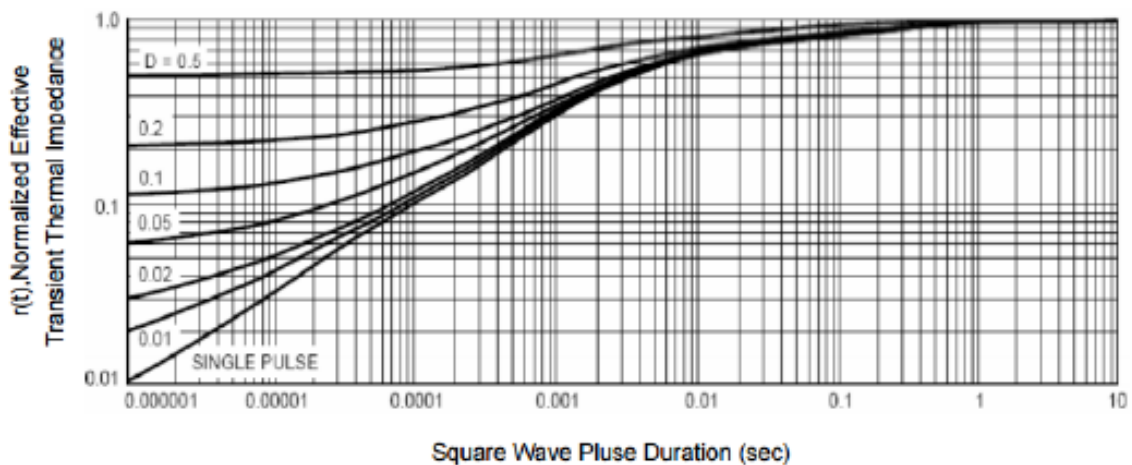


Figure 11 Normalized Maximum Transient Thermal Impedance



## Test Circuits and Waveforms

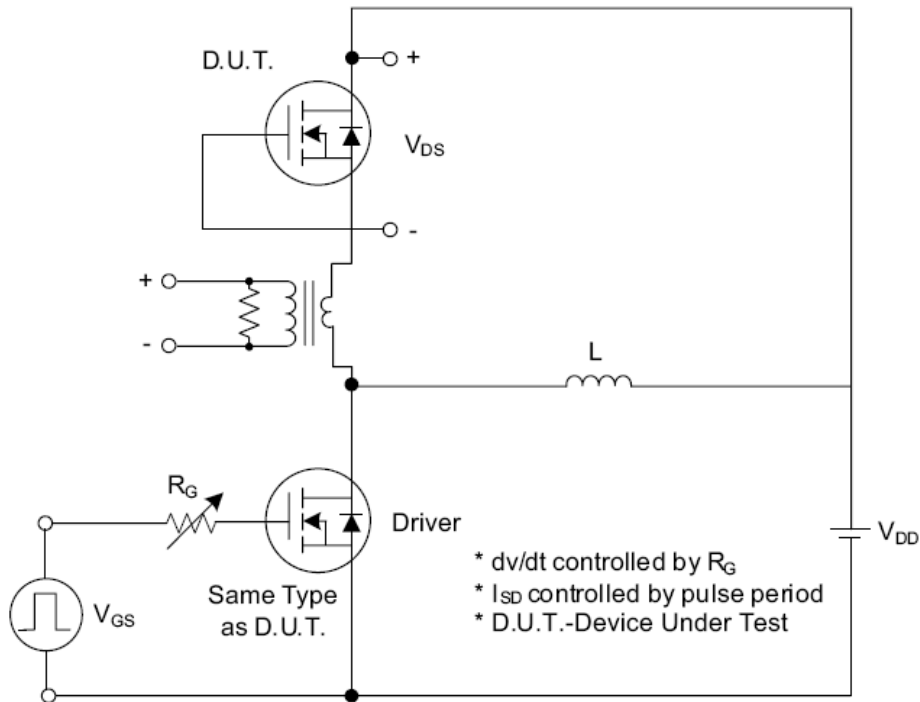


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

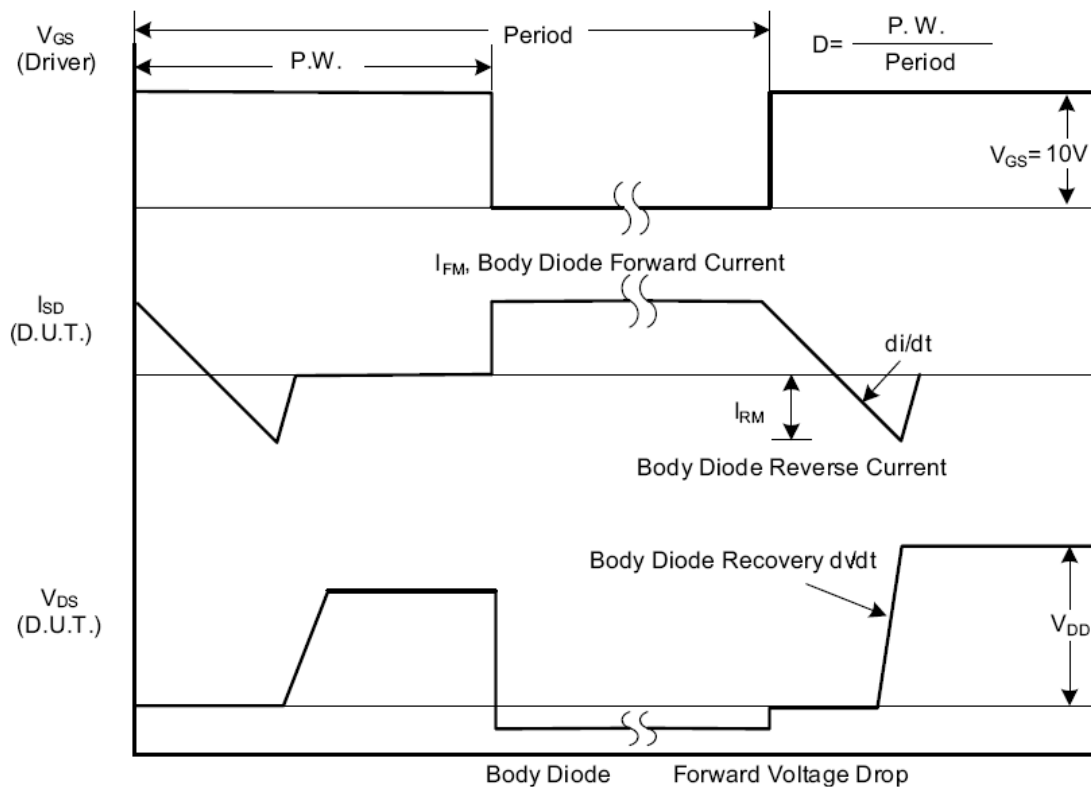


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms



Test Circuits and Waveforms (Cont.)

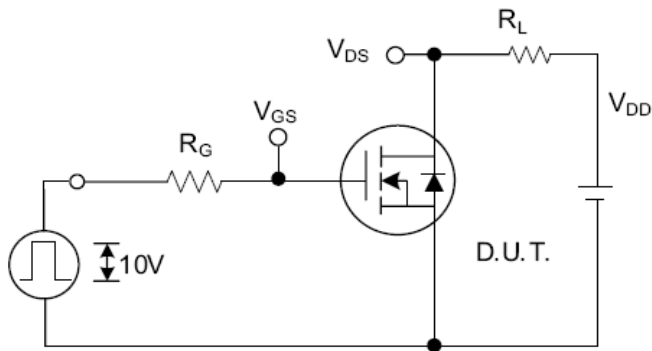


Fig. 2.1 Switching Test Circuit

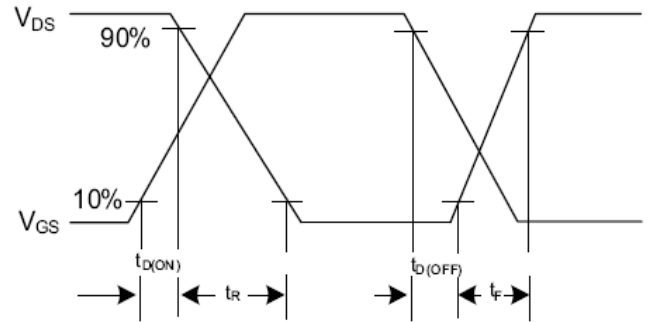


Fig. 2.2 Switching Waveforms

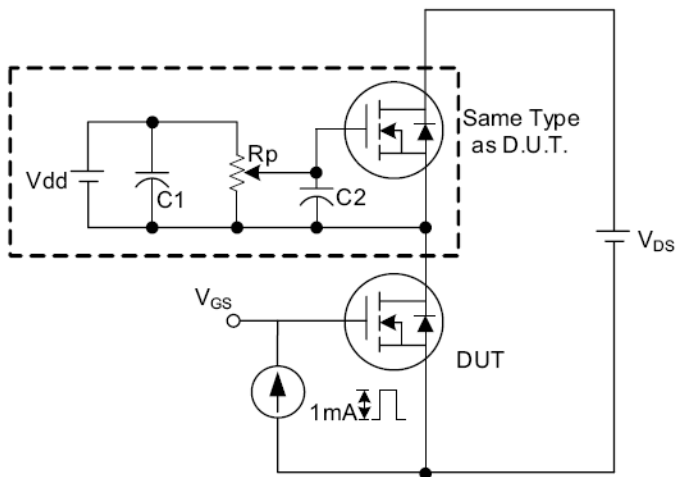


Fig. 3.1 Gate Charge Test Circuit

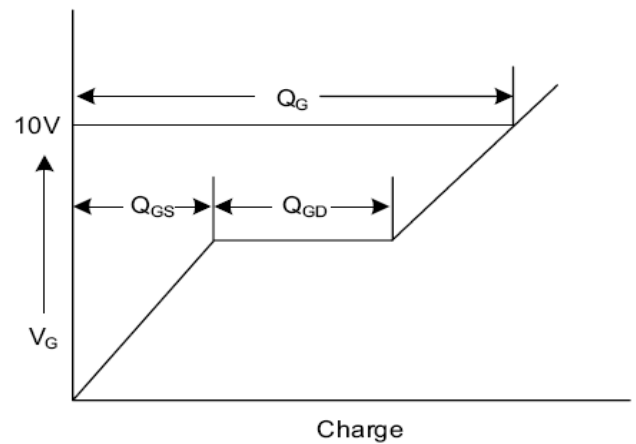


Fig. 3.2 Gate Charge Waveform

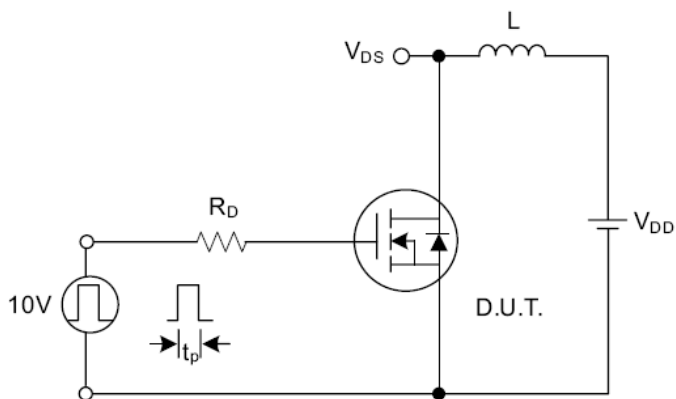


Fig. 4.1 Unclamped Inductive Switching Test Circuit

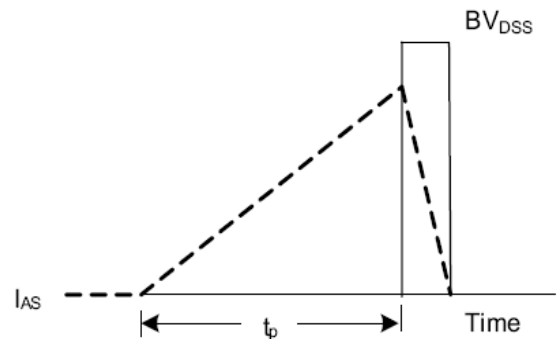


Fig. 4.2 Unclamped Inductive Switching Waveforms



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