



## 600V N-ch Planar MOSFET

Lead Free Package and Finish

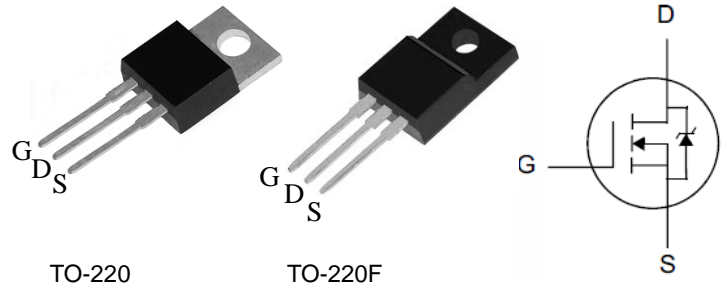
### General Features

- RoHS Compliant
- $R_{DS(ON),typ.}=0.55\ \Omega@V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

$BV_{DSS}$	$R_{DS(ON),typ.}$	$I_D$
600V	0.55Ω	12A

### Applications

- Adaptor
- Charger
- SMPS Standby Power



TO-220

TO-220F

Package No to Scale

### Ordering Information

Part Number	Package	Brand
PTP12N60	TO-220	
PTA12N60	TO-220F	

### Absolute Maximum Ratings

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

Symbol	Parameter	PTP12N60	PTA12N60	Unit
$V_{DSS}$	Drain-to-Source Voltage	600		V
$V_{GSS}$	Gate-to-Source Voltage	±30		
$I_D$	Continuous Drain Current	12		A
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10V$	48		
$E_{AS}$	Single Pulse Avalanche Energy	790		mJ
$P_D$	Power Dissipation	125	70	W
	Derating Factor above $25^\circ\text{C}$	1.0	0.56	W/°C
$T_L$	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300		°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	PTP12N60	PTA12N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.0	1.78	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	100	



## 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	600	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	$\mu A$	$V_{DS}=600V, V_{GS}=0V$
		--	--	100		$V_{DS}=480V, V_{GS}=0V, T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Current	--	--	+100	$nA$	$V_{GS}=+30V, V_{DS}=0V$
		--	--	-100		$V_{GS}=-30V, V_{DS}=0V$

### 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	--	0.55	0.70	$\Omega$	$V_{GS}=10V, I_D=6.0A$
$V_{GS(TH)}$	Gate Threshold Voltage	3.0	--	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance	--	5.0	--	S	$V_{DS}=15V, I_D=6.0A$

### Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$C_{iss}$	Input Capacitance	--	1540	--	$pF$	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$
$C_{rss}$	Reverse Transfer Capacitance	--	21	--		
$C_{oss}$	Output Capacitance	--	175	--		
$Q_g$	Total Gate Charge	--	44	--	$nC$	$V_{DD}=480V, I_D=12A, V_{GS}=0 \text{ to } 10V$
$Q_{gs}$	Gate-to-Source Charge	--	8.6	--		
$Q_{gd}$	Gate-to-Drain (Miller) Charge	--	21	--		

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	30	--	$nS$	$V_{DD}=300V, I_D=12A, V_{GS}=10V, R_g=25\Omega$
$t_{rise}$	Rise Time	--	115	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	95	--		
$t_{fall}$	Fall Time	--	85	--		



**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>	--	--	12	A	Integral pn-diode in MOSFET
$I_{SM}$	Pulsed Source Current <sup>[2]</sup>	--	--	48		
$V_{SD}$	Diode Forward Voltage	--	--	1.4	V	$I_S=12\text{A}$ , $V_{GS}=0\text{V}$
$t_{rr}$	Reverse Recovery Time	--	380	--	ns	$V_{GS}=0\text{V}$ $I_F=I_S$ , $di/dt=100\text{A}/\mu\text{s}$
$Q_{rr}$	Reverse Recovery Charge	--	3.5	--	$\mu\text{C}$	

**Note:**

- [1]  $T_J=+25^\circ\text{C}$  to  $+150^\circ\text{C}$   
[2] Pulse width $\leq 380\mu\text{s}$ ; duty cycle $\leq 2\%$ .



## Typical Characteristics

Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )

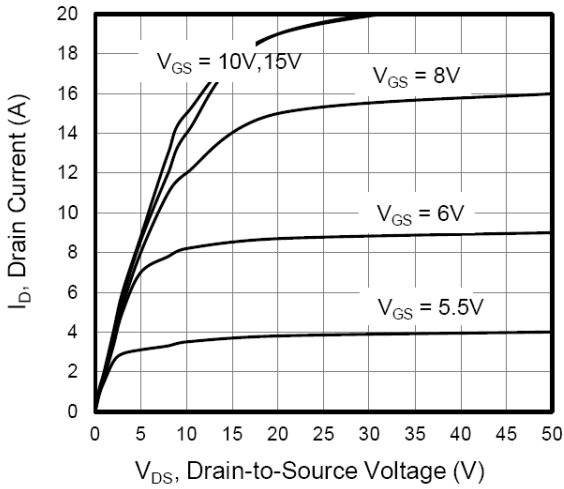


Figure 2. On-Resistance Variation vs. Drain Current

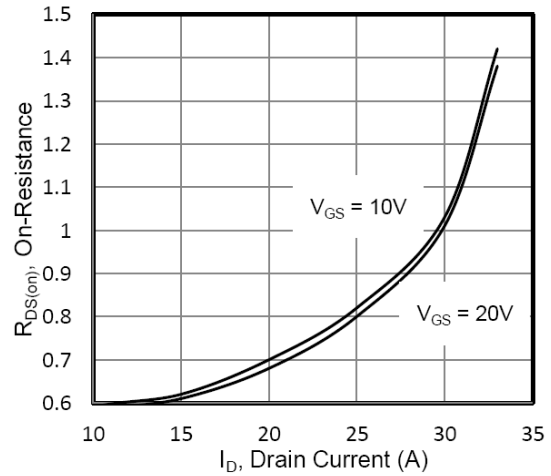


Figure 3. On-Resistance vs. Drain Current

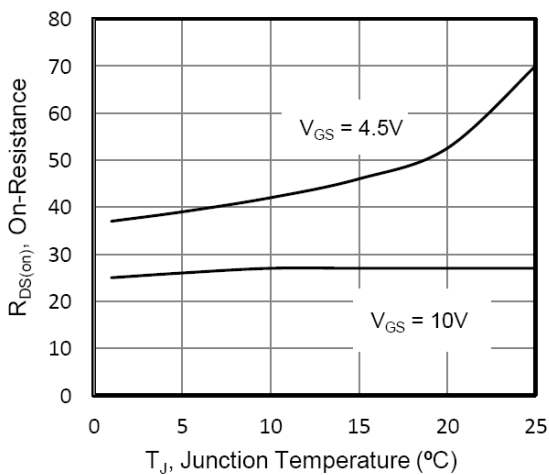


Figure 4. Transfer Characteristics

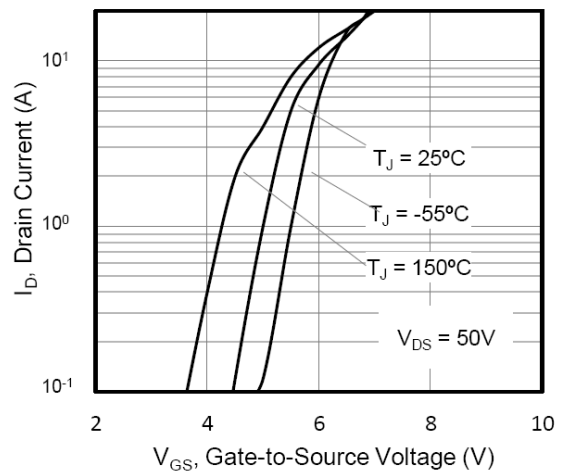


Figure 5. Gate Charge

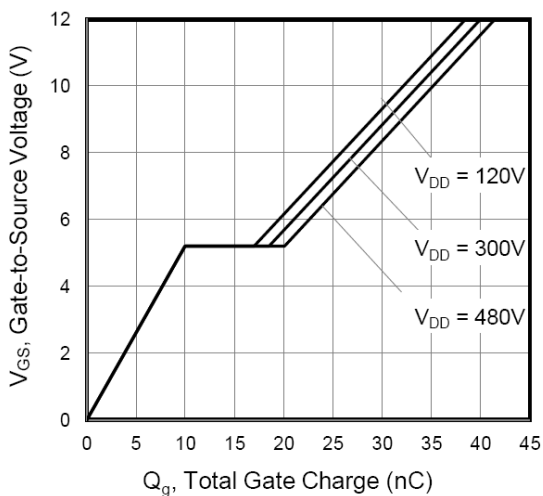
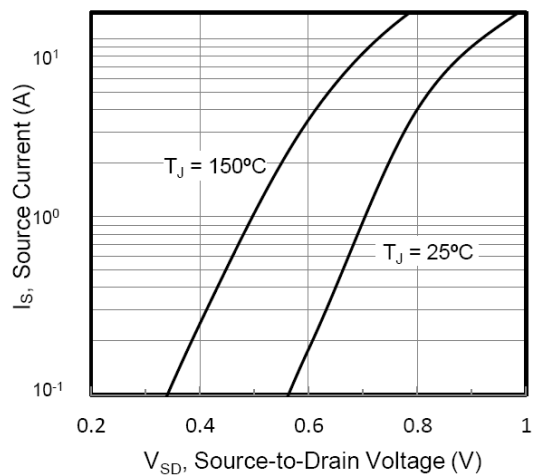


Figure 6. Body Diode Forward Voltage





## Typical Characteristics

Figure 7. Safe Operating Area

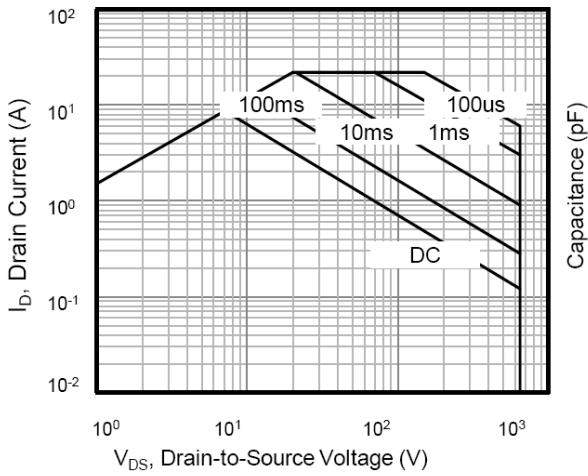


Figure 8. Capacitance

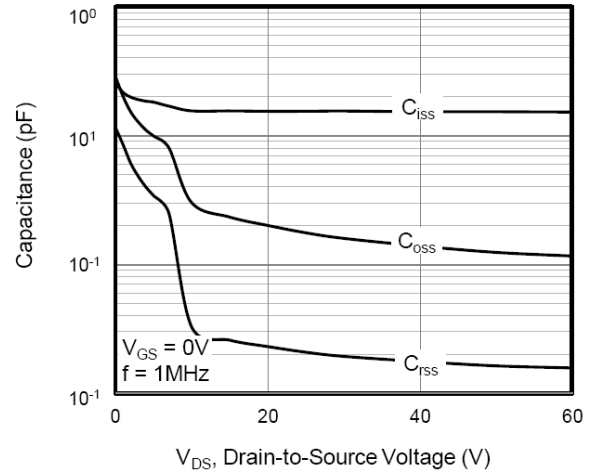
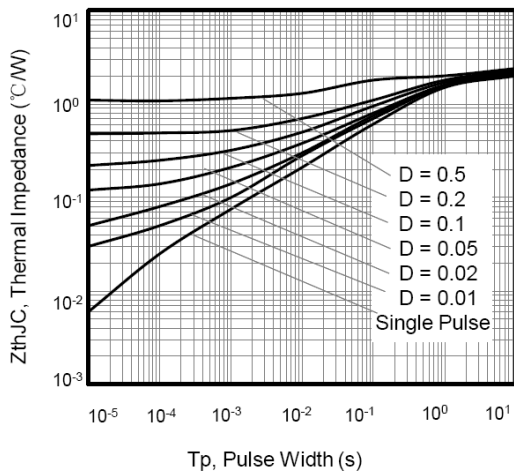


Figure 9. Transient Thermal Impedance





## Test Circuits and Waveforms

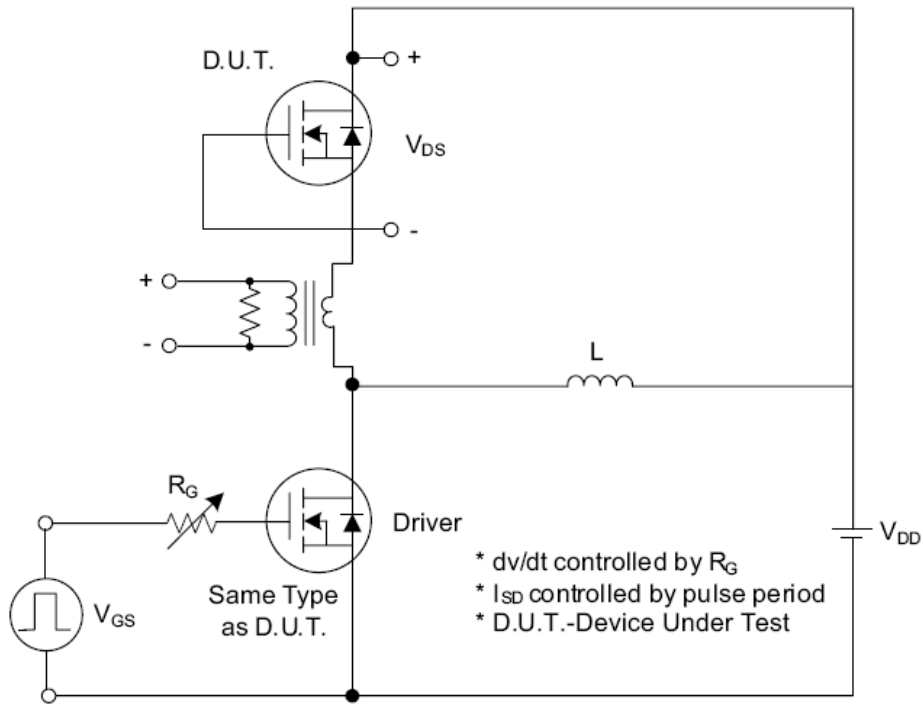


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

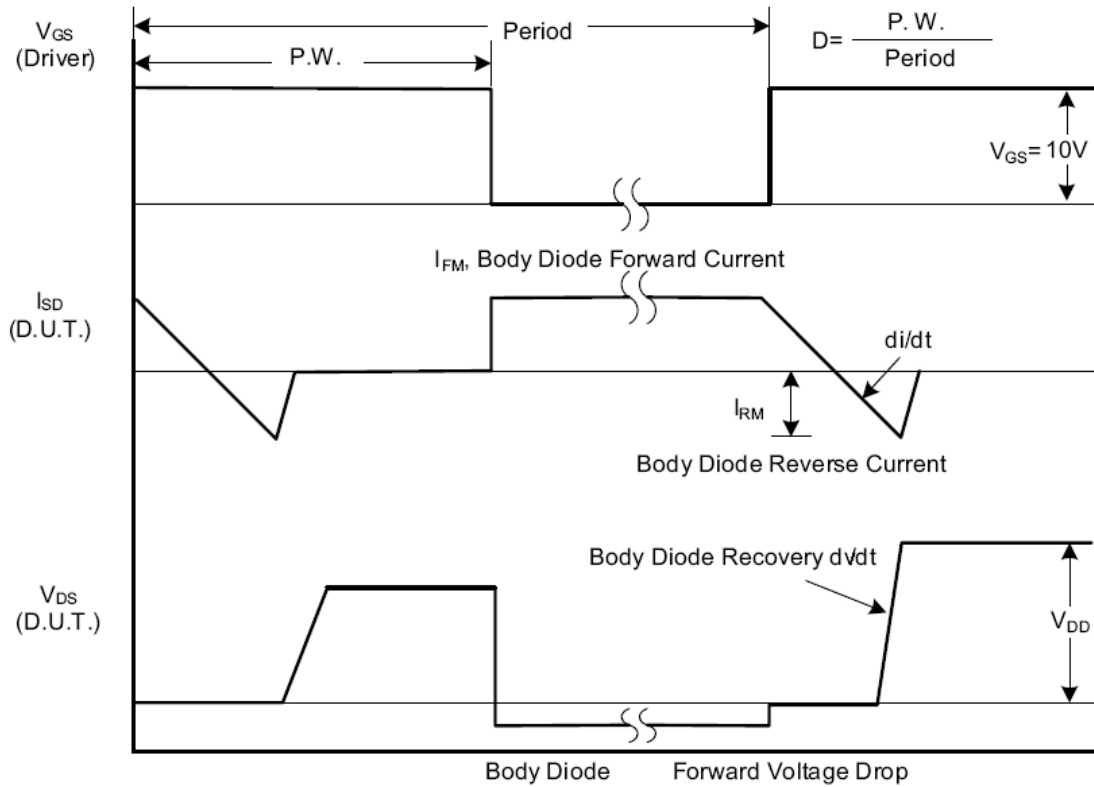


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms

Test Circuits and Waveforms (Cont.)

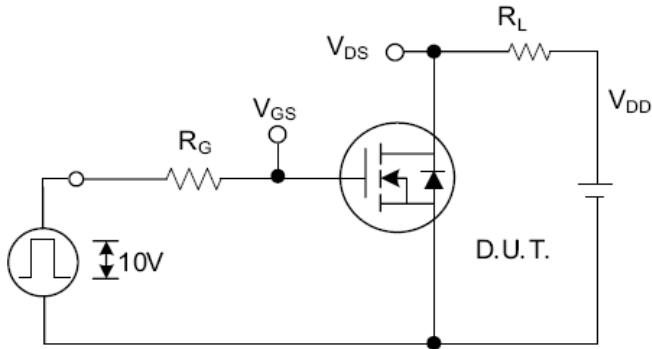


Fig. 2.1 Switching Test Circuit

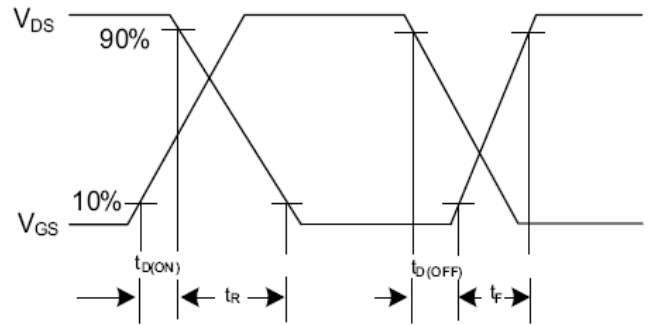


Fig. 2.2 Switching Waveforms

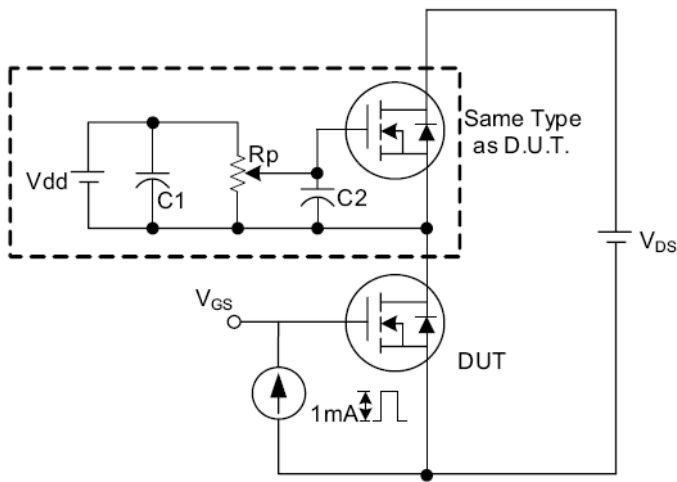


Fig. 3.1 Gate Charge Test Circuit

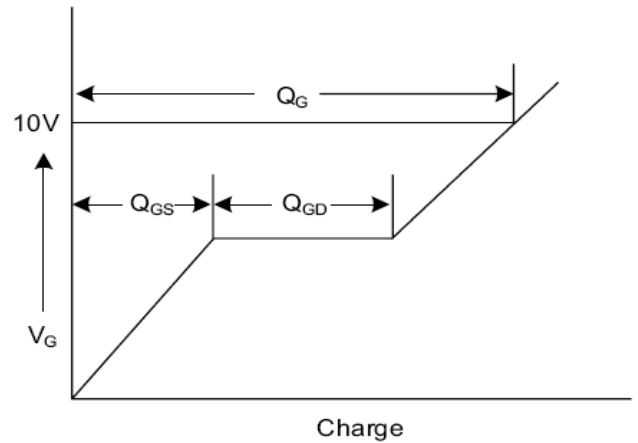


Fig. 3.2 Gate Charge Waveform

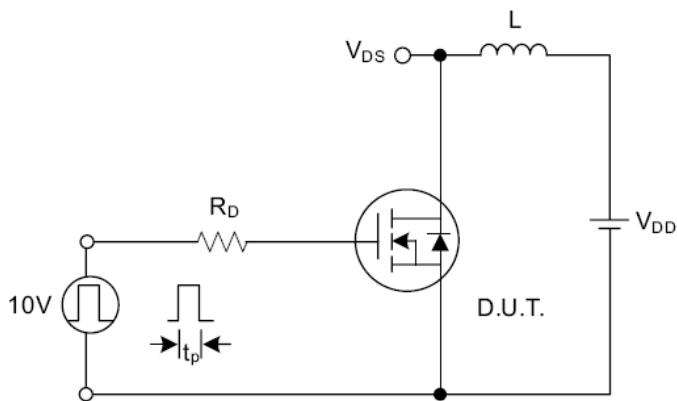


Fig. 4.1 Unclamped Inductive Switching Test Circuit

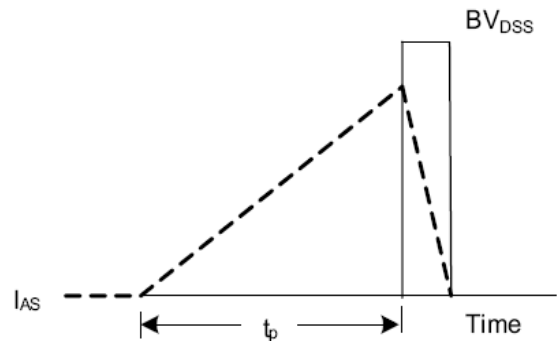


Fig. 4.2 Unclamped Inductive Switching Waveforms



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