

## N-Channel MOSFET

**Lead Free Package and Finish**

### Applications:

- Adaptor
- Charger
- SMPS

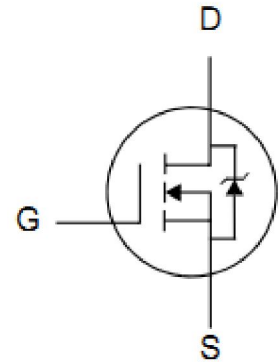
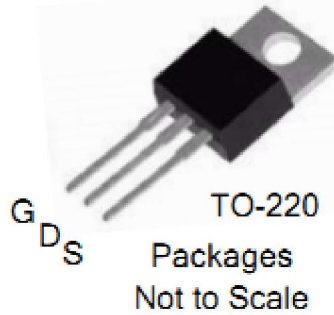
$V_{DSS}$	$R_{DS(ON)}(Typ.)$	$I_D$
400V	0.44Ω	10A

### Features:

- RoHS Compliant
- Low ON Resistance
- Low Gate Charge
- Peak Current vs Pulse Width Curve
- Inductive Switching Curves

### Ordering Information

PART NUMBER	PACKAGE	BRAND
ITP10N40R	TO-220	<b>IPS</b>



### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	ITP10N40R	Units
$V_{DSS}$	Drain-to-Source Voltage	400	V
$I_D$	Continuous Drain Current	10	A
	Continuous Drain Current $T_C = 100^\circ\text{C}$	6.3	A
$I_{DM}$	Pulsed Drain Current (NOTE *1)	40	A
$P_D$	Power Dissipation	100	W
	Derating Factor above $25^\circ\text{C}$	0.8	W/ $^\circ\text{C}$
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy(NOTE *2)	450	mJ
dv/dt	Peak Diode Recovery dv/dt(NOTE *3)	5	V/ns
$T_L$	Maximum Temperature for Soldering	300	$^\circ\text{C}$
$T_J$ and $T_{STG}$	Operating Junction and Storage Temperature Range	150, -55 to 150	

### Thermal Resistance

Symbol	Parameter	Max.	Units	Test Conditions
$R_{\theta JC}$	Junction-to-Case	1.25	$^\circ\text{C}/\text{W}$	Water cooled heatsink, $P_D$ adjusted for a peak junction temperature of $+150^\circ\text{C}$ .
$R_{\theta JA}$	Junction-to-Ambient	62.5		1 cubic foot chamber, free air.



# ITP10N40R

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	400	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	$\mu A$	$V_{DS}=400V, V_{GS}=0V$ $T_J=25^\circ\text{C}$
		--	--	100		$V_{DS}=320V, V_{GS}=0V$ $T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	--	--	+100	nA	$V_{GS}=+30V$
	Gate-to-Source Reverse Leakage	--	--	-100		$V_{GS}=-30V$

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	0.44	0.55	$\Omega$	$V_{GS}=10V, I_D=5A$
$V_{GS(TH)}$	Gate Threshold Voltage	2	--	4	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$g_{fs}$	Forward Transconductance	--	8.5	--	S	$V_{DS}=15V, I_D=5A$
Pulse width $\leq 300\mu s$ ; duty cycle $\leq 2\%$						

## Dynamic Characteristics Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$C_{iss}$	Input Capacitance	--	1126	--	$\mu F$	$V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$
$C_{oss}$	Output Capacitance	--	124	--		
$C_{rss}$	Reverse Transfer Capacitance	--	8	--		
$Q_g$	Total Gate Charge	--	23	--	nC	$I_D=10A, V_{DD}=320V$ $V_{GS}=10V$
$Q_{gs}$	Gate-to-Source Charge	--	5.2	--		
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	--	8.5	--		

## Resistive Switching Characteristics Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	18	--	ns	$V_{DD}=200V, I_D=10A,$ $V_G=10V, R_G=10\Omega$
$t_{rise}$	Rise Time	--	23	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	41	--		
$t_{fall}$	Fall Time	--	19	--		



## Source-Drain Diode Characteristics Tc=25°C unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	--	--	10	A	$T_C=25^\circ\text{C}$
$I_{SM}$	Maximum Pulsed Current (Body Diode)	--	--	40	A	
$V_{SD}$	Diode Forward Voltage	--	--	1.5	V	$I_{SD}=10\text{A}, V_{GS}=0\text{V}$
$t_{rr}$	Reverse Recovery Time	--	376	--	ns	$I_F=I_S$ $di/dt=100\text{A}/\mu\text{s}$
$Q_{rr}$	Reverse Recovery Charge	--	2560	--	nC	
Pulse width $\leq 300\mu\text{s}$ ; duty cycle $\leq 2\%$						

### Notes:

- \*1. Repetitive rating; pulse width limited by maximum junction temperature.
- \*2.  $L=10\text{mH}$ ,  $I_D=9.5\text{A}$ , Start  $T_J=25^\circ\text{C}$
- \*3.  $I_{SD}=10\text{A}$ ,  $di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DS}$ , Start  $T_J=25^\circ\text{C}$

## Characteristics Curve:

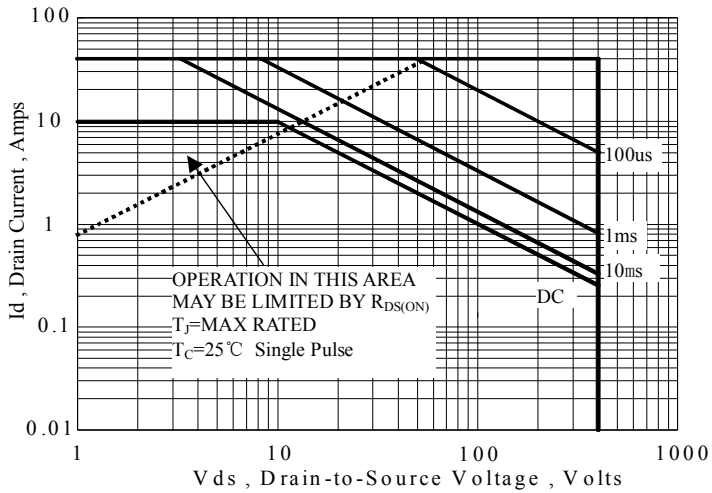


Figure 1 Maximum Forward Bias Safe Operating Area

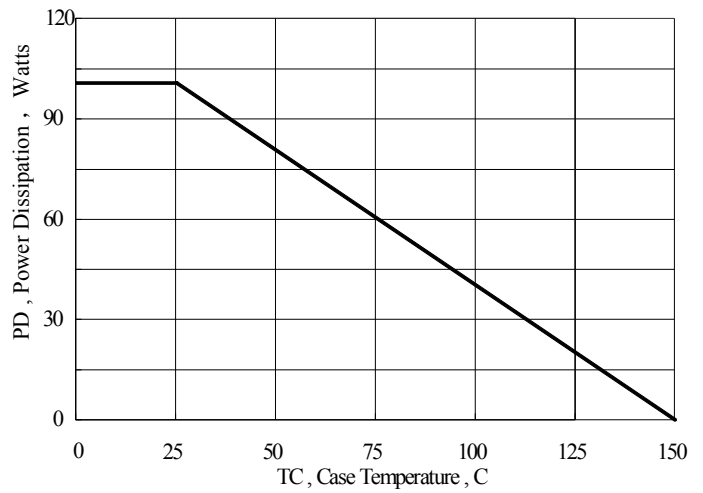


Figure 2 Maximum Power Dissipation vs Case Temperature

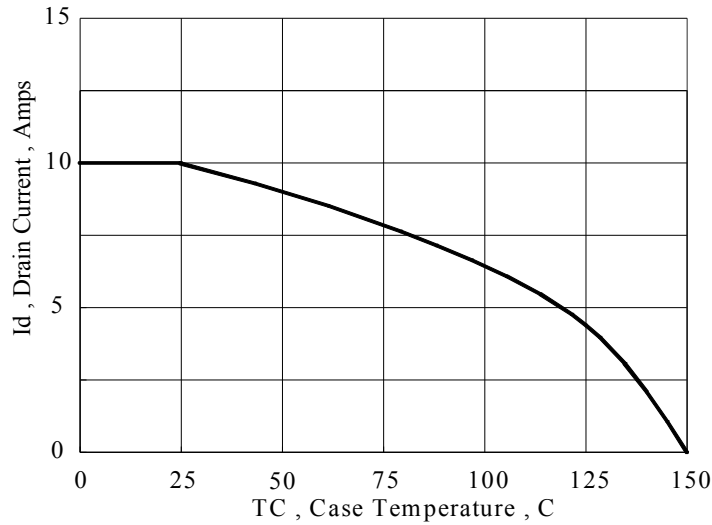


Figure 3 Maximum Continuous Drain Current vs Case Temperature

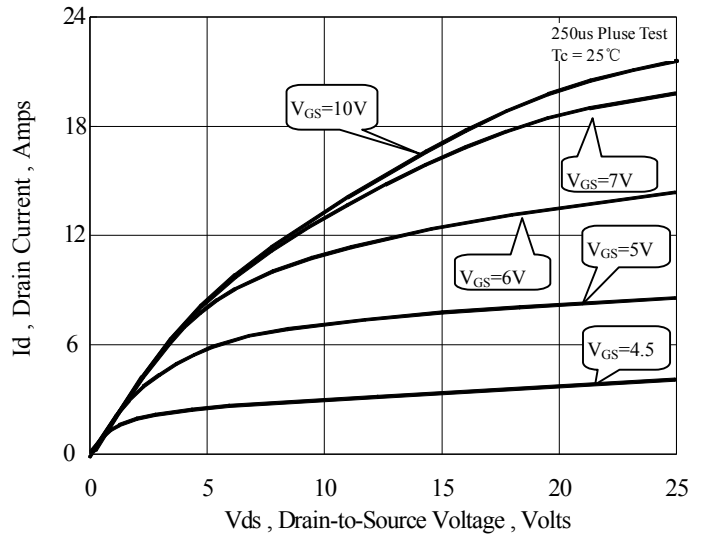


Figure 4 Typical Output Characteristics

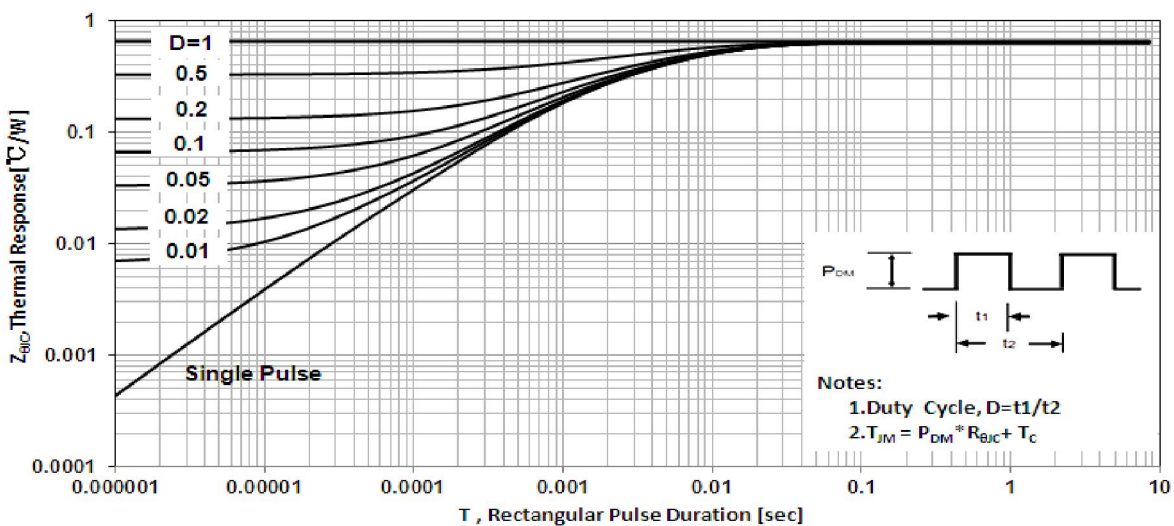


Figure 5 Maximum Effective Thermal Impedance , Junction to

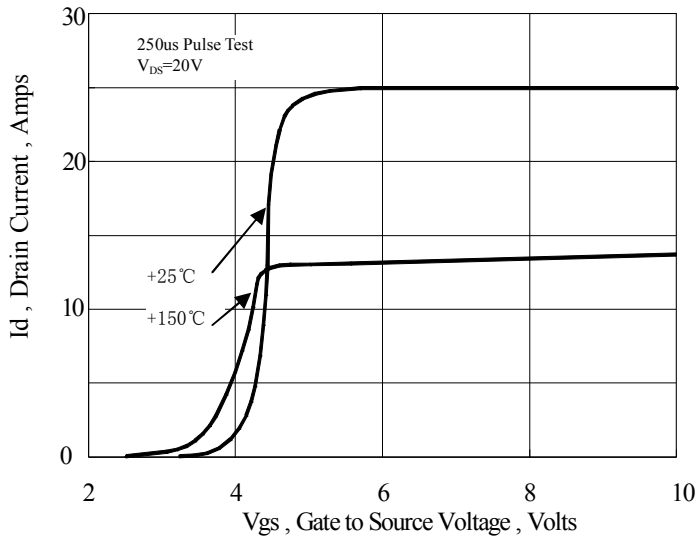


Figure 6 Typical Transfer Characteristics

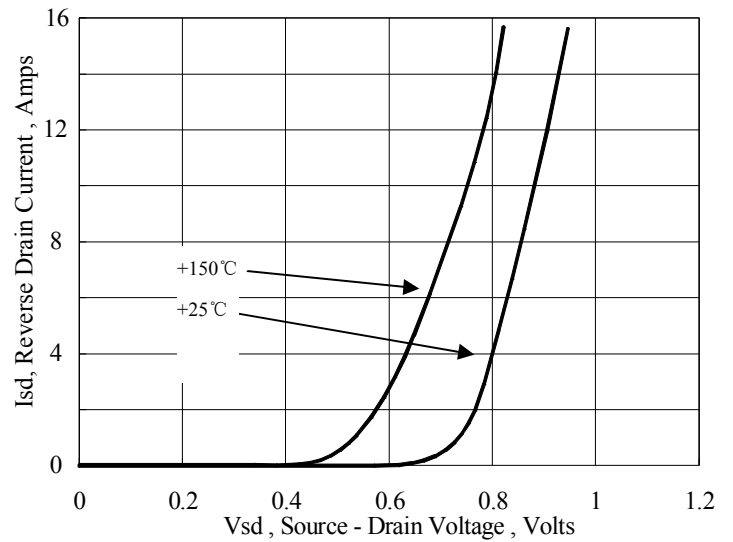


Figure 7 Typical Body Diode Transfer Characteristics

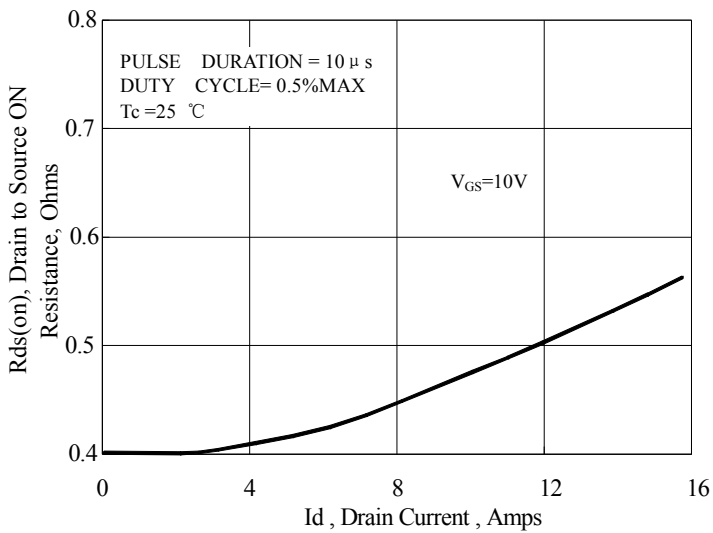


Figure 8 Typical Drain to Source ON Resistance vs Drain Current

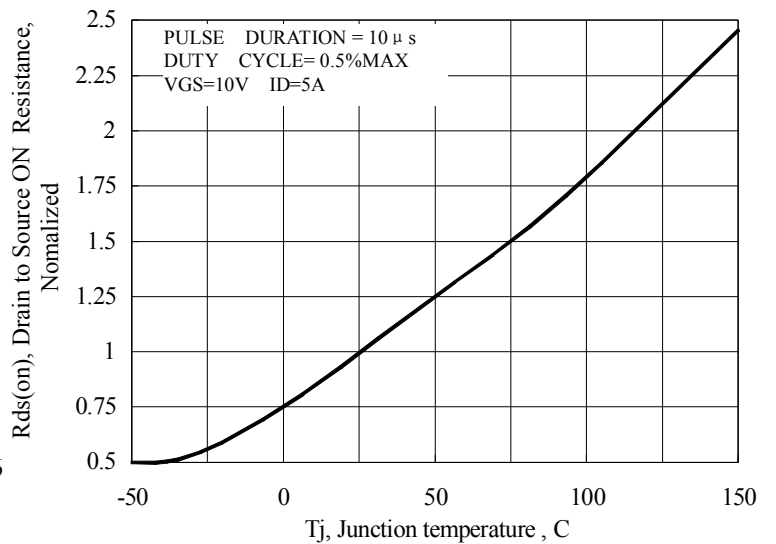


Figure 9 Typical Drain to Source on Resistance vs Junction Temperature

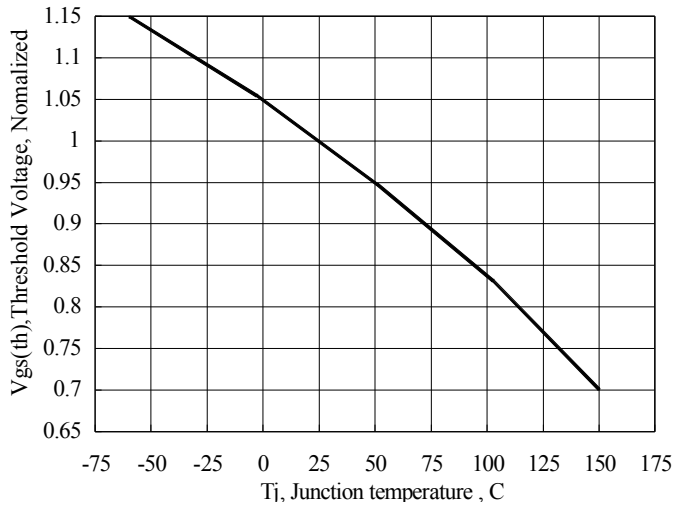


Figure 10 Typical Theshold Voltage vs Junction Temperature

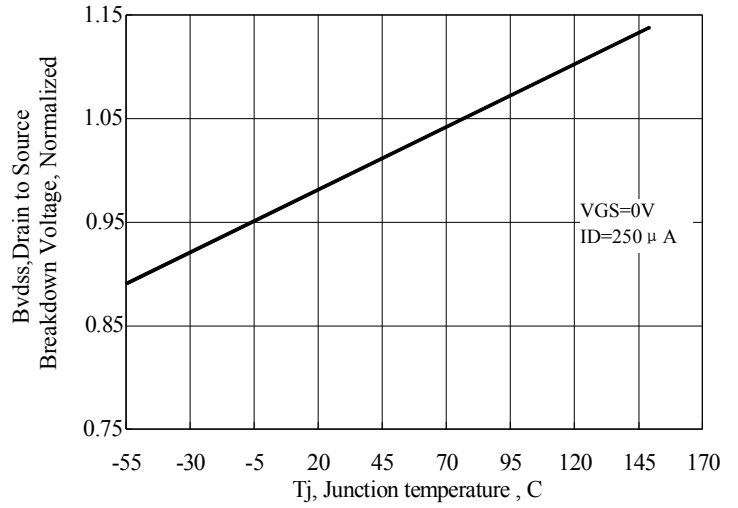


Figure 11 Typical Breakdown Voltage vs Junction Temperature

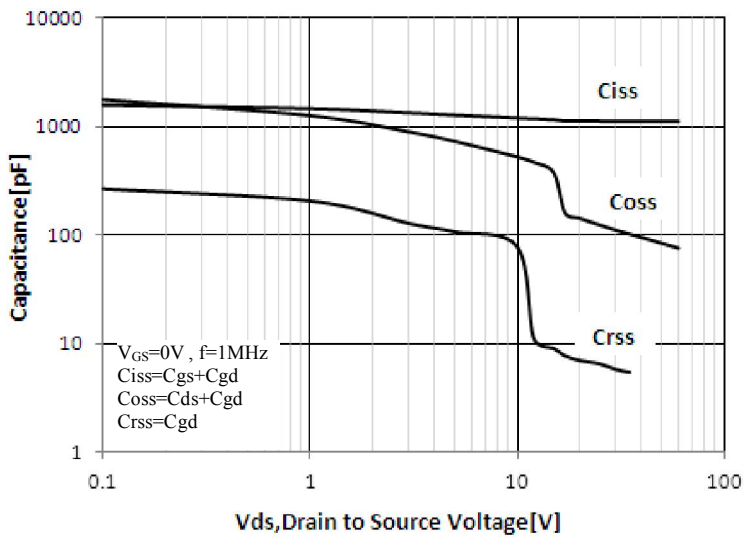


Figure 12 Typical Capacitance vs Drain to Source Voltage

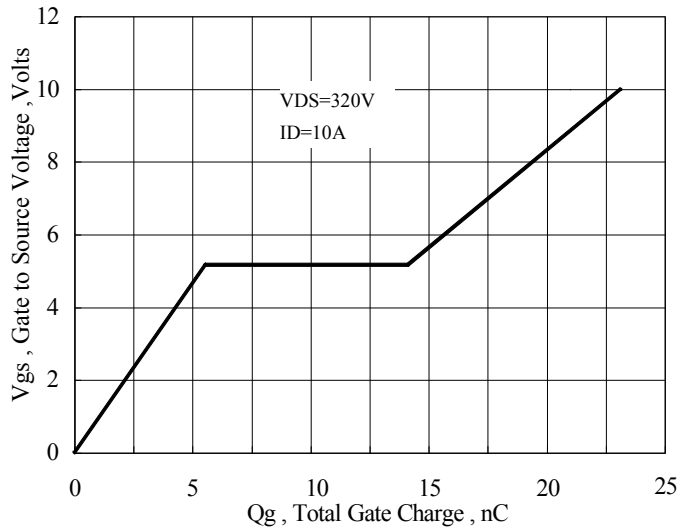


Figure 13 Typical Gate Charge vs Gate to Source Voltage

## Test Circuits and Waveforms

Figure 14. Gate Charge Test Circuit

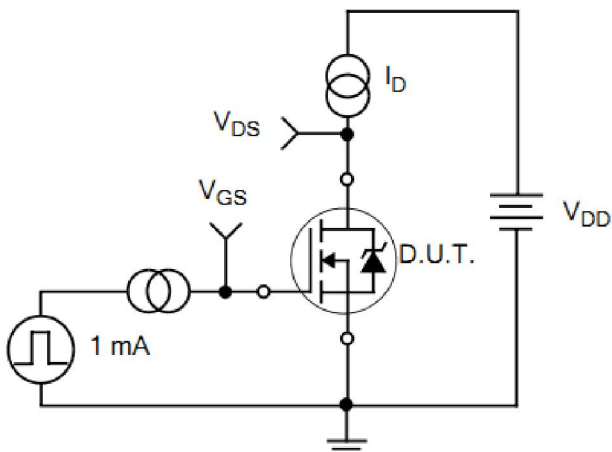


Figure 15. Gate Charge Waveforms

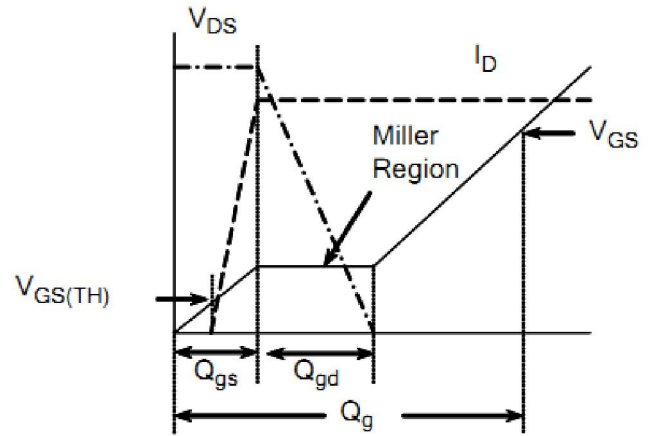


Figure 16. Resistive Switching Test Circuit

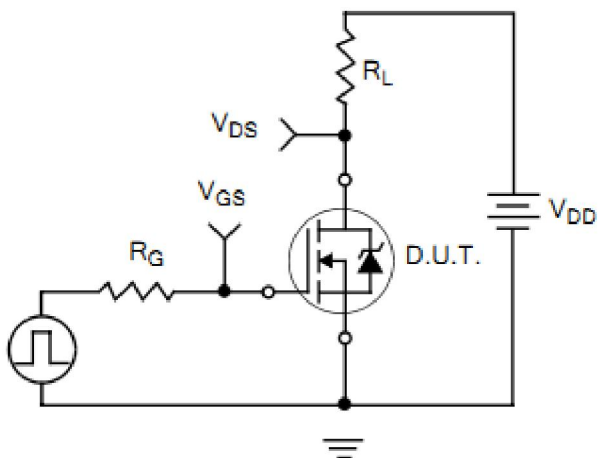


Figure 17. Resistive Switching Waveforms

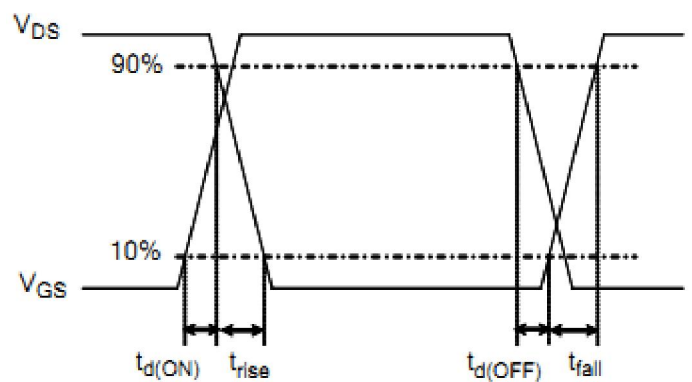


Figure 18. Diode Reverse Recovery Test Circuit

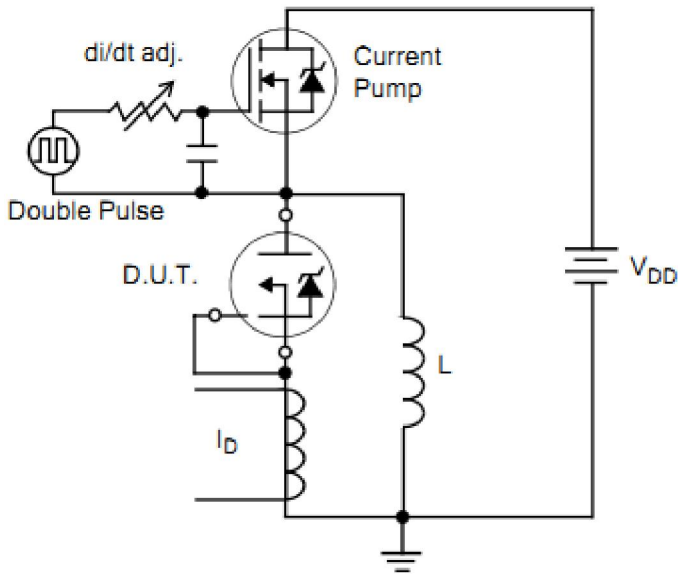


Figure 19. Diode Reverse Recovery Waveform

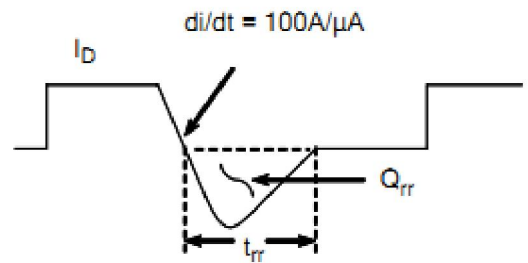


Figure20.Unclamped Inductive Switching Test Circuit

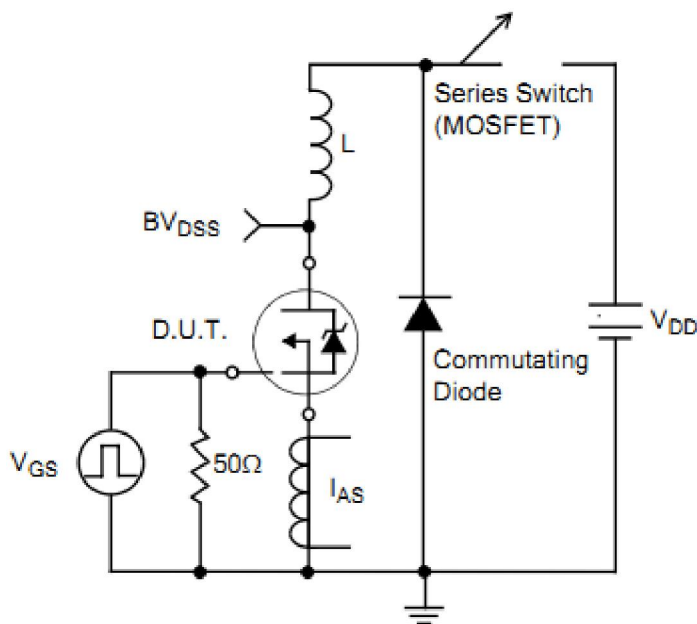
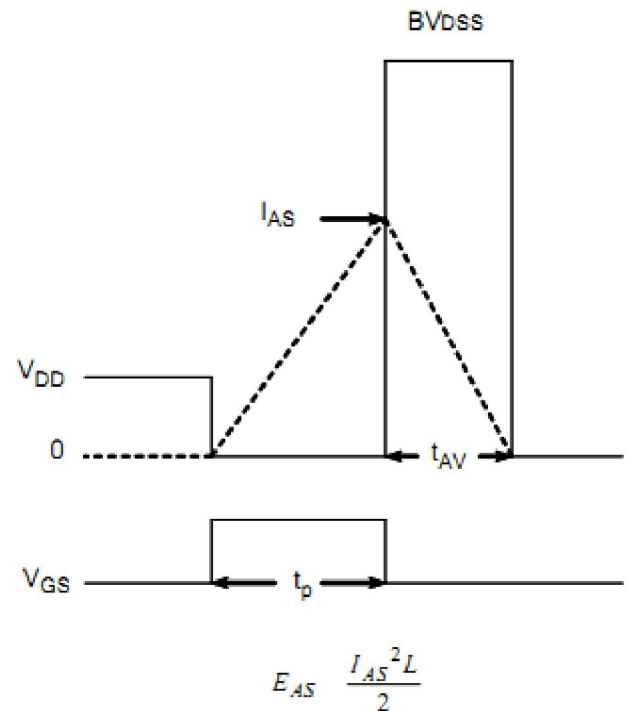


Figure21.Unclamped Inductive Switching Waveform







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