

# MP13N50

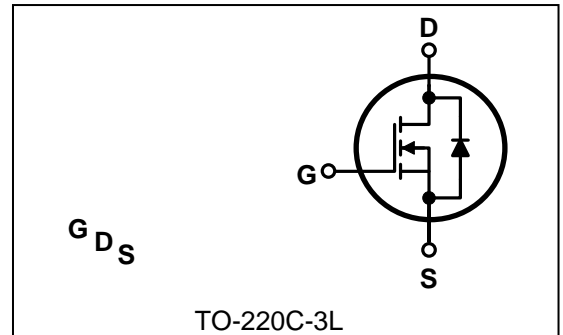
Power MOSFET

## SWITCHING REGULATOR APPLICATIONS

### Features

- High Voltage :  $BV_{DSS}=500V(\text{Min.})$
- Low  $C_{rSS}$  :  $C_{rSS}=21pF(\text{Typ.})$
- Low gate charge :  $Q_g=43nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.46\Omega(\text{Max.})$

### PIN Connection

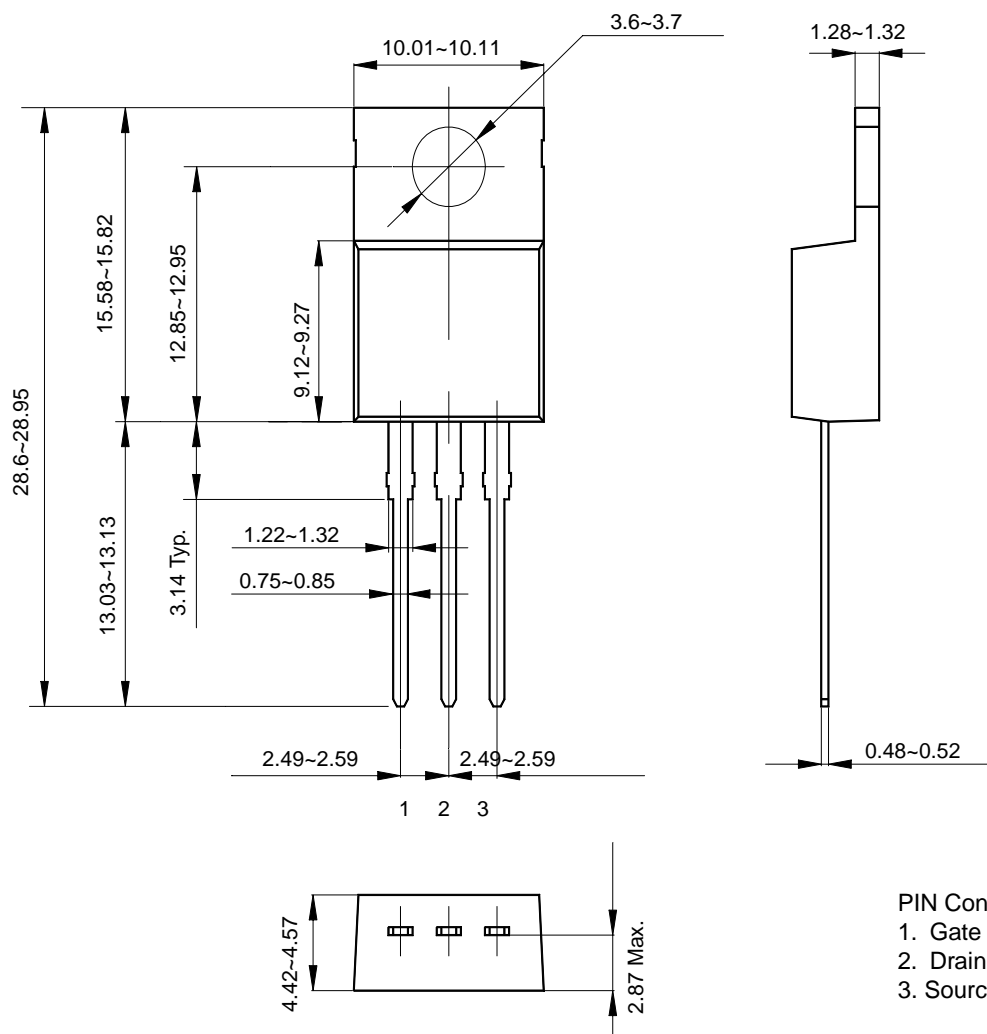


### Ordering Information

Type NO.	Marking	Package Code
MP13N50	MP13N50C	TO-220C-3L

### Outline Dimensions

unit : mm



## Absolute Maximum Ratings

Power MOSFET

Symbol	Parameter	Value	Units
V <sub>DSS</sub>	Drain Source Voltage	500	V
I <sub>D</sub>	Continuous Drain Current(@Tc=25°C)	13*	A
	Continuous Drain Current(@Tc=100°C)	8*	A
I <sub>DM</sub>	Drain Current Pulsed (Note1)	52*	A
V <sub>GS</sub>	Gate to Source Voltage	±30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note2)	845	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy (Note1)	5	mJ
dv/dt	Peak Diode Recovery dv /dt (Note3)	3.5	V/ ns
P <sub>D</sub>	Total Power Dissipation(@Tc=25°C)	190	W
	Derating Factor above 25°C	0.39	W/°C
T <sub>J</sub> , T <sub>stg</sub>	Junction and Storage Temperature	-55~150	°C
T <sub>L</sub>	Channel Temperature	300	°C

\*Drain current limited by maximum junction temperature

## Thermal Characteristics

Symbol	Parameter	Value			Units
		Min	Typ	Max	
R <sub>QJC</sub>	Thermal Resistance , Junction -to -Case	-	-	0.66	°C/W
R <sub>QCS</sub>	Thermal Resistance , Case-to-Sink	-	0.5	-	°C/W
R <sub>QJA</sub>	Thermal Resistance , Junction-to -Ambient	-	-	62.5	°C/W

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristics		Symbol	Test Condition	Min	Type	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	-	-	±100	nA
Gate-source breakdown voltage		V <sub>(BR)GSS</sub>	I <sub>G</sub> =±10 μA, V <sub>DS</sub> =0V	±30	-	-	V
Drain cut -off current		I <sub>DSS</sub>	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V	-	-	1	μA
			V <sub>DS</sub> =400V, T <sub>C</sub> =125°C			10	μA
Drain -source breakdown voltage		V <sub>(BR)DSS</sub>	I <sub>D</sub> =250 μA, V <sub>GS</sub> =0V	500	-	-	V
Breakdown voltage Temperature Coefficient		ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C	-	0.5	-	V/°C
Gate threshold voltage		V <sub>GS(th)</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =250 μA	3	-	4.5	V
Drain -source ON resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =6.5A	-	0.39	0.46	Ω
Forward Transconductance		g <sub>fs</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =6.5A	-	15	-	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> =25V,	-	1580	2055	pF
Reverse transfer capacitance		C <sub>rss</sub>	V <sub>GS</sub> =0V,	-	21	26	
Output capacitance		C <sub>oss</sub>	f=1MHz	-	180	235	
Switching time	Rise time	t <sub>r</sub>	V <sub>DD</sub> =250V,	-	160	270	ns
	Turn-on time	t <sub>on</sub>	I <sub>D</sub> =13A	-	100	210	
	Fall time	t <sub>f</sub>	R <sub>G</sub> =9.1Ω	-	130	270	
	Turn-off time	t <sub>off</sub>	R <sub>D</sub> =31Ω (Note4,5)	-	100	210	
Total gate charge(gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> =400V, V <sub>GS</sub> =10V,	-	43	56	nC
Gate-source charge		Q <sub>gs</sub>	I <sub>D</sub> =13A	-	10.9	-	
Gate-drain("miller") Charge		Q <sub>gd</sub>	(Note4,5)	-	18.5	-	

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristics	Symbol	Test Condition	Min	Type	Max	Unit
Continuous drain reverse current	I <sub>DR</sub>	-	-	-	13	A
Pulse drain reverse current	I <sub>DRP</sub>	-	-	-	52	A
Forward voltage(diode)	V <sub>DSF</sub>	I <sub>DR</sub> =13A, V <sub>GS</sub> =0V	-	-	1.4	V
Reverse recovery time	t <sub>rr</sub>	I <sub>DR</sub> =13A, V <sub>GS</sub> =0V,	-	442	633	ns
Reverse recovery charge	Q <sub>rr</sub>	dI <sub>DR</sub> / dt =100 A / μs	-	2.16	3.24	μC

Note 1.Repeativity rating :pulse width limited by junction temperature

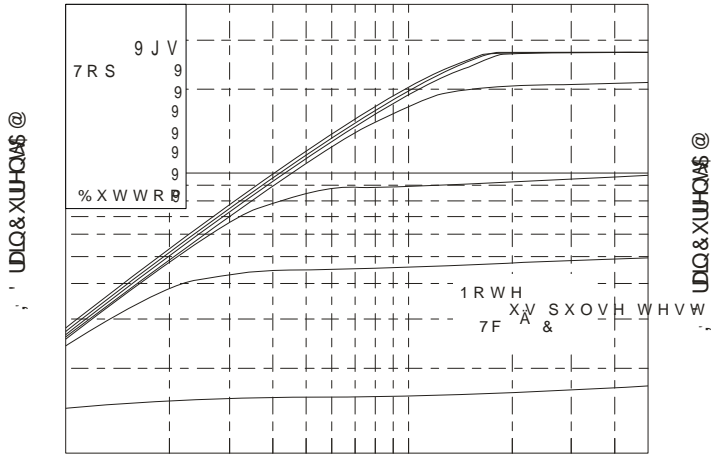
2.L=500uH I<sub>AS</sub>=13A, V<sub>DD</sub>=50V, R<sub>G</sub>=0Ω, Starting T<sub>J</sub>=25°C

3.I<sub>SD</sub>≤13A, di/dt≤300A/us, V<sub>DD</sub><BV<sub>DSS</sub>, STARTING T<sub>J</sub>=25°C

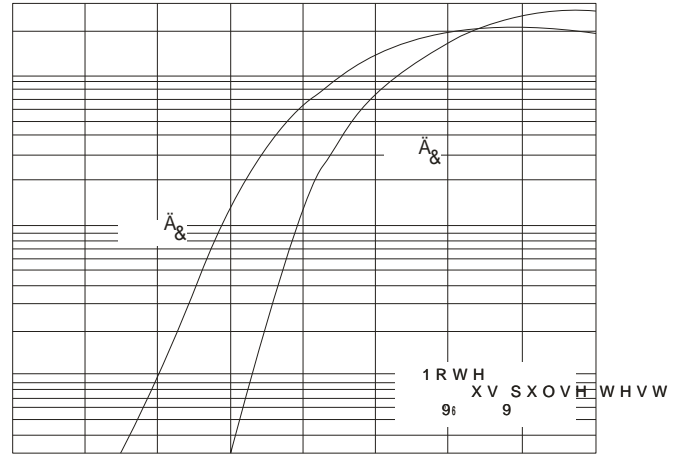
4.Pulse Test:Pulse Width≤300us, Duty Cycle≤2%

5. Essentially independent of operating temperature.

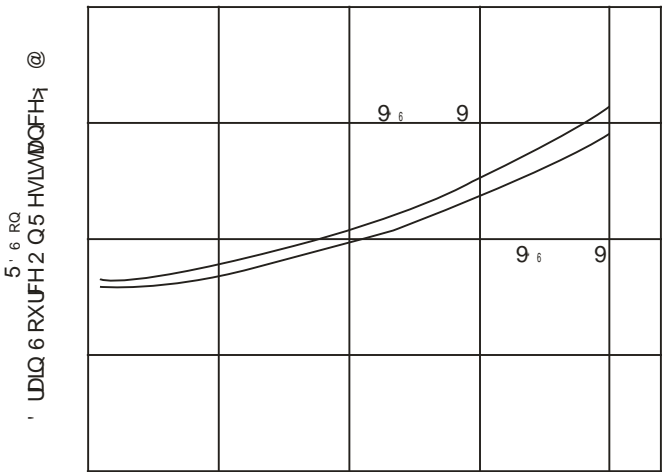
## Electrical Characteristic Curves



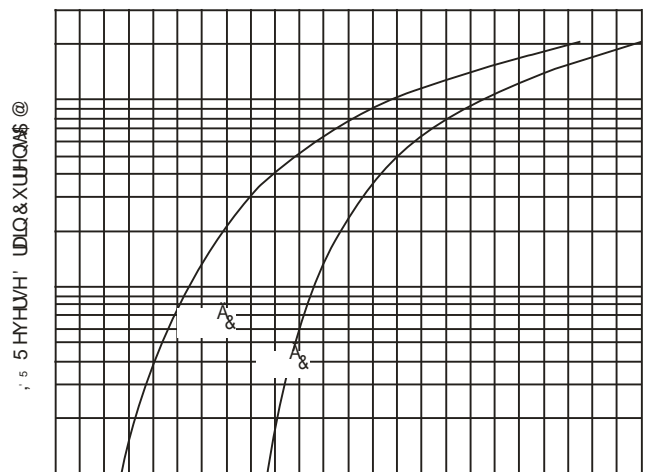
9: 'UDLQ 6RXUFH 9ROWDJH>9@  
)LJ 2Q5HJL & KDUDFWHULVWLFV



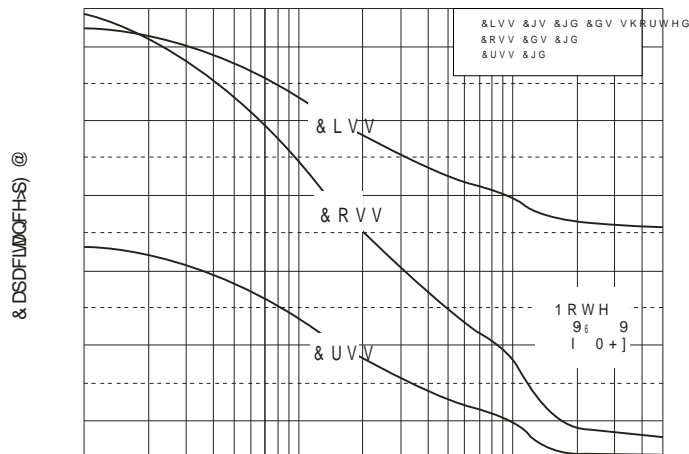
9: \*DWH 6RXUFH 9ROWDJH>9@  
)LJ 7UDQ & KDUDFWHULVWLFV



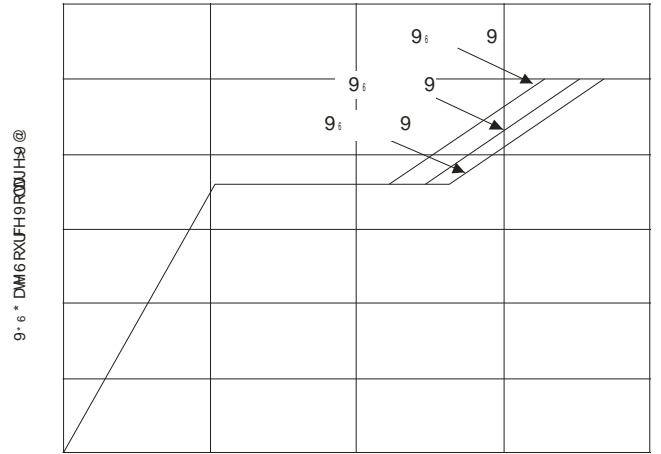
; 'UDLQ & XUHQW>\$@  
)LJ 2Q 5HVLV & KDUDFWHULVWLFV  
& XUUDQW 9ROWDJH



9: 6RXUFH 'UDLQ 9ROWDJH>9@  
)LJ % RGLRGIRUZDURG WDJL DWL RQ  
6RXUFH XUUDQW PSHUDWXUH

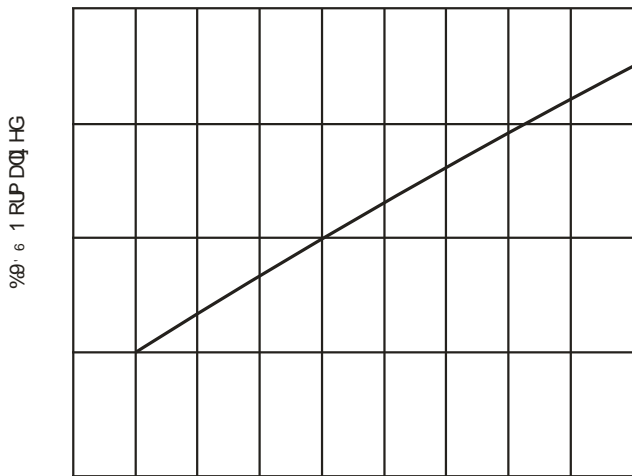


9: 'UDLQ 6RXUFH 9ROWDH>9@  
)LJ & DSDFLV & KDUDFWHULVWLFV

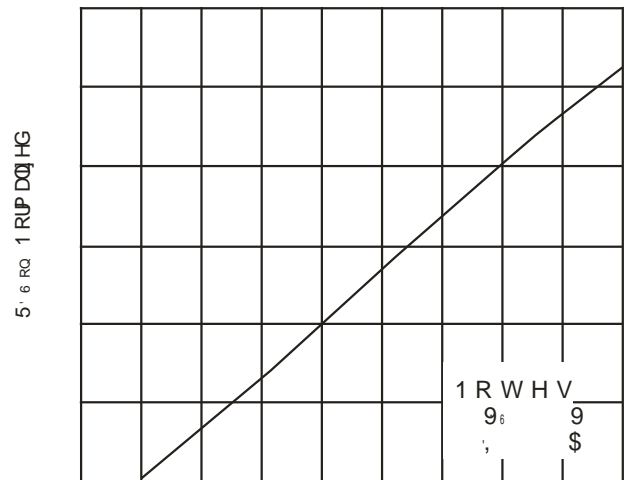


4J 7ROWDO \*DWH & KDUDFWHULVWLFV  
)LJ \*DWH & KDUDFWHULVWLFV

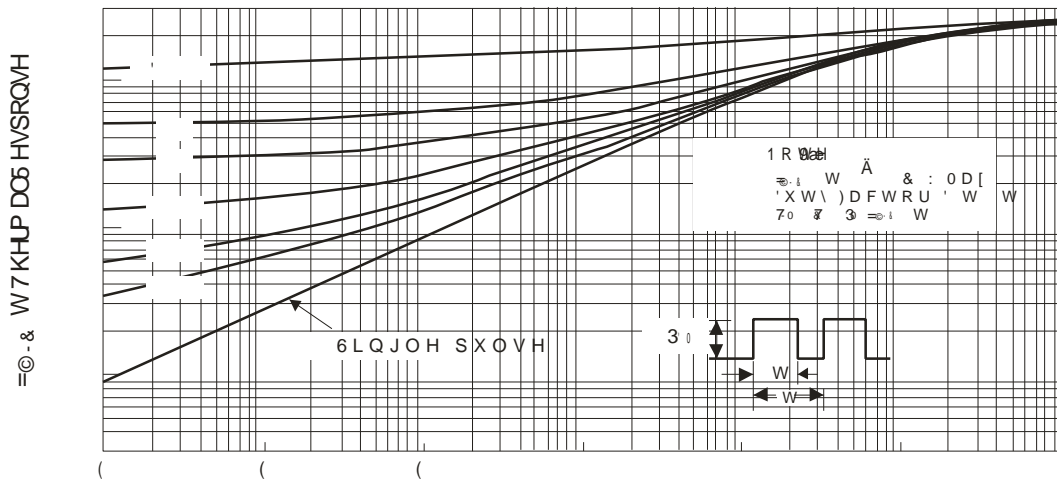
## Electrical Characteristic Curves



1 RUP DQ HG  
7 M > & @  
)LJ % UHDN G R Z Q D U L D W L R Q  
Y V 7 H P S H U D W X U H

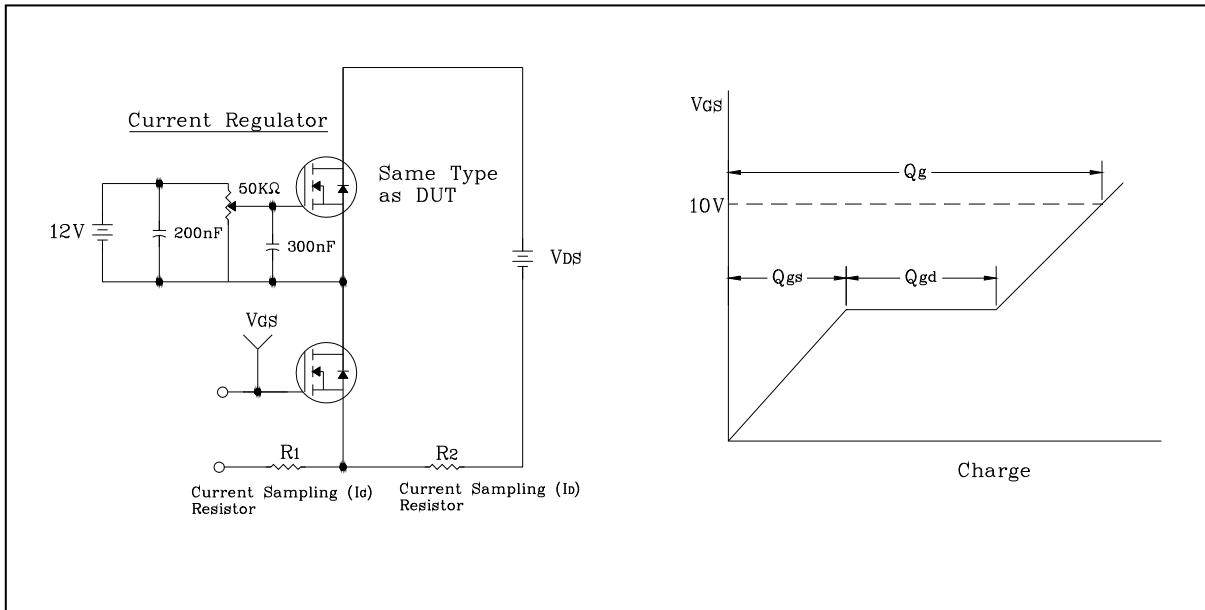


5 . 6 RQ 1 RUP DQ HG  
7 M > & @  
)LJ 2 Q 5 H V L V 9 D D Q L D W L R Q  
Y V 7 H P S H U D W X U H

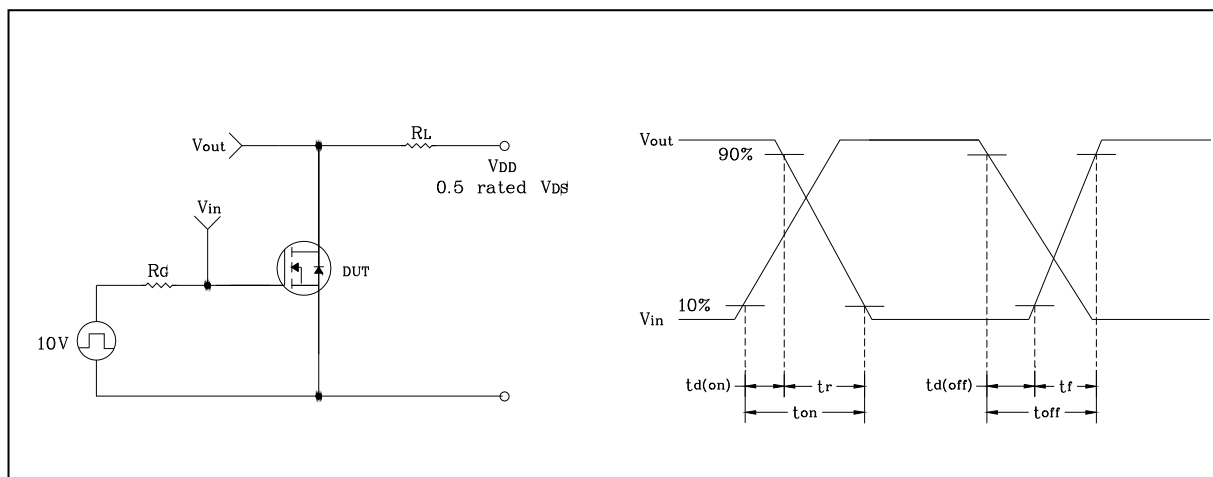


W 6 T X D U H : D Y H 3 X O V H ' X U D W L R Q > V H F @  
7 U D Q W K Q W P D S R Q X H Y H

**Fig. 11 Gate Charge Test Circuit & Waveform**



**Fig. 12 Resistive Switching Test Circuit & Waveform**



**Fig. 13 EAS Test Circuit & Waveform**

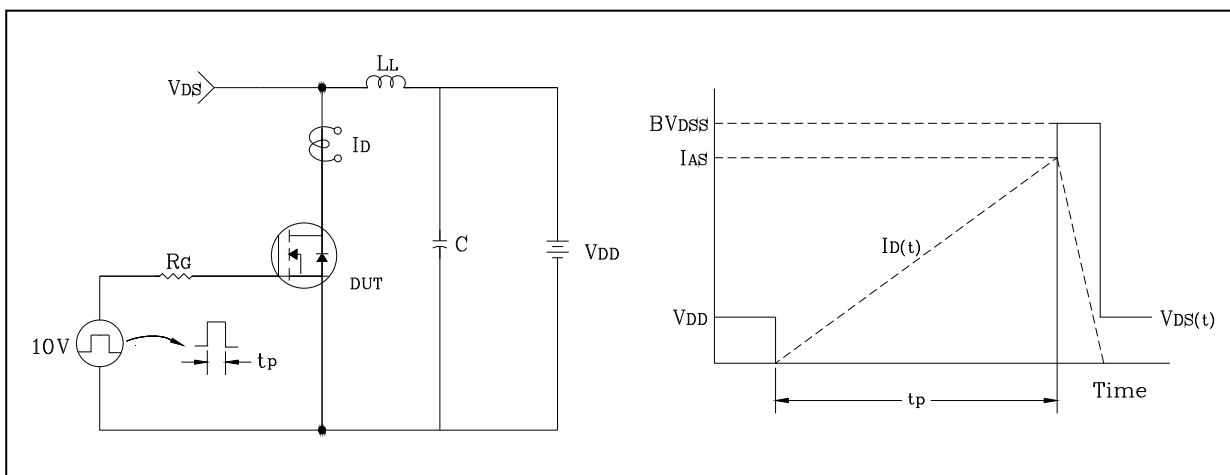


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform

