

## SWITCHING REGULATOR APPLICATIONS

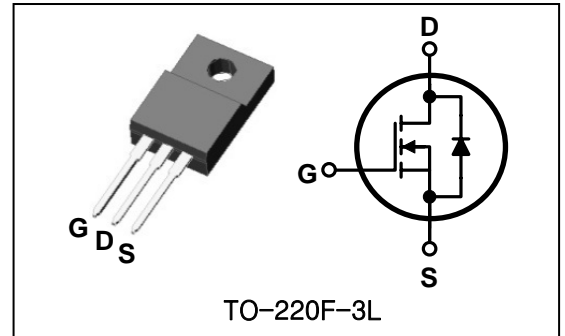
### Features

- High Voltage:  $BV_{DSS}=650V(\text{Min.})$
- Low  $C_{rSS}$  :  $C_{rSS}=18pF(\text{Typ.})$
- Low gate charge :  $Qg=50nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.85\Omega(\text{Max.})$

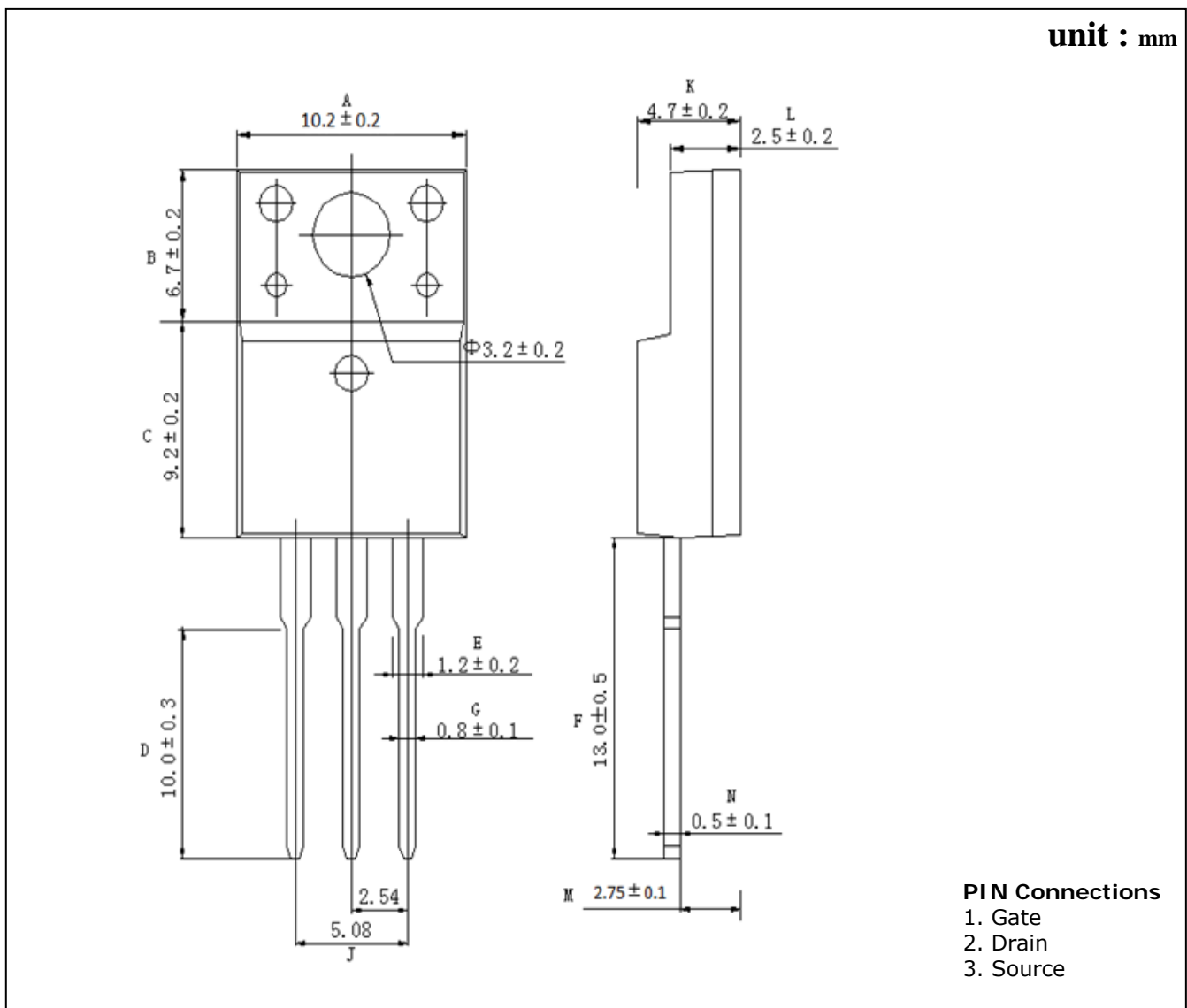
### Ordering Information

Type NO.	Marking	Package Code
MF12N65	MF12N65	TO-220F-3L

### PIN Connection



### Outline Dimensions



## Absolute maximum ratings

(Tc=25°C)

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	$V_{DSS}$	650	V	
Gate-source voltage	$V_{GSS}$	±30	V	
Drain current (DC)*	$I_D$	(Tc=25°C)	12	A
		(Tc=100°C)	9.0	A
Drain current (Pulsed)*	$I_{DM}$	48	A	
Drain power dissipation	$P_D$	51	W	
Avalanche current (Single) ②	$I_{AS}$	12	A	
Single pulsed avalanche energy ②	$E_{AS}$	700	mJ	
Avalanche current (Repetitive) ①	$I_{AR}$	12	A	
Repetitive avalanche energy ①	$E_{AR}$	11.6	mJ	
Junction temperature	$T_J$	150	°C	
Storage temperature range	$T_{stg}$	-55~150		

\* Limited by maximum junction temperature

Characteristic		Symbol	Typ.	Max	Unit
Thermal resistance	Junction-case	$R_{th(J-C)}$	-	2.44	°C/W
	Junction-ambient	$R_{th(J-a)}$	-	62.5	

## Electrical Characteristics

(Tc=25°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$I_D=250\mu A, V_{GS}=0$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu A, V_{DS}=V_{GS}$	2.0	-	4.0	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$	-	-	1	$\mu A$
Gate leakage current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
Drain-source on-resistance ④	$R_{DS(ON)}$	$V_{GS}=10V, I_D=6.0A$	-	-	0.85	$\Omega$
Forward transfer conductance ④	$g_{fs}$	$V_{DS}=10V, I_D=6.0A$	-	10	-	S
Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=25V$ $f=1MHz$	-	2100	2950	pF
Output capacitance	$C_{oss}$		-	168	200	
Reverse transfer capacitance	$C_{rss}$		-	18	22	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=300V, I_D=12A$ $R_G=25\Omega$	-	30	-	ns
Rise time	$t_r$		-	85	-	
Turn-off delay time	$t_{d(off)}$		-	140	-	
Fall time	$t_f$		-	90	-	
Total gate charge	$Q_g$	$V_{DS}=480V, V_{GS}=10V$ $I_D=12A$	-	50	63	nC
Gate-source charge	$Q_{gs}$		-	9.8	-	
Gate-drain charge	$Q_{gd}$		-	18.5	-	

## Source-Drain Diode Ratings and Characteristics

(Tc=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Source current (DC)	$I_S$	Integral reverse diode in the MOSFET	-	-	12	A
Source current (Pulsed) ①	$I_{SM}$		-	-	48	
Forward voltage ④	$V_{SD}$	$V_{GS}=0V, I_S=12A$	-	-	1.4	V
Reverse recovery time	$t_{rr}$	$I_S=12A, V_{GS}=0,$ $di_S/dt=100A/\mu s$	-	500	-	ns
Reverse recovery charge	$Q_{rr}$		-	4.3	-	$\mu C$

Note ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=10mH, I_{AS}=12A, V_{DD}=50V, R_G=25\Omega$  , Starting T = 25 °C
- ③ Pulse Test : Pulse Width < 300us, Duty cycle ≤ 2%
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

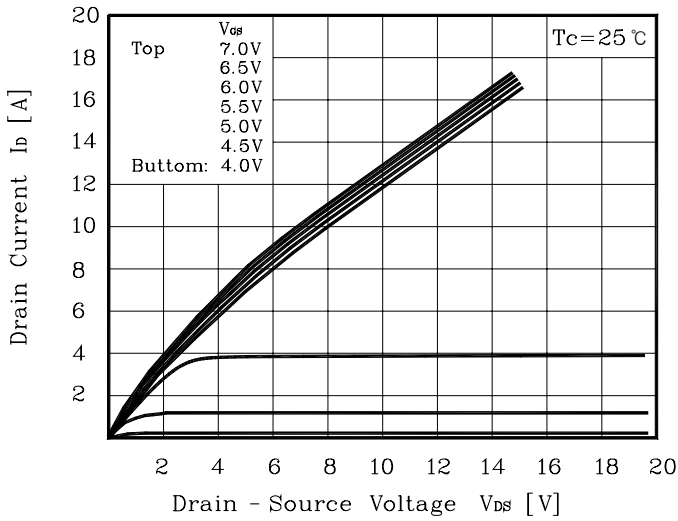


Fig. 2  $I_D - V_{GS}$

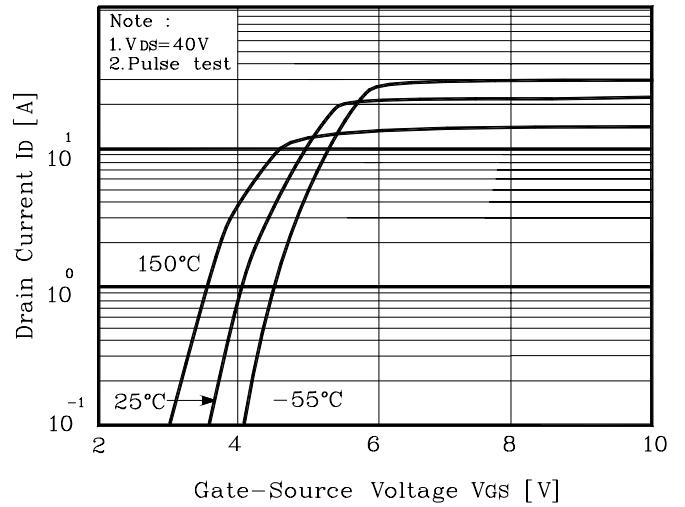


Fig. 3  $R_{DS(on)} - I_D$

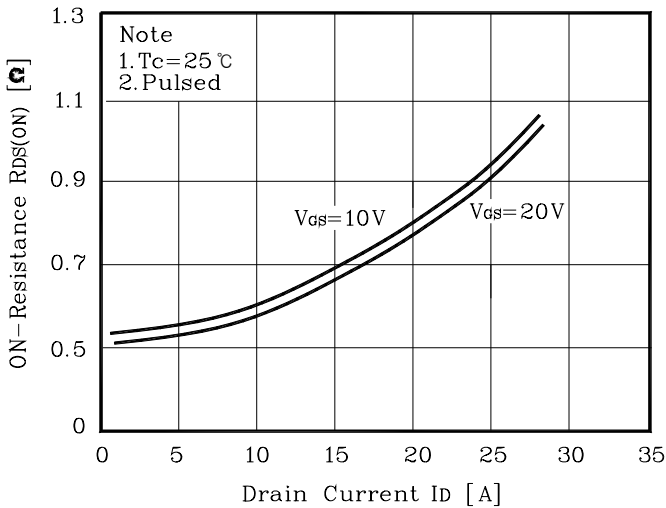


Fig. 4  $I_S - V_{SD}$

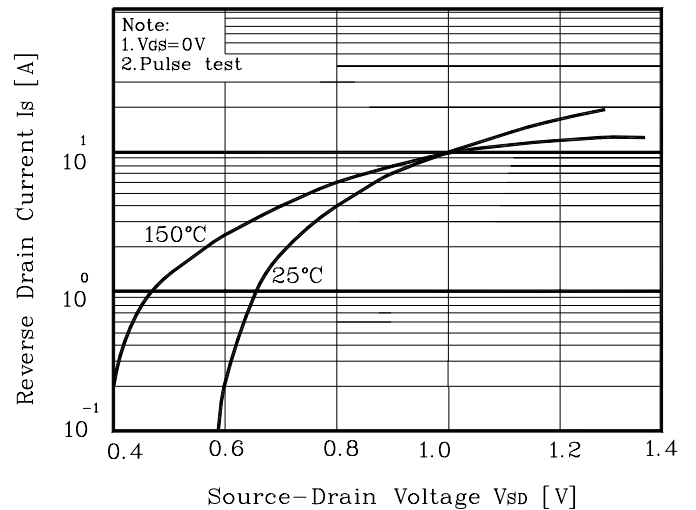


Fig. 5 Capacitance -  $V_{DS}$

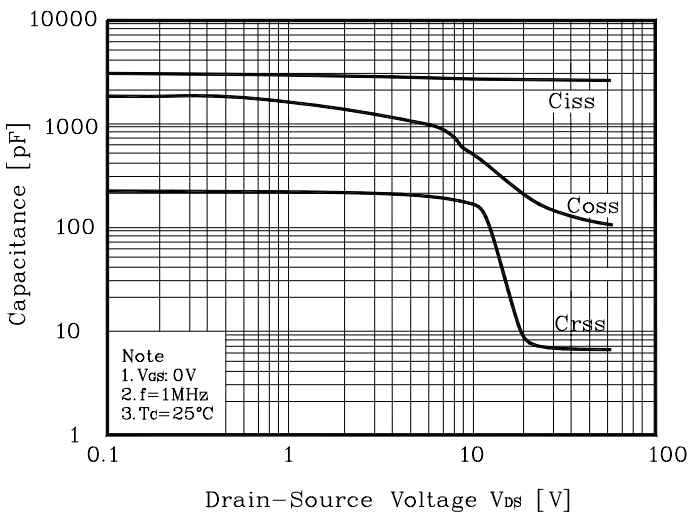
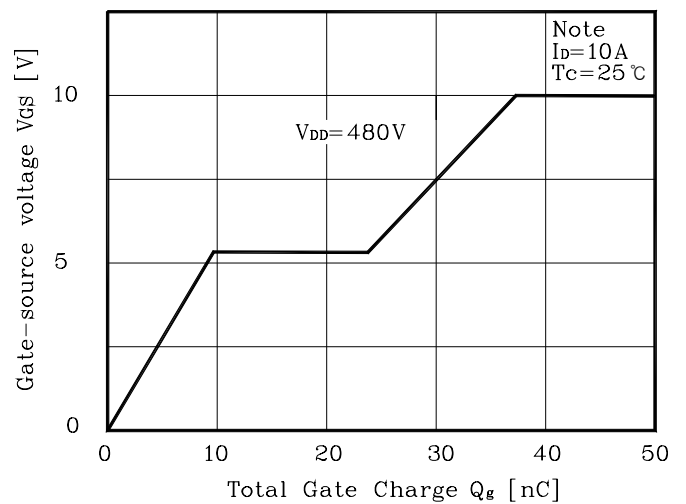
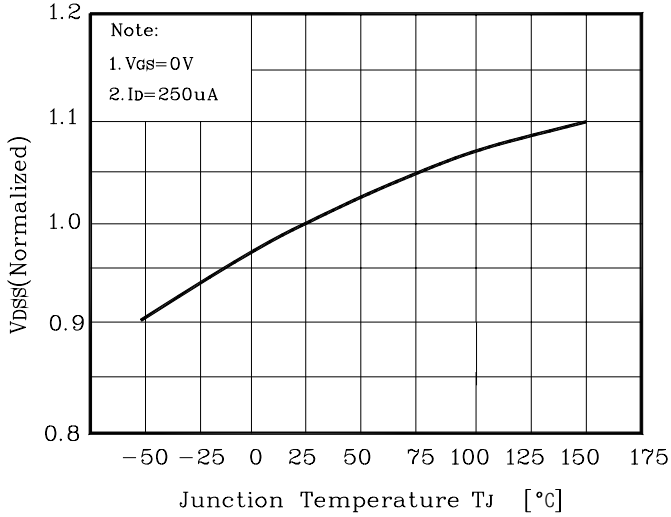


Fig. 6  $V_{GS} - Q_g$

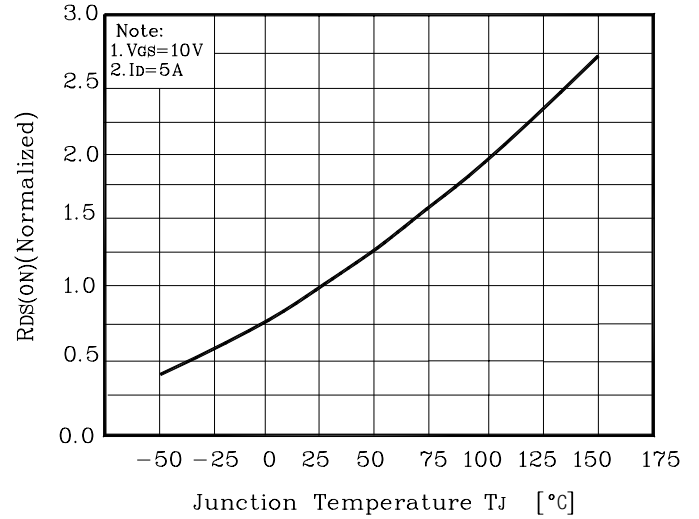


## Electrical Characteristic Curves

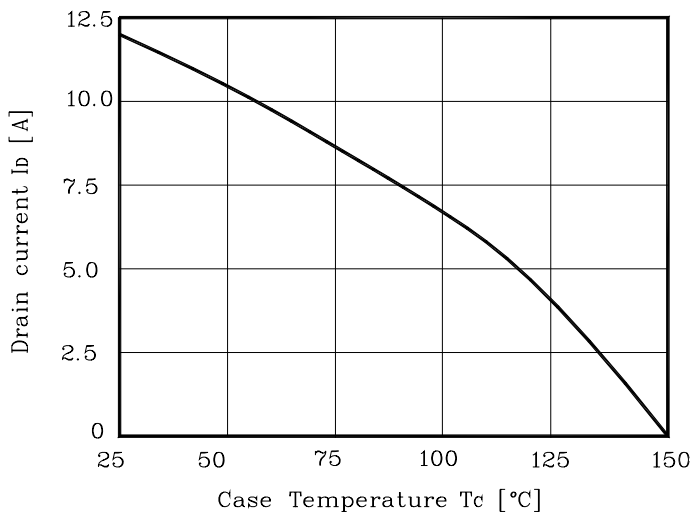
**Fig. 7**  $V_{DSS} - T_J$



**Fig. 8**  $R_{DS(on)} - T_J$



**Fig. 9**  $I_D - T_C$



**Fig. 10** Safe Operating Area

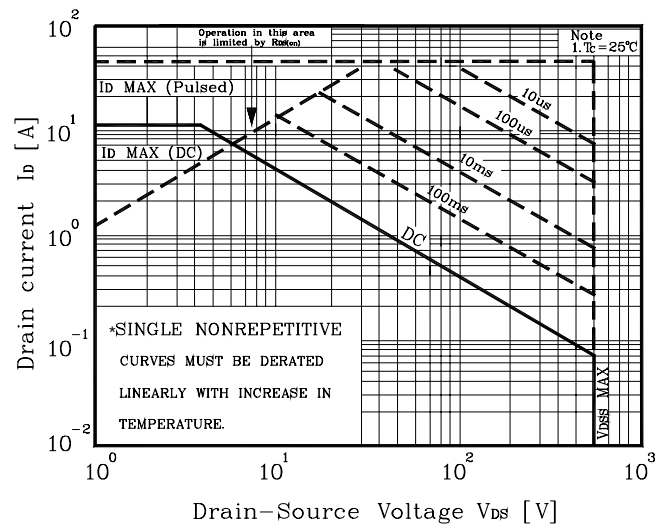


Fig. 10 Gate Charge Test Circuit & Waveform

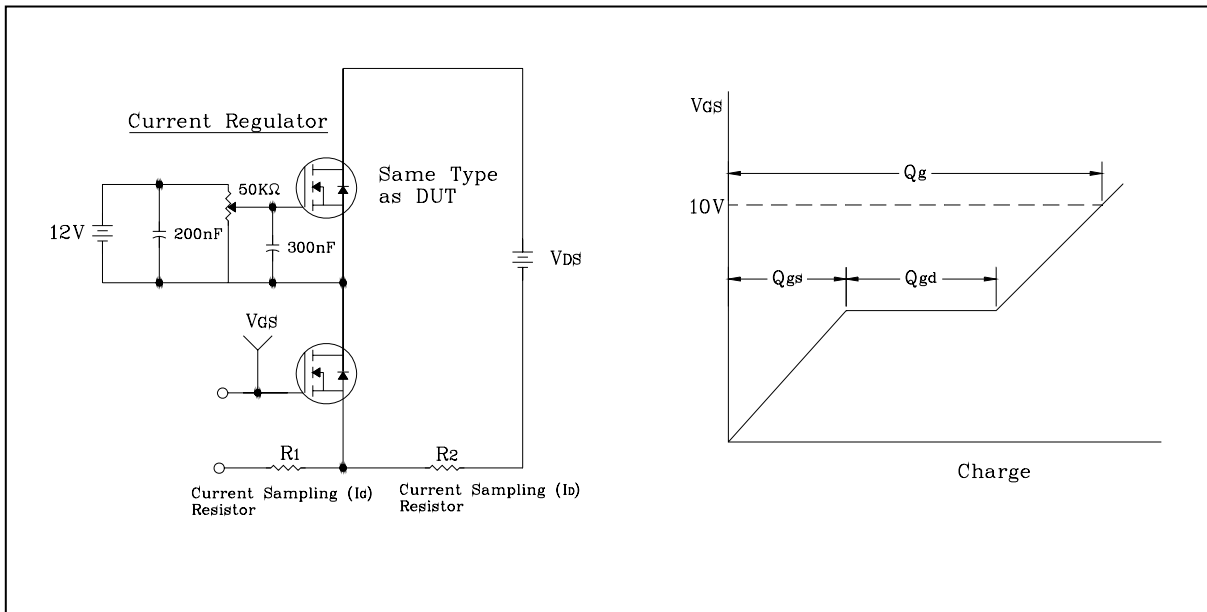


Fig. 11 Resistive Switching Test Circuit & Waveform

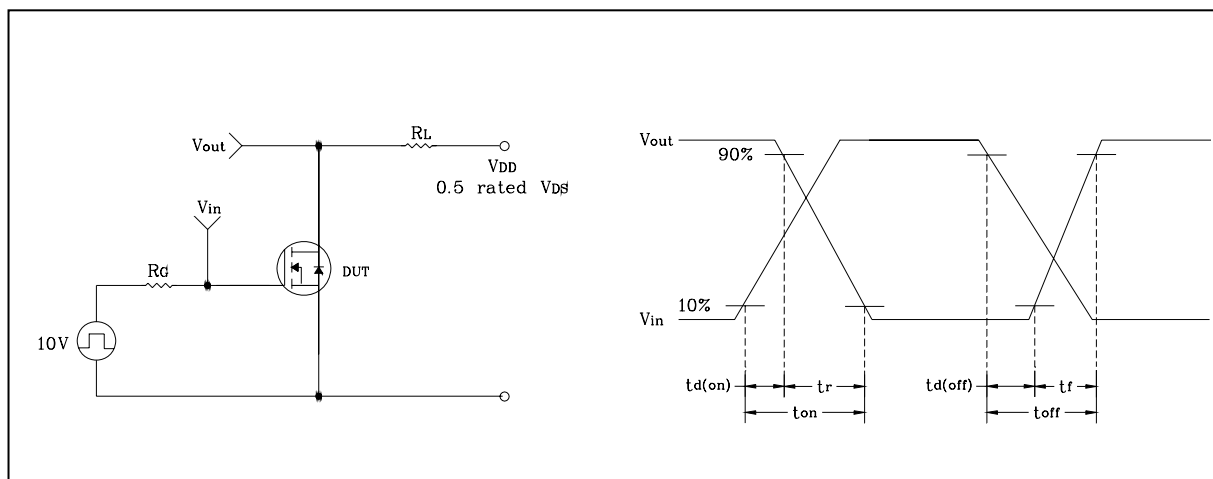


Fig. 12 E<sub>AS</sub> Test Circuit & Waveform

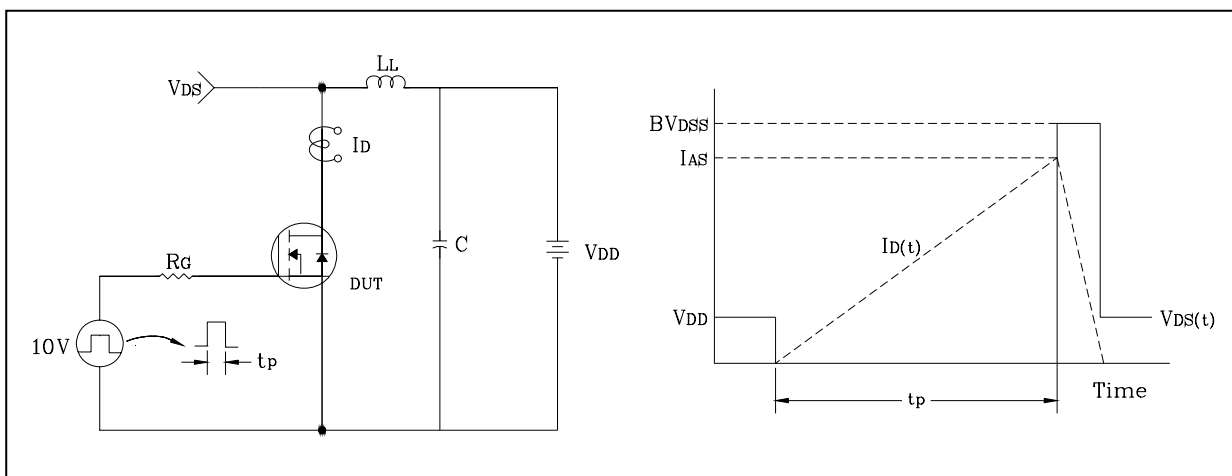


Fig. 13 Diode Reverse Recovery Time Test Circuit & Waveform

