KHB9D5N20P/F/F2

N CHANNEL MOS FIELD EFFECT TRANSISTOR

General Description

This planar stripe MOSFET has better characteristics, such as fast switching time, low on resistance, low gate charge and excellent avalanche characteristics. It is mainly suitable for electronic ballast and switch mode power supplies.

FEATURES

- V_{DSS}=200V, I_D=9.5A
- Drain-Source ON Resistance
  : $R_{DS(ON)}$=400mΩ @V_{GS} = 10V
- Qg(typ.)=18.5nC

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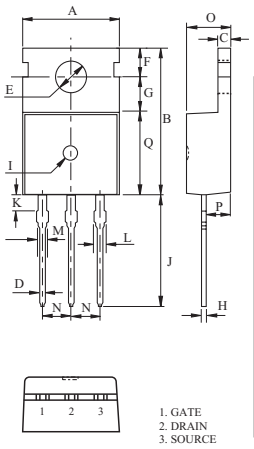

DIM	MILLIMETERS
A	9.9 ± 0.2
B	15.95 MAX
C	1.3+0.1/-0.05
D	0.8 ± 0.1
E	ø3.6 ± 0.2
F	2.8 ± 0.1
G	3.7
H	0.5+0.1/-0.05
I	ø1.5
J	13.08 ± 0.3
K	1.46
L	1.4 ± 0.1
M	1.27 ± 0.1
N	2.54 ± 0.2
O	4.5 ± 0.2
P	2.4 ± 0.2
Q	9.2 ± 0.2

TO-220AB

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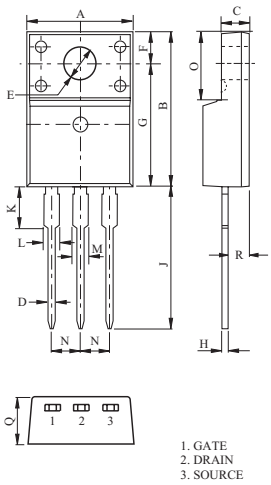
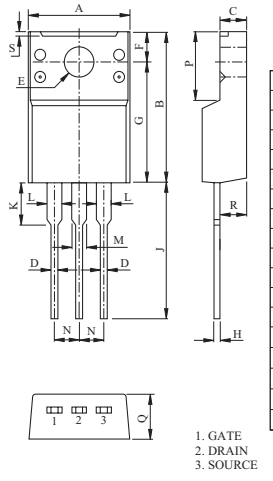


DIM	MILLIMETERS
A	10.16 ± 0.2
B	15.87 ± 0.2
C	2.54 ± 0.2
D	0.8 ± 0.1
E	ø3.18 ± 0.1
F	3.3 ± 0.1
G	12.57 ± 0.2
H	0.5 ± 0.1
J	13.0 MAX
K	3.23 ± 0.1
L	1.47 MAX
M	1.47 MAX
N	2.54 ± 0.2
O	6.68 ± 0.2
Q	4.7 ± 0.2
R	2.76 ± 0.2

TO-220IS (1)

KHB9D5N20F2



DIM	MILLIMETERS
A	10.0±0.3
B	15.0±0.3
C	2.70±0.3
D	0.76+0.09/-0.05
E	Φ3.2±0.2
F	3.0±0.3
G	12.0±0.3
H	0.5+0.1/-0.05
J	13.6±0.5
K	3.7±0.2
L	1.2+0.25/-0.1
M	1.5+0.25/-0.1
N	2.54±0.1
P	6.8±0.1
Q	4.5±0.2
R	2.6±0.2
S	0.5 Typ

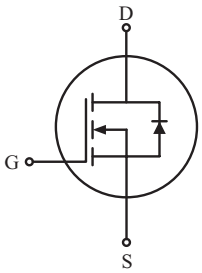
TO-220IS

MAXIMUM RATING (Ta=25℃)

CHARACTERISTIC		SYMBOL	RATING		UNIT
			KHB9D5N20P	KHB9D5N20F KHB9D5N20F2	
Drain-Source Voltage		V_{DSS}	200		V
Gate-Source Voltage		V_{GSS}	±30		V
Drain Current	@T_C=25℃	I_D	9.5	9.5*	A
	Pulsed (Note1)	I_{DP}	38	38*	
Single Pulsed Avalanche Energy (Note 2)		E_{AS}	180		mJ
Repetitive Avalanche Energy (Note 1)		E_{AR}	8.7		mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	5.5		V/ns
Drain Power Dissipation	Tc=25℃	P_D	87	40	W
	Derate above25℃		0.7	0.32	W/℃
Maximum Junction Temperature		T_j	150		℃
Storage Temperature Range		T_{stg}	-55 150		℃
Thermal Characteristics					
Thermal Resistance, Junction-to-Case		R_{thJC}	1.44	3.13	℃/W
Thermal Resistance, Junction-to-Ambient		R_{thJA}	62.5	62.5	℃/W

* : Drain current limited by maximum junction temperature.

PIN CONNECTION



ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	BV_{DSS}	I_D=250 μA, V_{GS}=0V	200	-	-	V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_j$	I_D=250 μA, Referenced to 25℃	-	0.19	-	V/℃
Gate Threshold Voltage	V_{th}	V_{DS}=V_{GS}, I_D=250 μA	2.0	-	4.0	V
Drain Cut-off Current	I_{DSS}	V_{DS}=200V, V_{GS}=0V,	-	-	1	μA
Gate Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	-	-	±100	nA
Drain-Source ON Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=4.75A	-	345	400	mΩ
Forward Transconductance	g_{FS}	V_{DS}=40V, I_D=4.75A (Note4)	-	6.7	-	S
Dynamic						
Total Gate Charge	Q_g	V_{DS}=160V, I_D=9.5A V_{GS}=10V (Note4, 5)	-	18.5	23	nC
Gate-Source Charge	Q_{gs}		-	2.7	-	
Gate-Drain Charge	Q_{gd}		-	9	-	
Turn-on Delay time	$t_{d(on)}$	V_{DD}=100V, R_G=25Ω I_D=9.5A (Note4, 5)	-	11	32	ns
Turn-on Rise time	t_r		-	62	135	
Turn-off Delay time	$t_{d(off)}$		-	46	102	
Turn-off Fall time	t_f		-	80	170	
Input Capacitance	C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1.0MHz	-	387	503	pF
Output Capacitance	C_{oss}		-	96	125	
Reverse Transfer Capacitance	C_{rss}		-	34	45	
Source-Drain Diode Ratings						
Continuous Source Current	I_S	V_{GS}<V_{th}	-	-	9.5	A
Pulsed Source Current	I_{SP}		-	-	38	
Diode Forward Voltage	V_{SD}	I_S=9.5A, V_{GS}=0V	-	-	1.5	V
Reverse Recovery Time	t_{rr}	I_S=9.5A, V_{GS}=0V, dIs/dt=100A/μs (Note 4)	-	130	-	ns
Reverse Recovery Charge	Q_{rr}		-	0.6	-	μC

Note 1) Repetivity rating : Pulse width limited by junction temperature.

Note 2) L =3mH, I_{AS}=9.5A, V_{DD}=50V, R_G=25Ω, Starting T_j=25℃.

Note 3) I_S ≤9.5A, dI/dt≤300A/μs, V_{DD}≤BV_{DSS}, Starting T_j=25℃.

Note 4) Pulse Test : Pulse width ≤ 300μs, Duty Cycle ≤ 2%.

Note 5) Essentially independent of operating temperature.

Fig1. I_D - V_{DS}

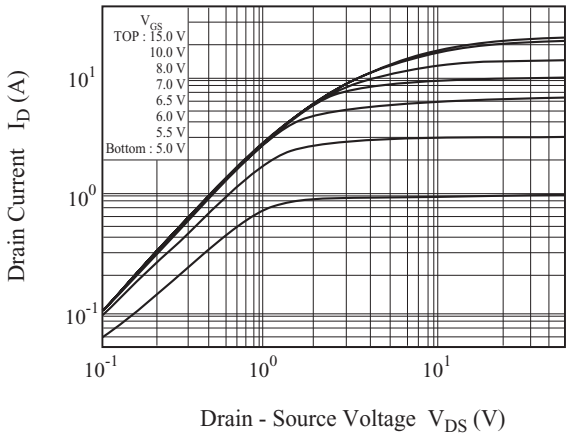


Fig2. I_D - V_{GS}

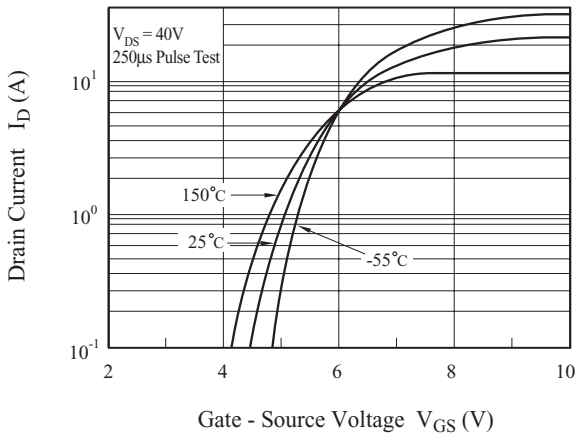


Fig4. BV_{DSS} - T_j

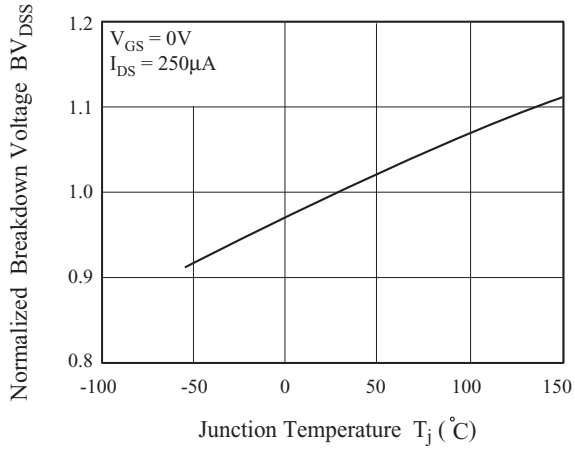


Fig5. $R_{DS(ON)}$ - I_D

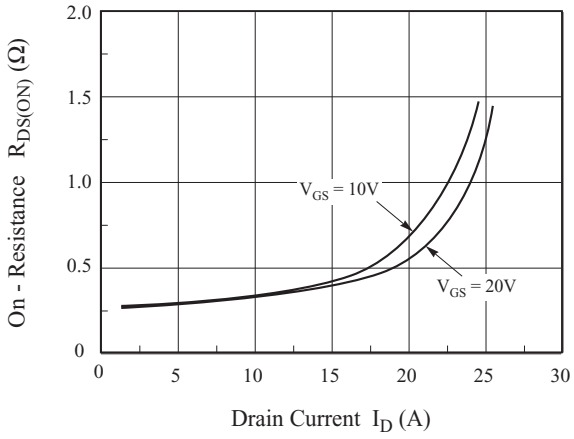


Fig6. I_S - V_{SD}

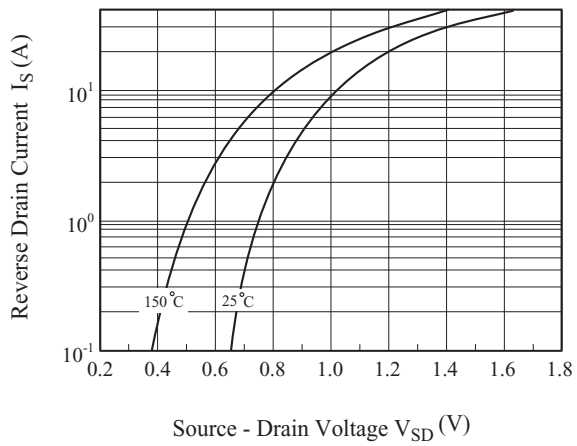


Fig6. $R_{DS(ON)}$ - T_j

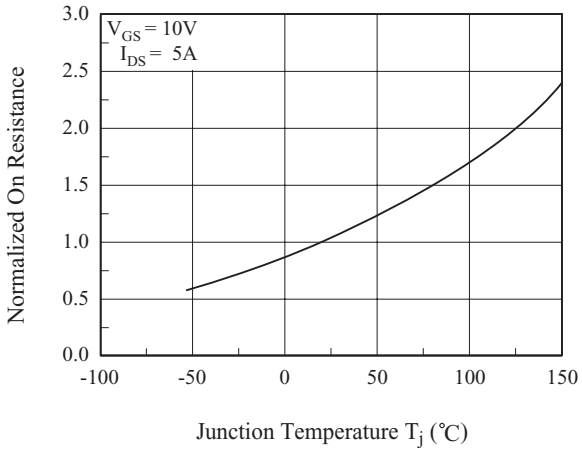


Fig7. C - V_{DS}

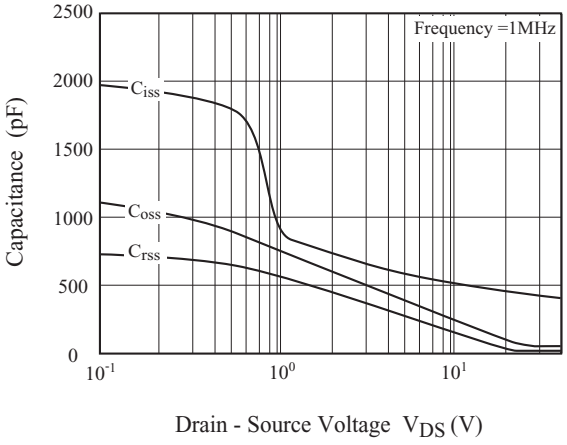


Fig8. Q_g- V_{GS}

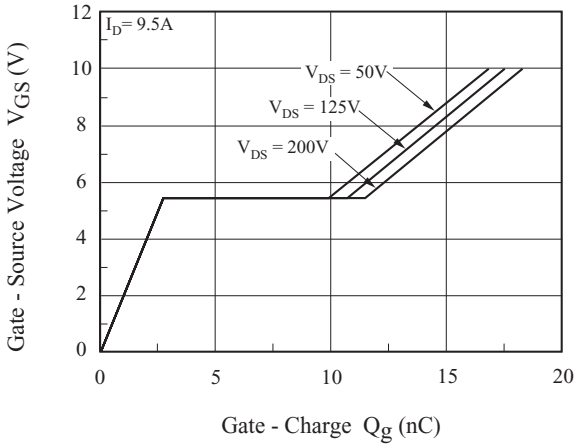


Fig9. Safe Operation Area

(KHB9D5N20P)

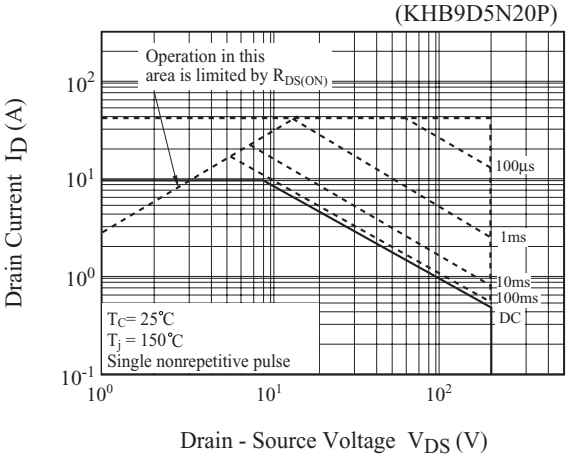


Fig10. Safe Operation Area

(KHB9D5N20F, KHB9D5N20F2)

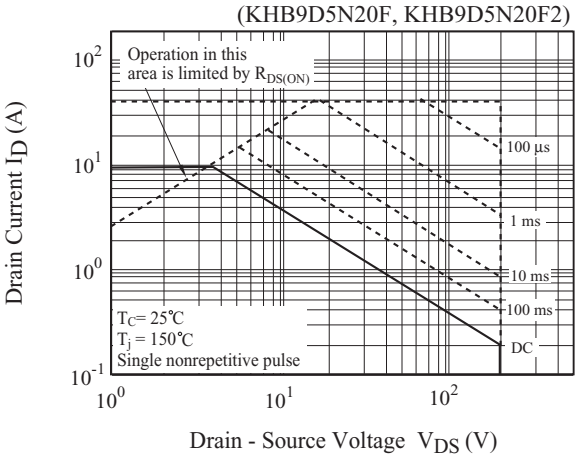


Fig11. I_D - T_j

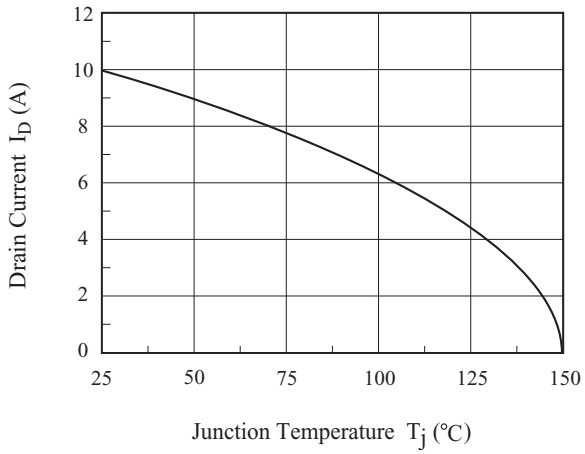


Fig12. Transient Thermal Response Curve

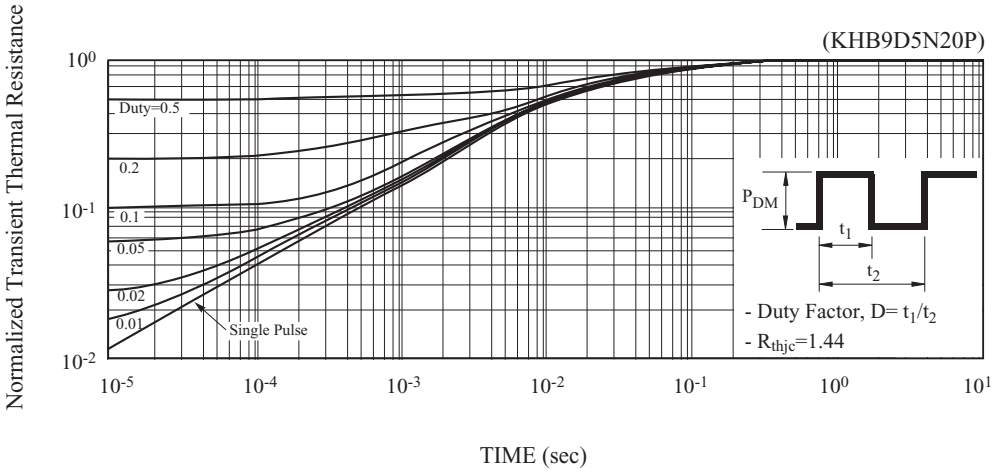


Fig13. Transient Thermal Response Curve

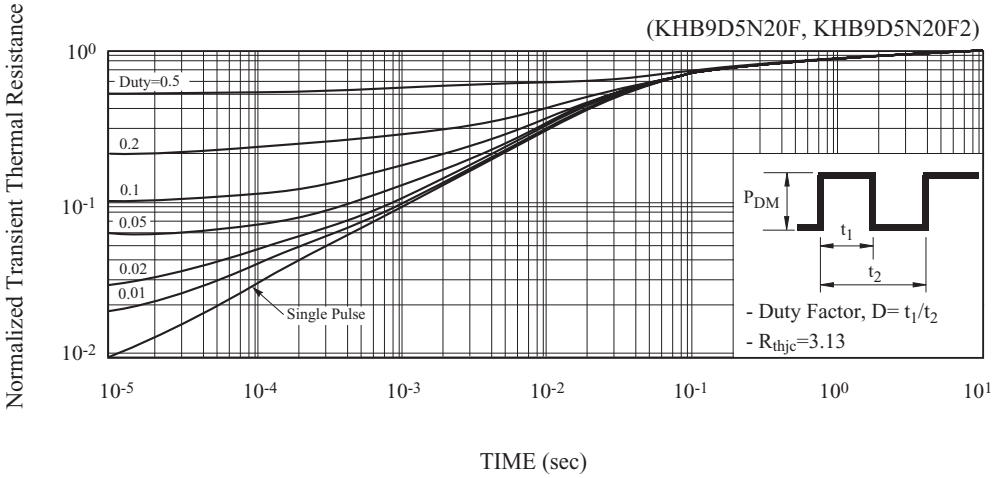
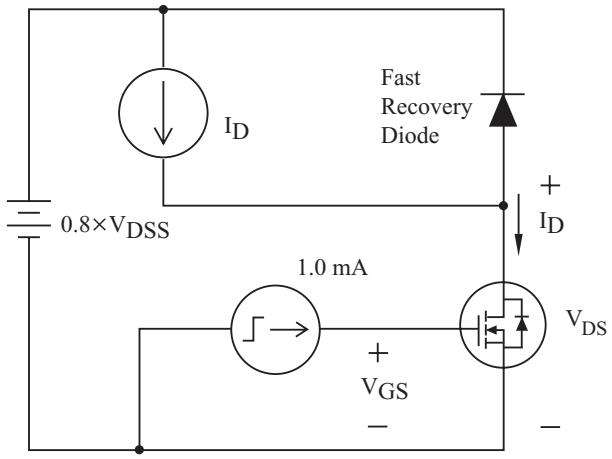


Fig14. Gate Charge



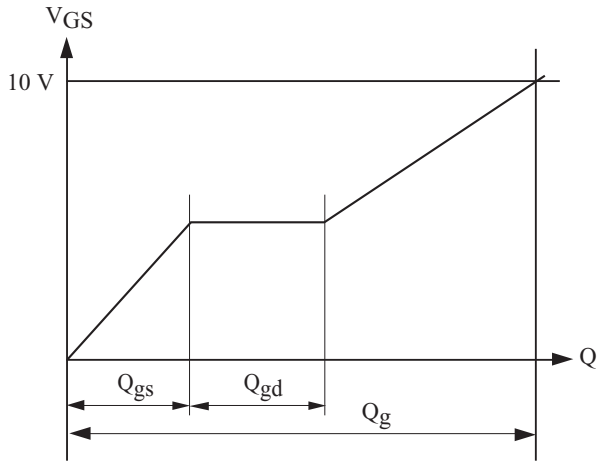
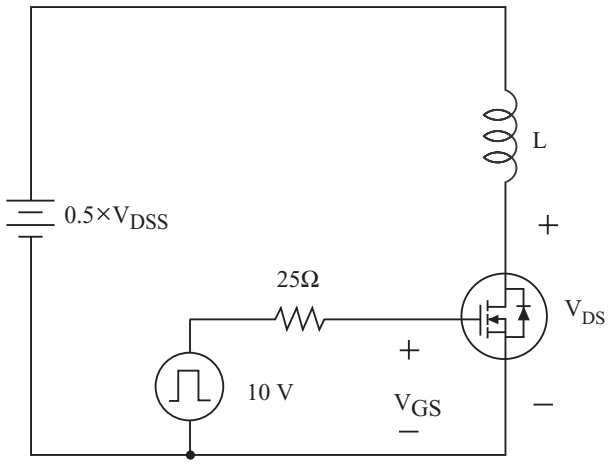


Fig15. Single Pulsed Avalanche Energy



$$E_{AS}=\frac{1}{2}\ LI_{AS}^2\ \frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$

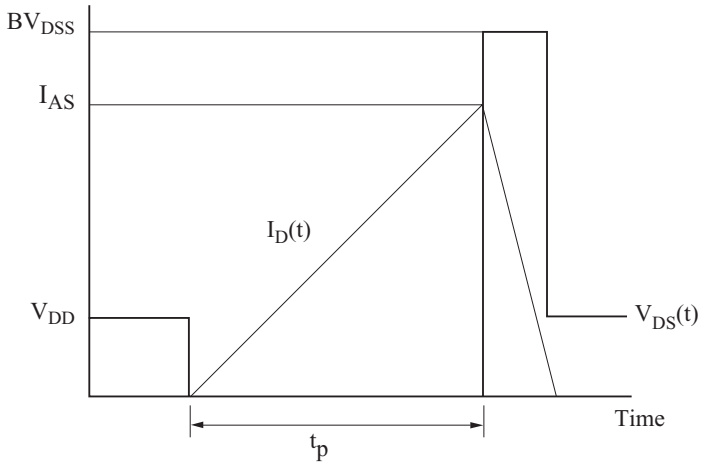
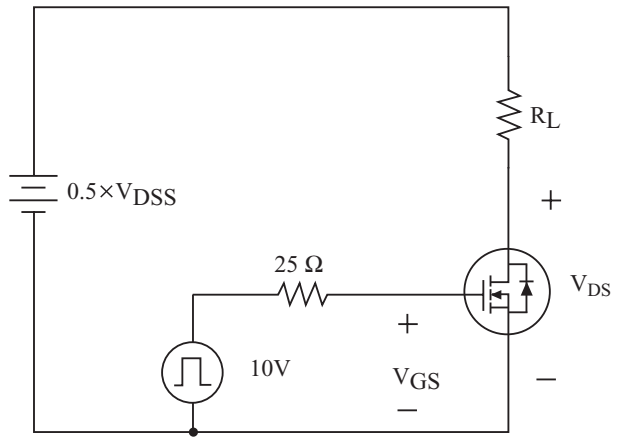


Fig16. Resistive Load Switching



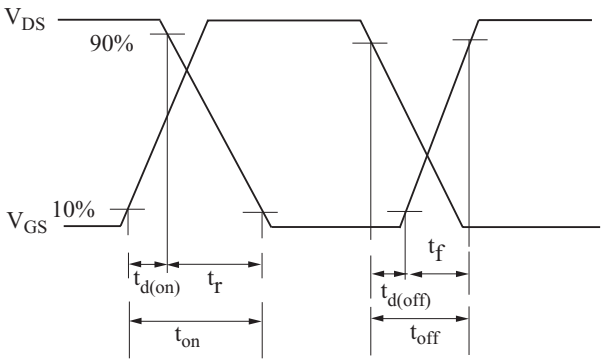


Fig17. Source - Drain Diode Reverse Recovery and dv /dt