

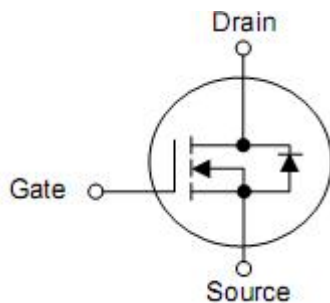
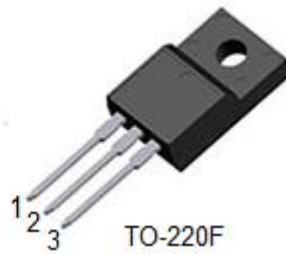
## 1. Features

- n  $R_{DS(ON)}=3.6\Omega(\text{typ.})@V_{GS}=10V$
- n Proprietary New Planar Technology
- n Low Gate Charge Minimize Switching Loss
- n Fast Recovery Body Diode

## 2. Applications

- n CRT,TV/Monitor
- n Other Applications

## 3. Symbol



Pin	Function
1	Gate
2	Drain
3	Source

## 4. Ordering Information

Part Number	Package	Brand
KND4390A	TO-252	KIA
KNF4390A	TO-220F	KIA

## 5. Absolute maximum ratings

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

Parameter	Symbol	Rating		Units
		TO-252	TO-220F	
Drain-source voltage <sup>1)</sup>	$V_{DSS}$	900		V
Gate-to-Source Voltage	$V_{GSS}$	$\pm 30$		V
Continuous drain current	$T_C=25^{\circ}\text{C}$ $I_D$	4		A
	$T_C=100^{\circ}\text{C}$ $I_D$	Figure 3		A
Pulsed Drain Current at $V_{GS}=10\text{V}$ <sup>2)</sup>	$I_{DM}$	16	Figure 6	A
Single pulse avalanche energy	$E_{AS}$	650		mJ
Peak Diode Recovery $dv/dt$ <sup>3)</sup>	$dv/dt$	5.0		V/ns
Power dissipation	$T_C=25^{\circ}\text{C}$ $P_D$	90	30	W
	Derate above $25^{\circ}\text{C}$	0.72	0.24	W/ $^{\circ}\text{C}$
Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	$T_L$ $T_{PAK}$	300 260		$^{\circ}\text{C}$
Operating junction and storage temperature range	$T_J, T_{STG}$	-55 to 150		$^{\circ}\text{C}$

Caution: Stresses greater than those listed in the “Absolute Maximum Ratings” may cause permanent damage to the device.

## 6. Thermal characteristics

Parameter	Symbol	Rating		Unit
		TO-252	TO-220F	
Thermal resistance junction-case	$R_{\theta JC}$	1.38	4.17	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	75	100	$^{\circ}\text{C}/\text{W}$

## 7. Electrical characteristics

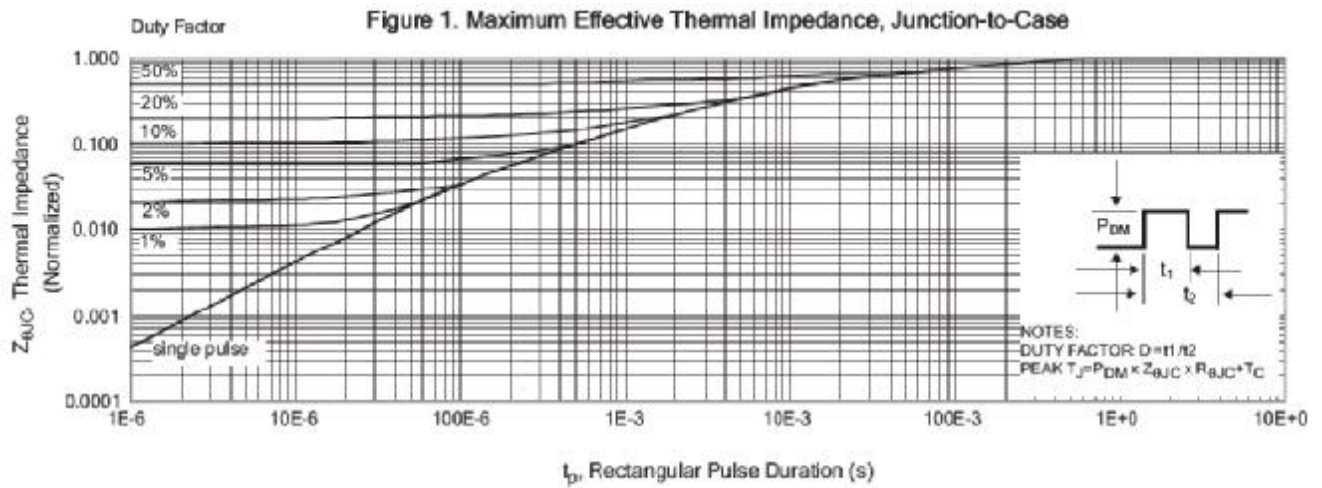
(T<sub>C</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Drain-source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	900	-	-	V
Drain-source leakage current	I <sub>DSS</sub>	V <sub>DS</sub> =900V, V <sub>GS</sub> =0V	-	-	1	uA
		V <sub>DS</sub> =720V, T <sub>C</sub> =125°C			100	uA
Gate-source forward leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	-	-	±100	nA
Drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.0A	-	3.6	4.8	Ω
Gate threshold voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2.0	-	4.0	V
Forward Transconductance <sup>4)</sup>	g <sub>fs</sub>	V <sub>DS</sub> =15V, I <sub>D</sub> =4.0A	-	5.5	-	S
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V f=1MHz	-	495	-	pF
Reverse transfer capacitance	C <sub>rss</sub>		-	26	-	pF
Output capacitance	C <sub>oss</sub>		-	52	-	pF
Total gate charge(10V)	Q <sub>g</sub>	V <sub>DD</sub> =400V, I <sub>D</sub> =4A V <sub>GS</sub> =0~10V	-	15	-	nC
Gate-source charge	Q <sub>gs</sub>		-	3.1	-	nC
Gate-drain charge	Q <sub>gd</sub>		-	6.2	-	nC
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =400V, V <sub>GS</sub> =10V, R <sub>G</sub> =12Ω, I <sub>D</sub> =4A		11		ns
Rise time	t <sub>r</sub>			11		ns
Turn-off delay time	t <sub>d(off)</sub>			32		ns
Fall time	t <sub>f</sub>			16		ns
Continuous Source Current <sup>4)</sup>	I <sub>SD</sub>	Integral PN-diode in MOSFET			4.0	A
Pulsed Source Current <sup>4)</sup>	I <sub>SM</sub>		-	-	16	A
Diode forward voltage	V <sub>SD</sub>	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V,	-	-	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>F</sub> =4.0A, dI <sub>F</sub> /dt=100A/μs	-	135	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	446	-	nC

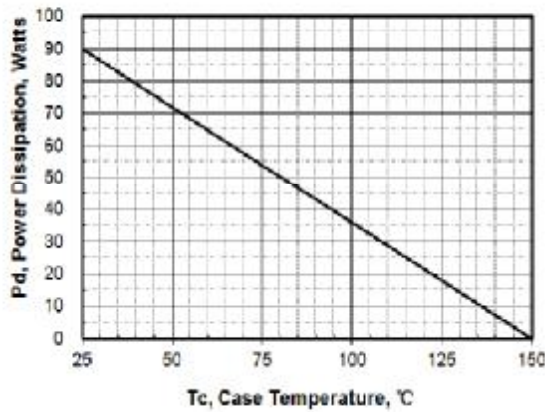
Note:

- 1) T<sub>J</sub>=+25 °C to +150 °C
- 2) Repetitive rating; pulse width limited by maximum junction temperature.
- 3) I<sub>SD</sub>=4A di/dt<100 A/us, V<sub>DD</sub><BV<sub>DSS</sub>, T<sub>J</sub>=150 °C.
- 4) Pulse width≤380us; duty cycle≤2%.

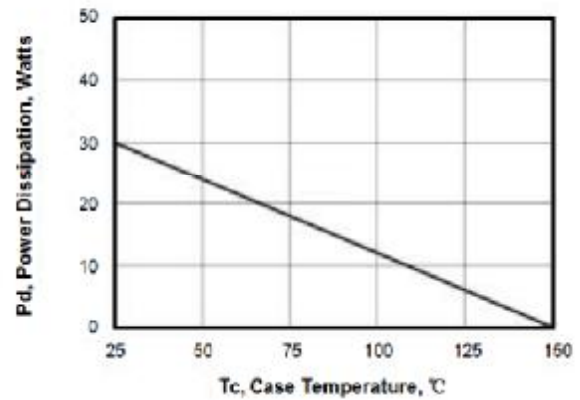
8. Typical operating characteristics



**Figure 2.1. Max. Power Dissipation vs Case Temperature (TO-252)**



**Figure 2.2. Max. Power Dissipation vs Case Temperature (TO-220F)**



**Figure 3. Maximum Continuous Drain Current vs Case Temperature**

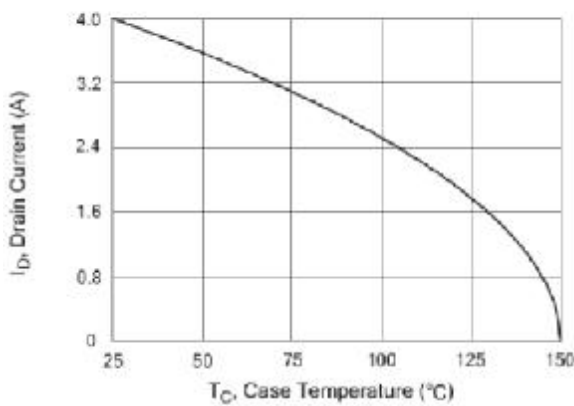


Figure 4. Typical Output Characteristics

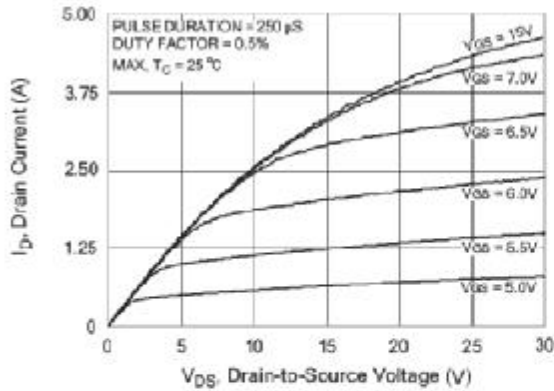


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current

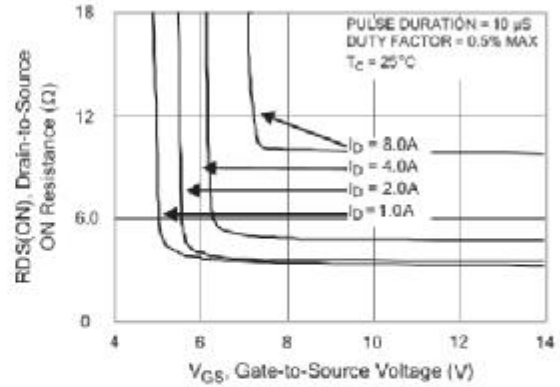


Figure 6. Maximum Peak Current Capability

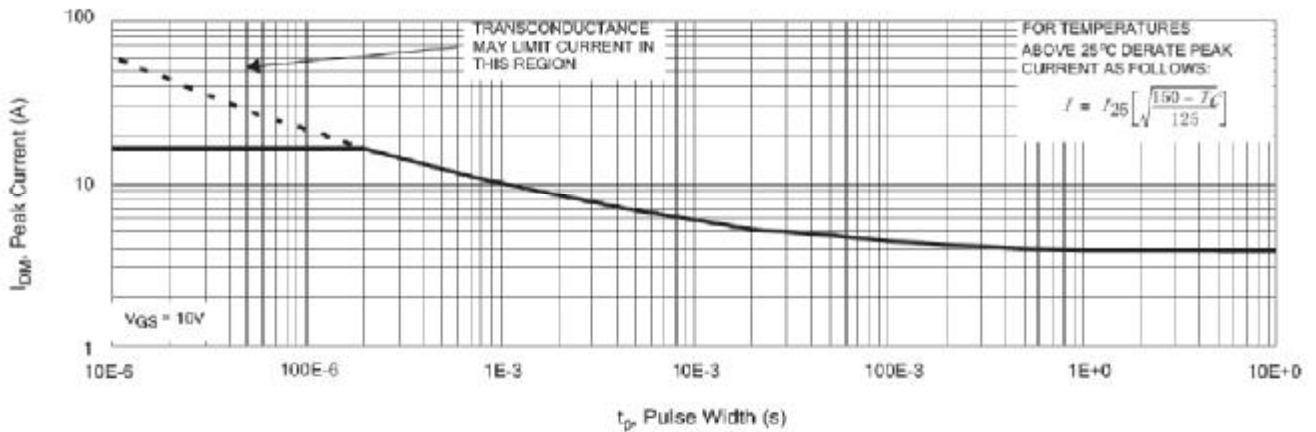


Figure 7. Typical Transfer Characteristics

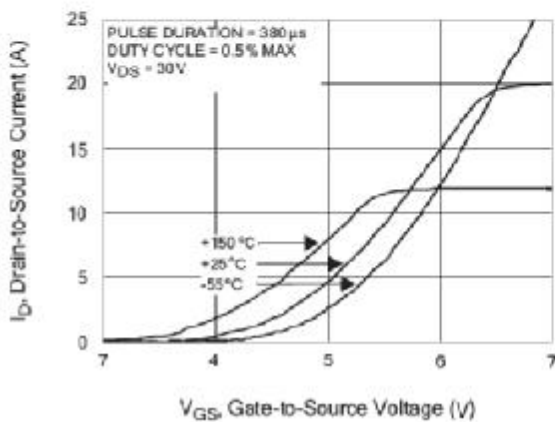
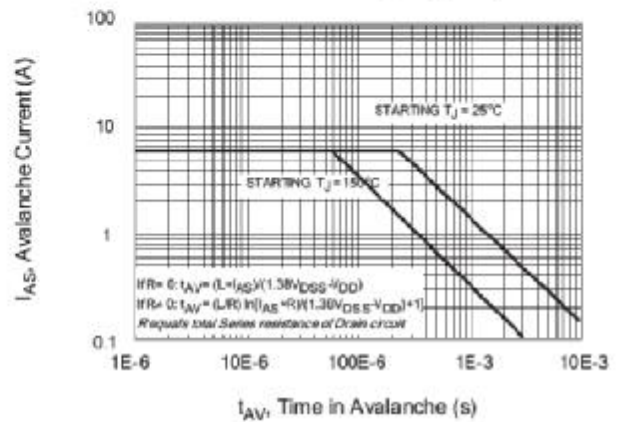
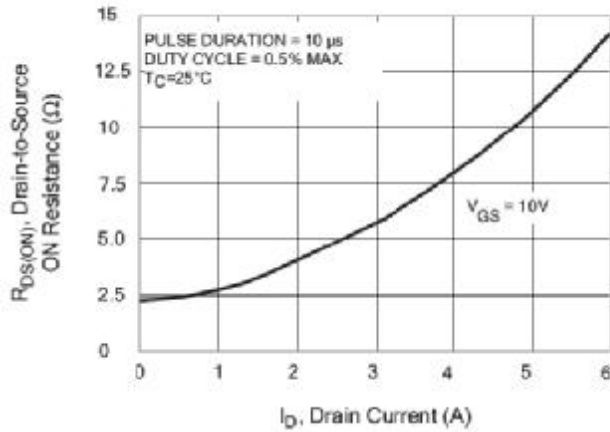


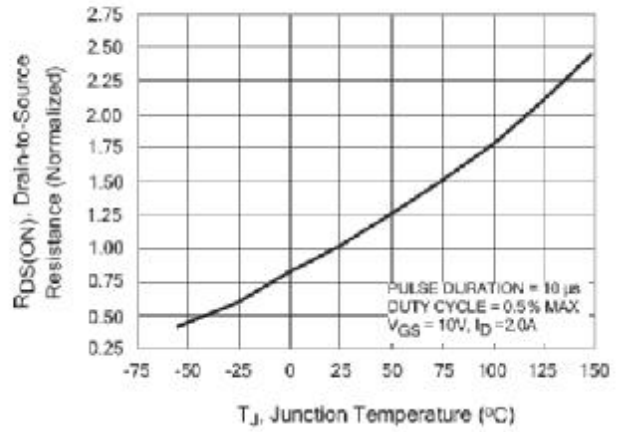
Figure 8. Unclamped Inductive Switching Capability



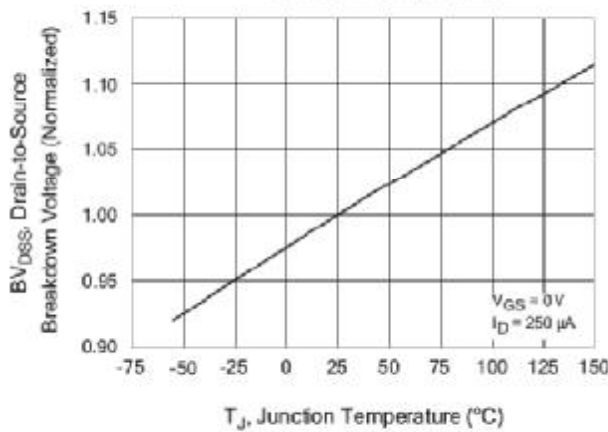
**Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current**



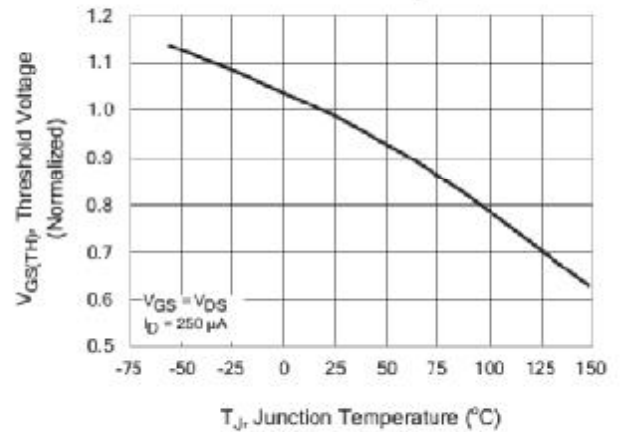
**Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature**



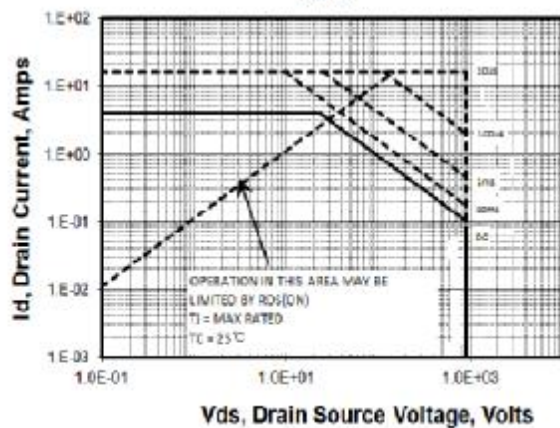
**Figure 11. Typical Breakdown Voltage vs Junction Temperature**



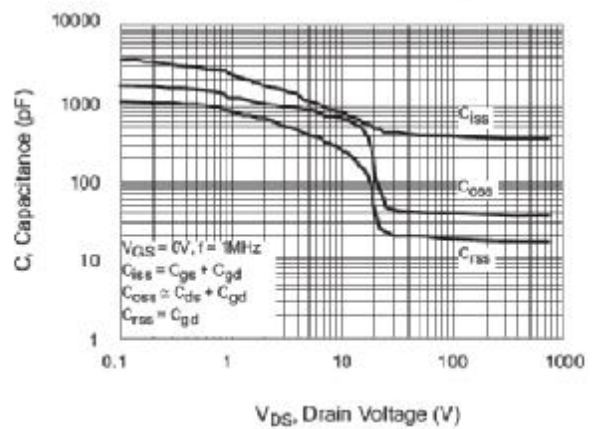
**Figure 12. Typical Threshold Voltage vs Junction Temperature**



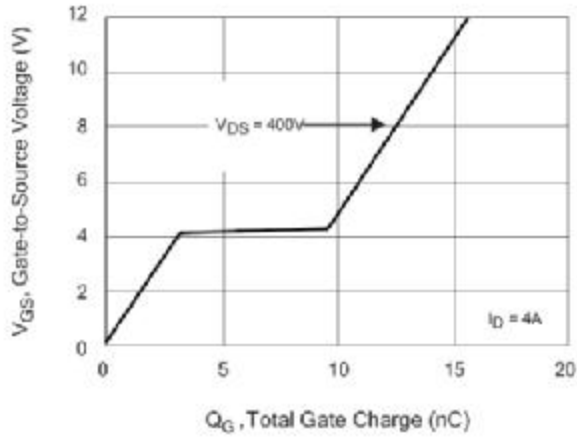
**Figure 13. Maximum Safe Operating Area**



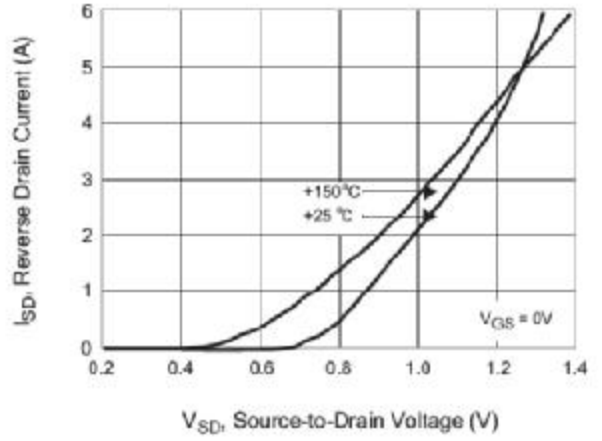
**Figure 14. Typical Capacitance vs Drain-to-Source Voltage**



**Figure 15. Typical Gate Charge vs Gate-to-Source Voltage**



**Figure 16. Typical Body Diode Transfer Characteristics**



**9. Test Circuits and Waveforms**

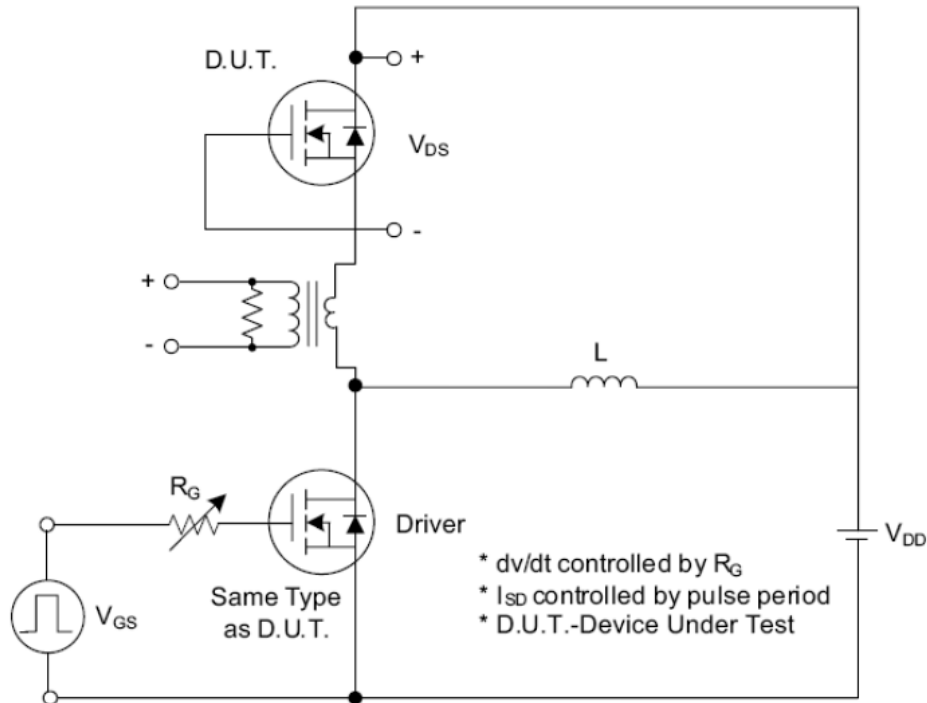


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

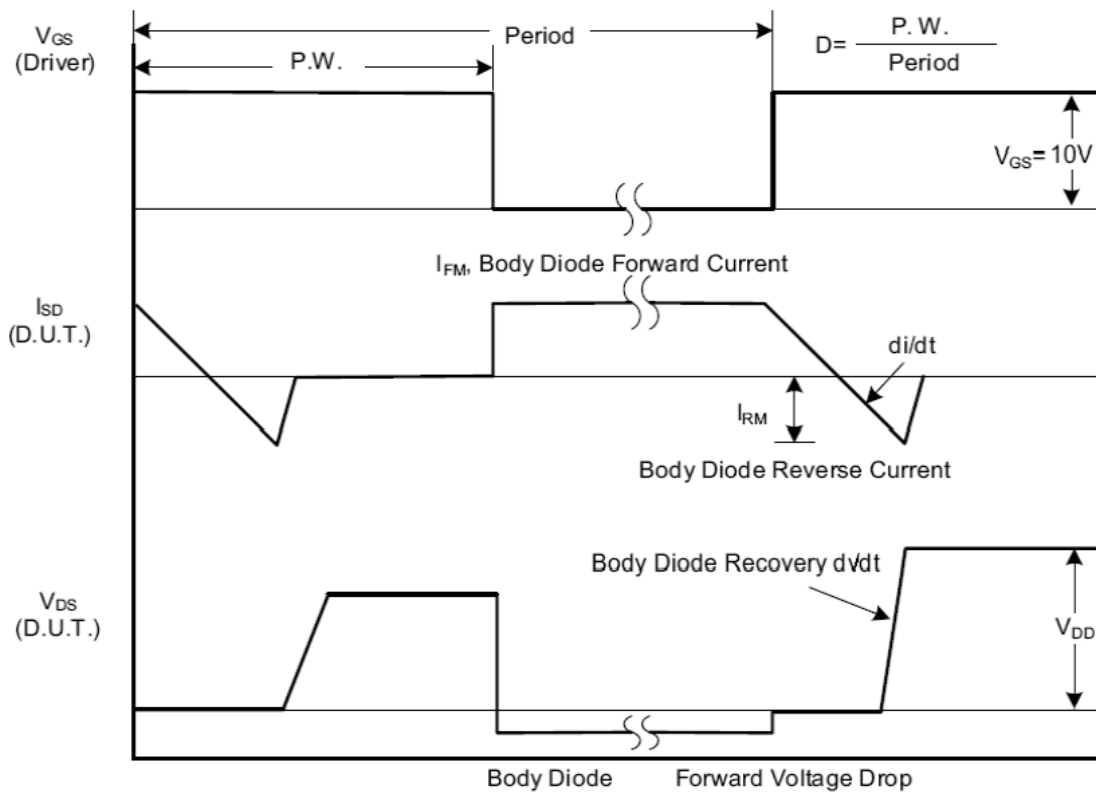


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms



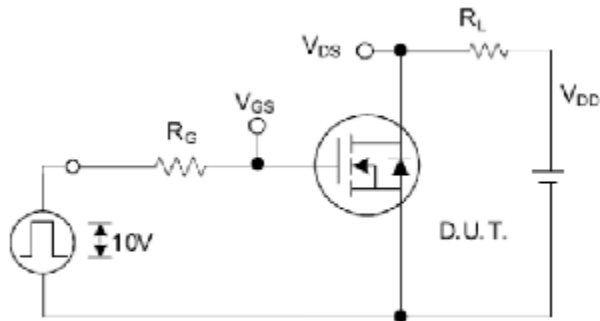


Fig. 2.1 Switching Test Circuit

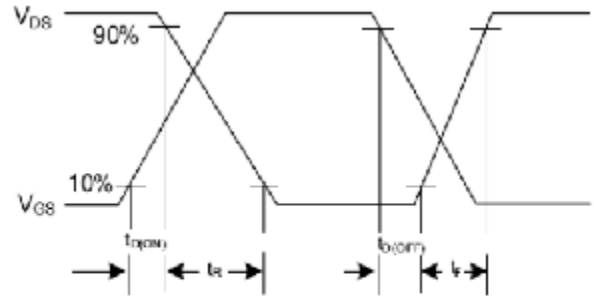


Fig. 2.2 Switching Waveforms

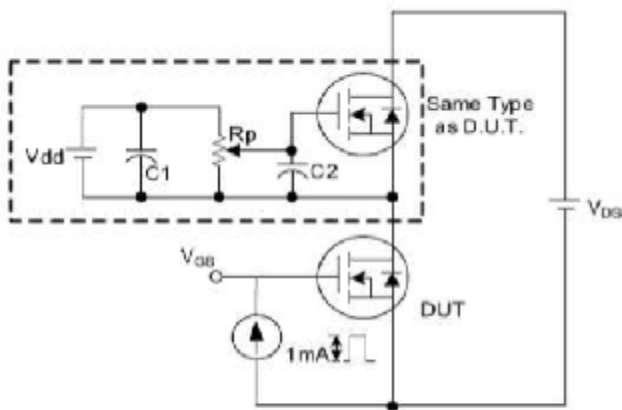


Fig. 3.1 Gate Charge Test Circuit

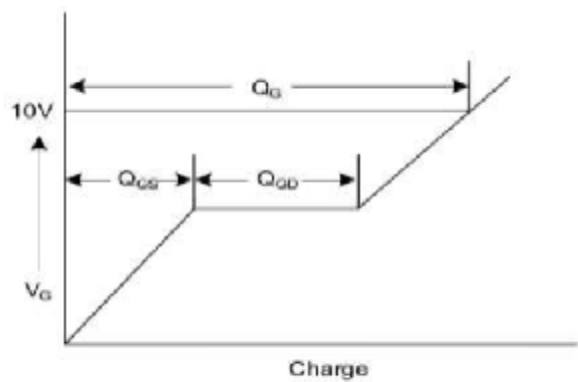


Fig. 3.2 Gate Charge Waveform

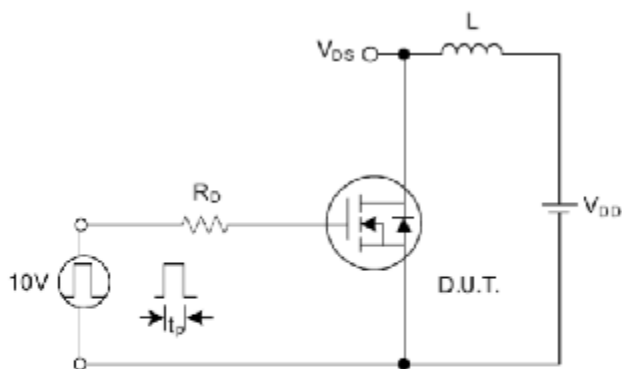


Fig. 4.1 Unclamped Inductive Switching Test Circuit

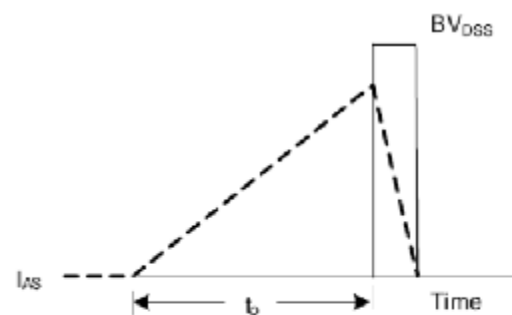


Fig. 4.2 Unclamped Inductive Switching Waveforms