

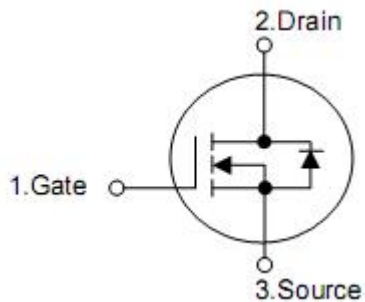
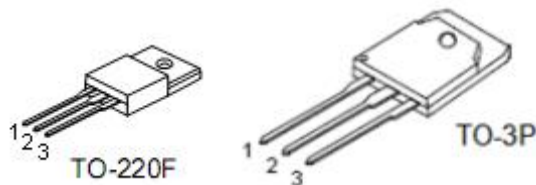
## 1. Features

- Advanced Planar Process
- $R_{DS(ON),(typ.)}=170m\Omega@V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Rugged Poly silicon Gate Structure

## 2. Features

- BLDC Motor Driver
- Electric Welder
- High Efficiency SMPS

## 3. Pin configuration



Pin	Function
1	Gate
2	Drain
3	Source

## 4. Ordering Information

Part Number	Package	Brand
KNF7650A	TO-220F	KIA
KNH7650A	TO-3P	KIA

## 5. Absolute maximum ratings

TC=25 °C unless otherwise specified

Parameter	Symbol	Ratings		Unit
		To-220F	TO-3P	
Drain-to-Source Voltage	$V_{DSS}$	500		V
Gate-to-Source Voltage	$V_{GSS}$	±30		
Continuous Drain Current	$I_D$	25		A
Continuous Drain Current @ $T_c=100\text{ °C}$		16		
Pulsed Drain Current at $V_{GS}=10V$ [2,4]	$I_{DM}$	100		
Single Pulse Avalanche Energy	$E_{AS}$	1800		mJ
Peak Diode Recovery $dv/dt$ [3]	$dv/dt$	5.0		
Power Dissipation	$P_D$	105	290	W
Derating Factor above 25 °C		0.84	2.33	W/ °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		°C
Operating and Storage Temperature Range	$T_J$ & $T_{STG}$	-55 to 150		

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

## 6. Thermal characteristics

Parameter	Symbol	Ratings		Units
		To-220F	TO-3P	
Thermal resistance, junction-ambient	$R_{\theta JA}$	100	55	°C/W
Thermal resistance, Junction-case	$R_{\theta JC}$	1.19	0.43	

## 7. Electrical characteristics

(T<sub>J</sub>=25°C, unless otherwise notes)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>Off characteristics</b>						
Drain-source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	500	-	-	V
Drain-to-source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V	-	-	1	μA
		V <sub>DS</sub> =400V, V <sub>GS</sub> =0V T <sub>C</sub> =125°C,	-	-	125	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> =30V, V <sub>DS</sub> =0V	-	-	+100	nA
		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	-	-	-100	nA
<b>On characteristics</b>						
Static drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =14A	-	170	210	mΩ
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	-	4.0	V
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =14A	-	30	-	S
<b>Dynamic characteristics</b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz	-	4280	-	pF
Output capacitance	C <sub>OSS</sub>		-	1400	-	pF
Reverse transfer capacitance	C <sub>RSS</sub>		-	185	-	pF
<b>Total gate charge</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =250V, I <sub>D</sub> =14A, V <sub>GS</sub> =10V, R <sub>G</sub> =10Ω	-	24	-	ns
Rise time	t <sub>r</sub>		-	40	-	ns
Turn-off delay time	t <sub>d(off)</sub>		-	100	-	ns
Fall time	t <sub>f</sub>		-	35	-	ns
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =250V, I <sub>D</sub> =28A, V <sub>GS</sub> =0 to 10V	-	76	-	nC
Gate-source charge	Q <sub>gs</sub>		-	20	-	nC
Gate-drain charge	Q <sub>gd</sub>		-	19	-	nC
<b>Drain-source diode characteristics</b>						
Drain-source diode forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =18A	-	-	1.5	V
Continuous drain-source current <sup>[2]</sup>	I <sub>SD</sub>	Integral pn-diode In MOSFET	-	-	25	A
Pulsed drain-source current <sup>[2]</sup>	I <sub>SM</sub>		-	-	100	A
Reverse recovery time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>F</sub> =28A	-	530	-	ns
Reverse recovery charge	Q <sub>rr</sub>	DI <sub>F</sub> /dt=100A/μs	-	4.5	-	μC

Note: 1. T<sub>J</sub>=+25°C to +150°C

2. Silicon limited current only.

3. Package limited current

4. Repetitive rating; pulse width by maximum junction temperature

5. Pulse width ≤ 380μs; duty cycle ≤ 2%

8. Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

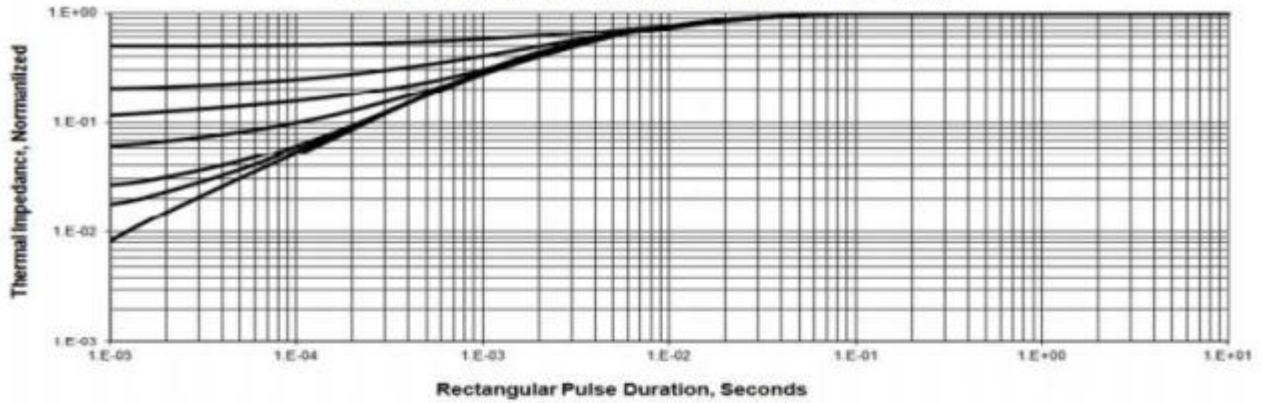


Figure 2. Max. Power Dissipation vs Case Temperature

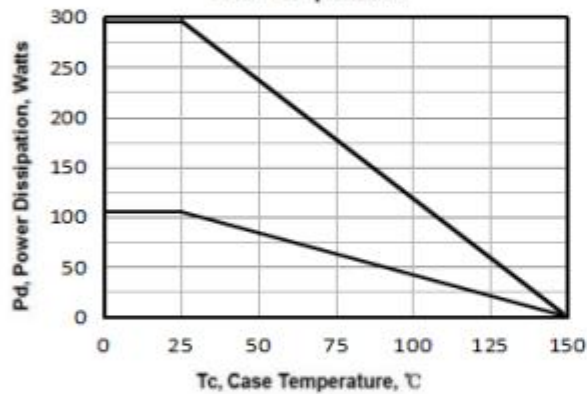


Figure 3. Maximum Continuous Drain Current vs Tc

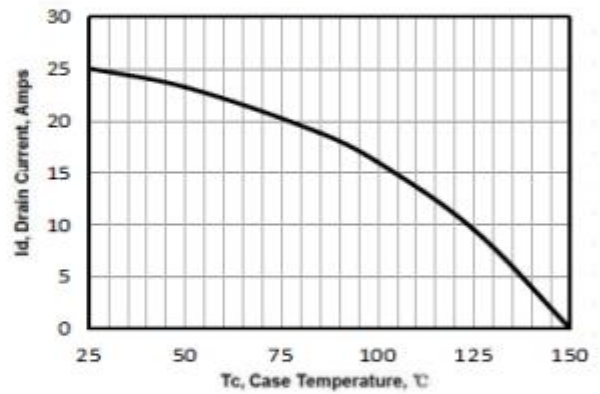


Figure 4. Output Characteristics

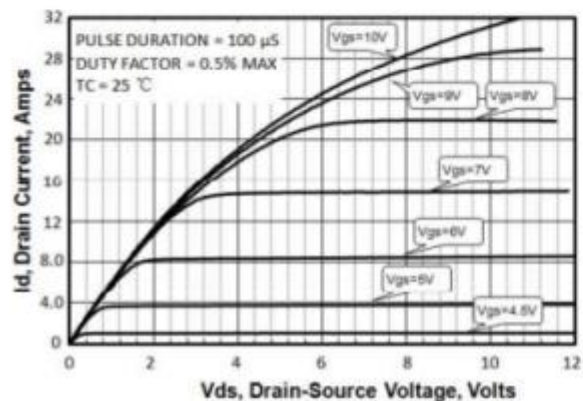
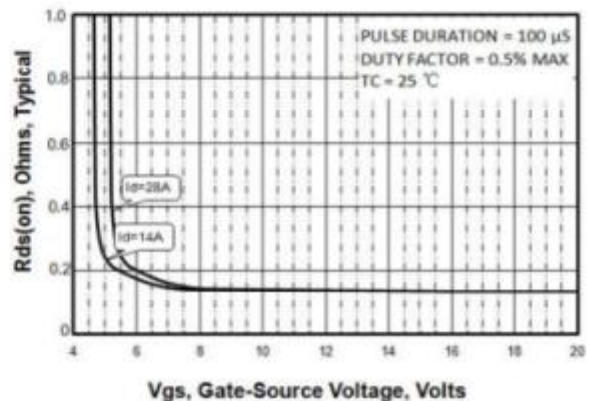
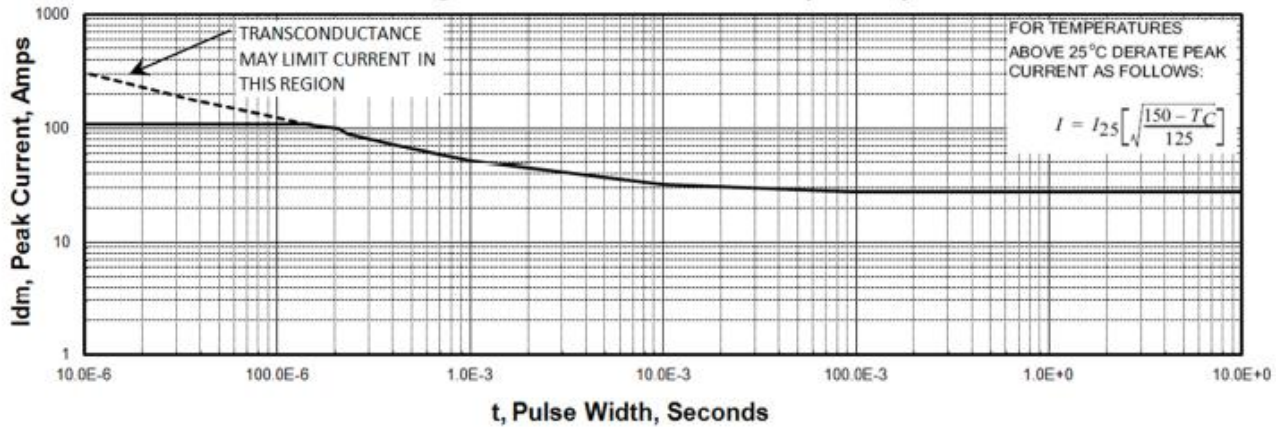


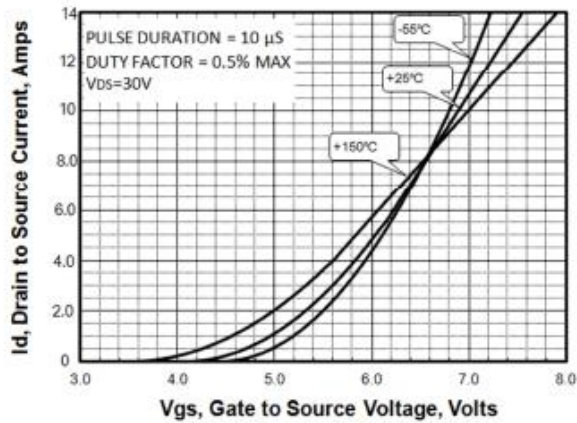
Figure 5. Rds(on) vs Gate Voltage



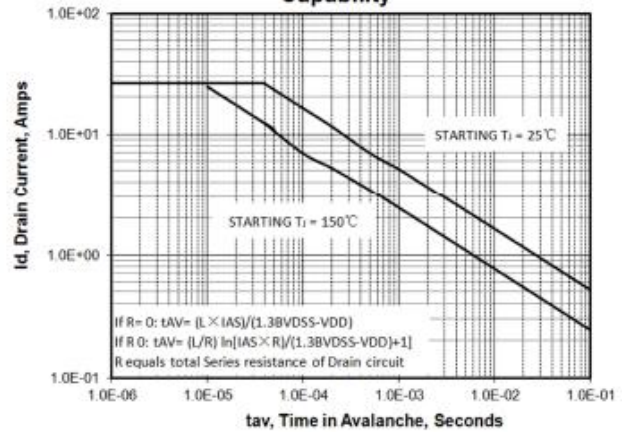
**Figure 6. Peak Current Capability**



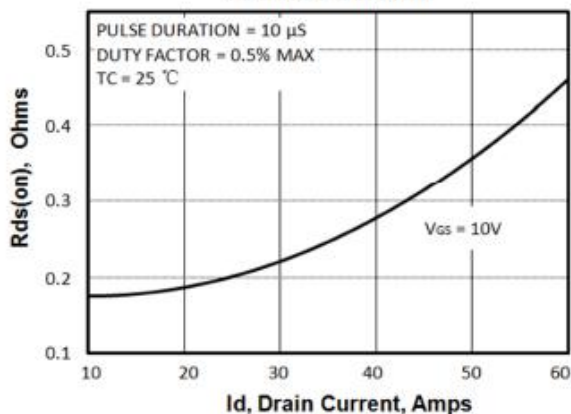
**Figure 7. Transfer Characteristics**



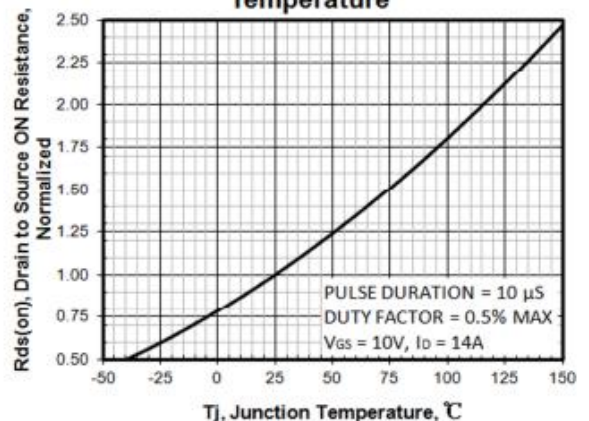
**Figure 8. Unclamped Inductive Switching Capability**



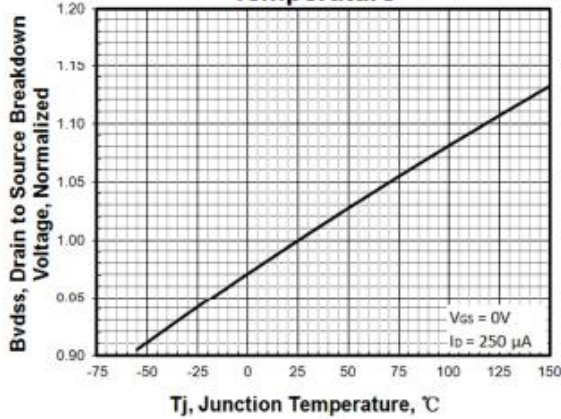
**Figure 9. Drain to Source ON Resistance vs Drain Current**



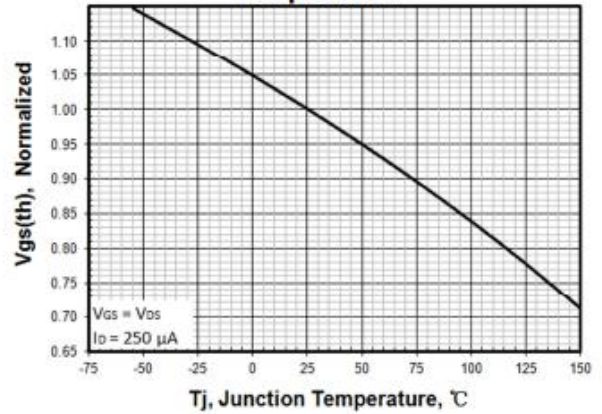
**Figure 10. Rds(on) vs Junction Temperature**



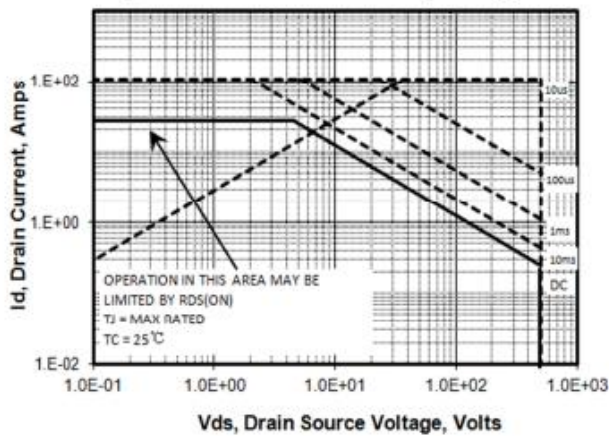
**Figure 11. Breakdown Voltage vs Temperature**



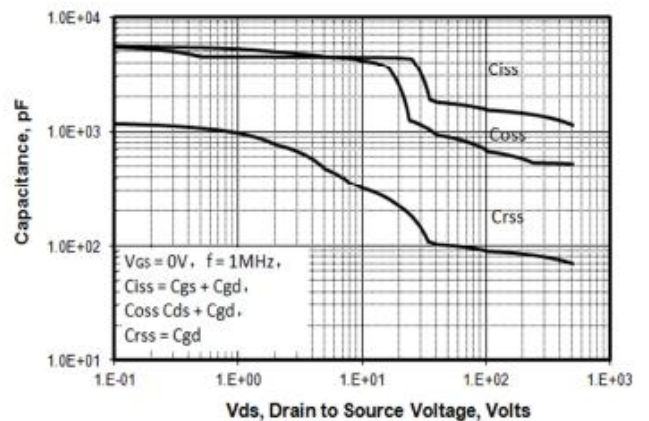
**Figure 12. Threshold Voltage vs Temperature**



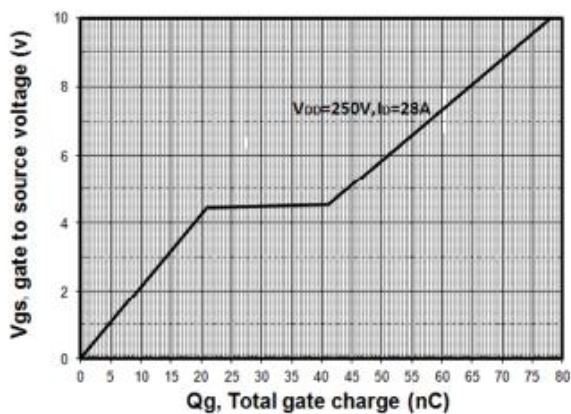
**Figure 13. Maximum Safe Operating Area**



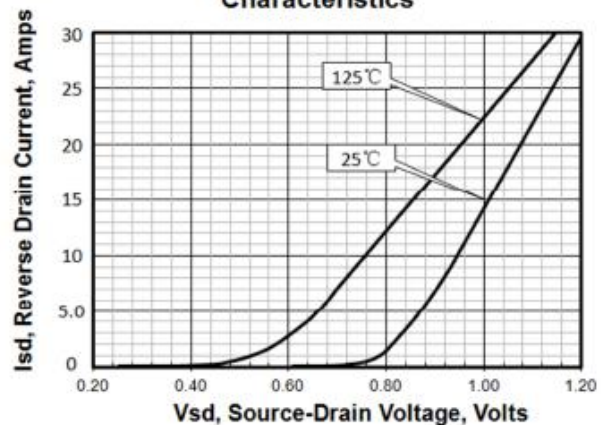
**Figure 14. Capacitance vs Vds**



**Figure 15. Typical Gate Charge**



**Figure 16. Body Diode Transfer Characteristics**



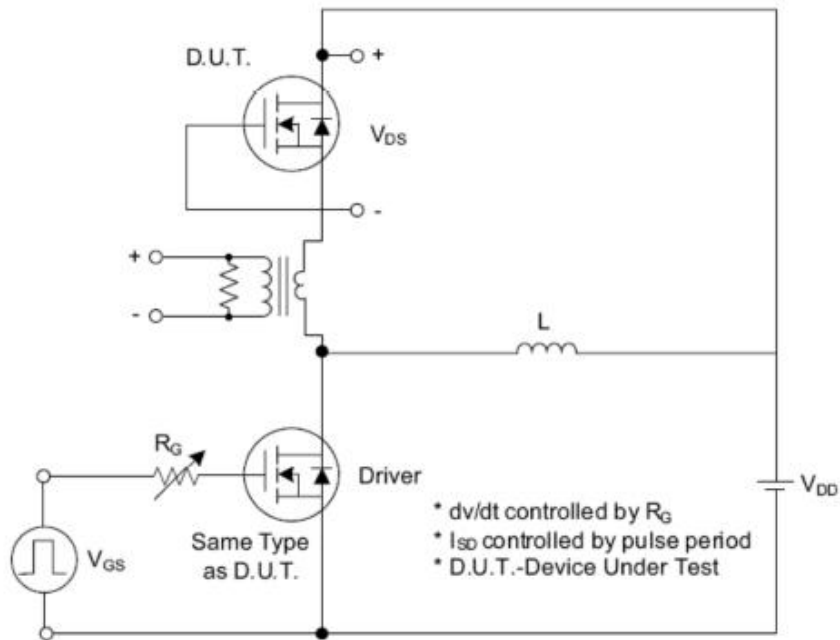


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

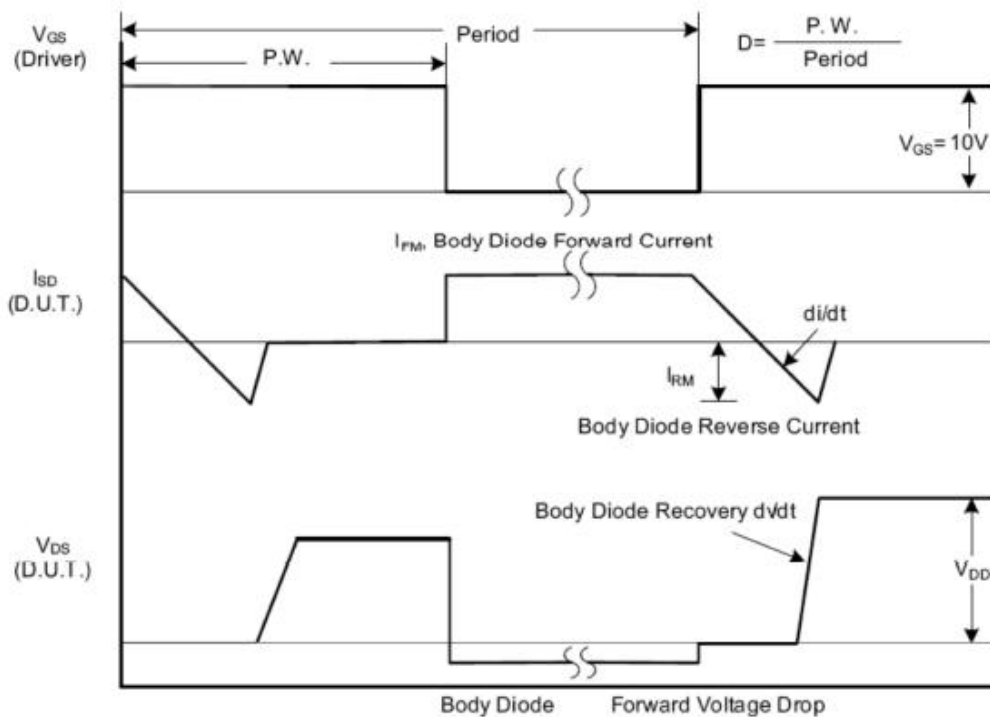


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms

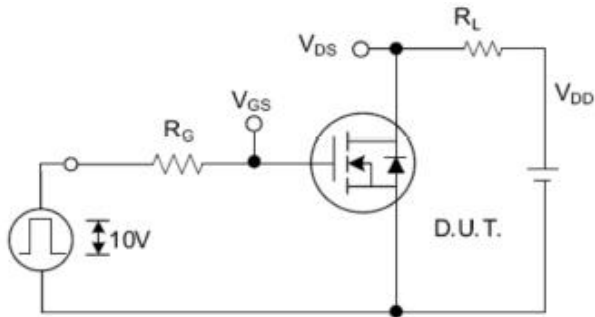


Fig. 2.1 Switching Test Circuit

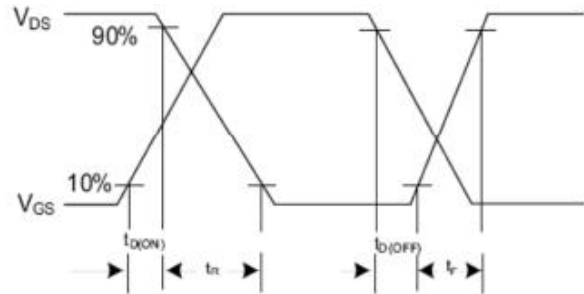


Fig. 2.2 Switching Waveforms

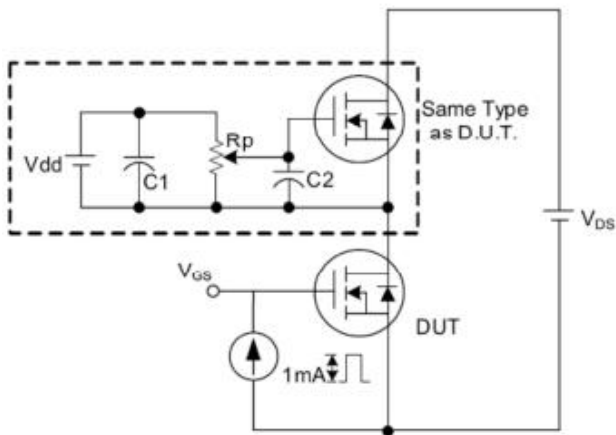


Fig. 3.1 Gate Charge Test Circuit

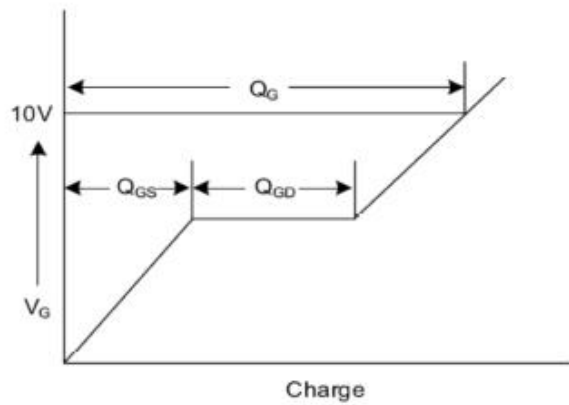


Fig. 3.2 Gate Charge Waveform

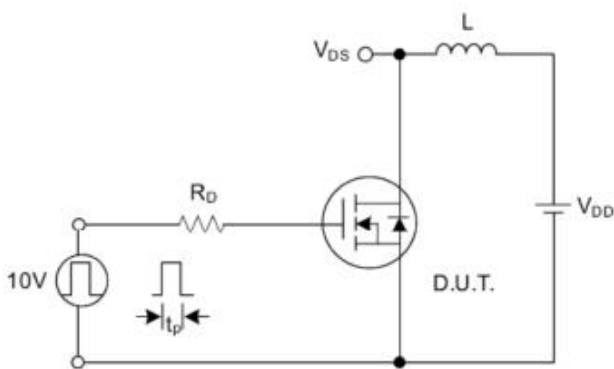


Fig. 4.1 Unclamped Inductive Switching Test Circuit

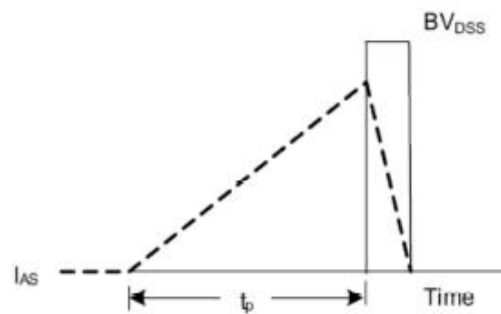


Fig. 4.2 Unclamped Inductive Switching Waveforms