

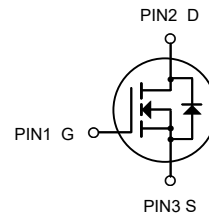


## Description

The SWF13N50 can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220/TO-220F, which accords with the RoHS standard.



**TO-220F**



N-Channel MOSFET

## General Features

$V_{DS} = 500V, I_D = 13A$   
 $R_{DS(ON)} < 0.48\Omega @ V_{GS}=10V$

## Application

- Power switch circuit of adaptor and charger.

## Package Marking and Ordering Information

Product ID	Pack	Marking	Units Tube
SWF13N50	TO-220F	13N50 XXX YYYY	50

## Absolute Maximum Ratings@T =25°C(unless otherwise specified)

Symbol	Parameter	Limit	Unit
$V_{DSS}$	Drain-to-Source Voltage <sup>[1]</sup>	500	V
$V_{GSS}$	Gate-to-Source Voltage	±30	
$I_D @ T_c=100^\circ C$	Continuous Drain Current @ Tc=100°C	13	A
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10V$ <sup>[2]</sup>	52	
$E_{AS}$	Single Pulse Avalanche Energy	900	mJ
$P_D$	Power Dissipation	48	W
$T_L$ $T_{PAK}$	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260	°C
$T_J \& T_{STG}$	Operating and Storage Temperature Range	-55 to 150	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.6	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100	

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



**Electrical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	500	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	uA	$V_{DS}=500V, V_{GS}=0V$
		--	--	100		$V_{DS}=400V, V_{GS}=0V, T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Current	--	--	+100	nA	$V_{GS}=30V, V_{DS}=0V$
		--	--	-100		$V_{GS}=-30V, V_{DS}=0V$
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	0.40	0.48	$\Omega$	$V_{GS}=10V, I_D=6.5A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance	--	15	--	S	$V_{DS}=30V, I_D=13A$
$C_{iss}$	Input Capacitance	--	2150	--	pF	$V_{GS}=0V, V_{DS}=25V, f=1.0\text{MHz}$
$C_{rss}$	Reverse Transfer Capacitance	--	23	--		
$C_{oss}$	Output Capacitance	--	210	--		
$Q_g$	Total Gate Charge	--	45	--	nC	$V_{DD}=250V, I_D=13A, V_{GS}=0 \text{ to } 10V$
$Q_{gs}$	Gate-to-Source Charge	--	10	--		
$Q_{gd}$	Gate-to-Drain (Miller) Charge	--	18	--		
$t_{d(ON)}$	Turn-on Delay Time	--	15	--	ns	$V_{DD}=250V, I_D=13A, V_{GS}=10V, R_g=6.1\Omega$
$t_{rise}$	Rise Time	--	25	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	45	--		
$t_{fall}$	Fall Time	--	35	--		
$I_{SD}$	Continuous Source Current <sup>[2]</sup>	--	--	13	A	Integral pn-diode in MOSFET
$I_{SM}$	Pulsed Source Current <sup>[2]</sup>	--	--	52		
$V_{SD}$	Diode Forward Voltage	--	--	1.5	V	$I_S=13A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	500	--	ns	$V_{GS}=0V, I_F=13A, di/dt=100A/\mu s$
$Q_{rr}$	Reverse Recovery Charge	--	4.0	--	uC	

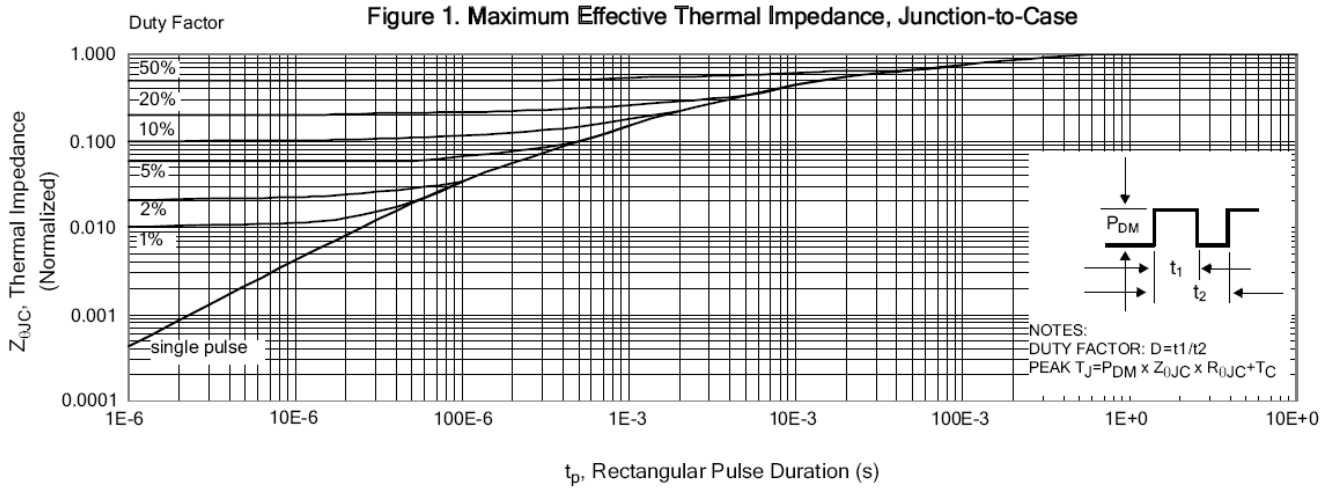
**Note:**

[1]  $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$

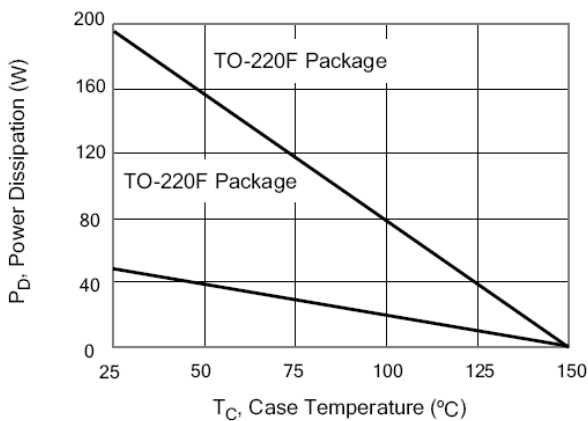
[2] Pulse width  $\leq 380\mu s$ ; duty cycles  $\leq 2\%$ .



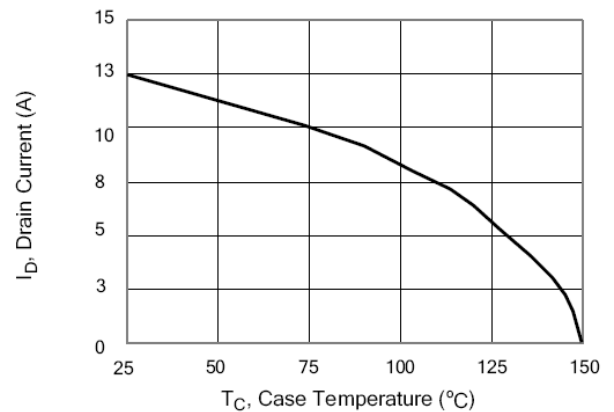
## Typical Characteristics



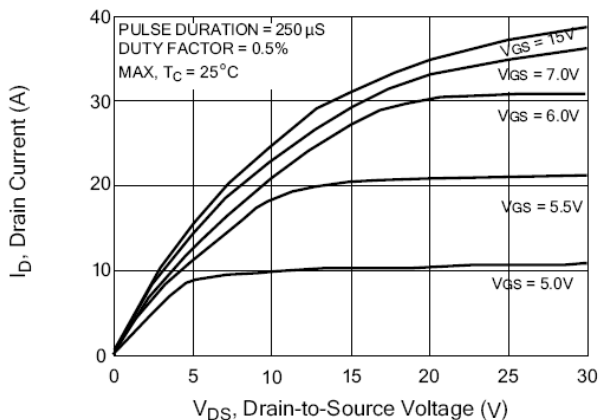
**Figure 2. Maximum Power Dissipation vs Case Temperature**



**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**

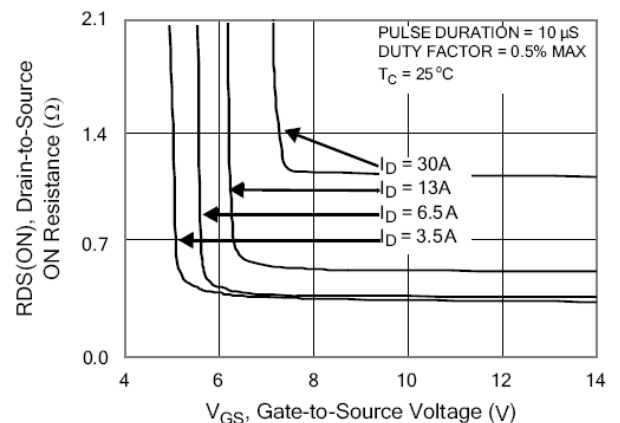




Figure 6. Maximum Peak Current Capability

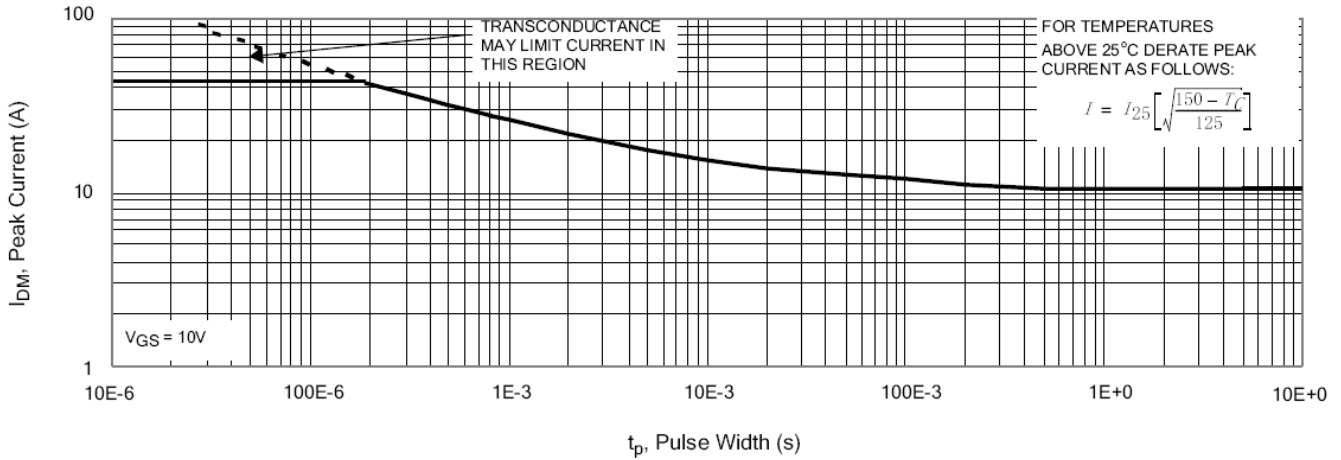


Figure 7. Typical Transfer Characteristics

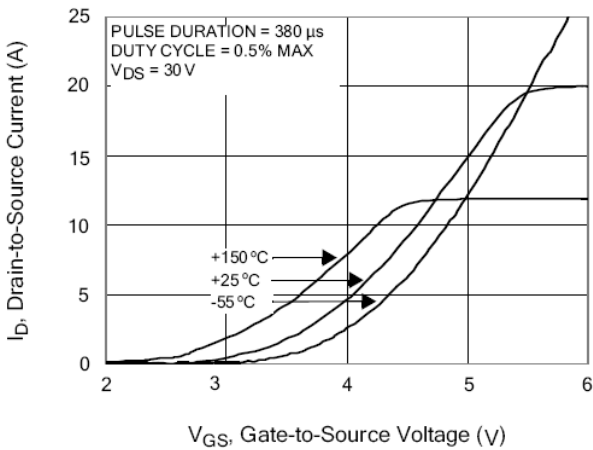


Figure 8. Unclamped Inductive Switching Capability

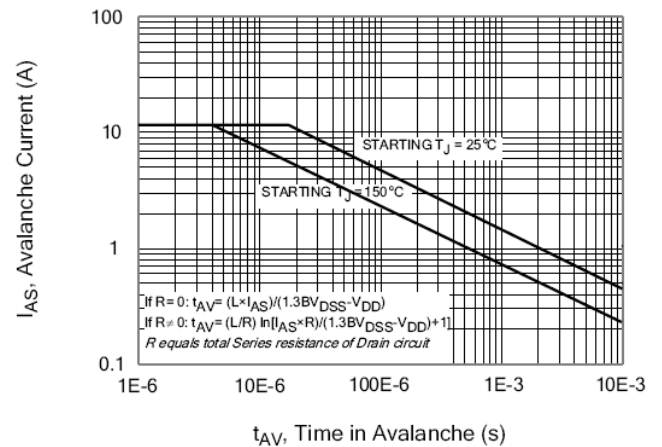


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

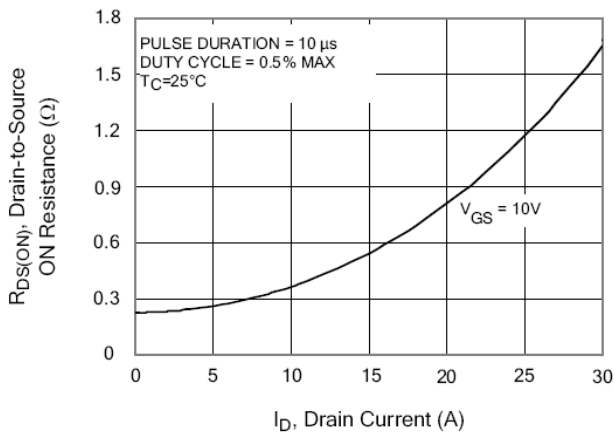
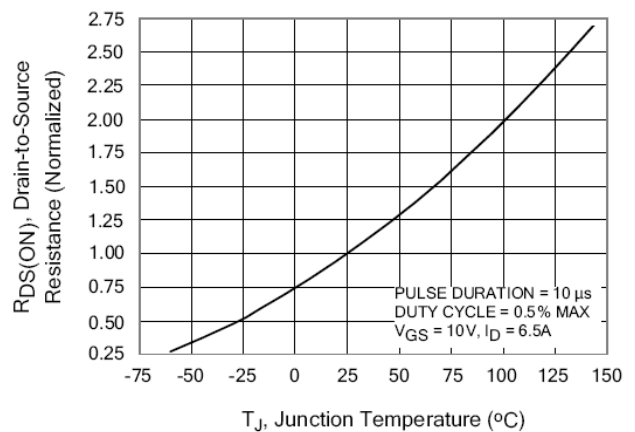


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature





### Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

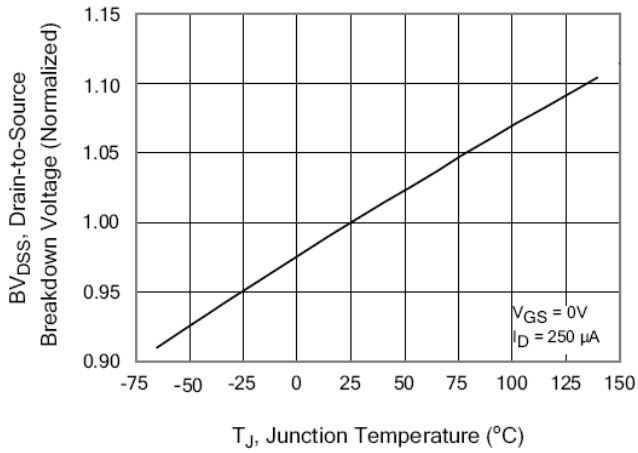


Figure 12. Typical Threshold Voltage vs Junction Temperature

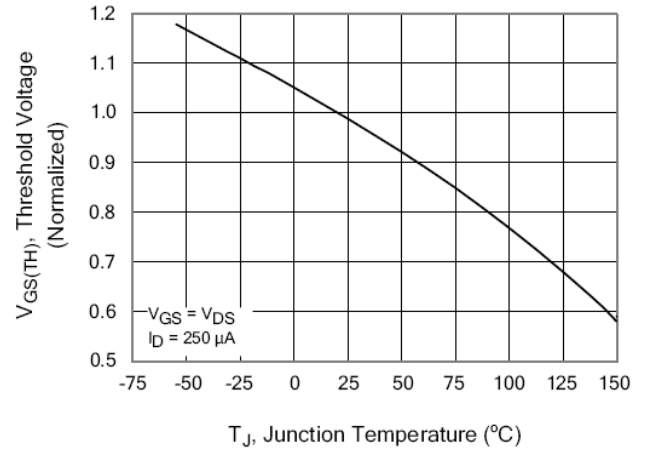


Figure 13. Maximum Forward Bias Safe Operating Area

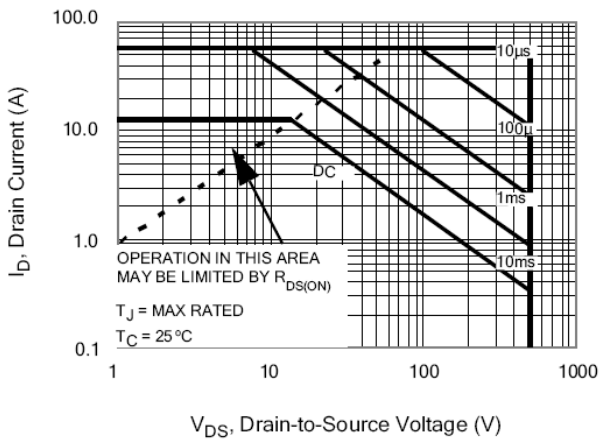


Figure 14. Typical Capacitance vs Drain-to-Source Voltage

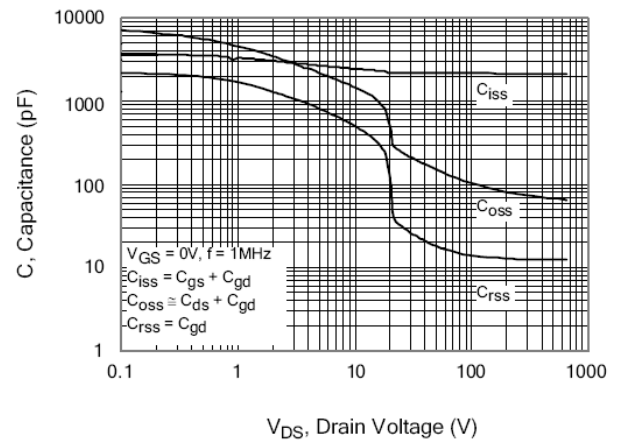


Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

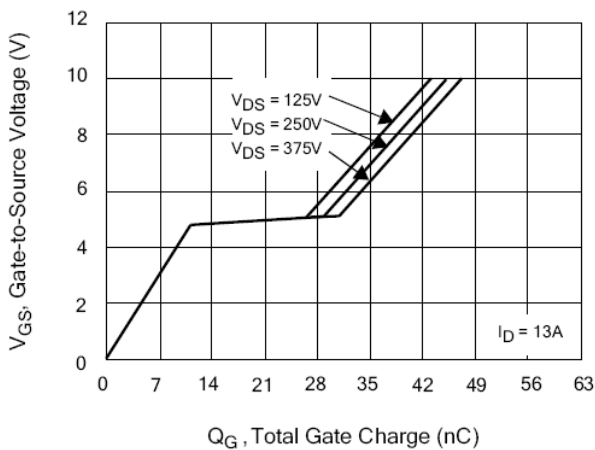
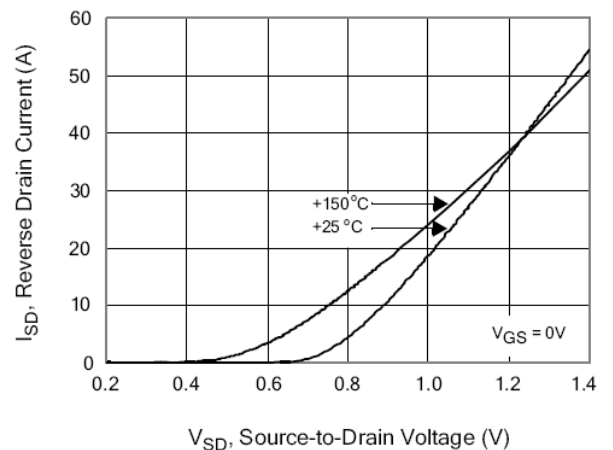


Figure 16. Typical Body Diode Transfer Characteristics





### Test Circuits and Waveforms

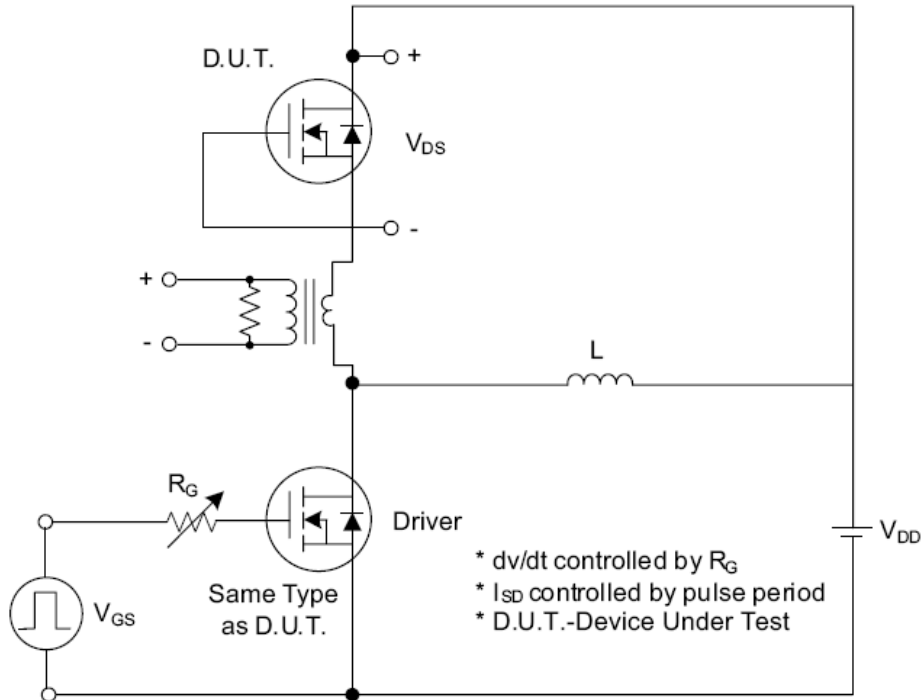


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

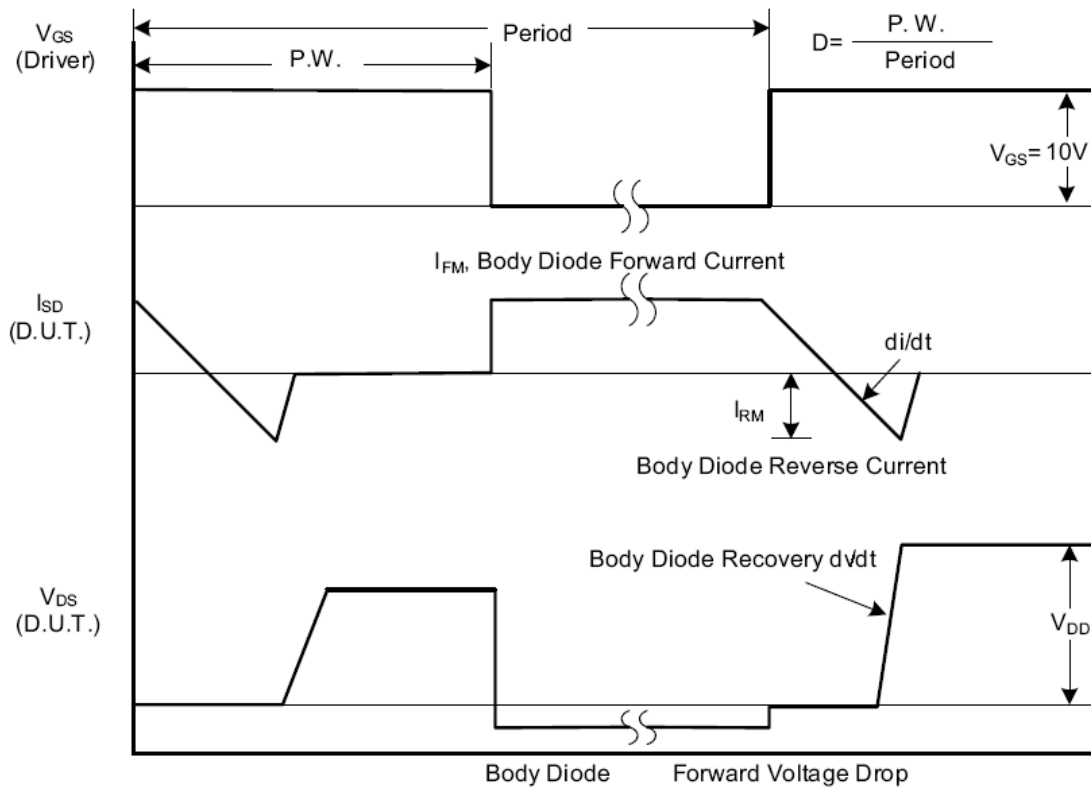


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms



### Test Circuits and Waveforms (Cont.)

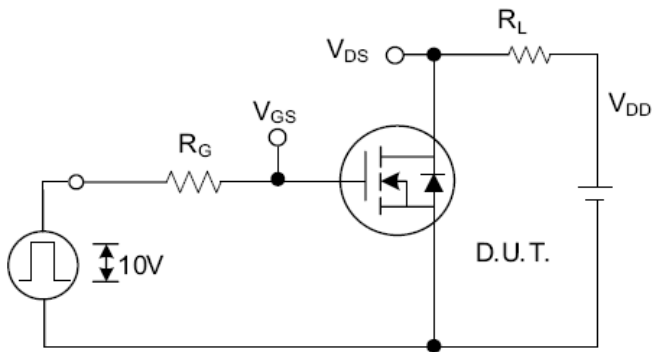


Fig. 2.1 Switching Test Circuit

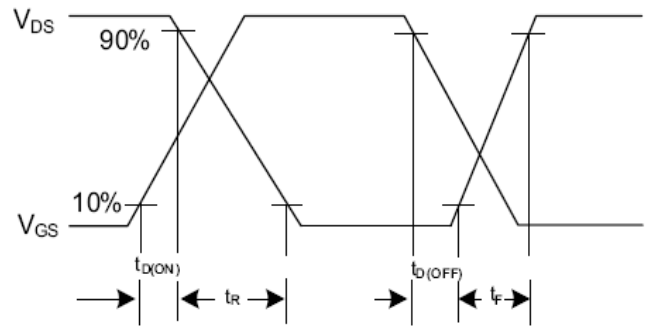


Fig. 2.2 Switching Waveforms

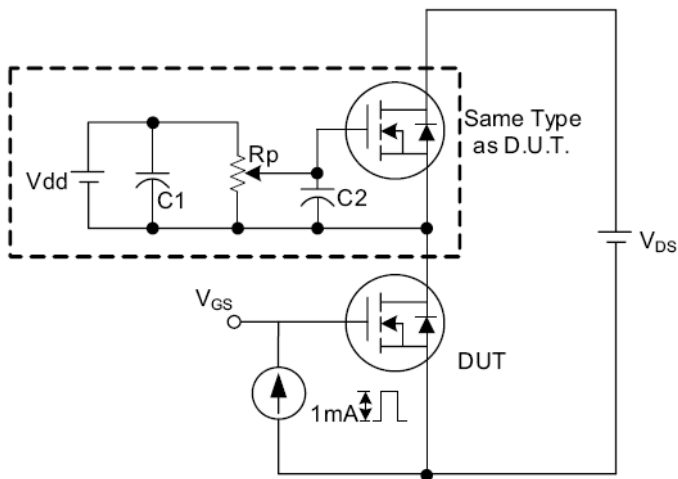


Fig. 3.1 Gate Charge Test Circuit

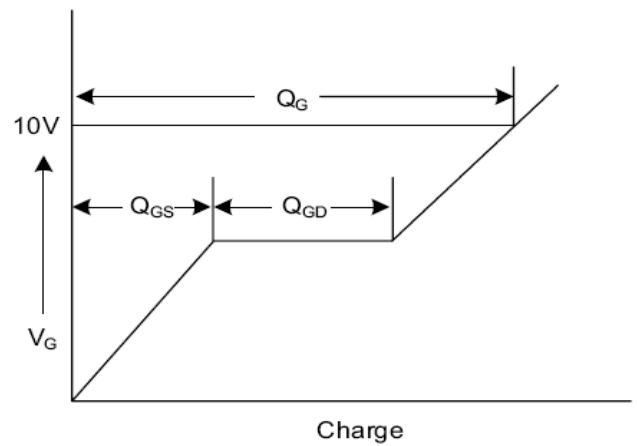


Fig. 3.2 Gate Charge Waveform

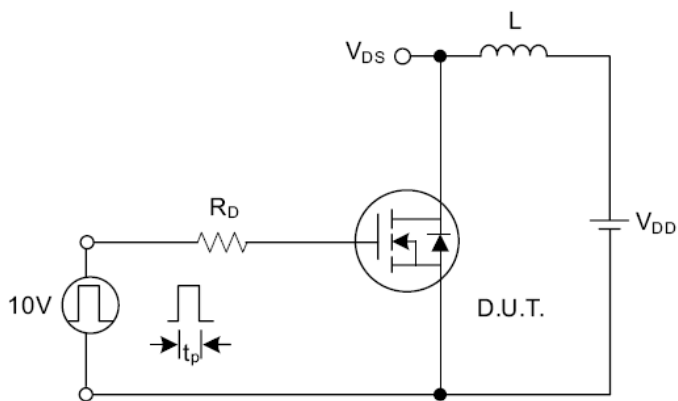


Fig. 4.1 Unclamped Inductive Switching Test Circuit

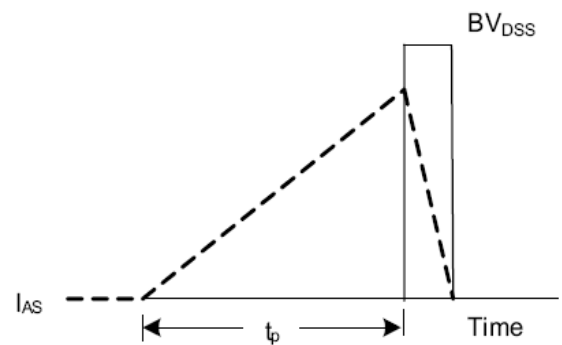
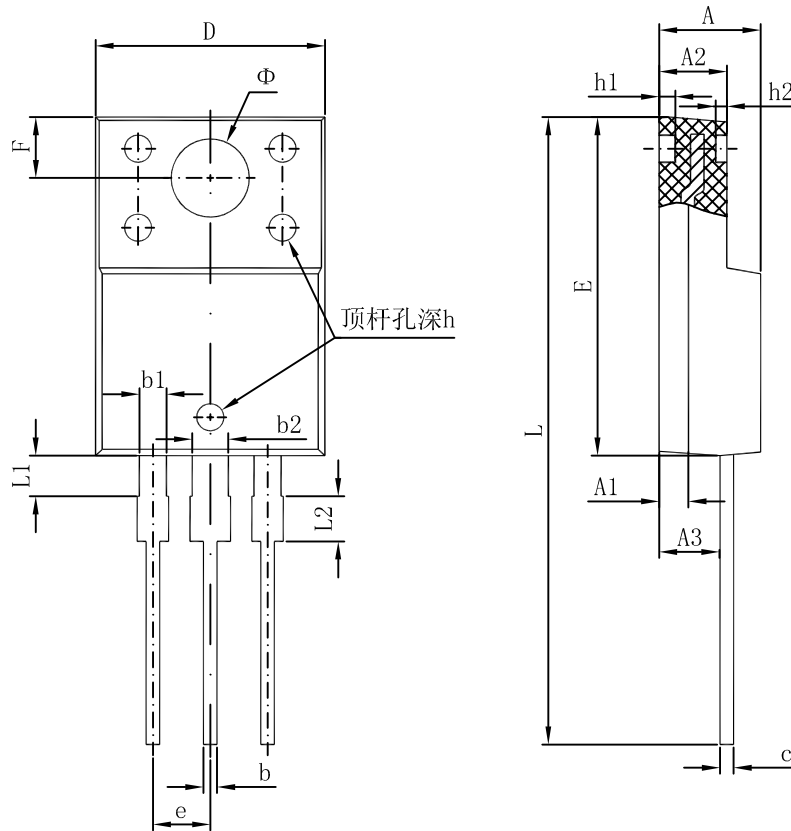


Fig. 4.2 Unclamped Inductive Switching Waveforms



Package Dimension TO-220F



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300 REF.		0.051 REF.	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540 TYP.		0.100 TYP.	
F	2.700 REF.		0.106 REF.	
Φ	3.500 REF.		0.138 REF.	
h	0.000	0.300	0.000	0.012
h1	0.800 REF.		0.031 REF.	
h2	0.500 REF.		0.020 REF.	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	1.900	2.100	0.075	0.083





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