

**N Channel MOSFET**

Lead Free Package and Finish

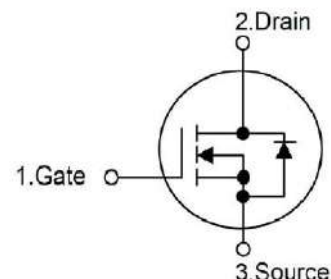
**Applications:**

- Adapter & Charger
- SMPS Standby Power
- AC-DC Switching Power Supply
- LED driving power

**Features:**

- Low On Resistance
- Low Gate Charge
- Peak Current vs Pulse Width Curve
- RoHS Compliant

$I_D$	$R_{DS(ON)}(Typ.)$	$V_{DSS}$
9A	0.65Ω	500V

**Ordering Information**

Part Number	Package	Marking
RS9N50F	TO-220F	RS9N50F

**Absolute Maximum Ratings  $T_c=25^{\circ}\text{C}$  unless otherwise specified**

Symbol	Parameter	RS9N50F	Units
$V_{DSS}$	Drain-to-Source Voltage (Note*1)	500	V
$I_D$	Continuous Drain Current	9.0	A
$I_{D@100^{\circ}\text{C}}$	Continuous Drain Current	4.8	
$I_{DM}$	Pulsed Drain Current (Note*2)	34.0	
$P_D$	Power Dissipation	63	W
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
EAS	Single Pulse Avalanche Energy L=10mH VDD=50V $R_G=25\Omega$ Starting $T_J=25^{\circ}\text{C}$	320	mJ
IAS	(Note*2)	8	A
EAR	Repetitive Avalanche Energy	40	mJ
TL TPKG	Maximum Temperature for Soldering	300 260	$^{\circ}\text{C}$
	Leads at 0.063in(1.6mm)from Case for 10 seconds		
	Package Body for 10 seconds		
$T_J$ and $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to 150	

\*Drain Current Limited by Maximum Junction Temperature

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

**Thermal Resistance**

Symbol	Parameter	RS9N50F	Units	Test Conditions
$R_{\theta JC}$	Junction-to-Case	1.98	$^{\circ}\text{C}/\text{W}$	Drain lead soldered to water cooled heatsink, $P_D$ adjusted for a peak junction temperature of $+150^{\circ}\text{C}$ .
$R_{\theta JA}$	Junction-to-Ambient	62		1 cubic foot chamber,free air.

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

Symbol	Parameter	Min.	Typ.	Max.	Units	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	--	--	1.0	$\mu A$	$V_{DS}=500V, V_{GS}=0V$
$I_{GSS}$	Gate-to-Source Forward Leakage	--	--	100	nA	$V_{GS}=+30V, V_{DS}=0V$
	Gate-to-Source Reverse Leakage	--	--	-100		$V_{GS}=-30V, V_{DS}=0V$

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{DS(on)}$	Static Drain-to-Source On-Resistance (Note*3)	--	0.65	0.8	$\Omega$	$V_{GS}=10V, I_D=5A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{GS}=V_{DS}, I_D=250\mu A$

**Resistive Switching Characteristics** Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$t_d(ON)$	Turn-on Delay Time	--	25	--	nS	$V_{DS}=250V$ $I_D=9A$ $R_G=25\Omega$
$t_{rise}$	Rise Time	--	19	--		
$t_d(OFF)$	Turn-OFF Delay Time	--	95	--		
$t_{fall}$	Fall Time	--	24	--		

**Dynamic Characteristics** Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$C_{iss}$	Input Capacitance	--	1056	--	pF	$V_{GS}=0V$ $V_{DS}=25V$ $f=1.0MHz$
$C_{oss}$	Output Capacitance	--	105	--		
$C_{rss}$	Reverse Transfer Capacitance	--	4.4	--		
$Q_g$	Total Gate Charge	--	22	--	nC	$V_{DS}=400V$ $I_D=9A$ $V_{GS}=10V$ (Note:3,4)
$Q_{gs}$	Gate-to-Source Charge	--	5.2	--		
$Q_{gd}$	Gate-to-Drain("Miller") Charge	--	9.3	--		

## Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current	--	--	9.0	A	Integral pn-diode in MOSFET
$I_{SM}$	Maximum Pulsed Current	--	--	34.0	A	
$V_{SD}$	Diode Forward Voltage	--	--	1.4	V	$I_S=9A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	320	--	nS	$V_{GS}=0V$ $I_S=9A, di/dt=100A/\mu s$
$Q_{rr}$	Reverse Recovery Charge	--	1.83	--	$\mu C$	

## Notes:

\*1.  $T_J = \pm 25^\circ C$  to  $+150^\circ C$ .

\*2. Repetitive rating; pulse width limited by maximum junction temperature.

\*3. Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 1\%$ .

## Typical Feature curve

$T_J = 25^\circ C$ , unless otherwise noted

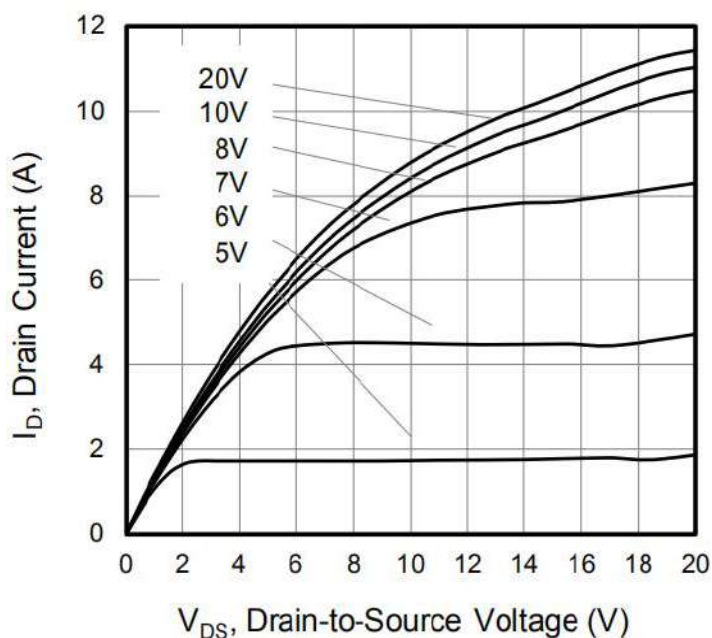
Figure 1. Output Characteristics ( $T_J = 25^\circ C$ )

Figure 2. Body Diode Forward Voltage

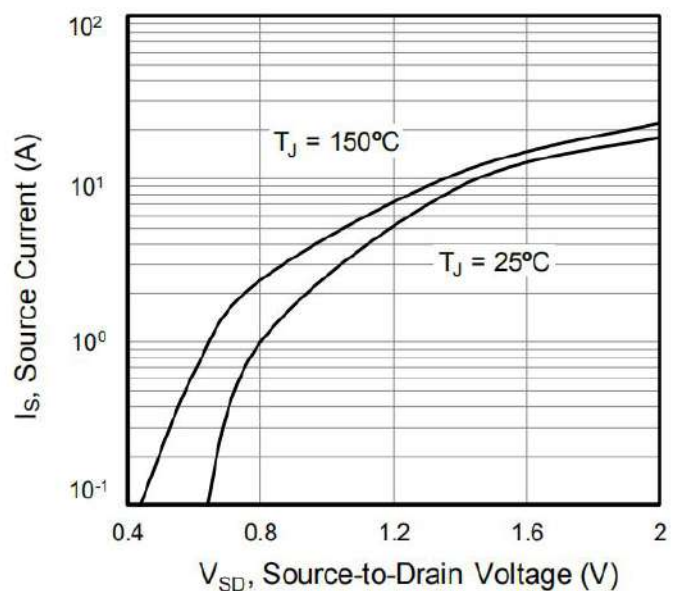


Figure 3. Drain Current vs. Temperature

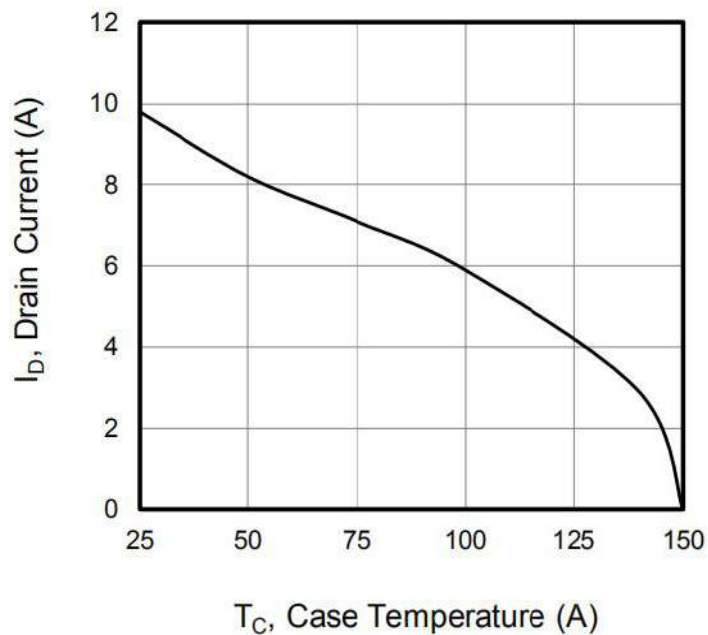


Figure 4. BVDSS Variation vs. Temperature

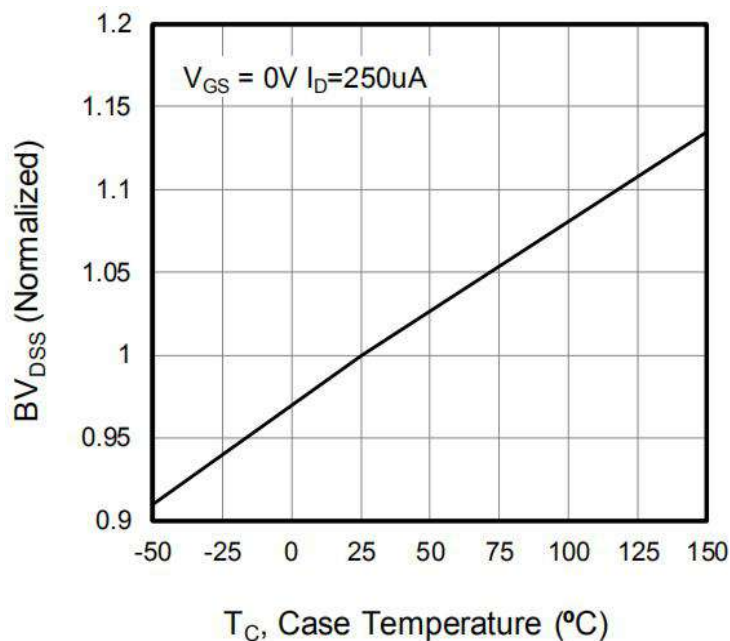


Figure 5. Transfer Characteristics

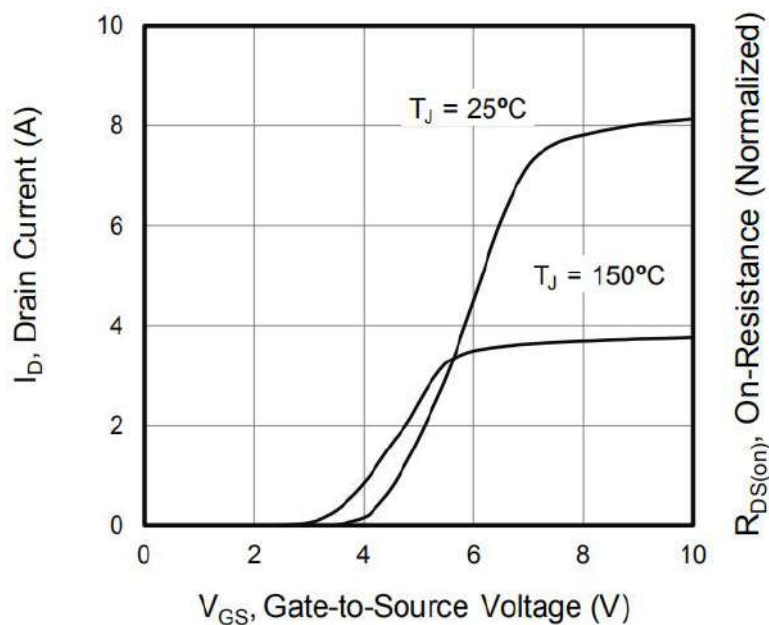


Figure 6. On-Resistance vs. Temperature

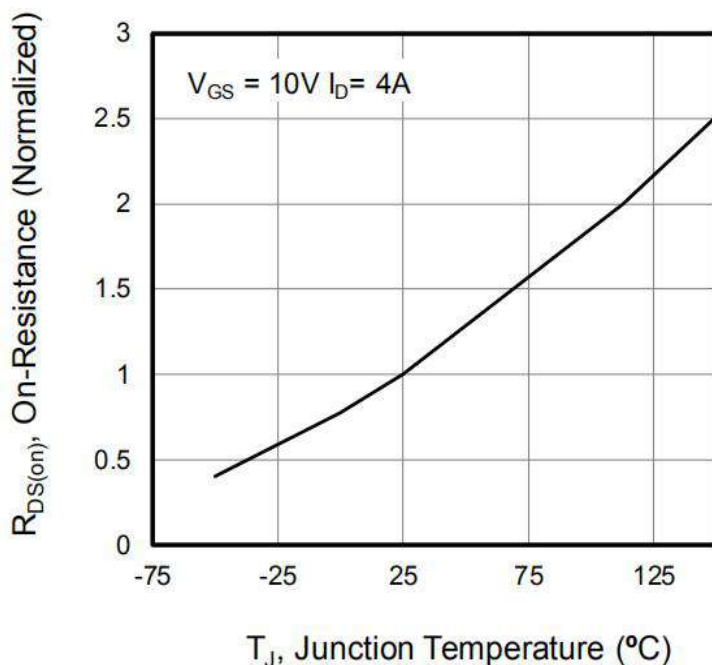


Figure 7. Capacitance

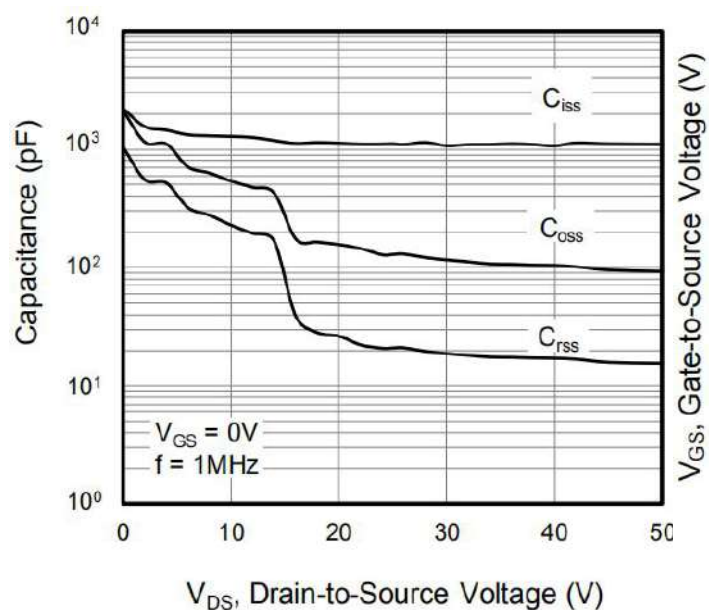


Figure 8. Gate Charge

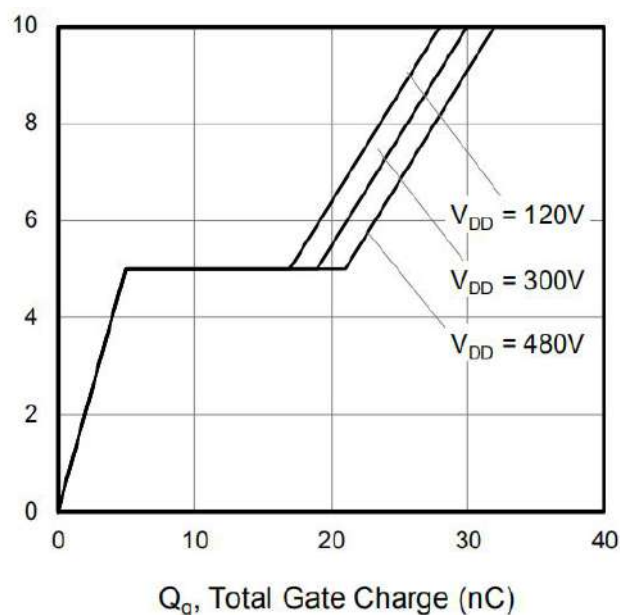
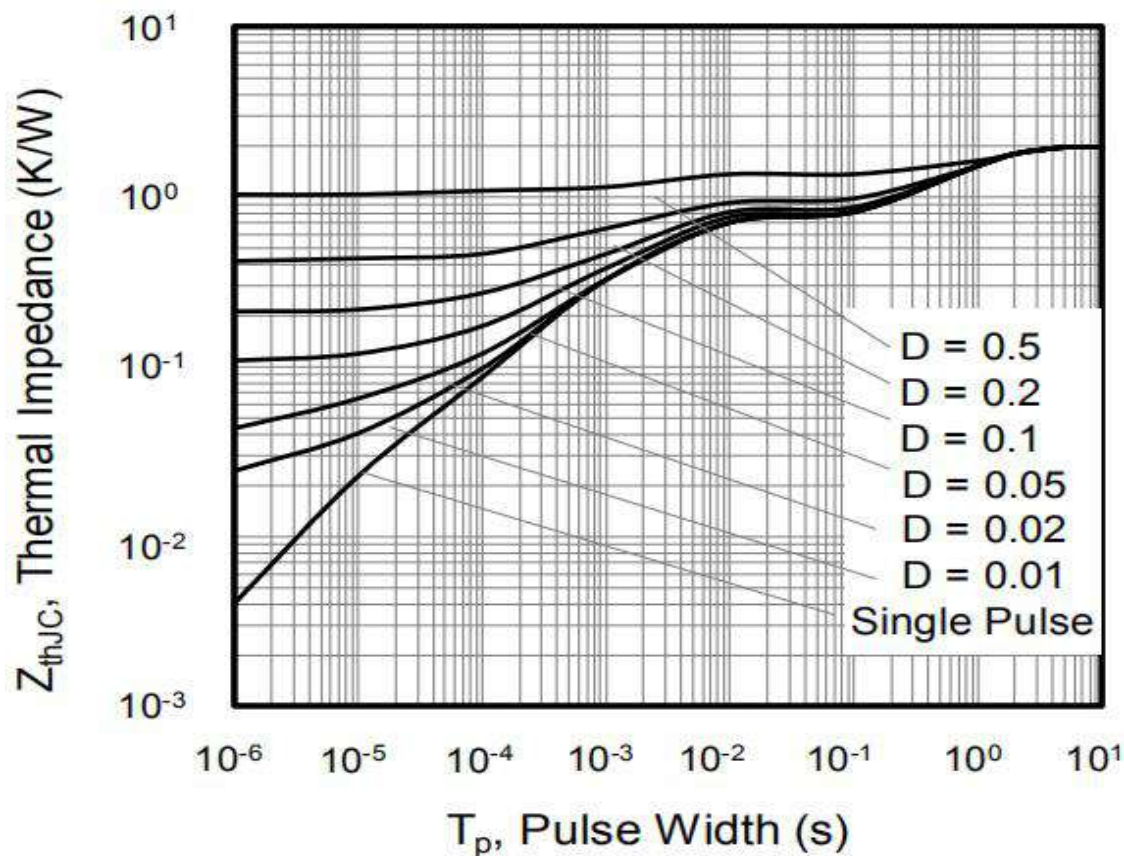


Figure 9. Transient Thermal Impedance  
TO-220F





### Test Circuits and Waveforms

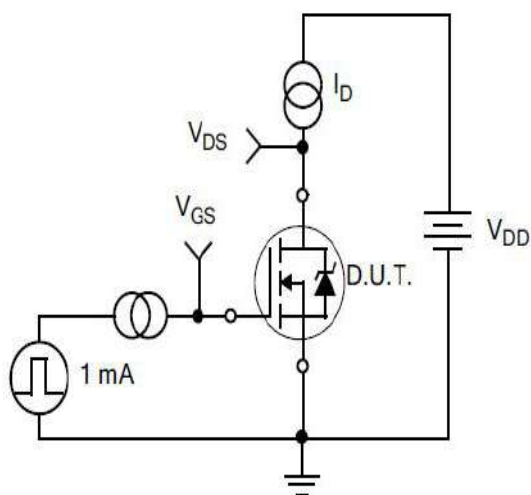


Figure10.  
Gate Charge Test Circuit

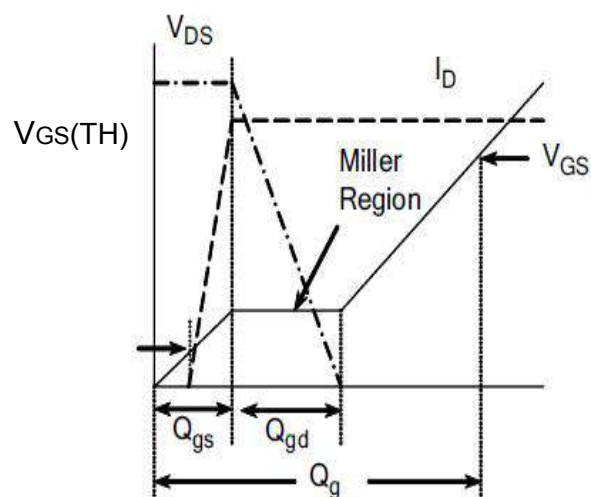


Figure11.  
Gate Charge Waveform

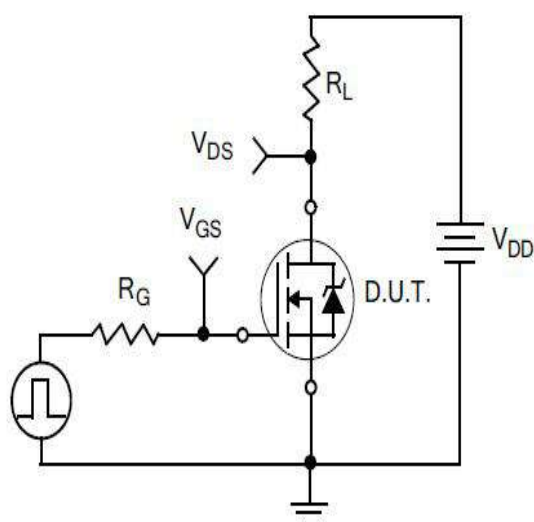


Figure12.  
Resistive Switching Test Circuit

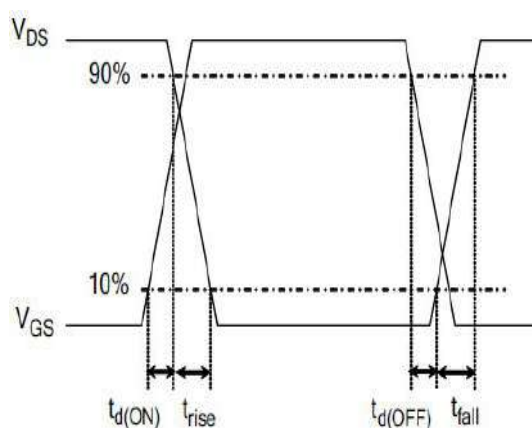


Figure13.  
Resistive Switching Waveforms

## Test Circuits and Waveforms

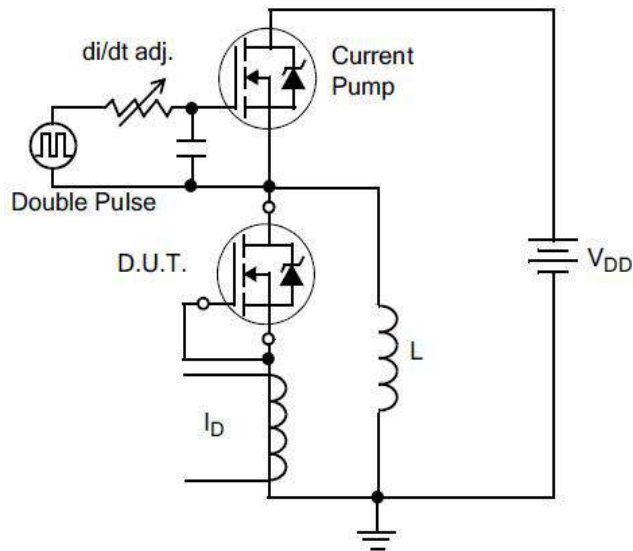


Figure14.Diode Reverse Recovery Test Circuit

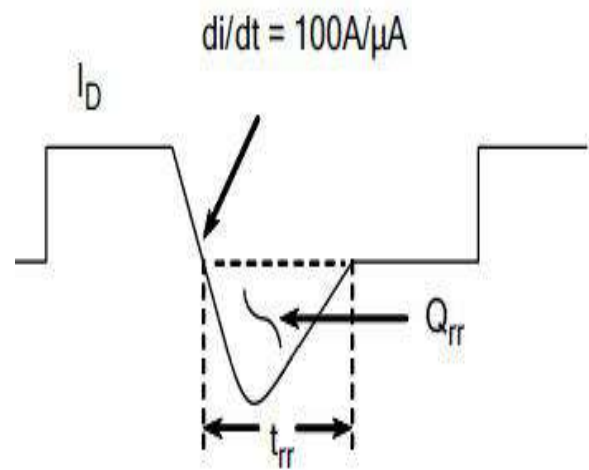


Figure15.Diode Reverse Recovery Waveform

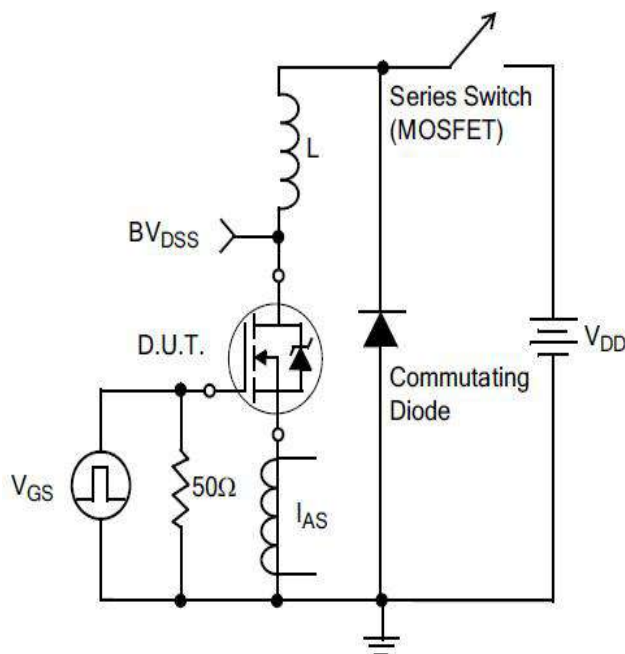
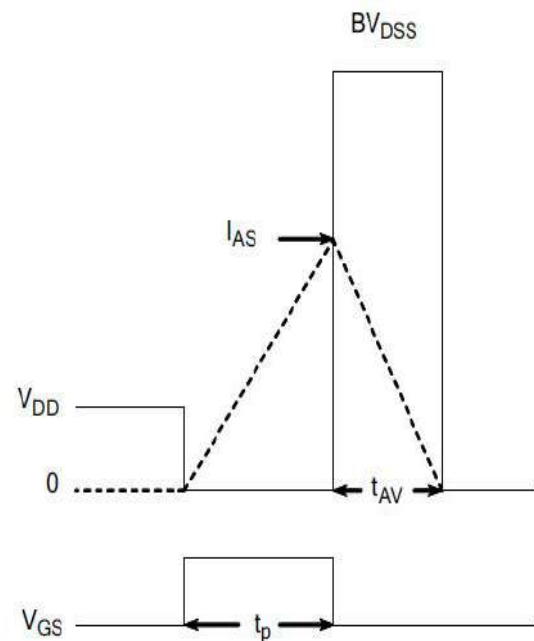


Figure16.Unclamped Inductive Switching Test Circuit

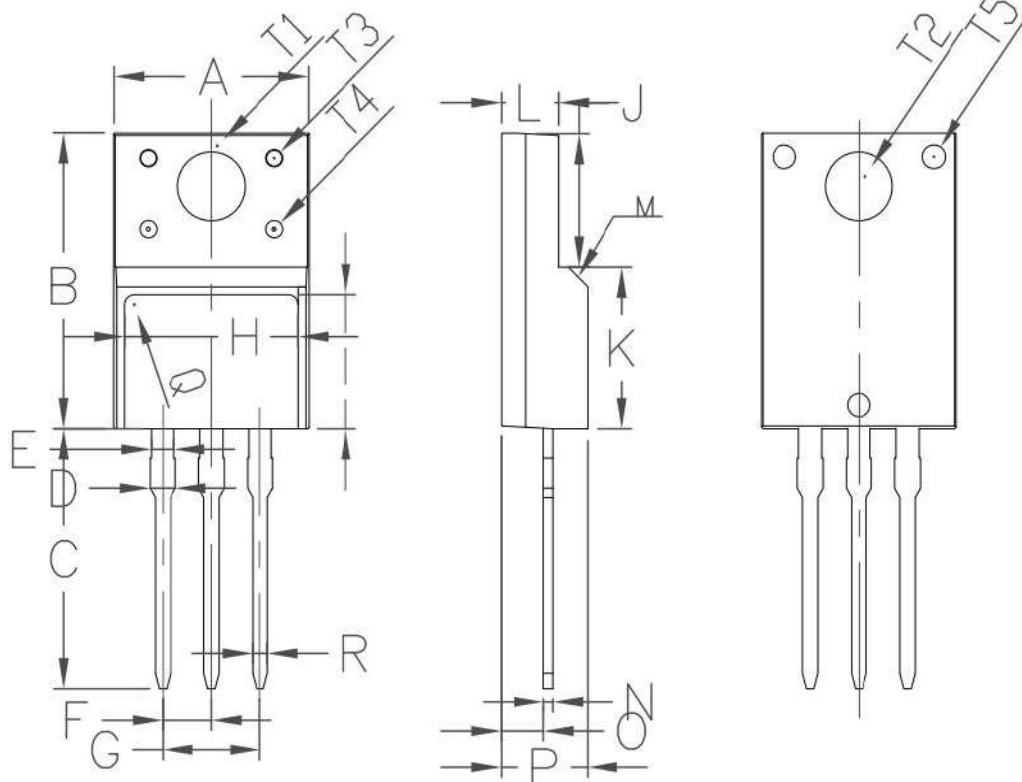


$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Figure17.Unclamped Inductive Switching Waveforms

**Package outline drawing****TO-220F**

Unit: mm



Symbol	Min	Non	Max
A	9.96	10.16	10.36
B	15.67	15.87	16.07
C	13.14	13.34	13.54
D	1.20	1.30	1.40
E		1.20	
F		2.54	
G		5.08	
H	7.60	7.80	8.00
I	7.10	7.30	7.50
J	6.48	6.68	6.88
K	8.99	9.19	9.39
L	2.34	2.54	2.74
M		45°	
N	0.49	0.50	0.52
O	2.15	2.35	2.55
P	4.50	4.70	4.90
Q		0.50	
S	4°	4.5°	5°
T1		3.45	
T2		3.18	
T3		1.50	
T4		1.20	
T5		1.50	
R	0.77	0.8	0.83



---

**Disclaimers:**

Reasunos Semiconductor Technology CO.,LTD(Reasunos)reserves the right to make changes without notice in order to improve reliability,function or design and to discontinue any product or service without notice .Customers should obtain the latest relevant information before orders and should verify that such information in current and complete.All products are sold subject to Reasunos's terms and conditions supplied at the time of order acknowledgement.

Reasunos Semiconductor Technology CO.,LTD warrants performance of its hardware products to the specifications at the time of sale.Testing,reliability and quality control are used to the extene Reasunos deems necessary to support this warrantee. Except where agreed upon by contr-actual agreement,testing of all parameters of each product is not necessarily performed.

Reasunos Semiconductor Technology CO.,LTD does not assume any liability arising from the use of any product or circuit designs described herein.Customers are responsible for their products and applications using Reasunos's components.To minimize risk,customers must provide adequate design and operating safeguards.

Reasunos Semiconductor Technology CO.,LTD does not warrant or convey any license either expressed or implied under its patent rights,nor the rights of others.Reproduction of information in Reasunos's data sheeets or data books is permissible only if reproduction is without modification oralteration.Reproduction of this information with any alteration is an unfair and deceptive business practice. Reasunos Semiconductor Technology CO.,LTD is not responsible or liable for such altered documentation.

Resale of Reasunos's products with statements different from or beyond the parameters stated by Reasunos Semiconductor Technology CO.,LTD for that product or service voids all express or implied warranties for the associated Reasunos's product or service and is unfair and deceptive business practice. Reasunos Semiconductor Technology CO.,LTD is not responsible or liable for such statements.

---

**Life Support Policy:**

Reasunos Semiconductor Technology CO.,LTD's Products are not authorized for use as critical components in life support devices or systems without the expressed written approval of Reasunos Semiconductor Technology CO.,LTD.

As used herein:

- 1.Life support devices or systems are devices or systems which:
  - a.are intended for surgical implant into the human body,
  - b.support or sustain life,
  - c.whose failuer to when properly used in accordance with instructions for used provided in the laeling,can be reasonably expected to result in significant injury to the user.
- 2.A critical component is any component of a life support device or system whose failure to system whose failure to perform can be reasonably expected to cause the failure of the life support device or system,or to affect its safety or effectiveness.