

**N Channel MOSFET**

Lead Free Package and Finish

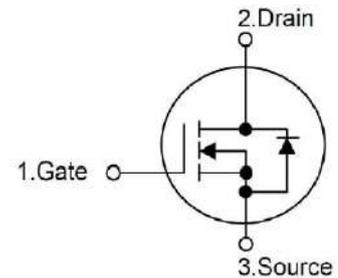
**Applications:**

- 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

Id	R <sub>DS(ON)</sub> (Typ.)	V <sub>DSS</sub>
12A	0.6Ω	650V



Not to Scale

**Ordering Information**

Part Number	Package	Marking
RS12N65F	TO-220F	RS12N65F

**Absolute Maximum Ratings T<sub>c</sub>=25°C unless otherwise specified**

Symbol	Parameter	RS12N65F	Units
V <sub>DSS</sub>	Drain-to-Source Voltage (Note*1)	650	V
I <sub>D</sub>	Continuous Drain Current	12.0	A
I <sub>D@ 100 °C</sub>	Continuous Drain Current	7.2	
I <sub>DM</sub>	Pulsed Drain Current (Note*2)	48.0	
P <sub>D</sub>	Power Dissipation	70	W
	Derating Factor above 25°C	0.56	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	±30	V
EAS	Single Pulse Avalanche Energy L=10mH V <sub>DD</sub> =150V R <sub>G</sub> =25Ω T <sub>J</sub> =25°C	810	mJ
T <sub>L</sub> TPKG	Maximum Temperature for Soldering	300 260	°C
	Leads at 0.063in(1.6mm)from Case for 10 seconds		
	Package Body for 10 seconds		
T <sub>J</sub> and T <sub>STG</sub>	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	RS12N65F	Units	Test Conditions
R <sub>θJC</sub>	Junction-to-Case	1.92	°C/W	Drain lead soldered to water cooled heatsink,P <sub>D</sub> adjusted for a peak junction temperature of +150°C.
R <sub>θJA</sub>	Junction-to-Ambient	62.5		1 cubic foot chamber,free air.

**OFF 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	650	--	--	v	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1.0	$\mu A$	$V_{DS}=650V, V_{GS}=0V$
$I_{GSS}$	Gate-to-Source Forward Leakage	--	--	100	nA	$V_{GS}=+30V, V_{DS}=0V$
	Gate-to-Source Reverse Leakage	--	--	-100		$V_{GS}=-30V, V_{DS}=0V$

**ON 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	--	0.6	0.75	$\Omega$	$V_{GS}=10V, I_D=6A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{GS}=V_{DS}, I_D=250\mu A$
gfs	Forward Trans conductance		--	12	S	$V_{DS}=15V, I_D=6A$

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$t_d(ON)$	Turn-on Delay Time	--	28	--	nS	$V_{DS}=325V$ $I_D=12A$ $R_G=25\Omega$ (Note:3,4)
$t_{rise}$	Rise Time	--	29	--		
$t_d(OFF)$	Turn-OFF Delay Time	--	86	--		
$t_{fall}$	Fall Time	--	31	--		

**Dynamic Characteristics** Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$C_{iss}$	Input Capacitance	--	2023	--	pF	$V_{GS}=0V$
$C_{oss}$	Output Capacitance	--	159	--		$V_{DS}=25V$
$C_{rss}$	Reverse Transfer Capacitance	--	8	--		$f=1.0MHz$
$Q_g$	Total Gate Charge	--	39	--	nC	$V_{DS}=520V$
$Q_{gs}$	Gate-to-Source Charge	--	10	--		$I_D=12A$
$Q_{gd}$	Gate-to-Drain("Miller") Charge	--	15	--		$V_{GS}=10V$ (Note:3,4)

## Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I <sub>S</sub>	Continuous Source Current	--	--	12	A	Integral pn-diode in MOSFET
I <sub>SM</sub>	Maximum Pulsed Current	--	--	48	A	
V <sub>SD</sub>	Diode Forward Voltage	--	--	1	V	I <sub>S</sub> =12A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	--	521	--	nS	V <sub>GS</sub> =0V
Q <sub>rr</sub>	Reverse Recovery Charge	--	4.1	--	μC	I <sub>S</sub> =10A, di/dt=100A/μs

## Notes:

- \*1. T<sub>J</sub>=±25°C to +150°C.
- \*2. Repetitive rating; pulse width limited by maximum junction temperature.
- \*3. Pulse width ≤ 300μs; duty cycle ≤ 1%.
- \*4. Basically not affected by temperature.

## Typical Feature curve

Figure1. Typical Output Characteristics

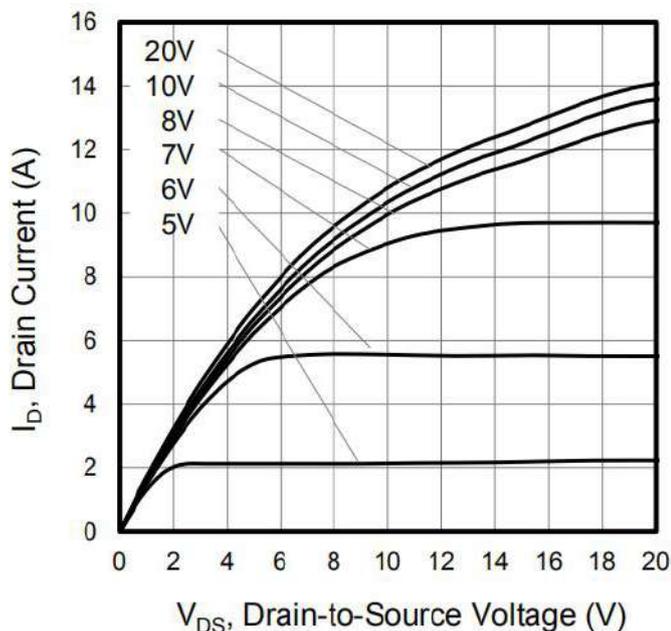
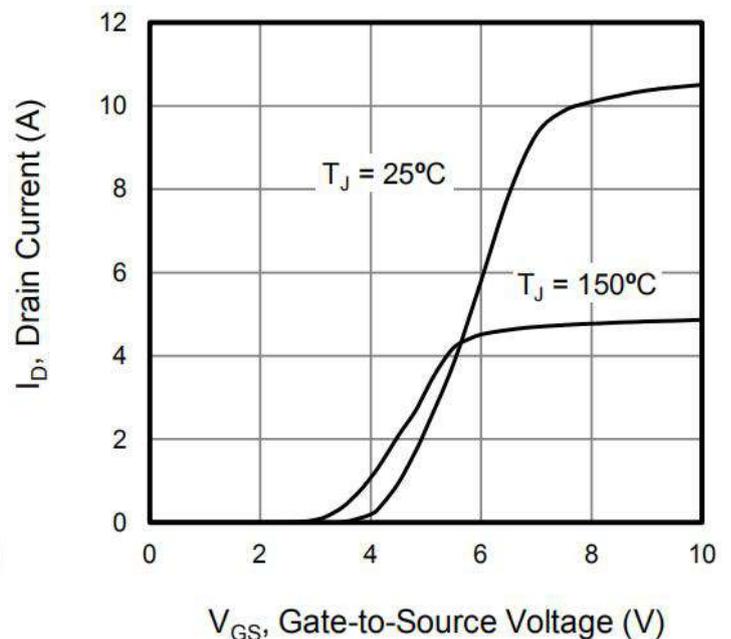
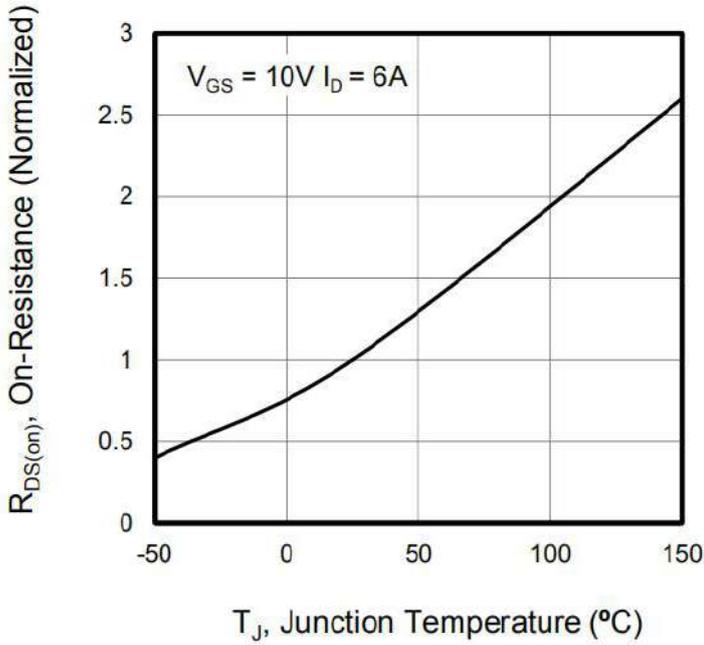


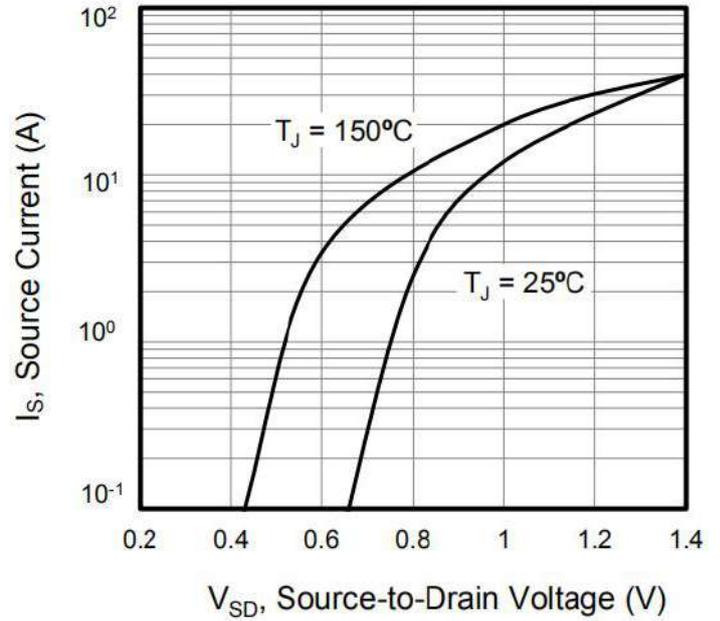
Figure2. Typical Transfer Characteristics



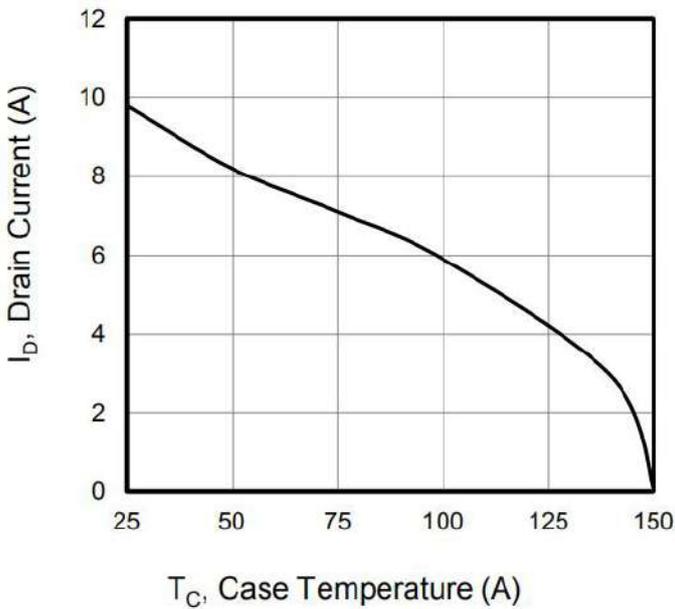
**Figuer3. Typical ON Resistance vs Temperature**



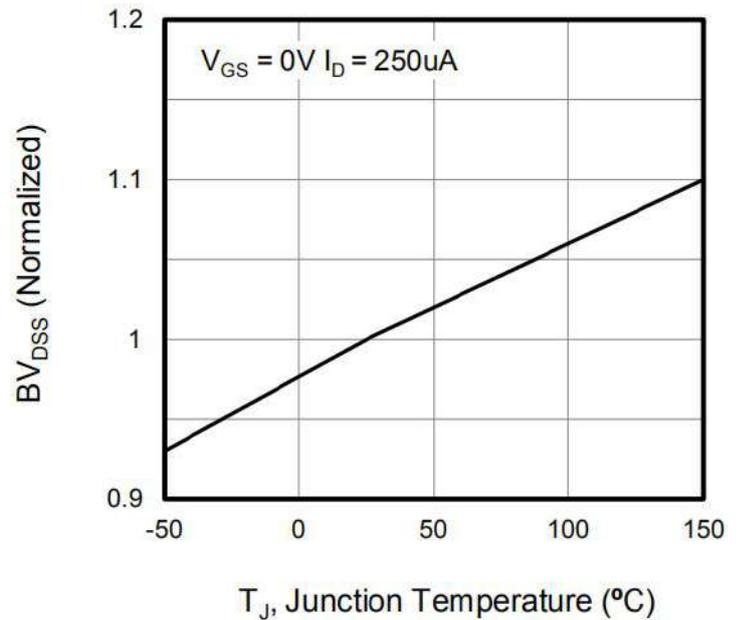
**Figuer4. Typical Body Diode Transfer Characteristics**



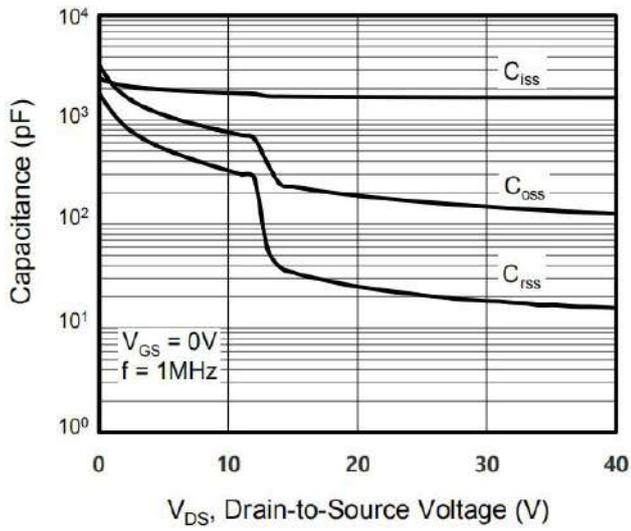
**Figure5. Typical Drain current vs. Temperature**



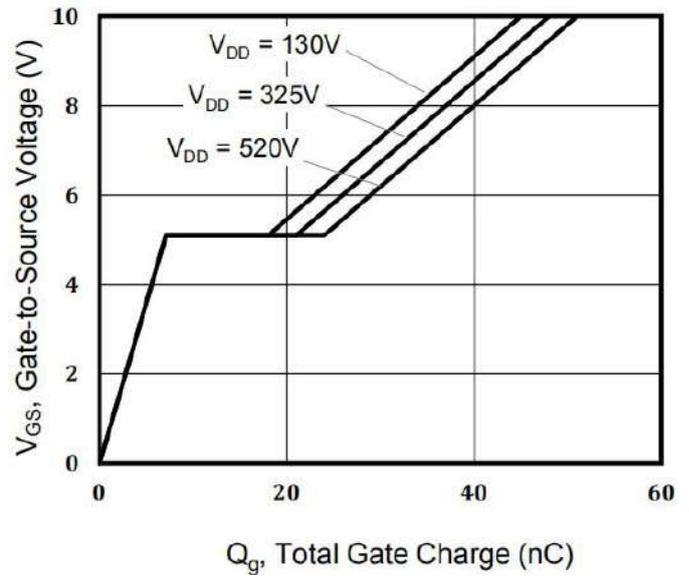
**Figure6. BVDSS Variation vs. Temperature**



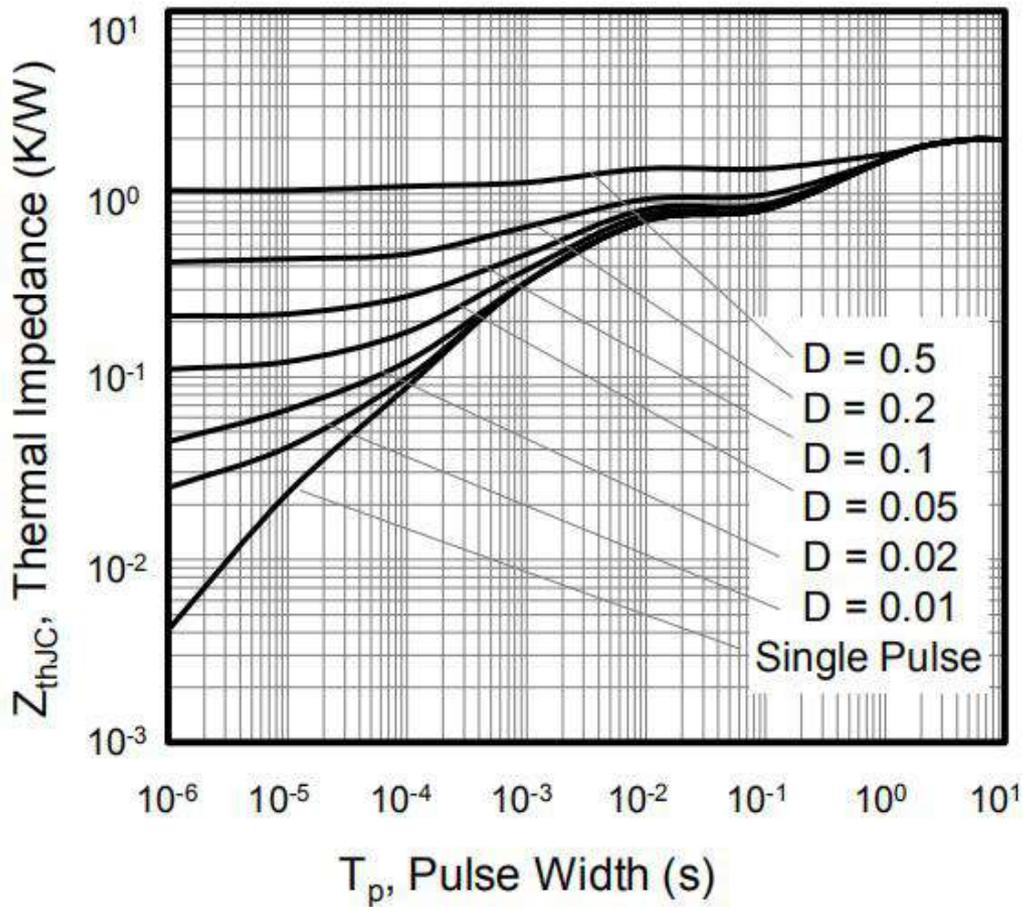
**Figure7. Capacitance vs. Drain to Source Voltage**



**Figure8. Gate Charge**



**Figure9. Transient Thermal Impedance**



## Test Circuits and Waveforms

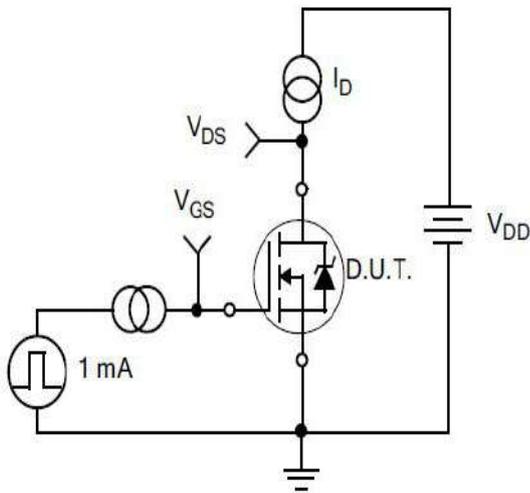


Figure 11.  
Gate Charge Test Circuit

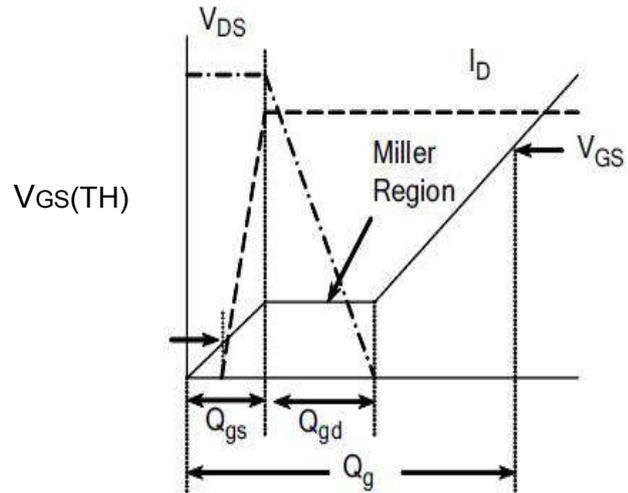


Figure 12.  
Gate Charge Waveform

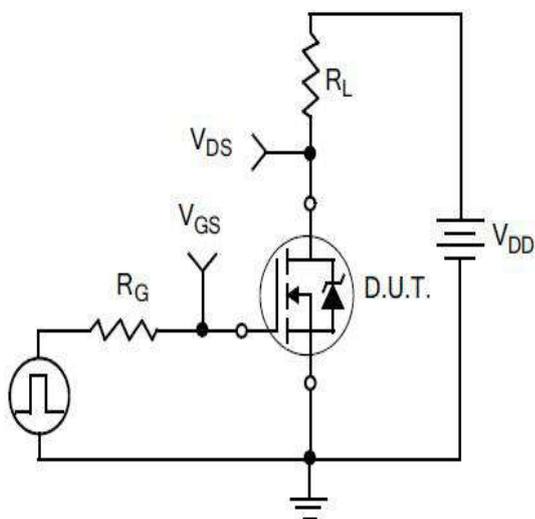


Figure 13.  
Resistive Switching Test Circuit

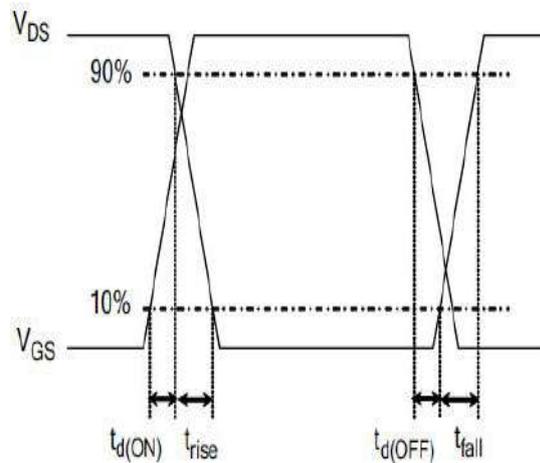


Figure 14.  
Resistive Switching Waveforms

**Test Circuits and Waveforms**

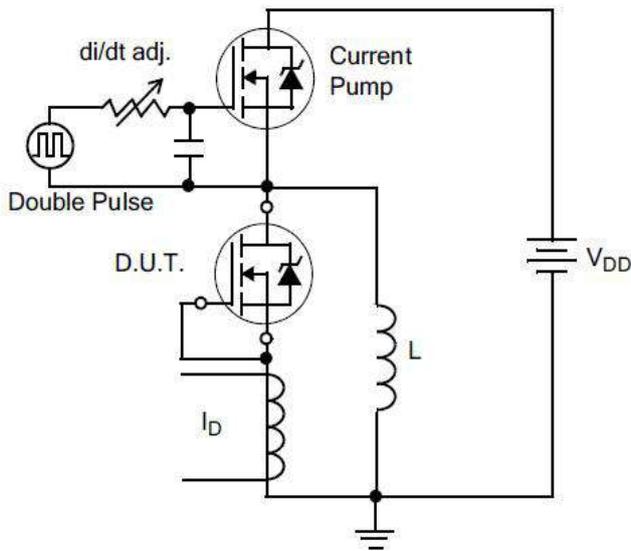


Figure15.Diode Reverse Recovery Test Circuit

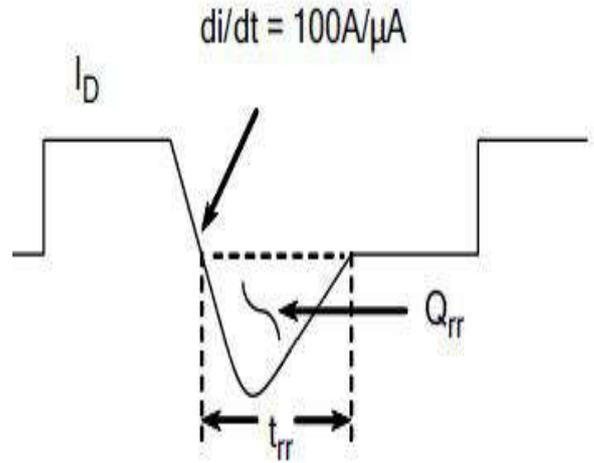


Figure16.Diode Reverse Recovery Waveform

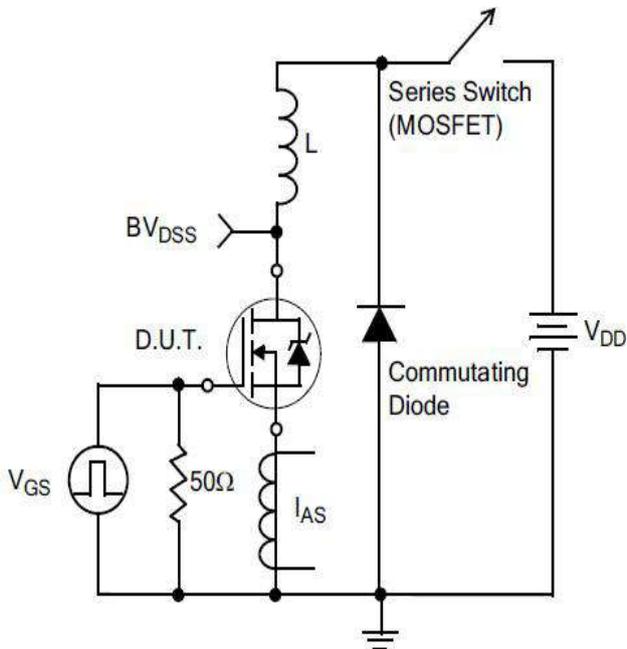
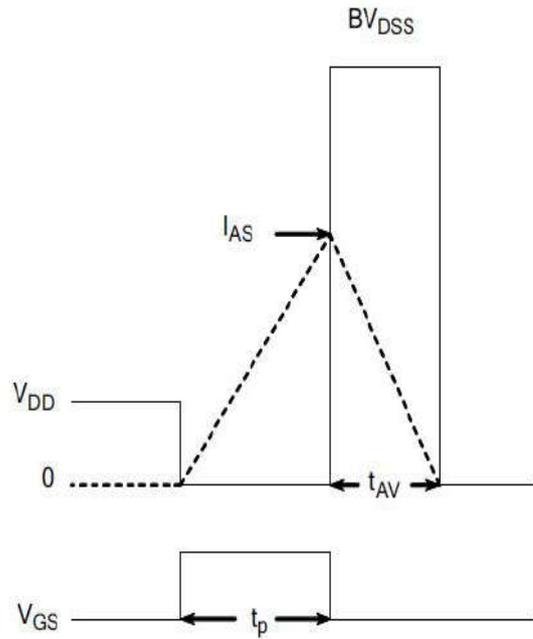


Figure17.Unclamped Inductive Switching Test Circuit



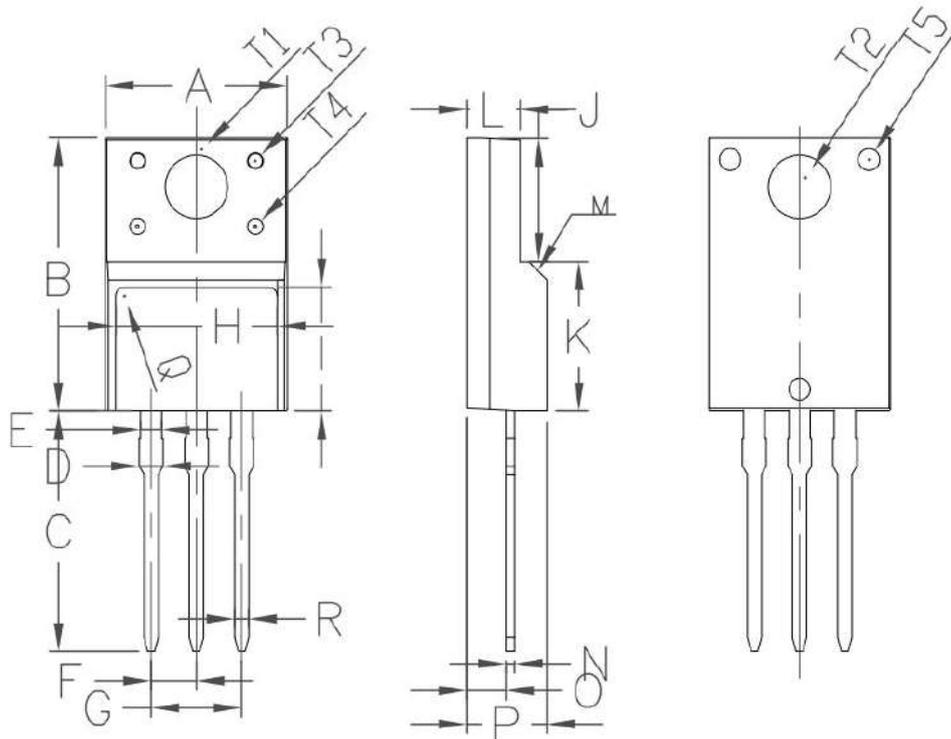
$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Figure18.Unclamped Inductive Switching Waveforms

**Package outline drawing**

Unit: mm

**TO-220F**



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

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