

**N Channel MOSFET**

 Lead Free Package and Finish

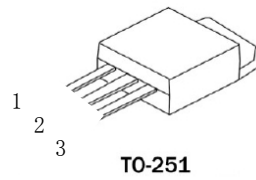
**Applications:**

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

$I_D$	$R_{DS(ON)}$ (Typ.)	$V_{DSS}$
4.0A	2.0 $\Omega$	600V

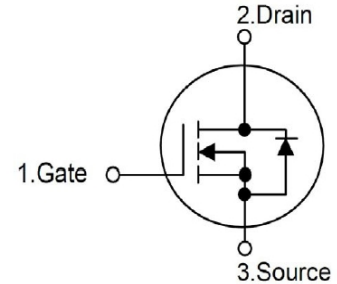
**Features:**

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



**TO-251**

Not to Scale



**Ordering Information**

Part Number	Package	Marking
RS4N60MD	TO-251	RS4N60MD

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

Symbol	Parameter	RS4N60MD	Units
$V_{DSS}$	Drain-to-Source Voltage (Note*1)	600	V
$I_D$	Continuous Drain Current	4.0	A
$I_{D@ 100^\circ\text{C}}$	Continuous Drain Current	2.5	
$I_{DM}$	Pulsed Drain Current (Note*2)	16.0	
$P_D$	Power Dissipation	86	W
	Derating Factor above $25^\circ\text{C}$	0.69	W/ $^\circ\text{C}$
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
EAS	Single Pulse Avalanche Energy $L=30\text{mH}$ $I_{AS}=3.45\text{A}$ $V_{DD}=100\text{V}$ $R_G=25\Omega$ $T_J=25^\circ\text{C}$	217	mJ
$T_L$ $T_{PKG}$	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	RS4N60MD	Units	Test Conditions
$R_{\theta JC}$	Junction-to-Case	1.45	$^\circ\text{C}/\text{W}$	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	110		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 <sub>DSS</sub>	Drain-to-source Breakdown Voltage	600	---	---	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250 $\mu$ A
I <sub>DSS</sub>	Drain-to-Source Leakage Current	---	---	1.0	$\mu$ A	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	---	---	100	nA	V <sub>GS</sub> =+30V V <sub>DS</sub> =0V
	Gate-to-Source Reverse Leakage	---	---	-100		V <sub>GS</sub> =-30V V <sub>DS</sub> =0V

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	---	2.0	2.4	$\Omega$	V <sub>GS</sub> =10V, I <sub>D</sub> =2A
V <sub>GS(TH)</sub>	Gate Threshold Voltage	2.0	---	4.0	V	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250 $\mu$ A

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
t <sub>d(ON)</sub>	Turn-on Delay Time	---	14.2	---	nS	V <sub>DS</sub> =300V I <sub>D</sub> =4.0A R <sub>G</sub> =25 $\Omega$ (Note:3, 4)
t <sub>rise</sub>	Rise Time	---	27.73	---		
t <sub>d(OFF)</sub>	Turn-OFF Delay Time	---	34.67	---		
t <sub>fall</sub>	Fall Time	---	28.53	---		

**Dynamic Characteristics** Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
C <sub>iss</sub>	Input Capacitance	---	509.0	---	pF	V <sub>GS</sub> =0V V <sub>DS</sub> =25V f=1.0MHz
C <sub>oss</sub>	Output Capacitance	---	57.57	---		
C <sub>rss</sub>	Reverse Transfer Capacitance	---	2.59	---		
Q <sub>g</sub>	Total Gate Charge	---	11.88	---	nC	V <sub>DS</sub> =480V I <sub>D</sub> =4.0A V <sub>GS</sub> =10V (Note:3, 4)
Q <sub>gs</sub>	Gate-to-Source Charge	---	3.33	---		
Q <sub>gd</sub>	Gate-to-Drain("Miller") Charge	---	4.90	---		

Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I <sub>S</sub>	Continuous Source Current	--	--	4.0	A	Integral pn-diode in MOSFET
I <sub>SM</sub>	Maximum Pulsed Current	--	--	16.0	A	
V <sub>SD</sub>	Diode Forward Voltage	--	--	1.4	V	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	--	408.00	--	nS	V <sub>GS</sub> =0V I <sub>S</sub> =4.0A, di/dt=100A/μs
Q <sub>rr</sub>	Reverse Recovery Charge	--	1.98	--	μC	

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 ≤ 2%.
- \*4. Basically not affected by temperature.

Typical Feature curve

Figure1. Typical Output Characteristics

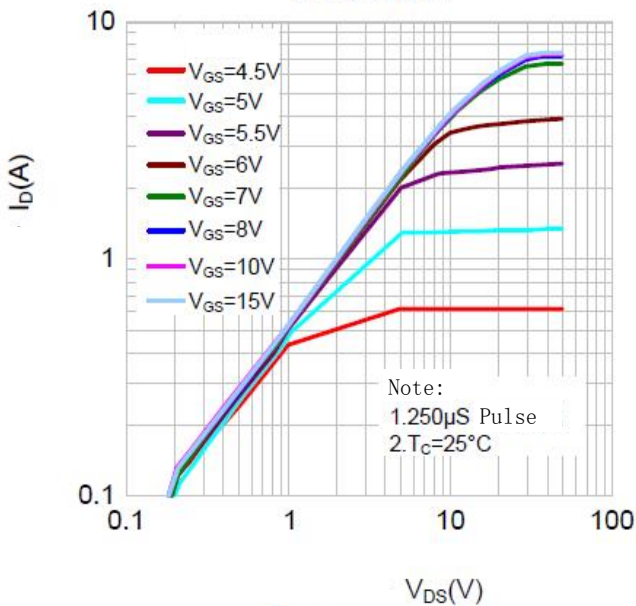


Figure2. Typical Transfer Characteristics

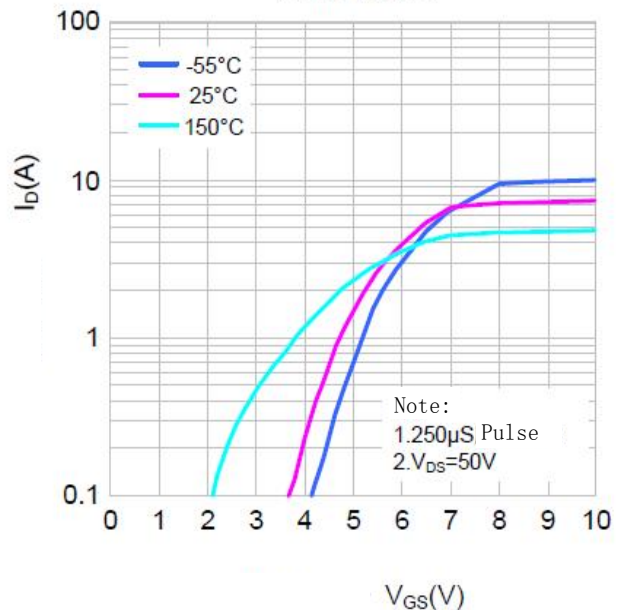


Figure3. Typical ON Resistance vs Drain Current

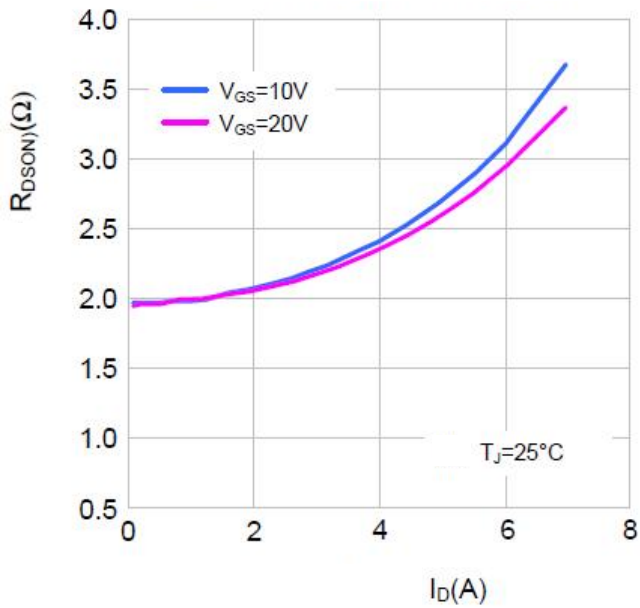


Figure4. Typical Body Diode Transfer Characteristics

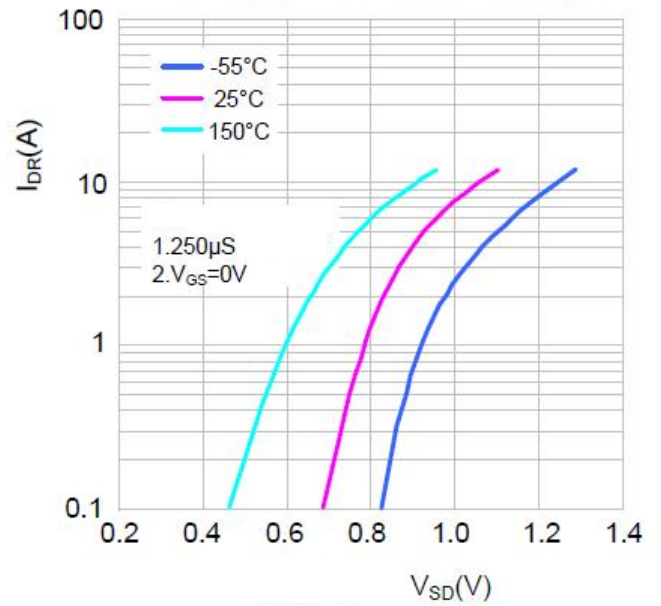


Figure5. Typical Capacitance vs Drain-to-Source Voltage

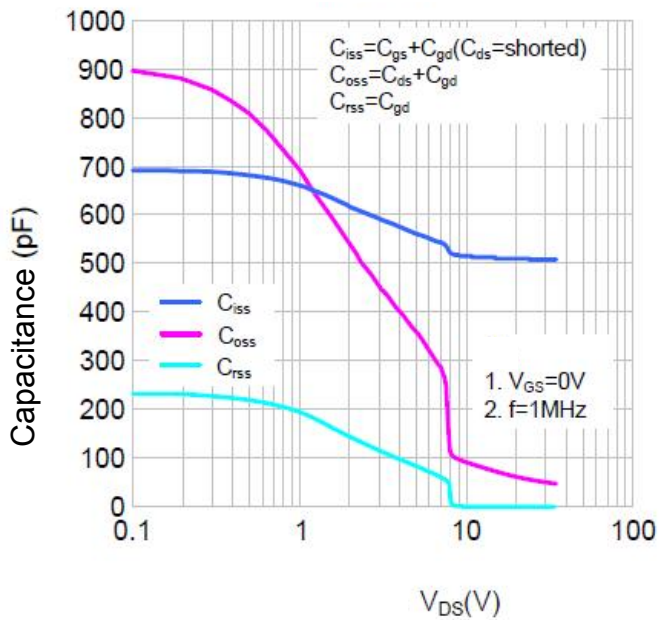


Figure6. Typical Gate Charge vs Gate-to-Source Voltage

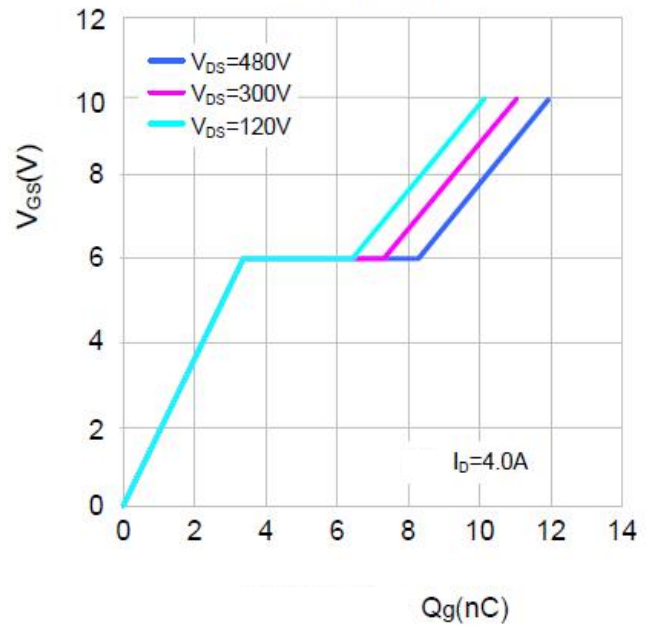


Figure7. Typical Breakdown Voltage vs Junction Temperature

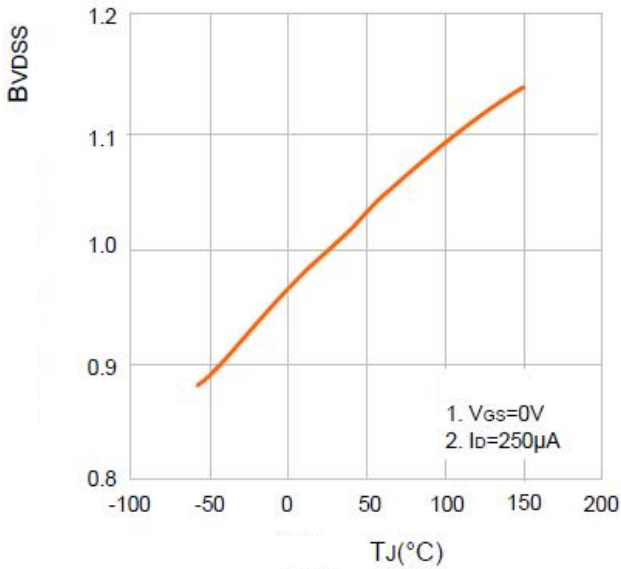


Figure8. Figure10. Typical Drain-to-Source ON Resistance vs Junction Temperature

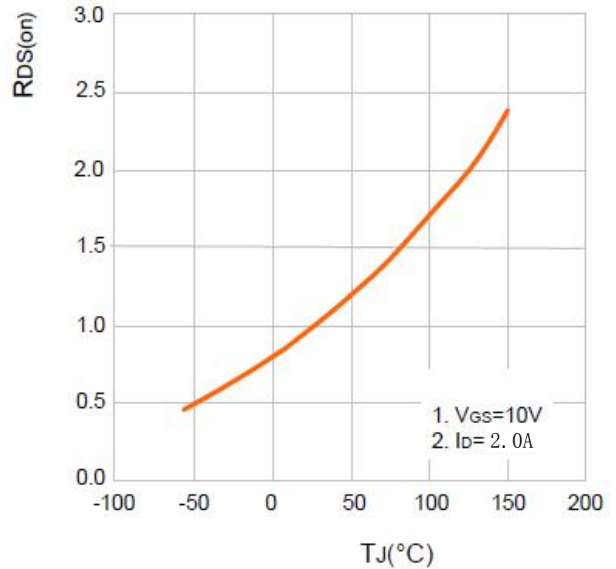


Figure9. Maximum Continuous Drain Current vs Case Temperature

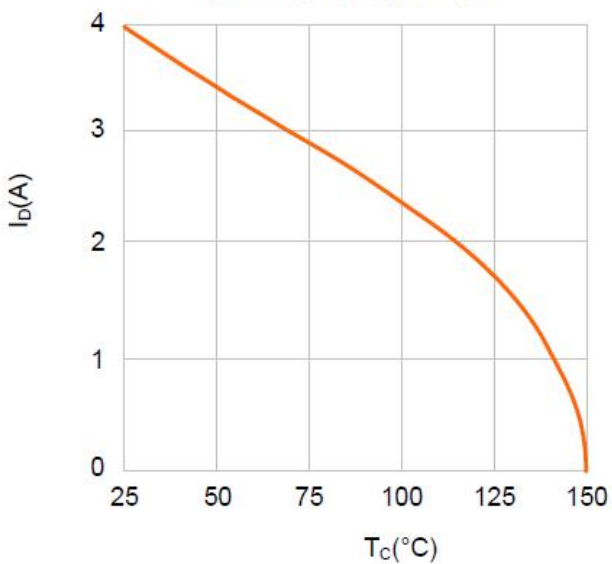
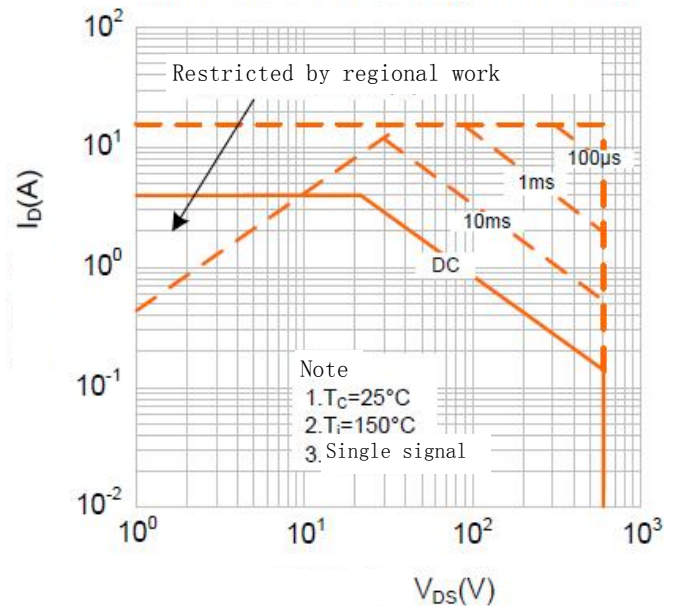


Figure10. Maximum Continuous Drain Current vs Case Temperature



Test Circuits and Waveforms

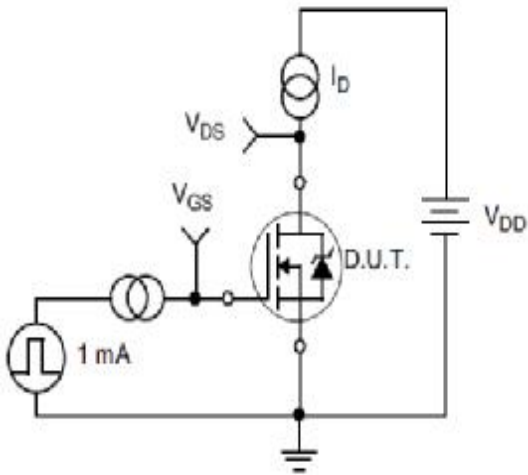


Figure11.  
Gate Charge Test Circuit

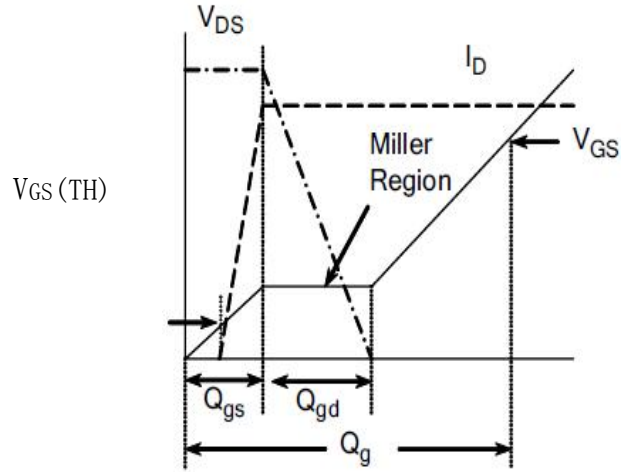


Figure12.  
Gate Charge Waveform

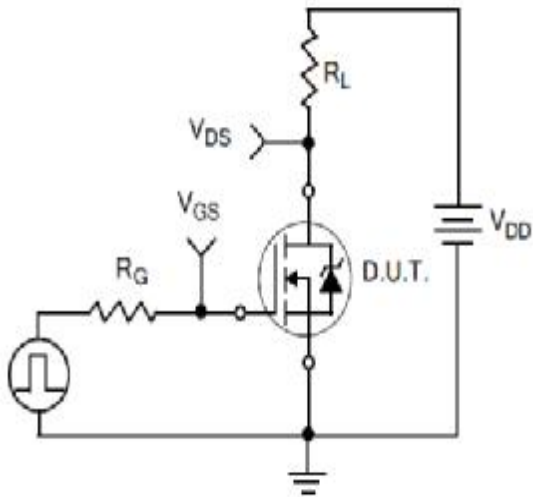


Figure13.  
Resistive Switching Test Circuit

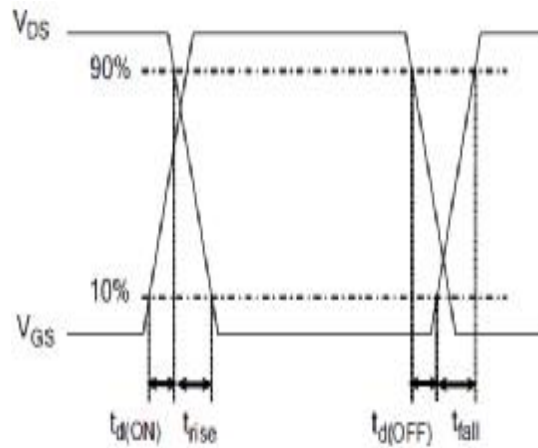


Figure14.  
Resistive Switching Waveforms

Test Circuits and Waveforms

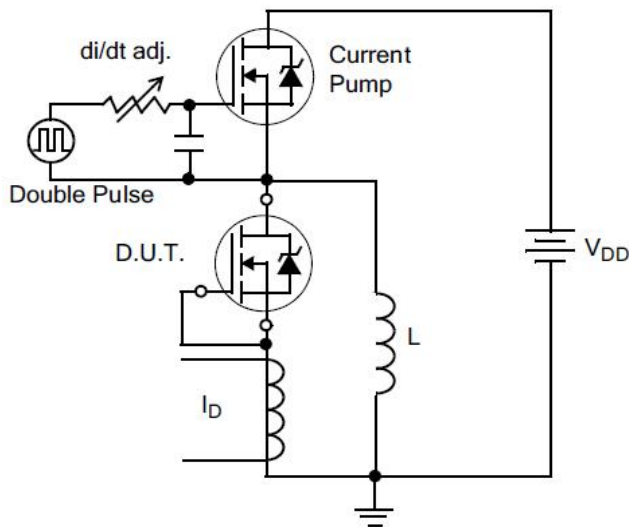


Figure15. Diode Reverse Recovery Test Circuit

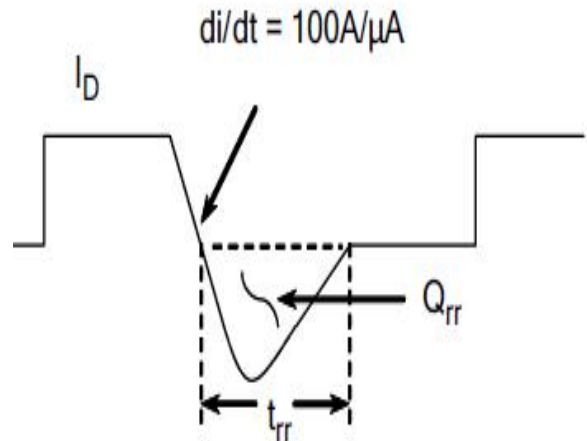


Figure16. Diode Reverse Recovery Waveform

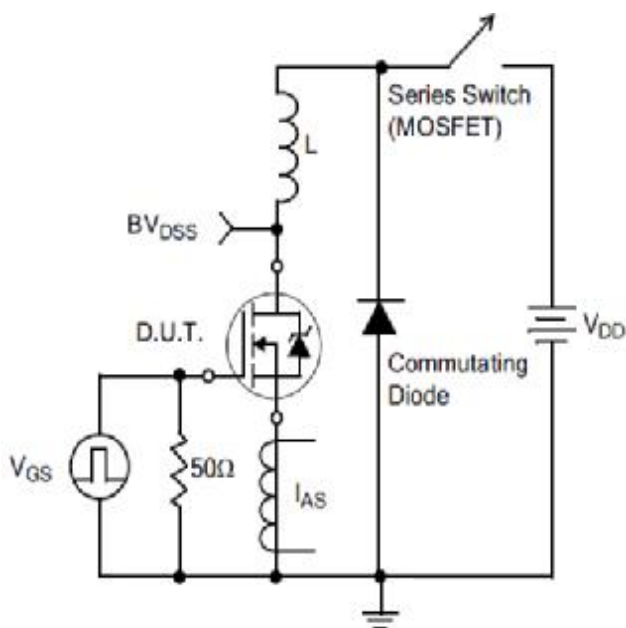
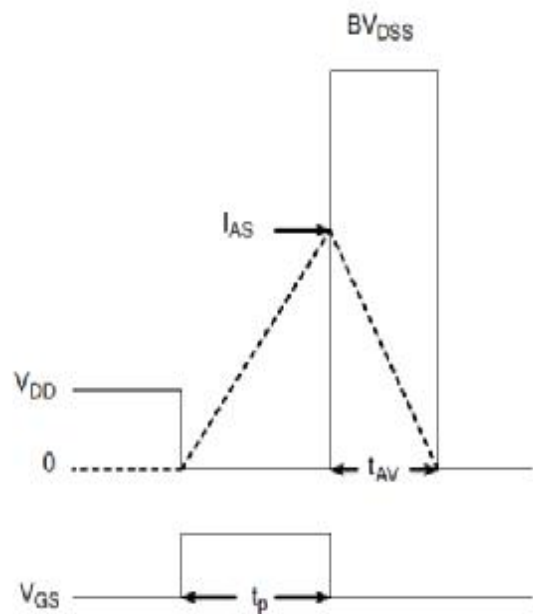


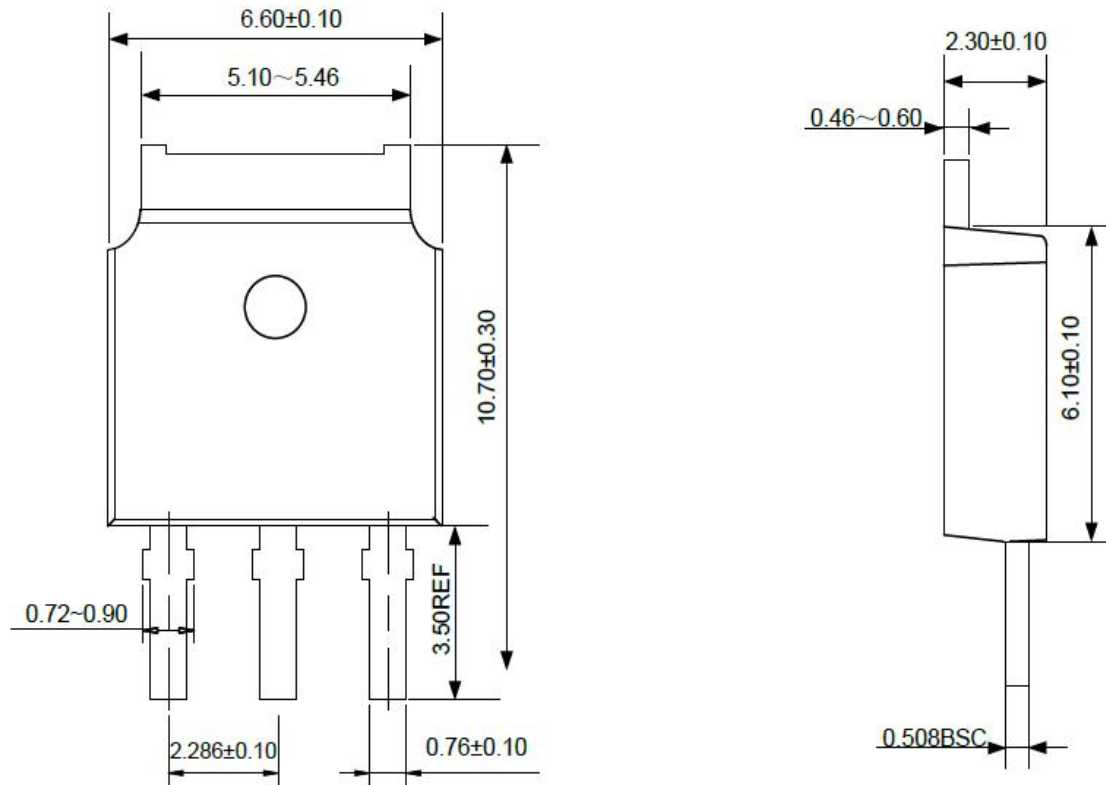
Figure17. Unclamped Inductive Switching Test Circuit



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

Figure18. Unclamped Inductive Switching Waveforms

Package outline drawing



T0-251 (Short Pin)



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    - 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.
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-