N Channel MOSFET

Lead Free Package and Finish

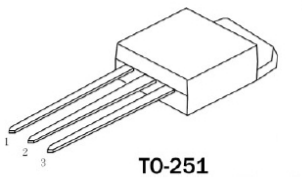
Applications:

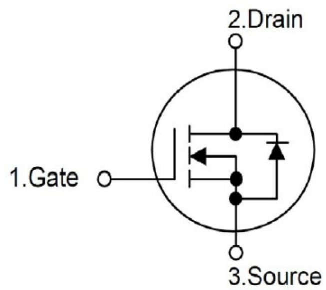
- •Adapter & Charger
- •SMPS Standby Power
- •AC-DC Switching Power Supply
- •LED driving power

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

Features:

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





Not to Scale

Ordering Information

Part Number	Package	Marking
RS4N60M	TO-251	RS4N60M

Absolute Maximun Ratings Tc=25℃ unless otherwise specified

Symbol	Parameter	RS4N60M	Units
VDSS	Drain-to-Source Voltage (Note*1)	600	V
ID	Continuous Drain Current	4.0	A
ID@ 100 ℃	Continuous Drain Current	2.5	
IDM	Pulsed Drain Current (Note*2)	16.0	
PD	Power Dissipation	86	W
	Derating Factor above 25℃	0.69	W/℃
VGS	Gate-to-Source Voltage	±30	V
EAS	Single Pulse Avalanche Engergy L=30mH IAS=3.45A VDD=100V RG=25Ω TJ=25℃	217	mJ
TL TPKG	Maximum Temperature for Soldering Leads at 0.063in(1.6mm)from Case for 10 seconds Package Body for 10 seconds	300 260	℃
TJ and TSTG	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	RS4N60M	Units	Test Conditions
$R_{\theta JC}$	Junction-to-Case	1.45	℃/W	Drain lead soldered to water cooled heatsink, PD adjusted for a peak junction temperature of +150℃.
$R_{\theta JA}$	Junction-to-Ambient	110		1 cubic foot chamber, free air.

OFF Characteristics TJ=25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain-to-source Breakdown Voltage	600	--	--	V	V_{GS}=0V, I_D=250μA
I_{DSS}	Drain-to-Source Leakage Current	--	--	1.0	μA	V_{DS}=600V, 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 TJ=25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R_{DS}(on)	Static Drain-to-Source On-Resistance	--	2.0	2.4	Ω	V_{GS}=10V, I_D=2A
V_{GS}(TH)	Gate Threshold Voltage	2.0	--	4.0	V	V_{GS}=V_{DS}, I_D=250μA

Resistive Switching Characteristics Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
t_d(ON)	Turn-on Delay Time	--	14.2	--	nS	V_{DS}=300V I_D=4.0A R_G=25Ω (Note:3,4)
t_{rise}	Rise Time	--	27.73	--		
t_d(OFF)	Turn-OFF Delay Time	--	34.67	--		
t_{fall}	Fall Time	--	28.53	--		

Dynamic Characteristics Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
C_{iss}	Input Capacitance	--	509.0	--	pF	V_{GS}=0V V_{DS}=25V f=1.0MHz
C_{oss}	Output Capacitance	--	57.57	--		
C_{rss}	Reverse Transfer Capacitance	--	2.59	--		
Q_g	Total Gate Charge	--	11.88	--	nC	V_{DS}=480V I_D=4.0A V_{GS}=10V (Note:3,4)
Q_{gs}	Gate-to-Source Charge	--	3.33	--		
Q_{gd}	Gate-to-Drain("Miller") Charge	--	4.90	--		

Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current	--	--	4.0	A	Integral pn-diode in MOSFET
I_{SM}	Maximum Pulsed Current	--	--	16.0	A	
V_{SD}	Diode Forward Voltage	--	--	1.4	V	I_S=4.0A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	--	408.00	--	nS	V_{GS}=0V I_S=4.0A, di/dt=100A/µs
Q_{rr}	Reverse Recovery Charge	--	1.98	--	µC	

Notes:

*1. TJ=±25℃ to +150℃.
*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

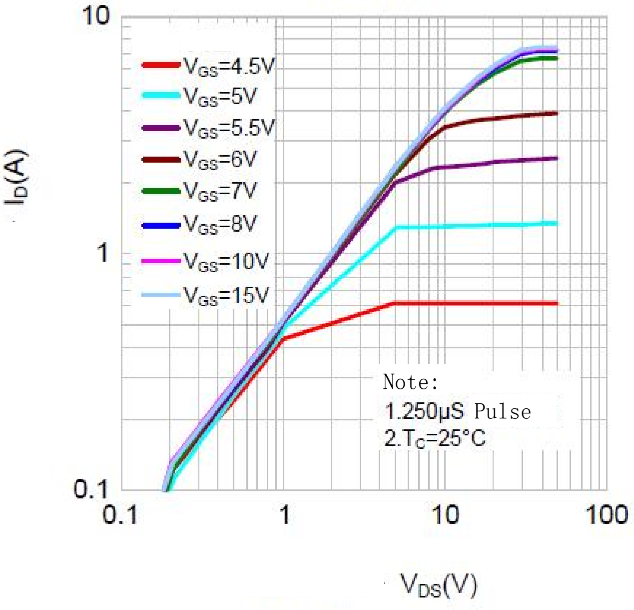
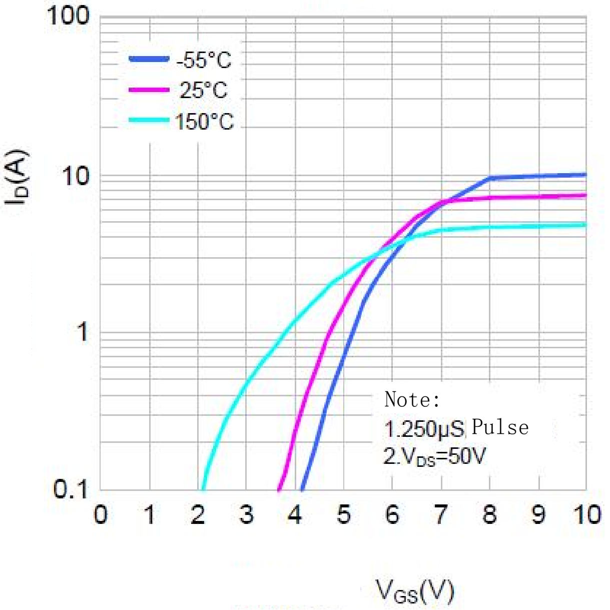
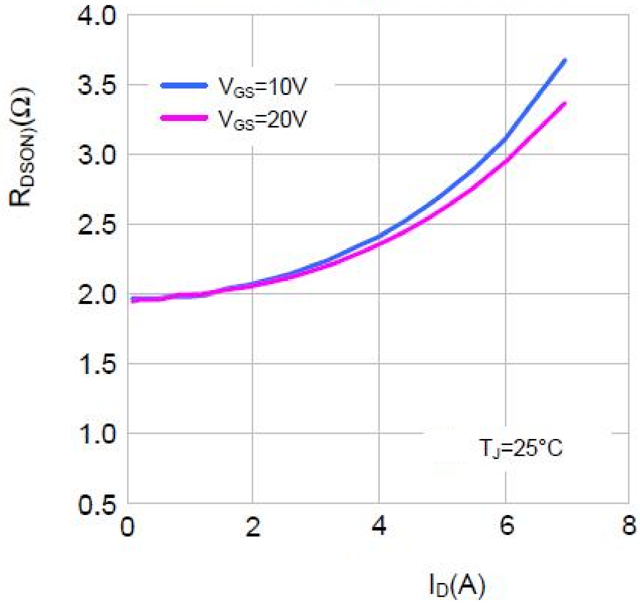


Figure2. Typical Transfer Characteristics



Figuer3.Typical ON Resistance vs Drain Current



Figuer4.Typical Body Diode Transfer Characteristics

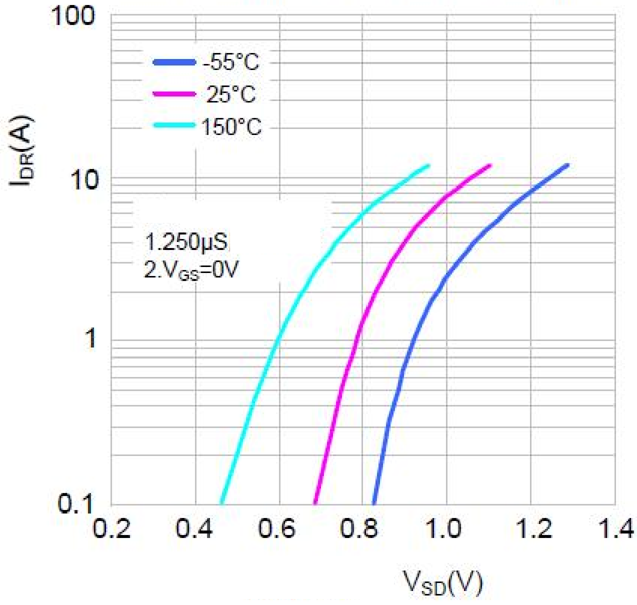


Figure5.Typical Capacitance vs Drain-to-Source Voltage

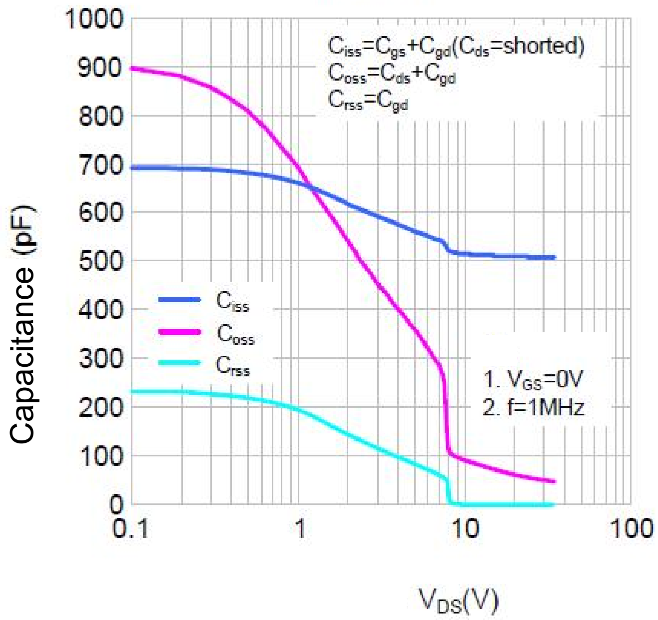


Figure6.Typical Gate Charge vs Gate-to-Source Voltage

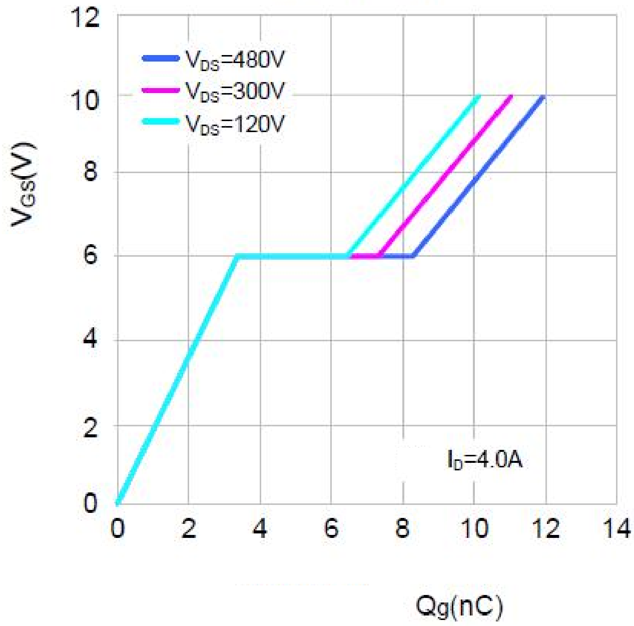


Figure7. Typical Breakdown Voltage vs Junation Temperature

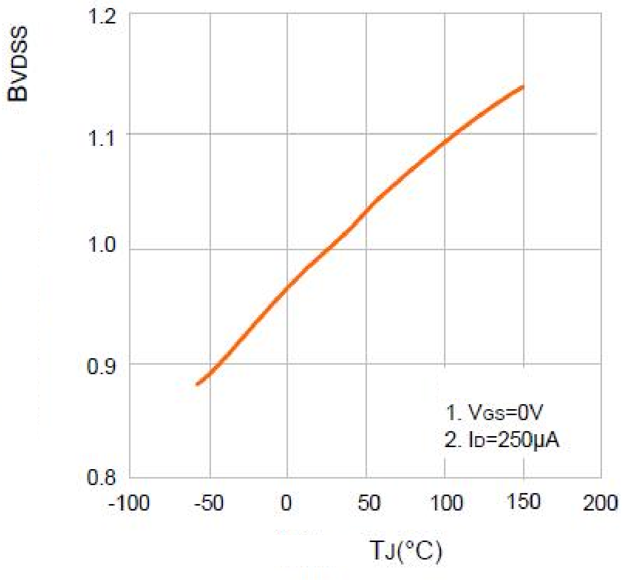


Figure8. Figure10.Typical Drain-to-Source ON Resistance vs Junction Temperature

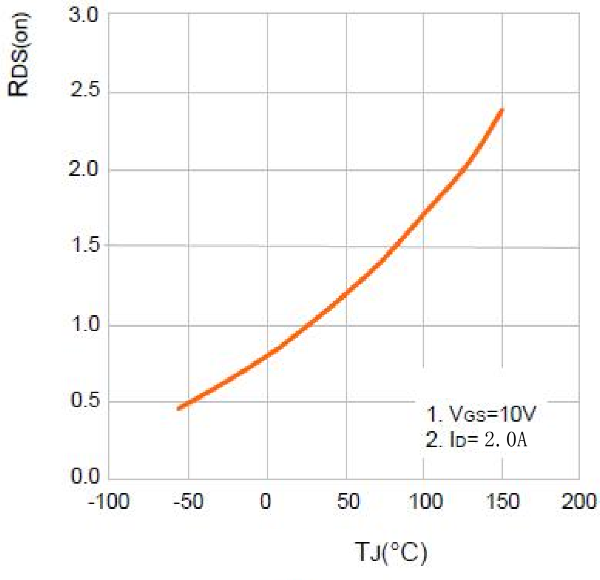


Figure9.Maximum Continuous Drain Current vs Case Temperature

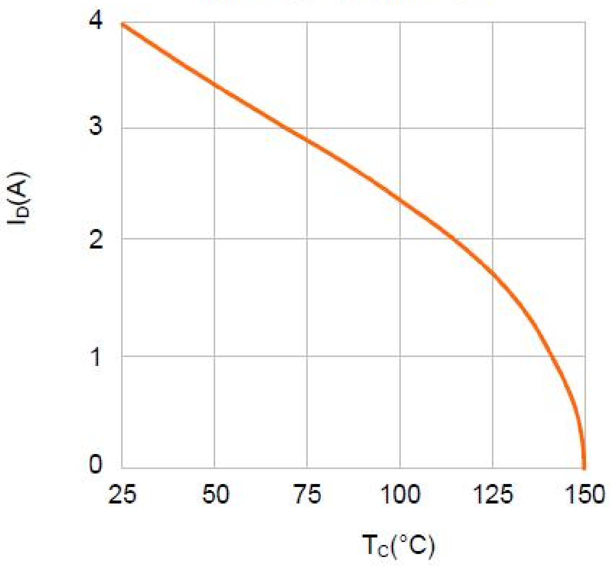
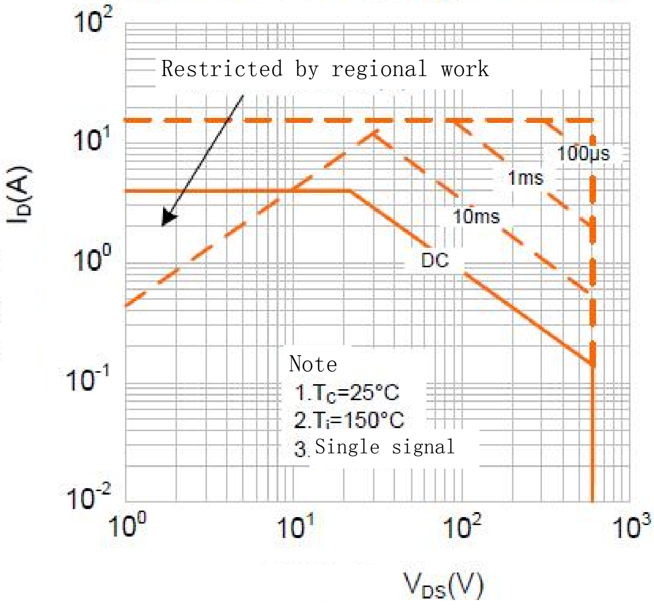


Figure10.Maximum Continuous Drain Current vs Case Temperature



Test Circuits and Waveforms

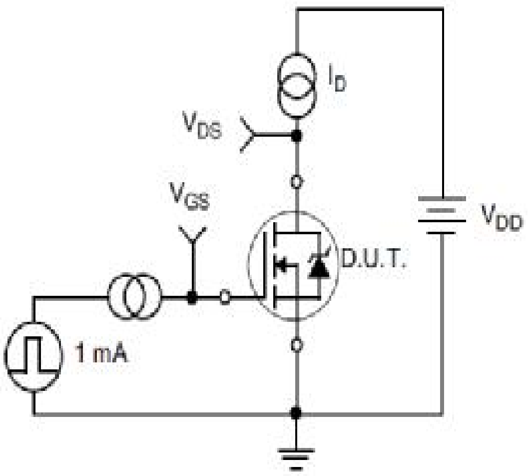


Figure11.
Gate Charge Test Circuit

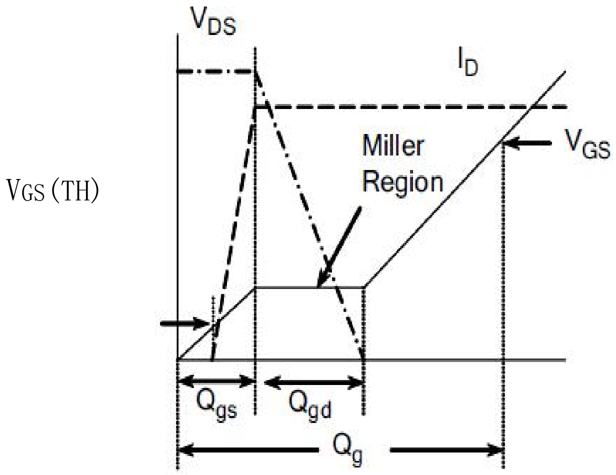


Figure12.
Gate Charge Waveform

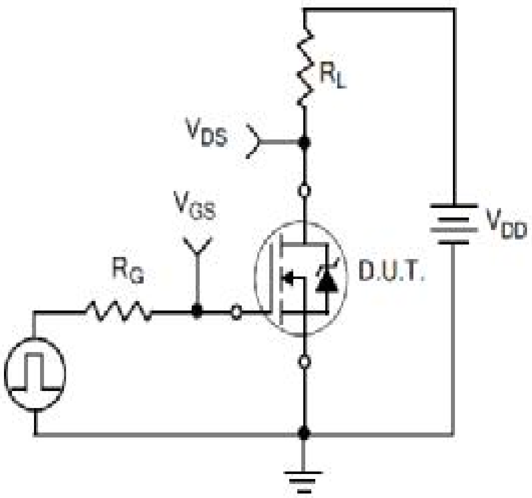


Figure13.
Resistive Switching Test Circuit

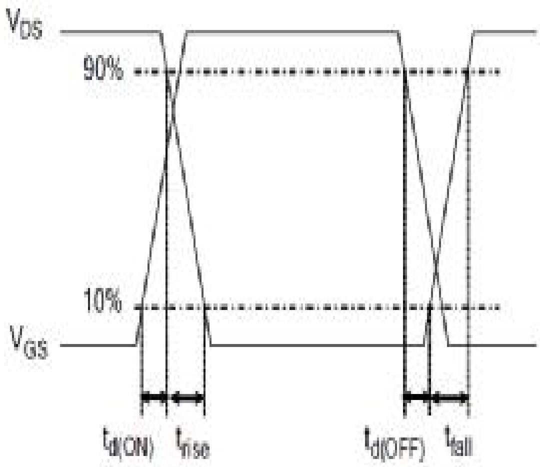


Figure14.
Resistive Switching Waveforms

Test Circuits and Waveforms

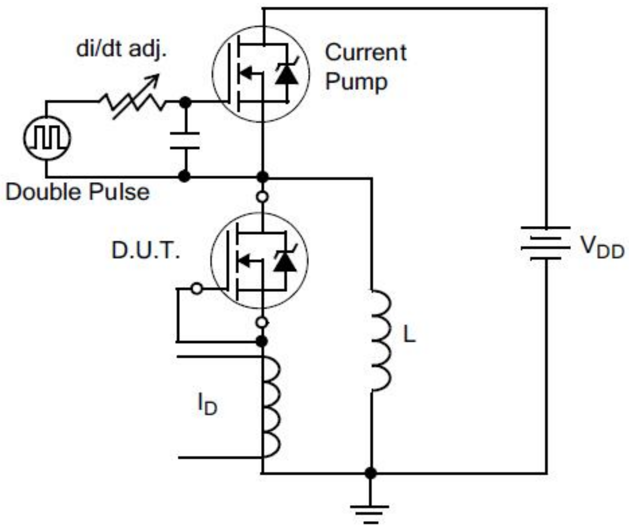


Figure15. Diode Reverse Recovery
Test Circuit

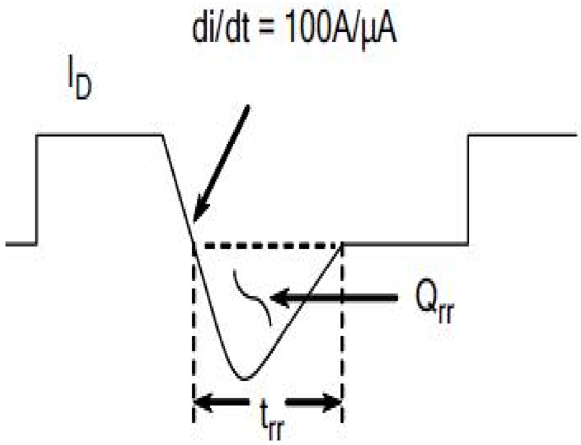


Figure16. Diode Reverse Recovery
Waveform

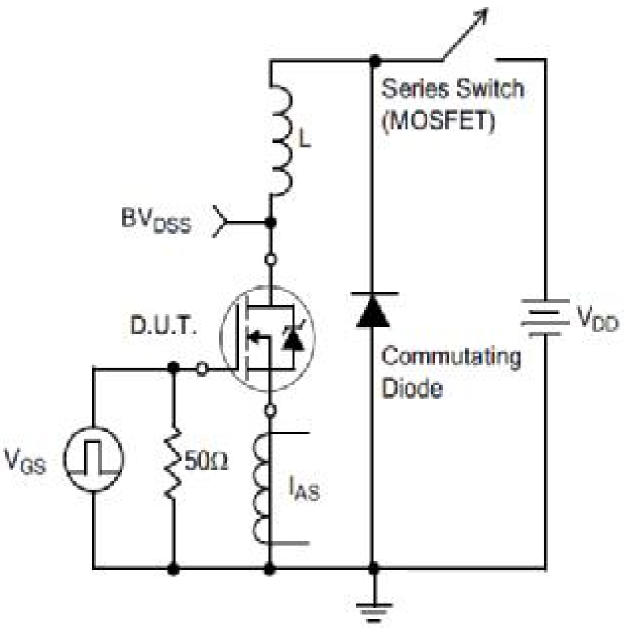
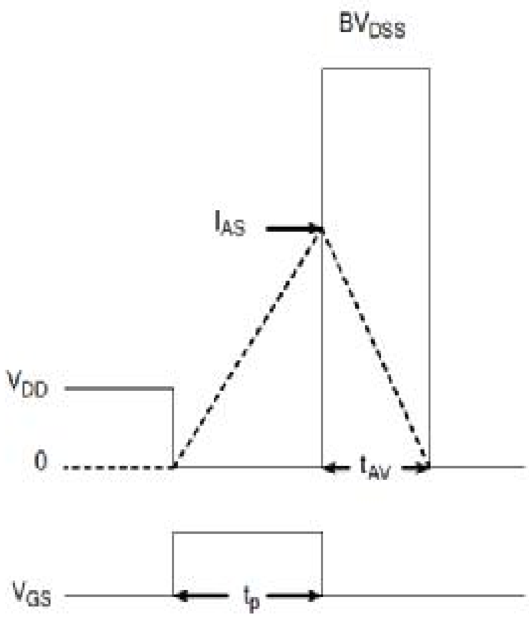


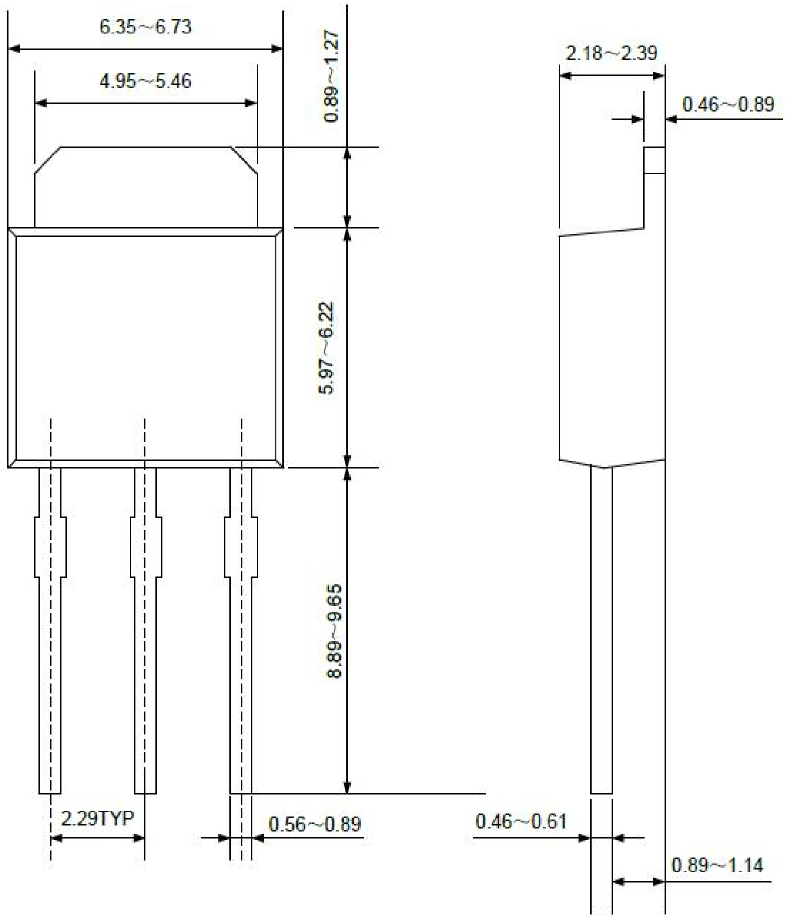
Figure17. Unclamped Inductive
Switching Test Circuit



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

Figure18. Unclamped Inductive
Switching Waveforms

Package outline drawing



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