



### N-Channel Enhancement Mode Power MOSFET **MX6010**

#### DESCRIPTION

The MX6010 is the high cell density trench N-Channel MOSFETs, which provide excellent  $R_{DS(ON)}$  and gate charge for most of the synchronous buck converter applications.

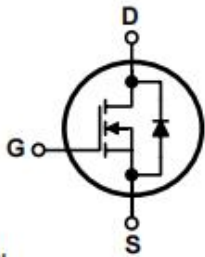
#### GENERAL FEATURES

- $V_{DS}=60V$ ,  $I_D=10A$   
 $R_{DS(ON)}(Typ.)=15m\Omega$  @  $V_{GS}=10V$   
 $R_{DS(ON)}(Typ.)=18m\Omega$  @  $V_{GS}=4.5V$
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

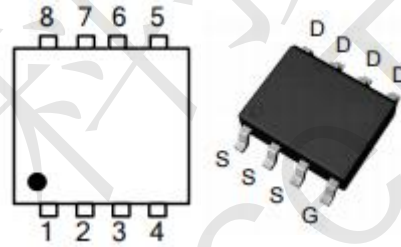
#### Applications

- SMPS Synchronous Rectification
- DC-DC Conversion
- Load Switch

#### PINOUT



Schematic diagram



SOP-8 top view

#### ORDERING INFORMATION

Part Number	Storage Temperature	Package	Devices Per Reel
MX6010	-55°C to 150°C	SOP-8	-

#### ABSOLUTE MAXIMUM RATINGS ( $T_A=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	10	A
Continuous Drain Current ( $T_A=70^\circ C$ )	$I_D$	8	A
Diode Continuous Forward Current	$I_S$	5	A
Pulsed Drain Current <sup>(Note1)</sup>	$I_{DM}$	38	A
Avalanche Current <sup>(Note2)</sup>	$I_{AS}$	27	A
Single Pulse Avalanche Energy <sup>(Note2)</sup>	$E_{AS}$	36	mJ
Maximum Power Dissipation	$P_D$	3.5	W
Maximum Power Dissipation ( $T_A=70^\circ C$ )	$P_D$	2.2	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$
Thermal Resistance, Junction-to-Ambient <sup>(Note3)</sup>	$R_{\theta JA}$	35	$^\circ C/W$

Note 1. Repetitive Rating: Pulse width limited by maximum junction temperature.

Note 2. UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature  $T_J=25^\circ C$ )

Note 3. Surface Mounted on 1 in<sup>2</sup> pad area.



#### ELECTRICAL CHARACTERISTICS ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_{DS}=250\mu A$	60	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=48V, V_{GS}=0V$	-	-	1	$\mu A$
		$V_{DS}=48V, V_{GS}=0V, T_J=85^\circ C$	-	-	30	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1.4	-	2.4	V
Drain-Source On-Resistance <sup>(Note1)</sup>	$R_{DS(ON)}$	$V_{GS}=10V, I_{DS}=10A$	-	15	22	m $\Omega$
		$V_{GS}=4.5V, I_{DS}=7A$	-	18	28	m $\Omega$
Gate Resistance	$R_G$	$V_{GS}=0V, V_{DS}=0V, F=1MHz$	-	2.5	-	$\Omega$
<b>Dynamic Characteristics<sup>(Note2)</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS}=30V, V_{GS}=0V, F=1.0MHz$	-	1378	1780	pF
Output Capacitance	$C_{oss}$		-	135	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	60	-	pF
<b>Switching Characteristics<sup>(Note2)</sup></b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_{DS}=1A, R_G=6\Omega, R_L=30\Omega, V_{GEN}=10V$	-	14	26	nS
Turn-on Rise Time	$t_r$		-	8	15	nS
Turn-Off Delay Time	$t_{d(off)}$		-	38	69	nS
Turn-Off Fall Time	$t_f$		-	12	22	nS
Total Gate Charge	$Q_g$	$V_{DS}=30V, I_{DS}=10A, V_{GS}=10V$	-	26	37	nC
Gate-Source Charge	$Q_{gs}$		-	5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	5	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note1)</sup>	$V_{SD}$	$V_{GS}=0V, I_{SD}=10A$	-	0.8	1.3	V
Reverse Recovery Time	$t_{rr}$	$I_{SD}=10A, dl_{SD}/dt=100A/\mu s$	-	21	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	22	-	nC

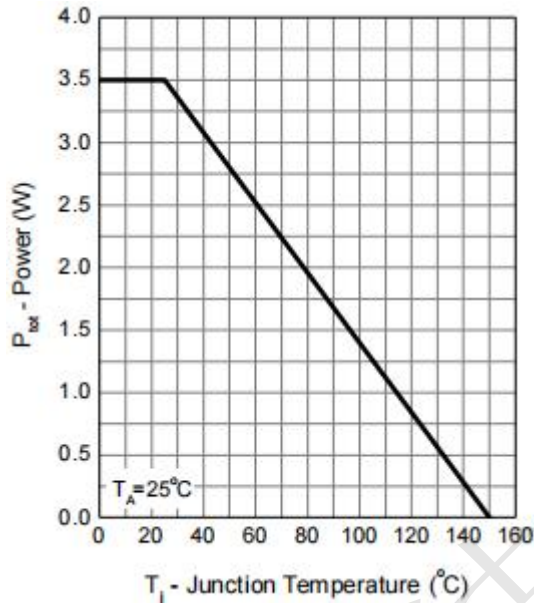
Note 1. Pulse test: Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

Note 2. Guaranteed by design, not subject to production testing

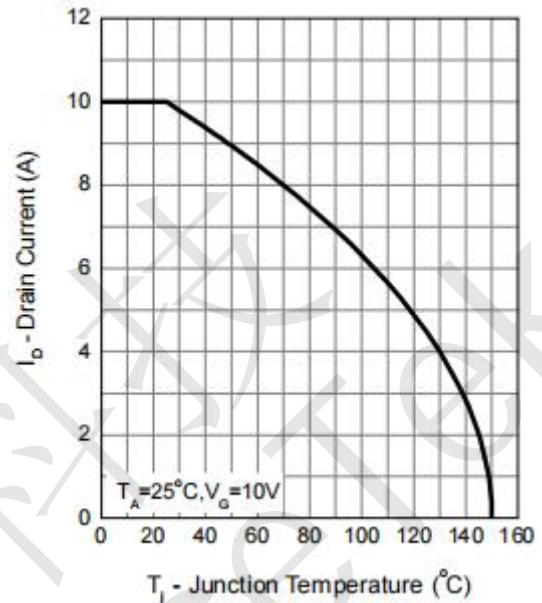


## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

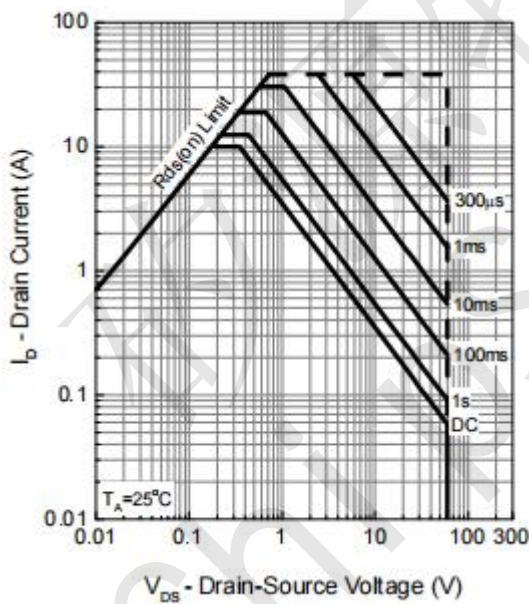
### Figure 1. Power Dissipation



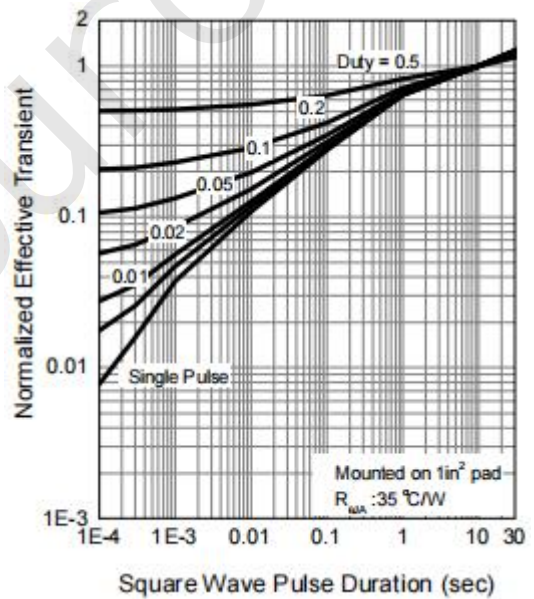
### Figure 2. Drain Current



### Figure 3. Safe Operation Area



### Figure 4. Thermal Transient Impedance





#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 5. Output Characteristics

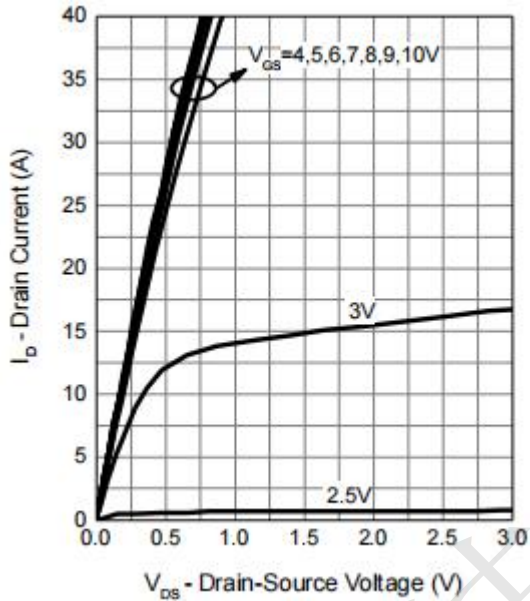


Figure 6. Drain-Source On Resistance

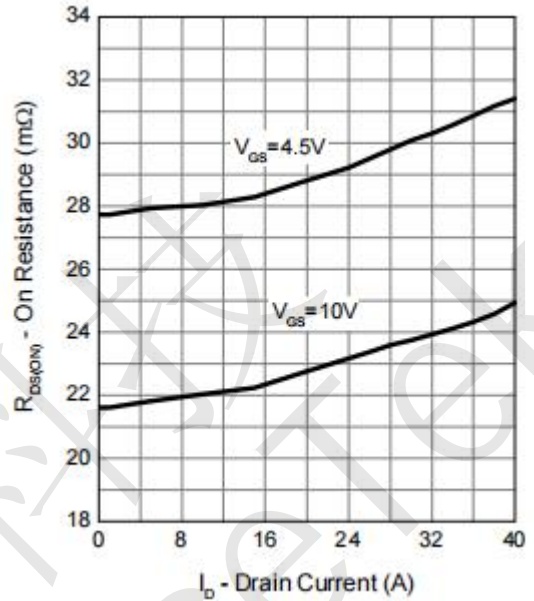


Figure 7. Gate-Source On Resistance

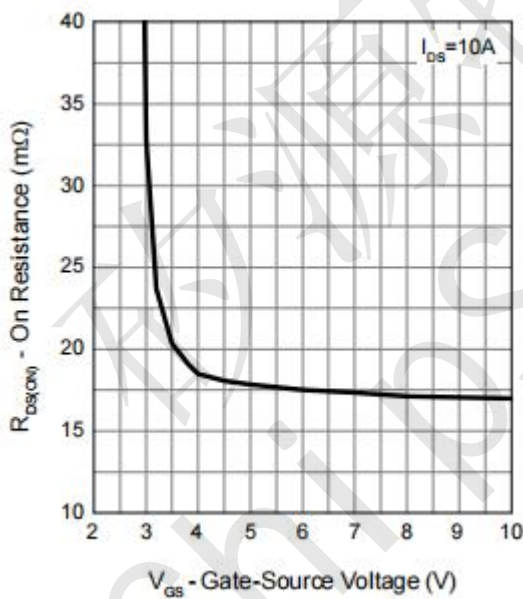
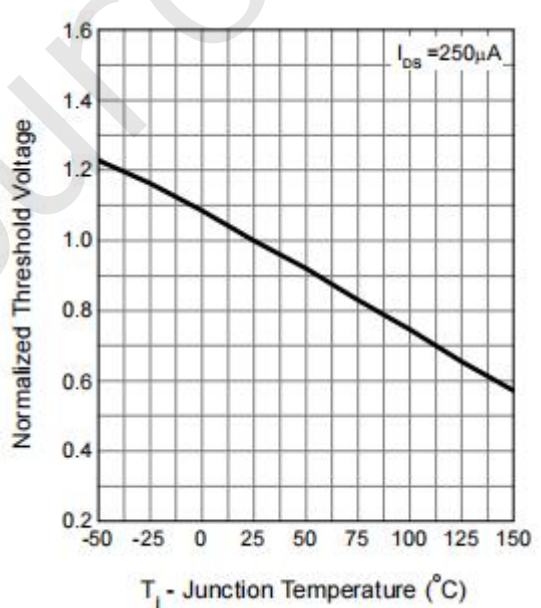


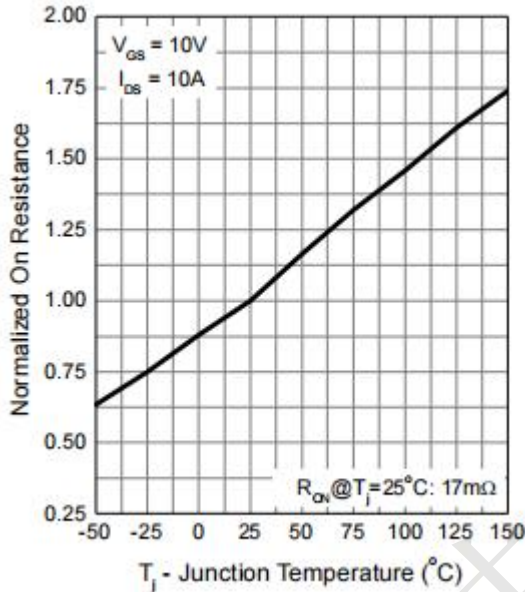
Figure 8. Gate Threshold Voltage



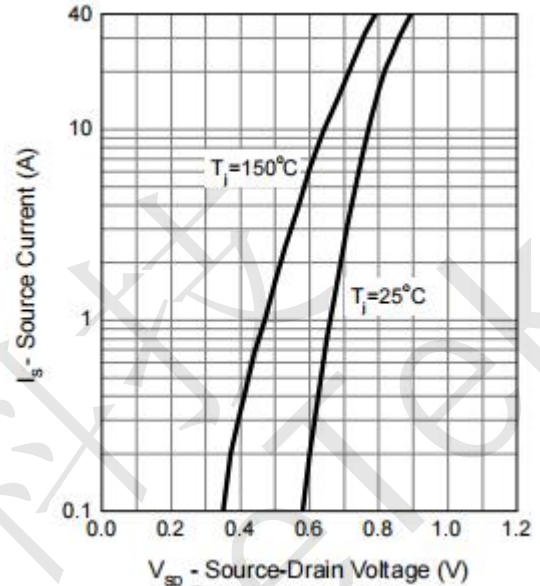


#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

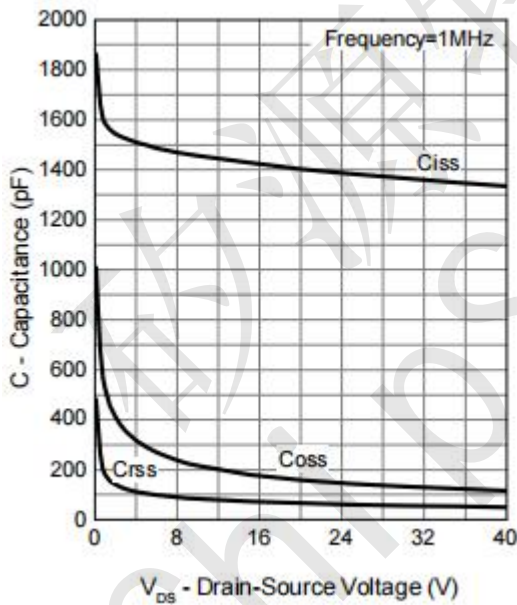
**Figure 9. Drain-Source On Resistance**



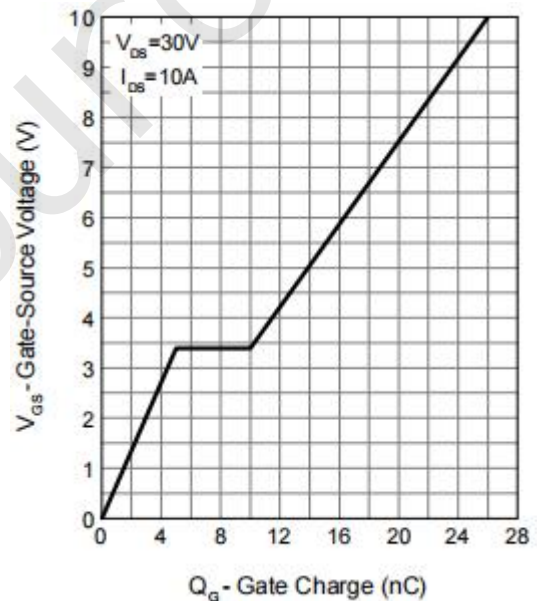
**Figure 10. Source-Drain Diode Forward**



**Figure 11. Capacitance**



**Figure 12. Gate Charge**





## TEST CIRCUIT AND WAVEFORMS

Figure 1. Avalanche Test Circuit and Waveforms

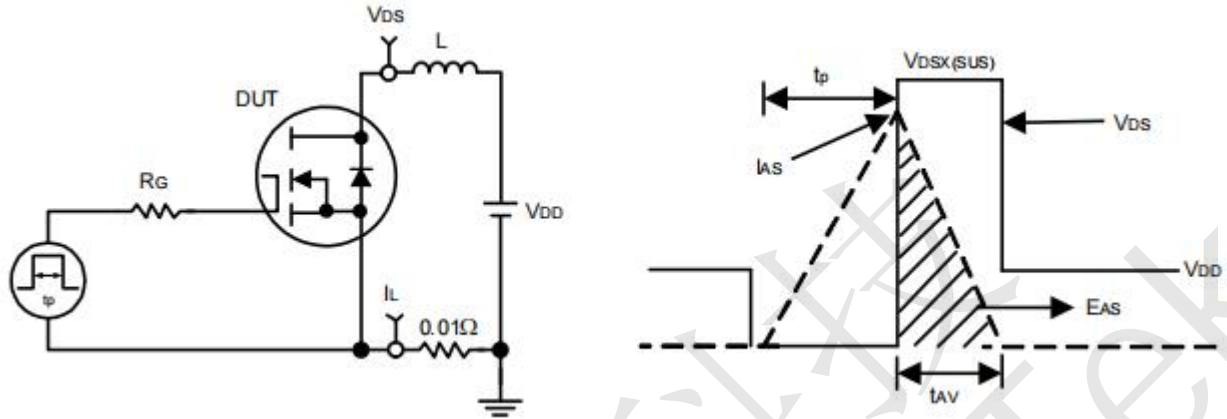
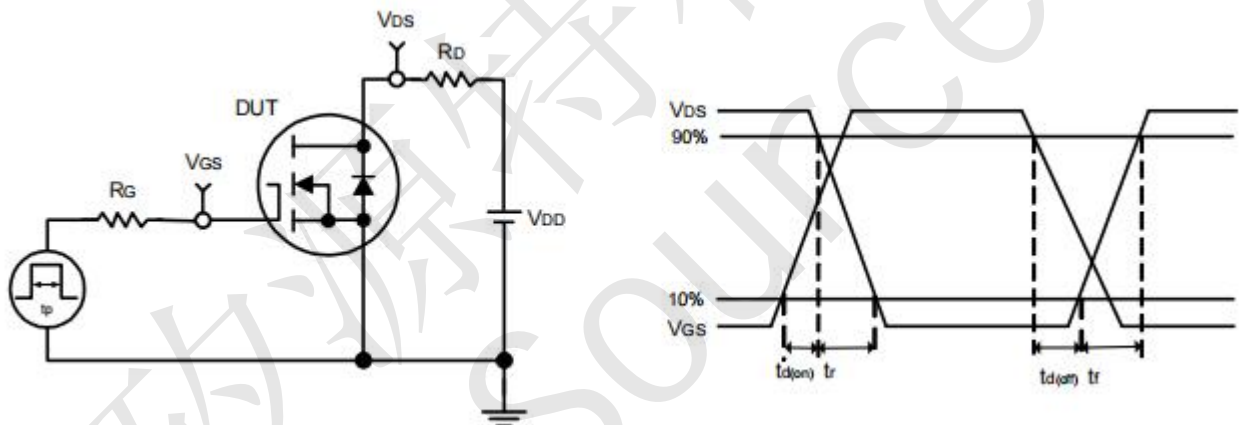


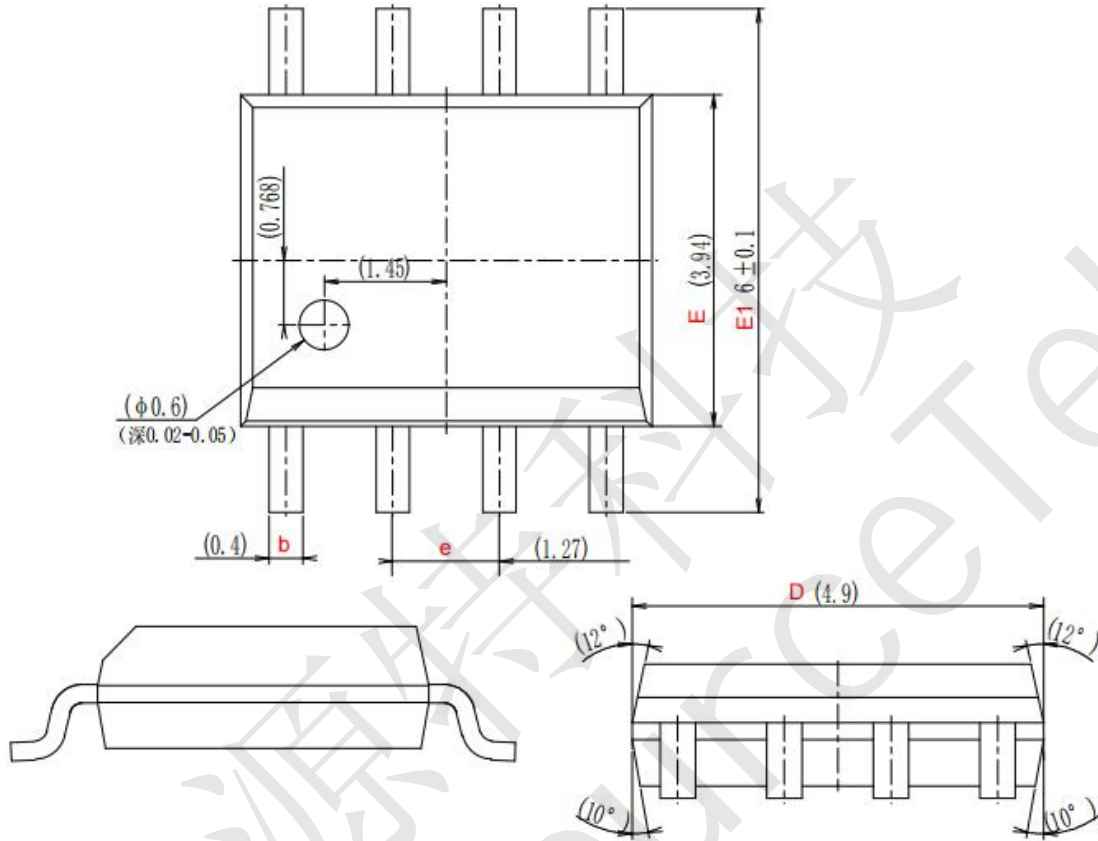
Figure 2. Switching Time Test Circuit and Waveforms





## PACKAGE INFORMATION

SOP8



Symbol	Dimensions in Millimeters		
	Min.	Nom.	Max.
A	1.500	1.600	1.700
A1	0.050	-	-
A2	1.350	1.450	1.550
b	0.300	0.400	0.500
c	0.220	0.254	0.280
D	4.800	4.900	5.000
E	3.840	3.940	4.040
E1	5.900	6.000	6.100
e	1.27 (BSC)		
L	0.520	0.620	0.720
θ	0°	-	8°