

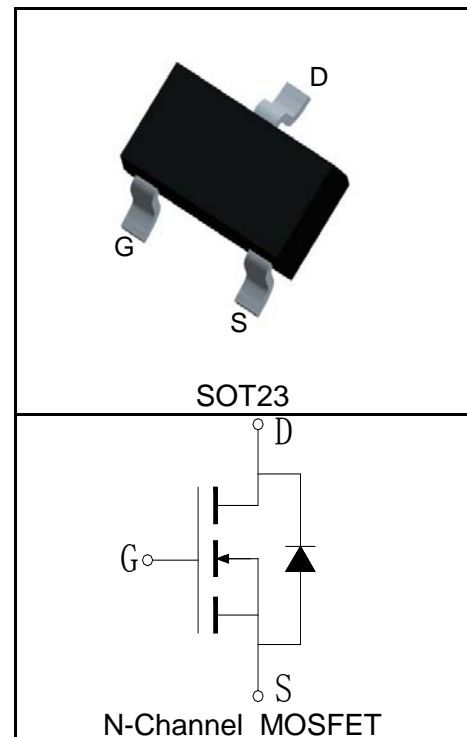
### Features

- 60V/0.5A,  
 $R_{DS(ON)} = 4500m\Omega(Typ.)@V_{GS}=10V$   
 $R_{DS(ON)} = 5250m\Omega(Typ.)@V_{GS}=4.5V$
- Low On-Resistance
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

### Applications

- Power Management in Desktop Computer or DC/DC Converters

### Pin Description



### Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	
<b>Common Ratings</b> ( $T_A=25^\circ C$ Unless Otherwise Noted)				
$V_{DSS}$	Drain-Source Voltage	60	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		
$T_J$	Maximum Junction Temperature	150	$^\circ C$	
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$	
$I_S$	Diode Continuous Forward Current	$T_A=25^\circ C$	1.25	A
<b>Mounted on Large Heat Sink</b>				
$I_{DP}^{①}$	300 $\mu s$ Pulse Drain Current Tested	$T_A=25^\circ C$	2	A
$I_D^{②}$	Continuous Drain Current( $V_{GS}=10V$ )	$T_A=25^\circ C$	0.5	A
		$T_A=70^\circ C$	0.4	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ C$	1	W
		$T_A=70^\circ C$	0.64	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	-	$^\circ C/W$	
$R_{\theta JA}^{③}$	Thermal Resistance-Junction to Ambient	125	$^\circ C/W$	
<b>Drain-Source Avalanche Ratings</b>				
$E_{AS}^{④}$	Avalanche Energy, Single Pulsed	TBD	mJ	

**Electrical Characteristics** ( $T_A=25^{\circ}\text{C}$  Unless Otherwise Noted)

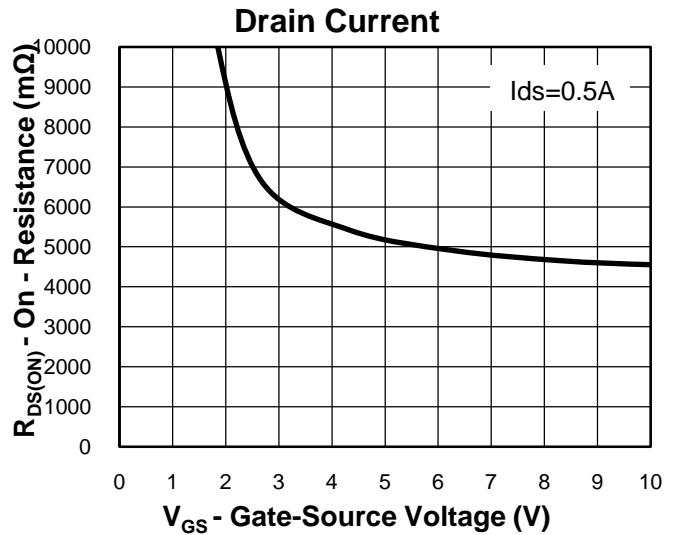
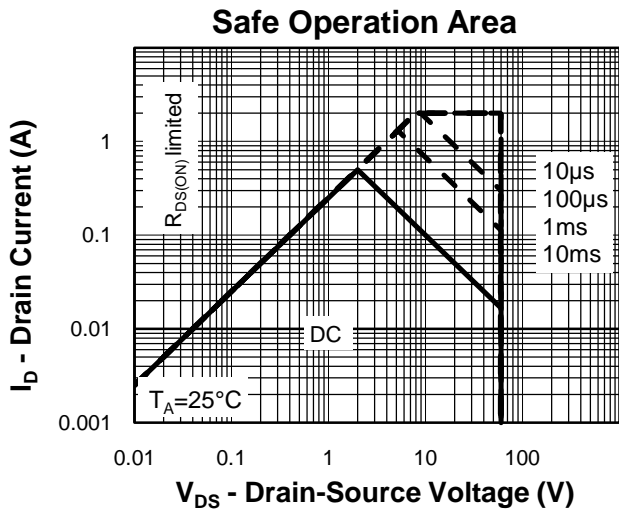
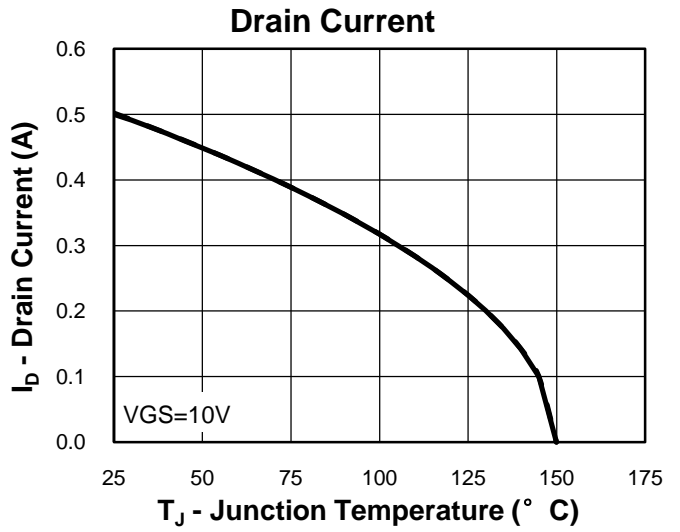
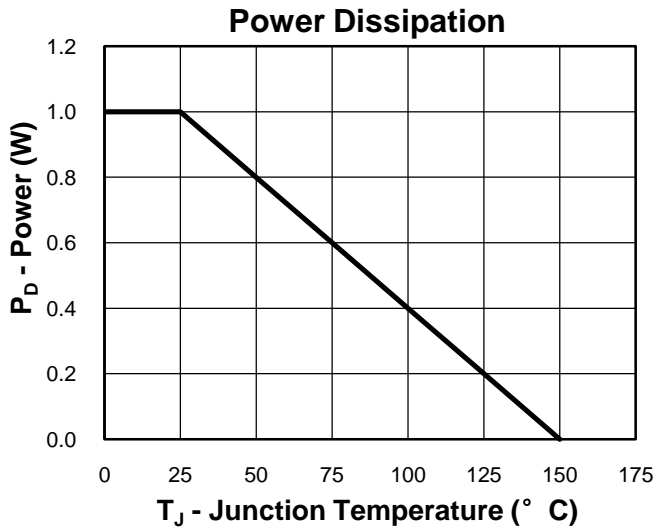
Symbol	Parameter	Test Condition	2N7002			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	60			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=60V, V_{GS}=0V$			1	$\mu A$
		$T_J=125^{\circ}\text{C}$			30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1		2.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$R_{DS(ON)}^{(5)}$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=0.5A$		4500	7500	$m\Omega$
		$V_{GS}=4.5V, I_{DS}=0.2A$		5250	7500	$m\Omega$
<b>Diode Characteristics</b>						
$V_{SD}^{(5)}$	Diode Forward Voltage	$I_{SD}=0.5A, V_{GS}=0V$			1.2	V
$t_{rr}$	Reverse Recovery Time	$I_{SD}=0.5A, dI_{SD}/dt=100A/\mu s$		19		ns
$Q_{rr}$	Reverse Recovery Charge			8		nC
<b>Dynamic Characteristics<sup>(6)</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$		0.5		$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=30V, \text{Frequency}=1.0\text{MHz}$		250		pF
$C_{oss}$	Output Capacitance			65		
$C_{rss}$	Reverse Transfer Capacitance			30		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=30V, I_{DS}=0.5A, V_{GEN}=10V, R_G=6\Omega$		6		ns
$t_r$	Turn-on Rise Time			15		
$t_{d(OFF)}$	Turn-off Delay Time			29		
$t_f$	Turn-off Fall Time			9		
<b>Gate Charge Characteristics<sup>(6)</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=48V, V_{GS}=10V, I_{DS}=0.5A$		7		nC
$Q_{gs}$	Gate-Source Charge			1.4		
$Q_{gd}$	Gate-Drain Charge			2.5		

- Notes:
- ① Pulse width limited by safe operating area.
  - ② Calculated continuous current based on maximum allowable junction temperature.
  - ③ When mounted on 1 inch square copper board,  $t \leq 10\text{sec}$ . The value in any given application depends on the user's specific board design.
  - ④ Limited by  $T_{jmax}$ . Starting  $T_j = 25^{\circ}\text{C}$ .
  - ⑤ Pulse test; Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
  - ⑥ Guaranteed by design, not subject to production testing.

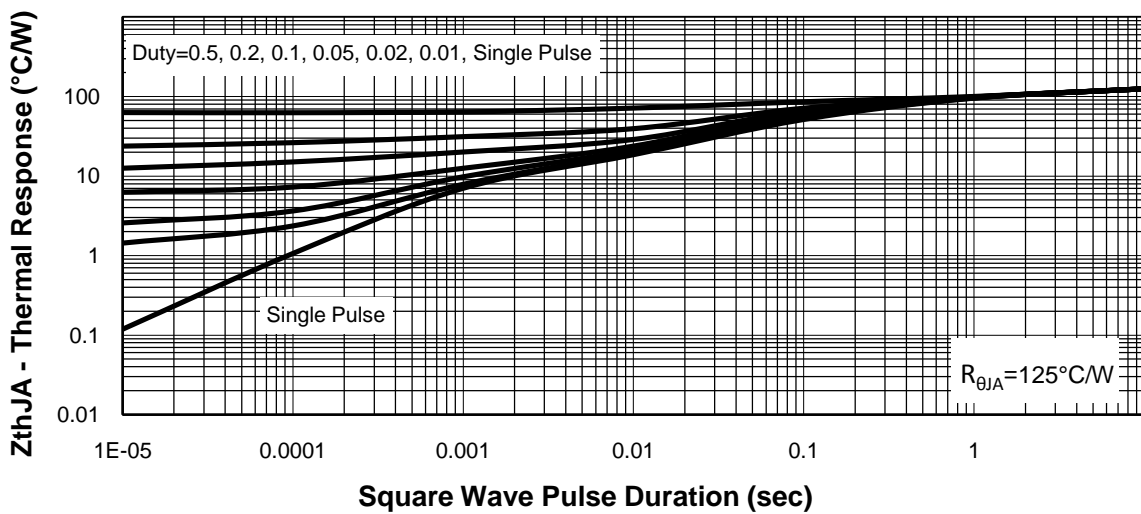
**Ordering and Marking Information**

<b>Device</b>	<b>Marking</b>	<b>Package</b>	<b>Packaging</b>	<b>Quantity</b>	<b>Reel Size</b>	<b>Tape width</b>
2N7002	7002	SOT23	Tape&Reel	3000	7"	8mm

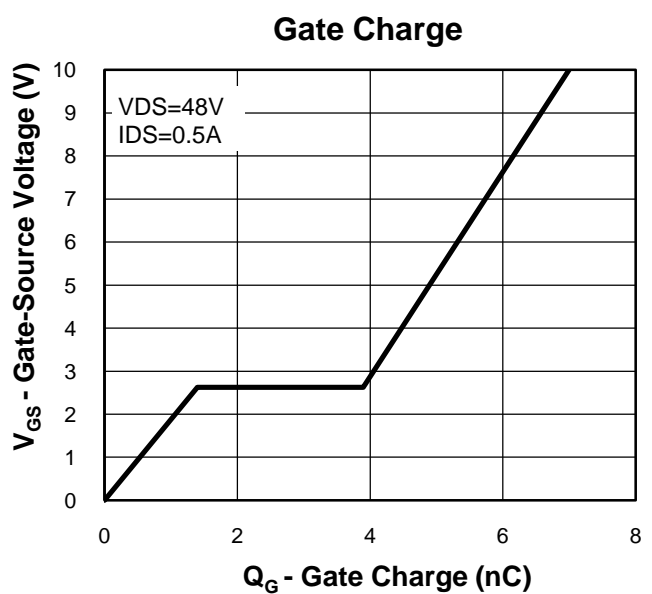
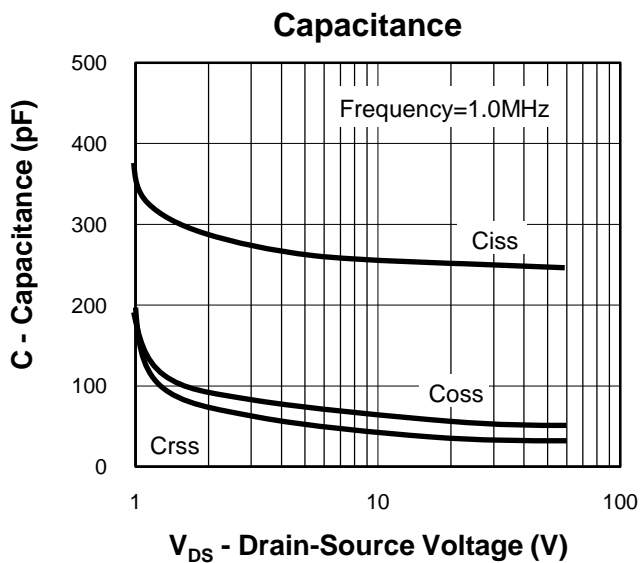
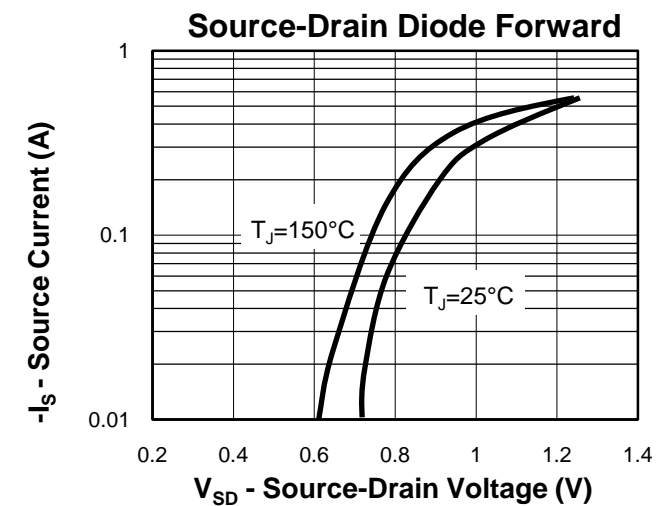
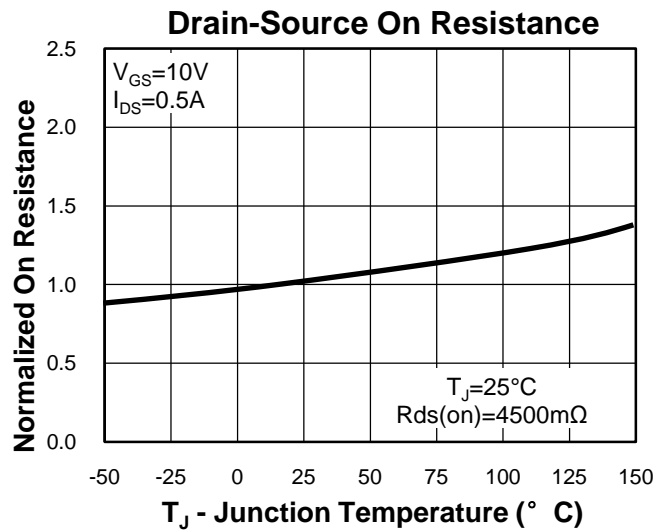
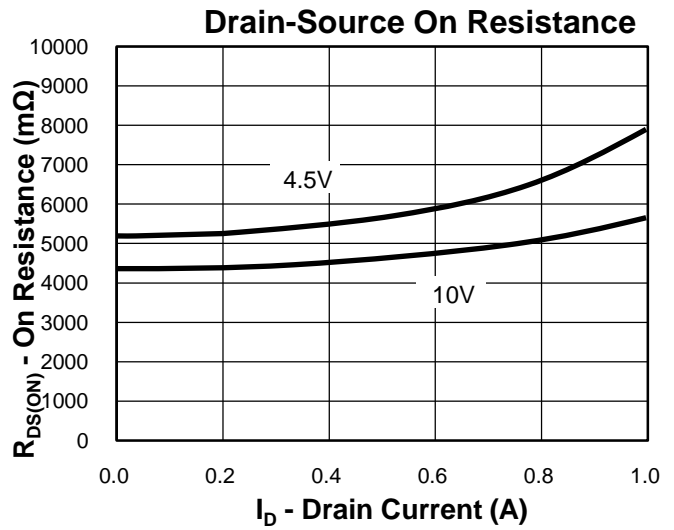
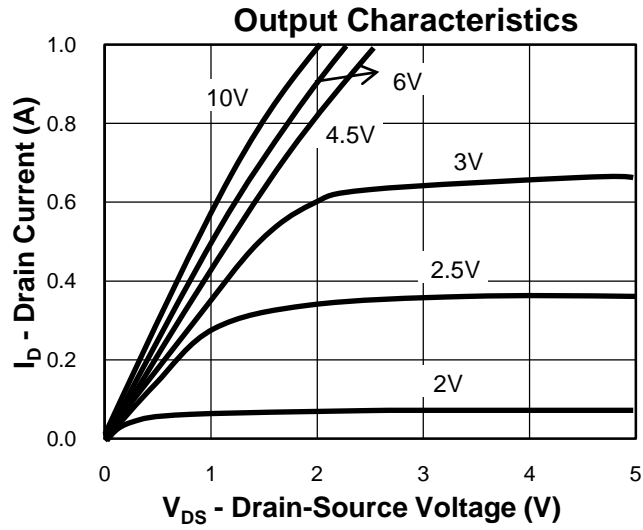
Typical Characteristics



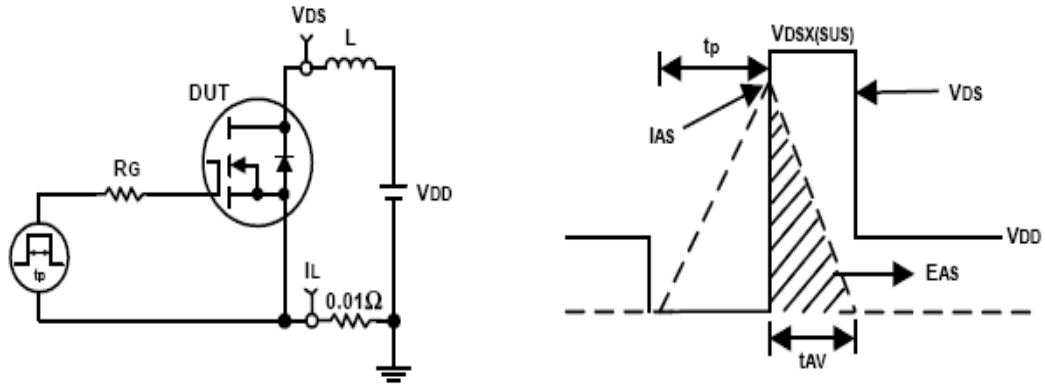
Thermal Transient Impedance



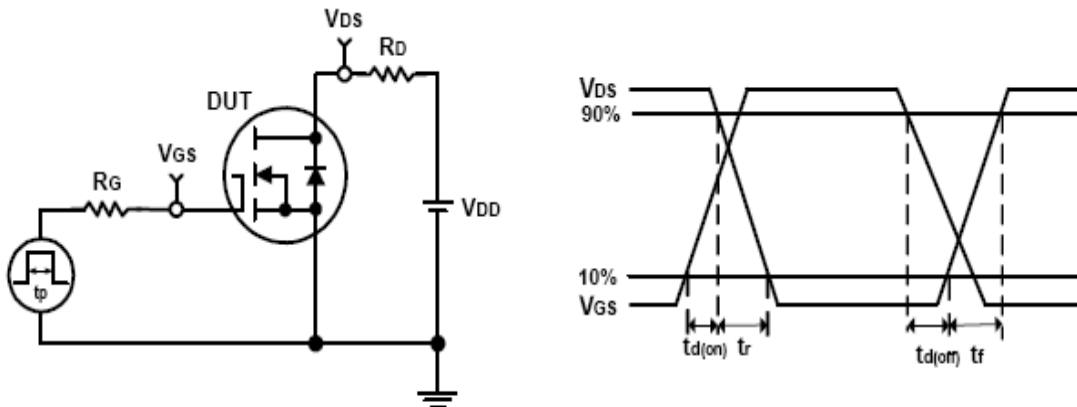
Typical Characteristics



**Avalanche Test Circuit and Waveforms**

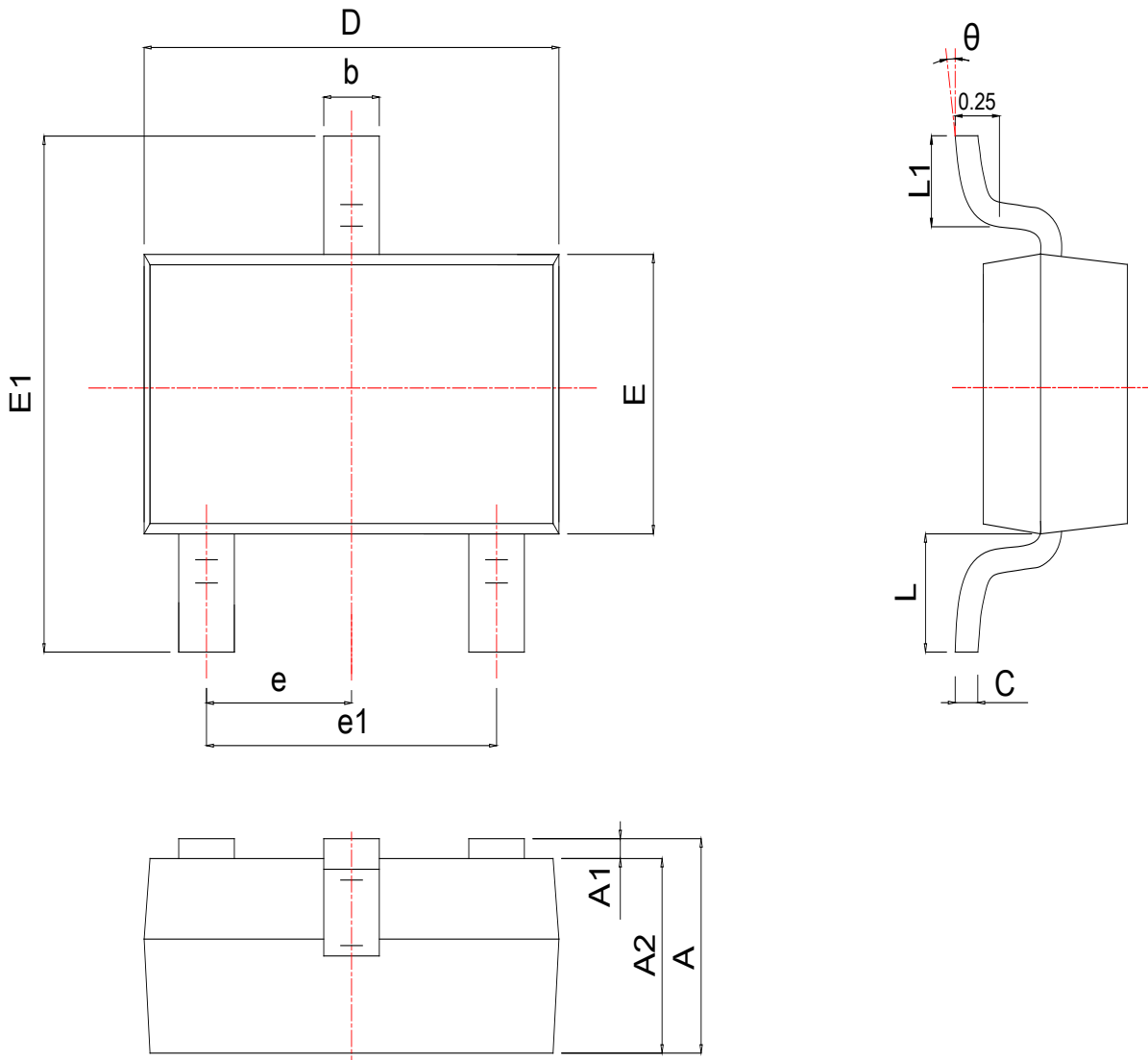


**Switching Time Test Circuit and Waveforms**



**Package Information**

**SOT23**



SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.900	1.025	1.150	0.035	0.040	0.045
A1	0.050	0.075	0.100	0.002	0.003	0.004
A2	0.900	0.975	1.020	0.035	0.038	0.040
b	0.300	0.400	0.500	0.012	0.016	0.020
c	0.080	0.115	0.150	0.003	0.005	0.006
D	2.800	2.900	3.000	0.110	0.114	0.118
E	1.200	1.300	1.400	0.047	0.051	0.055
E1	2.250	2.400	2.550	0.089	0.094	0.100
e	0.950 TYP			0.037 TYP		
e1	1.800	1.900	2.000	0.071	0.075	0.079
L	0.540 REF			0.021 REF		
L1	0.400	0.500	0.600	0.016	0.018	0.020
$\theta$	0°	*	8°	0°	*	8°

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