



# 74LVC125A

## LOW VOLTAGE CMOS QUAD BUS BUFFERS (3-STATE) HIGH PERFORMANCE

- 5V TOLERANT INPUTS
- HIGH SPEED:  $t_{pD} = 4.8\text{ns}$  (MAX.) at  $V_{CC} = 3\text{V}$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24\text{mA}$  (MIN) at  $V_{CC} = 3\text{V}$
- PCI BUS LEVELS GUARANTEED AT 24 mA
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(\text{OPR}) = 1.65\text{V}$  to  $3.6\text{V}$  (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 125
- LATCH-UP PERFORMANCE EXCEEDS 500mA (JESD 17)
- ESD PERFORMANCE:  
HBM > 2000V (MIL STD 883 method 3015);  
MM > 200V

### DESCRIPTION

The 74LVC125A is a low voltage CMOS QUAD BUS BUFFER fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for 1.65 to 3.6 V<sub>CC</sub> operations and low power and low noise applications.



**Table 1: Order Codes**

PACKAGE	T & R
SOP	74LVC125AMTR
TSSOP	74LVC125ATTR

It can be interfaced to 5V signal environment for inputs in mixed 3.3/5V system.

These devices require the same 3-STATE control input  $\bar{G}$  to be taken high to make the output go in to the high impedance state.

It has more speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

**Figure 1: Pin Connection And IEC Logic Symbols**

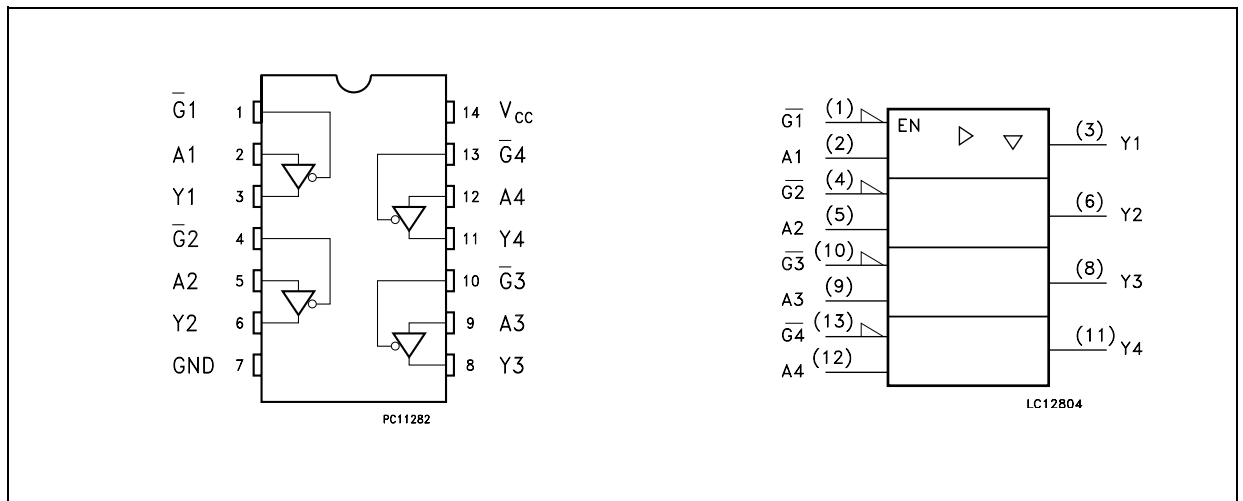


Figure 2: Input And Output Equivalent Circuit

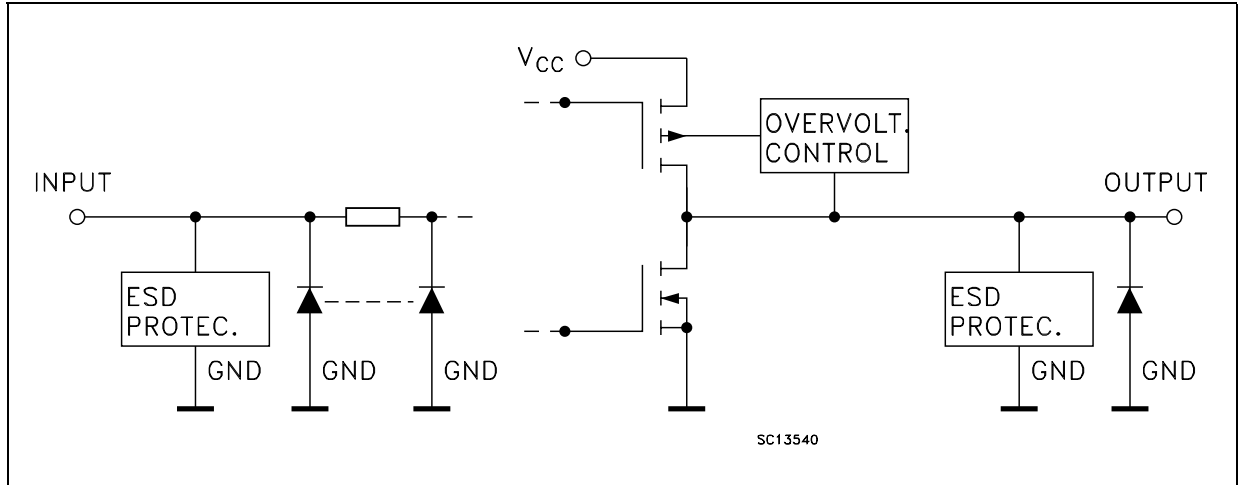


Table 2: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
1, 4, 9, 12	G1 to G4	Output Enable Inputs
2, 5, 10, 13	A1 to A4	Data Inputs
3, 6, 8, 11	Y1 to Y4	Data Outputs
7	GND	Ground (0V)
14	V <sub>CC</sub>	Positive Supply Voltage

Table 3: Truth Table

A	$\bar{G}$	Y
X	H	Z
L	L	L
H	L	H

X : Don't care  
Z : High Impedance

Table 4: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7.0	V
V <sub>I</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>O</sub>	DC Output Voltage (High Impedance or V <sub>CC</sub> = 0V)	-0.5 to +7.0	V
V <sub>O</sub>	DC Output Voltage (High or Low State) (note 1)	-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	- 50	mA
I <sub>OK</sub>	DC Output Diode Current (note 2)	- 50	mA
I <sub>O</sub>	DC Output Current	± 50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current per Supply Pin	± 100	mA
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

- 1) I<sub>O</sub> absolute maximum rating must be observed
- 2) V<sub>O</sub> < GND

Table 5: Recommended Operating Conditions

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage (note 1)	1.65 to 3.6	V
$V_I$	Input Voltage	0 to 5.5	V
$V_O$	Output Voltage (High Impedance or $V_{CC} = 0V$ )	0 to 5.5	V
$V_O$	Output Voltage (High or Low State)	0 to $V_{CC}$	V
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 3.0$ to $3.6V$ )	$\pm 24$	mA
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 2.7$ to $3.0V$ )	$\pm 12$	mA
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 2.3$ to $2.7V$ )	$\pm 8$	mA
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 1.65$ to $2.3V$ )	$\pm 4$	mA
$T_{op}$	Operating Temperature	-55 to 125	$^{\circ}C$
dt/dv	Input Rise and Fall Time (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.2V to 3.6V

2)  $V_{IN}$  from 0.8V to 2V at  $V_{CC} = 3.0V$ 

Table 6: DC Specifications

Symbol	Parameter	Test Condition		Value				Unit
		$V_{CC}$ (V)		-40 to 85 $^{\circ}C$		-55 to 125 $^{\circ}C$		
				Min.	Max.	Min.	Max.	
$V_{IH}$	High Level Input Voltage	1.65 to 1.95		$0.65V_{CC}$		$0.65V_{CC}$		V
		2.3 to 2.7		1.7		1.7		
		2.7 to 3.6		2		2		
$V_{IL}$	Low Level Input Voltage	1.65 to 1.95			$0.35V_{CC}$		$0.35V_{CC}$	V
		2.3 to 2.7			0.7		0.7	
		2.7 to 3.6			0.8		0.8	
$V_{OH}$	High Level Output Voltage	1.65 to 3.6	$I_O = -100 \mu A$	$V_{CC} - 0.2$		$V_{CC} - 0.2$		V
		1.65	$I_O = -4 \text{ mA}$	1.2		1.2		
		2.3	$I_O = -8 \text{ mA}$	1.7		1.7		
		2.7	$I_O = -12 \text{ mA}$	2.2		2.2		
		3.0	$I_O = -18 \text{ mA}$	2.4		2.4		
$V_{OL}$	Low Level Output Voltage	1.65 to 3.6	$I_O = 100 \mu A$		0.2		0.2	V
		1.65	$I_O = 4 \text{ mA}$		0.45		0.45	
		2.3	$I_O = 8 \text{ mA}$		0.7		0.7	
		2.7	$I_O = 12 \text{ mA}$		0.4		0.4	
		3.0	$I_O = 24 \text{ mA}$		0.55		0.55	
$I_I$	Input Leakage Current	3.6	$V_I = 0$ to $5.5V$		$\pm 5$		$\pm 5$	$\mu A$
$I_{off}$	Power Off Leakage Current	0	$V_I$ or $V_O = 5.5V$		10		10	$\mu A$
$I_{OZ}$	High Impedance Output Leakage Current	3.6	$V_I = V_{IH}$ or $V_{IL}$ $V_O = 0$ to $5.5V$		$\pm 5$		$\pm 5$	$\mu A$
$I_{CC}$	Quiescent Supply Current	3.6	$V_I = V_{CC}$ or GND		10		10	$\mu A$
			$V_I$ or $V_O = 3.6$ to $5.5V$		$\pm 10$		$\pm 10$	
$\Delta I_{CC}$	$I_{CC}$ incr. per Input	2.7 to 3.6	$V_{IH} = V_{CC} - 0.6V$		500		500	$\mu A$

Table 7: Dynamic Switching Characteristics

Symbol	Parameter	Test Condition		Value			Unit
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C			
				Min.	Typ.	Max.	
V <sub>OLP</sub>	Dynamic Low Level Quiet Output (note 1)	3.3	C <sub>L</sub> = 50pF V <sub>IL</sub> = 0V, V <sub>IH</sub> = 3.3V		0.8		V
V <sub>OLV</sub>					-0.8		

1) Number of output defined as "n". Measured with "n-1" outputs switching from HIGH to LOW or LOW to HIGH. The remaining output is measured in the LOW state.

Table 8: AC Electrical Characteristics

Symbol	Parameter	Test Condition				Value				Unit
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	R <sub>L</sub> (Ω)	t <sub>s</sub> = t <sub>r</sub> (ns)	-40 to 85 °C		-55 to 125 °C		
						Min.	Max.	Min.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	1.65 to 1.95	30	1000	2.0		9.0		12	ns
		2.3 to 2.7	30	500	2.0		6.3		8.5	
		2.7	50	500	2.5	1.5	5.5		6.5	
		3.0 to 3.6	50	500	2.5	1	4.8		5.8	
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time	1.65 to 1.95	30	1000	2.0		9.9		13	ns
		2.3 to 2.7	30	500	2.0		7.4		9.6	
		2.7	50	500	2.5	1	6.6		7.9	
		3.0 to 3.6	50	500	2.5	1	5.4		6.5	
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time	1.65 to 1.95	30	1000	2.0		11		14	ns
		2.3 to 2.7	30	500	2.0		5.6		7.3	
		2.7	50	500	2.5	2	5.0		6.0	
		3.0 to 3.6	50	500	2.5	2	4.6		5.5	
t <sub>OSLH</sub> t <sub>OSHL</sub>	Output To Output Skew Time (note1, 2)	2.7 to 3.6					1		1	ns

1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW (t<sub>OSLH</sub> = | t<sub>PLHm</sub> - t<sub>PLHn</sub> |, t<sub>OSHL</sub> = | t<sub>PHLm</sub> - t<sub>PHLn</sub> |)

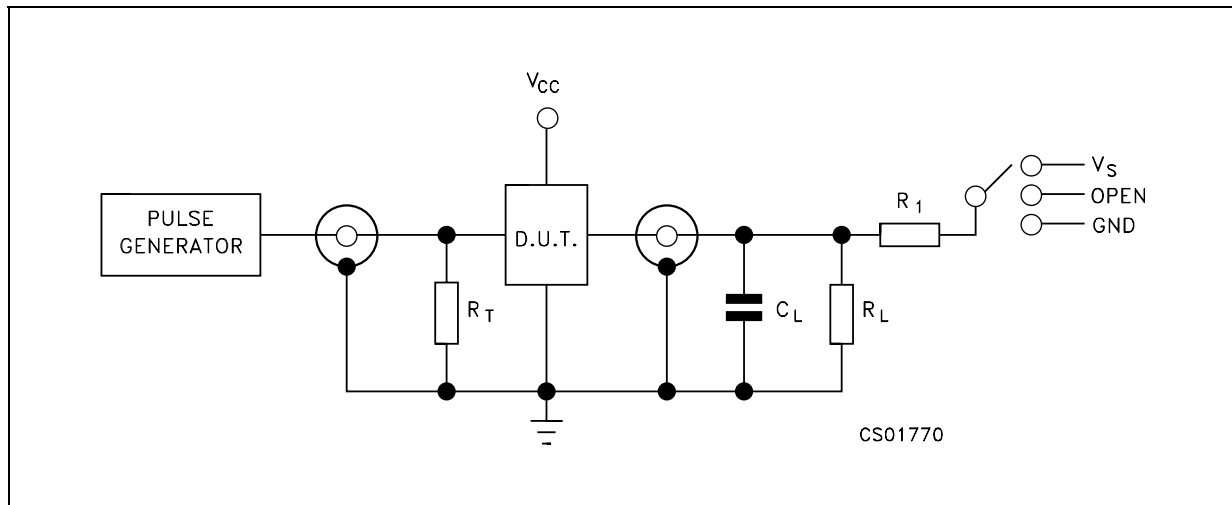
2) Parameter guaranteed by design

Table 9: Capacitive Characteristics

Symbol	Parameter	Test Condition		Value			Unit
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C			
				Min.	Typ.	Max.	
C <sub>IN</sub>	Input Capacitance				4		pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)	1.8	f <sub>IN</sub> = 10MHz		28		pF
		2.5			30		
		3.3			34		

1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I<sub>CC(opr)</sub> = C<sub>PD</sub> × V<sub>CC</sub> × f<sub>IN</sub> + I<sub>CC</sub>/n (per circuit)

Figure 3: Test Circuit



$R_T = Z_{OUT}$  of pulse generator (typically 50Ω)

Table 10: Test Circuit And Waveform Symbol Value

Symbol	$V_{CC}$			
	1.65 to 1.95V	2.3 to 2.7V	2.7V	3.0 to 3.6V
$C_L$	30pF	30pF	50pF	50pF
$R_L = R_1$	1000Ω	500Ω	500Ω	500Ω
$V_S$	$2 \times V_{CC}$	$2 \times V_{CC}$	6V	6V
$V_{IH}$	$V_{CC}$	$V_{CC}$	2.7V	2.7V
$V_M$	$V_{CC}/2$	$V_{CC}/2$	1.5V	1.5V
$V_{OH}$	$V_{CC}$	$V_{CC}$	3.0V	3.0V
$V_X$	$V_{OL} + 0.15V$	$V_{OL} + 0.15V$	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$
$V_Y$	$V_{OH} - 0.15V$	$V_{OH} - 0.15V$	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$
$t_r = t_f$	<2.0ns	<2.0ns	<2.5ns	<2.5ns

Figure 4: Waveform - Propagation Delays (f=1MHz; 50% duty cycle)

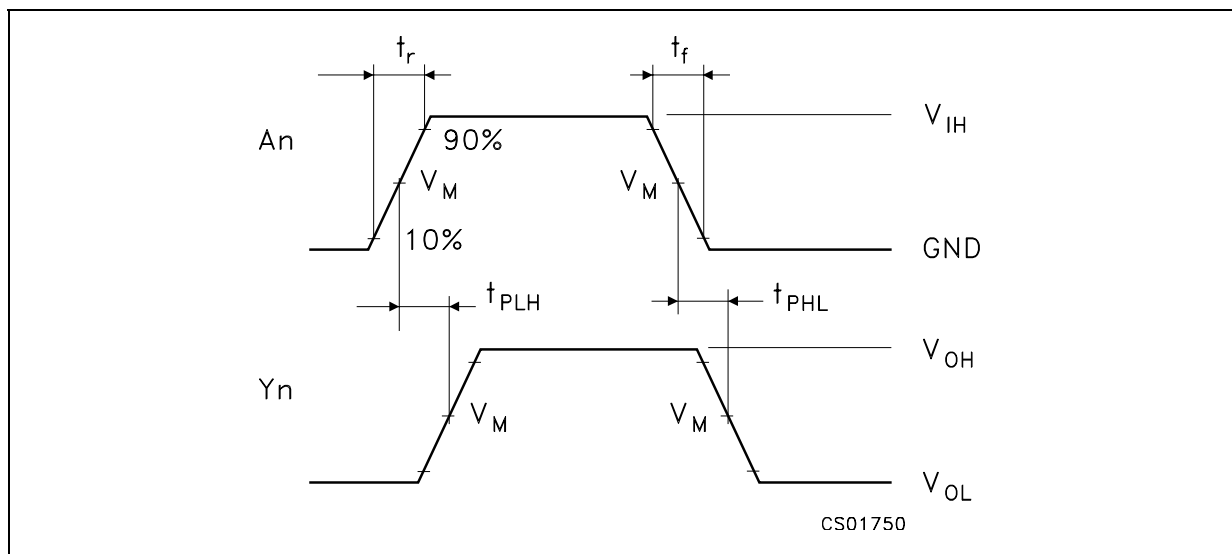
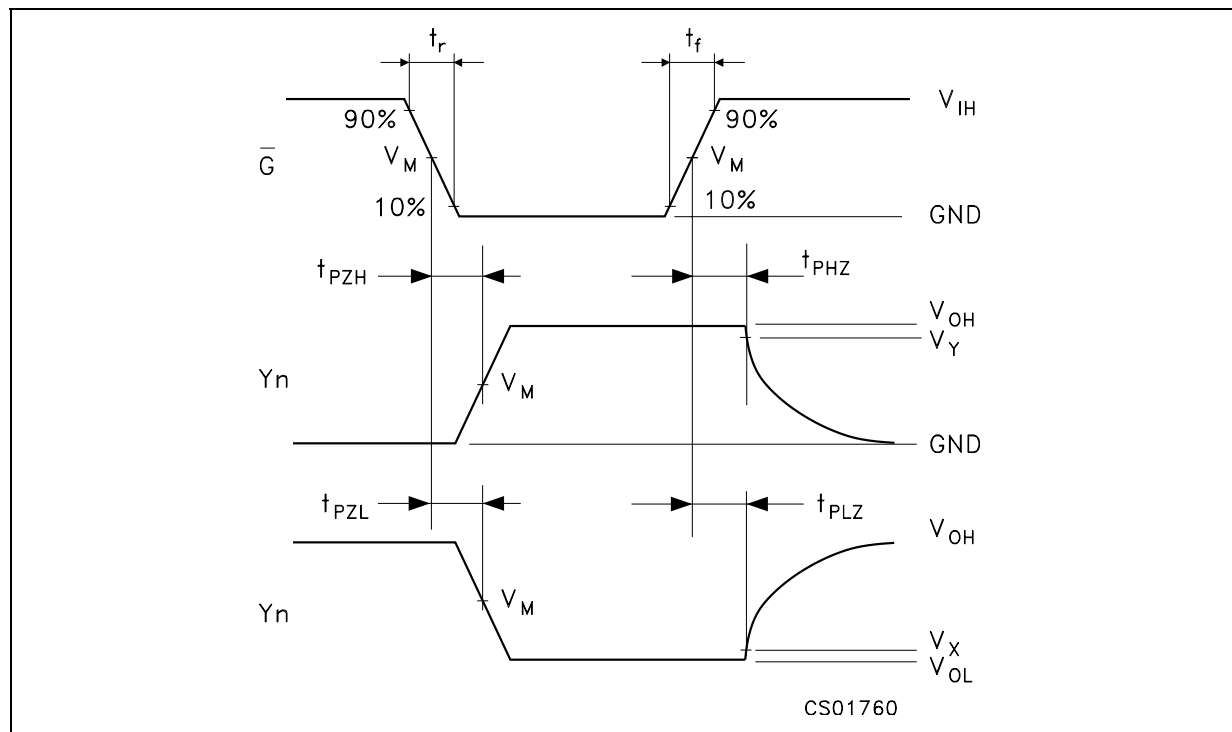
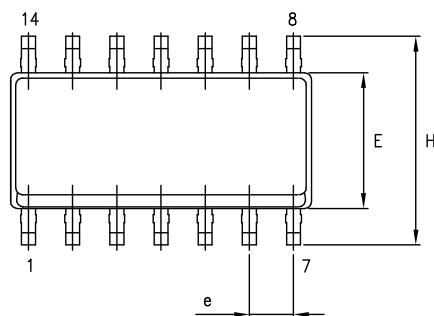
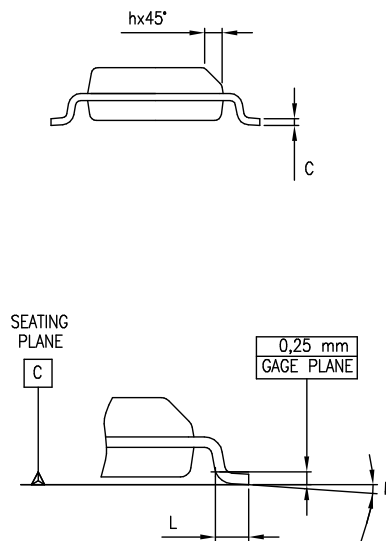
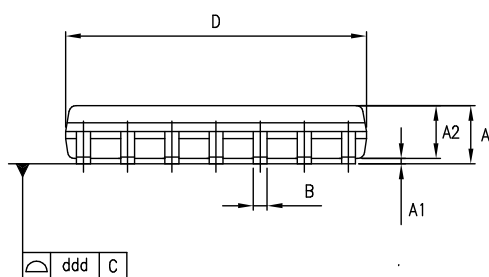


Figure 5: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)



## SO-14 MECHANICAL DATA

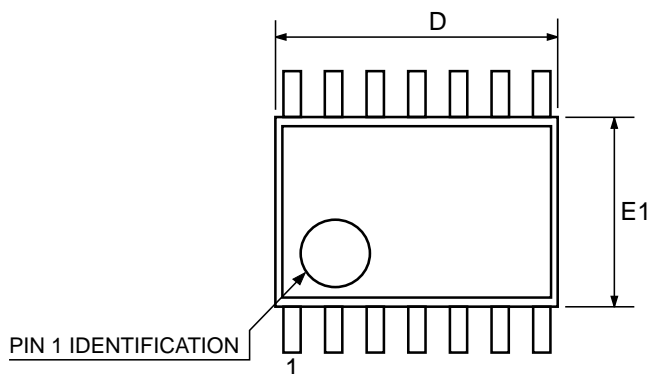
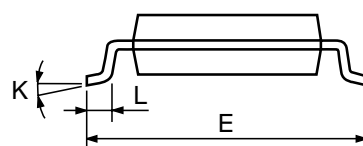
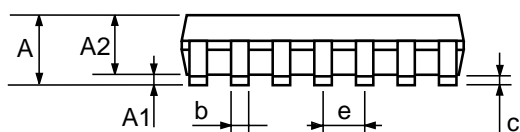
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.1		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	8.55		8.75	0.337		0.344
E	3.8		4.0	0.150		0.157
e		1.27			0.050	
H	5.8		6.2	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.4		1.27	0.016		0.050
k	0°		8°	0°		8°
ddd			0.100			0.004



0016019D

## TSSOP14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



0080337D



## Tape &amp; Reel SO-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.4		6.6	0.252		0.260
Bo	9		9.2	0.354		0.362
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



## Tape &amp; Reel TSSOP14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.7		6.9	0.264		0.272
Bo	5.3		5.5	0.209		0.217
Ko	1.6		1.8	0.063		0.071
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



**Table 11: Revision History**

Date	Revision	Description of Changes
26-Jul-2004	8	Ordering Codes Revision - pag. 1.

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