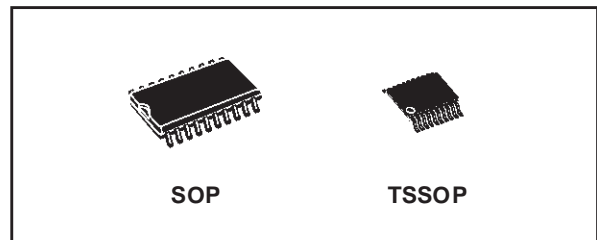




# 74LVX541

## LOW VOLTAGE CMOS OCTAL BUS BUFFER (3-STATE NON INV.) WITH 5V TOLERANT INPUTS

- HIGH SPEED:  
 $t_{PD} = 5.0 \text{ ns}$  (TYP.) at  $V_{CC} = 3.3V$
- 5V TOLERANT INPUTS
- POWER-DOWN PROTECTION ON INPUTS
- INPUT VOLTAGE LEVEL:  
 $V_{IL} = 0.8V, V_{IH} = 2V$  at  $V_{CC} = 3V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu A$  (MAX.) at  $T_A = 25^\circ C$
- LOW NOISE:  
 $V_{OLP} = 0.3V$  (TYP.) at  $V_{CC} = 3.3V$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4 \text{ mA}$  (MIN) at  $V_{CC} = 3V$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 2V$  to  $3.6V$  (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 541
- IMPROVED LATCH-UP IMMUNITY



### ORDER CODES

PACKAGE	TUBE	T & R
SOP	74LVX541M	74LVX541MTR
TSSOP		74LVX541TTR

### DESCRIPTION

The 74LVX541 is a low voltage CMOS OCTAL BUS BUFFER with 3 STATE OUTPUT NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for low power, battery operated and low noise 3.3V applications. The 3 STATE control gate operates as two input AND such that if either G1 or G2 are high, all eight outputs are in the high impedance state.

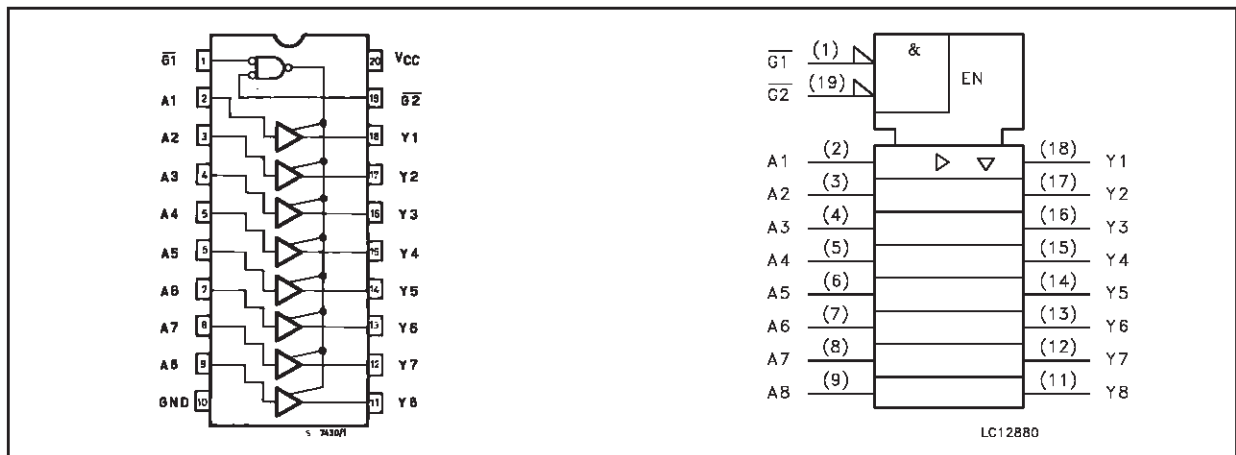
In order to enhance PC board layout, the 74VHC541 offers a pinout having inputs and outputs on opposite sides of the package.

Power down protection is provided on all inputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage.

This device can be used to interface 5V to 3V. It combines high speed performance with the true CMOS low power consumption.

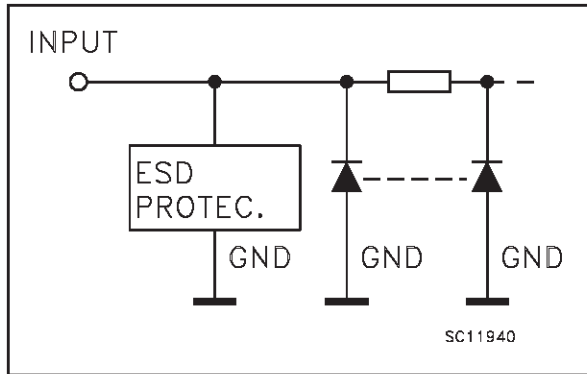
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# 74LVX541

## INPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	G1, G2	Output Enable Inputs
2, 3, 4, 5, 6, 7, 8, 9	A1 to A8	Data Inputs
18, 17, 16, 15, 14, 13, 12, 11	Y1 to Y8	Data Outputs
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

## TRUTH TABLE

INPUT			OUTPUT
$\overline{G1}$	$\overline{G2}$	A <sub>n</sub>	Y <sub>n</sub>
H	X	X	Z
X	H	X	Z
L	L	H	H
L	L	L	L

X : Don't Care  
Z : High Impedance

## 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	-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	- 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 20	mA
I <sub>O</sub>	DC Output Current	± 25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	± 50	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

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage (note 1)	2 to 3.6	V
V <sub>I</sub>	Input Voltage	0 to 5.5	V
V <sub>O</sub>	Output Voltage	0 to V <sub>CC</sub>	V
T <sub>op</sub>	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (note 2) (V <sub>CC</sub> = 3V)	0 to 100	ns/V

1) Truth Table guaranteed: 1.2V to 3.6V

2) V<sub>IN</sub> from 0.8V to 2.0V

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>IH</sub>	High Level Input Voltage	2.0		1.5			1.5		1.5		V
		3.0		2.0			2.0		2.0		
		3.6		2.4			2.4		2.4		
V <sub>IL</sub>	Low Level Input Voltage	2.0				0.5		0.5		0.5	V
		3.0				0.8		0.8		0.8	
		3.6				0.8		0.8		0.8	
V <sub>OH</sub>	High Level Output Voltage	2.0	I <sub>O</sub> =-50 μA	1.9	2.0		1.9		1.9		V
		3.0	I <sub>O</sub> =-50 μA	2.9	3.0		2.9		2.9		
		3.0	I <sub>O</sub> =-4 mA	2.58			2.48		2.4		
V <sub>OL</sub>	Low Level Output Voltage	2.0	I <sub>O</sub> =50 μA		0.0	0.1		0.1		0.1	V
		3.0	I <sub>O</sub> =50 μA		0.0	0.1		0.1		0.1	
		3.0	I <sub>O</sub> =4 mA			0.36		0.44		0.55	
I <sub>OZ</sub>	High Impedance Output Leakage Current	3.6	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = V <sub>CC</sub> or GND			±0.25		± 2.5		± 2.5	μA
I <sub>I</sub>	Input Leakage Current	3.6	V <sub>I</sub> = 5V or GND			± 0.1		± 1		± 1	μA
I <sub>CC</sub>	Quiescent Supply Current	3.6	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		40	μA

## DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	3.3	C <sub>L</sub> = 50 pF		0.3	0.8					V
V <sub>OLV</sub>				-0.8	-0.3						
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	3.3		2.0							
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	3.3				0.8					

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.3V. Inputs under test switching: 3.3V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

AC ELECTRICAL CHARACTERISTICS (Input  $t_r = t_f = 3\text{ns}$ )

Symbol	Parameter	Test Condition		Value								Unit
		$V_{CC}$ (V)	$C_L$ (pF)	$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ to $125^\circ\text{C}$			
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	2.7	15		6.3	8.3	1.0	10.0	1.0	10.0	ns	
		2.7	50		9.0	12.0	1.0	15.0	1.0	15.0		
		3.3(*)	15		5.0	7.0	1.0	8.5	1.0	8.5		
		3.3(*)	50		7.5	10.5	1.0	12.0	1.0	12.0		
$t_{PZL}$ $t_{PZH}$	Output Enable Time	2.7	15		8.0	12.0	1.0	14.0	1.0	14.0	ns	
		2.7	50		11.0	15.0	1.0	16.0	1.0	16.0		
		3.3(*)	15		6.8	10.8	1.0	12.5	1.0	12.5		
		3.3(*)	50		9.3	14.0	1.0	16.0	1.0	16.0		
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	2.7	50		12.5	16.5	1.0	19.0	1.0	19.0	ns	
		3.3(*)	50		11.2	15.4	1.0	17.5	1.0	17.5		
$t_{OSLH}$ $t_{OSHL}$	Output to Output Skew Time (note 1,2)	2.7	50		0.5	1.0		1.5		1.5	ns	
		3.3(*)	50		0.5	1.0		1.5		1.5		

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

2) Parameter guaranteed by design

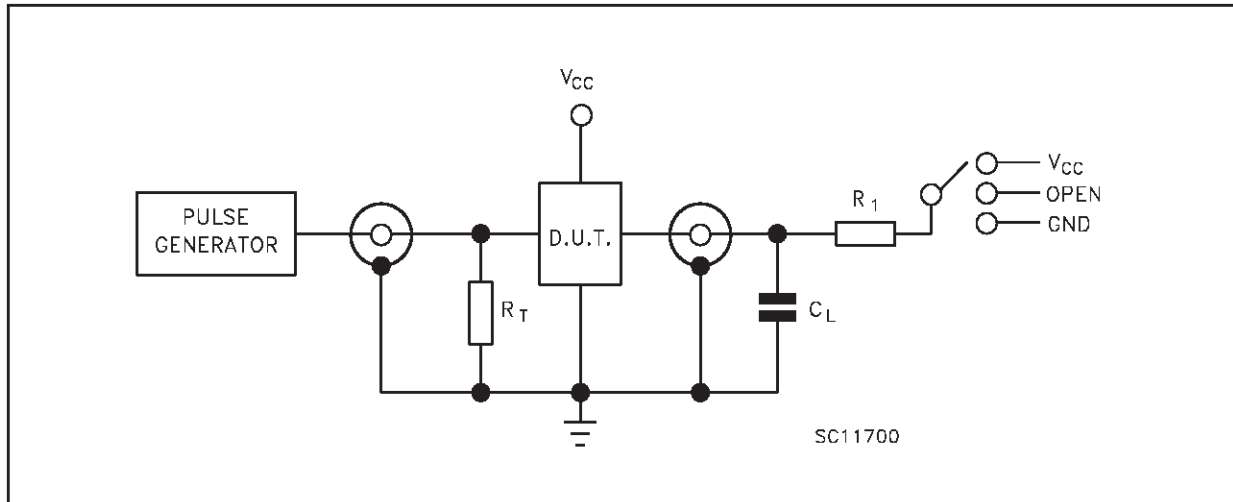
(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value								Unit
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ to $125^\circ\text{C}$			
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
$C_{IN}$	Input Capacitance	3.3			7	10		10		10	pF	
$C_{OUT}$	Output Capacitance	3.3			9						pF	
$C_{PD}$	Power Dissipation Capacitance (note 1)	3.3	$f_{IN} = 10\text{MHz}$		20						pF	

1)  $C_{PD}$  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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per circuit)

## TEST CIRCUIT



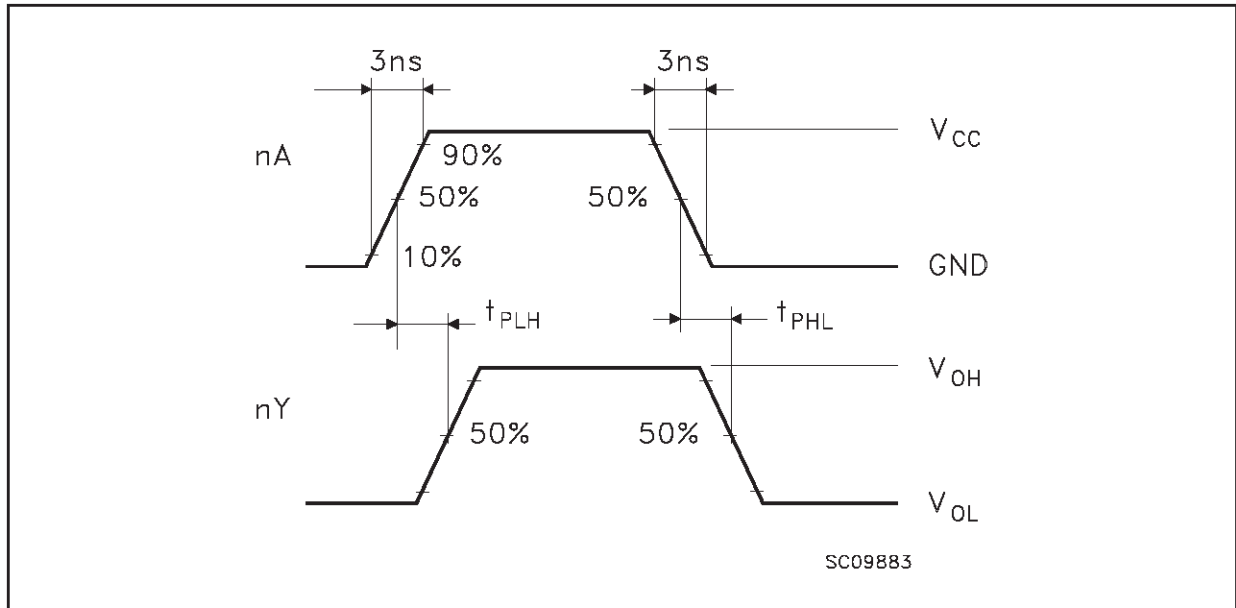
TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	$V_{CC}$
$t_{PZH}$ , $t_{PHZ}$	GND

$C_L = 15/50\text{pF}$  or equivalent (includes jig and probe capacitance)

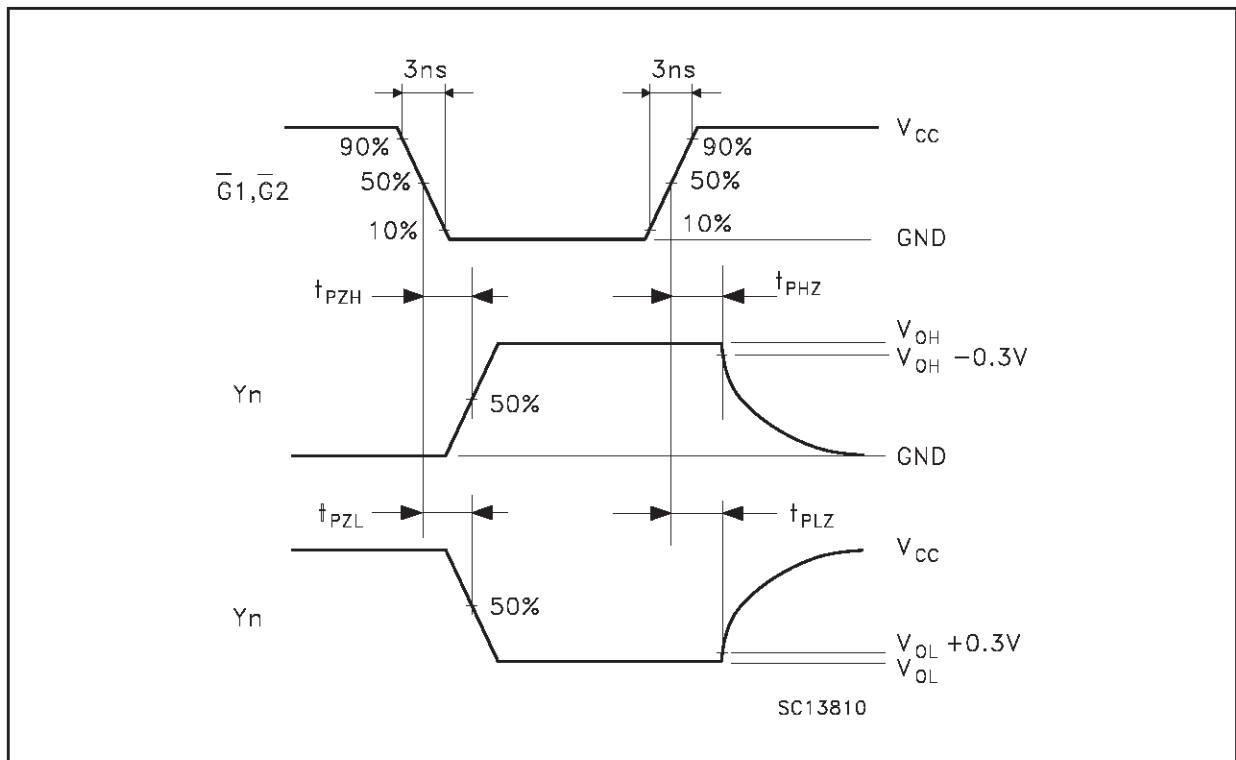
$R_L = R_1 = 1\text{K}\Omega$  or equivalent

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

WAVEFORM 1 : PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

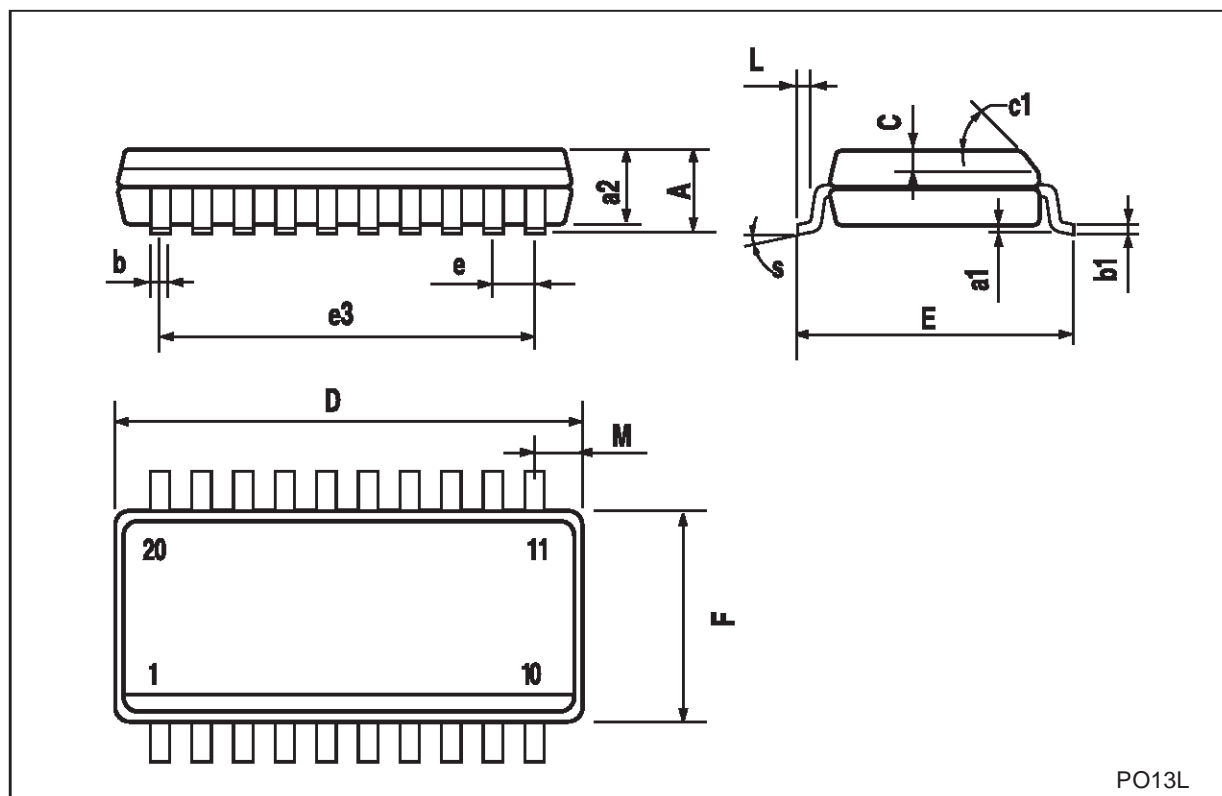


WAVEFORM 2 : OUTPUT ENABLE AND DISABLE TIMES (f=1MHz; 50% duty cycle)



## SO-20 MECHANICAL DATA

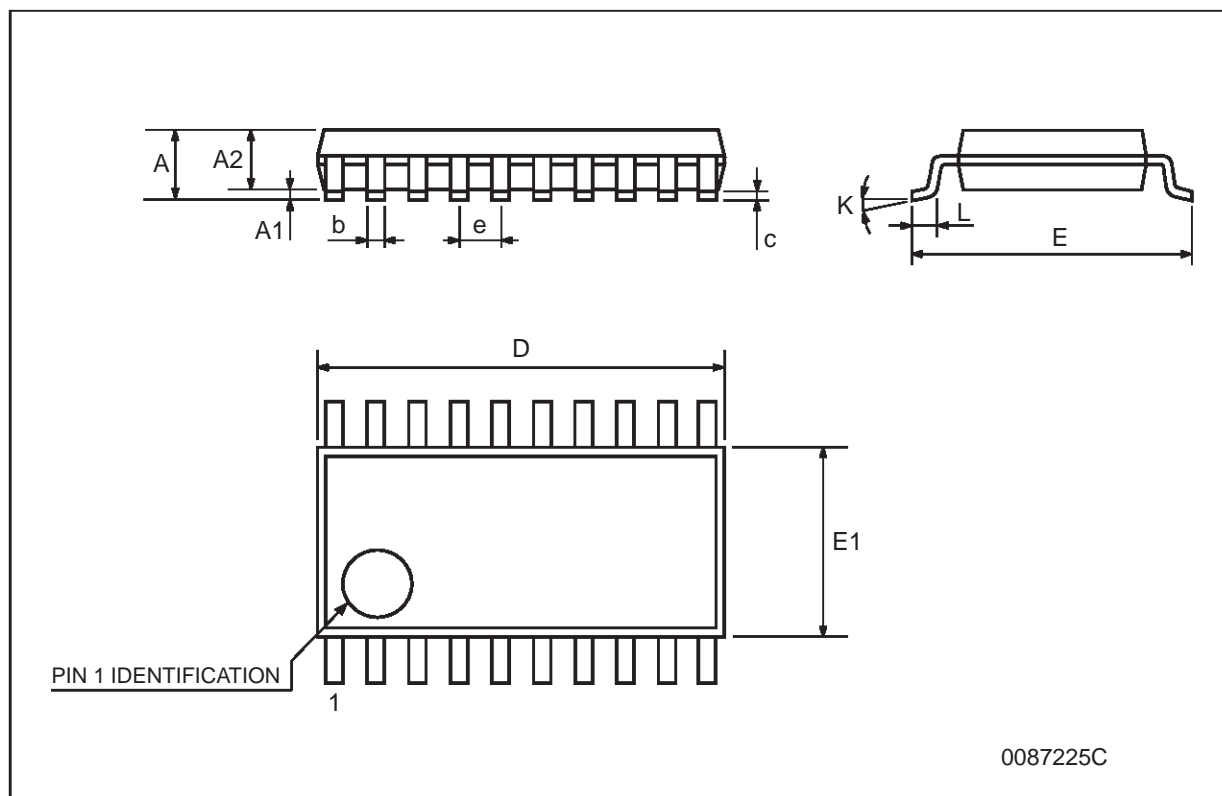
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.300
L	0.50		1.27	0.020		0.050
M			0.75			0.029
S	8° (max.)					



PO13L

## TSSOP20 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	6.4	6.5	6.6	0.252	0.256	0.260
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





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