



# 74VHCT245A

## OCTAL BUS TRANSCEIVER (3-STATE)

- HIGH SPEED:  $t_{PD} = 4.5 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:  
 $V_{IH} = 2V$  (MIN.),  $V_{IL} = 0.8V$  (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(\text{OPR}) = 4.5V \text{ to } 5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 245
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9V$  (MAX.)



### ORDER CODES

PACKAGE	TUBE	T & R
SOP	74VHCT245AM	74VHCT245AMTR
TSSOP		74VHCT245ATTR

### DESCRIPTION

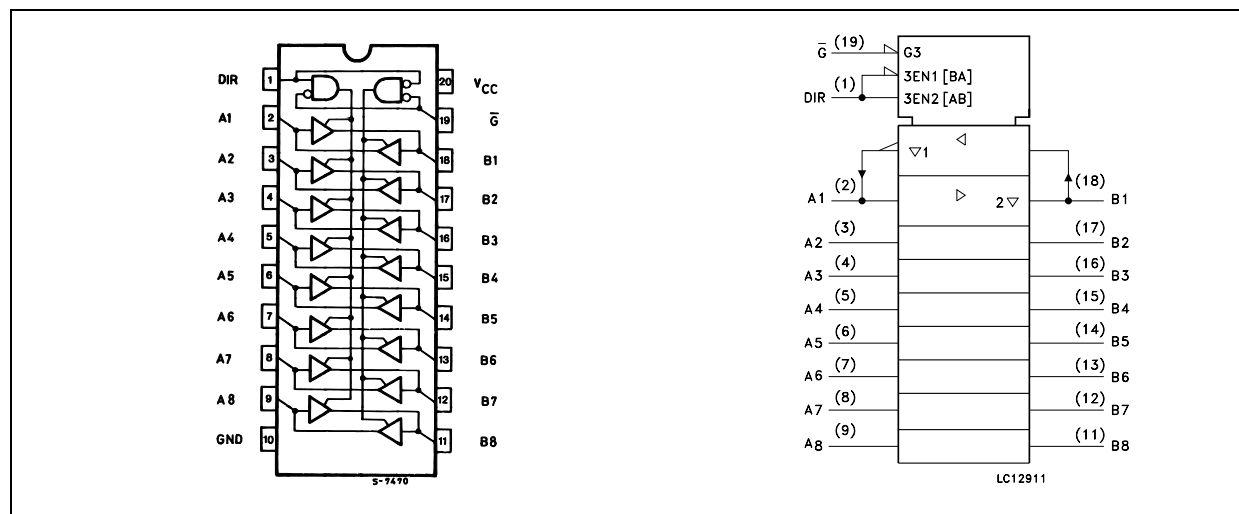
The 74VHCT245A is an advanced high-speed CMOS OCTAL BUS TRANSCEIVER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. This IC is intended for two-way asynchronous communication between data busses; the direction of data transmission is determined by DIR input. The enable input  $\bar{G}$  can be used to

disable the device so that the busses are effectively isolated.

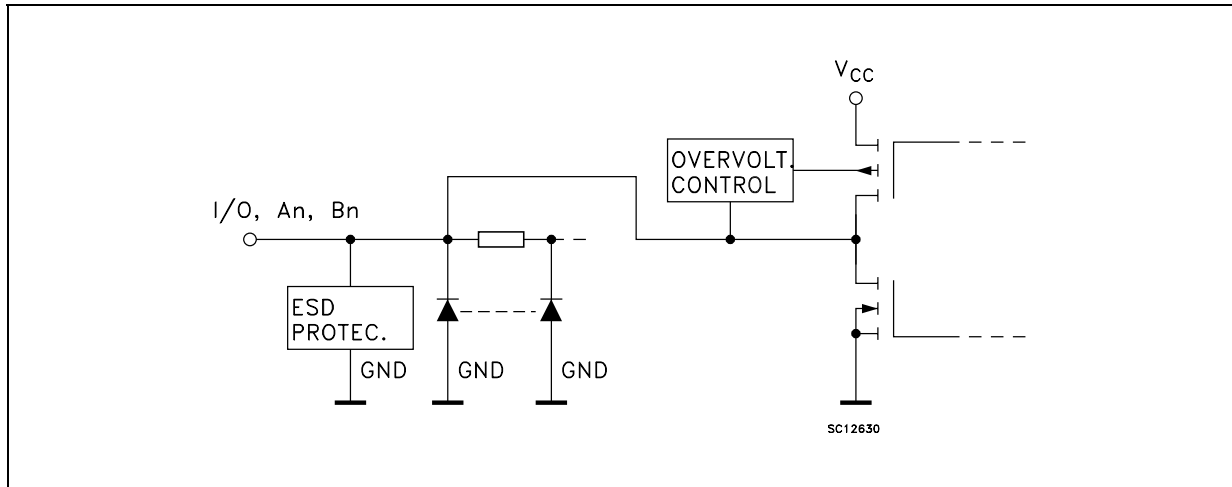
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

All floating bus terminals during High Z State must be held HIGH or LOW.

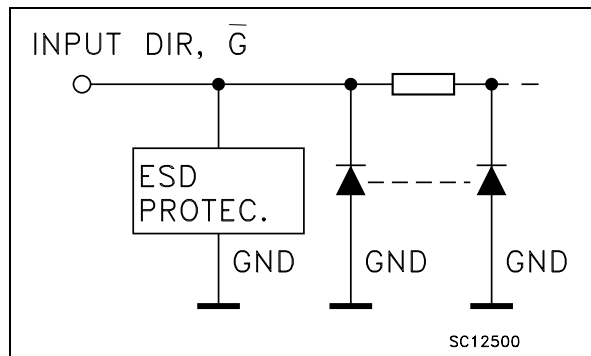
### PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT/ OUTPUT EQUIVALENT CIRCUIT



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	DIR	Directional Control
2, 3, 4, 5, 6, 7, 8, 9	A1 to A8	Data Inputs/Outputs
18, 17, 16, 15, 14, 13, 12, 11	B1 to B8	Data Inputs/Outputs
19	$\bar{G}$	Enable Input
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

TRUTH TABLE

INPUTS		FUNCTION		OUTPUT
$\bar{G}$	DIR	A BUS	B BUS	
L	L	OUTPUT	INPUT	A = B
L	H	INPUT	OUTPUT	B = A
H	X	Z	Z	Z

X : Don't Care  
Z : High Impedance

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$V_I$	DC Input Voltage (DIR, G)	-0.5 to +7.0	V
$V_{I/O}$	DC BUS I/O Voltage (see note 1)	-0.5 to +7.0	V
$V_{I/O}$	DC BUS I/O Voltage (see note 2)	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	- 20	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Current	$\pm 25$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 75$	mA
$T_{stg}$	Storage Temperature	-65 to +150	°C
$T_L$	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) Output in OFF State

2) High or Low State. Io absolute maximum rating must be observed

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	4.5 to 5.5	V
$V_I$	Input Voltage	0 to 5.5	V
$V_{I/O}$	BUS I/O Voltage (see note 1)	0 to 5.5	V
$V_{I/O}$	BUS I/O Voltage (see note 2)	0 to $V_{CC}$	V
$T_{op}$	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (see note 3) ( $V_{CC} = 5.0 \pm 0.5V$ )	0 to 20	ns/V

1) Output in OFF State

2) High or Low State. Io absolute maximum rating must be observed

3) VIN from 0.8V to 2V

## 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	4.5 to 5.5		2			2		2		V
V <sub>IL</sub>	Low Level Input Voltage	4.5 to 5.5				0.8		0.8		0.8	V
V <sub>OH</sub>	High Level Output Voltage	4.5	I <sub>O</sub> =-50 μA	4.4	4.5		4.4		4.4		V
		4.5	I <sub>O</sub> =-8 mA	3.94			3.8		3.7		
V <sub>OL</sub>	Low Level Output Voltage	4.5	I <sub>O</sub> =50 μA		0.0	0.1		0.1		0.1	V
		4.5	I <sub>O</sub> =8 mA			0.36		0.44		0.55	
I <sub>oz</sub>	High Impedance Output Leakage Current	5.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = 0V to 5.5V			±0.25		± 2.5		± 2.5	μA
I <sub>I</sub>	Input Leakage Current	0 to 5.5	V <sub>I</sub> = 5.5V or GND			± 0.1		± 1.0		± 1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		40	μA
Δ I <sub>CC</sub>	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V <sub>CC</sub> or GND			1.35		1.5		1.5	mA
I <sub>OPD</sub>	Output Leakage Current	0	V <sub>OUT</sub> = 5.5V			0.5		5.0		5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

Symbol	Parameter	Test Condition		Value						Unit		
		V <sub>CC</sub> (*) (V)	C <sub>L</sub> (pF)		T <sub>A</sub> = 25°C			-40 to 85°C			-55 to 125°C	
					Min.	Typ.	Max.	Min.	Max.		Min.	Max.
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5.0	15		4.5	7.5	1.0	8.5	1.0	10.0	ns	
		5.0	50		5.3	8.7	1.0	9.5	1.0	11.0		
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time	5.0	15	RL = 1KΩ	9.0	13.8	1.0	15.0	1.0	16.0	ns	
		5.0	50		9.7	14.8	1.0	16.0	1.0	17.0		
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time	5.0	50	RL = 1KΩ	10.0	15.4	1.0	16.5	1.0	17.5	ns	
t <sub>OSLH</sub> t <sub>OSHL</sub>	Output to Output Skew Time (note 1)	5.0	50			1.0		1.0		1.0	ns	

(\*) Voltage range is 5.0V ± 0.5V

Note 1 : Parameter guaranteed by design. t<sub>soLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>soHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value						Unit	
				T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
C <sub>IN</sub>	Input Capacitance		6	10		10		10	pF		
C <sub>I/O</sub>	Bus Input Capacitance		8						pF		
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)		18						pF		

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

## DYNAMIC SWITCHING CHARACTERISTICS

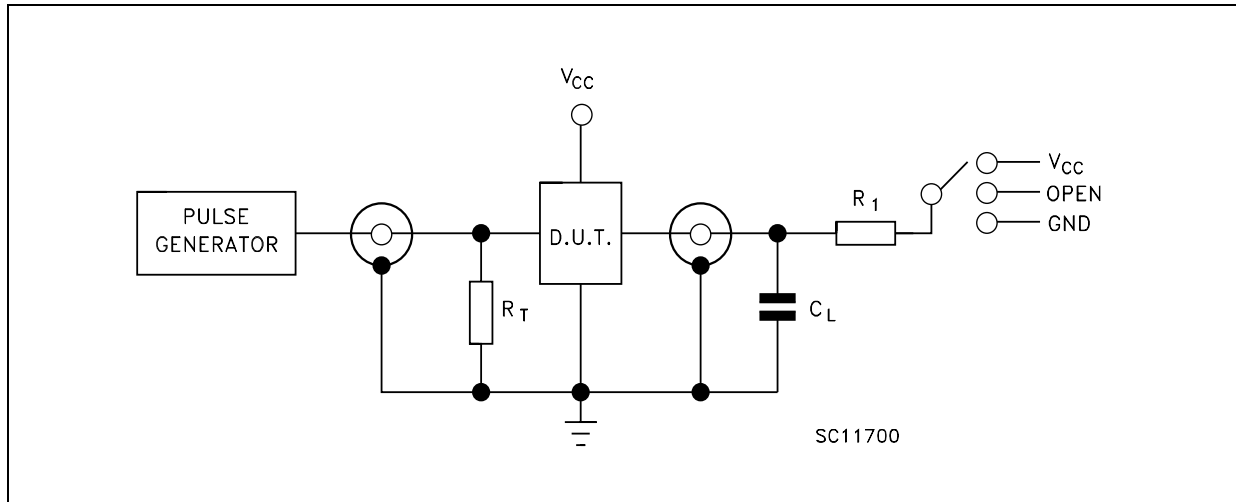
Symbol	Parameter	Test Condition		Value						Unit		
				V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-40 to 85°C			-55 to 125°C	
					Min.	Typ.	Max.	Min.	Max.		Min.	Max.
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C <sub>L</sub> = 50 pF		0.6	0.9					V	
V <sub>OLV</sub>				-0.9	-0.6							
V <sub>IHD</sub>	5.0	2.0										
V <sub>ILD</sub>	5.0				0.8							

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

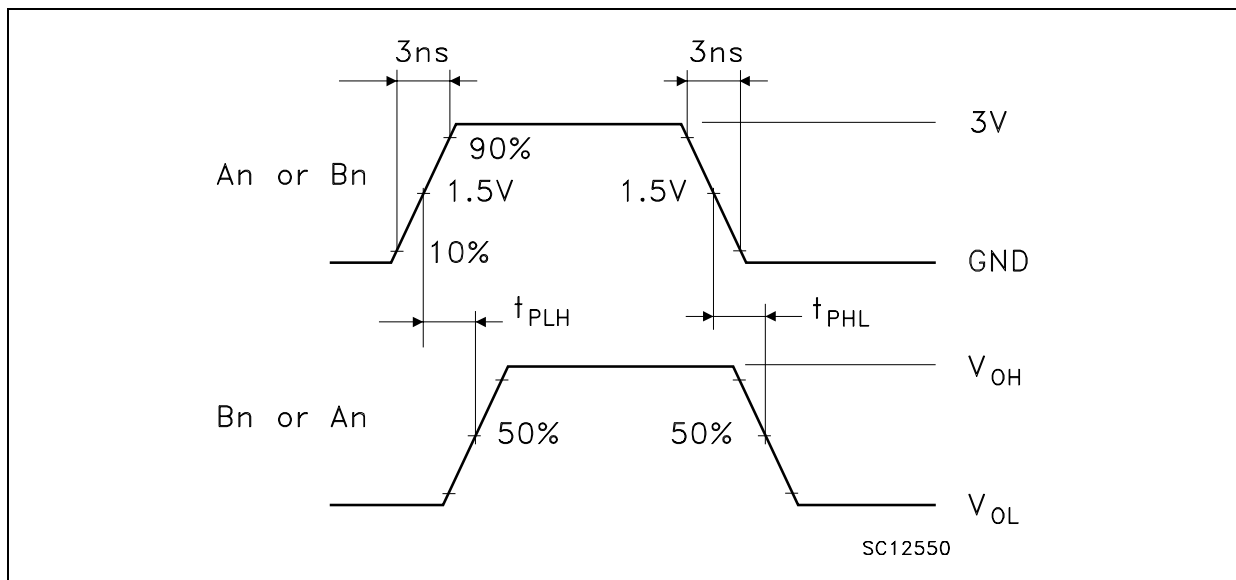
TEST CIRCUIT

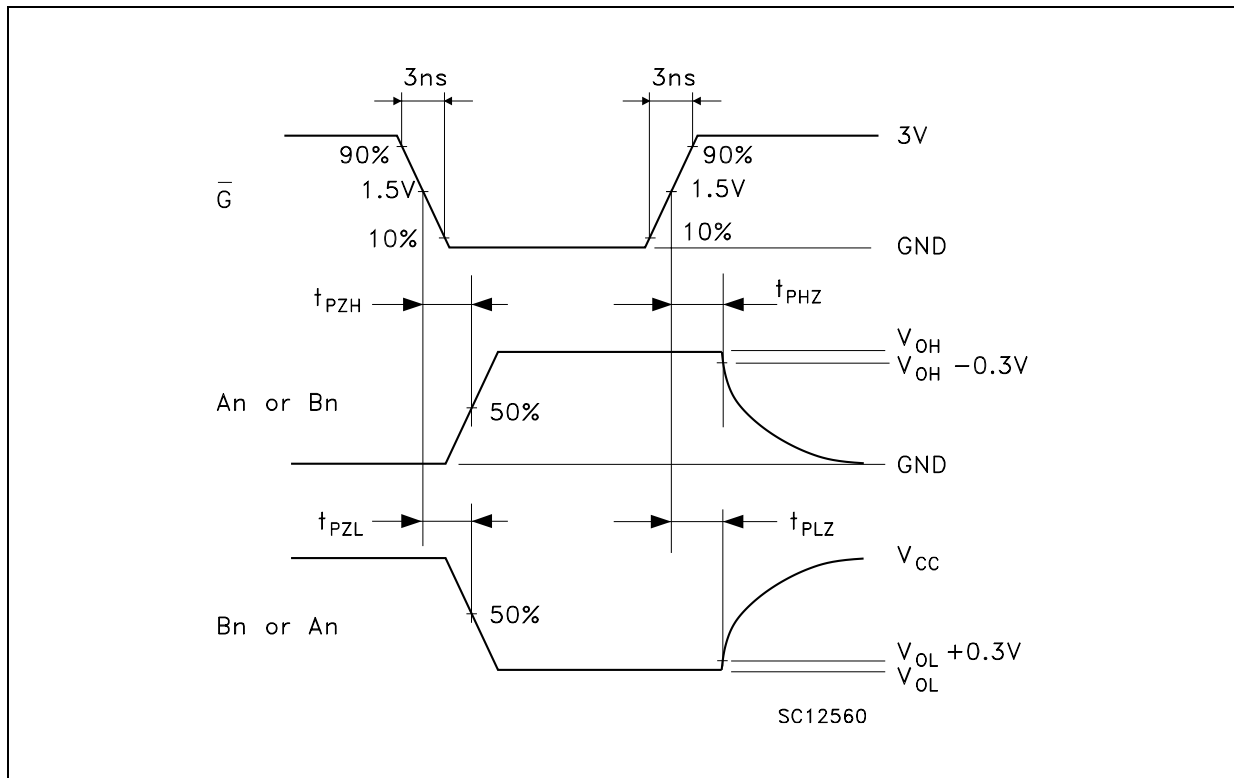


TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	$V_{CC}$
$t_{PZH}$ , $t_{PHZ}$	GND

$C_L = 15/50\text{pF}$  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  $50\Omega$ )

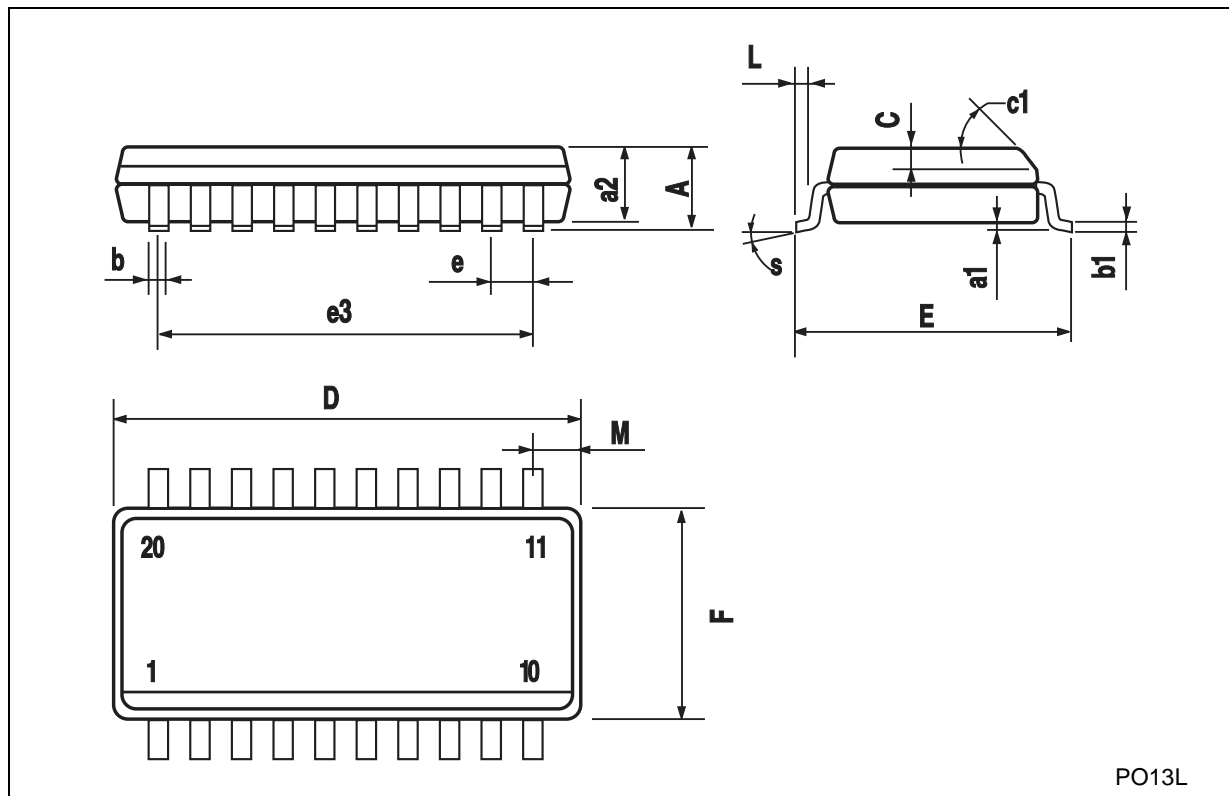
WAVEFORM 1: PROPAGATION DELAYS ( $f=1\text{MHz}$ ; 50% duty cycle)



WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME ( $f=1\text{MHz}$ ; 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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