

## 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:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(\text{OPR}) = 4.5V$  to  $5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 245
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9V$  (MAX.)

### 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

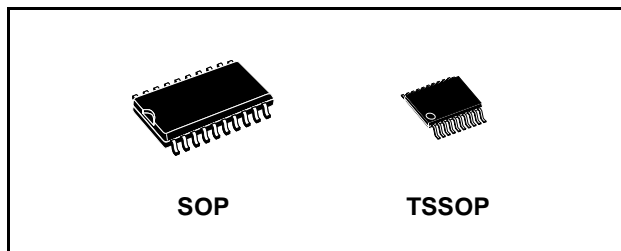


Table 1: Order Codes

PACKAGE	T & R
SOP	74VHCT245AMTR
TSSOP	74VHCT245ATTR

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.

Figure 1: Pin Connection And IEC Logic Symbols

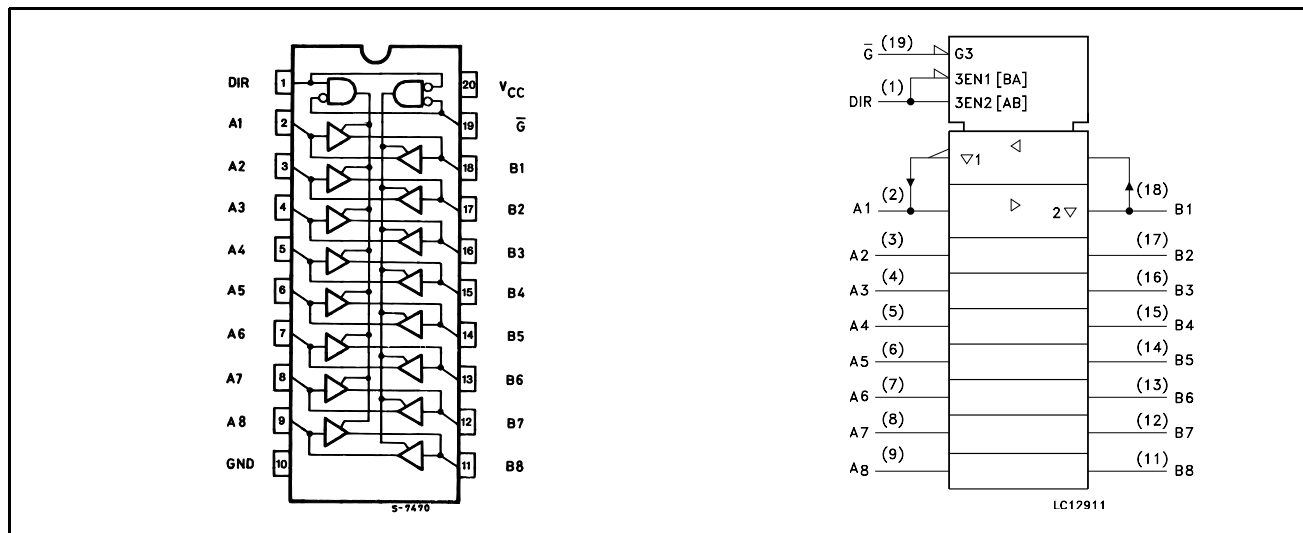


Figure 2: Input/ Output Equivalent Circuit

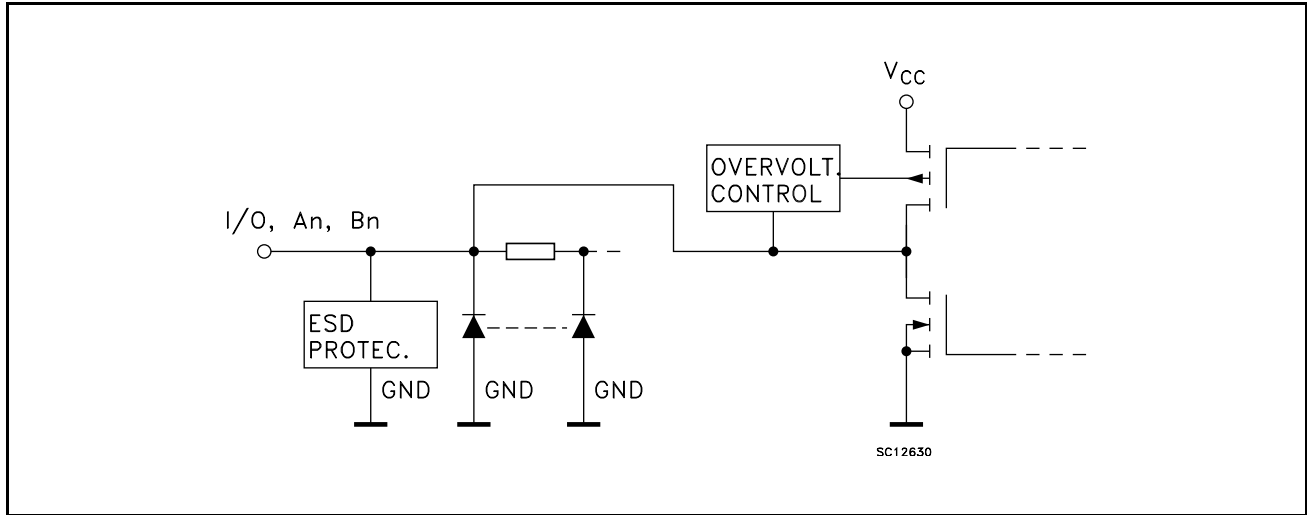


Figure 3: Input Equivalent Circuit

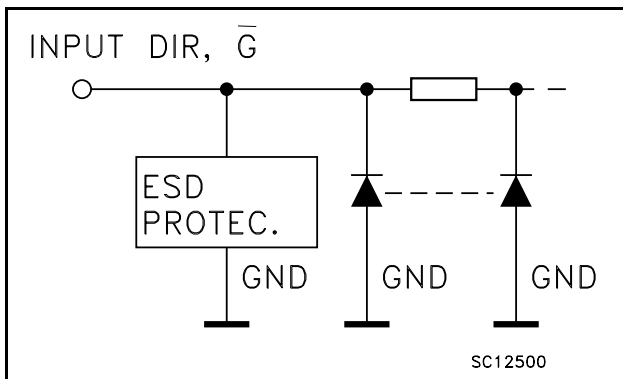


Table 2: Pin Description

PIN N°	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	G	Enable Input
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

Table 3: Truth Table

INPUTS		FUNCTION		OUTPUT
G-bar	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

**Table 4: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$V_I$	DC Input Voltage (DIR, $\overline{G}$ )	-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.  $I_O$  absolute maximum rating must be observed

**Table 5: 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.  $I_O$  absolute maximum rating must be observed

3)  $V_{IN}$  from 0.8V to 2V

Table 6: 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
+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

Table 7: 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>|

**Table 8: 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)

**Table 4: DYNAMIC SWITCHING CHARACTERISTICS**

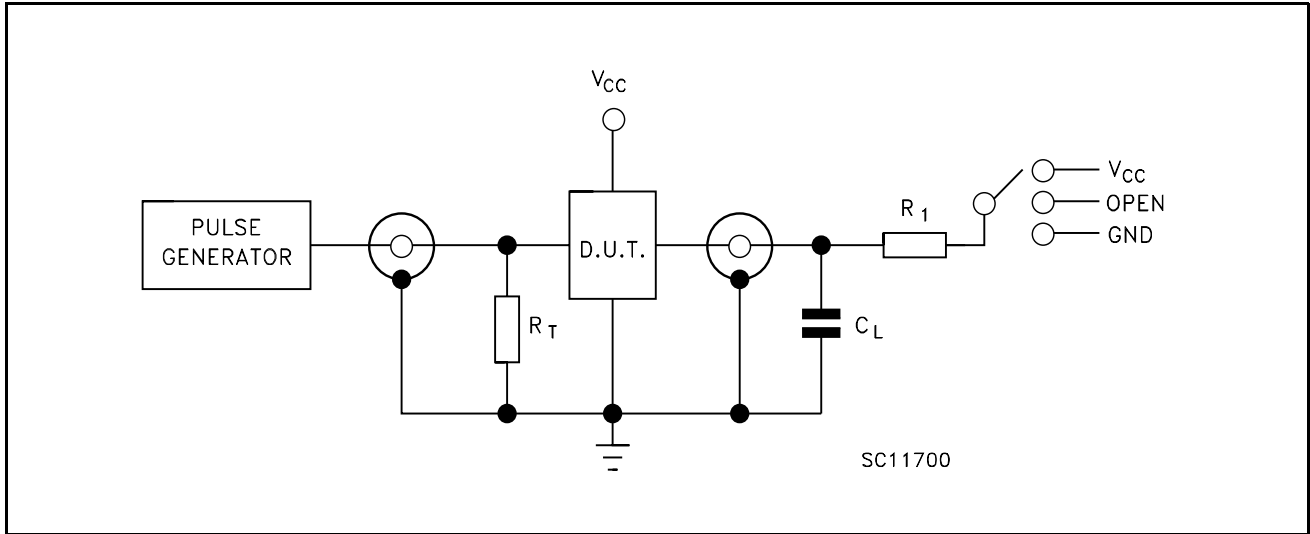
Symbol	Parameter	Test Condition		Value						Unit	
				T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
		V <sub>CC</sub> (V)		Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C <sub>L</sub> = 50 pF		0.6	0.9					V
V <sub>OLV</sub>				-0.9	-0.6						
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	5.0		2.0							
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	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.

Figure 5: 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  $50\Omega$ )

Figure 6: Waveform - Propagation Delays ( $f=1\text{MHz}$ ; 50% duty cycle)

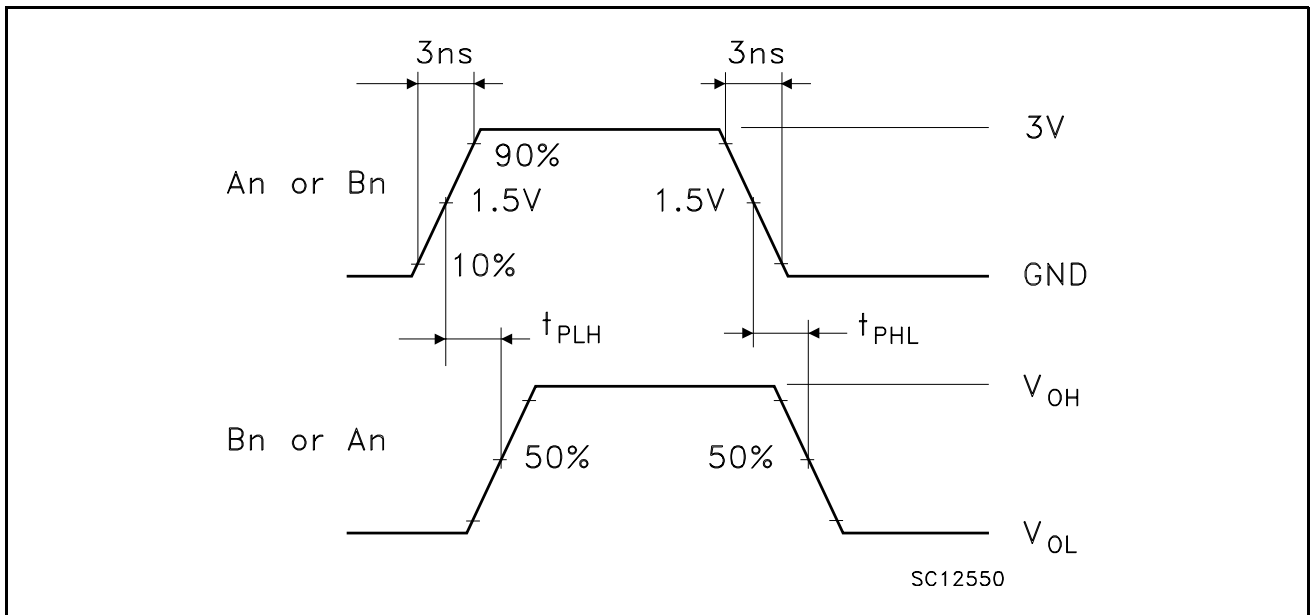
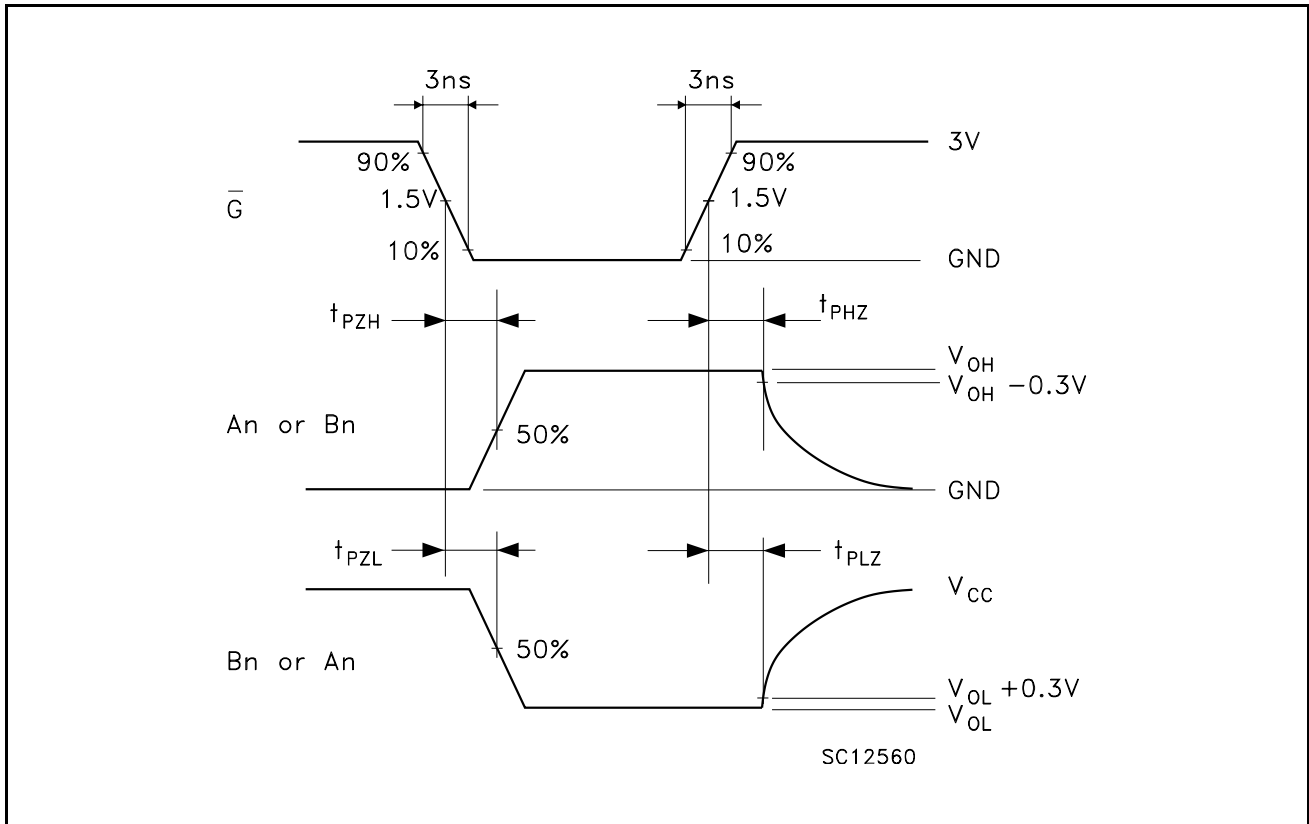
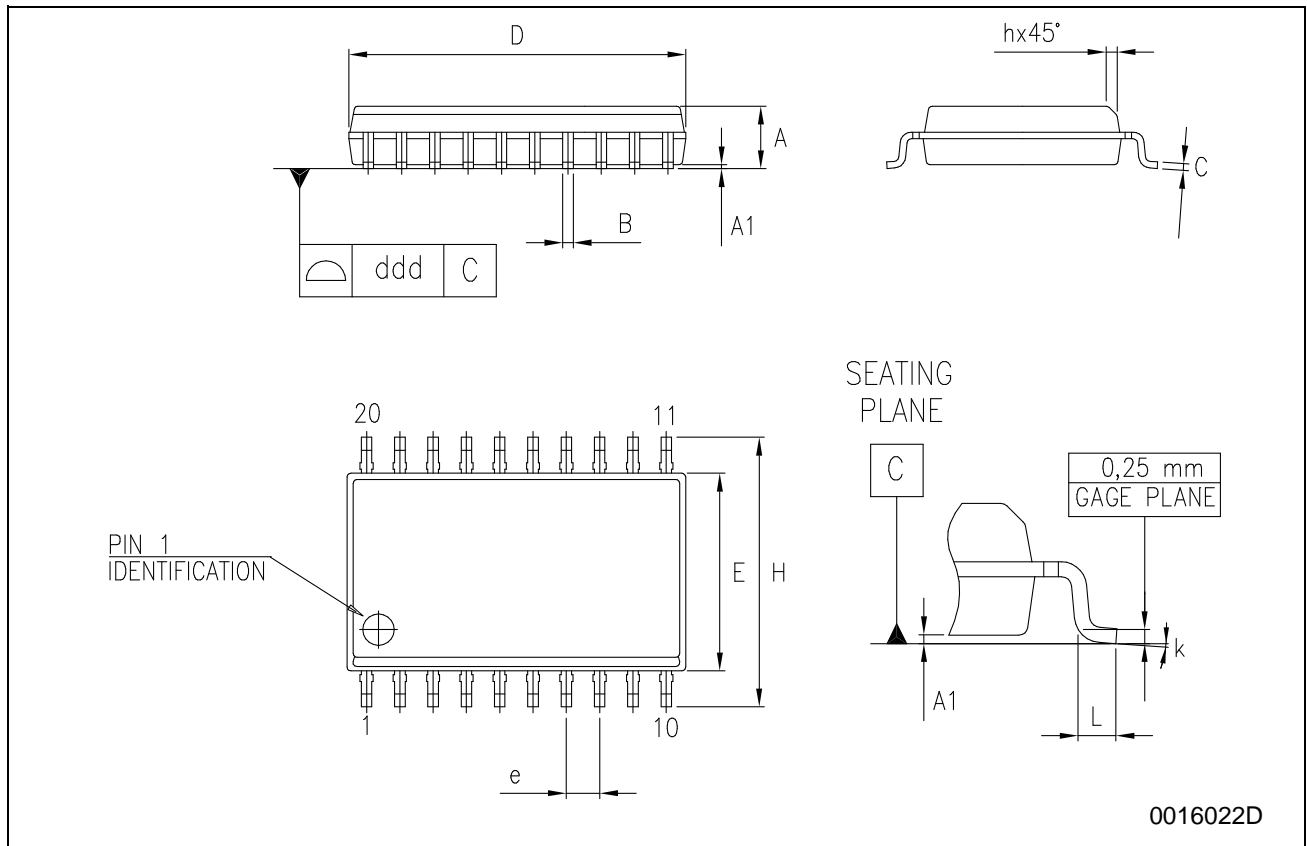


Figure 7: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)



**SO-20 MECHANICAL DATA**

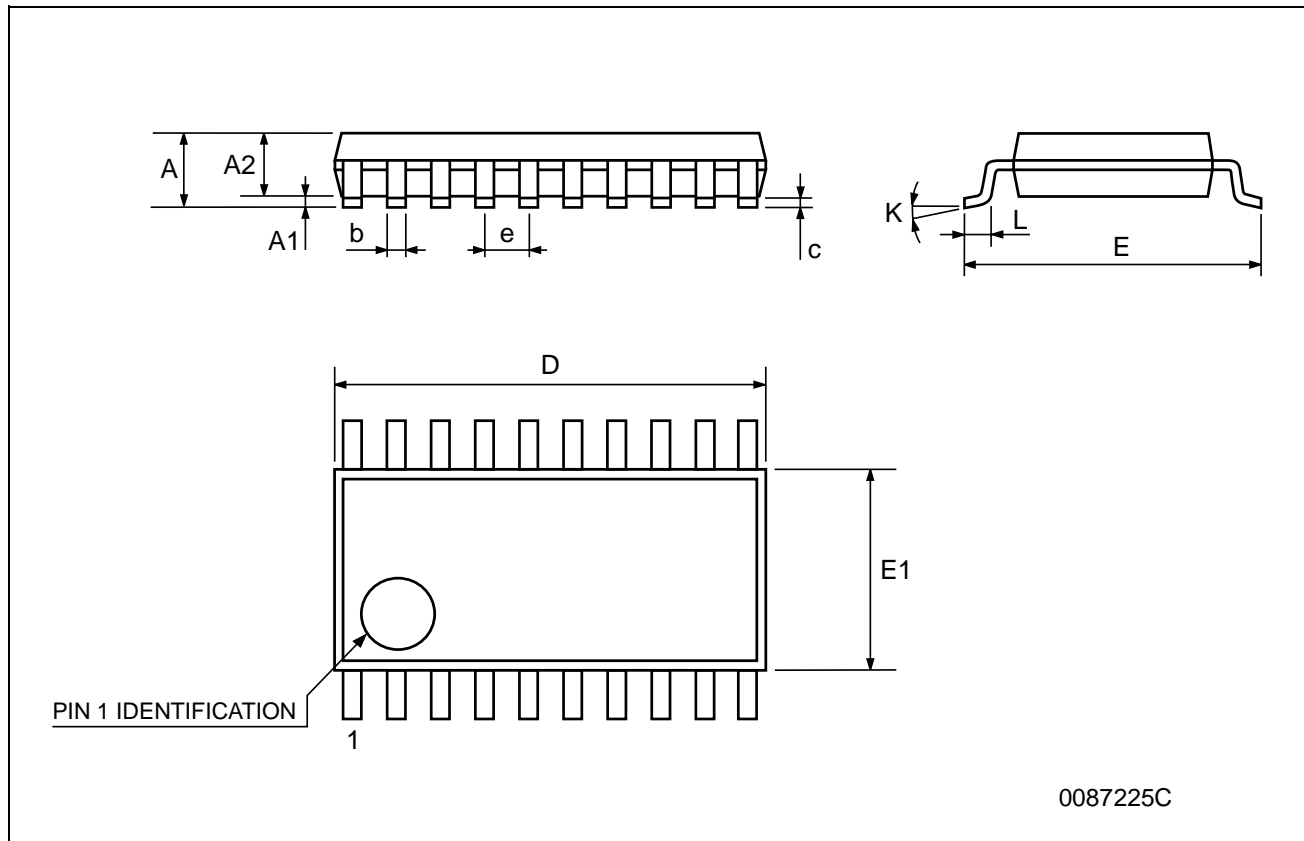
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.30	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.60		13.00	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10.00		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
k	0°		8°	0°		8°
ddd			0.100			0.004





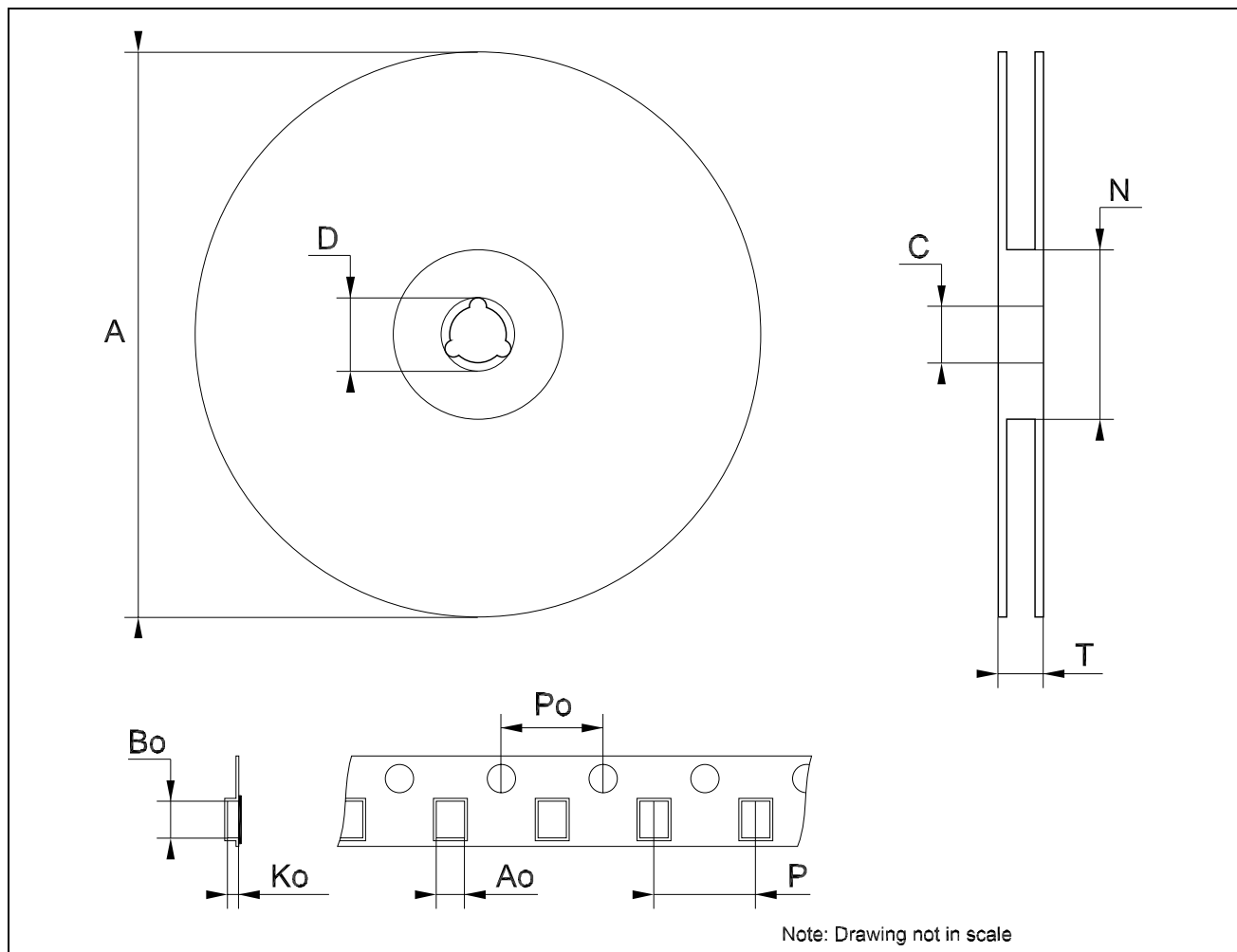
### TSSOP20 MECHANICAL DATA

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		0.0079
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



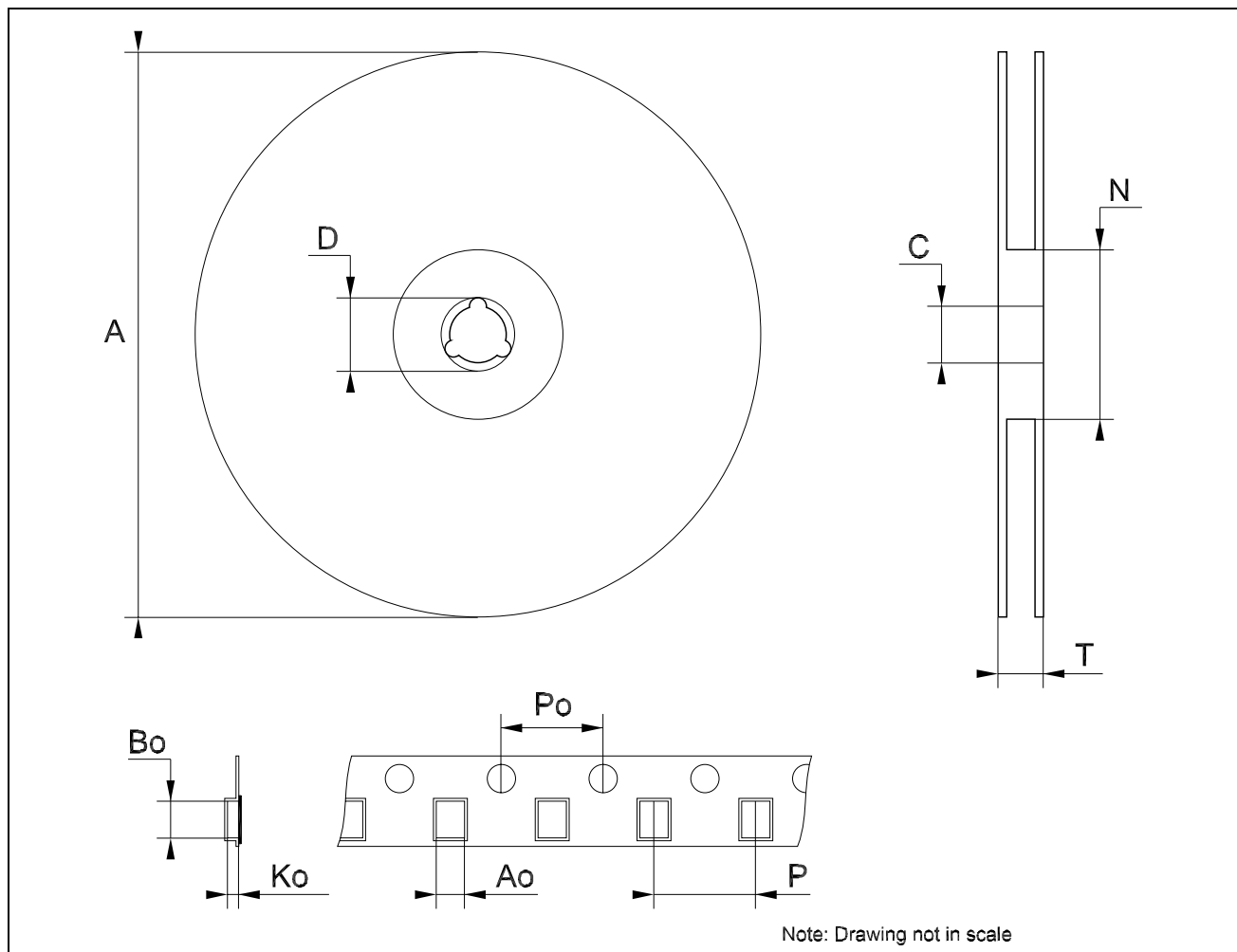
## Tape &amp; Reel SO-20 MECHANICAL DATA

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			30.4			1.197
Ao	10.8		11	0.425		0.433
Bo	13.2		13.4	0.520		0.528
Ko	3.1		3.3	0.122		0.130
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



## Tape &amp; Reel TSSOP20 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	6.8		7	0.268		0.276
Bo	6.9		7.1	0.272		0.280
Ko	1.7		1.9	0.067		0.075
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



**Table 9: Revision History**

Date	Revision	Description of Changes
16-Dec-2004	4	Order Codes Revision - pag. 1.

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