

## QUAD 2 CHANNEL MULTIPLEXER (3-STATE)

- HIGH SPEED:  $t_{PD} = 3.7ns$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu A$  (MAX.) at  $T_A = 25^\circ C$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8mA$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 2V$  to  $5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 257
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.8V$  (MAX.)

### DESCRIPTION

The 74VHC257 is an advanced high-speed CMOS QUAD 2-CHANNEL MULTIPLEXER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is composed of four independent 2-channel multiplexers with common SELECT and ENABLE ( $\overline{OE}$ ) INPUT. The VHC257 is a non-inverting multiplexer. When the ENABLE INPUT is held

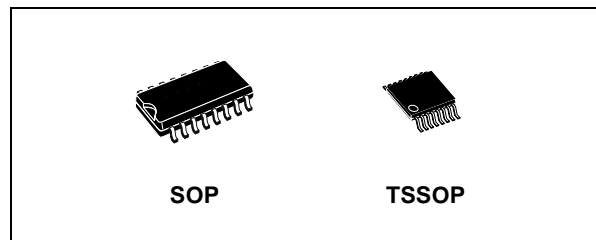


Table 1: Order Codes

PACKAGE	T & R
SOP	74VHC257MTR
TSSOP	74VHC257TTR

"High", all outputs become in high impedance state. If SELECT INPUT is held "Low", "A" data is selected, when SELECT INPUT is "High", "B" data is chosen.

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.

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

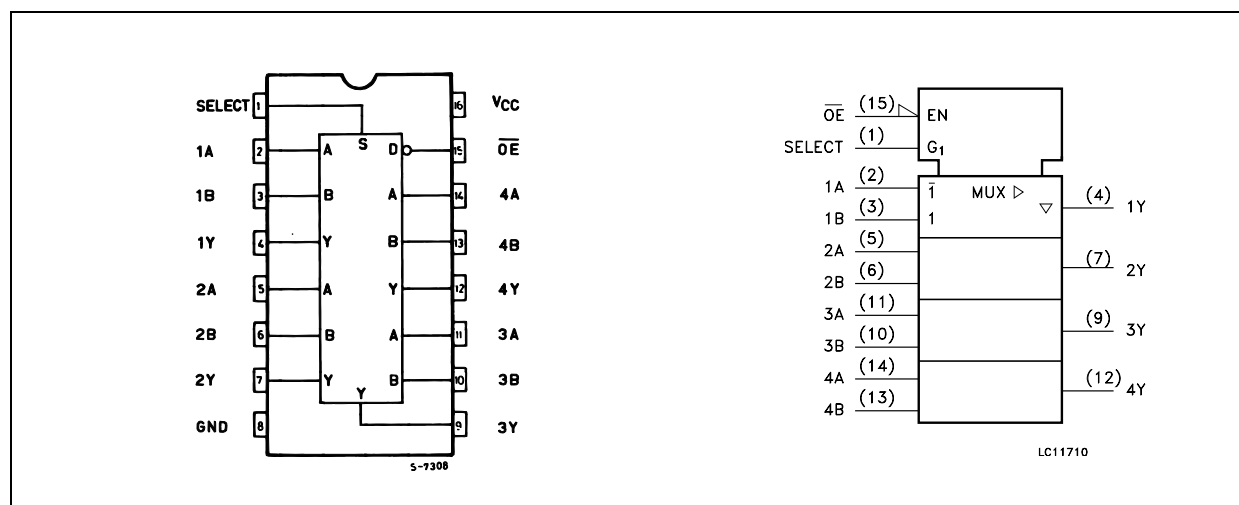


Figure 2: Input Equivalent Circuit

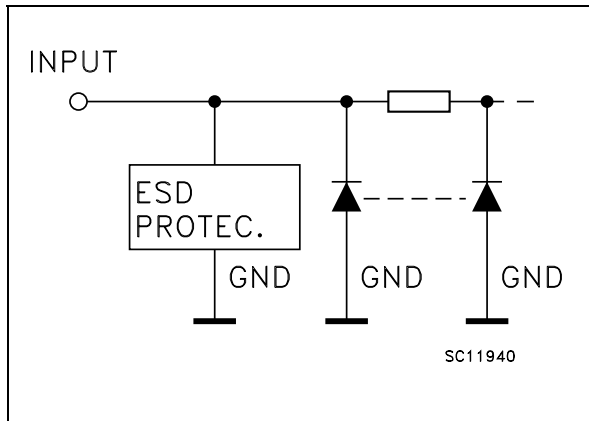


Table 2: Pin Description

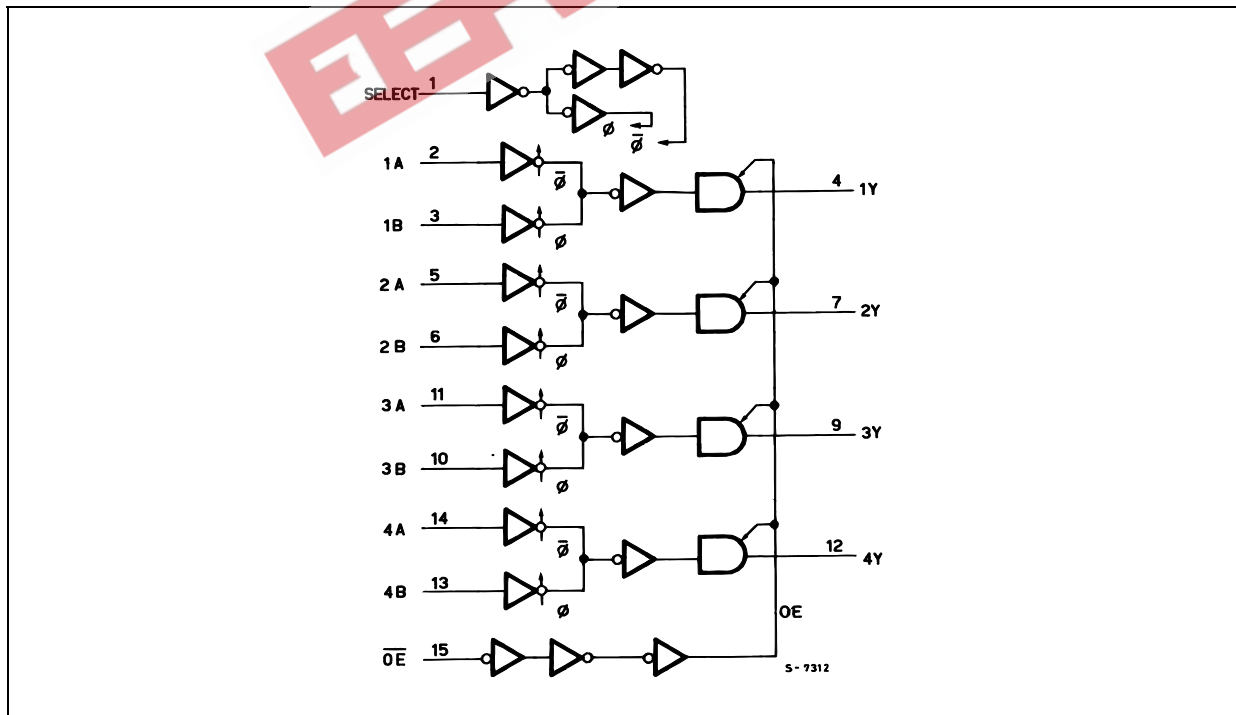
PIN N°	SYMBOL	NAME AND FUNCTION
1	SELECT	Common Data Select Inputs
2, 5, 11, 14	1A to 4A	Data Inputs From Source A
3, 6, 10, 13	1B to 4B	Data Inputs From Source B
4, 7, 9, 12	1Y to 4Y	3 State Multiplexer Outputs
15	OE	3 State Output Enable Inputs (Active LOW)
8	GND	Ground (0V)
16	V <sub>CC</sub>	Positive Supply Voltage

Table 3: Truth Table

INPUTS				OUTPUT
$\overline{OE}$	SELECT	A	B	Y
H	X	X	X	Z
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

X : Don't Care  
Z : High Impedance

Figure 3: Logic Diagram



This logic diagram has not be used to estimate propagation delays

**Table 4: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$V_I$	DC Input Voltage	-0.5 to +7.0	V
$V_O$	DC Output Voltage	-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	$\pm 50$	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.

**Table 5: Recommended Operating Conditions**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	2 to 5.5	V
$V_I$	Input Voltage	0 to 5.5	V
$V_O$	Output Voltage	0 to $V_{CC}$	V
$T_{op}$	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (note 1) ( $V_{CC} = 3.3 \pm 0.3V$ ) ( $V_{CC} = 5.0 \pm 0.5V$ )	0 to 100 0 to 20	ns/V

1)  $V_{IN}$  from 30% to 70% of  $V_{CC}$

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	2.0		1.5			1.5		1.5		V
		3.0 to 5.5		0.7V <sub>CC</sub>			0.7V <sub>CC</sub>		0.7V <sub>CC</sub>		
V <sub>IL</sub>	Low Level Input Voltage	2.0				0.5		0.5		0.5	V
		3.0 to 5.5				0.3V <sub>CC</sub>		0.3V <sub>CC</sub>		0.3V <sub>CC</sub>	
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		
		4.5	I <sub>O</sub> =-50 μA	4.4	4.5		4.4		4.4		
		3.0	I <sub>O</sub> =-4 mA	2.58			2.48		2.4		
		4.5	I <sub>O</sub> =-8 mA	3.94			3.8		3.7		
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	
		4.5	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	
		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> = V <sub>CC</sub> or GND			±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		± 1	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		40	μA

Table 7: 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 A, B to Y	3.3(*)	15			5.8	9.3	1.0	11.0	1.0	11.0	ns
		3.3(*)	50			8.3	12.8	1.0	14.5	1.0	14.5	
		5.0(**)	15			3.6	5.9	1.0	7.0	1.0	7.0	
		5.0(**)	50			5.1	7.9	1.0	9.0	1.0	9.0	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time SELECT to Y	3.3(*)	15			7.0	11.0	1.0	13.0	1.0	13.0	ns
		3.3(*)	50			9.5	14.5	1.0	16.5	1.0	16.5	
		5.0(**)	15			4.0	6.8	1.0	8.0	1.0	8.0	
		5.0(**)	50			5.5	8.8	1.0	10.0	1.0	10.0	
$t_{PZL}$ $t_{PZH}$	Output Enable Time	3.3(*)	15	$R_L = 1\text{K}\Omega$		6.7	10.5	1.0	12.5	1.0	12.5	ns
		3.3(*)	50	$R_L = 1\text{K}\Omega$		9.2	14.0	1.0	16.0	1.0	16.0	
		5.0(**)	15	$R_L = 1\text{K}\Omega$		3.6	6.8	1.0	8.0	1.0	8.0	
		5.0(**)	50	$R_L = 1\text{K}\Omega$		5.1	8.8	1.0	10.0	1.0	10.0	
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	3.3(*)	50	$R_L = 1\text{K}\Omega$		8.6	12.0	1.0	13.5	1.0	13.5	ns
		5.0(**)	50	$R_L = 1\text{K}\Omega$		5.7	7.9	1.0	9.0	1.0	9.0	

(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$ (\*\*) Voltage range is  $5.0\text{V} \pm 0.5\text{V}$ 

Table 8: Capacitive Characteristics

Symbol	Parameter	Test Condition			Value						Unit	
					$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ to $125^\circ\text{C}$		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$C_{IN}$	Input Capacitance					6	10		10		10	pF
$C_{OUT}$	Output Capacitance					8						pF
$C_{PD}$	Power Dissipation Capacitance (note 1)					18						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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$  (per channel)

Table 9: Dynamic Switching Characteristics

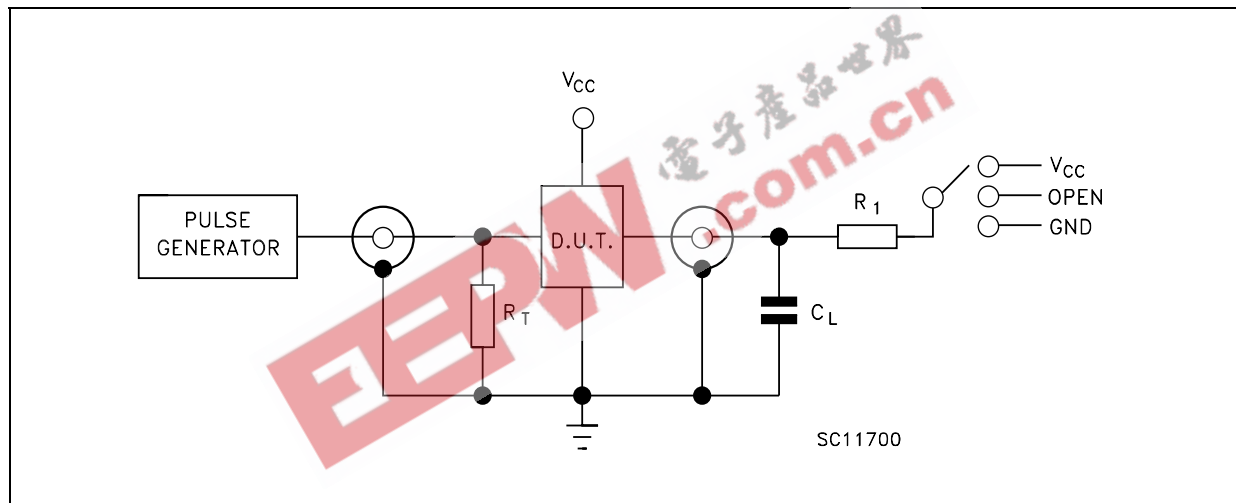
Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)	C <sub>L</sub> = 50 pF	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C <sub>L</sub> = 50 pF		0.3	0.8					V
V <sub>OLV</sub>				-0.8	-0.3						
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	5.0		3.5						V	
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	5.0				1.5				V	

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 5.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 5.0V. Inputs under test switching: 5.0V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

Figure 4: Test Circuit



TEST	SWITCH
t <sub>PLH</sub> , t <sub>PHL</sub>	Open
t <sub>PZL</sub> , t <sub>PLZ</sub>	V <sub>CC</sub>
t <sub>PZH</sub> , t <sub>PHZ</sub>	GND

C<sub>L</sub> = 15/ 50 pF or equivalent (includes jig and probe capacitance)

R<sub>L</sub> = R<sub>1</sub> = 1KΩ or equivalent

R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

Figure 5: Waveform - Propagation Delays For Inverting Conditions (f=1MHz; 50% duty cycle)

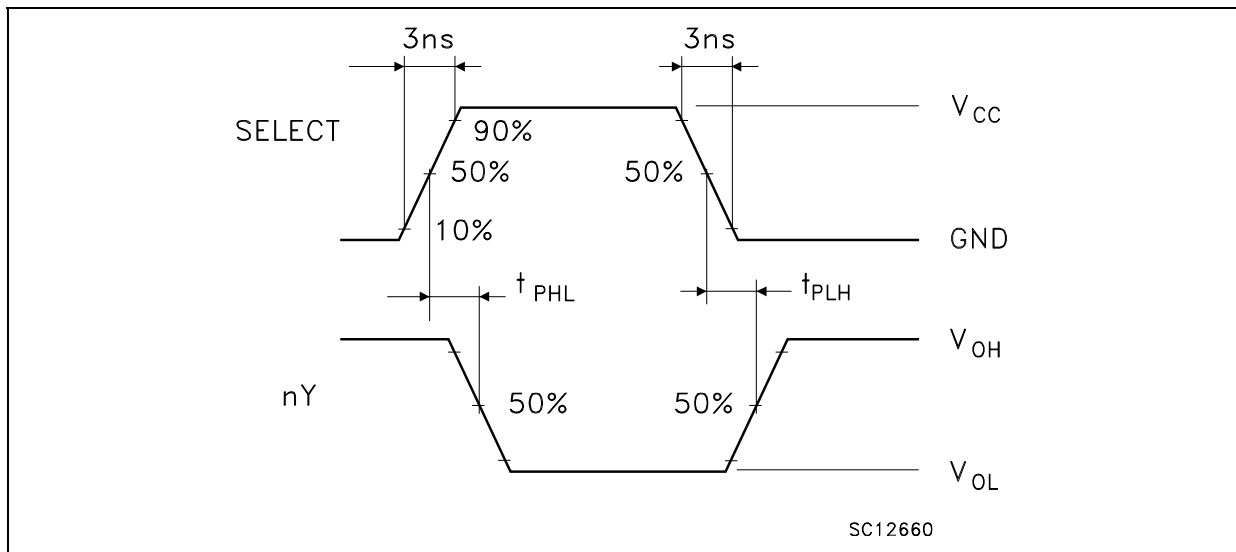


Figure 6: Waveform - Propagation Delays For Non-inverting Conditions (f=1MHz; 50% duty cycle)

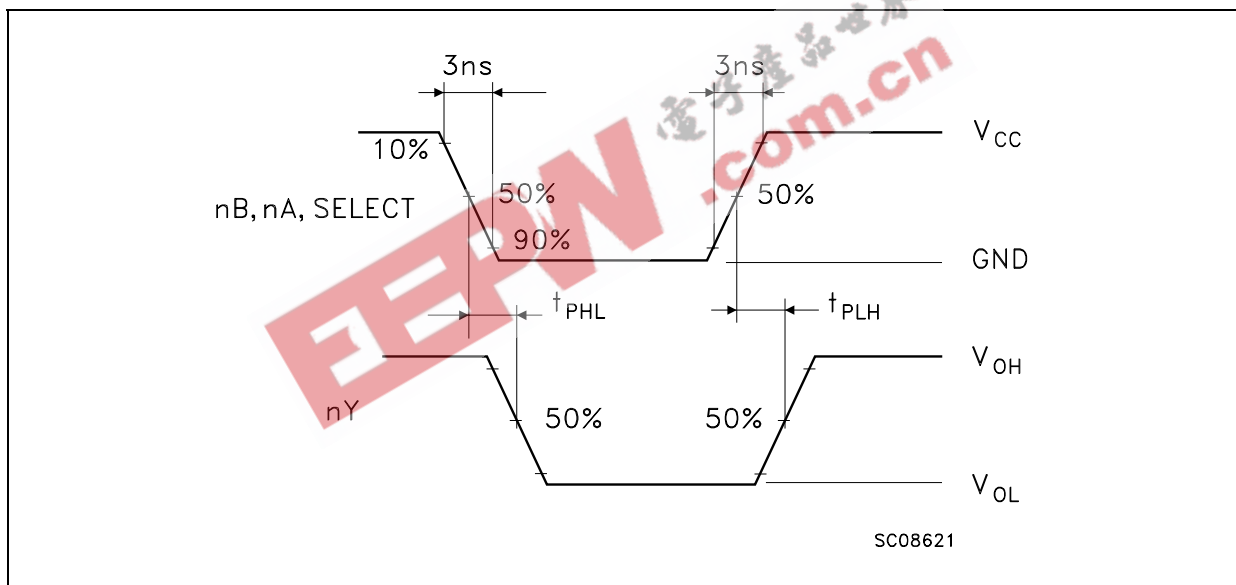
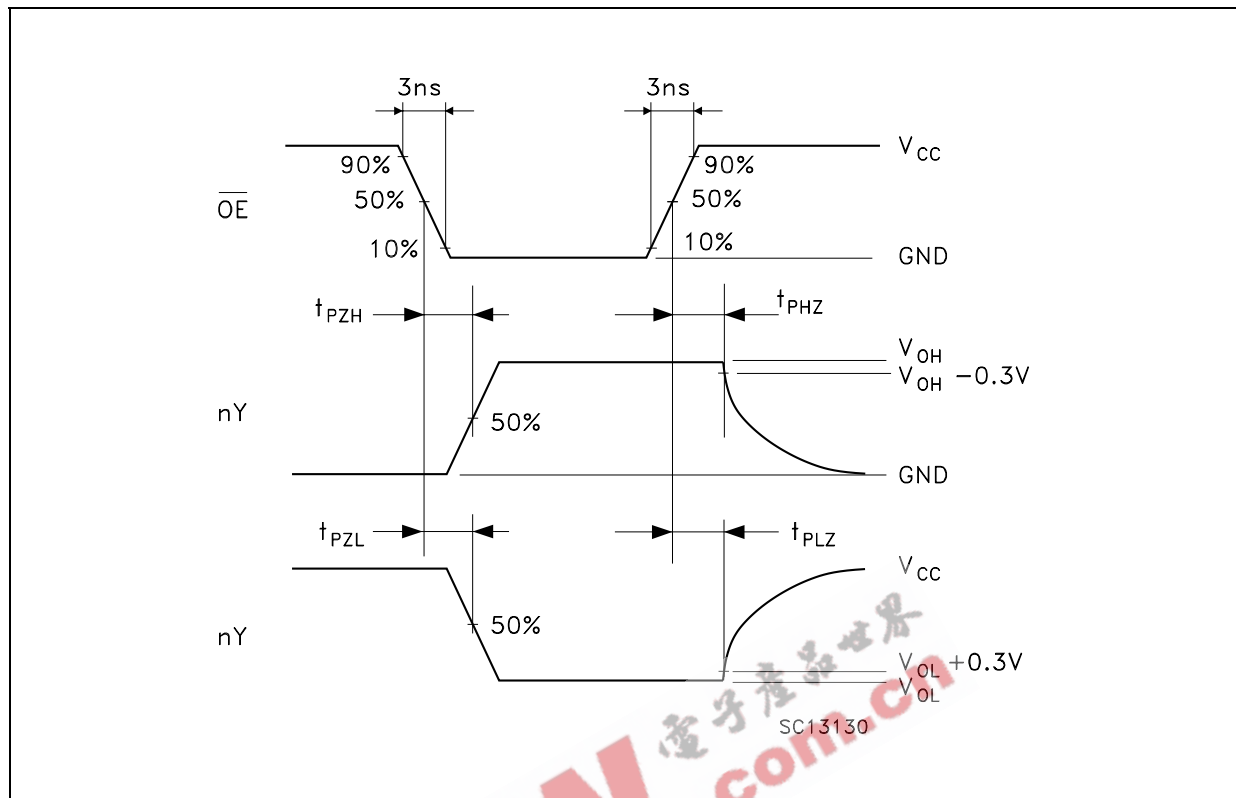


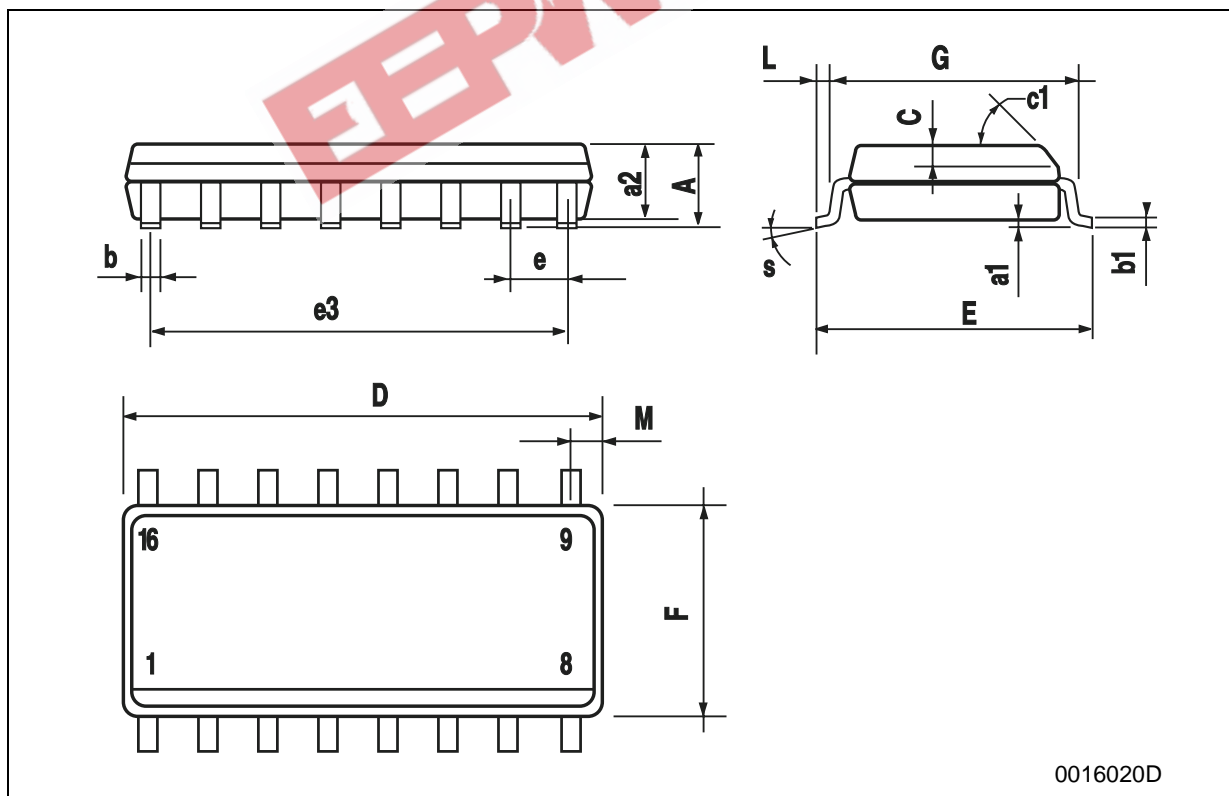
Figure 7: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)





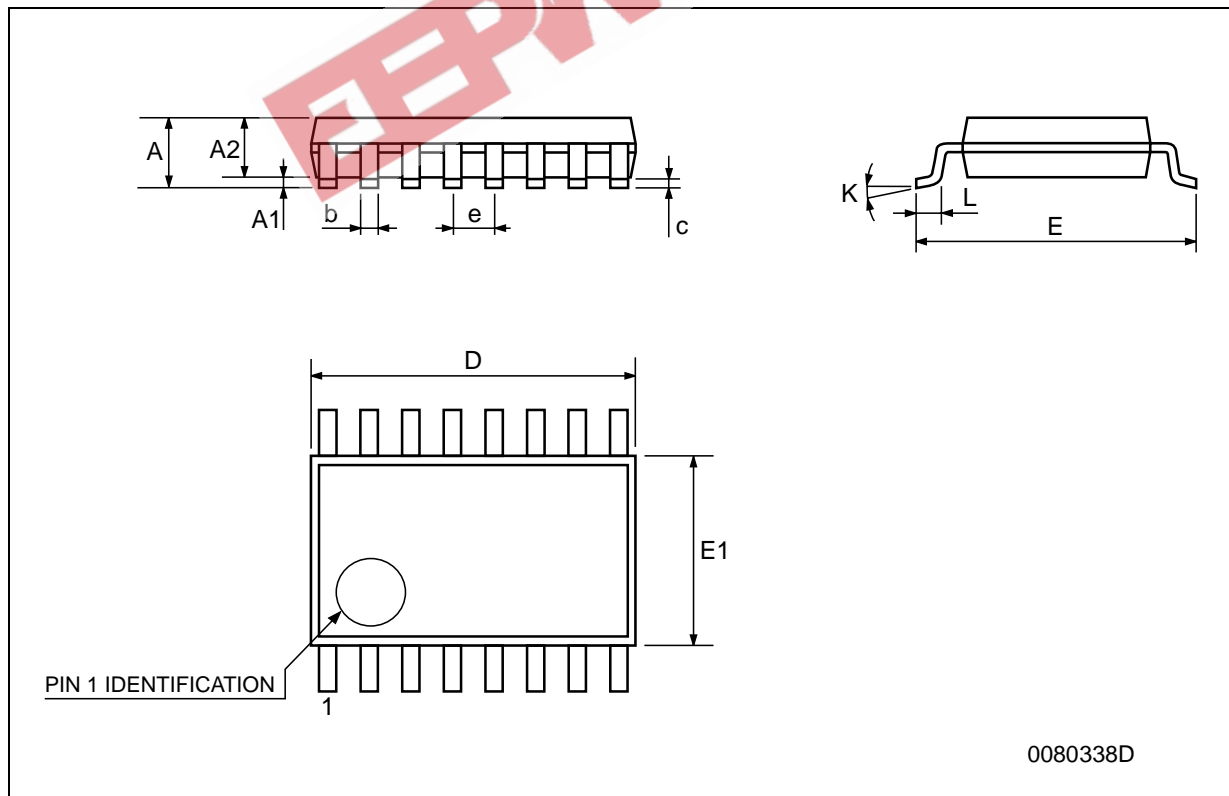
## SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



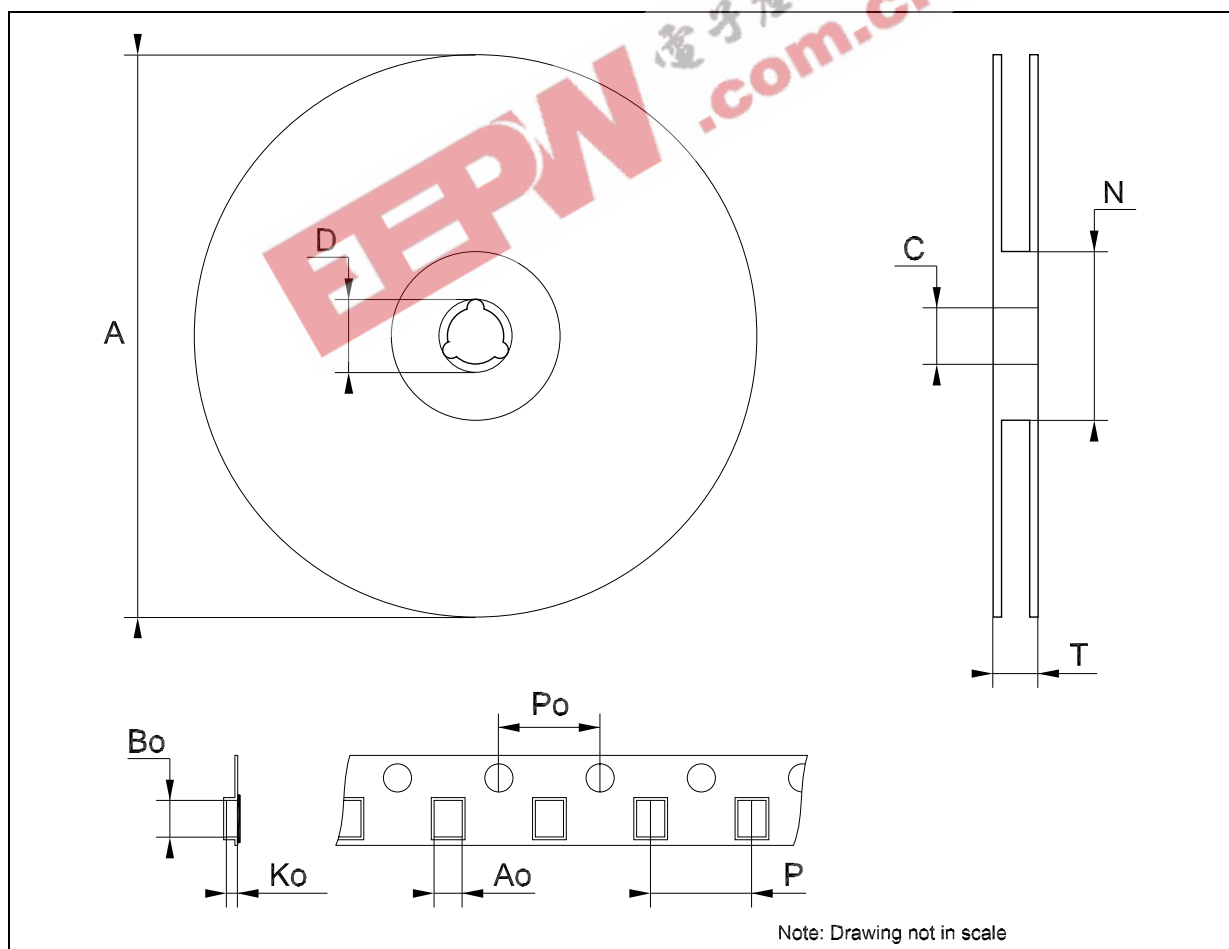
## TSSOP16 MECHANICAL DATA

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	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



## Tape &amp; Reel SO-16 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	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
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 TSSOP16 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

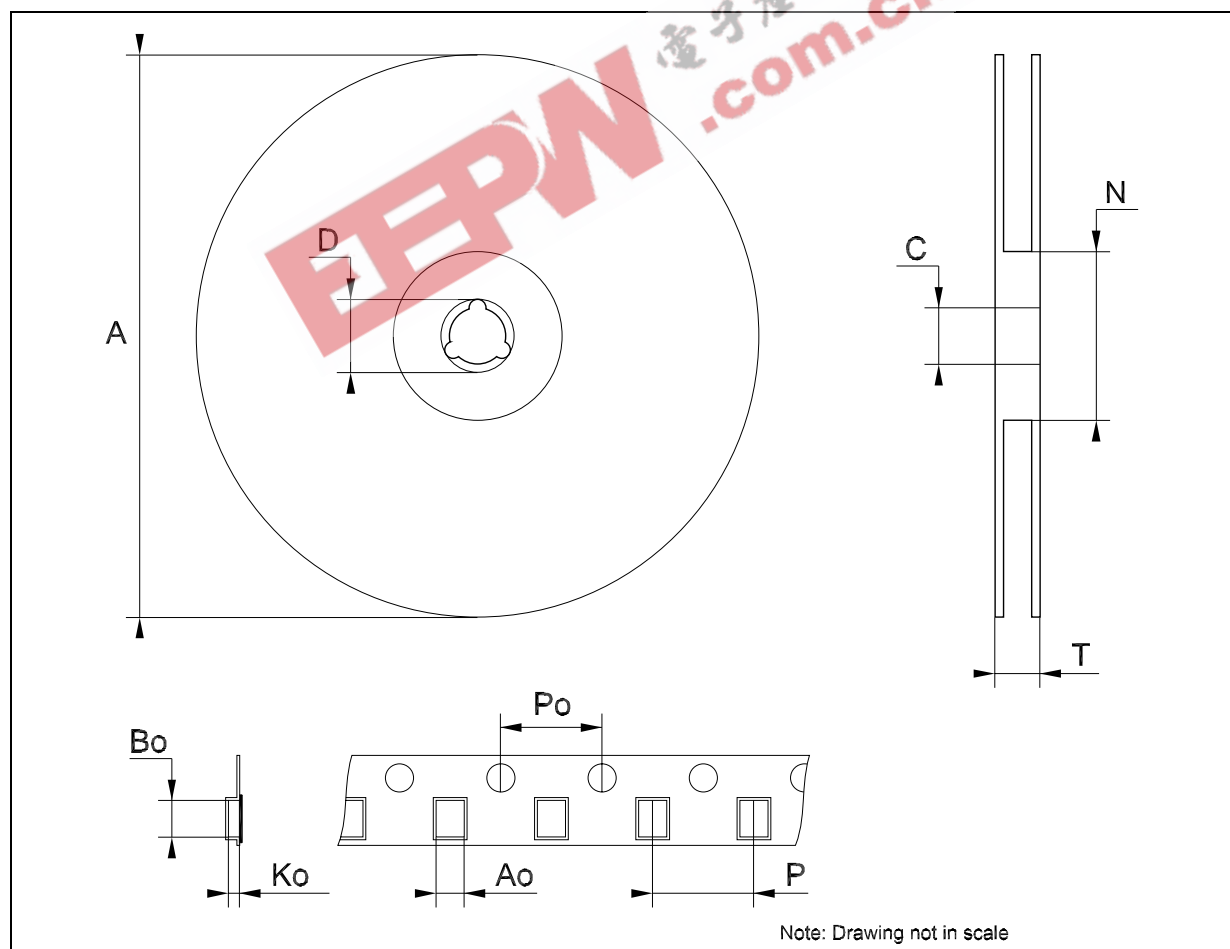


Table 10: Revision History

Date	Revision	Description of Changes
12-Nov-2004	4	Order Codes Revision - pag. 1.

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