

QUAD 2-INPUT OPEN DRAIN NAND GATE

- HIGH SPEED: $t_{pZ} = 3.9 \text{ ns}$ (TYP.) at $V_{CC} = 5V$
- LOW POWER DISSIPATION:
 $I_{CC} = 2 \mu A$ (MAX.) at $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS:
 $V_{IH} = 2V$ (MIN.), $V_{IL} = 0.8V$ (MAX)
- POWER DOWN PROTECTION ON INPUTS
- OPERATING VOLTAGE RANGE:
 $V_{CC}(OPR) = 4.5V$ to $5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 03
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: $V_{OLP} = 0.8V$ (MAX.)

DESCRIPTION

The 74VHCT03A is an advanced high-speed CMOS QUAD 2-INPUT OPEN DRAIN NAND GATE fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology.

The internal circuit is composed of 3 stages including buffer output, which provides high noise immunity and stable output.

This device can, with an external pull-up resistor, be used in wired AND configuration. This device can also be used as a led driver and in any other application requiring a current sink.

Power down protection is provided on all inputs and 0 to 7V can be accepted on inputs with no

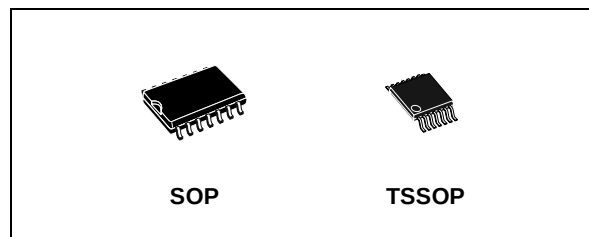


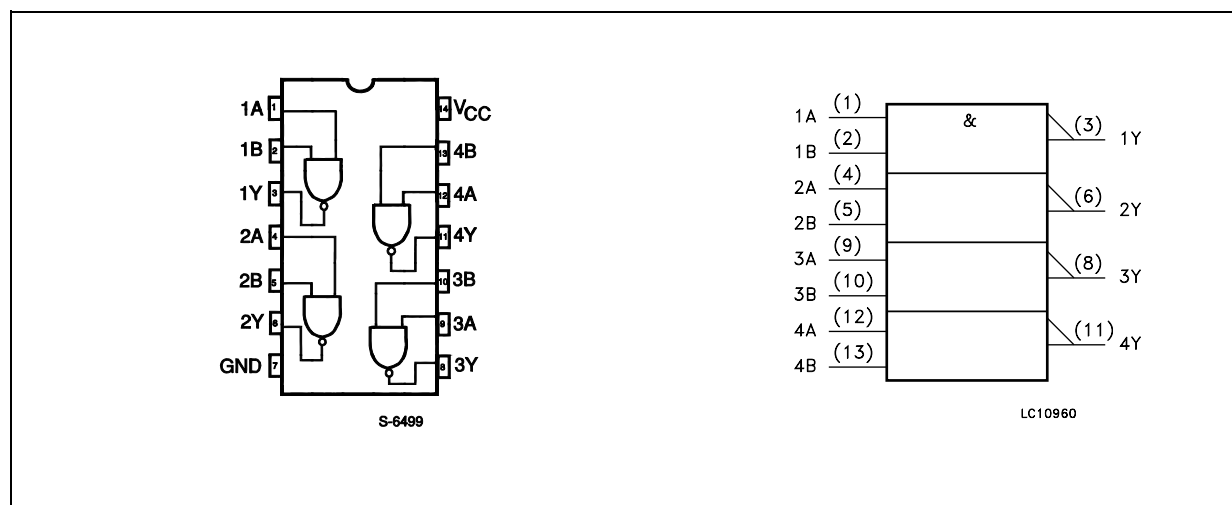
Table 1: Order Codes

PACKAGE	T & R
SOP	74VHCT03AMTR
TSSOP	74VHCT03ATTR

regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold.

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



The diagram shows an input signal line labeled "INPUT" entering from the left. A node on this line is connected to a rectangular block labeled "ESD PROTEC.". This node is also connected to ground (GND) through a diode pointing towards the signal line. Further along the signal line, there is another node connected to ground through a second diode, also pointing towards the signal line. A resistor is connected between the two nodes on the signal line. The output of the signal line continues to the right, indicated by a dashed line. The text "SC11940" is located at the bottom right of the diagram.

PIN N°	SYMBOL	NAME AND FUNCTION
1, 4, 9, 12	1A to 4A	Data Inputs
2, 5, 10, 13	1B to 4B	Data Inputs
3, 6, 8, 11	1Y to 4Y	Data Outputs
7	GND	Ground (0V)
14	V _{CC}	Positive Supply Voltage

A	B	Y
L	L	Z
L	H	Z
H	L	Z
H	H	L

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	± 20	mA
I _O	DC Output Current	± 25	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 50	mA
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature (10 sec)	300	°C

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	4.5 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 (see note 3) (V _{CC} = 5.0 ± 0.5V)	0 to 20	ns/V

Table 6: DC Specifications

Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V _{IH}	High Level Input Voltage	4.5 to 5.5		2			2		2		V
V _{IL}	Low Level Input Voltage	4.5 to 5.5				0.8		0.8		0.8	V
V _{OL}	Low Level Output Voltage	4.5	I _O =50 μA		0.0	0.1		0.1		0.1	V
		4.5	I _O =8 mA			0.36		0.44		0.44	
I _{OZ}	High Impedance Output Leakage Current	5.5	V _I = V _{IH} or V _{IL} V _O = 0V to 5.5V			±0.25		± 2.5		± 2.5	μA
I _I	Input Leakage Current	0 to 5.5	V _I = 5.5V or GND			± 0.1		± 1.0		± 1.0	μA
I _{CC}	Quiescent Supply Current	5.5	V _I = V _{CC} or GND			2		20		20	μA
+I _{CC}	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V _{CC} or GND			1.35		1.5		1.5	mA

Table 7: AC Electrical Characteristics (Input t_r = t_f = 3ns)

Symbol	Parameter	Test Condition			Value						Unit	
		V _{CC} (*) (V)	C _L (pF)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{PZL}	Propagation Delay Time	5.0	15			3.9	5.1	1.0	6.0	1.0	6.0	ns
		5.0	50			4.4	5.7	1.0	6.6	1.0	6.6	
t _{PLZ}	Propagation Delay Time	5.0	50			7.5	9.8	1.0	11.3	1.0	11.3	ns

(*) Voltage range is 5.0V ± 0.5V

Table 8: Capacitive Characteristics

Symbol	Parameter	Test Condition	Value								Unit
			T _A = 25°C			-40 to 85°C		-55 to 125°C			
		Min.	Typ.	Max.	Min.	Max.	Min.	Max.			
C _{IN}	Input Capacitance			5.8	10		10		10	pF	
C _{OUT}	Output Capacitance			8.8						pF	
C _{PD}	Power Dissipation Capacitance (note 1)			6						pF	

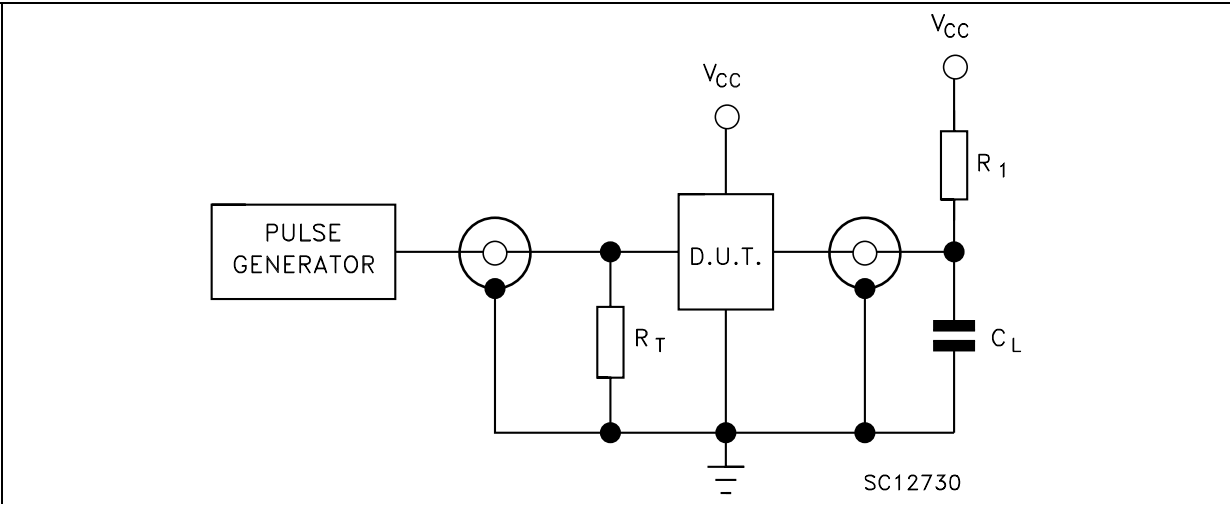
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I_{CC(opr)} = C_{PD} × V_{CC} × f_{IN} + I_{CC}/4 (per gate)

Table 9: Dynamic Switching Characteristics

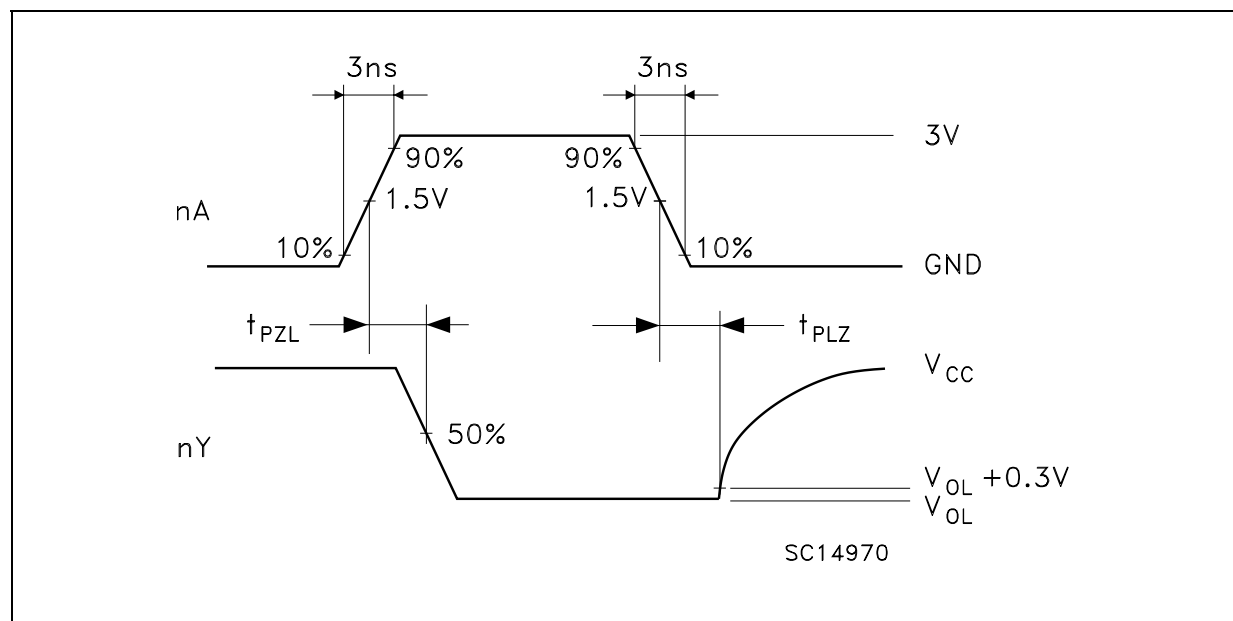
Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C _L = 50 pF		0.3	0.8					V
V _{OLV}				-0.8	-0.3						
V _{IHD}	Dynamic High Voltage Input (note 1, 3)	5.0		2.0							
V _{ILD}	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_{ILD}), 0V to threshold (V_{IHD}), f=1MHz.

Figure 3: Test Circuit

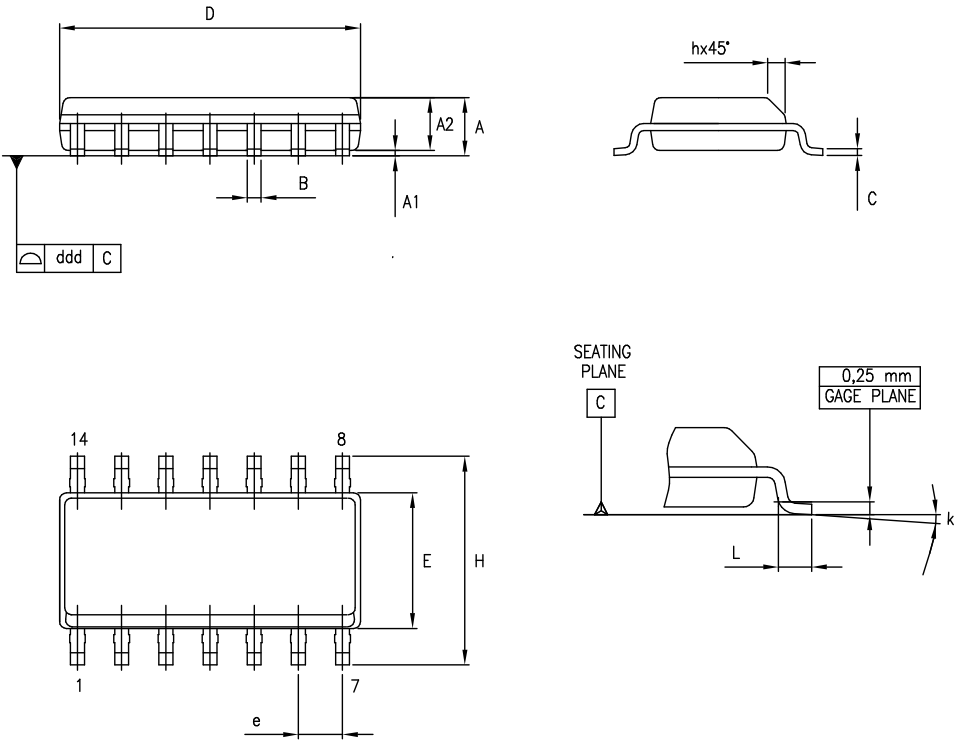


C_L =15/50pF or equivalent (includes jig and probe capacitance)
 $R_L = R_1 = 1K\Omega$ or equivalent
 $R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

Figure 4: Waveform - Propagation Delays ($f=1\text{MHz}$; 50% duty cycle)

SO-14 MECHANICAL DATA

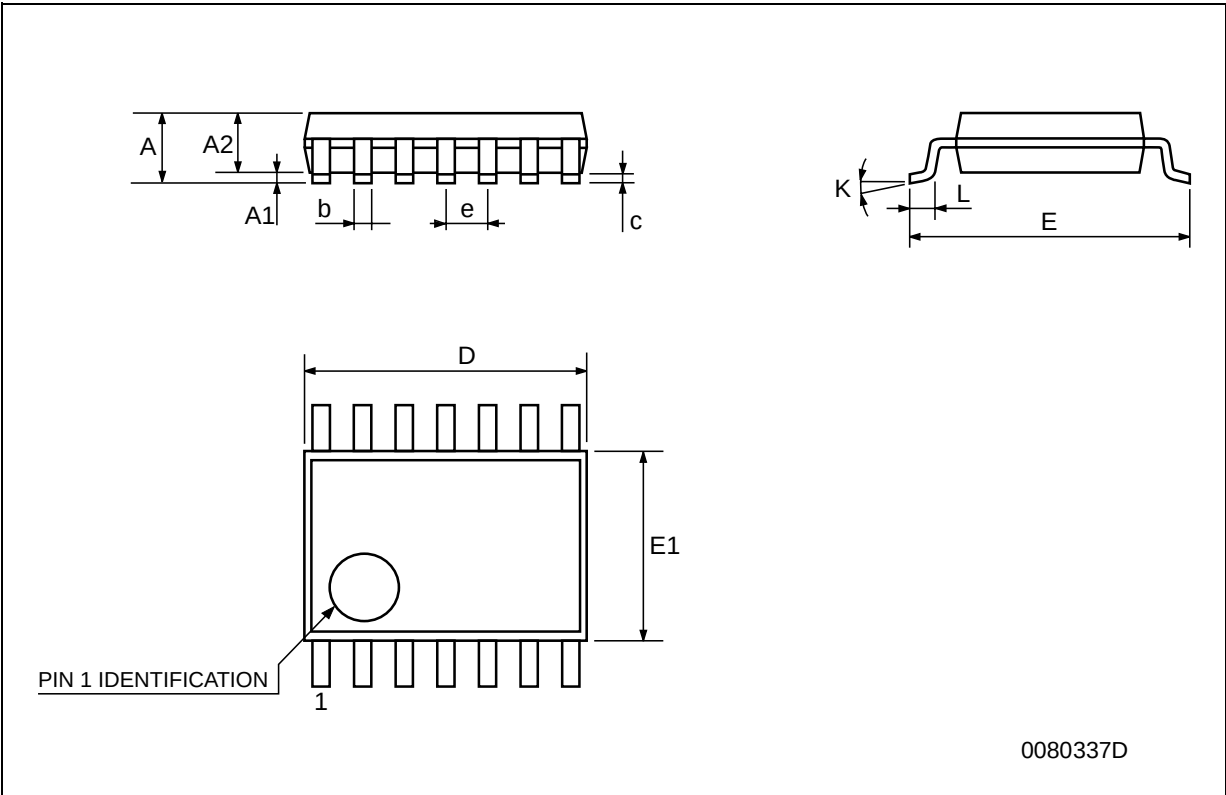
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.1		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	8.55		8.75	0.337		0.344
E	3.8		4.0	0.150		0.157
e		1.27			0.050	
H	5.8		6.2	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.4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



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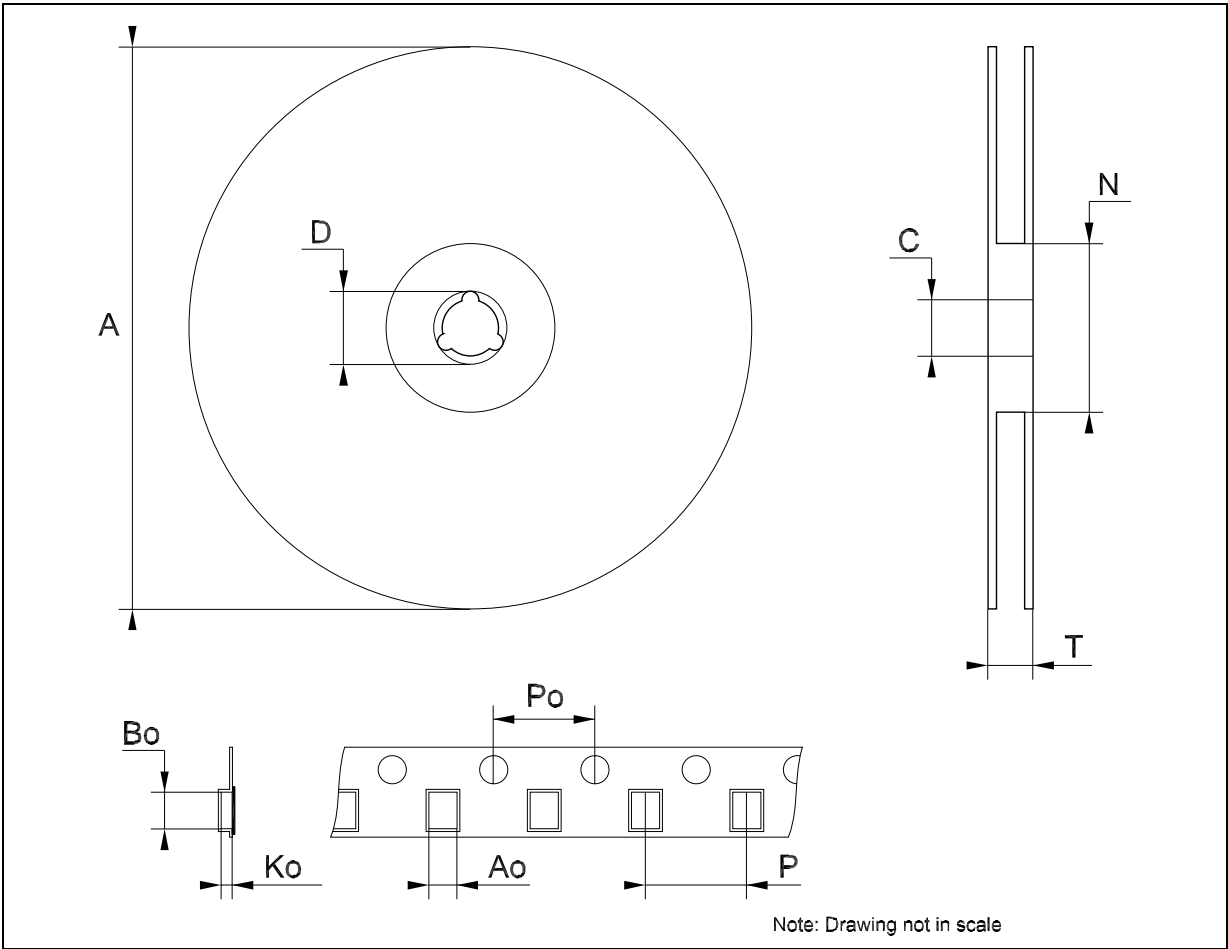
TSSOP14 MECHANICAL DATA

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



Tape & 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 & 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

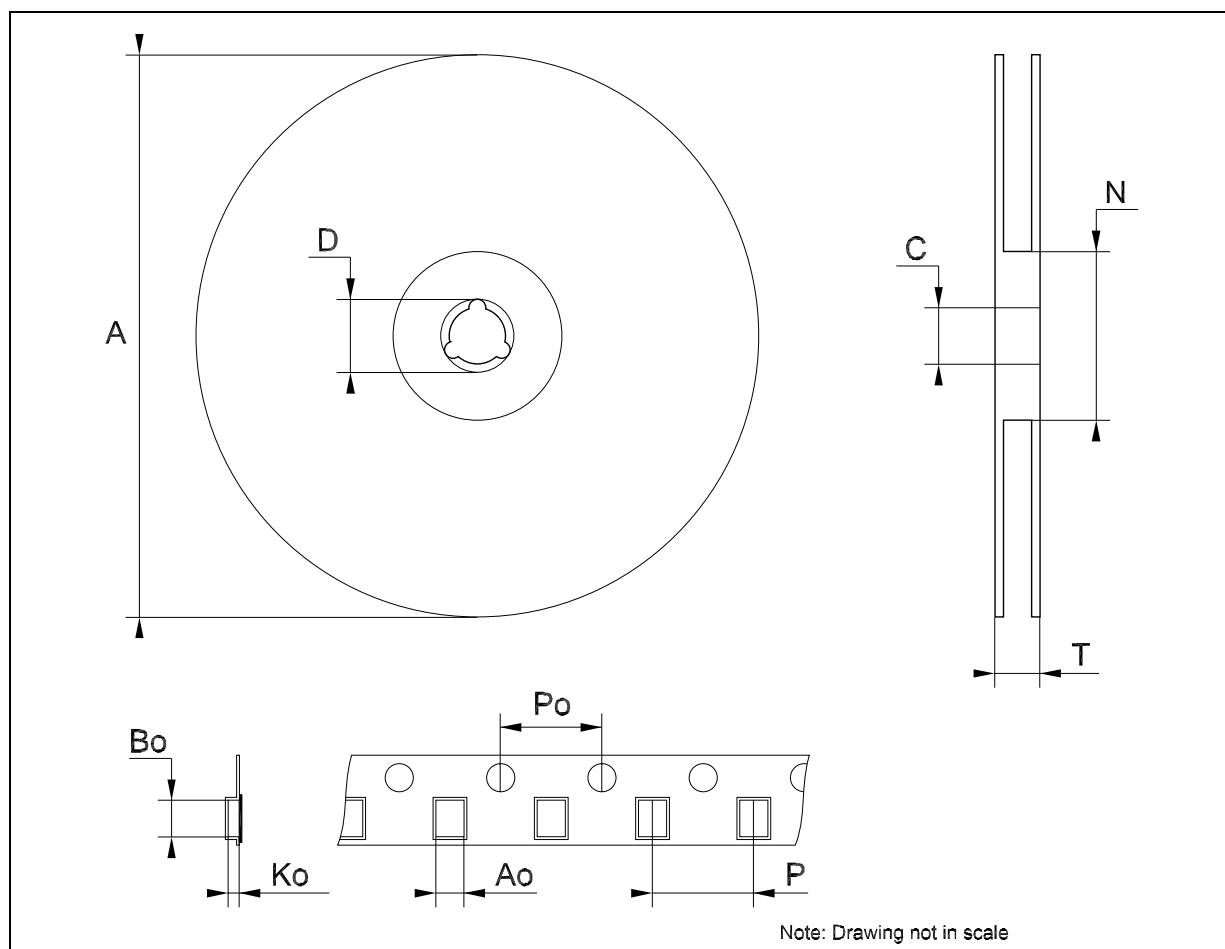


Table 10: Revision History

Date	Revision	Description of Changes
16-Dec-2004	3	Order Codes Revision - pag. 1.

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