

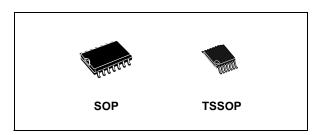
### **QUAD 2-INPUT AND GATE**

- HIGH SPEED:  $t_{PD} = 4.3 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  $I_{CC} = 2 \mu A \text{ (MAX.)}$  at  $T_A = 25 \text{°C}$
- HIGH NOISE IMMUNITY: V<sub>NIH</sub> = V<sub>NIL</sub> = 28% V<sub>CC</sub> (MIN.)
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE: |I<sub>OH</sub>| = I<sub>OL</sub> = 8mA (MIN)
- BALANCED PROPAGATION DELAYS: tpl H ≅ tpHI
- OPERATING VOLTAGE RANGE: V<sub>CC</sub>(OPR) = 2V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 08
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.8V$  (MAX.)

#### **DESCRIPTION**

The 74VHC08 is an advanced high-speed CMOS QUAD 2-INPUT AND GATE fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

The internal circuit is composed of 2 stages including buffer output, which provides high noise immunity and stable output.



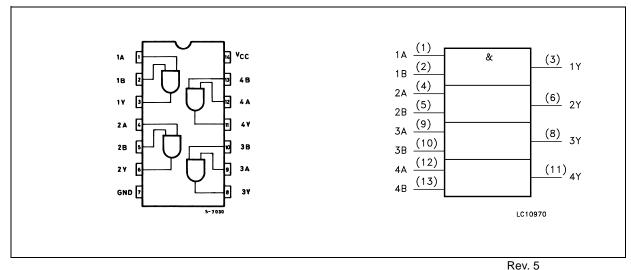
**Table 1: Order Codes** 

PACKAGE	T & R
SOP	74VHC08MTR
TSSOP	74VHC08TTR

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.

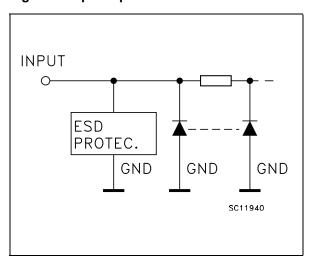
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

Figure 1: Pin Connection And IEC Logic Symbols



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**Figure 2: Input Equivalent Circuit** 



**Table 2: Pin Description** 

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 <sub>CC</sub>	Positive Supply Voltage

**Table 3: Truth Table** 

Α	В	Y
L	L	L
L	Н	L
Н	L	L
Н	Н	Н

**Table 4: 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
Vo	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

**Table 5: Recommended Operating Conditions** 

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	2 to 5.5	V
V <sub>I</sub>	Input Voltage	0 to 5.5	V
Vo	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 1) ( $V_{CC}$ = 3.3 $\pm$ 0.3V) ( $V_{CC}$ = 5.0 $\pm$ 0.5V)	0 to 100 0 to 20	ns/V

<sup>1)</sup>  $\rm V_{IN}$  from 30% to 70% of  $\rm V_{CC}$ 

**Table 6: DC Specifications** 

		Т	est Condition				Value				
Symbol	Parameter	v <sub>cc</sub>		T,	T <sub>A</sub> = 25°C		-40 to 85°C		-55 to 125°C		Unit
		(V)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
V <sub>IH</sub>	High Level Input	2.0		1.5			1.5		1.5		
	Voltage	3.0 to 5.5		0.7V <sub>CC</sub>			0.7V <sub>CC</sub>		0.7V <sub>CC</sub>		V
$V_{IL}$	Low Level Input	2.0				0.5		0.5		0.5	
	Voltage	3.0 to 5.5				0.3V <sub>CC</sub>		0.3V <sub>CC</sub>		0.3V <sub>CC</sub>	V
V <sub>OH</sub>	High Level Output	2.0	I <sub>O</sub> =-50 μA	1.9	2.0		1.9		1.9		
	Voltage	3.0	I <sub>O</sub> =-50 μA	2.9	3.0		2.9		2.9		
ı		4.5	I <sub>O</sub> =-50 μA	4.4	4.5		4.4		4.4		V
		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		
$V_{OL}$	Low Level Output	2.0	I <sub>O</sub> =50 μA		0.0	0.1		0.1		0.1	
	Voltage	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	V
		3.0	I <sub>O</sub> =4 mA			0.36		0.44		0.55	
ı		4.5	I <sub>O</sub> =8 mA			0.36		0.44		0.55	
I <sub>I</sub>	Input Leakage Current	0 to 5.5	V <sub>I</sub> = 5.5V or GND			± 0.1		± 1		± 1	μΑ
I <sub>CC</sub>	Quiescent Supply Current	5.5	$V_I = V_{CC}$ or GND			2		20		20	μА

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

			Test Condition		Value							
Symbol	Parameter	V <sub>CC</sub>	CL		Т	<sub>A</sub> = 25°	С	-40 to	85°C	-55 to	125°C	Unit
		V <sub>CC</sub>	(pF)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
t <sub>PLH</sub>	Propagation Delay	3.3 <sup>(*)</sup>	15			6.2	8.8	1.0	10.5	1.0	10.5	
t <sub>PHL</sub>	Time	3.3 <sup>(*)</sup>	50			8.7	12.3	1.0	14.0	1.0	14.0	ns
		5.0 <sup>(**)</sup>	15			4.3	5.9	1.0	7.0	1.0	7.0	113
		5.0 <sup>(**)</sup>	50			5.8	7.9	1.0	9.0	1.0	9.0	

<sup>(\*)</sup> 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** 

		Test Condition	Value							
Symbol	Parameter		Т	<sub>A</sub> = 25°	С	-40 to	85°C	-55 to	125°C	Unit
			Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
C <sub>IN</sub>	Input Capacitance			6	10		10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)			15						pF

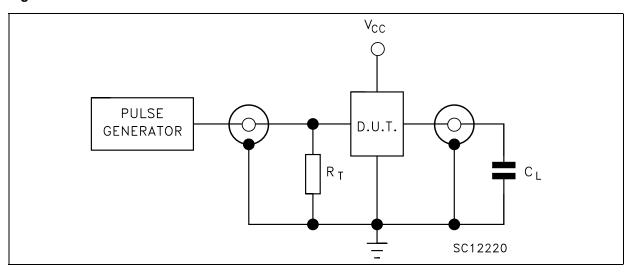
<sup>1)</sup>  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times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

**Table 9: Dynamic Switching Characteristics** 

			est Condition	Value							
Symbol	Parameter	v <sub>cc</sub>		Т	A = 25°	С	-40 to	85°C	-55 to	125°C	Unit
		(V)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
V <sub>OLP</sub>	Dynamic Low	- 0			0.3	0.8					.,
V <sub>OLV</sub>	Voltage Quiet Output (note 1, 2)	5.0		-0.8	-0.3						V
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	5.0	C <sub>L</sub> = 50 pF	3.5							V
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	5.0				1.5					V

<sup>1)</sup> Worst case package.

Figure 3: Test Circuit

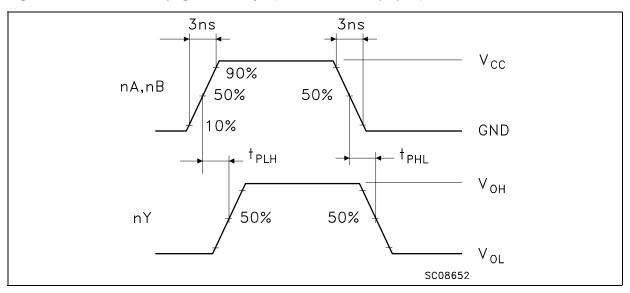


 $C_L=15/50pF$  or equivalent (includes jig and probe capacitance)  $R_T=Z_{OUT}$  of pulse generator (typically  $50\Omega)$ 

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

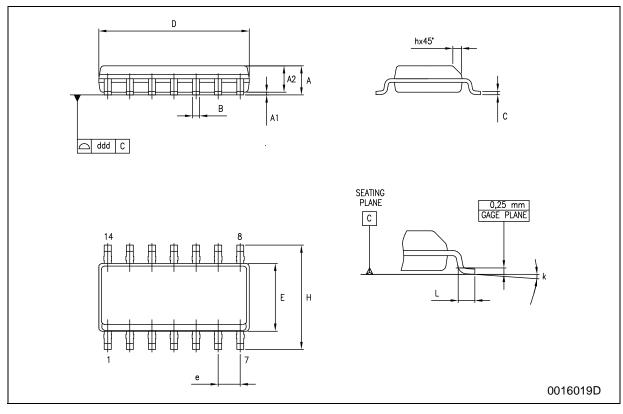
3) Max number of data inputs (n) switching. (n-1) switching 0V to 5.0V. Inputs under test switching: 5.0V to threshold (V<sub>ILD</sub>), 0V to threshold  $(\dot{V}_{IHD})$ , f=1MHz.





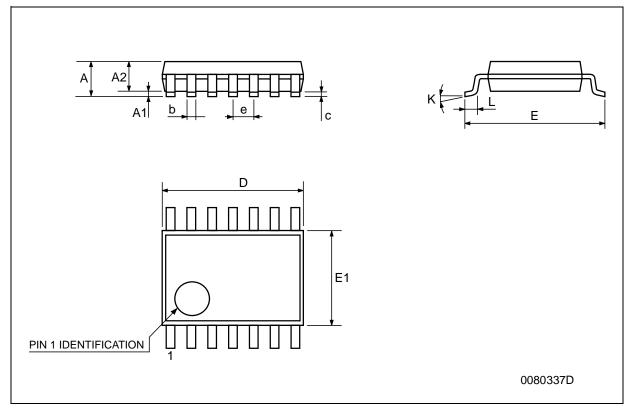
## **SO-14 MECHANICAL DATA**

DIM		mm.			inch	
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
А	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
В	0.33		0.51	0.013		0.020
С	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
е		1.27			0.050	
Н	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



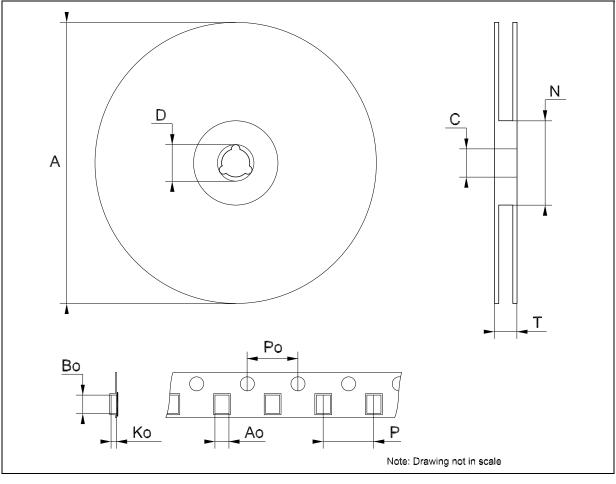
## **TSSOP14 MECHANICAL DATA**

DIM		mm.			inch	
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
А			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
С	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
е		0.65 BSC			0.0256 BSC	
К	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



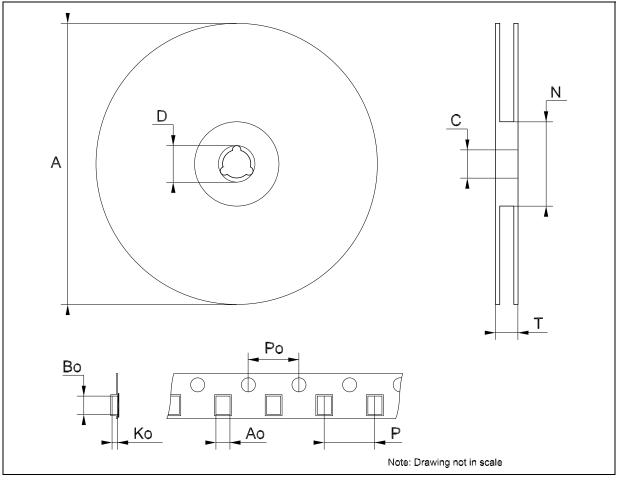
# Tape & Reel SO-14 MECHANICAL DATA

	mm.				
MIN.	TYP	MAX.	MIN.	TYP.	MAX.
		330			12.992
12.8		13.2	0.504		0.519
20.2			0.795		
60			2.362		
		22.4			0.882
6.4		6.6	0.252		0.260
9		9.2	0.354		0.362
2.1		2.3	0.082		0.090
3.9		4.1	0.153		0.161
7.9		8.1	0.311		0.319
	12.8 20.2 60 6.4 9 2.1 3.9	MIN. TYP  12.8  20.2  60  6.4  9  2.1  3.9	MIN.         TYP         MAX.           330         12.8         13.2           20.2         60         22.4           6.4         6.6         9           9         9.2           2.1         2.3           3.9         4.1	MIN.         TYP         MAX.         MIN.           330         12.8         13.2         0.504           20.2         0.795         0.795           60         2.362           22.4         6.6         0.252           9         9.2         0.354           2.1         2.3         0.082           3.9         4.1         0.153	MIN.         TYP         MAX.         MIN.         TYP.           330         12.8         13.2         0.504           20.2         0.795         0.795           60         2.362         0.252           6.4         6.6         0.252           9         9.2         0.354           2.1         2.3         0.082           3.9         4.1         0.153



# Tape & Reel TSSOP14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
А			330			12.992
С	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
Т			22.4			0.882
Ao	6.7		6.9	0.264		0.272
Во	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
Р	7.9		8.1	0.311		0.319



### **Table 10: Revision History**

Date	Revision	Description of Changes
12-Nov-2004	5	Order Codes Revision - pag. 1.

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