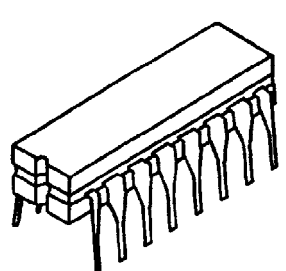


BRITISH STANDARDS INSTITUTION 2 PARK STREET, LONDON. W1A 2BS Specification available from:- AS SHOWN IN PD 9002 AND CECC 00 200 AND	BS CECC 90 104 - 151 ISSUE 1 DECEMBER 1981  Page 1 of 29 pages
ELECTRONIC COMPONENTS OF ASSESSED QUALITY DETAIL SPECIFICATION IN ACCORDANCE WITH: BS CECC 90 000 : 1976 BS CECC 90 100 : 1977	MANUFACTURERS TYPE NUMBER 4501UB SEE PD 9002 AND CECC 00 200 For ordering information see page 10
Outline not to scale: Isometric projection Marking information see page 9  For detail dimensions see IEC 191-2 (A50C)	TRIPLE GATE WHICH MAY BE COMBINED TO GIVE DUAL 4-INPUT NAND GATE 2-INPUT NOR/OR GATE, 8-INPUT AND/NAND GATE. SILICON COMPLEMENTARY MOS. WITH (UB) UNBUFFERED OUTPUTS AND CAVITY PACKAGING Assessment levels R, S, T and V and optional screening categories A, B, C and D

CAUTION: THESE ARE STATIC SENSITIVE DEVICES - See clause 1.11

1. Limiting conditions of use (not for inspection purposes)

All voltages referenced to V_{SS}

1.1	Maximum supply voltage, positive	V_{DD}	+18,0V
1.2	Maximum supply voltage, negative	V_{DD}	-0,5V
1.3	Maximum positive input voltage	V_I	$V_{DD} + 0,5V$
1.4	Maximum negative input voltage	V_I	-0,5V

Refer to Qualified Products List PD 9002 and/or CECC 00 200
 for details of manufacturers approved to this specification

1. Limiting conditions of use (contd)

1.5	Maximum power dissipation, per package	P_{D1}	200,0mW
	per output	P_{D2}	50,0mW
1.6	Maximum continuous current into any input.	$ I_I $	10,0mA
1.7	Maximum continuous current into any output.	$ I_O $	10,0mA
1.8	Operating temperature range	T_{amb}	
		Full	-55 to +125°C
		Limited	-40 to + 85°C
1.9	Storage temperature range	T_{stg}	-65 to +150°C
1.10	Transient energy rating		400V at 100pF through 1,5kΩ

1.11 Recommended handling precautions

- 1.11.1 Store devices in either conductive foam or conductive rails, or connect all leads together using a similar electrical shorting method.
- 1.11.2 Use grounded tip soldering irons.
- 1.11.3 Ground all test equipment.
- 1.11.4 Connect all unused device inputs to V_{DD} or V_{SS} .
- 1.11.5 PC boards used to mount MOS devices should have all metal leads grounded during device mounting or flow soldering operations.
- 1.11.6 Soldering equipment, solder pots or flow soldering equipment should be grounded whenever in contact with PC boards and/or MOS devices.
- 1.11.7 Do not use ungrounded automatic insertion equipment or other handling equipment that precludes the use of suitable device lead grounding techniques during inspection or handling.
- 1.11.8 When PC boards containing mounted MOS devices are removed from equipment for test, shipping or storage, 'Dummy connectors' should be used to electrically short all PC board terminals together.
- 1.11.9 Switch off power supply before inserting or removing devices from circuits.
- 1.11.10 Disconnect all low impedance equipment and input signals from the device before d.c. power supplies are switched off.



2 Recommended conditions of use and associated characteristics (not for inspection purposes)

These apply over the operating temperature range unless otherwise stated. All voltages referenced to V_{SS} .

Characteristics	Conditions	Symbol	$V_{DD}(V)$	T_{amb} LOW	T_{amb} = 25°C	T_{amb} HIGH	Unit
Quiescent device current	$V_{IL} = 0V$						
Full temperature range	$V_{IH} = V_{DD}$ Outputs open circuit	I_{DDA}	5,0	0,25	0,25	7,5	μA
		I_{DDA}	10,0	0,50	0,50	15,0	μA
		I_{DDA}	15,0	1,00	1,00	30,0	μA
Limited temperature range		I_{DDA}	5,0	1,0	1,0	7,5	μA
		I_{DDA}	10,0	2,0	2,0	15,0	μA
		I_{DDA}	15,0	4,0	4,0	30,0	μA
LOW level output voltage at $ I_O < 1,0\mu A$	$V_{IL} = 0V$ $V_{IH} = V_{DD}$	V_{OLA}	5,0	0,05	0,05	0,05	V
		V_{OLA}	10,0	0,05	0,05	0,05	V
		V_{OLA}	15,0	0,05	0,05	0,05	V
HIGH level output voltage at $ I_O < 1,0\mu A$	$V_{IL} = 0V$ $V_{IH} = V_{DD}$	V_{OHB}	5,0	4,95	4,95	4,95	V
		V_{OHB}	10,0	9,95	9,95	9,95	V
		V_{OHB}	15,0	14,95	14,95	14,95	V
LOW level output voltage (for worst case combinations) at $ I_O < 1,0\mu A$	$V_{IL} = 1,5V$ $V_{IL} = 3,0V$ $V_{IL} = 4,0V$	V_{OLA}	5,0	0,5	0,5	0,5	V
		V_{OLA}	10,0	1,0	1,0	1,0	V
		V_{OLA}	15,0	1,5	1,5	1,5	V
HIGH level output voltage (for worst case combinations) at $ I_O < 1,0\mu A$	$V_{IH} = 3,5V$ $V_{IH} = 7,0V$ $V_{IH} = 11,0V$	V_{OHB}	5,0	4,5	4,5	4,5	V
		V_{OHB}	10,0	9,0	9,0	9,0	V
		V_{OHB}	15,0	13,5	13,5	13,5	V
Output LOW (sink) current NAND gate							
Full temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB}	5,0	0,64	0,51	0,36	mA
		I_{OLB}	10,0	1,60	1,30	0,90	mA
		I_{OLB}	15,0	4,20	3,40	2,40	mA
Limited temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB}	5,0	0,52	0,44	0,36	mA
		I_{OLB}	10,0	1,30	1,10	0,90	mA
		I_{OLB}	15,0	3,60	3,00	2,40	mA

Characteristics	Conditions	Symbol	$V_{DD}(V)$	T_{amb} LOW	T_{amb} = 25°C	T_{amb} HIGH	Unit
Output LOW (sink) current NOR gate Full temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB} I_{OLB} I_{OLB}	5,0 10,0 15,0	0,92 2,34 6,12	0,77 1,95 5,10	0,54 1,36 3,57	mA mA mA
Limited temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB} I_{OLB} I_{OLB}	5,0 10,0 15,0	0,79 1,98 5,40	0,66 1,65 4,50	0,54 1,36 3,57	mA mA mA
NOR -inverter							
Full temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB} I_{OLB} I_{OLB}	5,0 10,0 15,0	1,54 3,90 10,20	1,28 3,25 8,50	0,90 2,27 5,95	mA mA mA
Limited temperature range	$V_O = 0,4V$ $V_O = 0,5V$ $V_O = 1,5V$	I_{OLB} I_{OLB} I_{OLB}	5,0 10,0 15,0	1,32 3,30 9,00	1,10 2,75 7,50	0,90 2,27 5,95	mA mA mA
Output HIGH (source) current NAND gate Full temperature range	$V_O = 4,6V$ $V_O = 9,5V$ $V_O = 13,5V$	$-I_{OHB}$ $-I_{OHB}$ $-I_{OHB}$	5,0 10,0 15,0	0,25 0,62 1,80	0,2 0,5 1,5	0,14 0,35 1,10	mA mA mA
Limited temperature range	$V_O = 4,6V$ $V_O = 9,5V$ $V_O = 13,5V$	$-I_{OHB}$ $-I_{OHB}$ $-I_{OHB}$	5,0 10,0 15,0	0,2 0,5 1,4	0,16 0,4 1,2	0,12 0,30 1,00	mA mA mA
Output HIGH (source) current NOR gate Full temperature range	$V_O = 4,6V$ $V_O = 9,5V$ $V_O = 13,5V$	$-I_{OHB}$ $-I_{OHB}$ $-I_{OHB}$	5,0 10,0 15,0	0,42 1,06 3,10	0,35 0,88 2,63	0,24 0,62 1,84	mA mA mA
Limited temperature range	$V_O = 4,6V$ $V_O = 9,5V$ $V_O = 13,5V$	$-I_{OHB}$ $-I_{OHB}$ $-I_{OHB}$	5,0 10,0 15,0	0,34 0,84 2,52	0,28 0,70 2,10	0,21 0,52 1,57	mA mA mA

Characteristics	Conditions	Symbol	V _{DD} (V)	T _{amb} LOW	T _{amb} = 25°C	T _{amb} HIGH	Unit
NOR -inverter							
Full temperature range	V _O = 4,6V	-I _{OHB}	5,0	0,72	0,60	0,42	mA
	V _O = 9,5V	-I _{OHB}	10,0	1,80	1,50	1,05	mA
	V _O = 13,5V	-I _{OHB}	15,0	5,40	4,50	3,15	mA
Limited temperature range	V _O = 4,6V	-I _{OHB}	5,0	0,58	0,48	0,36	mA
	V _O = 9,5V	-I _{OHB}	10,0	1,44	1,20	0,90	mA
	V _O = 13,5V	-I _{OHB}	15,0	4,32	3,60	2,70	mA
Input leakage current	V _{IL} = 0V V _{IH} = V _{DD}						
Full temperature range		I _{IA}	15,0	0,10	0,10	1,00	μA
Limited temperature range		I _{IA}	15,0	0,30	0,30	1,00	μA
Input capacitance per unit load (Any input)	V _I = 0V f = 1MHz	C _{IA}	-	-	7,5	-	pF
Noise margin at LOW level output (equal to the difference between V _{IL} and V _{OL} for worst case combinations)		V _{NLB}	5,0	1,0	1,0	1,0	V
		V _{NLB}	10,0	2,0	2,0	2,0	V
		V _{NLB}	15,0	2,5	2,5	2,5	V
Noise margin at HIGH level output (equal to the difference between V _{IH} and V _{OH} for worst case combinations)		V _{NHB}	5,0	1,0	1,0	1,0	V
		V _{NHB}	10,0	2,0	2,0	2,0	V
		V _{NHB}	15,0	2,5	2,5	2,5	V
Propagation and Transition Times	C _L = 50pF (Test conditions as in Sub-group A5)						

Characteristics	Conditions	Symbol	V _{DD} (V)	T _{amb} LOW	T _{amb} = 25°C	T _{amb} HIGH	Unit
Propagation Delay Time HIGH to LOW and LOW to HIGH level NAND gate, NOR -inverter		t _{PHLA} /	5,0	-	260,0	-	ns
		t _{PLHA}	10,0	-	140,0	-	ns
			15,0	-	100,0	-	ns
Propagation Delay Time HIGH to LOW and LOW to HIGH level NOR gate		t _{PHLA} /	5,0	-	230,0	-	ns
		t _{PLHA}	10,0	-	130,0	-	ns
			15,0	-	90,0	-	ns
Transition Time LOW to HIGH level NAND , NOR gates		t _{TLHA}	5,0	-	360,0	-	ns
		t _{TLHA}	10,0	-	180,0	-	ns
		t _{TLHA}	15,0	-	130,0	-	ns
Transition Time HIGH to LOW level NAND , NOR gates		t _{THLA}	5,0	-	200,0	-	ns
		t _{THLA}	10,0	-	100,0	-	ns
		t _{THLA}	15,0	-	80,0	-	ns
Transition Time LOW to HIGH level NOR -inverter		t _{TLHA}	5,0	-	200,0	-	ns
		t _{TLHA}	10,0	-	100,0	-	ns
		t _{TLHA}	15,0	-	80,0	-	ns
Transition Time HIGH to LOW level NOR -inverter		t _{THLA}	5,0	-	120,0	-	ns
		t _{THLA}	10,0	-	80,0	-	ns
		t _{THLA}	15,0	-	60,0	-	ns

Terminal identification

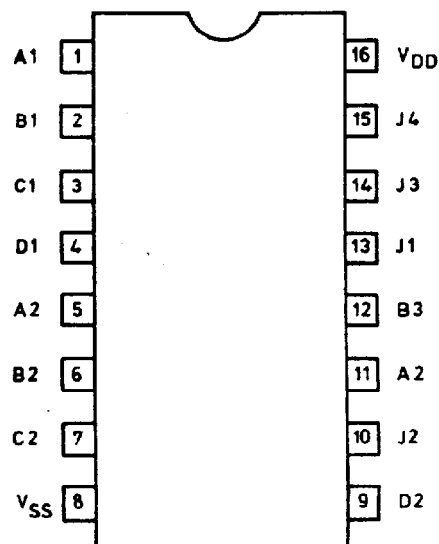


Figure 1

Function tables

Table 1

4-INPUT NAND

INPUT				OUTPUT
A	B	C	D	J
H	H	H	H	L
L	H	H	H	H
H	L	H	H	H
H	H	L	H	H
H	H	H	L	H
L	L	L	L	H

2-INPUT NOR/OR

INPUT		OUTPUT J	
A	B	NOR	OR
H	H	L	H
H	L	L	H
L	H	L	H
L	L	H	L

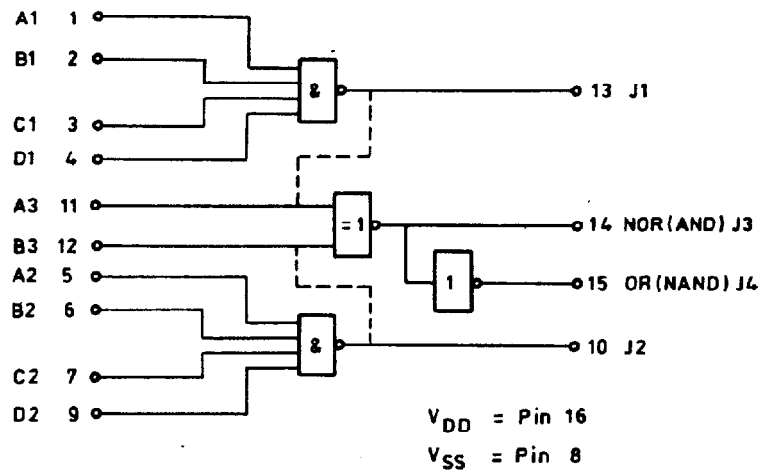
8-INPUT AND/NAND

INPUT								OUTPUT J	
A	B	C	D	E	F	G	H	AND	NAND
H	H	H	H	H	H	H	H	H	L
L	H	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	L	H
H	H	L	H	H	H	H	H	L	H
H	H	H	L	H	H	H	H	L	H
H	H	H	H	L	H	H	H	L	H
H	H	H	H	H	L	H	H	L	H
H	H	H	H	H	H	L	H	L	H
L	L	L	L	L	L	L	L	L	H

H = HIGH level

L = LOW level

Function block diagram



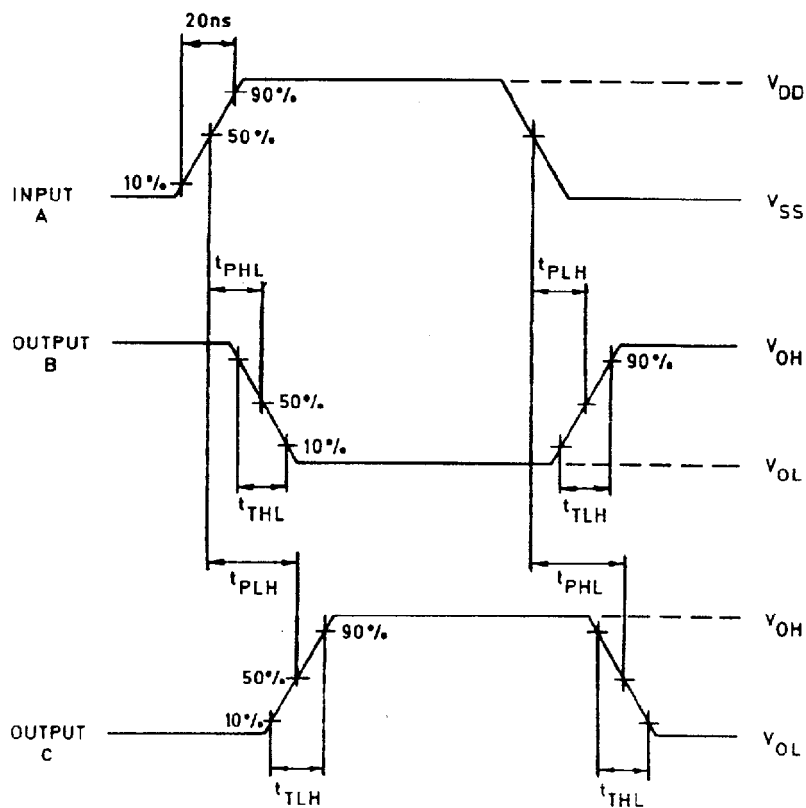
Use Dotted Connection externally to obtain 8-input 'AND', 'NAND'

NOTE: Pin 14 must not be used as an input to the inverter.

Figure 2

Switching time waveforms

(a) NOR gate and NOR-INVERTER .



Switching time waveforms (contd)

(b) 4-input NAND gate

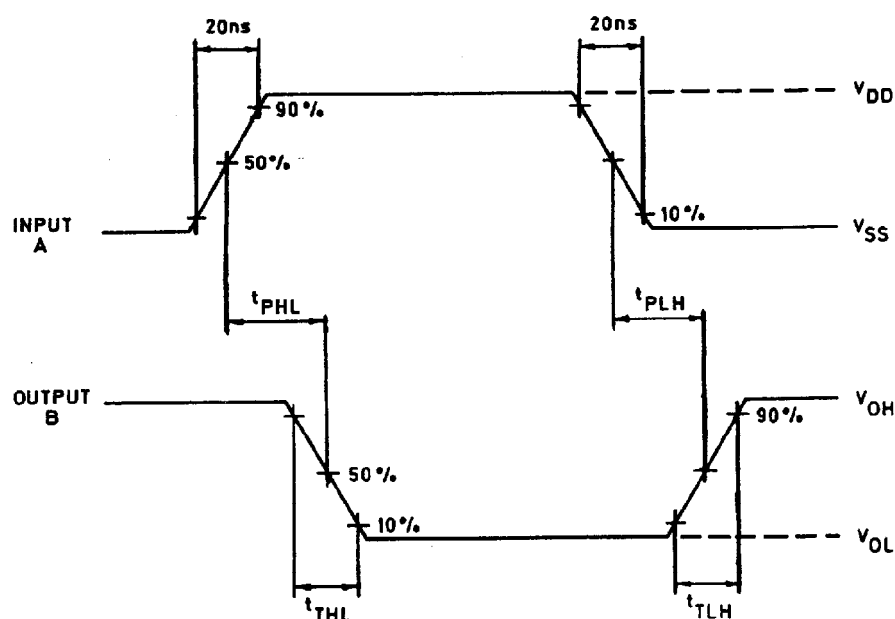


Figure 3

Marking

The following shall be marked on the device, in the following order of precedence, as space permits. All information, except the terminal marking shall appear on the primary package used as initial protection or wrapping for delivery:

- (1) Terminal identification
- (2) Type number
- (3) Operating temperature range (if not included in 2)
- (4) Quality assessment level applied
- (5) Screening class applied
- (6) Date-code (year-week defined by three or four figures)
- (7) Mark of conformity (CECC logo)
- (8) Manufacturers name or trade mark (may include factory code)
- (9) Factory identification code
- (10) Package materials
- (11) Caution label for devices susceptible to damage by electrostatic discharge
- (12) Optional tests

The marking symbols shall be located following the figures below.