

DATA SHEET

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74LVT20

3.3V Dual 4-input NAND gate

Product specification

1996 Aug 28

IC24 Data Handbook

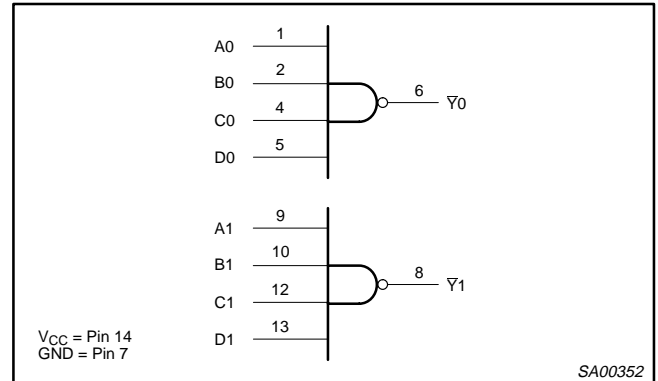
3.3V Dual 4-input NAND gate

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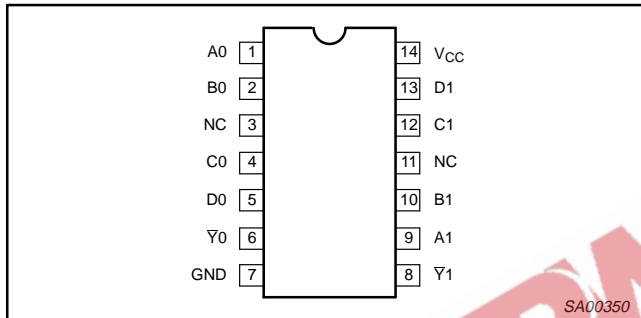
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}\text{C};$ $GND = 0\text{V}$	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay An, Bn, Cn, Dn to \bar{Y}_n	$C_L = 50\text{pF};$ $V_{CC} = 3.3\text{V}$	3.4 3.2	ns
C_{IN}	Input capacitance	$V_I = 0\text{V}$ or 3.0V	3	pF
I_{CCL}	Total supply current	Outputs Low; $V_{CC} = 3.6\text{V}$	0.5	mA

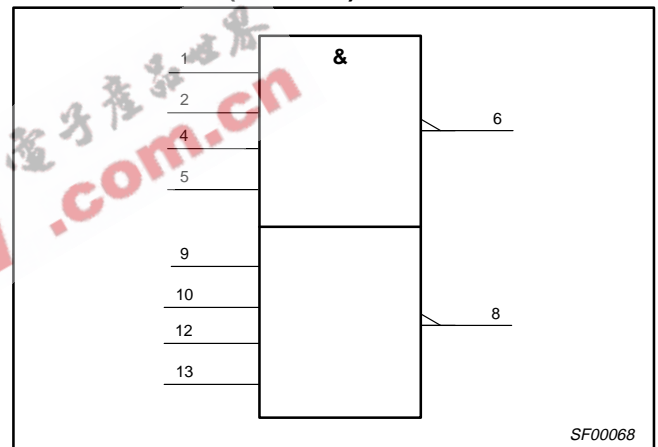
LOGIC DIAGRAM



PIN CONFIGURATION



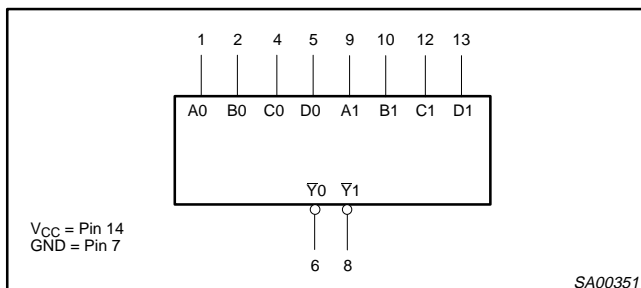
LOGIC SYMBOL (IEEE/IEC)



PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 2, 4, 5, 9, 10, 12, 13	An, Bn, Cn, Dn	Data inputs
6, 8	\bar{Y}_n	Data outputs
7	GND	Ground (0V)
14	V_{CC}	Positive supply voltage

LOGIC SYMBOL



FUNCTION TABLE

INPUTS				OUTPUT
Dna	Dnb	Dnc	Dnd	\bar{Q}_n
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H
H	H	H	H	L

NOTES:

- H = High voltage level
- L = Low voltage level
- X = Don't care

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
14-Pin Plastic SO	-40°C to +85°C	74LVT20 D	74LVT20 D	SOT108-1
14-Pin Plastic SSOP	-40°C to +85°C	74LVT20 DB	74LVT20 DB	SOT337-1
14-Pin Plastic TSSOP	-40°C to +85°C	74LVT20 PW	74LVT20PW DH	SOT402-1

3.3V Dual 4-input NAND gate

74LVT20

ABSOLUTE MAXIMUM RATINGS^{1, 2}

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +4.6	V
I_{IK}	DC input diode current	$V_I < 0$	-50	mA
V_I	DC input voltage ³		-0.5 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	-50	mA
V_{OUT}	DC output voltage ³	Output in Off or High state	-0.5 to +7.0	V
I_{OUT}	DC output current	Output in High state	-32	mA
		Output in Low state	64	
T_{stg}	Storage temperature range		-65 to 150	°C

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage	2.7	3.6	V
V_I	Input voltage	0	5.5	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Low-level Input voltage		0.8	V
I_{OH}	High-level output current		-20	mA
I_{OL}	Low-level output current		32	mA
	Low-level output current; current duty cycle $\leq 50\%$, $f \geq 1$ kHz		48	
T_{amb}	Operating free-air temperature range	-40	+85	°C

3.3V Dual 4-input NAND gate

74LVT20

DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP ¹	MAX	
V_{IK}	Input clamp voltage	$V_{CC} = 2.7V$; $I_{IK} = -18mA$			-1.2	V
V_{OH}	High-level output voltage	$V_{CC} = 2.7$ to $3.6V$; $I_{OH} = -100\mu A$	$V_{CC}-0.2$			V
		$V_{CC} = 2.7V$; $I_{OH} = -6mA$	2.4			
		$V_{CC} = 3.0V$; $I_{OH} = -20mA$	2.0			
V_{OL}	Low-level output voltage	$V_{CC} = 2.7V$; $I_{OL} = 100\mu A$				V
		$V_{CC} = 2.7V$; $I_{OL} = 24mA$	0.5			
		$V_{CC} = 3.0V$; $I_{OL} = 32mA$	0.5			
I_I	Input leakage current	$V_{CC} = 0$ or $3.6V$; $V_I = 5.5V$	10			μA
		$V_{CC} = 3.6V$; $V_I = V_{CC}$ or GND	± 1			
I_{OFF}	Output off current	$V_{CC} = 0V$; V_I or $V_O = 0$ to $4.5V$	± 100			μA
I_{CCH}	Quiescent supply current	$V_{CC} = 3.6V$; Outputs High, $V_I = GND$ or V_{CC} , $I_O = 0$	0.02			mA
I_{CCL}		$V_{CC} = 3.6V$; Outputs Low, $V_I = GND$ or V_{CC} , $I_O = 0$	0.5	1.2		
ΔI_{CC}	Additional supply current per input pin ²	$V_{CC} = 3V$ to $3.6V$; One input at $V_{CC}-0.6V$, Other inputs at V_{CC} or GND	0.2			μA
C_I	Input capacitance	$V_I = 3V$ or 0	3			pF

NOTES:

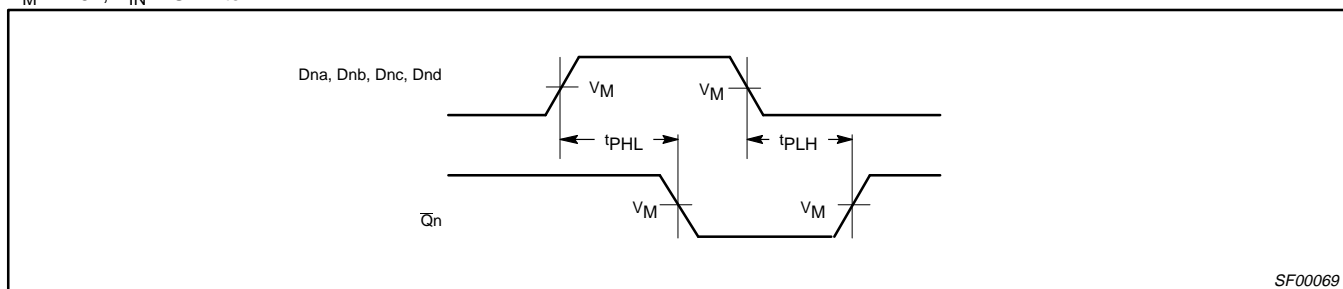
- All typical values are at $V_{CC} = 3.3V$ and $T_{amb} = 25^\circ C$.
- This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

AC CHARACTERISTICSGND = 0V; $t_R = t_F = 2.5ns$; $C_L = 50pF$, $R_L = 500\Omega$; $T_{amb} = -40^\circ C$ to $+85^\circ C$.

SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$	
			MIN	TYP ¹	MAX	MAX	
t_{PLH} t_{PHL}	Propagation delay An, Bn, Cn, Dn to \bar{Y}_n	1	1.0 1.0	3.4 3.2	5.4 4.4	6.4 4.3	ns

NOTE:

- All typical values are at $V_{CC} = 3.3V$ and $T_{amb} = 25^\circ C$.

AC WAVEFORMS $V_M = 1.5V$, $V_{IN} = GND$ to $2.7V$ 

SF00069

Waveform 1. Propagation Delay for Inverting Outputs

3.3V Dual 4-input NAND gate

74LVT20

TEST CIRCUIT AND WAVEFORMS

Test Circuit for Outputs

$V_M = 1.5V$
Input Pulse Definition

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_w	t_R	t_F
74LVT	2.7V	$\leq 10\text{MHz}$	500ns	$\leq 2.5\text{ns}$	$\leq 2.5\text{ns}$

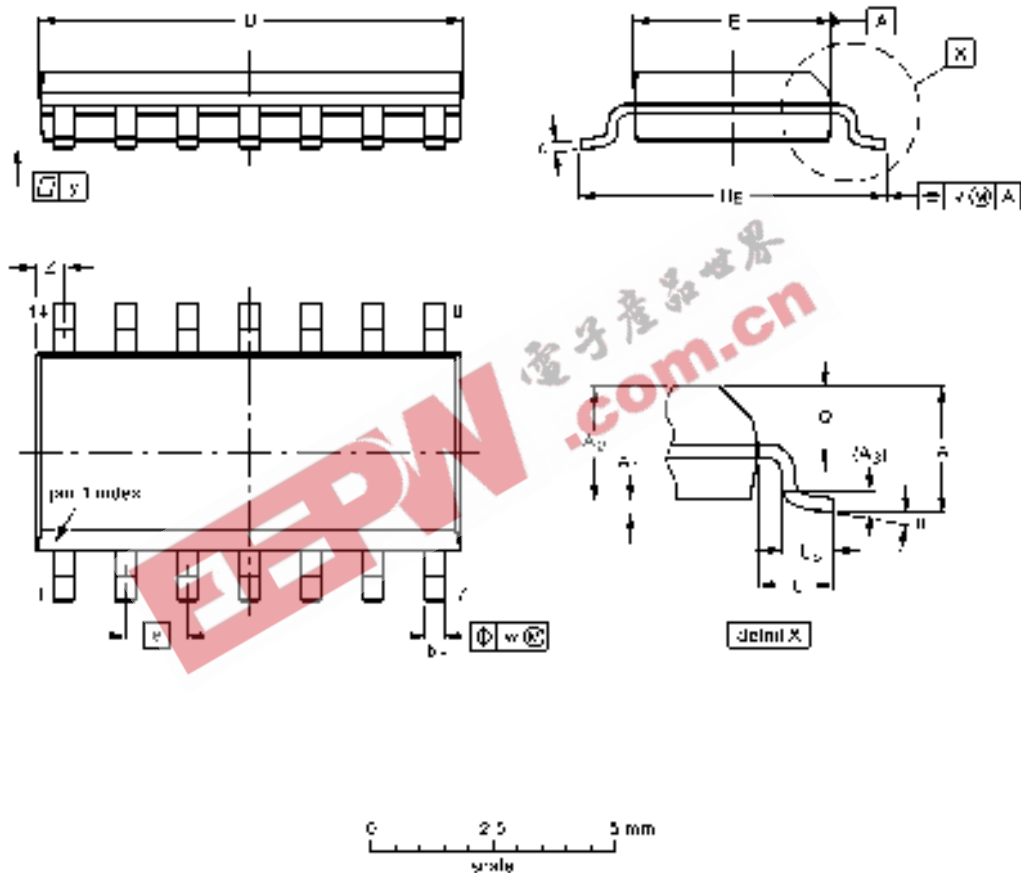
SV00022

3.3V Dual 4-input NAND gate

74LVT20

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	e	Ø ⁽¹⁾	E ⁽¹⁾	+	HE	L	L _p	Q	v	w	y	z ⁽¹⁾	+
mm	1.75	0.25 0.10	1.45 1.25	0.20	0.45 0.30	0.25 0.19	8.75 8.50	4.0 3.8	1.27	5.2 5.0	1.6	1.0 0.8	0.7 0.6	0.25	0.25	0.1	0.7 0.3	
inches	0.069	0.0098 0.0039	0.057 0.049	0.008	0.018 0.014	0.0099 0.0075	0.34 0.34	0.16 0.15	0.050	0.21 0.20	0.063	0.039 0.0316	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Note

1 Plastic or metal protrusions of 0.15 mm maximum per side are not included

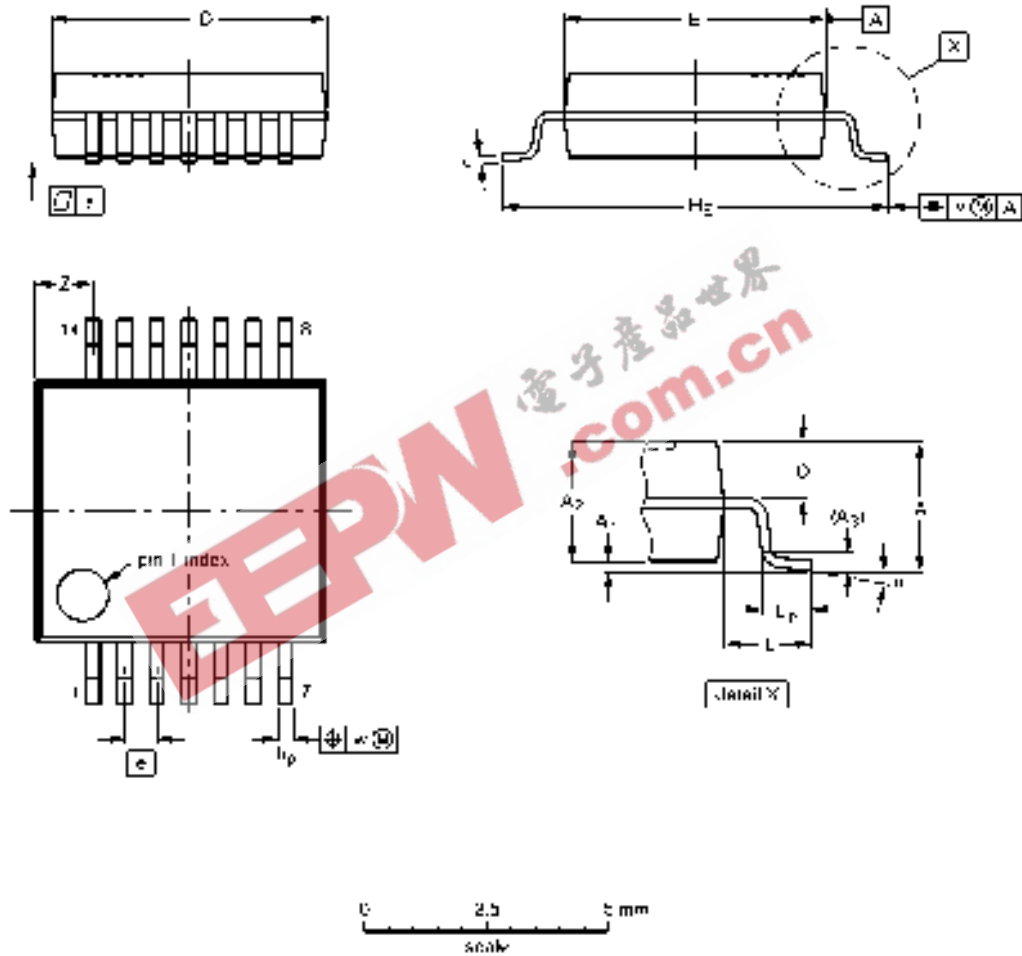
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT108-1	076E065	MS-012AB			91-08-19 95-01-23

3.3V Dual 4-input NAND gate

74LVT20

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	φ ⁽¹⁾	E ⁽¹⁾	e	H ₂	L	L _p	Q	y	w	y	z ⁽¹⁾	φ ²
mm	2.0	0.21 0.25	1.80 1.65	0.20	0.08 0.25	0.20 0.09	6.4 6.0	6.4 5.2	0.65	7.0 7.5	1.25	1.00 0.62	0.9 0.7	0.2	0.10	0.1	1.4 0.9	0° 0°

Note

1 Plastic or metal protrusions of 0.25 mm maximum per side are not included

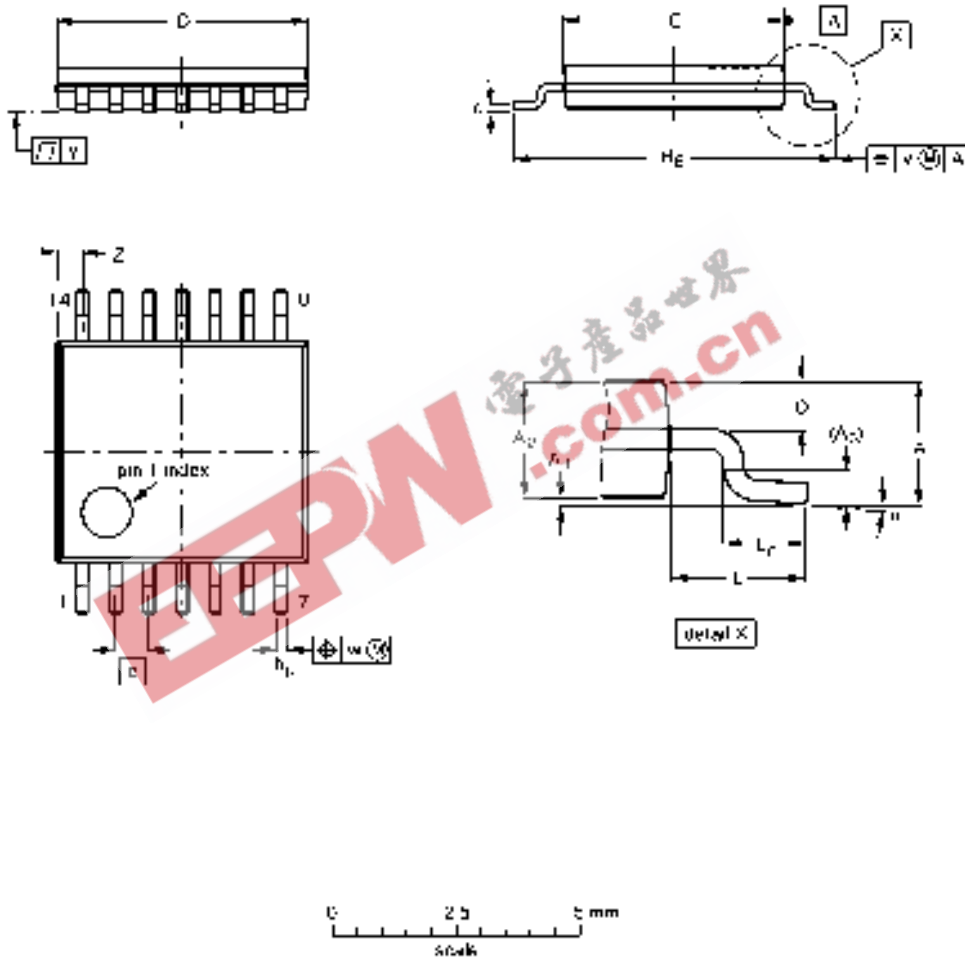
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT337-1		MO-150AB			95-85-94 96-01-19

3.3V Dual 4-input NAND gate

74LVT20

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



DIMENSIONS (mm are the original dimensions):

UNIT	A max	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	
mm	1.10	0.15 0.25	0.03 0.00	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.85	6.6 6.2	1.0	0.75 0.57	0.4 0.3	0.2	0.13	0.1	0.72 0.20	0° 0°

Notes

- 1 Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2 Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-150				94-07-12 95-11-01

3.3V Dual 4-input NAND gate

74LVT20

NOTES



3.3V Dual 4-input NAND gate

74LVT20

DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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