

# DATA SHEET

**74LVT20**

3.3V Dual 4-input NAND gate

Product specification

1996 Aug 28

IC24 Data Handbook

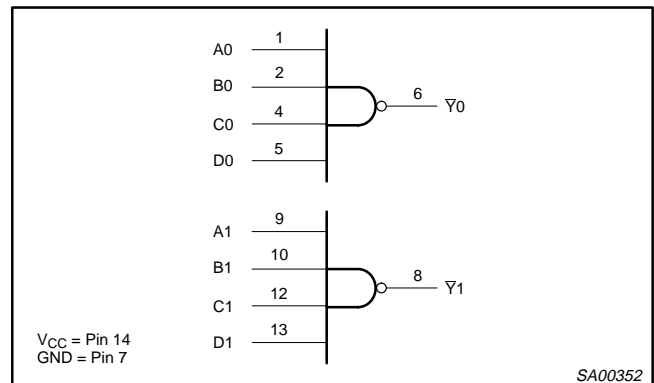
# 3.3V Dual 4-input NAND gate

# 74LVT20

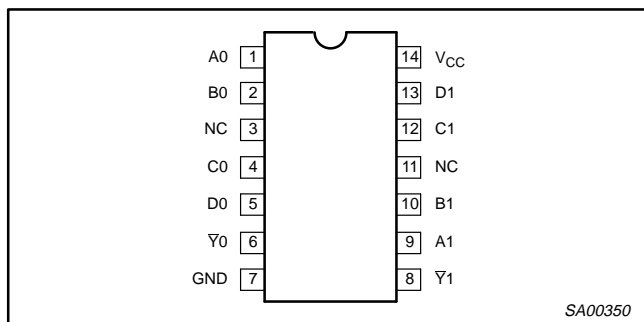
### QUICK REFERENCE DATA

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 $3.0\text{V}$	3	pF
$I_{CCL}$	Total supply current	Outputs Low; $V_{CC} = 3.6\text{V}$	0.5	mA

### LOGIC DIAGRAM



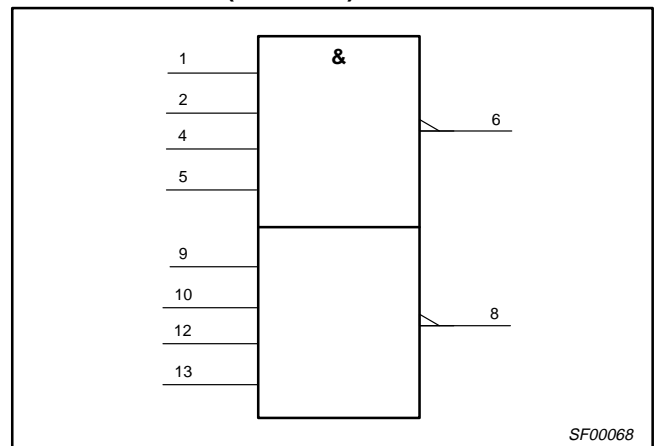
### PIN CONFIGURATION



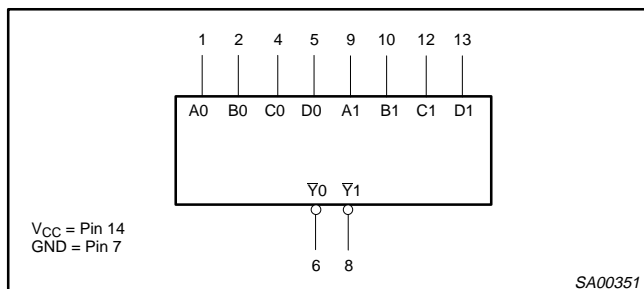
### PIN DESCRIPTION

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 (IEEE/IEC)



### 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

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**ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>**

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V <sub>CC</sub>	DC supply voltage		-0.5 to +4.6	V
I <sub>IK</sub>	DC input diode current	V <sub>I</sub> < 0	-50	mA
V <sub>I</sub>	DC input voltage <sup>3</sup>		-0.5 to +7.0	V
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> < 0	-50	mA
V <sub>OUT</sub>	DC output voltage <sup>3</sup>	Output in Off or High state	-0.5 to +7.0	V
I <sub>OUT</sub>	DC output current	Output in High state	-32	mA
		Output in Low state	64	
T <sub>stg</sub>	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 <sub>CC</sub>	DC supply voltage	2.7	3.6	V
V <sub>I</sub>	Input voltage	0	5.5	V
V <sub>IH</sub>	High-level input voltage	2.0		V
V <sub>IL</sub>	Low-level Input voltage		0.8	V
I <sub>OH</sub>	High-level output current		-20	mA
I <sub>OL</sub>	Low-level output current		32	mA
	Low-level output current; current duty cycle ≤ 50%, f ≥ 1kHz		48	
T <sub>amb</sub>	Operating free-air temperature range	-40	+85	°C

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## 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 <sup>1</sup>	MAX	
$V_{IK}$	Input clamp voltage	$V_{CC} = 2.7V; I_{IK} = -18mA$			-1.2	V
$V_{OH}$	High-level output voltage	$V_{CC} = 2.7 \text{ to } 3.6V; I_{OH} = -100\mu A$	$V_{CC}-0.2$			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	$V_{CC} = 2.7V; I_{OL} = 100\mu A$			0.2	V
		$V_{CC} = 2.7V; I_{OL} = 24mA$			0.5	
		$V_{CC} = 3.0V; I_{OL} = 32mA$			0.5	
$I_I$	Input leakage current	$V_{CC} = 0 \text{ or } 3.6V; V_I = 5.5V$			10	$\mu A$
		$V_{CC} = 3.6V; V_I = V_{CC} \text{ or } GND$			$\pm 1$	
$I_{OFF}$	Output off current	$V_{CC} = 0V; V_I \text{ or } V_O = 0 \text{ to } 4.5V$			$\pm 100$	$\mu A$
$I_{CCH}$	Quiescent supply current	$V_{CC} = 3.6V; \text{Outputs High, } V_I = GND \text{ or } V_{CC}, I_O = 0$			0.02	mA
$I_{CCL}$		$V_{CC} = 3.6V; \text{Outputs Low, } V_I = GND \text{ or } V_{CC}, I_O = 0$		0.5	1.2	
$\Delta I_{CC}$	Additional supply current per input pin <sup>2</sup>	$V_{CC} = 3V \text{ to } 3.6V; \text{One input at } V_{CC}-0.6V, \text{Other inputs at } V_{CC} \text{ or } GND$			0.2	$\mu A$
$C_I$	Input capacitance	$V_I = 3V \text{ or } 0$		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 CHARACTERISTICS

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

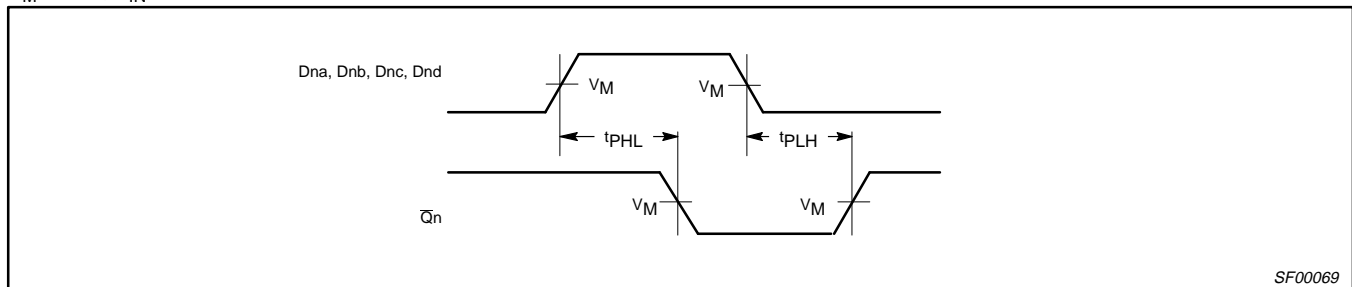
SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$	
			MIN	TYP <sup>1</sup>	MAX	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay An, Bn, Cn, Dn to $\bar{Y}_n$	1	1.0 1.0	3.4 3.2	5.4 4.4	6.4 4.3	ns

**NOTE:**

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

## AC WAVEFORMS

$V_M = 1.5V, V_{IN} = GND \text{ to } 2.7V$



**Waveform 1. Propagation Delay for Inverting Outputs**

SF00069

# 3.3V Dual 4-input NAND gate

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## 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	$\leq 2.5\text{ns}$	$\leq 2.5\text{ns}$

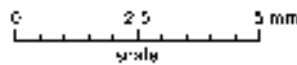
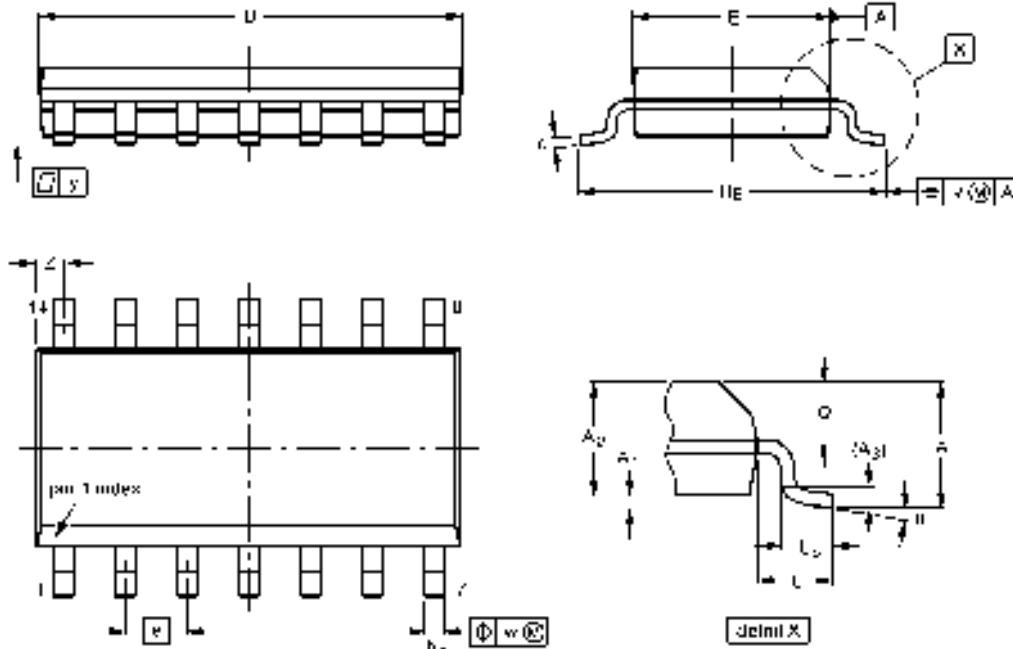
SV00022

# 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.	$\Delta_1$	$\Delta_2$	$\Delta_3$	$b_p$	$e$	$\phi^{(1)}$	$\epsilon^{(1)}$	$\phi$	$H_E$	L	$L_p$	Q	v	w	y	$z^{(1)}$	$\dots$
mm	1.75	0.25 0.10	1.45 1.25	0.20	0.45 0.30	0.25 0.19	0.75 0.50	4.0 3.0	1.27	5.2 5.0	1.5	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	$B^C$
inches	0.069	0.0098 0.0039	0.057 0.049	0.008	0.018 0.014	0.0099 0.0075	0.03 0.02	0.16 0.12	0.050	0.21 0.20	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.029 0.012	$D^C$

**Note**

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

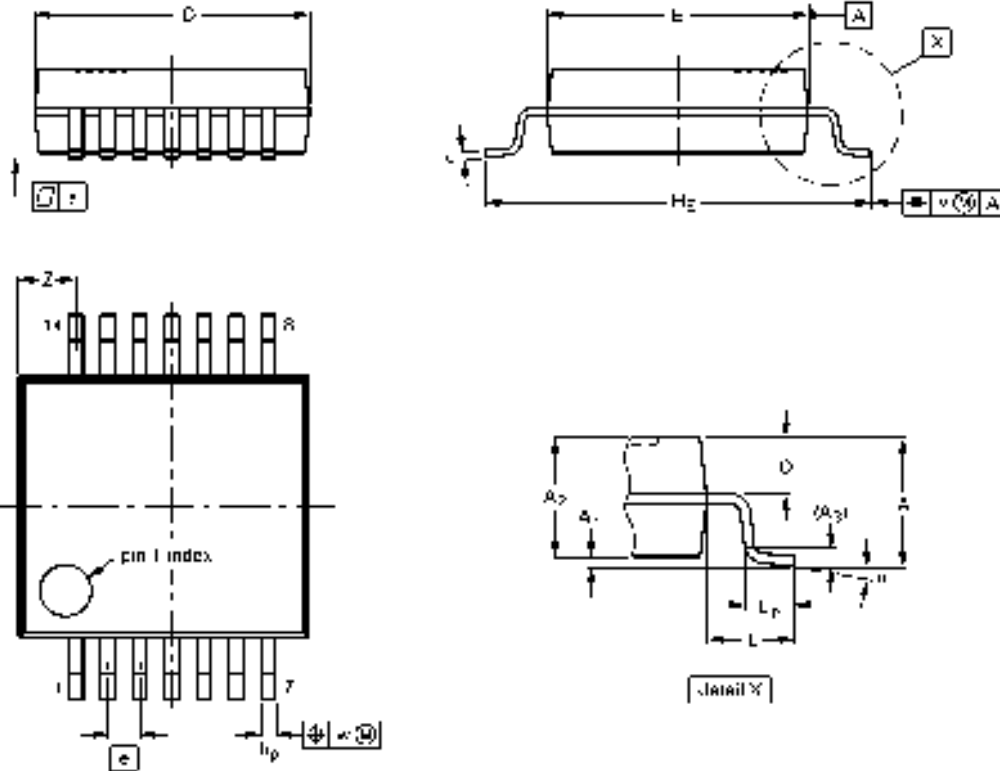
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT108-1	076E060	MS-012AB			5-198-19 95-01-23

# 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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	D <sup>(1)</sup>	e	H <sub>2</sub>	L	L <sub>p</sub>	Q	y	w	y	z <sup>(1)</sup>	φ
mm	2.0	0.71 0.75	1.80 1.05	0.20	0.50 0.25	0.20 0.09	6.4 0.0	5.4 5.2	0.65	7.0 7.8	1.25	1.00 0.82	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

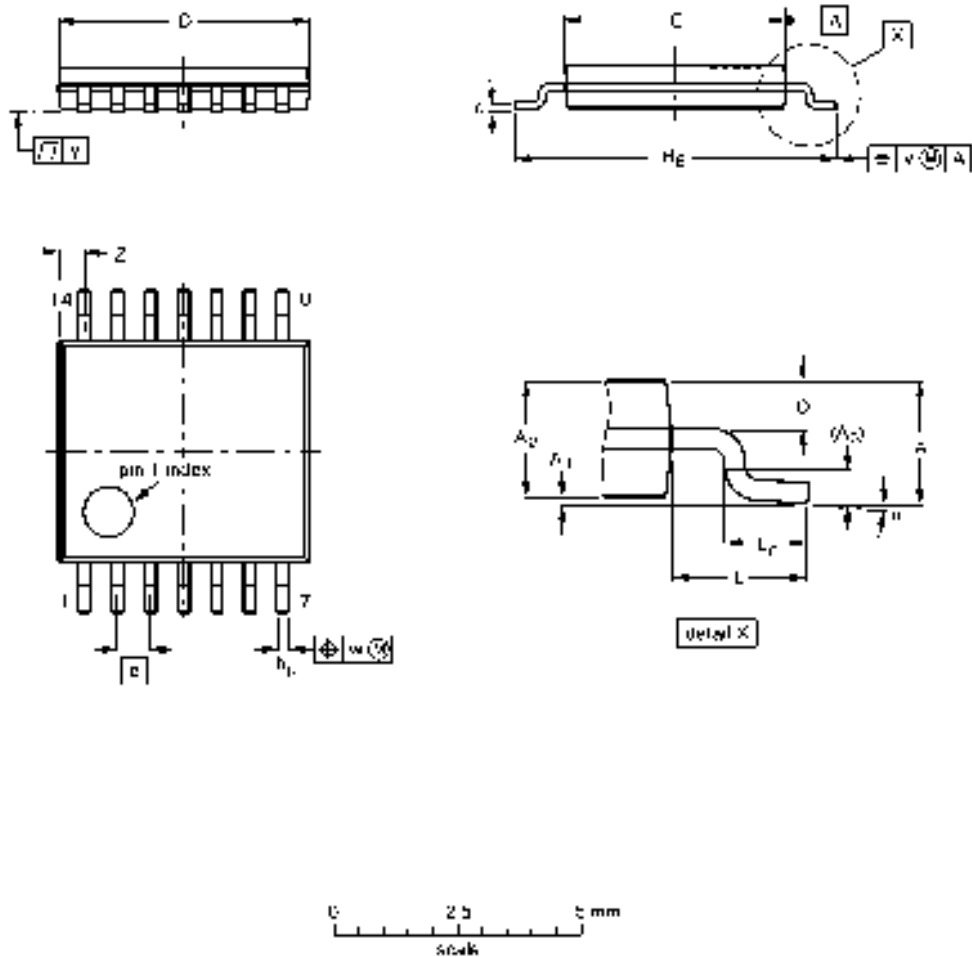
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT337-1		MO-150AB			95-85-94 96-01-19

# 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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	Ø(1)	Ø(2)	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	II
mm	1.10	0.15 0.75	0.05 0.00	0.25	0.50 0.19	0.2	5.1 4.9	4.5 4.3	0.55	6.6 6.2	1.0	0.75 0.57	0.4 0.3	0.2	0.13	0.1	0.72 0.30	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



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3.3V Dual 4-input NAND gate

74LVT20

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**NOTES**

## 3.3V Dual 4-input NAND gate

74LVT20

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	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>	<b>Preproduction Product</b>	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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