74HC27; 74HCT27 Triple 3-input NOR gate Rev. 5.1 — 27 November 2015

#### 1. **General description**

The 74HC27; 74HCT27 is a triple 3-input NOR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V<sub>CC</sub>.

#### **Features and benefits** 2.

- Complies with JEDEC standard no. 7A
- Input levels:
  - For 74HC27: CMOS level
  - For 74HCT27: TTL level
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

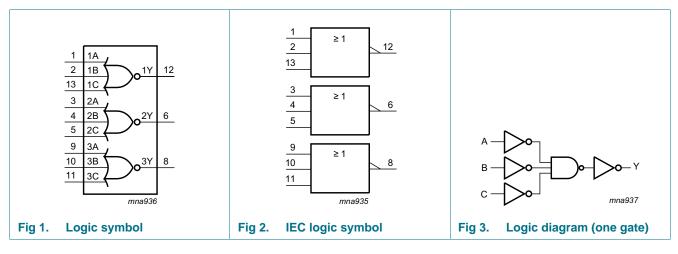
#### **Ordering information** 3.

#### Table 1. **Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74HC27D	–40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74HCT27D				
74HC27DB	–40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body width	SOT337-1
74HCT27DB			5.3 mm	
74HC27PW	–40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body	SOT402-1
74HCT27PW			width 4.4 mm	
74HC27BQ	–40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin	SOT762-1
74HCT27BQ			quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85$ mm	

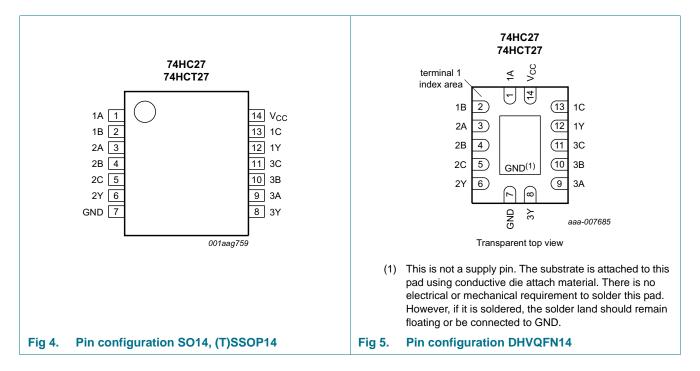
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## 4. Functional diagram



## 5. Pinning information

## 5.1 Pinning



## 5.2 Pin description

Table 2.         Pin description							
Symbol	Pin	Description					
1A, 2A, 3A	1, 3, 9	data input					
1B, 2B, 3B	2, 4, 10	data input					
1C, 2C, 3C	13, 5, 11	data input					
1Y, 2Y, 3Y	12, 6, 8	data output					
GND	7	ground (0 V)					
V <sub>cc</sub>	14	supply voltage					

## 6. Functional description

#### Table 3. Function table<sup>[1]</sup>

Inputs	Outputs		
nA	nB	nC	nY
L	L	L	Н
Х	Х	Н	L
Х	Н	Х	L
Н	Х	Х	L

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

## 7. Limiting values

#### Table 4.Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>CC</sub>	supply voltage			-0.5	+7	V
I <sub>IK</sub>	input clamping current	$V_{I}$ < -0.5 V or $V_{I}$ > $V_{CC}$ + 0.5 V	<u>[1]</u>	-	±20	mA
I <sub>ОК</sub>	output clamping current	$V_{O}$ < -0.5 V or $V_{O}$ > $V_{CC}$ + 0.5 V	<u>[1]</u>	-	±20	mA
lo	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±25	mA
I <sub>CC</sub>	supply current			-	50	mA
I <sub>GND</sub>	ground current			-50	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	SO14, (T)SSOP14 and DHVQFN14 packages	[2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

For SO14 package: P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.
 For (T)SSOP14 packages: P<sub>tot</sub> derates linearly with 5.5 mW/K above 60 °C.
 For DHVQFN14 packages: P<sub>tot</sub> derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

#### Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions		74HC27			74HCT2	7	Unit
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
Vo	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t / \Delta V$	input transition rise and fall rate	$V_{CC} = 2.0 V$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5 V$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0 V$	-	-	83	-	-	-	ns/V

## 9. Static characteristics

#### Table 6. Static characteristics type 74HC27; 74HCT27

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		–40 °C t	o +85 °C	–40 °C to	o +125 ℃	Unit
			Min	Тур	Max	Min	Max	Min	Мах	1
74HC27		1				1		1	1	-
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_0 = -20 \ \mu A; V_{CC} = 2.0 \ V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_0 = -20 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_0 = -20 \ \mu A; V_{CC} = 6.0 \ V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_0 = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_0 = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V
V <sub>OL</sub>	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_0 = 20 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O}$ = 4.0 mA; $V_{CC}$ = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		$I_0 = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
lı	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I <sub>CC</sub>	supply current		-	-	2.0	-	20	-	40	μΑ

Triple 3-input NOR gate

Symbol	Parameter	Conditions		25 °C		–40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
CI	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT27	7	·	·							
V <sub>IH</sub>	HIGH-level input voltage	$V_{CC}$ = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	$V_{CC}$ = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub> HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$									
	output voltage	I <sub>O</sub> = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub> LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$									
	output voltage	I <sub>O</sub> = 20 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 V$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V; $I_O = 0$ A	-	-	2.0	-	20	-	40	μΑ
ΔI <sub>CC</sub>	additional supply current	per input pin; $V_I = V_{CC} - 2.1 V$ ; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5 V$ to 5.5 V; $I_O = 0 A$								
		nA, nB or nC inputs	-	150	540	-	675	-	735	μA
CI	input capacitance		-	3.5	-	-	-	-	-	pF

#### Table 6. Static characteristics type 74HC27; 74HCT27 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

## **10.** Dynamic characteristics

#### Table 7. Dynamic characteristics type 74HC27; 74HCT27

GND = 0 V; for load circuit see <u>Figure 7</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C to	o +125 ℃	Unit
				Min	Тур	Max	Max (85 °C)	Max (125 °C)	
74HC27									
t <sub>pd</sub>	propagation delay	nA, nB, nC to nY; see Figure 6	[1]						
		V <sub>CC</sub> = 2.0 V		-	28	90	115	135	ns
		V <sub>CC</sub> = 4.5 V		-	10	18	23	27	ns
		$V_{CC} = 5.0 \text{ V}; C_{L} = 15 \text{ pF}$		-	8	-	-	-	ns
		V <sub>CC</sub> = 6.0 V		-	8	15	20	23	ns
t <sub>t</sub>	transition time	see Figure 6	[2]						
		V <sub>CC</sub> = 2.0 V		-	19	75	95	110	ns
		V <sub>CC</sub> = 4.5 V		-	7	15	19	22	ns ns ns ns
		V <sub>CC</sub> = 6.0 V		-	6	13	16	19	ns
C <sub>PD</sub>	power dissipation capacitance	per package; $V_I = GND$ to $V_{CC}$	<u>[3]</u>	-	24	-	-	-	pF
74HCT27	7	l			1	4	1	1	-
t <sub>pd</sub>	propagation delay	nA, nB, nC to nY; see Figure 6	<u>[1]</u>						
		V <sub>CC</sub> = 4.5 V		-	12	21	26	32	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF		-	10	-	-	-	ns
tt	transition time	$V_{CC} = 4.5 V$ ; see Figure 6	[2]	-	7	15	19	22	ns
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> – 1.5 V	<u>[3]</u>	-	30	-	-	-	pF

[1]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W):

 $P_{D}$  =  $C_{PD} \times V_{CC}{}^{2} \times f_{i} \times N$  +  $\sum$  ( $C_{L} \times V_{CC}{}^{2} \times f_{o}$ ) where:

 $f_i$  = input frequency in MHz;

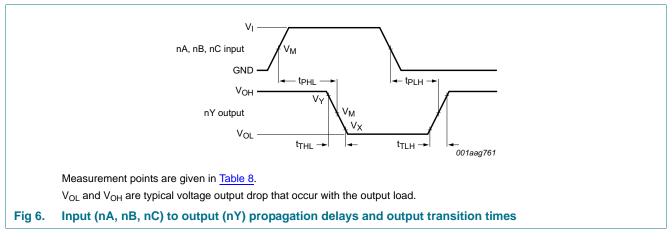
 $f_o$  = output frequency in MHz;  $C_L$  = output load capacitance in pF;

 $C_L$  = output load capacitance in p

V<sub>CC</sub> = supply voltage in V; N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_o) = \text{sum of outputs.}$ 

## 11. Waveforms



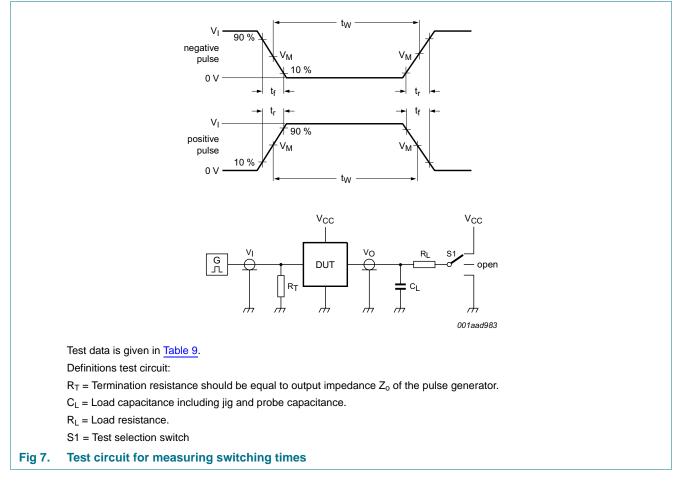
#### Table 8. Measurement points

Туре	Input	Output		
	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
74HC27	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	0.1V <sub>CC</sub>	0.9V <sub>CC</sub>
74HCT27	1.3 V	1.3 V	0.1V <sub>CC</sub>	0.9V <sub>CC</sub>

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## 74HC27; 74HCT27

### Triple 3-input NOR gate

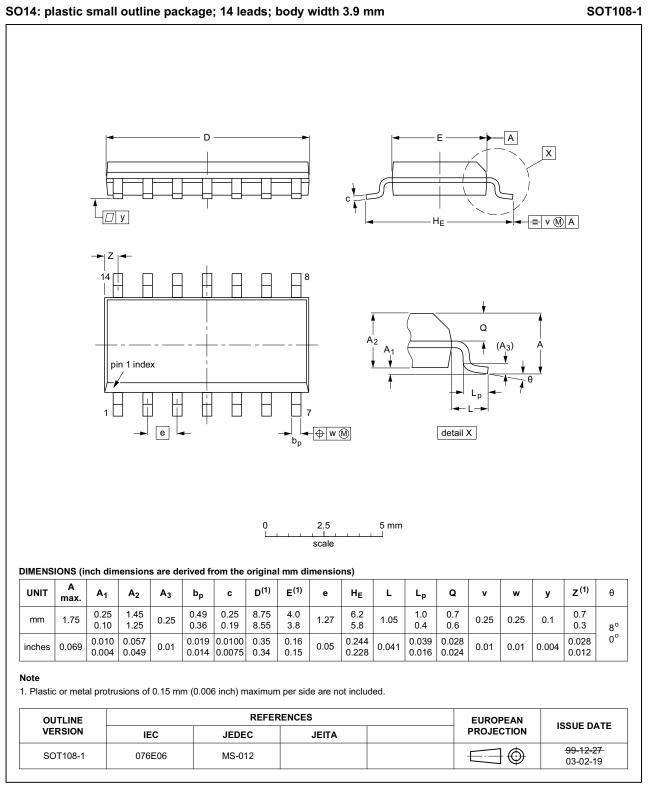


#### Table 9. Test data

Туре	Input		Load		S1 position
	VI	t <sub>r</sub> , t <sub>f</sub>	CL	RL	t <sub>PHL</sub> , t <sub>PLH</sub>
74HC27	V <sub>CC</sub>	6 ns	15 pF, 50 pF	1 kΩ	open
74HCT27	3 V	6 ns	15 pF, 50 pF	1 kΩ	open

**Triple 3-input NOR gate** 

## 12. Package outline



#### Fig 8. Package outline SOT108-1 (SO14)

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74HC\_HCT27

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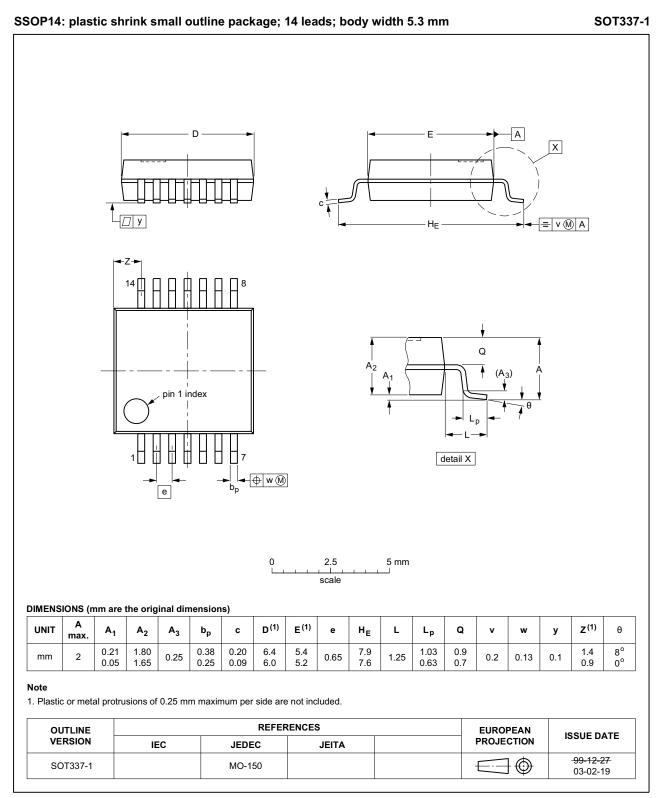
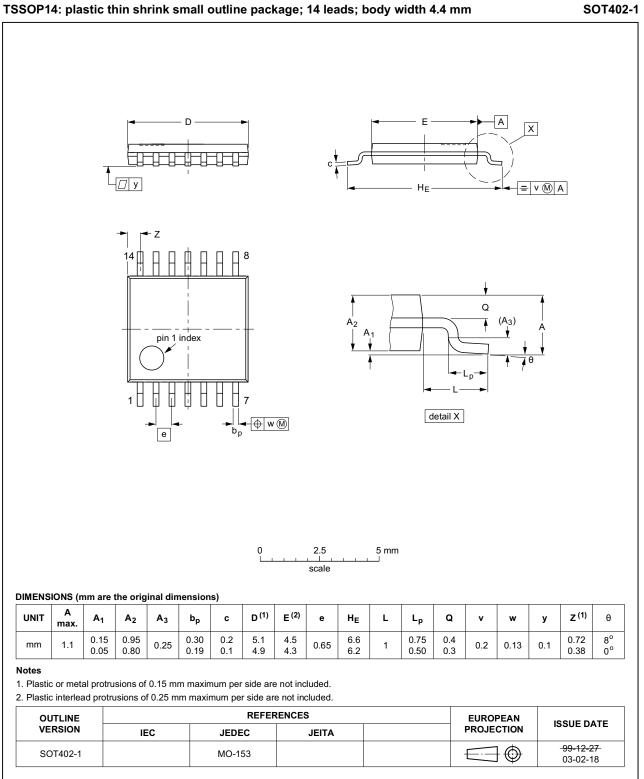


Fig 9. Package outline SOT337-1 (SSOP14)

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Triple 3-input NOR gate

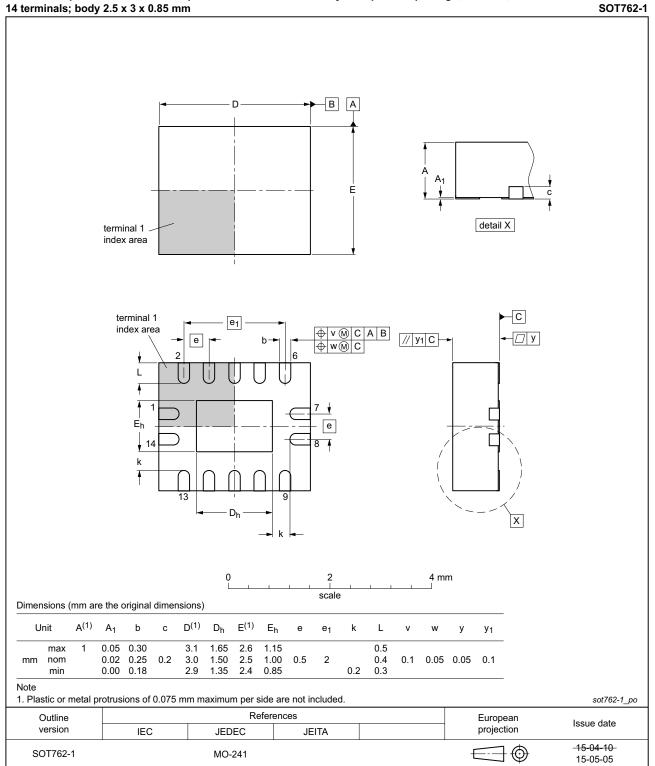


### Fig 10. Package outline SOT402-1 (TSSOP14)

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74HC\_HCT27

**Triple 3-input NOR gate** 



#### DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;

Fig 11. Package outline SOT762-1 (DHVQFN14)

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## **13. Abbreviations**

Table 10. Abbreviations						
Acronym	Description					
CMOS	Complementary Metal Oxide Semiconductor					
DUT	Device Under Test					
ESD	ElectroStatic Discharge					
НВМ	Human Body Model					
MM	Machine Model					
TTL	Transistor-Transistor Logic					

## 14. Revision history

### Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74HC_HCT27 v.5.1	20151127	Product data sheet	-	74HC_HCT27 v.5			
Modifications:	Correction of	f typo modification date.					
74HC_HCT27 v.5	20151115	Product data sheet	-	74HC_HCT27 v.4			
Modifications:	Type numbers 74HC27N and 74HCT27N (SOT27-1) removed.						
74HC_HCT27 v.4	20130605	Product data sheet	-	74HC_HCT27 v.3			
Modifications:		f this data sheet has been NXP Semiconductors.	redesigned to con	nply with the new identity			
	<ul> <li>Legal texts h</li> </ul>	ave been adapted to the ne	ew company name	e where appropriate.			
74HC_HCT27 v.3	20080107	Product data sheet	-	74HC_HCT27_CNV v.2			
74HC_HCT27_CNV v.2	19970828	Product specification	-	-			

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Document status[1][2]	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Product data sheet

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## 74HC27; 74HCT27

#### **Triple 3-input NOR gate**

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74HC HCT27

Triple 3-input NOR gate

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