

# DATA SHEET

## **74LVC32A** Quad 2-input OR gate

Product specification  
IC24 Data Handbook

1997 Jun 30

## Quad 2-input OR gate

## 74LVC32A

## FEATURES

- Wide supply voltage range of 1.2 V to 3.6 V
- In accordance with JEDEC standard no. 8-1A.
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels

## DESCRIPTION

The 74LVC32A is a high-performance, low-power, low-voltage Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V/5V environment.

The 74LVC32A provides the 2-input OR function.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25^{\circ}\text{C}$ ;  $t_r = t_f \leq 2.5 \text{ ns}$

| SYMBOL            | PARAMETER                              | CONDITIONS  | TYPICAL | UNIT |
|-------------------|--|---|---------|------|
| $t_{PHL}/t_{PLH}$ | Propagation delay<br>nA, nB to nY      | $C_L = 50 \text{ pF}$ ;<br>$V_{CC} = 3.3 \text{ V}$ | 2.6     | ns   |
| $C_I$             | Input capacitance                      |   | 5.0     | pF   |
| $C_{PD}$          | Power dissipation capacitance per gate | Notes 1 and 2                                       | 28      | pF   |

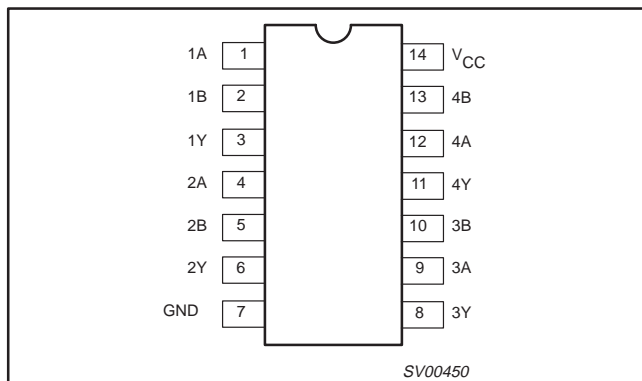
## NOTES:

- $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  $C_L$  = output load capacity in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.
- The condition is  $V_I = \text{GND to } V_{CC}$ .

## ORDERING INFORMATION

| PACKAGES                    | TEMPERATURE RANGE                             | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|-----------------------------|---|-----------------------|---------------|------------|
| 14-Pin Plastic SO           | $-40^{\circ}\text{C to } +85^{\circ}\text{C}$ | 74LVC32A D            | 74LVC32A D    | SOT108-1   |
| 14-Pin Plastic SSOP Type II | $-40^{\circ}\text{C to } +85^{\circ}\text{C}$ | 74LVC32A DB           | 74LVC32A DB   | SOT337-1   |
| 14-Pin Plastic TSSOP Type I | $-40^{\circ}\text{C to } +85^{\circ}\text{C}$ | 74LVC32A PW           | 74LVC32APW DH | SOT402-1   |

## PIN CONFIGURATION



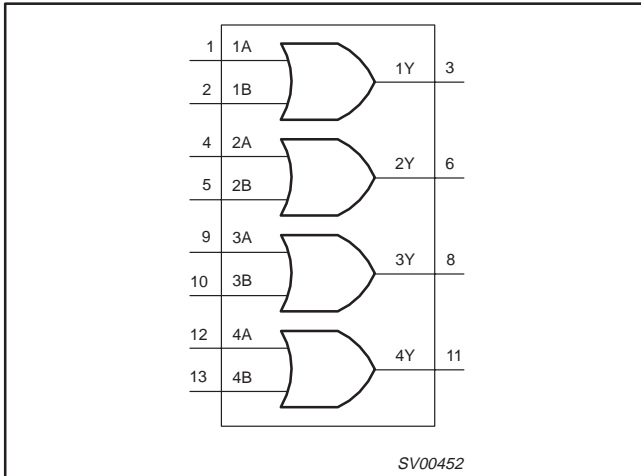
## PIN DESCRIPTION

| PIN NUMBER   | SYMBOL   | NAME AND FUNCTION       |
|--------------|----------|-------------------------|
| 1, 4, 9, 12  | 1A – 4A  | Data inputs             |
| 2, 5, 10, 13 | 1B – 4B  |                         |
| 3, 6, 8, 11  | 1Y – 4Y  | Data outputs            |
| 7            | GND      | Ground (0 V)            |
| 14           | $V_{CC}$ | Positive supply voltage |

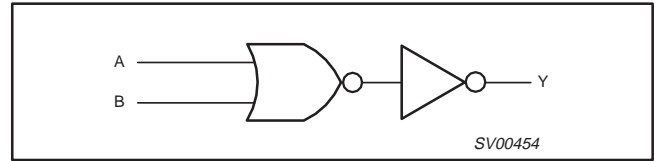
# Quad 2-input OR gate

# 74LVC32A

### LOGIC SYMBOL



### LOGIC DIAGRAM (ONE GATE)



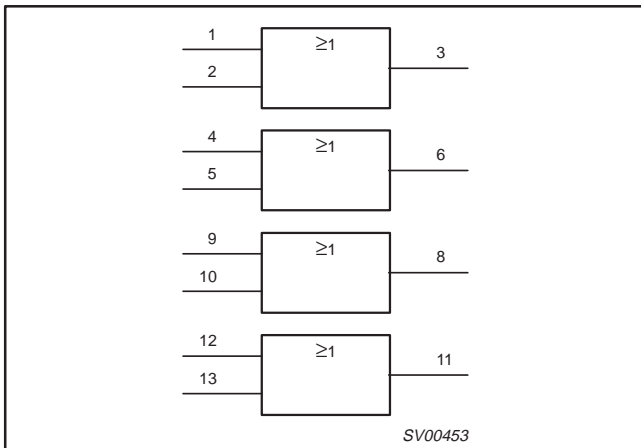
### FUNCTION TABLE

| INPUTS |    | OUTPUTS |
|--------|----|---------|
| nA     | nB | nY      |
| L      | L  | L       |
| L      | H  | H       |
| H      | L  | H       |
| H      | H  | H       |

**NOTES:**

H = HIGH voltage level  
 L = LOW voltage level

### LOGIC SYMBOL (IEEE/IEC)



## Quad 2-input OR gate

74LVC32A

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER   | CONDITIONS   | LIMITS |          | UNIT |
|------------|---|--|--------|----------|------|
|            |   |  | MIN    | MAX      |      |
| $V_{CC}$   | DC supply voltage (for max. speed performance)    |  | 2.7    | 3.6      | V    |
| $V_{CC}$   | DC supply voltage (for low-voltage applications)  |  | 1.2    | 3.6      | V    |
| $V_I$      | DC input voltage range                            |  | 0      | 5.5      | V    |
| $V_O$      | DC output voltage range; output HIGH or LOW state |  | 0      | $V_{CC}$ | V    |
| $T_{amb}$  | Operating ambient temperature range in free-air   |  | -40    | +85      | °C   |
| $t_p, t_f$ | Input rise and fall times                         | $V_{CC} = 1.2$ to $2.7V$<br>$V_{CC} = 2.7$ to $3.6V$ | 0      | 20<br>10 | ns/V |

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

In accordance with the Absolute Maximum Rating System (IEC 134).  
Voltages are referenced to GND (ground = 0V).

| SYMBOL            | PARAMETER  | CONDITIONS   | RATING                 | UNIT |
|-------------------|--|--|------------------------|------|
| $V_{CC}$          | DC supply voltage  |  | -0.5 to +6.5           | V    |
| $I_{IK}$          | DC input diode current   | $V_I < 0$  | -50                    | mA   |
| $V_I$             | DC input voltage   | Note 2   | -0.5 to +6.5           | V    |
| $I_{OK}$          | DC output diode current  | $V_O > V_{CC}$ or $V_O < 0$  | ±50                    | mA   |
| $V_O$             | DC output voltage; output HIGH or LOW state  | Note 2   | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_O$             | DC output source or sink current   | $V_O = 0$ to $V_{CC}$  | ±50                    | mA   |
| $I_{GND}, I_{CC}$ | DC $V_{CC}$ or GND current   |  | ±100                   | mA   |
| $T_{stg}$         | Storage temperature range  |  | -65 to +150            | °C   |
| $P_{TOT}$         | Power dissipation per package<br>– plastic mini-pack (SO)<br>– plastic shrink mini-pack (SSOP and TSSOP) | above +70°C derate linearly with 8 mW/K<br>above +60°C derate linearly with 5.5 mW/K | 500<br>500             | mW   |

## 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 input and output voltage ratings may be exceeded if the input and output current ratings are observed.

# Quad 2-input OR gate

# 74LVC32A

## DC 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 <sub>IH</sub>  | HIGH level Input voltage                          | V <sub>CC</sub> = 1.2V  | V <sub>CC</sub>       |                  |      | V    |
|                  |   | V <sub>CC</sub> = 2.7 to 3.6V   | 2.0                   |                  |      |      |
| V <sub>IL</sub>  | LOW level Input voltage                           | V <sub>CC</sub> = 1.2V  |                       |                  | GND  | V    |
|                  |   | V <sub>CC</sub> = 2.7 to 3.6V   |                       |                  | 0.8  |      |
| V <sub>OH</sub>  | HIGH level output voltage                         | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA  | V <sub>CC</sub> - 0.5 |                  |      | V    |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100µA | V <sub>CC</sub> - 0.2 | V <sub>CC</sub>  |      |      |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18mA  | V <sub>CC</sub> - 0.6 |                  |      |      |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA  | V <sub>CC</sub> - 0.8 |                  |      |      |
| V <sub>OL</sub>  | LOW level output voltage                          | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA   |                       |                  | 0.40 | V    |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA  |                       |                  | 0.20 |      |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA   |                       |                  | 0.55 |      |
| I <sub>I</sub>   | Input leakage current                             | V <sub>CC</sub> = 3.6V; V <sub>I</sub> = 5.5V or GND  |                       | ±0.1             | ±5   | µA   |
| I <sub>CC</sub>  | Quiescent supply current                          | V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                   |                       | 0.1              | 10   | µA   |
| ΔI <sub>CC</sub> | Additional quiescent supply current per input pin | V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0           |                       | 5                | 500  | µA   |

**NOTE:**

1. All typical values are at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25°C.

## AC CHARACTERISTICS

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> ≤ 2.5 ns; C<sub>L</sub> = 50 pF

| SYMBOL                                 | PARAMETER                         | WAVEFORMS | LIMITS                       |                  |     |                        |     |     |                        | UNIT |
|--|-----------------------------------|-----------|------------------------------|------------------|-----|------------------------|-----|-----|------------------------|------|
|  |                                   |           | V <sub>CC</sub> = 3.3V ±0.3V |                  |     | V <sub>CC</sub> = 2.7V |     |     | V <sub>CC</sub> = 1.2V |      |
|  |                                   |           | MIN                          | TYP <sup>1</sup> | MAX | MIN                    | TYP | MAX | TYP                    |      |
| t <sub>PHL</sub> /<br>t <sub>PLH</sub> | Propagation delay<br>nA, nB to nY | 1, 2      | 1.5                          | 2.6              | 4.9 | 1.5                    | 3.0 | 5.9 | 16                     | ns   |

**NOTE:**

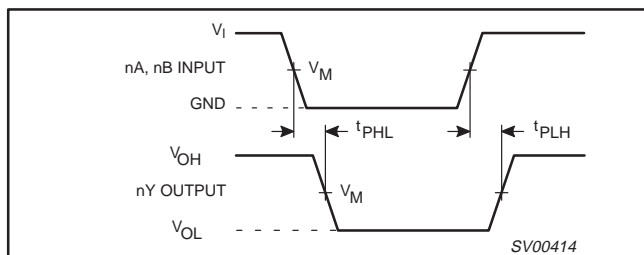
1. These typical values are at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25°C.

## AC WAVEFORMS

V<sub>M</sub> = 1.5 V at V<sub>CC</sub> ≥ 2.7 V

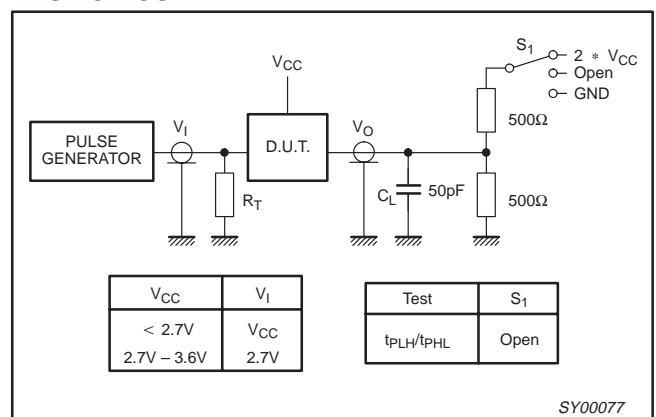
V<sub>M</sub> = 0.5 • V<sub>CC</sub> at V<sub>CC</sub> < 2.7 V

V<sub>OL</sub> and V<sub>OH</sub> are the typical output voltage drop that occur with the output load.



Waveform 1. Input (nA, nB) to output (nY) propagation delays.

## TEST CIRCUIT



Waveform 2. Load circuitry for switching times.

# Quad 2-input OR gate

# 74LVC32A

**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 <sub>1</sub>   | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | Z <sup>(1)</sup> | θ        |
|--------|--------|------------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10     | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 8.75<br>8.55     | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.0098<br>0.0039 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0098<br>0.0075 | 0.35<br>0.34     | 0.16<br>0.15     | 0.050 | 0.24<br>0.23   | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>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        | 076E06S    | MS-012AB |      |  |                     | 91-08-13<br>95-01-23 |

# Quad 2-input OR gate

## 74LVC32A

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

**SOT337-1**

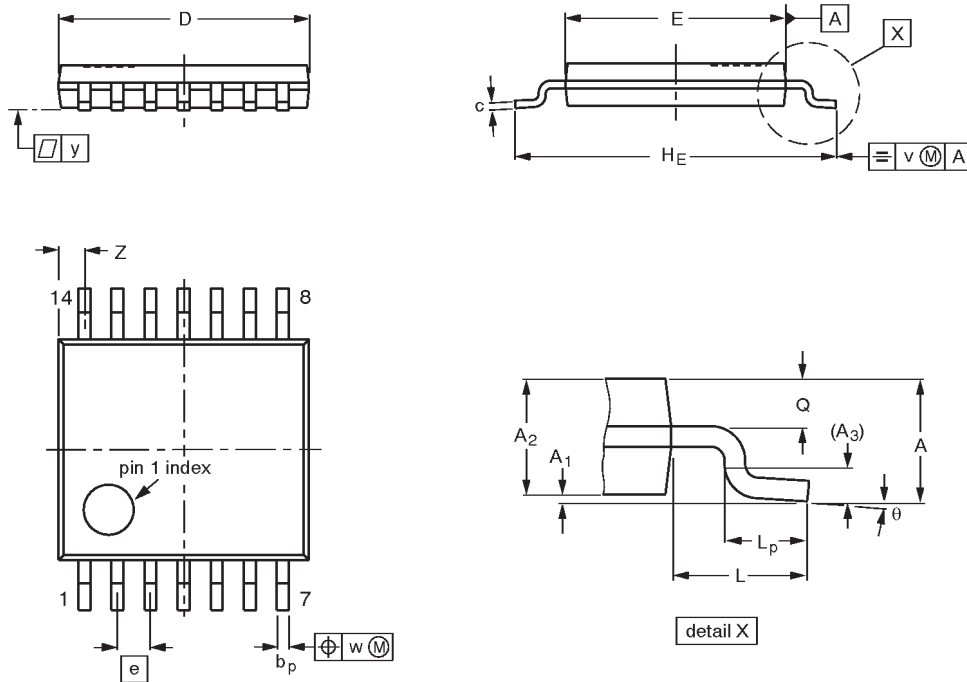


# Quad 2-input OR gate

# 74LVC32A

**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          | D <sup>(1)</sup> | E <sup>(2)</sup> | e    | H <sub>E</sub> | L   | L <sub>p</sub> | Q          | v   | w    | y   | Z <sup>(1)</sup> | θ        |
|------|--------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|-----|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 1.10   | 0.15<br>0.05   | 0.95<br>0.80   | 0.25           | 0.30<br>0.19   | 0.2<br>0.1 | 5.1<br>4.9       | 4.5<br>4.3       | 0.65 | 6.6<br>6.2     | 1.0 | 0.75<br>0.50   | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38     | 8°<br>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-153 |      |  |                     | -94-07-12-<br>95-04-04 |



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Quad 2-input OR gate

74LVC32A

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**NOTES**

## Quad 2-input OR gate

74LVC32A

## 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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