

74LVC1G06

Inverter with open-drain output

Rev. 07 — 12 July 2007

Product data sheet

1. General description

The 74LVC1G06 provides the inverting buffer.

Input can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices in a mixed 3.3 V and 5 V environment.

Schmitt-trigger action at all inputs makes the circuit tolerant for slower input rise and fall time.

This device is fully specified for partial power-down applications using I_{OFF} .

The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

The output of the device is an open drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

2. Features

- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- Complies with JEDEC standard:
 - ◆ JESD8-7 (1.65 V to 1.95 V)
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Multiple package options
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to $+125$ °C

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|--------|---------------------------------------------------------------------------------------------|----------|
| | Temperature range | Name | Description | |
| 74LVC1G06GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G06GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74LVC1G06GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74LVC1G06GF | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm | SOT891 |

4. Marking

Table 2. Marking codes

| Type number | Marking |
|-------------|---------|
| 74LVC1G06GW | VR |
| 74LVC1G06GV | V06 |
| 74LVC1G06GM | VR |
| 74LVC1G06GF | VR |

5. Functional diagram

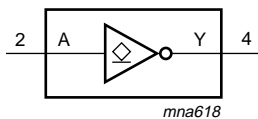


Fig 1. Logic symbol

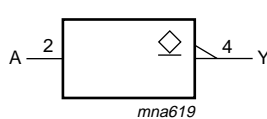


Fig 2. IEC logic symbol

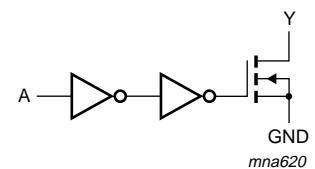
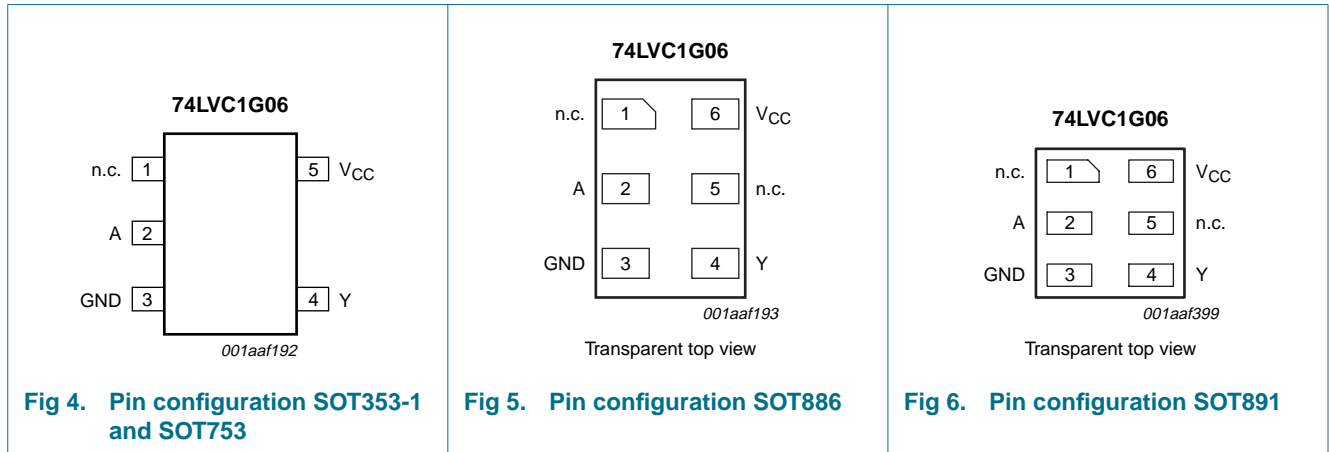


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|-----------------|---------------|----------------|
| | SOT353-1/SOT753 | SOT886/SOT891 | |
| n.c. | 1 | 1 | not connected |
| A | 2 | 2 | data input |
| GND | 3 | 3 | ground (0 V) |
| Y | 4 | 4 | data output |
| n.c. | - | 5 | not connected |
| V _{CC} | 5 | 6 | supply voltage |

7. Functional description

Table 4. Function table^[1]

| Input | Output |
|-------|--------|
| A | Y |
| L | Z |
| H | L |

[1] H = HIGH voltage level;
L = LOW voltage level.

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------------|---------------------------------|-------------|----------|------|
| V_{CC} | supply voltage | | -0.5 | +6.5 | V |
| I_{IK} | input diode current | $V_I < 0$ V | -50 | - | mA |
| V_I | input voltage | | [1] -0.5 | +6.5 | V |
| I_{OK} | output diode current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ± 50 | mA |
| V_O | output voltage | Active mode and Power-down mode | [1][2] -0.5 | +6.5 | V |
| I_O | output source or sink current | $V_O = 0$ V to V_{CC} | - | ± 50 | mA |
| I_{CC} | supply current | | - | +100 | mA |
| I_{GND} | ground current | | -100 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +125 °C | [3] - | 250 | mW |

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

[2] When $V_{CC} = 0$ V (Power-down mode), the output voltage can be 5.5 V in normal operation.

[3] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-------------------------------------|---------------------------------|------|-----|------|------|
| V_{CC} | supply voltage | | 1.65 | - | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | V |
| V_O | output voltage | Active mode | 0 | - | 5.5 | V |
| | | Power-down mode; $V_{CC} = 0$ V | 0 | - | 5.5 | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65$ V to 2.7 V | - | - | 20 | ns/V |
| | | $V_{CC} = 2.7$ V to 5.5 V | - | - | 10 | ns/V |

10. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit | | | | | | | |
|-----------------|---------------------------|---------------------------------------------------------------|---------------------------|-----------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------------------------|-----|----|------|----|----|
| | | | Min | Typ ^[1] | Max | Min | Max | | | | | | | | |
| V _{IH} | HIGH-level output voltage | V _{CC} = 1.65 V to 1.95 V | 0.65V _{CC} | - | - | 0.65V _{CC} | - | V | | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | 1.7 | - | V | | | | | | | |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | 2.0 | - | V | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7V _{CC} | - | - | 0.7V _{CC} | - | V | | | | | | | |
| V _{IL} | LOW-level output voltage | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35V _{CC} | - | 0.35V _{CC} | V | | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | - | 0.7 | V | | | | | | | |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | - | 0.8 | V | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3V _{CC} | - | 0.3V _{CC} | V | | | | | | | |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | - | - | - | - | - | | | | | | | | |
| | | I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V | - | - | 0.10 | - | 0.10 | V | | | | | | | |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.45 | - | 0.70 | V | | | | | | | |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.30 | - | 0.45 | V | | | | | | | |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.40 | - | 0.60 | V | | | | | | | |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.55 | - | 0.80 | V | | | | | | | |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | ±0.1 | ±5 | - | ±100 | μA | | | | | | | |
| | | I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | ±0.1 | ±10 | - | ±200 | μA | | | | | |
| | | | | I _{CC} | supply current | V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V | - | 0.1 | 10 | - | 200 | μA | | | |
| | | | | | | ΔI _{CC} | additional supply current | V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 5.5 V; per pin | - | 5 | 500 | - | 5000 | μA | |
| | | | | | | | | C _I | input capacitance | V _{CC} = 3.3 V; V _I = GND to V _{CC} | - | 5 | - | - | pF |

[1] All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for load circuit see [Figure 8](#).

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|-------------------------------|----------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| t _{pd} | propagation delay | A to Y; see Figure 7 ^[2] | | | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | 3 | 6.5 | 1.0 | 8.5 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.5 | 1.9 | 4 | 0.5 | 5.5 | ns |
| | | V _{CC} = 2.7 V | 0.5 | 2.5 | 4.5 | 0.5 | 6 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.5 | 2.3 | 4 | 0.5 | 5.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.5 | 1.7 | 3 | 0.5 | 4 | ns |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[3] | - | 14 | - | - | - | pF |

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

[2] t_{pd} is the same as t_{PLZ} and t_{PZL}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

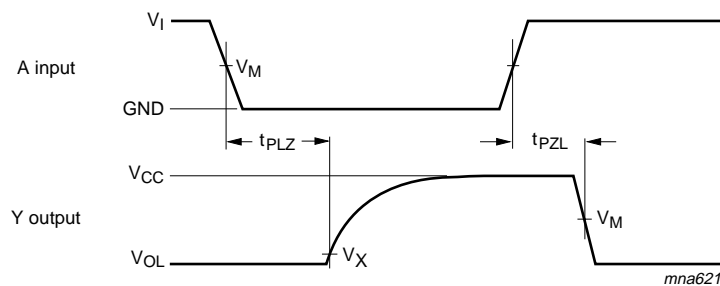
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of outputs.

12. Waveforms



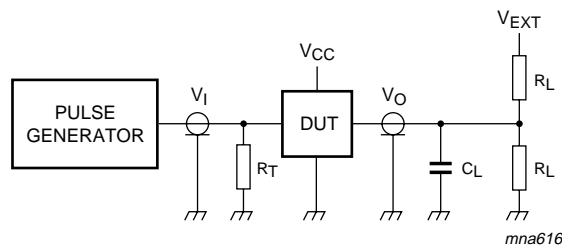
Measurement points are given in [Table 9](#).

V_{OL} is the typical output voltage level that occurs with the output load.

Fig 7. The input A to output Y propagation delay times

Table 9. Measurement points

| Supply voltage | Input | Output | |
|------------------|-------------|-------------|-------------------|
| V_{CC} | V_M | V_M | V_X |
| 1.65 V to 1.95 V | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.15 V$ |
| 2.3 V to 2.7 V | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.15 V$ |
| 2.7 V | 1.5 V | 1.5 V | $V_{OL} + 0.3 V$ |
| 3.0 V to 3.6 V | 1.5 V | 1.5 V | $V_{OL} + 0.3 V$ |
| 4.5 V to 5.5 V | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ |



Test data is given in [Table 10](#).

Definitions test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

V_{EXT} = External voltage for measuring switching times.

Fig 8. Load circuitry for switching times

Table 10. Test data

| Supply voltage | Input | | Load | | V_{EXT} |
|------------------|----------|-----------------------|-------|--------------|--------------------|
| V_{CC} | V_I | $t_r = t_f$ | C_L | R_L | t_{pZL}, t_{PLZ} |
| 1.65 V to 1.95 V | V_{CC} | $\leq 2.0 \text{ ns}$ | 30 pF | 1 k Ω | $2V_{CC}$ |
| 2.3 V to 2.7 V | V_{CC} | $\leq 2.0 \text{ ns}$ | 30 pF | 500 Ω | $2V_{CC}$ |
| 2.7 V | 2.7 V | $\leq 2.5 \text{ ns}$ | 50 pF | 500 Ω | 6 V |
| 3.0 V to 3.6 V | 2.7 V | $\leq 2.5 \text{ ns}$ | 50 pF | 500 Ω | 6 V |
| 4.5 V to 5.5 V | V_{CC} | $\leq 2.5 \text{ ns}$ | 50 pF | 500 Ω | $2V_{CC}$ |

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



Fig 9. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



Fig 10. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886

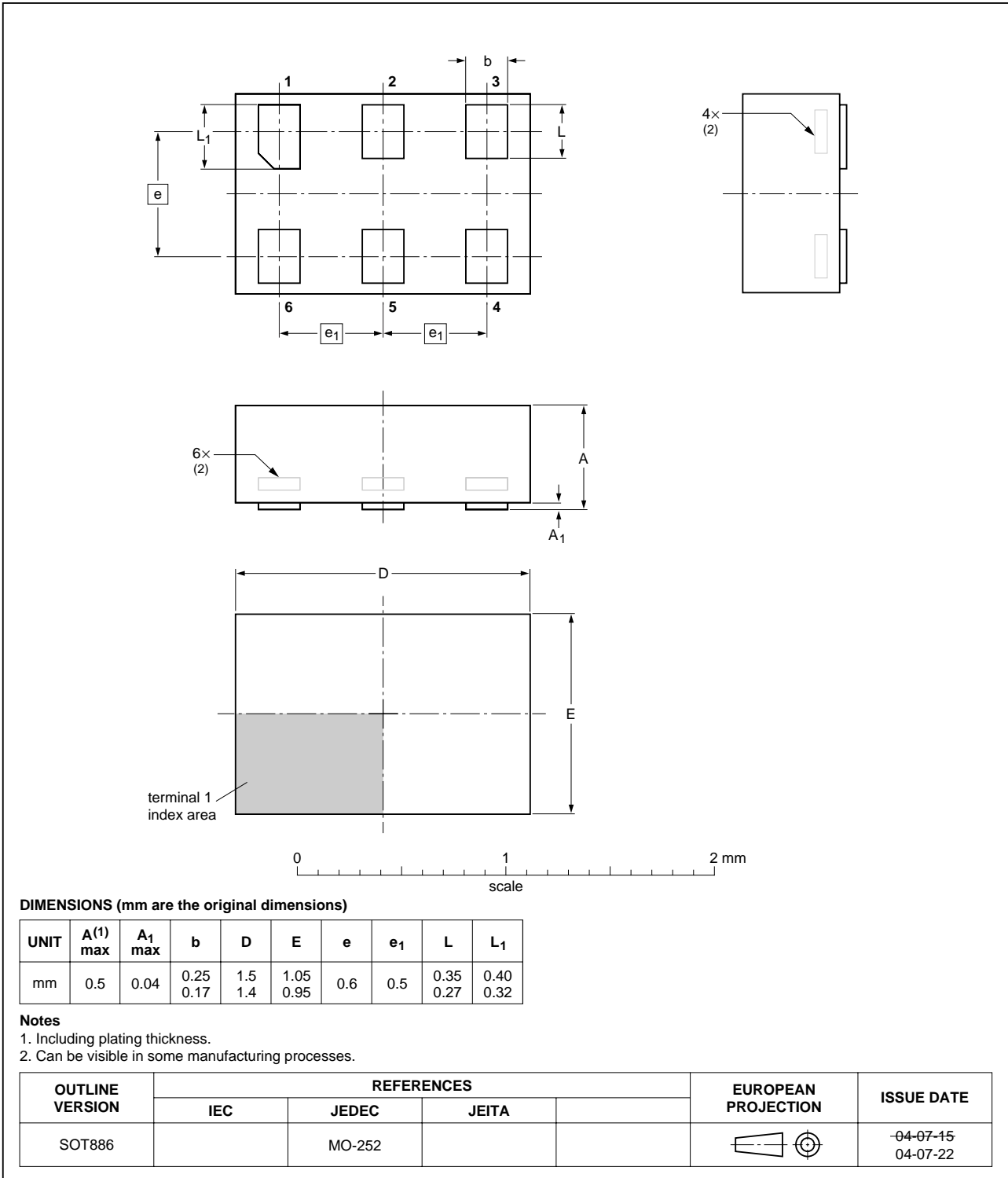


Fig 11. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891



Fig 12. Package outline SOT891 (XSON6)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-----------------------------------------|
| CMOS | Complementary Metal Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|-------------|
| 74LVC1G06_7 | 20070712 | Product data sheet | - | 74LVC1G06_6 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Section 10 "Static characteristics": Changed: Conditions for input leakage current and supply current. New package outline drawing for XSON6/SOT891. | | | |
| 74LVC1G06_6 | 20060912 | Product data sheet | - | 74LVC1G06_5 |
| 74LVC1G06_5 | 20040907 | Product specification | - | 74LVC1G06_4 |
| 74ALV1G06_4 | 20030303 | Product specification | - | 74LVC1G06_3 |
| 74LVC1G06_3 | 20020529 | Product specification | - | 74LVC1G06_2 |
| 74LVC1G06_2 | 20010405 | Product specification | - | 74LVC1G06_1 |
| 74LVC1G06_1 | 20001121 | Product specification | - | - |

16. Legal information

16.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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