

74LVC1G38

2-input NAND gate; open drain

Rev. 10 — 12 January 2022

Product data sheet

1. General description

The 74LVC1G38 is a single 2-input NAND gate with open-drain output. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

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

This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant outputs for interfacing with 5 V logic
- High noise immunity
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- Open drain outputs
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8-B/JESD36 (2.7 V to 3.6 V).
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+125$ °C.

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|--------|--|-----------|
| | Temperature range | Name | Description | |
| 74LVC1G38GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G38GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74LVC1G38GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74LVC1G38GN | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm | SOT1115 |
| 74LVC1G38GS | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm | SOT1202 |
| 74LVC1G38GX | -40 °C to +125 °C | X2SON5 | plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm | SOT1226-3 |

4. Marking

Table 2. Marking

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| 74LVC1G38GW | YB |
| 74LVC1G38GV | YB |
| 74LVC1G38GM | YB |
| 74LVC1G38GN | YB |
| 74LVC1G38GS | YB |
| 74LVC1G38GX | YB |

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

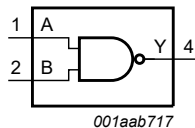


Fig. 1. Logic symbol

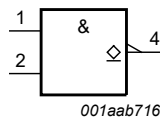


Fig. 2. IEC logic symbol

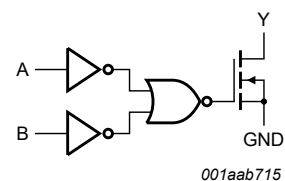


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

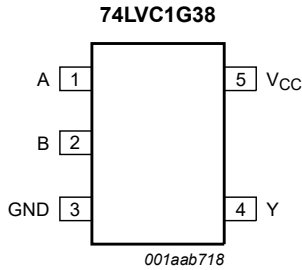


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

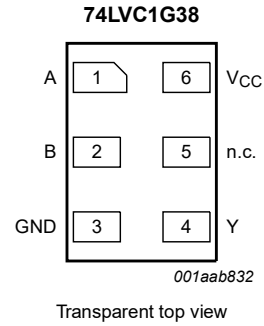


Fig. 5. Pin configuration SOT886 (XSON6)

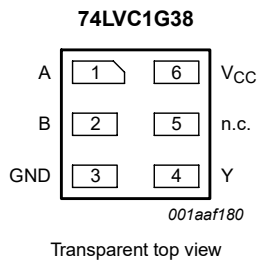


Fig. 6. Pin configuration SOT1115 and SOT1202 (XSON6)

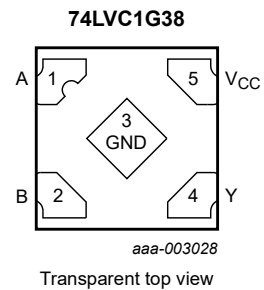


Fig. 7. Pin configuration SOT1226-3 (X2SON5)

6.2. Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|---------------------------|-------|----------------|
| | TSSOP5, SC-74A and X2SON5 | XSON6 | |
| A | 1 | 1 | data input |
| B | 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

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF state.

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

8. Limiting values

Table 5. 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_{CC} | supply voltage | | -0.5 | +6.5 | V |
| I_{IK} | input clamping current | $V_I < 0$ V | -50 | - | mA |
| V_I | input voltage | | [1] -0.5 | +6.5 | V |
| I_{OK} | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ± 50 | mA |
| V_O | output voltage | Active mode | [1] -0.5 | +6.5 | V |
| | | Power-down mode; $V_{CC} = 0$ V | [1] -0.5 | +6.5 | V |
| I_O | output 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 | [2] - | 250 | mW |

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

[2] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

| 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 |
| | | Disable mode; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | 0 | - | 5.5 | V |
| | | Power-down mode; $V_{CC} = 0\text{ V}$ | 0 | - | 5.5 | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65\text{ V to }2.7\text{ V}$ | - | - | 20 | ns/V |
| | | $V_{CC} = 2.7\text{ V to }5.5\text{ V}$ | - | - | 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 | Min | Typ[1] | Max | Unit |
|--|---------------------------|---|----------------------|-----------|----------------------|---------------|
| $T_{amb} = -40\text{ °C to }+85\text{ °C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | $0.65 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.7 | - | - | V |
| | | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$ | 2.0 | - | - | V |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | $0.7 \times V_{CC}$ | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ | - | - | $0.35 \times V_{CC}$ | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | - | 0.7 | V |
| | | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$ | - | - | 0.8 | V |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | - | - | $0.3 \times V_{CC}$ | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = 100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | - | - | 0.1 | V |
| | | $I_O = 4\text{ mA}$; $V_{CC} = 1.65\text{ V}$ | - | - | 0.45 | V |
| | | $I_O = 8\text{ mA}$; $V_{CC} = 2.3\text{ V}$ | - | - | 0.3 | V |
| | | $I_O = 12\text{ mA}$; $V_{CC} = 2.7\text{ V}$ | - | - | 0.4 | V |
| | | $I_O = 24\text{ mA}$; $V_{CC} = 3.0\text{ V}$ | - | - | 0.55 | V |
| $I_O = 32\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | - | 0.55 | V | | |
| I_I | input leakage current | $V_I = 5.5\text{ V}$ or GND; $V_{CC} = 0\text{ V to }5.5\text{ V}$ | - | ± 0.1 | ± 1 | μA |
| I_{OZ} | OFF-state output current | $V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ | - | ± 0.1 | ± 2 | μA |
| I_{OFF} | power-off leakage current | V_I or $V_O = 5.5\text{ V}$; $V_{CC} = 0\text{ V}$ | - | ± 0.1 | ± 2 | μA |
| I_{CC} | supply current | $V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$; $I_O = 0\text{ A}$ | - | 0.1 | 4 | μA |
| ΔI_{CC} | additional supply current | $V_I = V_{CC} - 0.6\text{ V}$; $I_O = 0\text{ A}$; $V_{CC} = 2.3\text{ V to }5.5\text{ V}$; per pin | - | 5 | 500 | μA |
| C_I | input capacitance | | - | 2.5 | - | pF |

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---------------------------|---|------------------------|--------|------------------------|------|
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.65 × V _{CC} | - | - | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | V |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7 × V _{CC} | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3 × V _{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 | - | - | 0.1 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.70 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.45 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.60 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.80 | V |
| I _O = 32 mA; V _{CC} = 4.5 V | - | - | 0.80 | V | | |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | ±1 | μA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±2 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | - | ±2 | μA |
| I _{CC} | supply current | V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A | - | - | 4 | 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 | - | - | 500 | μA |

[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 test circuit see Fig. 9.

| 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, B to Y; see Fig. 8 [2] | | | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | 3.0 | 10.0 | 1.0 | 12.5 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.5 | 1.8 | 6.0 | 0.5 | 7.5 | ns |
| | | V _{CC} = 2.7 V | 0.5 | 2.5 | 5.0 | 0.5 | 6.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.5 | 2.3 | 4.5 | 0.5 | 5.7 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.5 | 1.5 | 3.9 | 0.5 | 4.9 | ns |
| C _{PD} | power dissipation capacitance | V _{CC} = 3.3 V; V _I = GND to V _{CC} [3] | - | 6 | - | - | - | 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_{PZL} and t_{PLZ}.

[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;

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

11.1. Waveforms and test circuit

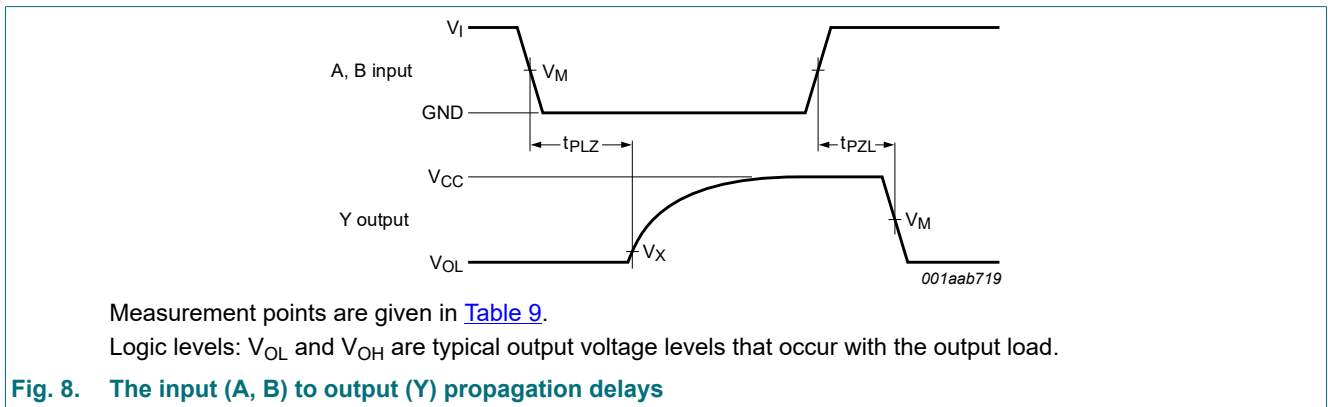
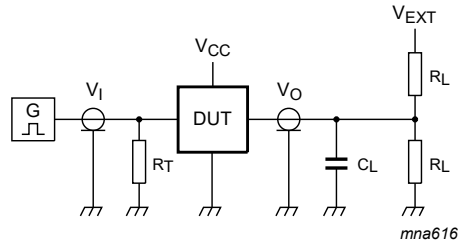


Fig. 8. The input (A, B) to output (Y) propagation delays

Table 9. Measurement points

| Supply voltage | Input | Output | |
|------------------|-----------------------|-----------------------|--------------------------|
| | | V _M | V _X |
| V _{CC} | V _M | V _M | V _X |
| 1.65 V to 1.95 V | 0.5 x V _{CC} | 0.5 x V _{CC} | V _{OL} + 0.15 V |
| 2.3 V to 2.7 V | 0.5 x V _{CC} | 0.5 x V _{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 | 0.5 x V _{CC} | 0.5 x V _{CC} | V _{OL} + 0.3 V |



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

Definitions for test circuit:

R_L = Load resistance;

C_L = Load capacitance including jig and probe capacitance;

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

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

Fig. 9. Test circuit for measuring 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} | ≤ 2.0 ns | 30 pF | 1 k Ω | V_{CC} |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2.0 ns | 30 pF | 500 Ω | V_{CC} |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | V_{CC} |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | V_{CC} |
| 4.5 V to 5.5 V | V_{CC} | ≤ 2.5 ns | 50 pF | 500 Ω | V_{CC} |

12. Package outline

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

SOT353-1



Fig. 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

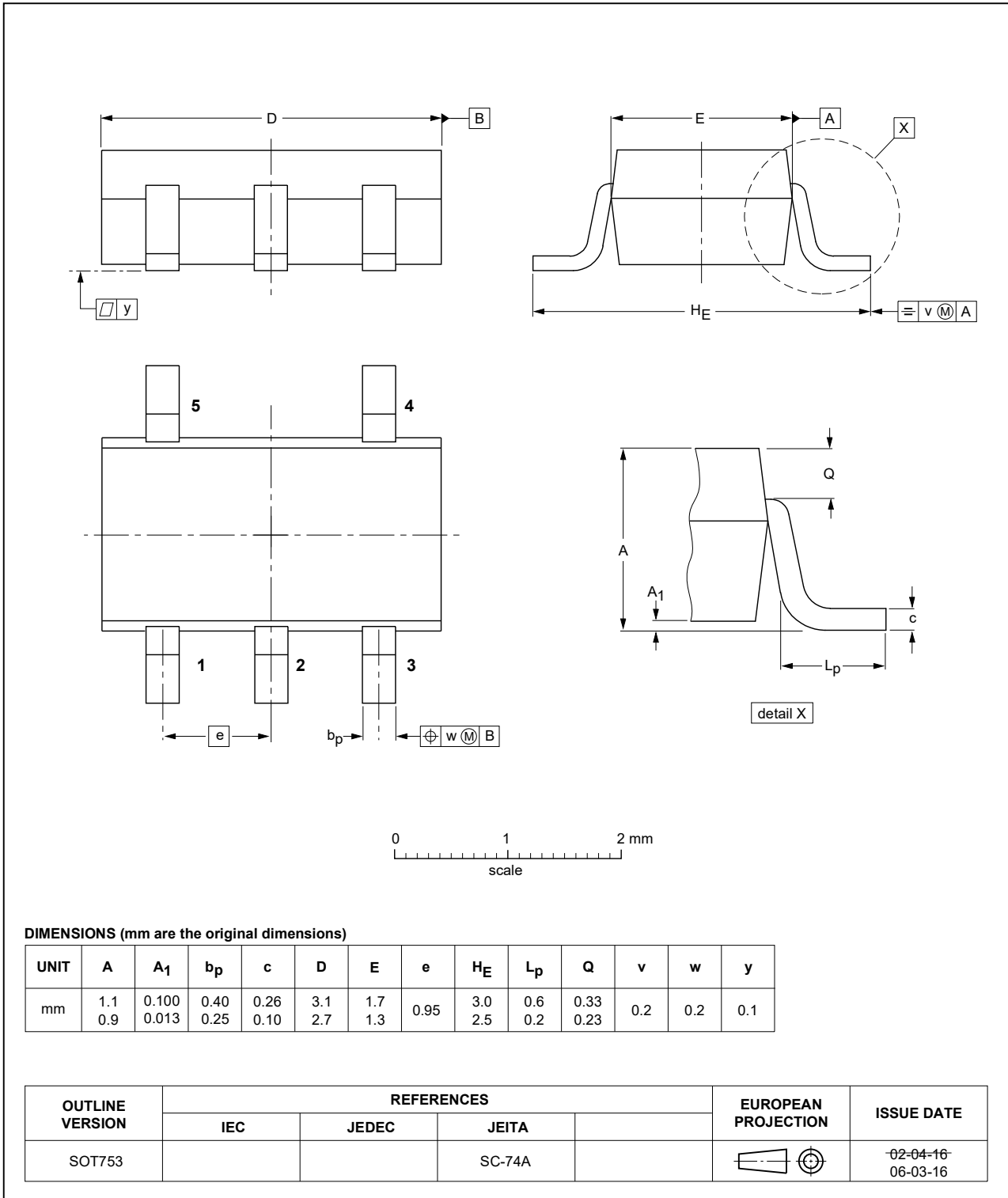


Fig. 11. Package outline SOT753 (SC-74A)

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

SOT886

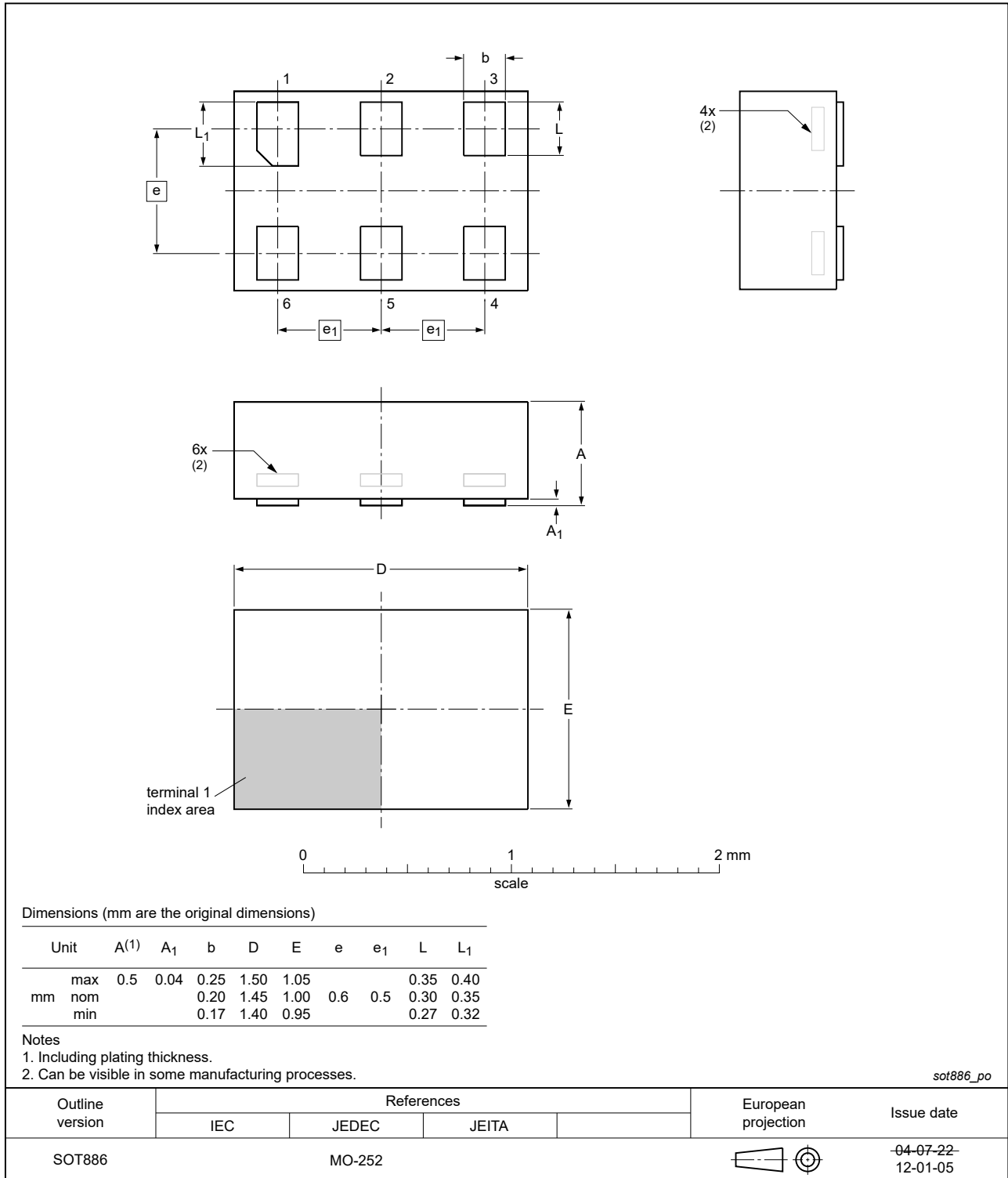


Fig. 12. Package outline SOT886 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 0.9 x 1.0 x 0.35 mm

SOT1115



Fig. 13. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 1.0 x 1.0 x 0.35 mm

SOT1202



Fig. 14. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;
5 terminals; body 0.8 x 0.8 x 0.32 mm

SOT1226-3

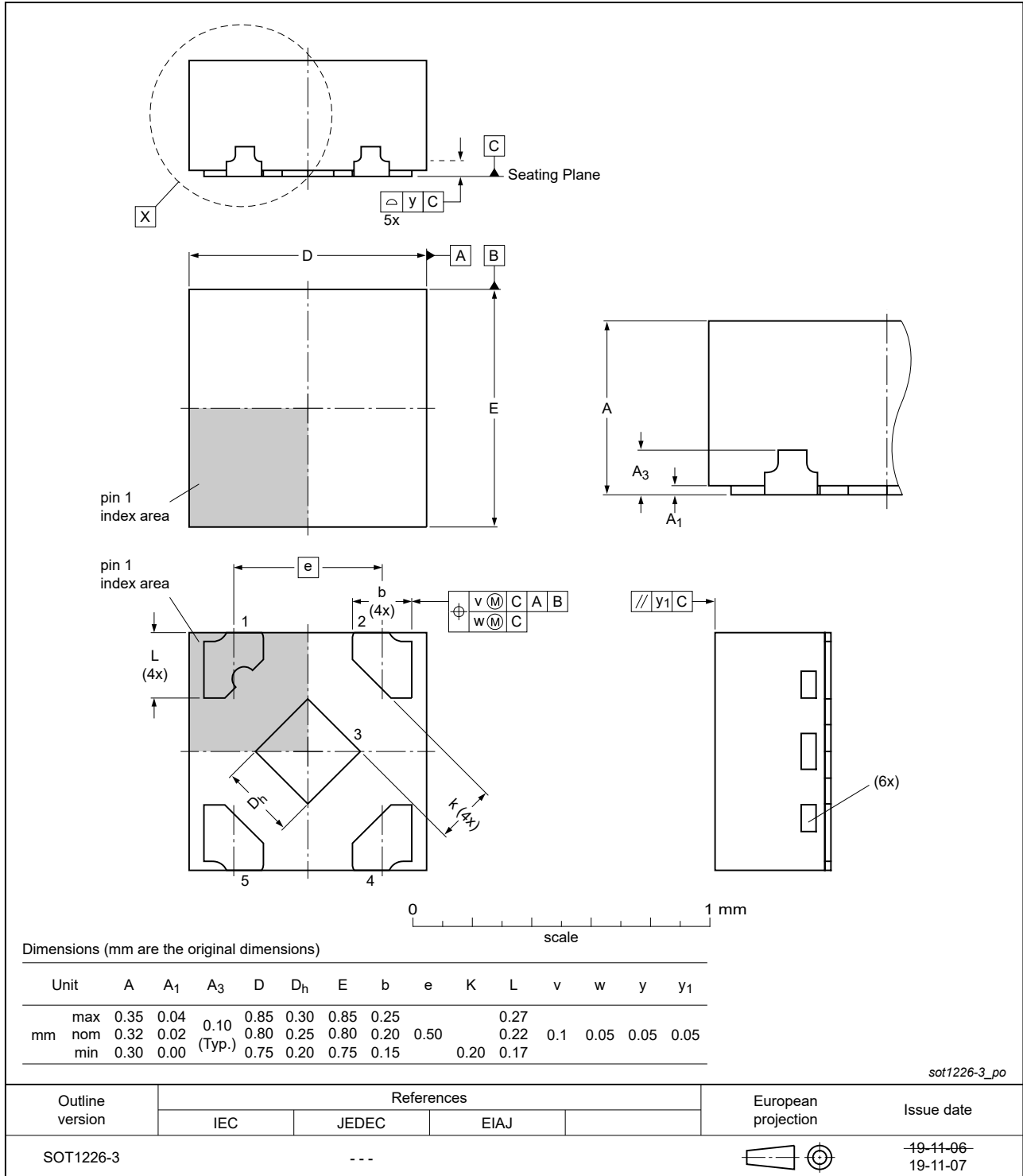


Fig. 15. Package outline SOT1226-3 (X2SON5)

13. 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 |

14. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|---|--------------------|---------------|---------------|
| 74LVC1G38 v.10 | 20220112 | Product data sheet | - | 74LVC1G38 v.9 |
| Modifications: | <ul style="list-style-type: none"> • Fig. 10: Package outline drawing SOT353-1 (TSSOP5) has changed. | | | |
| 74LVC1G38 v.9 | 20210518 | Product data sheet | - | 74LVC1G38 v.8 |
| Modifications: | <ul style="list-style-type: none"> • SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. • Type number 74LVC1G38GF (SOT891/XSON6) removed. • Section 1 updated. • Table 5: P_{tot} total power dissipation and derating values updated. | | | |
| 74LVC1G38 v.8 | 20161207 | Product data sheet | - | 74LVC1G38 v.7 |
| Modifications: | <ul style="list-style-type: none"> • Table 7: The maximum limits for leakage current and supply current have changed. | | | |
| 74LVC1G38 v.7 | 20121004 | Product data sheet | - | 74LVC1G38 v.6 |
| Modifications: | <ul style="list-style-type: none"> • Pin configuration SOT1226 (Fig. 7) modified. | | | |
| 74LVC1G38 v.6 | 20120702 | Product data sheet | - | 74LVC1G38 v.5 |
| Modifications: | <ul style="list-style-type: none"> • Added type number 74LVC1G38GX (SOT1226) • Package outline drawing of SOT886 (Fig. 12) modified. | | | |
| 74LVC1G38 v.5 | 20111206 | Product data sheet | - | 74LVC1G38 v.4 |
| Modifications: | <ul style="list-style-type: none"> • Legal pages updated. | | | |
| 74LVC1G38 v.4 | 20101005 | Product data sheet | - | 74LVC1G38 v.3 |
| 74LVC1G38 v.3 | 20070827 | Product data sheet | - | 74LVC1G38 v.2 |
| 74LVC1G38 v.2 | 20060913 | Product data sheet | - | 74LVC1G38 v.1 |
| 74LVC1G38 v.1 | 20041018 | Product data sheet | - | - |

15. Legal information

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. |
| Product [short] data sheet | Production | This document contains the product specification. |

- [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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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Date of release: 12 January 2022