

74LVC1G14

Single Schmitt-trigger inverter

Rev. 16 — 3 May 2021

Product data sheet

1. General description

The 74LVC1G14 is a single inverter with Schmitt-trigger inputs. 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. 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
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- I_{OFF} circuitry provides partial Power-down mode operation
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Unlimited rise and fall times
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 V)
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2000 V
 - MM: JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C.

3. Applications

- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

4. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|--------------|-------------------|--------|--|-----------|
| | Temperature range | Name | Description | Version |
| 74LVC1G14GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G14GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74LVC1G14GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74LVC1G14GN | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm | SOT1115 |
| 74LVC1G14GS | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm | SOT1202 |
| 74LVC1G14GX | -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 |
| 74LVC1G14GX4 | -40 °C to +125 °C | X2SON4 | plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 × 0.6 × 0.32 mm | SOT1269-2 |

5. Marking

Table 2. Marking

| Type number | Marking code ^[1] |
|--------------|-----------------------------|
| 74LVC1G14GW | VF |
| 74LVC1G14GV | V14 |
| 74LVC1G14GM | VF |
| 74LVC1G14GN | VF |
| 74LVC1G14GS | VF |
| 74LVC1G14GX | VF |
| 74LVC1G14GX4 | VF |

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

6. Functional diagram

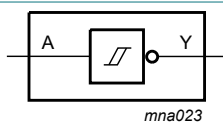


Fig. 1. Logic symbol

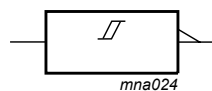


Fig. 2. IEC logic symbol

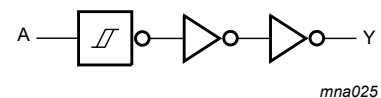


Fig. 3. Logic diagram

7. Pinning information

7.1. Pinning

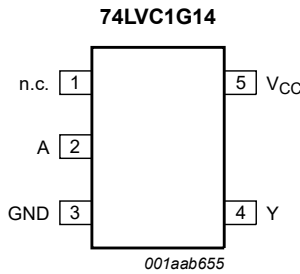


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

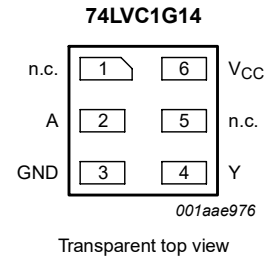


Fig. 5. Pin configuration SOT886, SOT1115 and SOT1202 (XSON6)

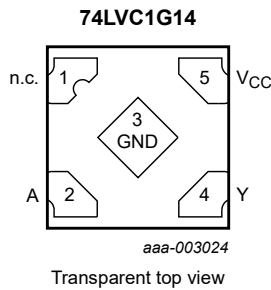


Fig. 6. Pin configuration SOT1226-3 (X2SON5)

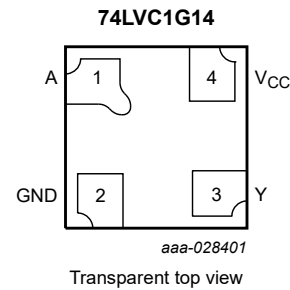


Fig. 7. Pin configuration SOT1269-2 (X2SON4)

7.2. Pin description

Table 3. Pin description

| Symbol | Pin | | | Description |
|-----------------|---------------------------|-------|--------|----------------|
| | TSSOP5, SC-74A and X2SON5 | XSON6 | X2SON4 | |
| n.c. | 1 | 1, 5 | - | not connected |
| A | 2 | 2 | 1 | data input |
| GND | 3 | 3 | 2 | ground (0 V) |
| Y | 4 | 4 | 3 | data output |
| V _{CC} | 5 | 6 | 4 | supply voltage |

8. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

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

9. 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 | |
| V_I | input voltage | [1] | -0.5 | +6.5 | V | |
| V_O | output voltage | Active mode | [1] | -0.5 | $V_{CC} + 0.5$ | V |
| | | Power-down mode; $V_{CC} = 0$ V | [1] | -0.5 | +6.5 | V |
| I_{IK} | input clamping current | $V_I < 0$ V | -50 | - | mA | |
| I_{OK} | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ± 50 | mA | |
| 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 | | | | |
| | | TSSOP5, SC-74A, XSON6 and X2SON5 package [2] | - | 250 | mW | |
| | | X2SON4 package [3] | - | 150 | 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.

[3] For SOT1269-2 (X2SON4) package: P_{tot} derates linearly with 1.7 mW/K above 57 °C.

10. 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 | - | V_{CC} | V |
| | | Power-down mode; $V_{CC} = 0$ V | 0 | - | 5.5 | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |

11. 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 _{OH} | HIGH-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | |
| | | I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | 1.2 | 1.54 | - | 0.95 | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | 1.9 | 2.15 | - | 1.7 | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | 2.2 | 2.50 | - | 1.9 | - | V |
| | | I _O = -24 mA; V _{CC} = 3.0 V | 2.3 | 2.62 | - | 2.0 | - | V |
| | | I _O = -32 mA; V _{CC} = 4.5 V | 3.8 | 4.11 | - | 3.4 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{T+} or V _{T-} | | | | | | |
| | | 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 | - | 0.07 | 0.45 | - | 0.70 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | 0.12 | 0.30 | - | 0.45 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | 0.17 | 0.40 | - | 0.60 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | 0.33 | 0.55 | - | 0.80 | V |
| | | I _O = 32 mA; V _{CC} = 4.5 V | - | 0.39 | 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 | ±1 | - | ±1 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | ±0.1 | ±2 | - | ±2 | 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 | 4 | - | 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 | - | 5 | 500 | - | 500 | μA |
| C _I | input capacitance | V _{CC} = 3.3 V; V _I = GND to V _{CC} | - | 5.0 | - | - | - | pF |

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

11.1. Transfer characteristics

Table 8. Transfer characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|----------------------------------|--|------------------|--------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| V _{T+} | positive-going threshold voltage | see Fig. 8 and Fig. 9 | | | | | | |
| | | V _{CC} = 1.8 V | 0.82 | 1.0 | 1.14 | 0.79 | 1.14 | V |
| | | V _{CC} = 2.3 V | 1.03 | 1.2 | 1.40 | 1.00 | 1.40 | V |
| | | V _{CC} = 3.0 V | 1.29 | 1.5 | 1.71 | 1.26 | 1.71 | V |
| | | V _{CC} = 4.5 V | 1.84 | 2.1 | 2.36 | 1.81 | 2.36 | V |
| V _{T-} | negative-going threshold voltage | see Fig. 8 and Fig. 9 | | | | | | |
| | | V _{CC} = 1.8 V | 0.46 | 0.6 | 0.75 | 0.46 | 0.78 | V |
| | | V _{CC} = 2.3 V | 0.65 | 0.8 | 0.96 | 0.65 | 0.99 | V |
| | | V _{CC} = 3.0 V | 0.88 | 1.0 | 1.24 | 0.88 | 1.27 | V |
| | | V _{CC} = 4.5 V | 1.32 | 1.5 | 1.84 | 1.32 | 1.87 | V |
| V _H | hysteresis voltage | (V _{T+} - V _{T-}); see Fig. 8, Fig. 9 and Fig. 10 | | | | | | |
| | | V _{CC} = 1.8 V | 0.26 | 0.4 | 0.51 | 0.19 | 0.51 | V |
| | | V _{CC} = 2.3 V | 0.28 | 0.4 | 0.57 | 0.22 | 0.57 | V |
| | | V _{CC} = 3.0 V | 0.31 | 0.5 | 0.64 | 0.25 | 0.64 | V |
| | | V _{CC} = 4.5 V | 0.40 | 0.6 | 0.77 | 0.34 | 0.77 | V |
| | | V _{CC} = 5.5 V | 0.47 | 0.6 | 0.88 | 0.41 | 0.88 | V |

[1] Typical values are measured at T_{amb} = 25 °C.

11.2. Waveforms transfer characteristics

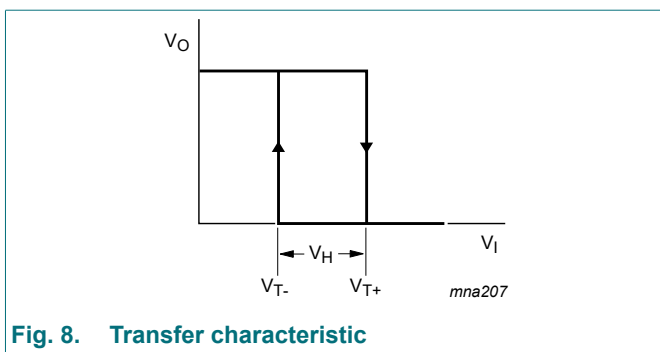


Fig. 8. Transfer characteristic

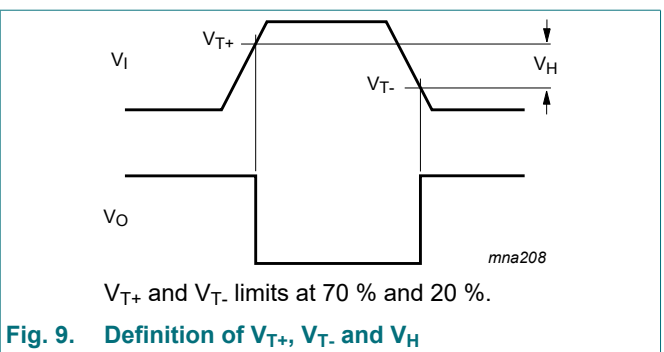
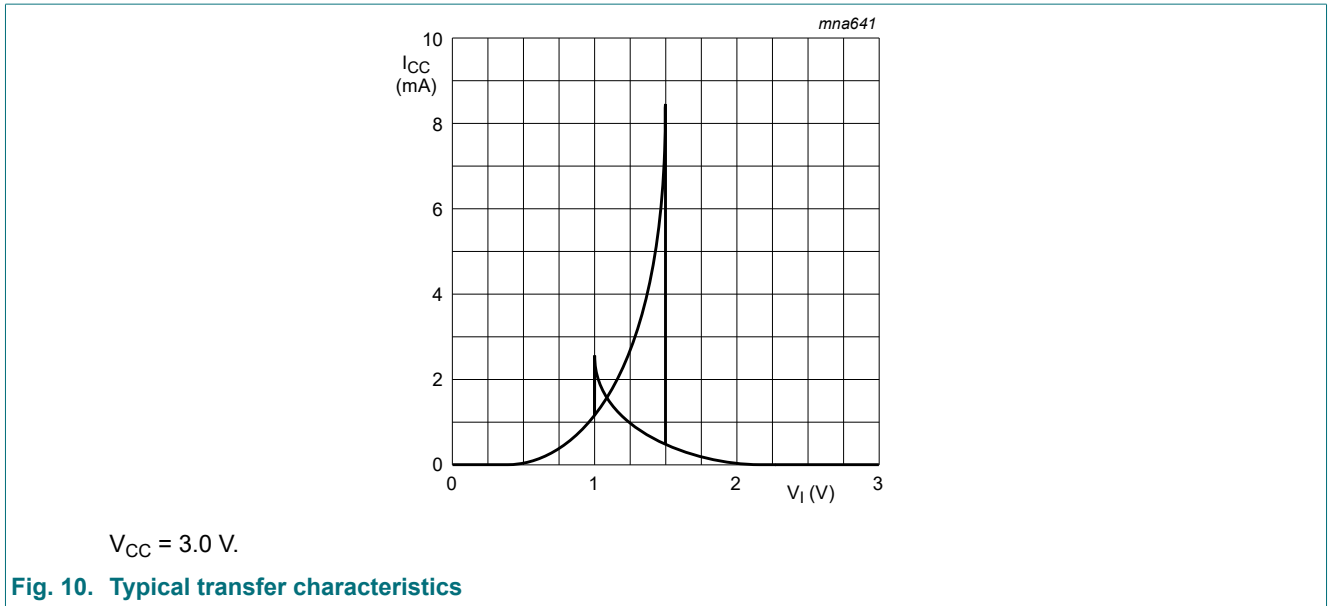


Fig. 9. Definition of V_{T+}, V_{T-} and V_H



12. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12.

| 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 Fig. 11 [2] | | | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | 4.1 | 11.0 | 1.0 | 14.0 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.7 | 2.8 | 6.5 | 0.7 | 8.5 | ns |
| | | V _{CC} = 2.7 V | 0.7 | 3.2 | 6.5 | 0.7 | 8.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.7 | 3.0 | 5.5 | 0.7 | 7.0 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7 | 2.2 | 5.0 | 0.7 | 6.5 | ns |
| C _{PD} | power dissipation capacitance | V _{CC} = 3.3 V; V _I = GND to V _{CC} [3] | - | 15.4 | - | - | - | 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_{PLH} and t_{PHL}.

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

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

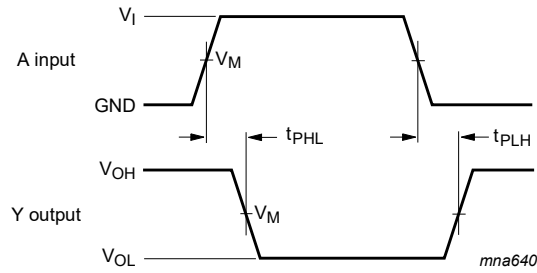
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

12.1. Waveform and test circuit



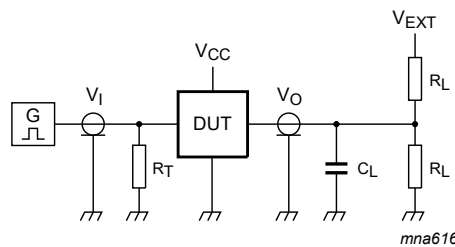
Measurement points are given in [Table 10](#).

V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 11. The data input (A) to output (Y) propagation delays

Table 10. Measurement points

| Supply voltage | Input | Output |
|------------------|---------------------|---------------------|
| V_{CC} | V_M | V_M |
| 1.65 V to 1.95 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3 V to 2.7 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7 V | 1.5 V | 1.5 V |
| 3.0 V to 3.6 V | 1.5 V | 1.5 V |
| 4.5 V to 5.5 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |



Test data is given in [Table 11](#).

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. 12. Test circuit for measuring switching times

Table 11. Test data

| Supply voltage | Input | Load | | V_{EXT} | |
|------------------|----------|---------------|-------|--------------|--------------------|
| V_{CC} | V_I | $t_r = t_f$ | C_L | R_L | t_{PLH}, t_{PHL} |
| 1.65 V to 1.95 V | V_{CC} | ≤ 2.0 ns | 30 pF | 1 k Ω | open |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2.0 ns | 30 pF | 500 Ω | open |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |
| 4.5 V to 5.5 V | V_{CC} | ≤ 2.5 ns | 50 pF | 500 Ω | open |

13. Application information

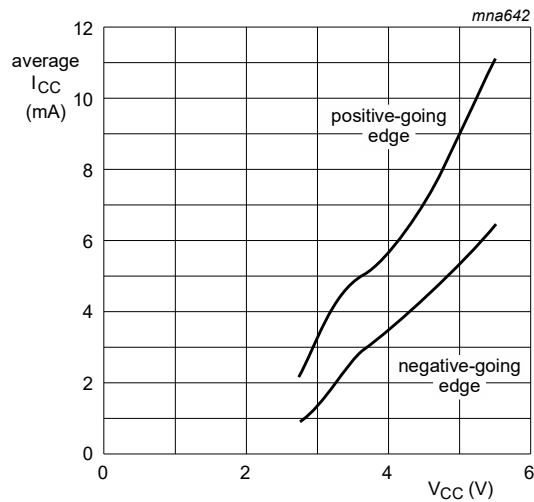
The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

- P_{add} = additional power dissipation (μW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- $\Delta I_{CC(AV)}$ = average additional supply current (μA).

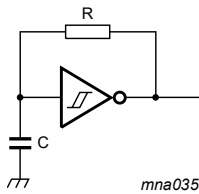
Average $\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Fig. 13.

An example of a relaxation circuit using the 74LVC1G14 is shown in Fig. 14.



Linear change of V_I between 0.8 V to 2.0 V.
All values given are typical unless otherwise specified.

Fig. 13. Average additional supply current as a function of supply voltage



$$f = \frac{1}{T} \approx \frac{1}{K \times RC}$$

For K-factor, see Fig. 15

Fig. 14. Relaxation oscillator

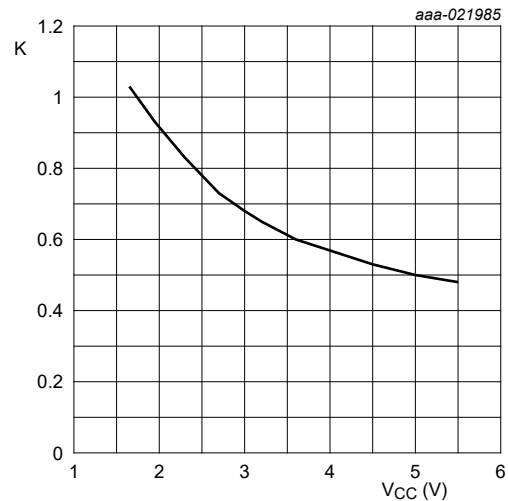


Fig. 15. Typical K-factor for relaxation oscillator

14. Package outline

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

SOT353-1

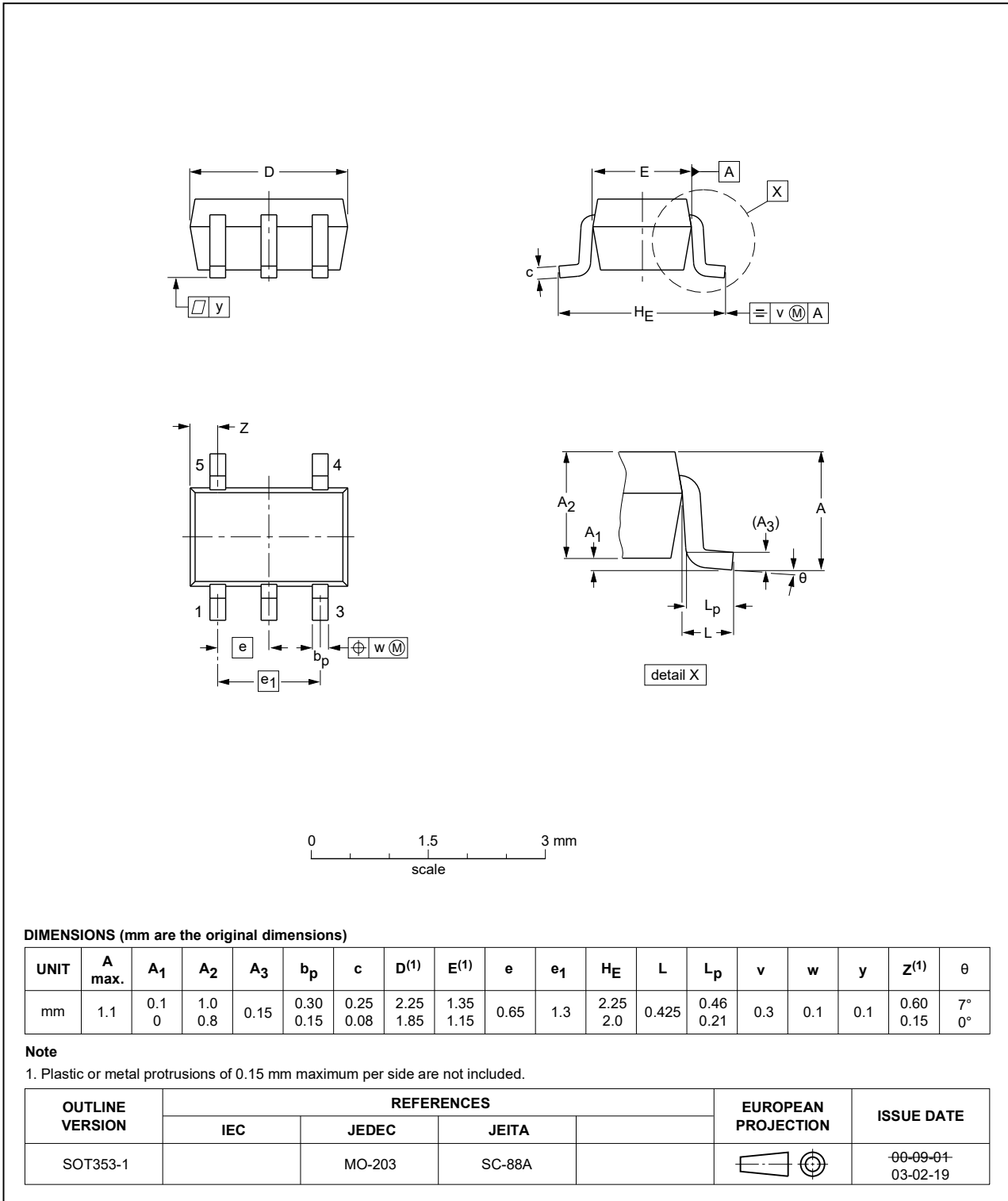


Fig. 16. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

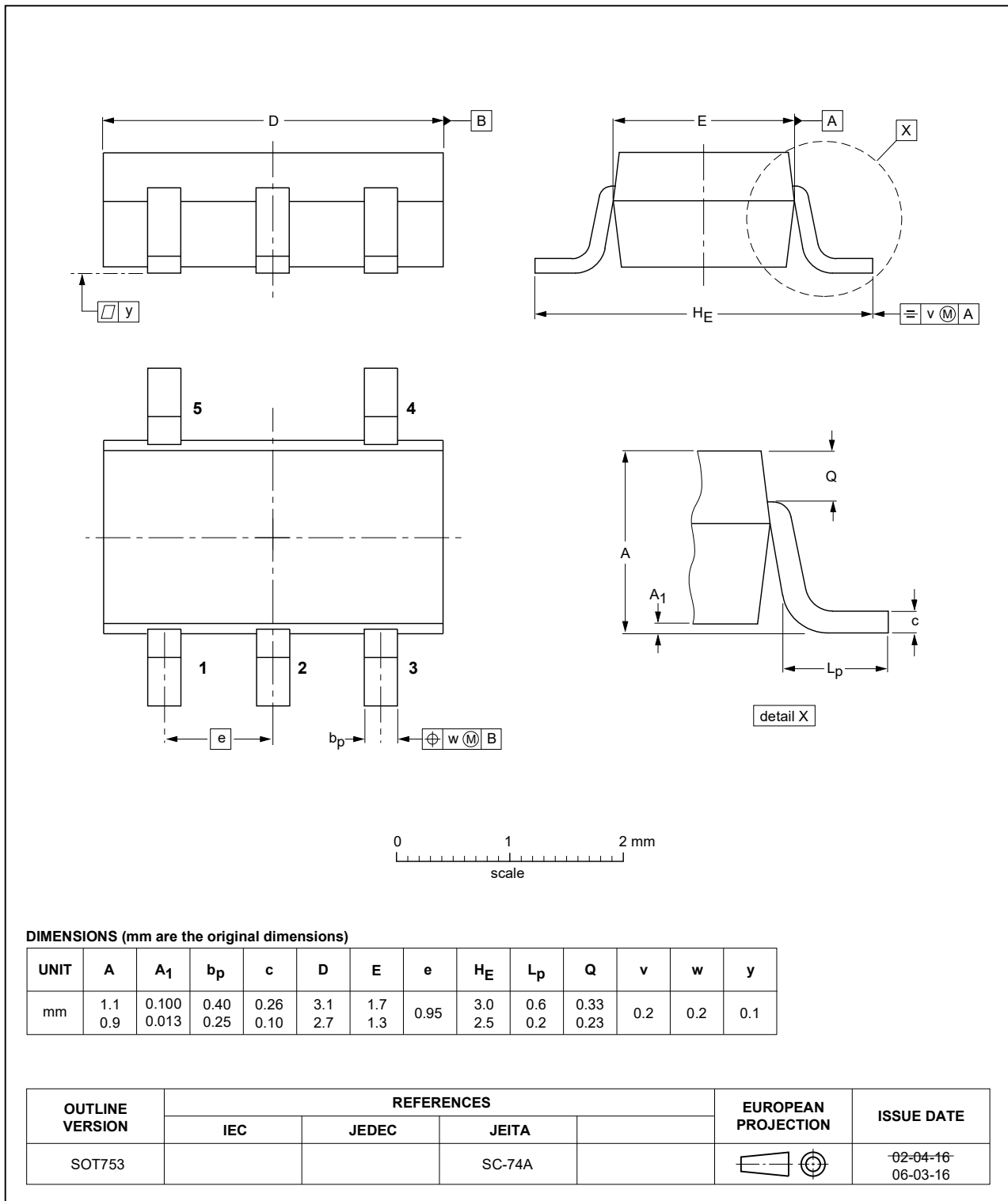


Fig. 17. Package outline SOT753 (SC-74A)

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

SOT886



Fig. 18. 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. 19. 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. 20. 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. 21. Package outline SOT1226-3 (X2SON5)

X2SON4: plastic thermal enhanced extremely thin small outline package; no leads;
4 terminals; body 0.6 x 0.6 x 0.32 mm

SOT1269-2

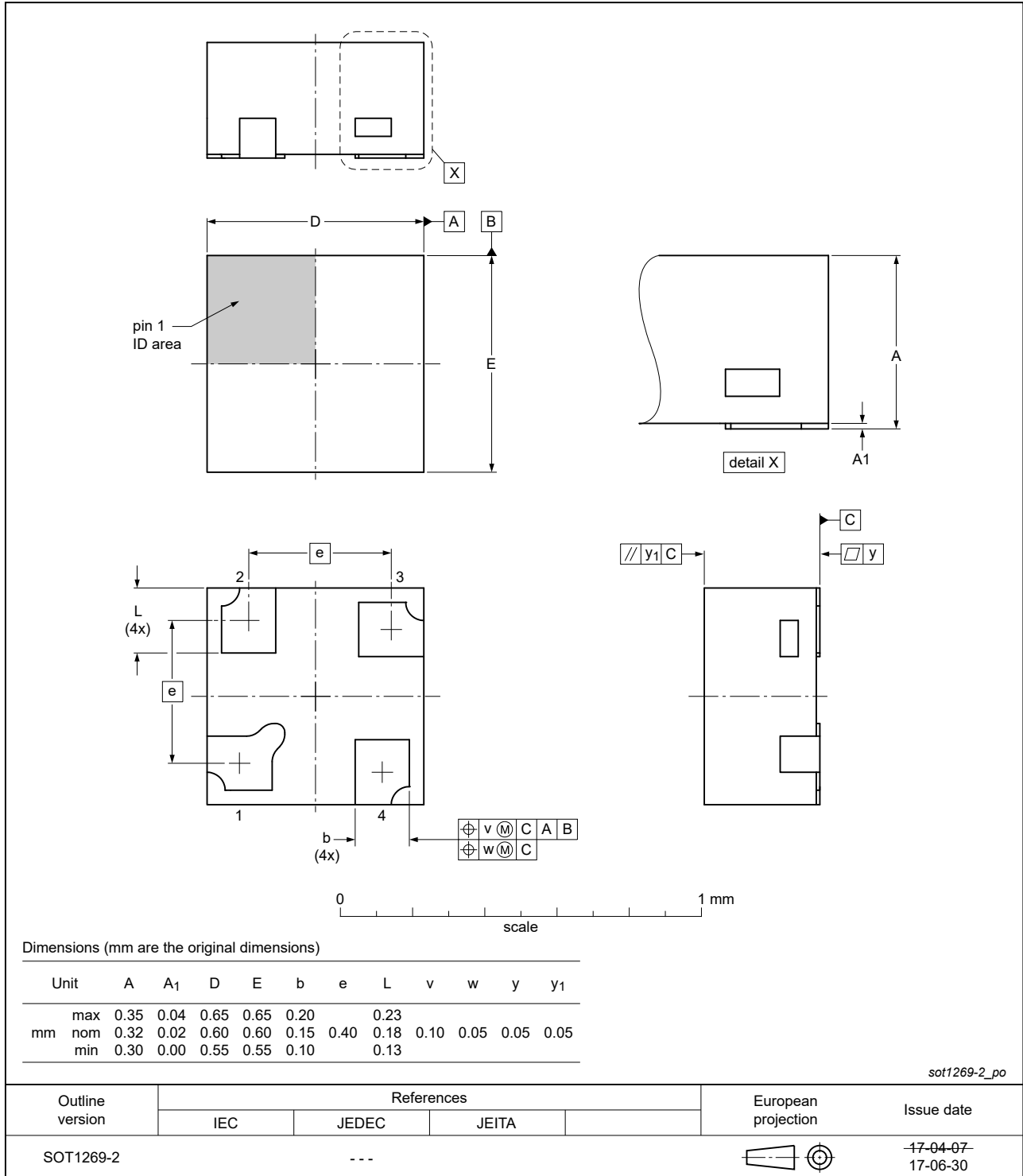


Fig. 22. Package outline SOT1269-2 (X2SON4)

15. Abbreviations

Table 12. 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 |

16. Revision history

Table 13. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|-----------------------|---------------|----------------|
| 74LVC1G14 v.16 | 20210504 | Product data sheet | - | 74LVC1G14 v.15 |
| Modifications: | <ul style="list-style-type: none"> • Section 1 and Section 2 updated. • SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. • Type number 74LVC1G14GF (SOT891/XSON6) removed. • Table 5: Derating values for P_{tot} total power dissipation updated. | | | |
| 74LVC1G14 v.15 | 20180608 | Product data sheet | - | 74LVC1G14 v.14 |
| Modifications: | <ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Added type number 74LVC1G14GX4 (SOT1269-2) | | | |
| 74LVC1G14 v.14 | 20161202 | Product data sheet | - | 74LVC1G14 v.13 |
| Modifications: | <ul style="list-style-type: none"> • Table 7: The maximum limits for leakage current and supply current have changed. | | | |
| 74LVC1G14 v.13 | 20160315 | Product data sheet | - | 74LVC1G14 v.12 |
| Modifications: | <ul style="list-style-type: none"> • Fig. 15 added (typical K-factor for relaxation oscillator). | | | |
| 74LVC1G14 v.12 | 20120806 | Product data sheet | - | 74LVC1G14 v.11 |
| Modifications: | <ul style="list-style-type: none"> • Package outline drawing of SOT1226 modified. | | | |
| 74LVC1G14 v.11 | 20120412 | Product data sheet | - | 74LVC1G14 v.10 |
| Modifications: | <ul style="list-style-type: none"> • Added type number 74LVC1G14GX (SOT1226) • Package outline drawing of SOT886 (Fig. 18) modified. | | | |
| 74LVC1G14 v.10 | 20111206 | Product data sheet | - | 74LVC1G14 v.9 |
| Modifications: | <ul style="list-style-type: none"> • Legal pages updated. | | | |
| 74LVC1G14 v.9 | 20110922 | Product data sheet | - | 74LVC1G14 v.8 |
| 74LVC1G14 v.8 | 20101110 | Product data sheet | - | 74LVC1G14 v.7 |
| 74LVC1G14 v.7 | 20070718 | Product data sheet | - | 74LVC1G14 v.6 |
| 74LVC1G14 v.6 | 20060615 | Product data sheet | - | 74LVC1G14 v.5 |
| 74LVC1G14 v.5 | 20040910 | Product specification | - | 74LVC1G14 v.4 |
| 74LVC1G14 v.4 | 20021119 | Product specification | - | 74LVC1G14 v.3 |
| 74LVC1G14 v.3 | 20020521 | Product specification | - | 74LVC1G14 v.2 |
| 74LVC1G14 v.2 | 20010406 | Product specification | - | 74LVC1G14 v.1 |
| 74LVC1G14 v.1 | 20001212 | Product specification | - | - |

17. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| Product [short] data sheet | Production | This document contains the product specification. |

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Date of release: 3 May 2021