



**THE DATASHEET OF
74LVC1G14GW-Q100,1**



74LVC1G14-Q100

Single Schmitt trigger inverter

Rev. 4 — 25 January 2019

Product data sheet

1. General description

The 74LVC1G14-Q100 provides the inverting buffer function with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment. Schmitt trigger action at the input 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 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)
 - JESD8-B/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
- Unlimited rise and fall times
- Input accepts voltages up to 5 V
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V ($C = 200$ pf, $R = 0$ Ω)

3. Applications

- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

4. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|------------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | |
| 74LVC1G14GW-Q100 | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G14GV-Q100 | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74LVC1G14GM-Q100 | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm | SOT886 |

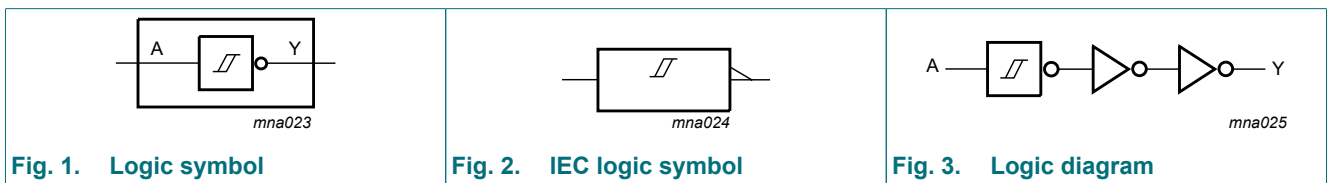
5. Marking

Table 2. Marking

| Type number | Marking code [1] |
|------------------|------------------|
| 74LVC1G14GW-Q100 | VF |
| 74LVC1G14GV-Q100 | V14 |
| 74LVC1G14GM-Q100 | VF |

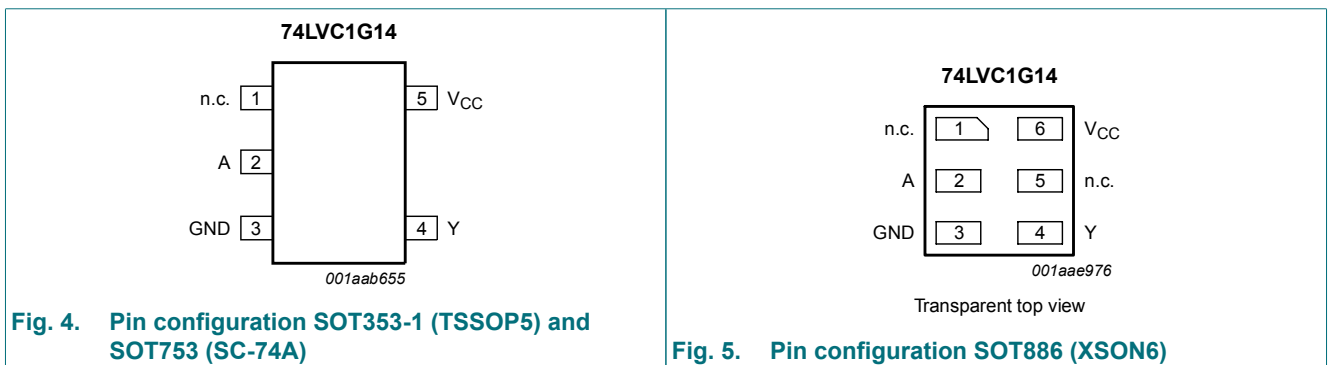
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|-------------------|-------|----------------|
| | TSSOP5 and SC-74A | XSON6 | |
| n.c. | 1 | 1, 5 | not connected |
| A | 2 | 2 | data input |
| GND | 3 | 3 | ground (0 V) |
| Y | 4 | 4 | data output |
| V _{CC} | 5 | 6 | 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 [2] | - | 250 | mW |

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

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

For XSON6 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

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-} | | | | | | |
| | | $I_O = -100 \mu\text{A}$; $V_{CC} = 1.65$ 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-} | | | | | | |
| | | $I_O = 100 \mu\text{A}$; $V_{CC} = 1.65$ 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; $V_I = \text{GND to } V_{CC}$ | - | 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. 10.

| 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. 6 and Fig. 7 | | | | | | |
| | | 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 _{CC} = 5.5 V | 2.19 | 2.5 | 2.79 | 2.16 | 2.79 | V |
| V _{T-} | negative-going threshold voltage | see Fig. 6 and Fig. 7 | | | | | | |
| | | 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 _{CC} = 5.5 V | 1.58 | 1.8 | 2.24 | 1.58 | 2.27 | V |
| V _H | hysteresis voltage | (V _{T+} - V _{T-}); see Fig. 6, Fig. 7 and Fig. 8 | | | | | | |
| | | 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

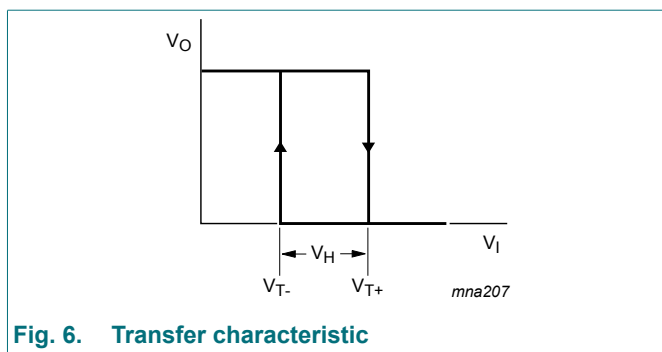


Fig. 6. Transfer characteristic

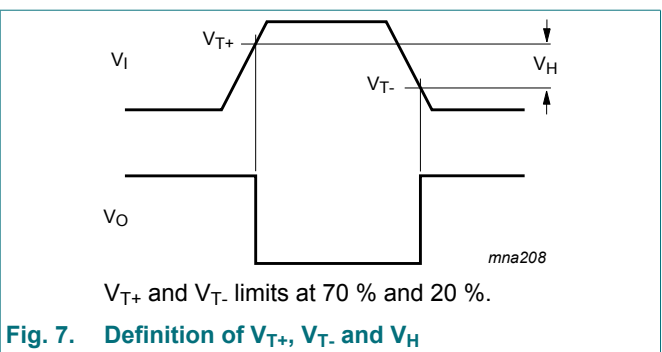
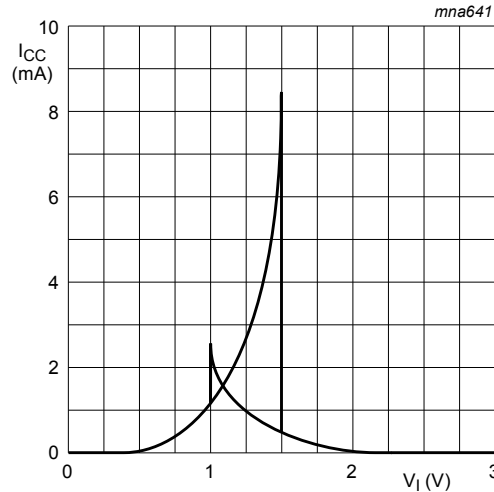


Fig. 7. Definition of V_{T+}, V_{T-} and V_H



V_{CC} = 3.0 V.

Fig. 8. Typical transfer characteristics

12. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 10.

| 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. 9 [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).

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

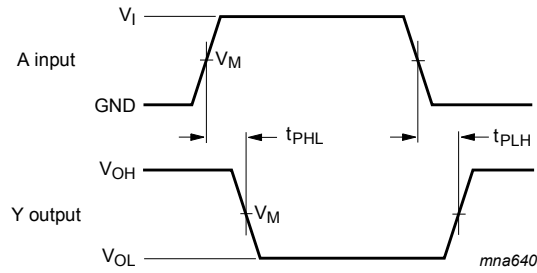
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

12.1. Waveforms and test circuit

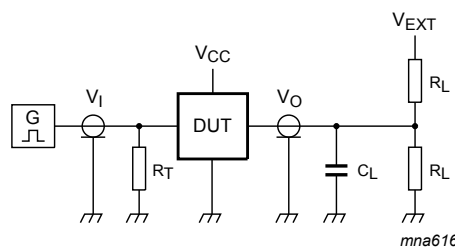


Measurement points are given in [Table 10](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 9. 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. 10. 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

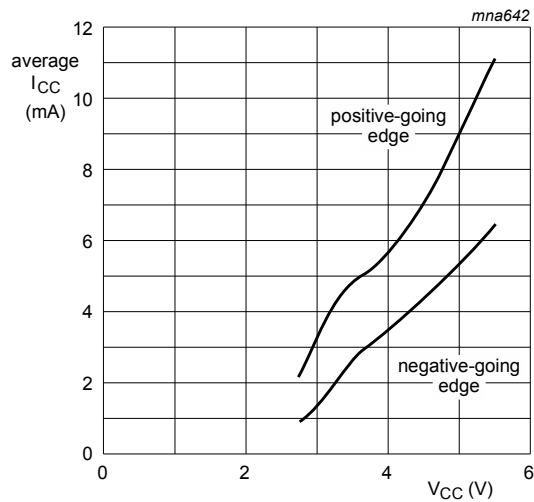
The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

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

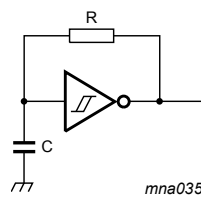
Average $\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Fig. 11.

An example of a relaxation circuit using the 74LVC1G14-Q100 is shown in Fig. 12.



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

Fig. 11. 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. 13

Fig. 12. Relaxation oscillator

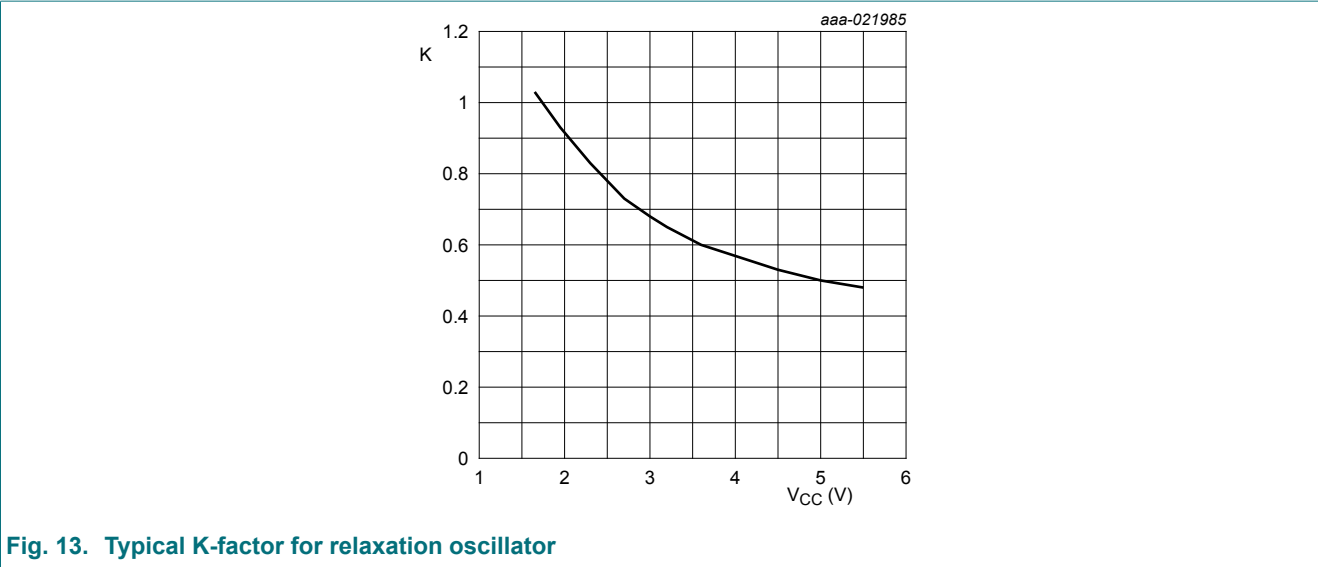
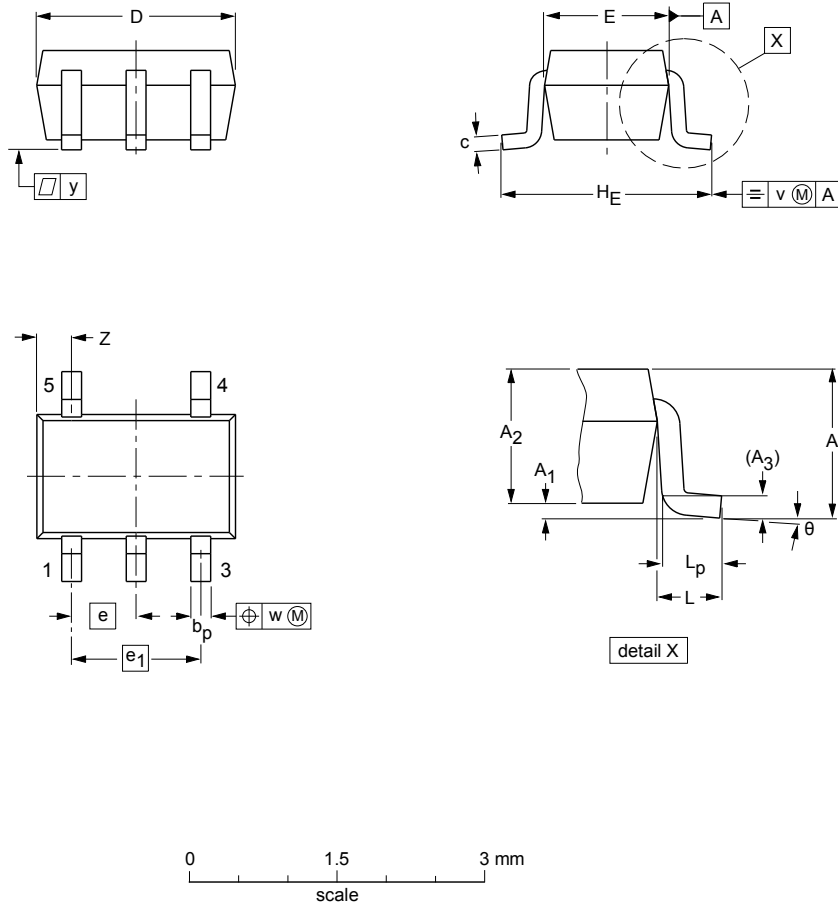


Fig. 13. Typical K-factor for relaxation oscillator

14. Package outline

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

SOT353-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | e ₁ | H _E | L | L _p | v | w | y | z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|----------------|-------|----------------|-----|-----|-----|------------------|----------|
| mm | 1.1 | 0.1 0 | 1.0 0.8 | 0.15 | 0.30 0.15 | 0.25 0.08 | 2.25 1.85 | 1.35 1.15 | 0.65 | 1.3 | 2.25 2.0 | 0.425 | 0.46 0.21 | 0.3 | 0.1 | 0.1 | 0.60 0.15 | 7° 0° |

Note

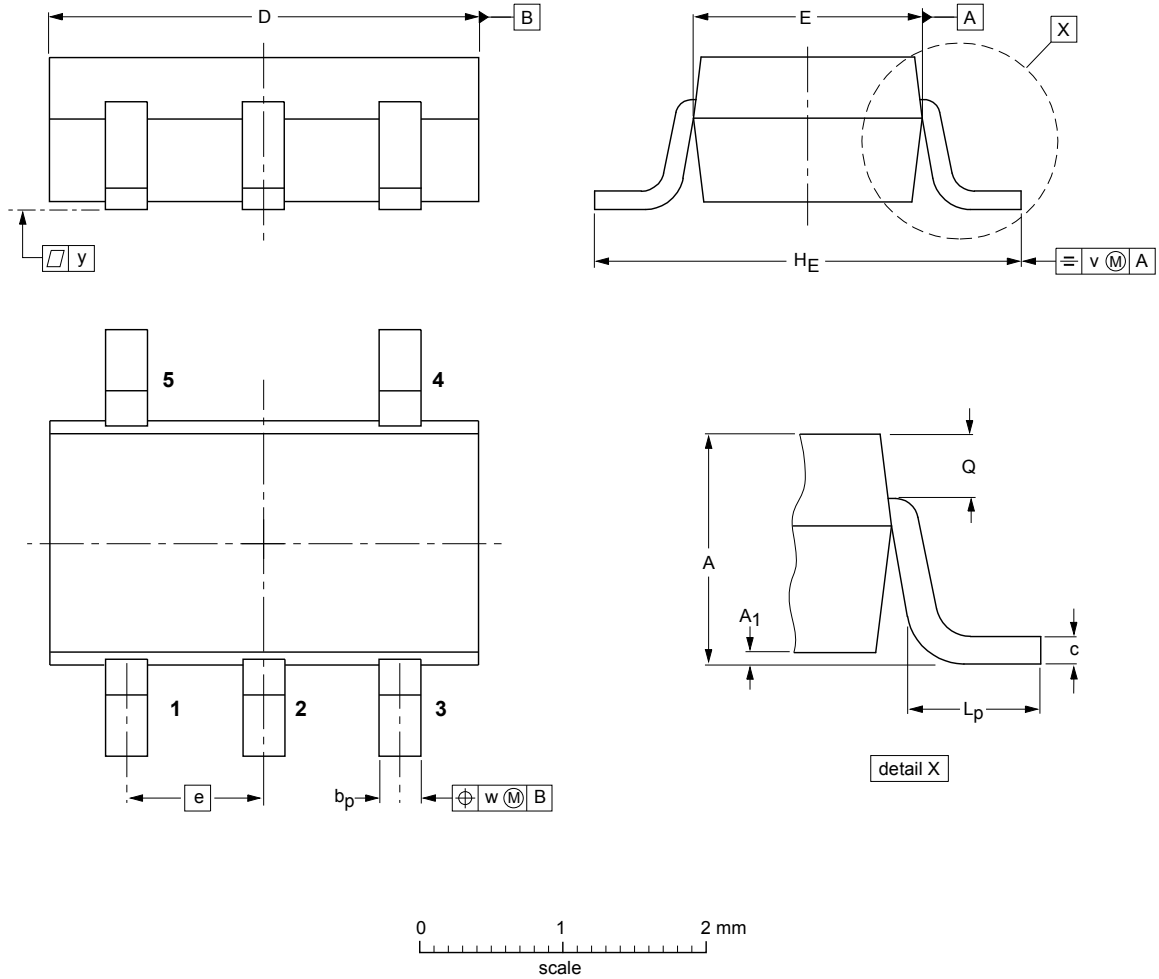
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|--------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT353-1 | | MO-203 | SC-88A | | | 00-09-01 03-02-19 |

Fig. 14. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



DIMENSIONS (mm are the original dimensions)

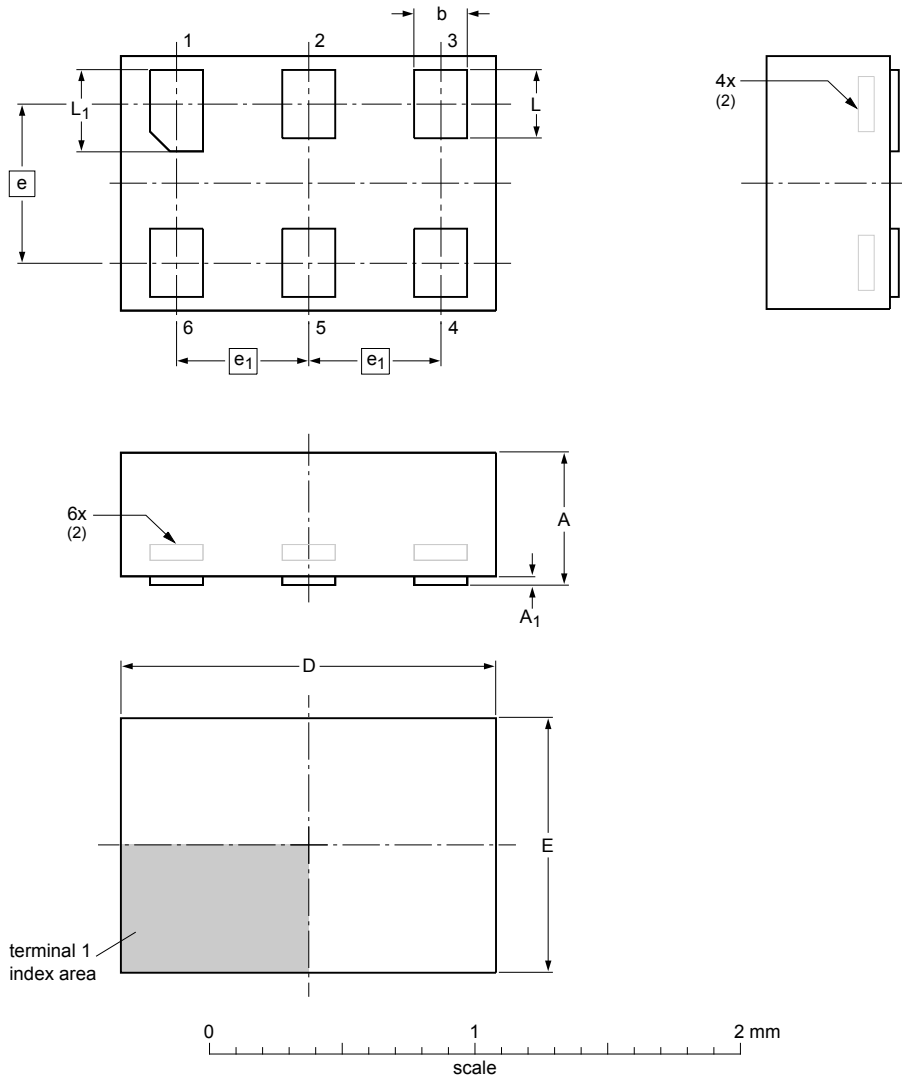
| UNIT | A | A ₁ | b _p | c | D | E | e | H _E | L _p | Q | v | w | y |
|------|------------|----------------|----------------|--------------|------------|------------|------|----------------|----------------|--------------|-----|-----|-----|
| mm | 1.1 0.9 | 0.100 0.013 | 0.40 0.25 | 0.26 0.10 | 3.1 2.7 | 1.7 1.3 | 0.95 | 3.0 2.5 | 0.6 0.2 | 0.33 0.23 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|--------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT753 | | | SC-74A | | | 02-04-16 06-03-16 |

Fig. 15. 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



Dimensions (mm are the original dimensions)

| Unit | A ⁽¹⁾ | A ₁ | b | D | E | e | e ₁ | L | L ₁ |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| mm | max | 0.5 | 0.04 | 0.25 | 1.50 | 1.05 | | 0.35 | 0.40 |
| | nom | | | 0.20 | 1.45 | 1.00 | 0.6 | 0.30 | 0.35 |
| | min | | | 0.17 | 1.40 | 0.95 | | 0.27 | 0.32 |

Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

sot886_po

| Outline version | References | | | European projection | Issue date |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT886 | | MO-252 | | | 04-07-22 12-01-05 |

Fig. 16. Package outline SOT886 (XSON6)

15. Abbreviations

Table 12. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MIL | Military |
| 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_Q100 v.4 | 20190125 | Product data sheet | - | 74LVC1G14_Q100 v.3 |
| 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 74LVC1G14GM-Q100 (SOT886) | | | |
| 74LVC1G14_Q100 v.3 | 20161208 | Product data sheet | - | 74LVC1G14_Q100 v.2 |
| Modifications: | <ul style="list-style-type: none"> Table 7: The maximum limits for leakage current and supply current have changed. | | | |
| 74LVC1G14_Q100 v.2 | 20160315 | Product data sheet | - | 74LVC1G14_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none"> Fig. 13 added (typical K-factor for relaxation oscillator). | | | |
| 74LVC1G14_Q100 v.1 | 20120709 | Product data sheet | - | - |

17. 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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