# 74LV4060

## 14-stage binary ripple counter with oscillator

Rev. 4 — 17 March 2016 Product data sheet

## 1. General description

The 74LV4060 is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC4060; 74HCT4060.

The 74LV4060 is a 14-stage ripple-carry counter/divider and oscillator with three oscillator terminals (RS, RTC and CTC). It has ten buffered outputs (Q3 to Q9 and Q11 to Q13) and an overriding asynchronous master reset (MR). The oscillator configuration allows design of either RC or crystal oscillator circuits. The oscillator can be replaced by an external clock signal at input RS. In this case, keep the oscillator pins (RTC and CTC) floating.

The counter advances on the negative-going transition of RS. A HIGH-level on MR resets the counter (Q3 to Q9 and Q11 to Q13 = LOW), independent of the other input conditions.

## 2. Features and benefits

- Wide operating voltage range from 1.0 V to 5.5 V
- Optimized for low voltage applications from 1.0 V to 3.6 V
- Accepts TTL input levels between $V_{CC}$ = 2.7 V and $V_{CC}$ = 3.6 V
- Typical $V_{OLP}$ (output ground bounce) < 0.8 V at $V_{CC}$ = 3.3 V; $T_{amb}$ = 25 °C
- Typical $V_{OHV}$ (output $V_{OH}$ undershoot) > 2 V at $V_{CC}$ = 3.3 V; $T_{amb}$ = 25 °C
- All active components on-chip
- RC or crystal oscillator configuration
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115A exceeds 200 V

## 3. Applications

- Control counters
- Timers
- Frequency dividers
- Time-delay circuits

## 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74LV4060D | –40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74LV4060DB | –40 °C to +125 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74LV4060PW | –40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

## 5. Functional diagram

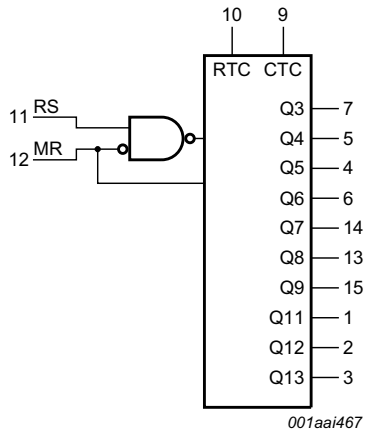



**Fig 1. Logic symbol**

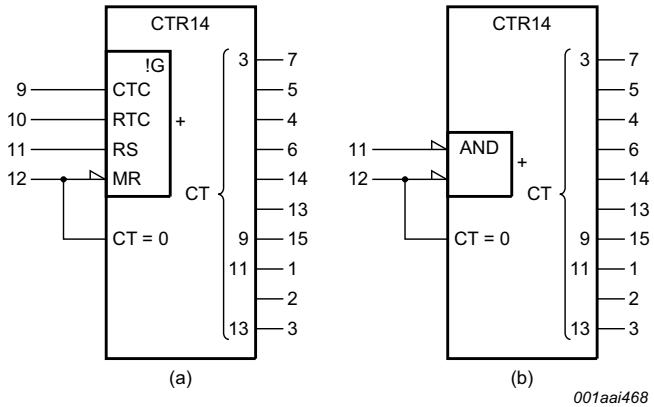



**Fig 2. IEC logic symbol**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

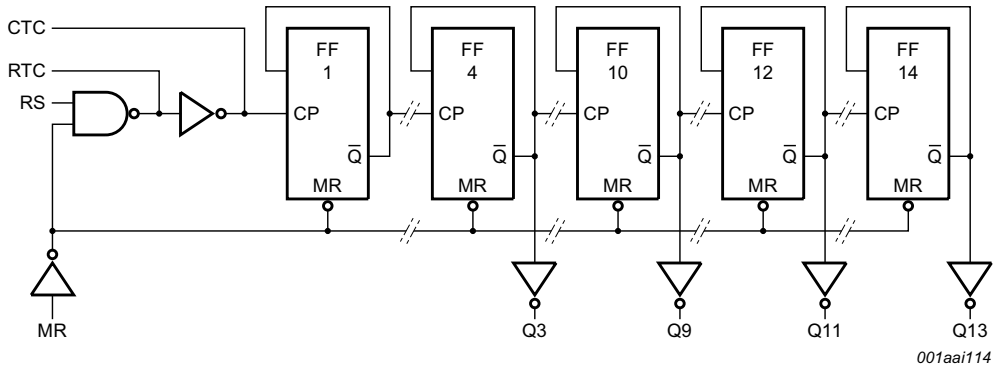



**Fig 3. Logic diagram**

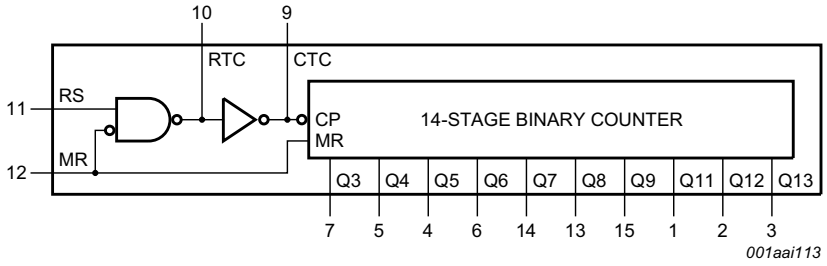



**Fig 4. Functional diagram**

# 6. Pinning information

## 6.1 Pinning

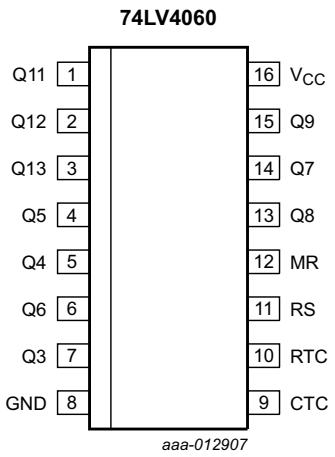



**Fig 5. Pin configuration**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

### 6.2 Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| Q11 to Q13 | 1, 2, 3 | counter output |
| Q3 to Q9 | 7, 5, 4, 6, 14, 13, 15 | counter output |
| GND | 8 | ground (0 V) |
| CTC | 9 | external capacitor connection |
| RTC | 10 | external resistor connection |
| RS | 11 | clock input/oscillator pin |
| MR | 12 | master reset |
| $V_{CC}$ | 16 | supply voltage |

## 7. Functional description

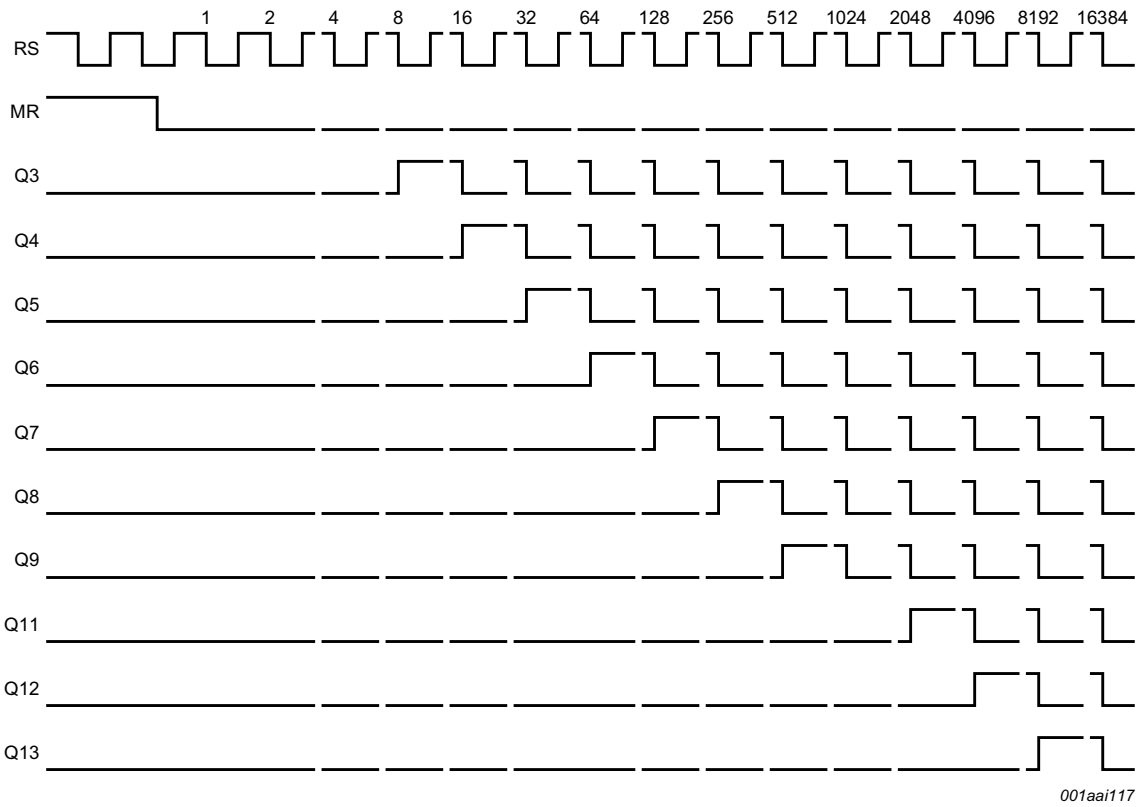



**Fig 6. Timing diagram**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

# 8. Limiting values

**Table 3. 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 | +7.0 | V |
| $I_{IK}$ | input clamping current | $V_I < –0.5$ V or $V_I > V_{CC} + 0.5$ V | [1] | - | ±20 | mA |
| $I_{OK}$ | output clamping current | $V_O < –0.5$ V or $V_O > V_{CC} + 0.5$ V | [1] | - | ±50 | mA |
| $I_O$ | output current | $–0.5$ V $< V_O < V_{CC} + 0.5$ V | | - | ±25 | mA |
| $I_{CC}$ | supply current | | | - | +50 | mA |
| $I_{GND}$ | ground current | | | –50 | - | mA |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |
| $P_{tot}$ | total power dissipation | $T_{amb} = –40$ °C to +125 °C | | | | |
| | | SO16 package | [2] | - | 500 | mW |
| | | SSOP16 package | [3] | - | 500 | mW |
| | | TSSOP16 package | [3] | - | 500 | mW |

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

[2] $P_{tot}$ derates linearly with 8 mW/K above 70 °C.

[3] $P_{tot}$ derates linearly with 5.5 mW/K above 60 °C.

# 9. Recommended operating conditions

**Table 4. Recommended operating conditions**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | [1] | 1.0 | 3.3 | 5.5 | V |
| $V_I$ | input voltage | | | 0 | - | $V_{CC}$ | V |
| $V_O$ | output voltage | | | 0 | - | $V_{CC}$ | V |
| $T_{amb}$ | ambient temperature | in free air | | –40 | - | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.0$ V to 2.0 V | | - | - | 500 | ns/V |
| | | $V_{CC} = 2.0$ V to 2.7 V | | - | - | 200 | ns/V |
| | | $V_{CC} = 2.7$ V to 3.6 V | | - | - | 100 | ns/V |
| | | $V_{CC} = 3.6$ V to 5.5 V | | - | - | 50 | ns/V |

[1] The 74LV4060 is guaranteed to function down to $V_{CC} = 1.0$ V (input levels GND or $V_{CC}$); DC characteristics are guaranteed from $V_{CC} = 1.2$ V to $V_{CC} = 5.5$ V.


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

## 10. Static characteristics

**Table 5. 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 input voltage | MR input | | | | | | |
| | | $V_{CC}$ = 1.2 V | 0.9 | - | - | 0.9 | - | V |
| | | $V_{CC}$ = 2.0 V | 1.4 | - | - | 1.4 | - | 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 |
| | | RS input | | | | | | |
| | | $V_{CC}$ = 1.2 V | 1.0 | - | - | 1.0 | - | V |
| | | $V_{CC}$ = 2.0 V | 1.6 | - | - | 1.6 | - | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.4 | - | - | 2.4 | - | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | $0.8V_{CC}$ | - | - | $0.8V_{CC}$ | - | V |
| $V_{IL}$ | LOW-level input voltage | MR input | | | | | | |
| | | $V_{CC}$ = 1.2 V | - | - | 0.3 | - | 0.3 | V |
| | | $V_{CC}$ = 2.0 V | - | - | 0.6 | - | 0.6 | 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 |
| | | RS input | | | | | | |
| | | $V_{CC}$ = 1.2 V | - | - | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 2.0 V | - | - | 0.4 | - | 0.4 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | - | - | 0.5 | - | 0.5 | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | - | - | $0.2V_{CC}$ | - | $0.2V_{CC}$ | V |
| $V_{OH}$ | HIGH-level output voltage | RTC output; RS = MR = GND | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –3.4 mA | 2.40 | 2.82 | - | 2.20 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | RTC output; RS = MR = $V_{CC}$ | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –0.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –0.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –0.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –0.8 mA | 2.40 | 2.82 | - | 2.20 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –0.8 mA | - | - | - | - | - | V |


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Table 5. Static characteristics** *…continued*

*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 | RTC output; RS = MR = GND | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –100 μA | 1.0 | 1.2 | - | 1.0 | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –100 μA | 1.8 | 2.0 | - | 1.8 | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –100 μA | 2.8 | 3.0 | - | 2.8 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | RTC output; RS = MR = $V_{CC}$ | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –100 μA | 1.0 | 1.2 | - | 1.0 | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –100 μA | 1.8 | 2.0 | - | 1.8 | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –100 μA | 2.8 | 3.0 | - | 2.8 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | CTC output; RS = $V_{IH}$ and MR = $V_{IL}$ | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –3.8 mA | - | 1.2 | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –3.8 mA | 2.40 | 2.82 | - | 2.20 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | except RTC output; $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –100 μA | 1.0 | 1.2 | - | 1.0 | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –100 μA | 1.8 | 2.0 | - | 1.8 | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –100 μA | 2.8 | 3.0 | - | 2.8 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | except RTC and CTC outputs; $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –6 mA | 2.40 | 2.82 | - | 2.20 | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| $V_{OL}$ | LOW-level output voltage | RTC output; RS = $V_{CC}$ and MR = GND | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –3.4 mA | - | 0.25 | 0.40 | - | 0.50 | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –3.4 mA | - | - | - | - | - | V |


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Table 5. Static characteristics** *…continued*

*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 | |
| $V_{OL}$ | LOW-level output voltage | RTC output; RS = $V_{CC}$ and MR = GND; | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | CTC output; RS = $V_{IH}$ and MR = $V_{IL}$; | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –3.8 mA | - | 0.25 | - | 0.40 | 0.50 | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –3.8 mA | - | - | - | - | - | V |
| | | except RTC output; $V_I$ = $V_{IH}$ or $V_{IL}$; | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –100 μA | - | 0 | 0.2 | - | 0.2 | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –100 μA | - | - | - | - | - | V |
| | | except RTC and CTC output; $V_I$ = $V_{IH}$ or $V_{IL}$; | | | | | | |
| | | $V_{CC}$ = 1.2 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.0 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 2.7 V; $I_O$ = –6 mA | - | 0.25 | 0.40 | - | 0.50 | V |
| | | $V_{CC}$ = 3.0 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| | | $V_{CC}$ = 4.5 V; $I_O$ = –6 mA | - | - | - | - | - | V |
| $I_I$ | input leakage current | $V_{CC}$ = 5.5 V; $V_I$ = $V_{CC}$ or GND | - | - | 1.0 | - | 1.0 | μA |
| $I_{CC}$ | supply current | $V_{CC}$ = 3.6 V; $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A | - | - | 20 | - | 160 | μA |
| | | $V_{CC}$ = 5.5 V; $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A | - | - | - | - | 80 | μA |
| $\Delta I_{CC}$ | additional supply current | $V_{CC}$ = 2.7 V to 3.6 V; $V_I$ = $V_{CC}$ – 0.6 V; $I_O$ = 0 A | - | - | 500 | - | 850 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | - | - | pF |

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


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

## 11. Dynamic characteristics

**Table 6. Dynamic characteristics**

*GND = 0 V; for test circuit, see Figure 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 | RS to Q3; see Figure 7 and Figure 9 [2] | | | | | | |
| | | $V_{CC}$ = 1.2 V | - | 180 | - | - | - | ns |
| | | $V_{CC}$ = 2.0 V | - | 52 | 84 | - | 105 | ns |
| | | $V_{CC}$ = 2.7 V | - | 42 | 66 | - | 83 | ns |
| | | $V_{CC}$ = 3.3 V; $C_L$ = 15 pF | - | 29 | - | - | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | - | 33 | 53 | - | 66 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | - | 24 | 39 | - | 49 | ns |
| | | Qn to Qn+1; see Figure 8 and Figure 9 | | | | | | |
| | | $V_{CC}$ = 1.2 V | - | 40 | - | - | - | ns |
| | | $V_{CC}$ = 2.0 V | - | 14 | 23 | - | 29 | ns |
| | | $V_{CC}$ = 2.7 V | - | 10 | 16 | - | 20 | ns |
| | | $V_{CC}$ = 3.3 V; $C_L$ = 15 pF | - | 6 | - | - | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | - | 8 | 13 | - | 16 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | - | 6 | 9 | - | 11 | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | MR to Qn; see Figure 8 and Figure 9 | | | | | | |
| | | $V_{CC}$ = 1.2 V | - | 100 | - | - | - | ns |
| | | $V_{CC}$ = 2.0 V | - | 29 | 46 | - | 58 | ns |
| | | $V_{CC}$ = 2.7 V | - | 24 | 39 | - | 49 | ns |
| | | $V_{CC}$ = 3.3 V; $C_L$ = 15 pF | - | 16 | - | - | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | - | 19 | 31 | - | 39 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | - | 14 | 23 | - | 29 | ns |
| $t_W$ | pulse width | RS HIGH or LOW; see Figure 7 | | | | | | |
| | | $V_{CC}$ = 2.0 V | 34 | 9 | - | 38 | - | ns |
| | | $V_{CC}$ = 2.7 V | 25 | 6 | - | 30 | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | 20 | 5 | - | 24 | - | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | 16 | 4 | - | 20 | - | ns |
| | | MR HIGH; see Figure 9 | | | | | | |
| | | $V_{CC}$ = 2.0 V | 34 | 10 | - | 38 | - | ns |
| | | $V_{CC}$ = 2.7 V | 25 | 8 | - | 30 | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | 20 | 6 | - | 24 | - | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | 16 | 4 | - | 20 | - | ns |


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Table 6. Dynamic characteristics**

*GND = 0 V; for test circuit, see Figure 10.*

| Symbol | Parameter | Conditions | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | |
| $t_{rec}$ | recovery time | MR to RS; see Figure 9 | | | | | | |
| | | $V_{CC}$ = 2.0 V | 29 | 18 | - | 37 | - | ns |
| | | $V_{CC}$ = 2.7 V | 26 | 16 | - | 32 | - | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | 18 | 11 | - | 23 | - | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | 12 | 7 | - | 15 | - | ns |
| $f_{max}$ | maximum frequency | see Figure 7 | | | | | | |
| | | $V_{CC}$ = 2.0 V | 14 | 40 | - | 9 | - | MHz |
| | | $V_{CC}$ = 2.7 V | 19 | 70 | - | 12 | - | MHz |
| | | $V_{CC}$ = 3.3 V; $C_L$ = 15 pF | - | 99 | - | - | - | MHz |
| | | $V_{CC}$ = 3.0 V to 3.6 V [3] | 24 | 90 | - | 15 | - | MHz |
| | | $V_{CC}$ = 4.5 V to 5.5 V [4] | 30 | 100 | - | 19 | - | MHz |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$ [5] | - | 40 | - | - | - | pF |

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

[2] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$.

[3] Typical value measured at $V_{CC}$ = 3.3 V.

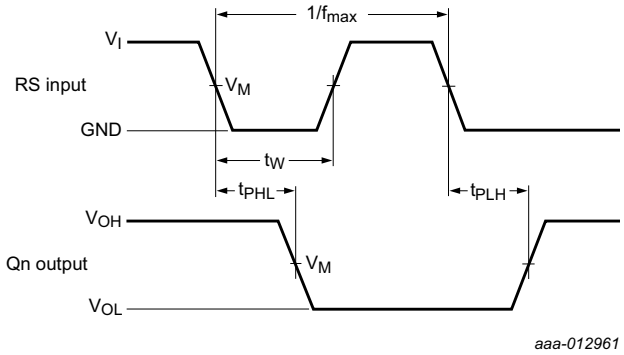
[4] Typical value measured at $V_{CC}$ = 5.0 V.

[5] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

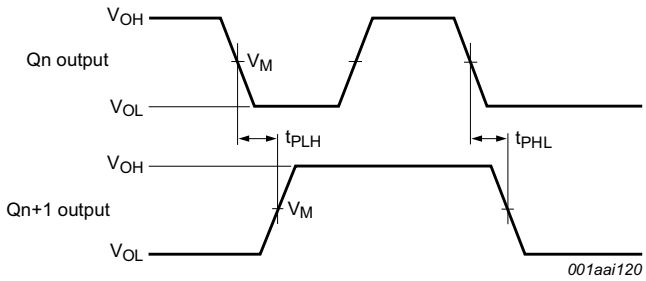
## 12. Waveforms




Measurement points are given in Table 7.

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

**Fig 7. Waveforms showing the clock (RS) to output (Qn) propagation delays, the clock pulse width, the output transition times and the maximum frequency**



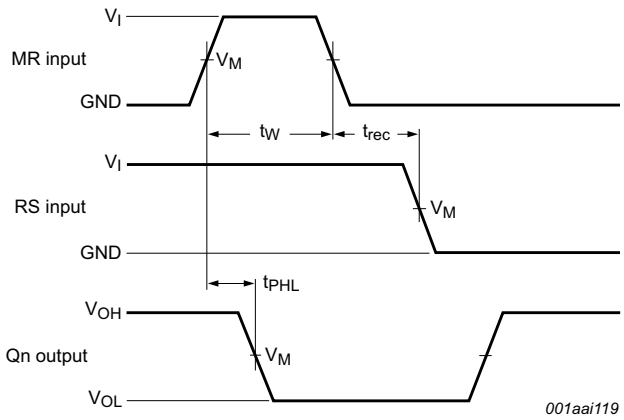

Measurement points are given in Table 7.

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

**Fig 8. Waveforms showing the output Qn to output Qn+1 propagation delays**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved



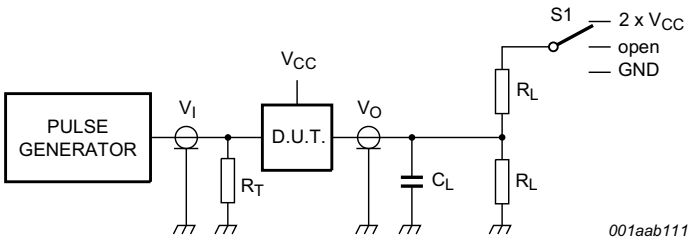

Measurement points are given in Table 7.

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

**Fig 9. Waveforms showing the master reset (MR) pulse width, the master reset to output (Qn) propagation delays and the master reset to clock (RS) recovery time**

**Table 7. Measurement points**

| Supply voltage | Input | Output |
|---|---|---|
| $V_{CC}$ | $V_M$ | $V_M$ |
| < 2.7 V | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 2.7 V to 3.6 V | 1.5 V | 1.5 V |
| ≥ 4.5 V | $0.5V_{CC}$ | $0.5V_{CC}$ |




Test data is given in Table 8.

Definitions test circuit:

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

$C_L$ = Load capacitance including jig and probe capacitance.

$R_L$ = Load resistance.

**Fig 10. Test circuit for measuring switching times**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

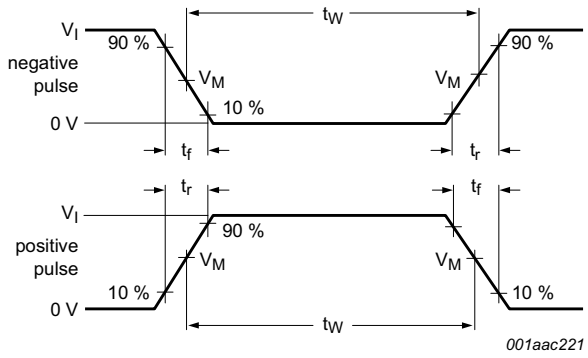
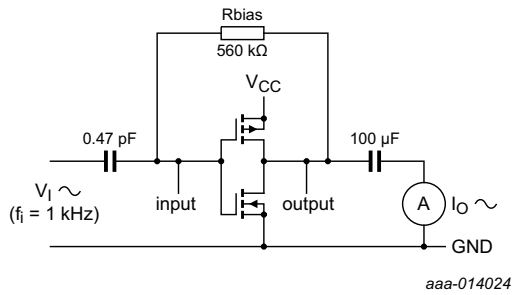



**Fig 11. Input pulse definition**

**Table 8. Test data**

| Supply voltage | Input | | Load | | S1 |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ |
| $V_{CC}$ < 2.7 V | $V_{CC}$ | 2.5 ns | 50 pF | 1 kΩ | open |
| 2.7 V < $V_{CC}$ < 3.6 V | 2.7 V | 2.5 ns | 15 pF, 50 pF | 1 kΩ | open |
| $V_{CC}$ ≥ 4.5 V | $V_{CC}$ | 2.5 ns | 50 pF | 1 kΩ | open |

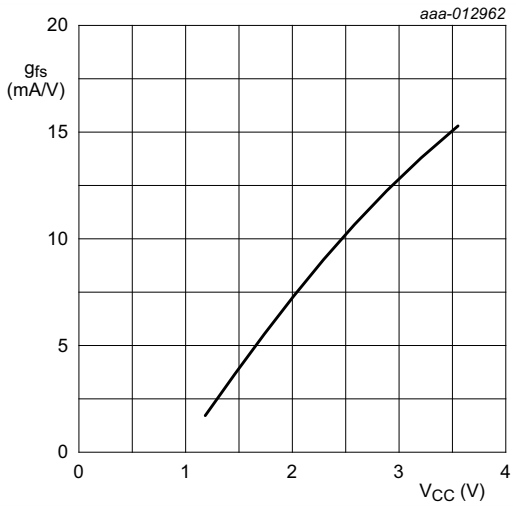
## 13. Typical forward transconductance




$g_{fs} = \Delta I_O / \Delta V_I$ at $V_O$ is constant; MR = LOW.

See Figure 13.

**Fig 12. Test setup for measuring forward transconductance**




$T_{amb}$ = 25 °C

**Fig 13. Typical forward transconductance as function of the supply voltage**

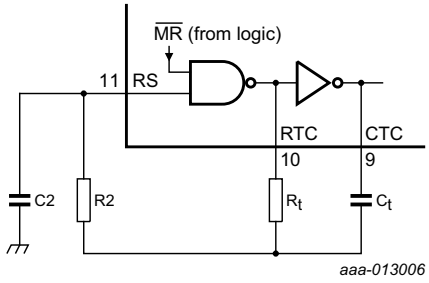

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

# 14. RC oscillator

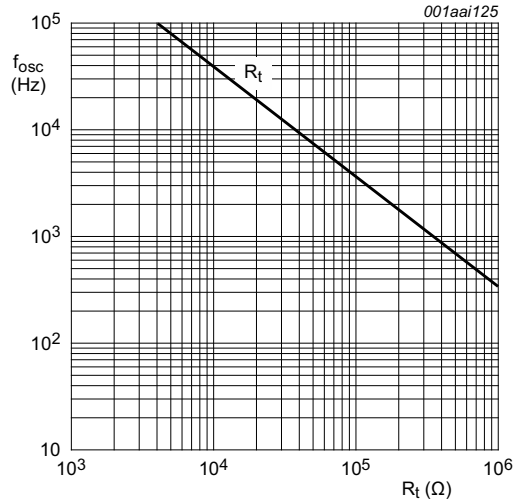
## 14.1 Timing component limitations

The oscillator frequency is mainly determined by $R_t \times C_t$, provided R2 ≈ 2$R_t$ and R2 × C2 is much less than $R_t \times C_t$. The function of R2 is to minimize the influence of the forward voltage across the input protection diodes on the frequency. The stray capacitance C2 should be kept as small as possible. In consideration of accuracy, $C_t$ must be larger than the inherent stray capacitance. $R_t$ must be larger than the 'ON' resistance in series with it, which typically is 280 Ω at $V_{CC}$ = 1.2 V, 130 Ω at $V_{CC}$ = 2.0 V and 100 Ω at $V_{CC}$ 3.0 V. The recommended values for these components to maintain agreement with the typical oscillation formula are: $C_t$ > 50 pF, up to any practical value, 10 kΩ < $R_t$ < 1 MΩ. In order to avoid start-up problems, $R_t \geq 1$ kΩ.




Typical formula for oscillator frequency: $f_{osc} = \frac{1}{2.5 \times R_t \times C_t}$

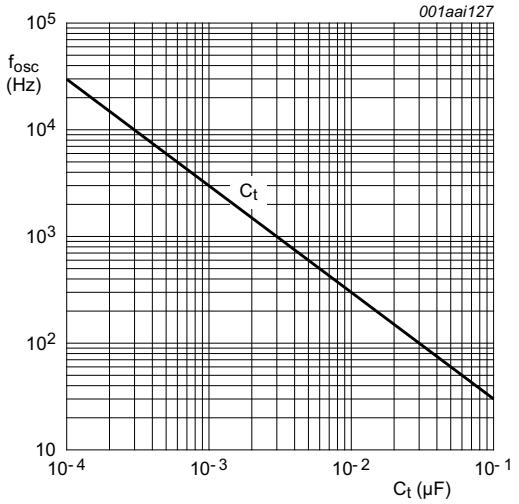
**Fig 14. Example of an RC oscillator**




$V_{CC}$ = 1.2 V to 3.6 V; $T_{amb}$ = 25 °C

$R_t$ curve: $C_t$ = 1 nF; R2 = 2 × $R_t$

**Fig 15. RC oscillator frequency as a function of $R_t$**




$V_{CC}$ = 1.2 V to 3.6 V; $T_{amb}$ = 25 °C

$C_t$ curve: $R_t$ = 100 kΩ; R2 = 200 kΩ

**Fig 16. RC oscillator frequency as a function of $C_t$**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

## 14.2 Typical crystal oscillator circuit

In Figure 17, R2 is the power limiting resistor. For starting and maintaining oscillation, a minimum transconductance is necessary, so R2 must not be too large. A practical value for R2 is 2.2 kΩ.

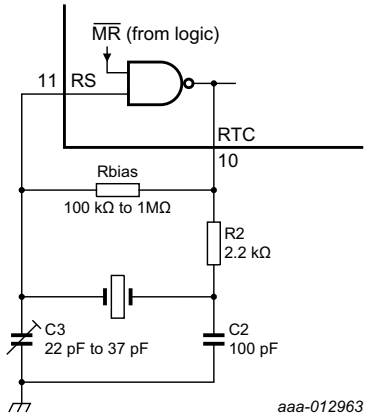


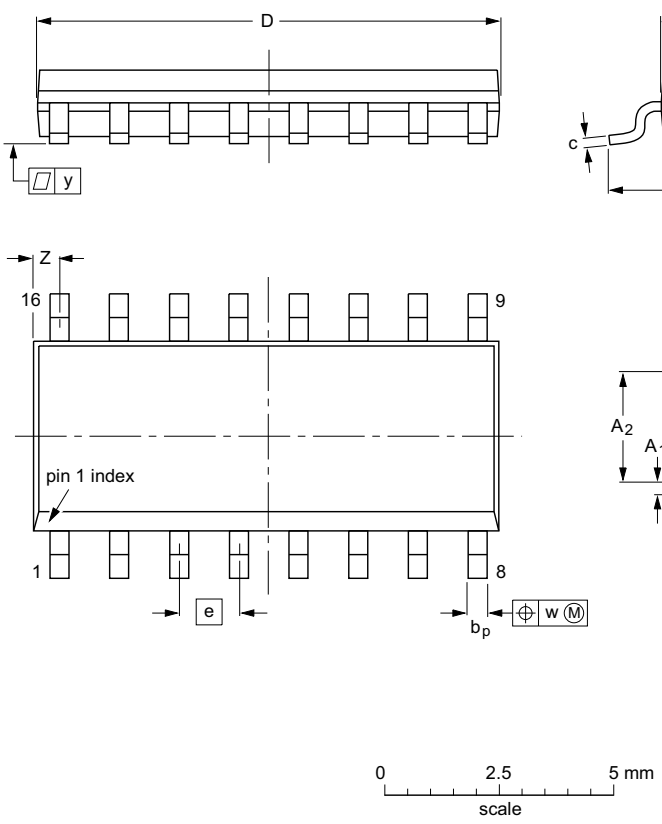

**Fig 17. External components connection for a typical crystal oscillator**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

# 15. Package outline

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | 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 | 10.0<br>9.8 | 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 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

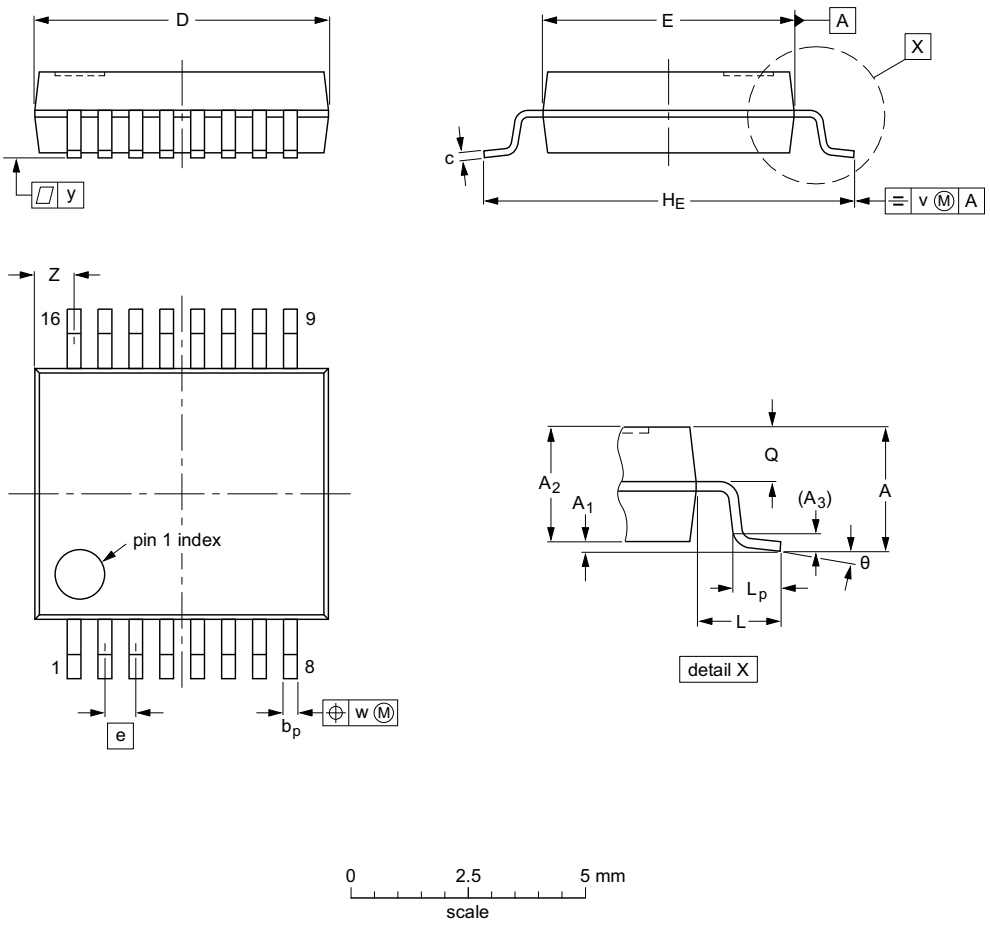
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT109-1 | 076E07 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 18. Package outline SOT109-1 (SO16)**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm** **SOT338-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 6.4<br>6.0 | 5.4<br>5.2 | 0.65 | 7.9<br>7.6 | 1.25 | 1.03<br>0.63 | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.00<br>0.55 | $8^o$<br>$0^o$ |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

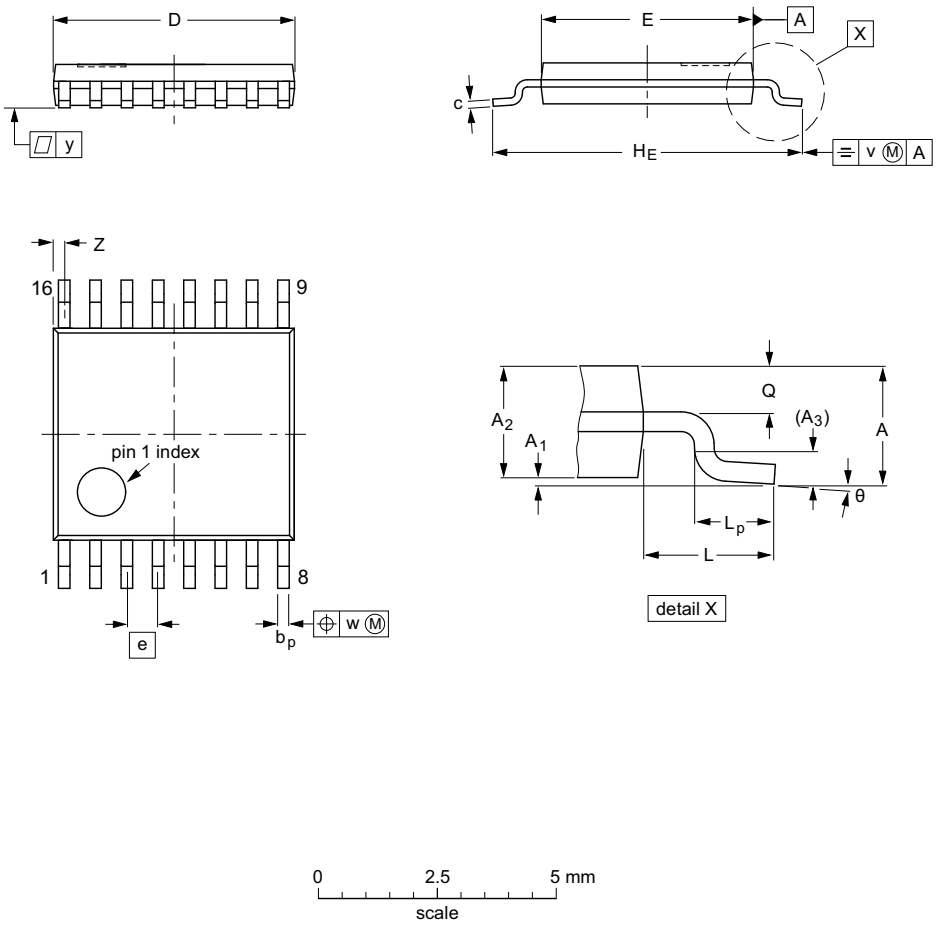
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT338-1 | | MO-150 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 19. Package outline SOT338-1 (SSOP16)**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm** **SOT403-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 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 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.40<br>0.06 | $8^o$<br>$0^o$ |

**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 | JEITA | | | |
| SOT403-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**Fig 20. Package outline SOT403-1 (TSSOP16)**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

# 16. Abbreviations

**Table 9. 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 |

# 17. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74LV4060 v.4 | 20160317 | Product data sheet | - | 74LV4060 v.3 |
| Modifications: | • Type number 74LV4060N (SOT38-4) removed. | | | |
| 74LV4060 v.3 | 20140728 | Product data sheet | - | 74LV4060 v.2 |
| Modifications: | • Minimum value $V_{OH}$ and $V_{OL}$ corrected (errata). | | | |
| 74LV4060 v.2 | 20140703 | Product data sheet | - | 74LV4060 v.1 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| 74LV4060 v.1 | 19980623 | Product specification | - | - |


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

# 18. Legal information

## 18.1 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. |
| 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 URL http://www.nexperia.com.

## 18.2 Definitions

**Draft —** The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet —** A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification —** The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

## 18.3 Disclaimers

**Limited warranty and liability —** Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Nexperia.

**Right to make changes —** Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use —** Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications —** Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Limiting values —** Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale —** Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

**No offer to sell or license —** Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

**Export control —** This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products —** Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

**Translations —** A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

### 18.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 19. Contact information

For more information, please visit: **http://www.nexperia.com**

For sales office addresses, please send an email to: **salesaddresses@nexperia.com**


All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved