

# 74HC590

## 8-bit binary counter with output register; 3-state

Rev. 4 — 14 March 2022

Product data sheet

### 1. General description

The 74HC590 is an 8-bit binary counter with a storage register and 3-state outputs. The storage register has parallel (Q0 to Q7) outputs. The binary counter features master reset counter ( $\overline{MRC}$ ) and count enable (CE) inputs. The counter and storage register have separate positive edge triggered clock (CPC and CPR) inputs. If both clocks are connected together, the counter state is always one count ahead of the register. Internal circuitry prevents clocking from the clock enable. A ripple carry output ( $\overline{RCO}$ ) is provided for cascading. Cascading is accomplished by connecting  $\overline{RCO}$  of the first stage to CE of the second stage. Cascading for larger count chains can be accomplished by connecting  $\overline{RCO}$  of each stage to the counter clock (CPC) input of the following stage. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### 2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- CMOS input levels
- Counter and register have independent clock inputs
- Counter has master reset
- Multiple package options
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Ordering information

Table 1. Ordering information

| Type number | Package           |          |  |          |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  | Version  |
| 74HC590D    | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm   | SOT109-1 |
| 74HC590PW   | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74HC590BQ   | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |

4. Functional diagram

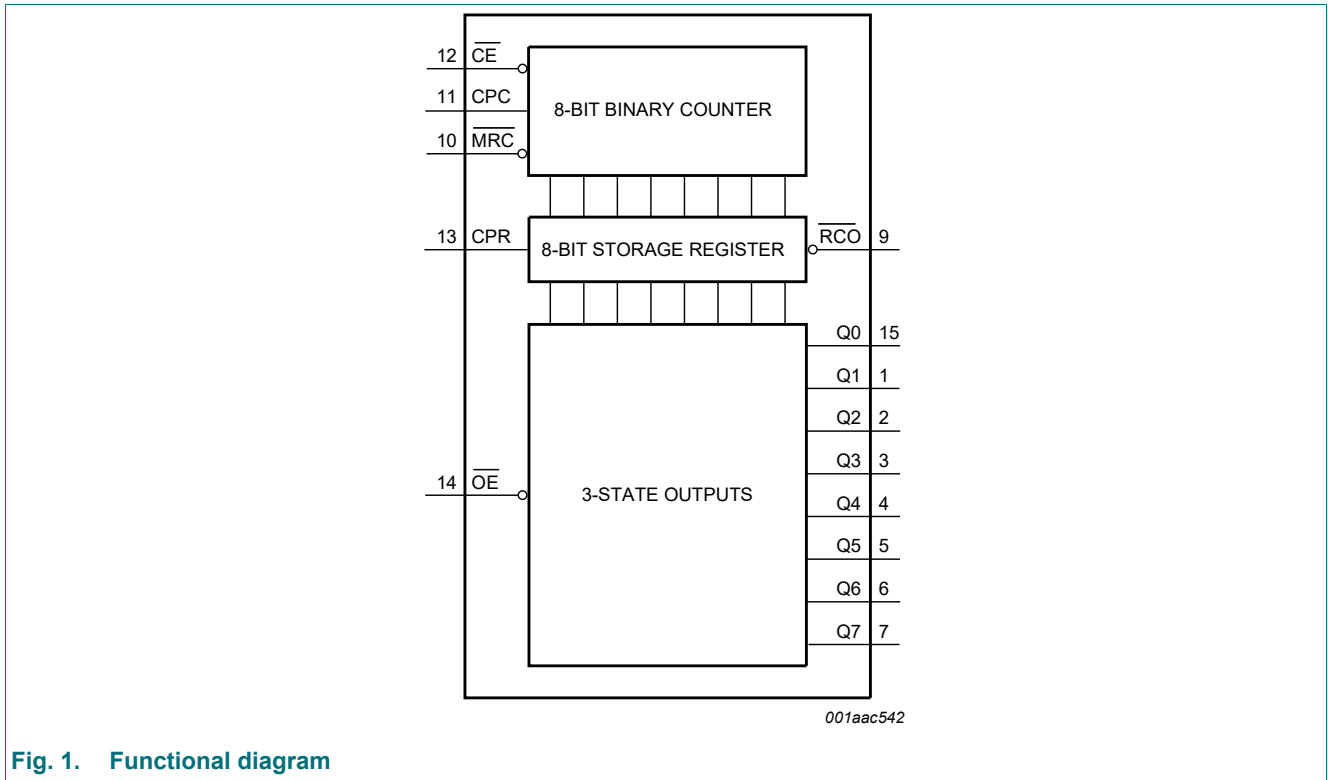


Fig. 1. Functional diagram

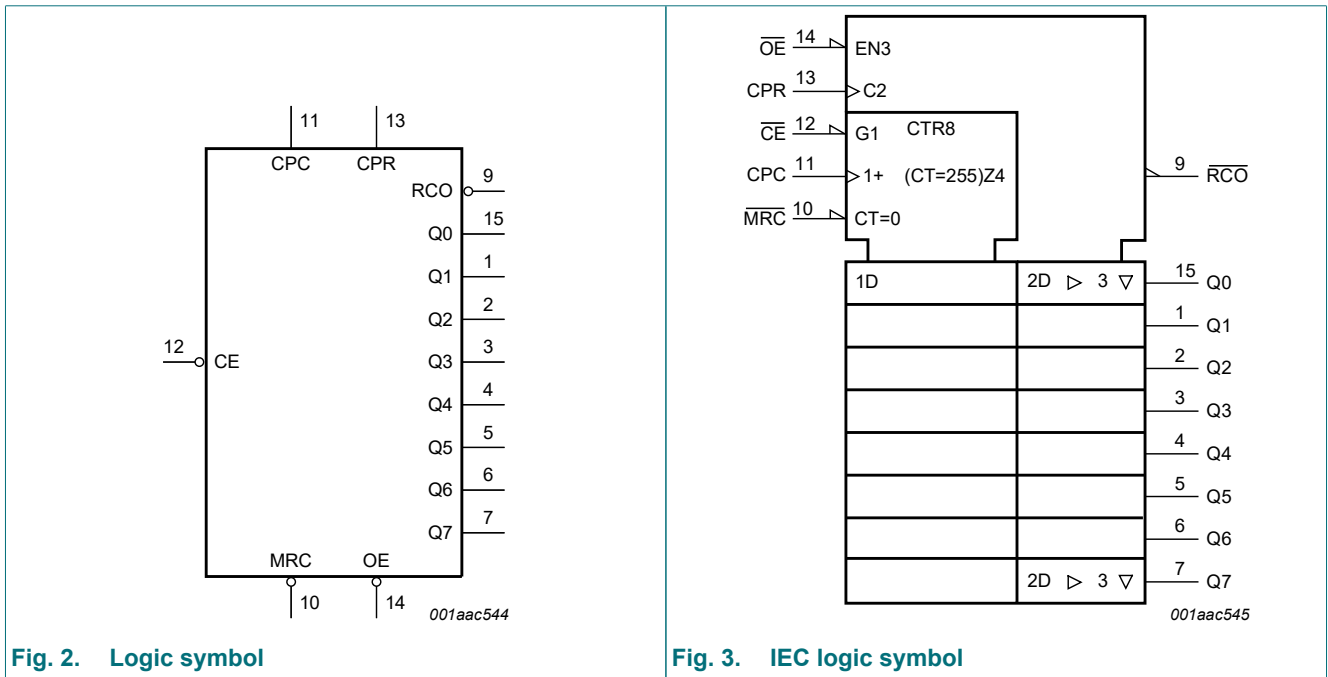


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

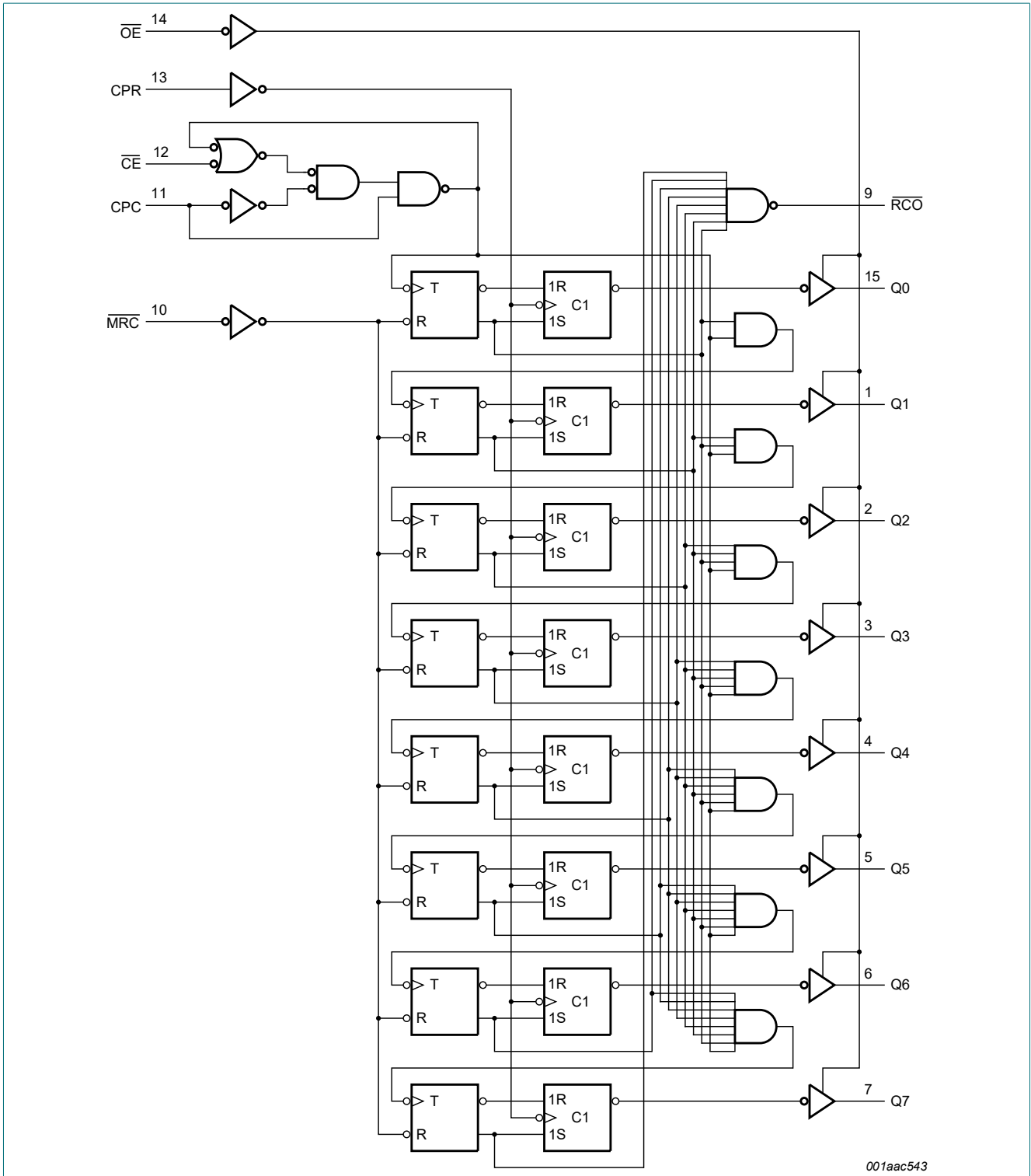
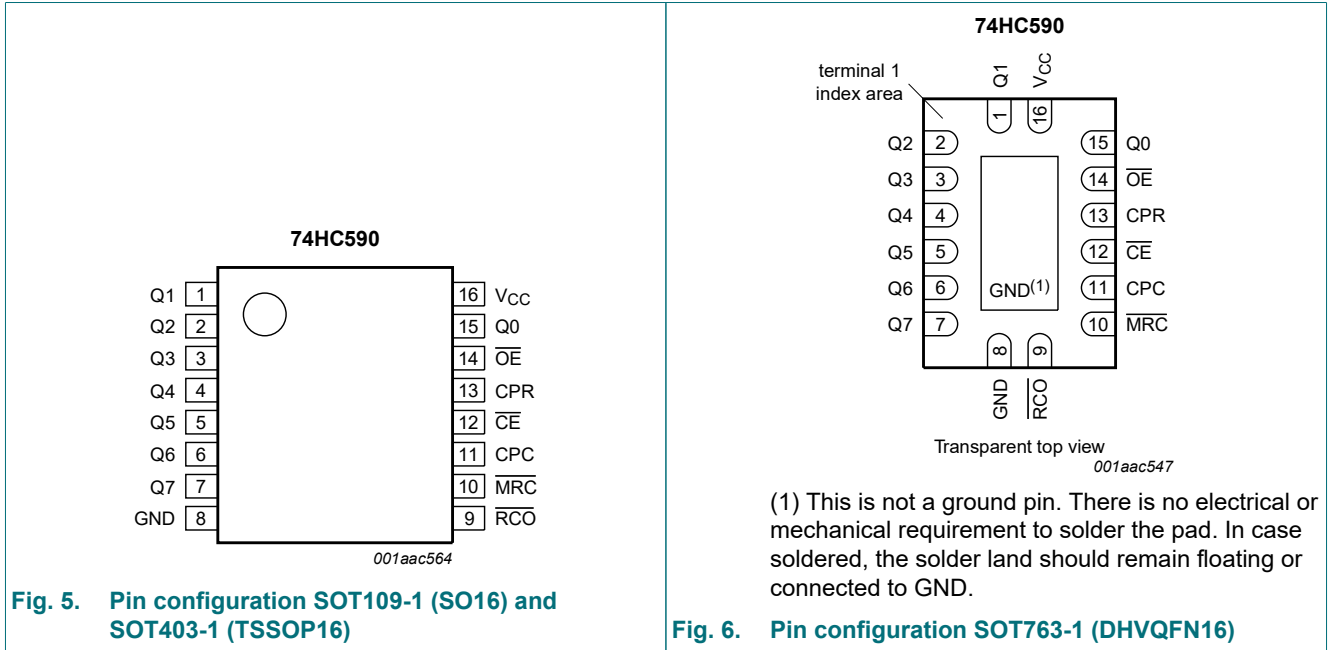


Fig. 4. Logic diagram

## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

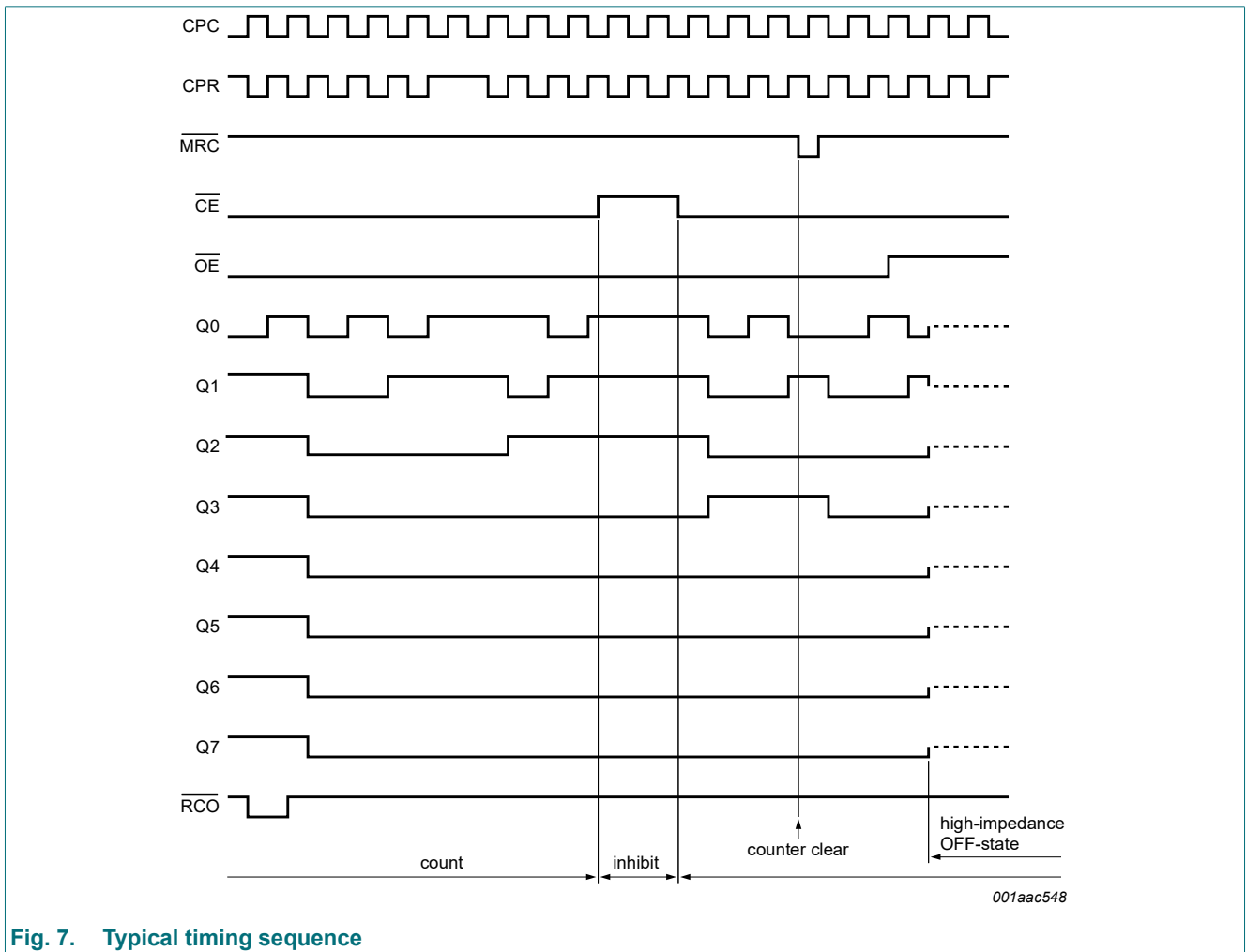
| Symbol                         | Pin                     | Description                             |
|--------------------------------|-------------------------|---|
| Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 | 15, 1, 2, 3, 4, 5, 6, 7 | parallel data output                    |
| GND                            | 8                       | ground (0 V)                            |
| $\overline{RCO}$               | 9                       | ripple carry output (active LOW)        |
| $\overline{MRC}$               | 10                      | master reset counter input (active LOW) |
| CPC                            | 11                      | counter clock input (active HIGH)       |
| $\overline{CE}$                | 12                      | count enable input (active LOW)         |
| CPR                            | 13                      | register clock input (active HIGH)      |
| $\overline{OE}$                | 14                      | output enable input (active LOW)        |
| V <sub>CC</sub>                | 16                      | supply voltage                          |

## 6. Functional description

**Table 3. Function table**

H = HIGH voltage level; L = LOW voltage level; X = don't care; ↑ = LOW-to-HIGH transition; ↓ = HIGH-to-LOW transition.  
 $\overline{RCO} = \overline{Q0} \cdot \overline{Q1} \cdot \overline{Q2} \cdot \overline{Q3} \cdot \overline{Q4} \cdot \overline{Q5} \cdot \overline{Q6} \cdot \overline{Q7}$  ( $Q0'$  to  $Q7'$  are internal outputs of the counter).

| Inputs |     |     |    |     | Description                       |
|--------|-----|-----|----|-----|-----------------------------------|
| OE     | CPR | MRC | CE | CPC |                                   |
| H      | X   | X   | X  | X   | Q outputs disable                 |
| L      | X   | X   | X  | X   | Q outputs enable                  |
| X      | ↑   | X   | X  | X   | counter data stored into register |
| X      | ↓   | X   | X  | X   | register stage is not changed     |
| X      | X   | L   | X  | X   | counter clear                     |
| X      | X   | H   | L  | ↑   | advance one count                 |
| X      | X   | H   | L  | ↓   | no count                          |
| X      | X   | H   | H  | X   | no count                          |



**Fig. 7. Typical timing sequence**

## 7. Limiting values

**Table 4. 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  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$           |      |          |      |
|           |                         | RCO standard output  | -    | $\pm 25$ | mA   |
|           |                         | Qn bus driver output                                       | -    | $\pm 35$ | mA   |
| $I_{CC}$  | supply current          |  | -    | 70       | mA   |
| $I_{GND}$ | ground current          |  | -70  | -        | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2]          | -    | 500      | mW   |

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

[2] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions              | Min | Typ  | Max      | Unit |
|---------------------|-------------------------------------|-------------------------|-----|------|----------|------|
| $V_{CC}$            | supply voltage                      |                         | 2.0 | 5.0  | 6.0      | V    |
| $V_I$               | input voltage                       |                         | 0   | -    | $V_{CC}$ | V    |
| $V_O$               | output voltage                      |                         | 0   | -    | $V_{CC}$ | V    |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.0\text{ V}$ | -   | -    | 625      | ns/V |
|                     |                                     | $V_{CC} = 4.5\text{ V}$ | -   | 1.67 | 139      | ns/V |
|                     |                                     | $V_{CC} = 6.0\text{ V}$ | -   | -    | 83       | ns/V |
| $T_{amb}$           | ambient temperature                 |                         | -40 | -    | +125     | °C   |

## 9. Static characteristics

**Table 6. Static characteristics**

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

| Symbol          | Parameter   | Conditions  | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|-----------------|---|---|-------|------|------|------------------|------|-------------------|------|------|
|                 |   |   | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| V <sub>IH</sub> | HIGH-level input voltage                          | V <sub>CC</sub> = 2.0 V   | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |   | V <sub>CC</sub> = 4.5 V   | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |   | V <sub>CC</sub> = 6.0 V   | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage                           | V <sub>CC</sub> = 2.0 V   | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |   | V <sub>CC</sub> = 4.5 V   | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |   | V <sub>CC</sub> = 6.0 V   | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>   |       |      |      |                  |      |                   |      |      |
|                 |   | all outputs   |       |      |      |                  |      |                   |      |      |
|                 |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V  | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V  | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V  | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |   | $\overline{RCO}$ standard output  |       |      |      |                  |      |                   |      |      |
|                 |   | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V   | 4.18  | 4.31 | -    | 4.13             | -    | 4.1               | -    | V    |
|                 |   | I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V   | 5.68  | 5.80 | -    | 5.63             | -    | 5.6               | -    | V    |
|                 |   | Qn bus driver output  |       |      |      |                  |      |                   |      |      |
|                 | I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V | 4.18  | 4.31  | -    | 4.13 | -                | 4.1  | -                 | V    |      |
|                 | I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V | 5.68  | 5.80  | -    | 5.63 | -                | 5.6  | -                 | V    |      |
| V <sub>OL</sub> | LOW-level output voltage                          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>   |       |      |      |                  |      |                   |      |      |
|                 |   | all outputs   |       |      |      |                  |      |                   |      |      |
|                 |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V   | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V   | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V   | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |   | $\overline{RCO}$ standard output  |       |      |      |                  |      |                   |      |      |
|                 |   | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V  | -     | 0.17 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |   | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V  | -     | 0.18 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |   | Qn bus driver output  |       |      |      |                  |      |                   |      |      |
|                 | I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V  | -   | 0.17  | 0.26 | -    | 0.33             | -    | 0.4               | V    |      |
|                 | I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V  | -   | 0.18  | 0.26 | -    | 0.33             | -    | 0.4               | V    |      |
| I <sub>I</sub>  | input leakage current                             | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V  | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | μA   |
| I <sub>OZ</sub> | OFF-state output current                          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V | -     | -    | ±0.5 | -                | ±5.0 | -                 | ±10  | μA   |
| I <sub>CC</sub> | supply current                                    | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 6.0 V                                 | -     | -    | 4.0  | -                | 40   | -                 | 80   | μA   |
| C <sub>I</sub>  | input capacitance                                 |   | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND (ground = 0 V); for test circuit see Fig. 14.

| Symbol    | Parameter                     | Conditions   | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
|           |                               |  | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| $t_{pd}$  | propagation delay             | CPC to $\overline{RCO}$ ; see Fig. 8 [1]           |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | -     | 52  | 150 | -                | 190 | -                 | 230 | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | -     | 19  | 30  | -                | 38  | -                 | 45  | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | -     | 15  | 26  | -                | 33  | -                 | 40  | ns   |
|           |                               | CPR to Qn; see Fig. 9                              |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | -     | 50  | 140 | -                | 175 | -                 | 210 | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | -     | 17  | 28  | -                | 35  | -                 | 42  | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | -     | 14  | 24  | -                | 30  | -                 | 36  | ns   |
| $t_{PLH}$ | LOW to HIGH propagation delay | $\overline{MRC}$ to $\overline{RCO}$ ; see Fig. 10 |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | -     | 53  | 130 | -                | 165 | -                 | 200 | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | -     | 18  | 26  | -                | 33  | -                 | 40  | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | -     | 14  | 22  | -                | 28  | -                 | 34  | ns   |
| $t_{en}$  | enable time                   | $\overline{OE}$ to Qn; see Fig. 11 [2]             |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | -     | 28  | 105 | -                | 130 | -                 | 160 | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | -     | 13  | 21  | -                | 26  | -                 | 32  | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | -     | 11  | 18  | -                | 22  | -                 | 27  | ns   |
| $t_{dis}$ | disable time                  | $\overline{OE}$ to Qn; see Fig. 11 [3]             |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | -     | 28  | 105 | -                | 130 | -                 | 160 | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | -     | 13  | 21  | -                | 26  | -                 | 32  | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | -     | 11  | 18  | -                | 22  | -                 | 27  | ns   |
| $t_{W}$   | pulse width                   | CPC and CPR; HIGH or LOW; see Fig. 8 and Fig. 9    |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | 100   | 24  | -   | 125              | -   | 145               | -   | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | 20    | 9   | -   | 25               | -   | 29                | -   | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | 17    | 8   | -   | 21               | -   | 25                | -   | ns   |
|           |                               | $\overline{MRC}$ ; LOW; see Fig. 10                |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | 75    | 28  | -   | 95               | -   | 110               | -   | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | 15    | 8   | -   | 19               | -   | 22                | -   | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | 13    | 6   | -   | 16               | -   | 19                | -   | ns   |
| $t_{su}$  | set-up time                   | CPC to CPR; see Fig. 13                            |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | 100   | 46  | -   | 125              | -   | 150               | -   | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | 20    | 14  | -   | 25               | -   | 30                | -   | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | 17    | 10  | -   | 21               | -   | 26                | -   | ns   |
|           |                               | $\overline{CE}$ to CPC; see Fig. 12                |       |     |     |                  |     |                   |     |      |
|           |                               | $V_{CC} = 2.0\text{ V}$                            | 100   | 44  | -   | 125              | -   | 150               | -   | ns   |
|           |                               | $V_{CC} = 4.5\text{ V}$                            | 20    | 11  | -   | 25               | -   | 30                | -   | ns   |
|           |                               | $V_{CC} = 6.0\text{ V}$                            | 17    | 9   | -   | 21               | -   | 26                | ns  |      |



## 8-bit binary counter with output register; 3-state

| Symbol           | Parameter                     | Conditions  | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
|                  |                               |   | Min   | Typ | Max | Min              | Max | Min               | Max |      |
| t <sub>h</sub>   | hold time                     | CE to CPC; see <a href="#">Fig. 12</a>                            |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V   | 0     | -   | -   | 0                | -   | 0                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V   | 0     | -   | -   | 0                | -   | 0                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V   | 0     | -   | -   | 0                | -   | 0                 | -   | ns   |
| t <sub>rec</sub> | recovery time                 | MRC to CPC; see <a href="#">Fig. 10</a>                           |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V   | 75    | 28  | -   | 95               | -   | 110               | -   | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V   | 15    | 7   | -   | 19               | -   | 22                | -   | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V   | 13    | 6   | -   | 16               | -   | 19                | -   | ns   |
| f <sub>max</sub> | maximum frequency             | CPC or CPR; see <a href="#">Fig. 8</a> and <a href="#">Fig. 9</a> |       |     |     |                  |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 2.0 V   | 6.6   | 16  | -   | 5.2              | -   | 4.4               | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 4.5 V   | 33    | 52  | -   | 26               | -   | 22                | -   | MHz  |
|                  |                               | V <sub>CC</sub> = 6.0 V   | 39    | 61  | -   | 31               | -   | 26                | -   | MHz  |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> [4]                       | -     | 44  | -   | -                | -   | -                 | -   | pF   |

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

[2] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.

[3] t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

10.1. Waveforms and test circuit

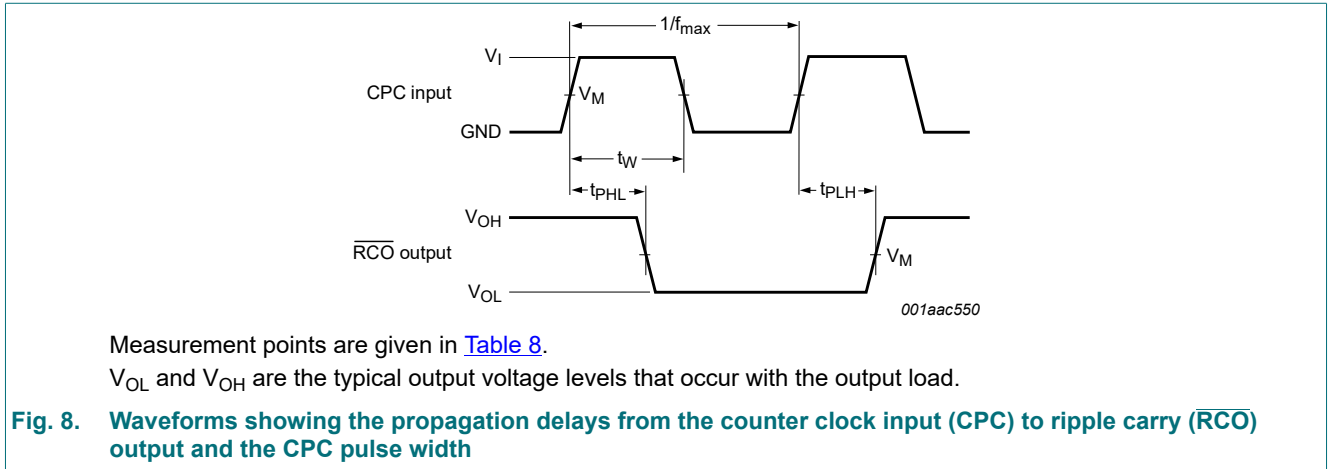
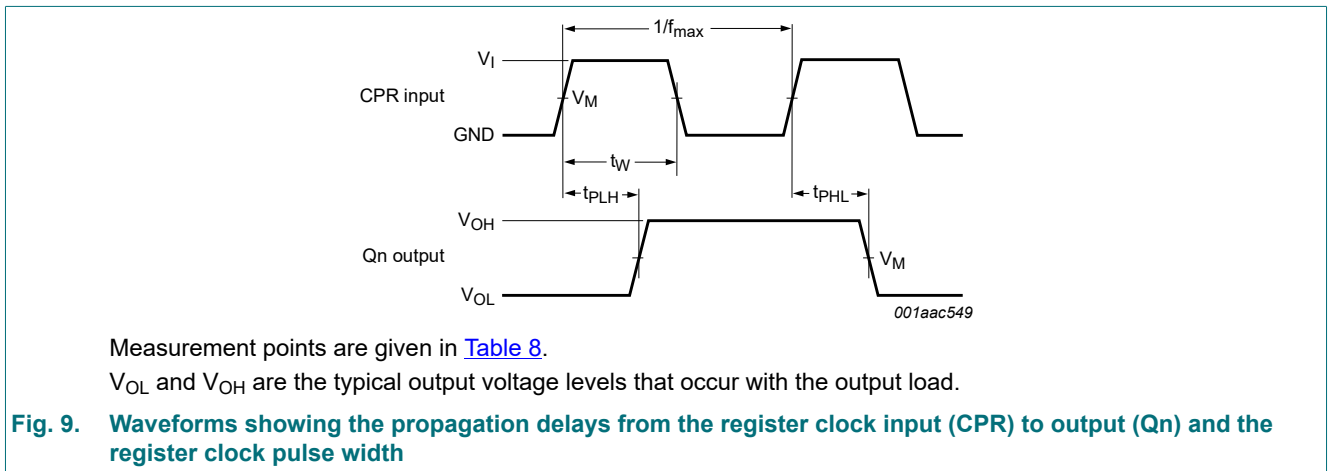
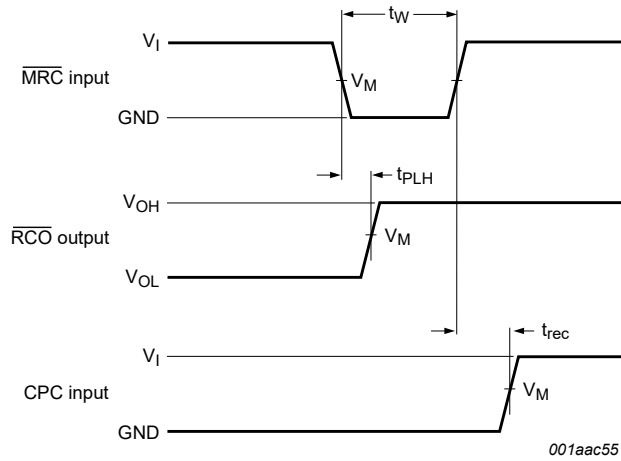


Table 8. Measurement points

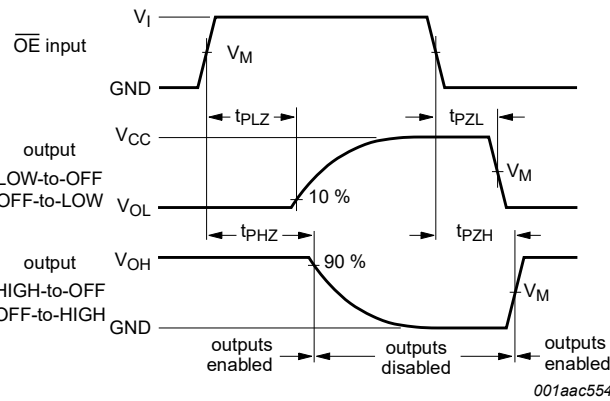
| Input    |             | Output      |
|----------|-------------|-------------|
| $V_I$    | $V_M$       | $V_M$       |
| $V_{CC}$ | $0.5V_{CC}$ | $0.5V_{CC}$ |





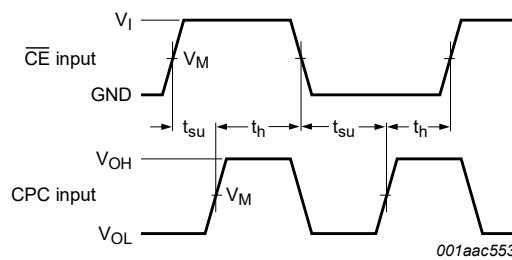
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage levels that occur with the output load.

**Fig. 10. Waveforms showing the propagation delays from the master reset counter input ( $\overline{\text{MRC}}$ ) to output ( $\overline{\text{RCO}}$ ), the  $\overline{\text{MRC}}$  pulse width and recovery time**



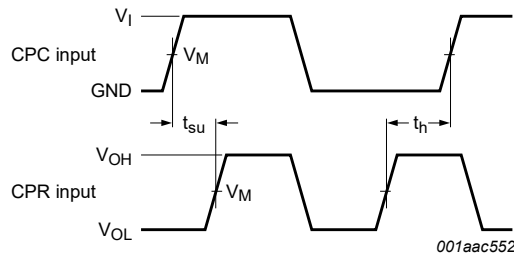
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage levels that occur with the output load.

**Fig. 11. Waveforms showing the 3-state enable and disable times**



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage levels that occur with the output load.

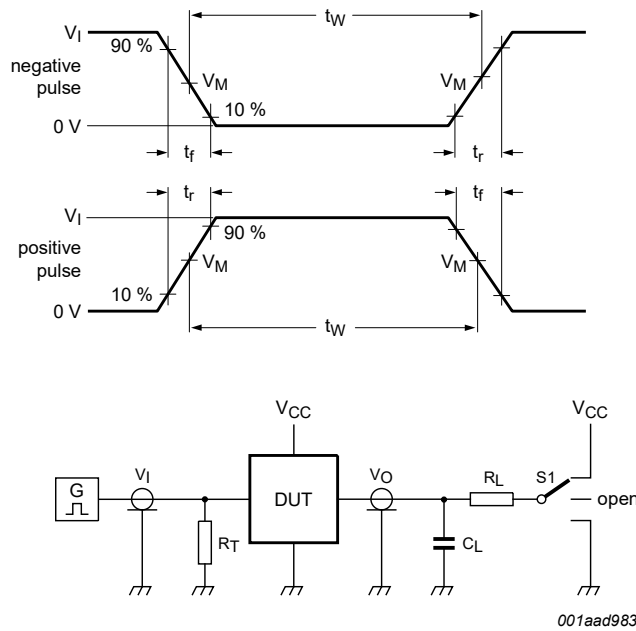
**Fig. 12. Waveforms showing the set-up and hold times for the count enable input ( $\overline{\text{CE}}$ ) to the counter clock input (CPC)**



Measurement points are given in [Table 8](#).

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

**Fig. 13. Waveforms showing the set-up and hold times for the counter clock input (CPC) to the register clock input (CPR)**



Test data is given in [Table 9](#).

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;

S1 = Test selection switch.

**Fig. 14. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage | Input    |            | Load  |              | Switch position    |                    |                    |
|----------------|----------|------------|-------|--------------|--------------------|--------------------|--------------------|
| $V_{CC}$       | $V_I$    | $t_r, t_f$ | $C_L$ | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 2.0 V to 6.0 V | $V_{CC}$ | 6 ns       | 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

### 11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

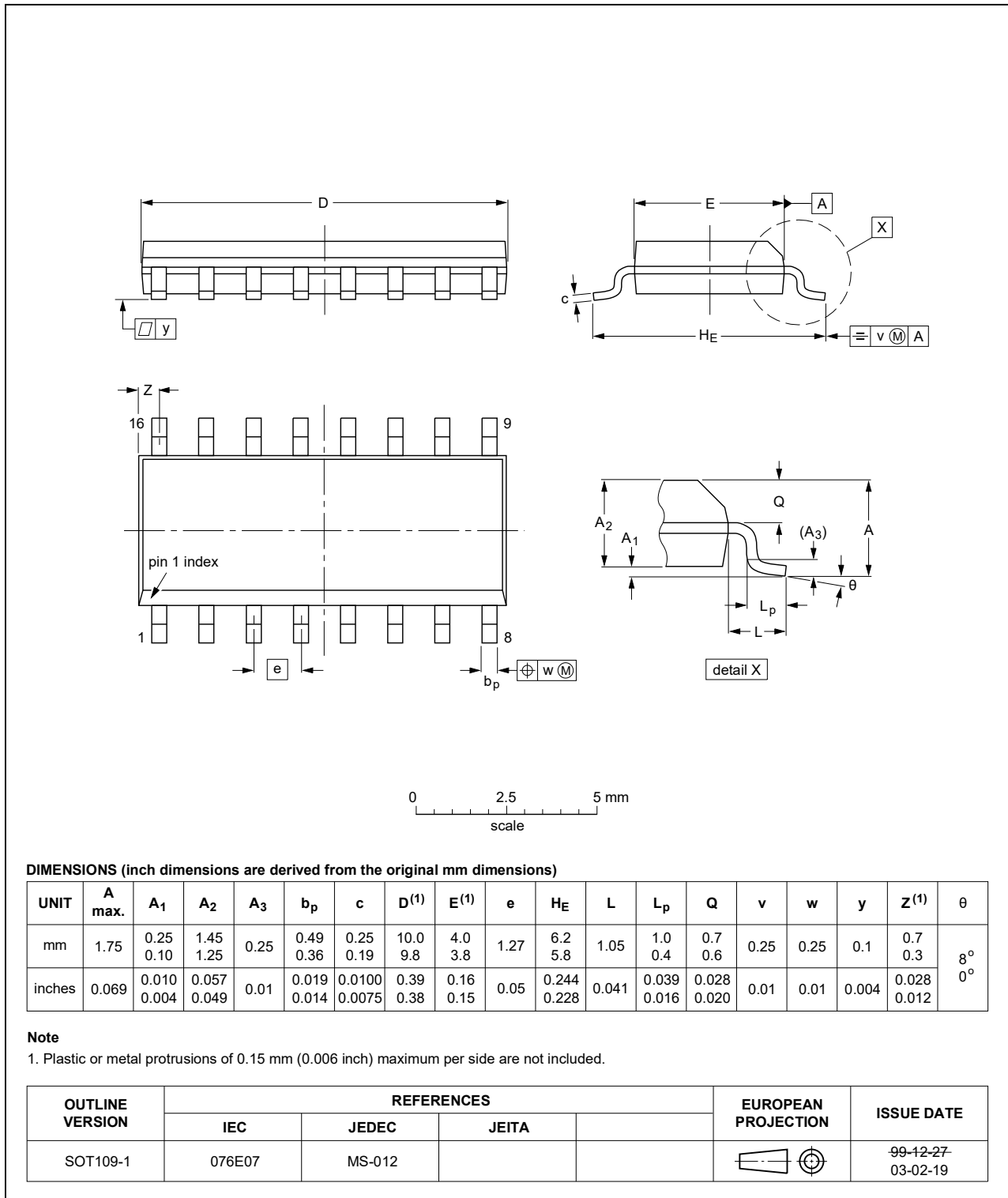


Fig. 15. Package outline SOT109-1 (SO16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

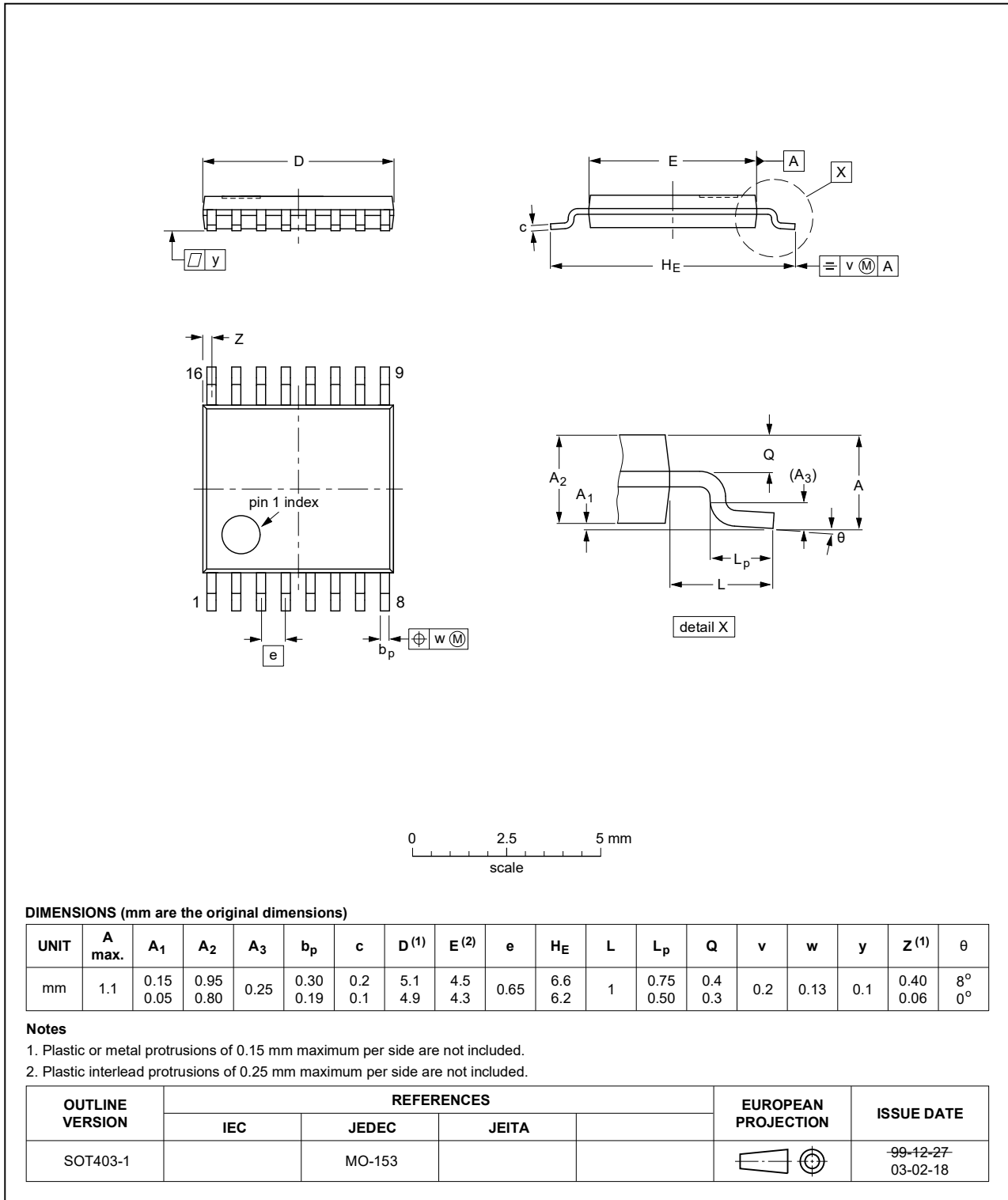


Fig. 16. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

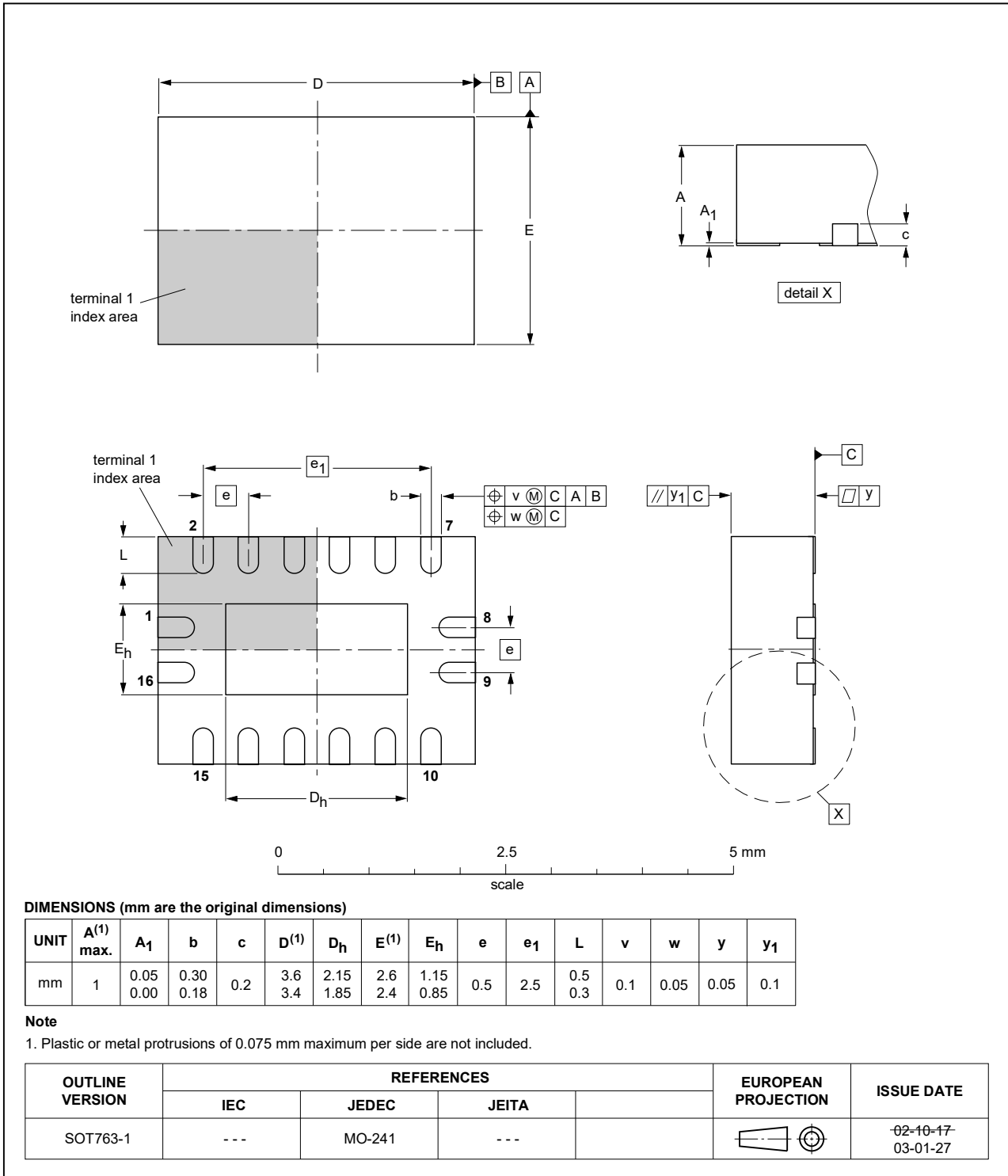


Fig. 17. Package outline SOT763-1 (DHVQFN16)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes  |
|----------------|--|--------------------|---------------|-------------|
| 74HC590 v.4    | 20220314   | Product data sheet | -             | 74HC590 v.3 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 2</a> updated.</li> <li>ESD CDM value changed from 2000 V to 1000 V (errata).</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul> |                    |               |             |
| 74HC590 v.3    | 20160224   | Product data sheet | -             | 74HC590 v.2 |
| Modifications: | <ul style="list-style-type: none"> <li>Type number 74HC590N (SOT38-4) removed.</li> </ul>  |                    |               |             |
| 74HC590 v.2    | 20090428   | Product data sheet | -             | 74HC590 v.1 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Quick reference data incorporated in to <a href="#">Section 9</a> and <a href="#">Section 10</a>.</li> <li>Added type number 74HC590N (DIP16 package)</li> </ul>   |                    |               |             |
| 74HC590 v.1    | 20050330   | Product data sheet | -             | -           |



## 14. 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>.

### 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.

### 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 an 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.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

**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.

**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.

### Trademarks

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

## Contents

---

|  |           |
|--|-----------|
| <b>1. General description</b> .....              | <b>1</b>  |
| <b>2. Features and benefits</b> .....            | <b>1</b>  |
| <b>3. Ordering information</b> .....             | <b>1</b>  |
| <b>4. Functional diagram</b> .....               | <b>2</b>  |
| <b>5. Pinning information</b> .....              | <b>4</b>  |
| 5.1. Pinning.....                                | 4         |
| 5.2. Pin description.....                        | 4         |
| <b>6. Functional description</b> .....           | <b>5</b>  |
| <b>7. Limiting values</b> .....                  | <b>6</b>  |
| <b>8. Recommended operating conditions</b> ..... | <b>6</b>  |
| <b>9. Static characteristics</b> .....           | <b>7</b>  |
| <b>10. Dynamic characteristics</b> .....         | <b>8</b>  |
| 10.1. Waveforms and test circuit.....            | 10        |
| <b>11. Package outline</b> .....                 | <b>13</b> |
| <b>12. Abbreviations</b> .....                   | <b>16</b> |
| <b>13. Revision history</b> .....                | <b>16</b> |
| <b>14. Legal information</b> .....               | <b>17</b> |

---

© Nexperia B.V. 2022. All rights reserved

For more information, please visit: <http://www.nexperia.com>  
For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)  
Date of release: 14 March 2022

---