# 74HC4020-Q100; 74HCT4020-Q100

## 14-stage binary ripple counter

Rev. 1 — 23 May 2013 Product data sheet

## 1. General description

The 74HC4020-Q100; 74HCT4020-Q100 are 14-stage binary ripple counters with a clock input ($\overline{CP}$), an overriding asynchronous master reset input (MR) and 12 buffered parallel outputs (Q0, and Q3 to Q13). The counter advances on the HIGH-to-LOW transition of $\overline{CP}$. A HIGH on MR clears all counter stages and forces all outputs LOW, independent of the state of $\overline{CP}$. Each counter stage is a static toggle flip-flop.. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of $V_{CC}$.

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
- Input levels:
  - For 74HC4020-Q100: CMOS level
  - For 74HCT4020-Q100: TTL level
- Complies with JEDEC standard no. 7A
- 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)
- Multiple package options

## 3. Applications

- Frequency dividing circuits
- Time delay circuits
- Control counters

## 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74HC4020D-Q100 | –40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74HCT4020D-Q100 | | | | |
| 74HC4020PW-Q100 | –40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |
| 74HCT4020PW-Q100 | | | | |
| 74HC4020BQ-Q100 | –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 |
| 74HCT4020BQ-Q100 | | | | |

## 5. Functional diagram

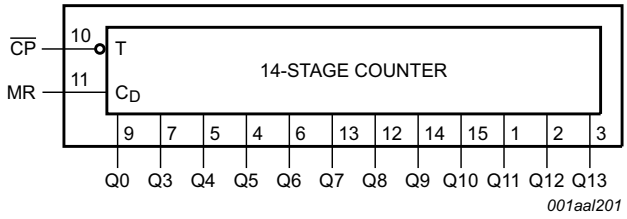



**Fig 1. Functional diagram**

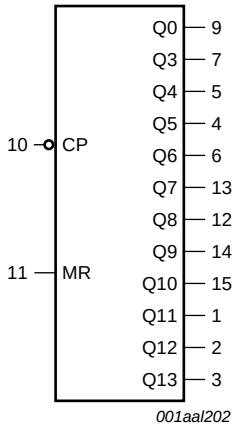



**Fig 2. Logic symbol**

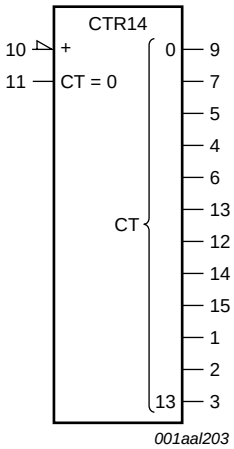



**Fig 3. IEC logic symbol**

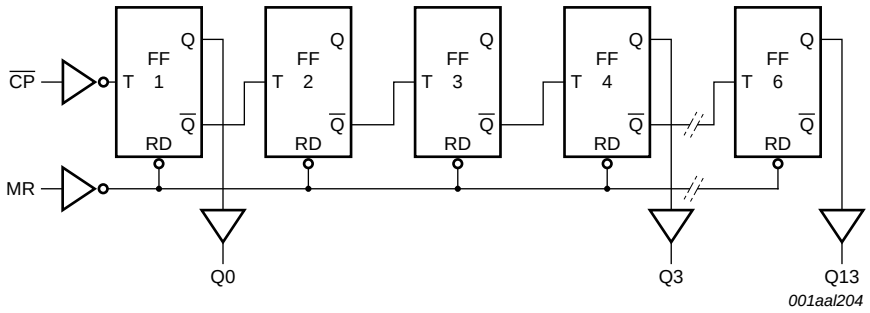



**Fig 4. Logic diagram**

# 6. Pinning information

## 6.1 Pinning

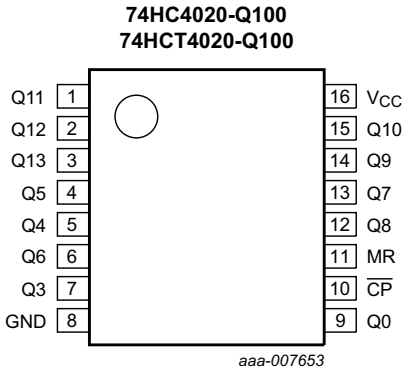
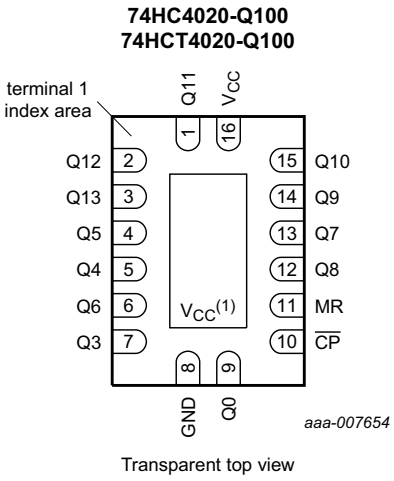



**Fig 5. Pin configuration SO16 and TSSOP16**




Transparent top view

(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to $V_{CC}$.

**Fig 6. Pin configuration DHVQFN16**

### 6.2 Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| Q0, Q3 to Q13 | 9, 7, 5, 4, 6, 13, 12, 14, 15, 1, 2, 3 | output |
| GND | 8 | ground (0 V) |
| $\overline{CP}$ | 10 | clock input (HIGH-to-LOW, edge-triggered) |
| MR | 11 | master reset input (active HIGH) |
| $V_{CC}$ | 16 | positive supply voltage |

## 7. Functional description

**Table 3. Function table**

| Input | | Output |
|---|---|---|
| $\overline{CP}$ | MR | Q0, Q3 to Q13 |
| ↑ | L | no change |
| ↓ | L | count |
| X | H | L |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; ↑ = LOW-to-HIGH clock transition; ↓ = HIGH-to-LOW clock transition.

### 7.1 Timing diagram

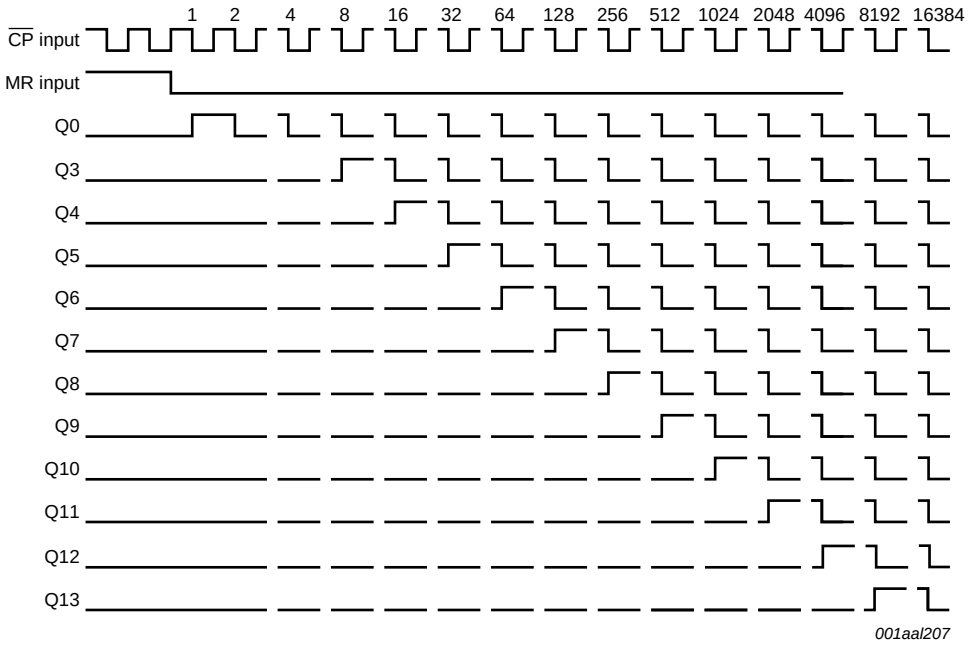



**Fig 7. Timing diagram**

## 8. 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 | V |
| $I_{IK}$ | input clamping current | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V | | - | ±20 | mA |
| $I_{OK}$ | output clamping current | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V | | - | ±20 | 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 | [1] | - | 500 | mW |

[1] For SO16 package: $P_{tot}$ derates linearly with 8 mW/K above 70 °C.
For TSSOP16 package: $P_{tot}$ derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN16 package: $P_{tot}$ derates linearly with 4.5 mW/K above 60 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | 74HC4020-Q100 | | | 74HCT4020-Q100 | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $V_{CC}$ | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| $V_I$ | input voltage | | 0 | - | $V_{CC}$ | 0 | - | $V_{CC}$ | V |
| $V_O$ | output voltage | | 0 | - | $V_{CC}$ | 0 | - | $V_{CC}$ | V |
| $\Delta t/\Delta V$ | input transition rise and fall rate | except for Schmitt trigger inputs | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | $V_{CC}$ = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | $V_{CC}$ = 6.0 V | - | - | 83 | - | - | - | ns/V |
| $T_{amb}$ | ambient temperature | | −40 | +25 | +125 | −40 | +25 | +125 | °C |

## 10. 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 | |
| **74HC4020-Q100** | | | | | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | 1.5 | - | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | 3.15 | - | V |
| | | $V_{CC}$ = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | 4.2 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | - | 0.5 | V |
| | | $V_{CC}$ = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | - | 1.35 | V |
| | | $V_{CC}$ = 6.0 V | - | 2.8 | 1.8 | - | 1.8 | - | 1.8 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | | | |
| | | $I_O$ = –20 μA; $V_{CC}$ = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | $I_O$ = –20 μA; $V_{CC}$ = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O$ = –20 μA; $V_{CC}$ = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | $I_O$ = –4.0 mA; $V_{CC}$ = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | $I_O$ = –5.2 mA; $V_{CC}$ = 6.0 V | 5.48 | 5.81 | - | 5.34 | - | 5.2 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | | | |
| | | $I_O$ = 20 μA; $V_{CC}$ = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 20 μA; $V_{CC}$ = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 20 μA; $V_{CC}$ = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | $I_O$ = 5.2 mA; $V_{CC}$ = 6.0 V | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| $I_I$ | input leakage current | $V_I$ = $V_{CC}$ or GND; $V_{CC}$ = 6.0 V | - | - | ±0.1 | - | ±1 | - | ±1 | μA |
| $I_{CC}$ | supply current | $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 6.0 V | - | - | 8.0 | - | 80 | - | 160 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | - | - | - | - | pF |
| **74HCT4020-Q100** | | | | | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | 2.0 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | - | 0.8 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_{CC}$ = 4.5 V | | | | | | | | |
| | | $I_O$ = –20 μA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O$ = –4.0 mA | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_{CC}$ = 4.5 V | | | | | | | | |
| | | $I_O$ = 20 μA; $V_{CC}$ = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| $I_I$ | input leakage current | $V_I$ = $V_{CC}$ or GND; $V_{CC}$ = 5.5 V | - | - | ±0.1 | - | ±1 | - | ±1 | μA |

**Table 6. Static characteristics** *...continued*

*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 | |
| $I_{CC}$ | supply current | $V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V | - | - | 8.0 | - | 80 | - | 160 | µA |
| $\Delta I_{CC}$ | additional supply current | $V_I = V_{CC} - 2.1$ V; $I_O = 0$ A; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5$ V to 5.5 V | | | | | | | | |
| | | pin MR | - | 110 | 396 | - | 495 | - | 539 | µA |
| | | pin $\overline{CP}$ | - | 85 | 306 | - | 383 | - | 417 | µA |
| $C_I$ | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

*GND (ground = 0 V); $C_L = 50$ pF unless otherwise specified; for test circuit, see Figure 10*

| Symbol | Parameter | Conditions | | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| **74HC4020-Q100** | | | | | | | | | | | |
| $t_{pd}$ | propagation delay | $\overline{CP}$ to Q0; see Figure 8 | [1] | | | | | | | | |
| | | $V_{CC} = 2.0$ V; $C_L = 50$ pF | | - | 39 | 140 | - | 175 | - | 210 | ns |
| | | $V_{CC} = 4.5$ V; $C_L = 50$ pF | | - | 14 | 28 | - | 35 | - | 42 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | | - | 11 | - | - | - | - | - | ns |
| | | $V_{CC} = 6.0$ V; $C_L = 50$ pF | | - | 11 | 24 | - | 30 | - | 36 | ns |
| | | Qn to Qn+1; see Figure 9 | | | | | | | | | |
| | | $V_{CC} = 2.0$ V; $C_L = 50$ pF | | - | 22 | 75 | - | 95 | - | 110 | ns |
| | | $V_{CC} = 4.5$ V; $C_L = 50$ pF | | - | 8 | 15 | - | 19 | - | 22 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | | - | 6 | - | - | - | - | - | ns |
| | | $V_{CC} = 6.0$ V; $C_L = 50$ pF | | - | 6 | 13 | - | 16 | - | 19 | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | MR to Qn; see Figure 8 | | | | | | | | | |
| | | $V_{CC} = 2.0$ V; $C_L = 50$ pF | | - | 55 | 170 | - | 215 | - | 225 | ns |
| | | $V_{CC} = 4.5$ V; $C_L = 50$ pF | | - | 20 | 34 | - | 43 | - | 51 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | | - | 17 | - | - | - | - | - | ns |
| | | $V_{CC} = 6.0$ V; $C_L = 50$ pF | | - | 16 | 29 | - | 37 | - | 43 | ns |
| $t_t$ | transition time | Qn; see Figure 8 | [2] | | | | | | | | |
| | | $V_{CC} = 2.0$ V; $C_L = 50$ pF | | - | 19 | 75 | - | 95 | - | 110 | ns |
| | | $V_{CC} = 4.5$ V; $C_L = 50$ pF | | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | $V_{CC} = 6.0$ V; $C_L = 50$ pF | | - | 6 | 13 | - | 16 | - | 19 | ns |

**Table 7. Dynamic characteristics** *...continued*

*GND (ground = 0 V); $C_L$ = 50 pF unless otherwise specified; for test circuit, see Figure 10*

| Symbol | Parameter | Conditions | | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_W$ | pulse width | $\overline{CP}$ HIGH or LOW; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | | 80 | 14 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 16 | 4 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | | 14 | 3 | - | 17 | - | 20 | - | ns |
| | | MR HIGH; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | | 80 | 17 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 16 | 6 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | | 14 | 5 | - | 17 | - | 20 | - | ns |
| $t_{rec}$ | recovery time | MR to $\overline{CP}$; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | | 50 | 6 | - | 65 | - | 75 | - | ns |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 10 | 2 | - | 13 | - | 15 | - | ns |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | | 9 | 2 | - | 11 | - | 13 | - | ns |
| $f_{max}$ | maximum frequency | see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | | 6.0 | 30 | - | 4.8 | - | 4.0 | - | MHz |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 30 | 92 | - | 24 | - | 20 | - | MHz |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 101 | - | - | - | - | - | MHz |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | | 35 | 109 | - | 28 | - | 24 | - | MHz |
| $C_{PD}$ | power dissipation capacitance | | [3] | - | 19 | - | - | - | - | - | pF |
| **74HCT4020-Q100** | | | | | | | | | | | |
| $t_{pd}$ | propagation delay | $\overline{CP}$ to Q0; see Figure 8 | [1] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | - | 18 | 36 | - | 45 | - | 54 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 15 | - | - | - | - | - | ns |
| | | Qn to Qn+1; see Figure 9 | | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | - | 8 | 15 | - | 19 | - | 22 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 6 | - | - | - | - | - | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | MR to Qn; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | - | 22 | 45 | - | 56 | - | 68 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 19 | - | - | - | - | - | ns |
| $t_t$ | transition time | Qn; see Figure 8 | [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | - | 7 | 15 | - | 19 | - | 22 | ns |
| $t_W$ | pulse width | $\overline{CP}$ HIGH or LOW; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 20 | 7 | - | 25 | - | 30 | - | ns |
| | | MR HIGH; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 20 | 8 | - | 25 | - | 30 | - | ns |
| $t_{rec}$ | recovery time | MR to $\overline{CP}$; see Figure 8 | | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | | 10 | 2 | - | 13 | - | 15 | - | ns |

**Table 7. Dynamic characteristics** *...continued*

*GND (ground = 0 V); $C_L$ = 50 pF unless otherwise specified; for test circuit, see Figure 10*

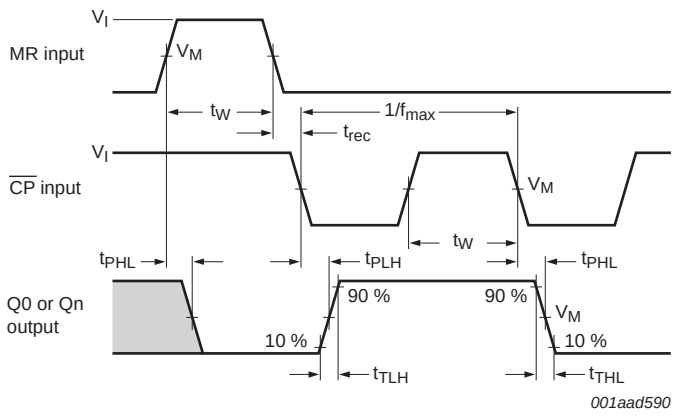
| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $f_{max}$ | maximum frequency | see Figure 8 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | 25 | 47 | - | 20 | - | 17 | - | MHz |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 52 | - | - | - | - | - | MHz |
| $C_{PD}$ | power dissipation capacitance | [3] | - | 20 | - | - | - | - | - | pF |

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

[2] $t_t$ is the same as $t_{THL}$ and $t_{TLH}$.

[3] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
$f_i$ = input frequency in MHz;
$f_o$ = output frequency in MHz;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs;
$C_L$ = output load capacitance in pF;
$V_{CC}$ = supply voltage in V.

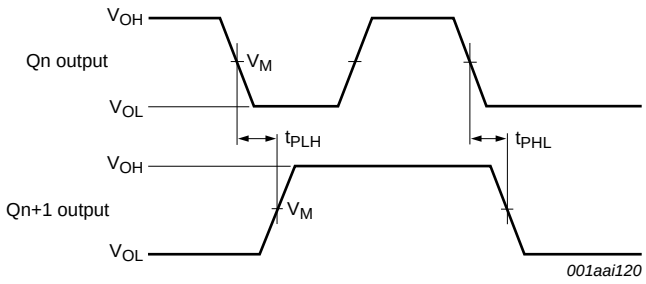
## 12. Waveforms




Measurement points are given in Table 8.

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

**Fig 8. Clock timing, propagation delays, pulse widths and measurement points**



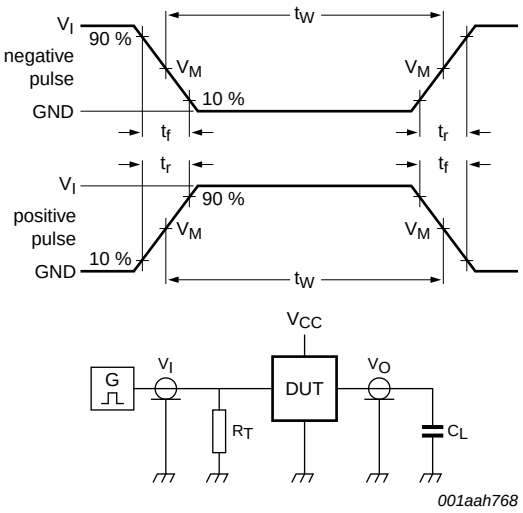

Measurement points are given in Table 8.

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

**Fig 9. Waveforms showing the output Qn to output Qn+1 propagation delays**

**Table 8. Measurement points**

| Type | Input | Output |
|---|---|---|
| | $V_M$ | $V_M$ |
| 74HC4020-Q100 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74HCT4020-Q100 | 1.3 V | 1.3 V |




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.

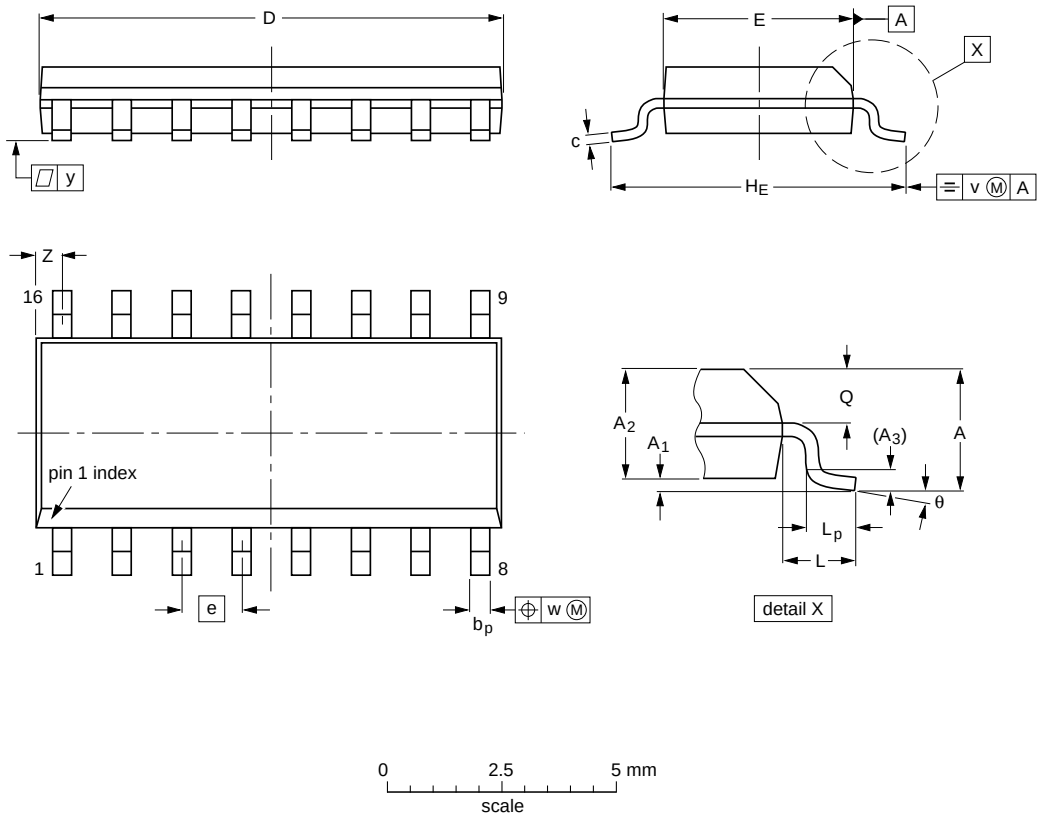
**Fig 10. Test circuit for measuring switching times**

**Table 9. Test data**

| Type | Input | | Load |
|---|---|---|---|
| | $V_I$ | $t_r$, $t_f$ | $C_L$ |
| 74HC4020-Q100 | $V_{CC}$ | 6 ns | 15 pF, 50 pF |
| 74HCT4020-Q100 | 3 V | 6 ns | 15 pF, 50 pF |

## 13. 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 | |

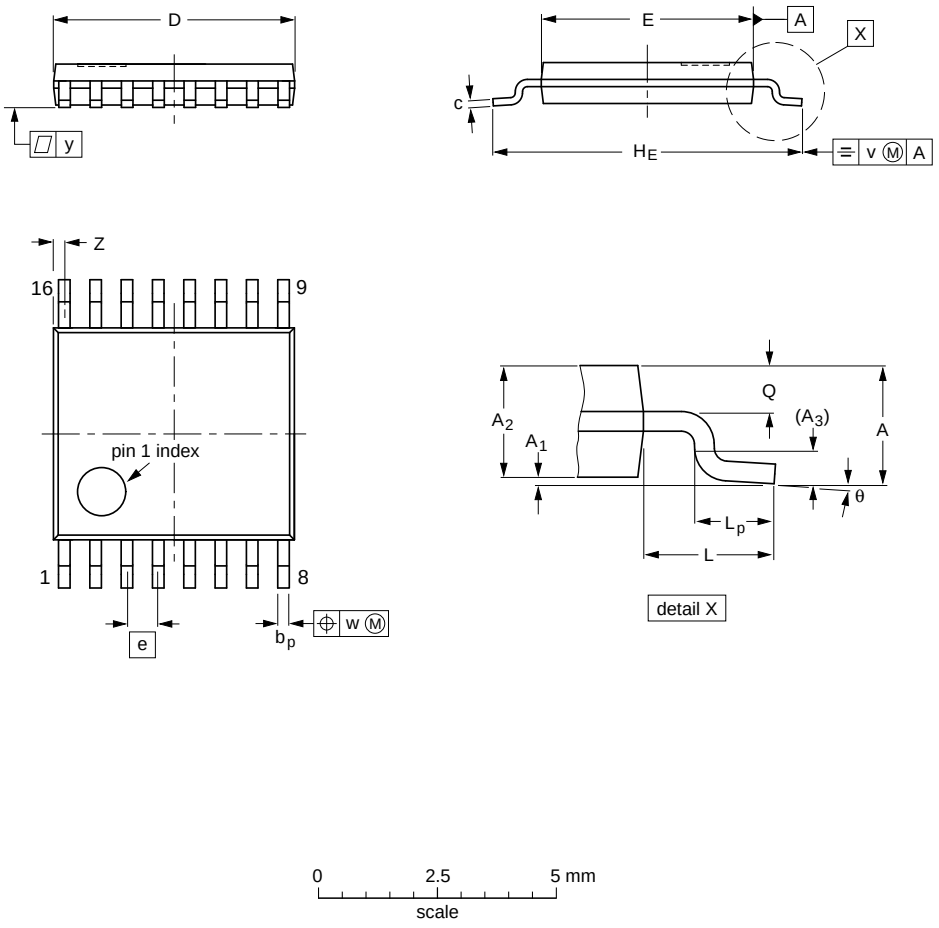
**Note**

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 11. Package outline SOT109-1 (SO16)**

**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>$0^o$ |

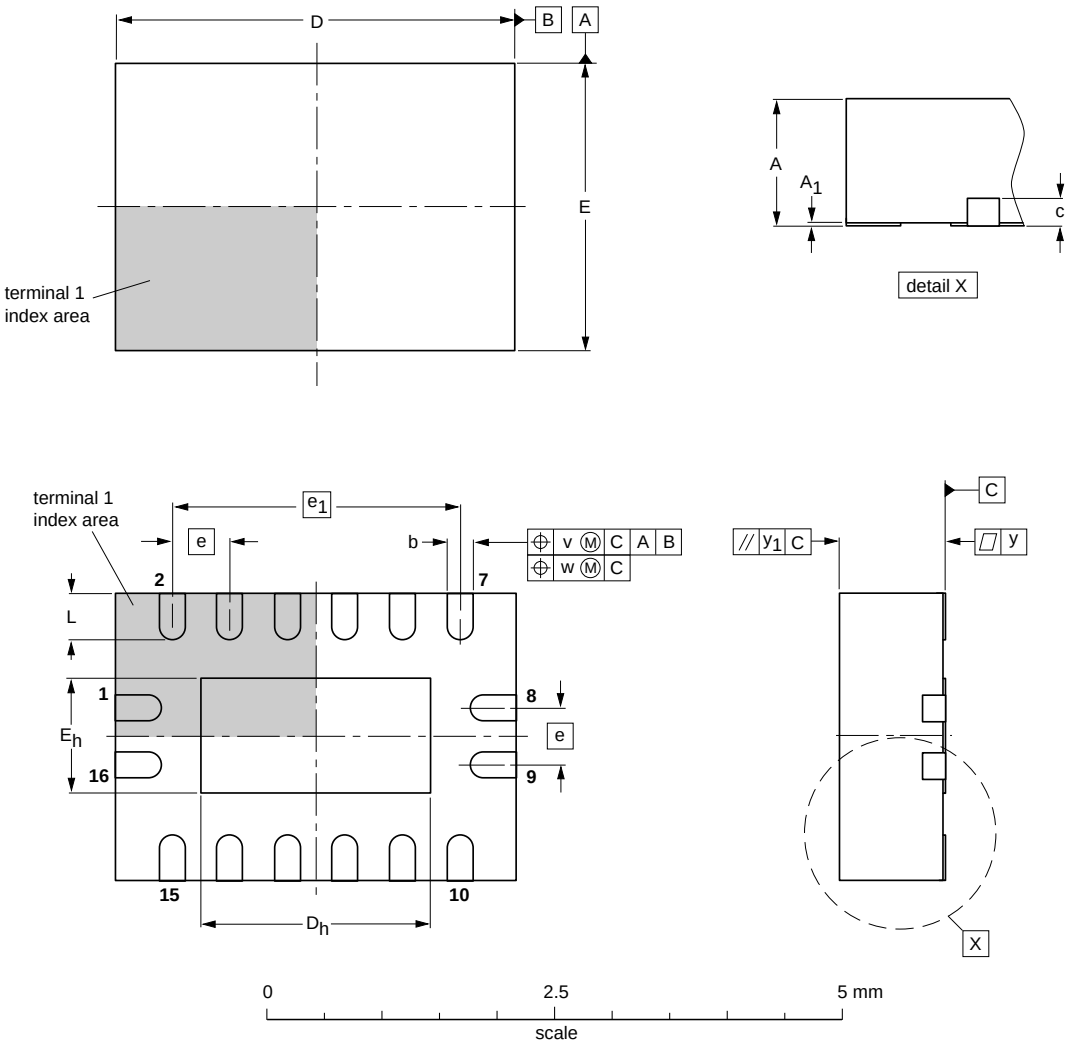
**Notes**

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 12. 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**




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

| UNIT | $A^{(1)}$ max. | $A_1$ | b | c | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1 | 0.05<br>0.00 | 0.30<br>0.18 | 0.2 | 3.6<br>3.4 | 2.15<br>1.85 | 2.6<br>2.4 | 1.15<br>0.85 | 0.5 | 2.5 | 0.5<br>0.3 | 0.1 | 0.05 | 0.05 | 0.1 |

**Note**

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT763-1 | - - - | MO-241 | - - - | | | ~~02-10-17~~<br>03-01-27 |

**Fig 13. Package outline SOT763-1 (DHVQFN16)**

## 14. Abbreviations

**Table 10. 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 |

## 15. Revision history

**Table 11. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74HC_HCT4020_Q100 v.1 | 20130523 | Product data sheet | - | - |

# 16. Legal information

## 16.1 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.nxp.com.

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## 18. Contents





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