# 74HC393-Q100; 74HCT393-Q100

## Dual 4-bit binary ripple counter

Rev. 1 — 19 June 2014 Product data sheet

## 1. General description

The 74HC393-Q100; 7474HCT393-Q100 is a dual 4-stage binary ripple counter. Each counter features a clock input (n$\overline{CP}$), an overriding asynchronous master reset input (nMR) and 4 buffered parallel outputs (nQ0 to nQ3). The counter advances on the HIGH-to-LOW transition of n$\overline{CP}$. A HIGH on nMR clears the counter stages and forces the outputs LOW, independent of the state of n$\overline{CP}$. 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 74HC393-Q100: CMOS level
  - For 74HCT393-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)
- Two 4-bit binary counters with individual clocks
- Divide by any binary module up to 28 in one package
- Two master resets to clear each 4-bit counter individually

## 3. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74HC393D-Q100 | –40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74HCT393D-Q100 | | | | |
| 74HC393PW-Q100 | –40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74HCT393PW-Q100 | | | | |
| 74HC393BQ-Q100 | –40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |
| 74HCT393BQ-Q100 | | | | |

## 4. Functional diagram

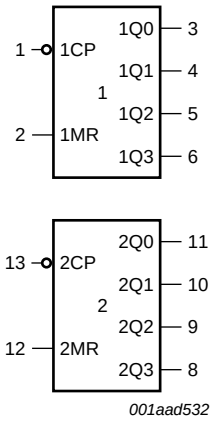


**Fig 1. Logic symbol**

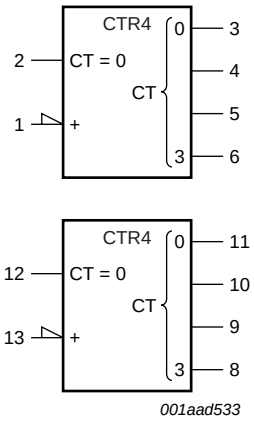


**Fig 2. IEC logic symbol**


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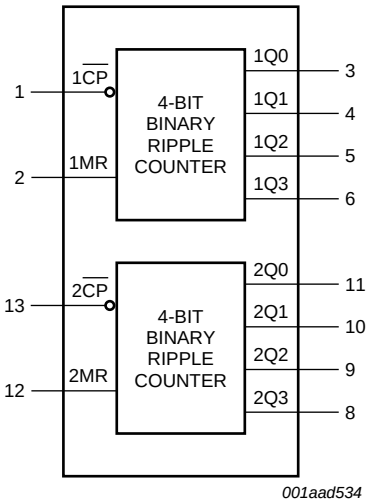


**Fig 3. Functional diagram**

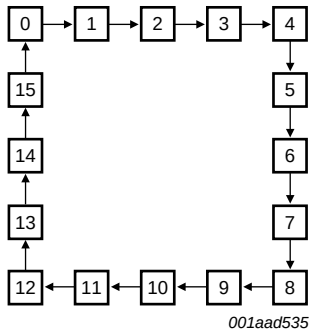


**Fig 4. State diagram**

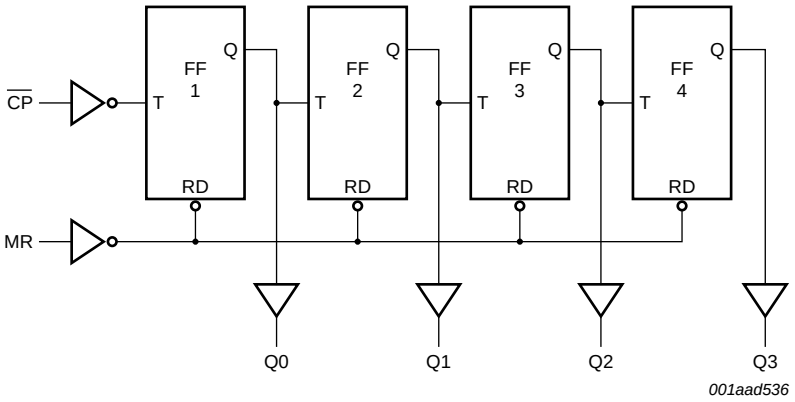


**Fig 5. Logic diagram (one counter)**


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# 5. Pinning information

## 5.1 Pinning

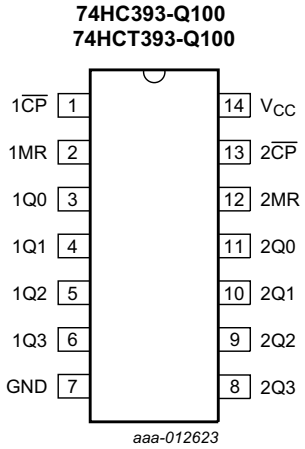



**Fig 6. Pin configuration SO14**

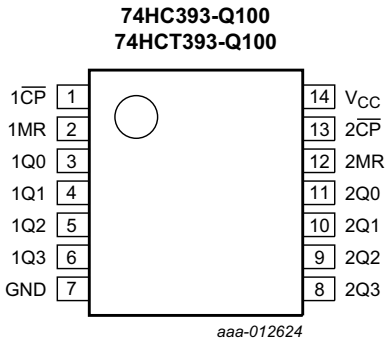
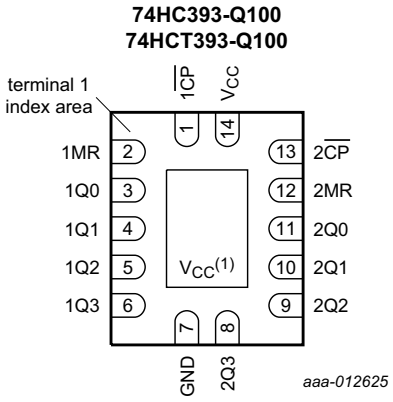



**Fig 7. Pin configuration TSSOP14**




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 8. Pin configuration DHVQFN14**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## 5.2 Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| 1$\overline{CP}$ | 1 | clock input (HIGH-to-LOW, edge-triggered) |
| 1MR | 2 | asynchronous master reset input (active HIGH) |
| 1Q0 | 3 | flip-flop output |
| 1Q1 | 4 | flip-flop output |
| 1Q2 | 5 | flip-flop output |
| 1Q3 | 6 | flip-flop output |
| GND | 7 | ground (0 V) |
| 2Q3 | 8 | flip-flop output |
| 2Q2 | 9 | flip-flop output |
| 2Q1 | 10 | flip-flop output |
| 2Q0 | 11 | flip-flop output |
| 2MR | 12 | asynchronous master reset input (active HIGH) |
| 2$\overline{CP}$ | 13 | clock input (HIGH-to-LOW, edge-triggered) |
| $V_{CC}$ | 14 | supply voltage |


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# 6. Functional description

**Table 3. Count sequence for one counter [1]**

| Count | Output | | | |
|---|---|---|---|---|
| | nQ0 | nQ1 | nQ2 | nQ3 |
| 0 | L | L | L | L |
| 1 | H | L | L | L |
| 2 | L | H | L | L |
| 3 | H | H | L | L |
| 4 | L | L | H | L |
| 5 | H | L | H | L |
| 6 | L | H | H | L |
| 7 | H | H | H | L |
| 8 | L | L | L | H |
| 9 | H | L | L | H |
| 10 | L | H | L | H |
| 11 | H | H | L | H |
| 12 | L | L | H | H |
| 13 | H | L | H | H |
| 14 | L | H | H | H |
| 15 | H | H | H | H |

[1] H = HIGH voltage level; L = LOW voltage level.

# 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 | 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 | $V_O < –0.5$ V or $V_O > V_{CC} + 0.5$ V | - | ±20 | mA |
| $I_O$ | output current | $V_O = –0.5$ V to $V_{CC} + 0.5$ 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 | [1] | - | 500 | mW |

[1] For SO14 package: $P_{tot}$ derates linearly with 8 mW/K above 70 °C.
For TSSOP14 packages: $P_{tot}$ derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN14 packages: $P_{tot}$ derates linearly with 4.5 mW/K above 60 °C.


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## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

*Voltages are referenced to GND (ground = 0 V)*

| Symbol | Parameter | Conditions | 74HC393-Q100 | | | 74HCT393-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 |
| $T_{amb}$ | ambient temperature | | –40 | +25 | +125 | –40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 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 |

## 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 | |
| **74HC393-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 | - | ±0.1 | - | ±0.1 | 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 |


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**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 | |
| $C_I$ | input capacitance | | - | 3.5 | - | | | | | pF |
| **74HCT393-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 |
| | | $I_O$ = −6 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 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 6.0 mA | - | 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 | - | ±1.0 | - | ±1.0 | μA |
| $I_{CC}$ | 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; other inputs at $V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V; $I_O$ = 0 A | | | | | | | | |
| | | per input pin; $n\overline{CP}$ | - | 40 | 144 | - | 180 | - | 196 | μA |
| | | per input pin; nMR | - | 100 | 360 | - | 450 | - | 490 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | | | | | pF |


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## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); $C_L$ = 50 pF unless otherwise specified; for test circuit see Figure 11.*

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| **74HC393-Q100** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | $n\overline{CP}$ to nQ0; see Figure 9 [1] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 41 | 125 | - | 155 | - | 190 | ns |
| | | $V_{CC}$ = 4.5 V | - | 15 | 25 | - | 31 | - | 38 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 12 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 12 | 21 | - | 26 | - | 32 | ns |
| | | nQx to nQ(x+1); see Figure 9 [1] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 14 | 45 | - | 55 | - | 70 | ns |
| | | $V_{CC}$ = 4.5 V | - | 5 | 9 | - | 11 | - | 14 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 5 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 4 | 8 | - | 9 | - | 12 | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | nMR to nQx; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 39 | 140 | - | 175 | - | 210 | ns |
| | | $V_{CC}$ = 4.5 V | - | 14 | 28 | - | 35 | - | 42 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 11 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 11 | 24 | - | 30 | - | 36 | ns |
| $t_t$ | transition time | Qn; see Figure 9 [2] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 19 | 75 | - | 95 | - | 110 | ns |
| | | $V_{CC}$ = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | $V_{CC}$ = 6.0 V | - | 6 | 13 | - | 16 | - | 19 | ns |
| $t_W$ | pulse width | $n\overline{CP}$ HIGH or LOW; see Figure 9 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 80 | 17 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V | 16 | 6 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V | 14 | 5 | - | 17 | - | 20 | - | ns |
| | | nMR HIGH; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 80 | 19 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V | 16 | 7 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V | 14 | 6 | - | 17 | - | 20 | - | ns |
| $t_{rec}$ | recovery time | nMR to $n\overline{CP}$; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 5 | 3 | - | 5 | - | 5 | - | ns |
| | | $V_{CC}$ = 4.5 V | 5 | 1 | - | 5 | - | 5 | - | ns |
| | | $V_{CC}$ = 6.0 V | 5 | 1 | - | 5 | - | 5 | - | ns |


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

*Voltages are referenced to GND (ground = 0 V); $C_L$ = 50 pF unless otherwise specified; for test circuit see Figure 11.*

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $f_{clk(max)}$ | maximum clock frequency | see Figure 9 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 6 | 30 | - | 5 | - | 4 | - | MHz |
| | | $V_{CC}$ = 4.5 V | 30 | 90 | - | 24 | - | 20 | - | MHz |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 99 | - | - | - | - | - | MHz |
| | | $V_{CC}$ = 6.0 V | 35 | 107 | - | 28 | | 24 | - | MHz |
| $C_{PD}$ | power dissipation capacitance | $C_L$ = 50 pF; f = 1 MHz; $V_I$ = GND to $V_{CC}$ [3] | - | 23 | - | - | - | - | - | pF |
| **74HCT393-Q100** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | $n\overline{CP}$ to nQ0; see Figure 9 [1] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 15 | 25 | - | 31 | - | 38 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 20 | - | - | - | - | - | ns |
| | | nQx to nQ(x+1); see Figure 9 [1] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 6 | 10 | - | 13 | - | 15 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 6 | - | - | - | - | - | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | nMR to nQx; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 18 | 32 | - | 40 | - | 48 | ns |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 15 | - | - | - | - | - | ns |
| $t_t$ | transition time | Qn; see Figure 9 [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| $t_W$ | pulse width | $n\overline{CP}$ HIGH or LOW; see Figure 9 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 19 | 11 | - | 24 | - | 29 | - | ns |
| | | nMR HIGH; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 16 | 6 | - | 20 | - | 24 | - | ns |
| $t_{rec}$ | recovery time | nMR to $n\overline{CP}$; see Figure 10 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 5 | 0 | - | 5 | - | 5 | - | ns |
| $f_{clk(max)}$ | maximum clock frequency | see Figure 9 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 27 | 48 | - | 22 | - | 18 | - | MHz |
| | | $V_{CC}$ = 5 V; $C_L$ = 15 pF | - | 53 | - | - | - | - | - | MHz |


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

*Voltages are referenced to GND (ground = 0 V); $C_L$ = 50 pF unless otherwise specified; for test circuit see Figure 11.*

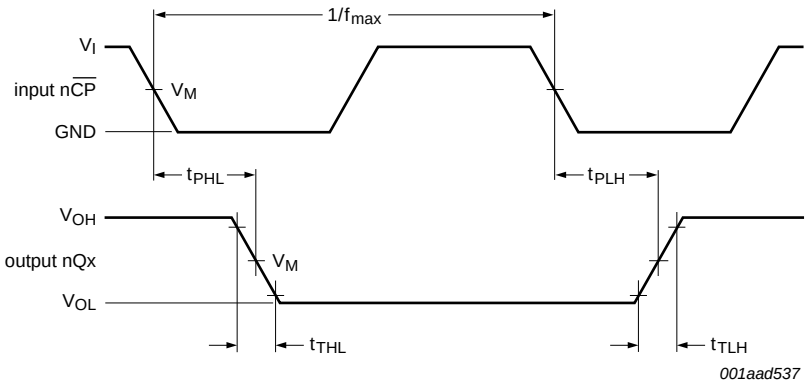
| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $C_{PD}$ | power dissipation capacitance | $C_L$ = 50 pF; f = 1 MHz; $V_I$ = GND to $V_{CC}$ − 1.5 V [3] | - | 25 | - | - | - | - | - | pF |

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

[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).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ 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;
$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

## 10.1 Waveforms




Measurement points are given in Table 8.

**Fig 9. Propagation delays clock (nCP) to output (nQx), the output transition times and the maximum clock frequency**

**Table 8. Measurement points**

| Type | Input | Output |
|---|---|---|
| | $V_M$ | $V_M$ |
| 74HC393-Q100 | 0.5$V_{CC}$ | 0.5$V_{CC}$ |
| 74HCT393-Q100 | 1.3 V | 1.3 V |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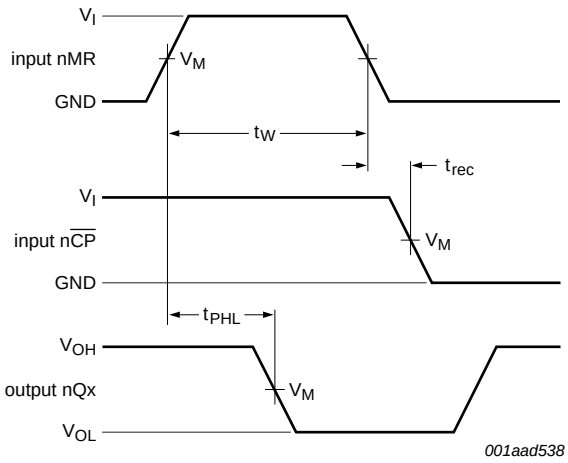


Measurement points are given in Table 8.

**Fig 10. Propagation delays clock ($\overline{nCP}$) to output (nQx), pulse width master reset (nMR), and recovery time master reset (nMR) to clock ($\overline{nCP}$)**


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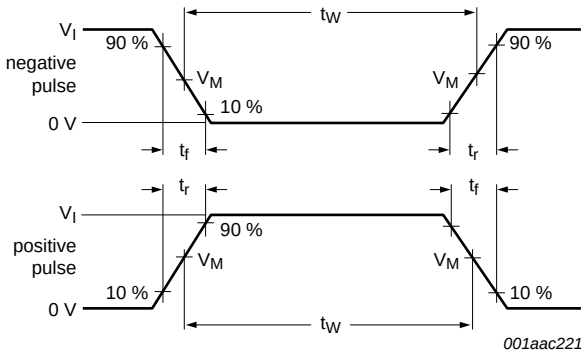
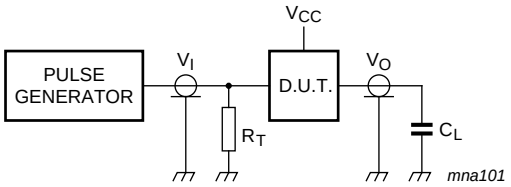



Measurement points are given in Table 8.

a. Input pulse definition




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.

b. Test circuit

**Fig 11. Test circuit for measuring switching times**

**Table 9. Test data**

| Type | Input | | Load |
|---|---|---|---|
| | $V_I$ | $t_r$, $t_f$ | $C_L$ |
| 74HC393-Q100 | $V_{CC}$ | 6 ns | 15 pF, 50 pF |
| 74HCT393-Q100 | 3 V | 6 ns | 15 pF, 50 pF |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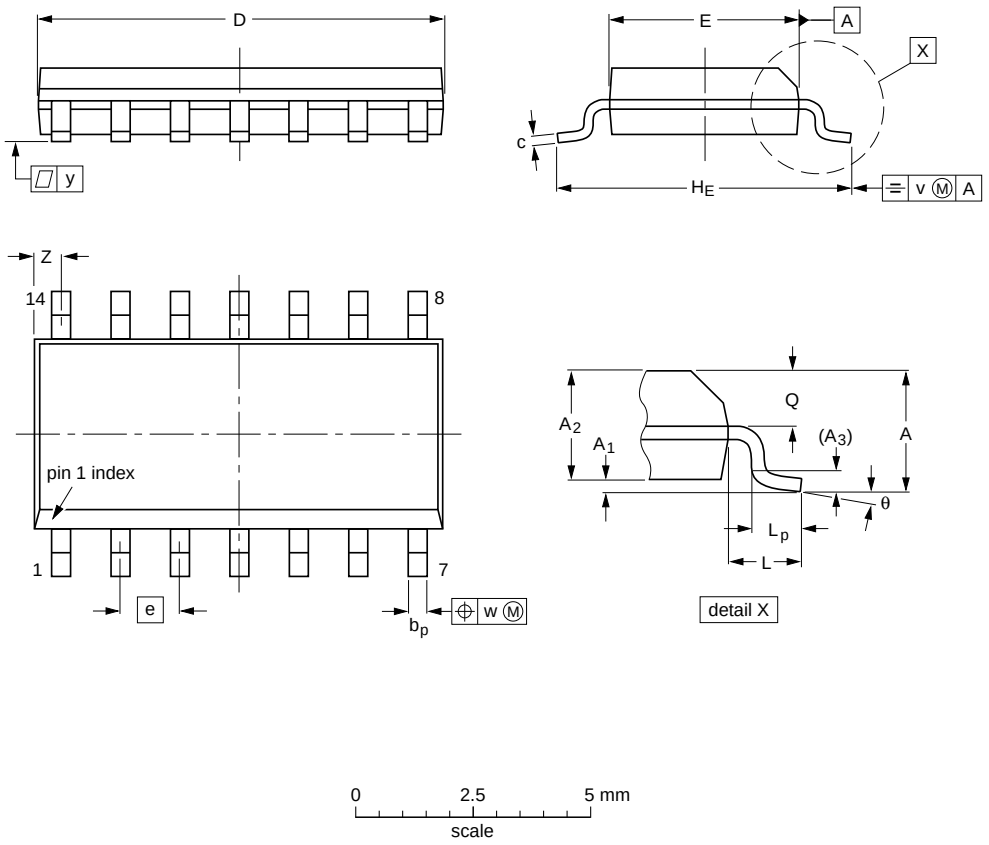
## 11. Package outline

**SO14: plastic small outline package; 14 leads; body width 3.9 mm** **SOT108-1**




**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 | 8.75<br>8.55 | 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 | 0.35<br>0.34 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 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 | | | |
| SOT108-1 | 076E06 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 12. Package outline SOT108-1 (SO14)**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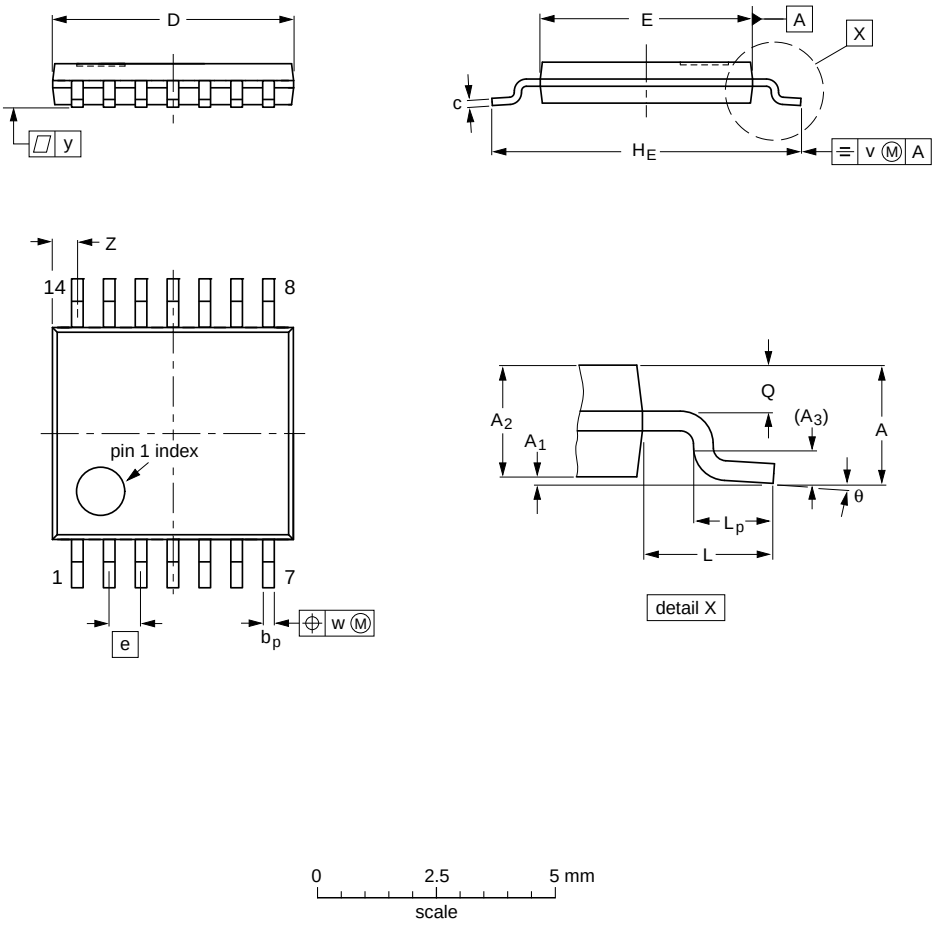
**TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm** **SOT402-1**




**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 | 0.72<br>0.38 | $8^o$<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 | | | |
| SOT402-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**Fig 13. Package outline SOT402-1 (TSSOP14)**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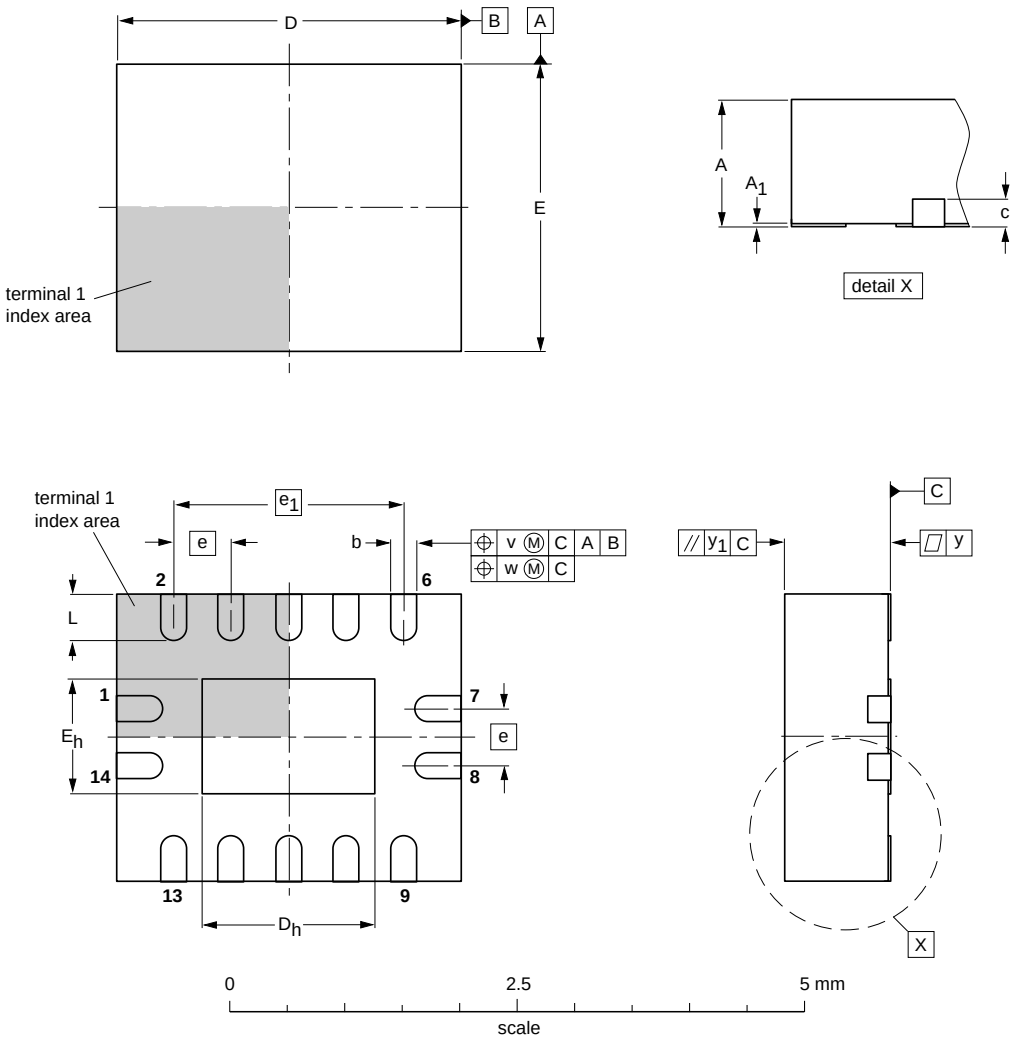
**DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm** **SOT762-1**




**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 | 3.1<br>2.9 | 1.65<br>1.35 | 2.6<br>2.4 | 1.15<br>0.85 | 0.5 | 2 | 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 | | | |
| SOT762-1 | - - - | MO-241 | - - - | | | ~~02-10-17~~<br>03-01-27 |

**Fig 14. Package outline SOT762-1 (DHVQFN14)**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## 12. 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 |

## 13. Revision history

**Table 11. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74HC_HCT393_Q100 v.1 | 20140619 | Product data sheet | - | - |


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| 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".

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