# 74HC4520; 74HCT4520

## Dual 4-bit synchronous binary counter

Rev. 3 — 4 December 2014 Product data sheet

## 1. General description

The 74HC4520; 74HCT4520 are dual 4-bit internally synchronous binary counters with two clock inputs (nCP0 and $n\overline{CP}1$). They have buffered outputs from all 4 bit positions (nQ0 to nQ3) and an asynchronous master reset input (nMR). The counter advances on the LOW-to-HIGH transition of nCP0 when $n\overline{CP}1$ is HIGH. It also advances on the HIGH-to-LOW transition of $n\overline{CP}1$ when nCP0 is LOW. Either nCP0 or $n\overline{CP}1$ may be used as the clock input to the counter. The other clock input may be used as a clock enable input. A HIGH on nMR, resets the counter (nQ0 to nQ3 = LOW) independent of nCP0 and $n\overline{CP}1$. Inputs include clamp diodes. It enables the use of current limiting resistors to interface inputs to voltages in excess of $V_{CC}$.

## 2. Features and benefits

- Complies with JEDEC standard no. 7A
- Input levels:
  - For 74HC4520: CMOS level
  - For 74HCT4520: TTL level
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from −40 °C to +85 °C and −40 °C to +125 °C

## 3. Applications

- Multistage synchronous counting
- Multistage asynchronous counting
- Frequency dividers

## 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74HC4520N | –40 °C to +125 °C | DIP16 | plastic dual in-line package; 16 leads (300 mil) | SOT38-4 |
| 74HCT4520N | | | | |
| 74HC4520D | –40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74HCT4520D | | | | |
| 74HC4520DB | –40 °C to +125 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74HCT4520DB | | | | |
| 74HC4520PW | –40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

## 5. Functional diagram

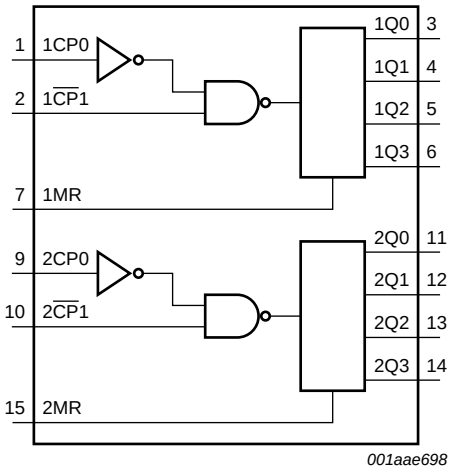



**Fig 1. Functional diagram**


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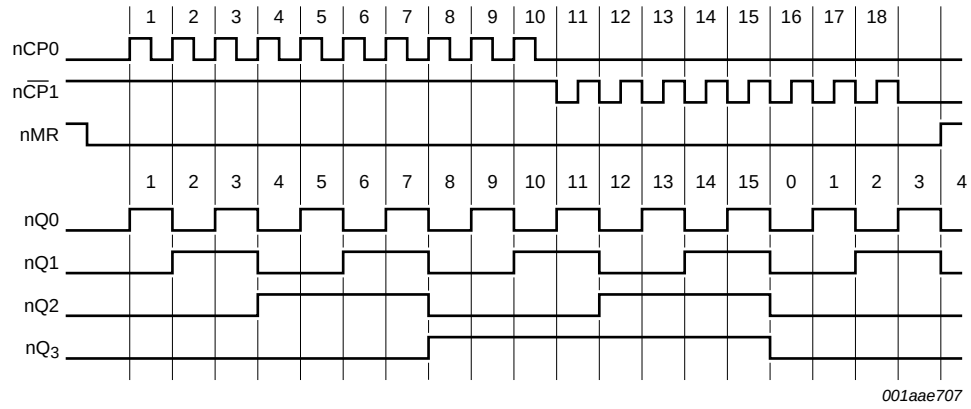



**Fig 2. Timing diagram**

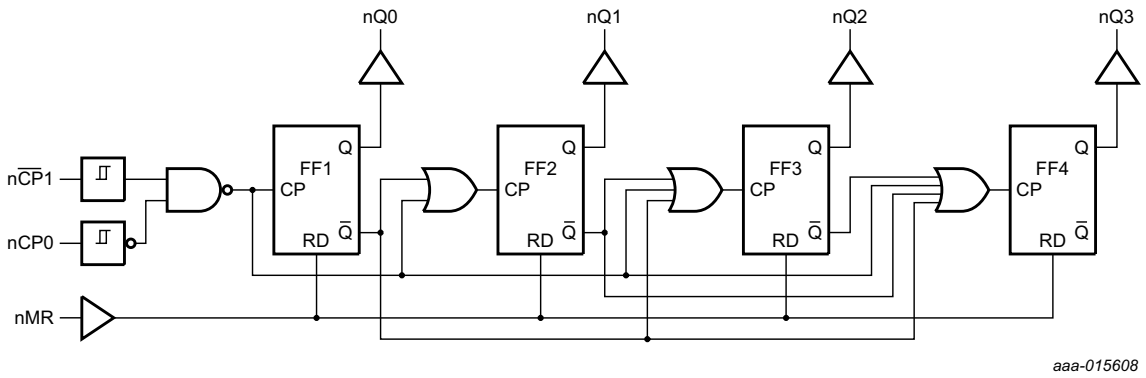



**Fig 3. Logic diagram for one counter**


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# 6. Pinning information

## 6.1 Pinning

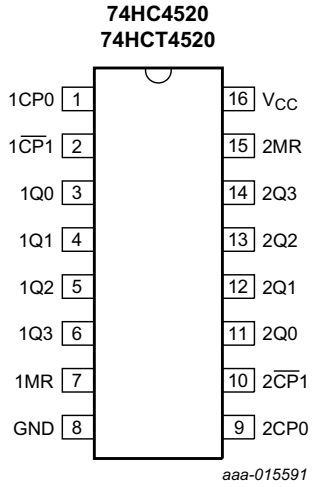



Fig 4. Pin configuration DIP16

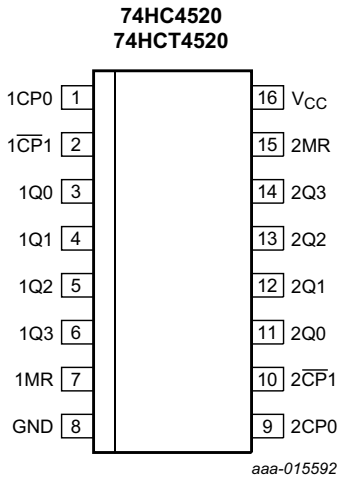



Fig 5. Pin configuration SO16

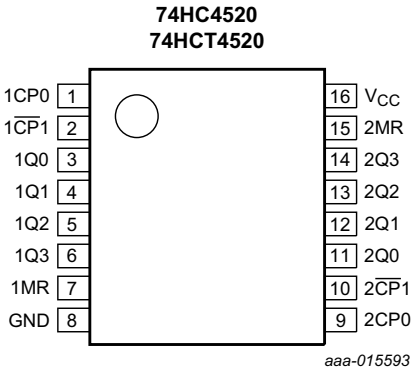



Fig 6. Pin configuration TSSOP16 and SSOP16

## 6.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|---|---|---|
| 1CP0, 2CP0 | 1, 9 | clock input (LOW-to-HIGH edge-triggered) |
| $1\overline{CP}1$, $2\overline{CP}1$ | 2, 10 | clock input (HIGH-to-LOW edge-triggered) |
| 1Q0 to 1Q3 | 3, 4, 5, 6 | output |
| 1MR, 2MR | 7, 15 | asynchronous master reset input (active HIGH) |
| GND | 8 | ground (0 V) |
| 2Q0 to 2Q3 | 11, 12, 13, 14 | output |
| $V_{CC}$ | 16 | supply voltage |


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# 7. Functional description

**Table 3. Function table[1]**

| nCP0 | $\overline{nCP1}$ | nMR | Mode |
|---|---|---|---|
| ↑ | H | L | counter advances |
| L | ↓ | L | counter advances |
| ↓ | X | L | no change |
| X | ↑ | L | no change |
| ↑ | L | L | no change |
| H | ↓ | L | no change |
| X | X | H | nQ0 to nQ3 = LOW |

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

# 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 | +7.0 | 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 | DIP16 package [1] | - | 750 | mW |
| | | SO16 package [1] | - | 500 | mW |
| | | (T)SSOP16 package [1] | - | 500 | mW |

[1] For DIP16 packages: above 70 °C the value of $P_{tot}$ derates linearly at 12 mW/K.
For SO16 packages: above 70 °C the value of $P_{tot}$ derates linearly at 8 mW/K.
For (T)SSOP16 packages: above 60 °C the value of $P_{tot}$ derates linearly at 5.5 mW/K.


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## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

| Symbol | Parameter | Conditions | 74HC4520 | | | 74HCT4520 | | | 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 |

## 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 | |
| **74HC4520** | | | | | | | | | | |
| $V_{IH}$ | 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; $V_{CC}$ = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | $I_O$ = –5.2; $V_{CC}$ = 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 | - | ±1.0 | - | ±1.0 | μA |
| $I_{CC}$ | supply current | $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 6.0 V | - | - | 8.0 | - | 80.0 | - | 160.0 | 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 |
| **74HCT4520** | | | | | | | | | | |
| $V_{IH}$ | 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 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 4.0 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 | - | 80.0 | - | 160.0 | μA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I$ = $V_{CC}$ – 2.1 V; other inputs at $V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V; $I_O$ = 0 A | | | | | | | | |
| | | pin nCP0, $\overline{nCP1}$ | - | 80 | 288 | - | 360 | - | 392 | μA |
| | | pin nMR | - | 150 | 540 | - | 675 | - | 735 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

# 11. 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 8.*

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| **74HC4520** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | nCP0 to nQn; see Figure 7 [1] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 77 | 240 | - | 300 | - | 360 | ns |
| | | $V_{CC}$ = 4.5 V | - | 28 | 48 | - | 60 | - | 72 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 24 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 22 | 41 | - | 51 | - | 61 | ns |
| | | $\overline{nCP1}$ to nQn; see Figure 7 [1] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 77 | 240 | - | 300 | - | 360 | ns |
| | | $V_{CC}$ = 4.5 V | - | 28 | 48 | - | 60 | - | 72 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 24 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 22 | 41 | - | 51 | - | 61 | 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 8.*

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{PHL}$ | HIGH to LOW propagation delay | nMR to nQn; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | - | 44 | 150 | - | 190 | - | 225 | ns |
| | | $V_{CC}$ = 4.5 V | - | 16 | 30 | - | 38 | - | 45 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 13 | - | - | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | - | 13 | 26 | - | 33 | - | 38 | ns |
| $t_t$ | transition time | nQn; see Figure 7 [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 | nCP0, $\overline{nCP1}$ HIGH or LOW; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 80 | 22 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V | 16 | 8 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V | 14 | 6 | - | 17 | - | 20 | - | ns |
| | | nMR HIGH; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 120 | 39 | - | 150 | - | 180 | - | ns |
| | | $V_{CC}$ = 4.5 V | 24 | 14 | - | 30 | - | 36 | - | ns |
| | | $V_{CC}$ = 6.0 V | 20 | 11 | - | 26 | - | 31 | - | ns |
| $t_{rec}$ | recovery time | nMR to nCP0, $\overline{nCP1}$; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 0 | –28 | - | 0 | - | 0 | - | ns |
| | | $V_{CC}$ = 4.5 V | 0 | –10 | - | 0 | - | 0 | - | ns |
| | | $V_{CC}$ = 6.0 V | 0 | –8 | - | 0 | - | 0 | - | ns |
| $t_{su}$ | set-up time | nCP0 to $\overline{nCP1}$; $\overline{nCP1}$ to nCP0; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 80 | 14 | - | 100 | - | 120 | - | ns |
| | | $V_{CC}$ = 4.5 V | 16 | 5 | - | 20 | - | 24 | - | ns |
| | | $V_{CC}$ = 6.0 V | 14 | 4 | - | 17 | - | 20 | - | ns |
| $f_{max}$ | maximum frequency | nCP0, $\overline{nCP1}$; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 2.0 V | 6 | 19 | - | 4.8 | - | 4 | - | MHz |
| | | $V_{CC}$ = 4.5 V | 30 | 58 | - | 24 | - | 20 | - | MHz |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 68 | - | - | - | - | - | MHz |
| | | $V_{CC}$ = 6.0 V | 35 | 69 | - | 28 | - | 24 | - | MHz |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$; $V_{CC}$ = 5 V; $f_i$ = 1 MHz [3] | - | 29 | - | - | - | - | - | pF |
| **74HCT4520** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | nCP0 to nQn; see Figure 7 [1] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 28 | 53 | - | 66 | - | 80 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 24 | - | - | - | - | - | ns |
| | | $\overline{nCP1}$ to nQn; see Figure 7 [1] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 25 | 53 | - | 66 | - | 80 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 24 | - | - | - | - | - | 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 8.*

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{PHL}$ | HIGH to LOW propagation delay | nMR to nQn; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 16 | 35 | - | 44 | - | 53 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 13 | - | - | - | - | - | ns |
| $t_t$ | transition time | nQn; see Figure 7 [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| $t_W$ | pulse width | nCP0, n$\overline{CP}$1 HIGH or LOW; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 20 | 10 | - | 25 | - | 30 | - | ns |
| | | nMR HIGH; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 20 | 12 | - | 25 | - | 30 | - | ns |
| $t_{rec}$ | recovery time | nMR to nCP0, n$\overline{CP}$1; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 0 | –8 | - | 0 | - | 0 | - | ns |
| $t_{su}$ | set-up time | nCP0 to n$\overline{CP}$1; n$\overline{CP}$1 to nCP0; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 16 | 6 | - | 20 | - | 24 | - | ns |
| $f_{max}$ | maximum frequency | nCP0, n$\overline{CP}$1; see Figure 7 | | | | | | | | |
| | | $V_{CC}$ = 4.5 V | 30 | 58 | - | 24 | - | 20 | - | MHz |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | - | 64 | - | - | - | - | - | MHz |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$ − 1.5 V; $V_{CC}$ = 5 V; $f_i$ = 1 MHz [3] | - | 24 | - | - | - | - | - | pF |

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

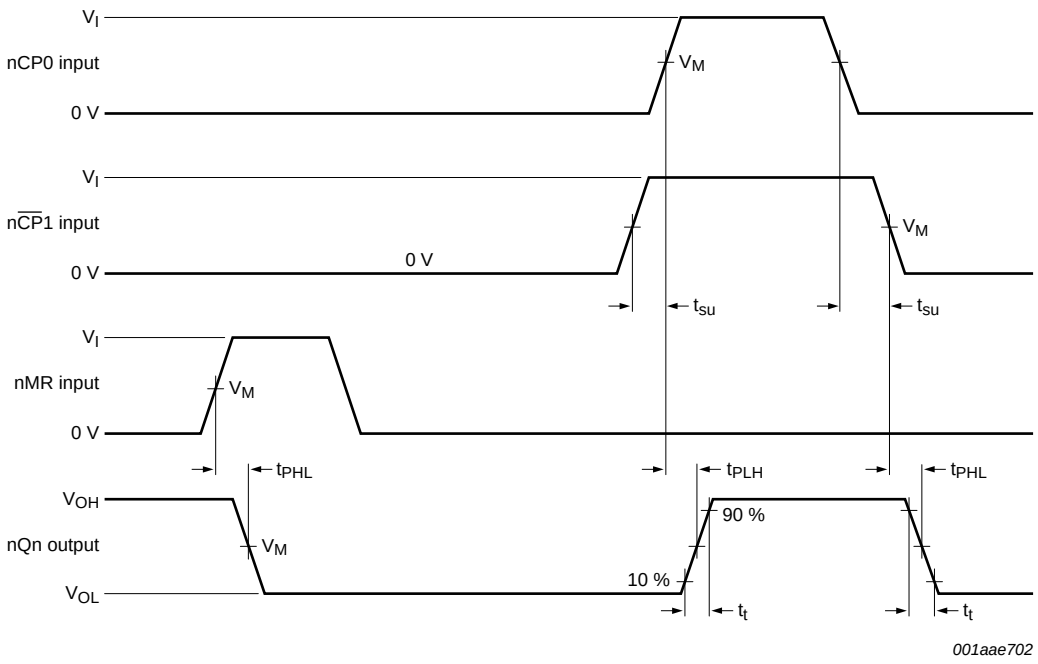
[2] $t_t$ is the same as $t_{THL}$ and $t_{TLH}$.

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

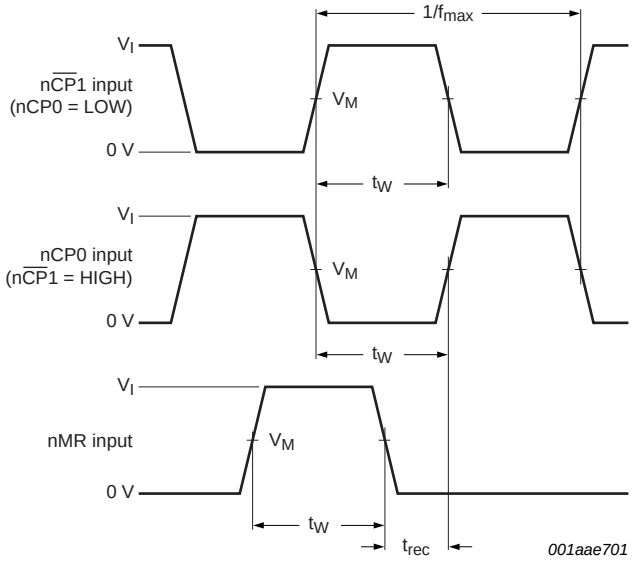

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## 12. Waveforms




a. nCP0 and nCP1 set-up times, propagation delays and output transition times




b. nMR recovery time, minimum nCP0, nCP1, nMR pulse widths and maximum frequency

Measurement points are given in Table 8.

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

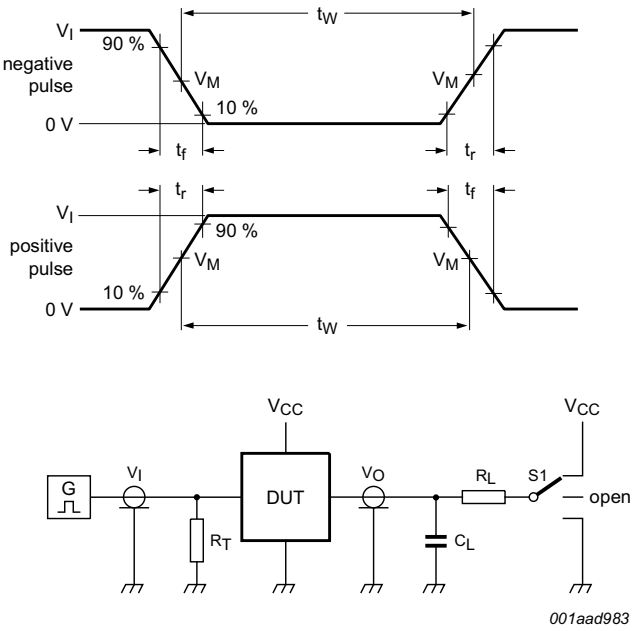
**Fig 7. Waveforms showing measurements for switching times**


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**Table 8. Measurement points**

| Type | Input | | Output |
|---|---|---|---|
| | $V_M$ | $V_I$ | $V_M$ |
| 74HC4520 | $0.5 \times V_{CC}$ | GND to $V_{CC}$ | $0.5 \times V_{CC}$ |
| 74HCT4520 | 1.3 V | GND to 3 V | 1.3 V |




Test data is given in Table 9.

Test circuit definitions:

$R_T$ = 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 8. Test circuit for measuring switching times**

**Table 9. Test data**

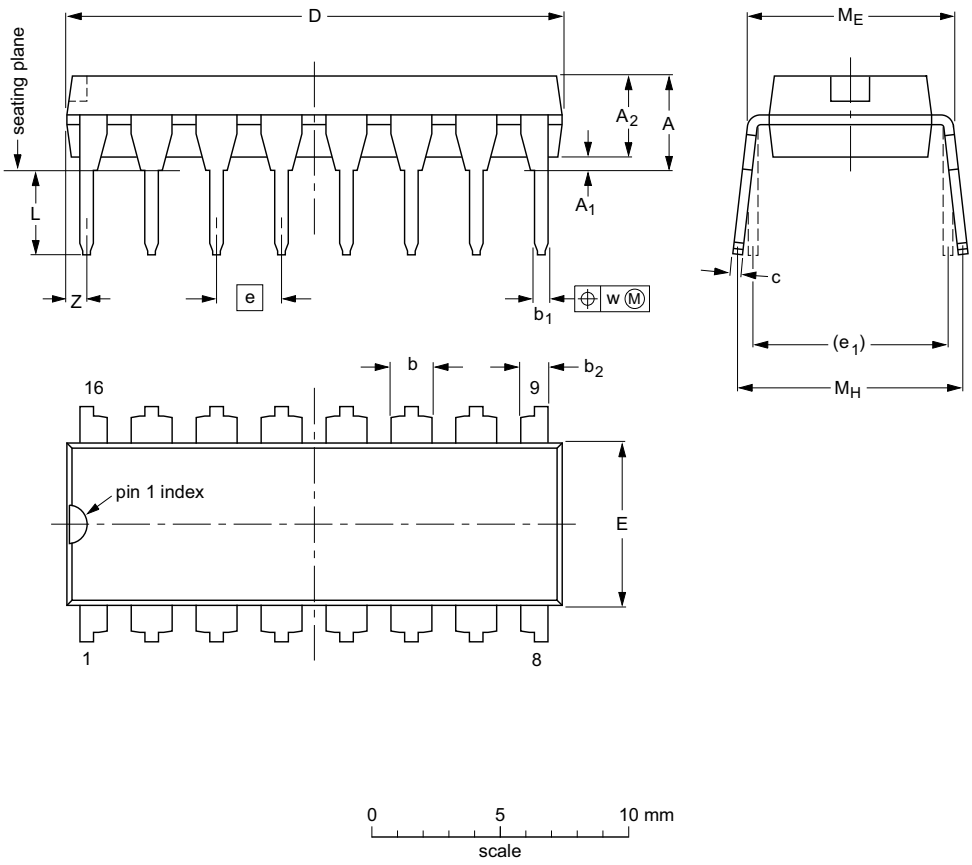
| Type | Input | | Load | | S1 position |
|---|---|---|---|---|---|
| | $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PHL}$, $t_{PLH}$ |
| 74HC4520 | $V_{CC}$ | 6 ns | 15 pF, 50 pF | 1 kΩ | open |
| 74HCT4520 | 3 V | 6 ns | 15 pF, 50 pF | 1 kΩ | open |


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## 13. Package outline

**DIP16: plastic dual in-line package; 16 leads (300 mil)** **SOT38-4**




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

| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | $b_2$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.30 | 0.53<br>0.38 | 1.25<br>0.85 | 0.36<br>0.23 | 19.50<br>18.55 | 6.48<br>6.20 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 0.76 |
| inches | 0.17 | 0.02 | 0.13 | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 0.014<br>0.009 | 0.77<br>0.73 | 0.26<br>0.24 | 0.1 | 0.3 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.03 |

**Note**

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

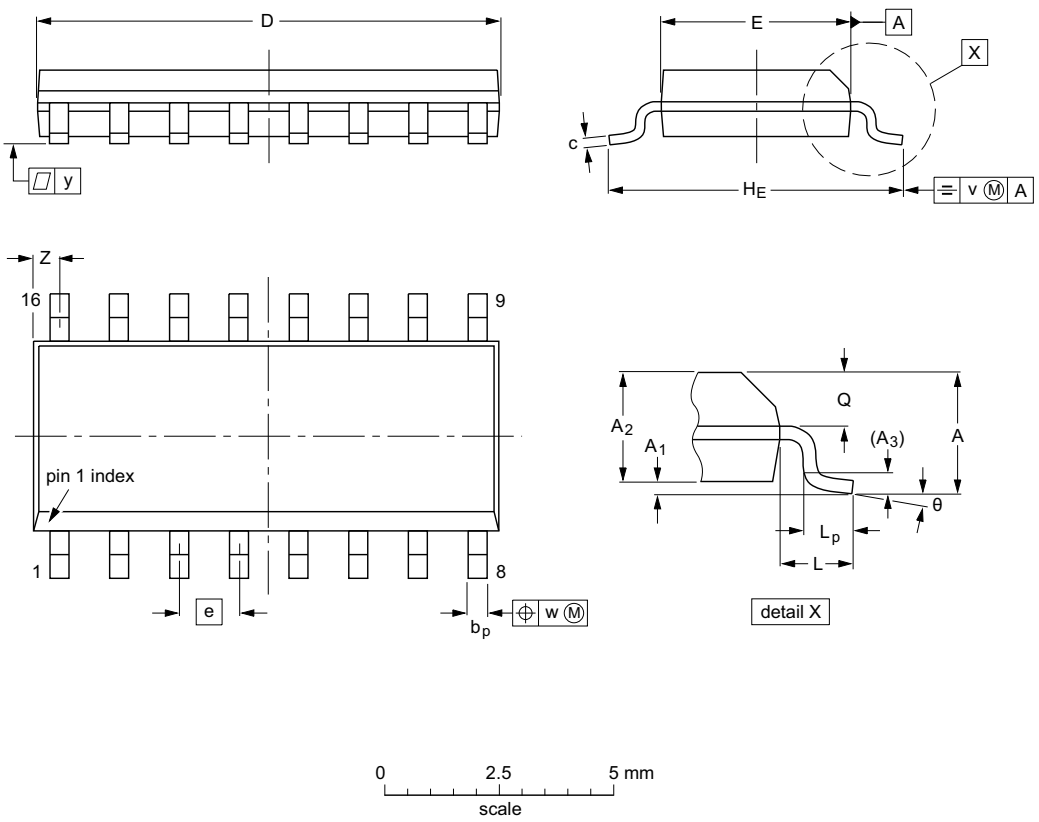
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT38-4 | | | | | | ~~95-01-14~~<br>03-02-13 |

**Fig 9. Package outline SOT38-4 (DIP16)**


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**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.

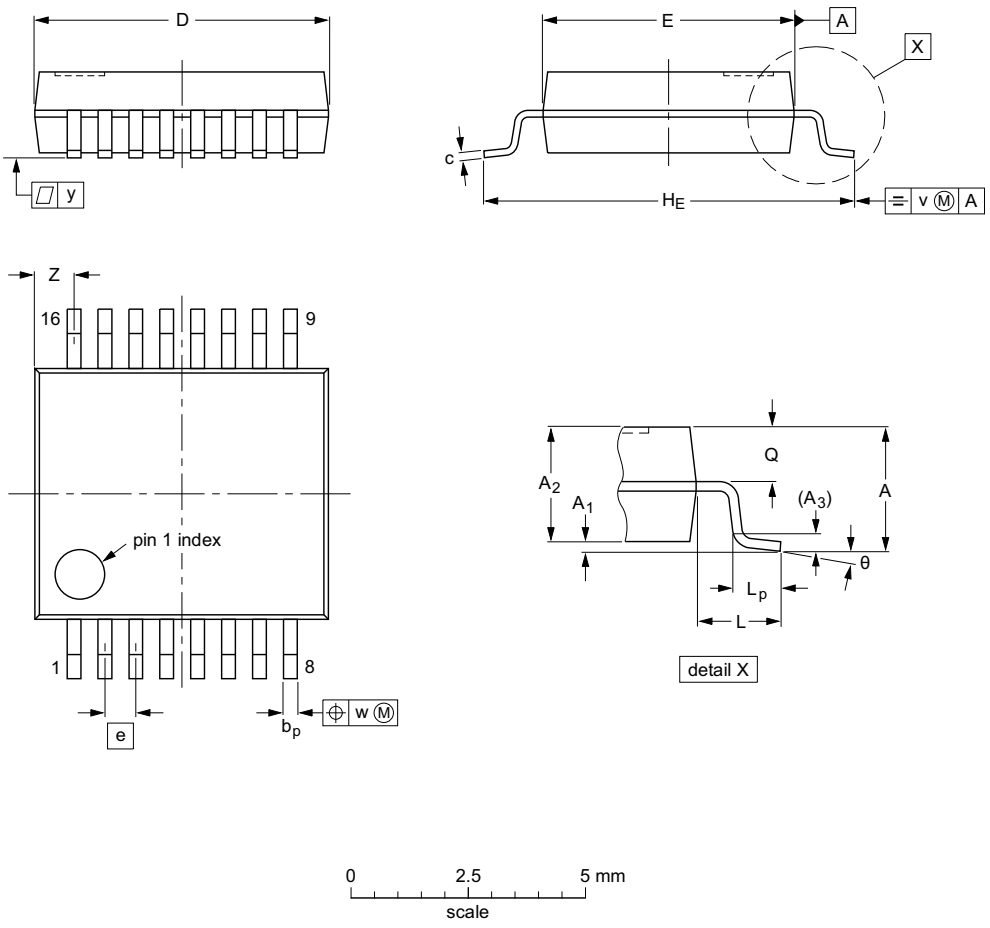
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT109-1 | 076E07 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 10. Package outline SOT109-1 (SO16)**


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**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°<br>0° |

**Note**

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

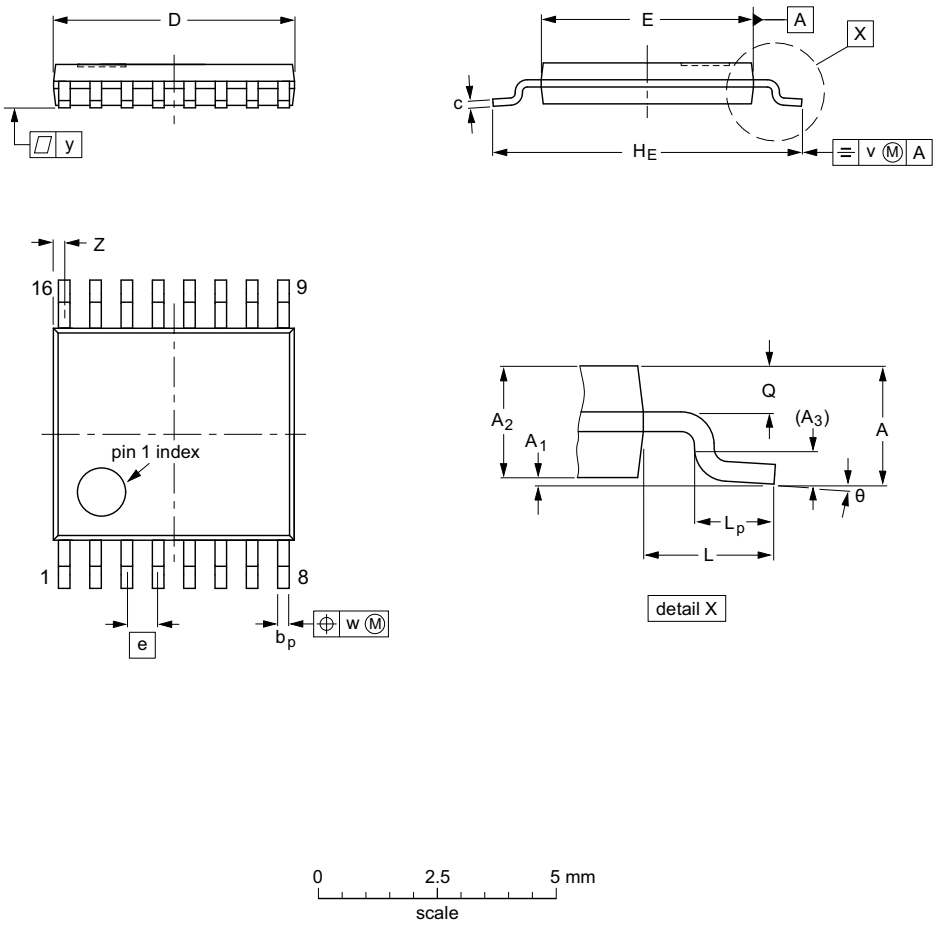
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT338-1 | | MO-150 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 11. Package outline SOT338-1 (SSOP16)**


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**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)**


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## 14. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| LSTTL | Low-power Schottky Transistor-Transistor Logic |
| 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_HCT4520 v.3 | 20141204 | Product data sheet | - | 74HC_HCT4520_CNV v.2 |
| 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. | | | |
| 74HC_HCT4520_CNV v.2 | 19930927 | Product specification | - | - |


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|---|---|---|
| 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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