

74HC4053; 74HCT4053

Triple 2-channel analog multiplexer/demultiplexer

Rev. 9 — 10 February 2016

Product data sheet

1. General description

The 74HC4053; 74HCT4053 is a triple single-pole double-throw analog switch (3x SPDT) suitable for use in analog or digital 2:1 multiplexer/demultiplexer applications. Each switch features a digital select input (S_n), two independent inputs/outputs (nY_0 and nY_1) and a common input/output (nZ). A digital enable input (\bar{E}) is common to all switches. When \bar{E} is HIGH, the switches are turned off. 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 analog input voltage range from -5 V to $+5\text{ V}$
- Complies with JEDEC standard no. 7A
- Low ON resistance:
 - ◆ $80\ \Omega$ (typical) at $V_{CC} - V_{EE} = 4.5\text{ V}$
 - ◆ $70\ \Omega$ (typical) at $V_{CC} - V_{EE} = 6.0\text{ V}$
 - ◆ $60\ \Omega$ (typical) at $V_{CC} - V_{EE} = 9.0\text{ V}$
- Logic level translation: to enable 5 V logic to communicate with $\pm 5\text{ V}$ analog signals
- Typical 'break before make' built-in
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Applications

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating

4. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|----------|--|----------|
| | Temperature range | Name | Description | |
| 74HC4053D | -40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74HCT4053D | | | | |
| 74HC4053DB | -40 °C to +125 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74HCT4053DB | | | | |
| 74HC4053PW | -40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |
| 74HCT4053PW | | | | |
| 74HC4053BQ | -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 |
| 74HCT4053BQ | | | | |

5. Functional diagram

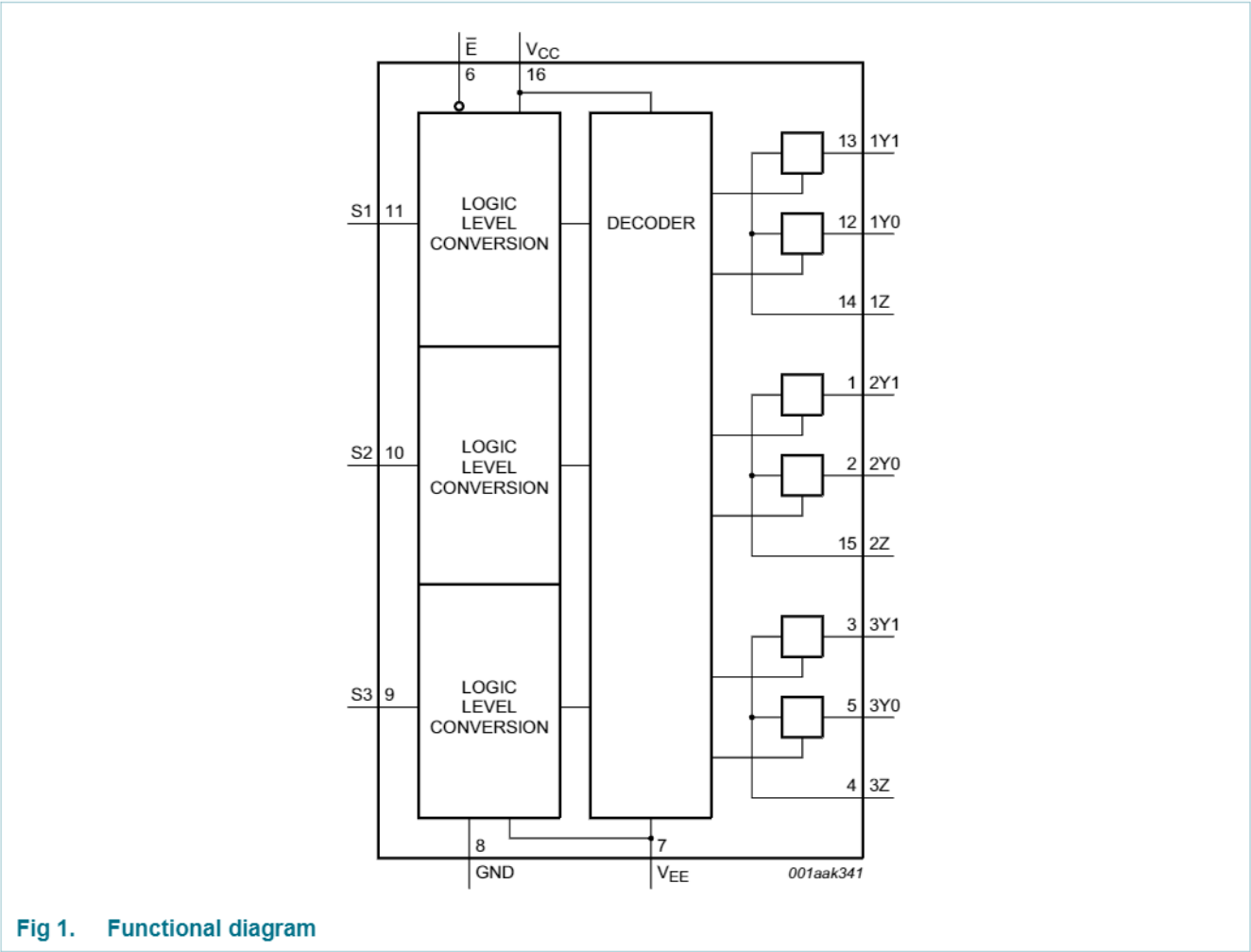
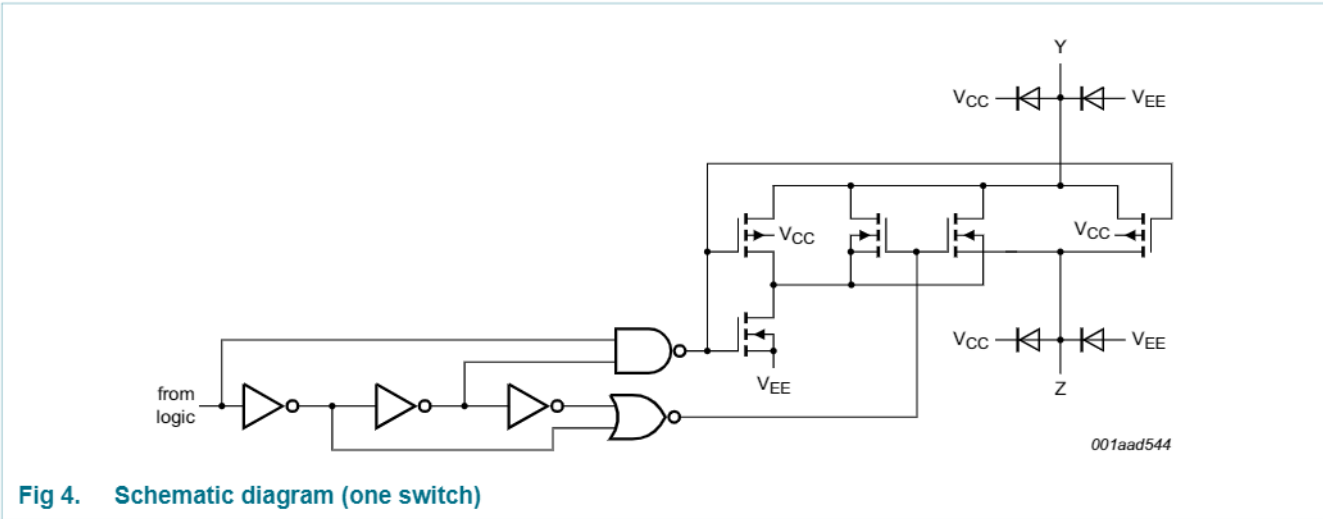
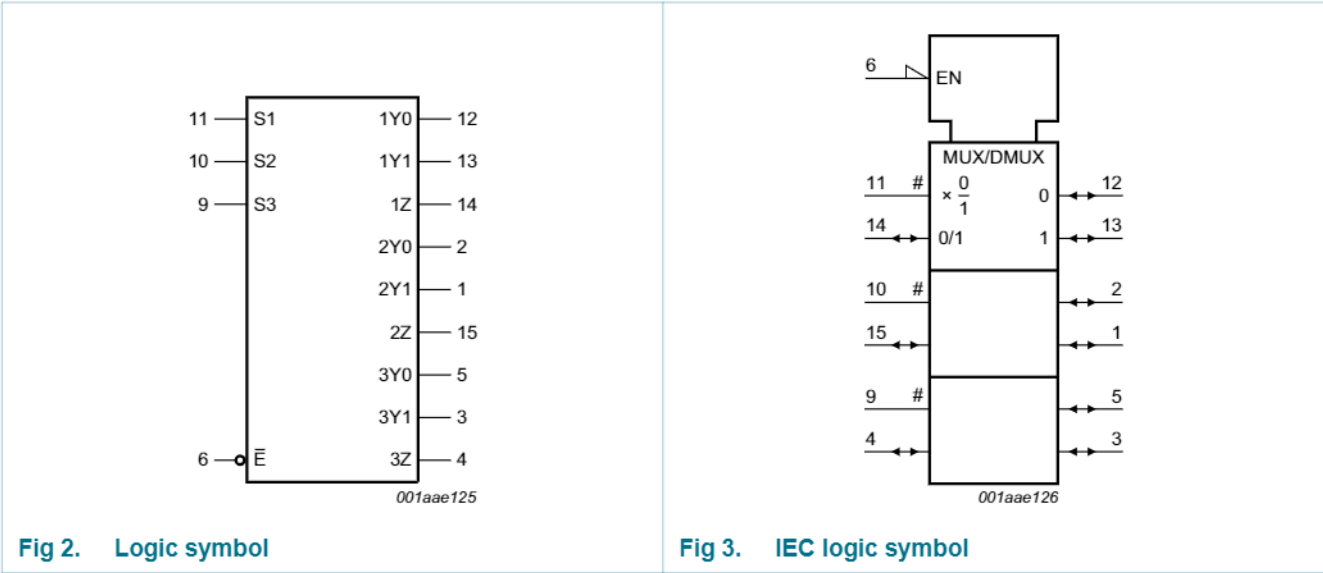
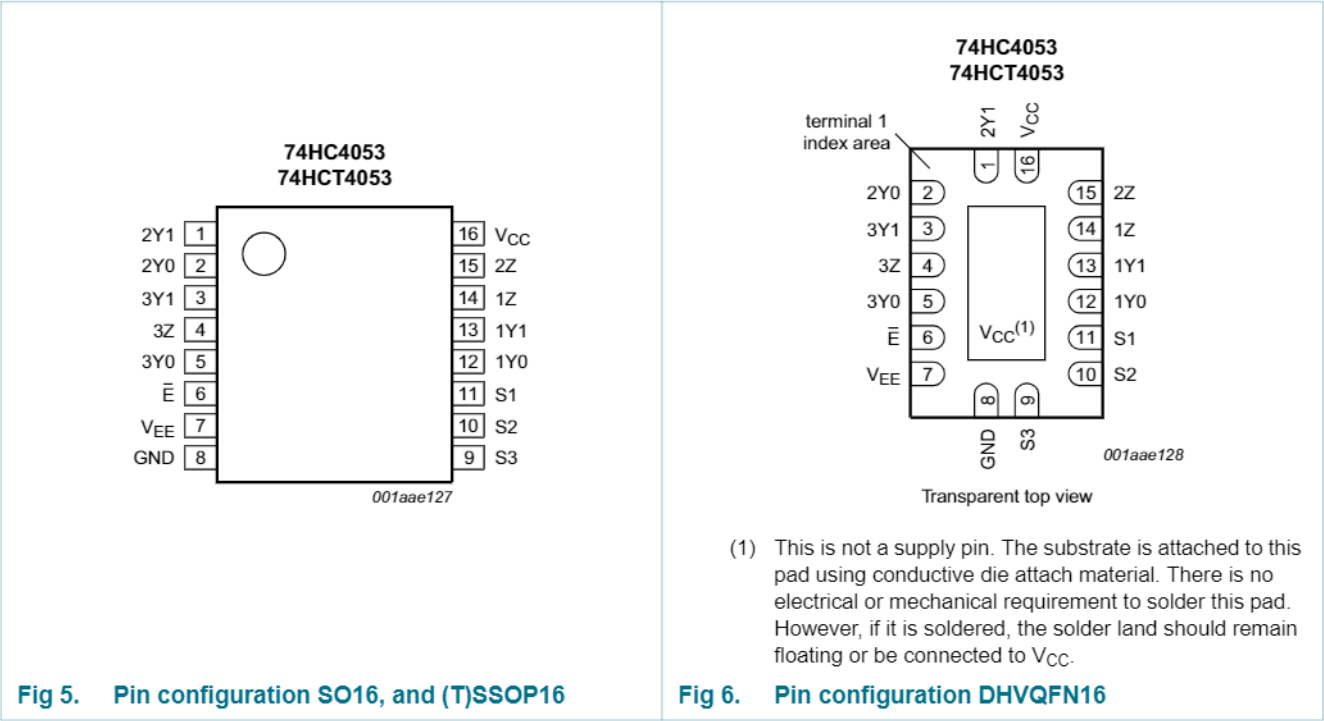


Fig 1. Functional diagram



6. Pinning information

6.1 Pinning



6.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|---------------|-----------|-----------------------------|
| \bar{E} | 6 | enable input (active LOW) |
| V_{EE} | 7 | supply voltage |
| GND | 8 | ground supply voltage |
| S1, S2, S3 | 11, 10, 9 | select input |
| 1Y0, 2Y0, 3Y0 | 12, 2, 5 | independent input or output |
| 1Y1, 2Y1, 3Y1 | 13, 1, 3 | independent input or output |
| 1Z, 2Z, 3Z | 14, 15, 4 | common output or input |
| V_{CC} | 16 | supply voltage |

7. Functional description

Table 3. Function table [1]

| Inputs | | Channel on |
|-----------------------|--------------|--------------|
| $\overline{\text{E}}$ | S_n | |
| L | L | nY0 to nZ |
| L | H | nY1 to nZ |
| H | X | switches off |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

8. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to $V_{SS} = 0 \text{ V}$ (ground).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|-------|------|
| V_{CC} | supply voltage | [1] | -0.5 | +11.0 | V |
| I_{IK} | input clamping current | $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$ | - | ±20 | mA |
| I_{SK} | switch clamping current | $V_{SW} < -0.5 \text{ V}$ or $V_{SW} > V_{CC} + 0.5 \text{ V}$ | - | ±20 | mA |
| I_{SW} | switch current | $-0.5 \text{ V} < V_{SW} < V_{CC} + 0.5 \text{ V}$ | - | ±25 | mA |
| I_{EE} | supply current | | - | ±20 | 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 | SO16, (T)SSOP16, and DHVQFN16 package [2] | - | 500 | mW |
| P | power dissipation | per switch | - | 100 | mW |

[1] To avoid drawing V_{CC} current out of terminal nZ, when switch current flows into terminals nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal nZ, no V_{CC} current will flow out of terminals nYn, and in this case there is no limit for the voltage drop across the switch, but the voltages at nYn and nZ may not exceed V_{CC} or V_{EE} .

[2] For SO16 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
 For SSOP16 and TSSOP16 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN16 packages: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

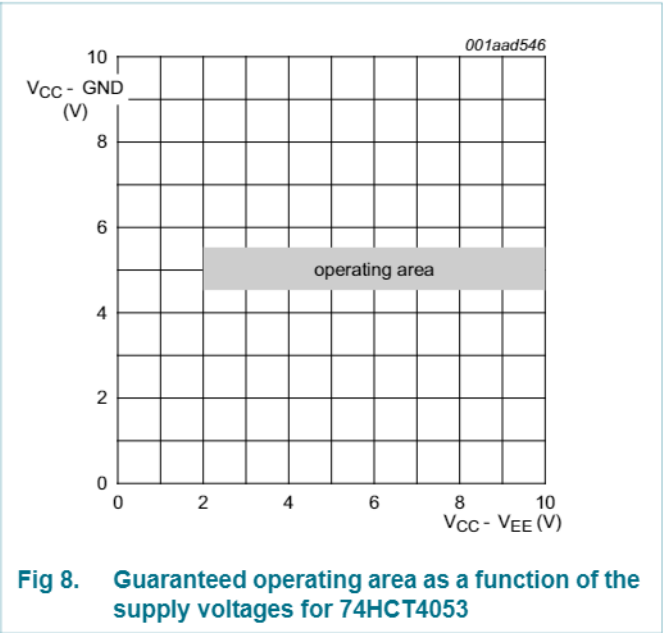
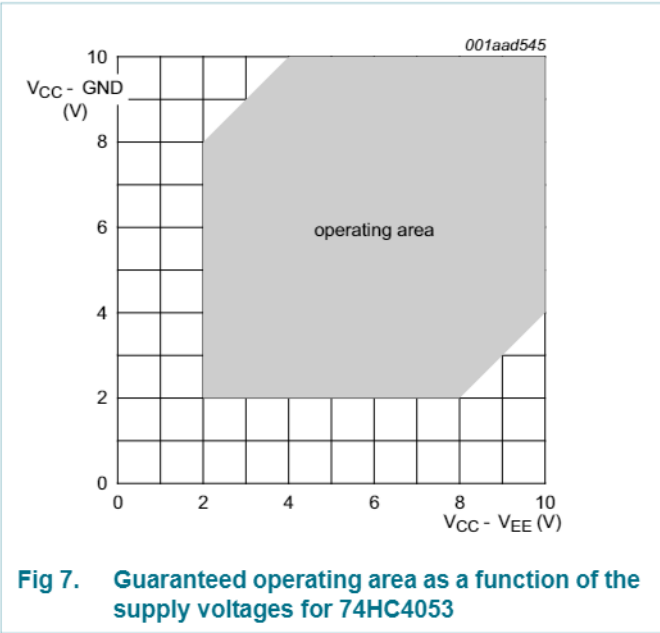
9. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | 74HC4053 | | | 74HCT4053 | | | Unit |
|----------|----------------|---------------------------|----------|-----|----------|-----------|-----|----------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | supply voltage | see Figure 7 and Figure 8 | | | | | | | |
| | | $V_{CC} - GND$ | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V |
| | | $V_{CC} - V_{EE}$ | 2.0 | 5.0 | 10.0 | 2.0 | 5.0 | 10.0 | V |
| V_I | input voltage | | GND | - | V_{CC} | GND | - | V_{CC} | V |
| V_{SW} | switch voltage | | V_{EE} | - | V_{CC} | V_{EE} | - | V_{CC} | V |

Table 5. Recommended operating conditions ...continued

| Symbol | Parameter | Conditions | 74HC4053 | | | 74HCT4053 | | | Unit |
|------------------|-------------------------------------|--------------------------|----------|------|------|-----------|------|------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| T _{amb} | ambient temperature | | −40 | +25 | +125 | −40 | +25 | +125 | °C |
| Δt/ΔV | 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 |
| | | V _{CC} = 10.0 V | - | - | 31 | - | - | - | ns/V |



10. Static characteristics

Table 6. R_{ON} resistance per switch for 74HC4053 and 74HCT4053

$V_I = V_{IH}$ or V_{IL} ; for test circuit see [Figure 9](#).

V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

For 74HC4053: $V_{CC} - GND$ or $V_{CC} - V_{EE} = 2.0\text{ V}$, 4.5 V , 6.0 V and 9.0 V .

For 74HCT4053: $V_{CC} - GND = 4.5\text{ V}$ and 5.5 V , $V_{CC} - V_{EE} = 2.0\text{ V}$, 4.5 V , 6.0 V and 9.0 V .

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|---|--|-----|-----|-----|------|
| T _{amb} = 25 °C | | | | | | |
| R _{ON(peak)} | ON resistance (peak) | V _{IS} = V _{CC} to V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 100 | 180 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 90 | 160 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | 70 | 130 | Ω |
| R _{ON(rail)} | ON resistance (rail) | V _{IS} = V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | 150 | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 80 | 140 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 70 | 120 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | 60 | 105 | Ω |
| | | V _{IS} = V _{CC} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | 150 | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 90 | 160 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | 80 | 140 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | 65 | 120 | Ω |
| ΔR _{ON} | ON resistance mismatch between channels | V _{IS} = V _{CC} to V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | 9 | - | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | 8 | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | 6 | - | Ω |
| T _{amb} = -40 °C to +85 °C | | | | | | |
| R _{ON(peak)} | ON resistance (peak) | V _{IS} = V _{CC} to V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 225 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 200 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 165 | Ω |

Table 6. R_{ON} resistance per switch for 74HC4053 and 74HCT4053 ...continued

$V_I = V_{IH}$ or V_{IL} ; for test circuit see [Figure 9](#).

V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

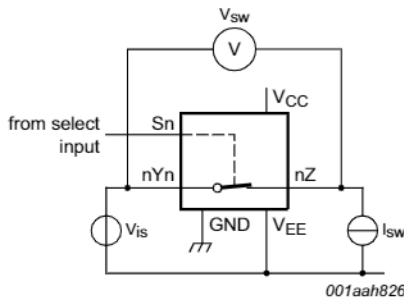
V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

For 74HC4053: $V_{CC} - GND$ or $V_{CC} - V_{EE} = 2.0\text{ V}$, 4.5 V , 6.0 V and 9.0 V .

For 74HCT4053: $V_{CC} - GND = 4.5\text{ V}$ and 5.5 V , $V_{CC} - V_{EE} = 2.0\text{ V}$, 4.5 V , 6.0 V and 9.0 V .

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|----------------------|--|-----|-----|-----|------|
| R _{ON(rail)} | ON resistance (rail) | V _{IS} = V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 175 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 150 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 130 | Ω |
| | | V _{IS} = V _{CC} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 200 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 175 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 150 | Ω |
| T _{amb} = -40 °C to +125 °C | | | | | | |
| R _{ON(peak)} | ON resistance (peak) | V _{IS} = V _{CC} to V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 270 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 240 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 195 | Ω |
| R _{ON(rail)} | ON resistance (rail) | V _{IS} = V _{EE} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 210 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 180 | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 160 | Ω |
| | | V _{IS} = V _{CC} | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V; I _{SW} = 100 μA [1] | - | - | - | Ω |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 240 | Ω |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V; I _{SW} = 1000 μA | - | - | 210 | Ω |
| V _{CC} = 4.5 V; V _{EE} = -4.5 V; I _{SW} = 1000 μA | - | - | 180 | Ω | | |

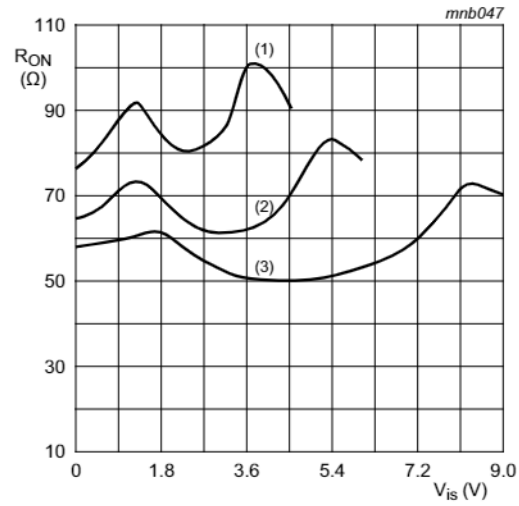
- [1] When supply voltages ($V_{CC} - V_{EE}$) near 2.0 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 2 V , it is recommended to use these devices only for transmitting digital signals.



$V_{is} = 0 \text{ V to } (V_{CC} - V_{EE}).$

$$R_{ON} = \frac{V_{sw}}{I_{sw}}$$

Fig 9. Test circuit for measuring R_{ON}



$V_{is} = 0 \text{ V to } (V_{CC} - V_{EE}).$

- (1) $V_{CC} = 4.5 \text{ V}$
- (2) $V_{CC} = 6 \text{ V}$
- (3) $V_{CC} = 9 \text{ V}$

Fig 10. Typical R_{ON} as a function of input voltage V_{is}

Table 7. Static characteristics for 74HC4053

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

V_{is} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V_{os} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---------------------------|---|------|-----|-----------|---------------|
| $T_{amb} = 25 \text{ }^{\circ}\text{C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0 \text{ V}$ | 1.5 | 1.2 | - | V |
| | | $V_{CC} = 4.5 \text{ V}$ | 3.15 | 2.4 | - | V |
| | | $V_{CC} = 6.0 \text{ V}$ | 4.2 | 3.2 | - | V |
| | | $V_{CC} = 9.0 \text{ V}$ | 6.3 | 4.7 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0 \text{ V}$ | - | 0.8 | 0.5 | V |
| | | $V_{CC} = 4.5 \text{ V}$ | - | 2.1 | 1.35 | V |
| | | $V_{CC} = 6.0 \text{ V}$ | - | 2.8 | 1.8 | V |
| | | $V_{CC} = 9.0 \text{ V}$ | - | 4.3 | 2.7 | V |
| I_I | input leakage current | $V_{EE} = 0 \text{ V}; V_I = V_{CC} \text{ or GND}$ | | | | |
| | | $V_{CC} = 6.0 \text{ V}$ | - | - | ± 0.1 | μA |
| | | $V_{CC} = 10.0 \text{ V}$ | - | - | ± 0.2 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}; V_I = V_{IH} \text{ or } V_{IL}; V_{SW} = V_{CC} - V_{EE}; \text{ see Figure 11}$ | | | | |
| | | per channel | - | - | ± 0.1 | μA |
| | | all channels | - | - | ± 0.1 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_I = V_{IH} \text{ or } V_{IL}; V_{SW} = V_{CC} - V_{EE}; V_{CC} = 10.0 \text{ V}; V_{EE} = 0 \text{ V}; \text{ see Figure 12}$ | - | - | ± 0.1 | μA |

Table 7. Static characteristics for 74HC4053 ...continued

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

V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V_{OS} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|---------------------------|---|------|-----|-------|------|
| I _{CC} | supply current | V _{EE} = 0 V; V _I = V _{CC} or GND; V _{IS} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE} | | | | |
| | | V _{CC} = 6.0 V | - | - | 8.0 | μA |
| | | V _{CC} = 10.0 V | - | - | 16.0 | μA |
| C _I | input capacitance | | - | 3.5 | - | pF |
| C _{SW} | switch capacitance | independent pins nYn | - | 5 | - | pF |
| | | common pins nZ | - | 8 | - | pF |
| T _{amb} = −40 °C to +85 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | V |
| | | V _{CC} = 4.5 V | 3.15 | - | - | V |
| | | V _{CC} = 6.0 V | 4.2 | - | - | V |
| | | V _{CC} = 9.0 V | 6.3 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | - | 1.8 | V |
| | | V _{CC} = 9.0 V | - | - | 2.7 | V |
| I _I | input leakage current | V _{EE} = 0 V; V _I = V _{CC} or GND | | | | |
| | | V _{CC} = 6.0 V | - | - | ±1.0 | μA |
| | | V _{CC} = 10.0 V | - | - | ±2.0 | μA |
| I _{S(OFF)} | OFF-state leakage current | V _{CC} = 10.0 V; V _{EE} = 0 V; V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} − V _{EE} ; see Figure 11 | | | | |
| | | per channel | - | - | ±1.0 | μA |
| | | all channels | - | - | ±1.0 | μA |
| I _{S(ON)} | ON-state leakage current | V _I = V _{IH} or V _{IL} ; V _{SW} = V _{CC} − V _{EE} ; V _{CC} = 10.0 V; V _{EE} = 0 V; see Figure 12 | - | - | ±1.0 | μA |
| I _{CC} | supply current | V _{EE} = 0 V; V _I = V _{CC} or GND; V _{IS} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE} | | | | |
| | | V _{CC} = 6.0 V | - | - | 80.0 | μA |
| | | V _{CC} = 10.0 V | - | - | 160.0 | μA |
| T _{amb} = −40 °C to +125 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | V |
| | | V _{CC} = 4.5 V | 3.15 | - | - | V |
| | | V _{CC} = 6.0 V | 4.2 | - | - | V |
| | | V _{CC} = 9.0 V | 6.3 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | - | 1.8 | V |
| | | V _{CC} = 9.0 V | - | - | 2.7 | V |

Table 7. Static characteristics for 74HC4053 ...continued

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

V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V_{OS} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------|---------------------------|--|-----|-----|-----------|---------------|
| I_I | input leakage current | $V_{EE} = 0\text{ V}$; $V_I = V_{CC}$ or GND | | | | |
| | | $V_{CC} = 6.0\text{ V}$ | - | - | ± 1.0 | μA |
| | | $V_{CC} = 10.0\text{ V}$ | - | - | ± 2.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 10.0\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11 | | | | |
| | | per channel | - | - | ± 1.0 | μA |
| | | all channels | - | - | ± 1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; $V_{CC} = 10.0\text{ V}$; $V_{EE} = 0\text{ V}$; see Figure 12 | - | - | ± 1.0 | μA |
| I_{CC} | supply current | $V_{EE} = 0\text{ V}$; $V_I = V_{CC}$ or GND; $V_{IS} = V_{EE}$ or V_{CC} ; $V_{OS} = V_{CC}$ or V_{EE} | | | | |
| | | $V_{CC} = 6.0\text{ V}$ | - | - | 160.0 | μA |
| | | $V_{CC} = 10.0\text{ V}$ | - | - | 320.0 | μA |

Table 8. Static characteristics for 74HCT4053

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

V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V_{OS} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|--|-----|-----|-----------|---------------|
| $T_{amb} = 25\text{ }^{\circ}\text{C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | 2.0 | 1.6 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | - | 1.2 | 0.8 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | ± 0.1 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 10.0\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11 | | | | |
| | | per channel | - | - | ± 0.1 | μA |
| | | all channels | - | - | ± 0.1 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC} = 10.0\text{ V}$; $V_{EE} = 0\text{ V}$; $V_I = V_{IH}$ or V_{IL} ; $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12 | - | - | ± 0.1 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $V_{IS} = V_{EE}$ or V_{CC} ; $V_{OS} = V_{CC}$ or V_{EE} | | | | |
| | | $V_{CC} = 5.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 8.0 | μA |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ | - | - | 16.0 | μA |
| ΔI_{CC} | additional supply current | per input; $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5\text{ V to }5.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 50 | 180 | μA |
| C_I | input capacitance | | - | 3.5 | - | pF |
| C_{SW} | switch capacitance | independent pins nYn | - | 5 | - | pF |
| | | common pins nZ | - | 8 | - | pF |

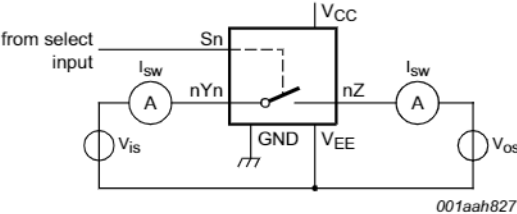
Table 8. Static characteristics for 74HCT4053 ...continued

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

V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

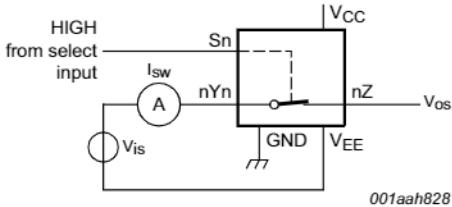
V_{OS} is the output voltage at pins nZ or nYn, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|---|-----|-----|-----------|---------------|
| T_{amb} = -40 °C to +85 °C | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ | - | - | 0.8 | V |
| I_I | input leakage current | $V_I = V_{CC} \text{ or GND; } V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | ± 1.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 10.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL};$ $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11 | | | | |
| | | per channel | - | - | ± 1.0 | μA |
| | | all channels | - | - | ± 1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC} = 10.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL};$ $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12 | - | - | ± 1.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC} \text{ or GND; } V_{IS} = V_{EE} \text{ or } V_{CC};$ $V_{OS} = V_{CC} \text{ or } V_{EE}$ | | | | |
| | | $V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | 80.0 | μA |
| | | $V_{CC} = 5.0 \text{ V; } V_{EE} = -5.0 \text{ V}$ | - | - | 160.0 | μA |
| ΔI_{CC} | additional supply current | per input; $V_I = V_{CC} - 2.1 \text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | 225 | μA |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ | - | - | 0.8 | V |
| I_I | input leakage current | $V_I = V_{CC} \text{ or GND; } V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | ± 1.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 10.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL};$ $ V_{SW} = V_{CC} - V_{EE}$; see Figure 11 | | | | |
| | | per channel | - | - | ± 1.0 | μA |
| | | all channels | - | - | ± 1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC} = 10.0 \text{ V; } V_{EE} = 0 \text{ V; } V_I = V_{IH} \text{ or } V_{IL};$ $ V_{SW} = V_{CC} - V_{EE}$; see Figure 12 | - | - | ± 1.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC} \text{ or GND; } V_{IS} = V_{EE} \text{ or } V_{CC};$ $V_{OS} = V_{CC} \text{ or } V_{EE}$ | | | | |
| | | $V_{CC} = 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | 160.0 | μA |
| | | $V_{CC} = 5.0 \text{ V; } V_{EE} = -5.0 \text{ V}$ | - | - | 320.0 | μA |
| ΔI_{CC} | additional supply current | per input; $V_I = V_{CC} - 2.1 \text{ V}$; other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V; } V_{EE} = 0 \text{ V}$ | - | - | 245 | μA |



$V_{is} = V_{CC}$ and $V_{os} = V_{EE}$.
 $V_{is} = V_{EE}$ and $V_{os} = V_{CC}$.

Fig 11. Test circuit for measuring OFF-state current



$V_{is} = V_{CC}$ and $V_{os} = \text{open-circuit}$.
 $V_{is} = V_{EE}$ and $V_{os} = \text{open-circuit}$.

Fig 12. Test circuit for measuring ON-state current

11. Dynamic characteristics

Table 9. Dynamic characteristics for 74HC4053

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).
 V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.
 V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|-------------------|---|-----|-----|-----|------|
| $T_{amb} = 25\text{ °C}$ | | | | | | |
| t_{pd} | propagation delay | V_{is} to V_{os} ; $R_L = \infty\text{ }\Omega$; see Figure 13 [1] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 15 | 60 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 5 | 12 | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 4 | 10 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 4 | 8 | ns |

Table 9. Dynamic characteristics for 74HC4053 ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).

V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------|---|-----|-----|-----|------|
| t_{on} | turn-on time | \bar{E} to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 14 [2] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 60 | 220 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 20 | 44 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 17 | - | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 16 | 37 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 15 | 31 | ns |
| | | Sn to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 14 [2] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 75 | 220 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 25 | 44 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 21 | - | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 20 | 37 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 15 | 31 | ns |
| t_{off} | turn-off time | \bar{E} to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 63 | 210 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 21 | 42 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 18 | - | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 17 | 36 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 15 | 29 | ns |
| | | Sn to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 60 | 210 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 20 | 42 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 17 | - | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 16 | 36 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 15 | 29 | ns |
| C_{PD} | power dissipation capacitance | per switch; $V_I = GND$ to V_{CC} [4] | - | 36 | - | pF |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$ | | | | | | |
| t_{pd} | propagation delay | V_{IS} to V_{OS} ; $R_L = \infty\ \Omega$; see Figure 13 [1] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 75 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 15 | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 13 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | - | 10 | ns |

Table 9. Dynamic characteristics for 74HC4053 ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).

V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|-------------------|--|-----|-----|-----|------|
| t _{on} | turn-on time | \overline{E} to V _{os} ; R _L = ∞ Ω; see Figure 14 [2] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 275 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 55 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 47 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 39 | ns |
| | | Sn to V _{os} ; R _L = ∞ Ω; see Figure 14 [2] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 275 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 55 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 47 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 39 | ns |
| t _{off} | turn-off time | \overline{E} to V _{os} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 265 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 53 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 45 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 36 | ns |
| | | Sn to V _{os} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 265 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 53 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 45 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 36 | ns |
| T _{amb} = -40 °C to +125 °C | | | | | | |
| t _{pd} | propagation delay | V _{is} to V _{os} ; R _L = ∞ Ω; see Figure 13 [1] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 90 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 18 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 15 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 12 | ns |
| t _{on} | turn-on time | \overline{E} to V _{os} ; R _L = ∞ Ω; see Figure 14 [2] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 330 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 66 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 56 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 47 | ns |
| | | Sn to V _{os} ; R _L = ∞ Ω; see Figure 14 [2] | | | | |
| | | V _{CC} = 2.0 V; V _{EE} = 0 V | - | - | 330 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 66 | ns |
| | | V _{CC} = 6.0 V; V _{EE} = 0 V | - | - | 56 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 47 | ns |

Table 9. Dynamic characteristics for 74HC4053 ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).

V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------|---|-----|-----|-----|------|
| t_{off} | turn-off time | \overline{E} to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 315 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 63 | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 54 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | - | 44 | ns |
| | | Sn to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 315 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 63 | ns |
| | | $V_{CC} = 6.0\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 54 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | - | 44 | ns |

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

[2] t_{on} is the same as t_{pZH} and t_{pZL} .

[3] t_{off} is the same as t_{pHZ} and t_{pLZ} .

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{SW}) \times V_{CC}^2 \times f_o\}$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

N = number of inputs switching;

$\Sigma\{(C_L + C_{SW}) \times V_{CC}^2 \times f_o\}$ = sum of outputs;

C_L = output load capacitance in pF;

C_{SW} = switch capacitance in pF;

V_{CC} = supply voltage in V.

Table 10. Dynamic characteristics for 74HCT4053

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).

V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|-------------------|---|-----|-----|-----|------|
| $T_{amb} = 25\text{ }^\circ\text{C}$ | | | | | | |
| t_{pd} | propagation delay | V_{IS} to V_{OS} ; $R_L = \infty\text{ }\Omega$; see Figure 13 [1] | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 5 | 12 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 4 | 8 | ns |
| t_{on} | turn-on time | \overline{E} to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [2] | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 27 | 48 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 23 | - | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 16 | 34 | ns |
| | | Sn to V_{OS} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [2] | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | 25 | 48 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $V_{EE} = 0\text{ V}$; $C_L = 15\text{ pF}$ | - | 21 | - | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | 16 | 34 | ns |

Table 10. Dynamic characteristics for 74HCT4053 ...continued

$GND = 0\text{ V}$; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see [Figure 15](#).

V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|-------------------------------|--|-----|-----|-----|------|
| t _{off} | turn-off time | \overline{E} to V _{OS} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | 24 | 44 | ns |
| | | V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF | - | 20 | - | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | 15 | 31 | ns |
| | | Sn to V _{OS} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | 22 | 44 | ns |
| | | V _{CC} = 5.0 V; V _{EE} = 0 V; C _L = 15 pF | - | 19 | - | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | 15 | 31 | ns |
| C _{PD} | power dissipation capacitance | per switch; V _I = GND to V _{CC} - 1.5 V [4] | - | 36 | - | pF |
| T _{amb} = -40 °C to +85 °C | | | | | | |
| t _{pd} | propagation delay | V _{IS} to V _{OS} ; R _L = ∞ Ω; see Figure 13 [1] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 15 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 10 | ns |
| t _{on} | turn-on time | \overline{E} to V _{OS} ; R _L = 1 kΩ; see Figure 14 [2] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 60 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 43 | ns |
| | | Sn to V _{OS} ; R _L = 1 kΩ; see Figure 14 [2] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 60 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 43 | ns |
| t _{off} | turn-off time | \overline{E} to V _{OS} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 55 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 39 | ns |
| | | Sn to V _{OS} ; R _L = 1 kΩ; see Figure 14 [3] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 55 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 39 | ns |
| T _{amb} = -40 °C to +125 °C | | | | | | |
| t _{pd} | propagation delay | V _{IS} to V _{OS} ; R _L = ∞ Ω; see Figure 13 [1] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 18 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 12 | ns |
| t _{on} | turn-on time | \overline{E} to V _{OS} ; R _L = 1 kΩ; see Figure 14 [2] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 72 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 51 | ns |
| | | Sn to V _{OS} ; R _L = 1 kΩ; see Figure 14 [2] | | | | |
| | | V _{CC} = 4.5 V; V _{EE} = 0 V | - | - | 72 | ns |
| | | V _{CC} = 4.5 V; V _{EE} = -4.5 V | - | - | 51 | ns |

Table 10. Dynamic characteristics for 74HCT4053 ...continued

GND = 0 V; $t_r = t_f = 6\text{ ns}$; $C_L = 50\text{ pF}$; for test circuit see Figure 15.

V_{is} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

V_{os} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------|---|-----|-----|-----|------|
| t_{off} | turn-off time | \overline{E} to V_{os} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 66 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | - | 47 | ns |
| | | Sn to V_{os} ; $R_L = 1\text{ k}\Omega$; see Figure 14 [3] | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = 0\text{ V}$ | - | - | 66 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $V_{EE} = -4.5\text{ V}$ | - | - | 47 | ns |

- [1] t_{pd} is the same as t_{pHL} and t_{pLH} .
- [2] t_{on} is the same as t_{pZH} and t_{pZL} .
- [3] t_{off} is the same as t_{pHZ} and t_{pLZ} .
- [4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 N = number of inputs switching;
 $\Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ = sum of outputs;
 C_L = output load capacitance in pF;
 C_{sw} = switch capacitance in pF;
 V_{CC} = supply voltage in V.

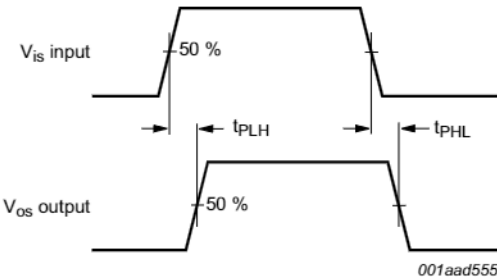
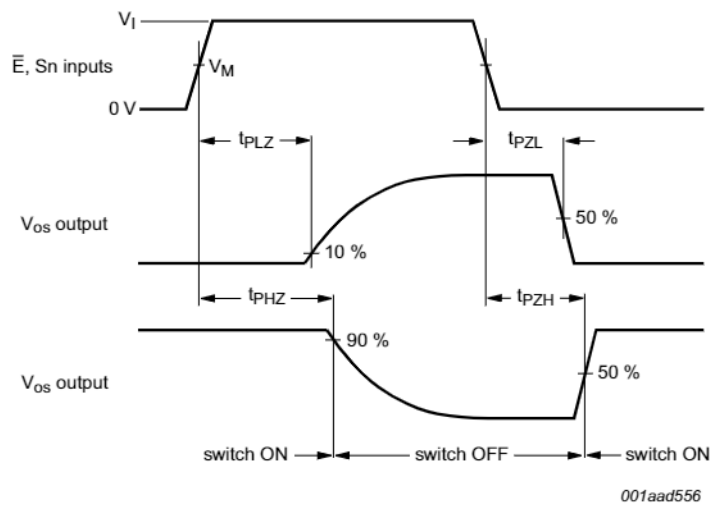


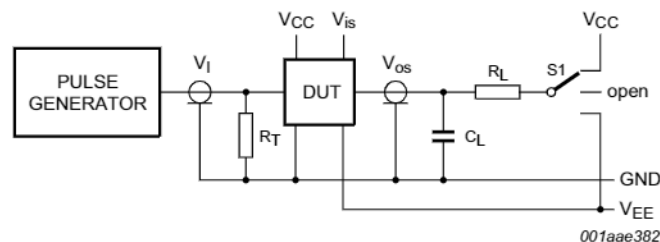
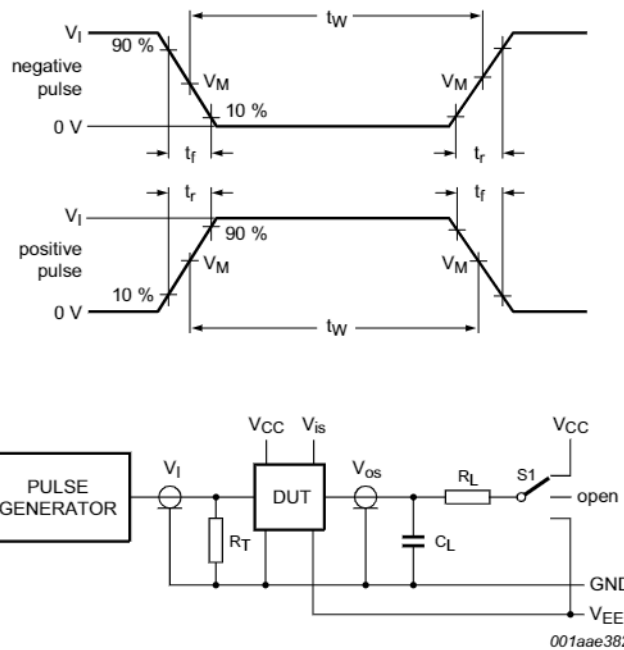
Fig 13. Input (V_{is}) to output (V_{os}) propagation delays



For 74HC4053: $V_M = 0.5 \times V_{CC}$.

For 74HCT4053: $V_M = 1.3 \text{ V}$.

Fig 14. Turn-on and turn-off times



Definitions for test circuit; see [Table 11](#):

R_T = termination resistance should be equal to the 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 15. Test circuit for measuring AC performance

Table 11. Test data

| Test | Input | | | | Load | | S1 position |
|--------------------|-------|----------|----------------------------|----------------------|-------|--------------|-------------|
| | V_I | V_{is} | t_r, t_f at f_{max} | other ^[1] | C_L | R_L | |
| t_{PHL}, t_{PLH} | [2] | pulse | < 2 ns | 6 ns | 50 pF | 1 k Ω | open |
| t_{PZH}, t_{PHZ} | [2] | V_{CC} | < 2 ns | 6 ns | 50 pF | 1 k Ω | V_{EE} |
| t_{PZL}, t_{PLZ} | [2] | V_{EE} | < 2 ns | 6 ns | 50 pF | 1 k Ω | V_{CC} |

[1] $t_r = t_f = 6$ ns; when measuring f_{max} , there is no constraint to t_r and t_f with 50 % duty factor.

[2] V_I values:

- a) For 74HC4053: $V_I = V_{CC}$
- b) For 74HCT4053: $V_I = 3$ V

11.1 Additional dynamic characteristics

Table 12. Additional dynamic characteristics

Recommended conditions and typical values; $GND = 0$ V; $T_{amb} = 25$ °C; $C_L = 50$ pF.

V_{is} is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V_{os} is the output voltage at pins nYn or nZ, whichever is assigned as an output.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|--------------------------|---|-----|------|-----|------|
| d_{sin} | sine-wave distortion | $f_i = 1$ kHz; $R_L = 10$ k Ω ; see Figure 16 | | | | |
| | | $V_{is} = 4.0$ V (p-p); $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V | - | 0.04 | - | % |
| | | $V_{is} = 8.0$ V (p-p); $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V | - | 0.02 | - | % |
| | | $f_i = 10$ kHz; $R_L = 10$ k Ω ; see Figure 16 | | | | |
| | | $V_{is} = 4.0$ V (p-p); $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V | - | 0.12 | - | % |
| | | $V_{is} = 8.0$ V (p-p); $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V | - | 0.06 | - | % |
| α_{iso} | isolation (OFF-state) | $R_L = 600$ Ω ; $f_i = 1$ MHz; see Figure 17 | | | | |
| | | $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V [1] | - | -50 | - | dB |
| | | $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V [1] | - | -50 | - | dB |
| Xtalk | crosstalk | between two switches/multiplexers; $R_L = 600$ Ω ; $f_i = 1$ MHz; see Figure 18 | | | | |
| | | $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V [1] | - | -60 | - | dB |
| | | $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V [1] | - | -60 | - | dB |
| V_{ct} | crosstalk voltage | peak-to-peak value; between control and any switch; $R_L = 600$ Ω ; $f_i = 1$ MHz; \bar{E} or Sn square wave between V_{CC} and GND; $t_r = t_f = 6$ ns; see Figure 19 | | | | |
| | | $V_{CC} = 4.5$ V; $V_{EE} = 0$ V | - | 110 | - | mV |
| | | $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V | - | 220 | - | mV |
| $f_{(-3dB)}$ | -3 dB frequency response | $R_L = 50$ Ω ; see Figure 20 | | | | |
| | | $V_{CC} = 2.25$ V; $V_{EE} = -2.25$ V [2] | - | 160 | - | MHz |
| | | $V_{CC} = 4.5$ V; $V_{EE} = -4.5$ V [2] | - | 170 | - | MHz |

[1] Adjust input voltage V_{is} to 0 dBm level (0 dBm = 1 mW into 600 Ω).

[2] Adjust input voltage V_{is} to 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω).

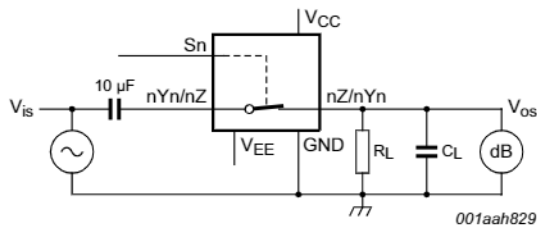
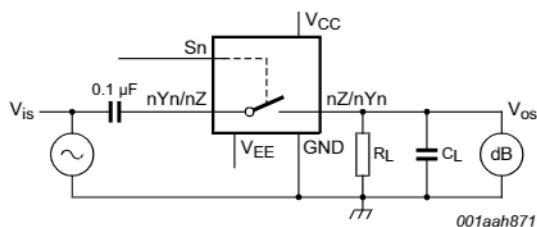
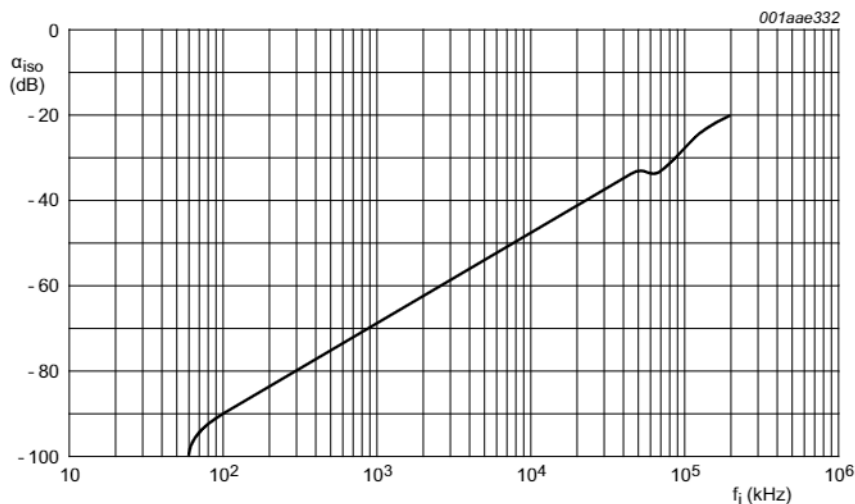


Fig 16. Test circuit for measuring sine-wave distortion



$V_{CC} = 4.5 \text{ V}$; $GND = 0 \text{ V}$; $V_{EE} = -4.5 \text{ V}$; $R_L = 600 \Omega$; $R_S = 1 \text{ k}\Omega$.

a. Test circuit



b. Isolation (OFF-state) as a function of frequency

Fig 17. Test circuit for measuring isolation (OFF-state)

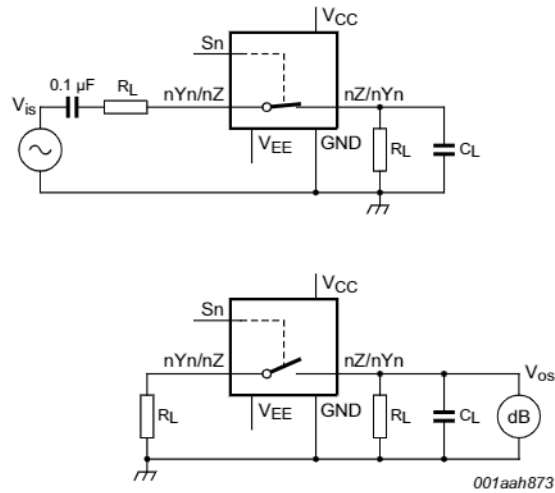


Fig 18. Test circuits for measuring crosstalk between any two switches/multiplexers

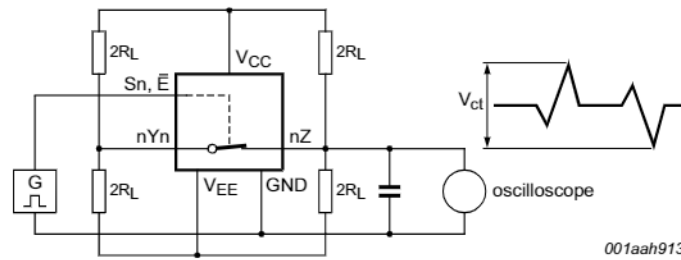
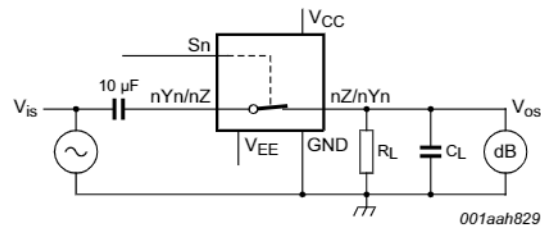
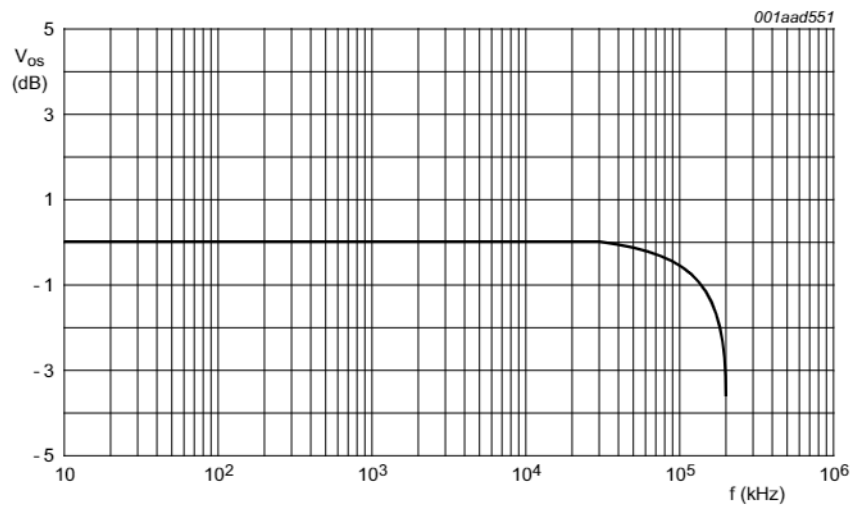


Fig 19. Test circuit for measuring crosstalk between control input and any switch



$V_{CC} = 4.5 \text{ V}$; $GND = 0 \text{ V}$; $V_{EE} = -4.5 \text{ V}$; $R_L = 50 \Omega$; $R_S = 1 \text{ k}\Omega$.

a. Test circuit



b. Typical frequency response

Fig 20. Test circuit for frequency response

12. Package outline

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

SOT109-1

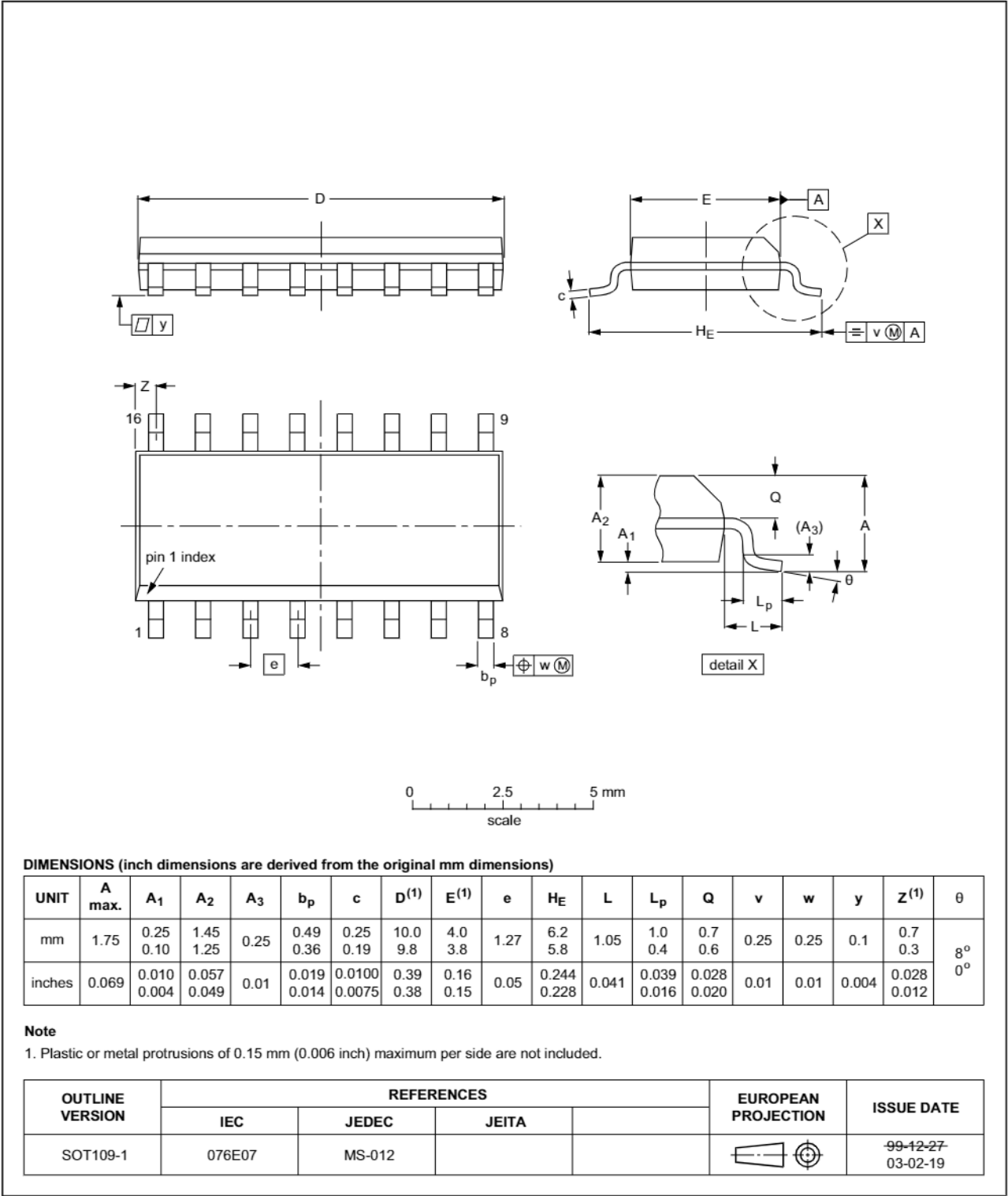


Fig 21. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

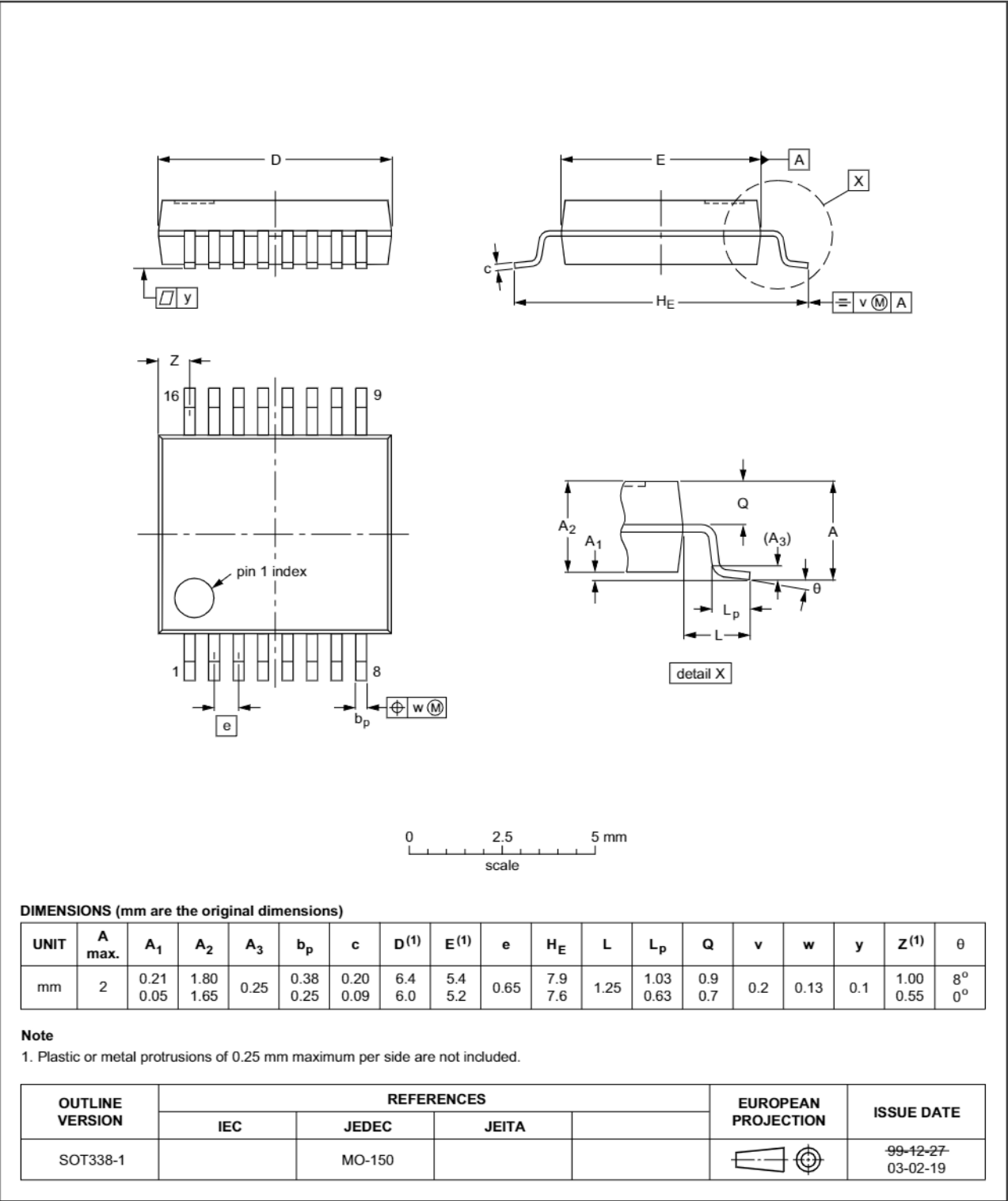


Fig 22. Package outline SOT338-1 (SSOP16)

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

SOT403-1

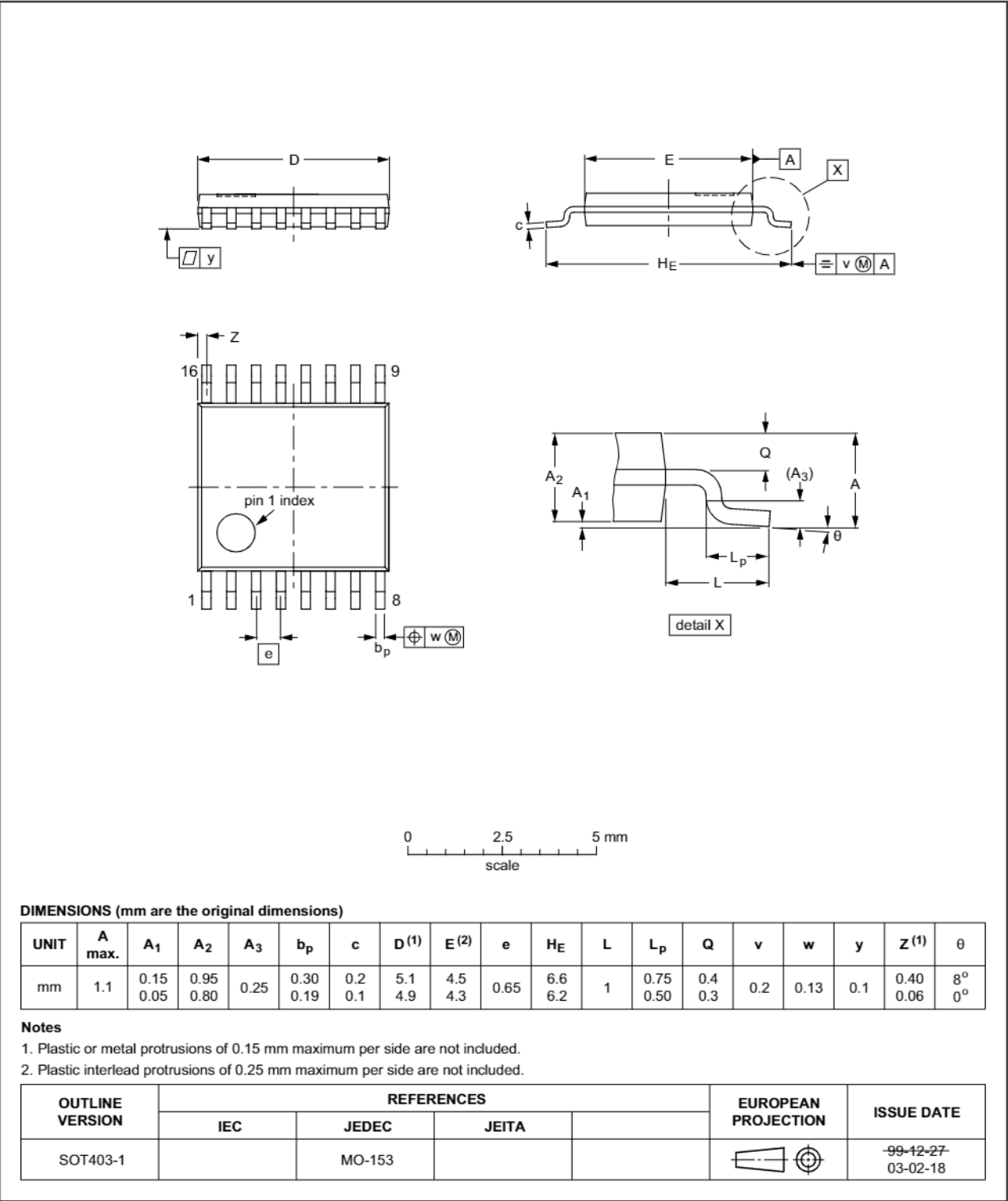


Fig 23. Package outline SOT403-1 (TSSOP16)

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

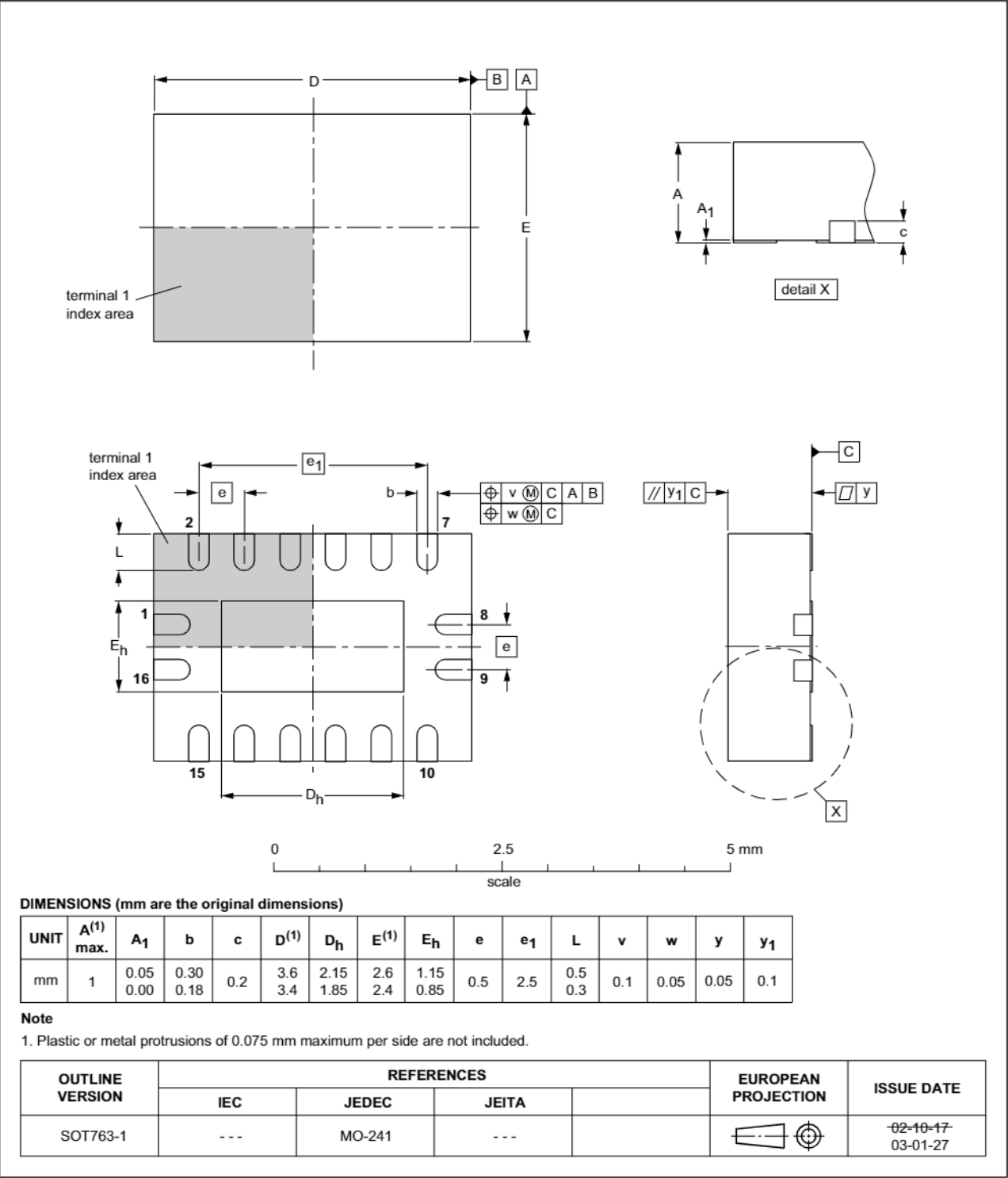


Fig 24. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 13. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |

14. Revision history

Table 14. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------------|--|-----------------------|---------------|----------------------|
| 74HC_HCT4053 v.9 | 20160210 | Product data sheet | - | 74HC_HCT4053 v.8 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC4053N and 74HCT4053N (SOT38-4) removed. | | | |
| 74HC_HCT4053 v.8 | 20120719 | Product data sheet | - | 74HC_HCT4053 v.7 |
| Modifications: | <ul style="list-style-type: none"> CDM added to features. | | | |
| 74HC_HCT4053 v.7 | 20111213 | Product data sheet | - | 74HC_HCT4053 v.6 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74HC_HCT4053 v.6 | 20110511 | Product data sheet | - | 74HC_HCT4053 v.5 |
| 74HC_HCT4053 v.5 | 20110118 | Product data sheet | - | 74HC_HCT4053 v.4 |
| 74HC_HCT4053 v.4 | 20060509 | Product data sheet | - | 74HC_HCT4053 v.3 |
| 74HC_HCT4053 v.3 | 20060315 | Product data sheet | - | 74HC_HCT4053_CNV v.2 |
| 74HC_HCT4053_CNV v.2 | 19901201 | Product specification | - | - |

15. Legal information

15.1 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".

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