

# 74HC4051; 74HCT4051

## 8-channel analog multiplexer/demultiplexer

Rev. 6 — 13 December 2011

Product data sheet

### 1. General description

The 74HC4051; 74HCT4051 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). The device is specified in compliance with JEDEC standard no. 7A.

The 74HC4051; 74HCT4051 is an 8-channel analog multiplexer/demultiplexer with three digital select inputs (S0 to S2), an active-LOW enable input ( $\overline{E}$ ), eight independent inputs/outputs (Y0 to Y7) and a common input/output (Z). With  $\overline{E}$  LOW, one of the eight switches is selected (low impedance ON-state) by S0 to S2. With  $\overline{E}$  HIGH, all switches are in the high-impedance OFF-state, independent of S0 to S2.

$V_{CC}$  and GND are the supply voltage pins for the digital control inputs (S0 to S2, and  $\overline{E}$ ). The  $V_{CC}$  to GND ranges are 2.0 V to 10.0 V for 74HC4051 and 4.5 V to 5.5 V for 74HCT4051. The analog inputs/outputs (Y0 to Y7, and Z) can swing between  $V_{CC}$  as a positive limit and  $V_{EE}$  as a negative limit.  $V_{CC} - V_{EE}$  may not exceed 10.0 V.

For operation as a digital multiplexer/demultiplexer,  $V_{EE}$  is connected to GND (typically ground).

### 2. Features and benefits

- Wide analog input voltage range from -5 V to +5 V
- Low ON resistance:
  - ◆ 80  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5$  V
  - ◆ 70  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 6.0$  V
  - ◆ 60  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 9.0$  V
- Logic level translation: to enable 5 V logic to communicate with  $\pm 5$  V analog signals
- Typical 'break before make' built-in
- 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

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



## 4. Ordering information

Table 1. Ordering information

| Type number | Package           |          |                                                                                                                                      |          |
|-------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range | Name     | Description                                                                                                                          | Version  |
| 74HC4051N   | –40 °C to +125 °C | DIP16    | plastic dual in-line package; 16 leads (300 mil)                                                                                     | SOT38-4  |
| 74HCT4051N  |                   |          |                                                                                                                                      |          |
| 74HC4051D   | –40 °C to +125 °C | SO16     | plastic small outline package; 16 leads;<br>body width 3.9 mm                                                                        | SOT109-1 |
| 74HCT4051D  |                   |          |                                                                                                                                      |          |
| 74HC4051DB  | –40 °C to +125 °C | SSOP16   | plastic shrink small outline package; 16 leads;<br>body width 5.3 mm                                                                 | SOT338-1 |
| 74HCT4051DB |                   |          |                                                                                                                                      |          |
| 74HC4051PW  | –40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads;<br>body width 4.4 mm                                                            | SOT403-1 |
| 74HCT4051PW |                   |          |                                                                                                                                      |          |
| 74HC4051BQ  | –40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very<br>thin quad flat package; no leads; 16 terminals;<br>body 2.5 × 3.5 × 0.85 mm | SOT763-1 |
| 74HCT4051BQ |                   |          |                                                                                                                                      |          |

## 5. Functional diagram

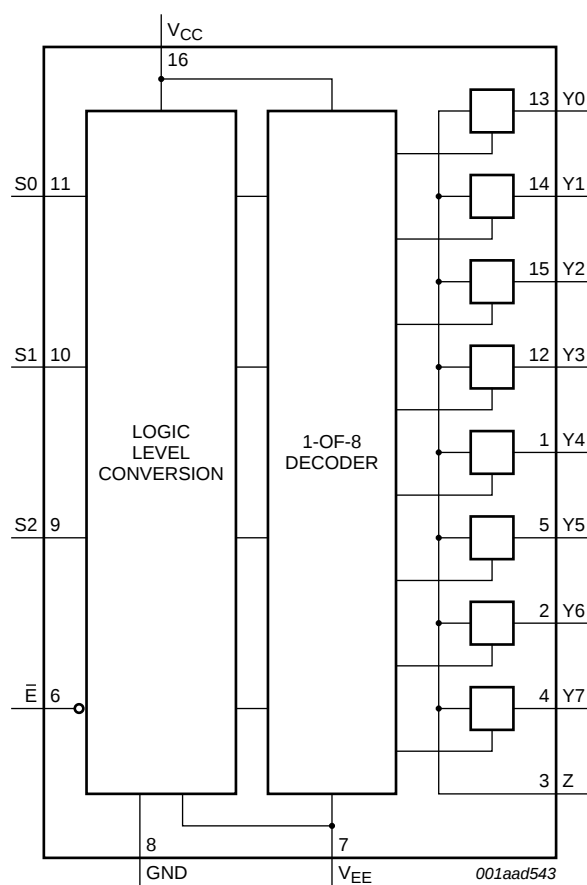


Fig 1. Functional diagram

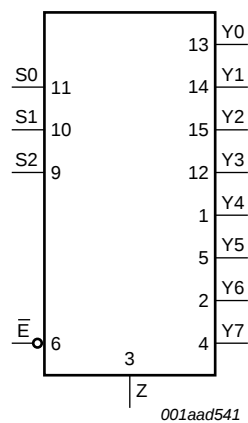


Fig 2. Logic symbol

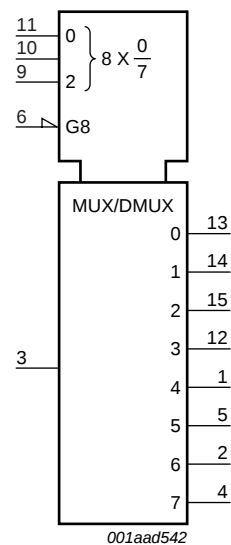


Fig 3. IEC logic symbol

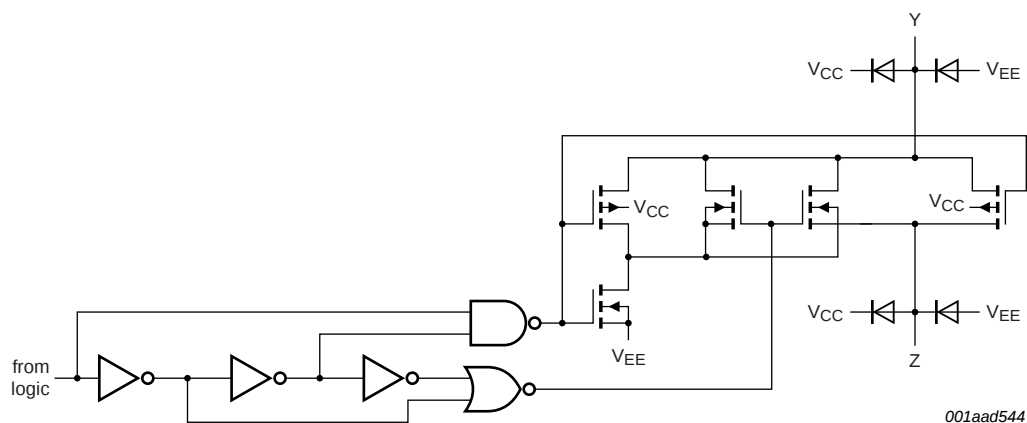
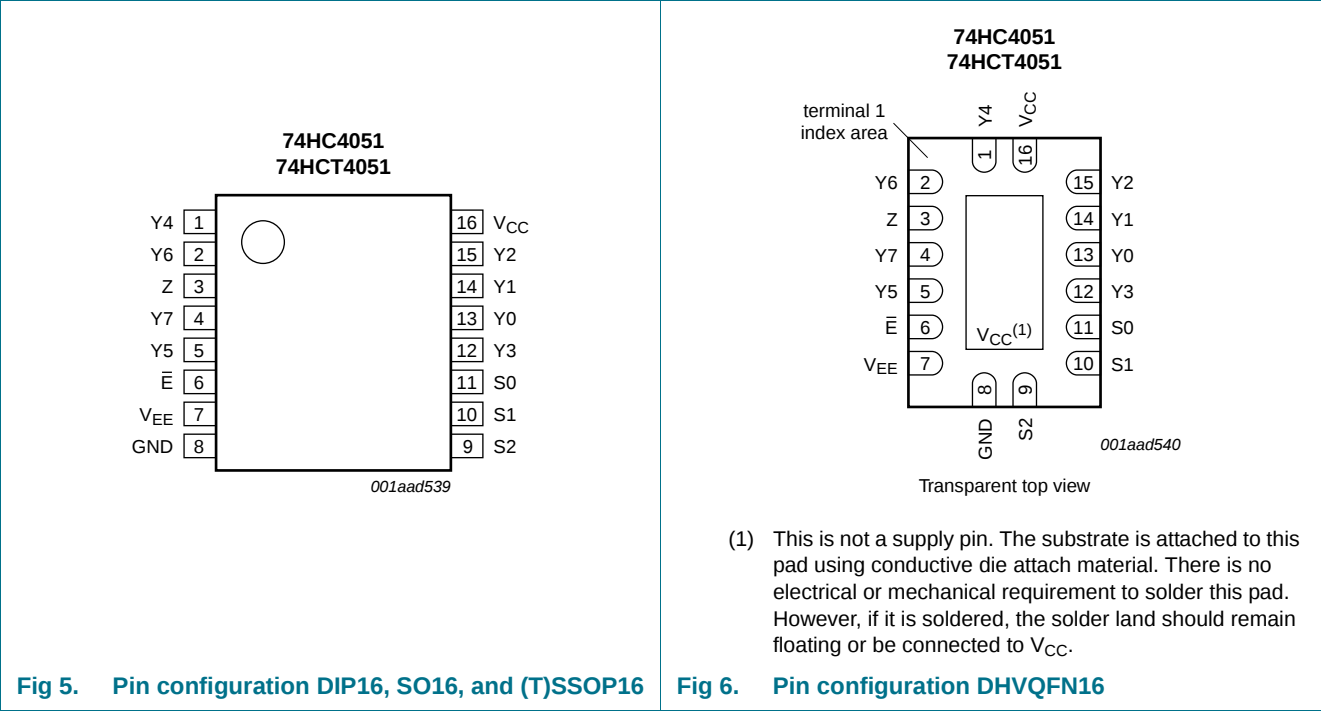


Fig 4. Schematic diagram (one switch)

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 2. Pin description

| Symbol                         | Pin                        | Description                 |
|--------------------------------|----------------------------|-----------------------------|
| E̅                             | 6                          | enable input (active LOW)   |
| VEE                            | 7                          | supply voltage              |
| GND                            | 8                          | ground supply voltage       |
| S0, S1, S2                     | 11, 10, 9                  | select input                |
| Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7 | 13, 14, 15, 12, 1, 5, 2, 4 | independent input or output |
| Z                              | 3                          | common output or input      |
| VCC                            | 16                         | supply voltage              |

## 7. Functional description

### 7.1 Function table

Table 3. Function table<sup>[1]</sup>

| Input          |    |    |    | Channel ON   |
|----------------|----|----|----|--------------|
| $\overline{E}$ | S2 | S1 | S0 |              |
| L              | L  | L  | L  | Y0 to Z      |
| L              | L  | L  | H  | Y1 to Z      |
| L              | L  | H  | L  | Y2 to Z      |
| L              | L  | H  | H  | Y3 to Z      |
| L              | H  | L  | L  | Y4 to Z      |
| L              | H  | L  | H  | Y5 to Z      |
| L              | H  | H  | L  | Y6 to Z      |
| L              | H  | H  | H  | Y7 to Z      |
| H              | X  | X  | 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  $V_{SS} = 0$  V (ground).

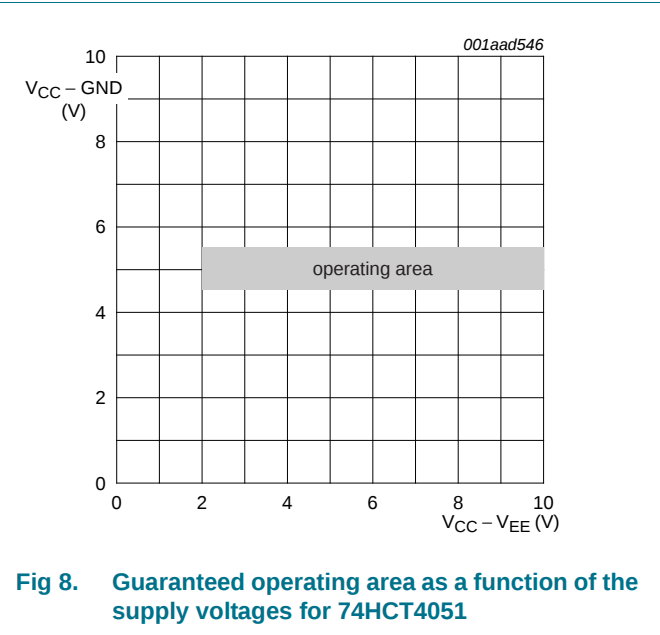
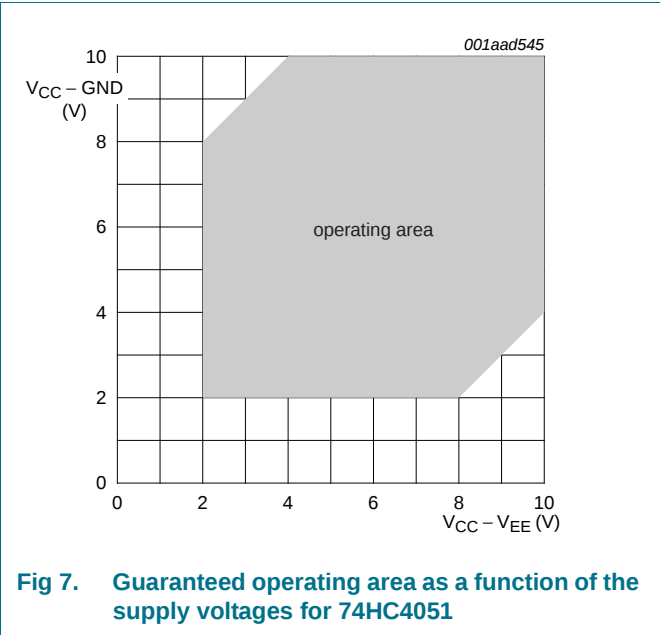
| Symbol    | Parameter               | Conditions                                     | Min                 | Max   | Unit |
|-----------|-------------------------|------------------------------------------------|---------------------|-------|------|
| $V_{CC}$  | supply voltage          |                                                | <sup>[1]</sup> -0.5 | +11.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V       | -                   | ±20   | mA   |
| $I_{SK}$  | switch clamping current | $V_{SW} < -0.5$ V or $V_{SW} > V_{CC} + 0.5$ V | -                   | ±20   | mA   |
| $I_{SW}$  | switch current          | $-0.5$ V < $V_{SW}$ < $V_{CC} + 0.5$ 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 | DIP16 package                                  | <sup>[2]</sup> -    | 750   | mW   |
|           |                         | SO16, (T)SSOP16, and<br>DHVQFN16 package       | <sup>[3]</sup> -    | 500   | mW   |
| P         | power dissipation       | per switch                                     | -                   | 100   | mW   |

- [1] To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows into terminals Yn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no  $V_{CC}$  current will flow out of terminals Yn, and in this case there is no limit for the voltage drop across the switch, but the voltages at Yn and Z may not exceed  $V_{CC}$  or  $V_{EE}$ .
- [2] For DIP16 packages: above 70 °C the value of  $P_{tot}$  derates linearly with 12 mW/K.
- [3] 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                                                | 74HC4051        |      |                 | 74HCT4051       |      |                 | Unit |
|------------------|-------------------------------------|-----------------------------------------------------------|-----------------|------|-----------------|-----------------|------|-----------------|------|
|                  |                                     |                                                           | Min             | Typ  | Max             | Min             | Typ  | Max             |      |
| V <sub>CC</sub>  | supply voltage                      | see <a href="#">Figure 7</a> and <a href="#">Figure 8</a> |                 |      |                 |                 |      |                 |      |
|                  |                                     | V <sub>CC</sub> – GND                                     | 2.0             | 5.0  | 10.0            | 4.5             | 5.0  | 5.5             | V    |
|                  |                                     | V <sub>CC</sub> – V <sub>EE</sub>                         | 2.0             | 5.0  | 10.0            | 2.0             | 5.0  | 10.0            | V    |
| V <sub>I</sub>   | input voltage                       |                                                           | GND             | -    | V <sub>CC</sub> | GND             | -    | V <sub>CC</sub> | V    |
| V <sub>SW</sub>  | switch voltage                      |                                                           | V <sub>EE</sub> | -    | V <sub>CC</sub> | V <sub>EE</sub> | -    | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                                           | -40             | +25  | +125            | -40             | +25  | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V                                   | -               | -    | 625             | -               | -    | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V                                   | -               | 1.67 | 139             | -               | 1.67 | 139             | ns/V |
|                  |                                     | V <sub>CC</sub> = 6.0 V                                   | -               | -    | 83              | -               | -    | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 10.0 V                                  | -               | -    | 31              | -               | -    | -               | ns/V |



## 10. Static characteristics

**Table 6.**  $R_{ON}$  resistance per switch for 74HC4051 and 74HCT4051

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

$V_{IS}$  is the input voltage at a Yn or Z terminal, whichever is assigned as an input.

$V_{OS}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

For 74HC4051:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}$ ,  $4.5\text{ V}$ ,  $6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4051:  $V_{CC} - GND = 4.5\text{ V}$  and  $5.5\text{ V}$ ,  $V_{CC} - V_{EE} = 2.0\text{ V}$ ,  $4.5\text{ V}$ ,  $6.0\text{ V}$  and  $9.0\text{ V}$ .

| Symbol                                                       | Parameter                               | Conditions                                                                              | Min               | Typ | Max | Unit     |
|--------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------|-------------------|-----|-----|----------|
| <b><math>T_{amb} = 25\text{ °C}</math></b>                   |                                         |                                                                                         |                   |     |     |          |
| $R_{ON(peak)}$                                               | ON resistance (peak)                    | $V_{IS} = V_{CC}$ to $V_{EE}$                                                           |                   |     |     |          |
|                                                              |                                         | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 100\text{ }\mu\text{A}$     | <a href="#">1</a> | -   | -   | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 100 | 180 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 90  | 160 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$ | -                 | 70  | 130 | $\Omega$ |
| $R_{ON(rail)}$                                               | ON resistance (rail)                    | $V_{IS} = V_{EE}$                                                                       |                   |     |     |          |
|                                                              |                                         | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 100\text{ }\mu\text{A}$     | <a href="#">1</a> | -   | 150 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 80  | 140 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 70  | 120 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$ | -                 | 60  | 105 | $\Omega$ |
|                                                              |                                         | $V_{IS} = V_{CC}$                                                                       |                   |     |     |          |
|                                                              |                                         | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 100\text{ }\mu\text{A}$     | <a href="#">1</a> | -   | 150 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 90  | 160 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | 80  | 140 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$ | -                 | 65  | 120 | $\Omega$ |
| $\Delta R_{ON}$                                              | ON resistance mismatch between channels | $V_{IS} = V_{CC}$ to $V_{EE}$                                                           |                   |     |     |          |
|                                                              |                                         | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                         | <a href="#">1</a> | -   | -   | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                         | -                 | 9   | -   | $\Omega$ |
|                                                              |                                         | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                         | -                 | 8   | -   | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                      | -                 | 6   | -   | $\Omega$ |
| <b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b> |                                         |                                                                                         |                   |     |     |          |
| $R_{ON(peak)}$                                               | ON resistance (peak)                    | $V_{IS} = V_{CC}$ to $V_{EE}$                                                           |                   |     |     |          |
|                                                              |                                         | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 100\text{ }\mu\text{A}$     | <a href="#">1</a> | -   | -   | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | -   | 225 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$    | -                 | -   | 200 | $\Omega$ |
|                                                              |                                         | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$ ; $I_{SW} = 1000\text{ }\mu\text{A}$ | -                 | -   | 165 | $\Omega$ |

**Table 6.**  $R_{ON}$  resistance per switch for 74HC4051 and 74HCT4051 ...continued

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

$V_{IS}$  is the input voltage at a Yn or Z terminal, whichever is assigned as an input.

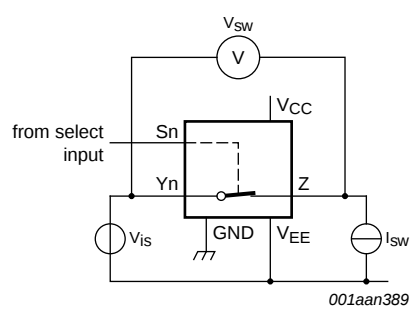
$V_{OS}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

For 74HC4051:  $V_{CC} - GND$  or  $V_{CC} - V_{EE} = 2.0\text{ V}$ ,  $4.5\text{ V}$ ,  $6.0\text{ V}$  and  $9.0\text{ V}$ .

For 74HCT4051:  $V_{CC} - GND = 4.5\text{ V}$  and  $5.5\text{ V}$ ,  $V_{CC} - V_{EE} = 2.0\text{ V}$ ,  $4.5\text{ V}$ ,  $6.0\text{ V}$  and  $9.0\text{ V}$ .

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

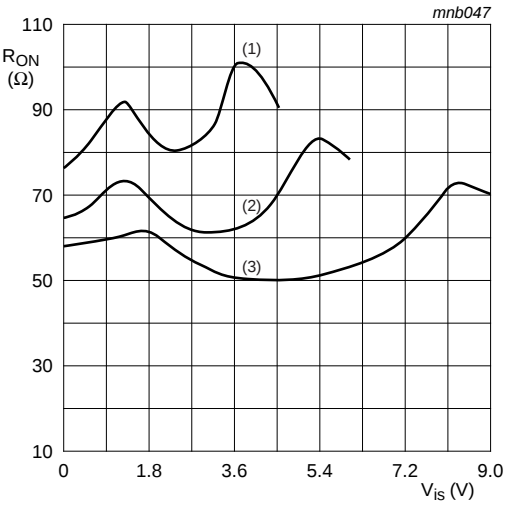
- [1] When supply voltages ( $V_{CC} - V_{EE}$ ) near  $2.0\text{ V}$  the analog switch ON resistance becomes extremely non-linear. When using a supply of  $2\text{ V}$ , it is recommended to use these devices only for transmitting digital signals.



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

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

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 74HC4051

Voltages are referenced to GND (ground = 0 V).  
 $V_{is}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.  
 $V_{os}$  is the output voltage at pins Z or Yn, 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     | $V_{EE} = 0\text{ V}; V_I = V_{CC}\text{ or GND}$                                                                                        |      |     |           |               |
|                                        |                           | $V_{CC} = 6.0\text{ V}$                                                                                                                  | -    | -   | $\pm 0.1$ | $\mu\text{A}$ |
|                                        |                           | $V_{CC} = 10.0\text{ V}$                                                                                                                 | -    | -   | $\pm 0.2$ | $\mu\text{A}$ |
| $I_{S(OFF)}$                           | 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 <a href="#">Figure 11</a> |      |     |           |               |
|                                        |                           | per channel                                                                                                                              | -    | -   | $\pm 0.1$ | $\mu\text{A}$ |
|                                        |                           | all channels                                                                                                                             | -    | -   | $\pm 0.4$ | $\mu\text{A}$ |
| $I_{S(ON)}$                            | ON-state leakage current  | $V_I = V_{IH}\text{ or } V_{IL};  V_{SW}  = V_{CC} - V_{EE}; V_{CC} = 10.0\text{ V}; V_{EE} = 0\text{ V};$ see <a href="#">Figure 12</a> | -    | -   | $\pm 0.4$ | $\mu\text{A}$ |

**Table 7.** Static characteristics for 74HC4051 ...continued

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

$V_{IS}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

$V_{OS}$  is the output voltage at pins Z or Yn, whichever is assigned as an output.

| Symbol                               | Parameter                 | Conditions                                                                                                                                                                                    | Min  | Typ | Max   | Unit |
|--------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-------|------|
| I <sub>CC</sub>                      | supply current            | V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>is</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or V <sub>EE</sub>                   |      |     |       |      |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | -    | -   | 8.0   | μA   |
|                                      |                           | V <sub>CC</sub> = 10.0 V                                                                                                                                                                      | -    | -   | 16.0  | μA   |
| C <sub>I</sub>                       | input capacitance         |                                                                                                                                                                                               | -    | 3.5 | -     | pF   |
| C <sub>sw</sub>                      | switch capacitance        | independent pins Yn                                                                                                                                                                           | -    | 5   | -     | pF   |
|                                      |                           | common pins Z                                                                                                                                                                                 | -    | 25  | -     | pF   |
| T <sub>amb</sub> = −40 °C to +85 °C  |                           |                                                                                                                                                                                               |      |     |       |      |
| V <sub>IH</sub>                      | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                                                                                                                       | 1.5  | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                                                       | 3.15 | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | 4.2  | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 9.0 V                                                                                                                                                                       | 6.3  | -   | -     | V    |
| V <sub>IL</sub>                      | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                                                                                                                       | -    | -   | 0.5   | V    |
|                                      |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                                                       | -    | -   | 1.35  | V    |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | -    | -   | 1.8   | V    |
|                                      |                           | V <sub>CC</sub> = 9.0 V                                                                                                                                                                       | -    | -   | 2.7   | V    |
| I <sub>I</sub>                       | input leakage current     | V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                                                                |      |     |       |      |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | -    | -   | ±1.0  | μA   |
|                                      |                           | V <sub>CC</sub> = 10.0 V                                                                                                                                                                      | -    | -   | ±2.0  | μA   |
| I <sub>S(OFF)</sub>                  | OFF-state leakage current | V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> − V <sub>EE</sub> ; see <a href="#">Figure 11</a> |      |     |       |      |
|                                      |                           | per channel                                                                                                                                                                                   | -    | -   | ±1.0  | μA   |
|                                      |                           | all channels                                                                                                                                                                                  | -    | -   | ±4.0  | μA   |
| I <sub>S(ON)</sub>                   | ON-state leakage current  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;  V <sub>SW</sub>   = V <sub>CC</sub> − V <sub>EE</sub> ; V <sub>CC</sub> = 10.0 V; V <sub>EE</sub> = 0 V; see <a href="#">Figure 12</a> | -    | -   | ±4.0  | μA   |
| I <sub>CC</sub>                      | supply current            | V <sub>EE</sub> = 0 V; V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>is</sub> = V <sub>EE</sub> or V <sub>CC</sub> ; V <sub>os</sub> = V <sub>CC</sub> or V <sub>EE</sub>                   |      |     |       |      |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | -    | -   | 80.0  | μA   |
|                                      |                           | V <sub>CC</sub> = 10.0 V                                                                                                                                                                      | -    | -   | 160.0 | μA   |
| T <sub>amb</sub> = −40 °C to +125 °C |                           |                                                                                                                                                                                               |      |     |       |      |
| V <sub>IH</sub>                      | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                                                                                                                       | 1.5  | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                                                       | 3.15 | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | 4.2  | -   | -     | V    |
|                                      |                           | V <sub>CC</sub> = 9.0 V                                                                                                                                                                       | 6.3  | -   | -     | V    |
| V <sub>IL</sub>                      | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                                                                                                                       | -    | -   | 0.5   | V    |
|                                      |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                                                       | -    | -   | 1.35  | V    |
|                                      |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                                                       | -    | -   | 1.8   | V    |
|                                      |                           | V <sub>CC</sub> = 9.0 V                                                                                                                                                                       | -    | -   | 2.7   | V    |

**Table 7.** Static characteristics for 74HC4051 ...continued

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

$V_{IS}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

$V_{OS}$  is the output voltage at pins Z or Yn, 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                                                                                                |     |     |           |               |
|              |                           | $V_{CC} = 6.0\text{ V}$                                                                                                                      | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
|              |                           | $V_{CC} = 10.0\text{ V}$                                                                                                                     | -   | -   | $\pm 2.0$ | $\mu\text{A}$ |
| $I_{S(OFF)}$ | 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 <a href="#">Figure 11</a> |     |     |           |               |
|              |                           | per channel                                                                                                                                  | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
|              |                           | all channels                                                                                                                                 | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{S(ON)}$  | 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 <a href="#">Figure 12</a> | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{CC}$     | 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     | $\mu\text{A}$ |
|              |                           | $V_{CC} = 10.0\text{ V}$                                                                                                                     | -   | -   | 320.0     | $\mu\text{A}$ |

**Table 8.** Static characteristics for 74HCT4051

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

$V_{IS}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

$V_{OS}$  is the output voltage at pins Z or Yn, whichever is assigned as an output.

| Symbol                                                   | Parameter                 | Conditions                                                                                                                                    | Min | Typ | Max       | Unit          |
|----------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----------|---------------|
| <b><math>T_{amb} = 25\text{ }^{\circ}\text{C}</math></b> |                           |                                                                                                                                               |     |     |           |               |
| $V_{IH}$                                                 | 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; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                                        | -   | -   | $\pm 0.1$ | $\mu\text{A}$ |
| $I_{S(OFF)}$                                             | 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 <a href="#">Figure 11</a>  |     |     |           |               |
|                                                          |                           | per channel                                                                                                                                   | -   | -   | $\pm 0.1$ | $\mu\text{A}$ |
|                                                          |                           | all channels                                                                                                                                  | -   | -   | $\pm 0.4$ | $\mu\text{A}$ |
| $I_{S(ON)}$                                              | 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 <a href="#">Figure 12</a>  | -   | -   | $\pm 0.4$ | $\mu\text{A}$ |
| $I_{CC}$                                                 | 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       | $\mu\text{A}$ |
|                                                          |                           | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$                                                                                            | -   | -   | 16.0      | $\mu\text{A}$ |
| $\Delta I_{CC}$                                          | 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       | $\mu\text{A}$ |
| $C_I$                                                    | input capacitance         |                                                                                                                                               | -   | 3.5 | -         | pF            |
| $C_{SW}$                                                 | switch capacitance        | independent pins Yn                                                                                                                           | -   | 5   | -         | pF            |
|                                                          |                           | common pins Z                                                                                                                                 | -   | 25  | -         | pF            |

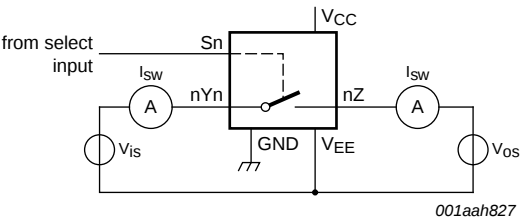
**Table 8.** Static characteristics for 74HCT4051 ...continued

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

$V_{IS}$  is the input voltage at pins Yn or Z, whichever is assigned as an input.

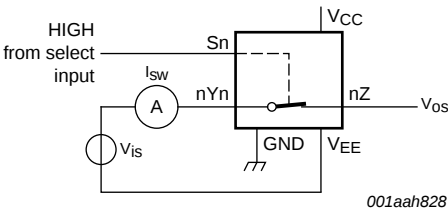
$V_{OS}$  is the output voltage at pins Z or Yn, whichever is assigned as an output.

| Symbol                                                        | Parameter                 | Conditions                                                                                                                                   | Min | Typ | Max       | Unit          |
|---------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----------|---------------|
| <b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>  |                           |                                                                                                                                              |     |     |           |               |
| $V_{IH}$                                                      | 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     | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                                       | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{S(OFF)}$                                                  | 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 <a href="#">Figure 11</a> |     |     |           |               |
|                                                               |                           | per channel                                                                                                                                  | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
|                                                               |                           | all channels                                                                                                                                 | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{S(ON)}$                                                   | 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 <a href="#">Figure 12</a> | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{CC}$                                                      | supply current            | $V_I = V_{CC}$ or GND; $V_{IS} = V_{EE}$ or $V_{CC}$ ; $V_{OS} = V_{CC}$ or $V_{EE}$                                                         |     |     |           |               |
|                                                               |                           | $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                                                              | -   | -   | 80.0      | $\mu\text{A}$ |
|                                                               |                           | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$                                                                                           | -   | -   | 160.0     | $\mu\text{A}$ |
| $\Delta I_{CC}$                                               | 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       | $\mu\text{A}$ |
| <b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b> |                           |                                                                                                                                              |     |     |           |               |
| $V_{IH}$                                                      | 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     | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                                       | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{S(OFF)}$                                                  | 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 <a href="#">Figure 11</a> |     |     |           |               |
|                                                               |                           | per channel                                                                                                                                  | -   | -   | $\pm 1.0$ | $\mu\text{A}$ |
|                                                               |                           | all channels                                                                                                                                 | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{S(ON)}$                                                   | 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 <a href="#">Figure 12</a> | -   | -   | $\pm 4.0$ | $\mu\text{A}$ |
| $I_{CC}$                                                      | supply current            | $V_I = V_{CC}$ or GND; $V_{IS} = V_{EE}$ or $V_{CC}$ ; $V_{OS} = V_{CC}$ or $V_{EE}$                                                         |     |     |           |               |
|                                                               |                           | $V_{CC} = 5.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                                                              | -   | -   | 160.0     | $\mu\text{A}$ |
|                                                               |                           | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = -5.0\text{ V}$                                                                                           | -   | -   | 320.0     | $\mu\text{A}$ |
| $\Delta I_{CC}$                                               | 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       | $\mu\text{A}$ |



$V_{is} = V_{CC}$  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 74HC4051

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

$V_{is}$  is the input voltage at a Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

| Symbol                                                   | Parameter         | Conditions                                                                          | Min                 | Typ | Max | Unit |
|----------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------|---------------------|-----|-----|------|
| <b><math>T_{amb} = 25\text{ }^{\circ}\text{C}</math></b> |                   |                                                                                     |                     |     |     |      |
| $t_{pd}$                                                 | propagation delay | $V_{is}$ to $V_{os}$ ; $R_L = \infty\text{ }\Omega$ ; see <a href="#">Figure 13</a> | <a href="#">[1]</a> |     |     |      |
|                                                          |                   | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                     | -                   | 14  | 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 74HC4051 ...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 Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z 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 <a href="#">Figure 14</a>   | <a href="#">[2]</a> |     |     |      |
|                                                                                          |                               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 72  | 345 | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 29  | 69  | ns   |
|                                                                                          |                               | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$           | -                   | 22  | -   | ns   |
|                                                                                          |                               | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 21  | 59  | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -                   | 18  | 51  | ns   |
|                                                                                          |                               | Sn to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 14</a>          | <a href="#">[2]</a> |     |     |      |
|                                                                                          |                               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 66  | 345 | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 28  | 69  | ns   |
|                                                                                          |                               | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$           | -                   | 20  | -   | ns   |
|                                                                                          |                               | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 19  | 59  | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -                   | 16  | 51  | ns   |
| $t_{off}$                                                                                | turn-off time                 | $\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> | <a href="#">[3]</a> |     |     |      |
|                                                                                          |                               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 58  | 290 | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 31  | 58  | 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  | 49  | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -                   | 18  | 42  | ns   |
|                                                                                          |                               | Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>        | <a href="#">[3]</a> |     |     |      |
|                                                                                          |                               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 61  | 290 | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 25  | 58  | ns   |
|                                                                                          |                               | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$           | -                   | 19  | -   | ns   |
|                                                                                          |                               | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | 18  | 49  | ns   |
|                                                                                          |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -                   | 18  | 42  | ns   |
| $C_{PD}$                                                                                 | power dissipation capacitance | per switch; $V_I = GND$ to $V_{CC}$                                              | <a href="#">[4]</a> | -   | 25  | pF   |
| <b><math>T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}</math></b> |                               |                                                                                  |                     |     |     |      |
| $t_{pd}$                                                                                 | propagation delay             | $V_{is}$ to $V_{os}$ ; $R_L = \infty\ \Omega$ ; see <a href="#">Figure 13</a>    | <a href="#">[1]</a> |     |     |      |
|                                                                                          |                               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -                   | -   | 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 74HC4051 ...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 Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

| Symbol                                            | Parameter         | Conditions                                                                               | Min | Typ | Max | Unit |
|---------------------------------------------------|-------------------|------------------------------------------------------------------------------------------|-----|-----|-----|------|
| t <sub>on</sub>                                   | turn-on time      | $\overline{E}$ to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see <a href="#">Figure 14</a>  | [2] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 430 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 86  | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 73  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 64  | ns   |
|                                                   |                   | Sn to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see <a href="#">Figure 14</a>              | [2] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 430 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 86  | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 73  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 64  | ns   |
| t <sub>off</sub>                                  | turn-off time     | $\overline{E}$ to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see <a href="#">Figure 14</a> | [3] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 365 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 73  | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 62  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 53  | ns   |
|                                                   |                   | Sn to V <sub>os</sub> ; R <sub>L</sub> = 1 kΩ; see <a href="#">Figure 14</a>             | [3] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 365 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 73  | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 62  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 53  | ns   |
| T <sub>amb</sub> = -40 °C to +125 °C              |                   |                                                                                          |     |     |     |      |
| t <sub>pd</sub>                                   | propagation delay | V <sub>is</sub> to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see <a href="#">Figure 13</a> | [1] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 90  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 18  | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 15  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 12  | ns   |
| t <sub>on</sub>                                   | turn-on time      | $\overline{E}$ to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see <a href="#">Figure 14</a>  | [2] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 520 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 104 | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 88  | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                        | -   | -   | 77  | ns   |
|                                                   |                   | Sn to V <sub>os</sub> ; R <sub>L</sub> = ∞ Ω; see <a href="#">Figure 14</a>              | [2] |     |     |      |
|                                                   |                   | V <sub>CC</sub> = 2.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 520 | ns   |
|                                                   |                   | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 104 | ns   |
|                                                   |                   | V <sub>CC</sub> = 6.0 V; V <sub>EE</sub> = 0 V                                           | -   | -   | 88  | ns   |
| V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V | -                 | -                                                                                        | 77  | ns  |     |      |

**Table 9. Dynamic characteristics for 74HC4051 ...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 Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

| Symbol    | Parameter     | Conditions                                                                       | Min | Typ | Max | Unit |
|-----------|---------------|----------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{off}$ | turn-off time | $\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> | [3] |     |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 435 | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 87  | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 74  | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -   | -   | 72  | ns   |
|           |               | Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>        | [3] |     |     |      |
|           |               | $V_{CC} = 2.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 435 | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 87  | ns   |
|           |               | $V_{CC} = 6.0\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 74  | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -   | -   | 72  | 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  $\mu\text{W}$ ).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$  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 74HCT4051**

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

$V_{is}$  is the input voltage at a Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

| Symbol                                                 | Parameter         | Conditions                                                                          | Min | Typ | Max | Unit |
|--------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------|-----|-----|-----|------|
| <b><math>T_{amb} = 25\text{ }^\circ\text{C}</math></b> |                   |                                                                                     |     |     |     |      |
| $t_{pd}$                                               | propagation delay | $V_{is}$ to $V_{os}$ ; $R_L = \infty\text{ }\Omega$ ; see <a href="#">Figure 13</a> | [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      | $\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>    | [2] |     |     |      |
|                                                        |                   | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                     | -   | 26  | 55  | ns   |
|                                                        |                   | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$              | -   | 22  | -   | ns   |
|                                                        |                   | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                  | -   | 16  | 39  | ns   |
|                                                        |                   | Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>           | [2] |     |     |      |
|                                                        |                   | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                     | -   | 28  | 55  | ns   |
|                                                        |                   | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$              | -   | 24  | -   | ns   |
|                                                        |                   | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                  | -   | 16  | 39  | ns   |

**Table 10. Dynamic characteristics for 74HCT4051 ...continued**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF; for test circuit see [Figure 15](#). $V_{is}$  is the input voltage at a Yn or Z terminal, whichever is assigned as an input. $V_{os}$  is the output voltage at a Yn or Z 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 <a href="#">Figure 14</a> <a href="#">[3]</a> |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | 19  | 45  | ns   |
|                                                                                                        |                               | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$                                    | -   | 16  | -   | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | 16  | 32  | ns   |
|                                                                                                        |                               | Sn to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[3]</a>             |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | 23  | 45  | ns   |
|                                                                                                        |                               | $V_{CC} = 5.0\text{ V}$ ; $V_{EE} = 0\text{ V}$ ; $C_L = 15\text{ pF}$                                    | -   | 20  | -   | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | 16  | 32  | ns   |
| $C_{PD}$                                                                                               | power dissipation capacitance | per switch; $V_I = \text{GND}$ to $V_{CC} - 1.5\text{ V}$ <a href="#">[4]</a>                             | -   | 25  | -   | pF   |
| <b><math>T_{amb} = -40\text{ }^{\circ}\text{C}</math> to <math>+85\text{ }^{\circ}\text{C}</math></b>  |                               |                                                                                                           |     |     |     |      |
| $t_{pd}$                                                                                               | propagation delay             | $V_{IS}$ to $V_{OS}$ ; $R_L = \infty\text{ }\Omega$ ; see <a href="#">Figure 13</a> <a href="#">[1]</a>   |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 15  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 10  | ns   |
| $t_{on}$                                                                                               | turn-on time                  | $\overline{E}$ to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[2]</a> |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 69  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 49  | ns   |
|                                                                                                        |                               | Sn to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[2]</a>             |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 69  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 49  | ns   |
| $t_{off}$                                                                                              | turn-off time                 | $\overline{E}$ to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[3]</a> |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 56  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 40  | ns   |
|                                                                                                        |                               | Sn to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[3]</a>             |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 56  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 40  | ns   |
| <b><math>T_{amb} = -40\text{ }^{\circ}\text{C}</math> to <math>+125\text{ }^{\circ}\text{C}</math></b> |                               |                                                                                                           |     |     |     |      |
| $t_{pd}$                                                                                               | propagation delay             | $V_{IS}$ to $V_{OS}$ ; $R_L = \infty\text{ }\Omega$ ; see <a href="#">Figure 13</a> <a href="#">[1]</a>   |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 18  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 12  | ns   |
| $t_{on}$                                                                                               | turn-on time                  | $\overline{E}$ to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[2]</a> |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 83  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 59  | ns   |
|                                                                                                        |                               | Sn to $V_{OS}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> <a href="#">[2]</a>             |     |     |     |      |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                                           | -   | -   | 83  | ns   |
|                                                                                                        |                               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                                                        | -   | -   | 59  | ns   |

**Table 10. Dynamic characteristics for 74HCT4051 ...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 Yn or Z terminal, whichever is assigned as an input.

$V_{os}$  is the output voltage at a Yn or Z terminal, whichever is assigned as an output.

| Symbol    | Parameter     | Conditions                                                                       | Min | Typ | Max | Unit |
|-----------|---------------|----------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{off}$ | turn-off time | $\bar{E}$ to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a> | [3] |     |     |      |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 68  | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -   | -   | 48  | ns   |
|           |               | Sn to $V_{os}$ ; $R_L = 1\text{ k}\Omega$ ; see <a href="#">Figure 14</a>        | [3] |     |     |      |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = 0\text{ V}$                                  | -   | -   | 68  | ns   |
|           |               | $V_{CC} = 4.5\text{ V}$ ; $V_{EE} = -4.5\text{ V}$                               | -   | -   | 48  | 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  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

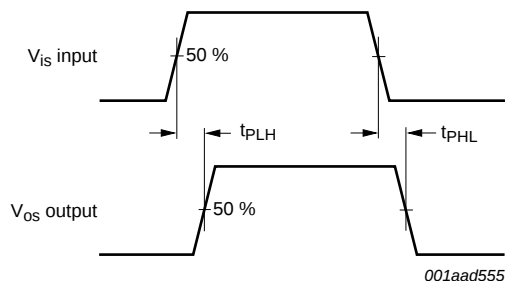
N = number of inputs switching;

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

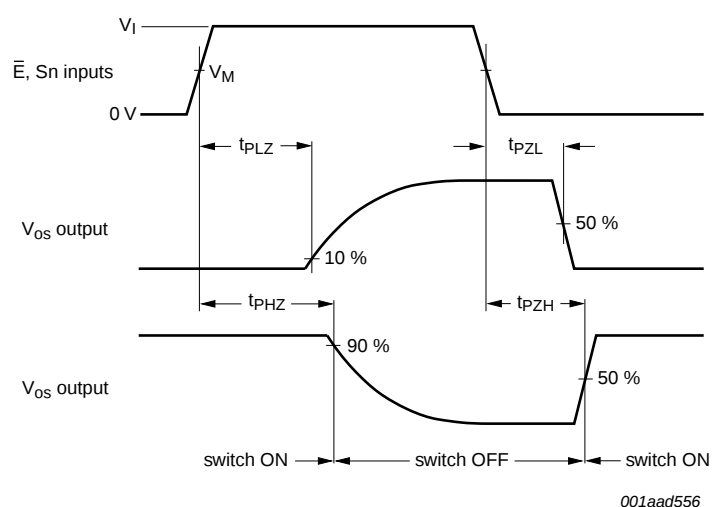
$C_L$  = output load capacitance in pF;

$C_{sw}$  = switch capacitance in pF;

$V_{CC}$  = supply voltage in V.



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

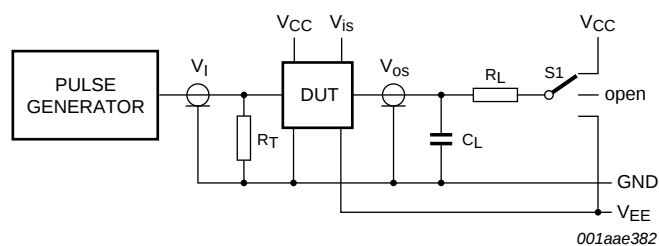
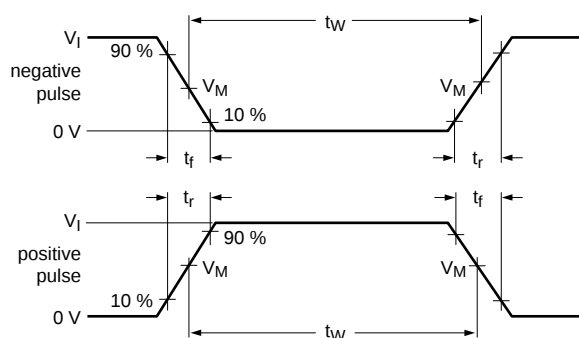


001aad556

For 74HC4051:  $V_M = 0.5 \times V_{CC}$ .

For 74HCT4051:  $V_M = 1.3 \text{ V}$ .

**Fig 14. Turn-on and turn-off times**



001aae382

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 <sub>I</sub> | V <sub>is</sub> | t <sub>r</sub> , t <sub>f</sub> |                      | C <sub>L</sub> | R <sub>L</sub> |                 |
|                                     |                |                 | at f <sub>max</sub>             | other <sup>[1]</sup> |                |                |                 |
| t <sub>PHL</sub> , t <sub>PLH</sub> | [2]            | pulse           | < 2 ns                          | 6 ns                 | 50 pF          | 1 kΩ           | open            |
| t <sub>PZH</sub> , t <sub>PHZ</sub> | [2]            | V <sub>CC</sub> | < 2 ns                          | 6 ns                 | 50 pF          | 1 kΩ           | V <sub>EE</sub> |
| t <sub>PZL</sub> , t <sub>PLZ</sub> | [2]            | V <sub>EE</sub> | < 2 ns                          | 6 ns                 | 50 pF          | 1 kΩ           | V <sub>CC</sub> |

[1] t<sub>r</sub> = t<sub>f</sub> = 6 ns; when measuring f<sub>max</sub>, there is no constraint to t<sub>r</sub> and t<sub>f</sub> with 50 % duty factor.

[2] V<sub>I</sub> values:

a) For 74HC4051: V<sub>I</sub> = V<sub>CC</sub>

b) For 74HCT4051: V<sub>I</sub> = 3 V

## 12. Additional dynamic characteristics

Table 12. Additional dynamic characteristics

Recommended conditions and typical values; GND = 0 V; T<sub>amb</sub> = 25 °C; C<sub>L</sub> = 50 pF.

V<sub>is</sub> is the input voltage at pins nYn or nZ, whichever is assigned as an input.

V<sub>os</sub> is the output voltage at pins nYn or nZ, whichever is assigned as an output.

| Symbol              | Parameter                | Conditions                                                                                                                                                                                                                             | Min                   | Typ  | Max | Unit |
|---------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-----|------|
| d <sub>sin</sub>    | sine-wave distortion     | f <sub>i</sub> = 1 kHz; R <sub>L</sub> = 10 kΩ; see <a href="#">Figure 16</a>                                                                                                                                                          |                       |      |     |      |
|                     |                          | V <sub>is</sub> = 4.0 V (p-p); V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V                                                                                                                                                     | -                     | 0.04 | -   | %    |
|                     |                          | V <sub>is</sub> = 8.0 V (p-p); V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                                                                                                                                       | -                     | 0.02 | -   | %    |
|                     |                          | f <sub>i</sub> = 10 kHz; R <sub>L</sub> = 10 kΩ; see <a href="#">Figure 16</a>                                                                                                                                                         |                       |      |     |      |
|                     |                          | V <sub>is</sub> = 4.0 V (p-p); V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V                                                                                                                                                     | -                     | 0.12 | -   | %    |
|                     |                          | V <sub>is</sub> = 8.0 V (p-p); V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                                                                                                                                       | -                     | 0.06 | -   | %    |
| α <sub>iso</sub>    | isolation (OFF-state)    | R <sub>L</sub> = 600 Ω; f <sub>i</sub> = 1 MHz; see <a href="#">Figure 17</a>                                                                                                                                                          |                       |      |     |      |
|                     |                          | V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V                                                                                                                                                                                    | <a href="#">[1]</a> - | -50  | -   | dB   |
|                     |                          | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                                                                                                                                                                      | <a href="#">[1]</a> - | -50  | -   | dB   |
| V <sub>ct</sub>     | crosstalk voltage        | peak-to-peak value; between control and any switch; R <sub>L</sub> = 600 Ω; f <sub>i</sub> = 1 MHz; $\bar{E}$ or Sn square wave between V <sub>CC</sub> and GND; t <sub>r</sub> = t <sub>f</sub> = 6 ns; see <a href="#">Figure 18</a> |                       |      |     |      |
|                     |                          | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = 0 V                                                                                                                                                                                         | -                     | 110  | -   | mV   |
|                     |                          | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                                                                                                                                                                      | -                     | 220  | -   | mV   |
| f <sub>(-3dB)</sub> | -3 dB frequency response | R <sub>L</sub> = 50 Ω; see <a href="#">Figure 19</a>                                                                                                                                                                                   |                       |      |     |      |
|                     |                          | V <sub>CC</sub> = 2.25 V; V <sub>EE</sub> = -2.25 V                                                                                                                                                                                    | <a href="#">[2]</a> - | 170  | -   | MHz  |
|                     |                          | V <sub>CC</sub> = 4.5 V; V <sub>EE</sub> = -4.5 V                                                                                                                                                                                      | <a href="#">[2]</a> - | 180  | -   | MHz  |

[1] Adjust input voltage V<sub>is</sub> to 0 dBm level (0 dBm = 1 mW into 600 Ω).

[2] Adjust input voltage V<sub>is</sub> to 0 dBm level at V<sub>os</sub> for 1 MHz (0 dBm = 1 mW into 50 Ω).

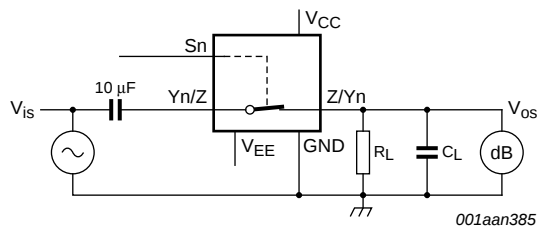
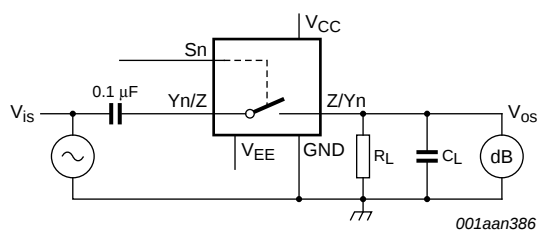
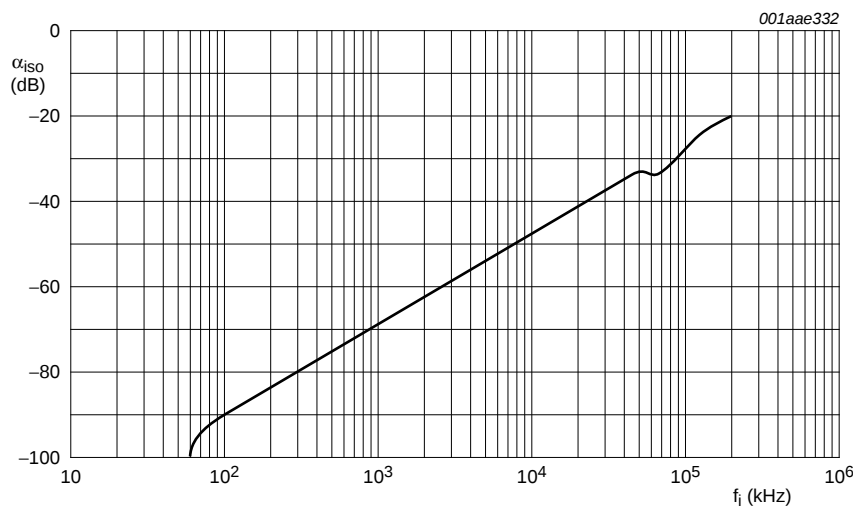


Fig 16. Test circuit for measuring sine-wave distortion



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

a. Test circuit



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

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

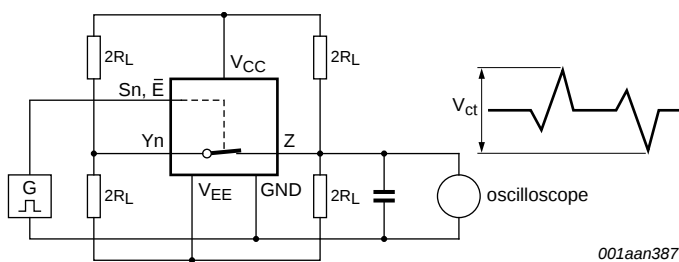
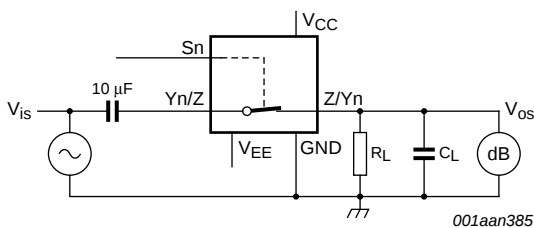
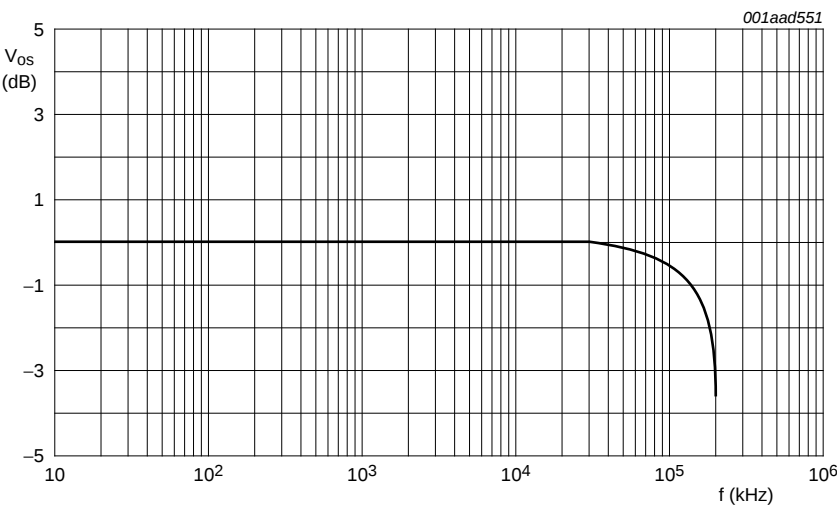


Fig 18. Test circuit for measuring crosstalk between control input and any switch



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

a. Test circuit



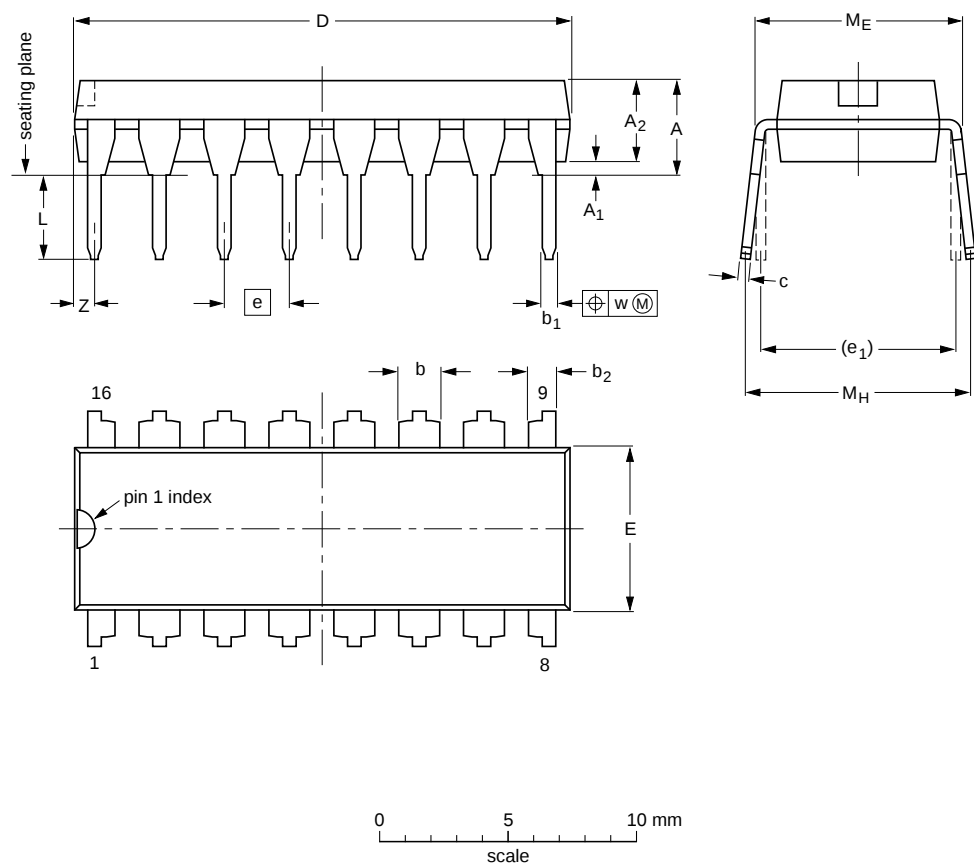
b. Typical frequency response

Fig 19. Test circuit for frequency response

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<br>max. | A <sub>1</sub><br>min. | A <sub>2</sub><br>max. | b              | b <sub>1</sub> | b <sub>2</sub> | c              | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | e <sub>1</sub> | L            | M <sub>E</sub> | M <sub>H</sub> | w     | Z <sup>(1)</sup><br>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                     |

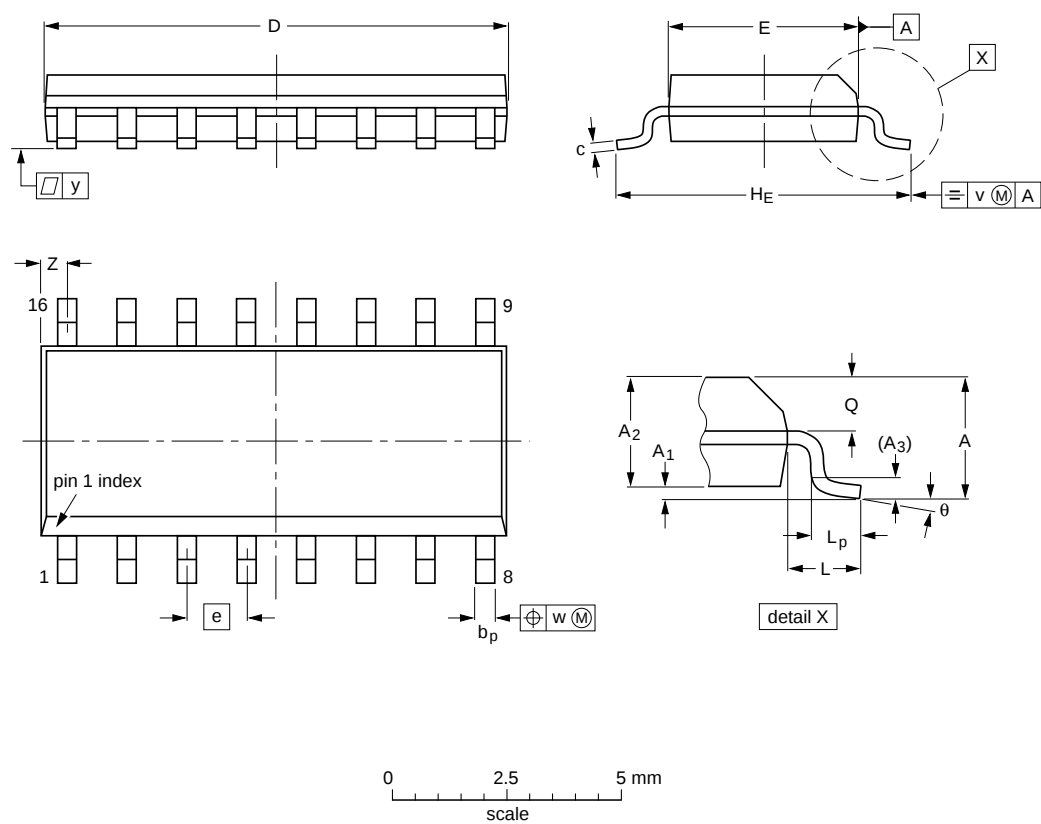
**Note**  
1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

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

Fig 20. Package outline SOT38-4 (DIP16)

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<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | z <sup>(1)</sup> | 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°<br>0° |
| 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<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|--------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC  | JEITA |  |                        |                      |
| SOT109-1           | 076E07     | MS-012 |       |  |                        | 99-12-27<br>03-02-19 |

Fig 21. Package outline SOT109-1 (SO16)

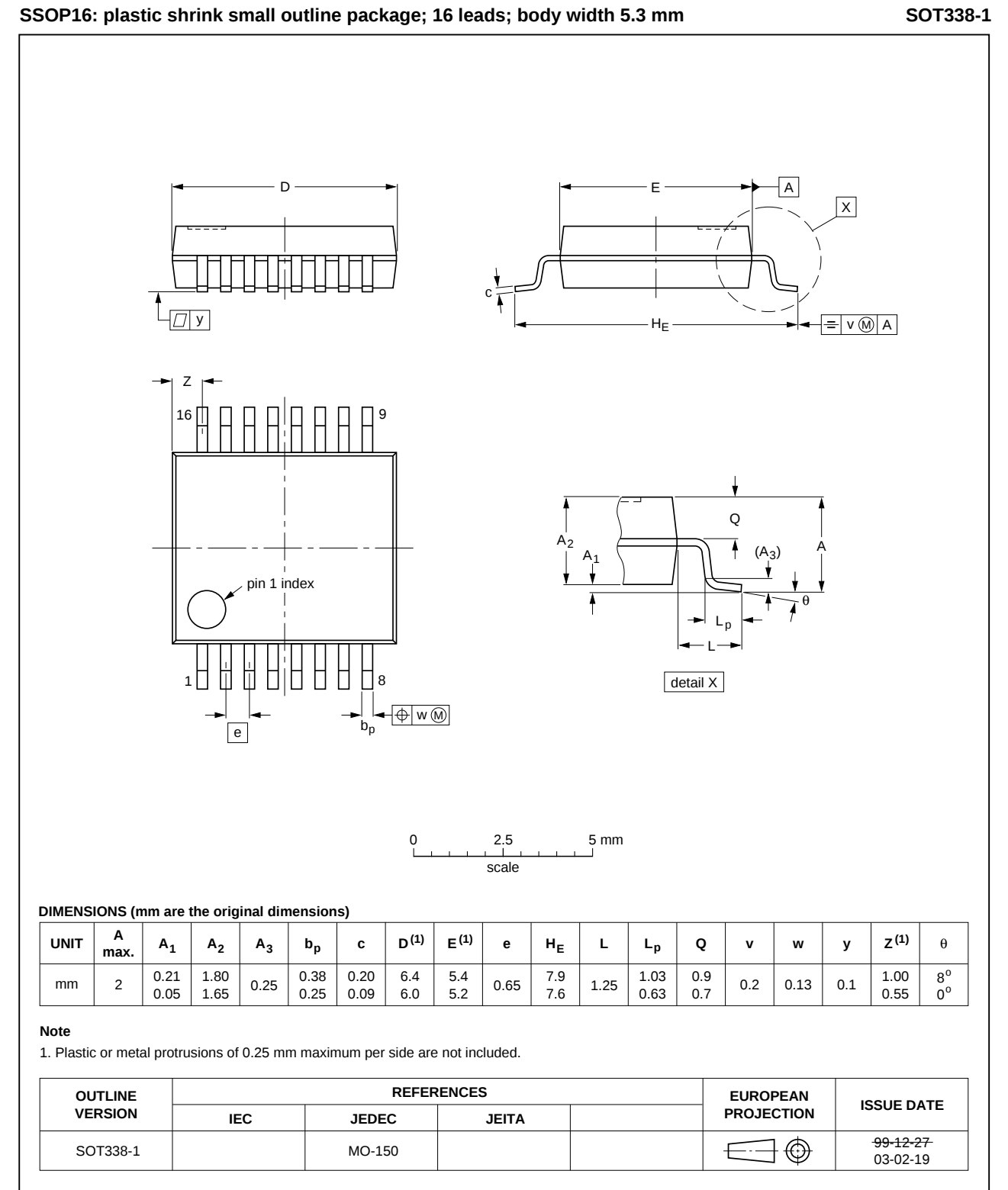


Fig 22. Package outline SOT338-1 (SSOP16)

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

SOT403-1

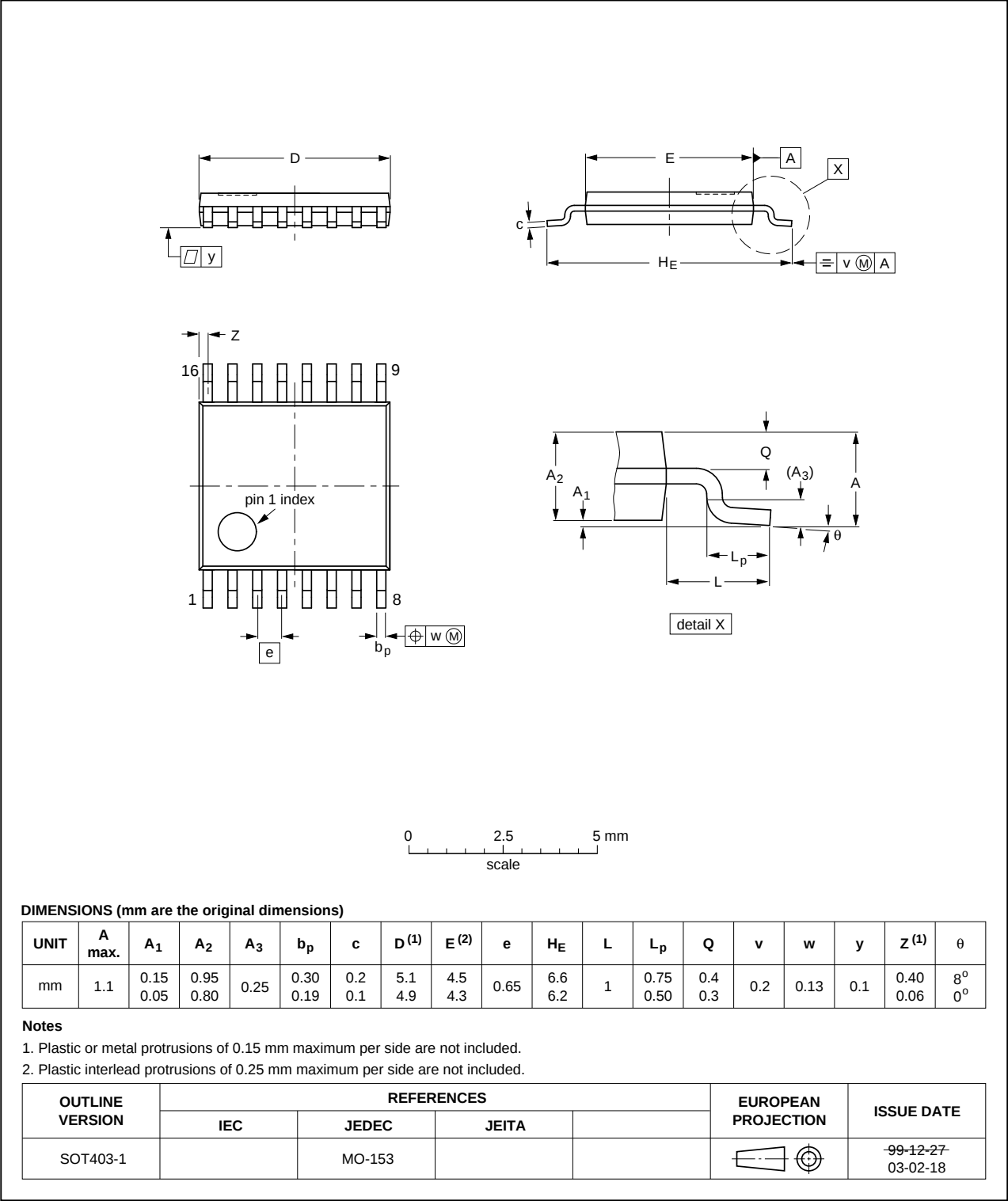


Fig 23. Package outline SOT403-1 (TSSOP16)

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

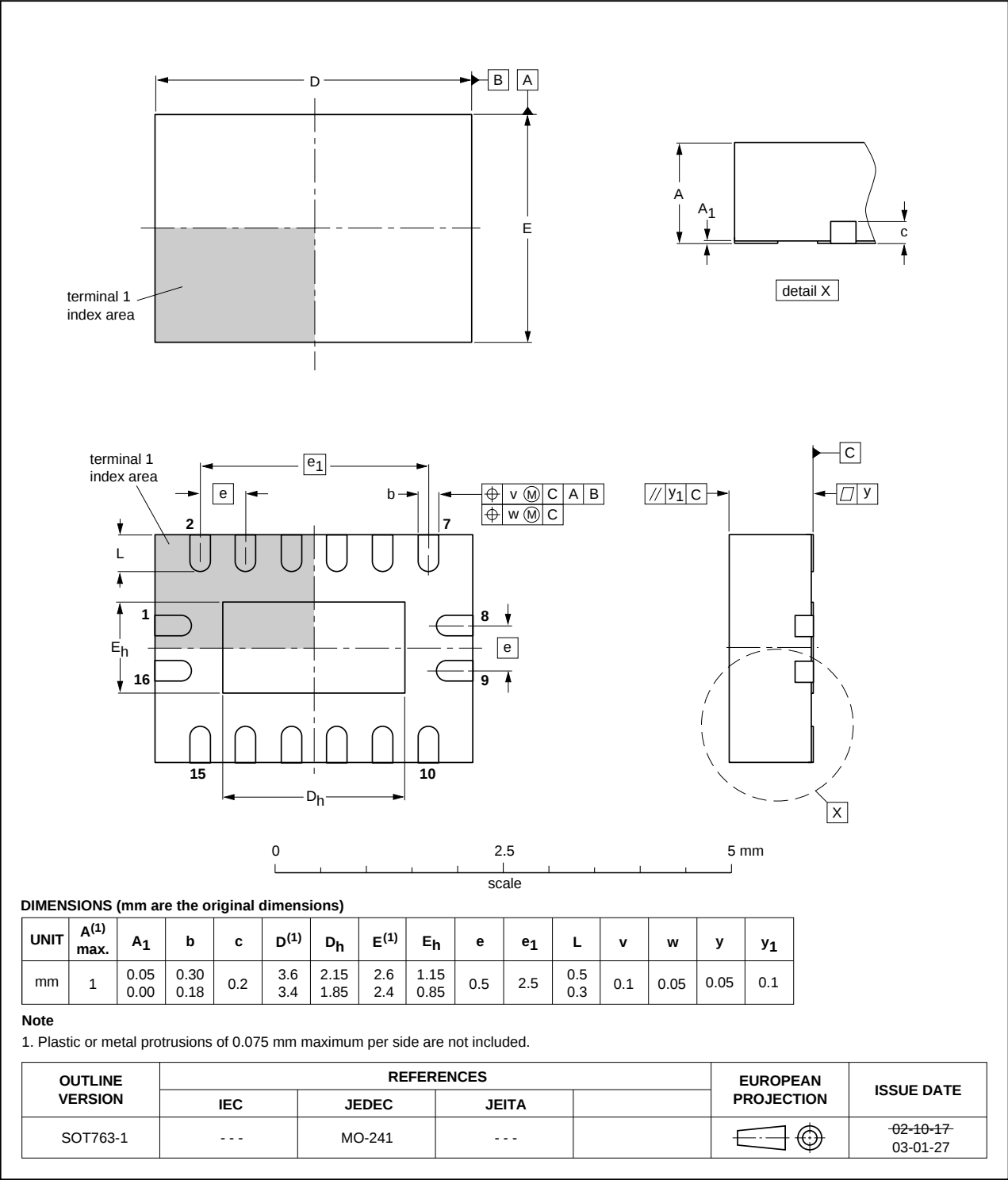


Fig 24. Package outline SOT763-1 (DHVQFN16)

## 14. Abbreviations

Table 13. Abbreviations

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

## 15. Revision history

Table 14. Revision history

| Document ID      | Release date           | Data sheet status     | Change notice | Supersedes         |
|------------------|------------------------|-----------------------|---------------|--------------------|
| 74HC_HCT4051 v.6 | 20111213               | Product data sheet    | -             | 74HC_HCT4051 v.5   |
| Modifications:   | • Legal pages updated. |                       |               |                    |
| 74HC_HCT4051 v.5 | 20110513               | Product data sheet    | -             | 74HC_HCT4051 v.4   |
| 74HC_HCT4051 v.4 | 20110117               | Product data sheet    | -             | 74HC_HCT4051 v.3   |
| 74HC_HCT4051 v.3 | 20051219               | Product specification | -             | 74HC_HCT4051_CNV_2 |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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Date of release: 13 December 2011

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<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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