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Kind regards,

Team Nexperia

# 74LV4053

## Triple single-pole double-throw analog switch

Rev. 6 — 17 March 2016

Product data sheet

### 1. General description

The 74LV4053 is a triple single-pole double-throw (SPDT) analog switch, suitable for use as an analog or digital multiplexer/demultiplexer. It is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC4053 and 74HCT4053. Each switch has a digital select input ( $S_n$ ), two independent inputs/outputs ( $nY0$  and  $nY1$ ) and a common input/output ( $nZ$ ). All three switches share an enable input ( $\overline{E}$ ). A HIGH on  $\overline{E}$  causes all switches into the high-impedance OFF-state, independent of  $S_n$ .

$V_{CC}$  and GND are the supply voltage connections for the digital control inputs ( $S_n$  and  $\overline{E}$ ). The  $V_{CC}$  to GND range is 1 V to 6 V. The analog inputs/outputs ( $nY0$ ,  $nY1$  and  $nZ$ ) can swing between  $V_{CC}$  as a positive limit and  $V_{EE}$  as a negative limit.  $V_{CC} - V_{EE}$  may not exceed 6 V. For operation as a digital multiplexer/demultiplexer,  $V_{EE}$  is connected to GND (typically ground).  $V_{EE}$  and  $V_{SS}$  are the supply voltage connections for the switches.

### 2. Features and benefits

- Optimized for low-voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Low ON resistance:
  - ◆ 180  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 2.0$  V
  - ◆ 100  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 3.0$  V
  - ◆ 75  $\Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5$  V
- Logic level translation:
  - ◆ To enable 3 V logic to communicate with  $\pm 3$  V analog signals
- Typical 'break before make' built in
- ESD protection:
  - ◆ HBM JESD22-A114-C exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and from  $-40$  °C to  $+125$  °C

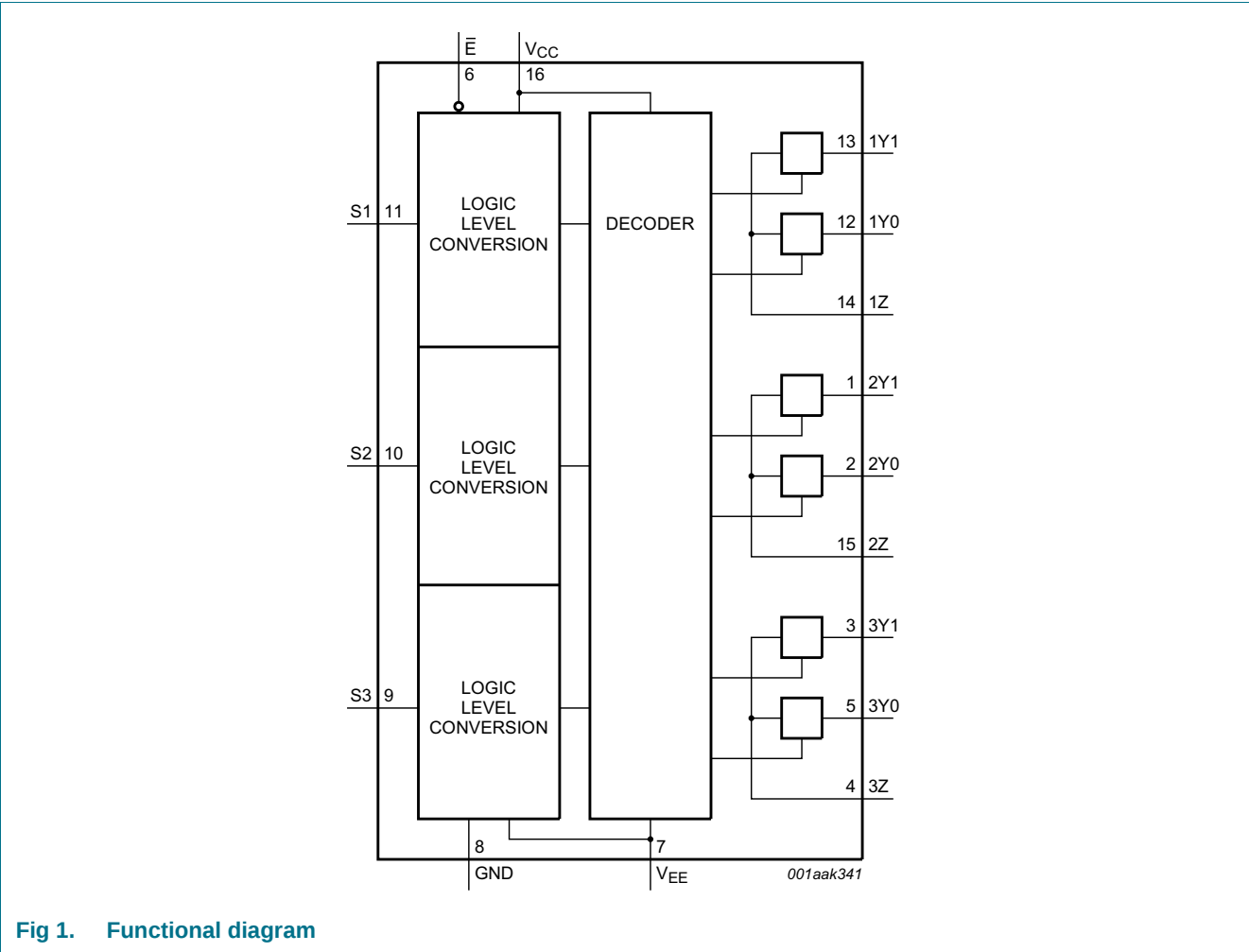


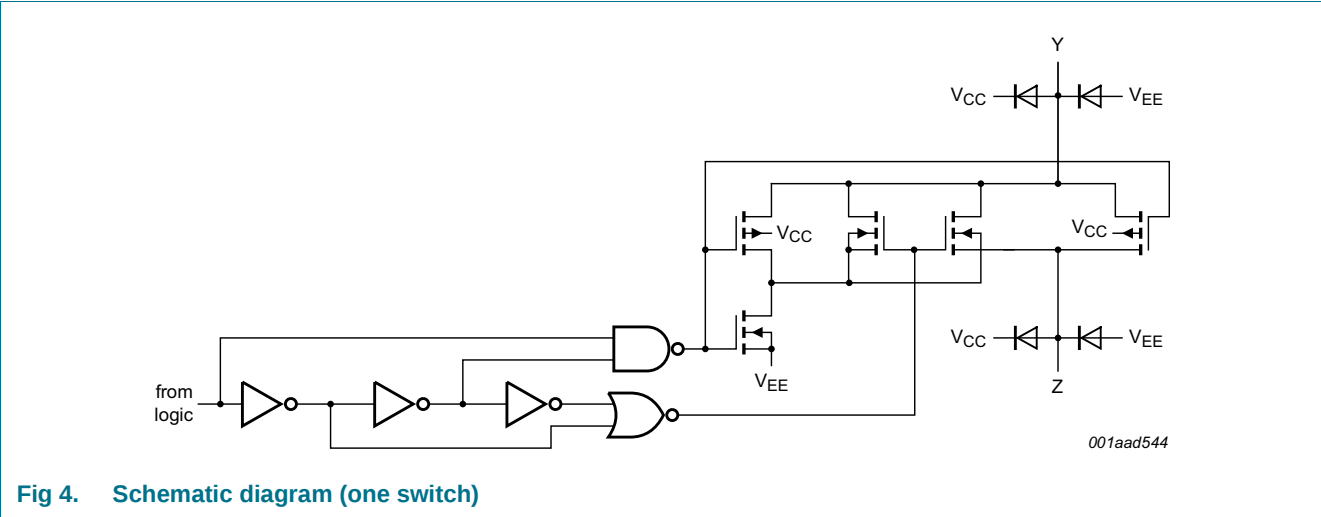
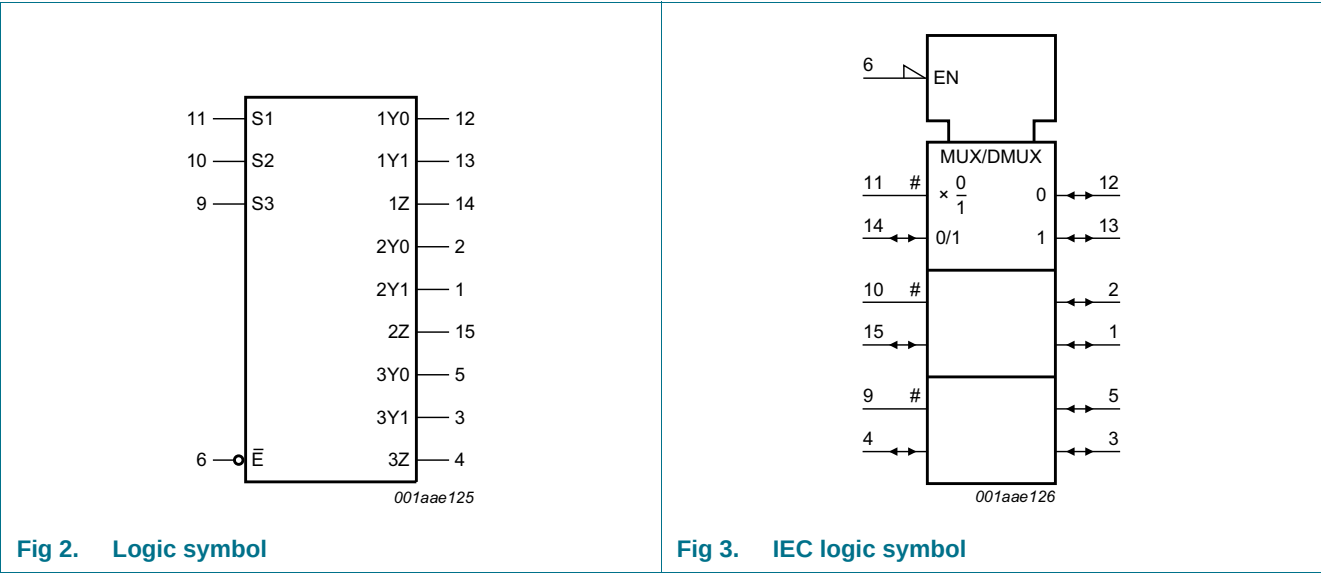
3. Ordering information

Table 1. Ordering information

| Type number | Package           |          |                                                                                                                                |          |
|-------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range | Name     | Description                                                                                                                    | Version  |
| 74LV4053D   | −40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm                                                                     | SOT109-1 |
| 74LV4053DB  | −40 °C to +125 °C | SSOP16   | plastic shrink small outline package; 16 leads; body width 5.3 mm                                                              | SOT338-1 |
| 74LV4053PW  | −40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm                                                         | SOT403-1 |
| 74LV4053BQ  | −40 °C to +125 °C | DHVQFN16 | plastic dual-in line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |

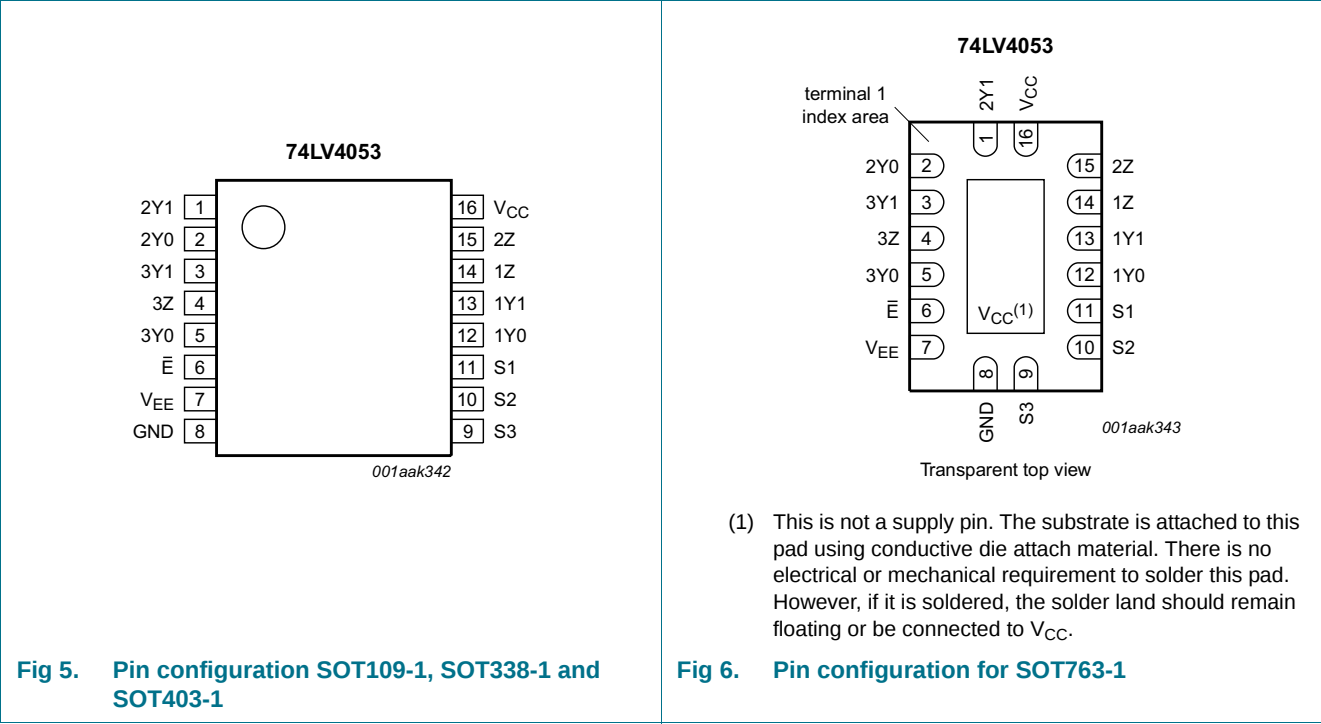
4. Functional diagram





5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

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

## 6. Functional description

Table 3. Function table [\[1\]](#)

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

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

## 7. 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          | <a href="#">[1]</a>                                                                        | -0.5 | +7.0     | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V <a href="#">[2]</a>                               | -    | $\pm 20$ | mA   |
| $I_{SK}$  | switch clamping current | $V_{SW} < -0.5$ V or $V_{SW} > V_{CC} + 0.5$ V <a href="#">[2]</a>                         | -    | $\pm 20$ | mA   |
| $I_{SW}$  | switch current          | $V_{SW} > -0.5$ V or $V_{SW} < V_{CC} + 0.5$ V; source or sink current <a href="#">[2]</a> | -    | $\pm 25$ | mA   |
| $T_{stg}$ | storage temperature     |                                                                                            | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C <a href="#">[3]</a>                                          |      |          |      |
|           |                         | DIP16 package                                                                              | -    | 750      | mW   |
|           |                         | SO16 package                                                                               | -    | 500      | mW   |
|           |                         | TSSOP16 package                                                                            | -    | 500      | mW   |
|           |                         | DHVQFN16 package                                                                           | -    | 500      | mW   |

- [1] To avoid drawing  $V_{CC}$  current out of terminal nZ, when switch current flows into terminals nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal nZ, no  $V_{CC}$  current will flow out of terminals nYn, and in this case there is no limit for the voltage drop across the switch, but the voltages at nYn and nZ may not exceed  $V_{CC}$  or  $V_{EE}$ .
- [2] The minimum input voltage rating may be exceeded if the input current rating is observed.
- [3] For DIP16 packages: above 70 °C the value of  $P_{tot}$  derates linearly with 12 mW/K.  
 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.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol           | Parameter                           | Conditions                       | Min | Typ | Max             | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| V <sub>CC</sub>  | supply voltage                      | see <a href="#">Figure 7</a>     | 1   | 3.3 | 6               | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | -   | V <sub>CC</sub> | V    |
| V <sub>SW</sub>  | switch voltage                      |                                  | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 | in free air                      | −40 | -   | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 1.0 V to 2.0 V | -   | -   | 500             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.0 V to 2.7 V | -   | -   | 200             | ns/V |
|                  |                                     | V <sub>CC</sub> = 2.7 V to 3.6 V | -   | -   | 100             | ns/V |

[1] The static characteristics are guaranteed from V<sub>CC</sub> = 1.2 V to 6.0 V, but LV devices are guaranteed to function down to V<sub>CC</sub> = 1.0 V (with input levels GND or V<sub>CC</sub>).

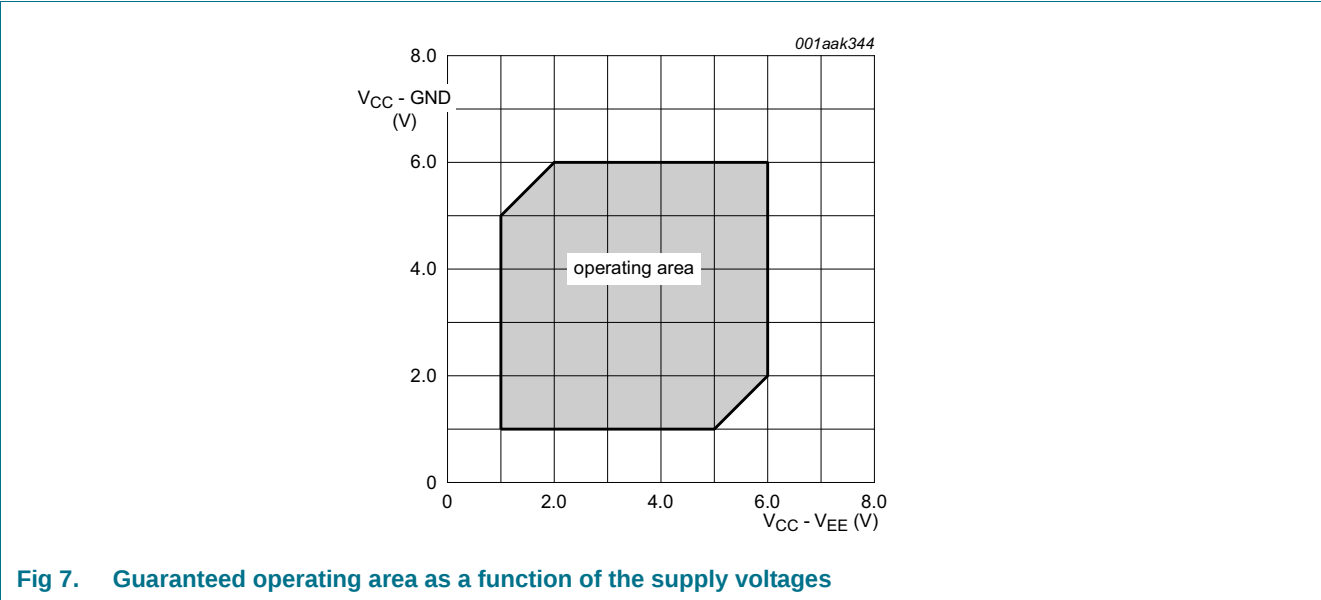


Fig 7. Guaranteed operating area as a function of the supply voltages

## 9. Static characteristics

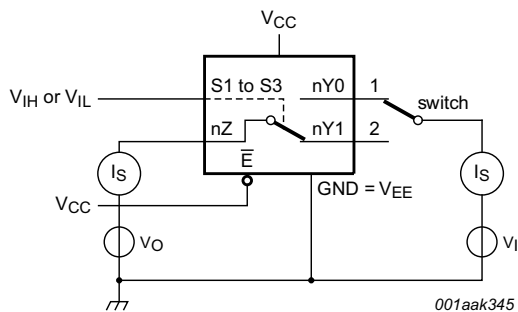
**Table 6. Static characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol              | Parameter                 | Conditions                                                                               | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|---------------------|---------------------------|------------------------------------------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                     |                           |                                                                                          | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| V <sub>IH</sub>     | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                                                                  | 0.9              | -                  | -    | 0.9               | -    | V    |
|                     |                           | V <sub>CC</sub> = 2.0 V                                                                  | 1.4              | -                  | -    | 1.4               | -    | V    |
|                     |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                                                         | 2.0              | -                  | -    | 2.0               | -    | V    |
|                     |                           | V <sub>CC</sub> = 4.5 V                                                                  | 3.15             | -                  | -    | 3.15              | -    | V    |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | 4.20             | -                  | -    | 4.20              | -    | V    |
| V <sub>IL</sub>     | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                                                                  | -                | -                  | 0.3  | -                 | 0.3  | V    |
|                     |                           | V <sub>CC</sub> = 2.0 V                                                                  | -                | -                  | 0.6  | -                 | 0.6  | V    |
|                     |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                                                         | -                | -                  | 0.8  | -                 | 0.8  | V    |
|                     |                           | V <sub>CC</sub> = 4.5 V                                                                  | -                | -                  | 1.35 | -                 | 1.35 | V    |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | -                | -                  | 1.80 | -                 | 1.80 | V    |
| I <sub>I</sub>      | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND                                                  |                  |                    |      |                   |      |      |
|                     |                           | V <sub>CC</sub> = 3.6 V                                                                  | -                | -                  | 1.0  | -                 | 1.0  | μA   |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | -                | -                  | 2.0  | -                 | 2.0  | μA   |
| I <sub>S(OFF)</sub> | OFF-state leakage current | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; see <a href="#">Figure 8</a>       |                  |                    |      |                   |      |      |
|                     |                           | V <sub>CC</sub> = 3.6 V                                                                  | -                | -                  | 1.0  | -                 | 1.0  | μA   |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | -                | -                  | 2.0  | -                 | 2.0  | μA   |
| I <sub>S(ON)</sub>  | ON-state leakage current  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; see <a href="#">Figure 9</a>       |                  |                    |      |                   |      |      |
|                     |                           | V <sub>CC</sub> = 3.6 V                                                                  | -                | -                  | 1.0  | -                 | 1.0  | μA   |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | -                | -                  | 2.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>     | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A                            |                  |                    |      |                   |      |      |
|                     |                           | V <sub>CC</sub> = 3.6 V                                                                  | -                | -                  | 20   | -                 | 40   | μA   |
|                     |                           | V <sub>CC</sub> = 6.0 V                                                                  | -                | -                  | 40   | -                 | 80   | μA   |
| ΔI <sub>CC</sub>    | additional supply current | per input; V <sub>I</sub> = V <sub>CC</sub> – 0.6 V;<br>V <sub>CC</sub> = 2.7 V to 3.6 V | -                | -                  | 500  | -                 | 850  | μA   |
| C <sub>I</sub>      | input capacitance         |                                                                                          | -                | 3.5                | -    | -                 | -    | pF   |
| C <sub>SW</sub>     | switch capacitance        | independent pins nYn                                                                     | -                | 5                  | -    | -                 | -    | pF   |
|                     |                           | common pins nZ                                                                           | -                | 8                  | -    | -                 | -    | pF   |

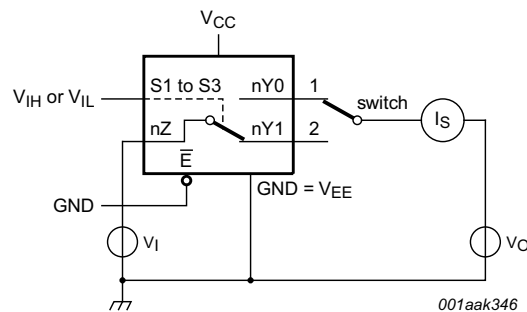
[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 9.1 Test circuits



$V_I = V_{CC}$  or  $V_{EE}$  and  $V_O = V_{EE}$  or  $V_{CC}$ .

**Fig 8. Test circuit for measuring OFF-state leakage current**



$V_I = V_{CC}$  or  $V_{EE}$  and  $V_O = \text{open circuit}$ .

**Fig 9. Test circuit for measuring ON-state leakage current**

## 9.2 ON resistance

**Table 7. ON resistance**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for graphs see [Figure 10](#) and [Figure 11](#).

| Symbol          | Parameter                               | Conditions                                                            | -40 °C to +85 °C |                    |     | -40 °C to +125 °C |     | Unit     |
|-----------------|-----------------------------------------|-----------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|----------|
|                 |                                         |                                                                       | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |          |
| $R_{ON(peak)}$  | ON resistance (peak)                    | $V_I = 0 \text{ V to } V_{CC} - V_{EE}$                               |                  |                    |     |                   |     |          |
|                 |                                         | $V_{CC} = 1.2 \text{ V}; I_{SW} = 100 \mu\text{A}$ <sup>[2]</sup>     | -                | -                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 2.0 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 180                | 365 | -                 | 435 | $\Omega$ |
|                 |                                         | $V_{CC} = 2.7 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 115                | 225 | -                 | 270 | $\Omega$ |
|                 |                                         | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}; I_{SW} = 1000 \mu\text{A}$ | -                | 100                | 200 | -                 | 245 | $\Omega$ |
|                 |                                         | $V_{CC} = 4.5 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 75                 | 150 | -                 | 180 | $\Omega$ |
|                 |                                         | $V_{CC} = 6.0 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 70                 | 140 | -                 | 165 | $\Omega$ |
| $\Delta R_{ON}$ | ON resistance mismatch between channels | $V_I = 0 \text{ V to } V_{CC} - V_{EE}$                               |                  |                    |     |                   |     |          |
|                 |                                         | $V_{CC} = 1.2 \text{ V}; I_{SW} = 100 \mu\text{A}$ <sup>[2]</sup>     | -                | -                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 2.0 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 5                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 2.7 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 4                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}; I_{SW} = 1000 \mu\text{A}$ | -                | 4                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 4.5 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 3                  | -   | -                 | -   | $\Omega$ |
|                 |                                         | $V_{CC} = 6.0 \text{ V}; I_{SW} = 1000 \mu\text{A}$                   | -                | 2                  | -   | -                 | -   | $\Omega$ |

**Table 7.** ON resistance ...continued

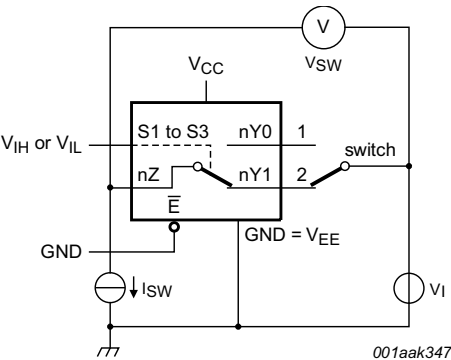
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for graphs see [Figure 10](#) and [Figure 11](#).

| Symbol                | Parameter            | Conditions                                                       | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|-----------------------|----------------------|------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                       |                      |                                                                  | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| R <sub>ON(rail)</sub> | ON resistance (rail) | V <sub>I</sub> = GND                                             |                  |                    |     |                   |     |      |
|                       |                      | V <sub>CC</sub> = 1.2 V; I <sub>SW</sub> = 100 µA <sup>[2]</sup> | -                | 250                | -   | -                 | -   | Ω    |
|                       |                      | V <sub>CC</sub> = 2.0 V; I <sub>SW</sub> = 1000 µA               | -                | 120                | 280 | -                 | 325 | Ω    |
|                       |                      | V <sub>CC</sub> = 2.7 V; I <sub>SW</sub> = 1000 µA               | -                | 75                 | 170 | -                 | 195 | Ω    |
|                       |                      | V <sub>CC</sub> = 3.0 V to 3.6 V;<br>I <sub>SW</sub> = 1000 µA   | -                | 70                 | 155 | -                 | 180 | Ω    |
|                       |                      | V <sub>CC</sub> = 4.5 V; I <sub>SW</sub> = 1000 µA               | -                | 50                 | 120 | -                 | 135 | Ω    |
|                       |                      | V <sub>CC</sub> = 6.0 V; I <sub>SW</sub> = 1000 µA               | -                | 45                 | 105 | -                 | 120 | Ω    |
| R <sub>ON(rail)</sub> | ON resistance (rail) | V <sub>I</sub> = V <sub>CC</sub> – V <sub>EE</sub>               |                  |                    |     |                   |     |      |
|                       |                      | V <sub>CC</sub> = 1.2 V; I <sub>SW</sub> = 100 µA <sup>[2]</sup> | -                | 350                | -   | -                 | -   | Ω    |
|                       |                      | V <sub>CC</sub> = 2.0 V; I <sub>SW</sub> = 1000 µA               | -                | 170                | 340 | -                 | 400 | Ω    |
|                       |                      | V <sub>CC</sub> = 2.7 V; I <sub>SW</sub> = 1000 µA               | -                | 105                | 210 | -                 | 250 | Ω    |
|                       |                      | V <sub>CC</sub> = 3.0 V to 3.6 V;<br>I <sub>SW</sub> = 1000 µA   | -                | 95                 | 190 | -                 | 225 | Ω    |
|                       |                      | V <sub>CC</sub> = 4.5 V; I <sub>SW</sub> = 1000 µA               | -                | 70                 | 140 | -                 | 165 | Ω    |
|                       |                      | V <sub>CC</sub> = 6.0 V; I <sub>SW</sub> = 1000 µA               | -                | 65                 | 125 | -                 | 150 | Ω    |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

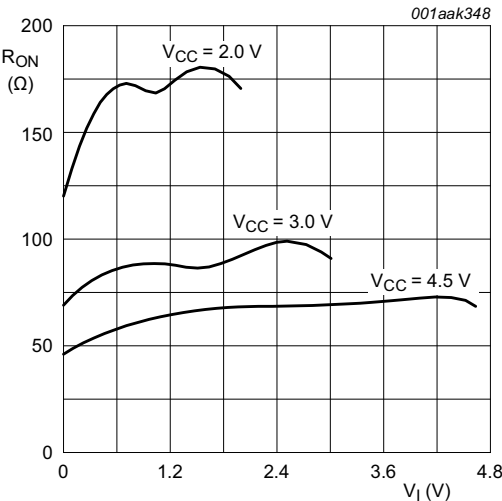
[2] When supply voltages (V<sub>CC</sub> – V<sub>EE</sub>) near 1.2 V the analog switch ON resistance becomes extremely non-linear. When using a supply of 1.2 V, it is recommended to use these devices only for transmitting digital signals.

9.3 On resistance waveform and test circuit



$R_{ON} = V_{SW} / I_{SW}$

Fig 10. Test circuit for measuring  $R_{ON}$



$V_i = 0\text{ V to }V_{CC} - V_{EE}$

Fig 11. Typical  $R_{ON}$  as a function of input voltage

## 10. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 14](#).

| Symbol          | Parameter         | Conditions                                                              | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|-----------------|-------------------|-------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                 |                   |                                                                         | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>pd</sub> | propagation delay | nYn, nZ to nZ, nYn; see <a href="#">Figure 12</a> <sup>[2]</sup>        |                  |                    |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                                 | -                | 25                 | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 2.0 V                                                 | -                | 9                  | 17  | -                 | 20  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                                 | -                | 6                  | 13  | -                 | 15  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                         | -                | 5                  | 10  | -                 | 12  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                                                 | -                | 4                  | 9   | -                 | 10  | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                                                 | -                | 3                  | 7   | -                 | 8   | ns   |
| t <sub>en</sub> | enable time       | $\bar{E}$ to nYn, nZ; see <a href="#">Figure 13</a> <sup>[2]</sup>      |                  |                    |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                                 | -                | 100                | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 2.0 V                                                 | -                | 34                 | 65  | -                 | 77  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                                 | -                | 25                 | 48  | -                 | 56  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup> | -                | 16                 | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                         | -                | 19                 | 38  | -                 | 45  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                                                 | -                | 17                 | 32  | -                 | 38  | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                                                 | -                | 13                 | 25  | -                 | 29  | ns   |
|                 |                   | Sn to nYn, nZ; see <a href="#">Figure 13</a> <sup>[2]</sup>             |                  |                    |     |                   |     |      |
|                 |                   | V <sub>CC</sub> = 1.2 V                                                 | -                | 125                | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 2.0 V                                                 | -                | 43                 | 82  | -                 | 97  | ns   |
|                 |                   | V <sub>CC</sub> = 2.7 V                                                 | -                | 31                 | 60  | -                 | 71  | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup> | -                | 20                 | -   | -                 | -   | ns   |
|                 |                   | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                         | -                | 24                 | 48  | -                 | 57  | ns   |
|                 |                   | V <sub>CC</sub> = 4.5 V                                                 | -                | 21                 | 41  | -                 | 48  | ns   |
|                 |                   | V <sub>CC</sub> = 6.0 V                                                 | -                | 16                 | 31  | -                 | 37  | ns   |

**Table 8. Dynamic characteristics ...continued**Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 14](#).

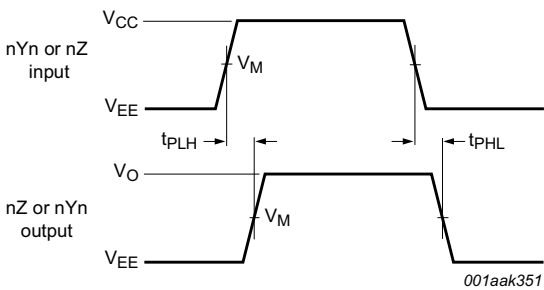
| Symbol           | Parameter                     | Conditions                                                                                                | –40 °C to +85 °C |                    |     | –40 °C to +125 °C |     | Unit |
|------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                  |                               |                                                                                                           | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| t <sub>dis</sub> | disable time                  | $\bar{E}$ to nYn, nZ; see <a href="#">Figure 13</a> <sup>[2]</sup>                                        |                  |                    |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 1.2 V                                                                                   | -                | 95                 | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                                                   | -                | 34                 | 61  | -                 | 73  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                                                   | -                | 26                 | 46  | -                 | 54  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>                                   | -                | 17                 | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                           | -                | 20                 | 37  | -                 | 44  | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                                   | -                | 18                 | 32  | -                 | 38  | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                                                   | -                | 15                 | 25  | -                 | 30  | ns   |
|                  |                               | Sn to nYn, nZ; see <a href="#">Figure 13</a> <sup>[2]</sup>                                               |                  |                    |     |                   |     |      |
|                  |                               | V <sub>CC</sub> = 1.2 V                                                                                   | -                | 90                 | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 2.0 V                                                                                   | -                | 32                 | 59  | -                 | 70  | ns   |
|                  |                               | V <sub>CC</sub> = 2.7 V                                                                                   | -                | 24                 | 44  | -                 | 52  | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>                                   | -                | 16                 | -   | -                 | -   | ns   |
|                  |                               | V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>                                                           | -                | 19                 | 36  | -                 | 42  | ns   |
|                  |                               | V <sub>CC</sub> = 4.5 V                                                                                   | -                | 17                 | 31  | -                 | 36  | ns   |
|                  |                               | V <sub>CC</sub> = 6.0 V                                                                                   | -                | 14                 | 24  | -                 | 28  | ns   |
| C <sub>PD</sub>  | power dissipation capacitance | C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; <sup>[4]</sup><br>V <sub>I</sub> = GND to V <sub>CC</sub> | -                | 36                 | -   | -                 | -   | pF   |

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.[3] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V).[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ((C<sub>L</sub> + C<sub>SW</sub>) × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:f<sub>i</sub> = input frequency in MHz, f<sub>o</sub> = output frequency in MHzC<sub>L</sub> = output load capacitance in pFC<sub>SW</sub> = maximum switch capacitance in pF;V<sub>CC</sub> = supply voltage in Volts

N = number of inputs switching

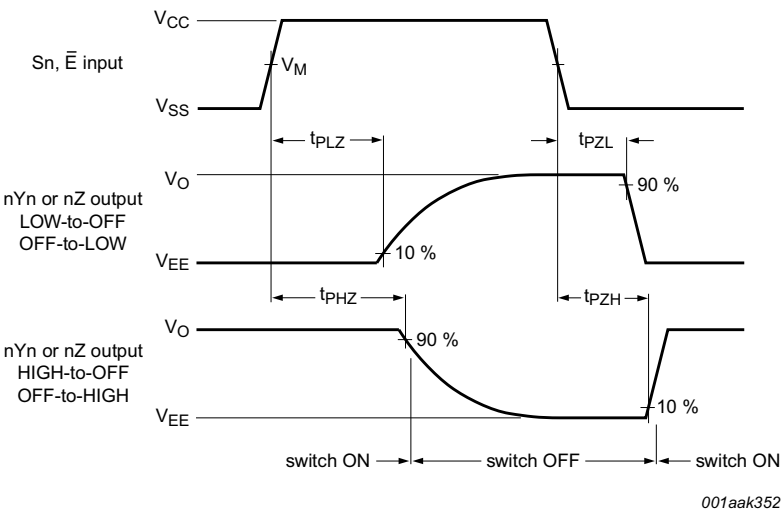
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

10.1 Waveforms



Measurement points are given in [Table 9](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig 12. Propagation delay input (nYn, nZ) to output (nZ, nYn)

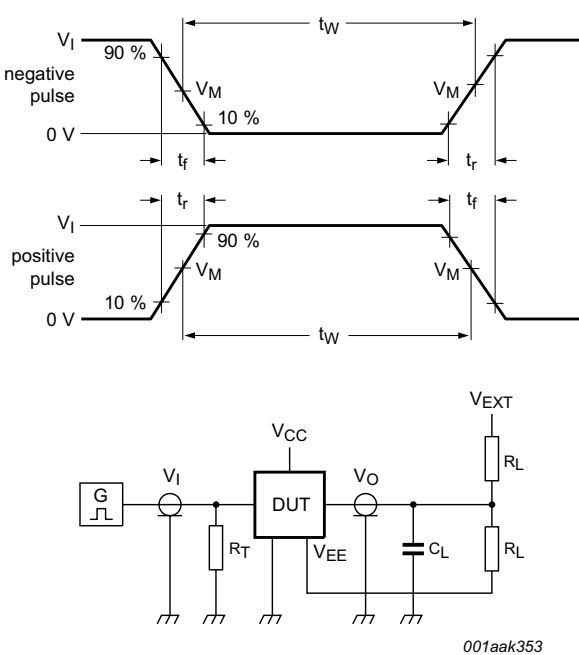


Measurement points are given in [Table 9](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig 13. Enable and disable times

Table 9. Measurement points

| Supply voltage | Input       | Output      |                      |                      |
|----------------|-------------|-------------|----------------------|----------------------|
| $V_{CC}$       | $V_M$       | $V_M$       | $V_X$                | $V_Y$                |
| < 2.7 V        | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.1V_{CC}$ | $V_{OH} - 0.1V_{CC}$ |
| 2.7 V to 3.6 V | 1.5 V       | 1.5 V       | $V_{OL} + 0.3 V$     | $V_{OH} - 0.3 V$     |
| > 3.6 V        | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.1V_{CC}$ | $V_{OH} - 0.1V_{CC}$ |



Test data is given in [Table 10](#).

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$V_{EXT}$  = External voltage for measuring switching times.

Fig 14. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage | Input    |             | Load         |              | $V_{EXT}$          |                    |                    |
|----------------|----------|-------------|--------------|--------------|--------------------|--------------------|--------------------|
| $V_{CC}$       | $V_I$    | $t_r, t_f$  | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| < 2.7 V        | $V_{CC}$ | $\leq 6$ ns | 50 pF        | 1 k $\Omega$ | open               | $V_{EE}$           | $2V_{CC}$          |
| 2.7 V to 3.6 V | 2.7 V    | $\leq 6$ ns | 15 pF, 50 pF | 1 k $\Omega$ | open               | $V_{EE}$           | $2V_{CC}$          |
| > 3.6 V        | $V_{CC}$ | $\leq 6$ ns | 50 pF        | 1 k $\Omega$ | open               | $V_{EE}$           | $2V_{CC}$          |

## 10.2 Additional dynamic parameters

**Table 11. Additional dynamic characteristics**

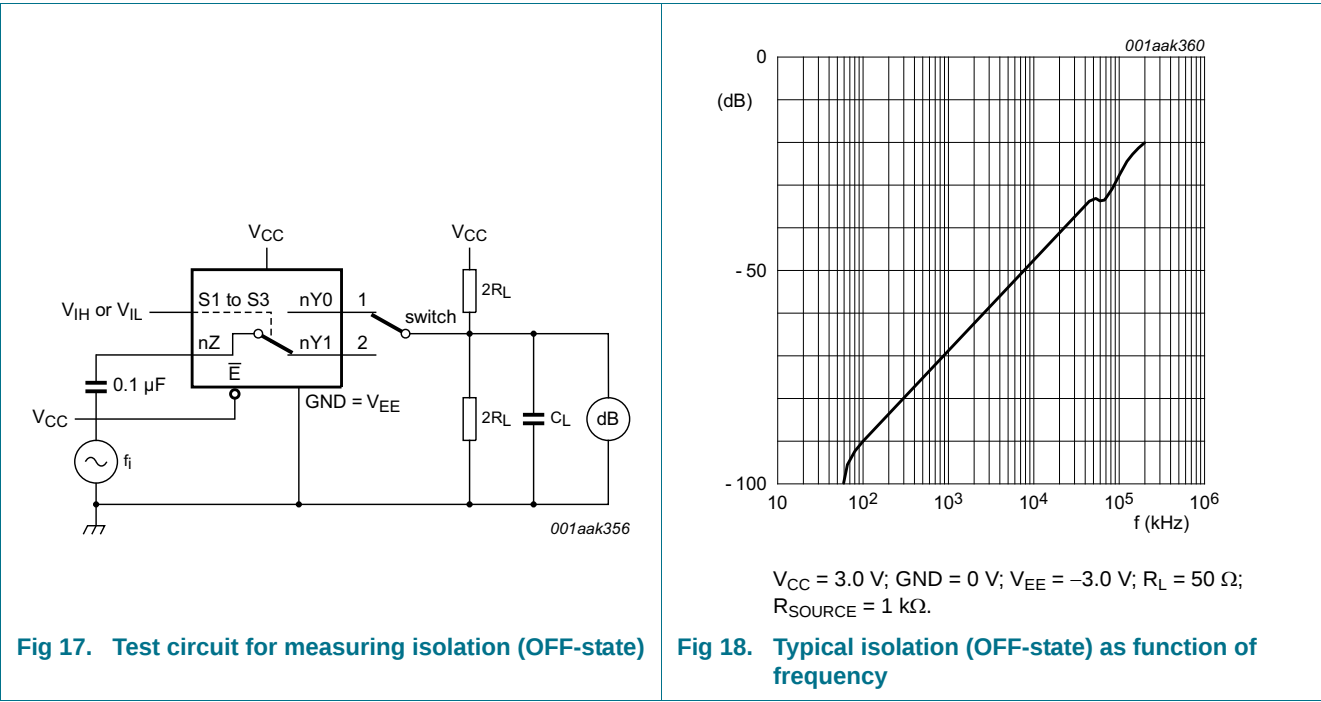
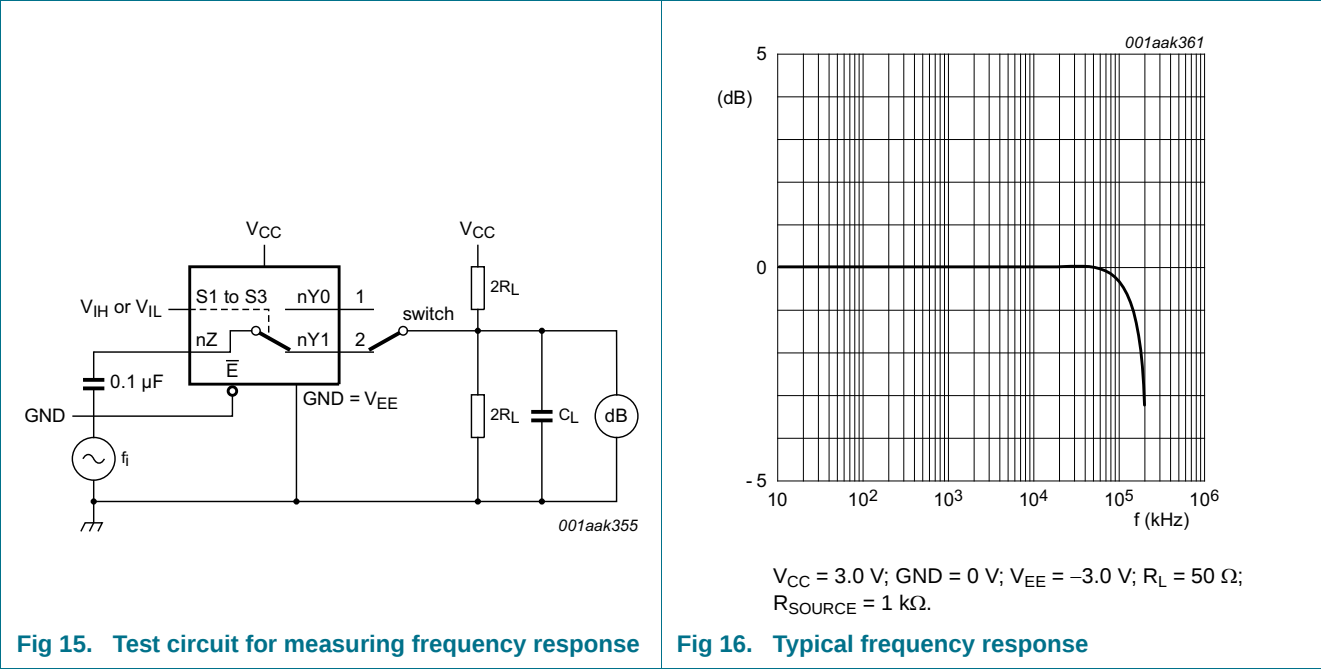
At recommended operating conditions; voltages are referenced to GND (ground = 0 V);  $V_I = \text{GND or } V_{CC}$  (unless otherwise specified);  $t_r = t_f \leq 6.0 \text{ ns}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

| Symbol                | Parameter                 | Conditions                                                                                                                                                   | Min | Typ  | Max | Unit |
|-----------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| THD                   | total harmonic distortion | $f_i = 1 \text{ kHz}$ ; $C_L = 50 \text{ pF}$ ; $R_L = 10 \text{ k}\Omega$ ; see <a href="#">Figure 19</a>                                                   |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$ ; $V_I = 2.75 \text{ V (p-p)}$                                                                                                      | -   | 0.8  | -   | %    |
|                       |                           | $V_{CC} = 6.0 \text{ V}$ ; $V_I = 5.5 \text{ V (p-p)}$                                                                                                       | -   | 0.4  | -   | %    |
|                       |                           | $f_i = 10 \text{ kHz}$ ; $C_L = 50 \text{ pF}$ ; $R_L = 10 \text{ k}\Omega$ ; see <a href="#">Figure 19</a>                                                  |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$ ; $V_I = 2.75 \text{ V (p-p)}$                                                                                                      | -   | 2.4  | -   | %    |
|                       |                           | $V_{CC} = 6.0 \text{ V}$ ; $V_I = 5.5 \text{ V (p-p)}$                                                                                                       | -   | 1.2  | -   | %    |
| $f_{(-3\text{dB})}$   | –3 dB frequency response  | $C_L = 50 \text{ pF}$ ; $R_L = 50 \text{ }\Omega$ ; see <a href="#">Figure 15</a> <sup>[1]</sup>                                                             |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$                                                                                                                                     | -   | 180  | -   | MHz  |
|                       |                           | $V_{CC} = 6.0 \text{ V}$                                                                                                                                     | -   | 200  | -   | MHz  |
| $\alpha_{\text{iso}}$ | isolation (OFF-state)     | $f_i = 1 \text{ MHz}$ ; $C_L = 50 \text{ pF}$ ; $R_L = 600 \text{ }\Omega$ ; see <a href="#">Figure 17</a> <sup>[2]</sup>                                    |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$                                                                                                                                     | -   | –50  | -   | dB   |
|                       |                           | $V_{CC} = 6.0 \text{ V}$                                                                                                                                     | -   | –50  | -   | dB   |
| $V_{\text{ct}}$       | crosstalk voltage         | between digital inputs and switch; $f_i = 1 \text{ MHz}$ ; $C_L = 50 \text{ pF}$ ; $R_L = 600 \text{ }\Omega$ ; see <a href="#">Figure 20</a> <sup>[2]</sup> |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$                                                                                                                                     | -   | 0.11 | -   | V    |
|                       |                           | $V_{CC} = 6.0 \text{ V}$                                                                                                                                     | -   | 0.12 | -   | V    |
| Xtalk                 | crosstalk                 | between switches; $f_i = 1 \text{ MHz}$ ; $C_L = 50 \text{ pF}$ ; $R_L = 600 \text{ }\Omega$ ; see <a href="#">Figure 21</a>                                 |     |      |     |      |
|                       |                           | $V_{CC} = 3.0 \text{ V}$                                                                                                                                     | -   | –60  | -   | dB   |
|                       |                           | $V_{CC} = 6.0 \text{ V}$                                                                                                                                     | -   | –60  | -   | dB   |

[1] Adjust  $f_i$  voltage to obtain 0 dBm level at output for 1 MHz (0 dBm = 1 mW into 50  $\Omega$ ).

[2] Adjust  $f_i$  voltage to obtain 0 dBm level at output for 1 MHz (0 dBm = 1 mW into 600  $\Omega$ ).

10.2.1 Test circuits



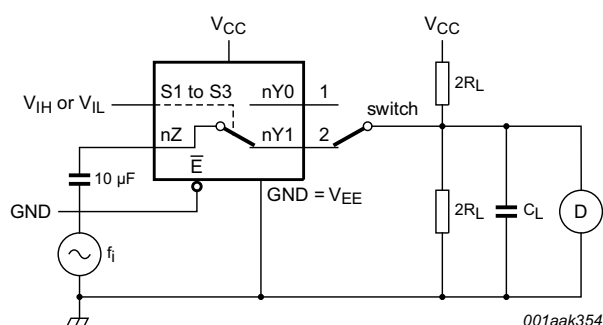
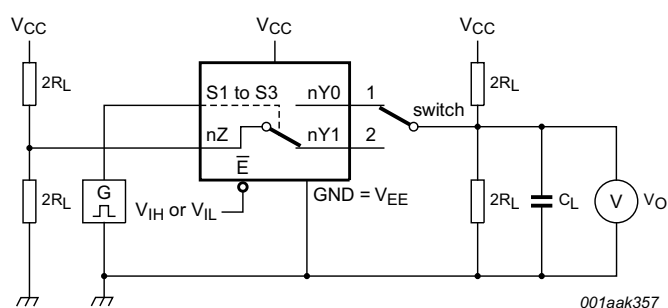
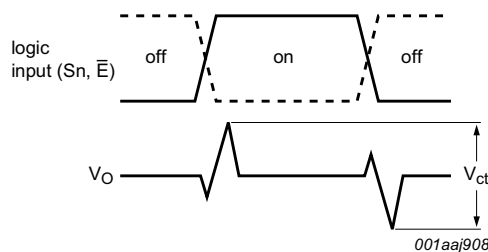


Fig 19. Test circuit for measuring total harmonic distortion



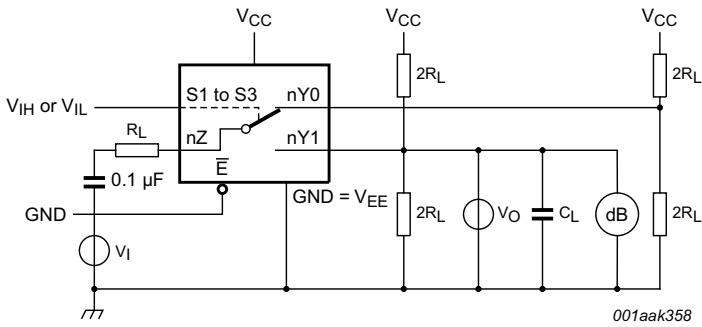
a. Test circuit



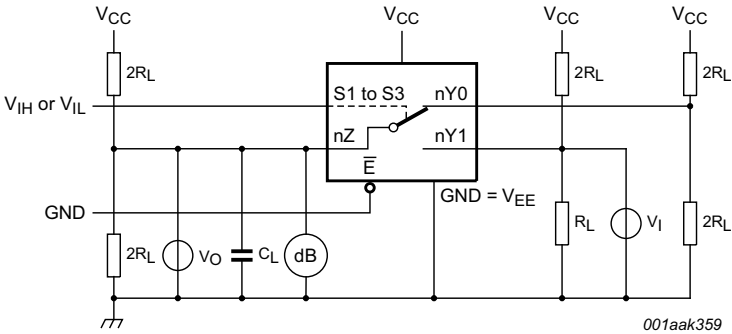
b. Input and output pulse definitions

$V_I$  may be connected to  $S_n$  or  $\bar{E}$ .

Fig 20. Test circuit for measuring crosstalk voltage between digital inputs and switch



a. Switch closed condition



b. Switch open condition

Fig 21. Test circuit for measuring crosstalk between switches

11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm SOT109-1

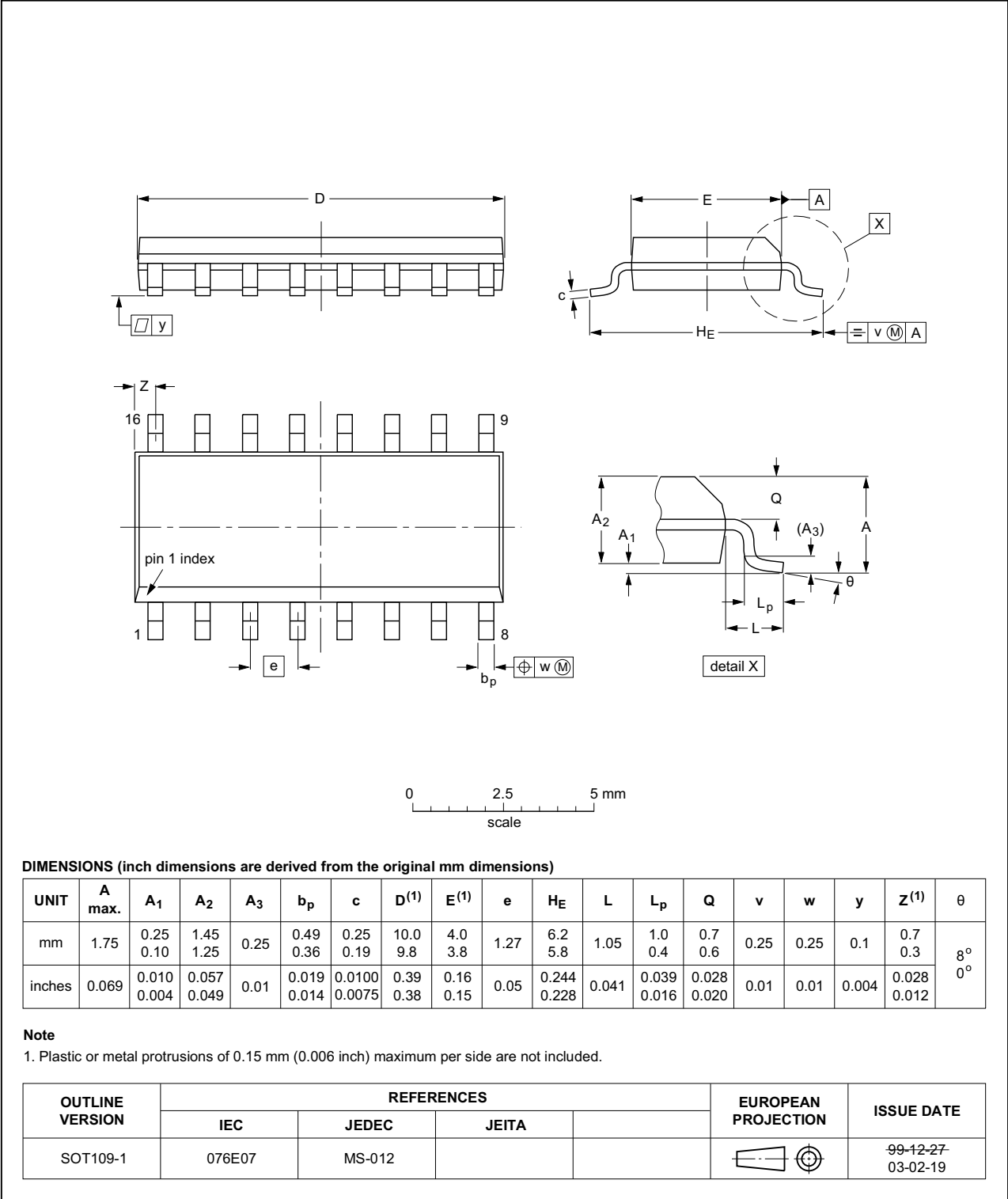


Fig 22. Package outline SOT109-1 (SO16)

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

SOT338-1

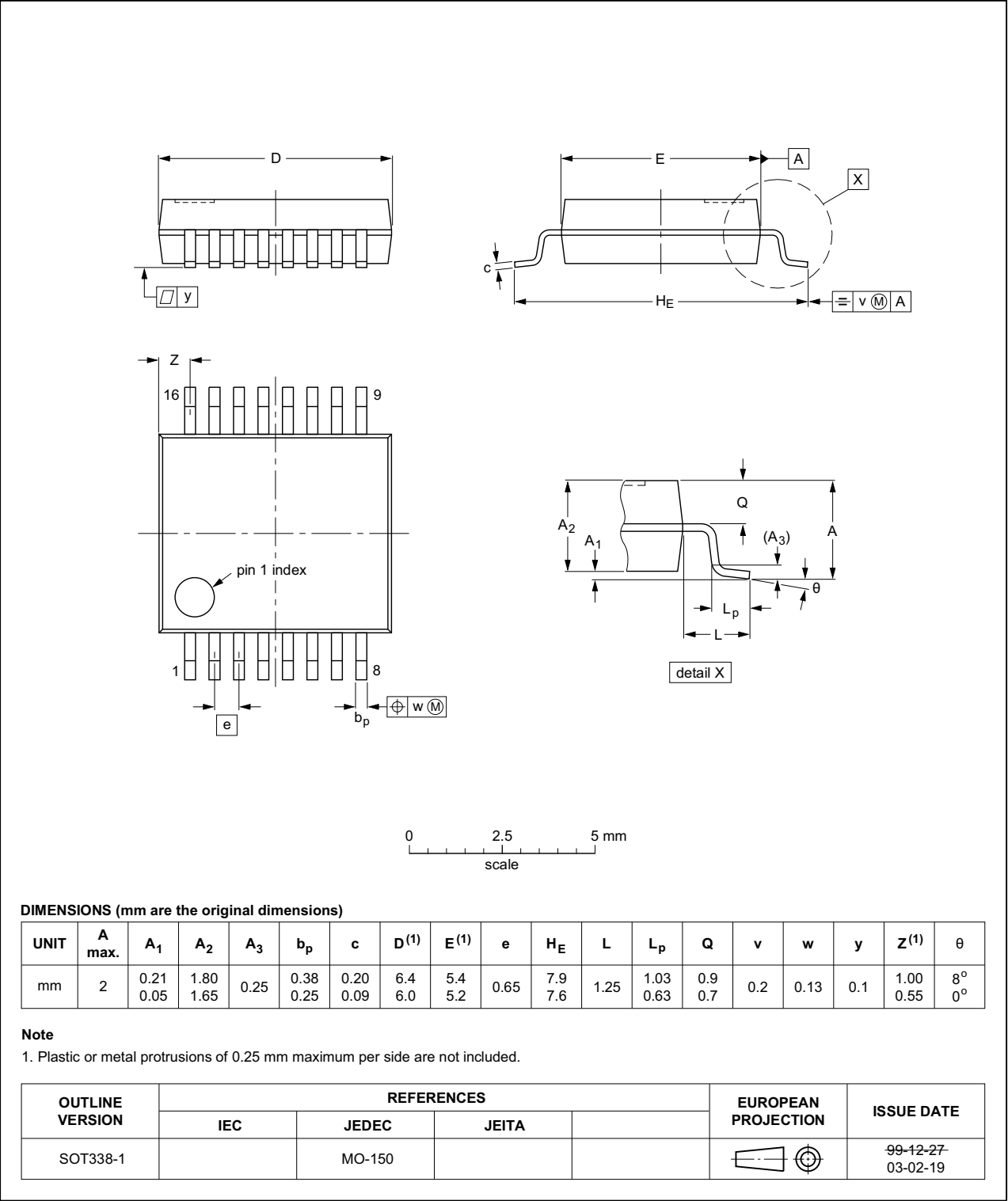


Fig 23. Package outline SOT338-1 (SSOP16)

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

SOT403-1

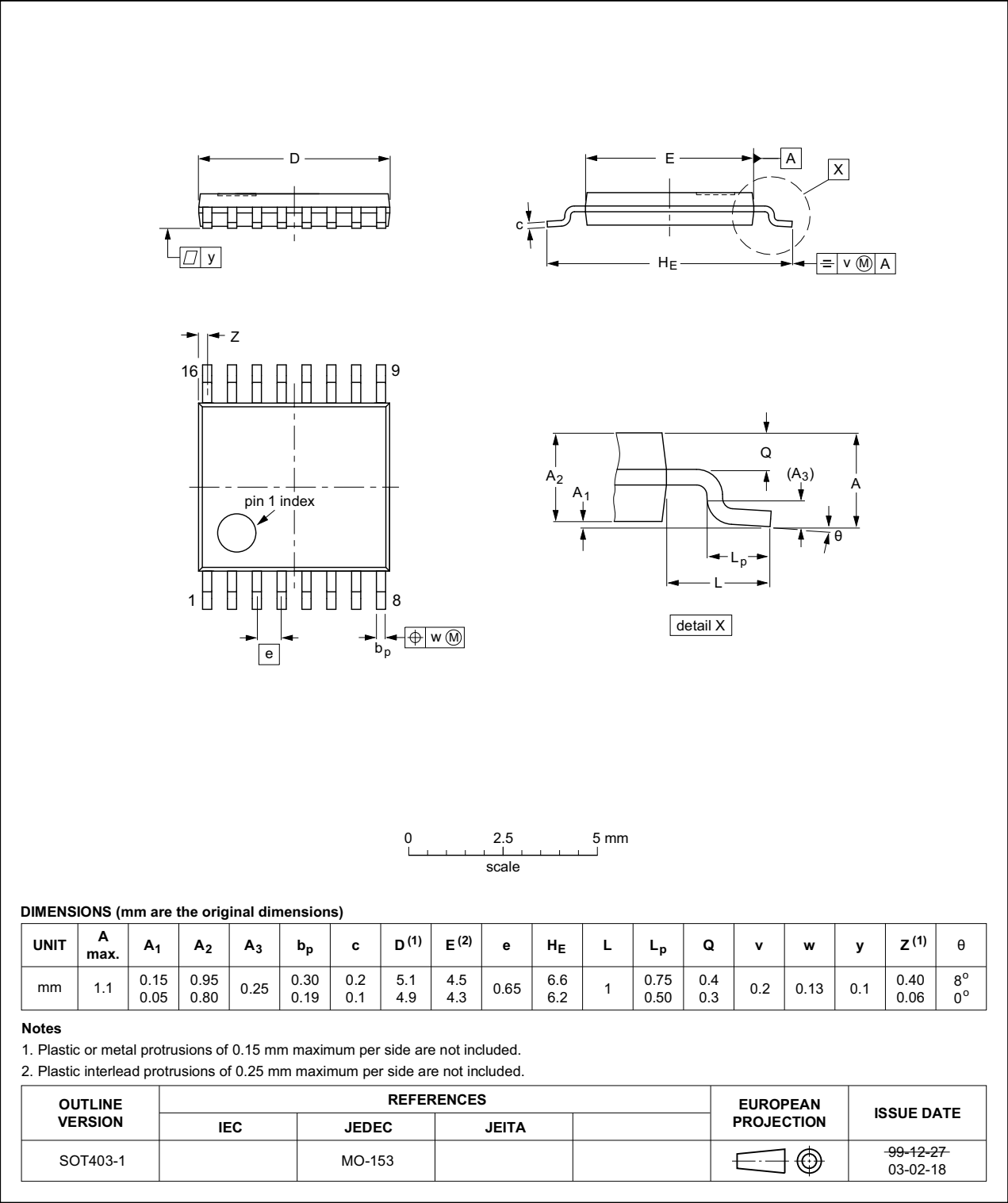


Fig 24. Package outline SOT403-1 (TSSOP16)

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

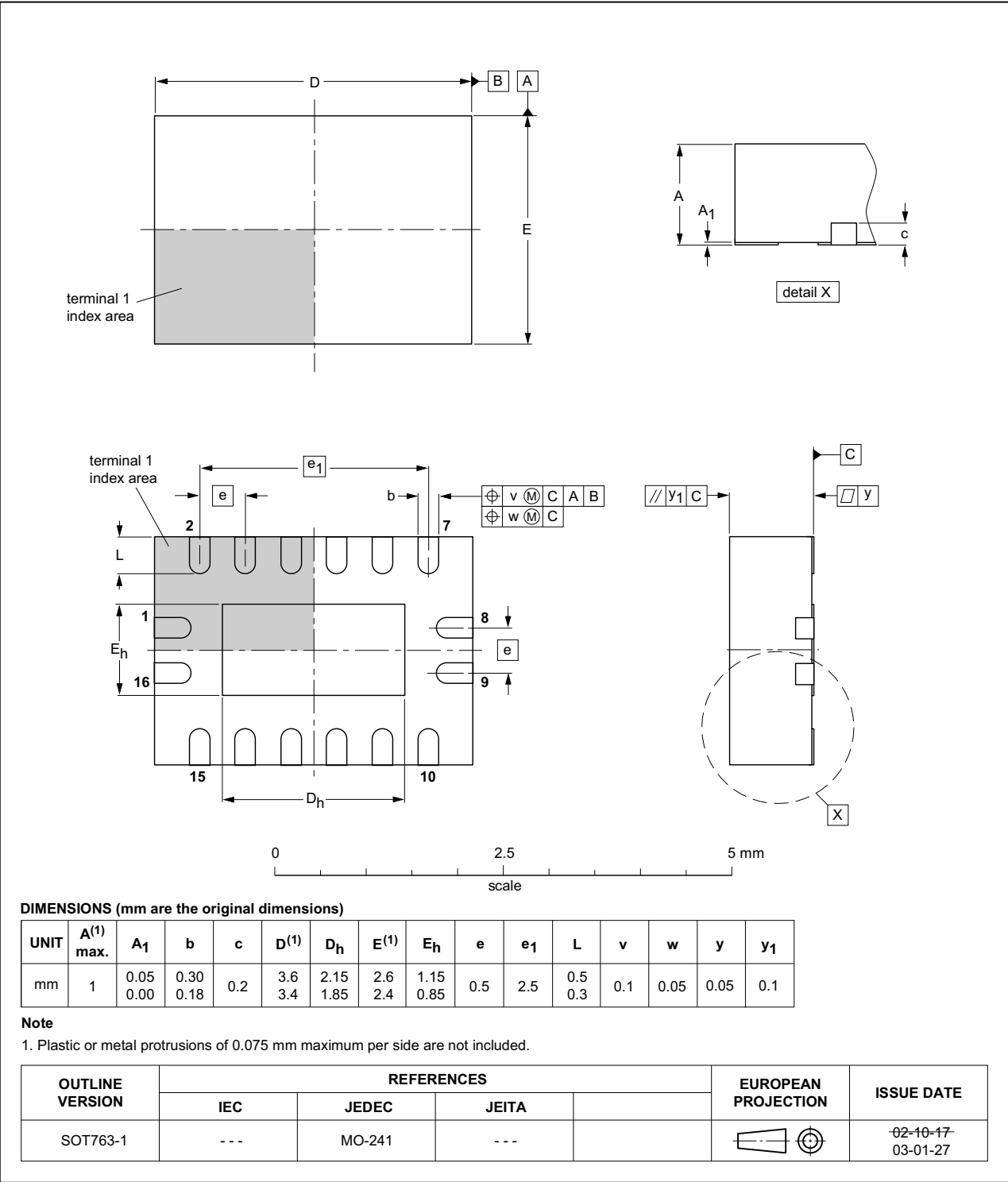


Fig 25. Package outline SOT763-1 (DHVQFN16)

## 12. Abbreviations

Table 12. Abbreviations

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

## 13. Revision history

Table 13. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Data sheet status     | Change notice | Supersedes   |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------|
| 74LV4053 v.6   | 20160317                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV4053 v.5 |
| Modifications: | <ul style="list-style-type: none"> <li>Type number 74LV4053N (SOT38-4) removed.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                             |                       |               |              |
| 74LV4053 v.5   | 20140918                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV4053 v.4 |
| Modifications: | <ul style="list-style-type: none"> <li><a href="#">Figure 6</a>: Figure note added for DHVQFN16 package.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                    |                       |               |              |
| 74LV4053 v.4   | 20090810                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74LV4053 v.3 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Added type number 74LV4053BQ (DHVQFN16 package)</li> <li>R<sub>ON</sub> values changed in <a href="#">Section 2</a>.</li> <li>Package version SOT38-1 changed to SOT38-4 in <a href="#">Section 3</a>, and Figure 23.</li> </ul> |                       |               |              |
| 74LV4053 v.3   | 19980623                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product specification | -             | 74LV4053 v.2 |
| 74LV4053 v.2   | 19970715                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product specification | -             | -            |

## 14. Legal information

### 14.1 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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