# 74HC4066; 74HCT4066

## Quad single-pole single-throw analog switch

Rev. 7 — 2 April 2013 Product data sheet

## 1. General description

The 74HC4066; 74HCT4066 is a quad single pole, single throw analog switch. Each switch features two input/output terminals (nY and nZ) and an active HIGH enable input (nE). When nE is LOW, the analog switch is turned off. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of $V_{CC}$.

## 2. Features and benefits

- Input levels nE inputs:
  - For 74HC4066: CMOS level
  - For 74HCT4066: TTL level
- Low ON resistance:
  - 50 Ω (typical) at $V_{CC}$ = 4.5 V
  - 45 Ω (typical) at $V_{CC}$ = 6.0 V
  - 35 Ω (typical) at $V_{CC}$ = 9.0 V
- Specified in compliance with JEDEC standard no. 7A
- 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. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74HC4066N | –40 °C to +125 °C | DIP14 | plastic dual in-line package; 14 leads (300 mil) | SOT27-1 |
| 74HCT4066N | | | | |
| 74HC4066D | –40 °C to +125 °C | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74HCT4066D | | | | |
| 74HC4066DB | –40 °C to +125 °C | SSOP14 | plastic shrink small outline package; 14 leads; body width 5.3 mm | SOT337-1 |
| 74HCT4066DB | | | | |
| 74HC4066PW | –40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74HCT4066PW | | | | |
| 74HC4066BQ | –40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |
| 74HCT4066BQ | | | | |

## 4. Functional diagram

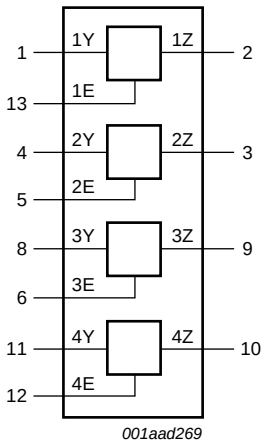



**Fig 1. Logic symbol**

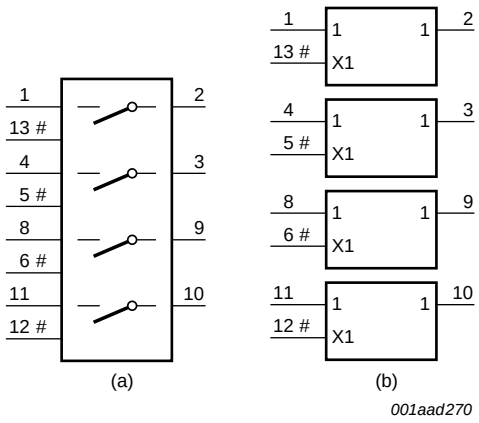



**Fig 2. IEC logic symbol**

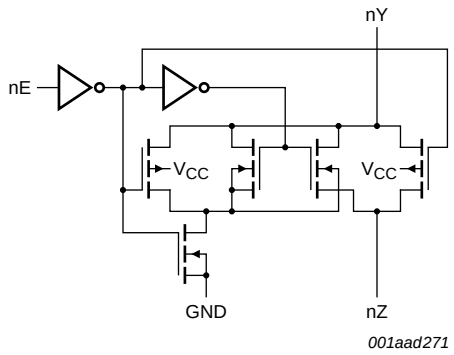



**Fig 3. Schematic diagram (one switch)**

# 5. Pinning information

## 5.1 Pinning

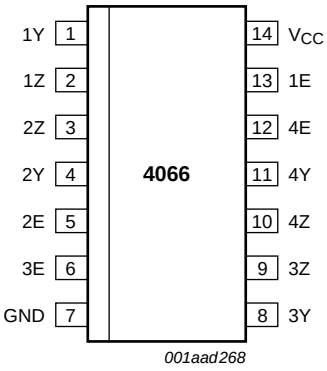
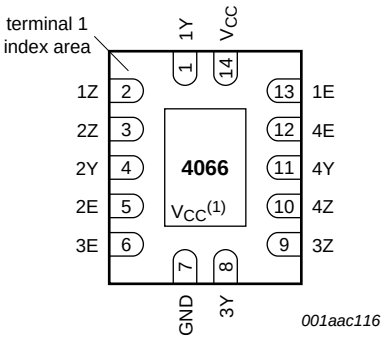



**Fig 4. Pin configuration for DIP14, SO14, SSOP14 and TSSOP14**




Transparent top view

(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to VCC.

**Fig 5. Pin configuration for DHVQFN14**

## 5.2 Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| 1Z, 2Z, 3Z, 4Z | 2, 3, 9, 10 | independent input or output |
| 1Y, 2Y, 3Y, 4Y | 1, 4, 8, 11 | independent input or output |
| GND | 7 | ground (0 V) |
| 1E, 2E, 3E, 4E | 13, 5, 6, 12 | enable input (active HIGH) |
| $V_{CC}$ | 14 | supply voltage |

# 6. Functional description

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

| Input nE | Switch |
|---|---|
| L | OFF |
| H | ON |

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

# 7. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | | −0.5 | +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 | $V_{SW} = -0.5$ V to $V_{CC} + 0.5$ V | [1] | - | ±25 | mA |
| $I_{CC}$ | supply current | | | - | 50 | mA |
| $I_{GND}$ | ground current | | | - | −50 | mA |
| $T_{stg}$ | storage temperature | | | −65 | +150 | °C |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C | [2] | | | |
| | | DIP14 package | | | - | 750 |
| | | SO14, (T)SSOP14 and DHVQFN14 packages | | | - | 500 |
| P | power dissipation | per switch | | - | 100 | mW |

[1] To avoid drawing $V_{CC}$ current out of terminal Z, when switch current flows in 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. 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 GND.

[2] For DIP14 package: $P_{tot}$ derates linearly with 12 mW/K above 70 °C.
For SO14 package: $P_{tot}$ derates linearly with 8 mW/K above 70 °C.
For (T)SSOP14 packages: $P_{tot}$ derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN14 packages: $P_{tot}$ derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | 74HC4066 | | | 74HCT4066 | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $V_{CC}$ | supply voltage | | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V |
| $V_I$ | input voltage | | GND | - | $V_{CC}$ | GND | - | $V_{CC}$ | V |
| $V_{SW}$ | switch voltage | | GND | - | $V_{CC}$ | GND | - | $V_{CC}$ | V |
| $T_{amb}$ | ambient temperature | | –40 | +25 | +125 | –40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | $V_{CC}$ = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | $V_{CC}$ = 6.0 V | - | - | 83 | - | - | - | ns/V |
| | | $V_{CC}$ = 10.0 V | - | - | 35 | - | - | - | ns/V |

## 9. Static characteristics

**Table 6. $R_{ON}$ resistance per switch for types 74HC4066 and 74HCT4066**

*$V_I$ = $V_{IH}$ or $V_{IL}$; for test circuit see Figure 6.*
*$V_{is}$ 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 74HC4066: $V_{CC}$ − GND = 2.0 V, 4.5 V, 6.0 V and 9.0 V.*
*For 74HCT4066: $V_{CC}$ − GND = 4.5 V.*

| Symbol | Parameter | Conditions | | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ[1] | Max | Min | Max | |
| $R_{ON(peak)}$ | ON resistance (peak) | $V_{is}$ = $V_{CC}$ to GND | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $I_{SW}$ = 100 μA | [2] | - | - | - | - | - | Ω |
| | | $V_{CC}$ = 4.5 V; $I_{SW}$ = 1000 μA | | - | 54 | - | 118 | 142 | Ω |
| | | $V_{CC}$ = 6.0 V; $I_{SW}$ = 1000 μA | | - | 42 | - | 105 | 126 | Ω |
| | | $V_{CC}$ = 9.0 V; $I_{SW}$ = 1000 μA | | - | 32 | - | 88 | 105 | Ω |
| $R_{ON(rail)}$ | ON resistance (rail) | $V_{is}$ = GND | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $I_{SW}$ = 100 μA | [2] | - | 80 | - | - | - | Ω |
| | | $V_{CC}$ = 4.5 V; $I_{SW}$ = 1000 μA | | - | 35 | - | 95 | 115 | Ω |
| | | $V_{CC}$ = 6.0 V; $I_{SW}$ = 1000 μA | | - | 27 | - | 82 | 100 | Ω |
| | | $V_{CC}$ = 9.0 V; $I_{SW}$ = 1000 μA | | - | 20 | - | 70 | 85 | Ω |
| | | $V_{is}$ = $V_{CC}$ | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $I_{SW}$ = 100 μA | [2] | - | 100 | - | - | - | Ω |
| | | $V_{CC}$ = 4.5 V; $I_{SW}$ = 1000 μA | | - | 42 | - | 106 | 128 | Ω |
| | | $V_{CC}$ = 6.0 V; $I_{SW}$ = 1000 μA | | - | 35 | - | 94 | 113 | Ω |
| | | $V_{CC}$ = 9.0 V; $I_{SW}$ = 1000 μA | | - | 20 | - | 78 | 95 | Ω |

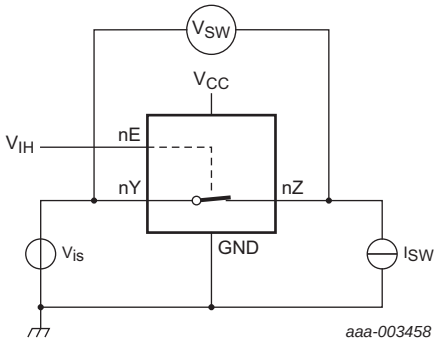
**Table 6. $R_{ON}$ resistance per switch for types 74HC4066 and 74HCT4066** *…continued*

*$V_I$ = $V_{IH}$ or $V_{IL}$; for test circuit see Figure 6.*
*$V_{is}$ 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 74HC4066: $V_{CC}$ − GND = 2.0 V, 4.5 V, 6.0 V and 9.0 V.*
*For 74HCT4066: $V_{CC}$ − GND = 4.5 V.*

| Symbol | Parameter | Conditions | | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ[1] | Max | Min | Max | |
| $\Delta R_{ON}$ | ON resistance mismatch between channels | $V_{is}$ = $V_{CC}$ to GND | | | | | | | |
| | | $V_{CC}$ = 2.0 V | [2] | - | - | - | - | - | Ω |
| | | $V_{CC}$ = 4.5 V | | - | 5 | - | - | - | Ω |
| | | $V_{CC}$ = 6.0 V | | - | 4 | - | - | - | Ω |
| | | $V_{CC}$ = 9.0 V | | - | 3 | - | - | - | Ω |

[1] Typical values are measured at $T_{amb}$ = 25 °C.

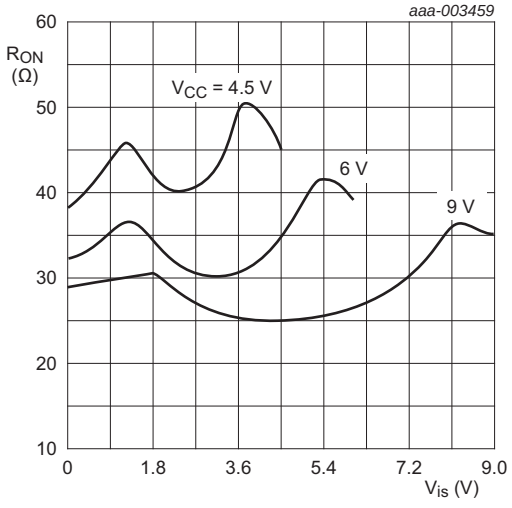
[2] At supply voltages ($V_{CC}$ − GND) approaching 2 V, the analog switch ON resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.




$V_{is}$ = 0 V to $V_{CC}$

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

**Fig 6. Test circuit for measuring $R_{ON}$**




$V_{is}$ = 0 V to $V_{CC}$

**Fig 7. Typical $R_{ON}$ as a function of input voltage $V_{is}$**

**Table 7. Static characteristics 74HC4066**

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*
*$V_{is}$ 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[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = –40 °C to +85 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.5 | 1.2 | - | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | 2.4 | - | V |
| | | $V_{CC}$ = 6.0 V | 4.2 | 3.2 | - | V |
| | | $V_{CC}$ = 9.0 V | 6.3 | 4.7 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | 0.8 | 0.5 | V |
| | | $V_{CC}$ = 4.5 V | - | 2.1 | 1.35 | V |
| | | $V_{CC}$ = 6.0 V | - | 2.8 | 1.80 | V |
| | | $V_{CC}$ = 9.0 V | - | 4.3 | 2.70 | V |
| $I_I$ | input leakage current | $V_I$ = $V_{CC}$ or GND | | | | |
| | | $V_{CC}$ = 6.0 V | - | - | ±1.0 | μA |
| | | $V_{CC}$ = 10.0 V | - | - | ±2.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC}$ = 10.0 V; $V_I$ = $V_{IH}$ or $V_{IL}$; $\|V_{SW}\|$ = $V_{CC}$ − GND; see Figure 8 | | | | |
| | | per channel | - | - | ±1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC}$ = 10.0 V; $V_I$ = $V_{IH}$ or $V_{IL}$; $\|V_{SW}\|$ = $V_{CC}$ − GND; see Figure 9 | - | - | ±1.0 | μA |
| $I_{CC}$ | supply current | $V_I$ = $V_{CC}$ or GND; $V_{is}$ = GND or $V_{CC}$; $V_{os}$ = $V_{CC}$ or GND | | | | |
| | | $V_{CC}$ = 6.0 V | - | - | 20.0 | μA |
| | | $V_{CC}$ = 10.0 V | - | - | 40.0 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | pF |
| $C_{sw}$ | switch capacitance | | - | 8 | - | pF |
| **$T_{amb}$ = –40 °C to +125 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.5 | - | - | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | - | - | V |
| | | $V_{CC}$ = 6.0 V | 4.2 | - | - | V |
| | | $V_{CC}$ = 9.0 V | 6.3 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | - | 0.50 | V |
| | | $V_{CC}$ = 4.5 V | - | - | 1.35 | V |
| | | $V_{CC}$ = 6.0 V | - | - | 1.80 | V |
| | | $V_{CC}$ = 9.0 V | - | - | 2.70 | V |
| $I_I$ | input leakage current | $V_I$ = $V_{CC}$ or GND | | | | |
| | | $V_{CC}$ = 6.0 V | - | - | ±1.0 | μA |
| | | $V_{CC}$ = 10.0 V | - | - | ±2.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC}$ = 10.0 V; $V_I$ = $V_{IH}$ or $V_{IL}$; $\|V_{SW}\|$ = $V_{CC}$ − GND; see Figure 8 | | | | |
| | | per channel | - | - | ±1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC}$ = 10.0 V; $V_I$ = $V_{IH}$ or $V_{IL}$; $\|V_{SW}\|$ = $V_{CC}$ − GND; see Figure 9 | - | - | ±1.0 | μA |

**Table 7. Static characteristics 74HC4066** *…continued*

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*
*$V_{is}$ 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[1] | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | supply current | $V_I = V_{CC}$ or GND; $V_{is}$ = GND or $V_{CC}$; $V_{os} = V_{CC}$ or GND | | | | |
| | | $V_{CC}$ = 6.0 V | - | - | 40 | μA |
| | | $V_{CC}$ = 10.0 V | - | - | 80 | μA |

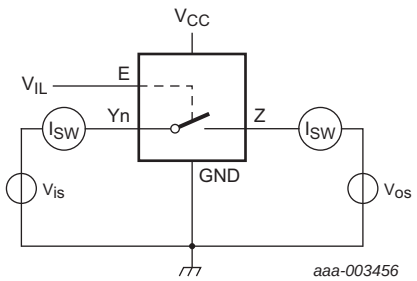
[1] Typical values are measured at $T_{amb}$ = 25 °C.

**Table 8. Static characteristics 74HCT4066**

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*
*$V_{is}$ 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[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = –40 °C to +85 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2.0 | 1.6 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | - | 1.2 | 0.8 | V |
| $I_I$ | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC}$ = 5.5 V | - | - | ±1.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC}$ = 5.5 V; $V_I = V_{IH}$ or $V_{IL}$; $\|V_{SW}\| = V_{CC}$ – GND; see Figure 8 | | | | |
| | | per channel | - | - | ±1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC}$ = 5.5 V; $V_I = V_{IH}$ or $V_{IL}$; $\|V_{SW}\| = V_{CC}$ – GND; see Figure 9 | - | - | ±1.0 | μA |
| $I_{CC}$ | supply current | $V_I = V_{CC}$ or GND; $V_{is}$ = GND or $V_{CC}$; $V_{os} = V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V | - | - | 20.0 | μA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I = V_{CC}$ – 2.1 V; other inputs at $V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V | - | 100 | 450 | μA |
| $C_I$ | input capacitance | | - | 3.5 | - | pF |
| $C_{SW}$ | switch capacitance | | - | 8 | - | pF |
| **$T_{amb}$ = –40 °C to +125 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2.0 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.8 | V |
| $I_I$ | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC}$ = 5.5 V | - | - | ±1.0 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC}$ = 5.5 V; $V_I = V_{IH}$ or $V_{IL}$; $\|V_{SW}\| = V_{CC}$ – GND; see Figure 8 | | | | |
| | | per channel | - | - | ±1.0 | μA |
| $I_{S(ON)}$ | ON-state leakage current | $V_{CC}$ = 5.5 V; $V_I = V_{IH}$ or $V_{IL}$; $\|V_{SW}\| = V_{CC}$ – GND; see Figure 9 | - | - | ±1.0 | μA |
| $I_{CC}$ | supply current | $V_I = V_{CC}$ or GND; $V_{is}$ = GND or $V_{CC}$; $V_{os} = V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V | - | - | 40 | μA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I = V_{CC}$ – 2.1 V; other inputs at $V_{CC}$ or GND; $V_{CC}$ = 4.5 V to 5.5 V | - | - | 490 | μA |

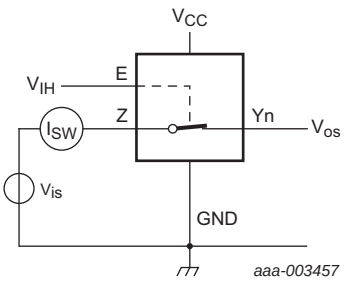
[1] Typical values are measured at $T_{amb}$ = 25 °C.




$V_{is}$ = $V_{CC}$ and $V_{os}$ = GND

$V_{is}$ = GND and $V_{os}$ = $V_{CC}$

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




$V_{is}$ = $V_{CC}$ and $V_{os}$ = open

$V_{is}$ = GND and $V_{os}$ = open

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

## 10. Dynamic characteristics

**Table 9. Dynamic characteristics 74HC4066**

*GND = 0 V; $t_r$ = $t_f$ = 6 ns; $C_L$ = 50 pF unless specified otherwise; for test circuit see Figure 12.*
*$V_{is}$ 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 | | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ[1] | Max | Min | Max | |
| $t_{pd}$ | propagation delay | nY to nZ or nZ to nY; $R_L$ = ∞ Ω; see Figure 10 | [2] | | | | | | |
| | | $V_{CC}$ = 2.0 V | | - | 8 | 75 | - | 90 | ns |
| | | $V_{CC}$ = 4.5 V | | - | 3 | 15 | - | 18 | ns |
| | | $V_{CC}$ = 6.0 V | | - | 2 | 13 | - | 15 | ns |
| | | $V_{CC}$ = 9.0 V | | - | 2 | 10 | - | 12 | ns |
| $t_{off}$ | turn-off time | nE to nY or nZ; see Figure 11 | [4] | | | | | | |
| | | $V_{CC}$ = 2.0 V | | - | 44 | 190 | - | 225 | ns |
| | | $V_{CC}$ = 4.5 V | | - | 16 | 38 | - | 45 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 13 | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | | - | 13 | 33 | - | 38 | ns |
| | | $V_{CC}$ = 9.0 V | | - | 16 | 26 | - | 30 | ns |
| $t_{on}$ | turn-on time | nE to nY or nZ; see Figure 11 | [3] | | | | | | |
| | | $V_{CC}$ = 2.0 V | | - | 36 | 125 | - | 150 | ns |
| | | $V_{CC}$ = 4.5 V | | - | 13 | 25 | - | 30 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 11 | - | - | - | ns |
| | | $V_{CC}$ = 6.0 V | | - | 10 | 21 | - | 26 | ns |
| | | $V_{CC}$ = 9.0 V | | - | 8 | 16 | - | 20 | ns |
| $C_{PD}$ | power dissipation capacitance | per switch; $V_I$ = GND to $V_{CC}$ | [5] | 11 | | - | - | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C.

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

[3] $t_{on}$ is the same as $t_{PHZ}$ and $t_{PLZ}$.

[4] $t_{off}$ is the same as $t_{PZH}$ and $t_{PZL}$.

[5] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ where:
$f_i$ = input frequency in MHz;
$f_o$ = output frequency in MHz;
$\sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ = 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 74HCT4066**

*GND = 0 V; $t_r = t_f$ = 6 ns; $C_L$ = 50 pF unless specified otherwise; for test circuit see Figure 12.*
*$V_{is}$ 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 | | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ[1] | Max | Min | Max | |
| $t_{pd}$ | propagation delay | nY to nZ or nZ to nY; $R_L = \infty\ \Omega$; see Figure 10 | [2] | | | | | | |
| | | $V_{CC}$ = 4.5 V | | - | 3 | 15 | - | 18 | ns |
| $t_{off}$ | turn-off time | nE to nY or nZ; see Figure 11 | [4] | | | | | | |
| | | $V_{CC}$ = 4.5 V | | - | 20 | 44 | - | 53 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 16 | - | - | - | ns |
| $t_{on}$ | turn-on time | nE to nY or nZ; see Figure 11 | [3] | | | | | | |
| | | $V_{CC}$ = 4.5 V | | - | 12 | 30 | - | 36 | ns |
| | | $V_{CC}$ = 5.0 V; $C_L$ = 15 pF | | - | 12 | - | - | - | ns |
| $C_{PD}$ | power dissipation capacitance | per switch; $V_I$ = GND to ($V_{CC}$ − 1.5 V) | [5] | - | 12 | - | - | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C.

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

[3] $t_{on}$ is the same as $t_{PHZ}$ and $t_{PLZ}$.

[4] $t_{off}$ is the same as $t_{PZH}$ and $t_{PZL}$.

[5] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ where:
$f_i$ = input frequency in MHz;
$f_o$ = output frequency in MHz;
$\sum\{(C_L + C_{sw}) \times V_{CC}^2 \times f_o\}$ = sum of outputs;
$C_L$ = output load capacitance in pF;
$C_{sw}$ = switch capacitance in pF;
$V_{CC}$ = supply voltage in V.

## 11. Waveforms

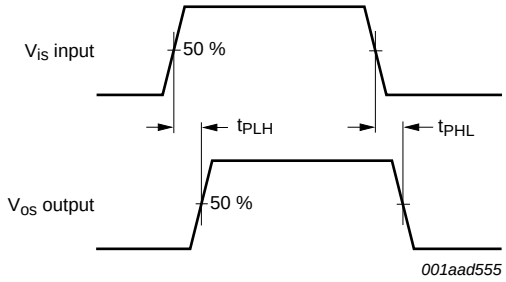
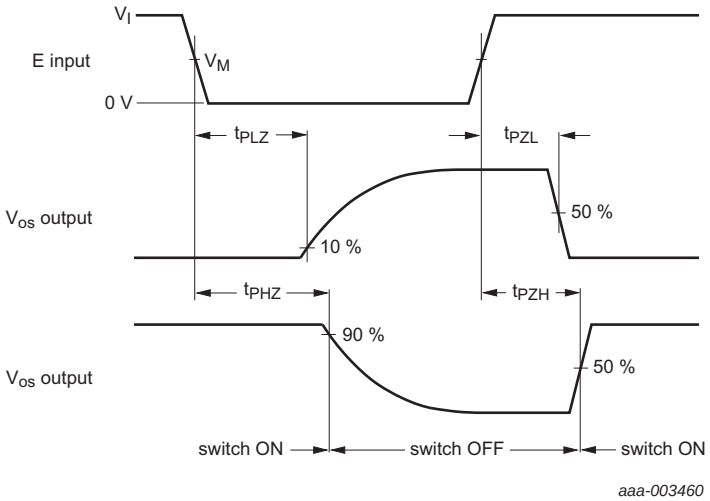



**Fig 10. Input ($V_{is}$) to output ($V_{os}$) propagation delays**

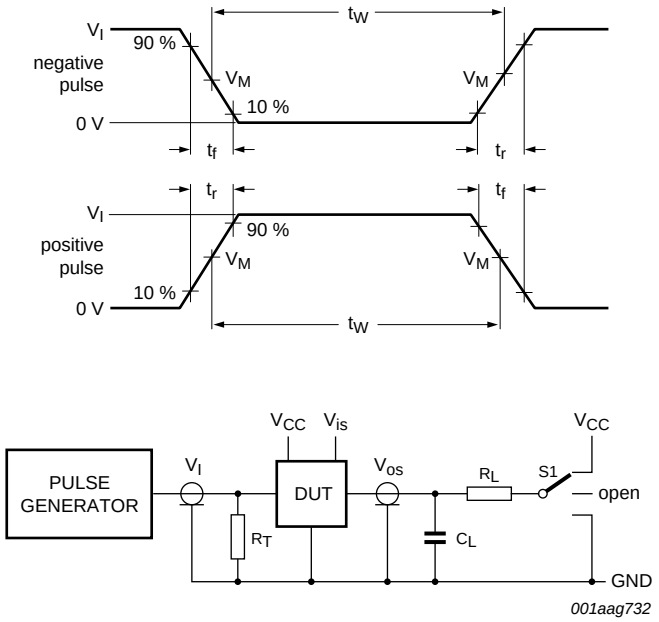



Measurement points are shown in Table 11.

**Fig 11. Turn-on and turn-off times**

**Table 11. Measurement points**

| Type | $V_I$ | $V_M$ |
|---|---|---|
| 74HC4066 | $V_{CC}$ | $0.5V_{CC}$ |
| 74HCT4066 | 3.0 V | 1.3 V |




Test data is given in Table 12.

Definitions test circuit:

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

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

$R_L$ = Load resistor.

S1 = Test selection switch.

**Fig 12. Load circuitry for measuring switching times**

**Table 12. Test data**

| Test | Input | | | Output | | S1 position |
|---|---|---|---|---|---|---|
| | Control E | Switch Yn (Z) | $t_r$, $t_f$ | Switch Z (Yn) | | |
| | $V_I$[1] | $V_{is}$ | | $C_L$ | $R_L$ | |
| $t_{PHL}$, $t_{PLH}$ | GND | GND to $V_{CC}$ | 6 ns | 50 pF | - | open |
| $t_{PHZ}$, $t_{PZH}$ | GND to $V_{CC}$ | $V_{CC}$ | 6 ns | 50 pF, 15 pF | 1 kΩ | GND |
| $t_{PLZ}$, $t_{PZL}$ | GND to $V_{CC}$ | GND | 6 ns | 50 pF, 15 pF | 1 kΩ | $V_{CC}$ |

[1] For 74HCT4066: maximum input voltage $V_I$ = 3.0 V.

## 12. Additional dynamic characteristics

**Table 13. Additional dynamic characteristics**

*Recommended conditions and typical values; GND = 0 V; $T_{amb}$ = 25 °C.*
*$V_{is}$ 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 |
|---|---|---|---|---|---|---|---|
| THD | total harmonic distortion | $f_i$ = 1 kHz; $R_L$ = 10 kΩ; $C_L$ = 50 pF; see Figure 13 | | | | | % |
| | | $V_{CC}$ = 4.5 V; $V_I$ = 4.0 V (p-p) | | - | 0.04 | - | % |
| | | $V_{CC}$ = 9.0 V; $V_I$ = 8.0 V (p-p) | | - | 0.02 | - | % |
| | | $f_i$ = 10 kHz; $R_L$ = 10 kΩ; $C_L$ = 50 pF; see Figure 13 | | | | | |
| | | $V_{CC}$ = 4.5 V; $V_I$ = 4.0 V (p-p) | | - | 0.12 | - | % |
| | | $V_{CC}$ = 9.0 V; $V_I$ = 8.0 V (p-p) | | - | 0.06 | - | % |
| $f_{(-3dB)}$ | −3 dB frequency response | $R_L$ = 50 Ω; $C_L$ = 10 pF; see Figure 15 | [2] | | | | |
| | | $V_{CC}$ = 4.5 V | | - | 180 | - | MHz |
| | | $V_{CC}$ = 9.0 V | | - | 200 | - | MHz |
| $\alpha_{iso}$ | isolation (OFF-state) | $R_L$ = 600 Ω; $C_L$ = 50 pF; $f_i$ = 1 MHz; see Figure 14 | [1] | | | | |
| | | $V_{CC}$ = 4.5 V | | - | −50 | - | dB |
| | | $V_{CC}$ = 9.0 V | | - | −50 | - | dB |
| $V_{ct}$ | crosstalk voltage | between digital input and switch (peak to peak value); $R_L$ = 600 Ω; $C_L$ = 50 pF; $f_i$ = 1 MHz; see Figure 16 | | | | | |
| | | $V_{CC}$ = 4.5 V | | - | 110 | - | mV |
| | | $V_{CC}$ = 9.0 V | | - | 220 | - | mV |
| Xtalk | crosstalk | between switches; $R_L$ = 600 Ω; $C_L$ = 50 pF; $f_i$ = 1 MHz; see Figure 17 | [1] | | | | |
| | | $V_{CC}$ = 4.5 V | | - | −60 | - | dB |
| | | $V_{CC}$ = 9.0 V | | - | −60 | - | dB |

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

[2] Adjust input voltage $V_{is}$ to 0 dBm level at $V_{os}$ for $f_i$ = 1 MHz (0 dBm = 1 mW into 50 Ω). After set-up, $f_i$ is increased to obtain a reading of −3 dB at $V_{os}$.

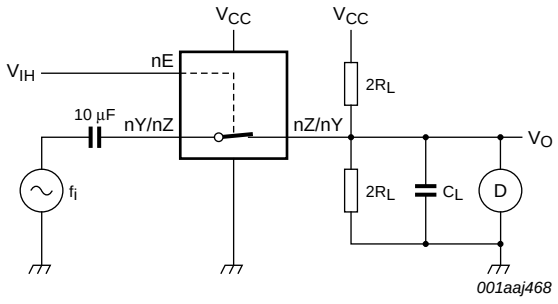
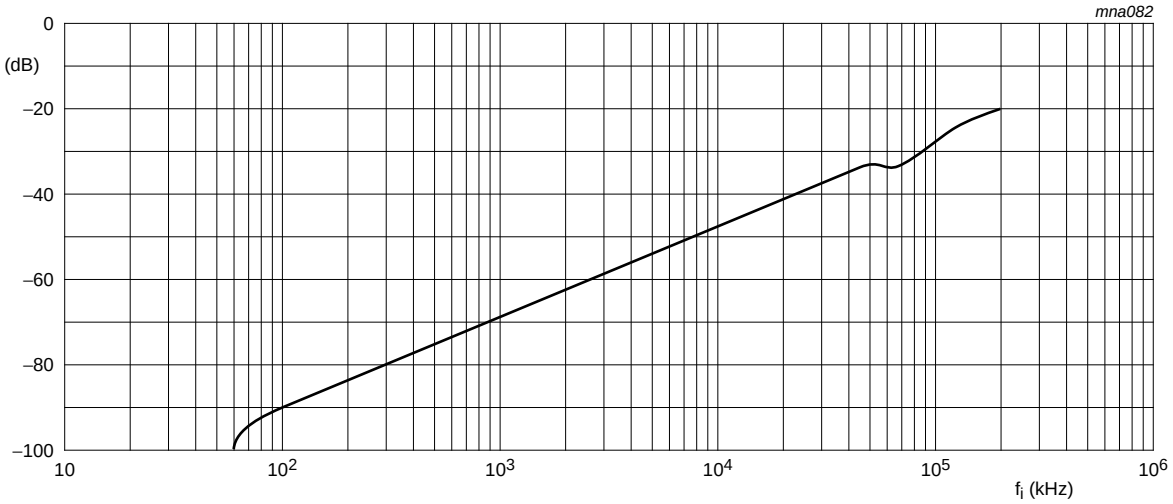
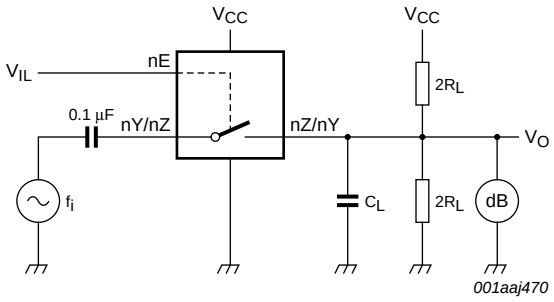



**Fig 13. Test circuit for measuring total harmonic distortion**



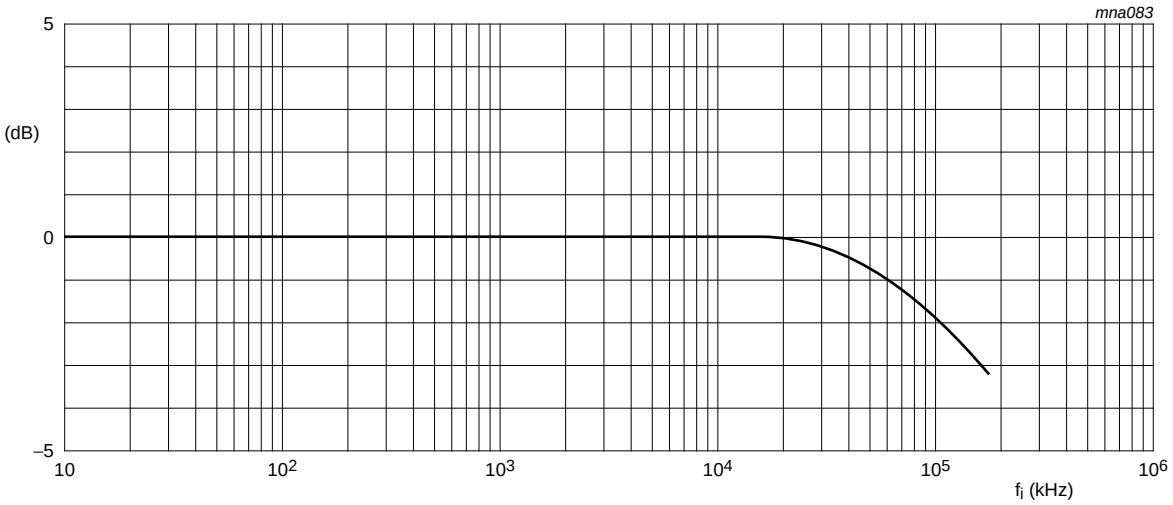

a. Isolation (OFF-state)



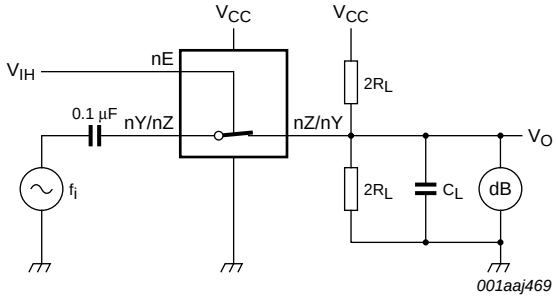

b. Test circuit

$V_{CC}$ = 4.5 V; GND = 0 V; $R_L$ = 600 Ω; $R_{source}$ = 1 kΩ.

**Fig 14. Isolation (OFF-state) as a function of frequency**



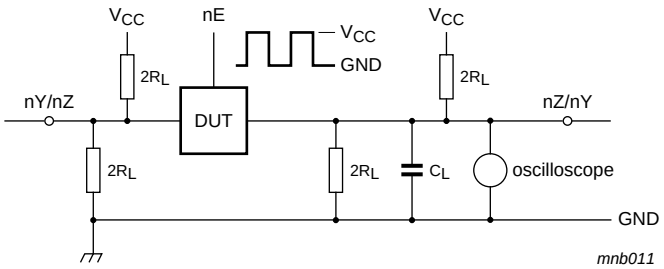

a. Typical −3 dB frequency response



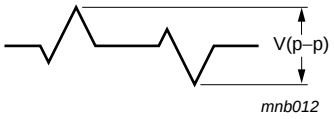

b. Test circuit

$V_{CC}$ = 4.5 V; GND = 0 V; $R_L$ = 50 Ω; $R_{source}$ = 1 kΩ.

**Fig 15. –3 dB frequency response**




a. Circuit




b. Crosstalk voltage

**Fig 16. Test circuit for measuring crosstalk voltage (between the digital input and the switch)**

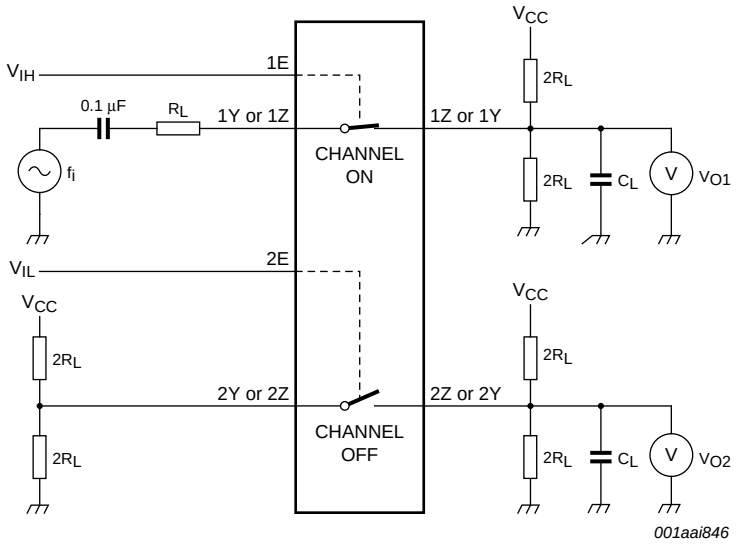
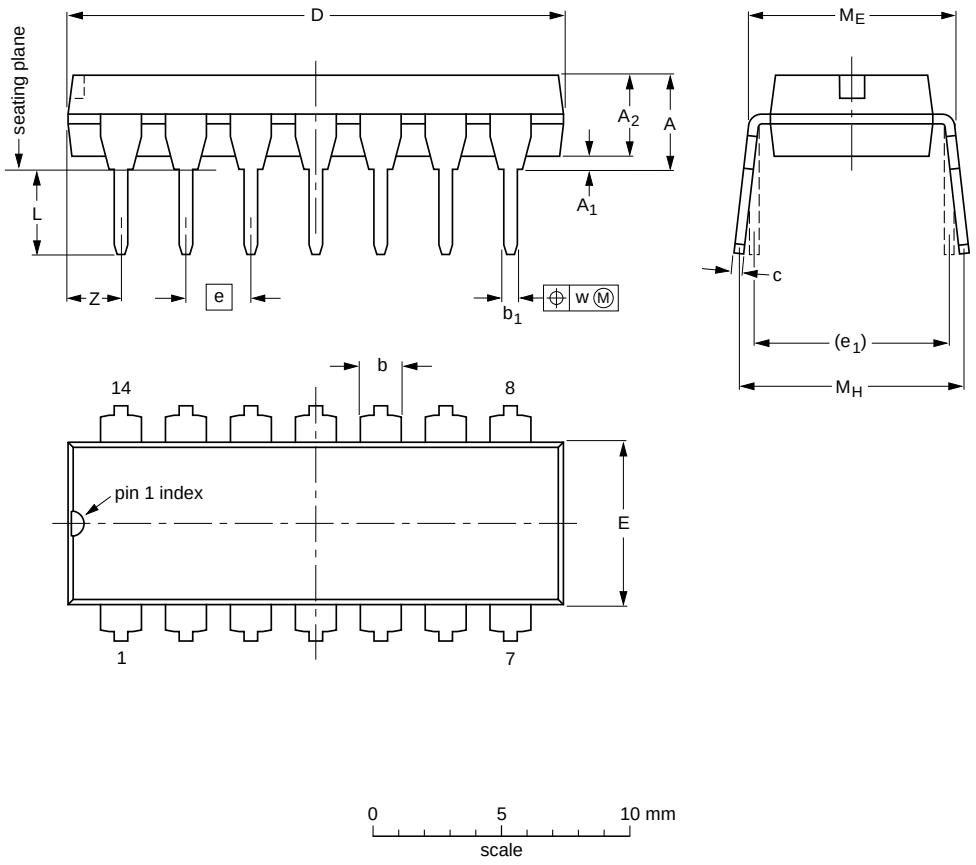



**Fig 17. Test circuit for measuring crosstalk (between the switches)**

## 13. Package outline

**DIP14: plastic dual in-line package; 14 leads (300 mil)** **SOT27-1**




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

| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.13 | 0.53<br>0.38 | 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 | 2.2 |
| inches | 0.17 | 0.02 | 0.13 | 0.068<br>0.044 | 0.021<br>0.015 | 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 | 0.087 |

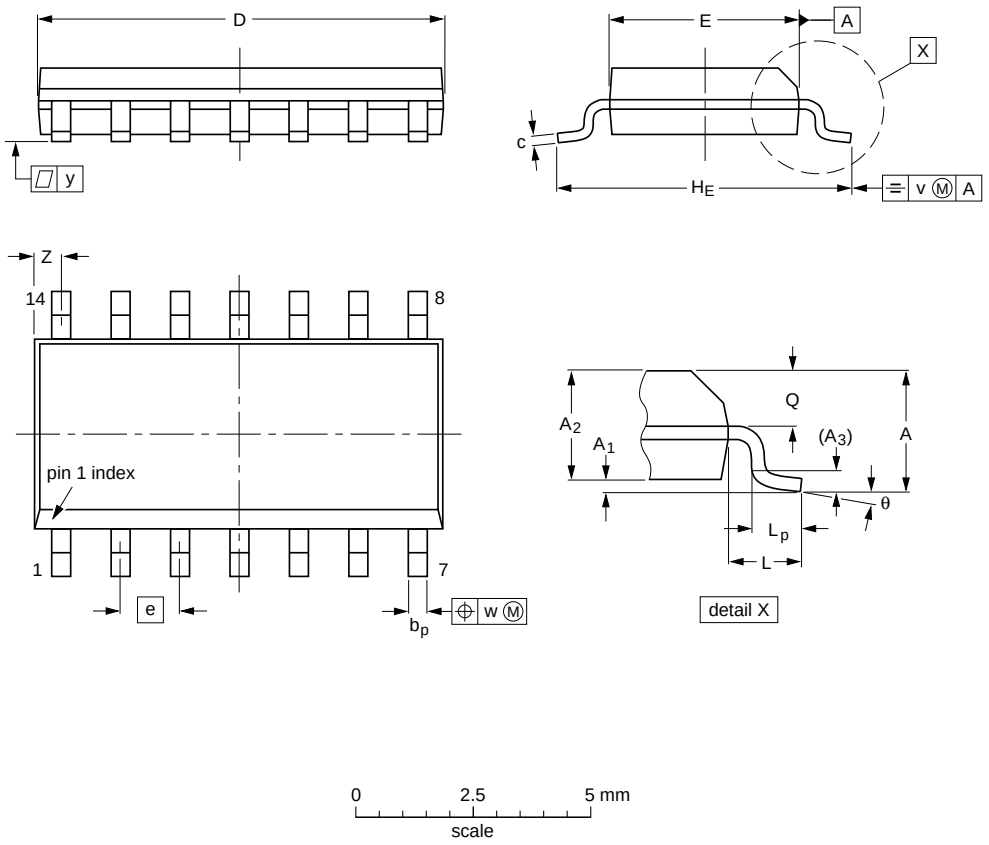
**Note**

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

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT27-1 | 050G04 | MO-001 | SC-501-14 | | | ~~99-12-27~~<br>03-02-13 |

**Fig 18. Package outline SOT27-1 (DIP14)**

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




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

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 8.75<br>8.55 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

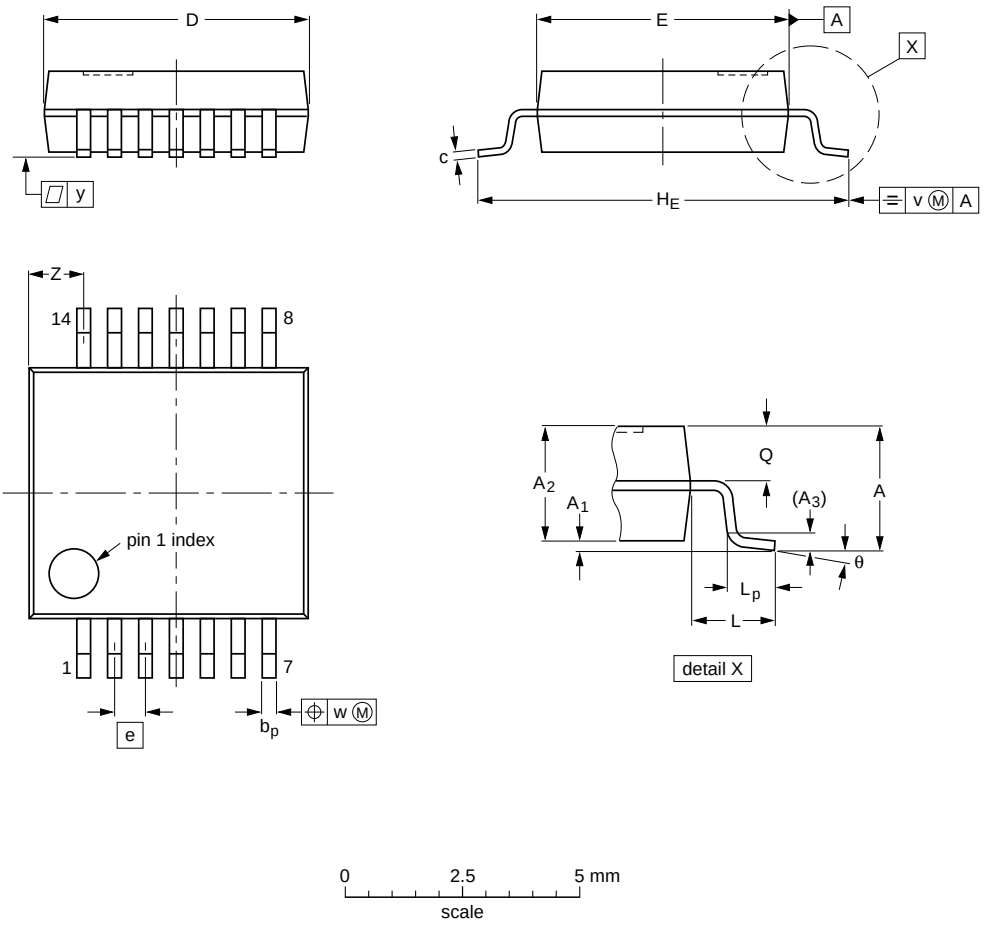
**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT108-1 | 076E06 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 19. Package outline SOT108-1 (SO14)**

**SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm** **SOT337-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 6.4<br>6.0 | 5.4<br>5.2 | 0.65 | 7.9<br>7.6 | 1.25 | 1.03<br>0.63 | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.4<br>0.9 | $8^o$<br>$0^o$ |

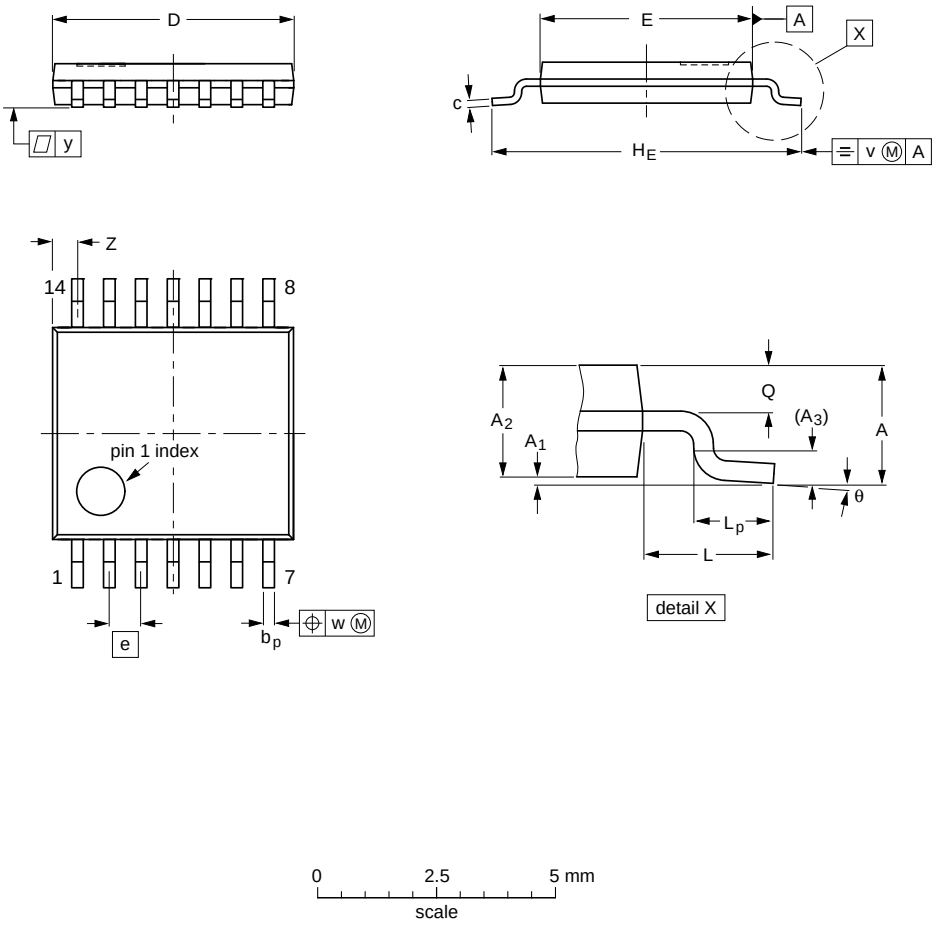
**Note**

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

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT337-1 | | MO-150 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig 20. Package outline SOT337-1 (SSOP14)**

**TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm** **SOT402-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 5.1<br>4.9 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38 | $8^o$<br>$0^o$ |

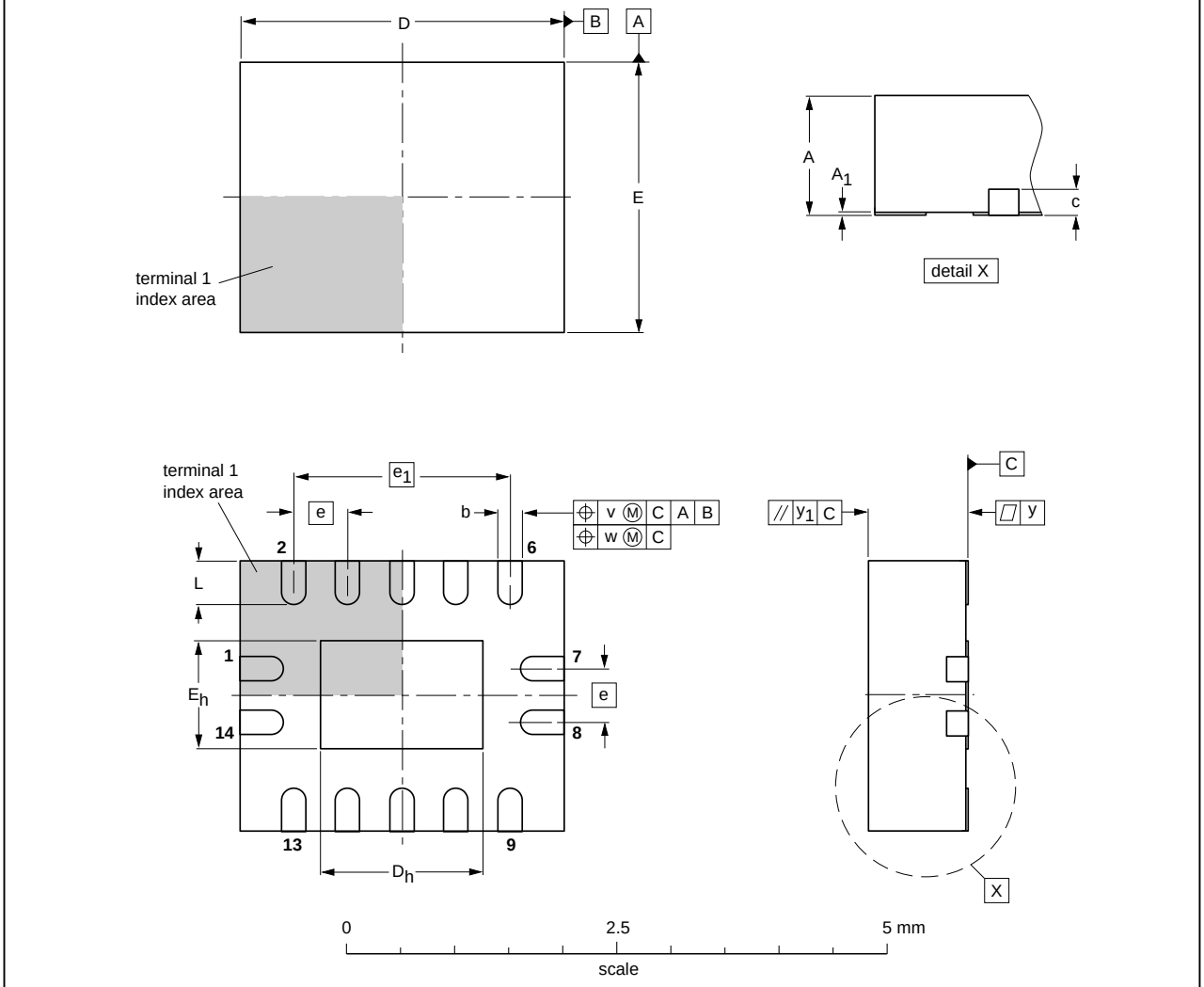
**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT402-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**Fig 21. Package outline SOT402-1 (TSSOP14)**

**DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm** **SOT762-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | $A^{(1)}$ max. | $A_1$ | b | c | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1 | 0.05<br>0.00 | 0.30<br>0.18 | 0.2 | 3.1<br>2.9 | 1.65<br>1.35 | 2.6<br>2.4 | 1.15<br>0.85 | 0.5 | 2 | 0.5<br>0.3 | 0.1 | 0.05 | 0.05 | 0.1 |

**Note**

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT762-1 | - - - | MO-241 | - - - | | | ~~02-10-17~~<br>03-01-27 |

**Fig 22. Package outline SOT762-1 (DHVQFN14)**

## 14. Abbreviations

**Table 14. Abbreviations**

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

## 15. Revision history

**Table 15. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74HC_HCT4066 v.7 | 20130402 | Product data sheet | - | 74HC_HCT4066 v.6 |
| Modifications: | • Descriptive title corrected (errata).<br>• New general description (errata). | | | |
| 74HC_HCT4066 v.6 | 20120718 | Product data sheet | - | 74HC_HCT4066 v.5 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| 74HC_HCT4066 v.5 | 20041111 | Product data sheet | - | 74HC_HCT4066 v.4 |
| 74HC_HCT4066 v.4 | 20030617 | Product data sheet | - | 74HC_HCT4066_CNV v.3 |
| 74HC_HCT4067_CNV v.3 | 19981110 | Product data sheet | - | 74HC_HCT4066_CNV v.2 |
| 74HC_HCT4066_CNV v.2 | 19981002 | Product specification | - | - |

# 16. Legal information

## 16.1 Data sheet status

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

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

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

[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.

## 16.2 Definitions

**Draft —** The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet —** A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

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