

DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications

74HC/HCT4066 Quad bilateral switches

Product specification
Supersedes data of 1998 Oct 02
File under Integrated Circuits, IC06

1998 Nov 10

Quad bilateral switches

74HC/HCT4066

FEATURES

- Very low “ON” resistance:
50 Ω (typ.) at $V_{CC} = 4.5$ V
45 Ω (typ.) at $V_{CC} = 6.0$ V
35 Ω (typ.) at $V_{CC} = 9.0$ V
- Output capability: non-standard
- I_{CC} category: SSI.

The 74HC/HCT4066 have four independent analog switches. Each switch has two input/output terminals (nY, nZ) and an active HIGH enable input (nE). When nE is LOW the belonging analog switch is turned off.

The “4066” is pin compatible with the “4016” but exhibits a much lower “ON” resistance. In addition, the “ON” resistance is relatively constant over the full input signal range.

GENERAL DESCRIPTION

The 74HC/HCT4066 are high-speed Si-gate CMOS devices and are pin compatible with the “4066” of the “4000B” series. They are specified in compliance with JEDEC standard no. 7A.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25$ °C; $t_r = t_f = 6$ ns

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|-------------------|--|--|---------|-----|------|
| | | | HC | HCT | |
| t_{PZH}/t_{PZL} | turn-on time nE to V_{os} | $C_L = 15$ pF; $R_L = 1$ k Ω ; $V_{CC} = 5$ V | 11 | 12 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time nE to V_{os} | | 13 | 16 | ns |
| C_I | input capacitance | | 3.5 | 3.5 | pF |
| C_{PD} | power dissipation capacitance per switch | notes 1 and 2 | 11 | 12 | pF |
| C_S | max. switch capacitance | | 8 | 8 | pF |

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W):
 - a) $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$ where:
 - b) f_i = input frequency in MHz
 - c) f_o = output frequency in MHz
 - d) $\sum \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$ = sum of outputs
 - e) C_L = output load capacitance in pF
 - f) C_S = maximum switch capacitance in pF
 - g) V_{CC} = supply voltage in V
2. For HC the condition is $V_I = \text{GND to } V_{CC}$
For HCT the condition is $V_I = \text{GND to } V_{CC} - 1.5$ V

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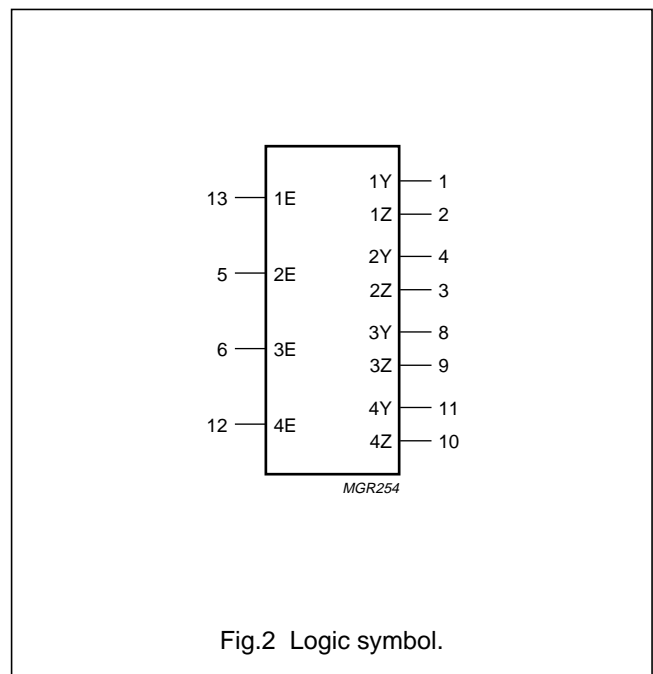
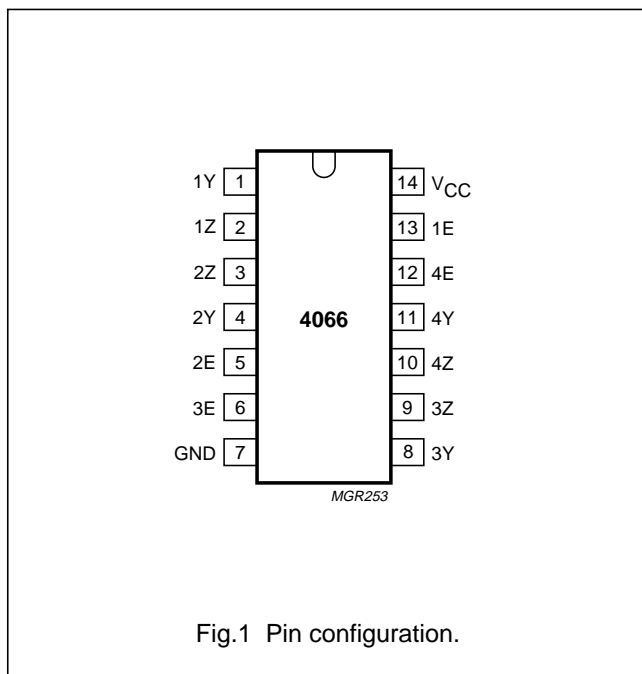
74HC/HCT4066

ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|-------------|---------|--|----------|
| | NAME | DESCRIPTION | VERSION |
| 74HC4066 | DIP14 | plastic dual in-line package; 14 leads (300 mil) | SOT27-1 |
| 74HC4066 | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74HC4066 | SSOP14 | plastic shrink small outline package; 14 leads; body width 5.3 mm | SOT337-1 |
| 74HC4066 | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74HCT4066 | DIP14 | plastic dual in-line package; 14 leads (300 mil) | SOT27-1 |
| 74HCT4066 | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |
| 74HCT4066 | SSOP14 | plastic shrink small outline package; 14 leads; body width 5.3 mm | SOT337-1 |
| 74HCT4066 | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |

PIN DESCRIPTION

| PIN NO. | SYMBOL | NAME AND FUNCTION |
|--------------|-----------------|-----------------------------|
| 1, 4, 8, 11 | 1Y to 4Y | independent inputs/outputs |
| 2, 3, 9, 10 | 1Z to 4Z | independent inputs/outputs |
| 7 | GND | ground (0 V) |
| 13, 5, 6, 12 | 1E to 4E | enable inputs (active HIGH) |
| 14 | V _{CC} | positive supply voltage |



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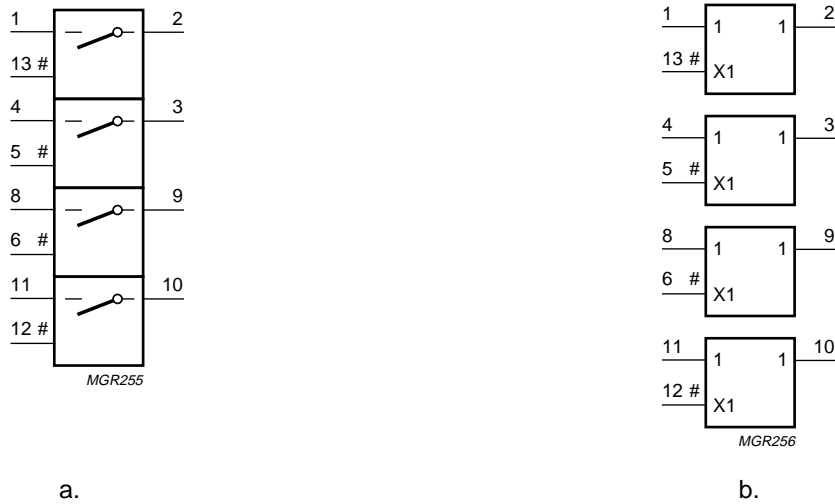


Fig.3 IEC logic symbol.

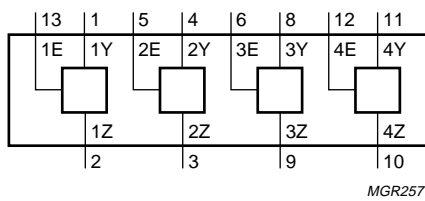


Fig.4 Functional diagram.

FUNCTION TABLE

| INPUT NE | SWITCH |
|----------|--------|
| L | off |
| H | on |

Note

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

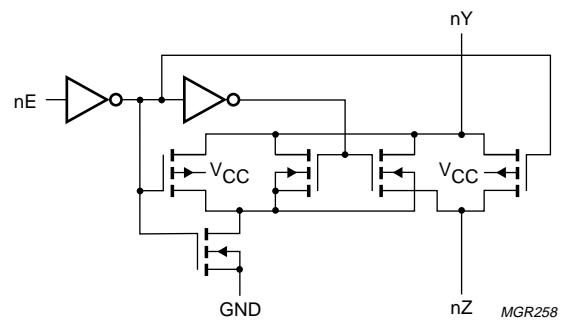


Fig.5 Schematic diagram (one switch).

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134) Voltages are referenced to GND (GND = 0 V)

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT | CONDITIONS |
|--------------------------------|--|------|------------|----------|--|
| V_{CC} | DC supply voltage | -0.5 | +11.0 | V | |
| $\pm I_{IK}$ | DC digital input diode current | | 20 | mA | for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V |
| $\pm I_{SK}$ | DC switch diode current | | 20 | mA | for $V_S < -0.5$ V or $V_S > V_{CC} + 0.5$ V |
| $\pm I_{IS}$ | DC switch current | | 25 | mA | for -0.5 V $< V_S < V_{CC} + 0.5$ V |
| $\pm I_{CC};$ $\pm I_{GND}$ | DC V_{CC} or GND current | | 50 | mA | |
| T_{stg} | storage temperature range | -65 | +150 | °C | |
| P_{tot} | power dissipation per package plastic DIL plastic mini-pack (SO) | | 750 500 | mW mW | for temperature range: -40 to +125 °C 74HC/HCT above +70 °C: derate linearly with 12 mW/K above +70 °C: derate linearly with 8 mW/K |
| P_S | power dissipation per switch | | 100 | mW | |

Note

1. To avoid drawing V_{CC} current out of terminal nZ, when switch current flows in terminal nY, 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 terminal nY. In this case there is no limit for the voltage drop across the switch, but the voltages at nY and nZ may not exceed V_{CC} or GND.

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | 74HC | | | 74HCT | | | UNIT | CONDITIONS |
|------------|-------------------------------------|------|------|---------------------------|-------|------|----------|------|---|
| | | min. | typ. | max. | min. | typ. | max. | | |
| V_{CC} | DC supply voltage | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V | |
| V_I | DC input voltage range | GND | | V_{CC} | GND | | V_{CC} | V | |
| V_S | DC switch voltage range | GND | | V_{CC} | GND | | V_{CC} | V | |
| T_{amb} | operating ambient temperature range | -40 | | +85 | -40 | | +85 | °C | see DC and AC CHARACTERISTICS |
| T_{amb} | operating ambient temperature range | -40 | | +125 | -40 | | +125 | °C | |
| t_r, t_f | input rise and fall times | | 6.0 | 1000 500 400 250 | | 6.0 | 500 | ns | $V_{CC} = 2.0$ V $V_{CC} = 4.5$ V $V_{CC} = 6.0$ V $V_{CC} = 10.0$ V |

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DC CHARACTERISTICS FOR 74HC/HCT

For 74HC: $V_{CC} = 2.0, 4.5, 6.0$ and 9.0 V; For 74HCT: $V_{CC} = 4.5$ V

| SYMBOL | PARAMETER | T_{amb} (°C) | | | | | | UNIT | TEST CONDITIONS | | | | |
|-----------------|---|----------------|------|------|------------|------|-------------|------|-----------------|---------------------|----------|-----------------------|----------------------------|
| | | 74HC/HCT | | | | | | | V_{CC} (V) | I_S (μ A) | V_{IS} | V_I | |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | | | | | | max. |
| R_{ON} | ON-resistance (peak) | | – | – | | – | | – | Ω | 2.0 | 100 | V_{CC} to GND | V_{IH} or V_{IL} |
| | | | 54 | 95 | | 118 | | 142 | Ω | 4.5 | 1000 | | |
| | | | 42 | 84 | | 105 | | 126 | Ω | 6.0 | 1000 | | |
| | | | 32 | 70 | | 88 | | 105 | Ω | 9.0 | 1000 | | |
| R_{ON} | ON-resistance (rail) | | 80 | – | | – | | – | Ω | 2.0 | 100 | GND | V_{IH} or V_{IL} |
| | | | 35 | 75 | | 95 | | 115 | Ω | 4.5 | 1000 | | |
| | | | 27 | 65 | | 82 | | 100 | Ω | 6.0 | 1000 | | |
| | | | 20 | 55 | | 70 | | 85 | Ω | 9.0 | 1000 | | |
| R_{ON} | ON-resistance (rail) | | 100 | – | | – | | – | Ω | 2.0 | 100 | V_{CC} | V_{IH} or V_{IL} |
| | | | 42 | 80 | | 106 | | 128 | Ω | 4.5 | 1000 | | |
| | | | 35 | 75 | | 94 | | 113 | Ω | 6.0 | 1000 | | |
| | | | 27 | 60 | | 78 | | 95 | Ω | 9.0 | 1000 | | |
| ΔR_{ON} | maximum variation of ON-resistance between any two channels | | – | | | | | | Ω | 2.0 | | V_{CC} to GND | V_{IH} or V_{IL} |
| | | | 5 | | | | | | Ω | 4.5 | | | |
| | | | 4 | | | | | | Ω | 6.0 | | | |
| | | | 3 | | | | | | Ω | 9.0 | | | |

Note

- At supply voltages 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.

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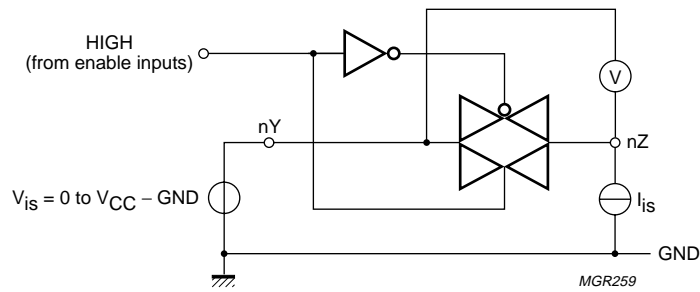


Fig.6 Test circuit for measuring ON-resistance (R_{ON}).

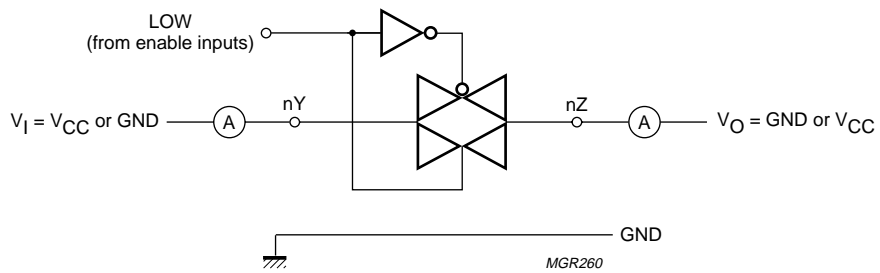


Fig.7 Test circuit for measuring OFF-state current.

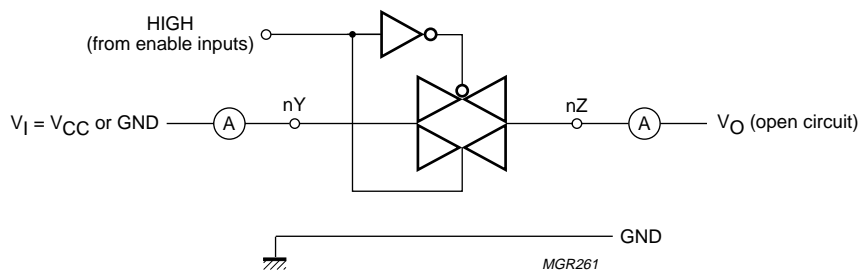


Fig.8 Test circuit for measuring ON-state current.

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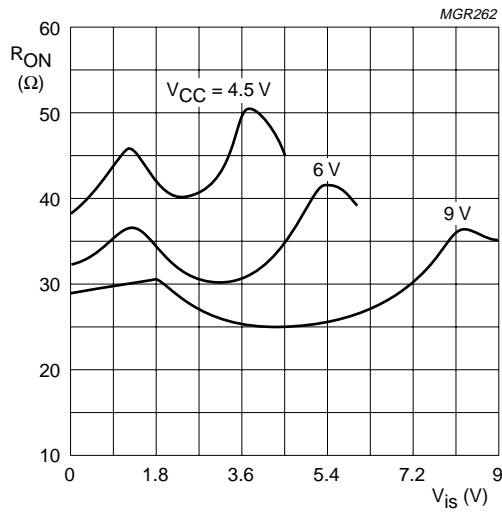


Fig.9 Typical ON-resistance (R_{ON}) as a function of input voltage (V_{is}) for $V_{is} = 0$ to V_{CC} .

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DC CHARACTERISTICS FOR 74HC

Voltage are referenced to GND (ground = 0 V)

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | | UNIT | TEST CONDITIONS | | |
|-----------------|---|-----------------------|------|------|------------|------|-------------|------|------|------------------------|--|--|
| | | 74HC | | | | | | | | V _{CC} (V) | V _I | OTHER |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | |
| V _{IH} | HIGH-level input voltage | 1.5 | 1.2 | | 1.5 | | 1.5 | | V | 2.0 | | |
| | | 3.15 | 2.4 | | 3.15 | | 3.15 | | | 4.5 | | |
| | | 4.2 | 3.2 | | 4.2 | | 4.2 | | | 6.0 | | |
| | | 6.3 | 4.7 | | 6.3 | | 6.3 | | | 9.0 | | |
| V _{IL} | LOW-level input voltage | | 0.8 | 0.50 | | 0.50 | | 0.50 | V | 2.0 | | |
| | | | 2.1 | 1.35 | | 1.35 | | 1.35 | | 4.5 | | |
| | | | 2.8 | 1.80 | | 1.80 | | 1.80 | | 6.0 | | |
| | | | 4.3 | 2.70 | | 2.70 | | 2.70 | | 9.0 | | |
| ±I _I | input leakage current | | | 0.1 | | 1.0 | | 1.0 | µA | 6.0 | V _{CC} or GND | |
| | | | | 0.2 | | 2.0 | | 2.0 | | 10.0 | | |
| ±I _S | analog switch OFF-state current per channel | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | V _{IH} or V _{IL} | V _S = V _{CC} - GND (see Fig.7) |
| ±I _S | analog switch ON-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | V _{IH} or V _{IL} | V _S = V _{CC} - GND (see Fig.8) |
| I _{CC} | quiescent supply current | | | 2.0 | | 20.0 | | 40.0 | µA | 6.0 | V _{CC} or GND | V _{is} = GND or V _{CC} ; V _{os} = V _{CC} or GND |
| | | | | 4.0 | | 40.0 | | 80.0 | | 10.0 | | |

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AC CHARACTERISTICS FOR 74HC

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF

| SYMBOL | PARAMETER | T_{amb} (°C) | | | | | | | UNIT | TEST CONDITIONS | |
|-------------------|---|----------------|----------------------|-----------------------|------------|-----------------------|-------------|-----------------------|------|--------------------------|--|
| | | 74HC | | | | | | | | V_{CC} (V) | OTHER |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | |
| t_{PHL}/t_{PLH} | propagation delay V_{is} to V_{os} | | 8 3 2 2 | 60 12 10 8 | | 75 15 13 10 | | 90 18 15 12 | ns | 2.0 4.5 6.0 9.0 | $R_L = \infty$; $C_L = 50$ pF (see Fig.18) |
| t_{PZH}/t_{PZL} | turn-on time nE to V_{os} | | 36 13 10 8 | 100 20 17 13 | | 125 25 21 16 | | 150 30 26 20 | ns | 2.0 4.5 6.0 9.0 | $R_L = 1$ k Ω ; $C_L = 50$ pF (see Figs 19 and 20) |
| t_{PHZ}/t_{PLZ} | turn-off time nE to V_{os} | | 44 16 13 16 | 150 30 26 24 | | 190 38 33 16 | | 225 45 38 20 | ns | 2.0 4.5 6.0 9.0 | $R_L = 1$ k Ω ; $C_L = 50$ pF (see Figs 19 and 20) |

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DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0 V)

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | | UNIT | TEST CONDITIONS | | |
|------------------|---|-----------------------|------|------|------------|------|-------------|------|------|------------------------|------------------------------------|---|
| | | 74HCT | | | | | | | | V _{CC} (V) | V _I | OTHER |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | |
| V _{IH} | HIGH-level input voltage | 2.0 | 1.6 | | 2.0 | | 2.0 | | V | 4.5 to 5.5 | | |
| V _{IL} | LOW-level input voltage | | 1.2 | 0.8 | | 0.8 | | 0.8 | V | 4.5 to 5.5 | | |
| ±I _I | input leakage current | | | 0.1 | | 1.0 | | 1.0 | µA | 5.5 | V _{CC} or GND | |
| ±I _S | analog switch OFF-state current per channel | | | 0.1 | | 1.0 | | 1.0 | µA | 5.5 | V _{IH} or V _{IL} | V _S = V _{CC} - GND (see Fig.7) |
| ±I _S | analog switch ON-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 5.5 | V _{IH} or V _{IL} | V _S = V _{CC} - GND (see Fig.8) |
| I _{CC} | quiescent supply current | | | 2.0 | | 20.0 | | 40.0 | µA | 4.5 to 5.5 | V _{CC} or GND | V _{IS} = GND or V _{CC} ; V _{OS} = V _{CC} or GND |
| ΔI _{CC} | additional quiescent supply current per input pin for unit load coefficient is 1 (note 1) | | 100 | 360 | | 450 | | 490 | µA | 4.5 to 5.5 | V _{CC} - 2.1 V | other inputs at V _{CC} or GND |

Note

- The value of additional quiescent supply current (ΔI_{CC}) for a unit load of 1 is given here. To determine ΔI_{CC} per input, multiply this value by the unit load coefficient shown in the table below.

Table 1

| INPUT | UNIT LOAD COEFFICIENT |
|-------|-----------------------|
| nE | 1.00 |

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AC CHARACTERISTICS FOR 74HCT

GND = 0 V; $t_r = t_f = 6$ ns

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | | UNIT | V _{CC} (V) | TEST CONDITIONS |
|------------------------------------|--|-----------------------|------|------|------------|------|-------------|------|------|------------------------|--|
| | | 74HCT | | | | | | | | | OTHER |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | |
| t _{PHL} /t _{PLH} | propagation delay V _{is} to V _{os} | | 3 | 12 | | 15 | | 18 | ns | 4.5 | R _L = ∞; C _L = 50 pF (see Fig.18) |
| t _{PZH} /t _{PZL} | turn-on time nE to V _{os} | | 12 | 24 | | 30 | | 36 | ns | 4.5 | R _L = 1 kΩ; C _L = 50 pF (see Figs 19 and 20) |
| t _{PHZ} /t _{PLZ} | turn-off time nE to V _{os} | | 20 | 35 | | 44 | | 53 | ns | 4.5 | R _L = 1 kΩ; C _L = 50 pF (see Figs 19 and 20) |

ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

Recommended conditions and typical values GND = 0 V; $t_r = t_f = 6$ ns

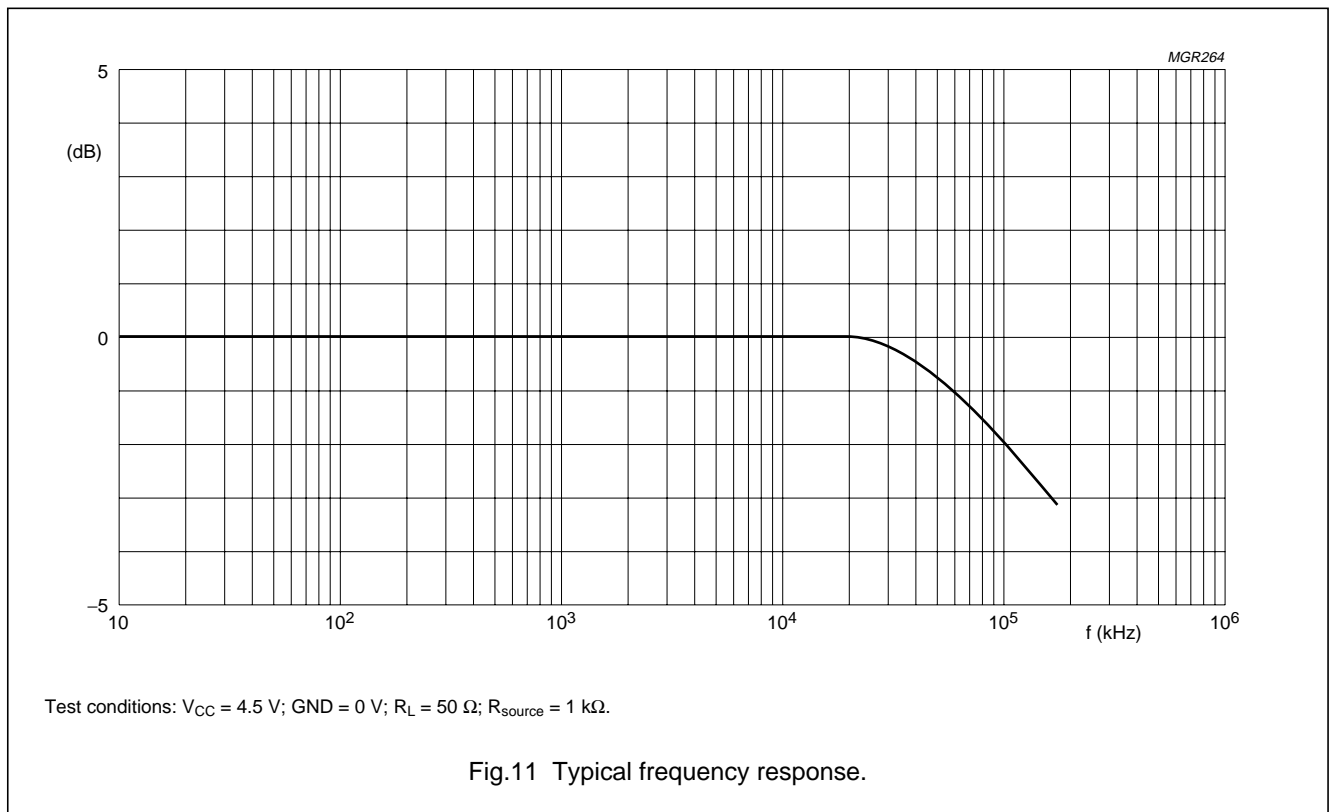
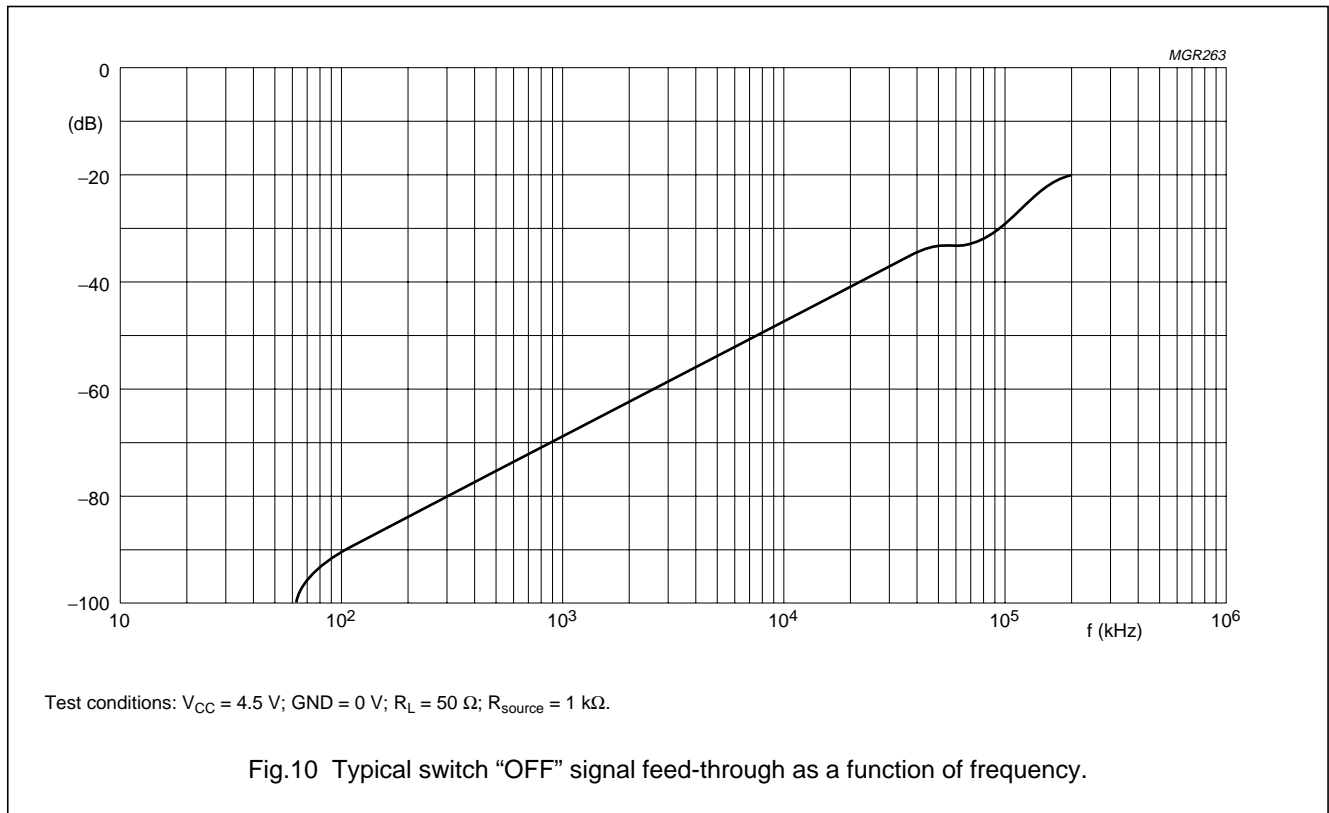
| SYMBOL | PARAMETER | TYP. | UNIT | V _{CC} (V) | V _{IS(p-p)} (V) | CONDITIONS |
|--------------------|--|------|------|------------------------|-----------------------------|--|
| | sine wave distortion f = 1 kHz | 0.04 | % | 4.5 | 4.0 | R _L = 10 kΩ; C _L = 50 pF (see Fig.16) |
| | | 0.02 | % | 9.0 | 8.0 | |
| | sine wave distortion f = 10 kHz | 0.12 | % | 4.5 | 4.0 | R _L = 10 kΩ; C _L = 50 pF (see Fig.16) |
| | | 0.06 | % | 9.0 | 8.0 | |
| | switch "OFF" signal feed-through | -50 | dB | 4.5 | note 3 | R _L = 600 Ω; C _L = 50 pF; f = 1 MHz (see Figs 10 and 17) |
| | | -50 | dB | 9.0 | | |
| | crosstalk between any two switches | -60 | dB | 4.5 | note 3 | R _L = 600 Ω; C _L = 50 pF; f = 1 MHz (see Fig.12) |
| | | -60 | dB | 9.0 | | |
| V _(p-p) | crosstalk voltage between enable or address input to any switch (peak-to-peak value) | 110 | mV | 4.5 | | R _L = 600 Ω; C _L = 50 pF; f = 1 MHz (nE, square wave between V _{CC} and GND, t _r = t _f = 6 ns) (see Fig.14) |
| | | 220 | mV | 9.0 | | |
| f _{max} | minimum frequency response (-3 dB) | 180 | MHz | 4.5 | note 4 | R _L = 50 Ω; C _L = 10 pF (see Figs 11 and 15) |
| | | 200 | MHz | 9.0 | | |
| C _S | maximum switch capacitance | 8 | pF | | | |

Notes

1. V_{is} is the input voltage at nY or nZ terminal, whichever is assigned as an input.
2. V_{os} is the output voltage at nY or nZ terminal, whichever is assigned as an output.
3. Adjust input voltage V_{is} is 0 dBm level (0 dBm = 1 mW into 600 Ω).
4. Adjust input voltage V_{is} is 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω).

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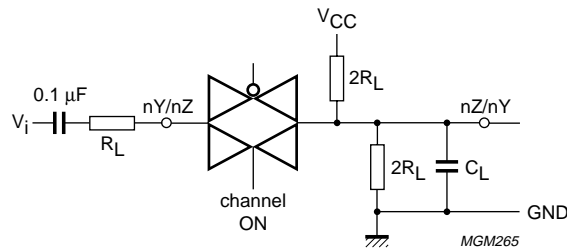


Fig.12 Test circuit for measuring crosstalk between any two switches; channel ON condition.

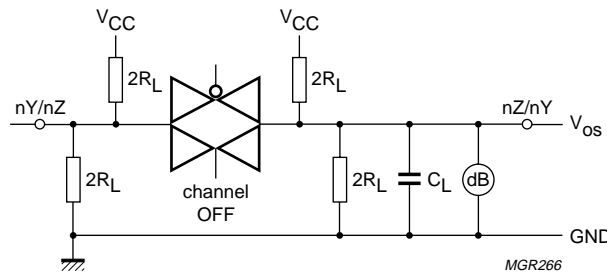


Fig.13 Test circuit for measuring crosstalk between any two switches; channel OFF condition.

The crosstalk is defined as follows (oscilloscope output):

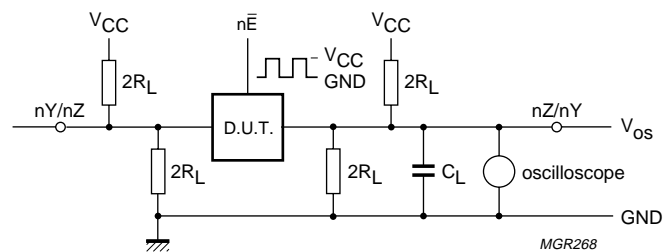
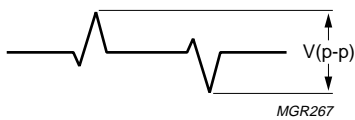
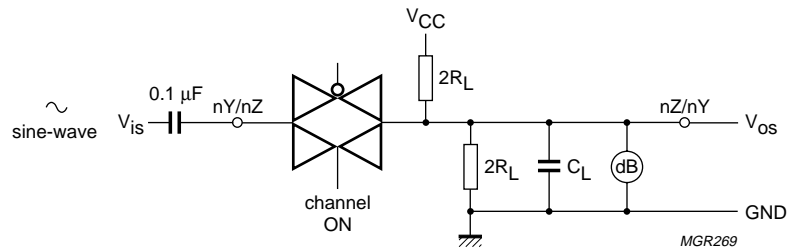


Fig.14 Test circuit for measuring crosstalk between control and any switch.

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Adjust input voltage to obtain 0 dBm at V_{os} when $f_{in} = 1$ MHz. After set-up frequency of f_{in} is increased to obtain a reading of -3 dB at V_{os} .

Fig.15 Test circuit for measuring minimum frequency response.

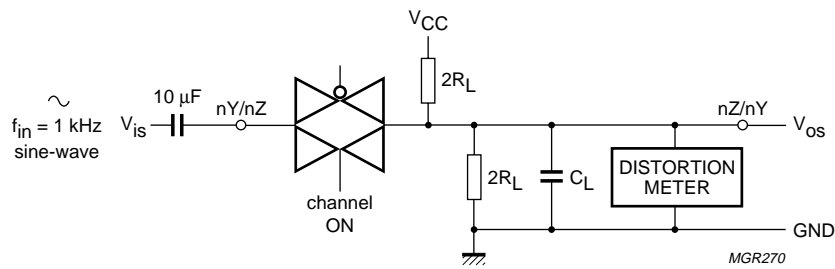


Fig.16 Test circuit for measuring sine wave distortion.

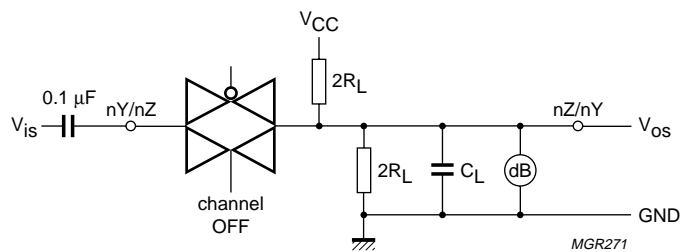
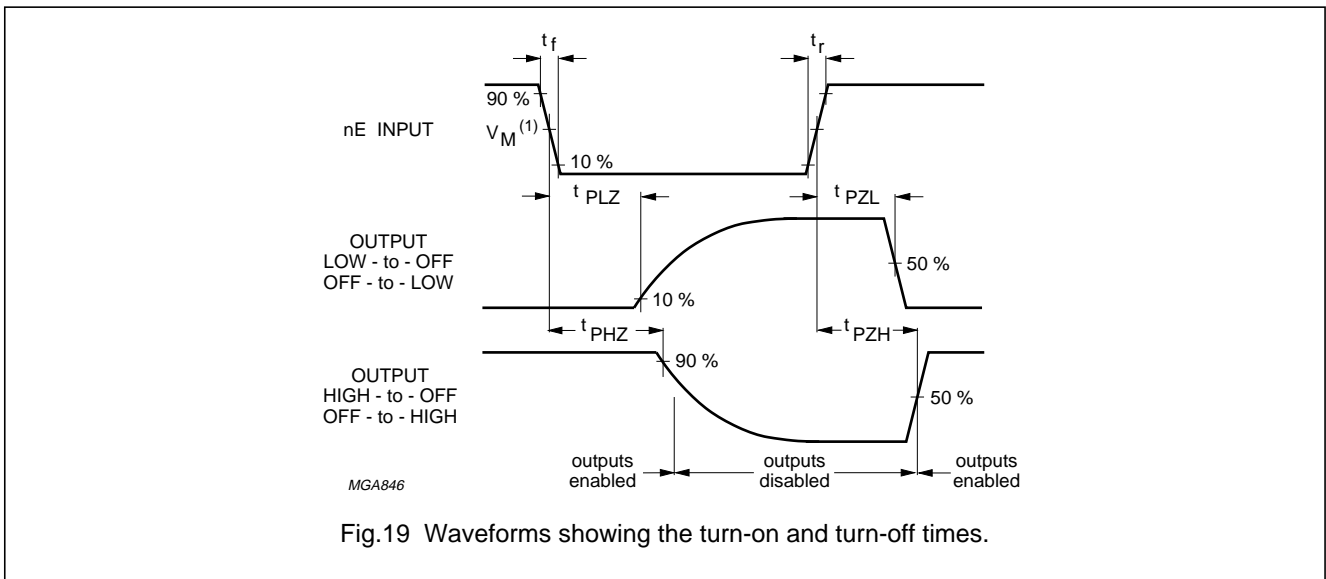
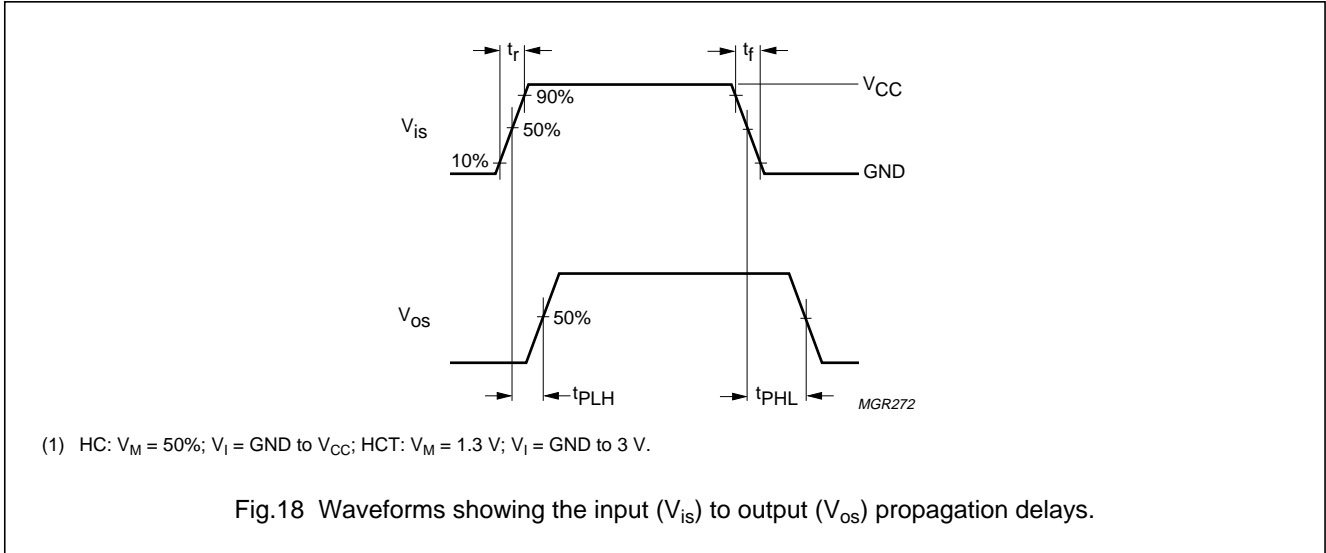


Fig.17 Test circuit for measuring switch "OFF" signal feed-through.

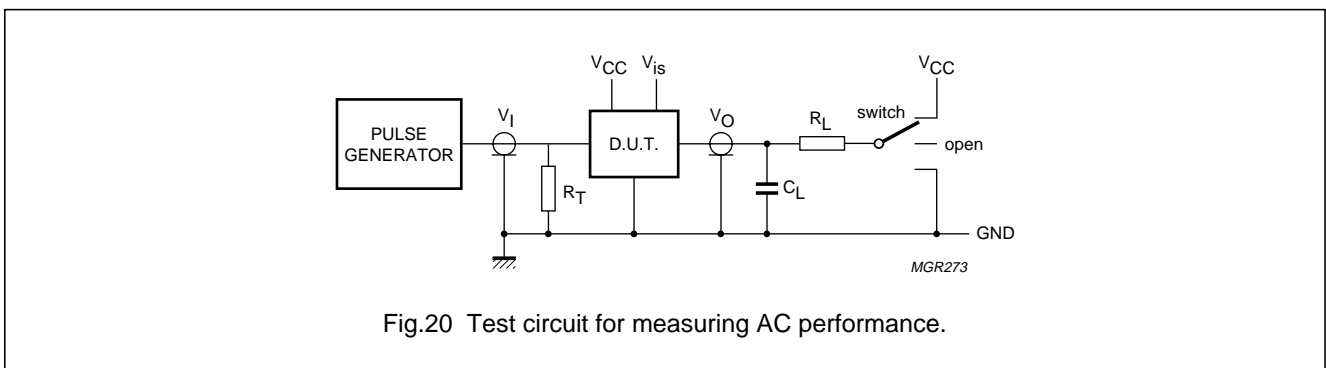
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AC WAVEFORMS



TEST CIRCUIT AND WAVEFORMS



Quad bilateral switches

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Table 2 Conditions

| TEST | SWITCH | V _{IS} |
|------------------|-----------------|-----------------|
| t _{PZH} | GND | V _{CC} |
| t _{PZL} | V _{CC} | GND |
| t _{PHZ} | GND | V _{CC} |
| t _{PLZ} | V _{CC} | GND |
| others | open | pulse |

Table 3 Definitions for Figs 20 and 21:

| SYMBOL | DEFINITION |
|----------------|---|
| C _L | load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values) |
| R _T | termination resistance should be equal to the output impedance Z _O of the pulse generator |
| t _r | t _r = 6 ns, when measuring f _{max} , there is no constraint on t _r , t _f with 50% duty factor |

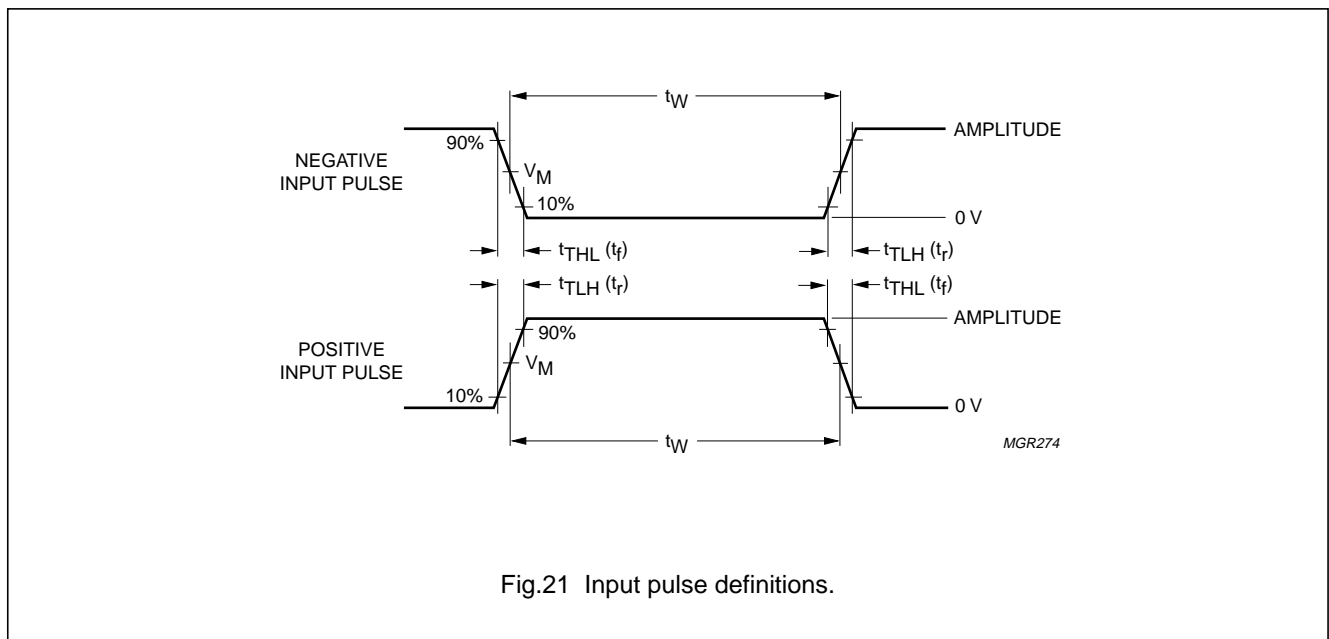


Fig.21 Input pulse definitions.

Table 4

| FAMILY | AMPLITUDE | V _M | t _r ; t _f | |
|--------|-----------------|----------------|---------------------------------|-------|
| | | | f _{max} ; PULSE WIDTH | OTHER |
| 74HC | V _{CC} | 50% | < 2 ns | 6 ns |
| 74HCT | 3.0 V | 1.3 V | < 2 ns | 6 ns |

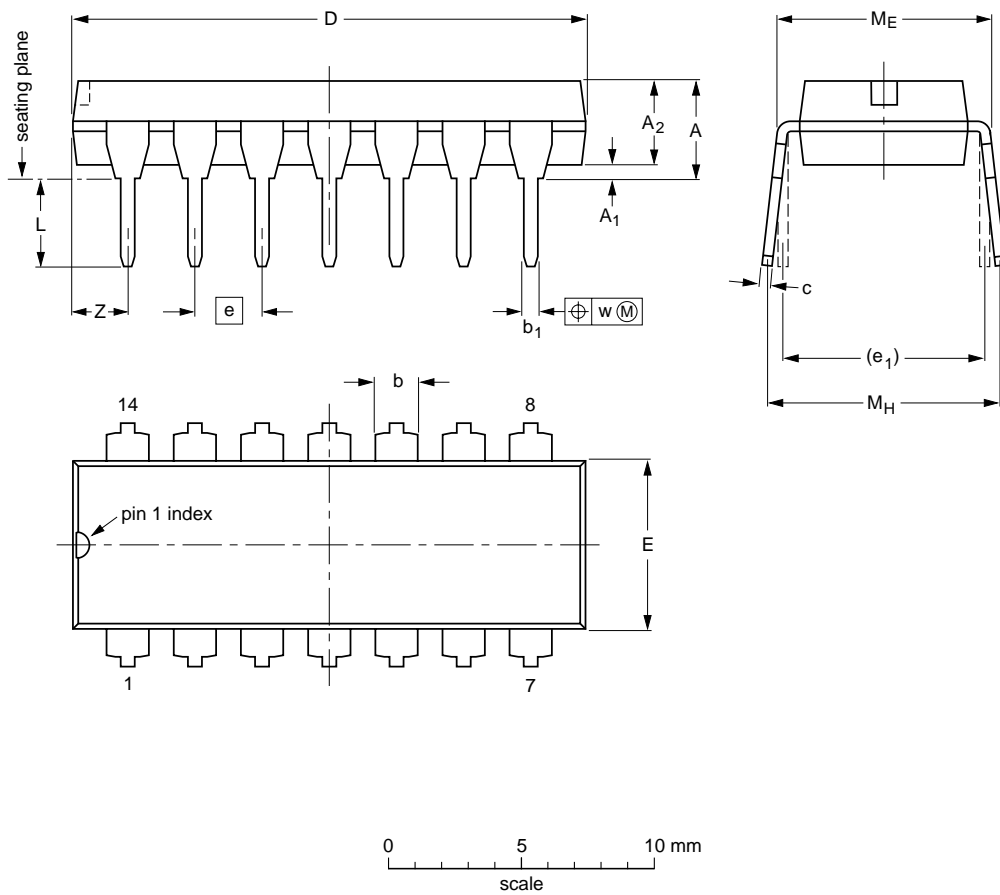
Quad bilateral switches

74HC/HCT4066

PACKAGE OUTLINES

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 1.13 | 0.53 0.38 | 0.36 0.23 | 19.50 18.55 | 6.48 6.20 | 2.54 | 7.62 | 3.60 3.05 | 8.25 7.80 | 10.0 8.3 | 0.254 | 2.2 |
| inches | 0.17 | 0.020 | 0.13 | 0.068 0.044 | 0.021 0.015 | 0.014 0.009 | 0.77 0.73 | 0.26 0.24 | 0.10 | 0.30 | 0.14 0.12 | 0.32 0.31 | 0.39 0.33 | 0.01 | 0.087 |

Note

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

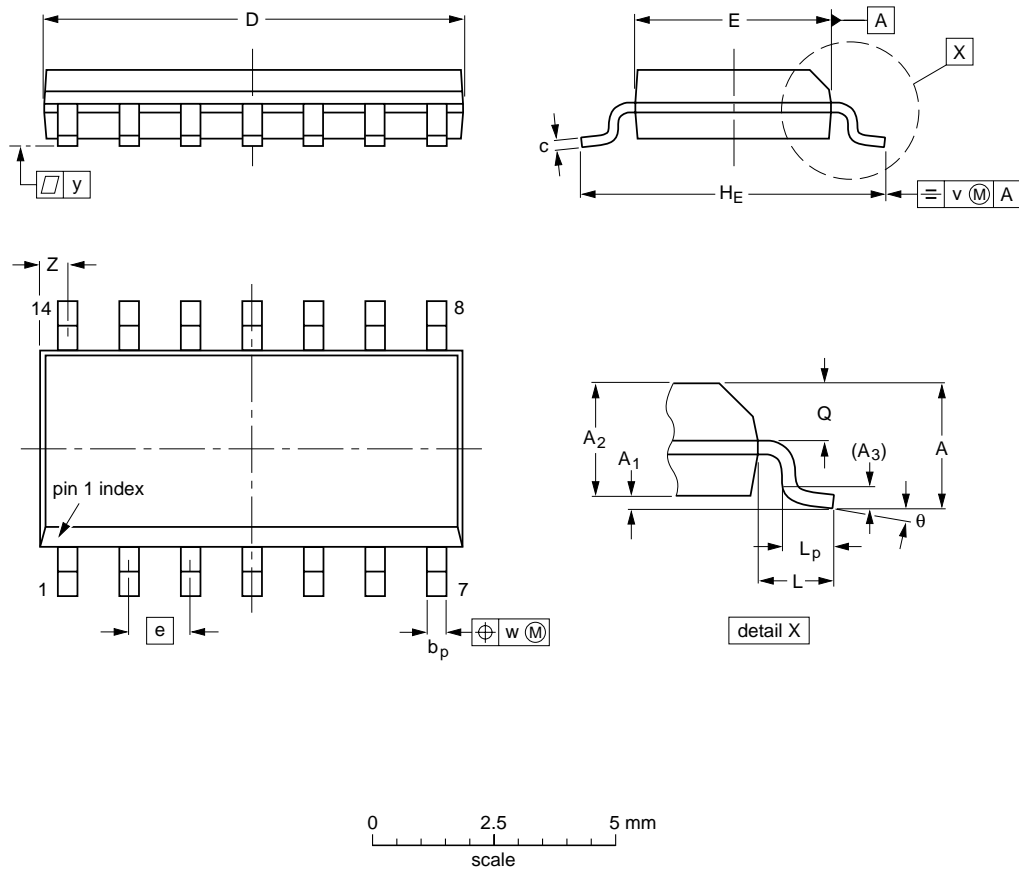
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT27-1 | 050G04 | MO-001AA | | | | 92-11-17 95-03-11 |

Quad bilateral switches

74HC/HCT4066

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 0.10 | 1.45 1.25 | 0.25 | 0.49 0.36 | 0.25 0.19 | 8.75 8.55 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.7 0.6 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 | 0.010 0.004 | 0.057 0.049 | 0.01 | 0.019 0.014 | 0.0100 0.0075 | 0.35 0.34 | 0.16 0.15 | 0.050 | 0.244 0.228 | 0.041 | 0.039 0.016 | 0.028 0.024 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Note

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

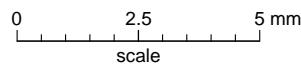
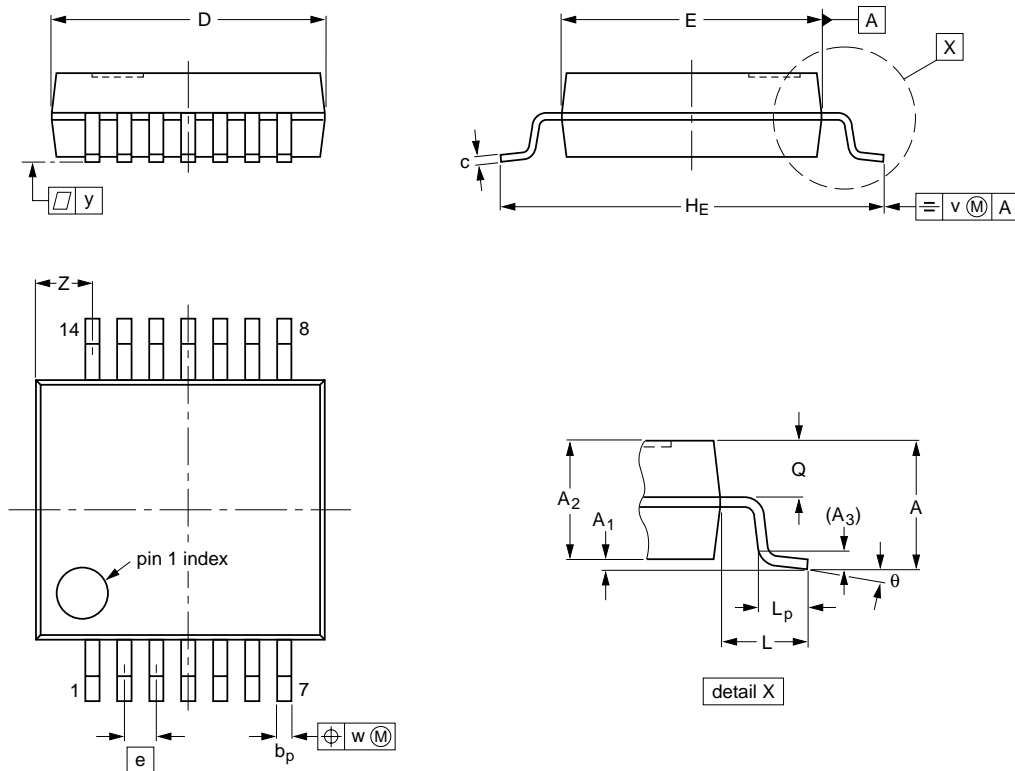
| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | |
| SOT108-1 | 076E06S | MS-012AB | | | 95-01-23 97-05-22 |

Quad bilateral switches

74HC/HCT4066

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 | 0.21 0.05 | 1.80 1.65 | 0.25 | 0.38 0.25 | 0.20 0.09 | 6.4 6.0 | 5.4 5.2 | 0.65 | 7.9 7.6 | 1.25 | 1.03 0.63 | 0.9 0.7 | 0.2 | 0.13 | 0.1 | 1.4 0.9 | 8° 0° |

Note

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

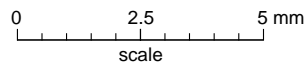
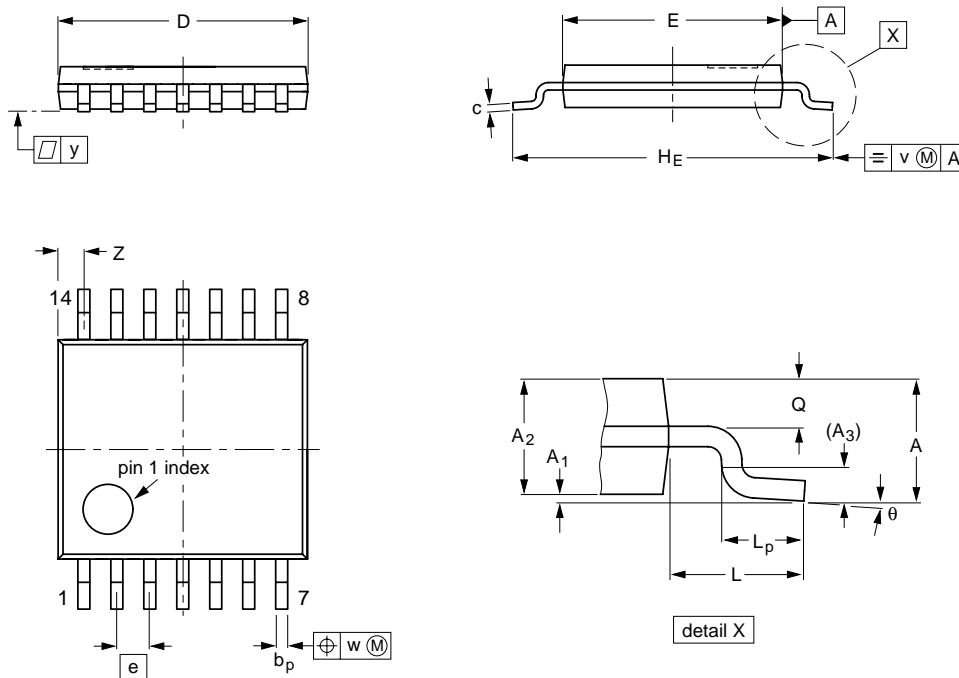
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|----------|------|--|------------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT337-1 | | MO-150AB | | | | 95-02-04 96-01-18 |

Quad bilateral switches

74HC/HCT4066

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 | 1.10 | 0.15 0.05 | 0.95 0.80 | 0.25 | 0.30 0.19 | 0.2 0.1 | 5.1 4.9 | 4.5 4.3 | 0.65 | 6.6 6.2 | 1.0 | 0.75 0.50 | 0.4 0.3 | 0.2 | 0.13 | 0.1 | 0.72 0.38 | 8° 0° |

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 | EIAJ | | | |
| SOT402-1 | | MO-153 | | | | 94-07-12 95-04-04 |

Quad bilateral switches

74HC/HCT4066

SOLDERING

Introduction

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *“Data Handbook IC26; Integrated Circuit Packages”* (document order number 9398 652 90011).

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mount components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mount ICs, or for printed-circuit boards with high population densities. In these situations reflow soldering is often used.

Through-hole mount packages

SOLDERING BY DIPPING OR BY SOLDER WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joints for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg(max)}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

MANUAL SOLDERING

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

Surface mount packages

REFLOW SOLDERING

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, infrared/convection heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250 °C. The top-surface temperature of the packages should preferably be kept below 230 °C.

WAVE SOLDERING

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
 - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
 - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

MANUAL SOLDERING

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

Quad bilateral switches

74HC/HCT4066

Suitability of IC packages for wave, reflow and dipping soldering methods

| MOUNTING | PACKAGE | SOLDERING METHOD | | |
|--------------------|---------------------------|-----------------------------------|-----------------------|----------|
| | | WAVE | REFLOW ⁽¹⁾ | DIPPING |
| Through-hole mount | DBS, DIP, HDIP, SDIP, SIL | suitable ⁽²⁾ | – | suitable |
| Surface mount | HLQFP, HSQFP, HSOP, SMS | not suitable ⁽³⁾ | suitable | – |
| | PLCC ⁽⁴⁾ , SO | suitable | suitable | – |
| | LQFP, QFP, TQFP | not recommended ⁽⁴⁾⁽⁵⁾ | suitable | – |
| | SQFP | not suitable | suitable | – |
| | SSOP, TSSOP, VSO | not recommended ⁽⁶⁾ | suitable | – |

Notes

- All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the "Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods".
- For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.
- These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).
- If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.
- Wave soldering is only suitable for LQFP, QFP and TQFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
- Wave soldering is only suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

DEFINITIONS

| Data sheet status | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| Limiting values | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| Application information | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010, Fax. +43 160 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6, 220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

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Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S, Tel. +45 32 88 2636, Fax. +45 31 57 0044

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France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex, Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG, Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS, Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor, 254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025, Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division, Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510, Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

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Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053, TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3, 20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR, Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905, Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB, Tel. +31 40 27 82785, Fax. +31 40 27 88399

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Philippines: Philips Semiconductors Philippines Inc., 106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI, Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA, Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

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Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW, Tel. +7 095 755 6918, Fax. +7 095 755 6919

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Slovakia: see Austria

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South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale, 2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000, Tel. +27 11 470 5911, Fax. +27 11 470 5494

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Spain: Balmes 22, 08007 BARCELONA, Tel. +34 93 301 6312, Fax. +34 93 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM, Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

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Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1, TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

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Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7, 252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes, MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

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