

INTEGRATED CIRCUITS

DATA SHEET

74HC2G14; 74HCT2G14 **Inverting Schmitt-triggers**

Preliminary specification

2003 May 1

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

FEATURES

- Wide supply voltage range from 2.0 to 6.0 V
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Very small 6 pins package.

APPLICATIONS

- Wave and pulse shapers for highly noisy environments
- Astable multivibrators

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_r = t_f \leq 6.0\text{ ns}$.

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|-------------------|-------------------------------|--|---------|-------|------|
| | | | HC2G | HCT2G | |
| t_{PHL}/t_{PLH} | propagation delay nA to nY | $C_L = 50\text{ pF}$; $V_{CC} = 4.5\text{ V}$ | 16 | 21 | ns |
| C_I | input capacitance | | 2 | 2 | pF |
| C_{PD} | power dissipation capacitance | notes 1 and 2 | 10 | 10 | pF |

Notes

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

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

f_i = input frequency in MHz; f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts;

N = total switching outputs;

$\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

2. For HC2G the condition is $V_I = \text{GND to } V_{CC}$.

For HCT2G the condition is $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$.

FUNCTION TABLE

See note 1.

| INPUTS | OUTPUTS |
|--------|---------|
| nA | nY |
| L | H |
| H | L |

Note

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

- Monostable multivibrators
- Output capability: standard.

DESCRIPTION

The 74HC2G/HCT2G14 is a high-speed Si-gate CMOS device.

The 74HC2G/HCT2G14 provides two inverting buffers with Schmitt-trigger action. This device is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

ORDERING INFORMATION

| TYPE NUMBER | PACKAGES | | | | | |
|-------------|-------------------|------|---------|----------|--------|---------|
| | TEMPERATURE RANGE | PINS | PACKAGE | MATERIAL | CODE | MARKING |
| 74HC2G14GW | -40 to +125 °C | 6 | SC-88 | plastic | SOT363 | HK |
| 74HC2G14GV | -40 to +125 °C | 6 | SC-74 | plastic | SOT457 | H14 |
| 74HCT2G14GW | -40 to +125 °C | 6 | SC-88 | plastic | SOT363 | TK |
| 74HCT2G14GV | -40 to +125 °C | 6 | SC-74 | plastic | SOT457 | T14 |

PINNING

| PIN | SYMBOL | DESCRIPTION |
|------|-----------------|-------------------|
| 1, 3 | 1A to 2A | data input |
| 2 | GND | ground (0 V) |
| 4, 6 | 2Y to 1Y | data output |
| 8 | V _{CC} | DC supply voltage |

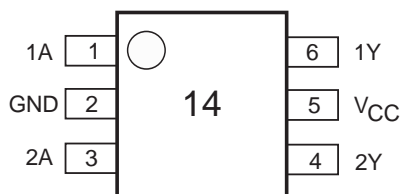


Fig.1 Pin configuration.

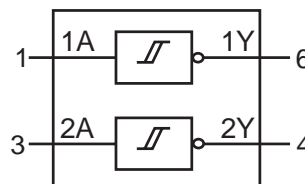


Fig.2 Logic symbol.

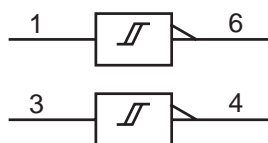


Fig.3 IEC logic symbol.

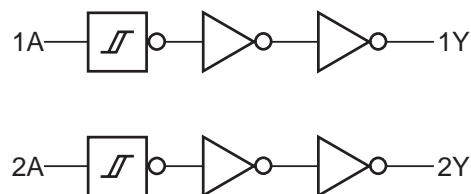


Fig.4 Logic diagram (one driver).

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | 74HC2G14 | | | 74HCT2G14 | | | UNIT |
|-----------|-------------------------------|--|----------|------|----------|-----------|------|----------|------|
| | | | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | – | V_{CC} | 0 | – | V_{CC} | V |
| V_O | output voltage | | 0 | – | V_{CC} | 0 | – | V_{CC} | V |
| T_{amb} | operating ambient temperature | see DC and AC characteristics per device | –40 | +25 | +125 | –40 | +25 | +125 | °C |

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 | +7.0 | V |
| I_{IK} | input diode current | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$; note 1 | – | ±20 | mA |
| I_{OK} | output diode current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$; note 1 | – | ±20 | mA |
| I_O | output source or sink current | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$; note 1 | – | 25 | mA |
| I_{CC} | V_{CC} or GND current | note 1 | – | 50 | mA |
| T_{stg} | storage temperature | | –65 | +150 | °C |
| P_D | power dissipation per package | for temperature range from –40 to +125 °C; note 2 | – | 300 | mW |

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. Above 110 °C the value of P_D derates linearly with 8 mW/K.

Inverting Schmitt-triggers

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DC CHARACTERISTICS

Type 74HC2G14

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

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|-----------------|---------------------------|---|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | OTHER | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = -20 μA | 2.0 | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = -20 μA | 4.5 | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = -20 μA | 6.0 | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = -4.0 mA | 4.5 | 4.18 | 4.32 | - | 4.13 | - | 3.7 | - | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = -5.2 mA | 6.0 | 5.68 | 5.81 | - | 5.63 | - | 5.2 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = 20 μA | 2.0 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = 20 μA | 4.5 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = 20 μA | 6.0 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = 4.0 mA | 4.5 | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = 5.2 mA | 6.0 | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND | 6.0 | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| I _{CC} | quiescent supply current | V _I = V _{CC} or GND; I _O = 0 | 6.0 | - | - | 1.0 | - | 10 | - | 20 | μA |

Note

1. All typical values are measured at T_{amb} = 25 °C.

Inverting Schmitt-triggers

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Type 74HCT2G14

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

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|------------------|-------------------------------------|---|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | OTHER | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = -20 μA | 4.5 | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = -4.0 mA | 4.5 | 4.18 | 4.32 | - | 4.13 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; I _O = 20 μA | 4.5 | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | V _I = V _{IH} or V _{IL} ; I _O = 4.0 mA | 4.5 | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND | 5.5 | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| I _{CC} | quiescent supply current | V _I = V _{CC} or GND; I _O = 0 | 5.5 | - | - | 1.0 | - | 10 | - | 20 | μA |
| ΔI _{CC} | additional supply current per input | V _I = V _{CC} - 2.1 V; I _O = 0 | 4.5 to 5.5 | - | - | 300 | - | 375 | - | 410 | μA |

Note1. All typical values are measured at T_{amb} = 25 °C.

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

TRANSFER CHARACTERISTICS

Type 74HC2G14

Over recommended operating conditions; voltage are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|-----------------|---|-------------------|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | WAVEFORMS | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| V _{t+} | positive going threshold | see Figs. 5 and 6 | 2.0 | 1.0 | 1.18 | 1.5 | 1.0 | 1.5 | 1.0 | 1.5 | V |
| | | | 4.5 | 2.3 | 2.6 | 3.15 | 2.3 | 3.15 | 2.3 | 3.15 | V |
| | | | 6.0 | 3.0 | 3.46 | 4.2 | 3.0 | 4.2 | 3.0 | 4.2 | V |
| V _{t-} | negative going threshold | see Figs. 5 and 6 | 2.0 | 0.3 | 0.6 | 0.9 | 0.3 | 0.9 | 0.3 | 0.9 | V |
| | | | 4.5 | 1.13 | 1.47 | 2.0 | 1.13 | 2.0 | 1.13 | 2.0 | V |
| | | | 6.0 | 1.5 | 2.06 | 2.6 | 1.5 | 2.6 | 1.5 | 2.6 | V |
| V _h | hysteresis (V _{t+} - V _{t-}) | see Figs. 5 and 6 | 2.0 | 0.3 | 0.6 | 1.0 | 0.3 | 1.0 | 0.3 | 1.0 | V |
| | | | 4.5 | 0.6 | 1.13 | 1.4 | 0.6 | 1.4 | 0.6 | 1.4 | V |
| | | | 6.0 | 0.8 | 1.40 | 1.7 | 0.8 | 1.7 | 0.8 | 1.7 | V |

Note

1. All typical values are measured at T_{amb} = 25 °C.

Type 74HCT2G14

Over recommended operating conditions; voltage are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|-----------------|---|-------------------|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | OTHER | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| V _{t+} | positive going threshold | see Figs. 5 and 6 | 4.5 | 1.2 | 1.58 | 1.9 | 1.2 | 1.9 | 1.2 | 1.9 | V |
| | | | 5.5 | 1.4 | 1.78 | 2.1 | 1.4 | 2.1 | 1.4 | 2.1 | V |
| V _{t-} | negative going threshold | see Figs. 5 and 6 | 4.5 | 0.5 | 0.87 | 1.2 | 0.5 | 1.2 | 0.5 | 1.2 | V |
| | | | 5.5 | 0.6 | 1.11 | 1.4 | 0.6 | 1.4 | 0.6 | 1.4 | V |
| V _h | hysteresis (V _{t+} - V _{t-}) | see Figs. 5 and 6 | 4.5 | 0.4 | 0.71 | – | 0.4 | – | 0.4 | – | V |
| | | | 5.5 | 0.4 | 0.67 | – | 0.4 | – | 0.4 | – | V |

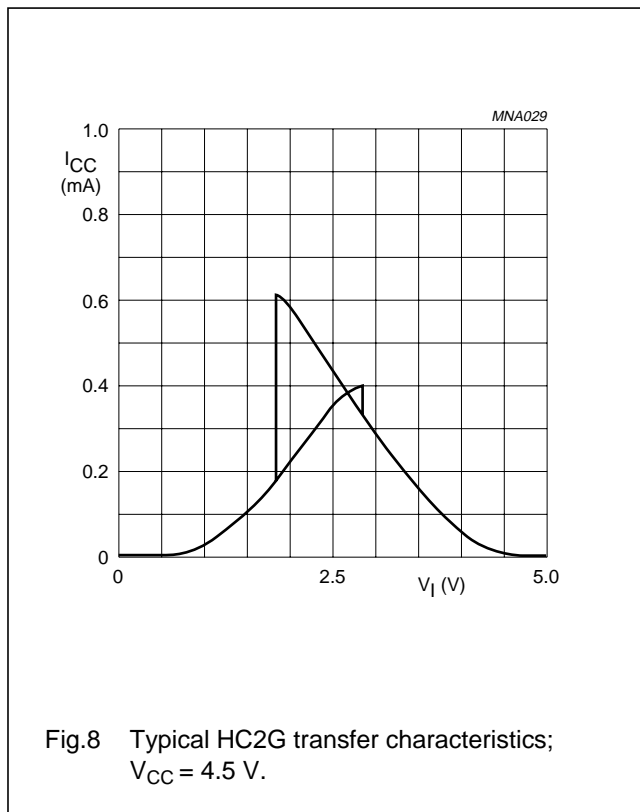
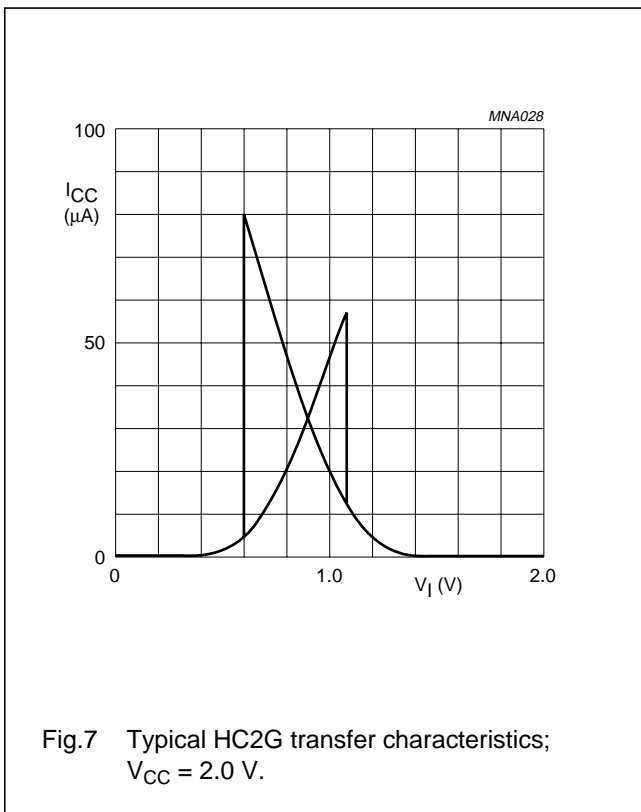
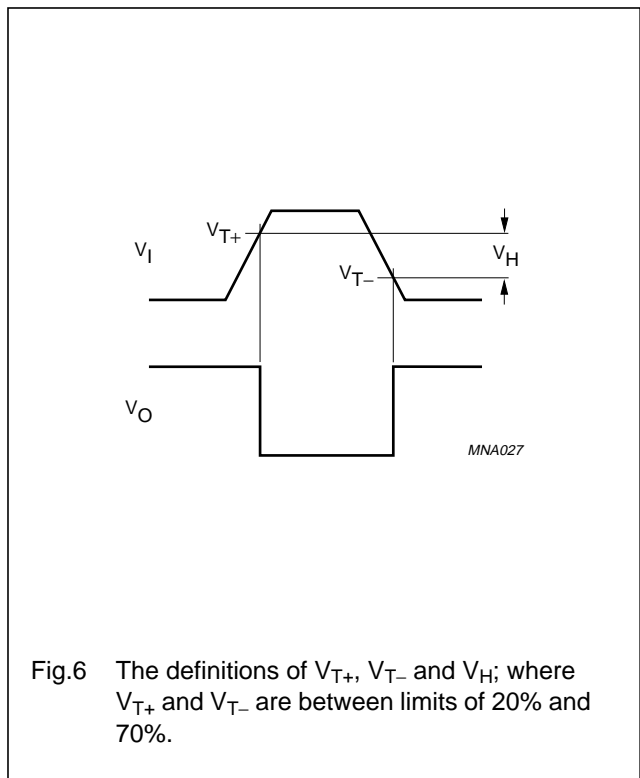
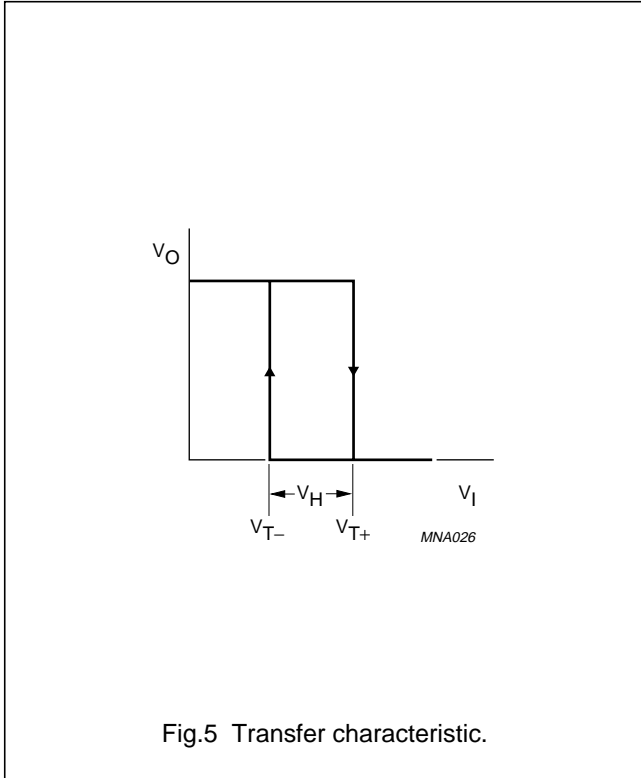
Note

1. All typical values are measured at T_{amb} = 25 °C.

Inverting Schmitt-triggers

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TRANSFER CHARACTERISTIC WAVEFORMS



Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

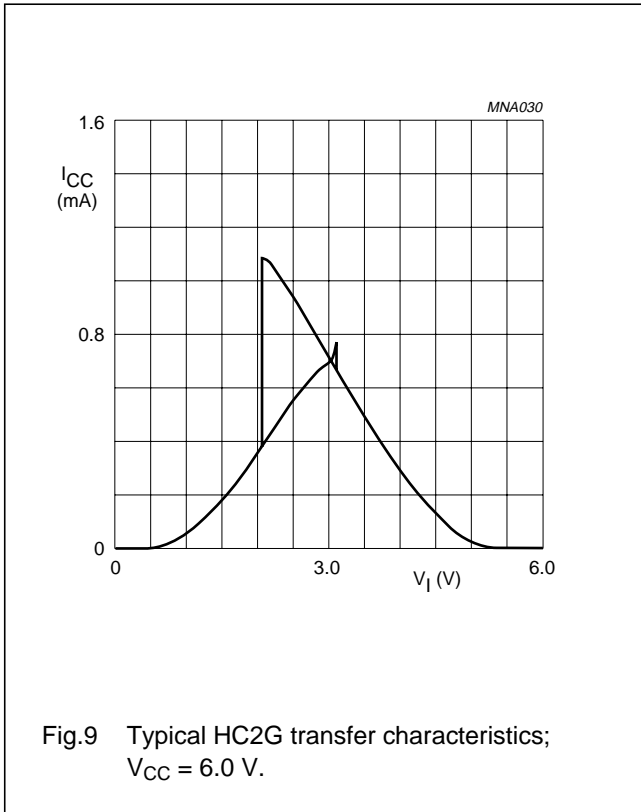


Fig.9 Typical HC2G transfer characteristics;
 $V_{CC} = 6.0$ V.

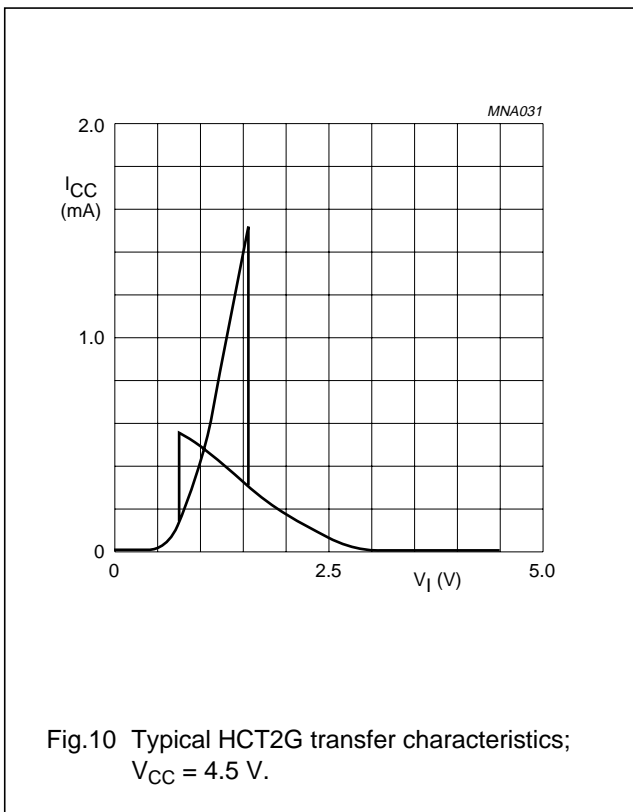


Fig.10 Typical HCT2G transfer characteristics;
 $V_{CC} = 4.5$ V.

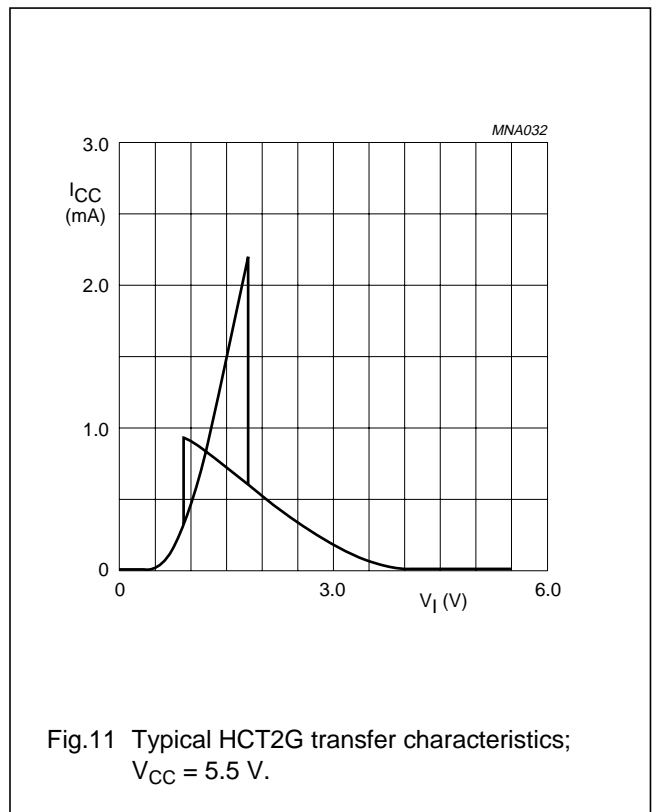


Fig.11 Typical HCT2G transfer characteristics;
 $V_{CC} = 5.5$ V.

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

AC CHARACTERISTICS

Type 74HC2G14

GND = 0 V; $t_r = t_f \leq 6.0$ ns; $C_L = 50$ pF.

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|------------------------------------|-------------------------------|--------------------|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | WAVEFORMS | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| t _{PHL} /t _{PLH} | propagation delay nA to nY | see Figs 12 and 13 | 2.0 | – | 53 | 125 | – | 155 | – | 190 | ns |
| | | | 4.5 | – | 16 | 25 | – | 31 | – | 38 | ns |
| | | | 6.0 | – | 13 | 21 | – | 26 | – | 32 | ns |
| t _{THL} /t _{TLH} | output transition time | see Figs 12 and 13 | 2.0 | – | 20 | 75 | – | 95 | – | 110 | ns |
| | | | 4.5 | – | 7 | 15 | – | 19 | – | 22 | ns |
| | | | 6.0 | – | 5 | 13 | – | 16 | – | 19 | ns |

Note

1. All typical values are measured at T_{amb} = 25 °C.

Type 74HCT2G14

GND = 0 V; $t_r = t_f \leq 6.0$ ns; $C_L = 50$ pF.

| SYMBOL | PARAMETER | TEST CONDITIONS | | T _{amb} (°C) | | | | | | UNIT | |
|------------------------------------|-------------------------------|--------------------|---------------------|-----------------------|---------------------|------|------------|------|-------------|------|------|
| | | WAVEFORMS | V _{CC} (V) | +25 | | | -40 to +85 | | -40 to +125 | | |
| | | | | MIN. | TYP. ⁽¹⁾ | MAX. | MIN. | MAX. | MIN. | | MAX. |
| t _{PHL} /t _{PLH} | propagation delay nA to nY | see Figs 12 and 13 | 4.5 | – | 21 | 32 | – | 40 | – | 48 | ns |
| t _{THL} /t _{TLH} | output transition time | see Figs 12 and 13 | 4.5 | – | 6 | 15 | – | 19 | – | 22 | ns |

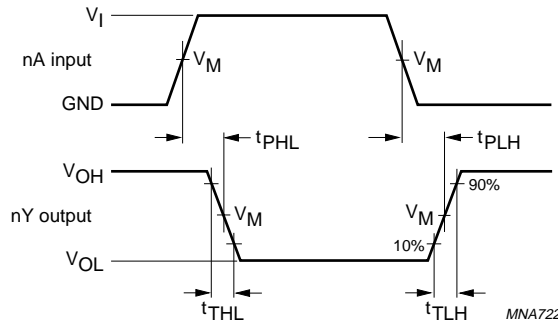
Note

1. All typical values are measured at T_{amb} = 25 °C.

Inverting Schmitt-triggers

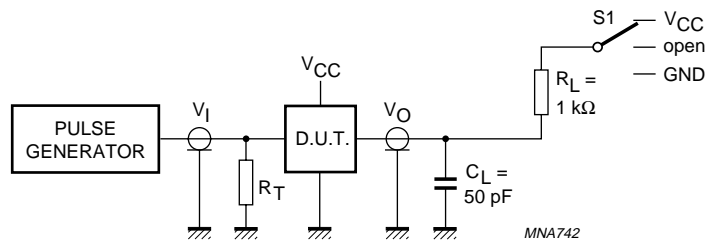
74HC2G14; 74HCT2G14

AC WAVEFORMS



For HC2G: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
 For HCT2G: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3.0 \text{ V}$.

Fig.12 The input (nA) to output (nY) propagation delays and output transition times.



| TEST | S ₁ |
|------------------------------------|-----------------|
| t _{PLH} /t _{PHL} | open |
| t _{PLZ} /t _{PZL} | V _{CC} |
| t _{PHZ} /t _{PZH} | GND |

Definitions for test circuit:
 C_L = load capacitance including jig and probe capacitance (see "AC characteristics").
 R_T = termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig.13 Load circuitry for switching times.

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

APPLICATION INFORMATION

The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$$P_{ad} = f_i \times (t_r \times I_{CCa} + t_f \times I_{CCa}) \times V_{CC}$$

Where:

P_{ad} = additional power dissipation (μW)

f_i = input frequency (MHz)

t_r = input rise time (ns); 10% to 90%

t_f = input fall time (ns); 90% to 10%

I_{CCa} = average additional supply current (μA).

Average I_{CCa} differs with positive or negative input transitions, as shown in Fig.14 and Fig.15.

HC2G14/HCT2G14 used in relaxation oscillator circuit, see Fig.16.

Note to the application information:

1. All values given are typical unless otherwise specified.

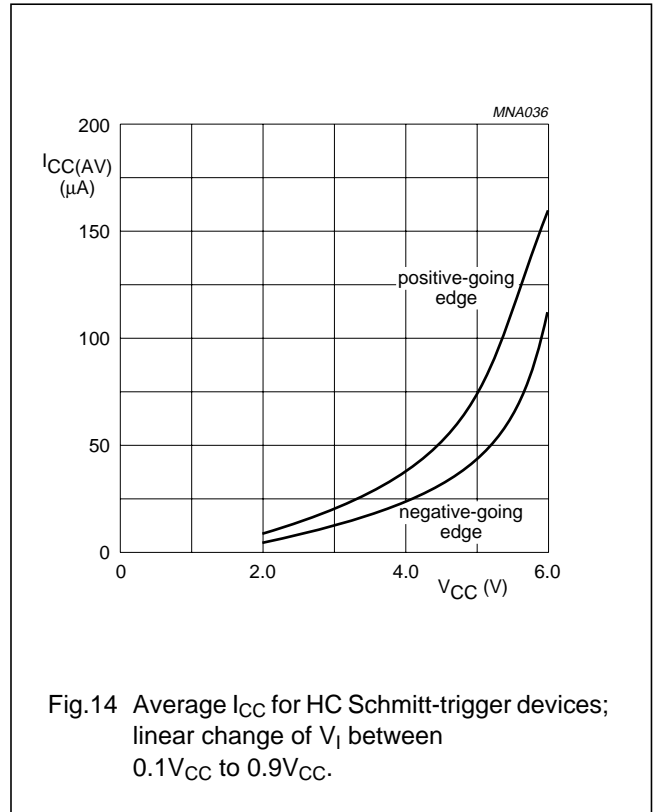


Fig.14 Average I_{CC} for HC Schmitt-trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$.

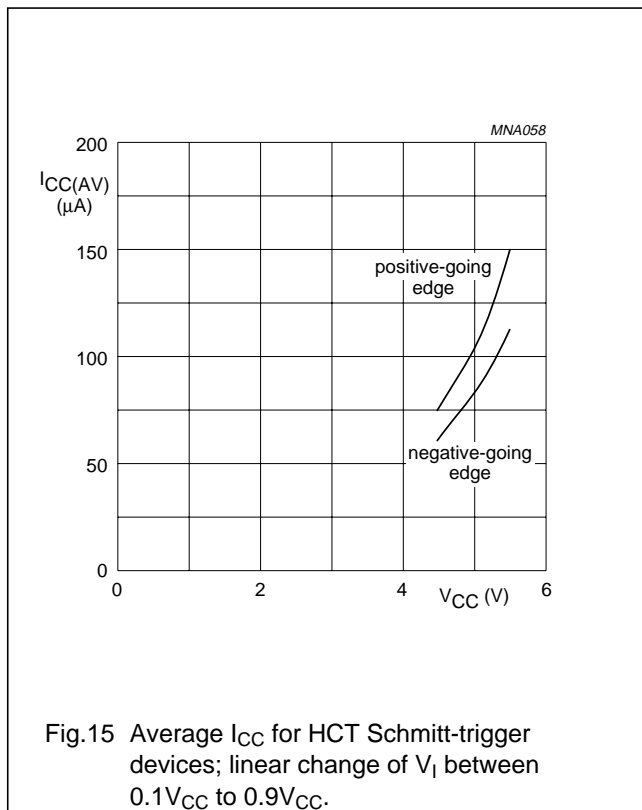
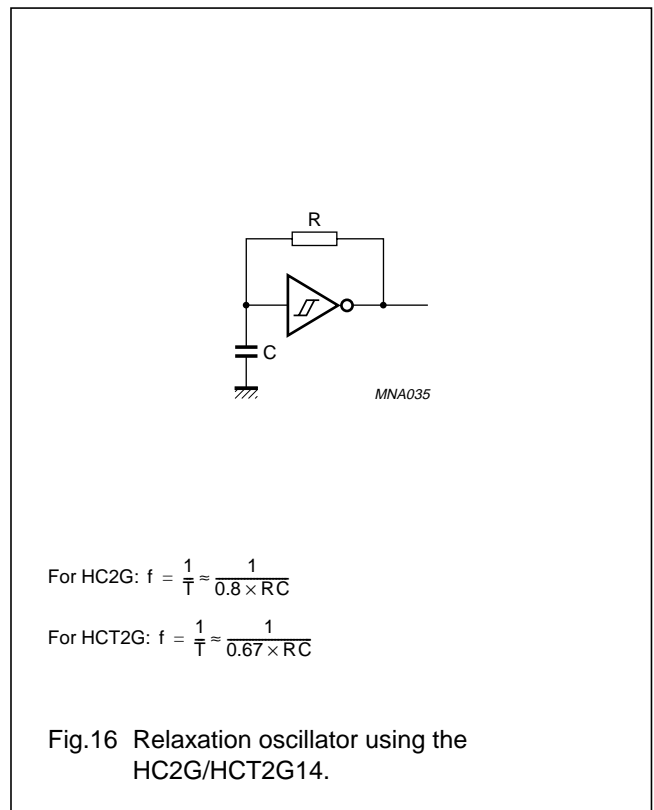


Fig.15 Average I_{CC} for HCT Schmitt-trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$.



For HC2G: $f = \frac{1}{T} = \frac{1}{0.8 \times RC}$

For HCT2G: $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$

Fig.16 Relaxation oscillator using the HC2G/HCT2G14.

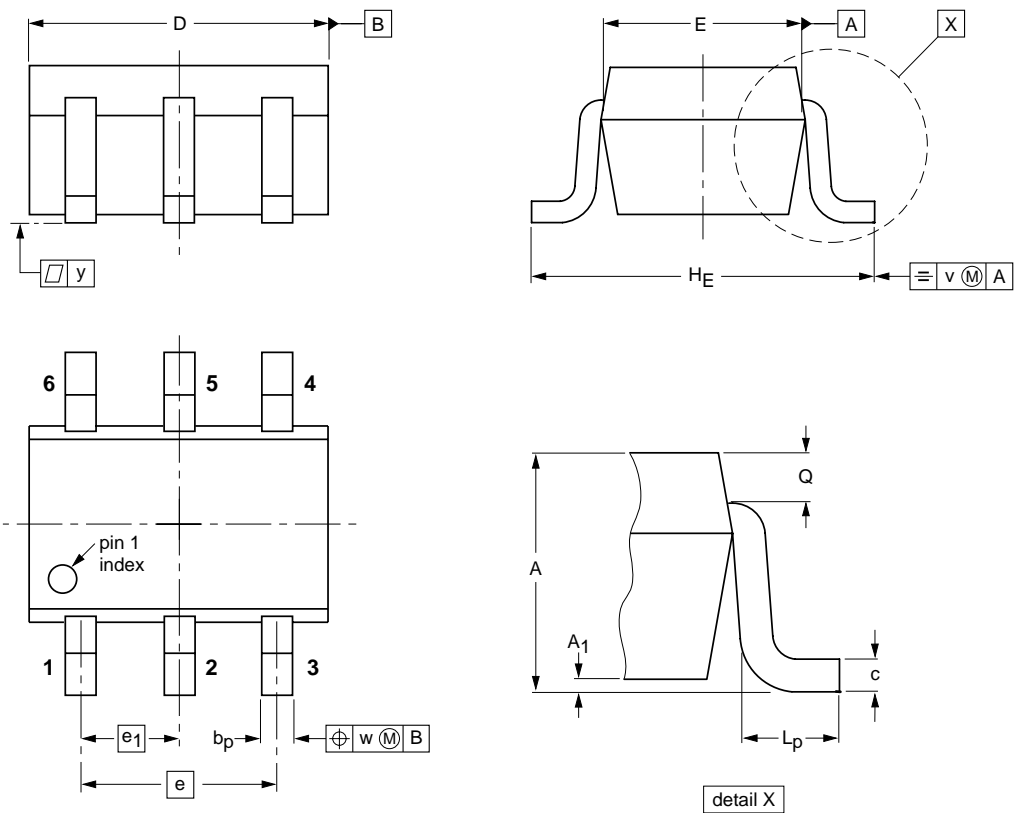
Inverting Schmitt-triggers

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PACKAGE OUTLINE

Plastic surface mounted package; 6 leads

SOT363



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ max | b _p | c | D | E | e | e ₁ | H _E | L _p | Q | v | w | y |
|------|------------|-----------------------|----------------|--------------|------------|--------------|-----|----------------|----------------|----------------|--------------|-----|-----|-----|
| mm | 1.1 0.8 | 0.1 | 0.30 0.20 | 0.25 0.10 | 2.2 1.8 | 1.35 1.15 | 1.3 | 0.65 | 2.2 2.0 | 0.45 0.15 | 0.25 0.15 | 0.2 | 0.2 | 0.1 |

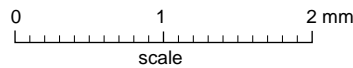
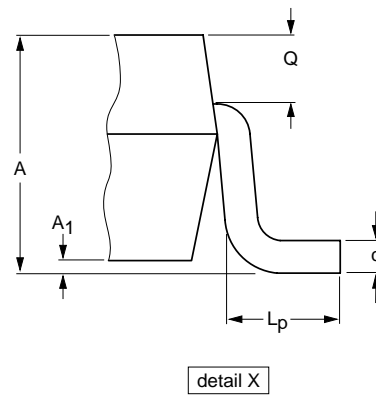
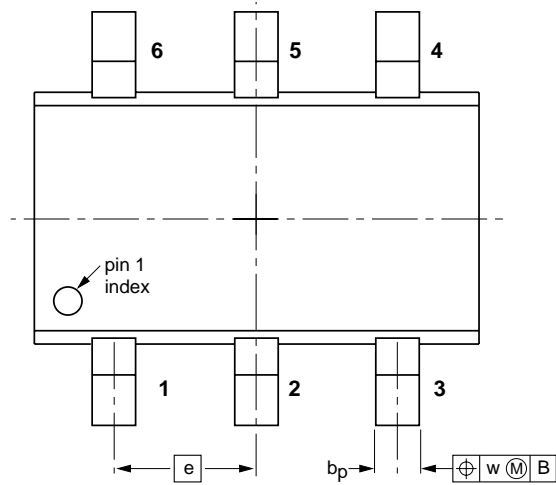
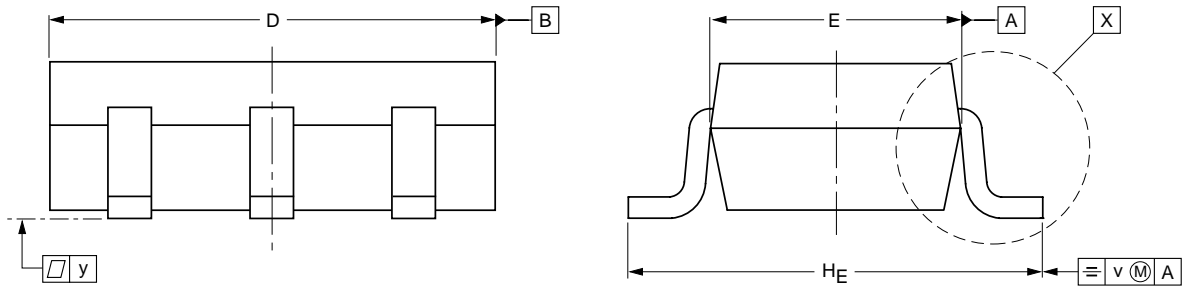
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|--|---------------------|------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT363 | | | SC-88 | | | 97-02-28 |

Inverting Schmitt-triggers

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Plastic surface mounted package; 6 leads

SOT457



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ | b _p | c | D | E | e | H _E | L _p | Q | v | w | y |
|------|------------|----------------|----------------|--------------|------------|------------|------|----------------|----------------|--------------|-----|-----|-----|
| mm | 1.1 0.9 | 0.1 0.013 | 0.40 0.25 | 0.26 0.10 | 3.1 2.7 | 1.7 1.3 | 0.95 | 3.0 2.5 | 0.6 0.2 | 0.33 0.23 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|---------------------|------------------------|
| | IEC | JEDEC | EIAJ | | |
| SOT457 | | | SC-74 | | -97-02-28- 01-05-04 |

Inverting Schmitt-triggers

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SOLDERING

Introduction to soldering surface mount packages

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 surface mount IC packages. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended.

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, convection or convection/infrared 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 220 °C for thick/large packages, and below 235 °C for small/thin packages.

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.

Inverting Schmitt-triggers

74HC2G14; 74HCT2G14

Suitability of surface mount IC packages for wave and reflow soldering methods

| PACKAGE | SOLDERING METHOD | |
|---|-----------------------------------|-----------------------|
| | WAVE | REFLOW ⁽¹⁾ |
| BGA, HBGA, LFBGA, SQFP, TFBGA | not suitable | suitable |
| HBCC, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, HVQFN, SMS | not suitable ⁽²⁾ | suitable |
| PLCC ⁽³⁾ , SO, SOJ | suitable | suitable |
| LQFP, QFP, TQFP | not recommended ⁽³⁾⁽⁴⁾ | suitable |
| SSOP, TSSOP, VSO | not recommended ⁽⁵⁾ | suitable |

Notes

1. 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"*.
2. 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).
3. 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.
4. Wave soldering is only suitable for LQFP, TQFP and QFP 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.
5. 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.

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DATA SHEET STATUS

| DATA SHEET STATUS | PRODUCT STATUS | DEFINITIONS ⁽¹⁾ |
|---------------------------|----------------|--|
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Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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