# 74HC2GU04

## Dual unbuffered inverter

Rev. 3 — 4 February 2022 Product data sheet

## 1. General description

The 74HC2GU04 is a dual unbuffered inverter. 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

- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Balanced propagation delays
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- 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 |
| 74HC2GU04GW | -40 °C to +125 °C | TSSOP6 | plastic thin shrink small outline package; 6 leads; body width 1.25 mm | SOT363-2 |
| 74HC2GU04GV | -40 °C to +125 °C | SC-74; TSOP6 | plastic surface-mounted package; 6 leads | SOT457 |

## 4. Marking

**Table 2. Marking**

| Type number | Marking code [1] |
|---|---|
| 74HC2GU04GW | PD |
| 74HC2GU04GV | HU4 |

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

# 5. Functional diagram

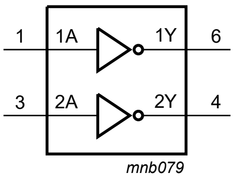



Fig. 1. Logic symbol

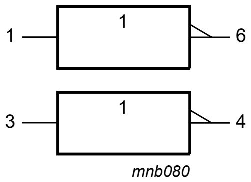



Fig. 2. IEC logic symbol

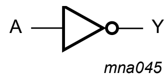



Fig. 3. Logic diagram (one gate)

# 6. Pinning information

## 6.1. Pinning

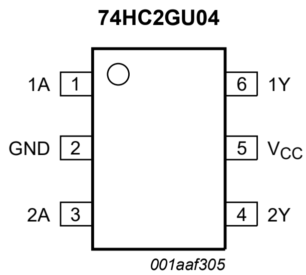



Fig. 4. Pin configuration SOT363-2 (TSSOP6) and SOT457 (SC-74; TSOP6)

## 6.2. Pin description

**Table 3. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| 1A | 1 | data input |
| GND | 2 | ground (0 V) |
| 2A | 3 | data input |
| 2Y | 4 | data output |
| $V_{CC}$ | 5 | supply voltage |
| 1Y | 6 | data output |

# 7. Functional description

**Table 4. Function table**

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

| Input | Output |
|---|---|
| **nA** | **nY** |
| L | H |
| H | L |

## 8. Limiting values

**Table 5. 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 clamping current | $V_I$ < -0.5 V or $V_I$ > $V_{CC}$ + 0.5 V | [1] | - | ±20 | mA |
| $I_{OK}$ | output clamping current | $V_O$ < -0.5 V or $V_O$ > $V_{CC}$ + 0.5 V | [1] | - | ±20 | mA |
| $I_O$ | output current | $V_O$ = -0.5 V to $V_{CC}$ + 0.5 V | [1] | - | ±25 | mA |
| $I_{CC}$ | supply current | | [1] | - | +50 | mA |
| $I_{GND}$ | ground current | | [1] | - | -50 | mA |
| $T_{stg}$ | storage temperature | | | -65 | +150 | °C |
| $P_{tot}$ | total power dissipation | | [2] | - | 250 | mW |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT363-2 (TSSOP6) package: $P_{tot}$ derates linearly with 3.7 mW/K above 83 °C.
For SOT457 (SC-74; TSOP6) package: $P_{tot}$ derates linearly with 4.1 mW/K above 89 °C.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 2.0 | 5.0 | 6.0 | V |
| $V_I$ | input voltage | | 0 | - | $V_{CC}$ | V |
| $V_O$ | output voltage | | 0 | - | $V_{CC}$ | V |
| $T_{amb}$ | ambient temperature | | -40 | +25 | +125 | °C |
| $t_r$ | rise time | except for Schmitt trigger inputs | | | | |
| | | $V_{CC}$ = 2.0 V | - | - | 1000 | ns |
| | | $V_{CC}$ = 4.5 V | - | - | 500 | ns |
| | | $V_{CC}$ = 6.0 V | - | - | 400 | ns |
| $t_f$ | fall time | except for Schmitt trigger inputs | | | | |
| | | $V_{CC}$ = 2.0 V | - | - | 1000 | ns |
| | | $V_{CC}$ = 4.5 V | - | - | 500 | ns |
| | | $V_{CC}$ = 6.0 V | - | - | 400 | ns |

## 10. Static characteristics

**Table 7. Static characteristics**

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = 25 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.7 | 1.1 | - | V |
| | | $V_{CC}$ = 4.5 V | 3.6 | 2.4 | - | V |
| | | $V_{CC}$ = 6.0 V | 4.8 | 3.1 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | 0.9 | 0.3 | V |
| | | $V_{CC}$ = 4.5 V | - | 2.1 | 0.9 | V |
| | | $V_{CC}$ = 6.0 V | - | 2.9 | 1.2 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I = V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 μA; $V_{CC}$ = 2.0 V | 1.9 | 2.0 | - | V |
| | | $I_O$ = -20 μA; $V_{CC}$ = 4.5 V | 4.4 | 4.5 | - | V |
| | | $I_O$ = -20 μA; $V_{CC}$ = 6.0 V | 5.9 | 6.0 | - | V |
| | | $I_O$ = -4.0 mA; $V_{CC}$ = 4.5 V | 4.13 | 4.32 | - | V |
| | | $I_O$ = -5.2 mA; $V_{CC}$ = 6.0 V | 5.63 | 5.81 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I = V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 μA; $V_{CC}$ = 2.0 V | - | 0 | 0.1 | V |
| | | $I_O$ = 20 μA; $V_{CC}$ = 4.5 V | - | 0 | 0.1 | V |
| | | $I_O$ = 20 μA; $V_{CC}$ = 6.0 V | - | 0 | 0.1 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 4.5 V | - | 0.15 | 0.26 | V |
| | | $I_O$ = 5.2 mA; $V_{CC}$ = 6.0 V | - | 0.16 | 0.26 | V |
| $I_I$ | input leakage current | $V_I$ = GND or $V_{CC}$; $V_{CC}$ = 6.0 V | - | - | ±0.1 | μA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 6.0 V | - | - | 1.0 | μA |
| $C_I$ | input capacitance | | - | 3.0 | - | pF |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{amb}$ = -40 °C to +85 °C | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.7 | 1.1 | - | V |
| | | $V_{CC}$ = 4.5 V | 3.6 | 2.4 | - | V |
| | | $V_{CC}$ = 6.0 V | 4.8 | 3.1 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | 0.9 | 0.3 | V |
| | | $V_{CC}$ = 4.5 V | - | 2.1 | 0.9 | V |
| | | $V_{CC}$ = 6.0 V | - | 2.9 | 1.2 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 µA; $V_{CC}$ = 2.0 V | 1.9 | 2.0 | - | V |
| | | $I_O$ = -20 µA; $V_{CC}$ = 4.5 V | 4.4 | 4.5 | - | V |
| | | $I_O$ = -20 µA; $V_{CC}$ = 6.0 V | 5.9 | 6.0 | - | V |
| | | $I_O$ = -4.0 mA; $V_{CC}$ = 4.5 V | 4.13 | 4.32 | - | V |
| | | $I_O$ = -5.2 mA; $V_{CC}$ = 6.0 V | 5.63 | 5.81 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 µA; $V_{CC}$ = 2.0 V | - | 0 | 0.1 | V |
| | | $I_O$ = 20 µA; $V_{CC}$ = 4.5 V | - | 0 | 0.1 | V |
| | | $I_O$ = 20 µA; $V_{CC}$ = 6.0 V | - | 0 | 0.1 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 4.5 V | - | 0.15 | 0.33 | V |
| | | $I_O$ = 5.2 mA; $V_{CC}$ = 6.0 V | - | 0.16 | 0.33 | V |
| $I_I$ | input leakage current | $V_I$ = GND or $V_{CC}$; $V_{CC}$ = 6.0 V | - | - | ±1.0 | µA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 6.0 V | - | - | 10.0 | µA |
| $T_{amb}$ = -40 °C to +125 °C | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 2.0 V | 1.7 | - | - | V |
| | | $V_{CC}$ = 4.5 V | 3.6 | - | - | V |
| | | $V_{CC}$ = 6.0 V | 4.8 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 2.0 V | - | - | 0.3 | V |
| | | $V_{CC}$ = 4.5 V | - | - | 0.9 | V |
| | | $V_{CC}$ = 6.0 V | - | - | 1.2 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 µA; $V_{CC}$ = 2.0 V | 1.9 | - | - | V |
| | | $I_O$ = -20 µA; $V_{CC}$ = 4.5 V | 4.4 | - | - | V |
| | | $I_O$ = -20 µA; $V_{CC}$ = 6.0 V | 5.9 | - | - | V |
| | | $I_O$ = -4.0 mA; $V_{CC}$ = 4.5 V | 3.7 | - | - | V |
| | | $I_O$ = -5.2 mA; $V_{CC}$ = 6.0 V | 5.2 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 µA; $V_{CC}$ = 2.0 V | - | - | 0.1 | V |
| | | $I_O$ = 20 µA; $V_{CC}$ = 4.5 V | - | - | 0.1 | V |
| | | $I_O$ = 20 µA; $V_{CC}$ = 6.0 V | - | - | 0.1 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 4.5 V | - | - | 0.4 | V |
| | | $I_O$ = 5.2 mA; $V_{CC}$ = 6.0 V | - | - | 0.4 | V |
| $I_I$ | input leakage current | $V_I$ = GND or $V_{CC}$; $V_{CC}$ = 6.0 V | - | - | ±1.0 | µA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 6.0 V | - | - | 20.0 | µA |

# 11. Dynamic characteristics

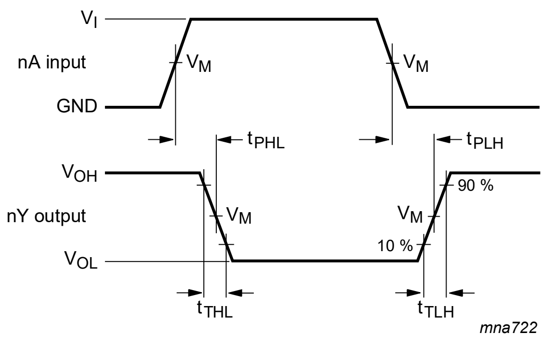
**Table 8. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 6.*

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{pd}$ | propagation delay | nA to nY; see Fig. 5 [1] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | - | 13 | 60 | - | 75 | - | 90 | ns |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | - | 6 | 12 | - | 15 | - | 18 | ns |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | - | 5 | 10 | - | 13 | - | 15 | ns |
| $t_t$ | transition time | nY; see Fig. 5 [2] | | | | | | | | |
| | | $V_{CC}$ = 2.0 V; $C_L$ = 50 pF | - | 18 | 75 | - | 95 | - | 125 | ns |
| | | $V_{CC}$ = 4.5 V; $C_L$ = 50 pF | - | 6 | 15 | - | 19 | - | 25 | ns |
| | | $V_{CC}$ = 6.0 V; $C_L$ = 50 pF | - | 5 | 13 | - | 16 | - | 20 | ns |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$ [3] | - | 5 | - | - | - | - | - | pF |

[1] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$.
[2] $t_t$ is the same as $t_{TLH}$ and $t_{THL}$.
[3] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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 V;
N = number of inputs switching;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

## 11.1. Waveform and test circuit



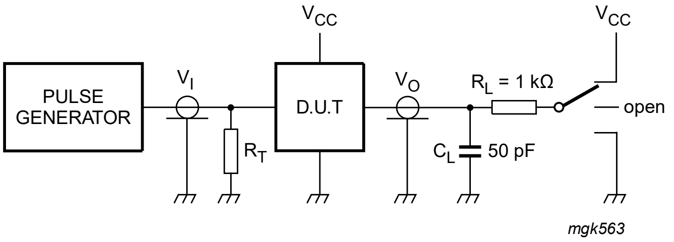

Measurement points are given in Table 9.

$V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Fig. 5. The data input (nA) to output (nY) propagation delays and output transition times**

**Table 9. Measurement points**

| Input | | | Output |
|---|---|---|---|
| $V_M$ | $V_I$ | $t_r = t_f$ | $V_M$ |
| $0.5V_{CC}$ | GND to $V_{CC}$ | 6.0 ns | $0.5V_{CC}$ |




Test data is given in Table 10.

Definitions test circuit:

$R_L$ = Load resistance.

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

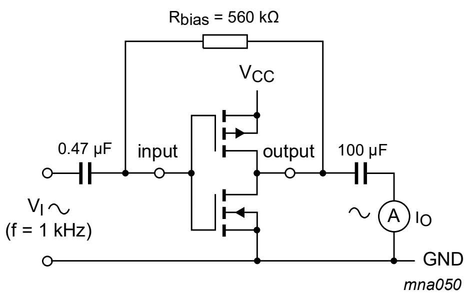
$R_T$ = Termination resistance should be equal to output impedance $Z_o$ of the pulse generator.

**Fig. 6. Test circuit for measuring switching times**

**Table 10. Test data**

| Input | | Test |
|---|---|---|
| $V_I$ | $t_r$, $t_f$ | $t_{PHL}$, $t_{PLH}$ |
| GND to $V_{CC}$ | 6 ns | open |

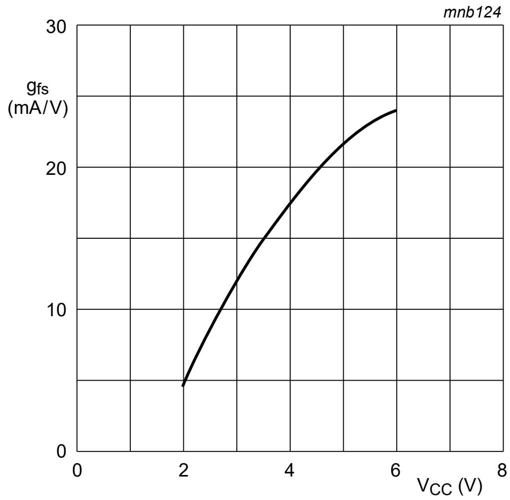
## 12. Additional characteristics




$$g_{fs} = \frac{\Delta I_O}{\Delta V_I}$$

$V_O$ is constant.

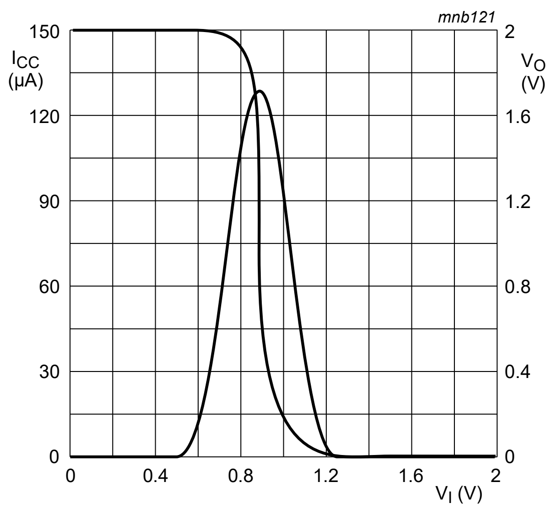
**Fig. 7. Test setup for measuring forward transconductance**




$T_{amb}$ = 25 °C.

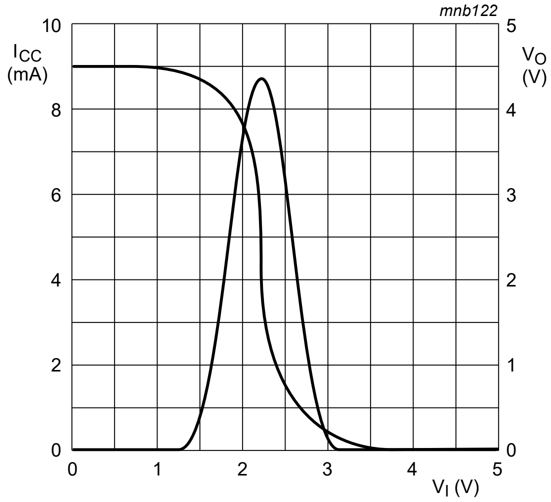
**Fig. 8. Typical forward transconductance as a function of supply voltage**

## 13. Typical transfer characteristics



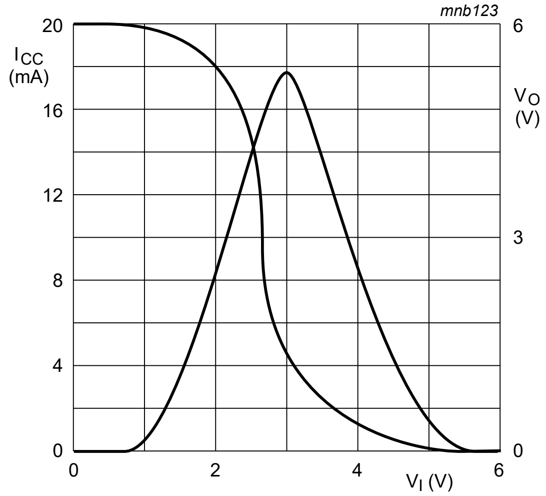

$V_{CC}$ = 2.0 V; $I_O$ = 0 A.

**Fig. 9. Typical transfer characteristics $V_{CC}$ = 2.0 V**




$V_{CC}$ = 4.5 V; $I_O$ = 0 A.

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




$V_{CC}$ = 6.0 V; $I_O$ = 0 A.

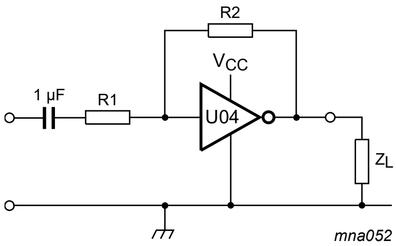
**Fig. 11. Typical transfer characteristics $V_{CC}$ = 6.0 V**

## 14. Application information

Some applications for the 74HC2GU04 are:

- Linear amplifier (see Fig. 12)
- Crystal oscillator (see Fig. 13)

**Remark:** All values given are typical values unless otherwise specified.

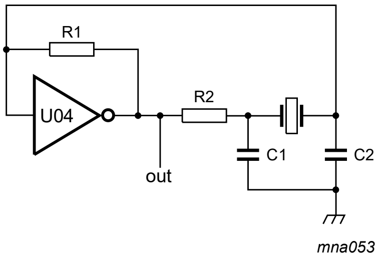



$Z_L$ > 10 kΩ.
R1 ≥ 3 kΩ.
R2 ≤ 1 MΩ.
Open loop amplification: $A_{OL}$ = 20.

Voltage amplification: $$A_V = -\frac{A_{OL}}{1 + \frac{R1}{R2}(1 + A_{OL})}$$

$V_{o(p\text{-}p)} = V_{CC}$ - 1.5 V centered at 0.5 × $V_{CC}$.
Unity gain bandwidth product is 5 MHz.

**Fig. 12. Linear amplifier application**




See Table 11 and Table 12.

C1 = 47 pF.

C2 = 22 pF.

R1 = 1 MΩ to 10 MΩ.

R2 optimum value depends on the frequency and required stability against changes in $V_{CC}$ or average minimum $I_{CC}$

($I_{CC}$ = 2 mA at $V_{CC}$ = 3.0 V and f = 1 MHz).

**Fig. 13. Crystal oscillator application**

**Table 11. External components for resonator (f < 1 MHz)**

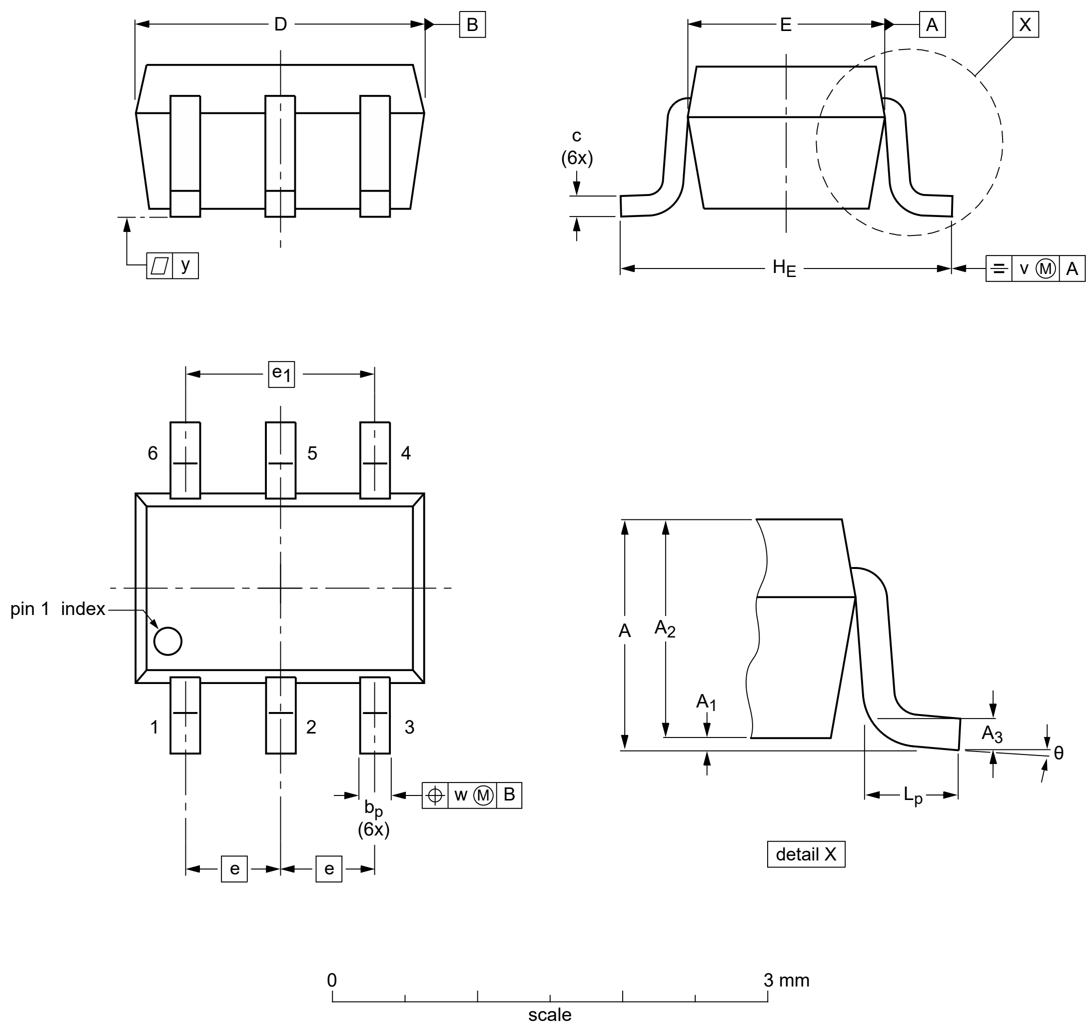
| Frequency | R1 | R2 | C1 | C2 |
|---|---|---|---|---|
| 10 kHz to 15.9 kHz | 2.2 MΩ | 220 kΩ | 56 pF | 20 pF |
| 16 kHz to 24.9 kHz | 2.2 MΩ | 220 kΩ | 56 pF | 10 pF |
| 25 kHz to 54.9 kHz | 2.2 MΩ | 100 kΩ | 56 pF | 10 pF |
| 55 kHz to 129.9 kHz | 2.2 MΩ | 100 kΩ | 47 pF | 5 pF |
| 130 kHz to 199.9 kHz | 2.2 MΩ | 47 kΩ | 47 pF | 5 pF |
| 200 kHz to 349.9 kHz | 2.2 MΩ | 47 kΩ | 47 pF | 5 pF |
| 350 kHz to 600 kHz | 2.2 MΩ | 47 kΩ | 47 pF | 5 pF |

**Table 12. Optimum value for R2**

| Frequency | R2 | Optimum |
|---|---|---|
| 3 kHz | 2.0 kΩ | for minimum required $I_{CC}$ |
| | 8.0 kΩ | for minimum influence due to change in $V_{CC}$ |
| 6 kHz | 1.0 kΩ | or minimum required $I_{CC}$ |
| | 4.7 kΩ | or minimum influence by $V_{CC}$ |
| 10 kHz | 0.5 kΩ | or minimum required $I_{CC}$ |
| | 2.0 kΩ | or minimum influence by $V_{CC}$ |
| 14 kHz | 0.5 kΩ | or minimum required $I_{CC}$ |
| | 2.0 kΩ | or minimum influence by $V_{CC}$ |
| > 14 kHz | replace R2 by C3 = 35 pF (typical) | |

# 15. Package outline

**TSSOP6: plastic thin shrink small outline package; 6 leads; body width 1.25 mm** **SOT363-2**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D(1) | E(1) | e | $e_1$ | $H_E$ | $L_p$ | v | w | y | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.1 | 0.1 | 1.0 | 0.15 | 0.30 | 0.25 | 2.2 | 1.35 | 0.65 | 1.3 | 2.4 | 0.46 | 0.3 | 0.1 | 0.1 | 8° |
| | min | 0.8 | 0 | 0.8 | | 0.15 | 0.08 | 1.8 | 1.15 | | | 1.8 | 0.26 | | | | 0° |

Note

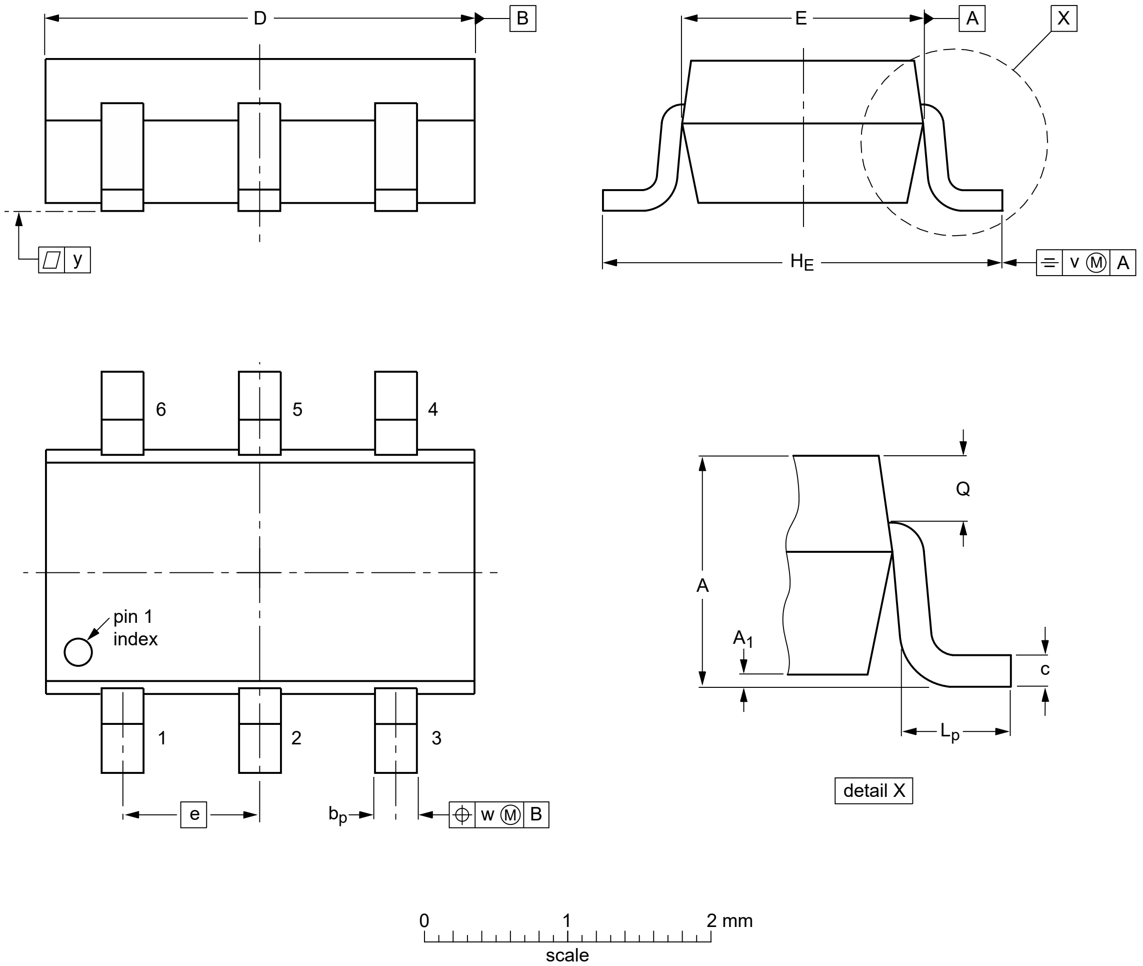
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

*sot363-2_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT363-2 | | MO-203 | SC-88A | | | ~~21-12-15~~ 21-12-16 |

**Fig. 14. Package outline SOT363-2 (TSSOP6)**

**Plastic, surface-mounted package (SC-74; TSOP6); 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 | max | 1.1 | 0.1 | 0.40 | 0.26 | 3.1 | 1.7 | | 3.0 | 0.6 | 0.33 | | | |
| | nom | | | | | | | 0.95 | | | | 0.2 | 0.2 | 0.1 |
| | min | 0.9 | 0.013 | 0.25 | 0.10 | 2.7 | 1.3 | | 2.5 | 0.2 | 0.23 | | | |

*sot457_po*

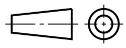
| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT457 | | | SC-74 | |  | ~~06-03-16~~<br>18-11-27 |

**Fig. 15. Package outline SOT457 (SC-74; TSOP6)**

## 16. Abbreviations

**Table 13. Abbreviations**

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

## 17. Revision history

**Table 14. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74HC2GU04 v.3 | 20220204 | Product data sheet | - | 74HC2GU04 v.2 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Package SOT363 (SC-88) changed to SOT363-2 (TSSOP6).<br>• Section 1 and Section 2 updated.<br>• Section 8: Derating values for $P_{tot}$ total power dissipation updated.<br>• Fig. 15: Package outline drawing SOT457 (SC-74; TSOP6) updated. | | | |
| 74HC2GU04 v.2 | 20140820 | Product data sheet | - | 74HC2GU04 v.1 |
| 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. | | | |
| 74HC2GU04 v.1 | 20061006 | Product data sheet | - | - |

# 18. Legal information

### 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 https://www.nexperia.com.

### 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. Nexperia 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 Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

**Right to make changes** — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale** — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products** — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

### Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## Contents

**1. General description......1**
**2. Features and benefits......1**
**3. Ordering information......1**
**4. Marking......1**
**5. Functional diagram......2**
**6. Pinning information......2**
6.1. Pinning......2
6.2. Pin description......2
**7. Functional description......2**
**8. Limiting values......3**
**9. Recommended operating conditions......3**
**10. Static characteristics......4**
**11. Dynamic characteristics......6**
11.1. Waveform and test circuit......6
**12. Additional characteristics......7**
**13. Typical transfer characteristics......8**
**14. Application information......9**
**15. Package outline......11**
**16. Abbreviations......13**
**17. Revision history......13**
**18. Legal information......14**



For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
**Date of release: 4 February 2022**