

74AHC1G125; 74AHCT1G125

Bus buffer/line driver; 3-state

Rev. 10 — 23 August 2012

Product data sheet

1. General description

74AHC1G125 and 74AHCT1G125 are high-speed Si-gate CMOS devices. They provide one non-inverting buffer/line driver with 3-state output. The 3-state output is controlled by the output enable input (\overline{OE}). A HIGH at \overline{OE} causes the output to assume a high-impedance OFF-state.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
 - ◆ HBM JESD22-A114F: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101E: exceeds 1000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------------------------|---|--------|--|----------|
| | Temperature range | Name | Description | Version |
| 74AHC1G125GW 74AHCT1G125GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74AHC1G125GV 74AHCT1G125GV | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74AHC1G125GM 74AHCT1G125GM | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5\text{ mm}$ | SOT886 |
| 74AHC1G125GF 74AHCT1G125GF | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1 \times 0.5\text{ mm}$ | SOT891 |

4. Marking

Table 2. Marking codes

| Type number | Marking ^[1] |
|---------------|------------------------|
| 74AHC1G125GW | AM |
| 74AHCT1G125GW | CM |
| 74AHC1G125GV | A25 |
| 74AHCT1G125GV | C25 |
| 74AHC1G125GM | AM |
| 74AHCT1G125GM | CM |
| 74AHC1G125GF | AM |
| 74AHCT1G125GF | CM |

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

5. Functional diagram

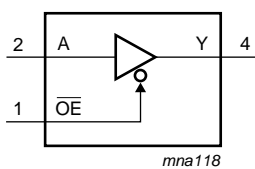


Fig 1. Logic symbol

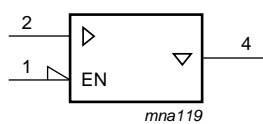


Fig 2. IEC logic symbol

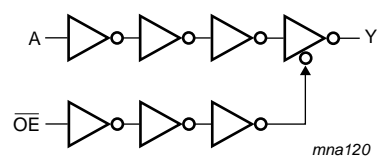


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

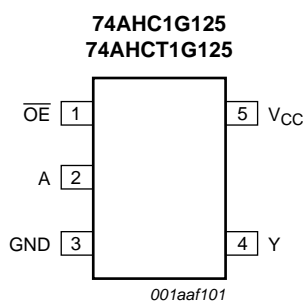


Fig 4. Pin configuration SOT353-1 and SOT753

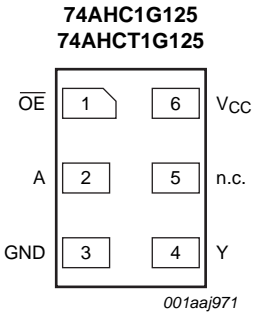


Fig 5. Pin configuration SOT886

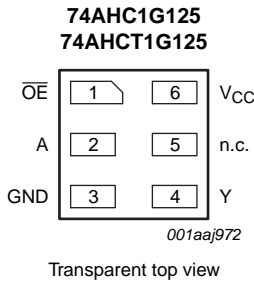


Fig 6. Pin configuration SOT891

6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|------------------------|-----------------|---------------|---------------------|
| | SOT353-1/SOT753 | SOT886/SOT891 | |
| $\overline{\text{OE}}$ | 1 | 1 | output enable input |
| A | 2 | 2 | data input |
| GND | 3 | 3 | ground (0 V) |
| Y | 4 | 4 | data output |
| n.c. | - | 5 | not connected |
| V _{CC} | 5 | 6 | supply voltage |

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state

| Inputs | | | Output |
|------------------------|---|---|--------|
| $\overline{\text{OE}}$ | A | Y | |
| L | L | L | |
| L | H | H | |
| H | X | Z | |

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 |
| V _I | input voltage | | -0.5 | +7.0 | V |
| I _{IK} | input clamping current | V _I < -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 | -0.5 V < V _O < V _{CC} + 0.5 V | - | ±25 | mA |
| I _{CC} | supply current | | - | 75 | mA |
| I _{GND} | ground current | | -75 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C | [2] - | 250 | mW |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 74AHC1G125 | | | 74AHCT1G125 | | | Unit |
|------------------|-------------------------------------|---------------------------------|------------|-----|-----------------|-------------|-----|-----------------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V _{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | 4.5 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | - | 5.5 | 0 | - | 5.5 | V |
| V _O | output voltage | | 0 | - | V _{CC} | 0 | - | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 3.3 V ± 0.3 V | - | - | 100 | - | - | - | ns/V |
| | | V _{CC} = 5.0 V ± 0.5 V | - | - | 20 | - | - | 20 | ns/V |

10. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-------------------|---------------------------|---|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74AHC1G125 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 3.0 V | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | V _{CC} = 5.5 V | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 3.0 V | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | V _{CC} = 5.5 V | - | - | 1.65 | - | 1.65 | - | 1.65 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = -50 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 3.0 V | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 3.0 V | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| | | I _O = -8.0 mA; V _{CC} = 4.5 V | 3.94 | - | - | 3.8 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 50 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 3.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 3.0 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| | | I _O = 8.0 mA; V _{CC} = 4.5 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _{OZ} | OFF-state output current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | 0.25 | - | 2.5 | - | 10 | μA |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | μA |

Table 7. Static characteristics ...continued
 Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|--------------------|---------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |
| 74AHCT1G125 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = −50 μA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = −8.0 mA | 3.94 | - | - | 3.8 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 50 μA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _{OZ} | OFF-state output current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | 0.25 | - | 2.5 | - | 10 | μA |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _I = 3.4 V; other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |

11. Dynamic characteristics

Table 8. Dynamic characteristics
 GND = 0 V; For test circuit see [Figure 9](#).

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|-------------------|-------------------|--------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74AHC1G125 | | | | | | | | | | |
| t _{pd} | propagation delay | A to Y; see Figure 7 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | | | | | | | | |
| | | C _L = 15 pF | - | 4.7 | 8.0 | 1.0 | 9.5 | 1.0 | 11.5 | ns |
| | | C _L = 50 pF | - | 6.6 | 11.5 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | | | | | | | | |
| | | C _L = 50 pF | - | 4.8 | 7.5 | 1.0 | 8.5 | 1.0 | 9.5 | ns |

Table 8. Dynamic characteristics ...continued
GND = 0 V; For test circuit see Figure 9.

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|--------------------|-------------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{en} | enable time | \overline{OE} to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V [2] | | | | | | | | |
| | | C _L = 15 pF | - | 5.0 | 8.0 | 1.0 | 9.5 | 1.0 | 11.5 | ns |
| | | C _L = 50 pF | - | 6.9 | 11.5 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.6 | 5.1 | 1.0 | 6.0 | 1.0 | 6.5 | ns |
| t _{dis} | disable time | \overline{OE} to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V [2] | | | | | | | | |
| | | C _L = 15 pF | - | 6.0 | 9.7 | 1.0 | 11.5 | 1.0 | 12.5 | ns |
| | | C _L = 50 pF | - | 8.3 | 13.2 | 1.0 | 15.0 | 1.0 | 16.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 4.1 | 6.8 | 1.0 | 8.0 | 1.0 | 8.5 | ns |
| C _{PD} | power dissipation capacitance | per buffer; C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} [4] | - | 9 | - | - | - | - | - | pF |
| | | | | | | | | | | |
| 74AHCT1G125 | | | | | | | | | | |
| t _{pd} | propagation delay | A to Y; see Figure 7 [1] | | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.4 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| t _{en} | enable time | \overline{OE} to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.9 | 5.1 | 1.0 | 6.0 | 1.0 | 6.5 | ns |
| t _{dis} | disable time | \overline{OE} to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 4.5 | 6.8 | 1.0 | 8.0 | 1.0 | 8.5 | ns |
| | | C _L = 50 pF | - | 6.1 | 8.8 | 1.0 | 10.0 | 1.0 | 11.0 | ns |

Table 8. Dynamic characteristics ...continued
GND = 0 V; For test circuit see Figure 9.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|----------|-------------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| C_{PD} | power dissipation capacitance | per buffer; $C_L = 50 \text{ pF}$; $f = 1 \text{ MHz}$; $V_I = \text{GND to } V_{CC}$ | [4] | - | 11 | - | - | - | - | pF |

- [1] t_{pd} is the same as t_{PLH} and t_{PHL} .
 t_{en} is the same as t_{PZL} and t_{PZH} .
 t_{dis} is the same as t_{PLZ} and t_{PHZ} .
- [2] Typical values are measured at $V_{CC} = 3.3 \text{ V}$.
- [3] Typical values are measured at $V_{CC} = 5.0 \text{ V}$.
- [4] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum(C_L \times V_{CC}^2 \times f_o)$ 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 Volts.

12. Waveforms



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

Fig 7. Input (A) to output (Y) propagation delays



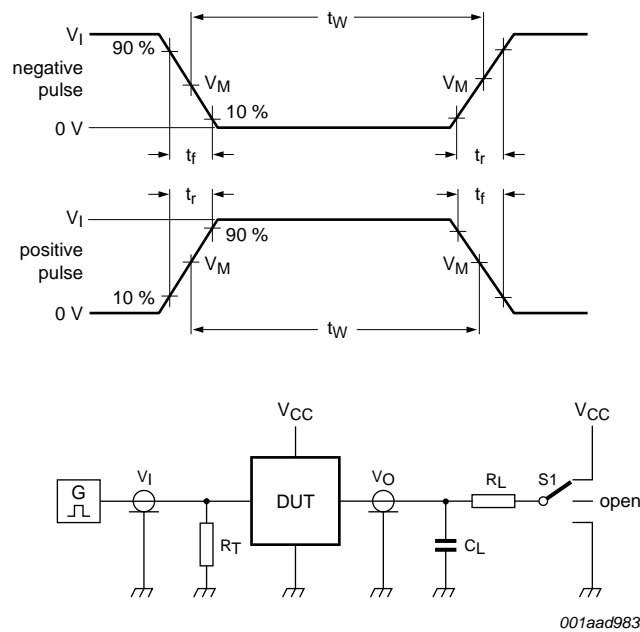
Measurement points are given in [Table 9](#).

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

Fig 8. Enable and disable times

Table 9. Measurement point

| Type | Inputs | | Output | | |
|-------------|-----------------|-------------|-------------|------------------|------------------|
| | V_I | V_M | V_M | V_X | V_Y |
| 74AHC1G125 | GND to V_{CC} | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |
| 74AHCT1G125 | GND to 3.0 V | 1.5 V | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |



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

Definitions test circuit:

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

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistance.

S1 = Test selection switch.

Fig 9. Test circuit for measuring switching times

Table 10. Test data

| Type | Input | | Load | | S1 position | | |
|-------------|----------|-------------|--------------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PHL}, t_{PLH} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| 74AHC1G125 | V_{CC} | ≤ 3 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74AHCT1G125 | 3 V | ≤ 3 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

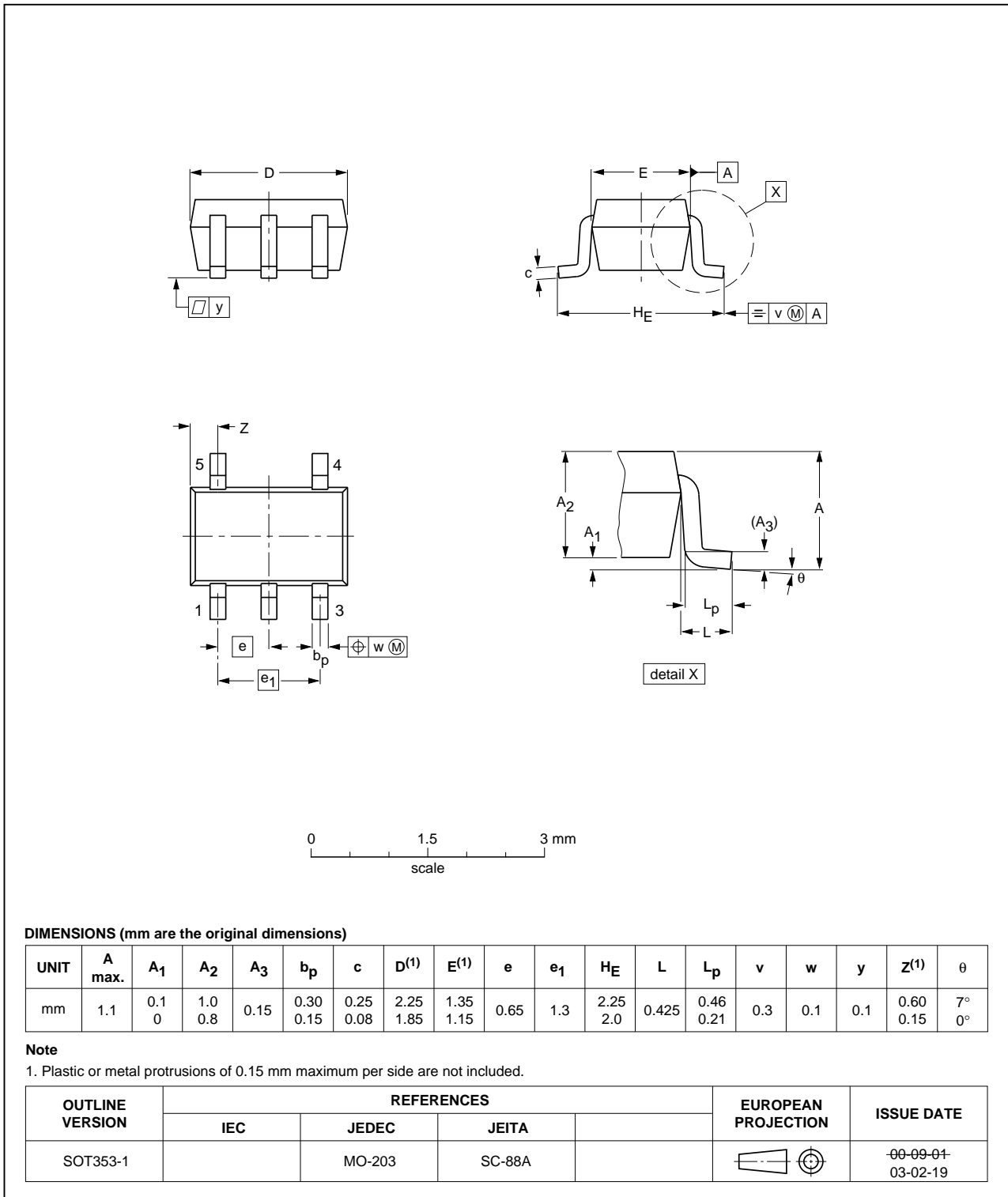


Fig 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



Fig 11. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



Fig 12. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891



Fig 13. Package outline SOT891 (XSON6)

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------------|---|---------------------------|---------------|-----------------------|
| 74AHC_AHCT1G125 v10 | 20120823 | Product data sheet | - | 74AHC_AHCT1G125 v.9 |
| Modifications: | <ul style="list-style-type: none"> Package outline drawing of SOT886 (Figure 12) modified. | | | |
| 74AHC_AHCT1G125 v.9 | 20090622 | Product data sheet | - | 74AHC_AHCT1G125 v.8 |
| 74AHC_AHCT1G125 v.8 | 20090409 | Product data sheet | - | 74AHC_AHCT1G125 v.7 |
| 74AHC_AHCT1G125 v.7 | 20070707 | Product data sheet | - | 74AHC_AHCT1G125 v.6 |
| 74AHC_AHCT1G125 v.6 | 20020606 | Product specification | - | 74AHC_AHCT1G125 v.5 |
| 74AHC_AHCT1G125 v.5 | 20020322 | Product specification | - | 74AHC_AHCT1G125 v.4 |
| 74AHC_AHCT1G125 v.4 | 20010222 | Product specification | - | 74AHC_AHCT1G125 v.3 |
| 74AHC_AHCT1G125 v.3 | 19990615 | Product specification | - | 74AHC_AHCT1G125_N v.2 |
| 74AHC_AHCT1G125_N v.2 | 19981207 | Preliminary specification | - | 74AHC_AHCT1G125_N v.1 |
| 74AHC_AHCT1G125_N v.1 | 19981125 | Preliminary specification | - | - |

16. Legal information

16.1 Data sheet status

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

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