



**THE DATASHEET OF  
CBT16212DL,518**



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# CBT16212

24-bit bus exchange switch with 12-bit output enables

Rev. 02 — 3 November 2008

Product data sheet

## 1. General description

The CBT16212 provides 24 bits of high-speed TTL-compatible bus switching or exchanging. The low ON resistance of the switch allows connections to be made with minimal propagation delay.

The CBT16212 operates either as a 24-bit bus switch or as a 12-bit bus exchanger, providing data exchange between four signal ports using the port select inputs (S0, S1 and S2).

The CBT16212 is characterized for operation from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

## 2. Features

- $5\ \Omega$  switch connection between two ports
- TTL compatible input levels
- ESD protection:
  - ◆ HBM JESD22-A114E Class 1C exceeds 1500 V
  - ◆ CDM JESD22-C101C exceeds 1000 V
- Latch-up performance:
  - ◆ JESD78 exceeds 100 mA

## 3. Ordering information

Table 1. Ordering information

| Type number | Package   |         |  |          |
|-------------|---|---------|--|----------|
|             | Temperature range   | Name    | Description  | Version  |
| CBT16212DGG | $-40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$ | TSSOP56 | plastic thin shrink small outline package; 56 leads; body width 6.1 mm | SOT364-1 |
| CBT16212DL  | $-40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$ | SSOP56  | plastic shrink small outline package; 56 leads; body width 7.5 mm      | SOT371-1 |

### 4. Functional diagram

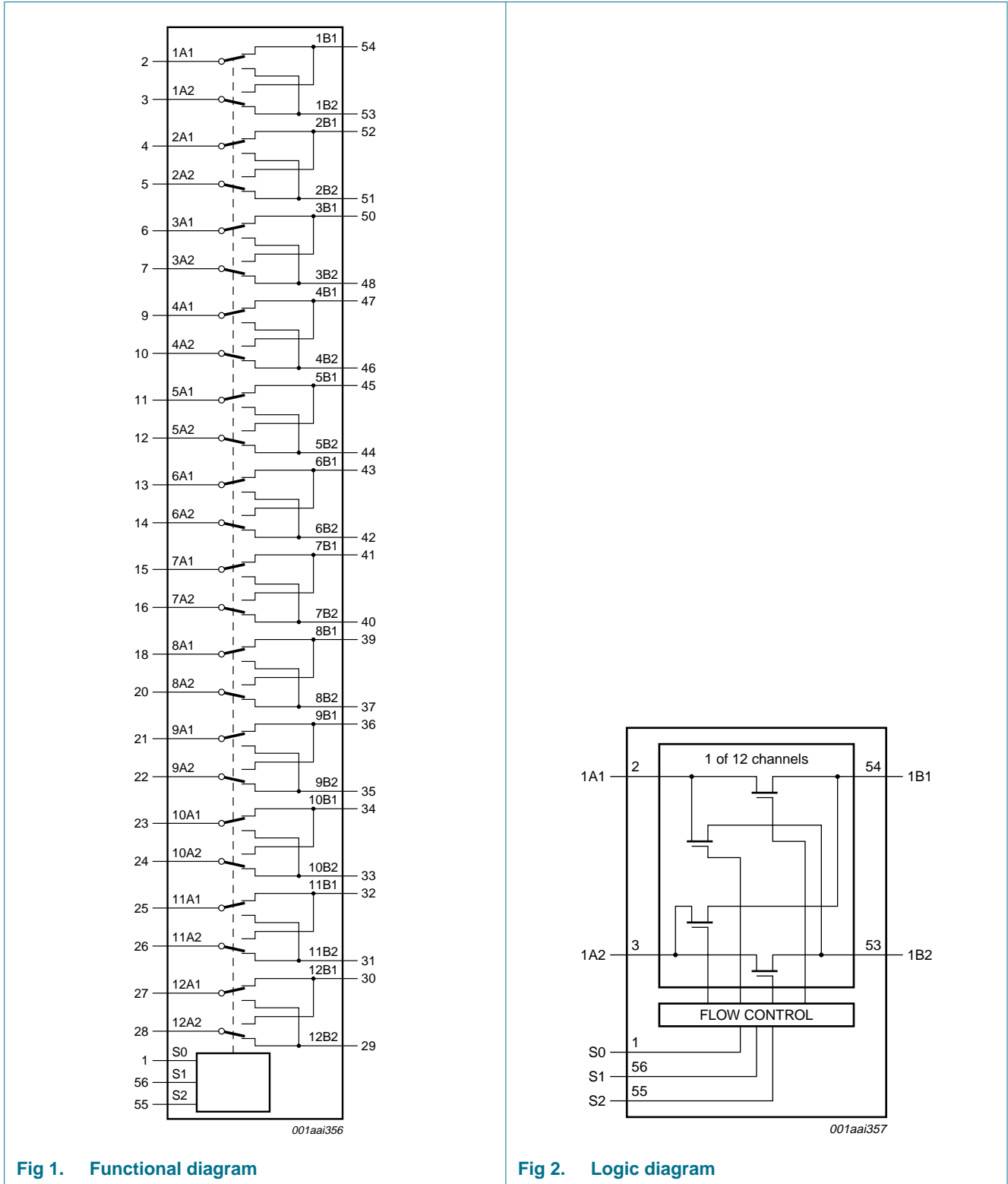
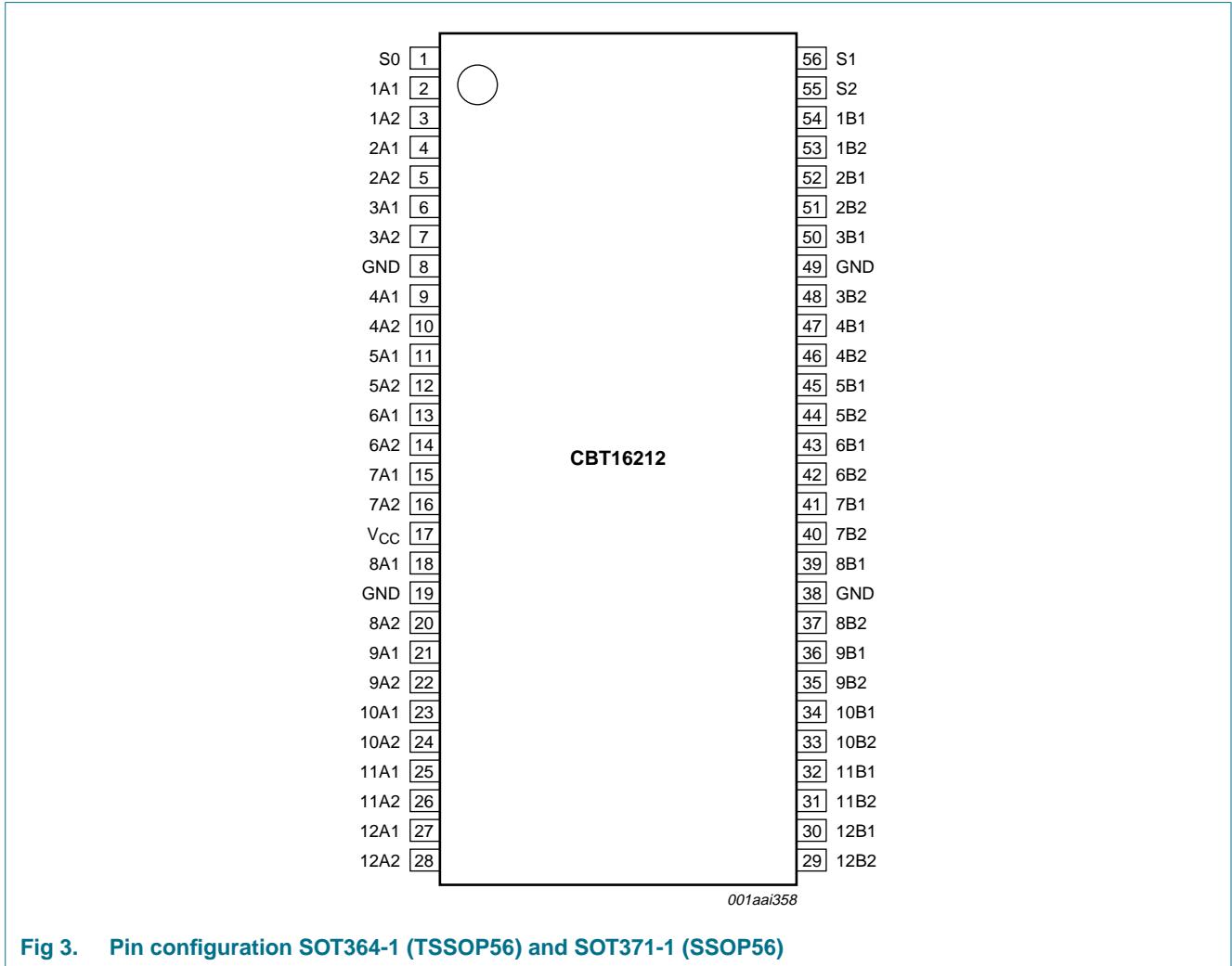


Fig 1. Functional diagram

Fig 2. Logic diagram

## 5. Pinning information

### 5.1 Pinning



### 5.2 Pin description

**Table 2. Pin description**

| Symbol          | Pin  | Description       |
|-----------------|--|-------------------|
| S0, S1, S2      | 1, 56, 55                                      | port select input |
| 1A1 to 12A1     | 2, 4, 6, 9, 11, 13, 15, 18, 21, 23, 25, 27     | A1 port           |
| 1A2 to 12A2     | 3, 5, 7, 10, 12, 14, 16, 20, 22, 24, 26, 28    | A2 port           |
| GND             | 8, 19, 38, 49                                  | ground (0 V)      |
| V <sub>CC</sub> | 17   | supply voltage    |
| 1B1 to 12B1     | 54, 52, 50, 47, 45, 43, 41, 39, 36, 34, 32, 30 | B1 port           |
| 1B2 to 12B2     | 53, 51, 48, 46, 44, 42, 40, 37, 35, 33, 31, 29 | B2 port           |

## 6. Functional description

Table 3. Function selection<sup>[1]</sup>

| Port select input |    |    | Input/output |     | Function                |
|-------------------|----|----|--------------|-----|-------------------------|
| S2                | S1 | S0 | nA1          | nA2 |                         |
| L                 | L  | L  | Z            | Z   | disconnect              |
| L                 | L  | H  | nB1          | Z   | nA1 = nB1               |
| L                 | H  | L  | nB2          | Z   | nA1 = nB2               |
| L                 | H  | H  | Z            | nB1 | nA2 = nB1               |
| H                 | L  | L  | Z            | nB2 | nA2 = nB2               |
| H                 | L  | H  | Z            | Z   | disconnect              |
| H                 | H  | L  | nB1          | nB2 | nA1 = nB1 and nA2 = nB2 |
| H                 | H  | H  | nB2          | nB1 | nA1 = nB2 and nA2 = nB1 |

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

## 7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter               | Conditions                           | Min                 | Max  | Unit |
|------------------|-------------------------|--------------------------------------|---------------------|------|------|
| V <sub>CC</sub>  | supply voltage          |                                      | -0.5                | +7.0 | V    |
| V <sub>I</sub>   | input voltage           |                                      | <sup>[1]</sup> -0.5 | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                 | -50                 | -    | mA   |
| V <sub>O</sub>   | output voltage          | output at HIGH level or OFF-state    | -0.5                | +5.5 | V    |
| I <sub>O</sub>   | output current          | output at LOW level                  | -                   | 128  | mA   |
| T <sub>stg</sub> | storage temperature     |                                      | -65                 | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C |                     |      |      |
|                  |                         | SSOP56 package                       | <sup>[3]</sup> -    | 850  | mW   |
|                  |                         | TSSOP56 package                      | <sup>[4]</sup> -    | 600  | mW   |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- [2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- [3] Above 55 °C the value of P<sub>tot</sub> derates linearly with 11.3 mW/K.
- [4] Above 55 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K.

## 8. Recommended operating conditions

Table 5. Operating conditions

All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

| Symbol           | Parameter                | Conditions            | Min | Max | Unit |
|------------------|--------------------------|-----------------------|-----|-----|------|
| V <sub>CC</sub>  | supply voltage           |                       | 4.0 | 5.5 | V    |
| V <sub>IH</sub>  | HIGH-level input voltage |                       | 2.0 | -   | V    |
| V <sub>IL</sub>  | LOW-level input voltage  |                       | -   | 0.8 | V    |
| T <sub>amb</sub> | ambient temperature      | operating in free-air | -40 | +85 | °C   |

## 9. Static characteristics

**Table 6. Static characteristics**

$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

| Symbol          | Parameter                          | Conditions  | Min | Typ <sup>[1]</sup> | Max     | Unit          |   |
|-----------------|------------------------------------|---|-----|--------------------|---------|---------------|---|
| $V_{IK}$        | input clamping voltage             | $V_{CC} = 4.5\text{ V}$ ; $I_I = -18\text{ mA}$   | -   | -                  | -1.2    | V             |   |
| $I_I$           | input leakage current              | $V_{CC} = 0\text{ V}$ ; $V_I = 5.5\text{ V}$  | -   | -                  | 10      | $\mu\text{A}$ |   |
|                 |                                    | $V_{CC} = 5.5\text{ V}$ ; $V_I = V_{CC}$ or GND   | -   | -                  | $\pm 1$ | $\mu\text{A}$ |   |
| $I_{CC}$        | supply current                     | $V_{CC} = 5.5\text{ V}$ ; $I_O = 0\text{ A}$ ;<br>$V_I = V_{CC}$ or GND   | -   | -                  | 3       | $\mu\text{A}$ |   |
| $\Delta I_{CC}$ | additional supply current          | per port select input pin; $V_{CC} = 5.5\text{ V}$ ; <sup>[2]</sup><br>one input at 3.4 V, other inputs at $V_{CC}$<br>or GND | -   | -                  | 2.5     | mA            |   |
| $C_I$           | input capacitance                  | port select input pins; $V_I = 3\text{ V}$ or $0\text{ V}$ ;<br>$V_{CC} = 5.0\text{ V}$ ;                                     | -   | 4.7                | -       | pF            |   |
| $C_{io(off)}$   | off-state input/output capacitance | $V_O = 3\text{ V}$ or $0\text{ V}$ ; $V_{CC} = 0\text{ V}$  | -   | 11.5               | -       | pF            |   |
| $R_{ON}$        | ON resistance                      | $V_{CC} = 4.0\text{ V}$ <sup>[3]</sup>  | -   | -                  | -       | -             |   |
|                 |                                    | $V_I = 2.4\text{ V}$ ; $I_I = 15\text{ mA}$   | -   | -                  | 21      | $\Omega$      |   |
|                 |                                    | $V_{CC} = 4.5\text{ V}$ <sup>[3]</sup>  | -   | -                  | -       | -             | - |
|                 |                                    | $V_I = 0\text{ V}$ ; $I_I = 64\text{ mA}$   | -   | 4                  | 7       | $\Omega$      |   |
|                 |                                    | $V_I = 0\text{ V}$ ; $I_I = 30\text{ mA}$   | -   | 4                  | 7       | $\Omega$      |   |
|                 |                                    | $V_I = 2.4\text{ V}$ ; $I_I = 15\text{ mA}$   | -   | 6                  | 12      | $\Omega$      |   |

[1] All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than  $V_{CC}$  or GND.

[3] Measured by the voltage drop between the A and the B terminals at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (A or B) terminals.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ;  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ ; for test circuit see [Figure 6](#).

| Symbol    | Parameter         | Conditions  | Min | Max  | Unit |
|-----------|-------------------|---|-----|------|------|
| $t_{pd}$  | propagation delay | input A or B to output B or A; see <a href="#">Figure 4</a> <sup>[1][2]</sup> | -   | 0.25 | ns   |
| $t_{en}$  | enable time       | port select input to output A or B; <a href="#">Figure 5</a> <sup>[3]</sup>   | 2.4 | 8.0  | ns   |
| $t_{dis}$ | disable time      | port select input to output A or B; <a href="#">Figure 5</a> <sup>[4]</sup>   | 2.4 | 8.0  | ns   |

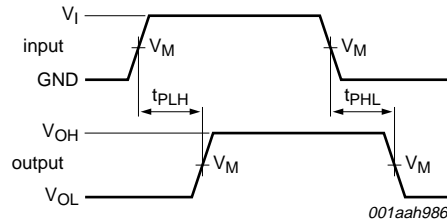
[1] This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON resistance of the switch and a load capacitance of 50 pF, when driven by an ideal voltage source (zero output impedance).

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

[3]  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

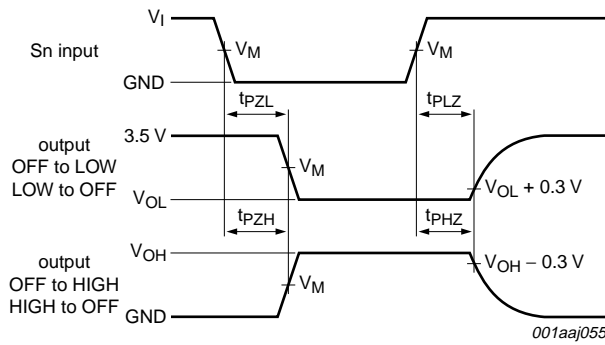
[4]  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ .

### 11. Waveforms



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 4. Input to output propagation delays**

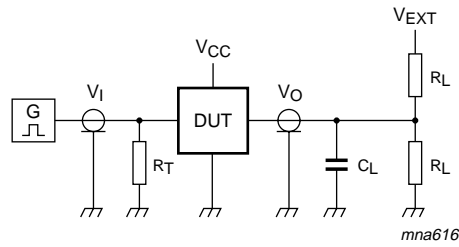


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 5. Enable and disable times**

**Table 8. Measurement points**

| Supply voltage | Input | Output |
|----------------|-------|--------|
| $V_{CC}$       | $V_M$ | $V_M$  |
| 4.5 V to 5.5 V | 1.5 V | 1.5 V  |



Test data is given in [Table 9](#).

Definitions for test circuit:

$R_L$  = Load resistance.

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

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

$V_{EXT}$  = External voltage for measuring switching times.

**Fig 6. Test circuit**

**Table 9. Test data**

| Supply voltage | Input        |               | Load  |              | $V_{EXT}$          |                    |                    |
|----------------|--------------|---------------|-------|--------------|--------------------|--------------------|--------------------|
| $V_{CC}$       | $V_I$        | $t_r = t_f$   | $C_L$ | $R_L$        | $t_{PLH}, t_{PHL}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 4.5 V to 5.5 V | GND to 3.0 V | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | open               | open               | 7.0 V              |

12. Package outline

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm

SOT364-1

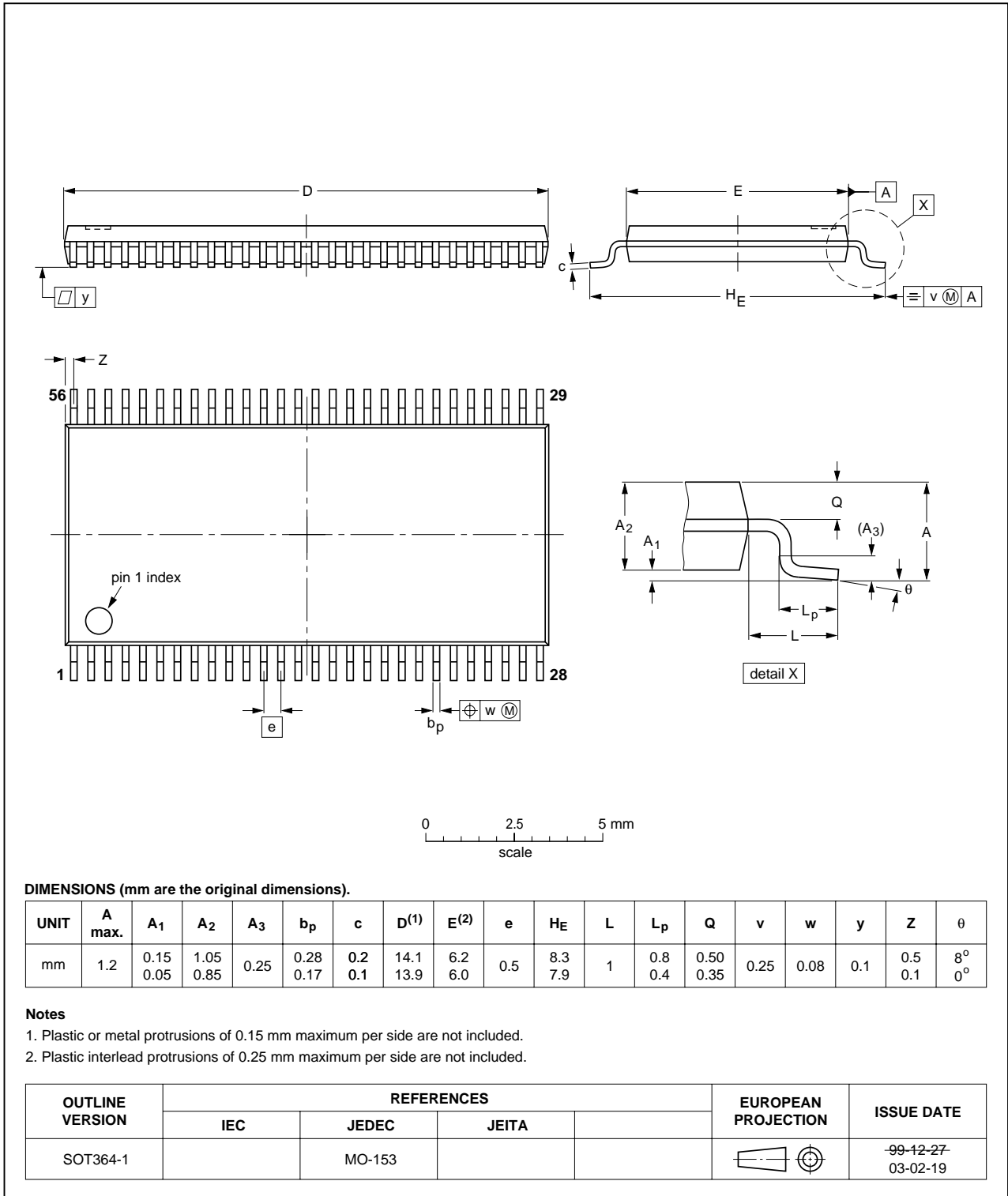


Fig 7. Package outline SOT364-1 (TSSOP56)

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm

SOT371-1

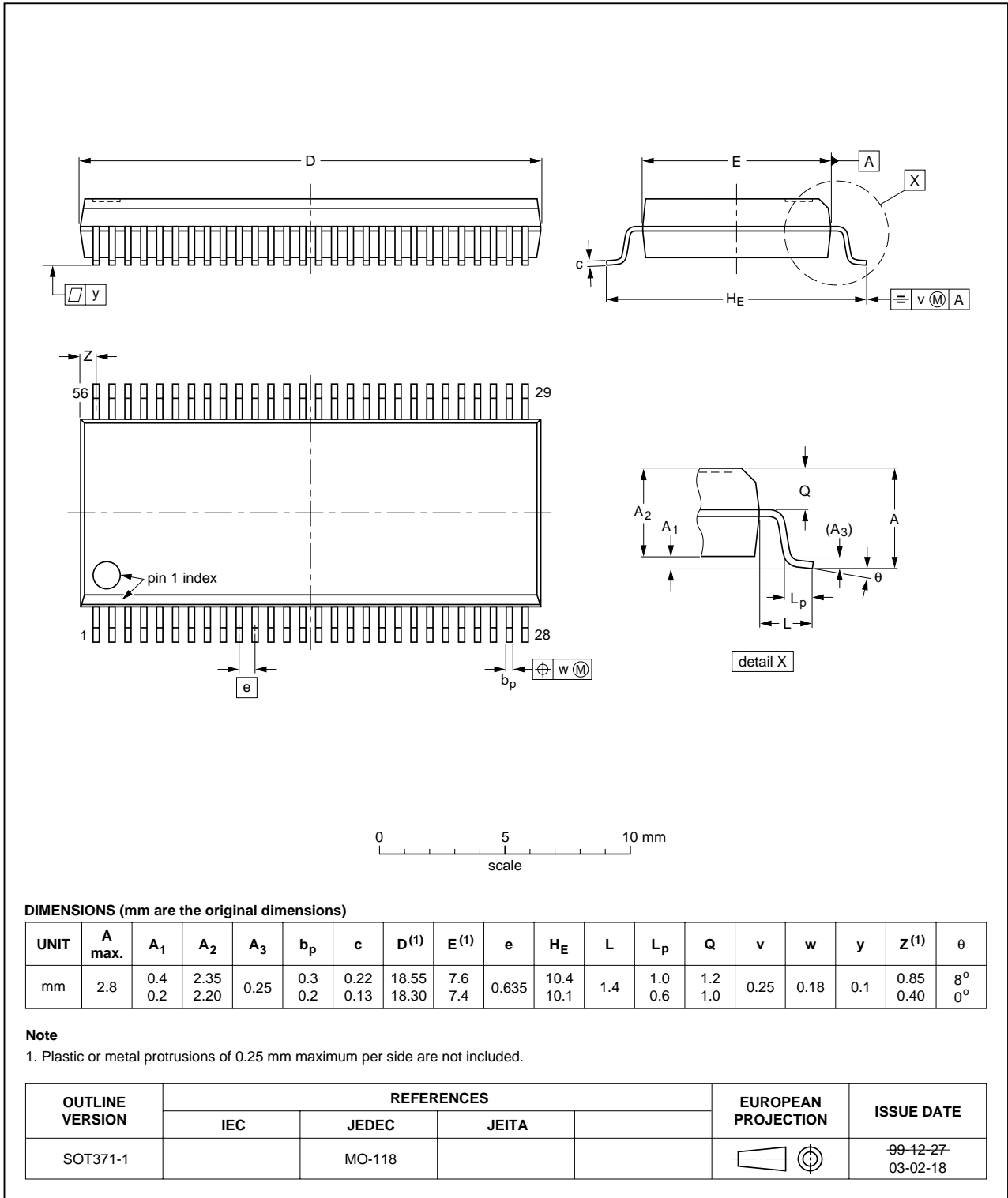


Fig 8. Package outline SOT371-1 (SSOP56)

## 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                 |
|---------|-----------------------------|
| CDM     | Charged Device Model        |
| DUT     | Device Under Test           |
| ESD     | ElectroStatic Discharge     |
| HBM     | Human Body Model            |
| TTL     | Transistor-Transistor Logic |

## 14. Revision history

Table 11. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes |
|----------------|--|--------------------|---------------|------------|
| CBT16212_2     | 03112008   | Product data sheet | -             | CBT16212_1 |
| Modifications: | <ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Table 7 “Dynamic characteristics”</a>: <ul style="list-style-type: none"> <li>– Enable time: min value changed from 3.6 into 2.4.</li> <li>– Disable time: min value changed from 4.5 into 2.4.</li> </ul> </li> </ul> |                    |               |            |
| CBT16212_1     | 20010928   | Product data       | -             | -          |

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### 15.1 Data sheet status

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

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