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Kind regards,

Team Nexperia

DATA SHEET

CBTD16211

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

Product data

2001 Jun 13

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

CBTD16211

FEATURES

- 5Ω switch connection between two ports
- TTL compatible control input levels
- Designed to be used in level shifting applications
- Package options include shrink small outline (SSOP) and thin shrink small outline (TSSOP)
- ESD protection exceeds 1000 V CDM per JESD22-C101
- Latch-up testing is done to JESDEC Standard JESD78 which exceeds 100 mA

DESCRIPTION

The CBTD16211 provides 24 bits of high-speed TTL-compatible bus switching. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

A diode to V_{CC} is integrated in the circuit to allow for level shifting between 5 V inputs and 3.3 V outputs.

The device is organized as a dual 12-bit bus switch with separate output-enable (\overline{OE}) inputs. It can be used as two 10-bit bus switches or as one 20-bit bus switch. When \overline{OE} is low, the associated 10-bit bus switch is on, and port A is connected to port B. When \overline{OE} is high, the switch is open, and a high-impedance state exists between the ports.

The CBTD16211 is characterized for operation from -40 to $+85$ °C.

QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS $T_{amb} = 25$ °C; GND = 0 V | TYPICAL | UNIT |
|------------------------|-------------------------------|--|---------|------|
| t_{PLH} t_{PHL} | Propagation delay An to Yn | $C_L = 50$ pF; $V_{CC} = 5$ V | 0.25 | ns |
| C_{IN} | Input capacitance | $V_I = 0$ V or V_{CC} | 4.3 | pF |
| C_{OUT} | Output capacitance | Outputs disabled; $V_O = 0$ V or V_{CC} | 6.9 | pF |
| I_{CC} | Total supply current | Outputs disabled; $V_{CC} = 5.5$ V | 3.0 | μA |

ORDERING INFORMATION

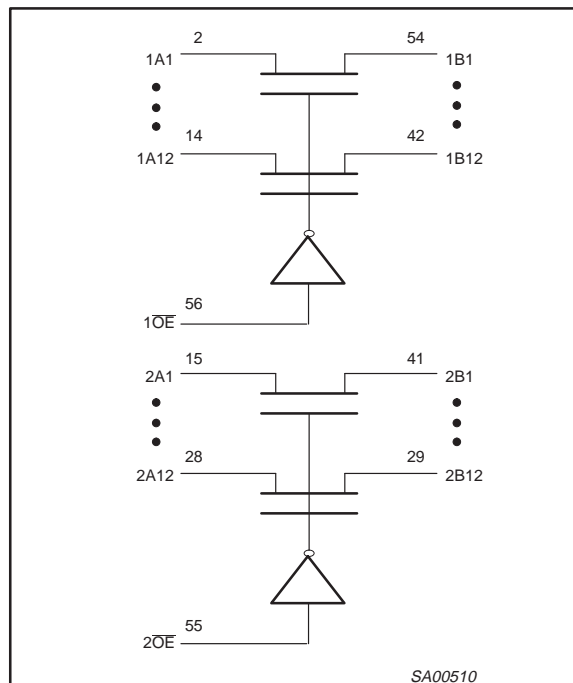
| PACKAGES | TEMPERATURE RANGE | ORDER CODE | DWG NUMBER |
|------------------------------|-------------------|--------------|------------|
| 56-Pin Plastic SSOP Type III | -40 to $+85$ °C | CBTD16211DL | SOT371-1 |
| 56-Pin Plastic TSSOP Type II | -40 to $+85$ °C | CBTD16211DGG | SOT364-1 |

FUNCTION TABLE

| INPUTS | | OUTPUTS | |
|------------------|------------------|---------|---------|
| $1\overline{OE}$ | $2\overline{OE}$ | 1A, 1B | 2A, 2B |
| L | L | 1A = 1B | 2A = 2B |
| L | H | 1A = 1B | Z |
| H | L | Z | 2A = 2B |
| H | H | Z | Z |

H = High voltage level
L = Low voltage level
Z = High impedance "off" state

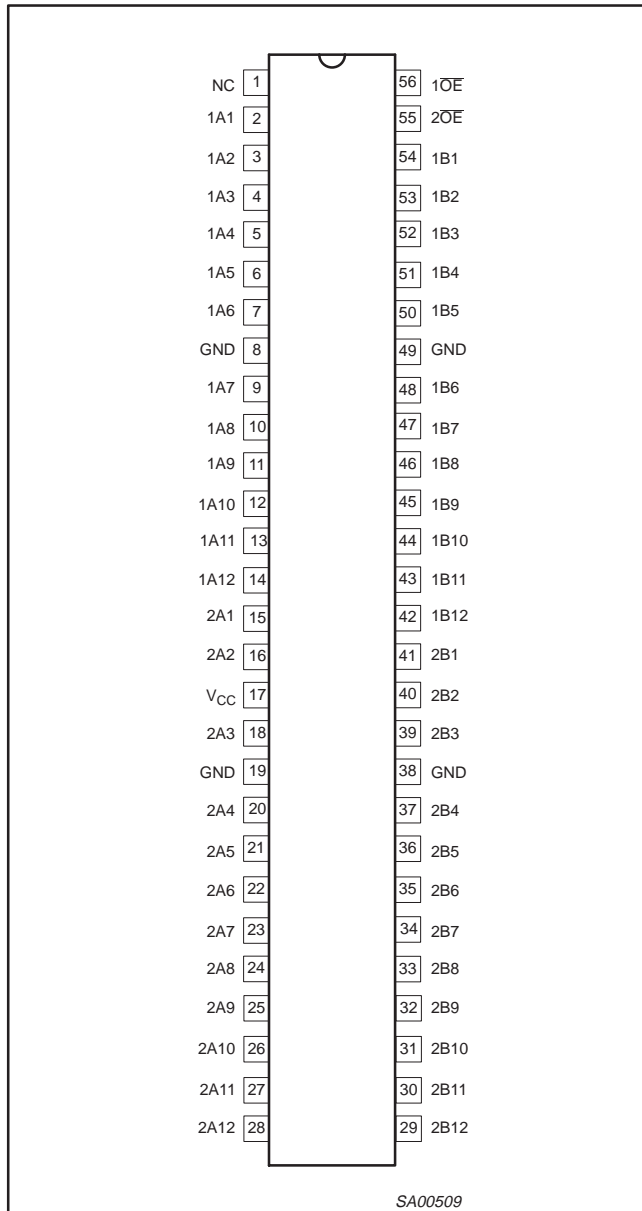
LOGIC SYMBOL



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

CBTD16211

PIN CONFIGURATION



PIN DESCRIPTION

| PIN NUMBER | SYMBOL | NAME AND FUNCTION |
|--|-----------------|-------------------------|
| 1 | NC | No internal connection |
| 56, 55 | 1OE, 2OE | Output enables |
| 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14 | 1A1-1A12 | Inputs |
| 54, 53, 52, 51, 50, 48, 47, 46, 45, 44, 43, 42 | 1B1-1B12 | Outputs |
| 15, 16, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28 | 2A1-2A12 | Inputs |
| 41, 40, 39, 37, 36, 35, 34, 33, 32, 31, 30, 29 | 2B1-2B12 | Outputs |
| 8, 19, 38, 49 | GND | Ground (0 V) |
| 17 | V _{CC} | Positive supply voltage |

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

CBTD16211

ABSOLUTE MAXIMUM RATINGS^{1, 2}

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|------------------|--------------------------------|-----------------------------|--------------|------|
| V _{CC} | DC supply voltage | | -0.5 to +7.0 | V |
| I _{IK} | DC input diode current | V _I < 0 | -50 | mA |
| V _I | DC input voltage ³ | | -0.5 to +7.0 | V |
| V _{OUT} | DC output voltage ³ | output in Off or High state | -0.5 to +5.5 | V |
| I _{OUT} | DC output current | output in Low state | 128 | mA |
| T _{stg} | Storage temperature range | | -65 to +150 | °C |

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- 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.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | UNIT |
|------------------|--------------------------------------|--------|-----|------|
| | | Min | Max | |
| V _{CC} | DC supply voltage | 4.5 | 5.5 | V |
| V _{IH} | High-level input voltage | 2.0 | — | V |
| V _{IL} | Low-level Input voltage | — | 0.8 | V |
| T _{amb} | Operating free-air temperature range | -40 | +85 | °C |

DC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|------------------------------|--|--|----------------------------------|------------------|------|------|
| | | | T _{amb} = -40 to +85 °C | | | |
| | | | Min | Typ ¹ | Max | |
| V _{IK} | Input clamp voltage | V _{CC} = 4.5 V; I _I = -18 mA | — | — | -1.2 | V |
| V _{OH} | Output high pass voltage | See Figure 1 | — | — | — | V |
| I _I | Input leakage current | V _{CC} = 0 V; V _I = 5.5 V | — | — | 10 | μA |
| | | V _{CC} = 5.5 V; V _I = GND or 5.5 V | — | — | ±1 | |
| I _{CC} | Quiescent supply current | V _{CC} = 5.5 V; I _O = 0, V _I = V _{CC} or GND; 1OE=2OE=GND | — | — | 1.5 | mA |
| ΔI _{CC} | Additional supply current per input pin ² | V _{CC} = 5.5 V, one input at 3.4 V, other inputs at V _{CC} or GND | — | — | 2.5 | mA |
| C _I | Control pins | V _I = 3 V or 0 | — | 4.5 | — | pF |
| C _{I(OFF)} | Port OFF capacitance | V _O = 3 V or 0, OE = V _{CC} | — | 8 | — | pF |
| r _{on} ³ | | V _{CC} = 4.5 V; V _I = 0 V; I _I = 64 mA | — | 5 | 7 | Ω |
| | | V _{CC} = 4.5 V; V _I = 0 V; I _I = 30 mA | — | 5 | 7 | |
| | | V _{CC} = 4.5 V; V _I = 2.4 V; I _I = -15 mA | — | 35 | 50 | |

NOTES:

- All typical values are at V_{CC} = 5 V, T_{amb} = 25 °C.
- This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.
- Measured by the voltage drop between the A and the B terminals at the indicated current through the switch.
On-state resistance is determined by the lowest voltage of the two (A or B) terminals.

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

CBTD16211

AC CHARACTERISTICS

GND = 0 V; t_R ; $C_L = 50$ pF

| SYMBOL | PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|-----------|--|-----------------|----------------|--|------|------|
| | | | | Min | Max | |
| t_{pd} | Propagation delay ¹ | A or B | B or A | — | 0.25 | ns |
| t_{en} | Output enable time to High and Low level | \overline{OE} | A or B | 1.5 | 8.5 | ns |
| t_{dis} | Output disable time from High and Low level | \overline{OE} | A or B | 1.5 | 7 | ns |

NOTE:

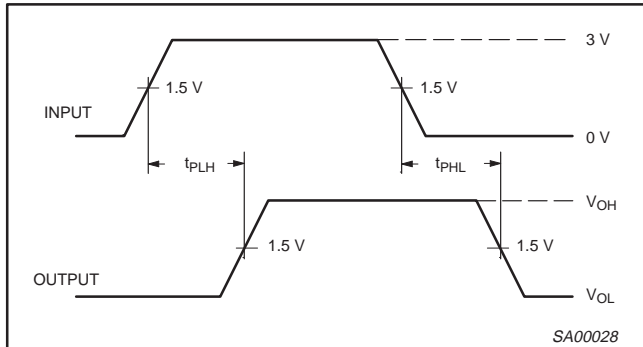
1. This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical on-state resistance of the switch and a load capacitance of 50 pF, when driven by an ideal voltage source (zero output impedance).

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

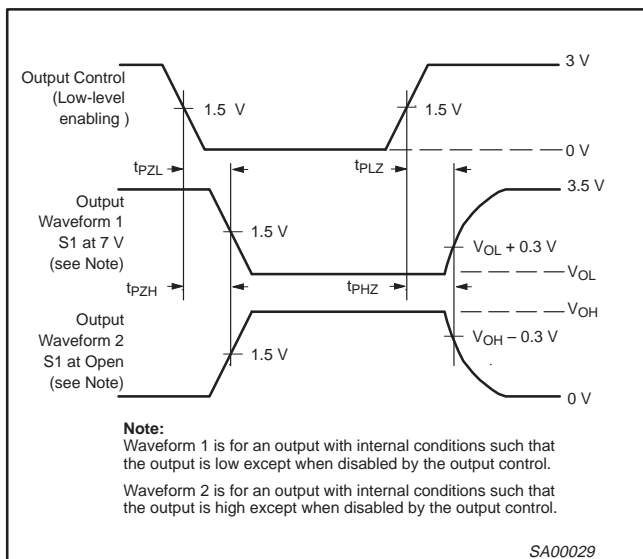
CBTD16211

AC WAVEFORMS

$V_M = 1.5\text{ V}$, $V_{IN} = \text{GND to } 3.0\text{ V}$



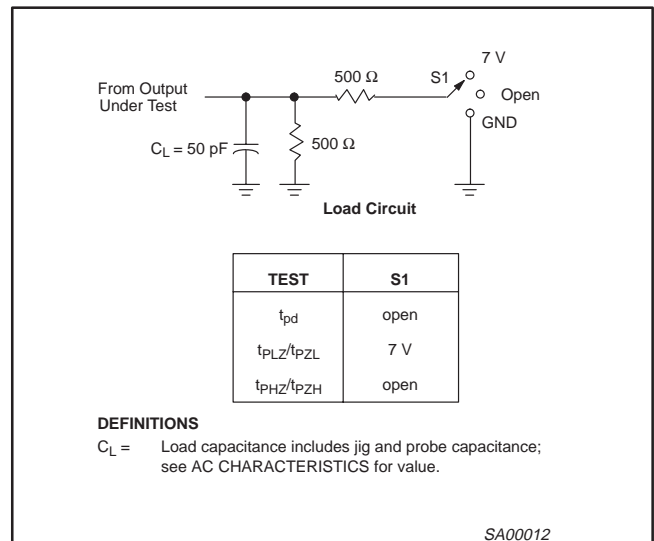
Waveform 1. Input (An) to Output (Yn) Propagation Delays



Note:
Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

Waveform 2. 3-State Output Enable and Disable Times

TEST CIRCUIT AND WAVEFORMS



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

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TYPICAL CHARACTERISTICS

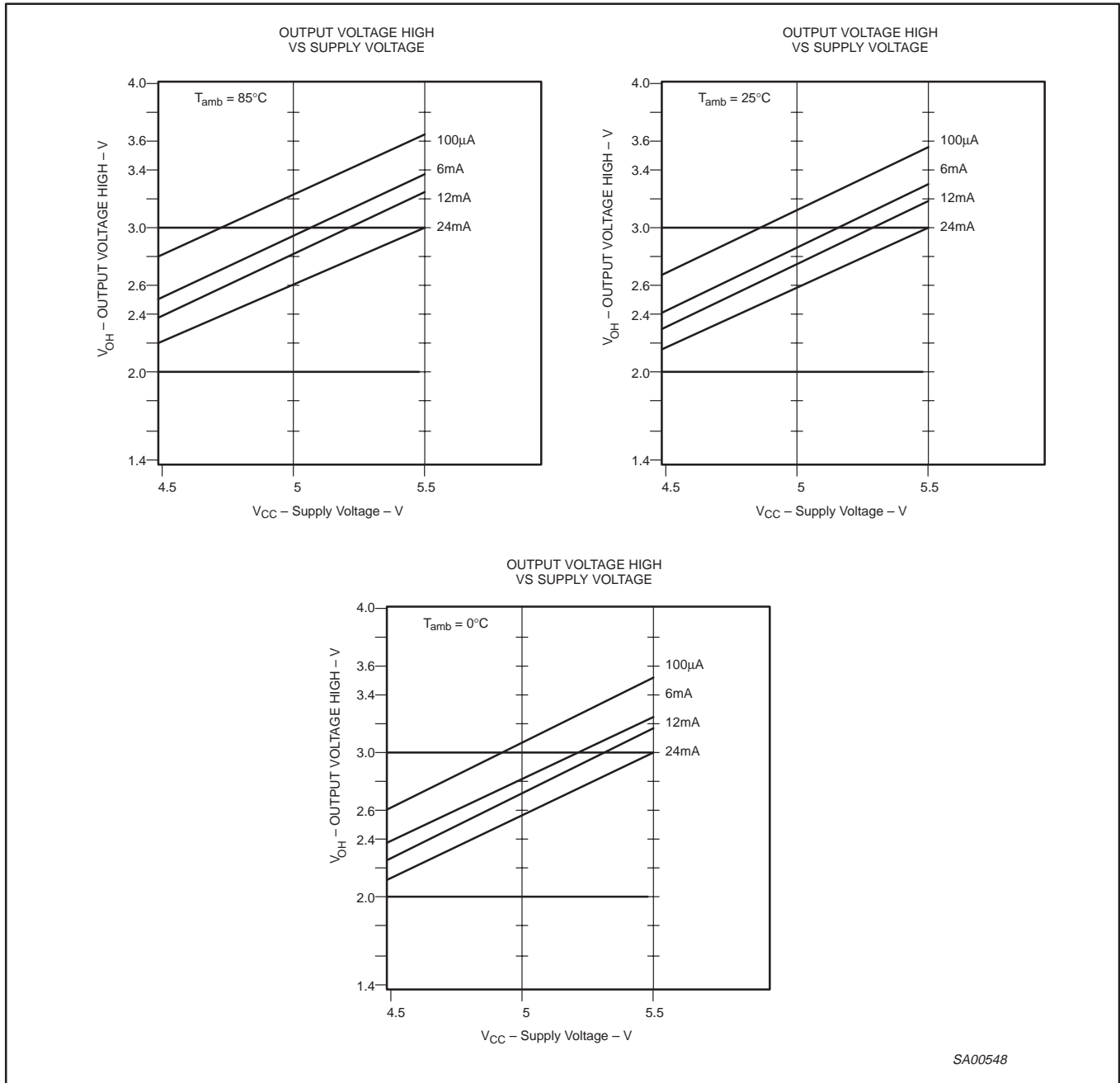


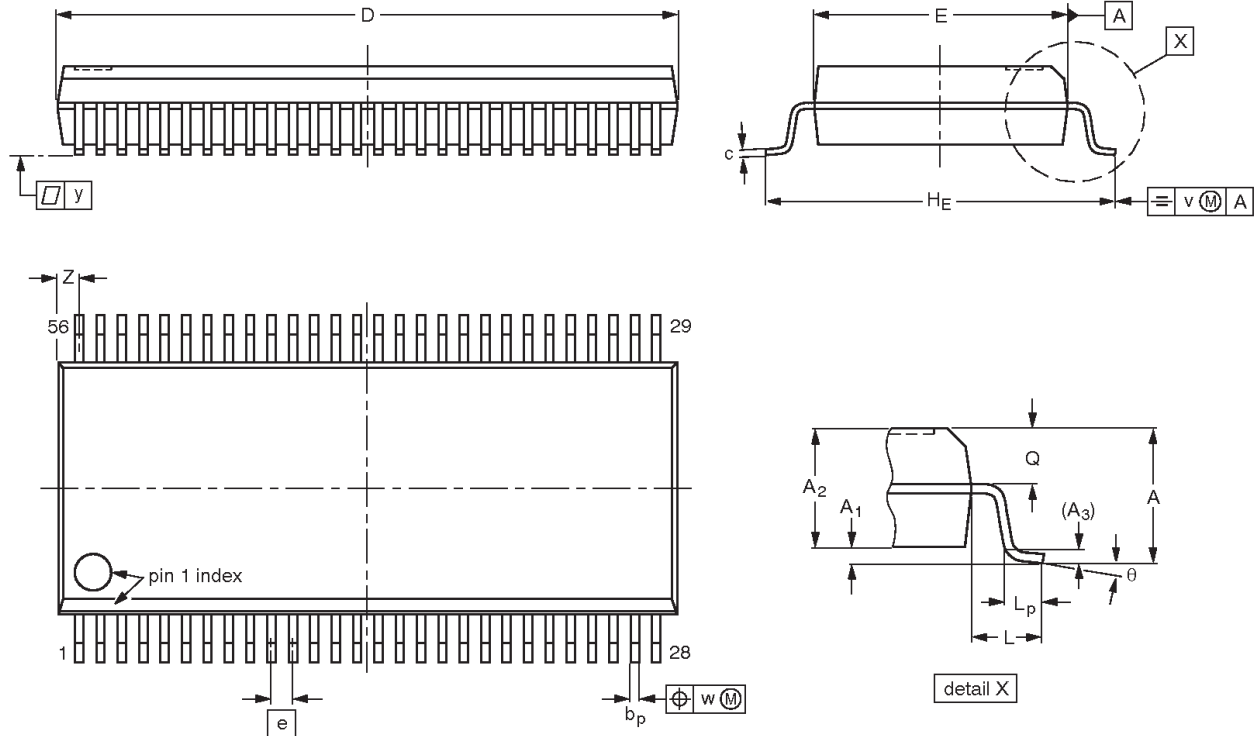
Figure 1. V_{OH} values ($V_{in} = V_{CC}$)

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

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

SOT371-1



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 | 2.8 | 0.4 0.2 | 2.35 2.20 | 0.25 | 0.3 0.2 | 0.22 0.13 | 18.55 18.30 | 7.6 7.4 | 0.635 | 10.4 10.1 | 1.4 | 1.0 0.6 | 1.2 1.0 | 0.25 | 0.18 | 0.1 | 0.85 0.40 | 8° 0° |

Note

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

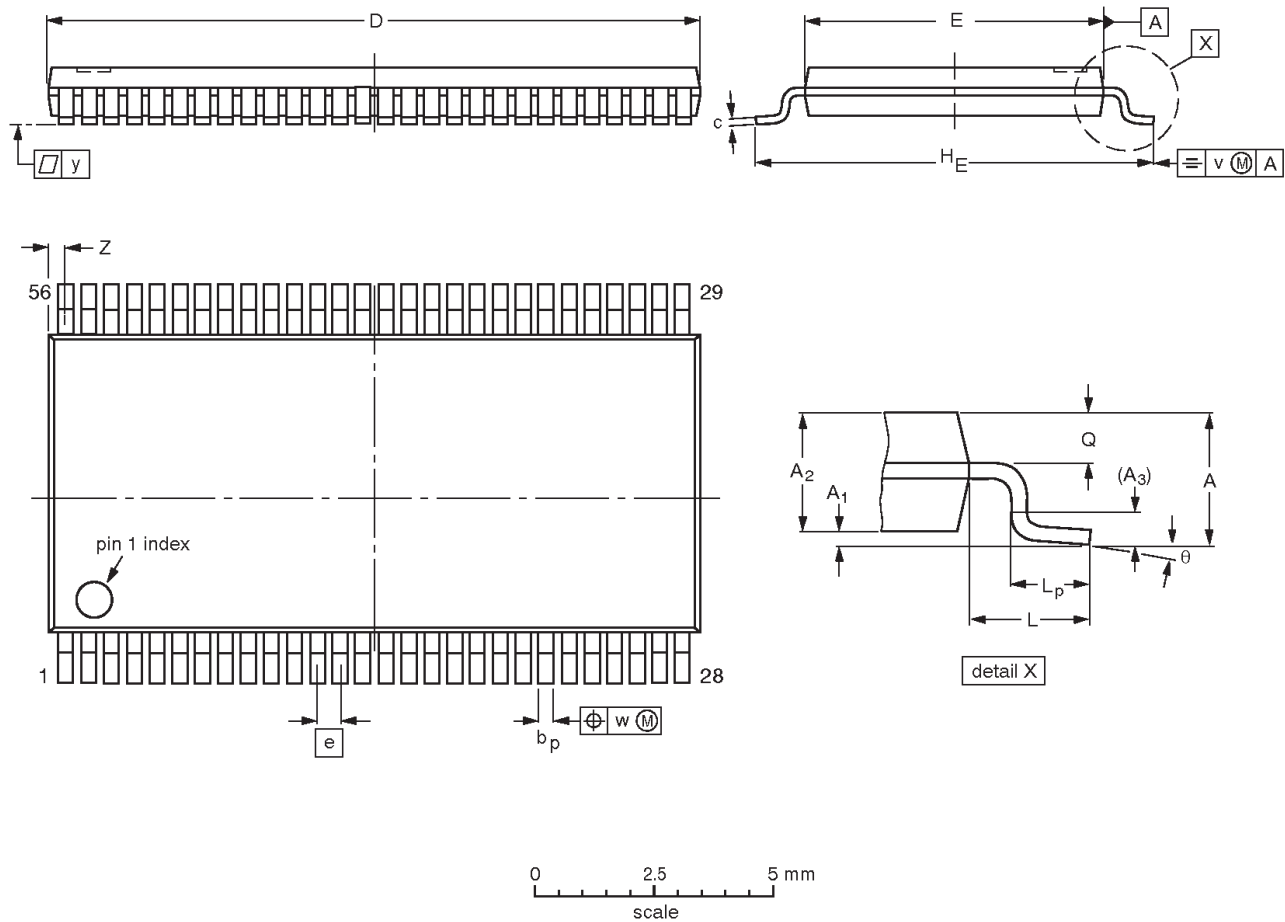
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT371-1 | | MO-118 | | | | 95-02-04 99-12-27 |

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

CBTD16211

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

SOT364-1



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 | θ |
|------|--------|----------------|----------------|----------------|----------------|------------|------------------|------------------|-----|----------------|-----|----------------|--------------|------|------|-----|------------|----------|
| mm | 1.2 | 0.15 0.05 | 1.05 0.85 | 0.25 | 0.28 0.17 | 0.2 0.1 | 14.1 13.9 | 6.2 6.0 | 0.5 | 8.3 7.9 | 1.0 | 0.8 0.4 | 0.50 0.35 | 0.25 | 0.08 | 0.1 | 0.5 0.1 | 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 | | | |
| SOT364-1 | | MO-153 | | | | 95-02-10 99-12-27 |

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

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|----------------------------------|-------------------------------|--|
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