

# CBT3384

10-bit bus switch with 5-bit output enables

Rev. 7 — 6 March 2019

Product data sheet

## 1. General description

The CBT3384 provides ten bits of high-speed TTL-compatible bus switching. The low ON resistance of the switch allows connections to be made with minimal propagation delay.

The CBT3384 device is organized as two 5-bit bus switches with two separate output enable ( $\overline{1OE}$ ,  $\overline{2OE}$ ) inputs. When  $\overline{nOE}$  is LOW, the switch is on and port A is connected to the B port. When  $\overline{nOE}$  is HIGH, each switch is disabled.

## 2. Features

- 5  $\Omega$  switch connection between two ports
- TTL-compatible control input levels
- See CBTD3384 for CBT3384 with level shifting diodes
- Latch-up protection exceeds 100 mA per JESD78
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - CDM JESD22-C101C exceeds 1000 V
  - Specified from -40 °C to +85 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
CBT3384D	-40 °C to +85 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
CBT3384PW	-40 °C to +85 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1

## 4. Functional diagram

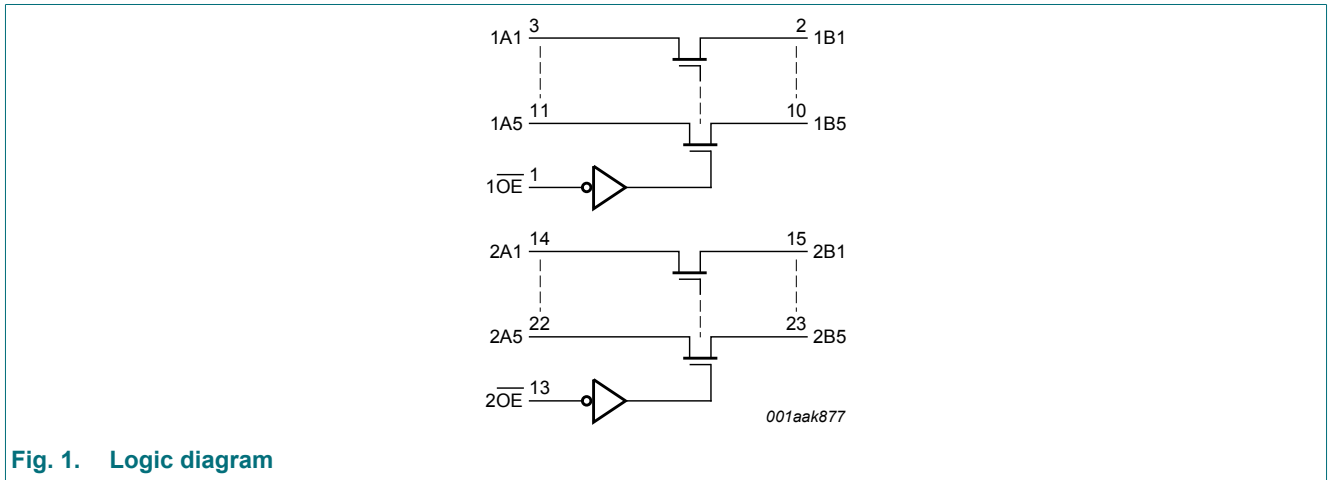


Fig. 1. Logic diagram

## 5. Pinning information

### 5.1. Pinning

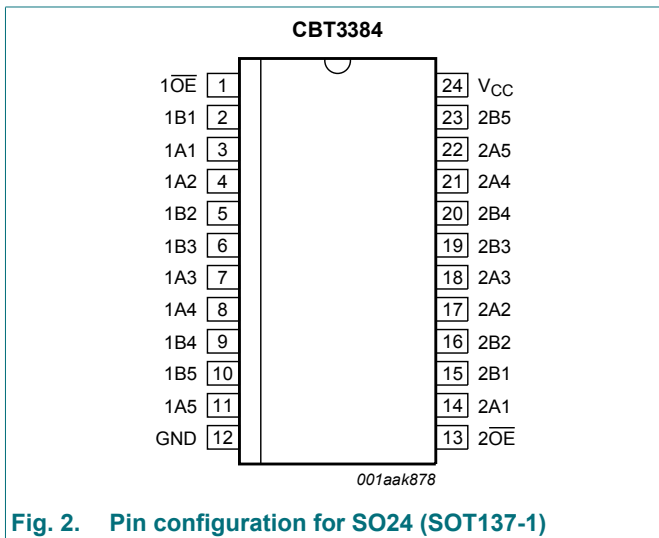


Fig. 2. Pin configuration for SO24 (SOT137-1)

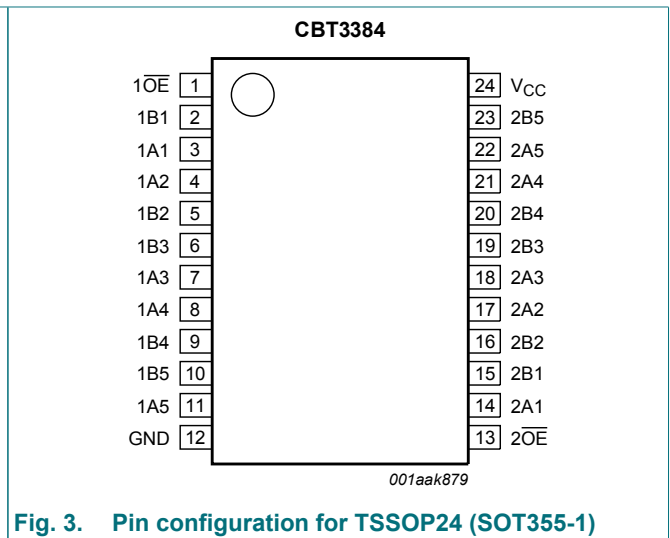


Fig. 3. Pin configuration for TSSOP24 (SOT355-1)

### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE, 2OE	1, 13	output enable input (active LOW)
1A1 to 1A5	3, 4, 7, 8, 11	data input/output (A port)
2A1 to 2A5	14, 17, 18, 21, 22	data input/output (A port)
1B1 to 1B5	2, 5, 6, 9, 10	data input/output (B port)
2B1 to 2B5	15, 16, 19, 20, 23	data input/output (B port)
GND	12	ground (0 V)
V <sub>CC</sub>	24	positive supply voltage

## 6. Functional description

**Table 3. Function selection**

*H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.*

Input		Input/output	
1OE	2OE	1An, 1Bn	2An, 2Bn
L	L	1An = 1Bn	2An = 2Bn
L	H	1An = 1Bn	Z
H	L	Z	2An = 2Bn
H	H	Z	Z

## 7. Limiting values

**Table 4. Limiting values**

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

*T<sub>amb</sub> = -40 °C to +85 °C, unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
V <sub>I</sub>	input voltage	[1]	-0.5	+7.0	V
I <sub>O</sub>	output current	V <sub>O</sub> < 0 V	-	±128	mA
I <sub>IK</sub>	input clamping current	V <sub>I/O</sub> = 0 V	-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C

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

## 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	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		4.5	-	5.5	V
V <sub>IH</sub>	HIGH-state input voltage		2.0	-	-	V
V <sub>IL</sub>	LOW-state 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**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 4.5 V; I <sub>I</sub> = -18 mA	-	-	-1.2	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or 5.5 V	-	-	±1	µA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 mA; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	3	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 5.5 V; one input at 3.4 V, other inputs at V <sub>CC</sub> or GND [2]	-	-	2.5	mA
V <sub>pass</sub>	pass voltage	output HIGH; V <sub>I</sub> = V <sub>CC</sub> = 5.0 V; I <sub>O</sub> = -100 µA	3.6	3.9	4.2	V
C <sub>I</sub>	input capacitance	control pins; V <sub>I</sub> = 3 V or 0 V	-	4.0	-	pF
C <sub>io(off)</sub>	off-state input/output capacitance	port off; V <sub>I</sub> = 3 V or 0 V; n $\overline{OE}$ = V <sub>CC</sub>	-	10.0	-	pF
R <sub>ON</sub>	ON resistance	V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 0 V; I <sub>I</sub> = 64 mA [3]	-	5	7	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 0 V; I <sub>I</sub> = 30 mA [3]	-	5	7	Ω
		V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 2.4 V; I <sub>I</sub> = -15 mA [3]	-	10	15	Ω

[1] All typical values are at V<sub>CC</sub> = 5 V, T<sub>amb</sub> = 25 °C.

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.

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

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 6.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nAn, nBn to nBn, nAn; see Fig. 4 [1][2]						
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	-	0.25	-	0.25	ns
t <sub>pZH</sub>	OFF-state to HIGH propagation delay	n $\overline{OE}$ to nAn or nBn; see Fig. 5						
		V <sub>CC</sub> = 5.0 V ± 0.5 V	1.2	2.3	5.7	1.2	5.6	ns
t <sub>pZL</sub>	OFF-state to LOW propagation delay	n $\overline{OE}$ to nAn or nBn; see Fig. 5						
		V <sub>CC</sub> = 5.0 V ± 0.5 V	1.2	2.3	5.7	1.2	6.0	ns
t <sub>pHZ</sub>	HIGH to OFF-state propagation delay	n $\overline{OE}$ to nAn or nBn; see Fig. 5						
		V <sub>CC</sub> = 5.0 V ± 0.5 V	1.7	3.6	5.2	1.7	5.5	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	n $\overline{OE}$ to nAn or nBn; see Fig. 5						
		V <sub>CC</sub> = 5.0 V ± 0.5 V	1.7	2.7	5.2	1.7	6.6	ns

[1] The propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

10.1. Waveforms and test circuit

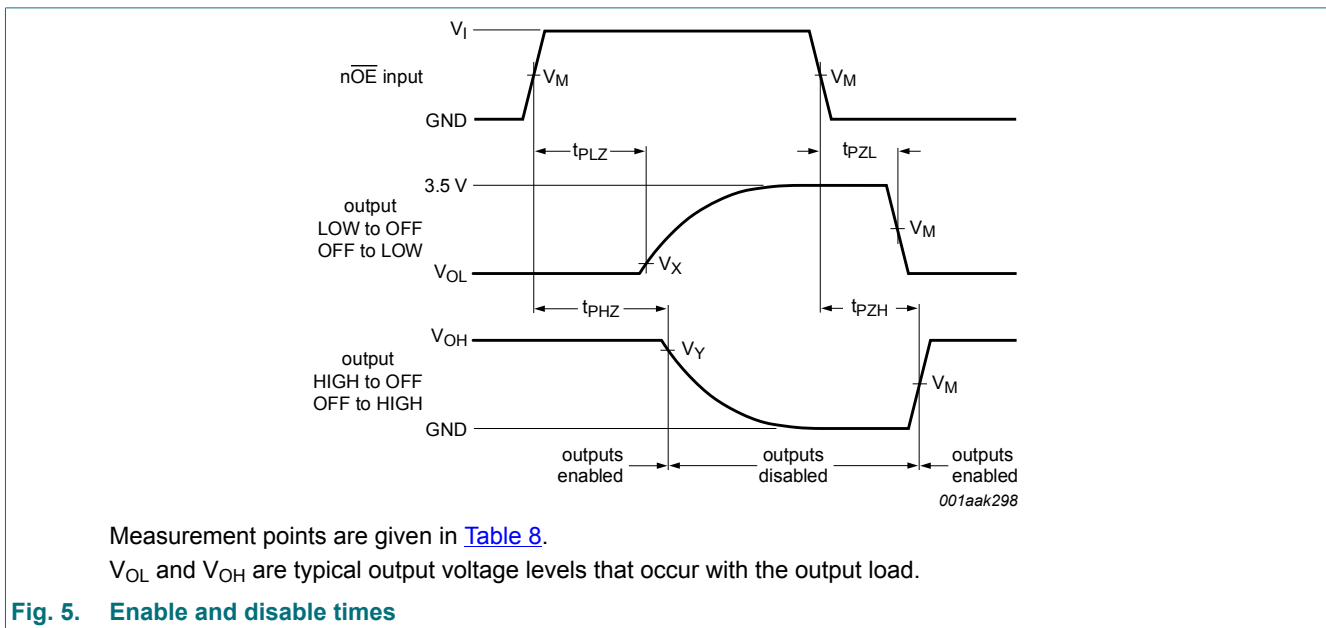
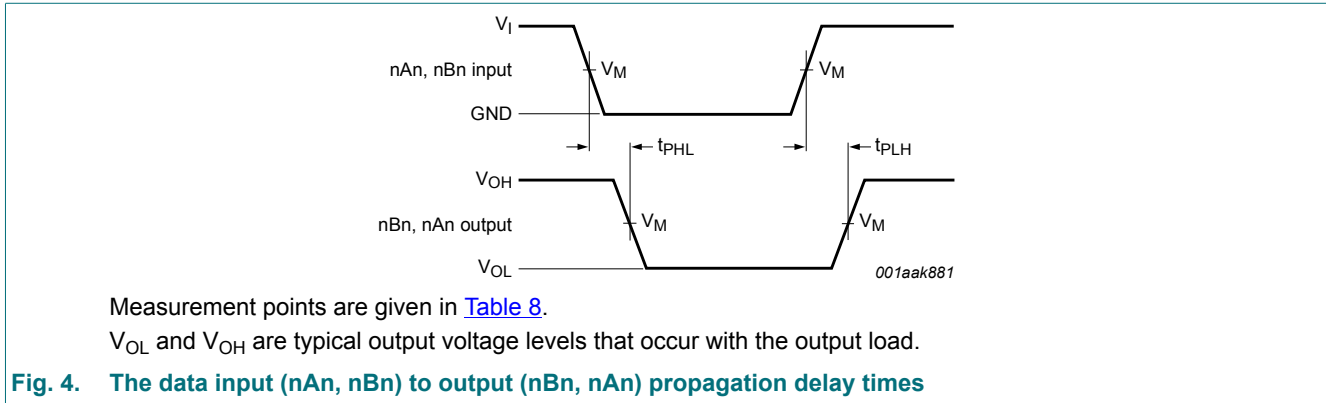
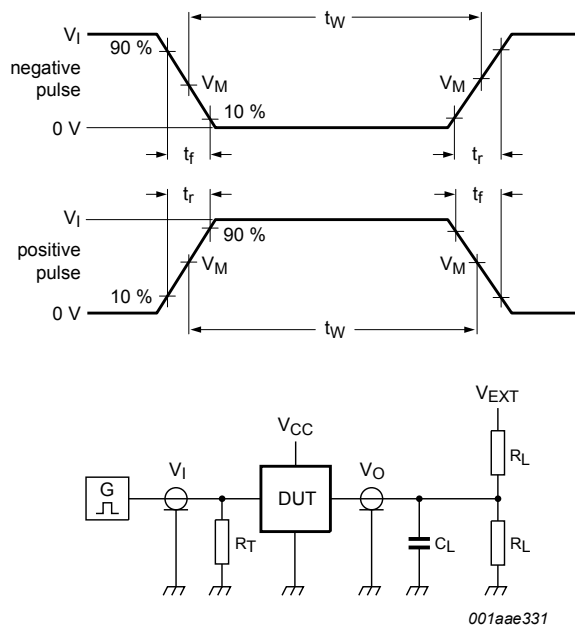


Table 8. Measurement points

Supply voltage	Input		Output		
$V_{CC}$	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$	GND to 3.0 V	1.5 V	1.5 V	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$



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

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz; Z<sub>o</sub> = 50 Ω.

The outputs are measured one at a time with one transition per measurement.

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.

V<sub>EXT</sub> = External voltage for measuring switching times.

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

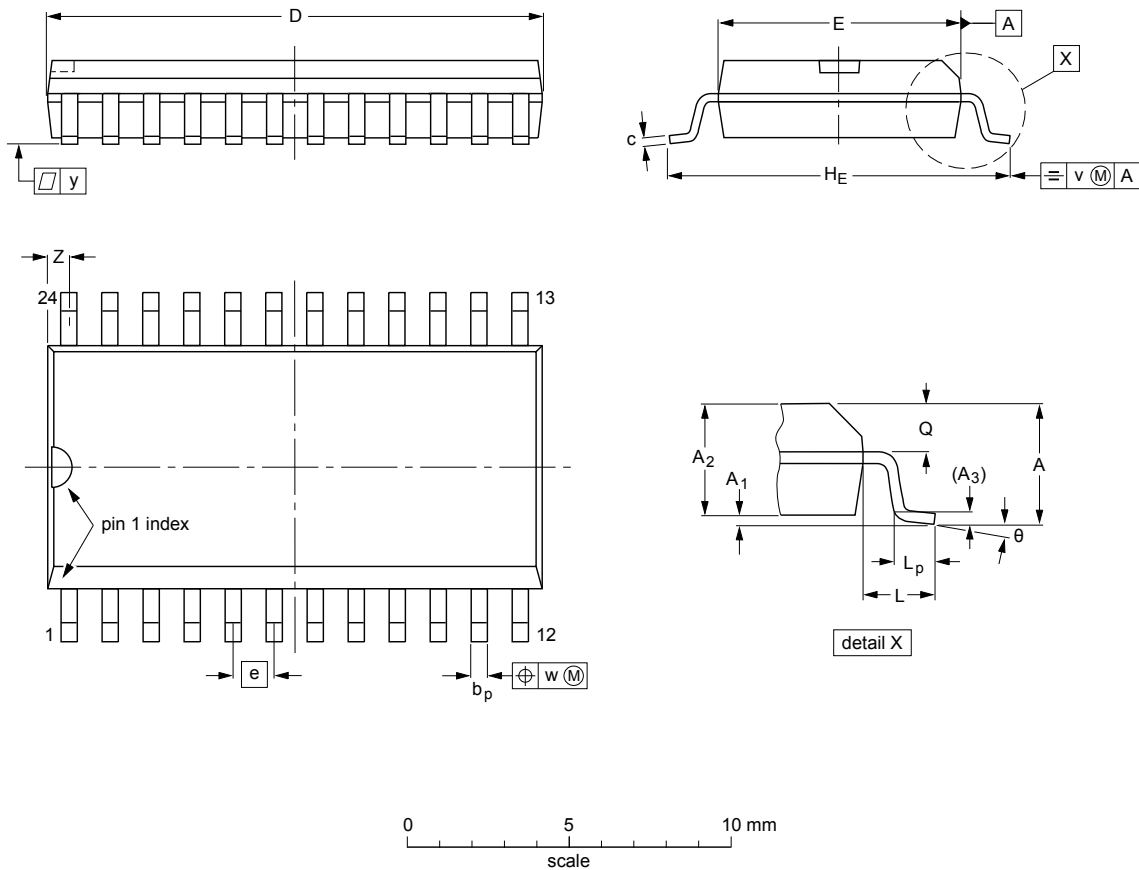
**Table 9. Test data**

Supply voltage	Input		Load		V <sub>EXT</sub>		
	V <sub>I</sub>	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PHZ</sub> , t <sub>PZH</sub>
V <sub>CC</sub> = 5.0 V ± 0.5 V	GND to 3.0 V	≤ 2.5 ns	50 pF	500 Ω	open	7.0 V	open

### 11. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

**Note**

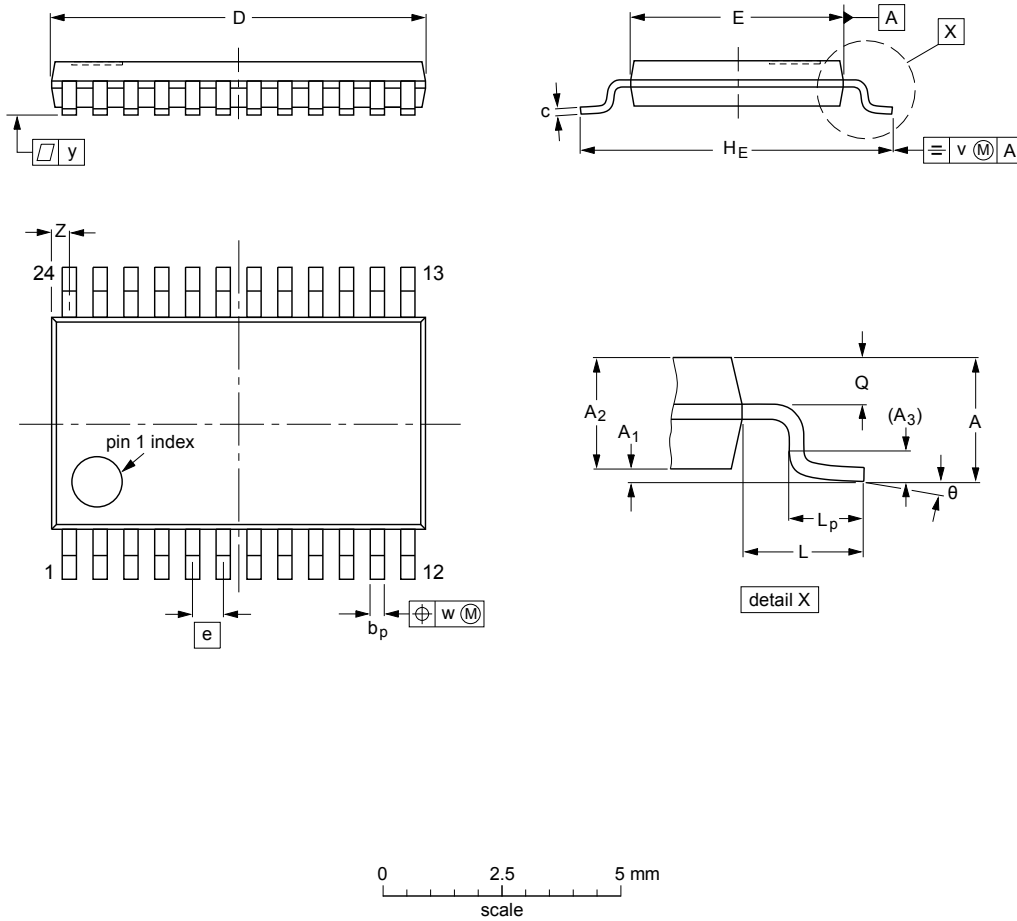
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT137-1	075E05	MS-013				-99-12-27 03-02-19

Fig. 7. Package outline SOT137-1 (SO24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	7.9 7.7	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	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	JEITA			
SOT355-1		MO-153				99-12-27 03-02-19

Fig. 8. Package outline SOT355-1 (TSSOP24)



## 12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
PRR	Pulse Rate Repetition
TTL	Transistor-Transistor Logic

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
CBT3384 v.7	20190306	Product data sheet	-	CBT3384 v.6
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number CBT3384DB (SOT340-1) and CBT3384DK (SOT556-1) removed.</li> </ul>			
CBT3384 v.6	20091102	Product data sheet	-	CBT3384 v.5
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>Changed: <a href="#">Table 6</a> <ol style="list-style-type: none"> <li>Pass voltage values have changed.</li> <li>Undershoot static current protection removed.</li> </ol> </li> <li>Changed: <a href="#">Table 7</a> <ol style="list-style-type: none"> <li>Enable and disable times values have changed.</li> </ol> </li> </ul>			
CBT3384 v.5	20011220	Product specification	-	CBT3384 v.4
CBT3384 v.4	20010319	Product specification	-	CBT3384 v.3
CBT3384 v.3	20001113	Product specification	-	CBT3384 v.2
CBT3384 v.2	20000128	Product specification	-	-

## 14. 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.

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## Contents

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<b>1. General description</b> .....	<b>1</b>
<b>2. Features</b> .....	<b>1</b>
<b>3. Ordering information</b> .....	<b>1</b>
<b>4. Functional diagram</b> .....	<b>2</b>
<b>5. Pinning information</b> .....	<b>2</b>
5.1. Pinning.....	2
5.2. Pin description.....	2
<b>6. Functional description</b> .....	<b>3</b>
<b>7. Limiting values</b> .....	<b>3</b>
<b>8. Recommended operating conditions</b> .....	<b>3</b>
<b>9. Static characteristics</b> .....	<b>4</b>
<b>10. Dynamic characteristics</b> .....	<b>4</b>
10.1. Waveforms and test circuit.....	5
<b>11. Package outline</b> .....	<b>7</b>
<b>12. Abbreviations</b> .....	<b>9</b>
<b>13. Revision history</b> .....	<b>9</b>
<b>14. Legal information</b> .....	<b>10</b>

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