

# CBT3861

10-bit bus switch with output enable

Rev. 3 — 21 November 2011

Product data sheet

## 1. General description

The CBT3861 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 CBT3861 device is organized as one 10-bit bus switches with one output enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the switch is on and port A is connected to the B port. When  $\overline{OE}$  is HIGH, each switch is disabled.

The CBT3861 is characterized for operation from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

## 2. Features and benefits

- 5  $\Omega$  switch connection between two ports
- TTL-compatible control input levels
- Multiple package options
- Latch-up protection exceeds 100 mA per JESD78
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ CDM JESD22-C101C exceeds 1000 V

## 3. Ordering information

Table 1. Ordering information

Type number	Package				Version
	Temperature range	Name	Description		
CBT3861PW	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm		SOT355-1
CBT3861DK	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	SSOP24 <sup>[1]</sup>	plastic shrink small outline package; 24 leads; body width 3.9 mm; lead pitch 0.635 mm		SOT556-1
CBT3861BQ	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	DHVQFN24	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body $3.5 \times 5.5 \times 0.85$ mm		SOT815-1

[1] Also known as QSOP24 package



## 4. Functional diagram

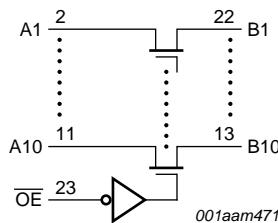


Fig 1. Logic diagram

## 5. Pinning information

### 5.1 Pinning

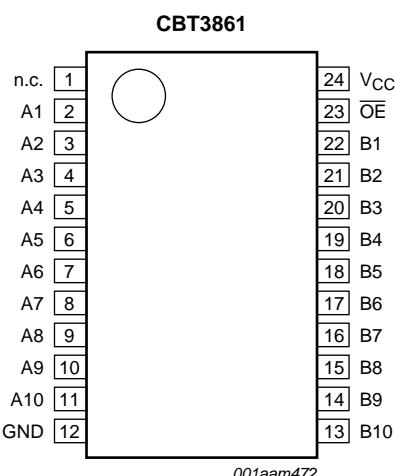


Fig 2. Pin configuration for TSSOP24 (SOT355-1)

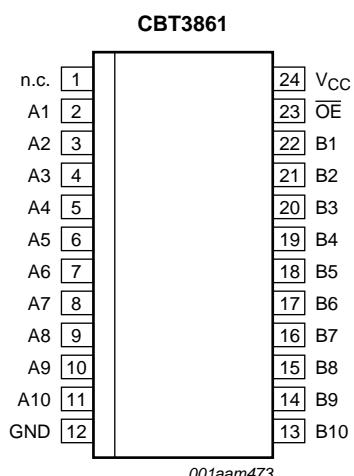
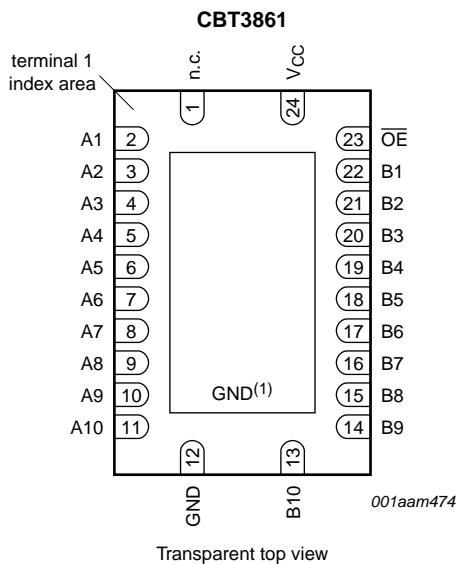


Fig 3. Pin configuration for SSOP24 (SOT556-1)



(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

**Fig 4.** Pin configuration for DHVQFN24 (SOT815-1)

## 5.2 Pin description

**Table 2.** Pin description

Symbol	Pin	Description
nc	1	not connected
A1 to A10	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	data input/output (A port)
GND	12	ground (0 V)
B1 to B10	22, 21, 20, 19, 18, 17, 16, 15, 14, 13	data input/output (B port)
OE	23	output enable input (active LOW)
V <sub>CC</sub>	24	positive supply voltage

## 6. Functional description

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

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

[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).<sup>[1]</sup>

$T_{amb}$  = -40 °C to +85 °C, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$V_I$	input voltage		[2] -0.5	+7.0	V
$I_O$	output current	$V_O < 0$ V	-	$\pm 128$	mA
$I_{IK}$	input clamping current	$V_{I/O} = 0$ V	-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C

[1] 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 [Section 8](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

[2] 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  $V_{CC}$  or GND to ensure proper device operation.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	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
$T_{amb}$	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	$T_{amb} = -40$ °C to +85 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	
$V_{IK}$	input clamping voltage	$V_{CC} = 4.5$ V; $I_I = -18$ mA	-	-	-1.2	V
$I_I$	input leakage current	$V_{CC} = 5.5$ V; $V_I = \text{GND}$ or 5.5 V	-	-	$\pm 1$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 5.5$ V; $I_O = 0$ mA; $V_I = V_{CC}$ or GND	-	-	3	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 5.5$ V; one input at 3.4 V, other inputs at $V_{CC}$ or GND	[2]	-	-	2.5 mA
$V_{pass}$	pass voltage	output HIGH; $V_I = V_{CC} = 5.0$ V; $I_O = -100$ $\mu\text{A}$	3.6	3.9	4.2	V
$C_I$	input capacitance	control pins; $V_I = 3$ V or 0 V	-	3.0	-	pF
$C_{io(off)}$	off-state input/output capacitance	port off; $V_I = 3$ V or 0 V; $\overline{OE} = V_{CC}$	-	5.0	-	pF

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			Unit	
			Min	Typ <sup>[1]</sup>	Max		
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

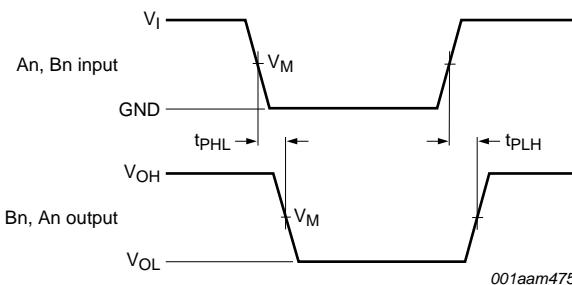
**Table 7. Dynamic characteristics**Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 7](#).

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	An, Bn to Bn, An; see <a href="#">Figure 5</a>	[1][2]					
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	-	0.25	-	0.25	ns
t <sub>en</sub>	enable time	OE to An or Bn; see <a href="#">Figure 6</a>	[2]					
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	3.3	-	1.6	7.5	ns
t <sub>dis</sub>	disable time	OE to An or Bn; see <a href="#">Figure 6</a>	[2]					
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	3.4	-	2.1	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>.t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

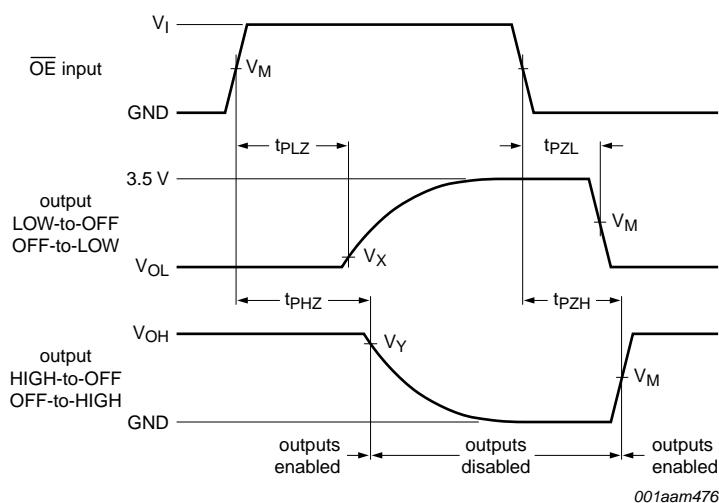
## 11. Waveforms



Measurement points are given in [Table 8](#).

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

**Fig 5. The data input (An, Bn) to output (Bn, An) propagation delay times**



Measurement points are given in [Table 8](#).

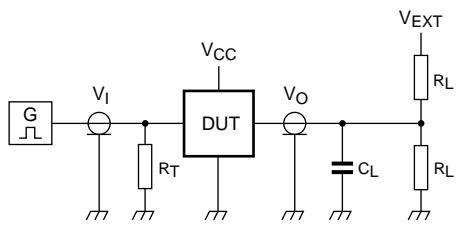
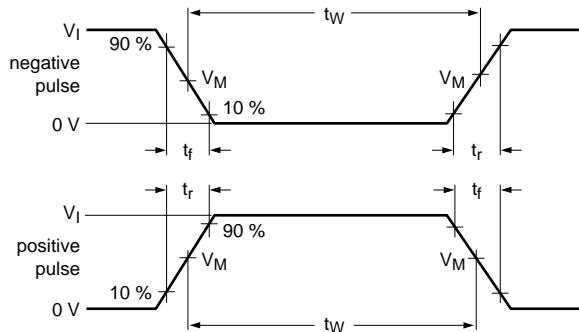
Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 6. Enable and disable times**

**Table 8. Measurement points**

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

## 12. Test information



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

All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz;  $Z_0 = 50 \Omega$ .

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

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 output impedance  $Z_0$  of the pulse generator.

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

**Fig 7. Test circuit for measuring switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	GND to 3.0 V	$\leq 2.5 \text{ ns}$	50 pF	500 $\Omega$	open	7.0 V	open

## 13. Package outline

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

SOT355-1

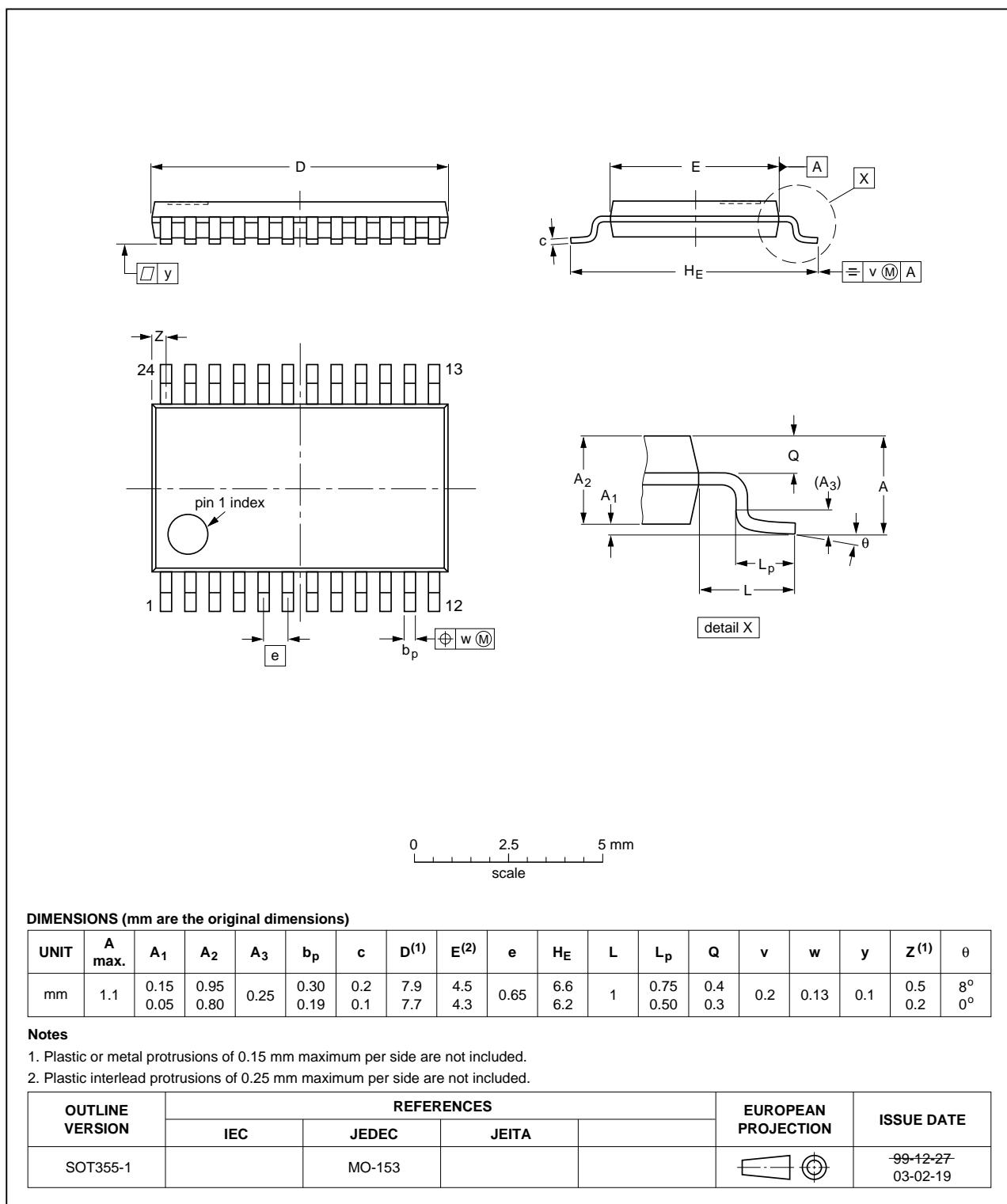
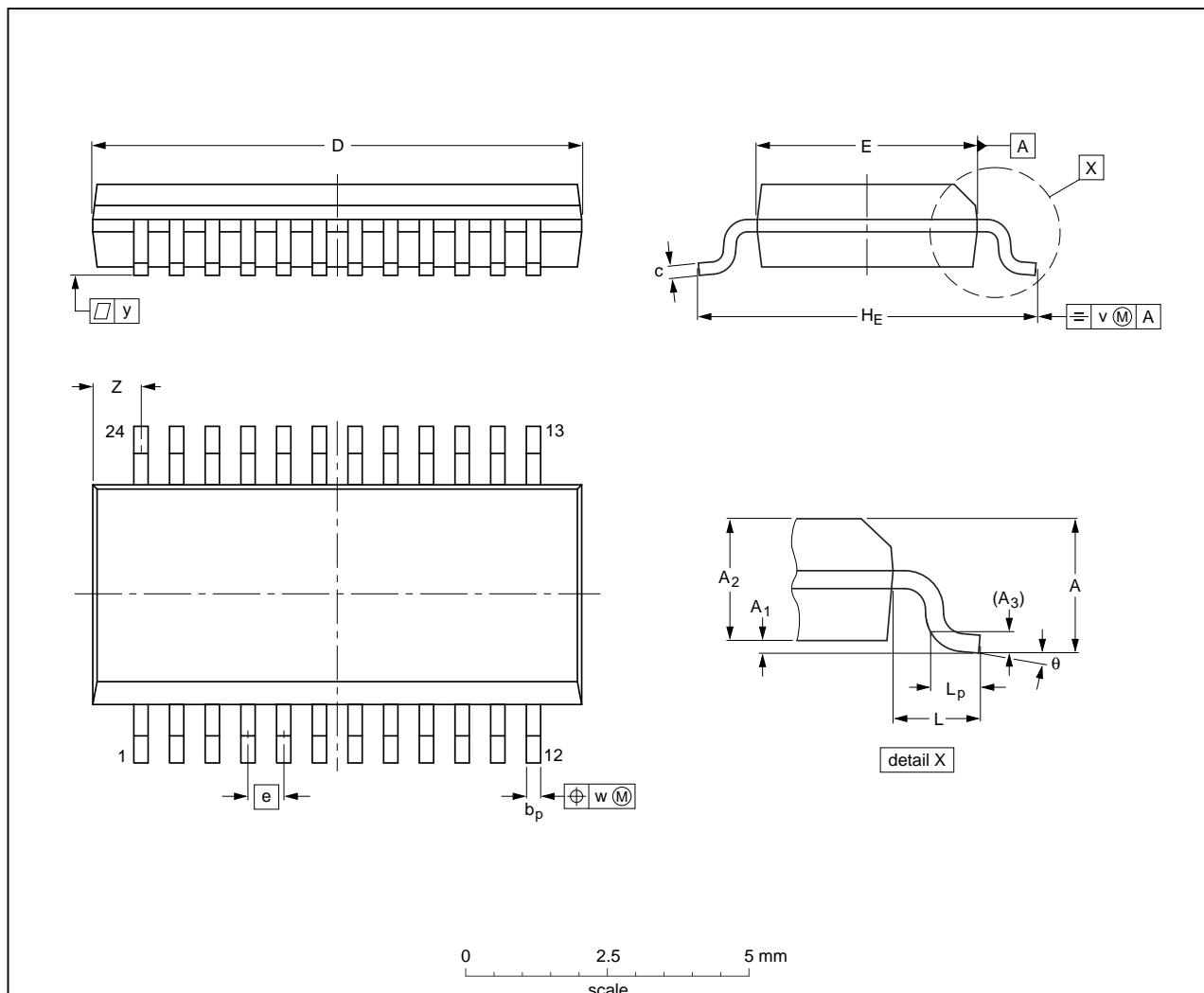


Fig 8. Package outline SOT355-1 (TSSOP24)

SSOP24: plastic shrink small outline package; 24 leads; body width 3.9 mm; lead pitch 0.635 mm SOT556-1



## DIMENSIONS (millimetre dimensions are derived from the original inch 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>	v	w	y	Z <sup>(1)</sup>	θ
mm	1.73	0.25 0.10	1.55 1.40	0.25	0.31 0.20	0.25 0.18	8.8 8.6	4.0 3.8	0.635	6.2 5.8	1	0.89 0.41	0.25	0.18	0.1	1.05 0.66	8° 0°
inches	0.068	0.0098 0.0040	0.061 0.055	0.01	0.012 0.008	0.0098 0.0075	0.344 0.337	0.157 0.150	0.025	0.244 0.228	0.041	0.035 0.016	0.01	0.007	0.004	0.040 0.026	8° 0°

## Note

1. Plastic or metal protrusions of 0.2 mm (0.008 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT556-1		MO-137				-99-12-27- 03-02-18

Fig 9. Package outline SOT556-1 (SSOP24)

DHVQFN24: plastic dual in-line compatible thermal enhanced very thin quad flat package;  
no leads; 24 terminals; body 3.5 x 5.5 x 0.85 mm

SOT815-1

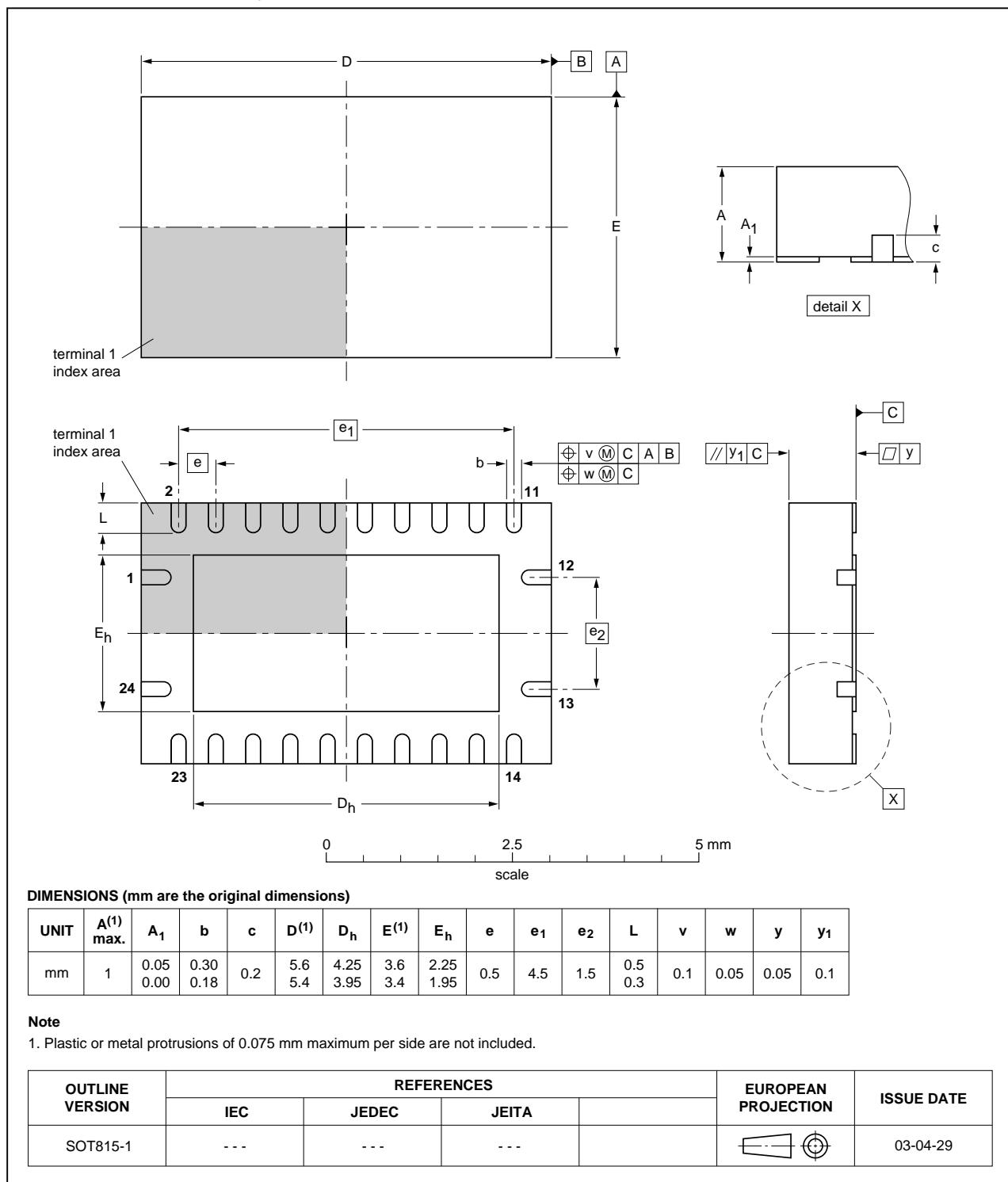


Fig 10. Package outline SOT815-1 (DHVQFN24)

## 14. Abbreviations

**Table 10. Abbreviations**

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

## 15. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
CBT3861 v.3	20111121	Product data sheet	-	CBT3861 v.2
Modifications:		• Legal pages updated.		
CBT3861 v.2	20101124	Product data sheet	-	CBT3861 v.1
CBT3861 v.1	20100819	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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".

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