

# DATA SHEET

## **CBT6810**

10-bit bus switch with precharged outputs  
and Schottky undershoot protection for  
live insertion

Product data  
Supersedes data of 2000 Jun 19

2002 Dec 13

# 10-bit bus switch with precharged outputs and Schottky undershoot protection for live insertion

## CBT6810

### FEATURES

- 5  $\Omega$  switch connection between port A and port B
- TTL compatible input and output levels
- Undershoot protection included to prevent shoot through level changes
- Bias voltage pre-charges the outputs to minimize signal distortion during live insertion
- Latch-up protection exceeds 500 mA per JESD78
- ESD protection exceeds 2000 V HBM per JESD22-A114, 200 V MM per JESD22-A115 and 1000 V CDM per JESD22-C101

### DESCRIPTION

The CBT6810 provides ten bits of high-speed TTL-compatible bus switching. The low on-state resistance of the switch allows bi-directional connections to be made while adding near-zero propagation delay. The device also precharges the B port to a user-selectable bias voltage (BIASV) to minimize live-insertion noise.

The CBT6810 is organized as one 10-bit switch with a single enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is low, the switch is on and port A is connected to port B. When  $\overline{OE}$  is high, the switch between port A and port B is open and the B port is precharged to BIASV through the equivalent of a 10-k $\Omega$  resistor.

The CBT6810 is characterized for operation from -40 to +85  $^{\circ}\text{C}$ .

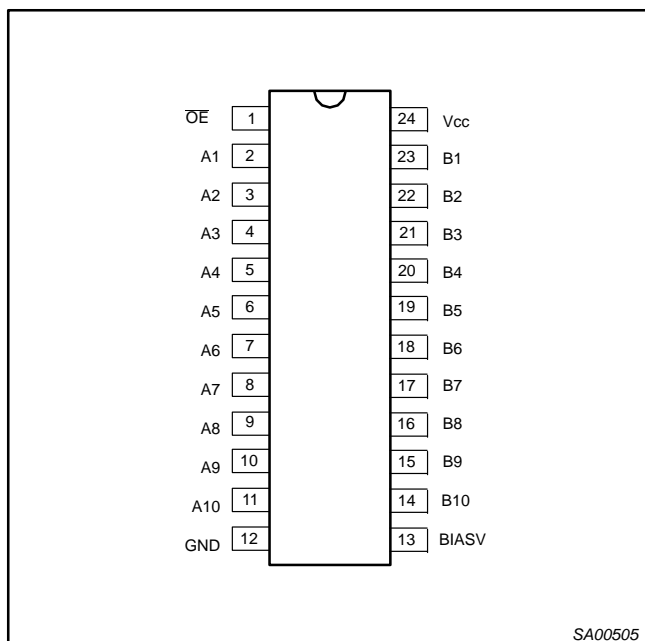
### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{\text{amb}} = 25^{\circ}\text{C}; \text{GND} = 0 \text{ V}$	TYPICAL	UNIT
$t_{\text{PLH}}$ $t_{\text{PHL}}$	Propagation delay An to Bn or Bn to An	$C_L = 50 \text{ pF}; V_{\text{CC}} = 5 \text{ V}$	250	ps
$C_{\text{IN}}$	Input capacitance	$V_I = 0 \text{ V}$ or $V_{\text{CC}}$	3.5	pF
$C_{\text{IO}}$	Input/output capacitance	Outputs disabled; $V_O = 0 \text{ V}$ or $V_{\text{CC}}$	9.0	pF

### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DWG NUMBER
24-Pin Plastic TSSOP	-40 to +85 $^{\circ}\text{C}$	CBT6810PW	SOT355-1
24-Pin Plastic SSOP (QSOP)	-40 to +85 $^{\circ}\text{C}$	CBT6810DK	SOT556-1

### PIN CONFIGURATION



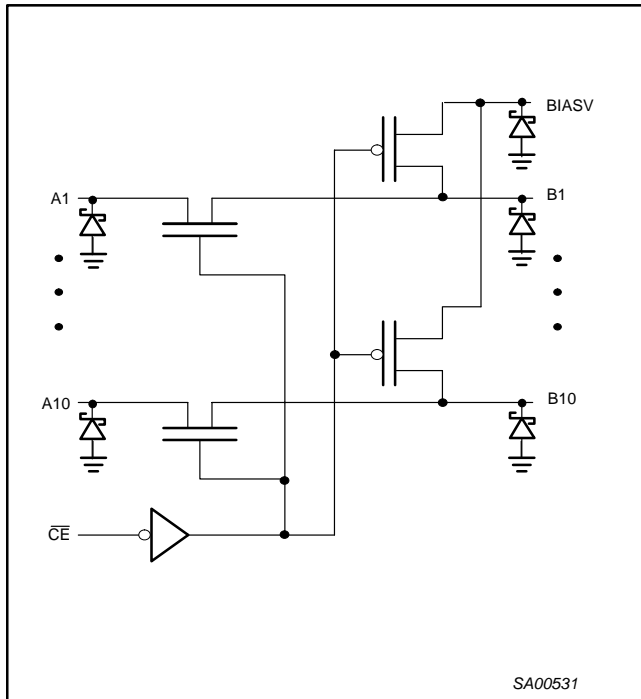
### PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	$\overline{OE}$	Output enable
13	BIASV	Precharge bias voltage input
2, 3, 4, 5, 6, 7, 8, 9, 10, 11	A1-A10	A - port side
23, 22, 21, 20, 19, 18, 17, 16, 15, 14	B1-B10	B - port side with active pullup
12	GND	Ground (V)
24	$V_{\text{CC}}$	Positive supply voltage

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## LOGIC SYMBOL



## FUNCTION TABLE

OE	STATE
L	A port = B port
H	A port = Z
H	B port = BIASV

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

## ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V <sub>CC</sub>	DC supply voltage		-0.5 to +7.0	V
I <sub>IK</sub>	DC clamp diode current		-50	mA
V <sub>I</sub>	DC input voltage <sup>3</sup>		-0.5 to +7.0	V
I <sub>SW</sub>	DC continuous channel current		± 128	mA
T <sub>stg</sub>	Storage temperature range		-65 to 150	°C
BIASV	DC Bias voltage range		-0.5 to 7.0	V
θ <sub>JA</sub>	Power dissipation per package Plastic thin shrink small outline package		134	°C/W

### NOTES:

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 "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
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. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		Min	Max	
$V_{CC}$	DC supply voltage	4.0	5.5	V
BIASV	DC supply voltage	1.3	$V_{CC}$	V
$V_{IH}$	High-level input voltage (control pin)	2.0	—	V
$V_{IL}$	Low-level Input voltage (control pin)	—	0.8	V
$T_{amb}$	Operating free-air temperature range	-40	+85	°C

## DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			$T_{amb} = -40 \text{ to } +85 \text{ } ^\circ\text{C}$			
			Min	Typ <sup>1</sup>	Max	
$V_{IK}$	Input clamp voltage	$V_{CC} = 4.5 \text{ V}; I_I = -18 \text{ mA}$	—	—	-1.2	V
$I_I$	Input leakage current (control pin)	$V_{CC} = 5.5 \text{ V}; V_I = \text{GND or } 5.5 \text{ V}$	—	—	$\pm 5$	$\mu\text{A}$
$I_O$	Output bias current (B pins)	$V_{CC} = 4.5 \text{ V}; \text{BiasV} = 2.4 \text{ V}; V_O = 0, \text{OE} = V_{CC}$	—	—	-0.25	mA
$I_{CC}$	Quiescent supply current	$V_{CC} = 5.5 \text{ V}; I_O = 0, V_I = V_{CC} \text{ or GND}$	—	—	2.5	mA
$\Delta I_{CC}$	Control pins <sup>2</sup>	$V_{CC} = 5.5 \text{ V}$ , one input at 3.4 V, other inputs at $V_{CC}$ or GND	—	—	2.5	mA
$C_I$	Control pins	$V_I = 3 \text{ V or } 0$	—	3.5	—	pF
$C_{O(\text{OFF})}$	Terminal capacitance	$V_O = 3 \text{ V or } 0$ ; switch off	—	9.0	—	pF
$r_{on}^3$	On-resistance	$V_{CC} = 4.5 \text{ V}; V_I = 0 \text{ V}; I_I = 64 \text{ mA}$	—	5	7	$\Omega$
		$V_{CC} = 4.5 \text{ V}; V_I = 0 \text{ V}; I_I = 30 \text{ mA}$	—	5	7	
		$V_{CC} = 4.5 \text{ V}; V_I = 2.4 \text{ V}; I_I = -15 \text{ mA}$	—	10	15	
$V_P$	Pass voltage	$V_{IN} = V_{CC} = 5.0 \text{ V}; I_{out} = -100 \mu\text{A}$	3.4	3.6	3.9	V
$I_{USP}^4$	Undershoot static current protection	$V_{CC} = 5.0 \text{ V}, \text{BiasV} = V_{CC}$ $I_B = -5 \mu\text{A}, V_B \geq 3 \text{ V}$	—	-10	—	mA

### NOTES:

- All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_{amb} = 25^\circ\text{C}$
- 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.
- Force  $I_{USP}$  measure  $V_B \geq 3 \text{ V}$

# 10-bit bus switch with precharged outputs and Schottky undershoot protection for live insertion

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## AC CHARACTERISTICS FOR $V_{CC} = 5.0 \pm 0.5 \text{ V}$ RANGE

$GND = 0 \text{ V}$ ;  $t_r = t_f \leq 2.5 \text{ ns}$ ;  $C_L = 50 \text{ pF}$ .

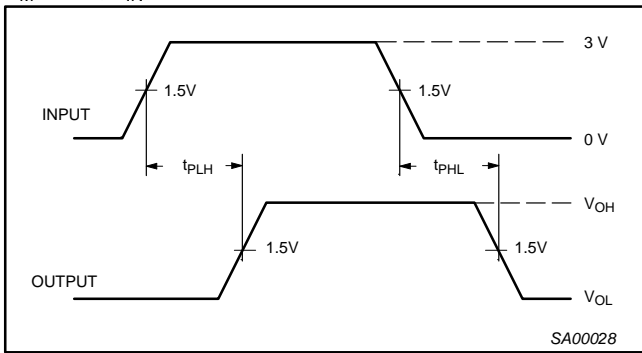
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$T_{amb} = -40 \text{ to } +85^\circ\text{C}$			
			MIN	TYP <sup>1</sup>	MAX	
$t_{pd}$	Propagation delay An to Bn; Bn to An <sup>2</sup>	1			0.25	ns
$t_{pZH}$	3-State output enable time OE to An; OE to Bn; BIASV = GND	2	1.8	3.5	5.3	ns
$t_{pZL}$	3-State output enable time OE to An; OE to Bn; BIASV = 3.0V	2	2.1	4.2	7.2	ns
$t_{pHZ}$	3-State output enable time $\overline{\text{OE}}$ to An; $\overline{\text{OE}}$ to Bn; BIASV = GND	2	1.7	3.7	6.1	ns
$t_{pLZ}$	3-State output enable time $\overline{\text{OE}}$ to An; $\overline{\text{OE}}$ to Bn; BIASV = 3.0V	2	1.0	5.5	7.3	ns

**NOTE:**

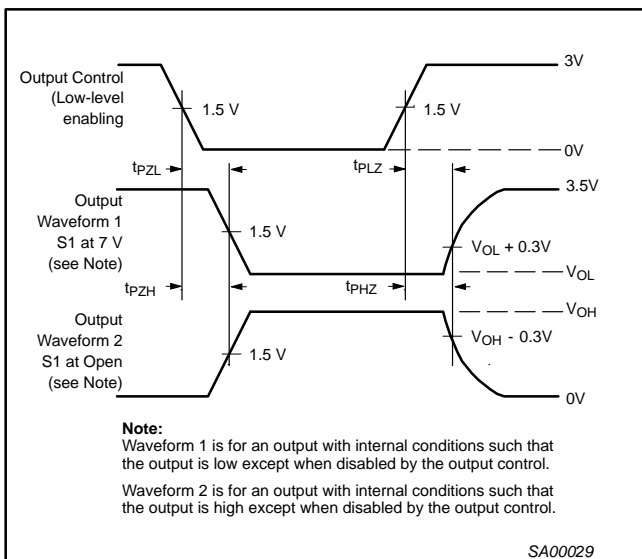
- All typical values are measured at  $T_{amb} = 25^\circ\text{C}$  and  $V_{CC} = 5.0 \text{ V}$
- Warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON-state resistance of the switch and a load capacitance of 50pF, when driven by an ideal voltage source (zero output impedance)

### AC WAVEFORMS

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



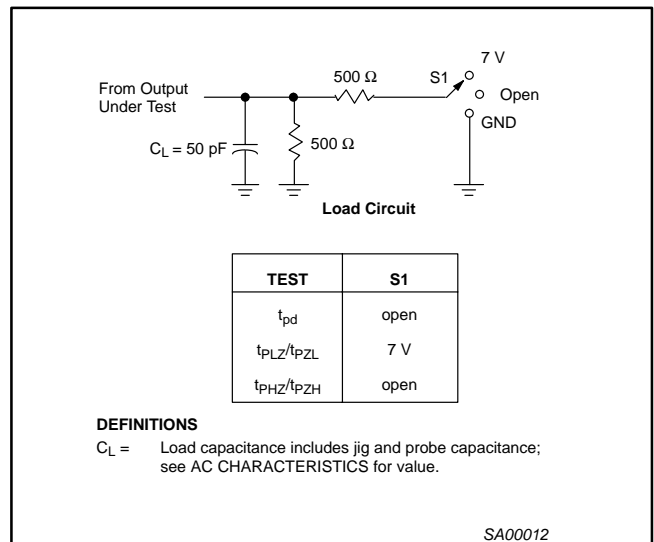
**Waveform 1. Waveforms Showing the Input (An) to Output (Yn) Propagation Delays**



**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. Waveforms Showing the 3-State Output Enable and Disable Times**

### TEST CIRCUIT AND WAVEFORMS



**DEFINITIONS**

$C_L =$  Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

**NOTES:**

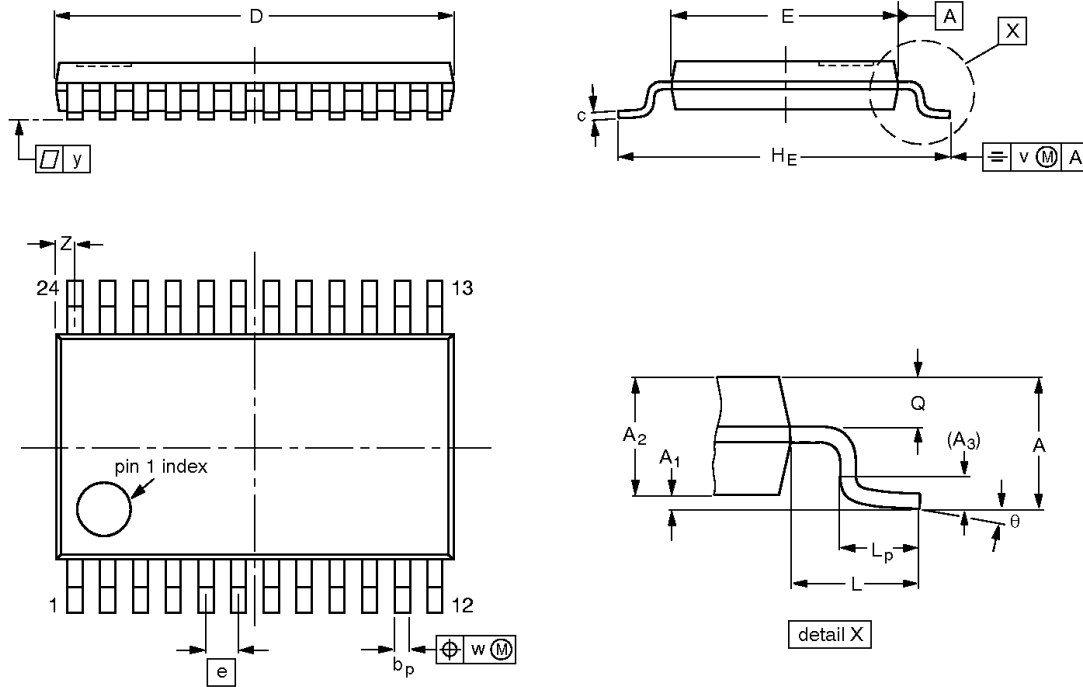
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
- The outputs are measured one at a time with one transition per measurement.

# 10-bit bus switch with precharged outputs and Schottky undershoot protection for live insertion

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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	1.10	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	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.

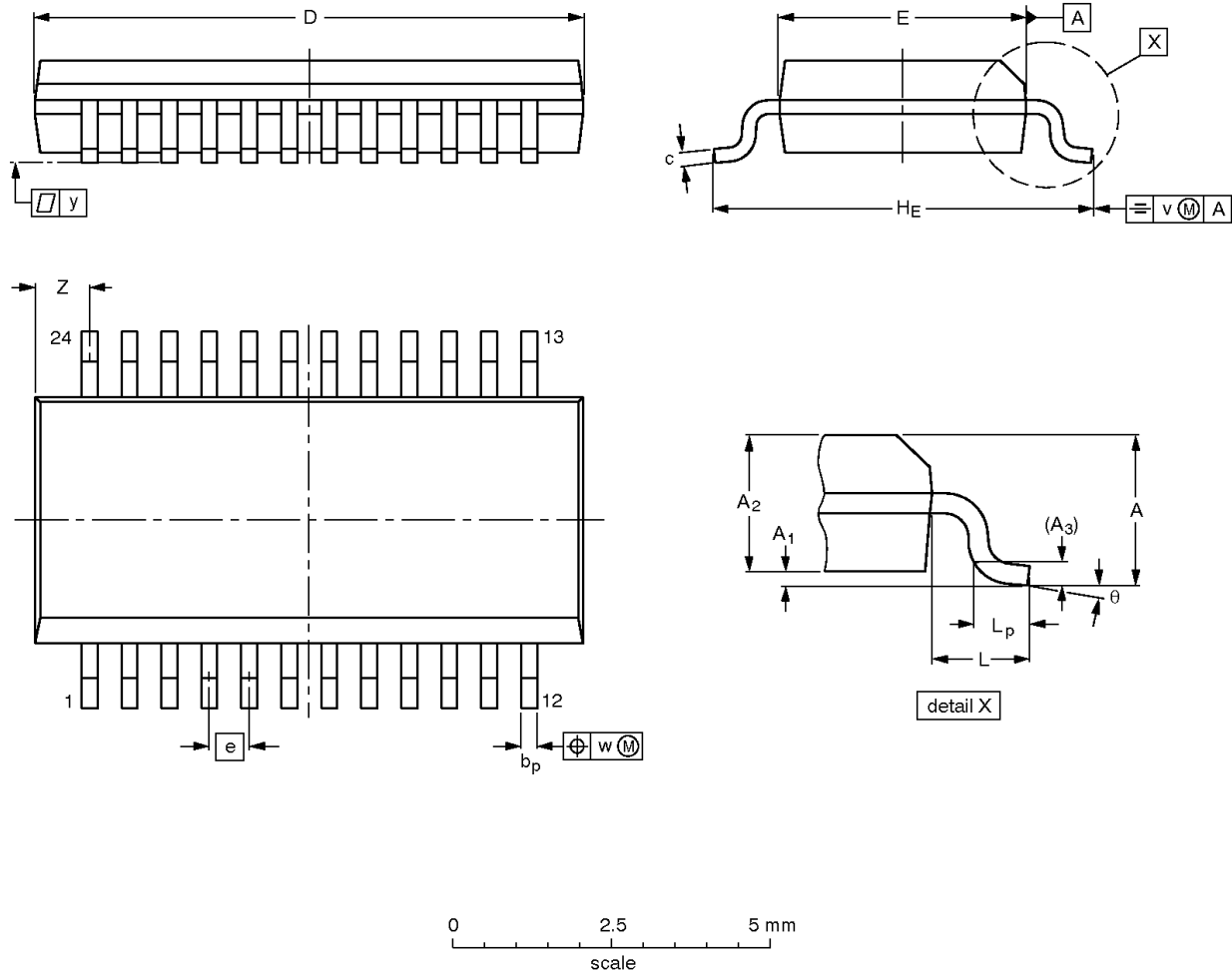
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT355-1		MO-153				95-02-04 99-12-27

# 10-bit bus switch with precharged outputs and Schottky undershoot protection for live insertion

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**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	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	0.010	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	0.010	0.007	0.004	0.040 0.026	8° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT556-1		MO-137			99-05-05 99-12-27

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**CBT6810****REVISION HISTORY**

<b>Rev</b>	<b>Date</b>	<b>Description</b>
_3	20021213	Product data (9397 750 10871); ECN 853-2151 29159 of 06 November 2002. Modifications: <ul style="list-style-type: none"><li>• New package release.</li></ul>
_2	20000619	Product data (9397 750 07214); ECN 853-2151 23905 of 19 June 2000.



# 10-bit bus switch with precharged outputs and Schottky undershoot protection for live insertion

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