



# **Cross Bar Switch (CBT)**

**October 2006**

# Agenda

- Introduction
- Application
- Device Overview
- Selection and Status
- Roadmap

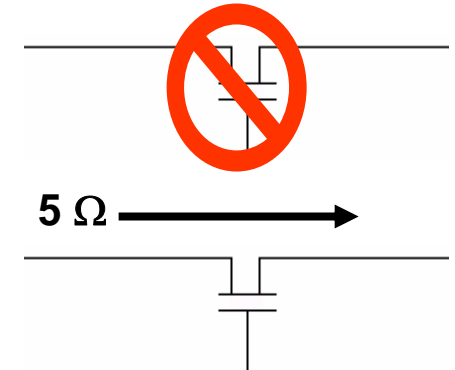


# Introduction

# What is CBT?

- CBT is **C**ross **B**ar Switch **T**echnology
  - Also known as Quick Switch (QS), FST or PI5C
- Consists of a simple n-channel MOS transistor

- ✓ **When the switch is open, it provides isolation (3-state) to voltage/current**
- ✓ **When the switch is closed, it imposes a near-zero prop delay through  $5\ \Omega$  resistance**



- Operates at 4.5 to 5.5 V and  $-40$  to  $+85\ ^\circ\text{C}$
- Offered in various functions, bit widths and pinouts
- Offered in SO, SSOP, QSOP, TSSOP, TVSOP, PLCC and HVQFN packages

# CBT Summary

- Industry standard pin-outs
- TTL - Compatible input and output levels
- Near-zero propagation delays (250 ps typical)
- Isolation, Bus Exchange and Mux/Demux functions
- Used in:
  - Communications (servers/set top box)
  - Computing applications

# CBT Devices

5V

- CBT3125
- CBT3126
- CBT3244A
- CBT3245A
- CBT3251
- CBT3253A
- CBTS3253
- CBT3257A
- CBTS3257
- CBT3306
- CBTD3306
- CBTS3306

5V

- CBT3384
- CBTD3384
- CBTS3384
- CBT6800
- CBT6810
- CBT6820
- CBT6832
- CBT6832C
- CBT6832D
- CBT6832E
- CBT16210
- CBTD16210

5V

- CBT16211
- CBTD16211
- CBT16212
- CBTD16212
- CBTD16213
- CBT16292

2.5V

- CBTV4010
- CBTV4020



# Applications

# What Type of CBT Functions are there?

## Bus Switch

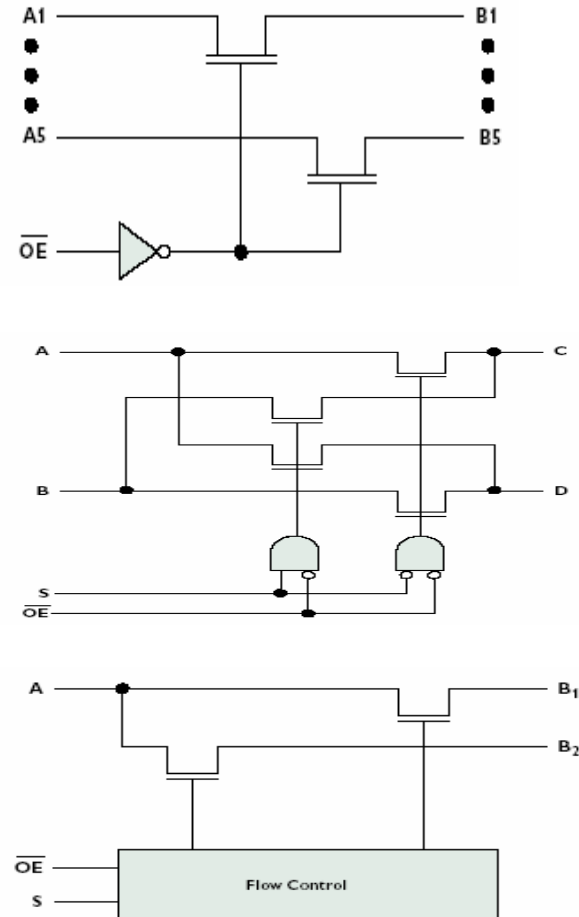
Single line with FET to turn signal on and off. Can be flow-through pinout or with both I/Os on the same side. Possible features include internal diode for level shifting and/or Schottky diode for undershoot protection.

## Bus Exchanger

Two lines that can be connected straight through, crossed or one-to-two, depending on the control pin position. Flow-through pinout. Features include internal level shifting diode.

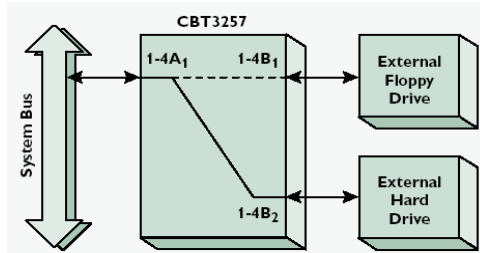
## Mux/Demux

One line to two, four or eight lines to multiplex signals. Features include internal level shifting diode and Schottky undershoot diode.

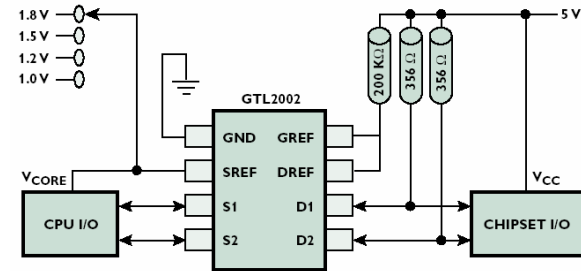


# What is CBT used for?

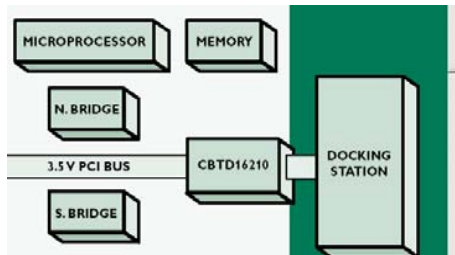
## General Purpose Switching



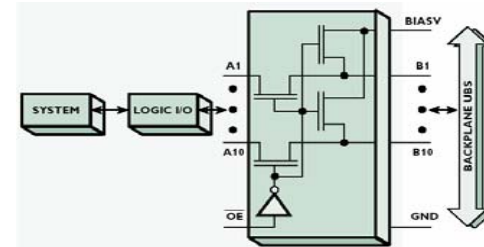
## Voltage Level Translation



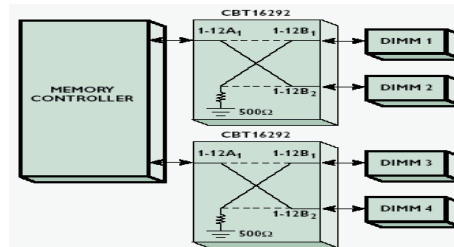
## Notebook Docking Support



## PCI Hot Card Insertion

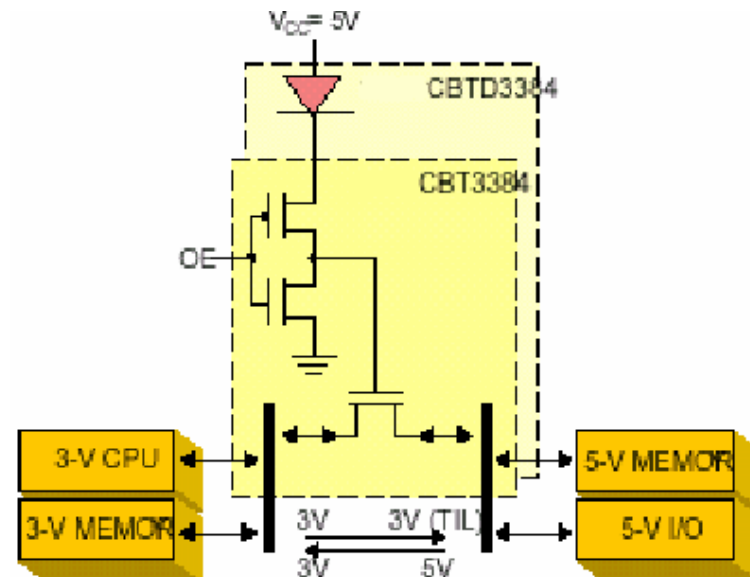
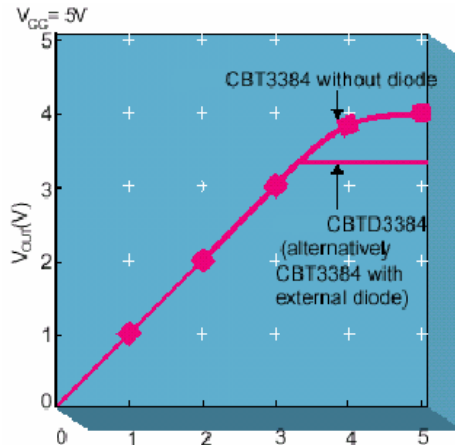


## Memory Interleaving



# What is CBTD?

- N-channel transistors clamp CBT output by approx. 1V
- As a result, CBTs with an external diode or CBTs with an internal diode (D) provide 5V to 3.3V translation with virtually no added propagation delay or direction control
- Option on bus switches and multiplexers/demultiplexers



# What is CBTS?

## Undershoot Protection

Undershoot conditions can occur on busses that are poorly terminated, on signals with fast edge rates or on busses that allow hot swapping. When undershoot occurs, voltage potential reaches a level that can turn on NMOS transistors or other parasitic bipolar elements.

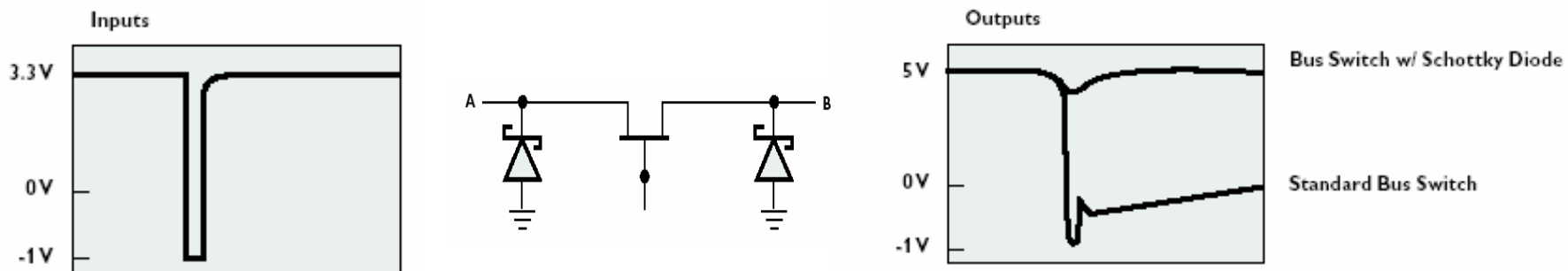
## Schottky diode protection (CBTS)

Schottky diodes integrated within the device conduct over voltage to GND, clamping the inputs and outputs, which helps to prevent undershoot.

## Charge Pump Protection

The charge pump charges the device substrate negatively, suppressing the parasitic NPN between the source and drain of the pass transistor, which helps prevent undershoot.

## Option on PCI Hot Card and other bus switches

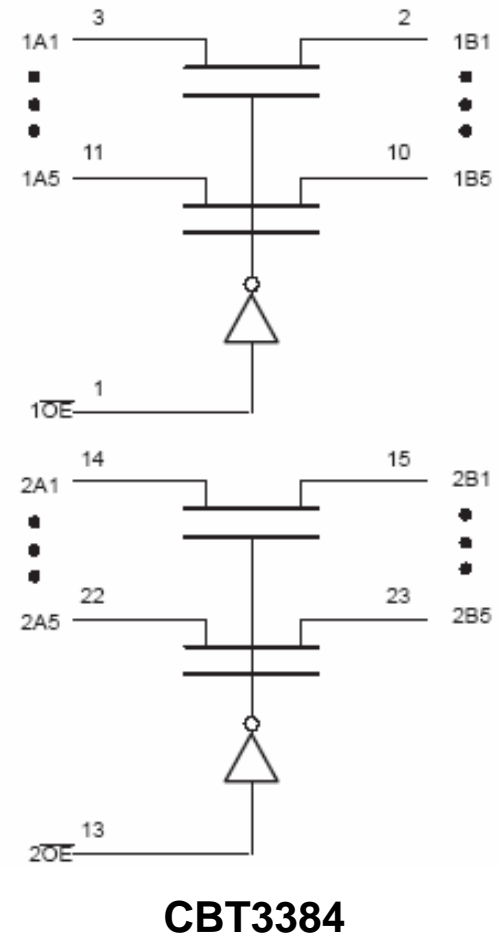




# Device Overview

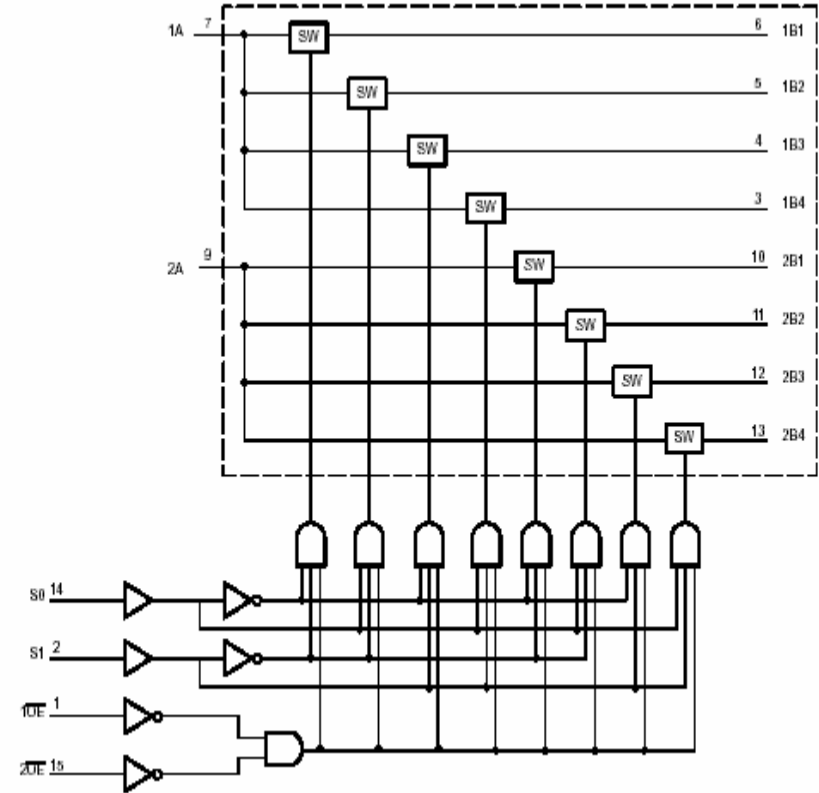
# CBT Bus Switch - General Purpose

Device	# of Bits	# of Bits per Enable	Flow Through Pinout	Level Shift Diode	Schottky Undershoot Diode
CBT3306	2	1			
CBTD3306	2	1		x	
CBTS3306	2	1			x
CBT3125	4	1			
CBT3126	4	1			
CBT3244A	8	4	x		
CBT3245A	8	8	x		
CBT3384	10	5			
CBTD3384	10	5		x	
CBTS3384	10	5			x
CBT16210	20	10	x		
CBTD16210	20	10	x	x	
CBT16211	24	12	x		
CBTD16211	24	12	x	x	



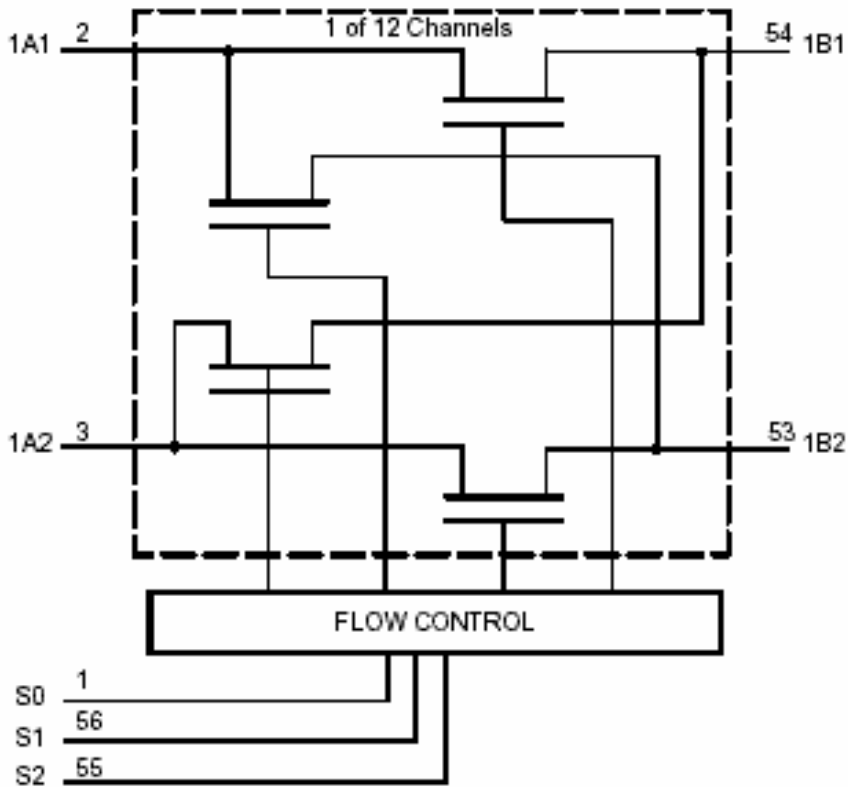
# CBT Mux/Demux - General Purpose

Device	# of Bits	Mux/Demux	Schottky Undershoot Diode
CBT3251	1	1 of 8	
CBT3253A	2	1 of 4	
CBTS3253	2	1 of 4	x
CBT3257A	4	1 of 2	
CBTS3257	4	1 of 2	x



**CBT3253A**

# CBT Bus Exchanger - Notebook Docking

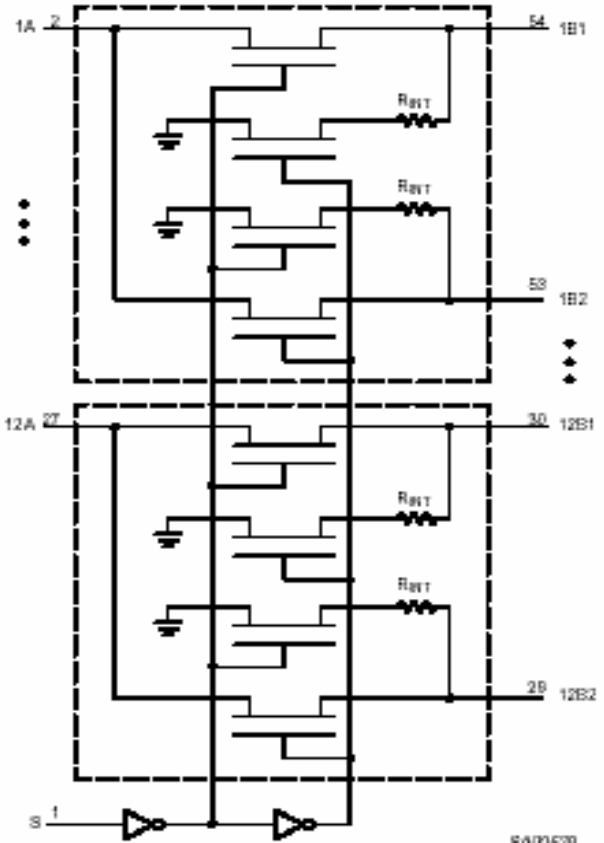


**CBT16212**

Device	# of Bits	Flow Through Pinout	Level Shift Diode
<b>CBT16212</b>	<b>24</b>	<b>x</b>	
<b>CBTD16212</b>	<b>24</b>	<b>x</b>	<b>x</b>
<b>CBTD16213</b>	<b>24</b>	<b>x</b>	<b>x</b>

# CBT for Memory - Interleaving Applications

Device	Type of Bus Switch	# of Bits	# of Bits per Enable	Mux/Demux	Flow Through Pinout	Internal Pull Down Resistor
CBT3857	Bus Switch	10	10		x	x
CBT16292	Mux/Demux	12		1 of 2	x	x
CBTV4010	Mux/Demux	10		1 of 4		x
CBTV4020	Mux/Demux	20		1 of 2		x

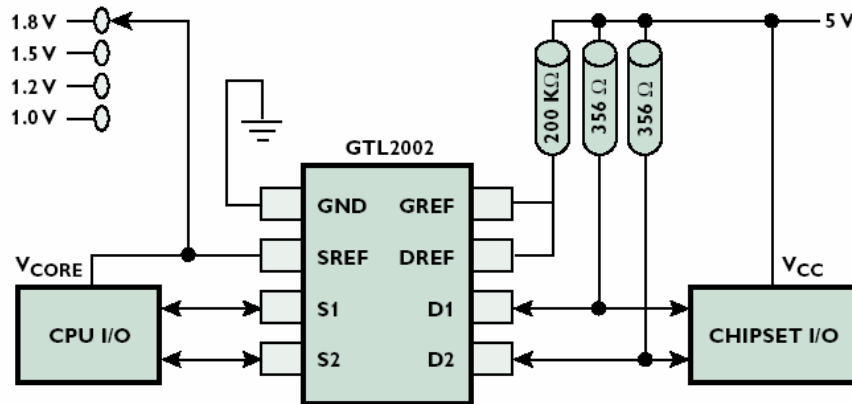


**CBT16292**



# Voltage Translation

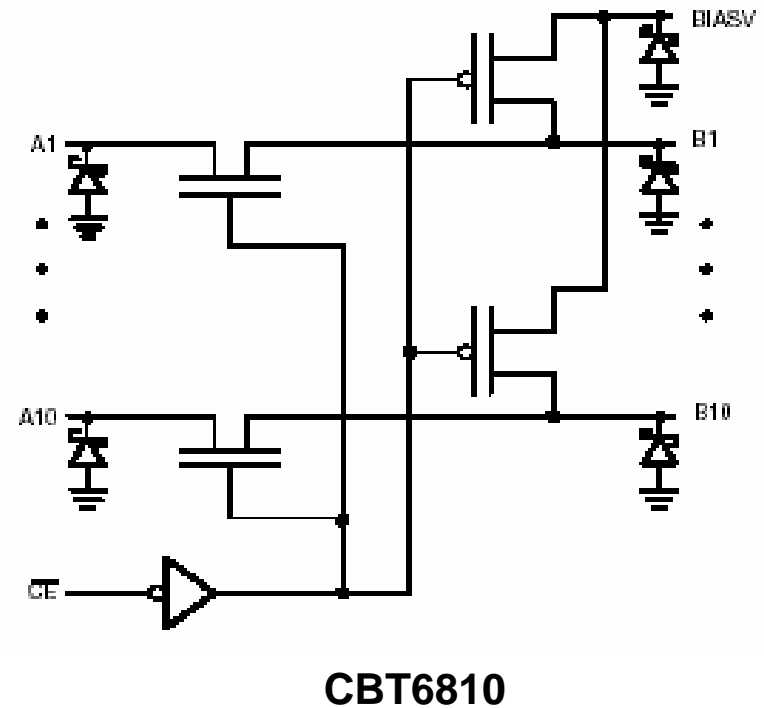
- Voltage translation between any voltage from 1.0 V to 5.5 V
- Reference voltage clamps the output voltage with low propagation delay
- Used for translation from 1.0 V or 1.5 V or 1.8 V I<sup>2</sup>C bus to 3.3 V SMBus and/or 5 V I<sup>2</sup>C bus
- No direction pin required for bi-directional translations
- BiCMOS process provides excellent ESD performance
- Application Note AN10145 Bi-Directional Voltage Translators provides more information on applications and implementation



- **GTL2002 2-Bit**
- **GTL2003 8-bit**
- **GTL2010 10-Bit**
- **GTL2000 22-Bit**

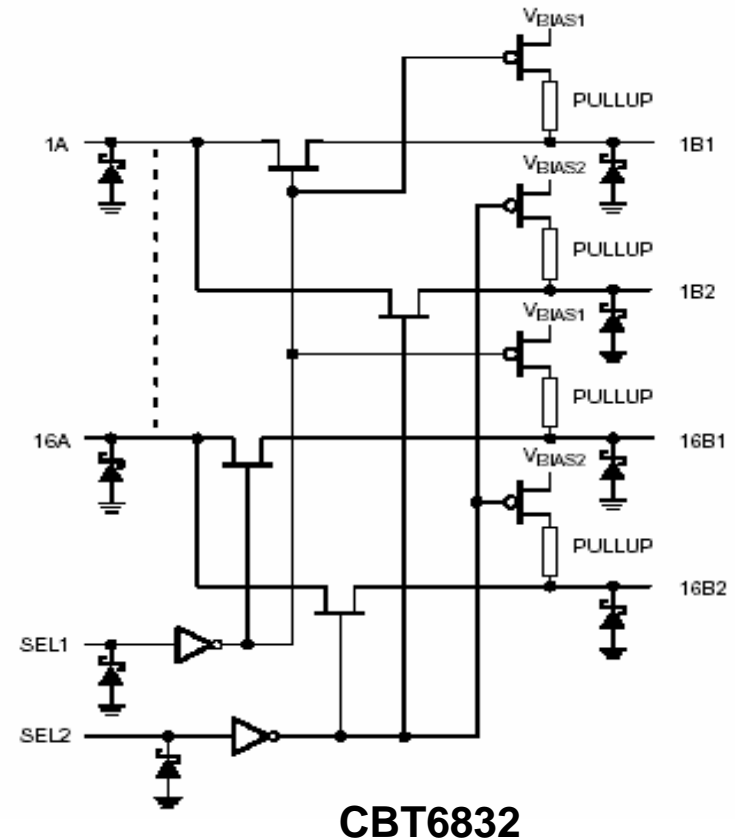
# Bus Switch CBT with Precharge for PCI Hot Card Insertion Applications

Device	# of Bits	# of Bits per Enable	Flow Through Pinout	Schottky Undershoot Diode	Precharged Outputs
CBT6800	10	10	x		x
CBT6810	10	10	x	x	x
CBT6820	20	10	x	x	x



# Mux/Demux CBT with Precharge for PCI Hot Card Insertion Applications

Device	# of Bits	Mux/Demux	Schottky Undershoot Diode	Charge Pump Undershoot	Precharged Outputs
CBT6832	16	1 of 2	x		x
CBT6832C	16	1 of 2	x	x	x
CBT6832D	16	1 of 2	Delay	Delay	x
CBT6832E	16	1 of 2	Delay		x





# **Selection and Status**

# General Purpose CBT - Octal

Device	Description	Pin Count	SOIC	SSOP	QSOP	TSSOP	Samples	Sales
CBT3125	Quadruple FET Bus Switch	14	D		DS	PW	Now	Now
CBT3126	Quadruple FET Bus Switch	14	D		DS	PW	Now	Now
CBT3244A	Octal Bus Switch with Quad Output Enables	20	D	DB	DK	PW	Now	Now
CBT3245A	Octal Bus Switch with Output Enable	20	D	DB	DK	PW	Now	Now
CBT3251	1-of-8 multiplexer/demultiplexer with internal pulldown resistors	16	D	DB	DS	PW	Now	Now
CBT3253A	Dual 1-of-4 multiplexer/demultiplexer with internal pulldown resistors	16	D	DB	DS	PW	Now	Now
CBTS3253	Dual 1-of-4 multiplexer/demultiplexer with Schottky Undershoot	16	D	DB	DS	PW	Now	Now
CBT3257A	4-bit 1-of-2 multiplexer/demultiplexer with internal pulldown resistors	16	D	DB	DS	PW	Now	Now
CBTS3257	4-bit 1-of-2 multiplexer/demultiplexer with Schottky Undershoot	16	D	DB	DS	PW	Now	Now
CBT3306	Dual FET Bus Switch	8	D			PW	Now	Now
CBTD3306	Dual FET Bus Switch with Level Shifting	8	D			PW	Now	Now
CBTS3306	Dual FET Bus Switch with Schottky Undershoot	8	D			PW	Now	Now
CBT3384	10-Bit Bus Switch with 5-bit Output Enables	24	D	DB	DK	PW	Now	Now
CBTD3384	10-Bit Bus Switch with 5-bit Output Enables and Level Shifting	24	D	DB	DK	PW	Now	Now
CBTS3384	10-Bit Bus Switch with 5-bit Output Enables and Schottky Undershoot	24	D	DB	DK	PW	Now	Now

# General Purpose CBT - Widebus

Device	Description	Pin Count	SSOP	TSSOP	TSSOP	Samples	Sales
CBT16210	20-Bit Bus Switch with 10-Bit Output Enables	56	DL	DGG	DGV	Now	Now
CBTD16210	20-Bit Bus Switch with 10-Bit Output Enables with Level Shifting	56	DL	DGG	DGV	Now	Now
CBT16211	24-Bit Bus Switch with 12-Bit Output Enables	56	DL	DGG		Now	Now
CBTD16211	24-Bit Bus Switch with 12-Bit Output Enables with Level Shifting	56	DL	DGG		Now	Now
CBT16212	24-Bit Bus Exchange Switch with 12-Bit Output Enables	56	DL	DGG		Now	Now
CBTD16212	24-Bit Bus Exchange Switch with 12-Bit Output Enables with Level Shifting	56	DL	DGG		Now	Now
CBTD16213	24-Bit Bus Exchange Switch with 12-Bit Output Enables with Level Shifting	56	DL	DGG		Now	Now
CBT16292	12-bit 1-of-2 multiplexer/demultiplexer with internal pulldown resistors	56	DL	DGG		Now	Now

# GTL - Voltage Translation

Device	Description	Pin Count	SO	SSOP	TSSOP	HVQFN	VSSOP	HQFN	Samples	Sales
GTL2000	20-Bit Voltage Translator	48		DL	DGG				Now	Now
GTL2002	2-Bit Voltage Translator	8	D		DP		DC	GM	Now	Now
GTL2003	8-Bit Voltage Translator	20			PW	BQ			4Q06	1Q07
GTL2010	10-Bit Voltage Translator	24			PW	BS			Now	Now

# PCI Hot Plug CBT

Device	Description	Pin Count	TSSOP	Samples	Sales
CBT6800	10-Bit Bus Switch with Precharged Outputs for Live Insertion	24	PW	Now	Now
CBT6810	10-Bit Bus Switch with Precharged Outputs and Schottky Undershoot Protection for Live Insertion	24	PW	Now	Now
CBT6820	20-bit Bus Switch with Precharged Outputs and Schottky Undershoot Protection for Live Insertion	48	DGG	Now	Now
CBT6832	16-Bit 1-of-2 Multiplexer/Demultiplexer with Schottky Undershoot Protection for Live Insertion	56	DGG	Now	Now
CBT6832C	16-Bit 1-of-2 Multiplexer/Demultiplexer with Charge Pump Undershoot Protection for Live Insertion	56	DGG	Now	Now
CBT6832D	16-Bit 1 of 2 Delayed Enable Multiplexer/ Demultiplexer with Charge Pump Protection for Live Insertion	56	DGG	Now	Now
CBT6832E	16-Bit 1 of 2 Delayed Enable Multiplexer/ Demultiplexer with Schottky Undershoot Protection for Live Insertion	56	DGG	Now	Now

# Memory Data CBT

Device	Description	Pin Count	SSOP	TSSOP	PLCC	Samples	Sales
CBT16292	12-bit 1-of-2 multiplexer/demultiplexer with internal pulldown resistors	56	DL	DGG		Now	Now
CBT3857	10-Bit Bus Switch with 10kW Pull-down Termination Resistors	24		PW		Now	Now
CBTV4010	10-Bit DDR SDRAM Mux/Bus Switch	64			EE	Now	Now

The image consists of a solid blue vertical bar on the left side. A large yellow arrow points from the blue bar towards the right, with its tip on the left and its tail on the right. The background is a solid dark green color. The word "Roadmap" is written in white, bold, sans-serif font, centered within the yellow arrow.

# Roadmap

# Roadmap

- Philips continues to evaluate the Bus Switch market and is the primary source of high performance low voltage Bus Switches and will continue to expand the portfolio including alternate source of industry standard Bus Switches in Pico Gate, QSOP and HVQFN/DQFN packages

