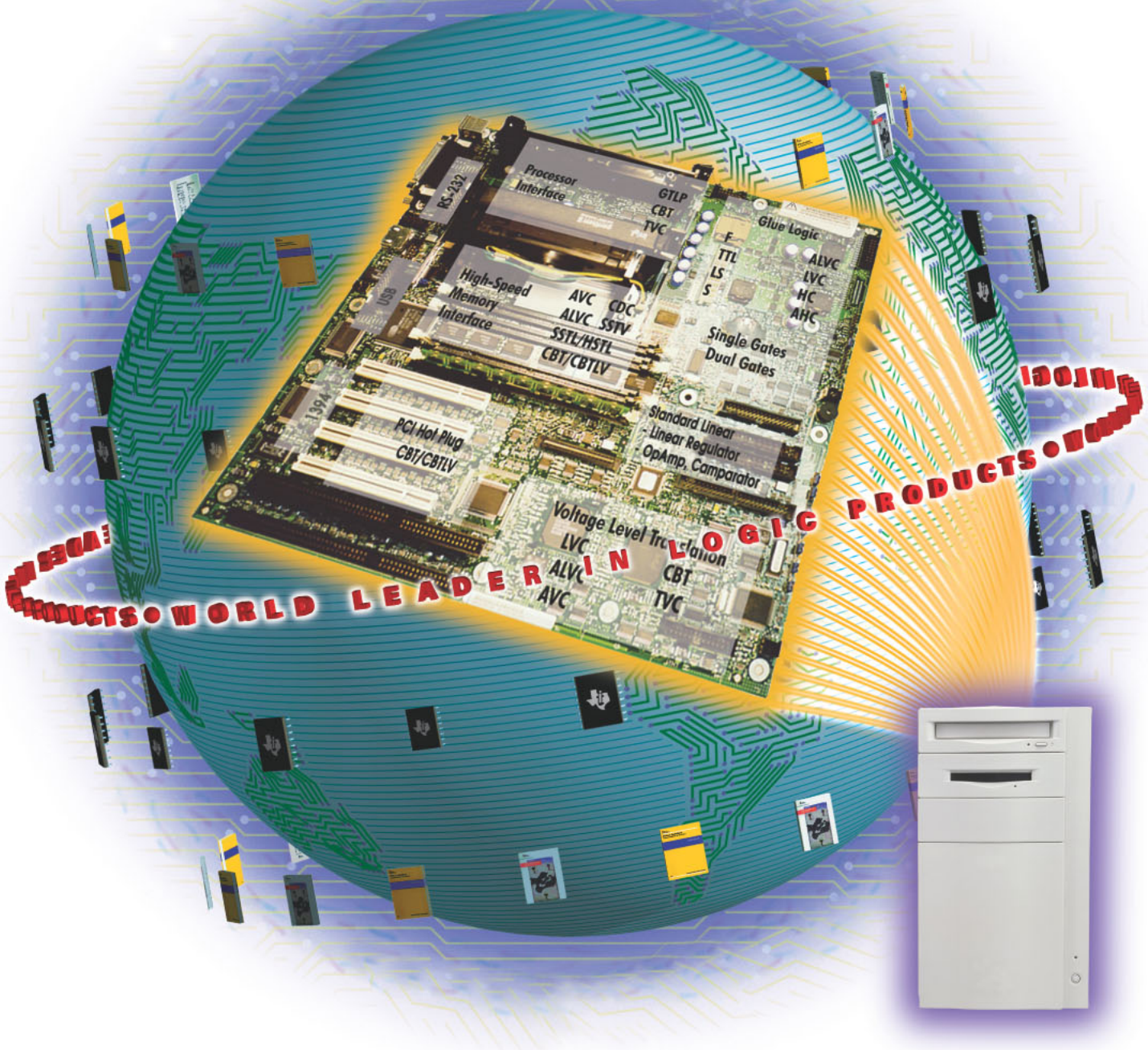
Texas Instruments

RELIABLE. LOGIC. INNOVATION.™

STANDARD LINEAR AND LOGIC SOLUTIONS GUIDE FOR PCS, SERVERS AND MOTHERBOARDS

2Q 2002



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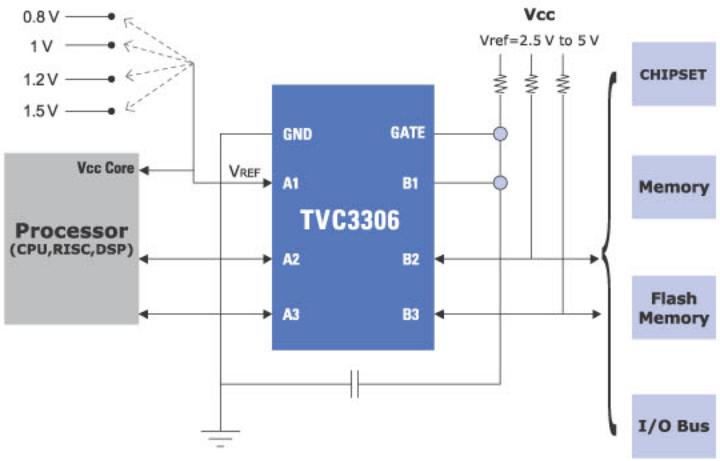
CPU/Switching Level Shifter

Bi-Directional Level Shifter (<1.8V)



Features ▸

- No logic supply-voltage required (no internal control logic)
- Acts as a voltage translator or voltage clamp
- 7Ω on resistance with gate at 3.3V
- Pass transistor current 64 mA
- Direct interface with GTL+ levels
- Accepts any I/O voltage from 0 to 5.5V
- Speed
  - 3.3V(Gate)=0.5ns
  - 2.5V(Gate)=0.6ns
  - 1.5V(Gate)=0.8ns

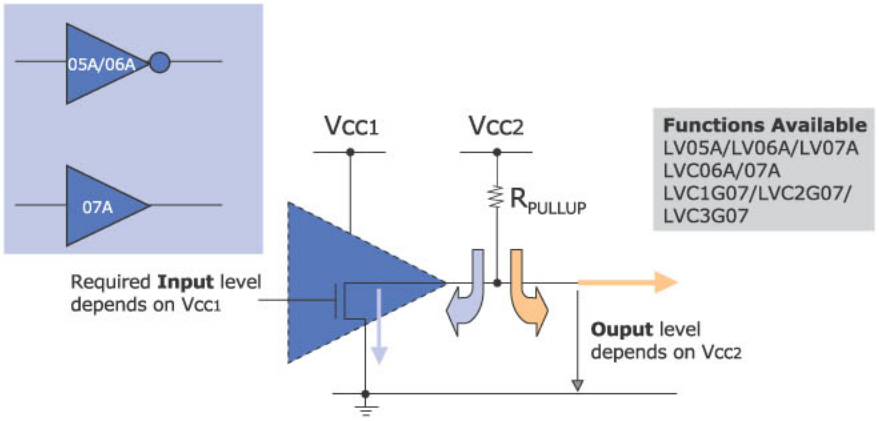
Applications ▸

- PC, Desktop
- Telecommunication

Device Name	Description	No. Pins	Package
SN74TVC3010	10-Bit Translation Voltage Clamps	24	SOIC/ SSOP/ TSSOP/ TVSOP
SN74TVC16222A	22-Bit Translation Voltage Clamps	48	SSOP/ TSSOP/ TVSOP
SN74TVC3306	2-Bit Translation Voltage Clamps	8	DCT/ DCU

CPU/Switching Level Shifter

Uni-Directional Voltage Translator by Open-Drain



Features ▸

- Operating Vcc LVC = 1.65V-5.5V, LV = 2V-5.5V
- Inputs and open-drain outputs
- Latch-Up performance 250mA (LVC), 100mA (LV/LVC3G)
- 5V I/O tolerant
- Supports mixed-mode voltage operation
- Good for voltage translator for CPUs

Applications ▸

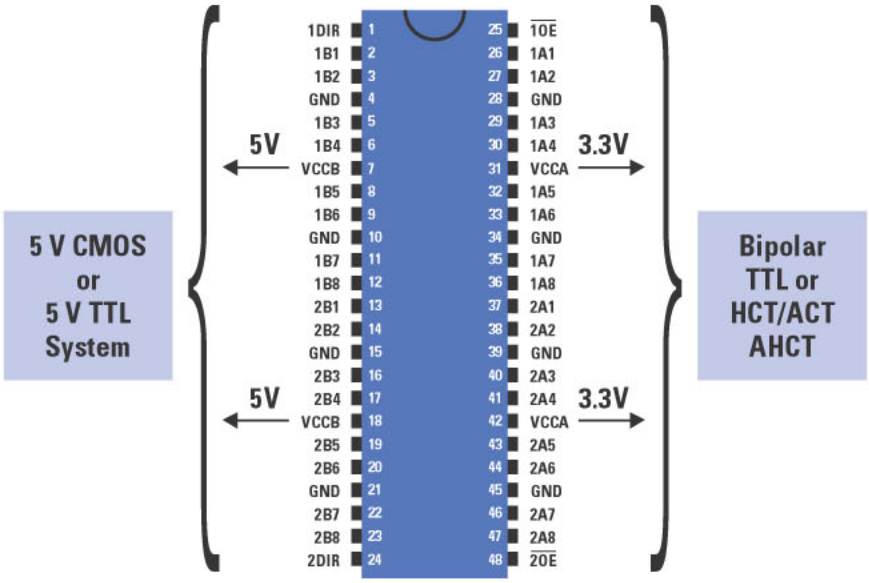
- PC, Desktop
- Portable Equipment

Performance Comparison

Supply Voltage Vcc1	LV05A / 06A / 07A Vi Level	LV05A / 06A / 07A Speed (ns)	LVC06A / 07A Vi Level	LVC06A / 07A Speed (ns)	LVC1G07A / 2G07A / 3G07A Vi Level	LVC1G07A / 2G07A / 3G07A Speed (ns)	Pullup resistor may be connected to Vcc2	Level conversion range (Vcc1)
1.8	-	-	1.8	1-3.5	1.8	2.4-3.8	1.8,2.5,3.3 and 5	1.8 →1.8-5.5
2.5	2.5	6.6-10.4	2.5	1-2.8	2.5	1-5.5	1.8,2.5,3.3 and 5	2.5 →1.8-5.5
3.3	3.3	5-7.1	3.3	1-2.9	3.3	1.5-4.2	1.8,2.5,3.3 and 5	3.3 →1.8-5.5
5	5	3.4-5.5	5	1-2.6	5	1-3.5	1.8,2.5,3.3 and 5	5 →1.8-5.5

CPU/Switching Level Shifter

Dual Vcc Level Shifter for CMOS



Features ▸

8-Bit Transceiver

- **SN74LVC4245**
  VccA = 5 V , VccB = 3.3 V
- **SN74LVCC3245A**
  VccA = 2.3 V - 3.6 V, VccB = 3 V - 5.5 V
- **SN74LVCC4245A**
  VccA = 4.5 V - 5.5 V, VccB = 2.7 V - 5.5 V

16-Bit Transceiver

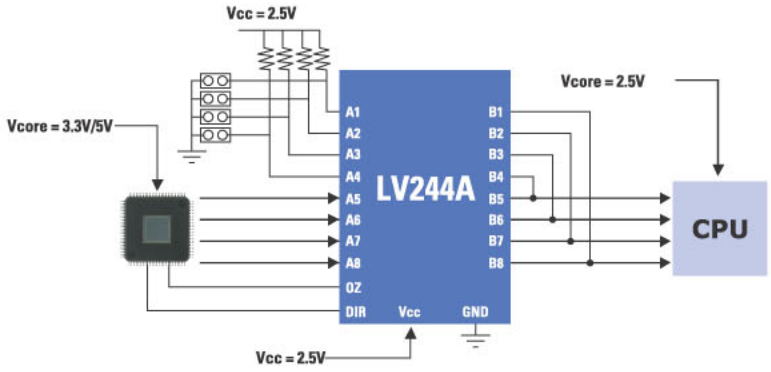
- **SN74ALVC164245**
  VccA = 2.3 V - 3.6 V, VccB = 3 V - 5.5 V
- **SN74AVCA1642451**
- **SN74AVCB164245**
  VccA / VccB = 1.1 V - 3.6 V

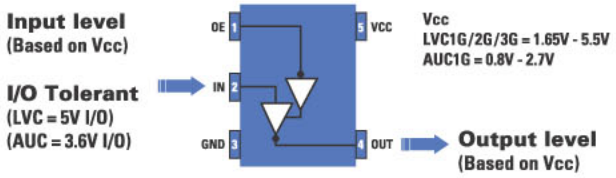
Performance Comparison

Parameter Name	SN74LVC4245	SN74LVCC3245A	SN74LVCC4245A	SN74ALVC164245	SN74AVCA164245*
Voltage Nodes (VccA)	5	2.3 - 3.6	5	2.3 - 3.6	1.1 - 3.6
Voltage Nodes (VccB)	3.3	3 - 5.5	2.7 - 5.5	3 - 5.5	1.1 - 3.6
No. of Bits	8	8	8	16	16
CMOS Level-Shifter					
5 V CMOS, LVTTL	Yes	Yes	Yes	Yes	No
5 V CMOS, 2.5 V CMOS	No	Yes	No	Yes	No
5 V CMOS, 5 V CMOS	No	No	Yes	Yes	No
3.3 V LVTTL, 2.5 V/1.8 V/1.5 V CMOS	No	Yes	No	3.3V - 2.5V	Yes
2.5 V CMOS, 2.5 V/1.8 V/1.5 V CMOS	No	No	No	No	Yes
1.5 V CMOS, 2.5 V/1.8 V/1.5 V CMOS	No	No	No	No	Yes
5V CMOS, LVTTL (VccA = 5V, VccB = 3.3V)					
IOH (mA)	-24	-24	-24	-24	-
IOL (mA)	24	24	24	24	-
tpd max (ns)	1 - 6.7	1 - 6.7	1 - 6.7	1 - 5.8	-
2.5V CMOS, 3.3V LVTTL (VccA = 2.5V, VccB = 3.3V)					
IOH (mA)	-	-8	-	-18	-12
IOL (mA)	-	8	-	18	12
tpd max (ns)	-	1 - 9.4	-	-	1.2 - 3.9
1.8V CMOS, 3.3V LVTTL (VccA = 1.8V, VccB = 3.3V)					
IOH (mA)	-	-	-	-	-4
IOL (mA)	-	-	-	-	4
tpd max (ns)	-	-	-	-	1.4 - 3.3
1.5V CMOS, 3.3V LVTTL (VccA = 1.5V, VccB = 3.3V)					
IOH (mA)	-	-	-	-	-2
IOL (mA)	-	-	-	-	2
tpd max (ns)	-	-	-	-	1.6 - 3.8

*SN74AVCA164245 is focused on the ultra-low level CMOS level-shifter.
*SN74AVCA164245 is under development.

Standard Level Shifter





Features

LV-A

- Ioff 5 µA
- Vcc: 2 V to 5.5V
- 5V I/O tolerant
- DW, DB, PW, DGV

LVC/LVC1G/2G/3G

- LVC: 1.65 V to 3.6 V
- LVC1G/2G/3G: 1.65V to 5.5V
- Ioff 10 µA
- 5V I/O tolerant
- LVC1G/2G/3G: DCK, DBV, DCU, DCT

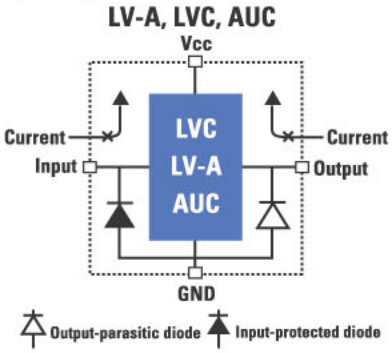
AUC1G04

- Vcc: 0.8V to 2.7V
- Ioff 10 µA
- 3.6V I/O tolerant
- 5-pin DCK, 5-pin DBV

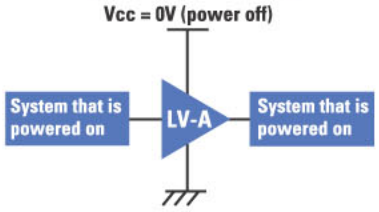
Performance Comparison

Parameter Name	LV-A	LVC	LVC1G/2G/3G	AUC1G04
Voltage Nodes (V)	2 - 5.5	2.7 - 3.6	1.65 - 5.5	0.8 - 2.7
I/O Tolerant (V)	5	5	5	3.6
Ioff for Partial-Power Down	Yes	Yes	Yes	Yes
Vcc = 3.3 V +/- 0.3 V				
tpd (Propagation Delay) (ns)	5 - 7.9	1 - 4.1	1.1 - 4.5	-
tpd (Output Enable) (ns)	6.9 - 11.4	7.6 - 11.5	1.4 - 5.4	-
Driving Capability (mA)	6	24	24	-
Vcc = 2.5 V +/- 0.2 V				
tpd (Propagation Delay) (ns)	7.1 - 12.9	1 -7.9	1.4 - 5.5	1.9
tpd (Output Enable) (ns)	9.6 - 16.9	1 - 9.6	2.1 - 6.5	-
Driving Capability (mA)	2	8	8	9 - 10
Vcc = 1.8 V				
tpd (Propagation Delay) (ns)	-	9 - 10	3 - 8	2.5
tpd (Output Enable) (ns)	-	14.6	3.8 - 9.4	-
Driving Capability (mA)	-	4 - 6	4 - 6	8
Vcc = 1.5 V				
tpd (Propagation Delay) (ns)	-	-	-	2.2
tpd (Output Enable) (ns)	-	-	-	-
Driving Capability (mA)	-	-	-	5 - 6
Vcc = 1.2 V				
tpd (Propagation Delay) (ns)	-	-	-	3.3
tpd (Output Enable) (ns)	-	-	-	-
Driving Capability (mA)	-	-	-	3 - 4

I/O Equivalent Circuit

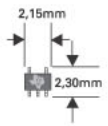
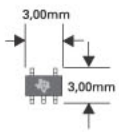
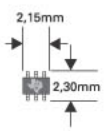
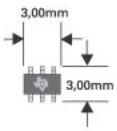
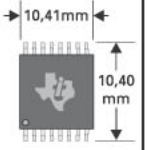
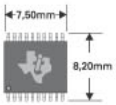
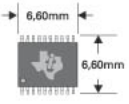
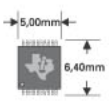


Partial-power-down application



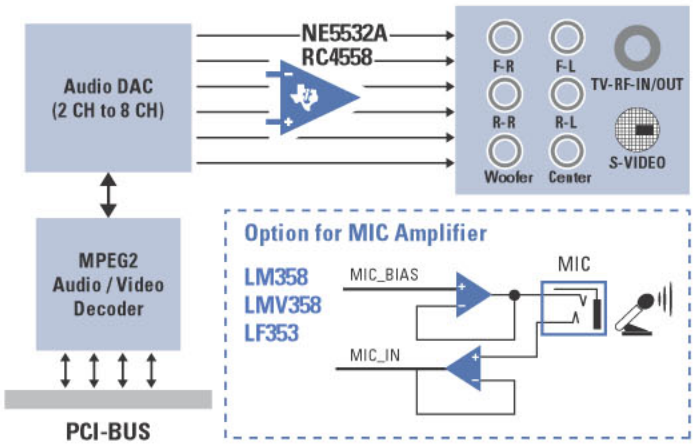
The path is completely isolated without being affected by systems under operation.

Package

5-pin SC-70 (DCK)	5-pin SOT-23 (DBV)	6-pin SC-70 (DCK)	6-pin SOT-23 (DBV)	8-pin US-8 (DCU)	8-pin SM-8 (DCT)	16-pin SOIC (DW)	20-pin SSOP (DB)	20-pin TSSOP (PW)	20-pin TVSOP (DGV)
									

Audio Pre-Amp/Audio Switch

Dual Low-Noise Operational Amplifier



Features ▸

NE5532A

- Bandwidth..10MHz
- Slew Rate..9 V/µs
- CMRR..100 dB
- Dynamic Range
- Low Noise..5nV/√Hz @1KHz
- Package : P, PS

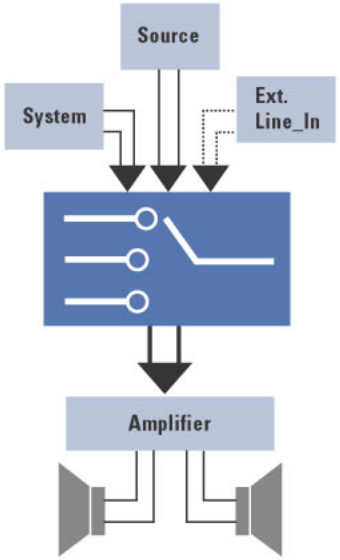
RC4558

- Bandwidth..3MHz
- Slew Rate..1.7 V/µs
- CMRR..90 dB
- Dynamic Range
- Low Noise..8nV/√Hz @1KHz
- Package : P, PS, D, JG

Selection of Pre-Amp

Device Name	No. of Channels	Vs Min (V)	Vs Max (V)	IQ per Channel Max (mA)	GBW Typ (MHz)	Slew Rate Typ (V/µs)	VIO (25C) Max (mV)	Offset Drift Typ (µV/C)	IIB (25C) Max (pA)	CMRR Min (dB)	Vn at 1KHz Typ (nV/rtHz)
LF353	2	7	36	3.25	3	13	10	10	200	70	18
LM324A	4	3	32	0.3	-	-	3	-	100000	65	-
LM358	2	3	32	1	-	-	7	7	250000	65	-
LMV321	1	2.7	5.5	0.17	1	1	7	5	250000	50	39
LMV324	4	2.7	5.5	0.17	1	1	7	5	250000	50	39
LMV358	2	2.7	5.5	0.17	1	1	7	5	250000	50	39
NE5532	2	10	30	8	10	9	4	-	800000	70	5
RC4558	2	10	30	2.8	3	1.7	6	-	500000	70	8
TLV2361I	1	2	5	2.5	7	3	6	-	150000	-	8
TLV2362I	2	2	5	2.5	7	3	6	-	150000	-	8

Analog Switch for Audio/Signals

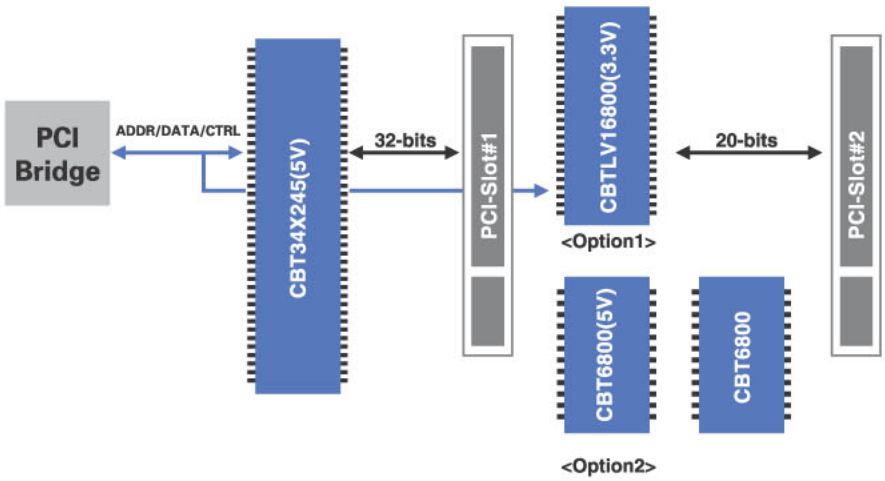


Device Name	No.of pins	Description
SN74LV4051A	16	8 - Channel Analog Multiplexer/Demultiplexer
SN74LV4052A	16	Dual 4 - Channel Analog Multiplexer/Demultiplexer
SN74LV4053A	16	Triple 2 - Channel Analog Multiplexer/Demultiplexer
SN74LV4040A	16	12 - Bit Asynchronous Binary Counters
SN74LV4066A	14	Quadruple Bilateral Analog Switch
SN74LVC2G53	8	Dual Analog Multiplexer Demultiplexer
SN74LVC1G66	5	Single Analog Switch
SN74LVC2G66	8	Dual Analog Switch

SN74LVC2G53

Parameter Name	LVC2G53	LVC2G53	LVC2G53	LVC2G53
Voltage Nodes (V)	5	3.3	2.5	1.8
Vcc min (V)	1.65	1.65	1.65	1.65
Vcc max (V)	5.5	5.5	5.5	5.5
tpd max (ns)	0.6	0.8	1.2	2
ICC (uA)	10	10	10	10

Bus Isolation for PCI Hot-Plug



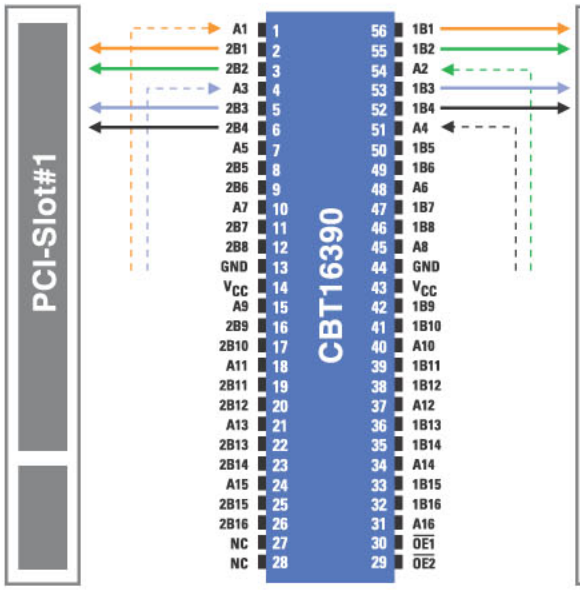
Features ▸

- 5Ω switch
- Zero propagation delay (0.25 ns)
- Low power consumption (3µA)
- 1 to 32-bit product choices
- CBT=5V, CBTLV=3.3V

Options ▸

- **CBTD** = Integrate Diode to Vcc for voltage translation (5V⟷3.3V)
- **CBTS** = Integrate Schottky Diode to I/O for better undershoot
- **CBTK** = Clamp Diode to I/O for undershoot protection
- **CBTR** = Integrate series damping resistor to I/O

Bus Multi-Plexer for PCI Hot-Plug



CBT16390

Inputs OE1	Inputs OE2	Function
L	L	Ax=1Bx and Ax=2Bx
L	H	A=1B
H	L	A=2B
H	H	Isolation

- 16-bit to 32-bit Multi-plexer
- SSOP, TSSOP, TVSOP package
- 5V Vcc operated
- Can work for PCI Bus Isolation for Hot-Plug
- Save space by reducing component count

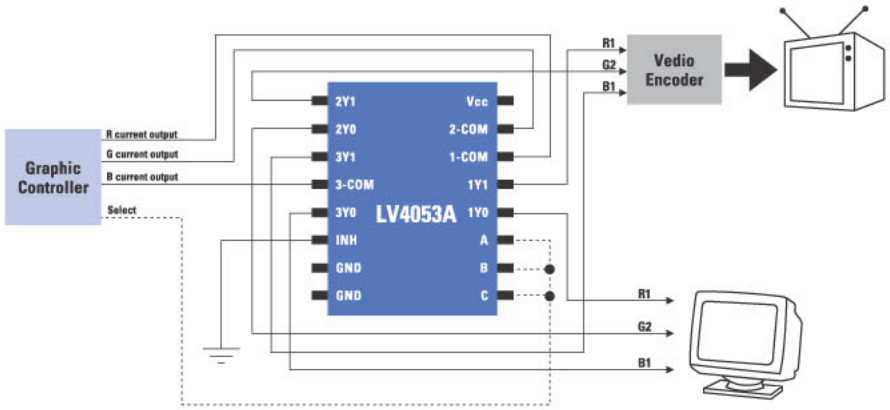
Applications ▸

- Level translator
- High speed Isolation
- Hot-plugging, Hot-insertion

Bus Switch for Hot-Plug Table

	32-Bit	24-Bit	20-Bit	10-Bit
BGA	SN74CBT32245GKE SN74CBTK32245GKE	-	-	-
TVSOP	SN74CBT34X245DBB	SN74CBT16211ADGV SN74CBTD16211DGV SN74CBTH16211DGV SN74CBTS16211DGV SN74CBTLV16211DGV	SN74CBT16211DGV SN74CBTD16210DGV SN74CBT16861DGV SN74CBTD16861DGV SN74CBTS16861DGV SN74CBTLV16210 **SN74CBTLV16800DGV**	SN74CBT6800ADGV SN74CBTK6800DGV SN74CBT3861/3384DGV SN74CBTLV3861/3384DGV
TSSOP	-	SN74CBT16211ADGG SN74CBTD16211DGG SN74CBTH16211DGG SN74CBTS16211DGG	SN74CBT16211DGG SN74CBTD16210DGG SN74CBT16861DGG SN74CBTD16861DGG SN74CBTS16861DGG **SN74CBTLV16800DGG**	SN74CBT6800ADGG SN74CBTK6800DGG SN74CBT3861/3384PW SN74CBTLV3861/3384PW

Video Graphics Port Switch



Features

- 2-V to 5.5-V Vcc operation
- Support mixed-mode voltage operation on all ports
- High on-off output-voltage ratio
- Low crosstalk between switches
- Individual switch controls
- Extremely low input current

Function

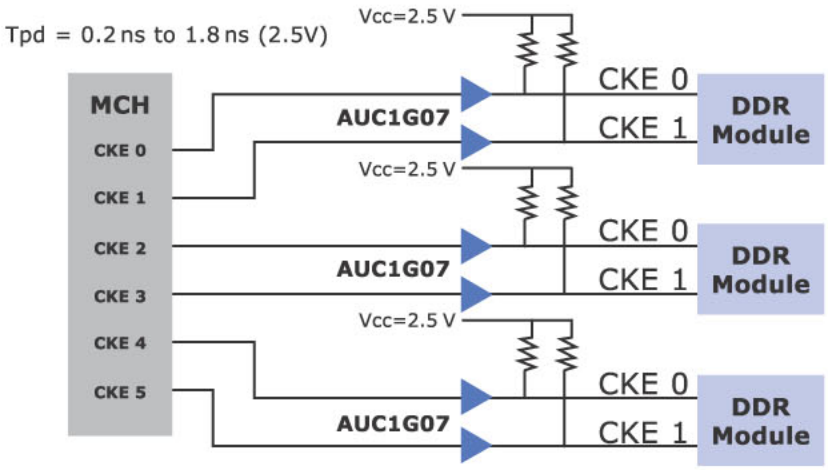
INH	H, B, C	On Channel
L	L	1Y0, 2Y0, 3Y0
L	H	1Y1, 2Y1, 3Y1
H	X	None

Selection Guide for 2-1Multi-Plexer

Device Name	Type of Switch	Description	Speed	Vcc	Package
SN74LV4053A	Analog Switch	5V I/O tolerant, 3 x1-2 Mux/Demux	10 ns	2-5.5V	D, DB, PW, DGV
SN74LVC2G53	Analog Switch	5V I/O tolerant, 1-bit Mux/Demux	0.8 ns	1.8-5.5V	DCT, DCU
SN74CBT3257	Bus Switch	4 x1-2 Mux/Demux	0.25 ns	5V	D, DB, PW
SN74CBT16390	Bus Switch	16Bit, 1-2 Mux/Demux	0.25 ns	5V	DL, DGG, DGV
SN74CBT16233	Bus Switch	16Bit, 1-2 Mux/Demux	0.25 ns	5V	DL, DGG, DGV

Logic for Memory

Memory Clock Enable Driver



Features

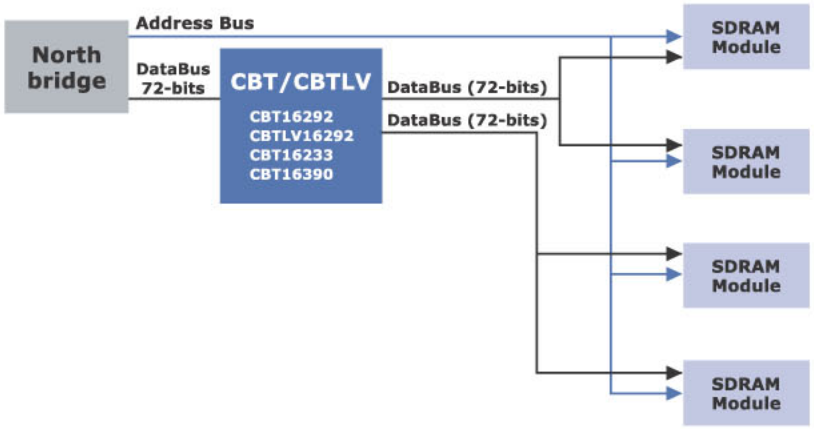
- NanoStar™ and NanoFree™ packages
- I_{off} supports partial-power-down mode operation
- Optimized for 1.8V operation and is 3.3V tolerant
- Sub 1V operable
- Latch-up performance exceeds 100 mA per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V human-body model (A114-A)
  - 200-V machine model (A115-A)
  - 1000-V charged-device model (C101)

Performance Comparison

Parameter Name	AUC1G07 (0.8V)	AUC1G07 (1.2V)	AUC1G07 (1.5V)	AUC1G07 (1.8V)	AUC1G07 (2.5V)
IOH (mA)	-0.7	-3	-5	-8	-9
IOL (mA)	0.7	3	5	8	9
tpd max (ns)	-	3.1	2.4	2.5	1.8
ICC (uA)	10	10	10	10	10
Input Level	0.8 V CMOS Proposed	1.2 V CMOS	1.5 V CMOS	1.8 V CMOS	2.5 V CMOS
Output Level	0.8 V CMOS Proposed	1.2 V CMOS	1.5 V CMOS	1.8 V CMOS	2.5 V CMOS

Logic for Memory

Bus Switch for SDRAM Memory



Features

- 4-Ω switch connection between two ports
- TTL-compatible control input levels
- Make-Before-Break feature
- Internal 500-Ω pulldown resistors to ground
- Latch-Up performance exceeds 250 mA per JESD 17

CBT/CBTLV16292 (12-bits, 1-2)

Selected Pin	Function
L	Aport = B1 port Rint = B2 port
H	Aport = B2 port Rint = B1 port

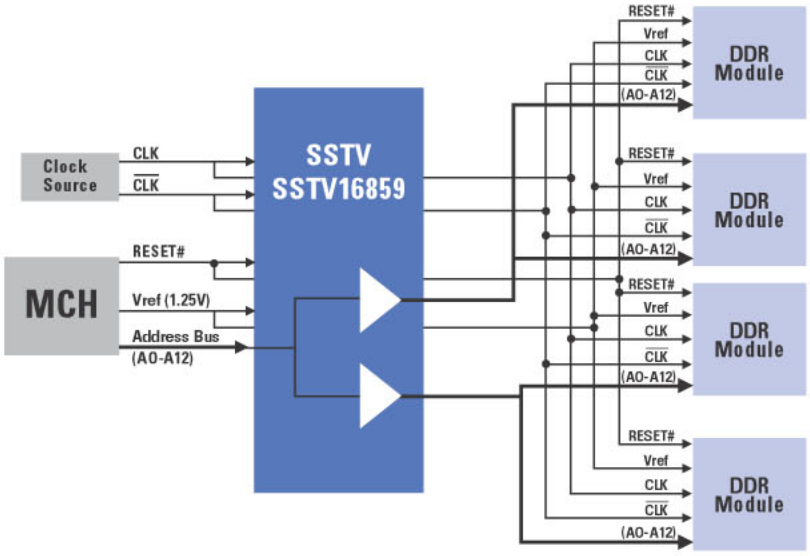
CBT16390(16-bits, 1-2)

Inputs OE1	Inputs $\overline{OE2}$	Function
L	L	A~1B and A~2B
L	H	A~1B
H	L	A~2B
H	H	Isolation

CBT16233 (16-bits, 1-2)

Selected Pin	Test	Function
L	L	A = B1
H	L	A = B2
X	H	A = B1 A = B2

Memory Driver for DDR SDRAM



Features

- 1-to-2 outputs to support stacked DDR DIMMs
- Supports SSTL_2 data inputs
- Outputs meet SSTL_2 Class II Specifications
- Differential clock (CLK and $\overline{CLK}$) inputs
- Supports LVCMOS switching levels on the $\overline{RESET}$ input
- $\overline{RESET}$ input disables differential input receivers, resets all registers, and forces all outputs low
- Pinout optimizes DIMM PCB layout
- Latch-Up performance exceeds 100 mA per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V human-body model (A114-A)
  - 1000-V charged-device model (C101)

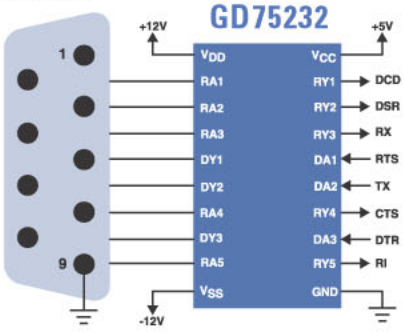
Performance Comparison

Device Name	No. of Pins	No. of Bits	No. of Fan_Outs	Frequency (Mhz)	Package	Description
SN74SSTV16857	48	14	1:1	200	TSSOP	Registered Buffer W SSTL_2 I/O
SN74SSTV16859	64	13	1:2	200	TSSOP	Registered Buffer W SSTL_2 I/O
SN74SSTV32852	114	24	1:2	200	LFBGA	Registered Buffer W SSTL_2 I/O
SN74SSTV32867	114	26	1:1	200	LFBGA	Registered Buffer W SSTL_2 Inputs and LVCMOS Outputs
SN74SSTV32877	114	26	1:1	200	LFBGA	Registered Buffer W SSTL_2 I/O

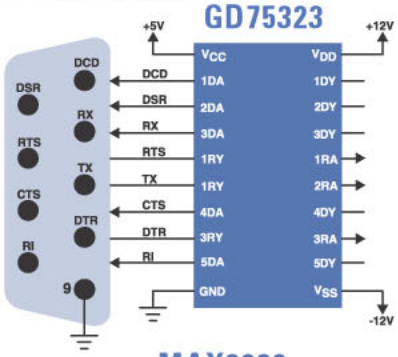
RS-232 Selection Guide

Host System

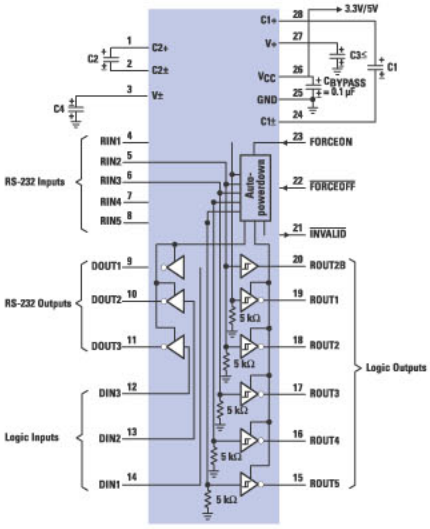
EIA-232 Port



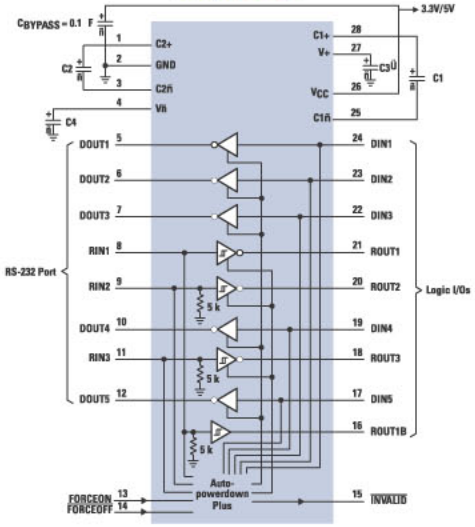
Peripheral Site



MAX3243



MAX3238



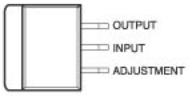
Device Name	Max Speed (kbps)	Max Supply Current ('mA)	Shutdown Mode	HBM ESD Protection (kv)	Package Options	Temp. Range	Cross Reference
Single Supply 3.3V or 5V							
3 Driver and 5 Receivers							
SN75LV4737A	128	20.7	No	4	28/DBR	C	DC14335/DS14535
MAX3243	250	1	No	15	28/DW, 28/DB, 28/PW	I, C	MAX3243 SP3243E
MAX3243E	250	1	No	15	28/DW, 28/DB, 28/PW	I, C	MAX3243E SP3243E
1 Driver and 1 Reciver							
MAX3221	250	1	No	15	16/DB, 16/PW	I, C	MAX3221
5 Drivers and 3 Recivers							
MAX3238	250	1	No	15	28/DB, 28/PW	I, C	MAX3238 SP3238E
2 Drivers and 2 Recivers							
MAX3222	250	1	Yes	15	20/DB, 20/DGV, 20/DW, 20/PW	I, C	MAX3222 SP3222E
MAX3223	250	1	No	15	20/DB, 20/DGV, 20/DW, 20/PW	I, C	MAX3223 SP3223E
MAX3232	250	1	No	15	16/D, 16/DW, 16/DB, 16/PW	I, C	MAX3232 SP3232E
Single Supply 5V							
2 Drivers and 2 Recivers							
MAX232	-	10	NA	2	16/D, 16/DW, 16/N	I, C	Max232 SP232A/E
Multiple Supply, 5V and +/-12V							
3 Drivers and 5 Receivers							
GD75232	120	20	NA	2	20-PIN/N/DW/DB/PW	C	
75185	120	30	No	10	20/N, 20/DW	C	
75C185	120	0.75	No	-	20/N, 20/DW	C	
75LP1185	256	1	No	15	20-PIN/N/DW/DB/PW	C	
75LPE185	-	-	No	15	24-PIN/NT/DW/DB/PW	C	

Linear Regulator

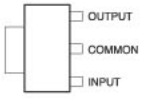
Device Name	Device Description	Packages
LM237	3-Terminal, 1.5A Adjustable Negative Voltage Regulator	KC, KTE
LM317	3-Terminal, 1.5A Adjustable Positive Voltage Regulator	KC, KTE, DCY
LM317M	3-Terminal, 500mA Adjustable Positive Voltage Regulator	KTP, DCY
LM337	3-Terminal, 1.5A Adjustable Negative Voltage Regulator	KC, KTE
MC79L05A	5V, 100mA Fixed Negative Voltage Regulator	D, LP
MC79L12A	12V, 100mA Fixed Negative Voltage Regulator	D, LP
MC79L15	15V, 100mA Fixed Negative Voltage Regulator	D, LP
MC79L15A	15V, 100mA Fixed Negative Voltage Regulator	D, LP
TL317	3-Terminal, 100mA Adjustable Positive Voltage Regulator	D, LP
TL780-05	5V, 1.5A Fixed Positive Voltage Regulator (Upgrade for UA7805)	KC, KTE
TL780-12	12V, 1.5A Fixed Positive Voltage Regulator (Upgrade for UA7812)	KC, KTE
TL780-15	15V, 1.5A Fixed Positive Voltage Regulator (Upgrade for UA7815)	KC, KTE
TL783	3-Terminal, 700mA, High-Voltage Adjustable Positive Voltage Regulator	KC
UA723	Adjustable, 150mA Precision Voltage Regulator	D
UA7805	5V, 1.5A Fixed Positive Voltage Regulator	KC, KTE
UA7808	8V, 1.5A Fixed Positive Voltage Regulator	KC, KTE
UA7810	10V, 1.5A Fixed Positive Voltage Regulator	KC, KTE
UA7812	12V, 1.5A Fixed Positive Voltage Regulator	KC, KTE
UA78L02A	2V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L05	5V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L05A	5V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L06A	6V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L08	8V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L08A	8V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L09	9V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L09A	9V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L10A	10V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L12A	12V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78L15A	15V, 100mA Fixed Positive Voltage Regulator	D, LP, PK
UA78M05	5V, 500mA Fixed Positive Voltage Regulator	KC, KTP, DCY
UA78M06	6V, 500mA Fixed Positive Voltage Regulator	KC, KTP, DCY
UA78M08	8V, 500mA Fixed Positive Voltage Regulator	KC, KTP, DCY
UA78M09	9V, 500mA Fixed Positive Voltage Regulator	KC, KTP, DCY
UA79M08	8V, 500mA Fixed Negative Voltage Regulator	KC, KTP, DCY

Package Options

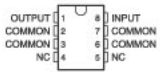
KC (TO220AB)



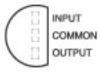
KTE



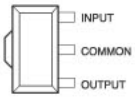
DCY (SOT223)



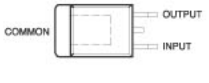
D



LP



PK



KTP

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ALVC Data Book	SCED006A
AHC/AHCT Data Book	SCLD003B

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