Texas Instruments

Technology for Innovators™

Logic Selection Guide

2006 / 2007

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LOGIC SELECTION GUIDE

2006/2007

TEXAS INSTRUMENTS

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Texas Instruments offers a full spectrum of logic functions and technologies from the mature to the advanced, including bipolar, BiCMOS, and CMOS. TI's process technologies offer the logic performance and features required for modern logic designs, while maintaining support for more traditional logic products. TI's offerings include products in the following process technologies or device families:

- AC, ACT, AHC, AHCT, ALVC, AUC, AUP, AVC, FCT, HC, HCT, LV-A, LV-AT, LVC, TVC
- ABT, ABTE, ALB, ALVT, BCT, HSTL, LVT
- BTA, CB3Q, CB3T, CBT, CBT-C, CBTLV, FB, FIFO, GTL, GTLP, JTAG, PCA, PCF, VME
- ALS, AS, F, LS, S, TTL

TI offers specialized, advanced logic products that improve overall system performance and address design issues, including testability, low skew requirements, bus termination, memory drivers, and low-impedance drivers.

TI offers a wide variety of packaging options, including advanced surface-mount packaging in fine-pitch small-outline ball-grid-array (BGA) packages, quad flat no-lead (QFN) packages for gates and octals, and WCSP (NanoStar™/NanoFree™) packages for single-, dual-, and triple-gate functions. The NanoStar™/NanoFree™ packages are the newest logic options. These WCSP packages are the world's smallest logic packages offering a 70% savings in space over industry standard SC-70 packages.

For further information on TI logic families, refer to the list of current TI logic technical documentation provided in this preface. For an overview of TI logic, see Section 1. Sections 2, 3, and 4 contain must-have product information, a product index, and a functional cross-reference, respectively. These sections list the functions offered, package availability, and applicable literature numbers of data sheets. Appendix A includes additional information about packaging and symbolization. Appendix B provides a cross-reference to match other manufacturers' products to those of TI. Data sheets can be downloaded from the internet at http://www.ti.com or ordered through your local sales office or TI authorized distributor. Please see the back cover of this selection guide for additional information.

CURRENT TI LOGIC TECHNICAL DOCUMENTATION

Listed below is the current collection of TI logic technical documentation. These documents can be ordered through a TI representative or authorized distributor by referencing the appropriate literature number.

Document	Literature Number
ABT Logic Advanced BiCMOS Technology Data Book (1997)	SCBD002C
AC/ACT CMOS Logic Data Book (1997)	SCAD001D
AHC/AHCT Logic Advanced High-Speed CMOS Data Book (April 2000)	SCLD003B
AHC/AHCT Designer's Guide (February 2000)	SCLA013D
ALS/AS Logic Data Book (1995)	SDAD001C
ALVC Advanced Low-Voltage CMOS Data Book	SCED006B
AUC Advanced Ultra-Low-Voltage CMOS Data Book (January 2003)	SCED011A
AVC Advanced Very-Low-Voltage CMOS Data Book (March 2000)	SCED008C
BCT BiCMOS Bus-Interface Logic Data Book (1994)	SCBD001B
CBT (5-V) and CBTLV (3.3-V) Bus Switches Data Book (December 1998)	SCDD001B
Design Considerations for Logic Products Application Book (1997)	SDYA002
Design Considerations for Logic Products Application Book, Volume 2 (September 1999)	SDYA018
Design Considerations for Logic Products Application Book, Volume 3 (December 2000)	SDYA019
Digital Logic Pocket Data Book (January 2004)	SCYD013A
F Logic Data Book (1994)	SDFD001B
GTL/GTLP Logic High-Performance Backplane Drivers (September 2001)	SCED004A
HC/HCT Logic High-Speed CMOS Data Book (2003)	SCLD001E
Little Logic Data Book (November 2001)	SCED010
Logic Cross-Reference (May 2005)	SCYB017B
Logic Packaging Migration Card	SCYB006A
LVC and LV Low-Voltage CMOS Logic Data Book (1998)	SCBD152B
LVT Logic Low-Voltage Technology Data Book (1998)	SCBD154
Mobile Computing Logic Solutions Data Book (July 1999)	SCPD002
Semiconductor Group Package Outlines Reference Guide (1999)	SSYU001E
Signal Switch Including Digital/Analog/Bilateral Switches and Voltage Clamps Data Book (January 2004)	SCDD003A

See www.ti.com/sc/logic for the most current data sheets.

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SECTION 3 (continued)

LOGIC OVERVIEW

SECTION 1
LOGIC OVERVIEW

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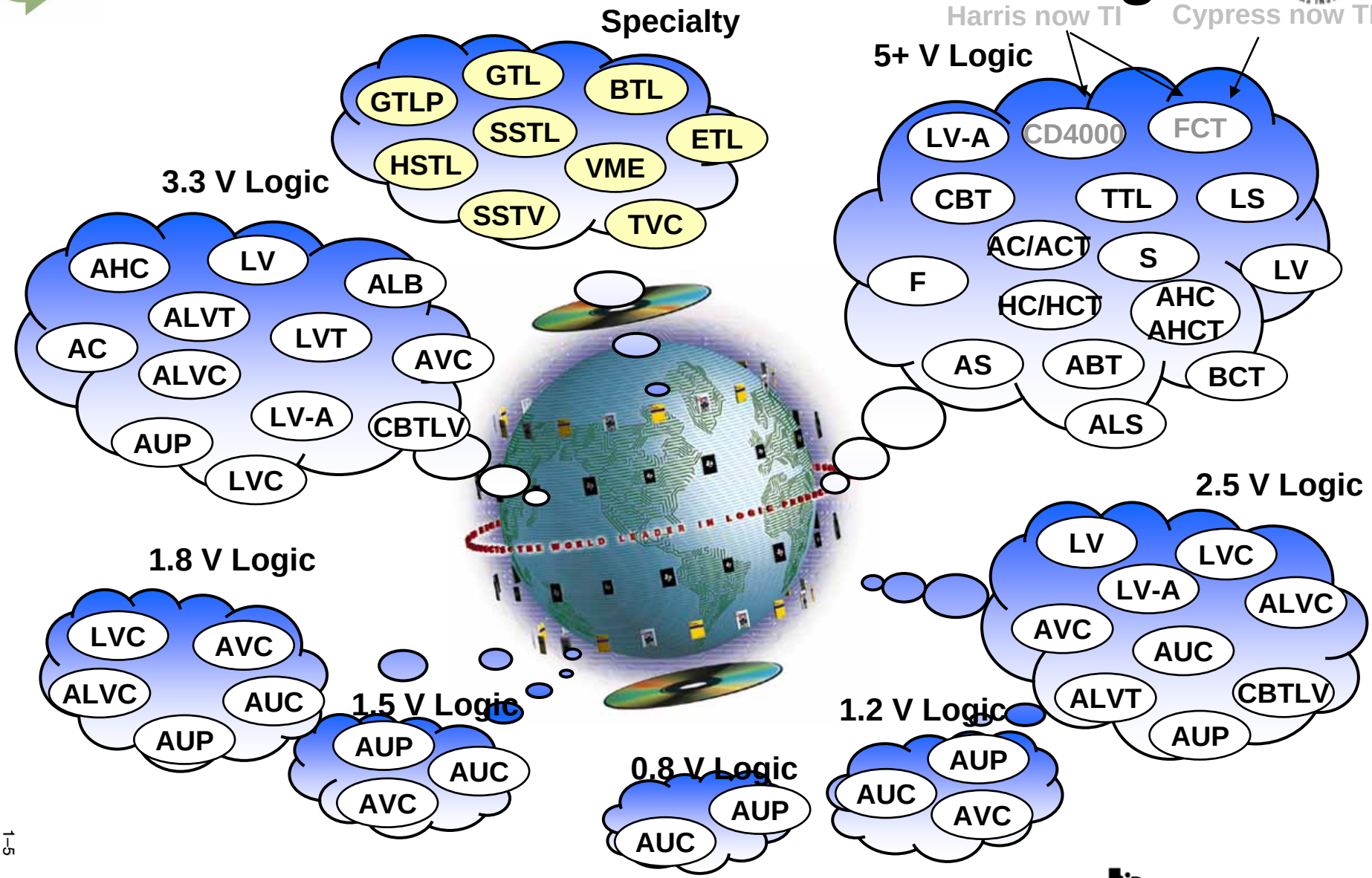
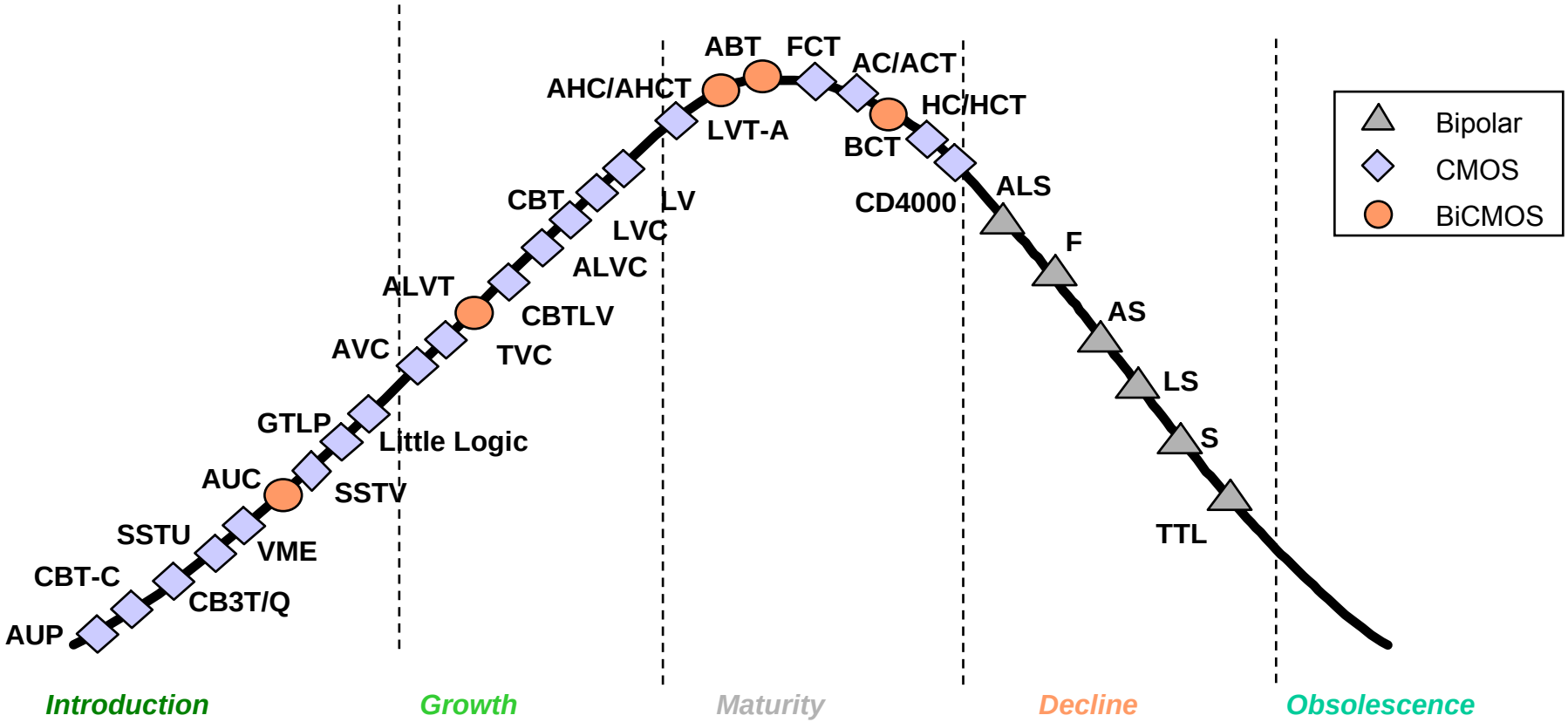
CONTENTS (continued)

Welcome to the World of TI Logic



Product Life Cycle



TI remains committed to be the last supplier in the older families.

Family Specification Comparison

	Technology	V_{CC} (V)	V_{CC} Range	t_{pd} max (ns)	I/O Tolerance (V)	Input Compatibility	Output Compatibility	Port	I_{OH} (max) (mA)	I_{OL} (max) (mA)	Static Current I_{CC} (µA)	Isolation Level*
5-V Logic	**Bipolar**											
	ALS	5	4.5 to 5.5	10.0	5	TTL	TTL	Both	Ð15	24	58 mA	0
	AS	5	4.5 to 5.5	7.5	5	TTL	TTL	Both	Ð15	64	143 mA	0
	74F	5	4.5 to 5.5	6.0	5	TTL	TTL	A	Ð3	24	120 mA	0
								B	Ð15	64		
	LS	5	4.75 to 5.25	12.0	5	TTL	TTL	Both	Ð15	24	95 mA	0
	S	5	4.75 to 5.25	9.0	5	TTL	TTL	Both	Ð15	64	180 mA	0
	TTL	5	4.75 to 5.25	22.0	5	TTL	TTL	Both	Ð0.4	16	22 mA	0
	BiCMOS											
	ABT	5	4.5 to 5	3.5	5	LVTTL/TTL	TTL	Both	Ð32	64	250	1
	ABTE	5	4.5 to 5.5	5.2	5	ETL	TTL	A	Ð60	90	48	1
								B	Ð12	12		
	BCT	5	4.5 to 5.5	6.6	5	LVTTL/TTL	TTL	A	Ð3	24	90 mA	2
								B	Ð15	64		
	CMOS											
	AC	5	3.0 to 5.5	6.5	V_{CC} + 0.5	CMOS	CMOS	Both	Ð24	24	40	0
	ACT	5	4.5 to 5.5	8.0	V_{CC}	TTL	CMOS	Both	Ð24	24	40	0
	AHC	5	2.0 to 5.5	7.5	5.5**	CMOS	CMOS	Both	Ð8	8	40	0
	AHC1G	5	2.0 to 5.5	5.0	5.5**	CMOS	CMOS	Both	Ð8	8	10	0
	AHCT	5	4.5 to 5.5	7.7	5.5**	TTL	CMOS	Both	Ð8	8	40	0
	AHCT1G	5	4.5 to 5.5	5.0	5.5**	TTL	CMOS	Both	Ð8	8	40	0
	CBT	5	4.0 to 5.5	0.25	5.5	TTL	TTL	Both	N/A	N/A	3	0
	CBT-C	5	4.0 to 5.5	0.25	5.5	TTL	TTL	Both	N/A	N/A	3	1
	CBT1G	5	4.0 to 5.5	0.25	5.5	TTL	TTL	Both	N/A	N/A	1	0
	CD4K	5,10,15	3.0 to 18.0	Ð	V_{CC}	CMOS	CMOS	Both	Ð0.2, Ð0.5, Ð1.4	0.52, 1.3, 3.6	5, 10, 20	0
	FB (Q2040)	5	Ð	8.2	5	LVTTL/TTL	BTL	A	Ð3	24	70 mA	3
			Ð			BTL	LVTTL/TTL	B	N/A	100		
	FCT	5	4.75 to 5.25	5.3	5	TTL	TTL	Both	Ð15	64	80	0
	HC	5	2.0 to 6.0	21.0	V_{CC}	CMOS	CMOS	Both	Ð7.8	7.8	80	0
	HCT	5	4.5 to 5.5	30.0	V_{CC}	TTL	CMOS	Both	Ð6	6	80	0

Family Specification Comparison

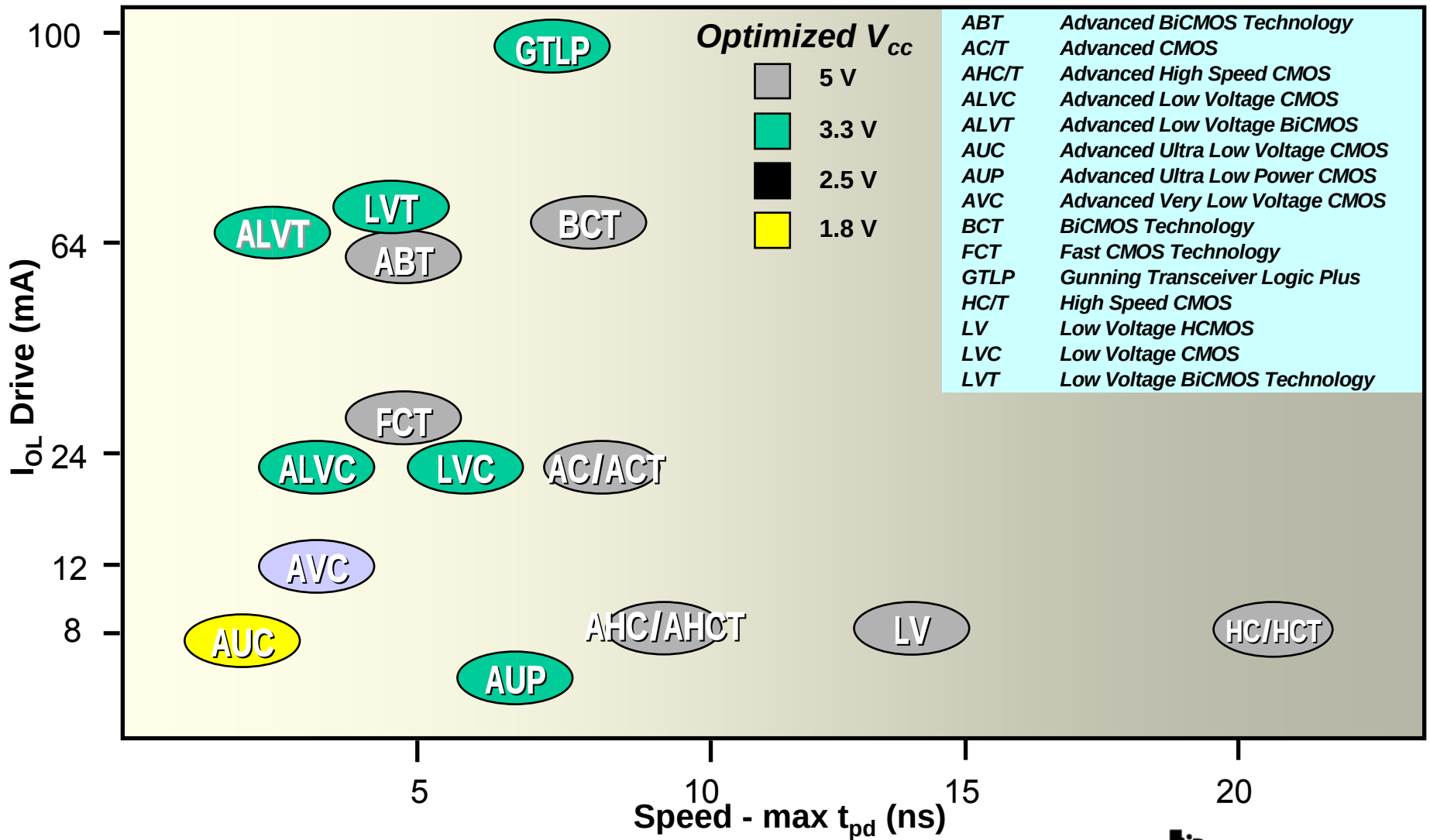
	Technology	V_{CC} (V)	V_{CC} Range	t_{pd} max (ns)	I/O Tolerance (V)	Input Compatibility	Output Compatibility	Port	I_{OH} (max) (mA)	I_{OL} (max) (mA)	Static Current I_{CC} (µA)	Isolation Level*
3.3-V Logic	**Bipolar**											
	ALB	3.3	3.0 to 3.6	2.0	V_{CC} + 0.5	Custom	Custom	Both	Ð25	25	800	0
	BiCMOS											
	ALVT	3.3	2.3 to 3.6	3.5	5	LVTTL/TTL	LVTTL	Both	Ð8	24	4.5 mA	2
	LVT	3.3	2.7 to 3.6	3.5	5	LVTTL/TTL	LVTTL	Both	Ð32	64	190	2
	VME	3.3	3.15 to 3.45	14.5	5	LVTTL/TTL	LVTTL/TTL	A	Ð24	24	30 mA	3
								B	Ð48	64		
	CMOS											
	ALVC	3.3	1.65 to 3.6	3.0	V_{CC}	LVTTL/TTL	LVCMOS	Both	Ð24	24	20	0
	ALVCF	3.3	2.3 to 3.6	3.5	V_{CC}	LVTTL/TTL	LVCMOS	Both	Ð12	12	40	0
	AUP1G/2G/3G	3.3	0.8 to 3.6	4.0	3.6	LVCMOS	LVCMOS	Both	Ð4	4	0.9	1
	CBTLV	3.3	2.3 to 3.6	0.25	3.6	LVCMOS	LVCMOS	Both	N/A	N/A	10	1
	CBTLV1G	3.3	2.3 to 3.6	0.25	3.6	LVCMOS	LVCMOS	Both	N/A	N/A	10	1
	CB3Q	3.3	2.3 to 3.6	0.2	5	LVTTL/TTL	LVTTL/TTL	Both	N/A	N/A	0.7 mA	1
	CB3T	3.3	2.3 to 3.6	0.2	5	TTL	TTL	Both	N/A	N/A	40	1
	GTL	3.3	3.15 to 3.45	6.5	5	LVTTL/TTL	GTL	A	Ð24	24	80 mA	1
						GTL	LVTTL/TTL	B	N/A	50		
	GTLP	3.3	3.15 to 3.45	7.7	5	LVTTL/TTL	GTLP	A	Ð24	24	40 mA	3
					4.6	GTLP	LVTTL/TTL	B	N/A	100		
	HSTL	3.3	3.15 to 3.45	5.0	3.3	HSTL	LVTTL	D	N/A	N/A	50 mA	0
					N/A	N/A		Q	Ð24	24		
	LV-A	3.3	2.0 to 5.5	14.0	5	LVCMOS	LVTTL	Both	Ð8	8	20	1
	LVC	3.3	1.65 to 3.6	4.0	5.5	LVTTL/TTL	LVCMOS	Both	Ð24	24	10	1
	LVC1G/2G/3G	3.3	1.65 to 5.5	3.5	5.5	LVTTL	LVTTL	Both	Ð24	24	10	1
	LVCZ	3.3	2.7 to 3.6	4.0	5.5	LVTTL/TTL	LVCMOS	Both	Ð24	24	60	2
	SSTL	3.3	2.3 to 3.6	3.7	3.3	SSTL_3	SSTL_3	D/A	N/A	N/A	90 mA	0
					N/A	N/A		Q/Y	Ð20	20		

Family Specification Comparison

	Technology	V_{CC} (V)	V_{CC} Range	t_{pd} max (ns)	I/O Tolerance (V)	Input Compatibility	Output Compatibility	Port	I_{OH} (max) (mA)	I_{OL} (max) (mA)	Static Current I_{CC} (µA)	Isolation Level*
2.5-V Logic	CMOS											
	AVC	2.5	1.4 to 3.6	2.0	3.6	LVCMOS	LVCMOS	Both	Ð8	8	20	1
	SSTV	2.5	2.3 to 2.7	2.8	3.3	SSTL_2	SSTL_2	D	N/A	N/A	56 mA	0
					N/A	N/A	Class 2	Q	Ð16	16		
	SSTVF	2.5	2.3 to 2.7	2.6	3.3	SSTL_2	SSTL_2	D	N/A	N/A	56 mA	0
					N/A	N/A	Class 1	Q	Ð16	16		
1.8-V Logic	CMOS											
	AUC	1.8	0.8 to 2.7	2.0	3.6	LVCMOS	LVCMOS	Both	Ð8	8	10	1
	AUC1G/2G/3G	1.8	0.8 to 2.7	2.0	3.6	LVCMOS	LVCMOS	Both	Ð8	8	10	1
	SSTU	1.8	1.7 to 1.9	2.5	2.3	SSTL_18	SSTL_18	D	N/A	N/A	50 mA	0
					N/A	N/A		Q	Ð8	8		

*V_{CC} listed is optimized node. For more specification information visit **logic.ti.com**
The information provided is general product specifications. For specific device information, please consult the respective data sheet.
Level 1 = Partial power-down Level 2 = Hot insertion Level 3 = Live insertion **5.5-V tolerance at input only

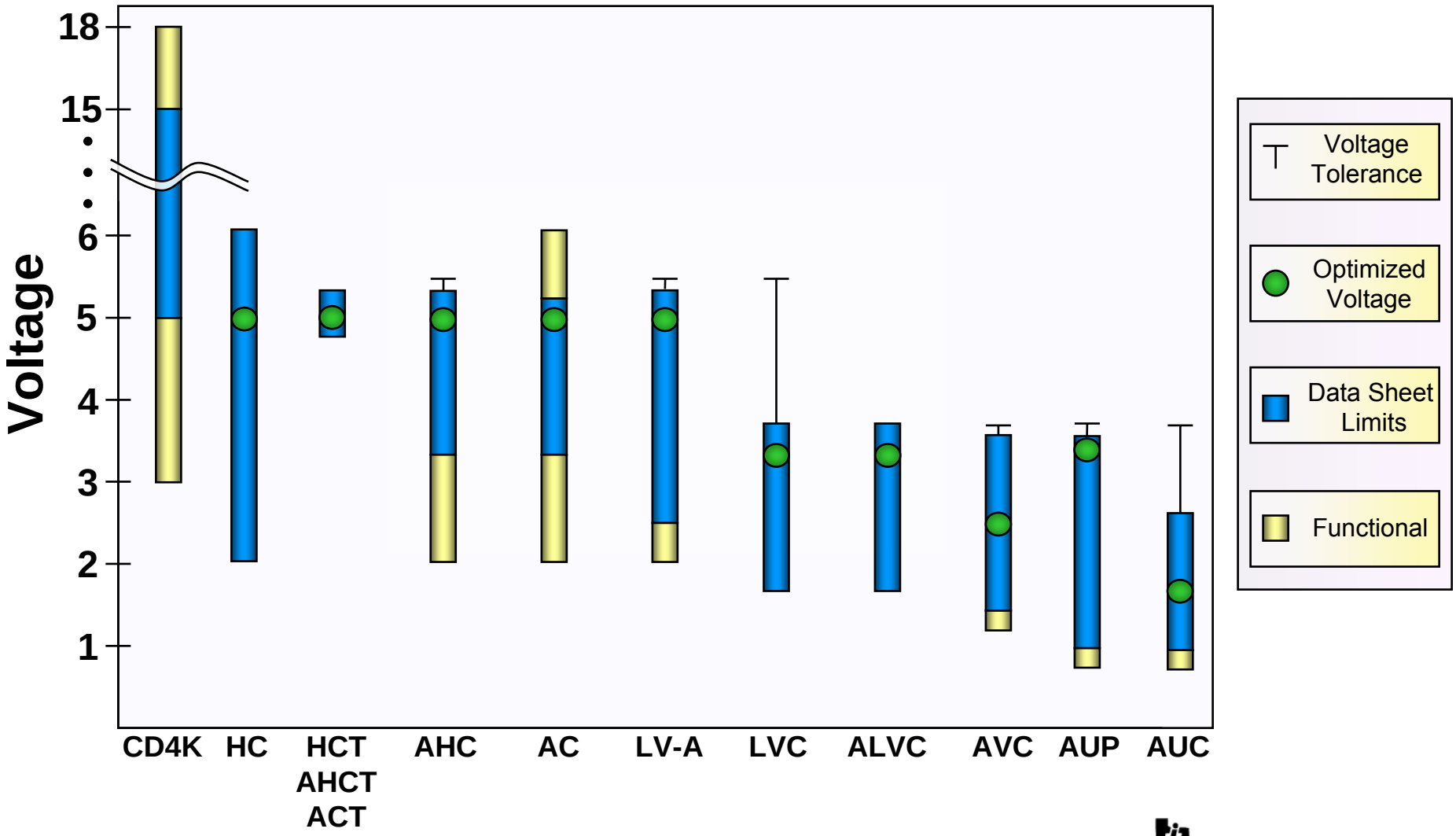
Family Performance Positioning



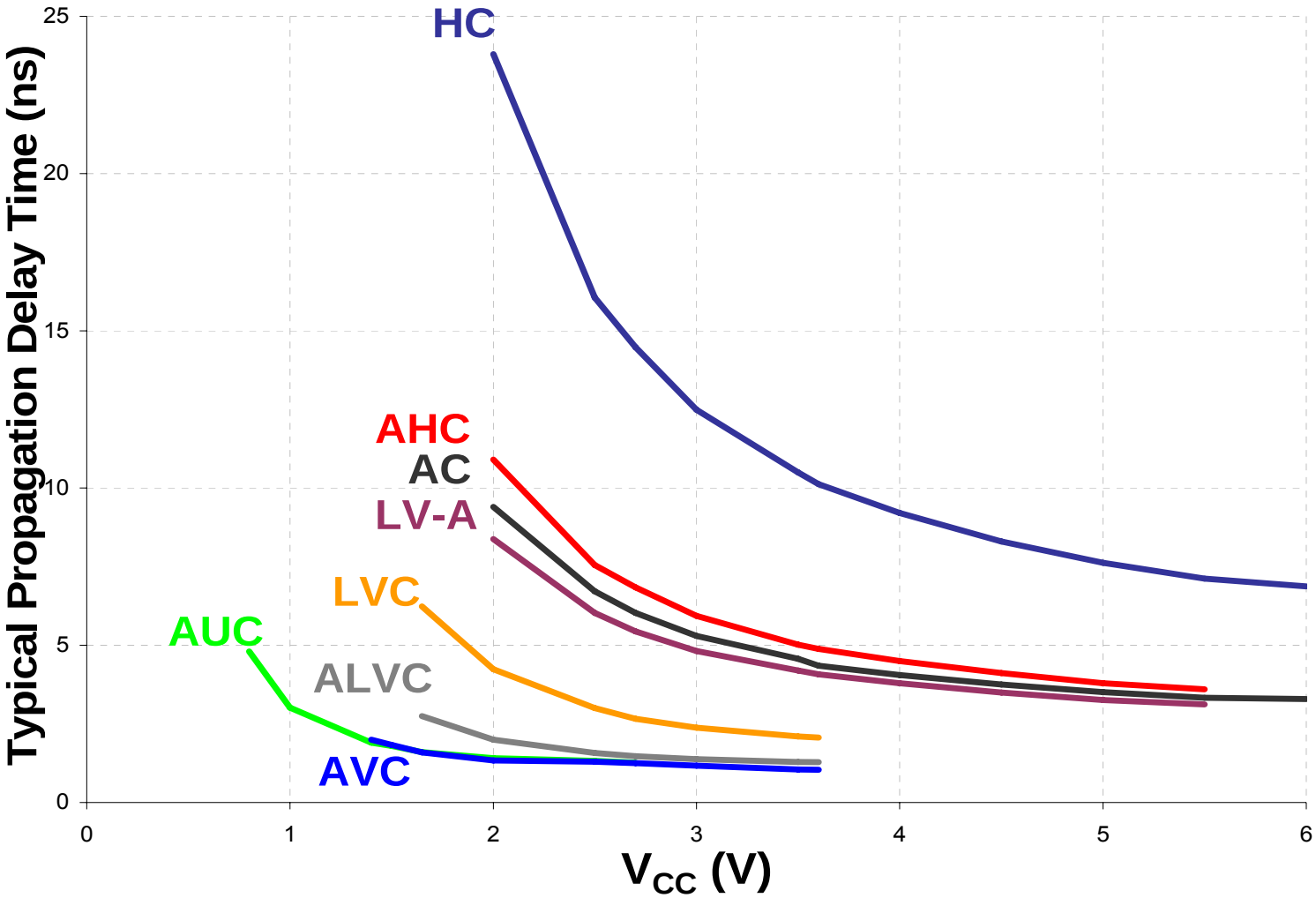
ABT	Advanced BiCMOS Technology
AC/T	Advanced CMOS
AHC/T	Advanced High Speed CMOS
ALVC	Advanced Low Voltage CMOS
ALVT	Advanced Low Voltage BiCMOS
AUC	Advanced Ultra Low Voltage CMOS
AUP	Advanced Ultra Low Power CMOS
AVC	Advanced Very Low Voltage CMOS
BCT	BiCMOS Technology
FCT	Fast CMOS Technology
GTLP	Gunning Transceiver Logic Plus
HC/T	High Speed CMOS
LV	Low Voltage HCMOS
LVC	Low Voltage CMOS
LVT	Low Voltage BiCMOS Technology

TEXAS INSTRUMENTS

CMOS Voltage Roadmap



CMOS Voltage vs. Speed



Comparison of 16245 functions with 500 ohm/30pF load. (AUC not yet tested)

Selection of a Logic Family for a Particular Load

Point-to-point, Light Load (0pF to 30pF)	LVC-R, AVC, AUC	LVC, LV-A
Point-to-point, Medium Load (30pF to 50pF)	AVC, LVC	ALVC
Point-to-point, Heavy Load (50pF to 100pF)	LVT, ALVT	LVC
Simultaneous Switching	AVC, AUC	LVC-R, LV-A
Portable Application, Slow Speed (<50MHz)	AUP, LV-A	AVC, LVC
Portable Application, Fast Speed (50MHz to 150MHz)	AVC, AUC	LVC
Multi-point Load (Unbalanced stub or daisy-chain)	VME, GTLP Backplane	LVT

Best Solution: Good Solution:

Note: Multi-point load, with equal stubs, can be treated as point-to-point load

Device Names and Package Designators

SN74 ABT H 16 2 244 A DGG R

Family
ABT/E
AC/ACT
AHC/AHCT
ALB
ALS
ALVC
ALVT
AS
AUC
AUP
AVC
BCT
CBT/LV/CB3x
CD4000
F
FB
FCT
GTL
GTLP
HC/HCT
HSTL
LS
LV-A
LVC
LVT
S
SSTL
SSTU
SSTV/SSTVF
TTL
TVC
VME

Standard Prefix
Military (54)
Commercial (74)

Special Feature
Blank = no special features
A, B, C = Configurable V_{CC}
D = Level Shifting Diode
H = Bus Hold
K = Undershoot Clamp
R = Damping Resistor on Inputs/Outputs
S = Schottky Clamping Diodes
Z = Power Up 3 State

Bit Width
Blank = Gates, MSI, and Octals
1G = Single Gate
2G = Dual Gate
3G = Triple Gate
8 = Octal IEEE 1149 (JTAG)
16 = Widebus™ (16,18, and 20)
18 = Widebus IEEE 1149.1 (JTAG)
32 = Widebus+™ (32 and 36 bit)

Options
Blank = No Options
2 = Series Damping Resistor on Outputs
3 = Level Shifter
4 = Level Shifter
25 = 25Ω Line Driver

Function
00
174
244

Package Type
D,DW = SOIC
DB,DL = SSOP
DBB,DGV = TVSOP
DCT,DCU = TSSOP
DBV, DCK = SOT
DGG,PW = TSSOP
FK = LCCC
FN = PLCC
GB = CPGA
GKE,GKF = LFBGA
GQL = VFBGA
HFP,HS,HT,HV = CQFP
J,JT = CDIP
N,NP,NT = PDIP
PAG,PAH,PCA,PCB,PM, PN, PZ = TQFP
PH,PQ,RC = QFP
RGY,RGQ = QFN
W,WA,WD = CFP
YEP, YZP = DSBGA†

Tape & Reel
R = 3000
T = 250

Device Revision
Blank = No Revision
Letter Designator A-Z

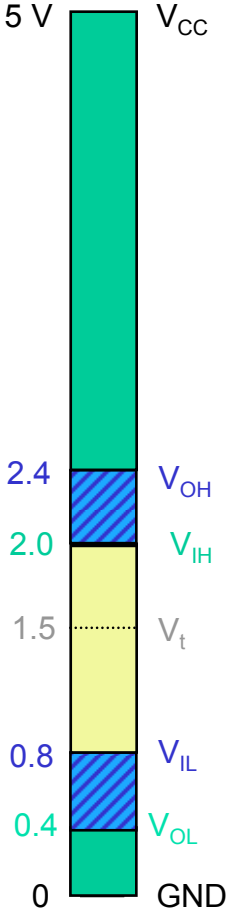
† DSBGA is the JEDEC reference for wafer chip scale package (WCSP).

Logic Vendor Partnerships

Performance Range		TI	Philips	(Renesas) Hitachi	IDT	Toshiba	FSC	On
5 V	high	ABT	ABT	ABT		ABT	ABT-C	
	low	AHC	AHC			VHC	VHC	VHC
3 V	high	CBT-LV			CBT-LV			
		ALVT	ALVT					
		ALVC	ALVC	ALVC	ALVC	VCX	VCX	VCX
	medium	LVT	LVT	LVT			LVT	
		LVC	LVC	LVC	LVC	LCX	LCX	LCX
	low	LV-A	LV	LV-A		LVQ	LVQ	LVQ
							LVX	LVX
2.5 V	high	AVC	AVC					
1.8 V	high	AUC	AUC		AUC			

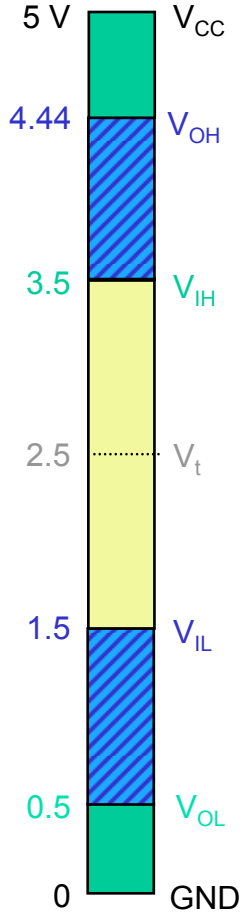
IC Basics

Comparison of Switching Standards



5-V TTL

Standard TTL: ABT, AHCT, HCT, ACT, Bipolar

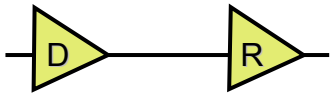


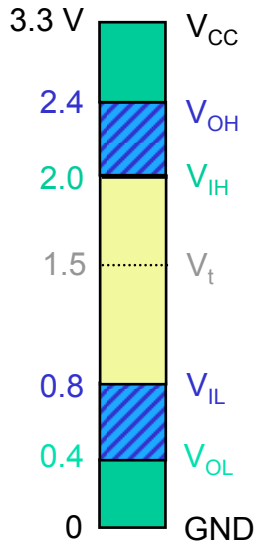
5-V CMOS

Rail-to-Rail 5 V HC, AHC, AC, LV-A

Is V_{OH} higher than V_{IH}?

Is V_{OL} less than V_{IL}?



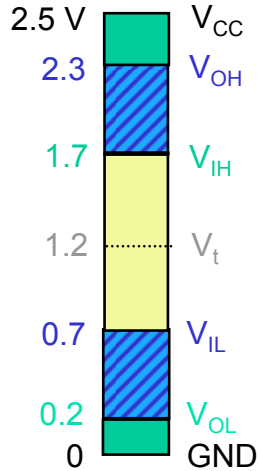


3.3-V LVTTL

LVT, LVC, ALVC AUP, LV-A, ALVT

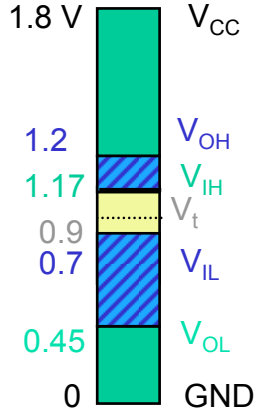
D \ R	5TTL	5CMOS	3LVTTL	2.5CMOS	1.8CMOS
5TTL	Yes	No	Yes *	Yes*	Yes*
5 CMOS	Yes	Yes	Yes*	Yes*	Yes*
3 LVTTL	Yes	No	Yes	Yes*	Yes*
2.5 CMOS	Yes	No	Yes	Yes	Yes*
1.8 CMOS	No	No	No	No	Yes

* Requires V_{IH} Tolerance



2.5-V CMOS

AUC, AUP, AVC, ALVC, LVC, ALVT



1.8-V CMOS

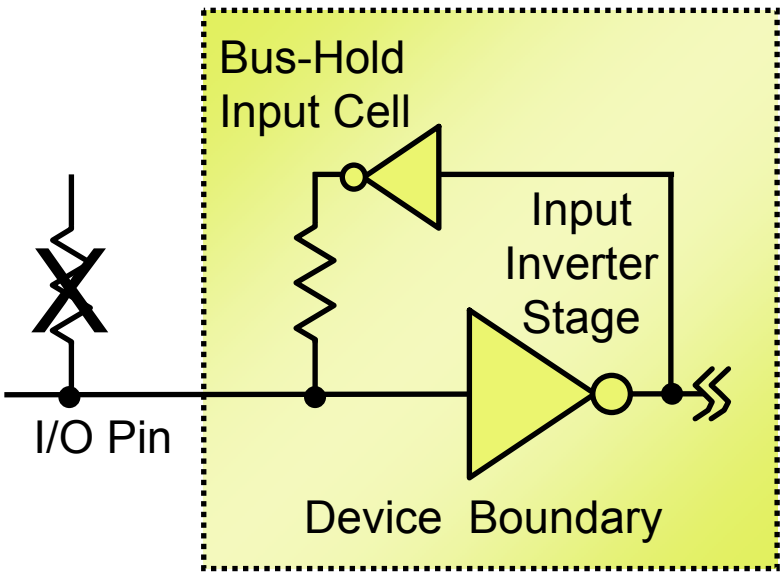
AUC, AUP, AVC, ALVC, LVC

Logic Feature List †

- **Bus Hold – ABT, ALVC, ALVT, AVC, AUC, FCT, GTL, GTLP, LVC, LVT, VME**
  - Bus-hold circuitry in selected logic families helps solve the problem of floating inputs and eliminates the need for pull-up or pull-down resistors by holding the last known state of the input. See $I_{I(HOLD)}$ or I_{BHL}, I_{BHH}, I_{BHLO}, and I_{BHHO} on data sheet.
- **Series Damping Resistors – ABT, ALVC, ALVT, F, GTLP, LVC, LVT, VME**
  - Series damping resistors limit signal overshoot and undershoot by providing better impedance matching and line termination without the need for external resistors.
- **Partial Power Down (Level 1 Isolation - I_{off}) – ABT, ALVT, AVC, AUC, AUP, CBTLV, CBT-C, GTL, GTLP LV-A, LVC, LVT, VME**
  - IOFF circuitry prevents the device from being damaged during hot insertion. See IOFF specifications on data sheet.
- **Hot Insertion (Level 2 Isolation – Ioff and Power-up 3-state) – ABT, ALVT, GTLP, LVCZ, LVT, VME**
  - Power-up 3-state ensures valid output levels during power up and valid Z on the outputs during power down. See IOZPU, IOZPD.
- **Live Insertion (Level 3 Isolation – Ioff, Power-up 3-state, and BIAS VCC) – GTLP, FB, CBT, CBTLV, VME**
  - Precharges I/O capacitance, preventing glitching of active data.
- **Mixed-Voltage-Tolerant I/Os and Level Shifting – AVC, ALVC, ALVT, AUC, AUP, GTL, GTLP, LV-A, LVC, LVT**
  - Systems use mixed supply voltages and TLL or CMOS levels in many designs. Most advanced-logic families allow mixed-signal interfacing and provide level-shifting functions for certain mixed-voltage applications.
- **JTAG – ABT, ACT, BCT, LVT**

(†selected functions)

Bus-Hold Input

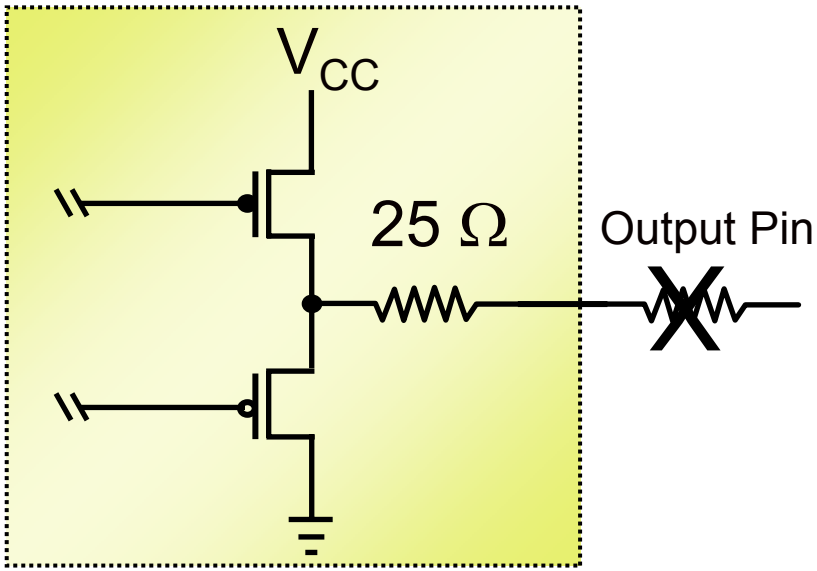


Bus-hold input cell replaces pullup resistor

- Holds the last known state of the input – avoids floating inputs
- $I_{i(HOLD)}$ or I_{BHL}, and I_{BHH} specifies min holding current
- Bus-hold current does NOT load down the driving output significantly at valid logic levels.
- Eliminates the need for external resistors on unused or floating input/output pins
- The “H” in the device name indicates bus hold.
- Negligible increase in systems power consumption.

Families with Bus-Hold Options
ABT, ALVC, ALVT, AVC, AUC, FCT, GTL, GTLP, LVC, LVT, VME

Series Damping Resistors

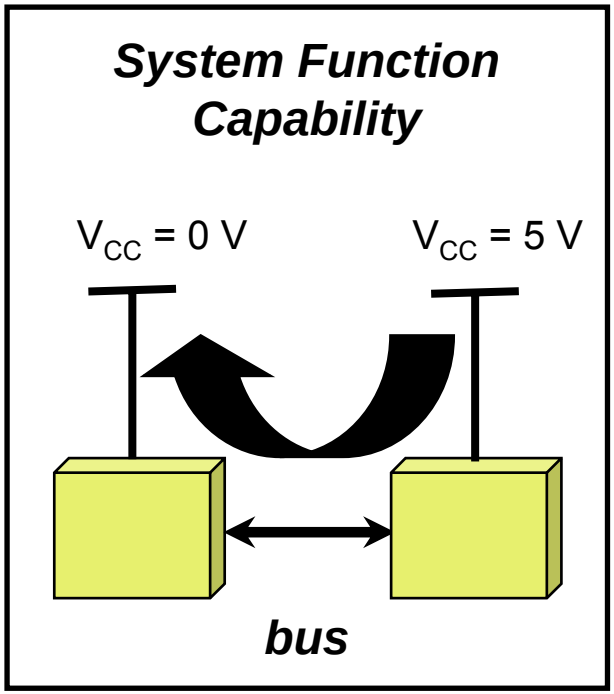


Damping resistors replace external series resistors

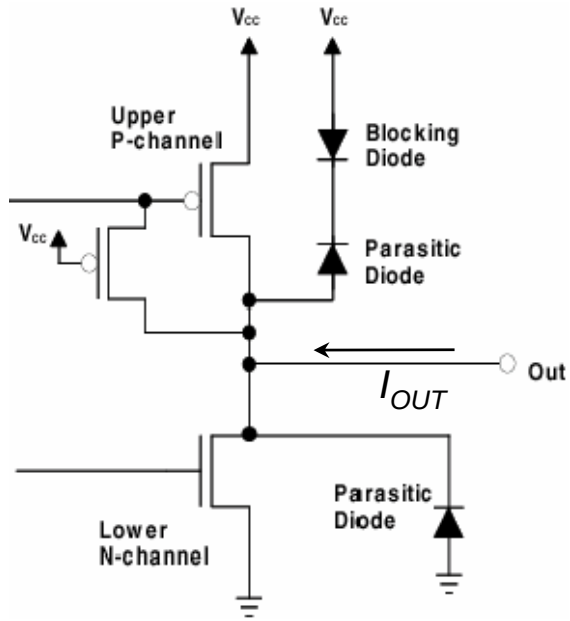
- Improves signal integrity
- Provides better impedance matching and line termination
- Eliminates the need for external series resistors
- Extra “2” or “R” in device name indicates damping resistor option
  - R: I/O pins (LVCHR16245)
  - 2: Output pins (LVC162244)

Families with Damping Resistor Options
ABT, ALVC, ALVT, F, GTLP, LVC, LVT, VME

Partial Power Down Live Insertion, Level 1



- Prevents unexpected device behavior during power up or power down
- Prevents signals from sourcing current through parasitic diodes
- Allows for power down of partial circuits within a system
- I_{off} spec is required for partial power down operations

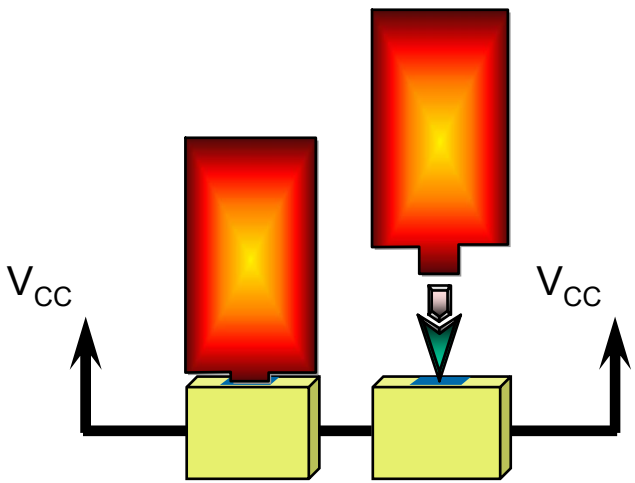


When V_{CC} = 0, I_{OUT} = 0 for $V_{OUT} > V_{CC}$.

Families Supporting Partial Power Down (I_{off})
ABT, ALVT, AVC, AUC, AUP, CBTLV, CBT-C, GTL, GTLP LV-A, LVC, LVT, VME

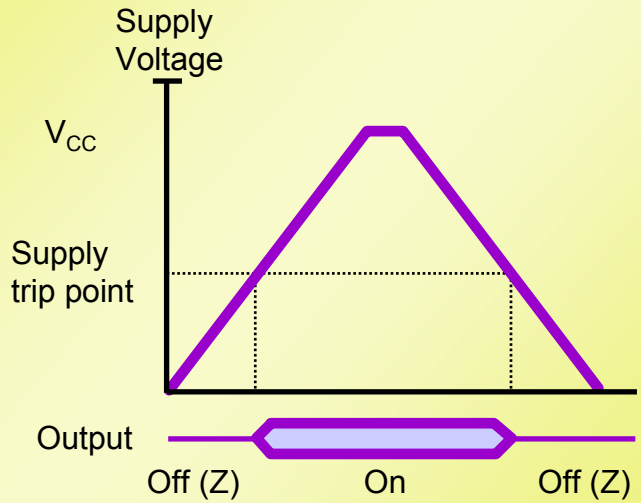
Hot Insertion
Live Insertion, Level 2

System Function/Capability



- Prevents unwanted turn-on of output before V_{CC} trip point
- Prevents bus to be loaded down upon power up of device
- Allows for hot insertion
- I_{off} and PU3S specs are required for Hot Insertion

Example
Circuit Implementation
PU3S Circuit

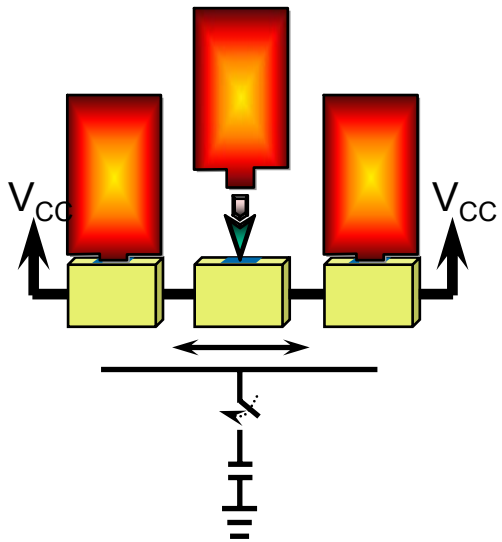


Families Supporting Hot Insertion (I_{off} and Power-up 3-state)

ABT, ALVT, GTLP, LVCZ, LVT, VME

Live Insertion
Live Insertion, Level 3

System Function/Capability



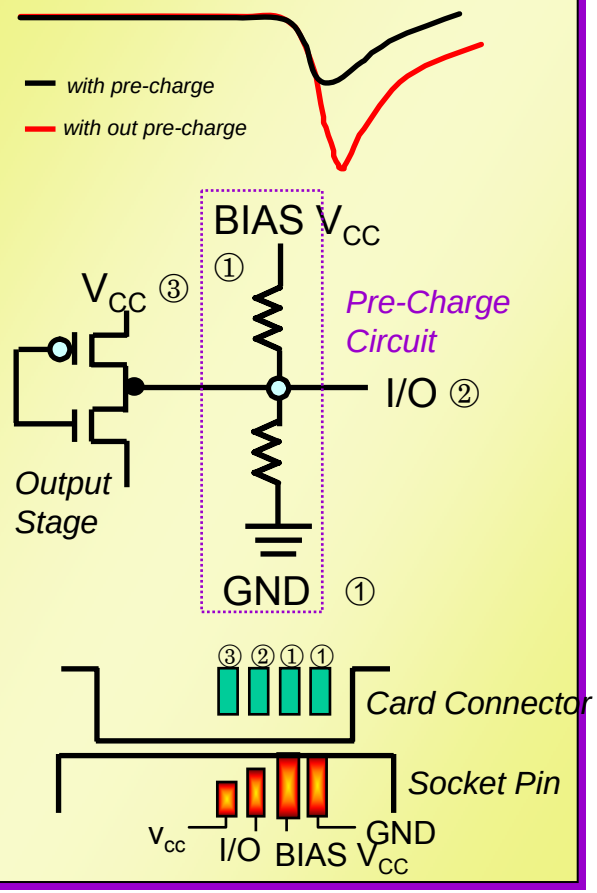
- Prevents unwanted glitches at the I/O
- Allows for live insertion
- I_{off}, PU3S, and BIAS V_{CC} required for Live Insertion
- Staggered pins required pre-charge functionality

Families Supporting Live Insertion (I_{off}, Power-up 3-state, and BIAS V_{CC})

GTLP, FB, CBT, CBTLV, VME

Circuit Implementation

Pre-Charge Circuit



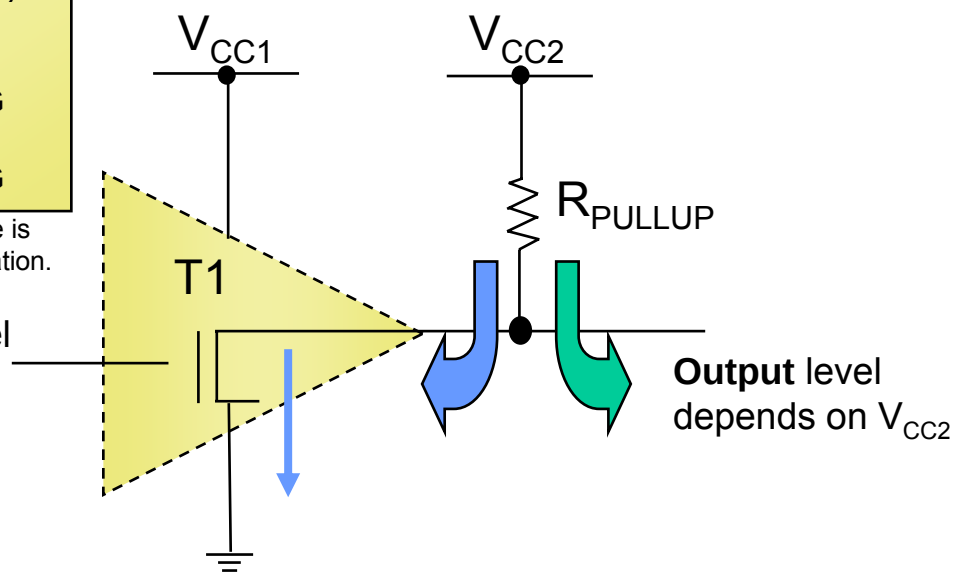
Mixed-Voltage Interfacing

Open-Drain Outputs 05/06/07 Functions

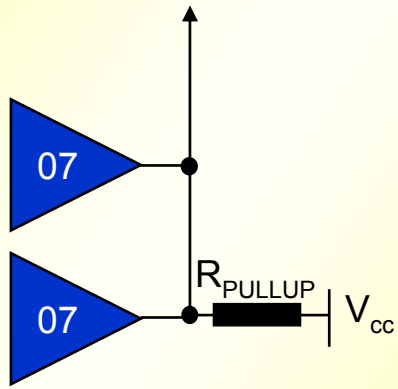
Functions Available

- 05 -S, LS, ALS, AC, HC, AHC, LV, LVC
- 06 -TTL, LS, LV, LVC, LVC1G/3G, AUC1G
- 07 -TTL, LS, LV, LVC, LVC1G/3G, AUC1G

NOTE: Over voltage tolerance is required to support UP translation.



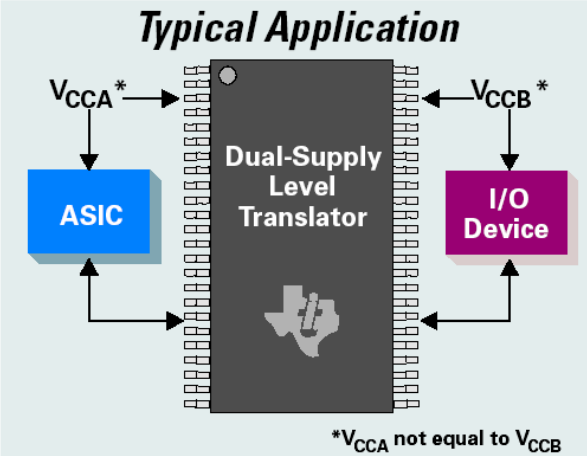
Also Possible
Wired-Function Technique



Phantom links on output side can reduce component count.

Supply Voltage Vcc1	LV05A/06A/07A		LVC06A/07A		LVC1G07/2G07/3G07		Pullup resistor may be connected to	Level conversion range
	Vi Level	Speed	Vi Level	Speed	Vi Level	Speed		
1.8 V	NA	NA	1.8 V Levels	1- 3.5 ns	1.8 V Levels	2.4 - 8.3 ns	1.8V, 2.5V, 3.3V and 5V	1.8 V ⇨ 1.8V - 5.5V
2.5 V	2.5 V Levels	6.6 - 10.4 ns	2.5 V Levels	1 - 2.8 ns	2.5 V Levels	1 - 5.5 ns	1.8V, 2.5V, 3.3V and 5V	2.5 V ⇨ 1.8V - 5.5V
3.3 V	3.3 V Levels	5 - 7.1 ns	3.3 V Levels	1 - 2.9 ns	3.3 V Levels	1.5 - 4.2 ns	1.8V, 2.5V, 3.3V and 5V	3.3 V ⇨ 1.8V - 5.5V
5 V	5 V Levels	3.4 - 5.5 ns	5 V Levels	1 - 2.6 ns	5 V Levels	1 - 3.5 ns	1.8V, 2.5V, 3.3V and 5V	5 V ⇨ 1.8V - 5.5V

Dual-Supply Level Translators



Features:

- Allow bi-directional voltage translation between different voltage nodes from 1.2-V to 3.6-V and 1.65-V to 5.5-V.
- Low power mode – if either VCC is turned off, then both ports are in the high-impedance mode, no power sequencing concerns (AVC devices and LVC 1- and 2-bit devices only)
- Bus-hold circuitry available (AVC devices only)
- I_{off} feature allows partial power-down operation (AVC devices and LVC 1- and 2-bit devices only)
- 1-through 32 bit options available

Device	Bit Width	V_{CCA}	V_{CCB}	Smallest Package
SN74AVC1T45[1]	1	1.2 to 3.6-V	1.2 to 3.6-V	6-pin Nanostar/Nanofree
SN74LVC1T45	1	1.65 to 5.5-V	1.65 to 5.5-V	6-pin Nanostar/Nanofree
SN74AVC2T45[1]	2	1.2 to 3.6-V	1.2 to 3.6-V	8-pin Nanostar/Nanofree
SN74LVC2T45	2	1.65 to 5.5-V	1.65 to 5.5-V	8-pin Nanostar/Nanofree
SN74AVC4T245[1,2]	4	1.2 to 3.6-V	1.2 to 3.6-V	16-pin QFN
SN74AVC8T245[1]	8	1.2 to 3.6-V	1.2 to 3.6-V	24-pin QFN
SN74LVC8T245[1,2]	8	1.65 to 5.5-V	1.65 to 5.5-V	24-pin QFN
SN74LVCC3245A	8	2.3 to 3.3-V	2.7 to 5.5-V	24-pin TSSOP
SN74LVC4245A	8	4.5 to 5.5-V	2.7 to 3.3-V	24-pin TSSOP
SN74LVCC4245A	8	4.5 to 5.5-V	2.7 to 5.5-V	24-pin TSSOP
SN74AVC16T245[1]	16	1.2 to 3.6-V	1.2 to 3.6-V	56-ball VFBGA
SN74AVCA164245[1]	16	1.4 to 3.6-V	1.4 to 3.6-V	56-ball VFBGA
SN74AVCB164245[1]	16	1.4 to 3.6-V	1.4 to 3.6-V	56-ball VFBGA
SN74LVC16T245[1,2]	16	1.65 to 5.5-V	1.65 to 5.5-V	56-ball VFBGA
SN74AVC20T245[1]	20	1.2 to 3.6-V	1.2 to 3.6-V	56-ball VFBGA
SN74AVC24T245[1,2]	24	1.2 to 3.6-V	1.2 to 3.6-V	83-ball LFBGA
SN74AVC32T245[1]	32	1.2 to 3.6-V	1.2 to 3.6-V	96-ball LFBGA
SN74AVCB324245[1]	32	1.4 to 3.6-V	1.4 to 3.6-V	96-ball LFBGA

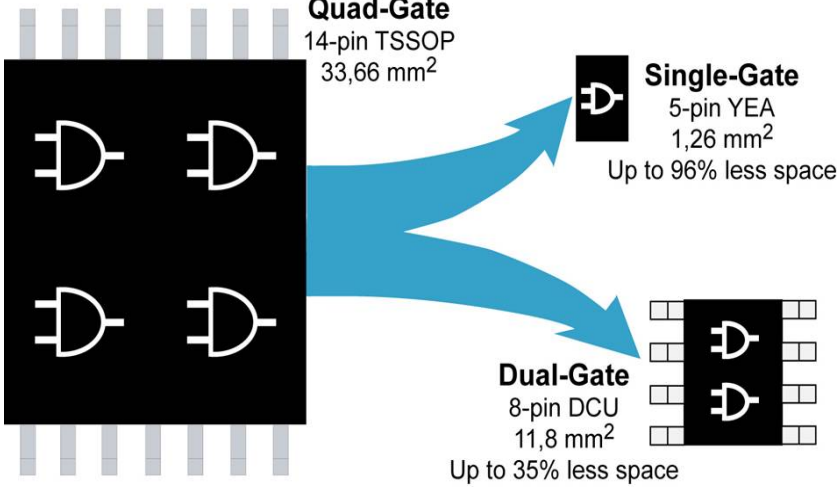
[1] Bus-Hold Option Available

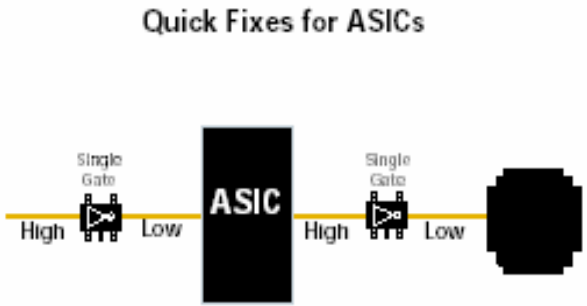
[2] In Development

What is Little Logic?

Single Gate/Dual Gate/Triple Gate

Principle





Naming

SN74 LVC 1G xx YEP R

Tape & Reel
R = 3000 piece
T = 250 piece

Package Type
YEP = NanoStar™ (230µ)
YZP = NanoFree™ (230µ)
DCK = SC-70
DBV = SOT-23
DCU = US-8
DCT = SM-8

Logic Function
xx

Gate Count
1G - Single Gate
2G - Dual Gate
3G - Triple Gate

Product Family
AHC/T, AUC, AUP, CBT, LVC

Standard Prefix

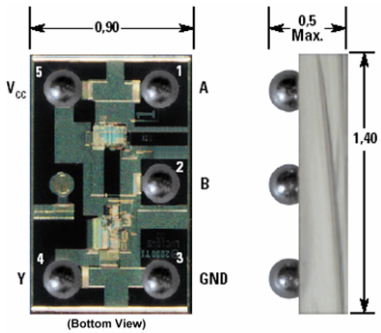
TI Little Logic Portfolio

- Provides wide range of operating voltages (0.8V to 5.5V)
- World's first 1.8V optimized logic family (AUC)
- World's lowest power logic family (AUP)
- Available in NanoStar and NanoFree (YEP/YZP)

Family	Operating Voltage	Optimized Voltage	Prop Delay$_{typ}$	Output Drive	V_i Tolerant	I_{off}
AUC	0.8-2.7V	1.8V	2.0ns	8mA	3.6V	Yes
AUP	0.8-3.6V	3.3V	5.4ns	4mA	3.6V	Yes
LVC	1.65-5.5V	3.3V	3.5ns	24mA	5.5V	Yes
AHC	2.0-5.5V	5.0V	5.0ns	8mA	5.5V	No
CBT	4.5-5.5V	5.0V	0.25ns	n/a	5.5V	n/a
CBTD	4.5-5.5V	5.0V	0.25ns	n/a	5.5V	n/a
CBTLV	2.3-3.6V	3.3V	0.25ns	n/a	3.6V	Yes

NanoStar™/NanoFree™ Package

- Offered in SnPb (NanoStar) and Pb-free (NanoFree)
- Available in solder bump size (230µ diameter)
- Bump locations facilitate device probing and rework
- 0.5-mm height meets aggressive LCD design requirements
- 70% smaller than industry standard SC-70 (DCK)
- 72% smaller than industry standard US-8 (DCU)
- Improved thermal and electrical characteristics
- Targeted for space constrained, portable applications: Cellular, DVD/CD ROMs, DVC, Digital Watch, DSC, MD/MP3/CD players, notebook computers, PC cards and PDA's

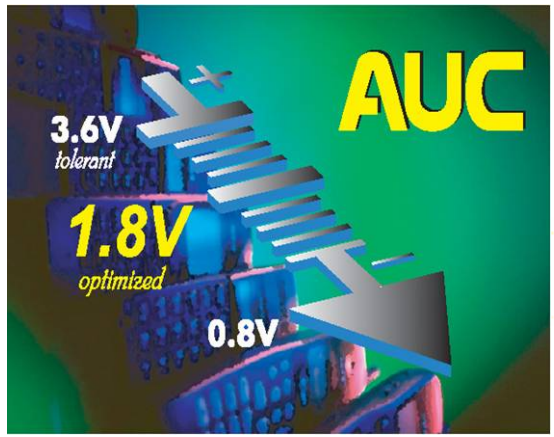


Package Designators
YEP = SnPb Bump
YZP = Pb-Free Bump

AUC
The World's First 1.8-V Logic

Features

- 1.8-V Optimized Performance
- V_{CC} Specified at 2.5 V, 1.8 V, 1.2 V
- 0.8 V Typical
- Balanced Drive
- 3.6-V I/O Tolerance
- Bus Hold Option
- I_{OFF} Spec for Partial Power Down
- ESD Protection
- Low Noise
- Alternate -Source Agreements



Advanced Packaging

NanoStar™ - YEP
NanoFree™ - YZP
SOT 23 - DBV (Microgate)
SC-70 - DCK (PicoGate)
TSSOP - PW & DGG
TVSOP - DGV
LFBGA - GKE, GKF
VFBGA - ZKE, ZKF
VFBGA - GQL
VFBGA - ZQL
QFN - RGY

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74AUC1G00	1.8 V	–8/8 mA	2.5 ns
SN74AUC16244	1.8 V	–8/8 mA	2.0 ns

Alternate Source: Philips, IDT

Texas Instruments

AUP
The World's Lowest Power Logic

Features

- Very low power consumption → high battery life
- Ideal for portable applications
- Excellent signal integrity
- Input hysteresis (250mV typ at 3.3V) allows for slow input transition
- Operating $V_{CC:}$ 0.8V-3.6V (optimized at 3.3V)
- Best in class for speed-power optimization
- Balanced Drive
- 3.6-V I/O tolerant
- I_{OFF} Spec for Partial Power Down
- ESD Protection

Advanced Packaging

NanoStar™ - YEP

NanoFree™ - YZP

SOT 23 - DBV (Microgate)

SC-70 - DCK (PicoGate)

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74AUP1G08	3.3 V	–4.0/4.0 mA (static)	4.3 ns
	1.8 V	–1.9/1.9 mA (static)	8.2 ns
	1.2 V	–1.1/1.1 mA (static)	15.6 ns

ALVC Family

Features

- V_{CC} Specified at 3.3 V, 2.5 V, and 1.8 V
- Balanced Drive
- Bus-Hold Option
- Drive Capability –6/12 mA at 2.5 V
- Low Noise
- Damping Resistor Options
- ESD Protection

Advanced Packaging

SOIC - D and DW
SSOP - DB and DL
TSSOP - PW and DGG
TVSOP - DGV

LFBGA - GKE, GKF
LFBGA - ZKE, ZKF
VFBGA - GQL
VFBGA – ZQL

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74ALVCH244	3.3 V	–24/24 mA	2.8 ns
SN74ALVCH16244	3.3 V	–24/24 mA	3.0 ns

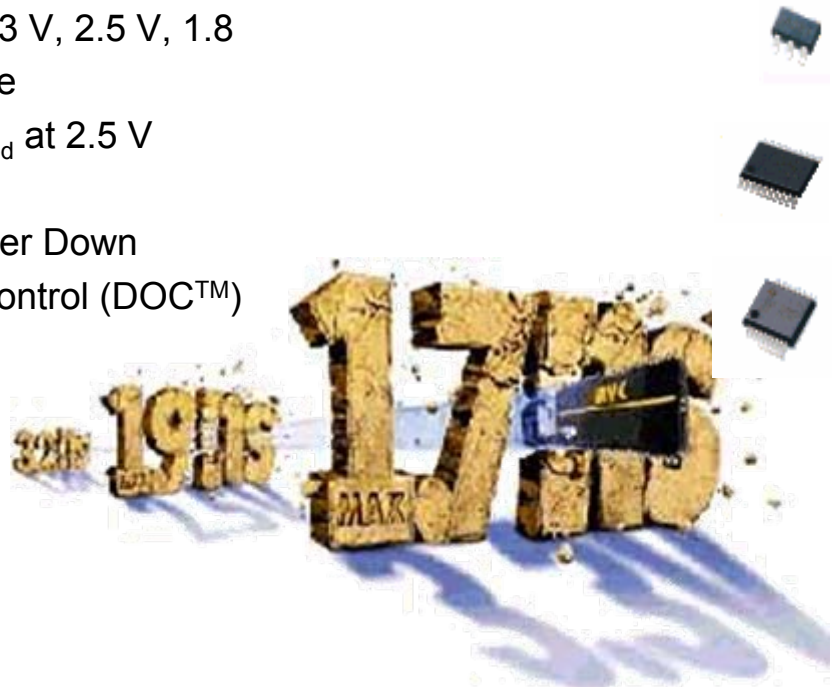
Literature
ALVC Low-Voltage CMOS Logic Data Book
Lit # SCED006

Alternate Source
ALVC: Philips, Hitachi, IDT
VCX: Fairchild, ON, Toshiba

AVC Family

Features

- V_{CC} Specified at 3.3 V, 2.5 V, 1.8
- 3.3-V I/O Tolerance
- Sub-2.0-ns max T_{pd} at 2.5 V
- Bus Hold Option
- I_{OFF} for Partial Power Down
- Dynamic Output Control (DOC™) Circuit



Advanced Packaging

SOIC - DW
TSSOP - PW, DGG
TVSOP - DGV
LFBGA - GKE, GKF
LFBGA - ZKE, ZKF
VFBGA - GQL
VFBGA - ZQL

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74AVC16244	3.3 V	–12/12 mA (static)	1.7 ns
	2.5 V	–8/8 mA (static)	1.9 ns
	1.8 V	–4/4 mA (static)	3.2 ns

Alternate Source: Philips

DOC is a trademark of Texas Instruments.

LVC Family

Features

- V_{CC} Specified at 3.3 V, 2.5 V, and 1.8 V
- Balanced Drive
- 5-V I/O Tolerance
- Bus-Hold Option
- Series Damping Resistor Option
- I_{OFF} Spec for Partial Power Down
- ESD Protection
- LVCZ has Power-Up 3-State for Hot Insertion

Advanced Packaging


NanoStar™ - YEP

NanoFree™ - YZP


SOT 23 - DBV (Microgate)

SC-70 - DCK (PicoGate)

SOIC - D and DW


SSOP - DB and DL

TSSOP - PW and DGG

TVSOP - DGV


LFBGA - GKE, GKF

LFBGA - ZKE, ZKF

VFBGA - GQL

VFBGA – ZQL


QFN - RGY

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74LVCH244	3.3 V	–24/24 mA	5.9 ns
SN74LVCH16244	3.3 V	–24/24 mA	4.1 ns

Literature

LVC Low-Voltage CMOS Logic Data Book — Lit # SCBD152

LVC Designers Guide Application Report — Lit # SDZAE16

Alternate Source

LVC: Philips, Hitachi, IDT

LCX: Fairchild, Motorola, Toshiba

LV-A Family

Features

- V_{CC} Specified at 5.0 V, 3.3 V, 2.5 V
- 5-V I/O Tolerance
- Balanced Drive
- I_{OFF} Spec for Partial Power Down
- ESD Protection
- Low Noise

Advanced Packaging

SOIC - D, DW
SOP - NS
SSOP - DB
TSSOP - PW, DGG
TVSOP - DGV
QFN - RGY, RGQ

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74LV244A	5.0 V	–16/16 mA	6.5 ns
	3.3 V	–8/8 mA	10.0 ns

Literature
LV Low-Voltage CMOS Logic Data Book
Lit # SCBD152

Alternate Source
LV: Philips, Hitachi
LVQ: Fairchild, ON, Toshiba
LVX: Fairchild, ON

LVT Family

Features

- V_{CC} Specified at 3.3 V
- High-Drive Output – up to 64 mA
- 5-V I/O Tolerance
- Bus Hold Option
- Partial Power Down (I_{OFF})
- Power - Up 3-State (I_{OZPU} ,I_{OZPD})
- Hot Insertion (I_{OFF} and PU3S)
- Low Noise
- Damping Resistor Options

Advanced Packaging

SOIC - DW

SSOP - DB and DL

TSSOP - PW and DGG

TVSOP - DGV

LFBGA - GKE and GKF

LFBGA - ZKE and ZKF

VFBGA - GQL

VFBGA - ZQL

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74LVTH244	3.3 V	–32/64 mA	3.5 ns
SN74LVTH16244	3.3 V	–32/64 mA	3.2 ns

Literature

LVT Low-Voltage Technology Data Book
Lit # SCBD154
LVT-to-LVTH Conversion Application Report
On the Internet

Alternate Source

LVT: Philips, Hitachi,
Fairchild*, ON*
** Similar Device, No Second-Source Agreement*

ALVT Family

Features

- V_{CC} Specified at 3.3 V and 2.5 V
- High-Drive Output – up to 64 mA
- 5-V I/O Tolerance
- Power-Up 3-State (I_{OZPU} ,I_{OZPD})
- Partial Power Down (I_{OFF})
- Hot Insertion (I_{OFF} and PU3S)
- Bus Hold

Advanced Packaging

SSOP - DL

TSSOP - DGG

TVSOP - DGV

LFBGA - GKE and GKF

LFBGA - GKE and GKF

VFBGA - GQL

VFBGA - ZQL

Device	V_{CC}	Drive	$T_{PD(MAX)}$
SN74ALVTH16244	3.3 V	–32/64 mA	2.4 ns
	2.5 V	–8/24 mA	3.0 ns

Literature

ALVT Low-Voltage Technology Data Book

Lit # SCED003

Second Source

ALVT: Philips

TI Signal Switch Product Overview

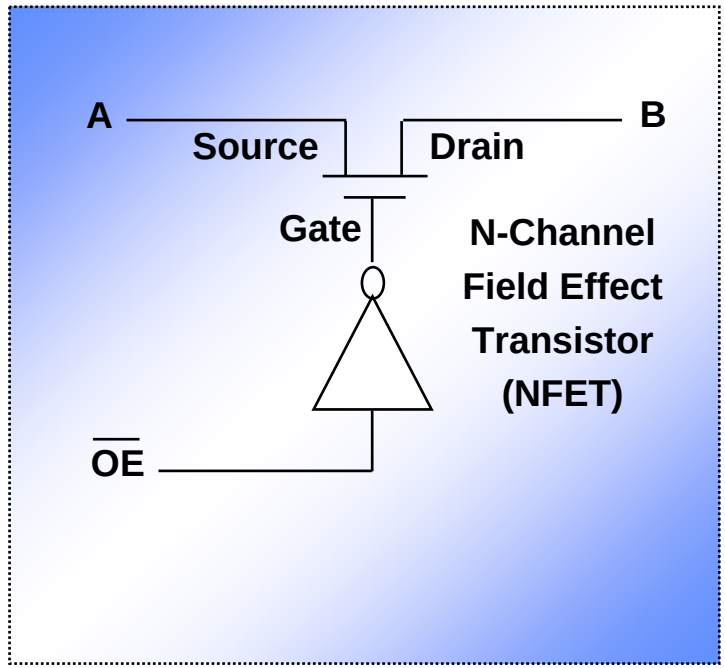
- Include Digital Bus Switches, Analog Switches, and Specialty Switches
- Provide High-Performance, Low-Power Bus-Interfacing When Signal Buffering is Not Required
- Support Digital, Analog, and System Specific Applications
  - PCI Interface
  - USB Interface
  - Memory Interleaving
  - Low-Distortion Signal Gating

Digital Bus Switch: Description

What are Bus Switches?

- Simple digital FET switches that can quickly turn ON / OFF the connection to a line or bus
- Provide industry standard functions and pinouts (i.e. ‘244, ‘245) in a full range of bit widths (from 32-bit Widebus to 1-bit Little Logic)
- Offer extremely low power consumption (µA range), ideal for portable systems
- High performance replacements for standard Logic devices when signal buffering (current drive) is not required

Bus Switch Circuit Diagram



Digital Bus Switch: Key Characteristics

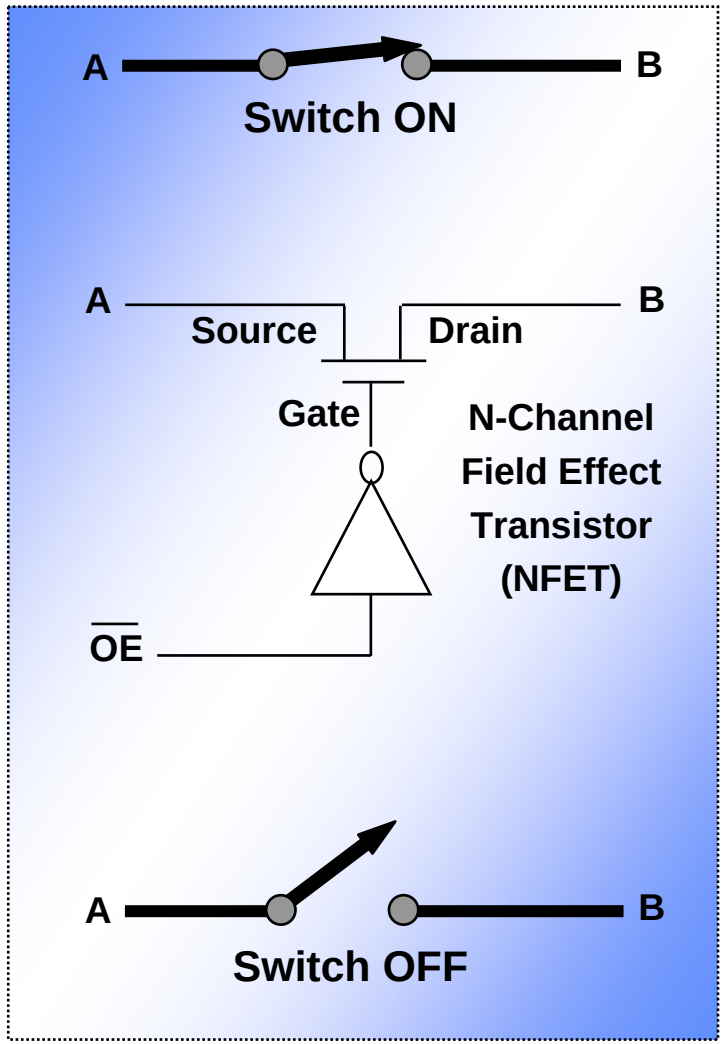
When ON, a Bus Switch Provides

- Bi-directional signal passing
- Near zero propagation delay (0.25ns) for maximum system performance
- Very low resistance (Ron ≈ 5Ω to 10Ω)
- Very low capacitance (Cio ≈ 8pF to 12pF)
- Fast data throughput (100MHz to 500MHz)
- No drive current (pass-through current only)

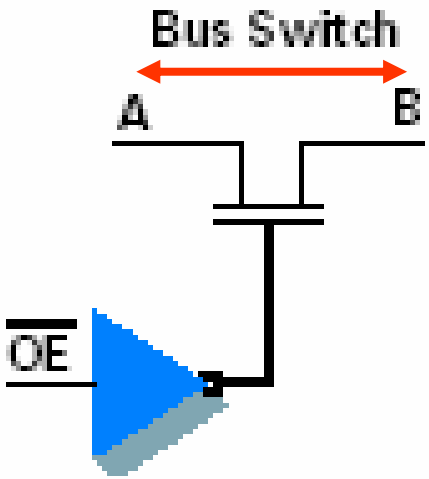
When OFF, a Bus Switch Provides

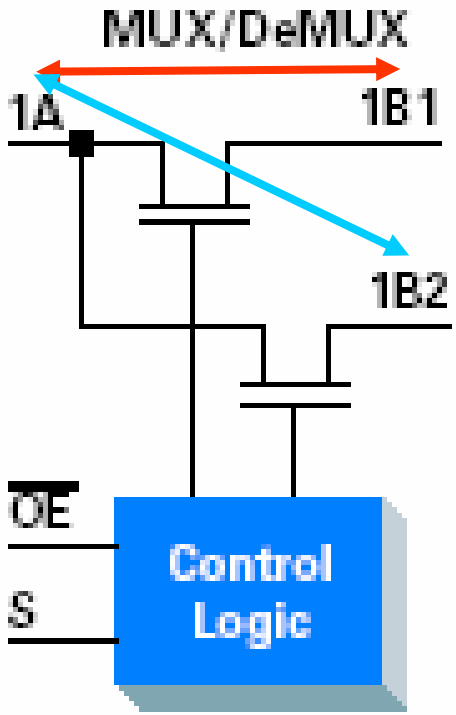
- Excellent isolation with very high resistance (Ron = 10's of MΩ)
- Very low capacitance (Cio ≈ 3pF to 5pF) minimizes capacitive loading and signal distortion

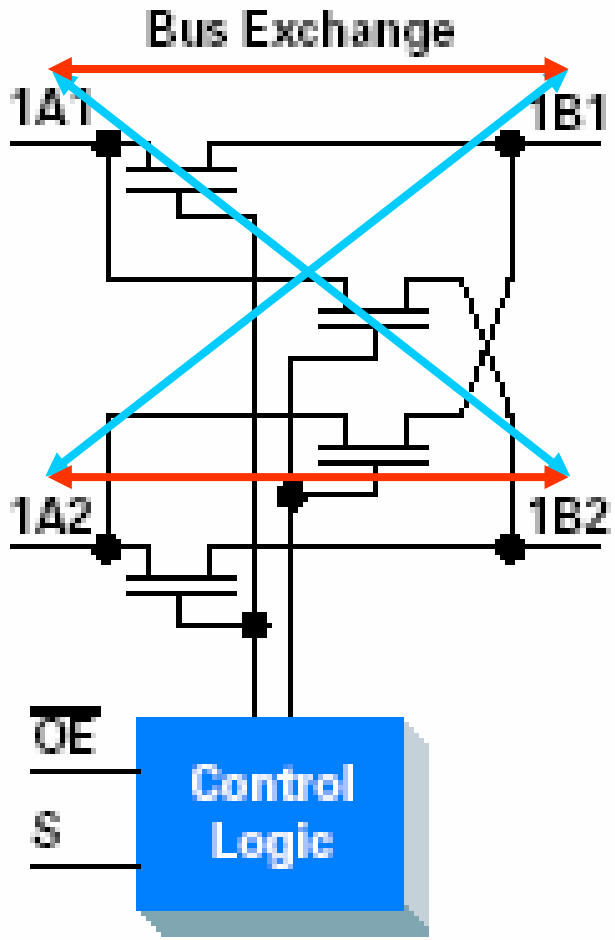
Bus Switch Circuit Diagram



Digital Bus Switch: Configurations







Flexible Configurations

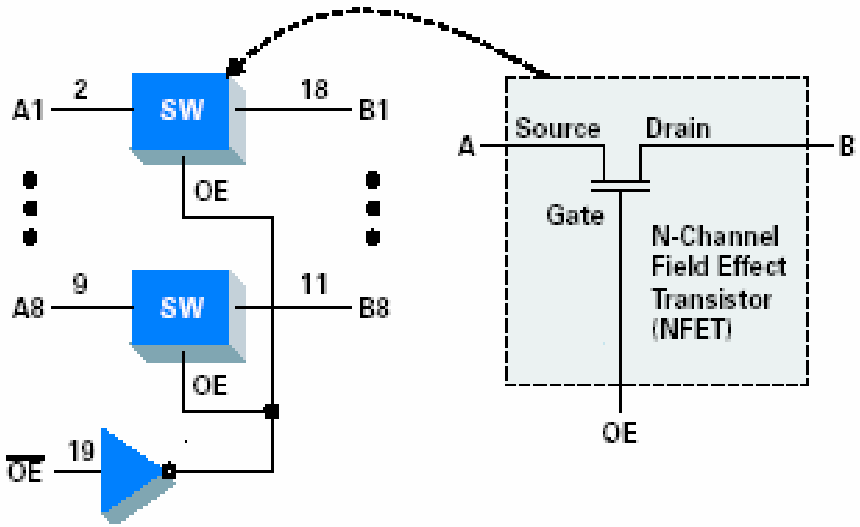
- Many Bit width Options
- Many Signal Routing Options (Isolation, MUX, DeMUX, Exchange)

Digital Bus Switch: CBT

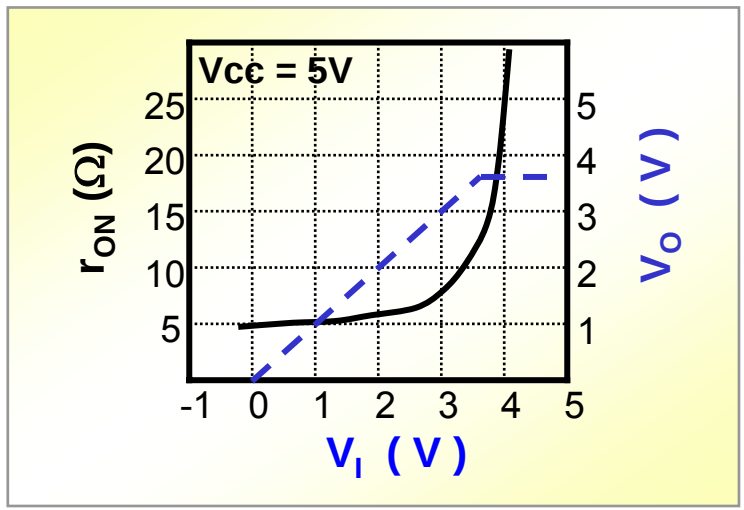
CBT: 5V General Purpose Bus Switch Family

- NMOS Switch uses NFET
- Supports 5V operation (Vcc = 4V – 5.5V)
- Switch ON when positive signal applied at gate (/OE low)
- Switch OFF when low signal applied at gate (/OE high)
- Bi-directional operation (Source & Drain interchangeable)
- CBTD = NMOS Switch configured as level shifter with Level Shifting Diode
- CBTR features Series Damping Resistors for improved noise control

CBT3245 Logic Diagram



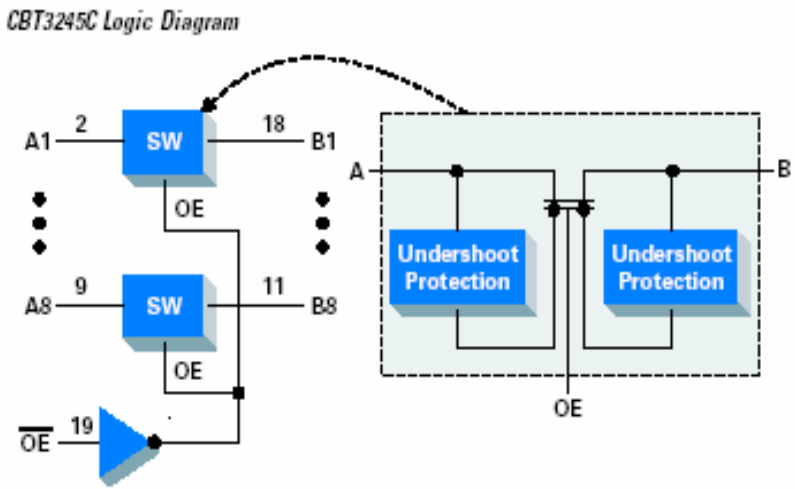
CBT V_{IN}/V_{OUT} Graph

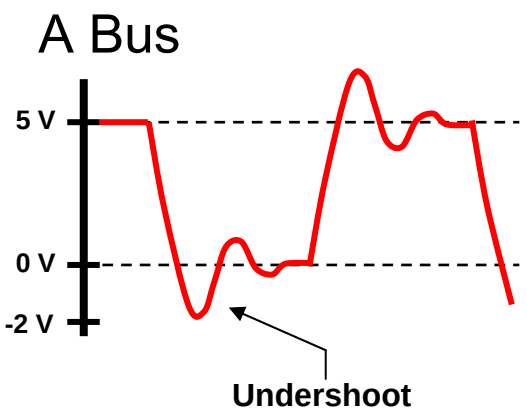


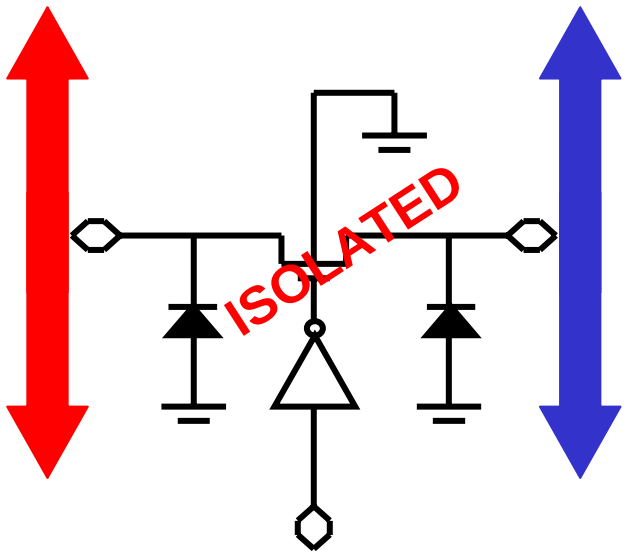
Digital Bus Switch: CBT-C

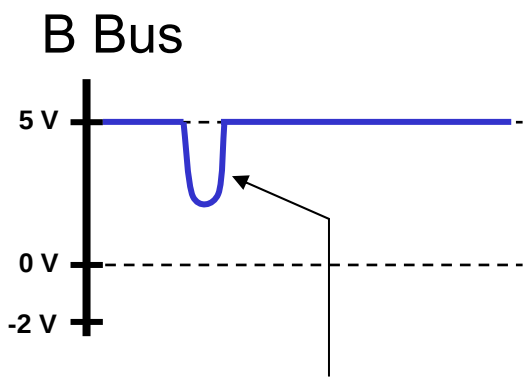
CBT-C: Improved 5V General Purpose Bus Switch Family

- Active Undershoot Protection Circuitry provides protection down to -2V
- Ioff supports Partial-Power-Down Mode Operation
- Enhanced performance vs. CBT family (faster Ten/Tdis, lower Ron)
- Improved ESD protection; 2KV HBM, 1KV CDM









/OE = H (Switch OFF)

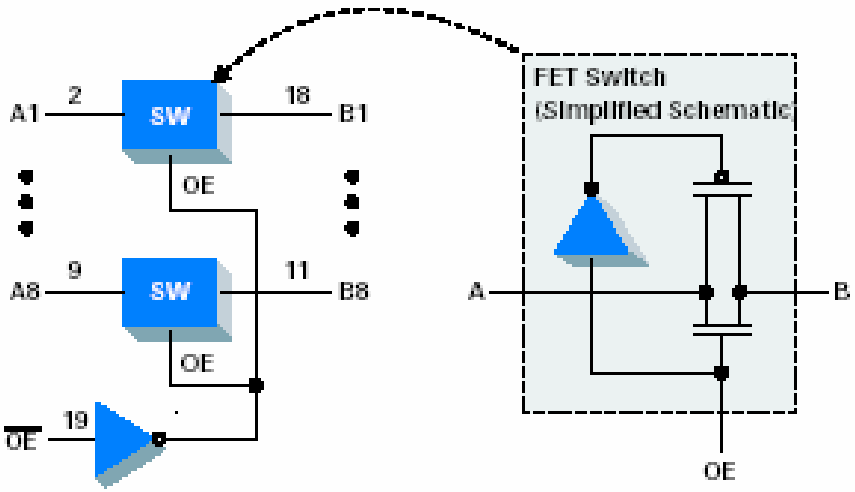
CBT-C prevents this type of undershoot induced data glitch on the B Bus

Digital Bus Switch: CBTLV

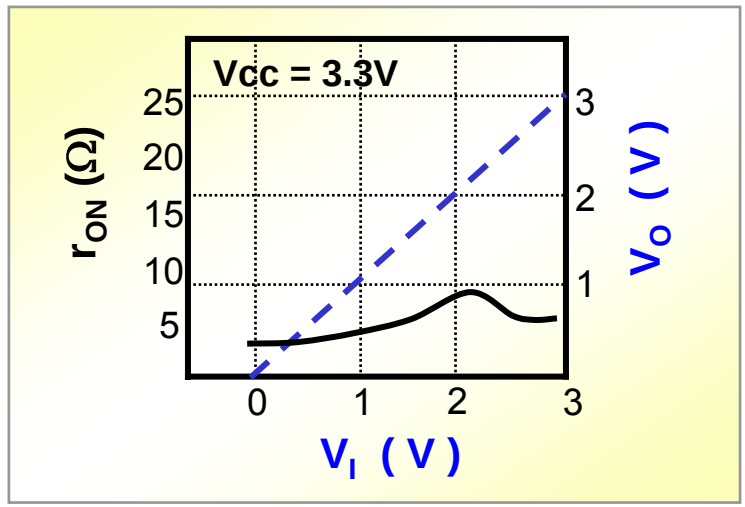
CBTLV: 3.3V / 2.5V General Purpose Bus Switch Family

- CMOS Switch consisting of an NFET and PFET in parallel
- Supports 3.3V / 2.5V Operation (Vcc = 2.3V – 3.6V)
- Switch ON when positive signal applied at NFET gate, and low signal applied at the PFET gate (/OE low)
- Switch OFF when low signal applied at NFET gate, and positive signal applied at PFET gate (/OE high)
- Bi-directional Operation (Source and Drain interchangeable)
- Offers rail-to-rail I/O (RRIO) signal transmission (no voltage clamping)

CBTLV 3245 Logic Diagram



CBTLV V_{IN}/V_{OUT} Graph

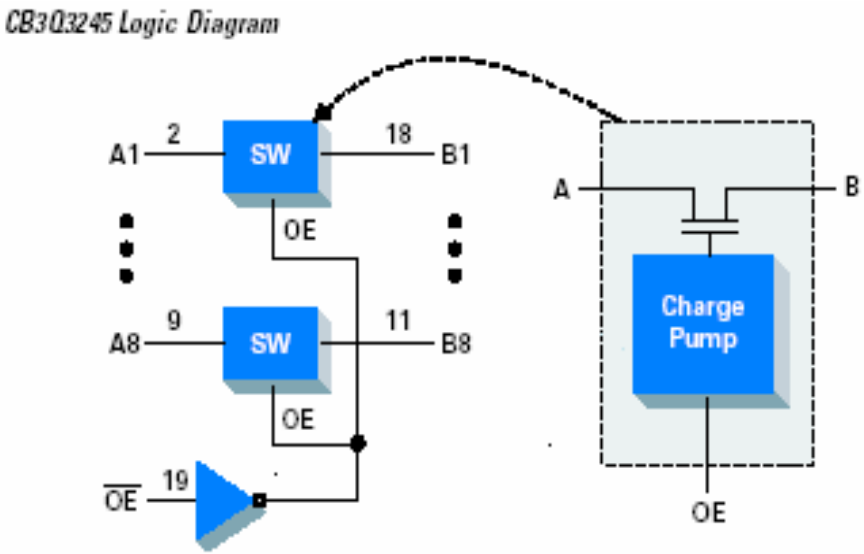


TEXAS INSTRUMENTS

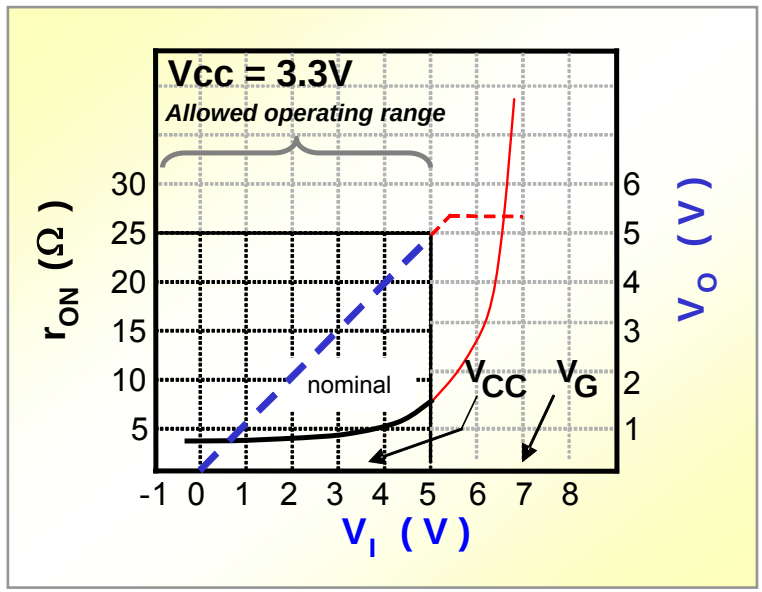
Digital Bus Switch: CB3Q

CB3Q: High-Bandwidth Bus Switch Family

- High-Bandwidth Data Path (Up to 500MHz)
- Provides Low and Flat On-State Resistance (Ron) Characteristics
- Supports Rail-to-Rail I/O (RRIO) Switching from 0V to 5V
- VCC Operating Range from 2.3V to 3.6V
- Ideal for Broadband Communications and Networking Systems
- Equivalent to IDTQS3VH HotSwitch™ Line of IDT QuickSwitch® Products



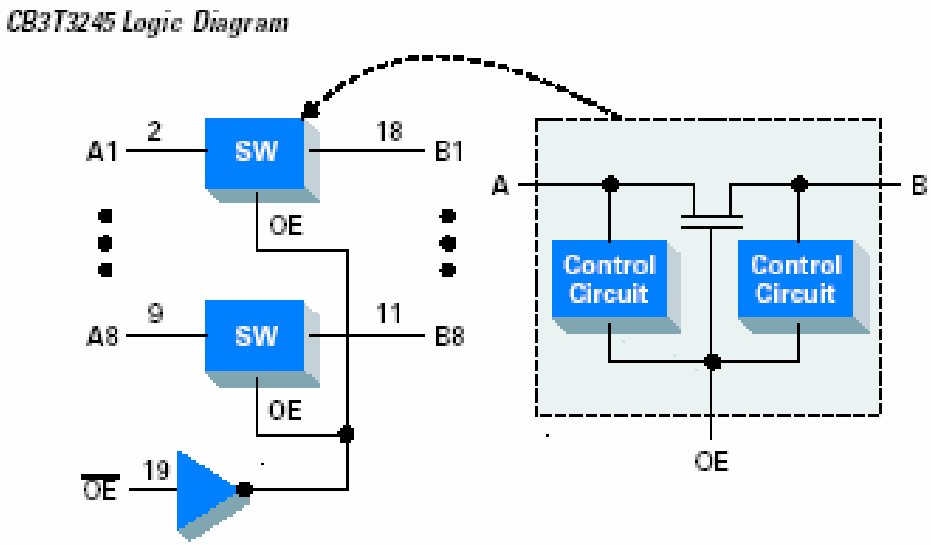
CB3Q V_{IN}/V_{OUT} Graph

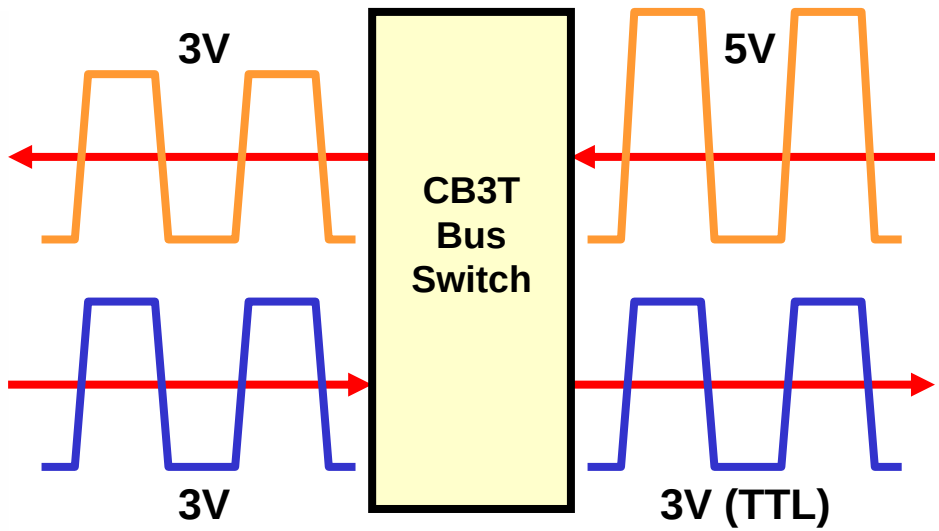


Digital Bus Switch: CB3T

CB3T: Low-Voltage Translator Bus Switch Family

- Output Voltage Translation Tracks Vcc
  - 5V Input to 3.3V Output Level Shift with Vcc = 3.3V
  - 5V / 3.3V Input to 2.5V Output Level Shift with Vcc = 2.5V
- Fully Supports Mixed-Mode Signal Operation (2.5V, 3.3V, and 5V Environments)
- VCC Operating Range From 2.3V to 3.6V
- Low Icc Ideal for Notebooks, PDAs, Cell Phones, Digital Cameras

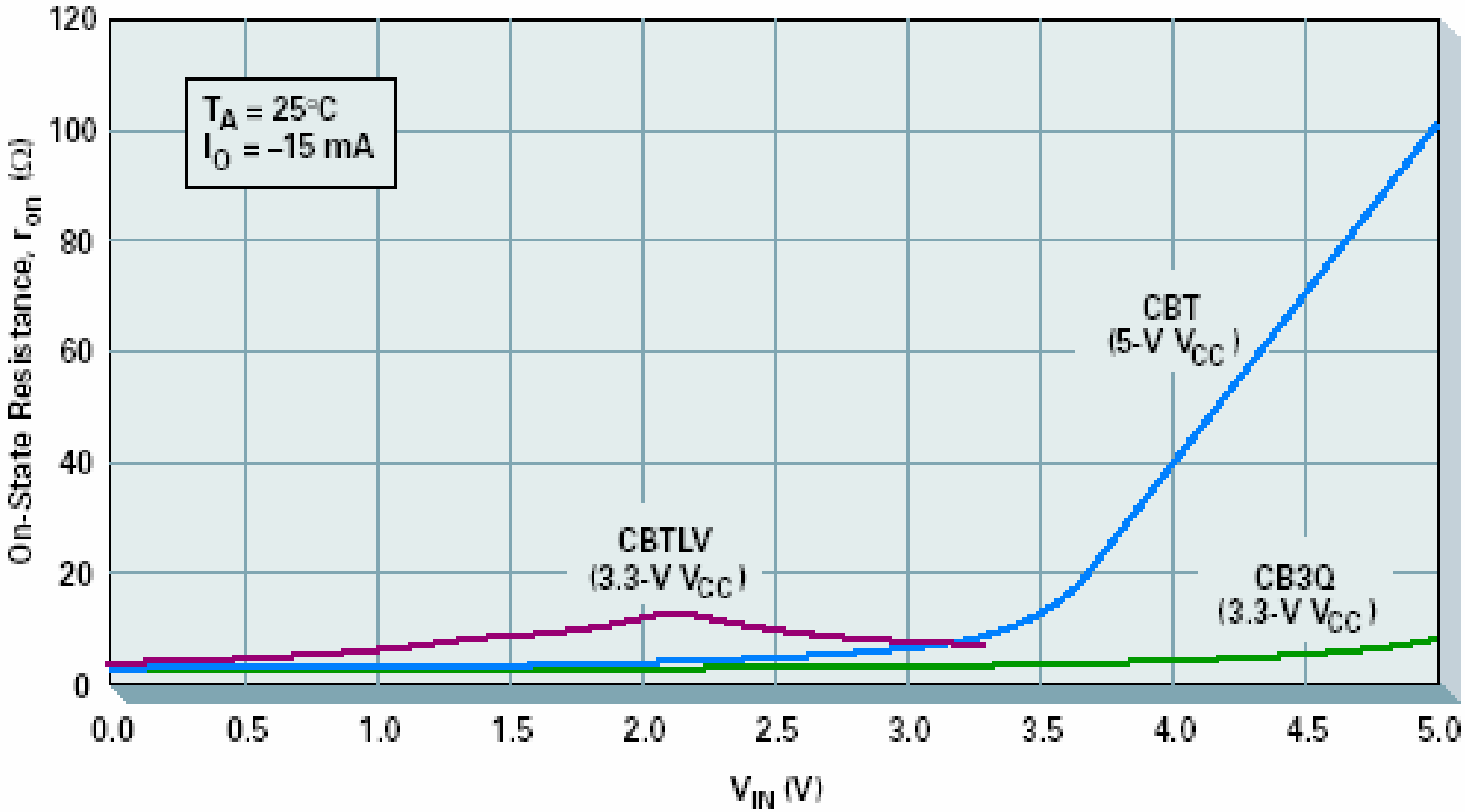




Texas Instruments

Digital Bus Switch: r_{on} Characteristics

Comparison of typical r_{on} vs. V_{IN} for the CBT, CBTLV and CB3Q Bus Switch Families

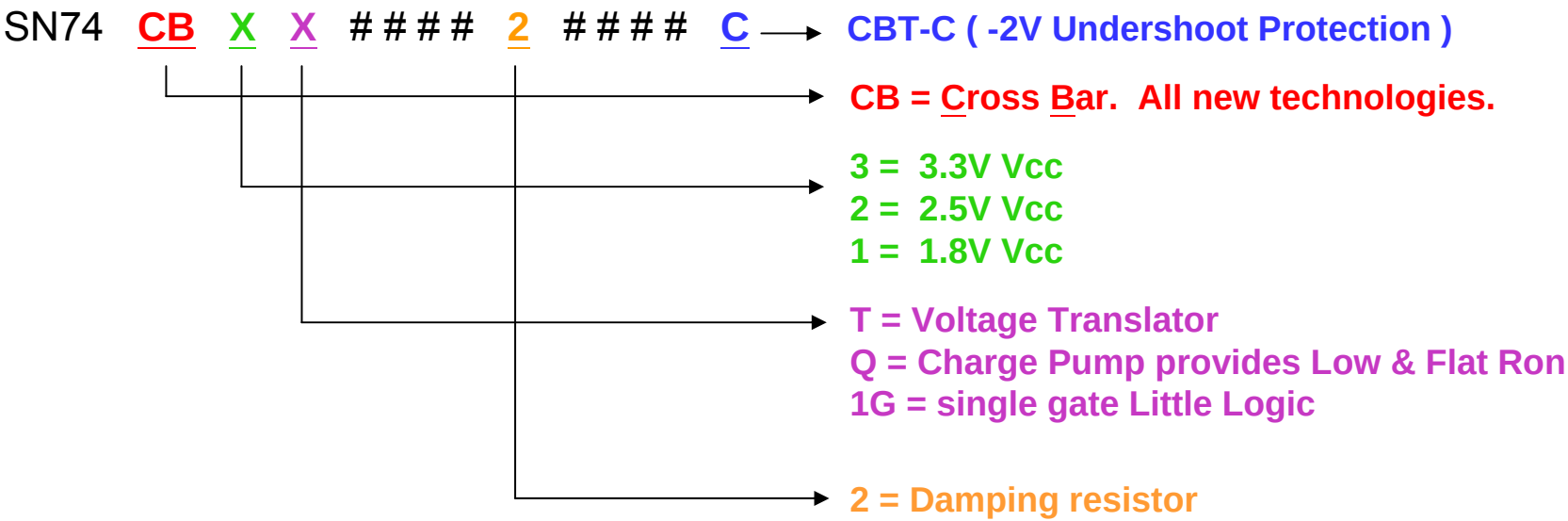


Digital Bus Switch Naming

CBT & CBT-C

- C-rev to indicate new improved performance CBT-C products (CBT####C)
- Both CBT and CBT-C solutions to be offered, (no obsolescence planned)

New CBT-C, CB3Q & CB3T Families



- I/O Tolerant feature is a Default Option stated on the datasheet
- Undershoot Performance is a Default Option and stated on the datasheet

Analog Switch: Families and Configurations

AUC (Advanced Ultra-Low-Voltage CMOS Technology)
- Operational from 0.8V to 2.5V (3.6V tolerance)
- Sub-1V family operates at low power and high speed
- Supports overall system signal integrity
- Ideal for portable consumer electronics

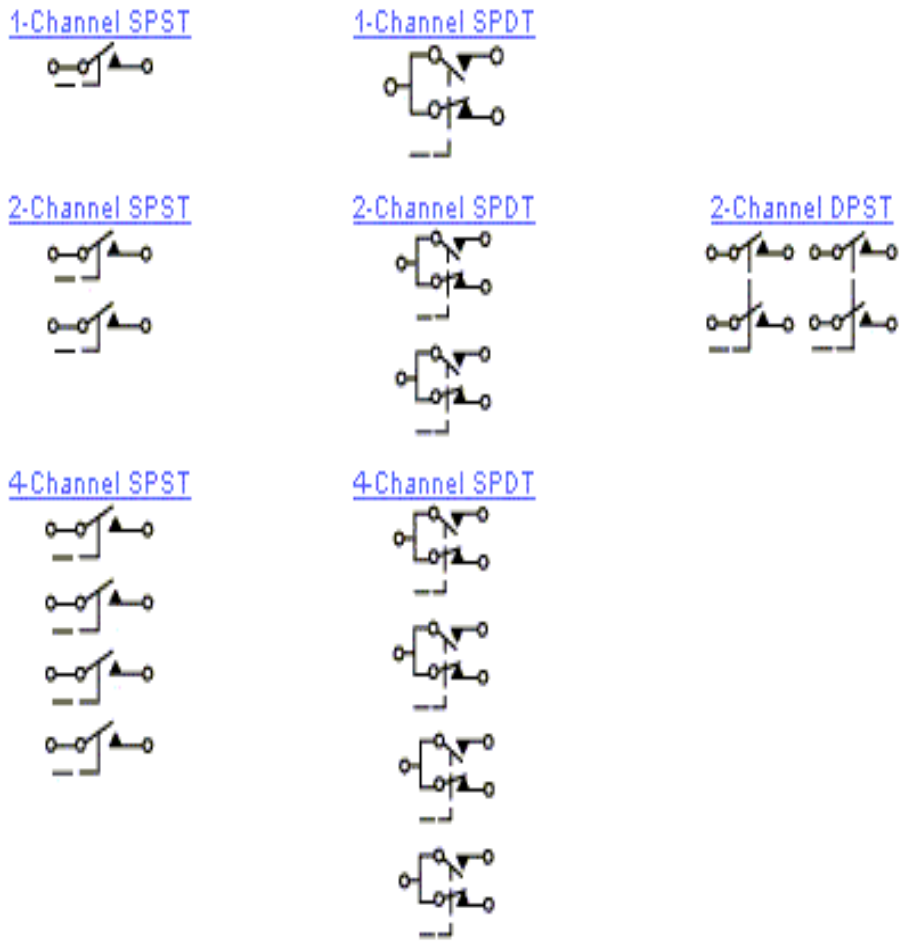
LVC (Low-Voltage CMOS Technology)
- Specially designed for 3V power supplies
- 5V tolerant inputs and outputs

LV-A (Low-Voltage CMOS Technology)
- 5V tolerance, fast performance, partial power down
- Superior migration path from HC/HCT technology
- Voltage operation range from 2V to 5.5V Vcc

HCT (High-Speed CMOS Technology)
- Low power, low noise, at a low price
- TTL-compatible inputs

HC (High-Speed CMOS Technology)
- Low power & low noise at a low price

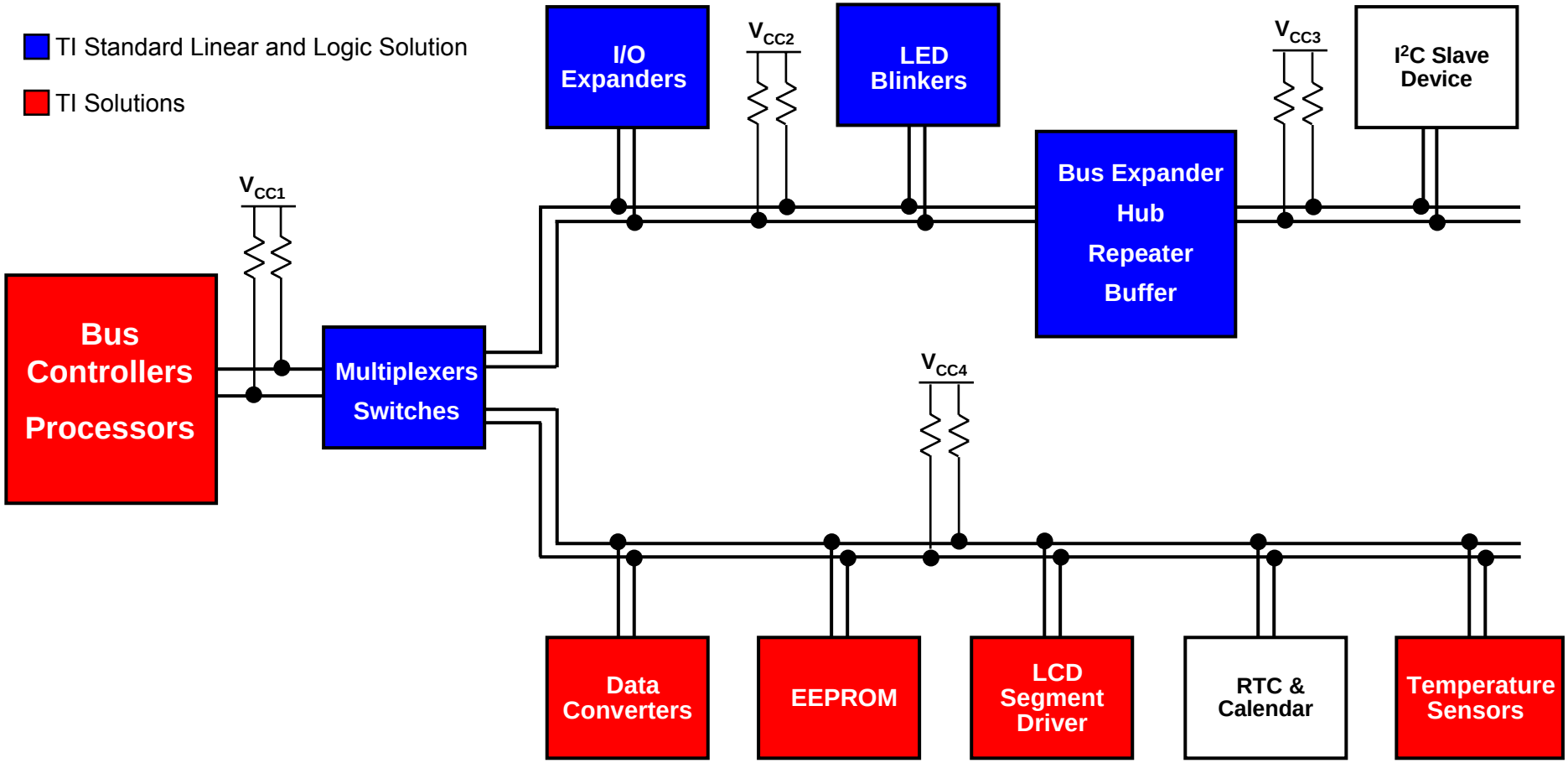
CD4000 (CMOS Technology)
- Maximum DC supply-voltage rating of 20V
- Wide operating voltage range supports: Instrumentation, Control, and Communications



Introduction to I²C

- Architecture: Two-wire communication bus
  - Bidirectional Serial Data (SDA)
  - Unidirectional Serial Clock (SCL)
- Interface: Well known bus interface standard
  - Protocol allows for bidirectional transfer of data between a master and several slave devices on the bus
  - The master device controls the bus
  - Each slave device on the same bus has a unique I²C address
- Speed: Three modes of operation
  - Standard mode (0 to 100 Kbps)
  - Fast mode (0 to 400 Kbps)
  - High-speed mode (0 to 3.4 Mbps)
  - Higher speed-mode devices are backward compatible
  - Mixed-mode communication is possible with the speed of the bus controlled by the bus master
- History: Well known bus interface standard
  - Created and developed by Philips Semiconductor in the 1980s
  - More than 20 years of existence
  - Has become a world-wide standard
- Applications: Wide Use
  - Intended for simple control, status check & update, and maintenance functions
  - Standard adopted by all industry (automotive, computing, consumer, industrial, networking, telecom)
  - Used in many system applications (PCs, portables, printers, test equipment, DVD/TV, etc.)
- Life of Product: Designed to stay in the market for many years
  - P82B715 (since 1992)
  - PCF8574/A (since 1994)
- SMBus: System Management Bus (SMBus) is a 2-wire serial communication protocol
  - Uses the I²C protocol as a backbone
  - V_{CC} = 5V (not scaleable); minimum frequency is 10KHz

System Block Diagram using I²C Devices



FEATURES:

- Requires one master device (processor) and multiple slave devices
- Each device on the bus must have a unique address
- Maximum bus capacitive-load of 400 pF
- Rise time of 1000ns (standard mode) and 300ns (fast mode)

Typical I²C-Bus Device Applications

Portables
- Expanders (GPIO)
- LED Blinkers
- LCD & Segment Drivers

Telecom & Networking Applications
- Maintenance & Control
- Multiplexer
- Voltage Level Shifting
- Repeaters & Hubs

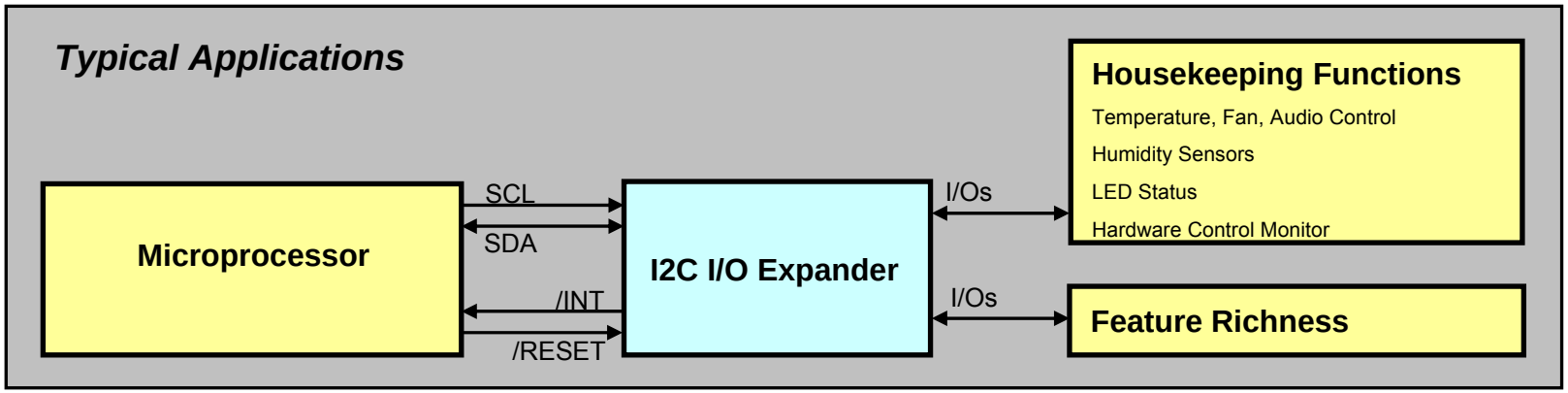
Memory Modules
- SPD (Serial EEPROMs)

Laptops, PCs & Servers
- Bus Controllers
- Expanders (GPIO)
- Temperature Sensors

Test Equipment
- Bus Controllers
- Data Converters
- I/O Expanders
- LED Blinker
- LCD & Segment Drivers
- Temperature Sensors

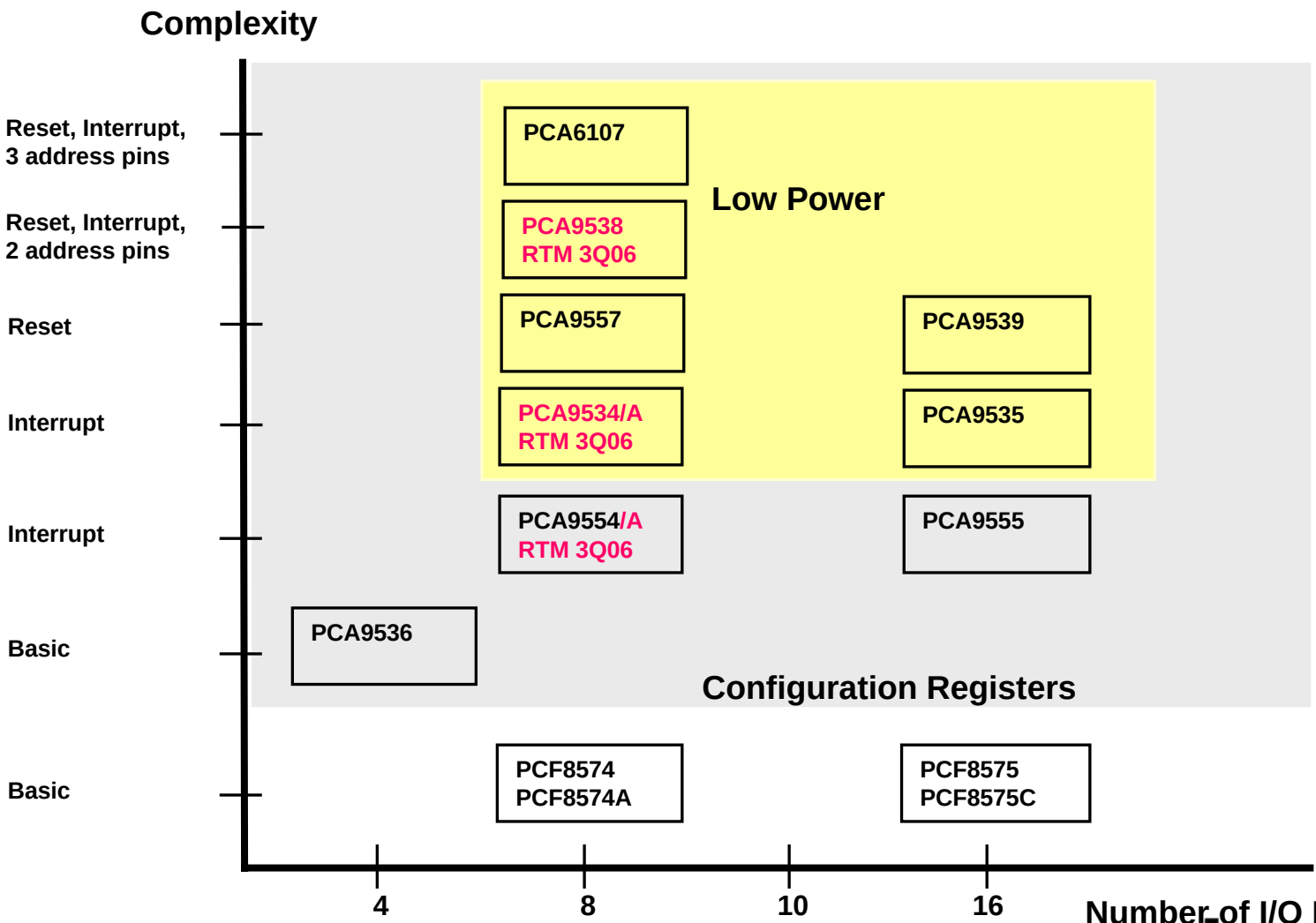
Systems	Automotive	Consumer	Industrial	PC/Server	Radio/TV	Telecom	Telephony
Bus Expanders, Hubs & Repeaters	✓	✓	✓	✓	✓	✓	✓
General Purpose I/O Expanders	✓	✓	✓	✓	✓	✓	✓
LED Blinkers	✓	✓	✓	✓	✓	✓	✓
Multiplexers & Switches	✓	✓	✓	✓	✓	✓	✓

I²C I/O Expanders



I²C I/O Expanders	Max Frequency (kHz)	I²C Address	V_{CC} Range (V)	Bit or Channel Width	Additional Features					I/O Type	
					Low Power	Interrupt	Reset	Configuration Registers	5-V Tolerant I/O	Push-Pull	Open-drain
PCA9536	400	1000 001	2.3 to 5.5	4 bits				✔	✔	✔	
PCF8574	100	0100 xxx	2.5 to 6.0	8 bits		✔				✔	
PCF8574A	100	0111 xxx	2.5 to 6.0	8 bits		✔				✔	
PCA9554	400	0100 xxx	2.3 to 5.5	8 bits		✔		✔	✔	✔	
PCA9557	400	0011 xxx	2.3 to 5.5	8 bits	✔		✔	✔	✔	✔	✔
PCA6107	400	0011 xxx	2.3 to 5.5	8 bits	✔	✔	✔	✔	✔	✔	✔
PCF8575	400	0100 xxx	2.5 to 5.5	16 bits		✔				✔	
PCF8575C	400	0100 xxx	4.5 to 5.5	16 bits		✔					✔
PCA9535	400	0100 xxx	2.3 to 5.5	16 bits	✔	✔		✔	✔	✔	
PCA9539	400	1110 1xx	2.3 to 5.5	16 bits	✔	✔	✔	✔	✔	✔	
PCA9555	400	0100 xxx	2.3 to 5.5	16 bits		✔		✔	✔	✔	

I²C I/O Expanders Portfolio



PCA9306 Dual Bidirectional Voltage-Level Translator

Features

- Less than 1.5ns Maximum Propagation Delay
- Open-Drain I^2C I/O Ports (SCL1, SDA1, SCL2, SDA2)
- 5V Tolerant I^2C I/O Port to Support Mixed-Mode Signal Operation
- High Impedance SCL1, SDA1, SCL2, and SDA2 Pins for EN=Low

Applications

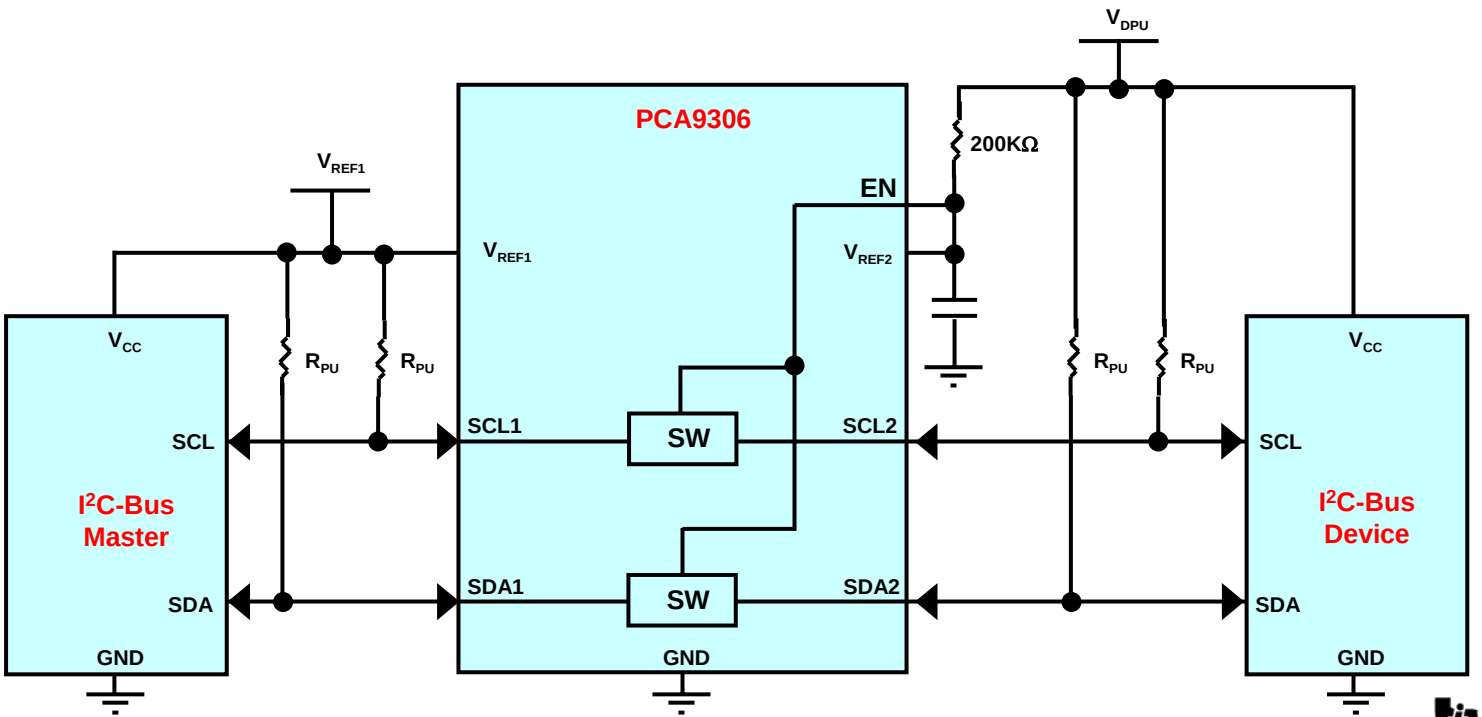
- Mixed-Mode Voltage Applications
- I^2C Bus Isolation

Benefits

- Lead-free options available
- I^2C and SMBus Compatible
- Provides Bidirectional Voltage Translation With No Direction Pin
- Accommodates Standard Mode and Fast Mode I^2C Devices and Multiple Masters
- Flow-Through Pin-out for Ease of PCB Trace Routing

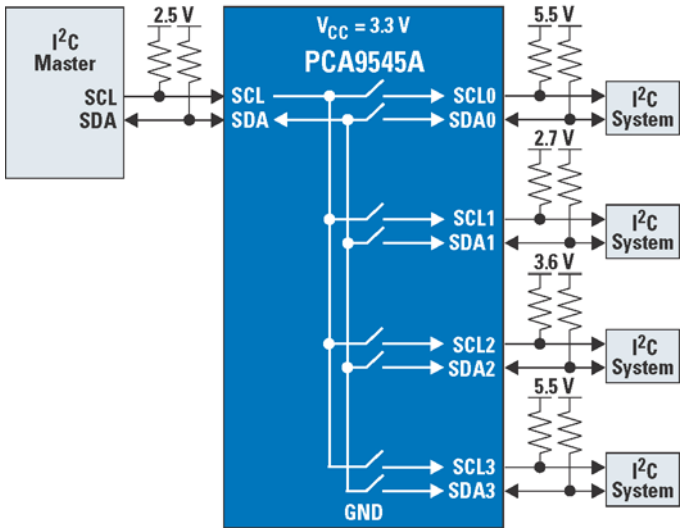
Competition

- First to Market!



V_{REF1}	V_{DPU}
1.2V	2.5V
	3.3V
	5V
1.5V	2.5V
	3.3V
	5V
1.8V	3.3V
	5V
2.5V	5V
3.3V	5V

I²C Switches and Multiplexers



Advantages

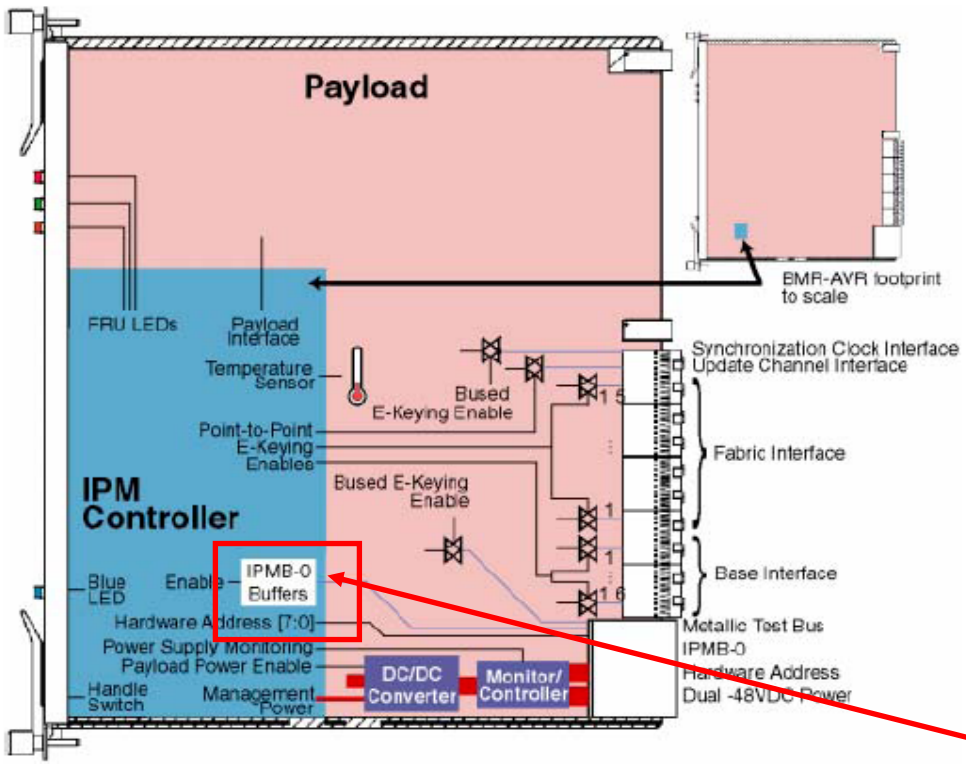
- I²C Bus Expansion
- Resolve I²C Address Conflicts (SPFs, temp sensors)
- Can isolate a section on the I²C Bus
- Pin Savings as each switch is activated or isolated through the I²C software
- Supports voltage level translation between 2.5V, 3.3V and 5V buses

I²C Multiplexers and Switches	Max Frequency (kHz)	I2C Address	Vcc Range (V)	Bit or Channel Width	Additional Features			I/O Type	
					Interrupt	Reset	5-V Tolerant I/O	Totem Pole	Open-drain
PCA8550	400	1001 110	3.0 to 3.6	5 bits				✔	
PCA9544A	400	1110 xxx	2.3 to 5.5	4 channels	✔		✔		✔
PCA9545A	400	1110 0xx	2.3 to 5.5	4 channels	✔	✔	✔		✔
PCA9546A	400	1110 xxx	2.3 to 5.5	4 channels		✔	✔		✔
PCA9548A	400	1110 xxx	2.3 to 5.5	8 channels		✔	✔		✔

Sampling!

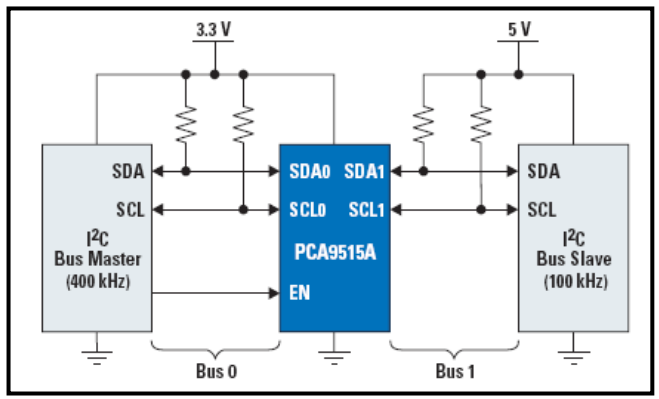
I²C Buffers

Intelligent Peripheral Management Controller (IPMC) on ATCA boards for Communications Applications



Advantages

- Extends the I²C bus without degradation of system performance
- Isolates a section on the I²C Bus through Enable (EN) pin
- I²C Bus Expansion
- Supports voltage level translation between 2.5V, 3.3V and 5V buses



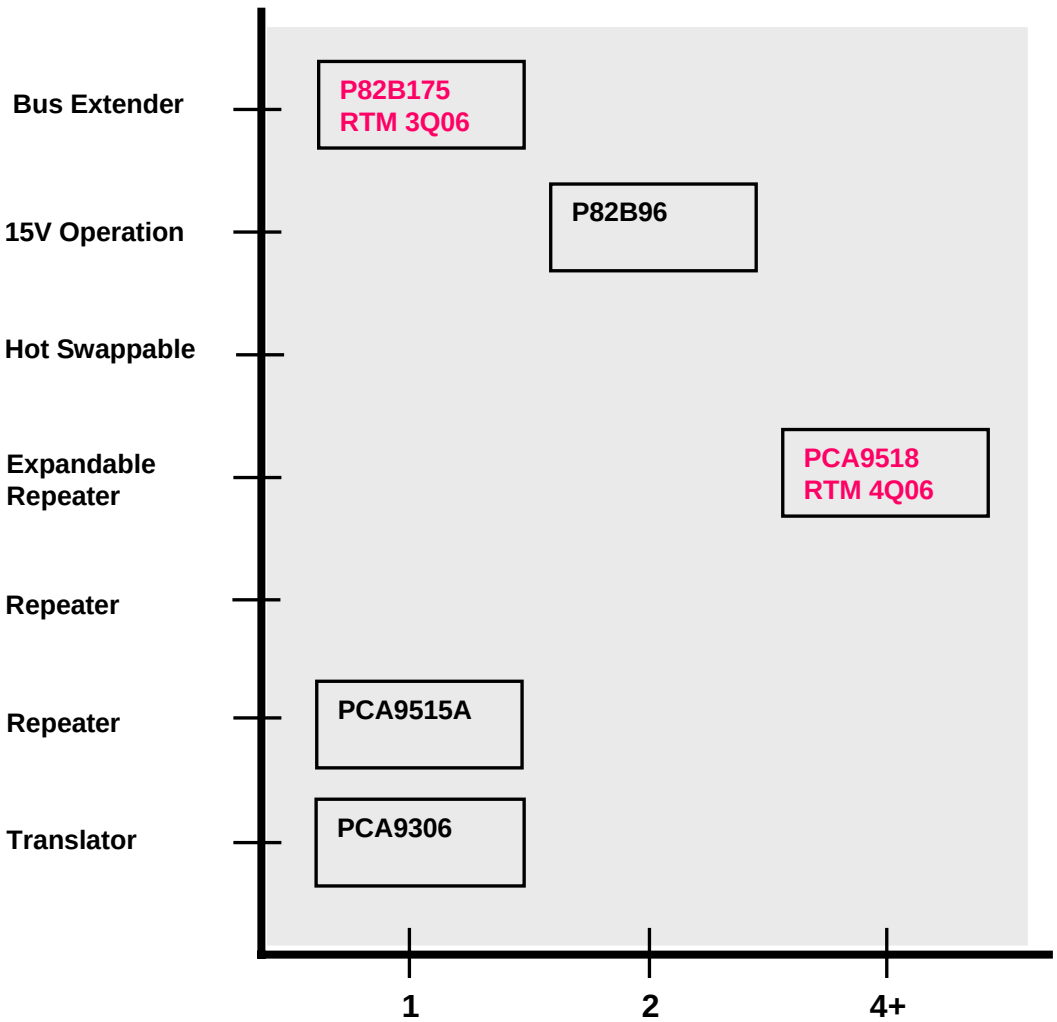
I2C Buffers used to interface with IPMB

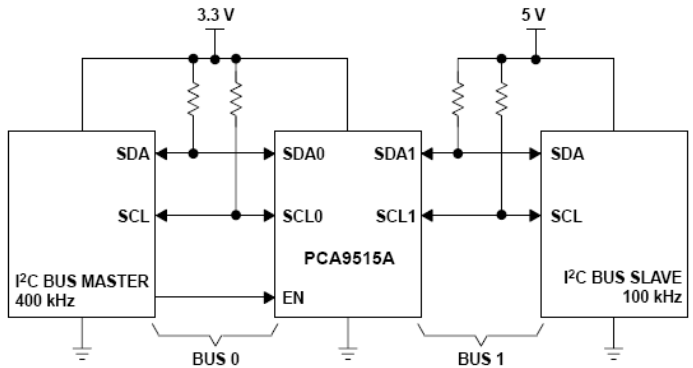
PCA9515A

PCA9515A can be used as IPMB-0 Buffers

PCA9557 can be used to store the Hardware Address

SLL I²C Device Portfolio
Bus Expanders, Hubs, Repeaters and Buffers





SLL I²C Device Roadmap
Product Development Status

Device	Description	Status
PCA9554A	8-Bit I/O Expander with Interrupt and Configuration Registers (Address: 0111xxx)	Sampling 3Q06
PCA9538	8-Bit I/O Expander with Interrupt, Reset, and Configuration Registers; Low Power	Sampling 3Q06
PCA9534	8-Bit I/O Expander with Interrupt and Configuration Registers; Low Power (Address: 0100xxx)	Sampling 3Q06
PCA9534A	8-Bit I/O Expander with Interrupt and Configuration Registers; Low power (Address: 0111xxx)	Sampling 3Q06
P82B715	Bidirectional, Unity Voltage Gain Buffer for I²C-Bus and SMBus Extending	Sampling 3Q06
PCA9548A	8-Channel Multiplexer with Reset	Sampling 3Q06
PCA9518	Expandable 5-Channel Bidirectional I²C-Bus and SMBus Hub	Sampling 4Q06

I²C-Bus Logic Applications and Marketing Resources
Additional Information and Contacts

Application Literature

- I²C Selection Guide
  - TI Literature Number: SSZC003
  - http://focus.ti.com/pdfs/logic/i2cselguide.pdf
- I²C Application Clip
  - TI Literature Number: SCYB030
  - http://www-s.ti.com/sc/techlit/scyb030
- PCF8574 and PCF8574 Product Clip
  - TI Literature Number: SCYB031
  - http://www-s.ti.com/sc/techlit/scyb031
- PCF8574 and PCF8574 Application Report
  - TI Literature Number: SCPA032
  - http://www-s.ti.com/sc/techlit/scpa032
- I²C Assessment Pack
  - Contact your local Field Sales Office

Product & Applications Support

- Sujatha Garimella
  - Office: 903 868–7812
  - E-mail: s-garimella1@ti.com

I²C Logic Information

http://www.ti.com/i2c

Specialty Switch: TL52055 Wide-Bandwidth, 2-Input, 1-Output, 3-Circuit Video Switch

Features:

- Low Differential Gain and Phase (DG = 0.3%, DP = 0.3° Typ)
- Low Crosstalk (XTALK = −75 dB Typ at 4.43 MHz)
- Vcc Operating Range From 4.5 V to 9 V
- Bi-CMOS Technology
- High Input Impedance (Zi = 20k Ω Typ)

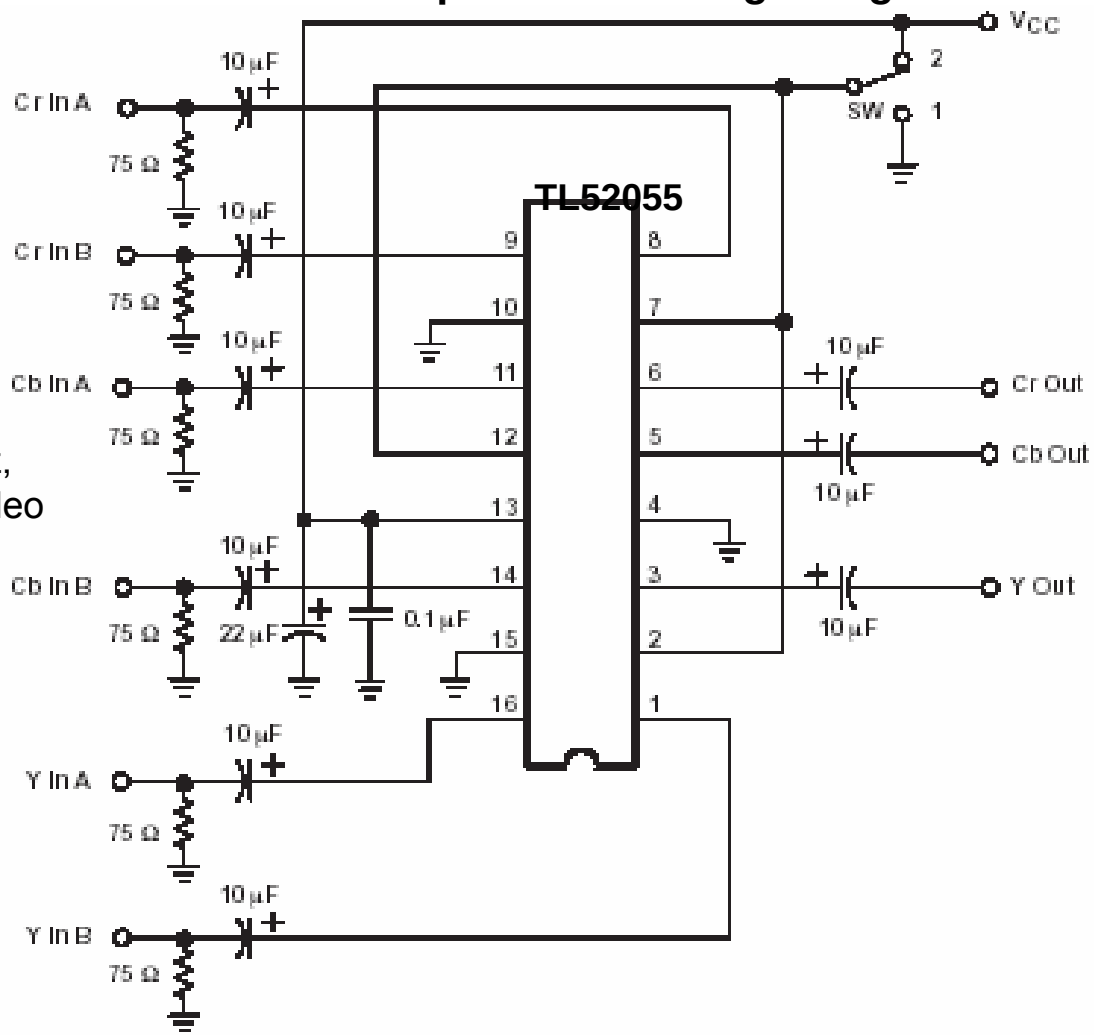
Benefits:

- Supports Composite Video Switching
- Wide Frequency Range (0 dB at 40 MHz, Vcc = 5 V) Supports High-Frequency Video Applications
- Available in Lead-Free (Per JEDEC STD-020B) Packages: SOIC16 (D), TSSOP16 (PW)

Applications:

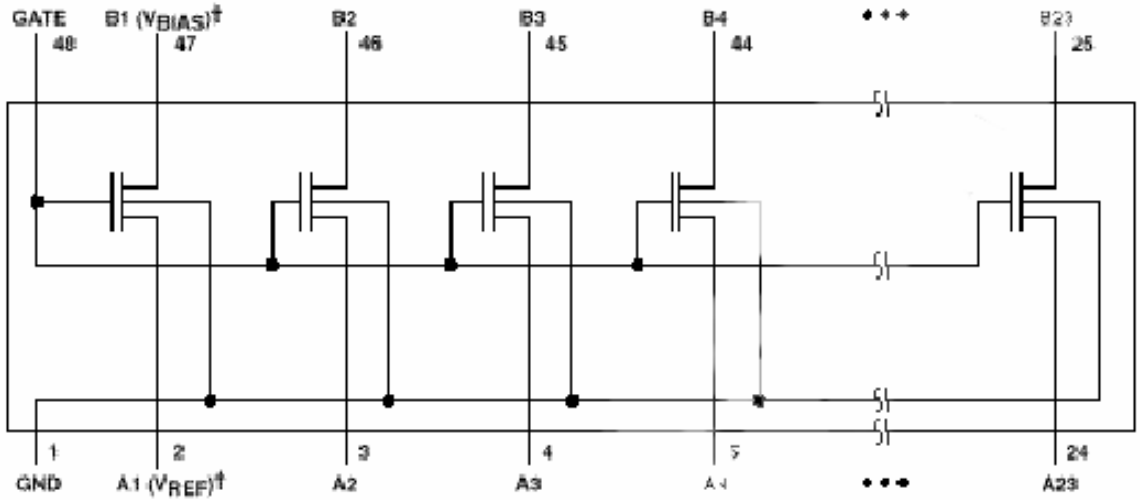
- TVs (CRT, LCD, PDP, HDTV)
- DVD Players
- VCRs
- Set Top Box
- Video Projectors
- Car Navigation Systems

Composite Video Signaling



TVC
Translation Voltage Clamp

logic diagram (positive logic)



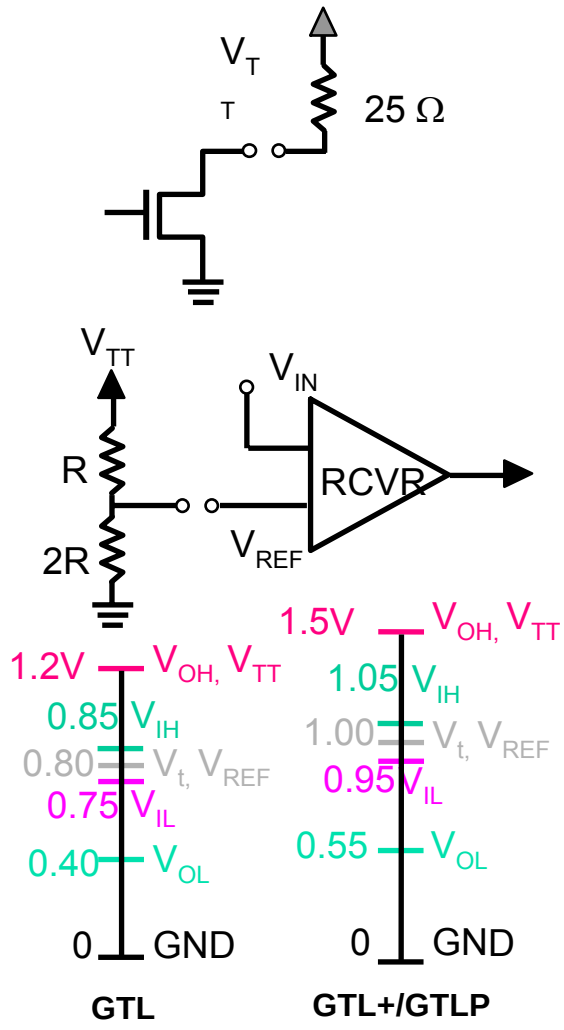
† The (V_{REF}) and (V_{BIAS}) may be applied to any one of the pass transistors. The GATE must be externally connected to the V_{BIAS}.

- Overshoot protection
- Voltage translator or a voltage clamp
- Abs 7 to -0.5V

Device	Bit
TVC3306	2
TVC3010	10
TVC16222A	22

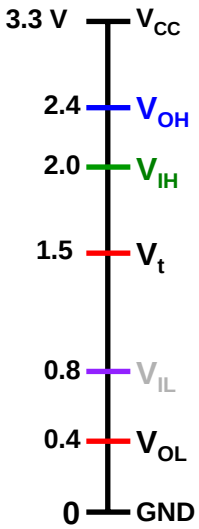
What is GTL/GTLP?

- Open drain n-channel CMOS outputs. The pull-up resistor pulls the signal high and the device pulls the signal low
- Receiver stage is a differential input with external VREF. VREF is derived from a simple R/2R voltage divider of the termination voltage, V-TT
- GTLP enjoys increased noise margin over GTL
- GTLP edge rates have been optimized for distributed loads
- The reduced voltage swing reduces power consumption and EMI



GTLP Is a Bidirectional Translator

CARD SIDE



LVTTL

A Port and Control Pi

3.3-V V_{CC}

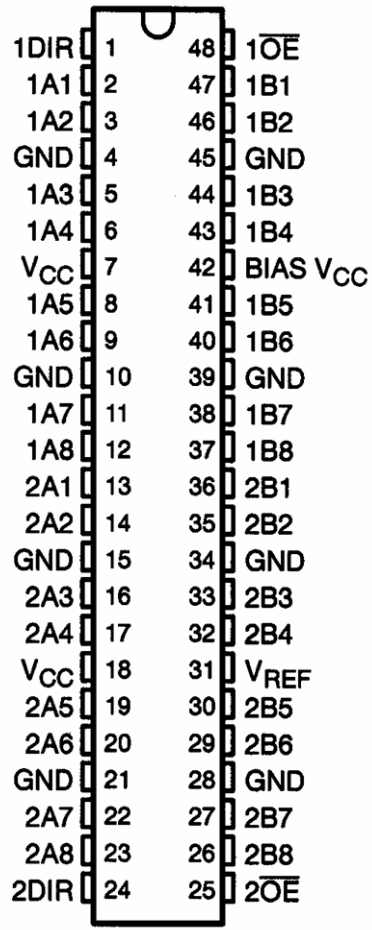
5 V Tolerant

Drive +/-24 mA

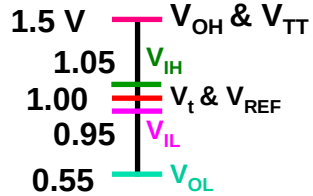
Bus-Hold Option

Flow-Through Pinou

DGG, DGV, OR DL PACKAGE
(TOP VIEW)



BACKPLANE SIDE



TI-OPC™ Overshoot Protection Circuitry

OEC™ Improved Output Edge Control

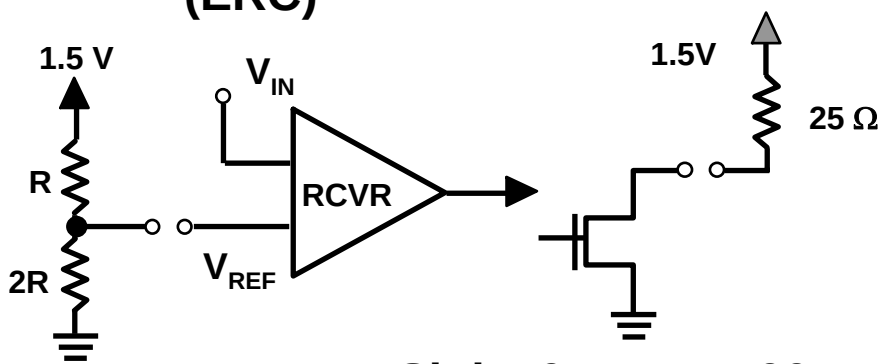
Live Insertion

Reduced EMI

Edge Rate Control (ERC)

GTLP

B Port



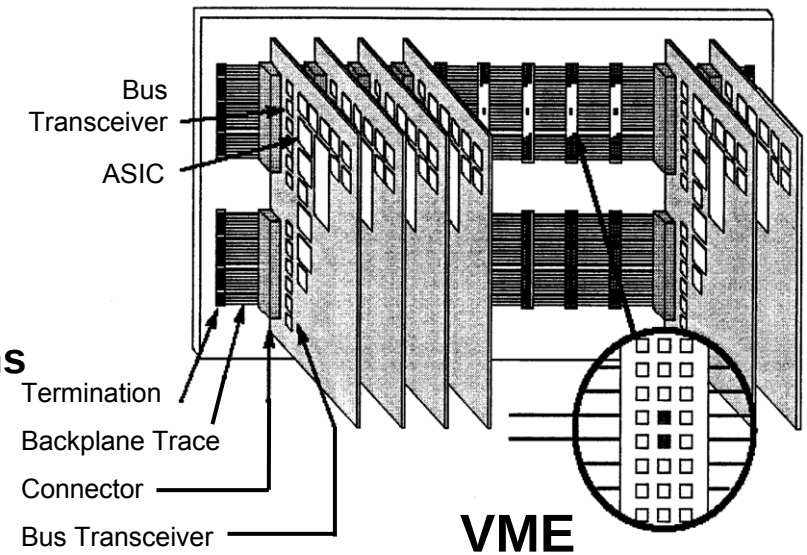
Sink 50 mA or 100 mA

Differential Input

TEXAS INSTRUMENTS

GTLP and VME Are Specifically Designed for High-Performance Multi-slot Parallel Backplanes

- **Mass Storage**
- **ISDN Remote Access**
- **Internet Routers**
- **ATM Switches**
- **Wireless Base Stations**
- **Flight Equipment**



- **Industrial Controls**
- **Aerospace**
- **Transportation**
- **Medical**
- **Instrumentation Systems**

GTLP

- Open-drain technology
- Allows high frequencies (up to 100-MHz clock)
- Standard pinouts allow ease of migration from standard logic
- Improved signal integrity over standard logic

VME

- Push-pull output structure
- Transmits data at 40 Mbit/s on legacy termination topologies
- Backward compatible to existing VME backplane
- Reduced input threshold for greater noise immunity

GTLP
Distributed-Load Devices

Features

- CMOS
- 3.3-V V_{CC} – 5 V Tolerant
- I_{off}, PU3S, and BIAS V_{CC}
- Slow Edge Rates – ERC
- A Port
  - +/-24 mA – SDR +/-12 mA
  - Bus-Hold Option (on Die)
- B Port
  - V_{TT} 1.2 V to 2.1 V (BTL)
  - 100 mA (22-Ω Effective Characteristic Impedance)
  - TI-OPC
  - Low C_{IO}

Benefits

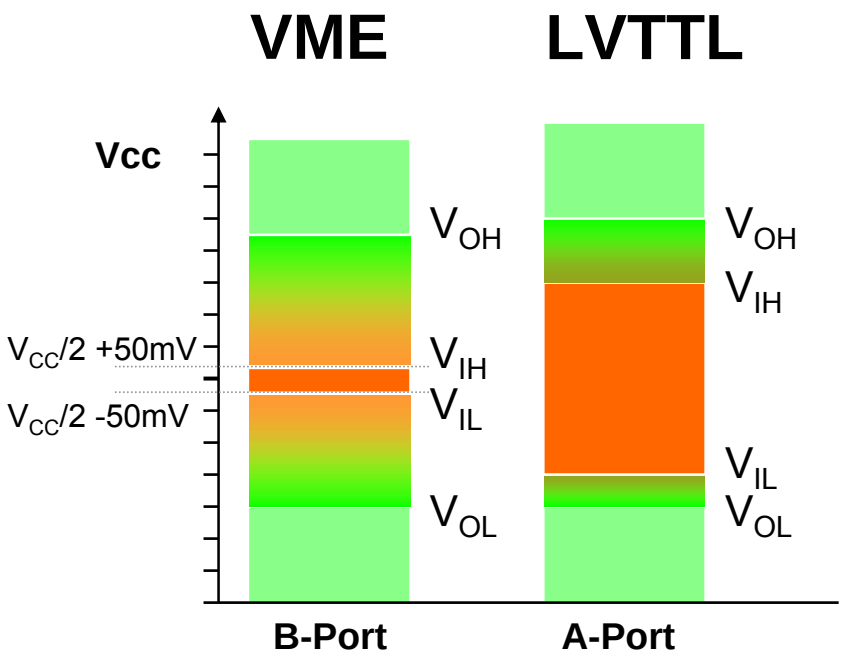
- ✓ Low Power Consumption
- ✓ Mixed Supply Capability
- ✓ Supports Live Insertion
- ✓ Reduced EMI
- ✓ A Port
  - ✓ Standard CMOS Output
  - ✓ No Need to Use Pullup/Pulldown
- ✓ B Port
  - ✓ Can Use GTLP in BTL Applications
  - ✓ High Drive for Heavily Loaded Systems
  - ✓ Improved Signal Integrity
  - ✓ Helps Live Insertion

SN74VMEH22501/A UBT

The VME-Compatible Device for Low-Voltage Environments

Benefits:

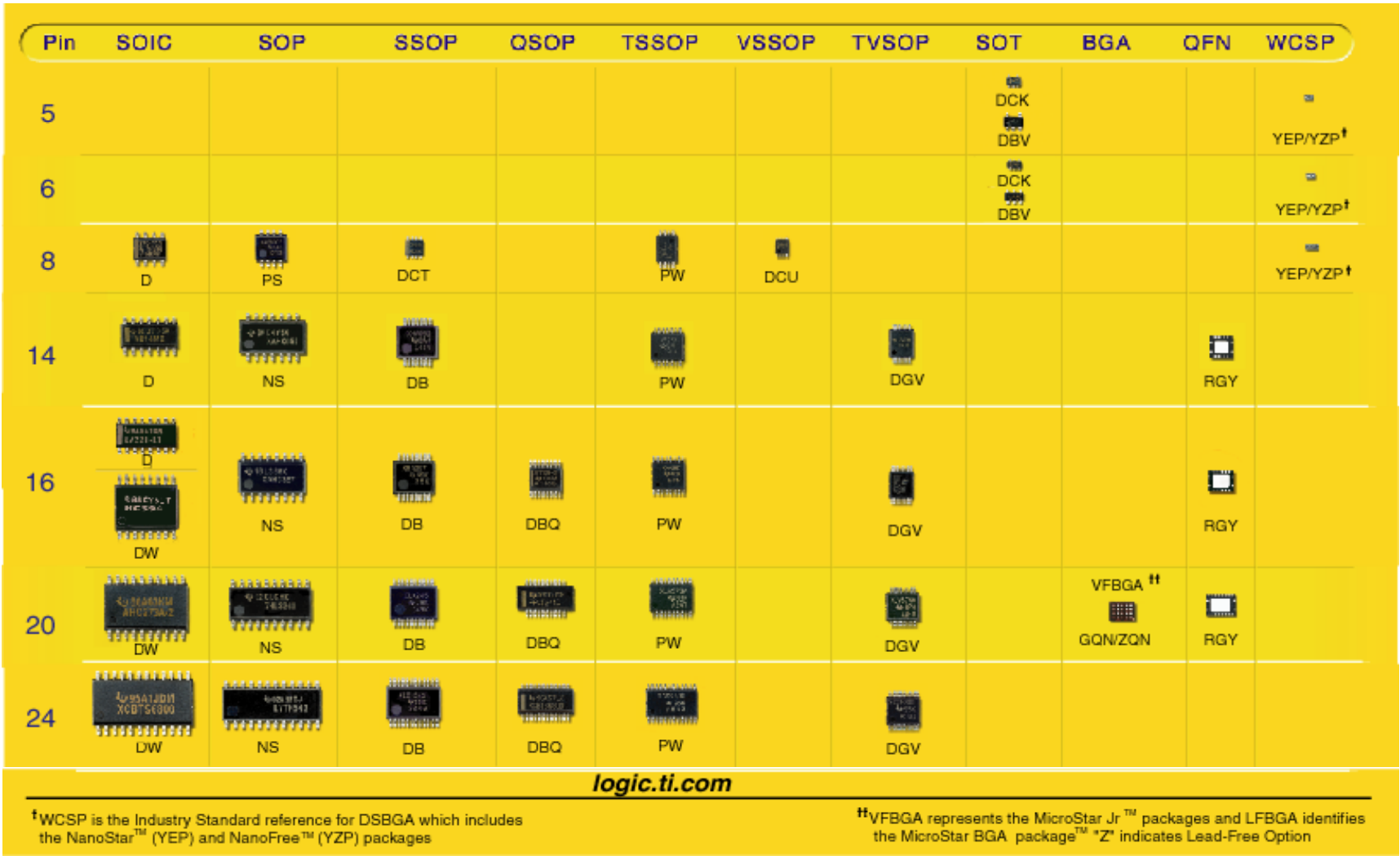
- Extends life of VME characteristic bus
- Supports 2eVME and 2eSST protocols (VITA1.5)
- Increased noise immunity
- Supports transparent, latched or clocked mode
- 5-V tolerance at both ports
- Full live insertion capability with pre-charge
- Bus-hold and series resistors on A-Port
- Up to 320 MBps on standard VME backplane and up to 1 GBps on VME320 (star topology)
- VMEH22501 – 0 to 85 C
- VMEH22501A – - 40 to 85C



Characteristics:

- Tighter input threshold (VCC/2 ± 50 mV)
- -48/64 mA drive capability
- Huge AC pull-up/down drive capability to drive backplanes (slow edge rates)
- BIAS-V_{CC} used to control pre-charge during live-insertion

Packaging Options



Pin	SOIC	SOP	SSOP	QSOP	TSSOP	VSSOP	TVSOP	SOT	BGA	QFN	WCSP
5								DCK DBV			YEP/YZP†
6								DCK DBV			YEP/YZP†
8	D	PS	DCT		PW	DCU					YEP/YZP†
14	D	NS	DB		PW		DGV			RGY	
16	D DW	NS	DB	DBQ	PW		DGV			RGY	
20	DW	NS	DB	DBQ	PW		DGV		VFBGA †† GQN/ZQN	RGY	
24	DW	NS	DB	DBQ	PW		DGV				

†WCSP is the Industry Standard reference for DSBGA which includes the NanoStar™ (YEP) and NanoFree™ (YZP) packages

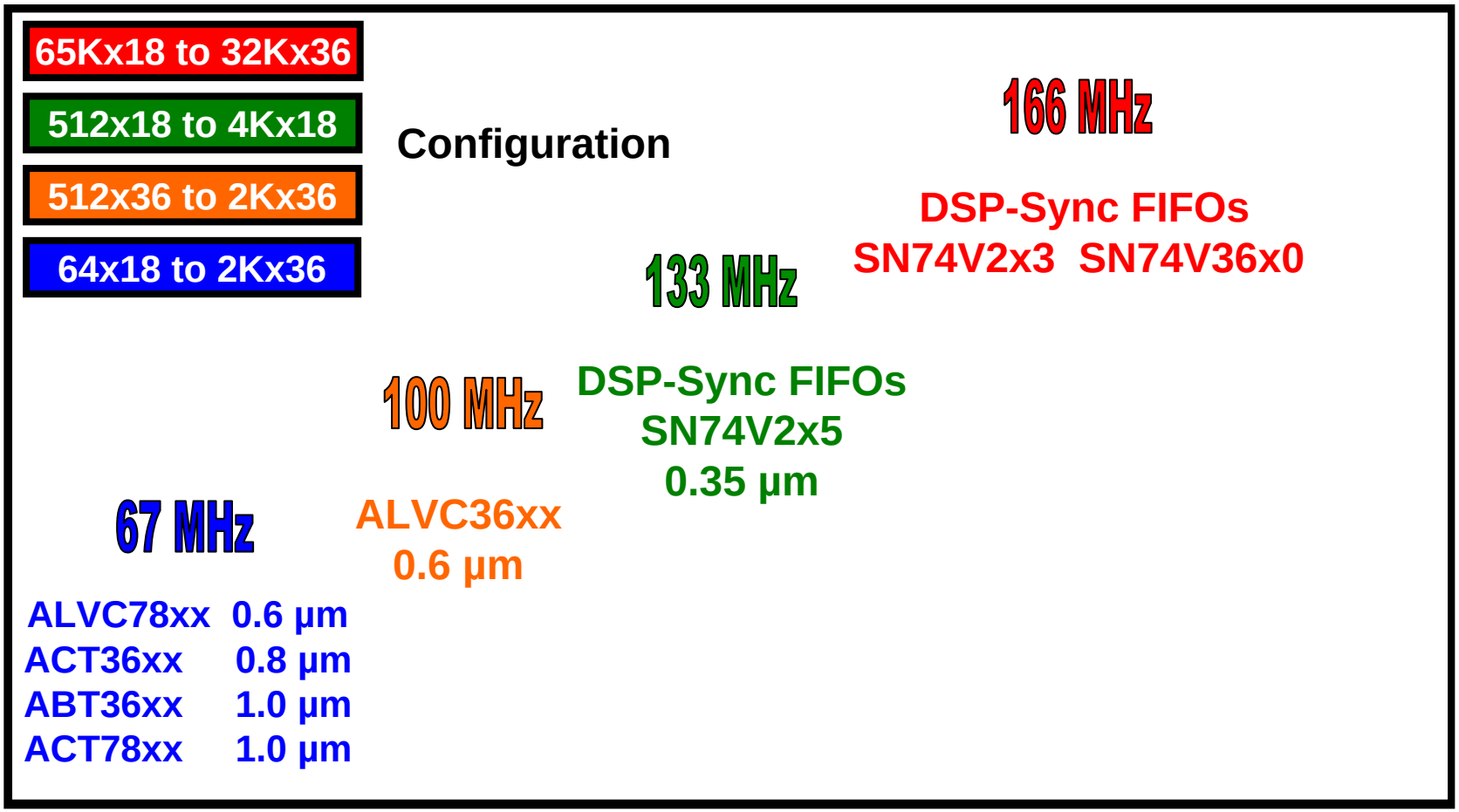
††VFBGA represents the MicroStar Jr™ packages and LFBGA identifies the MicroStar BGA package™ "Z" indicates Lead-Free Option

Packaging Options

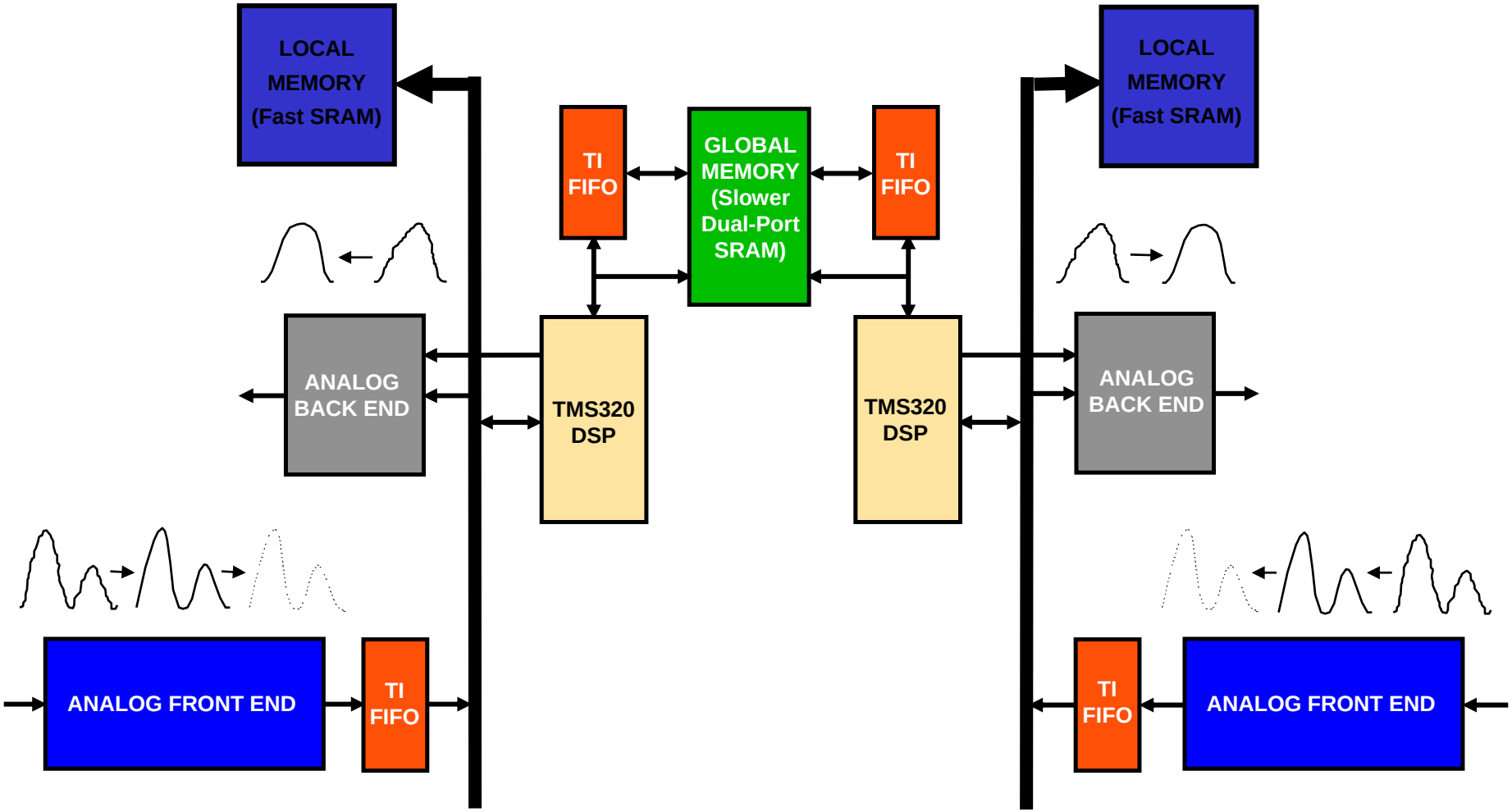
TI FIFO Products

- TI FIFOs Provide Cost Effective “Pin-for-Pin Functional Equivalents” to IDT’s 18-bit and 36-bit Synchronous FIFOs
- TI DSP-Sync FIFOs Optimize DSP Performance in High Bandwidth Applications by Eliminating Data Bottlenecks
- TI DSP-Sync FIFOs provide a *DSP Glueless Interface* to Leading Edge TI TMS320™ DSPs
- TI Technology Leadership Creates World Class FIFO Performance with Industry's Fastest 3.3V FIFOs
- High Bandwidth Applications Include:
  - Wireless Base Stations
  - Remote Access Servers (RAS)
  - Digital Subscriber Line (DSL)
  - Network Security Cameras
  - Medical & Industrial Imaging
  - Multi-Channel Telephony
  - Gigabit-Ethernet Routers
  - ATM Switches & SONET/ATM Multiplexers

TI FIFO
Product and Technology Availability



TI FIFOs Optimize System Performance



IEEE Std 1149.1 (JTAG) Boundary-Scan Logic

Generic IEEE 1149.1 functionality

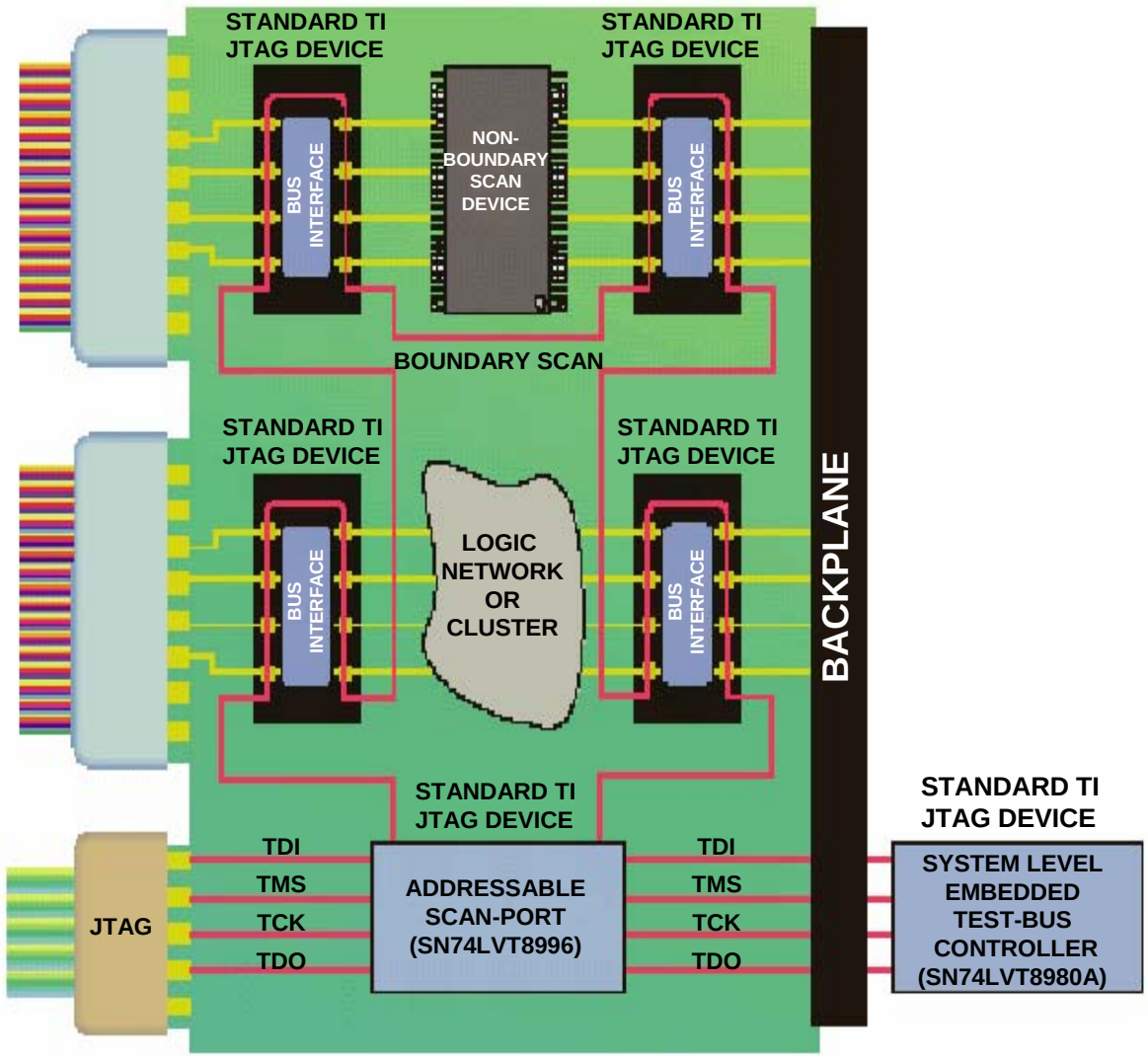
◆ Between each I/O pin and the chip, there must be a boundary scan cell (BSC).

◆ All BSC's must be connected to the serial scan path, which functions like a shift register.

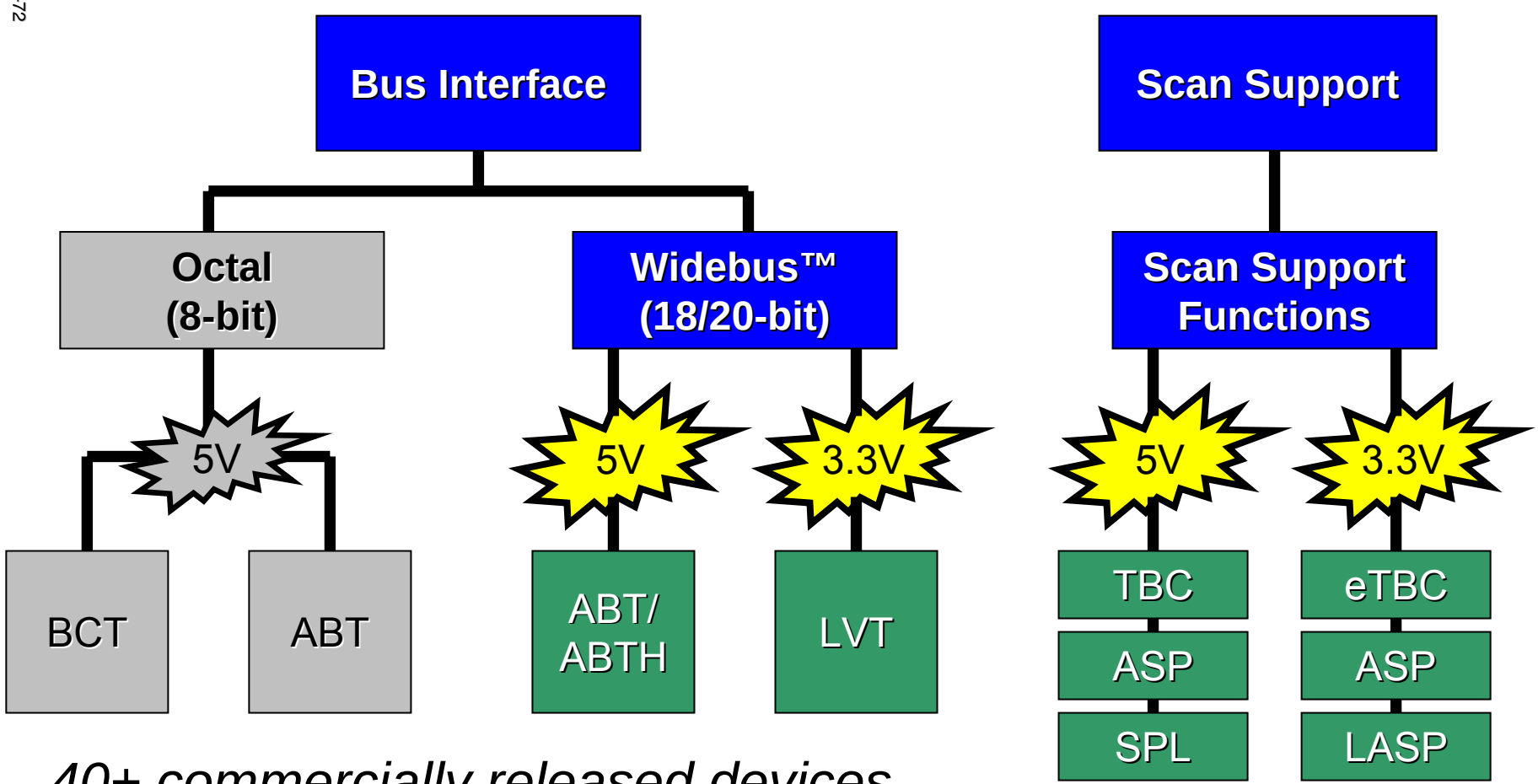
◆ The BSC's are controlled via four test control pins:

- TCK (test clock)
- TMS (test mode select)
- TDI (test data input)
- TDO (test data output)

◆ The BSC allows capturing data from and providing data to the chip data path.



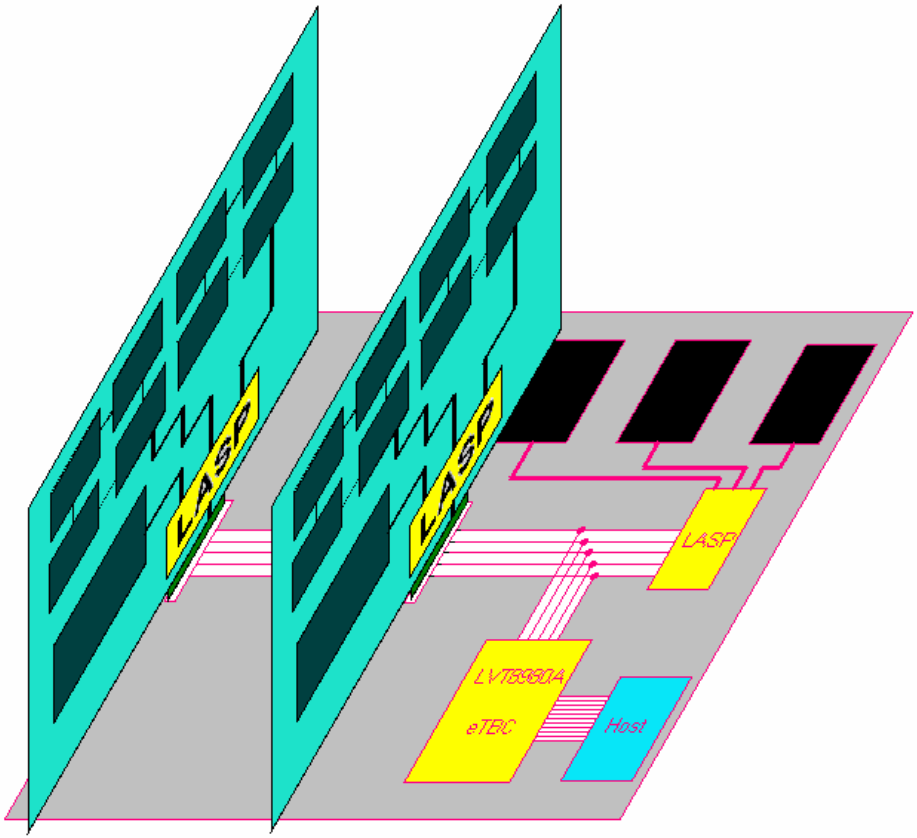
Current TI JTAG Product Offering



40+ commercially released devices

eTBC = embedded Test Bus Controller
ASP = Addressable Scan Port
LASP = Linking Addressable Scan Port
SPL = Scan Path Linker

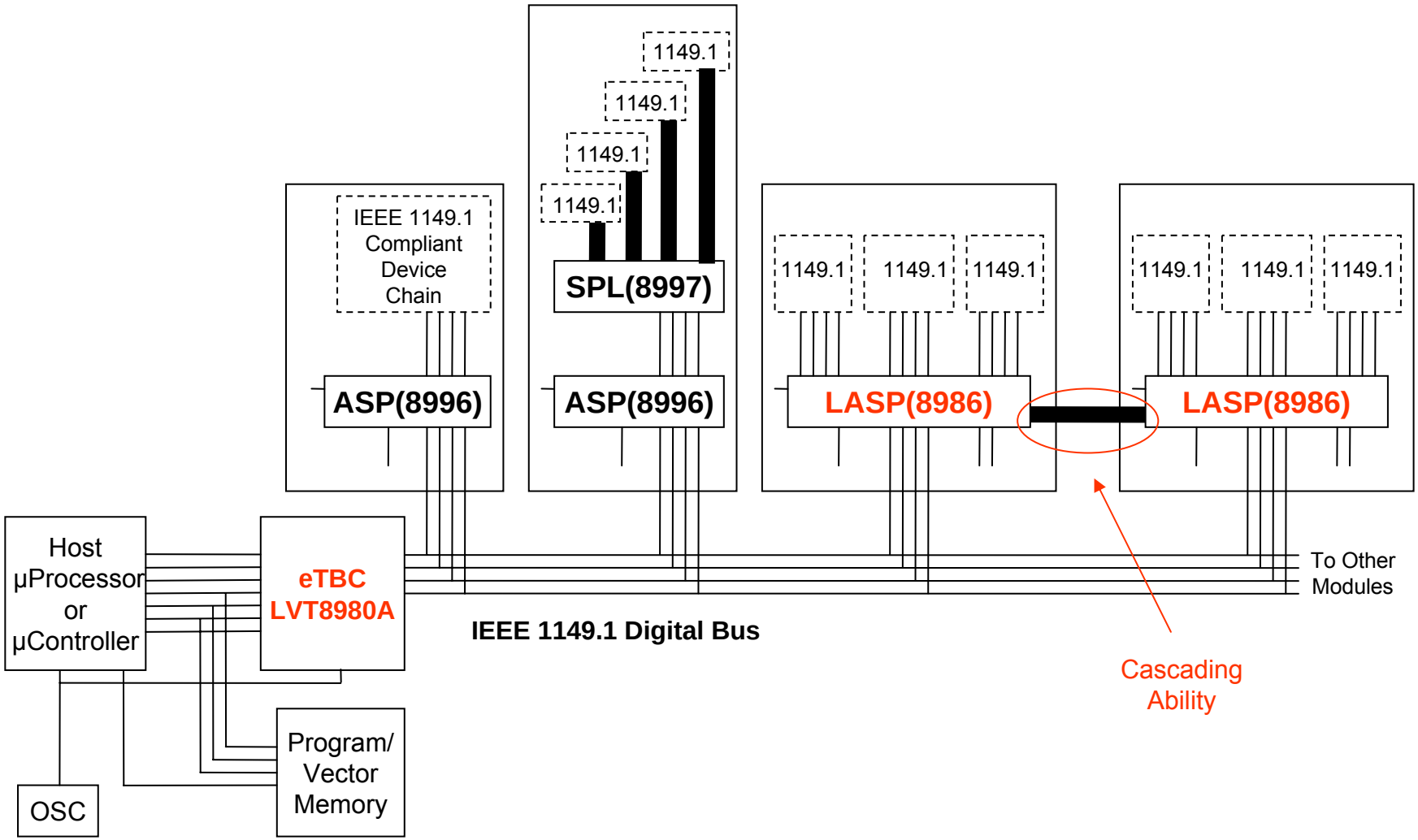
Typical System-Level Application



Active Backplane
Multi-Drop Architectures

- eTBC converts parallel microprocessor instructions into serial JTAG commands through TMS and TCK
- eTBC addresses the correct target scan chain via LASP's
- LASP or ASP buffers/drives the JTAG scan commands into IEEE1149.1 compliant devices

Typical System-Level Application (Cont.)



Typical JTAG Applications

Applications

- Manufacturing Board Level Test
  - Complex board assemblies (i.e. BGA packages)
- Manufacturing System Level Test
  - Fault Isolation rather than pass/fail
- Embedded System Level Test
  - Field testing or re-programming
- In System Programming(ISP)
  - Flash or PLD programming
- Emulation
  - eTBC (16-bit) used for DSP emulation/debug

SECTION 2
MUST-HAVE PRODUCTS

CONTENTS

Must-Have Products

A select group of products providing a focused priority for our customer

- Easy reference
- Value-added SLL solutions
- Design-In interest in any application
- Significant design TAM around the world
- Technical assistance available for Design-In
- Inventory available to support immediate demand
- Free Samples are available for all products
- List updated each quarter with new solutions

Must-Have Products

Signal Switches

TS5A3159A	- 0.9Ω SPDT single Analog Switch
TS5A23166	- 0.9Ω SPST dual Analog Switch
TS5A6542	- 0.75Ω SPDT single with Translation
TS3A24157	- 0.75 Ω SPDT dual
TS3A4684	- 0.4 Ω SPDT dual
TS3L500	- 16-Bit to 8-Bit Gigabit Ethernet LAN Switch
TS3V340	- 3V, 500 MHz Video Switch
TS3DV520	- 5-Channel Differential 10:20 Mux for DVI/DMI
TS2PCIE2212	- PCIE Signal Switch

Translation

AUP1T97	- Single Supply Configurable Translator
AVC2T245	- 2-Bit, Dual Supply, Bus XCVR w Configurable Voltage Translation and 3S Outputs
AVC16T245	- 16-Bit, Dual Supply, Bus XCVR w Configurable Voltage Translation and 3S Outputs
AVCA406L	- Memory Card Voltage Translating XCVR
LV4320A	- Dual Supply, Level Translating CF Interface
TXS0104E	- 4 bit Bi-Directional Translator

If nothing else, remember

- Product Focus
- Valued solutions in any system
- Every application can use at least 1 Must-Have

- Free Samples Available
- Significant Inventory to support demand

Linear

TLV431	- Low-Voltage Adjustable Shunt Regulators
TLVH431	- Enhanced version of the TLV431
LM4040	- Precision Micro-power Shunt Voltage Regulators
LM4041	- Precision Micro-power Shunt Voltage Regulators
MC33063A	- 1.5A Peak Boost/Buck/Inverting Switching Regulator

Operational Amplifiers

LMV715	- Single Low-Power RRIO Op-Amp with High O/P Current-Drive and Shutdown
LMV822	- Dual 5MHz RRO Op Amp
LMV932	- Dual 1.8/5V RRIO Op Amp
LMV982	- Dual 1.8/5V RRIO Op Amp with shutdown
LPV358	- Dual Low-Voltage/Low-Power RRO Op Amp
TLV341	- Low-Voltage/RRO CMOS Op-Amp with Shutdown

Interface

TPL9201	- µController PS and Low Side Driver
SN74LV8153	- Serial-to-Parallel Interface
MAX3243E	- 3/5V Multi-Channel RS-232 XCVR, IEC 15KV ESD
MAX3221E	- 3/5V Single Channel RS-232 XCVR, IEC 15KV ESD
MAX3318E	- 2.5V 460Kbps RS232 XCVR, IEC 15KV ESD
653221E	- 3/5V Single Channel RS-232 1 Mbps Line Driver/Rcvr

I^2C Interface

PCF8574	- 8-bit I2C Remote I/O Expander
PCA9306	- Bi-Directional I^2C-Bus/SMBus Level-Translator
PCF8575	- Remote 16-Bit I^2C-Bus/SMBus I/O Expander
PCA9539	- Remote 16-Bit I^2C-Bus/SMBus Low-Power I/O Expander
PCA9545A	- 4-Channel I^2C-Bus/SMBus MUX with Interrupt and Reset
PCA9536	- 4-Channel I^2C-Bus/SMBus MUX with Reset

Texas Instruments

Must-Have Products

The Must-Have Homepage
www.ti.com/musthave

Voltage References	
TLV431 TLVH431	Low-Voltage Adjustable Precision Shunt Regulators
LM4040 LM4041	Precision Micro-power Shunt Voltage Regulators
Switcher	
MC33063A	1.5 -A Peak Boost/Buck/Inverting Switching Regulator
Operational Amplifiers	
LMV715	Single Low-Power RRIO Op Amp With High Output Current Drive And Shutdown
LMV822	Dual, Low-Voltage, Low Power, RRO Op Amp
LMV932	Dual 1.8-V Op Amp with RRIO
LMV982	Dual 1.8-V Op Amp with RRIO and Shutdown
LPV358	Dual, Low-Voltage, Low Power, RRO Op Amp
TLV341	Low-Voltage, RRO CMOS Op Amp with Shutdown NEW
Interface	
TPL9201	Microcontroller Power Supply and Low-Side Driver IC NEW
LV8153	Serial-To-Parallel Interface NEW
MAX3243E MAX3221E	3-V to 5.5-V Multi-channel RS-232 Line Drivers/Receivers With +/-15kV IEC ESD Protection
MAX3318	2.5-V 460-Kbps RS-232 Transceiver With +/-15 KV ESD Protection
65C3221E	3-V To 5.5-V Single Channel RS-232 1 Mbps Line Driver/Receiver

Analog Switches	
TS5A3159A	0.9 Ω Single SPDT Analog Switch
TS5A23166	0.9 Ω Dual SPST 5-V/3.3-V 2-Channel Analog Switch
TS5A6542	0.75Ω Single SPDT with Translation NEW
TS3A24157	0.75 Ω Dual SPDT Preview
TS3A4684	0.4 Ω Dual SPDT Preview
TS3L500	16:8 SPDT 1 Gbps LAN Switch with Low/Flat Ron
TS3V340	Quad SPDT High-Bandwidth Video Switch with Low/Flat Ron
TS3DV520	5-Channel Differential 10:20 Mux Switch for DVI/DMI
TS2PCIE2212	PCIE Signal Switch
Translation	
SN74AUP1T97	Single-Supply Voltage Translator
SN74AVC2T45 SN74AVC16T245	2- and 16- Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs
SN74AVCA406L	Memory Card Voltage Translation Transceiver
SN74LV4320A	Low-Power, Dual Supply, CompactFlash Interface
TXS0104E	4 bit Bi-Directional Translator NEW
I^2C	
PCF8574	Remote 8-Bit I/O Expander for I2C-Bus
PCA9306	Dual Bi-Directional I2C/SMBus Voltage Level-Translator
PCF8575	Remote 16-Bit I2C/SMBus I/O Expander
PCA9539	Remote 16-Bit I2C-Bus/SMBus Low-Power I/O Expander
PCA9536	4-Channel I2C-Bus/SMBus MUX with Reset NEW
PCA9545A	4-Channel I2C/SMBus MUX With Interrupt Logic & Rese NEW

Must-Have Products
Linear: Op-Amps

TLV341
NEW
- Low Voltage RRO Op Amp with shutdown
- Low Power Battery operated applications
- Consumer, Handheld, Medical

LMV982
- 1.8V RRIO 1.4MHz Op Amp with Shutdown
- Low Power Battery operated applications
- Consumer, Handheld, Medical

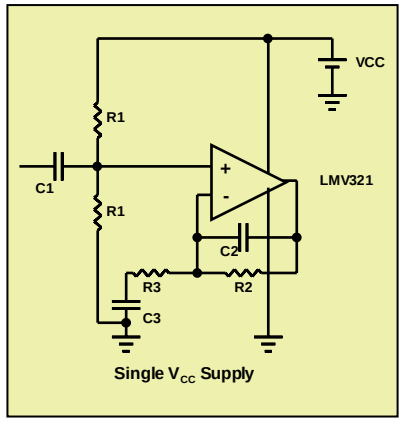
LMV932
- 1.8V RRIO Op Amp
- Low Power and voltage general purpose applications
- Consumer, Computing

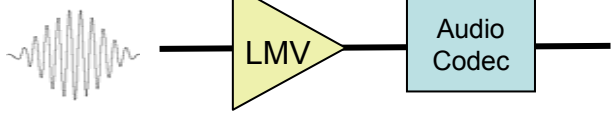
LMV821/822/824
- 5MHz RRO Op Amp
- Low Power Battery operated applications
- Utility and Energy Metering

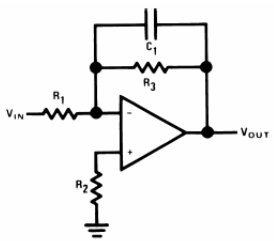
LMV715
NEW
- Low Power RRIO Op Amp with Shutdown
- 5MHz bandwidth
- Cordless phones, consumer, preamp

LPV321/358/324
- Low Voltage Low Power RRO Op Amp
- General purpose active filters

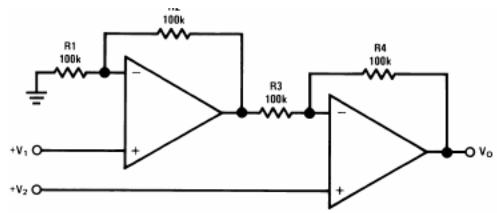
Microphone Preamp







Low Pass FIter



Instrumentation Amp

TEXAS INSTRUMENTS

Must-Have Products
Linear: Power Management

TL431B / TL432B
- 0.5% Tolerance Adjustable Shunt Regulator
- First in small SC70 package

TLV431B
- 0.5% Tolerance Low Voltage Adjustable Shunt Regulator
- 3 temp ranges, including -40 – 125C
- TLVH431B provides wider Vka 1.24V-18V

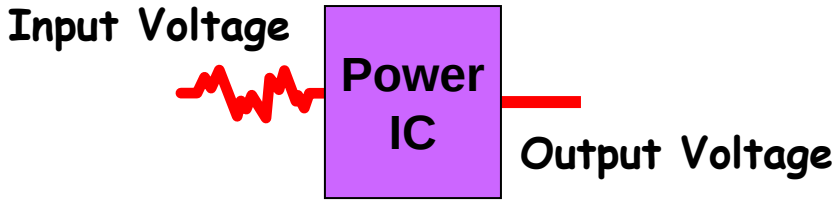
NEW

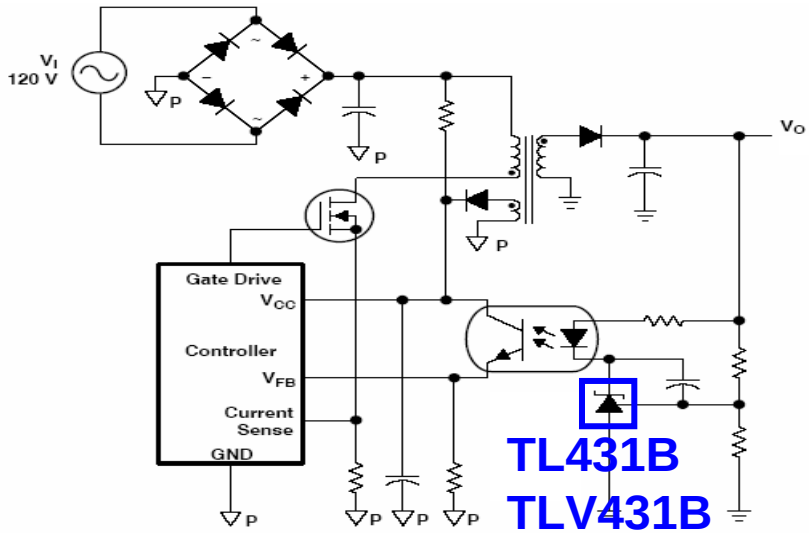
LM4040 / LM4041
- Precision Micropower Shunt Voltage Referecne
- 0.1 – 1.0% accuracy grades
- Power switching supplies, data acquisition systems, audio

MC33063A / MC34063A
- Buck / Boost / Inverting Switching Regulator
- 3-40V Vin range, 1.25-40V Vout range

Preview

TL2575 / TL2576
- Buck / Inverting / Negative Boost Switching Regulator
- 4.75 – 60V Vin range



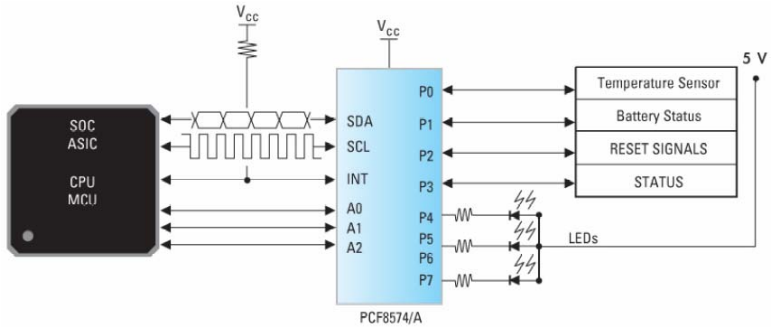


Voltage Reference and Error Amplifier

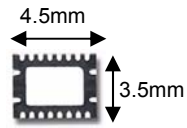
Must-Have Products
I2C

PCF8574/A
PCF8575/C

- I²C-bus parallel-port expander
- 8574 (8bit). 8575 (16bit)
- Optimizes the usage of CPU/MCU I/Os
- Smallest package available (QFN), Pb-Free



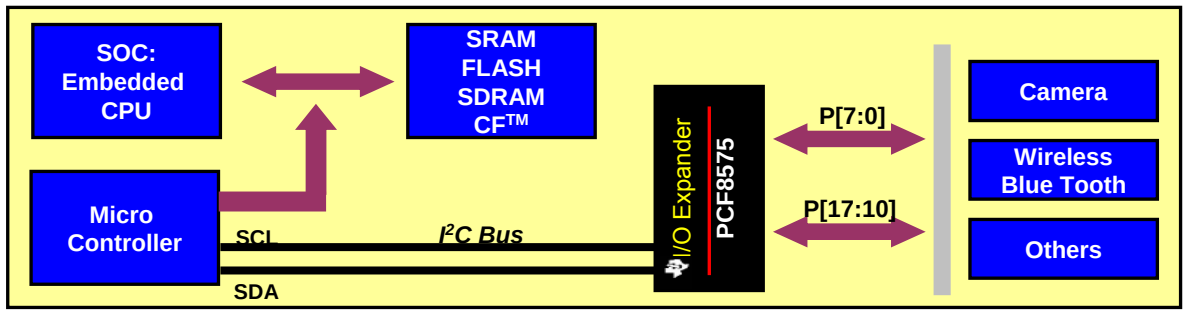
20-Pin QFN



Pb-FREE

PCA9306

- I²C-bus SMbusTranslator
- Directionless Translator
- Smallest package available (QFN)



PCA9539

- Remote 16bit low power I/O Expander
- Reset input prevents need to power down
- Telecom, server, and PC solutions

NEW

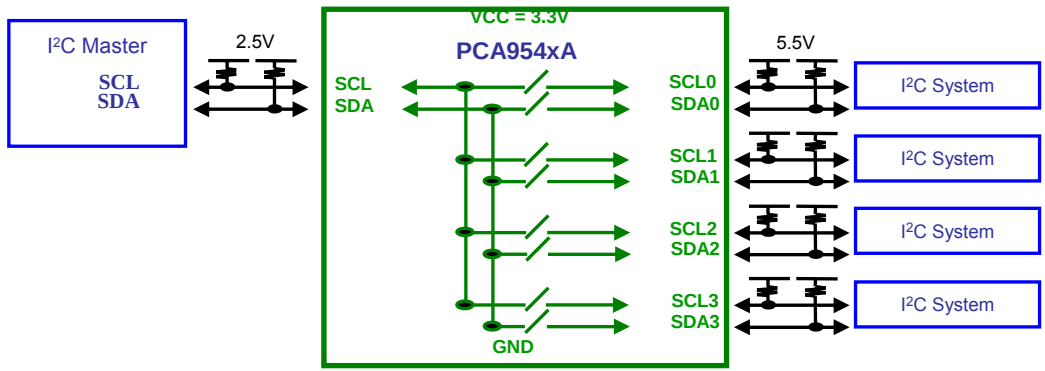
PCA9536

- 4-Channel I2C-Bus/SMBus MUX with Reset
- Interface with 400KHz bus

NEW

PCA9545A

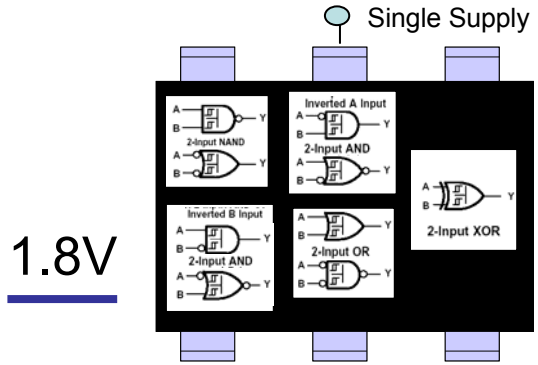
- 4channel I2C Multiplexer
- Level translation between 2.5V, 3.3V, and 5.0V
- Industry's smallest I2C switch



Texas Instruments

Must-Have Products
Translation

AUP1T97/98
- Single Supply Configurable Translator
- 9 functions in 1 device
- Translate voltages 1.8V to 3.3V
- Ultra Low Power for battery operation



AVC2T45
AVC16T245
- Memory Interface Translator 1.2-3.3V
- 1 and 2bit widths (xT45)
- 4, 8, 16, 20, 24, 32 bit widths (xT245)
- Broadest portfolio of translation solutions

NEW

AVCA406L
- Memory Interface Translator
- Interfaces MemoryStick™, MMC, SmartMedia, XD PictureCard
- Optimized flexibility between interfaces

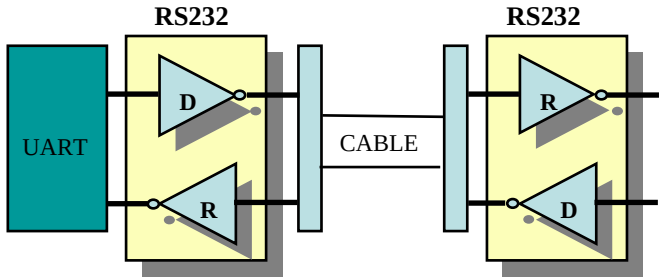
LV4320
- CompactFlash™ Memory Interface Translator
- Optimized for CompactFlash™
- 8Kv ESD high voltage protection

NEW

TXS0104E
- 4 bit Bi-Directional Translator
- Space and routing savings without direction

Must-Have Products
Interface

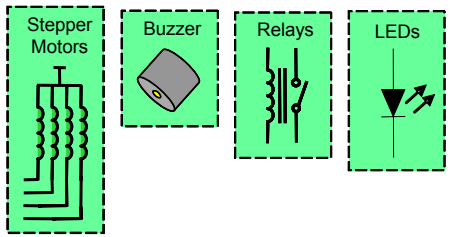
MAX3243E
- Single Supply 3D/5R RS-232 Transceiver
- Computing and Data Cable interface
- IEC 15KV HBM ESD



MAX3221E/65C3221E
- Single Supply 1D/1R RS-232 Transceiver
- IEC 15KV HBM ESD
- 65C3221 provides 1Mbps

NEW

MAX3318
- 2.5-V 460Kbps RS-232 Transceiver
- +/-15 KV ESD Protection



NEW

LV8153
- Serial to parallel interface/driver
- Compatible with UART serial-data format
- LED driver – up to 64 channels.

NEW

TPL9201 / TPL9202
- Integrated 8-output Relay Driver, 5V LDO, and PowerOnReset
- Microcontroller interface to relays, motors, LEDs, buzzers
- ‘9201 with Brown out, ‘9202 with Zero Voltage Detect

Texas Instruments

Must-Have Products
Switches

TS5A3159A/23166
- 0.9ohm SPDT single/dual Analog Switch
- TV, DVD, STB video switching

NEW

TS5A6542
- 0.75Ω Single SPDT with Translation

TS3A24157
- 0.75Ω Dual SPDT Analog Switch

Preview

TS3A4684
- 0.4 Ω SPDT Analog Switch

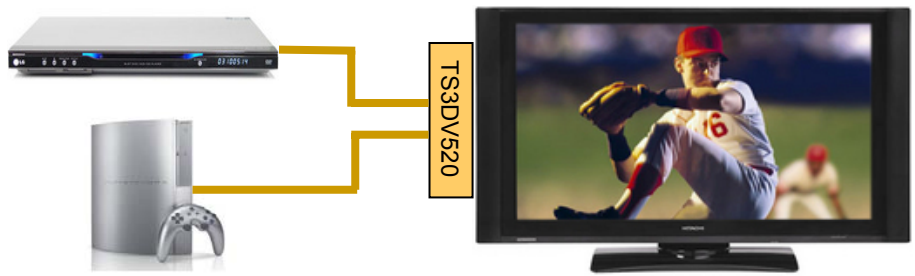
TS3DV520
- 10:20 DVI/HDMI video multiplexer
- ideal for audio/video equipment and HDTV

TS3V340
- 3V Wide Bandwidth Video Switch SPDT
- 500MHz performance video switching, HDTV, DVI

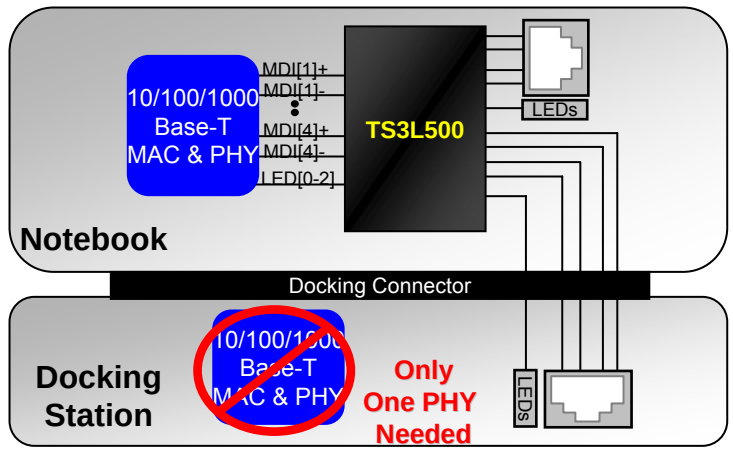
NEW

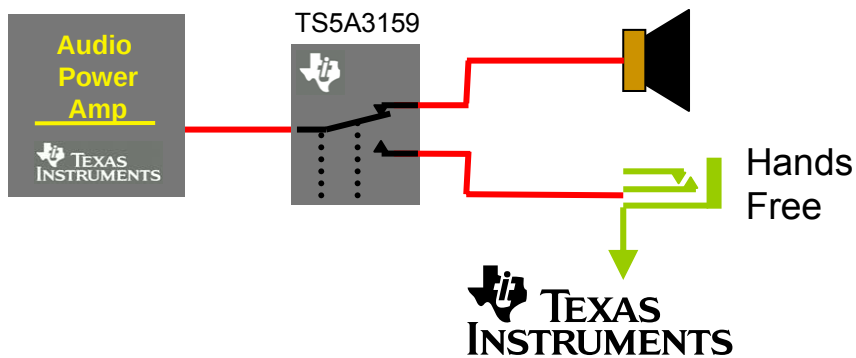
TS3L500
-10/100/1000 BaseT High Bandwidth LAN Switch
- 1GHz bandwidth, N/B docking

TS3USB221
- dual channel
- 2:1 2.0 USB in Micro QFN



Docking Station Application





FUNCTIONAL INDEX

SECTION 3
PRODUCT INDEX

CONTENTS

CONTENTS (continued)

✔ Product available in technology indicated ✛ New product planned in technology indicated
CP = center pin OC = open collector OD = open drain PP = push-pull TP = totem pole 3S = 3-state

BUFFERS, DRIVERS, AND TRANSCEIVERS

Inverting Buffers and Drivers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																					
			ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AUP	BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S	TTL
Single Buffers/Drivers	OD	1G06										✔	✔									✔			
	3S	1G240										✔	✔									✔			
Single Inverters		1G04				✔	✔					✔	✔									✔			
Single Schmitt-Trigger Inverters		1G14				✔	✔					✔	✔									✔			
Unbuffered Single Inverters		1GU04				✔						✔										✔			
Dual Buffers/Drivers	3S	2G06										✔										✔			
		2G240										✔										✔			
Dual Inverters		2G04										✔										✔			
		2GU04										✔										✔			
Dual Schmitt-Trigger Inverters		2G14																				✔			
Triple Buffers/Drivers	OD	3G06																				✔			
Triple Inverters		3G04																				✔			
Triple Schmitt-Trigger Inverters		3G14																				✔			
Unbuffered Triple Inverters		3GU04																				✔			
Hex Buffers/Drivers	OC	06																		✔					✔
	OD	06										✔									✔	✔			
	OC	16																							✔
	3S	366																✔							
		368																✔	✔	✔					
	OC	1005						✔																	
Hex Buffers/Converters		4009													✔										
Hex Buffers/Converters		4049													✔			✔							
Hex Drivers		1004						✔			✔														

Inverting Buffers and Drivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																						
			ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AUP	BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S	TTL
Hex Inverters		04		✔	✔	✔	✔	✔	✔		✔	✔				✔		✔	✔	✔	✔	✔		✔	✔
	CP	11004		✔	✔																				
	OC	05						✔												✔				✔	✔
	OD	05		✔	✔	✔												✔			✔				
	OC	1005						✔																	
		4069													✔										
Hex Schmitt-Trigger Buffers/Drivers		40106													✔										
Hex Schmitt-Trigger Inverters		14		✔	✔	✔	✔		✔			✔						✔	✔	✔	✔	✔			✔
		19																		✔					
Strobed Hex Inverters/Buffers	3S	4502													✔										
Unbuffered Hex Inverters		U04				✔						✔						✔			✔	✔			
Octal Buffers/Drivers	3S	240	✔	✔	✔	✔	✔	✔			✔	✔		✔		✔		✔	✔	✔	✔	✔	✔	✔	
		11240		✔	✔																				
		540	✔	✔	✔	✔	✔	✔						✔			✔	✔	✔	✔	✔	✔	✔		
	OC	756									✔			✔											
Octal Buffers and Line/MOS Drivers with Series Damping Resistors	3S	2240	✔											✔			✔								
Oscillator Drivers for Crystal Oscillator or Ceramic Resonator		1404																				✔			
10-Bit Buffers/Drivers	3S	828																				✔			
		29828						✔																	
11-Bit Line/Memory Drivers	3S	5401	✔																						
12-Bit Line/Memory Drivers	3S	5403	✔																						
16-Bit Buffers/Drivers	3S	16240	✔		✔	✔	✔		✔	✔		✔					✔					✔	✔		
		16540	✔			✔	✔															✔			

Inverting Buffers and Drivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																						
			ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AUP	BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S	TTL
16-Bit Buffers/Drivers with Series Damping Resistors	3S	162240															✔						✔		
32-Bit	3S	32240																				✔	✔		

Noninverting Buffers and Drivers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																								
			ABT	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AUP	AVC	BCT	64BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S	TTL
Single Buffers		1G34												✔												✔			
Single Bus Buffers	OD	1G07											✔	✔												✔			
		1G17											✔	✔												✔			
	3S	1G125				✔	✔						✔	✔												✔			
		1G126				✔	✔						✔	✔												✔			
Dual		2G07											✔													✔			
Dual Bus Buffers	OD	2G17																								✔			
		2G34											✔													✔			
	3S	2G125											✔													✔			
		2G126											✔													✔			
		2G241											✔													✔			
Triple Buffers/Drivers	OD	3G07																								✔			
Triple Schmitt-Trigger Buffers		3G17																								✔			
Triple Buffer Gates		3G34																								✔			
Quad True/ Complement Buffers		4041																✔											
Quad Bus Buffers	3S	125	✔			✔	✔			✔			✔		÷	✔	✔		✔		✔	✔	✔	✔	✔	✔	✔	✔		
		126	✔			✔	✔			✔			✔			✔	✔		✔		✔	✔	✔	✔		✔	✔			
Hex Buffers		34											✔																
	OC	1035							✔																				
	3S	4503																✔											
Hex Buffers/ Converters		4010																✔											
		4050																✔			✔								

Noninverting Buffers and Drivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																									
			ABT	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AUP	AVC	BCT	64BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S	TTL
Hex Buffers/ Line Drivers	3S	365																			✔	✔	✔						
		367				✔	✔														✔	✔	✔	✔					✔
	OC	07																					✔						✔
	OD	07											✔											✔		✔			
	OC	17																											✔
		35							✔																				
Hex Schmitt-Trigger Buffers		17											✔																
Hex Drivers		1034							✔			✔																	
Octal	3S	241	✔	✔	✔				✔			✔				✔			✔		✔	✔	✔				✔	✔	
		244	✔	✔	✔	✔	✔		✔	✔		✔	✔			✔	✔		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
		1244							✔																				
	CP/3S	11244		✔	✔																								
	3S	541	✔	✔	✔	✔	✔		✔							✔			✔	✔	✔	✔	✔	✔	✔	✔	✔		
	OC	757										✔				✔	✔												
		760							✔			✔				✔													
Octal with Series Damping Resistors	3S	2244	✔													✔				✔						✔			
		25244														✔	✔												
Octal Buffers	3S	465																					✔						
Octal Buffers and Line/MOS Drivers with Series Damping Resistors	3S	2241	✔													✔													
Octal Line Drivers/ MOS Drivers	3S	2541							✔											✔									
10 Bit	3S	827	✔																	✔						✔			
		29827							✔							✔													
10 Bit with Series Damping Resistors	3S	2827	✔													✔				✔									

TEXAS INSTRUMENTS

Noninverting Buffers and Drivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																										
			ABT	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AUP	AVC	BCT	64BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S	TTL
10-Bit Universal Schmitt-Trigger Buffers	3S	8151																					✔					
11-Bit Line/Memory Drivers	3S	5400	✔																									
12-Bit Line/Memory Drivers	3S	5402	✔																									
16 Bit	3S	16241	✔																							✔		
		16244	✔	✔	✔	✔	✔	✔		✔	✔		✔		✔					✔						✔	✔		
		16541	✔		✔	✔	✔																			✔	✔		
16 Bit with Series Damping Resistors	3S	162241																									✔		
		162244								✔	✔									✔						✔	✔		
		162541																									✔		
18 Bit	3S	16825	✔		✔					✔																			
18 Bit with Series Damping Resistors	3S	162825	✔																										
20 Bit	3S	16827	✔		✔					✔	✔				✔					✔									
20 Bit with Series Damping Resistors	3S	162827	✔							✔	✔									✔									
1-Bit to 2-Bit Address Drivers	3S	162830								✔																			
1-Bit to 4-Bit Address Drivers	3S	16344								✔																			
		162344								✔																			
1-to-4 Address Registers/Drivers	3S	16831								✔																			
		16832								✔																			
1-Bit to 4-Bit Address Drivers	3S	162831								✔																			
		162832								✔																			
1-to-4 Address Registers/Drivers with Series Damping Resistors	3S	162832								✔																			
32 Bit	3S	32244								✔	✔		✔													✔	✔		

Noninverting Buffers and Drivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																									
			ABT	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AUP	AVC	BCT	64BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S	TTL
32 Bit with Series Resistors	3S	322244																								✔			
4-Segment Liquid Crystal Display Drivers		4054																✔											

Parity Transceivers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY				
			ABT	ACT	ALS	BCT	F
Octal with Parity Generators/Checkers	3S	657	✔				✔
8 Bit to 9 Bit		833	✔				
		853	✔				
		29854			✔	✔	
Dual 8 Bit to 9 Bit		16833	✔				
		16853	✔				
16 Bit with Parity Generators/Checkers	3S	16657	✔	✔			

Registered Transceivers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY														
			ABT	AC	ACT	ALS	ALVC	AS	AVC	BCT	F	FCT	HC	HCT	LS	LVC	LVT
Octal	3S	52										✔					
		543	✔							✔	✔	✔				✔	✔
		11543			✔												
		646	✔	✔	✔	✔		✔		✔		✔	✔	✔	✔	✔	✔
		648				✔		✔							✔		
		651	✔		✔	✔											
		652	✔	✔	✔	✔		✔		✔		✔	✔	✔	✔	✔	✔
		11652			✔												
	OC/3S	653				✔											
		654				✔											
Octal with Series Damping Resistors	3S	2543										✔					
		2646										✔					
		2652										✔					
		2952	✔													✔	✔
16 Bit	3S	16470	✔														
		16543	✔		✔		✔					✔				✔	✔
		162543										✔					
		16646	✔		✔		✔		✔			✔				✔	✔
		162646										✔					
		16651			✔												
		16652	✔	✔	✔							✔				✔	✔
		162652										✔					
		16952	✔		✔		✔					✔				✔	✔
		162952										✔					
18 Bit	3S	16524					✔										
		16525					✔										
		162525					✔										
32 Bit	3S	32543	✔														
4 to 1 Multiplexed/Demultiplexed	3S	162460	✔														

Standard Transceivers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																									
			ABT	ABTE	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	64BCT	F	FCT	GTL	GTLP	HC	HCT	LS	LV-A	LV-AT	LVC	LVT
Dual 1 Bit LVTTL to GTLP Adjustable Edge Rate with Split LVTTL Port, Feedback Path, and Selectable Polarity	3S	1395																			✔								
2 Bit LVTTL to GTLP Adjustable Edge Rate with Selectable Parity	3S	1394																			✔								
Quad	3S	243								✔												✔	✔	✔					
Quad Tridirectional	3S	442																						✔					
8-Bit Transceivers and Transparent D-Type Latches with Four Independent Buffers		16973									✔																		
8 Bit LVTTL to GTLP	3S	306																			✔								

TEXAS INSTRUMENTS

Standard Transceivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																										
			ABT	ABTE	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	64BCT	F	FCT	GTL	GTLP	HC	HCT	LS	LV-A	LV-AT	LVC	LVT
Octal	3S	245	✔		✔	✔	✔	✔		✔	✔		✔	✔		✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔
		1245								✔																		
		11245			✔	✔																						
		620	✔							✔																		
	OC	621								✔																		
	3S	623	✔		✔	✔				✔						✔			✔			✔	✔	✔				
		11623				✔																						
		638								✔			✔															
		639								✔																		
		640	✔							✔			✔			✔						✔	✔	✔				
	OC	641								✔			✔											✔				
		642								✔														✔				
	3S	645								✔			✔									✔	✔	✔				
		1645								✔																		
Octal with Series Damping Resistors	3S	2245	✔																								✔	✔
Octal Transceivers and Line/MOS Drivers with B-Port Series Damping Resistors	3S	2245	✔													✔			✔									
Octal with Adjustable Output Voltage	3S	3245																									✔	
Octal Dual Supply with Configurable Output Voltage	3S	4245																									✔	
Octal with 3.3-V to 5-V Shifters	3S	4245																									✔	

Standard Transceivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																									
			ABT	ABTE	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	64BCT	F	FCT	GTL	GTLP	HC	HCT	LS	LV-A	LV-AT	LVC	LVT
9 Bit	3S	863	✔																								✔	
		29863								✔						✔												
		29864														✔												
10 Bit	3S	861	✔																								✔	
11 Bit Incident Wave Switching	3S/OC	16246		✔																								
16 Bit	3S	16245	✔		✔	✔		✔	✔		✔	✔		✔	✔				✔								✔	✔
		16623	✔			✔																						
		16640	✔																									
16-Bit Bus Transceivers and Transparent D-Type Latches with Eight Independent Buffers	3S	32973									✔																	
16 Bit Incident Wave Switching	3S	16245		✔																								
16 Bit with Series Damping Resistors	3S	16245									✔	✔																
16 Bit with Series Damping Resistors	3S	162245	✔									✔							✔								✔	✔
16 Bit Level Shifting	3S	164245									✔				✔													
16 Bit LVTTL to GTLP Adjustable Edge Rate	3S	1645																			✔							

Standard Transceivers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																									
			ABT	ABTE	AC	ACT	AHC	AHCT	ALB	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	64BCT	F	FCT	GTL	GTLP	HC	HCT	LS	LV-A	LV-AT	LVC	LVT
16 Bit LVTTL to GTLP	3S	16945																			✔							
18 Bit Bus Interface	3S	16863	✔			✔					✔																	
18 Bit LVTTL to GTL/GTL+		16622																		✔								
		16923																		✔								
18 Bit LVTTL to GTLP Source Synchronous Clock Outputs	3S	1627																			✔							
		16927																			✔							
20 Bit	3S	16861				✔																						
25 Ω Octal	3S	25245	✔													✔	✔											
	OC	25642														✔												
32 Bit	3S	32245	✔								✔			✔													✔	✔
32 Bit LVTTL to GTLP	3S	32945																			✔							
32 Bit LVTTL to GTLP Adjustable Edge Rate	3S	3245																			✔							

D-Type Flip-Flops (3-state)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																			
			ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S
Dual 4 Bit Edge Triggered	3S	874						✔			✔												
		876						✔			✔												
Quad	3S	173															✔	✔	✔				
Octal Bus Interface	3S	825									✔					✔							
		29825												✔									
Octal Edge Triggered	3S	374	✔	✔	✔	✔	✔	✔	✔		✔			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	3S/CP	11374			✔																		
	3S	574	✔	✔	✔	✔	✔	✔			✔			✔	✔	✔	✔	✔		✔	✔	✔	
		575						✔															
		576						✔			✔												
		577						✔															
Octal Edge Triggered Dual Rank	3S	4374									✔												
Octal Edge Triggered with Series Damping Resistors	3S	2374														✔							
		2574														✔							
Octal Inverting	3S	534	✔	✔	✔			✔									✔	✔					
		564		✔	✔			✔									✔	✔					
9 Bit Bus Interface	3S	823	✔								✔					✔					✔		
10 Bit Bus Interface	3S	821	✔								✔					✔					✔		
		29821						✔						✔									
10 Bit with Dual Outputs	3S	16820							✔														
		162820							✔														
16 Bit Edge Triggered	3S	16374	✔	✔	✔	✔	✔		✔	✔		✔	✔			✔					✔	✔	
		162374							✔							✔						✔	
18 Bit	3S	16823	✔		✔				✔							✔							
		162823	✔													✔							

D-Type Flip-Flops (3-state) (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																			
			ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S
20 Bit	3S	16721							✔														
		162721							✔														
		16722											✔										
		16821	✔						✔	✔													
32 Bit Edge Triggered	3S	32374							✔	✔		✔									✔	✔	
		322374																				✔	

D-Type Flip-Flops (non 3-state)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																			
			ABT	AC	ACT	AHC	AHCT	ALS	AS	AUC	AUP	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	LVT	S	
Single Edge Triggered		1G79								✔	✔								✔			
		1G80								✔	✔								✔			
Single Edge Triggered with Preset and Clear		1G74								✔												
		2G74																	✔			
Dual		4013										✔										
		74		✔	✔	✔	✔	✔	✔	✔			✔		✔	✔	✔	✔	✔		✔	
	CP	11074		✔	✔																	
Dual Edge Triggered		2G79								✔									✔			
		2G80								✔									✔			
Quad		175		✔	✔			✔	✔				✔		✔	✔	✔	✔			✔	
	CP	11175		✔																		
		40175										✔										
Hex		174		✔	✔	✔	✔	✔	✔				✔		✔	✔	✔	✔			✔	
		40174										✔										
Hex with Enable		378															✔					
Octal		273	✔	✔	✔	✔	✔	✔						✔	✔	✔	✔	✔		✔		
Octal with Enable		377	✔										✔	✔	✔	✔	✔					

J-K Flip-Flops

DESCRIPTION	TYPE	TECHNOLOGY											
		AC	ACT	ALS	AS	CD4K	F	HC	HCT	LS	LVC	S	TTL
Dual Edge Triggered J-K Master-Slave	4027					✔							
Dual Edge Triggered J-K with Reset	73							✔	✔	✔			
	107							✔	✔	✔			✔
Dual Edge Triggered J-K with Set and Reset	112	✔	✔	✔			✔	✔	✔	✔	✔	✔	
Dual Positive Edge Triggered J-$\overline{K}$ with Set and Reset	109	✔	✔	✔	✔		✔	✔	✔	✔			

D-Type Latches (3-state)

DESCRIPTION	TYPE	TECHNOLOGY																					
		ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S
Single	1G373																				✔		
1-Bit to 4-Bit Address Registers/Drivers	162831							✔															
	162832							✔															
Dual 4 Bit	873						✔																
Octal Inverting Transparent	533	✔	✔	✔			✔			✔						✔	✔						
	563		✔	✔			✔									✔	✔						
Octal Transparent	373	✔	✔	✔	✔	✔	✔	✔		✔			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	11373			✔																			
	573	✔	✔	✔	✔	✔	✔			✔			✔	✔	✔	✔	✔		✔	✔	✔	✔	
	580						✔																
Octal Transparent Read Back	990						✔																
Octal Transparent Read Back	666						✔																
	667						✔																
Octal Transparent with Series Damping Resistors	2373													✔	✔								
	2573														✔								
Octal Edge Triggered Read Back	996						✔																
9 Bit Transparent	843	✔					✔								✔								
	29843												✔										
9 Bit Transparent Read Back	992						✔																

TEXAS INSTRUMENTS

D-Type Latches (3-state) (continued)

DESCRIPTION	TYPE	TECHNOLOGY																				
		ABT	AC	ACT	AHC	AHCT	ALS	ALVC	ALVT	AS	AUC	AVC	BCT	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	LVT	S
10 Bit Transparent	841	✔					✔								✔						✔		
10 Bit Transparent Read Back	994						✔																
12 Bit to 24 Bit Multiplexed	16260	✔						✔															
12 Bit to 24 Bit Multiplexed with Series Damping Resistors	162260	✔						✔															
16 Bit Transparent	16373	✔	✔	✔	✔	✔		✔	✔		÷	✔			✔						✔	✔	
	162373							✔							✔							✔	
18 Bit Transparent	16843	✔																					
20 Bit Transparent	16841	✔		✔				✔							✔								
	162841	✔						✔							✔								
32 Bit Transparent	32373								✔												✔	✔	

Other Latches

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY				
			ALS	CD4K	HC	HCT	LS
Dual 2 Bit Bistable Transparent		75			✔	✔	
Dual 4 Bit with Strobe	3S	4508		✔			
4 Bit Bistable		75					✔
		375					✔
Quad Clocked D		4042		✔			
Quad Clocked D	3S	4076		✔			
Quad NAND R-S	3S	4044		✔			
Quad NOR R-S	3S	4043		✔			
Quad $\overline{S}$-$\overline{R}$		279					✔
8 Bit Addressable		259	✔		✔	✔	✔
		4099		✔			
		4724		✔			
4-by-4 Register Files	3S	670			✔	✔	✔
Dual 16-by-4 Register Files	3S	870	✔				

Shift Registers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY													
			AC	ACT	AHC	AHCT	ALS	ALVC	AS	CD4K	F	FCT	HC	HCT	LS	LV-A
4 Bit Bidirectional Universal Shift		194							✔				✔	✔	✔	
		195											✔			
		40194								✔						
4 Stage Parallel-In/Parallel-Out Shift		4035								✔						
Dual 4 Stage Static Shift		4015								✔			✔			
8 Bit Diagnostic Scan	3S	818										✔				
8 Bit Multilevel Pipeline	3S	520										✔				
8 Bit Serial In, Parallel Out Shift		164	✔	✔			✔						✔	✔	✔	✔
8 Bit Parallel In, Serial Out Shift with Gated Clock		165					✔						✔	✔	✔	✔
8 Bit Parallel In, Serial In, Serial Out Shift		166					✔						✔	✔	✔	✔
8 Bit Shift with Output Registers	OC	594			✔	✔							✔		✔	✔
8 Bit Shift with 3-State Output Registers	3S	595			✔	✔							✔		✔	✔
8 Bit Shift with 3-State Output Latches	3S	596													✔	
8 Bit Shift with Input Latches		597											✔	✔	✔	
8 Bit Shift with Input Latches and 3-State Input/Output Ports	3S	598													✔	
8 Bit Universal Shift/Storage	3S	299	✔	✔			✔				✔		✔	✔	✔	
		323	✔				✔									
8 Stage Static Shift		4014								✔						
		4021								✔						
8-Stage Shift-and-Store Bus	3S	4094								✔			✔	✔		
8-Stage Static Bidirectional Parallel-/Serial-Input/Output Bus		4034								✔						
16 Bit Serial In/Out with 16-Bit Parallel-Out Storage		673													✔	
		674													✔	
64 Stage Static Shift		4031								✔						
Dual 64 Stage Static Shift	3S	4517								✔						
Serial-to-Parallel Interface	OC/PP	8153														✔

AND Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY															
			AC	ACT	AHC	AHCT	ALS	ALVC	AS	AUC	AUP	CD4K	F	HC	HCT	LS	LV	LVC	S
Single 2 Input		1G08			✔	✔				✔	✔							✔	
Single 3 Input		1G11																✔	
Single 3 Input AND-OR		1G0832																✔	
Single 3 Input OR-AND		1G3208																✔	
Dual 2 Input		2G08								✔								✔	
Quad 2 Input		08	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔
	CP	11008	✔	✔															
	OC	09					✔									✔			✔
		4081										✔							
Quad 2-Input Buffers/Drivers		1008							✔										
Quad 2 Input with Schmitt-Trigger Inputs		7001												✔					
Dual 4 Input		21					✔		✔				✔	✔	✔	✔	✔		
		4082										✔							
Triple 3 Input		11	✔	✔			✔		✔				✔	✔	✔	✔	✔		
		4073										✔							
Hex 2-Input Drivers		809							✔										

Configurable Gates

DESCRIPTION	TYPE	TECHNOLOGY		
		CD4K	LS	S
Dual 2 Wide 2 Input AND-OR-Invert	51			✔
	4085	✔		
2 Wide 2 Input and 2 Wide 3 Input AND-OR-Invert	51		✔	
Expandable 4 Wide 2 Input	4086	✔		
Expandable 8 Input	4048	✔		
Quad AND-OR Select	4019	✔		

Exclusive-OR Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY														
			AC	ACT	AHC	AHCT	ALS	AS	AUC	CD4K	F	HC	HCT	LS	LV-A	LVC	S
Single 2 Input		1G86			✔	✔			✔							✔	
Single 3 Input		1G386														✔	
Dual 2 Input		2G86							✔							✔	
Quad 2 Input		4030								✔							
		4070								✔							
		86	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔
	CP	11086	✔														
	OC	136												✔			

Exclusive-NOR Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			CD4K	HC	LS
Quad 2 Input	OC	266			✔
	OD	266		✔	
		4077	✔		
		7266		✔	

NAND Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			AC	ACT	AHC	AHCT	ALS	ALVC	AS	AUC	AUP	CD4K	F	HC	HCT	LS	LV-A	LVC	S	TTL
Single 2 Input		1G00			✔	✔				✔	✔							✔		
	OD	1G38																✔		
Single 3 Input Positive		1G10																✔		
Dual 2 Input		2G00								✔								✔		
	OD	2G38																✔		
Dual 2 Input with Schmitt-Trigger Inputs		8003							✔											
		2G132																✔		
Dual 2-Input Buffers/Drivers		40107										✔								

NAND Gates (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			AC	ACT	AHC	AHCT	ALS	ALVC	AS	AUC	AUP	CD4K	F	HC	HCT	LS	LV-A	LVC	S	TTL
Quad 2 Input		00	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔	✔
	CP	11000	✔	✔																
	OC	03					✔									✔				
	OD	03												✔	✔					
		4011										✔								
	3S	26														✔				
		37					✔									✔			✔	
	OC	38					✔						✔			✔			✔	✔
Quad 2-Input Buffers/Drivers		1000							✔											
Quad 2 Input Unbuffered		4011										✔								
Quad 2 Input with Schmitt-Trigger Inputs		132			✔	✔								✔	✔	✔	✔		✔	
		4093										✔								
Hex 2-Input Drivers		804					✔		✔											
Triple 3 Input		10	✔	✔			✔	✔	✔				✔	✔	✔	✔	✔	✔	✔	✔
		4023										✔								
Dual 4 Input		4012										✔								
		20	✔	✔			✔		✔				✔	✔	✔	✔	✔		✔	
Dual 4-Input Positive 50-Ω Line Drivers		140																	✔	
8 Input		30					✔		✔				✔	✔	✔	✔				
	CP	11030		✔																
8 Input AND/NAND		4068										✔								
13 Input		133					✔													

NOR Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY															
			AC	ACT	AHC	AHCT	ALS	AS	AUC	AUP	CD4K	F	HC	HCT	LS	LV-A	LVC	S	TTL
Single 2 Input		1G02			✔	✔			✔	✔							✔		
Single 3 Input		1G27															✔		
Dual 2 Input		2G02							✔								✔		
Quad 2 Input		4001									✔								
		02	✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔	✔
	OC	33					✔								✔				
Quad 2 Input with Schmitt-Trigger Inputs		7002											✔						
Quad 2 Input Unbuffered		4001									✔								
Quad 2 Input 50-Ω Line Drivers		128																	✔
Hex 2-Input Drivers		805					✔	✔											
Triple 3 Input		4025									✔								
		27					✔	✔				✔	✔	✔	✔	✔			
Dual 4 Input		4002									✔		✔						
Dual 4 Input with Strobe		25																	✔
Dual 5 Input		260										✔						✔	
8 Input NOR/OR		4078									✔								

OR Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			AC	ACT	AHC	AHCT	ALS	ALVC	AS	AUC	AUP	CD4K	F	HC	HCT	LS	LV-A	LVC	S	TTL
Single 2 Input		1G32			✔	✔				✔	✔							✔		
Single 3 Input		1G332																✔		
Single 3 Input AND-OR		1G0832																✔		
Single 3 Input OR-AND		1G3208																✔		
Dual 2 Input		2G32								✔								✔		
Quad 2 Input		32	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔	✔
	CP	11032	✔	✔																
		4071										✔								
Quad 2-Input Buffers/Drivers		1032							✔											
Quad 2 Input with Schmitt-Trigger Inputs		7032												✔						
Hex 2-Input Drivers		832					✔		✔											
Dual 4 Input		4072										✔								
Triple 3 Input		4075										✔		✔	✔					

I²C Logic

DESCRIPTION	TYPE	TECHNOLOGY		
		P82	PCA	PCF
Buffers				
Bidirectional Unity Voltage Gain Buffers for I²C Bus and SMBus Extending	B715	✢		
Dual Bidirectional Bus Buffers	B96	✔		
Dual Bidirectional I²C Bus and SMBus Repeaters	9515A		✔	
Dual Bidirectional I²C Bus and SMBus Voltage-Level Translators	9306		✔	
Expandable 5-Channel Bidirectional I²C-Bus and SMBus Hub	9518		✢	
I/O Expanders				
Remote 4-Bit I²C and SMBus I/O Expanders with Configuration Registers	9536		✔	
Remote 8-Bit I/O Expanders for I²C Bus	8574			✔
	8574A			✔
Remote 8-Bit I²C and SMBus Low-Power I/O Expanders with Reset and Configuration Registers	9557		✔	
Remote 8-Bit I²C and SMBus Low-Power I/O Expanders with Interrupt Output, Reset, and Configuration Registers	6107		✔	
Remote 8-Bit I²C-Bus and SMBus I/O Expanders with Interrupt and Configuration Registers	9554		✔	
	9554A		✢	
Remote 8-Bit I²C-Bus and SMBus I/O Expanders with Interrupt and Configuration Registers (Low Power)	9534		✢	
	9534A		✢	
Remote 8-Bit I²C-Bus and SMBus I/O Expanders with Interrupt, Reset, and Configuration Registers (Low Power)	9538		✢	
Remote 16-Bit I²C and SMBus I/O Expanders with Interrupt Output	8575			✔
	8575C			✔
Remote 16-Bit I²C and SMBus I/O Expanders with Interrupt Output and Configuration Registers	9555		✔	
Remote 16-Bit I²C and SMBus Low-Power I/O Expanders with Interrupt Output and Configuration Registers	9535		✔	
Remote 16-Bit I²C and SMBus Low-Power I/O Expanders with Interrupt Output, Reset, and Configuration Registers	9539		✔	
Switches and Multiplexers				
4-Channel I²C and SMBus Multiplexers with Interrupt Logic	9544A		✔	
4-Channel I²C and SMBus Multiplexers with Reset Functions	9546A		✔	
4-Channel I²C and SMBus Multiplexers with Interrupt Logic and Reset Functions	9545A		✔	
Nonvolatile 5-Bit Registered Multiplexers with I²C Interface	8550		✔	
8-Channel I²C-Bus and SMBus Multiplexers with Reset	9548A		✢	

Single Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY							
			AHC	AHCT	AUC	AUP	CBT	CB3T	CBTLV	LVC
Configurable Multiple-Function Gates		1G57				✔				✔
		1G58				✔				✔
		1G97				✔				✔
		1G98				✔				✔
		1G99				✔				✔
Single Bilateral Bus Switches (Analog or Digital)		1G66			✔					✔
Single Crystal Oscillator Drivers		1GX04								✔
Single D-Type Flip-Flops	3S	1G374								✔
Single Edge-Triggered D-Type Flip-Flops		1G79			✔	✔				✔
		1G80			✔	✔				✔
Single Edge-Triggered Flip-Flops with Preset and Clear		1G74			✔	✔				
Single FET Bus Switches		1G125					✔		✔	
		1G384					✔			
Single FET Bus Switches with Level Shifting		1G125					✔	✔		
		1G384					✔			
Single Buffer Gates		1G34				✔				✔
Single Inverters		1GU04	✔		✔					✔
		1G04	✔	✔	✔	✔				✔
Single Inverting Buffers/Drivers	OD	1G06			✔	✔				✔
	3S	1G240			✔	✔				✔
Single Latches	3S	1G373								✔
Single NAND Gates		1G10								✔
		1G11								✔
		1G27								✔
		1G332								✔
		1G386								✔
Single Noninverting Buffers/Drivers	OD	1G07			✔	✔				✔

Single Gates (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY							
			AHC	AHCT	AUC	AUP	CBT	CB3T	CBTLV	LVC
Single Noninverting Bus Buffers	3S	1G125	✔	✔	✔	✔				✔
		1G126	✔	✔	✔	✔				✔
Single Noninverting Schmitt-Trigger Buffers/Drivers		1G17			✔	✔				✔
Single-Pole Double-Throw Analog Switches		1G3157								✔
Single Schmitt-Trigger Inverters		1G14	✔	✔	✔	✔				✔
Single 2 Input AND Gates		1G08	✔	✔	✔	✔				✔
Single 2 Input Exclusive-OR Gates		1G86	✔	✔	✔					✔
Single 2 Input NAND Gates		1G00	✔	✔	✔	✔				✔
	OD	1G38								✔
Single 2 Input NOR Gates		1G02	✔	✔	✔	✔				✔
Single 2 Input OR Gates		1G32	✔	✔	✔	✔				✔
Single 3 Input AND-OR Gates		1G0832								✔
Single 3-Input OR-AND Gates		1G3208								✔
1-of-2 Decoders/Demultiplexers		1G19			✔					✔
1-of-2 Noninverting Demultiplexers	3S	1G18								✔
2-of-3 Decoders/Demultiplexers		1G29								✔
2-to-4 Line Decoders		1G139								✔
Single Retriggerable Monostable Multivibrators with Schmitt-Trigger Inputs		1G123								✔

Dual Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY	
			AUC	LVC
Single 2- to 1-Line Data Selectors/Multiplexers		2G157		✔
Single Edge-Triggered D-Type Flip-Flops with Preset and Clear		2G74		✔
Dual Analog Multiplexers/Demultiplexers		2G53	✔	✔
Dual Bilateral Bus Switches (Analog or Digital)		2G66	✔	✔
Dual Edge-Triggered D-Type Flip-Flops		2G79	✔	✔
		2G80	✔	✔
Dual Inverters		2G04	✔	✔
		2GU04	✔	✔
Dual Inverting Buffers/Drivers	3S	2G06	✔	✔
		2G240	✔	✔
Dual Noninverting Buffers/Drivers	OD	2G07	✔	✔
		2G34	✔	✔
Dual Noninverting Bus Buffers	OD	2G17		✔
	3S	2G125	✔	✔
		2G126	✔	✔
		2G241	✔	✔
Dual Schmitt-Trigger Inverters		2G14		✔
Dual 2-Input AND Gates		2G08	✔	✔
Dual 2-Input Exclusive-OR Gates		2G86	✔	✔
Dual 2-Input NAND Gates		2G00	✔	✔
	OD	2G38		✔
Dual 2-Input NAND Gates with Schmitt-Trigger Inputs		2G132		✔
Dual 2-Input NOR Gates		2G02	✔	✔
Dual 2-Input OR Gates		2G32	✔	✔

LITTLE LOGIC

Triple Gates

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY
			LVC
Triple Inverting Buffers/Drivers	OD	3G06	✔
Triple Noninverting Buffers/Drivers	OD	3G07	✔
		3G17	✔
		3G34	✔
Triple Schmitt-Trigger Inverters		3G04	✔
		3G14	✔
Triple Unbuffered Inverters		3GU04	✔

MSI FUNCTIONS

ARITHMETIC AND PARITY FUNCTIONS

Adders

DESCRIPTION	TYPE	TECHNOLOGY						
		AC	ACT	F	HC	HCT	LS	S
9 Bit Binary Full with Fast Carry	283	✔	✔	✔	✔	✔	✔	✔

Arithmetic Logic Units

DESCRIPTION	TYPE	TECHNOLOGY	
		AS	LS
Arithmetic Logic Units/Function Generators	181	✔	✔

Parity Generators and Checkers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY									
			AC	ACT	ALS	AS	F	FCT	HC	HCT	LS	S
Dual 8 Bit Odd		480						✔				
9 Bit Odd/Even		280	✔	✔	✔	✔	✔		✔	✔	✔	✔
9 Bit with Bus-Driver Parity Input/Output Port		286				✔						
	CP	11286		✔								

COUNTERS

Binary Counters

DESCRIPTION	TYPE	TECHNOLOGY											
		AC	ACT	ALS	AS	CD4K	F	FCT	HC	HCT	LS	LV-A	S
4 Bit Ripple	93								✔	✔	✔		
	293										✔		
Dual 4 Bit	393								✔	✔	✔	✔	
Dual 4 Bit Up	4520					✔			✔	✔			
Presettable 4 Bit Up/Down	4516					✔							
Presettable 4 Bit BCD Up/Down with Dual Clock and Reset	40193					✔							
Presettable Synchronous 4 Bit Up/Down	191			✔				✔	✔	✔	✔		
	193			✔					✔	✔	✔		
Programmable 4 Bit with Asynchronous Clear	40161					✔							
Synchronous 4 Bit	569			✔									
Synchronous 4 Bit with 3-State Outputs and Carry Out	561			✔									
Synchronous 4 Bit Up/Down	169			✔	✔		✔				✔		
	669										✔		
	697										✔		
Synchronous 4 Bit with Preset and Asynchronous Clear	161	✔	✔	✔	✔		✔		✔	✔	✔	✔	
Synchronous 4 Bit with Preset and Synchronous Clear	163	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔	✔
8-Bit Counters/Dividers with 1-of-8 Decoded Outputs	4022					✔							
8 Bit with 3-State Output Registers	590								✔		✔		
8 Bit with Input Registers	592										✔		
8 Bit with Input Registers and Parallel Counter Outputs	593										✔		
8 Bit Synchronous Up/Down	867			✔	✔								
	869			✔	✔								
8 Bit Presettable Synchronous Down	40103					✔			✔	✔			
7-Stage Ripple-Carry Counters/Dividers	4024					✔			✔	✔			
12-Stage Ripple-Carry Counters/Dividers	4040					✔			✔	✔		✔	
14-Stage Ripple-Carry Counters/Dividers with Oscillators	4020					✔			✔	✔			
	4060					✔			✔	✔			
21 Stage	4045					✔							

Binary Counters (continued)

DESCRIPTION	TYPE	TECHNOLOGY											
		AC	ACT	ALS	AS	CD4K	F	FCT	HC	HCT	LS	LV	S
Divide by 12	92										✔		
Divide by N	4018					✔							
Dual 16 Bit with Output Registers	8154											✔	
Programmable Divide by N	4059					✔			✔				
Presettable Up/Down or BCD Decade	4029					✔							

Decade Counters

DESCRIPTION	TYPE	TECHNOLOGY			
		CD4K	HC	HCT	LS
Divide by 2, Divide by 5	90				✔
Dual Divide by 2, Divide by 5	390		✔	✔	✔
Synchronous Presettable BCD Up/Down	190		✔		
	192		✔		
Counters/Dividers with 1-of-10 Decoded Outputs	4017	✔	✔		
Counters/Drivers with Decoded 7-Segment Display Outputs	4026	✔			
	4033	✔			
BCD-to-Decimal Decoders	4028	✔			
Presettable BCD Up/Down	4510	✔			
Dual BCD Up	4518	✔	✔		
Programmable BCD Divide by N	4522	✔			
2 Decade Synchronous Presettable BCD Down	40102	✔			
Up-Down Counters/Latches/7-Segment Display Drivers	40110	✔			
Presettable BCD-Type Up/Down with Dual Clock and Reset	40192	✔			

Data Selectors/Multiplexers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			ABT	AC	ACT	AHC	AHCT	ALS	AS	AUC	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	PCA	S	TTL
Single 2-to-1 Line Data Selectors/Multiplexers		2G157																✔			
1-of-8 Analog Multiplexers/Demultiplexers		4051												✔	✔		✔				
1-of-8 Analog Multiplexers/Demultiplexers with Logic Level Conversion		4051									✔										
1-of-8 Analog Multiplexers/Demultiplexers with Latches		4351												✔	✔						
1-of-8 Data Selectors	3S	4512									✔										
1-of-8 Data Selectors/Multiplexers		151		✔	✔			✔	✔			✔		✔	✔	✔				✔	
	3S	251		✔				✔				✔		✔	✔	✔					
1-of-8 Data Selectors/Multiplexers/Registers	3S	354												✔	✔						
		356													✔						
1-of-8 Differential Analog Multiplexers/Demultiplexers		4097									✔										
1-of-16 Analog Multiplexers/Demultiplexers		4067									✔			✔	✔						
1-of-16 Data Selectors/Multiplexers		150																			✔
1-of-16 Data Generators/Multiplexers	3S	250							✔												
Dual 1-of-4 Data Selectors/Multiplexers		153		✔	✔			✔	✔			✔		✔	✔	✔					
	3S	253		✔	✔			✔	✔			✔		✔	✔	✔					
Dual Analog Multiplexers/Demultiplexers		2G53								✔								✔			
Dual 1-of-4 Analog Multiplexers/Demultiplexers		4052									✔										
Dual 1-of-4 Analog Multiplexers/Demultiplexers with Logic Level Conversion		4052												✔	✔		✔				
Dual 1-of-4 Analog Multiplexers/Demultiplexers with Latches		4352												✔							
Triple 1-of-2 Analog Multiplexers/Demultiplexers		4053												✔	✔		✔				
Triple 1-of-2 Analog Multiplexers/Demultiplexers with Logic Level Conversion		4053									✔										

Data Selectors/Multiplexers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			ABT	AC	ACT	AHC	AHCT	ALS	AS	AUC	CD4K	F	FCT	HC	HCT	LS	LV-A	LVC	PCA	S	TTL
Quad 1-of-2 Data Selectors/Multiplexers	3S	257		✔	✔			✔	✔			✔	✔	✔	✔	✔		✔		✔	
		258			✔			✔	✔			✔		✔	✔	✔					
	CP/3S	11257		✔	✔																
Quad 1-of-2 Data Selectors/Multiplexers with Series Damping Resistors	3S	2257											✔								
Quad 2-to-1 Data Selectors/Multiplexers		157		✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	
	3S	40257									✔										
Quad 2-to-1 Data Selectors/Multiplexers with Storage		298							✔							✔					
		399											✔			✔					
Quad 2-to-4 Data Selectors/Multiplexers		158		✔	✔	✔	✔	✔	✔					✔	✔	✔					
Hex 2-to-1 Universal Multiplexers	3S	857						✔													
4-to-1 Multiplexers/Demultiplexers	3S	16460	✔																		
Nonvolatile 5-Bit Registers with I^2C Interface		8550																	✔		

Decoders/Demultiplexers

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																		
			AC	ACT	AHC	AHCT	ALS	AS	AUC	BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	S	TTL
1-of-2 Decoders/Demultiplexers		1G19							✔										✔		
1-of-2 Noninverting Demultiplexers	3S	1G18																	✔		
2-of-3 Decoders/Demultiplexers		1G29																	✔		
2-to-4 Line Decoders		1G139																	✔		
Dual 2-to-4 Line Decoders/Demultiplexers		139	✔	✔	✔	✔	✔							✔	✔	✔	✔		✔	✔	
	CP	11139		✔																	
		155														✔					
	OC	156					✔									✔					
Dual 2-Line to 4-Line Memory Decoders with On-Chip Supply-Voltage Monitors		2414								✔											
Dual Binary 1-of-4 Decoders/Demultiplexers		4555									✔										
		4556									✔										
3-to-8 Line Decoders/Demultiplexers		238	✔	✔										✔	✔						
3-to-8 Line Inverting Decoders/Demultiplexers		138	✔	✔	✔	✔	✔	✔				✔	✔	✔	✔	✔	✔	✔	✔	✔	
	CP	11138	✔																		
3-to-8 Line Decoders/Demultiplexers with Address Latches		137					✔							✔	✔						
		237												✔	✔						
4-Bit Latch/4 to 16 Line		4514									✔			✔	✔						
		4515									✔			✔	✔						
4-to-16 Line Decoders/Demultiplexers		154												✔	✔						✔
	OC	159																			✔
BCD-to-Decimal or Binary-to-Octal Decoders/Drivers		4028									✔										
BCD-to-Decimal Decoders/Drivers	OC	45																			✔
		145														✔					✔
BCD to 7-Segment Decoders/Drivers	OC	47														✔					✔
		247														✔					
BCD to 7-Segment Latches/Decoders/Drivers		4511									✔			✔	✔						
BCD to 7-Segment LCD Decoders/Drivers with Display-Frequency Outputs		4055									✔										
BCD to 7-Segment LCD Decoders/Drivers with Strobed Latch Function		4056									✔										

Decoders/Demultiplexers (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY																	
			AC	ACT	AHC	AHCT	ALS	AS	AUC	BCT	CD4K	F	FCT	HC	HCT	LS	LV-A	LV-AT	LVC	S	TTL
BCD to 7-Segment Latches/Decoders/Drivers for LCDs		4543									✔			✔	✔						
BCD to 10-Line Decimal		42												✔	✔	✔					

Priority Encoders

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY			
			CD4K	HC	HCT	LS
8 to 3 Line		148		✔		✔
	3S	348				✔
		4532	✔			
10 to 4 Line		147		✔	✔	
10 to 4 Line BCD		40147	✔			

Address, Identity, and Magnitude Comparators

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY							
			ALS	AS	CD4K	F	HC	HCT	LS	S
4 Bit Magnitude		4063			✔					
		4585			✔					
		85					✔	✔	✔	✔
8 Bit Identity (P = Q) with Enable and 20-Ω Pullup Resistors on Q Inputs	OC	518	✔							
8 Bit Identity ($\overline{P = Q}$) with Enable and 20-Ω Pullup Resistors on Q Inputs		520	✔							
8 Bit Identity ($\overline{P = Q}$) with Enable		521	✔			✔				
		688	✔							
8 Bit Magnitude (P > Q, P < Q) with Latched Inputs and Logical or Arithmetic Comparison		885		✔						
8 Bit Magnitude ($\overline{P = Q}$, $\overline{P > Q}$) and 100K-Ω Pullup Resistors on Q Inputs		682					✔			
8 Bit Magnitude ($\overline{P = Q}$, $\overline{P > Q}$) and 20K-Ω Pullup Resistors on Q Inputs		682							✔	
8 Bit Magnitude ($\overline{P = Q}$, $\overline{P > Q}$)		684					✔			
8 Bit Magnitude ($\overline{P = Q}$, $\overline{P > Q}$) with Enable		684							✔	
8 Bit Magnitude (P = Q) with Enable		688					✔	✔		
8 Bit Magnitude/Identity ($\overline{P = Q}$) with Enable		688							✔	
12 Bit Address with Output Enable		679	✔							

Analog Switches and Multiplexers

DESCRIPTION	TYPE	TECHNOLOGY						
		AHC	AUC	CD4K	HC	HCT	LV-A	LVC
Single Switches	1G66		✔					✔
Dual Switches	2G66		✔					✔
Dual 4-Channel Multiplexers/Demultiplexers	4052				✔	✔	✔	
Dual 4-Channel Multiplexers/Demultiplexers with Injection-Current Effect Control	4852				✔			
Dual 4-Channel Multiplexers/Demultiplexers with Latches	4352				✔			
Dual 4-Channel Multiplexers/Demultiplexers with Logic-Level Conversion	4052			✔				
Triple 2-Channel Multiplexers/Demultiplexers	4053				✔	✔	✔	
Triple 2-Channel Multiplexers/Demultiplexers with Logic-Level Conversion	4053			✔				
Quadruple Switches	4066	✔		✔	✔		✔	
Quadruple Switches with Level Translation	4316				✔	✔		
8-Channel Multiplexers/Demultiplexers	4051				✔	✔	✔	
	4097			✔				
8-Channel Multiplexers/Demultiplexers with Injection-Current Effect Control	4851				✔			
8-Channel Multiplexers/Demultiplexers with Latches	4651				✔	✔		
8-Channel Analog Multiplexers/Demultiplexers with Latches	4351				✔	✔		
8-Channel Multiplexers/Demultiplexers with Logic-Level Conversion	4051			✔				
16-Channel Multiplexers/Demultiplexers	4067			✔	✔	✔		
SPDT Switches	1G3157							✔
SPDT Switches or 2:1 Multiplexers/Demultiplexers	2G53		✔					✔

Digital Bus Exchange/Multiplexing Switches

DESCRIPTION	TYPE	TECHNOLOGY				
		CB3Q	CB3T	CBT	CBT-C	CBTLV
1-of-8 FET Multiplexers/Demultiplexers	3251	✔		✔		✔
Dual 1-of-4 FET Multiplexers/Demultiplexers	3253	✔	✔	✔	✔	✔
4-Bit 1-of-2 FET Multiplexers/Demultiplexers	3257	✔	✔	✔	✔	✔
10-Bit FET Bus-Exchange Switches	3383		✔	✔	✔	✔
12-Bit 1-of-2 FET Multiplexers/Demultiplexers with Internal Pulldown Resistors	16292			✔		✔
	162292			✔		
12-Bit 1-of-2 FET Multiplexers/Demultiplexers with Internal Pulldown Resistors and Series Damping Resistors	16292					✔
12-Bit 1-of-3 FET Multiplexers/Demultiplexers	16214			✔	✔	
Synchronous 16-Bit 1-of-2 FET Multiplexers/Demultiplexers	16232			✔		
16-Bit 1-of-2 FET Multiplexers/Demultiplexers	16233			✔		
16-Bit to 32-Bit FET Multiplexer/Demultiplexer Bus Switches	16390			✔		
18-Bit FET Bus-Exchange Switches	16209			✔		
24-Bit FET Bus-Exchange Switches	16212		✔	✔	✔	✔
	16213			✔		
24-Bit FET Bus-Exchange Switches with Schottky Diode Clamping	16212			✔		

Digital Bus Switches

DESCRIPTION	TYPE	TECHNOLOGY							
		CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	HC	HCT
Single FET	1G125			✔		✔			
	1G384			✔					
Single FET with Level Shifting	1G125		✔	✔					
	1G384			✔					
Dual FET	3305	✔			✔				
	3306	✔	✔	✔	✔				
Dual FET with Level Shifting	3305				✔				
	3306			✔	✔				
Dual FET with Schottky Diode Clamping	3306			✔					
Quad Bilateral	4016						✔	✔	
Quad FET	3125	✔	✔	✔	✔	✔			
	3126			✔		✔			
Octal FET	3244	✔		✔	✔				
	3245	✔	✔	✔	✔	✔			
	3345	✔		✔	✔				
Octal 5 V with Precharged Outputs and Undershoot Protection	6845				✔				
10 Bit FET	3384	✔	✔	✔	✔	✔			
	3861			✔		✔			
10 Bit FET with Internal Pulldown Resistors	3857					✔			
10 Bit FET with Level Shifting	3384				✔				
	3861			✔					
10 Bit FET with Precharged Outputs and Diode Clamping	6800			✔					
10 Bit FET with Precharged Outputs and Active Clamp Undershoot Protection	6800	✔		✔	✔				
10 Bit FET with Precharged Outputs for Live Insertion	6800			✔					
10 Bit FET with Schottky Diode Clamping	3384	✔		✔					
16 Bit FET	16244	✔		✔	✔				
	16245	✔		✔	✔				
16 Bit FET with Active Clamp Undershoot Protection	16245			✔					
20 Bit FET	16210	✔	✔	✔	✔	✔			
	16861			✔					
20 Bit FET with Active Clamp Undershoot Protection	16861			✔					

Digital Bus Switches (continued)

DESCRIPTION	TYPE	TECHNOLOGY							
		CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	HC	HCT
20 Bit FET with Level Shifting	16210			✔					
20 Bit FET with Precharged Outputs	16800				✔	✔			
24 Bit FET	16211	✔	✔	✔	✔	✔			
24 Bit FET with Bus Hold	16211			✔					
24 Bit FET with Level Shifting	16211			✔					
24 Bit FET with Precharged Outputs	16811	✔			✔				
24 Bit FET with Schottky Diode Clamping	16211			✔					
32 Bit FET	34X245			✔					
	32245			✔					
32 Bit FET with Active Clamp Undershoot Protection	32245	✔		✔					

SPECIALTY LOGIC

Backplane Logic

DESCRIPTION	TYPE	TECHNOLOGY				
		ABTE	FB	GTL	GTLP	VME
1:6/1:2 GTLP-to-LVTTL Fanout Drivers	817				✔	
Dual 1-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceivers with Split LVTTL Port, Feedback Path, and Selectable Polarity	1395				✔	
	21395				✔	
2-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceivers with Selectable Polarity	1394				✔	
7-Bit TTL/BTL Transceivers (IEEE Std 1194.1)	2041		✔			
8-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Registered Transceivers with Split LVTTL Port and Feedback Path	22033				✔	
	2034				✔	
	22034				✔	
8-Bit LVTTL-to-GTLP Bus Transceivers with Bus Hold	306				✔	
8-Bit TTL/BTL Registered Transceivers (IEEE Std 1194.1)	2033		✔		✔	
8-Bit TTL/BTL Transceivers (IEEE Std 1194.1)	2040		✔			

Backplane Logic (continued)

DESCRIPTION	TYPE	TECHNOLOGY				
		ABTE	FB	GTL	GTLP	VME
8-Bit Universal Bus Transceivers and Two 1-Bit Bus Transceivers with 3-State Outputs	22501					✔
9-Bit TTL/BTL Address/Data Transceivers (IEEE Std 1194.1)	2031		✔			
11-Bit Incident Wave Switching Bus Transceivers with 3-State and Open-Collector Outputs	16246	✔				
16-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceivers with Bus Hold	1645				✔	
16 Bit LVTTL-to-GTL/GTL+ Universal Bus Transceivers with Live Insertion	1655			✔		
16 Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceivers with Bus Hold	1655				✔	
16-Bit Incident Wave Switching Bus Transceivers with 3-State Outputs	16245	✔				
16-Bit LVTTL-to-GTLP Bus Transceivers with Bus Hold	16945				✔	
17-Bit LVTTL-to-GTL/GTL+ Universal Bus Transceivers with Buffered Clock Outputs	16616			✔		
17-Bit LVTTL-to-GTLP Universal Bus Transceivers with Buffered Clock and Bus Hold	16916				✔	
17-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceivers with Buffered Clock and Bus Hold	1616				✔	
17-Bit TTL/BTL Universal Storage Transceivers with Buffered Clock Lines (IEEE Std 1194.1)	1651		✔			
17-Bit LVTTL/BTL Universal Storage Transceivers with Buffered Clock Lines (IEEE Std 1194.1)	1653		✔			
18-Bit TTL/BTL Universal Storage Transceivers (IEEE Std 1194.1)	1650		✔			
18-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceivers with Bus Hold	1612				✔	
18-Bit LVTTL-to-GTL/GTL+ Universal Bus Transceivers	16612			✔		
18-Bit LVTTL-to-GTLP Universal Bus Transceivers with Bus Hold	16612				✔	
	16912				✔	
18-Bit LVTTL-to-GTL/GTL+ Bus Transceivers	16622			✔		
	16923			✔		
18-Bit LVTTL-to-GTLP Bus Transceivers with Source-Synchronous Clock Outputs and Bus Hold	1627				✔	
	16927				✔	
32-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceivers with Bus Hold	3245				✔	
32-Bit LVTTL-to-GTLP Bus Transceivers with Bus Hold	32945				✔	
34-Bit LVTTL-to-GTLP Universal Bus Transceivers with Bus Hold	32916				✔	
36-Bit LVTTL-to-GTLP Universal Bus Transceivers with Bus Hold	32912				✔	

Boundary-Scan (JTAG) Bus Devices

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			ABT	BCT	LVT
Scan-Test Devices with Octal Buffers	3S	8240		✔	
		8244		✔	
Scan-Test Devices with Octal Bus Transceivers and Registers	3S	8646	✔		
		8652	✔		
Scan-Test Devices with Octal D-Type Latches	3S	8373		✔	
Scan-Test Devices with Octal D-Type Edge-Triggered Flip-Flops	3S	8374		✔	
Scan-Test Devices with Octal Registered Bus Transceivers		8543	✔		
		8952	✔		
Scan-Test Devices with Octal Transceivers	3S	8245	✔	✔	
Scan-Test Devices with 18-Bit Bus Transceivers		18245	✔		
Scan-Test Devices with 18-Bit Inverting Bus Transceivers		18640	✔		
Scan-Test Devices with 18-Bit Transceivers and Registers	3S	18646	✔		✔
		182646	✔		✔
		18652	✔		✔
		182652	✔		✔
Scan-Test Devices with 18-Bit Universal Bus Transceivers	3S	18502	✔		✔
		182502	✔		✔
		18511			✔
		18512			✔
		182512			✔
Scan-Test Devices with 20-Bit Universal Bus Transceivers	3S	18504	✔		✔
		182504	✔		✔
		18514			✔

Boundary-Scan (JTAG) Support Devices

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			ABT	ACT	LVT
Embedded Test-Bus Controllers with 8-Bit Generic Host Interfaces	3S	8980			✔
Test-Bus Controllers IEEE Std 1149.1 (JTAG) TAP Masters with 16-Bit Generic Host Interfaces	3S	8990		✔	
10-Bit Addressable Scan Ports Multidrop-Addressable IEEE Std 1149.1 (JTAG) TAP Transceivers		8996	✔		✔
10-Bit Linking Addressable IEEE Std 1149.1 (JTAG) TAP Transceivers	3S	8986			✔
Scan-Path Linkers with 4-Bit Identification Buses Scan-Controlled IEEE Std 1149.1 (JTAG) TAP Concatenators	3S	8997		✔	

Bus-Termination Arrays and Networks

DESCRIPTION	TYPE	TECHNOLOGY			
		ACT	CD4K	F	S
Dual 4-Bit Programmable Terminators	40117		✔		
8-Bit Schottky Barrier Diode Bus-Termination Arrays	1056			✔	
10-Bit Bus-Termination Networks with Bus Hold	1071	✔			
12-Bit Schottky Barrier Diode Bus-Termination Arrays	1050				✔
	1051				✔
16-Bit Bus-Termination Networks with Bus Hold	1073	✔			
16-Bit Schottky Barrier Diode Bus-Termination Arrays	1052				✔
	1053				✔
16-Bit Schottky Barrier Diode R-C Bus-Termination Arrays	1016			✔	

DIMM Memory Drivers and Transceivers

DESCRIPTION	TYPE	TECHNOLOGY
		HSTL
9-Bit to 18-Bit HSTL-to-LVTTL Memory Address Latches	16918	✔
9-Bit to 18-Bit HSTL-to-LVTTL Memory Address Latches with Input Pullup Resistors	16919	✔
14-Bit to 28-Bit HSTL-to-LVTTL Memory Address Latches	162822	✔

FIFOs (FIRST-IN, FIRST-OUT MEMORIES)

Asynchronous FIFO Memories

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY							
			ABT	ACT	ALS	ALVC	CD4K	HC	HCT	S
16 × 4	3S	232			✔					
		40105					✔	✔	✔	
16 × 5	3S	225								✔
		229			✔					
64 × 4	3S	236			✔					
64 × 18	3S	7814		✔						
64 × 18 3.3 V	3S	7814				✔				
256 × 18	3S	7806		✔						
256 × 18 3.3 V	3S	7806				✔				
512 × 18	3S	7804		✔						
512 × 18 3.3 V	3S	7804				✔				
512 × 18 × 2 Bidirectional	3S	7820	✔							
1024 × 9 × 2 Bidirectional	3S	2235		✔						
1024 × 18	3S	7802		✔						
2048 × 9	3S	7808		✔						

Synchronous FIFO Memories

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY			
			ABT	ACT	ALVC	V
64 × 1 × 2 Independent	3S	2226		✔		
		2227		✔		
64 × 18	3S	7813		✔		
64 × 18 3.3 V	3S	7813			✔	
64 × 36 × 2 Bidirectional	3S	3612	✔			
		3614	✔			
256 × 1 × 2 Independent	3S	2228		✔		
		2229		✔		
256 × 18	3S	7805		✔		

Synchronous FIFO Memories (continued)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY			
			ABT	ACT	ALVC	V
256 × 18 3.3 V	3S	7805			✔	
256 × 36 × 2 Bidirectional	3S	3622		✔		
512 × 18	3S	7803		✔		
512 × 18 3.3 V	3S	215				✔
		7803			✔	
512 × 18 × 2 Bidirectional	3S	7819	✔			
512 × 36	3S	3631		✔		
512 × 36 × 2 Bidirectional	3S	3632		✔		
1024 × 18	3S	7801		✔		
		7811		✔		
		7881		✔		
1024 × 18 3.3 V	3S	225				✔
1024 × 36	3S	3641		✔		
1024 × 36 3.3 V	3S	3640				✔
2048 × 9	3S	7807		✔		
2048 × 18	3S	7882		✔		
2048 × 18 3.3 V	3S	235				✔
2048 × 36	3S	3651		✔		
2048 × 36 3.3 V	3S	3650				✔
		3651			✔	
4096 × 18 3.3 V	3S	245				✔
4096 × 36 3.3 V	3S	3660				✔
8192 × 18 or 16384 × 9 3.3 V	3S	263				✔
8192 × 36 3.3 V	3S	3670				✔
16384 × 18 or 32768 × 9 3.3 V	3S	273				✔
16384 × 36 3.3 V	3S	3680				✔
32768 × 18 or 65536 × 9 3.3 V	3S	283				✔
32768 × 36 3.3 V	3S	3690				✔
65536 × 18 or 131072 × 9 3.3 V	3S	293				✔

IEEE Std 1284 (Parallel Port Interface)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			ACT	LV	LVC
7-Bit Bus Interfaces	3S	1284	✔		
19-Bit Bus Interfaces	OD/TP	161284		✔	✔
19-Bit Translation Transceivers with Error-Free Power Up	OD/TP	E161284			✔
	OD/TP	Z161284			✔

Miscellaneous Gate and Delay Elements

DESCRIPTION	TYPE	TECHNOLOGY	
		CD4K	LS
Hex Delay Elements for Generating Delay Lines	31		✔
Dual Complementary Pairs Plus Inverters	4007	✔	
Hex Gates (Four Inverters, One 2-Input NOR, One 2-Input NAND)	4572	✔	

Monostable Multivibrators

DESCRIPTION	TYPE	TECHNOLOGY								
		AHC	AHCT	CD4K	HC	HCT	LS	LV-A	LVC	TTL
Low Power Monostable/Astable	4047			✔						
Monostable Multivibrators with Schmitt-Trigger Inputs	121									✔
Retriggerable	122						✔			
Single Retriggerable with Schmitt-Trigger Inputs	1G123								✔	
Dual	4098			✔						
Dual with Schmitt-Trigger Inputs	221				✔	✔	✔	✔		✔
Dual Precision	14538			✔						
Dual Retriggerable with Reset	123	✔	✔		✔	✔	✔	✔		✔
	423				✔	✔	✔			
Dual Retriggerable Precision	4538				✔	✔				

PHASE-LOCKED LOOPS (PLLs) AND OSCILLATORS

PLLs

DESCRIPTION	TYPE	TECHNOLOGY					
		ACT	CD4K	HC	HCT	LS	LV-A
Digital PLLs	297	✔		✔	✔	✔	
PLLs with VCO	4046		✔	✔	✔		✔
PLLs with VCO and Lock Detectors	7046			✔	✔		

Oscillators

DESCRIPTION	TYPE	TECHNOLOGY	
		LS	S
Single Voltage Controlled	624	✔	
	628	✔	
Dual Voltage Controlled	124		✔
	629	✔	

Rate Multipliers and Frequency Dividers/Timers

DESCRIPTION	TYPE	TECHNOLOGY		
		CD4K	LS	TTL
4-Bit Binary Rate Multipliers	4089	✔		
BCD Rate Multipliers	4527	✔		
Synchronous 6-Bit Binary Rate Multipliers	97			✔
24-Stage Frequency Dividers	4521	✔		
Programmable Frequency Dividers/Digital Timers	292		✔	
	294		✔	
Programmable Timers	4536	✔		
	4541	✔		

Universal Bus Drivers (UBDs)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			ALVC	AVC	LVT
12 Bit with Parity Checker and Dual 3-State Outputs	3S	16903	✔		
16 Bit	3S	16334	✔	✔	
		162334	✔		
18 Bit	3S	16834	✔	✔	
		162834	✔		
		16835	✔	✔	✔
		162835	✔		
20 Bit	3S	162836	✔		

Universal Bus Exchangers (UBEs)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY		
			ABT	ALVC	AVC
9 Bit 4 Port	3S	16409		✔	
		162409		✔	
12 Bit to 24 Bit Multiplexed	3S	16271		✔	
12 Bit to 24 Bit Registered	3S	16269		✔	✔
		16270		✔	
		162268		✔	
16 Bit to 32 Bit with Byte Masks	3S	162280		✔	
16 Bit Tri-Port	3S	32316	✔		
18 Bit to 36 Bit Registered	3S	16282		✔	
		162282		✔	
18 Bit Tri-Port	3S	32318	✔		

UNIVERSAL BUS FUNCTIONS

Universal Bus Transceivers (UBTs)

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY								
			ABT	ALVC	ALVT	FCT	GTL	GTLP	LVC	LVT	VME
8 Bit and Two 1-Bit Split Outputs with Feedback Path	3S	22501									✔
16 Bit LVTTL to GTL/GTL+ with Live Insertion		1655					✔				
16 Bit LVTTL to GTLP Adjustable Edge Rate	3S	1655						✔			
17 Bit LVTTL to GTLP Adjustable Edge Rate with Buffered Clock Outputs and Bus Hold	3S	1616						✔			
17 Bit LVTTL to GTL/GTL+		16616					✔				
17 Bit LVTTL to GTLP with Buffered Clock	3S	16916						✔			
18 Bit	3S	16500	✔	✔		✔				✔	
		162500	✔			✔					
		16501	✔	✔		✔				✔	
		162501	✔			✔					
		16600	✔	✔							
		16601	✔	✔	✔						
		162601	✔	✔							
18 Bit with Boundary Scan	3S	18511								✔	
18 Bit with Parity Generators/Checkers	3S	16901		✔					✔		
18 Bit LVTTL to GTL/GTL+		16612					✔				
18 Bit LVTTL to GTLP with Bus Hold	3S	16612						✔			
		16912						✔			
18 Bit LVTTL to GTLP Adjustable Edge Rate with Bus Hold	3S	1612						✔			
32 Bit	3S	32501	✔	✔							

Application Specific [CompactFlash™, SD Cards, MultiMediaCards (MMCs), I²C]

DESCRIPTION	TYPE	TECHNOLOGY	
		AVC	LV-A
Voltage-Translation Transceivers for MMCs, SD Cards, Memory Stick™ Compliant Products, SmartMedia Cards, and xD-Picture Cards™	A406	✔	
Voltage-Translation Transceivers for MMCs, SD Cards, and Memory Stick™ Compliant Products	A406L	✔	
Low-Power, Dual-Supply, Level-Translating CompactFlash Interfaces with 16-Bit Data, 11-Bit Address	4320		✔

Dual-Supply Translators

DESCRIPTION		TYPE	TECHNOLOGY			
			ALVC	AVC	CD4K	LVC
Single Bus Transceivers	Translate Between 1.2 V to 3.6 V	1T45		✔		
	Translate Between 1.65 V to 5.5 V	1T45				✔
Dual Bus Transceivers	Translate Between 1.2 V to 3.6 V	2T45		✔		
	Translate Between 1.65 V to 5.5 V	2T45				✔
Quad Low-to-High Voltage Level Shifters		40109			✔	
Hex Voltage Level Shifters for TTL-to-CMOS or CMOS-to-TTL Operation		4504			✔	
Octal Bus Transceivers	Translate Between 1.4 V to 3.6 V	8T245		✔		
	Translate Between 1.65 V to 5.5 V	8T245				✔
	Translate Between 2.3 V to 3.6 V and 3 V to 5.5 V	C3245				✔
	Translate Between 2.7 V to 3.6 V and 4.5 V to 5.5 V	4245				✔
	Translate Between 2.7 V to 5.5 V and 4.5 V to 5.5 V	C4245				✔
16-Bit Bus Transceivers	Translate Between 1.4 V to 3.6 V	A164245		✔		
		B164245		✔		
	Translate Between 1.4 V to 3.6 V and 1.2 V to 3.6 V	16T245		✔		
	Translate Between 1.65 V to 5.5 V	1GT245				✔
	Translate Between 2.5 V to 3.3 V and 3.5 V to 5 V	164245	✔			
20-Bit Bus Transceivers Translate Between 1.4 V to 3.6 V and 1.2 V to 3.6 V		20T245		✔		
24-Bit Bus Transceivers Translate Between 1.4 V to 3.6 V and 1.2 V to 3.6 V		24T245		✔		
32-Bit Bus Transceivers	Translate Between 1.4 V to 3.6 V	B324245		✔		
	Translate Between 1.4 V to 3.6 V and 1.2 V to 3.6 V	32T245		✔		

VOLTAGE-LEVEL TRANSLATION

ECL/TTL Translators

DESCRIPTION	OUTPUT	TYPE	TECHNOLOGY
			ECL
Octal	3S	10KHT5541	✔
Octal with Edge-Triggered D-Type Flip-Flops	3S	10KHT5574	✔
Octal TTL-to-ECL with Edge-Triggered D-Type Flip-Flops and Output Enable		10KHT5578	✔
Octal TTL-to-ECL with Output Enable		10KHT5542	✔
		10KHT5543	✔

GTL/TTL Translators

DESCRIPTION	TYPE	TECHNOLOGY
		GTL
10-Bit Voltage Clamp	2010	✔
12-Bit GTL–/GTL/GTL+ to LVTTL	2007	✔
	2107	✔
13-Bit GTL–/GTL/GTL+ to LVTTL	2006	✔

Single-Supply Translators

DESCRIPTION	TYPE	TECHNOLOGY
		AUP
Voltage Translators	1T57	✔
	1T58	✔
	1T97	✔
	1T98	✔

Translating Bus Switches

DESCRIPTION	TYPE	TECHNOLOGY			
		CB3T	CBT	CBTC	TVC
Single FET 2.5-V/3.3-V Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	1G125	✔			
Single FET Bus Switches with Level Shifting	D1G125		✔		
	D1G384		✔		
Dual FET Bus Switches with Level Shifting	D3306		✔		
Dual FET Bus Switches with Level Shifting and –2-V Undershoot Protection	D3305			✔	
	D3306			✔	
Dual Bus Switch Voltage Translators	3306	✔			
Dual 1-of-4 FET Multiplexers/Demultiplexers 2.5-V/3.3-V Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	3253	✔			
Dual Voltage Clamps	3306				✔
4-Bit 1-of-2 FET Multiplexing/Demultiplexing Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	3257	✔			
Quad FET Bus Switches with 5-V-Tolerant Level Shifters	3125	✔			
8-Bit FET Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	3245	✔			
10-Bit FET Bus Switches with Level Shifting	D3384		✔		
	D3861		✔		
10-Bit FET Bus Switches with Level Shifting and –2-V Undershoot Protection	D3384			✔	
10-Bit FET 2.5-V/3.3-V Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	3384	✔			
10-Bit Voltage Clamps	3010				✔
20-Bit FET Bus Switches with Level Shifting	D16210		✔		
20-Bit FET 2.5-V/3.3-V Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	16210	✔			
22-Bit Voltage Clamps	16222				✔
24-Bit FET Bus Switches with Level Shifting	D16211		✔		
24-Bit FET 2.5-V/3.3-V Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	16211	✔			
24-Bit FET Bus-Exchange Low-Voltage Bus Switches with 5-V-Tolerant Level Shifters	16212	✔			

4

FUNCTIONAL CROSS-REFERENCE

✔ Product available in technology indicated ✛ New product planned in technology indicated

DEVICE	BiCMOS						BIPOLAR						CMOS																				OTHER									
	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
1G00															✔	✔		✔	✔													✔										
1G02															✔	✔		✔	✔													✔										
1G04															✔	✔		✔	✔													✔										
1GU04															✔			✔	✔													✔										
1GX04																																✔										
1G06																		✔	✔													✔										
1G07																		✔	✔													✔										
1G08															✔	✔		✔	✔													✔										
1G0832																																✔										
1G10																																✔										
1G11																																✔										
1G14															✔	✔		✔	✔													✔										
1G17																		✔	✔													✔										
1G18																																✔										
1G19																		✔														✔										
1G27																																✔										
1G29																																✔										
1G32															✔	✔		✔	✔													✔										
1G34																																✔										
1G38																																✔										
1G57																			✔													✔										
1G58																			✔													✔										
1G66																		✔														✔										
1G74																		✔																								
1G79																		✔	✔													✔										
1G80																		✔	✔													✔										
1G86															✔	✔		✔														✔										
1G97																			✔													✔										

DEVICE	BiCMOS						BIPOLAR						CMOS																						OTHER										
	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
1G98																			✔												✔												
1G99																			✔												✔												
1G123																															✔												
1G125															✔	✔		✔	✔			✔	✔		✔						✔												
1G126															✔	✔		✔	✔												✔												
1G139																															✔												
1G240																		✔													✔												
1G244																		✔																									
1G245																		✔																									
1G332																															✔												
1G373																															✔												
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	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
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138							✔	✔	✔	✔	✔		✔	✔	✔	✔												✔	✔	✔	✔	✔												
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241	✔			✔		✔	✔	✔	✔	✔	✔		✔	✔														✔	✔														
243							✔			✔																		✔	✔														
244	✔			✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔									✔	✔	✔	✔	✔											
245	✔			✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔		✔							✔	✔	✔	✔	✔				✔							
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258							✔	✔	✔	✔				✔														✔	✔														
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	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
18504																																							✔			
18511						✔																																					
18512																																							✔			
18514																																							✔			
18640																																							✔			
18646																																							✔			
18652																																							✔			
21395																																					✔						
22033																																					✔						
22034																																					✔						
22501																																										✔
25244				✔	✔																																				
25245	✔			✔	✔																																				
25642				✔																																					
29821				✔			✔																																		
29823							✔																																		
29825				✔																																					
29827				✔			✔																																		
29828							✔																																		
29833							✔																																		
29843				✔																																					
29854							✔																																		
29863				✔			✔																																		
29864				✔																																					
32240						✔																																			
32244			✔			✔											✔	✔													✔											
32245	✔					✔											✔	✔			✔		✔								✔											
32316	✔																																								
32318	✔																																								

DEVICE	BiCMOS						BIPOLAR						CMOS																								OTHER											
	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
32373			✔			✔																									✔													
32374			✔			✔											✔	✔													✔													
32501	✔																✔																										
32543	✔																																										
32852																																											✔
32867																																											✔
32877																																											✔
32912																																				✔							
32916																																				✔							
32945																																				✔							
32973																	✔																										
40102																										✔																
40103																										✔		✔	✔														
40105																																			✔								
40106																										✔																
40107																										✔																
40109																										✔																
40110																										✔																
40117																										✔																
40147																										✔																
40161																										✔																
40174																										✔																
40175																										✔																
40192																										✔																
40193																										✔																
40194																										✔																
40257																										✔																
161284																														✔	✔												
162240						✔																					✔																

DEVICE	BiCMOS						BIPOLAR						CMOS																								OTHER										
	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
162241						✔																																							
162244	✔		✔			✔											✔										✔				✔													
162245	✔		✔			✔											✔										✔				✔													
162260	✔																✔																											
162268																	✔																											
162280																	✔																											
162282																	✔																											
162334																	✔																											
162344																	✔																											
162373						✔											✔										✔																	
162374						✔											✔										✔																	
162409																	✔																											
162460	✔																																										
162500	✔																										✔																
162501	✔																										✔																
162525																	✔																											
162541						✔																																					
162543																											✔																
162601	✔																✔																											
162646																											✔																
162652																											✔																
162721																	✔																											
162820																	✔																											
162822																																						✔						
162823	✔																										✔																
162825	✔																																										
162827	✔		✔														✔										✔																
162830																	✔																											
162831																	✔																											

DEVICE	BiCMOS						BIPOLAR						CMOS																								OTHER									
	ABT	ALB	ALVT	BCT	64BCT	LVT	ALS	AS	F	LS	S	TTL	AC	ACT	AHC	AHCT	ALVC	AUC	AUP	AVC	CB3Q	CB3T	CBT	CBT-C	CBTLV	CD4K	FCT	HC	HCT	LV/LV-A/LV-AT	LVC	TVC	ABTE	FB	FIFO	GTL	GTLP	HSTL	JTAG	PCA	PCF	VME
162832																	✔																											
162834																	✔																											
162835																	✔																											
162836																	✔																											
162841	✔																✔										✔																
162952																											✔															
164245																	✔			✔																							
182502																																							✔			
182504																																							✔			
182512																																							✔			
182646																																							✔			
182652																																							✔			
322374						✔																																			
324245																				✔																						
34X245																							✔																			

APPENDIX A
PACKAGING AND MARKING INFORMATION

CONTENTS

Everything you want to know about Texas Instruments Lead (Pb)-Free Semiconductor products

Texas Instruments (TI's) Definition of Lead(Pb)-Free

Pb-Free at TI means semiconductor products that are compatible with the current RoHS requirements for all six substances, including the requirement that lead not exceed 0.1% by weight in homogeneous material. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

TI's Key Information Resources

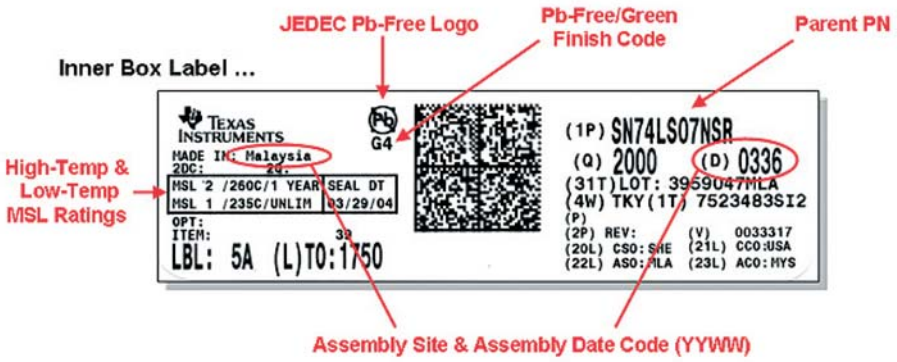
General Information:
www.ti.com/ecoinfo

Substance and Pb-Free schedule search tool:
www.ti.com/productcontent

Frequently Asked Questions:
www.ti.com/leadfree

Alternatively, you can contact your TI sales representative or an authorized TI distributor.

Or visit the worldwide Product Information Center:
support.ti.com



TI's Pb-Free Initiative (RoHS Compatibility)

TI is committed to delivering Pb-Free products (that comply with RoHS).

We follow an aggressive migration roadmap and have already converted the majority of our semiconductor portfolio to Pb-Free solutions.

TI's Proven Pb-Free Solutions

TI began removing lead (Pb) from semiconductor products more than a decade ago.

Nickel-palladium-gold (NiPdAu) is our primary Pb-Free finish for leadframes.

The industry generally recognizes this finish as the proven, reliable (whisker-free) solution of choice.

We offer one of the most comprehensive selections of semiconductor products with NiPdAu finish.

The solder balls in our Pb-Free array packages are based on the industry-standard tin-silver-copper (SnAgCu) process (lead solder ball versions will continue to be available).

DEVICE NAMES AND PACKAGE DESIGNATORS FOR TI LOGIC PRODUCTS

Example:

SN	74	LVC	H	16	2	244	A	DGG	R	E4
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*

1 Standard Prefix

Examples: SN – Standard Prefix
SNJ – Conforms to MIL-PRF-38535 (QML)

2 Temperature Range

Examples: 54 – Military
74 – Commercial

3 Family

Examples: Blank = Transistor-Transistor Logic (TTL)
ABT – Advanced BiCMOS Technology
ABTE/ETL – Advanced BiCMOS Technology/ Enhanced Transceiver Logic
AC/ACT – Advanced CMOS Logic
AHC/AHCT – Advanced High-Speed CMOS Logic
ALB – Advanced Low-Voltage BiCMOS
ALS – Advanced Low-Power Schottky Logic
ALVC – Advanced Low-Voltage CMOS Technology
ALVT – Advanced Low-Voltage BiCMOS Technology
AS – Advanced Schottky Logic
AUC – Advanced Ultra-Low-Voltage CMOS Logic
AUP – Advanced Ultra-Low-Power CMOS Logic
AVC – Advanced Very Low-Voltage CMOS Logic
BCT – BiCMOS Bus-Interface Technology
CB3Q – 2.5-V/3.3-V Low-Voltage High-Bandwidth Bus-Switch Crossbar Technology Logic
CB3T – 2.5-V/3.3-V Low-Voltage Translator Bus-Switch Crossbar Technology Logic
CBT – Crossbar Technology
CBT-C – 5-V Bus-Switch Crossbar Technology Logic With –2-V Undershoot Protection
CBTLV – Low-Voltage Crossbar Technology Logic
CD4000 – CMOS B-Series Integrated Circuits
F – F Logic
FB – Backplane Transceiver Logic/Futurebus+
FCT – Fast CMOS TTL Logic
GTL – Gunning Transceiver Logic
GTLP – Gunning Transceiver Logic Plus
HC/HCT – High-Speed CMOS Logic
HSTL – High-Speed Transceiver Logic
LS – Low-Power Schottky Logic
LV-A – Low-Voltage CMOS Technology
LV-AT – Low-Voltage CMOS Technology – TTL Compatible
LVC – Low-Voltage CMOS Technology
LVT – Low-Voltage BiCMOS Technology
PCA/PCF – I^2C Inter-Integrated Circuit Applications
S – Schottky Logic
SSTL – Stub Series-Terminated Logic
SSTU – Stub Series-Terminated Ultra-Low-Voltage Logic
SSTV/SSTVF – Stub Series-Terminated Low-Voltage Logic
TVC – Translation Voltage Clamp Logic
VME – VERSAmodule Eurocard Bus Technology

4 Special Features

Examples: Blank = No Special Features
C – Configurable V_{CC} (LVCC)
D – Level-Shifting Diode (CBTD)
H – Bus Hold (ALVCH)
K – Undershoot-Protection Circuitry (CBTK)
R – Damping Resistor on Both Output Ports (LVCR)
S – Schottky Clamping Diode (CBTS)
Z – Power-Up 3-State (LVCZ)

† DSBGA is the JEDEC reference for wafer chip scale package (WCSP).

5 Bit Width

Examples: Blank = Gates, MSI, and Octals
1G – Single Gate
2G – Dual Gate
3G – Triple Gate
8 – Octal IEEE 1149.1 (JTAG)
16 – Widebus™ (16, 18, and 20 bit)
18 – Widebus IEEE 1149.1 (JTAG)
32 – Widebus+™ (32 and 36 bit)

6 Options

Examples: Blank = No Options
2 – Series Damping Resistor on One Output Port
4 – Level Shifter
25 – 25-Ω Line Driver

7 Function

Examples: 244 – Noninverting Buffer/Driver
374 – D-Type Flip-Flop
573 – D-Type Transparent Latch
640 – Inverting Transceiver

8 Device Revision

Examples: Blank = No Revision
Letter Designator A–Z

9 Packages

Commercial: D, DW – Small-Outline Integrated Circuit (SOIC)
DB, DBQ, DCT, DL – Shrink Small-Outline Package (SSOP)
DBB, DGV – Thin Very Small-Outline Package (TVSOP)
DBQ – Quarter-Size Small-Outline Package (QSOP)
DBV, DCK, DCY, PK – Small-Outline Transistor (SOT)
DCU – Very Thin Shrink Small-Outline Package (VSSOP)
DGG, PW – Thin Shrink Small-Outline Package (TSSOP)
FN – Plastic Leaded Chip Carrier (PLCC)
GGM, GKE, GKF, ZKE, ZKF – MicroStar BGA™ Low-Profile Fine-Pitch Ball Grid Array (LFBGA)
GQL, GQN, ZQL, ZQN – MicroStar Jr.™ Very-Thin-Profile Fine-Pitch Ball Grid Array (VFBGA)
N, NT, P – Plastic Dual-In-Line Package (PDIP)
NS, PS – Small-Outline Package (SOP)
PAG, PAH, PCA, PCB, PM, PN, PZ – Thin Quad Flatpack (TQFP)
PH, PQ, RC – Quad Flatpack (QFP)
PZA – Low-Profile Quad Flatpack (LQFP)
RGQ, RGY – Quad Flatpack No Lead (QFN)
YEA, YEP, YZA, YZP – NanoStar™ and NanoFree™ Die-Size Ball Grid Array (DSBGA†)

Military: FK – Leadless Ceramic Chip Carrier (LCCC)
GB – Ceramic Pin Grid Array (CPGA)
HFP, HS, HT, HV – Ceramic Quad Flatpack (CQFP)
J, JT – Ceramic Dual-In-Line Package (CDIP)
W, WA, WD – Ceramic Flatpack (CFP)

10 Tape and Reel

Devices in the DB and PW package types include the R designation for reeled product. Existing product inventory designated LE may remain, but all products are being converted to the R designation.

Examples: Old Nomenclature – SN74LVTxxxDBLE
New Nomenclature – SN74LVTxxxADBR
R – Standard (valid for all surface-mount packages)
T – Small Quantity Reels (available in Little Logic only)

There is no functional difference between LE and R designated products, with respect to the carrier tape, cover tape, or reels used.

11 RoHS and Green Status

E_ – Conforms to JEDEC JESD97 E-Category specification for Pb-Fee and reduced environmentally unfriendly substances
G_ – Additional reductions in environmentally unfriendly substances (Sb and Br) in addition to E_ reductions

DEVICE NAMES AND PACKAGE DESIGNATORS FOR LOGIC PRODUCTS FORMERLY OFFERED BY CYPRESS SEMICONDUCTOR

CY-FCT Nomenclature

Example:

CY	74	FCT	162	H	245	A	T	PV	C	T	E4
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*

1 Prefix Designation for Acquired Cypress FCT Logic

May be blank to accommodate 18-character limitation

2 Temperature Range

Examples: 54 – Military (–55°C to 125°C)
74 – Commercial/Industrial (–40°C to 85°C)
29 – Commercial/Industrial or Military (see data sheet)

3 Family

Example: FCT – FAST™ CMOS TTL Logic

4 16 or Greater Bit Width With Balanced Drive

Examples: Blank
16x – 16 or Greater Bit Width With Balanced Drive
162 – Balanced Drive (series output resistors)

5 Bus Hold

Examples: Blank = No Bus Hold
H – Bus Hold (present only when preceded by 16x – see item 4)

6 Type Designation

Up to Five Digits
Examples: 245
1652
16245

7 Speed Grade

Examples: Blank = Standard Speed Grade
A
B
C
D

8 TTL or CMOS Outputs

Examples: Blank = CMOS Outputs
T – TTL Outputs

9 Packages

Examples: P – Plastic Dual-In-Line Package (PDIP) (N)
PA – Thin Shrink Small-Outline Package (TSSOP) (DGG/G)
PV – Shrink Small-Outline Package (SSOP) (DL)
Q – Quarter-Size Outline Package (QSOP) (DBQ)
SO – Small-Outline Integrated Circuit (SOIC) (DL)

10 Processing

Example: C – Commercial Processing

11 Tape and Reel

Example: T – Tape-and-Reel Packing

12 RoHS and Green Status

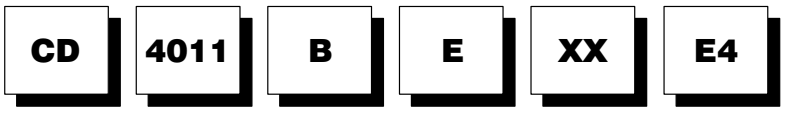
E_ – Conforms to JEDEC JESD97 E-Category specification for Pb-Fee and reduced environmentally unfriendly substances
G_ – Additional reductions in environmentally unfriendly substances (Sb and Br) in addition to E_ reductions

FAST is a trademark of Fairchild Semiconductor.

DEVICE NAMES AND PACKAGE DESIGNATORS FOR LOGIC PRODUCTS FORMERLY OFFERED BY HARRIS SEMICONDUCTOR

CD4000 Nomenclature

Example



1 Prefix Designation for Acquired Harris Digital Logic

2 Type Designation

Up to Five Digits

3 Supply Voltage

Examples: A – 12 V Maximum
B – 18 V Maximum
UB – 18 V Maximum, Unbuffered

4 Packages

Examples: D – Ceramic Side-Brazed Dual-In-Line Package (DIP)
E – Plastic DIP
F – Ceramic DIP
K – Ceramic Flatpack
M – Plastic Surface-Mount Small-Outline Integrated Circuit (SOIC)
SM – Plastic Shrink SOIC (SSOP)
M96 – Reeled Plastic Surface-Mount SOIC
SM96 – Reeled Plastic Shrink SOIC (SSOP)

5 High-Reliability Screening

Military Products Only

Examples: 3 – Noncompliant With MIL-STD-883, Class B
3A – Fully Compliant With MIL-STD-883, Class B

6 RoHS and Green Status

E_ – Conforms to JEDEC JESD97 E-Category specification for Pb-Fee and reduced environmentally unfriendly substances
G_ – Additional reductions in environmentally unfriendly substances (Sb and Br) in addition to E_ reductions

CD-AC/CD-ACT Advanced CMOS and CD-HC/CD-HCT/CD-HCU High-Speed CMOS Nomenclature

Example

1 Prefix Designation for Acquired Harris Digital Logic

2 Temperature Range

Examples: 54 – Military (–55°C to 125°C)
74 – Commercial (0°C to 70°C)

3 Family

Examples: AC – Advanced CMOS Logic, CMOS Input Levels
ACT – Advanced CMOS Logic, TTL Input Levels
HC – High-Speed CMOS Logic, CMOS Input Levels
HCT – High-Speed CMOS Logic, TTL Input Levels
HCU – High-Speed CMOS Logic, CMOS Input Levels, Unbuffered

4 Type Designation

Up to Five Digits

5 Packages

Examples: E – Plastic Dual-In-Line Package (DIP)
EN – Plastic Slim-Line 24-Lead DIP
F – Ceramic DIP
M – Plastic Surface-Mount Small-Outline Integrated Circuit (SOIC)
SM – Plastic Shrink SOIC (SSOP)
M96 – Reeled Plastic Surface-Mount SOIC
SM96 – Reeled Plastic Shrink SOIC (SSOP)

6 High-Reliability Screening

HiRel Products Only

Example: 3A – Fully Compliant With MIL-STD-883

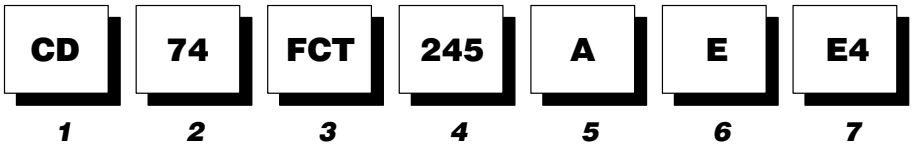
7 RoHS and Green Status

E_ – Conforms to JEDEC JESD97 E-Category specification f Pb-Fee and reduced environmentally unfriendly substances
G_ – Additional reductions in environmentally unfriendly substances (Sb and Br) in addition to E_ reductions

DEVICE NAMES AND PACKAGE DESIGNATORS FOR LOGIC PRODUCTS FORMERLY OFFERED BY HARRIS SEMICONDUCTOR

CD-FCT Nomenclature

Example



1 Prefix Designation for Acquired Harris Digital Logic

2 Temperature Range

Examples: 54 – Military (–55°C to 125°C)
74 – Commercial (0°C to 70°C)

3 Family

Example: FCT – Bus Interface, TTL Input Levels

4 Type Designation

Up to Five Digits

5 Speed Grade

Example: Blank or A – Standard Equivalent to FAST™

6 Packages

Examples: E – Plastic Dual-In-Line Package (DIP)
EN – Plastic Slim-Line 24-Lead DIP
F – Ceramic DIP
M – Plastic Surface-Mount Small-Outline Integrated Circuit (SOIC)
SM – Plastic Shrink SOIC (SSOP)
M96 – Reeled Plastic Surface-Mount SOIC
SM96 – Reeled Plastic Shrink SOIC (SSOP)

7 RoHS and Green Status

E_ – Conforms to JEDEC JESD97 E-Category specification for Pb-Fee and reduced environmentally unfriendly substances
G_ – Additional reductions in environmentally unfriendly substances (Sb and Br) in addition to E_ reductions

FAST is a trademark of Fairchild Semiconductor.

In the past, logic products had the complete device name on the package. It has become necessary to reduce the character count, as package types have become smaller and logic names longer. Information about package symbolization can be found at http://focus.ti.com/general/docs/partmarking/partmarkinghome.jsp.

You may enter either the marking as shown on a device, or the desired part number to see the resulting part marking.

MOISTURE SENSITIVITY BY PACKAGE

Table A-1 lists the moisture sensitivity of TI packages by level. Some packages differ in level by pin count.

Table A-1. Package Moisture Sensitivity by Levels

PACKAGE	LEVEL 1	LEVEL 2	LEVEL 2A	LEVEL 3	LEVEL 4
PLCC	FN (20/28)			FN (44/68)	
SOT	DBV (5) DCK (5)				
SOP		NS (14/16/20)† PS (8)†			
SOIC		D (8/14/16)† DW (16/20/24/28)†			
SSOP	DCT (8) DL (28/48/56)	DB (14/16/20/24/28/30/38)† DBQ (16/20/24)†			
QSOP		DBQ (16/20/24)†			
TSSOP	DGG (48/56/64)† PW (8/14/16/20/24)†				
TVSOP	DBB (80)† DGV (14/16/20/24/48/56)†				
VSSOP	DCU (8)				
QFN		RGY (14/16/20)†			
QFP		RC (52)			
TQFP		PAG (64) PCA (100) PN (80) PZ (100)			PM (64)
MicroStar BGA				GKE (96) GKF (114)	
MicroStar Jr. BGA			GQL (56)		
NanoStar	YEA (5/8)				

† Meets 250°C

NOTES: 1. No current device packages are moisture-sensitivity levels 5 or 6.
2. Some device types in these packages may have different moisture-sensitivity levels than shown.
3. All levels except level 1 are dry packed.

TI's through-hole packages (N, NT) have not been tested per the JESD22-A112A/JESD22-A113A standards. Due to the nature of the through-hole PCB soldering process, the component package is shielded from the solder wave by the PC board and is not subjected to the higher reflow temperatures experienced by surface-mount components.

TI's through-hole component packages are classified as not moisture sensitive.

The information in Table A-2 was derived using the test procedures in JESD22-A112A and JESD22-A113A. The *Floor Life* column lists the time that products can be exposed to the open air while in inventory or on the manufacturing floor. The worst-case environmental conditions are given. The *Soak Requirements* column lists the preconditioning, or soak, conditions used when testing to determine the floor-life exposure time.

Table A-2. Moisture-Sensitivity Levels (JESD22-A112A/JESD22-A113A)

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS	
	CONDITIONS	TIME (hours)	CONDITIONS	TIME (hours)
1	≤ 30°C/90% RH	Unlimited	85°C/85% RH	168
2	≤ 30°C/60% RH	1 year	85°C/60% RH	168
2A	≤ 30°C/60% RH	4 weeks	30°C/60% RH	696
				X + Y = Z†
3	≤ 30°C/60% RH	168	30°C/60% RH	24 + 168 = 192
4	≤ 30°C/60% RH	72	30°C/60% RH	24 + 72 = 96
5	≤ 30°C/60% RH	24	30°C/60% RH	24 + 24 = 48
6	≤ 30°C/60% RH	6	30°C/60% RH	0 + 6 = 6

RH = Relative humidity

† X + Y = Z, where:

X = Default value of time between bake and bag. If the actual time exceeds this value, use the actual time and adjust the soak time (Z). For levels 3–6, X can be standardized at 24 hours as long as the actual time does not exceed this value.

Y = Floor life of package after it is removed from dry-pack bag

Z = Total soak time for the evaluation

For more information, see:

Packaging Material Standards for Moisture-Sensitive Items, EIA Std EIA-583

Symbol and Labels for Moisture-Sensitive Devices, EIA/JEDEC Engineering Publication EIA/JEP113-B, May 1999

Guidelines for the Packing, Handling, and Repacking of Moisture-Sensitive Components, EIA/JEDEC Publication EIA/JEP124, December 1995

Table A-3 is a packaging cross-reference for TI and other semiconductor manufacturing companies. If a specific alternate source agreement exists between TI and a particular company, the cell is shaded.

Table A-3. Logic Package Competitive Cross-Reference

PACKAGE TYPE	NO. PINS	TI	TI-ACQUIRED HARRIS	TI-ACQUIRED CYPRESS	FAIRCHILD	IDT	IDT-ACQUIRED QUALITY	ON (formerly Motorola)	PERICOM	PHILIPS	RENESAS	ST MICRO	TOSHIBA
DSBGA†	5	YEA‡	—	—	MicroPak™	—	—	—	—	—	—	—	—
	8	YEA‡	—	—	MicroPak™	—	—	—	—	—	—	—	—
LFBGA	96	GKE‡	—	—	G	BF	—	—	—	EC	—	—	—
	114	GKF‡	—	—	—	BF	—	—	NB	EC	—	—	—
PDIP	8	P	E	P	N, P, PC	P	P	P, N	P	N	—	EY	P
	14	N	E	P	N, P, PC	P	P	P, N	P	N	—	B, B1R, EY	P
	16	N	E	P	P, PC	P	—	P, N	P	N	—	B, B1R, EY	P
	20	N	E	P	P, PC	P	—	P, N	P	N	—	B, B1R, EY	P
	24	NT	EN	P	NT, SP	PT	P	N	P	N2	—	B, B1R, EY	P
	28	NT	—	P	—	PT	—	—	P	—	—	—	—
QSOP	16	DBQ	—	Q	—	Q	Q	—	—	—	—	—	—
	20	DBQ	—	Q	—	Q	Q	—	Q	—	—	—	—
	24	DBQ	—	Q	—	Q	Q	—	—	—	—	—	—
SOIC	14	D	M	SO	M, S, SC	DC	S1	D	W	D	RP	M/MTR, M1R/RM13TR, M1/M013TR	FN
	16	D	D, M	SO	M, S, SC	DC	S1	D	W	D	RP	M/MTR, M1R/RM13TR, M1/M013TR	FN
	16	DW	DW, M	SO	—	SO	S0	DW	S	—	—	M/MTR, M1R/RM13TR, M1/M013TR	—
	20	DW	M	SO	WM, SC	SO	S0	DW	S	DW	RP	M/MTR, M1R/RM13TR, M1/M013TR	FW
	24	DW	M	SO	WM, SC	SO	S0	DW	S	DW	RP	M/MTR, M1R/RM13TR, M1/M013TR	—
	28	DW	—	SO	—	SO	S0	—	S	DW	RP	—	—
SOP	14	NS	—	—	SJ	—	—	F, M(EL)	—	—	FP	—	—
	16	NS	—	—	SJ	—	—	F, M(EL)	—	—	FP	—	—
	20	NS	—	—	SJ	—	—	F, M(EL)	—	—	FP	—	—

LEGEND:

TI and this company have an alternate source agreement.

MicroPak is a trademark of Fairchild Semiconductor Corporation.

Table A-3. Logic Package Competitive Cross-Reference (continued)

PACKAGE TYPE	NO. PINS	TI	TI-ACQUIRED HARRIS	TI-ACQUIRED CYPRESS	FAIRCHILD	IDT	IDT-ACQUIRED QUALITY	ON (formerly Motorola)	PERICOM	PHILIPS	RENESAS	ST MICRO	TOSHIBA
SSOP	14	DB	—	—	—	—	—	SD	H	DB	—	—	—
	16	DB	SM	—	—	—	—	SD	H	DB	—	—	—
	16	DBQ	—	Q	—	Q	Q	—	Q	—	—	—	—
	20	DB	SM	—	MSA	PY	—	SD	H	DB	—	—	—
	20	DBQ	—	Q	QSC	Q	Q	—	Q	—	—	—	—
	24	DB	SM	—	MSA	PY	—	SD	H	DB	—	—	—
	24	DBQ	—	Q	—	Q	Q	—	Q	—	—	—	—
	28	DB	—	—	—	PY	—	—	H	DB	—	—	—
	30	DB	—	—	—	—	—	—	—	—	—	—	—
	38	DB	—	—	—	—	—	—	—	—	—	—	—
	28	DL	—	—	—	—	—	—	—	—	—	—	—
	48	DL	—	PV	MEA/SSC	PV	PV	—	V	DL	—	—	—
	56	DL	—	PV	MEA/SSC	PV	PV	—	V	DL	—	—	—
TSSOP	14	PW	—	—	MTC	—	—	DT	L	PW/DH	TTP	TTR	FS, FT
	16	PW	—	—	MTC	—	—	DT	L	PW/DH	TTP	TTR	FS, FT
	20	PW	—	—	MTC	PG	—	DT	L	PW/DH	TTP	TTR	FS, FT
	24	PW	—	—	MTC	PG	PA	DT	L	PW/DH	TTP	TTR	—
	28	PW	—	—	—	PG	—	—	L	—	TTP	TTR	—
	48	DGG	—	PA	MTD	PA	PA	DT	A	DGG	TTP	TTR	FT
	56	DGG	—	PA	MTD	PA	PA	DT	A	DGG	TTP	TTR	FT
	64	DGG	—	—	—	—	—	—	—	—	TTP	TTR	—
TVSOP	14	DGV	—	—	—	—	—	—	—	DGV	—	—	—
	16	DGV	—	—	—	—	—	—	—	—	—	—	—
	20	DGV	—	—	—	—	—	—	—	—	—	—	—
	24	DGV	—	—	—	—	—	—	—	—	—	—	—
	48	DGV	—	—	—	PF	Q1[§]	—	K[¶]	—	—	—	—
	56	DGV	—	—	—	PF	—	—	K6	—	—	—	—
	80	DBB	—	—	—	—	—	—	—	—	TTP	—	—

LEGEND:

TI and this company have an alternate source agreement.

Table A-3. Logic Package Competitive Cross-Reference (continued)

PACKAGE TYPE	NO. PINS	TI	TI-ACQUIRED HARRIS	TI-ACQUIRED CYPRESS	FAIRCHILD	IDT	IDT-ACQUIRED QUALITY	ON (formerly Motorola)	PERICOM	PHILIPS	RENESAS	ST MICRO	TOSHIBA
VFBGA	20	GQN‡	—	—	—	—	—	—	—	—	—	—	—
	56	GQL‡	—	—	—	—	—	—	—	—		—	—
Single Gate	5	DBV	—	—	P5	—	—	—	—	GV	—	STR	F
	5	DCK	—	—	M5	—	—	DF	—	GW	CM(E)	CTR	FU
Dual Gate	8	DCT	—	—	—	—	—	—	—	—	—	—	FU
	8	DCU	—	—	K8	—	—	—	—	—	US(E)	CTR	FK
Triple Gate	8	DCT	—	—	—	—	—	—	—	—	—	—	FU
	8	DCU	—	—	K8	—	—	—	—	—	US(E)	—	FK

† DSBGA is the JEDEC reference for wafer chip scale package (WCSP).
‡ Also available in lead free (YZA)
§ Quality Semiconductor's QVSOP package has the same pitch but slightly different footprint than the TI TVSOP package.
¶ Pericom has a QVSOP with similar specifications and lead pitch to the TI TVSOP package.
# Tape-and-reel packaging is valid for surface-mount packages only. All orders must be for whole reels.
|| LE = Left-embossed tape and reel may be seen with some DB and PW packages, however, the nomenclature is transitioning to R.
☆ R = Standard tape and reel (required for DBB, DBV, and DGG; optional for D, DL, and DW packages)

LEGEND:

TI and this company have an alternate source agreement.

Logic Devices

Tables A-4 through A-7 list the standard pack quantities, by package type, for tubes, reels, boxes, and trays, respectively.

Table A-4. Tube Quantities

	PIN COUNT									
	8	**14**	**16**	**20**	**24**	**28**	**44**	**48**	**56**	**68**
DIP	50	25	25	20	15	13	N/A	N/A	N/A	N/A
PLCC	N/A	N/A	N/A	46	N/A	37	26	N/A	N/A	18
SOIC	75	50	40	25	25	20	N/A	N/A	N/A	N/A
SSOP	N/A	N/A	NS	N/A	N/A	40	N/A	25	20	N/A

NOTE 1: QSOP (DBQ) and EIAJ devices (DB, NS, PS, and PW packages) are not available in tubes.

Table A-5. Reel Quantities

		PACKAGE DESIGNATOR	UNITS PER REEL
DSBGA†	96/114 pin	YEAR‡	3000
EIAJ surface mount		DBR/DBLE, NSR/NSLE, PWR/PWLE	2000
LFBGA	96/114 pin	GKE‡, GKF‡	1000
PLCC	20 pin	FNR	1000
	28 pin	FNR	750
	44 pin	FNR	500
QFN	14/16/20 pin	RGY	1000
	56 pin	RGQ	2000
QSOP	16/20/24 pin	DBQR	2500
SSOP	48/56 pin	DLR	1000
SOIC/SOP	14/16 pin	DR	2500
	Widebody 16 pin	DWR	2000
	20/24 pin	DWR	2000
	28 pin	DWR	1000
TQFP	64 pin	PMR	1000
TSSOP		DGGR	2000
VFBGA	20/56 pin	GQN‡, GQL‡	1000

† DSBGA is the JEDEC reference for wafer chip scale package (WCSP).
‡ Also available in lead free

Table A-6. Box Quantities

		PACKAGE DESIGNATOR	UNITS PER BOX
DIP		N	1000
		NT	750
		NP	700
SOIC		D, DW	1000
SSOP	48/56 pin	DL	1000

Table A-7. Tray Quantities

		PACKAGE DESIGNATOR	UNITS PER TRAY
TQFP	64 pin	PM	160

Tables B-1 through B-4 list equivalent or similar product types for most logic families available in the industry, separated by voltage node and specialty logic. As the world leader in logic products, TI offers the broadest logic portfolio to meet your design needs.

Alternate sourcing agreements between TI and other companies are shown with shaded table cells. Crosshatched cells are used where the products are identical (or nearly identical). Cells with no background are used where the products are similar.

Table B-1. 5-V Logic

TI	FAIRCHILD	HITACHI	IDT	ON	PERICOM	PHILIPS	TOSHIBA
ABT	ABT	ABT				ABT	ABT
AC	AC	AC		AC			AC
ACT	ACT	ACT		ACT			ACT
AHC	VHC			VHC		AHC	
AHCT	VHCT			VHCT		AHCT	
AHC1G	NC7S					HC1G	7SHU
AHCT1G	NC7ST						
ALS	ALS					ALS	
AS	AS						
BCT							BC
CBT	FST		FST, QS		PI5C		
CD4000	CD4000			MC14000			
F	F					F	
FCT			FCT		FCT		
HC	HC	HC		HC		HC	HC
HCT	HCT	HCT		HCT		HCT	HCT
LS							
S							
TTL							

LEGEND:

TI and this company have an alternate source agreement.

Same product but no alternate source agreement

NAME Similar product and technology

Cypress = Cypress Semiconductor, Fairchild = Fairchild Semiconductor, Hitachi = Hitachi Semiconductor (America), Inc., IDT = Integrated Device Technology, Inc., ON = ON Semiconductor, Pericom = Pericom Semiconductor Corporation, Philips = Philips Semiconductors, Toshiba = Toshiba America Electronic Components, Inc.

Table B-2. 3.3-V Logic

TI	FAIRCHILD	HITACHI	IDT	ON	PERICOM	PHILIPS	TOSHIBA
ALB							
ALVC	ALVC/VCX	ALVC	ALVC	VCX	ALVC	ALVC	VCX
CBTLV/CB3Q			CBTLV/QS3VH		P13B		
CB3T							
LV-A	LVQ/LVX	LV		LVX		LV	LVQ/LVX
LVC	LCX	LVC	LVC	LCX	LPT	LVC	LCX
LVT	LVT	LVT				LVT	

LEGEND:

TI and this company have an alternate source agreement.

Same product but no alternate source agreement

NAME Similar product and technology

Table B-3. 2.5-V Logic

TI	IDT	PERICOM	PHILIPS
ALVT		ALVT	ALVT
AVC		AVC	AVC
CB3Q	QS3VH		
CB3T			

LEGEND:

TI and this company have an alternate source agreement.

Same product but no alternate source agreement

NAME Similar product and technology

Table B-4. 1.8-V Logic

TI	HITACHI	IDT	PHILIPS
AUC		AUC	

LEGEND:

TI and this company have an alternate source agreement.

Same product but no alternate source agreement

NAME Similar product and technology

Table B-5. Specialty Logic

TI	FAIRCHILD	IDT	PERICOM	PHILIPS
ABTE	ETL/VME			
FB	DS			FB
GTL				GTL
GTLP	GTLP	GTLP	GTLP	
HSTL				
JTAG	SCAN	QS3J		
TVC				GTL
PCA				PCA

LEGEND:

TI and this company have an alternate source agreement.

Same product but no alternate source agreement

NAME Similar product and technology

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com

TI Semiconductor KnowledgeBase Home Page
support.ti.com/sc/knowledgebase

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Korea	080-551-2804
Malaysia	1-800-80-3973
New Zealand	0800-446-934
Philippines	1-800-765-7404
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