Texas Instruments

THE WORLD LEADER IN LOGIC PRODUCTS

LOGIC REFERENCE GUIDE

Bipolar, BiCMOS, and CMOS Logic Technology

4Q 2001

LOGIC OVERVIEW

Welcome to the world of TI Logic! Texas Instruments (TI) offers a full spectrum of logic functions and technologies from mature Bipolar and BiCMOS families to the latest advanced CMOS families. TI's process technologies offer the logic performance and features required for logic designs, while maintaining support for the traditional logic products.

TI also 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.

A wide variety of packaging options are a bonus for those looking to design with TI Logic. TI has made advancements in the logic industry by introducing logic in the latest packaging innovations, including the world's smallest logic package, NanoStar™, and the latest in ball grid array packaging, MicroStar Jr.™ and MicroStar BGA™.

As the world leader in logic, TI offers logic families at every price/performance node, benchmark delivery reliability, and leading service and support. Start here to find the right TI Logic for your needs.

For additional logic information including application reports, samples, and datasheets, visit:

www.ti.com/sc/logic

To access the TI Logic KnowledgeBase and get answers to your technical questions go to:

www.ti.com/sc/lkb

To subscribe to LogicNews, a monthly newsletter featuring new products and other TI Logic news, visit:

www.ti.com/sc/logicnews

PRODUCT LIFE CYCLE

LOGIC INDUSTRY CROSS-REFERENCE

TI	Fairchild	Hitachi	IDT	ON	Pericom	Philips	Toshiba
Bipolar							
ALS	ALS	–	–	–	–	ALS	–
AS	AS	–	–	–	–	–	–
74F	F	–	–	F	–	F	–
LS	LS	–	–	LS	–	–	–
S	S	–	–	–	–	–	–
TTL	TTL	–	–	–	–	–	–
BiCMOS							
ABT	ABT	ABT	–	–	–	ABT	ABT
ALB	–	–	–	–	–	–	–
ALVT	–	–	–	–	ALVT	ALVT	–
BCT	BCT	–	–	BC	–	–	BC
LVT	LVT	LVT	–	–	–	LVT	–
CMOS							
AC/ACT	AC/ACT	AC/ACT	–	AC/ACT	–	–	AC/ACT
AHC/AHCT	VHC	–	–	VHC	–	AHC	VHC
ALVC	VCX	ALVC	ALVC	VCX	ALVC	ALVC	VCX
AUC	–	–	AUC	–	–	AUC	–
AVC	–	–	–	–	AVC	AVC	–
CBT	FST	–	FST/QS	–	PI5C	–	–
CBTLV	–	–	CBTLV	–	P13B	–	–
CD4K	CD4K	–	–	MC1400	–	–	–
FCT	–	–	FCT	–	FCT	–	–
HC/HCT	HC/HCT	HC/HCT	–	HC/HCT	–	HC/HCT	HC/HCT
LV-A	LVQ/LVX	LV	–	LVQ/LVX	–	LV	LVQ/LVX
LVC	LCX	LVC	LVC/LCX	LCX	LCX/LPT	LVC	LCX

SPECIALTY LOGIC

TI	Fairchild	Hitachi	IDT	ON	Pericom	Philips	Toshiba
Advanced Interface Logic							
GTL	–	–	–	–	–	GTL	–
GTLP	GTLP	–	–	–	GTLP	–	–
FB+ (BTL)	DS	–	–	–	–	FB	–
ABTE (ETL)	ETL/VME	–	–	–	–	–	–
Advanced Memory Drivers							
SSTV	SSTV	SSTV	SSTV	–	SSTV	SSTV	–
HSTL	–	–	–	–	–	–	–
SSTL	–	–	–	–	–	SSTL	–
I^2C Bus							
PCA	–	–	–	–	–	PCA	–
PCF	–	–	–	–	–	PCF	–

LITERATURE

Selection Guides	**Lit. Number**
Logic Selection Guide	SDYU001P
Little Logic Selection Guide	SCYB001B
Advanced Bus Interface Logic Selection Guide	SCYT126
Design Considerations for Logic Products, Volume 3	SDYA019

Data Books	
GTL/GTLP Data Book	SCED004A
Little Logic Data Book	SCED010
Signal Switch Data Book	SCDD003
CBT/CBTLV Data Book	SCDD001B
AVC Data Book	SCED008B
ALVC Data Book	SCED006A
AHC/AHCT Data Book	SCLD003B

Brochures/Product Bulletins	**Lit. Number**
NanoStar Design Summary	SCET006
MicroStar Junior Design Summary	SCET004
GTLP Brochure	SCEB005
LV-A Brochure	SCEB008
AVC Product Bulletin	SCEB003C
Bus Switches (CBT & CBTLV) Product Bulletin	SCDB002A
AUC Brochure	SCEB011

To order any TI Logic literature listed, please contact the Texas Instruments Literature Response Center at 1-800-477-8924 and provide the literature number.

FAMILY PORTFOLIO

Technology Family	Voltage	Function: Buffers/Drivers/Bus Transceivers	Flip Flops/Latches	Bus Termination Arrays	Counters	Registers	Encoders/Data Selectors/Multiplexers	Decoders/Demultiplexers	Comparators/Parity Generators and Checkers	Arithmetic Circuits	Gates	Universal Bus Drivers/Transceivers	Bus Switches	Little Logic	Gates
Bipolar															
ALS	5.0	✔	✔	–	✔	✔	✔	✔	✔	–	✔	–	–	–	✔
AS	5.0	✔	✔	–	✔	✔	✔	✔	✔	✔	✔	–	–	–	✔
74F	5.0	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	–	–	–	✔
LS	5.0	✔	✔	–	✔	✔	✔	✔	✔	✔	✔	–	–	–	✔
S	5.0	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	–	–	–	✔
TTL	5.0	✔	✔	–	✔	–	✔	✔	–	✔	✔	–	–	–	✔
BiCMOS															
ABT	5.0	✔	✔	–	–	–	✔	✔	–	–	–	✔	–	–	–
ALB	3.3	✔	–	–	–	–	–	–	–	–	–	–	–	–	–
ALVT	3.3	✔	✔	–	–	–	–	–	–	–	–	✔	–	–	–
BCT	5.0	✔	✔	–	–	–	–	✔	–	–	–	✔	–	–	–
LVT	3.3	✔	✔	–	–	–	–	–	–	–	–	✔	–	–	–
CMOS															
AC/ACT	5.0	✔	✔	✔	–	–	✔	✔	✔	–	✔	–	–	–	✔
AHC/AHCT	5.0	✔	✔	–	✔	✔	✔	✔	–	–	✔	–	–	✔	✔
ALVC	3.3	✔	✔	–	–	✔	–	–	–	–	✔	✔	–	–	✔
AUC	1.8	–	–	–	–	–	–	–	–	–	–	–	–	✔	–
AVC	2.5	✔	✔	–	–	–	–	–	–	–	–	✔	–	–	–
CBT	5.0	–	–	–	–	–	–	–	–	–	–	–	✔	✔	–
CBTLV	3.3	–	–	–	–	–	–	–	–	–	–	–	✔	✔	–
CD4K	5.0	✔	✔	✔	✔	✔	✔	✔	✔	–	✔	–	✔	–	–
FCT	5.0	✔	✔	–	✔	✔	✔	✔	✔	–	–	✔	–	–	✔
HC/HCT	5.0	✔	✔	–	✔	✔	✔	✔	✔	–	✔	–	–	–	✔
LV-A	3.3	✔	✔	–	✔	✔	✔	✔	–	–	✔	–	✔	–	✔
LVC	3.3	✔	✔	–	–	–	✔	✔	–	–	✔	✔	✔	✔	✔

SPECIALTY LOGIC PORTFOLIO

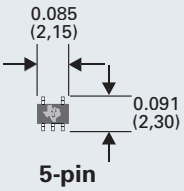
	Device Type/Application	Performance Details
Advanced Interface Logic		
GTL	Backplane Driver	Low-power consumption; live insertion; 3.3-V V_{CC}, 5-V tolerant; supports both GTL and GTL+ Logic levels
GTLP	Backplane Driver	4x more data throughput over traditional TTL Logic devices; 3.3-V V_{CC}, 5-V tolerant; device acts as 5-V TTL-to-GTLP, as well as 3.3-V LVTTL-to-GTLP translators; TI-OPC™
FB+ (BTL)	Backplane Driver	Drive ≤100 mA; true live insertion
ABTE (ETL)	Backplane Driver	TTL backward compatible; live insertion; bus hold
Advanced Memory Drivers		
SSTL	High-Speed Memory Driver	High-speed memory interface for PC
SSTV	High-Speed Memory Driver	High-speed memory interface for PC1600/2100 (DDR1) and PC2400/2700 (DDR2)
HSTL	High-Speed Memory Driver	HSTL-to-LVTTL memory address latches
I²C Bus		
PCA	I²C Bus	Non-volatile 5-bit register
PCF	I²C Bus	General purpose I/O expansion
Testability		
JTAG	IEEE 1149.1	Device, speed, system testability

Bit-Width Octals	Widebus	WideBus+	Features
✔	–	–	140 bipolar logic functions
✔	–	–	High-speed, high-drive TTL Logic family
✔	–	–	General-purpose family of high-speed advanced bipolar logic
✔	–	–	Classic line of logic devices; TI stands to be the last major supplier
✔	–	–	Continues to offer replacement alternatives for mature systems; TI stands to be the last major supplier
✔	–	–	Well-known mature Logic family; TI stands to be the last major supplier
✔	✔	✔	High-drive, low-power consumption, and reduced transmission-line effects; includes I_{OFF} and power-up 3-state
–	✔	–	3.3-V family with maximum propagation delays of 2.2 ns
–	✔	–	3.3-V or 2.5-V operation with 5-V tolerant I/O capability for use in a mixed-voltage environment
✔	–	–	TTL I/O with high speeds, 64-mA output drive, very low power in the disabled mode
✔	✔	✔	Delivers 3.5-ns propagation delays at 3.3 V and current drive of 64 mA; ideal for workstation, networking, and telecommunication applications
✔	✔	–	Reliable, low-power Logic family with 24-mA output current at 5-V V_{CC}
✔	✔	–	Natural migration path for HCMOS users who need more speed in low-power, low-noise, and low-drive applications
✔	✔	–	High-performance 3.3-V family with typical propagation delays of less than 3 ns
–	–	–	First Logic family optimized at 1.8 V with operation to sub-1-V levels; initial offering in Little Logic
–	✔	–	Optimized at 2.5 V with propagation delays under 2 ns; includes TI's DOC™ circuitry
✔	✔	–	TI's original Bus Switch family; offers a broad line of 5-V bus switches in a variety of packages
✔	✔	–	3.3-V bus switch family to complement the CBT family
–	–	–	Wide operating voltage range allows use of CD4K devices in varied applications; maximum dc supply-voltage rating of 20 V
✔	–	–	Designed for high-current-drive bus interface applications; optimized at 5 V
✔	–	–	Reliable family designed for low-power, medium- to low-speed applications; over 250 functions
✔	–	–	Expanded voltage operation range while maintaining low power consumption (2-V to 5.5-V V_{CC}); includes I_{OFF} for partial power-down
✔	✔	✔	Reliable, high-performance Logic family optimized at 3.3 V; 5-V tolerance

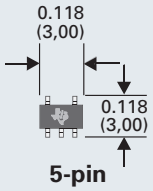
PART NUMBER DEFINITION

SN	74	LVC	H	16	2	244	A	DGG	R
									Tape & Reel
								Packaging	
							Device Revision		
						Function			
					Options				
				Bit Width					
			Features						
		Family							
	Temperature Range								
Standard Prefix									

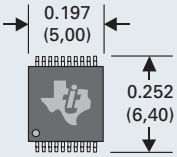
PACKAGING



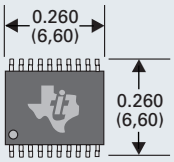
5-pin
SC-70 (DCK)
Lead pitch = 0.026 (0,65)
Height = 0.037 (0,95)
Area = 0.008 (4.95)



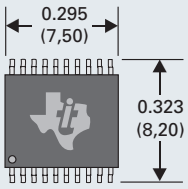
5-pin
SOT-23 (DBV)
Lead pitch = 0.037 (0,95)
Height = 0.047 (1,20)
Area = 0.014 (9)



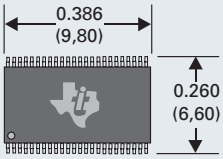
20-pin
TVSOP (DGV)
Lead pitch = 0.016 (0,40)
Height = 0.047 (1,20)
Area = 0.050 (32)



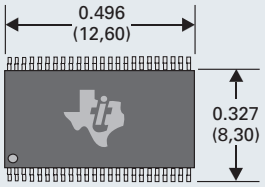
20-pin
TSSOP (PW)
Lead pitch = 0.026 (0,65)
Height = 0.047 (1,20)
Area = 0.068 (44)



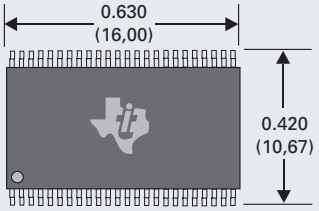
20-pin
SSOP (DB)
Lead pitch = 0.026 (0,65)
Height = 0.079 (2,0)
Area = 0.095 (62)



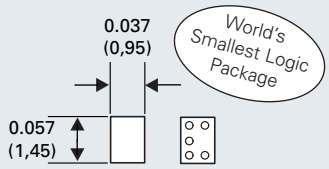
48-pin Widebus™
TVSOP (DGV)
Lead pitch = 0.016 (0,40)
Height = 0.047 (1,20)
Area = 0.100 (63)



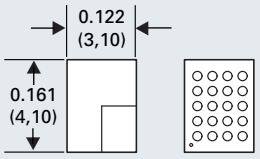
48-pin Widebus™
TSSOP (DGG)
Lead pitch = 0.020 (0,50)
Height = 0.047 (1,20)
Area = 0.162 (105)



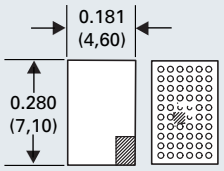
48-pin Widebus™
SSOP (DL)
Lead pitch = 0.025 (0,635)
Height = 0.110 (2,79)
Area = 0.265 (171)



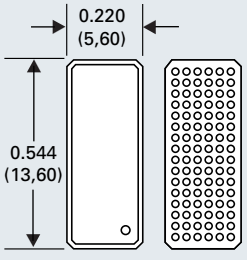
5-ball
NanoStar™ BGA (YEA)
Ball pitch = 0.020 (0,50)
Height = 0.020 (0,50)
Area = 0.002 (1,26)



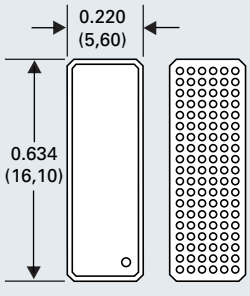
20-ball
MicroStar Jr.™ BGA (GQN)
Ball pitch = 0.026 (0,65)
Height = 0.039 (1,00)
Area = 0.020 (12,7)



56/48-ball
MicroStar Jr.™ BGA (GQL)
Ball pitch = 0.026 (0,65)
Height = 0.039 (1,00)
Area = 0.051 (32,7)



96-ball
MicroStar BGA™ (GKE)
Ball pitch = 0.031 (0,80)
Height = 0.055 (1,40)
Area = 0.139 (90,2)



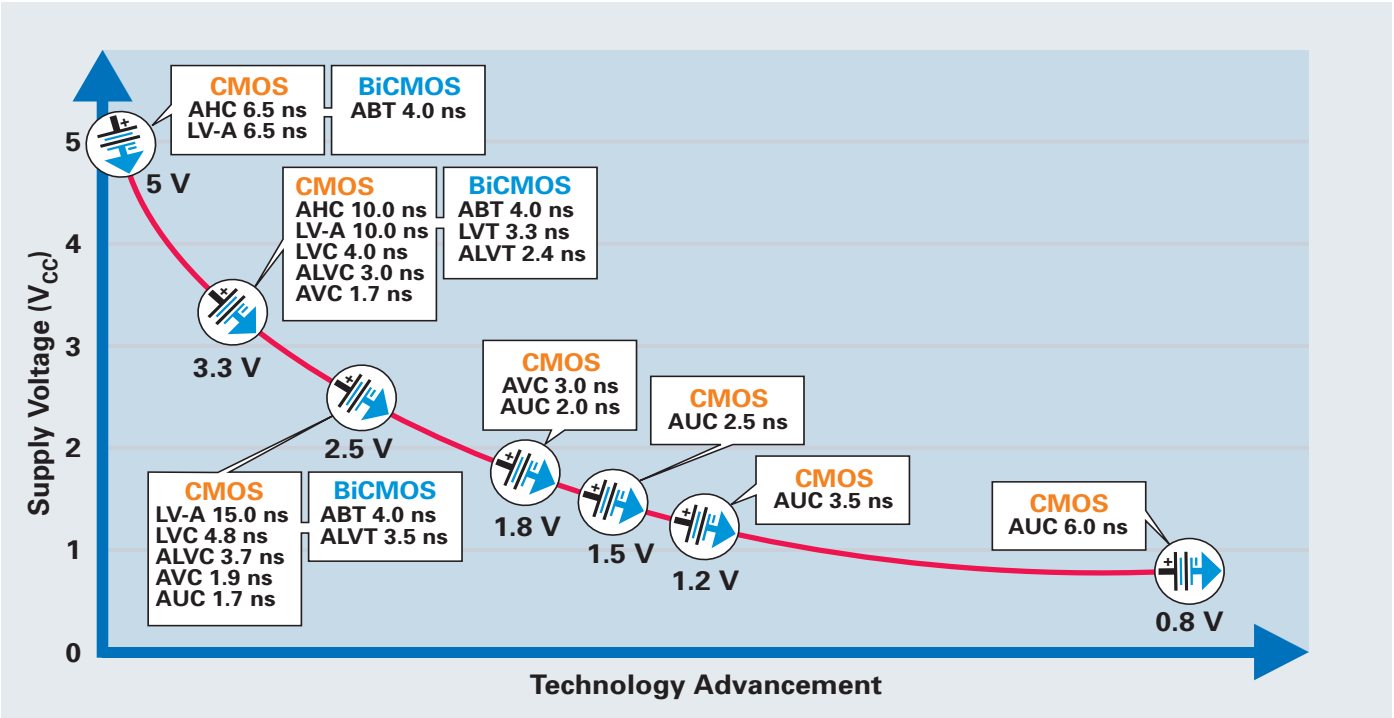
114-ball
MicroStar BGA™ (GKF)
Ball pitch = 0.031 (0,80)
Height = 0.055 (1,40)
Area = 0.139 (90,2)

Dimensions are in inches (millimeters)

FAMILY SPECIFICATION COMPARISON

	Family	Technology	Compatibility		Drive	Static Current	Speed
			Input V_{IL}/V_{IH}	Output V_{OL}/V_{OH}	I_{OL}/I_{OH} (mA)	I_{CC} (µA)	T_{pd} max (ns)
1.8 V							
('16245)	AUC	CMOS	CMOS	CMOS	8/–8	10	2.0
2.5 V							
('16245)	AVC	CMOS	CMOS	CMOS	8/–8	40	2.0
3.3 V							
('16244)	ALVT	BiCMOS	CMOS	LVTTL	24/–8	4.5 mA	3.5
('16245)	LVT	BiCMOS	LVTTL	LVTTL	64/–32	190	3.5
('16245)	ALVC	CMOS	LVTTL	LVTTL	24/–24	40	3.0
('16245)	LVC	CMOS	LVTTL	LVTTL	24/–24	10	4.0
	ALB	BiCMOS	LVTTL	LVTTL	25/–25	800	2.0
	AC	CMOS	CMOS	CMOS	12/–12	20	8.5
	AHC	CMOS	CMOS	CMOS	4/–4	20	11.9
	LV	CMOS	LVTTL	LVTTL	8/–8	20	14.0
5 V							
	FCT	BiCMOS	TTL	TTL	64/–15	80	7.0
	ABT	BiCMOS	TTL	TTL	64/–32	250	3.5
	AHC	CMOS	CMOS	CMOS	8/–8	40	7.5
	AHCT	CMOS	TTL	CMOS	8/–8	40	7.7
	AC	CMOS	CMOS	CMOS	24/–24	40	6.5
	ACT	CMOS	TTL	CMOS	24/–24	40	8.0
	74F	Bipolar	TTL	TTL	64/–15	120 mA	6.0
	BCT	BiCMOS	TTL	TTL	64/–15	90 mA	6.6
	HC	CMOS	CMOS	CMOS	6/–6	80	21.0
	HCT	CMOS	TTL	CMOS	6/–6	80	30.0
	AS	Bipolar	TTL	TTL	64/–15	143 mA	7.5
	ALS	Bipolar	TTL	TTL	24/–15	58 mA	10.0
	LS	Bipolar	TTL	TTL	24/–15	95 mA	12.0
	S	Bipolar	TTL	TTL	64/–15	180 mA	9.0
('00)	TTL	Bipolar	TTL	TTL	16/–0.4	22 mA	22.0

LOGIC MIGRATION



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	Domestic	www.tij.co.jp/pic

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Domestic	Local Access Code	TI Number
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China	108-00-886-0015	–
Hong Kong	800-96-1111	-800-800-1450
India	000-117	-800-800-1450
Indonesia	001-801-10	-800-800-1450
Korea	080-551-2804	–
Malaysia	1-800-800-011	-800-800-1450
New Zealand	000-911	-800-800-1450
Philippines	105-11	-800-800-1450
Singapore	800-0111-111	-800-800-1450
Taiwan	0800-006800	–
Thailand	0019-991-1111	-800-800-1450
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