XC3000A
Field Programmable Gate Arrays

June 1, 1996 (Version 1.0) — Product Specification

Features

- Enhanced, high performance FPGA family with five device types
  - Improved redesign of the basic XC3000 FPGA family
  - Logic densities from 1,000 to 6,000 gates
  - Up to 144 user-definable I/Os
- Superset of the industry-leading XC3000 family
  - Identical to the basic XC3000 in structure, pin out, design methodology, and software tools
  - 100% compatible with all XC3000, XC3000L, and XC3100A bitstreams
  - Improved routing and additional features
- Additional programmable interconnection points (PIPs)
  - Improved access to longlines and CLB clock enable inputs
  - Most efficient XC3000-class solution to bus-oriented designs
- Advanced 0.8 µ and 0.6 µ CMOS static memory technology
  - Low quiescent and active power consumption
- Performance specified by logic delays, faster than corresponding XC3000 versions
- XC3000A-specific features
  - 4 mA output sink and source current
  - Error checking of the configuration bitstream
  - Soft startup starts all outputs in slew-limited mode upon power-up
  - Easy migration to the XC3400 series of HardWire mask programmed devices for high-volume production.

Description

The XC3000A family offers the following enhancements over the popular XC3000 family:

The XC3000A family has additional interconnect resources to drive the I-inputs of TBUFs driving horizontal Longlines. The CLB Clock Enable input can be driven from a second vertical Longline. These two additions result in more efficient and faster designs when horizontal Longlines are used for data bussing.

During configuration, the XC3000A devices check the bitstream format for stop bits in the appropriate positions. Any error terminates the configuration and pulls INIT Low.

When the configuration process is finished and the device starts up in user mode, the first activation of the outputs is automatically slew-rate limited. This feature, called Soft Startup, avoids the potential ground bounce when all outputs are turned on simultaneously. After start-up, the slew rate of the individual outputs is, as in the XC3000 family, determined by the individual configuration option.

The XC3000A family is a superset of the XC3000 family. Any bitstream used to configure an XC3000, XC3100 or XC3100A device configures an XC3000A device exactly the same way.

Device	Max Logic Gates	Typical Gate Range	CLBs	Array	User I/Os Max	Flip-Flops	Horizontal Longlines	Configuration Data Bits
XC3020A	1,500	1,000 - 1,500	64	8 x 8	64	256	16	14,779
XC3030A	2,000	1,500 - 2,000	100	10 x 10	80	360	20	22,176
XC3042A	3,000	2,000 - 3,000	144	12 x 12	96	480	24	30,784
XC3064A	5,000	4,000 - 5,000	224	16 x 14	120	688	32	46,064
XC3090A	6,000	5,000 - 6,000	320	16 x 20	144	928	40	64,160

XC3000A Switching Characteristics

Xilinx maintains test specifications for each product as controlled documents. To insure the use of the most recently released device performance parameters, please request a copy of the current test-specification revision.

XC3000A Operating Conditions

Symbol	Description	Min	Max	Units
V_{CC}	Supply voltage relative to GND Commercial 0°C to +85°C junction	4.75	5.25	V
	Supply voltage relative to GND Industrial -40°C to +100°C junction	4.5	5.5	V
V_{IHT}	High-level input voltage — TTL configuration	2.0	V_{CC}	V
V_{ILT}	Low-level input voltage — TTL configuration	0	0.8	V
V_{IHC}	High-level input voltage — CMOS configuration	70%	100%	V_{CC}
V_{ILC}	Low-level input voltage — CMOS configuration	0	20%	V_{CC}
T_{IN}	Input signal transition time		250	ns

Note: At junction temperatures above those listed as Operating Conditions, all delay parameters increase by 0.3% per °C.

XC3000A DC Characteristics Over Operating Conditions

Symbol	Description		Min	Max	Units
V_{OH}	High-level output voltage (@ I_{OH} = –4.0 mA, V_{CC} min)	Commercial	3.86		V
V_{OL}	Low-level output voltage (@ I_{OL} = 4.0 mA, V_{CC} min)	Commercial		0.40	V
V_{OH}	High-level output voltage (@ I_{OH} = –4.0 mA, V_{CC} min)	Industrial	3.76		V
V_{OL}	Low-level output voltage (@ I_{OL} = 4.0 mA, V_{CC} min)	Industrial		0.40	V
V_{CCPD}	Power-down supply voltage (PWRDWN must be Low)		2.30		V
I_{CCPD}	Power-down supply current ($V_{CC(MAX)}$ @ T_{MAX})	3020A		100	µA
		3030A		160	µA
		3042A		240	µA
		3064A		340	µA
		3090A		500	µA
I_{CCO}	Quiescent FPGA supply current in addition to I_{CCPD}				
	Chip thresholds programmed as CMOS levels			500	µA
	Chip thresholds programmed as TTL levels			10	µA
I_{IL}	Input Leakage Current		–10	+10	µA
C_{IN}	Input capacitance, all packages except PGA175 (sample tested)				
	All Pins except XTL1 and XTL2			10	pF
	XTL1 and XTL2			15	pF
	Input capacitance, PGA 175 (sample tested)				
	All Pins except XTL1 and XTL2			16	pF
	XTL1 and XTL2			20	pF
I_{RIN}	Pad pull-up (when selected) @ V_{IN} = 0 V (sample tested)		0.02	0.17	mA
I_{RLL}	Horizontal Longline pull-up (when selected) @ logic Low			3.4	mA

Notes: 1. With no output current loads, no active input or Longline pull-up resistors, all package pins at V_{CC} or GND, and the FPGA device configured with a MakeBits tie option.
2. Total continuous output sink current may not exceed 100 mA per ground pin. Total continuous output source may not exceed 100 mA per V_{CC} pin. The number of ground pins varies from the XC3020A to the XC3090A.

XC3000A Absolute Maximum Ratings

Symbol	Description		Units
V_{CC}	Supply voltage relative to GND	–0.5 to +7.0	V
V_{IN}	Input voltage with respect to GND	–0.5 to V_{CC} +0.5	V
V_{TS}	Voltage applied to 3-state output	–0.5 to V_{CC} +0.5	V
T_{STG}	Storage temperature (ambient)	–65 to +150	°C
T_{SOL}	Maximum soldering temperature (10 s @ 1/16 in.)	+260	°C
T_J	Junction temperature plastic	+125	°C
	Junction temperature ceramic	+150	°C

Note: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions is not implied. Exposure to Absolute Maximum Ratings conditions for extended periods of time may affect device reliability.

XC3000A Global Buffer Switching Characteristics Guidelines

	Speed Grade	-7	-6	
Description	**Symbol**	**Max**	**Max**	**Units**
Global and Alternate Clock Distribution[1]				
Either: **Normal** IOB input pad through clock buffer to any CLB or IOB clock input	T_{PID}	7.5	7.0	ns
Or: **Fast** (CMOS only) input pad through clock buffer to any CLB or IOB clock input	T_{PIDC}	6.0	5.7	ns
TBUF driving a Horizontal Longline (L.L.)[1]				
I to L.L. while T is Low (buffer active)	T_{IO}	4.5	4.0	ns
T↓ to L.L. active and valid with single pull-up resistor	T_{ON}	9.0	8.0	ns
T↓ to L.L. active and valid with pair of pull-up resistors	T_{ON}	11.0	10.0	ns
T↑ to L.L. High with single pull-up resistor	T_{PUS}	16.0	14.0	ns
T↑ to L.L. High with pair of pull-up resistors	T_{PUF}	10.0	8.0	ns
BIDI				
Bidirectional buffer delay	T_{BIDI}	1.7	1.5	ns

Note: 1. Timing is based on the XC3042A, for other devices see XACT timing calculator.

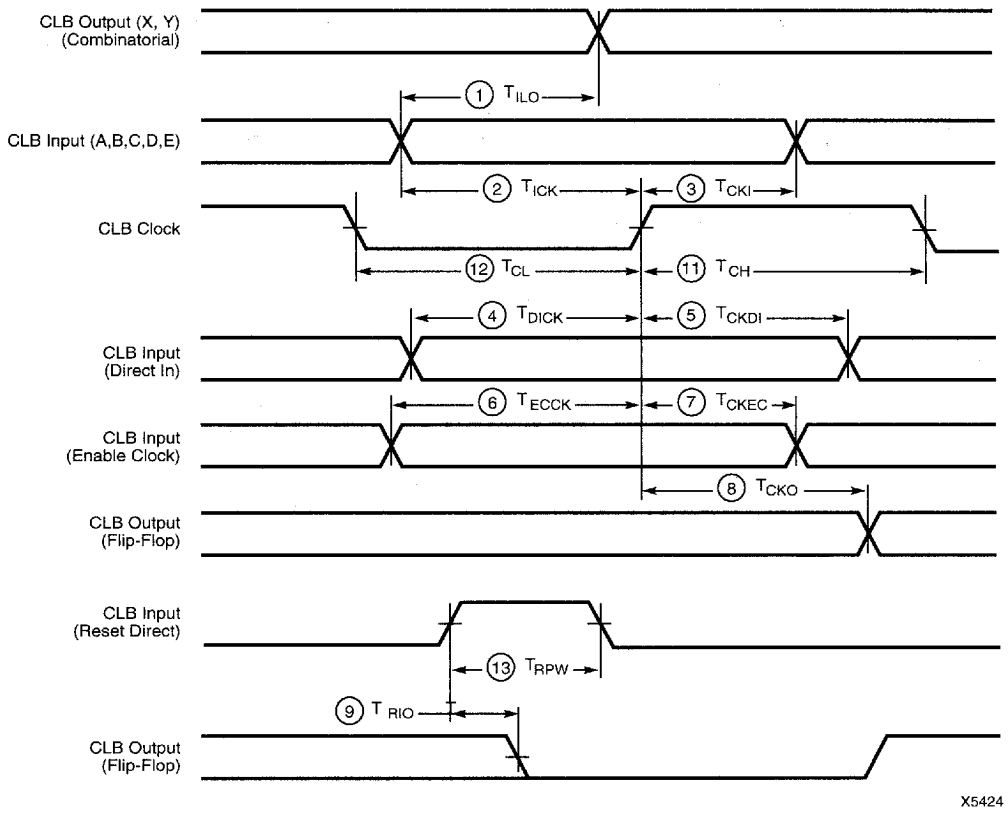
XC3000A CLB Switching Characteristics Guidelines

Testing of the switching parameters is modeled after testing methods specified by MIL-M-38510/605. All devices are 100% functionally tested. Since many internal timing parameters cannot be measured directly, they are derived from benchmark timing patterns. The following guidelines reflect worst-case values over the recommended operating conditions. For more detailed, more precise, and more up-to-date timing information, use the values provided by the XACT timing calculator and used in the simulator.

		Speed Grade		-7		-6		
Description		**Symbol**		**Min**	**Max**	**Min**	**Max**	**Units**
Combinatorial Delay								
Logic Variables	A, B, C, D, E, to outputs X or Y							
	FG Mode	1	T_{ILO}		5.1		4.1	ns
	F and FGM Mode				5.6		4.6	ns
Sequential delay								
Clock k to outputs X or Y		8	T_{CKO}		4.5		4.0	ns
Clock k to outputs X or Y when Q is returned through function generators F or G to drive X or Y								
	FG Mode		T_{QLO}		9.5		8.0	ns
	F and FGM Mode				10.0		8.5	ns
Set-up time before clock K								
Logic Variables	A, B, C, D, E							
	FG Mode	2	T_{ICK}	4.5		3.5		ns
	F and FGM Mode			5.0		4.0		ns
Data In	DI	4	T_{DICK}	4.0		3.0		ns
Enable Clock	EC	6	T_{ECCK}	4.5		4.0		ns
Hold Time after clock K								
Logic Variables	A, B, C, D, E	3	T_{CKI}	0		0		ns
Data In	DI[2]	5	T_{CKDI}	1.0		1.0		ns
Enable Clock	EC	7	T_{CKEC}	2.0		2.0		ns
Clock								
Clock High time		11	T_{CH}	4.0		3.5		ns
Clock Low time		12	T_{CL}	4.0		3.5		ns
Max. flip-flop toggle rate			F_{CLK}	113.0		135.0		MHz
Reset Direct (RD)								
RD width		13	T_{RPW}	6.0		5.0		ns
delay from RD to outputs X or Y		9	T_{RIO}		6.0		5.0	ns
Global Reset ($\overline{\text{RESET}}$ Pad)[1]								
$\overline{\text{RESET}}$ width (Low)			T_{MRW}	16.0		14.0		ns
delay from $\overline{\text{RESET}}$ pad to outputs X or Y			T_{MRQ}		19.0		17.0	ns

Notes: 1. Timing is based on the XC3042A, for other devices see XACT timing calculator.
2. The CLB K to Q output delay (T_{CKO}, #8) of any CLB, plus the shortest possible interconnect delay, is always longer than the Data In hold time requirement (T_{CKDI}, #5) of any CLB on the same die.

XC3000A CLB Switching Characteristics Guidelines (continued)



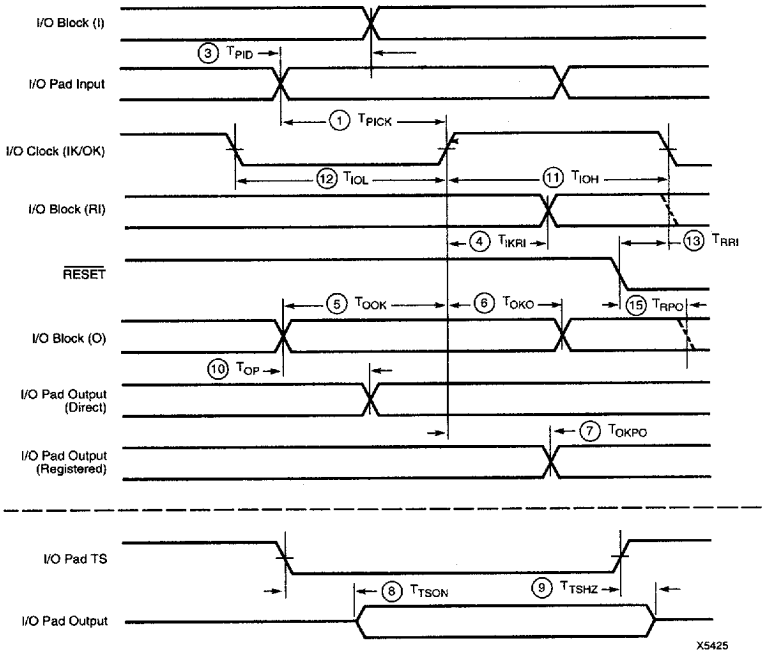
XC3000A IOB Switching Characteristics Guidelines

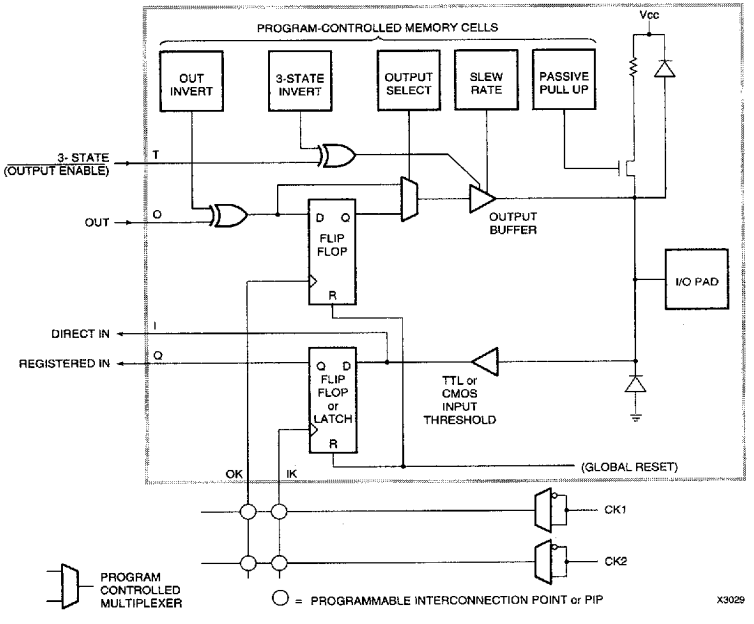
Testing of the switching parameters is modeled after testing methods specified by MIL-M-38510/605. All devices are 100% functionally tested. Since many internal timing parameters cannot be measured directly, they are derived from benchmark timing patterns. The following guidelines reflect worst-case values over the recommended operating conditions. For more detailed, more precise, and more up-to-date timing information, use the values provided by the XACT timing calculator and used in the simulator.

		Speed Grade		-7		-6		
Description		**Symbol**		**Min**	**Max**	**Min**	**Max**	**Units**
Propagation Delays (Input)								
Pad to Direct In (I)		3	T_{PID}		4.0		3.0	ns
Pad to Registered In (Q) with latch transparent			T_{PTG}		15.0		14.0	ns
Clock (IK) to Registered In (Q)		4	T_{IKRI}		3.0		2.5	ns
Set-up Time (Input)								
Pad to Clock (IK) set-up time		1	T_{PICK}	14.0		12.0		ns
Propagation Delays (Output)								
Clock (OK) to Pad	(fast)	7	T_{OKPO}		8.0		7.0	ns
same	(slew rate limited)	7	T_{OKPO}		18.0		15.0	ns
Output (O) to Pad	(fast)	10	T_{OPF}		6.0		5.0	ns
same	(slew-rate limited)	10	T_{OPS}		16.0		13.0	ns
3-state to Pad begin hi-Z	(fast)	9	T_{TSHZ}		10.0		9.0	ns
same	(slew-rate limited)	9	T_{TSHZ}		20.0		12.0	ns
3-state to Pad active and valid	(fast)	8	T_{TSON}		11.0		10.0	ns
same	(slew -rate limited)	8	T_{TSON}		21.0		18.0	ns
Set-up and Hold Times (Output)								
Output (O) to clock (OK) set-up time		5	T_{OOK}	8.0		7.0		ns
Output (O) to clock (OK) hold time		6	T_{OKO}	0		0		ns
Clock								
Clock High time		11	T_{IOH}	4.0		3.5		ns
Clock Low time		12	T_{IOL}	4.0		3.5		ns
Max. flip-flop toggle rate			F_{CLK}	113.0		135.0		MHz
Global Reset Delays (based on XC3042A)								
$\overline{\text{RESET}}$ Pad to Registered In	(Q)	13	T_{RRI}		24.0		23.0	ns
$\overline{\text{RESET}}$ Pad to output pad	(fast)	15	T_{RPO}		33.0		29.0	ns
	(slew-rate limited)	15	T_{RPO}		43.0		37.0	ns

Notes:
1. Timing is measured at pin threshold, with 50 pF external capacitive loads (incl. test fixture). Typical slew rate limited output rise/fall times are approximately four times longer.
2. Voltage levels of unused (bonded and unbonded) pads must be valid logic levels. Each can be configured with the internal pull-up resistor or alternatively configured as a driven output or driven from an external source.
3. Input pad set-up time is specified with respect to the internal clock (ik). In order to calculate system set-up time, subtract clock delay (pad to ik) from the input pad set-up time value. Input pad holdtime with respect to the internal clock (ik) is negative. This means that pad level changes immediately before the internal clock edge (ik) will not be recognized.
4. T_{PID}, T_{PTG}, and T_{PICK} are 3 ns higher for XTL2 when the pin is configures as a user input.

XC3000A IOB Switching Characteristics Guidelines (continued)





Product Availability

PINS		44	64	68	84		100			
TYPE		PLAST. PLCC	PLAST. VQFP	PLAST. PLCC	PLAST. PLCC	CERAM PGA	PLAST. PQFP	PLAST. TQFP	PLAST. VQFP	TOP-BRAZED CQFP
CODE		PC44	VQ64	PC68	PC84	PG84	PQ100	TQ100	VQ100	CB100
XC3020A	-7			C I	C I	C I	C I			
	-6			C	C	C	C			
XC3030A	-7	C I	C I	C I	C I	C I	C I		C I	
	-6	C	C	C	C	C	C		C	
XC3042A	-7				C I	C I	C I		C I	
	-6				C	C	C		C	
XC3064A	-7				C I					
	-6				C					
XC3090A	-7				C I					
	-6				C					

PINS		132		144	160	164	175		176	208	223
TYPE		PLAST. PGA	CERAM. PGA	PLAST. TQFP	PLAST. PQFP	TOP-BRAZED CQFP	PLAST. PGA	CERAM. PGA	PLAST. TQFP	PLAST. PQFP	CERAM. PGA
CODE		PP132	PG132	TQ144	PQ160	CB164	PP175	PG175	TQ176	PQ208	PG223
XC3020A	-7										
	-6										
XC3030A	-7										
	-6										
XC3042A	-7	C I	C I	C I							
	-6	C	C	C							
XC3064A	-7	C I	C I	C I	C I						
	-6	C	C	C	C						
XC3090A	-7			C I	C I		C I	C I	C I	C I	
	-6			C	C		C	C	C	C	

Note: C = Commercial, T_J = 0° to +85°C I = Industrial, T_J = -40° to +100°C

Ordering Information

Example: