XC3100A
Field Programmable Gate Arrays

June 1, 1996 (Version 4.1) — Product Specification

Features

- Ultra-high-speed FPGA family with six members
  - 50-95 MHz system clock rates
  - 190 to 370 MHz guaranteed flip-flop toggle rates
  - 1.55 to 4.1 ns logic delays
- High-end additional family member in the 22 X 22 CLB array-size XC3195A device
- 8 mA output sink current and 8 mA source current
- Maximum power-down and quiescent current is 5 mA
- 100% architecture and pin-out compatible with other XC3000 families
- Software and bitstream compatible with the XC3000, XC3000A, and XC3000L families
- 100% PCI complaint (A-2, A-1, A-09 speed grade in plastic quad flat pack (PQFP) packaging).

XC3100A combines the features of the XC3000A and XC3100 families.

- Additional interconnect resources for TBUFs and CE inputs
- Error checking of the configuration bitstream
- Soft startup holds all outputs slew-rate limited during initial power-up
- More advanced CMOS process

Description

The XC3100A is a performance-optimized relative of the XC3000A and XC3100A families. While all families are footprint compatible, XC3100A family extends the typical system performance beyond 85 MHz.

The XC3100A family follows the XC4000 speed-grade nomenclature, indicating device performance with a number that is based on the internal logic-block delay, in ns.

The XC3100A family offers the following enhancements over the popular XC3000 family.

The XC3100A 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 XC3100A 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 all XC3000 families, determined by the individual configuration option.

The XC3100A family is a superset of the XC3000 families. Any bitstream used to configure an XC3000, XC3000A, XC3000L or XC3100 device, will configure the same-size XC3100A 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
XC3120A	1,500	1,000 - 1,500	64	8 x 8	64	256	16	14,779
XC3130A	2,000	1,500 - 2,000	100	10 x 10	80	360	20	22,176
XC3142A	3,000	2,000 - 3,000	144	12 x 12	96	480	24	30,784
XC3164A	4,500	3,500 - 4,500	224	16 x 14	120	688	32	46,064
XC3190A	6,000	5,000 - 6,000	320	16 x 20	144	928	40	64,160
XC3195A	7,500	6,500 - 7,500	484	22 x 22	176	1,320	44	94,944

XC3100A 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.

XC3100A Operating Conditions

Symbol	Description	Min	Max	Units
V_{CC}	Supply voltage relative to GND Commercial 0°C to +85°C junction	4.25	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.

XC3100A DC Characteristics Over Operating Conditions

Symbol	Description		Min	Max	Units
V_{OH}	High-level output voltage (@ I_{OH} = –8.0 mA, V_{CC} min)	Commercial	3.86		V
V_{OL}	Low-level output voltage (@ I_{OL} = 8.0 mA, V_{CC} min)			0.40	V
V_{OH}	High-level output voltage (@ I_{OH} = –8.0 mA, V_{CC} min)	Industrial	3.76		V
V_{OL}	Low-level output voltage (@ I_{OL} = 8.0 mA, V_{CC} min)			0.40	V
V_{CCPD}	Power-down supply voltage (PWRDWN must be Low)		2.30		V
I_{CCO}	Quiescent LCA supply current in addition to I_{CCPD}[1] Chip thresholds programmed as CMOS levels Chip thresholds programmed as TTL levels			 8 14	 mA mA
I_{IL}	Input Leakage Current		–10	+10	µA
C_{IN}	Input capacitance, all packages except PGA175 (sample tested) All Pins except XTL1 and XTL2 XTL1 and XTL2			 10 15	 pF pF
	Input capacitance, PGA 175 (sample tested) All Pins except XTL1 and XTL2 XTL1 and XTL2			 15 20	 pF 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		0.20	2.80	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 LCA device configured with a MakeBits tie option.
2. Total continuous output sink current may not exceed 100 mA per ground pin. The number of ground pins varies from two for the XC3120A in the PC84 package, to eight for the XC3195A in the PQ208 or PG223 package.

XC3100A 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.

XC3100A Global Buffer Switching Characteristics Guidelines

Description	Symbol	-5 Max	-4 Max	-3 Max	-2 Max	-1 Max	-09 Max	Units
	Speed Grade							
Global and Alternate Clock Distribution[1]								
Either: **Normal** IOB input pad through clock buffer to any CLB or IOB clock input	T_{PID}	6.8	6.5	5.6	4.7	4.3	3.9	ns
Or: **Fast** (CMOS only) input pad through clock buffer to any CLB or IOB clock input	T_{PIDC}	5.4	5.1	4.3	3.7	3.5	3.1	ns
TBUF driving a Horizontal Longline (L.L.)[1]								
I to L.L. while T is Low (buffer active) (XC3100)	T_{IO}	4.1	3.7	3.1				ns
(XC3100A)	T_{IO}	3.6	3.6	3.1	3.1	2.9	2.1	ns
T↓ to L.L. active and valid with single pull-up resistor	T_{ON}	5.6	5.0	4.2	4.2	4.0	3.1	ns
T↓ to L.L. active and valid with pair of pull-up resistors	T_{ON}	7.1	6.5	5.7	5.7	5.5	4.6	ns
T↑ to L.L. High with single pull-up resistor	T_{PUS}	15.6	13.5	11.4	11.4	10.4	8.9	ns
T↑ to L.L. High with pair of pull-up resistors	T_{PUF}	12.0	10.5	8.8	8.1	7.1	5.9	ns
BIDI								
Bidirectional buffer delay	T_{BIDI}	1.4	1.2	1.0	0.9	0.85	0.75	ns
							Prelim	

Note: 1. Timing is based on the XC3142A, for other devices see XACT timing calculator.
The use of two pull-up resistors per longline, available on other XC3000 devices, is not a valid design option for XC3100A devices.

XC3100A 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.

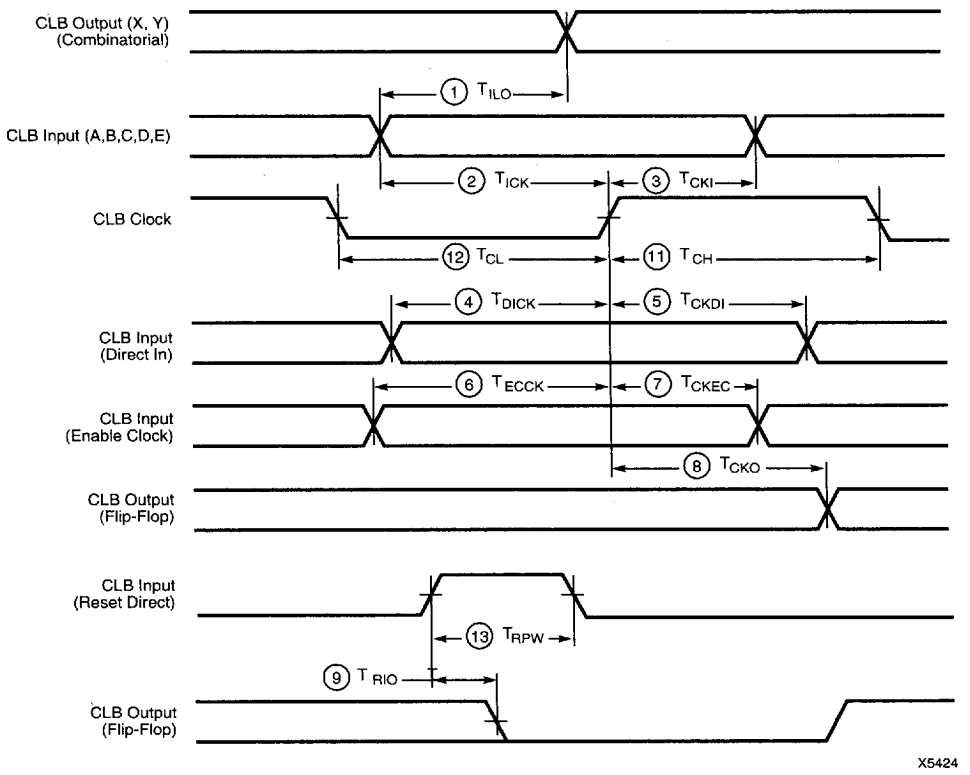
Description		Symbol		-5 Min	-5 Max	-4 Min	-4 Max	-3 Min	-3 Max	-2 Min	-2 Max	-1 Min	-1 Max	-09 Min	-09 Max	Units
Speed Grade																
Combinatorial Delay																
Logic Variables to outputs X or Y	A, B, C, D, E,	1	T_{ILO}		4.1		3.3		2.7		2.2		1.75		1.5	ns
Sequential delay																
Clock k to outputs X or Y		8	T_{CKO}		3.1		2.5		2.1		1.7		1.4		1.25	ns
Clock k to outputs X or Y when Q is returned through function generators F or G to drive X or Y			T_{QLO}		6.3		5.2		4.3		3.5		3.1		2.7	ns
Set-up time before clock K																
Logic Variables	A, B, C, D, E	2	T_{ICK}	3.1		2.5		2.1		1.8		1.7		1.5		ns
Data In	DI	4	T_{DICK}	2.0		1.6		1.4		1.3		1.2		1.0		ns
Enable Clock	EC	6	T_{ECCK}	3.8		3.2		2.7		2.5		2.3		2.05		ns
Reset Direct inactive	RD			1.0		1.0		1.0		1.0		1.0		1.0		ns
Hold Time after clock K																
Logic Variables	A, B, C, D, E	3	T_{CKI}	0		0		0		0		0		0		ns
Data In	DI	5	T_{CKDI}	1.0		1.0		0.9		0.9		0.8		0.7		ns
Enable Clock	EC	7	T_{CKEC}	1.0		0.8		0.7		0.7		0.6		0.55		ns
Clock																
Clock High time		11	T_{CH}	2.4		2.0		1.6		1.3		1.3		1.3		ns
Clock Low time		12	T_{CL}	2.4		2.0		1.6		1.3		1.3		1.3		ns
Max. flip-flop toggle rate			F_{CLK}	188		227		270		323		323		370		MHz
Reset Direct (RD)																
RD width		13	T_{RPW}	3.8		3.2		2.7		2.3		2.3		2.05		ns
delay from RD to outputs X or Y		9	T_{RIO}		4.4		3.7		3.1		2.7		2.4		2.15	ns
Global Reset ($\overline{\text{RESET}}$ Pad)[1]																
$\overline{\text{RESET}}$ width (Low)	(XC3142A)		T_{MRW}	14.0		14.0		12.0		12.0		12.0		12.0		ns
delay from $\overline{\text{RESET}}$ pad to outputs X or Y			T_{MRQ}		17.0		14.0		12.0		12.0		12.0		12.0	ns

Prelim

Notes: 1. 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.

2. T_{ILO}, T_{QLO} and T_{ICK} are specified for 4-input functions. For 5-input functions or base FGM functions, each of these specifications for the XC3100A family increases by 0.50 ns (-5), 0.42 ns (-4) and 0.35 ns (-3), 0.35 ns (-2), 0.30 ns (-1), and 0.30 ns (-09).

XC3100A CLB Switching Characteristics Guidelines (continued)



XC3100A IOB Switching Characteristics Guidelines

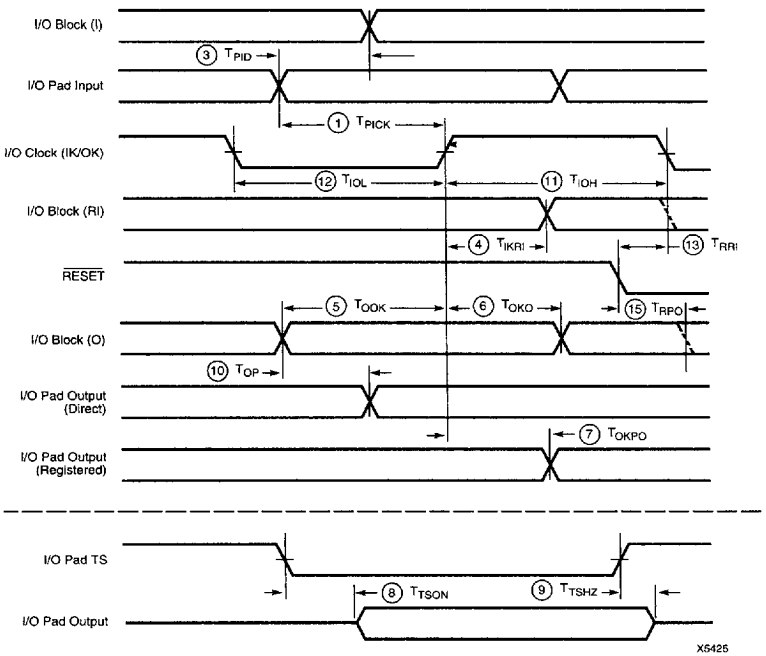
Testing of the switching parameters is modeled after testing methods specified by MIL-M-38510/605. All devices are 100% functionally tested. Since many internal timing parameters cannot be measured directly, they are derived from benchmark timing patterns. The following guidelines reflect worst-case 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.

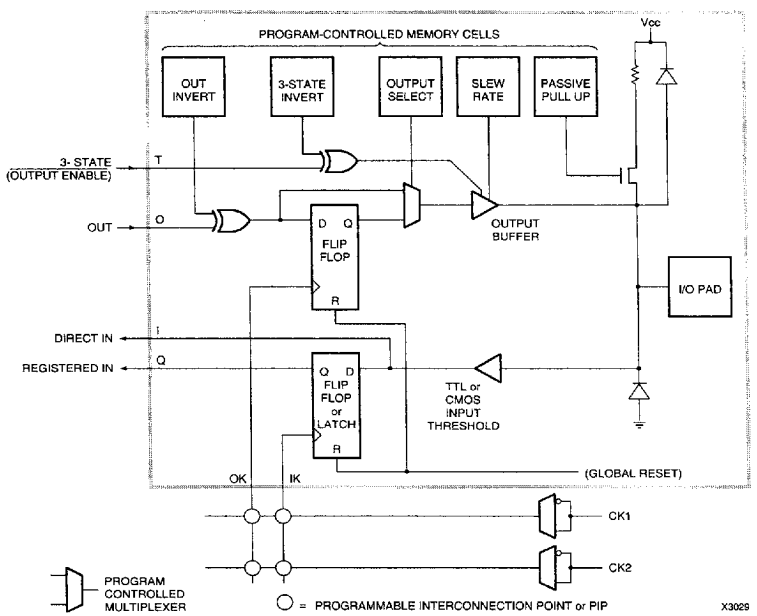
Description		Symbol	-5 Min	-5 Max	-4 Min	-4 Max	-3 Min	-3 Max	-2 Min	-2 Max	-1 Min	-1 Max	-09 Min	-09 Max	Units
Propagation Delays (Input)															
Pad to Direct In (I)	3	T_{PID}		2.8		2.5		2.2		2.0		1.7		1.55	ns
Pad to Registered In (Q)															
with latch transparent (XC3100A)		T_{PTG}		14.0		12.0		11.0		11.0		10.0		9.2	ns
Clock (IK) to Registered In (Q)	4	T_{IKRI}		2.8		2.5		2.2		1.9		1.7		1.55	ns
Set-up Time (Input)															
Pad to Clock (IK) set-up time															
XC3120A, XC3130A	1	T_{PICK}	10.9		10.6		9.4		8.9		8.0		7.2		ns
XC3142A			11.0		10.7		9.5		9.0		8.1		7.3		ns
XC3164A			11.2		11.0		9.7		9.2		8.3		7.5		ns
XC3190A			11.5		11.2		9.9		9.4		8.5		7.7		ns
XC3195A			12.0		11.6		10.3		9.8		8.9		8.1		ns
Propagation Delays (Output)															
Clock (OK) to Pad (fast)	7	T_{OKPO}		5.5		5.0		4.4		3.7		3.4		3.3	ns
same (slew rate limited)	7	T_{OKPO}		14.0		12.0		10.0		9.7		8.4		6.9	ns
Output (O) to Pad (fast)	10	T_{OPF}		4.1		3.7		3.3		3.0		3.0		2.9	ns
same (slew-rate limited)															ns
(XC3100A)	10	T_{OPS}		12.1		11.0		9.0		8.7		8.0		6.5	ns
3-state to Pad															
begin hi-Z (fast)	9	T_{TSHZ}		6.9		6.2		5.5		5.0		4.5		4.05	ns
same (slew-rate limited)	9	T_{TSHZ}		6.9		6.2		5.5		5.0		4.5		4.05	ns
3-state to Pad															
active and valid (fast) (XC3100A)	8	T_{TSON}		10.0		10.0		9.0		8.5		6.5		5.0	ns
same (slew -rate limited)	8	T_{TSON}		18.0		17.0		15.0		14.2		11.5		8.6	ns
Set-up and Hold Times (Output)															
Output (O) to clock (OK) set-up time															
(XC3100A)	5	T_{OOK}	5.0		4.5				3.6		3.2		2.9		ns
Output (O) to clock (OK) hold time	6	T_{OKO}	0		0				0		0				ns
Clock															
Clock High time	11	T_{IOH}	2.4		2.0		1.6		1.3		1.3		1.3		ns
Clock Low time	12	T_{IOL}	2.4		2.0		1.6		1.3		1.3		1.3		ns
Max. flip-flop toggle rate		F_{CLK}	188		227		270		323		323		370		MHz
Global Reset Delays															
RESET Pad to Registered In (Q)															
(XC3142A)	13	T_{RRI}		18.0		15.0		13.0		13.0		13.0		14.4	ns
(XC3190A)				29.5		25.5		21.0		21.0		21.0		21.0	ns
RESET Pad to output pad (fast)	15	T_{RPO}		24.0		20.0		17.0		17.0		17.0		17.0	ns
(slew-rate limited)	15	T_{RPO}		32.0		27.0		23.0		23.0		22.0		21.0	ns

Preliminary

Notes: 1. Timing is measured at pin threshold, with 50 pF external capacitive loads (incl. test fixture). For larger capacitive loads, see page XAPP024. 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.

XC3100A IOB Switching Characteristics Guidelines (continued)





Product Availability

PINS		44	64	68	84		100				132		144	160	164	175		176	208	223
TYPE		Plast. PLCC	Plast. VQFP	Plast. PLCC	Plast. PLCC	Ceram PGA	Plast. PQFP	Plast. TQFP	Plast. VQFP	Top-Brazed CQFP	Plast. PGA	Ceram PGA	Plast. TQFP	Plast. PQFP	Top-Brazed CQFP	Plast. PGA	Ceram PGA	Plast. TQFP	Plast. PQFP	Ceram PGA
CODE		PC44	VQ64	PC68	PC84	PG84	PQ100	TQ100	VQ100	CB100	PP132	PG132	TQ144	PQ160	CB164	PP175	PG175	TQ176	PQ208	PG223
XC3120/A	-5			C I	C I	C I	C I													
	-4			C I	C I	C I	C I													
	-3			C I	C I	C I	C I													
	-2			C I	C I	C I	C I													
	-1			C	C	C	C													
	-09			C	C	C	C													
XC3130A	-5	C I	C I	C I	C I	C I	C I		C I											
	-4	C I	C I	C I	C I	C I	C I		C I											
	-3	C I	C I	C I	C I	C I	C I		C I											
	-2	C I	C I	C I	C I	C I	C I		C I											
	-1	C	C	C	C	C	C		C											
	-09	C	C	C	C	C	C		C											
XC3142A	-5				C I	C I M B	C I		C I	MB	C I	C I M B	C I							
	-4				C I	C I	C I		C I		C I	C I	C I							
	-3				C I	C I	C I		C I		C I	C I	C I							
	-2				C I	C I	C I		C I		C I	C I	C I							
	-1				C	C	C		C		C	C	C							
	-09				C	C	C		C		C	C	C							
XC3164A	-5				C I						C I	C I	C I	C I						
	-4				C I						C I	C I	C I	C I						
	-3				C I						C I	C I	C I	C I						
	-2				C I						C I	C I	C I	C I						
	-1				C						C	C	C	C						
	-09				C						C	C	C	C						
XC3190A	-5				C I									C I	M B	C I	C I M B	C I	C I	
	-4				C I									C I		C I	C I	C I	C I	
	-3				C I									C I		C I	C I	C I	C I	
	-2				C I									C I		C I	C I	C I	C I	
	-1				C									C		C	C	C	C	
	-09				C									C		C	C	C	C	
XC3195A	-5				C I									C I	M B	C I	C I M B		C I	C I M B
	-4				C I									C I		C I	C I		C I	C I
	-3				C I									C I		C I	C I		C I	C I
	-2				C I									C I		C I	C I		C I	C I
	-1				C									C		C	C		C	C
	-09				C									C		C	C		C	C

Note: C = Commercial, T_J = 0° to +85°C I = Industrial, T_J = -40° to +100°C M = Military, T_C = -55° to +125° C B = MIL-STD-883C Class B

Ordering Information

Example:

XC3130A-3PC44C

- Device Type
- Speed Grade
- Package Type
- Number of Pins
- Temperature Range