AMD Xilinx - XC2C256-7VQG100I Datasheet

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Understanding Embedded - CPLDs (Complex Programmable Logic Devices)

Embedded - CPLDs, or Complex Programmable Logic Devices, are highly versatile digital logic devices used in electronic systems. These programmable components are designed to perform complex logical operations and can be customized for specific applications. Unlike fixed-function ICs, CPLDs offer the flexibility to reprogram their configuration, making them an ideal choice for various embedded systems. They consist of a set of logic gates and programmable interconnects, allowing designers to implement complex logic circuits without needing custom hardware.

Applications of Embedded - CPLDs

Details	
Product Status	Active
Programmable Type	In System Programmable
Delay Time tpd(1) Max	6.7 ns
Voltage Supply - Internal	1.7V ~ 1.9V
Number of Logic Elements/Blocks	16
Number of Macrocells	256
Number of Gates	6000
Number of I/O	80
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	100-TQFP
Supplier Device Package	100-VQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/xilinx/xc2c256-7vqg100i

By mapping a signal to the DataGATE function, lower power can be achieved due to reduction in signal switching.

Another feature that eases voltage translation is I/O banking. Two I/O banks are available on the CoolRunner-II 256 macrocell device that permit easy interfacing to 3.3V, 2.5V, 1.8V, and 1.5V devices.

The CoolRunner-II 256 macrocell CPLD is I/O compatible with various I/O standards (see Table 1). This device is also 1.5V I/O compatible with the use of Schmitt-trigger inputs.

RealDigital Design Technology

Xilinx CoolRunner-II CPLDs are fabricated on a 0.18 micron process technology which is derived from leading edge FPGA product development. CoolRunner-II CPLDs employ RealDigital, a design technique that makes use of CMOS technology in both the fabrication and design methodology. RealDigital design technology employs a cascade of CMOS gates to implement sum of products instead of traditional sense amplifier methodology. Due to this technology, Xilinx CoolRunner-II CPLDs achieve both high-performance and low power operation.

Supported I/O Standards

The CoolRunner-II 256 macrocell features LVCMOS, LVTTL, SSTL and HSTL I/O implementations. See Table 1 for I/O standard voltages. The LVTTL I/O standard is a general purpose EIA/JEDEC standard for 3.3V applications that use an LVTTL input buffer and Push-Pull output buffer. The LVCMOS standard is used in 3.3V, 2.5V, 1.8V applications. Both HSTL and SSTL I/O standards make use of a V_{REF} pin for JEDEC compliance. CoolRunner-II CPLDs are also 1.5V I/O compatible with the use of Schmitt-trigger inputs

Table 1: **I/O Standards for XC2C256(1)**

IOSTANDARD Attribute	Output V_{CCIO}	Input V_{CCIO}	Input V_{REF}	Board Termination Voltage V_{TT}
LVTTL	3.3	3.3	N/A	N/A
LVCMOS33	3.3	3.3	N/A	N/A
LVCMOS25	2.5	2.5	N/A	N/A
LVCMOS18	1.8	1.8	N/A	N/A
LVCMOS15 (2)	1.5	1.5	N/A	N/A
HSTL_1	1.5	1.5	0.75	0.75
SSTL2_1	2.5	2.5	1.25	1.25
SSTL3_1	3.3	3.3	1.5	1.5

(1)For information on Vref, see XAPP399.
(2) LVCMOS15 requires Schmitt-trigger inputs.

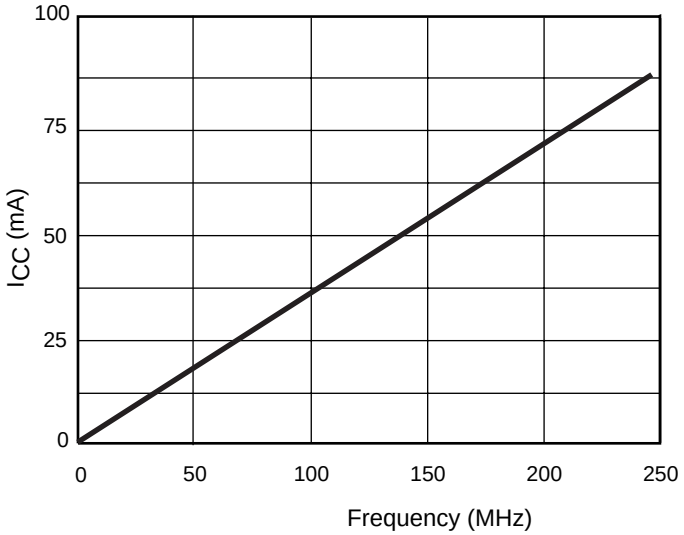


Figure 1: **I_{CC} vs Frequency**

Table 2: **I_{CC} vs Frequency (LVCMOS 1.8V T_A = 25°C)(1)**

	Frequency (MHz)										
	0	30	50	70	100	120	150	170	190	220	240
Typical I_{CC} (mA)	0.021	11.68	19.40	27.01	38.18	45.54	56.32	63.37	70.40	80.90	88.03

Notes:
1. 16-bit up/down, resettable binary counter (one counter per function block).

Absolute Maximum Ratings

Symbol	Description	Value	Units
V_{CC}	Supply voltage relative to ground	–0.5 to 2.0	V
V_{CCIO}	Supply voltage for output drivers	–0.5 to 4.0	V
V_{JTAG}(2)	JTAG input voltage limits	–0.5 to 4.0	V
V_{CCAUX}	JTAG input supply voltage	–0.5 to 4.0	V
V_{IN}(1)	Input voltage relative to ground	–0.5 to 4.0	V
V_{TS}(1)	Voltage applied to 3-state output	–0.5 to 4.0	V
T_{STG}(3)	Storage Temperature (ambient)	–65 to +150	°C
T_J	Junction Temperature	+150	°C

Notes:
1. Maximum DC undershoot below GND must be limited to either 0.5V or 10 mA, whichever is easiest to achieve. During transitions, the device pins may undershoot to –2.0v or overshoot to +4.5V, provided this over or undershoot lasts less than 10 ns and with the forcing current being limited to 200 mA.
2. Valid over commercial temperature range.
3. For soldering guidelines and thermal considerations, see the Device Packaging information on the Xilinx website. For Pb free packages, see XAPP427.

Recommended Operating Conditions

Symbol	Parameter		Min	Max	Units
V_{CC}	Supply voltage for internal logic and input buffers	Commercial T_A = 0°C to +70°C	1.7	1.9	V
		Industrial T_A = –40°C to +85°C	1.7	1.9	V
V_{CCIO}	Supply voltage for output drivers @ 3.3V operation		3.0	3.6	V
	Supply voltage for output drivers @ 2.5V operation		2.3	2.7	V
	Supply voltage for output drivers @ 1.8V operation		1.7	1.9	V
	Supply voltage for output drivers @ 1.5V operation		1.4	1.6	V
V_{CCAUX}	JTAG programming		1.7	3.6	V

DC Electrical Characteristics (Over Recommended Operating Conditions)

Symbol	Parameter	Test Conditions	Typical	Max.	Units
I_{CCSB}	Standby current Commercial	V_{CC} = 1.9V, V_{CCIO} = 3.6V	33	150	µA
I_{CCSB}	Standby current Industrial	V_{CC} = 1.9V, V_{CCIO} = 3.6V	54	300	µA
I_{CC}	Dynamic current	f = 1 MHz	-	410	µA
		f = 50 MHz	-	27	mA
C_{JTAG}	JTAG input capacitance	f = 1 MHz	-	10	pF
C_{CLK}	Global clock input capacitance	f = 1 MHz	-	12	pF
C_{IO}	I/O capacitance	f = 1 MHz	-	10	pF
I_{IL}(2)	Input leakage current	V_{IN} = 0V or V_{CCIO} to 3.9V	-	+/–1	µA
I_{IH}(2)	I/O High-Z leakage	V_{IN} = 0V or V_{CCIO} to 3.9V	-	+/–1	µA

Notes:
1. 16-bit up/down, resettable binary counter (one counter per function block) tested at V_{CC}= V_{CCIO} = 1.9V
2. See Quality and Reliability section of the CoolRunner-II family data sheet

LVCMOS 3.3V and LVTTL 3.3V DC Voltage Specifications

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{CCIO}	Input source voltage	-	3.0	3.6	V
V_{IH}	High level input voltage	-	2	3.9	V
V_{IL}	Low level input voltage	-	–0.3	0.8	V
V_{OH}	High level output voltage	I_{OH} = –8 mA, V_{CCIO} = 3V	V_{CCIO} – 0.4V	-	V
		I_{OH} = –0.1 mA, V_{CCIO} = 3V	V_{CCIO} – 0.2V	-	V
V_{OL}	Low level output voltage	I_{OL} = 8 mA, V_{CCIO} = 3V	-	0.4	V
		I_{OL} = 0.1 mA, V_{CCIO} = 3V	-	0.2	V

LVCMOS 2.5V DC Voltage Specifications

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{CCIO}	Input source voltage	-	2.3	2.7	V
V_{IH}	High level input voltage	-	1.7	V_{CCIO} + 0.3(1)	V
V_{IL}	Low level input voltage	-	–0.3	0.7	V
V_{OH}	High level output voltage	I_{OH} = –8 mA, V_{CCIO} = 2.3V	V_{CCIO} – 0.4V	-	V
		I_{OH} = –0.1 mA, V_{CCIO} = 2.3V	V_{CCIO} – 0.2V	-	V
V_{OL}	Low level output voltage	I_{OL} = 8 mA, V_{CCIO} = 2.3V	-	0.4	V
		I_{OL} = 0.1 mA, V_{CCIO} = 2.3V	-	0.2	V

(1) The V_{IH} Max value represents the JEDEC specification for LVCMOS25. The CoolRunner-II input buffer can tolerate up to 3.9V without physical damage.

LVCMOS 1.8V DC Voltage Specifications

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{CCIO}	Input source voltage	-	1.7	1.9	V
V_{IH}	High level input voltage	-	0.65 x V_{CCIO}	V_{CCIO} + 0.3(1)	V
V_{IL}	Low level input voltage	-	–0.3	0.35 x V_{CCIO}	V
V_{OH}	High level output voltage	I_{OH} = –8 mA, V_{CCIO} = 1.7V	V_{CCIO} – 0.45	-	V
		I_{OH} = –0.1 mA, V_{CCIO} = 1.7V	V_{CCIO} – 0.2	-	V
V_{OL}	Low level output voltage	I_{OL} = 8 mA, V_{CCIO} = 1.7V	-	0.45	V
		I_{OL} = 0.1 mA, V_{CCIO} = 1.7V	-	0.2	V

(1) The V_{IH} Max value represents the JEDEC specification for LVCMOS18. The CoolRunner-II input buffer can tolerate up to 3.9V without physical damage.

LVCMOS 1.5V DC Voltage Specifications(1)

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{CCIO}	Input source voltage	-	1.4	1.6	V
V_{T+}	Input hysteresis threshold voltage	-	0.5 x V_{CCIO}	0.8 x V_{CCIO}	V
V_{T-}		-	0.2 x V_{CCIO}	0.5 x V_{CCIO}	V

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{OH}	High level output voltage	I_{OH} = –8 mA, V_{CCIO} = 1.4V	V_{CCIO} – 0.45	-	V
		I_{OH} = –0.1 mA, V_{CCIO} = 1.4V	V_{CCIO} – 0.2	-	V
V_{OL}	Low level output voltage	I_{OL} = 8 mA, V_{CCIO} = 1.4V	-	0.4	V
		I_{OL} = 0.1 mA, V_{CCIO} = 1.4V	-	0.2	V

Notes:
1. Hysteresis used on 1.5V inputs.

Schmitt Trigger Input DC Voltage Specifications

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{CCIO}	Input source voltage	-	1.4	3.9	V
V_{T+}	Input hysteresis threshold voltage	-	0.5 x V_{CCIO}	0.8 x V_{CCIO}	V
V_{T-}		-	0.2 x V_{CCIO}	0.5 x V_{CCIO}	V

SSTL2-1 DC Voltage Specifications

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
V_{CCIO}	Input source voltage	-	2.3	2.5	2.7	V
V_{REF}(1)	Input reference voltage	-	1.15	1.25	1.35	V
V_{TT}(2)	Termination voltage	-	V_{REF} – 0.04	1.25	V_{REF} + 0.04	V
V_{IH}	High level input voltage	-	V_{REF} + 0.18	-	3.9	V
V_{IL}	Low level input voltage	-	–0.3	-	V_{REF} – 0.18	V
V_{OH}	High level output voltage	I_{OH} = –8 mA, V_{CCIO} = 2.3V	V_{CCIO} – 0.62	-	-	V
V_{OL}	Low level output voltage	I_{OL} = 8 mA, V_{CCIO} = 2.3V	-	-	0.54	V

Notes:
1. V_{REF} should track the variations in V_{CCIO}, also peak to peak AC noise on V_{REF} may not exceed ± 2% V_{REF}
2. V_{TT} of transmitting device must track V_{REF} of receiving devices

Symbol	Parameter	-6		-7		Units
		Min.	Max.	Min.	Max.	
T_{PSU1}	P-term clock setup time (single p-term)	1.2	-	1.5	-	ns
T_{PSU2}	P-term clock setup time (OR array)	1.5	-	2.0	-	ns
T_{PHD}	Direct input register p-term clock hold time	1.1	-	1.2	-	ns
T_{PH}	P-term clock hold	1.0	-	1.0	-	ns
T_{PCO}	P-term clock to output	-	6.5	-	7.3	ns
T_{OE}/T_{OD}	Global OE to output enable/disable	-	5.6	-	7.0	ns
T_{POE}/T_{POD}	P-term OE to output enable/disable	-	7.3	-	8.0	ns
T_{MOE}/T_{MOD}	Macrocell driven OE to output enable/disable	-	7.4	-	9.9	ns
T_{PAO}	P-term set/reset to output valid	-	7.5	-	8.1	ns
T_{AO}	Global set/reset to output valid	-	5.7	-	7.6	ns
T_{SUEC}	Register clock enable setup time	2.8	-	3.1	-	ns
T_{HEC}	Register clock enable hold time	0	-	0	-	ns
T_{CW}	Global clock pulse width High or Low	1.1	-	1.6	-	ns
T_{PCW}	P-term pulse width High or Low	6.0	-	7.5	-	ns
T_{APRPW}	Asynchronous preset/reset pulse width (High or Low)	6.0	-	7.5	-	ns
T_{DGSU}	Set-up before DataGATE latch assertion	0	-	0	-	ns
T_{DGH}	Hold to DataGATE latch assertion	4.0	-	6.0	-	ns
T_{DGR}	DataGATE recovery to new data	-	8.2	-	9.0	ns
T_{DGW}	DataGATE low pulse width	2.5	-	3.5	-	ns
T_{CDRSU}	CDRST setup time before falling edge GCLK2	1.6	-	2.0	-	ns
T_{CDRH}	Hold time CDRST after falling edge GCLK2	0	-	0	-	ns
T_{CONFIG}(4)	Configuration time	-	150	-	150	µs

Notes:

1. F_{TOGGLE} is the maximum clock frequency to which a T-Flip Flop can reliably toggle (see the CoolRunner-II family data sheet for more information).
2. $F_{SYSTEM1}$ ($1/T_{CYCLE}$) is the internal operating frequency for a device fully populated with one 16-bit counter through one p-term per macrocell while $F_{SYSTEM2}$ is through the OR array.
3. F_{EXT1} ($1/T_{SU1}+T_{CO}$) is the maximum external frequency using one p-term while F_{EXT2} is through the OR array.
4. Typical configuration current during T_{CONFIG} is approximately 7.7 mA.

Internal Timing Parameters

Symbol	Parameter[2]	-6		-7		Units
		Min.	Max.	Min.	Max.	
Buffer Delays						
T_{IN}	Input buffer delay	-	2.4	-	2.6	ns
T_{DIN}	Direct data register input delay	-	3.1	-	3.9	ns
T_{GCK}	Global Clock buffer delay	-	1.8	-	2.7	ns
T_{GSR}	Global set/reset buffer delay	-	2.0	-	3.5	ns
T_{GTS}	Global 3-state buffer delay	-	2.1	-	3.0	ns
T_{OUT}	Output buffer delay	-	2.3	-	2.6	ns
T_{EN}	Output buffer enable/disable delay	-	3.5	-	4.0	ns
P-term Delays						
T_{CT}	Control term delay	-	1.1	-	1.4	ns
T_{LOGI1}	Single P-term delay adder	-	0.5	-	1.1	ns
T_{LOGI2}	Multiple P-term delay adder	-	0.3	-	0.5	ns
Macrocell Delay						
T_{PDI}	Input to output valid	-	0.5	-	0.7	ns
T_{SUI}	Setup before clock	1.3	-	1.8	-	ns
T_{HI}	Hold after clock	0	-	0	-	ns
T_{ECSU}	Enable clock setup time	0.8	-	1.8	-	ns
T_{ECHO}	Enable clock hold time	0	-	0	-	ns
T_{COI}	Clock to output valid	-	0.4	-	0.7	ns
T_{AOI}	Set/reset to output valid	-	1.4	-	1.5	ns
T_{CDBL}	Clock doubler delay	-	0	-	0	ns
Feedback Delays						
T_{F}	Feedback delay	-	1.7	-	3.0	ns
T_{OEM}	Macrocell to global OE delay	-	1.7	-	2.5	ns
I/O Standard Time Adder Delays 1.5V CMOS						
T_{HYS15}	Hysteresis input adder	-	3.0	-	4.0	ns
T_{OUT15}	Output adder	-	0.8	-	1.0	ns
T_{SLEW15}	Output slew rate adder	-	4.0	-	5.0	ns
I/O Standard Time Adder Delays 1.8V CMOS						
T_{HYS18}	Hysteresis input adder	-	2.0	-	3.0	ns
T_{OUT18}	Output adder	-	0	-	0	ns
T_{SLEW}	Output slew rate adder	-	2.0	-	4.0	ns

Internal Timing Parameters *(Continued)*

Symbol	Parameter[2]	-6		-7		Units
		Min.	Max.	Min.	Max.	
I/O Standard Time Adder Delays 2.5V CMOS						
T_{IN25}	Standard input adder	-	0.6	-	0.7	ns
T_{HYS25}	Hysteresis input adder	-	1.5	-	3.0	ns
T_{OUT25}	Output adder	-	0.8	-	1.0	ns
T_{SLEW25}	Output slew rate adder	-	3.0	-	4.0	ns
I/O Standard Time Adder Delays 3.3V CMOS/TTL						
T_{IN33}	Standard input adder	-	0.5	-	0.7	ns
T_{HYS33}	Hysteresis input adder	-	1.2	-	3.0	ns
T_{OUT33}	Output adder	-	1.2	-	1.6	ns
T_{SLEW33}	Output slew rate adder	-	3.0	-	4.0	ns
I/O Standard Time Adder Delays HSTL, SSTL						
SSTL2-1	Input adder to T_{IN}, T_{DIN}, T_{GCK}, T_{GSR}, T_{GTS}	-	0.4	-	1.0	ns
	Output adder to T_{OUT}	-	-0.5	-	0.0	ns
SSTL3-1	Input adder to T_{IN}, T_{DIN}, T_{GCK}, T_{GSR}, T_{GTS}	-	0.4	-	1.0	ns
	Output adder to T_{OUT}	-	-0.5	-	0.0	ns
HSTL-1	Input adder to T_{IN}, T_{DIN}, T_{GCK}, T_{GSR}, T_{GTS}	-	0.6	-	1.0	ns
	Output adder to T_{OUT}	-	0	-	0	ns

Notes:
1. 1.5 ns input pin signal rise/fall.

Switching Characteristics

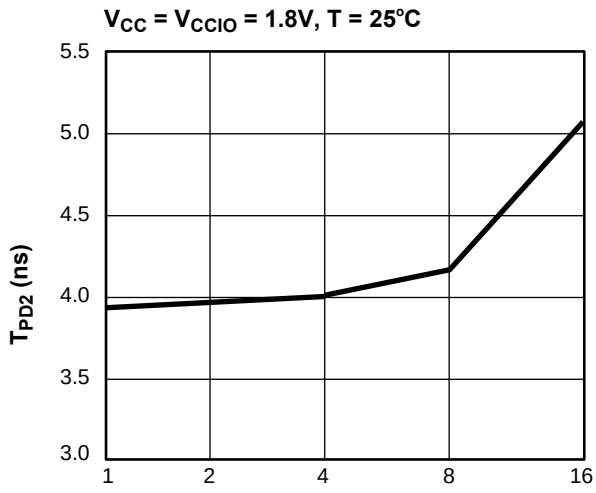
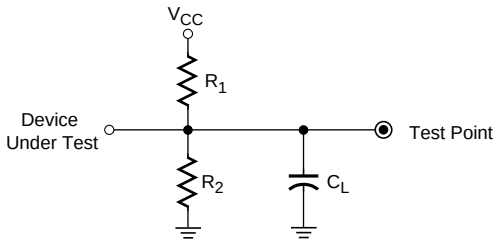


Figure 2: **Derating Curve for T_{PD}**

AC Test Circuit



Output Type	R_1	R_2	C_L
LVTTL33	268Ω	235Ω	35 pF
LVCMOS33	275Ω	275Ω	35 pF
LVCMOS25	188Ω	188Ω	35pF
LVCMOS18	112.5Ω	112.5Ω	35pF
LVCMOS15	150Ω	150Ω	35pF

C_L includes test fixtures and probe capacitance.
1.5 nsec maximum rise/fall times on inputs.

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Figure 3: **AC Load Circuit**

Typical I/V Output Curves

The I/V curve illustrates the nominal amount of current that an I/O can source/sink at different voltage levels.

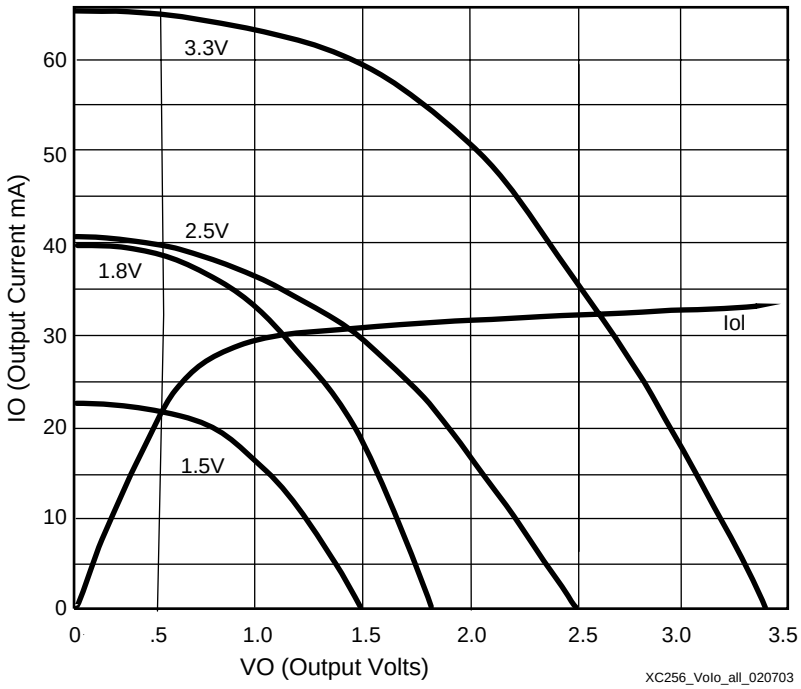


Figure 4: **Typical I/V Curve for XC2C256**

Pin Descriptions

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
1	1	-	-	-	2	B3	2
1	2	-	-	-	208	B4	2
1(GSR)	3	99	A3	143	206	C4	2
1	4	-	-	142	205	A2	2
1	5	-	-	-	203	A3	2
1	6	97	B4	140	202	A4	2
1	7	-	-	-	-	-	-
1	8	-	-	-	-	-	-
1	9	-	-	-	-	-	-
1	10	-	-	-	-	-	-
1	11	-	-	-	-	-	-
1	12	96	-	139	201	B5	2
1	13	95	-	138	200	A5	2
1	14	94	A4	137	199	E8	2
1	15	-	-	-	198	B6	2
1	16	-	C5	-	197	C7	2
2(GTS2)	1	1	A1	2	3	D3	2
2	2	-	-	-	4	C3	2
2(GTS3)	3	2	B2	3	5	E3	2
2	4	-	B1	4	6	B2	2
2(GTS0)	5	3	C3	5	7	D4	2
2	6	-	-	-	8	D2	2
2	7	-	-	-	-	-	-
2	8	-	-	-	-	-	-
2	9	-	-	-	-	-	-
2	10	-	-	-	-	-	-
2	11	-	-	-	-	-	-
2(GTS1)	12	4	C2	6	9	E5	2
2	13	-	C1	7	10	B1	2
2	14	6	D2	9	12	E4	2
2	15	7	-	10	14	C1	2
2	16	-	D1	-	-	E2	2

Pin Descriptions *(Continued)*

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
3	1	-	-	136	196	A6	2
3	2	-	B5	135	195	D7	2
3	3	-	-	134	194	B7	2
3	4	-	A5	-	193	E9	2
3	5	93	-	133	192	A7	2
3	6		C6		191	D8	2
3	7	-	-	-	-	-	-
3	8	-	-	-	-	-	-
3	9	-	-	-	-	-	-
3	10	-	-	-	-	-	-
3	11	-	-	-	-	-	-
3	12	92	-	-	189	B8	2
3	13	-	B6	-	188	C8	2
3	14	91	A6	132	187	A8	2
3	15	-	C7	-	186	E11	2
3	16	90	B7	131	185	E10	2
4	1	8	E3	11	15	F2	2
4	2	9	-	12	16	F3	2
4	3	10	E2	13	17	G4	2
4	4	-	E1	14	18	G3	2
4	5	11	F3	15	19	F5	2
4	6	12	F2	16	20	G5	2
4	7	-	-	-	-	-	-
4	8	-	-	-	-	-	-
4	9	-	-	-	-	-	-
4	10	-	-	-	-	-	-
4	11	-	-	-	-	-	-
4	12	-	F1	17	21	H2	2
4	13	13	G1	-	22	H4	2
4	14	-	-	18	23	H3	2
4	15	-	-	-	-	H1	2
4	16	-	-	-	25	H5	2

Pin Descriptions *(Continued)*

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
5	1	-	L3	-	49	R1	1
5	2	-	-	33	48	N4	1
5	3	-	-	-	47	N2	1
5(GCK1)	4	23	L2	32	46	M3	1
5	5		L1	31	45	P1	1
5(GCK0)	6	22	K3	30	44	M2	1
5	7	-	-	-	-	-	-
5	8	-	-	-	-	-	-
5	9	-	-	-	-	-	-
5	10	-	-	-	-	-	-
5	11	-	-	-	-	-	-
5	12	-	-	-	43	L3	1
5	13	-	-	-	41	N1	1
5	14	-	-	28	40	L4	1
5	15	-	-	-	39	M1	1
5	16	-	K1	-	38	L5	1
6	1	-	M1	34	50	N3	1
6 (CDRST)	2	24	M2	35	51	P2	1
6	3	-	-	-	54	P4	1
6(GCK2)	4	27	N2	38	55	P5	1
6	5	-	-	-	56	R2	1
6	6	-	-	-	57	T1	1
6	7	-	-	-	-	-	-
6	8	-	-	-	-	-	-
6	9	-	-	-	-	-	-
6	10	-	-	-	-	-	-
6	11	-	-	-	-	-	-
6(DGE)	12	28	P2	39	58	T2	1
6	13	-	M3	40	60	N5	1
6	14	29	N3	41	61	R4	1
6	15	-	P3	42	62	M5	1
6	16	30	M4	43	63	R5	1

Pin Descriptions *(Continued)*

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
7	1	-	-	-	37	K4	1
7	2	-	-	-	36	L2	1
7	3	-	-	-	35	K3	1
7	4	-	-	-	34	L1	1
7	5	19	J2	26	32	K5	1
7	6	18	J1	25	31	K2	1
7	7	-	-	-	-	-	-
7	8	-	-	-	-	-	-
7	9	-	-	-	-	-	-
7	10	-	-	-	-	-	-
7	11	17	H3	24	30	J4	1
7	12	16	H2	23	29	K1	1
7	13	15	H1	22	28	J3	1
7	14	14	G3	21	27	J2	1
7	15	-	G2	20	-	J5	1
7	16	-	-	19	-	J1	1
8	1	-	N4	44	64	R6	1
8	2	-	-	45	65	N6	1
8	3	-	-	46	66	R3	1
8	4	-	-	-	67	M6	1
8	5	-	-	48	69	T3	1
8	6	32	-	49	70	P6	1
8	7	-	-	-	-	-	-
8	8	-	-	-	-	-	-
8	9	-	-	-	-	-	-
8	10	-	-	-	-	-	-
8	11	33	M5	50	71	T4	1
8	12	34	N5	51	72	P7	1
8	13	35	P5	52	73	T5	1
8	14	36	M6	-	74	N7	1
8	15	37	N6	-	75	R7	1
8	16	-	-	-	76	M7	1

Pin Descriptions *(Continued)*

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
13	1	-	N13	75	107	R15	1
13	2	53	N14	76	108	T16	1
13	3	-	M12	77	109	N14	1
13	4	54	-	-	110	R16	1
13	5	-	M13	78	111	N15	1
13	6	55	-	79	112	M15	1
13	7	-	-	-	-	-	-
13	8	-	-	-	-	-	-
13	9	-	-	-	-	-	-
13	10	-	-	-	-	-	-
13	11	-	-	-	-	-	-
13	12	-	M14	80	113	M13	1
13	13	56	-	81	114	P16	1
13	14	-	L12	82	115	N16	1
13	15	-	-	-	116	L14	1
13	16	-	L13	-	117	M14	1
14	1	52	P14	74	106	P15	1
14	2	-	-	71	103	P14	1
14	3	50	P12	70	102	P13	1
14	4	-	M11	69	101	R13	1
14	5	49	N11	-	100	N13	1
14	6	-	P11	68	-	R14	1
14	7	-	-	-	-	-	-
14	8	-	-	-	-	-	-
14	9	-	-	-	-	-	-
14	10	-	-	-	-	-	-
14	11	-	-	-	-	-	-
14	12	-	-	-	99	T15	1
14	13	-	-	66	97	R12	1
14	14	46	P10	64	95	N11	1
14	15	44	-	-	-	M11	1
14	16	-	P9	61	91	N10	1

Pin Descriptions *(Continued)*

Function Block	Macro-cell	VQ100	CP132	TQ144	PQ208	FT256	I/O Bank
15	1	-	-	-	118	L15	1
15	2	-	L14	83	119	L13	1
15	3	-	-	-	120	M12	1
15	4	-	-	-	121	M16	1
15	5	-	-	-	122	K14	1
15	6	-	-	-	123	L16	1
15	7	-	-	-	-	-	-
15	8	-	-	-	-	-	-
15	9	-	-	-	-	-	-
15	10	-	-	-	-	-	-
15	11	58	K13	85	125	K15	1
15	12	59	K14	86	126	L12	1
15	13	60	J12	87	127	K16	1
15	14	61	J13	88	128	J14	1
15	15	63	H13	91	-	J15	1
15	16	64	H12	92	131	J13	1
16	1	-	-	-	90	P10	1
16	2	-	-	-	89	R10	1
16	3	-	M8	-	88	T10	1
16	4	-	-	-	87	R9	1
16	5	43	N8	60	86	N9	1
16	6	42	-	59	85	M8	1
16	7	-	-	-	-	-	-
16	8	-	-	-	-	-	-
16	9	-	-	-	-	-	-
16	10	-	-	-	-	-	-
16	11	41	P8	58	84	T8	1
16	12	40	M7	57	83	P8	1
16	13	39	N7	56	82	R8	1
16	14	-	-	-	80	T7	1
16	15	-	-	54	78	N8	1
16	16	-	P6	53	77	T6	1

Notes:

1. GTS = global output enable, GSR = global reset/set, GCK = global clock, CDRST = clock divide reset, DGE = DataGATE enable.
2. GTS, GSR and GCK pins can be used for general purpose I/O.

XC2C256 JTAG, Power/Ground, No Connect Pins and Total User I/O

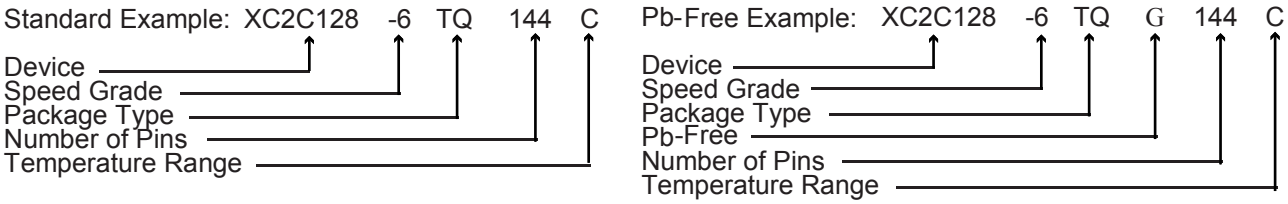
Pin Type	VQ100	CP132	TQ144	PQ208	FT256
TCK	48	M10	67	98	P12
TDI	45	M9	63	94	R11
TDO	83	B9	122	176	A10
TMS	47	N10	65	96	N12
V_{CCAUX} (JTAG supply voltage)	5	D3	8	11	F4
Power internal (V_{CC})	26, 57	P1, K12, A2	1, 37, 84	1, 53, 124	P3, K13, D12, D5
Power Bank 1 I/O (V_{CCIO1})	20, 38, 51	J3, P7, G14, P13	27, 55, 73, 93	33, 59, 79, 92, 105, 132	J6, K6, L7, L8, J11, K11, L10, L9
Power Bank 2 I/O (V_{CCIO2})	88, 98	A14, C4, A7	109, 127, 141	26, 133, 157, 172, 181, 204	F7, F8, G6, H6, F10, F9, H11
Ground	21, 25, 31, 62, 69, 75, 84, 100	K2, N1, P4, N9, N12, J14, H14, E14, B14, A9, B3	29, 36, 47, 62, 72, 89, 90, 99, 108, 123, 144	13, 24, 42, 52, 68, 81, 93, 104, 129, 130, 141, 156, 177, 190, 207	F11, F6, G10, G7, G8, G9, H10, H7, H8, H9, J10, J7, J8, J9, K10, K7, K8, K9, L11, L6
No connects	-	-	-	-	A1, C2, E6, D1, E1, G2, F1, G1, M4, T9, P9, M9, M10, T11, T12, T13, P11, T14, J16, K12, D16, G12, C15, D14, D6, C6, E7, C5
Total user I/O	80	106	118	173	184

Ordering Information

Part Number	Pin/Ball Spacing	θ_{JA} (C/Watt)	θ_{JC} (C/Watt)	Package Type	Package Body Dimensions	I/O	Commercial (C) Industrial (I)[1]
XC2C256-6VQ100C	0.5mm	43.1	10.9	Very Thin Quad Flat Pack	14mm x 14mm	80	C
XC2C256-7VQ100C	0.5mm	43.1	10.9	Very Thin Quad Flat Pack	14mm x 14mm	80	C
XC2C256-6CP132C	0.5mm	65.0	15.0	Chip Scale Package	8mm x 8mm	106	C
XC2C256-7CP132C	0.5mm	65.0	15.0	Chip Scale Package	8mm x 8mm	106	C
XC2C256-6TQ144C	0.5mm	37.2	7.2	Thin Quad Flat Pack	20mm x 20mm	118	C
XC2C256-7TQ144C	0.5mm	37.2	7.2	Thin Quad Flat Pack	20mm x 20mm	118	C
XC2C256-6PQ208C	0.5mm	36.9	9.7	Plastic Quad Flat Pack	28mm x 28mm	173	C
XC2C256-7PQ208C	0.5mm	36.9	9.7	Plastic Quad Flat Pack	28mm x 28mm	173	C
XC2C256-6FT256C	1.0mm	34.6	6.1	Fine Pitch Thin BGA	17mm x 17mm	184	C
XC2C256-7FT256C	1.0mm	34.6	6.1	Fine Pitch Thin BGA	17mm x 17mm	184	C
XC2C256-6VQG100C	0.5mm	43.1	10.9	Very Thin Quad Flat Pack; Pb-free	14mm x 14mm	80	C
XC2C256-7VQG100C	0.5mm	43.1	10.9	Very Thin Quad Flat Pack; Pb-free	14mm x 14mm	80	C
XC2C256-6CPG132C	0.5mm	65.0	15.0	Chip Scale Package; Pb-free	8mm x 8mm	106	C
XC2C256-7CPG132C	0.5mm	65.0	15.0	Chip Scale Package; Pb-free	8mm x 8mm	106	C
XC2C256-6TQG144C	0.5mm	37.2	7.2	Thin Quad Flat Pack; Pb-free	20mm x 20mm	118	C
XC2C256-7TQG144C	0.5mm	37.2	7.2	Thin Quad Flat Pack; Pb-free	20mm x 20mm	118	C
XC2C256-6PQG208C	0.5mm	36.9	9.7	Plastic Quad Flat Pack; Pb-free	28mm x 28mm	173	C
XC2C256-7PQG208C	0.5mm	36.9	9.7	Plastic Quad Flat Pack; Pb-free	28mm x 28mm	173	C
XC2C256-6FTG256C	1.0mm	34.6	6.1	Fine Pitch Thin BGA; Pb-free	17mm x 17mm	184	C
XC2C256-7FTG256C	1.0mm	34.6	6.1	Fine Pitch Thin BGA; Pb-free	17mm x 17mm	184	C
XC2C256-7VQ100I	0.5mm	43.1	10.9	Very Thin Quad Flat Pack	14mm x 14mm	80	I
XC2C256-7CP132I	0.5mm	65.0	15.0	Chip Scale Package	8mm x 8mm	106	I
XC2C256-7TQ144I	0.5mm	37.2	7.2	Thin Quad Flat Pack	20mm x 20mm	118	I
XC2C256-7PQ208I	0.5mm	36.9	9.7	Plastic Quad Flat Pack	28mm x 28mm	173	I
XC2C256-7FT256I	1.0mm	34.6	6.1	Fine Pitch Thin BGA	17mm x 17mm	184	I

Part Number	Pin/Ball Spacing	θ_{JA} (C/Watt)	θ_{JC} (C/Watt)	Package Type	Package Body Dimensions	I/O	Commercial (C) Industrial (I)[1]
XC2C256-7VQG100I	0.5mm	43.1	10.9	Very Thin Quad Flat Pack; Pb-free	14mm x 14mm	80	I
XC2C256-7CPG132I	0.5mm	65.0	15.0	Chip Scale Package; Pb-free	8mm x 8mm	106	I
XC2C256-7TQG144I	0.5mm	37.2	7.2	Thin Quad Flat Pack; Pb-free	20mm x 20mm	118	I
XC2C256-7PQG208I	0.5mm	36.9	9.7	Plastic Quad Flat Pack; Pb-free	28mm x 28mm	173	I
XC2C256-7FTG256I	1.0mm	34.6	6.1	Fine Pitch Thin BGA; Pb-free	17mm x 17mm	184	I

Notes:
1. C = Commercial (T_A = 0°C to +70°C); I = Industrial (T_A = –40°C to +85°C).



Device Part Marking

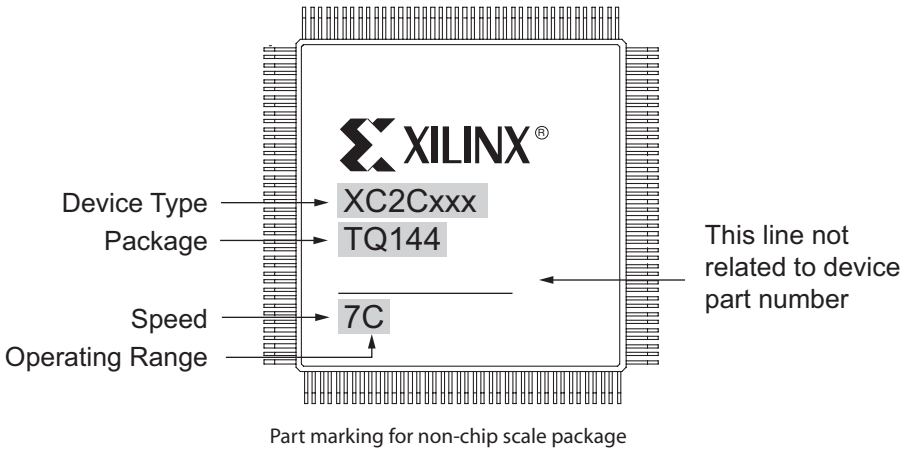


Figure 5: **Sample Package with Part Marking**

Note: Due to the small size of chip scale packages, the complete ordering part number cannot be included on the package marking. Part marking on chip scale packages by line are:

- Line 1 = X (Xilinx logo) then truncated part number
- Line 2 = Not related to device part number
- Line 3 = Not related to device part number

1. Line 4 = Package code, speed, operating temperature, three digits not related to device part number. Package codes: C5 = CP132, C6 = CPG132.

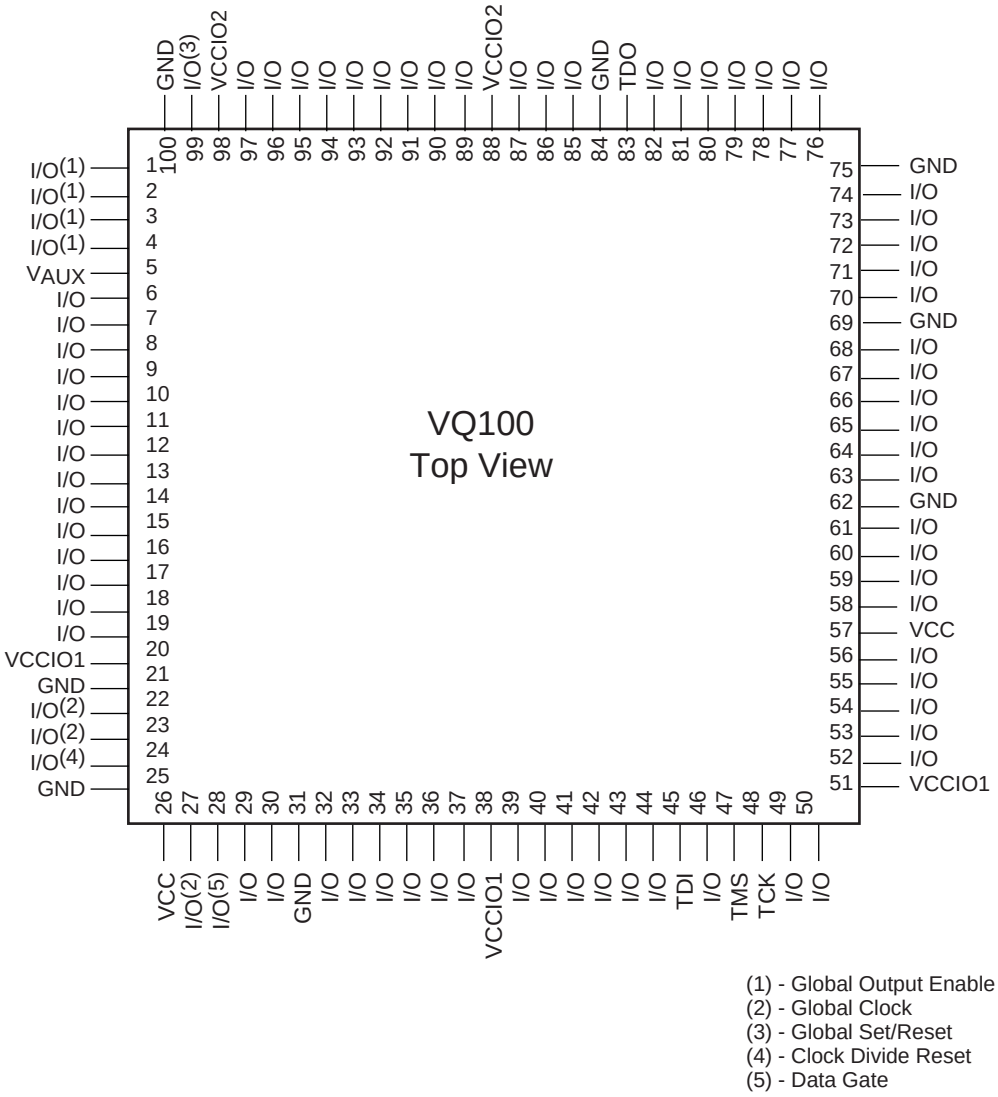
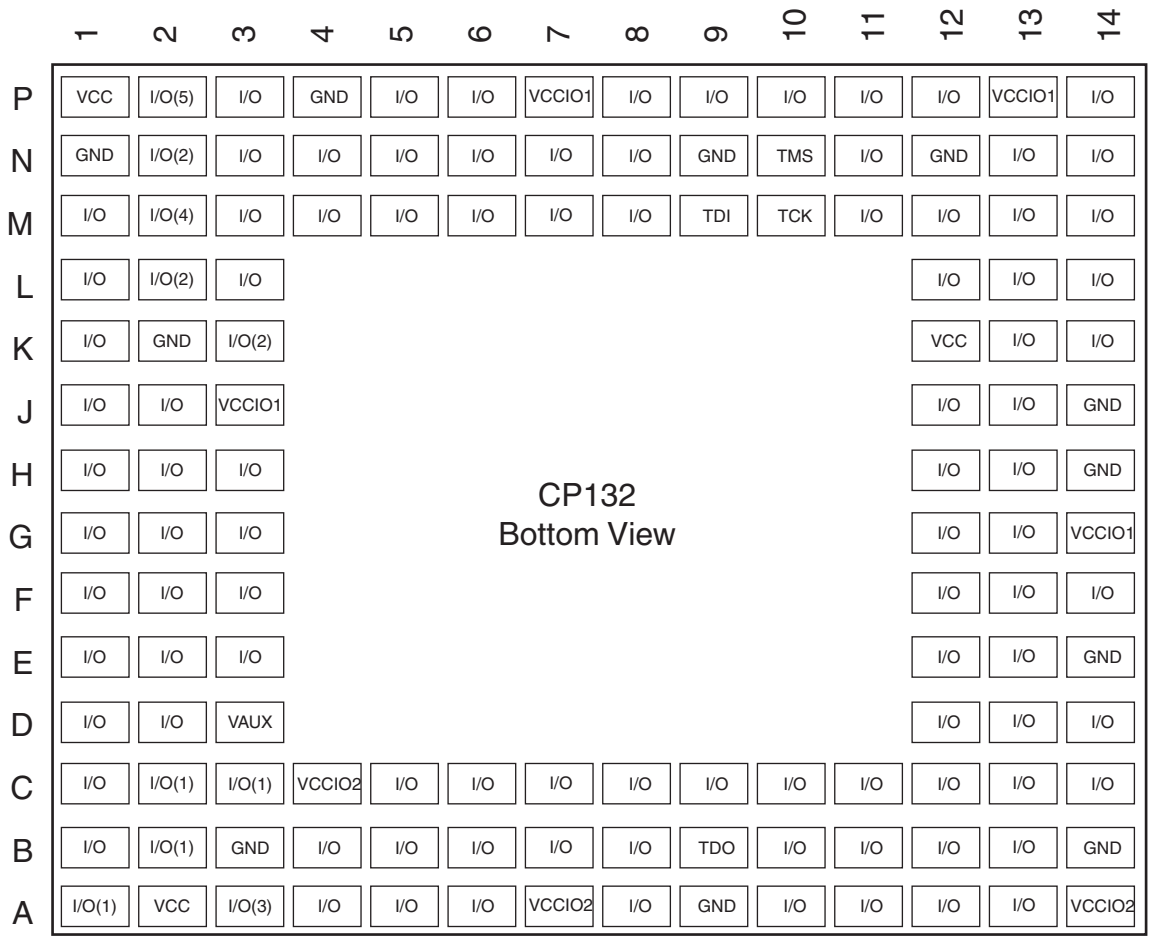
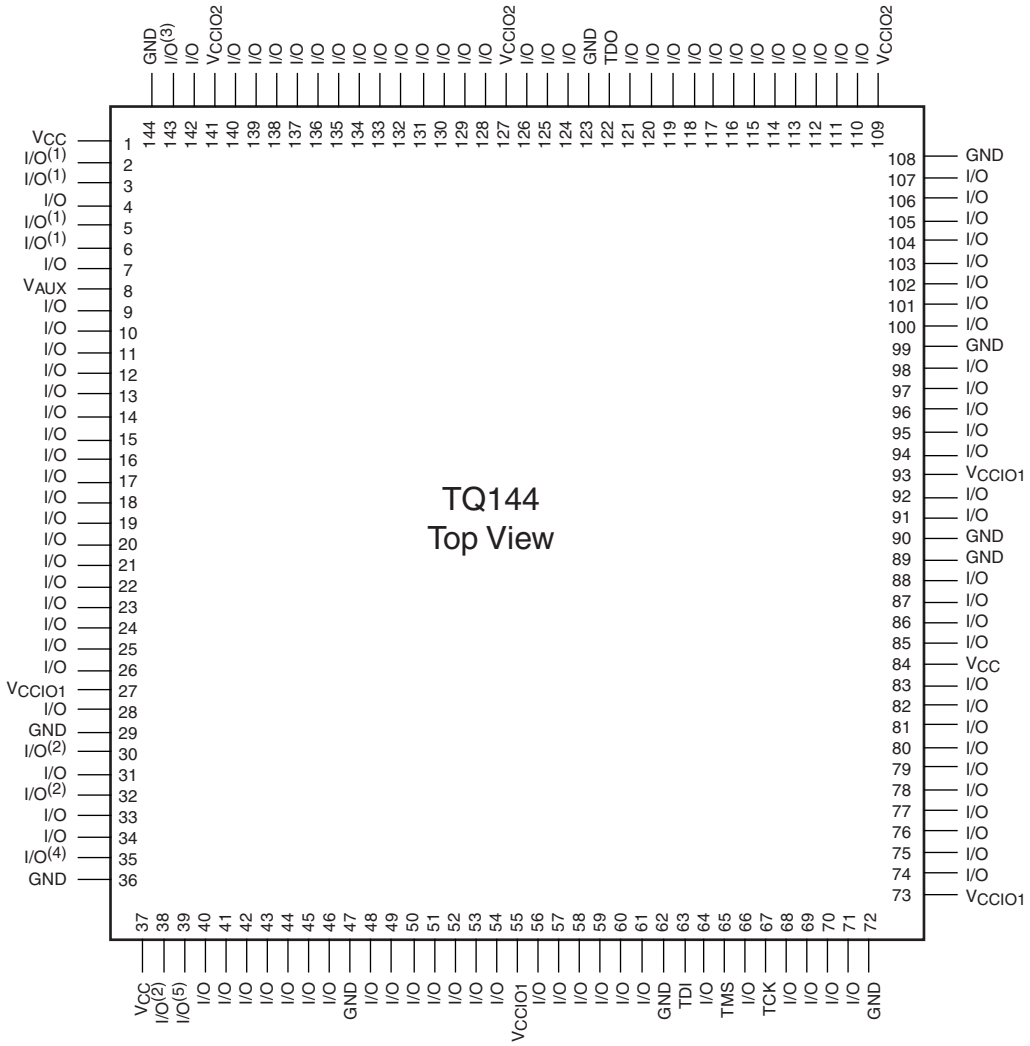


Figure 6: **VQ100 Very Thin Quad Flat Pack**



(1) - Global Output Enable
(2) - Global Clock
(3) - Global Set/Reset
(4) - Clock Divide Reset
(5) - DataGATE Enable

Figure 7: **CP132 Chip Scale Package**



(1) - Global Output Enable
(2) - Global Clock
(3) - Global Set/Reset
(4) - Clock Divide Reset
(5) - DataGATE Enable

Figure 8: **TQ144 Thin Quad Flat Pack**

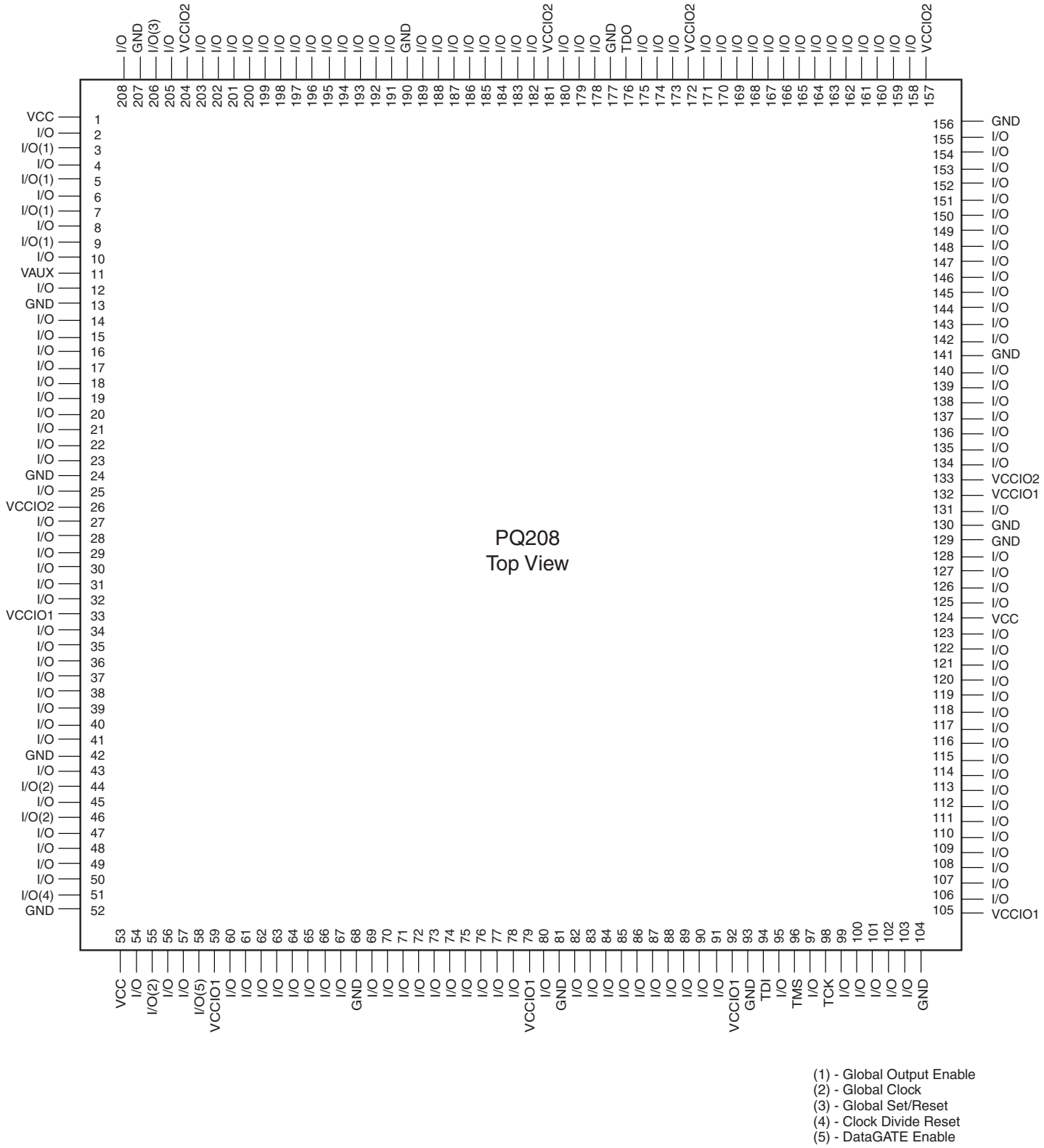


Figure 9: **PQ208 Quad Flat Package**

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
A	I/O	I/O	I/O	I/O	I/O	I/O	TDO	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	NC
B	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O
C	I/O	NC	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	NC	NC	I/O(3)	I/O	NC	I/O
D	NC	I/O	NC	I/O	VCC	I/O	I/O	I/O	I/O	I/O	NC	VCC	I/O(1)	I/O(1)	I/O	NC
E	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	NC	NC	I/O(1)	I/O	I/O(1)	I/O	NC
F	I/O	I/O	I/O	I/O	I/O	GND	VCCIO2	VCCIO2	VCCIO2	VCCIO2	GND	I/O	VAUX	I/O	I/O	NC
G	I/O	I/O	I/O	I/O	NC	I/O	GND	GND	GND	GND	VCCIO2	I/O	I/O	I/O	NC	NC
H	I/O	I/O	I/O	I/O	I/O	VCCIO2	GND	GND	GND	GND	VCCIO2	I/O	I/O	I/O	I/O	I/O
J	NC	I/O	I/O	I/O	I/O	VCCIO1	GND	GND	GND	GND	VCCIO1	I/O	I/O	I/O	I/O	I/O
K	I/O	I/O	I/O	VCC	NC	VCCIO1	GND	GND	GND	GND	VCCIO1	I/O	I/O	I/O	I/O	I/O
L	I/O	I/O	I/O	I/O	I/O	GND	VCCIO1	VCCIO1	VCCIO1	VCCIO1	GND	I/O	I/O	I/O	I/O	I/O
M	I/O	I/O	I/O	I/O	I/O	I/O	NC	NC	I/O	I/O	I/O	I/O	NC	I/O(2)	I/O(2)	I/O
N	I/O	I/O	I/O	I/O	TMS	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O
P	I/O	I/O	I/O	I/O	TCK	NC	I/O	NC	I/O	I/O	I/O	I/O(2)	I/O	VCC	I/O(4)	I/O
R	I/O	I/O	I/O	I/O	I/O	TDI	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O
T	I/O	I/O	NC	NC	NC	NC	I/O	NC	I/O	I/O	I/O	I/O	I/O	I/O	I/O(5)	I/O

FT256 Bottom View

(1) - Global Output Enable
(2) - Global Clock
(3) - Global Set/Reset
(4) - Clock Divide Reset
(5) - DataGATE Enable

Figure 10: **FT256 Fine Pitch Thin BGA**

Warranty Disclaimer

THESE PRODUCTS ARE SUBJECT TO THE TERMS OF THE XILINX LIMITED WARRANTY WHICH CAN BE VIEWED AT http://www.xilinx.com/warranty.htm. THIS LIMITED WARRANTY DOES NOT EXTEND TO ANY USE OF THE PRODUCTS IN AN APPLICATION OR ENVIRONMENT THAT IS NOT WITHIN THE SPECIFICATIONS STATED ON THE THEN-CURRENT XILINX DATA SHEET FOR THE PRODUCTS. PRODUCTS ARE NOT DESIGNED TO BE FAIL-SAFE AND ARE NOT WARRANTED FOR USE IN APPLICATIONS THAT POSE A RISK OF PHYSICAL HARM OR LOSS OF LIFE. USE OF PRODUCTS IN SUCH APPLICATIONS IS FULLY AT THE RISK OF CUSTOMER SUBJECT TO APPLICABLE LAWS AND REGULATIONS.

Additional Information

Additional information is available for the following CoolRunner-II topics:

- XAPP784: Bulletproof CPLD Design Practices
- XAPP375: Timing Model
- XAPP376: Logic Engine
- XAPP378: Advanced Features
- XAPP382: I/O Characteristics
- XAPP389: Powering CoolRunner-II
- XAPP399: Assigning VREF Pins

To access these and all application notes with their associated reference designs, click the following link and scroll down the page until you find the document you want:

CoolRunner-II Data Sheets and Application Notes

Device Packages

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
05/09/02	1.0	Initial Xilinx release.
05/13/02	1.1	Updated AC Electrical Characteristics and added new parameters.
10/31/02	1.2	Corrected package user I/O, added Voltage Referenced DC tables.
03/17/03	2.0	Added Characterization numbers for product release and device part marking
04/02/03	2.1	Updated T_{SOL} max from 260 to 220. Changed I_{CCSB} units from mA to µA.
01/26/04	2.2	Updated Device Part Marking. Updated links and Tsol.
02/26/04	2.3	Corrected Theta JC value on XC2C256-7TQ144.
08/03/04	2.4	Pb-free documentation
08/19/04	2.5	Changes to I_{CCSB} maximum specifications in DC Electrical Characteristics table, on page 3.
10/01/04	2.6	Add Asynchronous Preset/Reset Pulse Width specification to AC Electrical Characteristics.
03/07/05	2.7	Removed -5 speed grade. Changes to Table 1, I/O Standards.
06/28/05	2.8	Move to Product Specification. Change to T_{IN25}, T_{OUT25}, T_{IN33}, and T_{OUT33} for -7 speed grade.
03/20/06	2.9	Add Warranty Disclaimer. Add note to Pin Description table that GTS, GSR and GCK pins can be used for general purpose I/O.
5/20/06	3.0	Moved T_{CONFIG} specification values from MIN column to MAX column, page 7.
02/15/07	3.1	Corrections to timing parameters t_{AOI}, t_{PSUD}, t_{PSU1}, t_{PSU2}, t_{PHD}, t_{PCO}, t_{POE}, t_{PAO}, t_{AO}, t_{SUEC}, t_{CW}, t_{CDRSU}, and f_{TOGGLE} for -6 speed grade. Corrections to t_{PSUD}, t_{CW}, and t_{CDRSU} for the -7 speed grade. Values now match the software. There were no changes to silicon or characterization. Change to V_{IH} specification for 2.5V and 1.8V LVCMOS.
03/08/07	3.2	Fixed typo in note for V_{IL} for LVCMOS18; removed note for V_{IL} for LVCMOS33.