Footprint Compatibility Guide

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Application Note BY PETER ALFKE

Xilinx manufactures over 45 different FPGA device types, available in more than 30 different packages. Several different devices are usually available in the same package with identical pinouts, and users can take advantage of this in two different ways:

- If a design is being modified to add features without changing the I/O requirements, a larger device in the same package avoids a re-layout of the PC board.
- If a design was prototyped in a larger part, the design can later be cost-reduced using a smaller device in the same package. Usually, no PC-board change is required.

There is always 100% compatibility between same-size devices in different subfamilies, like:

XC2000, XC2000L, or
XC3000, XC3000A, XC3100, XC3100A, XC3000L, or
XC4000, XC4000A and XC4010D
(XC4000 and XC4000A are not bitstream compatible).

To maintain the PC-board layout, any design migration to a different-size device requires identical pinouts. In most cases, Xilinx offers 100% footprint compatibility, but there are some exceptions, as indicated in the table below.

When different devices use the same package, the larger devices usually have more chip connections (pads) than the package has pins. Some IOBs are, therefore, not brought out. Migration between these devices (**boldface type**) in either direction is no problem, since the package is the common constraint, and the pinouts are identical.

For smaller devices, indicated by *italicized text*, the package has more pins than there are pads on the device, so some package pins remain unconnected. There is no problem migrating to a larger device, to the right, since a larger device always connects to all the pins used by a smaller device. **Migration to a smaller device, to the left, however, has restrictions.** It works only when the designer anticipated the migration and used only the pins connected on the smaller device.

Package	Devices in each row are footprint-compatible						
PC44	*XC7318*	*XC7336*					
	XC2064	**XC2018**					
PC68	*XC2064*	**XC2018**					
	XC3020	**XC3030**					
PC84	*XC7372*	*XC73108*					
	XC3020	**XC3030**	**XC3042**	*(See next page)*	**XC3064**	**XC3090**	**XC3195**
	XC4002A	**XC4003/3A**	**XC4004A**	**XC4005/5A**	**XC4006**	**XC4006**	**XC4010/10D**
PG84	*XC3020*	**XC3030**	**XC3042**				
PQ100	*XC3020*	*XC3030*					
	XC4002A	**XC4003/3A**					
TQ100	*XC3030*	**XC3042**					
VQ100	*XC3030*	**XC3042**					
	XC4002A	**XC4003A**					
PG120	*XC4002A*	*XC4003/3A*	**XC4004A**				
PG/PP132	*XC3042*	**XC3064**					
TQ144	*XC3042*	*XC3064*					
	XC4004A	*XC4005A*					
PG156	*XC4005/5A*	**XC4006**					
PQ160	*XC3064*	**XC3090**	**XC3195A**				
	XC4004A	*XC4005/5A*	*XC4006*	**XC4006**	**XC4010/10D**	**XC4013/13D**	
PG/PP175	*XC3090*	**XC3195**					
PG191	*XC4003H*	*XC4008*	*XC4010*				
PQ208	*XC3090*	*XC3195*					
	XC4003H	*XC4005/5A*	*XC4006*	*XC4008*	*XC4010*	**XC4013**	**XC4020**
PG223	*XC4005H*	*XC4013*	**XC4020**	**XC4025**			
BG225	*XC4010/10D*	*XC4013/13D*					
PQ/MQ240	*XC4005H*	*XC4013*	**XC4020**	**XC4025**			
PG299	*XC4020*	*XC4025*					

NOTE: The XC3000, XC3000A, XC3100, XC3100A and XC3000L families have identical pinouts. Only the XC3000 version is listed throughout this document.

With the constraints mentioned on the previous page, **XC4000** parts are 100% pinout compatible with all other XC4000 or XC4000A parts in the same package, and **XC2000** parts are 100% pinout compatible with all other XC2000 or XC2000L parts in the same package.

In **XC3000**, there are a few additional exceptions:

In PC84, there are differences between smaller and larger devices, that need two additional GND and V_{CC} connections. This moves INIT and some address, data, and chip select pins and affects five pins for all configuration modes, plus seven pins for Master Parallel or Peripheral modes.

Pin Number	XC3000, XC3030, XC3042	XC3064, XC3090, XC3195
2	A13-I/O	VCC
21	I/O	GND
41	I/O	$\overline{\text{INIT}}$-I/O
42	$\overline{\text{INIT}}$-I/O	VCC
65	D3-I/O	GND
3	A6-I/O	A13-I/O
4	A12-I/O	A6-I/O
5	A7-I/O	A12-I/O
6	I/O	A7-I/O
66	$\overline{\text{CS1}}$-I/O	D3-I/O
67	D2-I/O	$\overline{\text{CS1}}$-I/O
68	I/O	D2-I/O

In PQ208, there is no compatibility between XC3090 and XC3195

Pin-Compatibility Between Families is Limited

XC2000 and XC3000 have a few differences:

The two families differ in the position of the crystal oscillator output XTL1, and in the position of address and data pins used in Parallel Master configuration mode. Note that Peripheral mode is bit-serial in XC2000, byte-parallel in XC3000.

XC3000 and XC4000 are incompatible for several reasons:

XC4000 does not have a PWRDWN input and has no dedicated RESET input.

XC4000 does not have XTL1 and XTL2, the pins used in XC3000 to implement a crystal oscillator.

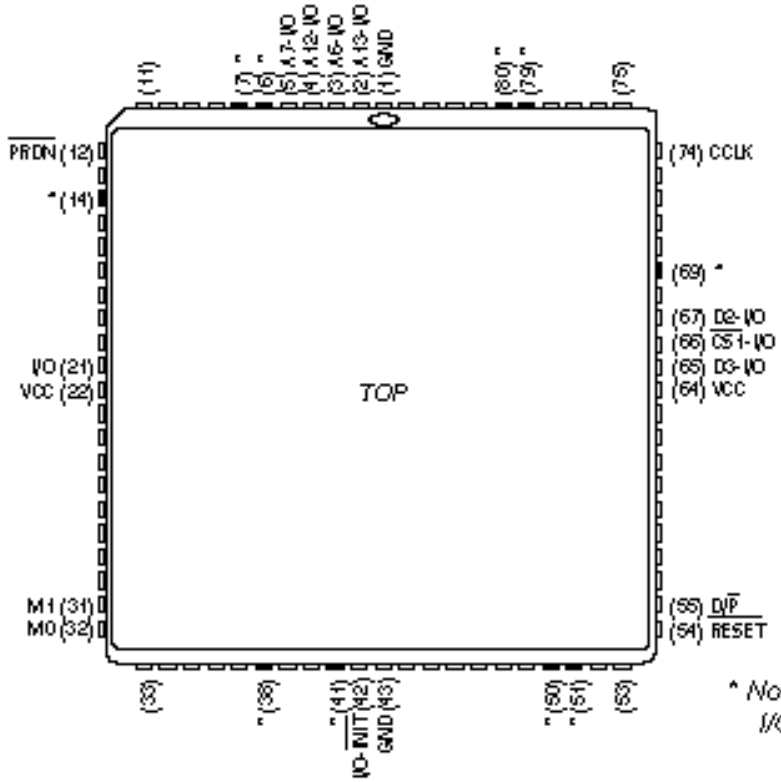
XC4000 separates the functionality of the XC3000 DONE/PROG pin into two pins, DONE and PROGRAM.

XC3000 does not support boundary scan, and has only two global clock net inputs, while XC4000 has eight.

In PC84, XC4000 devices have 8 GND connections, while XC3000 devices have 2 or 4. That moves most dedicated functions to incompatible pins.

XC7300 EPLD devices are not footprint compatible with FPGAs.

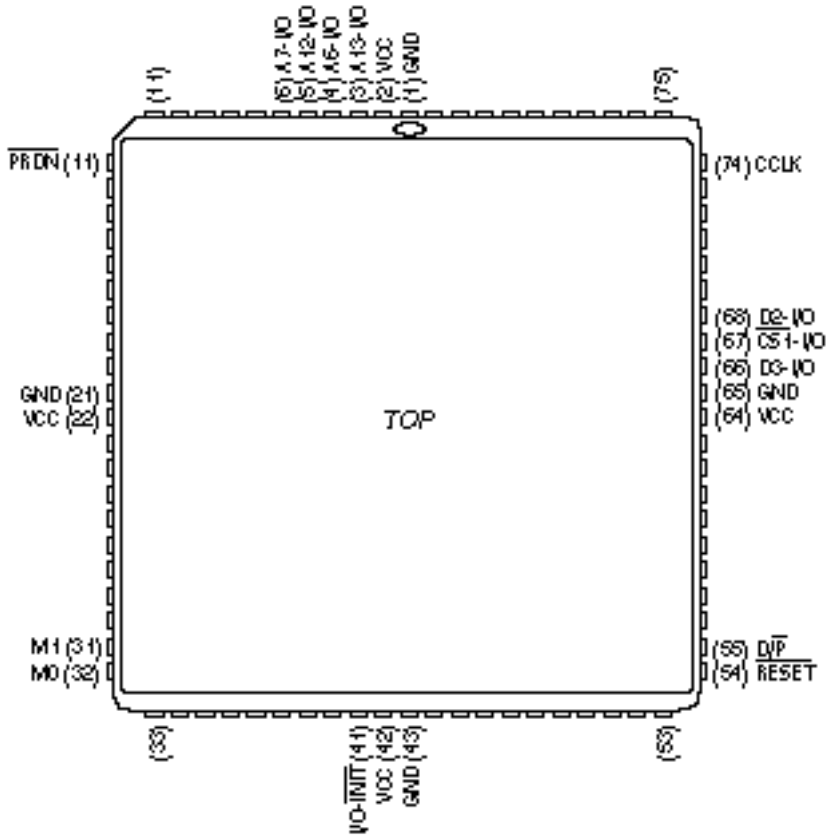
PC84 Plastic Leaded Chip Carrier with 84 Leads, 50-mil Lead Pitch



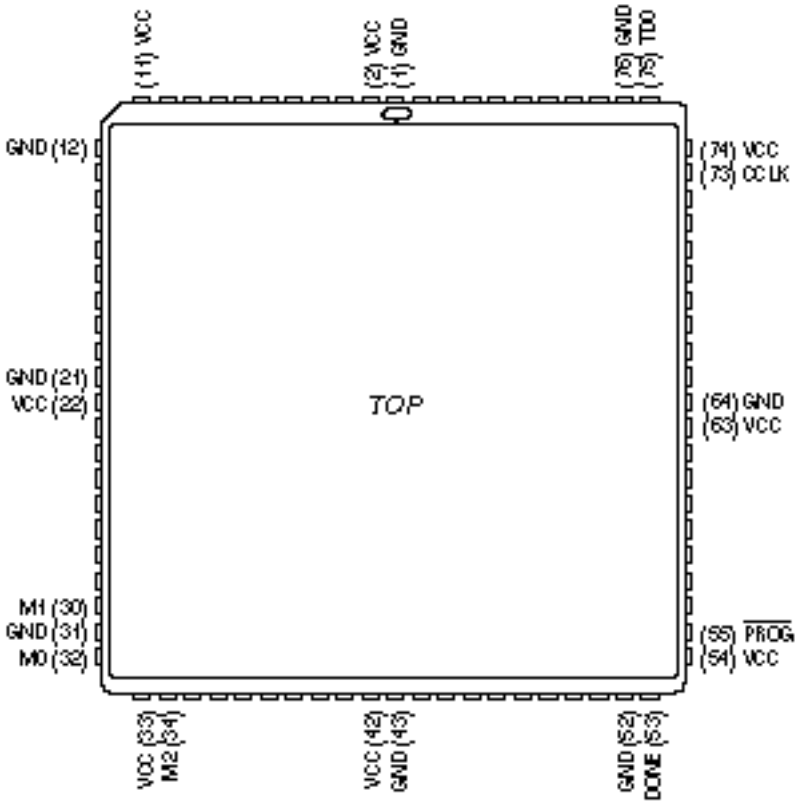
Part Number	Device I/Os	Available I/Os
XC3020	64	64
XC3030	80	74
XC3042	96	74

" *Not connected on XC3020, I/O on larger devices*

PC84 Plastic Lead Chip Carrier with 84 Leads, 50-mil Lead Pitch

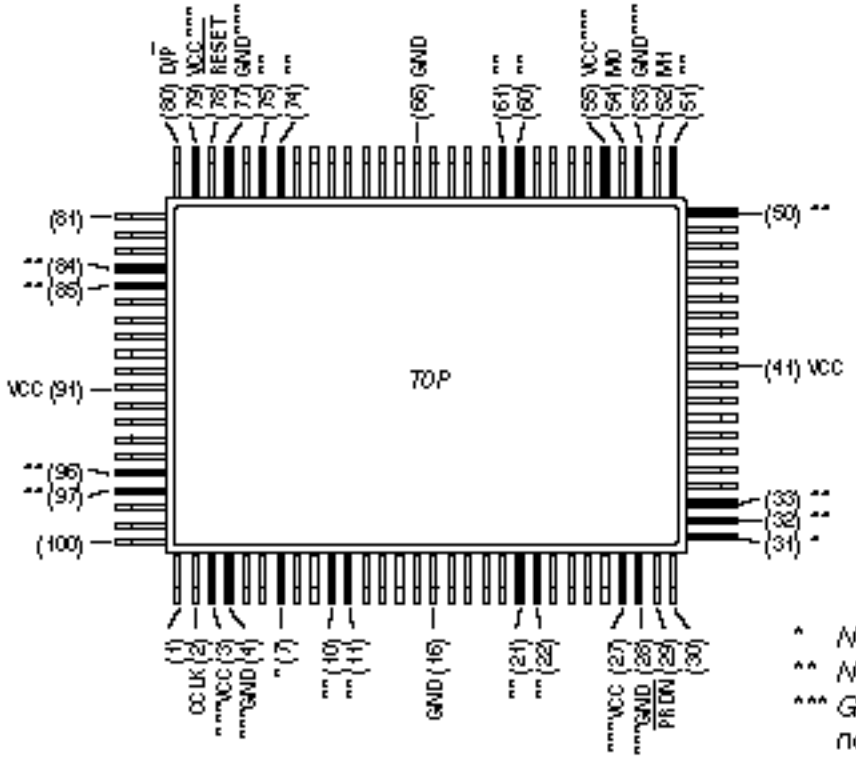


Part Number	Device I/Os	Available I/Os
XC3064	120	70
XC3090	144	70
XC3195A	176	70



Part Number	Device I/Os	Available I/Os
XC4002A	64	61
XC4003/3A	80	61
XC4004A	96	61
XC4005/5A	112	61
XC4006	128	61
XC4008	144	61
XC4010/10D	160	61

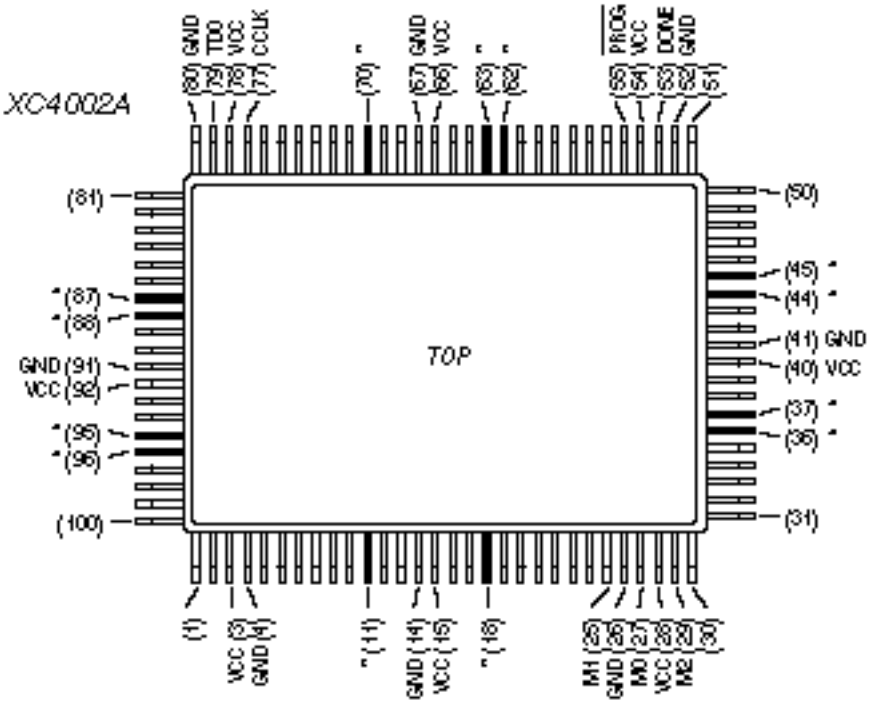
PQ100 Plastic Quad Flat Pack with 100 Leads, 0.65-mm Lead Pitch



Part Number	Device I/Os	Available I/Os
XC3020	64	64
XC3030	80	80
XC3042	96	82

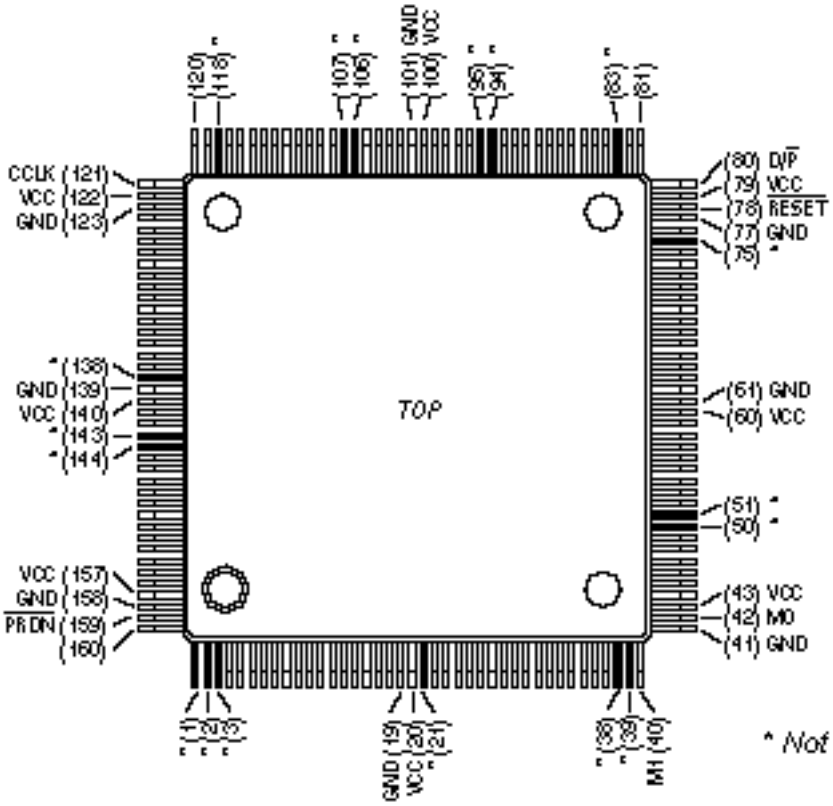
* *Not connected on XC3020 and XC3030*
** *Not connected only on XC3020*
*** *GND or VCC on XC3030 and XC3040, not connected on XC3020*

* *Not connected on XC4002A*



Part Number	Device I/Os	Available I/Os
XC4002A	64	64
XC4003/3A	80	77

PQ160 Plastic Quad Flat Pack with 160 Leads, 0.65-mm Lead Pitch



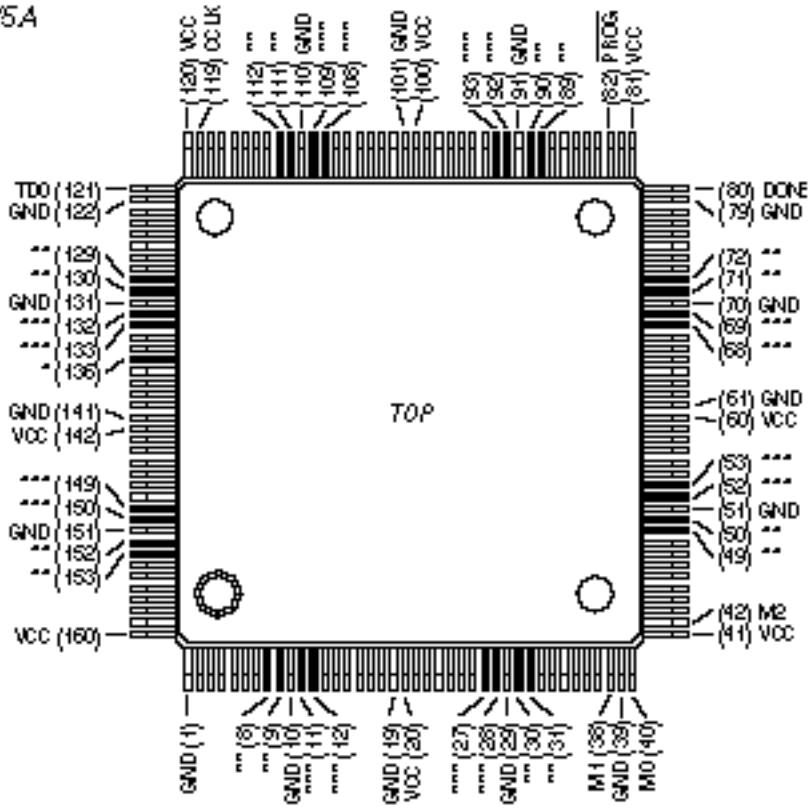
Part Number	Device I/Os	Available I/Os
XC3064	120	120
XC3090	144	138
XC3195A	176	138

* *Not connected on XC3064*

* *Not connected on XC4006, XC4005/5A and XC4004A*

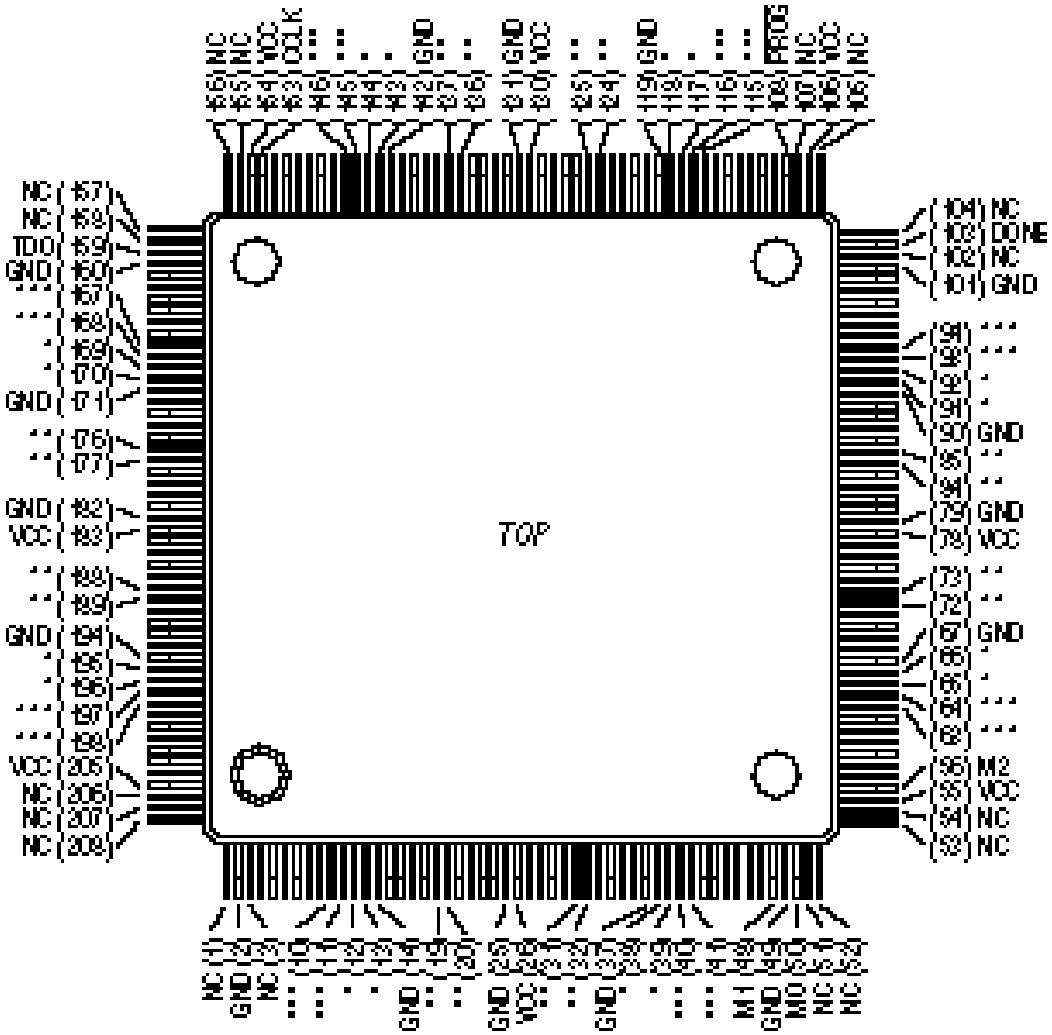
** *Not connected only on XC4005/5A and XC4004A*

*** *Not connected only on XC4004A*



Part Number	Device I/Os	Available I/Os
XC4004A	96	96
XC4005/5A	112	112
XC4006	128	128
XC4008	144	129
XC4010/10D	160	129
XC4013/13D	192	129

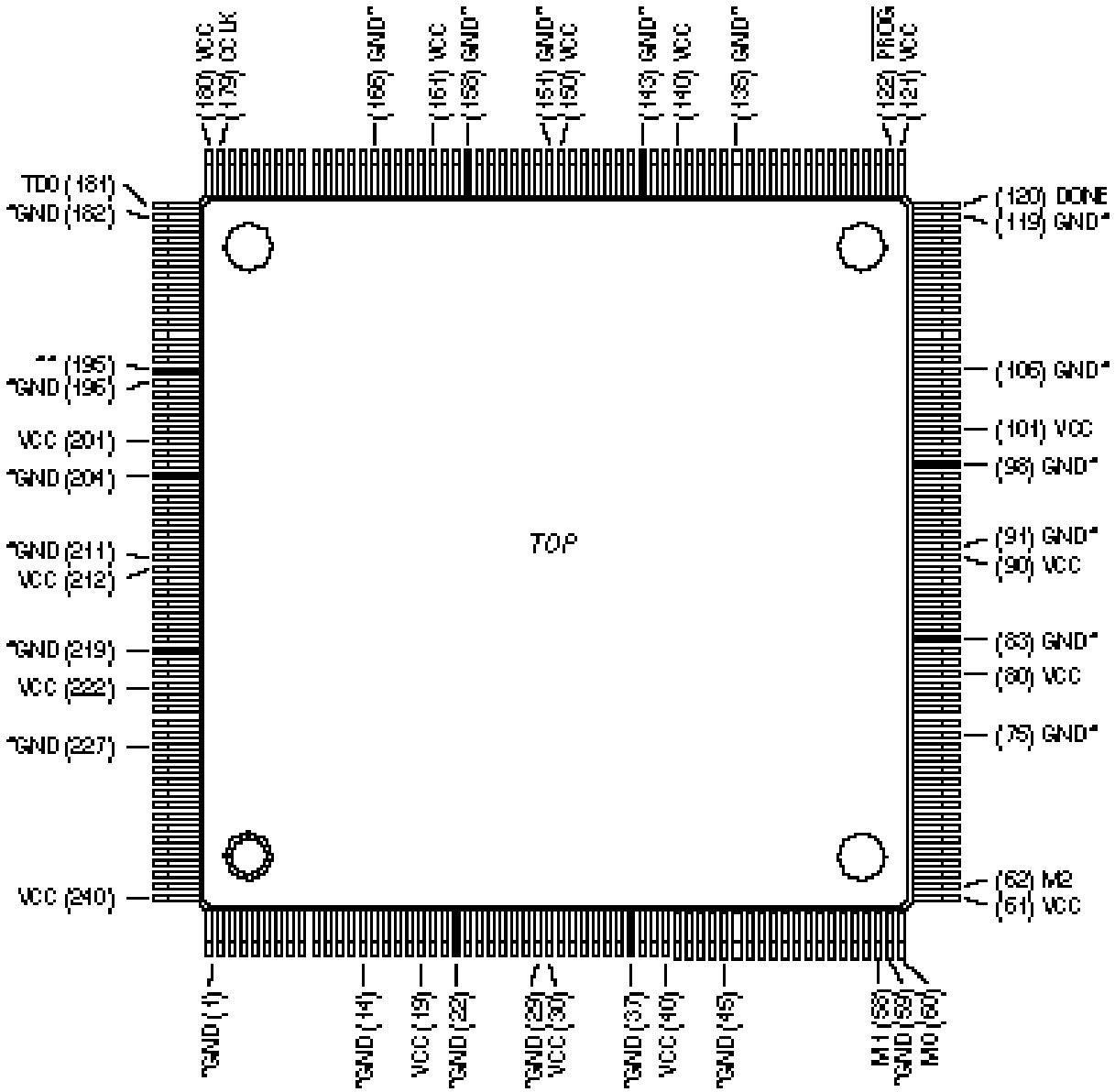
PQ208 Plastic Quad Flat Pack with 208 Leads, 0.50-mm Lead Pitch



NC Not connected on all devices
* Not connected on XC4008, XC4006 and XC4005/5A
** Not connected only on XC4006 and XC4005/5A
*** Not connected only on XC4005/5A

Part Number	Device I/Os	Available I/Os
XC4003H	160	160
XC4005/5A	112	112
XC4006	128	128
XC4008	144	144
XC4010	160	160
XC4013	192	160
XC4020	224	160

PQ240 Plastic Quad Flat Pack with 240 Leads, 0.50-mm Lead Pitch



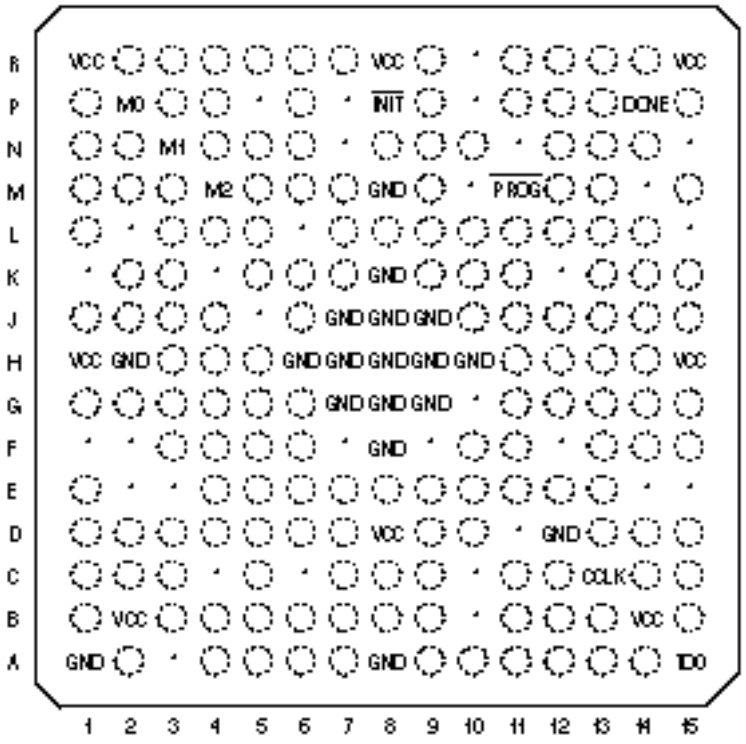
* *Not connected on XC4013 and XC4020*
GND on XC4025 and XC4005H

** *Not connected on XC4013, XC4020 and XC4005H*
I/O on XC4025 (Pin 196)

Part Number	Device I/Os	Available I/Os
XC4005H	192	192
XC4013	192	192
XC4020	224	193
XC4025	256	193

BG225 Plastic Ball Grid Array with 225 Balls, 1.50-mm Lead Pitch

Top View



Part Number	Device I/Os	Available I/Os
XC4010	160	160
XC4013	192	192

** Not connected on XC4010*

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