

## *N2 Newton Interconnect Designers Guide*

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This chapter describes the Newton Interconnect Port. This port was designed to connect the N2 device to a wide variety of peripherals and devices. The Newton Interconnect Port can be used for a variety of different connectivity purposes such as a simple AppleTalk/ serial cable connection, a wireless communication device connection port or a complex docking port for a desktop dock, providing audio input and output capabilities.

Because of the diverse types of devices that can be connected to the N2 device, the Newton Interconnect Port was designed with the flexibility to accommodate the vast majority of these devices. There is no minimum set of required signals: a device could, for example, use only audio out to provide a connection to a set of amplified speakers.

The Newton Interconnect Port contains the following groups of pins:

- 7-pin AppleTalk/Local Talk interface with handshaking signals, using the Serial Communications Controller Channel 0, interfaced through a LTC 1323 AppleTalk transceiver. This makes available differential pair data signals and buffered versions of the handshaking signals. This interface is controlled through two N2 internal GPIO signals that control the power source to the transceiver and shutdown mode.
- Serial Communications Controller Channel 3 with full control signals, Ring Indicator and enable.
- Power Adapter Pins which allow the N2 device to be powered and recharge the batteries through the Newton Interconnect Port.
- Auxillary Audio Input.
- Line Level Auxillary Audio Output.
- An auxillary +5V power source that can be turned on or off under software control.
- A Control input that allows an external peripheral to wake the N2 system if it is in the sleep state or can be used to alert the N2 system to perform AutoDocking functions, if a dock or cable has been inserted in the Newton Interconnect port.

### **Serial Channels Overview**

The Newton Interconnect provides two serial channels for use. Serial Channel 0 and Serial Channel 3. These serial channels are also available for use on the internal serial slot. To prevent the possibility of a two devices driving the bus, a specific serial channel can be enabled on only one connector at a time.

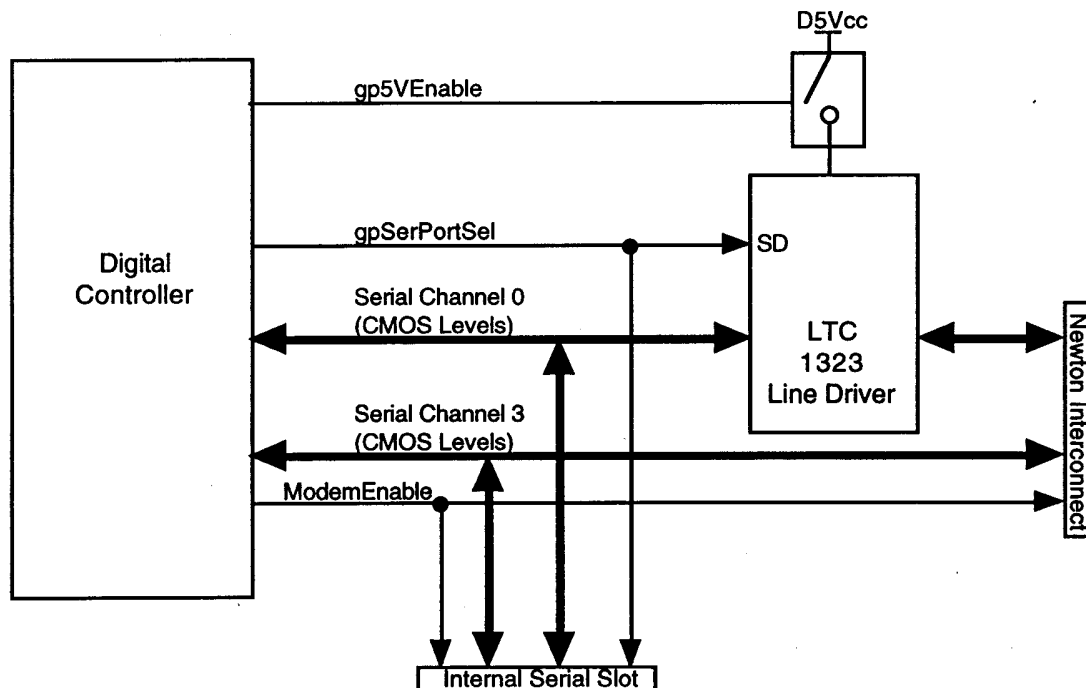
For Serial Channel 0, the LTC1323 line driver drives the Newton Interconnect Port. When this line driver is enabled, devices on the internal modem slot must not drive the serial channel 0 signals. To prevent this from occurring, the line driver enable is available on the internal serial slot. This enable is gpSerPortSel and when low indicates that the Internal Modem Slot can drive the bus. Additionally, the 5 Volt power supply that is used by the Line Driver is controlled by the gp5Venable signal that is internal to the device.

The operation of Serial Channel 3 is slightly different because there is no Line Driver on the Serial Channel 3 signals on the Newton Interconnect Port. The Newton Interconnect Port and the internal Serial Slot have a common enable signal. The signal, InternalModemSelect, indicates which port can drive the serial channel3 signals. If this signal is high, the internal serial slot can

drive the bus. If this signal is low, the Newton Interconnect Port can drive the bus.

Because there is no Line Driver on serial channel 3, care must be taken to ensure that a peripheral does not ignore this signal, possibly causing a bus clash.

A block diagram of the two serial ports and their enables are shown below.



### Serial Channel 0

The Digital Controller's Serial Channel 0 is connected to the Newton Interconnect Port through a LTC 1323 Apple Talk Line Driver. The LTC1323 line driver provides RS-422 level inputs and outputs. Serial Channel 0 provides a differential pair for Receive Data, RXD+/-, and Transmit Data TXD+/- . Additionally, there is a input and output that provide hardware handshaking, HSKi and HSKo. The last signal is a General Purpose Input that can be used as ring indicator.

#### Modes Supported

Serial Channel 0 supports the following modes

- Async, SDLC and LocalTalk protocols
- NRZ, NRZI or FM encoding/decoding
- clocking modes supporting both internal and external clocking
- Data Rates up to 230.4Kb/sec when using the internal clock
- Data Rates 2Mbit/sec when using external clocking

#### Asynchronous Capabilities

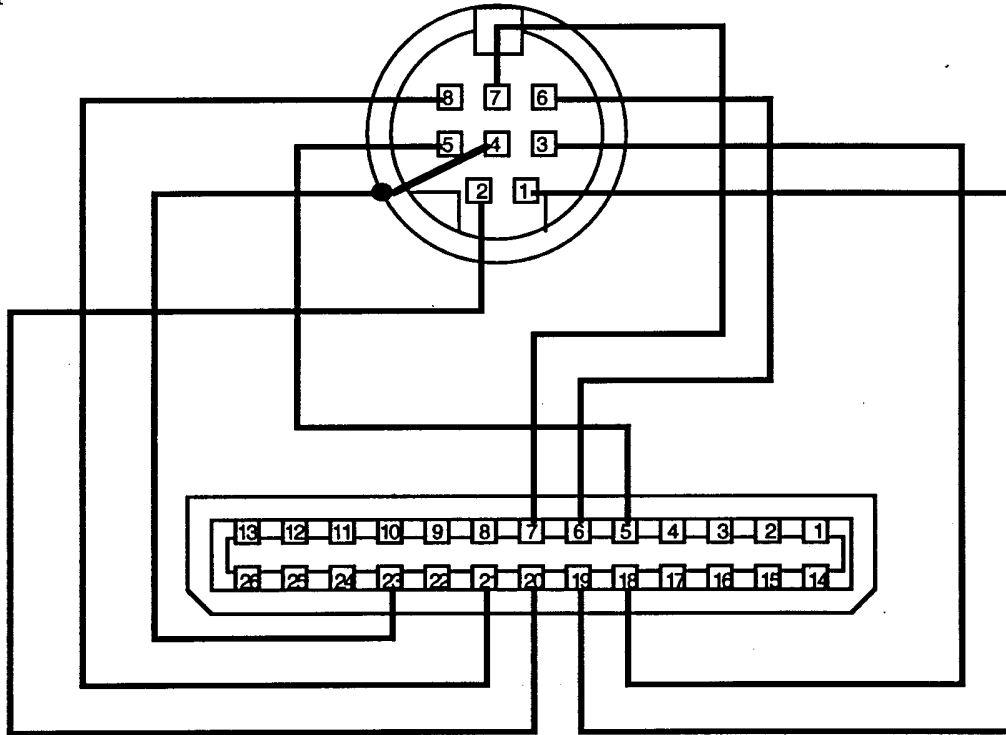
- 5, 6, 7 or 8 bits/character
- 1, 1.5, 2 stop bits
- Odd or even parity
- Break generation and detection capability

The line driver is enabled internally to the N2 device by a general purpose I/O pin. When this I/O pin is not enabled, the LTC part is in shutdown mode and will not drive the internal Serial

bus. Channel 0 is also available on the Internal Serial Slot, along with the enable signal gpserPortSel. The Newton OS is configured to enable the gpSerPortSel signal and the 5V power supply whenever Serial Port 0 is selected.

### Connection to a Standard Apple Serial Cable

The following diagram shows the connections to convert the Newton Interconnect Port to a standard Apple Serial Connection.



**Din 8 Connection to Newton Interconnect Serial Port 0**

Signal Name	Newton Interconnect Pin	DIN 8 Pin
HSKo	19	1
HSKi	20	2
TXD-	18	3
Gnd	23	4
RXD-	8	5
TXD+	6	6
GPI	7	7
RXD+	21	8

### Accessing Serial Channel 0

Serial Channel 0 can be accessed through communication endpoints by using the standard Newton Serial Tool, AppleTalk Tool and Modem Tool. This section assumes that the reader is already familiar with the Newton Os' communication architecture and is referred to the book *Newton Programmer's Guide : Communications* for an explanation of how to access Serial Channel0.

### Serial Tool

There are three varieties of serial tool that are built into the Newton OS:

- a standard asynchronous serial tool
- a standard asynchronous serial tool with Microcom Networking Protocol (MNP) Compression
- a framed asynchronous serial tool

### Standard Asynchronous Serial Tool

To create a standard asynchronous serial endpoint using the standard asynchronous serial tool, the following NewtonScript Code is used:

### Serial Channel 3

Serial Channel 3 is connected directly to the Newton Interconnect Port. The Channel is always enabled and care must be taken in its use. To use Channel 3, any device on the internal modem slot must first be disabled. This is accomplished through a General Purpose I/O signal present on the Internal Serial Slot, called InternalModemSelect. The Newton OS is configured to enable the serial port to the internal slot as the default.

If Serial Port 3 is to be used on the external Newton Interconnect Port, a software driver would need to disable the use of this channel on the internal serial channel. To do this, the GPIO signal InternalModemSelect needs to be driven High. Any device designed for the internal Serial Slot is required to place the outputs in high impedance state if the internal signal is disabled.

### Audio

The Newton Interconnection Port has both Audio Out and Audio In capabilities. These can be used to connect to auxiliary Audio In and Out devices.

AudioOut is a single-ended signal at Line level, referenced from AGND. AudioOut is capable of driving impedance loads down to 1K Ohms. The Analog Controller is capable of directing audio out to either the internal speaker, the AuxAudioOut pin or both.

AudioIn is a single-ended signal at Line level, referenced from AGND. The Analog Controller is capable of accepting input from either the internal microphone or the Newton Interconnect Port.

### Audio Out Specification

This section specifies the Audio Out parameters from the Newton Interconnect Port.

<u>Parameter</u>	<u>Min</u>	<u>Typ</u>	<u>Max</u>	<u>Units</u>
Full Scale Output Voltage	0.85	1.0	1.15	V <sub>peak</sub>
Instantaneous Dynamic Range (Attenuation at 0dB)	65	68		dB
Frequency Response (7.2Khz Word Rate)	-0.6	-	0.6	dB
Frequency Response (21.6kHz Word Rate)	-0.8	-	0.6	dB
Programmable Output Level Attenuation	-102.4	-	0	dB
Gain Step Size	-	2.49	-	dB
Gain Drift	-	350	-	ppm/C
Common Mode Output Voltage	-	1.0	-	Volts
Output Impedance	-	10	-	Ohms
Load Impedance	1K	-	-	Ohms
Short Circuit Current Limit	-	-	50	mA
Total Harmonic Distortion at -0.5db Full-Scale level	-	0.05	0.07	percent

## Software

Audio out from the Newton device can be set by the user by using the preferences Roll. Selecting Line or Line-speaker will cause the audio to be played on the external speaker. This can also be accomplished through the NewtonScript call XXXX.

## Audio In Specification

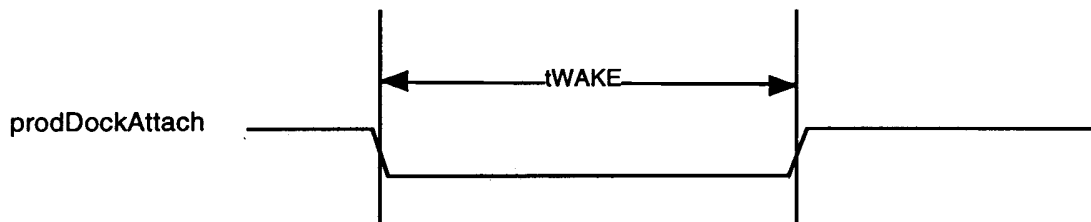
This section describes the Audio In parameters to the Newton Interconnect Port

### Dock Attached

Newton Interconnect provides a single control signal, prodDockAttach, that can be used to perform two functions. One function is to wake the system from the sleep state. The other function allows the N2 device to detect the presence of a dock and perform autodocking connection functions with a desktop machine. The signal prodDockAttach is a GPIO signal that the N2 system configures as an input, that is active low.

### Waking the system

If the N2 system is in the sleep state, it can be awakened by pulsing the prodDockAttach signal low for approximately 1msec. The Newton Operating System programs this GPIO to wake the N2 system under this condition. If the unit is awake, the pulse will be ignored. Timing for the prodDockAttach signal to wake the system is shown below:



**System WakeUp Timing**

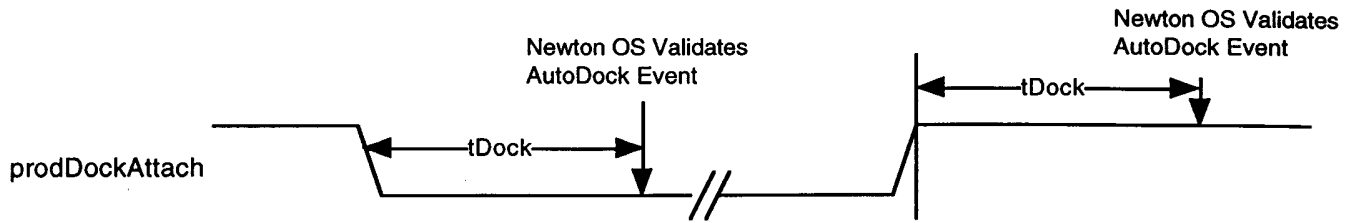
Parameter	Description	Min	Max	Units
tWake	Wake up Pulse Width	1	2	msec

### AutoDocking

The prodDockAttach signal can also be used to alert the system that a external system peripheral has been attached to the N2 unit and that autodocking should be performed.

To perform autodocking, the prodDockAttached signal must be driven low and must remain at low until the dock is removed. The prodDockAttach signal must remain low for at least 10msec to be recognized by the operating system as a docking event.

If the unit is in the sleep state, the unit will awake once the prodDockAttach signal has been asserted. Timing is shown below:



## AutoDocking Timing

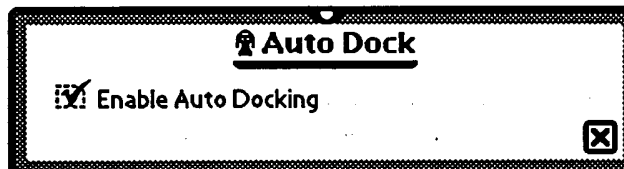
Parameter	Description	Min	Max	Units
tDock	prodDockAttach debounce time	10	--	msec

### Software

#### User Interface

#### AutoDock Prefs Roll Entry

To enable AutoDocking, the user must select the AutoDock prefs entry. Once this entry has been selected, a dialog will be presented. AutoDocking is selected by checking the Enable Auto Docking check box as shown below:



When this box is checked and the prodDockAttach signal is asserted for more than 10msec, the Newton OS will display the following AutoDock Floater. The prodDockAttached signal must remain asserted during the entire AutoDocking Session. If the signal is deasserted, the dialog box will be automatically closed. The user can then start the AutoDock session by selecting the AutoDock Button or can cancel the session by selecting the close box.



### API

There are two NewtonScript level functions that support the registering of an application to support AutoDocking.

#### Registering for AutoDock Events

This function allows a application to register a function that will be called when a dock event occurs. The method syntax is

RegAutoDock (appsymbol, fn)

Where

appsymbol is the application symbol  
fn is a method that is called once the autodock event occurs.  
fn's syntax is  
fn(dockEventSymbol)

Where dockEventSymbol is one of the following messages:

connect - When a device is attached to the Newton Interconnect port and asserts prodDockAttach

disconnect - When a device is removed from the Newton Interconnect port or deasserts prodDockAttached.

#### **Removing an App from the AutoDock Registry.**

To remove an application's function from the AutoDock Registry, the following API should be called

UnRegAutoDock(appsymbol)

Where

appsymbol is the application symbol

#### **+5 Volt Power Supply**

The Newton Interconnect Port has a +5 Volt Power Supply that can be used to power external devices that are connected to the port. This power supply is enabled by a General Purpose I/O signal and can be turned on under software control.

Currently, the Newton Operating System supplies 5 volt power to this signal when Serial Port 0 is configured to operate in GeoPort mode or when the user selects the recording source as "Line" in the "recording" section of the Preferences role. This can be used to power an external amplifier to drive the inputs of a microphone.

The Power supply is shared by the other devices in the system. Because of this, the amount of power that the supply can source is shared among a number of devices.

#### **Power Budget**

The 5V Power supply is shared among the Internal Serial Slot, the ROM simm connector, the two PCMCIA slots, internal FLASH during programming and the LTC Line Driver. Besides the internal components, the 5 V power supply can source 500ma of additional current. This current is shared among the Internal Serial Slot, the PCMCIA Slots and the Newton Interconnect Port. Any power that is used by these other slots must be subtracted to determine the amount of current available to the Newton Interconnect Port. However, the maximum current that can be sourced by the Newton Interconnect Port can never exceed 100ma.

#### **Power Supply Specifications**

This section specifies the DC operating conditions of the 5Volt Power Source available on the Newton Interconnect Port

<u>Supply</u>	<u>Min. Voltage</u>	<u>Max. Voltage</u>
Dock5V	4.5V	5.5V

<u>Supply</u>	<u>Min. Current</u>	<u>Max. Current</u>
Dock5V	--	100ma

#### **Power Adapter Signals**

The Newton Interconnect Port allows a power adaptor to source 2 cell or 4 cell devices. 2 cell devices are sourced through PowerInPos2, while 4 cell devices are sourced through PowerInPos4. Because the N2 device is a 4 Cell device, PowerInPos2 is not connected.

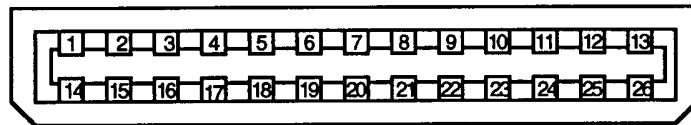
The power adapter is connected to two signals on the N2's Newton Interconnect Port. The Power Adapter Positive Voltage is applied to the signal PowerInPos4 on two pins. The Power Adapter Ground is applied to the signal PowerInNeg on 3 pins.

Besides powering the unit, a power adaptor can also charge the internal batteries if a rechargeable battery pack is installed and properly detected.

Specifications for design of a Power Adaptor that can source power to the N2 device is described in the chapter N2 Power Adaptor Designer's Guide.

### **Pinout**

This section describes the connection location of the signals on the Newton Interconnect Port. All pin numbers are referenced to the connector diagram shown below. The connector pinout numbers shown are the pin locations on the connector on the N2 device.



### **Newton Interconnect Port**

<b>Pin #</b>	<b>Signal Name</b>	<b>I/O</b>	<b>Signal Description</b>
1	PowerInPos2	I	Positive Power Adaptor Input Voltage 2 Cell Systems
2	PowerInPos4	I	Positive Power Adaptor Input Voltage 4 Cell Systems
3	PowerInNeg	I	Power Adaptor Input Ground
4	auxAudOutPos	O	Audio Out, Capable of driving a 1K load
5	AGnd	O	Auxillary Audio Ground
6	SerialTXdP	O	Serial Channel 0 TX+
7	SerialGpi		
8	SerialRXdN	I	Serial Channel 0 RX-
9	ModemTXd3	O	Serial Channel 3 Transmit
10	InternalMdmSel	O	Enable for internal serial slot
11	dock5V	O	+5 Volt Supply
12	ModemNotDTR	I	Serial Channel 3 Data Terminal Ready
13	ModemRTS3	O	Serial Channel 3 Request to Send
14	PowerInPos	I	Positive Power Adaptor Voltage 4 Cell Systems
15	PowerInNeg	I	Power Adaptor Ground
16	PowerInNeg	I	Power Adaptor Ground
17	auxAudioIn	I	Audio Input
18	SerialTXdN	O	Serial Channel 0 TX-
19	SerialHskO		Serial Channel 0
20	SerialHskI		Serial Channel 0
21	SerialRxdP	I	Serial Channel 0 Rx-
22	ModemRxd3	I	Serial Channel 3 RX
23	dGND	O	Digital Ground
24	ModemRI3	I	Serial Channel 3 Ring Indicator
25	Modem NotRTS3		Serial Channel 3 Request to Send
26	prodDockAttach		Wakeup/Docking Signal



<b>Power</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
PowerInPos2	1	I	Positive Power Adaptor Input Voltage 2 Cell Systems
PowerInPos4	2,14	I	Positive Power Adaptor Input Voltage 4 Cell Systems
PowerInNeg	3,15,16	I	Power Adaptor Input Ground
dGND	23	I	Digital Ground
dock5V	11	O	+5 Volt Supply

<b>Audio</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
auxAudOutPos	4	O	Line Level Audio Out
AudioIn	17	I	Audio Input
AGnd	5	O	Audio Ground

<b>Serial Port 0</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
SerialTXdP	6	O	Serial Channel 0 TX+
Serial Gpi	7		
SeriaRXdN	8	I	Serial Channel 0 RX-
SerialTXdN	18	O	Serial Channel 0 TX-
SerialHskO	19		Serial Channel 0
SerialHskI	20		Serial Channel 0
SerialRxdP	21	I	Serial Channel 0 Rx-

<b>Serial Port 3</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
ModemTXd3	9	O	Serial Channel 3 Transmit
ModemNotDTR	12	I	Serial Channel 3 Data Terminal Ready
ModemRTS3	13	O	Serial Channel 3 Request to Send
ModemRxd3	22	I	Serial Channel 3 RX
ModemRI3	24	I	Serial Channel 3 Ring Indicator
Modem NotRTS3	25		Serial Channel 3 Request to Send
IntModemSel	10	O	Enable for Internal Serial Channel 3

<b>Control Signals</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
prodDockAttach	26	I	Wakeup/ Docking Signal

<b>Power</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
PowerInPos2	1	I	Positive Power Adaptor Input Voltage 2 Cell Systems
PowerInPos4	2,14	I	Positive Power Adaptor Input Voltage 4 Cell Systems
PowerInNeg	3,15,16	I	Power Adaptor Input Ground
dGND	23	I	Digital Ground
dock5V	11	O	+5 Volt Supply

<b>Audio</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
auxAudOutPos	4	O	Line Level Audio Out
AudioIn	17	I	Audio Input
AGnd	5	O	Audio Ground

<b>Serial Port 0</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
SerialTXdP	6	O	Serial Channel 0 TX+
Serial Gpi	7		
SerialRXdN	8	I	Serial Channel 0 RX-
SerialTXdN	18	O	Serial Channel 0 TX-
SerialHskO	19		Serial Channel 0
SerialHskI	20		Serial Channel 0
SerialRxdP	21	I	Serial Channel 0 Rx-

<b>Serial Port 3</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
ModemTXd3	9	O	Serial Channel 3 Transmit
ModemNotDTR	12	I	Serial Channel 3 Data Terminal Ready
ModemRTS3	13	O	Serial Channel 3 Request to Send
ModemRxd3	22	I	Serial Channel 3 RX
ModemRI3	24	I	Serial Channel 3 Ring Indicator
Modem NotRTS3	25		Serial Channel 3 Request to Send
IntModemSel	10	O	Enable for Internal Serial Channel 3

<b>Control Signals</b>			
<b>Signal Name</b>	<b>Pin#</b>	<b>I/O</b>	<b>Signal Description</b>
prodDockAttach	26	I	Wakeup/ Docking Signal