Digi XBee Application Note

Migration from XBee/XBee-PRO ZB (S2/S2B) to XBee/XBee-PRO ZB (S2C)

This guide will assist you with migrating from the XBee/XBee-PRO ZB (S2/S2B) to the XBee/XBee-PRO ZB (S2C) Through-Hole modules. Even though these XBee modules are similar in function, there are some differences that you need to keep in mind. The S2/S2B used the Ember EM250 microprocessor to control the ZigBee Protocol. The XBee/XBee-PRO ZB (S2C) module uses the Ember EM357; this new microprocessor contains much more memory allowing for more flexibility. The footprint of the XBee/XBee-PRO ZB (S2C) Though-Hole is identical to the XBee/XBee-PRO ZB (S2/S2B) and is fully over-the-air (OTA) compatible. A key change with the XBee/XBee-PRO ZB (S2C) is that six firmware images (Coordinator AT, Coordinator API, Router AT, Router API, End Device AT, and End Device API) are combined into a single firmware load.

Migration Considerations

XBee ZigBee (S2) to XBee ZigBee (S2C) Through-Hole Considerations

Considerations	XBee ZB (S2)	XBee ZB (S2C) TH	Comments
Indoor/Urban Range	up to 133 ft. (40 m)	Up to 200 ft. (60 m)	Improved
Outdoor RF line-of-sight Range	up to 400 ft. (120 m)	Up to 4000 ft. (1200 m)	Improved
Transmit Power Output	2mW (+3dBm), Boost mode 1.25mW (+1dBm), Normal mode	6.3mW (+8dBm), Boost mode 3.1mW (+5dBm), Normal mode Channel 26 max power is +3dBm	Improved Note: An International variant of the XBee ZB (S2C) TH is not available; the +8dBm non-PRO variant should be used.
Receiver Sensitivity	-96 dBm, Boost mode -95 dBm, Normal mode	-102 dBm, Boost mode -100 dBm, Normal mode	Improved
Operating Current (Transmit)	40mA (@ 3.3 V, Boost mode) 35mA (@ 3.3 V, Normal mode)	45mA (+8 dBm, Boost mode) 33mA (+5 dBm, Normal mode)	Slightly higher on boost mode to due to increased output power. Improved on normal mode.
Operating Current (Receive)	40mA (@ 3.3 V, Boost mode) 38mA (@ 3.3 V, Normal mode)	31mA (Boost mode) 28mA (Normal mode)	Improved
SPI	Not Supported	5 Mbps maximum (burst)	Added SPI interface
FCC ID	OUR-XBEE2	MCQ-S2CTH	Customer will need to change the label on their end product to show the appropriate FCC ID for the S2C.
Industry Canada (IC) ID	4214A-XBEE2	1846A-S2CTH	Customer will need to change the label on their end product to show the appropriate IC ID for the S2C.

XBee-PRO ZigBee (S2) to XBee-PRO ZigBee (S2C) Through-Hole Considerations

Considerations	XBee-PRO ZB (S2)	XBee-PRO ZB (S2C) TH	Comments
Transmit Power Output	50mW (+17 dBm)	63mW (+18 dBm)	Improved
Receiver Sensitivity	-102 dBm	-101 dBm	Comparable
Supply Voltage	3.0 - 3.4 V	2.7 - 3.6 V	Larger voltage range
Operating Current (Transmit)	295mA (@3.3 V)	120mA @ +3.3 V, +18 dBm	Improved
Operating Current (Receive)	45 mA (@3.3 V)	31 mA	Improved
Power-down Current	3.5µA @ 25°C	< 1µA @ 25°C	Improved
Channels	11 to 24	11 to 25	One additional channel
SPI	Not Supported	5 Mbps maximum (burst)	Added SPI interface
FCC ID	MCQ-XBEEPRO2	MCQ-PS2CTH	Customer will need to change the label on their end product to show the appropriate FCC ID for the S2C.
Industry Canada (IC) ID	1846A-XBEEPRO2	1846A-PS2CTH	Customer will need to change the label on their end product to show the appropriate IC ID for the S2C.

XBee-PRO ZigBee (S2B) to XBee-PRO ZigBee (S2C) Through-Hole Considerations

Considerations	XBee-PRO ZB (S2B)	XBee-PRO ZB (S2C) TH	Comments
Receiver Sensitivity	-102 dBm	-101 dBm	Comparable
Operating Current (Transmit)	205mA, up to 220 mA with programmable variant (@3.3 V)	120mA @ +3.3 V, +18 dBm	Improved
Operating Current (Receive)	47 mA, up to 62 mA with programmable variant (@3.3 V)	31mA	Improved
Power-down Current	3.5µA @ 25°C	< 1µA @ 25°C	Improved
SPI	Not Supported	5 Mbps maximum (burst)	Added SPI interface
FCC ID	MCQ-PROS2B	MCQ-PS2CTH	Customer will need to change the label on their end product to show the appropriate FCC ID for the S2C.
Industry Canada (IC) ID	1846A-PROS2B	1846A-PS2CTH	Customer will need to change the label on their end product to show the appropriate IC ID for the S2C.

Pin Compatibility

The XBee/XBee-PRO ZB (S2C) introduces the SPI serial interface to Digi's through-hole ZigBee radio. The table below shows which pins are used for the SPI interface. Please refer to the XBee/XBee-PRO ZB (S2C) product manual for more information.

Pin #	XBee/XBee-PRO ZB (S2/S2B)	XBee/XBee-PRO ZB (S2C) TH
1	VCC	VCC
2	DOUT	DOUT / DIO13
3	DIN / CONFIG	DIN / CONFIG / DIO14
4	DIO12	DIO12 / SPI_MISO
5	RESET	RESET
6	RSSI PWM / DIO10	RSSI PWM / PWMO DIO10
7	DIO11	PWM1 / DIO11
8	[RESERVED]	[RESERVED]
9	DTR / SLEEP_RQ/ DIO8	DTR / SLEEP_RQ / DIO8
10	GND	GND
11	DIO4	SPI_MOSI / DIO4
12	CTS / DIO7	CTS / DIO7
13	ON / SLEEP	ON_SLEEP / DIO9
14	VREF	VREF
15	ASSOCIATE / DIO5	ASSOCIATE / DIO5
16	RTS / DIO6	RTS / DIO6
17	AD3 / DIO3	AD3 / DIO3 / SPI_SSEL
18	AD2 / DIO2	AD2 / DIO2 / SPI_CLK
19	AD1 / DIO1	AD1 / DIO1 / SPI_ATTN
20	AD0 / DIO0 / COMMISIONING BUTTON	AD0 / DIO0 / COMMISIONING BUTTON

Part Number Migration Guide

The following table shows which XBee/XBee-PRO ZB (S2C) module to migrate to depending on which XBee/XBee-PRO ZB (S2/S2B) module you are currently using.

Legacy Part Number	Description	Migrate To	Description
XB24-BPIT-***	XBee ZB (ZNet 2.5) low power ZigBee module w/ PCB antenna	XB24CZ7PIT-004	XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XB24-BSIT-***	XBee ZB (ZNet 2.5) low power ZigBee module w/ RPSMA connector	XB24CZ7SIT-004	XBee ZB (S2C) low power ZigBee module w/ RPSMA connector
XB24-BUIT-***	XBee ZB (ZNet 2.5) low power ZigBee module w/ U.FL connector	XB24CZ7UIT-004	XBee ZB (S2C) low power ZigBee module w/ U.FL connector
XB24-BWIT-***	XBee ZB (ZNet 2.5) low power ZigBee module w/ integrated wire antenna	XB24CZ7WIT-004	XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XBP24-BPIT-***	XBee-PRO ZB (ZNet 2.5) module w/ PCB antenna	XBP24CZ7PIT-004	XBee-PRO ZB (S2C) module w/ PCB antenna
XBP24-BSIT-***	XBee-PRO ZB (ZNet 2.5) module with RPSMA connector	XBP24CZ7SIT-004	XBee-PRO ZB (S2C) module with RPSMA connector
XBP24-BUIT-***	XBee-PRO ZB (ZNet 2.5) module w/ U.FL antenna connector	XBP24CZ7UIT-004	XBee-PRO ZB (S2C) module w/ U.FL antenna connector
XBP24-BWIT-***	XBee-PRO ZB (ZNet 2.5) module w/ wire antenna	XBP24CZ7WIT-004	XBee-PRO ZB (S2C) module w/ wire antenna
XBP24-BPIT-***J	XBee-PRO ZB (ZNet 2.5) module w/ PCB antenna (International)	XB24CZ7PIT-004	XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XBP24-BSIT-***J	XBee-PRO ZB (ZNet 2.5) module with RPSMA connector (International)	XB24CZ7SIT-004	XBee ZB (S2C) low power ZigBee module w/ RPSMA connector
XBP24-BUIT-***J	XBee-PRO ZB (ZNet 2.5) module w/ U.FL antenna connector (International)	XB24CZ7UIT-004	XBee ZB (S2C) low power ZigBee module w/ U.FL connector
XBP24-BWIT-***J	XBee-PRO ZB (ZNet 2.5) module w/ wire antenna (International)	XB24CZ7WIT-004	XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XB24-Z7PIT-***	XBee ZB (S2) low power ZigBee module w/ PCB antenna	XB24CZ7PIT-004	XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XB24-Z7WIT-***	XBee ZB (S2) low power ZigBee module w/ integrated wire antenna	XB24CZ7WIT-004	XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XB24-Z7UIT-***	XBee ZB (S2) low power ZigBee module w/ U.FL connector	XB24CZ7UIT-004	XBee ZB (S2C) low power ZigBee module w/ U.FL connector
XB24-Z7SIT-***	XBee ZB (S2) low power ZigBee module w/ RPSMA connector	XB24CZ7SIT-004	XBee ZB (S2C) low power ZigBee module w/ RPSMA connector
XBP24-Z7PIT-***	XBee-PRO ZB (S2) module w/ PCB antenna	XBP24CZ7PIT-004	XBee-PRO ZB (S2C) module w/ PCB antenna
XBP24-Z7WIT-***	XBee-PRO ZB (S2) module w/ wire antenna	XBP24CZ7WIT-004	XBee-PRO ZB (S2C) module w/ wire antenna

XBP24-Z7UIT-***	XBee-PRO ZB (S2) module w/ U.FL antenna connector	XBP24CZ7UIT-004	XBee-PRO ZB (S2C) module w/ U.FL antenna connector
XBP24-Z7SIT-***	XBee-PRO ZB (S2) module with RPSMA connector	XBP24CZ7SIT-004	XBee-PRO ZB (S2C) module with RPSMA connector
XBP24-Z7PIT-***J	XBee-PRO ZB (S2) module w/ PCB antenna (International)	XB24CZ7PIT-004	XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XBP24-Z7WIT-***J	XBee-PRO ZB (S2) module w/ wire antenna (International)	XB24CZ7WIT-004	XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XBP24-Z7UIT-***J	XBee-PRO ZB (S2) module w/ U.FL antenna connector (International)	XB24CZ7UIT-004	XBee ZB (S2C) low power ZigBee module w/ U.FL connector
XBP24-Z7SIT-***J	XBee-PRO ZB (S2) module with RPSMA connector (International)	XB24CZ7SIT-004	XBee ZB (S2C) low power ZigBee module w/ RPSMA connector
XBP24BZ7PIT-***	XBee-PRO ZB (S2B) module w/ PCB antenna	XBP24CZ7PIT-004	XBee-PRO ZB (S2C) module w/ PCB antenna
XBP24BZ7SIT-***	XBee-PRO ZB (S2B) module with RPSMA connector	XBP24CZ7SIT-004	XBee-PRO ZB (S2C) module with RPSMA connector
XBP24BZ7UIT-***	XBee-PRO ZB (S2B) module w/ U.FL antenna connector	XBP24CZ7UIT-004	XBee-PRO ZB (S2C) module w/ U.FL antenna connector
XBP24BZ7WIT-***	XBee-PRO ZB (S2B) module w/ wire antenna	XBP24CZ7WIT-004	XBee-PRO ZB (S2C) module w/ wire antenna
XBP24BZ7PIT-***J	XBee-PRO ZB (S2B) module w/ PCB antenna (International)	XB24CZ7PIT-004	XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XBP24BZ7SIT-***J	XBee-PRO ZB (S2B) module with RPSMA connector (International)	XB24CZ7SIT-004	XBee ZB (S2C) low power ZigBee module w/ RPSMA connector
XBP24BZ7UIT-***J	XBee-PRO ZB (S2B) module w/ U.FL antenna connector (International)	XB24CZ7UIT-004	XBee ZB (S2C) low power ZigBee module w/ U.FL connector
XBP24BZ7WIT-***J	XBee-PRO ZB (S2B) module w/ wire antenna (International)	XB24CZ7WIT-004	XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XBP24BZ7SITB***	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ RPSMA connector	XBP24CZ7SITB003	Programmable XBee-PRO ZB (S2C) extended range ZigBee module w/ RPSMA connector
XBP24BZ7WITB***	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ integrated wire antenna	XBP24CZ7WITB003	Programmable XBee-PRO ZB (S2C) extended range ZigBee module w/ integrated wire antenna
XBP24BZ7PITB***	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ PCB antenna	XBP24CZ7PITB003	Programmable XBee-PRO ZB (S2C) extended range ZigBee module w/ PCB antenna
XBP24BZ7UITB***	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ U.FL connector	XBP24CZ7UITB003	Programmable XBee-PRO ZB (S2C) extended range ZigBee module w/ U.FL connector
XBP24BZ7SITB***J	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ RPSMA connector (International)	XB24CZ7SITB003	Programmable XBee ZB (S2C) low power ZigBee module w/ RPSMA connector

XBP24BZ7WITB***J	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ integrated wire antenna (International)	XB24CZ7WITB003	Programmable XBee ZB (S2C) low power ZigBee module w/ integrated wire antenna
XBP24BZ7PITB***J	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ PCB antenna (International)	XB24CZ7PITB003	Programmable XBee ZB (S2C) low power ZigBee module w/ PCB antenna
XBP24BZ7UITB***J	Programmable XBee-PRO ZB (S2B) extended range ZigBee module w/ U.FL connector (International)	XB24CZ7UITB003	Programmable XBee ZB (S2C) low power ZigBee module w/ U.FL connector

Configuration

The XBee/XBee-PRO ZB (S2/S2B) modules had six different firmware images (Coordinator AT, Coordinator API, Router AT, Router API, End Device AT, and End Device API). The XBee/XBee-PRO ZB (S2C) modules combine these six function sets into a single firmware image. The table below shows you which settings to enable on the XBee/XBee-PRO ZB (S2C) modules to match the function set you were using on the XBee/XBee-PRO ZB (S2/S2B) modules.

XBee/XBee-PRO ZB (S2/S2B) Function Set	XBee/XBee-PRO ZB (S2C) Firmware Settings
ZigBee Router AT	Default Settings
ZigBee Router API	Set AP (API Enable) = API enabled [1]
ZigBee Coordinator AT	Set CE (Coordinator Enable) = Enabled [1]
ZigBee Coordinator API	Set CE (Coordinator Enable) = Enabled [1] Set AP (API Enable) = API enabled [1]
ZigBee End Device AT	Set SM (Sleep Mode) = Cyclic Sleep [4]
ZigBee End Device API	Set SM (Sleep Mode) = Cyclic Sleep [4] Set AP (API Enable) = API enabled [1]

What's New

The XBee/XBee-PRO ZB (S2C) introduces some new features and commands such as:

- An alternative serial port is available using SPI slave mode operation
- Six firmware images (Coordinator AT, Coordinator API, Router AT, Router API, End Device AT, and End Device API) are combined into a single firmware
  - ATCE command (1-enables/0-disables) Coordinator mode
  - ATSM command (0 is Router/Coordinator, nonzero is sleeping End Device)
  - Note that Coordinator mode cannot be enabled is SM is nonzero and you can't set a nonzero SM if CE is nonzero
- Fragmentation is now available in both API mode and transparent mode
- P3 (DOUT), P4 (DIN), D8 (SleepRq), and D9 (On-Sleep) are now available for I/O sampling
- Both pull-up and pull-down resistors can now be applied to pins configured for inputs
- ATVL command added for long version information
- ATDO command added for configuring device options
- ATAS command added for Active Scan
- Self-addressed Tx Status messages return a status code of 0x23
- ATDO has HIGH_RAM_CONCENTRATOR and NO_ACK_IO_SAMPLING options added
- Binding and Multicasting transmissions are supported
- AT&X command added to clear binding and group tables
- Added Tx options 0x04 (indirect addressing) and 0x08 (multicast addressing)
- A 5 second break will reset the XBee. Then it will boot with default baud settings into command mode.
- BD range increased from 0-7 to 0-0x0A, and nonstandard baud rates are permitted, but not guaranteed
- NI, DN, ND string parameters support upper and lower case
- TxOption 0x01 disables retries and route repair. RxOption 0x01 indicates the transmitter disabled retries.
- FR returns 0x00 modem status code instead of 0x01
- DC10 - verbose joining mode option
- Self-addressed fragmentable messages now return the self-addressed Tx Status code (0x23) instead of simply success (0x00)
- Three command characters ("+++") typed rapidly will shift the device from API mode to AT command mode
- ATCN will shift the device from AT command mode to API mode