SONY

CXN1000

Bluetooth™ Module

Description

The CXN1000 is a fully integrated Class 2 radio and baseband module conforming to ver. 1.1 of the Bluetooth™ specification.

Features

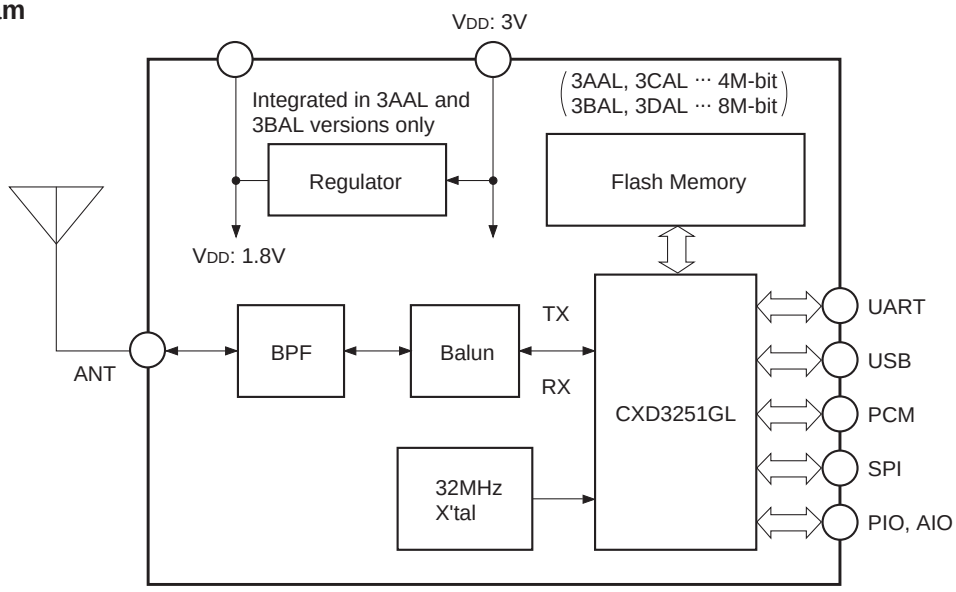
- UART, USB, PCM codec, PIO, and AIO interfaces, enabling a wide range of applications.
- Small package: 11 × 11 × 2.2mm
- 4M-bit or 8M-bit on-module flash memory options
- Voltage regulator options: either on-module or external 1.8V regulator supported
- The CXD3251GL is fully compatible with the Bluecore2-EXT from CSR
- Support for up to 7 slaves from a single master
- Channel quality driven data rate

General Specifications

- Product name: Bluetooth™ module
- Model number: CXN1000-3∗∗L
- Antenna connector impedance: 50Ω
- External interfaces: UART, USB, PCM, PIO, AIO
- Supply voltage: 2.7 to 3.6V*
- Package dimensions: 11.0 × 11.0 × 2.2mm

* An external 1.8 ± 0.1V power supply is required for modules without internal voltage regulator (customer option).

Block Diagram



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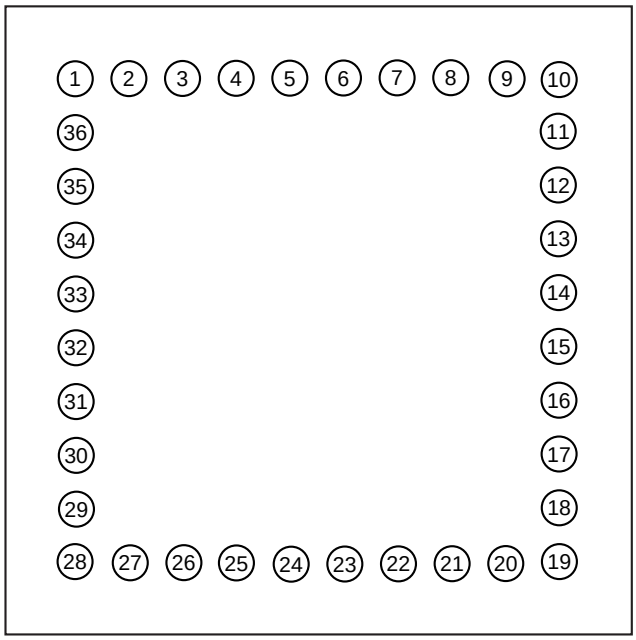
E02860D37

Pin Configuration



Bottom View

Pin Description

No.	Name	Type	Description
1	GND	GND	Ground.
2	V_{DD}3.0	V_{DD}	Supply voltage 3.0V.
3	CE	CMOS input	1.8V regulator control. Regulator on at high.
4	V_{DD}1.8	Monitor Output/V_{DD}	1.8V monitor(-3AAL/-3BAL)/Input 1.8V(-3CAL/-3DAL)
5	PD-RST	CMOS input with 1kΩ pull-down	Reset at high. Input is debounced, so this pin should be high for 5ms or more to cause a reset.
6	PIO_4/USB_ON	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line or USB on.
7	PIO_3/ USB_WAKE_UP	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line or output goes high to wake up PC when in USB mode.
8	PIO_6	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
9	PIO_8	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
10	GND	GND	Ground.
11	RF	Analog	RF input/output.
12	GND	GND	Ground.
13	PIO_7	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
14	AIO_0	Bi-directional	Programmable I/O line.

No.	Name	Type	Description
15	SPI_CSB	CMOS input with weak internal pull-up	Chip select for Serial Peripheral Interface, active low.
16	SPI_MISO	CMOS output, tristatable with weak internal pull-down	Serial Peripheral Interface data output.
17	SPI_CLK	CMOS input with weak internal pull-down	Serial Peripheral Interface clock.
18	SPI_MOSI	CMOS input with weak internal pull-down	Serial Peripheral Interface data input.
19	GND	GND	Ground.
20	GND	GND	Ground.
21	AIO_1	Bi-directional	Programmable I/O line.
22	PCM_CLK	Bi-directional with weak internal pull-down	Synchronous data clock.
23	PCM_OUT	CMOS output, tristatable with weak internal pull-down	Synchronous data output.
24	PCM_SYNC	Bi-directional with 100kΩ pull-down	Synchronous data sync.
25	PCM_IN	CMOS input with weak internal pull-down	Synchronous data input.
26	USB–	Bi-directional	USB data minus.
27	USB+	Bi-directional	USB data plus.
28	GND	GND	Ground.
29	UART_RX	CMOS input with weak internal pull-down	UART data input, active high.
30	UART_TX	CMOS output	UART data output, active high.
31	UART_RTS	CMOS output, tristatable with weak internal pull-up	UART request to send, active low.
32	UART_CTS	CMOS input with weak internal pull-down	UART clear to send, active low.
33	PIO_10	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
34	PIO_9	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
35	PIO_11	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line.
36	PIO_5/ USB_DETACH	Bi-directional with programmable weak internal pull-up/down	Programmable I/O line or chip detaches from USB when this input is high.

Product Name Specifications

CXN1000-3*1*2L

*1 See table below

*2 Firmware version

		Flash memory size	
		4M-bit	8M-bit
1.8V regulator	Integrated	CXN1000-3AAL	CXN1000-3BAL
	Not integrated (external 1.8V supply)	CXN1000-3CAL	CXN1000-3DAL

Electrical Characteristics

Absolute Maximum Ratings

Item		Min.	Max.	Unit
Storage temperature		–40	+85	°C
Supply voltage	V_{DD}1.8	–0.40	1.90	V
	V_{DD}3.0	–0.40	3.60	V

(Only for CXN1000-CAL and CXN1000-3DAL)

Recommended Operating Conditions

Item		Min.	Max.	Unit
Operating temperature range		–40	+85	°C
Supply voltage	V_{DD}1.8	1.70	1.90	V
	V_{DD}3.0	2.70	3.60	V

(Only for CXN1000-CAL and CXN1000-3DAL)

Input/Output Terminal Characteristics

(Temperature: –40 to +85°C)

This I/O pin characteristics is the CXD3251GL IC specifications used internally of the CXN1000.

Digital Terminals		Min.	Typ.	Max.	Unit
Input Voltage					
V_{IL} input logic level low	V_{DD}3.0 = 3.0V	–0.4		0.8	V
V_{IH} input logic level high		0.7 × V_{DD}3.0		V_{DD}3.0 + 0.4	V
Output Voltage					
V_{OL} output logic level low (I_O = 4.0mA)	V_{DD}3.0 = 3.0V	—	—	0.2	V
V_{OH} output logic level high (I_O = 4.0mA)	V_{DD}3.0 = 3.0V	V_{DD}3.0 – 0.2	—	—	V
Input and Tristate Current					
Weak pull-up		–5	–1	0	µA
Weak pull-down		0	1	5	µA
I/O pad leakage current		–1	0	1	µA
C_I input capacitance		2.5	—	10	pF

Input/Output Terminal Characteristics (continued)

USB Terminals	Min.	Typ.	Max.	Unit
Input Threshold				
V_{IL} input logic level low	—	—	$0.3 \times V_{DD}3.0$	V
V_{IH} input logic level high	$0.7 \times V_{DD}3.0$	—	—	V
Input Leakage Current				
$GND < V_{IN} < V_{DD}3.0$	–1	—	1	µA
C_I input capacitance	2.5	—	10	pF
Output Levels to Correctly Terminated USB Cable				
V_{OL} input logic level low	0	—	0.2	V
V_{OH} input logic level high	2.8	—	$V_{DD}3.0$	V

Auxiliary DAC, 8-bit Resolution	Min.	Typ.	Max.	Unit
Resolution	—	—	8	Bits
Average output step size	12.5	14.5	17	mV
Output Voltage	Monotonic: 0.2 to $V_{DD}3.0 – 0.2V$			
Voltage range (I_O = 0)	GND	—	$V_{DD}3.0$	V
Current range	–10	—	0.1	mA
Minimum output voltage (I_O = 100µA)	0	—	0.2	V
Maximum output voltage (I_O = 10mA)	$V_{DD}3.0 – 0.3$	—	$V_{DD}3.0$	V
High impedance leakage current	–1	—	1	µA
Offset	–220	—	120	mV
Integral non-linearity	–2	—	2	LSB
Starting time (50pF load)	—	—	10	µs
Setting time (50pF load)	—	—	5	µs

PD-RST Terminal	Min.	Typ.	Max.	Unit
V_{DD} falling threshold	1.40	1.50	1.60	V
V_{DD} rising threshold	1.50	1.60	1.70	V
Hysteresis	0.05	0.10	0.15	V

Input/Output Terminal Characteristics (continued)

CE Terminal	Min.	Typ.	Max.	Unit
Input Voltage				
V_{IL} input logic level low	—	—	0.2	V
V_{IH} input logic level high	1.7	—	V_{DD}3.0	V
Input Current				
I_{IL} input logic level low	–0.15	—	0.15	µA
I_{IH} input logic level high	–0.15	—	0.15	µA

Radio Characteristics

Transmitter		Condition	Min.	Typ.	Max.	Unit	Remark
Output power (Average)		N & ETC	–6	0	4	dBm	
Modulation characteristics	delta-f1 avg	N & ETC	140	165	175	kHz	11110000 mod.
	delta-f2 max	N & ETC	115	140		kHz	1010 mod.
Initial carrier frequency tolerance		N & ETC		10	75	kHz	
Carrier frequency drift	DH1	N & ETC		12	25	kHz	
	DH3	N & ETC		12	40	kHz	
	DH5	N & ETC		15	40	kHz	
Drift rate	DH1	N & ETC		8	20	kHz/ 50µs	
	DH3	N & ETC		10	20	kHz/ 50µs	
	DH5	N & ETC		12	20	kHz/ 50µs	
20dB bandwidth		N & ETC		900	1000	kHz	
Adjacent channel power	|M-N| = 2	N & ETC		–40	–20	dBm	
	|M-N| ≥3	N & ETC		–50	–40	dBm	
Out-of-band spurious emissions	30M-1G	N & ETC		–65	–36	dBm	
	1G-12.75G	N & ETC		–55	–30	dBm	
	1.8G-1.9G	N & ETC		–75	–47	dBm	
	5.15G-5.3G	N & ETC		–75	–47	dBm	

NTC: Normal Test Conditions +15 to +35°C, ETC: Extreme Test Conditions –40 to +85°C

Radio Characteristics (Continued)

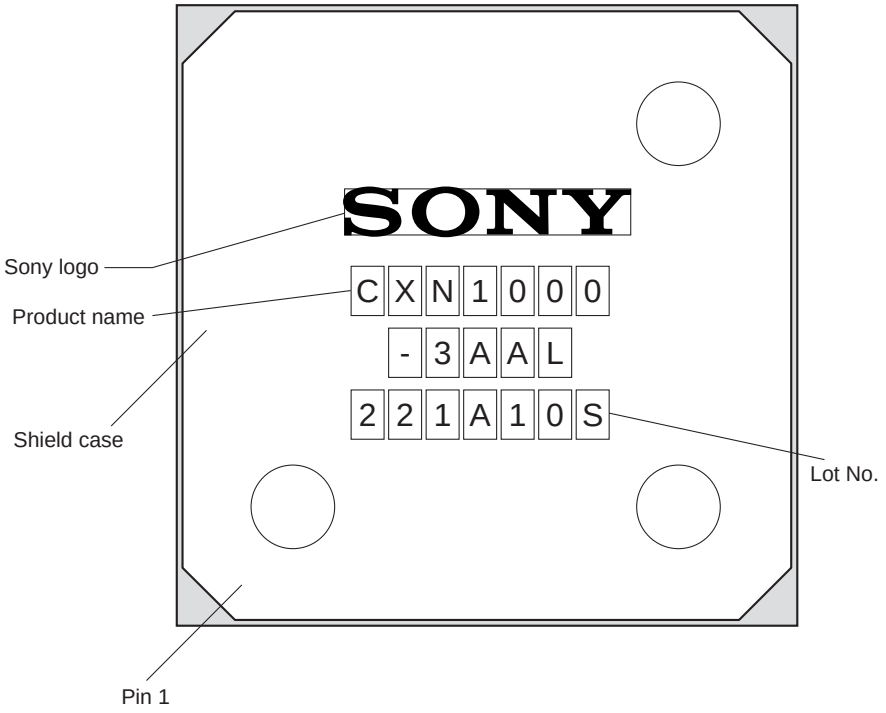
Receiver		Condition	Min.	Typ.	Max.	Unit	Remark
Sensitivity (single slot packets)		N & ETC		–85	–78	dBm	BER < 0.1%
C/I performance	co-ch.	NTC		9	11	dB	
	1MHz	NTC		–2	0	dB	
	2MHz	NTC		–34	–30	dB	
	≥3MHz	NTC		–43	–40	dB	
	Image	NTC		–18	–9	dB	
	Image ± 1MHz	NTC		–23	–20	dB	
Blocking performance	30-2000M	NTC	–10			dBm	
	(800M-1000M)	NTC		10		dBm	
	(1800M-1900M)	NTC		10		dBm	
	2000-2399M	NTC	–27			dBm	
	2498-3000M	NTC	–27			dBm	
	3G-12.75G	NTC	–10			dBm	
Inter modulation performance		NTC	–39	–30		dBm	
Spurious emissions	30M-1G	N & ETC		–78	–57	dBm	
	1G-12.75G	N & ETC		–55	–47	dBm	
Maximum input level		NTC	–20	2	5	dBm	

NTC: Normal Test Conditions +15 to +35°C, ETC: Extreme Test Conditions –40 to +85°C

Current Consumption (Temperature: –40 to +85°C)

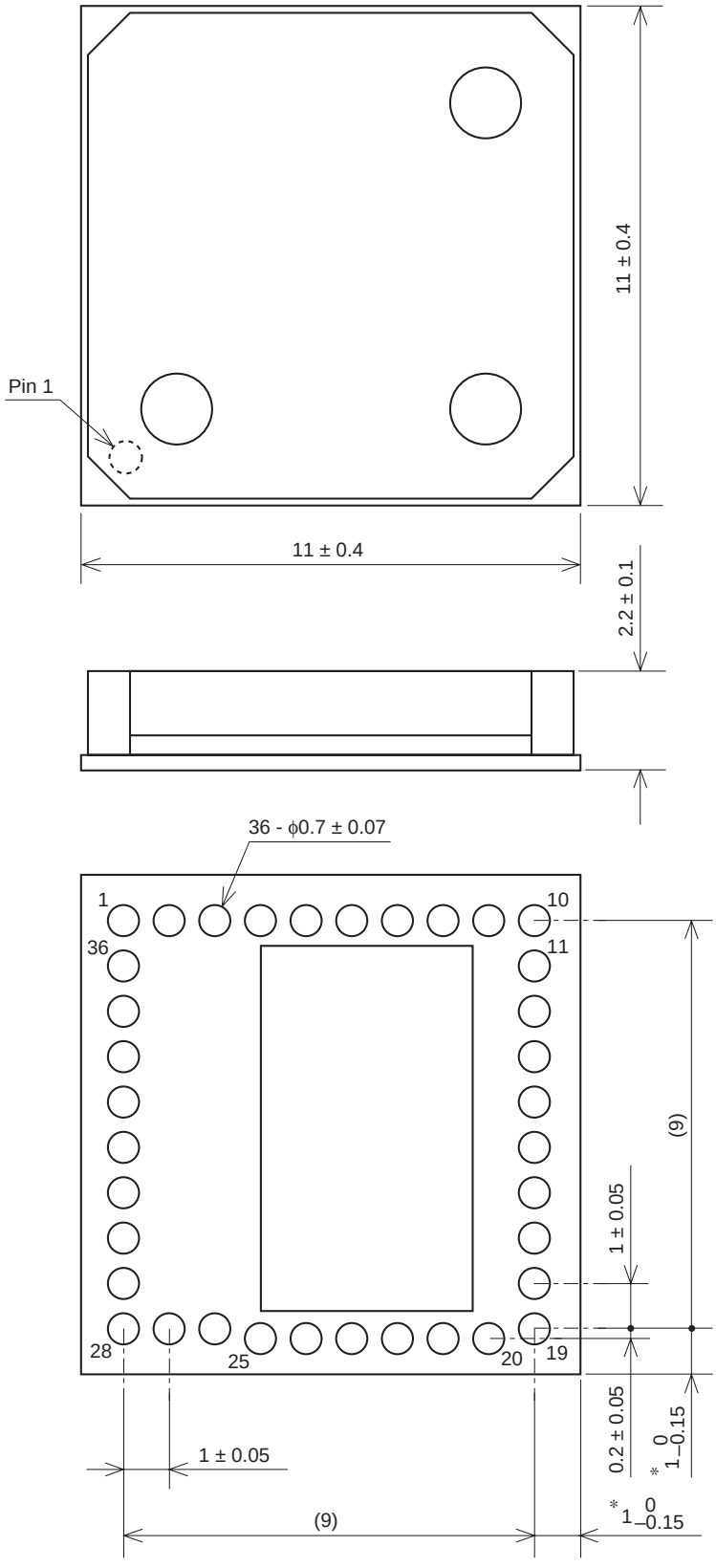
Mode		Average	Peak	Unit	Remark
SCO connection HV3 (1s interval sniff mode)		26		mA	Master or Slave
SCO connection HV1 (Master or Slave)		53		mA	
ACL data transfer 115.2Kbps UART (Master)		15.5		mA	
ACL data transfer 720Kbps USB		53		mA	Master or Slave
ACL connection, Sniff Mode 40ms interval		4		mA	38.4Kbps BCSP
ACL connection, Sniff Mode 1.28s interval		0.5		mA	38.4Kbps BCSP
Parked Slave, 1.28s beacon interval		0.6		mA	38.4Kbps BCSP
Deep sleep mode		0.06	20	mA	38.4Kbps BCSP
Sleep mode		2.2	22	mA	115.2Kbps H4
Peak RF current during RF burst	(0dBm Tx)	57	68	mA	
	(Rx)	47	70	mA	

Marking Contents



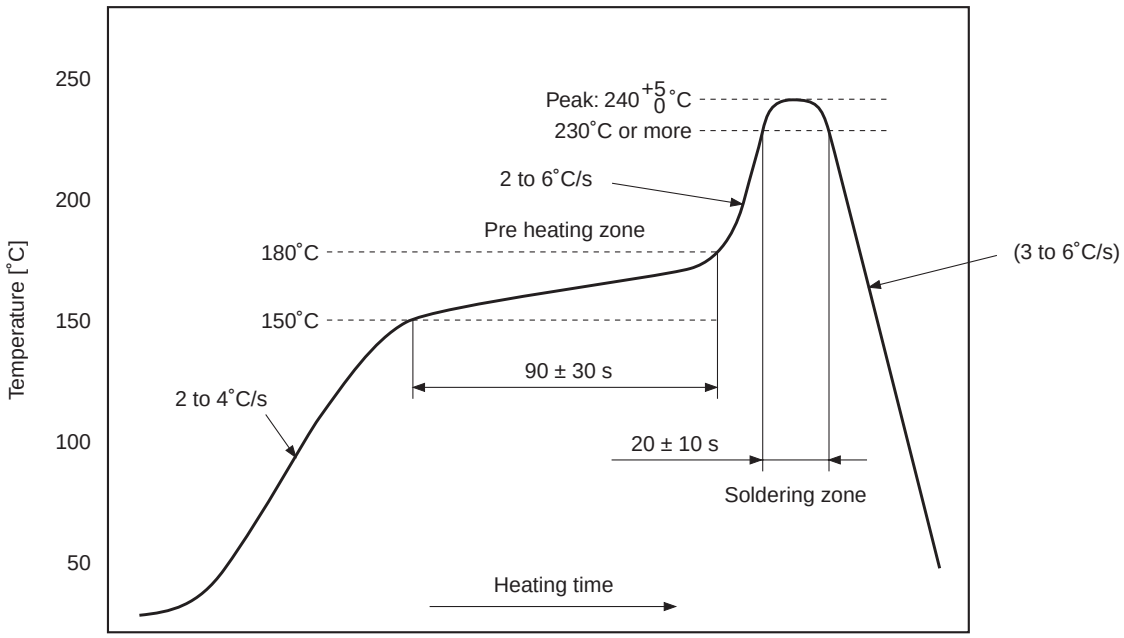
- Sony logo: Fixed
- Product name: The string of alphanumerics "-3AAL" on the second line differs according to the module contents.
- Lot No.: Control number, production location

CXN1000 Package Outline Unit: mm



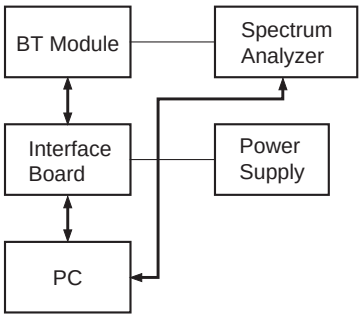
Note: * Without the boss for connection/disconnection

Recommended Temperature Profile for Unleaded Reflow Soldering



Radio Characteristics Measurement System Block Diagram (Application System Block Diagram)

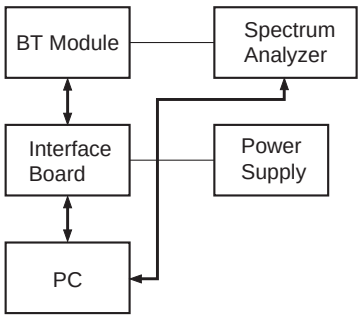
System A



Spectrum analyzer:
Agilent E4407B
or equivalent

[Measurement Item]
- Output power
- Out-of-Band spurious emissions
- Power density

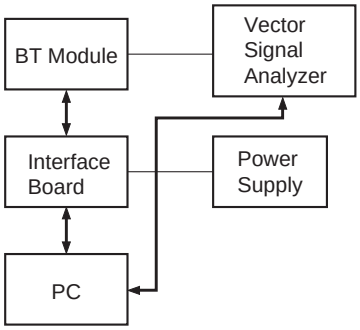
System B



Spectrum analyzer:
ROHDE&SCHWARZ FSEA20
or equivalent

[Measurement Item]
- Frequency range
- Adjacent channel power

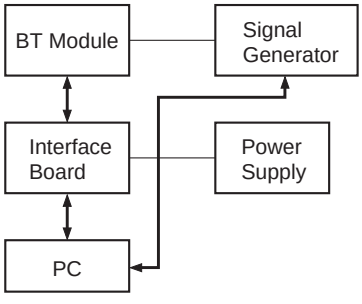
System C



Vector Signal Analyzer:
Agilent 89640
or equivalent

[Measurement Item]
- Modulation characteristics
- Initial carrier frequency tolerance
- Carrier frequency drift, Drift rate
- 20dB band width

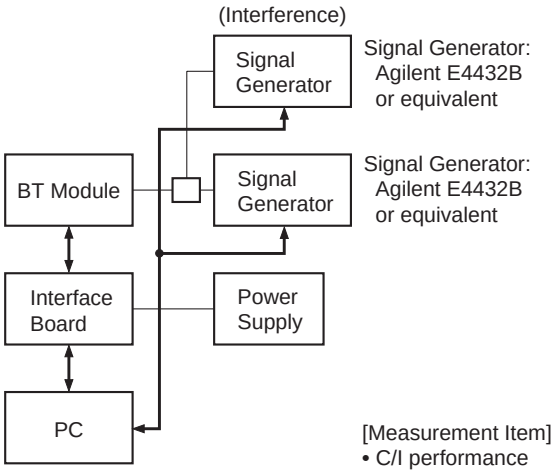
System D



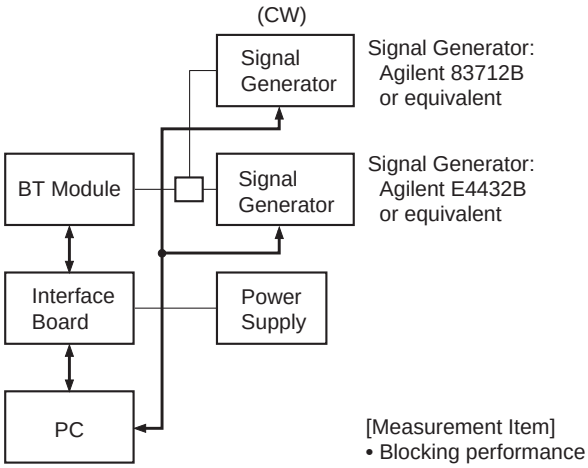
Signal Generator:
Agilent E4432B
or equivalent

[Measurement Item]
- Sensitivity (single slot)
- Maximum input level

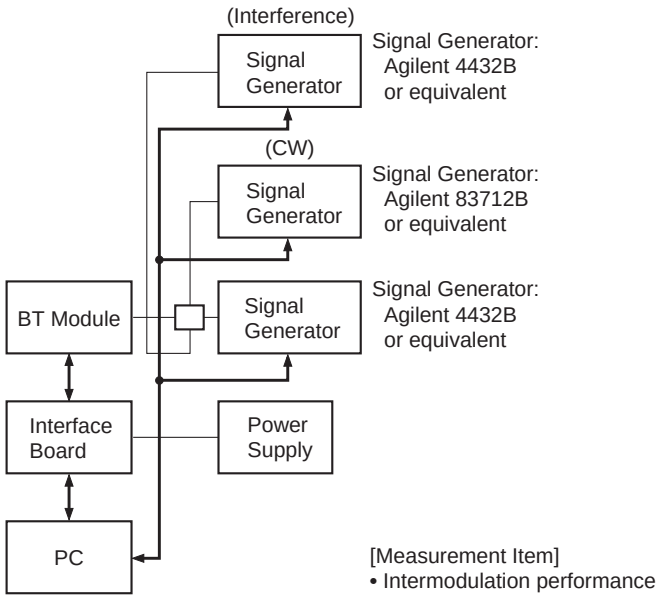
System E



System F



System G



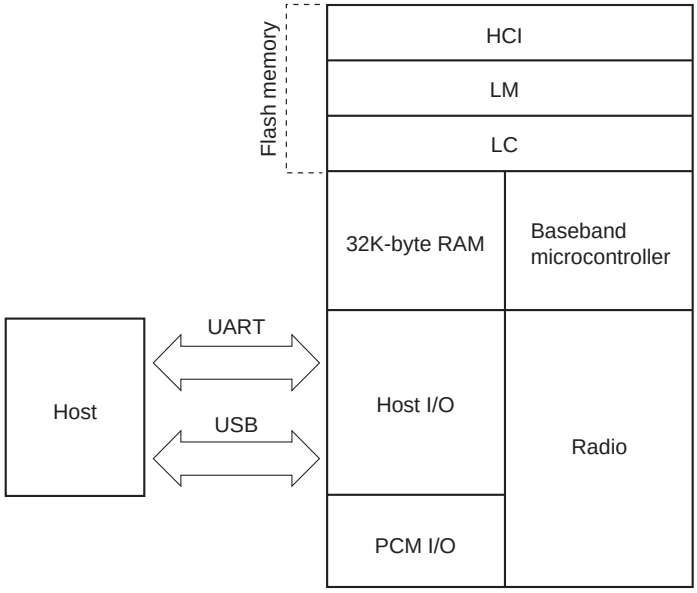
* For details of the contents below, see the specifications of the BlueCore 2-External (equivalent to the CXD3251GL) made by CSR.

Software Stack

The CXN1000 features a 16-bit RISC microcontroller which runs a software stack complying with Bluetooth specifications ver. 1.1.

The following are the three software stack options to integrate into the CXN1000.

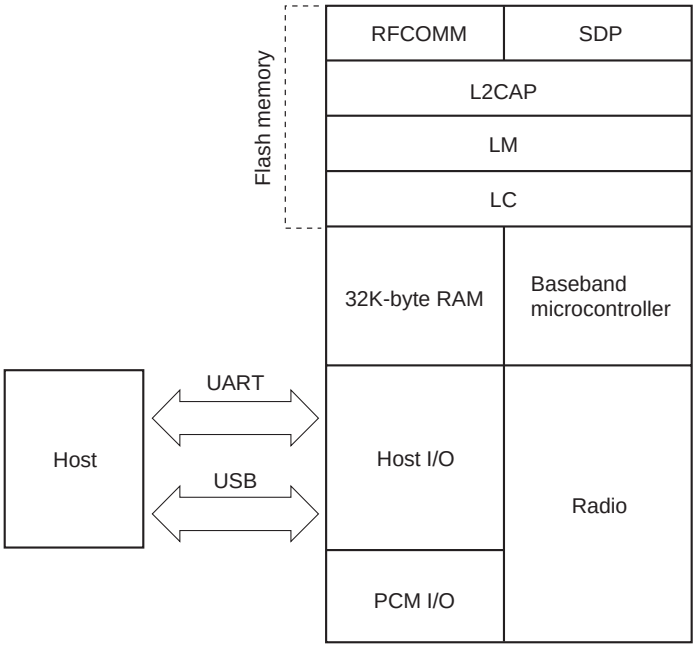
1) HCI Stack



HCI Stack Configuration

The HCI stack enables the layers up to the host controller interface (HCI) to be executed by the on-module RISC microcontroller. It is considered to be the most common stack configuration with general-purpose capabilities. All layers above HCI are handled by the host processor.

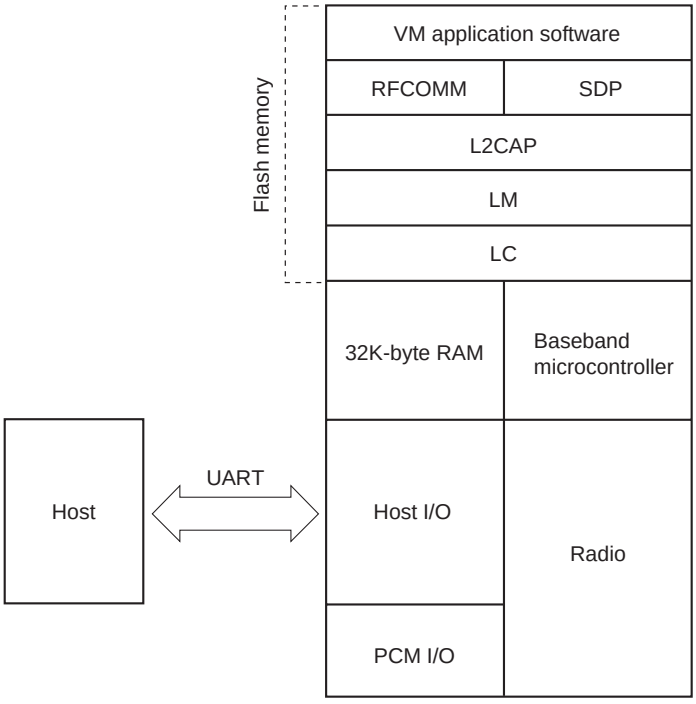
2) RFCOMM Stack



RFCOMM Stack Configuration

The RFCOMM stack enables the layers up to RFCOMM to be executed by the on-module RISC microcontroller. Then, the amount of processing is reduced on the host processor.

3) Virtual Machine Stack



Virtual Machine Stack Configuration

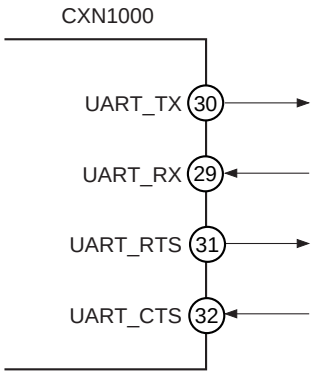
The Virtual Machine stack eliminates the need for a host processor. The applications and Bluetooth stack can be run on the integrated RISC microprocessor using a application execution environment called Virtual Machine (VM).

In order to develop applications, the BlueLab™ software development environment (SDK) and Casira development kit supplied by CSR are required. Inquire for further details.

• **External Interfaces**

UART Interface

The UART interface makes it easy to communicate with other serial devices using the RS-232 standard*1.



UART Pins

As shown in the figure above, four signals are used to execute the UART function. When the CXN1000 is connected to another digital device, data is transmitted between the two devices using the UART_RX and UART_TX signals. The remaining two low active signals, UART_CTS and UART_RTS, can be used for RS-232 hardware flow control. All the UART pins are configured as CMOS I/O pins. Their signal levels are 0V and V_{DD}3.0.

The baud rate, packet format and other UART configuration parameters are set using PS Tool or other BlueCore software.

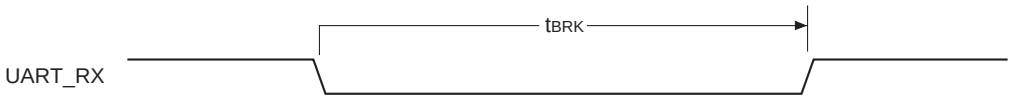
Note: In order to communicate with UART at the maximum data rate using a standard PC, a serial port adapter card with acceleration must be installed in the PC.

*1 The RS-232 protocol is used, but the voltage level is from 0V to V_{DD}3.0. (An RS-232 transceiver IC must be externally attached.)

Parameter		Possible values
Baud rate	Minimum	1200 baud (≤2% error)
		9600 baud (≤1% error)
	Maximum	1.5M baud (≤1% error)
Flow control		RTS/CTS or none
Parity		None, odd or even
Number of stop bits		1 or 2
Bits per channel		8

UART Settings

With the UART interface, the CXN1000 can be reset as soon as a break signal is received. As shown in the figure below, the break is identified by the continuous low logic level in the UART_RX pin. Resetting occurs if t_{BRK} is longer than the value defined by PSKEY_HOST_IO_UART_RESET_TIMEOUT (0x1A4) persistent store key. The system can be initialized to a known status from the host using this function.
The CXN1000 can also send break characters that can be used for starting the host.



Break Signal

The frequently used baud rates and the values of the PSKEY_UART_BAUD_RATE (0x204) persistent store key linked to those rates are shown in the table below. These standard values are not necessarily required conditions, and all baud rates within the range supported can be set by the persistent store key with the following equation.

$$\text{Baud Rate} = \frac{\text{PSKEY\_UART\_BAUD\_RATE}}{0.004096}$$

Baud rate	Persistent store value		Error
	Hex	Dec	
1200	0x0005	5	1.73%
2400	0x000A	10	1.73%
4800	0x0014	20	1.73%
9600	0x0027	39	–0.82%
19200	0x004F	79	0.45%
38400	0x009D	157	–0.18%
57600	0x00EC	236	0.03%
76800	0x013B	315	0.14%
115200	0x01D8	472	0.03%
230400	0x03B0	944	0.03%
460800	0x075F	1887	–0.02%
921600	0x0EBF	3775	0.00%
1382400	0x161E	5662	–0.01%

Standard Baud Rates

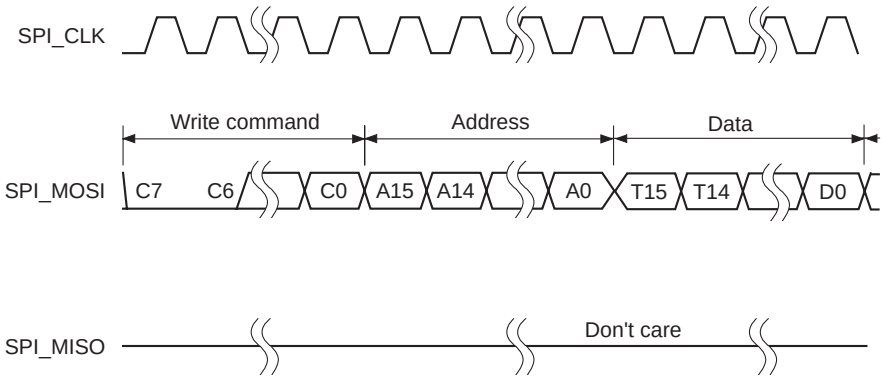
USB Interface

The USB pins of the CXN1000 support a full speed (12Mbps) USB interface. They enable direct drive of the USB cable, thereby obviating the need for an external USB transceiver. With this interface, the CXN1000 can operate as a USB unit and respond to requests from a PC or other master host controller. The interface supports both OHCI and UHCI standards. It also complies with Bluetooth specifications Ver.1.1 and part H2.

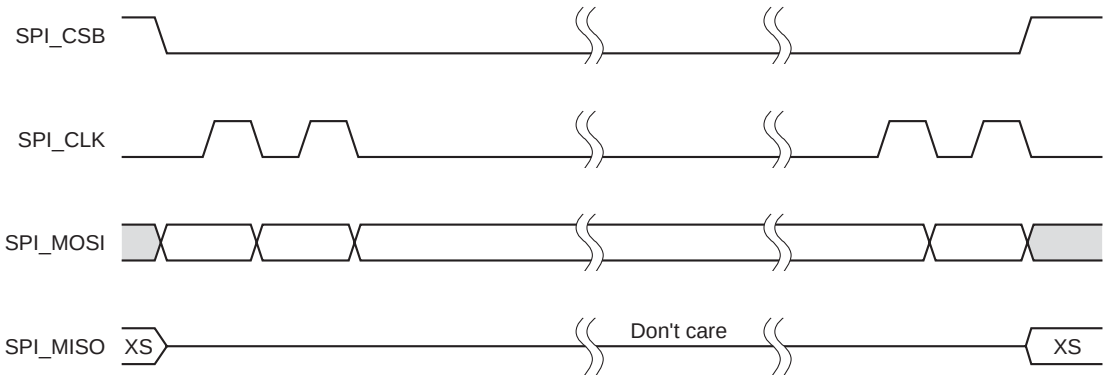
Although USB is a system that is capable of both master and slave operations, the CXN1000 supports USB slave operations only.

Serial Peripheral Interface (SPI)

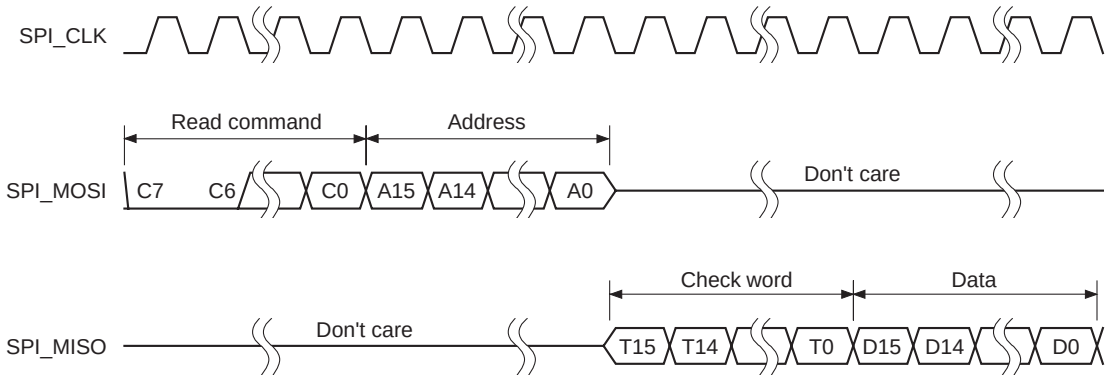
When data is sent or received through the SPI pins, the CXN1000 uses 16-bit data and 16-bit addresses. Through these pins, data is transmitted and received while both the internal processor is operating and it has stopped operating. Data is written or read one word at a time unless the auto increment function is used to access blocks.



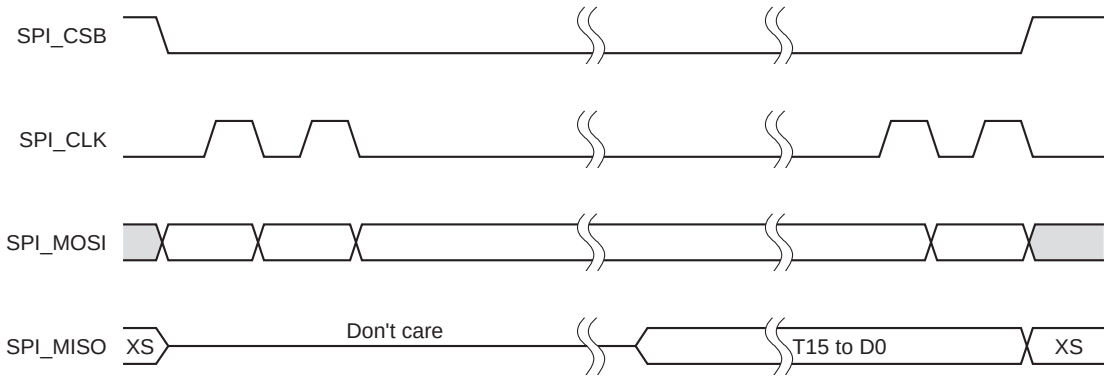
Write Operation A



Write Operation B



Read Operation A



Read Operation B

PCM Interface

The PCM interface of the CXN1000 supports the continuous transmission and reception of PCM data using hardware. This reduces the overhead of processors for wireless headset applications. The CXN1000 provides a bidirectional digital audio interface that is connected directly to the baseband layer of the on-chip firmware. The bidirectional digital audio interface does not pass the HCI protocol layer.

Data can be transmitted and received with one or more SCO connections using the hardware of the CXN1000.

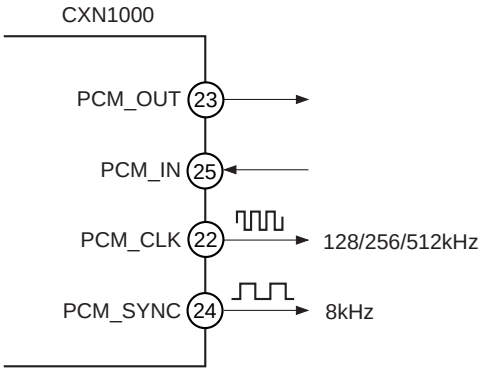
The PCM interface supports up to three SCO connections at a time.

The CXN1000 can operate as the PCM interface master for generating an output clock of 128, 256 or 512kHz. Alternatively, when it is set to serve as the PCM interface slave, it can operate using an input clock up to 2048kHz. The CXN1000 can support many different clock types including long frame sync, short frame sync and GCI timings.

In terms of 8k per second sampling, the CXN1000 supports 13- or 16-bit linear, 8-bit µ-Law and 8-bit A-Law companding sample formats. The PCM settings can be performed using the PSKEY_PCM_CONFIG (0x1B3) persistent store key.

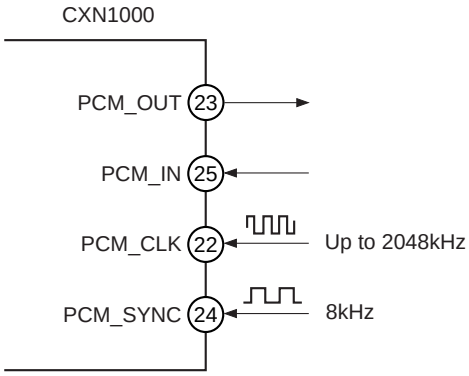
PCM Interface Master/Slave

When the CXN1000 is set as the PCM interface master, PCM_CLK and PCM_SYNC are generated.



PCM Interface Master

When the CXN1000 is configured as the PCM interface slave, PCM_CLK rates up to 2048kHz are accepted.



PCM Interface Slave

PIO Port

The parallel input/output (PIO) port serves as the general-purpose I/O interface of the CXN1000. It consists of nine programmable bidirectional I/O lines.

These programmable I/O lines can be accessed via either the installed application run by the CXN1000 or the private channel or manufacturer-designated HCI commands.

PIO[3]/USB_WAKE_UP[*1]

This multi-functional terminal is a programmable I/O line. Either the programmable I/O or USB_WAKE_UP function can be selected with the PSKEY_USB_PIO_WAKEUP (0x2CF) persistent store key setting.

PIO[4]/USB_ON[*1]

This multi-functional terminal is a programmable I/O line. It can also be used as the USB_ON function.

PIO[5]/USB_DETACH[*1]

This multi-functional terminal is a programmable I/O line. It can also be used as the USB_DETACH function.

PIO[6]/CLK_REQ

This is a multi-functional terminal whose function is determined by the persistent store keys.
Using PSKEY_CLOCK_REQUEST_ENABLE (0x246), it can be set to low when the CXN1000 is in deep sleep and to high when a clock is requested. If a shift in the timing in certain operation modes is to be avoided, the clock must be supplied within 4ms from the PIO[6] rising edge.

PIO[7]

Programmable I/O terminal

PIO[8]

Programmable I/O terminal

PIO[9]

Programmable I/O terminal

PIO[10]

Programmable I/O terminal

PIO[11]

Programmable I/O terminal

[*1] The USB function can be mapped in the software to any of the PIO terminals.