Bluetooth Module
Achieves the Industry's Top Class in Thinness: 1.2 mm

CXN2000

Sony’s newly-developed CXN2000 uses Sony’s passive device integration technology, which combines semiconductor and substrate technologies, to achieve the industry’s top level of performance and miniaturization.

This ultraminiature thin-form Bluetooth module is the first product implemented based on Sony’s technological innovation that allows organic substrates to be handled on a semiconductor fabrication line.

- **Conforms to the Bluetooth™ specifications Version 1.1 (Class 2)**
- **UART, PCM, and SPI interfaces**
- **4 Mbit flash memory, crystal, and band-pass filter built in**
- **1.8 V and 3.0 V power supply operation**
- **Passive component integration technology achieves ultraminiature package size: 8.4 × 8.7 × 1.2 mm**

* Bluetooth is a trademark of Bluetooth SIG, Inc., and is licensed by Sony Corporation.

Product Specifications Overview

The CXN2000 is an ultraminiature thin form factor Bluetooth module that combines a single-chip CMOS LSI and RF passive component substrate. It includes the oscillator crystal, supports Bluetooth Version 1.1 Class 2, integrates 4 Mbit of flash ROM, and provides PCM, SPI, UART, and other interfaces. It can be used as the HCI (Host Controller Interface) basic module in all types of Bluetooth applications. As an option, it can also support the USB interface.

VOICE

In this design effort, which applied Sony's integrated high-frequency passive device substrate technology, every time we'd make a prototype, we'd be asked to make it even smaller. This was extremely difficult within the strict constraints, but it was an extremely rewarding project. The desires for even further miniaturization in RF filter components in general, not only for Bluetooth products, are expected to increase, and we are committed to responding to those desires as well.

Ultraminiature Thin Form Factor Achieved

The substrate process technology used in this product can integrate low-loss, high-precision passive components, such as resistors, capacitors, and inductors on the substrate itself. The substrate can also integrate all the passive components, such as band-pass filters, baluns, and decoupling capacitors, required for the RF circuits. This allows the creation of modules in thin form factor ultraminiature packages that would have been impossible with conventional technologies.

High Sensitivity and Low Noise Characteristics

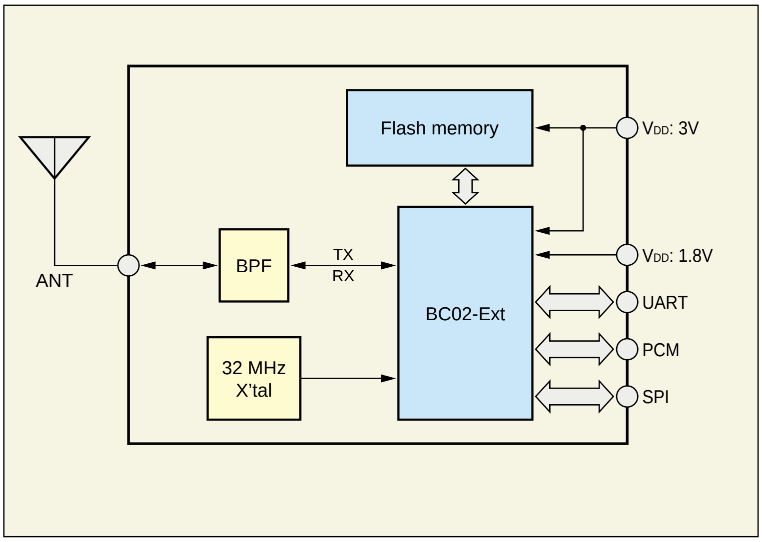
Passive components are only used in the upper thin-film section of the substrate and the digital wiring is formed mainly in the lower organic substrate area. By laying out the analog circuits in the upper section, this technology avoids interference between the analog and digital blocks. As a result, the CXN2000 achieves superlative characteristics, including a reception sensitivity of -82 dBm and a CI value of under -30 dB (at 2 MHz).

High Reliability

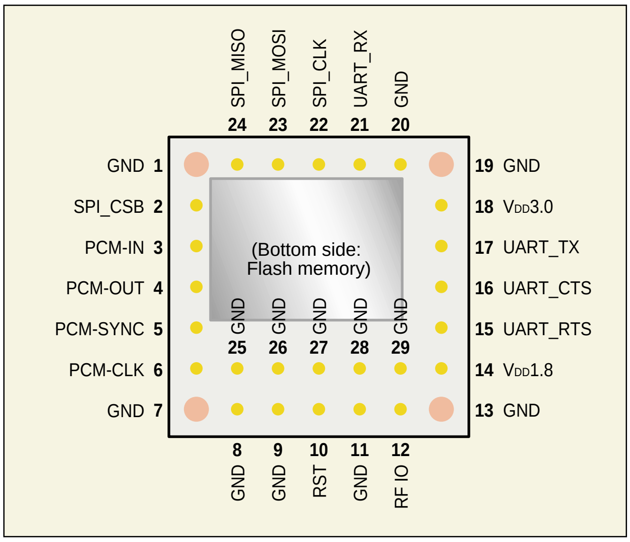
This module uses organic materials as the base for all components, and as is result is extremely light yet still provides superlative resistance to mechanical shock. Furthermore, the thermal expansion coefficient of the module is extremely close to that of the motherboard and the LGA structure (or BGA structure, if desired) is used for the mounting surface land structure. As a result, this module achieves superlative motherboard mounted reliability test results in heat cycle tests, drop strength tests, and bending strength tests.

Future Developments

The most important feature of the integrated passive component substrate mounting technology used in this module is that it allows high-frequency components to be implemented in a thin form factor. As a result, this technology can be used in all types of communication modules that will be included in portable electronic equipment. Furthermore, the self-oscillation frequency of these passive components (the highest frequency at which they can be used) is extremely high: over 10 GHz. This means that they are optimal for a wide range of applications, such as wireless LANs, that operate at 5 GHz and over.



■ **Figure 1 Bluetooth Module Block Diagram**



■ **Figure 2 Pin Configuration (Top View)**

■ Table 1 RF Characteristics (Transmission Characteristics)

Transmission		Conditions	Min.	Typ.	Max.	Unit	Notes
Output power		N & ETC	–6	0	4	dBm	Internal PA = 50
Modulation characteristics	Δf1 avg	N & ETC	140	170	175	kHz	11110000 modulation
	Δf2 max	N & ETC	115	150	—	kHz	1010 modulation
Allowable initial carrier frequency difference		N & ETC	—	10	75	kHz	
Carrier frequency drift	DH1	N & ETC	—	10	25	kHz	
	DH3	N & ETC	—	15	40	kHz	
	DH5	N & ETC	—	15	40	kHz	
Carrier frequency drift rate	DH1	N & ETC	—	10	20	kHz/50µs	
	DH3	N & ETC	—	10	20	kHz/50µs	
	DH5	N & ETC	—	12	20	kHz/50µs	
20 dB bandwidth		N & ETC	—	900	1000	kHz	
Adjacent channel power	|M–N| = 2	N & ETC	—	–35	–20	dBm	
	|M–N| ≥ 3	N & ETC	—	–45	–40	dBm	
Out-of-band spurious emission	30M–1G	N & ETC	—	–65	–36	dBm	
	1G–12.75G	N & ETC	—	–45	–30	dBm	
	1.8G–1.9G	N & ETC	—	–67	–47	dBm	
	5.15G–5.3G	N & ETC	—	–67	–47	dBm	

(V_{AIN} = 1.7 to 1.9V, V_{DIN} = 2.7 to 3.3V, Ta = –20 to +85°C)
NTC: Normal Test Conditions, N & ETC: Normal & Extreme Test Conditions

■ Table 2 RF Characteristics (Reception Characteristics)

Reception		Conditions	Min.	Typ.	Max.	Unit	Notes
Sensitivity (single slot packet)		N & ETC	—	–84	–80	dBm	BER < 0.1%
C/I performance	co–ch.	NTC	—	10	11	dB	
	1 MHz	NTC	—	–5	0	dB	
	2 MHz	NTC	—	–35	–30	dB	
	≥ 3 MHz	NTC	—	–42	–40	dB	
	Image	NTC	—	–14	–9	dB	
	Image ± 1 MHz	NTC	—	–22	–20	dB	
Blocking performance	30M–2000M	NTC	–10	—	—	dBm	
	800M–1000M	NTC	—	10	—	dBm	
	1800M–1900M	NTC	—	10	—	dBm	
	2000M–2399M	NTC	–27	—	—	dBm	
	2498M–3000M	NTC	–27	—	—	dBm	
	3G–12.75G	NTC	–10	—	—	dBm	
Intermodulation performance		NTC	–39	—	—	dBm	
Spurious emission	30M–1G	N & ETC	—	–70	–57	dBm	
	1G–12.75G	N & ETC	—	–59	–47	dBm	
Maximum input level		NTC	–20	–2	5	dBm	

(V_{AIN} = 1.7 to 1.9V, V_{DIN} = 2.7 to 3.3V, Ta = –20 to +85°C)
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