High-Performance Cellular Phone Antenna Switch/Receiver Module MMIC with Built-in SAW Element for PDC Full Packet Terminals

CXM5003

Sony has introduced a full line of MMIC products for the Japanese cellular phone market.
Sony, with this product, is now supplying the industry's first antenna switch/receiver module (includes GaAs switch, low-noise amplifier/mixer, and SAW devices) that provides PDC full packet support and was made possible by using all of Sony's most advanced mounting technologies.
Compared to earlier discrete device structures, this new module achieves adjustment-free manufacturing and miniaturization to about 1/3 the mounting area.
We hope that you will find this MMIC useful in your future high-performance cellular phone and portable communications terminal development.

- **Wide bandwidth, low insertion loss, low distortion**
- **High gain, low noise figure**
- **Low LO input power operation**
- **Miniature package**
- **Includes duplexer, TOP, and interstage SAW**

Transmission

A full packet terminal high-power antenna switch MMIC that provides PDC 800 MHz/1.5 GHz dual band support is used. This MMIC uses Sony's GaAs junction gate PHEMT process to achieve both low insertion loss and low voltage operation. A Si MOS process was adopted for the logic chip to reduce current consumption. The CXM5003 achieves simultaneous reception in full packet mode and uses an MMIC that provides 2 transmitter and 3 receiver ports for four antennas. It achieves even further miniaturization by using surface mounting for the SAW duplexer and matching components.

VOICE

In developing the CXM5003, we were quite aggressive about adopting new technologies, and there were times when we came together as a group in perfect synchronization and became so engrossed in the project that we forgot about time. I am convinced that this product will more than meet our customers' needs. I strongly suggest that you look into this device for your next product. It is clear that even higher added value features will be required for domestic Japanese PDC cellular phones in the future. We are committed to developing easy-to-use products that can meet these needs.

Reception

The CXM5003 uses an MMIC that consists of three low-noise amplifiers (one each for the LNA 800 MHz CD band, 800 MHz A band, and 1.5 GHz band) and two mixers. This MMIC uses Sony's GaAs J-FET process to achieve high sensitivity and low distortion. The CXM5003 reduces the RF design burden by eliminating the need for the low-noise amplifier/mixer I/O matching* and saw filter I/O matching, which were indispensable in conventional discrete structures. This can contribute to speeding up the product development cycle.

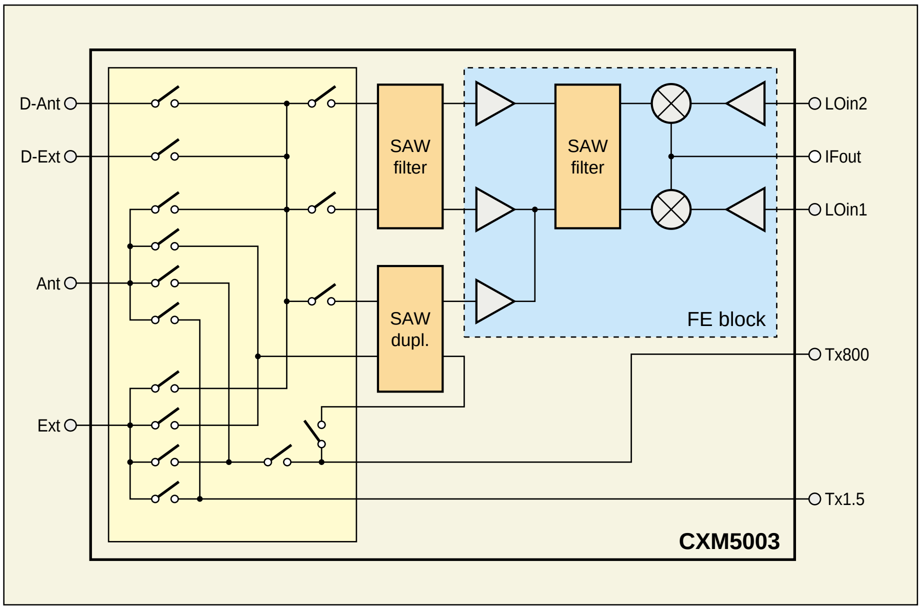
*: Except for the LO input block and IF output block matching.

Structure

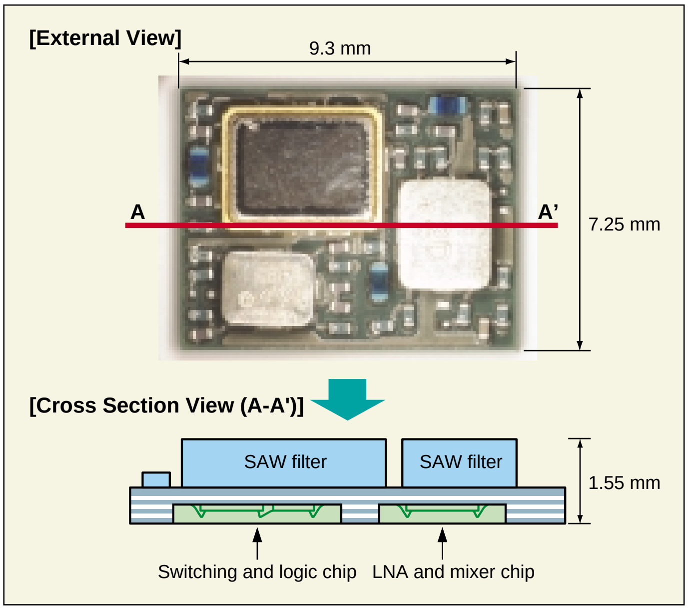
The CXM5003 differs from the conventional single molded structure in that a two-cavity molded resin sealed structure is adopted. In this structure, the SAW filter and chip components are surface mounted on an organic circuit board and after the switching and logic chip and the low-noise amplifier/mixer chip are mounted individually on the back of the circuit board, the device is sealed in the two-cavity structure. The adoption of this structure has allowed Sony to provide a module that is extremely general and can significantly reduce the mounting area required for this functionality.

Miniature Module

The CXM5003 has a 51-pin structure and is a miniature module with a size of only 7.25 mm × 9.3 mm × 1.55 mm. This module can contribute to reduction of the mounting area required and further miniaturization in cellular phones.



■ **Figure 1   CXM5003 Application Circuit Example**



■ **Figure 2   CXM5003 External and Cross Section Views**

■ **Table 1   CXM5003 Transmitter Block Representative Electrical Characteristics**

Path	Item	Condition	Typ.
Tx800 – Ext/Ant	Insertion loss	*1	0.55/0.6 dB
Tx1.5 – Ext/Ant		*2	0.45/0.5 dB
Tx800 – Ext/Ant	Isolation	*1	39/36 dB
Tx1.5 – Ext/Ant		*2	38/40 dB
Tx800 – Ext/Ant	High frequency 2 fo	*1	–68/–67 dBc
Tx1.5 – Ext/Ant	2 fo	*1	–68/–67 dBc
Tx800 – Ext/Ant	3 fo	*1	–71/–70 dBc
Tx1.5 – Ext/Ant	3 fo	*1	–69/–71 dBc
Tx800 – Ext/Ant	ACP ±50 kHz	*1	–68/–67 dBc
Tx1.5 – Ext/Ant	±50 kHz	*1	–65/–65 dBc
Tx800 – Ext/Ant	±100 kHz	*1	–75/–75 dBc
Tx1.5 – Ext/Ant	±100 kHz	*1	–74/–74 dBc

*1 : Pin = 29.5 dBm, 893 to 958 MHz, V_{DD} = 2.9 V, Vctl (H) = 2.4 V, Vctl (L) = 0.3 V
*2 : Pin = 29.5 dBm, 1439 to 1468 MHz, V_{DD} = 2.9 V, Vctl (H) = 2.4 V, Vctl (L) = 0.3 V

■ **Table 2   CXM5003 Receiver Block Representative Electrical Characteristics**

Symbol	Condition	800 MHz (CD)	800 MHz (A)	1.5 GHz	Dup
		Typ.	Typ.	Typ.	Typ.
Conversion gain (Gc)	*3	19	19.5	19	19
Noise figure (NF)	*4	4.5	4.4	4.6	4.5
Input IP3 (IIP3)	*5	–6	–6	–8	–6
Lo → Ant/Ext (Plk1)	*6	–70	–85	–72	–70

V_{DD}_SW = 2.9 V, V_{DD}_FE = 2.8 V, Vctl (H) = 2.4 V, Vctl (L) = 0.3 V
*3 : RF = (810 to 843 MHz)/–40 dBm, LO = (fRF – 130.05 MHz)/–10 dBm
*4 : RF = (870 to 885 MHz)/–40 dBm, LO = (fRF – 130.05 MHz)/–10 dBm
*5 : RF = (1487 to 1491 MHz, 1513 to 1516 MHz)/–40 dBm, LO = (fRF – 130.05 MHz)/–10 dBm
*6 : RF = (810 to 828 MHz)/–40 dBm, LO = (fRF – 130.05 MHz)/–10 dBm