

315MHz/400MHz MULTI-BAND MULTI-MODE ULP RADIO

DESCRIPTION

Imec's 315/400MHz multi-band multi-mode radio achieves best-in-class performance at world's lowest-power consumption. The radio supports IEEE802.15.6 standard and provides a proprietary 3.6Mbps high speed mode and low-power control mode. It complies with the FCC and ETSI regulations and delivers an output power up to -10dBm.

This highly integrated, full transceiver includes an RF front-end, digital baseband, microcontroller and memories. It is the first medical radio with extended high speed mode to cover multi-channel EEG applications. A dedicated low-power mode reduces the RX power further. The ultralow-power consumption guarantees long battery lifetimes.

APPLICATIONS

- Medical implantable and wearable applications
- Automotive applications
- Home and building automation
- Alarms, remote control, toys

KEY FEATURES

Multi-band radio

- MICS band 402-405MHz
- ISM bands between 420-450MHz
- 315MHz band

Multi-mode radio

- IEEE802.15.6 (medical BAN)
- Proprietary modes:
 - Low-power control
 - High data rate up to 3.6Mbps

Ultralow-power (ulp) consumption

- IEEE 15.6 mode:
Rx 2.8mW & Tx 2.9mW @ -16dBm
- Proprietary high data rate mode:
Rx 3.5mW & Tx 3mW @ -16dBm

Best-in-class sensitivity

- IEEE 15.6 $\pi/4$ -DQPSK: -96dBm @ 10%PER
- Proprietary high data rate: -76dBm @ 10%PER

INTEGRATED ARM CORTEX™ M0 CORE, 128KB SRAM, SPI, UART, GPIO
DESIGNED FOR 1V NOMINAL SUPPLY
TSMC 40nmLP

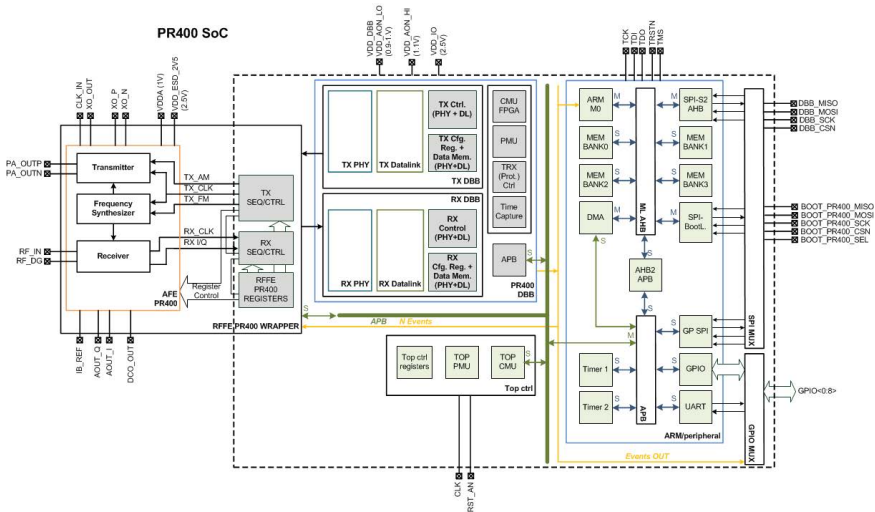
BLOCK DIAGRAM

The ULP radio uses an advanced architecture and digital-style circuits. The two-point modulation transmitter is based on a sub-mW All-Digital PLL and a Digital Power Amplifier. It has extensive self-calibration of DCO band selection and DCO amplitude control. The All-Digital PLL can support high data rate up to 3.6Mbps. The PA output power can be adjusted between -10dBm and -50dBm. The receiver is based on an energy efficient zero-IF architecture and has integrated offset calibration, digital RSSI and advanced Automatic Gain Calibration estimation algorithms.

The digital baseband includes all PHY processing, as well as the data link features for (de-)scrambling, (de-)interleaving, (de-)spreading, CRC and BCH (de-)coding. It is power optimized, including extensive clock and power gating, optimized HW/SW register interfaces, HW accelerators like event time-stamping for protocol support. The use of the AMBA AHB/APB bus enables straightforward control of the MCU. It is implemented with scan chains as part of a design-for-test strategy. The IC is integrated with ESD protection on all I/Os, including the RF ports.

315MHz/400MHz SPECIFICATIONS

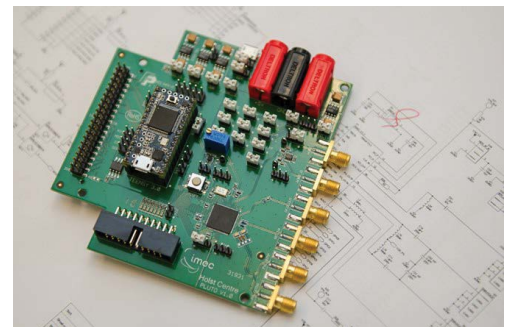
Frequency band	315MHz, 402-405MHz 402-450MHz
Modulations	$\pi/2$ -DBPSK, $\pi/4$ -DQPSK $\pi/8$ -D8PSK, GMSK
Power consumption	Tx active 15.6 - 2.9mW Tx active high-data rate - 3mW Rx active 15.6 - 2.8mW Rx active high-data rate - 3.5mW
Tx output power	(-10dBm) - (-50dBm)
Tx evm	<7.5%
Tx acplr	≤ -34 dBc
Rx sensitivity @ 10%per	-96dBm @ 303.kbps -91dBm @ 455.4kbps
Rx acr @ 10%per	$\pi/2$ -DBPSK: 17.14dBc $\pi/4$ -DQPSK: 13.64dBc $\pi/8$ -D8PSK: 8.54dBc GMSK: 26.54dBc
Nominal supply	1V
Technology	TSMC 40nm LP CMOS



EVALUATION BOARDS

Imec provides evaluation boards on request to prospective customers and partners interested in licensing imec's radio designs and IP.

Pluto: allows complete evaluation of the 315MHz/400MHz multi-band multi-mode SoC as well as demonstration including the ARM M0 core.



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