



## WirelessUSB™ PRoC™ Flash Programmable MCU + Radio

### Features

- Microcontroller with Mixed Signal Array
  - Cypress M8C CPU
  - CPU clock up to 12 MHz
  - Internal oscillator—no crystal required
  - 8-KB Flash Program Memory with EEPROM emulation
  - 512 Bytes SRAM Data Storage
  - 4 Analog Blocks Provide:
    - 2 Comparators with DAC Refs
    - Two ADCs with
    - 10-bit resolution
  - 4 Digital Blocks Provide:
    - 8- to 32-bit Timers, Counters, and PWMs
    - CRC and PRS modules
    - Full-Duplex UART, SPI Master or Slave
    - Connectable to all GPIO pins
  - 18 GPIO lines which are individually configurable. P0 [1:0], P1[7:0], P2[7:0]
- 2.4-GHz DSSS radio transceiver
  - Operates in the unlicensed Industrial, Scientific and Medical (ISM) band (2.4 GHz –2.483 GHz)
  - -95 dBm receive sensitivity
  - Up to 0 dBm output power
  - Range of up to 50 meters or more
  - Data throughput of up to 62.5 kbits/sec
  - Highly integrated low cost, minimal number of external components required
  - DSSS baseband controller
  - 13-MHz crystal clock
  - Integrated 30-bit Manufacturing ID
- Operating voltage from 2.7V to 3.6V

- Operating temperature from 0° to 70°C
- Offered in a small footprint 48 QFN

### Applications

- Consumer/PC
  - Locator Alarms
  - Presenter Tools
  - Remote Controls
  - Toys
  - White Goods
- Building/Home Automation
  - Climate Control
  - Lighting Control
  - Smart Appliances
  - On-site Paging Systems
  - Alarm and Security
- Industrial Control
  - Inventory Management
  - Factory Automation
  - Data Acquisition
  - Automatic Meter Reading (AMR)
- Transportation
  - Diagnostics
  - Remote Keyless Entry
- Medical

### Functional Description

The CYWUSB6953 WirelessUSB™ PRoC™ (Programmable Radio System-on-Chip) device is the world's first low-cost Flash programmable microcontroller with an integrated 2.4-GHz radio transceiver.

PRoC Block Diagram

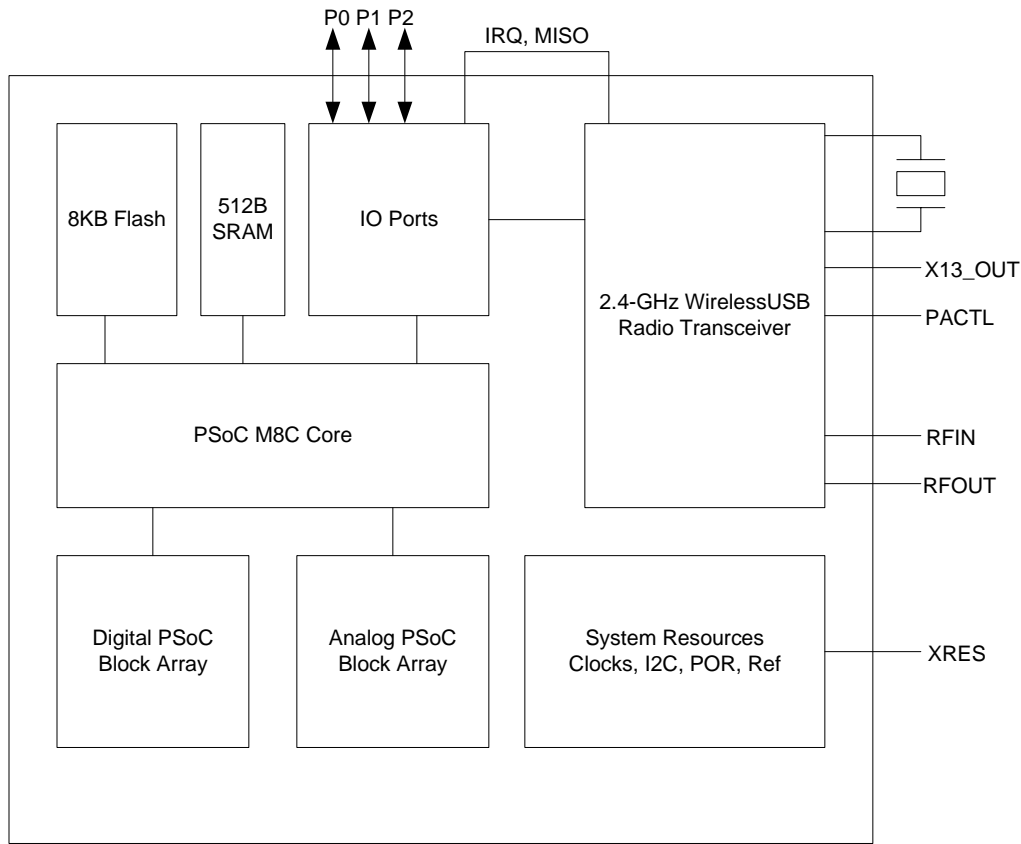


Figure 1. PROC Block Diagram

Functional Overview

The CYWUSB6953 is a complete Radio System-on-Chip device, enabling many simple RF systems to be implemented with a single device and a handful of discrete components. The CYWUSB6953 is designed to implement low cost wireless systems operating in the worldwide 2.4-GHz Industrial, Scientific, and Medical (ISM) frequency band (2.400 GHz–2.4835 GHz).

The radio meets the following world-wide regulatory requirements:

- **Europe**
  - ETSI EN 301 489-1 V1.4.1
  - ETSI EN 300 328-1 V1.3.1
- **North America**
  - FCC CFR 47 Part 15
- **Japan**
  - ARIB STD-T66

The microcontroller is a powerful mixed-signal array. It has highly reconfigurable and flexible digital and analog blocks. The microcontroller core is the M8C 8-bit engine that supports

a rich instruction set. It contains 512 Bytes of data SRAM and 8 Kbytes code Flash memory. Full data on the microcontroller can be found in the CY8C21534 data sheet and the PSoc™ Technical Reference Manual

The radio is a high-performance 2.4-GHz transceiver with a fully integrated DSSS baseband. The radio and baseband are both code and frequency agile. Protocols supporting frequency agile direct-spread interference avoidance algorithms such as WirelessUSB are fully compatible with this radio. Full data on the radio can be found in the CYWUSB6935 data sheet.

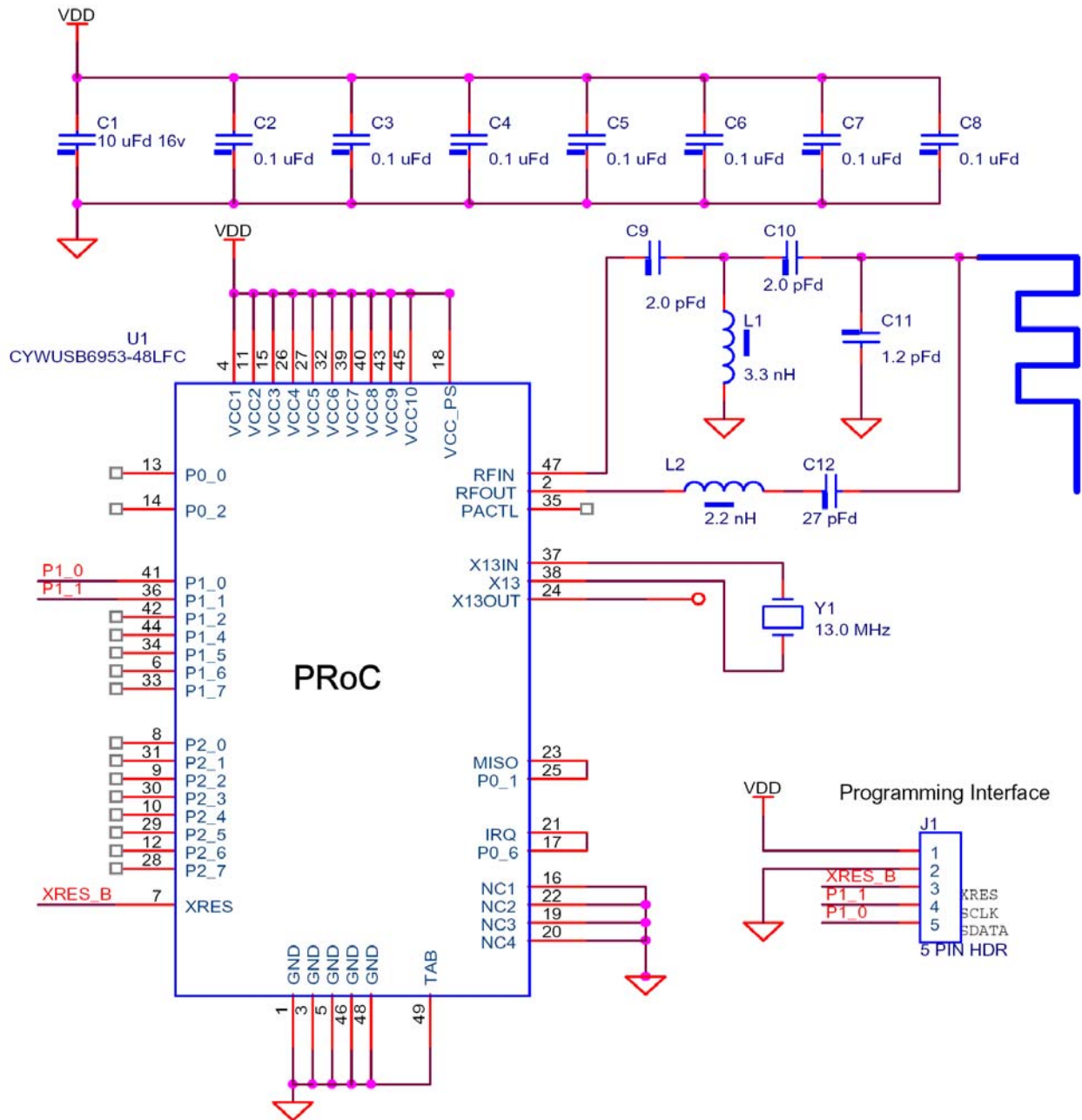
Radio Data Rate Considerations

The PSoc Designer tool provides a software-based SPI User Module for control of the radio portion of the PRoC. Therefore, there is a direct relationship between CPU clock speed and supportable radio data rate. For operation of CPU clock rates less than 12 MHz, radio data rate must be set to 16 Kbps. Also note that for operation at  $V_{CC} < 3.0V$ , the CPU clock rate must be set to 3 MHz per the CY8C21534 data sheet. Therefore, at operation below 3V, the radio data rate must be set to 16 Kbps.

**Pin Descriptions**

Pin QFN	Name	Type	Die	Description
<b>Analog RF</b>				
47	RFIN		Radio	Modulated RF Signal Received
2	RFOUT		Radio	Modulated RF Signal to be Transmitted
<b>Crystal/PA Control</b>				
38	X13	I	Radio	Crystal Input
37	X13IN	I	Radio	Crystal Input
24	X13OUT	O	Radio	Reference Clock Output
35	PACTL	IO	Radio	External Power Amplifier Control. Pull-down or make output
<b>Reserved</b>				
23, 25	MISO	IO	Radio, MCU	Radio SPI Master In, Slave Out. Connect pins 23 and 25 on the application board
17, 21	IRQ	IO	Radio, MCU	Radio Interrupt. Connect pins 17 and 21 on the application board
<b>Microcontroller Digital/Analog</b>				
13	P0[0]	IO/M	MCU	Analog Column Mux Input
14	P0[2]	IO/M	MCU	Analog Column Mux Input
41	P1[0]	IO/M	MCU	I2C Serial Data (SDA)
36	P1[1]	IO/M	MCU	I2C Serial Clock (SCL)
42	P1[2]	IO/M	MCU	
44	P1[4]	IO/M	MCU	Optional External Clock Input (EXT-CLK)
34	P1[5]	IO/M	MCU	I2C Serial Data (SDA)
6	P1[6]	IO/M	MCU	
33	P1[7]	IO/M	MCU	I2C Serial Clock (SCL)
8	P2[0]	IO/M	MCU	Direct Switched Capacitor Block Input
31	P2[1]	IO/M	MCU	Direct Switched Capacitor Block Input
9	P2[2]	IO/M	MCU	Direct Switched Capacitor Block Input
30	P2[3]	IO/M	MCU	Direct Switched Capacitor Block Input
10	P2[4]	IO/M	MCU	
29	P2[5]	IO/M	MCU	
12	P2[6]	IO/M	MCU	
28	P2[7]	IO/M	MCU	
7	XRES	I	MCU	Active HIGH External Reset with Internal Pull-down
<b>Power and Ground</b>				
4, 11, 15, 18, 26, 27, 32, 39, 40, 43, 45	V <sub>CC</sub>			Supply Voltage
1, 3, 5, 46, 48	GND			Ground Connection
PADDLE	GND			Ground Connection
19, 20	RSVD			Connect to Ground
16, 22,	NC			No Connect

Application Example



**PRoC Absolute Maximum Ratings**

Parameter	Description	Min.	Typ.	Max.	Unit
T <sub>STG</sub>	Storage Temperature	-55		100	°C
T <sub>A</sub>	Ambient Temperature with Power Applied	0		70	°C
V <sub>dd</sub>	Supply Voltage on V <sub>CC</sub> Relative to VSS	-0.3		3.9	V
V <sub>IO</sub>	DC Voltage to Logic Inputs	-0.3		V <sub>CC</sub> + 0.3	V
V <sub>IOZ</sub>	DC Voltage Applied to Outputs in High-Z State	-0.3		V <sub>CC</sub> + 0.3	V
I <sub>MIO</sub>	Maximum Current into Any Port Pin	-25		50	mA
ESD	Electrostatic Discharge Voltage (Other)			1600	V
I <sub>LU</sub>	Latch-up Current			200	mA

**PRoC Operating Conditions**

Parameter	Description	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	2.7	3	3.6	V
T <sub>A</sub>	Ambient Temperature	0	25	70	°C

**PRoC DC Electrical Characteristics**

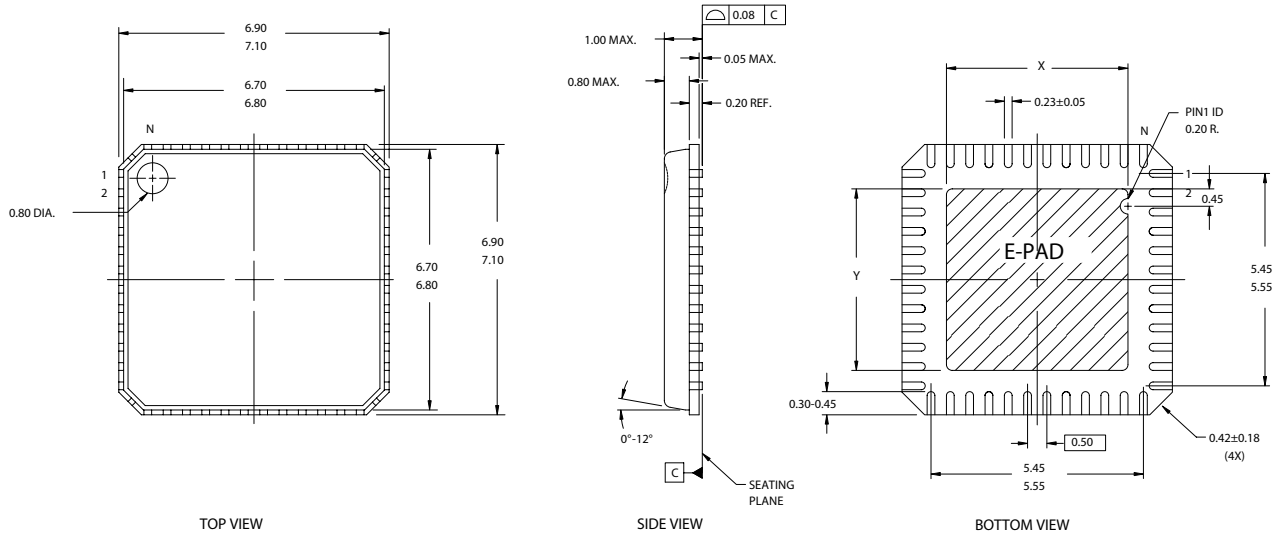
Parameter	Description	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	2.7	3	3.6	V
I <sub>CC</sub>	Supply Current (Radio in Power Down)		1.7	2	mA
RX I <sub>CC</sub>	Supply Current Radio Receive		61.3		mA
TX I <sub>CC</sub>	Supply Current Radio Transmit		74.7		mA
SYNTH SETTLE I <sub>CC</sub>	Current Consumption with Synthesizer on, No Transmit or Receive		33.0		mA
IDLE I <sub>CC</sub>	Supply Current Radio Idle		5		mA
I <sub>SLEEP</sub>	Sleep Mode Supply Current		3	20	μA

**Ordering Information**

Part Number	Radio	Package Name	Package Type	Operating Range
CYWUSB6953-48LFXC	Transceiver	48 QFN	Pb-Free 48 Quad Flat No Lead Package	Commercial

**Package Diagram**

**48-Lead QFN 7 × 7 mm LF48A**



DIMENSIONS IN mm MIN.  
MAX.  
REFERENCE JEDEC MO-220  
PKG. WEIGHT 0.13 gms

E-PAD SIZE (X, Y MAX.)	PADDLE SIZE
5.1 X 5.1	5.3 X 5.3
3.8 X 3.8	4.0 X 4.0

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**Document History Page**

Document Title: CYWUSB6953 WirelessUSB™ PRoC™ Flash Programmable MCU + Radio				
Document Number: 38-16017				
REV.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	329973	See ECN	BON	New data sheet
*A	337935	See ECN	BON	In the Feature Section, changed "90 dBm receive sensitivity" to "- 90 dBm receive sensitivity", and "13 MHz crystal clock" to "13 MHz crystal clock" In the Functional Overview, changed "CYWUSB6934" to "CYWUSB6935" In the Application Example, changed "ISSP" to "Programming Interface"
*B	380254	See ECN	BON	Updated the PRoC DC Electrical Characteristics. Changed "- 90 dBm receive sensitivity" to "- 95 dBm receive sensitivity" in the Feature section. Removed lead-free part offering. Changed supported CPU clock from 24 MHz to 12 MHz
*C	392781	See ECN	BON	Added the Radio Data Rate Considerations section
*D	495870	See ECN	OYR	Took off the photograph of the chip from the first page Added Pb-free part numbers Took off parts with lead Quad flat package to QFN Named Variables in Table