WirelessUSB™ PRoC™ Flash Programmable MCU + Radio

Features

■ Microcontroller with Programmable System-on-Chip
  ❏ 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 to 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 and PC
  ❏ Locator Alarms
  ❏ Presenter Tools
  ❏ Remote Controls
  ❏ Toys
  ❏ White Goods

■ Building and 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.

[+] Feedback

PRoC Block Diagram

P0 P1 P2   IRQ, MISO

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┌─────────────────────────────────────────────────────────────────────────┐
│  ┌──────────┐  ┌──────────┐  ┌──────────┐     ┌──────────────────┐        │
│  │          │  │          │  │          │     │                  │        │
│  │ 8KB Flash│  │  512B    │  │ IO Ports │     │                  │        │
│  │          │  │  SRAM    │  │          │     │ 2.4-GHz          │  X13_OUT│
│  └──────────┘  └──────────┘  └──────────┘     │ WirelessUSB      │        │
│                                               │ Radio Transceiver│  PACTL │
│  ┌─────────────────────────────────────┐     │                  │        │
│  │                                     │     │                  │  RFIN  │
│  │          PSoC M8C Core              │     │                  │        │
│  │                                     │     │                  │  RFOUT │
│  └─────────────────────────────────────┘     └──────────────────┘        │
│  ┌──────────┐  ┌──────────┐  ┌──────────────────┐                        │
│  │          │  │          │  │                  │                        │
│  │ Digital  │  │ Analog   │  │ System Resources │            XRES        │
│  │ PSoC     │  │ PSoC     │  │ Clocks, I2C,     │                        │
│  │ Block    │  │ Block    │  │ POR, Ref         │                        │
│  │ Array    │  │ Array    │  │                  │                        │
│  └──────────┘  └──────────┘  └──────────────────┘                        │
└─────────────────────────────────────────────────────────────────────────┘
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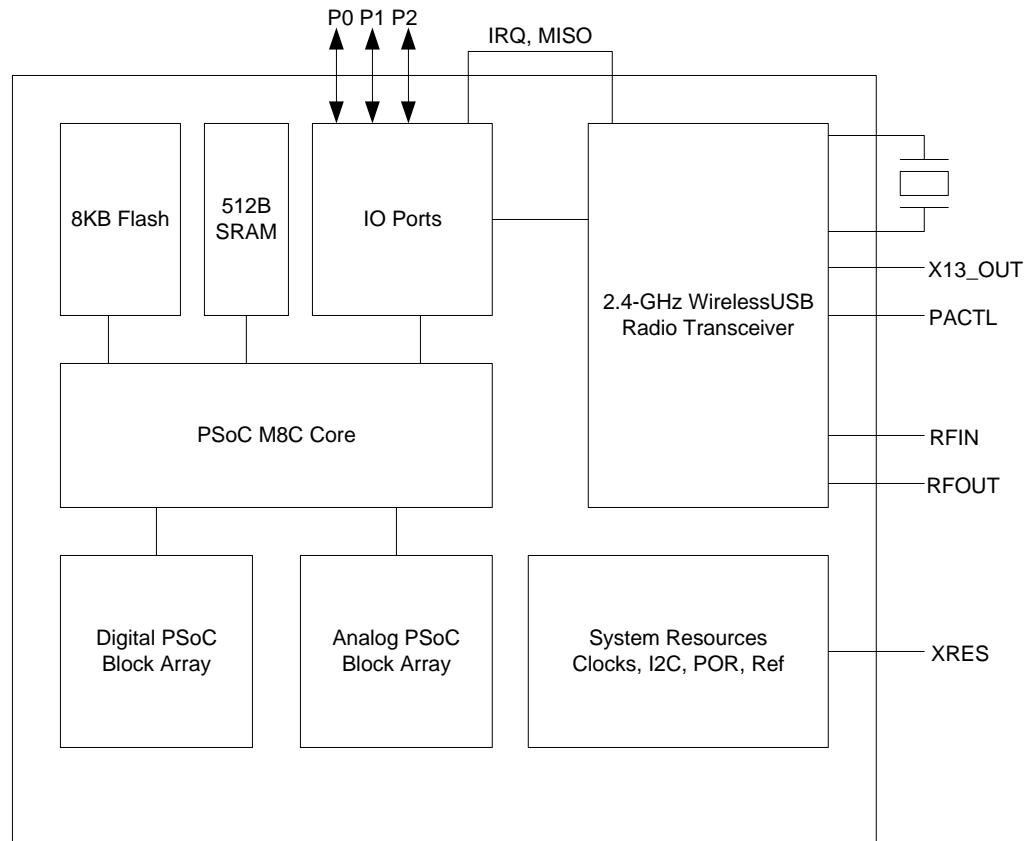
Functional Overview

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 to 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 programmable system-on-chip. 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
Analog RF				
47	RFIN		Radio	Modulated RF Signal Received
2	RFOUT		Radio	Modulated RF Signal to be Transmitted
Crystal and PA Control				
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
Reserved				
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
Microcontroller Digital and Analog				
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
Power and Ground				
4, 11, 15, 18, 26, 27, 32, 39, 40, 43, 45	V_CC			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

[+] Feedback

Application Example

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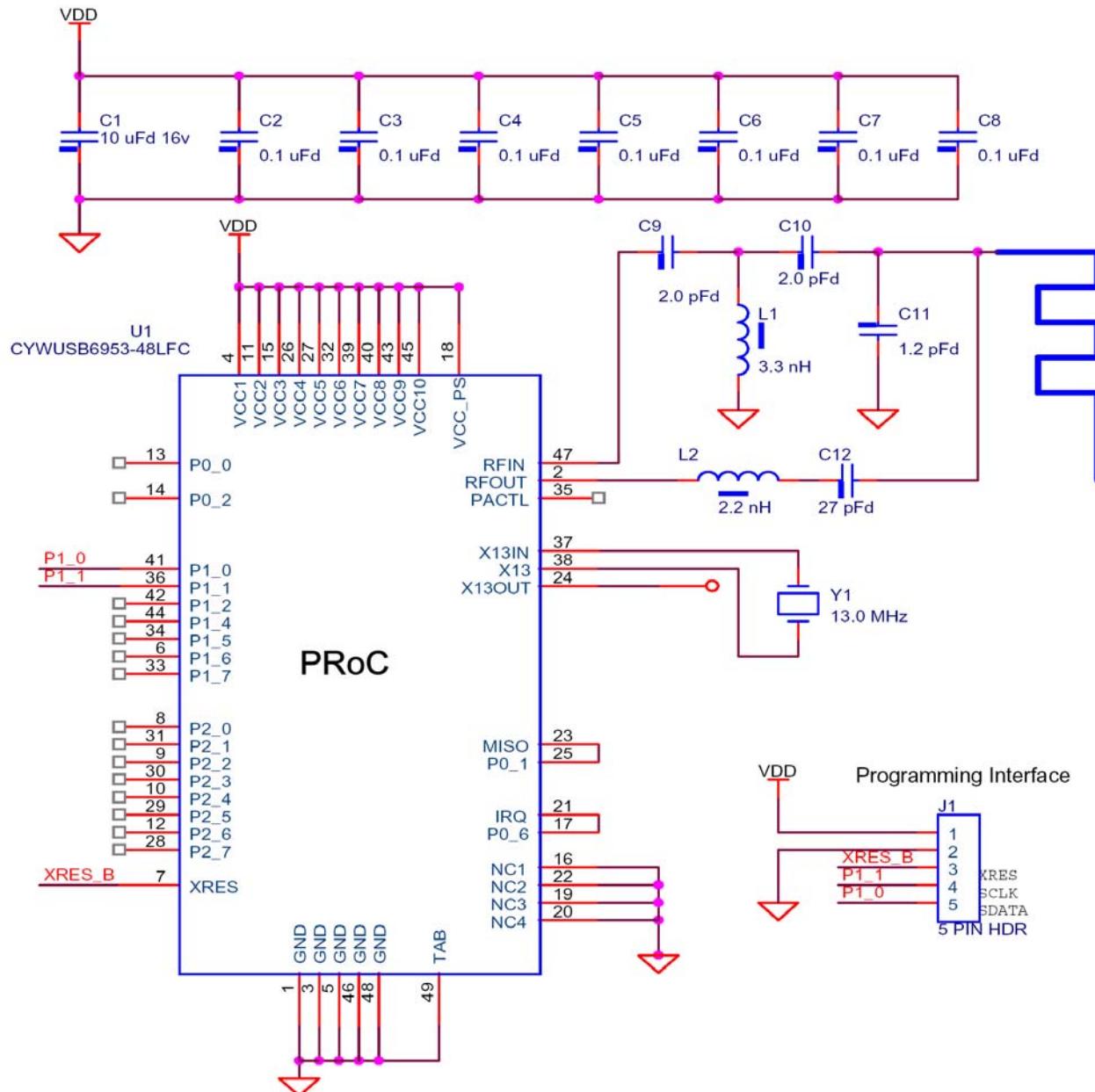
PRoC Absolute Maximum Ratings

Parameter	Description	Min	Typ	Max	Unit
T_{STG}	Storage Temperature	−55		100	°C
T_A	Ambient Temperature with Power Applied	0		70	°C
V_{dd}	Supply Voltage on V_{CC} Relative to VSS	−0.3		3.9	V
V_{IO}	DC Voltage to Logic Inputs	−0.3		$V_{CC} + 0.3$	V
V_{IOZ}	DC Voltage Applied to Outputs in High-Z State	−0.3		$V_{CC} + 0.3$	V
I_{MIO}	Maximum Current into Any Port Pin	−25		50	mA
ESD	Electrostatic Discharge Voltage (Other)			1600	V
I_{LU}	Latch Up Current			200	mA

PRoC Operating Conditions

Parameter	Description	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	2.7	3	3.6	V
TA	Ambient Temperature	0	25	70	°C

PRoC DC Electrical Characteristics

Parameter	Description	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	2.7	3	3.6	V
I_{CC}	Supply Current (Radio in Power Down)		1.7	2	mA
RX I_{CC}	Supply Current Radio Receive		61.3		mA
TX I_{CC}	Supply Current Radio Transmit		74.7		mA
SYNTH SETTLE I_{CC}	Current Consumption with Synthesizer on, No Transmit or Receive		33.0		mA
IDLE I_{CC}	Supply Current Radio Idle		5		mA
I_{SLEEP}	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

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Package Handling

Some IC packages require baking before they are soldered onto a PCB to remove moisture that may have been absorbed after leaving the factory. A label on the packaging has details about actual bake temperature and the minimum bake time to remove this moisture. The maximum bake time is the aggregate time that the parts are exposed to the bake temperature. Exceeding this exposure time may degrade device reliability.

Parameter	Description	Min	Typ	Max	Unit
$T_{BAKETEMP}$	Bake Temperature		125	See package label	°C
$T_{BAKETIME}$	Bake Time	See package label		72	hours

Package Diagram

Figure 1. 48-Pin QFN 7x7 mm LF48A
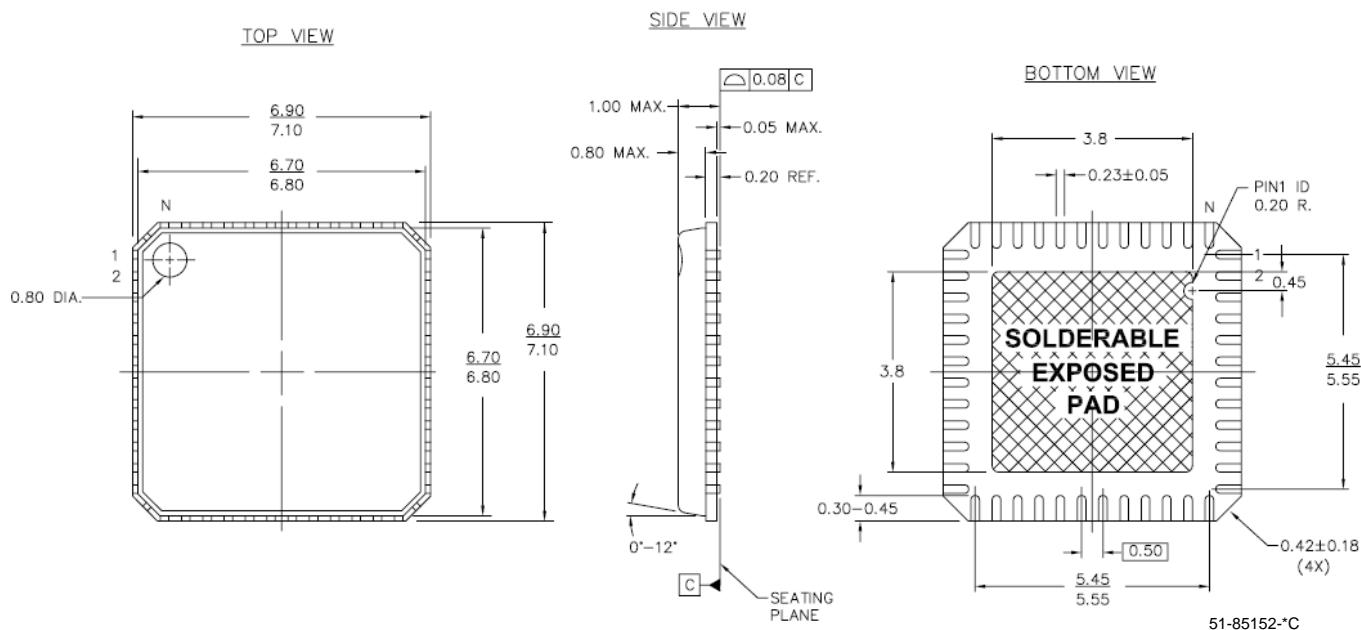
Document History Page

Document Title: CYWUSB6953 WirelessUSB™ PRoC™ Flash Programmable MCU + Radio Document Number: 38-16017					
Rev.	ECN No.	Orig. of Change	Submis-sion Date	Description of Change
**	329973	BON	See ECN	New data sheet
*A	337935	BON	See ECN	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	BON	See ECN	Updated the PRoC DC Electrical Characteristics. Changed "– 90 dBm receive sensi-tivity" 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	BON	See ECN	Added the Radio Data Rate Considerations section
*D	495870	OYR	See ECN	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
*E	2620679	CMCC/PYRS	12/12/08	Added Package Handling information

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