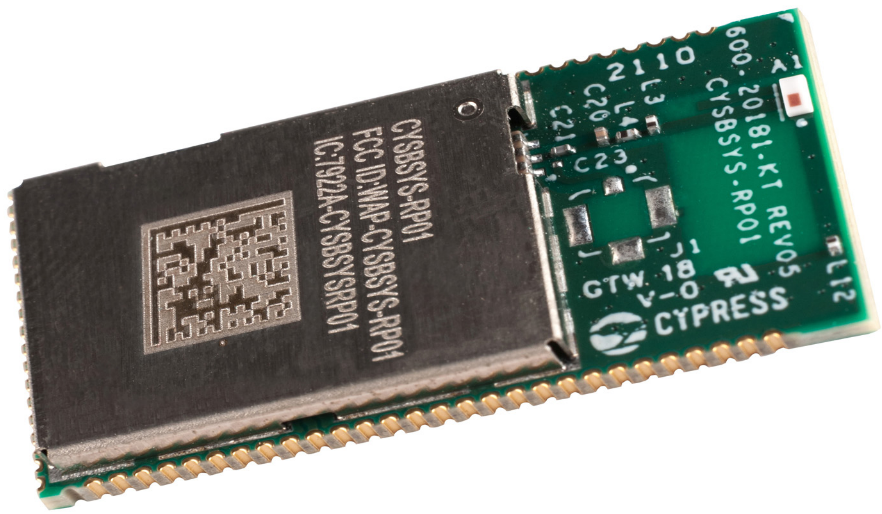
Rapid IoT Connect system on module

Dual band Wi-Fi and Bluetooth®

Description

CYSBSYS-RP01 Rapid IoT Connect system on module (SoM) is the easiest way to provide a secure, scalable, and reliable connection from device to cloud. CYSBSYS-RP01 is a pre-certified 802.11ac-friendly dual-band (2.4 and 5.0 GHz) Wi-Fi and Bluetooth® 5.0-compliant combo system-on module. The module includes a PSoC™ 6 MCU with an Arm® Cortex®-M4F CPU, and Cortex®-M0+ CPU, a single-chip radio, on-board crystals, oscillators, chip antenna, and passive components. CYSBSYS-RP01 provides up to 51 I/Os in a 26.59 x 14.0 x 2.5 mm castellated surface-mount PCB for easy manufacturing. CYSBSYS-RP01 is the fastest way to deploy a secure and reliable network of IoT devices.



Features

- Dual-core PSoC™ microcontroller
  - 150-MHz Arm® Cortex®-M4F
  - 100-MHz Cortex®-M0+
  - 2048-KB Application flash
  - 1024-KB SRAM
- Wi-Fi and Bluetooth® 5.0 combo radio
  - Dual band 2.4 and 5 GHz support
  - Simultaneous Wi-Fi and Bluetooth® operation
  - 801.11ac-friendly, MCS8 (256-QAM) for 20 MHz channels
  - Full IEEE 802.11 a/b/g/n compatibility
  - Bluetooth® 5.0-compliant
  - 2 Mbps data rate for Bluetooth® Low Energy
- On-board chip antenna
- Certified to FCC, ISED and CE regulations
- 51 programmable GPIOS including thirteen 12-bit SAR ADCs, USB, UART, I2C, SPi, QSPI, PWM, I2S, PDM, capacitive sensing
- 73-pin 0.8 mm pitch castellated solder pads SMD package

- Industrial temperature range: -20°C to 70°C
- Size: 26.59 mm x 14 mm x 2.5 mm (L x W x H)
- Weight: 2 gm
- Pb-free, Halogen-free and RoHS-compliant

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1 Overview

1.1 Functional block diagram

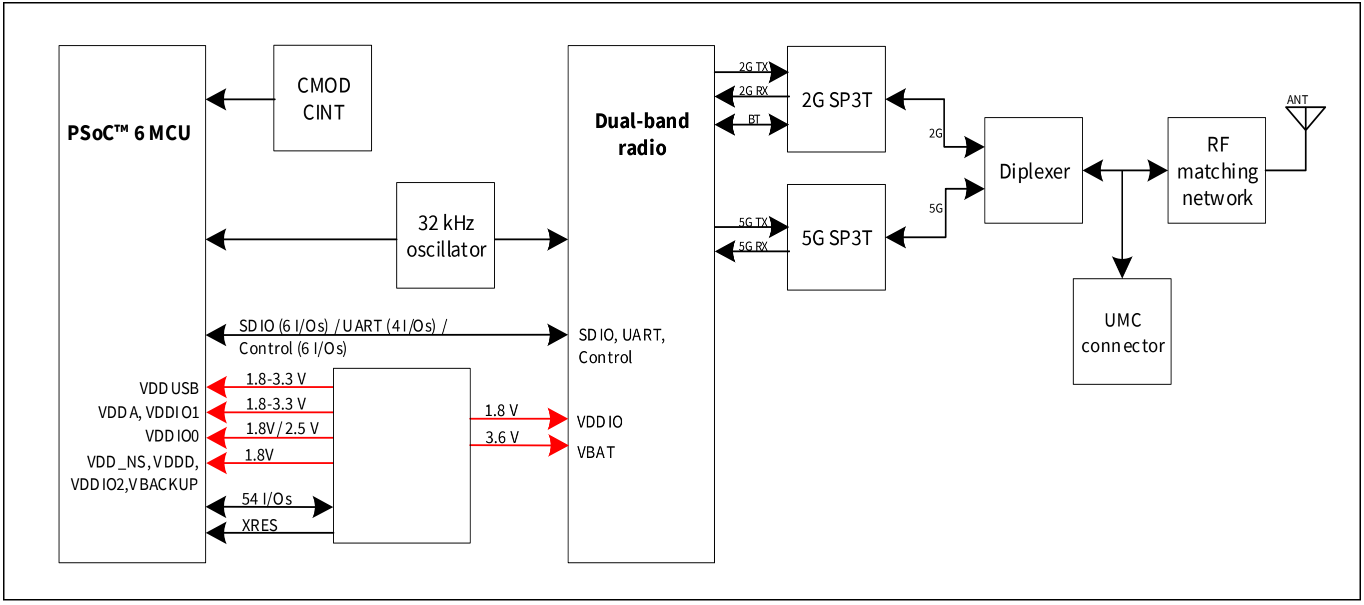


Figure 1 Functional block diagram

CYSBSYS-RP01 provides GPIO of PSoC™ 6 MCU via castellated solder pads. It has on-board connection between PSoC™6 MCU and the 802.11ac-friendly dual-band (2.4 and 5.0 GHz) Wi-Fi and Bluetooth® 5.0-compliant combo radio.

CYSBSYS-RP01 has an on-board dual-band chip antenna for Wi-Fi and Bluetooth®. CYSBSYS-RP01 has an on-board 32-kHz oscillator for the WCO of PSoC™ 6 MCU and the radio Wi-Fi sleep clock. It has the modulation and integration capacitors required for capacitive sensing. Furthermore, it has the diplexer and RF switches required for RF functionality.

CYSBSYS-RP01 is a complete hardware solution designed to be soldered to the applications main board. It provides a certified system for customers to design their end solutions.

There are five major subsystems:

- PSoC™ 6 MCU
- Single-chip, ultra-low-power, 802.11ac-friendly dual-band (2.4 and 5.0 GHz) Wi-Fi and Bluetooth® 5.0-compliant combo radio
- Crystal and oscillators
- Chip antenna for Wi-Fi and Bluetooth®
- CAPSENSE™ external modulation and integration capacitors and other passives like bypass capacitors and limiting resistors.

1.2 PSoC™ 6 MCU

PSoC™ 6 MCU is a high-performance, ultra-low-power and secured MCU platform, purpose-built for IoT applications. The PSoC™ 6 MCU is a combination of a dual CPU microcontroller with low-power flash technology, digital programmable logic, high-performance analog-to-digital conversion and standard communication and timing peripherals.

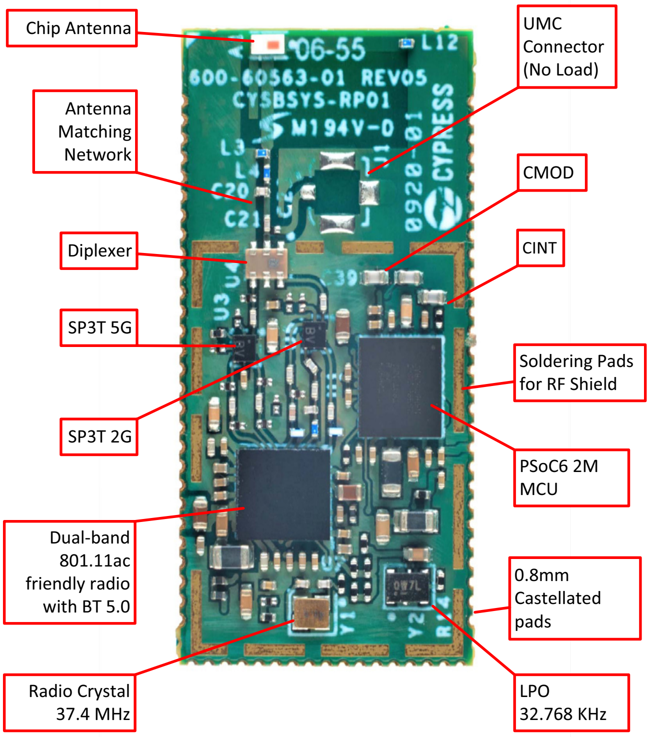


Figure 2 Key components

1.3 Dual-band 802.11ac-friendly radio with Bluetooth® 5.0

This radio is purpose-built for IoT applications. This radio is a 28-nm, ultra-low-power device that integrates a single-stream, dual band IEEE 802.11n-compliant, IEEE 802.11ac-friendly Wi-Fi sub-system, a Bluetooth® 5.0-compliant Bluetooth® sub-system, and an advanced coexistence engine for maximum combined performance. The 28-nm architecture enables dual band 802.11ac-friendly Wi-Fi and Bluetooth® 5.0 compliant combo radio to offer best-in-class power consumption in active and power saving modes. 802.11ac-friendliness enables the radio to guarantee superior performance in terms of throughput and power consumption compared to 802.11n products when operating in 802.11ac networks.

1.4 Crystal and oscillators

The CYSBSYS-RP01 system has an on-board 32.768-kHz oscillator shared between PSoC™ 6 MCU and the radio. The 32.768-kHz oscillator is used by PSoC™ 6 MCU for the WCO block.

1.5 Chip antenna for Wi-Fi and Bluetooth®

The system has an ultra-miniature chip antenna that supports 5-GHz and 2.4-GHz bands. The selected antenna has an efficiency of up to 51% at 2.4 GHz at 48% for 5 GHz. See **"System connections"** on page 7 for optimal placement of the CYSBSYS-RP01 board, and antenna efficiency details for different host board layouts.

1.6 CAPSENSE™ external modulation and integration capacitors

To enable CAPSENSE™ use cases on end applications, PSoC™ 6 MCU requires an external CMOD capacitor (modulator capacitor) for self-capacitance sensing, and CINTA and CINTB (integration capacitors) for mutual capacitance sensing. These external capacitors are connected between a dedicated GPIO pin and ground.

2 System connections

2.1 Power supply connections and recommended external components

Figure 3 shows the general requirements for power pins on CYSBSYS-RP01. See the tables in the section **"Recommended operating conditions"** on page 19 for details on the entire range of supported voltage for each power pins.

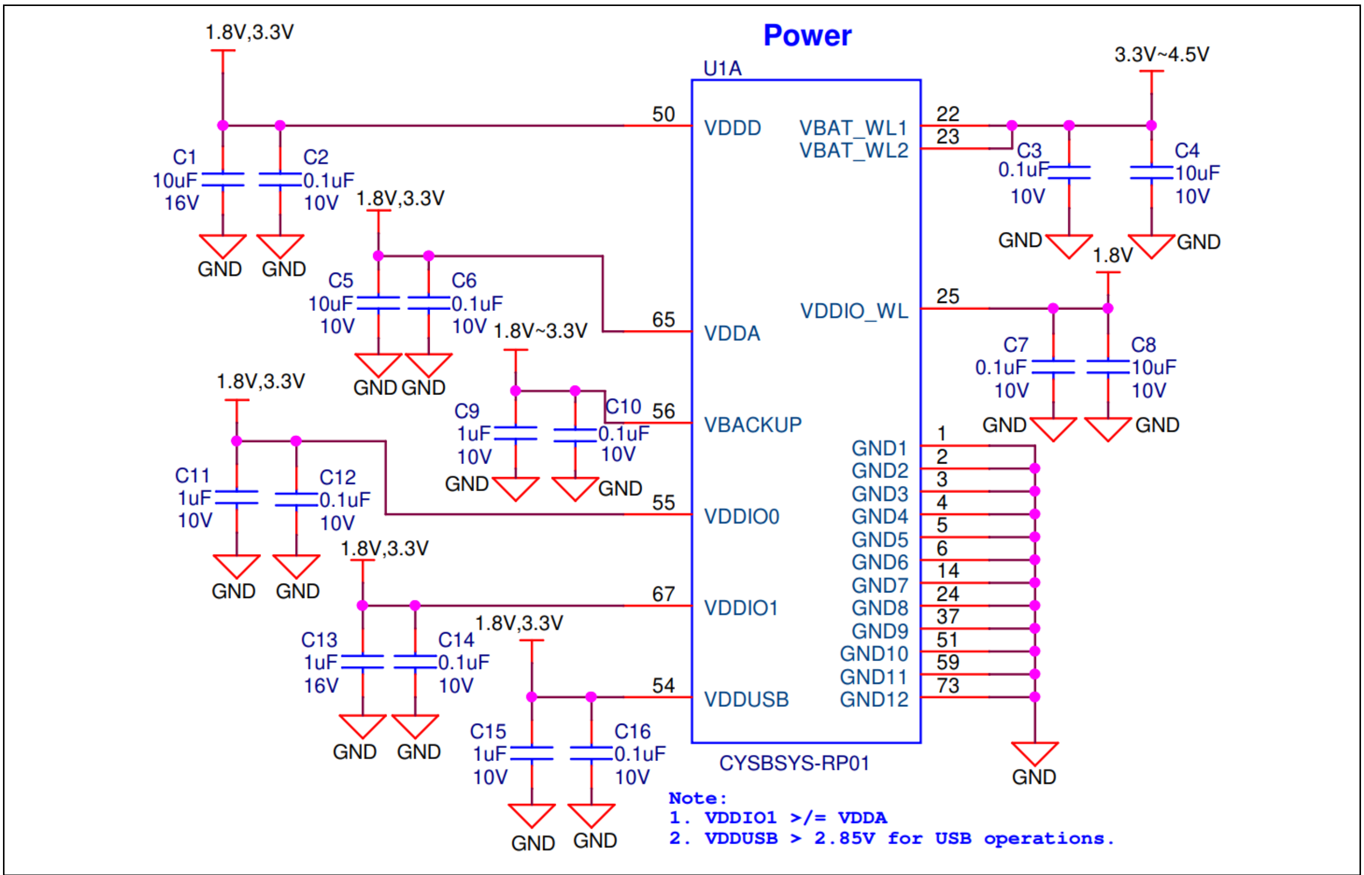


Figure 3 Board power pad connections

Bypass capacitors must be used from VBAT_WL, VDDD, and VDDA to ground and wherever indicated in the diagram. Typical practice for systems in this frequency range is to use a capacitor in the 10 µF range. A parallel smaller capacitor for each domain is provided on the CYSBSYS-RP01 board. Note that these are rules of thumb: for critical applications, the PCB layout, lead inductance, and the bypass capacitor parasitic should be simulated to design and obtain optimal bypassing. All capacitors should be ±20%, X5R ceramic or better.

Power supplies and ports correspond as follows:

- P0: VBACKUP
- P5, P6, P7, P8: VDDIO1
- P9, P10: VDDA
- P11, P12, P13: VDDIO0
- P14: VDDUSB

2.2 External reset (XRES)

CYSBSYS-RP01 has an integrated power-on reset circuit, which completely resets all circuits to a known power on state. This action can also be evoked by an external reset signal, forcing it into a power-on reset state. The XRES signal is an active LOW signal, which is an input to the CYSBSYS-RP01 (pad 49). The CYSBSYS-RP01 module does not require an external pull-up resistor on the XRES input.

2.3 Recommended host PCB layout

Figure 4 provides details that can be used for the recommended host PCB layout pattern for CYSBSYS-RP01. Dimensions are in millimeters unless otherwise noted. Pad length of 1.02 mm as shown in **Figure 4**, is the minimum recommended host pad length. All dimensions are referenced to the center of the solder pad.

To maximize performance, the host layout should follow these recommendations:

- The ideal placement of the CYSBSYS-RP01 board is in a corner of the host board with the antenna located outside the edge of the host board. This placement minimizes the additional recommended keep out area stated in item 2.
- To maximize RF performance, the area immediately around the system antenna should contain a keep out area, where no grounding or signal traces are contained. This keep out area applies to all layers of the host board. The recommended dimensions of the host PCB keep out area are shown in **Figure 4**.
- If fanout of traces are done under the board, care should be taken to fill the used area under the board with copper plane to avoid any unbalanced surface that may lead to an assembly issue.
- No metal should be located beneath or above the antenna area. Only bare PCB material should be located beneath the antenna area.

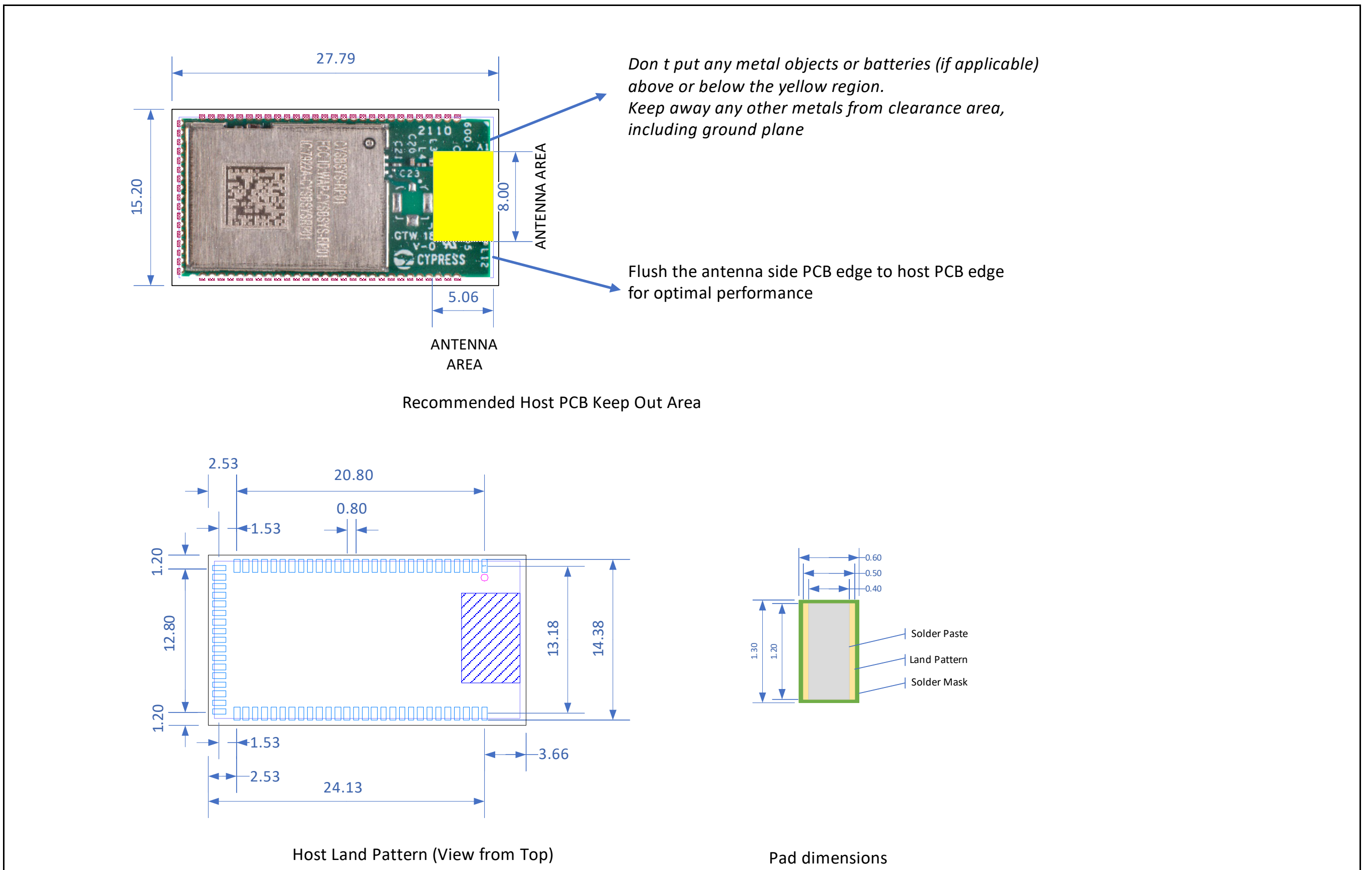


Figure 4 Board land pattern on host PCB (Top view seen on host PCB)

3 Pin information

3.1 Castellated pads layout

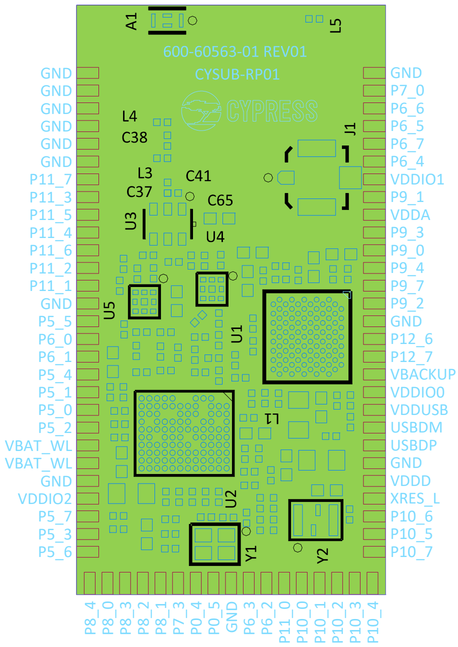


Figure 5 Module pad layout

Table 1 Pin information

Pad number	Pad name
1	GND
2	GND
3	GND
4	GND
5	GND
6	GND
7	P11_7
8	P11_3
9	P11_5
10	P11_4
11	P11_6
12	P11_2
13	P11_1
14	GND
15	P5_5
16	P6_0
17	P6_1
18	P5_4

Table 1 Pin information

Pad number	Pad name
19	P5_1
20	P5_0
21	P5_2
22	VBAT_WL
23	VBAT_WL
24	GND
25	VDDIO_WL
26	P5_7
27	P5_3
28	P5_6
29	P8_4
30	P8_0
31	P8_3
32	P8_2
33	P8_1
34	P7_3
35	P0_4
36	P0_5
37	GND
38	P6_3
39	P6_2
40	P11_0
41	P10_0
42	P10_1
43	P10_2
44	P10_3
45	P10_4
46	P10_7
47	P10_5
48	P10_6
49	XRES_L
50	VDDD
51	GND
52	USBDP
53	USBDM
54	VDDUSB
55	VDDIO0
56	VBACKUP
57	P12_7
58	P12_6

Table 1 Pin information

Pad number	Pad name
59	GND
60	P9_2
61	P9_7
62	P9_4
63	P9_0
64	P9_3
65	VDDA
66	P9_1
67	VDDIO1
68	P6_4
69	P6_7
70	P6_5
71	P6_6
72	P7_0
73	GND

3.2 Castellated pads pin description

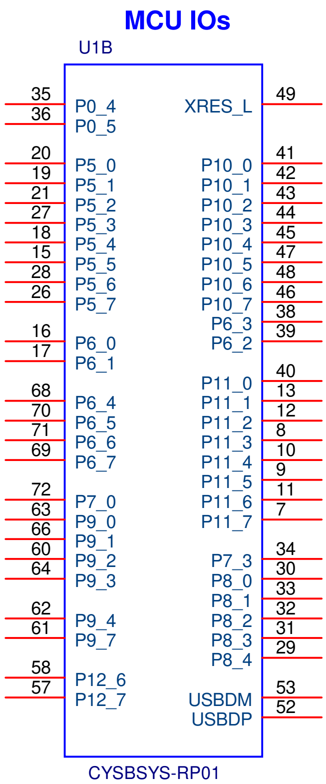


Figure 6 Castellated pads pinout

Each port pin has multiple alternate functions. These are defined in the table below. The columns ACT #x and DS #y denote active (System LP/ULP) and deepsleep mode signals respectively.

Port.Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P0.4	tcpwm[0].line[2]:0	tcpwm[1].line[2]:0	csd.csd_tx:4	csd.csd_tx_n:4					scb[0].uart_rts:0		scb[0].spi_clk:0				peri.tr_io_output[0]:2				
P0.5	tcpwm[0].line_compl[2]:0	tcpwm[1].line_compl[2]:0	csd.csd_tx:5	csd.csd_tx_n:5			srss.ext_clk:1		scb[0].uart_cts:0		scb[0].spi_select0:0				peri.tr_io_output[1]:2				
P5.0	tcpwm[0].line[4]:0	tcpwm[1].line[4]:0	csd.csd_tx:30	csd.csd_tx_n:30					scb[5].uart_rx:0	scb[5].i2c_scl:0	scb[5].spi_mosi:0		audioss[0].clk_i2s_if:0	peri.tr_io_input[10]:0					
P5.1	tcpwm[0].line_compl[4]:0	tcpwm[1].line_compl[4]:0	csd.csd_tx:31	csd.csd_tx_n:31					scb[5].uart_tx:0	scb[5].i2c_sda:0	scb[5].spi_miso:0		audioss[0].tx_sck:0	peri.tr_io_input[11]:0					
P5.2	tcpwm[0].line[5]:0	tcpwm[1].line[5]:0	csd.csd_tx:32	csd.csd_tx_n:32					scb[5].uart_rts:0		scb[5].spi_clk:0		audioss[0].tx_ws:0						
P5.3	tcpwm[0].line_compl[5]:0	tcpwm[1].line_compl[5]:0	csd.csd_tx:33	csd.csd_tx_n:33					scb[5].uart_cts:0		scb[5].spi_select0:0		audioss[0].tx_sdo:0						
P5.4	tcpwm[0].line[6]:0	tcpwm[1].line[6]:0	csd.csd_tx:34	csd.csd_tx_n:34					scb[10].uart_rx:0	scb[10].i2c_scl:0	scb[5].spi_select1:0		audioss[0].rx_sck:0						
P5.5	tcpwm[0].line_compl[6]:0	tcpwm[1].line_compl[6]:0	csd.csd_tx:35	csd.csd_tx_n:35					scb[10].uart_tx:0	scb[10].i2c_sda:0	scb[5].spi_select2:0		audioss[0].rx_ws:0						
P5.6	tcpwm[0].line[7]:0	tcpwm[1].line[7]:0	csd.csd_tx:36	csd.csd_tx_n:36					scb[10].uart_rts:0		scb[5].spi_select3:0		audioss[0].rx_sdi:0						

Port. Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P5.7	tcpwm[0].line_compl[7]:0	tcpwm[1].line_compl[7]:0	csd.csd_tx:37	csd.csd_tx_n:37					scb[10].uart_cts:0		scb[3].spi_select3:0								
P6.0	tcpwm[0].line[0]:1	tcpwm[1].line[8]:0	csd.csd_tx:38	csd.csd_tx_n:38	scb[8].i2c_scl:0				scb[3].uart_rx:0	scb[3].i2c_scl:0	scb[3].spi_mosi:0				cpuss.fault_out[0]				scb[8].spi_mosi:0
P6.1	tcpwm[0].line_compl[0]:1	tcpwm[1].line_compl[8]:0	csd.csd_tx:39	csd.csd_tx_n:39	scb[8].i2c_sda:0				scb[3].uart_tx:0	scb[3].i2c_sda:0	scb[3].spi_miso:0				cpuss.fault_out[1]				scb[8].spi_miso:0
P6.2	tcpwm[0].line[1]:1	tcpwm[1].line[9]:0	csd.csd_tx:40	csd.csd_tx_n:40					scb[3].uart_rts:0		scb[3].spi_clk:0								scb[8].spi_clk:0
P6.3	tcpwm[0].line_compl[1]:1	tcpwm[1].line_compl[9]:0	csd.csd_tx:41	csd.csd_tx_n:41					scb[3].uart_cts:0		scb[3].spi_select0:0								scb[8].spi_select0:0
P6.4	tcpwm[0].line[2]:1	tcpwm[1].line[10]:0	csd.csd_tx:42	csd.csd_tx_n:42	scb[8].i2c_scl:1				scb[6].uart_rx:2	scb[6].i2c_scl:2	scb[6].spi_mosi:2			peri.tr_io_input[12]:0	peri.tr_io_output[0]:1			cpuss.swj_swo_tdo	scb[8].spi_mosi:1
P6.5	tcpwm[0].line_compl[2]:1	tcpwm[1].line_compl[10]:0	csd.csd_tx:43	csd.csd_tx_n:43	scb[8].i2c_sda:1				scb[6].uart_tx:2	scb[6].i2c_sda:2	scb[6].spi_miso:2			peri.tr_io_input[13]:0	peri.tr_io_output[1]:1			cpuss.swj_swdoe_tdi	scb[8].spi_miso:1
P6.6	tcpwm[0].line[3]:1	tcpwm[1].line[11]:0	csd.csd_tx:44	csd.csd_tx_n:44					scb[6].uart_rts:2		scb[6].spi_clk:2							cpuss.swj_swdio_tms	scb[8].spi_clk:1
P6.7	tcpwm[0].line_compl[3]:1	tcpwm[1].line_compl[11]:0	csd.csd_tx:45	csd.csd_tx_n:45					scb[6].uart_cts:2		scb[6].spi_select0:2							cpuss.swj_swclk_tclk	scb[8].spi_select0:1

Port.Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P7.0	tcpwm[0].line[4]:1	tcpwm[1].line[12]:0	csd.csd_tx:46	csd.csd_tx_n:46					scb[4].uart_rx:1	scb[4].i2c_scl:1	scb[4].spi_mosi:1			peri.tr_io_input[14]:0		cpuss.trace_clock			
P7.3	tcpwm[0].line_compl[5]:1	tcpwm[1].line_compl[13]:0	csd.csd_tx:49	csd.csd_tx_n:49					scb[4].uart_cts:1		scb[4].spi_select0:1								
P8.0	tcpwm[0].line[0]:2	tcpwm[1].line[16]:0	csd.csd_tx:54	csd.csd_tx_n:54					scb[4].uart_rx:0	scb[4].i2c_scl:0	scb[4].spi_mosi:0			peri.tr_io_input[16]:0					
P8.1	tcpwm[0].line_compl[0]:2	tcpwm[1].line_compl[16]:0	csd.csd_tx:55	csd.csd_tx_n:55					scb[4].uart_tx:0	scb[4].i2c_sda:0	scb[4].spi_miso:0			peri.tr_io_input[17]:0					
P8.2	tcpwm[0].line[1]:2	tcpwm[1].line[17]:0	csd.csd_tx:56	csd.csd_tx_n:56		lpcomp.dsi_comp0:0			scb[4].uart_rts:0		scb[4].spi_clk:0								
P8.3	tcpwm[0].line_compl[1]:2	tcpwm[1].line_compl[17]:0	csd.csd_tx:57	csd.csd_tx_n:57		lpcomp.dsi_comp1:0			scb[4].uart_cts:0		scb[4].spi_select0:0								
P8.4	tcpwm[0].line[2]:2	tcpwm[1].line[18]:0	csd.csd_tx:58	csd.csd_tx_n:58					scb[11].uart_rx:0	scb[11].i2c_scl:0	scb[4].spi_select1:0								
P9.0	tcpwm[0].line[4]:2	tcpwm[1].line[20]:0	csd.csd_tx:62	csd.csd_tx_n:62					scb[2].uart_rx:0	scb[2].i2c_scl:0	scb[2].spi_mosi:0		audioss[0].clk_i2s_if:1	peri.tr_io_input[18]:0			cpuss.trace_data[3]:0		

Port.Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P9.1	tcpwm[0].line_compl[4]:2	tcpwm[1].line_compl[20]:0	csd.csd_tx:63	csd.csd_tx_n:63					scb[2].uart_tx:0	scb[2].i2c_sda:0	scb[2].spi_miso:0		audioss[0].tx_sck:1	peri.tr_io_input[19]:0			cpuss.trace_data[2]:0		
P9.2	tcpwm[0].line[5]:2	tcpwm[1].line[21]:0	csd.csd_tx:64	csd.csd_tx_n:64					scb[2].uart_rts:0		scb[2].spi_clk:0		audioss[0].tx_ws:1				cpuss.trace_data[1]:0		
P9.3	tcpwm[0].line_compl[5]:2	tcpwm[1].line_compl[21]:0	csd.csd_tx:65	csd.csd_tx_n:65					scb[2].uart_cts:0		scb[2].spi_select0:0		audioss[0].tx_sdo:1				cpuss.trace_data[0]:0		
P9.4	tcpwm[0].line[7]:5	tcpwm[1].line[0]:2	csd.csd_tx:66	csd.csd_tx_n:66							scb[2].spi_select1:0		audioss[0].rx_sck:1						
P9.7	tcpwm[0].line_compl[0]:6	tcpwm[1].line_compl[1]:2	csd.csd_tx:69	csd.csd_tx_n:69															
P10.0	tcpwm[0].line[6]:2	tcpwm[1].line[22]:0	csd.csd_tx:70	csd.csd_tx_n:70					scb[1].uart_rx:1	scb[1].i2c_scl:1	scb[1].spi_mosi:1			peri.tr_io_input[20]:0			cpuss.trace_data[3]:1		
P10.1	tcpwm[0].line_compl[6]:2	tcpwm[1].line_compl[22]:0	csd.csd_tx:71	csd.csd_tx_n:71					scb[1].uart_tx:1	scb[1].i2c_sda:1	scb[1].spi_miso:1			peri.tr_io_input[21]:0			cpuss.trace_data[2]:1		

Port. Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P10.2	tcpwm[0].line[7]:2	tcpwm[1].line[23]:0	csd.csd_tx:72	csd.csd_tx_n:72					scb[1].uart_rts:1		scb[1].spi_clk:1						cpuss.trace_data[1]:1		
P10.3	tcpwm[0].line_compl[7]:2	tcpwm[1].line_compl[23]:0	csd.csd_tx:73	csd.csd_tx_n:73					scb[1].uart_cts:1		scb[1].spi_select0:1						cpuss.trace_data[0]:1		
P10.4	tcpwm[0].line[0]:3	tcpwm[1].line[0]:1	csd.csd_tx:74	csd.csd_tx_n:74							scb[1].spi_select1:1	audioss[0].pdm_clk:0							
P10.5	tcpwm[0].line_compl[0]:3	tcpwm[1].line_compl[0]:1	csd.csd_tx:75	csd.csd_tx_n:75							scb[1].spi_select2:1	audioss[0].pdm_data:0							
P10.6	tcpwm[0].line[1]:6	tcpwm[1].line[2]:2	csd.csd_tx:76	csd.csd_tx_n:76							scb[1].spi_select3:1								
P10.7	tcpwm[0].line_compl[1]:6	tcpwm[1].line_compl[2]:2	csd.csd_tx:77	csd.csd_tx_n:77															
P11.0	tcpwm[0].line[1]:3	tcpwm[1].line[1]:1	csd.csd_tx:78	csd.csd_tx_n:78				smif.spi_select2	scb[5].uart_rx:1	scb[5].i2c_scl:1	scb[5].spi_mosi:1		audioss[1].clk_i2s_if:1	peri.tr_io_input[22]:0					
P11.1	tcpwm[0].line_compl[1]:3	tcpwm[1].line_compl[1]:1	csd.csd_tx:79	csd.csd_tx_n:79				smif.spi_select1	scb[5].uart_tx:1	scb[5].i2c_sda:1	scb[5].spi_miso:1		audioss[1].tx_sck:1	peri.tr_io_input[23]:0					

Port.Pin	Act #0	Act #1	Act #2	Act #3	DS #2	DS #3	Act #4	Act #5	Act #6	Act #7	Act #8	Act #9	Act #10	Act #12	Act #13	Act #14	Act #15	DS #5	DS #6
P11.2	tcpwm[0].line[2]:3	tcpwm[1].line[2]:1	csd.csd_tx:80	csd.csd_tx_n:80				smif.spi_select0	scb[5].uart_rts:1		scb[5].spi_clk:1		audioss[1].tx_ws:1						
P11.3	tcpwm[0].line_compl[2]:3	tcpwm[1].line_compl[2]:1	csd.csd_tx:81	csd.csd_tx_n:81				smif.spi_data3	scb[5].uart_cts:1		scb[5].spi_select0:1		audioss[1].tx_sdo:1		peri.tr_io_output[0]:0				
P11.4	tcpwm[0].line[3]:3	tcpwm[1].line[3]:1	csd.csd_tx:82	csd.csd_tx_n:82				smif.spi_data2			scb[5].spi_select1:1		audioss[1].rx_sck:1		peri.tr_io_output[1]:0				
P11.5	tcpwm[0].line_compl[3]:3	tcpwm[1].line_compl[3]:1	csd.csd_tx:83	csd.csd_tx_n:83				smif.spi_data1			scb[5].spi_select2:1		audioss[1].rx_ws:1						
P11.6			csd.csd_tx:84	csd.csd_tx_n:84				smif.spi_data0			scb[5].spi_select3:1		audioss[1].rx_sdi:1						
P11.7								smif.spi_clk											
P12.6	tcpwm[0].line[7]:3	tcpwm[1].line[7]:1	csd.csd_tx:91	csd.csd_tx_n:91							scb[6].spi_select3:0					sdhc[1].card_if_pwr_en			
P12.7	tcpwm[0].line_compl[7]:3	tcpwm[1].line_compl[7]:1	csd.csd_tx:92	csd.csd_tx_n:92												sdhc[1].io_volt_sel			
P14.1																			
P14.0																			

4 Electrical specifications

4.1 Absolute maximum ratings

Table 2 Absolute maximum ratings

Parameter	Description	Min	Max	Unit
VBAT_WL	DC supply voltage for dual-band 802.11ac-friendly radio with Bluetooth® 5.0, VBAT and PA driver supply	-0.5	+5.0	V
VDDIO_WL	DC supply voltage for digital I/O	-0.5	+2.20	V
VDDD, VBACKUP, VDDIO0	Internal regulator and Port 1 GPIO supply for PSoC™ 6 MCU Backup power and GPIO Port 0 supply when present GPIO supply for Ports 11 to 13 when present / Supply for eFuse programming	-0.5 -0.5	+4.0 +2.62	V V
VDDA, VDDIO1, VDDUSB	Analog power supply voltage for PSoC™ 6 MCU GPIO supply for ports 5 to 8 when present Supply for port 14 (USB or GPIO) when present	-0.5	+4.0	V
ESD_HBM	Human body model contact discharge per JEDEC EID/JESD22-A114	2200	-	V
ESD_CDM	Charged device model contact discharge per JEDEC EIA/JESD22-C101	500	8000	V

Usage above the absolute maximum conditions listed in above table may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods of time may affect device reliability. The maximum storage temperature is 150°C in compliance with JEDEC Standard JESD22-A103, high temperature storage life.

When used below absolute maximum conditions but above normal operating conditions, the device may not operate to specification.

4.2 Recommended operating conditions

4.2.1 DC specifications

Table 3 DC specifications

Parameter	Description	Min	Typ	Max	Unit	Details / conditions
VBAT_WL	DC supply voltage for dual-band 802.11ac-friendly radio with Bluetooth® 5.0, V_{BAT} and PA driver supply	3.2	3.6	4.4	V	
VDDIO_WL	DC supply voltage for digital I/O	1.62	1.8	1.98	V	
VDDD, VBACKUP, VDDIO0	Internal regulator and port 1 GPIO supply for PSoC™ 6 MCU backup power and GPIO port 0 supply when present GPIO supply for ports 11 to 13 when present / supply for eFuse programming	1.7 2.38	1.8 2.5	3.6 2.62	V V	V_{BACKUP} is 1.4 V in backup mode.
VDDA, VDDIO1,	Analog power supply voltage for PSoC™ 6 MCU, GPIO supply for ports 5 to 8 when present	1.7	3.3	3.6	V	V_{DDIO_1} must be ≥ to V_{DDA}.
VDDUSB	Supply for Port 14 (USB or GPIO) when present	1.7	3.3	3.6	V	Min supply is 2.85 V for USB

4.2.2 GPIO DC specifications

Table 4 GPIO DC specifications

Parameter	Description	Min	Max	Unit	Details / conditions
V_{IH}	Input voltage HIGH threshold	0.7 * V_{DD}	-	V	CMOS input
V_{IL}	Input voltage LOW threshold		0.3 * VDD	V	CMOS input
V_{OH}	Output voltage HIGH level	V_{DD} – 0.5		V	I_{OH} = 8 mA
V_{OL}	Output voltage LOW level		0.4	V	I_{OL} = 8 mA
I_{TOT_GPIO}	Maximum total source or sink chip current		200	mA	

4.3 External ECO specification

Table 5 External PSoC™ 6 MCU ECO specifications

Parameter	Description	Min	Typ	Max	Unit
F_MHz	Crystal frequency range for PSoC™ 6 MCU	4	33	33	MHz
Load capacitance	Crystal parallel load capacitance	-	-	18	pF
Drive Level		-	-	100	µW
Accuracy (±ppm)	Frequency stability	-20		+20	ppm
ESR	Equivalent series resistance		50	200	Ω

4.4 RF parameters

4.4.1 Wi-Fi radio

Table 6 5 GHz parameters

Parameter	Condition	Min	Typ	Max	Unit
Operating frequency range	-	4900	-	5845	MHz
Transmit power	11n, MCS7	17	17.5	18	dBm
	11a OFDM	18	18.5	18.8	dBm
Receiver sensitivity	11a, 6 Mbps	-	-92	-	dBm
	11a, 54 Mbps	-	-75	-	dBm
	11n, HT20, MCS0	-	-92	-	dBm
	11n, HT20, MCS7	-	-76	-	dBm
	11n, HT20, MCS8	-	-71	-	dBm

Table 7 2.4 GHz parameters

Parameter	Condition	Min	Typ	Max	Unit
Operating frequency range	-	2400	-	2500	MHz
Transmit power	11n, MCS7	16	17.5	18	dBm
	11b DSSS	17	18	18.7	dBm
Receiver sensitivity	11b, 1 Mbps	-	-97	-	dBm
	11b, 11 Mbps	-	-89	-	dBm
	11g, 6 Mbps	-	-94	-	dBm
	11g, 54 Mbps	-	-77	-	dBm
	11n, HT20, MCS0	-	-94	-	dBm
	11n, HT20, MCS7	-	-77	-	dBm

4.5 Bluetooth® and Bluetooth® LE

Table 8 Bluetooth® and Bluetooth® LE

Parameter	Condition	Min	Typ	Max	Unit
Operating frequency range	-	2402	-	2480	MHz
Transmit power	Bluetooth®	-	10.8	11.8	dBm
	Bluetooth® LE	-	6.5	7.5	dBm

4.6 Power consumption

4.6.1 2.4 GHz WLAN current consumption

LDO mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V , V_{DD_USB} = 3.3 V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Hibernate (radio off)	0.023	0.403	0.047	0.029	0.510	0.098
Deepsleep with radio beacons	0.115	0.574	0.047	213.707	13.338	0.098
Active RX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous RX	34.369	20.192	0.047	283.317	23.195	0.098
Active TX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous TX	89.168	21.853	0.048	276.021	24.553	0.099

Buck mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V, V_{DD_USB} = 3.3 V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Hibernate (radio off)	0.022	0.470	0.047	0.029	0.576	0.100
Deepsleep with radio beacons	0.116	0.609	0.047	235.280	12.702	0.100
Active RX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous RX	28.993	15.881	0.045	279.373	18.796	0.097
Active TX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous TX	89.419	17.285	0.048	277.439	19.814	0.100

4.6.2 5 GHz WLAN current consumption

LDO mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V, V_{DD_USB} = 3.3V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Hibernate (radio off)	0.023	0.403	0.047	0.029	0.510	0.098
Deepsleep with radio beacons	0.115	0.589	0.047	243.689	14.837	0.099
Active RX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous RX	82.640	21.503	0.046	268.122	23.818	0.099
Active TX modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous TX	109.585	22.065	0.047	294.697	24.584	0.100

Buck mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V, V_{DD_USB} = 3.3 V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Hibernate (radio off)	0.022	0.470	0.047	0.029	0.576	0.100
Deepsleep with radio beacons	0.106	0.662	0.046	240.673	11.807	0.097
Active RX Modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous RX	43.186	15.898	0.047	225.044	17.974	0.099
Active TX Modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Continuous TX	109.12	17.033	0.049	292.899	19.214	0.102

4.6.3 Bluetooth® and Bluetooth® LE current consumption

LDO mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V, V_{DD_USB} = 3.3 V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Advertise	4.512	13.892	0.049	167.673	14.453	0.100
Scan	5.331	13.728	0.047	167.097	14.288	0.099
Continuous RX	10.513	14.094	0.040	206.831	14.704	0.091
Continuous TX	16.407	14.285	0.041	209.131	14.722	0.092

Buck mode	V_{BAT_WL} = 3.6 V, V_{DDIO_WL}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 V, V_{DD_USB} = 3.3 V, T_A = 25°C					
	Average current (mA)			**Maximum current (mA)**		
Sleep modes	**3.6 V**	**1.8 V**	**3.3 V**	**3.6 V**	**1.8 V**	**3.3 V**
Advertise	4.514	10.268	0.048	178.820	10.723	0.100
Scan	5.283	10.528	0.046	167.101	11.058	0.097
Continuous RX	10.171	10.410	0.040	206.747	10.982	0.092
Continuous TX	17.833	10.759	0.040	206.664	11.319	0.091

5 Environmental specifications

CYSBSYS-RP01 is built in compliance with the Restriction of Hazardous Substances (RoHS) and halogen-free (HF) directives. The CYSBSYS-RP01 and components used to produce this module are RoHS- and HF-compliant.

5.1 RF certification

CYSBSYS-RP01 is certified under the following RF certification standards:

- CE
- FCC ID
- ISED

5.2 Environmental conditions

This section describes the operating and storage conditions for CYSBSYS-RP01.

Table 9 Environmental conditions for CYSBSYS-RP01

Description	Minimum specification	Maximum specification
Operating temperature	-20°C	+70°C
Operating humidity (relative, non-condensation)	5%	85%
Thermal ramp rate	1°C/s	3°C/s
Storage temperature	-40°C	+85°C
ESD	2.2 kV	8 kV

5.3 ESD and EMI protection

Exposed components require special attention to ESD and EMI.

Device handling: Proper ESD protocol must be followed in manufacturing to ensure component reliability.

6 Regulatory information

6.1 FCC

6.1.1 FCC notice

The device CYSBSYS-RP01 complies with Part 15 of the FCC Rules. The device meets the requirements for modular transmitter approval as detailed in FCC public Notice DA00-1407. Transmitter Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

6.1.2 Caution

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Cypress Semiconductor may void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

6.1.3 Labeling requirements

The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Cypress Semiconductor FCC identifier for this product as well as the FCC Notice above. The FCC identifier is FCC ID: WAP-CYSBSYS-RP01.

In any case the end product must be labeled exterior with “Contains FCC ID: WAP-CYSBSYS-RP01”.

6.1.4 Antenna warning

This device is tested with a standard SMA connector and with the on-board chip antenna. When integrated in the OEMs product, no rework or replacement is permitted to the on-board chip antenna with higher gain, nor mounting any other external antenna.

6.1.5 RF exposure

To comply with FCC RF Exposure requirements, the OEM must use the module with on-board chip antenna as-is.

Any notification to the end user of installation or removal instructions about the integrated radio module is not allowed.

The radiated output power of CYSBSYS-RP01 module is far below the FCC radio frequency exposure limits. End users may not be provided with the module installation instructions. OEM integrators and end users must be provided with transmitter operating conditions for satisfying RF exposure compliance. Nevertheless, the module is to be used in such a manner that the potential for human contact during normal operation is minimized. This can be accomplished by installing the module as per manufacturer instructions. The module has been evaluated for and shown compliant with the FCC RF Exposure limits under mobile exposure conditions (antennas are greater than 20cm from a person’s body). This device has also been evaluated for and shown compliant with the FCC RF exposure limits under portable exposure conditions (antennas are within 20 cm of a person's body) when installed in certain specific configurations.

6.1.6 ISED

Innovation, Science and Economic Development (ISED) Canada Certification

CYSBSYS-RP01 is licensed to meet the regulatory requirements of Innovation, Science and Economic Development (ISED) Canada.

License: IC: 7922A-6045

Manufacturers of mobile, fixed or portable devices incorporating this module are advised to clarify any regulatory questions and ensure compliance for SAR and/or RF exposure limits. Users can obtain Canadian information on RF exposure and compliance from **www.ic.gc.ca**.

This device has been designed to operate with the antennas listed in **Table 8** on page 20, having a maximum gain of -0.5 dBi. Antennas not included in Table or having a gain greater than -0.5 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

6.1.7 ISED notice

The device CYSBSYS-RP01 including the built-in trace antenna complies with Canada RSS-GEN Rules. The device meets the requirements for modular transmitter approval as detailed in RSS-GEN. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

L'appareil CYSBSYS-RP01, y compris l'antenne intégrée, est conforme aux Règles RSS-GEN de Canada. L'appareil répond aux exigences d'approbation de l'émetteur modulaire tel que décrit dans RSS-GEN. L'opération est soumise aux deux conditions suivantes: (1) Cet appareil ne doit pas causer d'interférences nuisibles, et (2) Cet appareil doit accepter toute interférence reçue, y compris les interférences pouvant entraîner un fonctionnement indésirable.

6.1.8 ISED interference statement for Canada

This device complies with Innovation, Science and Economic Development (ISED) Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme à la norme sur l'innovation, la science et le développement économique (ISED) norme RSS exempte de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

6.1.9 ISED radiation exposure statement for Canada

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme aux limites d'exposition aux radiations ISED prévues pour un environnement incontrôlé.

6.1.10 Labeling requirements

The Original Equipment Manufacturer (OEM) must ensure that ISED labelling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Cypress Semiconductor IC identifier for this product as well as the ISED Notices above. The IC identifier is 7922A-CYSBSYSRP01. In any case, the end product must be labeled in its exterior with “Contains IC: 7922A-CYSBSYSRP01”.

Le fabricant d'équipement d'origine (OEM) doit s'assurer que les exigences d'étiquetage ISED sont respectées. Cela comprend une étiquette clairement visible à l'extérieur de l'enceinte OEM spécifiant l'identifiant Cypress Semiconductor IC approprié pour ce produit ainsi que l'avis ISED ci-dessus. L'identificateur IC est 7922A-CYSBSYSRP01. En tout cas, le produit final doit être étiqueté dans son extérieur avec “Contient IC: 7922A-CYSBSYSRP01”.

6.2 European declaration of conformity

Hereby, Cypress Semiconductor declares that the Rapid IoT connect CYSBSYS-RP01 complies with the essential requirements and other relevant provisions of Directive 2014. As a result of the conformity assessment procedure described in Annex III of the Directive 2014, the end-customer equipment should be labeled as follows:

CE

All versions of the CYSBSYS-RP01 in the specified reference design can be used in the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, The Netherlands, the United Kingdom, Switzerland, and Norway.

7 Packaging

Table 10 Solder reflow peak temperature

Part number	Package	Maximum peak temperature	Maximum time at peak temperature	No. of cycles
CYSBSYS-RP01	73-pin castellated solder pads	260°C	30 seconds	2

Table 11 Package moisture sensitivity level (MSL), IPC/JEDEC J-STD-2

Part number	Package	MSL
CYSBSYS-RP01	73-pin castellated solder pads	3

CYSBSYS-RP01 is offered in tape and reel packaging. **Figure 7** details the tape dimensions used for CYSBSYS-RP01.

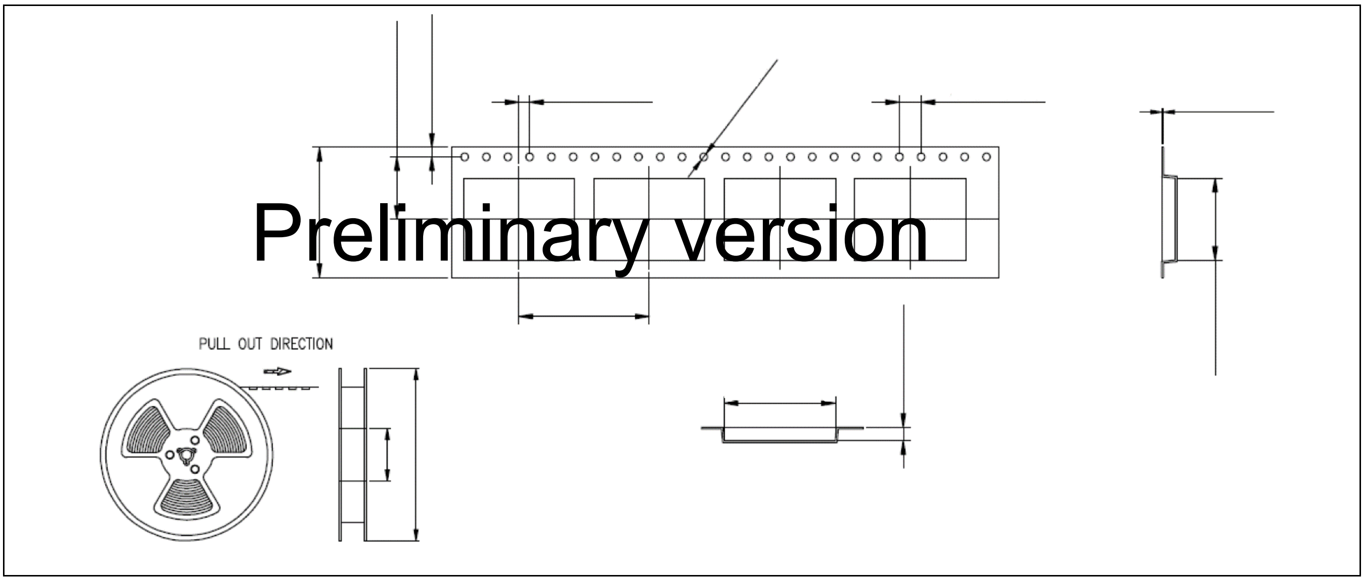


Figure 7 Tape dimensions

Figure 9 details the orientation of CYSBSYS-RP01 in the tape as well as the direction for unreeling.

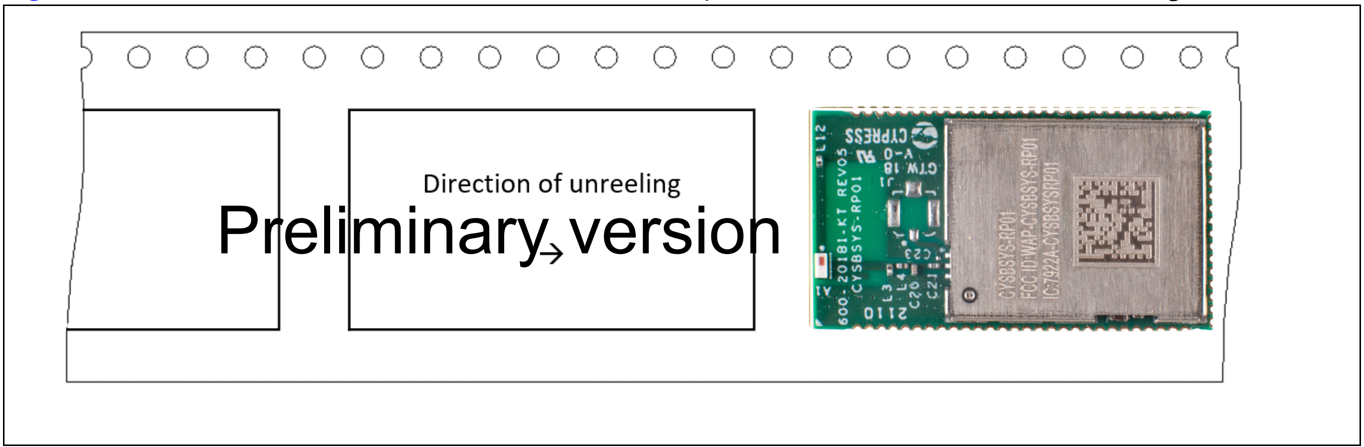


Figure 8 Tape dimensions

Figure 10 details reel dimensions used for CYSBSYS-RP01.

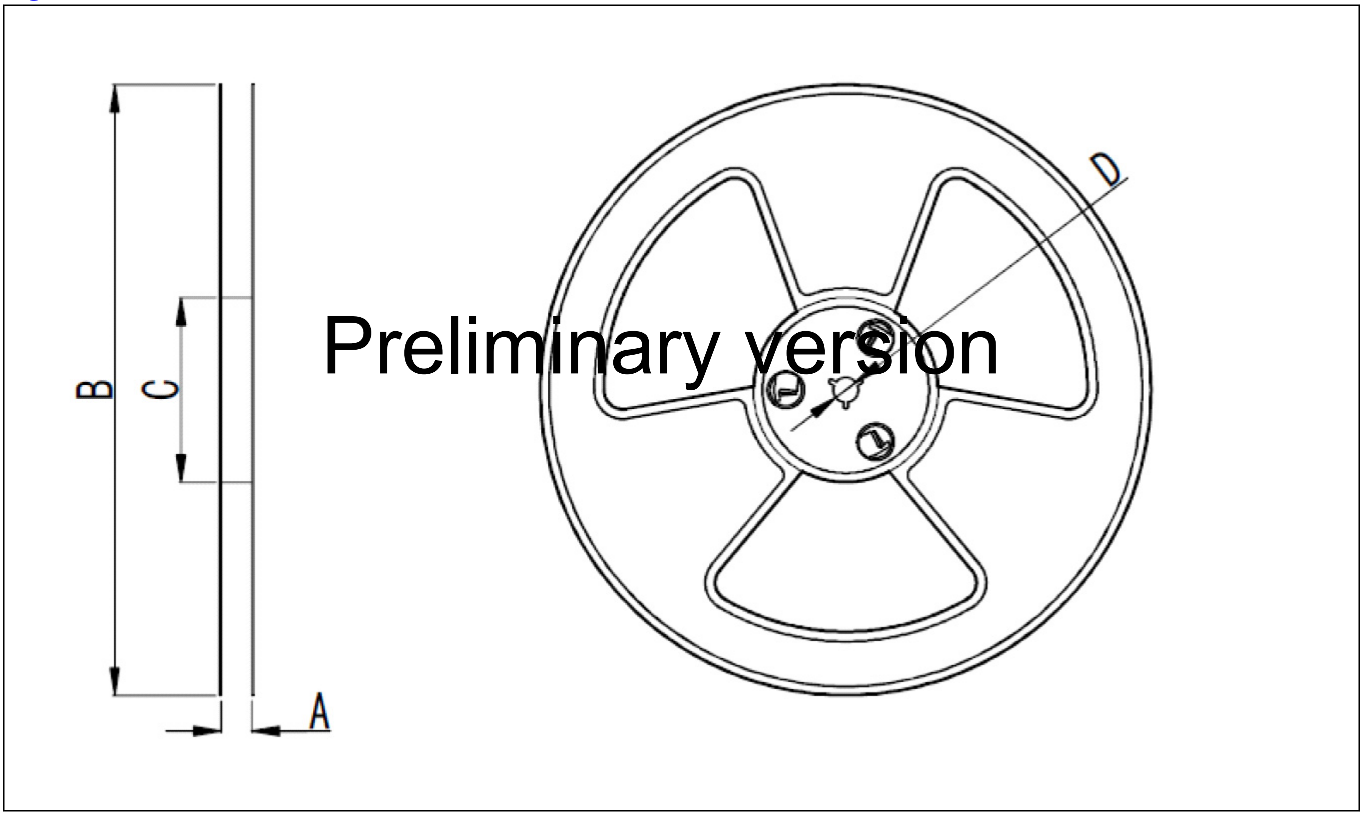


Figure 9 **Tape dimensions**

CYSBSYS-RP01 is designed to be used with pick-and-place equipment in an SMT manufacturing environment. **Figure 10** shows the center-of-mass for CYSBSYS-RP01.

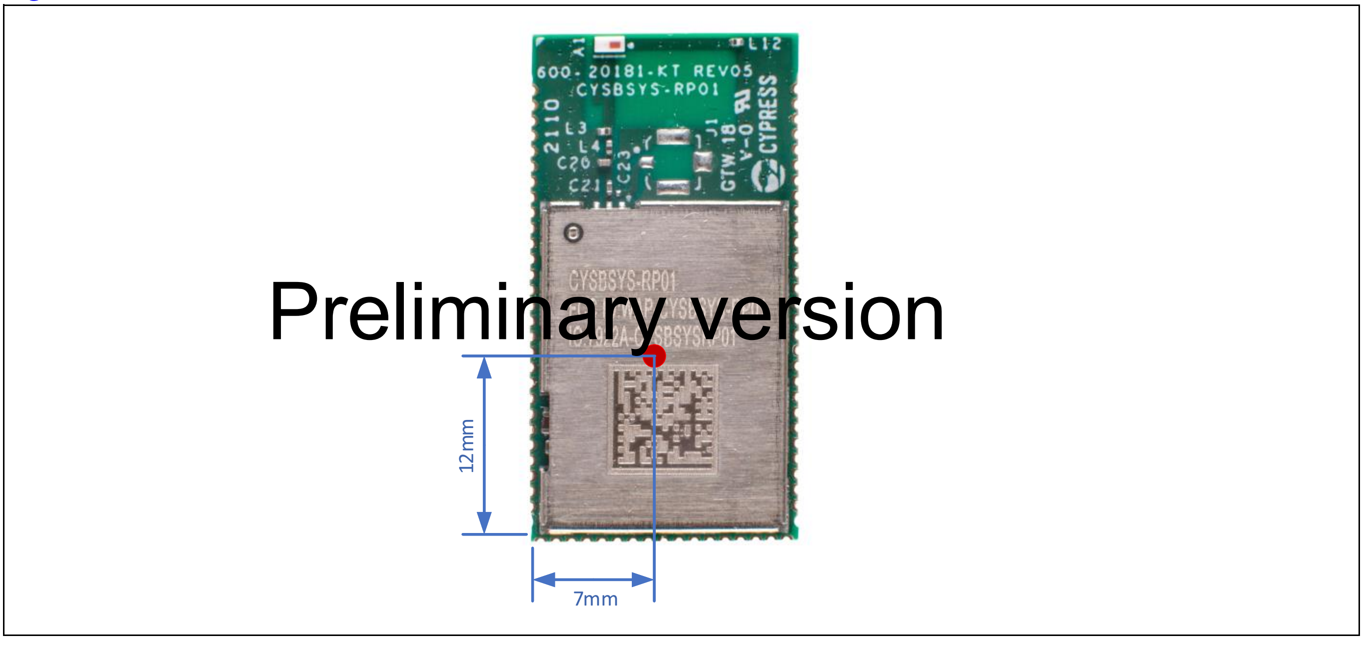


Figure 10 **Center-of-mass for CYSBSYS-RP01**

8 Mechanical dimensions

Physical dimensions of CYSBSYS-RP01 system is as shown in **Figure 11** and **Table 12**.

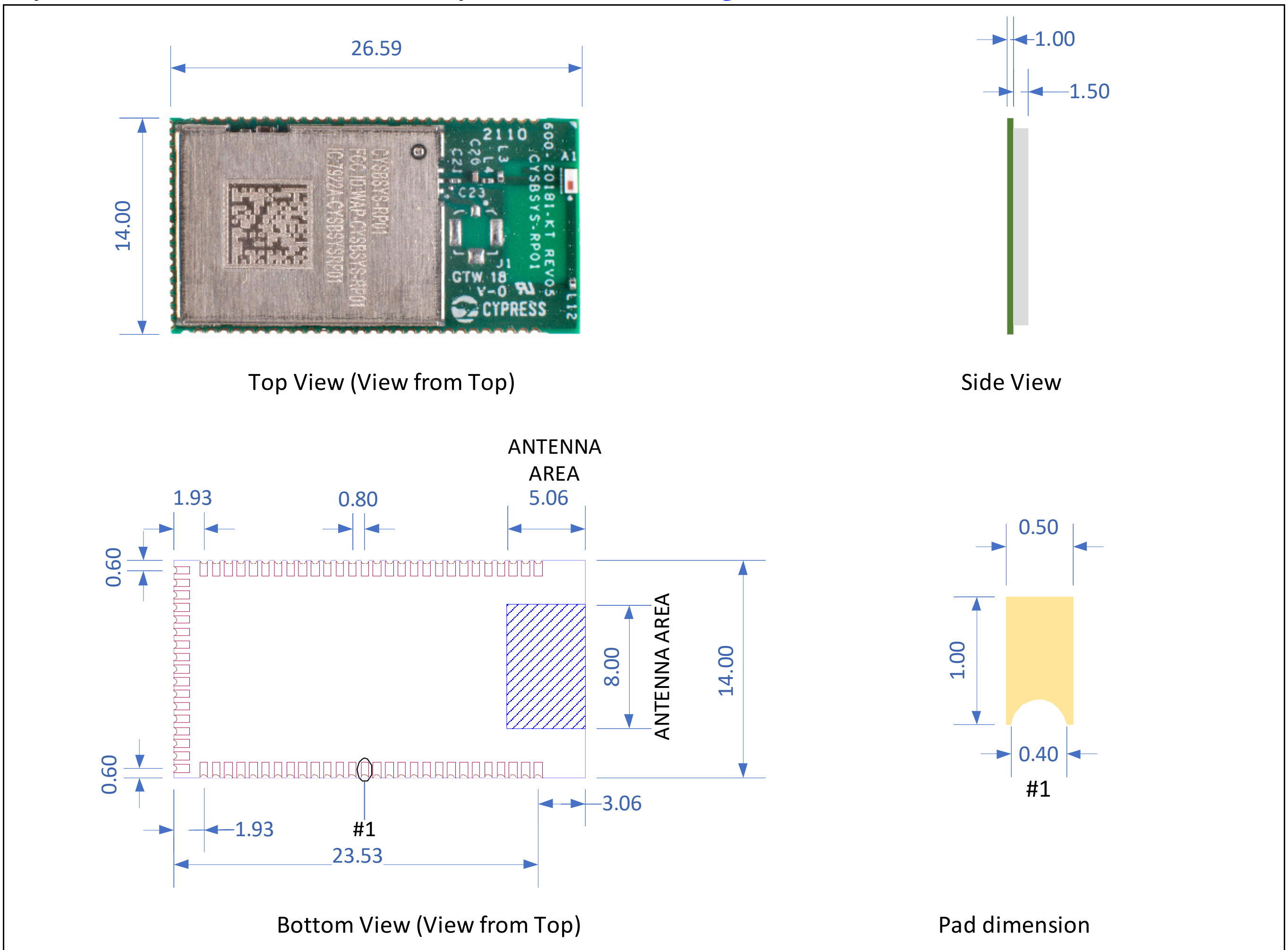


Figure 11 Board dimensions: Top side and bottom views

Table 12 Board dimensions

Mark	Dimension	Unit
L (Typical)	26.59	mm
W (Typical)	14	mm
PCB thickness	1.0	mm
RF shield height	1.5	mm
T (Total system thickness, max)	2.5	mm

9 Ordering information

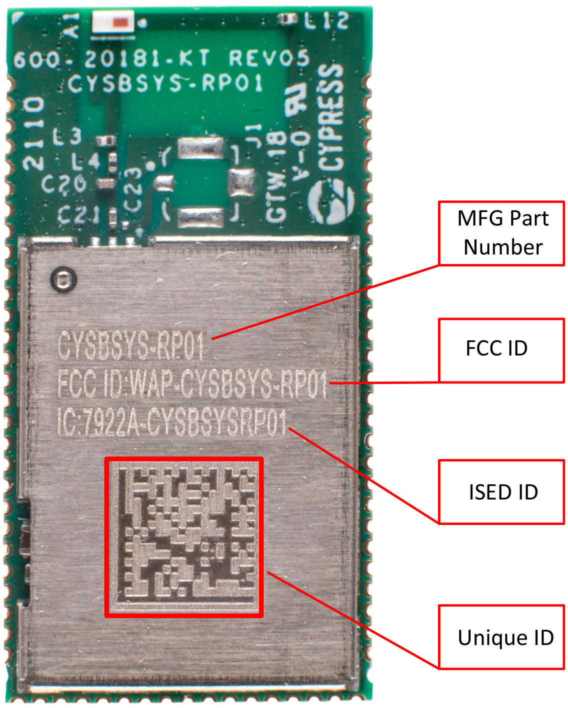
Table 13 Ordering information

Part number	Package	Features Antenna
CYSBSYS-RP01	73-pin castellated solder pads	Chip antenna

Table 14 Tape and reel package quantity and minimum order amount

Description	Minimum reel quantity	Maximum reel quantity	Comments
Reel quantity	400	400	Ships in 500-unit reel quantities
Minimum order quantity (MOQ)	400	-	
Order increment (OI)	400	-	

9.1 Part numbering convention



The part numbers are of the form CYSBSYS-RP01 where the fields are defined as follows:

CYSBSYS-RP01

- Radio type : 01 - Dual-band 2.4 GHz/5 GHz radio
- Marketing code : RP - Rapid IoT Connect
- Marketing code : SBSYS – Subsystem Product Family
- Company ID : CY- Cypress (An Infineon company)

For additional information and a complete list of Rapid IoT connect products, contact your local sales representative or visit our website **www.infineon.com**.

10 Acronyms

Table 15 Acronyms used in this document

Acronym	Description
ADC	analog-to-digital converter
CM4	Cortex®-M4, an Arm® CPU
CMOS	complementary metal-oxide-semiconductor, a process technology for IC fabrication
CM0+	Cortex-M0+, an Arm CPU
CPU	central processing unit
CSD	CAPSENSE™ sigma-delta
CSX	Cypress mutual capacitance sensing method
ECO	external crystal oscillator
EEPROM	electrically erasable programmable read-only memory
EMI	electromagnetic interference
ESD	electrostatic discharge
GPIO	general-purpose input and output, applies to a PSoC™ pin
GND	ground
IoT	Internet of Things
I^2C or IIC	inter-integrated circuit, a communications protocol
LE	low energy
MCU	microcontroller unit
PCB	printed circuit board
RAM	random-access memory
RF	radio frequency
ROM	read-only memory
RTC	real-time clock
RX	receive
SPI	serial peripheral interface, a communications protocol
TX	transmit
UART	universal asynchronous transmitter receiver, a communications protocol
USB	universal serial bus
WCO	watch crystal oscillator
XRES	external reset input pin

11 Document conventions

Table 16 Unit of measure

Symbol	Unit of measure
°C	degrees celsius
dB	decibel
dBm	decibel-milliwatts
Hz	hertz
KB	1024 bytes
kbps	kilobits per second
kHz	kilohertz
Mbps	megabits per second
MHz	megahertz
MΩ	mega-ohm
µF	microfarad
µW	microwatt
mA	milliampere
nA	nanoampere
Ω	ohm
pF	picofarad
ppm	parts per million
s	second
V	volt

Revision history

Document version	Date	Description of changes
*C	2021-08-02	Public release
*D	2023-01-20	Updated **"Description"** on page 1 and **"Features"** on page 1. Updated the section **"PSoC™ 6 MCU"** on page 5, **"Crystal and oscillators"** on page 6. Updated **Figure 3**. Updated the Max and min values in **Table 2** and **Table 3**. Replaced the title 2.4 with 5 GHz in **Table 6** and replaced 5 GHz with 2.4 GHz in **Table 7**. Updated all the tables in **"Power consumption"** on page 21. Updated **"Acronyms"** on page 31. Updated copyright information.

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