CYSBSYS-RP01 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
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Features

• 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

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.
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Overview

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 perfor-
mance. 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.
3 Pin information

3.1 Castellated pads layout

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## Pin information

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Pin information

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#### 3.2 Castellated pads pin description

![Figure 6 Castellated pads pinout](image-url)
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.

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Rapid IoT Connect system on module
Dual band Wi-Fi and Bluetooth®
<p>| Port. Pin | Act #0 | Act #1 | Act #2 | Act #3 | DS #2 | DS #3 | Act #4 | Act #5 | DS #4 | Act #6 | Act #7 | Act #8 | Act #9 | Act #10 | Act #11 | 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.cs_d_tx:4 | csd.cs_d_tx_n:46 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P7.3     | tcpwm[0].line_comp[5]:1 | tcpwm[1].line_comp[13]:0 | csd.cs_d_tx:4 | csd.cs_d_tx_n:49 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P8.0     | tcpwm[0].line[0]:2 | tcpwm[1].line[16]:0 | csd.cs_d_tx:5 | csd.cs_d_tx_n:54 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P8.1     | tcpwm[0].line_comp[0]:2 | tcpwm[1].line_comp[16]:0 | csd.cs_d_tx:5 | csd.cs_d_tx_n:55 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P8.2     | tcpwm[0].line[1]:2 | tcpwm[1].line[17]:0 | csd.cs_d_tx:5 | csd.cs_d_tx_n:56 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P8.3     | tcpwm[0].line_comp[1]:2 | tcpwm[1].line_comp[17]:0 | csd.cs_d_tx:5 | csd.cs_d_tx_n:57 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P8.4     | tcpwm[0].line[2]:2 | tcpwm[1].line[18]:0 | csd.cs_d_tx:5 | csd.cs_d_tx_n:58 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| P9.0     | tcpwm[0].line[4]:2 | tcpwm[1].line[20]:0 | csd.cs_d_tx:6 | csd.cs_d_tx_n:62 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |</p>
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</tr>
<tr>
<td>P11.3 tcpwm[0].line-compl[2]:3</td>
<td>tcpwm[1].line-compl[2]:1</td>
<td>csd.csdx:tx:8</td>
<td>csd.csdx:tx:8:1</td>
<td>smif.s</td>
<td>scb[5].uart_cpi</td>
<td>scb[5].uart_cpi</td>
<td>audios</td>
<td>s[1].tx _sdi:1</td>
<td>peri.tr _io_output[0]:0</td>
<td></td>
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<tr>
<td>P11.5 tcpwm[0].line-compl[3]:3</td>
<td>tcpwm[1].line-compl[3]:1</td>
<td>csd.csdx:tx:8</td>
<td>csd.csdx:tx:8:3</td>
<td>smif.s</td>
<td>scb[5].spi_data:1</td>
<td>scb[5].spi_data:1</td>
<td>audios</td>
<td>s[1].rx _sdi:1</td>
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<td>P11.6</td>
<td></td>
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<td>csd.csdx:tx:8:4</td>
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<td>P11.7</td>
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<td>smif.s</td>
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</tr>
<tr>
<td>P12.6 tcpwm[0].line[7]:3</td>
<td>tcpwm[1].line[7]:1</td>
<td>csd.csdx:tx:9</td>
<td>csd.csdx:tx:9:1</td>
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</tr>
<tr>
<td>P12.7 tcpwm[0].line-compl[7]:3</td>
<td>tcpwm[1].line-compl[7]:1</td>
<td>csd.csdx:tx:9</td>
<td>csd.csdx:tx:9:2</td>
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<td>P14.1</td>
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<td>P14.0</td>
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<td></td>
</tr>
</tbody>
</table>
4 Electrical specifications

4.1 Absolute maximum ratings

Table 2 Absolute maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT_WL</td>
<td>DC supply voltage for dual-band 802.11ac-friendly radio with Bluetooth® 5.0, VBAT and PA driver supply</td>
<td>-0.5</td>
<td>+5.0</td>
<td>V</td>
</tr>
<tr>
<td>VDDIO_WL</td>
<td>DC supply voltage for digital I/O</td>
<td>-0.5</td>
<td>+2.20</td>
<td>V</td>
</tr>
<tr>
<td>VDDD, VBACKUP, VDDIO0</td>
<td>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</td>
<td>-0.5</td>
<td>+4.0</td>
<td>V</td>
</tr>
<tr>
<td>VDDA, VDDIO1, VDDUSB</td>
<td>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</td>
<td>-0.5</td>
<td>+4.0</td>
<td>V</td>
</tr>
<tr>
<td>ESD_HBM</td>
<td>Human body model contact discharge per JEDEC EID/JESD22-A114</td>
<td>2200</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>ESD_CDM</td>
<td>Charged device model contact discharge per JEDEC EIA/JESD22-C101</td>
<td>500</td>
<td>8000</td>
<td>V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Details / conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT_WL</td>
<td>DC supply voltage for dual-band 802.11ac-friendly radio with Bluetooth® 5.0, VBAT and PA driver supply</td>
<td>3.2</td>
<td>3.6</td>
<td>4.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VDDIO_WL</td>
<td>DC supply voltage for digital I/O</td>
<td>1.62</td>
<td>1.8</td>
<td>1.98</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VDDD, VBACKUP, VDDIO0</td>
<td>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</td>
<td>1.7</td>
<td>1.8</td>
<td>3.6</td>
<td>V</td>
<td>V_BACKUP is 1.4 V in backup mode.</td>
</tr>
<tr>
<td>VDDA, VDDIO1, VDDUSB</td>
<td>Analog power supply voltage for PSoC™ 6 MCU, GPIO supply for ports 5 to 8 when present</td>
<td>1.7</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td>V_DDIO_1 must be ≥ to V_DDA.</td>
</tr>
<tr>
<td>VDDUSB</td>
<td>Supply for Port 14 (USB or GPIO) when present</td>
<td>1.7</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td>Min supply is 2.85 V for USB</td>
</tr>
</tbody>
</table>

4.2.2 GPIO DC specifications

Table 4 GPIO DC specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Details / conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_IH</td>
<td>Input voltage HIGH threshold</td>
<td>0.7 * V_DD</td>
<td>-</td>
<td>V</td>
<td>CMOS input</td>
</tr>
<tr>
<td>V_IL</td>
<td>Input voltage LOW threshold</td>
<td>0.3 * V_DD</td>
<td>200</td>
<td>V</td>
<td>CMOS input</td>
</tr>
<tr>
<td>V_OW</td>
<td>Output voltage HIGH level</td>
<td>V_DD - 0.5</td>
<td>200</td>
<td>V</td>
<td>I_OH = 8 mA</td>
</tr>
<tr>
<td>V_OL</td>
<td>Output voltage LOW level</td>
<td>0.4</td>
<td>200</td>
<td>V</td>
<td>I_OL = 8 mA</td>
</tr>
<tr>
<td>I_TOT_GPIO</td>
<td>Maximum total source or sink chip current</td>
<td>200</td>
<td>200</td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>

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

### Table 6 5 GHz parameters

### Table 7 2.4 GHz parameters

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

### 4.5 Bluetooth® and Bluetooth® LE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>-</td>
<td>2402</td>
<td>-</td>
<td>2480</td>
<td>MHz</td>
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<tr>
<td>Transmit power</td>
<td>Bluetooth®</td>
<td>-</td>
<td>10.8</td>
<td>11.8</td>
<td>dBm</td>
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<tr>
<td></td>
<td>Bluetooth® LE</td>
<td>-</td>
<td>6.5</td>
<td>7.5</td>
<td>dBm</td>
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</table>
## 4.6 Power consumption

### 4.6.1 2.4 GHz WLAN current consumption

<table>
<thead>
<tr>
<th>LDO mode</th>
<th>$V_{BAT_{WL}} = 3.6 \text{ V}, V_{DDIO_{WL}}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 \text{ V}, V_{DD_USB} = 3.3 \text{ V}, T_A = 25^\circ \text{C}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sleep modes</strong></td>
<td>Average current (mA)</td>
</tr>
<tr>
<td>Hibernate (radio off)</td>
<td>0.023</td>
</tr>
<tr>
<td>Deepsleep with radio beacons</td>
<td>0.115</td>
</tr>
<tr>
<td><strong>Active RX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous RX</td>
<td>34.369</td>
</tr>
<tr>
<td><strong>Active TX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous TX</td>
<td>89.168</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LDO mode</th>
<th>$V_{BAT_{WL}} = 3.6 \text{ V}, V_{DDIO_{WL}}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 \text{ V}, V_{DD_USB} = 3.3 \text{ V}, T_A = 25^\circ \text{C}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sleep modes</strong></td>
<td>Average current (mA)</td>
</tr>
<tr>
<td>Hibernate (radio off)</td>
<td>0.022</td>
</tr>
<tr>
<td>Deepsleep with radio beacons</td>
<td>0.116</td>
</tr>
<tr>
<td><strong>Active RX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous RX</td>
<td>28.993</td>
</tr>
<tr>
<td><strong>Active TX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous TX</td>
<td>89.419</td>
</tr>
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</table>

### 4.6.2 5 GHz WLAN current consumption

<table>
<thead>
<tr>
<th>LDO mode</th>
<th>$V_{BAT_{WL}} = 3.6 \text{ V}, V_{DDIO_{WL}}, V_{DDD}, V_{DDIO0}, V_{DDIO1}, V_{DDA} = 1.8 \text{ V}, V_{DD_USB} = 3.3 \text{ V}, T_A = 25^\circ \text{C}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sleep modes</strong></td>
<td>Average current (mA)</td>
</tr>
<tr>
<td>Hibernate (radio off)</td>
<td>0.023</td>
</tr>
<tr>
<td>Deepsleep with radio beacons</td>
<td>0.115</td>
</tr>
<tr>
<td><strong>Active RX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous RX</td>
<td>82.640</td>
</tr>
<tr>
<td><strong>Active TX modes</strong></td>
<td>3.6 V</td>
</tr>
<tr>
<td>Continuous TX</td>
<td>109.585</td>
</tr>
</tbody>
</table>
### Rapid IoT Connect system on module

#### Dual band Wi-Fi and Bluetooth®

#### Electrical specifications

**4.6.3 Bluetooth® and Bluetooth® LE current consumption**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Average current (mA)</th>
<th>Maximum current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LDO mode</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep modes</td>
<td>3.6 V, 1.8 V, 3.3 V</td>
<td>3.6 V, 1.8 V, 3.3 V</td>
</tr>
<tr>
<td>Advertise</td>
<td>4.512, 13.892, 0.049</td>
<td>167.673, 14.453, 0.100</td>
</tr>
<tr>
<td>Scan</td>
<td>5.331, 13.728, 0.047</td>
<td>167.097, 14.288, 0.099</td>
</tr>
<tr>
<td>Continuous RX</td>
<td>10.513, 14.094, 0.040</td>
<td>206.831, 14.704, 0.091</td>
</tr>
<tr>
<td>Continuous TX</td>
<td>16.407, 14.285, 0.041</td>
<td>209.131, 14.722, 0.092</td>
</tr>
<tr>
<td><strong>Buck mode</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep modes</td>
<td>3.6 V, 1.8 V, 3.3 V</td>
<td>3.6 V, 1.8 V, 3.3 V</td>
</tr>
<tr>
<td>Advertise</td>
<td>4.514, 10.268, 0.048</td>
<td>178.820, 10.723, 0.100</td>
</tr>
<tr>
<td>Scan</td>
<td>5.283, 10.528, 0.046</td>
<td>167.101, 11.058, 0.097</td>
</tr>
<tr>
<td>Continuous RX</td>
<td>10.171, 10.410, 0.040</td>
<td>206.747, 10.982, 0.092</td>
</tr>
<tr>
<td>Continuous TX</td>
<td>17.833, 10.759, 0.040</td>
<td>206.664, 11.319, 0.091</td>
</tr>
</tbody>
</table>
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

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

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](http://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:

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

<table>
<thead>
<tr>
<th>Part number</th>
<th>Package</th>
<th>Maximum peak temperature</th>
<th>Maximum time at peak temperature</th>
<th>No. of cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYSBSYS-RP01</td>
<td>73-pin castellated solder pads</td>
<td>260°C</td>
<td>30 seconds</td>
<td>2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Part number</th>
<th>Package</th>
<th>MSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYSBSYS-RP01</td>
<td>73-pin castellated solder pads</td>
<td>3</td>
</tr>
</tbody>
</table>

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
Rapid IoT Connect system on module
Dual band Wi-Fi and Bluetooth®

Packaging

Figure 10 details reel dimensions used for CYSBSYS-RP01.

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.
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

<table>
<thead>
<tr>
<th>Mark</th>
<th>Dimension</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (Typical)</td>
<td>26.59</td>
<td>mm</td>
</tr>
<tr>
<td>W (Typical)</td>
<td>14</td>
<td>mm</td>
</tr>
<tr>
<td>PCB thickness</td>
<td>1.0</td>
<td>mm</td>
</tr>
<tr>
<td>RF shield height</td>
<td>1.5</td>
<td>mm</td>
</tr>
<tr>
<td>T (Total system thickness, max)</td>
<td>2.5</td>
<td>mm</td>
</tr>
</tbody>
</table>
## 9 Ordering information

### Table 13 Ordering information

<table>
<thead>
<tr>
<th>Part number</th>
<th>Package</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYSBSYS-RP01</td>
<td>73-pin castellated solder pads</td>
<td>Chip antenna</td>
</tr>
</tbody>
</table>

### Table 14 Tape and reel package quantity and minimum order amount

<table>
<thead>
<tr>
<th>Description</th>
<th>Minimum reel quantity</th>
<th>Maximum reel quantity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reel quantity</td>
<td>400</td>
<td>400</td>
<td>Ships in 500-unit reel quantities</td>
</tr>
<tr>
<td>Minimum order quantity (MOQ)</td>
<td>400</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Order increment (OI)</td>
<td>400</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### 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](http://www.infineon.com).
## Acronyms

### Table 15 Acronyms used in this document

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC</td>
<td>analog-to-digital converter</td>
</tr>
<tr>
<td>CM4</td>
<td>Cortex®-M4, an Arm® CPU</td>
</tr>
<tr>
<td>CMOS</td>
<td>complementary metal-oxide-semiconductor, a process technology for IC fabrication</td>
</tr>
<tr>
<td>CM0+</td>
<td>Cortex-M0+, an Arm CPU</td>
</tr>
<tr>
<td>CPU</td>
<td>central processing unit</td>
</tr>
<tr>
<td>CSD</td>
<td>CAPSENSE™ sigma-delta</td>
</tr>
<tr>
<td>CSX</td>
<td>Cypress mutual capacitance sensing method</td>
</tr>
<tr>
<td>ECO</td>
<td>external crystal oscillator</td>
</tr>
<tr>
<td>EEPROM</td>
<td>electrically erasable programmable read-only memory</td>
</tr>
<tr>
<td>EMI</td>
<td>electromagnetic interference</td>
</tr>
<tr>
<td>ESD</td>
<td>electrostatic discharge</td>
</tr>
<tr>
<td>GPIO</td>
<td>general-purpose input and output, applies to a PSoC™ pin</td>
</tr>
<tr>
<td>GND</td>
<td>ground</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>I²C or IIC</td>
<td>inter-integrated circuit, a communications protocol</td>
</tr>
<tr>
<td>LE</td>
<td>low energy</td>
</tr>
<tr>
<td>MCU</td>
<td>microcontroller unit</td>
</tr>
<tr>
<td>PCB</td>
<td>printed circuit board</td>
</tr>
<tr>
<td>RAM</td>
<td>random-access memory</td>
</tr>
<tr>
<td>RF</td>
<td>radio frequency</td>
</tr>
<tr>
<td>ROM</td>
<td>read-only memory</td>
</tr>
<tr>
<td>RTC</td>
<td>real-time clock</td>
</tr>
<tr>
<td>RX</td>
<td>receive</td>
</tr>
<tr>
<td>SPI</td>
<td>serial peripheral interface, a communications protocol</td>
</tr>
<tr>
<td>TX</td>
<td>transmit</td>
</tr>
<tr>
<td>UART</td>
<td>universal asynchronous transmitter receiver, a communications protocol</td>
</tr>
<tr>
<td>USB</td>
<td>universal serial bus</td>
</tr>
<tr>
<td>WCO</td>
<td>watch crystal oscillator</td>
</tr>
<tr>
<td>XRES</td>
<td>external reset input pin</td>
</tr>
</tbody>
</table>
## Document conventions

### Table 16: Unit of measure

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

<table>
<thead>
<tr>
<th>Document version</th>
<th>Date</th>
<th>Description of changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>*C</td>
<td>2021-08-02</td>
<td>Public release</td>
</tr>
</tbody>
</table>
| *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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