Automotive PSOC™ 4700S Plus: CY8CKIT-4700S-PLUS Evaluation Kit user guide

About this document

Scope and purpose

The CY8CKIT-4700S-PLUS is an inductive sense V2 kit for the PSOC™ 4700S Plus microcontrollers, a scalable and reconfigurable platform architecture for a family of programmable embedded system controllers with an Arm® Cortex®-M0+ CPU while being AEC-Q100 compliant. It combines programmable and reconfigurable analog and digital blocks with flexible automatic routing.

Intended audience

This document is intended for design engineers for evaluation of automotive inductive sense applications with CY8CKIT-4700S Plus.

Important notice

“Evaluation Boards and Reference Boards” shall mean products embedded on a printed circuit board (PCB) for demonstration and/or evaluation purposes, which include, without limitation, demonstration, reference and evaluation boards, kits, and design (collectively referred to as “Reference Board”).

Environmental conditions have been considered in the design of the Evaluation Boards and Reference Boards provided by Infineon Technologies. The design of the Evaluation Boards and Reference Boards has been tested by Infineon Technologies only as described in this document. The design is not qualified in terms of safety requirements, manufacturing, and operation over the entire operating temperature range or lifetime.

The Evaluation Boards and Reference Boards provided by Infineon Technologies are subject to functional testing only under typical load conditions. Evaluation Boards and Reference Boards are not subject to the same procedures as regular products regarding returned material analysis (RMA), process change notification (PCN), and product discontinuation (PD).

Evaluation Boards and Reference Boards are not commercialized products, and are solely intended for evaluation and testing purposes. In particular, they shall not be used for reliability testing or production. The Evaluation Boards and Reference Boards may therefore not comply with CE or similar standards (including but not limited to the EMC Directive 2004/EC/108 and the EMC Act) and may not fulfill other requirements of the country in which they are operated by the customer. The customer shall ensure that all Evaluation Boards and Reference Boards will be handled in a way which is compliant with the relevant requirements and standards of the country in which they are operated.

The Evaluation Boards and Reference Boards as well as the information provided in this document are addressed only to qualified and skilled technical staff, for laboratory usage, and shall be used and managed according to the terms and conditions set forth in this document and in other related documentation supplied with the respective Evaluation Board or Reference Board.

It is the responsibility of the customer’s technical departments to evaluate the suitability of the Evaluation Boards and Reference Boards for the intended application, and to evaluate the completeness and correctness of the information provided in this document with respect to such application.

The customer is obliged to ensure that the use of the Evaluation Boards and Reference Boards does not cause any harm to persons or third-party property.
The Evaluation Boards and Reference Boards and any information in this document is provided “as is” and Infineon Technologies disclaims any warranties, express or implied, including but not limited to warranties of non-infringement of third-party rights and implied warranties of fitness for any purpose, or for merchantability.

Infineon Technologies shall not be responsible for any damages resulting from the use of the Evaluation Boards and Reference Boards and/or from any information provided in this document. The customer is obliged to defend, indemnify, and hold Infineon Technologies harmless from and against any claims or damages arising out of or resulting from any use thereof.

Infineon Technologies reserves the right to modify this document and/or any information provided herein at any time without further notice.

Safety precautions

Note: *Please note the following warnings regarding the hazards associated with development systems.*

Table 1 Safety precautions

	**Warning**: *The evaluation or reference board contains DC bus capacitors which take time to discharge after removal of the main supply. Before working on the drive system, wait for five minutes for the capacitors to discharge to safe voltage levels. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.*
	**Warning:** *The evaluation or reference board is connected to the grid input during testing. Therefore, high-voltage differential probes must be used when measuring voltage waveforms by oscilloscope. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.*
	**Warning:** *Remove or disconnect power from the drive before you disconnect or reconnect wires or perform maintenance work. Wait for five minutes after removing power to discharge the bus capacitors. Do not attempt to service the drive until the bus capacitors have discharged to zero. Failure to do so may result in personal injury or death.*
	**Caution:** *The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Therefore, necessary precautions are required while handling the board. Failure to comply may cause injury.*
	**Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing, or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*
	**Caution:** *A drive that is incorrectly applied or installed can lead to component damage or reduction in product lifetime. Wiring or application errors such as undersizing the motor, supplying an incorrect or inadequate AC supply, or excessive ambient temperatures may result in system malfunction.*
	**Caution:** *The evaluation or reference board is shipped with packing materials that need to be removed prior to installation. Failure to remove all packing materials that are unnecessary for system installation may result in overheating or abnormal operating conditions.*

Table of contents

1 CY8CKIT-4700S-PLUS kit contents

The kit includes one main board, and a metal target.

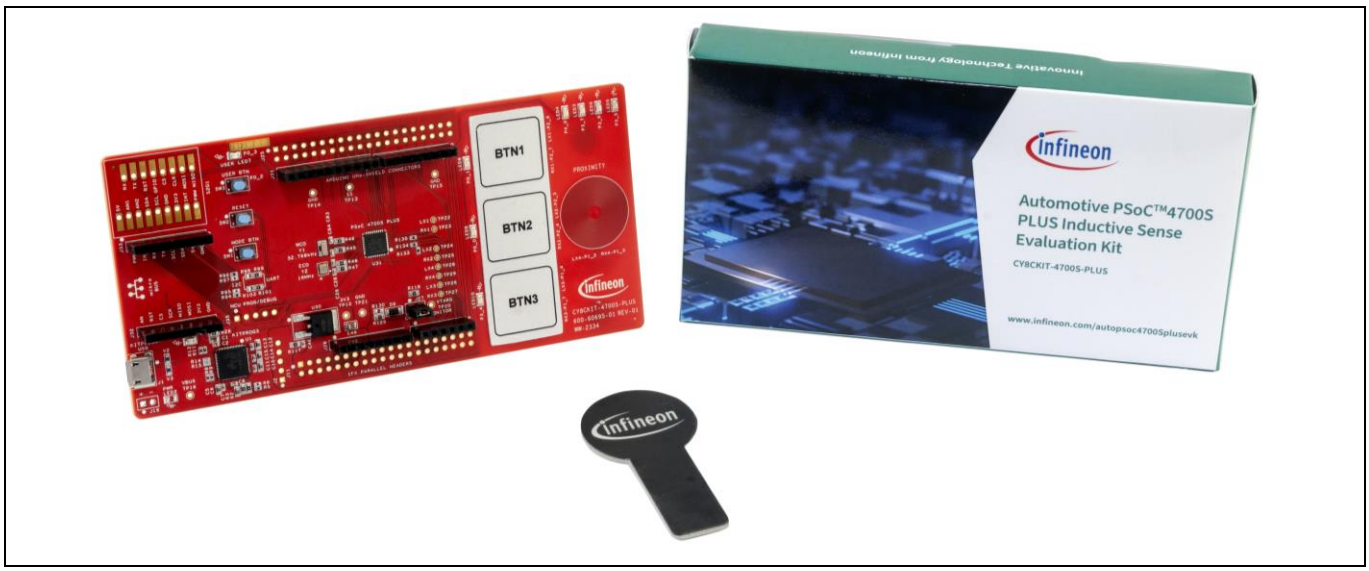

Figure 1 CY8CKIT-4700S-PLUS kit contents

1.1 Overview

The CY8CKIT-4700S-PLUS board contains the 40-QFN package of Automotive PSOC™ 4700S Plus microcontrollers (MCU), onboard debugger (KitProg), three inductive sense buttons, one metal proximity inductive sensor, seven sensor LEDs, one user LED, user buttons, and shield connectors (Arduino, mikroBUS, XENSIV™ S2G). Figure 2 shows the kit features and blocks.

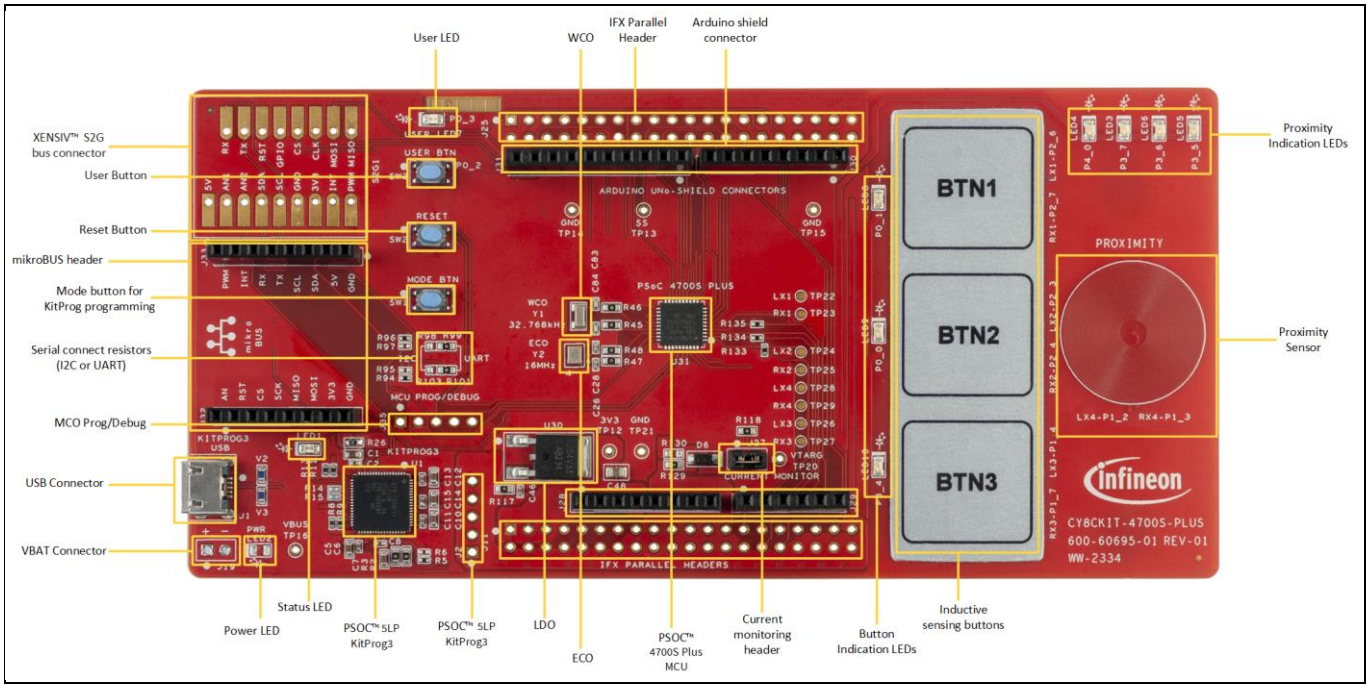

Figure 2 CY8CKIT-4700S-PLUS board - top view

1.2 Block diagram

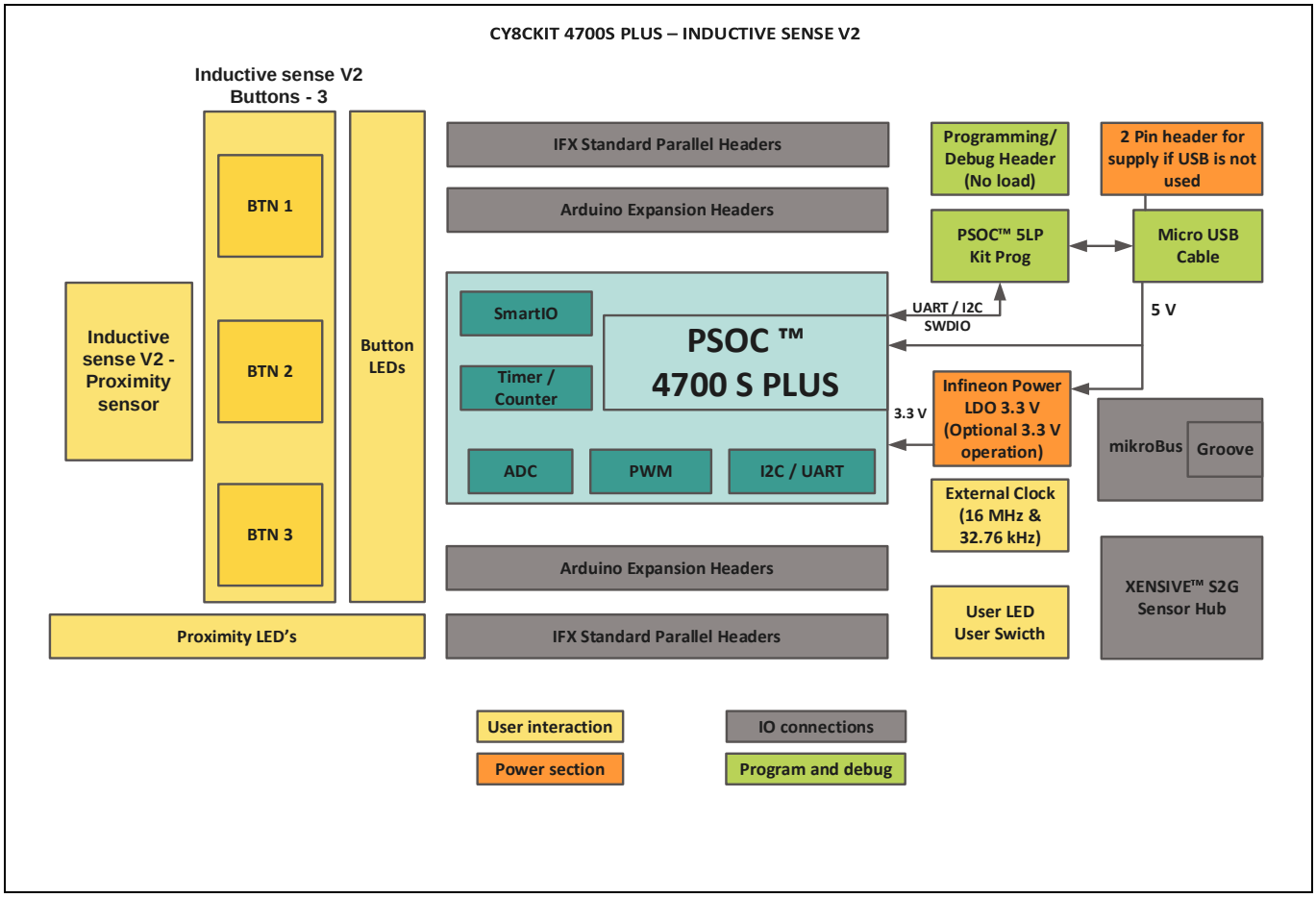

Figure 3 CY8CKIT-4700S-PLUS kit board – block diagram

1.3 Board functions

Table 2 CY8CKIT-4700S-PLUS kit board functions

#	Function	Specification	Remarks	Note
1	PSOC™ 4700S Plus	CY8C4747LQS-S453	U31: 40-QFN	–
2	PSOC™ 5LP KitProg3	CY8C5868LTI-LP039	U1: 68-QFN	–
3	USB connector	Micro-USB connector	J1	–
4	VBAT connector	Battery connector	J19	
5	Power LED	USB VBUS monitor LED	LED2 (blue)	–
6	Status LED	KitProg3 status LED	LED1 (green)	–
7	Program header	5-pin 4700S PLUS MCU prog/debug	J35	No load
8	Program connector	KitProg PSOC™ 5LP program connector	J2 (5 pins)	No load
9	LDO	3.3 V LDO: TLE4284DV33ATMA1	U30	–
10	Inductive buttons	Inductive sensors (3)	BTN1, BTN2, BTN3	PCB tracks
11	Proximity coil	Proximity sensor coils	PROXMITY	PCB tracks
12	Sensor LEDs	LEDs for inductive sense buttons (3)	LED8/LED9/LED10	–
13	Sensor LEDs	LEDs for proximity-sensing (4)	LED3/ LED4/ LED5/ LED6	–
14	Test header	Current measurement and monitoring	J27 (2 pins)	No Load
15	Jumper resistors	Serial connect resistors (I2C or UART)	R98/R103 (I2C), R99/R101 (UART)	–
16	Extension header	40-pin (2-row) IFX standard connector	J11/J25	No load
17	Arduino headers	1x6 (1), 1x8 (2) and 1x10 (1) for Arduino compatibility	J29/J28/J30/J31	–
18	mikroBUS header	Two 1x8 mikroBUS headers	J32/J33	–
19	Groove connector	6-pin, 100 mils, SMBus	J26	No load
20	XENSIV™ S2G bus connector	Infineon's XENSIV™ bus sensor 17-pin interface	S2G1	No load
21	User LED	User LED connected to MCU	LED7 (green)	–
22	User button	User push button connected to MCU	SW3	–
23	Reset button	System reset push button	SW2	–
24	Mode button	Mode push button for KitProg programming	SW1	–

2 Getting started

2.1 Power up the lite kit

The CY8CKIT-4700S-PLUS kit can be powered from the USB port.

To power up the lite kit, connect the Micro-USB cable between the evaluation kit and the host system. The same connection (KitProg3) also provides the programming and debugging over the CMSIS-DAP interface.

2.1.1 Power from USB

By default, the evaluation kit is configured to run on 5 V. In case of USB power, the different sections power requirements are as follows:

- MCU power: VBAT from USB (5 V) or 3.3 V from LDO
- mikroBUS power: 5 V from USB (5 V) or 3.3 V from LDO
- XENSIV™ bus power: 5 V from USB (5 V) or 3.3 V from LDO
- Arduino bus power: 5 V from USB (5 V) or 3.3 V from LDO
- IFX bus power: 5 V from USB (5 V) or 3.3 V from LDO
- Peripheral power: 5 V from VBAT USB or 3.3 V from LDO

Note: *5 V from VBUS or 3.3 V from LDO power could be selected through 0 Ω resistors- Mount R129 for 5 V VBUS or mount R130 for 3.3 V from LDO.*

2.2 Hands-on shipping firmware

The CY8CKIT-4700S-PLUS kit comes with preinstalled firmware to check all the onboard peripherals.

2.2.1 Hardware and tool setup

To check the preinstalled firmware on the CY8CKIT-4700S-PLUS kit, follow these steps to set up and communicate with the host system:

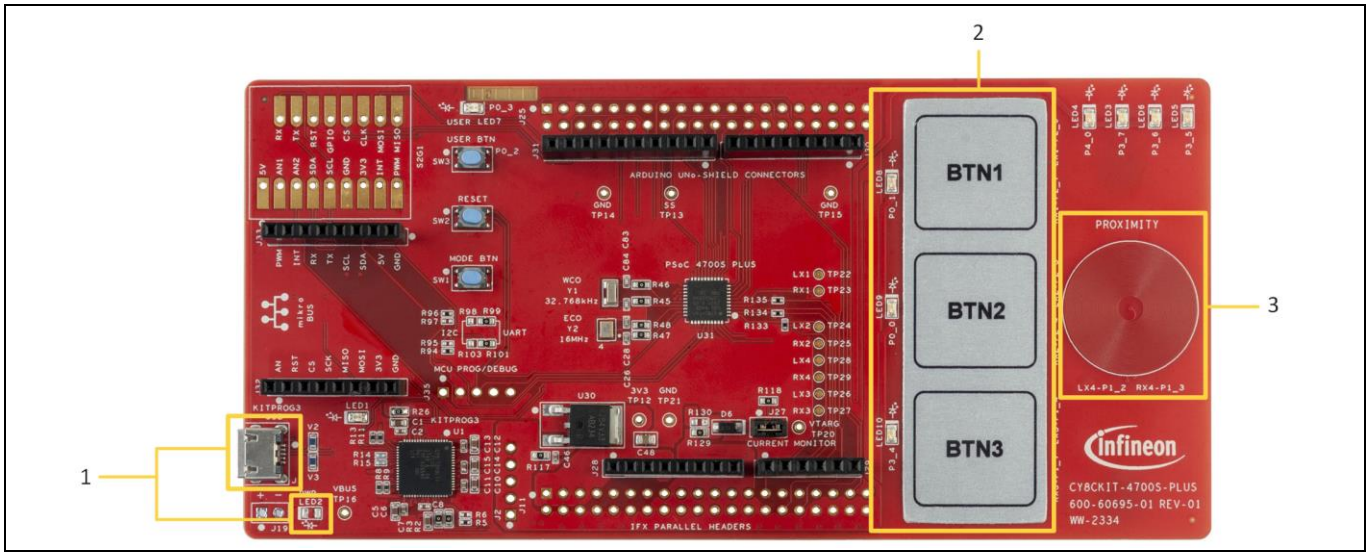

Figure 4 CY8CKIT-4700S-PLUS Evaluation Kit and tool setup

1. Connect the USB cable from the PC to the evaluation kit. The evaluation kit is powered by the PC via the USB cable (5 V). Ensure that the power LED2 (blue LED) is turned ON.
2. When powered ON, the PSOC™ 4700S Plus device starts executing the pre-installed firmware, which can be confirmed by touching the inductive sense buttons and observe the respective LED glows.
3. Also, confirm by using the metal target near the proximity sensor and observe the proximity LEDs glowing as the metal target move towards and away from the sensor.
4. To communicate with the PC, set up the serial terminal on the PC to send and receive messages to or from the evaluation kit. Follow these configurations in the Termite:

- **Port**: COMx KitProg3 USB-UART (COMx)
- **Baud rate**: 19200
- **Data bits**: 8
- **Stop bits**: 1
- **Parity**: None
- **Flow Control**: None

Getting started

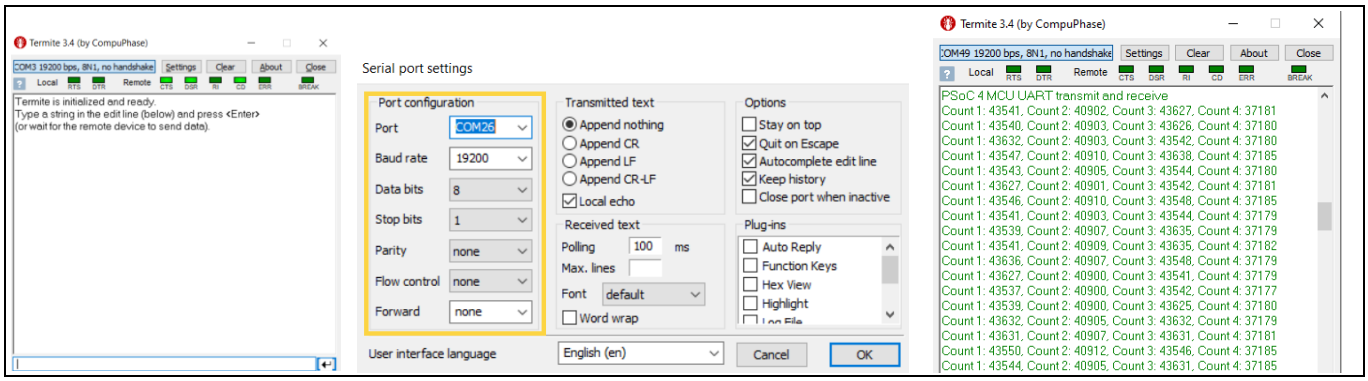

Figure 5 Termite setup

2.2.2 Software checks

The evaluation kit comes with the pre-installed firmware when turned ON, it starts executing. After completing the tool setup, follow these steps to check the firmware and lite kit features:

1. Reset the PSOC™ 4700S Plus device using the reset button (SW2).
2. Press the user button (SW3) to toggle the user LED7 (green LED).
3. Touch on any of the inductive sense buttons (BTN1, BTN2, BTN3) and verify using the onboard LEDs (LED8, LED9 and LED10).
4. Take the metal target near and farther from proximity coil to see the onboard LEDS (LED3, LED4, LED5 and LED6) turn o and OFF gradually.
5. Also monitor the UART terminal (Termite window) to see the raw counts of all the four sensors. Observe that the row count increases when a touch is detected.

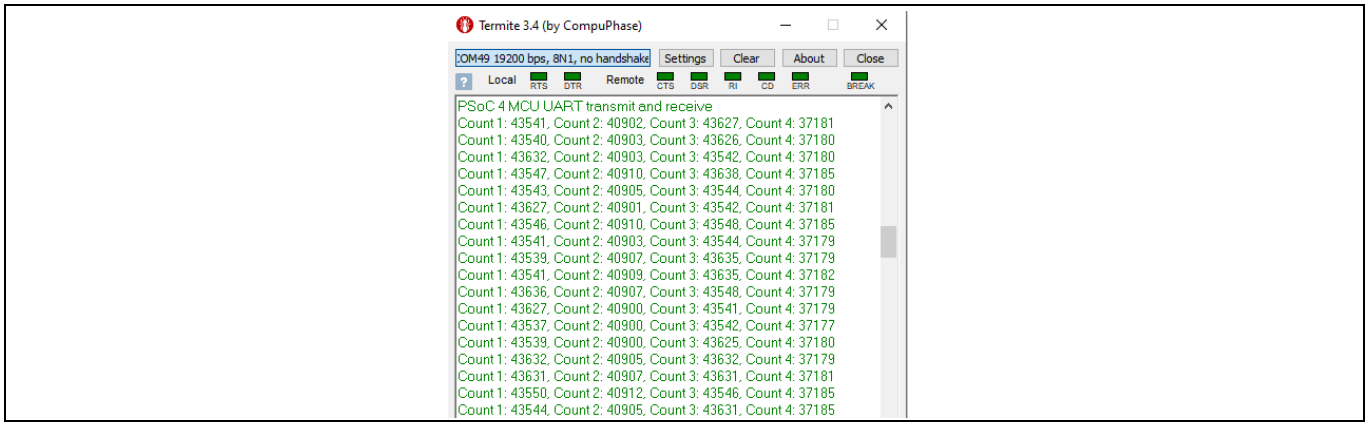

Figure 6 Firmware checks with on-board peripherals

3 Hardware

3.1 PSOC™ 4700S Plus device

The CY8CKIT-4700S-PLUS kit comes with the PSOC™ 4700S Plus device CY8C4747LQS soldered onto the board.

Table 3 IC socket description

Reference	Manufacturer	Part number	Size	Supported package
U31	Infineon Technologies	CY8C4747LQS	8 mm × 8 mm	40-QFN

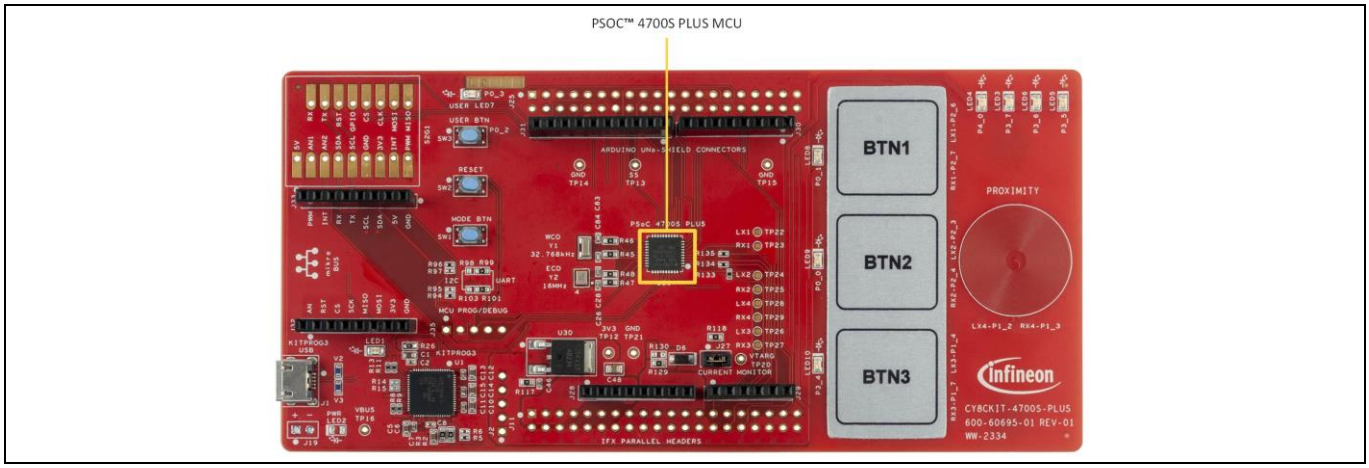

Figure 7 PSOC™ 4700S Plus MCU device

3.2 Power supply

The following are power inputs:

- 5 V from the USB connector (J1)
- 5 V from J19 header – battery connector

Note: Connect any one of the power inputs to the board, do not power the device simultaneously with both the above options.

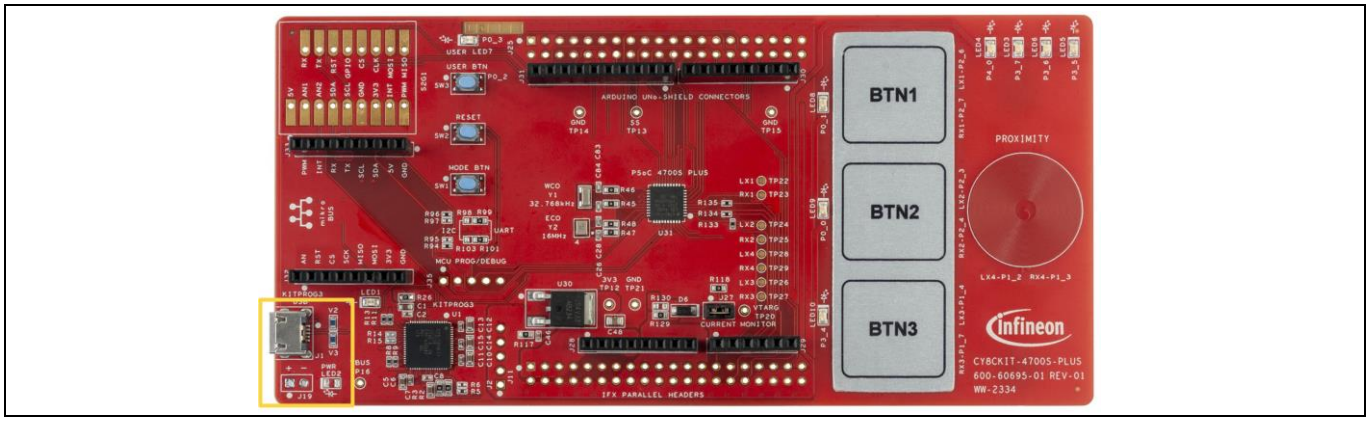

Figure 8 Power supply configuration

3.3 Inductive sense buttons

The CY8CKIT-4700S-PLUS kit has three on-board sensor buttons and one on-board proximity sensor coil. The sensors use the inductive button coil and proximity sensor coil which are connected to LX and RX each. It works on the principle of oscillator-based inductive sensing.

Three dedicated LEDs are available on-board (LED8, LED9 and LED10) to indicate the events on the sensor buttons (BTN1, BTN2 and BTN3) and four LEDs (LED3, LED4, LED5 and LED6) are available to indicate the events on the proximity sensor (PROXIMITY).

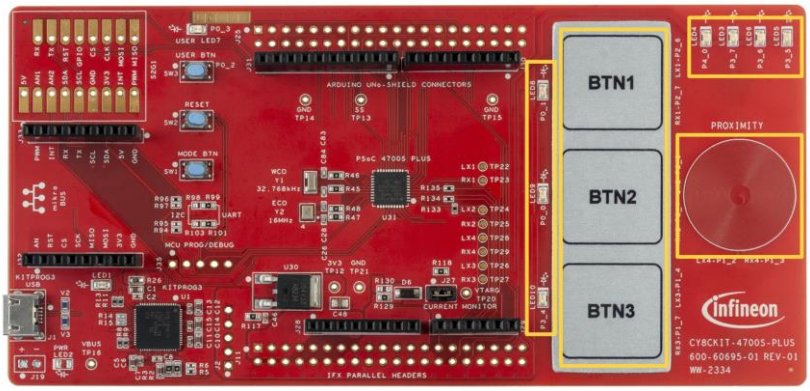

Figure 9 Inductive sensor buttons and proximity sensor

3.4 KitProg3 USB program interface

KitProg3 is the Infeneon low-level communication firmware for programming and debugging. It provides communication between the programming tool (Auto Flash Utility) and a target PSOC™ 4700S Plus device.

KitProg3 uses the industry-standard Serial Wire Debug (SWD) protocol. It uses CMSIS-DAP V2.0.0 and V1.2.0 as the bulk and HID endpoint transport mechanisms.

KitProg3 also supports bridging: USB-to-UART and USB-I2C. For more information, see the KitProg user guide.

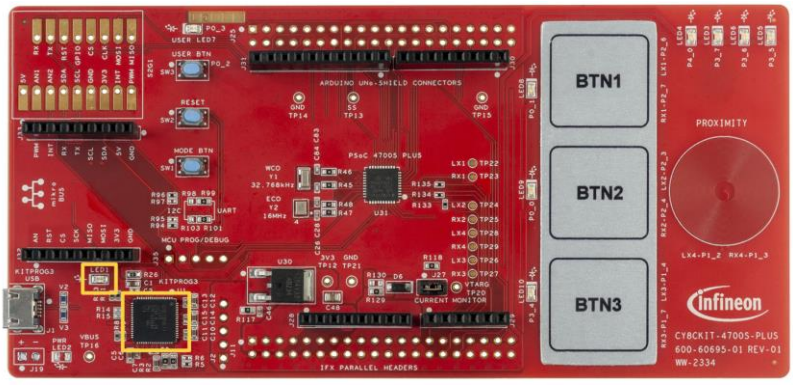

Figure 10 KitProg3 USB program interface

Note: By default, the bridging between the KitProg3 and CPU is configured for the USB-to-UART interface. To use the USB-I2C bridge on the kit, remove the resistors from the UART position and install resistors in the I2C position, see Figure 10.

3.5 Extension headers

The CY8CKIT-4700S-PLUS kit provides a variety of header expansions to be compatible with the most popular interfaces. The kit is designed to have an connection header compatible with Arduino (1), Infineon standard connector interface (2), mikroBUS header (4), Groove connector and XENSIV™ bus (3).

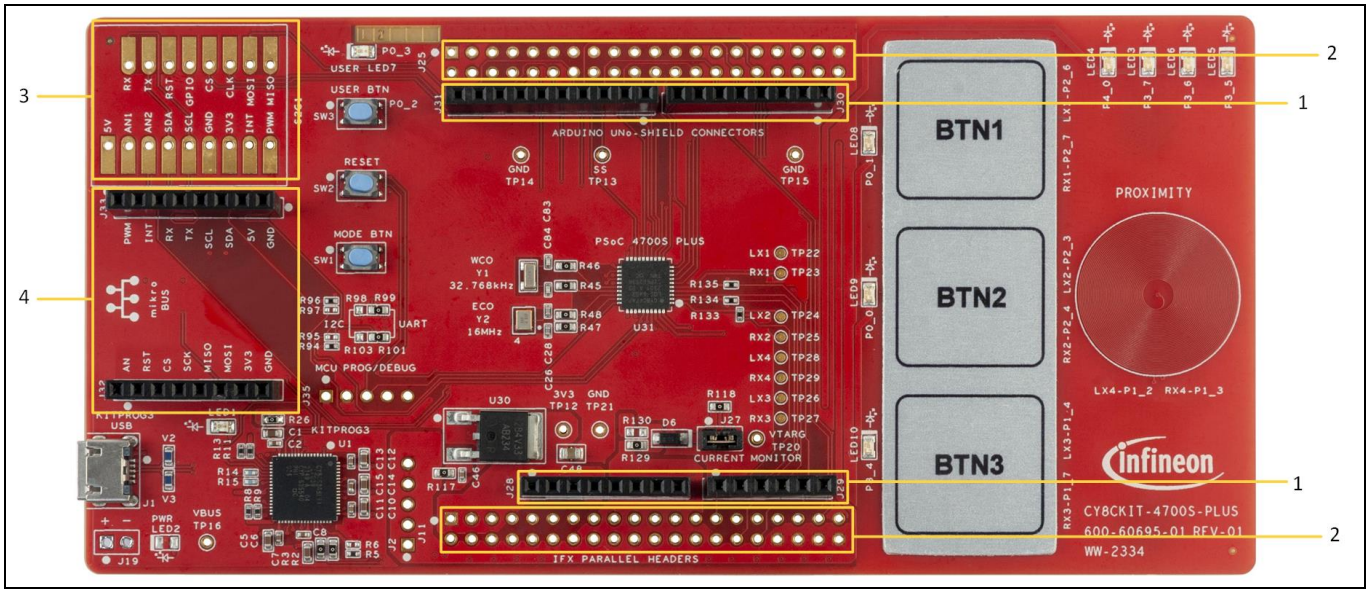

Figure 11 Extension headers on the kit

3.5.1 Arduino-compatible header

Table 4 Pin assignment of Arduino-compatible connections

Connector	Pin number	Pin name	CY8CKIT-4700S-PLUS kit connections
J28	1	NC	-
J28	2	IOREF	VDDD (5V)
J28	3	RESET	XRES
J28	4	3V3	3P3V_LDO
J28	5	5V	VBUS (5V)
J28	6	GND	GND
J28	7	GND	GND
J28	8	VIN	VBAT
J29	1	A0	P2.5
J29	2	A1	P2.3
J29	3	A2	P2.4
J29	4	A3	P2.6
J29	5	A4/SDA	P1.1
J29	6	A5/SCL	P1.0
J30	1	D0/RX	P1.0
J30	2	D1/TX	P1.1
J30	3	D2	P0.2
J30	4	D3	P0.3
J30	5	D4	P4.0
J30	6	D5	P3.7
J30	7	D6	NC
J30	8	D7	P3.6
J31	1	D8	P3.5
J31	2	D9	P3.4
J31	3	D10/SS	TP13
J31	4	D11/MOSI	P6.0
J31	5	D12/MISO	P6.1
J31	6	D13/SCK	P6.2
J31	7	GND	GND
J31	8	AREF	VDDD
J31	9	SDA	P6.1
J31	10	SCL	P6.0

3.5.2 Infineon standard header

Table 5 Pin assignment of Infineon standard connections

Connector	Pin number	CY8CKIT-4700S-PLUS kit connections
J11	1	3P3V_LDO
J11	2	DGND
J11	11	VDDD
J11	27	P2_5
J11	30	P0_0
J11	32	P0_1
J11	33	P1_0
J11	34	VBUS
J11	35	P1_1
J11	36	VBUS
J11	37	P3_4
J11	38	VBUS
J11	39	DGND
J11	40	5V_LDO
J25	1	3P3V_LDO
J25	2	DGND
J25	10	P6_2
J25	12	P6_1
J25	14	P6_0
J25	20	P3_5
J25	22	P3_1
J25	24	P3_0
J25	26	P3_6
J25	28	P3_7
J25	30	P4_0
J25	32	P0_3
J25	34	P0_2
J25	39	DGND
J25	40	5V_LDO

3.5.3 XENSIV™ header

Table 6 Pin assignment of XENSIV™ bus connections

Connector	Pin number	Pin name	CY8CKIT-4700S-PLUS kit connections
S2G1	1	5V	VBUS
S2G1	2	AN1	P2.5
S2G1	3	AN1	P2.3
S2G1	4	SDA	P1.1
S2G1	5	SCL	P1.0
S2G1	6	GND	GND
S2G1	7	3V3	3P3V_LDO
S2G1	8	INT	NC
S2G1	9	PWM	P3.4
S2G1	10	MISO	P6.1
S2G1	11	MOSI	P6.0
S2G1	12	CLK	P6.2
S2G1	13	CS	P3.7
S2G1	14	GPIO	NC
S2G1	15	RST	P3.5
S2G1	16	TX	P1.1
S2G1	17	RX	P1.0

3.5.4 mikroBUS-compatible header

Table 7 Pin assignment of mikroBUS-compatible connections

Connector	Pin number	Pin name	CY8CKIT-4700S-PLUS kit connections
J32	1	AN	P2.5
J32	2	RST	P3.5
J32	3	CS	P3.7
J32	4	SCK	P6.2
J32	5	MISO	P6.1
J32	6	MOSI	P6.0
J32	7	3V3	3P3V_LDO
J32	8	GND	GND
J33	1	GND	GND
J33	2	5V	VBUS_5V
J33	3	SDA	P1.1
J33	4	SCL	P1.0
J33	5	TX	P1.1
J33	6	RX	P1.0
J33	7	INT	P3.7
J33	8	PWM	P3.4

3.5.5 Groove header

Table 8 Pin assignment of Groove bus connections

Connector	Pin number	Pin name	CY8CKIT-4700S-PLUS kit connections
J26	1	SCL	P6.0
J26	2	SDA	P6.1
J26	3	3V3	3P3V_LDO
J26	4	GND	GND

3.6 Other peripherals

The GPIO pins are grouped into ports; a port can have up to eight GPIOs. See Table 9 for GPIO pin assignments of the CY8CKIT-4700S-PLUS kit board. Table 9 shows the connection to other peripherals.

Table 9 GPIO pins used by peripherals

#	GPIO pin assignment	Description
1	XRES pin	Connected to an external reset button (SW2) with a 0.1 µF capacitor
2	User button	SW3 (GPIO P0.2)
3	User LEDs	LED7 (GPIO P0.3 - green)
4	ECO	External crystal oscillator up to 16 MHz
5	WCO	Watch crystal oscillator up to 32.768 kHz

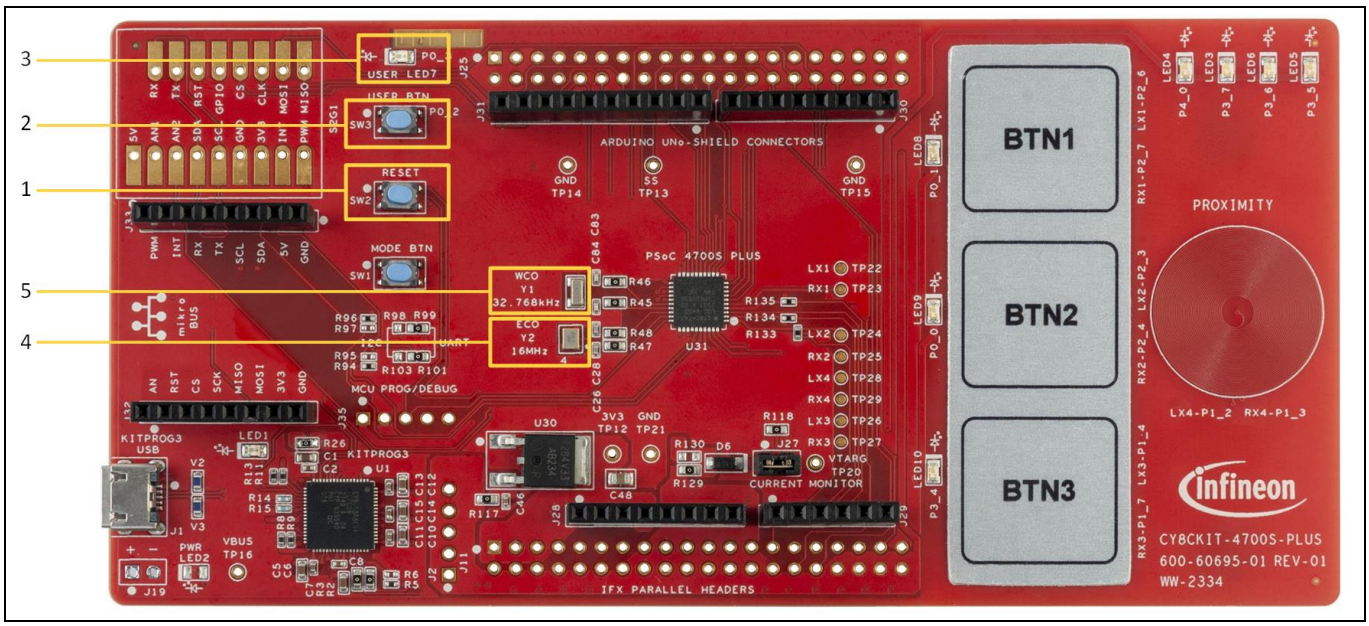

Figure 12 Onboard peripheral

4 Programming and debugging

4.1 Program and debug using ModusToolbox™ workspace

1. Create a new workspace in documents folder and copy the unzipped code example folder to the same.

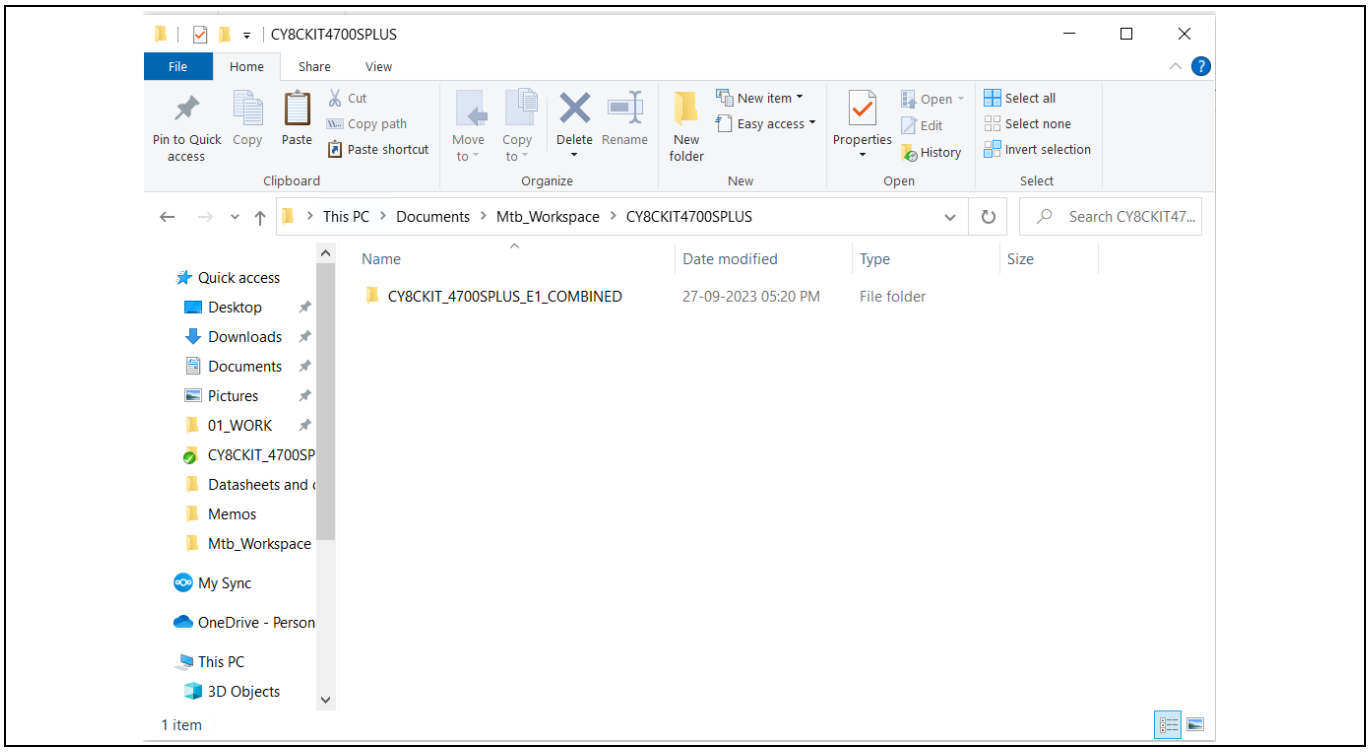

Figure 13 Creating workspace and copying code example folder

2. Open ModusToolbox™ (Eclipse IDE for ModusToolbox™ v3.3), browse and choose the created workspace from step 1 and launch.

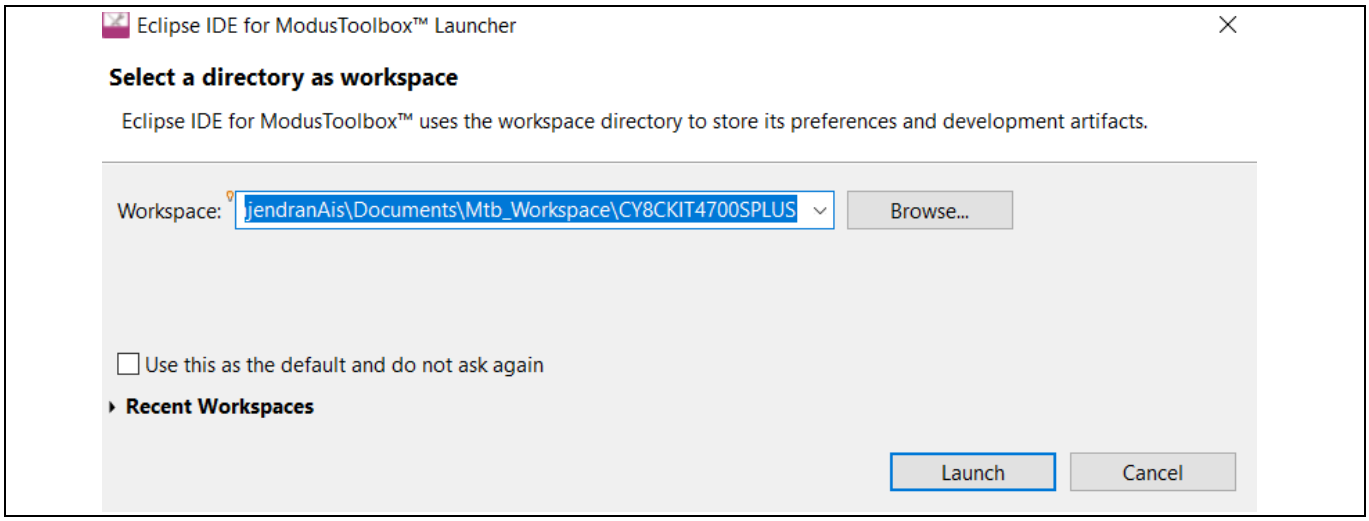

Figure 14 Launching the workspace

Programming and debugging

3. Import the project to ModusToolbox™ by following these steps: **File** > **Import** > **General** > **Existing Projects** into workspace. Click **Next**, under Select root directory, click **Browse** and choose the copied code example folder.

   Check on the "**Copy projects into workspace**" checkbox and click **Finish**.

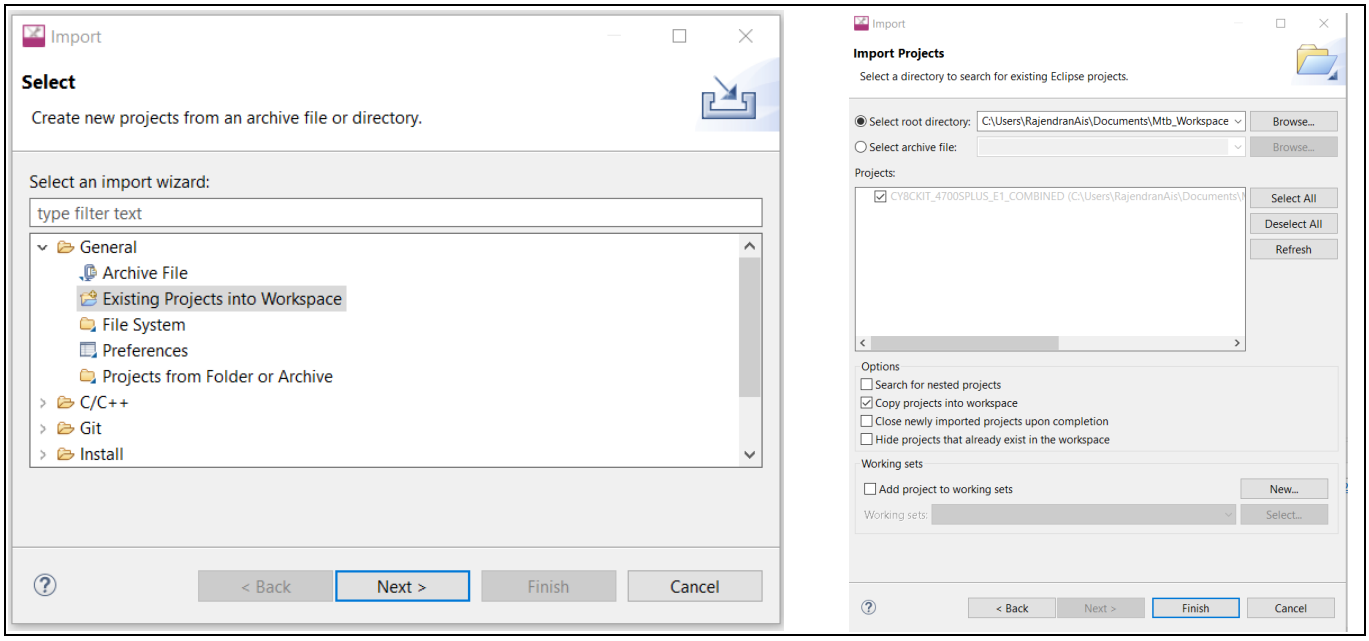

Figure 15 Importing the project to ModusToolbox™

4. In terminal window, run the command: "`make getlibs`" and wait for the importing to complete.

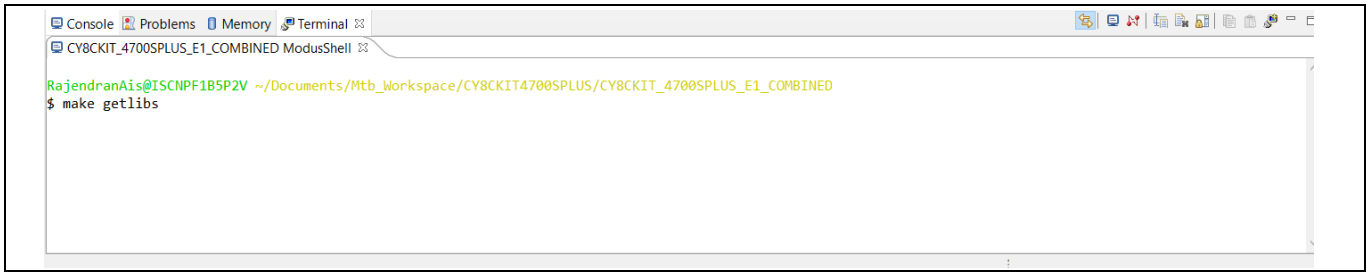

Figure 16 Terminal window command

5. Select the project in the project explorer. Build the application from the Quick Panel.
6. Connect the board to the PC using the given USB connector.

Programming and debugging

7. Run the application by selecting the "*Project_Name Program (KitProg3_MiniProg4)*" under the launches in the Quick Panel.

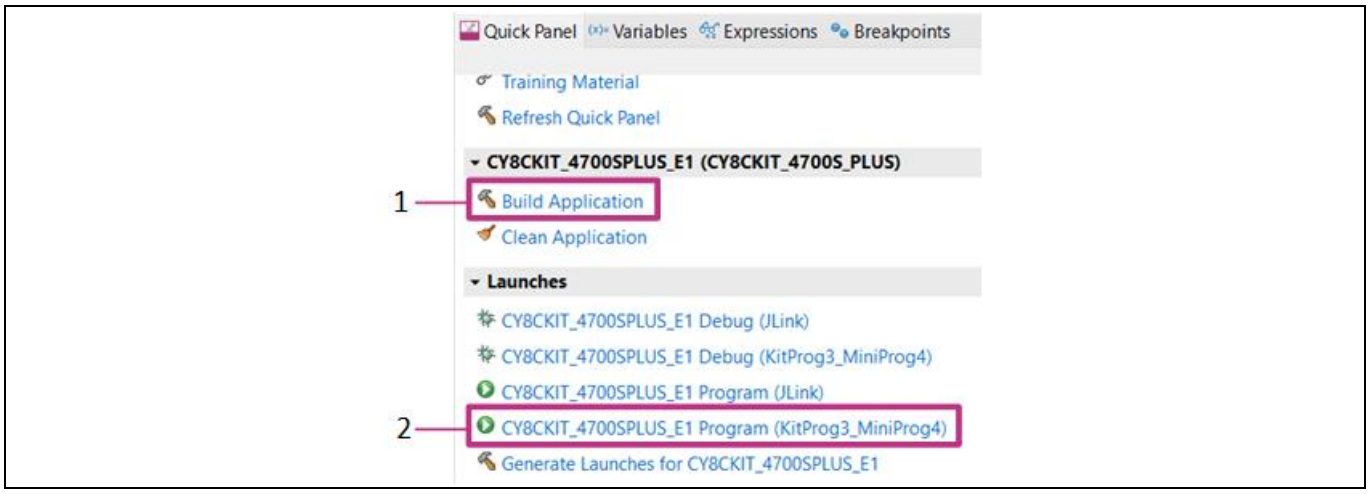

Figure 17 Running the application

8. Ensure that the project name is mentioned correctly; otherwise, generate the launches and then run the program.
9. Observe that the user LED (LED7) toggles every time the user button (SW3) is pressed and on every touch on the inductive sense buttons (BTN1, BTN2, BTN3), the respective LED (LED8, LED9, LED10 respectively) glows using a metal target the functionalities of the proximity sensor can be detected.
10. Also, open the terminal (for example, Termite or Tera Term), choose the right Com port: Kit_Prog port and set the baud rate to 19200. Figure 18 shows the raw counts of all the sensors are listed in the terminal window.

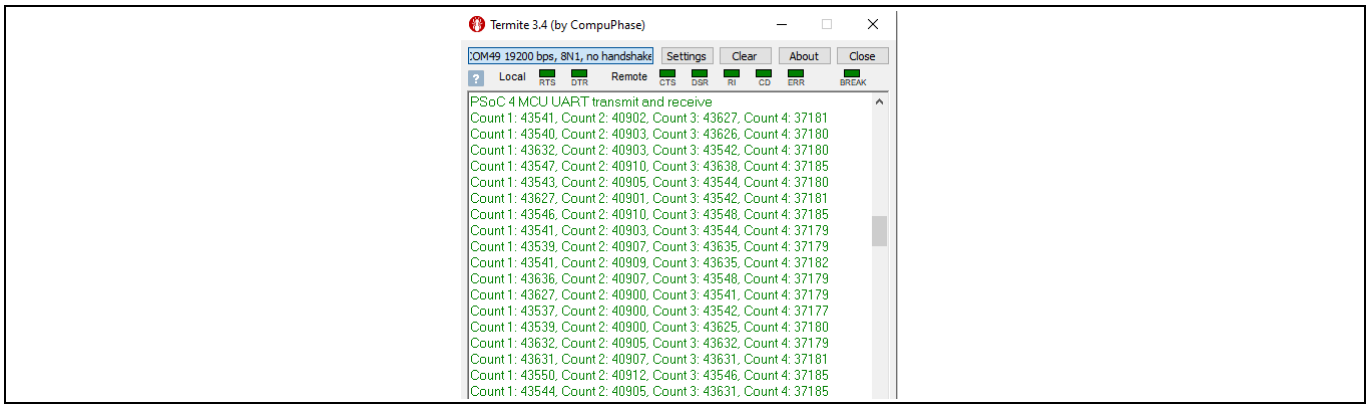

Figure 18 Terminal output

Note: The mtb_shared folder will be present in the ModusToolbox™_worspace folder and can be copied to the IDE is required. However, it is not mandatory to import it.

5 Schematics and designs

5.1 CY8CKIT-4700S-PLUS kit schematics

The section provides the CY8CKIT-4700S-PLUS kit schematics.

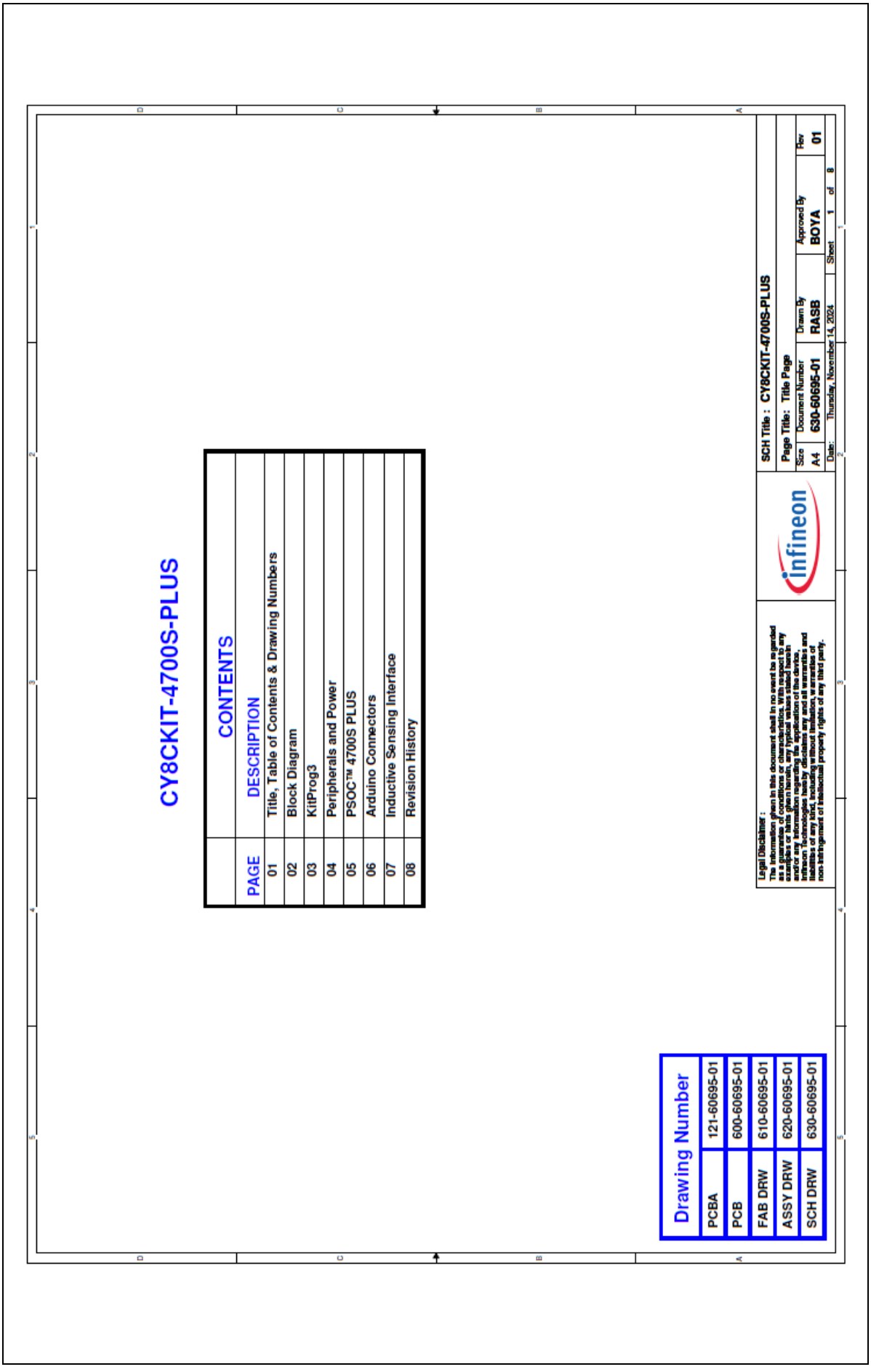

Figure 19 CY8CKIT-4700S-PLUS kit schematic

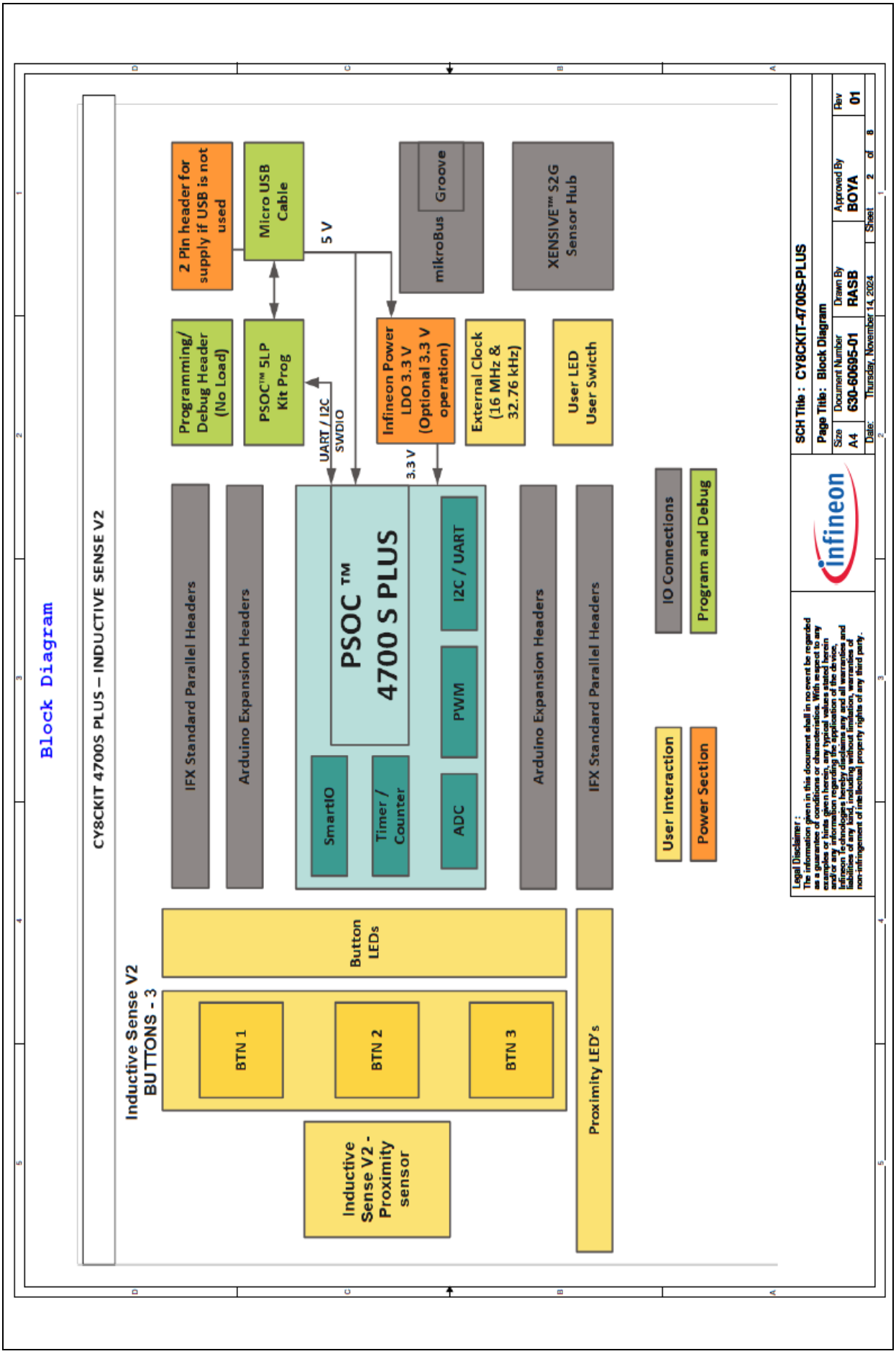

Figure 20 CY8CKIT-4700S-PLUS kit block diagram

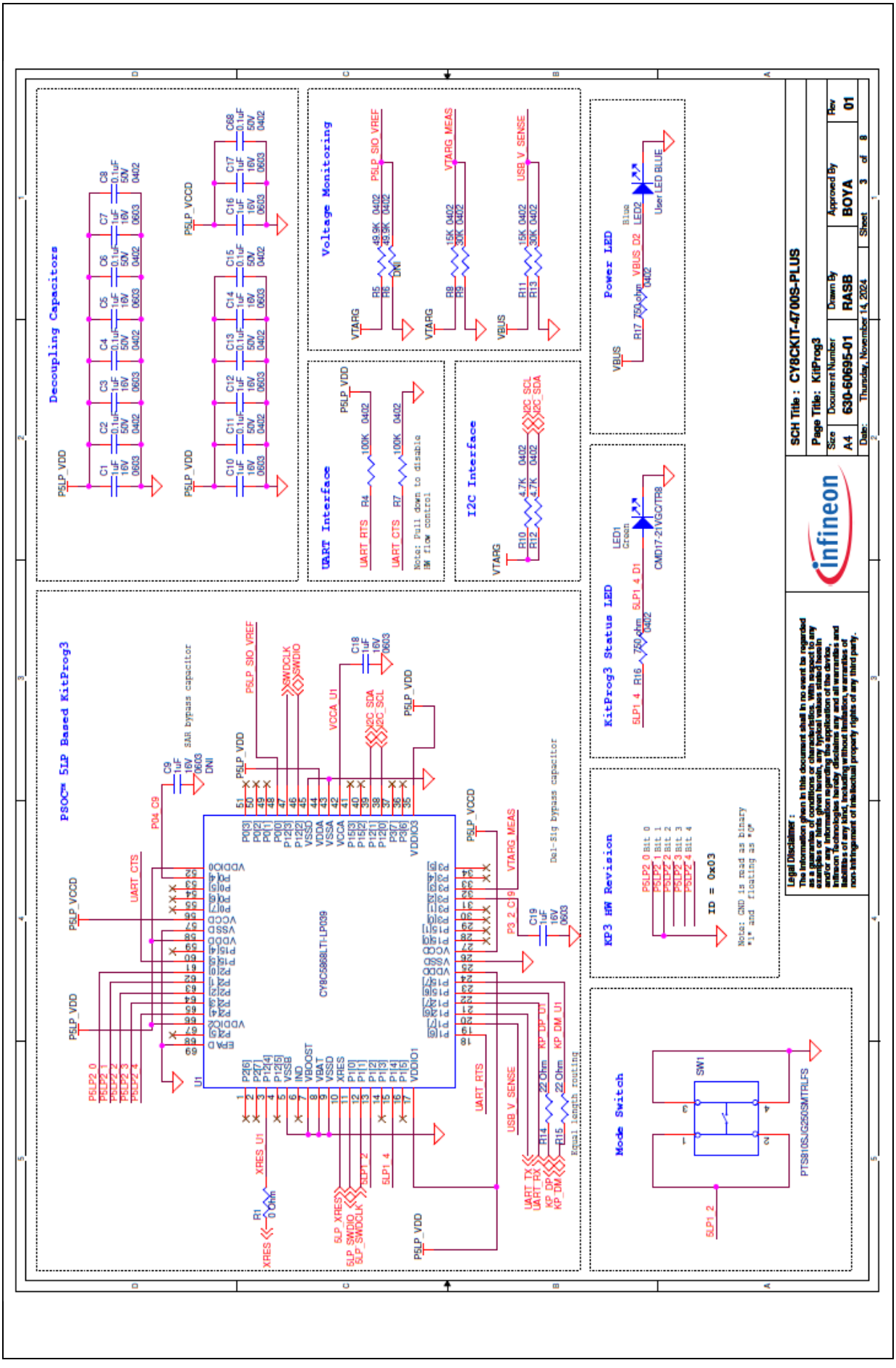

Figure 21 PSOC™ 5LP-based KitProg3 schematics

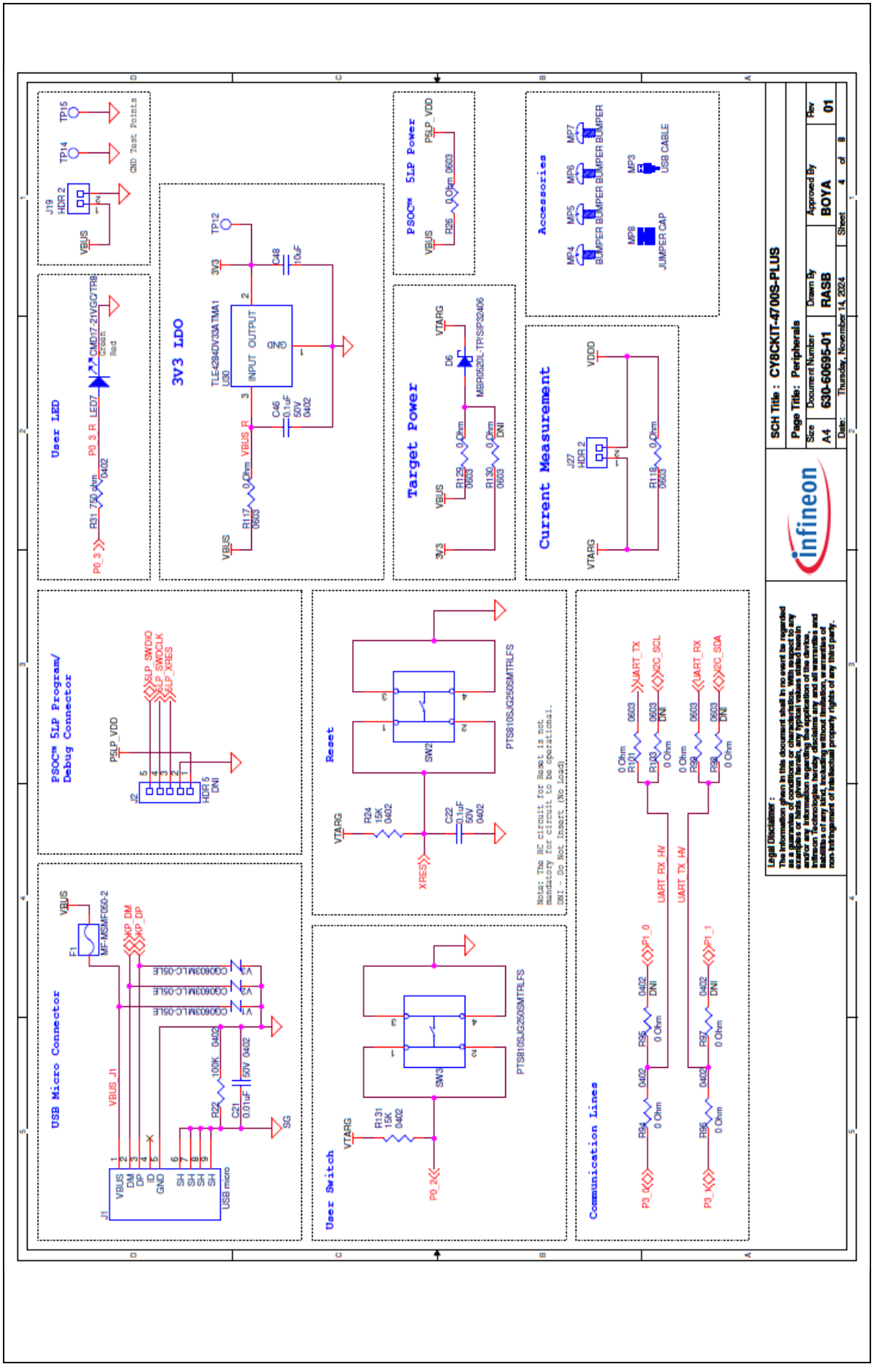

Figure 22 CY8CKIT-4700S-PLUS kit peripherals

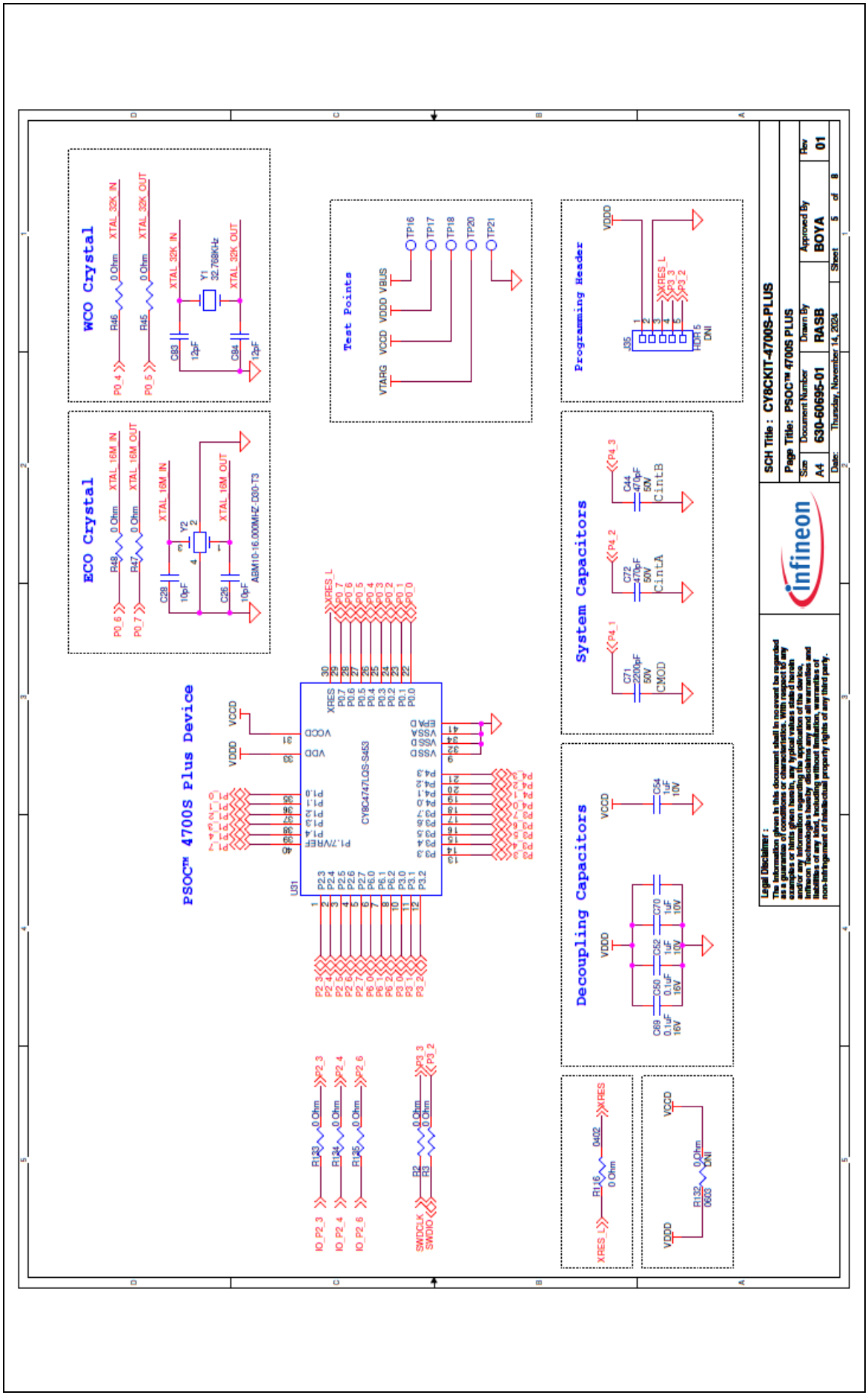

Figure 23 CY8CKIT-4700S-PLUS kit schematics

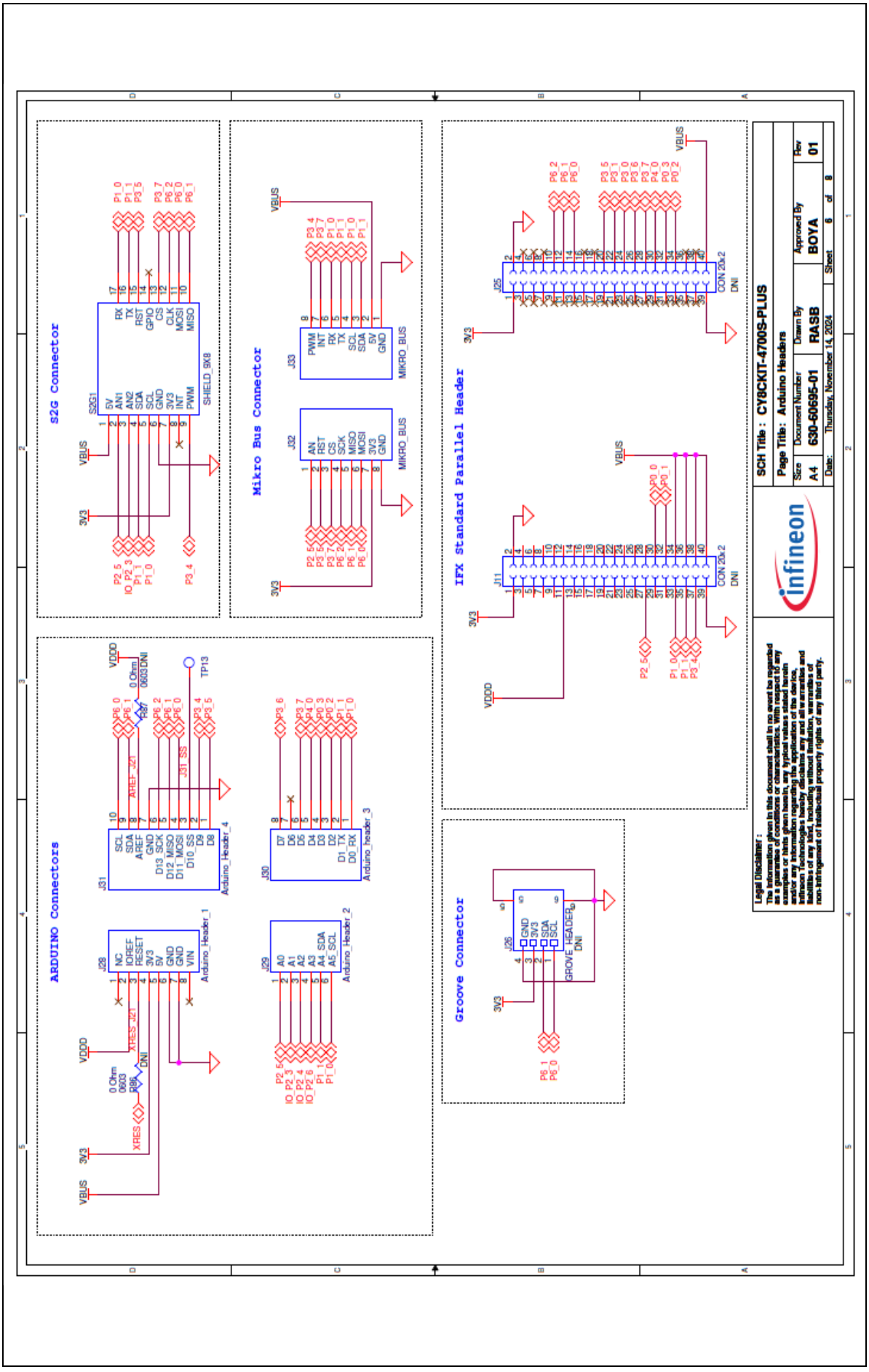

Figure 24 CY8CKIT-4700S-PLUS kit components schematics

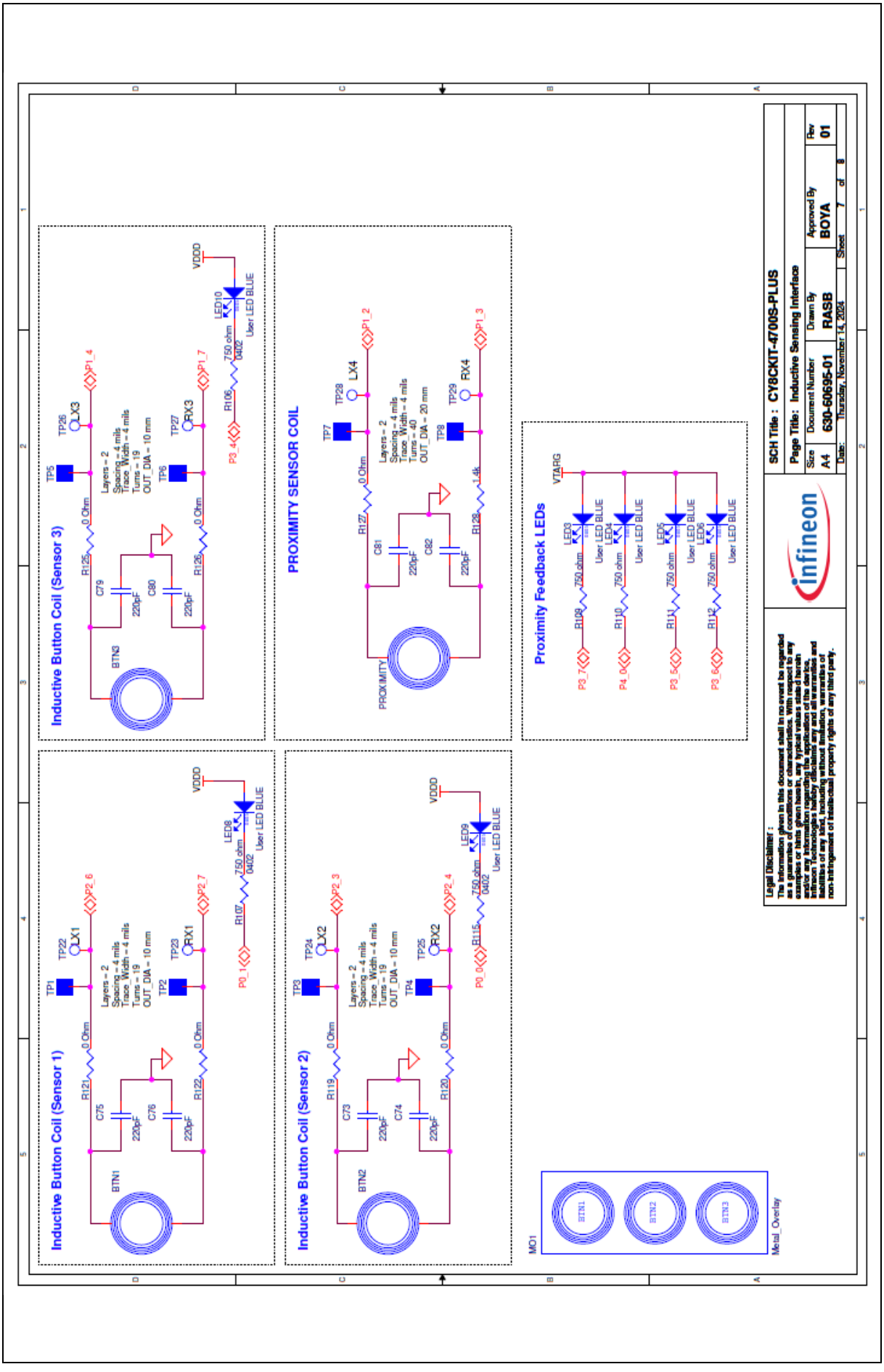

Figure 25 CY8CKIT-4700S-PLUS kit Arduino-compatible header schematics

5.2 CY8CKIT-4700S-PLUS kit assembly drawings

This section shows the CY8CKIT-4700S-PLUS kit assembly drawings.

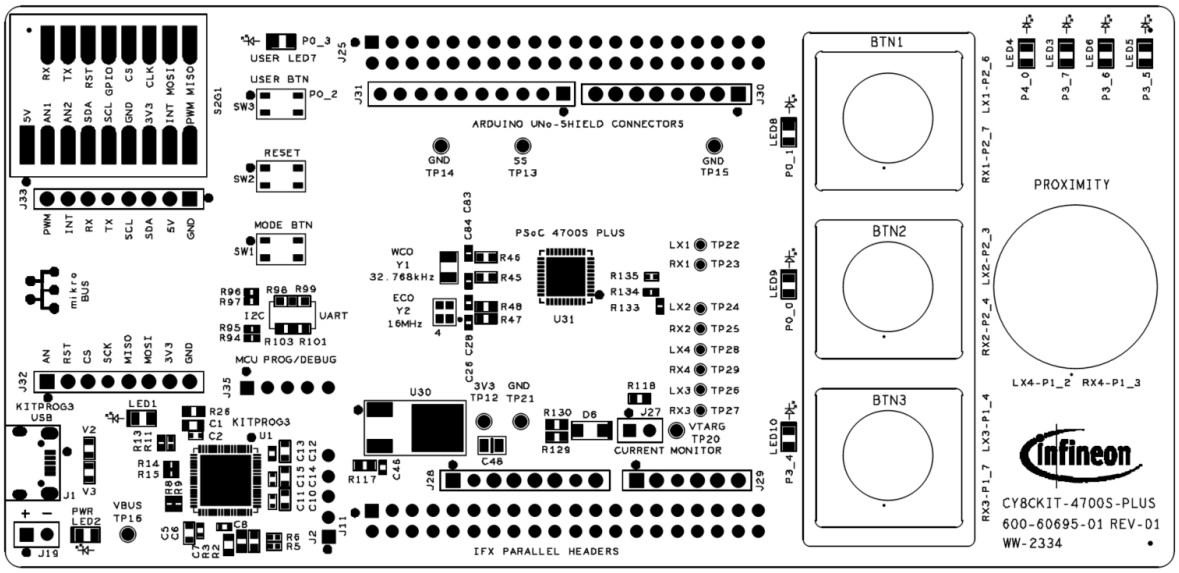

Figure 26 CY8CKIT-4700S-PLUS kit assembly drawing (top view)

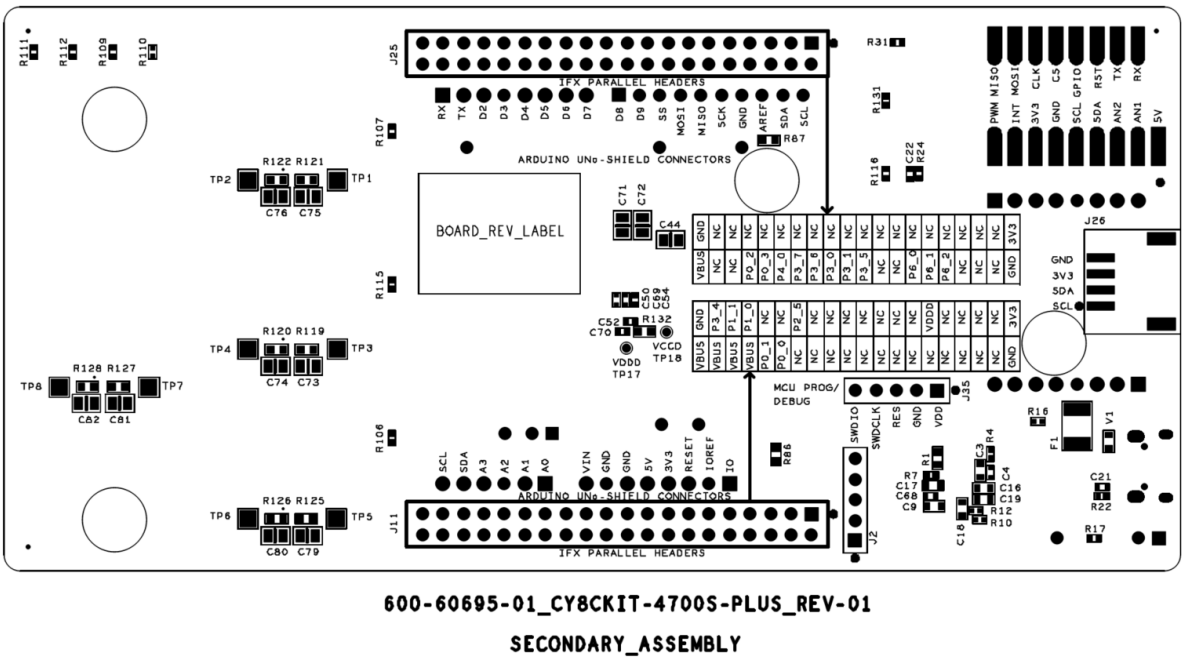

Figure 27 CY8CKIT-4700S-PLUS kit assembly drawing (bottom view)

References

[1] 002-34139: Automotive PSOC™ 4 MCU: PSOC™ 4700S Plus datasheet

[2] 001-96359: KitProg user guide

[3] 002-24616: KitProg3 user guide

For more information, see Automotive PSOC™ 4700S Plus webpage and contact Infineon Support to obtain this document.

Glossary

LED
light emitting diode

MCU
microcontroller

MTB
ModusToolbox™

PCB
printed circuit board

PWM
pulse width modulation

USB
Universal Serial Bus

Revision history

Document revision	Date	Description of changes
**	2023-12-11	Initial release.
*A	2024-11-19	Publish to web.

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

Edition 2024-11-19

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2024 Infineon Technologies AG. All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

002-39004 Rev. *A

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Infineon:

CY8CKIT4700SPLUSTOBO1