



# CY4532

## EZ-PD™ CCG3PA Evaluation Kit Guide

Doc. No. 002-18680 Rev. \*B

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# Safety Information



The CY4532 EZ-PD™ CCG3PA Evaluation Kit (EVK) is intended for use as an evaluation platform for hardware or software in a laboratory environment. The board is an open-system design, which does not include a shielded enclosure. Due to this reason, the board may cause interference to other electrical or electronic devices in close proximity. In such cases, take adequate preventive measures. Also, do not use this board near any medical equipment or RF devices.

Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures must be taken.



The CY4532 EZ-PD CCG3PA EVK boards contain ESD-sensitive devices. Electrostatic charges readily accumulate on the human body and any equipment, which can cause a discharge without detection. Permanent damage may occur to devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused CY4532 EZ-PD CCG3PA EVK boards in the protective shipping package.



## End-of-Life/Product Recycling

The end-of-life cycle for this kit is five years from the date of manufacture mentioned on the back of the box. Contact the nearest recycler to discard the kit.

## General Safety Instructions

### ESD Protection

ESD can damage boards and associated components. Cypress recommends that the user perform procedures only at an ESD workstation. If an ESD workstation is not available, use appropriate ESD protection by wearing an antistatic wrist strap attached to the chassis ground (any unpainted metal surface) on the board when handling parts.

### Handling Boards

The boards provided with CY4532 EZ-PD CCG3PA EVK are sensitive to ESD. This also applies to the boards that are provided with a plastic casing, when they are removed from the casing. Hold the boards only by the edges. After removing a board from the box/casing, place it on a grounded, static-free surface. Use a conductive foam pad, if available. Do not slide the board over any surface.

## Do's and Don'ts



- Use only a compatible 2-Cell Li-Ion battery. Make sure that the battery is connected to the Battery Terminal (J1) of CY4532 Power Board as per the marked polarity (+/-) on the hardware. See [Chapter 5. Kit Operation](#) for more details.
- Supply 12 V DC input only at the DC Jack (J3) of CY4532 Power Board.
- Do not exceed 24 V DC input at the DC Terminal (J2) of CY4532 Power Board.
- Do not connect any battery at the DC Terminal (J2) of CY4532 Power Board.
- Do not supply DC input at Load Terminals (J4 and J5) of CY4532 Power Board.
- Do not connect DC input at the DC Jack (J3) and battery at Battery Terminal (J1) simultaneously.
- Do not apply more than 6.5 V on the test points.
- Do not apply reverse voltage on the test points.
- Do not connect USB Type-C Power Adapter to the USB Type-C port (J13) located on the CY4532 Power Board.

## Identifying Kit Revision and Serial Number

The CY4532 kit revision and serial number are printed on a sticker and pasted at the bottom side of the CY4532 kit box. See the figure below for more details.



# 1. Introduction



The CY4532 EZ-PD™ CCG3PA Evaluation Kit (EVK) is based on the CCG3PA product family of Cypress' USB Type-C microcontrollers. This EVK is intended to be an evaluation vehicle for USB Type-C Power Adapter (PA) and USB Type-C Power Bank (PB) applications. The kit can be configured for a PA or PB application using a combination of firmware, jumper settings on the kit hardware, and external accessories. The following paragraphs provide a brief description of both applications:

- **USB Type-C Power Adapter (PA):** This application is used to charge a device such as a mobile phone or notebook, which supports their battery charging through the Type-C interface. The device can be connected to the Type-C port or Type-A port on the CY4532 EVK's Main Board. This application requires a DC input to be supplied to the EVK.
- **USB Type-C Power Bank (PB):** This application uses a 1-Cell or 2-Cell Lithium-ion battery connected to the CY4532 EVK, which acts as the power source to support charging on USB Type-C and USB Type-A ports. In addition, the battery can be charged using a USB Type-C Power Adapter connected to the USB Type-C port of the EVK's Main Board.

In addition to the applications described above, the CY4532 Power Board can be used as a Programmer for Cypress EZ-PD CCGx Products supporting Configuration Channel (CC) boot-loading. See [Chapter 5. Kit Operation](#) for more details.

## 1.1 Kit Contents

The CY4532 EZ-PD CCG3PA EVK consists of the following:

- CY4532 EZ-PD CCG3PA EVK Power Board
- CY4532 EZ-PD CCG3PA EVK Main Board (pre-mounted on the CY4532 EVK Power Board)
- 12 V 50.4 W DC Power Adapter
- Quick Start Guide

**Note:** The Rev \*\* of the CY4532 EVK has a 12 V 24 W DC Power Adapter.

### 1.1.1 Hardware Not Included with the Kit

The CY4532 EZ-PD CCG3PA EVK does not come with all the hardware required to perform the demonstrations mentioned in [Power Adapter \(PA\) Demo](#) and [Power Bank \(PB\) Demo](#) sections of [Chapter 5. Kit Operation](#). The following items are not included:

- A USB Type-C device that can consume power over the Type-C port (example: laptop or mobile phone with USB Type-C port)
- A device that can be charged over the USB Type-A interface (example: mobile phone which can be charged through the USB port)
- 1-cell (2.7 V–4.2 V) or 2-cell (5.4 V–8.4 V) Li-ion battery
- USB Type-C Power Adapter. This is required to charge the battery attached to the CY4532 EVK in PB use-case.
- USB cables required for connecting the devices to the USB Type-C and Type-A ports

## 1.2 Getting Started

For instructions on how to run a quick demonstration and observe the kit functionality, see the [Power Adapter \(PA\) Demo](#) section.

## 1.3 Acronyms

Table 1-1. Acronyms Used in this Document

| Acronym          | Definition                           |
|------------------|--------------------------------------|
| AFC              | Adaptive Fast Charging               |
| BC               | Battery Charging                     |
| CC               | Configuration Channel                |
| CCG              | Cable Controller Generation          |
| DFP              | Downstream Facing Port               |
| DRP              | Dual Role Port                       |
| EC               | Embedded Controller                  |
| EMCA             | Electronically Marked Cable Assembly |
| EMI              | Electromagnetic Interference         |
| ESD              | Electrostatic Discharge              |
| EVK              | Evaluation Kit                       |
| FET              | Field-Effect Transistor              |
| GPIO             | General-Purpose Input/ Output        |
| IC               | Integrated Circuit                   |
| I <sup>2</sup> C | Inter-Integrated Circuit             |
| LED              | Light-Emitting Diode                 |
| NA               | Not Applicable                       |
| OCP              | Over Current Protection              |
| PA               | Power Adapter                        |
| PB               | Power Bank                           |
| PD               | Power Delivery                       |
| PDO              | Power Data Object                    |
| PPS              | Programmable Power Supply            |
| PMIC             | Power Management Integrated Circuit  |
| PS               | Power Supply                         |
| PSoC®            | Programmable System-on-Chip          |

| Acronym | Definition                                  |
|---------|---------------------------------------------|
| QC      | Qualcomm Quick Charge                       |
| SWD     | Serial Wire Debug                           |
| UART    | Universal Asynchronous Receiver Transmitter |
| UFP     | Upstream Facing Port                        |
| USB     | Universal Serial Bus                        |
| USB-PD  | Universal Serial Bus Power Delivery         |

## 2. Kit Installation



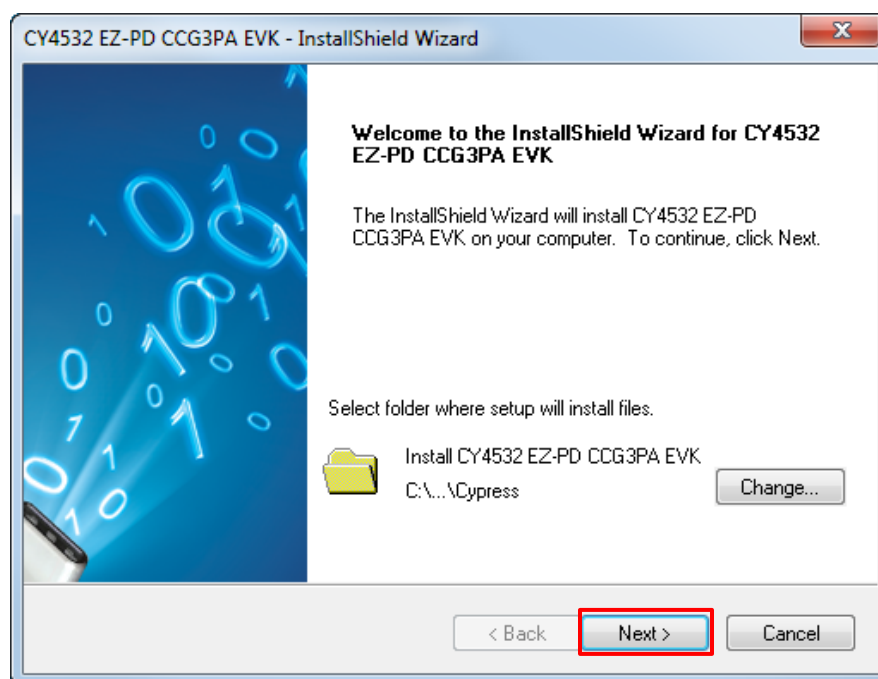
This chapter describes the procedure to install the CY4532 EZ-PD CCG3PA EVK software.

### 2.1 CY4532 EZ-PD™ CCG3PA EVK Kit Software Installation

To install the kit software, follow these steps:

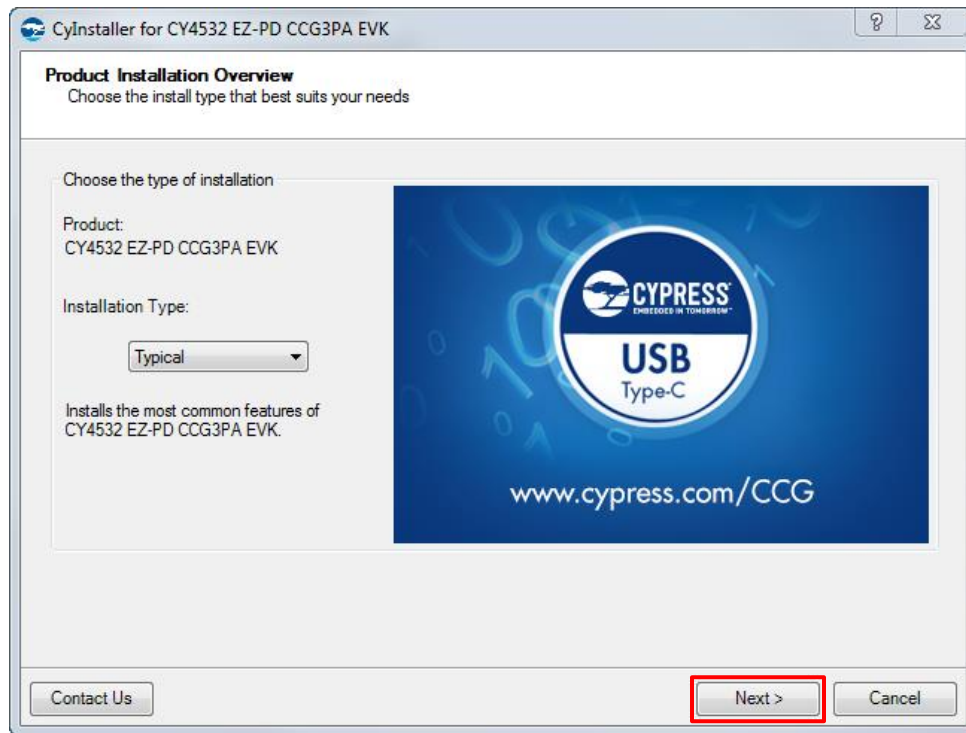
1. Download the latest kit software setup file *CY4532Setup.exe* from the kit's webpage [www.cypress.com/CY4532](http://www.cypress.com/CY4532). This package contains the kit hardware files, firmware binaries, and the kit documentation (Kit Guide, Quick Start Guide, and Release Notes). Double-click the executable to start the installation. Click **Next** when the screen shown in [Figure 2-1](#) appears.

Figure 2-1. CY4532 EZ-PD CCG3PA EVK Installer Screen



2. Select the required **Installation Type** and click **Next** to start the install ([Figure 2-2](#)). For first-time installation, it is recommended that you select **Typical** as the **Installation Type**.

Figure 2-2. Installation Wizard



3. Accept the license agreement for the software components and click **Next** (Figure 2-3).

Figure 2-3. License Agreement

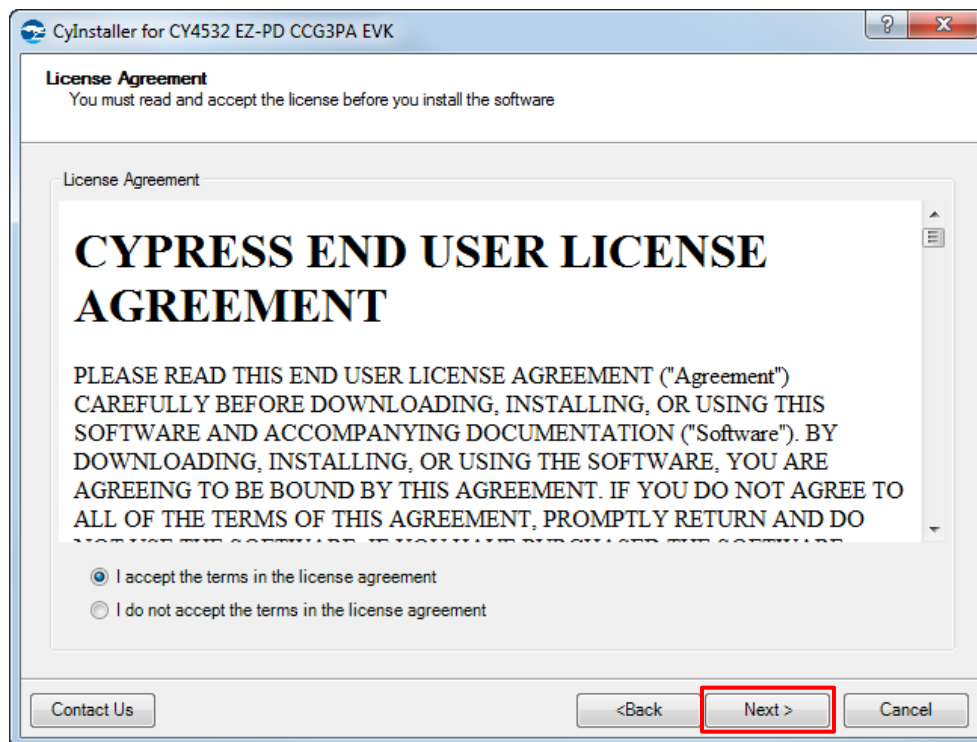
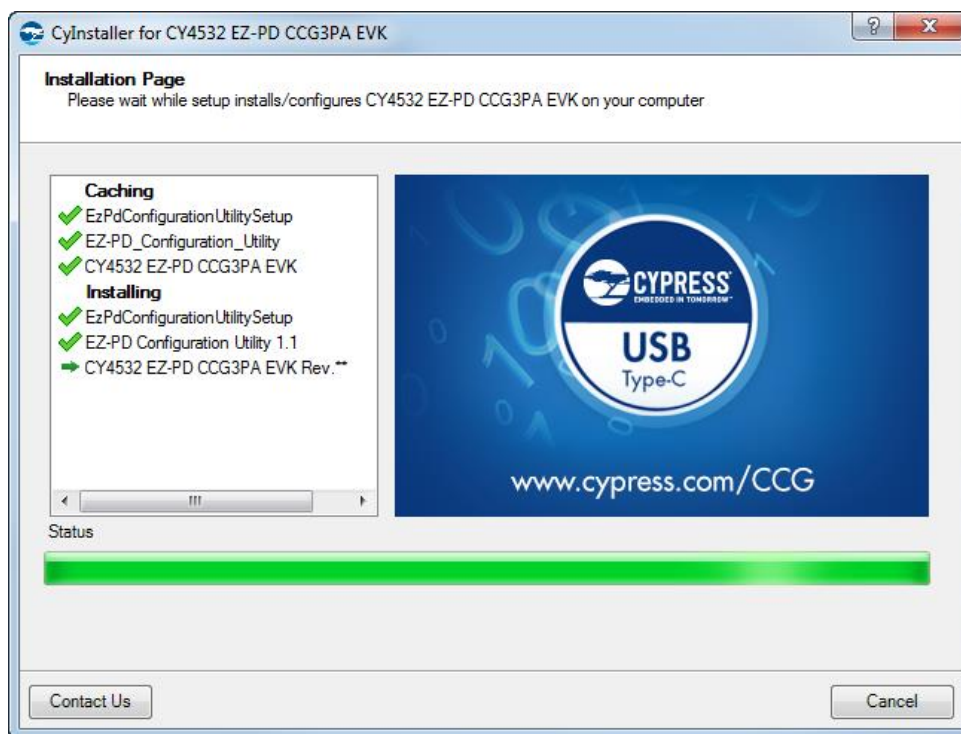


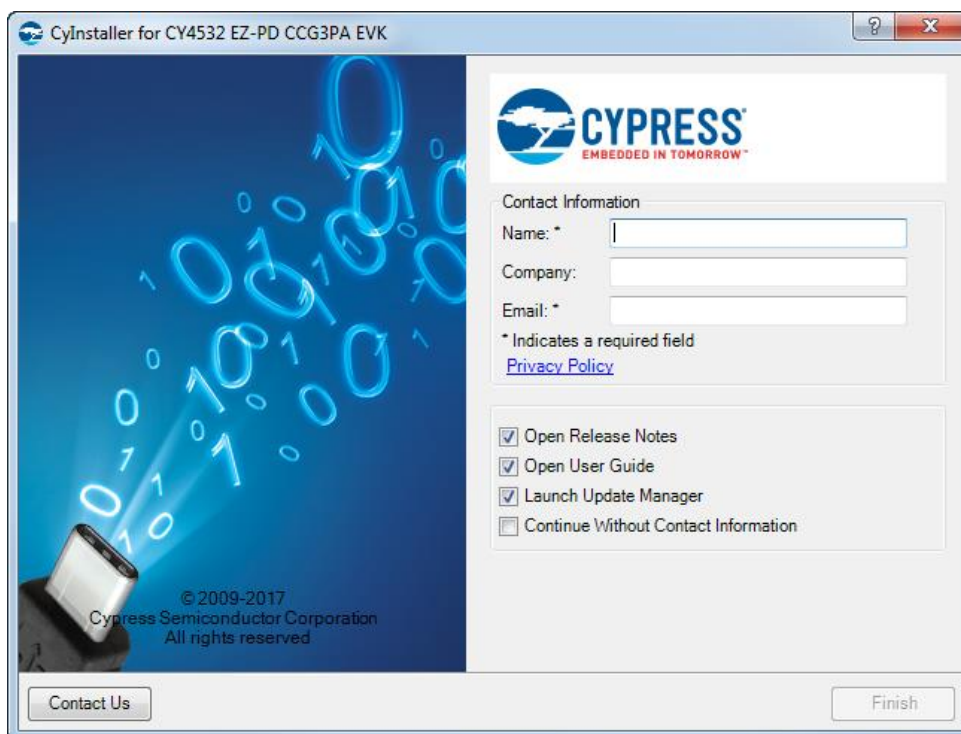
Figure 2-4 shows the installation progress.

Figure 2-4. Installation Progress



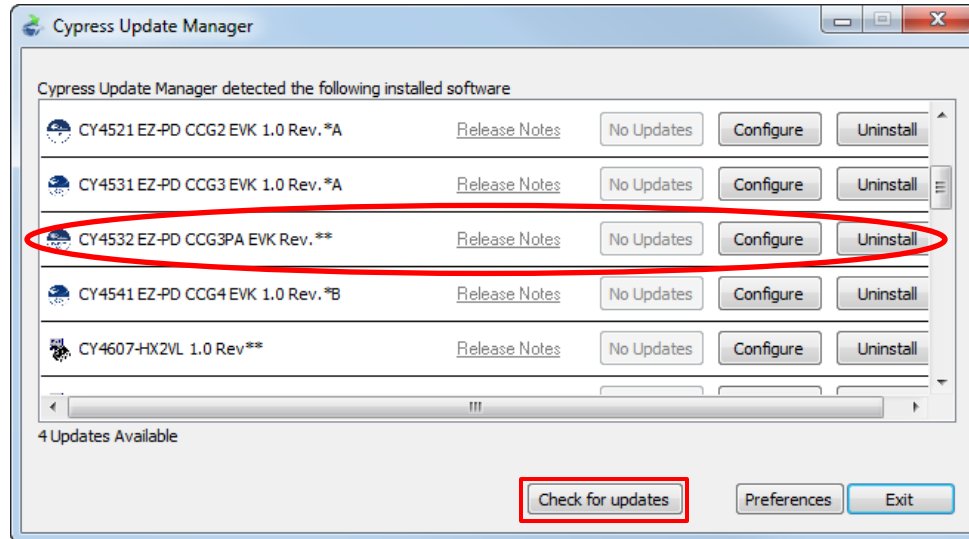
4. Enter the **Contact Information** or select **Continue Without Contact Information** and click **Finish**. (Figure 2-5).

Figure 2-5. Software Installation Complete



- When installation is complete, you have the option to launch the **Cypress Update Manager** (Figure 2-6) to make sure you have the latest software package. Click **Check for updates** at the bottom of the window. If **No Updates** appears adjacent to the CY4532 EZ-PD CCG3PA EVK, click **Exit**. If there are updates, click **Update** to download and install the latest kit package.

Figure 2-6. Cypress Update Manager



**Note:** You can launch the Cypress Update Manager at any time from **Start > All Programs > Cypress > Cypress Update Manager**.

After the installation is complete, the contents are available at this location: `<Install Directory>\CY4532 EZ-PD CCG3PA EVK\1.0\`.

**Note:** On the Windows 32-bit platform, the default `<Install Directory>` is `C:\Program Files\Cypress`; on the Windows 64-bit platform, it is `C:\Program Files(x86)\Cypress`.

## 3. CY4532 System Design Details



### 3.1 CY4532 EVK System Overview

This section provides details on the system capabilities of the CY4532 EVK. The kit supports USB Type-A and USB Type-C ports for charging.

#### 3.1.1 Power Adapter Application

For a Power Adapter (PA) application, the input power source is the DC adapter provided with the EVK. It is rated for 50.4 W (12 V/4.2 A) of power, so the total output power including both charging ports is limited to 50.4 W. Applications may charge two devices simultaneously, one on the USB Type-A port and other on the USB Type-C port, if these adhere to the 50.4 W limit, failing which the charging may intermittently or completely stop.

Table 3-1 lists the specifications for the DC adapter to be used with the CY4532 EVK.

Table 3-1. Specifications of the DC Adapter to Use with CY4532 EVK

| Parameter  | Min | Max  |
|------------|-----|------|
| DC Voltage | 6 V | 12 V |
| DC Current | -   | 5 A  |

Table 3-2 lists the charging protocols supported on the USB Type-A port.

Table 3-2. Charging Protocols Supported on USB Type-A Port

| Protocol                             | CY4532 Operating Specification         |
|--------------------------------------|----------------------------------------|
| QC 3.0 (Qualcomm Quick Charge)       | 3.6 V – 20 V                           |
| Apple Charging                       | 5 V, 2.4 A                             |
| Samsung AFC (Adaptive Fast Charging) | 5 V, 3 A<br>9 V, 2.1 A<br>12 V, 1.05 A |
| BC 1.2 (Battery Charging)            | 5 V                                    |

Table 3-3 lists the charging protocols supported on the USB Type-C port.

Table 3-3. Charging Protocols Supported on USB Type-C Port

| Protocol                             | CY4532 Operating Specification         |
|--------------------------------------|----------------------------------------|
| USB Type-C and PD                    | 5 V, 3 A<br>9 V, 3 A <sup>1</sup>      |
| QC 4.0 / PPS <sup>2</sup>            | 3 V - 11 V, 3 A                        |
| QC3.0                                | 3.6 V - 20 V                           |
| QC 2.0                               | 5 V, 9 V, 12 V, 20 V                   |
| Apple Charging                       | 5 V, 2.4 A                             |
| Samsung AFC (Adaptive Fast Charging) | 5 V, 3 A<br>9 V, 2.1 A<br>12 V, 1.05 A |
| BC 1.2 (Battery Charging)            | 5 V                                    |

**Note:**

1. Default Power Bank Application supports 9 V, 2 A
2. Supported only for Power Adapter application

If an application uses a USB Type-C-to-Type-A converter on the USB Type-C port, all charging protocols supported on the USB Type-A port of the EVK are applicable.

The USB Type-C port has the over-current protection (OCP) feature implemented in the system. If the charging current exceeds the negotiated contract current by more than 30%, CCG3PA will treat this as a fault and stop charging on the USB Type-C port.

The CY4532 Kit has an additional feature to support VCONN supply for cable discovery in the Power Adapter application. The CY4532 Kit hardware and firmware require changes to exercise the VCONN operation. Please contact Cypress Technical Support through [www.cypress.com/support](http://www.cypress.com/support) to enable the VCONN operation on the CY4532 Kit.

Applications that exceed the CY4532 operating specifications need a DC adapter with a higher power rating; however, it should not exceed the specifications mentioned in Table 3-1. Changes in the PA firmware are also required for exceeding the CY4532 operating specifications to avoid OCP fault on the USB Type-C port.

### 3.1.2 Power Bank Application

For Power Bank (PB) applications, use standard-quality Li-Ion batteries. Table 3-4 lists the specifications of the battery to be used with the CY4532 Kit for 2-Cell and 1-Cell operations.

Table 3-4. Specifications of 2-Cell and 1-Cell Batteries

| Parameter           | 2-Cell Specification |       | 1-Cell Specification |       |
|---------------------|----------------------|-------|----------------------|-------|
|                     | Min                  | Max   | Min                  | Max   |
| DC Voltage          | 5.5 V                | 8.4 V | 3.7 V                | 4.2 V |
| Charging Current    | 200 mA               | 3 A   | 200 mA               | 3 A   |
| Discharging Current | 3 A                  | 5 A   | 3 A                  | 5 A   |

Charging protocols listed in Table 3-2 and Table 3-3 are applicable for the Power Bank application as well.

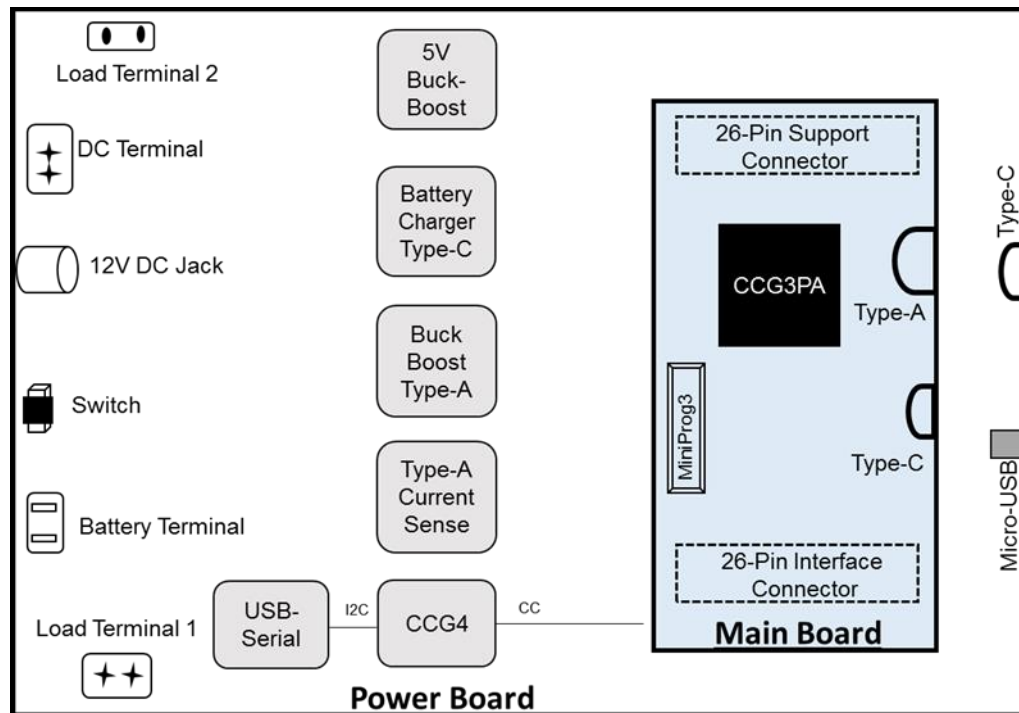
For applications that exceed the CY4532 operating specifications, a higher current rated battery is desired; however, the battery should not exceed specifications listed in Table 3-4. For exceeding the CY4532 operating specifications, applicable changes in PB firmware are also required to avoid OCP fault on the USB Type-C port.

**Important Note:** It is recommended to use 2-Cell battery as the maximum charging current supported by the EVK with 1-Cell battery operation is limited to 1.5 A. The charging may stop when the charging current exceeds 1.5 A.

## 3.2 CY4532 EVK Hardware Overview

The CY4532 EZ-PD CCG3PA EVK consists of a Power Board and a Main Board. The Main Board is pre-mounted on the Power Board during manufacturing. The CCG3PA device is located on the Main Board. The CY4532 hardware architecture is captured in [Figure 3-1](#).

Figure 3-1. CY4532 EZ-PD CCG3PA EVK Architecture



The CY4532 Power Board consists of the following key components:

- A DC Input Jack
- A Battery Input Terminal
- A Micro-USB connector to download firmware to CCG3PA
- A Type-C receptacle to enable programming of an external CCG3PA based hardware
- Regulators to support battery charging and to provide power for the USB Type-C and USB Type-A charging

The CY4532 Main Board consists of following the key components:

- CCG3PA silicon (CYPD3171-24LQXQ)
- A Type-C receptacle
- A USB Type-A connector
- MiniProg3 SWD header to program CCG3PA

The Main Board is mounted on the Power Board using two 26-pin connectors.

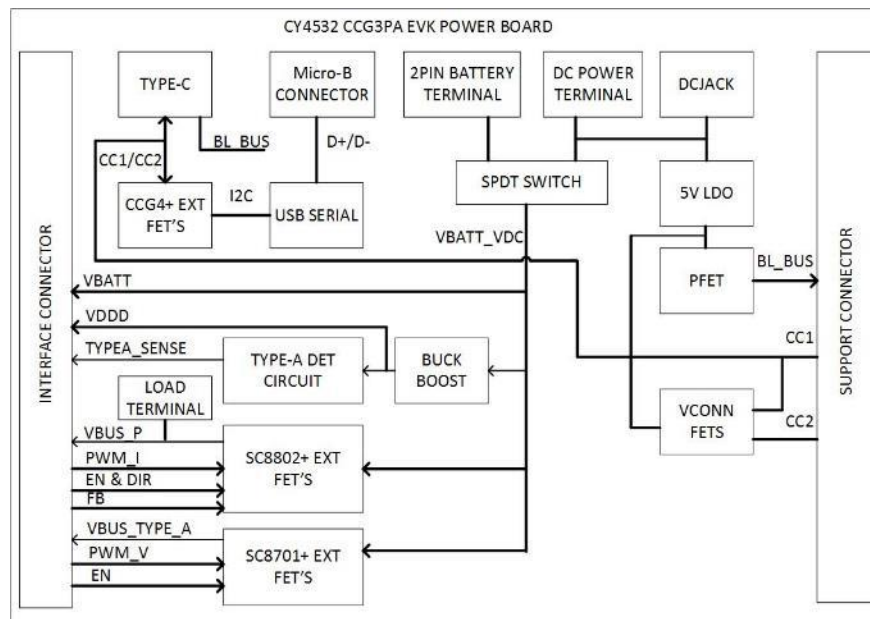
## 3.3 CY4532 Power Board

The CY4532 Power Board implements all the interfaces and logic to provide the required power supplies to the CY4532 Main Board. This board provides interfaces to connect a DC power input (for PA application) or a battery input terminal (for PB application).

### 3.3.1 Block Diagram

The block diagram of the CY4532 Power Board is shown in Figure 3-2. It provides two interfaces (DC Barrel Jack and DC Screw Terminals) to provide DC input power using an AC-DC power adapter or using a bench power supply respectively. It also includes a Battery Terminal to connect a 1-cell or 2-cell Li-ion battery. The input power mechanism (DC supply or battery) is selected using a switch (SW1).

Figure 3-2. CY4532 Power Board Block Diagram



The Power Board contains the following key parts:

- **SC8802 (U1):** This is a bidirectional buck boost regulator connected to the USB Type-C port on the main board. In the PA application, this part regulates the VBUS (VBUS\_P) voltage from 3 V to 20 V on the USB Type-C port as per the PD contract negotiated with the device being charged. The input voltage range for this part is 2.7 V to 24 V.  
 In the PB application, when the battery is being charged, this part provides power from the VBUS input (VBUS\_P) to the battery. The VBUS voltage of 3 V to 20 V supplied from a USB Type-C charger is fed to this part and it controls the power supplied to the battery as per the battery type (1-cell or 2-cell).
- **SC8701 (U2):** This is a buck boost regulator connected to the USB Type-A port located on the CY4532 EVK Main Board. In both the PA and PB applications, it supplies power from the DC input/battery to provide the VBUS output (VBUS\_TYPE\_A) on the Type-A port. The input voltage range for this part is 2.7 V to 24 V.
- **TPS63060DSCR (U4):** This is a buck boost regulator that provides a constant 5 V output. The input supply to this part is provided through the DC jack (J3) or the Battery input (J1), based on the SW1 switch setting. The recommended input voltage range for this part is up to 12 V only. The output from this part is used to provide:
  - ☐ V<sub>DDD</sub> supply to the CCG3PA device located on the CY4532 EVK Main Board
  - ☐ 5 V on the USB Type-A port of the CY4532 EVK Main Board to detect a device plug-in
  - ☐ VBUS on the USB Type-C port of the CY4532 EVK Power Board to enable flashing of an external CCG3PA based hardware
- **CYPD4126-40LQXI (U3):** This is a Cypress CCG4 controller part. It enables downloading firmware on to the CCG3PA part (which is located on the CY4532 EVK Main Board) using the EZ-PD configuration utility. It is connected to the

CCG3PA device using the CC lines. The CCG4 controller is connected to a Cypress USB-Serial part (U7) over I<sup>2</sup>C to receive the CCG3PA firmware.

**Note:** The CY4532 EVK Power Board can be used as an external CCG3PA programming accessory. The CY4532 EVK Main Board should not be connected to the Power Board for this use case. The CC lines of the CCG4 part are terminated at a USB Type-C receptacle on the Power Board. External CCG3PA based hardware can be connected to this USB Type-C receptacle to download firmware using the EZ-PD configuration utility running on a PC.

- **CY7C65211 (U7):** This is Cypress' USB-Serial part that is connected to the USB Micro-B connector (J12) of the CY4532 EVK Power Board. It is also connected to the CCG4 part over I<sup>2</sup>C. This part enables downloading the firmware on to the CCG3PA device (which is located on the CY4532 EVK Main Board) through the USB Micro-B port of the CY4532 Power Board.

### 3.3.2 Features

Table 3-5 lists the features of the CY4532 EVK Power Board.

Table 3-5. CY4532 EVK Power Board Features

| Feature                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power Supplies               | The input power can be provided through the DC input interface or the battery. The input supply is fed to SC8802 and SC8701 to enable charging through USB Type-C and USB Type-A ports. In addition, SC8802 supports charging of a battery connected to the Power Board.<br><b>Note:</b> The DC power adapter provided with the kit can support only up to 4.2 A (at 12 V). The CY4532 EVK will not work with 5 V DC power adapters. |
| CY4532 Main Board Connectors | Two 26-pin connectors (Interface Connector and Support Connector) are available on the Power Board to connect it to the Main Board.                                                                                                                                                                                                                                                                                                  |
| Firmware Download Interface  | The CCG3PA firmware can be downloaded to the CCG3PA device located on the Main Board through the USB Micro-B interface available on the Power Board.                                                                                                                                                                                                                                                                                 |

### 3.3.3 Connectors and Jumper Settings

Figure 3-3 shows the CY4532 Power Board connectors and the default jumper settings.

Table 3-6 lists the detailed description of the connectors and jumper settings.

Figure 3-3. CY4532 Power Board Connectors

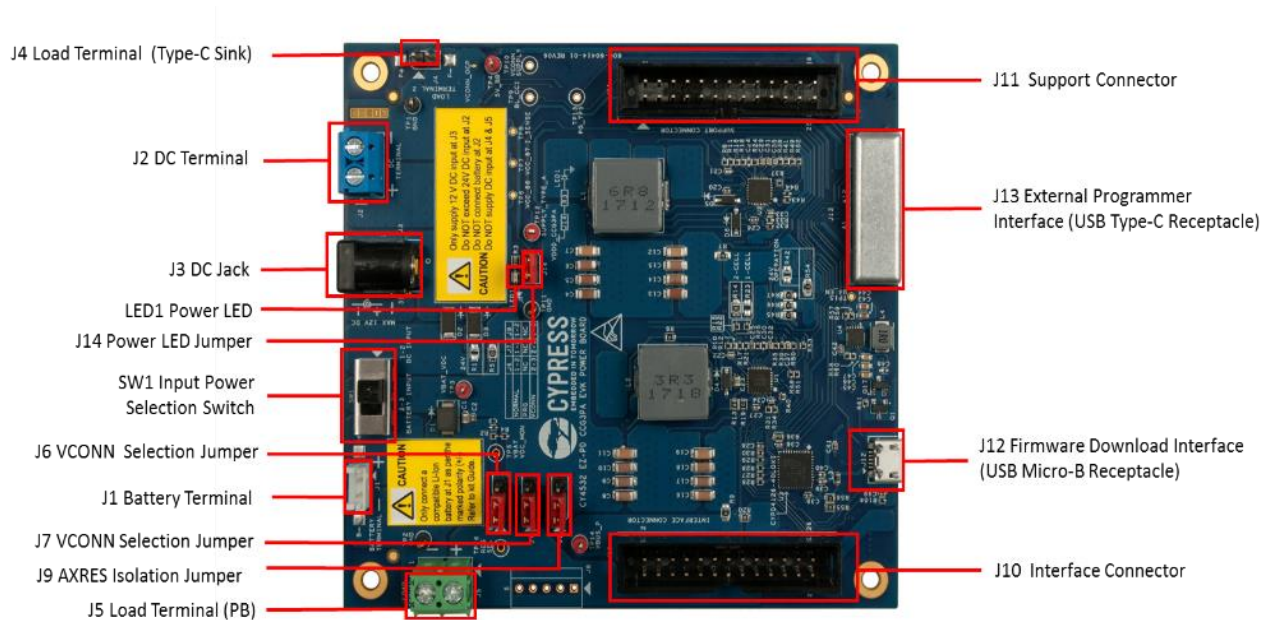


Table 3-6. CY4532 Power Board Connector/Jumper/LED Description

| Connector/Jumper | Description                   | Type         | Purpose                                                                                                                                                                                                                                                                                | Default State      |
|------------------|-------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| J1               | Battery Terminal              | Input        | To connect a 1-cell or 2-cell Li-ion battery<br>Battery voltage range: 2.7 V (Min) to 8.4 V (Max)                                                                                                                                                                                      | NA                 |
| J2               | DC Terminal                   | Input        | To connect any external power supply with the board<br>Supply voltage range: 6 V (Min) to 24 V (Max)<br>The board's default configuration does not support the usage of this terminal. See the CY4532 EVK's Power Board schematics to understand the usage of this terminal.           | NA                 |
| J3               | DC Jack                       | Input        | 12 V DC power adapter provided with the kit can plugged into this jack.<br>The AC/DC adapter shipping with the kit will provide 12 V with a current up to 4.2 A. If you need additional power sourcing, you can use your choice of power adapter that can source more current at 12 V. | NA                 |
| J4               | Load Terminal 2 (Type-C Sink) | Output       | For future use                                                                                                                                                                                                                                                                         | NA                 |
| J5               | Load Terminal 1 (PB)          | Output       | To connect an external electronic load for the PB application to emulate the battery charging current<br>Load range: 0 A (Min) to 5 A (Max)<br><b>Note:</b> Make sure to connect the load on J5 and not on J4.                                                                         | NA                 |
| J6               | VCONN Selection Jumper        | Input        | To enable the VCONN operation on the Power Board for PA application                                                                                                                                                                                                                    | Short pins 1 and 2 |
| J7               | VCONN Selection Jumper        | Input        | To enable the VCONN operation on the Power Board for PA application                                                                                                                                                                                                                    | Short pins 1 and 2 |
| J9               | AXRES Isolation Jumper        | Input        | To isolate the AXRES pin of CCG3PA device on the Main Board from the Power Board.                                                                                                                                                                                                      | Short pins 1 and 2 |
| J10              | Interface Connector           | Input/Output | To connect various control signals from the CCG3PA to the regulators.                                                                                                                                                                                                                  | NA                 |
| J11              | Support Connector             | Input/Output | To connect CCG4's CC signals and other signals between the Power board and the Main board                                                                                                                                                                                              | NA                 |
| J12              | USB Micro-B receptacle        | Input/Output | Interface to download firmware on to the CCG3PA part                                                                                                                                                                                                                                   | NA                 |
| J13              | USB Type-C receptacle         | Input/Output | External CCG3PA programming interface                                                                                                                                                                                                                                                  | NA                 |
| J14              | LED Jumper                    | NA           | This jumper connects power to anode of LED1. If the jumper is not installed LED indication will stop as there is no power supplied to LED.                                                                                                                                             | Short pins1 and 2  |
| LED1             | Power LED                     | Output       | LED to indicate that the board is powered either from a DC adapter, a battery, or an external Type-C charger.                                                                                                                                                                          | OFF                |

**Note:** In Rev \*\* of the CY4532 EVK, the features listed in [Table 3-7](#) are different from those listed in [Table 3-6](#).

Table 3-7. Connector/Jumper/LED Differences

| Connector/Jumper | Remark/Difference                                                                                                         | Default state |
|------------------|---------------------------------------------------------------------------------------------------------------------------|---------------|
| J12              | USB Mini-B receptacle instead of USB Micro-B receptacle                                                                   | NA            |
| J14              | Not Present                                                                                                               | NA            |
| LED1             | LED will blink for a second when the board is powered either from a DC adapter, a battery, or an external Type-C charger. | OFF           |

The Rev \*\* of the CY4532 EVK also can be identified using the board revision numbers listed in [Table 3-8](#). These revision numbers are printed on the silk screen of the boards:

### Table 3-8. Board Revision Numbers

| # | Board                               | Revision Number Printed on the Silk Screen |
|---|-------------------------------------|--------------------------------------------|
| 1 | CY4532 EZ-PD CCG3PA EVK MAIN BOARD  | 600-60412-01 REV04                         |
| 2 | CY4532 EZ-PD CCG3PA EVK POWER BOARD | 600-60414-01 REV04                         |

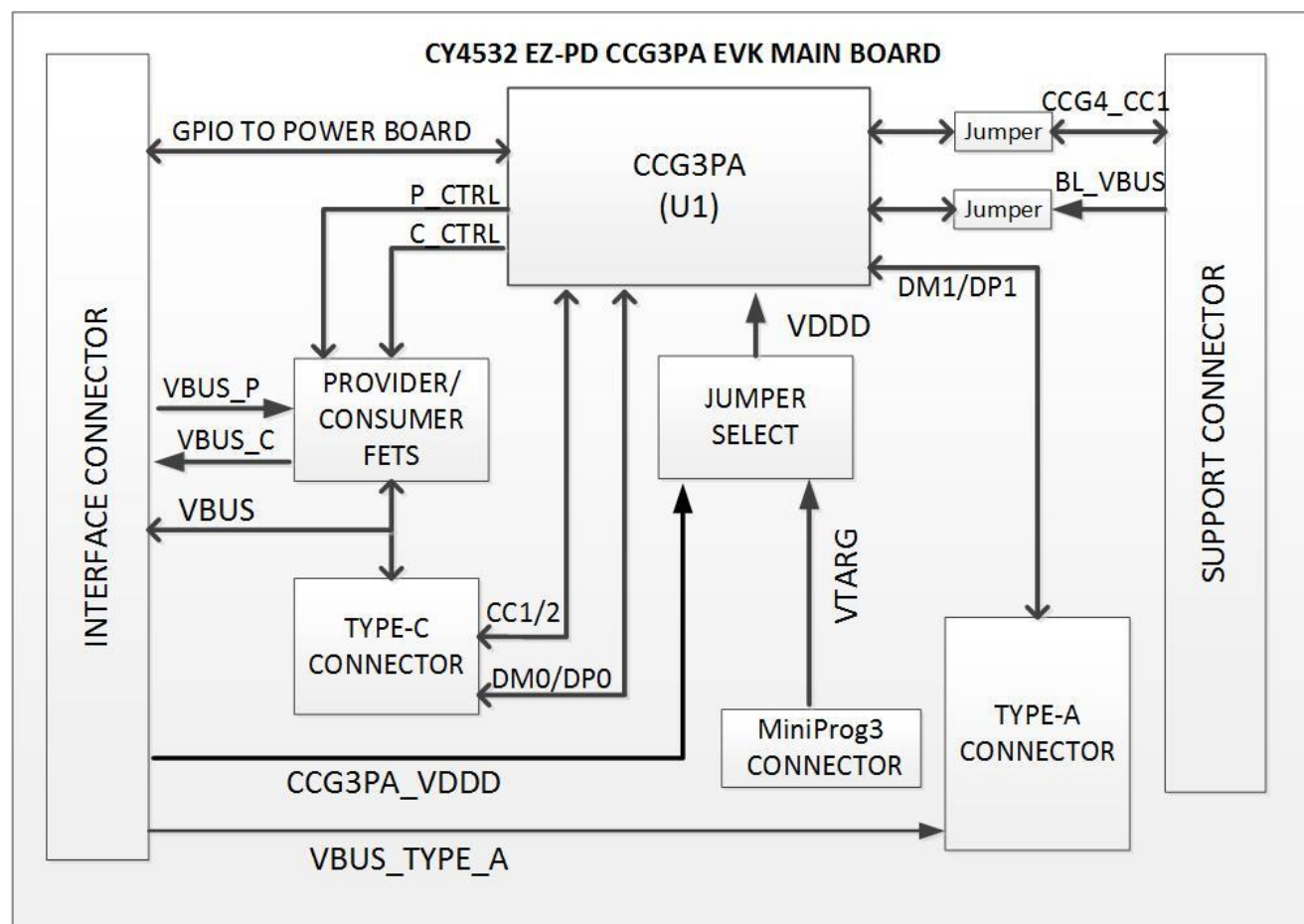
### 3.4 CY4532 Main Board

The CY4532 Main Board consists of the CCG3PA silicon (CYPD3171-24LQXQ), USB Type-C and USB Type-A ports and a MiniProg3 SWD header. The Main Board is mounted on the Power Board using two sets of connectors.

### 3.4.1 Block Diagram

Figure 3-4 shows the block diagram of the CY4532 EVK Main Board.

Figure 3-4. CY4532 EVK Main Board Block Diagram



The Main Board contains the following key parts:

- **CYPD3171-24LQXQ (U1):** This is the CCG3PA controller with the required control logic to implement PA and PB applications.
- **Power MOSFETs (Q1 and Q2):** These MOSFETs are P-Channel devices which control the Provider and the Consumer paths for VBUS at the Type-C connector.

### 3.4.2 Features

Table 3-9 lists the features of the CY4532 EVK Main Board.

Table 3-9. CY4532 EVK Main Board Features

| Feature                     | Description                                                                                                                                                                              |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CCG3PA controller           | The CYPD3171-24LQXQ part is located on the Main Board. This part implements the PA and PB control functionality                                                                          |
| USB Type-C Source/Sink Port | A USB Type-C receptacle to attach devices that can consume power over a USB Type-C port (PA and PB applications) and to charge the battery connected to the power board (PB application) |
| USB Type-A Source Port      | A USB Type-A receptacle to attach devices that can consume power over USB Type-A                                                                                                         |
| Programming                 | SWD pins to debug/program CCG3PA using MiniProg3 (not required if the EZ-PD configuration utility is used)                                                                               |

### 3.4.3 Connectors and Jumper Settings

Figure 3-5 shows the CY4532 Main Board connectors and default settings of the jumpers.

Table 3-10 lists the detailed description of the connectors/jumper settings

Figure 3-5. CY4532 EVK Main Board Connector/Jumper Settings

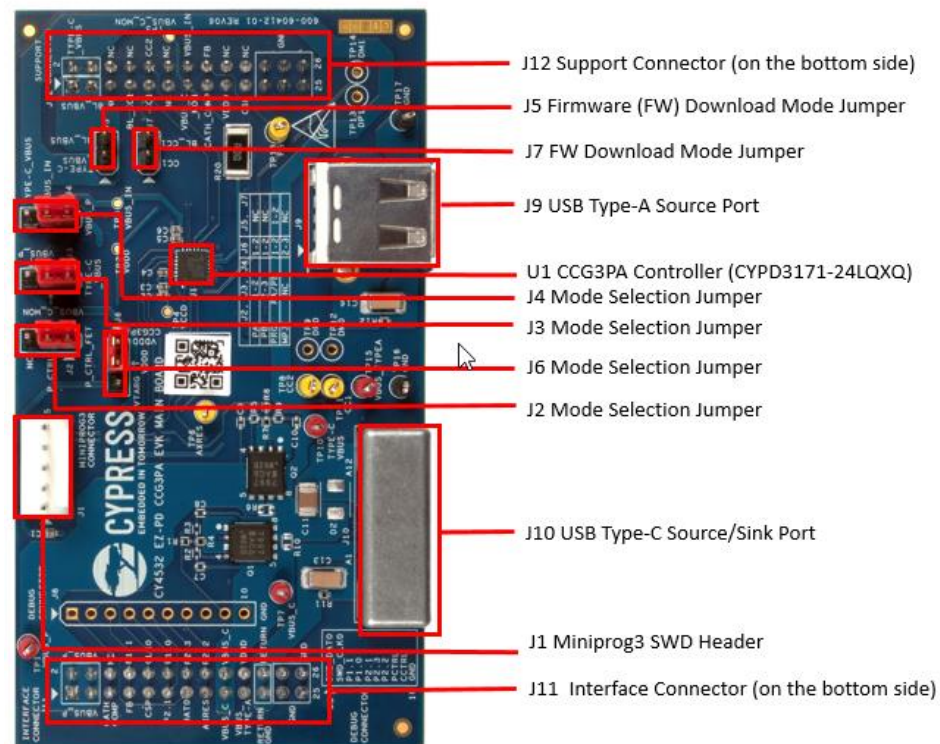


Table 3-10. CY4532 EVK Main Board Connector/Jumper Description

| Connector/Jumper   | Description                                     | Type         | Purpose                                                                                                                                                                     | Default State      |
|--------------------|-------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| J2, J3, J4, and J6 | Mode Selection Jumpers                          | Input        | To configure the Main Board for PA/ PB/ FW download/ MiniProg3 mode<br><b>Note:</b> Current consumed by the CCG3PA controller can be measured at J6 at any point of time.   | Short pins 1 and 2 |
| J5 and J7          | FW Download Mode Jumpers                        | Input        | To enable firmware download through the USB Mini-B connector located on the Power Board                                                                                     | Open               |
| J9                 | USB Type-A Source Port (Type-A receptacle)      | Input/Output | USB Type-A receptacle to attach devices that can consume power over a USB Type-A port                                                                                       | NA                 |
| J10                | USB Type-C Source/Sink Port (Type-C receptacle) | Input/Output | USB Type-C receptacle to attach devices which can consume power over a Type-C port (PA and PB applications) and to charge the battery connected to the EVK (PB application) | NA                 |
| J11                | Interface Connector                             | Input/Output | To connect the control signals from CCG3PA to the power regulators.                                                                                                         | NA                 |
| J12                | Support Connector                               | Input/Output | To connect CCG4's CC signals and other signals between the Power board and Main board                                                                                       | NA                 |

## 4. Programming the EZ-PD CCG3PA Controller



The CCG3PA controller on the CY4532 EZ-PD CCG3PA EVK is pre-programmed with the latest PA firmware binary image at the time of manufacturing. However, a newer firmware image may be available on the [CY4532 EZ-PD CCG3PA EVK webpage](#) and with the CY4532 EZ-PD CCG3PA EVK installer. The firmware version of the onboard CCG3PA controller can be verified by using the [EZ-PD Configuration Utility](#) as shown in [Figure 4-4](#).

If the onboard CCG3PA controller's firmware version does not match the latest version on the [CY4532 EZ-PD CCG3PA EVK webpage](#), follow the steps in this chapter to reprogram the CCG3PA device with the latest firmware. Device configuration parameters (such as vendor ID, Power Data Objects (PDOs), and so on) can be updated using the [EZ-PD Configuration Utility](#). See the EZ-PD Configuration Utility User Manual available in the [EZ-PD Configuration Utility](#) webpage.

### 4.1 Programming the CCG3PA Controller on the CY4532 EVK

#### 4.1.1 Procedure to Program the CCG3PA Controller

The EZ-PD Configuration Utility is a Windows Application, which can be used to configure and program the CCG3PA controller on the CY4532 Main Board. Steps to update the firmware running on the CCG3PA controller are as follows:

1. Download and install the latest kit software setup file "CY4532Setup.exe" from the kit's webpage: [www.cypress.com/CY4532](http://www.cypress.com/CY4532). This installs the EZ-PD Configuration Utility as well.  
**Note:** Make sure that no devices are connected on the Type-C or Type-A ports of the CY4532 EVK before proceeding with the next step.
2. Set the jumpers on the CY4532 Main Board and Power Board as list in [Table 4-1](#).

Table 4-1. CY4532 EVK Jumper Settings for programming the CCG3PA Controller

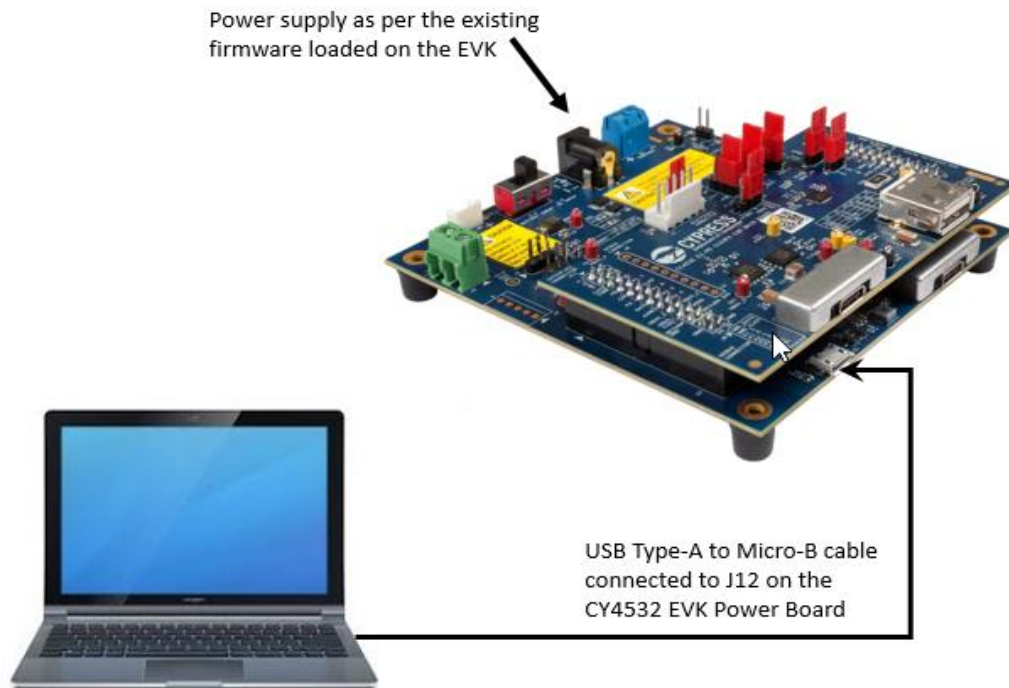
| Board Type  | Jumper Header | Status                                                                                                    |
|-------------|---------------|-----------------------------------------------------------------------------------------------------------|
| Main Board  | J2            | Short 1 and 2 if the existing FW loaded on the EVK is PA firmware. Short 2 and 3 if PB firmware is loaded |
|             | J3            |                                                                                                           |
|             | J4            |                                                                                                           |
|             | J6            | Short 1 and 2                                                                                             |
|             | J5            |                                                                                                           |
|             | J7            |                                                                                                           |
| Power Board | J6            | Open                                                                                                      |
|             | J7            | Open                                                                                                      |
|             | J9            | Open                                                                                                      |

**Note:** See [Appendix C - Identifying the Application Firmware Type](#) for instructions to identify the application firmware already loaded on the EVK.

3. Apply power to the EVK as per the existing firmware loaded on the EVK. If PA firmware is loaded, power the EVK using the DC Input. If PB firmware is loaded, power the EVK using the Battery Input. Make sure that the Input Power Selection Switch (SW1) is set as per the type of power input used.
4. Connect a USB Type-A to Micro-B cable from a host PC to connector J12 on the Power Board as shown in [Figure 4-1](#).

**Note:** For the Rev \*\* of the CY4532 EVK, use USB Type-A to Mini-B cable.

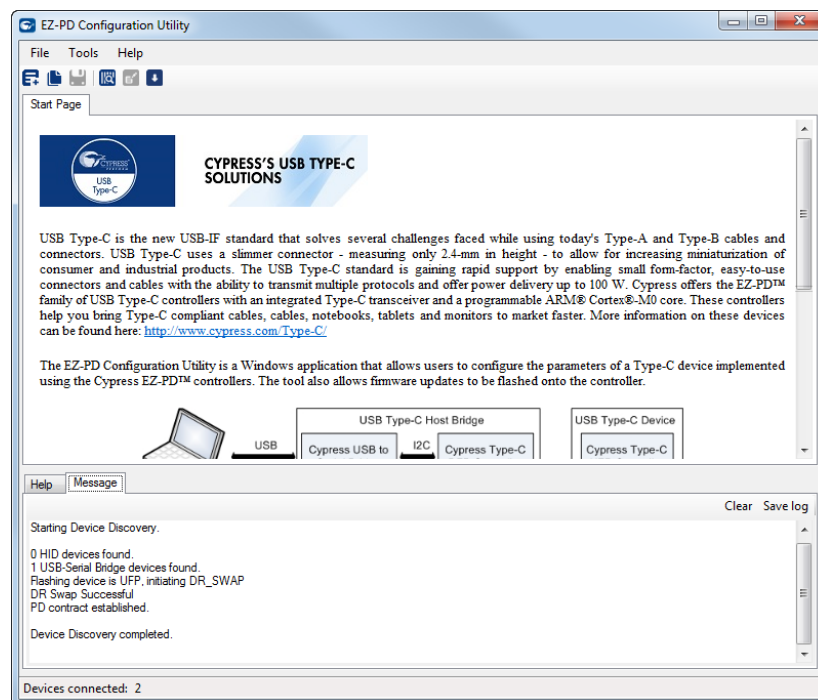
Figure 4-1. Programming the CCG3PA Controller on the CY4532 EZ-PD CCG3PA EVK



- Launch the EZ-PD Configuration Utility as shown in Figure 4-2. After installation, the EZ-PD Configuration Utility is available on the start menu at:

**Windows > Start > All Programs > Cypress > EZ-PD Configuration Utility > EZ-PD Configuration Utility**

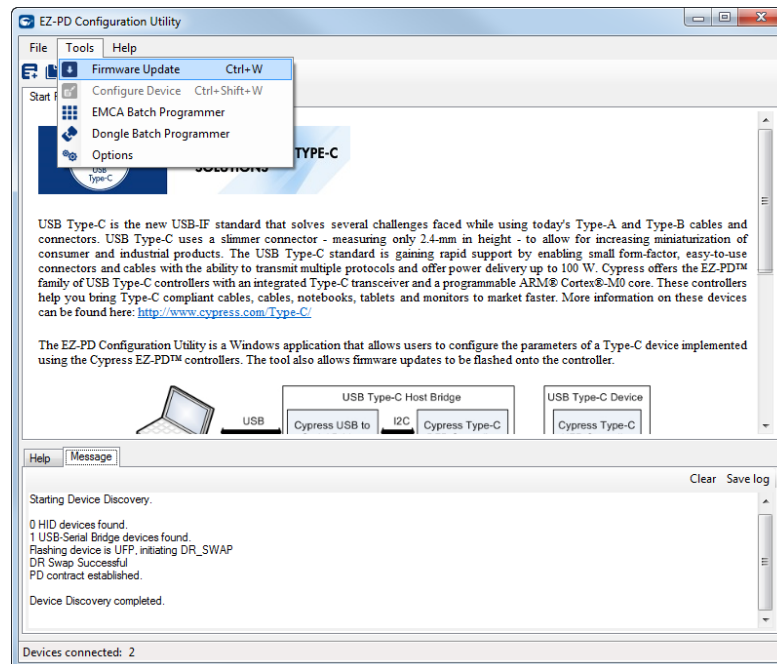
Figure 4-2. EZ-PD Configuration Utility



Confirm that the Utility's status bar displays the connection with two devices as shown in Figure 4-2.

6. Select **Tools > Firmware Update** to update the firmware of the CCG3PA controller as shown in [Figure 4-3](#). See the Utility's User Manual available on the [EZ-PD Configuration Utility](#) webpage for more details. You can also click **Help > User Manual** in the EZ-PD Configuration Utility to access this user manual.

Figure 4-3. Upgrading the CCG3PA Firmware



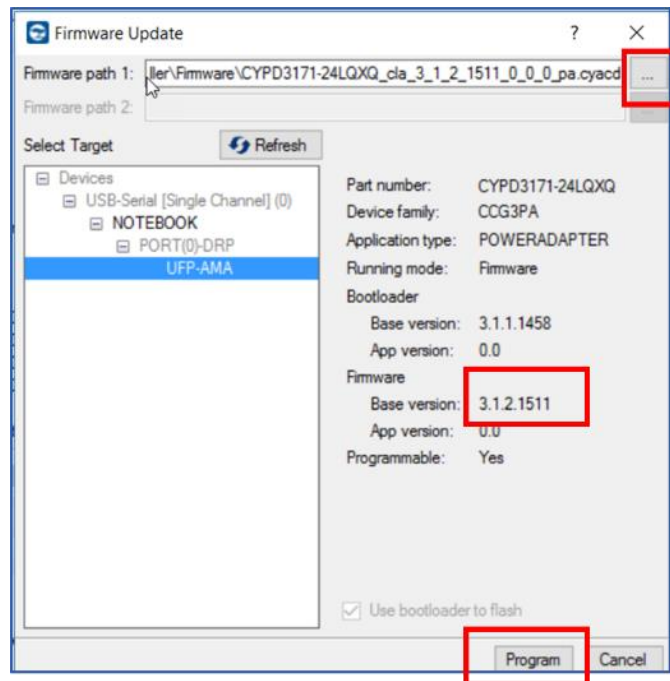
7. Download the latest firmware images from the [CY4532 EZ-PD CCG3PA EVK](#) webpage. Select the type of firmware (PA/PB application). The firmware filenames are:

- ☐ PA: *CYPD3171-24LQXQ\_cla\_<version>.pa.cyacd*
- ☐ PB: *CYPD3171-24LQXQ\_pb\_<version>.pb.cyacd*

The CCG3PA controller firmware is provided in the *.cyacd* format. The latest firmware binary for each application and the standard part numbers are provided on the [CY4532 EZ-PD CCG3PA EVK](#) webpage. The firmware images are also available at the following location after the CY4532 EZ-PD CCG3PA EVK installation: *<Install\_Directory>\CY4532 EZ-PD CCG3PA EVK\1.0\Firmware*

8. Select **UFP-AMA** from the **Select target** list shown in [Figure 4-4](#). Click the button located next to **Firmware path 1** at the top of the window and navigate to the location of the firmware image.

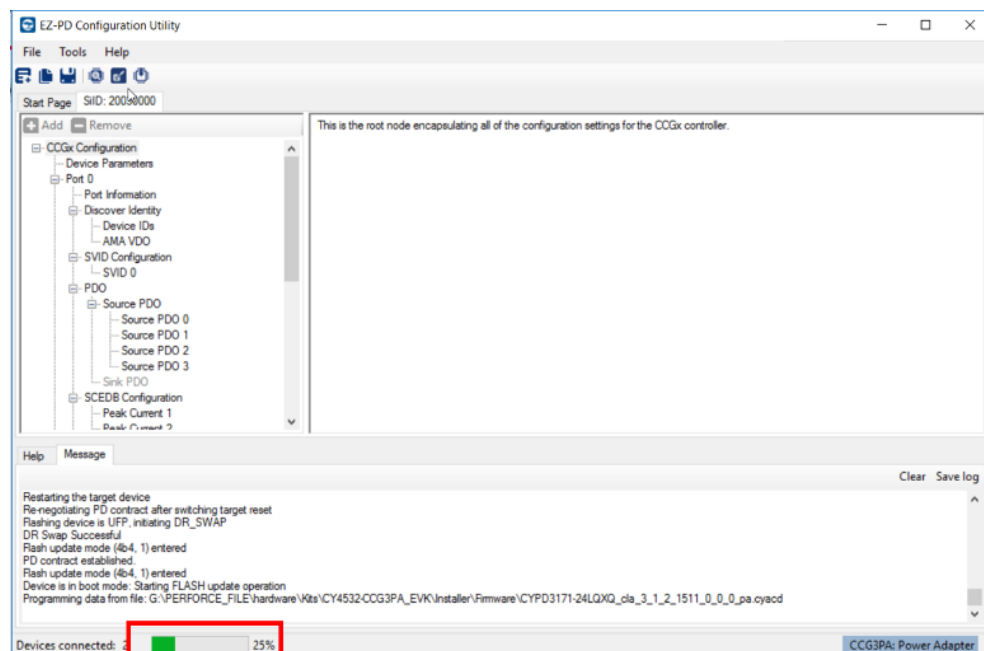
Figure 4-4. Updating Firmware Using EZ-PD Configuration Utility



**Note:** The current firmware version is displayed as **Base version** under **Firmware** as shown in Figure 4-4.

9. Click **Program** to initiate the firmware update process. The status bar at the bottom of the utility will show the progress. The firmware update process can take around six minutes to complete.

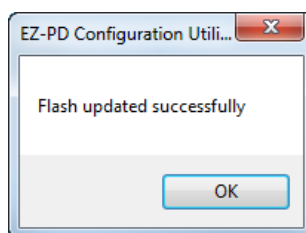
Figure 4-5. Firmware Update Process



**Warning:** Do not disconnect the EVK from the PC/laptop while the firmware update is in progress.

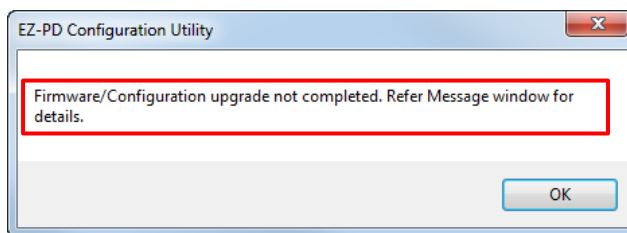
10. Upon successful completion of the firmware update process, a window with the message “Flash updated successfully” is displayed as shown in Figure 4-6. Click **OK**.

Figure 4-6. Completion of Firmware Update Process



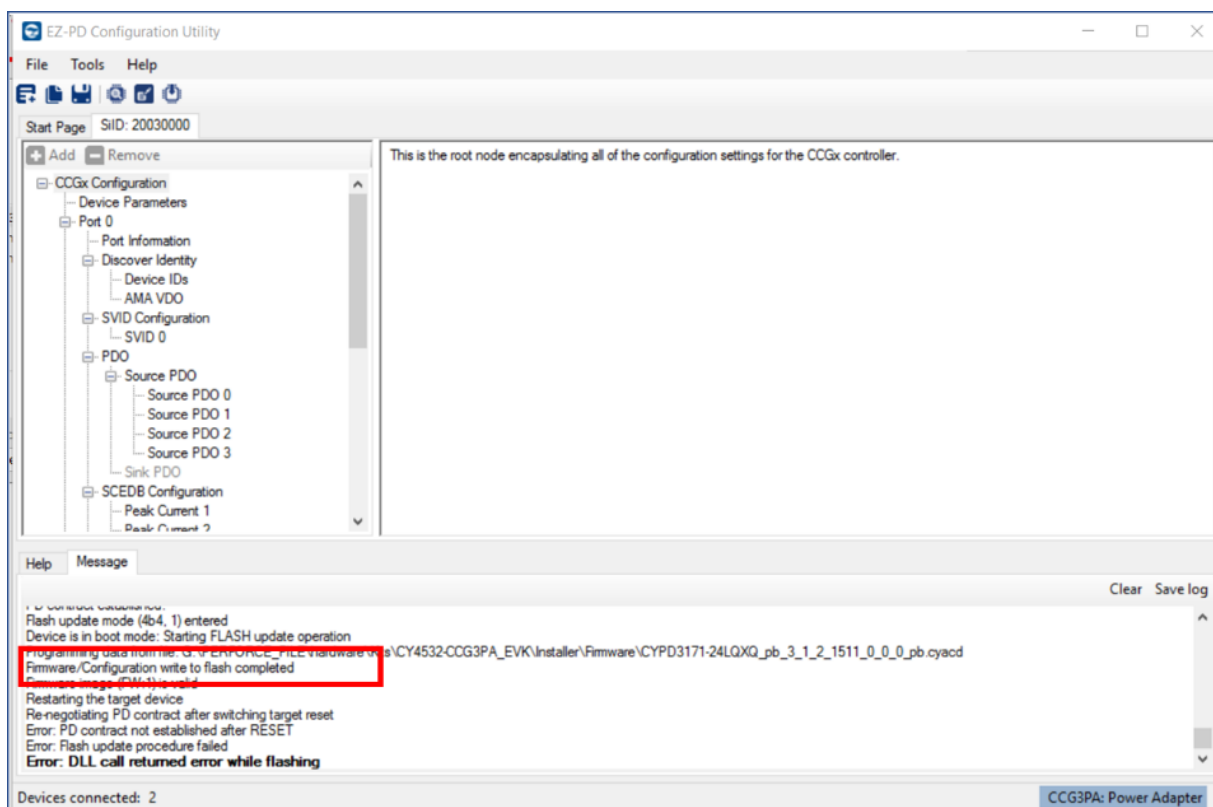
**Note:** If the firmware type being downloaded is different from the earlier firmware (for example, downloading a PB firmware on an EVK with PA firmware), the dialog box will display “Firmware/Configuration upgrade not completed. Refer Message window for details” as shown in [Figure 4-7](#) instead of “Flash updated successfully”. This error message comes up because the new firmware which was written to flash is unable to start since the jumper settings have not yet been changed to support the new firmware. This error message displayed on the dialog box can be ignored if “Firmware/Configuration write to flash completed” message is seen in the message window of the EZ-PD Configuration Utility GUI as shown in [Figure 4-8](#).

Figure 4-7. Downloading a Different Application Firmware Type: Pop-up Message



**Note:** This pop-up message may not appear if successful contract is made after switching the firmware.

Figure 4-8. Downloading a Different Application Firmware Type: Log Window



11. Configure the jumper settings as per the downloaded firmware requirements (PA/PB) and power cycle the CY4532 EVK to use the new firmware.

## 4.1.2 Common Problems and Troubleshooting

Table 4-2. Common Problems and Troubleshooting for Programming

| # | Issue                                                                                                                               | Possible Cause                                                                                                                                                                                                                                      | Possible Solution(s)                                                                                                                                                                                                                                                                  |
|---|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Unable to download firmware. <b>UFP-AMA</b> entry is not seen in the <b>Select target</b> window of the EZ-PD Configuration Utility | Jumpers J2, J3, and J4 on the CY4532 EVK Main Board may not have been set correctly as per the existing firmware loaded on the EVK.                                                                                                                 | Identify the existing application firmware (PA/PB) loaded on the CY4532 EVK using the procedure described in <a href="#">Appendix C - Identifying the Application Firmware Type</a> , set the jumpers J2, J3, and J4 as per the application firmware and download the firmware again. |
|   |                                                                                                                                     | Power may not have been supplied as per the existing firmware loaded on the EVK.                                                                                                                                                                    | Provide power using the correct supply (DC Power Adapter/Battery) and position the Power Selection Switch (SW1) as per the power supply used.                                                                                                                                         |
| 2 | A pop-up message "Firmware/configuration upgrade not completed. Refer message window for details" is displayed.                     | This is expected if the new firmware is of different application than the previous one, as the jumpers J2, J3, and J4 on the main board are set for previous application.<br>See <a href="#">Figure 4-7</a> and the explanation associated with it. | None                                                                                                                                                                                                                                                                                  |

## 5. Kit Operation



This chapter describes how to configure the CY4532 EZ-PD CCG3PA EVK to demonstrate the functionality as a USB Type-C Power Adapter (PA) and a USB Type-C Power Bank (PB). Two separate demonstrations are covered:

- Power Adapter (PA) Demo
- Power Bank (PB) Demo

**Important Note:** Before starting the demo make sure that the EVK is loaded with the intended firmware. Running a PA demo on an EVK loaded with PB firmware and vice versa can damage the EVK hardware including the CCG3PA silicon. [Appendix C - Identifying the Application Firmware Type](#) explains the procedure to identify the firmware type loaded on the kit.

Following is the list of USB Type-C and USB Type-A devices and power adapters which have been tested with the CY4532 EVK:

- USB Type-C devices
  - ☐ Apple MacBook Pro
  - ☐ LeEco Le Max 2 Phone
- USB Type-A devices
  - ☐ iPhone 6
  - ☐ iPad Air
  - ☐ Samsung Note 3
- USB Type-C Power Adapter
  - ☐ Apple 29W USB-C Power Adapter

It is recommended to use USB Type-A devices which are compliant with QC 3.0, Apple Charging 2.4A, Samsung AFC, and BC 1.2 charging protocols with the CY4532 EVK. Contact Cypress Technical Support through [www.cypress.com/support](http://www.cypress.com/support) for additional support.

In addition, this chapter explains the procedure to use the CY4532 Power Board as a Programmer for an external hardware with a Cypress EZ-PD CCGx Product supporting the CC bootloading feature.

### 5.1 Power Adapter (PA) Demo

The Power Adapter demo is a full end-to-end demo that demonstrates how to provide power through the USB Type-C and USB Type-A interfaces using an external supply.

The following items are needed to perform this demo:

- Items provided with the kit:
  - ☐ 12 V 50.4 W DC power adapter
  - ☐ CY4532 EZ-PD CCG3PA EVK boards (Power Board and Main Board)

- Items not provided with the kit:
  - ☐ Type-C device which can consume power over the USB Type-C (Example: A Laptop or Mobile Phone with USB Type-C port)
  - ☐ A device which can be charged by connecting to the USB Type-A interface (Example: A Mobile Phone which can be charged through the USB port)
  - ☐ USB cables to connect the devices to the Type-C and Type-A interfaces

### 5.1.1 Running the Power Adapter Demo

1. If the firmware has been changed from the default Power Adapter (PA) firmware, load the power adapter firmware first. See the [Programming the CCG3PA Controller on the CY4532 EVK](#) section for more details.
2. Set the jumpers on the CY4532 Main Board and Power Board as specified in [Table 5-1](#).

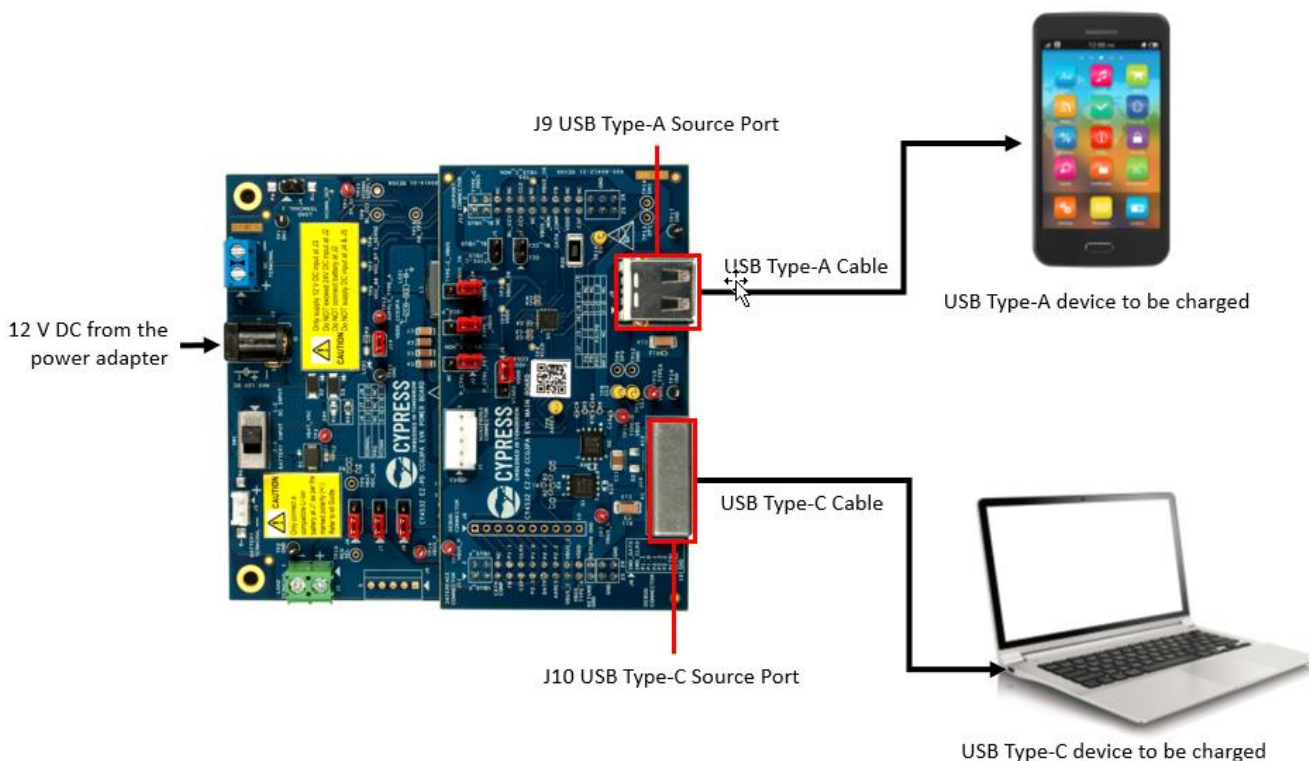
Table 5-1. CY4532 EVK Jumper Settings for the Power Adapter Demo

| Board Type  | Jumper Header | Status             |
|-------------|---------------|--------------------|
| Main Board  | J2            | Short pins 1 and 2 |
|             | J3            |                    |
|             | J4            |                    |
|             | J6            |                    |
|             | J5            | Open               |
|             | J7            |                    |
| Power Board | J6            | Short pins 1 and 2 |
|             | J7            |                    |
|             | J9            |                    |
|             | J14           |                    |

3. Set the Input Power Selection Switch (SW1) on the Power Board to the 'DC INPUT' position.
4. Connect the 12 V DC power adapter provided with the kit to the CY4532 Power Board's power jack J3. The Green LED (LED1) on the CY4532 EVK Power Board turns ON to indicate that the kit is powered.

**Note:** In Rev \*\* of the CY4532 EVK, the LED1 will blink for a second to indicate that the kit is powered.

Figure 5-1. Setup for Power Adapter Demo



5. Connect a USB Type-C device to the Type-C port (J10) located on the Main Board.

**Note:** The voltage provided by the CY4532 EVK to the device is determined based on the USB PD contract negotiated between the CY4532 EVK and the device. The PA firmware supports 5V, 9V and 12V output. This voltage can be monitored at the VBUS\_P test point (TP14) located on the Power Board.

6. Connect a USB Type-A device such as mobile phone on the Type-A receptacle (J9) to charge it.

**Note:** CY4532 supports simultaneous charging through the Type-C and Type-A ports. The voltage provided by the CY4532 kit to the device connected on the Type-A interface can be monitored at the SUPPLY\_TYPE\_A test point (TP12) on the Power Board.

7. Check the user feedback provided by the device (for example, battery charging status on the display of a mobile phone) connected to the USB Type-C and/or Type-A interfaces to determine the charging status. Disconnect the device from CY4532 once charging is completed to the desired level.

## 5.1.2 Common Problems and Troubleshooting

Table 5-2. Common Problems and Troubleshooting for PA Application

| # | Issue                                                                                                                           | Possible Cause                                                                                                                                                                                                                           | Possible Solution(s)                                                                                                                                                                       |
|---|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | The Type-C or Type-A device connected to the CY4532 is not getting charged.                                                     | Switch SW1 may not be at 'DC INPUT' position.                                                                                                                                                                                            | Set the Switch SW1 to 'DC INPUT' position.                                                                                                                                                 |
|   |                                                                                                                                 | CY4532 may not have been loaded with 'Power Adapter' firmware.                                                                                                                                                                           | Download 'Power Adapter' firmware using the details provided in <a href="#">Chapter 4. Programming the EZ-PD CCG3PA Controller</a> .                                                       |
| 2 | The device that is connected to the USB Type-A port gets charged intermittently.                                                | The device may implement a proprietary charging protocol instead of BC 1.2, QC, Apple Charging 2.4A, or Samsung AFC protocols.                                                                                                           | CY4532 EVK supports charging using BC 1.2, QC, Apple Charging 2.4A, and Samsung AFC protocols. Make sure that the device connected to CY4532 EVK is compliant with one of these protocols. |
| 3 | Unable to charge through the USB Type-C and USB Type-A ports simultaneously.                                                    | Note that the total power which can be provided to the devices is limited to 50.4 W with the DC adapter provided with the EVK.                                                                                                           | Use another DC adapter with higher power output. CY4532 EVK can support up to 12 V, 5 A DC input at J3.                                                                                    |
| 4 | Device connected to the USB Type-C port does not get charged or stops charging.                                                 | CY4532 EVK implements OCP for safety. This shuts down charging on the Type-C port if the current exceeds a certain limit. By default, this limit is set to 2 A.                                                                          | Check if the device connected to the USB Type-C port can be configured to set the current consumption limit to 2 A.                                                                        |
| 5 | Charging of the devices connected on the Type-C and Type-A ports goes through intermittent charging cycles before it stabilizes | CY4532 EVK supports multiple charging protocols (QC, Samsung AFC, BC 1.2, Apple Charging 2.4A). The communication between the EVK and the device being charged to align on the optimal voltage and current settings can happen in steps. | None                                                                                                                                                                                       |

## 5.2 Power Bank (PB) Demo

The Power Bank demo is a full end-to-end demo that demonstrates how to:

- Charge a 1-cell or 2-cell Lithium-ion battery connected to the CY4532 EVK
- Provide power through the USB Type-C and USB Type-A ports of the CY4532 from a 1-cell or 2-cell Lithium-ion battery

**Note:** Only use a Li-Ion battery with an appropriate protection circuit, and proper insulation between its terminals.

This is the recommended 2-cell battery: <http://www.batteryspace.com/custom-li-ion-18650-battery-7-2v-17-5ah-126wh-4a-rate-2x5s-s-inr18650-mj1.aspx>.

### 5.2.1 Required Boards, Cables, and Accessories

The following items are needed to perform this demo:

- Items provided with the kit:
  - ☐ CY4532 EZ-PD CCG3PA EVK boards (Power Board and Main Board)
- Items not provided with the kit:
  - ☐ A USB Type-C device that can consume power over Type-C (for example, a laptop or mobile phone with Type-C port)
  - ☐ A USB Type-C Power Adapter to charge the battery
  - ☐ A device which can be charged by connecting to USB Type-A interface (for example, a mobile phone which can be charged through the USB Type-A port)
  - ☐ 1-cell or 2-cell Lithium-ion battery
  - ☐ USB cables to connect the devices to the Type-C and Type-A interfaces

## 5.2.2 Running the Power Bank Demo

### 5.2.2.1 Charging the Battery Attached to CY4532 EVK

1. Program the latest Power Bank (PB) firmware into the kit. See the [Programming the CCG3PA Controller on the CY4532 EVK](#) section 4.1 for details.

**Note:** By default, the CY4532 EVK is configured to support a 2-cell battery. See [Appendix B - Configuring CY4532 EVK for 1-Cell or 2-Cell Li-Ion Battery Operation](#) to configure the EVK for 1-cell battery operation.

2. Remove the power supply connected on the DC Jack (J3).
3. Set the jumpers on the CY4532 Main Board and Power Board as specified [Table 5-3](#).

Table 5-3. CY4532 EVK Jumper Settings for the Power Bank Demo

| Board Type  | Jumper Header | Status             |
|-------------|---------------|--------------------|
| Main Board  | J2            | Short pins 2 and 3 |
|             | J3            |                    |
|             | J4            |                    |
|             | J6            | Short pins 1 and 2 |
|             | J5            | Open               |
|             | J7            |                    |
| Power Board | J6            | Short pins 1 and 2 |
|             | J7            |                    |
|             | J9            |                    |
|             | J14           |                    |

4. Connect a 2-cell Lithium-ion battery to the battery terminal (J1).

**Important Note:** Make sure that the battery terminals are connected to the CY4532 Power Board as per the positive (+) and negative (-) terminals marked on the Power Board. Alternatively, the battery terminals can be soldered on the B+ and B- pads, which are located around J1 as per the marked polarity.

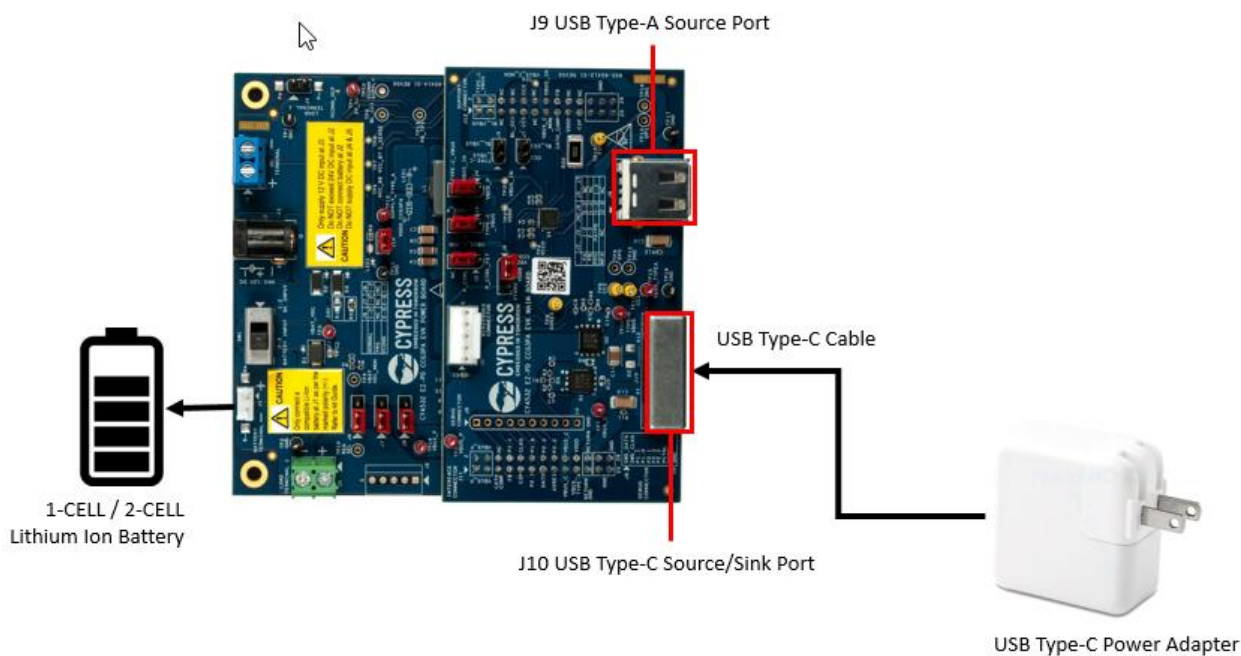
5. Set the Input Power Selection Switch (SW1) on the Power Board to the 'Battery Input' position. The Power LED (LED1) on the CY4532 EVK turns ON.

Note: In Rev \*\* of the CY4532 EVK, the LED1 will blink for a second to indicate that the kit is powered.

6. Connect a USB Type-C Power Adapter on the USB Type-C port (J10) of the CY4532 Main Board.

**Important Note:** The USB Type-C Power Adapter should not be connected to the USB Type-C port (J13) located on the CY4532 Power Board. This port (J13) is meant for using the CY4532 EVK Power Board as an external programmer with Cypress EZ-PD products that support bootloading using CC lines. See the [Common Problems and Troubleshooting](#) section for more details.

Figure 5-2. Setup for Charging a Battery Attached to CY4532 EVK



7. Verify that LED1 remains green, which indicates that the board is powered.

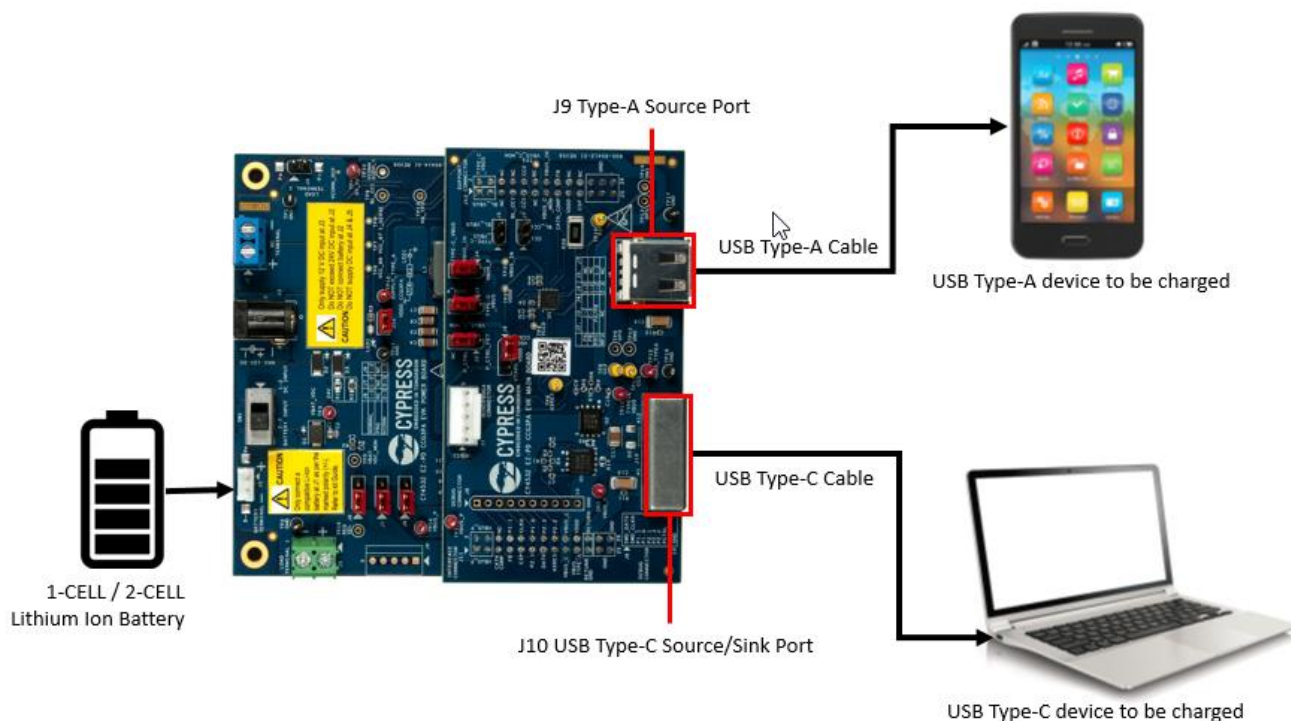
**Note:** While the battery is being charged using the USB Type-C Power Adapter, a USB Type-A device such as a mobile phone can be charged by connecting it to the USB Type-A port.

#### 5.2.2.2 Providing power on USB Type-C and USB Type-A ports

1. Disconnect the USB Type-C power adapter from the CY4532 EVK Main Board.
2. Connect a USB Type-C device that needs to be charged to the Type-C port (J10) located on the Main Board. The Power LED (LED1) on the CY4532 EVK Power Board remains ON to indicate supply of power on J10.

**Note:** In Rev \*\* of the CY4532 EVK, the LED1 will blink for a second to indicate that the kit is powered.

Figure 5-3. Setup for Providing Power on USB Type-C and USB Type-A Ports


**Note:**

- ❑ Make sure that a charged Lithium-ion battery is connected to the battery terminal (J1) and switch SW1 is at 'BATTERY INPUT' position before connecting the USB Type-C device for charging. If the battery is connected after the USB Type-C device is connected, the USB Type-C device can end up charging the Lithium-ion battery.
- ❑ The voltage provided by the CY4532 EVK to the device is determined based on the USB PD contract negotiated between the CY4532 EVK and the device. This voltage can be monitored at the VBUS\_P test point (TP14) located on the Power Board.
- ❑ A USB Type-A device also can be connected to the USB Type-C port (J10) for charging using a USB Type-C to Type-A converter.

3. Connect a USB Type-A device such as a mobile phone on the USB Type-A port to charge it.

**Note:** CY4532 supports simultaneous charging through the USB Type-C and USB Type-A ports. The voltage provided by the CY4532 EVK to the device connected on the Type-A port can be monitored at the SUPPLY\_TYPE\_A test point (TP12) on the Power Board.

4. Check the user feedback provided by the device connected to the USB Type-C and/or Type-A interfaces to determine the charging status. Disconnect the devices from the CY4532 EVK once charging is completed to the desired level.

**Note:** If CY4532 is no longer providing power through the USB Type-C and/or Type-A ports, the Lithium-ion battery connected to the EVK may require charging again. Repeat the steps specified in the [Charging the Battery Attached to CY4532 EVK](#) section to charge the battery.

## 5.2.3 Common Problems and Troubleshooting

Table 5-4. Common Problems and Troubleshooting for PB Application

| # | Issue                                                                                                                            | Possible Cause                                                                                                                                                                                                                                                                                                                                                                                       | Possible Solution(s)                                                                                                                                                                                                                                                                                                                                                                                                               |
|---|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | USB Type-C or Type-A device connected to CY4532 is not charging.                                                                 | Switch SW1 may not be in the 'BATTERY INPUT' position.<br>CY4532 may not have been loaded with 'Power Bank' firmware.                                                                                                                                                                                                                                                                                | Set the Switch SW1 at 'BATTERY INPUT' position.<br>Download 'Power Bank' firmware using the details provided in <a href="#">Chapter 4. Programming the EZ-PD CCG3PA Controller</a> .                                                                                                                                                                                                                                               |
| 2 | The Power LED (LED1) does not turn ON when SW1 is positioned at the 'BATTERY INPUT' position after connecting the battery.       | The battery may not have adequate charge to power the EVK.                                                                                                                                                                                                                                                                                                                                           | Charge the battery by connecting a USB Type-C Power Adapter on the Type-C port (J10) of the CY4532 Main Board.                                                                                                                                                                                                                                                                                                                     |
| 3 | The battery is not charging after connecting the USB Type-C Power Adapter.                                                       | Jumper settings on the Main Board and Power Board may not be set for Power Bank application.<br><br>The USB Type-C Power Adapter might have been connected to the USB Type-C port (J13) located on the CY4532 Power Board.<br><br>The battery type (1-Cell/ 2-Cell) configured on the CY4532 EVK hardware and firmware may not match with the type of battery (1-Cell/ 2-Cell) connected to the EVK. | Ensure that the jumpers on Main Board and Power Board are set for Power Bank application.<br><br>Ensure that the USB Type-C Power Adapter is connected to the USB Type-C port (J10) located on the CY4532 Main Board.<br><br>Configure the EVK hardware and firmware to match with the type of battery used.<br>See <a href="#">Appendix B - Configuring CY4532 EVK for 1-Cell or 2-Cell Li-Ion Battery Operation</a> for details. |
| 4 | The device connected to the USB Type-A port gets charged intermittently.                                                         | The device may implement a proprietary charging protocol instead of BC 1.2, QC, Apple Charging 2.4A or Samsung AFC protocols.                                                                                                                                                                                                                                                                        | CY4532 EVK supports charging using BC 1.2, QC, Apple Charging 2.4A, and Samsung AFC protocols. Make sure that the device connected to CY4532 EVK is compliant with one of these protocols.                                                                                                                                                                                                                                         |
| 5 | Unable to charge through the USB Type-C and USB Type-A ports simultaneously.                                                     | The output from the Li-Ion battery connected to the EVK may not be adequate to supply the required power to the devices connected to both the ports.                                                                                                                                                                                                                                                 | Use a battery with a higher output rating. CY4532 EVK can support 2-cell batteries with rating up to 8.4 V, 5 A.                                                                                                                                                                                                                                                                                                                   |
| 6 | Charging of the devices connected on the Type-C and Type-A ports goes through intermittent charging cycles before it stabilizes. | CY4532 EVK supports multiple charging protocols (QC, AFC, BC 1.2, Apple Charging 2.4A). The communication between the EVK and the device being charged to align on the optimal voltage and current settings can happen in steps.                                                                                                                                                                     | None                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 7 | Type device connected to the USB Type-C ports does not charge or stops charging.                                                 | The CY4532 EVK implements OCP for safety reason. This shuts down charging on Type-C port if the current exceeds a certain limit. By default, this limit is set to 2 A.                                                                                                                                                                                                                               | Check if the device connected to the USB Type-C port can be configured to set the current consumption limit to 2 A.                                                                                                                                                                                                                                                                                                                |

## 5.3 Using the CY4532 Power Board as a Programmer

This section explains how to use the CY4532 Power Board as a Programmer for external hardware with a Cypress EZ-PD CCGx Product supporting the CC bootloading feature. This feature is implemented using the CCG4 controller located on the CY4532 EVK Power Board.

### 5.3.1 Boards, Cables, and Accessories Needed

The following items are needed to use the CY4532 Power Board as a Programmer:

- Items provided with the kit:
  - ☐ CY4532 Power Board
  - ☐ 12 V 50.4 W DC power adapter
- Items not provided with the kit:
  - ☐ Hardware with Cypress EZ-PD CCGx product supporting CC bootloading feature
  - ☐ A USB Type-C Electronically Marked Cable Assembly (EMCA) cable
  - ☐ A USB Micro-B Cable
  - ☐ PC/Laptop installed with the Cypress EZ-PD Configuration Utility

**Note:** The CY4532 kit installer installs the EZ-PD Configuration Utility by default.

### 5.3.2 Using the CY4532 Power Board as a Programmer

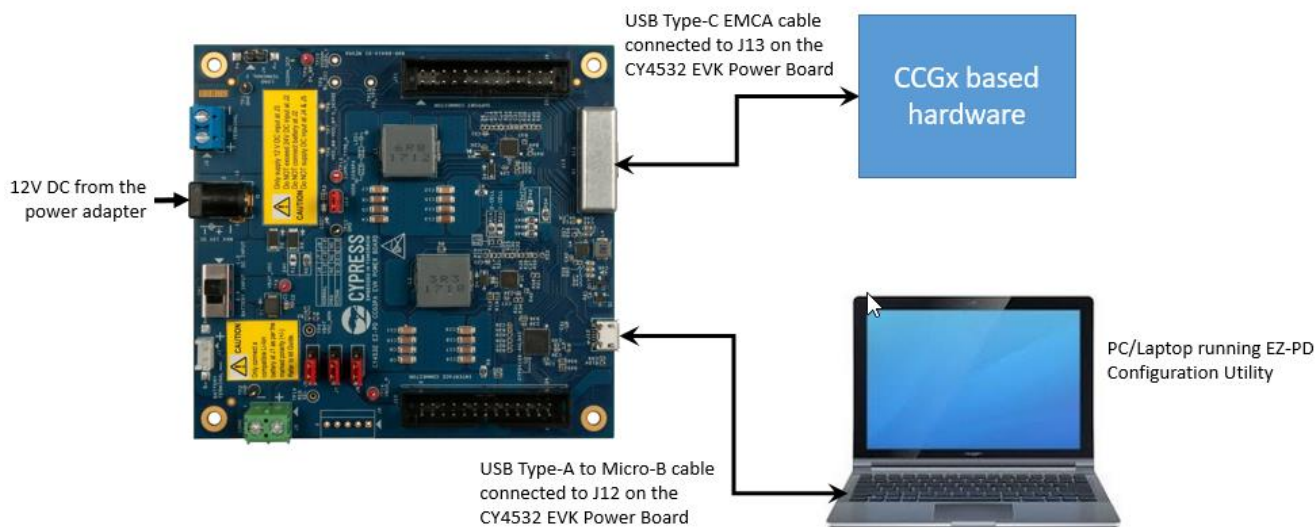
1. Remove the power supply connected on the DC Jack (J3) of the CY4532 Power Board.
2. Detach the CY4532 Main Board pre-mounted on top of the CY4532 Power Board.

**Note:**

- ☐ To remove the CY4532 Main Board, it is recommended to hold it around the longer edges of the board and lift it up.
  - ☐ No specific jumper setting is required on the CY4532 Power Board to use it as a Programmer.
3. Connect a USB Type-C EMCA cable between the USB Type-C port (J13) of the CY4532 Power Board and the USB Type-C port on the external hardware.
  4. Connect the USB Micro-B cable between the USB Micro-B port (J12) of CY4532 Power Board and a USB Type-A port of the PC/laptop.

**Note:** For the Rev \*\* of the CY4532 EVK, use USB Type-A to Mini-B cable.

Figure 5-4. Setup for using CY4532 Power Board as Programmer



5. Connect the 12 V DC power adapter provided with the kit to the CY4532 Power Board's DC Jack (J3).
6. Set the Switch (SW1) on the Power Board to the 'DC INPUT' position.
7. Invoke the EZ-PD Configuration Utility on the PC/laptop and follow the programming procedure described in the User Manual of the utility. You can also click **Help > User Manual** in the EZ-PD Configuration Utility to access this user manual.

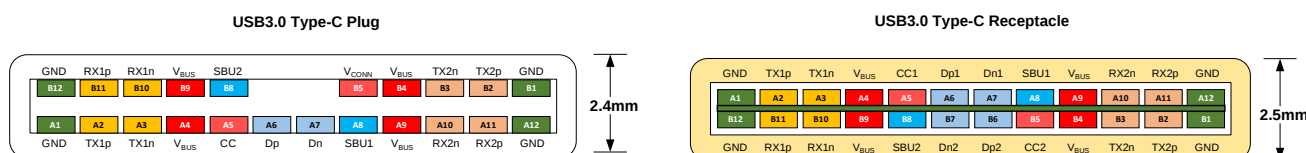
# A. Terminology



## Terminology

This guide assumes that the user of the CY4532 EZ-PD CCG3PA EVK is familiar with the fundamentals of the Type-C connectivity and the USB Power Delivery protocol. A brief description of Type-C terms is provided here for reference.

- **Alternate Modes:** A feature of a USB Type-C system whereby one or both SuperSpeed lanes may be repurposed for use with a different serial protocol, such as a DisplayPort, eSATA, or Thunderbolt.
- **Client:** A USB peripheral such as a hub, docking station, or monitor.
- **Configuration channel (CC):** A USB Type-C bus wire used to transmit protocol signals. This is a half-duplex 300 kHz signal.
- **Consumer:** A Type-C port that sinks power from VBUS.
- **DisplayPort:** A digital display interface standard developed by the Video Electronics Standards Association. It is used primarily to connect a video source to a display such as a computer monitor.
- **Downstream facing port (DFP):** A USB Type-C port on a host or a hub to which devices are connected.
- **Dp, Dn:** USB Type-C bus wires used to transmit and receive USB 2.0 data.
- **Dual-role port (DRP):** A USB Type-C port that can operate as either a DFP or a UFP.
- **Electronically Marked Cable Assembly (EMCA):** A USB cable that includes an IC that reports cable characteristics (such as current rating) to the Type-C ports.



- **Host:** A USB Host system such as a PC, notebook, and laptop.
- **Provider:** A Type-C port that sources power over VBUS.
- **Sideband use (SBU):** A USB Type-C bus wire used for non-USB control signals, such as DisplayPort control signals.
- **Type-C Transceiver:** A transmitter/receiver that communicates over the CC.
- **TX1p, TX1n, RX1p, RX1n, TX2p, TX2n, RX2p, and RX2n:** USB Type-C bus wires used to transmit and receive SuperSpeed USB and PCIe or DisplayPort data.
- **Upstream facing port (UFP):** A USB Type-C port on a device or a hub that connects to a host or the DFP of a hub.
- **USB Power Delivery (USB PD, PD):** A new USB standard that increases maximum power delivery over USB from 7.5 W to 100 W.
- **USB Type-C (Type-C):** A new standard with a slimmer USB connector and a reversible cable, capable of sourcing up to 100 W of power and supporting Alternate Modes.
- **VBUS:** A USB Type-C bus wire used for power; initially 5 V, but can be increased up to 20 V on USB PD systems.
- **VCONN:** A USB Type-C bus wire used to power the IC in the EMCA.

## B. Configuring CY4532 EVK for 1-Cell or 2-Cell Li-Ion Battery Operation



1-Cell Lithium-ion batteries support an operating voltage range of 2.7 V to 4.2 V while 2-Cell batteries support an operating voltage range of 5.4 V to 8.4 V. The CY4532 EVK hardware and firmware are configured, by default, to support 2-Cell battery operation. However, the CY4532 EVK can also be configured for 1-Cell battery operation.

**Note:** 1-Cell Lithium-ion batteries operate at low voltages and are typically used for low power applications.

The CY4532 kit operates at much higher efficiency with a 2-Cell Lithium ion battery. The 2-cell battery provides a longer duration of charging as compared to a 1-Cell battery. It is highly recommended to use 2-Cell Lithium ion batteries (default configuration) with the CY4532 kit. This is a reference for 1-Cell battery: <http://www.batteryspace.com/custom-li-ion-18650-battery-3-6v-2600mah-9-36wh-2a-rate-battery---un38-3-passed.aspx>.

The hardware and firmware configuration settings on the CY4532 kit must be updated for 1-Cell operation, as described in the sections [Hardware Update for 1-Cell Battery Operation](#) and [Firmware Update for 1-Cell Battery Operation](#).

### B1.1 Hardware Update for 1-Cell Battery Operation

1. Remove the power supply or the battery connected to the CY4532 EVK.
2. Detach the CY4532 Main Board from the CY4532 Power Board

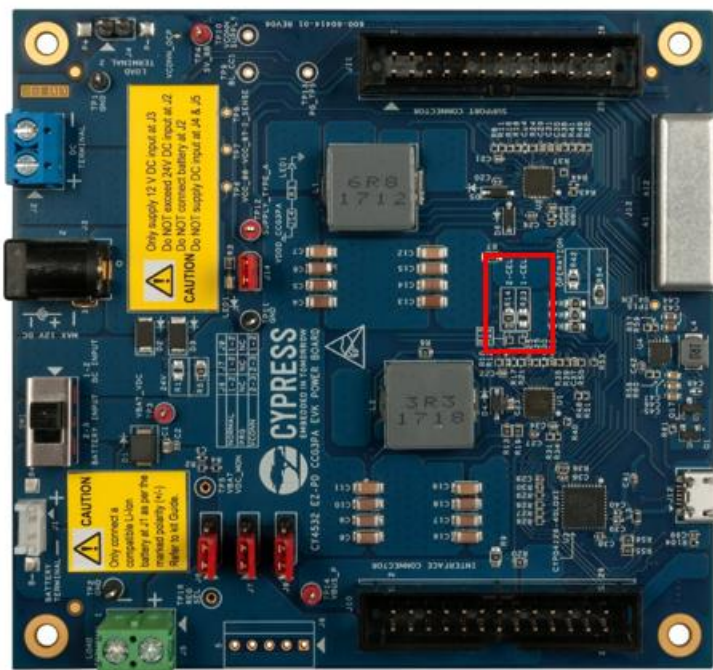
**Note:** To remove the CY4532 Main Board, it is recommended to hold it around the longer edges of the board and lift it up.

3. De-populate the 0  $\Omega$  resistor located at R14 and populate the same at R23.

**Note:** In case a new resistor is populated at R23, make sure that it meets the following specifications:

0.0  $\Omega$ , 0603 Package, 22.4 A Current Rating

Figure B-5. Hardware Configuration for 1-Cell and 2-Cell Battery Operation



4. Mount the CY4532 Main Board on the CY4532 Power Board.

The hardware is now ready for 1-cell battery operation.

**Note:** To switch from 1-cell battery configuration to 2-cell battery configuration (factory default state), de-populate the resistor from R23 and populate the same at R14.

## B1.2 Firmware Configuration Update for 1-Cell Battery Operation

Make sure to download the Power Bank application firmware using the procedure described in [Chapter 5. Kit Operation](#) before updating the firmware configuration for 1-cell battery.

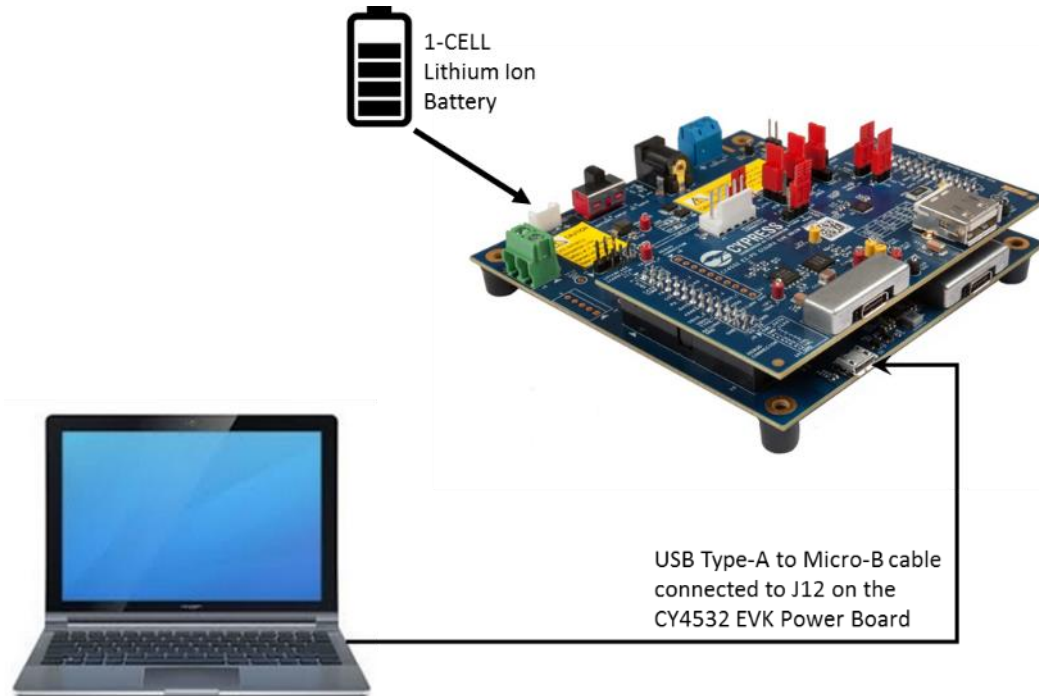
1. Set the jumpers on the CY4532 Main Board and Power Board as listed in [Table B-1](#):

Table B-1. CY4532 EVK Jumper Settings for the configuring the battery type

| Board Type  | Jumper Header | Status        |
|-------------|---------------|---------------|
| Main Board  | J2            | Short 2 and 3 |
|             | J3            |               |
|             | J4            |               |
|             | J6            | Short 1 and 2 |
|             | J5            |               |
|             | J7            |               |
| Power Board | J6            | Open          |
|             | J7            |               |
|             | J9            |               |

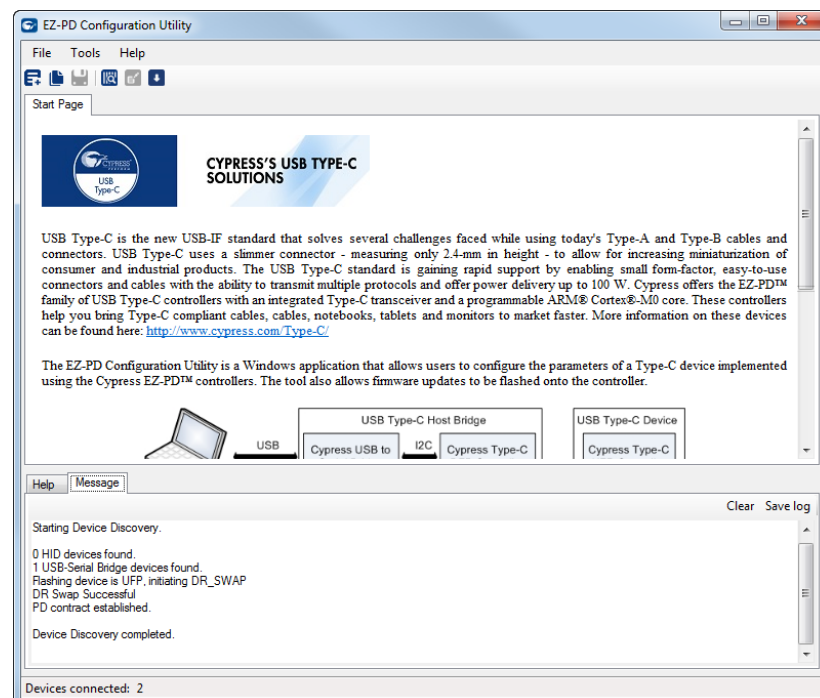
2. Power the CY4532 EVK using a 1-Cell battery to the battery terminal (J1).
3. Connect the USB Type-A to Mini-B cable from the host PC to the J12 connector on the Power Board as shown in [Figure B-2](#).

Figure B-2. Set-up for Configuring Firmware Settings for 1-Cell on CY4532 EVK



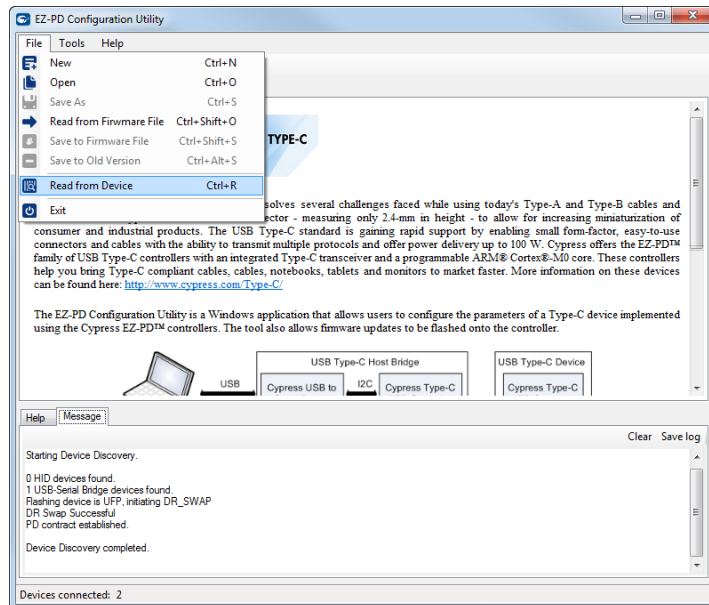
4. Launch the EZ-PD Configuration Utility as shown in Figure B-3. The EZ-PD Configuration Utility can be opened from: **Windows > Start > All Programs > Cypress > EZ-PD Configuration Utility > EZ-PD Configuration Utility**.

Figure B-3. EZ-PD Configuration Utility



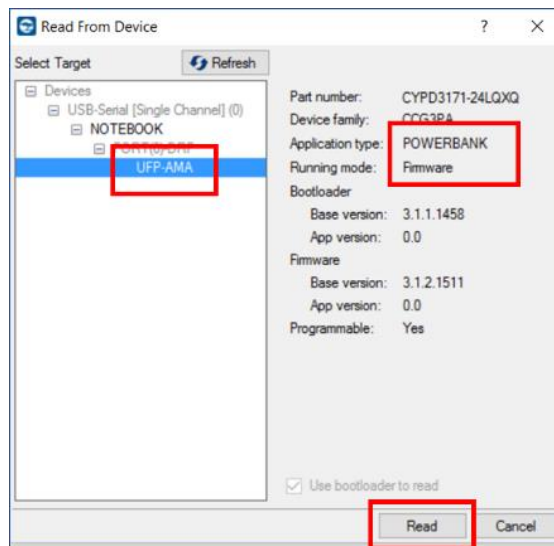
5. Select **File > Read from Device** as shown in Figure B-4. See the [EZ-PD Configuration Utility User Manual](#) for more details. You can also click **Help > User Manual** in the EZ-PD Configuration Utility to access this user manual.

Figure B-4. Invoking Read from Device Menu Item



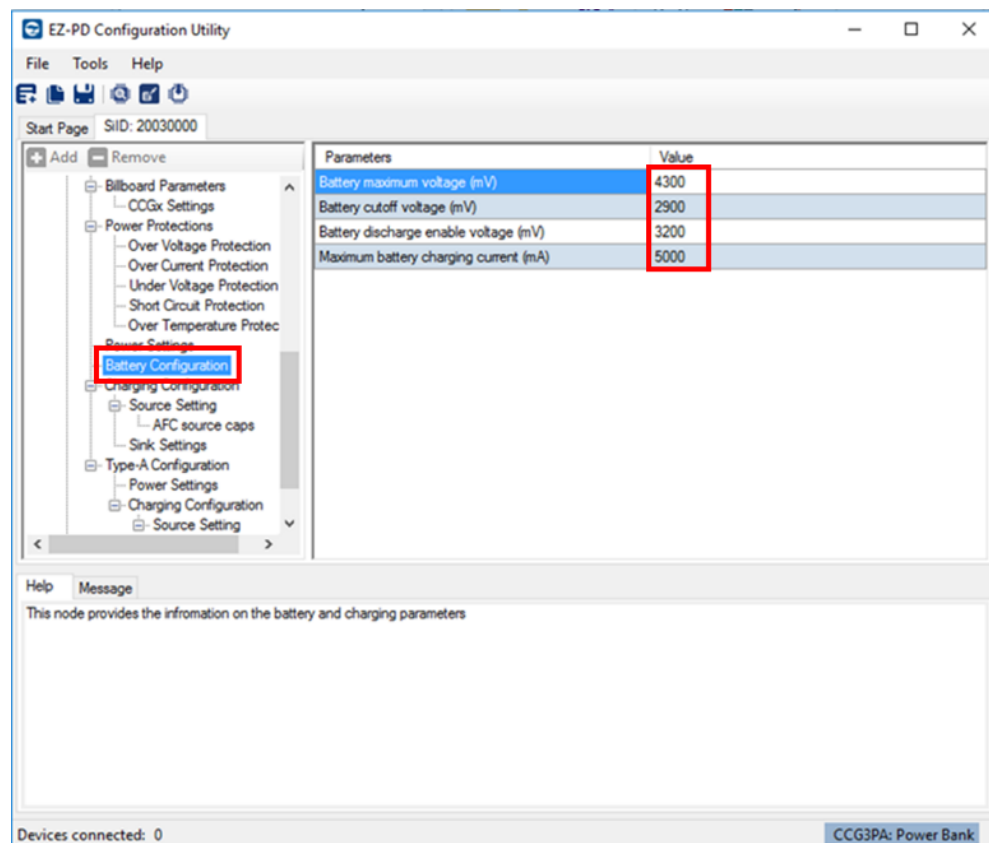
6. Select **UFP-AMA** from the Read from Device dialog box and click **Read** as shown in Figure B-5.

Figure B-5. Reading the Current Firmware Settings



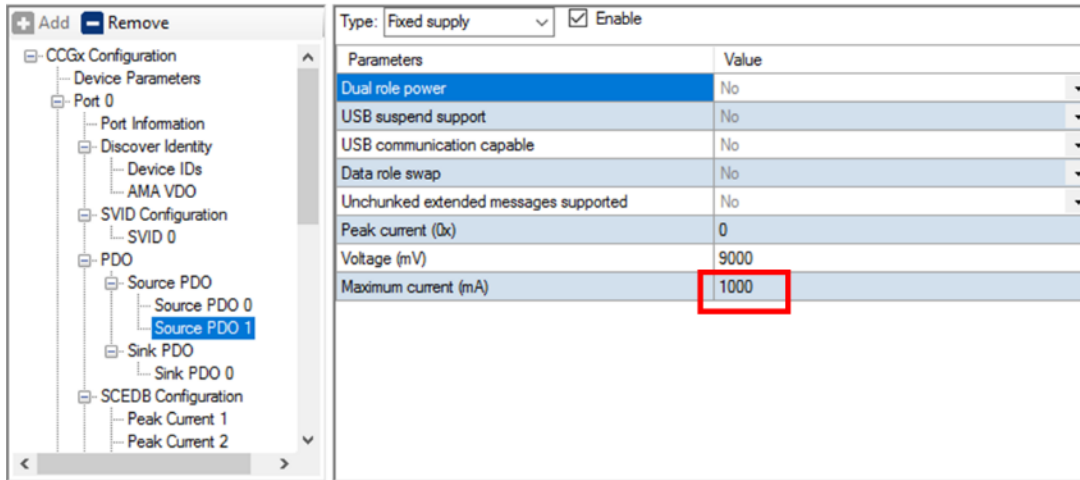
7. Select **Battery Configuration** from the firmware configuration settings and change the value for **Battery maximum voltage (mV)** to match the voltage rating of the 1-Cell battery being used as shown in Figure B-6. The typical voltage rating of 1-Cell battery is 4200 mV.

Figure B-6. Updating Battery Configuration



8. The 1-cell operates at a lower efficiency and the application might require limiting a Source PDO Maximum Current to 1 A. To change the Source PDO on the Type-C port follow the settings as shown in [Figure B-7](#).

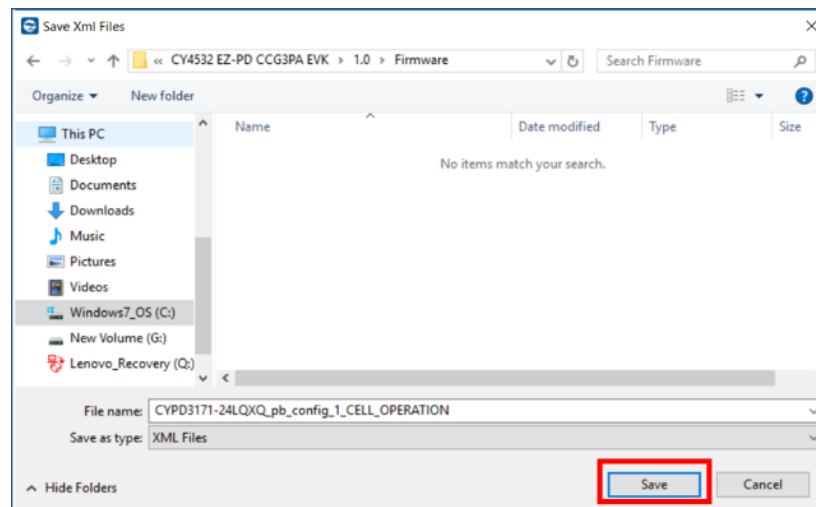
Figure B-7. Updating Source PDO



**Note:** Other Source PDOs can be modified similarly as per the requirement of the Sink and Battery capabilities.

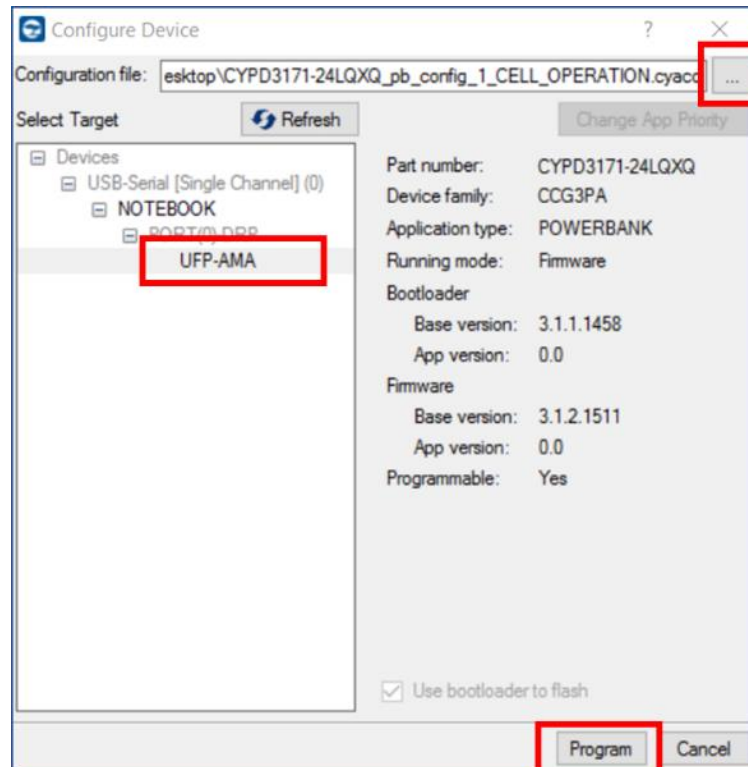
9. Select **File > Save As** and specify a path to store the updated firmware settings in a .xml file as shown in [Figure B-8](#).

Figure B-8. Saving Updated Firmware Settings



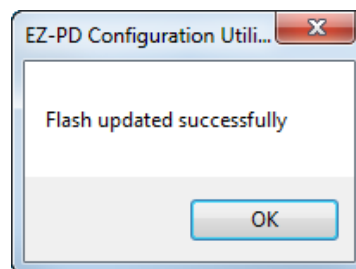
10. Select **Tools > Configure Device**. Specify the path to the firmware settings file (.xml), select **UFP-AMA** as the target and click **Program** in the Configure Device dialog box as shown in [Figure B-9](#).

Figure B-9. Downloading the Firmware Settings



11. Upon successful completion of the firmware settings update process, a window with the message “Flash updated successfully” is displayed as shown in [Figure B-10](#). Click **OK**.

Figure B-10. Configuration of Firmware Settings Update Process



12. Power off the CY4532 EVK by removing the battery.
13. Set the jumpers on the CY4532 Main Board and Power Board as listed in [Table B-2](#).

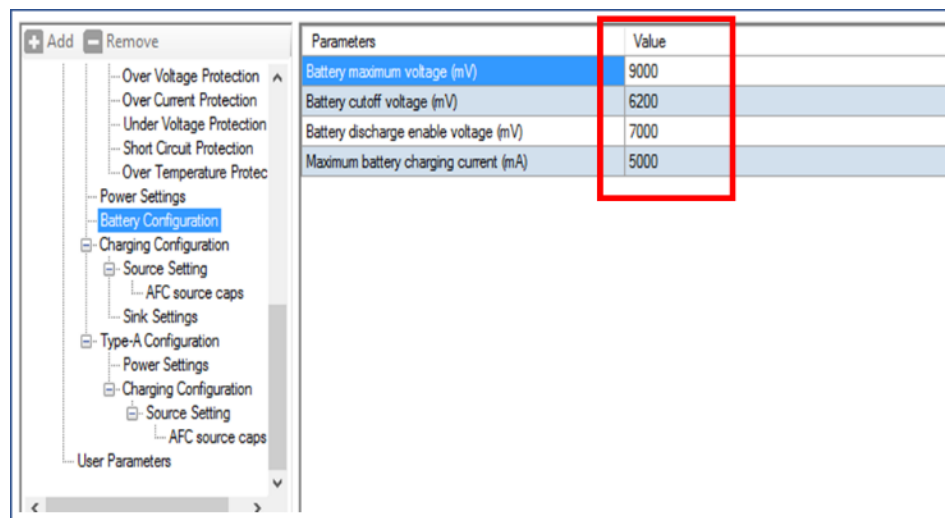
Table B-2. CY4532 EVK Jumper Settings for the Power Bank application

| Board Type  | Jumper Header | Status             |
|-------------|---------------|--------------------|
| Main Board  | J2            | Short pins 2 and 3 |
|             | J3            |                    |
|             | J4            |                    |
|             | J6            | Short pins 1 and 2 |
|             | J5            | Open               |
|             | J7            |                    |
| Power Board | J6            | Short pins 1 and 2 |
|             | J7            |                    |
|             | J9            |                    |
|             | J14           |                    |

14. Connect a 1-Cell battery to the EVK and start the usage.

**Note:** To switch from 1-cell battery configuration to 2-cell battery configuration (factory default state), repeat steps 1 to 9 and use configuration settings shown in Figure B-11. Also, use a 2-cell battery to power the EVK instead of 1-cell battery.

Figure B-11. Default 2-Cell Configuration Settings



# C. Identifying the Application Firmware Type



Follow these instructions to identify the application firmware type (PA/PB) loaded on the CY4532 EVK:

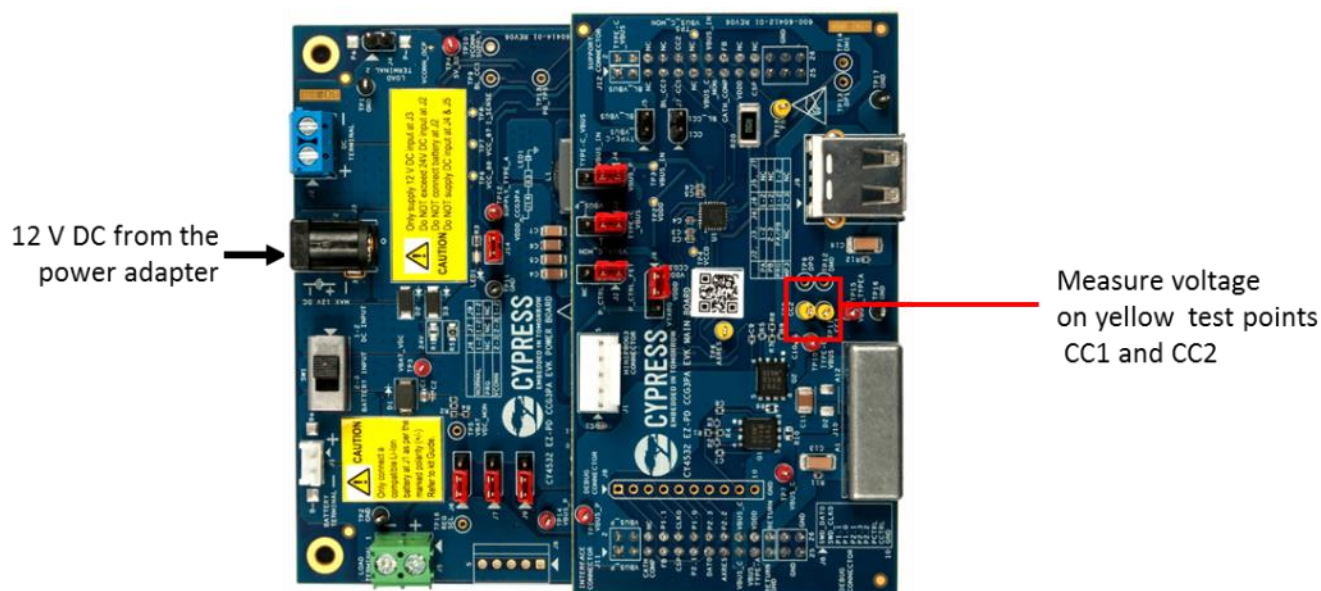
1. Connect the power adapter to the DC Jack (J3) of the CY4532 EVK Power Board.
2. Set the Input Power Selection Switch (SW1) on the Power Board to the 'DC input' position.
3. Now use a Multi-meter and measure the voltages on the yellow test-points TP11 (CC1 test-point) and TP8 (CC2 test-point).

Follow [Table C-1](#) to identify the application firmware type.

Table C-1. Voltage at CC lines for PA and PB applications

| Conditions                                        | Application Firmware Type                  |
|---------------------------------------------------|--------------------------------------------|
| Case 1: Voltage on both TP11 and TP8 $\geq 2.8$ V | Power Adapter FW (PA)                      |
| Case 2: Voltage on both TP11 and TP8 $\leq 2.0$ V | Power Bank FW (PB)                         |
| Case 3: None of above Case 1 or Case 2            | Reprogram the board with PA or PB firmware |

Figure C-1. Setup to Identify the Application Firmware Type



## D. CY4532 EVK Schematics, BoM, and Layout

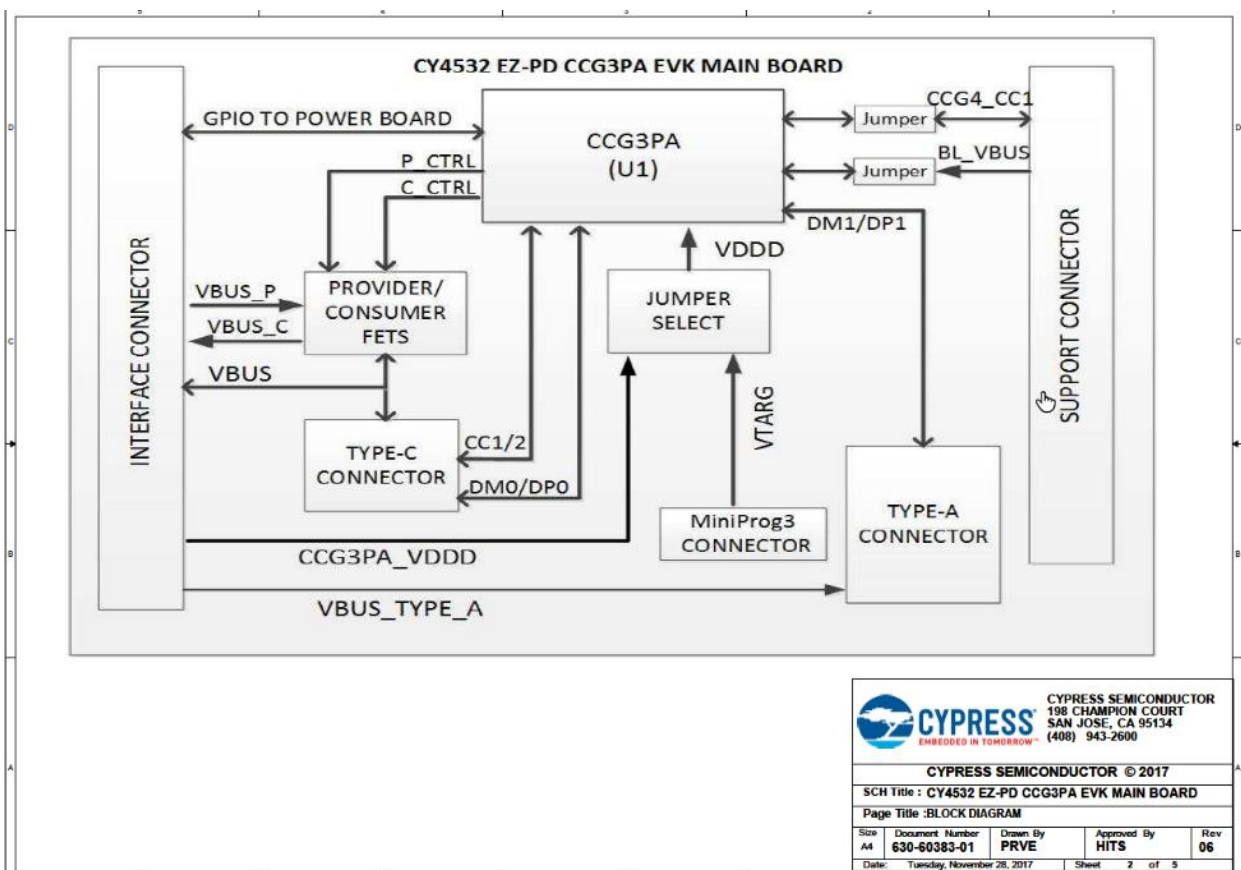


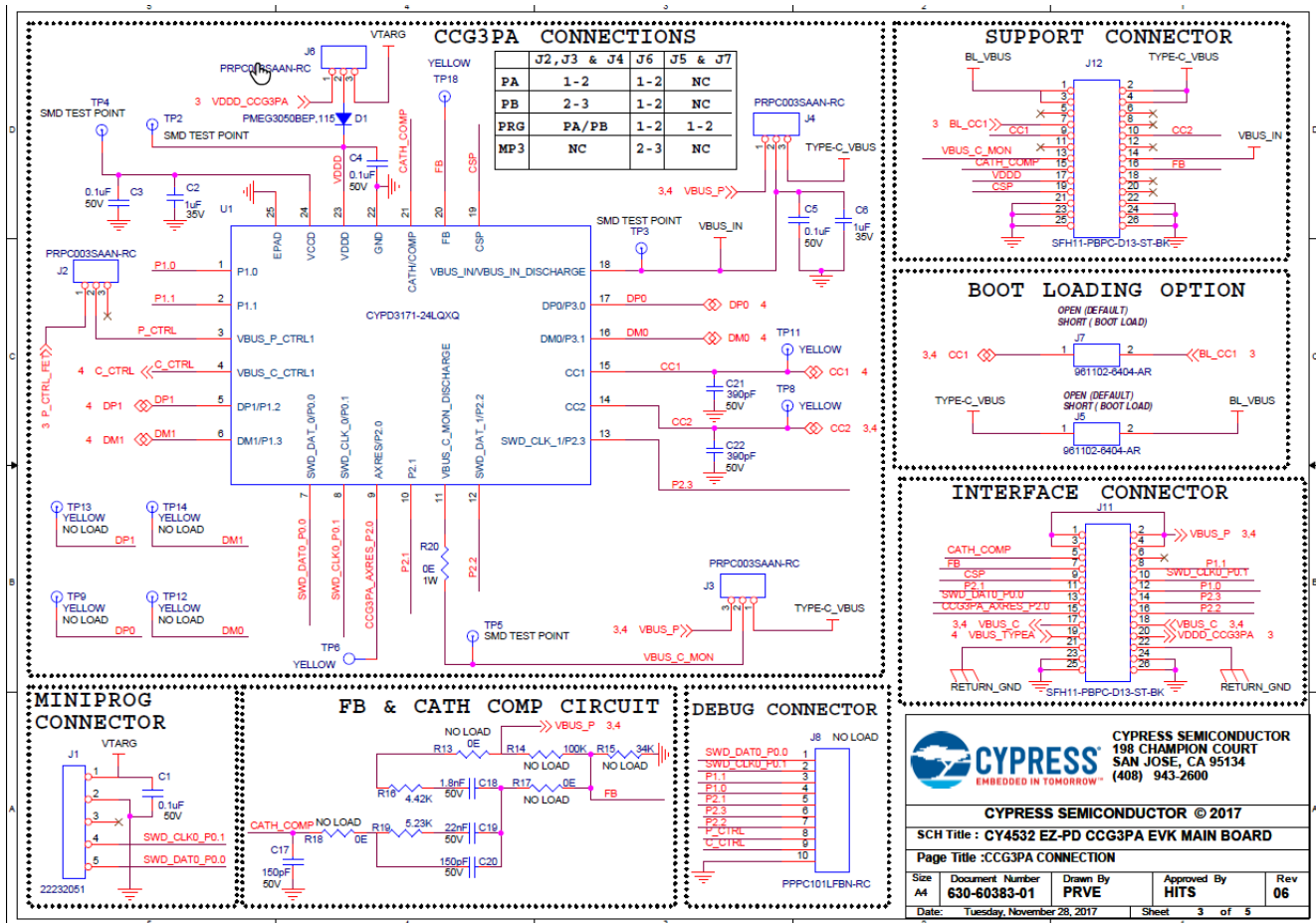
The CY4532 hardware design files are available in <Install Directory>\CY4532 EZ-PD CCG3PA EVK\1.0\Hardware\.

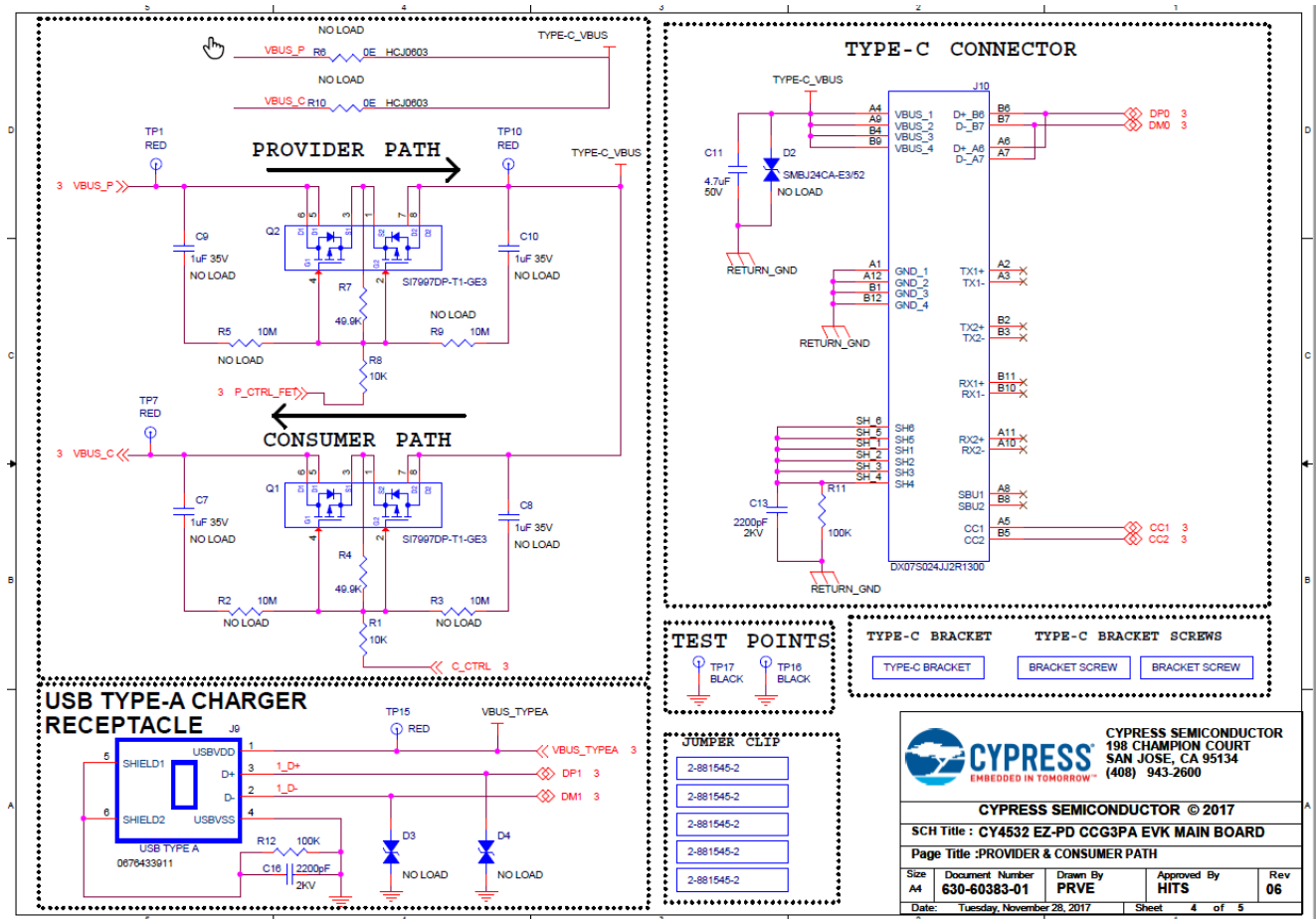
**Note:** On the Windows 32-bit platform, the default <Install Directory> is C:\Program Files\Cypress; on the Windows 64-bit platform, it is C:\Program Files(x86)\Cypress.

### D1.1 CY4532 EVK Main Board Schematics, BoM, and Layout

#### CY4532 EVK Main Board Schematics





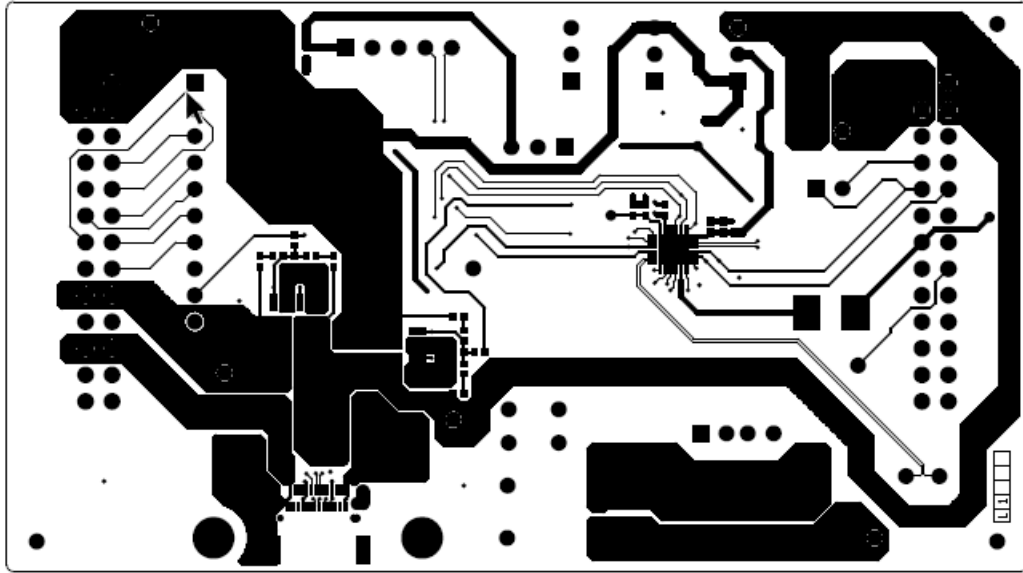


CY4532 EVK Main Board BoM

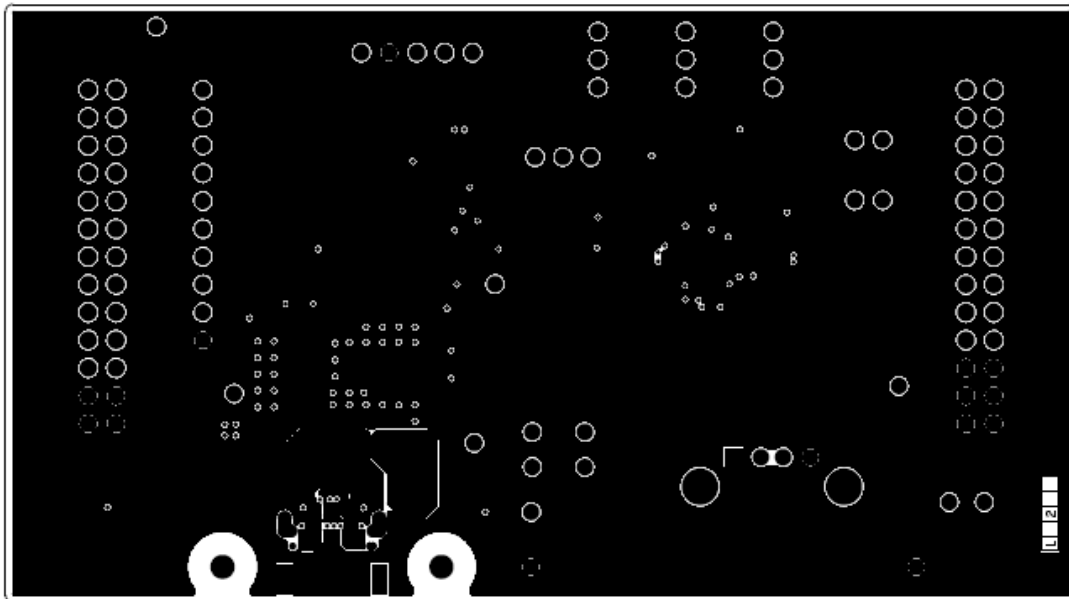
| #  | Qty | Reference      | Value            | Description                     | Manufacturer                            | Mfr Part #           |
|----|-----|----------------|------------------|---------------------------------|-----------------------------------------|----------------------|
| 1  | 4   | C1, C3, C4, C5 | 0.1 uF           | CAP CER 0.1UF 50V X7R 0402      | TDK Corporation                         | CGA2B3X7R1H104K050BB |
| 2  | 2   | C2, C6         | 1 uF             | CAP CER 1UF 35V X5R 0402        | Samsung Electro-Mechanics America, Inc. | CL05A105KL5NRNC      |
| 3  | 1   | C11            | 4.7 uF           | CAP CER 4.7UF 50V X7R 1210      | Samsung Electro-Mechanics America, Inc. | CL32B475KBUNNE       |
| 4  | 2   | C13, C16       | 2200 pF          | CAP CER 2200PF 2KV 10% X7R 1808 | Johanson Dielectrics Inc                | 202R29W222KV4E       |
| 5  | 2   | C17, C20       | 150 pF           | CAP CER 150PF 50V C0G/NP0 0402  | Murata Electronics North America        | GRM1555C1H151JA01D   |
| 6  | 1   | C18            | 1.8 nF           | CAP CER 1800PF 50V X7R 0402     | Murata Electronics North America        | GRM155R71H182KA01D   |
| 7  | 1   | C19            | 22 nF            | CAP CER 0.022UF 50V X7R 0402    | Murata Electronics North America        | GRM155R71H223KA12J   |
| 8  | 2   | C21, C22       | 390 pF           | CAP CER 390PF 50V C0G/NP0 0402  | Murata Electronics North America        | GRM1555C1H391JA01J   |
| 9  | 1   | D1             | PMEG3050BEP, 115 | DIODE SCHOTTKY 30V 5A SOD128    | Nexperia USA Inc.                       | PMEG3050BEP,115      |
| 10 | 1   | J1             | 22232051         | CONN HEADER 5POS .100 VERT TIN  | Molex, LLC                              | 22232051             |
| 11 | 4   | J2, J3, J4, J6 | PRPC003 SAAN-RC  | CONN HEADER .100" SNGL STR 3POS | Sullins Connector Solutions             | PRPC003SAAN-RC       |

| #  | Qty | Reference            | Value                | Description                       | Manufacturer                | Mfr Part #           |
|----|-----|----------------------|----------------------|-----------------------------------|-----------------------------|----------------------|
| 12 | 2   | J5, J7               | 961102-6404-AR       | CONN HEADER VERT SGL 2POS GOLD    | 3M                          | 961102-6404-AR       |
| 13 | 1   | J9                   | USB TYPE A           | CONN RCPT USB R/A TYPE A 4POS     | Molex, LLC                  | 0676433911           |
| 14 | 1   | J10                  | DX07S024 JJ2R1300    | CONN RCPT USB3.1 TYPE C SMD R/A   | JAE Electronics             | DX07S024JJ2R1300     |
| 15 | 2   | J11, J12             | SFH11-PBPC-D13-ST-BK | CONN HEADR FEMALE 26POS .1" DL AU | Sullins Connector Solutions | SFH11-PBPC-D13-ST-BK |
| 16 | 2   | Q1, Q2               | SI7997DP-T1-GE3      | MOSFET 2P-CH 30V 60A PPAK SO-8    | Vishay Siliconix            | SI7997DP-T1-GE3      |
| 17 | 2   | R1, R8               | 10K                  | RES SMD 10K OHM 1% 1/16W 0402     | Yageo                       | RC0402FR-0710KL      |
| 18 | 2   | R4, R7               | 49.9K                | RES SMD 49.9K OHM 1% 1/5W 0402    | Vishay Dale                 | RCS040249K9FKED      |
| 19 | 2   | R11, R12             | 100K                 | RES SMD 100K OHM 1% 1/16W 0402    | Yageo                       | RC0402FR-07100KL     |
| 20 | 1   | R16                  | 4.42K                | RES SMD 4.42K OHM 1% 1/10W 0603   | Yageo                       | RC0603FR-074K42L     |
| 21 | 1   | R19                  | 5.23K                | RES SMD 5.23K OHM 1% 1/10W 0603   | Yageo                       | RC0603FR-075K23L     |
| 22 | 1   | R20                  | 0E                   | RES SMD 0.0 OHM JUMPER 1W 2512    | Stackpole Electronics Inc.  | RMCF2512ZT0R00       |
| 23 | 4   | TP1, TP7, TP10, TP15 | RED                  | TEST POINT PC MINI .040"D RED     | Keystone Electronics        | 5000                 |
| 24 | 4   | TP6, TP8, TP11, TP18 | YELLOW               | TEST POINT PC MINI .040"D YELLOW  | Keystone Electronics        | 5004                 |
| 25 | 2   | TP16, TP17           | BLACK                | TEST POINT PC MINI .040"D BLACK   | Keystone Electronics        | 5001                 |
| 26 | 1   | U1                   | CYPD317 1-24LQXQ     | USB TYPE-C PORT CONTROLLER        | Cypress Semiconductor       | CYPD3171-24LQXQ      |

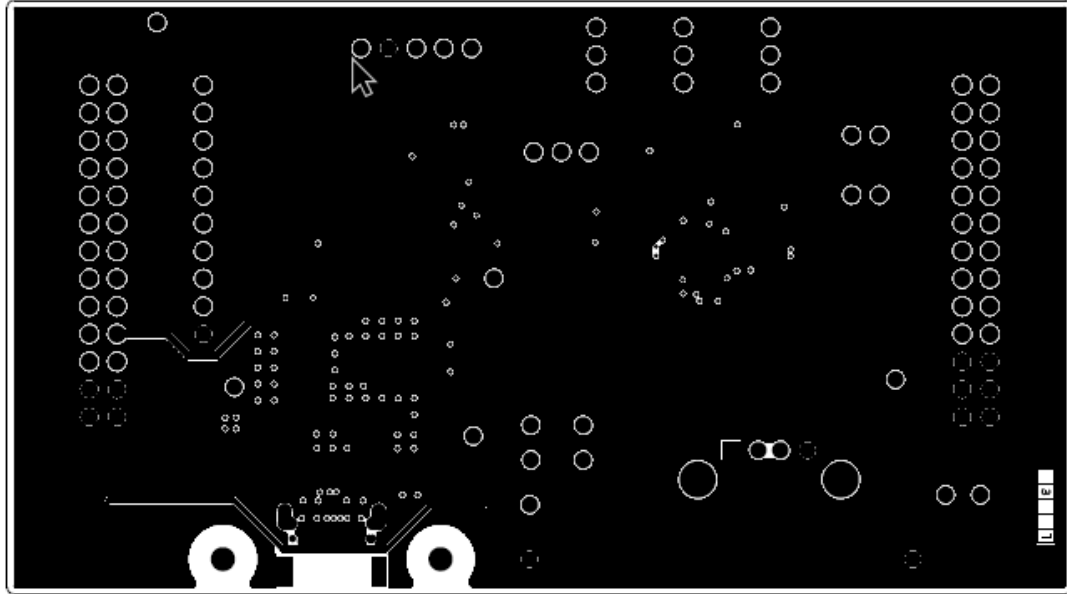
CY4532 EVK Main Board Layout



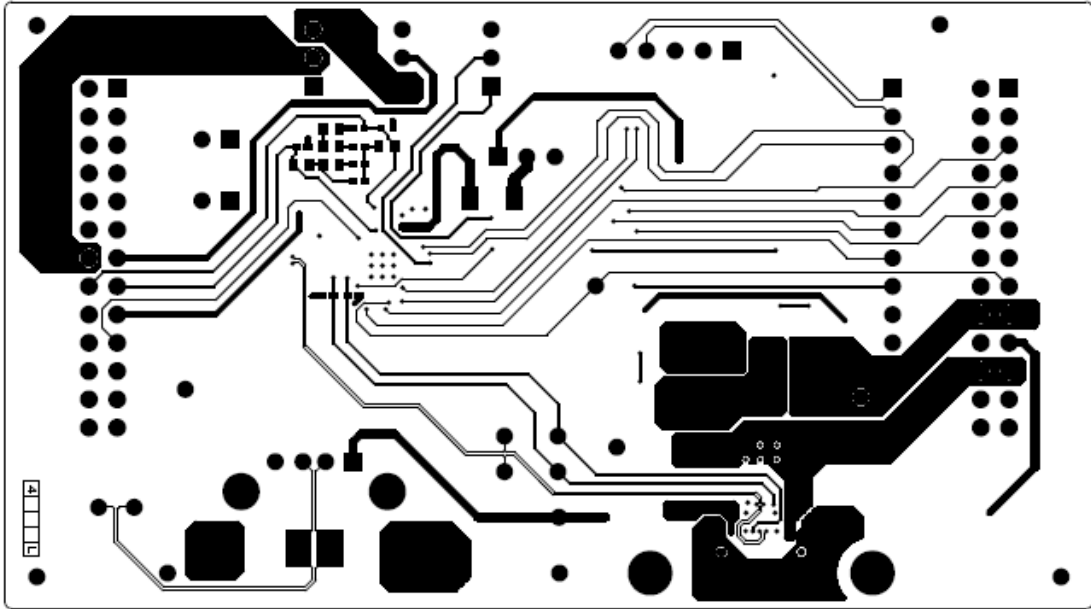
600-60412-01 REV06 PRIMARY SIDE



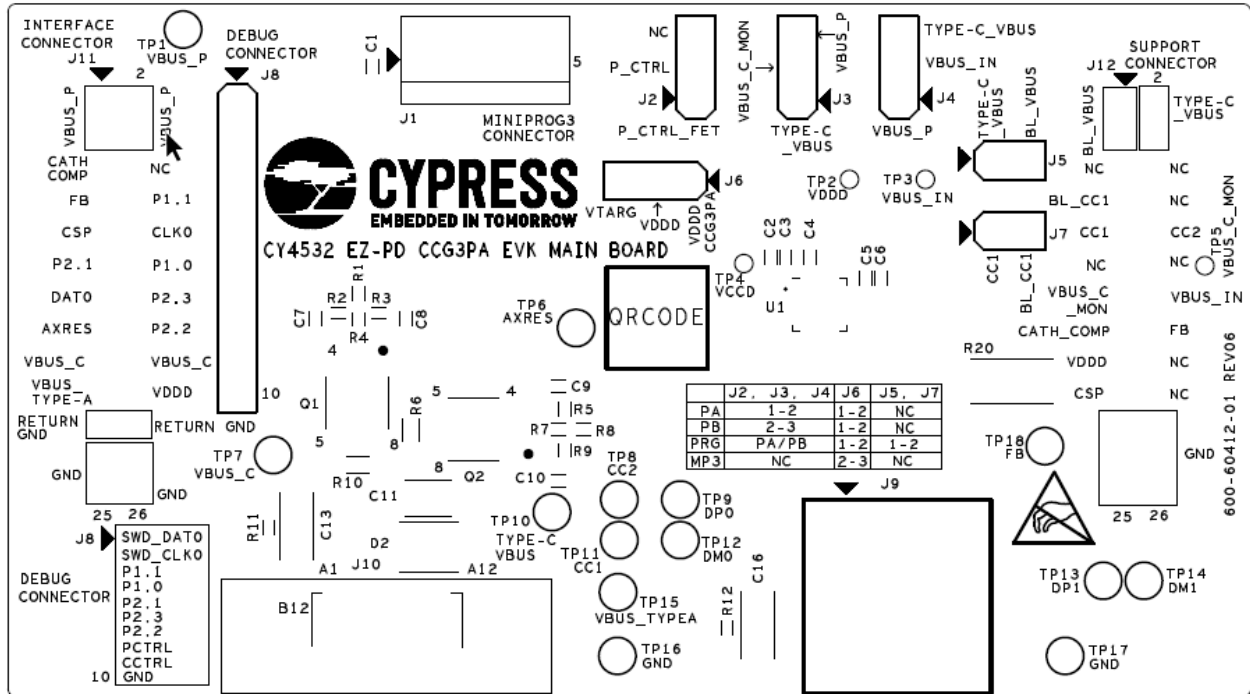
600-60412-01 REV06 GROUND1 LAYER



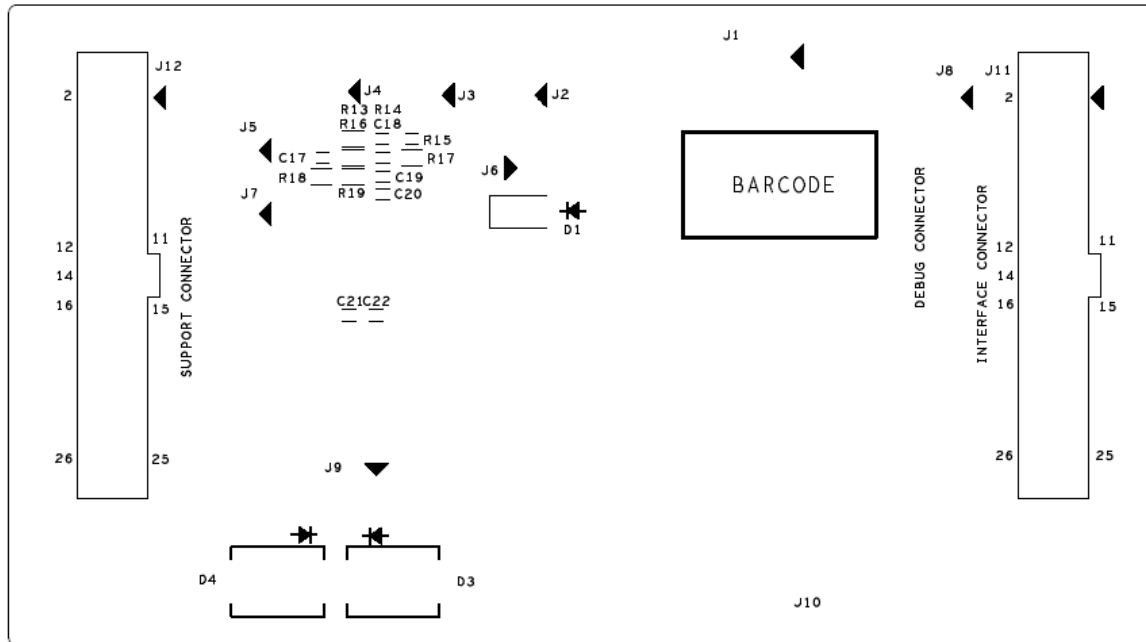
600-60412-01 REV06 GROUND2 LAYER



600-60412-01 REV06 SECONDARY SIDE



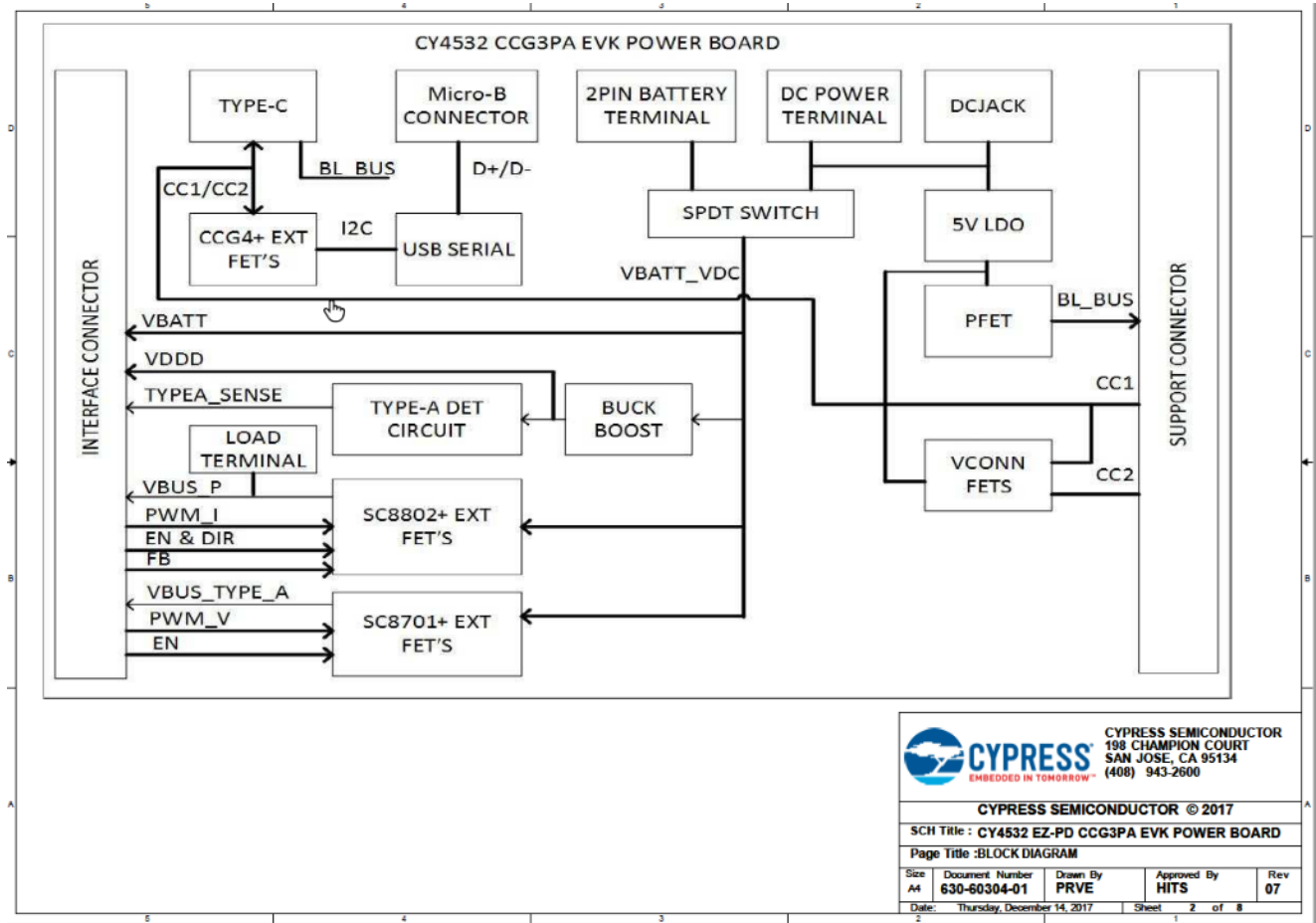
600-60412-01 REV06 PRIMARY SILKSCREEN

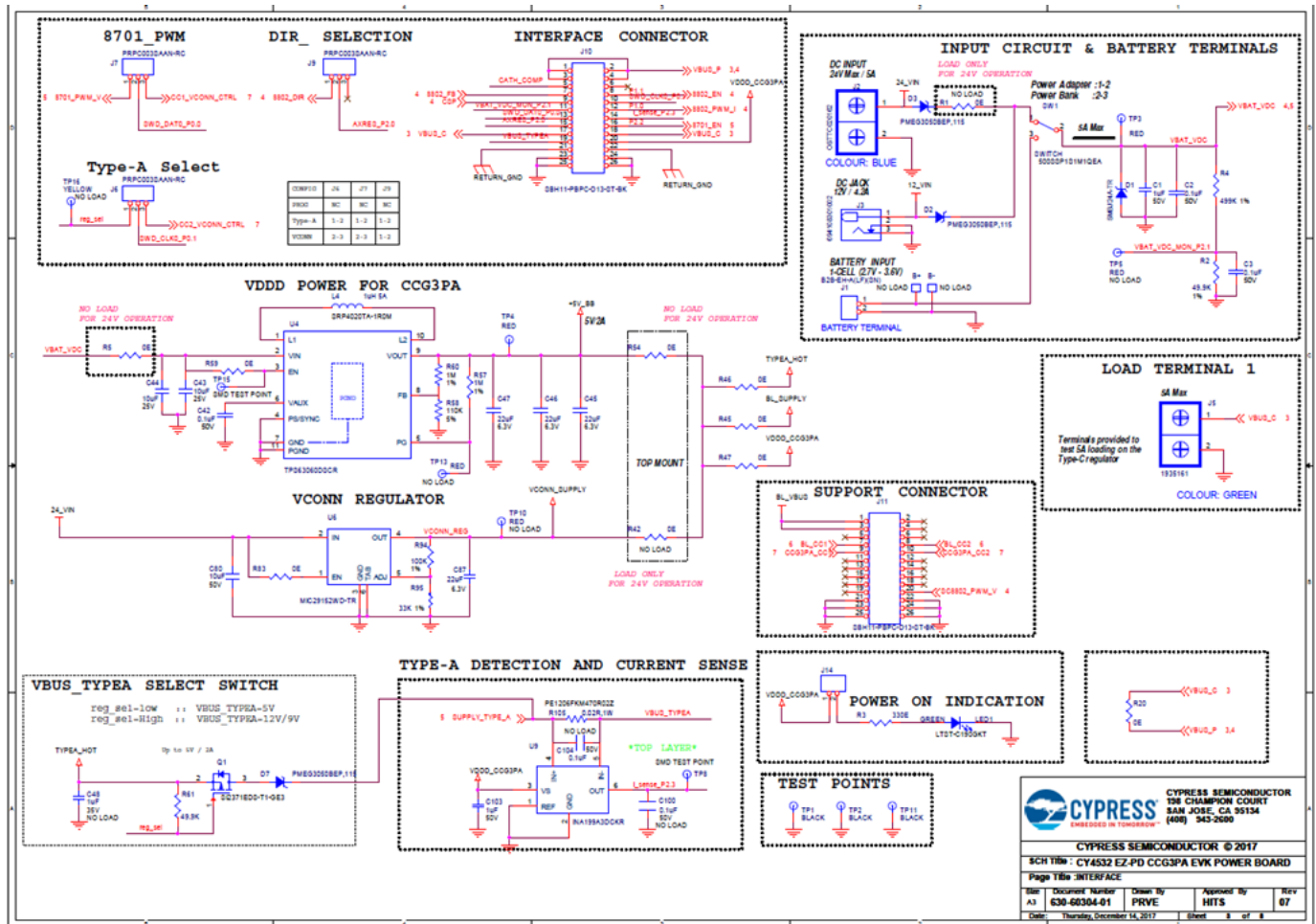


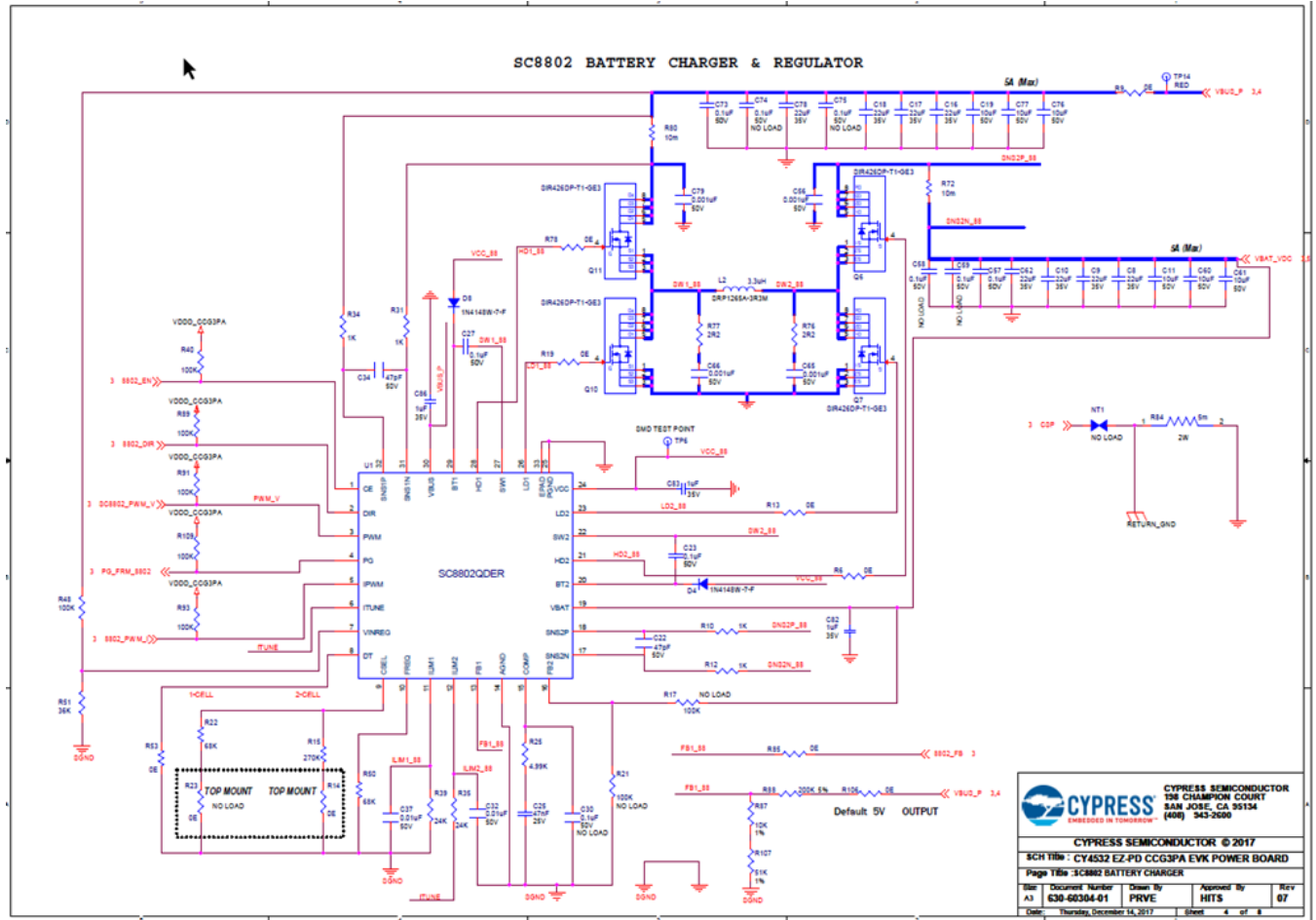
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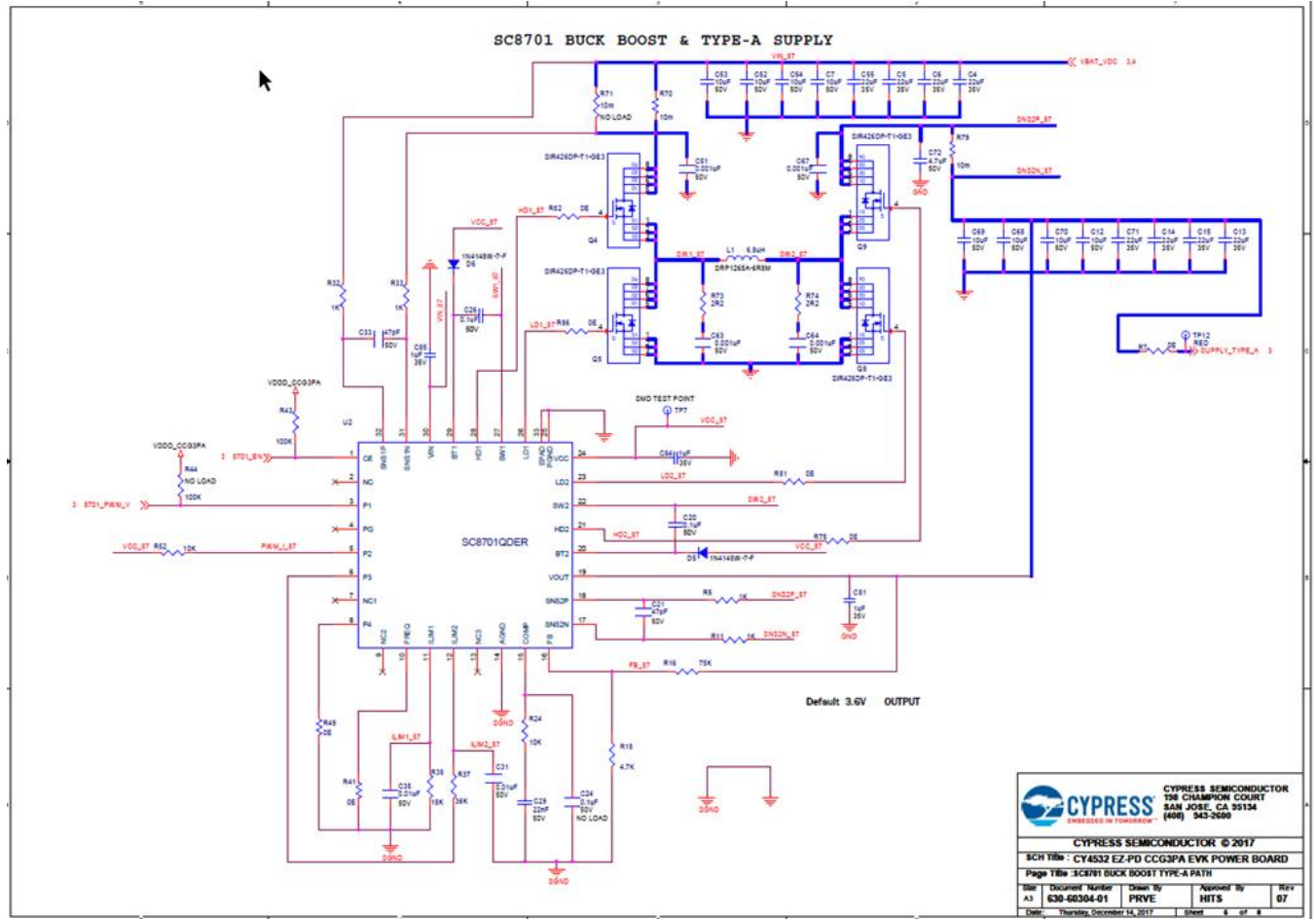
## D1.2 CY4532 EVK Power Board Schematics, BoM, and Layout

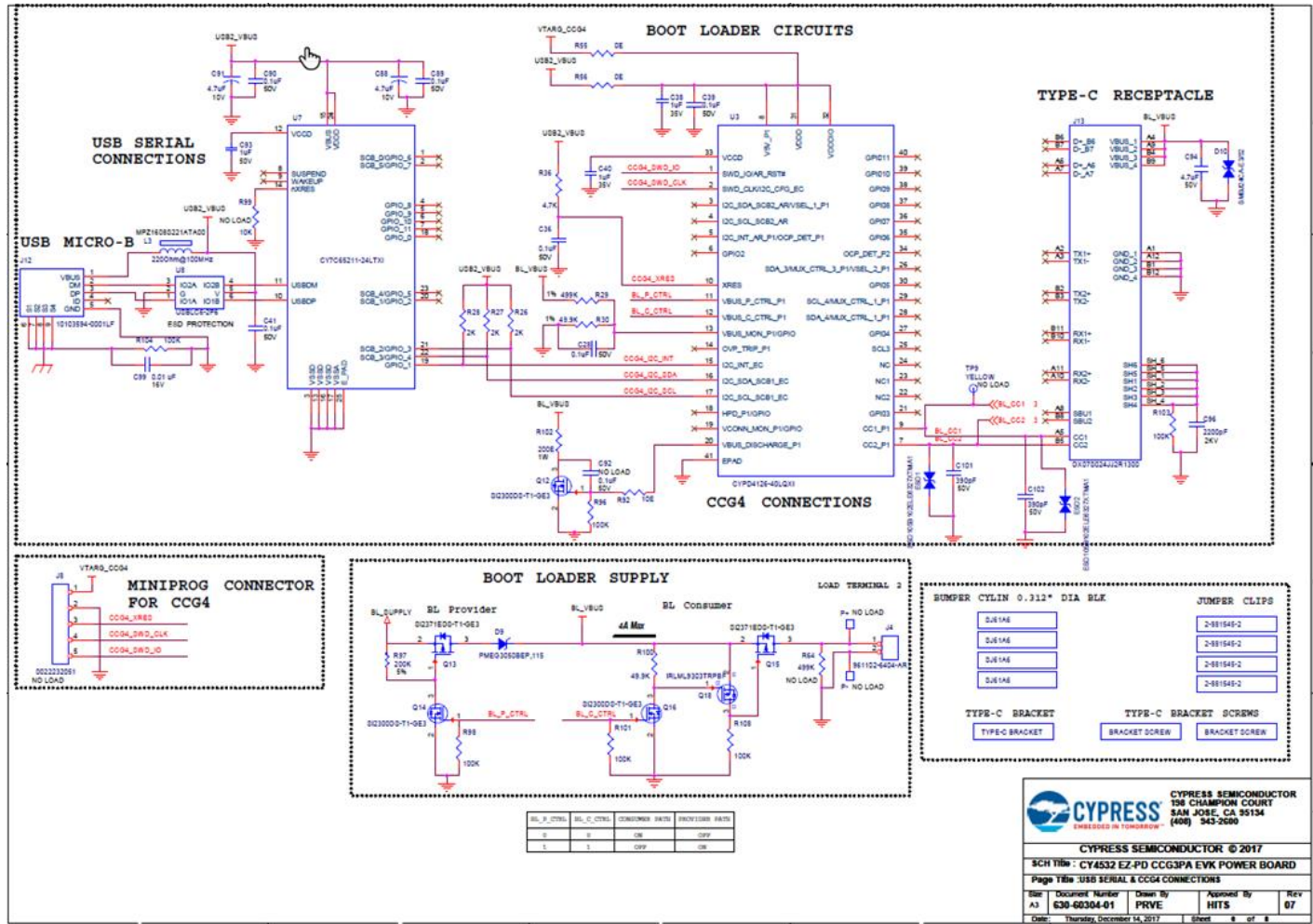
### CY4532 EVK Power Board Schematics

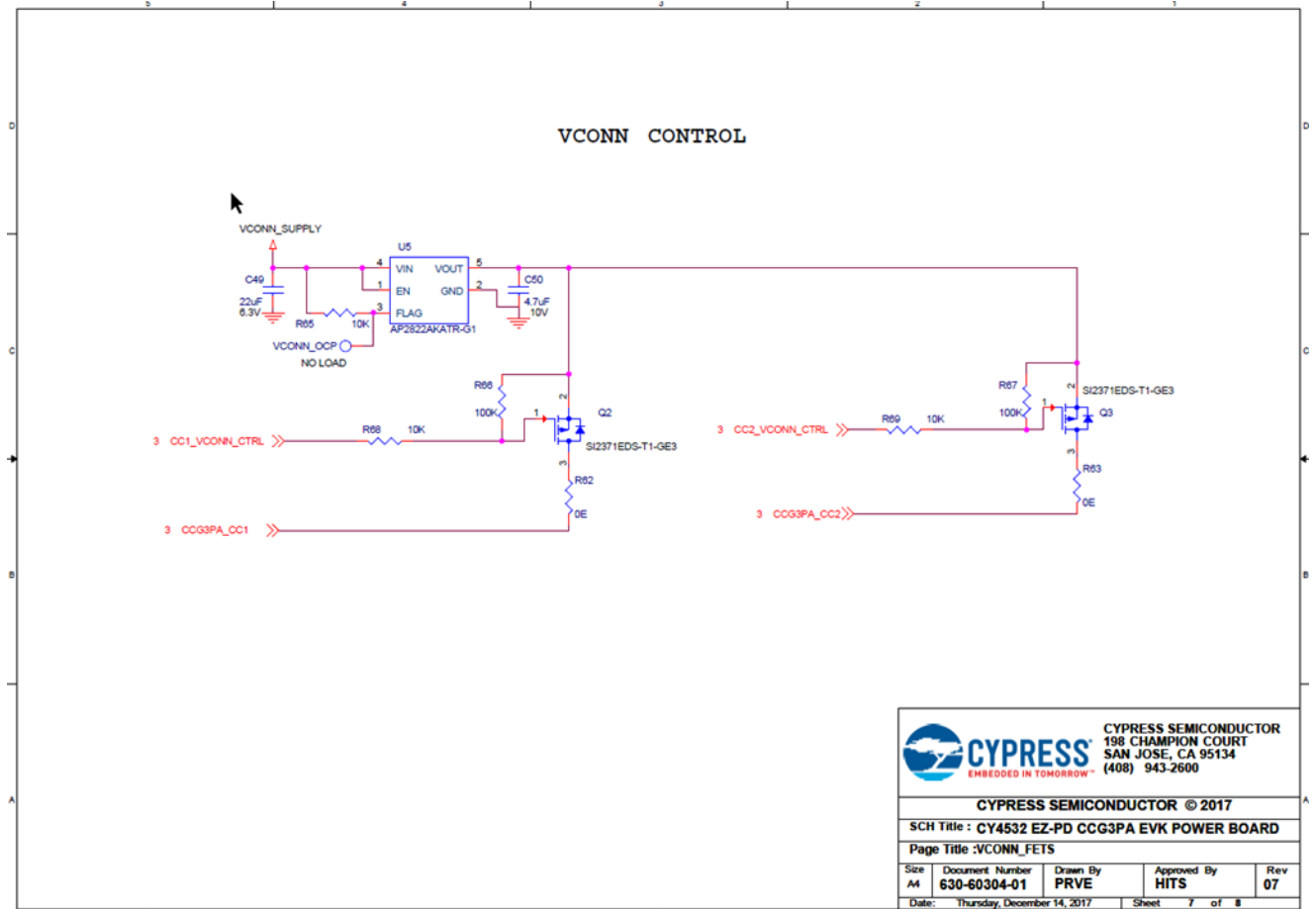












### CY4532 EVK Power Board BoM

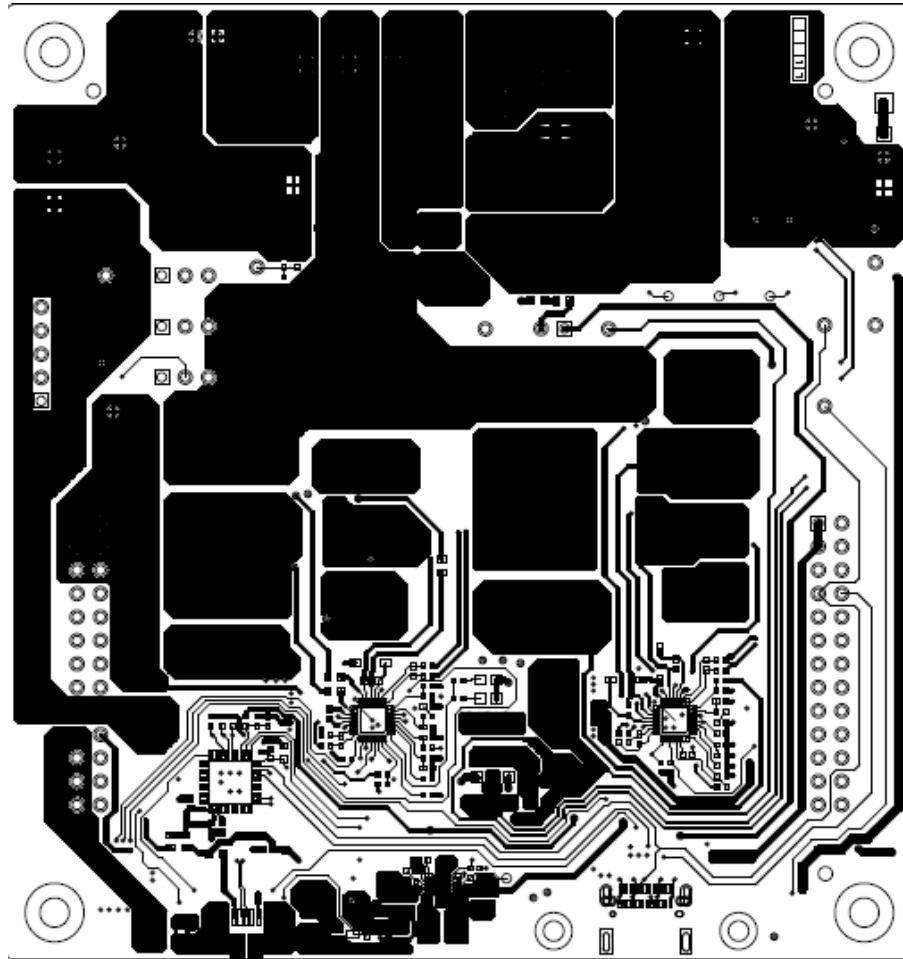
| # | Qty | Reference                                                                 | Value  | Description                   | Manufacturer                     | Mfr Part #           |
|---|-----|---------------------------------------------------------------------------|--------|-------------------------------|----------------------------------|----------------------|
| 1 | 3   | C1, C93, C103                                                             | 1 uF   | CAP CER 1UF 50V X7R 0603      | Taiyo Yuden                      | UMK107AB7105KA-T     |
| 2 | 14  | C2, C3, C20, C26, C27, C28, C36, C39, C41, C42, C57, C73, C89, C90        | 0.1 uF | CAP CER 0.1UF 50V X7R 0402    | TDK Corporation                  | CGA2B3X7R1H104K050BB |
| 3 | 16  | C4, C5, C6, C8, C9, C10, C13, C14, C15, C16, C17, C18, C55, C62, C71, C78 | 22 uF  | CAP CER 22UF 35V JB 1206      | TDK Corporation                  | C3216JB1V226M160AC   |
| 4 | 14  | C7, C11, C12, C19, C52, C53, C54, C60, C61, C68, C69, C70, C76, C77       | 10 uF  | CAP CER 10UF 50V X5R 1206     | Murata Electronics North America | GRM31CR61H106MA12L   |
| 5 | 4   | C21, C22, C33, C34                                                        | 47 pF  | CAP CER 47PF 50V C0G/NP0 0402 | Murata Electronics North America | GRM1555C1H470JA01D   |
| 6 | 1   | C23                                                                       | 0.1 uF | CAP CER 0.1UF 50V X7R 0603    | Kemet                            | C0603C104M5RACTU     |
| 7 | 1   | C25                                                                       | 47 nF  | CAP CER 0.047UF 25V X5R 0402  | TDK Corporation                  | CGA2B2X5R1E473M050BA |

| #  | Qty | Reference                              | Value                   | Description                       | Manufacturer                            | Mfr Part #             |
|----|-----|----------------------------------------|-------------------------|-----------------------------------|-----------------------------------------|------------------------|
| 8  | 1   | C29                                    | 22 nF                   | CAP CER 0.022μF 50V X5R 0402      | TDK Corporation                         | CGA2B3X5R1H223K050BB   |
| 9  | 4   | C31, C32, C35, C37                     | 0.01 uF                 | CAP CER 10000PF 50V X7R 0402      | AVX Corporation                         | 04025C103KAT2A         |
| 10 | 8   | C38, C40, C81, C82, C83, C84, C85, C86 | 1 uF                    | CAP CER 1UF 35V X5R 0402          | Samsung Electro-Mechanics America, Inc. | CL05A105KL5NRNC        |
| 11 | 2   | C43, C44                               | 10 uF                   | CAP CER 10UF 25V X5R 0603         | Murata Electronics North America        | GRM188R61E106MA73D     |
| 12 | 4   | C45, C46, C47, C49                     | 22 uF                   | CAP CER 22UF 6.3V X5R 0603        | Murata Electronics North America        | GRM188R60J226MEA0D     |
| 13 | 3   | C50, C88, C91                          | 4.7 uF                  | CAP CER 4.7UF 10V 20% X5R 0402    | TDK Corporation                         | C1005X5R1A475M050BC    |
| 14 | 8   | C51, C56, C63, C64, C65, C66, C67, C79 | 0.001 uF                | CAP CER 1000PF 50V X7R 0603       | Murata Electronics North America        | GRM188R71H102KA01D     |
| 15 | 1   | C72                                    | 4.7 uF                  | CAP CER 4.7UF 50V X7R 1206        | Samsung Electro-Mechanics America, Inc. | CL31B475KBHNNNE        |
| 16 | 1   | C80                                    | 10 uF                   | CAP CER 10UF 50V X7R 1210         | Kemet                                   | C1210C106K5RACTU       |
| 17 | 1   | C87                                    | 22 uF                   | CAP CER 22UF 6.3V X5R 0805        | Murata Electronics North America        | GRM21BR60J226ME39L     |
| 18 | 1   | C94                                    | 4.7 uF                  | CAP CER 4.7UF 50V X7R 1210        | Samsung Electro-Mechanics America, Inc. | CL32B475KBUYNNE        |
| 19 | 1   | C96                                    | 2200 pF                 | CAP CER 2200PF 2KV 10% X7R 1808   | Johanson Dielectrics Inc.               | 202R29W222KV4E         |
| 20 | 1   | C99                                    | 0.01 uF                 | CAP CER 10000PF 16V X7R 0402      | Kemet                                   | C0402C103K4RACTU       |
| 21 | 2   | C101, C102                             | 390 pF                  | CAP CER 390PF 50V 5% X7R 0603     | Kemet                                   | C0603C391J5RACTU       |
| 22 | 1   | D1                                     | SMBJ24A-TR              | TVS DIODE 24VWM 50VC DO214AA      | STMicroelectronics                      | SMBJ24A-TR             |
| 23 | 3   | D2, D3, D9                             | PMEG3050BE P,115        | DIODE SCHOTTKY 30V 5A SOD128      | Nexperia USA Inc                        | PMEG3050BEP,115        |
| 24 | 4   | D4, D5, D6, D8                         | 1N4148W-7-F             | DIODE GEN PURP 100V 300MA SOD123  | Diodes Incorporated                     | 1N4148W-7-F            |
| 25 | 1   | D7                                     | PMEG3050BE P,115        | DIODE SCHOTTKY 30V 5A SOD128      | NXP Semiconductors                      | PMEG3050BEP,115        |
| 26 | 1   | D10                                    | SMBJ24CA-E3/52GICT-ND   | TVS DIODE 24VWM 38.9VC SMB        | Vishay Semiconductor Diodes Division    | SMBJ24CA-E3/52         |
| 27 | 2   | ESD1, ESD2                             | ESD105B102E LE6327XTMA1 | TVS DIODE 5.5VWM 14VC TSLP2-20    | Infineon Technologies                   | ESD105B102ELE6327XTMA1 |
| 28 | 1   | J1                                     | B2B-EH-A(LF)(SN)        | CONN HEADER EH TOP 2POS 2.5MM     | JST Sales America Inc.                  | B2B-EH-A(LF)(SN)       |
| 29 | 1   | J2                                     | OSTTC020162             | TERMINAL BLOCK 5MM VERT 2POS PCB  | On Shore Technology Inc.                | OSTTC020162            |
| 30 | 1   | J3                                     | 694108301002            | CONN PWR JACK 2.5X5.5MM SOLDER    | Würth Electronics Inc                   | 694108301002           |
| 31 | 2   | J4, J14                                | 961102-6404-AR          | CONN HEADER VERT SGL 2POS GOLD    | 3M                                      | 961102-6404-AR         |
| 32 | 1   | J5                                     | 1935161                 | TERM BLOCK PCB 2POS 5.0MM GREEN   | Phoenix Contact                         | 1935161                |
| 33 | 3   | J6, J7, J9                             | PRPC003SAA N-RC         | CONN HEADER .100 SNGL STR 3POS    | Sullins Connector Solutions             | PRPC003SAAN-RC         |
| 34 | 2   | J10, J11                               | SBH11-PBPC-D13-ST-BK    | CONN HEADER 2.54MM 26POS GOLD     | Sullins Connector Solutions             | SBH11-PBPC-D13-ST-BK   |
| 35 | 1   | J12                                    | 10103594-0001LF         | CONN RCPT STD MICRO USB TYPE B    | Amphenol FCI                            | 10103594-0001LF        |
| 36 | 1   | J13                                    | DX07S024JJ2 R1300       | USB TYP C TP MNT DL RW SMT RECEPT | JAE Electronics                         | DX07S024JJ2R1300       |

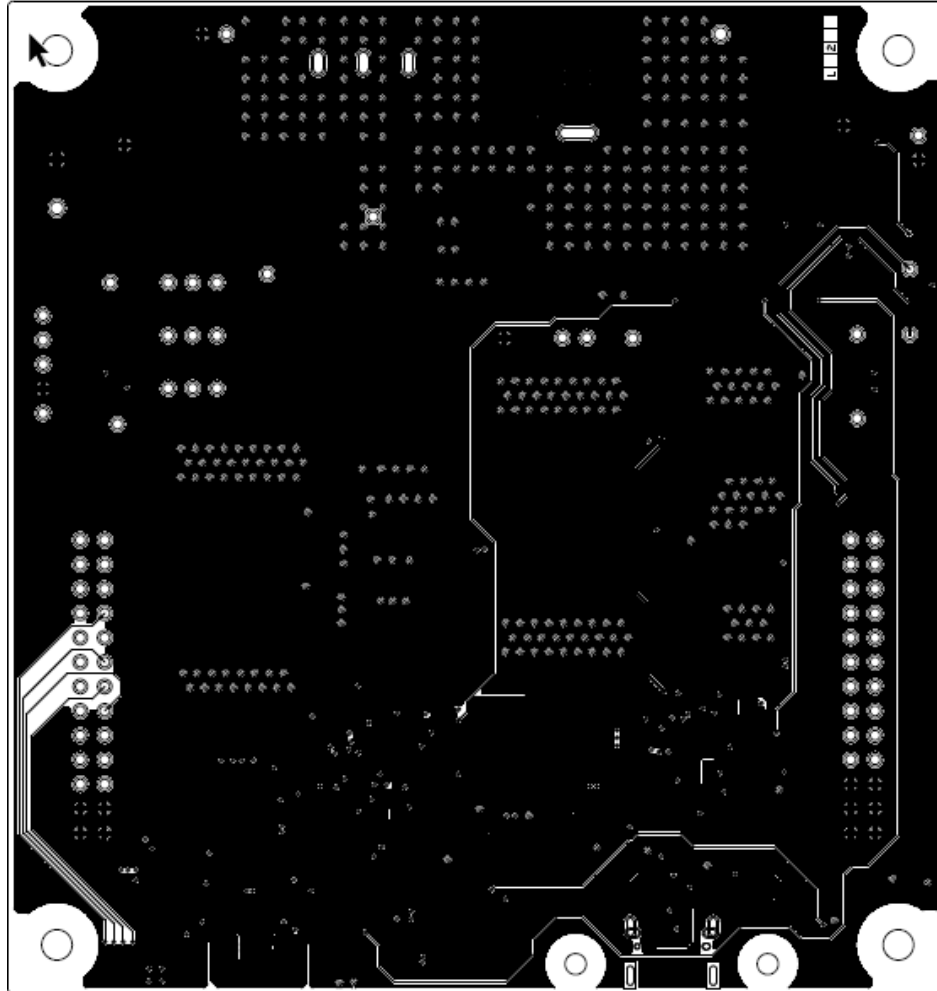
| #  | Qty | Reference                                                                                 | Value             | Description                      | Manufacturer                            | Mfr Part #       |
|----|-----|-------------------------------------------------------------------------------------------|-------------------|----------------------------------|-----------------------------------------|------------------|
| 37 | 1   | LED1                                                                                      | GREEN             | LED GREEN CLEAR 0603 SMD         | Lite-On Inc.                            | LTST-C190GKT     |
| 38 | 1   | L1                                                                                        | 6.8 uH            | FIXED IND 6.8UH 11.5A 11.5 MOHM  | Bourns Inc.                             | SRP1265A-6R8M    |
| 39 | 1   | L2                                                                                        | 3.3 uH            | FIXED IND 3.3UH 18A 6.8 MOHM SMD | Bourns Inc.                             | SRP1265A-3R3M    |
| 40 | 1   | L3                                                                                        | 220 Ohm @ 100 MHz | FERRITE BEAD 220 OHM 0603 1LN    | TDK Corporation                         | MPZ1608S221ATA00 |
| 41 | 1   | L4                                                                                        | 1 uH 5 A          | FIXED IND 1UH 5A 27 MOHM SMD     | Bourns Inc.                             | SRP4020TA-1R0M   |
| 42 | 5   | Q1, Q2, Q3, Q13, Q15                                                                      | SI2371EDS-T1-GE3  | MOSFET P-CH 30V 4.8A SOT-23      | Vishay Siliconix                        | SI2371EDS-T1-GE3 |
| 43 | 8   | Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11                                                          | SIR426DP-T1-GE3   | MOSFET N-CH 40V 30A PPAK SO-8    | Vishay Siliconix                        | SIR426DP-T1-GE3  |
| 44 | 3   | Q12, Q14, Q16                                                                             | SI2300DS-T1-GE3   | MOSFET N-CH 30V 3.6A SOT-23      | Vishay Siliconix                        | SI2300DS-T1-GE3  |
| 45 | 1   | Q18                                                                                       | IRLML9303TR PBF   | MOSFET P-CH 30V 2.3A SOT-23-3    | Infineon Technologies                   | IRLML9303TRPBF   |
| 46 | 4   | R2, R30, R61, R100                                                                        | 49.9K             | RES SMD 49.9K OHM 1% 1/16W 0402  | Yageo                                   | RC0402FR-0749K9L |
| 47 | 1   | R3                                                                                        | 330E              | RES SMD 330 OHM 5% 1/10W 0603    | Yageo                                   | RC0603JR-07330RL |
| 48 | 2   | R4, R29                                                                                   | 499K              | RES SMD 499K OHM 1% 1/16W 0402   | Yageo                                   | RC0402FR-07499KL |
| 49 | 19  | R5, R6, R7, R9, R13, R14, R19, R20, R45, R46, R47, R54, R55, R56, R75, R78, R81, R82, R86 | 0E                | RES SMD 0 OHM JUMPER 1/10W 0603  | Yageo                                   | RC0603JR-070RL   |
| 50 | 8   | R8, R10, R11, R12, R31, R32, R33, R34                                                     | 1K                | RES SMD 1K OHM 5% 1/10W 0402     | Panasonic Electronic Components         | ERJ-2GEJ102X     |
| 51 | 1   | R15                                                                                       | 270K              | RES SMD 270K OHM 1% 1/16W 0402   | Yageo                                   | RC0402FR-07270KL |
| 52 | 1   | R16                                                                                       | 75K               | RES SMD 75K OHM 1% 1/16W 0402    | Samsung Electro-Mechanics America, Inc. | RC1005F753CS     |
| 53 | 1   | R18                                                                                       | 4.7K              | RES SMD 4.7K OHM 5% 1/16W 0402   | Yageo                                   | RC0402JR-074K7L  |
| 54 | 2   | R22, R50                                                                                  | 68K               | RES SMD 68K OHM 5% 1/16W 0402    | Yageo                                   | RC0402JR-0768KL  |
| 55 | 6   | R24, R52, R65, R68, R69, R87                                                              | 10K               | RES SMD 10K OHM 1% 1/16W 0402    | Yageo                                   | RC0402FR-0710KL  |
| 56 | 1   | R25                                                                                       | 4.99K             | RES SMD 4.99K OHM 1% 1/16W 0402  | Stackpole Electronics Inc.              | RMCF0402FT4K99   |
| 57 | 3   | R26, R27, R28                                                                             | 2K                | RES SMD 2K OHM 5% 1/16W 0402     | Yageo                                   | RC0402JR-072KL   |
| 58 | 2   | R35, R39                                                                                  | 24K               | RES SMD 24K OHM 1% 1/16W 0402    | Yageo                                   | RC0402FR-0724KL  |
| 59 | 1   | R36                                                                                       | 4.7K              | RES SMD 4.7K OHM 1% 1/10W 0603   | Yageo                                   | RC0603FR-074K7L  |
| 60 | 2   | R37, R51                                                                                  | 36K               | RES SMD 36K OHM 1% 1/16W 0402    | Yageo                                   | RC0402FR-0736KL  |
| 61 | 1   | R38                                                                                       | 18K               | RES SMD 18K OHM 1% 1/16W 0402    | Yageo                                   | RC0402FR-0718KL  |
| 62 | 16  | R40, R43, R48, R66, R67, R89, R91, R93, R94, R96, R98, R101, R103, R104, R108, R109       | 100K              | RES SMD 100K OHM 1% 1/16W 0402   | Yageo                                   | RC0402FR-07100KL |

| #  | Qty | Reference                                    | Value            | Description                                                            | Manufacturer                    | Mfr Part #         |
|----|-----|----------------------------------------------|------------------|------------------------------------------------------------------------|---------------------------------|--------------------|
| 63 | 9   | R41, R49, R53, R59, R62, R63, R83, R85, R106 | 0E               | RES SMD 0 OHM JUMPER 1/10W 0402                                        | Vishay Beyschlag                | MCS04020Z0000ZE000 |
| 64 | 2   | R57, R60                                     | 1M               | RES SMD 1M OHM 1% 1/16W 0402                                           | Yageo                           | RC0402FR-071ML     |
| 65 | 1   | R58                                          | 110K             | RES SMD 110K OHM 5% 1/16W 0402                                         | Yageo                           | RC0402JR-07110KL   |
| 66 | 4   | R70, R72, R79, R80                           | 10m              | RES SMD 0.01 OHM 1% 1W 1206                                            | Panasonic Electronic Components | ERJ-8CWF010V       |
| 67 | 4   | R73, R74, R76, R77                           | 2R2              | RES SMD 2.2 OHM 5% 1/10W 0603                                          | Panasonic Electronic Components | ERJ-3GEYJ2R2V      |
| 68 | 1   | R84                                          | 5m               | RES SMD 0.005 OHM 1% 2W 2512                                           | Stackpole Electronics Inc.      | CSNL2512FT5L00     |
| 69 | 1   | R88                                          | 200K             | RES SMD 200K OHM 5% 1/10W 0402                                         | Panasonic Electronic Components | ERJ-2GEJ204X       |
| 70 | 1   | R92                                          | 10E              | RES SMD 10 OHM 5% 1/10W 0402                                           | Panasonic Electronic Components | ERJ-2GEJ100X       |
| 71 | 1   | R95                                          | 33K              | RES SMD 33K OHM 1% 1/10W 0603                                          | Yageo                           | RC0603FR-0733KL    |
| 72 | 1   | R97                                          | 200K             | RES SMD 200K OHM 5% 1/10W 0603                                         | Panasonic Electronic Components | ERJ-3GEYJ204V      |
| 73 | 1   | R102                                         | 200E             | RES SMD 200 OHM 5% 1W 2512                                             | Stackpole Electronics Inc.      | RMCF2512JT200R     |
| 74 | 1   | R105                                         | 0.02R,1W         | RES SMD 0.02 OHM 1% 1W 1206                                            | Yageo                           | PE1206FKM470R02Z   |
| 75 | 1   | R107                                         | 51K              | RES SMD 51K OHM 1% 1/16W 0402                                          | Yageo                           | RC0402FR-0751KL    |
| 76 | 1   | SW1                                          | SWITCH           | Slide Switch SPDT Through Hole                                         | E-Switch                        | 500SSP1S1M1QEA     |
| 77 | 3   | TP1, TP2, TP11                               | BLACK            | TEST POINT PC MINI .040D BLACK                                         | Keystone Electronics            | 5001               |
| 78 | 4   | TP3, TP4, TP12, TP14                         | RED              | TEST POINT PC MINI .040D RED                                           | Keystone Electronics            | 5000               |
| 79 | 1   | U1                                           | SC8802QDER       | SYNCHRONOUS 4-WAY BIDIRECTIONAL BUCK-BOOST CHARGE-DISCHARGE CONTROLLER | SouthChip                       | SC8802QDER         |
| 80 | 1   | U2                                           | SC8701QDER       | SYNCHRONOUS 4- PIPE BUCK-BOOST CONTROLLER                              | SouthChip                       | SC8701QDER         |
| 81 | 1   | U3                                           | CYPD4126-40LQXI  | USB TYPE-C PORT CONTROLLER                                             | Cypress Semiconductor           | CYPD4126-40LQXI    |
| 82 | 1   | U4                                           | TPS63060DSCR     | IC REG BUCK BOOST ADJ 2A 10WSON                                        | Texas Instruments               | TPS63060DSCR       |
| 83 | 1   | U5                                           | AP2822AKATR-G1   | IC USB POWER SWITCH SOT25                                              | Diodes Incorporated             | AP2822AKATR-G1     |
| 84 | 1   | U6                                           | MIC29152WD-TR    | IC REG LDO ADJ 1.5A TO252-5                                            | Microchip Technology            | MIC29152WD-TR      |
| 85 | 1   | U7                                           | CY7C65211-24LTXI | IC USB TO UART BRIDGE DUAL 24QFN                                       | Cypress Semiconductor           | CY7C65211-24LTXI   |
| 86 | 1   | U8                                           | USBLC6-2P6       | TVS DIODE 5.25VWM 17VC SOT666                                          | STMicroelectronics              | USBLC6-2P6         |
| 87 | 1   | U9                                           | INA199A3DCKR     | IC OPAMP CURR SENSE 14KHZ SC70-6                                       | Texas Instruments               | INA199A3DCKR       |

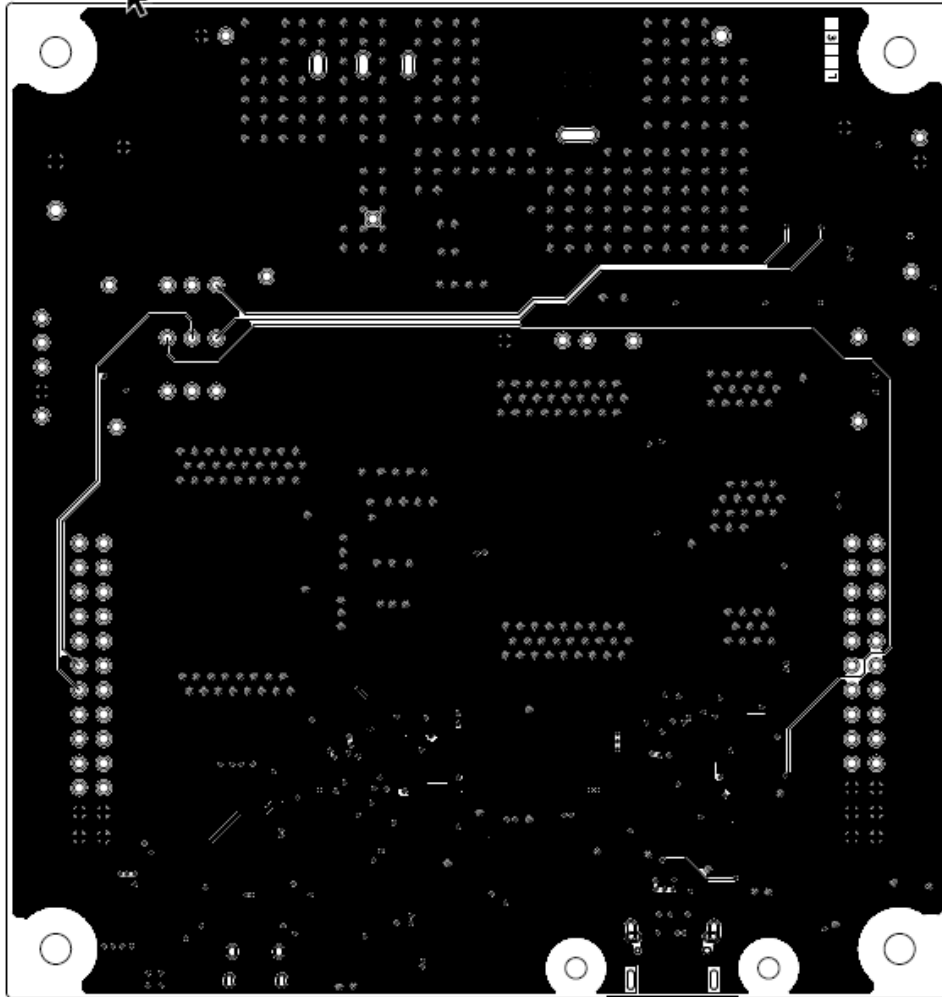
CY4532 EVK Power Board Layout



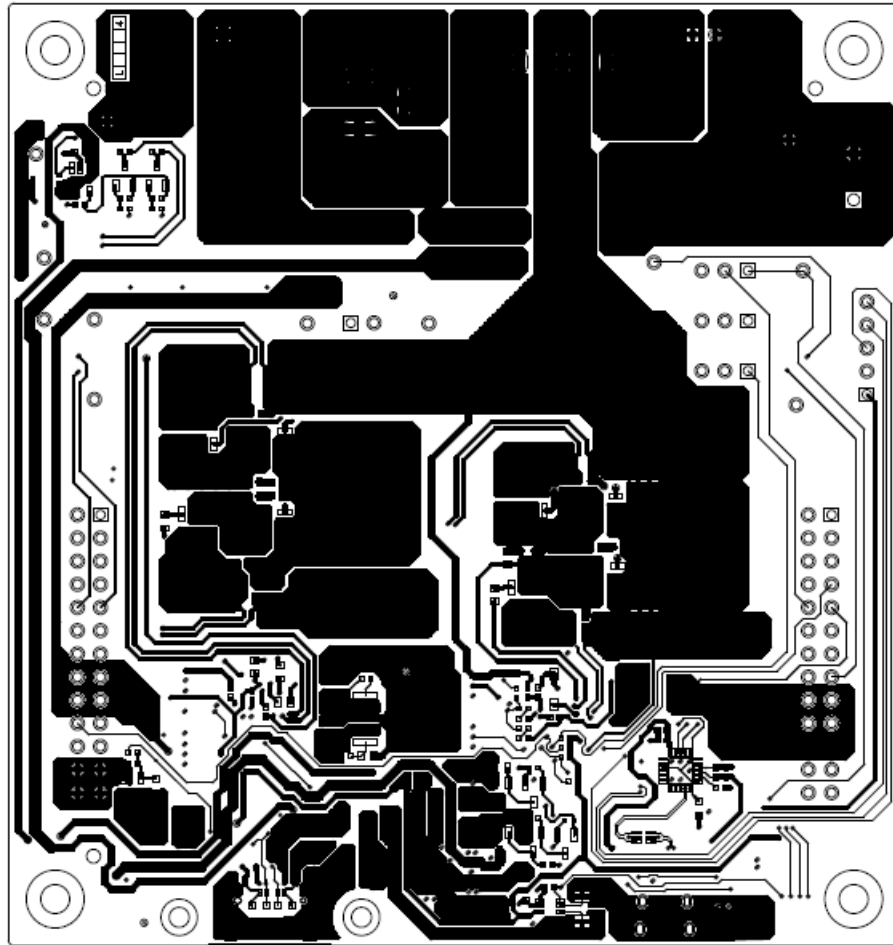
600-60414-01 REV07 PRIMARY SIDE



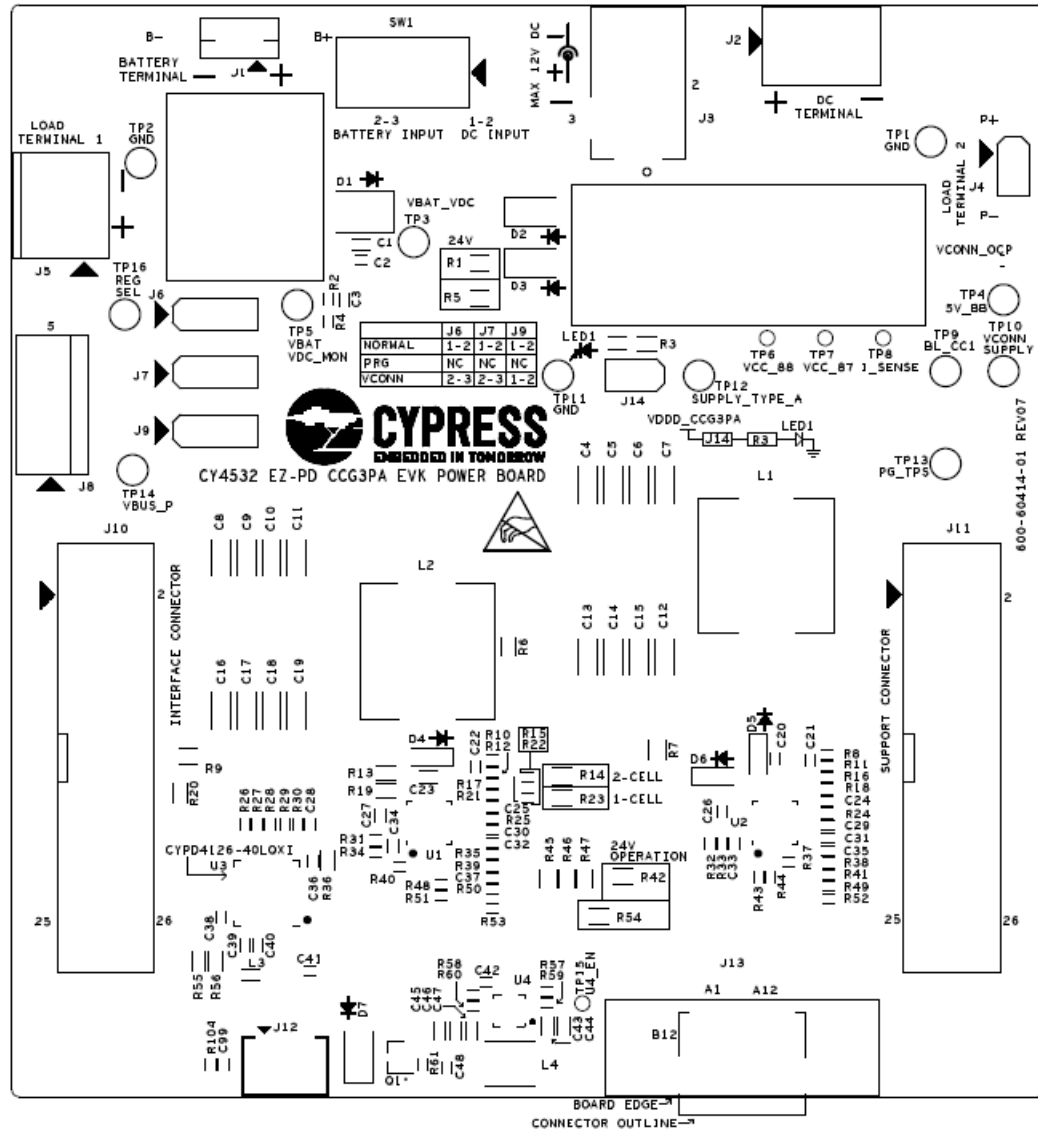
600-60414-01 REV07 GROUND1 LAYER



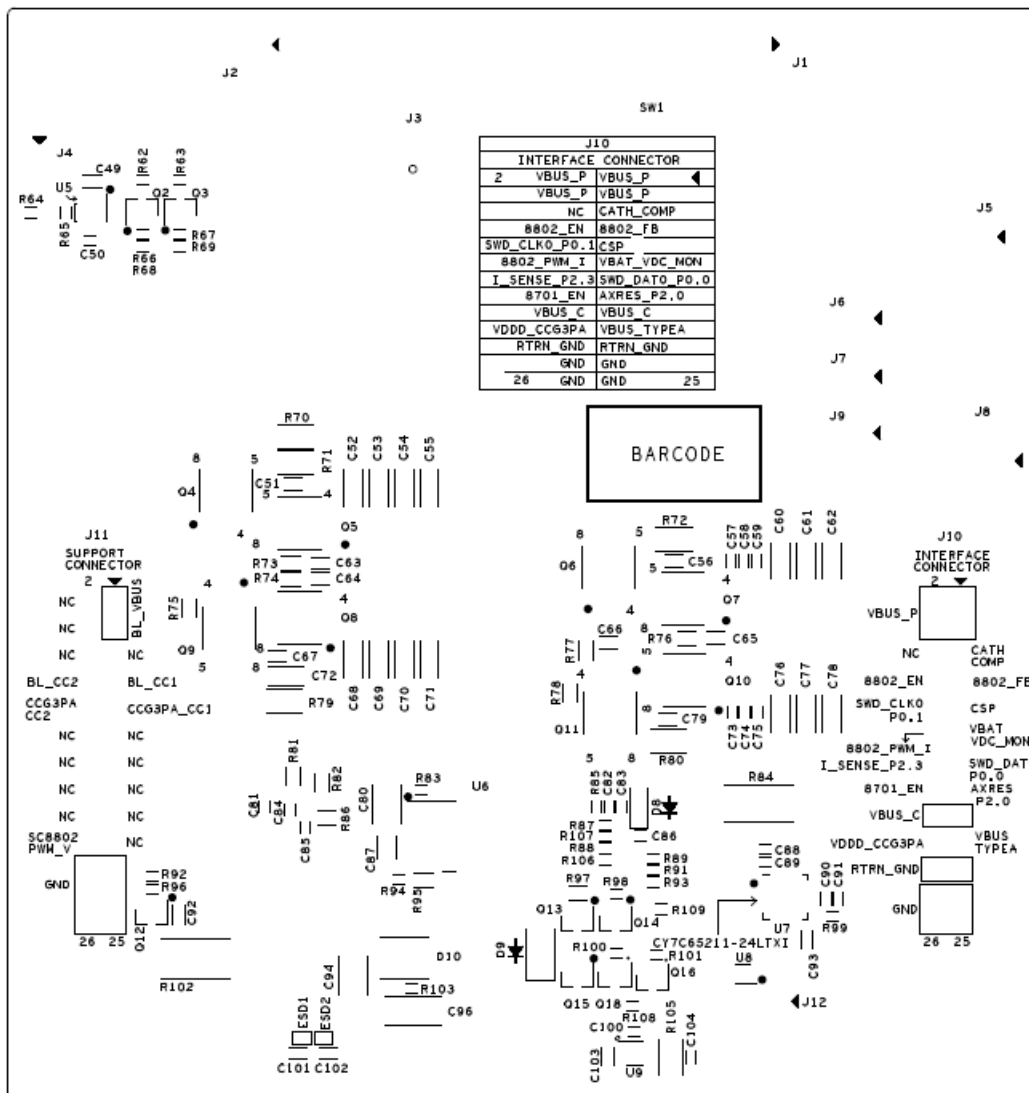
600-60414-01 REV07 GROUND2 LAYER



600-60414-01 REV07 SECONDARY SIDE



600-60414-01 REV07 PRIMARY SILKSCREEN



600-60414-01 REV07 SECONDARY SILKSCREEN

# Revision History



## Document Revision History

| Document Title: CY4532 EZ-PD™ CCG3PA Evaluation Kit Guide |            |                  |                                                                                                                                 |
|-----------------------------------------------------------|------------|------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Document Number: 002-18680                                |            |                  |                                                                                                                                 |
| Revision                                                  | Issue Date | Origin of Change | Description of Change                                                                                                           |
| **                                                        | 07/02/2017 | SELV             | New EVK kit guide.                                                                                                              |
| *A                                                        | 12/20/2017 | HITS             | EVK Release for ES100                                                                                                           |
| *B                                                        | 02/01/2018 | HITS             | Updated Safety Information to Identify Kit Revision.<br>Added Notes to distinguish LED behavior between REV ** and REV *A kits. |