



Customer Training Workshop:

EZ-PD™ CCG3PA

Power Delivery Solution

Use CCG3PA to Rapidly Design PD3.0 QC4.0 Power Solutions

Steven Zhu (China Marketing)

Daniel Shen(Sr. AE)



Cypress USB Type C/PD Marketing Overview

Cypress Is #1 In USB-C with 37%* Market Share

First-To-Market, Customer-Proven, Innovation Pace Setter

Over 10 Billion USB Ports, All Will Transition to USB-C

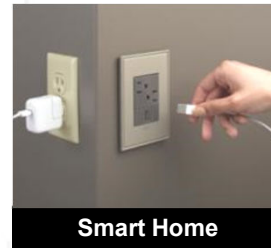
2017-2022 TAM¹
Growth: 40%



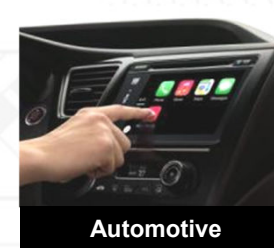
Computing



Gaming



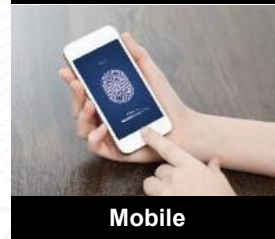
Smart Home



Automotive



Medical



Mobile



HD Video/Audio



Communications



Industrial



Everywhere

2015

2016

2017

2018

2019

2020

2021

Cypress USB-C Innovations

First USB PD Controller to Market	First EMCA Smallest USB PD Controller	First USB PD + Billboard Controller	First Dual-Port USB PD Controller	First PD 3.0 PPS Controller	First Integrated USB PD Hub	First HDMI Alternate Mode Controller	First to Achieve QC 4.0 & PPS Certification
-----------------------------------	---------------------------------------	-------------------------------------	-----------------------------------	-----------------------------	-----------------------------	--------------------------------------	---

OCT'14 MAR'15 DEC'15 JAN'16 JUN'16 AUG'16 JAN'17 NOV'17



Cypress USB-C Leadership:

- Five generations of market-proven solutions accelerate customer's time-to-Production
- Programmability keeps pace with standard changes
- Mature design tools empowers a broad customer base
- Worldwide customer training workshops proliferate best design practices

¹Data Source: Gartner 2017, IHS 2016 and Cypress estimates
Cypress estimation

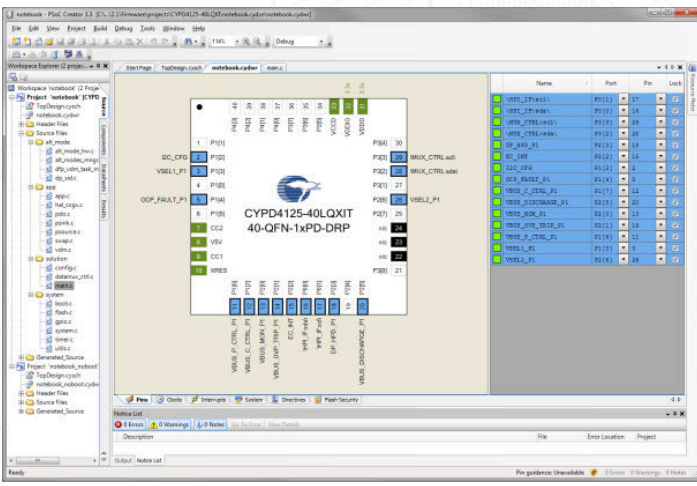
Cypress USB-C Portfolio

EZ-PD™ Programmable USB-C and Power Delivery Solutions

Solutions For Any USB-C Application



EZ-PD Config. GUI & PSoC Creator IDE



All-In-One Dev Kits & Reference Designs



EZ-PD Solution Families



General Purpose



Mobile, Cable, Dongle



Power adapter, Camera, Gaming, Automotive, General Purpose



Laptop, Tablet, Desktop, Server, PC Peripheral



Power Bank, Power Adapter, Power outlet



TBT PC, Dock, Automotive



USB Portfolio

	Device	Hub	Bridge	Host	Storage	Type-C
USB 3.1	CYUSB301x FX3 32-Bit Bus to USB 3.1 Gen 1 Arm9, 512KB RAM FX3PD USB 3.1 Gen 2 Type-C Peripheral Controller Contact Sales	CYUSB33xx HX3 USB 3.1 Gen 1, Shared Link™ ¹ BC 1.2 ² , Ghost Charge™ ³ CYUSB333x HX3C 4 Ports: 1 Type-C, 3 Type-A USB PD, Billboard, BC1.2 NEW HX3PD Q417 USB 3.1 Gen 2 Type-C Hub with PD Contact Sales	CYUSB306x CX3 CSI-2 ⁴ to USB 3.1 Gen 1 4 CSI-2 Lanes, 1 Gbps/Lane CYUSB361x GX3 USB 3.1 Gen 1 to GigE Energy Efficient Ethernet DX3 USB 3.1 Gen 1 to DSI ⁵ TX Contact Sales		CYUSB303x FX3S 16-Bit Bus to USB 3.1 Gen 1 RAID ⁶ , Dual SDXC ⁶ /eMMC ⁷ CYUSB302x SD3 USB 3.1 Gen 1 SD Reader SDXC/eMMC, RAID	CYPD1xxx CCG1 USB Type-C Port Controller 1 PD Port, 5 Profiles, 100 W CYPD2xxx CCG2 USB Type-C Cable Controller 1 PD Port, Termination, ESD CYPD3xxx CCG3 USB Type-C Port Controller 20-V, Crypto, Billboard CYPD4xxx CCG4/CCG4M USB Type-C Port Controller 2 PD Ports, 128KB Flash, Mux
	CY7C6801x/53 FX2LP 16-Bit Bus to USB 2.0 8051, 16KB RAM CY7C68003 TX2UL ULPI ⁸ PHY 13, 19.2, 24, 26 MHz CYUSB201x FX2G2 32-Bit Bus to USB 2.0 Arm9 512KB RAM	CY7C656x4 HX2VL 4 Ports 4 Transaction Translators CY7C656x1 HX2LP 4 Ports, Industrial Grade 1 Transaction Translator		CYWB016xBB Bay™ HS USB OTG Dual SDXC/eMMC SL811HS FS USB Host/Device 256Byte RAM CY7C67300 EZ-Host 4 Ports, FS USB OTG 32 GPIOs CY7C67200 EZ-OTG™ 2 Ports, FS USB OTG 25 GPIOs	CYWB0x2xABS Arroyo™, Astoria™ 16-Bit Bus to USB 2.0 8051, Dual SD/eMMC CY7C6803x NX2LP NAND Flash to USB 2.0 8051, 15KB RAM CY7C683xx AT2LP Parallel ATA to USB 2.0 8051	NEW CYPD37xx CCG3PA USB Type-C Port Controller 30V, PPS, QC4, 64KB Flash NEW CCG3PA2 Q118 USB Type-C Port Controller 30V, PPS, QC4, 128KB Flash NEW CYPD5xxx CCG5 USB Type-C Port Controller 2 PD Ports, 25V CC/SBU NEW CMG1 Q118 USB Type-C EMCA Controller Contact Sales NEW CCG6 Q318 USB Type-C Port Controller 1 PD Port, 128KB Flash, TBT Contact Sales
	CY7C638xx enCoRe™ II M8C MCU, 20 GPIOs SPI, 8KB Flash CY7C64215 enCoRe III M8C MCU, 50 GPIOs, ADC I ² C/SPI, 16KB Flash CY7C643xx enCoRe V M8C MCU, 36 GPIOs, ADC I ² C/SPI, 32KB Flash		CY7C6521x USB-Serial UART/SPI/I ² C to USB 2 Channels, CapSense® CY7C65213 USB-to-UART (Gen 2) 3 Mbps, 8 GPIOs CY7C65210/7 USB Billboard Arm Cortex® M0 1 or 2 UART/SPI/I ² C channels			

¹ Simultaneous USB 2.0 and SuperSpeed traffic on the same port
² Battery Charging specification v1.2

³ Enables USB charging without host connection
⁴ Camera Serial Interface v2.0

⁵ Redundant array of independent disks
⁶ SD extended capacity

⁷ Embedded Multimedia Card
⁸ Display Serial Interface
⁹ UTMI low-pin interface

Status
Availability

Concept Development Sampling Production

□ □ □ □

□ □ □ □

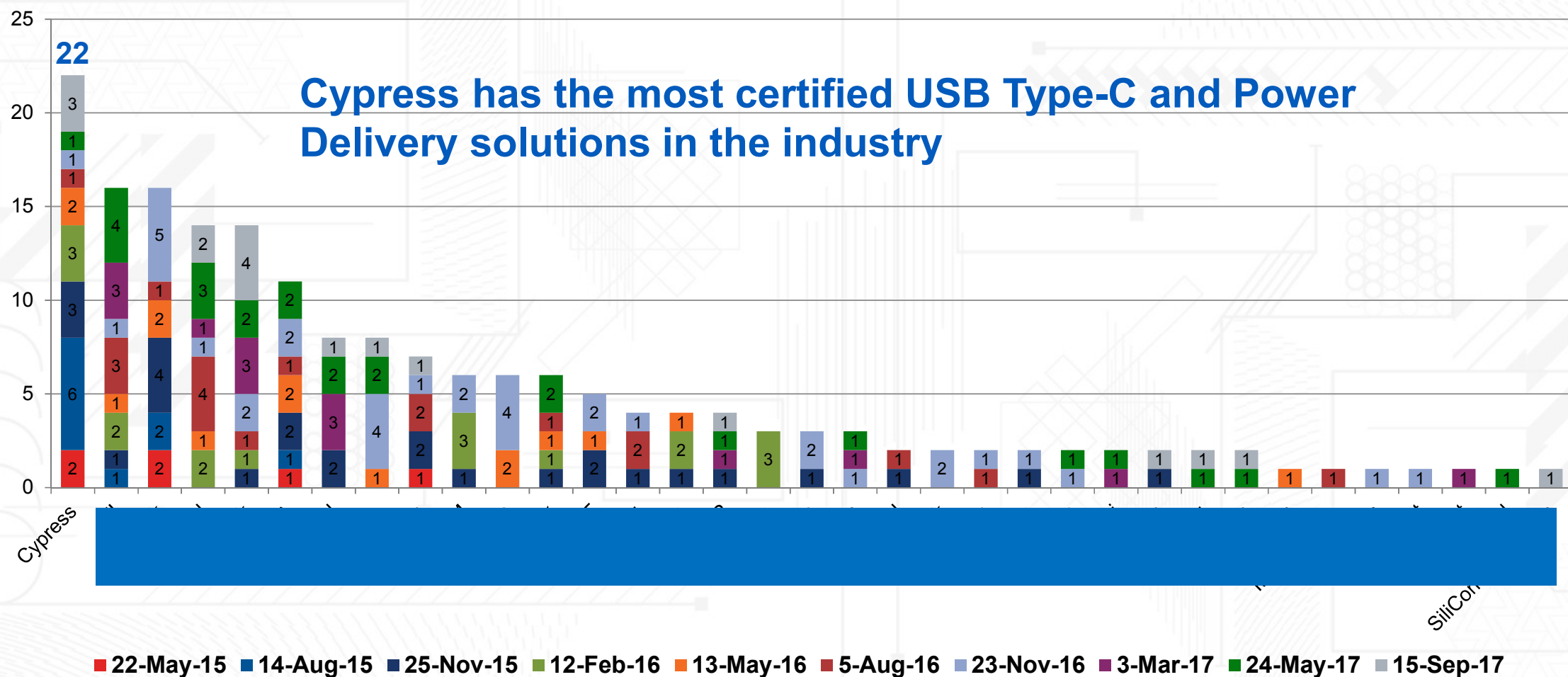
□ □ □ □

□ □ □ □



Roadmap

Cypress Leads USB-IF Certification



Certified EZ-PD Applications

EZ-PD Product	Part Number	Test ID (TID)	Application	Function	Date
CCG1	CYPD1103	1095059	Cable	EMCA	5/22/2015
	CYPD1120	1096044	Dongle	UFP	8/14/2015
	CYPD1122	1096037	Notebook	DRP	8/14/2015
	CYPD1132	1096040	Power Adapter	DFP	8/14/2015
	CYPD1134	1096042	Notebook, Desktop	DFP	8/14/2015
CCG2	CYPD2103	1095054	Cable	EMCA	5/22/2015
	CYPD2122	1096039	Tablet	DRP	8/14/2015
	CYPD2134	1096047	Power Adapter	DFP	8/14/2015
	CYPD2120	1097040	Dongle	UFP	11/25/2015
	CYPD2121	1097041	Monitor, Dock	DRP	11/25/2015
	CYPD2125	1097045	Monitor, Dock	DFP	11/25/2015
CCG2 Automotive	CYPD2194	1060084	Charger Port	DFP	12/8/2017
CCG3	CYPD3105	1098018	Thunderbolt Cable	EMCA	2/12/2016
	CYPD3120	1000061	Dongle	EMCA	8/5/2016
	CYPD3121	1010055	Power Bank	UFP	11/23/2016
	CYPD3123	1098119	Dongle	DRP	2/6/2018
	CYPD3125	1098019	Notebook, Phone	DRP	2/12/2016
	CYPD3135	1099031	Power Adapter	DFP	5/13/2016
CCG4	CYPD4225	1098024	Notebook, Desktop	DRP	2/12/2016
CCG4M	CYPD4255	1099030	Notebook, Desktop	DRP	5/13/2016

Certified EZ-PD Applications (cont.)

EZ-PD Product	Part Number	Test ID (TID)	Application	Function	Date
CCG5	CYPD5125	1071049	Notebook, Desktop	DRP	3/21/2018
	CYPD5225	1030056, 1070049	Notebook, Desktop	DRP	5/24/2017, 2/16/2018
CCG3PA	CYPD3171	1040045	Power Bank	DRP	9/15/2017
	CYPD3174	1050039	Opto-coupler based Adapter	DFP	9/15/2017
	CYPD3174	1060036	Opto-coupler based Adapter (PPS)	DFP	1/10/2018
	CYPD3175	1040032	Direct feedback based Adapter	DFP	9/15/2017
	CYPD3175	1060037	Direct feedback based Adapter (PPS)	DFP	1/10/2018

USB-IF PD Power Brick Certification with Cypress CCG3PA (Customer Design)

Customer/ Partner	Part Number	Test ID (TID)	Application	Wattage	Date
Active Semi	CYPD3175-24LQXQ	1080029	PD3.0 + PPS Car Charger	27W	4/27/2018
Diodes Inc	CYPD3174-24LQXQ	1080032	AC-DC PD3.0 + PPS Charger	27W	4/27/2018
Power Integrations	CYPD3175-24LQXQ	1080020	AC-DC PD3.0 + PPS Charger	27W	4/27/2018
	CYPD3174-24LQXQ	1080026	AC-DC PD3.0 + PPS Charger	27W	4/27/2018
	CYPD3175-24LQXQ	1080022	PD3.0 + PPS Car Charger	45W	4/27/2018
	CYPD3174-24LQXQ	1080062	AC-DC PD3.0 Charger	18W	4/27/2018
	CYPD3175-24LQXQ	1080028	Puregear USB-C 35W PD3.0 + USBA 30W Charging Station	35W	4/27/2018
	CYPD3174-16SXQ	1080053	PD3.0+PPS Charger	27W	4/27/2018
	CYPD3171-24LQXQ	1080006	PD3.0 Power Bank	18W	4/27/2018
	CYPD3174-24LQXQ	1080011	PD3.0+PPS Charger	27W	4/27/2018

Cypress USB-C Solutions Are Trusted by Leading OEMs/ODMs

Computing



Mobile



Consumer & Enterprise

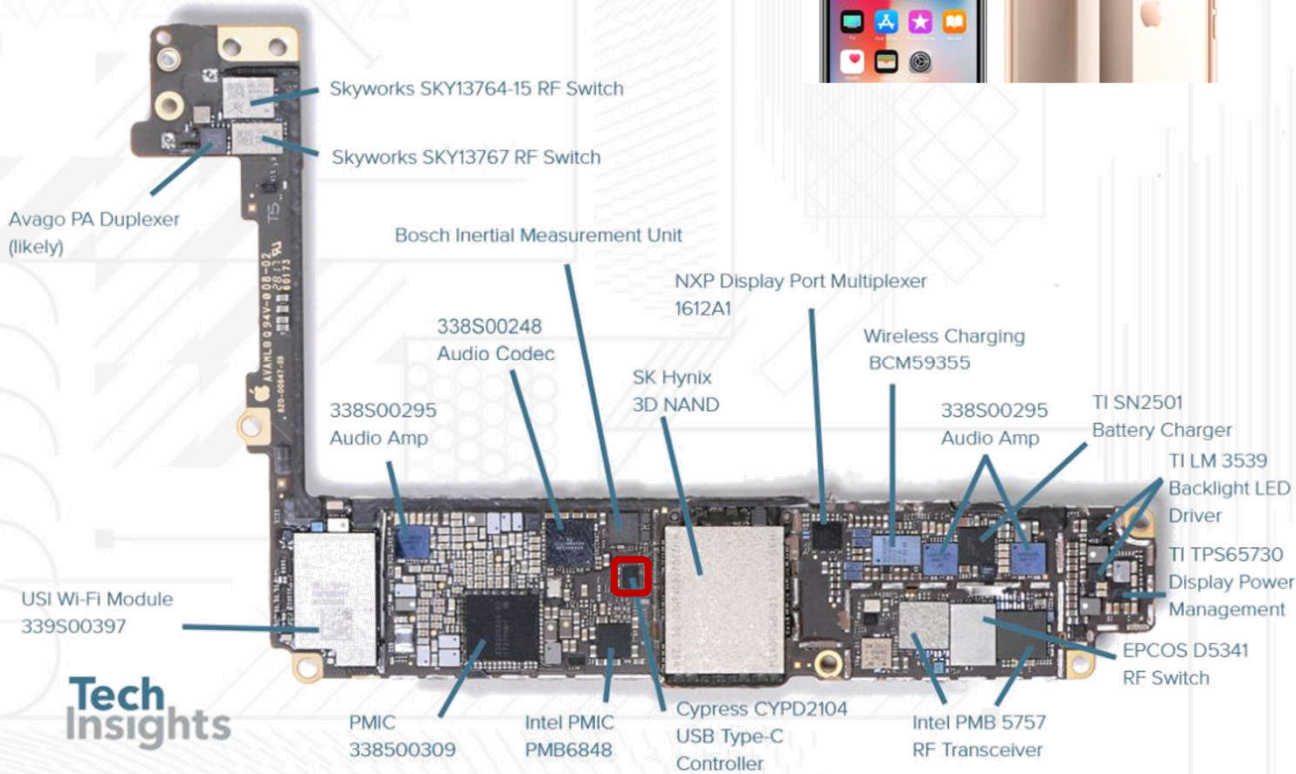


Cables and Adapters

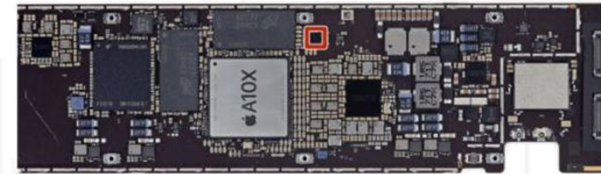


2017 Teardowns

iPhone 8/8-Plus/X (by Tech Insights)



iPad Pro 10.5"12.9" (by iFixit)



- Cypress **CYPD2104** USB Type-C Port Controller
- What's a USB-C controller doing in here? The iPad doesn't have a USB-C port.
- ① Ah, but if you pair this little chip with a Lightning-to-USB-C cable and Apple's 29W USB-C charger, you unlock a bonus feature: **USB Power Delivery**, a.k.a. *fast charging*.
- Previously featured only on the 12.9" iPad Pro, fast charging cuts your battery charging time in half. (This was an especially big deal on the 12.9" model, which otherwise needs up to *five hours* to drink enough electrons for a full charge.)

2017 Key USB-C Design Wins – Mobile and Accessories



Samsung Dex Station



Anker Power Banks



Huawei Wireless Charger



Mophie USB-C XXL



Mobileconn USB-C chargers



USB-C 30W/61W/87W Chargers

2017 Key USB-C Design Wins – PCs and Docks



HP Slice



Lenovo Yoga 720/920



Lenovo Duce Dock



HP ProDesk 400/600



HP Inspron/Envy



Dell XPS



Dell Precision Desktop

CCGx Portfolio Comparison for Power Applications

Features	CCG2	CCG3	CCG3PA/PA2
Number of Type-C+PD Ports	1	1	1
Integrated ARM® Cortex®-M0 MCU @ 48 MHz	Yes	Yes	Yes
Memory (Flash / SRAM)	32KB / 4KB	128KB / 8KB	64KB / 4KB / (128KB)
PD 3.0 with PPS Support	No	Yes	Yes
Serial Communication Blocks (I²C / SPI / UART)	2	4	2
V _{BUS} Current Sense	No	Yes, High-side	Yes, Low-side
Integrated Voltage (V _{BUS}) Regulation	No	No	Yes
Integrated V _{BUS} Discharge Drivers	0	1	2
Total GPIOs	14	20	12 / (16)
Integrated V _{CONN} FETs	0	1 Pair	0
Integrated High-Voltage V _{BUS} Gate Drivers	No	4 (NFET / PFET)	2 (PFET)
Supply Voltage	2.7–5.5 V	2.7–21.5 V	2.7–21.5 V
V _{BUS} (absolute maximum)	6 V (no V _{BUS})	24 V	30 V
V _{BUS} Short Protection on CC Pins	No	No	Yes
Dedicated V _{BUS} OVP and OCP	No	Yes	Yes
BC 1.2, Apple Charging, QC 4.0, Samsung Adaptive Fast Charging	No	Yes	Yes
ESD Protection ±8 kV (Contact), ±15 kV (Air)	Yes	Yes	Yes
Packages	24-QFN, 14-DFN, 20-CSP	40-QFN, 42-CSP	16-SOIC, 24-QFN / (32-CSP, 32-QFN)
Availability (Samples, Production)	Now	Now	Now / (Q218)

CCG3PA Reference Design Partners



	DIODES INCORPORATED	power integrations™	MPS® Monolithic Power Systems	SOUTHCHIP	active-semi® Solutions for Sustainability	Navitas
Mobile Charger 33-W PD 3.0 + QC 4.0	✓	✓	✓			✓
Notebook Power Adapter 45-W/60-W PD 3.0			✓			
Power Bank			✓	✓		
60-W Car Charger			✓	✓	✓	

Start your Design with EZ-PD Development Kits



EZ-PD CCG2 EMCA Kit (CY4502) - \$49



EZ-PD CCG2 Development Kit (CY4521) - \$199



EZ-PD CCG3 Evaluation Kit (CY4531) - \$249



EZ-PD Protocol Analyzer Kit (CY4500) - \$199



EZ-PD CCG4 Evaluation Kit (CY4541) - \$299



EZ-PD CCG3PA Evaluation Kit (CY4532) - \$149

New

Cypress: First in QC4 certification

Cypress USB-C Controller Speeds Up Power Delivery for Mobile Phone Chargers with Certification for Qualcomm® Quick Charge™ 4 Technology

*SAN JOSE, Calif., September 11, 2017: Cypress Semiconductor Corp. (CY), the market leader in USB-C, today announced that its EZ-PD™ CCG3PA USB-C controller is one of the industry's first to achieve Qualcomm® Quick Charge™ 4 certification, enabling mobile phone chargers to deliver an improved fast charging user experience. Quick Charge 4 supports USB Power Delivery (PD) 3.0. USB PD features programmable power supply (PPS), which provides fast, efficient charging by allowing a smartphone to communicate with the charger to intelligently select the optimal voltage and current levels. Quick Charge 4 also adds various safety enhancements and is engineered to allow for charging without overheating. Cypress' programmable CCG3PA controller enables firmware upgradeability to keep up with evolving standards while ensuring interoperability. The controller's high level of integration minimizes bill-of-material costs and simplifies designs, replacing multiple discrete components with a single-chip solution. More information on the EZ-PD CCG3PA controller is available at <http://www.cypress.com/ccg3pa>. "Having an industry leader in USB-C and USB Power Delivery such as Cypress support Quick Charge 4 demonstrates its growing adoption and points to its strong end-user benefits to make charging faster and easier than ever before," said **Josh Warner, Product Manager, Qualcomm Technologies, Inc.** "Quick Charge 4 is bringing the speed, reliability, safety and consistency of Quick Charge to a broader range of products, and having the Cypress EZ-PD CCG3PA controller certified marks another key step forward along that path."*

CCG3PA: USB-C and Power Delivery Port Controller

Applications

Power adapters, mobile chargers, car chargers, power banks and power sink

Features

- **USB-C PD Controller, PD 3.0 Transceiver and Qualcomm QC 4.0**
- **V_{BUS} -to-CC Short Protection**
- **Integrated High-Voltage 30-V-Tolerant LDO to Power CCG3PA**
- **Integrated Digital Blocks**
 - Four timer/counter/pulse-width modulator (TCPWM) blocks, 12x GPIOs
 - Two serial communication blocks (SCBs) for configurable master/slave I²C, SPI or UART
- **Integrated Analog Blocks**
 - Configurable V_{BUS} overvoltage protection (OVP) and overcurrent (OCP) protection
 - Integrated voltage regulation¹ with analog output and PFET gate drivers
 - Low-side current sense² capable of detecting 100mA change
 - Two legacy charge-detect block (BC 1.2, Apple Charging 2.4A, QC 4.0 and Samsung AFC³)
- **ARM® Cortex®-M0 with MCU Subsystem and 64KB Flash**
- **Low-Power Operation**
 - High-voltage (3–30 V, 30 V maximum) V_{BUS} voltage inputs
 - Sleep: 3 mA; Deep Sleep: 30 μ A with wake-on-CC
- **System-Level ESD on CC, Dp / Dn⁴ and V_{BUS} Pins**
 - ± 8 -kV contact, ± 15 -kV Air Gap IEC61000-4-2 level 4C
- **Packages**
 - 24 QFN (16 mm²), 16-SOIC (60 mm²)

Collateral

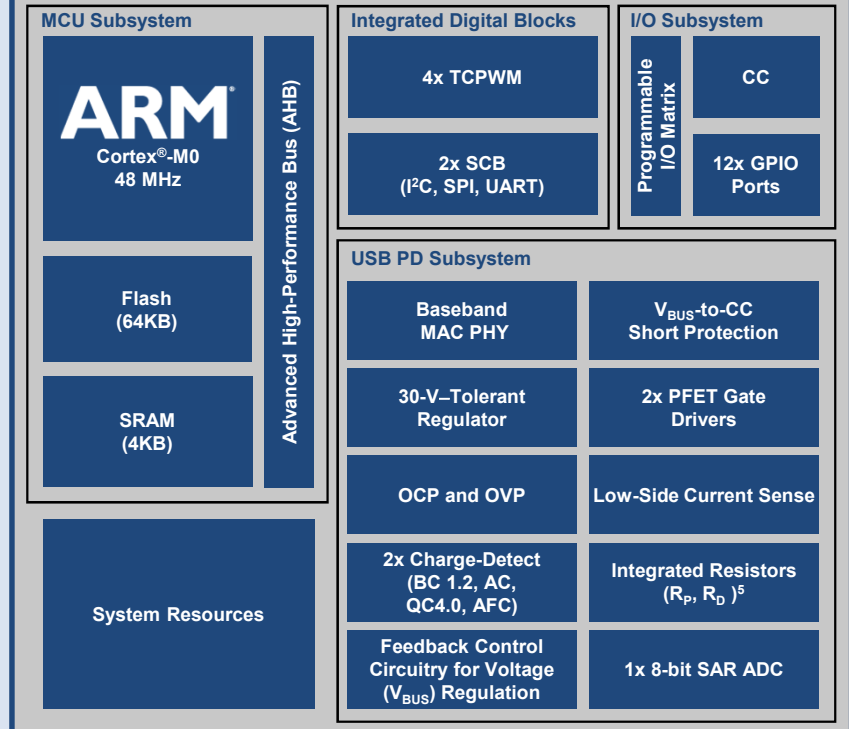
Datasheet: [CCG3PA Datasheet](#)

¹ Analog feedback control circuit to regulate V_{BUS} ³ Adaptive Fast Charging

² Circuit to measure the current flowing on the V_{BUS} ⁴ USB-C bus wires used to transmit and receive USB 2.0 data

⁵ Termination resistors: R_p read as a DFP, R_D as a UFP

CCG3PA: USB-C Cable Controller



Availability

Samples: Now

Production: November 2017

支持PD3.0 QC4.0 的电源适配器和移动电源的设计

研讨会安排

<u>Time</u>	<u>Page</u>	<u>Topic</u>
0:00 (15 min)	3	安装软件
0:15 (05 min)	4	Type-C 和 USB-PD 术语
0:20 (10 min)	6	Cypress USB Type-C 产品组合
0:30 (20 min)	8	CCG3PA 产品概况
0:50 (30 min)	23	Lab 1: 使用CY4532 CCG3PA EVK 的Type-C和Type-A进行VBUS 电源交互
1:35 (30 min)	32	Lab 2: 使用EZ-PD Configuration Utility 修改Type-C的配置参数
2:55 (20 min)	39	Lab 3: 观察CCG3PA的PPS功能
3:45 (15 min)	45	CCG3PA Power Bank参考设计介绍
4:05 (20 min)	53	Lab 4:CCG3PA Power Bank充电和放电观察
4:25 (30 min)	59	Demo:使用EZ-PD CCG3PA SDK实现CCG3PA的固件修改
4:55 (15 min)	64	讨论和提问

安装软件

■ 所需要的软件和安装步骤

- 拷贝提供的U盘里的所有内容到你的电脑里, 安装如下表格里的软件

Software	Version	File Location
EZ-PD Analyzer Utility	1.0.0.084 or above	http://www.cypress.com/CY4500 USB Drive: CCG3PA Workshop\Software\CY4500Setup_RevSA.exe
EZ-PD™ Configuration Utility	Rev *A or above	http://www.cypress.com/documentation/software-and-drivers/ez-pd-configuration-utility USB Drive: CCG3PA Workshop\Software\EzPdConfigurationUtilitySetup_1.1_b162
USBCEE Power Adapter Tester (PAT)	1.0.1	https://www.usbcee.com/product-details/2 USB Drive: CCG3PA Workshop\Software\PAT Tool\USBCEE_Advanced_Tester_V1.0.1

■ 所需要的硬件

- A PC running Windows 7, Windows 8/8.1, or Windows 10
- EZ-PD CCG3PA Evaluation Kit (CY4532) 开发板
- EZ-PD Protocol Analyzer Kit (CY4500) 协议分析器
- USB-C 口的手机
- USBCEE PAT Tool 电源测试板

■ 需要的文档

- 研讨会试验手册

如果需要帮助请举手

Type-C and USB-PD 术语

- **USB Power Delivery (USB-PD, Power Delivery, PD, PD 3.0)**

作为一种新型的USB标准,可以提高VBUS功率范围,从7.5W到最高100W. USB主机(例如PC)和设备(如硬盘驱动器)都可以作为电力的提供方或者消费者。

- **USB-C (Type-C)**

新的标准具有纤薄,支持USB反向插拔,数据线可以反插,支持多种协议,

功率最高到100w

- **可编程的功率提供(PPS)**

功率输出可以在宣称的范围内,对输出电压可编程调整,做小幅增加

- **快速充电4.0 (QC 4.0)**

受到广泛应用,卓越的高通QC-标准充电技术,可以实现对设备充电速度更快。

- **Battery Charge 1.2 (BC 1.2)** USB 电池充电规范1.2

- **Configuration Channel (CC)**

USB-C 总线线对,负责承载 PD 协议信号

- **Dp, Dn**

USB-C总线线对用于发送和接收USB 2.0 数据

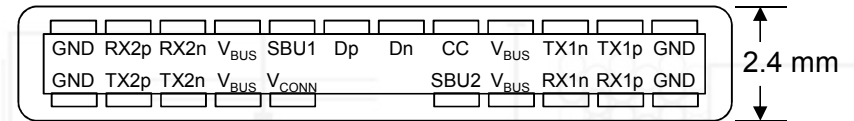
- **V_{BUS}**

USB-C总线线对用于系统功率传送;通常是 5 V,但是可以提高到20V,最高100W 的 USB-PD 系统

¹ Provider: A Type-C port that sources power over V_{BUS}

² Consumer: A Type-C port that sinks power from V_{BUS}

USB-C Plug



EZ-PD™ CCGx 产品介绍

Cypress USB-C 产品组合

EZ-PD™ 可编程的 USB-C and Power Delivery 方案

Solutions For Any USB-C Application



CCG1:
First To Market
Notebooks, dongles,
cables, docks, monitors



CCG2:
Smallest Footprint
Cables and
smartphones



CCG3:
Highest Integration
Power adapters
and accessories



CCG3PA:
Power Solutions
Power adapter, CLA
and power bank

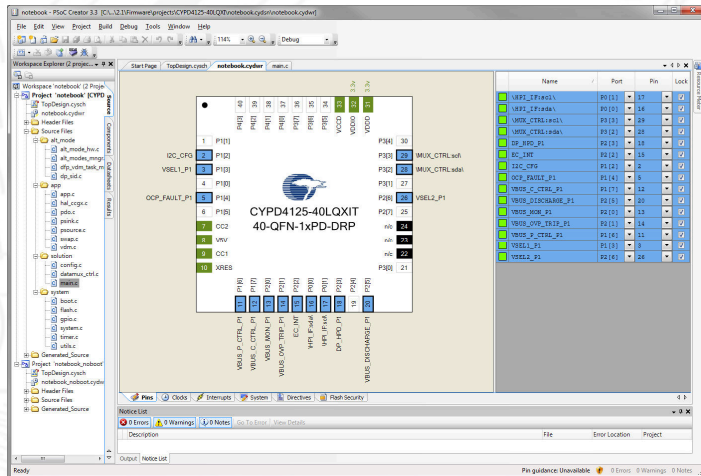


CCG4:
First 2-Port Type-C
PCs and peripherals



CCG5:
2nd-Gen 2-Port
TBT PCs and docks

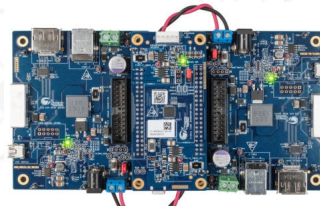
EZ-PD Config. GUI & PSoC Creator IDE



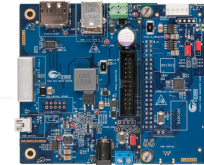
All-In-One Dev Kits & Reference Designs



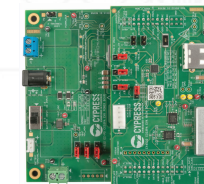
Cable Paddle Card



CY4541 Kit



CY4531 Kit



CY4532 Kit



Cigarette Light Adapter
Reference Design



Adapter Reference Design

Cypress CCGx 产品家族比较

特征	CCG2	CCG3	CCG3PA	CCG4/4M	CCG5
Type-C+PD 3.0 端口数	1 (PD2.0)	1	1	2	2
集成 Arm® Cortex®-M0 MCU @ 48 MHz	Yes	Yes	Yes	Yes	Yes
内存(Flash/SRAM)	32KB/4KB	128KB/8KB	64KB/4KB	128KB/8KB	128KB/12KB
集成Billboard Class FS USB 2.0 设备 和硬件认证模块(Crypto)	No	Yes	No	No	No
串行通讯模块(I²C/SPI/UART)	2	4	2	4	4
V _{BUS} 电流感知	No	Yes (High)	Yes (Low)	No	Yes (High)
可编程电力输出(PPS)/QC4.0	No	No	Yes	No	No
集成V _{BUS} 放电驱动器	No	Yes	Yes	No	Yes
GPIOs总数	14	20	12	24	28
集成 V _{CONN} FETs	No	Yes	No	Yes	Yes
集成 高压 V _{BUS} 门驱动器	No	4 (NFET/PFET)	2 (PFET)	No	2 (PFET)/port
V _{BUS} (最高绝对值)	6 V (no V _{BUS})	24 V	30 V	6 V (no V _{BUS})	24 V
V _{BUS} CC管脚短路保护	No	No	Yes	No	Yes
专用的 V _{BUS} OVP and OCP	No	Yes	Yes	No	Yes
BC 1.2, 苹果充电协议, QC 2.0/3.0, 三星 AFC	No	BC 1.2, QC2.0/3.0, AC	Yes	No	BC 1.2 & AC
ESD 保护±8 kV (Contact), ±15 kV (Air)	Yes	Yes	Yes	Yes	Yes
封装	24-QFN, 14-DFN, 20-CSP	40-QFN, 42-CSP	16-SOIC, 24-QFN	24-QFN, 40-QFN, 96-BGA (4M)	40-QFN 96-BGA

EZ-PD™ CCG3PA 产品概况

CCG3PA: 完全可编程的USB-C 和 Power Delivery 端口控制器

应用

电源充电器, 手机充电器, 车载充电器, 移动电源, 和功率耗散器

Features

- **USB-C PD 控制器, PD 3.0 收发器, 和 高通 QC 4.0**
- **V_{BUS}-to-CC 短路保护**
- **集成耐压30V的高压 LDO 以供电 CCG3PA**
- **集成数字模块**
 - 四个计时器/计数器/脉宽调制模块(TCPWM), 12x GPIOs
 - 两路可编程主/从串行通讯模块, I²C, SPI, 或 UART
- **集成模拟模块**
 - 可配置 V_{BUS} 过压保护(OVP) 和过流保护 (OCP)
 - 呆模拟输出的集成电压调整和PFET门驱动器
 - 低侧电流感知, 能够检测100-mA电流变化
 - 两路传统充电检测模块 (BC 1.2, Apple Charging 2.4 A, QC 4.0, and Samsung AFC³)
- **Arm® Cortex®-M0 MCU 子系统和 64KB 闪存**
- **低功耗工作模式**
 - 极宽的 (3–30 V, 30 V 最高) V_{BUS} 电压输入
 - 休眠: 3 mA; 深度休眠: 30 µA, CC可唤醒
- **CC, Dp/Dn⁴ 和 V_{BUS} 管脚系统级ESD保护**
 - ±8-kV 接触型, ±15-kV 空气隔离型IEC61000-4-2 level 4C
- **封装**
 - 24 QFN (16 mm²), 16-SOIC (60 mm²)

附录

数据手册: [CCG3PA Datasheet](#)

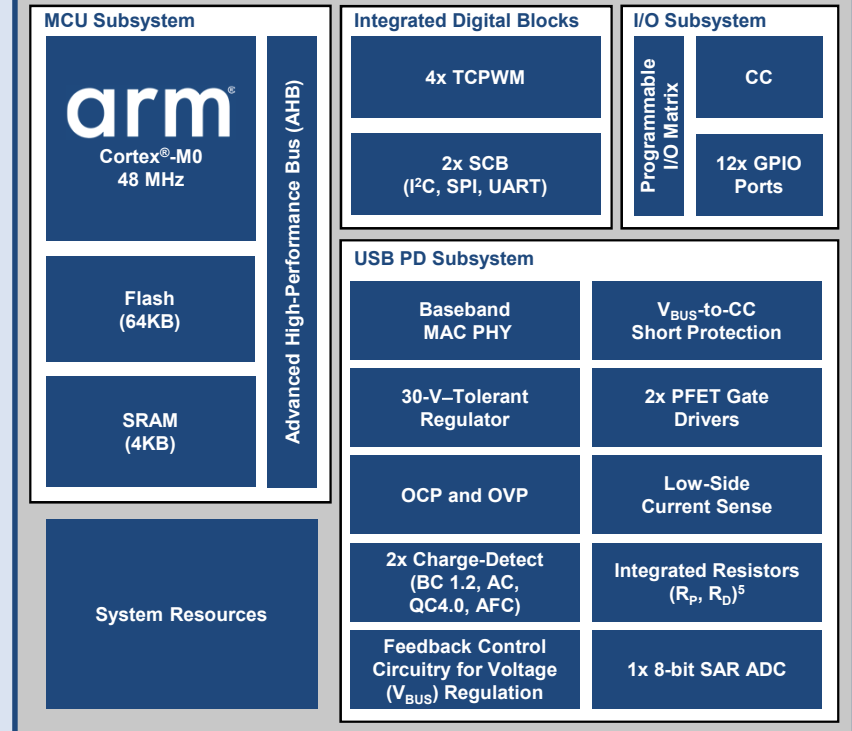
¹ 模拟反馈控制电路调整 V_{BUS}

² V_{BUS}电流测量电路

³ 自适应快速充电

⁴ USB-C 总线线对用于发送和接收USB 2.0 数据

CCG3PA: USB-C Cable Controller



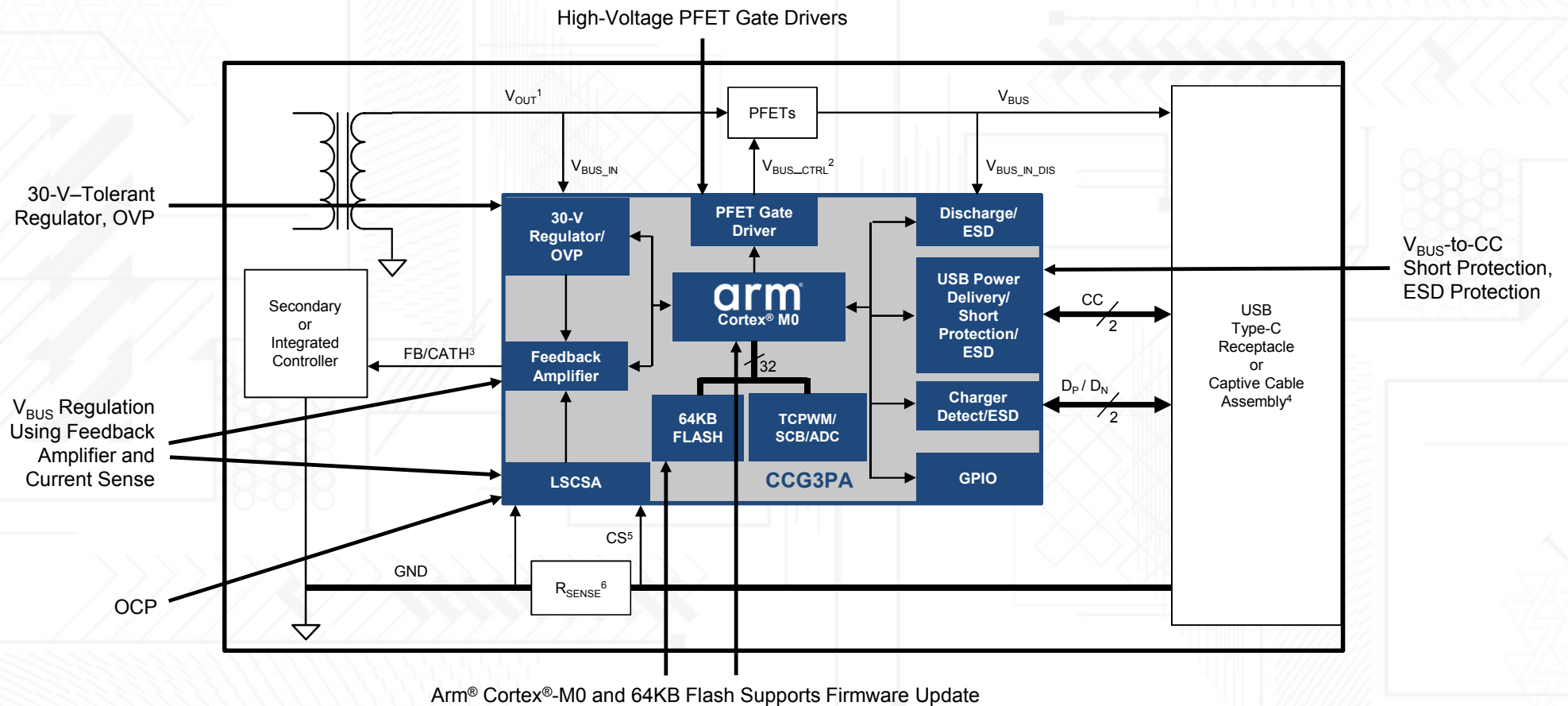
可用性

生产状态: 现在

⁵ 终结电阻: DFP时配置R_p, UFP时配置R_d

CCG3PA 减少BOM从而简化系统设计

Power Adapter Using CCG3PA



¹ Output voltage of the AC-to-DC adapter

² Signal to control V_{BUS} load switch

³ Output voltage selection using feedback control

⁴ A cable permanently attached to the AC adapter

⁵ Current-sensing input

⁶ Resistor used to sense overcurrent

CCG3PA 解决方案示例: Type-C 电源适配器/手机充电器

CCG3PA 参数

设计挑战

- 电源适配器/手机充电器必须支持最新标准
- 必须非常便于设计
- 必须高度集成以降低BOM成本
- 必须支持再编程以便随USB-IF标准更新
- 对空载条件有工业级别的低功耗要求

CCG3PA解决方案

- 提供支持PD3.0的Type-C解决方案, 同时支持可编程供电以及QC4.0快速充电协议
- 使用ARM® Cortex®-M0内核, 以及经过认证的USB-PD协议栈
- 集成了稳压单元, 30V耐受调节器, VBUS-to-CC短路保护, 高电压PFET栅极驱动器和ESD保护
- 支持自由的在线升级, 固件升级高度兼容
- 提供低功耗模式: 30 μ A (深度睡眠模式)

更多建议

Webpages: [Type-C](#), [CCG3PA](#), 和 [Reference Design](#)

Datasheet: [CCG3PA Datasheet](#)

如何开始

[联系销售](#)获取 CCG3PA 评估板

¹ AC-to-DC适配器输出电压

² V_{BUS} 负载开关的控制信号

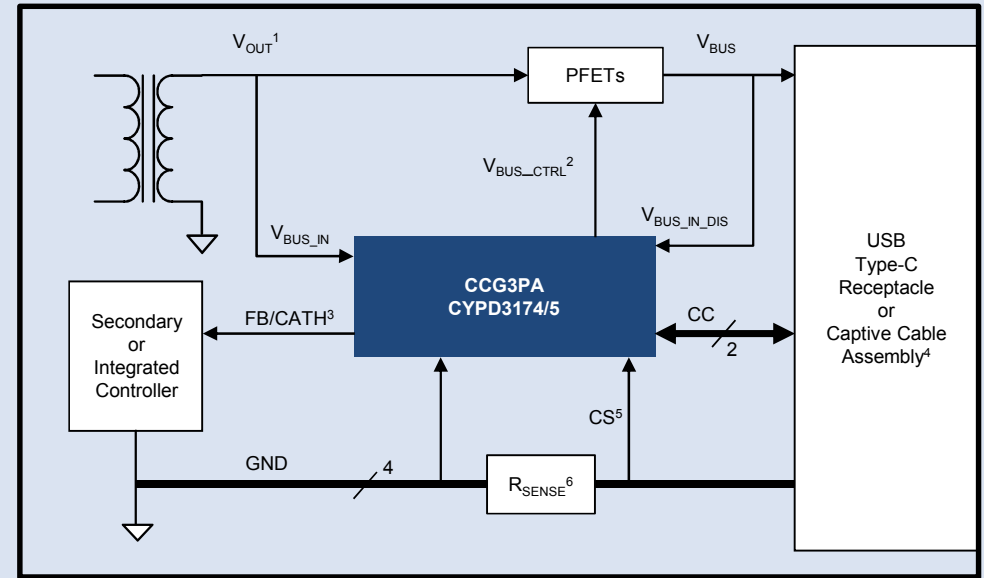
³ 采用反馈的方式选择输出电压

⁴ 永久连接在交流适配器上的电缆

⁵ 电流检测输入

⁶ 用于检测过流的电阻

使用CCG3PA的Type-C 电源适配器/手机充电器



全新智能手机充电器 使用 USB-C 接口

CCG3PA 支持手机充电器所需的 QC 4.0 以及 PD 3.0 PPS 功能



CCG3PA 解决方案示例: Type-C 汽车充电器

CCG3PA 参数

设计挑战

- 汽车充电器必须支持最新标准
- 必须非常便于设计
- 必须高度集成以降低BOM成本
- 必须支持再编程以便随USB-IF标准更新
- 对空载条件有工业级别的低功耗要求

CCG3PA 解决方案

- 提供支持PD3.0的Type-C解决方案, 同时支持可编程供电以及QC4.0快速充电协议
- 使用ARM® Cortex®-M0内核, 以及经过认证的USB-PD协议栈
- 集成了稳压单元, 30V耐受调节器, VBUS-to-CC短路保护, 高电压PFET栅极驱动器和ESD保护
- 支持自由的在线升级, 固件升级高度兼容
- 提供低功耗模式: 30 μ A (深度睡眠模式)

更多建议

Webpages: [Type-C](#), [CCG3PA](#), 和 [Reference Design](#)

Datasheet: [CCG3PA Datasheet](#)

如何开始

[联系销售](#)获取 CCG3PA 评估板

¹ AC-to-DC适配器输出电压

² V_{BUS} 负载开关的控制信号

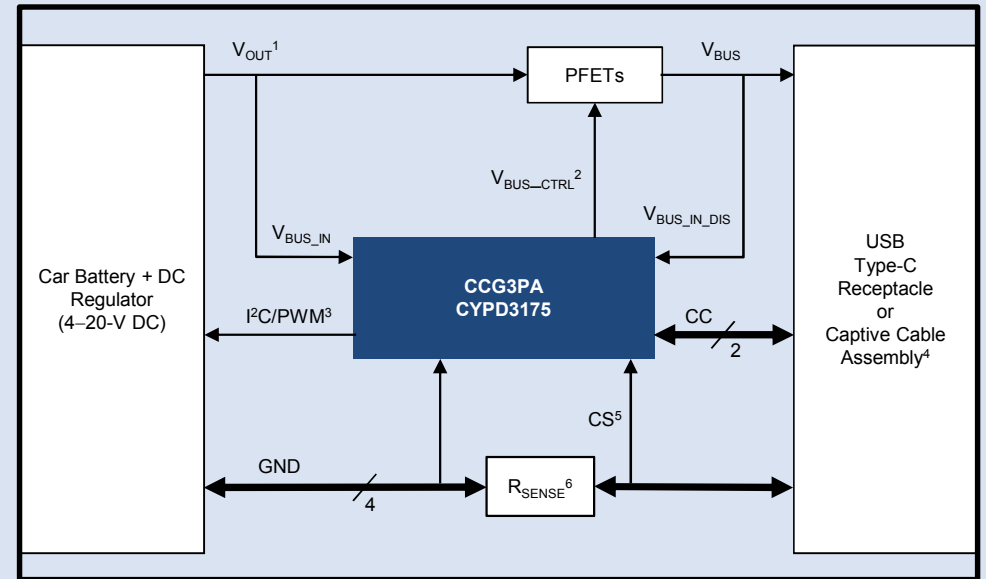
³ 使用I²C 或 PWM选择输出电压

⁴ 永久连接在交流适配器上的电缆

⁵ 电流检测输入

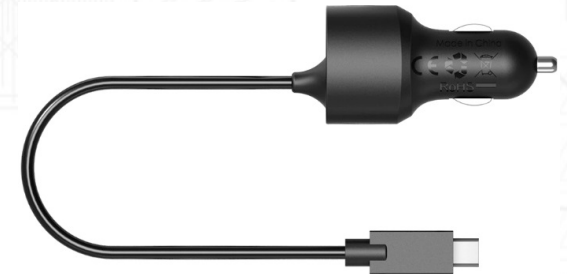
⁶ 用于检测过流的电阻

使用CCG3PA的汽车充电器



使用USB-PD的USB-C充电器

CCG3PA 支持所有的PD配置至100-W



CCG3PA 解决方案示例: Type-C Power Bank

CCG3PA 参数

设计挑战

- 充电宝必须支持最新标准
- 必须非常便于设计
- 必须高度集成以降低BOM成本
- 必须支持再编程以便随USB-IF标准更新
- 对空载条件有工业级别的低功耗要求

CCG3PA 解决方案

- 提供支持PD3.0的Type-C解决方案, 同时支持可编程供电以及QC4.0快速充电协议
- 使用ARM® Cortex®-M0内核, 以及经过认证的USB-PD协议栈
- 集成了稳压单元, 30V耐受调节器, VBUS-to-CC短路保护, 高电压PFET栅极驱动器和ESD保护
- 支持自由的在线升级, 固件升级高度兼容
- 提供低功耗模式: 30 μ A (深度睡眠模式)

更多建议

Webpages: [Type-C](#), [CCG3PA](#), 和 [Reference Design](#)

Datasheet: [CCG3PA Datasheet](#)

如何开始

[联系销售](#)获取 CCG3PA 评估板

¹ 电池电压

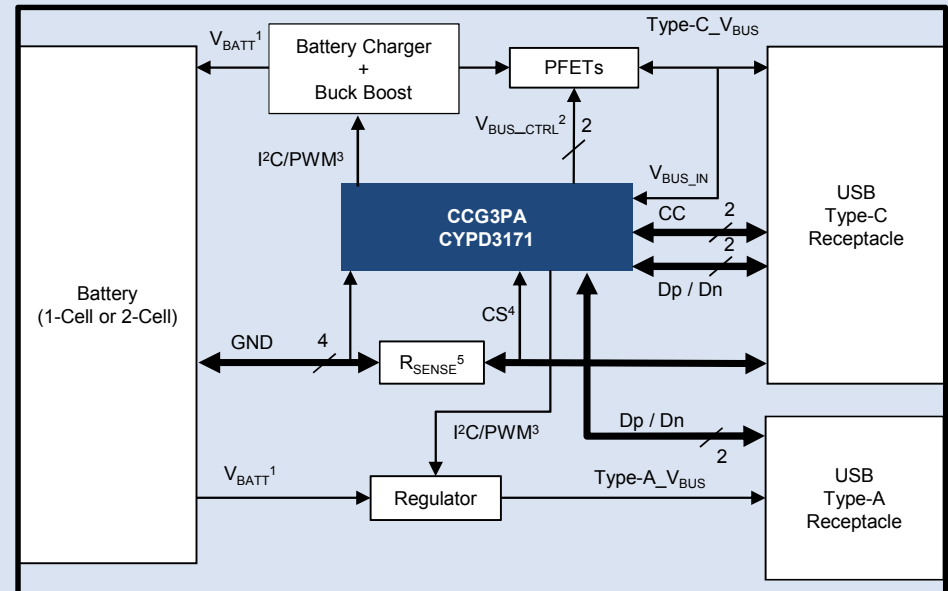
² V_{BUS} 负载开关的控制信号

³ 使用I²C 或 PWM选择输出电压

⁴ 电流检测输入

⁵ 用于检测过流的电阻

使用CCG3PA的Type-C充电宝



使用USB-PD的USB-C充电宝

CCG3PA 能同时支持Type-C和Type-A两种接口



Type-C 参考设计

[Click Here](#) for all Type-C Reference Designs

Overview

USB PD 3.0

Features

Products

Kits

Reference Designs

Design Support

Videos

Presentations

Cypress has developed numerous Type-C reference designs using CCGx to help reduce your design cycle time, effort and risk. Each reference design has been built and tested.

Applications	CCG1	CCG2	CCG3	CCG4	HX3C	CCG3PA
Electronically Marked Cable Assembly (EMCA)	Available	Available	-	-	-	-
Type-C to Legacy USB	Available	-	-	-	-	-
Type-C to DisplayPort	Available	Available	Available	-	-	-
Type-C to HDMI/VGA/DVI	Available	Available	Available	-	-	-
Monitor/Dock	-	Available	-	Available	Available	-
Charge-Through Dongle	-	-	Available	-	-	-
18W Power Adapter	-	Available	-	-	-	-
20W Power Adapter	-	Available	-	-	-	-
24W Power Adapter	-	Available	-	-	-	-
Car Charger	-	Available Available	-	-	-	Available (Southchip)
Power Bank	-	Available	Available	-	-	Available (Southchip 18W) Available (Southchip 45W)
QC4.0 Cell Phone chargers 27W	-	-	-	-	-	Available (Power Integration) Available (Diodes)
Notebook Adapter 45W	-	-	-	-	-	Available (MPS)
HDMI over USB-C Alternate Mode	-	-	Available	-	-	-

Please submit a case in the [Online Tech Support Case System](#) for any further information.

网站上的参考设计实例



Enter your keywords

Community | English | 中文 | My account

SOLUTIONS | PRODUCTS | DESIGN SUPPORT | BUY & SAMPLE | ABOUT CYPRESS

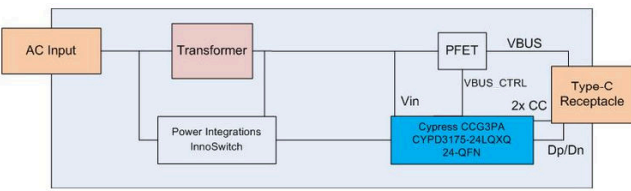
Home > Software & Tools > Reference Designs > EZ-PD™ CCG3PA USB-C Mobile Power Adapter Solution using Power Integrations

View published | New draft | Moderate

EZ-PD™ CCG3PA USB-C Mobile Power Adapter Solution using Power Integrations

Last Updated: May 29, 2017

The CCG3PA 27W Mobile Power Adapter Board is a receptacle based Type-C power adapter which supports a maximum power profile of 27W (9V, 3A). The two major components on the board are Cypress's EZ-PD CCG3PA (CYPD3175-24LQXQ) controller and Power Integrations InnoSwitch family's AC-DC controller. This design is targeted towards mobile phone Power Adapters.



CCG3PA regulates the VBUS voltage by controlling the feedback node of the InnoSwitch AC-DC controller. CCG3PA monitors and handles fault protection like Over-Voltage, Under-Voltage, Over-Current, Short-Circuit and Over-Temperature. CCG3PA drives the external PFET and also controls VBUS discharge with integrated discharge resistors. CYPD3175-24LQXQ is factory programmed with DFP CC with Direct Feedback Bootloader, the application firmware for this solution is available in CCGx SDK 3.2 and any further customization can be done using the EZ-PD™ Configuration utility (refer section 2.1.3 below for more details). CCG3PA CYPD3175-24LQXQ for this solution is available in 24-QFN package.

Reference Design Features:

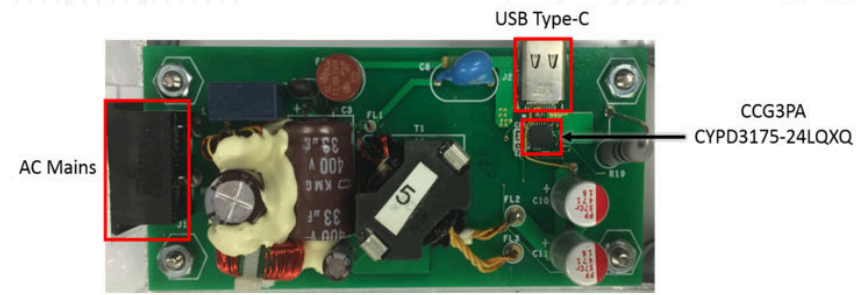
- Delivers up to 27W of power to charge USB PD3.0/QC 4.0 enabled mobile phones
- Supports USB Power Delivery 3.0 for Programmable Power Supply (PPS)
- Supports Qualcomm Quick Charge (QC) 4.0
- Integrates VBUS-to-CC short protection
- Reduces BOM with integrated:
 - Single-chip primary and secondary side controller
 - 30-V Tolerant regulator
 - VBUS PFET gate drivers
 - Feedback amplifier to directly drive Opto-Coupler
 - Low-side current sense amplifier
 - Legacy charge support on DP/DM lines
 - ESD on VBUS, CC and DP/DM

RELATED RESOURCES

Other Resources (1)
Datasheets (1)

RELATED PAGES

EZ-PD™ CCG3PA USB Type-C and Power Delivery



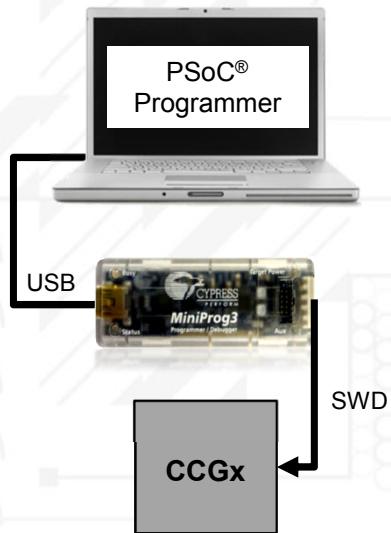
Need help? Ask a question and find answers in the [Cypress Developer Community](#).

Related Files			
File Title	Language	Size	Last Updated
 Solution Design Files.zip		415.11 KB	06/04/2018
 CCG3PA Mobile Power Adapter Demo User Guide.zip	English	322.06 KB	11/16/2017

CCGx 产品是可编程的和可在线升级的

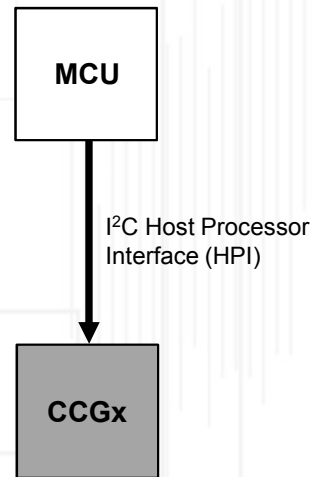
- CCGx 固件可以在线升级从而迅速跟上USB-IF规范的变化
 - 可以使用 SWD, I2C或者 CC对芯片内部的flash随时编程

更新CCGx使用SWD



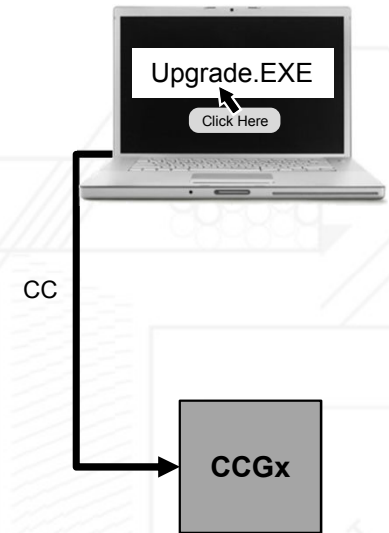
在产品开发阶段在电脑端使用 PSoC Programmer软件和 MiniProg3 USB程序下载器进行编程

更新CCGx使用I²C



在产线上, 如果 USB Type-C 的产品有额外的MCU, 可以使用I2C的方式进行编程

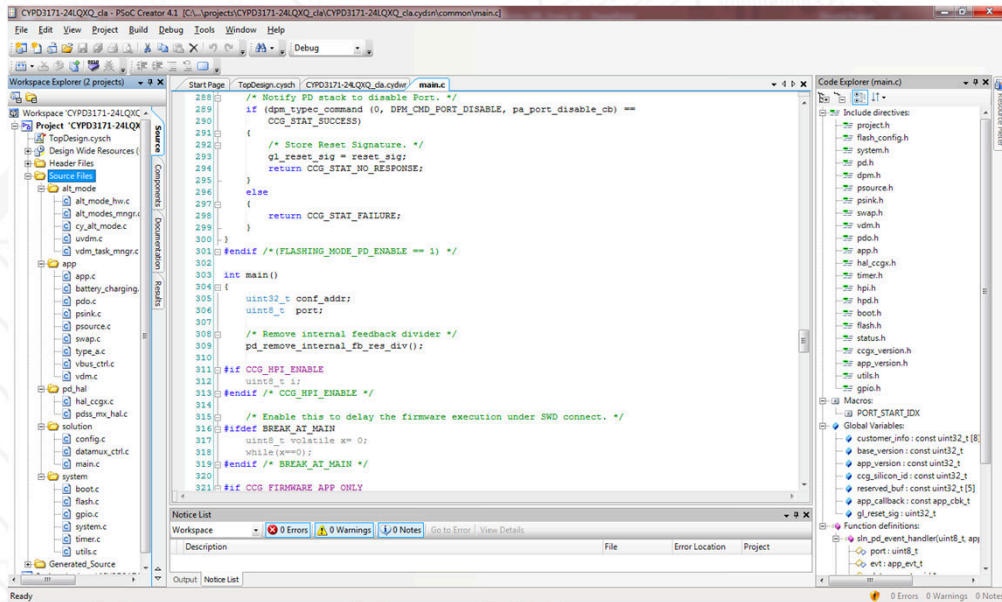
更新CCGx使用CC



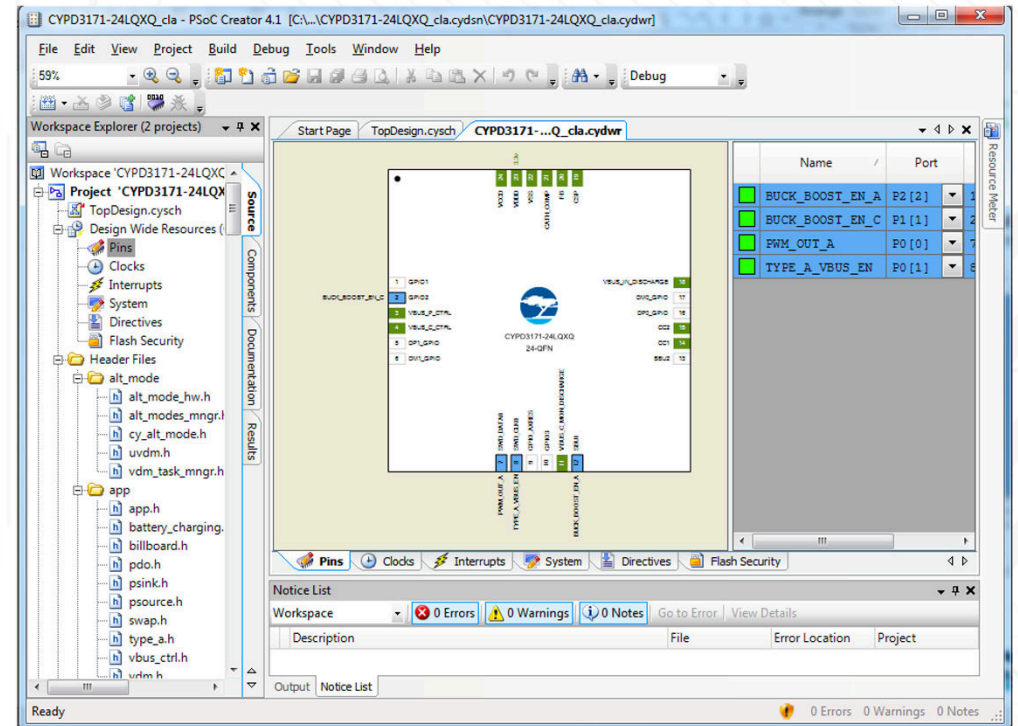
在最终用户手中, 产品制造商可以提供在PC上的固件升级程序进行产品的升级

USB-PD 软件开发包(SDK)：市场上唯一的PD软件开发包

在USB-IF认证过的协议栈上开发你自己的C语言的应用



引脚,模块和原理图的定义

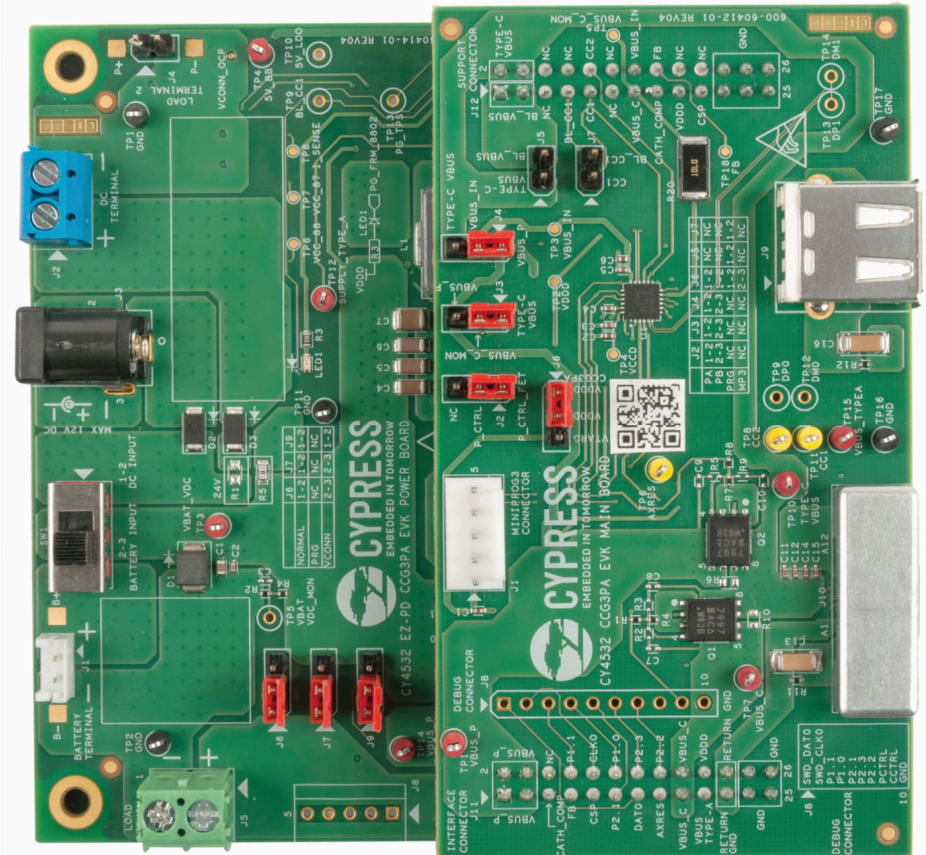


CCG3PA 评估板(CY4532)

■ CCG3PA 评估板提供如下功能:

- 支持电源适配器,充电器和充电宝
- 一个Type-C的供电或者受电口, 一个Type-A供电口
- 支持USB PD3.0 含PPS
- 支持QC 4.0, BC 1.2, Apple Charging 2.4A, 和 Samsung AFC¹ 充电协议
- 支持1-cell 和 2-cell 电池(充电宝应用)
- 给笔记本电脑, 手机等使用USB充电的设备供电
- 固件可升级

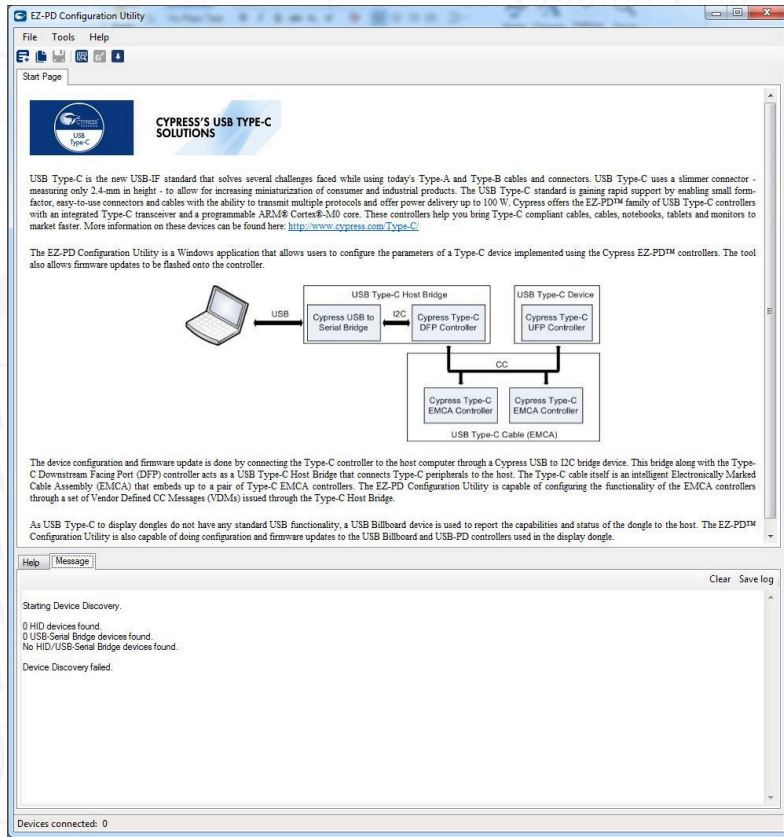
CCG3PA Evaluation Kit (CY4532)



¹ Adaptive Fast Charging

EZ-PD Configuration Utility 和 EZ-PD Analyzer

下载程序通过SWD, I²C, CC, USB 或 SBU



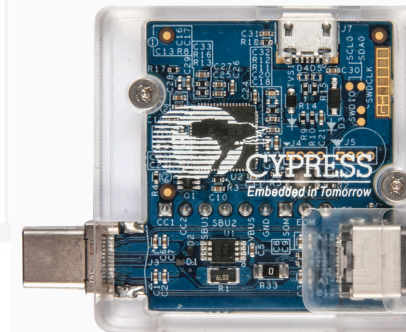
调试和分析USB-PD数据报

SNo	Status	SOP	Message	Mag Id	Data Role	Power Role	Obj Count	Data	Start Time (us)	Duration (us)	Delta (us)	VBUS (mV)
26	OK	SOP	VDM	5	UFP	SNK	1	0x1A4F 0xFF018144	4,292,10...	639	116	5,115
27	OK	SOP	GD_CRC	5	DFP	SRC	0	0xB61	4,292,10...	502	89	5,120
28	OK	SOP	VDM	0	DFP	SRC	2	0x216F 0xFF018110 0x1	4,292,10...	768	369	5,120
29	OK	SOP	GD_CRC	0	UFP	SNK	0	0x41	4,292,10...	504	75	5,120
30	OK	SOP	VDM	6	UFP	SNK	2	0x2C4F 0xFF018150 0x1A	4,292,10...	773	144	5,120
31	OK	SOP	GD_CRC	6	DFP	SRC	0	0xD61	4,292,09...	501	89	5,126
32	OK	SOP	VDM	1	DFP	SRC	2	0x236F 0xFF018111 0x806	4,292,09...	768	4,429	5,120
33	OK	SOP	GD_CRC	1	UFP	SNK	0	0x241	4,292,09...	504	75	5,120
34	OK	SOP	VDM	7	UFP	SNK	1	0x1E4F 0xFF018151	4,292,09...	639	116	5,120
35	OK	SOP	GD_CRC	7	DFP	SRC	0	0xF61	4,292,09...	502	98	5,120
36	OK	SOP	VDM	0	UFP	SNK	2	0x204F 0xFF018106 0x9A	4,291,87...	773	213,103	5,126
37	OK	SOP	GD_CRC	0	DFP	SRC	0	0x161	4,291,87...	501	106	5,120
38	OK	SOP	PR_SWAP	1	UFP	SNK	0	0x24A	4,291,19...	504	682,587	5,120
39	OK	SOP	GD_CRC	1	DFP	SRC	0	0x361	4,291,19...	501	106	5,115
40	OK	SOP	ACCEPT	2	DFP	SRC	0	0x563	4,291,19...	502	143	5,120
41	OK	SOP	GD_CRC	2	UFP	SNK	0	0x441	4,291,19...	504	74	5,115
42	OK	HARD_R...							4,290,38...	290	805,195	4,218
43	OK	SOP	SRC_CAP	0	DFP	SRC	1	0x1161 0x36019096	4,289,24...	635	1,143,4...	5,126
44	OK	SOP	GD_CRC	0	UFP	SNK	0	0x41	4,289,24...	505	75	5,115
45	OK	SOP	REQUEST	0	UFP	SNK	1	0x1042 0x16000000	4,289,24...	638	116	5,115
46	OK	SOP	GD_CRC	0	DFP	SRC	0	0x161	4,289,24...	501	90	5,120
47	OK	SOP	ACCEPT	1	DFP	SRC	0	0x363	4,289,24...	502	271	5,115
48	OK	SOP	GD_CRC	1	UFP	SNK	0	0x241	4,289,24...	505	74	5,120
49	OK	HARD_R...							4,288,73...	290	502,232	4,708

Transaction Overview
Message Type : Data Message
Message ID : Source Capabilities
SOP Type : HARD_RESET
Data Obj Count : 1

Description	Value
SOP Type	HARD_RESET

File Opened : C:\Users\Dustin\Desktop\CCG1_UFP_Issue_Mac_Chrome.ccgx



CY4500 EZ-PD Analyzer



电源适配器产品通过USB-IF认证的需求

- 电源适配器通过USB-PD兼容性认证必须通过如下测试
 - Ellisys
 - GRL
 - LeCroy
 - MQP
 - QuadraMax
 - BC 1.2 and Inrush Current

电源适配器通过USB-IF认证的设计指导

- 不要在USB-C口上的DP/DP上开启苹果充电协议和QC充电器协议
- 在固定PDO情况下, 电源适配器可以在错误事件(OCP/OVP/UVP/SCP/OTP)发生的时候挂起, 但是对于PPS模式下, 不能直接挂起, 在挂起前必须有重试机制
- 在USB-C的连接头上对于电源适配器至少有一个 FET, 对于充电宝至少有两个
- 对于大于5V的非PPS的PDO, 不要开启电流限制功能
- 不要开启线损补偿
- CC脚必须有能力承受和20V VBUS脚短路

为什么选择CCG3PA

- 自由的固件开发: 市面上唯一的开放SDK的PD控制器
- 完全验证的兼容USB-IF PD3.0 PPS 的固件
- 通过QC4.0+和PD3.0 PPS的电源控制芯片
- 全部可配置的引脚分配, 多个PWM口和多种串行通信的支持
- 很容易从一个平台切换到另一个平台. CCG3, CCG4, CCG3PA, CCG5. 电源适配器, 笔记本电脑, 手机充电器和线缆都使用同样的代码
- 支持USB-C口的固件升级
- 很多不同厂家的AC-DC和DC-DC控制器我们的参考设计已经做好
- Cypress的USB-PD应用工程师专家提供世界一流的技术支持
- 在USB-IF组织的兼容性测试活动中提供支持, 我们将会对所有客户的产品进行预测试

Lab 1:使用CY4532 CCG3PA EVK 的Type-C和Type-A口进行VBUS 电源交互

Lab 1: VBUS 电源交互

■ 目标

- 学习CY4532 CCG3PA EVK是如何通过 USB-PD进行VBUS交互的
- 学习使用CY4500 EZ-PD协议分析工具捕捉和分析Type-C接口的交互数据
- 学习CY4532 EZ-PD CCG3PA EVK's 作为电源适配器同时给Type-A和Type-C供电的能力

■ 试验详情

- 使用EZ-PD 协议分析器 观察和分析两个Type-C设备之间进行PD通信的 数据
- 使用EZ-PD 协议分析器调试你设计的产品

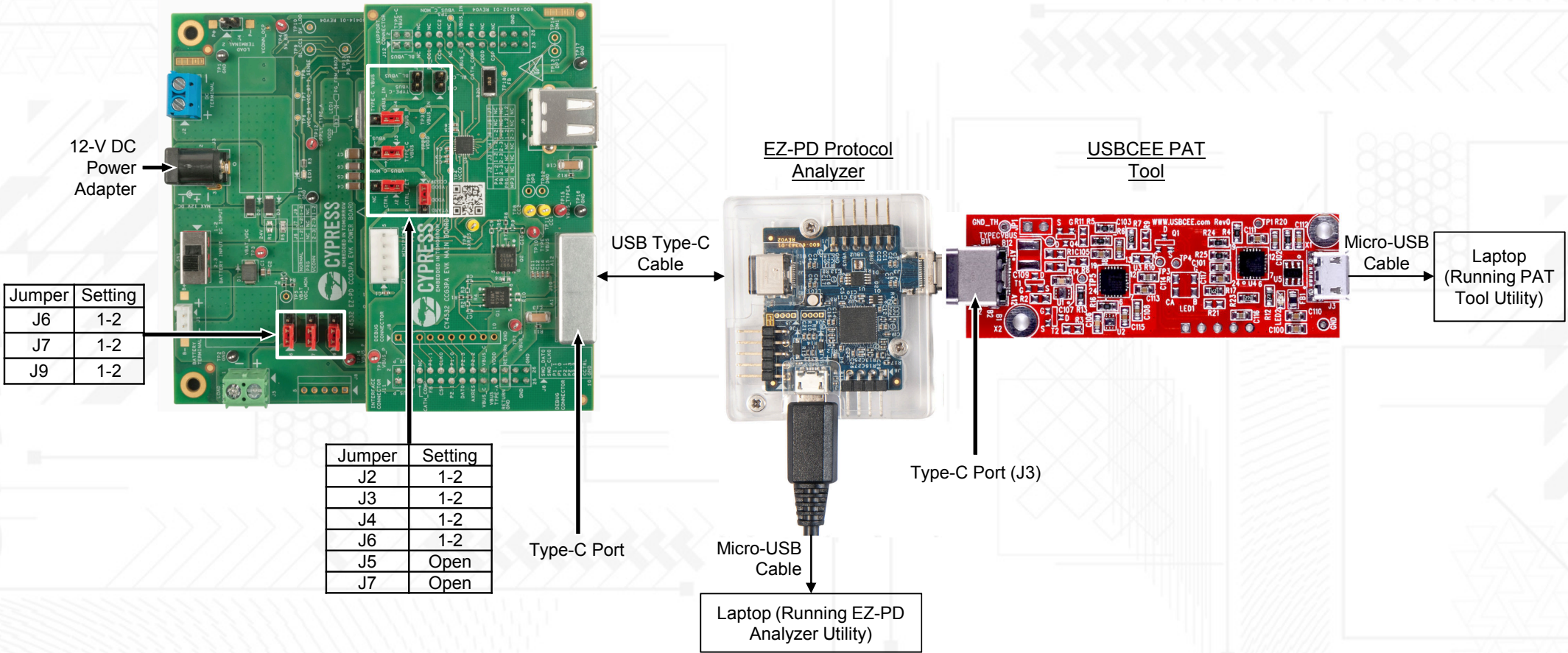
■ 硬件工具

- EZ-PD CCG3PA Evaluation Kit (CY4532) CCG3PA评估板
- EZ-PD Protocol Analyzer (CY4500) PD协议分析器
- USBCEE PAT 电源测试板
- USB-powered device, such as a mobile phone 使用USB充电的设备，如手机

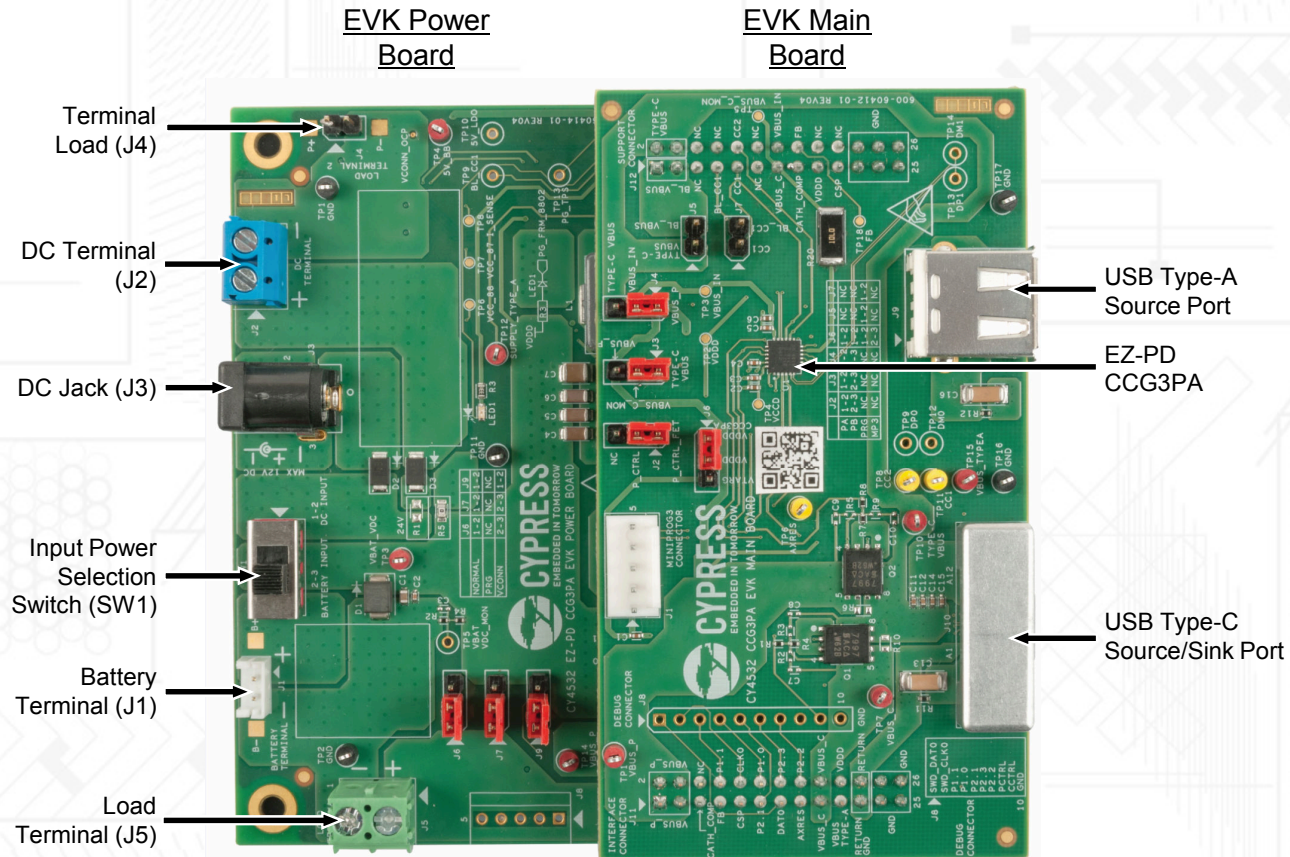
■ 软件工具

- EZ-PD Analyzer Utility
- PAT Tool Utility (USBCEE PAT 电源测试板的工具)

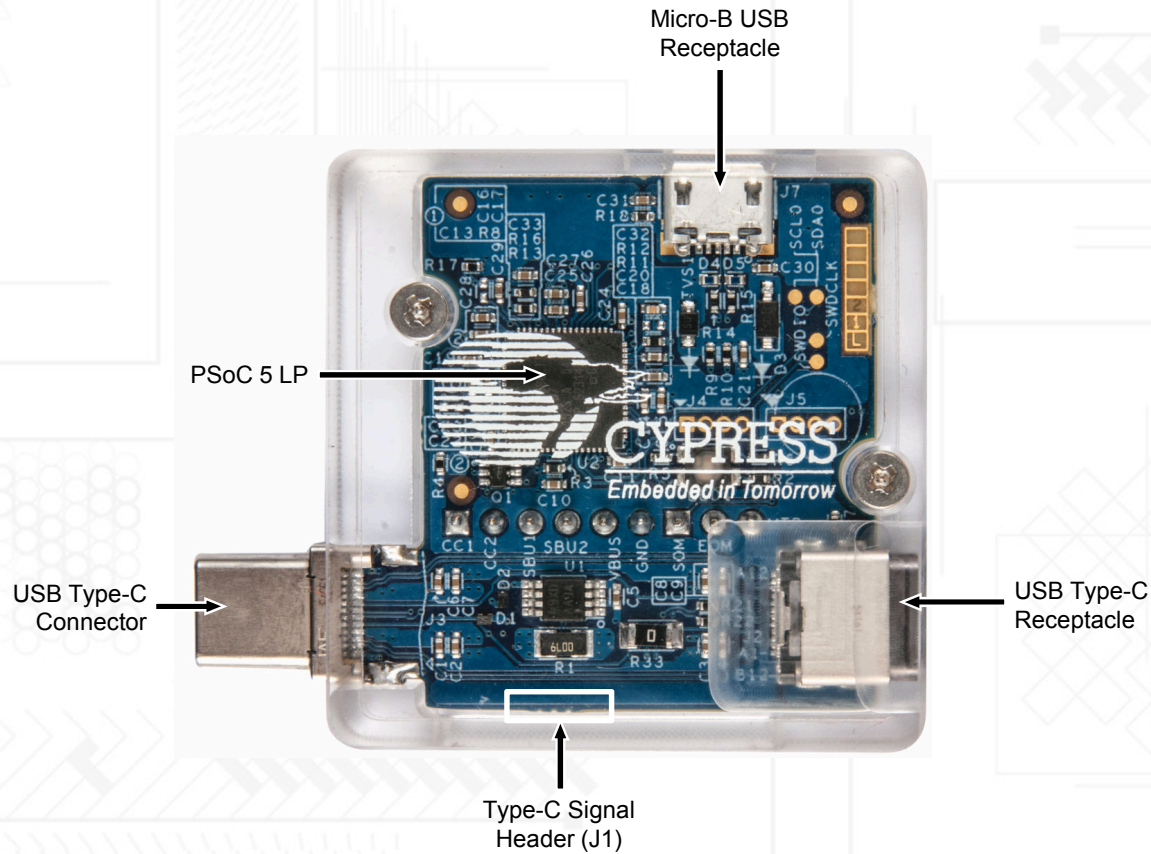
Lab 1: 连接设备



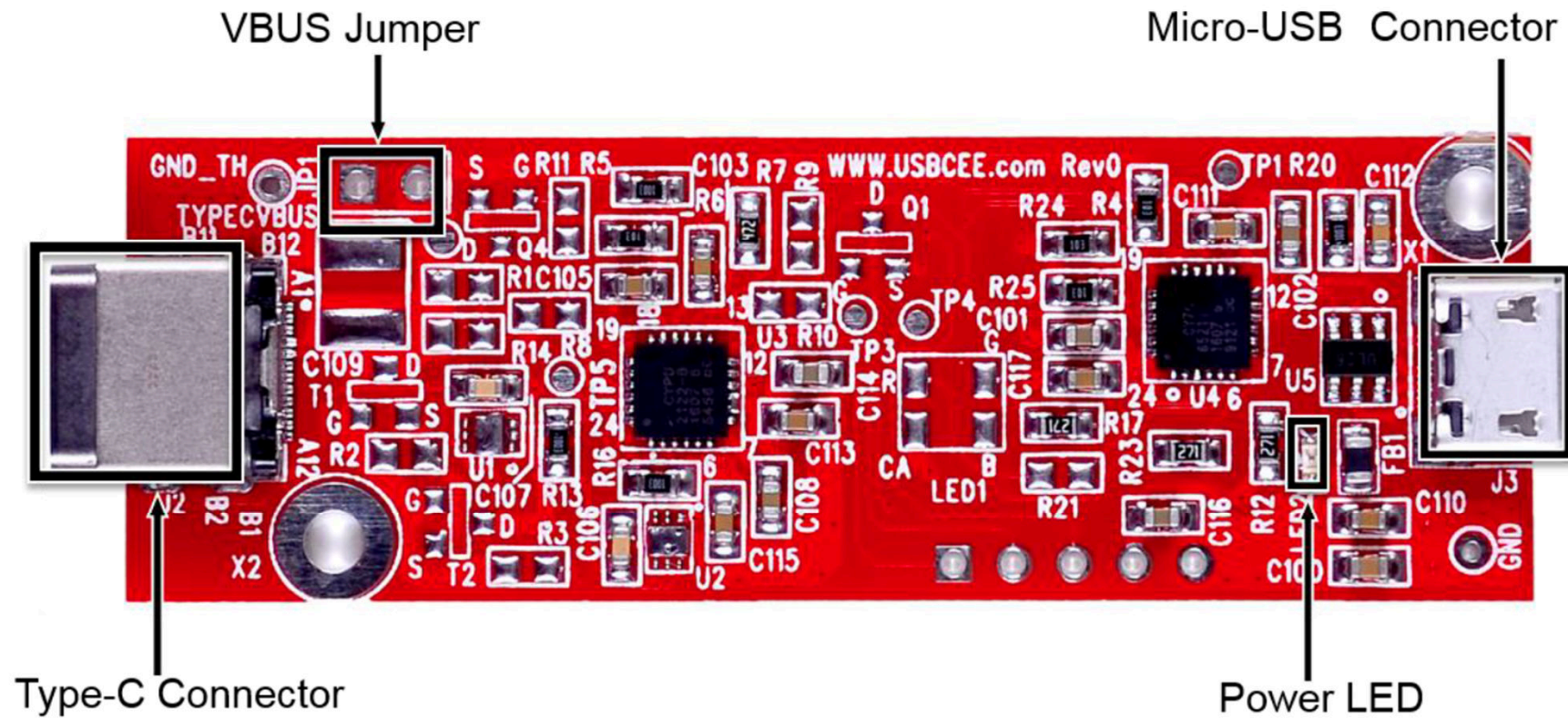
EZ-PD CCG3PA Evaluation Kit (CY4532) 介绍



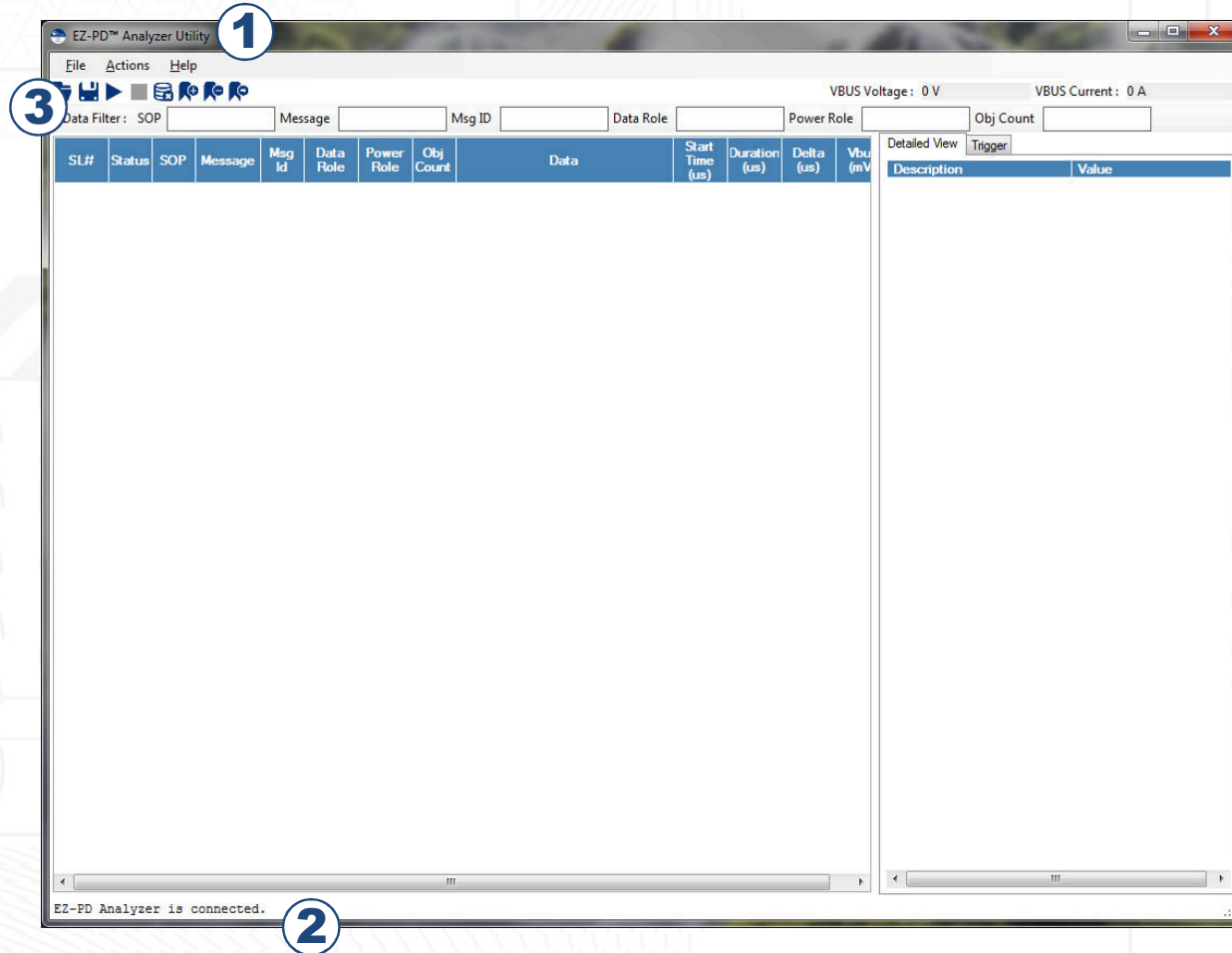
EZ-PD Protocol Analyzer Kit (CY4500) 介绍



USBCEE Power Adapter Tester (PAT) 介绍



Lab 1: 启动软件 EZ-PD Analyzer Utility

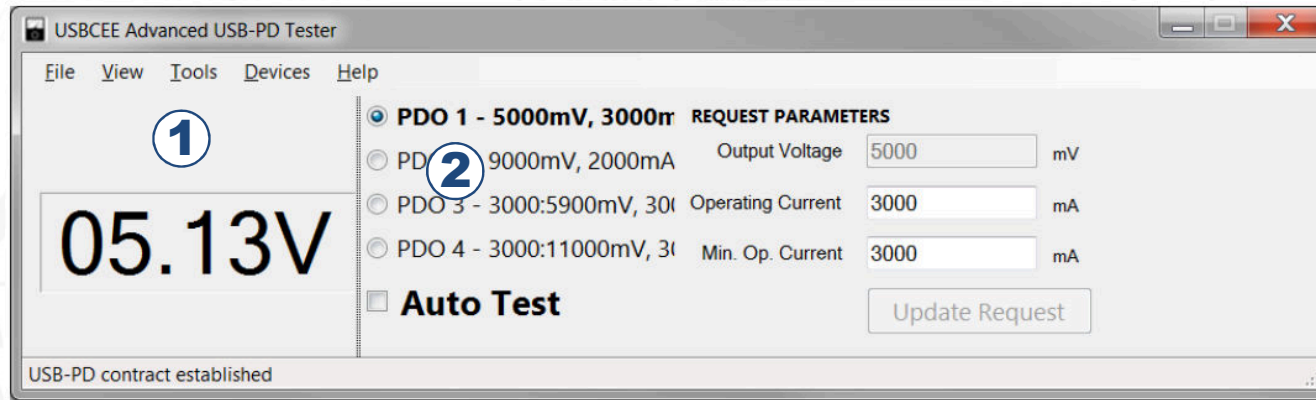


步骤

- 1 启动 EZ-PD Analyzer Utility:
Windows Start Menu >
All Programs >
Cypress Folder >
EZ-PD Analyzer Utility
- 2 确保软件的左下角显示 **EZ-PD Analyzer is Connected.**
- 3 点击**Start Capturing** 按键（三角形的）

Lab 1: PAT Tool Utility

PAT Tool Utility GUI



① 这个面板上会显示PD交互出来的电压

② 这个面板上显示出所有的由CY4532 开发板广播出来的 PDO

使用PAT Tool Utility 请求CY4532 开发板的不同的PDO

Lab 1: 观察EZ-PD Analyzer Utility 数据

EZ-PD™ Analyzer Utility

File Actions Help

Start delta 4,122,171 us Vbus Volt 14.79 V Vbus Current 0.04 A

Data Filter: SOP Type Msg Msg ID Data Role Power Role Obj Count

SL#	Status	SOP	Message	Msg Id	Data Role	Power Role	Obj Count	Data	Start Time (us)	Duration (us)	Delta (us)	Vbus (mV)
1	OK	SOP	Source_Cap	0	DFP	Source	2	0x2161 0x80190F0 0x4A0C8	4,033,551	767	0	5,120
2	OK	SOP	GoodCRC	0	UFP	Sink	0	0x41	4,034,468	507	150	5,225
3	OK	SOP	Request	0	UFP	Sink	1	0x1042 0x220168C8	4,035,421	642	446	5,170
4	OK	SOP	GoodCRC	0	DFP	Source	0	0x161	4,036,129	500	66	5,131
5	OK	SOP	Accept	1	DFP	Source	0	0x363	4,037,125	501	496	5,236
6	OK	SOP	GoodCRC	1	UFP	Sink	0	0x241	4,037,776	506	150	5,186
7	OK	SOP	PS_RDY	2	DFP	Source	0	0x566	4,129,856	500	91,574	14,861
8	OK	SOP	GoodCRC	2	UFP	Sink	0	0x441	4,130,504	507	148	14,850
9	OK	SOP	VDM	3	DFP	Source	1	0x176F 0xFF008001	4,131,113	633	102	14,833
10	OK	SOP	GoodCRC	3	UFP	Sink	0	0x641	4,131,895	506	149	14,861
11	OK	SOP	VDM	1	UFP	Sink	4	0x424F 0xFF008041 0x900004B4 0x0 0xF6400000	4,132,811	1,045	410	14,817
12	OK	SOP	GoodCRC	1	DFP	Source	0	0x361	4,133,920	500	64	14,767
13	OK	SOP	VDM	4	DFP	Source	1	0x196F 0xFF008002	4,134,930	633	510	14,877
14	OK	SOP	GoodCRC	4	UFP	Sink	0	0x841	4,135,714	506	151	14,839
15	OK	SOP	VDM	2	UFP	Sink	1	0x144F 0xFF008082	4,136,599	641	379	14,800
16	OK	SOP	GoodCRC	2	DFP	Source	0	0x561	4,137,307	500	67	14,773

Detailed View Trigger

Description	Value
SOP Type	SOP
Header	0x2161
Reserved (15)	0
Data Objs (14..12)	2
Message Id (11..9)	0
Port Power Role (8)	SOURCE (1)
Spec Rev (7..6)	Rev 2.0 (1)
Port Data Role (5)	DFP (1)
Reserved (4)	0
Msg Type (3..0)	Source Capabilities
Power Data Obj-Source 1	0x80190F0
Type (31..30)	Fixed
Dual-Role Power (29)	No (0)
USB Suspend Supported (28)	No (0)
Externally Powered (27)	Yes (1)
USB Communications Capable (...)	No (0)
Data Role Swap (25)	No (0)
Reserved (24..22)	0
Peak Current (21..20)	10C (default)
Volt in 50mV (19..10)	100(5V)
Max Current in 10mA (9..0)	240(2.40A)
Power Data Obj-Source 2	0x4A0C8
Type (31..30)	Fixed
Dual-Role Power (29)	No (0)
USB Suspend Supported (28)	No (0)
Externally Powered (27)	No (0)
USB Communications Capable (...)	No (0)
Data Role Swap (25)	No (0)

EZ-PD Analyzer is running.

Steps

- ① 这里会显示Type-C连接时所有的PD数据
- ② 这里会显示出解码后的PD的数据
- ③ 这里将会显示出VBUS上实时的电压和电流。电流从 CY4500 的插座到插头的方向为正向。

Lab 2:使用EZ-PD Configuration Utility 修改Type-C的配置参数

Lab 2:使用EZ-PD Configuration Utility 修改Type-C的配置参数

■ 目标

- 学习如何使用 EZ-PD Configuration Utility
- 如何使用EZ-PD Configuration Utility 在CY4532 EZ-PD CCG3PA EVK上修改CCG3PA的Type-C口的配置参数. 更新的配置使用 CY4500 EZ-PD Protocol Analyzer 来做测试和验证.

■ 试验详情

- 使用EZ-PD Configuration Utility, CCG3PA EVK, PAT, 和 CY4500 Protocol Analyzer 进行读,更新, 保存和烧录,测试修改后的CCG3PA设备的参数
- 使用EZ-PD Configuration Utility 更新CCG3PA 的Type-C 口的配置参数, 对于客户的应用不需要修改整个的固件

■ 硬件工具

- EZ-PD CCG3PA Evaluation Kit (CY4532) CCG3PA评估板
- EZ-PD Protocol Analyzer (CY4500) PD协议分析器
- USBCEE PAT Board 电源测试板

■ 软件工具

- EZ-PD Analyzer Utility
- EZ-PD Configuration Utility

Lab 2: 修改 Type-C 的配置

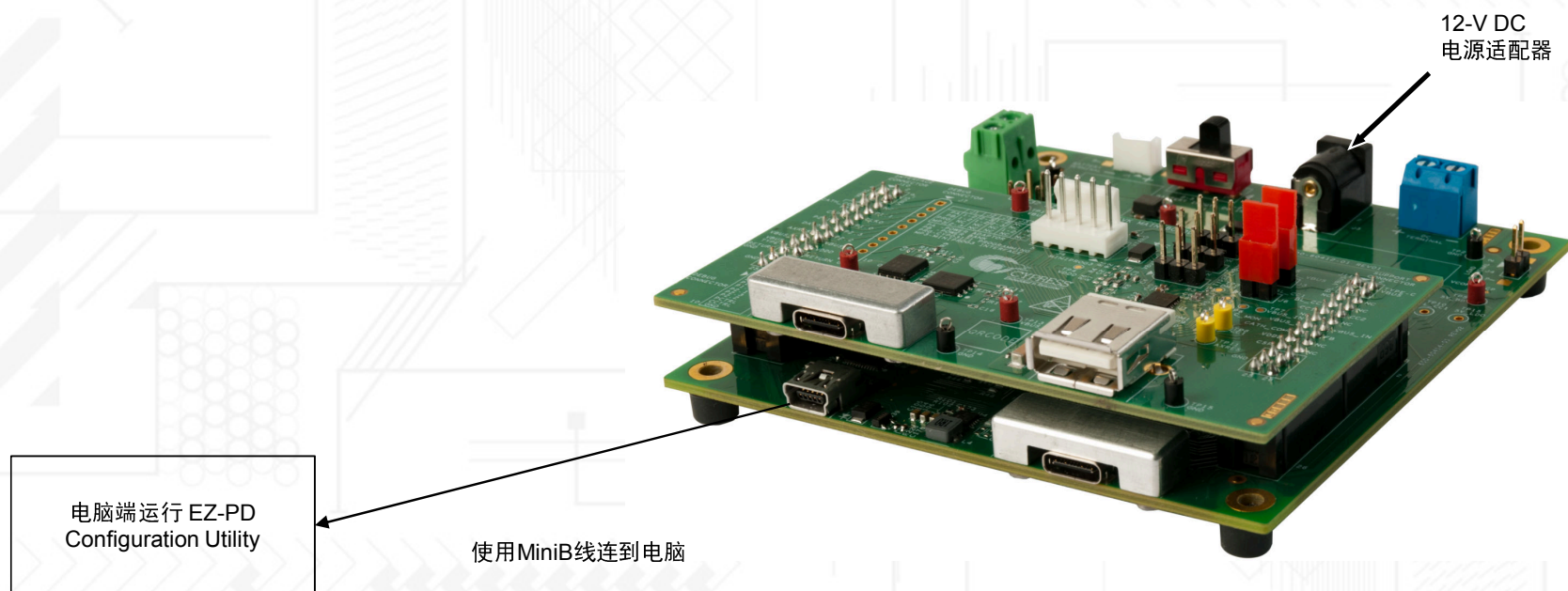
12-V DC
Power
Adapter

Jumper	Setting
J6	Open
J7	Open
J9	Open

Jumper	Setting
J2	1-2
J3	1-2
J4	1-2
J6	1-2
J5	Short
J7	Short

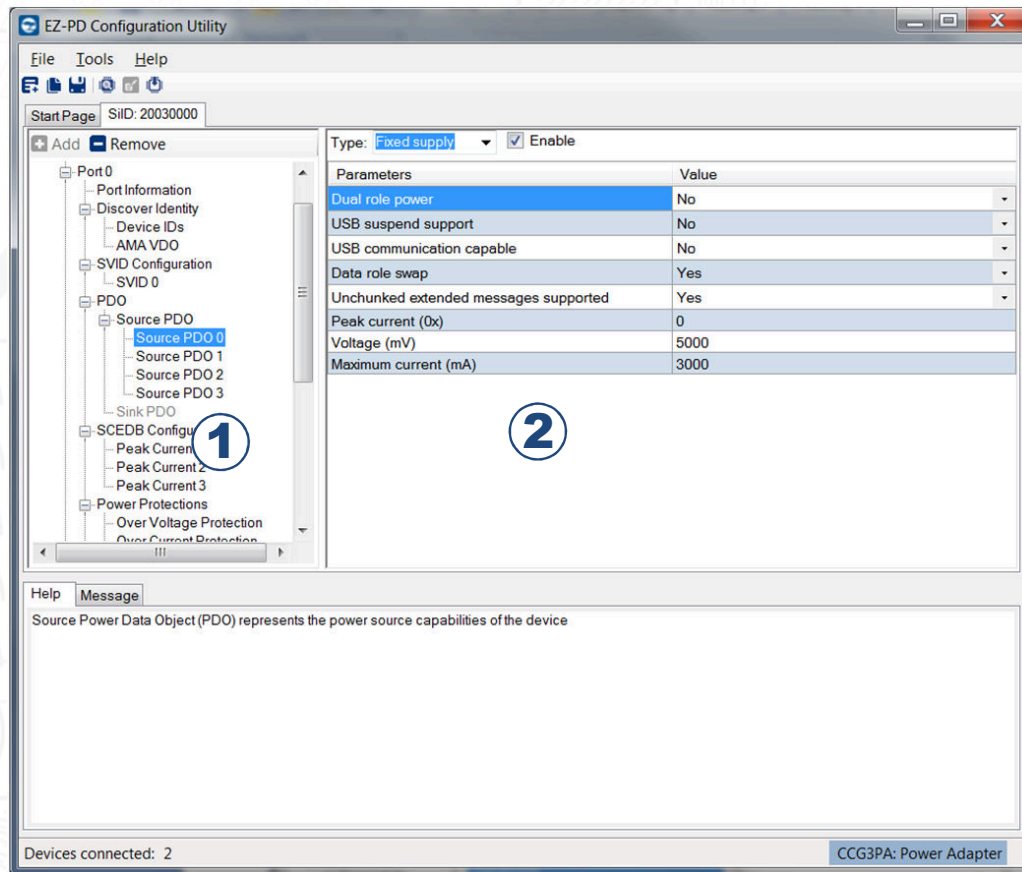
52 Customer Training Workshop: EZ-PD™ CCG3PA Power Delivery Solution

Lab 2: 连接CY4532 EVK 和你的电脑



Lab 2: EZ-PD Configuration Utility

EZ-PD Configuration Utility GUI

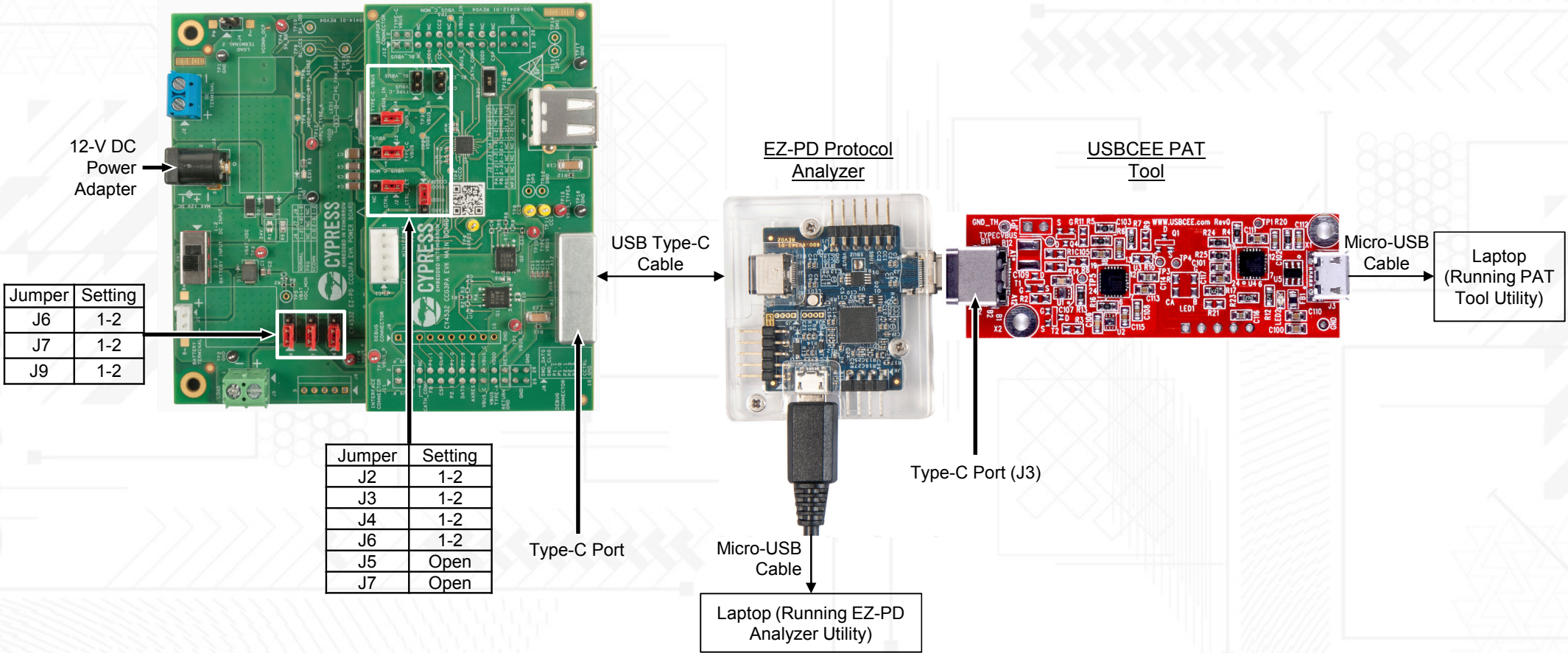


① 这个配置面板显示所有能配置的参数

② 这个面板显示配置参数的详细的项目

使用EZ-PD Configuration Utility 不需要固件的修改,
可以快速的修改你的设计

Lab 2: 测试更新过的参数



Lab 3:观察CCG3PA的PPS功能

Lab 3:观察CCG3PA的PPS功能

■ 目标

- 了解PPS的功能, 使用CY4532 EVK来看CCG3PA是如何支持这个功能
- 捕捉和分析 PAT电源测试板和CY4532 EVK 进行PPS交互的PD数据
- 捕捉和分析 Nubia Z17 NX563J 手机和CY4532 EVK 进行PPS交互的PD数据

■ 试验详情

- This lab introduces the concept of the PPS and type of APDO (augmented power data object) 这个试验介绍介绍PPS和APDO APDO (augmented power data object) 的基本概念
- 用CY4532 EVK演示CCG3PA支持PPS的功能, 在这个试验中将会使用the CY4532 EVK, CY4500 Protocol Analyzer, PAT Test Tool (PAT board)

■ 硬件工具

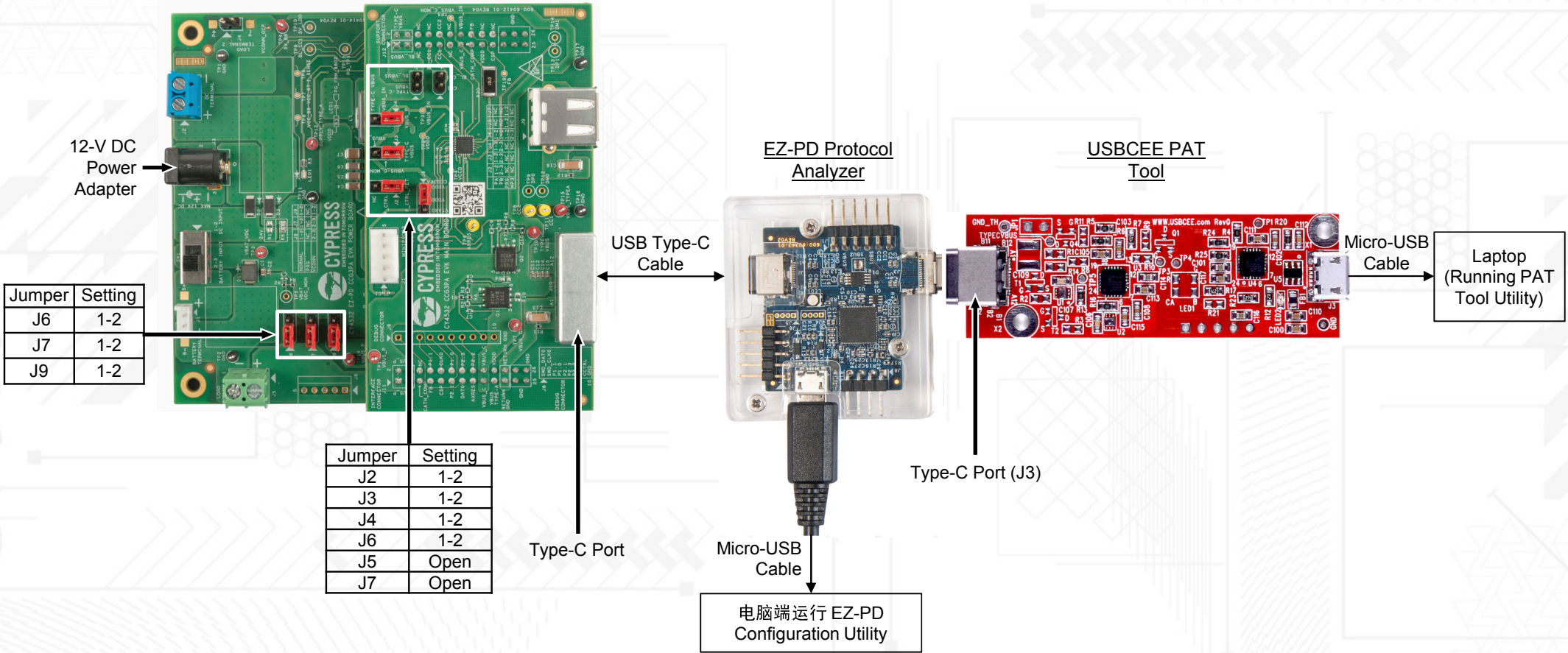
- EZ-PD CCG3PA Evaluation Kit (CY4532) CCG3PA评估板
- EZ-PD Protocol Analyzer (CY4500) PD协议分析器
- USBCEE PAT Board 电源测试板
- 使用Nubia Z17 NX563J 手机演示PPS功能

■ 软件工具

- EZ-PD Analyzer Utility
- PAT Tool Utility (USBCEE PAT 电源测试板的工具)

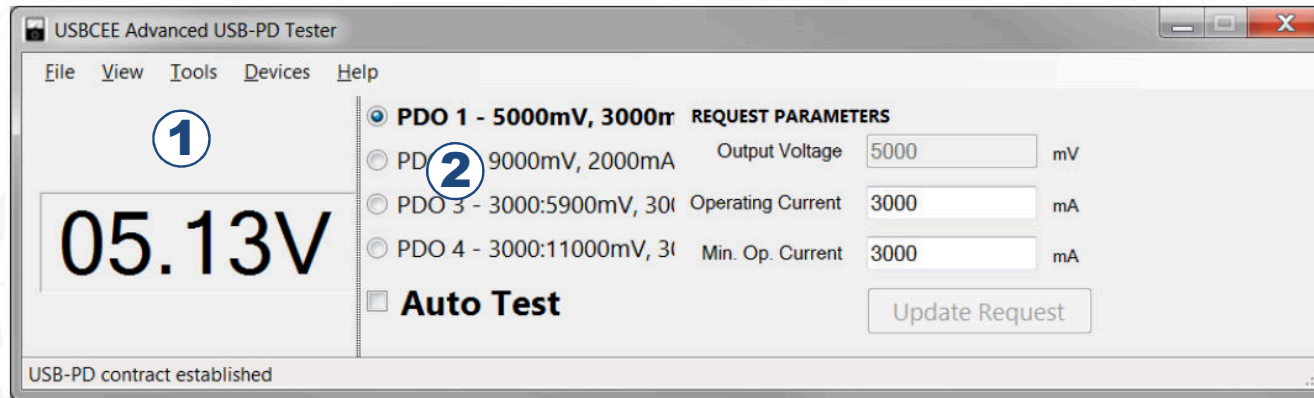
¹ Programmable power supply

Lab 3: 使用PAT Tool观察PPS的功能



Lab 3: PAT Tool Utility

PAT Tool Utility GUI

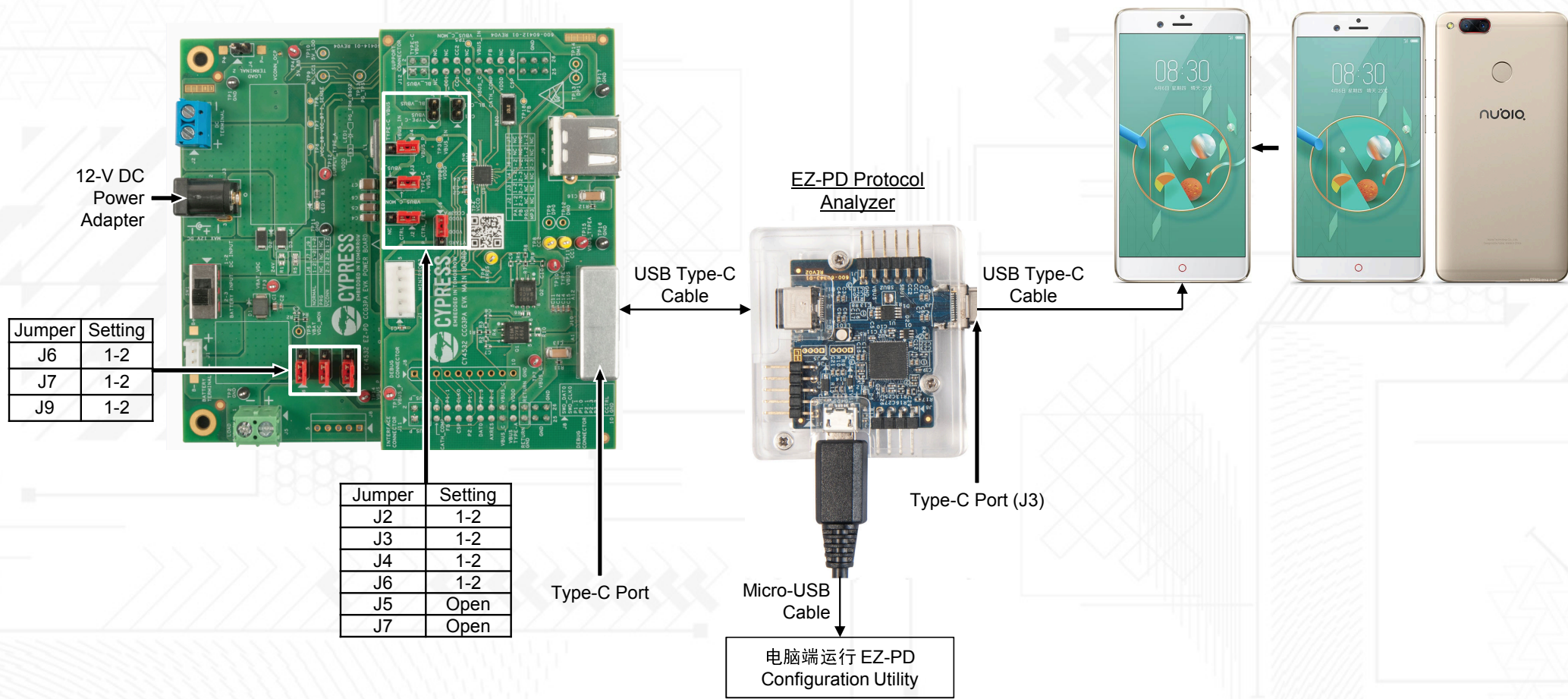


① 这个面板显示PD交互的电压

② 这个面板上显示出所有的由CY4532 开发板广播出来的 PDO

使用PAT Tool Utility 请求CY4532 开发板的不同的PDO

Lab 3: 使用Nubia Z17 手机观察PPS的功能



Lab 4:CCG3PA Power Bank参考设计实例

CCG3PA Power Bank参考设计

赛普拉斯和我们的合作伙伴Southchip, MPS, Active Semi开发了多款基于CCG3PA的Power Bank参考设计. 目前和南芯半导体合作开发的45W(1A + 1B+ 1C) 和低成本18W (2A + 1B + 1C) 方案已经发布了. 设计文档可以从网站下载:

http://www.cypress.com/products/usb-type-c-and-power-delivery#tabs-0-bottom_side-6

Overview

USB PD 3.0

Features

Products

Kits

Reference Designs

Design Support

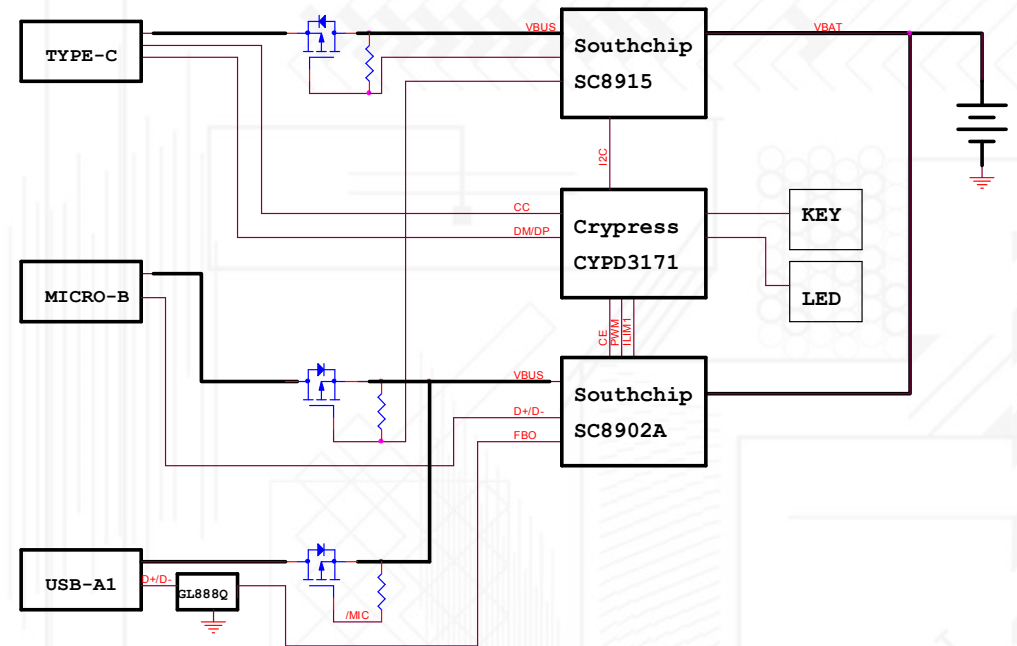
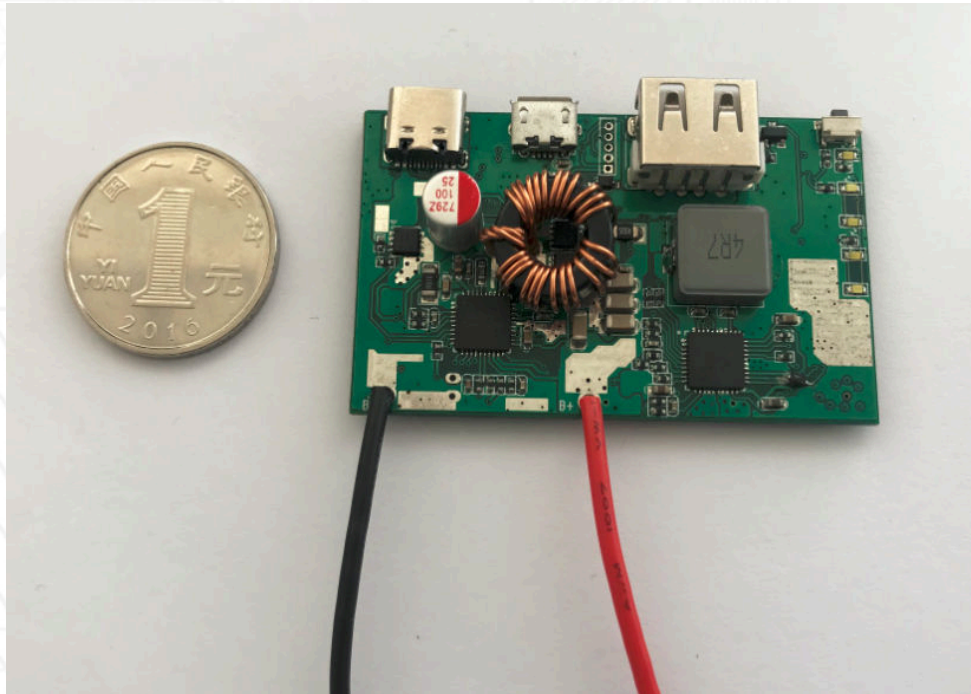
Videos

Presentations

Cypress has developed numerous Type-C reference designs using CCGx to help reduce your design cycle time, effort and risk. Each reference design has been built and tested.

Applications	CCG1	CCG2	CCG3	CCG4	HX3C	CCG3PA
Electronically Marked Cable Assembly (EMCA)	Available	Available	-	-	-	-
Type-C to Legacy USB	Available	-	-	-	-	-
Type-C to DisplayPort	Available	Available	Available	-	-	-
Type-C to HDMI/VGA/DVI Monitor/Dock	Available	Available	Available	-	-	-
Charge-Through Dongle	-	Available	-	Available	Available	-
18W Power Adapter	-	-	Available	-	-	-
20W Power Adapter	-	Available	-	-	-	-
24W Power Adapter	-	Available	-	-	-	-
Car Charger	-	Available	-	-	-	Available (Southchip)
Power Bank	-	Available	Available	-	-	Available (Southchip 18W) Available (Southchip 45W)
QC4.0 Cell Phone chargers 27W	-	-	-	-	-	Available (Power Integration) Available (Diodes)
Notebook Adapter 45W	-	-	-	-	-	Available (MPS)
HDMI over USB-C Alternate Mode	-	-	Available	-	-	-

45W Power Bank 参考设计

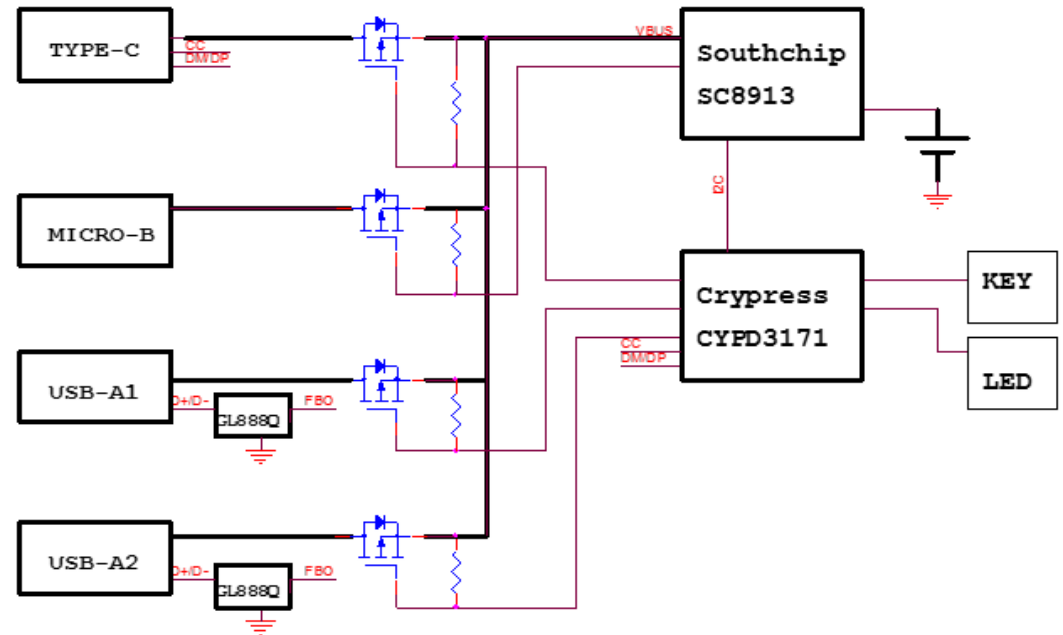
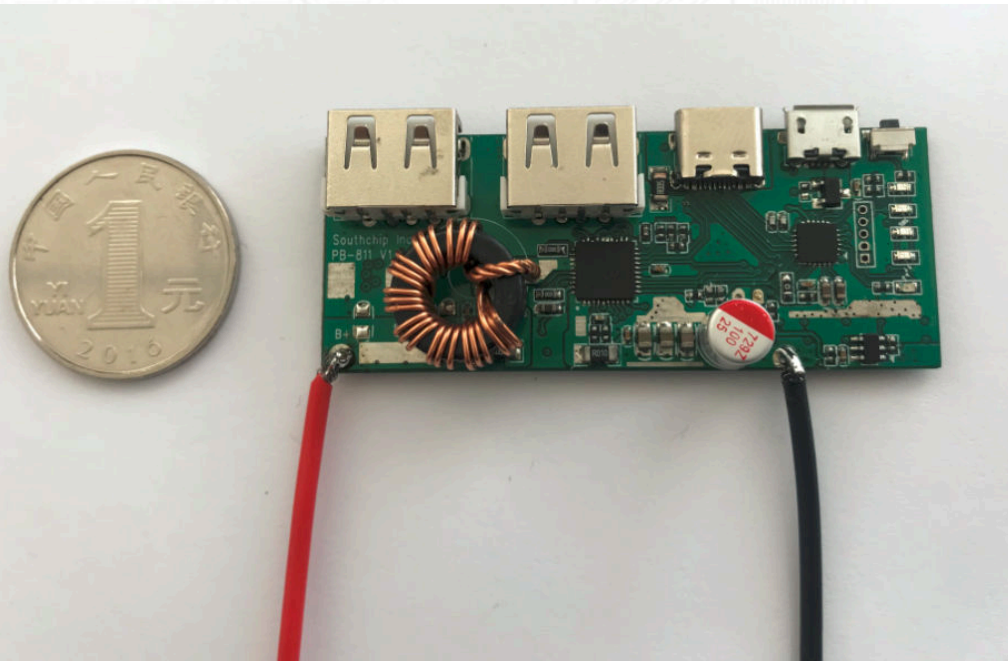


CCG3PA控制SC8915实现Type-C口的输入和输出
CCG3PA控制SC8902A实现Type-A的输出和MicroB的输入

45W Power Bank 输入输出能力

- 电池：基于3串锂电池
- TypeC 口: (45W 最大输入输出)
 - 输出:
 - USBPD: 5V/3A, 9V/3A, 15V/3A, 20V/2.25A, PPS 3~11V 20mV 步进, PPS 3~16V 20mV 步进
 - QC3.0: 5V/9V/12V and 200mV 步进
 - 输入:
 - USBPD: 5V ~ 20v /3A
- Type-A 口: (18W 最大输出)
 - 输出:
 - QC3.0: 5V/9V/12V and 200mV 步进
- Micro- B 口: (18w 最大输入)
 - 输入:
 - QC2.0

低成本18W Power Bank 参考设计



CCG3PA控制SC8913实现所有口的输入和输出

18W Power Bank 输入输出能力

- 基于单串电池，只使用一个DC-DC来实现多口控制（低成本）
- TypeC Port(18W 最大输入和输出):
 - 输出:
 - USBPD: 5V/3A,9V/2A,15V/1.2A, PPS 5~11V/2A (20mV 步进)
 - QC3.0: 5V/9V/12V , 200mV 步进
 - 输入:
 - USBPD: 5V ~ 15v 最大18W
- TypeA Port(18W 最大输出):
 - 输出:
 - QC3.0: 5V/9V/12V , 200mV 步进
- MicroB port(18W 最大输入):
 - 输入:
 - QC 2.0
- 限制:
 - A口和C口同时放电的时候，只支持5V输出

CCG3PA 实现Power Bank 的系统控制功能

1. LED 指示电量计

CCG3PA使用3GPIO来实现4LED指示灯和按键的功能。电量计使用对电流进行积分的方式来实现。

2. 电池的低电保护

比如:对于三串的电压

当电压低于9V时, LED会进行闪烁报警

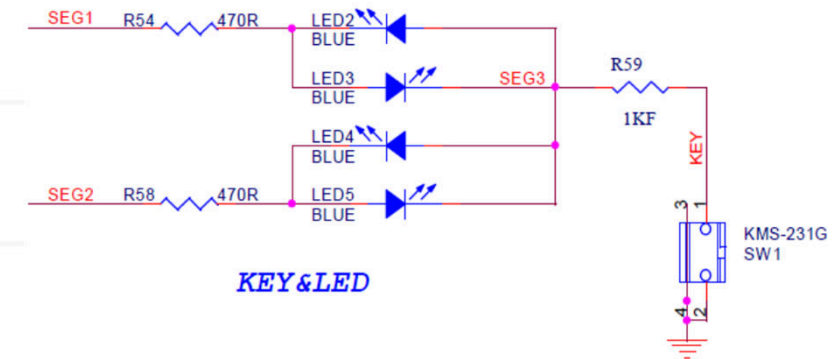
当电压低于8V时, 会直接关闭输出

设定的电压均可以在程序中进行改变

3. Type-A 口的插入和拔出检测

4. MicroB 插入检测

5. 低温和高温的保护

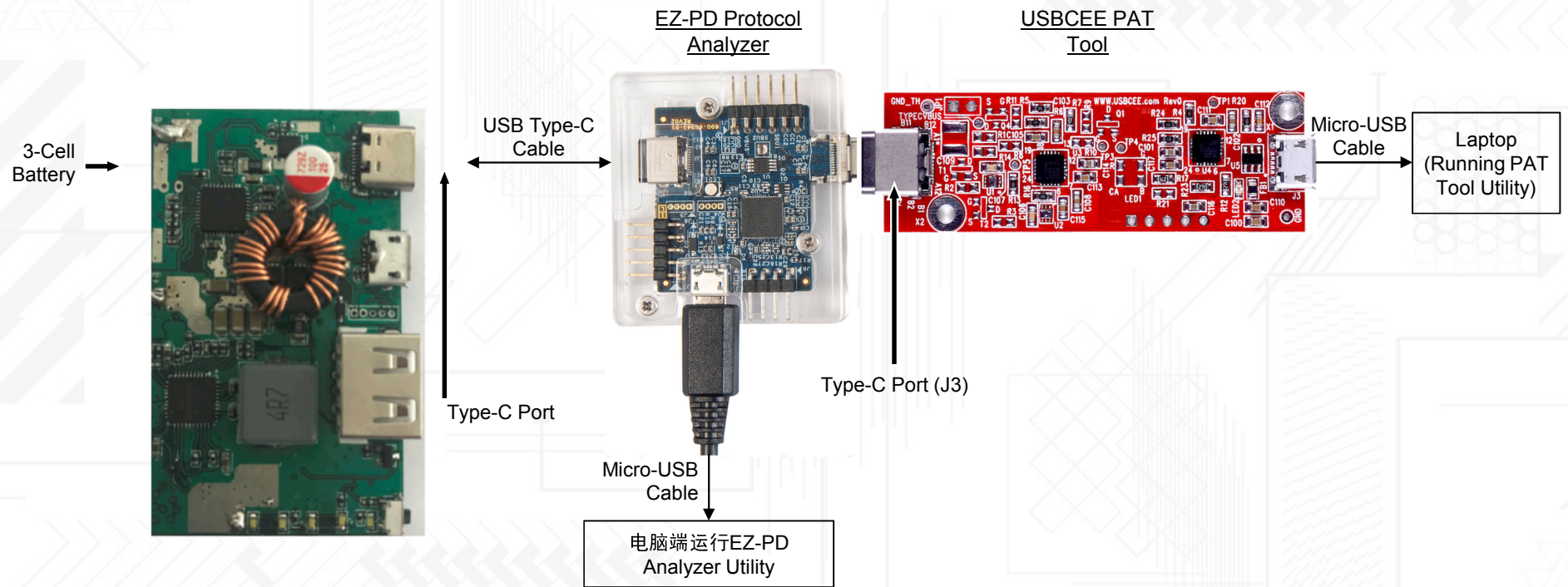


Lab 4: CCG3PA 45W Power Bank 充电和放电观察

Lab4: CCG3PA 45W Power Bank 充电和放电

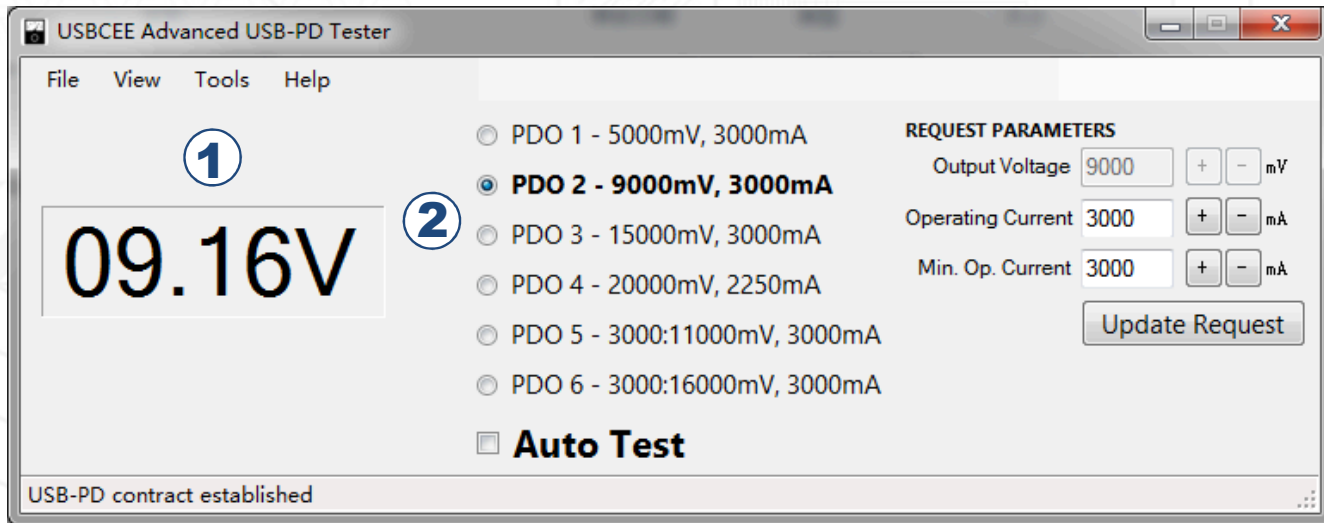
- **目标**
 - 熟悉CCG3PA 45W Power Bank 的充电和放电功能
 - 理解Type-C口是双角色口, 可以放电也可以充电
- **试验详情**
 - 这个试验介绍如何使用 CCG3PA Power Bank 的参考设计板, 展示Type-C口的充电和放电能力. 试验中需要用到CCG3PA 45W Power Bank 参考设计板和the EZ-PD Configuration Utility, CY4532 EZ-PD CCG3PA 评估板, CY4500 PD协议分析器
- **硬件工具**
 - EZ-PD CCG3PA Evaluation Kit (CY4532) CCG3PA评估板
 - EZ-PD Protocol Analyzer (CY4500) PD协议分析器
 - PAT Test Tool (Power Adapter Test Tool) 电源测试板
 - 45WPower Bank 参考设计板
- **Software tools**
 - EZ-PD Analyzer Utility
 - PAT Tool Utility (supplied with the PAT Tool)

Lab 4: 使用PAT工具观察Power Bank的放电



Lab 4: PAT Tool Utility

PAT Tool Utility GUI

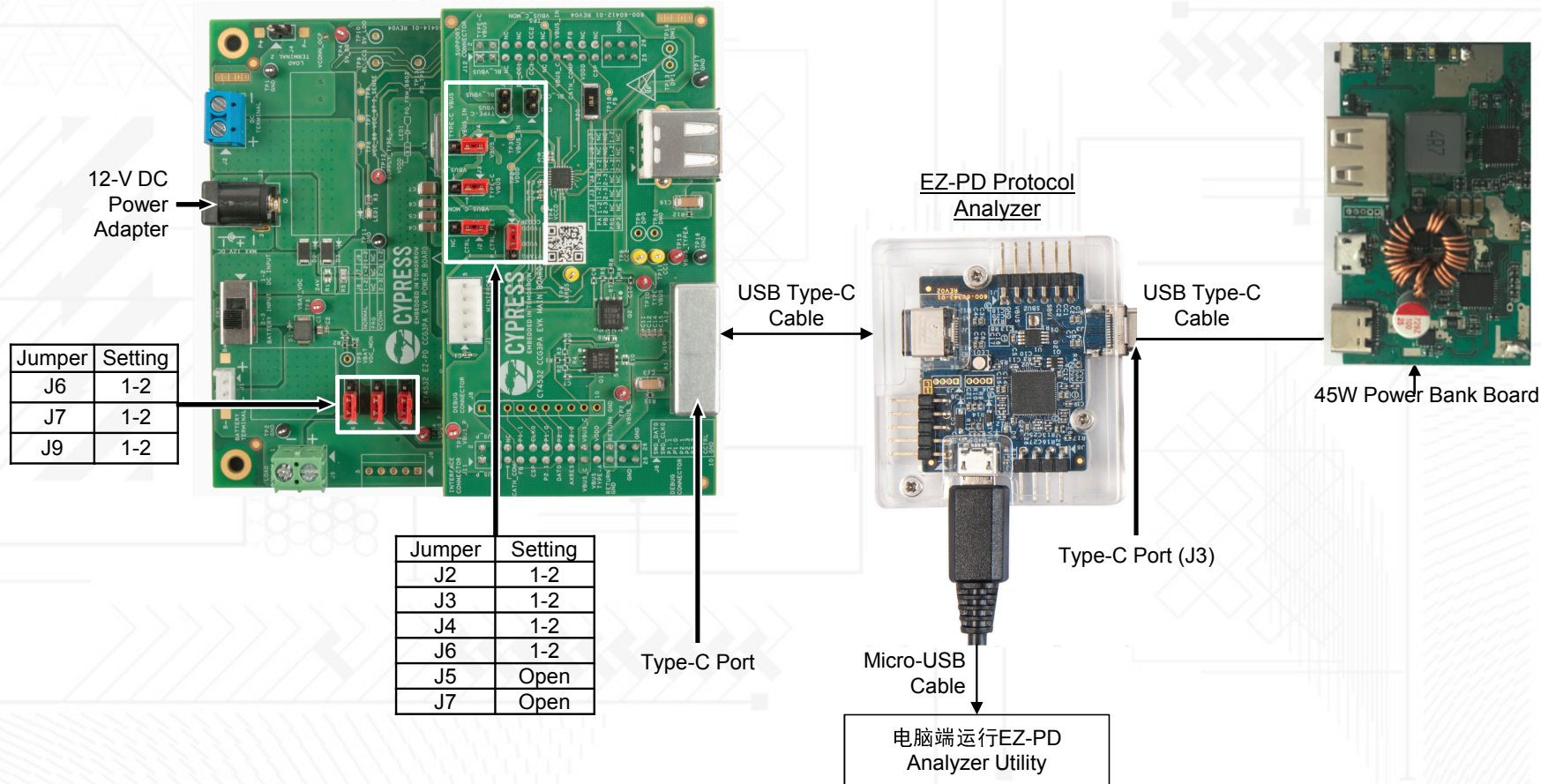


① 这个面板显示PD交互出来的电压

② 这个面板显示45W PowerBank 广播出来的所有PDO

使用PAT Tool Utility 请求45W Power Bank的不同的PDO

Lab 4: 观察Power Bank 的充电



Lab 4: 观察45W Power Bank 的充电功能

EZ-PD™ Analyzer Utility

File Actions Help

Status: None SOP: None Message: Msg ID: Obj Count: Data Role: Power Role:

SL#	Status	SOP	Message	Msg Id	Data Role	Power Role	Obj Count	Data	Start Time (us)	Duration (us)	Delta (us)	VBUS Voltage(V)	VBUS Current(A)
1	OK	SOP	Source_Cap	0	DFP	Source	4	0x41A1 0xB01912C 0x2D12C 0xC0761E3C ...	3,657,939	1,039	0	5.181	N/A
2	OK	SOP	GoodCRC	0	UFP	Sink	0	0x41	3,659,128	501	150	5.181	N/A
3	OK	SOP	Request	0	UFP	Sink	1	0x1082 0x2084B12C	3,660,824	635	1,195	5.225	N/A
4	OK	SOP	GoodCRC	0	DFP	Source	0	0x161	3,661,607	504	148	5.186	N/A
5	OK	SOP	Accept	1	DFP	Source	0	0x3A3	3,663,189	504	1,078	5.197	N/A
6	OK	SOP	GoodCRC	1	UFP	Sink	0	0x241	3,663,841	502	148	5.214	N/A
7	OK	SOP	PS_RDY	2	DFP	Source	0	0x5A6	3,714,110	503	49,767	9.064	N/A
8	OK	SOP	GoodCRC	2	UFP	Sink	0	0x441	3,714,760	501	147	9.135	N/A

VBUS Voltage: 8.62 V VBUS Current: 2.64 A

Detailed View Trigger

Description	Value
-------------	-------

①

① 这里显示Type-C连接时所有的PD数据

② 这里显示出VBUS上实时的电压和电流。电流从 CY4500 的插座到插头的方向为正向

Demo: 使用EZ-PD CCG3PA SDK实现CCG3PA的固件修改

Demo: 使用EZ-PD CCGx Power SDK 进行CCG3PA固件修改

■ 目标

- Learn to use the EZ-PD CCGx Power SDK 学习使用EZ-PD CCGx Power SDK
- 使用EZ-PD CCGx Power SDK修改CCG3PA 电源适配器的固件来实现客户特定的需求
- 使用the EZ-PD Configuration Utility 在CY4532 EZ-PD CCG3PA EVK 上实现CCG3PA的固件下载，并且使用CY4500 EZ-PD Protocol Analyzer 进行测试

■ 试验详情

- 这个实验介绍EZ-PD CCGx Power SDK，将会展示如何修改CCG3PA的固件来实现定制化的功能。将使用PSoC Creator 4.2 SP1 和 EZ-PD Configuration Utility

■ 硬件工具

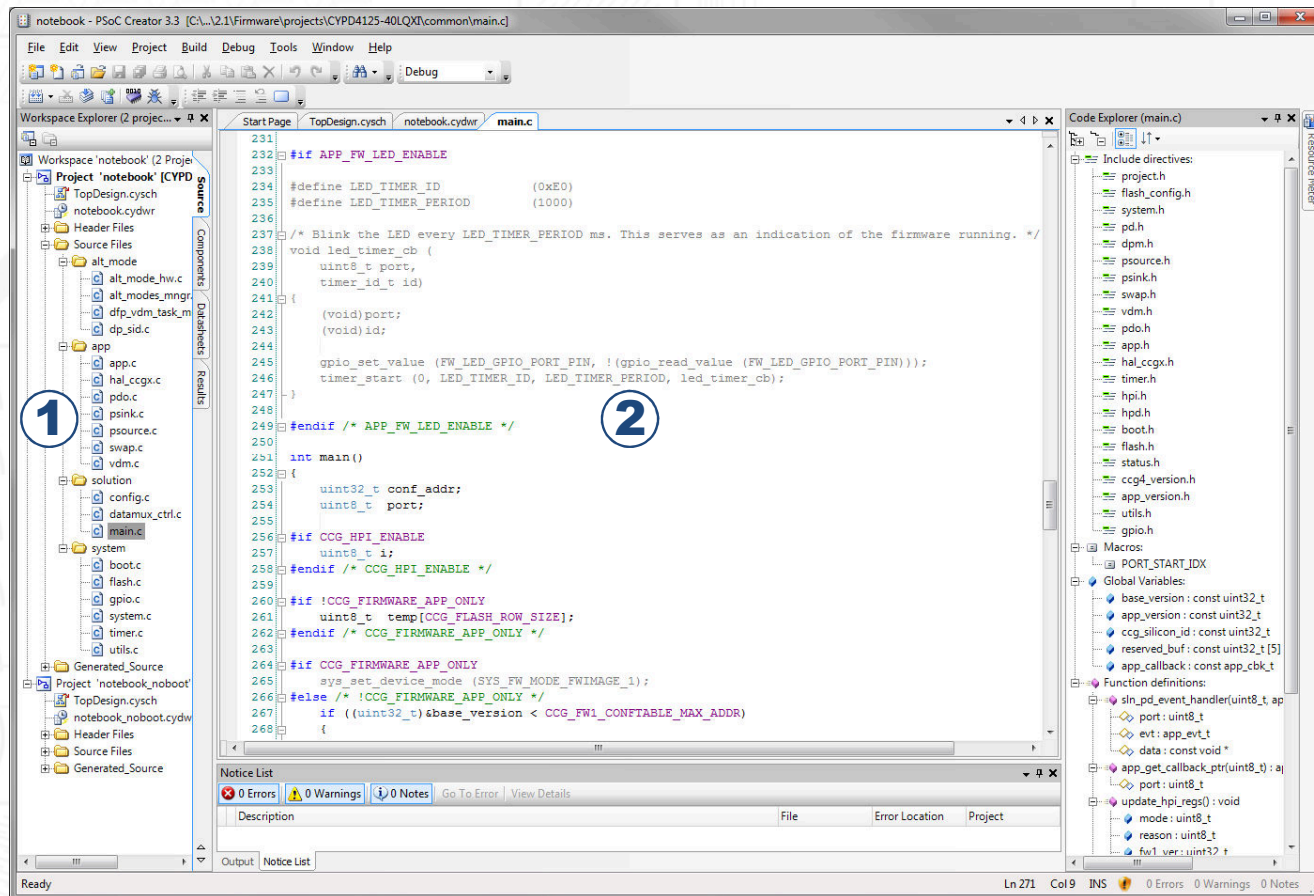
- EZ-PD CCG3PA Evaluation Kit (CY4532) CCG3PA评估板
- EZ-PD Protocol Analyzer (CY4500) PD协议分析器
- USBCEE PAT Board 电源测试板

■ 软件工具

- PSoC Creator 4.2 SP1
- EZ-PD CCGx Power SDK
- EZ-PD Configuration Utility

Demo: EZ-PD CCGx Power Software Development Kit

PSoC Creator IDE

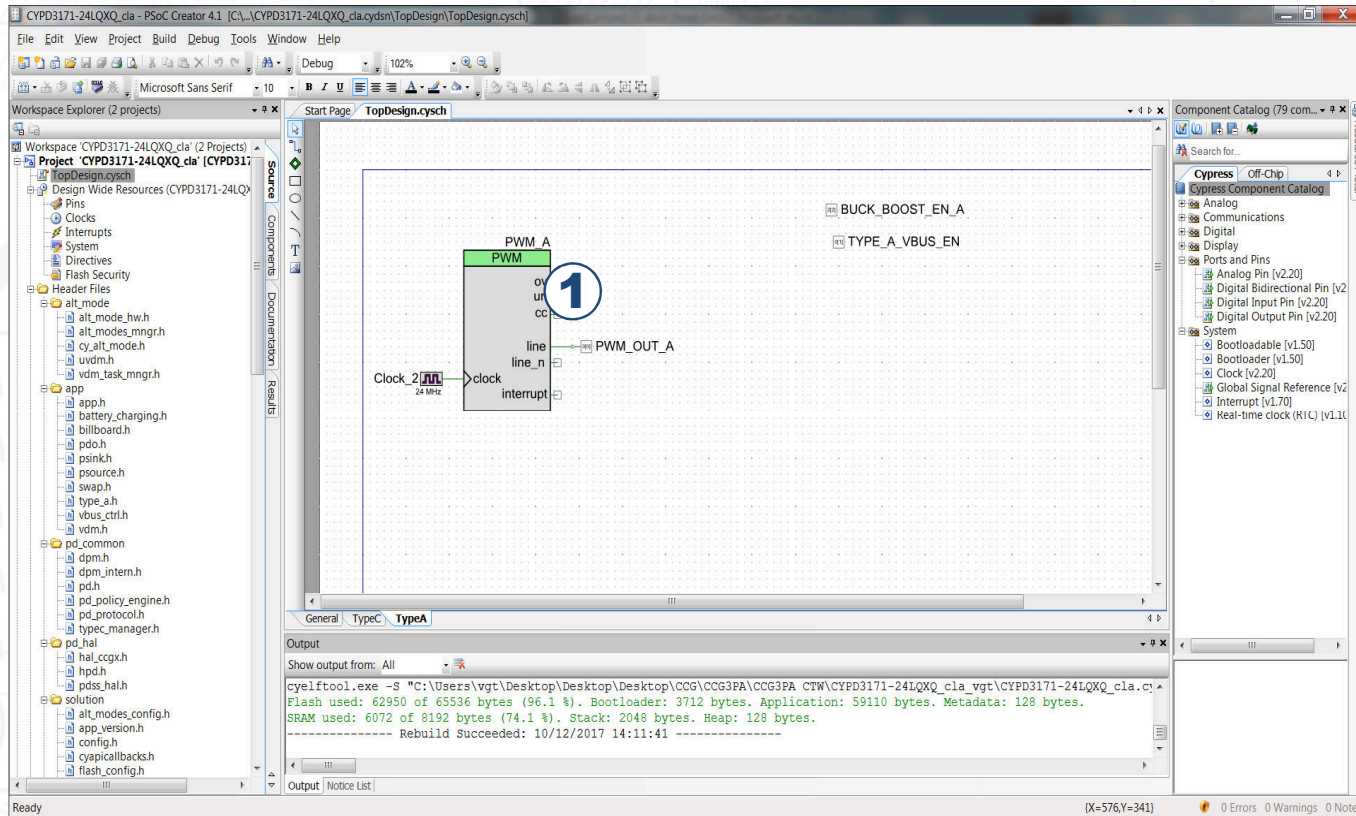


① 这个位置列出所有的.C文件

② 用户可以在这个位置进行代码的修改

Demo: EZ-PD CCGx Power Software Development Kit

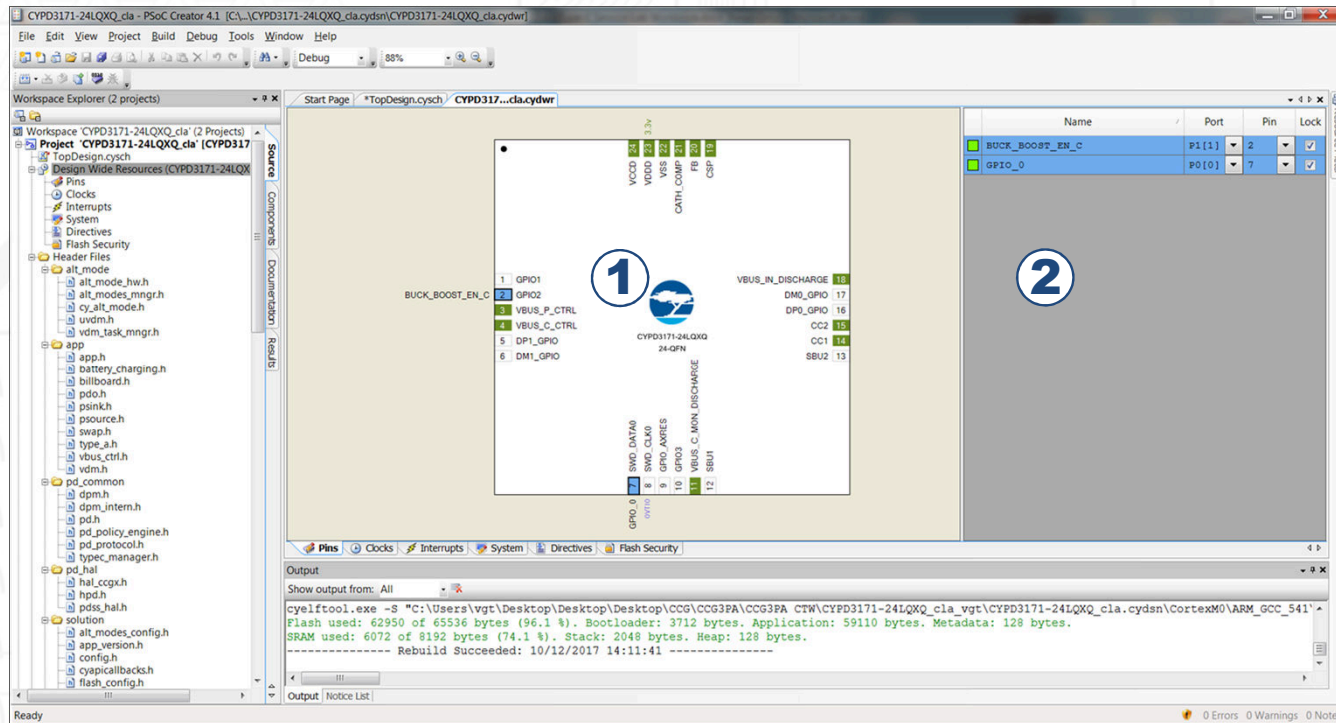
PSoC Creator Schematic View



① 这个原理图界面显示芯片内部的资源

Demo: EZ-PD CCGx Power Software Development Kit

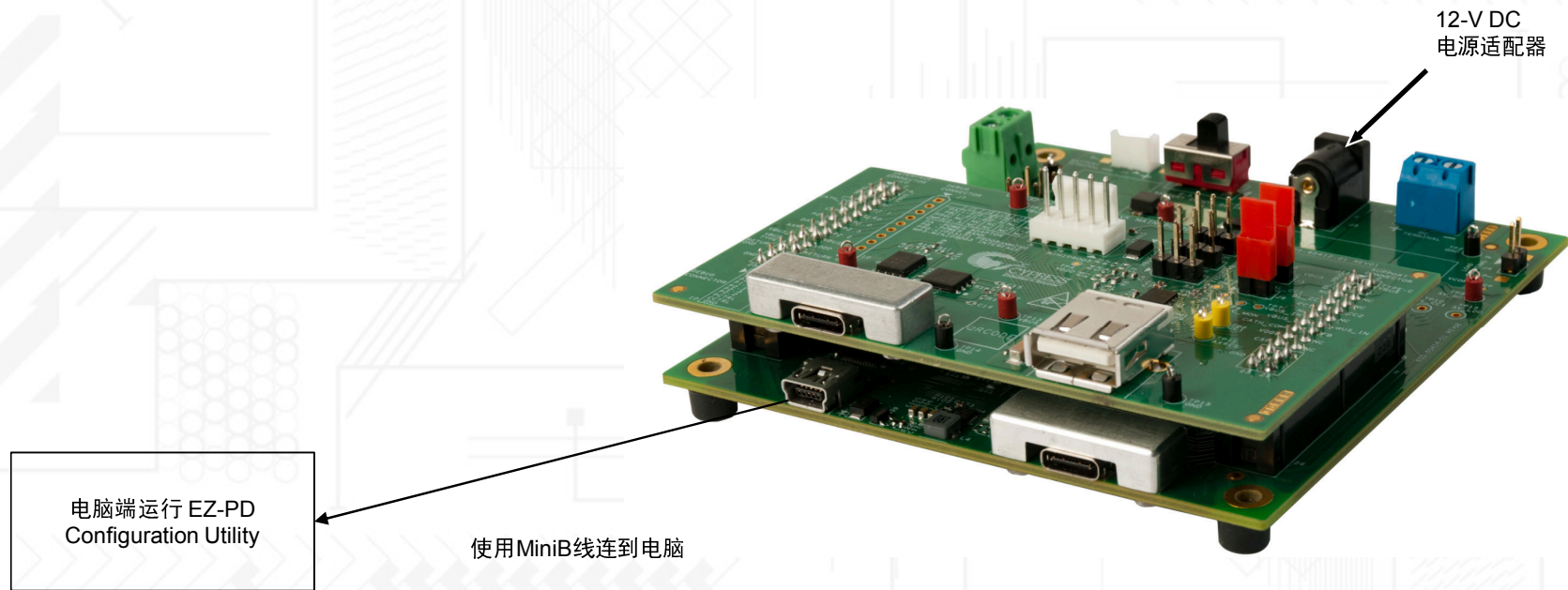
Design Wide Resource (DWR) View



① The DWR 界面显示芯片对不同内部资源进行的引脚分配

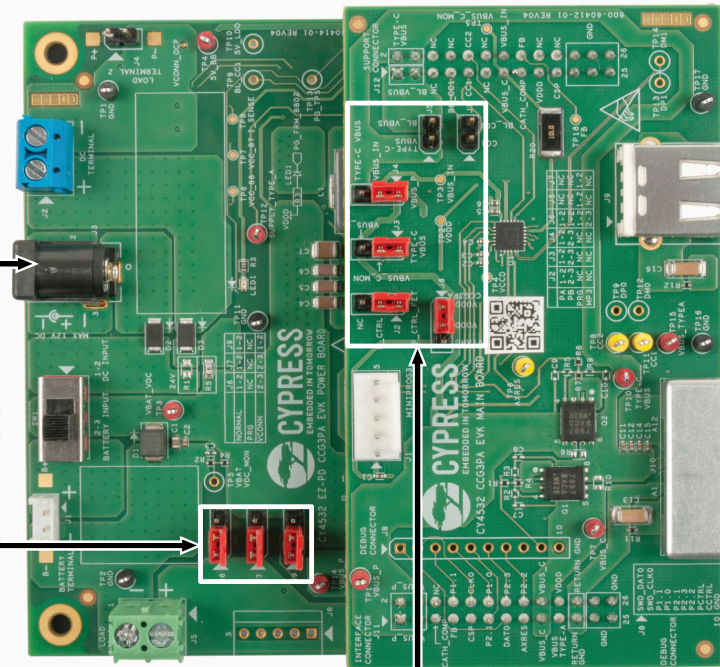
② 引脚的分配可以使用这个界面进行修改

Demo: CCG3PA固件下载



Demo: CCG3PA固件下载

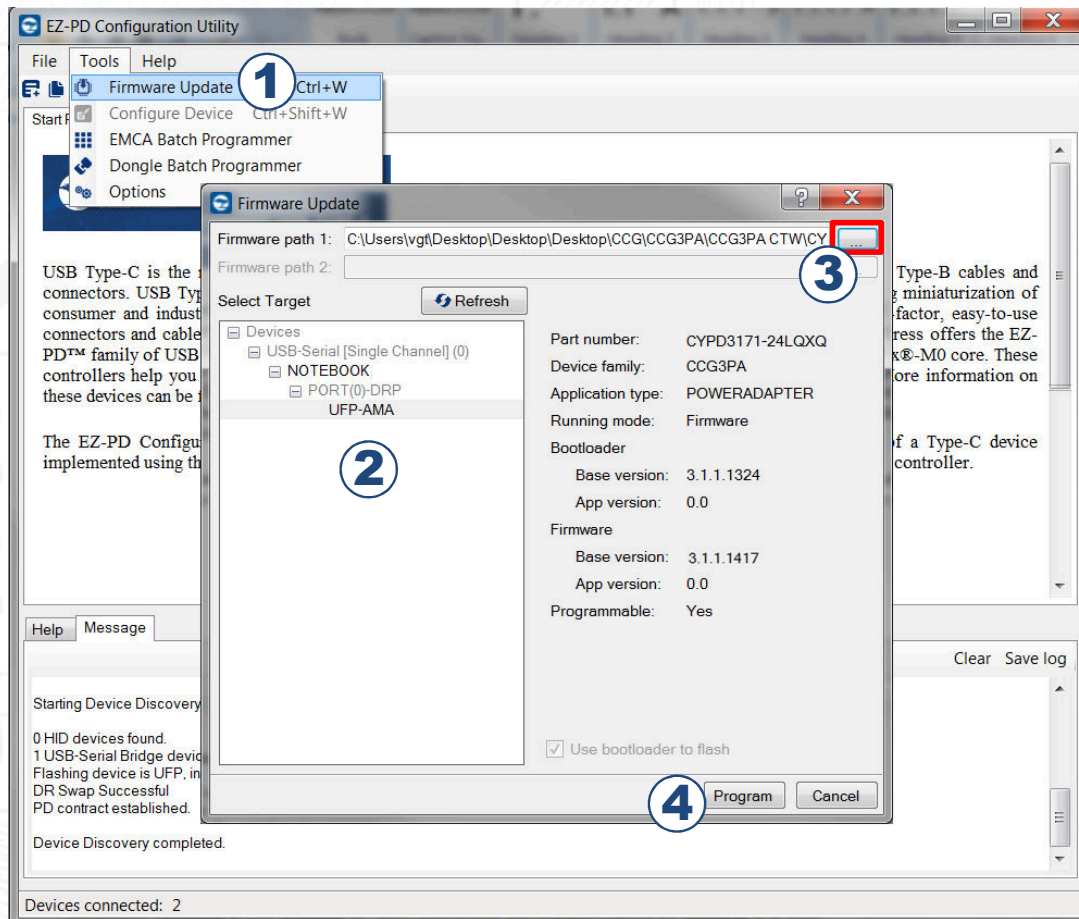
12-V DC Power Adapter



Jumper	Setting
J6	1-2
J7	1-2
J9	1-2

Jumper	Setting
J2	1-2
J3	1-2
J4	1-2
J6	1-2
J5	Open
J7	Open

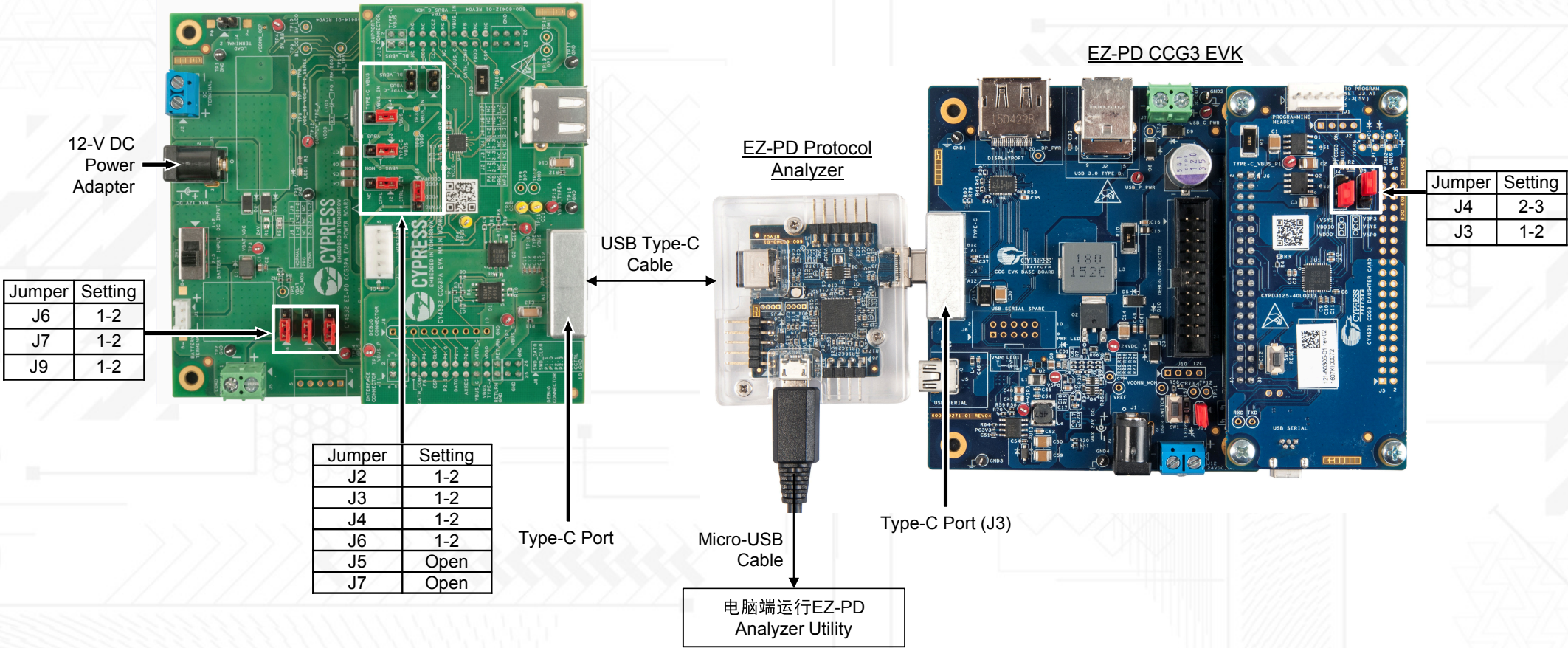
Demo: 使用EZ-PD Utility对CCG3PA下载修改后的固件



步骤

- ① 选择 **Tools > Firmware Update**. 将打开**Firmware Update** 窗口
- ② 选择 **UFP-AMA** 作为目标设备
- ③ 选择编译出来的“.cyacd”文件在如下文件夹中
CCG3PA_CTW\Projects\Lab5_Project
\CYPD3171-24LQXQ_cla.cydsn\CortexM0
\ARM_GCC_541\Debug
- ④ 点击**Program** 按键

Demo: 如何修改固件



讨论



请扫描二维码关注赛普拉斯官方微信

