

# Two-Port USBC with PD/QC4.0 Solution for Automotive Car Charger

Marketing: Steven Zhu AE Expert: Daniel Shen





# **USB-C/PD** Solutions for Consumer Market





# **Cumulative USB Shipments Reached 2.6 Billion in 2019**



# Cypress Is #1 In USB-C with 26%\* Market Share

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



<sup>1</sup>Data Source: Gartner 2018, IHS 2016 and Cypress estimates \*Cypress estimation

### **Cypress Provides End-to-End USB-C Power Delivery Solutions**



# **Cypress Leads USB-IF Certification**



# **Certified EZ-PD Applications**

EZ-PD Product	Part Number	Test ID (TID)	Application	Function	Date
	CYPD1103	1095059	Cable	EMCA	5/22/2015
	CYPD1120	1096044	Dongle	UFP	8/14/2015
CCG1	CYPD1122	1096037	Notebook	DRP	8/14/2015
	CYPD1132	1096040	Power Adapter	DFP	8/14/2015
	CYPD1134	1096042	Notebook, Desktop	DFP	8/14/2015
	CYPD2103	1095054	Cable	EMCA	5/22/2015
	CYPD2103	2086	PD 3.0 cable	EMCA	10/17/2019
	CYPD2122	1096039	Tablet	DRP	8/14/2015
CCG2	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
164	CYPD3105	1098018	Thunderbolt Cable	EMCA	2/12/2016
511	CYPD3120	1000061	Dongle	EMCA	8/5/2016
6000	CYPD3121	1010055	Power Bank	UFP	11/23/2016
CCG3	CYPD3123	1098119	Dongle	DRP	2/6/2018
	CYPD3125	1098019	Notebook, Phone	DRP	2/12/2016
	CYPD3135	1099031	Power Adapter	DFP	5/13/2016
	CYPD4126, CYPD4136	1090040	Notebook, Desktop	DRP	7/12/2018
CCG4	CYPD4225	1098024	Notebook, Desktop	DRP	2/12/2016
	CYPD4226, CYPD4236	795	Notebook, Desktop, Dock	DRP	1/25/2019



# **Certified EZ-PD Applications (cont.)**

EZ-PD Product	Part Number	Part Number Test ID (TID) Application		Function	Date
CCG4M	CYPD4255	1099030	Notebook, Desktop	DRP	5/13/2016
	CYPD5125	1071049	Notebook, Desktop	DRP	3/21/2018
CCG5	CYPD5225	1030056, 1070049, 1080040	Notebook, Desktop	DRP	5/24/2017, 2/16/2018
	CYPD5235	1072049	Dock (Upstream port)	DRP	4/19/2018
	CYPD5236	1073049	Dock (Downstream port)	DRP	4/19/2018
	CYPD3171	1040045, 349	Power Bank	DRP	9/15/2017
	CYPD3174	1050039, 1060036	Opto-coupler based Adapter, PPS	DFP	9/15/2017
CCG3PA	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
CCG5C	CYPD5126, CYPD5137	1101032	Notebook, Desktop, Dock	DRP	8/31/2018
CCG6	CYPD6125	1100033	Notebook, Desktop	DRP	8/31/2018
CMC4	CYPD2703	1000177	PD 3.0 Cable	EMCA	6/28/2018
CIVIGT	CYPD2704	1000178	PD 3.0 Cable	EMCA	6/28/2018
HX3PD	CYUSB4347, CYUSB4357	503000008	Dock	DRP	9/7/2018
CCG3PA Automotive	CYPD3196, CYPD3197	24, 142	Rear-seat Charger (PPS)	DFP	11/19/2018
CCG6F	CYPD6126	853	Notebook, Desktop	DRP	3/7/2019
	CYPD3184	1068	18W Direct feedback based adapter (PPS)	Power Brick	4/25/2019
PAG1S	CYPD3184	1102	33W Direct feedback based adapter (PPS)	Power Brick	4/25/2019
N.C.	CYPAS111	1475	27W Direct feedback based adapter (PPS)	Power Brick	6/27/2019
BCR	CYPD3177	1135	Barrel connector replacement	UFP	6/4/2019



# **1022 USB-C Design Wins in Production in Key Markets**



### 285 Notebooks & Desktops



**55** Docking Stations



### 13 Smartphones & Tablets

164 Cables & Dongles









8 Wireless Chargers



# **USB Portfolio (NDA)**



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



# Applications 2018

Power Adapter
Power Bank
Wireless Charger
Power Strip



### 65W快充/PD/OC协议 三口输出

<text><text>





专业电路芯片 | 高密度锂聚合物电芯 | 双向快充 | 电竞风格

20W 小米无线充电器

Qi充电标准,兼容更多 搭配小米9 手机峰值充电功率可达20W

SE

超静音风扇

噪音低 散热劲

带保护壳

也能充用

Oi充电标准

兼容更多

峰值功率20W

充电快



W HUAWEI





12



# RoadMap for Automotive Applications



# **USB Charging Trends in Automotive – Now & Future**





### USB-A BC1.2 (CDP, DCP): Now

- Charging Downstream Port: 5V, 1.5A
- Dedicated Charing Port: 5V, ~2A

### **USB-A Legacy Charging: Now**

- Apple Charging: 5V, ~ 2.4A
- Qualcomm's Quick Charge 3.0: up to 12V
- Samsung AFC: up to 12V





### USB Type-C: Now

- Type-C Only Charging: 5V, 3A
- Optional: Legacy Charging (above)

### USB Type-C PD: Future

- PD Charging: 15W ~ 100W (20V, 5A)
- Qualcomm's Quick Charge 4.0
- Optional: Legacy Charging (above)



# **USB Charging in Mobile Devices, including Notebooks**

Devices	Charging Voltages/Profiles
Google Pixel	18 W – USB PD PA from
Samsung Phones Samsung Note 10	18 W – AFC 45W
Samsung Tablets/Book 2	18 W, 27 W, 30 W– AFC and USB PD
iPhone 8 and above	18 W – USB PD
iPad Pro (USB Type-C Port)	30 W – USB PD
Xiaomi Phones	27 W – USB PD/QC 4.0
Huawei Phones	40 W – Super Charger 2.0
Anker Power Banks	30 W – USB PD
Apple Macbook Pro	12 W (5V/2.4A), 27 W (9V/3A), 60 W (20V/3A) – USB PD 87 W – USB PD (2019 Model)
HP Notebooks	Up to 65 W – USB PD
Dell	Up to 65 W – USB PD 135 W – USB PD (XPS 13)
Lenovo Thinkpads	Up to 65 W – USB-PD

### **Cypress USB Auto Portfolio**

16



# Auto USB-C Updates .. Contd.,

### Cypress Engagements with OEMs and Tier1s:

- Cypress is actively engaged with 27 OEMs worldwide
- Cypress is actively engaged with 45 Tier1s worldwide
- There are around 30 USB PD modules being designed by Tier1s, with CCG3PA
- Cypress USB-C/PD Roadmap:
  - USB-C/PD Controller: CCG3PA Available Now (AECQ-100 Qualified)
    - Multiple Reference Designs with MPS, TI, ADI and Maxim
  - Next Gen PD Controller: CCG7D Samples in Q2 2020, Production Q3 2020
    - 2 USB-C/PD and/or Type-A Ports w/ DC-DC Converter

### **Key Features Required by OEMs:**

- Load Sharing between ports
- Temperature Sensing and Battery Voltage Sensing
- Output Power Control based on Temperature and Battery Voltage
- Interface to Head Units and/or System Control Unit for Status and Control
- Support Cranking Conditions



# **USB-C and Power Delivery in Automotive**



<u>Head Units:</u>

- Interface to multi-Media Hubs
- Cable compensation for pig-tail cables
- Rear-Seat Entertainment Systems:
  - Support Alternate Mode functionality
  - Implement USB Billboard Device Class
- Rear-Seat Chargers:
  - Standalone Operation
  - Load-Sharing and Thermal Sensing
  - Programmable PD Controller:
    - Highly Integrated Standalone Controller
    - Single-chip solution for Type-C and Type-A
    - Dynamic Load Sharing between ports
    - Dynamic Cable Compensation
    - Temperature-based power throttling
    - Interface to Multi-Media USB Hubs
    - Alternate Mode support for rear seat systems
    - Support for Legacy Charging Standards
    - Flash upgradability





# EZ-PD USB-C CCG3PA

CCG3PA = Type-<u>C</u> Controller Gen3 for Power Adapter

# Add PD 3.0 and QC 4.0 to Your Charger Ports



# **CCG3PA: USB-C and Power Delivery Port Controller**

#### **Applications** CCG3PA: USB-C Cable Controller USB Type-C PD-based Automotive Chargers **MCU Subsystem Integrated Digital Blocks** I/O Subsystem **Features** Programmable I/O Matrix 4x TCPWM CC (AHB) • USB-C PD Controller, PD 3.0 Transceiver and Qualcomm QC 4.0 Bus V<sub>BUS</sub>-to-CC Short Protection Cortex<sup>®</sup>-M0 2x SCB 12x GPIO 48 MHz **High-Performance** (I<sup>2</sup>C, SPI, UART) Ports Integrated High-Voltage 30-V–Tolerant LDO to Power CCG3PA Integrated Digital Blocks **USB PD Subsystem** Four timer/counter/pulse-width modulator (TCPWM) blocks, 12x GPIOs - Two serial communication blocks (SCBs) for configurable master/slave I<sup>2</sup>C, SPI or UART Flash Baseband V<sub>BUS</sub>-to-CC (64KB) MAC PHY Short Protection Integrated Analog Blocks Advanced Configurable V<sub>BUS</sub> overvoltage protection (OVP) and overcurrent (OCP) protection 30-V-Tolerant 2x PFET Gate Integrated voltage regulation<sup>1</sup> with analog output and PFET gate drivers SRAM Regulator Drivers Low-side current sense<sup>2</sup> capable of detecting 100mA change (4KB) Two legacy charge-detect block (BC 1.2, Apple Charging 2.4A, QC 4.0 and Samsung AFC<sup>3</sup>) OCP and OVP Low-Side Current Sense ARM<sup>®</sup> Cortex<sup>®</sup>-M0 with MCU Subsystem and 64KB Flash Low-Power Operation 2x Charge-Detect **Integrated Resistors** - High-voltage (3-30 V, 30 V maximum) V<sub>BUS</sub> voltage inputs (BC 1.2, AC, (R<sub>P</sub>, R<sub>D</sub>)<sup>5</sup> QC4.0, AFC) System Resources Sleep: 3 mA; Deep Sleep: 30 µA with wake-on-CC **Feedback Control** System-Level ESD on CC, Dp / Dn<sup>4</sup> and V<sub>BUS</sub> Pins **Circuitry for Voltage** 1x 8-bit SAR ADC ±8-kV contact, ±15-kV Air Gap IEC61000-4-2 level 4C (V<sub>BUS</sub>) Regulation Packages 24 QFN (Industrial), 24 QFN (Automotive) AEC-Q100 Grade-S **Availability** Production: Now Collateral Samples: Q4 2018 (Auto) Production: Q3 2019 (Auto)

<sup>5</sup> Termination resistors: R<sub>P</sub> read as a DFP, R<sub>D</sub> as a UFP

Preliminary Datasheet: <u>CCG3PA Datasheet</u>

<sup>1</sup> Analog feedback control circuit to regulate  $V_{BUS}$ <sup>2</sup> Circuit to measure the current flowing on the  $V_{BUS}$ 

<sup>3</sup> Adaptive Fast Charging

<sup>4</sup> USB-C bus wires used to transmit and receive USB 2.0 data







# **EZ-PD** Features for Automotive Applications



# **Dynamic Load-Sharing**



- Two CCG3PA devices are inter-connected over I<sup>2</sup>C interface
- Power information shared between the two devices
- Source may request Sink's capabilities to determine the minimum power



# **Output Power Throttling**



### **Temperature Sensing:**

- Measure Temperature Using:
  - I<sup>2</sup>C based Temperature Sense Controller
  - <u>4 NTC Thermistors (2 per CCG3PA)</u>
    Measure temp using CCG3PA's ADC

#### Measure temp of Hot-spots on the PCB

- Zone 1 Input filtering
- Zone 2/3 DC-DC Converter w/ FETs (if any)
- Zone 4/5 Inductor on V<sub>BUS</sub> line
- Zone 6/7 PD controller and Power FET
- Zone 8 ambient temperature

### - Control O/P Power:

- Reduce Power when ambient temp is high
- Go Min 5V, 3A (15W) when hot
- Shut Down when temp is critical
- Configurable Temp and Power O/P Levels !!

### V<sub>IN</sub>/V<sub>BATT</sub> measurement:

- Define Input Voltage Thresholds
- Full O/P Power, if above Threshold
- Reduce O/P Power (ex. 15W), if below Threshold



# **Cable Compensation – for Head Unit Application**



### **USB PD has variable Voltages and Currents**

- Voltages 5V to 20V, Currents 0 5A
- Voltage Drop across the Cable Harness varies
- Increase O/P of DC-DC Converter to meet the drop
- Current Sense Amplifier measures the O/P current
- Measure the output Voltage (V<sub>BUS</sub>)
- Modify the FB voltage based on these measurements, for O/P voltage compensation
- Create a look-up table with:
  - Step size for Current measurements (ex. 50 mA)
  - Impedance of the Cable Harness
  - FB correction value to compensate for the drop
  - This is done once at Design Time
- Interrupt is generated when current step is crossed,
   O/P voltage is measured and FB is corrected



# **USB PD and Programmable Power Supplies**

	5V Fixed	9V Fixed	15V Fixed	20V Fixed	5V Prog (3 – 6 V)	<b>9V Prog</b> (3 – 11 V)	15V Prog (3 – 16 V)	20V Prog (3 – 21 V)
With 3 A cables								
0 < PDP ≤ 15 W	PDP ÷ 5				PDP÷5			
15 < PDP ≤ 27 W	3 A	PDP ÷ 9			3 A	PDP ÷ 9		
27 < PDP ≤ 45 W	3 A	3 A	PDP ÷ 15		3 A	3 A	PDP ÷ 15	
45 < PDP ≤ 60 W	3 A	3 A	3 A	PDP ÷ 20	3 A	3 A	3 A	PDP ÷ 20
Requires 5 A cables	S							
60 < PDP ≤ 100 W	3 A	3 A	3 A	PDP ÷ 20	3 A	3 A	3 A	PDP ÷ 20
		Fixed Volte	age Source		Progra	ımmable P	Y ower Suppl	ly (PPS)

- PPS is an optional feature in the USB PD 3.0 spec. The Minimum Voltage changed from 3V to 3.3V
- Devices supporting PPS will request a variable voltage (20mV steps) and current (50mA steps) from the Power Source, for an efficient battery charging
- In Automotive Applications, this feature will eliminate Cable Compensation
- Mobile devices will support PPS by 2020; we should enable customers with a futuristic



# **USB Type-C Connector and Short Protection (CCG3PA)**

- Max voltage on V<sub>BUS</sub> = 20V
- Proximity of CC and V<sub>BUS</sub> pins increases the possibility of short due to poor quality cables
- A short between CC and V<sub>BUS</sub> will destroy CCG3PA, disabling the port
- Protecting CC pins requires additional components: increasing BOM and PCB area
- <u>CCG3PA Integrates CC to V<sub>BUS</sub></u> <u>short-circuit protection –</u> <u>eliminates the need for external</u> <u>components</u>

### **USB Type-C Functional Pin-out**



A12	A11	A10	A9	<b>A8</b>	A7	<b>A6</b>	A5	A4	A3	A2	A1
GND	RX2+	RX2-	VBUS	SBU1	D-	D+	CC	VBUS	TX1-	TX1+	GND
			-								
GND	TX2+	TX2-	VBUS	VCONN			SBU2	VBUS	RX1-	RX1+	GND



# **USB-C Alternate Mode Support**

- USB-C Ports can traverse alternate protocols (DP, HDMI)
- The Super-Speed and SBU pins can be repurposed to carry these alternate signals
- USB-C ports are still required to function as compliant USB ports
- USB spec requires the Device to present a USB Device function on D+/D- signals, called the Billboard Device
- This is a key requirement for Rear-Seat-Entertainment systems in Automotive

A12	A11	A10	A9	<b>A8</b>	A7	A6	A5	A4	A3	A2	A1
GND	RX2+	RX2-	VBUS	SBU1	D-	D+	СС	VBUS	TX1-	TX1+	GND
GND	TX2+	TX2-	VBUS	VCONN			SBU2	VBUS	RX1-	RX1+	GND
B1	B2	B3	B4	B5	B6	B7	B8	<b>B9</b>	B10	B11	B12

### Alternate modes reconfigure the connector

- Repurpose pins to support another bus
- Change the mode of operation of a bus
- Enable sideband signals



# **Must-Have Features for Auto Type-C/PD Solution**

- Best-in-Class Interoperability and Compliance to operate with Mobile Phone, Notebook PC, Cables, Dongles and Docks
- Charging Standards/Protocols:
  - PD3.0, QC4.0 (upto 100W) with PPS
  - Legacy Charging Standards/Protocols: QC2.0/ QC3.0, Apple Charging, Samsung AFC, BC 1.2 (up to 18W)
- Power: Recommend 45W, to enable Fast Charging of Mobile Phones and Notebooks
- Output Power Sharing, Temperature Monitoring, Input Voltage Measurement and Output Power Control (based on Temp and Input Voltage)
- Safety: CC to Vbus pins Short Circuit Protection, Temperature Monitoring
- ✓ Update Flash Memory over I2C (OTA) and CC line, to keep up with PD protocol changes
- Configurable GUI enables Flexibility
- Easy development with SDK and Reference Design Boards





# **USB-C** in Automotive Applications



# Head Unit: USB-C PD Features



### Features:

- PD 3.0 with PPS
  - BC 1.2, QC 4.0, Apple VDMs
- Dynamic Load Sharing:
  - Inter-Connect Two CCG3PA with I<sup>2</sup>C interface
  - Power information shared between the two devices

### Interface to DC-DC Converters:

- Analog Control (PPS), I<sup>2</sup>C, PWM, GPIO
- Interface to USB Hub:
  - I<sup>2</sup>C interface to USB Hub
  - Share USB-C Port status
- FW Upgradability:
  - Future proof design with FW Upgradability
  - Over I<sup>2</sup>C Interface

### • Output Power Throttling:

- Temperature sensing with thermistors on CCG3PA
- V<sub>IN</sub> based output Power Throttling

### Protection:

- V<sub>BUS</sub> to CC pins SCP up to 20V
- OCP/OVP/OTP/SCP



### **Rear-Seat Chargers: USB-C PD Features**



### **Features:**

- PD 3.0 with PPS and Legacy Charging
  - BC 1.2, QC (2.0, 3.0, 4.0+), Apple, Samsung AFC
- Dynamic Load Sharing:
  - Inter-Connect Two CCG3PA with I<sup>2</sup>C interface
  - Power information shared between the two devices

### Interface to DC-DC Converters:

- Analog Control (PPS), I<sup>2</sup>C, PWM, GPIO

### • FW Upgradability:

- Future proof design with FW Upgradability
- Over CC pins

### Output Power Throttling:

- Temperature sensing with thermistors on CCG3PA
- (or) Use I<sup>2</sup>C based Temp Sense Controller
- V<sub>IN</sub> based output Power Throttling

### Protection:

- V<sub>BUS</sub> to CC pins SCP up to 30V
- OCP/OVP/OTP/SCP



### **Rear-Seat Entertainment: USB-C PD Features**



#### **Features:**

- PD 3.0 with PPS
  - BC 1.2 (CDP), QC 4.0, Apple VDMs
- Alternate Mode Support
  - USB Billboard Device Class, for error reporting
  - Generate HPD Signaling
  - Control DP Alt-Mode Mux
- **Dynamic Load Sharing:** 
  - Inter-Connect Two CCG3 with I<sup>2</sup>C interface
  - Power information shared between the two devices

### Interface to DC-DC Converters:

- Analog Control (PPS), PWM, I<sup>2</sup>C, GPIO
- FW Upgradability:
  - Future proof design with FW Upgradability
  - Over I<sup>2</sup>C Interface
- Output Power Throttling:
  - Temperature sensing with thermistors on CCG3PA
  - V<sub>IN</sub> based output Power Throttling
- Protection:
  - OCP/OVP/SCP



# **USB-C** Reference Designs

### 60W and 100W – Charge Only Ports



### 2x 60W USB-C PD Charge Only Ports



- PD 3.0 with PPS
- **USB-PD** Charging on Type-C Port:
  - 60W PD and QC 4.0
  - Optional Legacy Charging (BC/AC/QC/AFC) support



Top Side

Bottom Side





# 2x 100W USB-C PD Charge Only Ports



- PD 3.0 with PPS
- USB-PD Charging on Type-C Port:
  - 100W PD and QC 4.0
  - EMCA cable identification and negotiation
  - Optional Legacy Charging (BC/AC/QC/AFC) support



Top Side

**Bottom Side** 





# **USB-C PD RDBs, with TI and ADI**



2x 100 W TI RDB



2x 60W w/TI



45/65 W ADI RDB



2x 45/60W w/ADI



#### 1x 27W w/ADI



### **CCG3PA-Auto: MPNs, Features and Target Use-Cases**

MPN	Fea	Applications	
	Common Features	Differences	
CYPD3195-24LDXS (CCG3PA)	<ul> <li>PD 3.0 w/ PPS</li> <li>Support 1x Type-C and 1x Type-A ports</li> <li>Works with external DC-DC Buck-Boost Converter</li> <li>Legacy Charging</li> </ul>	<ul> <li>I<sup>2</sup>C Bootloader</li> <li>FW Update over I<sup>2</sup>C bus (from external Hub or MCU)</li> </ul>	<ul> <li>Head Units</li> <li>Rear Seat Charge only</li> </ul>
CYPD3196-24LDXS (CCG3PA)	<ul> <li>(BC1.2, Apple Charging, QC, Samsung AFC)</li> <li>Input Voltage Detection</li> <li>Interface 2x NTC Thermistors to GPIOs</li> </ul>	<ul> <li>CC Bootloader</li> <li>FW Update over CC pins<sup>2</sup></li> </ul>	ports
CYPD3193-24LDXS (CCG3PA)	<ul> <li>(for Temperature sensing)</li> <li>Cable Compensation</li> <li>I<sup>2</sup>C Interface to Ext. Processor</li> <li>V<sub>CONN</sub> FET control</li> <li>24 OFN 40° to 1405°C 4FC 0100</li> </ul>	<ul> <li>I<sup>2</sup>C Bootloader</li> <li>FW Update over I<sup>2</sup>C bus (from external MCU)</li> <li>Alternate-Mode Support (control external mux)</li> <li>USB Bill-Board Device Class Support<sup>3</sup></li> </ul>	Rear Seat
CYPD3194-24LDXS (CCG3PA)	<ul> <li>Dynamic Load-Sharing</li> <li>O/P Power Control (Temperature and I/P Voltage)</li> <li>Host Protocol Interface<sup>1</sup></li> </ul>	<ul> <li>CC Bootloader</li> <li>FW Update over CC pins<sup>2</sup></li> <li>Alternate-Mode Support (control external mux)</li> <li>USB Bill-Board Device Class Support<sup>3</sup></li> </ul>	Entertainment System





# EZ-PD Auto SDK



### **EZ-PD SDK Building Blocks**



Hardware Abstraction Layer







# How to Implement Two Port USB-C for Auto Application

41 CYPRESS CONFIDENTIAL		EMBEDDED IN TOMORROW
	-	



# APPENDIX





# **Auto USB-C/PD Features**

#### **Dynamic Cable Compensation: (Head Unit Applications)**

Compensate for voltage drop across Cable based on: Cable Impedance, Output Current and Voltage

### **Dynamic Load Sharing:**

Inter-connect two CCG3PA with I<sup>2</sup>C interface Re-Negotiate O/P power to match I/P power limit

### **Programmable Power Supplies (PPS):**

Enables Devices to request variable power from source Voltage (in 20mV) and Current (in 50mA) steps

#### **Output Power Throttling:**

Control Output Power Based Car Battery Voltage and Temperatures

#### **Integrated Protection:**

 $V_{BUS}$  to CC pins SCP up to 30V Protection against  $V_{BUS}$  to ground short and spills OCP/OVP/OTP/SCP Reduces external BOM; cost and PCB real-estate

#### **Rear-Seat Entertainment (Alt-Mode):**

USB Billboard Device Class Control DP Alt-Mode Mux and generate HPD signaling



Dynamic Cable Compensation for Head Units





# **CCG3PA: First in Quick Charge 4.0 Power Adapters**

Cypress Streamlines the Design of Next-Generation USB-C Power Adapters and Chargers with New, Highly-

Integrated Controller

Programmable EZ-PD<sup>™</sup> CCG3PA Controller Supports Power Delivery 3.0 and Quick Charge 4.0 and Enables Firmware Updates to Keep Up with Changes

COMPUTEX, TAIPEI, Taiwan, May 30, 2017—Cypress Semiconductor Corp. (NASDAQ: CY), the market leader in USB-C, today announced availability of a new USB-C controller with Power Delivery (PD) that streamlines the design of power adapters, mobile chargers, car chargers and power banks. The EZ-PD™ CCG3PA controller supports the PD 3.0 standard with programmable power supply (PPS) and Qualcomm's Quick Charge (QC) 4.0 protocol, which enable new power source product designs to provide an improved fast charging user experience. As these standards and the USB Type-C standard continue to evolve, compliance and interoperability pose an ongoing challenge, but the programmable CCG3PA controller enables firmware upgradeability to keep up with changes and overcome interoperability issues. The controller offers a high level of integration that 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.



# Legacy Charging and Display Port in Mobile Markets

Smartphones AP market share in 2017: Qualcomm = 42%, Apple and Mediatek = 18% each 100+ devices support Qualcomm Quick Charge (QC2.0, QC3.0, QC4.0) today Est. 85% smartphones will use either USB PD, BC, QC, Apple Charging, Samsung AFC by 2020 DP Alt Mode supported in QCOM Snapdragon 845 platform, used by all Android phone manufacturers Following are New/upcoming phones using Snapdragon 845:



# Thunderbolt: Display Port and USB over Type-C

Intel's Thunderbolt Chipset includes: USB, Display Port and PCIe, over Type-C Connector
Number of Devices with DP to surpass Devices with HDMI by 23Mu in 2019 (PCs, Smartphones)
Adoption of DP and HDMI Alt-Mode over Type-C to increase from 1% in 2016 → 37% in 2021
Number of Devices adopting DP Alt-Mode expected to rise from 14 Mu in 2016 → 920 Mu in 2021
HDMI Alt-Mode adoption into consumer market segment will start late 2018 with Digital-Still Cameras and Video-Cameras

Following are some of the brands with DP Alt-Mode over Type-C:

46



# **CCGx Auto: Family Comparison**

Features	CCG2	CCG3	CCG3PA
Number of Type-C+PD Ports	1	1	1 (Type-C), 1 (Type-A)
Integrated ARM <sup>®</sup> Cortex <sup>®</sup> -M0 MCU @ 48 MHz	Yes	Yes	Yes
Memory (Flash / SRAM)	32KB / 4KB	128KB / 8KB	64KB / 8KB
PD 3.0 with PPS Support	No	Yes	Yes
Serial Communication Blocks (I <sup>2</sup> C / SPI / UART)	2	4	2
USB Billboard Device Controller (for Alt-Mode)	No	Yes	No
V <sub>BUS</sub> Current Sense	No	Yes (High)	Yes (Low)
Integrated Voltage (V <sub>BUS</sub> ) Regulation	No	No	Yes
Integrated V <sub>BUS</sub> Discharge Drivers	0	1	2
Total GPIOs	14	20	12
Integrated V <sub>CONN</sub> FETs	0	1 Pair	0
Integrated High-Voltage V <sub>BUS</sub> 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 <sub>BUS</sub> (absolute maximum)	6 V (no V <sub>BUS</sub> )	24 V	30 V
V <sub>BUS</sub> Short Protection on CC Pins	No	No	Yes
Dedicated V <sub>BUS</sub> OVP and OCP	No	Yes	Yes
BC 1.2, Apple Charging, QC 4.0, Samsung Adaptive Fast Charging	No	BC1.2, AC, QC 3.0	Yes
ESD Protection ±8 kV (Contact), ±15 kV (Air)	Yes	Yes	Yes
Packages	24-QFN	40-QFN	24-QFN
Availability of Auto Grade parts(Samples / Production)	Now/Now	Now/Q219	Q418/Q119



# **Getting Started**

### CCG3PA Evaluation Kit provides:

- Support for power adapters/chargers and power banks
- One Type-C source or sink port and Type-A source port
- Support for USB PD 3.0 with PPS support
- Support for QC 4.0, BC 1.2, Apple Charging 2.4A and Samsung AFC<sup>1</sup> charging protocols on Type-A port
- Support for 1-cell and 2-cell battery (power bank application)
- Charging for notebooks, mobile phones and USB-powered devices
- Firmware upgradeability





<sup>1</sup> Adaptive Fast Charging



扫码关注赛普拉斯官方微信,获取更多信息及帮助



