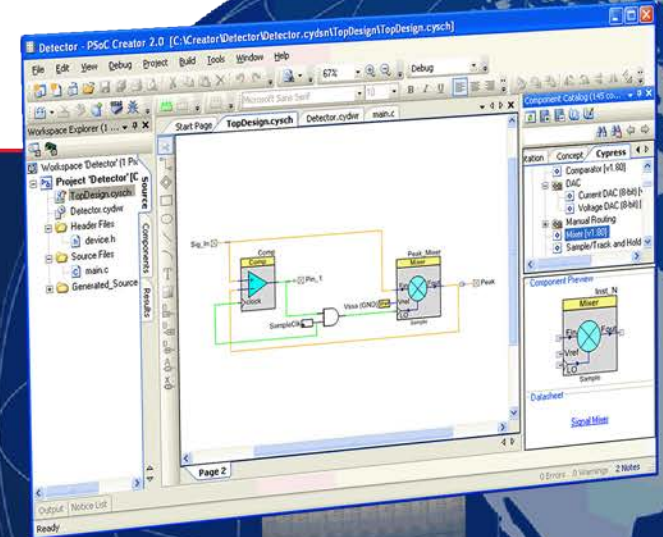**Quick Presentation:**

# EZ-PD CCG3: USB Type-C Controller With Power Delivery

**CCG3   = Type-C Controller Gen3**
**Type-C = Reversible Slim USB Connector**

Add 20-V Operation, USB Authentication and Fail-Safe Updates to Your Type-C Products With CCG3

# USB Type-C: Connector of the Future

**CYPRESS**
EMBEDDED IN TOMORROW™

**USB Type-A and Type-B are the current USB-IF[1] standards, but they have limitations**

They use large connectors that prevent slim industrial designs (plug height: A = 4.5 mm; B = 10.4 mm)

They require a fixed plug orientation and a fixed cable direction

They carry only USB signals

Power delivery implementation on them is complicated, expensive and limited to 7.5 W

**USB Type-C is the new USB-IF[1] standard that solves these problems and enables:**
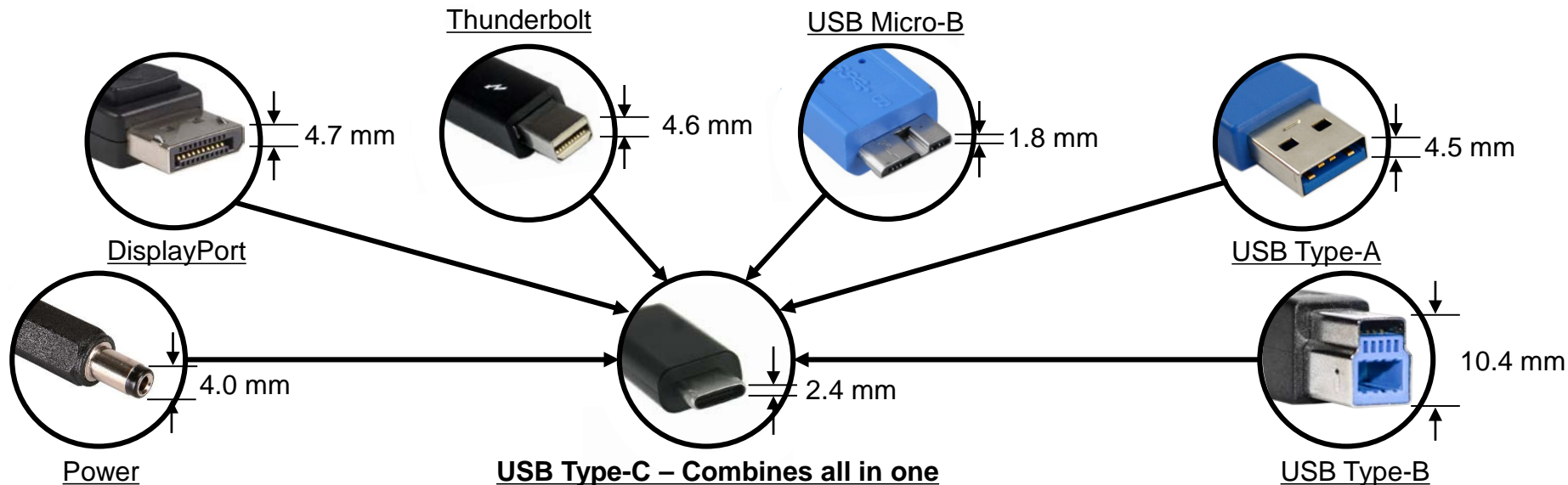
Slim industrial design with a 2.4-mm plug height

Reversible plug orientation and cable direction

Transport of both USB along with either DisplayPort or Thunderbolt signals on the same connector

Easy implementation of low-cost power delivery up to 100 W

**USB Type-C is the new, slimmer, all-in-one, 100-W connector**

Thunderbolt

USB Micro-B

4.7 mm

4.6 mm

1.8 mm

4.5 mm

DisplayPort

USB Type-A

4.0 mm

2.4 mm

10.4 mm

Power

**USB Type-C – Combines all in one**

USB Type-B

[1] The USB Implementers Forum creates and maintains USB specifications

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Tech Lead: AKN

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Market Vision    2

# USB Type-C Port Controllers
# A $436M Market by 2020

**USB Type-C port controllers are projected to grow from $15M in 2015 to $436M in 2020 at a 96% CAGR[1]**

The USB Type-C port is universal: it is slimmer, reversible, handles multiple protocols and supports up to 100-W PD

Every PD-capable, multiple-protocol USB Type-C port requires a dedicated controller

**This fast-growing market requires a USB-IF certified solution that:**

Marks cables electronically with a controller IC embedded in the cable plug to report the cable's characteristics (e.g., current rating)

Multiplexes USB signals with Thunderbolt or DisplayPort signals on the same connector

Supports all Power Delivery profiles[2] up to 100 W, for notebooks, tablets, monitors, USB cables and power adapters

Authenticates approved USB Type-C cables, devices and accessories

**Cypress has been "Making USB Universal®" since 1996**

Cypress has shipped over 1.4 billion USB controllers with industry-leading quality

Cypress has been a leading supplier in every generation of USB technology: USB 1.1, USB 2.0 and USB 3.0

**Accelerate your conversion to USB Type-C and PD with Cypress's CCGx Type-C port controllers**

Cypress CCGx Design Wins

Eliteone All-In-One PC
By HP

Elitebook Notebook PC
By HP

Elitedesk Desktop PC
By HP

USB Type-C Cable
By Belkin

Type-C to HDMI Dongle
By Lenovo

[1] Gartner 2015 and Cypress estimates       [2] A USB-IF specified combination of voltage and current ratings that define the power provided (e.g., 20 V and 5 A: 100-W power provided)

# CCG3 Simplifies Power Adapter Design

CCG3 is an Integrated Type-C Solution that Simplifies a Power Adapter Design
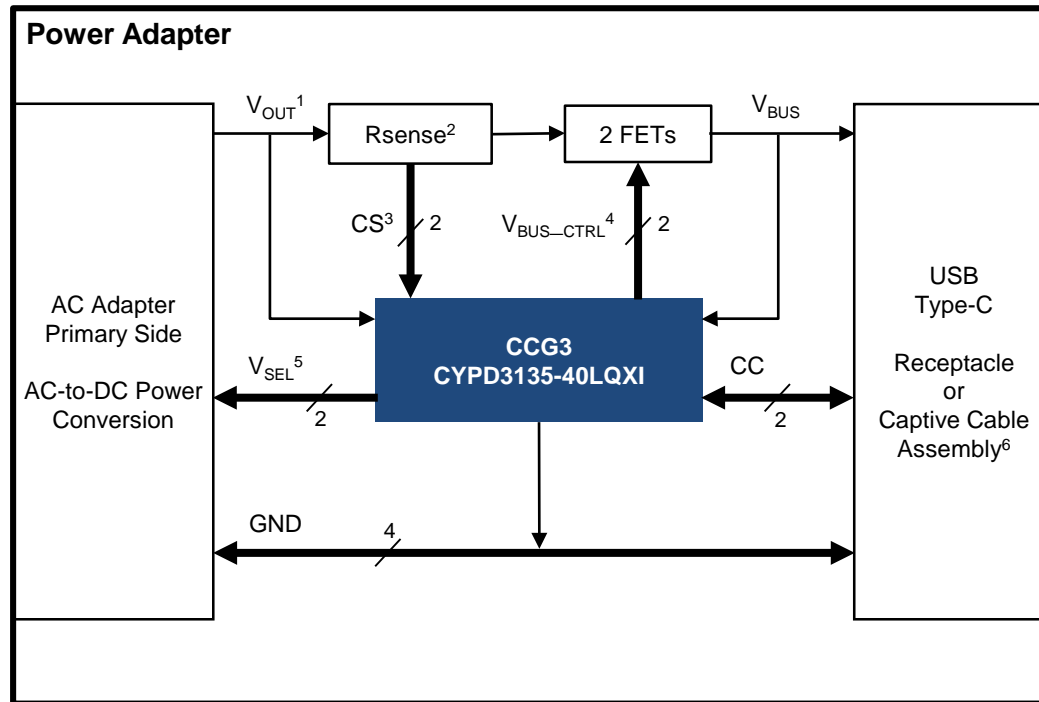


**CCG3's 20-V operation enables a high level of integration, reducing BOM cost for power adapters**

[1] Output voltage of the AC-to-DC adapter
[2] Resistor used to sense overcurrent
[3] Current-sensing input

[4] Signal to control $V_{BUS}$ load switch
[5] Output voltage selection
[6] A cable permanently attached to the AC adapter

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Proof Source    4

# CCG3 Simplifies Video Dongle Design

**A video dongle that converts Type-C to display standards such as DisplayPort, HDMI[1] or VGA[2] requires:**

1. A Type-C and PD Controller

2. A USB Billboard Controller to implement USB Billboard Device Class[3]

3. A Crypto Engine to implement USB Authentication

4. An analog switch for Sideband Use (SBU) signals

Multi-Chip Solution
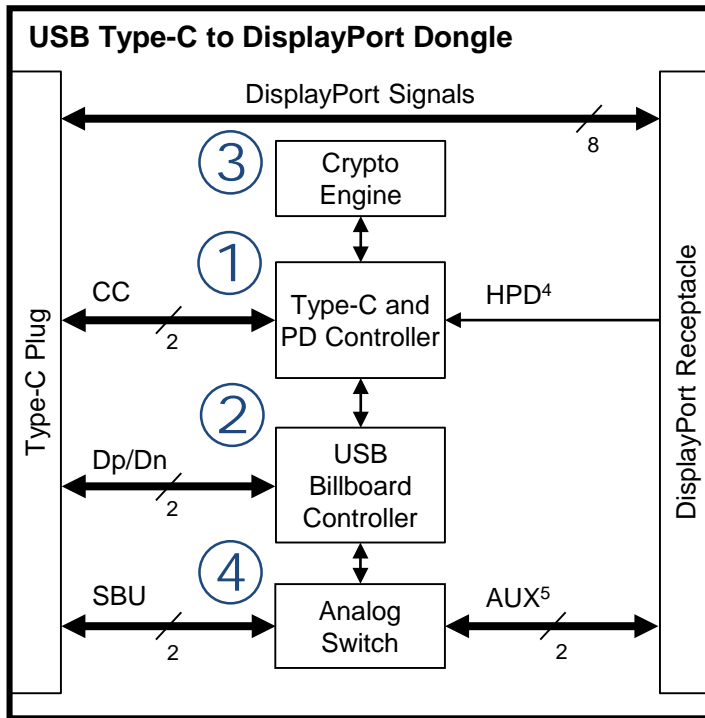
CCG3 Single-Chip Solution
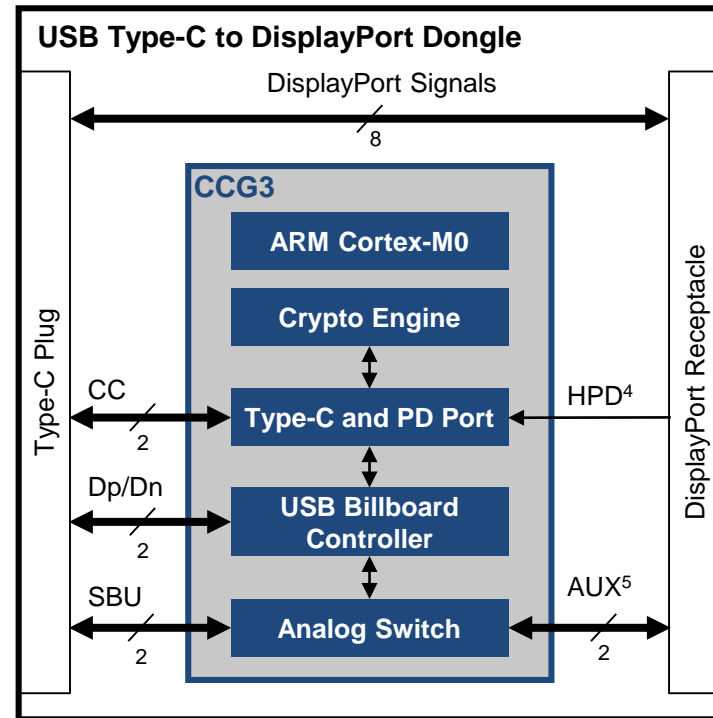


**CCG3 reduces complexity and BOM for video dongles**

[1] High-Definition Multimedia Interface is a display standard used for monitors/TVs
[2] Video Graphics Array is a legacy display standard used for monitors
[3] A specification that defines the method for a USB Device to communicate the supported Alternate Modes

[3] Hot Plug Detect (HPD) is DisplayPort control signal used to detect when a DisplayPort monitor is plugged in
[4] DisplayPort control signals used for audio

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Proof Source    5

# CCG3 Solution Example:
# Type-C Power Adapter With PD[1]

## Cypress Solution Value

### Design Challenges
Short time-to-market demands programmable solutions
Solutions must be turnkey for ease of design
Solutions must support 20-V operation
Solutions must be flexible to keep up with USB-IF standards
Solutions must include authentication for approved devices

### CCG3 Solution
Includes an ARM® Cortex®-M0 with dual 64KB flash
Ships with USB-IF-compliant factory-programmed firmware
Supports 20-V operation, including $V_{BUS}$ Gate Drivers[2], OVP[3] and OCP[3] circuitry
Integrates 2x64KB flash with fail-safe flash updates
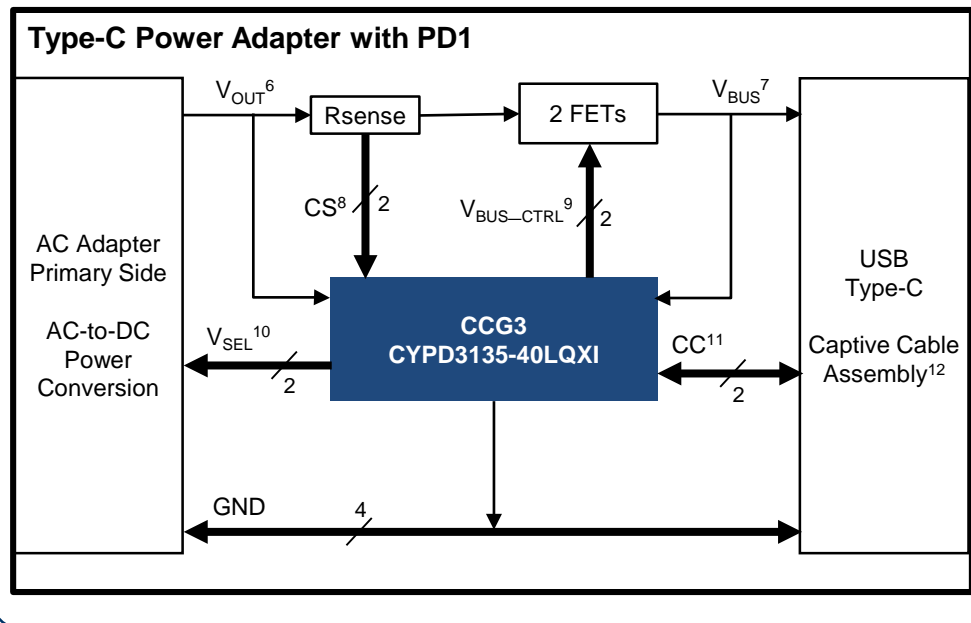Integrates a Crypto Engine[4] supporting USB Authentication[5]

## Suggested Collateral

| | |
|---|---|
| Webpage: | CCG3 Product Web Page |
| Datasheet: | CCG3 Datasheet |
| Development Kit: | CCG3 Development Kit |
| Video: | CCG3 Demo Video |

## How To Get Started

Get a CCG3 Development Kit

## Block Diagram

**Type-C Power Adapter with PD1**



Block diagram: AC Adapter Primary Side / AC-to-DC Power Conversion → CCG3 CYPD3135-40LQXI. Signals: $V_{OUT}$[6], Rsense, 2 FETs, $V_{BUS}$[7], $CS$[8]/2, $V_{BUS-CTRL}$[9]/2, $V_{SEL}$[10]/2, $CC$[11]/2, USB Type-C Captive Cable Assembly[12], GND/4

### Type-C Power Adapter with PD By Chicony

A 100-W power adapter that uses a Type-C connector and requires all PD profiles
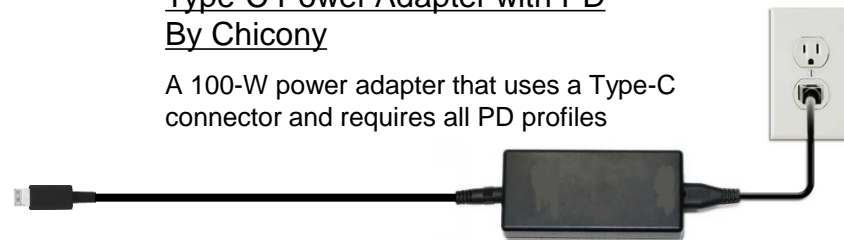


[1] A new USB standard that increases Power Delivery over $V_{BUS}$ from 7.5 W to 100 W
[2] Circuits to control the gates of external power Field-Effect Transistors (FETs) on $V_{BUS}$ (5-20 V)
[3] Overvoltage protection and overcurrent protection
[4] The encryption hardware and software required to implement USB Authentication
[5] A new USB-IF specification that defines the standard authentication protocol for Type-C accessories
[6] Output voltage of the AC to DC adapter
[7] The power wire of the USB bus
[8] Current-sensing input
[9] Signal to control $V_{BUS}$ load switch
[10] Output voltage selection
[11] Configuration Channel: The USB Type-C bus wire used to carry the PD protocol signals
[12] A cable permanently attached to the AC adapter

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Solution Example   6

# USB Type-C to DisplayPort[1] Dongle

## Cypress Solution Value

### Design Challenges
Short time-to-market demands programmable solutions
Solutions must be turnkey for ease of design
Solutions must support Alternate Modes[2]
Solutions must be flexible to keep up with USB-IF[3] standards
Solutions must include authentication for approved devices

### CCG3 Solution
Includes an ARM® Cortex®-M0 with dual 64KB flash
Ships with USB-IF-compliant factory-programmed firmware
Integrates USB Billboard Controller[4] for Alternate Modes[2]
Integrates 2x64KB flash with fail-safe flash updates
Integrates a Crypto Engine[5] supporting USB Authentication[6]

## Block Diagram

**USB Type-C to DisplayPort[1] Dongle**

Data Lines (USB SuperSpeed, DisplayPort)

Type-C Plug

$V_{BUS}$[7]
Dp/Dn[8]  2
$V_{CONN}$[9]
CC[10]
SBU[11]  2
GND  4

CCG3
CYPD3120-
40LQXI

AUXp/AUXn[12]  2
HPD[13]

DisplayPort Receptacle

8

## Suggested Collateral

Webpage:              CCG3 Product Web Page
Datasheet:            CCG3 Datasheet
Development Kit:      CCG3 Development Kit
Video:                CCG3 Demo Video

## How To Get Started

Get a CCG3 Development Kit
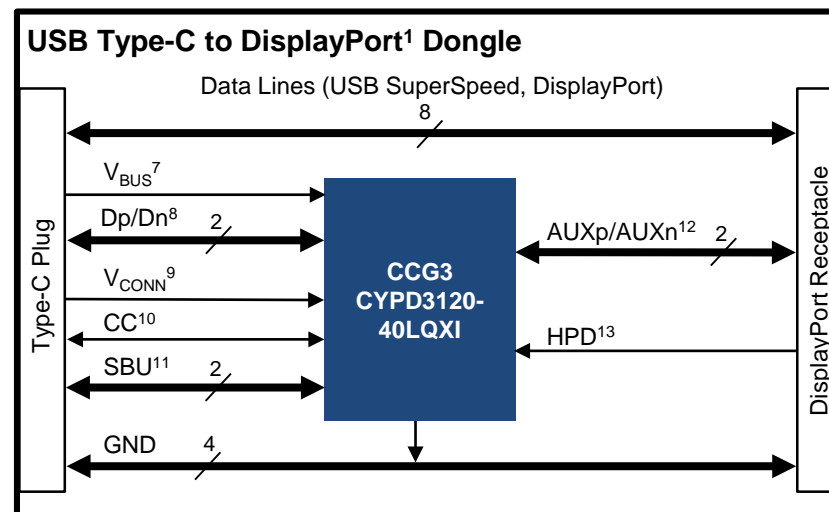
USB Type-C DisplayPort[1] Cable By Goodway

A notebook PC accessory that converts a USB Type-C port to a DisplayPort[1] output to connect a monitor

[1] A display interface standard developed by the Video Electronics Standards Association (VESA)
[2] Mode of operation in which the data lines are repurposed to transmit non-USB data
[3] The USB Implementers Forum creates and maintains USB specifications
[4] A USB Device controller that is used to implement the USB Billboard Device Class
[5] The encryption hardware and software required to implement USB Authentication
[6] A new USB-IF specification that defines the standard authentication protocol for Type-C accessories
[7] USB Type-C bus wire used for system power

[8] USB Type-C bus wires used to transmit and receive USB 2.0 data
[9] USB Type-C bus wire used to power the controller in the EMCA
[10] Configuration Channel: The USB Type-C bus wire used to carry the PD protocol signals
[11] The use of a USB Type-C bus wire for non-USB control signals, such as DisplayPort signals
[12] DisplayPort control signals used for audio
[13] Hot Plug Detect: A DisplayPort control signal used to detect when a monitor is plugged in

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Solution Example    7