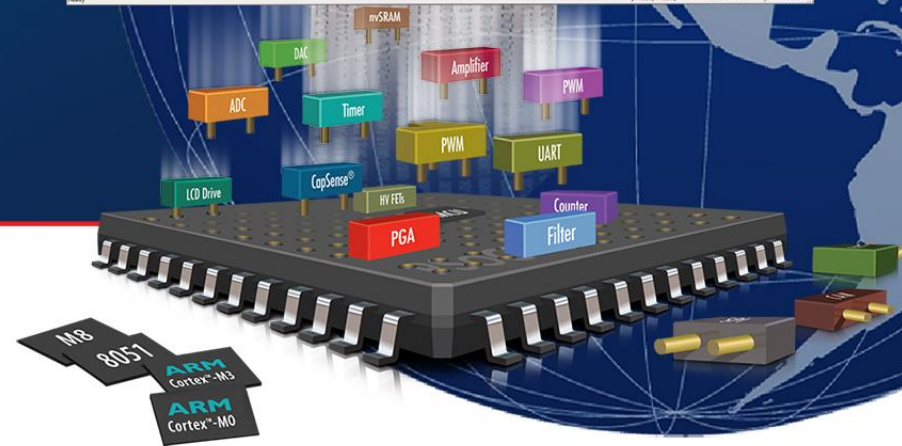
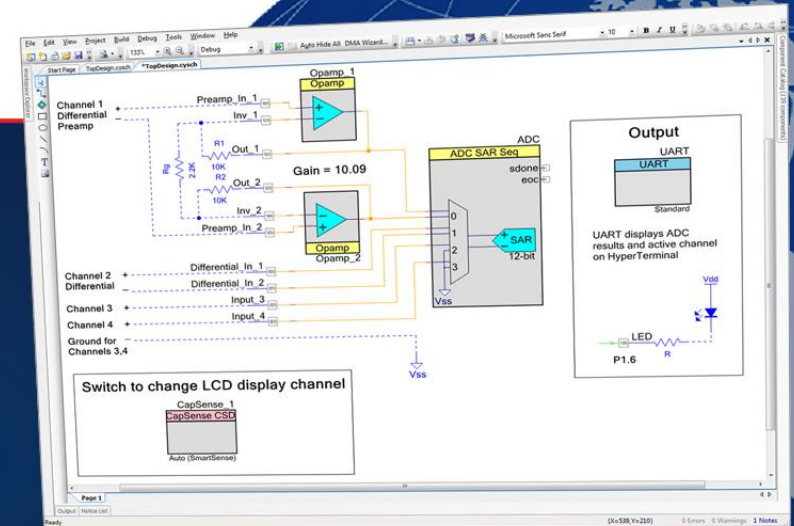


Solution Examples: EZ-PD™ CCG2



CCG2 Solution Example: Passive EMCA¹ With Two CCG2

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C cable plug

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via CC³ or SWD⁴
- Integrates transceiver, termination resistors, and ESD protection
- Available in 3.3-mm² CSP and 8.7-mm² DFN packages

Suggested Collateral

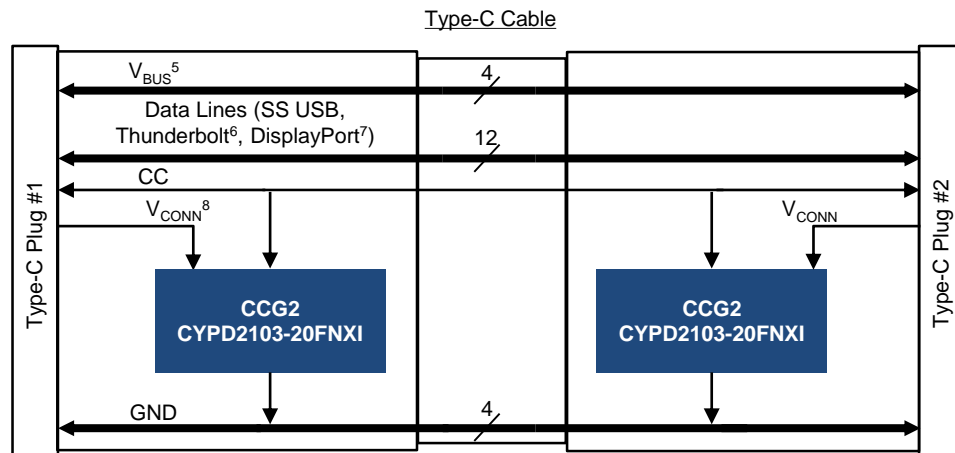
- Webpages: [Type-C](#), [CCG2](#), and [Reference Design](#)
- Datasheet: [CCG2 Datasheet](#)
- App Note: [Design USB 3.1 Type-C Cables Using CCG2](#)
- Video: [Introduction to CCG2](#)
- Demo Kit: [CY4502 EZ-PD CCG2 Development Kit](#)

How To Get Started

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Block Diagram

Passive EMCA With One CCG2 Per Cable Plug



Passive EMCA with CCG2

An EMCA that supports the PD protocol. A CCG2 is embedded at each end of the cable and is powered individually by the USB Type-C port at each end

¹ Electronically-marked cable assembly
² USB power delivery
³ Configuration channel
⁴ Single-wire debug port

⁵ The power wire of the USB bus
⁶ An interface jointly defined by Intel and Apple that connects peripherals to a computer; it uses the same connector as Mini DisplayPort

⁷ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor
⁸ USB Type-C bus wire used to power the IC in the EMCA

CCG2 Solution Example: Passive EMCA¹ With One CCG2

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C cable plug

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via CC³ or SWD⁴
- Integrates transceiver, termination resistors, and ESD protection
- Available in 3.3-mm² CSP and 8.7-mm² DFN packages

Suggested Collateral

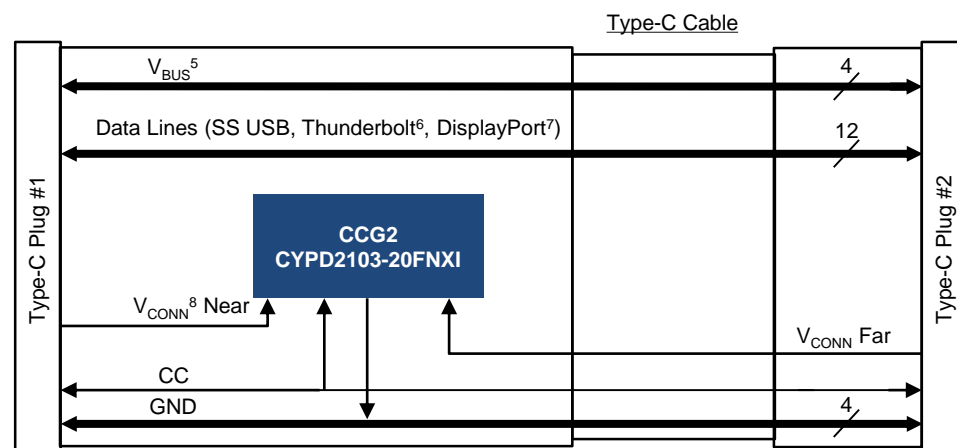
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Block Diagram

Passive EMCA With One CCG2 Per Cable



Passive EMCA with CCG2

A lower-cost implementation of EMCA that supports the PD protocol. A CCG2 is embedded at only one end of the cable and is powered by either USB Type-C port located at each end.

¹ Electronically marked cable assembly

² USB power delivery

³ Configuration channel

⁴ Single-wire debug port

⁵ The power wire of the USB bus

⁶ An interface jointly defined by Intel and Apple that connects peripherals to a computer; it uses the same connector as Mini DisplayPort

⁷ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁸ USB Type-C bus wire used to power the IC in the EMCA

CCG2 Solution Example: Active EMCA¹

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C cable plug

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via CC³ or SWD⁴
- Integrates transceiver, termination resistors, and ESD protection
- Available in 3.3-mm² CSP and 8.7-mm² DFN packages

Suggested Collateral

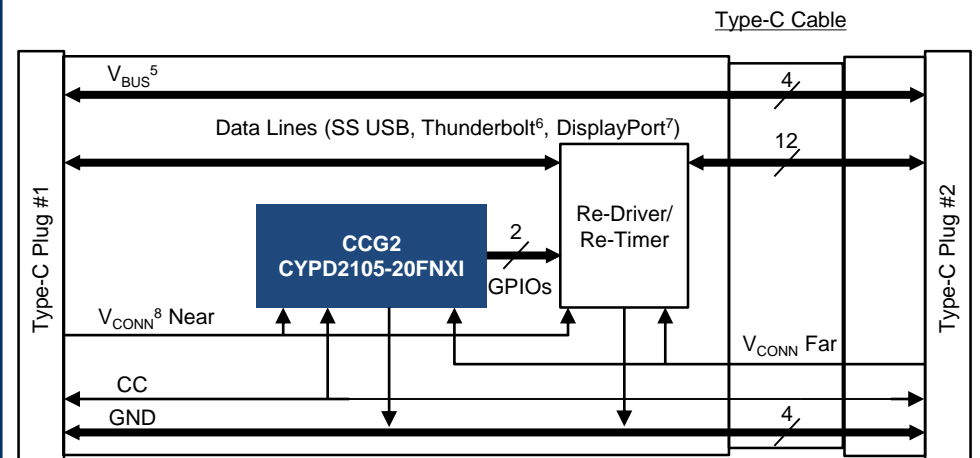
- Webpages: [Type-C](#) and [CCG2](#)
- Datasheet: [CCG2 Datasheet](#)
- App Note: [Design USB 3.1 Type-C Cables Using CCG2](#)
- Video: [Introduction to CCG2](#)
- Demo Kit: [CY4502 EZ-PD CCG2 Development Kit](#)

How To Get Started

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Block Diagram

Active EMCA



Active EMCA with CCG2

An EMCA that includes an embedded re-driver to extend the cable length

¹ Electronically marked cable assembly with a re-driver

² USB power delivery

³ Configuration channel

⁴ Single-wire debug port

⁵ The power wire of the USB bus

⁶ An interface jointly defined by Intel and Apple that connects peripherals to a computer; it uses the same connector as Mini DisplayPort

⁷ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁸ USB Type-C bus wire used to power the IC in the EMCA

CCG2 Solution Example: USB Type-C to DisplayPort¹ Cable

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C-to-DisplayPort dongle

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Integrates transceiver, termination resistors, and ESD protection
- Available in 16-mm² QFN package

Suggested Collateral

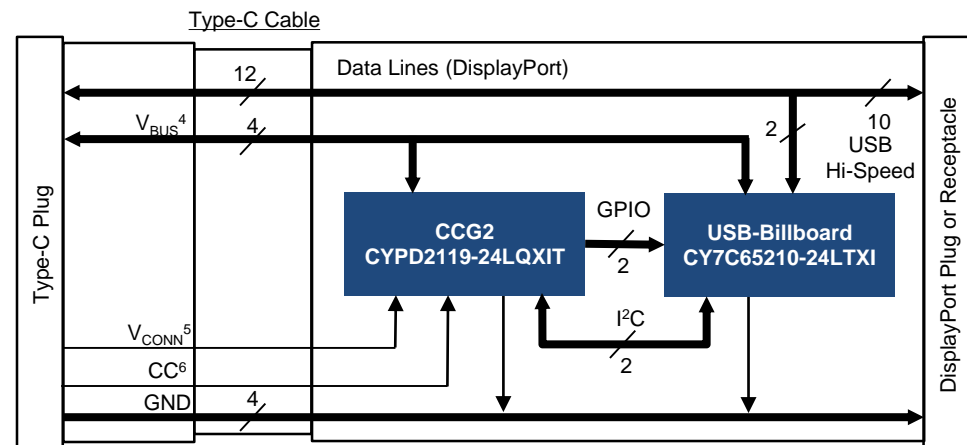
- Webpages: [Type-C](#), [CCG2](#), and [Reference Design](#)
- Datasheets: [CCG2 Datasheet](#), [USB Billboard Datasheet](#)
- App Note: [Hardware Design Guidelines for CCG2](#)
- Video: [Introduction to CCG2](#)

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Block Diagram

USB Type-C-to-DP¹ Dongle



USB Type-C DP Cable

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

¹ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

² USB power delivery

³ Single-wire debug port

⁴ The power wire of the USB bus

⁵ USB Type-C bus wire used to power the IC in the EMCA

⁶ Configuration channel

CCG2 Solution Example: USB Type-C to HDMI¹ Dongle Solution

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C-to-HDMI dongle

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Integrates transceiver, termination resistors, and ESD protection
- Available in 16-mm² QFN package

Suggested Collateral

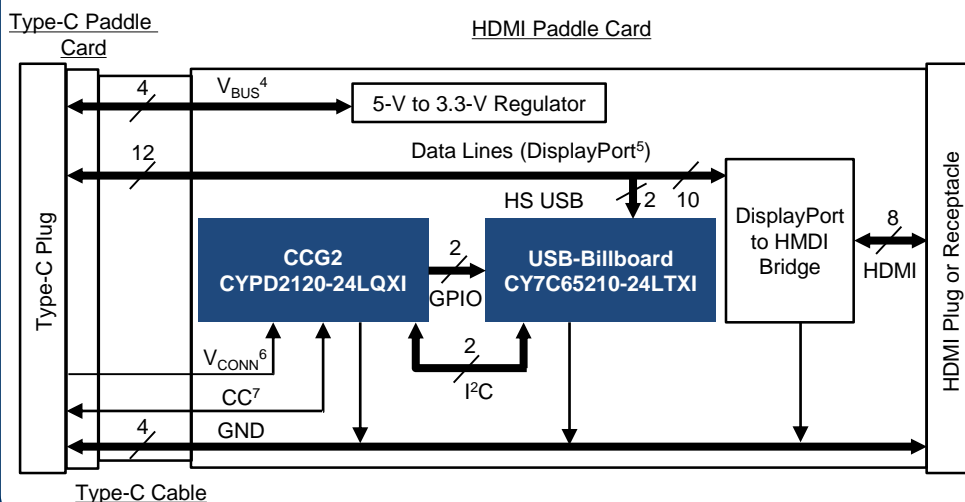
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- Video: [Introduction to CCG2](#)

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Block Diagram

USB Type-C-to-HDMI Dongle



USB Type-C HDMI Dongle

A notebook PC accessory that converts a USB Type-C port to an HDMI output to connect a monitor



¹ High-definition multimedia interface

⁴ The power wire of the USB bus

⁶ USB Type-C bus wire used to power the IC in the EMCA

² USB power delivery

⁵ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁷ Configuration channel

³ Single-wire debug port

CCG2 Solution Example: USB Type-C to DVI¹ Dongle Solution

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD² and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Fit inside a Type-C-to-DVI¹ dongle

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Integrates transceiver, termination resistors, and ESD protection
- Available in 16-mm² QFN package

Suggested Collateral

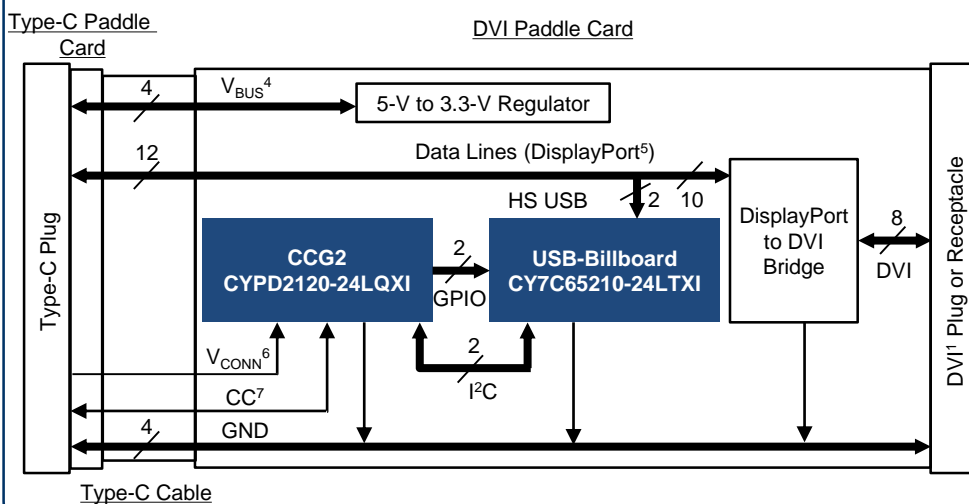
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- App Note: [Hardware Design Guidelines for CCG2](#)
- Video: [Introduction to CCG2](#)

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Block Diagram

USB Type-C-to-DVI Dongle



USB Type-C DVI Dongle

A notebook PC accessory that converts a USB Type-C port to an DVI output to connect a monitor



¹ Digital video interface
² USB power delivery
³ Single-wire debug port

⁴ The power wire of the USB bus
⁵ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁶ USB Type-C bus wire used to power the IC in the EMCA
⁷ Configuration channel

CCG2 Solution Example: USB Type-C to VGA¹ Dongle Solution

Cypress Solution Value

Design Challenges

Develop firmware for USB PD² and Billboard protocol
 Upgrade firmware to keep up with USB-IF standard changes
 Meet low BOM requirement
 Fit inside a Type-C-to-VGA dongle

CCG2 Solution

Ships with USB-IF-certified factory-programmed firmware
 Supports firmware upgrade via I²C or SWD³
 Integrates transceiver, termination resistors, and ESD protection
 Available in 16-mm² QFN package

Suggested Collateral

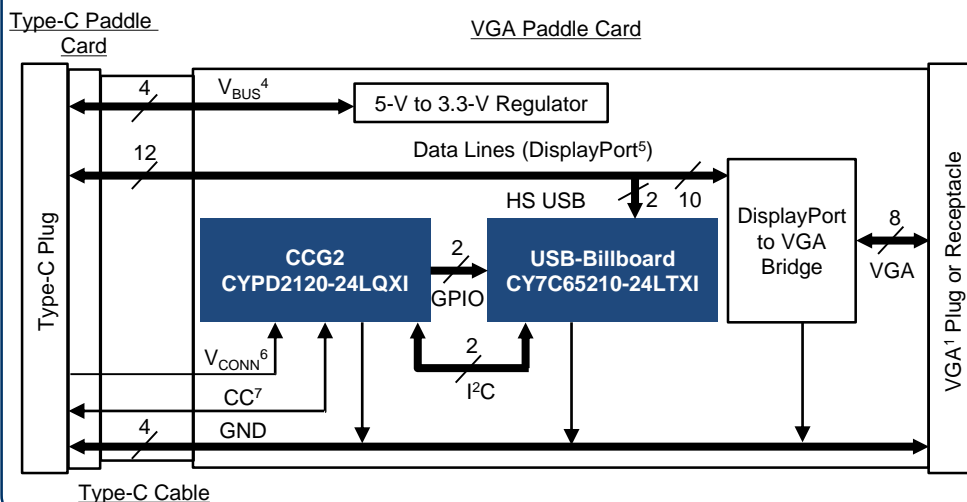
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 App Note: [Hardware Design Guidelines for CCG2](#)
 Video: [Introduction to CCG2](#)

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Block Diagram

USB Type-C-to-VGA Dongle



USB Type-C VGA Dongle

A notebook PC accessory that converts a USB Type-C port to an VGA output to connect a monitor



¹ Video graphics array
² USB power delivery
³ Single-wire debug port

⁴ The power wire of the USB bus
⁵ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁶ USB Type-C bus wire used to power the IC in the EMCA
⁷ Configuration channel

CCG2 Solution Example: Type-C Power Adapter

Cypress Solution Value

Design Challenges

Power adapter designers want a Type-C solution now
 Short time-to-market demands programmable solutions
 Must be turnkey for ease-of-design
 Must be highly integrated to lower BOM cost
 Must be reprogrammable to keep up with USB-IF standards
 Industry standards demand low power for no-load conditions

CCG2 Solution

Provides Type-C solution with Power Delivery (PD)¹
 Includes an ARM® Cortex®-M0 with 32KB flash
 Ships with USB-IF-compliant factory-programmed firmware
 Integrates Type-C transceiver, termination resistors, and system ESD protection
 Supports field upgrades with free, fully-compliant firmware
 Delivers low power: Deep Sleep² 2.5 μ A

Suggested Collateral

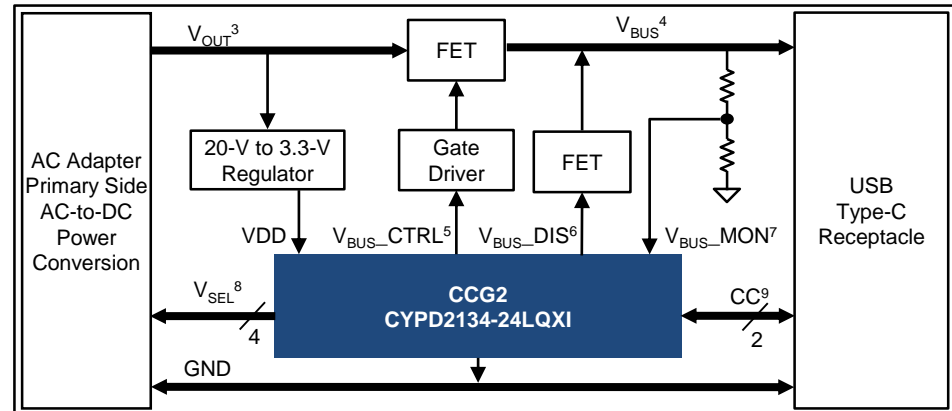
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Block Diagram

Type-C Power Adapter with CCG2



USB Type-C Cable



New Smartphone Charger with USB Type-C Receptacle

CCG2 supports the PD controller and supplies DC voltage



¹ USB power delivery
² Low power state where high-frequency clocks are shut down
³ DC output voltage of the AC adapter
⁴ The power wire of the USB bus
⁵ Signal to control V_{BUS} load

⁶ Signal to control V_{BUS} discharge FET
⁷ V_{BUS} monitoring node for overvoltage and undervoltage protection
⁸ Output voltage selection
⁹ Configuration channel

CCG2 Solution Example: Type-C Car Charger

Cypress Solution Value

Design Challenges

Car charger designers want a Type-C solution now
 Short time-to-market demands programmable solutions
 Must be turnkey for ease-of-design
 Must be highly integrated to lower BOM cost
 Must be reprogrammable to keep up with USB-IF standards
 Industry standards demand low power for no-load conditions

CCG2 Solution

Provides Type-C solution with Power Delivery (PD)¹
 Includes an ARM® Cortex®-M0 with 32KB flash
 Ships with USB-IF-compliant factory-programmed firmware
 Integrates Type-C transceiver, termination resistors, and system ESD protection
 Supports field upgrades with free, fully-compliant firmware
 Delivers low power: Deep Sleep² 2.5 μ A

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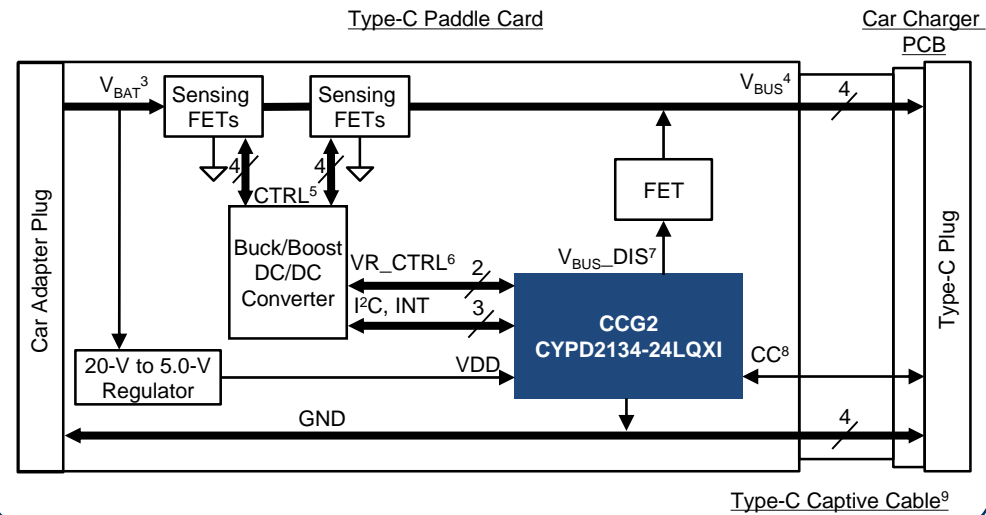
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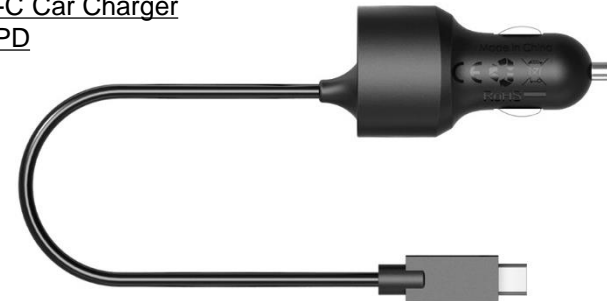
¹ A new USB standard that increases power delivery over V_{BUS} from 7.5 W to 100 W
² Low power state where high-frequency clocks are shut down
³ DC output voltage of the car battery and alternator
⁴ The power wire of the USB bus
⁵ Signals for V_{BUS} current sensing (CSP, CSN), high-side gate drive (HGATE), and low-side gate drive (LGATE)

Block Diagram

Type-C Car Charger with CCG2



USB Type-C Car Charger
with USB-PD



⁶ Control signals for the voltage regulator including current limit and enable
⁷ Signal to control V_{BUS} discharge FET
⁸ Configuration channel
⁹ A cable permanently attached to the car charger

CCG2 Solution Example: USB Type-C Notebook

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD¹ and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Meet low BOM requirement
- Use one Type-C connector for data, video, and power

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD²
- Integrates transceiver, termination resistors, and ESD protection
- Routes USB 3.0 signals, DisplayPort³ signals, and 100 W over a Type-C cable and connector

Suggested Collateral

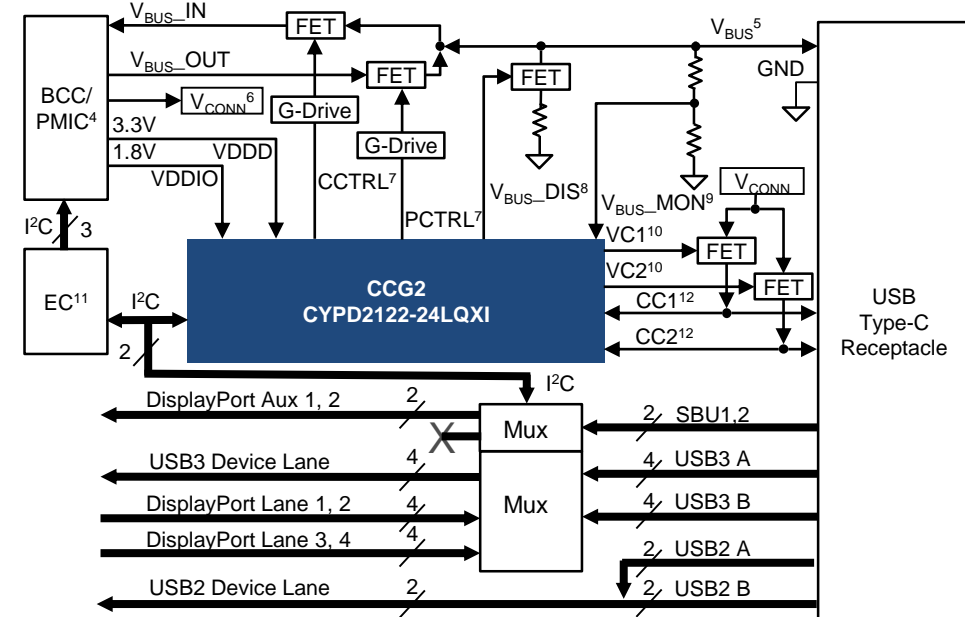
- Webpages: [Type-C](#) and [CCG2](#)
- Datasheet: [CCG2 Datasheet](#)
- Video: [Introduction to CCG2](#)

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Block Diagram

USB Type-C Notebook with CCG2



Type-C Notebook with CCG2

CCG2 supports both PD provider and consumer roles, allowing a notebook to provide power to or consume power from its Type-C port



¹ USB power delivery

² Single-wire debug port

³ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁴ Battery charge controller/Power Management IC

⁵ The power wire of the USB bus

⁶ The power wire of the USB Type-C bus that is used to power the IC in the EMCA

⁷ Signal to control the provider, consumer V_{BUS} load

⁸ Signal to control V_{BUS} discharge FET

⁹ V_{BUS} monitoring node for over and undervoltage protection

¹⁰ V_{CONN} control signal to turn on V_{CONN}

¹¹ Embedded Controller

¹² Configuration channel

CCG2 Solution Example: USB Type-C Monitor

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD¹ and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Support USB PD, BC1.2² and Apple charging
- Meet low BOM requirement
- Use one Type-C connector for data, video, and power

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Supports all USB charging standards with CCG2 and HX3
- Integrates transceiver, termination resistors, and ESD protection
- Routes USB 3.0 signals, DisplayPort⁴ signals, and 100 W over a Type-C cable and connector

Suggested Collateral

- Datasheets: [CCG2 Datasheet](#), [HX3 Datasheet](#), and [USB Billboard Datasheet](#)
- App Notes: [Design USB 3.1 Type-C Cables Using CCG2 and HX3 Hardware Design Guide](#)
- Demo Kits: [CCG2 Notebook/Monitor Demo Kit](#) and [HX3 CY4603 DVK](#)

How To Get Started

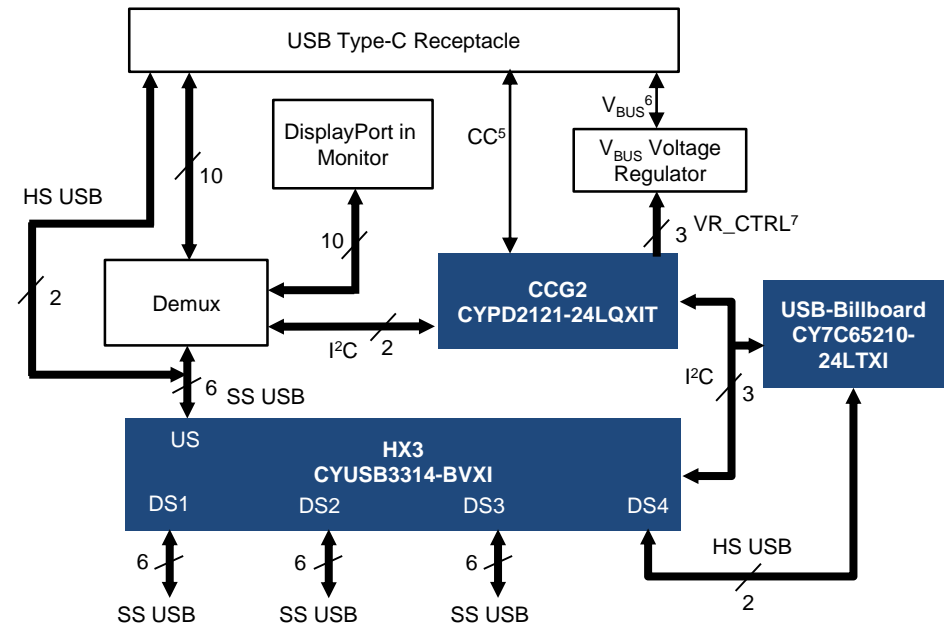
[Contact Sales](#) for Type-C reference design

¹ USB power delivery
² USB Battery Charging Specification Version 1.2
³ Single-wire debug port

⁴ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

Block Diagram

USB Type-C Monitor



Type-C Monitor with CCG2, HX3, and USB Billboard

A solution supporting all PD profiles and data routing control



⁵ Configuration channel
⁶ The power wire of the USB bus
⁷ Signals to control voltage regulator

CCG2 Solution Example: USB Type-C Tablet Charging Dongle

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD¹ and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Support USB PD, BC1.2² and Apple charging
- Meet low BOM requirement
- Use one Type-C connector for data, video, and power

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Supports all USB charging standards with CCG2 and HX3
- Integrates transceiver, termination resistors, and ESD protection
- Routes USB 3.0 signals, DisplayPort⁴ signals, and 100 W over a Type-C cable and connector

Suggested Collateral

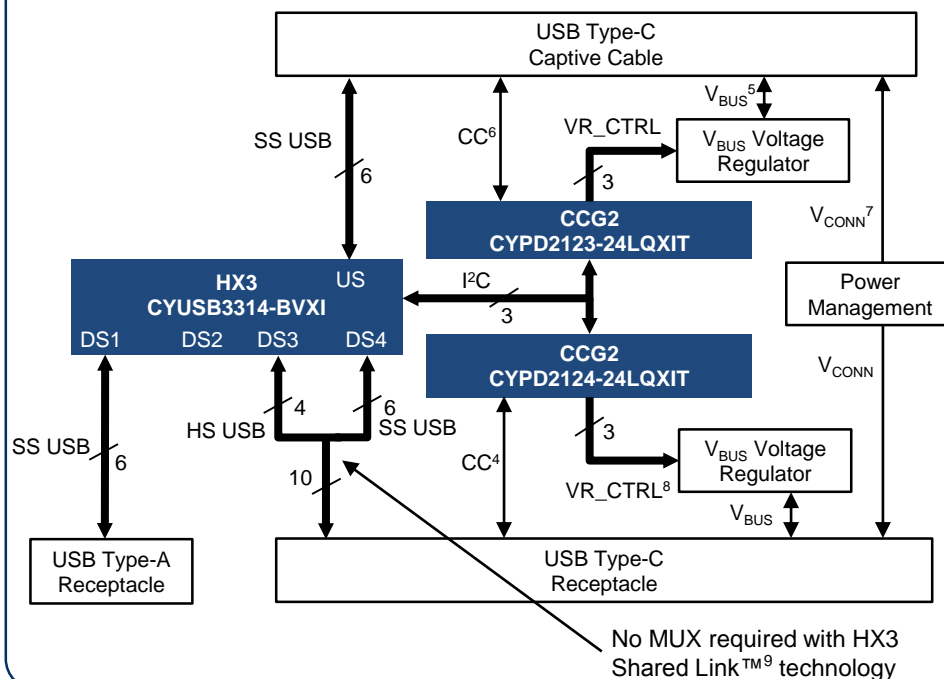
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Block Diagram

USB Type-C Tablet Charging Dongle



Type-C Charging Dongle with CCG2 and HX3

Solution can either be powered by tablet or charge tablet when downstream Type-C is connected to an AC power adapter



¹ USB power delivery

² USB Battery Charging Specification Version 1.2

³ Single-wire debug port

⁴ A display interface standard

⁵ The power wire of the USB bus

⁶ Configuration channel

⁷ The power wire of the USB Type-C bus that

is used to power the IC in the EMCA

⁸ Signals to control voltage regulator

⁹ A proprietary Cypress feature that enables a USB 3.0 port to be split into an internal SS port and a standard USB 2.0 port

CCG2 Solution Example: USB Type-C HDMI Multiport Adapter

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD¹ and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Support USB PD, BC1.2² and Apple charging
- Meet low BOM requirement
- Use one Type-C connector for data, video, and power

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Supports all USB charging standards with CCG2 and HX3
- Integrates transceiver, termination resistors, and ESD protection
- Routes USB 3.0 signals, DisplayPort⁴ signals, and 100 W over a Type-C cable and connector

Suggested Collateral

- Datasheets: [CCG2 Datasheet](#), [HX3 Datasheet](#), and [USB Billboard Datasheet](#)
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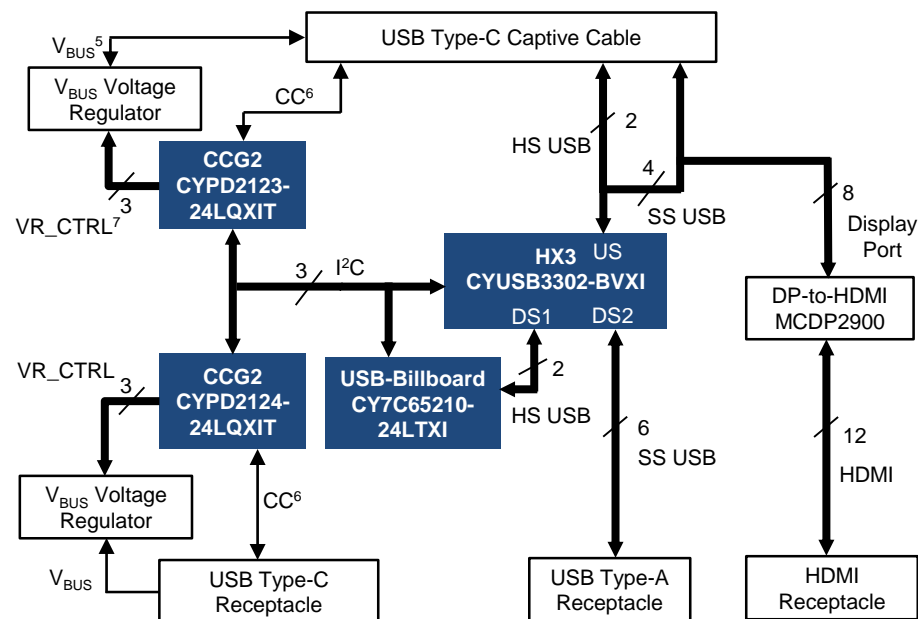
¹ USB power delivery
² USB Battery Charging Specification Version 1.2
³ Single-wire debug port

⁴ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁵ The power wire of the USB bus
⁶ Configuration channel
⁷ Signals to control voltage regulator

Block Diagram

USB Type-C HDMI Multiport Adapter



Type-C to HDMI Multiport Adapter with CCG2, HX3 and USB Billboard

Solution can either be powered by tablet or charge tablet when downstream Type-C is connected to AC power adapter



CCG2 Solution Example: USB Type-C Charging Dock

Cypress Solution Value

Design Challenges

- Develop firmware for USB PD¹ and Billboard protocol
- Upgrade firmware to keep up with USB-IF standard changes
- Support USB PD¹, BC1.2² and Apple charging
- Meet low BOM requirement
- Use one Type-C connector for data, video, and power

CCG2 Solution

- Ships with USB-IF-certified factory-programmed firmware
- Supports firmware upgrade via I²C or SWD³
- Supports all USB charging standards with CCG2 and HX3
- Integrates transceiver, termination resistors, and ESD protection
- Routes USB 3.0 signals, DisplayPort⁴ signals, and 100 W over a Type-C cable and connector

Suggested Collateral

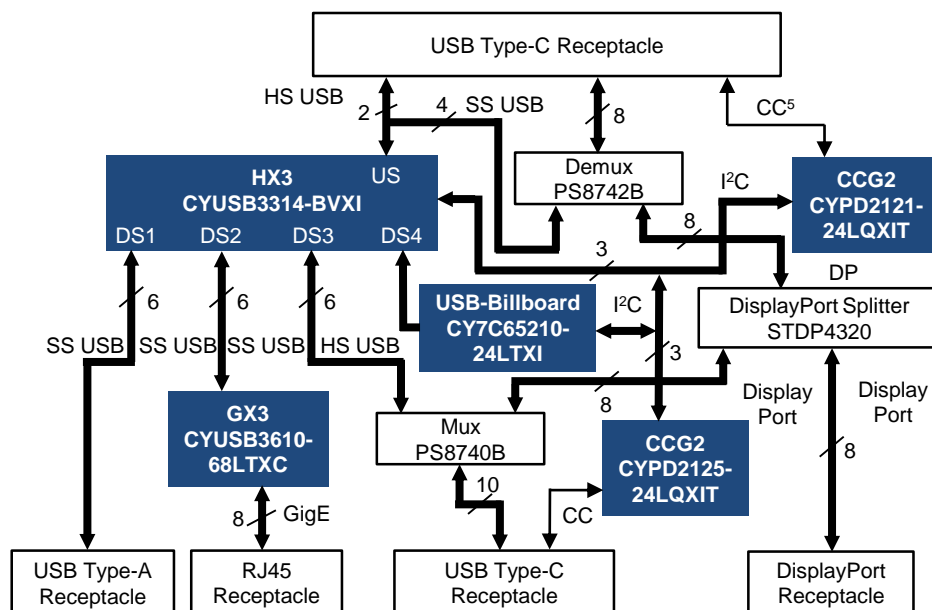
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- Demo Kits: [CCG2 Notebook/Monitor Demo Kit](#) and [HX3 CY4603 DVK](#)

How To Get Started

[Contact Sales](#) for Type-C reference design

Block Diagram

USB Type-C Charging Dock



USB Type-C Charging Dock with CCG2, HX3, GX3 and USB Billboard

Solution is powered by a 24-V @ 4-A power adapter and can provide up to 20 V @ 2 A on upstream Type-C port and 5 V @ 3 A on downstream Type-C port

¹ USB power delivery

² USB Battery Charging Specification Version 1.2

³ Single-wire debug port

⁴ A display interface standard developed by the Video Electronics Standards Association used primarily to connect a video source to a display such as a computer monitor

⁵ Configuration channel