Quick Presentation:
EZ-PD CCG1: USB Type-C Port Controller With PD

CCG1 = Type-C Controller Gen1
Type-C = New USB Connector Standard
PD = Power Delivery

Don’t Miss the Rapid Change Over to the New, Slimmer, All-in-One, 100-W, Type-C Connector
USB Type-C: Connector of the Future

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 signals and PCIe or DisplayPort signals on the same connector
- Easy implementation of low-cost USB Power Delivery up to 100 W

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

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\(^1\) The USB Implementers Forum creates and maintains USB specifications

\(^2\) Peripheral Component Interconnect Express is a standard for the primary bus in PCs
USB Type-C Port Controller Market Will Grow to $350M by 2019

USB Type-C port controllers are projected to grow from $65M in 2015 to $350M in 2019—a 40% CAGR

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 market requires a USB-IF\(^1\) 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 PCIe\(^2\) or DisplayPort\(^3\) signals on the same connector
- Supports all Power Delivery profiles\(^4\) up to 100 W, for notebooks, tablets, monitors, USB cables and power adapters

Cypress has been “Making USB Universal®” since 1996

Cypress has shipped over 1.4 billion USB controllers

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 CCG1 Type-C port controller

Products That Will Require Type-C Port Controllers

1 The USB Implementers Forum creates and maintains USB specifications
2 Peripheral Component Interconnect Express is a standard for the primary bus in PCs
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 monitor
4 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)
CCG1 Simplifies Design, Reduces BOM

Integrated Type-C transceivers, OVP¹ and OCP² circuitry simplify system design and reduce BOM cost

MCU-based solutions require external comparators to support Type-C signaling and overvoltage protection

MCU-based solutions implement the Type-C transceiver in firmware, requiring engineering effort and additional memory

**CCG1 Type-C Port Controller With Integrated Type-C Transceivers**

- **External components:**
  - 9 resistors
  - 1 capacitor
  - 0 comparators
  - Not required

- **Firmware development:**
  - Required

**MCU-Based Solutions**

- **External components:**
  - 12 resistors
  - 1 capacitor
  - 2 comparators

- **Firmware development:**
  - Required

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1. Overvoltage protection
2. Overcurrent protection
3. Reference voltage used to detect the value of the Configuration Channel (CC)
4. A control signal that is driven HIGH when there is a downstream-facing port
5. Configuration Channel: USB Type-C bus wire used to carry the PD protocol signals
6. A control signal that is driven LOW when there is an upstream-facing port
7. A reference voltage used to check for overvoltage
8. The bus voltage that is compared with the reference voltage
9. The I/O voltage of Type-C bus wire
10. A termination resistor denoting a downstream-facing port
11. A control signal that is driven LOW to transmit data
12. A termination resistor denoting an upstream-facing port
13. The receive signal of the CC
14. The transmit signal of the CC
CCG1 is Programmable and Upgradable

CCG1 can be upgraded to keep pace with changes in the USB-IF\(^1\) specification

The ARM\(^\circledast\) Cortex\(^\circledast\)-M0 and 32KB flash can be programmed anytime, anywhere using its Serial Wire Debug (SWD), I\(^2\)C or CC\(^2\) wires.

**Upgrading CCG1 Using SWD**

Run PSoC Programmer software on a PC with a MiniProg3 USB dongle to program the CCG1. Typically used during product development.

**Upgrading CCG1 Using I\(^2\)C**

Use an MCU embedded in the USB Type-C cable/accessory or a production tester to program CCG1. Can be used on the production line or in the field.

**Upgrading CCG1 Using CC\(^2\)**

Use a PC running a firmware upgrade application to program CCG1 in the USB Type-C cable directly. Can be deployed by cable manufacturers to provide upgrades to the end user.

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1 The USB Implementers Forum creates and maintains USB specifications

2 Configuration Channel: USB Type-C bus wire used to carry the PD protocol signals
**CCG1 Solution Example:**

**USB Type-C to DisplayPort (DP\(^1\)) Cable**

### Cypress Solution Value

**Design Challenges**
- Legacy displays have DP\(^1\) and not Type-C
- Type-C to DP\(^1\) adapter solutions are needed
- Solutions must be turnkey for ease of design
- Solutions must be flexible to keep up with USB-IF\(^2\) standards
- Solutions must be highly integrated to lower BOM cost
- Solutions must be in a package that fits in a cable assembly

**CCG1 Solution**
- Supports Type-C to DP\(^1\) with an ARM\(^\circledR\) Cortex\(^\circledR\)-M0 controller
- Supports PD protocol for Type-C to DP\(^1\) with the 32KB flash
- Ships with USB-IF\(^2\) compliant factory-programmed firmware
- Supports field upgrades with free, fully compliant firmware
- Integrates Type-C transceiver, supports multiple protocols
- Available in 35-ball CSP (6.8 mm\(^2\)) and 40-pin QFN (25 mm\(^2\))

### Suggested Collateral

- **Datasheet:** [CCG1 Datasheet](#)
- **Demo Kit:** [CCG1 Client Demo Kit](#)
- **Video:** [CCG1 Demo Video](#)

### How To Get Started

Get a [CCG1 Client Demo Kit](#)

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1 A display interface standard developed by the Video Electronics Standards
2 The USB Implementers Forum creates and maintains USB specifications
3 USB Type-C bus wire used to power the IC in the EMCA
4 Configuration Channel is the USB Type-C bus wire used to carry the PD protocol signals
**CCG1 Solution Example:**

**Type-C Power Adapter**

### Cypress Solution Value

**Design Challenges**
- Notebook designers want a Type-C solution now
- Short time-to-market demands programmable solutions
- Solutions must be turnkey for ease of design
- Solutions must be highly integrated to lower BOM cost
- Solutions must be flexible to keep up with USB-IF\(^1\) standards
- Industry standards demand low power for no-load conditions

**CCG1 Solution**
- Provides Type-C solution with PD\(^2\) today
- Includes an ARM\(^\circ\) Cortex\(^\circ\)-M0 with 32KB flash
- Ships with USB-IF\(^1\) compliant factory-programmed firmware
- Integrates Type-C transceiver and OVP\(^3\), OCP\(^4\) circuitry
- Supports field upgrades with free, fully compliant firmware
- Delivers low power: Deep Sleep 1.3 µA

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1 The USB Implementers Forum creates and maintains USB specification
2 A new USB standard that increases power delivery over \(V_{\text{bus}}\) from 7.5 W to 100 W
3 Overvoltage protection
4 Overcurrent protection
5 DC output voltage of the AC adapter

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The **Type-C Power Adapter With CCG1**

CCG1 supports all PD profiles required for a 100-W power adapter

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6 Output voltage selection
7 The power wire of the USB bus
8 Signal to control \(V_{\text{bus}}\) load
9 Configuration Channel is the USB Type-C bus wire used to carry the PD protocol signals
10 Current-sensing input
11 A cable permanently attached to the AC adapter