



# MCDP9000

## USB Type-C Port Controller

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## Features

- TPCP specification compliant device to support PD 3.0 standard
  - Port controller to be capable for DRP
  - Fast-Role swap
  - $V_{BUS}$  sourcing / sinking control
  - $V_{CONN}$  sourcing / sinking control
  - $V_{BUS}$  monitoring / alarming
  - USB Type-C CC logic
    - Port role swap
    - CC line status reporting
    - Rp / Rd control
    - CC sense / debounce / interrupt
  - USB PD message delivery
  - Debug Accessory Detection
  - TPCP Transmitter / Receiver state machine
  - TPCP register map
- USB Type-C  $V_{CONN}$ 
  - Integrated  $V_{CONN}$  switch and  $V_{CONN}$  path selection
  - $V_{CONN}$  supply voltage 3.0V – 5.5V
  - 1.5W support (up to 300mA)
- $V_{BUS}$  monitor
  - 10-bit measurement interface
  - 4V to 21.5V ( $\pm$  margin) with 25mV resolution
  - Accuracy of  $\pm 2\%$  or  $\pm 50\text{mV}$  in above voltage region
- Active low Alert# as status change indicator
- $V_{BUS}$  discharge control
  - Integrated 5V  $V_{BUS}$  discharge path
  - Control signal for  $> 5\text{V}$   $V_{BUS}$  discharge path
- $V_{BUS}$  load control
  - External FET control signal
- $V_{BUS}$  voltage control
  - Variable resistance interface connected to feedback voltage of buck regulators
- USB Billboard device class support
  - USB 2.0 FS (Full-Speed) support
  - Flexibility to configure the bit field of billboard device class attributes
- Reference Clock
  - Operate with internal ring oscillator when USB billboard device is not used
  - Internal 48MHz reference clock for USB 2.0 FS PHY
- Built-in Power-on-Reset
- Device Configuration
  - I<sup>2</sup>C by accessing vendor specific address space
- Dead battery operation support
  - CC cable detection (exposing Rd to both CC1 and CC2) in dead battery status
- Power consumption / management(targets)
  - 31mW in typical with Billboard device enabled
  - 7mW in typical with Billboard device disabled
- Power Management through I2C control
  - I<sup>2</sup>C Interface Idle
  - PD Messaging disable
  - CC Status Reporting disable
  - $V_{BUS}$  reporting disable
    - $V_{BUS}$  detection
    - $V_{BUS}$  voltage alarm
    - $V_{BUS}$  monitoring
    - $V_{BUS}$  auto discharge
  - Fault status reporting disable
- Power Supply and IO voltage
  - Power Supply
    - $5\text{V} \pm 10\%$
  - I/O voltage for I<sup>2</sup>C and GPIOs
    - From 1.8V to 3.6V
  - CC /  $V_{CONN}$  / USB 2.0 D+/-
    - 5V tolerant
- ESD Specification
  - 2kV HBM
- Package
  - 24 pin QFN (4 mm x 4 mm)

## Applications

- Desktop PC / Notebook / Tablet / Smartphone motherboard / Docking Station / USB Type-C AV accessory

## 1. Description

The MCDP9000 is a USB Type-C Port Controller (TCPC) primarily targeted for USB type-C alternate mode and / or Power Delivery (PD) provider/consumer/dual-role devices such as mobile phones, tablets, notebooks, dongles, docking stations etc., which implement USB PD communication stack based on TCPM / TCPC topology. The MCDP9000 implements Type-C CC logic, USB PD BMC PHY for CC communication,  $V_{CONN}$  switch,  $V_{BUS}$  voltage monitor,  $V_{BUS}$  voltage control logic, 5V  $V_{BUS}$  discharge path, high voltage  $V_{BUS}$  discharge control, I<sup>2</sup>C slave to interface with EC (Embedded Controller) or CPU running device / policy management stack of PD, USB 2.0 full speed (FS) PHY and device controller to support billboard device.

## 2. Application Overview

Figure 1 shows a typical use case of the MCDP9000 together with a MCDP6000 in the notebook. This diagram shows a use case where a notebook supports both PD source to charge mobile devices such as smartphones and tablets and PD sink for its operation and battery charging. As the PD source for the mobile devices, 5V / 3A should cover most of the use cases while a higher power profile is required as the sink. To support higher power profiles, the MCDP9000 needs external components to handle higher voltage  $V_{BUS}$  line.

**Figure 1. Typical use case of MCDP9000 together with MCDP6000 in Notebook**

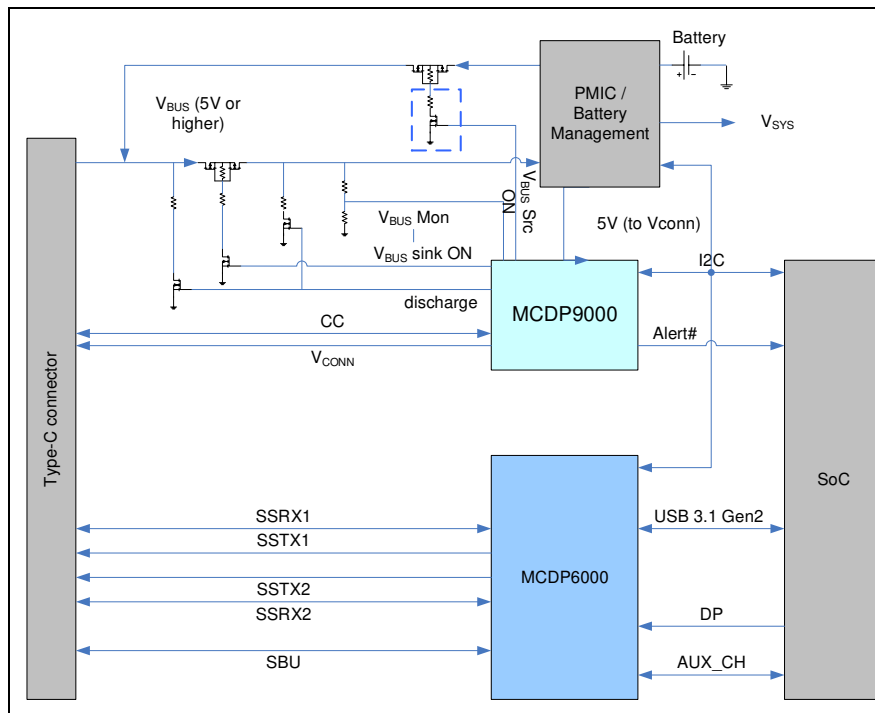


Figure 2 shows a typical use case of the MCDP9000 together with the MCDP6000 and the MCDP5xxx in a docking station. Type-C plug interface will be plugged into a notebook while USB Type-C pluggable device or cable will be plugged into the receptacle interface. In this use case, the MCDP9000 facing the plug interface will support “Provider” as PD source, which supports higher power profile than 15W. The receptacle receives the power from another PD source in this diagram. It is also possible that the Type-C receptacle interface supports “Provider” feature for battery charging of mobile devices. When the MCDP9000 is used with the MCDP5xxx, it will operate as TCPM interfacing with the MCDP9000 through I2C and Alert#. Since a typical docking station supports USB functionality, the MCDP9000’s billboard device class feature is defeatured for docking station type applications.

**Figure 2. Typical use case of MCDP9000 together with MCDP5xxx and MCDP6000 in Docking Station**

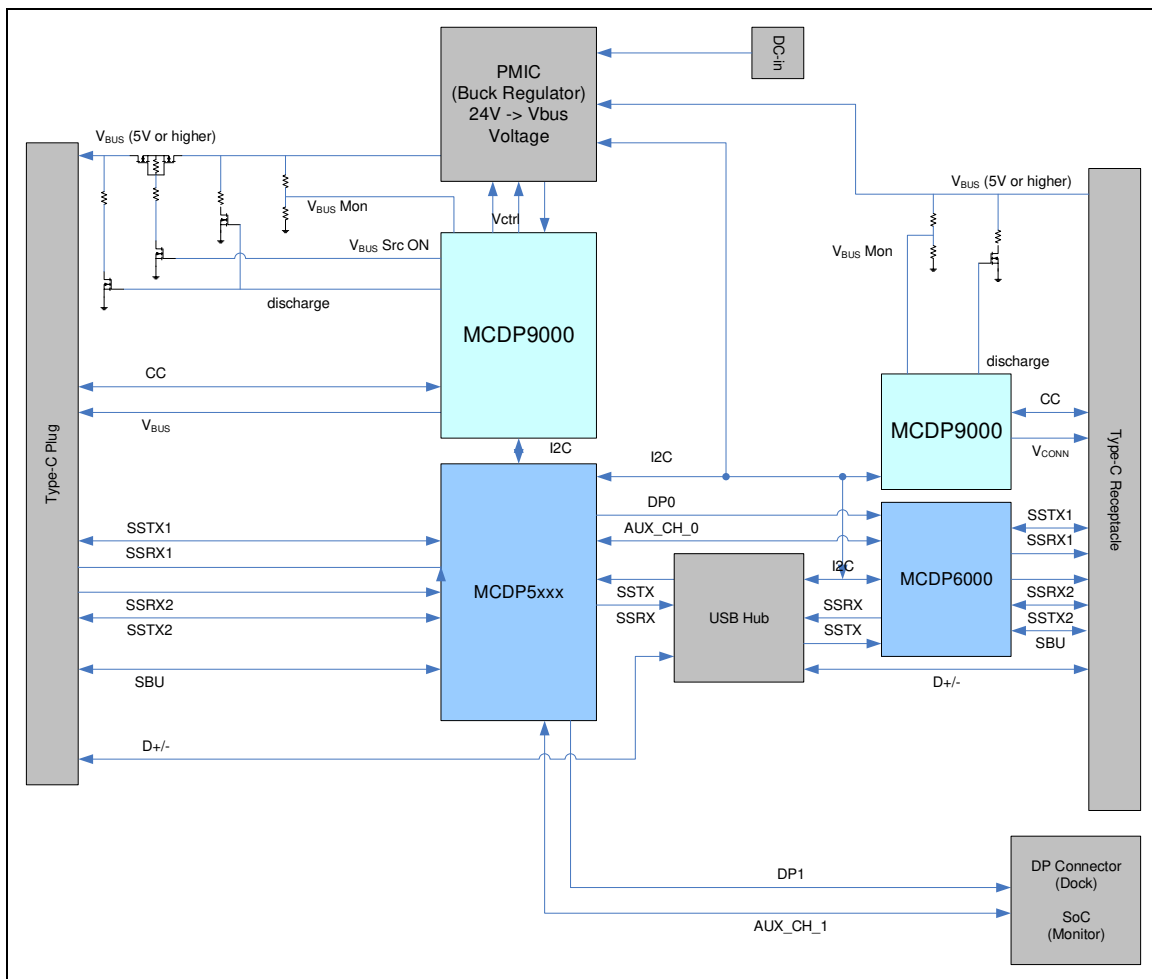
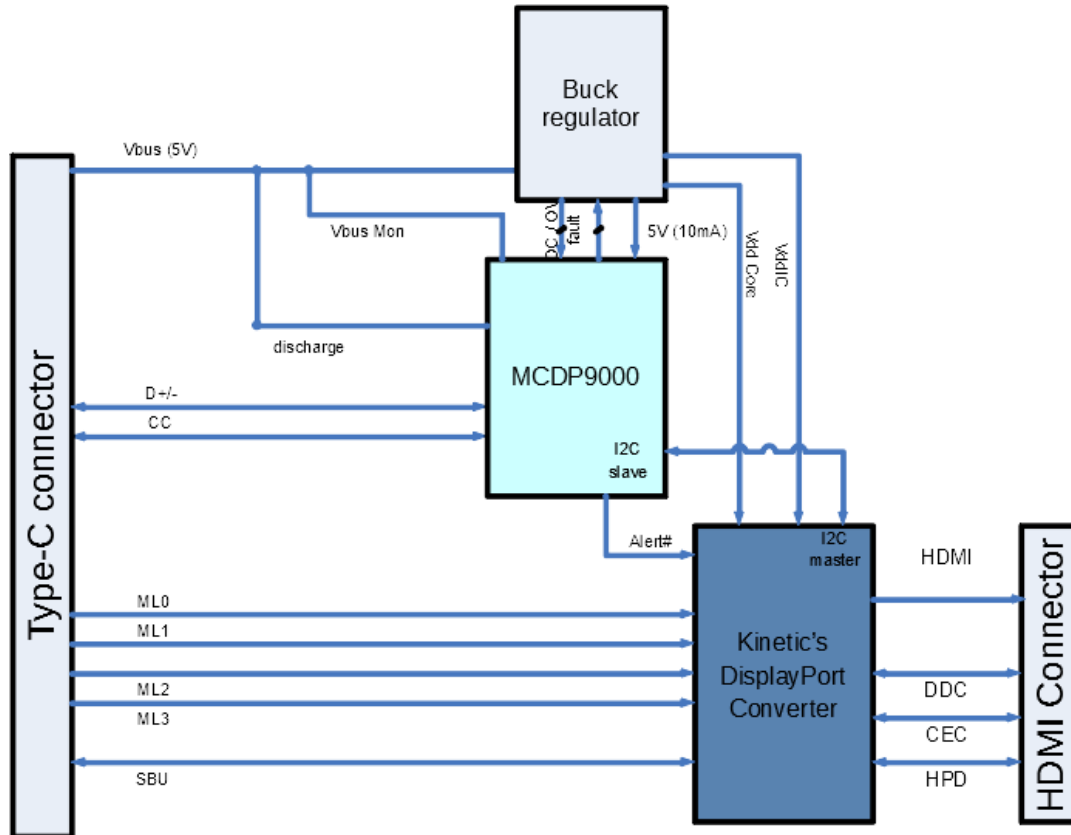


Figure 3 shows a typical use case of the MCDP9000 with a Kinetics’ DisplayPort converter product in an AV adapter. The AV adapter is going to use  $V_{BUS}$  line for its own power supply. 5V / 3A power profile should suffice for this application. Therefore, minimum BOM will be required in this use case. Because this

application does not support a separate USB function, the billboard device class in the MCDP9000 is used. A 48MHz reference clock is required to use USB 2.0 PHY and controller IP.

**Figure 3. Typical use case of the MCDP9000 together with Kinetic IC in A/V accessory**



### 3. Ordering Information

Part Number	Operating Temperature	Package
MCDP9000B0T	0°C to +70°C	QFN44-24