EZ-PD™ PMG1-S3 USB-C Dock solution release note

Version 1.0 build 139

About this document

Scope and purpose

This document contains release notes for the PMG1-S3 USB-C Dock solution firmware. It describes key features and known issues.

Intended audience

This document is intended for the customers of PMG1-S3-based Dock solutions who intend to develop their own docks based on the reference designs.

Table of contents

About this document **1**
Table of contents **2**
1 Introduction **3**
2 Firmware information **4**
2.1 Firmware features 4
2.2 Default device configuration 5
2.3 Default SVDM response 5
2.3.1 UFP (Port 0) 6
2.3.1.1 DISCOVER_ID response 6
2.3.1.2 DISCOVER_SVID response 7
2.3.1.3 DISCOVER_MODES response 7
2.3.2 DFP (Port 1) 7
2.3.2.1 DISCOVER_ID response 7
2.3.2.2 DISCOVER_SVID response 8
2.3.2.3 DISCOVER_MODES response 8
3 Limitations and known issues **9**
4 Technical support **10**
4.1 Additional information 10

1 Introduction

EZ-PD™ PMG1-S3 USB-C Dock is a self-powered dock that uses the EZ-PD™ PMG1-S3 device as a Power Delivery (PD) controller and also as a dock management controller (DMC). The USB-C dock uses CCG7SC as a PD controller and HX3 as a USB 3.1 Gen 1 controller.

EZ-PD PMG1-S3 USB-C Dock platform features three USB Type-C PD ports, one USB Type-A port, one display port, and one HDMI port. Two USB-C PD ports (upstream and downstream) are controlled by the PMG1-S3 PD microcontroller, while a third USB-C PD port (downstream) port is controlled by the CCG7SC USB Type-C PD controller, and one Type-A port is controlled by the HX3 USB hub. The display port (DP) hub VMM5320 from Synaptics takes the input from the upstream(US) port and routes to three separate display outputs connected to HDMI, DP, and USB-C downstream port.

Additionally, the solution supports MP4247 from MPS and RT6190 from Richtek external buck-boost controllers, which support power output up to 140 W on US PD port.

PMG1 (Power Delivery Microcontroller Gen1) is a family of high-voltage USB-C power delivery (PD) microcontrollers (MCU). These chips include an Arm® Cortex®-M0/M0+ CPU and USB-C PD controller along with analog and digital peripherals. PMG1-S3 expands the PMG1 family with 256 KB flash, 32 KB SRAM, 50 GPIOs, full-speed USB device controller, a crypto engine for authentication, analog resources (ADC, opamp, comparators, CAPSENSE™), and dual Type-C PD ports. It is targeted for device, dock, and accessory applications and is available in QFN and BGA packages.

2 Firmware information

2.1 Firmware features

This version of the PMG1-S3 USB-C Dock firmware is intended to be used on the PMG1-S3 USB-C Dock Reference Design Kit (RDK) platforms, which uses the CYPM1322-97BZXIT device as a USB PD controller and a dock management controller (DMC) supporting the following key application-level features:

- Type-C port configuration and connection detection in sink, source, and dual-role on Port 0, and source role on Port 1
- USB PD communication compliant with USB PD revision 3.1 version 1.8 specification
- Extended power range (EPR) support of 140 W in source role on Port 0
- Programmable power supply (PPS) support voltage range from 5 V to 21 V on Port 0
- Support for VESA DisplayPort Alt mode on Type-C standard version 1.0, which is compatible with the DisplayPort specifications 1.3 and 1.4
- USBFS device support (vendor, HID, and billboard classes)
- Support for power protections such as the following:
  - VBUS overvoltage protection (VBUS OVP)
  - VBUS overcurrent protection (VBUS OCP)
  - VBUS short-circuit protection (VBUS SCP)
  - VBUS undervoltage protection (VBUS UVP)
  - VCONN overcurrent protection (VCONN OCP)
- Dock management controller (DMC) features such as:
  - Signed/unsigned offline firmware update for EZ-PD™ PMG1-S3 and onboard components such as EZ-PD™ CCG7SC controller
  - Smart power management
  - Supports storing and retrieving ETAG information (for example, device serial number, MAC ID)
- Drivers for MP4247 buck-boost controllers from Monolithic Power Systems(MPS) and RT6190 regulators from Richtek Technology
- Host Processor Interface (HPI) master implementation for communication with EZ-PD™ CCG7SC slave device
- UART and internal flash logging mechanism for debugging
- LED control (for example, ON, OFF, blink, breath) driver for custom use cases in the dock design
- Adapter detection logic
- Deep Sleep operation
- Supports configurability of USB Type C, Power Delivery and dock management controller features through the EZ-PD™ Dock Configuration tool.

Refer to the README.md file in the mtb-example-pmg1s3-usbc-dock code example for additional details about the above features.

The PMG1-S3 USB-C Dock solution supports a dual asymmetric image, with a full-featured primary firmware and a reduced feature backup firmware. The solution uses a bootstrap to determine the image to be loaded at boot.

Table 1 Supported features in primary and backup firmware

Feature	Support in primary firmware	Support in backup firmware
USB PD communication with USB PD revision 3.1 version 1.8 compliance	Yes	No
Support for DP alternate mode version 1.0, compatible with DisplayPort specifications 1.3 and 1.4	Yes	No
HPI master for communication with CCG7SC	Yes	No
VBus OVP support	Yes	No
VBus OCP support	Yes	No
VBus UVP support	Yes	No
VBus SCP support	Yes	No
VConn OCP support	Yes	No
USBFS vendor class	Yes	No
USBFS HID class	Yes	No
USBFS billboard class	Yes	No
UART logging	Yes	Yes
Flash logging	Yes	No
LED control	Yes	Yes
Adapter detection logic	Yes	No
Smart power management	Yes	No
Supports storing and retrieving ETAG information	Yes	No
Offline firmware update	Yes	Yes (phase-2 only)
Extended alert message	Yes	No
Deep Sleep operation	Yes	No

2.2 Default device configuration

Table 2 Default device configuration Port 0

Parameter	Supported settings
Source PDOs	5 V @ 3 A, 9 V @ 3 A, 15 V @ 3 A, 20 V @ 5 A, 5 V-21 V @ 5 A (PPS), 28 V @ 5 A(EPR), 15 V-28 V @ 5 A (AVS)
Sink PDOs	5 V @ 0 A

Table 3 Default device configuration Port 1

Parameter	Supported settings
Source PDOs	5 V @ 3 A
Sink PDOs	N/A

2.3 Default SVDM response

The CYPM1322-97BZXIT device functions as a UFP on Port 0 and as a DFP on Port 1.

2.3.1 UFP (Port 0)

2.3.1.1 DISCOVER_ID response

The device reports PDUSB hub as UFP.

Response data: 0xFF00A841, 0x4C4004B4, 0x00, 0xF5040000, 0x61000031, 0x00

Table 4 DISCOVER_ID response

VDM header		
B31..16	Standard or vendor ID (SVID)	0xFF00
B15	VDM type	1b
B14..13	Structured VDM version (major)	01b
B12..11	Structured VDM version (minor)	01b
B10..8	Object position	000b
B7..6	Command type	01b
B5	Reserved	0b
B4..0	Command	00001b
ID header		
B31	Data capable as USB host	0b
B30	Data capable as a USB device	1b
B29..27	Product type (UFP) is PDUSB hub	001b
B26	Modal operation supported	1b
B25..23	Product type (DFP) is Not a DFP	000b
B22..21	Connector type (Receptacle)	10b
B20..16	Reserved. Shall be set to zero.	00000b
B15..0	16-bit USB vendor ID	0x04B4
Cert stat VDO		
B31..0	32-bit unsigned integer, XID	0
Product VDO		
B31..16	USB product ID	0xF504
B15..0	bcdDevice	0x0000
UFP VDO		
B31..29	UFP VDO version 1.3	011b
B28	Reserved	0b
B27..24	Device capability (USB 2.0 device capable)	0001b
B23..22	Connector type (legacy)	00b
B21..11	Reserved	0
B10..8	Vconn power	000b
B7	Vconn required	0
B6	Vbus required	0

B5..3	Alternate modes (except for TBT3 alternate mode)	110b
B2..0	USB Hi-Speed (USB3.2 Gen1)	001b

2.3.1.2 DISCOVER_SVID response

Response data: 0xFF00A842, 0xFF010000

Table 5 DISCOVER_SVID response

VDM header		
B31..16	Standard or vendor ID (SVID)	0xFF00
B15	VDM type	1b
B14..13	Structured VDM version (major)	01b
B12..11	Structured VDM version (minor)	01b
B10..8	Object position	000b
B7..6	Command type	01b
B5	Reserved	0b
B4..0	Command	00010b
VDO 1		
B31..16	SVID0	0xFF01
B15..0	SVID1	0

2.3.1.3 DISCOVER_MODES response

Mode response associated with DisplayPort Alt mode. Refer to the VESA DisplayPort Alt mode documentation.

Response data: 0xFF01A843, 0x001C0045

2.3.2 DFP (Port 1)

2.3.2.1 DISCOVER_ID response

The device reports as a PDUSB hub.

Response data: 0xFF00A841, 0x80C004B4, 0x00, 0x F5040000, 0x40000001

Table 6 DISCOVER_ID response

VDM header		
B31..16	Standard or vendor ID (SVID)	0xFF00
B15	VDM type	1b
B14..13	Structured VDM version	01b
B12..11	Reserved	01b
B10..8	Object position	000b
B7..6	Command type	01b
B5	Reserved	0b
B4..0	Command	00001b

VDM header		
ID header		
B31	Data capable as USB host	1b
B30	Data capable as a USB device	0b
B29..27	Product type (UFP) is undefined	000b
B26	Modal operation supported	0b
B25..23	Product type (DFP) is PDUSB hub	001b
B22..21	Connector type (Receptacle)	10b
B20..16	Reserved. Shall be set to zero.	0x0
B15..0	16-bit USB vendor ID	0x04B4
Cert Stat VDO		
B31..0	32-bit unsigned integer, XID	0
Product VDO		
B31..16	USB product ID	0xF504
B15..0	bcdDevice	0x0000
DFP VDO		
B31…29	DFP VDO version 1.2	010b
B28…27	Reserved	0
B26…24	Host capability (USB2.0 host capable)	0
B23…22	Connector type (legacy)	0
B21…5	Reserved	0
B4…0	Port number	00001b

2.3.2.2 DISCOVER_SVID response

No SVIDs supported. NAK response shall be provided.

2.3.2.3 DISCOVER_MODES response

No SVIDs supported. NAK response shall be provided.

3 Limitations and known issues

1. This version of the EZ-PD™ PMG1-S3 USB-C Dock solution has been built with GCC ARM toolchain only. Refer to README.md of the code example for toolchain version details.
2. A few failures related to the USB 3.1 terminations not being present were seen in the compliance tests. These failures were due to the compliance tester not issuing the appropriate USB requests to the hub.
3. An issue has been observed in the PMG1-S3 where it does not detect the disconnect of the port partner when there is a collision on the CC lines. This occurs when PMG1S3 is retrying a failed message at which time a PD packet is received from the port partner. However, the occurrence of this is very low.
4. A few failures due to the DisplayPort controller have been observed during the Interop testing. These failures cause the display mirroring to fail. However, the PD communication appears to be clean.

4 Technical support

For assistance and reference design kit information, go to Infineon support.

4.1 Additional information

For more information about the Infineon Type-C controller family, visit the USB-C High Voltage Microcontrollers webpage.

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

Edition 2024-02-19

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2024 Infineon Technologies AG. All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

002-39547 Rev. **

Important notice

The information contained in this document is given as a hint for the implementation of the product only and shall in no event be regarded as a description or warranty of a certain functionality, condition or quality of the product. Before implementation of the product, the recipient of this document must verify any function and other technical information given herein in the real application. Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind (including without limitation warranties of non-infringement of intellectual property rights of any third party) with respect to any and all information given in this document.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.