

DPDM Control Process Evaluation in BQ2589x Family Supporting HVDCP MaxCharge



Xiaohu Qin

ABSTRACT

In smartphone application, charging unit plays very important role because it has to detect correct charging port such as DCP/SDP/HVDCP to finish safe and correct charging process. It includes different charging protocols to identify different charging source, such as BC1.2 and other special fast charging protocol so as to execute correct charging profile in charging control unit. In this article, it provides some typical situations to make engineers understand DPDM working mechanism clearly in BQ2589x family that can support HVDCP/MaxCharge™ feature, such as BQ25890, BQ25890H, BQ25898, BQ25898D, BQ25895, and BQ25895M.

Table of Contents

1 Introduction	2
2 DPDM Waveform Analysis of BQ25890 in BC1.2 Detection in Different Configure Profile	2
2.1 DPDM Block Diagram and Working Flow Chart.....	2
2.2 SDP Waveform Analysis with Disable and Enable HVDCP/MaxCharge Feature in BQ25890 by Using Standard 5 V SDP Power Source.....	4
2.3 DCP Waveform Analysis with Disable and Enable HVDCP/MaxCharge Feature in BQ25890 by Using Standard 5 V DCP Power Source.....	5
3 Summary	7
4 References	7

List of Figures

Figure 2-1. DPDM Detection Unit Block Diagram.....	2
Figure 2-2. DPDM Working Flow Chart.....	3
Figure 2-3. SDP with Disable HVDCP+MaxCharge Feature.....	4
Figure 2-4. SDP with Enable HVDCP+MaxCharge Feature.....	5
Figure 2-5. DPDM Waveform with Normal 5 V DCP Source by Disable HVDCP/MaxCharge Feature.....	6
Figure 2-6. DPDM Waveform with Normal 5 V DCP Source by Enable HVDCP/MaxCharge Feature.....	7

Trademarks

MaxCharge™ is a trademark of CELLULAR EMPIRE INC.
All trademarks are the property of their respective owners.

1 Introduction

This application report showcases some typical samples for handshaking between dedicate charging port and BQ25890 that can support HVDCP and MaxCharge feature.

2 DPDM Waveform Analysis of BQ25890 in BC1.2 Detection in Different Configure Profile

2.1 DPDM Block Diagram and Working Flow Chart

Figure 2-1 shows that when DCP is detected, the device initiates adjustable high voltage adapter handshake including MaxCharge, and so on. The handshake connects combinations of voltage source(s) and/or current sink on D+/D- to signal input source to raise output voltage from 5 V to 9 V / 12 V. The adjustable high voltage adapter handshake can be disabled by clearing MAXC_EN and/or HVDCP_EN bits.

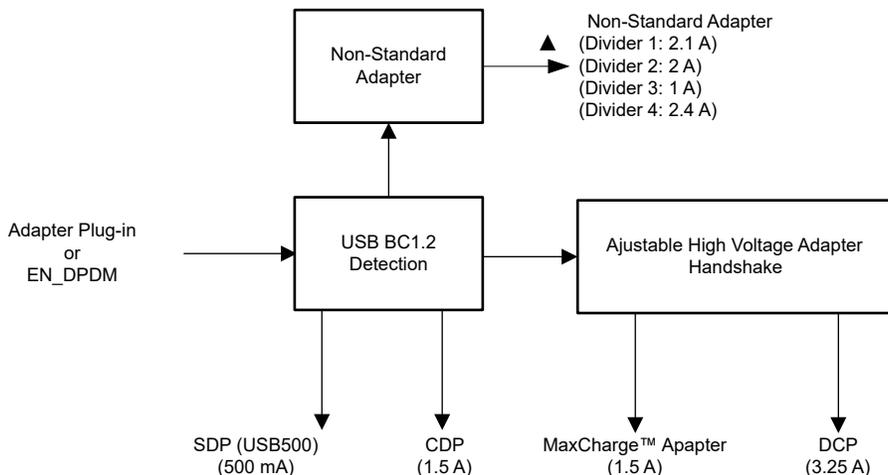


Figure 2-1. DPDM Detection Unit Block Diagram

Also, we can get same conclusion from Figure 2-2, HVDCP/MaxCharge detection only happens after DCP/CDP detection, otherwise, it does not trigger HVDCP/MaxCharge detection, such as, if the result of BC1.2 detection is SDP, it cannot move forward to HVDCP/MaxCharge detection process

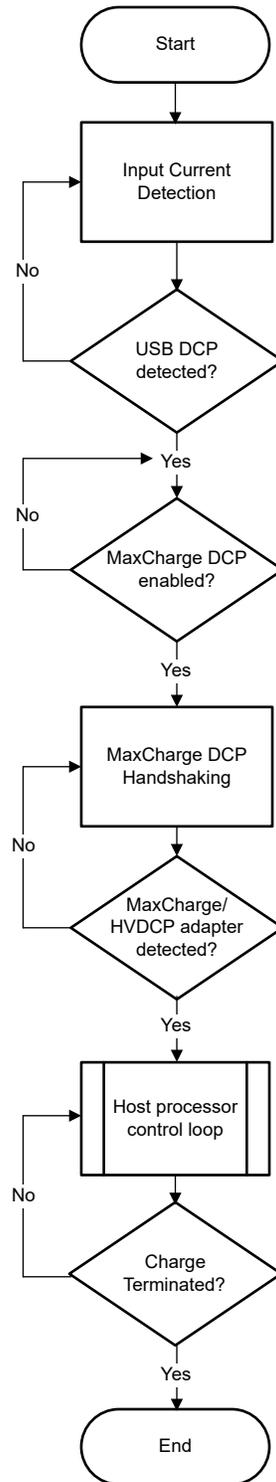


Figure 2-2. DPDM Working Flow Chart

2.2 SDP Waveform Analysis with Disable and Enable HVDCP/MaxCharge Feature in BQ25890 by Using Standard 5 V SDP Power Source

Disable HVDCP+MaxCharge Configure profile

Step 1: REG02, Bit 0=0, disable Auto DPDM detection

Description

Bit0: Automatic D+/D- Detection Enable

0 – Disable D+/D- or PSEL detection when VBUS is plugged-in

1 – Enable D+/D- or PEL detection when VBUS is plugged-in (default)

Step 2: REG02, Bit3=0, Bit2=0, Disable HVDCP and MaxCharge detection

Description

Bit3: High Voltage DCP Enable

0 – Disable HVDCP handshake

1 – Enable HVDCP handshake (default)

Bit2: MaxCharge Adapter Enable

0 – Disable MaxCharge handshake

1 – Enable MaxCharge handshake (default)

Step 3: REG02, Bit1=1, Enable DPDM Detection by manual.

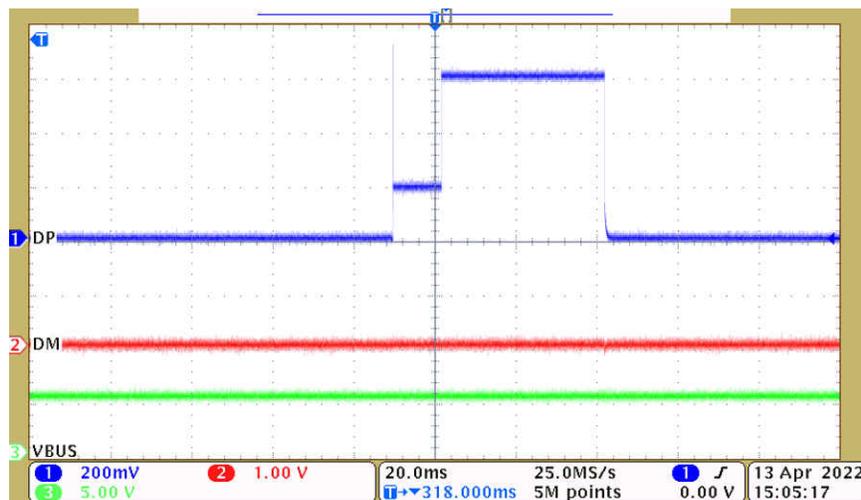


Figure 2-3. SDP with Disable HVDCP+MaxCharge Feature

Enable HVDCP+MaxCharge Configure profile

Step 1: REG02, Bit 0=0, disable Auto DPDM detection

Description

Bit0: Automatic D+/D- Detection Enable

0 –Disable D+/D- or PSEL detection when VBUS is plugged-in

1 –Enable D+/D- or PEL detection when VBUS is plugged-in (default)

Step 2: REG02, Bit3=1, Bit2=1 Enable HVDCP and MaxCharge detection

Description

Bit3: High Voltage DCP Enable

0 – Disable HVDCP handshake

1 – Enable HVDCP handshake (default)

Bit2: MaxCharge Adapter Enable

0 – Disable MaxCharge handshake

1 – Enable MaxCharge handshake (default)

Step 3: REG02, Bit1=1, Enable DPDM Detection by manual.

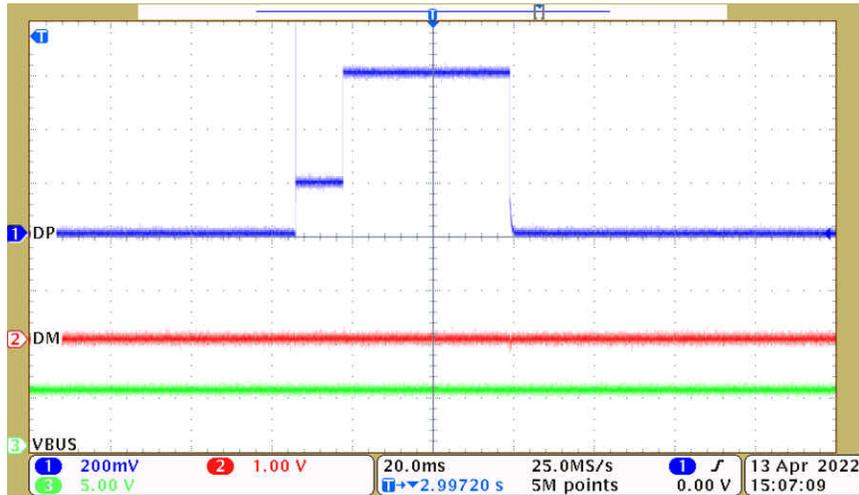


Figure 2-4. SDP with Enable HVDCP+MaxCharge Feature

Summary

From [Figure 2-3](#) and [Figure 2-4](#), for SDP condition, it only implements BC1.2 detection without HVDCP/MaxCharge detection whatever enables or disables HVDCP/MaxCharge.

2.3 DCP Waveform Analysis with Disable and Enable HVDCP/MaxCharge Feature in BQ25890 by Using Standard 5 V DCP Power Source

Disable HVDCP+MaxCharge Configure profile

Step 1: REG02, Bit 0=0, disable Auto DPDM detection

Description

Bit0: Automatic D+/D- Detection Enable

0 –Disable D+/D- or PSEL detection when VBUS is plugged-in

1 –Enable D+/D- or PEL detection when VBUS is plugged-in (default)

Step 2: REG02, Bit3=0, Bit2=0, Disable HVDCP and MaxCharge detection

Description

Bit3: High Voltage DCP Enable

0 – Disable HVDCP handshake

1 – Enable HVDCP handshake (default)

Bit2: MaxCharge Adapter Enable

0 – Disable MaxCharge handshake

1 – Enable MaxCharge handshake (default)

Step : REG02, Bit1=1, Enable DPDM Detection by manual.

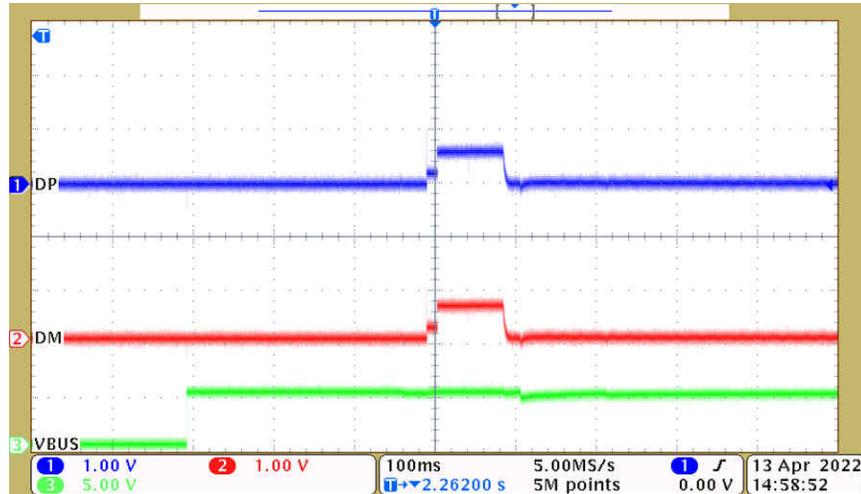


Figure 2-5. DPDM Waveform with Normal 5 V DCP Source by Disable HDCP/MaxCharge Feature

Enable HVDCP+MaxCharge Configure profile

Step 1: REG02, Bit 0=0, disable Auto DPDM detection

Description

Bit0: Automatic D+/D- Detection Enable

0 –Disable D+/D- or PSEL detection when VBUS is plugged-in

1 –Enable D+/D- or PEL detection when VBUS is plugged-in (default)

Step 2: REG02, Bit3=1, Bit2=1 Enable HVDCP and MaxCharge detection

Description

Bit3: High Voltage DCP Enable

0 – Disable HVDCP handshake

1 – Enable HVDCP handshake (default)

Bit2: MaxCharge Adapter Enable

0 – Disable MaxCharge handshake

1 – Enable MaxCharge handshake (default)

Step 3: REG02, Bit1=1, Enable DPDM Detection by manual.

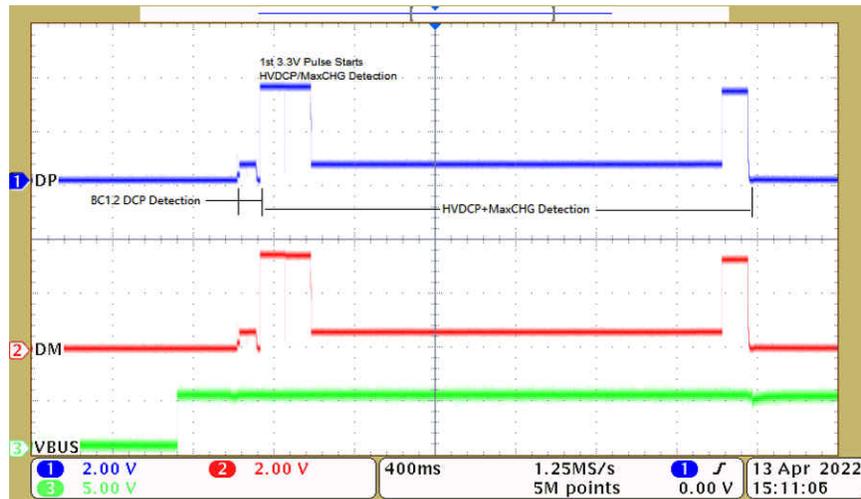


Figure 2-6. DPDM Waveform with Normal 5 V DCP Source by Enable HVDCP/MaxCharge Feature

3 Summary

To traditional DCP power source that does not support PPS(Program Power Supply) protocol, the waveform of DPDM in BQ25890 will be different when enable or disable HVDCP and MaxCharge feature. There will be a 3.3 V pulse (first 3.3 V as [Figure 2-6](#) showing) when enable HVDCP and MaxCharge after DCP detection. And there will be no first 3.3 V pulse as [Figure 2-5](#) showing after DCP detection when disable HVDCP and MaxCharge feature. DPDM detection cycle will be ended after HVDCP/MaxCharge detection cycle if enable HVDCP and MaxCharge feature, otherwise it will be ended after BC1.2 detection.

4 References

- Texas Instruments, [bq25890/2 I2C Controlled Single Cell 5-A Fast Charger with MaxCharge™ Technology for High Input Voltage and Adjustable Voltage USB On-the-Go Boost Mode](#) data sheet.
- Texas Instruments, [bq25890EVM, bq25892EVM, bq25895EVM, bq25896EVM and bq25895MEVM \(PWR664\)](#) users guide.
- Texas Instruments, [Handshaking Between Adjustable HVDCP Adapters and Battery Chargers](#) application report.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated