# TPS65987DDJ: Failure to maintain 15V PD contract

**Replies:** 15

**Views:** 498

Vyron Skouloudis

**Part Number:** TPS65987DDJ

Hello there,

We have built a USB PD 45W charger using a buck converter in conjuction with the TPS65987DDJ in a way similar to the one in the USB-C-PD-TKT-EVM.

When attempting to charge smartphones that request 5V, the circuit appears to be working fine.

However, when attempting to charge a chromebook that requests 15V, it gets stuck in an endless loop of events:

  1. GPIO13 (plug) goes HIGH, correctly indicating a compatible device is connected
  2. GPIO10 (N2) goes HIGH, correctly chaging the feedback of the buck converter and thereby requesting 15V
  3. VBUS transitions from 5V to 15V
  4. after 1 sec, all of the above 3 go LOW

The above process repeats continuously. It seems as if the PD contract is initially succesful, but for some reason it resets shortly afterwards.

When the chromebook is turned off, sometimes it is able to maintain the contract and might charge continuously for a minute or two before transitioning into the above loop.

When attempting to charge a phone by establishing a PD contract at 9V, this situation is considerably better, as it holds it for some time before resetting.  As previously mentioned, it doesnt happen at 5V.

We have tried using another entirely different converter but the situation is identical.
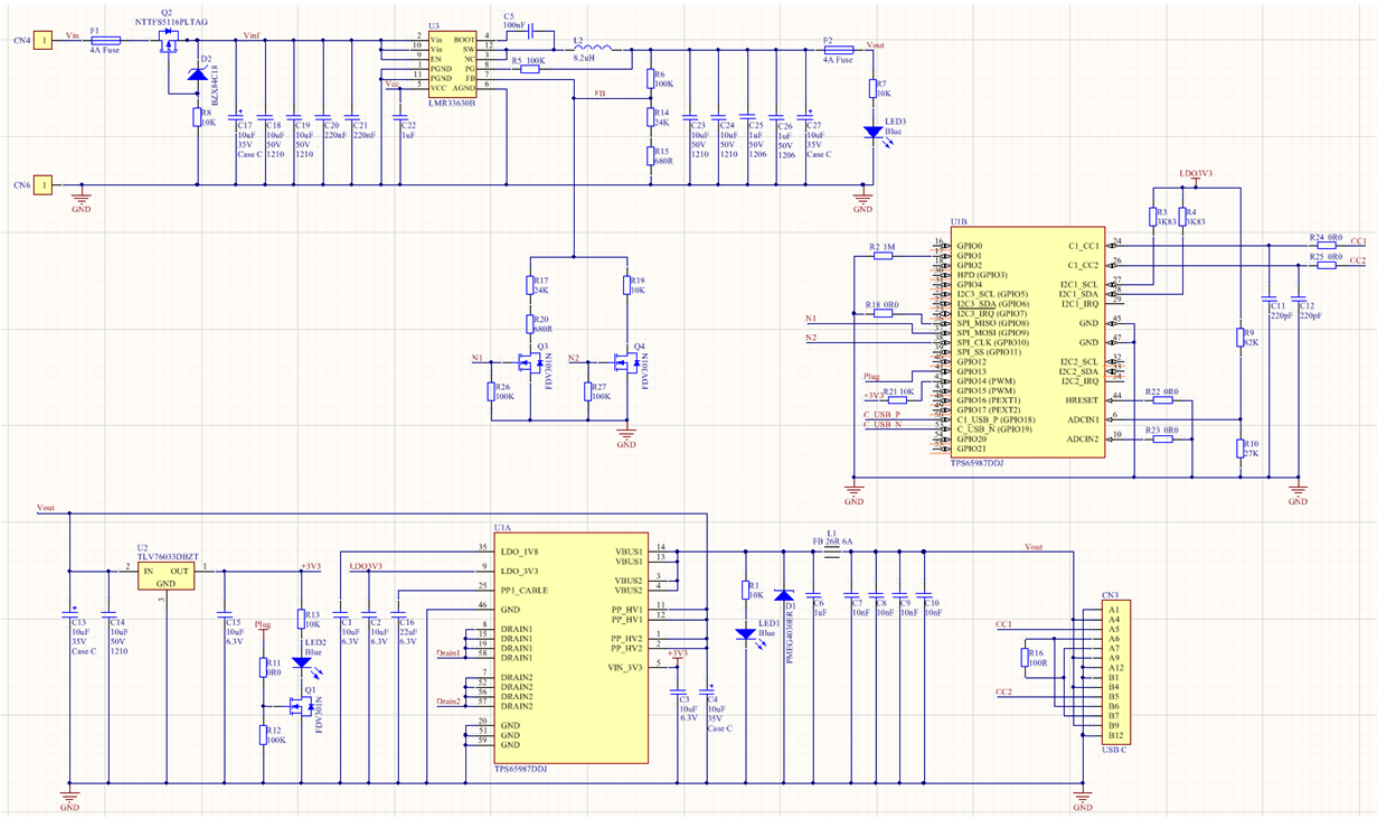
In addition, we have the TPS65987DD EVM Duo, which works fine and does not cause the issue.

I am attaching a circuit schematic of our application. Any help to troubleshoot this would be much appreciated.

Thank you in advance.

Kind regards,

Vyron

[Vyron Skouloudis](#)

## 15 Replies

[Hari Patel1](#)

Hi Vyron,

I noticed on the schematic that your LDO_1V8 signal has a 10uF cap, however, this exceeds the maximum requirements from the datasheet. I would recommend taking a look at the Recommended Operating Conditions and the Power Supply Requirements and Characteristics, sections 6.3 and 6.5 in the datasheet and making sure your schematic matches all the required conditions presented in that document for proper operation.

Also, how did you configure the [TPS65987DDJ](#)? If you have the project configuration file, I can take a look at it. Also, do you have any PD logs collected that I could look at?

Datasheet: [https://www.ti.com/lit/ds/symlink/tps65987ddj.pdf](https://www.ti.com/lit/ds/symlink/tps65987ddj.pdf)

Thank you,

Hari

Vyron Skouloudis

In reply to Hari Patel1:

Hi Hari,

thank you for the reply. I followed the schematic of the EVM, which is why I went for 10uF at LDO_1V8. However I will try to reduce it to 4.7uF and note the effect.

http://www.ti.com/tool/USB-C-PD-TKT-EVM

I did not configure the TPS65987DDJ, I am just attempting to use the default "Configuration 2" stored in the ROM, so that it can act as a DFP-only, 45W power source to act as a charger.

I was unclear if this was possible, i.e. to use the TPS65987DDJ out-of-the-box without configuration, which i asked about in another post:

https://e2e.ti.com/support/interface/f/138/t/842810

In addition, I would like to provide an update regarding the case of the 9V PD contract when attempting to charge a phone, which I witnessed today:

- If the screen of the phone is on, the TPS65987DDJ keeps resetting in the similar fashion as in the 15V case which I described previously.
- If the screen is off however, the TPS65987DDJ now is charging the phone but it alternates between outputting 5V and 9V every few minutes.For example, it charges the phone at 9V for 5 min, then drops to 5V and keeps charging for another 5min, later it reverts back to 9V and so on.

I hope this information helps. Please let me know if I can provide any further details that can be helpful.

Thanks again,

Vyron

Hari Patel1

In reply to <u>Vyron Skouloudis</u>:

Hi Vyron,

Yes, it is possible, you can use the default configurations for the PD controller. In this case, I would recommend ensuring that the ADCIN1 and the SPI_MISO pins match the value needed to go into "Configuration 2" using a multi-meter.

Are you seeing the same behavior with other phones/laptops?

It could possibly be some sort of a protection issue, I would recommend looking over your buck converter design to make sure you are within operating conditions specified on its datasheet. You could also attach a tag for that specific buck converter that you are using in this E2E post so an engineer in that group could look over your design as well.

Thank you,

Hari

<u>Vyron Skouloudis</u>

In reply to <u>Hari Patel1</u>:

Hi Hari,

In order to select "Configuration 2" the ADCIN1 must lie between 0.2x3.3V=0.66V and 0.28x3.3V=0.924, according to the datasheet. The SPI_MISO must be low, i.e. 0V.

I checked the ADCIN1 pin, it is at 0.8V. Also the SPI_MISO is indeed grounded.

I am attaching a link with a couple of videos, where you can see the multimeter measurement of the ADCIN1 pin.

Also you can see the oscillating behavior where the Vbus voltage transitions between 0V -> 5V -> 15V ->0 etc.

In the first clip I am using the LMR33630B as shown in the diagram previously attached.

In the second clip I am using an entirely different buck-boost 100W DC-DC converter and the situation is identical.

Again, I have managed to successfully charge the same laptop multiple times using the EVM of the TPS65987D:

http://www.ti.com/tool/USB-C-PD-DUO-EVM

Hari Patel1

In reply to Vyron Skouloudis:

Hi Vyron,

Yes that should be correct configuration then. If that's the case, then I will continue to look into your schematic and try to find out what the issue could be, but having some PD logs from an analyzer would help more to look deeper into what the issue is. Would you be able to collect them and upload them here?

I also recommend possibly creating another E2E thread for the buck converter design so we can make sure there are no protection issues interfering with the PD functionality.

Thank you,

Hari

Vyron Skouloudis

In reply to Hari Patel1:

Hi Hari,

thank you very much for looking into it.

I would definitely like to try analyzing in order to find out what is happening. Would you be able to help me how to go about doing this? Is there a special PD analyzer I would need to purchase for this purpose? If you can provide me with info I will obtain it at once and proceed with acquiring the logs.

In addition, I have ordered the USB-C-PD-TKT-EVM from the TI website and it should be with me in a week or so.

Thanks again,

Vyron

Hari Patel1

In reply to Vyron Skouloudis:

Hi Vyron,

Here is a popular PD analyzer you could look into getting: https://www.totalphase.com/products/usb-power-delivery-analyzer/

A PD analyzer will capture the communication data between the two devices to help see where the power cycle occurs.

Thank you,

Hari

Vyron Skouloudis

In reply to Hari Patel1:

Hi Hari,

I actually managed to obtain the CY4500 PD Analyzer, which I used to obtain the logs attached below.

HP Chromebook - LMR33630 plus TPS65987DDJ.xlsx

In addition, the USB-C-TKT-EVM arrived earlier, so I was able to use it for logging purposes. As it turns out, the EVM appears to be acting in the exact same way as our design. I am attaching the logs.HP Chromebook - TPS65987DDJ TKT-EVM.xlsx

On the other hand, the USB-C-PD-DUO-EVM, which uses the TPS65987D, appears to be working perfectly fine. Again I am attaching the logs.

HP Chromebook - TPS65987D DUO-EVM.xlsx

Below I am also attaching a couple of videos. The TPS65987D on its EVM is charging the chromebook at a steady rate. The TPS65987DDJ on the other hand is showing the exact erratic behaviour we observed on our own design.

https://photos.app.goo.gl/t58pcMrMmK49AQeK9

Please let me know if there is anything else I can provide.

Thank you very much.

Kind regards,

Vyron

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Hari Patel1

In reply to Vyron Skouloudis:

Hi Vyron,

Will you be able to attach the PD log file itself instead of the excel version? I have the CY4500 software that will allow me to open the log files.

In the meantime, I will look into reading the excel versions and see what the difference could be with the DUO-EVM and get back to you tomorrow with some feedback.

Thank you,

Hari

Vyron Skouloudis

In reply to Hari Patel1:

Hi Hari,

I am attaching the PD logs for the HP Chromebook 14-
db0000na: https://store.hp.com/UKStore/Merch/Product.aspx?id=5SX33EA&opt=ABU&sel=NTB

HP Chromebook.zip

I am also attaching the logs from the Huawei P20 mate pro:

Huawei P20 mate pro.zip

Thank you very much,

Vyron