How to identify the current explicit contract using STUSB4531

Introduction

The STUSB4531 stores meaningful information for the application when SPR contract is established in autorun or in hybrid mode. This application note will describe how to recover the information using I²C read.

1 I²C

1.1 I²C command

Two generic functions are defined in this document to indicate I²C read or write actions.

For both functions, the device address is omitted to avoid overloading the document. The device address can be 0x28 or 0x29, as specified in the datasheet.

I2C_Read(register_address, number_of_byte):

- Register_address: indicates address starting point to be read
- Number_of_byte: indicates if a single or multiple consecutive reads will be performed

1.2 Useful I²C registers

When receiving a source_capabilities message, the STUSB4531 stores the number of PDO objects and all Power Data Objects (PDOs), but also stores the entire Request Data Object (RDO) and the associated source PDO into I²C registers, which facilitate the extraction of voltage and current for the negotiated explicit contract.

Useful information is located in the following registers:

Table 1. Useful registers

Address offset	Register Name	Bit field
0xBC	DPM_RDO	[31:0] RDO
0xC4	DPM_SRC_PDO_NEGOCIATED	[31:0] SRC_PDO_NEGOCIATED

2 PDO type, voltage and current in PDOs

The following paragraphs of this section are based on [3] USB Power Delivery specification.

2.1 PDO type coding

In both source and sink capabilities, the PDO, as a 32-bits object, follows the coding below.

PDO type coding is:

Table 2. PDO type

Bits[31:30]	PDO Type
00b	Fixed Voltage
01b	Battery
10b	Variable
11b	Augmented PDO (APDO)

When APDO is discovered, further checks need to be done to analyze the APDO type:

Table 3. APDO type

Bits[29:28]	PDO Type
00b	PPS
01b	EPR AVS
10b	SPR AVS
11b	Reserved

2.2 Voltage and current coding in PDOs

Please note that the following coding applies to both sink and source PDOs.

2.2.1 Fixed PDO

Table 4. Fixed PDO voltage-current coding

Bits	Field name	Description
19..10	Voltage	In 50 mV units
9..0	Current	In 10 mA units

2.2.2 Variable PDO

Table 5. Variable PDO voltage-current coding

Bits	Field name	Description
29..20	Maximum voltage	Maximum voltage supported in 100 mV units
19..10	Minimum voltage	Minimum voltage supported in 100 mV units
9..0	Maximum current	Maximum current in 10 mA units

2.2.3 APDO PPS

Table 6. APDO PPS voltage-current coding

Bits	Field name	Description
24..17	Maximum voltage	Maximum voltage supported in 100 mV units
15..8	Minimum voltage	Minimum voltage supported in 100 mV units
6..0	Maximum current	Maximum current in 10 mA units

2.2.4 APDO SPR AVS

Table 7. APDO SPR AVS current coding per voltage range

Bits	Field name	Description
19..10	Maximum current 15 V	Maximum current supported when operating from 9-15 V in 100 mA units
9..0	Maximum current 20 V	Maximum current supported when operating from 15-20 V in 100 mA units

3 Request Data Object (RDO)

The RDO does not provide the PDO type information.
To interpret the RDO, the first checks need to be the object position requested, located in bits 31..28.
This number corresponds to the source PDO number listed in the source_capabilities message.
Based on the PDO type, the RDO fields can be interpreted.

3.1 RDO on fixed PDO

Table 8. Fixed voltage RDO current bit field

Bits	Field name	Description
19..10	Operating current	Operating current in 10 mA units

The requested voltage needs to be calculated using the Table 4. Fixed PDO voltage-current coding voltage field in the corresponding SRC_PDO.

3.2 RDO on APDO PPS

Table 9. PPS RDO voltage and current bit fields

Bits	Field name	Description
20..9	Output voltage	Requested output voltage in 20 mV units
6..0	Operating current	Operating current in 50 mA units

3.3 RDO on APDO AVS

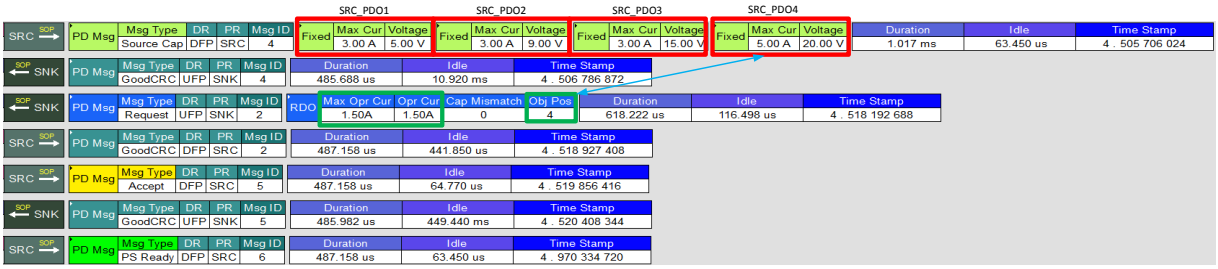
Table 10. AVS RDO voltage and current bit fields

Bits	Field name	Description
20..9	Output voltage	Requested output voltage in 25 mV units. Bits 10..9 shall be set to 00b making the effective voltage step size 100 mV
6..0	Operating current	Operating current in 50 mA units

3.4 Examples

3.4.1 Fixed PDO requested

Figure 1. Fixed PDO power negotiation



Check Source PDO negotiated:

- I2C_Read(DPM_SRC_PDO_NEGOCIATED, 4)
  - PDO_Type = 00b : this is a fixed voltage
  - The fixed voltage is 20 V in SRC_PDO4

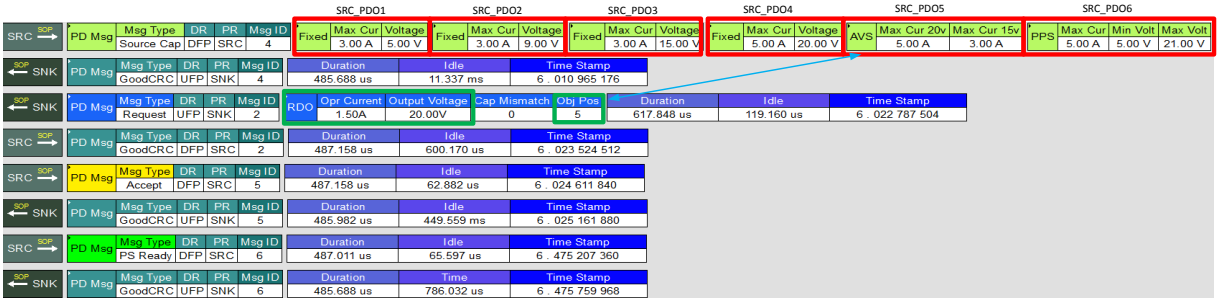
Check RDO:

- I2C_Read(DPM_RDO, 4)
  - Object position is 4
  - Referring to Table 8 fields, the operating current is 1.5 A

Final RDO analysis: 20 V / 1.5 A has been requested on fixed PDO.

3.4.2 APDO AVS requested

Figure 2. SPR-AVS power negotiation



Check Source PDO negotiated:

- I2C_Read(DPM_SRC_PDO_NEGOCIATED, 4)
  - PDO_Type = 11b : this is an APDO
  - bits [29..28] = 10b : this is an APDO AVS EPR

Check RDO:

- I2C_Read(DPM_RDO,4)
  - Object position is 5
  - Referring to Table 10 fields, the voltage is 20 V, the maximum current is 1.5 A.

Final RDO analysis: 20 V / 1.5 A has been requested on SPR-AVS PDO.

4 References

[1] DS15023: STUSB4531 datasheet

[2] RM0562: STUSB4531 register map

[3] USB Power Delivery specification: https://www.usb.org/document-library/usb-power-delivery

[4] USB Type-C Cable and Connector Specification: https://www.usb.org/document-library/usb-type-cr-cable-and-connector-specification-release-24

Revision history

Table 11. **Document revision history**

Date	Version	Changes
25-Feb-2026	1	Initial release.

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