

Summary TPS65987 Issue – Start September-26 2022

I'm using the TPS65987D in an UFP application and I'm trying to solve the following task:

The application is using 5V supply only depending on the current (1.5A or 3.0A) the source can supply the application should act in two different ways.

What I did:

- I defined 2 PDOs as shown in the picture "Define PDOs.jpg"
- I configured GPIO #14 / GPIO #15 as shown in the picture "Config GPIO14_15.jpg"

GPIO #14 should get high if the source can provide 1.5 A only

GPIO #15 should get high if the source can provide 3.0 A

| GPIO #14 (PWM1) | |
|------------------------------|------------------------------|
| Field | Value |
| Multiplexing for GPIO 14 pin | Pin Multiplexed to GPIO |
| Initial Value | 0x0 |
| Open Drain Output Enable | <input type="checkbox"/> |
| Internal Pull Down Enable | <input type="checkbox"/> |
| Internal Pull Up Enable | <input type="checkbox"/> |
| Mapped Event | Port 0 Sink PDO 0 Negotiated |
| GPIO Polarity | Direct-mapped Event |

| GPIO #15 (PWM2) | |
|------------------------------|------------------------------|
| Field | Value |
| Multiplexing for GPIO 15 pin | Pin Multiplexed to GPIO |
| Initial Value | 0x0 |
| Open Drain Output Enable | <input type="checkbox"/> |
| Internal Pull Down Enable | <input type="checkbox"/> |
| Internal Pull Up Enable | <input type="checkbox"/> |
| Mapped Event | Port 0 Sink PDO 1 Negotiated |
| GPIO Polarity | Direct-mapped Event |

Results:

1. If I connect to a source with 5V/1.5A max GPIO #14 becomes high => O.K.
In Debug-Mode please see following pictures

"Received Source Capabilities_Source PDO 1_5V-1A5.jpg"

connected
Polling FTDI, 0x38 (I2C2)

| Received Source Capabilities (0x30) | |
|---------------------------------------|--------------|
| Field | Value |
| Number of Source PDOs | 1 |
| Source PDO 1 | |
| Maximum Current | 1.5 A |
| Voltage | 5 V |
| Peak Current | 130% |
| Unchunked Extended Msg Supported | True |
| USB Capable | True |
| USB Suspend Supported | True |
| Dual Role Data | True |
| Externally Powered | False |
| Dual Role Power | True |
| Supply Type | Fixed Source |

“Active Contract PDO 5V_1A5-Source.jpg”

connected
Polling FTDI, 0x38 (I2C2)

Active Contract PDO (0x34)

| Field | Value |
|-----------------|--------------|
| Maximum Current | 1.5 A |
| Voltage | 5 V |
| Peak Current | 130% |
| Supply Type | Fixed Source |

2. If I connect to a source with 5V/3.0A max also GPIO #14 gets high BUT NOT GPIO #15
In Debug-Mode please see following pictures

“Received Source Capabilities_Source PDO 1_5V-3A0.jpg”

connected
Polling FTDI, 0x38 (I2C2)

Received Source Capabilities (0x30)

Number of Source PDOs
1

Source PDO 1

| Field | Value |
|----------------------------------|--------------|
| Maximum Current | 3 A |
| Voltage | 5 V |
| Peak Current | 100% |
| Unchunked Extended Msg Supported | True |
| USB Capable | False |
| USB Suspend Supported | False |
| Dual Role Data | False |
| Externally Powered | False |
| Dual Role Power | False |
| Supply Type | Fixed Source |

“Active Contract PDO 5V_3A0-Source.jpg”

connected
Polling FTDI, 0x38 (I2C2)

Active Contract PDO (0x34)

| Field | Value |
|-----------------|--------------|
| Maximum Current | 3 A |
| Voltage | 5 V |
| Peak Current | 100% |
| Supply Type | Fixed Source |

Initial Questions:

- Why is GPIO #15 not getting high in case I connect to a 5V/3.0A Source?
- If the above approach doesn't work at all, is there any other possibility to differentiate between 5V/1.5A and 5V/3.0A source capabilities?

Further step:
Using a PD-Analyzer

The transmitted sink capabilities have been adjusted as follows:

Transmit Sink Capabilities (0x33)

Sink PDO Count

| Field | Value |
|---------------------|-------|
| Number of Sink PDOs | 2 |

Sink PDO 1

| Field | Value |
|--|-------------------------------------|
| Operating Current | 0.9 A |
| Voltage | 5 V |
| Peak Current | 100% |
| Fast Role Swap required USB Type-C Current | Fast Swap not Supported |
| Higher Capability | <input checked="" type="checkbox"/> |
| Supply Type | Fixed Sink |
| Maximum Operating Current | 1.5 A |
| Minimum Operating Current | 0.9 A |
| Ask For Max | <input checked="" type="checkbox"/> |

Sink PDO 2

| Field | Value |
|---------------------------|-------------------------------------|
| Operating Current | 2 A |
| Voltage | 5 V |
| Peak Current | 100% |
| Supply Type | Fixed Sink |
| Maximum Operating Current | 3 A |
| Minimum Operating Current | 2 A |
| Ask For Max | <input checked="" type="checkbox"/> |

I'm using a simple USB-Power-supply with 5V/3000mA and 9V/2000mA

See the transmitted source capabilities below

| # | Status | SOP | Message | Msg... | Data R... | Power Role | Obj C... | Rev | Durat... | Delta | Vbus... | Data | Start Ti... | End Tim... |
|----|--------|---------|---------------------|---------|-----------|------------|----------|-----|----------|---------|---------|--------------------------|-------------|------------|
| 1 | | VBUS_UP | SOP | C_RSVD0 | 0 | UFP | SNK | 0 | v1 | 0 | 4,062 | 0x0 | 3279738 | 3279738 |
| 2 | OK | SOP | SOURCE_CAPABILITIES | 0 | DFP | SRC | 2 | v3 | 759 | 149,933 | 5,257 | 0x21A1 0xA01912C 0x2D0C8 | 3429671 | 3430430 |
| 3 | OK | SOP | SOURCE_CAPABILITIES | 0 | DFP | SRC | 2 | v3 | 758 | 981 | 5,248 | 0x21A1 0xA01912C 0x2D0C8 | 3431411 | 3432169 |
| 4 | OK | SOP | SOURCE_CAPABILITIES | 0 | DFP | SRC | 2 | v3 | 758 | 982 | 5,248 | 0x21A1 0xA01912C 0x2D0C8 | 3433151 | 3433909 |
| 5 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 143,046 | 5,257 | 0x23A1 0xA01912C 0x2D0C8 | 3578955 | 3577713 |
| 6 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 984 | 5,248 | 0x23A1 0xA01912C 0x2D0C8 | 3578997 | 3579455 |
| 7 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 985 | 5,248 | 0x23A1 0xA01912C 0x2D0C8 | 3580440 | 3581198 |
| 8 | OK | SOP | SOURCE_CAPABILITIES | 2 | DFP | SRC | 2 | v3 | 757 | 143,020 | 5,257 | 0x25A1 0xA01912C 0x2D0C8 | 3724218 | 3724975 |
| 9 | OK | SOP | GOODCRC | 2 | UFP | SNK | 0 | v2 | 504 | 42 | 5,231 | 0x441 | 3725017 | 3725521 |
| 10 | OK | SOP | REQUEST | 0 | UFP | SNK | 1 | v3 | 636 | 4,099 | 5,257 | 0x1082 0x13825896 | 3729620 | 3730256 |
| 11 | OK | SOP | GOODCRC | 0 | DFP | SRC | 0 | v1 | 496 | 115 | 5,248 | 0x121 | 3730371 | 3730867 |
| 12 | OK | SOP | ACCEPT | 3 | DFP | SRC | 0 | v3 | 496 | 1,205 | 5,248 | 0x7A3 | 3732072 | 3732568 |
| 13 | OK | SOP | GOODCRC | 3 | UFP | SNK | 0 | v2 | 497 | 52 | 5,222 | 0x641 | 3732620 | 3733117 |
| 14 | OK | SOP | PS_RDY | 4 | DFP | SRC | 0 | v3 | 496 | 29,395 | 5,257 | 0x9A6 | 3762512 | 3763008 |
| 15 | OK | SOP | GOODCRC | 4 | UFP | SNK | 0 | v2 | 504 | 35 | 5,240 | 0x841 | 3763043 | 3763547 |

Details

| Name | Value |
|--|---------------------|
| MESSAGE HEADER REVISION 3 SOP | 0x25a1 |
| Extended | No |
| Data objects | 2 |
| Message id | 2 |
| Power role | SRC |
| Specification revision | v3 |
| Data role | DFP |
| Message type | SOURCE_CAPABILITIES |
| FIXED 5V SOURCE PDO REVISION 3->5000 mV, 3000 mA | 0xa01912c |
| Supply | FIXED_SUPPLY |
| Dual role power | No |
| USB suspend support | No |
| Unconstrained power | Yes |
| USB communications capable | No |
| Dual role data | Yes |
| Unchunked support | No |
| EPR mode capable | No |
| Reserved | 0x0 |
| Peak current | PEAK_EQ_IOC |
| Voltage in 50mV units | 0x64 (5000 mV) |
| Maximum current in 10mA units | 0x12c (3000 mA) |
| FIXED SUPPLY PDO - SOURCE ->9000 mV, 2000 mA | 0x2d0c8 |
| Supply | FIXED_SUPPLY |
| Reserved | 0x0 |
| Peak current | PEAK_EQ_IOC |
| Voltage in 50mV units | 0xb4 (9000 mV) |
| Maximum current in 10mA units | 0xc8 (2000 mA) |

Graphical

CC1
 CC2
 VBUS
 AMP
 X Scale: 100ms/div
 Y: 5589u
 X: 377025m
 AY: 0
 AX: 0

As the PD analyzer shows, the TPS65987D is only requesting 5V/ 1500mA (PDO0) and not 5V/3000mA (PDO1)

| # | Status | SOP | Message | Msg... | Data R... | Power Role | Obj C... | Rev | Durat... | Delta... | Vbus... | Data | Start TI... | End Tim... |
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| 1 | VBUS_UP | SOP | C_RSVD0 | 0 | UFP | SNK | 0 | v1 | 0 | | 4,062 | 0x0 | 3279738 | 3279738 |
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| 4 | OK | SOP | SOURCE_CAPABILITIES | 0 | DFP | SRC | 2 | v3 | 758 | 982 | 5,248 | 0x21A1 0xA01912C 0x2D0C8 | 3431511 | 3433909 |
| 5 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 143,046 | 5,257 | 0x23A1 0xA01912C 0x2D0C8 | 3576955 | 3577713 |
| 6 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 984 | 5,248 | 0x23A1 0xA01912C 0x2D0C8 | 3578697 | 3579455 |
| 7 | OK | SOP | SOURCE_CAPABILITIES | 1 | DFP | SRC | 2 | v3 | 758 | 985 | 5,248 | 0x23A1 0xA01912C 0x2D0C8 | 3580440 | 3581198 |
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| 15 | OK | SOP | GOODCRC | 4 | UFP | SNK | 0 | v2 | 504 | 35 | 5,240 | 0x841 | 3763043 | 3763547 |

| Name | Value |
|---|----------------|
| MESSAGE HEADER REVISION 3 SOP | 0x1082 |
| Extended | No |
| Data objects | 1 |
| Message id | 0 |
| Power role | SNK |
| Specification revision | v3 |
| Data role | UFP |
| Message type | REQUEST |
| FIXED VARIABLE RDO REVISION 3 | 0x13825896 |
| EPR PDO requested | No |
| Object position | 1 |
| GiveBack flag | No |
| Capability mismatch | No |
| USB communications capable | Yes |
| No USB suspend | Yes |
| Unchunked extended messages supported | Yes |
| EPR mode capable | No |
| Reserved | 0x0 |
| Operating current in 10mA units | 0x96 (1500 mA) |
| Maximum operating current in 10mA units | 0x96 (1500 mA) |