

UCSI ENGINEERING CHANGE NOTICE FORM

Title: Addition of EPR Support

Applied to: UCSI Specification Version 2.1 Revision 1

Brief description of the functional changes:
Add EPR capability and PDOs

Benefits as a result of the changes:
Be able to have a higher power range up to 248W

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:

An analysis of the hardware implications:
HW shall be able to support the EPR capability

An analysis of the software implications:

An analysis of the compliance testing implications:

UCSI ENGINEERING CHANGE NOTICE FORM

Actual Change

(a). Section 4.5.7 GET_CONNECTOR_CAPABILITY, Page 33, Table 4-17

From Text:

Table 4-17: GET_CONNECTOR_CAPABILITY Data

Offset (Bits)	Field	Size (Bits)	Description																		
0	Operation Mode	8	<div><div>This field shall indicate the mode that the connector can support. Note: Additional capabilities are described in the Extended Operation Mode field.</div><table><tr><th>Bit</th><th>Meaning</th></tr><tr><td>0</td><td>Rp only</td></tr><tr><td>1</td><td>Rd only</td></tr><tr><td>2</td><td>DRP (Rp/Rd)</td></tr><tr><td>3</td><td>Analog Audio Accessory Mode (Ra/Ra)</td></tr><tr><td>4</td><td>Debug Accessory Mode (Rd/Rd)</td></tr><tr><td>5</td><td>USB2</td></tr><tr><td>6</td><td>USB3</td></tr><tr><td>7</td><td>Alternate Mode</td></tr></table></div>	Bit	Meaning	0	Rp only	1	Rd only	2	DRP (Rp/Rd)	3	Analog Audio Accessory Mode (Ra/Ra)	4	Debug Accessory Mode (Rd/Rd)	5	USB2	6	USB3	7	Alternate Mode
Bit	Meaning																				
0	Rp only																				
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3	Analog Audio Accessory Mode (Ra/Ra)																				
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5	USB2																				
6	USB3																				
7	Alternate Mode																				
8	Provider	1	This bit is valid only when the operation mode is DRP or Rp only. This bit shall be set to one if the connector is capable of providing power on this connector. [Either PD, USB Type-C Current or BC 1.2]																		
9	Consumer	1	This bit is valid only when the operation mode is DRP or Rd only. This bit shall be set to one if the connector is capable of consuming power on this connector. [Either PD, USB Type-C Current or BC 1.2]																		
10	Swap to DFP	1	This bit is valid only when the operation mode is DRP or Rp only or Rd only. This bit shall be set to one if the connector is capable of accepting swap to DFP																		
11	Swap to UFP	1	This bit is valid only when the operation mode is DRP or Rp only or Rd only. This bit shall be set to one if the connector is capable of accepting swap to UFP																		
12	Swap to SRC	1	This bit is valid only when the operation mode is DRP. This bit shall be set to one if the connector is capable of accepting swap to SRC																		
13	Swap to SNK	1	This bit is valid only when the operation mode is DRP. This bit shall be set to one if the connector is capable of accepting swap to SNK																		

UCSI ENGINEERING CHANGE NOTICE FORM

14	<i>Extended Operation Mode</i>	8		
			Bit	Meaning
			0	USB4
			1-7	Reserved
22	<i>Miscellaneous Capabilities</i>	4		
			Bit	Feature
			0	FW Update
			1	Security
			2	Reserved
			3	Reserved
26	<i>Reserved</i>	9	Set to zero.	

To Text:

Table 4-17: GET_CONNECTOR_CAPABILITY Data

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0	Operation Mode	8	<div><p>This field shall indicate the mode that the connector can support.</p><p>Note: Additional capabilities are described in the Extended Operation Mode field.</p><table><tr><th>Bit</th><th>Meaning</th></tr><tr><td>0</td><td>Rp only</td></tr><tr><td>1</td><td>Rd only</td></tr><tr><td>2</td><td>DRP (Rp/Rd)</td></tr><tr><td>3</td><td>Analog Audio Accessory Mode (Ra/Ra)</td></tr><tr><td>4</td><td>Debug Accessory Mode (Rd/Rd)</td></tr><tr><td>5</td><td>USB2</td></tr><tr><td>6</td><td>USB3</td></tr><tr><td>7</td><td>Alternate Mode</td></tr></table></div>	Bit	Meaning	0	Rp only	1	Rd only	2	DRP (Rp/Rd)	3	Analog Audio Accessory Mode (Ra/Ra)	4	Debug Accessory Mode (Rd/Rd)	5	USB2	6	USB3	7	Alternate Mode
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10	Swap to DFP	1	This bit is valid only when the operation mode is DRP or Rp only or Rd only. This bit shall be set to																		

UCSI ENGINEERING CHANGE NOTICE FORM

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11	Swap to UFP	1	This bit is valid only when the operation mode is DRP or Rp only or Rd only. This bit shall be set to one if the connector is capable of accepting swap to UFP										
12	Swap to SRC	1	This bit is valid only when the operation mode is DRP. This bit shall be set to one if the connector is capable of accepting swap to SRC										
13	Swap to SNK	1	This bit is valid only when the operation mode is DRP. This bit shall be set to one if the connector is capable of accepting swap to SNK										
14	Extended Operation Mode	8	<table><tr><th>Bit</th><th>Meaning</th></tr><tr><td>0</td><td>USB4</td></tr><tr><td>1</td><td>EPR Source</td></tr><tr><td>2</td><td>EPR Sink</td></tr><tr><td>3-7</td><td>Reserved</td></tr></table>	Bit	Meaning	0	USB4	1	EPR Source	2	EPR Sink	3-7	Reserved
Bit	Meaning												
0	USB4												
1	EPR Source												
2	EPR Sink												
3-7	Reserved												
22	Miscellaneous Capabilities	4	<table><tr><th>Bit</th><th>Feature</th></tr><tr><td>0</td><td>FW Update</td></tr><tr><td>1</td><td>Security</td></tr><tr><td>2</td><td>Reserved</td></tr><tr><td>3</td><td>Reserved</td></tr></table>	Bit	Feature	0	FW Update	1	Security	2	Reserved	3	Reserved
Bit	Feature												
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1	Security												
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3	Reserved												
26	Reserved	9	Set to zero.										

UCSI ENGINEERING CHANGE NOTICE FORM

(b). Section 4.5.27

From Text:

10.1.1 Get PDOs (O)

This command is used to get the Sink or Source PDOs associated with the connector identified with the command. For the connector, this command can be used to get the Source PDOs/Capabilities as defined below:

- **Maximum Supported Source Capabilities**
 - The Maximum Provider Capabilities that the Source can support. These wouldn't change for a connector.
- **Current Supported Source capabilities**
 - The Provider Capabilities that the Source currently supports. These could change dynamically and could be lower than the Maximum Source Capabilities if the system is Reaching Power Budget Limit due to multiple connected Sinks or if the Power Budget has been lowered due to it being unplugged from external power supply.
- **Advertised Source Capabilities**
 - The Provider Capabilities that are advertised by the Source during PD contract negotiation. These could be lower due to the Cable's current carrying capabilities. This is only valid when a port partner is present.

In addition, this command can be used to return the Sink or Source PDOs of the device that is connected to this connector. The format of the CONTROL Data Structure for this command is given in Table 4-35.

UCSI ENGINEERING CHANGE NOTICE FORM

Table 4-35: GET_PDOS Command

Offset (Bits)	Field	Size (Bits)	Description										
0	Command	8	This field shall be set to GET_PDOS.										
8	Data Length	8	Set to 0x00.										
16	Connector Number	7	This field shall be set to the connector being queried.										
23	Partner PDO	1	This field shall be set to one if the OPM wants to retrieve the PDOS of the device attached to the connector.										
24	PDO Offset	8	Starting offset of the first PDO to be returned. Valid values are 0 through 7. Values 8 through 255 shall not be used.										
32	Number of PDOs	2	Number of PDOs to return starting from the PDO Offset. The number of PDOs to return is the value in this field plus 1.										
34	Source or Sink PDOs	1	This field shall be set to one if the OPM wants to retrieve the Source PDOs otherwise it wants to retrieve the Sink PDOs.										
35	Source Capabilities Type	2	<div>This field indicates the type of Source Capabilities requested. This field is valid only if OPM sets <i>Partner PDO</i> to 0 and <i>Source or Sink PDOs</i> to 1.</div> <table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>Current Supported Source Capabilities</td></tr><tr><td>1</td><td>Advertised Capabilities</td></tr><tr><td>2</td><td>Maximum Supported Source Capabilities</td></tr><tr><td>3</td><td>Not Used</td></tr></table>	Value	Meaning	0	Current Supported Source Capabilities	1	Advertised Capabilities	2	Maximum Supported Source Capabilities	3	Not Used
Value	Meaning												
0	Current Supported Source Capabilities												
1	Advertised Capabilities												
2	Maximum Supported Source Capabilities												
3	Not Used												
37	Reserved	27	Reserved and shall be set to zero.										

On completion of the command the PPM shall set the CCI Data Structure as described in Table 4-36.

UCSI ENGINEERING CHANGE NOTICE FORM

Table 4-36: GET_PDOS Status

Offset (Bits)	Field	Size (Bits)	Description
0	<i>Reserved</i>	1	Reserved and shall be set to zero.
1	<i>Connector Change Indicator</i>	7	If an asynchronous event occurred on a connector, then the PPM shall set this field to the connector number on which the change occurred.
8	<i>Data Length</i>	8	Set to four times the number of PDOs returned. If not successful, shall be set to 0x00.
16	<i>Reserved</i>	7	Reserved and shall be set to zero.
23	<i>Security Request Indicator</i>	1	Set to 0b.
24	<i>FW Update Request Indicator</i>	1	Set to 0b.
25	<i>Not Supported Indicator</i>	1	Set to 0b.
26	<i>Cancel Completed Indicator</i>	1	Set to 0b.
27	<i>Reset Completed Indicator</i>	1	Set to 0b.
28	<i>Busy Indicator</i>	1	Set to 0b. If the PPM is Busy then the PPM shall set this field to a 1b and all other fields to zero.
29	<i>Acknowledge Command Indicator</i>	1	Set to 0b.
30	<i>Error Indicator</i>	1	If the command was not successfully completed the PPM shall set this field to 1b.
31	<i>Command Completed Indicator</i>	1	Set this field to a 1b.

If the command completed successfully and the *Data Length* field is not 0x00 then the PPM shall set the MESSAGE IN Data Structure as described in Table 4-37.

Table 4-37: GET_PDO Data

Offset (Bits)	Field	Size (Bits)	Description
0	<i>PDO[0]</i>	32	First PDO at PDO Offset.
32	<i>PDO[1]</i>	32	Next PDO (If present).
64	<i>PDO[2]</i>	32	Next PDO (If present).
96	<i>PDO[3]</i>	32	Next PDO (If present).

If the PPM receives an otherwise valid GET_PDOS Command for which the target cannot provide any PDOs, it shall set the Error Indicator to 0b in the GET_PDOS Status and shall set the Data Length field to 0. The PPM shall not return any GET_PDO data.

If the PPM receives a GET_PDOS Command in which the sum of the *PDO Offset* field and the *Number of PDOs* field is greater than 7, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Invalid Command Specific Parameters bit to 1b in the GET_ERROR_STATUS Data.

UCSI ENGINEERING CHANGE NOTICE FORM

If the PPM receives a GET_PDOS Command with the *Partner PDO* field set to 1 when no PD device is attached, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Incompatible Connector Partner bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS command with the *Partner PDO* field set to 1 when no Connector partner is present, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the CC Communication Error bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS Command with the *Partner PDOs* field set to 0 that is inappropriate for the target (e.g. requesting Source PDOs from a Sink-only target), it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Invalid Command Specific Parameters bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS Command with the *Partner PDOs* field set to 1 that is inappropriate for the target (e.g. requesting Source PDOs from a Sink-only target), it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Incompatible Connector Partner bit to 1b in the GET_ERROR_STATUS Data.

To Text:

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- **Maximum Supported Source Capabilities**
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16	Connector Number	7	This field shall be set to the connector being queried.										
23	Partner PDO	1	This field shall be set to one if the OPM wants to retrieve the PDOS of the device attached to the connector.										
24	PDO Offset	8	Starting offset of the first PDO to be returned. Valid values are 0 through 7 for the SPR range, 0 through 4 for the EPR range, 0 through 11 for SPR and EPR ranges Other values shall not be used.										
32	Number of PDOs	2	Number of PDOs to return starting from the PDO Offset. The number of PDOs to return is the value in this field plus 1.										
34	Source or Sink PDOs	1	This field shall be set to one if the OPM wants to retrieve the Source PDOs otherwise it wants to retrieve the Sink PDOs.										
35	Source Capabilities Type	2	<div>This field indicates the type of Source Capabilities requested. This field is valid only if OPM sets <i>Partner PDO</i> to 0 and <i>Source or Sink PDOs</i> to 1.</div> <table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>Current Supported Source Capabilities</td></tr><tr><td>1</td><td>Advertised Capabilities</td></tr><tr><td>2</td><td>Maximum Supported Source Capabilities</td></tr><tr><td>3</td><td>Not Used</td></tr></table>	Value	Meaning	0	Current Supported Source Capabilities	1	Advertised Capabilities	2	Maximum Supported Source Capabilities	3	Not Used
Value	Meaning												
0	Current Supported Source Capabilities												
1	Advertised Capabilities												
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37	Range	2	<div>This field shall be set to the value for range/s</div> <table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>SPR Range</td></tr><tr><td>1</td><td>EPR Range</td></tr><tr><td>2</td><td>SPR + EPR Range</td></tr><tr><td>3</td><td>Not Used</td></tr></table>	Value	Meaning	0	SPR Range	1	EPR Range	2	SPR + EPR Range	3	Not Used
Value	Meaning												
0	SPR Range												
1	EPR Range												
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3	Not Used												
39	Reserved	26	Reserved and shall be set to zero.										

On completion of the command the PPM shall set the CCI Data Structure as described in Table 4-36.

UCSI ENGINEERING CHANGE NOTICE FORM

Table 4-36: GET_PDOS Status

Offset (Bits)	Field	Size (Bits)	Description
0	<i>Reserved</i>	1	Reserved and shall be set to zero.
1	<i>Connector Change Indicator</i>	7	If an asynchronous event occurred on a connector then the PPM shall set this field to the connector number on which the change occurred.
8	<i>Data Length</i>	8	Set to four times the number of PDOs returned. If not successful, shall be set to 0x00.
16	<i>Reserved</i>	7	Reserved and shall be set to zero.
23	<i>Security Request Indicator</i>	1	Set to 0b.
24	<i>FW Update Request Indicator</i>	1	Set to 0b.
25	<i>Not Supported Indicator</i>	1	Set to 0b.
26	<i>Cancel Completed Indicator</i>	1	Set to 0b.
27	<i>Reset Completed Indicator</i>	1	Set to 0b.
28	<i>Busy Indicator</i>	1	Set to 0b. If the PPM is Busy then the PPM shall set this field to a 1b and all other fields to zero.
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30	<i>Error Indicator</i>	1	If the command was not successfully completed the PPM shall set this field to 1b.
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If the command completed successfully and the *Data Length* field is not 0x00 then the PPM shall set the MESSAGE IN Data Structure as described in Table 4-37.

Table 4-37: GET_PDO Data

Offset (Bits)	Field	Size (Bits)	Description
0	<i>PDO[0]</i>	32	First PDO at PDO Offset.
32	<i>PDO[1]</i>	32	Next PDO (If present).
64	<i>PDO[2]</i>	32	Next PDO (If present).
96	<i>PDO[3]</i>	32	Next PDO (If present).

If the PPM receives an otherwise valid GET_PDOS Command for which the target cannot provide any PDOs, it shall set the Error Indicator to 0b in the GET_PDOS Status and shall set the Data Length field to 0. The PPM shall not return any GET_PDO data.

If the PPM receives a GET_PDOS Command in which the sum of the *PDO Offset* field and the *Number of PDOs* field is greater than number allowed for the range by the PD specification, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Invalid Command Specific Parameters bit to 1b in the GET_ERROR_STATUS Data.

UCSI ENGINEERING CHANGE NOTICE FORM

If the PPM receives a GET_PDOS Command with the *Partner PDO* field set to 1 when no PD device is attached, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Incompatible Connector Partner bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS command with the *Partner PDO* field set to 1 when no Connector partner is present, it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the CC Communication Error bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS Command with the *Partner PDOs* field set to 0 that is inappropriate for the target (e.g. requesting Source PDOs from a Sink-only target), it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Invalid Command Specific Parameters bit to 1b in the GET_ERROR_STATUS Data.

If the PPM receives a GET_PDOS Command with the *Partner PDOs* field set to 1 that is inappropriate for the target (e.g. requesting Source PDOs from a Sink-only target), it shall set the Error Indicator to 1b in the GET_PDOS Status and shall set the Incompatible Connector Partner bit to 1b in the GET_ERROR_STATUS Data.