

# ECN for USB Power Delivery Specification Revision 3.2

Version 1.1, 2024-10

## Title: Dynamic Power Sources (DPS)

### Brief description of the functional changes proposed:

This ECR would introduce a new type of source. The Dynamic Power Source is a single-, or multi-port device that can supply additional power for a limited amount of time depending on certain conditions (e.g. low enough ambient temperature, device temperature, etc.)

### Benefits as a result of the proposed changes:

For manufacturers and customers, this type of source would offer faster charging capabilities on a smaller and lighter footprint

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

Current sinks already need to work correctly with a source that reduces its source capabilities at any time (shared capacity ports for example). Some corner cases of legacy battery-less systems that will not recognize the device as a dynamic limited source

### An analysis of the hardware implications:

No implications for existing devices  
New devices will have more flexibility during design phase for size/weight/cost.

### An analysis of the software implications:

### An analysis of the compliance testing implications:

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**Version 1.1, 2024-10**  
**Actual Change Requested**

**(a). Section 1.6, Page 42, Table 1.3**

**From Text:**

NA

**To Text:**

Term	Description
<i>Dynamic Power Source (DPS)</i>	A source that offers a guaranteed power and offers a maximum power when conditions are right. Conditions may include low enough internal temperature, ambient temperature, etc. The maximum power capability is not guaranteed and may be revoked by the source.

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### Actual Change Requested

(a). Section 6.4.6, Page 213, Figure/Table 6.48

From Text:

Table 6.48 “Alert Data Object (ADO)”

Bit(s)	Field	Description																		
B31...24	<i>Type of Alert</i>	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td><b>Reserved</b> and <b>Shall</b> be set to zero</td></tr><tr><td>1</td><td>Battery Status Change Event (Attach/Detach/charging/discharging/idle)</td></tr><tr><td>2</td><td>OCP event when set (Source only, for Sink <b>Reserved</b> and <b>Shall</b> be set to zero)</td></tr><tr><td>3</td><td>OTP event when set</td></tr><tr><td>4</td><td>Operating Condition Change when set</td></tr><tr><td>5</td><td>Source Input Change Event when set</td></tr><tr><td>6</td><td>OVP event when set</td></tr><tr><td>7</td><td>Extended Alert Event</td></tr></table>	Bit	Description	0	<b>Reserved</b> and <b>Shall</b> be set to zero	1	Battery Status Change Event (Attach/Detach/charging/discharging/idle)	2	OCP event when set (Source only, for Sink <b>Reserved</b> and <b>Shall</b> be set to zero)	3	OTP event when set	4	Operating Condition Change when set	5	Source Input Change Event when set	6	OVP event when set	7	Extended Alert Event
Bit	Description																			
0	<b>Reserved</b> and <b>Shall</b> be set to zero																			
1	Battery Status Change Event (Attach/Detach/charging/discharging/idle)																			
2	OCP event when set (Source only, for Sink <b>Reserved</b> and <b>Shall</b> be set to zero)																			
3	OTP event when set																			
4	Operating Condition Change when set																			
5	Source Input Change Event when set																			
6	OVP event when set																			
7	Extended Alert Event																			
B23...20	<i>Fixed Batteries</i>	When Battery Status Change bit set indicates which Fixed Batteries have had a status change. B20 corresponds to Battery 0 and B23 corresponds to Battery 3.																		
B19...16	<i>Hot Swappable Batteries</i>	When Battery Status Change bit set indicates which Hot Swappable Batteries have had a status change. B16 corresponds to Battery 4 and B19 corresponds to Battery 7.																		
B15...4	<b>Reserved</b>	<b>Shall</b> be set to zero																		
B3...0	<i>Extended Alert Event Type</i>	<p>When the Extended Alert Event bit in the <i>Type of Alert</i> field equals ‘1’, then the <i>Extended Alert Event Type</i> field indicates the event which has occurred:</p> <ul style="list-style-type: none"><li>0 = <b>Reserved</b>.</li><li>1 = Power state change (DFP only)</li><li>2 = Power button press (UFP only)</li><li>3 = Power button release (UFP only)</li><li>4 = Controller initiated wake e.g., Wake on Lan (UFP only)</li><li>5-15 = <b>Reserved</b></li></ul> <p>When the Extended Alert Event bit in the <i>Type of Alert</i> field equals ‘0’, then the <i>Extended Alert Event Type</i> field is <b>Reserved</b> and <b>Shall</b> be set to zero.</p>																		

To Text:

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Table 6.48 “Alert Data Object (ADO)”

Bit(s)	Field	Description																		
B31...24	Type of Alert	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1</td><td>Battery Status Change Event (Attach/Detach/charging/discharging/idle)</td></tr><tr><td>2</td><td>OCP event when set (Source only, for Sink Reserved and Shall be set to zero)</td></tr><tr><td>3</td><td>OTP event when set</td></tr><tr><td>4</td><td>Operating Condition Change when set</td></tr><tr><td>5</td><td>Source Input Change Event when set</td></tr><tr><td>6</td><td>OVP event when set</td></tr><tr><td>7</td><td>Extended Alert Event</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1	Battery Status Change Event (Attach/Detach/charging/discharging/idle)	2	OCP event when set (Source only, for Sink Reserved and Shall be set to zero)	3	OTP event when set	4	Operating Condition Change when set	5	Source Input Change Event when set	6	OVP event when set	7	Extended Alert Event
Bit	Description																			
0	Reserved and Shall be set to zero																			
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3	OTP event when set																			
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6	OVP event when set																			
7	Extended Alert Event																			
B23...20	Fixed Batteries	When Battery Status Change bit set indicates which Fixed Batteries have had a status change. B20 corresponds to Battery 0 and B23 corresponds to Battery 3.																		
B19...16	Hot Swappable Batteries	When Battery Status Change bit set indicates which Hot Swappable Batteries have had a status change. B16 corresponds to Battery 4 and B19 corresponds to Battery 7.																		
B15...4	Reserved	Shall be set to zero																		
B3...0	Extended Alert Event Type	<p>When the Extended Alert Event bit in the Type of Alert field equals ‘1’, then the Extended Alert Event Type field indicates the event which has occurred:</p> <ul style="list-style-type: none"><li>0 = Reserved.</li><li>1 = Power state change (DFP only)</li><li>2 = Power button press (UFP only)</li><li>3 = Power button release (UFP only)</li><li>4 = Controller initiated wake e.g., Wake on Lan (UFP only)</li><li>5 = Source is about to reduce Source Capabilities (Source only)</li><li>6-15 = Reserved</li></ul> <p>When the Extended Alert Event bit in the Type of Alert field equals ‘0’, then the Extended Alert Event Type field is Reserved and Shall be set to zero.</p>																		

### 6.4.6.4.5 Source Reducing Capabilities

Every port in the Source role **Should** send an Alert message within *tReducePowerAlert* before transmitting any new, reduced Source Capabilities. Upon sending this Alert message, the Status and Source Info message fields **Shall** also be updated to reflect the Source’s new status. If *tReducePowerAlert* can’t be met, the Alert message **Should** be sent as soon as possible before the power reduction. This warning allows the Sink to query for more information or otherwise prepare before receiving the reduced Source Capabilities message.

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### Actual Change Requested

(a). Section 6.4.11, Page 228, Figure/Table x-x

From Text:

#### 6.4.11 Source\_Info Message

The *Source\_Info* Message **Shall** be sent in response to a *Get\_Source\_Info* Message. The *Source\_Info* Message contains one Source Information Data Object (SIDO).

The *Source\_Info* Message returns a SIDO whose format **Shall** be as shown in *Figure 6-1 “Source\_Info Message”* and *Table 6.52 “Source\_Info Data Object (SIDO)”*. The *Number of Data Objects* field in the *Source\_Info* Message **Shall** be set to 1.

The *Port Maximum PDP*, *Port Present PDP*, *Port Reported PDP* and the *Port Type* are used to identify capabilities of a Source port.

Figure 6-34 “Source\_Info Message”

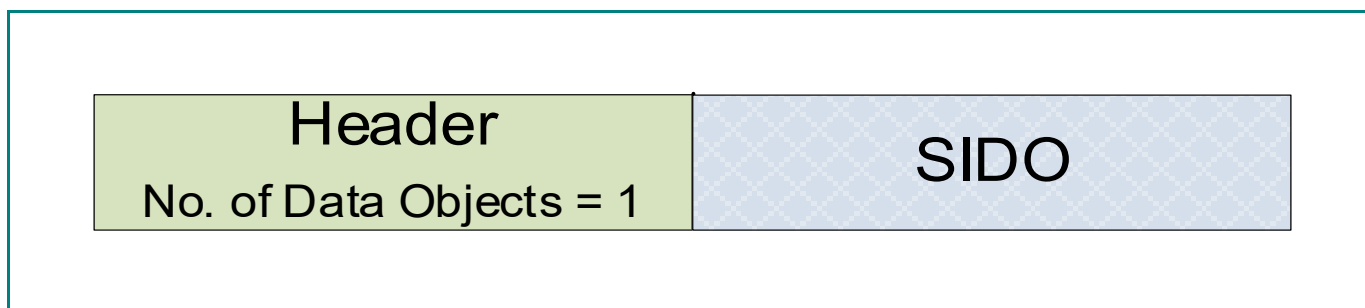


Table 6.52 “Source\_Info Data Object (SIDO)”

Bit(s)	Field	Description
B31	<i>Port Type</i>	0 = Managed Capability Port 1 = Guaranteed Capability Port
B30...24	<i>Reserved</i>	<b>Shall</b> be set to zero
B23...16	<i>Port Maximum PDP</i>	Power the port is designed to supply
B15...8	<i>Port Present PDP</i>	Power the port is presently capable of supplying
B7...0	<i>Port Reported PDP</i>	Power the port is actually advertising

##### 6.4.11.1 Port Type Field

*Port Type* is a static field that **Shall** be used to indicate whether the amount of power the port can provide is fixed or can change dynamically.

A Guaranteed Capability Port **Shall** always report its *Port Maximum PDP* equal to its *Port Present PDP* when the correct cable is used (e.g., 5A for Sources with PDPs greater than 60W or EPR Capable for EPR capable Sources). A Managed Capability Port is not required to have its *Port Maximum PDP* equal to its *Port Present PDP*.

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### 6.4.11.2 Port Maximum PDP Field

**Port Maximum PDP** is a static field that **Shall** indicate the maximum amount of power the Port is designed to deliver. A Guaranteed Capability Port (as indicated by the Port Type field being set to '1') **Shall** always be capable of supplying this amount of power. A Managed Capability Port (as indicated by the Port Type field being set to '0') **Shall** be able to offer this amount of power at some time.

The **Port Maximum PDP** **Shall** be the same as the larger of the Source PDP Rating and the EPR Source PDP Rating in the **Source\_Capabilities\_Extended** Message.

### 6.4.11.3 Port Present PDP Field

The **Port Present PDP** is a Static field when the **Port Type** is Guaranteed Capability and is dynamic when the **Port Type** field is Managed Capability. It **Shall** indicate the amount of power the port is presently capable of supplying. A Guaranteed Capability port **Shall** always set its **Port Present PDP** to be the same as its **Port Maximum PDP** except when limited by the cable's capabilities. A Managed Capability Port **Shall** set its **Port Present PDP** to the amount of power it has available to offer at this time which might be limited by the cable's capabilities.

### 6.4.11.4 Port Reported PDP Field

The **Port Reported PDP** field **Shall** track the amount of power the Port is offering in its **Source\_Capabilities** Message or **EPR\_Source\_Capabilities** Message. The **Port Reported PDP** field **May** be dynamic or static depending on the Port's other characteristics such as Managed/Guaranteed Capability, SPR/EPR mode, its power policy etc.

**Note:** The **Port Reported PDP** field is computed as the largest of the products of the Voltage times current of the fixed PDOs returned in the **Source\_Capabilities** Message or **EPR\_Source\_Capabilities** Messages.

## To Text:

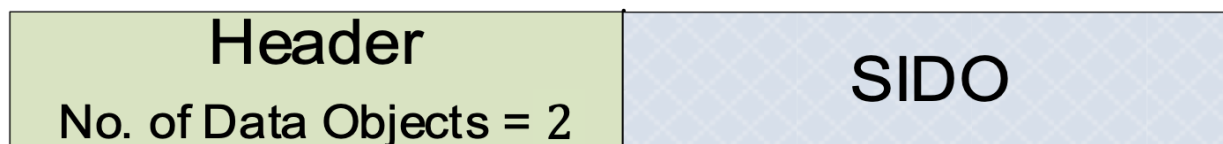
### 6.4.11 Source\_Info Message

The **Source\_Info** Message **Shall** be sent in response to a **Get\_Source\_Info** Message. The **Source\_Info** Message contains **one two** Source Information Data Objects (SIDO).

The **Source\_Info** Message returns a SIDO whose format **Shall** be as shown in **Figure 6-1 "Source\_Info Message"** and **Table 6.52 "Source\_Info Data Object (SIDO)"**. The **Number of Data Objects** field in the **Source\_Info** Message **Shall** be set to **1-2**.

The **Port Maximum PDP**, **Port Present PDP**, **Port Reported PDP**, **DPS Port** and the **Port Type** are used to identify capabilities of a Source port.

Figure 6-34 "Source\_Info Message"



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Table 6.52 “Source\_Info Data Object (SIDO) 1”

Bit(s)	Field	Description
B31	<i>Port Type</i>	0 = Managed Capability Port 1 = Guaranteed Capability Port
B30...24	<i>Reserved</i>	<i>Shall</i> be set to zero
B23...16	<i>Port Maximum PDP</i>	Maximum Power the port will provide in 1W steps
B15...8	<i>Port Present PDP</i>	Power the port is presently capable of supplying in 1W steps
B7...0	<i>Port Reported PDP</i>	Power the port is actually advertising in 1W steps

Table 6.53 “Source\_Info Data Object (SIDO) 2”

Bit(s)	Field	Description
B31	Port Type	0 = Managed Capability Port 1 = Guaranteed Capability Port
B30	DPS Port	0 = Non DPS port 1 = DPS Port (Port Type in B31 <i>Shall</i> be set to 0)
B29...18	<i>Reserved</i>	<i>Shall</i> be set to zero and <i>Shall</i> be ignored.
B17...9	<i>Port Maximum PDP</i>	Maximum power the port will provide in 0.5W steps.
B8...0	<i>Port Guaranteed PDP</i>	Minimum power the port is guaranteed to always be able to provide in 0.5W steps.

### 6.4.11.X DPS Port field

The *DPS Port* is a static field that *Shall* be used to indicate whether the source will behave as a Dynamic Power Source. If a source is a DPS it shall set the Port Type field to 1.

### 6.4.11.2 Port Maximum PDP Field

*Port Maximum PDP* is a static field that *Shall* indicate the maximum amount of power the Port is designed to deliver. A Guaranteed Capability Port (as indicated by the Port Type field being set to ‘1’) *Shall* always be capable of supplying this amount of power. A Managed Capability Port (as indicated by the Port Type field being set to ‘0’) *Shall* be able to offer this amount of power at some time.

The *Port Maximum PDP* *Shall* be the same as the larger of the Source PDP Rating and the EPR Source PDP Rating in the *Source\_Capabilities\_Extended* Message. This is the highest power fixed PDO that will ever be advertised. In SIDO1 this value *Shall* be rounded down to the nearest 1W, and in SIDO2 it *Shall* be rounded down to the nearest 0.5W.

### 6.4.11.3 Port Present PDP Field

The *Port Present PDP* is a Static field when the *Port Type* is Guaranteed Capability and is dynamic when the *Port Type* field is Managed Capability. It *Shall* indicate the amount of power the port is presently capable of supplying, rounded down to the nearest 1W. A Guaranteed Capability port *Shall* always set its *Port Present PDP* to be the same as its *Port Maximum PDP* except when limited by the cable’s capabilities. A Managed

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Capability Port **Shall** set its **Port Present PDP** to the amount of power it has available to offer at this time which might be limited by the cable's capabilities.

### 6.4.11.4 Port Reported PDP Field

The **Port Reported PDP** field **Shall track** be equal to the amount of power the Port is offering in its **Source\_Capabilities** Message or **EPR\_Source\_Capabilities** Message, **rounded down to the nearest 1W**. The **Port Reported PDP** field **May** be dynamic or static depending on the Port's other characteristics such as Managed/Guaranteed Capability, SPR/EPR mode, its power policy etc.

**Note:** The **Port Reported PDP** field is computed as the largest of the products of the Voltage times current of the fixed PDOs returned in the **Source\_Capabilities** Message or **EPR\_Source\_Capabilities** Messages.

### 6.4.11.5 Port Guaranteed PDP Field

The **Port Guaranteed PDP** is a Static field that **Shall** indicate the minimum amount of power the Source is guaranteed to be able to provide to a sink. The **Port Guaranteed PDP Shall** be rounded down to the nearest 0.5W.

Managed Capability Ports may offer less power than the value defined in the **Port Guaranteed PDP** but **Shall** be able to provide at least this power level once the Sink initiates the process of requesting more power by setting the mismatch bit, and following the process indicated in section 6.4.2.3.

The only scenario where the Source **May** not be able to reach **Port Guaranteed PDP** is if the cable capabilities limit the current.

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### Actual Change Requested

#### (a). Section 6.5.2.1, Page 239, Table 6.56

##### From Text:

Note that there is a source temperature information already, as well as a set of bits regarding to temperature. Since we are sending an alert message before we reduce power, we could use these bits. The warning flag has no meaning in the description field. Could give more context to a sink that would want to get confirmation...

4	Temperature Status	Bit	Description
		0	<b>Reserved</b> and <b>Shall</b> be set to zero
		1...2	00 – Not Supported. 01 – Normal 10 – Warning 11 – Over temperature
		3...7	<b>Reserved</b> and <b>Shall</b> be set to zero

5	Power Status	Bit	Description
		0	<b>Reserved</b> and <b>Shall</b> be set to zero
		1	Source power limited due to cable supported current
		2	Source power limited due to insufficient power available while sourcing other ports
		3	Source power limited due to insufficient external power
		4	Source power limited due to Event Flags in place (Event Flags must also be set)
		5	Source power limited due to temperature
		6...7	<b>Reserved</b> and <b>Shall</b> be set to zero

##### 6.5.2.1.5 Temperature Status Field

The Temperature Status field returns the current temperature status of the device either: normal, warning or over temperature. When the Temperature Status field is set to over temperature the OTP event flag **Shall** also be set.

##### 6.5.2.1.6 Power Status Field

The Power Status field indicates the current status of a Source. A non-zero return of the field indicates Advertised Source power is being reduced for either: the cable does not support the full Source current, the Source is supplying power to other ports and is unable to provide its full power, the external power to the Source is insufficient to support full power, or an Event has occurred that is causing the Source to reduce it Advertised power.

A Sink **Shall** set this field to zero.

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### To Text:

#### 6.5.2.1.5 Temperature Status Field

The Temperature Status field returns the current temperature status of the device either: normal, warning or over temperature. When the Temperature Status field is set to over temperature the OTP event flag **shall** also be set.

A DPS Source that is sending an Alert to reduce power due to Temperature **shall** set the Temperature Status to Warning.

#### 6.5.2.1.6 Power Status Field

The Power Status field indicates the current status of a Source. A non-zero return of the field indicates Advertised Source power is being reduced for either: the cable does not support the full Source current, the Source is supplying power to other ports and is unable to provide its full power, the external power to the Source is insufficient to support full power, or an Event has occurred that is causing the Source to reduce it Advertised power.

A DPS Source that is sending an Alert to reduce power due to Temperature **shall** set bit 5 of the Power Status Field to 1.

A Sink **shall** set this field to zero.

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### Actual Change Requested

(a). Section 7.4.1, Page 430, Table 7.25

**From Text:**

NA

**To Text:**

Table 7.25 “Source Electrical Parameters”

Parameter	Description	MIN	TYP	MAX	UNITS	Reference
<b><i>tReducePowerAlert</i></b>	Time between an alert, and the new Source Capabilities when reducing Source Capabilities.	2000		2400	ms	Section 7.1.6.1
<b><i>tDpsColdStart</i></b>	Time for a DPS Source to maintain the maximum Power PDP after a cold start due to thermal limiting.	15			min	Section 10.2.5
<b><i>tDpsRegular</i></b>	Time between new Source Capabilities for a DPS Source due to thermal limiting.	1			min	Section 10.2.5

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### Actual Change Requested

#### To Text:

#### (a). Section 10.2.5, Page 1057

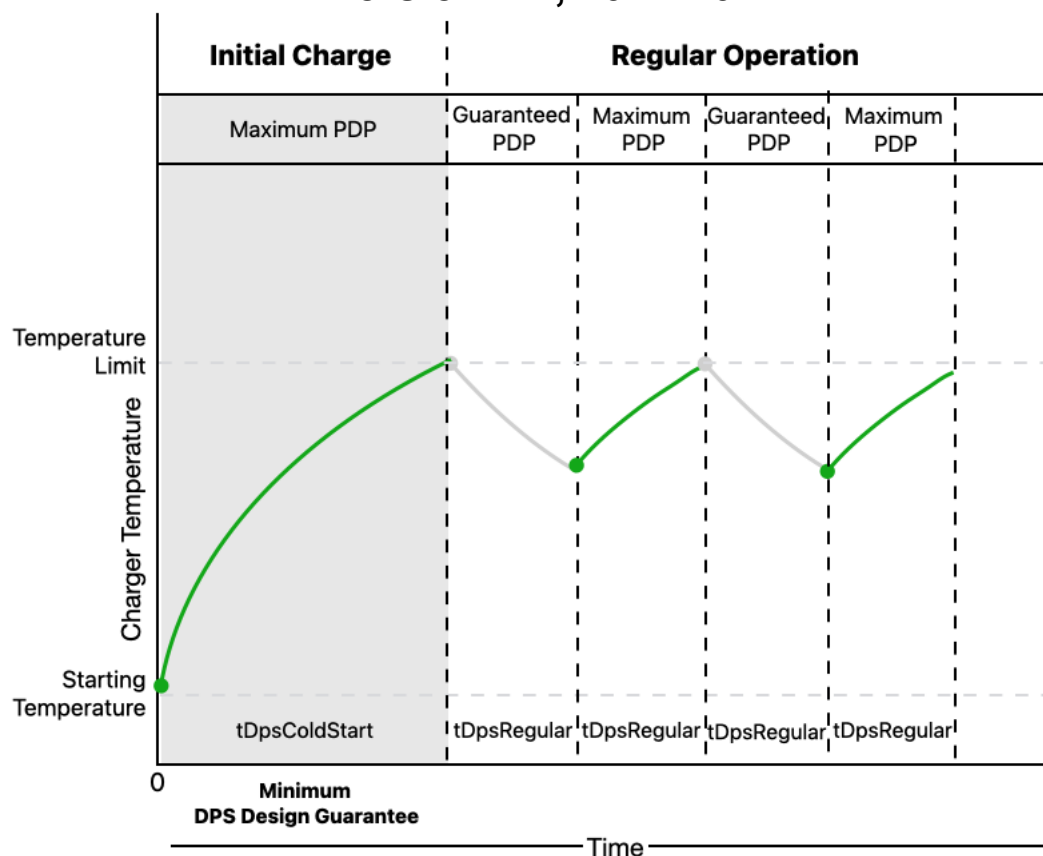
The Source power rules defined in *Section 10.2.2 “Normative Voltages and Currents”* and *Section 10.2.3 “Optional Voltages/Currents”* *Shall* apply to a DPS port, together with the following additional rules:

- A DPS Port **Shall** guarantee *tDpsColdStart* at Maximum PDP provided the following conditions are met:
  - The unit is starting from a cold start. This means the components inside the unit are at ambient temperature, and the ambient temperature **Should** be around 25°C.
  - The Source port is not sourced by an internal Battery, per the Source Inputs Field of the Source Capabilities Extended message.
  - No other events arise that may require the Source to send new Source Capabilities (e.g. a new Request from the Sink).
- The Source **Should** not send updated Source Capabilities within *tDpsRegular* or *tDpsColdStart*, with the following exceptions:
  - If the Source just entered its first explicit contract with the Sink, it **May** send an updated Source Capabilities message, provided the Sink sets the Capability Mismatch bit, and the Source can increase the power offered.
  - The updated Source Capabilities are due to sharing power with another port when the Source is a shared capability port.
  - Events arise that may require the Source to send new Source Capabilities (e.g. a new Request from the Sink).
  - Parameters other than the temperature affect the Source Capabilities.

Figure 10-xx “Example of a DPS temperature profile”

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A DPS Source uses Alert, Status messages, and Source Info message fields to inform a Sink about changes in its capabilities. See Chapters 6.4.6.4.5 and 6.5.2 for additional details on requirements for these fields.