USB Type-C ENGINEERING CHANGE NOTICE

Title: Rp Detect Timing
Applied to: USB Type-C Specification Release 1.2, March 25, 2016

Brief description of the functional changes proposed:
tPDDebounce is being over-loaded for several different purposes. It is being used to detect detach, also Rp current changes as well as Try attach time; tPDDebounce was intended only for detach with tCCDebounce being used for attach. This ECR separates the different functional usages and also clarifies the Rp change detect time in the absence of PD signaling for systems that can detect BMC idle.

Benefits as a result of the proposed changes:
Separation of timers so that the usage is clear. Value for Rp detection which is shorter than that currently specified for PD aware systems. Current detection timing in the absence of PD signaling corresponds to the assumed value for Rp detection for collision avoidance in the PD specification which is max 2ms.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
PD aware systems need to detect Rp current changes more quickly than presently in the absence of idle. Revision 3 PD systems already have an implicit requirement to make the detection this quickly.

An analysis of the hardware implications:
None

An analysis of the software implications:
PD aware systems need to detect Rp more quickly.

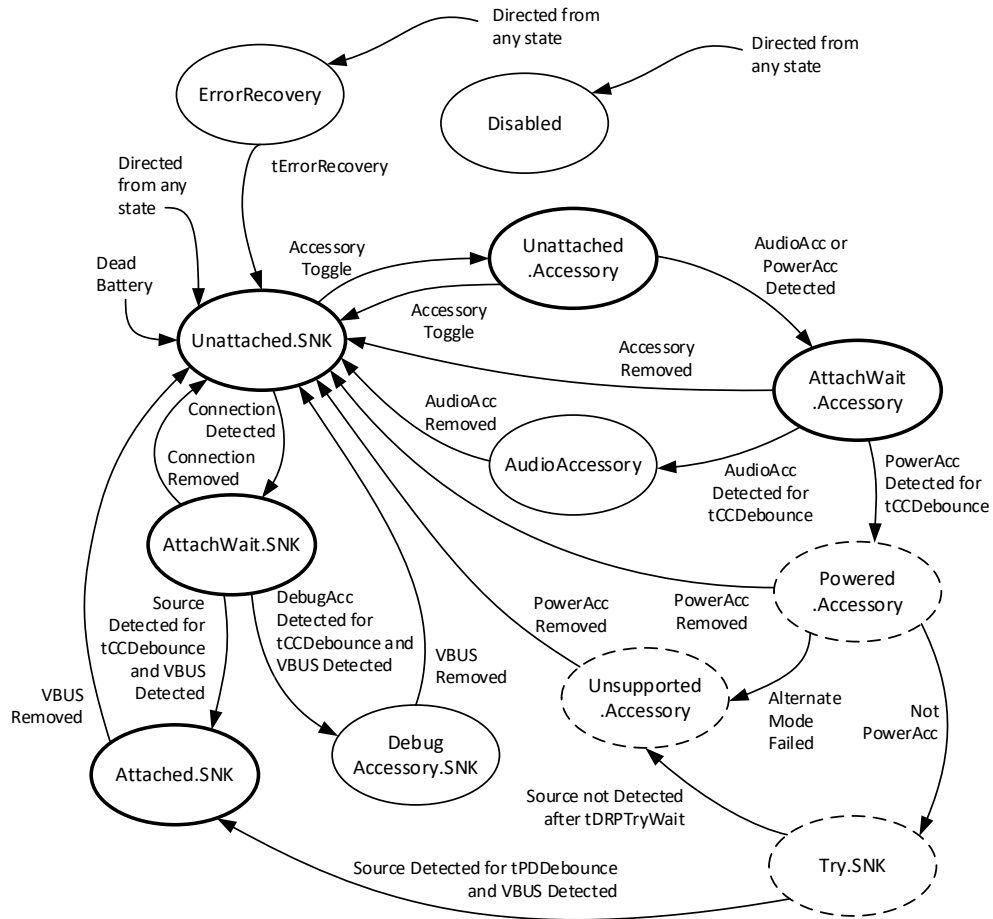| **An analysis of the compliance testing implications:** |
|---|
| Change in current timing detection. |

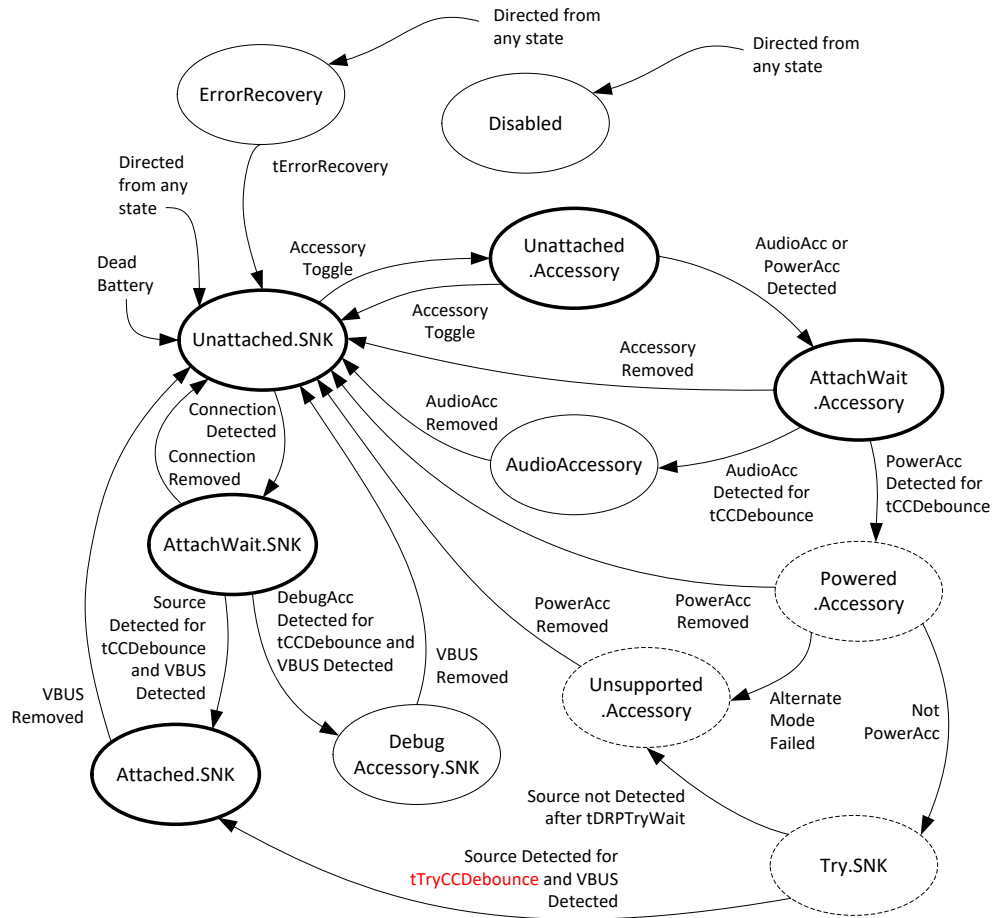# USB Type-C ENGINEERING CHANGE NOTICE

Actual Change Requested
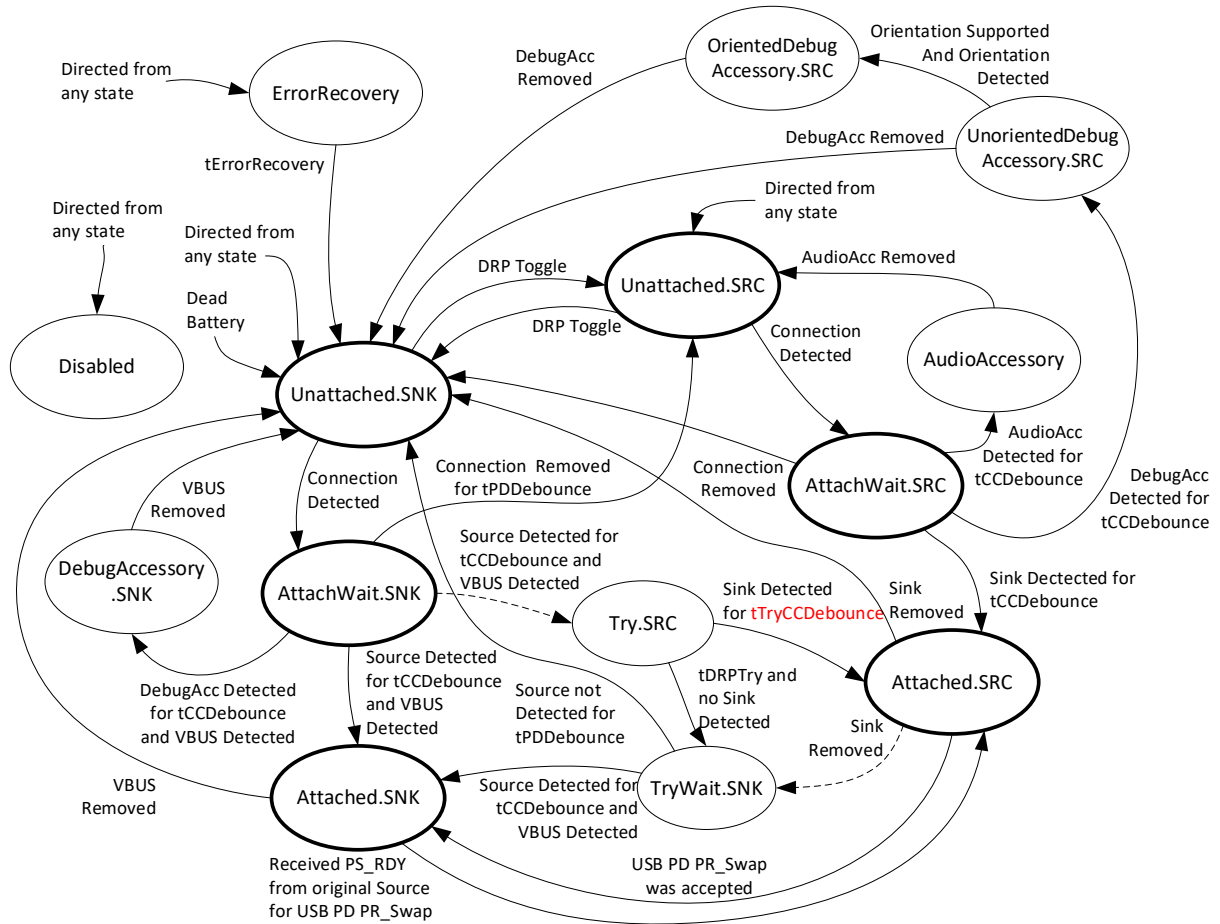
(a). Section 4.5.2, Figure 4-14, Page 137
From Text:

To Text:

Directed from any state

Directed from any state

ErrorRecovery

Disabled

tErrorRecovery

Directed from any state

Accessory Toggle

Dead Battery

Unattached .Accessory

AudioAcc or PowerAcc Detected

Unattached.SNK

Accessory Toggle

Accessory Removed

AttachWait .Accessory

Connection Detected

Connection Removed

AudioAcc Removed

AudioAccessory

AudioAcc Detected for tCCDebounce

PowerAcc Detected for tCCDebounce

AttachWait.SNK

Source Detected for tCCDebounce and VBUS Detected

DebugAcc Detected for tCCDebounce and VBUS Detected

VBUS Removed

PowerAcc Removed

PowerAcc Removed

Powered .Accessory

VBUS Removed

Unsupported .Accessory

Alternate Mode Failed

Not PowerAcc

Attached.SNK

Debug Accessory.SNK

Source not Detected after tDRPTryWait

Try.SNK

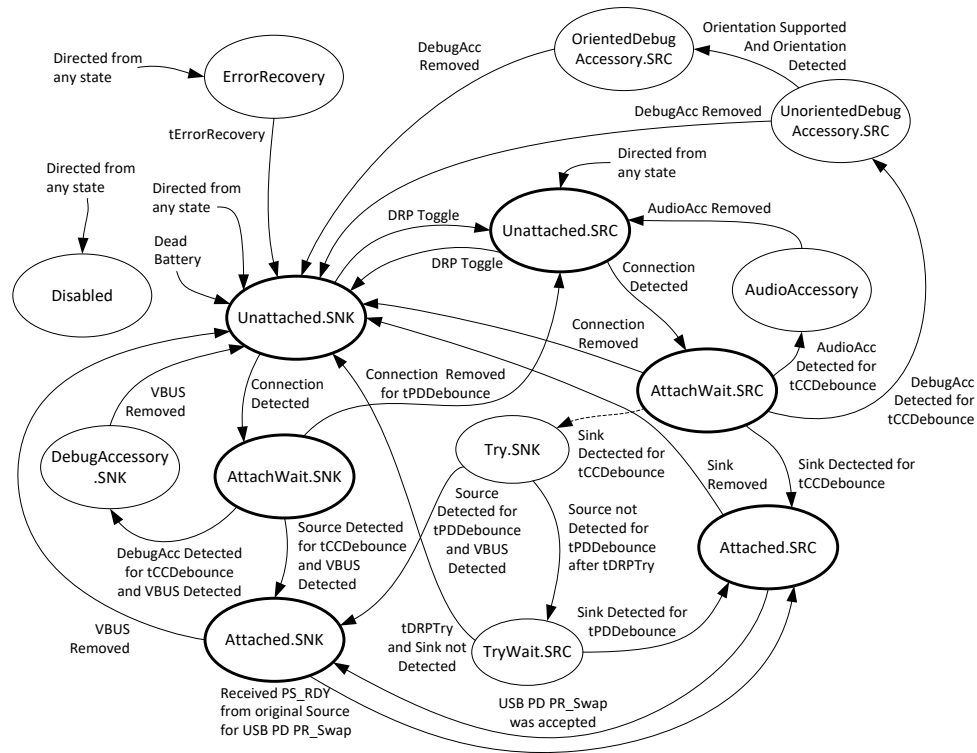Source Detected for tTryCCDebounce and VBUS Detected

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(b). Section 4.5.2, Figure 4-16, Page 138
From Text:

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To Text:

Directed from any state → ErrorRecovery

ErrorRecovery → Unattached.SNK : tErrorRecovery

Directed from any state → Disabled

Directed from any state → Unattached.SNK

Dead Battery → Unattached.SNK

OrientedDebug Accessory.SRC → Unattached.SRC : DebugAcc Removed

UnorientedDebug Accessory.SRC → OrientedDebug Accessory.SRC : Orientation Supported And Orientation Detected

UnorientedDebug Accessory.SRC → Unattached.SRC : DebugAcc Removed

Directed from any state → Unattached.SRC

Unattached.SRC → Unattached.SNK : DRP Toggle

Unattached.SNK → Unattached.SRC : DRP Toggle

AudioAccessory → Unattached.SRC : AudioAcc Removed

Unattached.SRC → AttachWait.SRC : Connection Detected

AttachWait.SRC → AudioAccessory : AudioAcc Detected for tCCDebounce

AttachWait.SRC → Unattached.SNK : Connection Removed

AttachWait.SRC → UnorientedDebug Accessory.SRC : DebugAcc Detected for tCCDebounce

Unattached.SNK → AttachWait.SNK : Connection Detected

AttachWait.SNK → Unattached.SNK : Connection Removed for tPDDebounce

DebugAccessory.SNK → Unattached.SNK : VBUS Removed

AttachWait.SNK → Try.SRC : Source Detected for tCCDebounce and VBUS Detected

AttachWait.SNK → Attached.SNK : Source Detected for tCCDebounce and VBUS Detected

AttachWait.SNK → DebugAccessory.SNK : DebugAcc Detected for tCCDebounce and VBUS Detected

Try.SRC → Attached.SRC : Sink Detected for tTryCCDebounce

Attached.SRC → Try.SRC : Sink Removed

Try.SRC → TryWait.SNK : tDRPTry and no Sink Detected

Attached.SRC → TryWait.SNK : Sink Removed

AttachWait.SRC → Attached.SRC : Sink Dectected for tCCDebounce

TryWait.SNK → Attached.SNK : Source Detected for tCCDebounce and VBUS Detected

TryWait.SNK → Unattached.SNK : Source not Detected for tPDDebounce

Attached.SNK → Unattached.SNK : VBUS Removed

Attached.SNK → Attached.SRC : Received PS_RDY from original Source for USB PD PR_Swap

Attached.SRC → Attached.SNK : USB PD PR_Swap was accepted
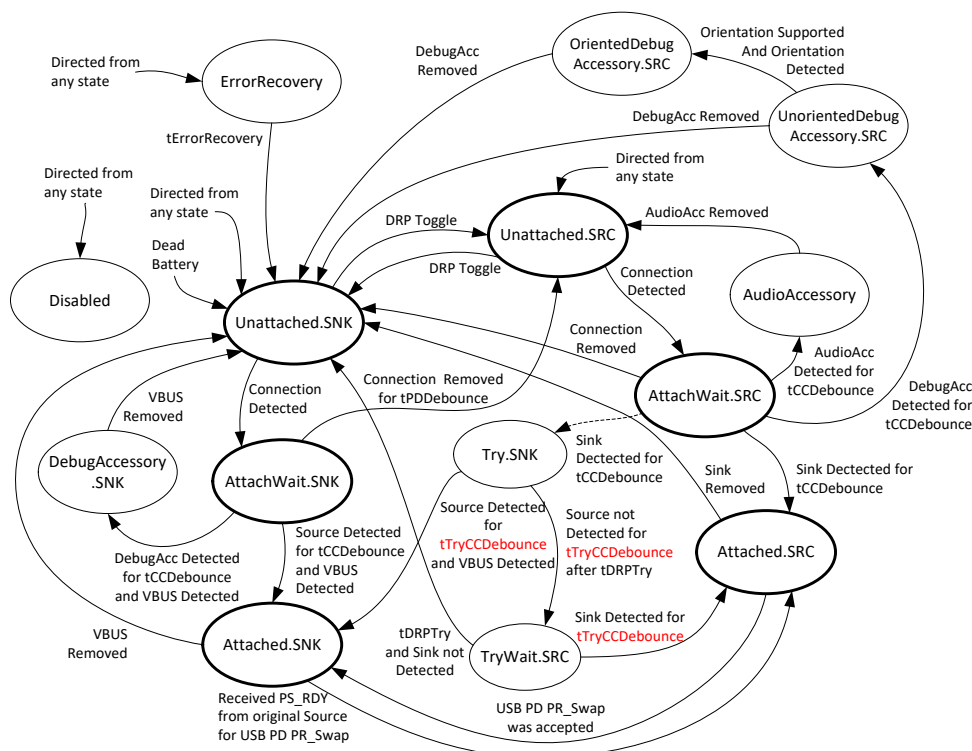
USB Type-C ENGINEERING CHANGE NOTICE

(c). Section 4.5.2, Figure 4-17, Page 139

From Text:

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To Text:

(d). Section 4.5.2.2.9.2, Page 146

From Text:

The port shall transition to Attached.SRC when the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tPDDebounce.

The port shall transition to TryWait.SNK after tDRPTry and the SRC.Rd state has not been detected.

To Text:

The port shall transition to Attached.SRC when the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tTryCCDebounce.

The port shall transition to TryWait.SNK after tDRPTry and the SRC.Rd state has not been detected.

(e). Section 4.5.2.2.11.2, Page 147

From Text:

The port shall wait for tDRPTry and only then begin monitoring the CC1 and CC2 pins for the SNK.Rp state.

The port shall then transition to Attached.SNK when the SNK.Rp state is detected on exactly one of the CC1 or CC2 pins for at least tPDDebounce and V$_{BUS}$ is detected.

Alternatively, the port shall transition to TryWait.SRC if SNK.Rp state is not detected for tPDDebounce. A Sink with Accessory Support shall transition to Unsupported.Accessory if SNK.Rp state is not detected for tDRPTryWait.

Note: The Source may initiate *USB PD* communications which will cause brief periods of the SNK.Open state on both the CC1 and CC2 pins, but this event will not exceed tPDDebounce.

To Text:

The port shall wait for tDRPTry and only then begin monitoring the CC1 and CC2 pins for the SNK.Rp state.

The port shall then transition to Attached.SNK when the SNK.Rp state is detected on exactly one of the CC1 or CC2 pins for at least tTryCCDebounce and V$_{BUS}$ is detected.

Alternatively, the port shall transition to TryWait.SRC if SNK.Rp state is not detected for tTryCCDebounce. A Sink with Accessory Support shall transition to Unsupported.Accessory if SNK.Rp state is not detected for tDRPTryWait.

Note: The Source may initiate *USB PD* communications which will cause brief periods of the SNK.Open state on both the CC1 and CC2 pins, but this event will not exceed tTryCCDebounce.

(f). Section 4.5.2.2.12.2, Page 147

From Text:

The port shall transition to Attached.SRC when V$_{BUS}$ is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC pins for at least tCCDebounce.

The port shall transition to Unattached.SNK after tDRPTry if neither of the CC1 or CC2 pins are in the SRC.Rd state.

To Text:

The port shall transition to Attached.SRC when V$_{BUS}$ is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC pins for at least tTryCCDebounce.

The port shall transition to Unattached.SNK after tDRPTry if neither of the CC1 or CC2 pins are in the SRC.Rd state.

(g). Section 4.5.2.3.1.2, Page 153

From Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least tPDDebounce.

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To Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least ~~tPDDebounce~~tRpValueChange.

(h). Section 4.5.2.3.2.2, Page 154

From Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least tPDDebounce.

To Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least ~~tPDDebounce~~tRpValueChange.

(i). Section 4.5.2.3.3.2, Page 154

From Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least tPDDebounce.

To Text:

For any change in vRd indicating a change in allowable power, the port shall not transition until the new vRd has been stable for at least ~~tPDDebounce~~tRpValueChange.

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(j). Section 4.11.2, Table 4-20, Page 180
From Text:

Table 4-xx V_{BUS} and V_{CONN} Timing Parameters

	Minimum	Maximum	Description
tV_{BUS}ON	0 ms	275 ms	From entry to Attached.SRC until V_{BUS} reaches the minimum vSafe5V threshold as measured at the source's receptacle.
tV_{BUS}OFF	0 ms	650 ms	From the time the Sink is detached until the Source removes V_{BUS} and reaches vSafe0V (See *USB PD*).
tV_{CONN}ON	Note 1	2 ms	From the time the Source supplied V_{BUS} in the Attached.SRC state. Measured from vSafe5V to the minimum V_{CONN} voltage (see Table 4-4)
tV_{CONN}ON-PA	0 ms	100 ms	From the time a Sink with accessory support enters the PoweredAccessory state until the Sink sources minimum V_{CONN} voltage (see Table 4-4)
tV_{CONN}OFF	0 ms	35 ms	From the time that a Sink is detached or as directed until the V_{CONN} supply is disconnected.
tSinkAdj	tPDDebounce	60 ms	Response time for a Sink to adjust its current consumption to be in the specified range due to a change in USB Type-C Current advertisement

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To Text:

Table 4-xx V_{BUS} and V_{CONN} Timing Parameters

	Minimum	Maximum	Description
tV_{BUS}ON	0 ms	275 ms	From entry to Attached.SRC until V_{BUS} reaches the minimum vSafe5V threshold as measured at the source's receptacle.
tV_{BUS}OFF	0 ms	650 ms	From the time the Sink is detached until the Source removes V_{BUS} and reaches vSafe0V (See *USB PD*).
tV_{CONN}ON	Note 1	2 ms	From the time the Source supplied V_{BUS} in the Attached.SRC state. Measured from vSafe5V to the minimum V_{CONN} voltage (see Table 4-4)
tV_{CONN}ON-PA	0 ms	100 ms	From the time a Sink with accessory support enters the PoweredAccessory state until the Sink sources minimum V_{CONN} voltage (see Table 4-4)
tV_{CONN}OFF	0 ms	35 ms	From the time that a Sink is detached or as directed until the V_{CONN} supply is disconnected.
tSinkAdj	tRpValueChange (Min)	60 ms	Response time for a Sink to adjust its current consumption to be in the specified range due to a change in USB Type-C Current advertisement

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(k). Section 4.11.2, Table 4-22, Page 182

From Text:

Table 4-22 CC Timing

	Minimum	Maximum	Description
tCCDebounce	100 ms	200 ms	Time a port shall wait before it can determine it is attached
tPDDebounce	10 ms	20 ms	Time a port shall wait before it can determine it is either detached or there has been a change in USB Type-C current due to the potential for *USB PD* BMC signaling on CC as described in the state definitions. The exit condition for the Attached.SRC state may not apply this timer.
tError Recovery			Time a self-powered port shall remain in the ErrorRecovery state.

To Text:

Table 4-22 CC Timing

	Minimum	Maximum	Description
tCCDebounce	100 ms	200 ms	Time a port shall wait before it can determine it is attached
tPDDebounce	10 ms	20 ms	Time a ~~Sink~~ port shall wait before it can determine it is ~~either~~ detached ~~or there has been a change in USB Type-C current~~ due to the potential for *USB PD* ~~BMC~~ signaling on CC as described in the state definitions. ~~The exit condition for the Attached.SRC state may not apply this timer.~~
tTryCCDebounce	10 ms	20ms	Time a port shall wait before it can determine it is re-attached during the try-wait process.
tError Recovery			Time a self-powered port shall remain in the ErrorRecovery state.
tRpValueChange	10 ms	20 ms	Time a Sink port shall wait before it can determine there has been a change in Rp where CC is not BMC Idle or the port is unable to detect BMC Idle.
	0 ms	5 ms	Time a Sink port shall wait before it can determine that there has been a change in Rp when *USB PD* signaling can be detected by the port and CC line is BMC Idle.

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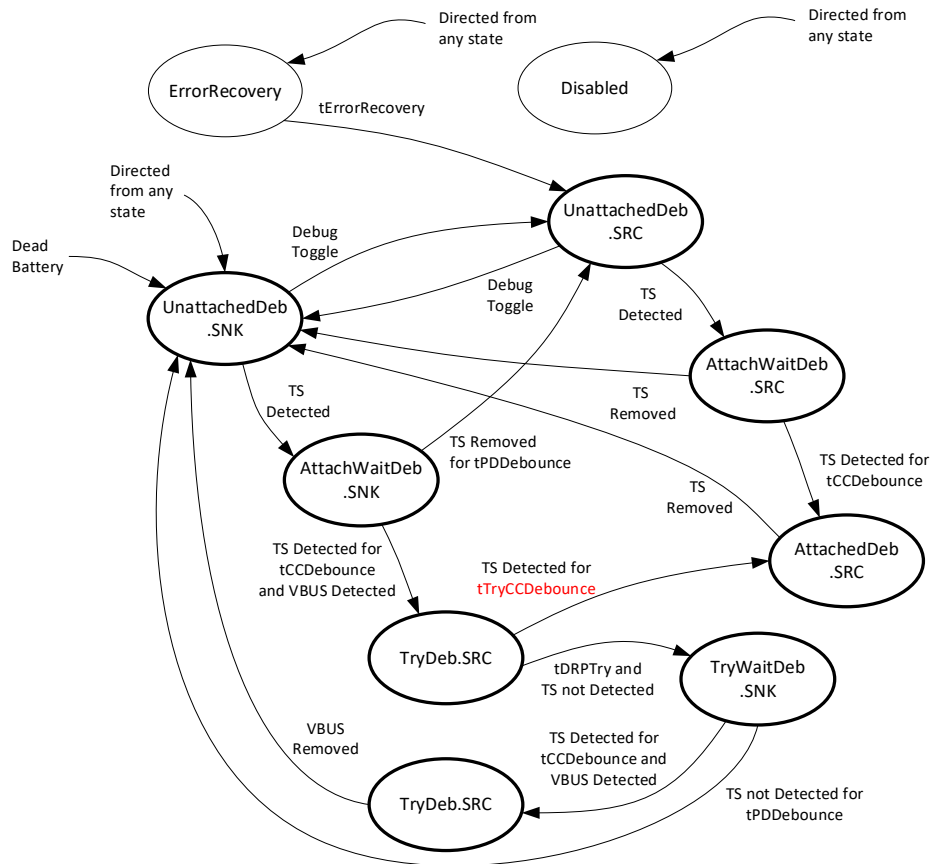
(I). Section B2.4, Figure B-5, Page 203

From Text:

Figure B-5 Connection State Diagram: DTS DRP
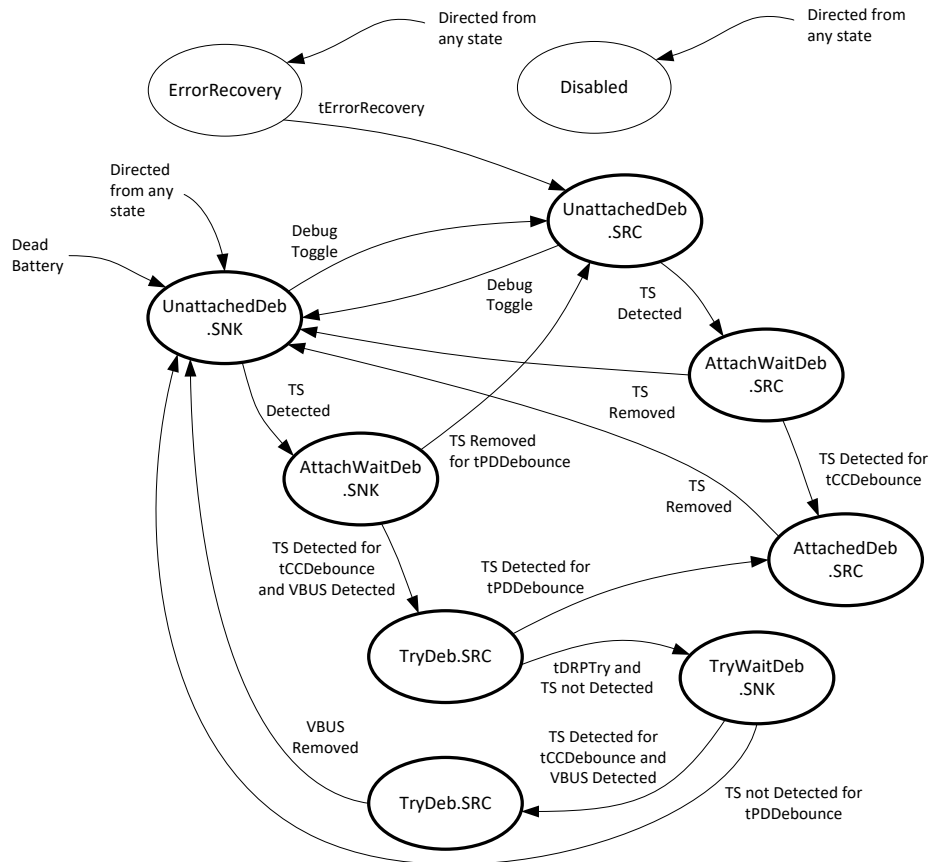
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To Text:

Figure B-5 Connection State Diagram: DTS DRP

(m). Section B2.4.1.8.2, Page 207

From Text:

The DTS shall transition to AttachedDeb.SRC when the SRC.Rd state is detected on both CC pins for at least tPDDebounce.

The DTS shall transition to TryWaitDeb.SNK after tDRPTry if the state of both CC pins is not SRC.Rd.

To Text:

The DTS shall transition to AttachedDeb.SRC when the SRC.Rd state is detected on both CC pins for at least tTryCCDebounce.

The DTS shall transition to TryWaitDeb.SNK after tDRPTry if the state of both CC pins is not SRC.Rd.

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(n). Section B2.5.1.6, Page 214

From Text:

Case #2:

1. Both DRPs in the unattached state

    • DTS DRP alternates between UnattachedDeb.SRC and UnattachedDeb.SNK

    • TS DRP alternate between Unattached.SRC and Unattached.SNK

2. DTS DRP transitions from UnattachedDeb.SNK to AttachWaitDeb.SNK

    • DTS DRP in UnattachedDeb.SNK detects both CC pull-ups of TS DRP in Unattached.SRC and enters AttachWaitDeb.SNK

3. TS DRP transitions from Unattached.SRC to UnorientedDebugAccessory.SRC through AttachWait.SRC

    • TS DRP in Unattached.SRC detects both CC pull-downs of DTS DRP and enters AttachWait.SRC

    • TS DRP in AttachWait.SRC continues to see both CC pull-downs of TS DRP for tCCDebounce, enters UnorientedDebugAccessory.SRC and turns on V$_{BUS}$

4. DTS DRP transitions from AttachWaitDeb.SNK to TryDeb.SRC

    • DTS DRP in AttachWaitDeb.SNK continues to see both CC pull-ups of TS DRP for tCCDebounce and detects VBUS, enters TryDeb.SRC

5. TS DRP transitions from UnorientedDebugAccessory.SRC to Unattached.SNK

    • TS DRP in UnorientedDebugAccessory.SRC detects the removal of both CC pull-downs of DTS DRP and enters Unattached.SNK

6. TS DRP transitions from Unattached.SNK to AttachWait.SNK

    • TS DRP in Unattached.SNK detects both CC pull-ups of DTS DRP and enters AttachWait.SNK

7. DTS DRP transitions from TryDeb.SRC to AttachedDeb.SRC

    • DTS DRP in TryDeb.SRC detects both CC pull-downs of TS DRP for tPDDebounce and enters AttachedDeb.SRC

    • DTS DRP turns on VBUS

To Text:

Case #2:

1. Both DRPs in the unattached state

    • DTS DRP alternates between UnattachedDeb.SRC and UnattachedDeb.SNK

    • TS DRP alternate between Unattached.SRC and Unattached.SNK

2. DTS DRP transitions from UnattachedDeb.SNK to AttachWaitDeb.SNK

    • DTS DRP in UnattachedDeb.SNK detects both CC pull-ups of TS DRP in Unattached.SRC and enters AttachWaitDeb.SNK

3. TS DRP transitions from Unattached.SRC to UnorientedDebugAccessory.SRC through AttachWait.SRC

    • TS DRP in Unattached.SRC detects both CC pull-downs of DTS DRP and enters AttachWait.SRC

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- TS DRP in AttachWait.SRC continues to see both CC pull-downs of TS DRP for tCCDebounce, enters UnorientedDebugAccessory.SRC and turns on V$_{BUS}$

4. DTS DRP transitions from AttachWaitDeb.SNK to TryDeb.SRC

- DTS DRP in AttachWaitDeb.SNK continues to see both CC pull-ups of TS DRP for tCCDebounce and detects VBUS, enters TryDeb.SRC

5. TS DRP transitions from UnorientedDebugAccessory.SRC to Unattached.SNK

- TS DRP in UnorientedDebugAccessory.SRC detects the removal of both CC pull-downs of DTS DRP and enters Unattached.SNK

6. TS DRP transitions from Unattached.SNK to AttachWait.SNK

- TS DRP in Unattached.SNK detects both CC pull-ups of DTS DRP and enters AttachWait.SNK

7. DTS DRP transitions from TryDeb.SRC to AttachedDeb.SRC

- DTS DRP in TryDeb.SRC detects both CC pull-downs of TS DRP for tTryCCDebounce and enters AttachedDeb.SRC

- DTS DRP turns on VBUS