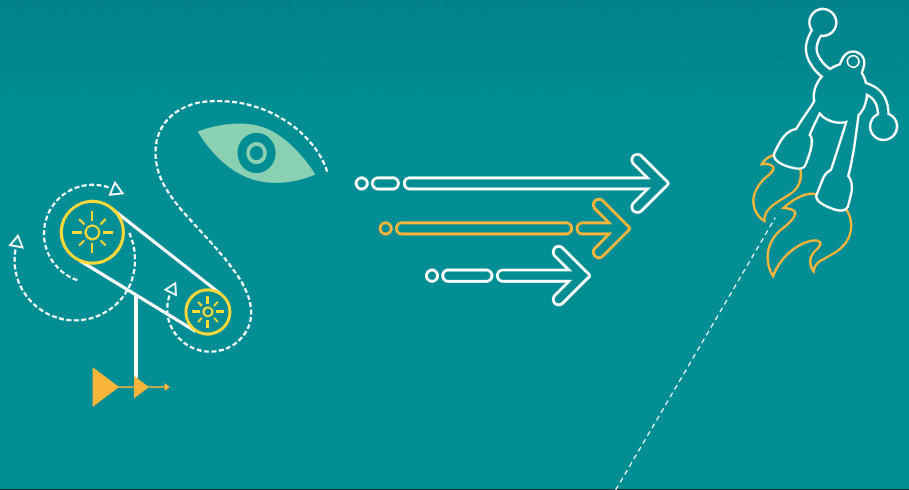
Qualcomm Charger Detect Issues Debug Guide

Qualcomm Technologies, Inc.



80-P8536-1 A

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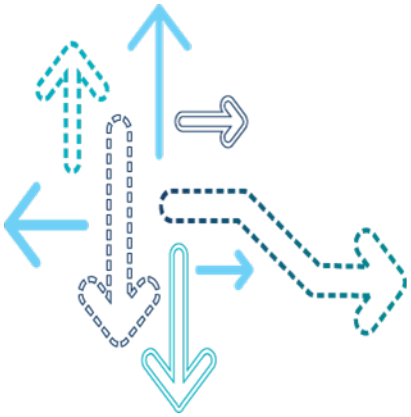
Revision History

Revision	Date	Description
A	September 2016	Initial release

Note: There is no Rev. I, O, Q, S, X, or Z per Mil. standards.

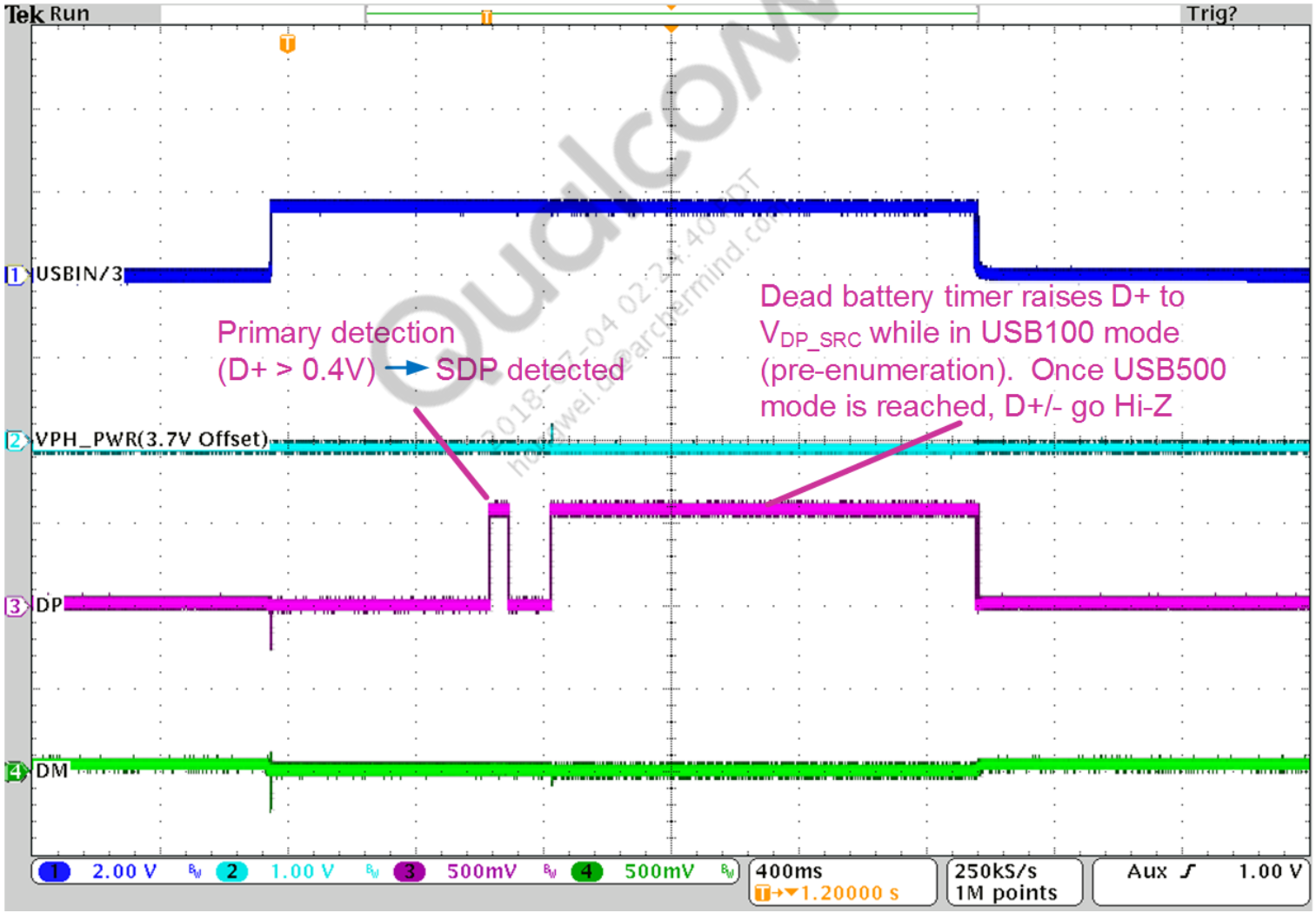
Contents

Automatic Power Source Detection (APSD)



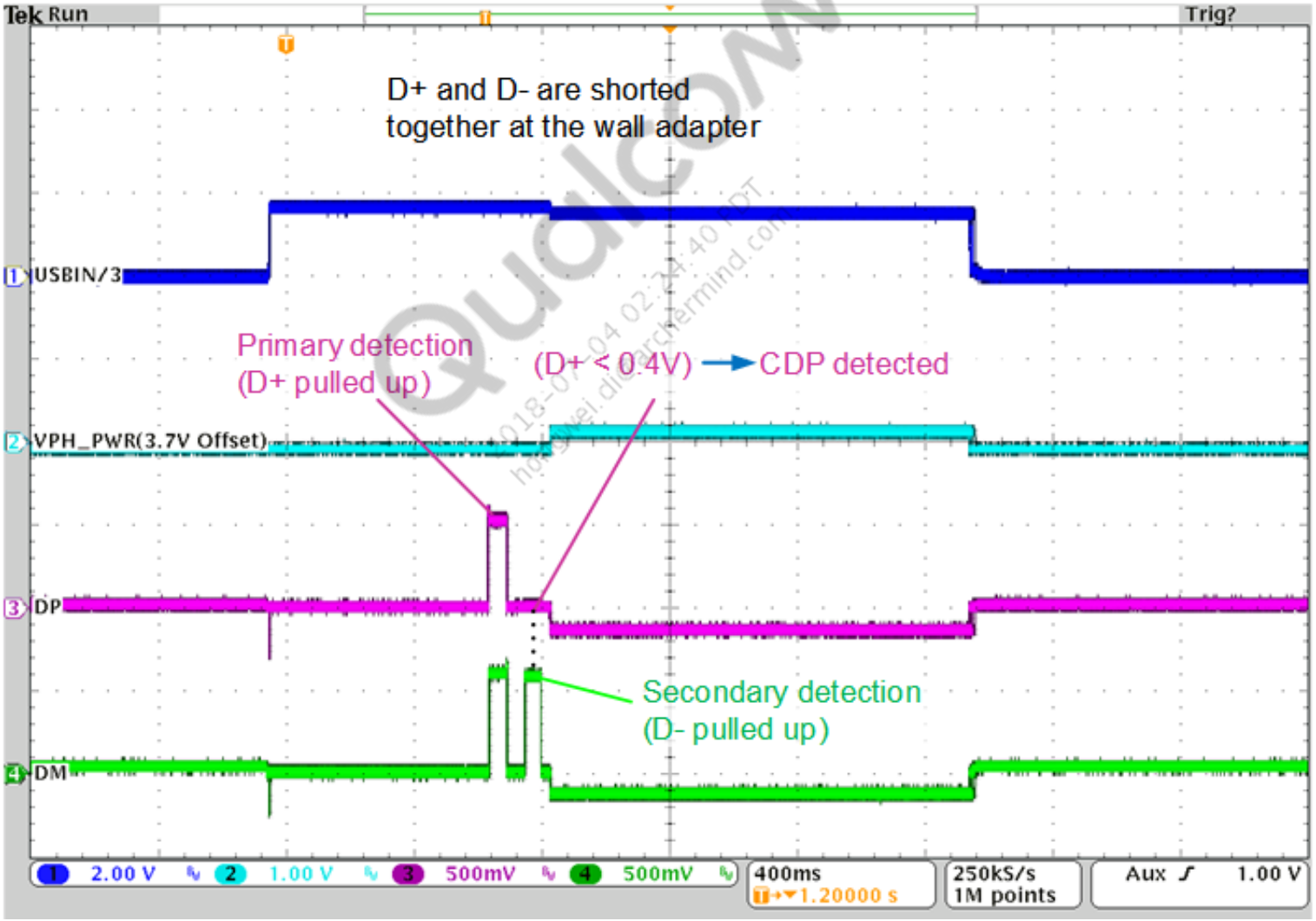
APSD Plots (1 of 4)

SDP – PMIC on, running from battery (VBAT = 3.7 V)



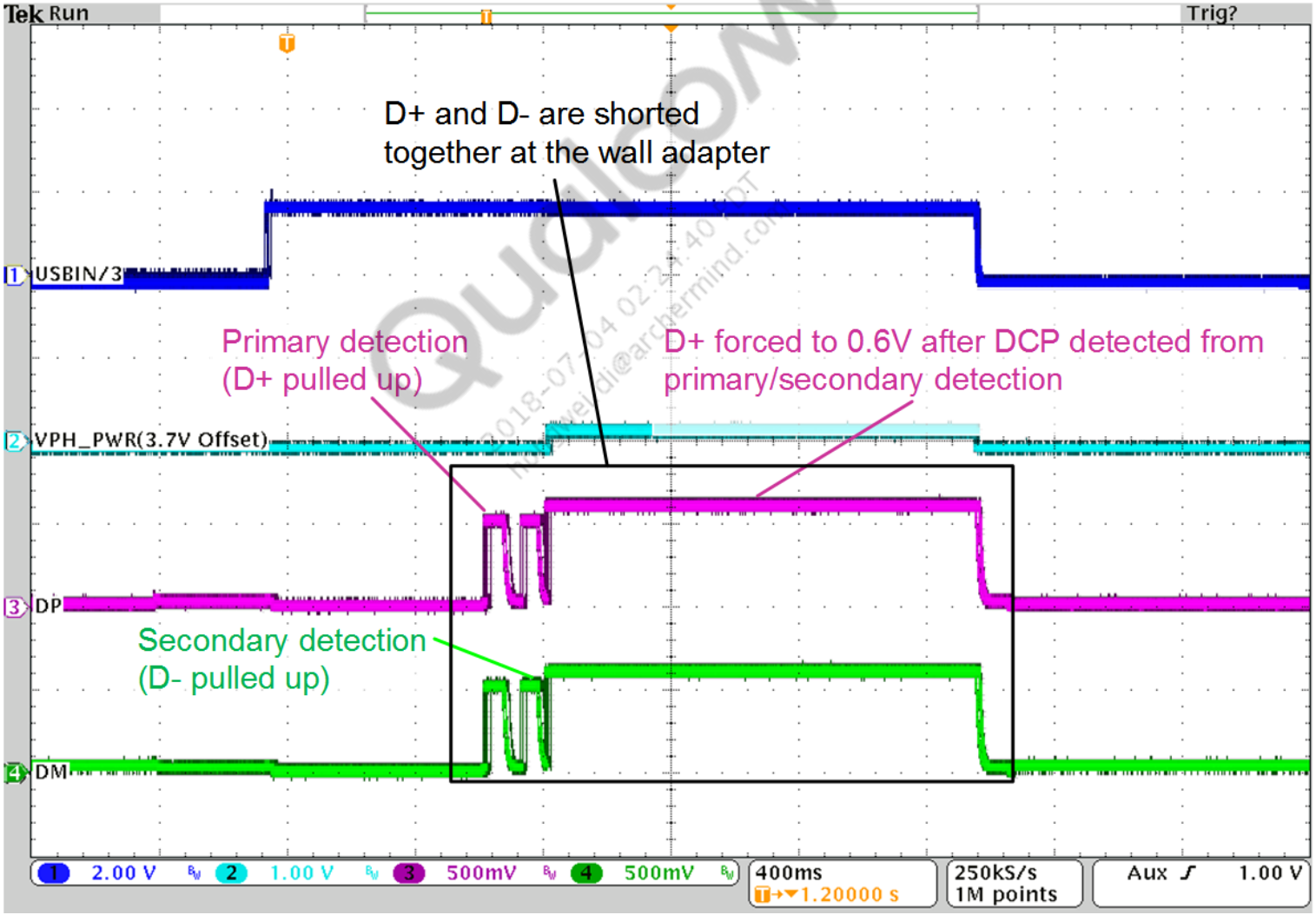
APSD Plots (2 of 4)

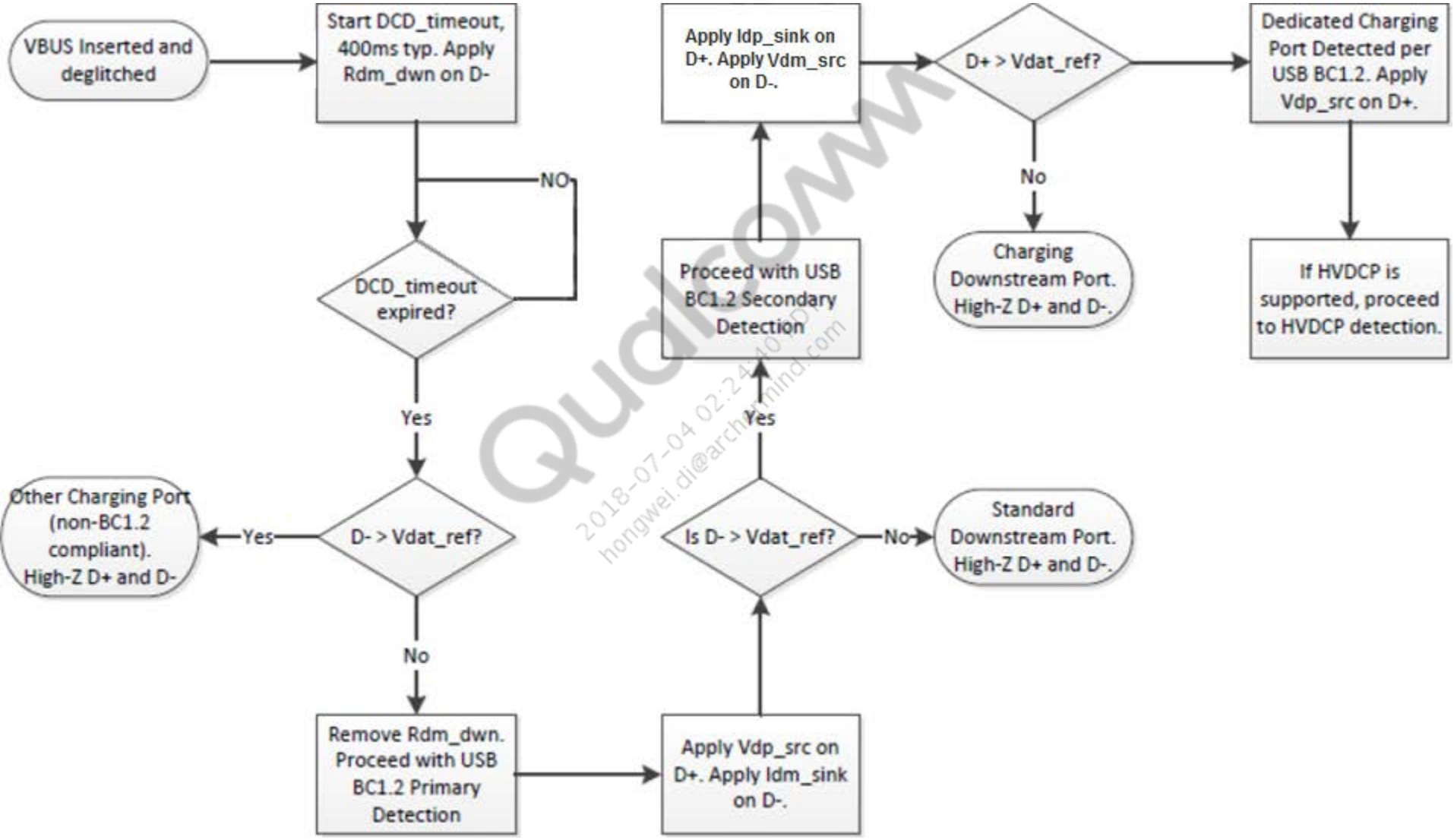
CDP – PMIC on, running from battery (VBAT = 3.7 V)



APSD Plots (3 of 4)

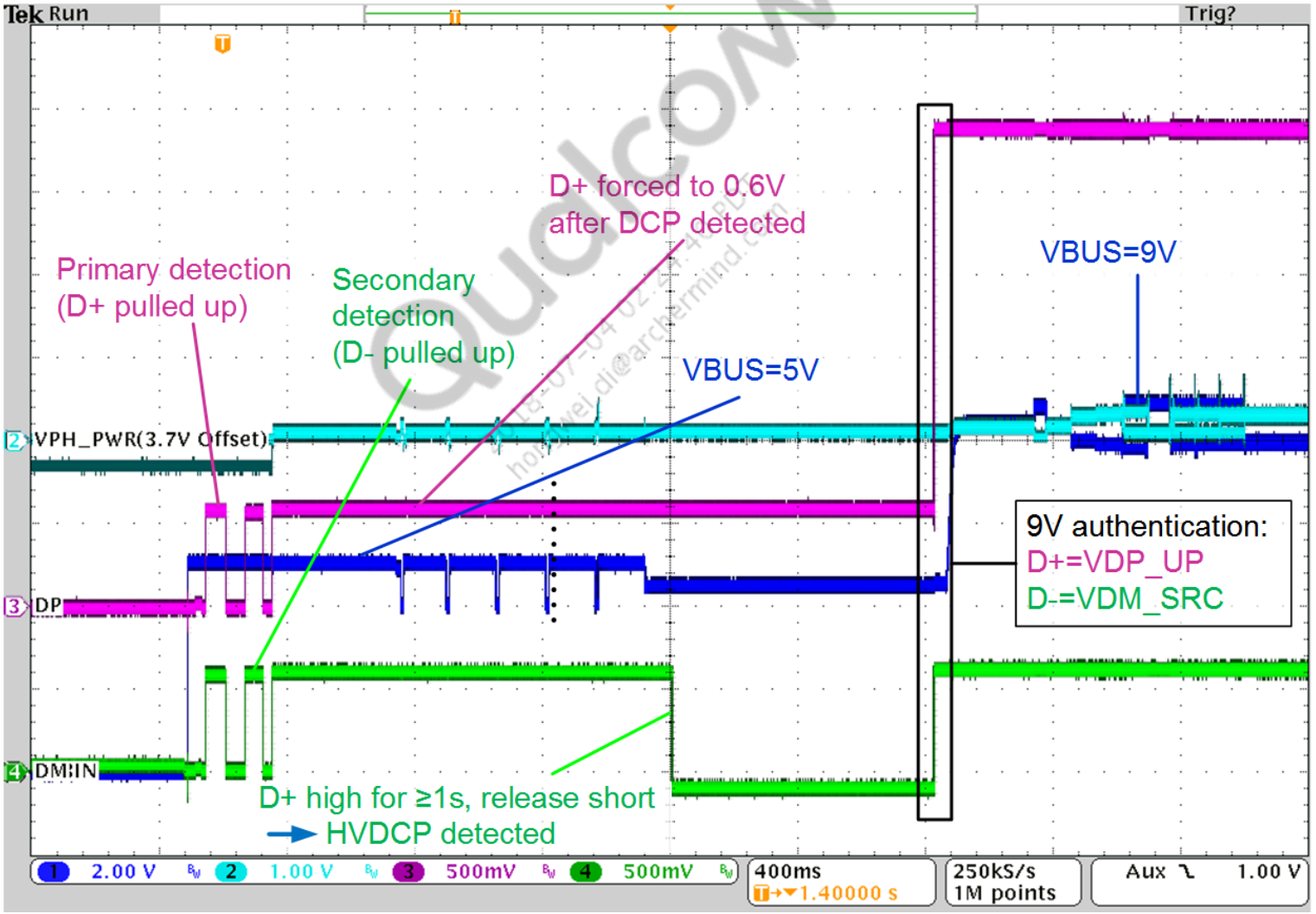
DCP – PMIC on, running from battery (VBAT = 3.7 V)

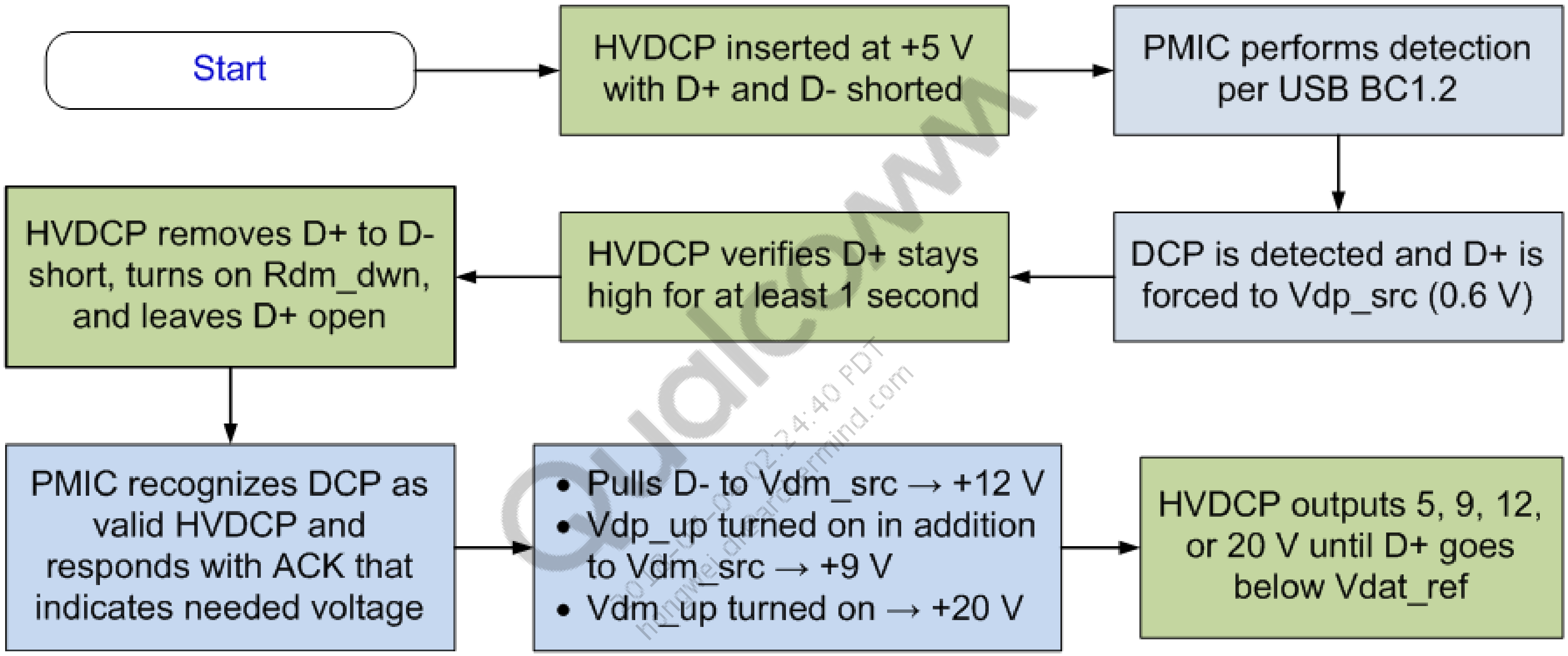




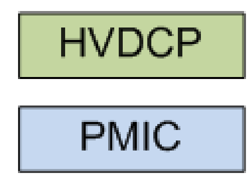
APSD Plots (4 of 4)

HVDCP – PMIC on, running from battery (VBAT = 3.7 V)

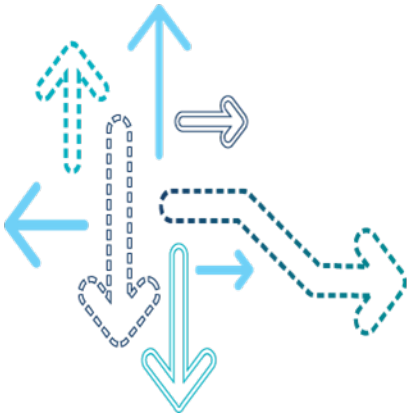




Portable device		HVDCP
D+	D-	Adapter voltage
0.6 V	0.6 V	12 V
3.3 V	0.6 V	9 V
0.6 V	3.3 V	Continuous mode
3.3 V	3.3 V	20 V
0.6 V	GND	5 V



Typical Issues and Solutions/WA Study



Typical Issue list

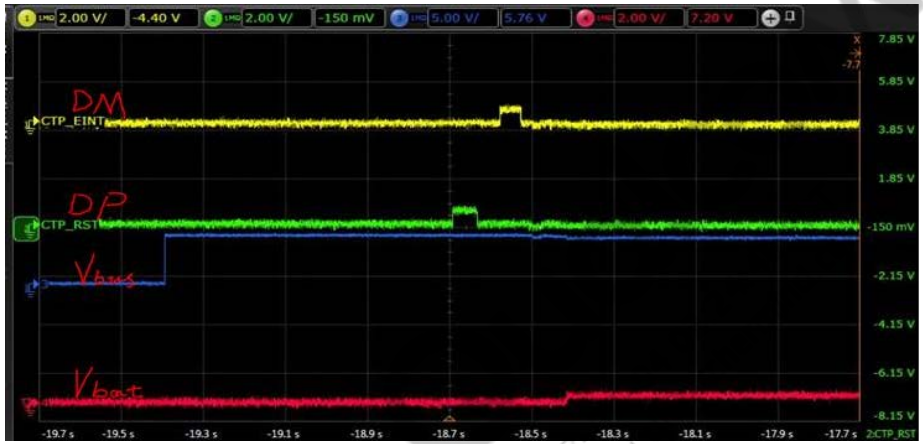
- Slowly Insertion Issue.
- USB Controller Power Issue.
- Incorrect APSD detection during PON at low battery voltage.
- Incorrect APSD results during power-on with no battery.
- Charging stops after hard reset or shutdown with HVDCP attached.
- HVDCP Booting Issue.

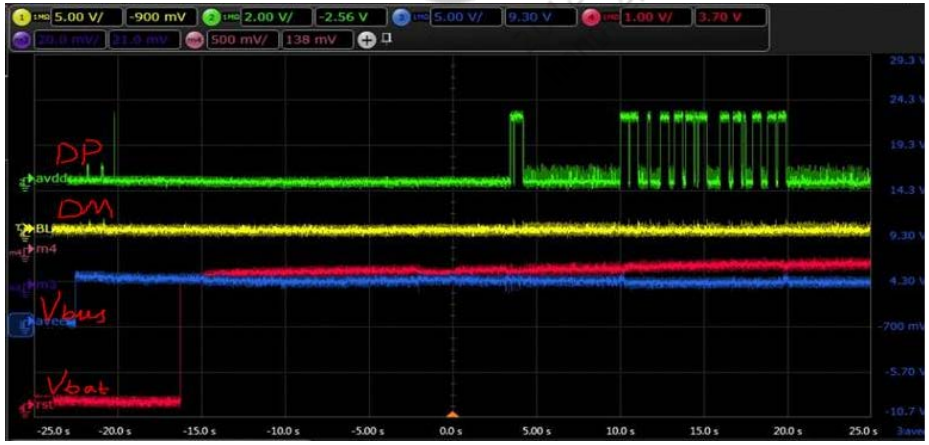
Slowly Insertion Issue

- Description
  - Plug in the DCP charger slowly (over 400ms), recognized as SDP.
- Analysis
  - The operation is against the BC1.2.
- Solution
  - No official solutions.
  - Customers could try with APSD rerun to reduce the probability.

[8952] USBID Connect Issue

- Description
  - Low battery, plug in SDP, detect as CDP sometimes

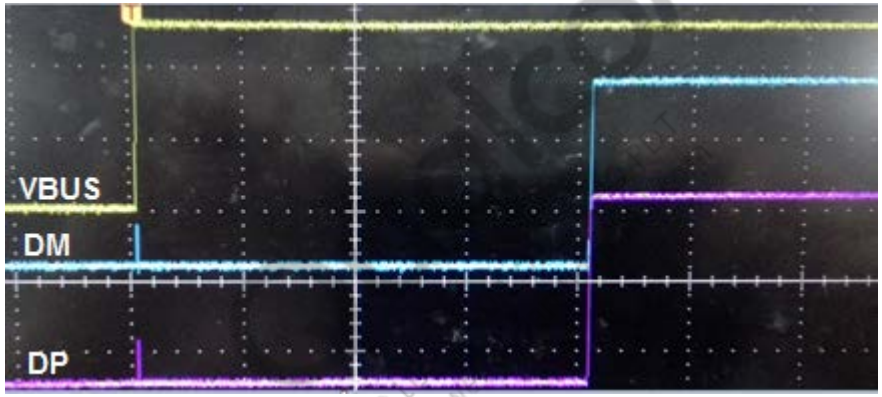




- Root cause
  - USBID is wrongly connected to both MSM and PMIC side in customers' design.

[8953/8996] USB Controller Power Issue

- Description
  - The device can't detect USB when the system is in suspend mode.
  - SDP will be recognized as DCP occasionally. From plot, D+/D- have been pulled up to 3.3V by fault.



- Analysis
  - ON 8953, QUSB PHY's DVDD is power supply with LDO3. This LDO3 is not always ON, it can be turned OFF.
  - When this LDO3 is turned OFF, QUSB PHY's configuration is not retained (this is happening on USB cable disconnect and putting system into suspend).
  - The results into QUSB PHY coming up with unknown state when LDO3 is turned ON which is interfering charger detection (i.e. USB cable connect case)
- Solution
  - Forcing L3 always on could be a WA, but will introduce sleep current.
  - CR1046610 (mainlined). Make sure QUSB PHY is into proper state to avoid interfering USB charger detection.

MSM Clamping D+/- Lines Issues

- [8996/8953] Incorrect APSD detection during PON at low battery voltage.

Description	During dead battery boot up/charging through charger insertion, there can be APSD misdetection (battery less than Vlowbatt threshold 2.88V). Root cause is that the MSM8953 PHY clamps D+/D- lines until it is powered (by VREG_L13 for 8953, VREG_L24 for 8996) during the PON sequence. During dead battery charging, SYSOK (PON trigger to PM) is asserted only after APSD is run. This results in incorrect APSD result and affects the input current limit until the software can intervene. It is to be noted that this issue does not occur if the battery voltage is above the Vlowbatt threshold, since SYSOK is asserted as soon as USB_IN is deemed valid.
Impact	During PON with a low VBATT, it is possible for APSD to detect incorrect adapter types. For example, a DCP may be detected as SDP. This affects the input current limit settings until the software is able to re-run APSD and evaluate the correct adapter type.
Workaround	A software workaround is available with CR885581, CR834431, CR884323 and CR939325, which places MSM PHY in non-driving mode and re-runs APSD in SBL.

MSM clamping D+/- lines issues(cont.)

- [8996/8953] Incorrect APSD results during power-on with no battery.

Description	APSD detection can be incorrect when the device is off, battery voltage is absent, and the charger is inserted to power on the device. The root cause is that the MSM8996 PHY clamps D+/D- lines until it is powered (by VREG_L13 for 8953, VREG_L24 for 8996) during the power-on sequence. When the battery is absent and the charger is inserted, SYSOK (power-on trigger to PM) is asserted only after APSD is run. This results in incorrect APSD results and affects the input current limit until the software can intervene.
Impact	During power-on with no battery, it is possible for APSD to detect incorrect adapter types. For example, an SDP may be detected as DCP or a DCP may be detected as SDP. Furthermore, in the case of SDP detected as DCP, the PMI chip may further incorrectly detect it as HVDCP and request 9V from the PC port. Since the PC port cannot support this request, it results in input UVLO, charger buck is turned off, and the system shuts down. This may impact OEMs who want to display a battery absent icon when SDP is inserted with no battery present.
Workaround	There is no workaround available to fix the incorrect APSD detection results since the battery is absent and APSD re-run cannot be performed. A software workaround (CR922874) has been identified to prevent the system from shutting down when an SDP is detected as DCP. This will allow OEMs to display a battery absent icon when SDP is inserted with no battery present: ▪ In XBL, check if a battery is present. If a battery is absent, do the following, regardless of charger type. 1. Disable HVDCP detection (this prevents the PMI chip from entering input UVLO by requesting 9V). 2. Set the input current limit to USB500 mode. This limits the USB input current to 500mA max even though charger type is DCP.

MSM clamping D+/- lines issues(cont.)

- [8996] Charging stops after hard reset or shutdown with HVDCP attached.

Description	If an MSM8996 device undergoes a hard reset or shutdown while an HVDCP is attached, charging will be suspended until the charging cable is unplugged and plugged back in. This issue does not affect any other charger types (DPC, SDP, CDP, or OCP).
Impact	Charging will be suspended after a hard reset or shutdown and will not resume until the charging cable is removed and plugged in again when connected to an HVDCP.
Workaround	This issue is a result of the MSM clamping D+/D- lines during reset, which interferes with correct charger type detection. For HLOS-initiated reset or shutdown, there is a software workaround (CR917683) that mitigates this issue by disabling the HVDCP before shutdown, and simulating charger attach and removal upon booting to HLOS. For non-software-initiated reset and shutdown (example: stage 2 reset using power key press), OEMs must ensure that the PMI is configured to undergo xVdd shutdown. See *PM8994/PM8996 and PMI8994/PMI8996 Power Management ICs Design Guidelines/Training Slides* (80-NJ117-5) for more details.

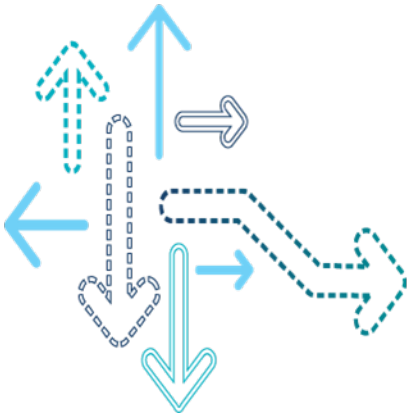
HVDCP Booting Issue

- Description
  - Insert a HVDCP charger and power on the device. At booting, HVDCP goes into OV(11V), and after booting up, battery is not charging

- Analysis
  - It is expected that at charger insertion, DP_DM property should be set prior to setting the USB power supply's PRESENT and TYPE property, and at charger removal DP_DM property should be set subsequent to setting the USB power supply's PRESENT and TYPE property.
  - At the time of booting up, if a charger is found present the driver only sets the PRESENT and TYPE property without setting DP_DM property.

- Solution
  - CR#920861. Force the D+/- lines to floating when charger is detected at booting

Check Points



Check Points

- Plot of D+/D-/VBUS/VBAT
- SCH of USBID, D+/D- related from h/w side
- Charge driver log
  - echo 'file qpnp-smbcharger.c +p' > /sys/kernel/debug/dynamic_debug/control
  - setprop "persist.hvdcp.log_level" 1
  - echo 0xFF > /sys/module/qpnp_smbcharger/parameters/debug_mask

    [676.819306] SMBCHG: smbchg_external_power_changed: usb type = OTHER current_limit = 2000

    [676.819331] SMBCHG: smbchg_set_usb_current_max: USB current_ma = 2000

    [676.819389] SMBCHG: smbchg_masked_write_raw: addr = 0x1340 writing 0x3

    [676.819484] SMBCHG: smbchg_masked_write_raw: addr = 0x13d0 writing 0xa5

    [676.819597] SMBCHG: smbchg_masked_write_raw: addr = 0x13f2 writing 0x19

    [676.819640] SMBCHG: smbchg_masked_write_raw: addr = 0x1340 writing 0x3

    [676.819658] SMBCHG: smbchg_set_usb_current_max: usb type = 5 current set to 2000 mA

    …

    [686.325463] SMBCHG: is_hvdcp_present: HVDCP_STS = 0x00

Check Points

- Registers dump 0x21000~0x216FF
  - Power source detection status (IDEV_STS[7:0], reg0x1608):
    - Indicates the result of BC1.2 detection, i.e. (SDP, DCP, CDP, OCP).
  - DCD timeout status (APSD_DG_STS[3], reg0x130A)
  - DCD deglitch status (APSD_DG_STS[2]):
    - USBIN input deglitch time has expired.
  - Other device DCD deglitch status (APSD_DG_STS[1]):
    - Other charger has been detected for the deglitch duration.
  - HVDCP status (HVDCP_STS, reg0x130C):
    - Indicates if an HVDCP has been enabled and detected.
  - USBIN input status (INPUT_STS[5:3], reg0x130D):
    - Indicates the voltage range (0V, 5V, Unregulated, 5V-9V, or 9V) of the USBIN input.
- Try with 3rd charger/cables test, exclude the setup issue.

References

Title	Number
Qualcomm Technologies, Inc.	
PMI8994/PMI8996 Device Revision Guide	80-NJ118-4
PMI8952 Device Revision Guide	80-NT391-4

Term	Definition
APSD	Automatic Power Source Detection
USB BC1.2	Universal Serial Bus, Battery Charging Specification, Revision 1.2
HVDCP	High-voltage dedicated charging port
PON	Power On

Questions?

https://createpoint.qti.qualcomm.com