Moto G Turbo Edition Troubleshooting Guide V1.0

(Note: This document only documents the differences between Moto G Turbo Edition and Moto G (3rd Generation))

DIFFERENCES FROM MOTO G (3RD GENERATION)

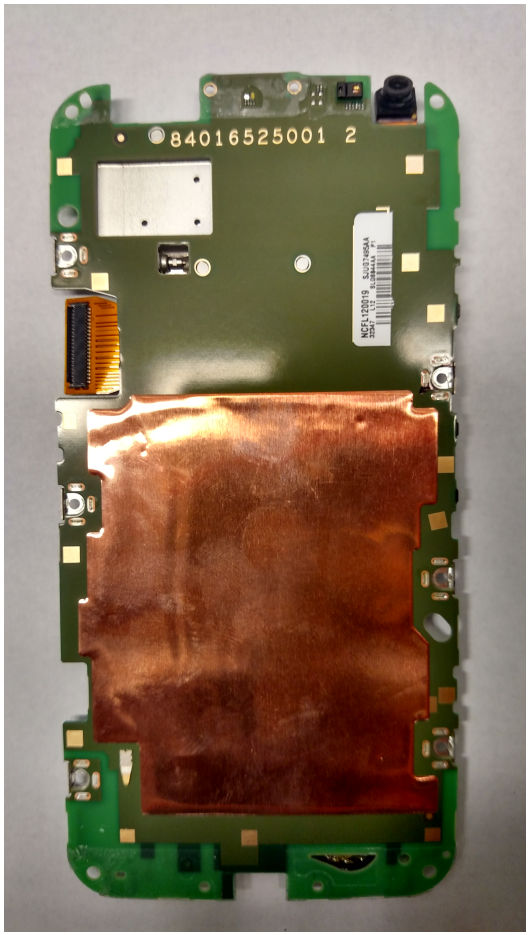
Differences between Moto G (3rd Generation) and Moto G Turbo Edition

Moto G (3rd Generation)	Moto G Turbo Edition
MSM8916 (U1000)	MSM8939 (1.5 GHz variant) (U1000) MSM Rev2.0 (CS1) MSM Rev3.0 (CS2)
Charging IC - FAN54053UCX (U5201) and associated circuitry	Charging IC - SMB1359 (U5240) and associated circuitry
Magnetometer IC (U6160)	Not present
5V charging	5V charging and 9V Turbo charging

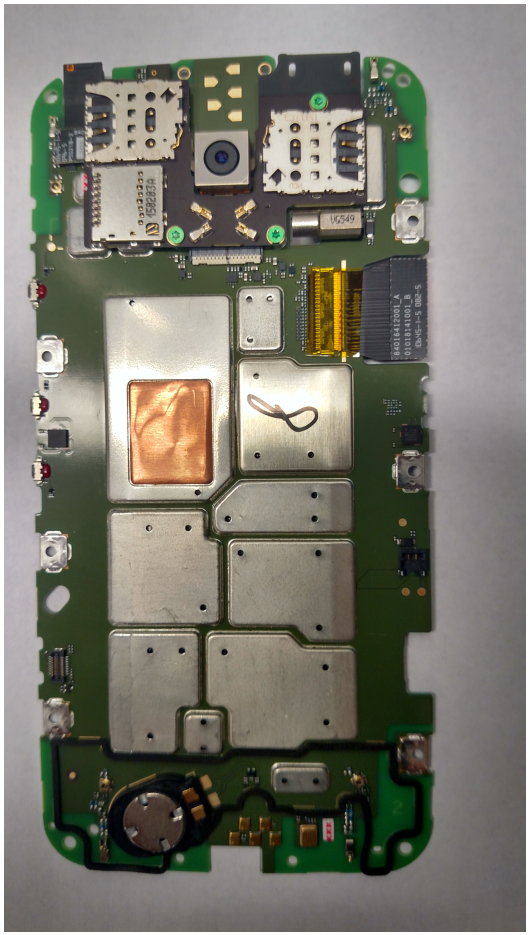
SNAPSHOTS OF MAIN BOARD

Snapshot of Main PCB

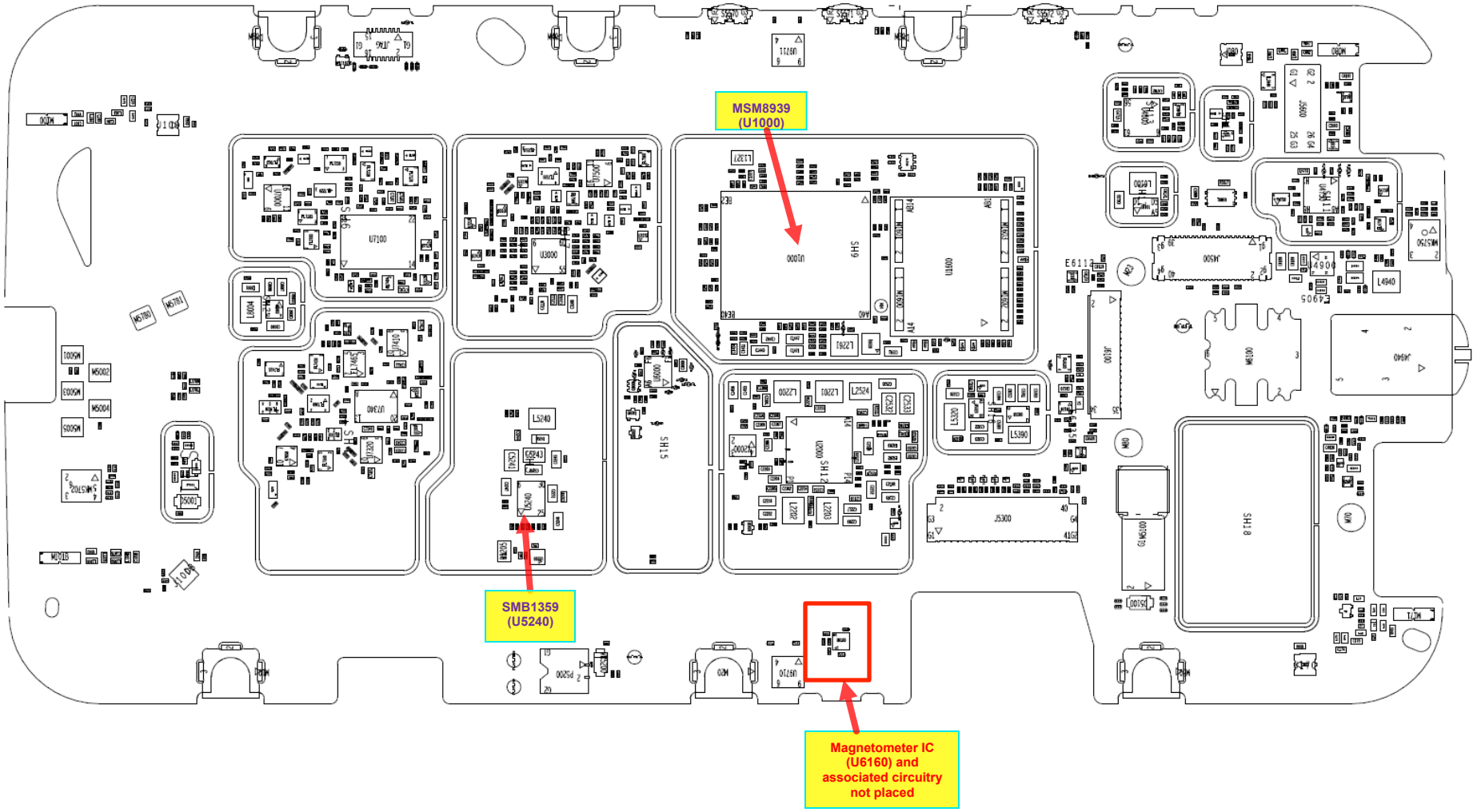
Bottom Side (Battery)



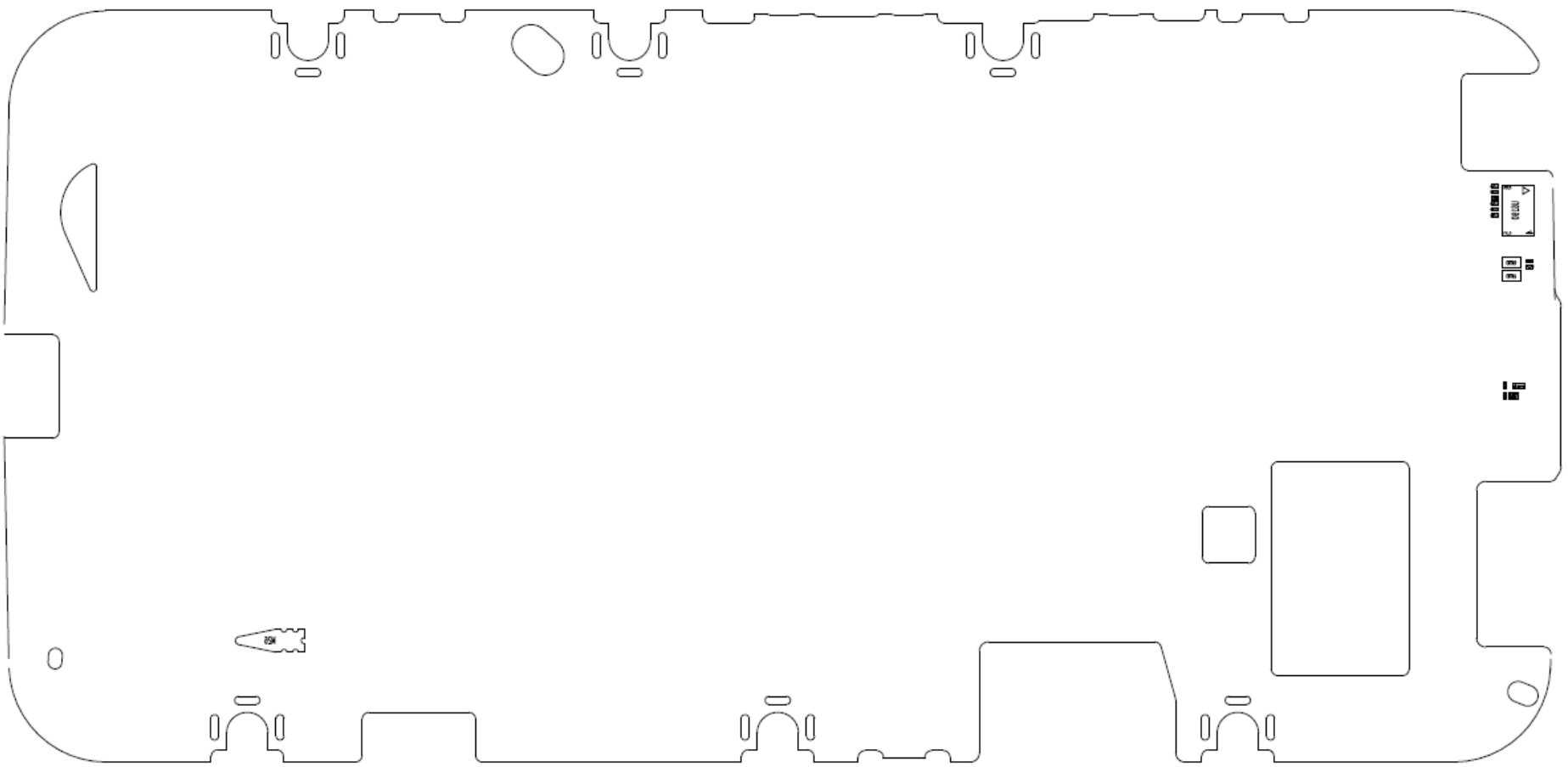
Top Side (Display)



Main Board – Top Placement
(Deltas from Moto G (3rd Generation) Indicated)



Main Board – Bottom Placement



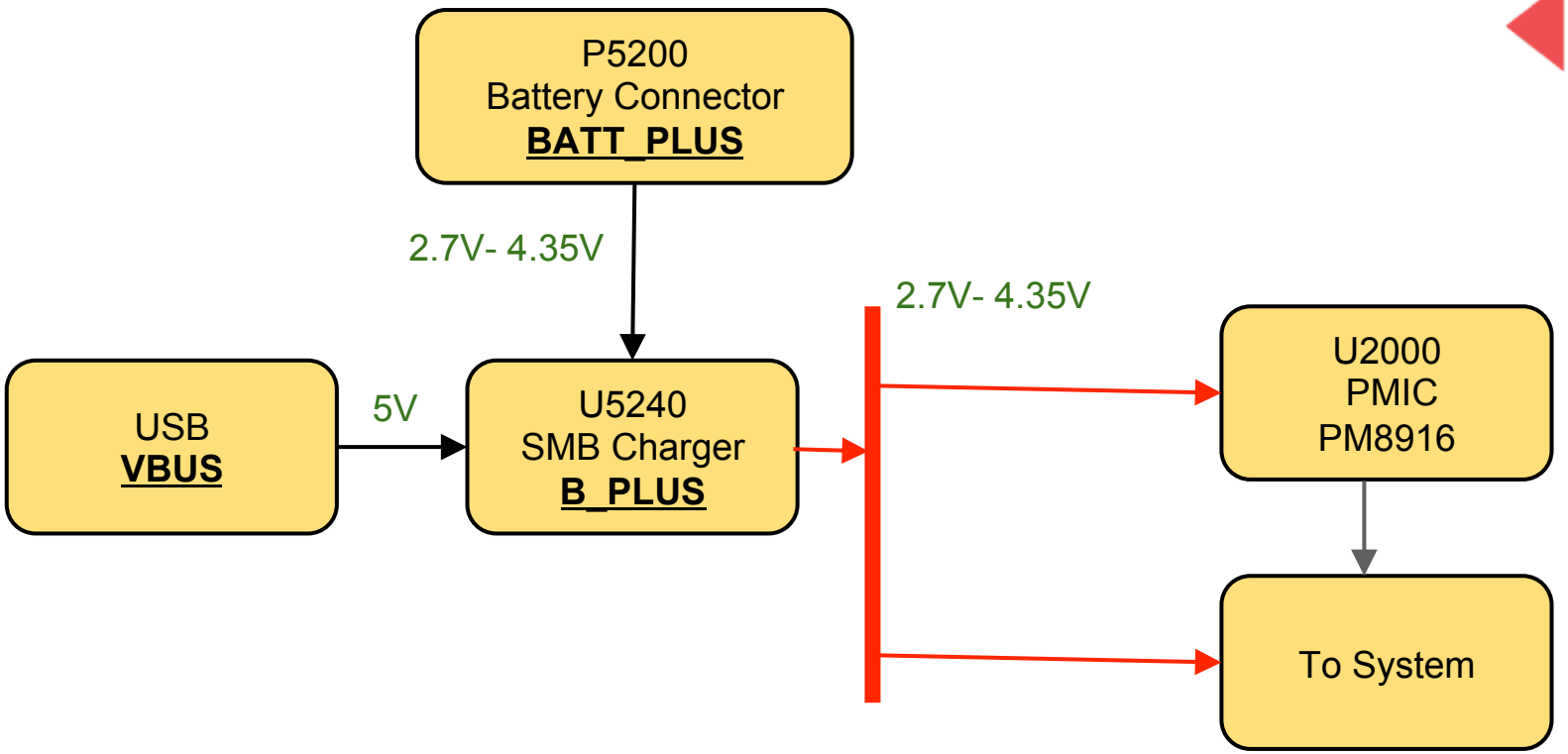
NO POWER UP DEBUGGING

Glossary/Synonyms

Terms on the same row are synonyms and will be used interchangeably in this guide.

MSM	AP/BP	MSM8939	U1000
Power Management IC	PM8916	PMIC	U2000
SMB	Charging IC	SMB1359	U5240
B_PLUS	VSYS	System Battery Voltage	
VBUS	USB Voltage	Charger Voltage	

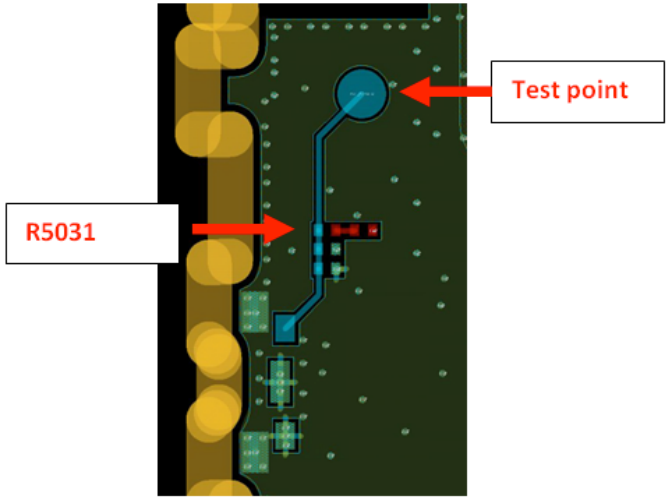
Simplified Input Power Tree



Power Up Failure Troubleshooting

Phone power could be triggered on with different reasons. Here we assume it is triggered by the power button press.

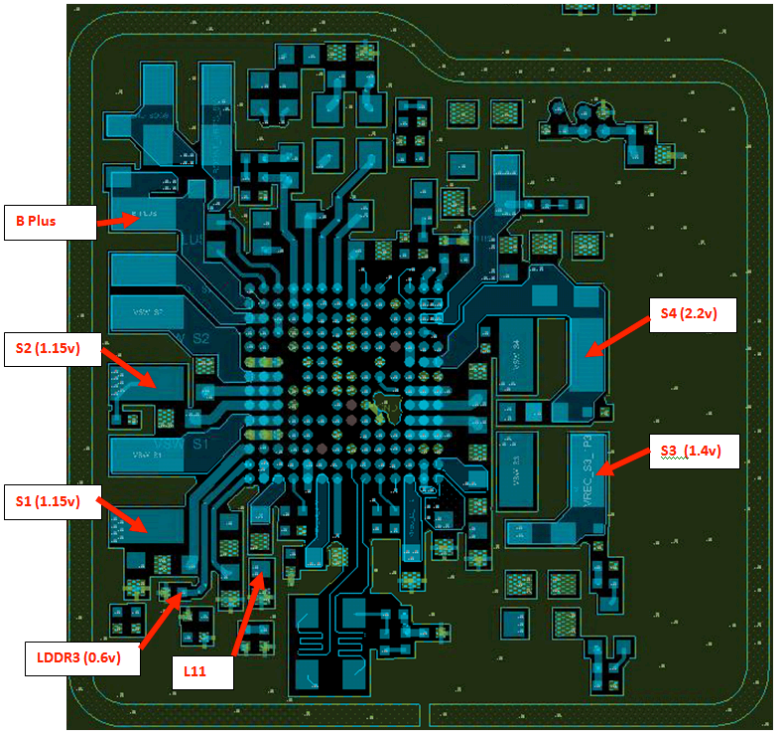
1. Before any action, the PMIC need to see a valid BATT+ (2.5V to 4.3V), and B+ should be the same as VBATT. PMIC is alive, ready to work. BATT+ being 2.5V will power up PMIC but to start a full power up sequence for the phone, SW need to see BATT+ at 3.6V.
2. Power button is pressed. This is a mechanical button. If pressed, the PMIC should receive a low voltage at pin K10. You can verify it at a resistor **R5031 or a test point below**. If this signal does not get lower, likely the button is failing.



Power Up Failure Troubleshooting (cont'd)

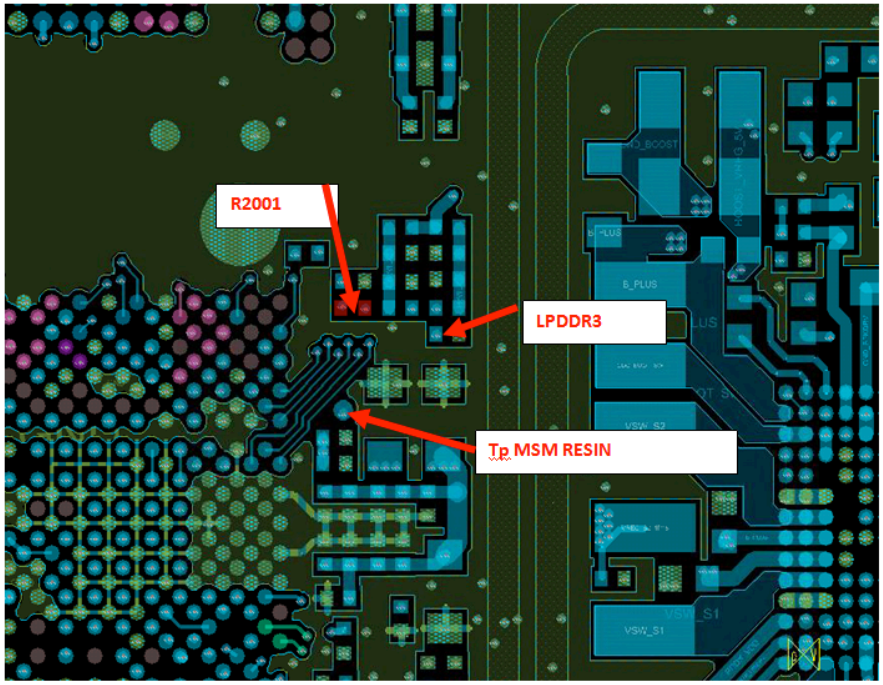
3. At this moment, the PMIC will check the battery voltage. It needs to be higher than 2.7V (default UVLO) to move forward. If the voltage is lower, or the PMIC is locked, (internal logic is messed up), you would see only a tiny current 2mA rises and falls, when you press the power button. Min turn-on Voltage is 3.6V at battery (and phone will shut down at Vbatt < 3.0V).

4. A power up sequence is started. From regulator Vreg_S4, to Vreg_L5, one by one, the regulator comes up. And then the PMIC clock comes up and feeds to MSM. Check the picture for reference.



Power Up Failure Troubleshooting (cont'd)

5. After the clock is ready, PMIC continues booting up sequence, until VREG_L11 is available.
6. PMIC will **pull up** the PON_RESET_N to inform MSM to start to work. A test point **TP_MSM_RESIN_N** can be used to verify the signal PON_RESET_N. MSM will run the primary boot load SW.
7. MSM responds back by **pulling up** PS_HOLD, telling PMIC to keep power up. **R2001** can be measured to verify this signal.



Power Up Failure Troubleshooting (cont'd)

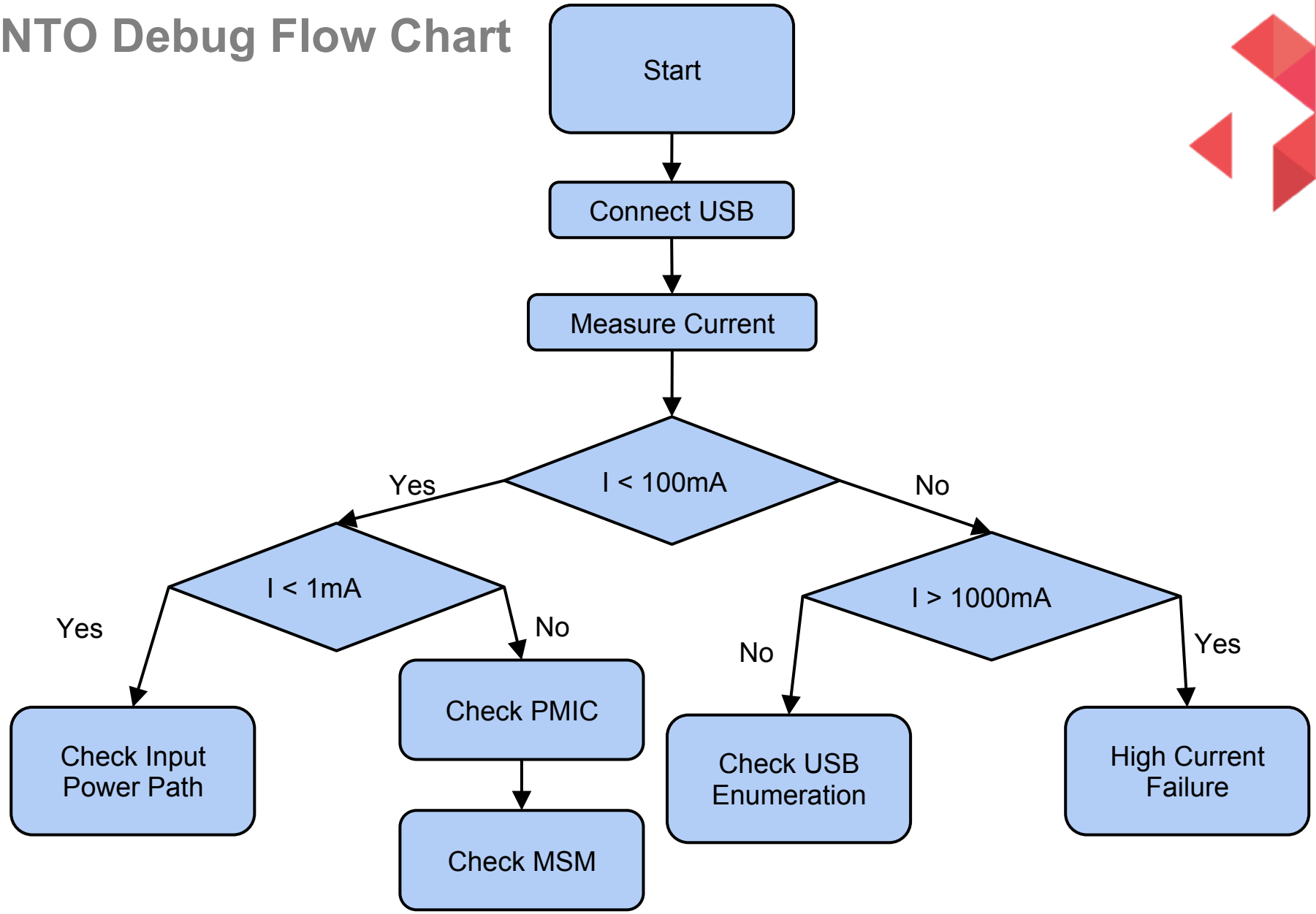
8. The rest of the regulators are turned on based on SW. SW will check the environment to see if it need to continue to power up. For example, if the BATT+ is lower than 3.6V, SW will decide to turn off the power, because battery energy is not sufficient to do a meaningful power up.

9. At this moment, if there is an issue in the SW (may or may not be HW related), PS_HOLD could be pulled lower to shut off the power, if the PS hold timer is still working. If not, then phone is stuck and freezing. SW log is critical for the troubleshooting in this case.

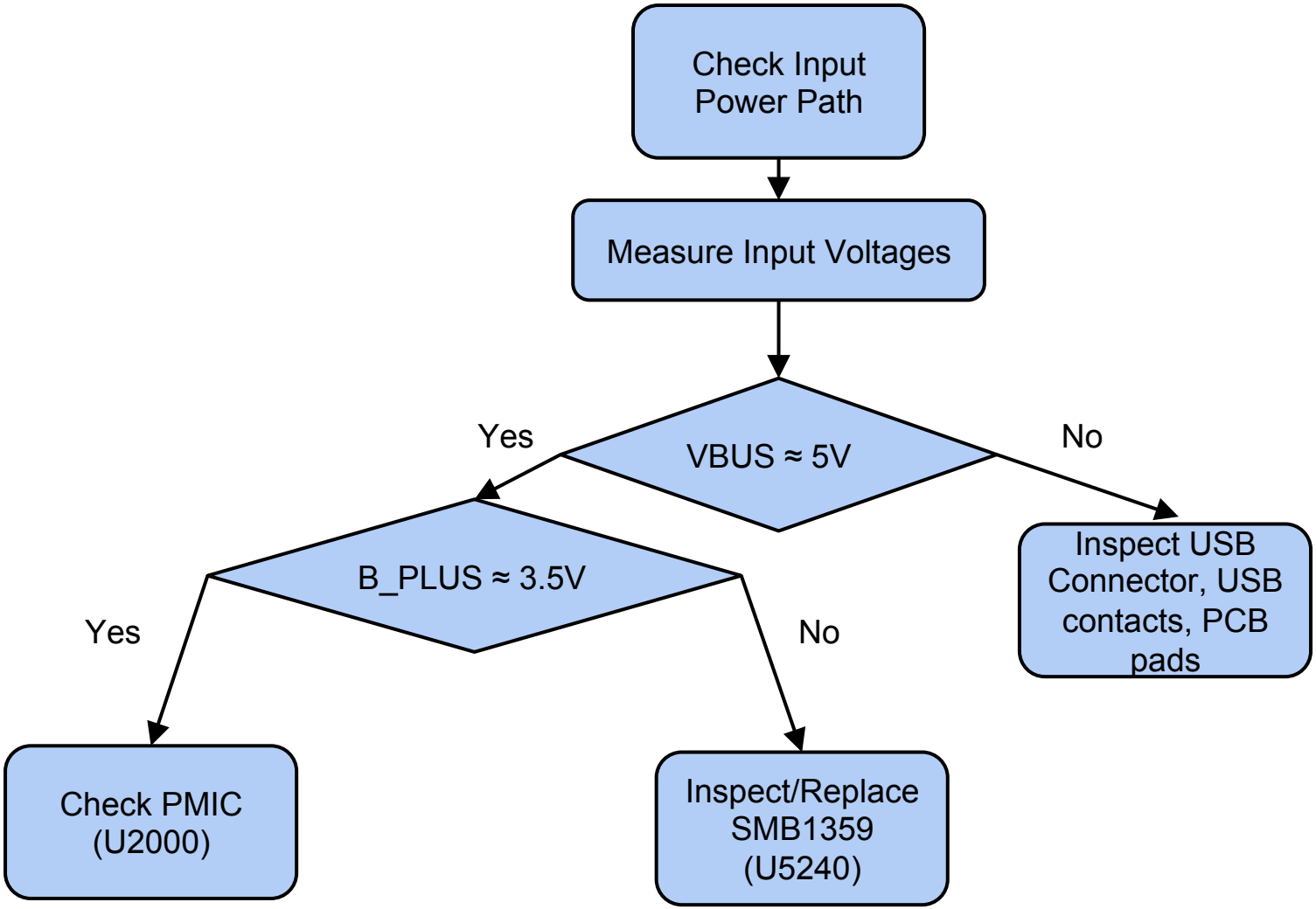
10. Some other possible reasons for power failures include, peripheral communication failure, memory failure, SW loading failure, etc.

Note: If the PMIC is draining high off current, likely PMIC is bad and its internal logic is messed up. Replace the PMIC. Here are some pins to measure, REF_BYP at C2001, AVDD_BYP at C2002, and the above signals in the power up steps.

NTO Debug Flow Chart

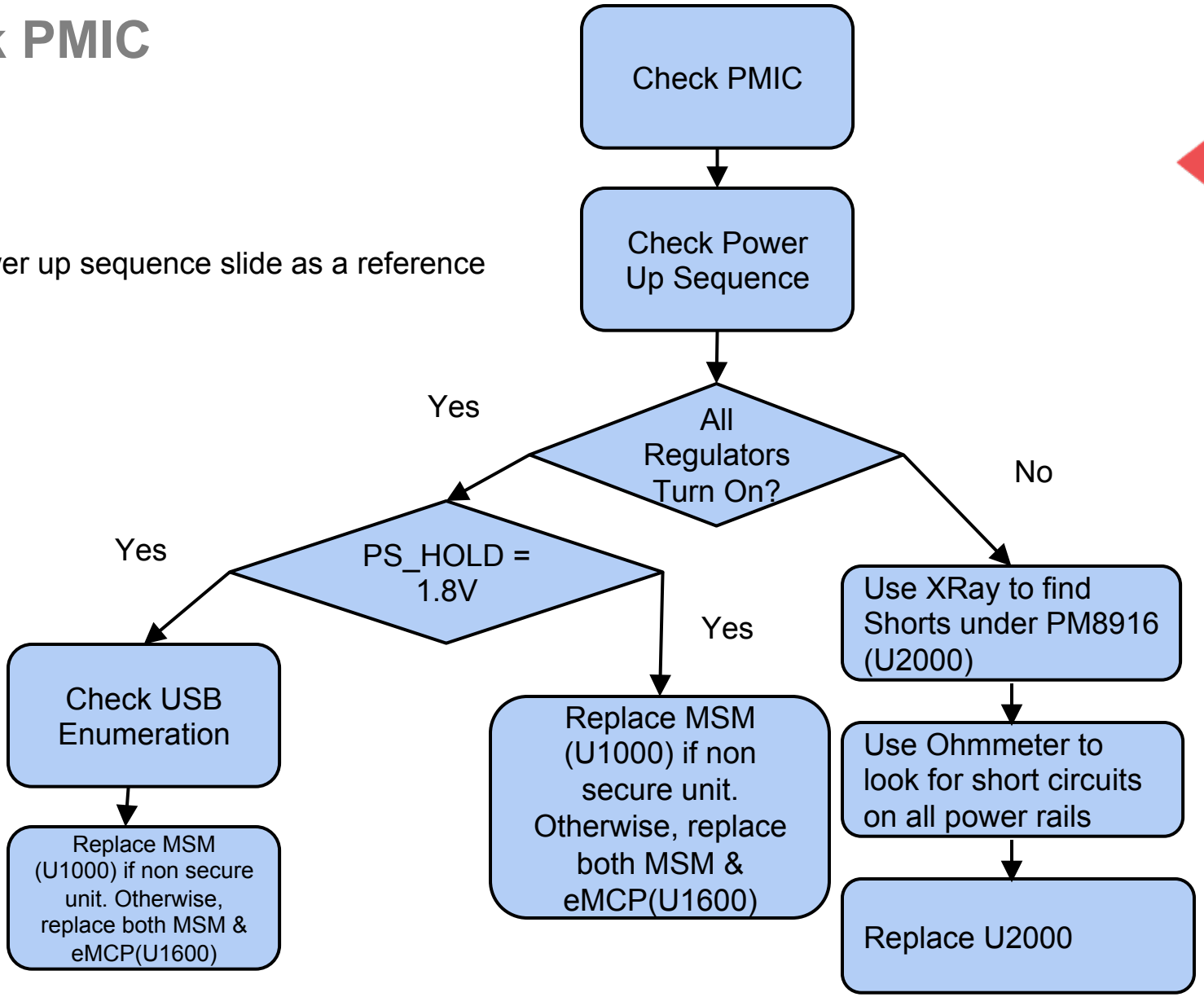


Check Input Power Path

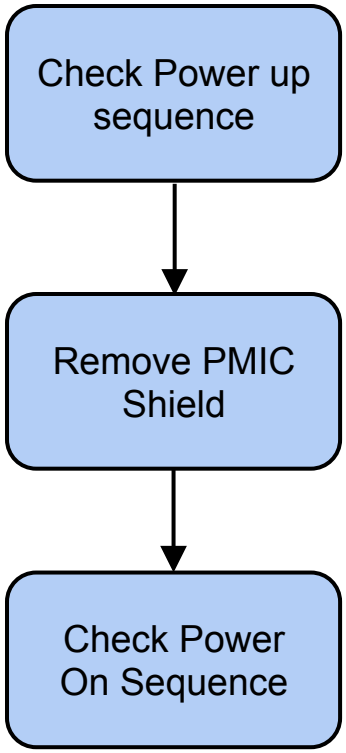


Check PMIC

Use Power up sequence slide as a reference



Check Power Up Sequence



Power On Sequence for PM8916

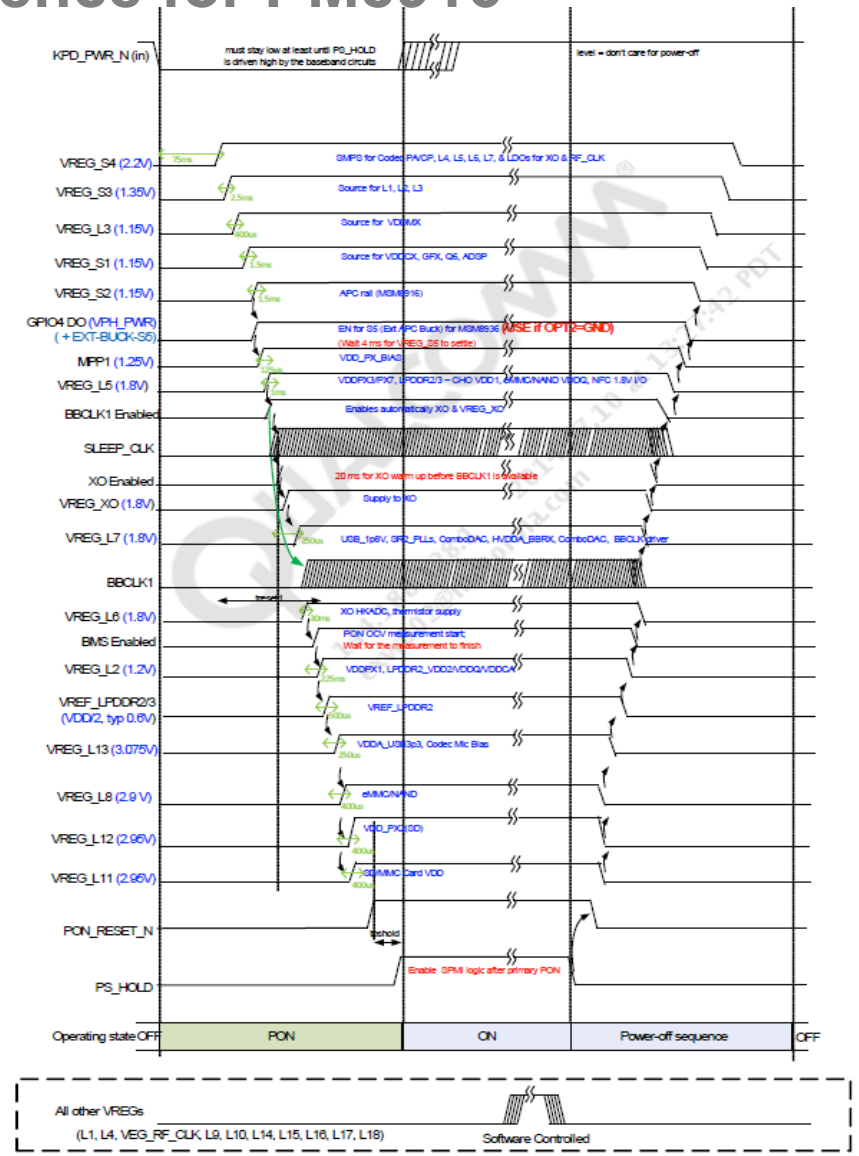
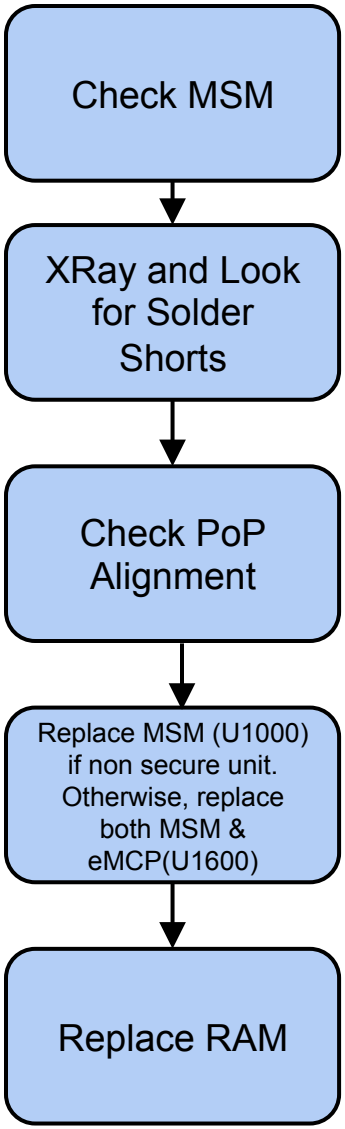
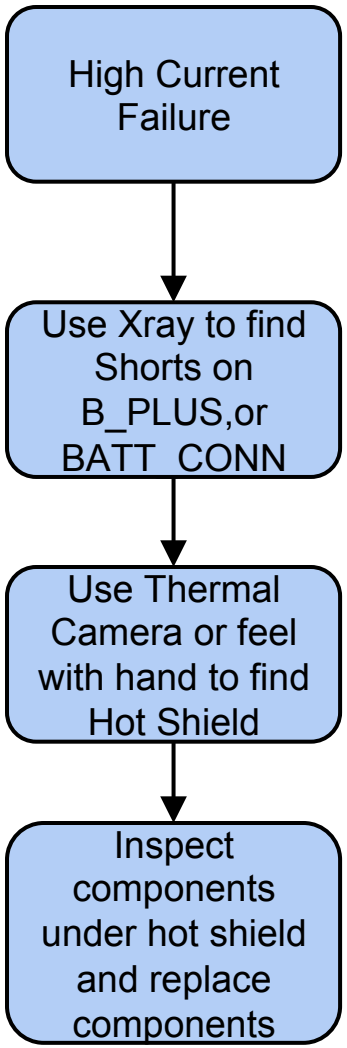


Figure 3-8 Poweron sequence

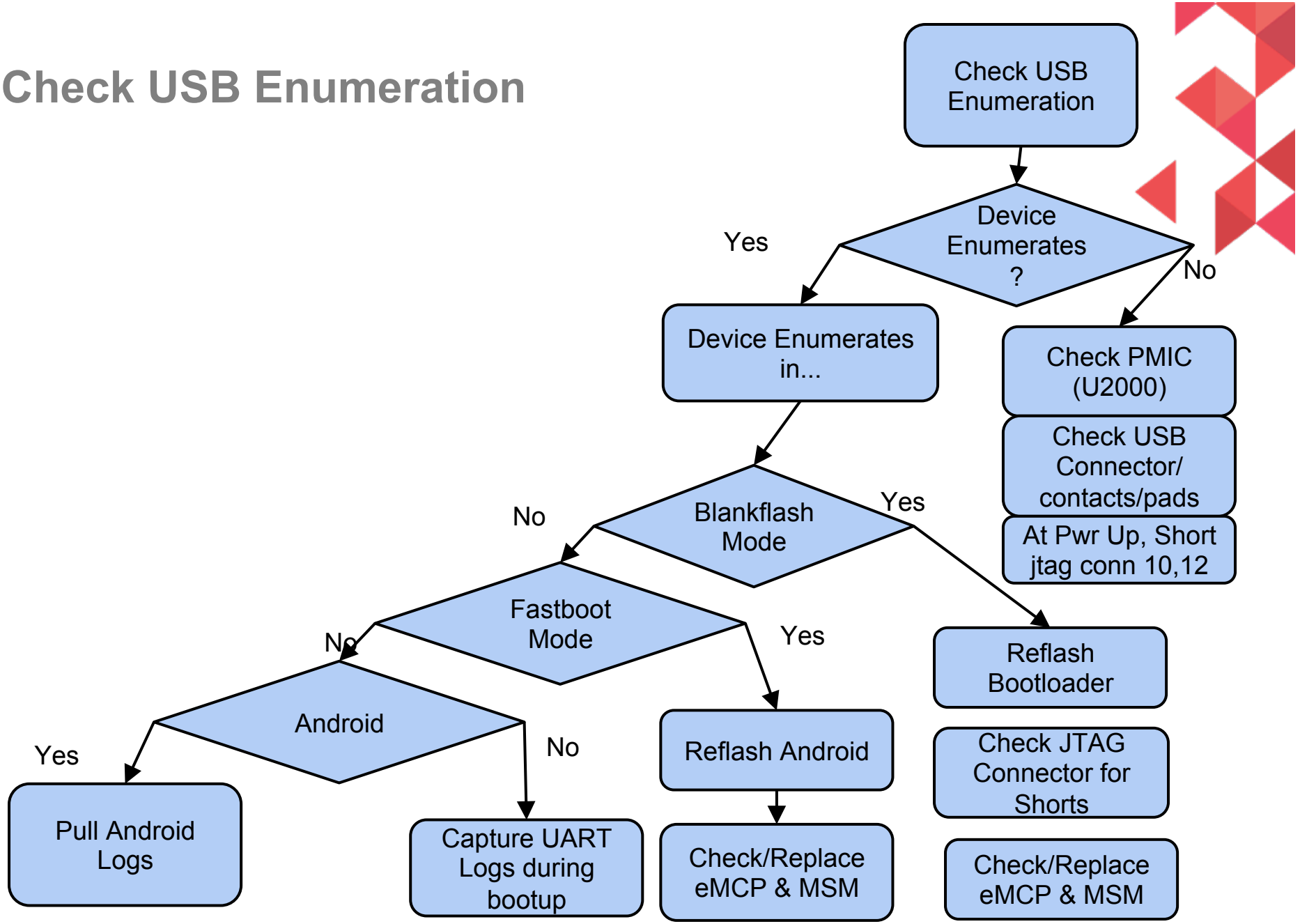
Check MSM


Check MSM
XRay and Look for Solder Shorts
Check PoP Alignment
Replace MSM (U1000) if non secure unit. Otherwise, replace both MSM & eMCP(U1600)
Replace RAM

High Current Failure

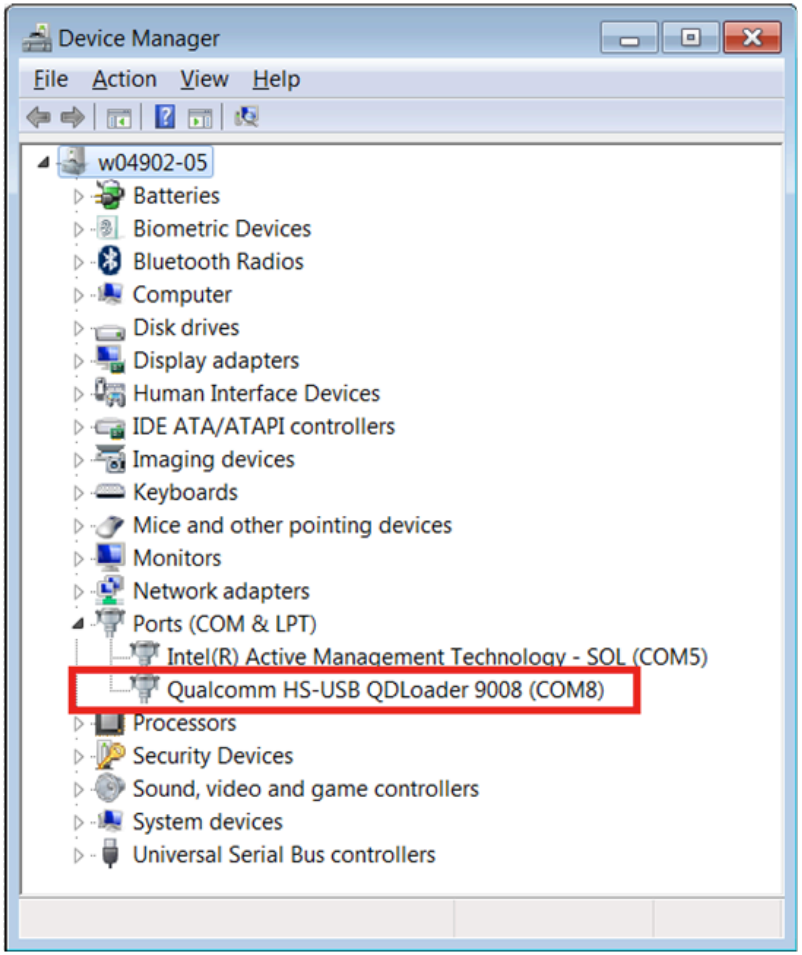


Check USB Enumeration



Debug Procedure

If the current looks normal, check for enumeration to Qcom blank device.



CHARGING TROUBLESHOOTING

Charging Troubleshooting

In the event of charging issues:

- Do visual inspection on USB connector and battery connector.
- Check charging voltages along the charging path
  - Measure USB_PWR charger input voltage at D5001. It should be around 5V for normal charging and 9V for turbo charging.
  - Check B_PLUS voltage at C5245. It should be 4.35V or lower.
  - Check battery voltage at P5200 pin1. It should be 4.35V or lower. If battery is below 2.1V, there maybe a short in the circuit somewhere and the battery protection circuit is triggered.
  - Check battery ground path R5205.
- Battery temperature should be between 0ºC ~ 45ºC to be fully charged. Check thermistor voltage at test point (TP_BAT_THERM). It should be around half of battery voltage at room temperature (25ºC).

Charging Issues

Ensure the device is not in factory mode. Ensure battery temperature reading is as expected (see previous slide).

Inspect the battery for any damage or abuse. Ensure by measurement or from CQA battery info menu that the battery pack voltage and cell plus sense voltage levels are according to the expected charge current level.

There could be an issue with the USB connector or its connections to the board and the charge IC. Measure VBUS (5V, or 9V for turbo charger), D+, D-. Measure this at the charger cable if possible or preferred at first, then on the PCB and, as needed, next to the charge IC. See table below for expected Turbo charger D+/D- levels.

HVDCP FOURTH DETECTION VOLTAGE TABLE

Portable Device		HVDCP
D+	D-	Adapter Voltage
0.6V	0.6V	12V
3.3V	0.6V	9V
0.6V	3.3V	Reserved
3.3V	3.3V	20V
0.6V	GND	5V

The lightning bolt in the battery meter icon represents a valid VBUS voltage. Also “Turbo charger connected” is displayed if a turbo charger is connected. It is not displayed otherwise, or if a turbo charger is connected partially into the device, and inserted all the way in more than a second or two later.

Charging Issues (cont'd)

Ensure the phone current drain does not exceed the charger supply current capacity in the use case where battery is not able to charge.

If the device power cycles when the battery is low and USB charger is connected, monitor the current drain in or out of the battery as well as the battery voltage with a scope across the sense resistor.

There is also the rare possibility of charge IC itself damaged or have damaged or intermittent BGAs where a reflow followed by replacement of the IC might be needed as a last attempt to recover charge operation. This should be done after exhausting all other possible root-causes.