Moto X Force/DROID Turbo 2
BASEBAND TROUBLESHOOTING GUIDE
V1.0

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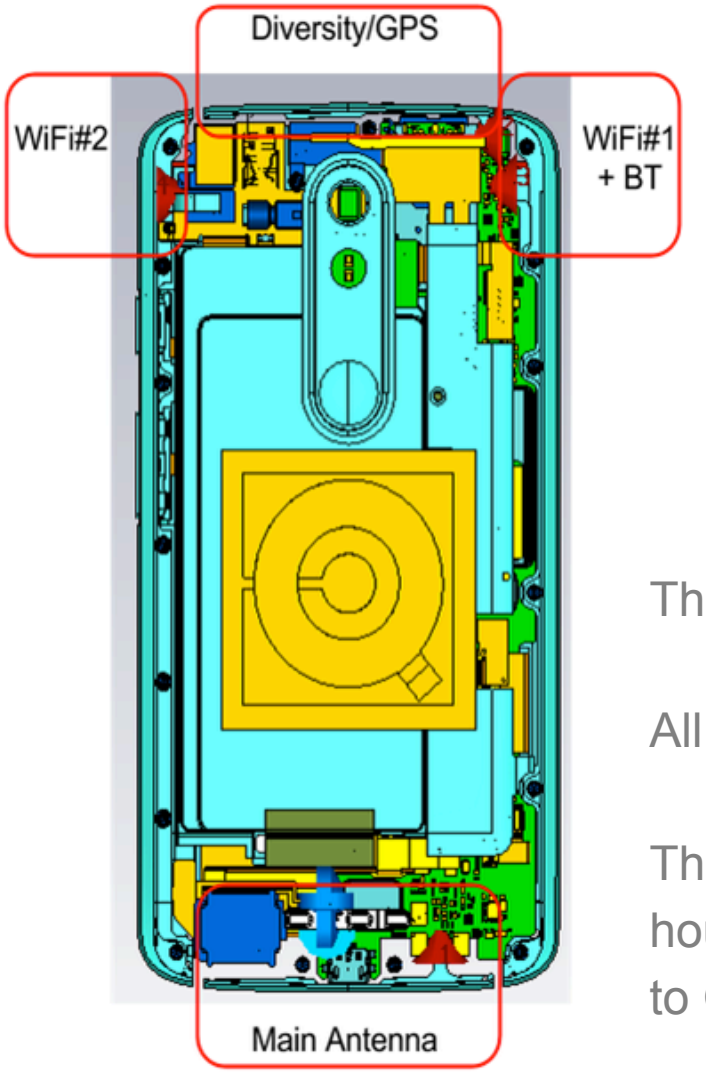
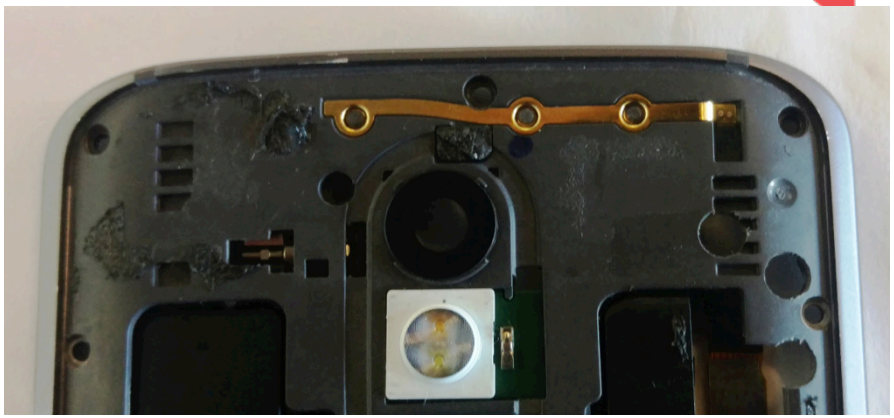
SNAPSHOTS OF ANTENNAS

Antenna Locations





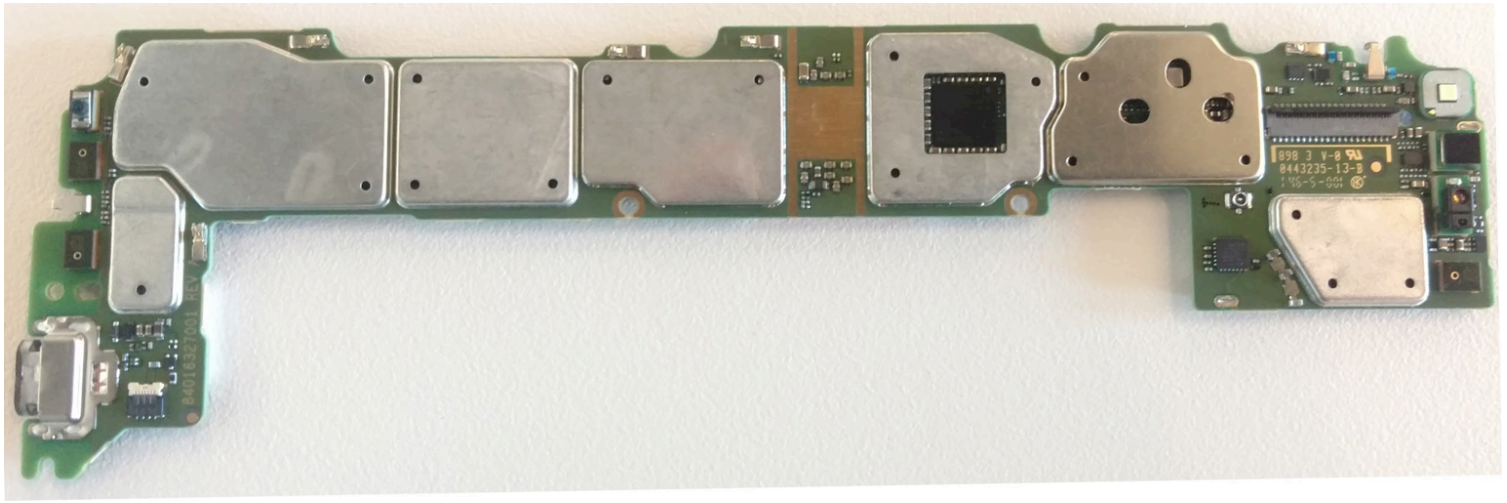
This product has an external metal antenna band.

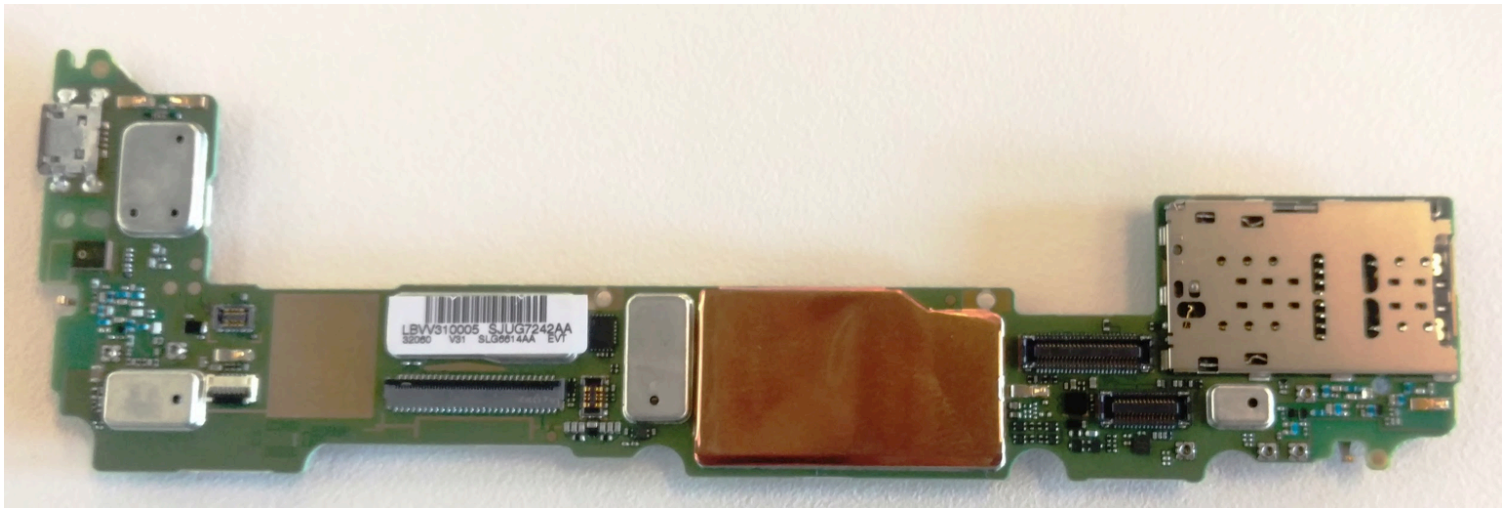
All antennas are made using the metal band.

There is an extra stamped metal piece on the rear housing for extra diversity bandwidth and isolation to GPS.

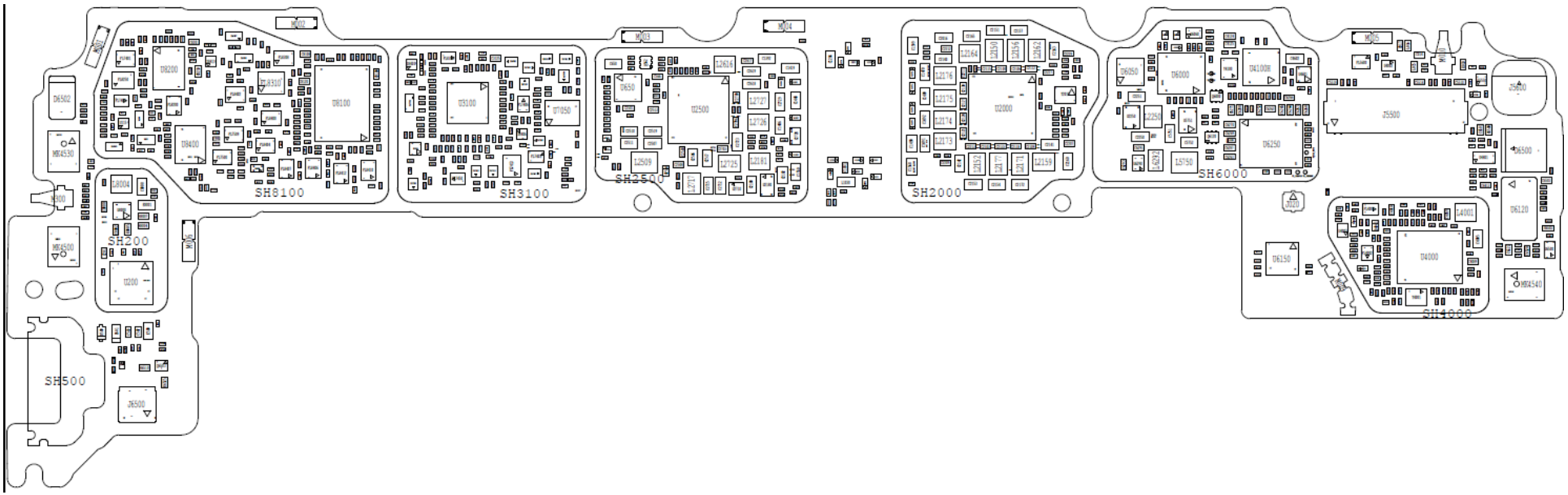
SNAPSHOTS OF MAIN BOARD

PCB

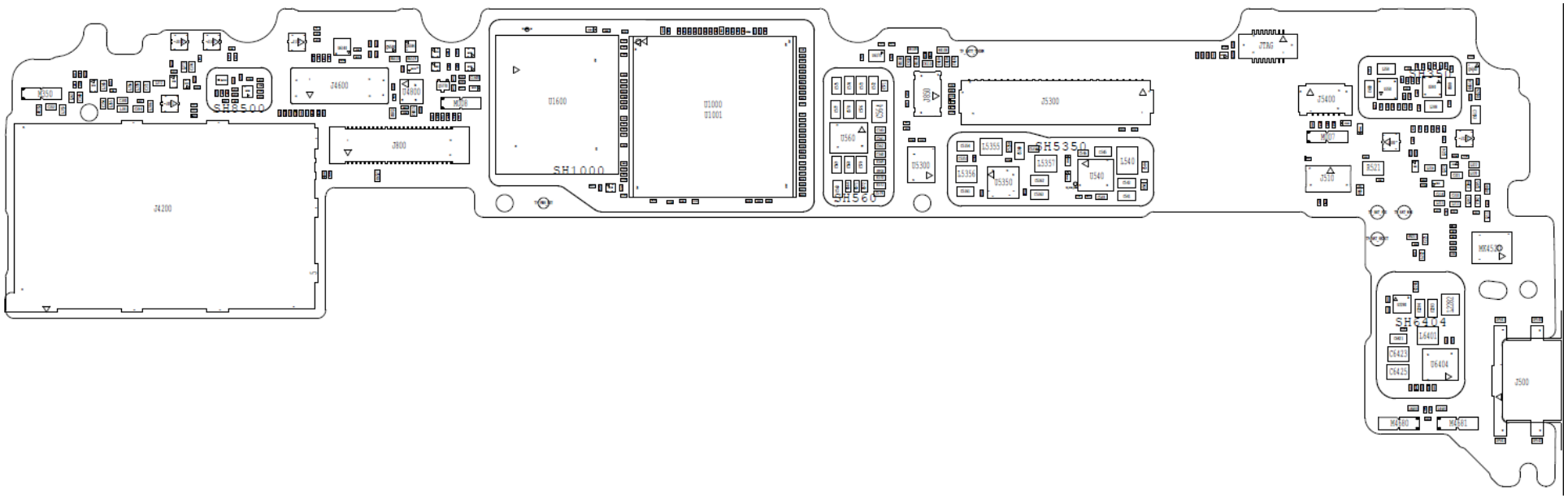




Main Board – Top Placement

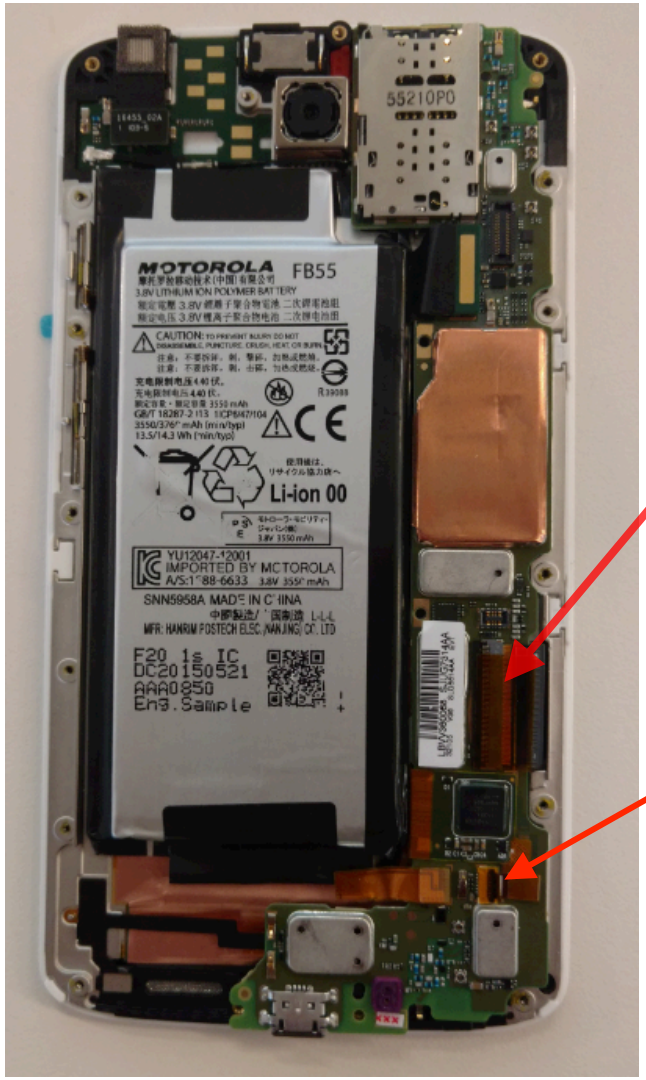


Main Board – Bottom Placement

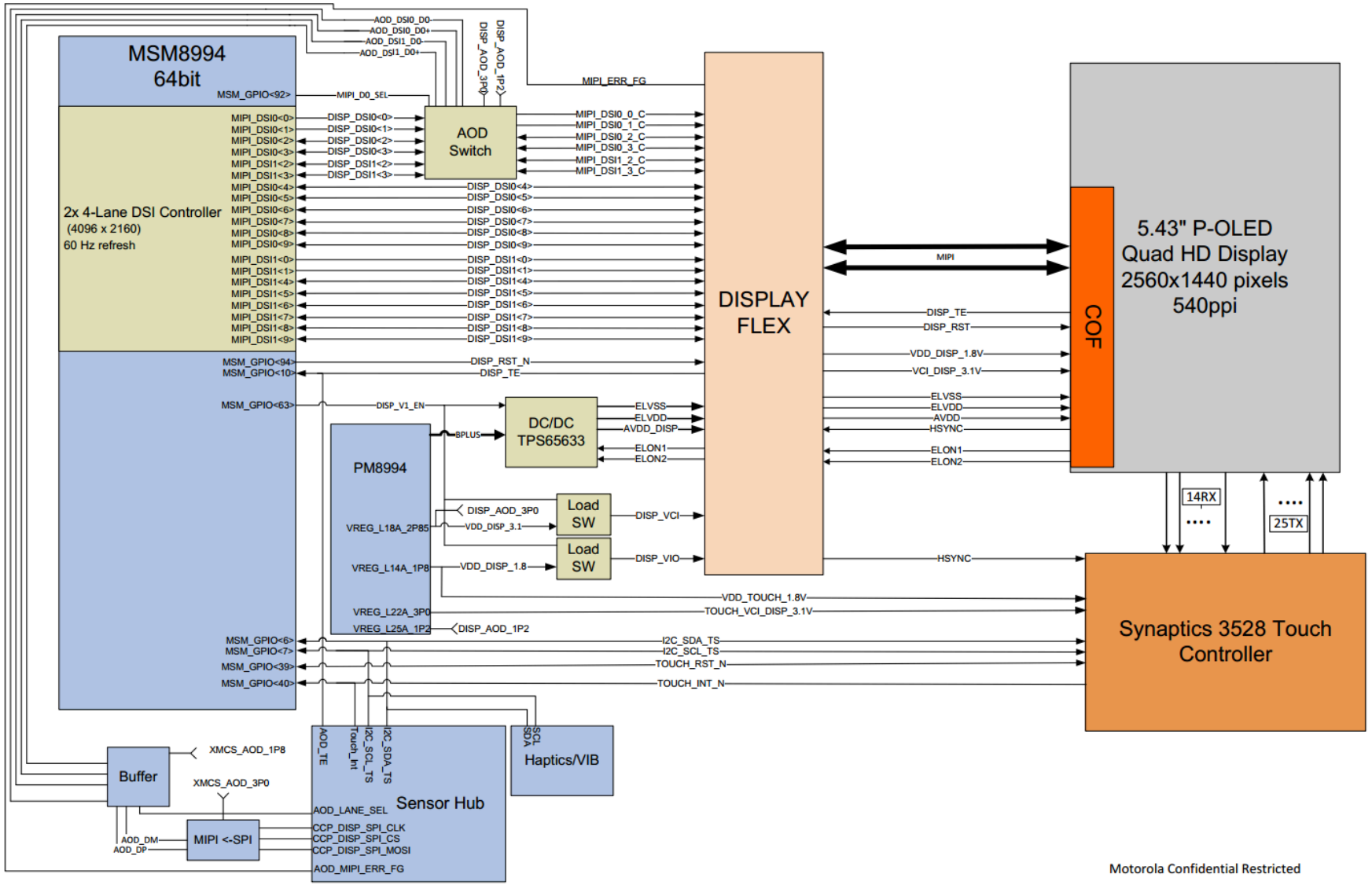


TOUCH TROUBLESHOOTING

Main Board – Location of LCD & Touch ZIF Connector

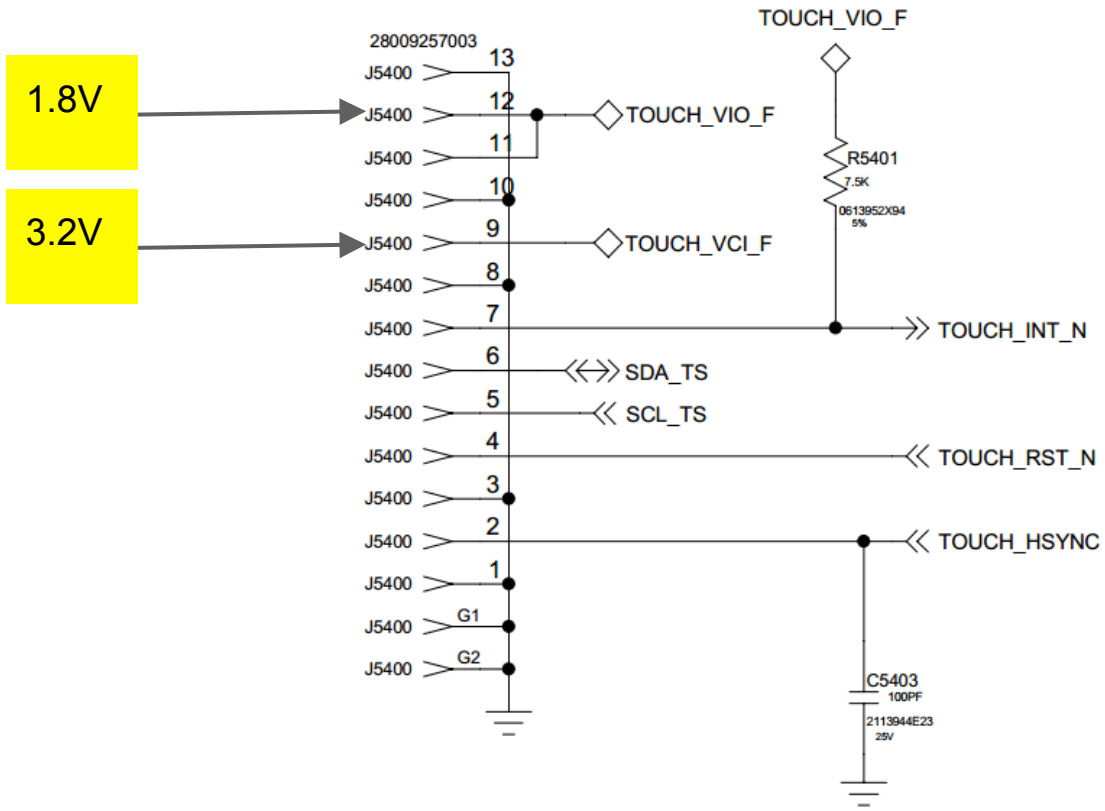


Touch System – Block Diagram

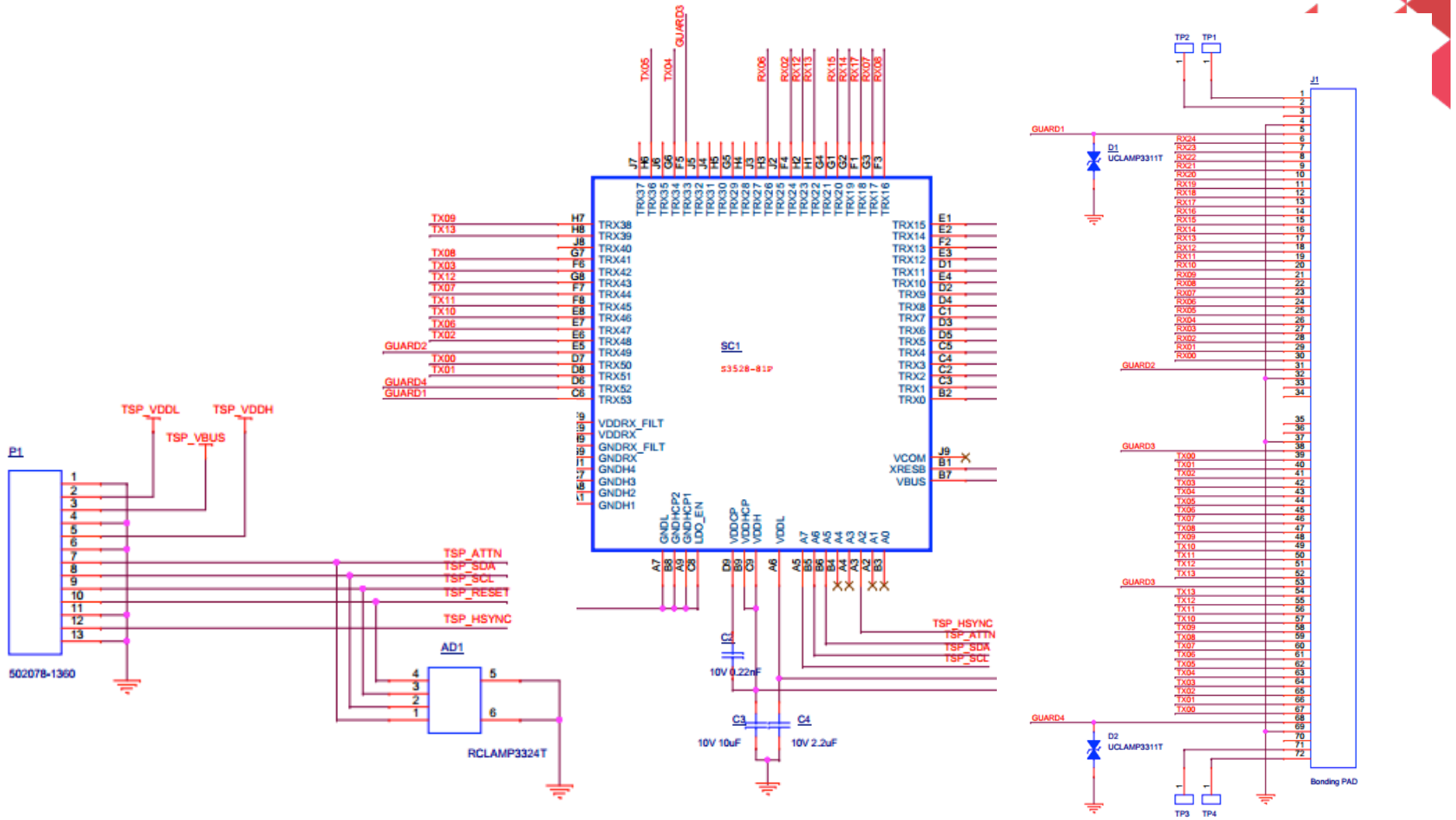


Motorola Confidential Restricted

Touch Connector



Touch IC Schematic



Touch Troubleshooting

1. No Touch response when display touched
    - Swap display panels with known good panel. If touch works, problem with display flex or IC (Go to 2). If still not working, problem with main board (Go to 3).

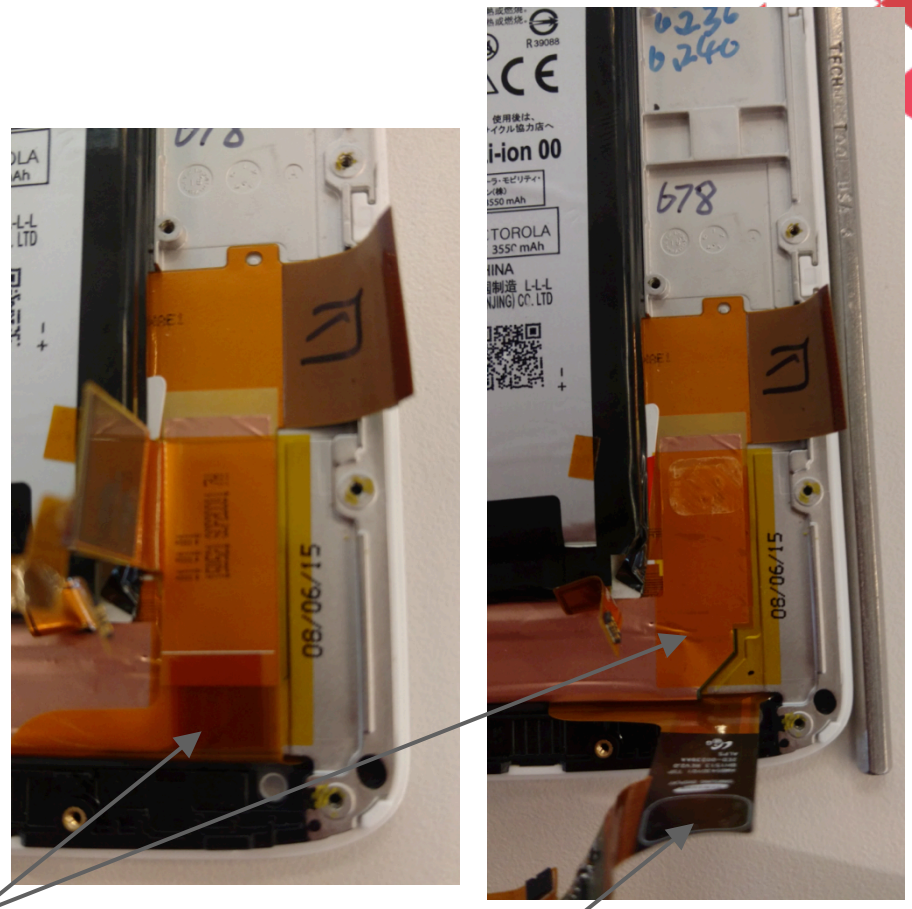
2. Display module issue
    - Check Touch flex for any damage
    - Ensure DC power is at ZIF pin 9 for 3.2VDC and pins 11&12 for 1.8VDC
    - Verify Reset signal is high on Touch ZIF pin 4, IRQ is high on ZIF pin 7
    - I2C Data and I2C Clock at 1.8VDC
    - When touching panel and moving finger, INT should toggle low, I2C data and clk will toggle.

Touch Troubleshooting (cont'd)

3. Main Board Issue
    - Check touch connector for proper insertion of flex
    - Ensure DC power is at ZIF pin 9 for 3.2VDC and pins 11&12 for 1.8VDC
    - Verify Reset signal is high on Touch ZIF pin 4, IRQ is high on ZIF pin 7
    - I2C Data and I2C Clock at 1.8VDC
    - When touching panel and moving finger, INT should toggle low, I2C data and clk will toggle

Touch Troubleshooting (cont'd)

4. TRX-GND test failures
   Transmitter/Receiver to short to ground check
   - Verify kapton tape is correctly placed
   - Kapton is used to isolate EMI coating (black layer) to any metal including copper tape and front housing

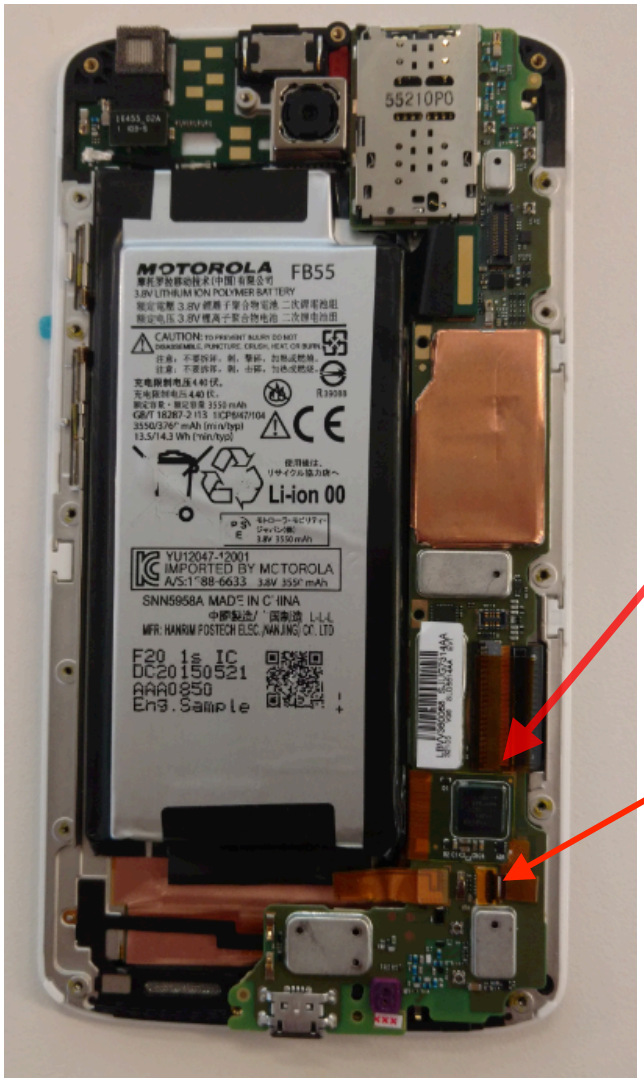


DISPLAY TROUBLESHOOTING

Display

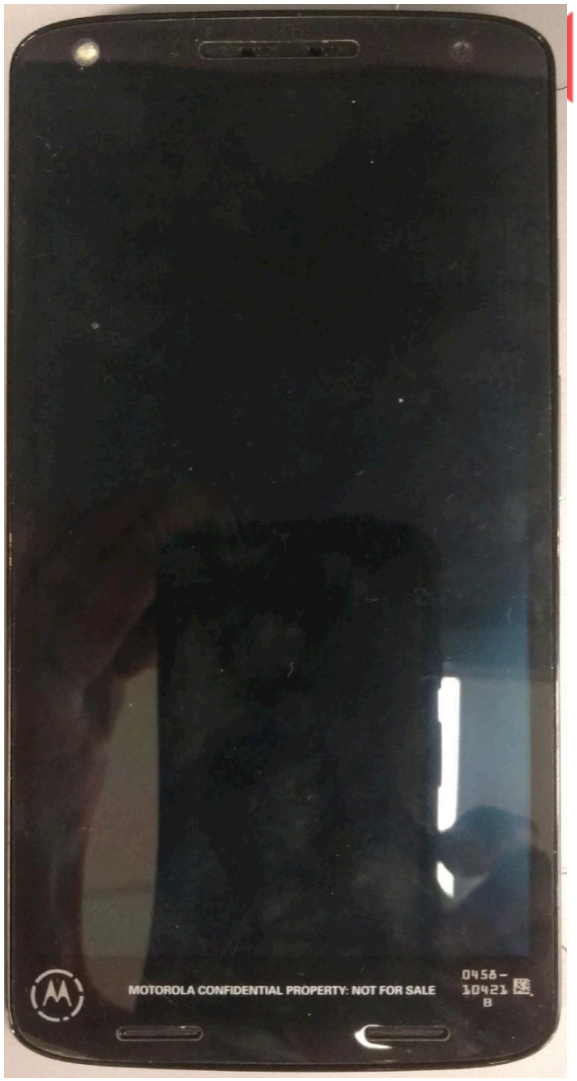
Display size: 5.43inch
Display Type: TFT, pOLED, Plastic Lens, Diamond Pixel Arrangement
Pixel Number: 1440xRGBx2560
Pixel configuration: RGB 16.77 M Colors (24 bits per Pixel)
Pixel Pitch: 47um
PPI: 540
Active Area: 67.68mm(H) x 120.32mm(V)
Response Time: <1ms
Max Brightness: 350
Contrast Ratio: min. 10000:1
Uniformity: 400P typ 1.05 max 1.47
Display Driver IC: S6E3HF2 (Samsung DDI, (1/2 Frame RAM))
Display AVDD/AVEE Driver: STOD32BTPQR

Main Board – Location of Display & Touch ZIF Connector



Display ZIF Pin 1

Touch ZIF



Display Main Schematic

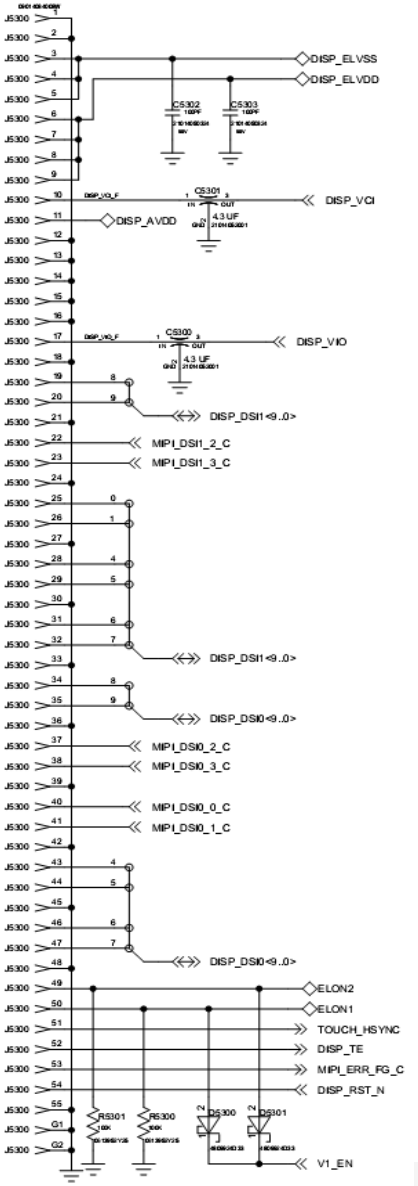
-2.5 V

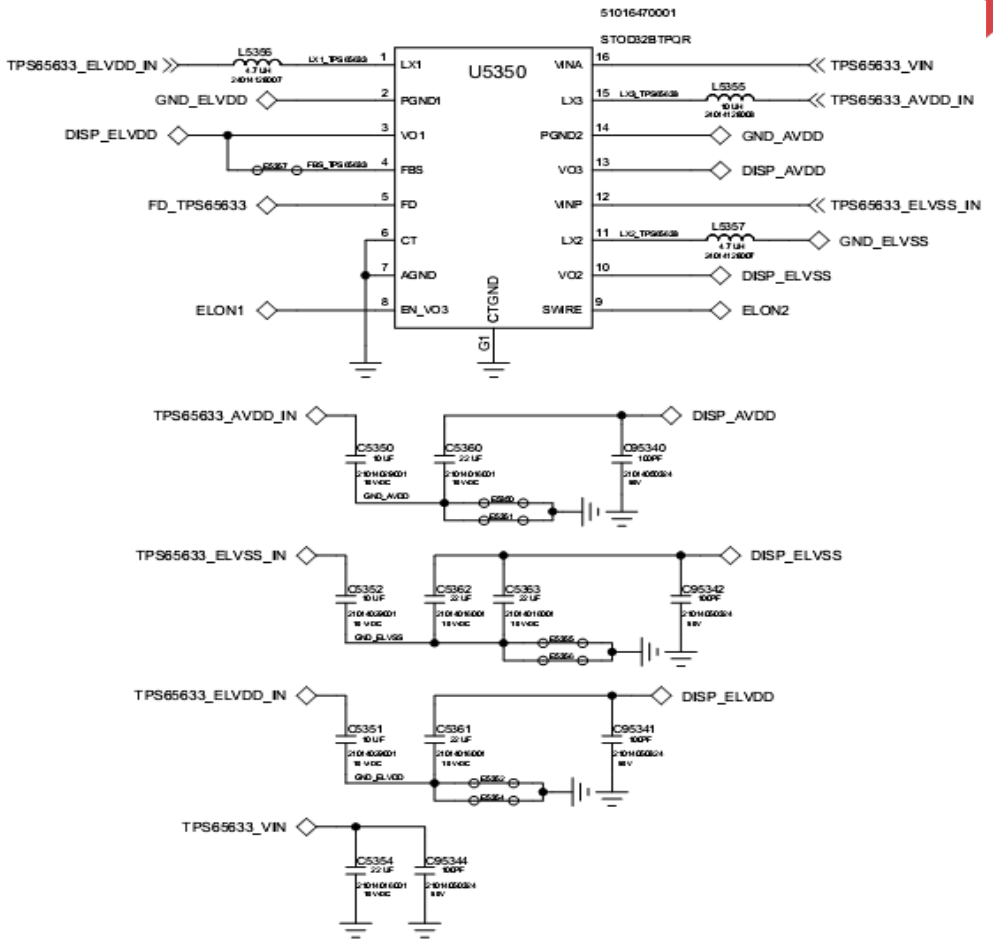
4.6V

3.1V

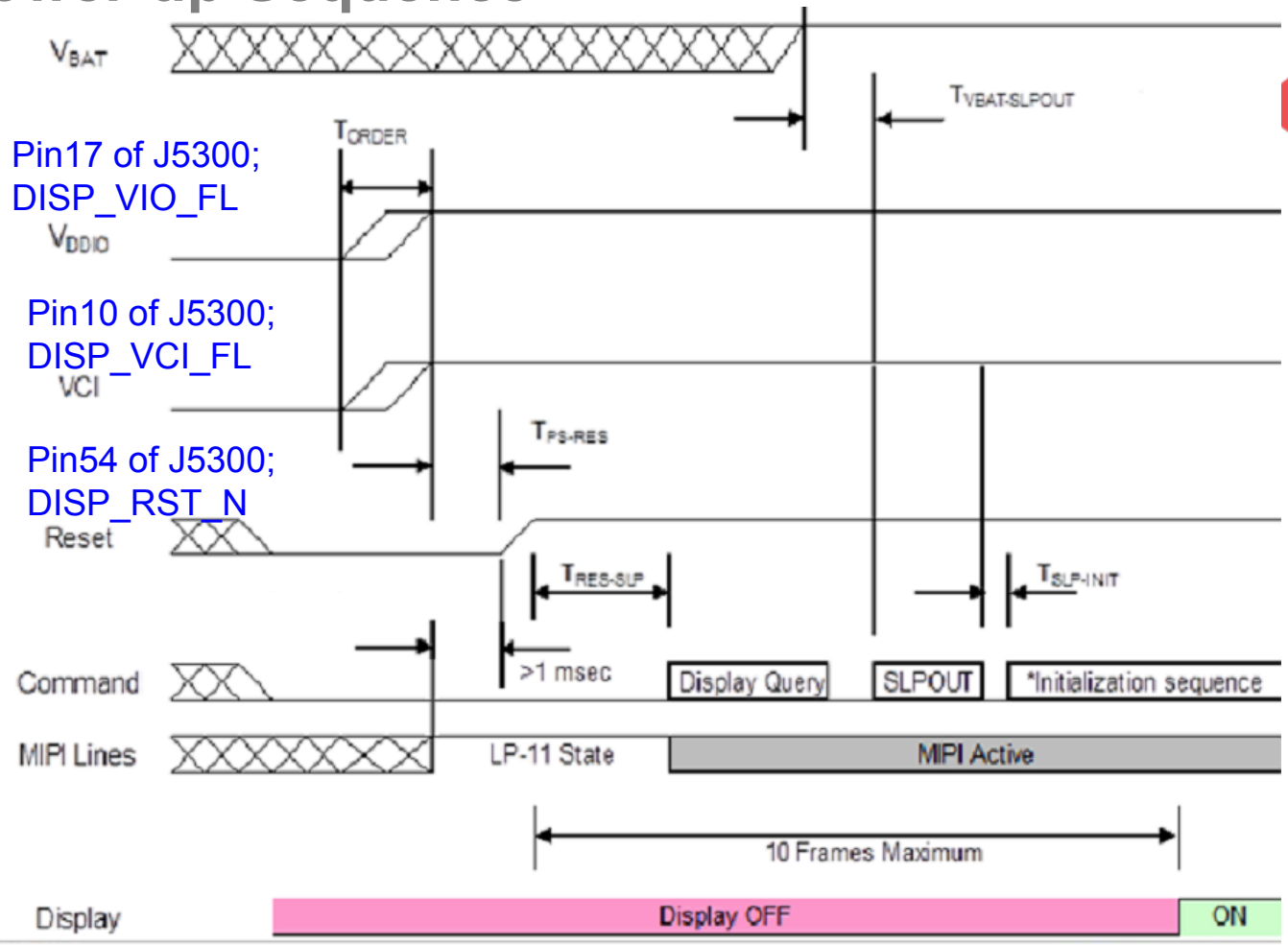
7.3V

1.8V





Display Power-up Sequence



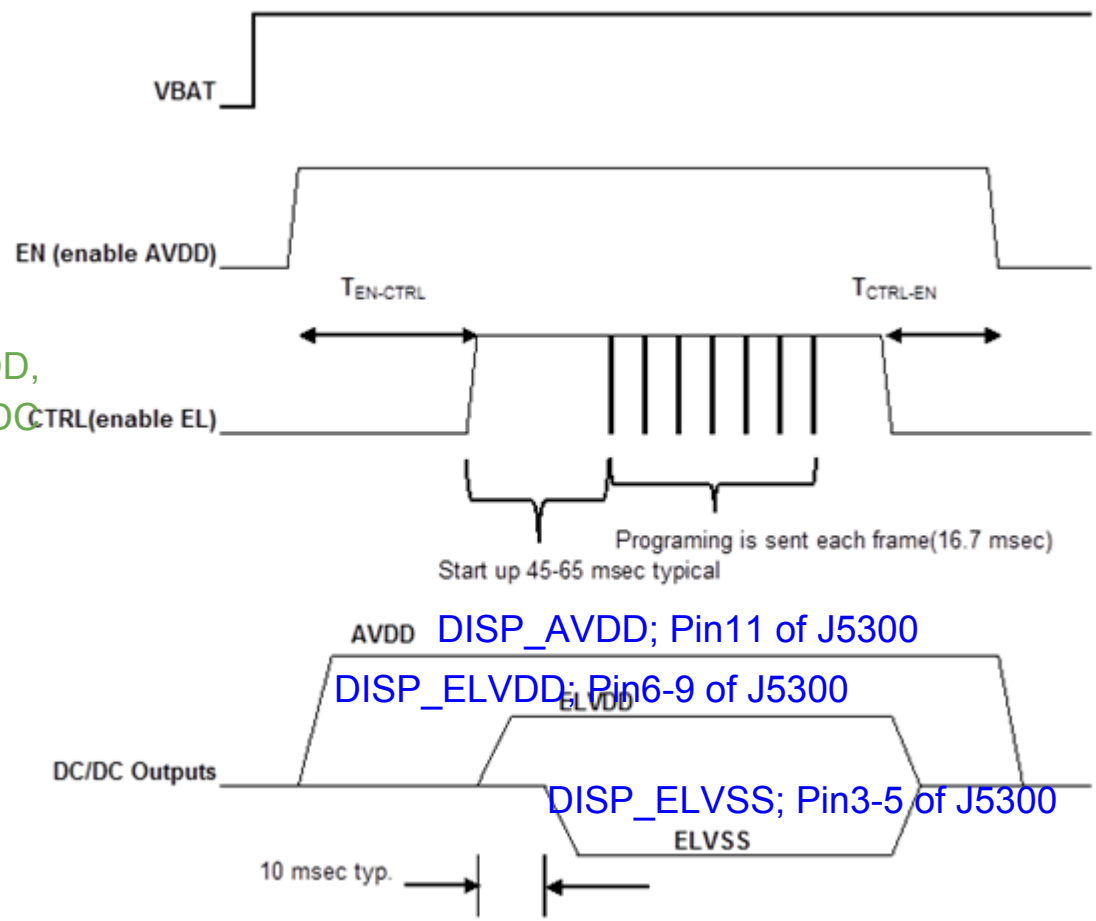
Characteristics	Symbol	Min	Typ	Max	Units
Power Supply Order	T_{ORDER}		∞		-
VCI and Vddio on to RESET high	T_{PS-RES}	10		-	ms
Reset to first command	$T_{RES-SLP}$	**10**			ms
SLPOUT to next command	$T_{RES-INIT}$	**10**			ms
SLPOUT to Display ON command	T_{SLP-ON}	120			ms
VBAT (stable) to SLPOUT Command	$T_{VBAT-SLPOUT}$	30			ms

External DC/DC Converter Power Up Sequence

TPS65633_VIN
; C5354

ELON1 (AVDD cntrl)
Pin50 of J5300

ELON2 (cntrl for ELVDD, ELVSS, AVDD at DC/DC U5350)
Pin49 of J5300



Display Troubleshooting

- Check 55pin display ZIF connector
  1. Properly inserted
  2. Any damage to ZIF receptacle on main PCB or plug on disp flex tail
  3. Swap in known good main PCB or good disp module to see if issue follows main PCB or display flex

- If the issue follows main PCB,
  a. Check DISP_VIO_F voltage 1.8V typ (1.65-1.95VDC) at Pin17 of J5300
  b. Check DISP_VCI_F voltage 3.1V typ (2.9-3.3VDC) Pin10 of J5300
  c. Check voltages from DCDC converter U5350 at J5300 conn (DISP_ELVDD 4.563-4.637VDC / Pins6-9, DISP_ELVSS -2.45V to -2.55VDC / Pins3-5, DISP_AVDD 7.2-7.37VDC / Pin11)
  d. Check DISP_RST_N, should be High (1.8V) / Pin54 at J5300 conn

- If the issue follows Display Module, replace the module.

AUDIO TROUBLESHOOTING

Audio Devices

Mic 5 (ANC) Port

Deco removed to expose actual port locations

3.5mm Headset Jack

Earpiece Port

Mic 2 (Secondary) Port

Mic 3 (Tertiary) Microphone Port

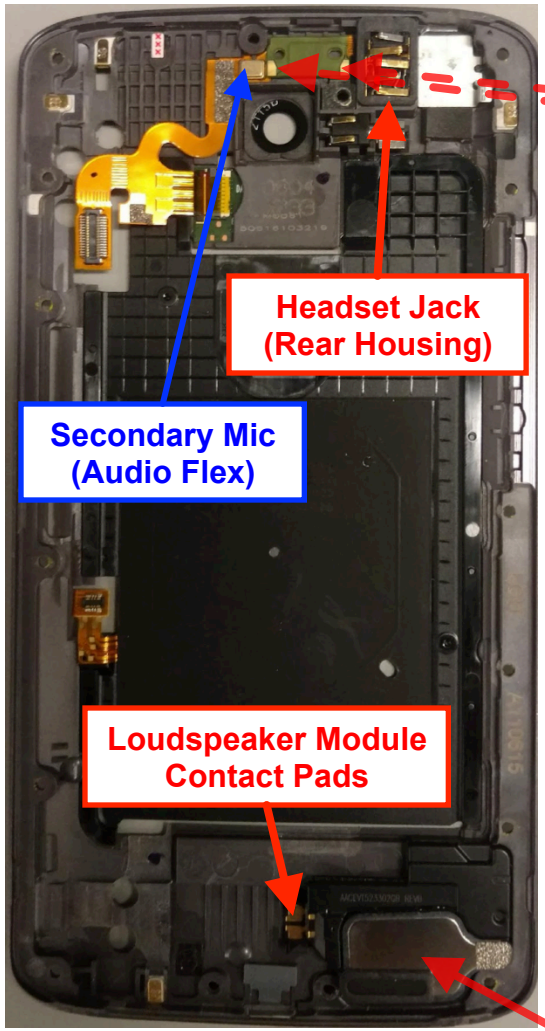
Loudspeaker Port

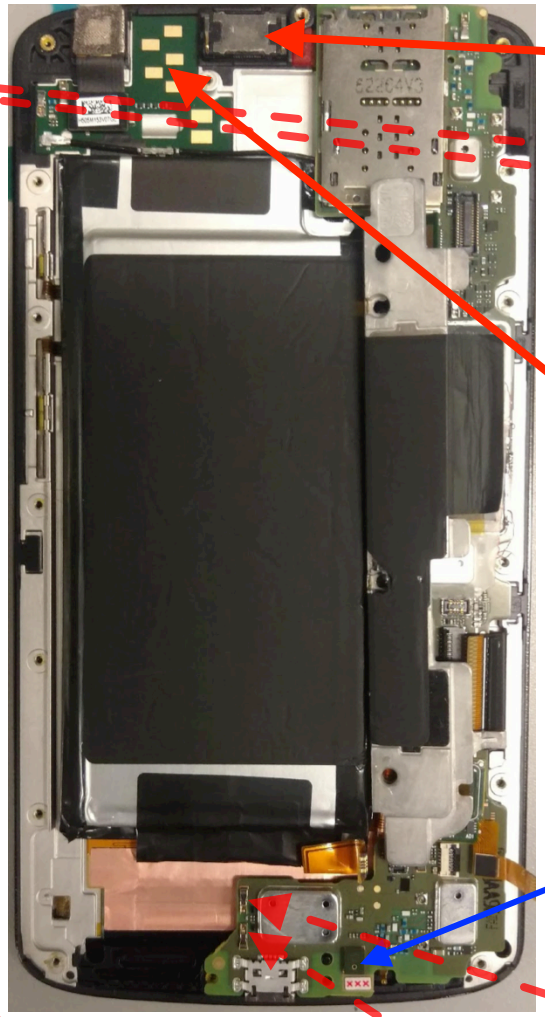
Mic 1 (Primary) & Mic 4 (Quaternary) Port

Audio Devices (Rear/Endo Assy View)

Rear Housing

"Endo" Assembly





Earpiece speaker (32 ohms)

Earpiece contact pads (Audio Flex)

Headset Jack (Rear Housing)

Headset Jack Pads (Top Flex)

Secondary Mic (Audio Flex)

Loudspeaker Module Contact Pads

Tertiary Mic (Grommet not shown)

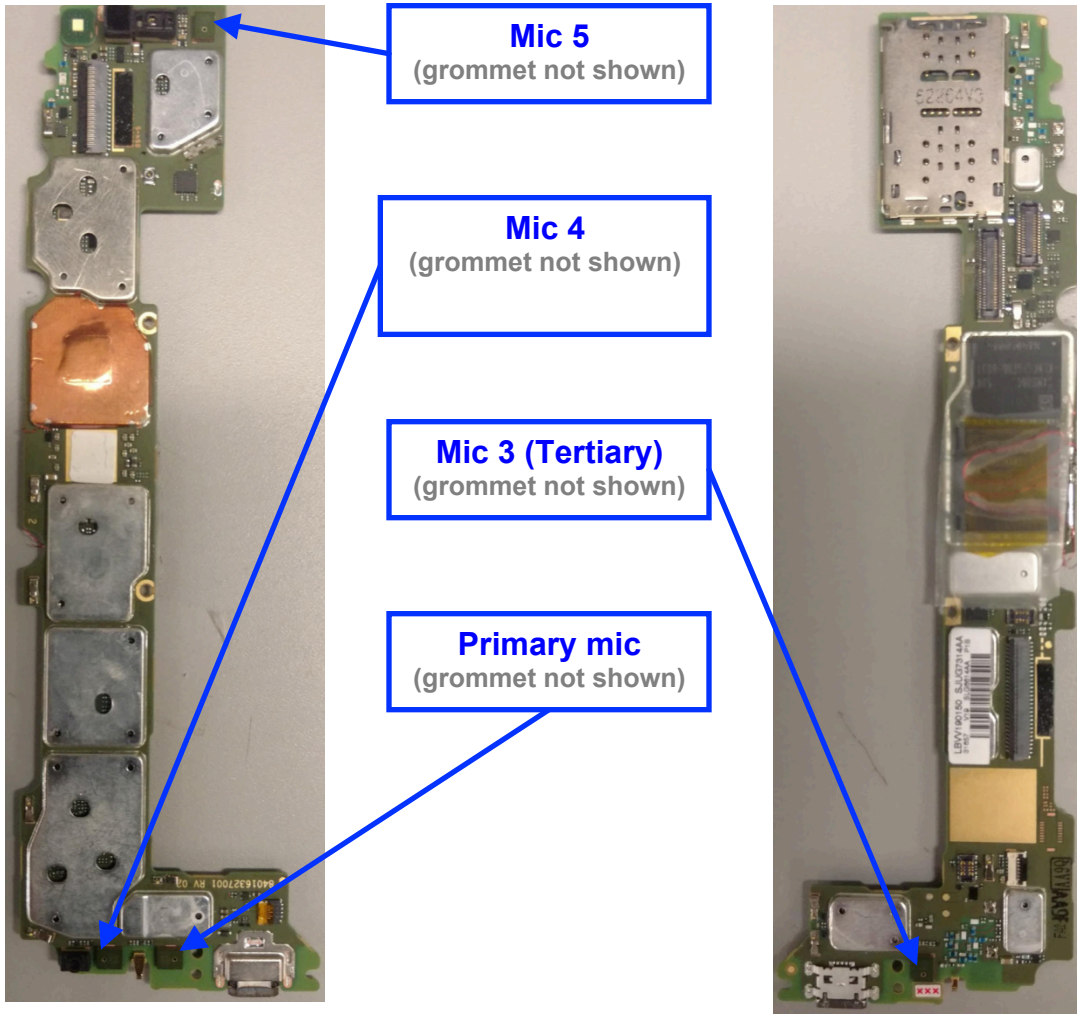
Loudspeaker Module (Pre-Sealed) 8-Ohms

Loudspeaker PCB Spring Contacts

Audio Devices (PCB View)

Display / “TOP” Side

Rear Hsg / “BOTTOM” Side



CQA Application

- Launching the CQA app will help resolve and root-cause the vast majority of problems.
- **Go to the phone/dialer and enter *#*#2486#*#***
- The CQA main menu will pop-up – select “Start CQA Test in Menu Mode”
- Select the appropriate debug area – for Audio, primarily you will use AUDIO and HEADSET
- The AUDIO CQA area has test capability for microphones, earpiece, and loudspeaker
- The HEADSET CQA area should be used to debug any detection, or lack of audio on the headset jack path

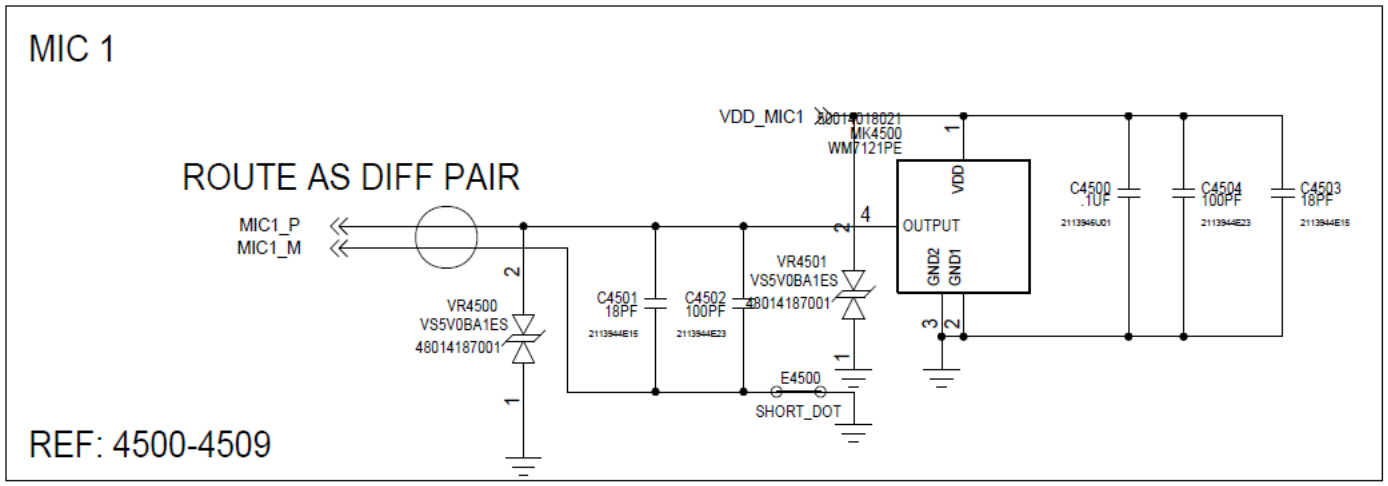
“No Audio” Complaints

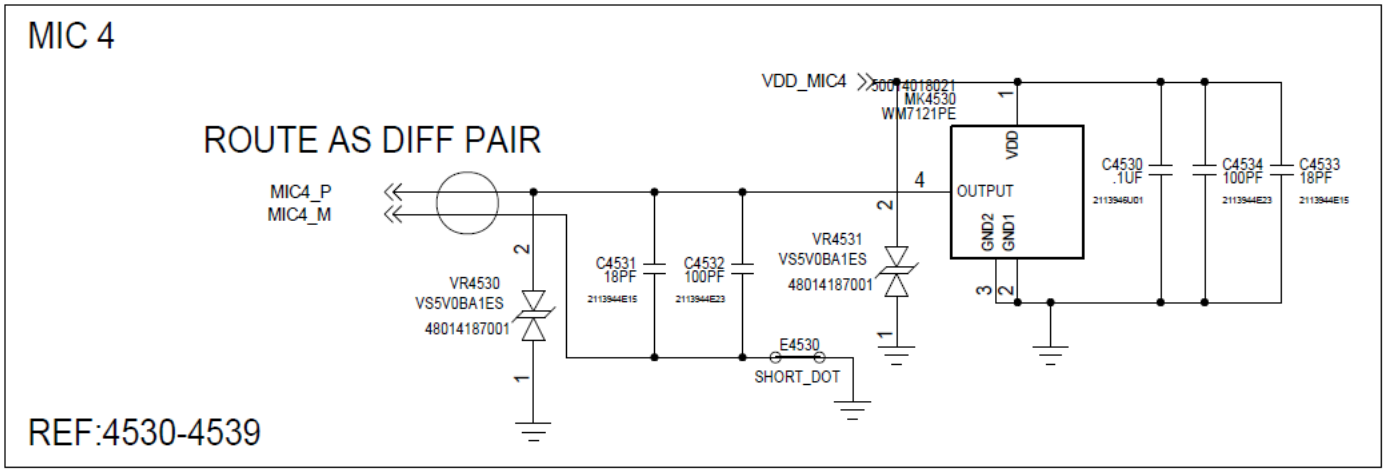
- The CQA apk can be used to verify a broken audio path. Under the “Audio” menu, select “Mic Loopback”.
  - The “PRIMARY MIC” setting allows a mic1 to earpiece loopback **(recommended)**
    - Note* - The “DEFAULT MIC” setting also allows this, if a headset device is not plugged in.
  - The “SECONDARY MIC” setting loops mic2 to the earpiece, and so on and so forth; *Note* there are **5** microphones on this device.
  - If a headset is inserted, the “DEFAULT MIC” setting will loopback the headset mic if one exists rather than the handset primary mic.
  - Selecting the other microphone paths while a headset is inserted will loopback the audio to the headset speakers/output device.

- If no mic-to-earpiece loopback paths are not functional, the earpiece speaker path is likely damaged. In the “AUDIO” menu of the CQA apk, select “Ear Speaker” and the “Buzz Sweep” should begin playing. Toggle and select “Play Harvard speech pattern” to hear human speech to be sure the transducer is operating correctly.
- The loudspeaker can be tested by selecting “Loudspeaker” via the CQA apk. A musical composition should start playing and be easily heard.
- If audio is not present on the HEADSET path, select the “Headset” entry in the main menu of the CQA app, then plug-in the headset device to view whether the lack of audio is a detection-cycling issue or other anomaly.

Microphones

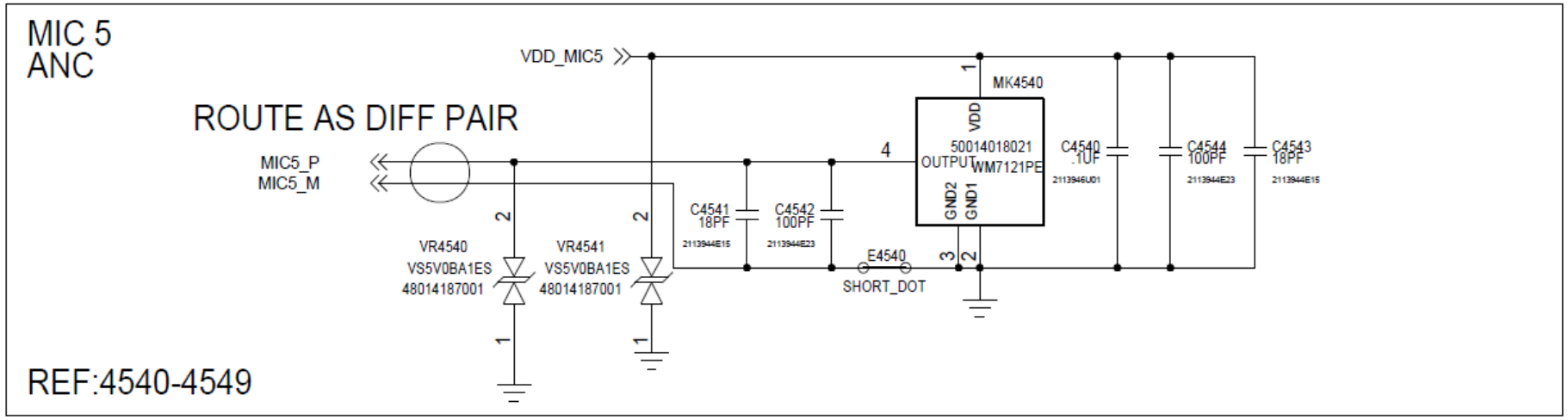
Microphone schematics are presented based on proximity on the PCB and/or location on a particular flex.





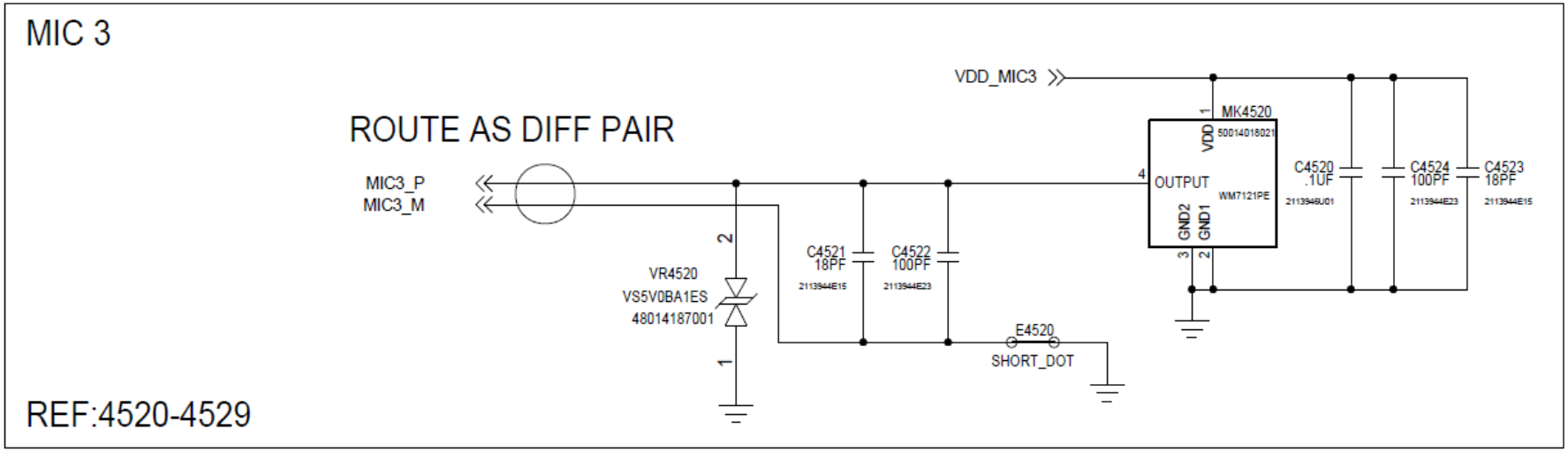
Microphones (cont'd)

Microphone schematics are presented based on proximity on the PCB and/or location on a particular flex.



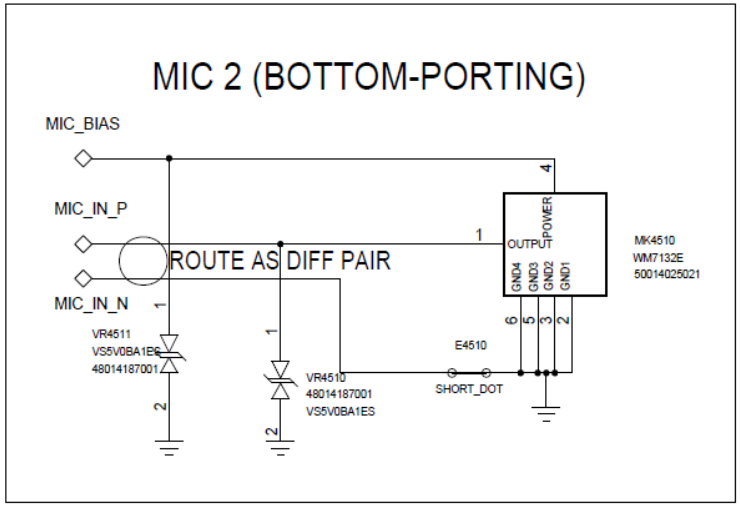
Microphones (cont'd)

Microphone schematics are presented based on proximity on the PCB and/or location on a particular flex.



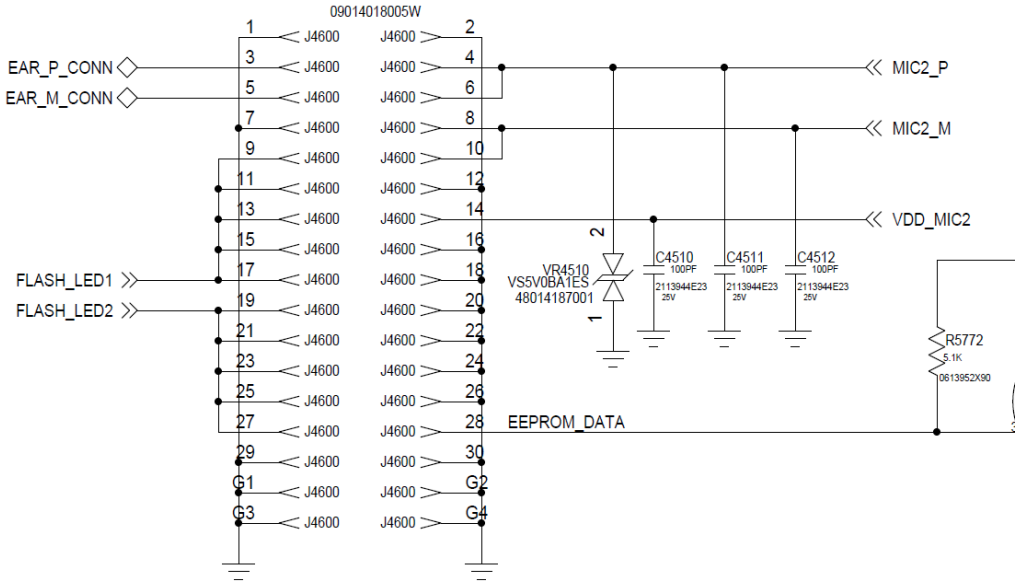
Microphones (cont'd)

Microphone schematics are presented based on proximity on the PCB and/or location on a particular flex.



MIC 2 CKT ABOVE IS LOCATED ON THE AUDIO FLEX (See Rear/Endo View)

Part of Mic 2 CKT located on Main PCB (near J4600, Audio Flex B2B)

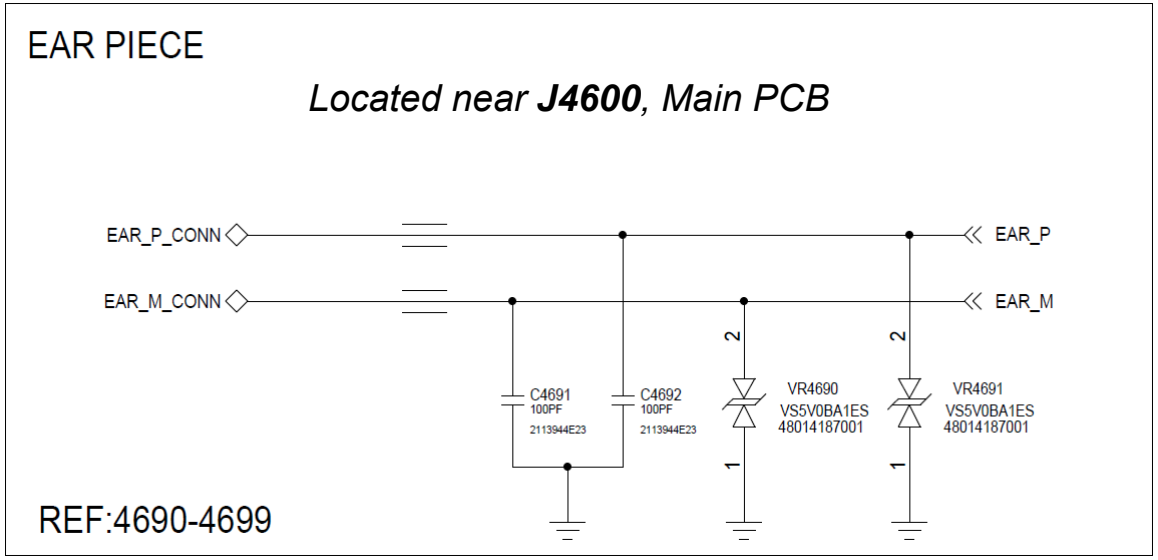


Microphones Troubleshooting

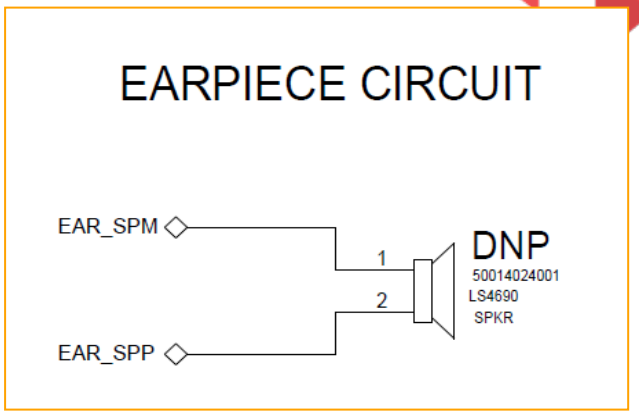
If a mic is not functioning…

- Check to make sure the microphone and mic ports are not blocked.
- Check to make sure the mic gasket and mic grommets are seated properly (Mic 1/3/4/5). Check to make sure the J4600 B2B connector is seated properly (**MIC 2 only**).
- Check the microphone for diaphragm debris indicating a shattered diaphragm. Look under a microscope to view inside the microphone port for damage or debris near port hole or surrounding the microphone area where tiny, shiny particulate material may be visible when varying viewing angle.
- Check to make sure no capacitors on any of the applicable mic lines are shorted or damaged.
- Check the mic bias C4500 (Mic1), C4510 (Mic2), C4520 (Mic3), C4530 (Mic4), C4540 (Mic5). The mic bias should be **1.8VDC** when the microphone is enabled.
- If the failure is no microphone audio, check mic loopback through CQA at the board level with a display connected. (Mic loopback may be easier to check with a headset plugged in, in which case the rear hsg assy may be req'd.)
- If there is no audio during mic loopback, inject a 35mVrms, 1kHz sine wave onto the mic signal side of C4501 (Mic1), C4511 (Mic2), C4521 (Mic3), C4531 (Mic4), C4541 (Mic5) and listen for the tone during loopback. If you can hear the tone now, you know either the mic is bad, or there's a process defect with the mic-to-PCB connection.
- X-ray the mic to check for process defects.
- If swapping the microphone fixes the issue, the bad microphone should be sent to the supplier for FA.

Earpiece Speaker (Handset Mode DOWNLINK)

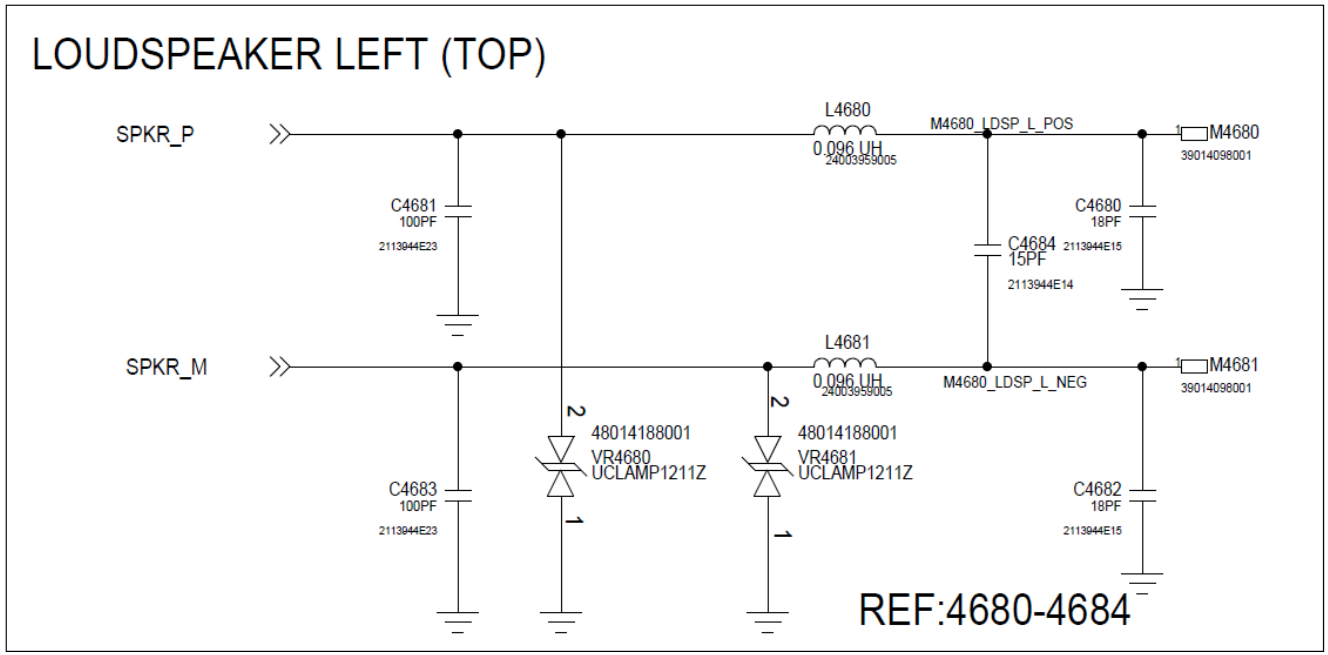


On Audio Flex (PADS ONLY)



- Check that the impedance of the earpiece speaker is near 32 ohms, and that the spring contacts are not bent.
- Check that the earpiece flex is seated properly in the rear housing with no debris on it. You should also be able to see slight imprints in the gold pads where the speaker spring contacts were touching the flex; these imprints should be centered - if they are on the edge of the pad, there may be an alignment issue.
- Check that the J4600 B2B flex connector on the PCB is seated properly with no damage to any pins on the PCB-side or Flex-side.
- Check C4691, C4692, VR4690 and VR4691 for any placement issues.

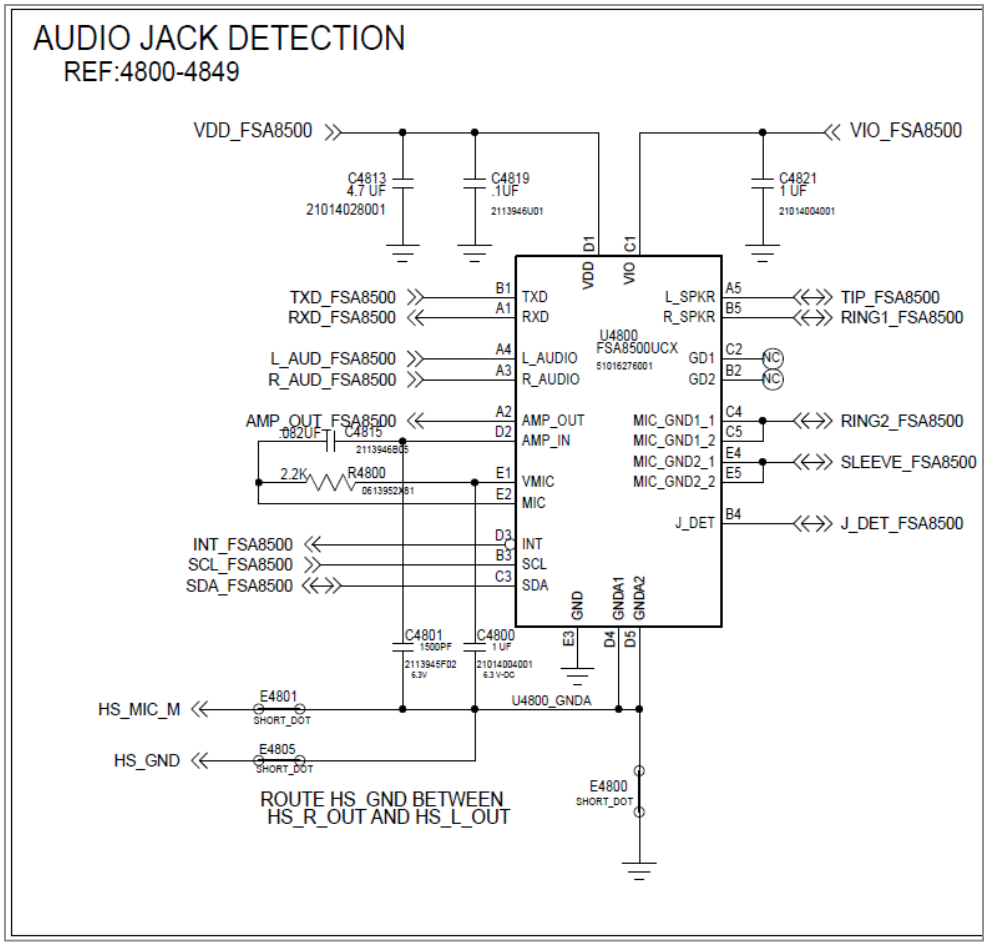
Loudspeaker

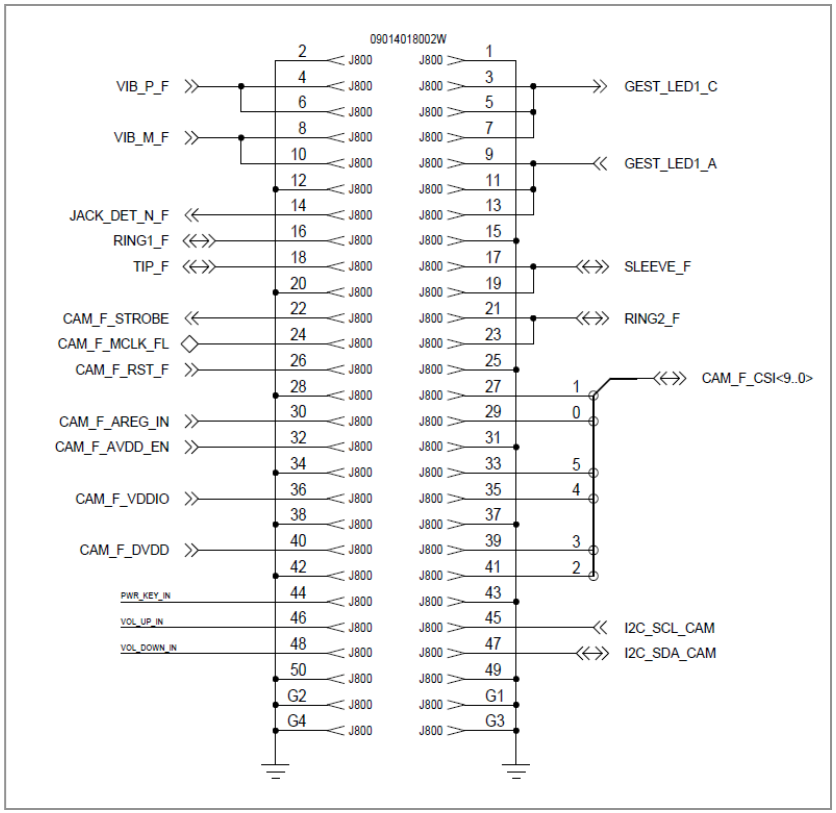


- Verify the impedance of the loudspeaker module is ~8 ohms.
- Lack of mechanical contact should also be checked between the PCB spring contacts and the loudspeaker module (check for bent/broken/missing pins on PCB spring contacts).
- Make sure L4680 and L4681 are not skewed or damaged.
- Check C4680, C4681, C4682, C4683, C4684, VR4680, and VR4681 for any placement issues.

3.5mm Headset Path

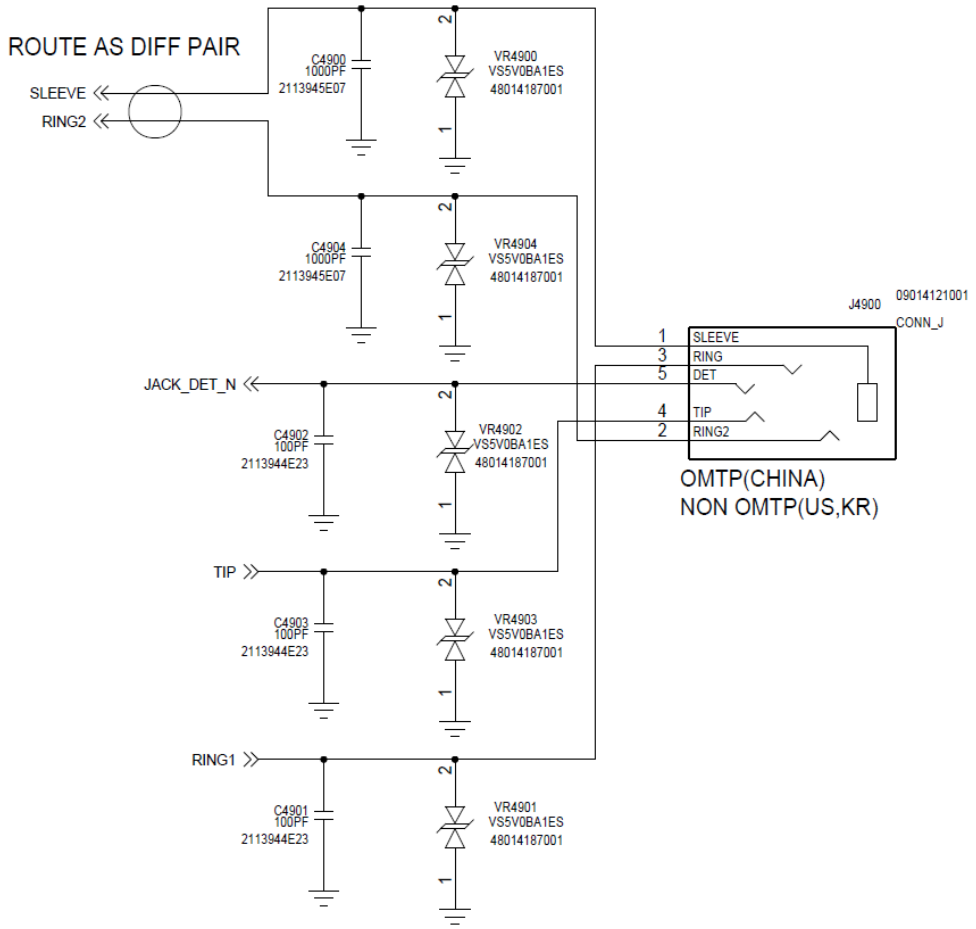
This section of headset circuit on MAIN PCB, at/near **J800**





3.5mm Headset Path (cont'd)

This section of headset circuit on TOP FLEX



Debug Procedure: Headset

- Check the pins on the headset jack for any bent pins or missing pins (In rear housing)
- **On the TOP FLEX:**
  - ESD Diodes VR4900, VR4901, VR4902, VR4903, VR4904 must be open circuit. Measure these with a DMM to ground. If any short circuit is found, replace the ESD diode.
  - Shunt caps C4900, C4901, C4902, C4903, and C4904 must not be shorted across.
  - Check that there are slight indentations on the headset pads, preferably centered. If any indentations fall close to the gold pad edge, there may be an alignment issue.
- **On the MAIN PCB:**
  - U4800 must have voltage on the VDD line, and can be probed on C4813 or C4819. This should measure 1.8V nominally.
  - Check that the **J800** B2B connector is seated properly and there is no damage to either the connector (TOP FLEX-side) or receptacle (MAIN PCB-side).

NO POWER UP DEBUGGING

No Power Up Debugging

Purpose of this document is to cover the debugging steps used to root cause PCB that do not power up properly so that they may be used again to initiate corrective actions.

Glossary/Synonyms

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

MSM	AP/BP	MSM8994	U1000
Power Management IC	PMIC	PM8994 PMI8994	U2000 U2500
SMB	Charging IC	SMB1351	U540
Kung Kow	Factory Kill IC	User Reset IC	U650
B_PLUS	VSYS	System Battery Voltage	
VBUS	USB Voltage	Charger Voltage	

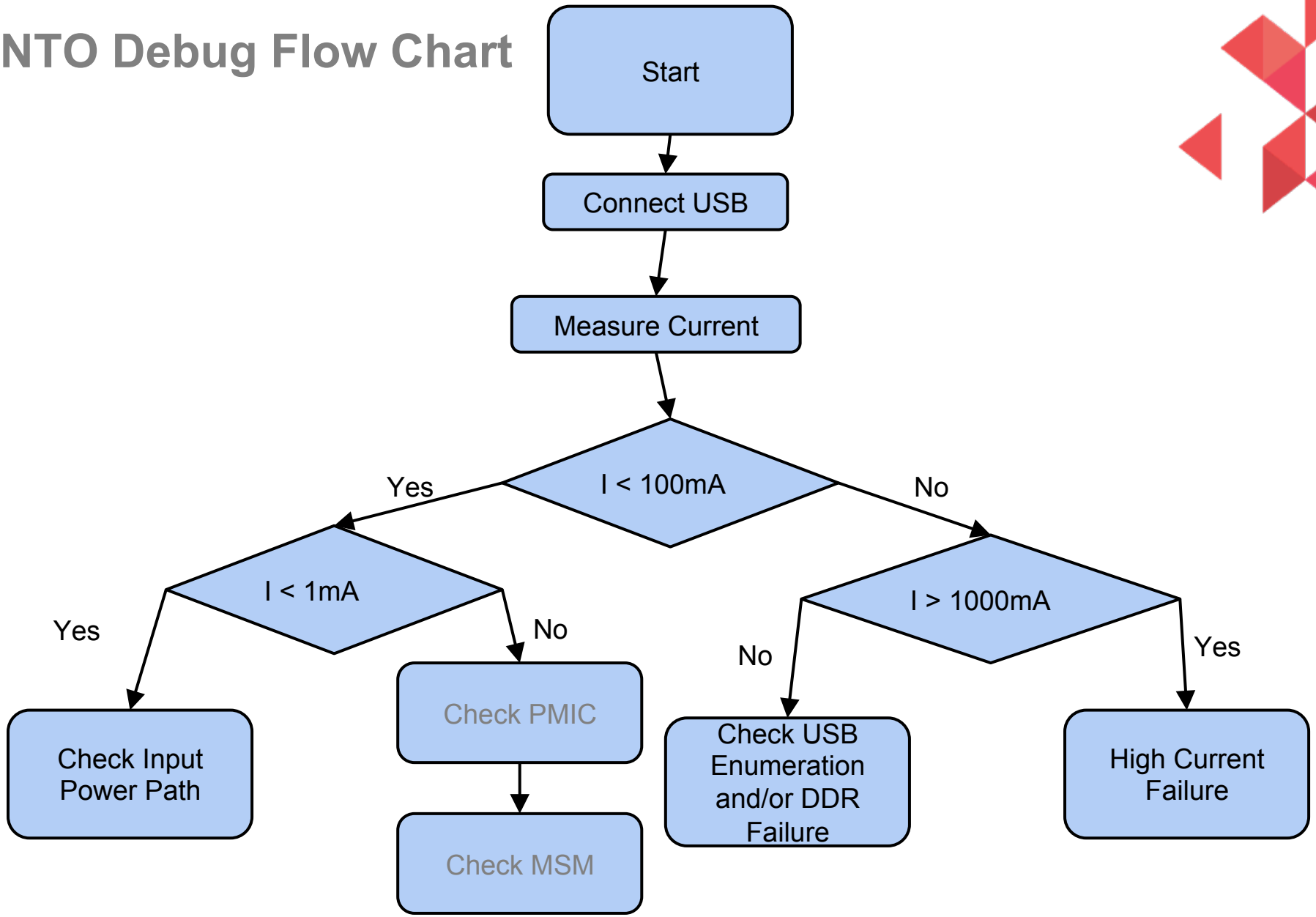
Debug Procedure

- Generally the first step to troubleshooting a no turn on PCB is to look at its boot current. A blank board (no software flashed yet) will normally draw about 80mA at a constant level.
- Also it is helpful to find out what level of functionality is available. These distinct modes were observed:

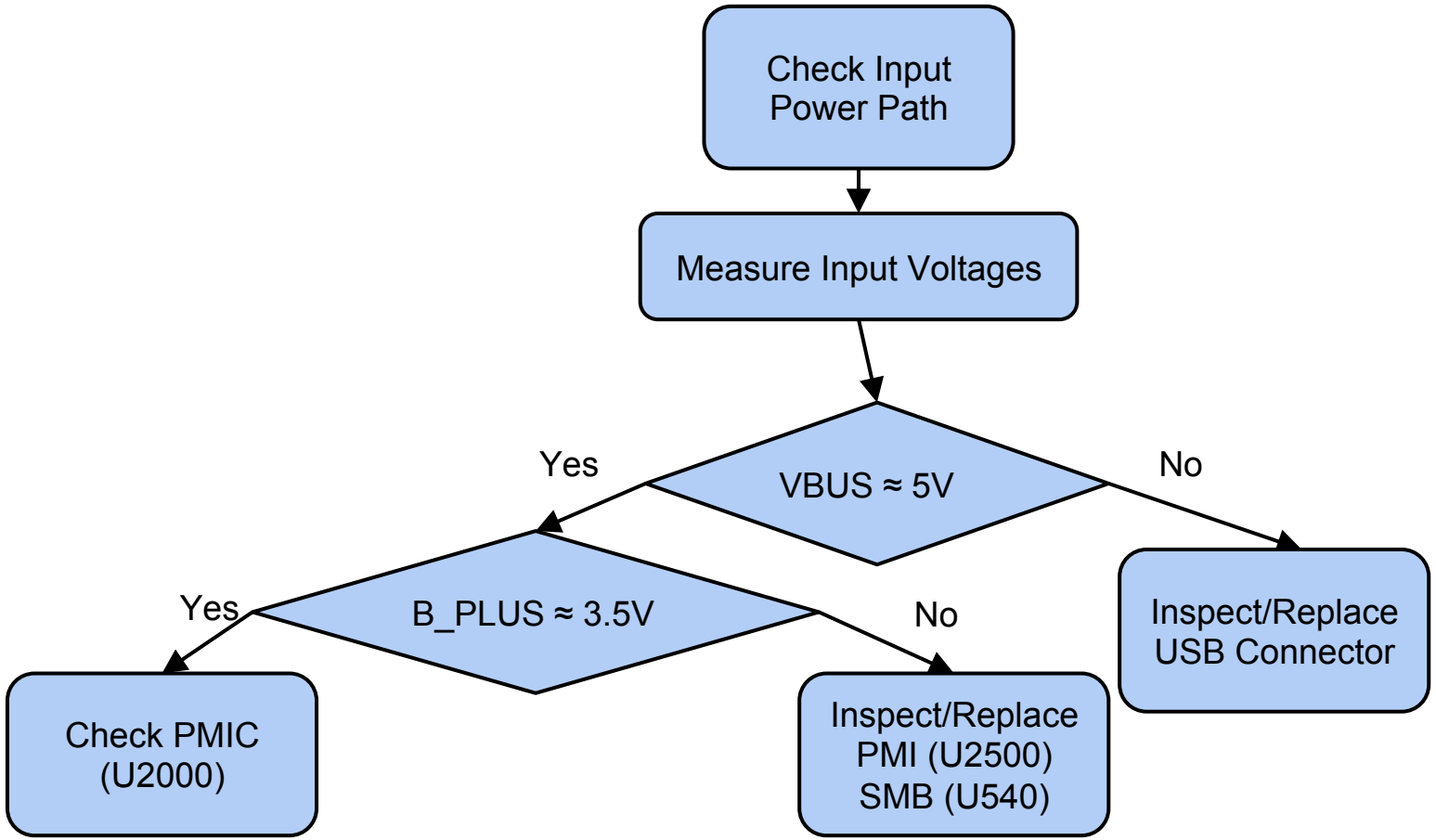
    1. Blank Flash mode
        - Normally will enter this mode for a newly built PCB.
        - Can be forced by shorting debug connector as shown in later slides.
    2. Fastboot mode
        - Normally will enter this mode after flashing bootloader into newly built PCB.
        - Can be forced using volume down key during bootup
    3. Full Power up
        - Will enumerate to PC as Motorola Network device and ready for board test.

- Failed boards will be able to achieve one of these modes but fail to get to the next. This bit of information is useful for debugging.
- Start with the phone off, then plug in the USB cable. If the phone does not turn on when the USB cable is inserted, there is most likely an issue with the connector.
- If the current is abnormally high for a blank board, the root cause is most likely a short. Going through the power on sequence is helpful for finding shorts, it is shown on the next page.

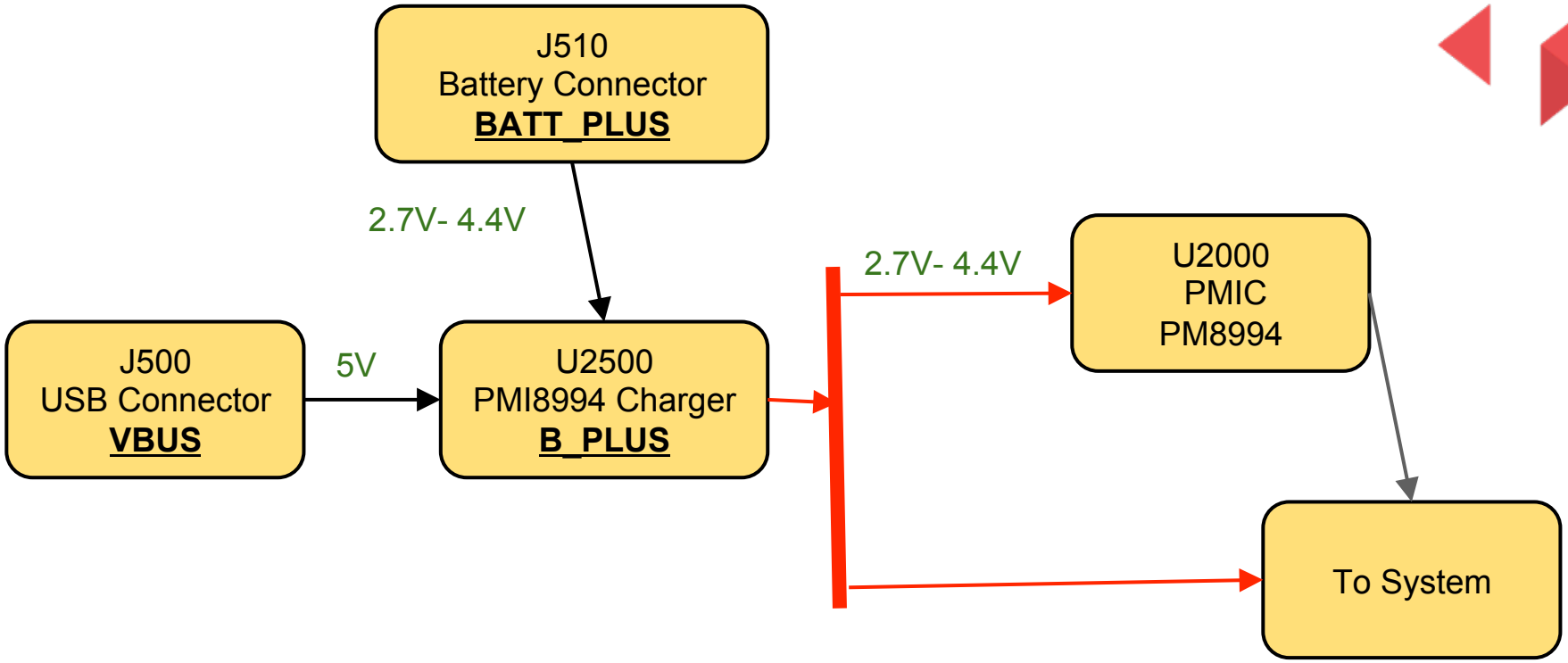
NTO Debug Flow Chart



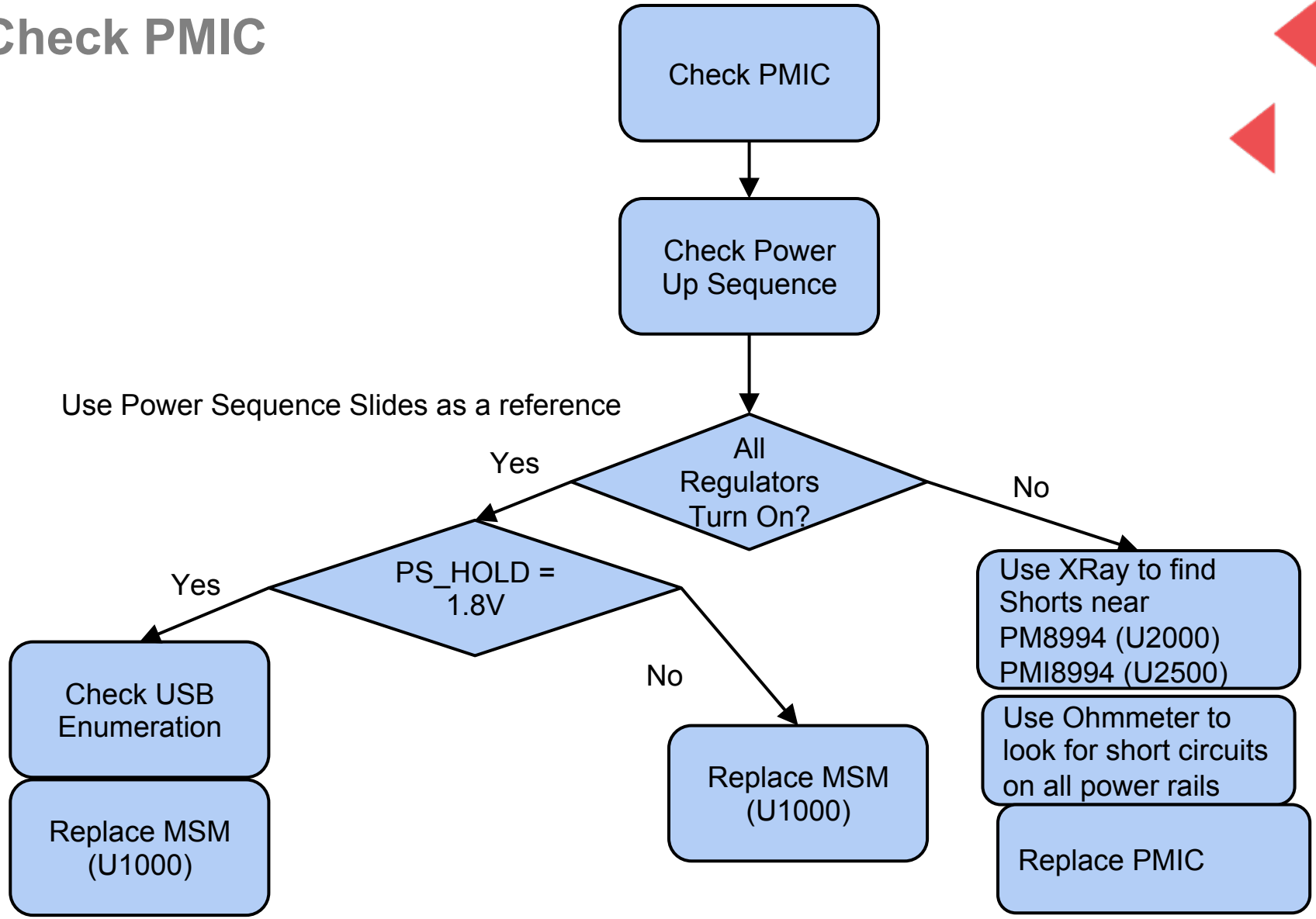
Check Input Power Path



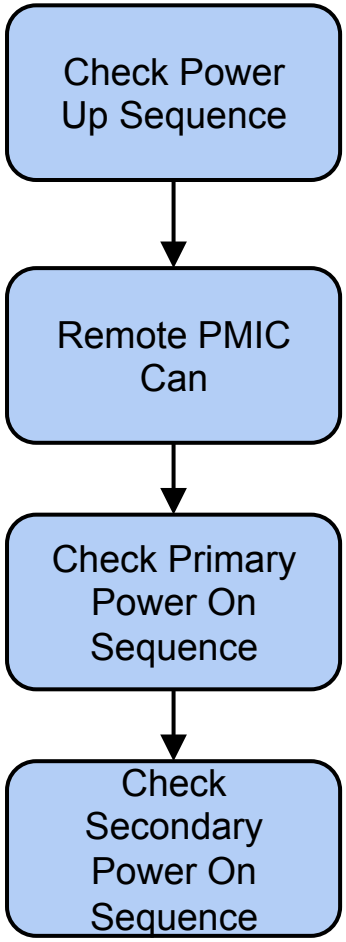
Simplified Input Power Tree



Check PMIC


Check PMIC
Check Power Up Sequence
Use Power Sequence Slides as a reference
All Regulators Turn On?
Yes
No
PS_HOLD = 1.8V
Yes
No
Check USB Enumeration
Replace MSM (U1000)
Replace MSM (U1000)
Use XRay to find Shorts near PM8994 (U2000) PMI8994 (U2500)
Use Ohmmeter to look for short circuits on all power rails
Replace PMIC

Check Power Up Sequence



Power-On Sequence

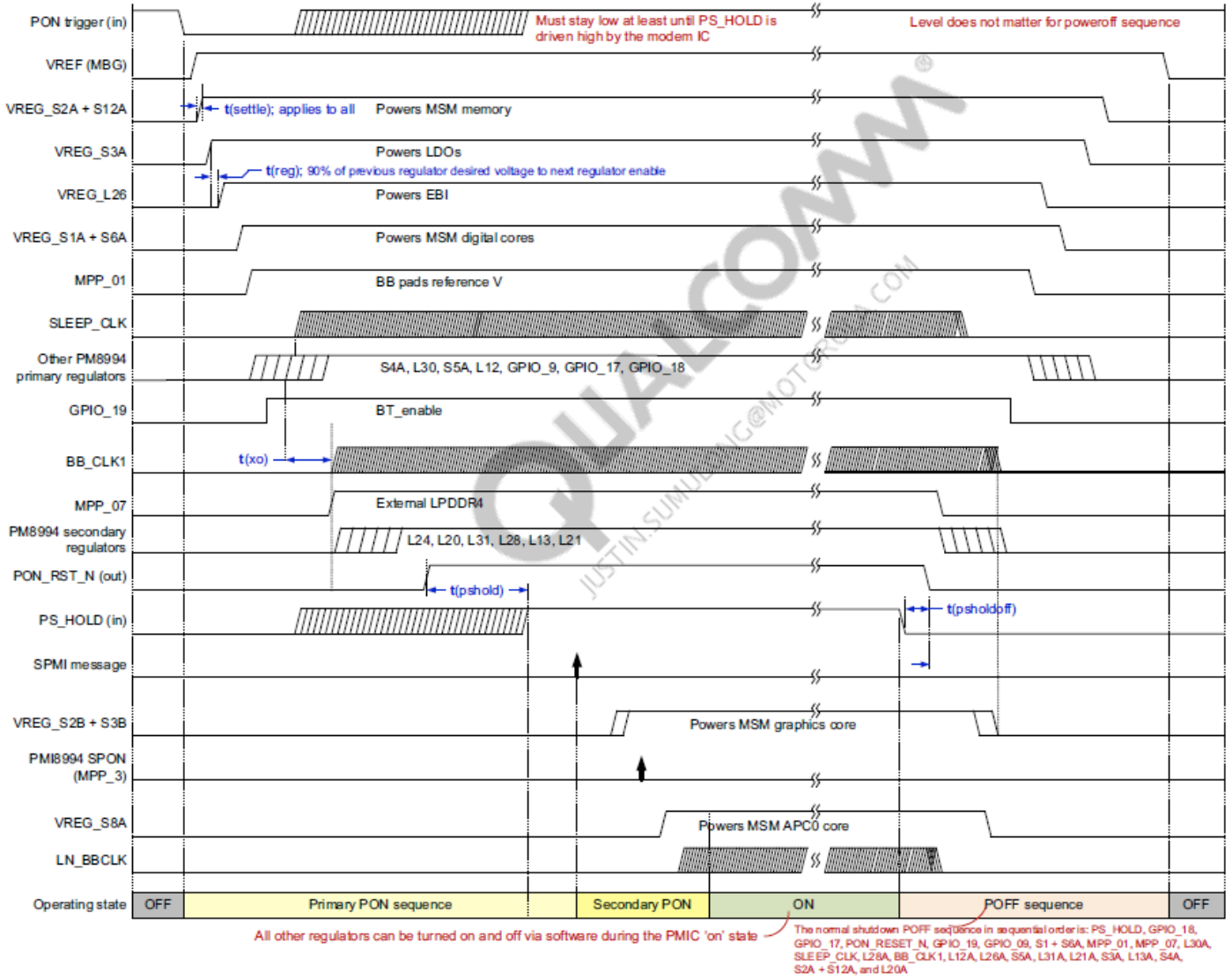
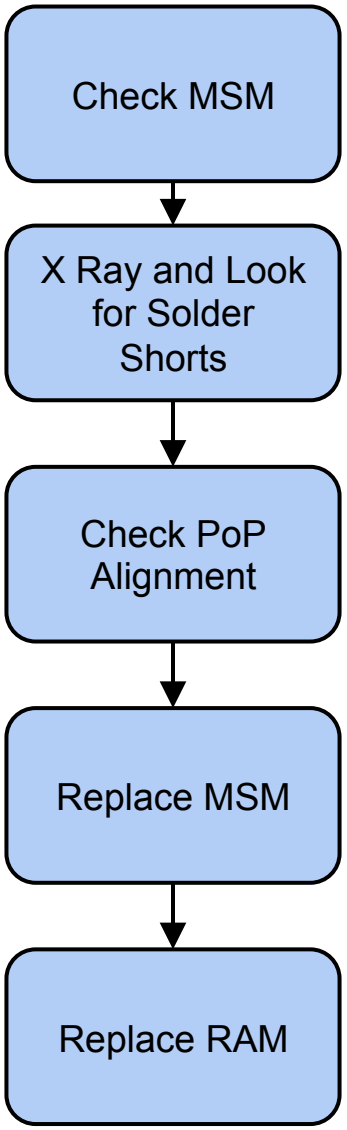
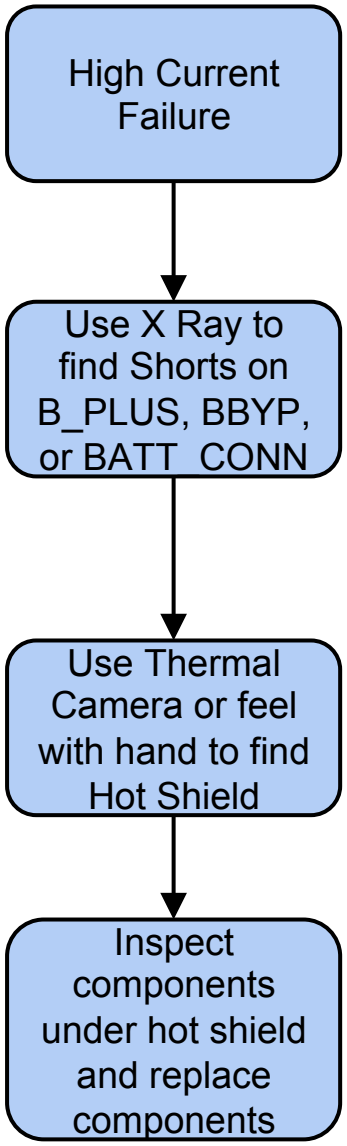


Figure 3-11 Example poweron sequence (MSM8994 chipset)

Check MSM


Check MSM
X Ray and Look for Solder Shorts
Check PoP Alignment
Replace MSM
Replace RAM

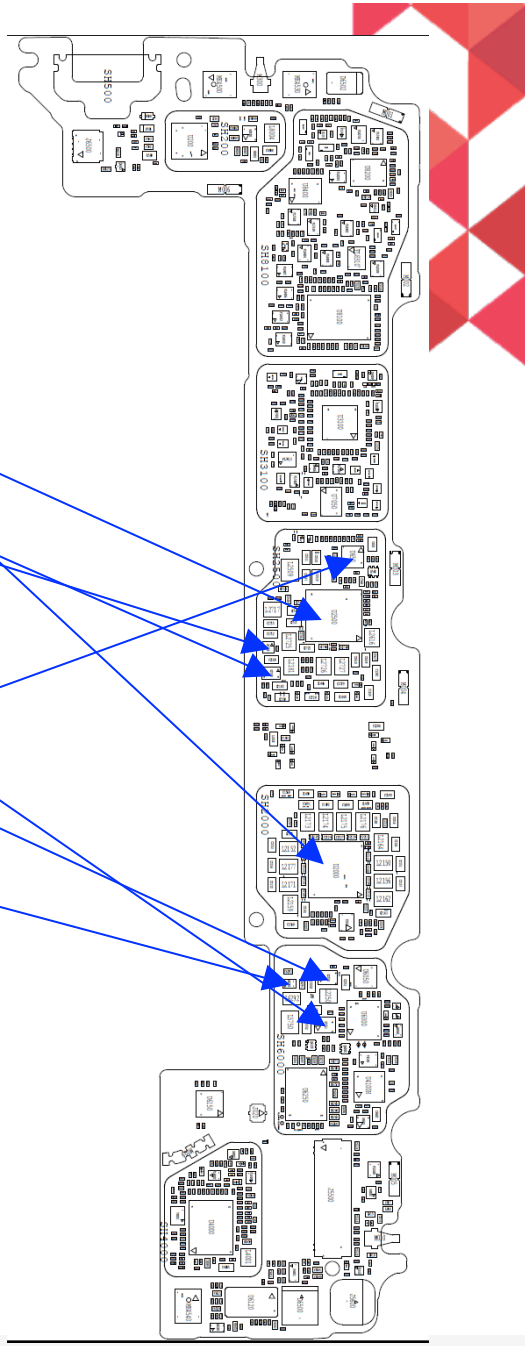
High Current Failure



High Kill or Off Current

- First check for solder ball shorts on major ICs or discrete resistors or capacitors that are skewed and shorting to each other
- Follow the list at right
- Replace parts in order
- Recheck test after removing each shield and after removing each component

Circuit	Typ [uA]	Ref
PM8994	18	1
PMI8994	52	2
SMB	7	3
LPDDR Buck	12	4
5V Boost	5	5
Loud Speaker	1	6
OLED Driver	5	7
LED Cam Flash	1	8
Tuner	1	9
WiFi Buck-Boost	5	10
RF Boost-Bypass	26	11
Kung Kow	3	12
Audio Buck	1	13
TOTAL	**137**	



High Kill or Off Current (cont'd)

- First check for solder ball shorts on major ICs or discrete resistors or capacitors that are skewed and shorting to each other
- Follow the list at right
- Replace parts in order
- Recheck test after removing each shield and after removing each component

Circuit	Typ [uA]	Ref
PM8994	18	1
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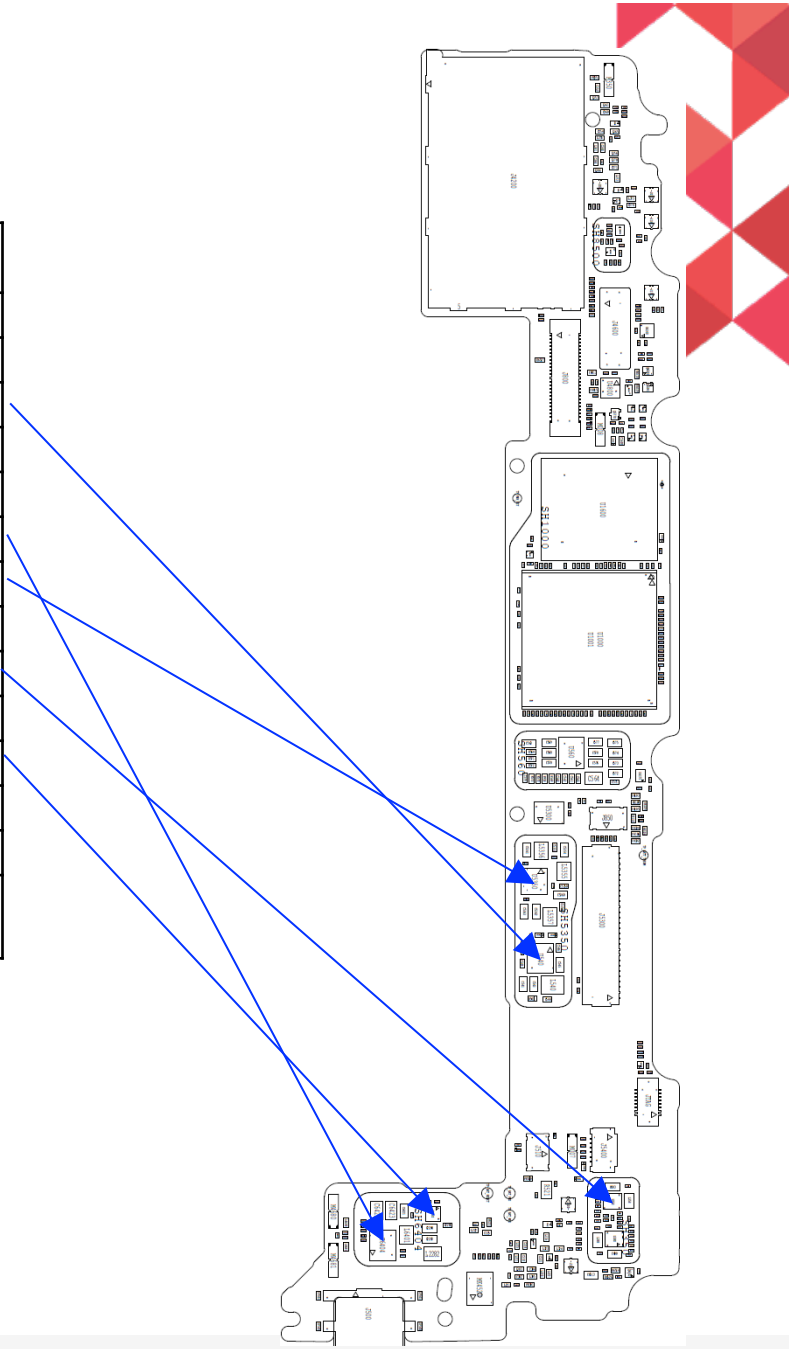
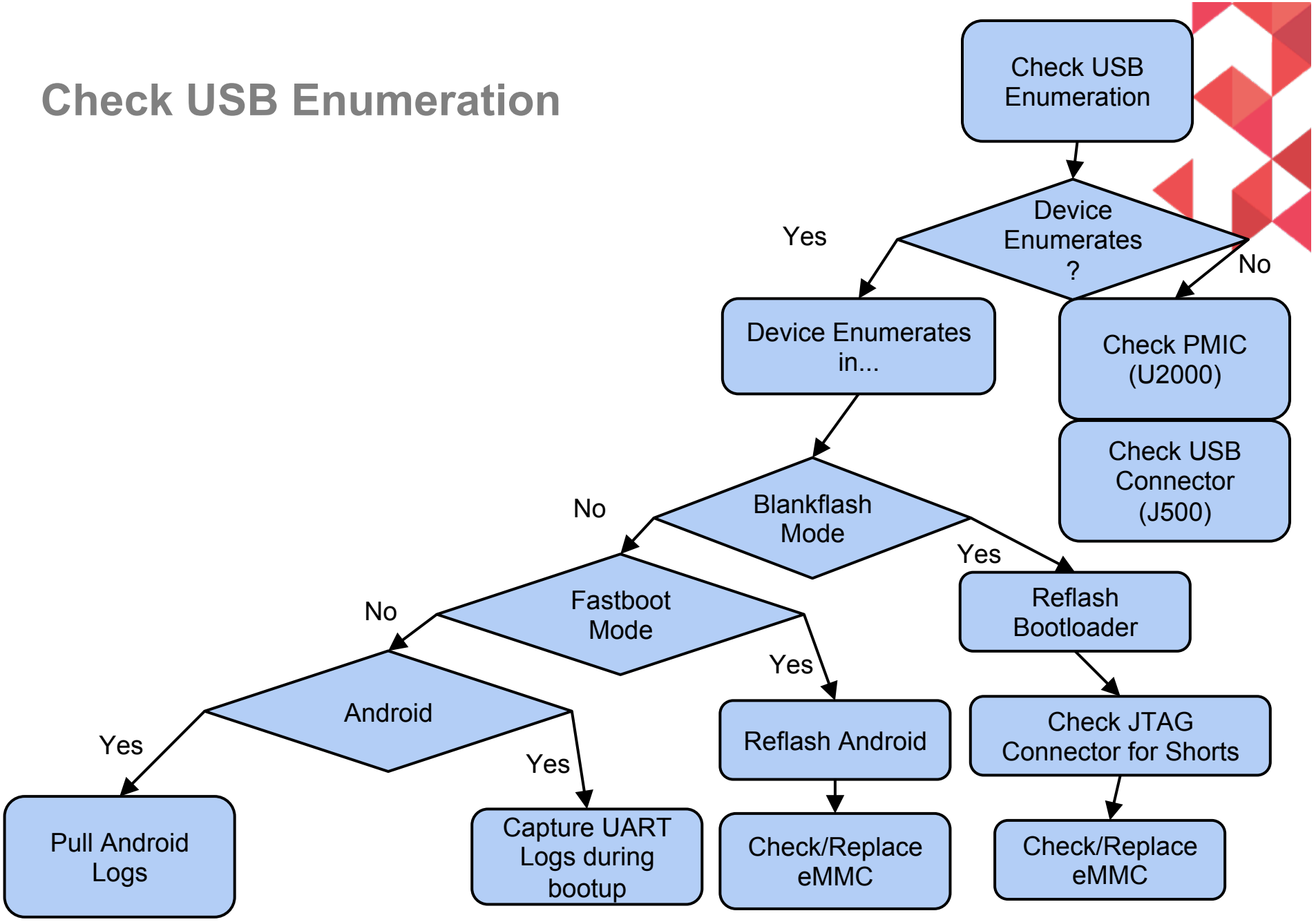
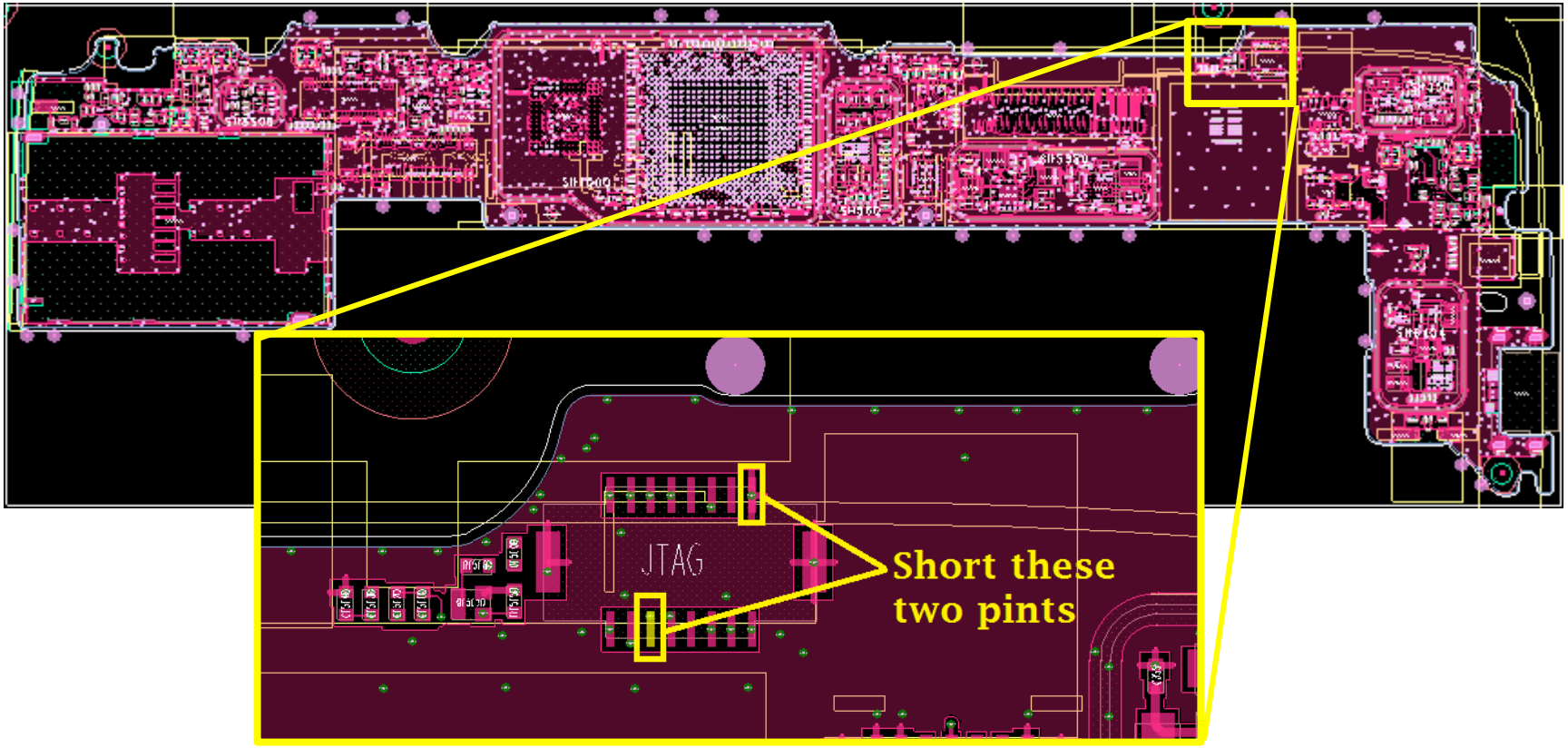


Check USB Enumeration



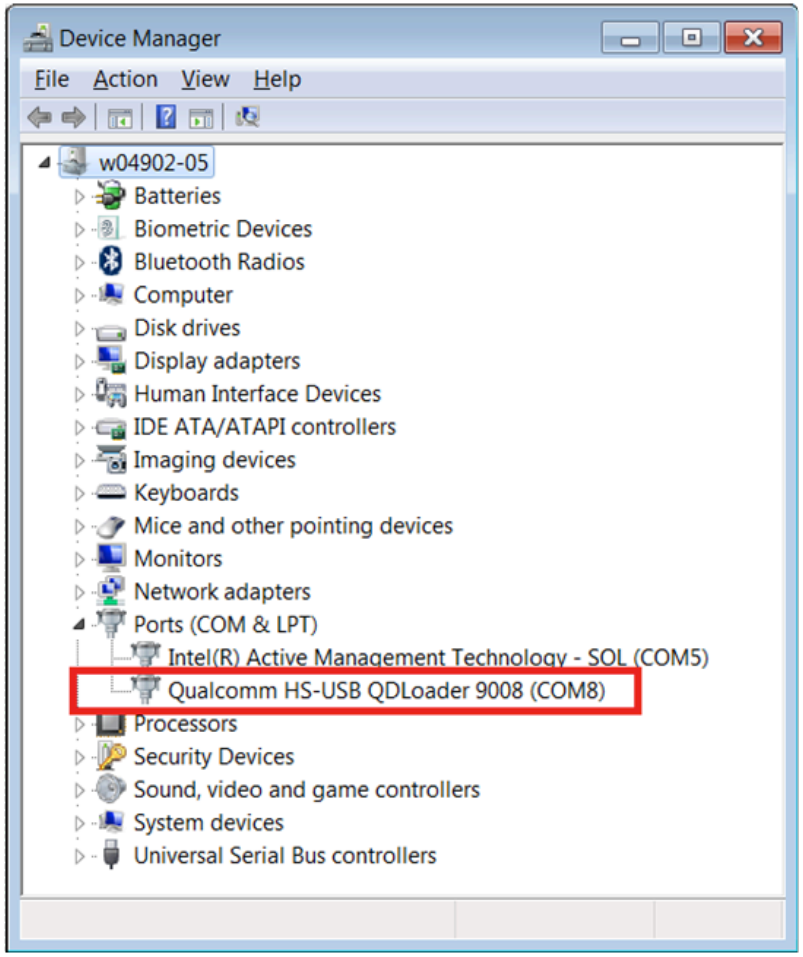
Force Blankflash Mode

- Sometimes if a board has software already flashed, or there was some problem with software, a board can be forced into this mode by shorting two highlighted pins on the debug connector.
- Then when board is in this mode, blank flashing can be attempted to reflash the device and/or find more information on the failure.



Blankflash Mode

- If in blankflash Mode, the device will enumerate like this.



BATTERY AND CHARGER TROUBLESHOOTING

Battery and Thermistor

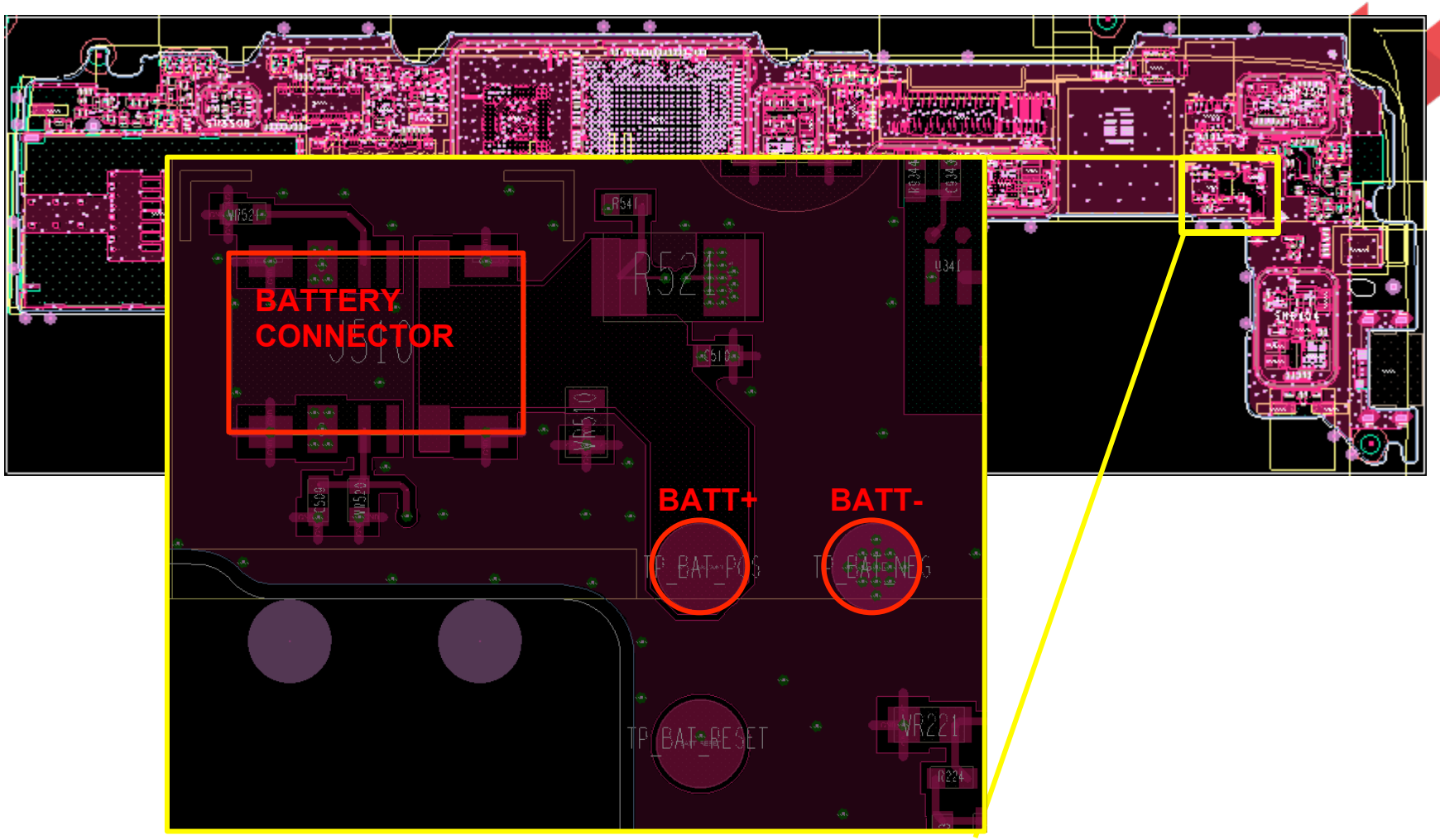
No turn on with battery only:

- If device does not power up with battery only, battery is most likely dead, or there could be an issue with the battery safety control FETs in the PMIC or the safety IC. Also likely is an intermittent or broken trace or via in the battery PCB or the flex, or with the board-to-board connection of the battery to the board.
- If dead battery cannot be recovered with a charger, measure the battery voltage. If it is normal, monitor on a scope for voltage dipping below 3V while attempting to power it up with battery. This can happen due to high impedance FET or IC in the battery or excess current drain.
- If device powers up with factory cable, replace the battery, and if the issue is resolved, send the battery to development team.

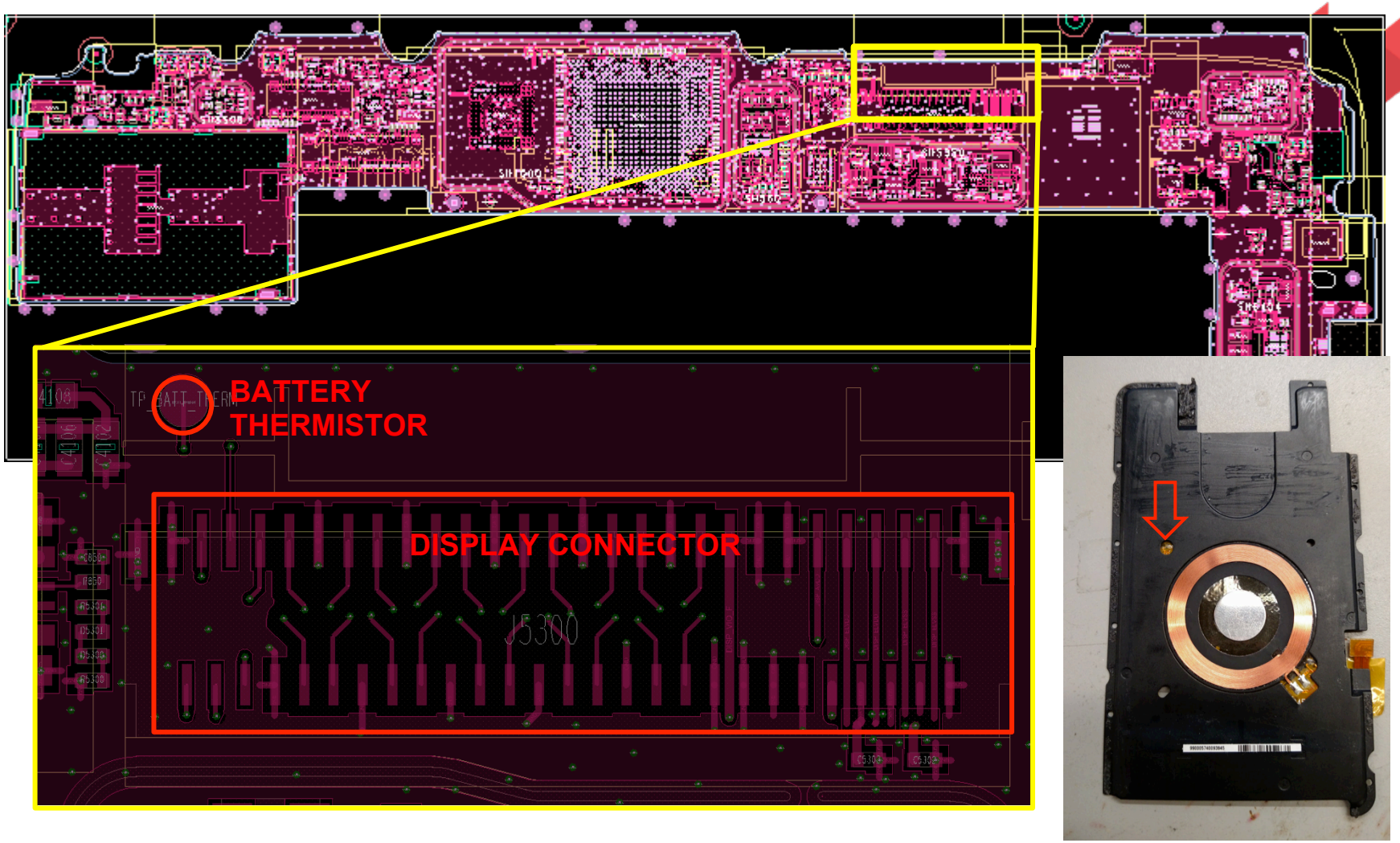
Thermistor reading out of spec:

- Thermistor usually reads between 20 to 30C, depending on ambient temperature and if device has been in use or charging. This can be read with adb commands or under “Battery Info” in CQA mode.
- Notify the mechanical engineer in charge of the battery and thermistor to inspect the rear housing of device for any signs of thermistor damage.
- X-ray the NFC connector to ensure that it is seated properly and shorts/debris are/is not present
- Carefully measure the thermistor resistance with a meter. Take care not to apply unnecessary pressure on the device so that condition can be preserved for analysis. If the measurement is not between 8-12Kohms, hand the device as is to the mechanical engineer for further analysis and corrective action.

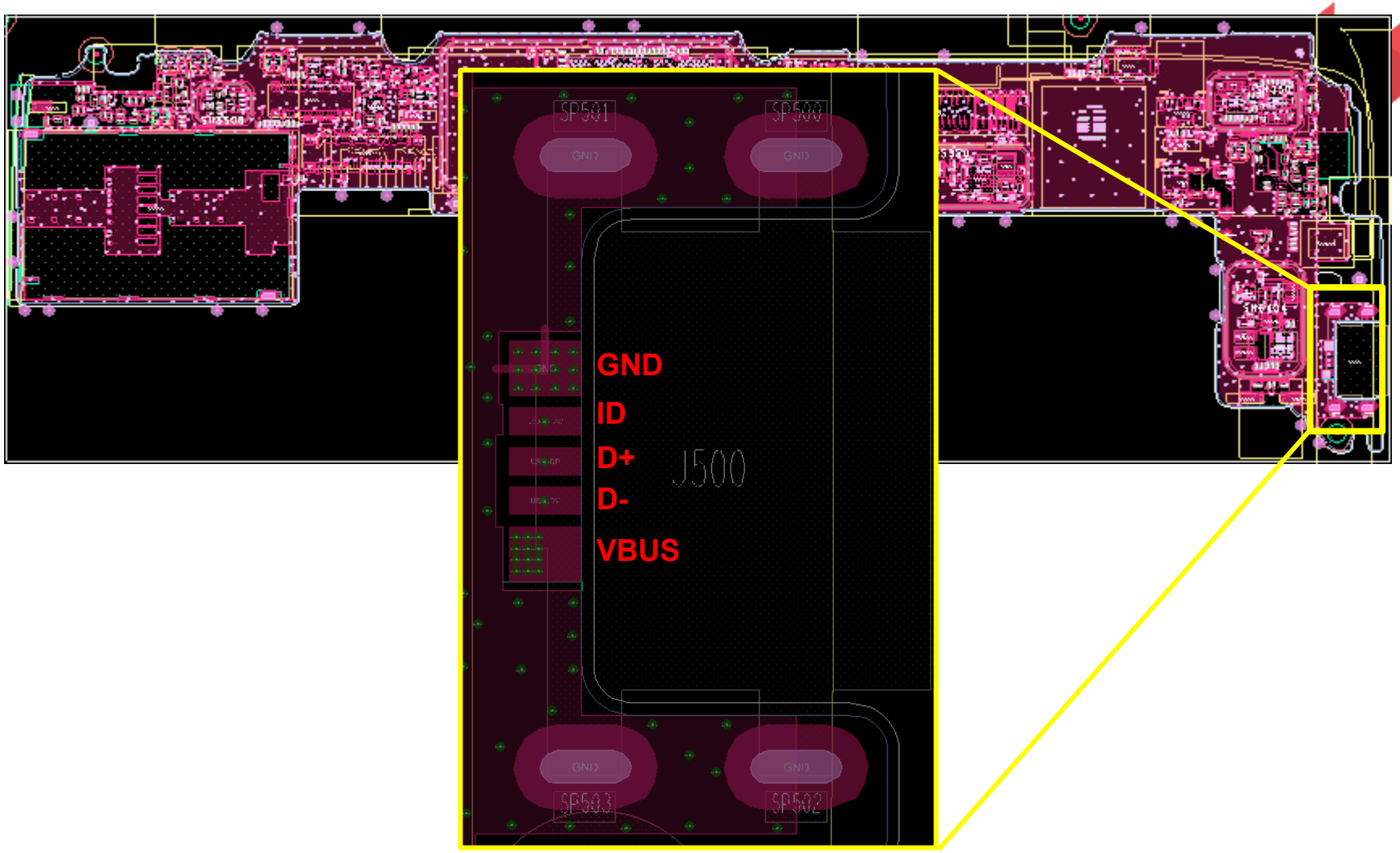
Battery Connector – Location and Test Points



Thermistor – Location and Test Point



USB Connector - Pinout



USB Charging Issue

Ensure the device is not in factory mode. Ensure battery temperature reading is as expected (between 20-30C). If the battery temperature reads cold (-20C), the NFC flex is disconnected and the thermistor is not present. If the battery temperature reads hot (>60C), the thermistor lines are shorted.

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 turbocharger), D+, D-, and ID (2V). 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 turbocharger 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

If the ID voltage is low (mV), with 5V on VBUS with no charger connected, the device is in host mode. When the device is in this mode, it will not charge. Measure the resistance of ID to GND. If it is less than 100Kohms, there is a short to GND on the line. Replace VR502.

USB Charging Issue (cont'd)

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

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 and discussing with development team.

Wireless Charging Issue

A device's failure to wirelessly charge generally goes hand in hand with failure to charge via USB.

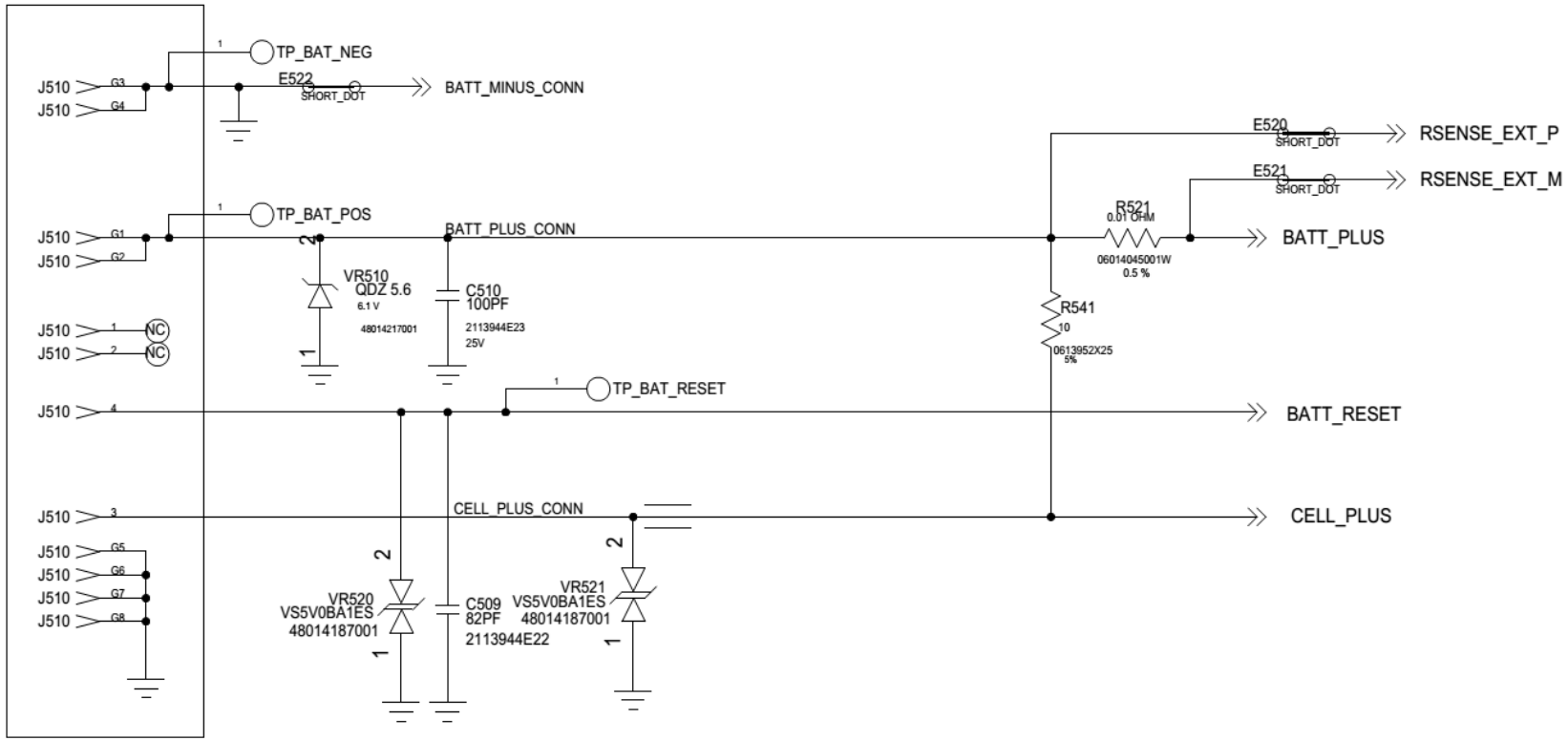
Ensure the device is not in factory mode. Ensure battery temperature reading is as expected (between 20-30C). If the battery temperature reads cold (-20C), the NFC flex is disconnected. If the battery temperature reads hot (>60C), the thermistor lines are shorted.

If the NFC flex is disconnected, no USB nor wireless charging will occur. If the NFC flex is connected, but wireless charging is not occurring, inspect the flex tail. A tear on the inner side of the flex tail where it makes a 90 degree turn, would sever the wireless charging coil trace and disconnects the coil from the board. Replace the flex.

Battery Components

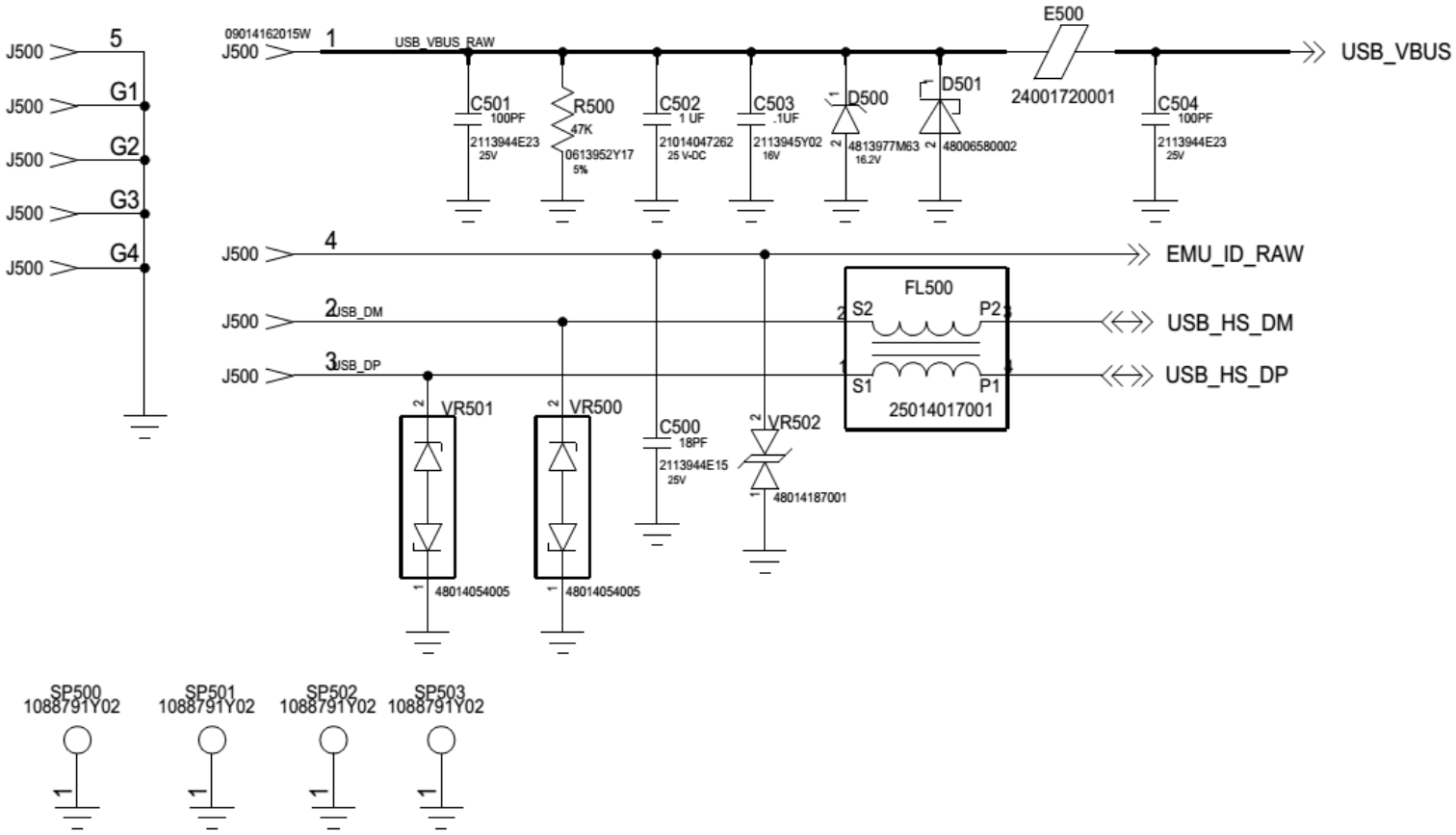
BATTERY BLOCK

CONNECTOR P/N: 09014099001W



USB Components

MICRO USB



Debug Procedure: Battery Level

If battery level reads 0%:

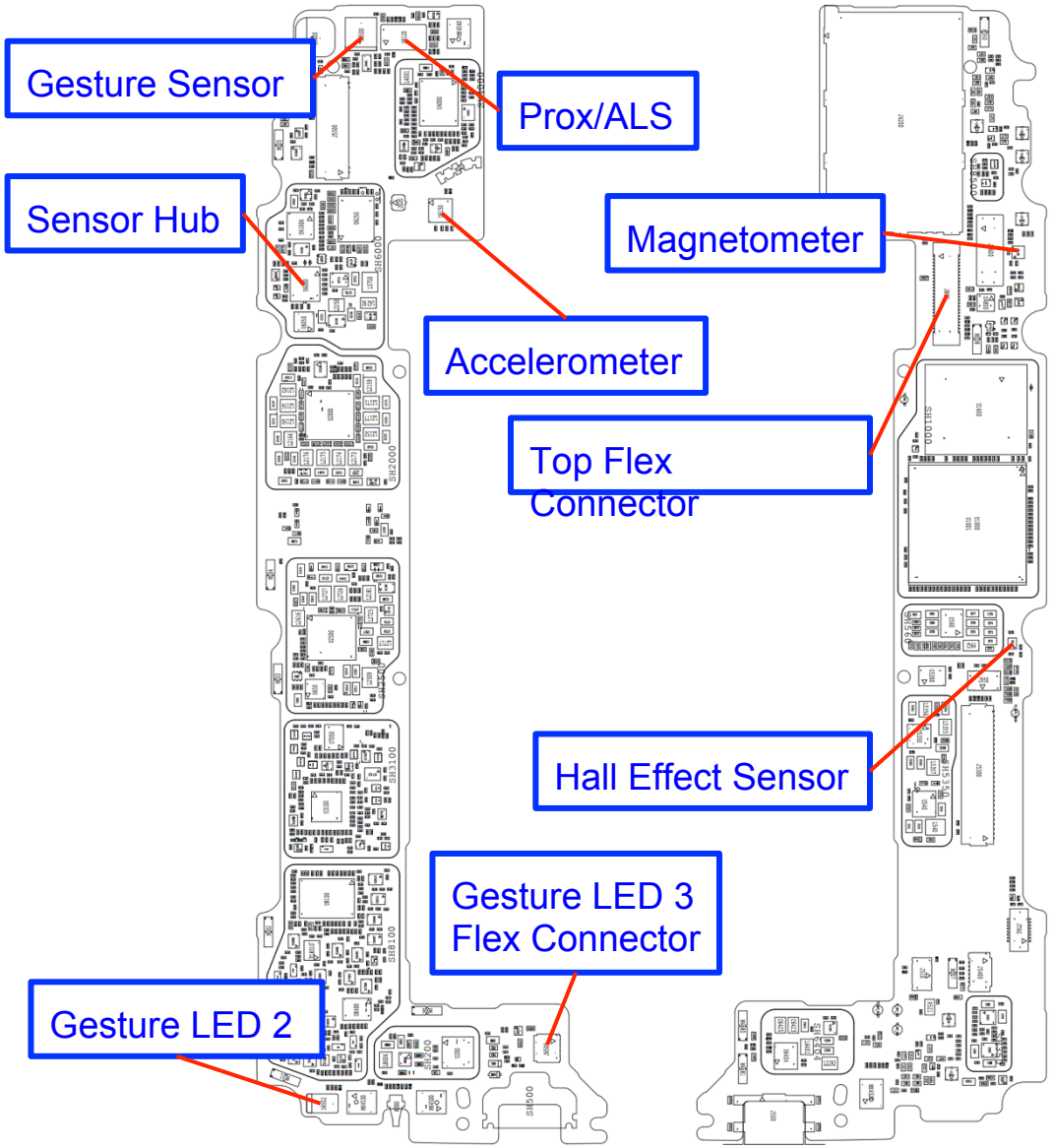
- Unplug factory cable, wait at least 3 seconds, then plug the cable back in.
- If this does not work, try plugging in a charger. If battery level is below 3V, SOC LED will blink. The blinking will stop when battery is above 3V, at which time soon after, phone will power into Charge Only Mode, and vibrate before displaying a battery logo.
- If charge level is 1% or higher, leave on charger until 100%.

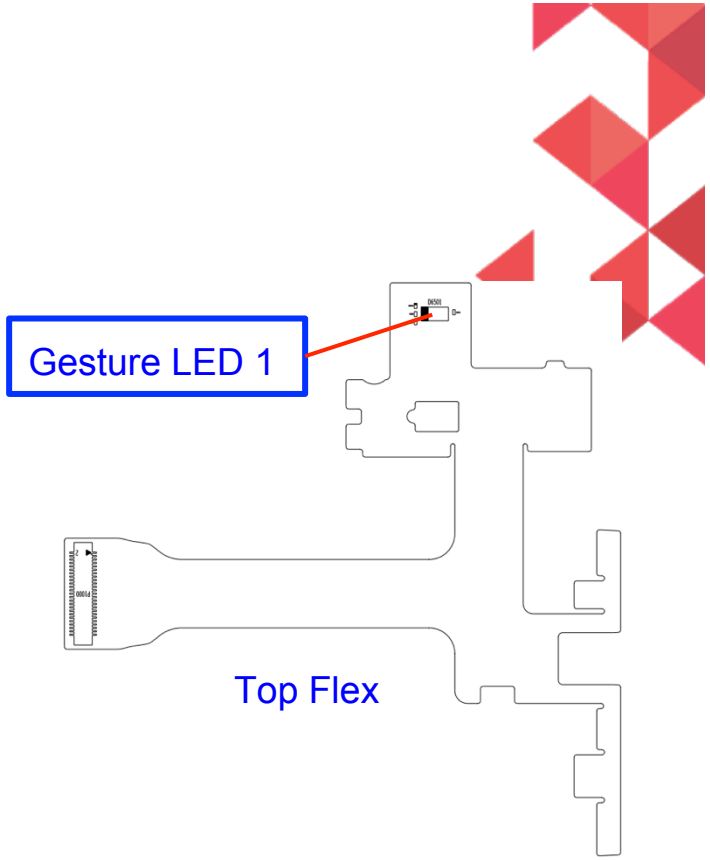
If battery level is too low, but 1% or higher:

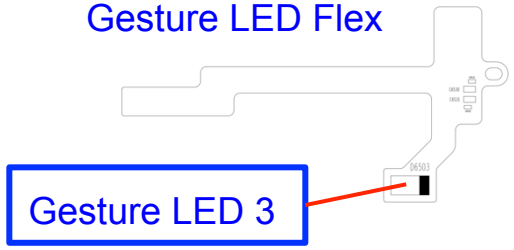
- Plug in charge and leave until 100% full.

SENSORS AND SIM TROUBLESHOOTING

Sensors


Gesture Sensor
Prox/ALS
Sensor Hub
Magnetometer
Accelerometer
Top Flex Connector
Hall Effect Sensor
Gesture LED 3 Flex Connector
Gesture LED 2


Gesture LED 1
Top Flex


Gesture LED Flex
Gesture LED 3

Sensor Hub Troubleshooting

- Firmware download failing/no communication with hub
  - Check U6000 supply at C6000 - Should be 1.8V
  - Check U6000 orientation
  - If everything else looks good, try replacing U6000

- If sensor hub is continuously rebooting
  - Check accelerometer (covered later)

Proximity Sensor Troubleshooting

- Proximity Sensor is part U6120.

- If reading is failing:
  - Check black grommet in housing is not obscuring the top of the part
  - Verify voltage at C6122 is between 3.3 to 4.35 V
  - Try replacing replacing the part

- If no reading at all:
  - Verify part orientation
  - Verify voltage at C6121 is 2.85V
  - Verify voltage at R6000 and R6001 is 1.8V
    - If voltage is missing try replacing U6120, U6000, or U2000 in that order

Ambient Light Sensor (ALS) Troubleshooting

- ALS Sensor is the same part as Proximity Sensor (U6120).

- If reading is failing:
  - Check black grommet in housing is not obscuring the top of the part
  - Inspect opening in lens. It should be translucent when holding front housing up to a light. Try swapping front housings.
  - Try replacing U6120
  - Test on different fixture, bulbs in fixture may be too old and dim.

- If no reading at all (error code):
  - Check part orientation of U6120
  - Verify voltage at C6121 is 2.85V
  - Verify voltage at R6000 and R6001 is 1.8V
    - If voltage is missing try replacing U6120, U6000, or U2000 in that order

Accelerometer Troubleshooting

- Accelerometer is part U6150.

- If no reading:
  - Verify U6150 orientation
  - Verify voltage at C6151 is 1.8V
  - Replace U6150 or possibly U6000 or U2000

- If reading is failing:
  - Replace U6150, likely damaged accelerometer part

Gyroscope Troubleshooting

- Gyroscope is part U6150 (same part as accelerometer).

- If no reading:
  - Verify U6150 orientation
  - Verify voltage at C6151 is 1.8V
  - Replace U6150 or possibly U6000 or U2000

- If reading is failing:
  - Replace U6150, likely damaged accelerometer part

Magnetometer Troubleshooting

- Magnetometer Part is U6140.

- If no reading:
  - Verify U6140 orientation
  - Verify voltage at C6141 is 1.8V
  - Replace U6140, if still not fixed try replacing U6150, then possibly U6000

- If reading is failing:
  - Replace U6140, likely damaged magnetometer part.
  - Test at board level if radio level testing is failing to determine if magnetic component in the housing is somehow affecting readings.

Hall Effect Sensor Troubleshooting

- Hall Effect Part is U6170.

- If no toggling:
  - Verify U6170 orientation
  - Verify voltage at C6175 is 1.8V
  - Make sure U6000 is placed and oriented correctly
  - Replace U6170, likely damaged hall effect part.
  - Can also replace U6000 if failure persists

IR Gesture Sensor Troubleshooting

- IR Gesture Receiver is part D6500, LED2 is D6502, LED1 & 3 are on flexes

- If no data received:
  - Verify D6500 & U6500 orientation
  - Verify voltage at R6590 is 5V
  - Verify voltage at C6504 is 2.85 V
  - Verify voltage at C6506 is 1.6 V
  - Replace U6500, D6500, then U6000 or U2000 if not fixed

- One or more LEDs have low readings:
  - Check black grommet on housing is not obscuring the sensor or the LEDs
  - Verify LED orientation (refer to sensor location drawing)
  - Verify Q6500, Q6501, Q6502, & Q6503 orientation
  - Verify voltage on LED anode is 5V
  - If LED 2, replace LED module, if LED 1 or 3, replace entire flex (do not rework on flex)

Vibrator Troubleshooting

- Check that the vibrator motor is seated properly (correct alignment and pads are not lifted) and the counter weight is not bent and can rotate freely.
- Measure the resistance across the vibrator, it should be 14ohms +/- 4ohms.
- Check that E5101 and E5102 are not skewed or damaged.
- Check C5105, C5106, C5107 for damage or any process related defects.
- Check the motor itself by applying 2.4V across the C5105, it should spin freely and continuously. If the motor spins when 2.4V is applied externally, but not when driven from CQA app, x-ray U5101 for defects and replace as needed.

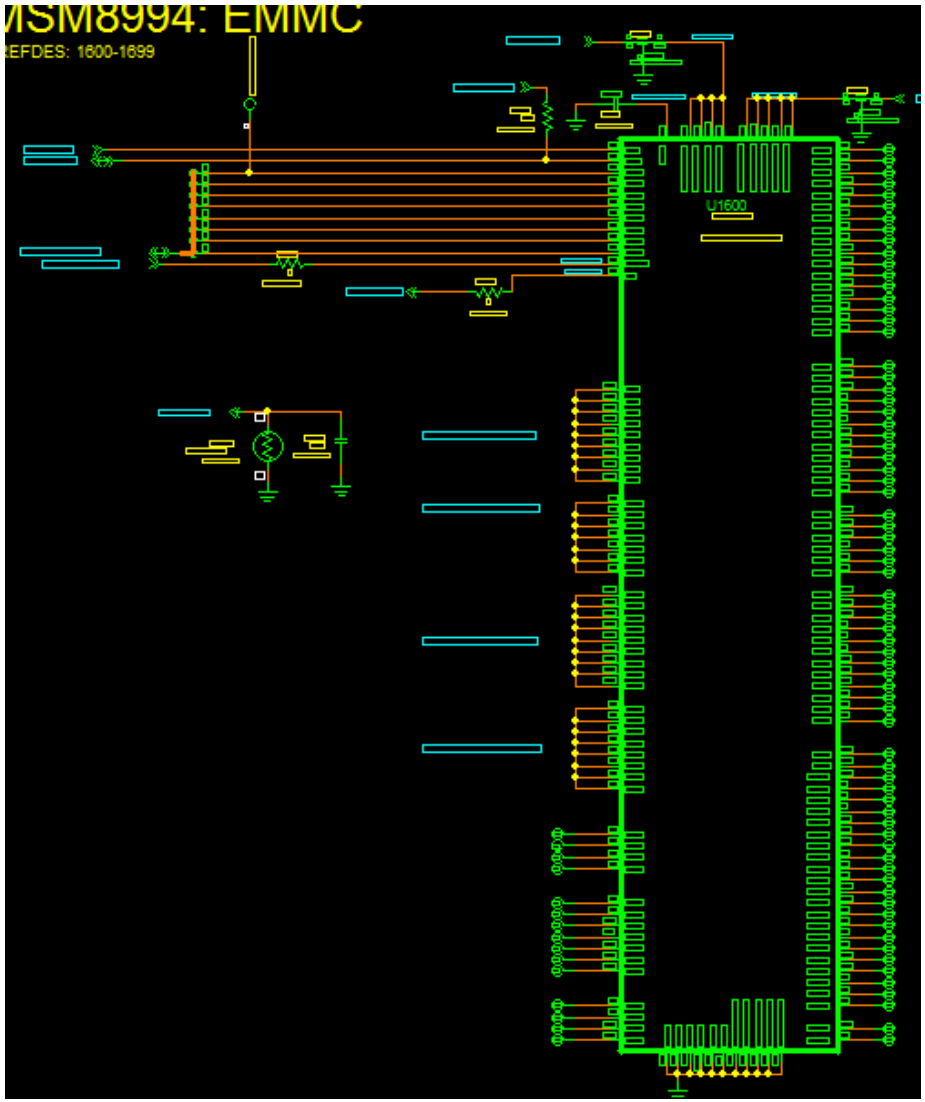
NOTE: If motor does not spin, or if motor stutters, but starts working normally after turning it manually, it has a “dead-spot”. Consider it a failure and replace the motor.

UIM (uSIM) Troubleshooting

- If SIM card errors occur:
  - Check orientation on ESD parts
    - SIM1: D5500, D5501, D5502
    - SIM2: D5510, D5511, D5512
  - Inspect card reader for bent or broken contacts.
  - Use multimeter to check connection between gold SIM contacts and pins on back of connector.
  - Verify a 0V voltage on Pin “tray_det” (C5803) when card is removed.
  - Verify 1.8 Volts on Pin “tray_det” (C5803) when card is inserted.
  - Check for unexpected shorts to ground on M5801 and M5802 pins 1, 2, 3, 6 (factory cable, USB, and battery must be removed).
  - SIM1 - Verify R5502, R5503, and R5505 are placed
  - SIM2 - Verify R5510, R5512, and R5513 are placed

PROCESSOR AND MEMORY TROUBLESHOOTING

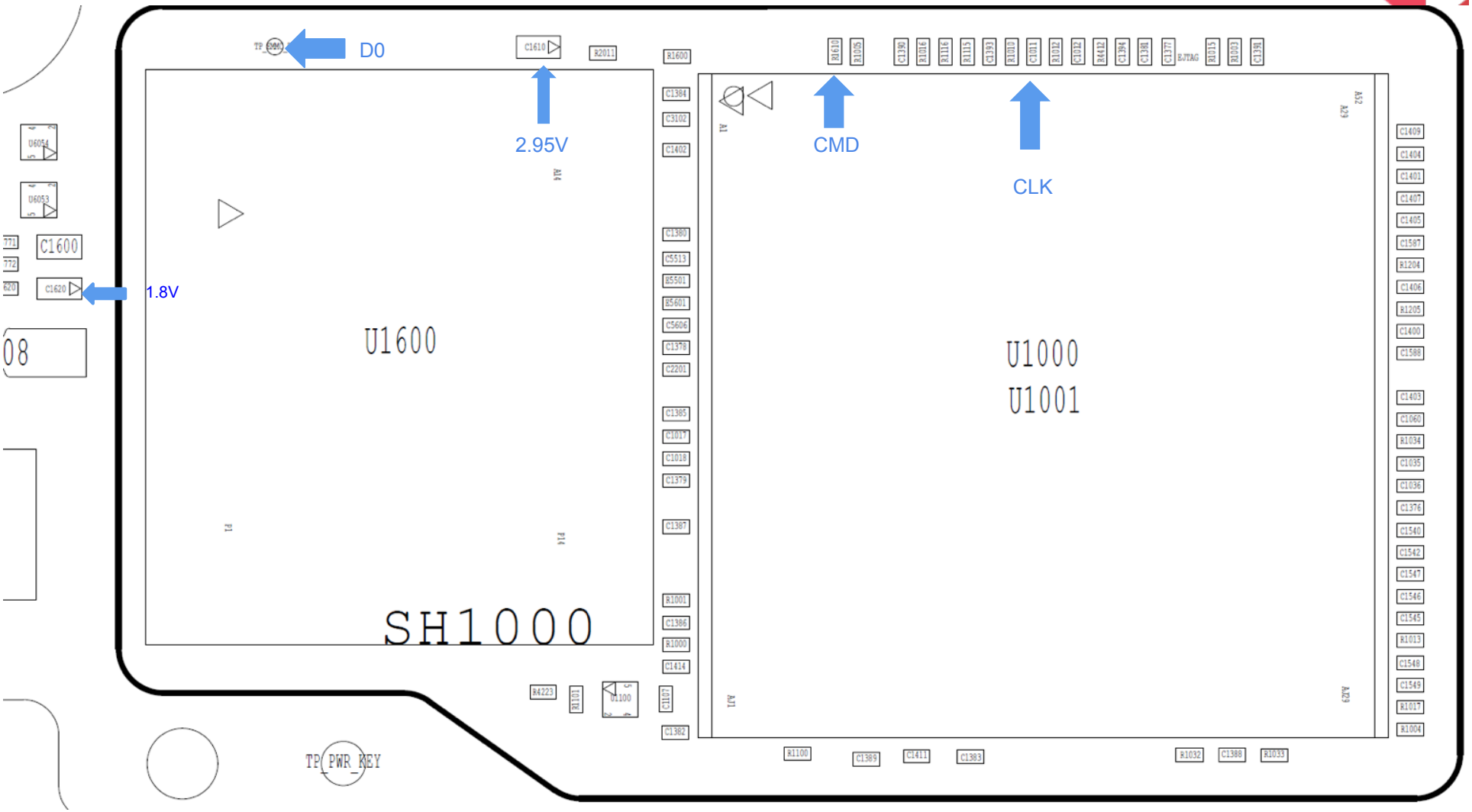
EMMC (Internal NAND)



If the phone is stuck at the logo screen or does not power up completely or keeps enumerating in blank flash mode then EMMC component could be suspected:

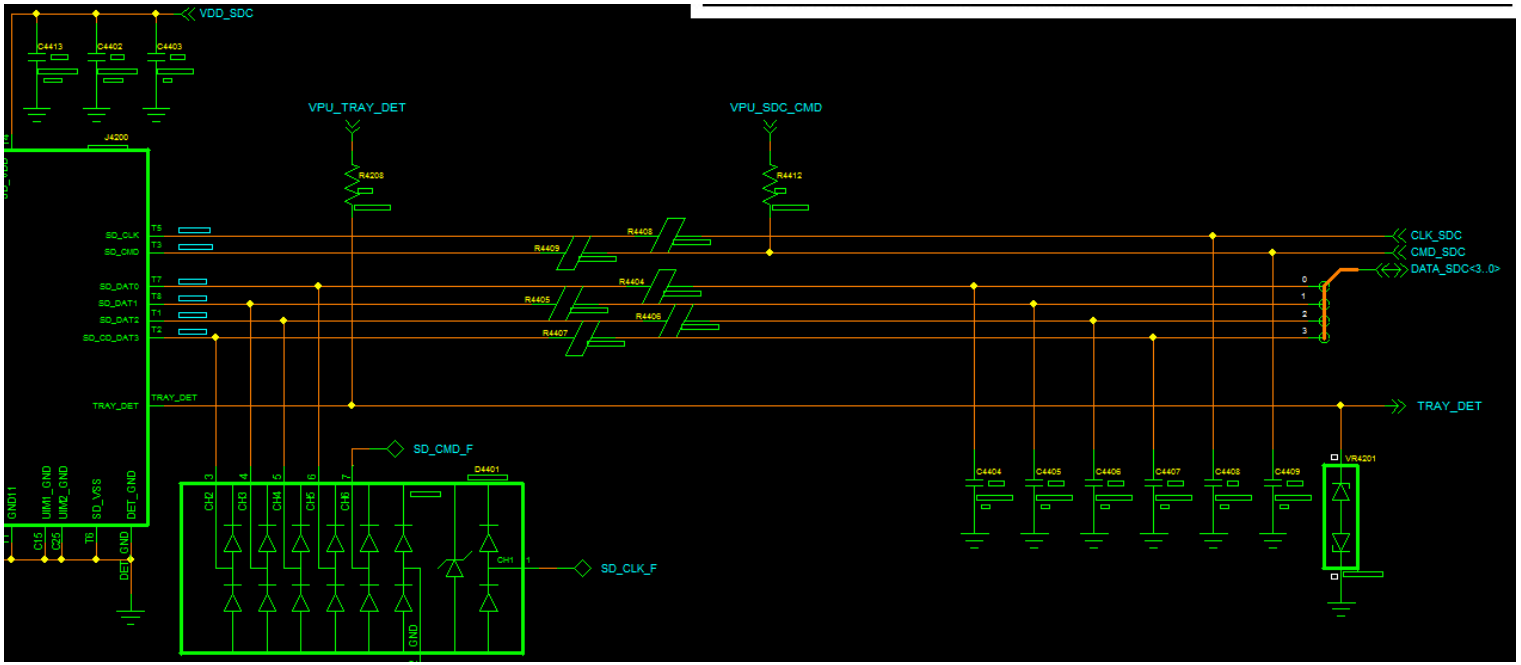
1. Check the 1.8V, 2.95V supplies
   2.95V accessible at C1610
   1.8V accessible at C1620
2. Probe the EMMC_CLK line to measure 400Khz first and then maximum of 177MHz.
   EMMC_CLK accessible at C1011 or R1010
3. Wire our command and data lines along with clock and put it on the scope. If the command does not output the command information then the EMMC controller inside the chip could be corrupted.
   CMD accessible at R1610
   D0 accessible at test point
4. Note down lot code and date code.
5. Try user reset (hold power key for 10secs) and restart the procedure.
6. If it still fails X-ray the board and reflow the part.
7. If it still continues to fail, the part might need to go back to supplier.

EMMC Probe Locations (Bottom Side)

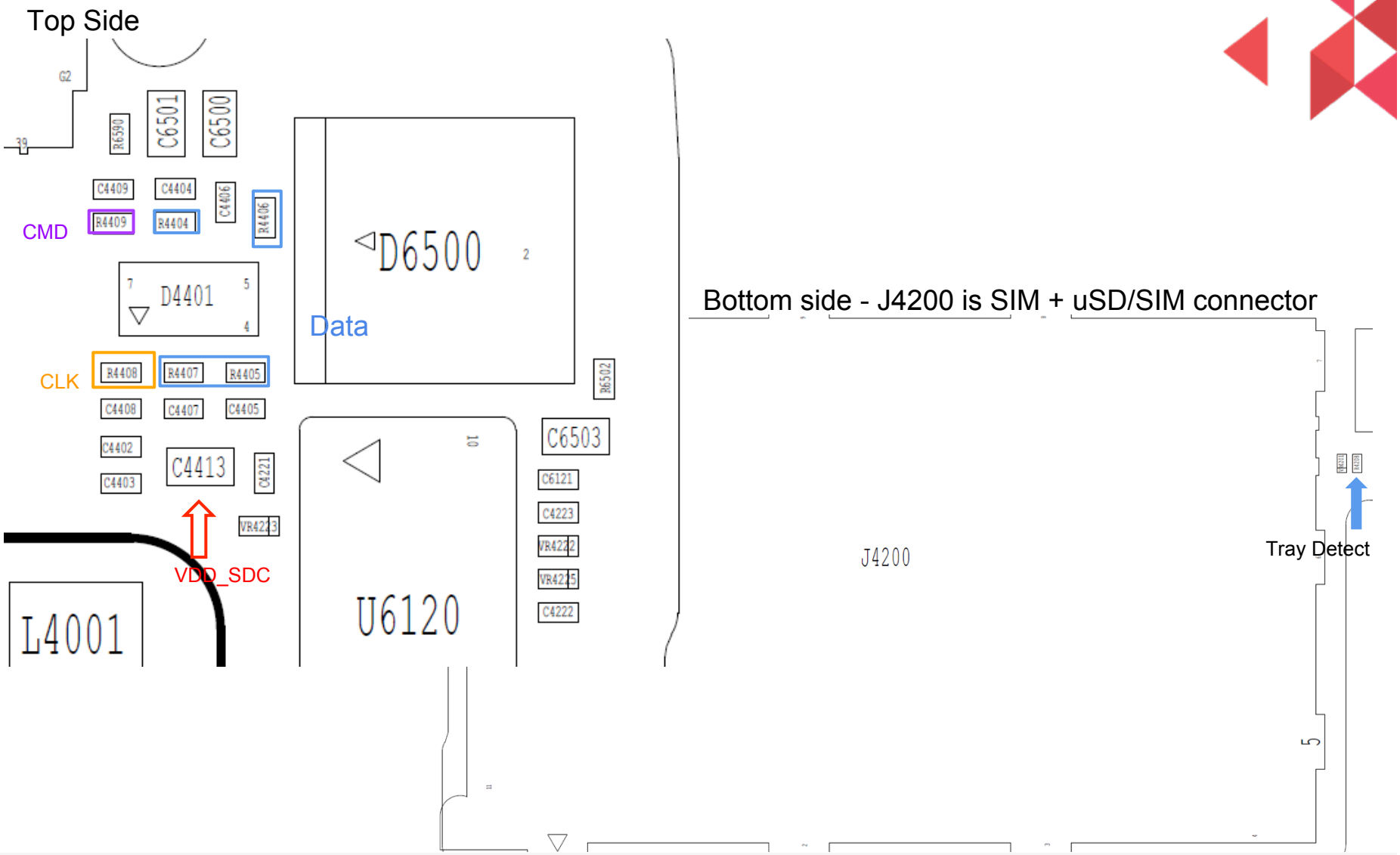


Micro SDCard (Removable Memory)

1. Tray Det (accessible at R4208) should be low when a tray is not present and high when a tray is present. If R4208 is high and no tray is present, the Detect pin on J4200 is most likely unsoldered
2. Measure supplies VDD_SDC (at C4413), VDD_P2 (at R4412) Both supplies can toggle between 3 and 1.8V
3. R4404-R4409 should all be placed. These are series components on CLK, CMD and DATA. Be sure to probe both sides of the part.
4. Depending on the type of card placed in the slot you can measure sdc2_clk as 12.5MHz, 25MHz, 50MHz, 100MHz, 200MHz during a read or write operation.
   CLK accessible at R4408
5. Probe SDC2_DATA<3..0>, SDC2_CMD to ensure there is activity on the bus. Start with Data0. R4404-R4407 is data and R4409 is CMD.
6. If any line is held low then measure the voltage across the ESD diodes placed on all data and detect line to ensure you read 0.7V confirming its not shorted to ground.

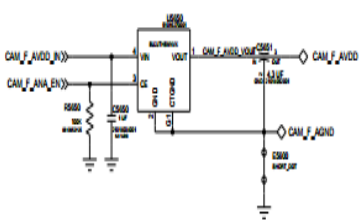


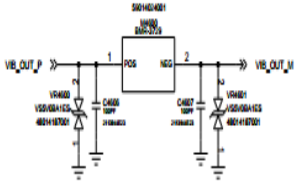
Micro SDCard Probe Points

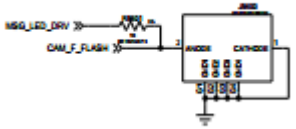


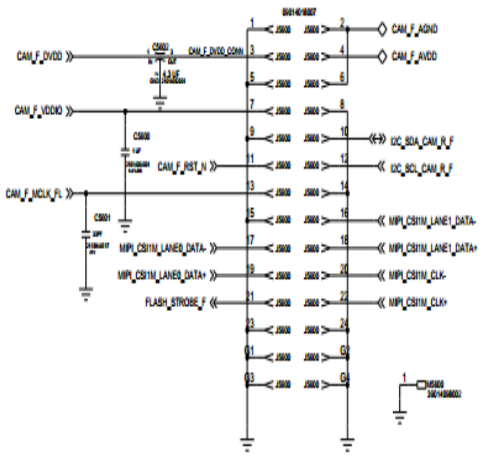
CAMERA TROUBLESHOOTING

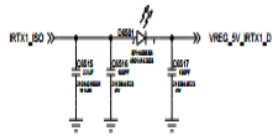
Front Imager Schematic

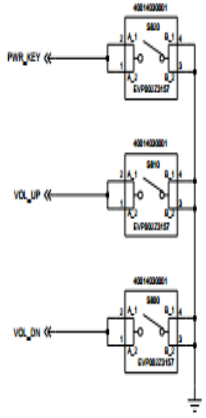




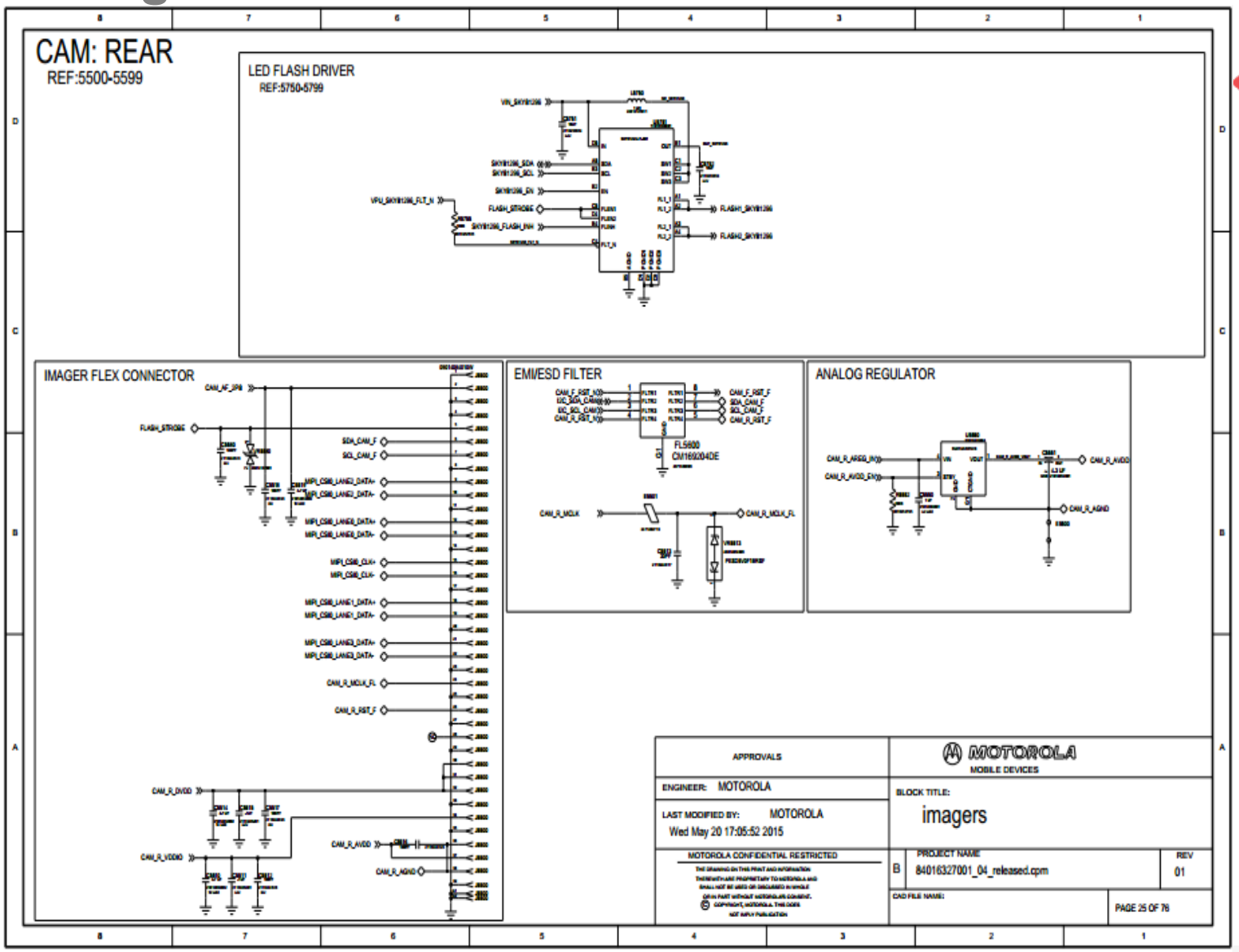




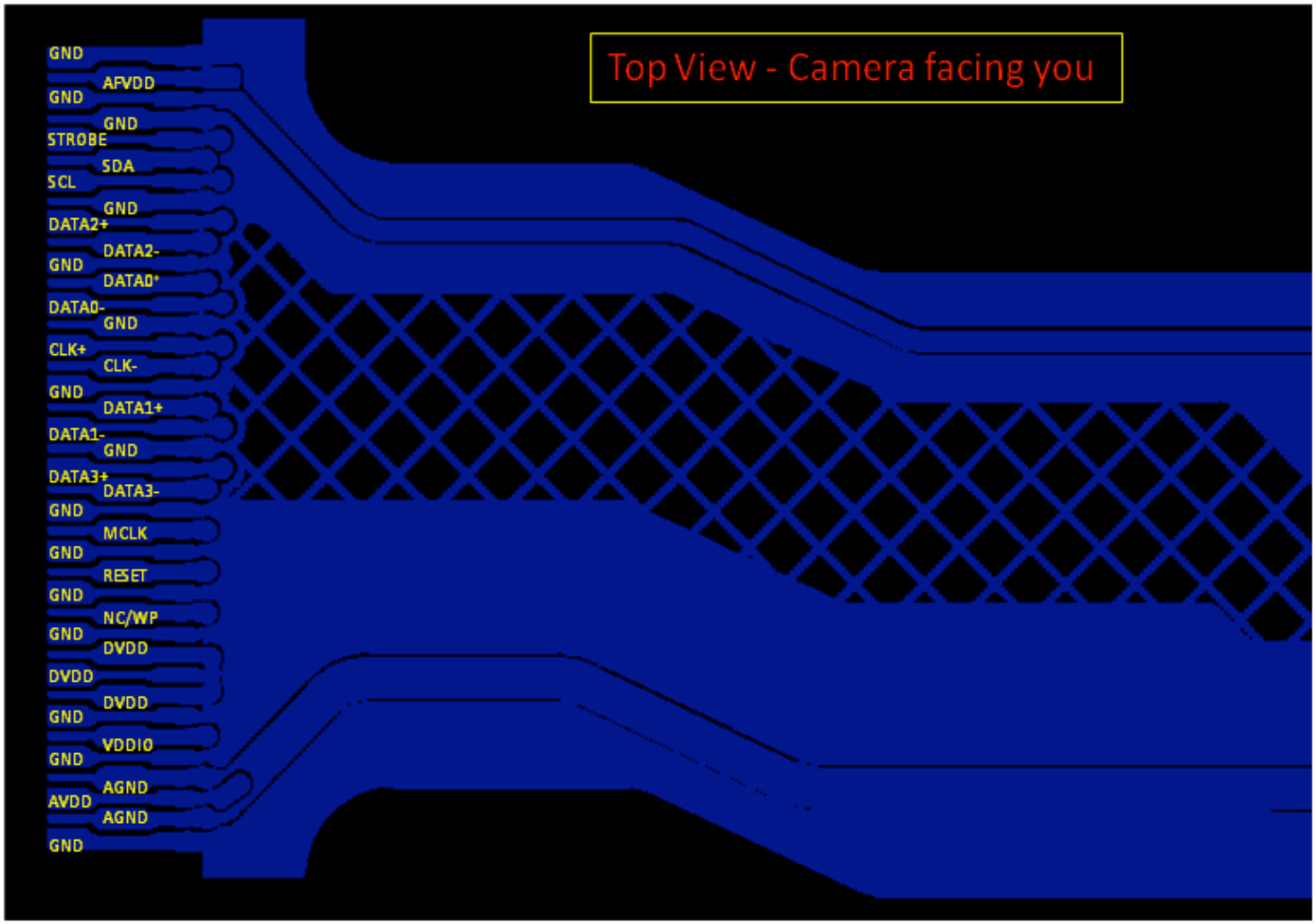




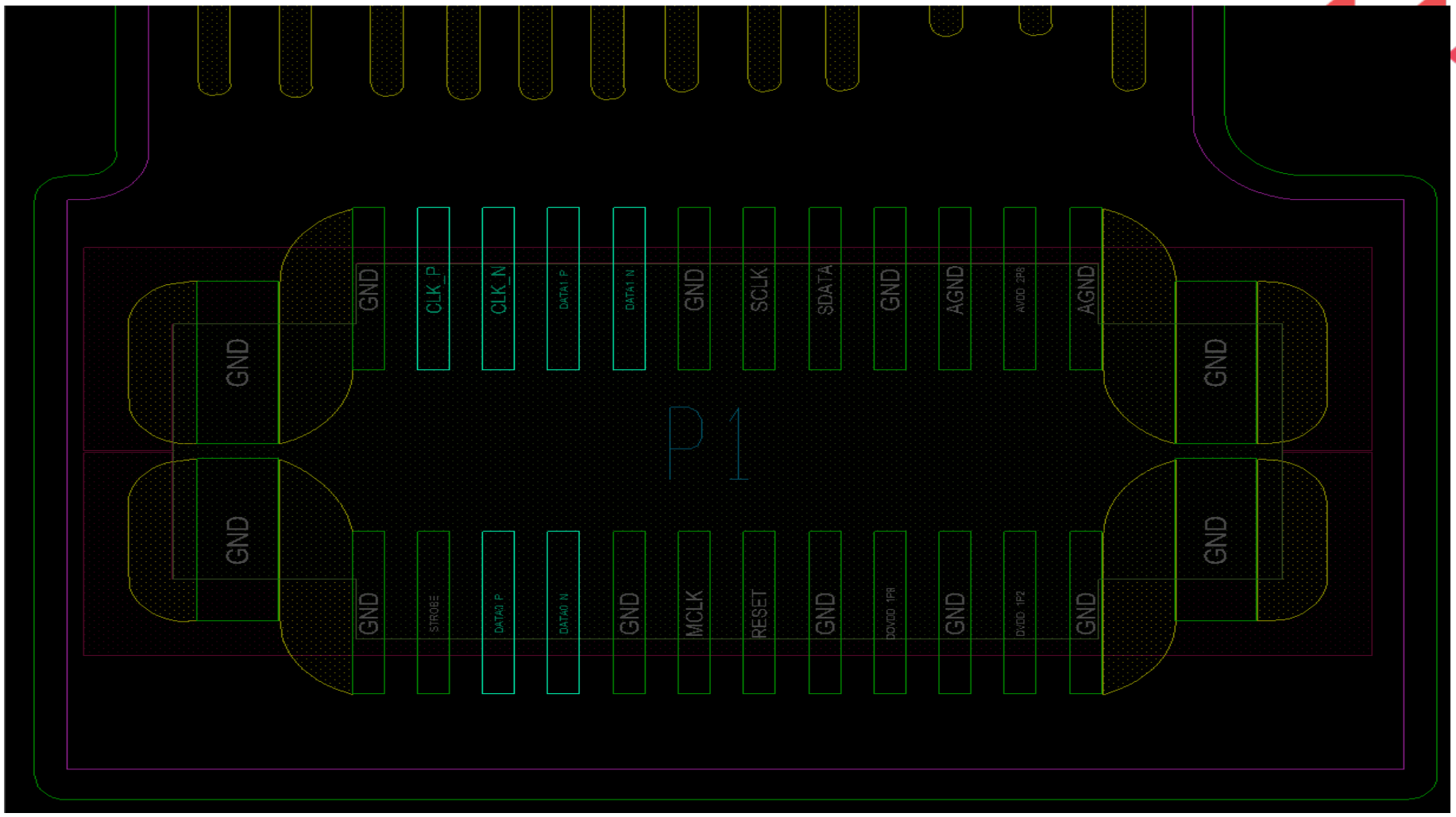
Rear Imager/Flash LED Schematic



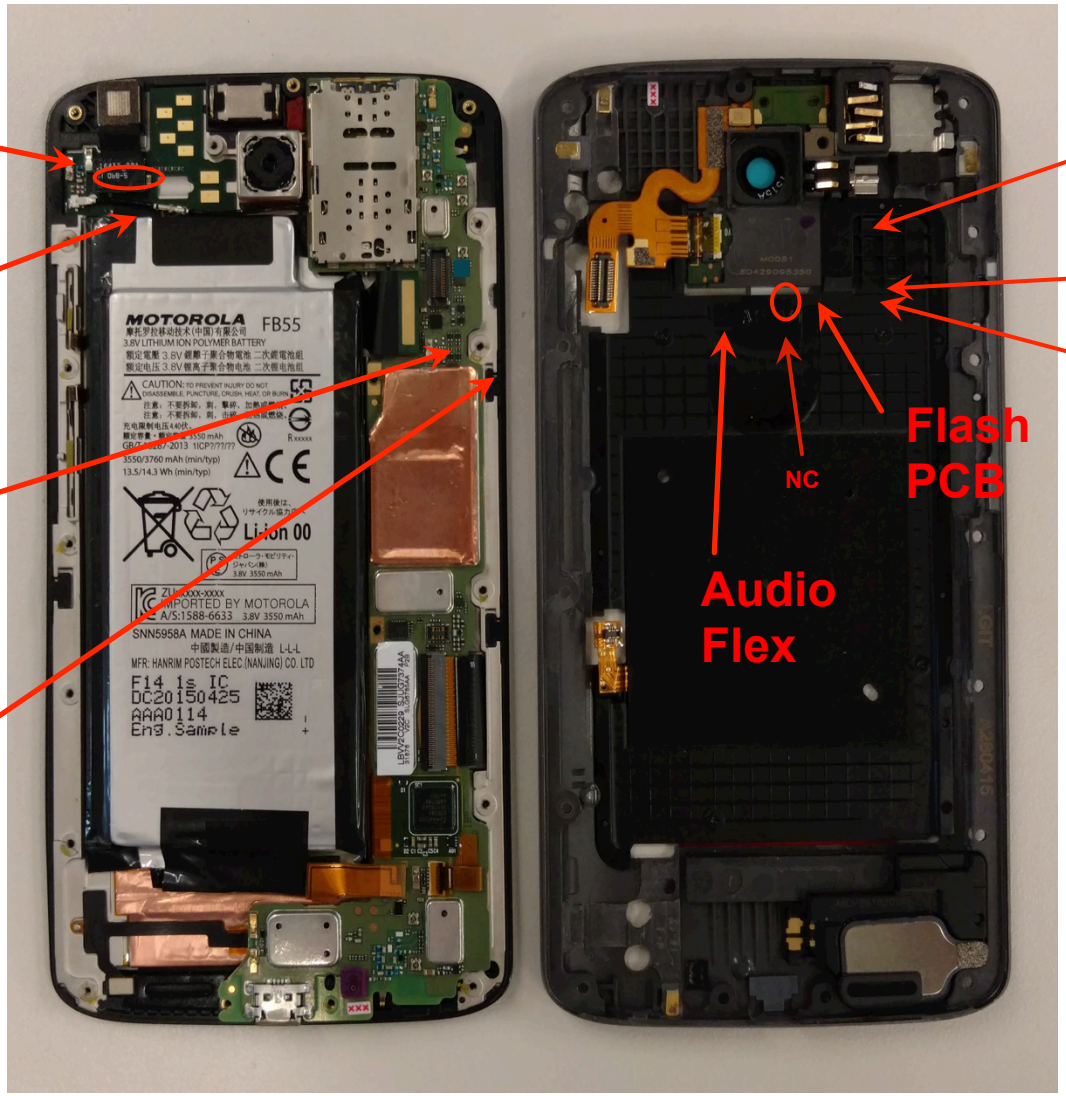
Camera Pinout – Rear (camera pointed at you)



Camera Pinout – Front (camera pointed at you)

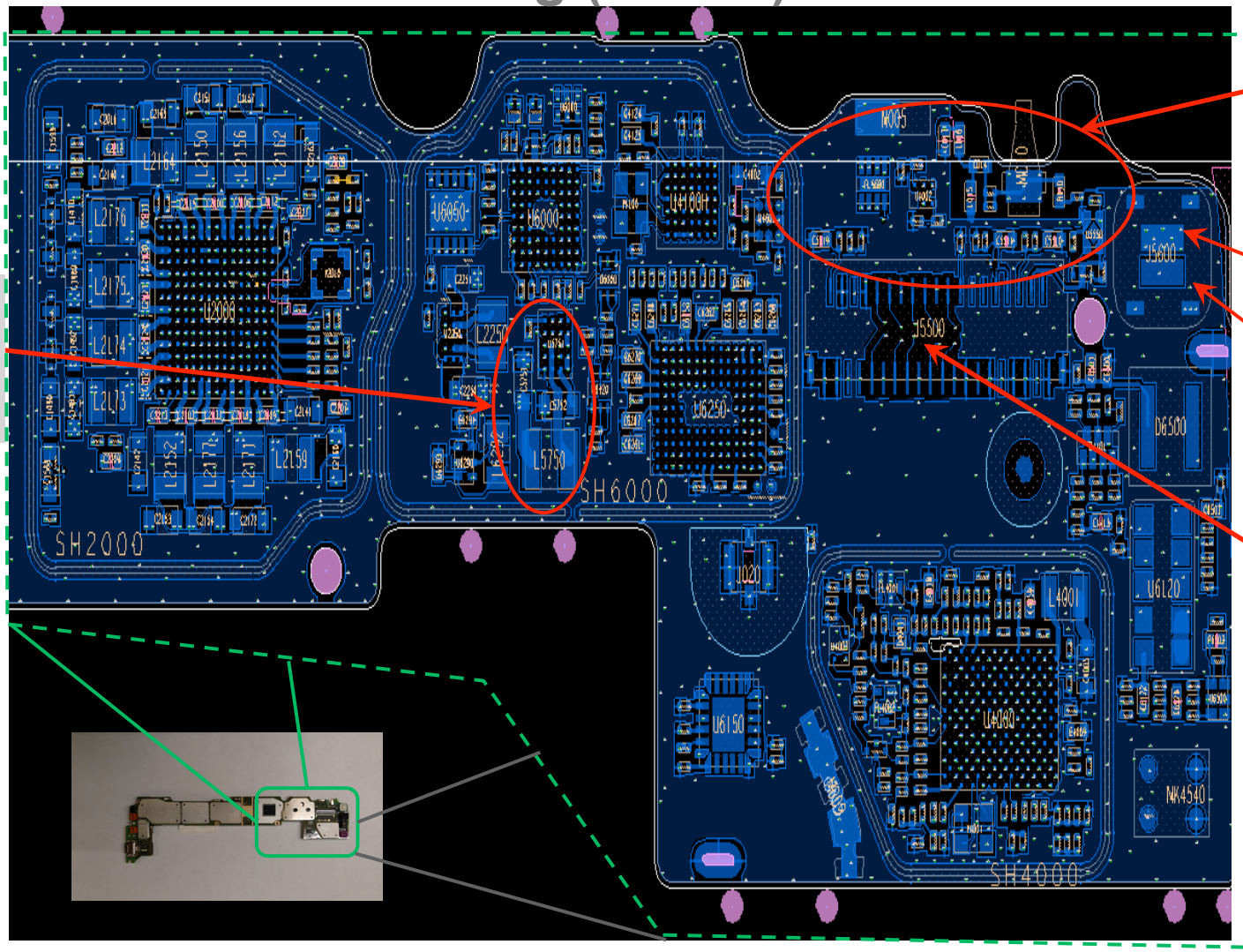


Camera Troubleshooting



If camera does not turn on, change camera module. If camera still does not power on, then it is likely an issue on main PCB.

Camera Troubleshooting (cont'd)



LED Flash circuit

Rear Camera circuit

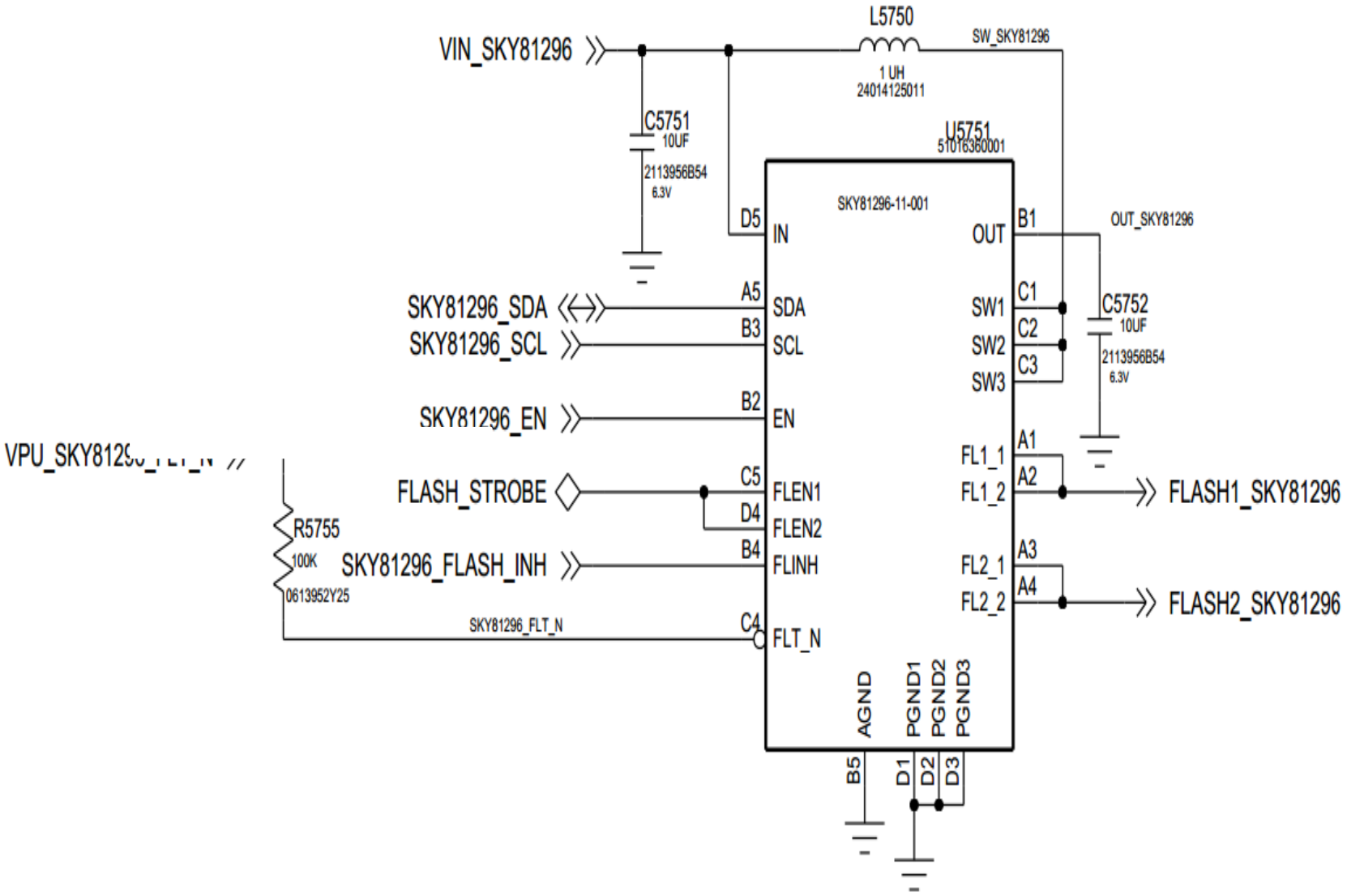
Front flash LED cathode

Front flash LED anode

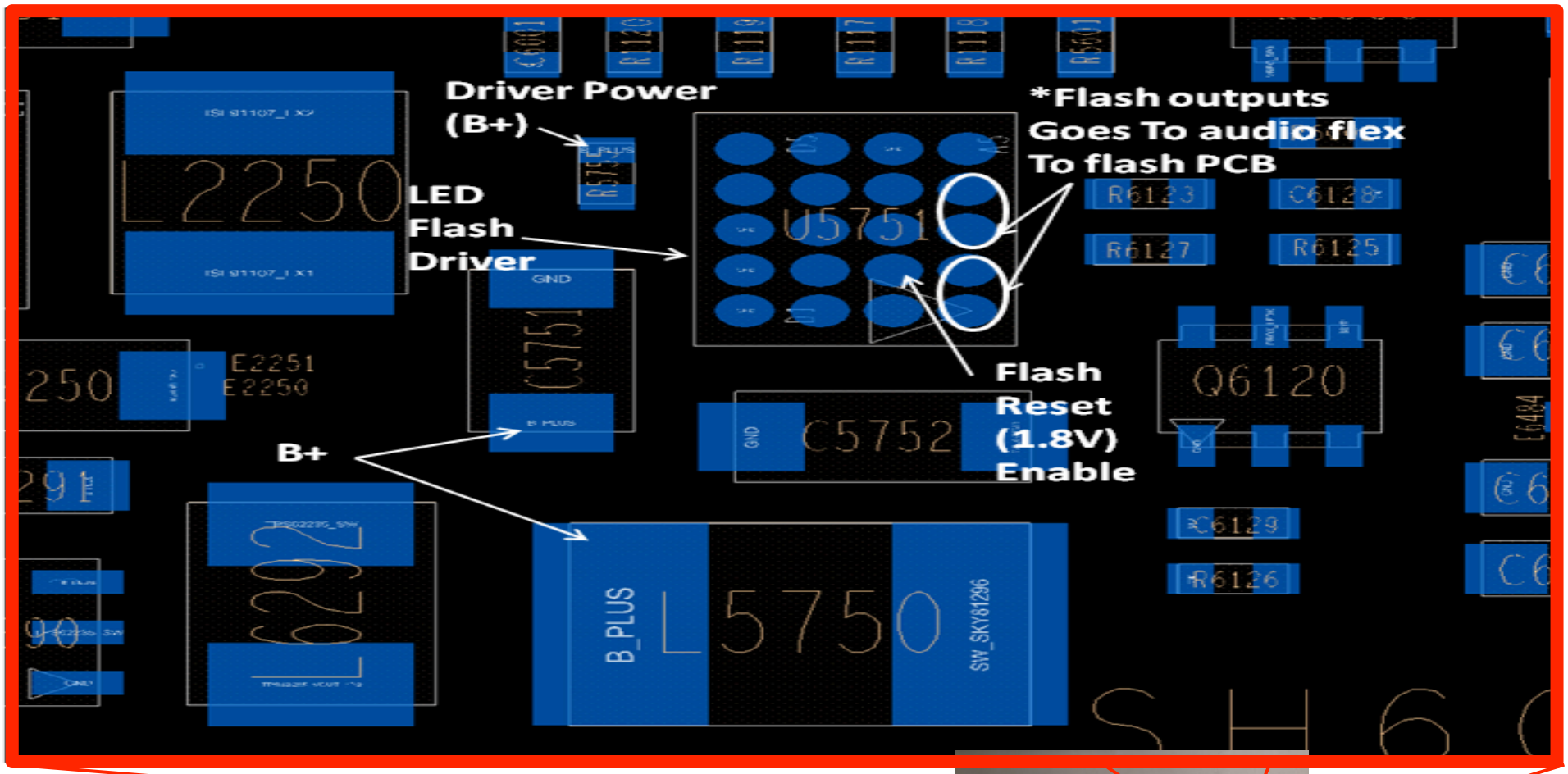
Rear imager connector

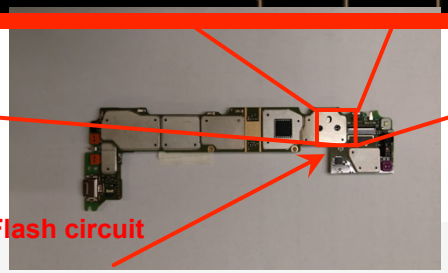
If camera does not turn on, change camera module. If camera still does not power on, then it is likely an issue on main PCB.

LED Flash Schematic



LED Flash Layout

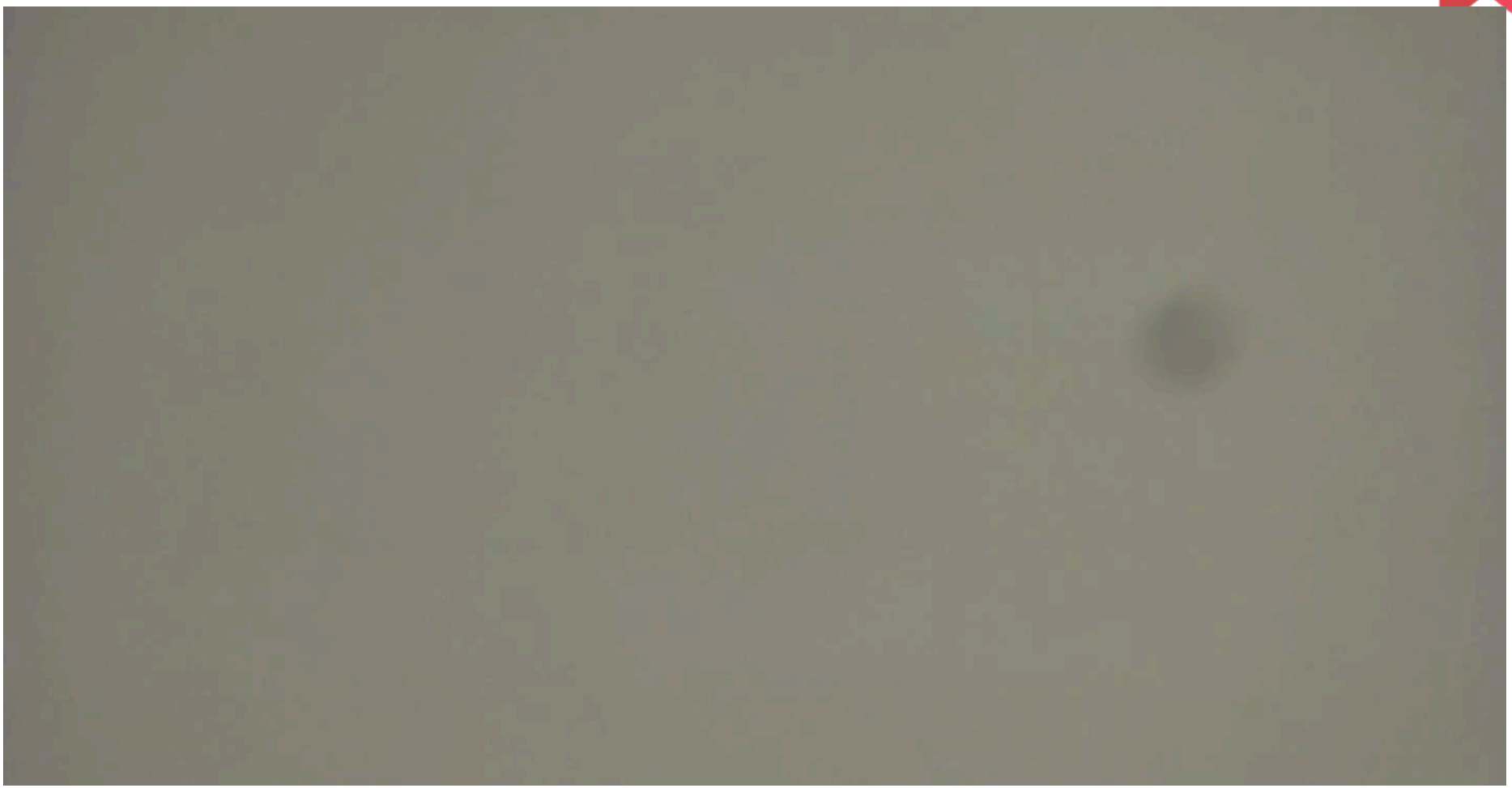




LED Flash circuit

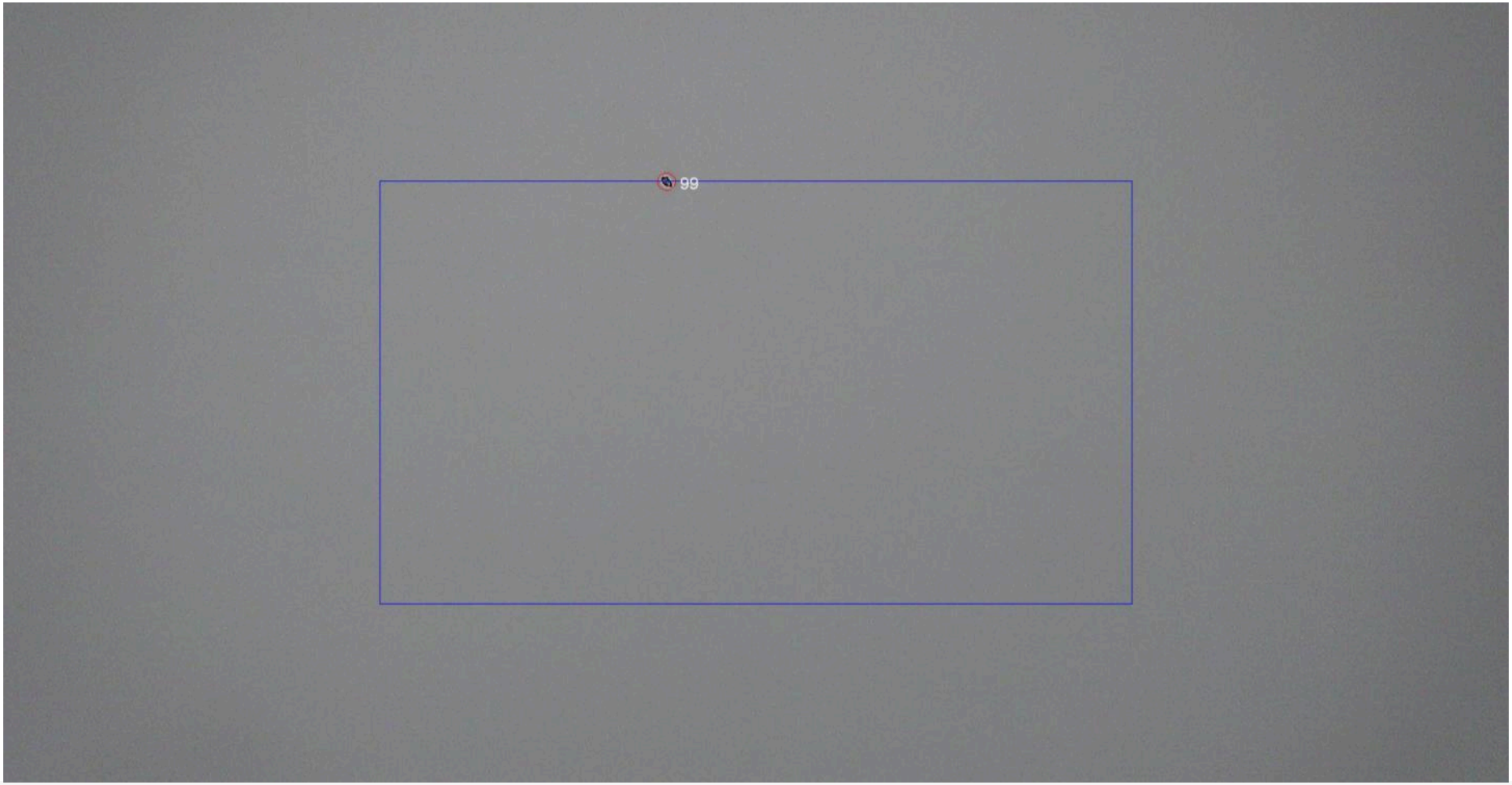
Blemish Example #1

Blemish failure due to FM. This FM is most likely beneath the lens.



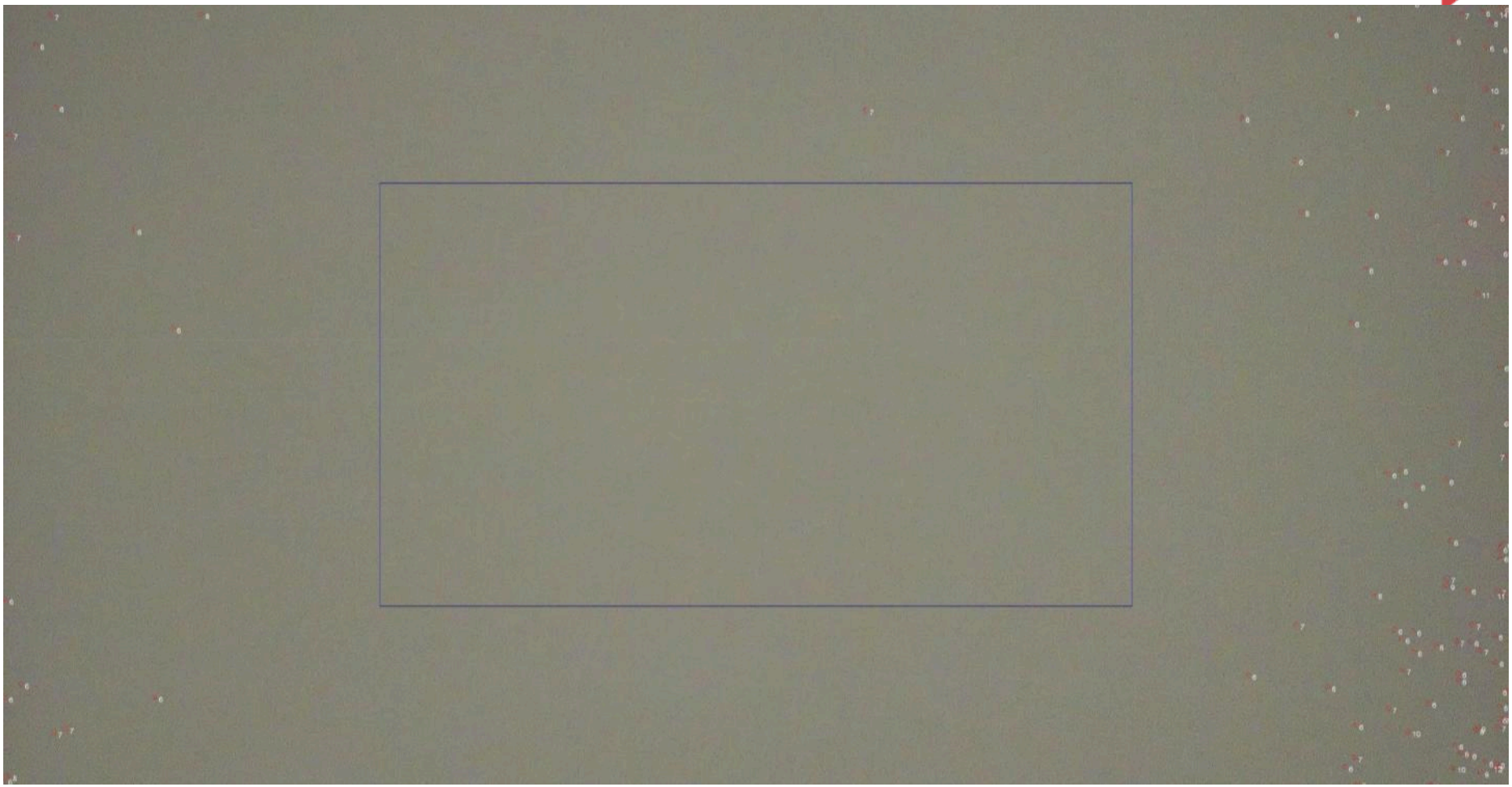
Blemish Example #2

Blemish failure due to FM. The blue box and red circle are part of the annotated



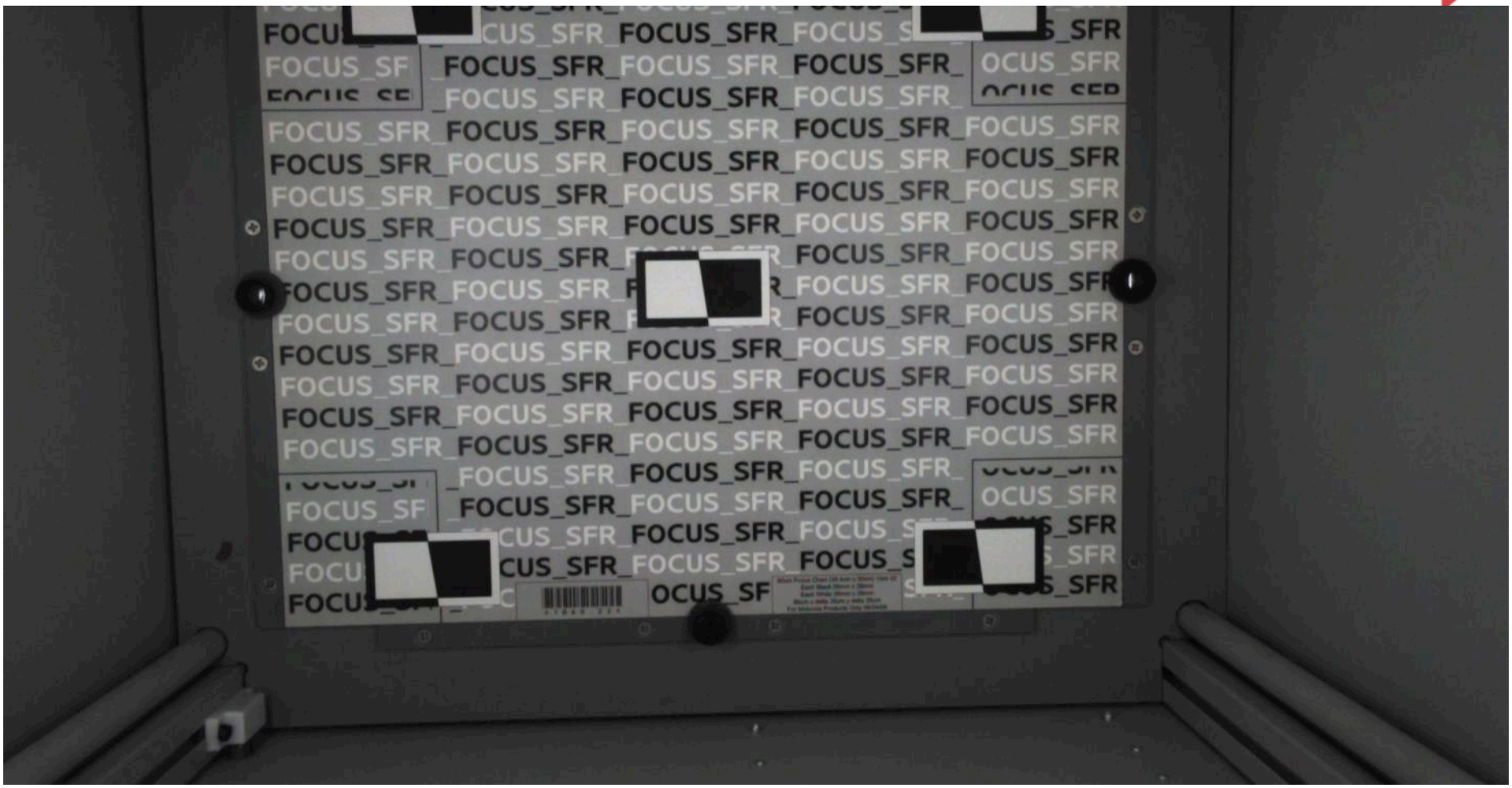
Blemish Example #3

Blemish failure due to noise. There are no particles or lens defects in this module, but the noise is so bad that it is getting mistaken for blemishes. This is most likely a problem with the sensor.



Placement Error Example

This picture shows a really severe case of the focus chart not being centered within the camera's view. This case is most likely caused by operator error when placing the phone into the test chamber.



Focus Error Example

The top side of this image is blurry. This will most likely be a problem with the lens placement inside the module.