Moto Z Play (Droid)/Moto Z Play Baseband Trouble Shooting Guide

V1.0

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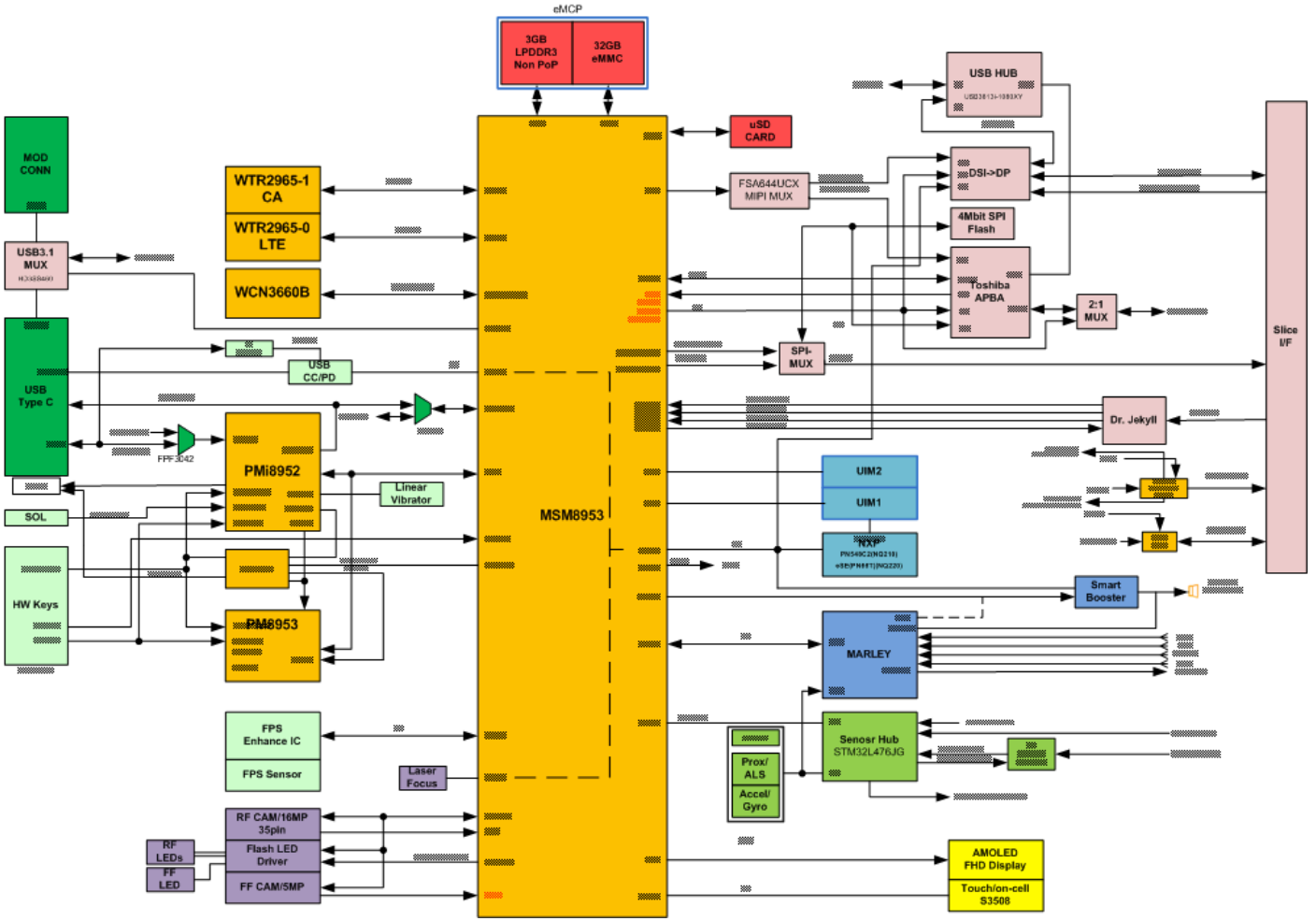
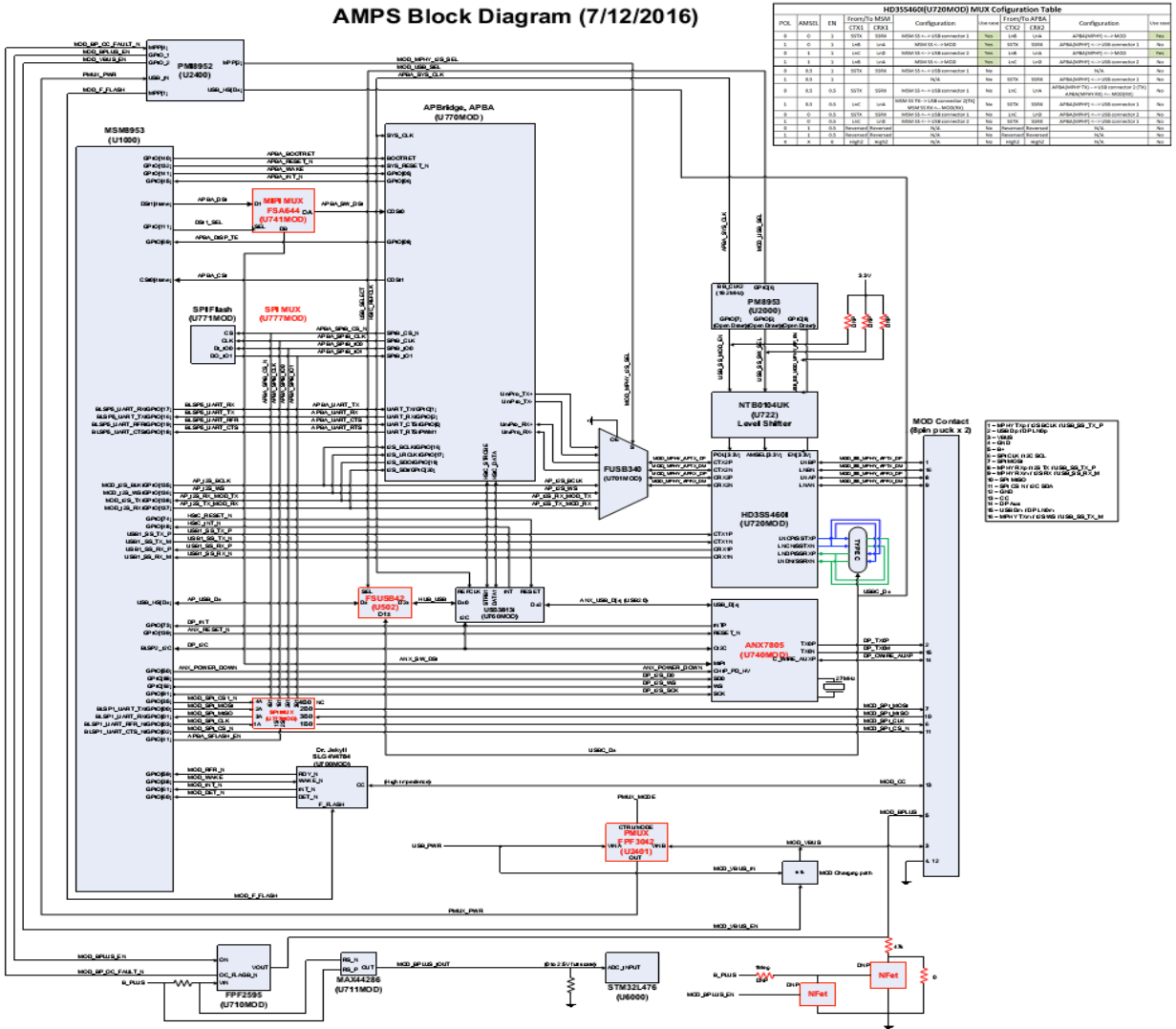
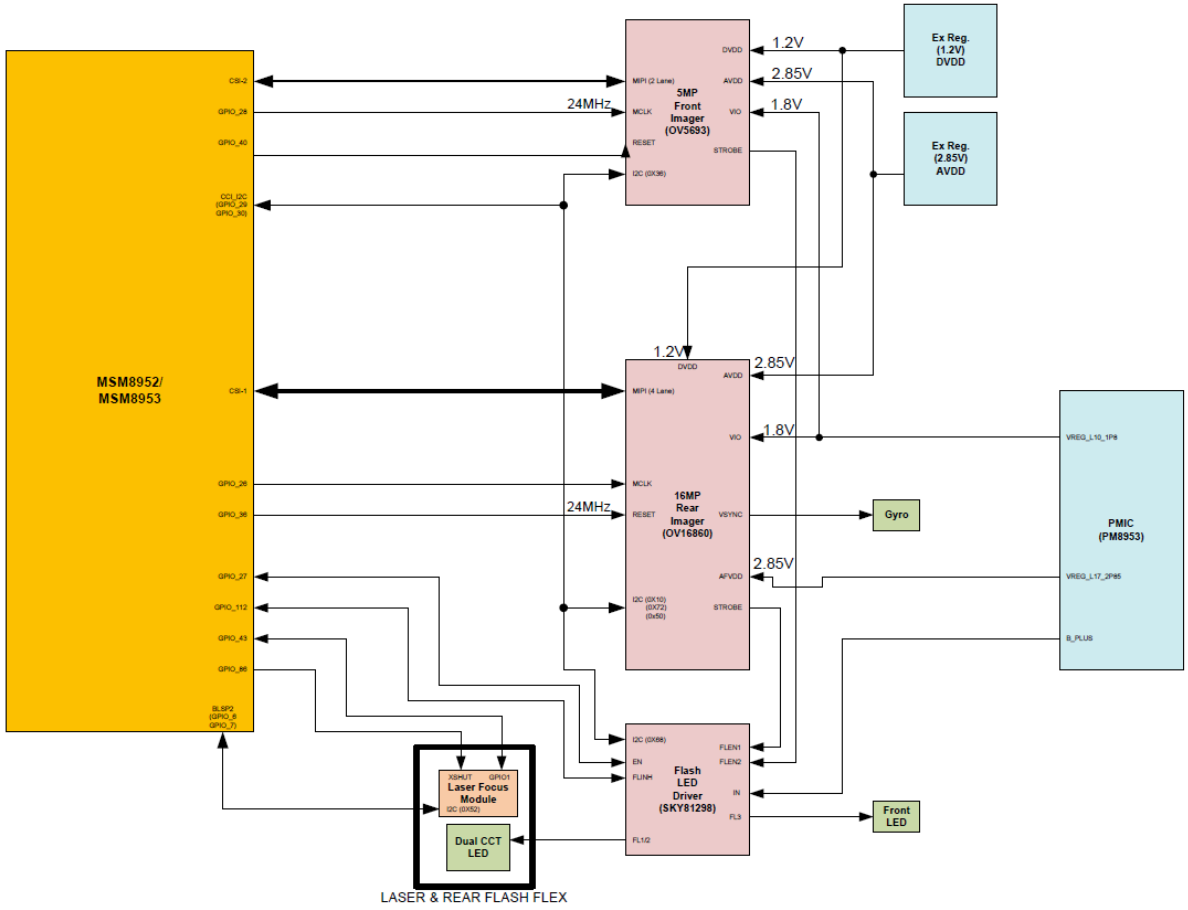
BLOCK DIAGRAM


eMCP
3GB LPDDR3 Non PoP
32GB eMMC
MSM8953
MOD CONN
USB3.1 MUX
USB Type C
SOL
HW Keys
WTR2965-1 CA
WTR2965-0 LTE
WCN3660B
USB CC/PD
FPF3042
PMi8952
PM8953
Linear Vibrator
FPS Enhance IC
FPS Sensor
Laser Focus
RF CAM/16MP 35pin
Flash LED Driver
FF CAM/5MP
RF LEDs
FF LED
uSD CARD
FSA644UCX MIPI MUX
SPI-MUX
USB HUB
DSI->DP
4Mbit SPI Flash
Toshiba APBA
2:1 MUX
Slice I/F
Dr. Jekyll
UIM2
UIM1
NXP
Smart Booster
MARLEY
Senosr Hub STM32L476JG
Prox/ ALS
Accel/ Gyro
AMOLED FHD Display
Touch/on-cell S3508

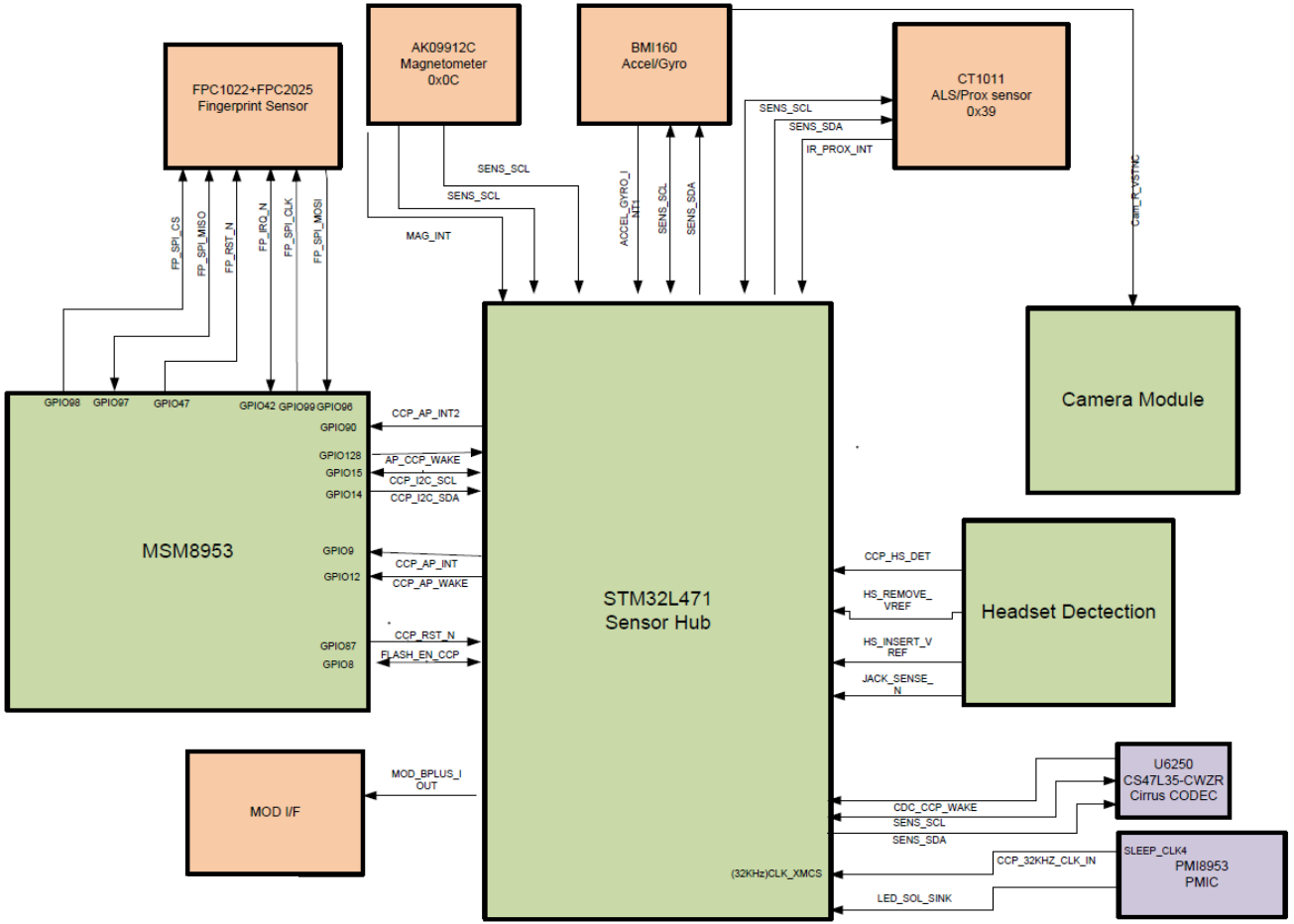
AMPS Block Diagram (7/12/2016)



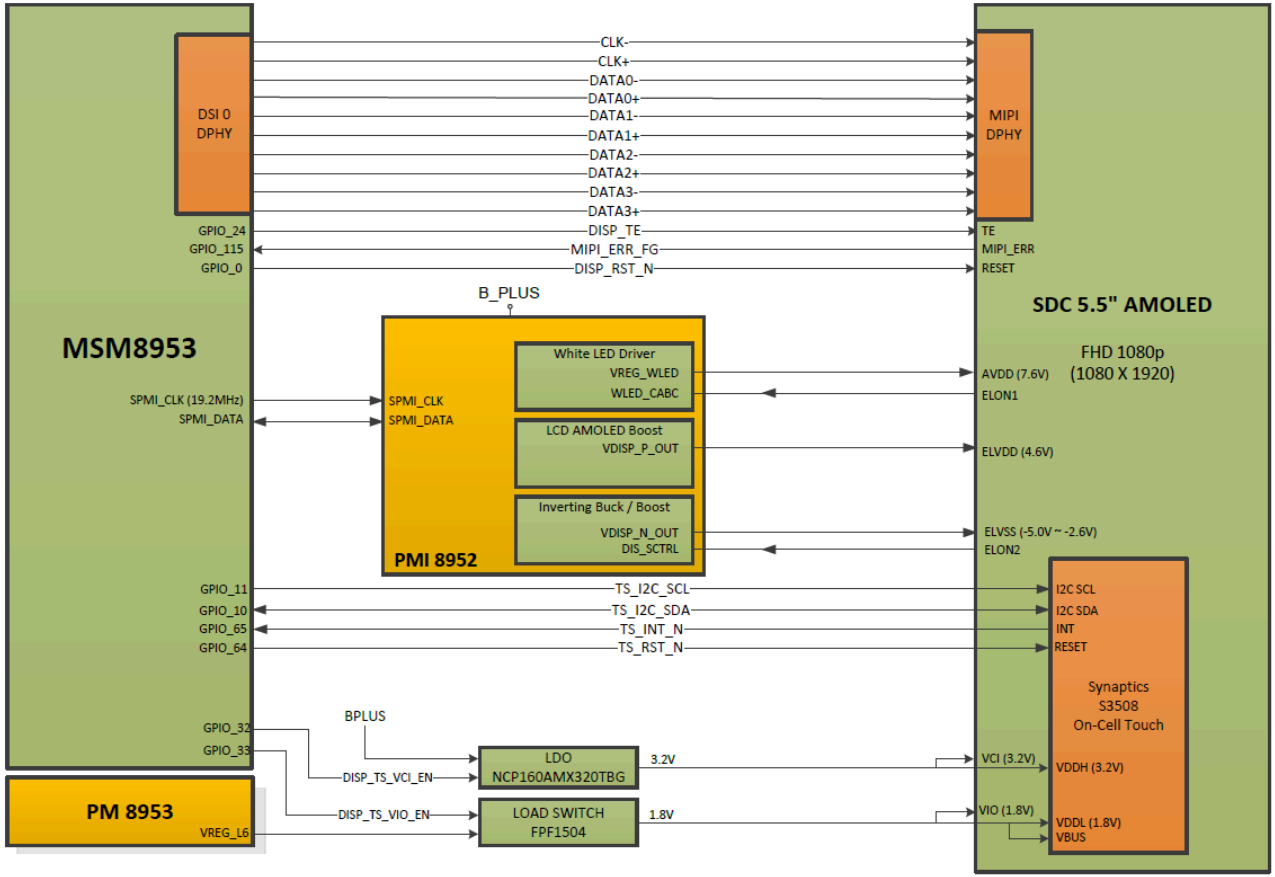
Imager System - Block Diagram (1/14/2016)



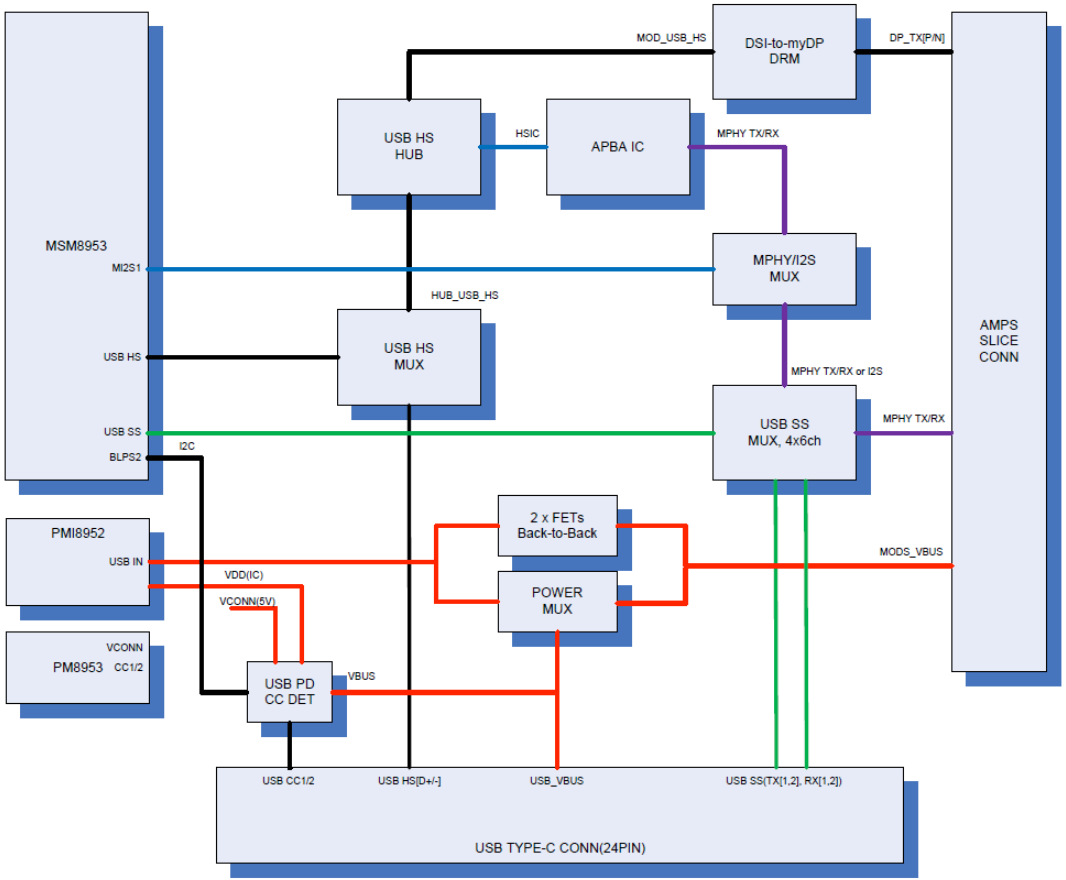
Sensor Block Diagram



Display & Touch System Block Diagram - (1/13/2016)

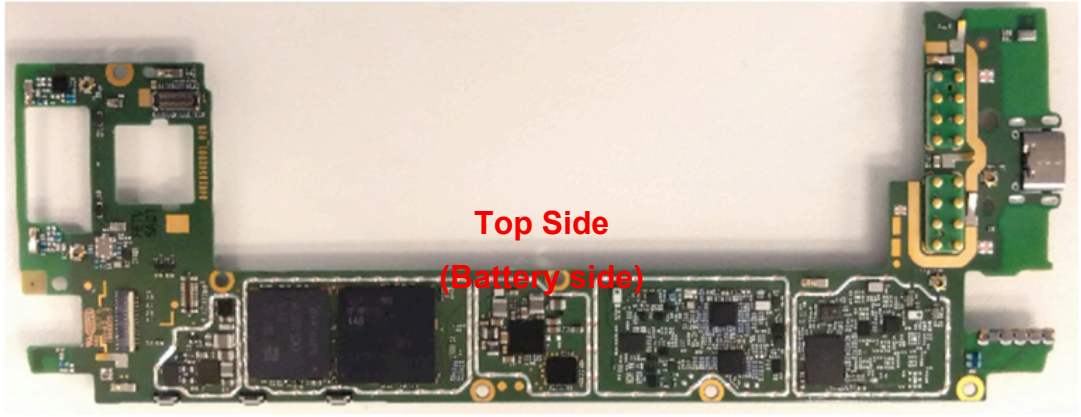


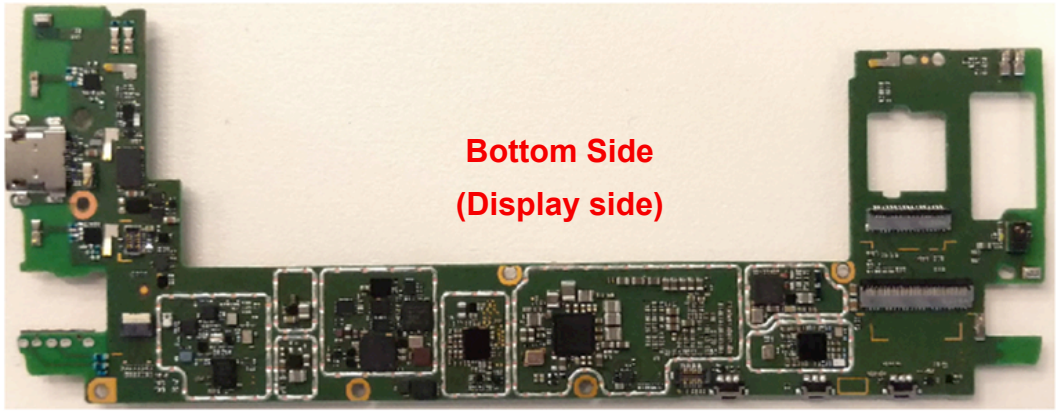
USB Type-C Block Diagram



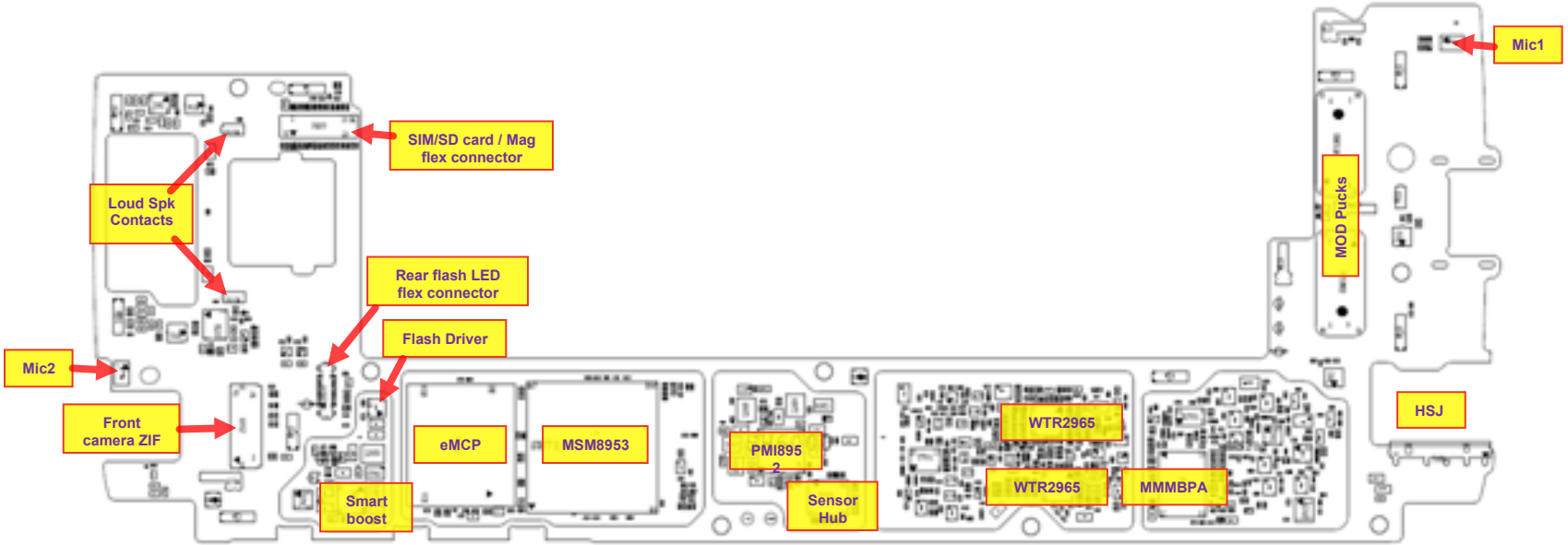
SNAPSHOT OF MAIN PCB

Main PCB – Top and Bottom

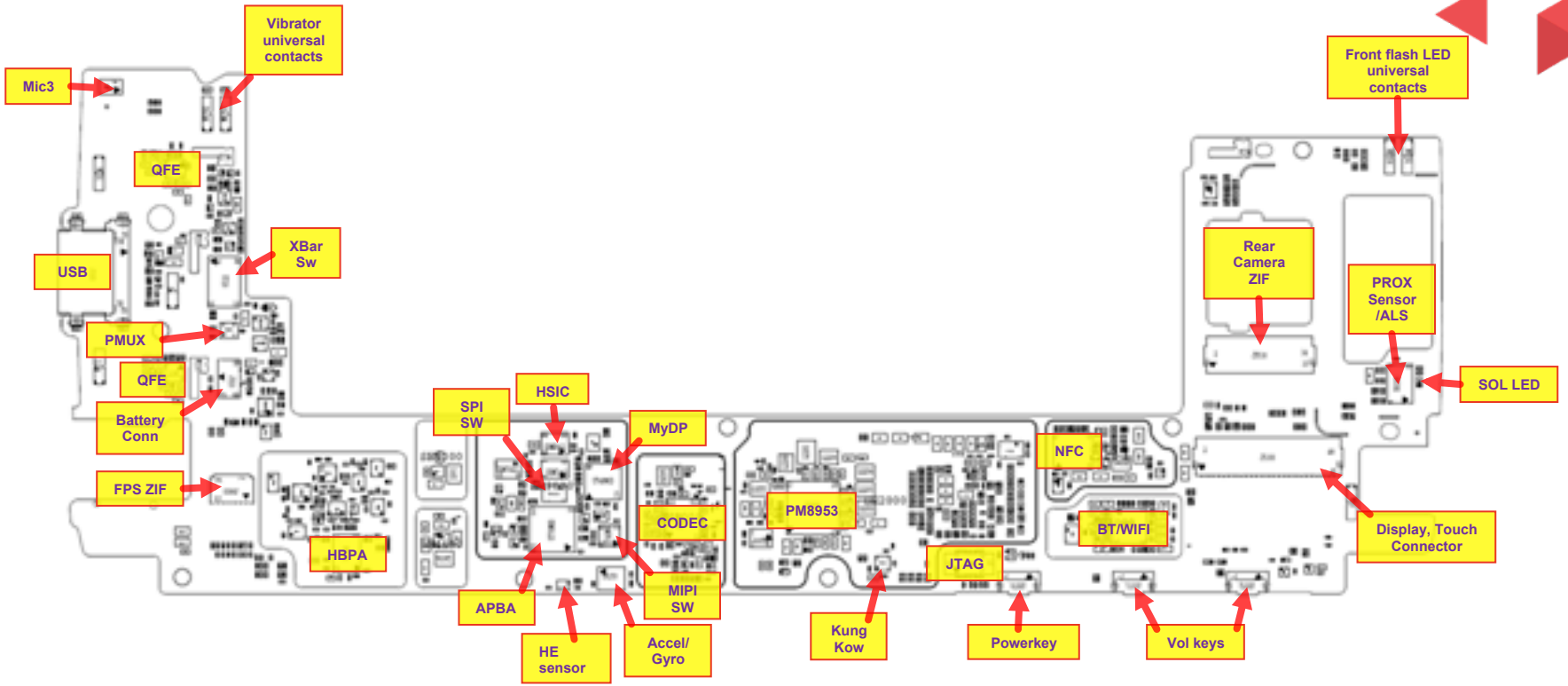




Main PCB – Top Placement



Main PCB – Bottom Placement



NO POWER UP DEBUGGING

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

Power Management – Glossary/Synonyms

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

MSM	AP / BP	MSM8953	U1000
Main PMIC	PM8953	PM	U2000
Charging PMIC	PMI8952	PMI	U2400
Kung Kalf(Kow)	Factory Kill IC	User Reset IC	U650
B_PLUS	VSYS	System Battery Voltage	
USB_PWR	USB Voltage	Charger Voltage	
USB_INx	PMUX_OUTx		

Power Management – 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 150mA. The current will also be very constant.

- Also it is helpful to find out what level of functionality is available. These distinct modes were observed:
  - 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.
  - Fastboot mode
    - Normally will enter this mode after flashing bootloader into newly built PCB.
    - Can be forced using volume down key during bootup
  - Full Power up
    - Will enumerate to PC as Motorola Network device and ready for board test

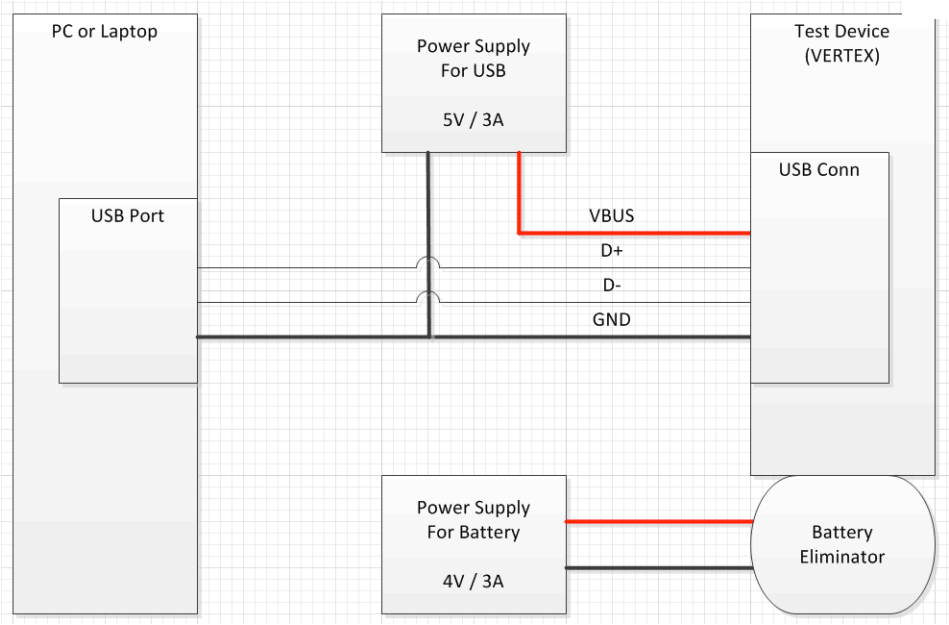
- Failed boards will be able to achieve one of these modes but fail to get to the next. This bit of information is useful for debugging.

- 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.

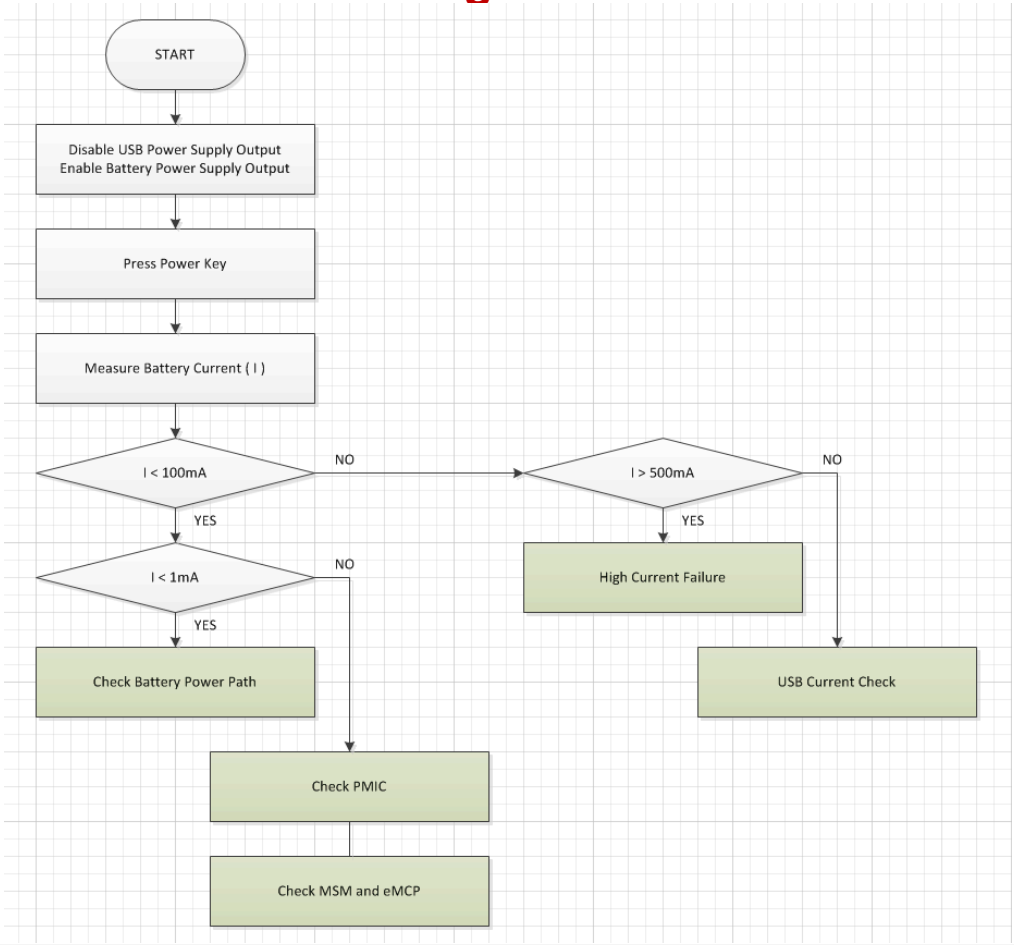
Power Management – Debug Test Setup

- Ideally, use 2 separate power supplies. This allows you to monitor current to both USB and battery at the same time.
- The USB power supply will always be 5.0V with a 3A current limit.
- The Battery power supply will always be 4.0V with a 3A current limit.
- For USB power supply, there are 2 options:
  - Use a Warthog board to supply USB power externally
  - Modify a USB cable. Cut open the cable, cut the red wire, and connect it to the external power supply.



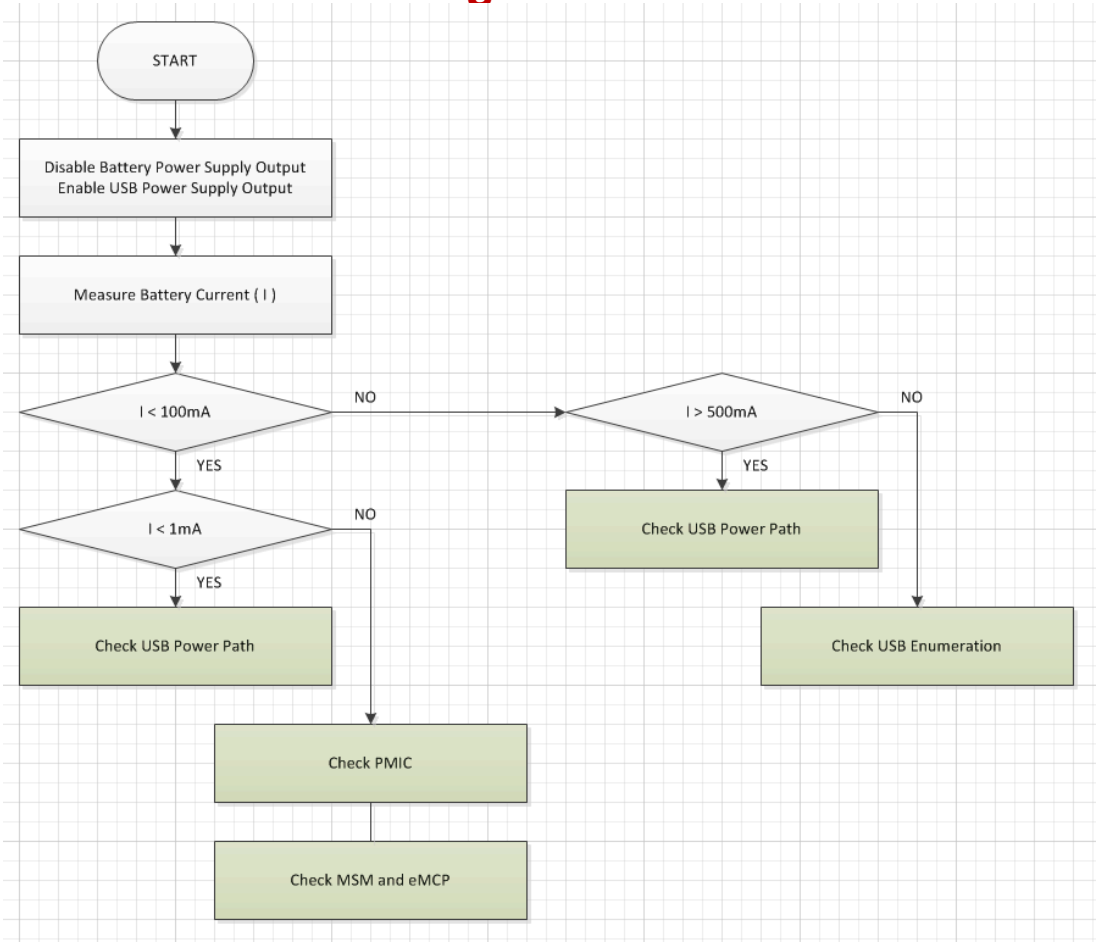
Power Management – No Power On Debug Flowchart

Battery Current Check



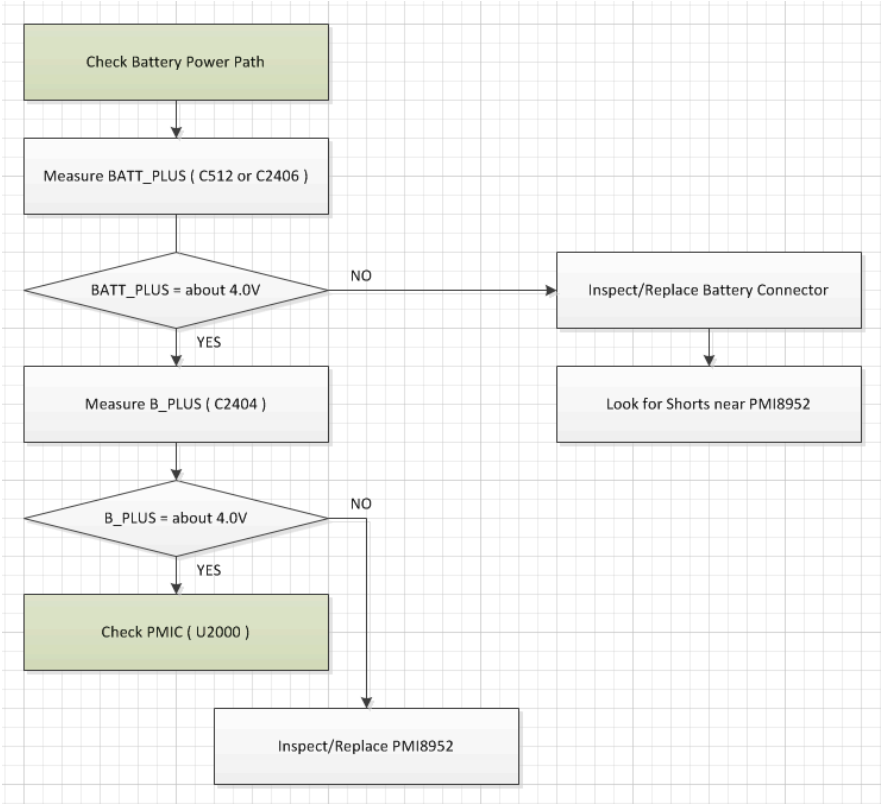
Power Management – No Power On Debug Flowchart

USB Current Check



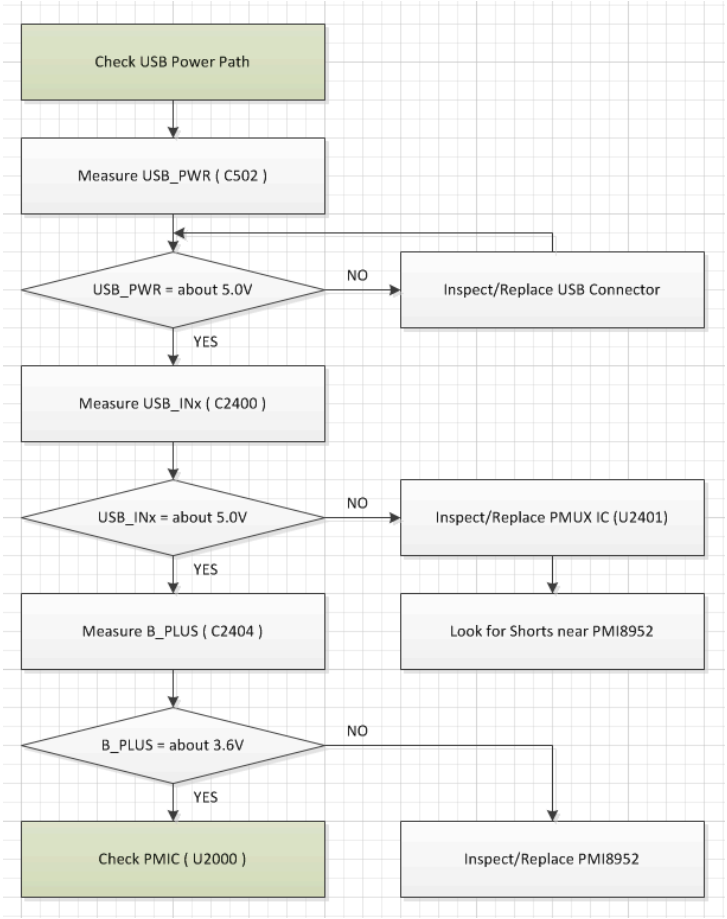
Power Management – No Power On Debug Flowchart

Battery Power Path



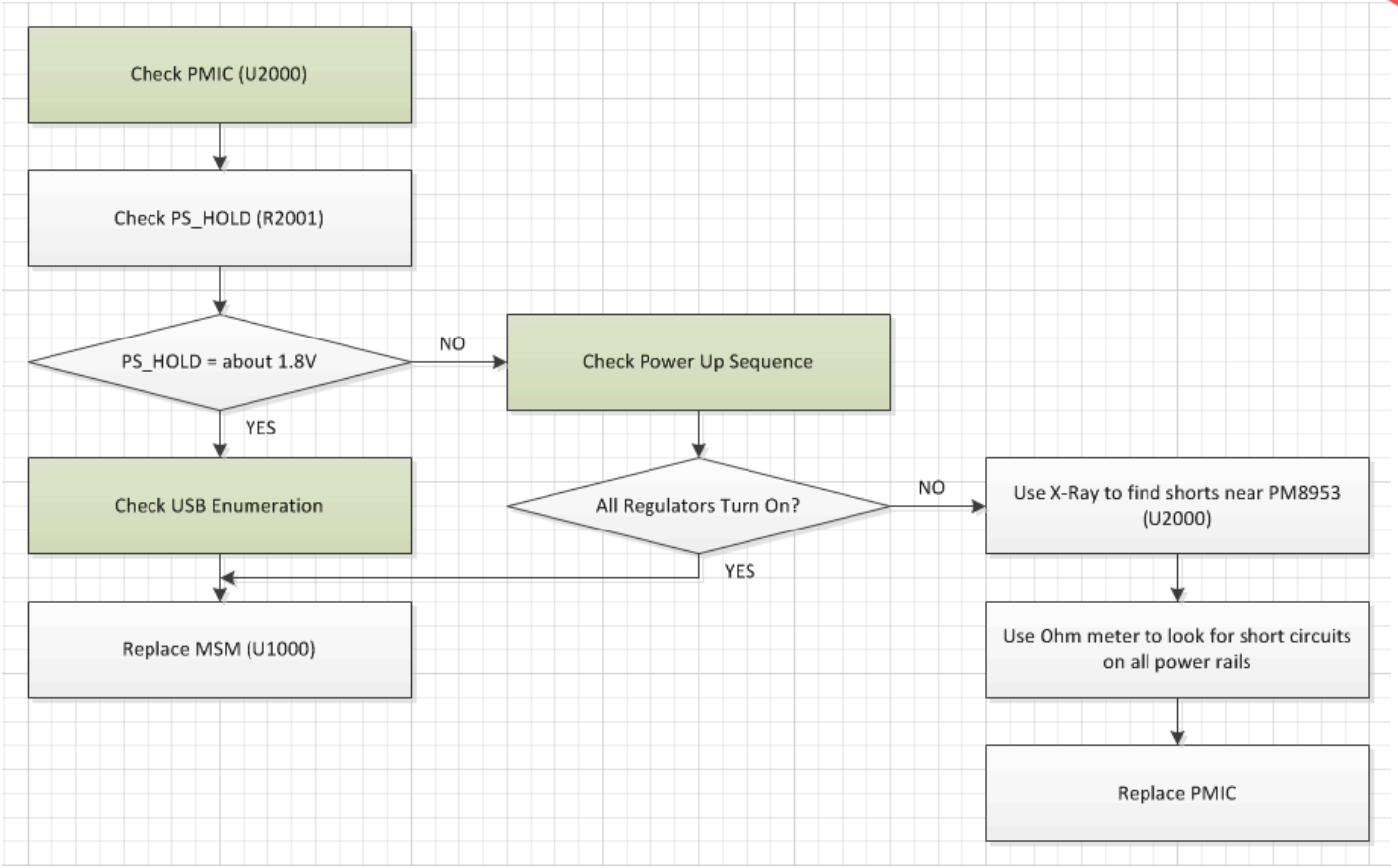
Power Management – No Power On Debug Flowchart

USB Power Path



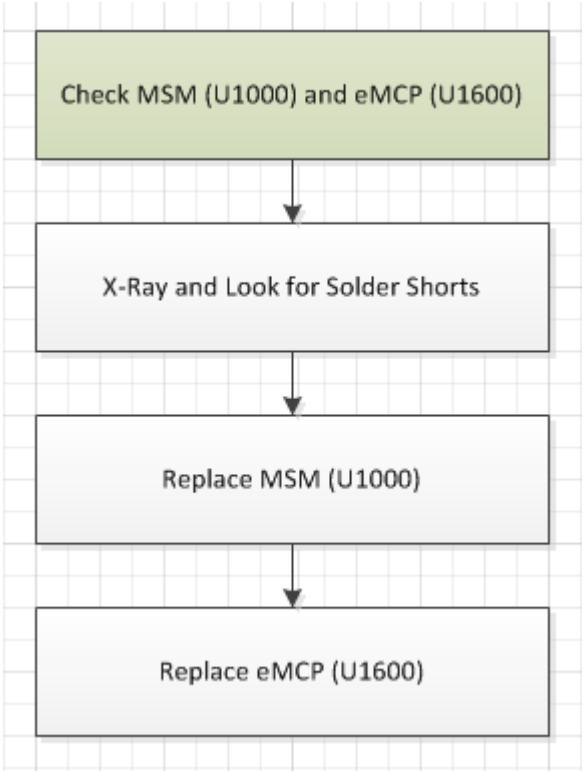
Power Management – No Power On Debug Flowchart

Check PMIC

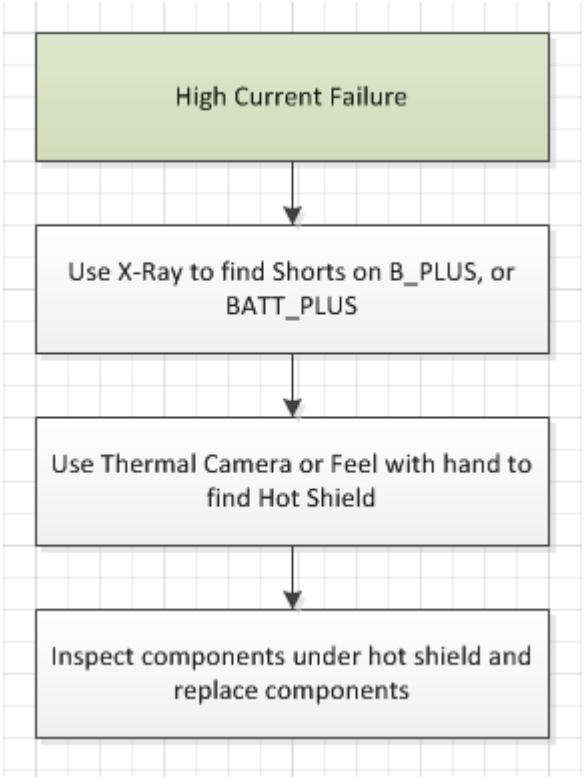


Power Management – No Power On Debug Flowchart

Check MSM and eMCP

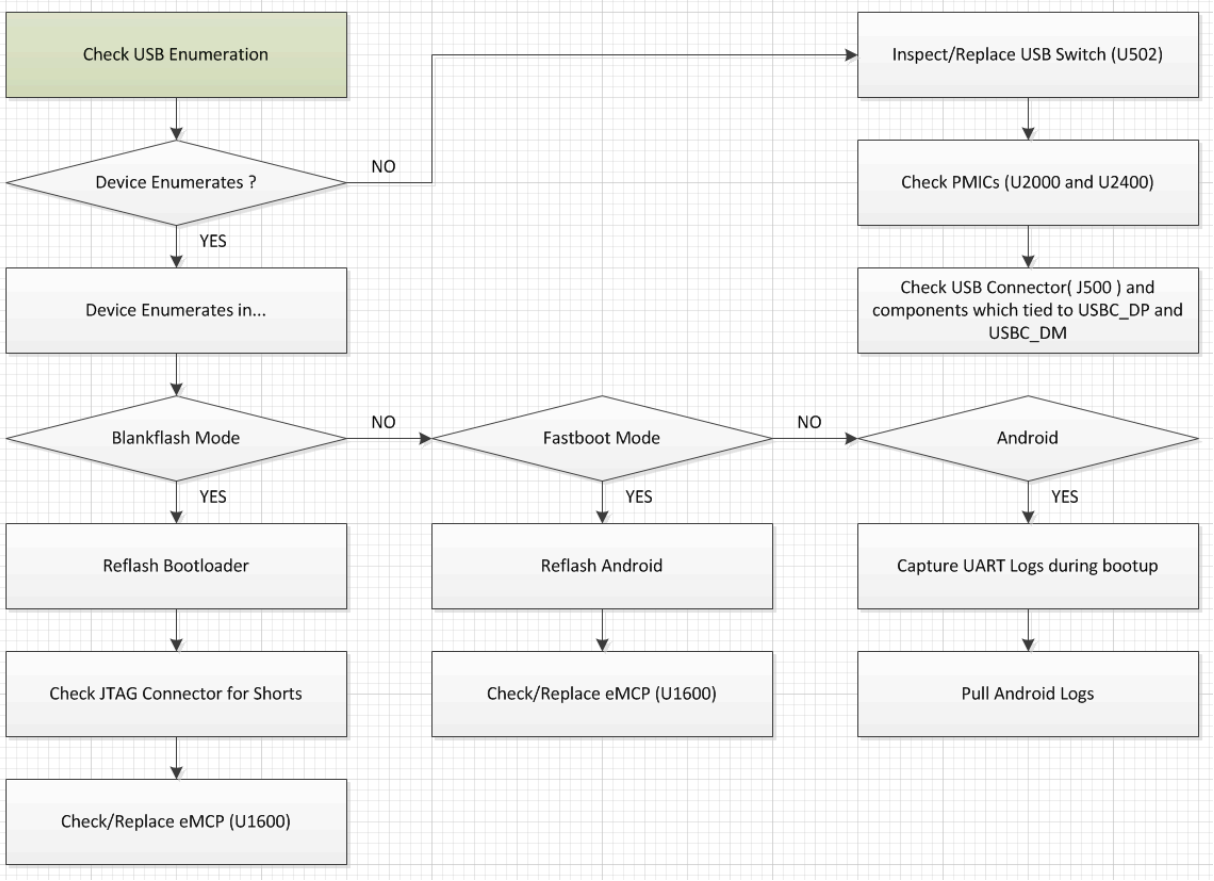


High Current Failure



Power Management – No Power On Debug Flowchart

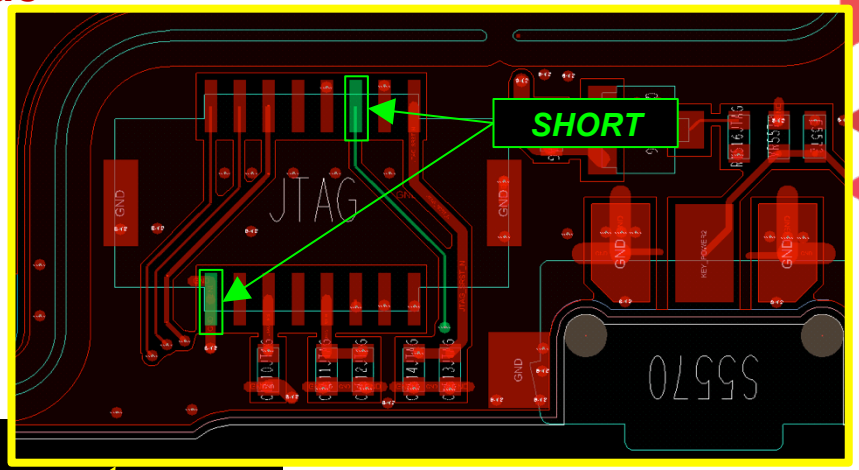
Check USB Enumeration

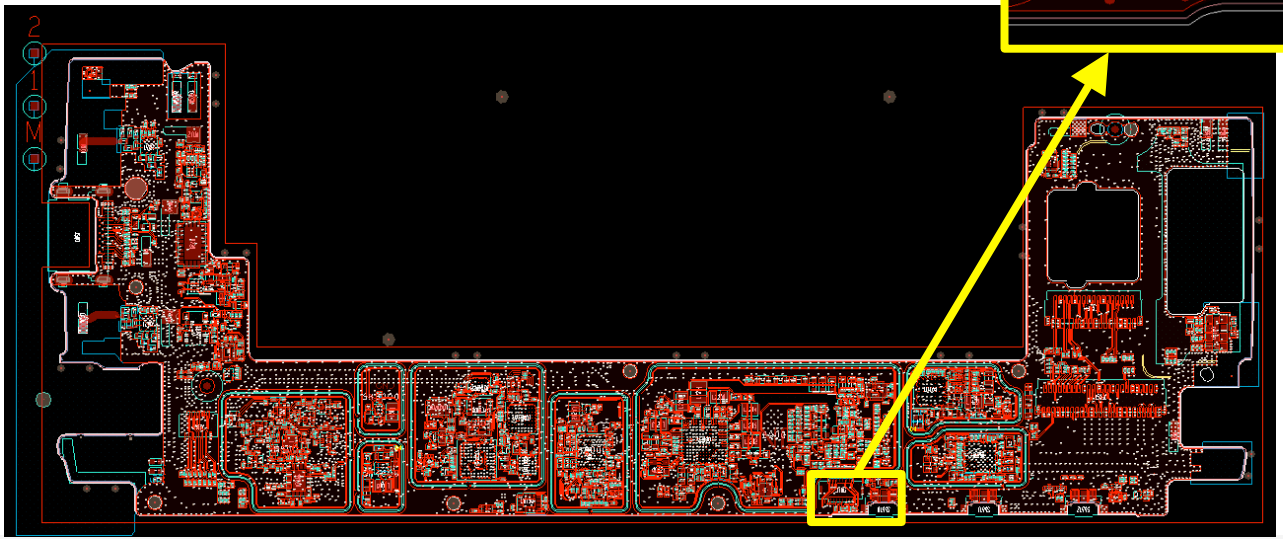


Power Management – Force Blankflash Mode

- 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.

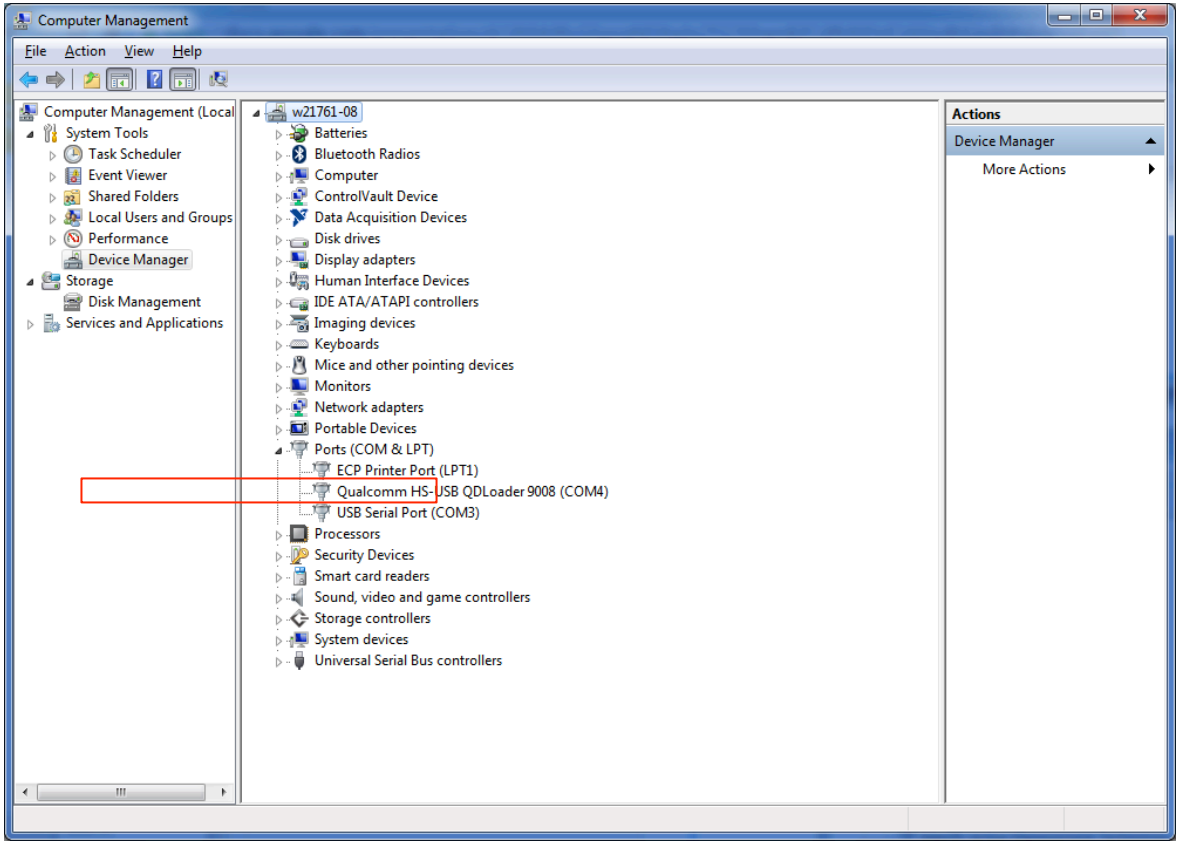
- When the board is in this mode, blank flashing can be attempted to reflash the device and/or find more information on the failure.





Power Management – Blankflash Mode

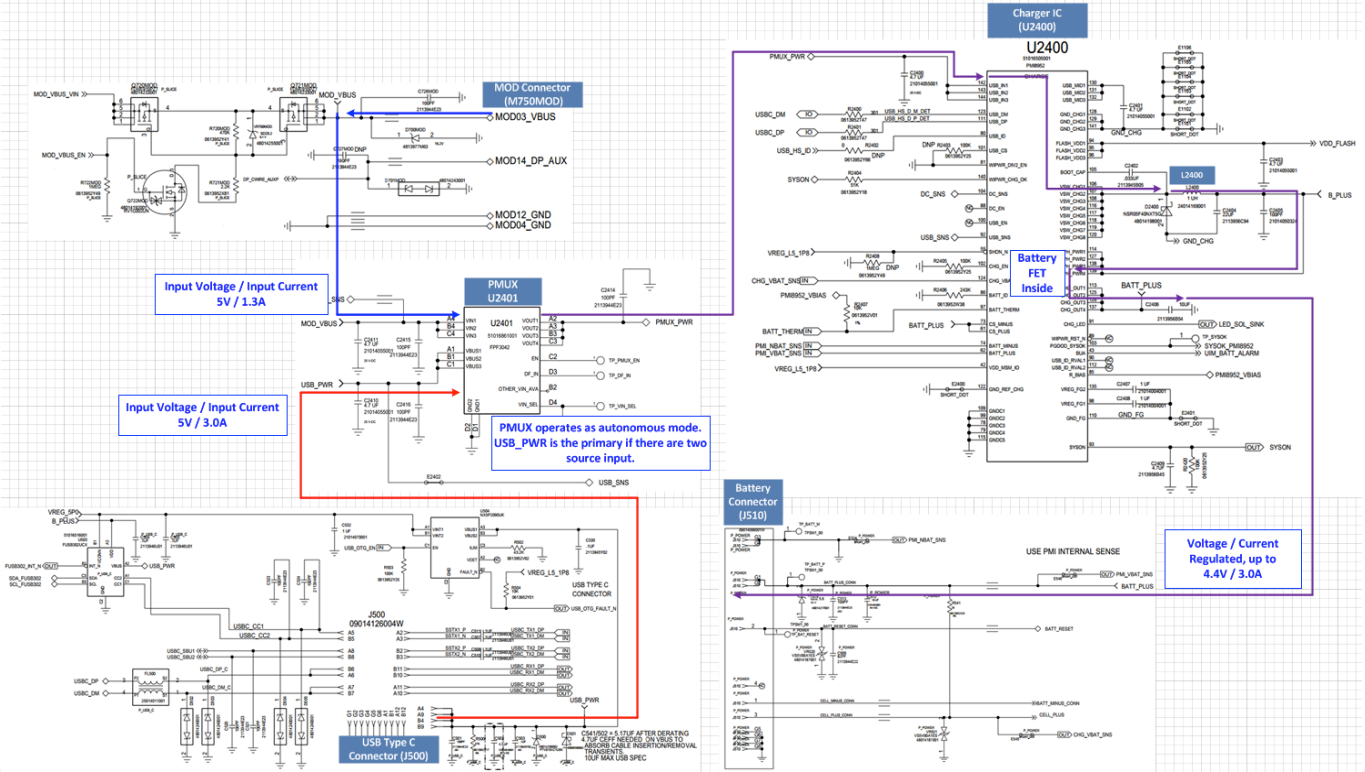
- If in blankflash Mode, the device will enumerate like in the diagram.



BATTERY & CHARGING TROUBLESHOOTING

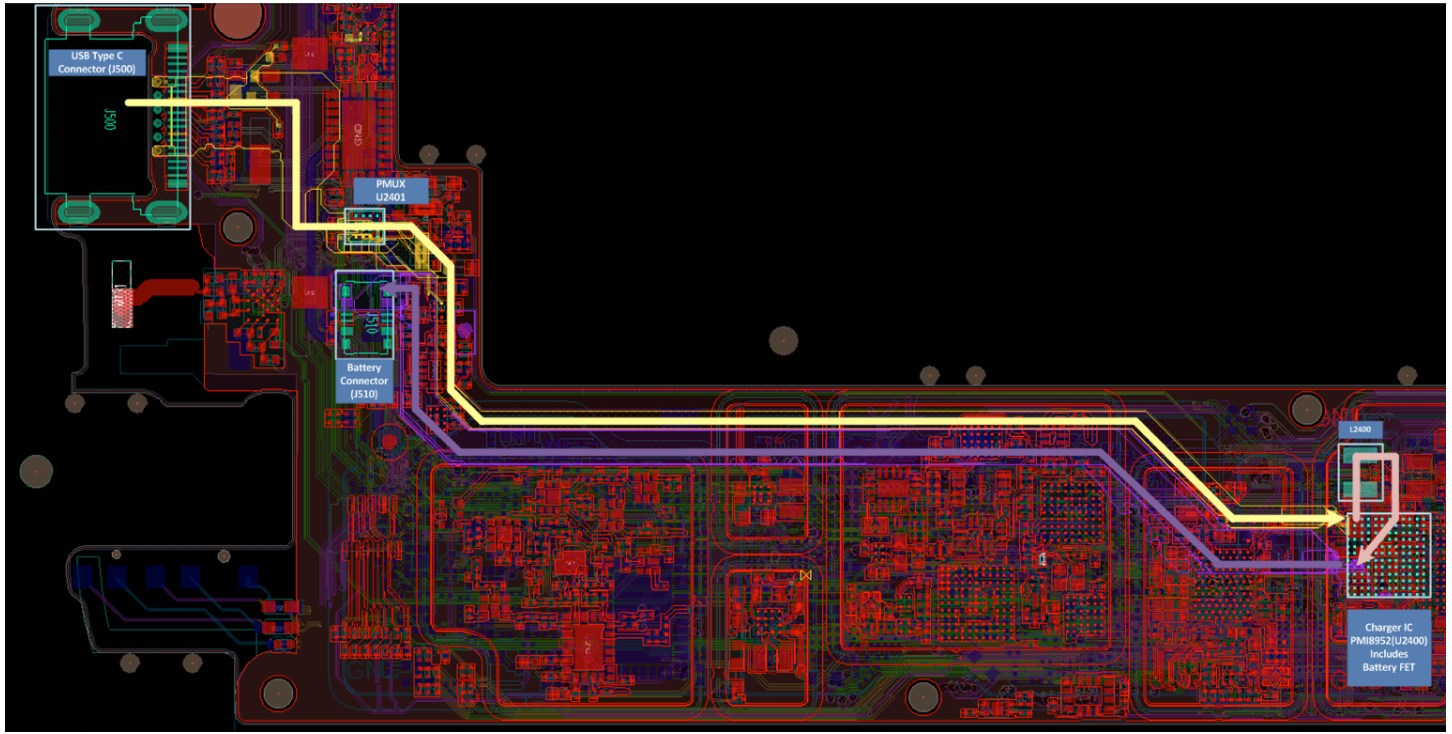
CHARGING PATH (Schematic)

- **USB Charger** : USB Type C Connector (J500) PMI8952, U2400) → Battery Pack (J510)
- **MOD-Espresso** : MOD Connector(M750MOD) → PowerMUX (FPF3042, U2401) → Charger IC (PMI8952, U2400) → Switch Regulator Circuit including L2400 → Battery FET (PMI8952, U2400) → Battery → PowerMUX (FPF3042, U2401) → Charger IC (PMI8952, U2400) → Switch Regulator Circuit including L2400 → Battery FET (Pack (J510)



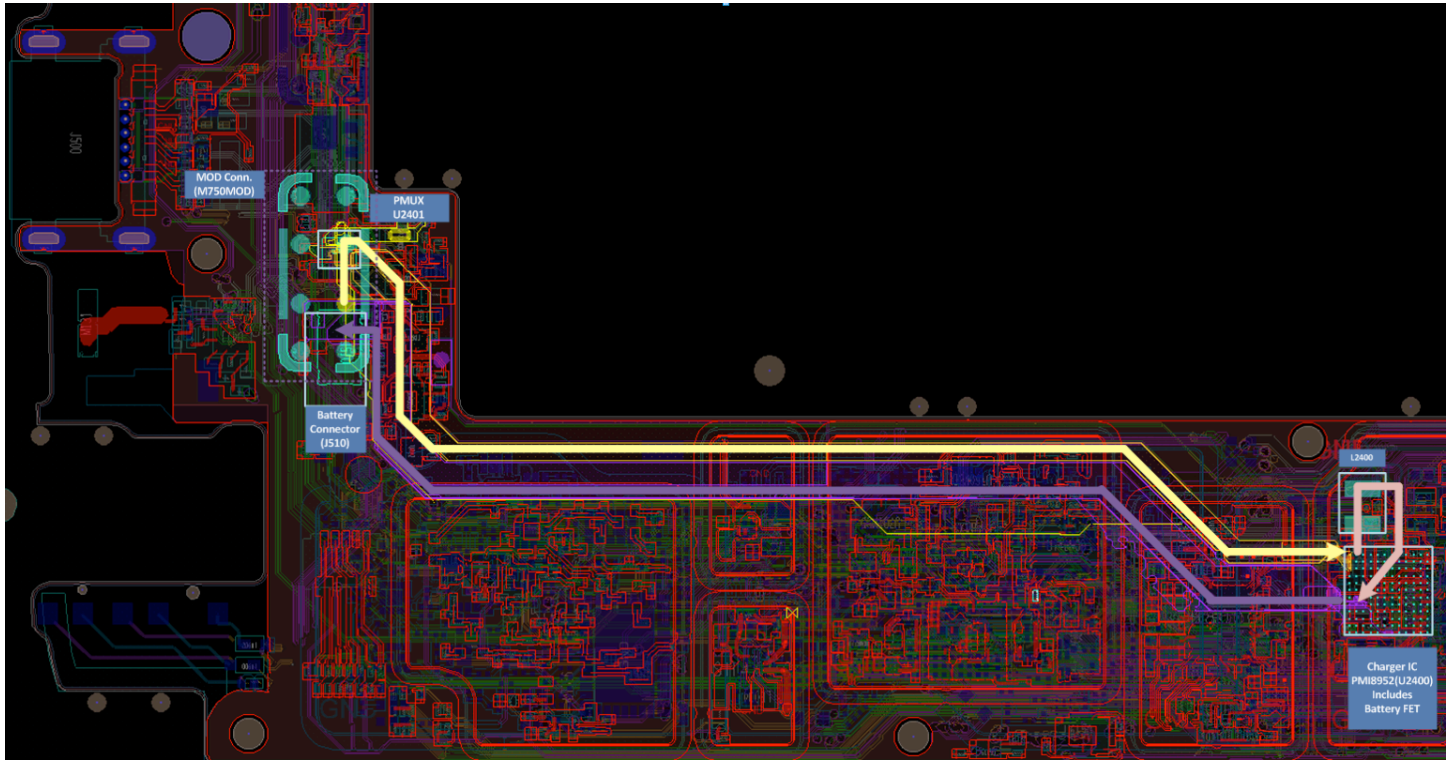
CHARGING PATH (Layout)

- **USB Charger** : USB Type C Connector (J500) → PowerMUX (FPF3042, U2401) → Charger IC (PMI8952, U2400) → Switch Regulator Circuit including L2400 → Battery FET (PMI8952, U2400) → Battery Pack (J510)



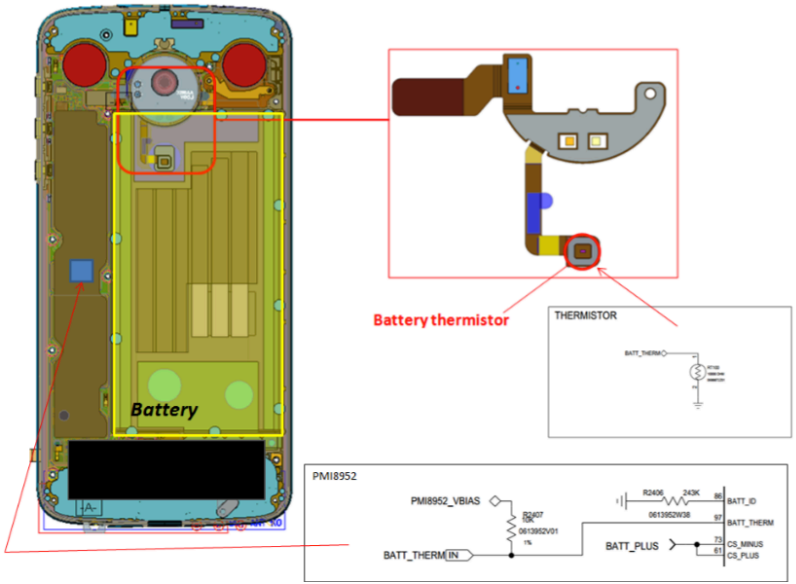
CHARGING PATH (Layout)

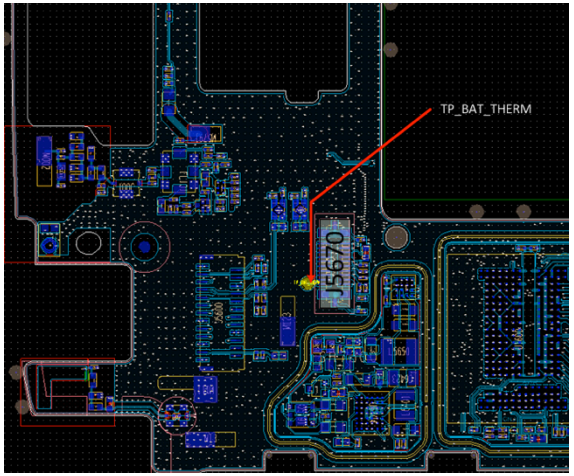
- **MOD-Espresso** : MOD Connector(M750MOD) → PowerMUX (FPF3042, U2401) → Charger IC (PMI8952, U2400) → Switch Regulator Circuit including L2400 → Battery FET (PMI8952, U2400) → Battery Pack (J510)



BATTERY THERMISTOR (Position/Schematic/Layout)

- **Battery Thermistor is placed at Rear Camera Flash Flex.**





CHARGING TROUBLESHOOTING

In the event of charging issues:

- Do visual inspection on USB Type-C connector, Battery Pack, and Rear Camera Flash Flex.

- Check charging voltages along the charging path:
  - Measure USB charger input voltage at C2410(PMUX Input - VBUSx pins) or MOD-Espresso input voltage at C2411(PMUX Input - VINx pins) and C2414(PMUX output) or C2400(PMI8952 input). The voltage should be around 5.0V.
  - Check B_PLUS voltage at C2404. It should be higher than 2.1V and lower than 4.4V.
  - Check battery voltage at J510 pin G1/G2 or C512. It should be higher than 2.1V and lower than 4.4V. If battery is below 2.1V, there maybe a short in the circuit somewhere and the battery protection circuit is triggered.

- Battery Check battery thermistor:
  - Do visual inspection on Camera Flash Flex connection. It has battery thermistor on it.
  - Battery temperature should be in the range of 0ºC ~ 45ºC to be fully charged. Check the thermistor voltage at the test point (TP_BAT_THERM). It should be around 1.35V at room temperature (25ºC).

BATTERY TROUBLESHOOTING

No turn on with battery only:

- If the device does not power up with battery alone, it could have a dead battery, there could be an issue with the battery safety control FETs or safety IC, or 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 you cannot recover the dead battery with charger, measure the battery voltage. And 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 it powers up with factory cable, replace the battery, and if the issue is resolved, send the battery to development team.

If battery level reads 0%:

- Unplug cable, wait at least 3 seconds, then plug back in.
- If this does not work, try plugging in charger. If charge level is 1% or higher, leave on charger until 100% is reached.

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

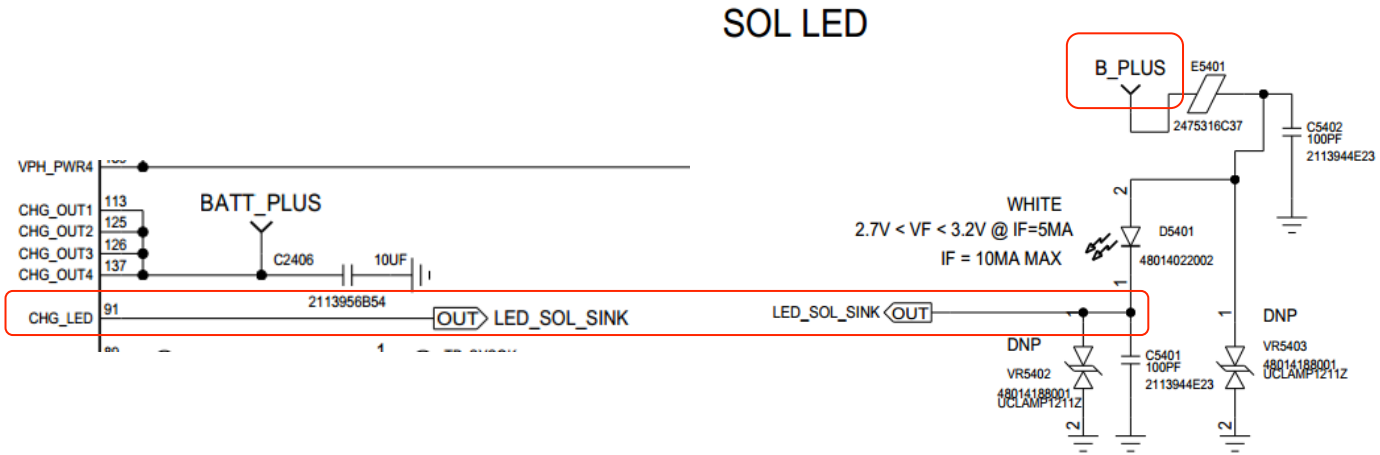
- Plug in charger and leave until 100% full

“No Turn On” TROUBLESHOOTING

1. Check the PMI device charger input power supply voltage (USB_INx - PMUX_PWR).
2. Check the PMI device charger output voltage (CHG_OUTx - B_PLUS).
3. Check the other input power pins (VDD_xxx) at both PMICs.
4. Verify the logic levels at the external control pins:
    a. PM device: CBL_PWR_N
    b. Keypad power pins at both PMICs
    c. PM device: OPT_[2:1]
    d. RESIN_N at both PMICs
5. Check the internal reference voltages by probing the REF_BYP pin on both PMICs.
6. Check the regulated voltages that default to their on state. Note that the sequence depends on the hardwired connections at the PM device’s OPT_2.
7. Each of these should settle to within 5 to 10% of their target voltage before the PMIC continues its power on sequence by initiating the next regulator. The devices shut down if any of these default regulators do not turn on and settle properly.
8. If a device shuts down due to a failed regulator output, the start signal must be removed and reapplied to attempt another power up.
9. Monitor the PM device’s PON_RESET_N; verify that it goes to logic high after all the default regulators power up correctly.
10. Monitor the PM device’s PS_HOLD; verify that it is at logic high. It can transition between logic states throughout the power on sequence but must be stable at logic high within hundreds of milliseconds after the PON_RESET_N signal went high. Confirm that this signal is applied to the PMI device’s PS_HOLD pin.
11. If any of the first nine steps are not completed successfully, one of the installed PMICs has failed. If step10 fails, there may be a problem with the modem device, one of the PMICs, or their interconnections.

SOL (Sign of Life) LED

- SOL LED(White) is driven by U2400 PMI8952 LED_SOL_SINK (PMI8952 CHG_LED) and B_PLUS



White SOL LED

In the event of SOL LED issue:

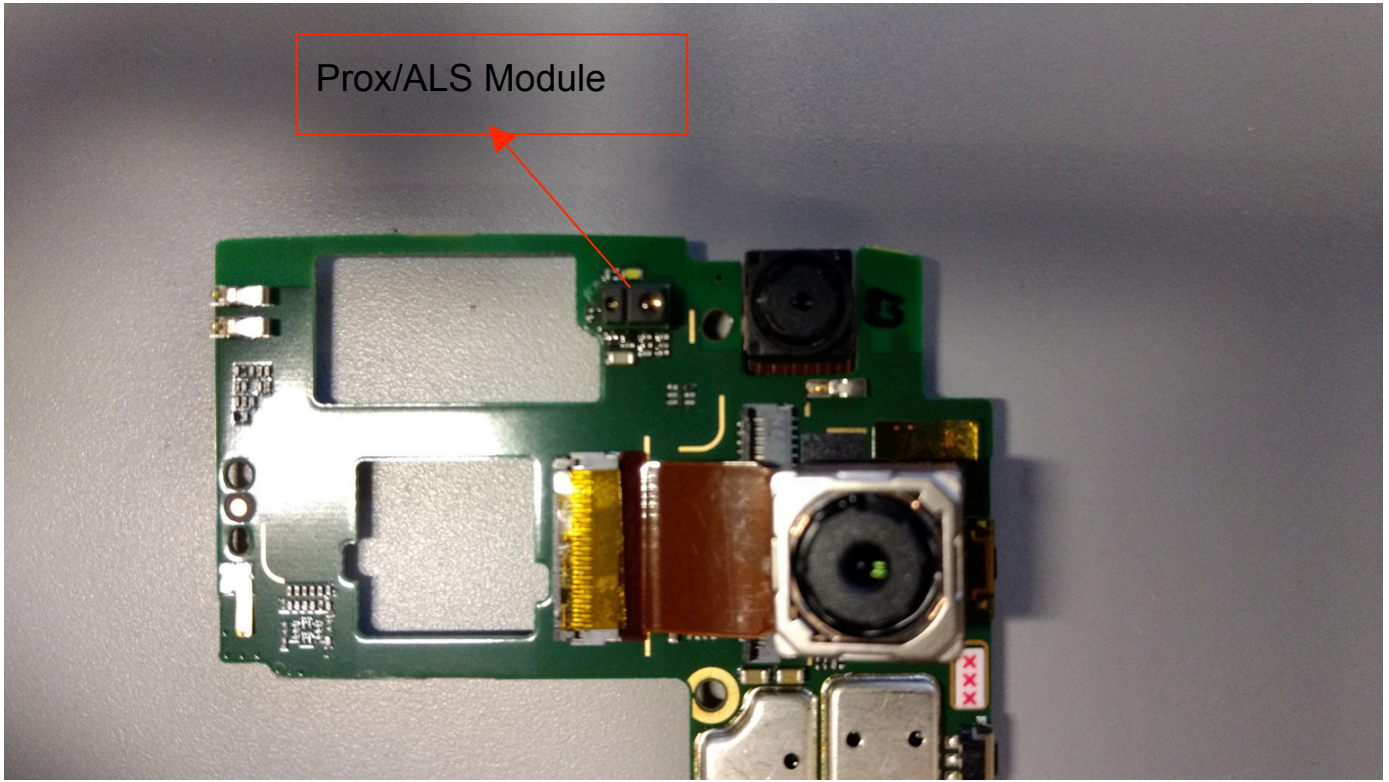
- Check voltage at LED Anode (pin 2) and Cathode (pin 1) of D5401
- LED Vf @If,10mA = V_anode - V_cathode = 2.7V(typ.), 3.2V(max)
- If LED is working, Vf should be in the available range, about 2.8V.

	LED On	LED Off
FTM power, w/o battery	V_Anode: 3.15V~3.2V V_Cathode: 0.3V Vf = 2.8V	V_Anode: 3.15V~3.2V V_Cathode: 0.95V Vf = 2.2V
FTM power, w/ battery(3.8V)	V_Anode: VBatt+ 0.1V, 3.9V V_Cathode: 1.05V Vf = 2.85V	V_Anode: VBatt+ 0.1V, 3.9V V_Cathode: 1.66V Vf = 1.95V

Prox/ALS TROUBLESHOOTING

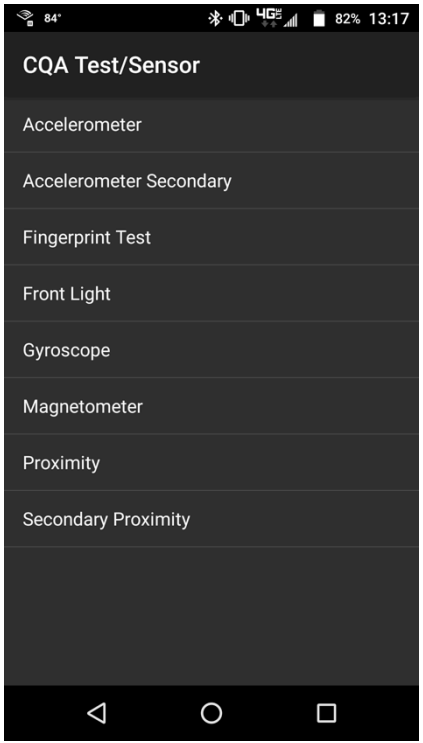
Prox/ALS Troubleshooting

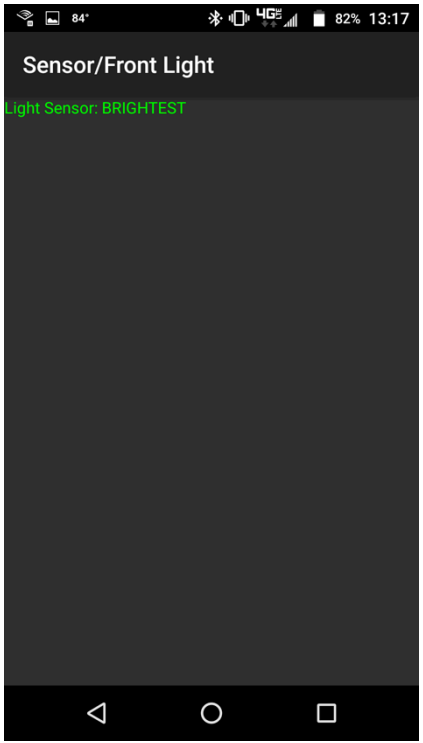
Verify part placement and orientation as shown in the picture below

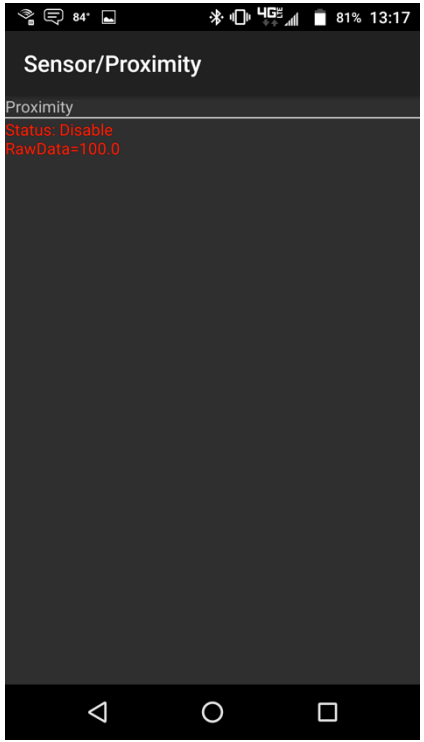


Prox/ALS Troubleshooting

Verify ALS and Proximity sensor functionality using CQA app







Prox/ALS Troubleshooting

If above action shows failure, please swap the Prox/ALS module

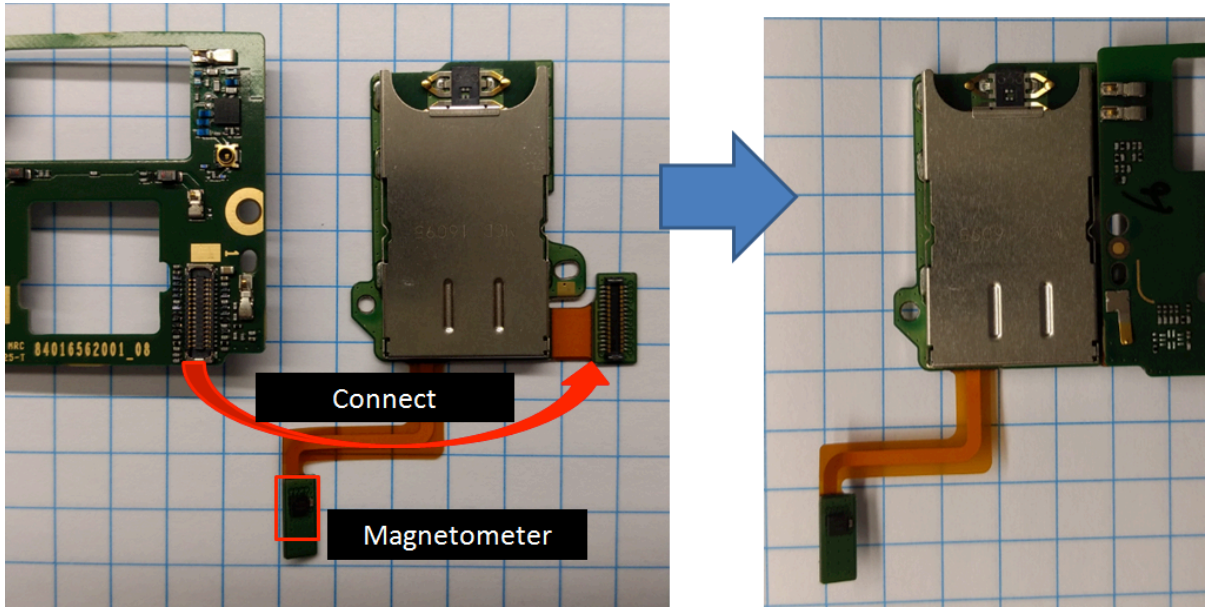
If swapping the Prox/ALS module does not resolve the failure mode. Please send the unit back to Chicago for DE analysis.

USIM/uSD CARD TROUBLESHOOTING

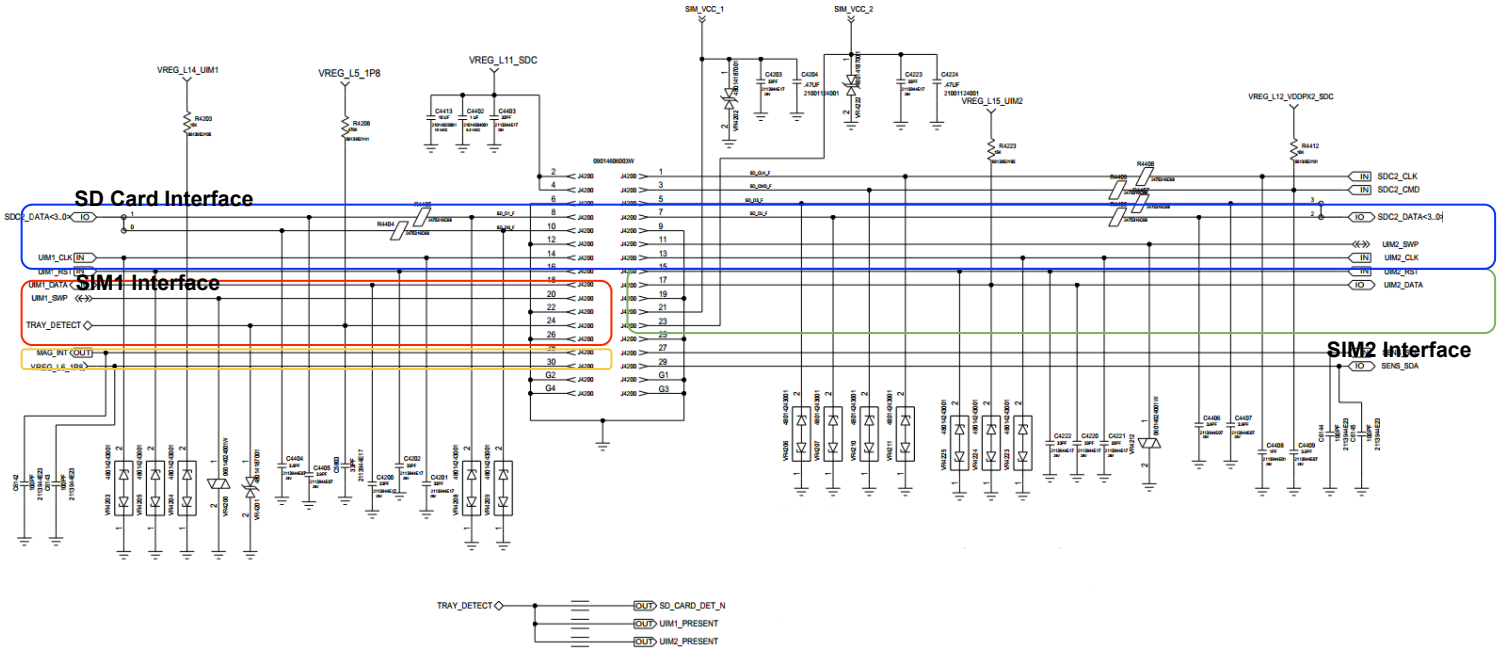
SIM1 / SIM2 / SD Card

- Moto Z Play has SIM/SDCARD board (84016569001). It is connected to main board through 30 pins BtoB connector.

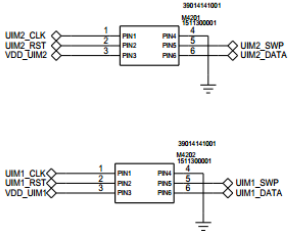
- SIM/SDCARD board has connectors for SIM/SD Card, Shield, and Magnetometer. All protection/detection/ Pull-up/Pull-down components are placed on main board.

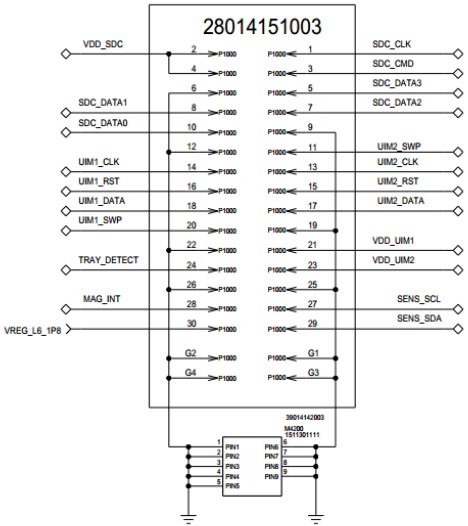


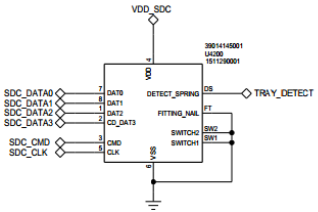
SIM1 / SIM2 / SD Card - Schematic on Main Board

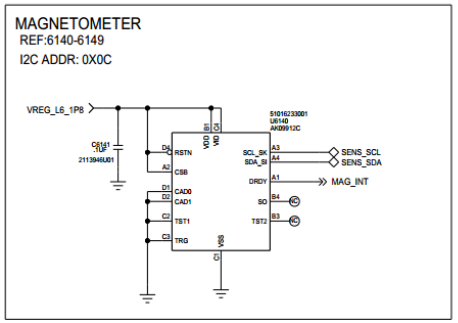


SIM1 / SIM2 / SD Card - Schematic on SIM/SDCARD board









SIM1 / SIM2 / SD Card - Troubleshooting

In the event of SIM issue:

- Make sure the connection between SIM/SDCARD board and main board.
- Inspect all SIM circuit components on main board and BtoB connector from both boards.
- Check SIM power at C4204 (for primary SIM) and at C4224 (for secondary SIM) and Detection signal TRAY_DETECT at C5803. TRAY_DETECT is high (1.6V~1.9V) when tray is inserted.
- Check SIM bus interface signal activities during SIM access (UIMx_RST, UIMx_CLK, UIMx_DATA)
- Do a thorough visual check on SIM connector M4201 and M4202 for any sign of mechanical contact issues
- Change to new SIM/SDCARD board

In the event of SD Card issue:

- Make sure the connection between SIM/SDCARD board and main board.
- Inspect all SD Card circuit components on main board and BtoB connector from both boards.
- Check SDCARD power at C4413(2.7V ~ 3.6V) and Detection signal TRAY_DETECT at C5803. TRAY_DETECT is high (1.6V~1.9V) when tray is inserted.
- Check SD bus interface signal activities during SD Card access (SDC_DATAx, SDC_CMD, SDC_CLK)
- Do a thorough visual check on SD connector U4200 for any sign of mechanical contact issues
- Change to new SIM/SDCARD board

BASE SENSORS TROUBLESHOOTING

Sensor hub

In the event of sensor hub failure:

- Inspect physical placement U6000 and their related components on main PCB board (see sensor hub schematic page on next slide)
- When all sensors stop reporting readings, please inspect the power supply on sensor hub. If the power is present, then please send the board back to Chicago for DE analysis.

Accelerometer

In the event of accelerometer failure:

- Inspect physical placement U6150 and their related components on main PCB board (see accelerometer schematic page on next slide)
- Connect the board to a display and power the board/display with battery or factory cable.
    - Launch CQA app, test each accelerometer at a time.
    - Look for accelerometer G-force activity on all axis X,Y,Z.
    - As you change the board orientation to have positive X,Y,Z accelerometer reading.
    - Good accelerometer IC will have G-force reading for each positive axis closed to 9.8 else the IC is faulty.

Gyroscope

In the event of Gyroscope failure:

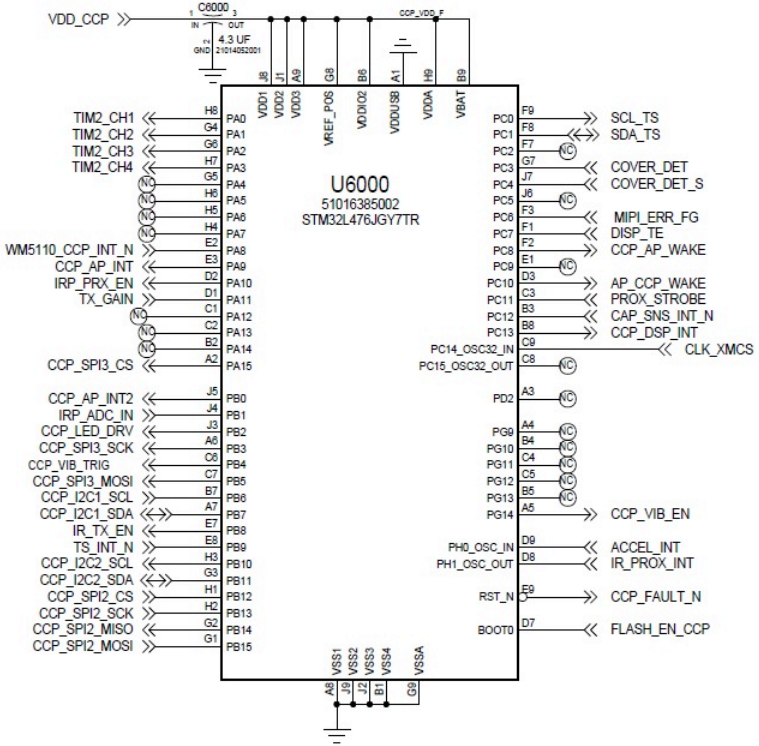
- Inspect physical placement U6150 and their related components on main PCB board (see gyroscope schematic page on next slide)
- Connect the board to a display and power the board/display with battery or factory cable.
    - Launch CQA app, test each gyroscope at a time.
    - Look for gyroscope activity on all axis X,Y,Z.
    - As you rotate the board orientation, gyroscope reading will register reading accordingly.
    - When the board is stationary, all gyroscope reading should be 0.

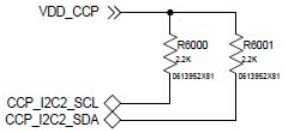
Magnetometer

In the event of Magnetometer failure:

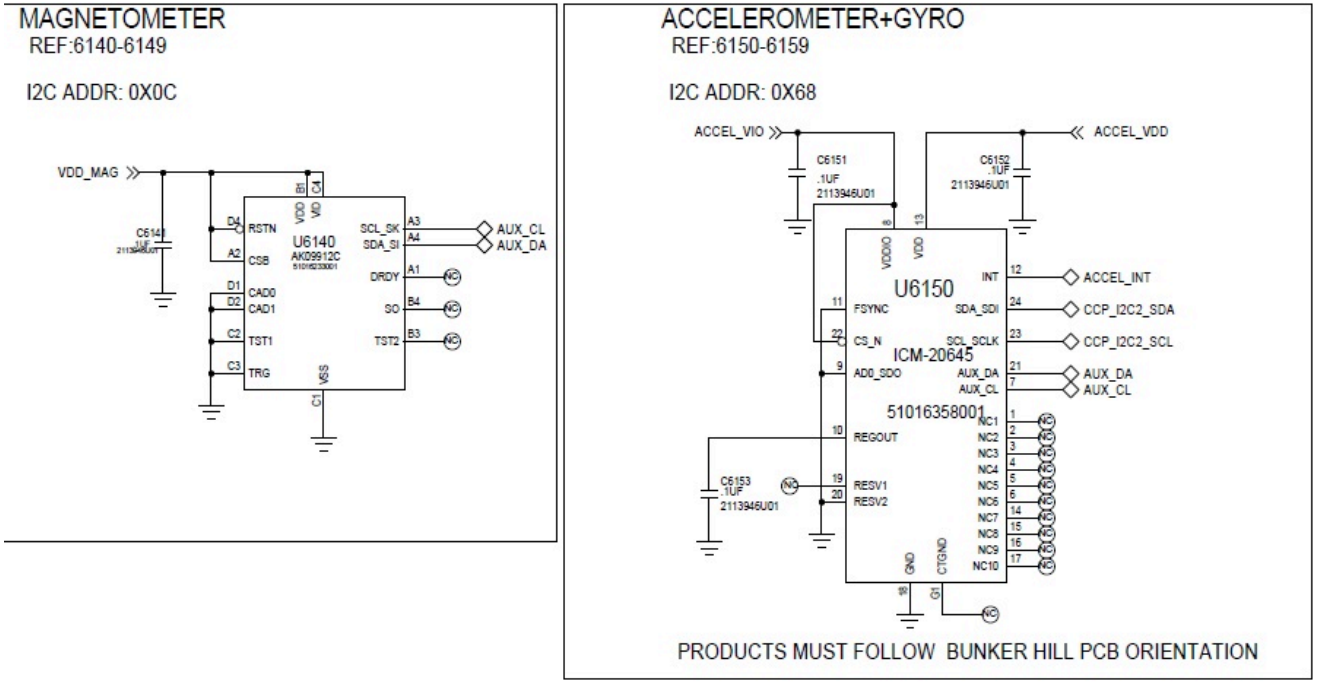
- Inspect physical placement U6140 and their related components on main PCB board (see gyroscope schematic page on next slide)
- Connect the board to a display and power the board/display with battery or factory cable.
    - Launch CQA app, test each magnetometer.
    - Look for magnetometer on all axis X,Y,Z.
    - As you rotate the board orientation, magnetometer reading will register reading accordingly.

Sensor Hub (Schematic)





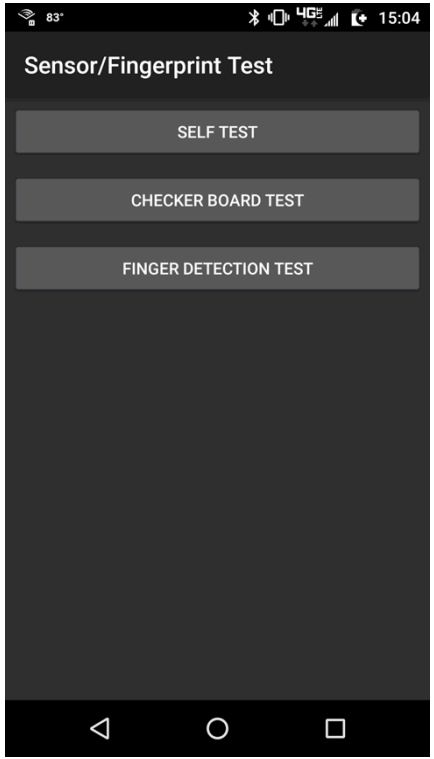
Accelerometer and Magnetometer (Schematic)



FPS TROUBLESHOOTING

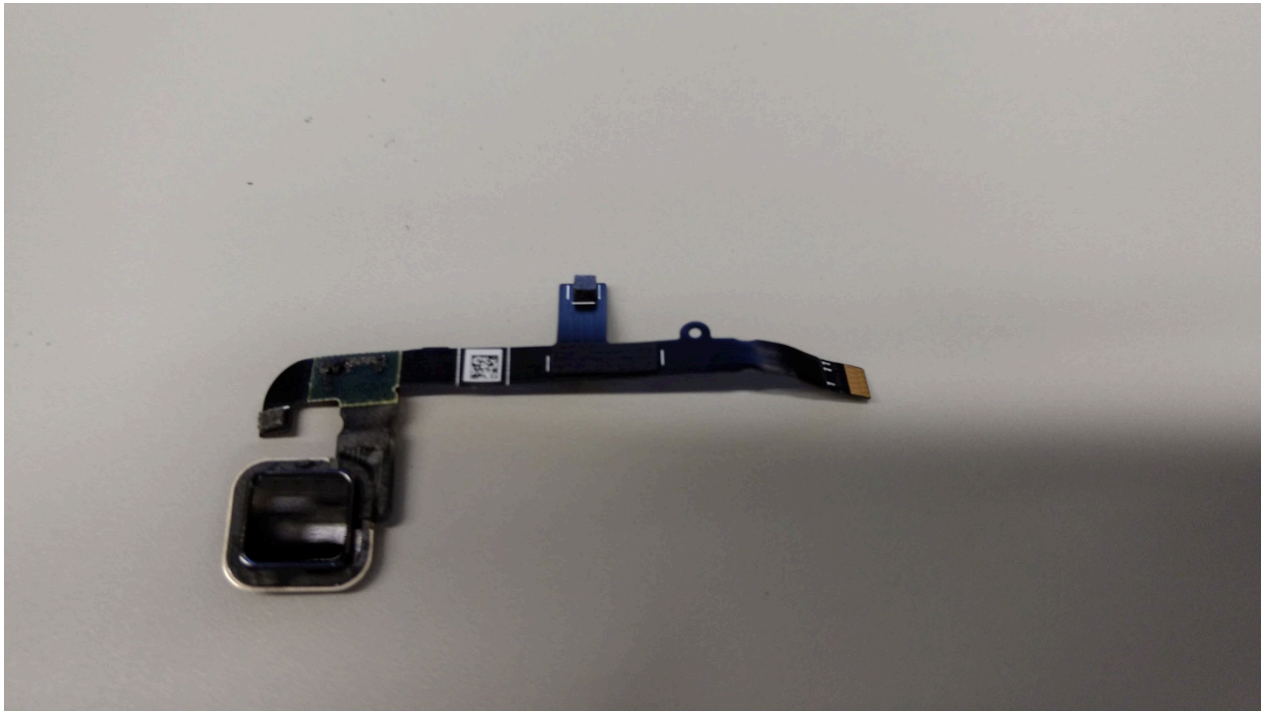
FPS Troubleshooting

CQA app testing FPS functionality



FPS Troubleshooting

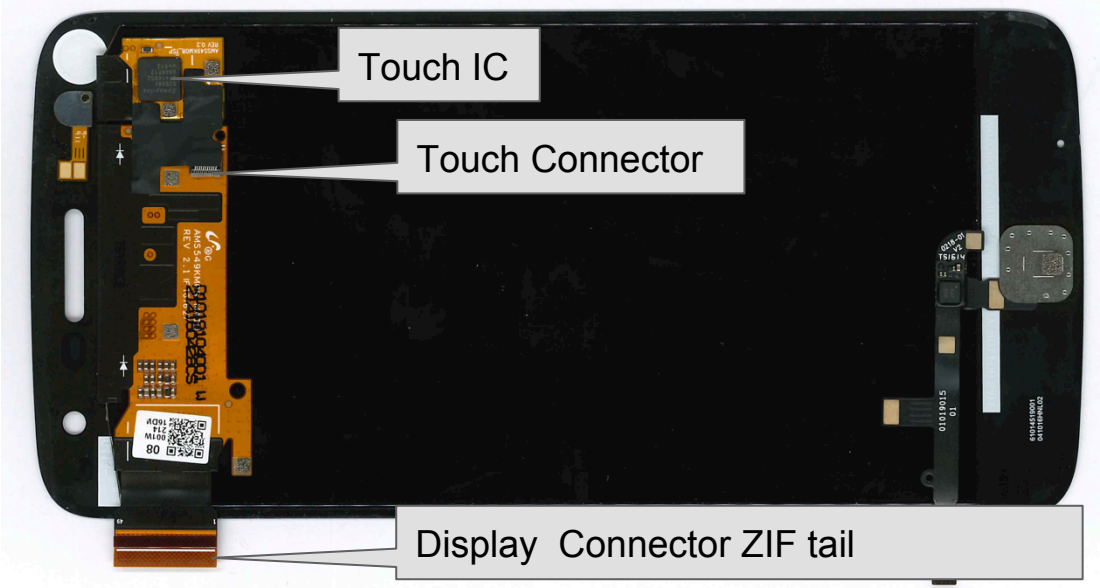
Swapping FPS module see if failure follows FPS module



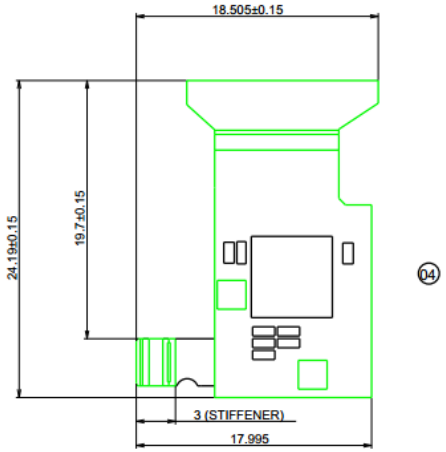
TOUCH SCREEN TROUBLESHOOTING

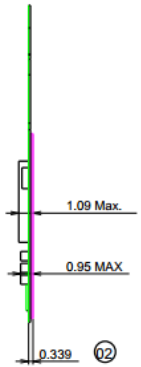
Touch Design - Overview

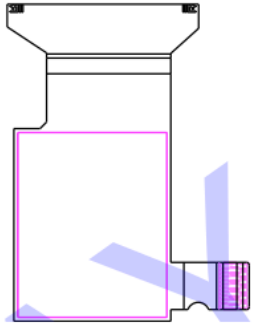
- Single Layer On-Cell Touch
  - Vendor: Samsung Display (SDC)
    - Touch Controller: Synaptics S3508
    - Sensor pattern configuration: 16 TXs * 28RXs



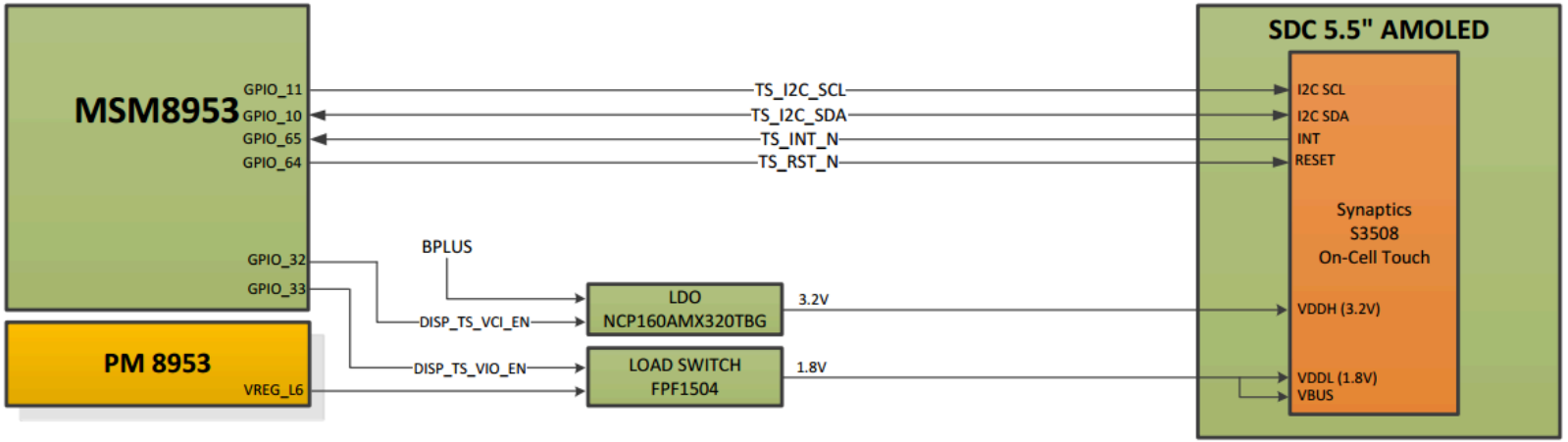
Touch Design - Mechanical



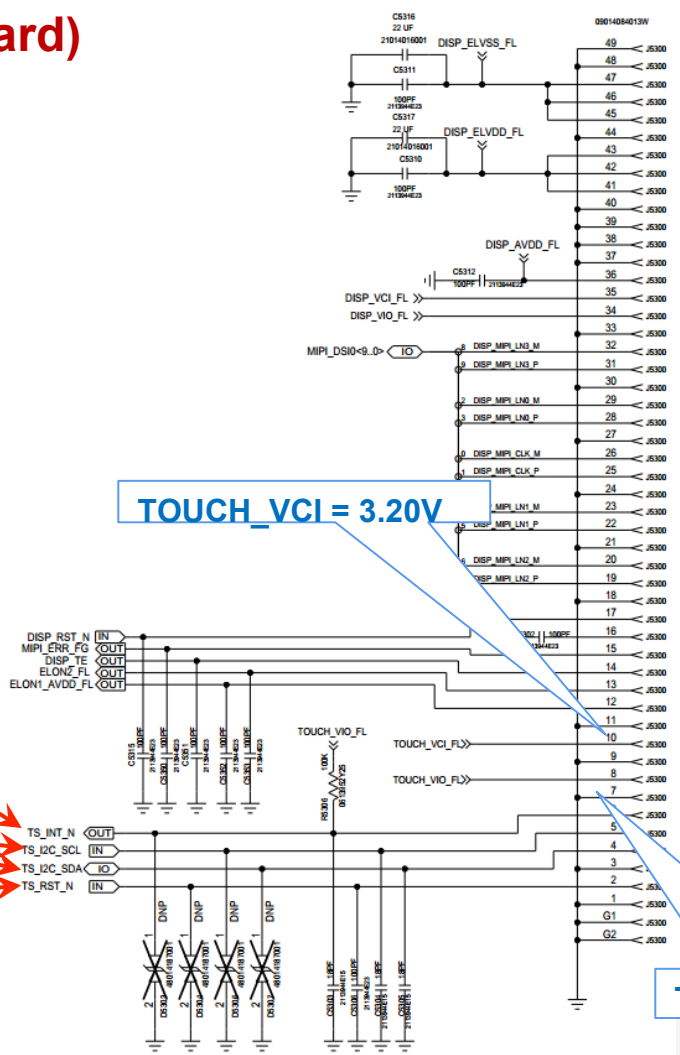




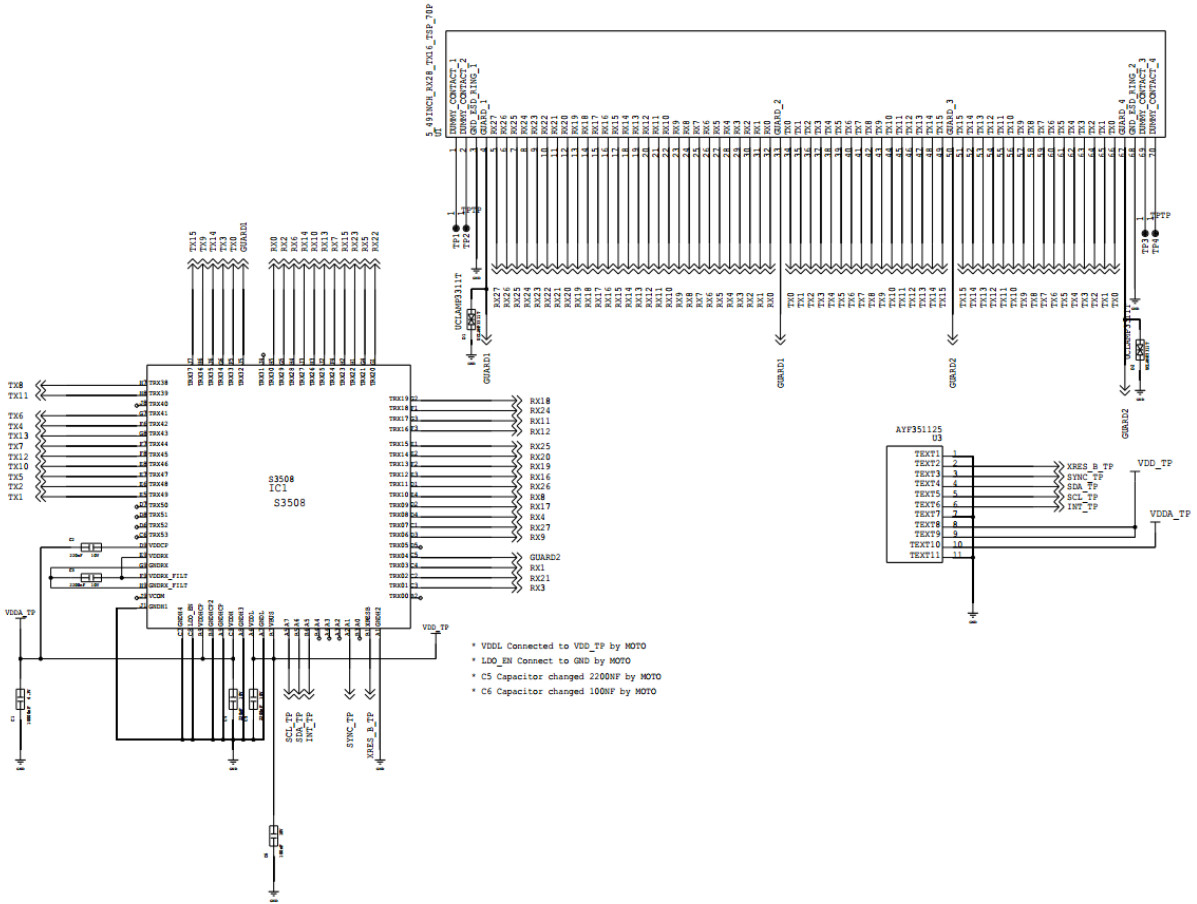
Touch Design - Block Diagram



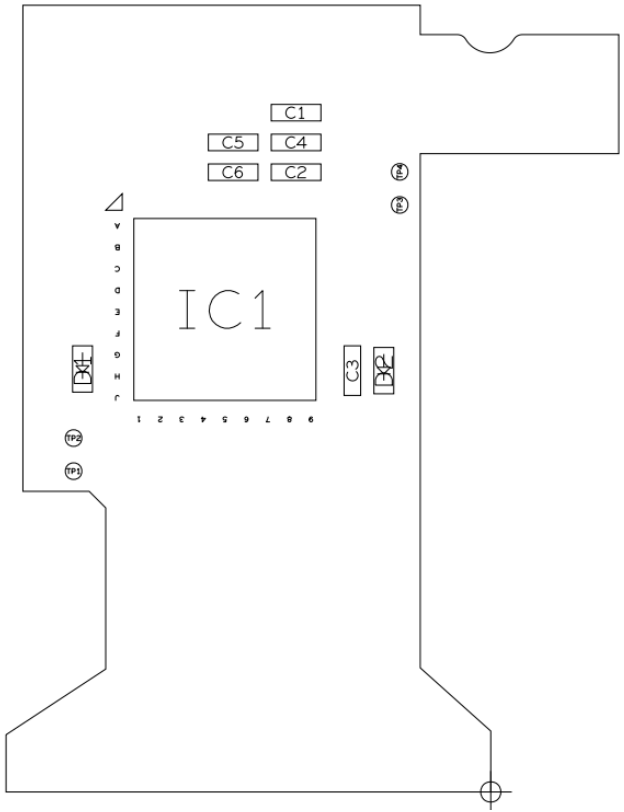
Touch Design - Schematic (Main Board)



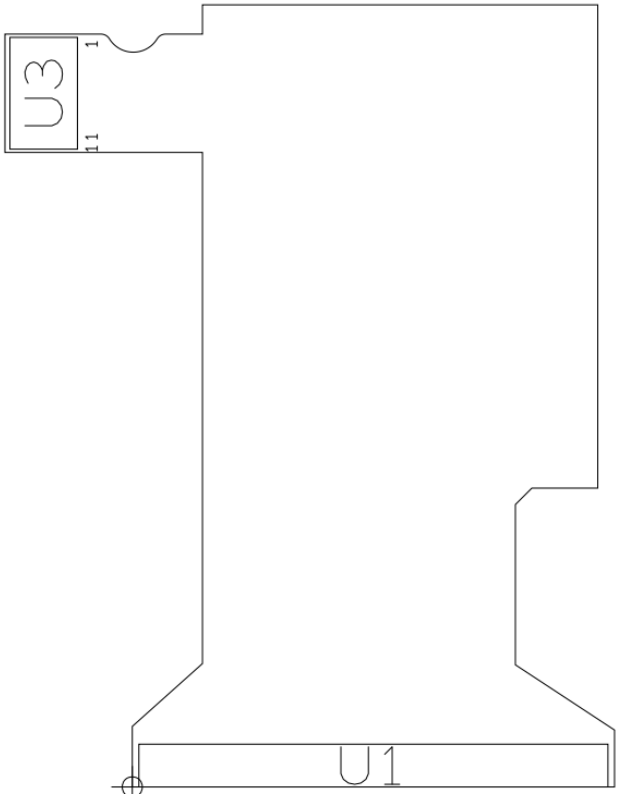
Touch Design - Schematic (Touch Flex)



Touch Design - Flex Layout (Touch Flex)



Top



Bottom

Touch Design - 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).

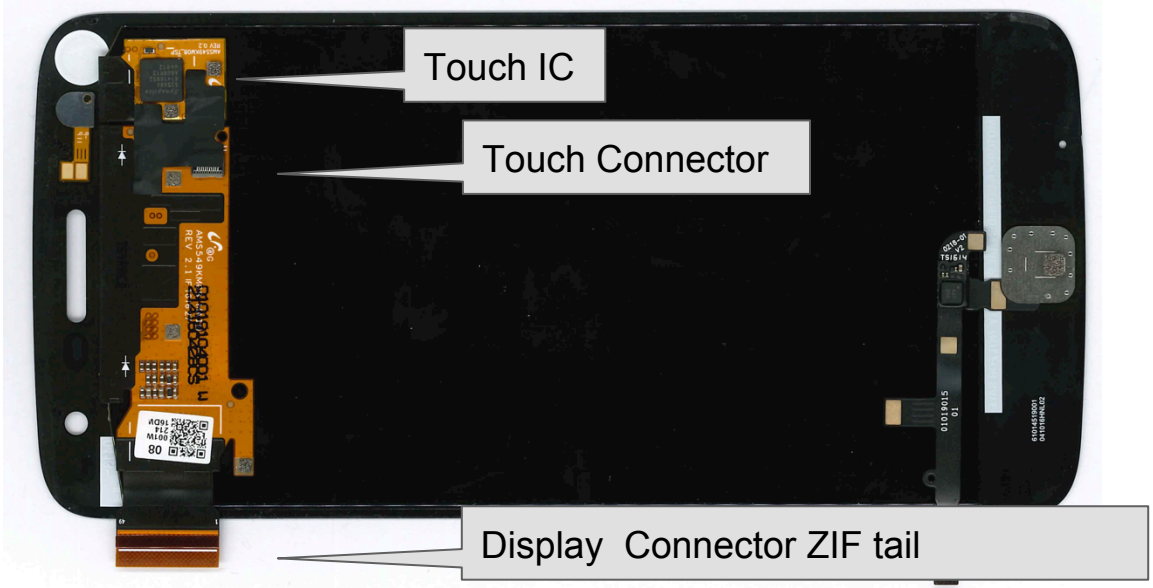
2. Display panel issue
    - Check Touch flex for any damage.
    - Ensure TOUCH_VCI 3.2VDC and TOUCH_VIO 1.8VDC power is at bypass caps C1, C5.
    - Verify Reset signal is high on Touch ZIF pin 2, ATTN is high on ZIF pin 2.
    - I2C Data and I2C Clock at 1.8VDC.

3. Main Board Issue
    - Check connector for full insertion.
    - Ensure TOUCH_VCI 3.2VDC and TOUCH_VIO 1.8 VDC supplies are on the main board display ZIF connector(J5300)Verify Reset signal is high, INT is high, I2C Data and Clock at 1.8VDC.
    - When touching panel, INT should toggle low, I2C data and clk will toggle.

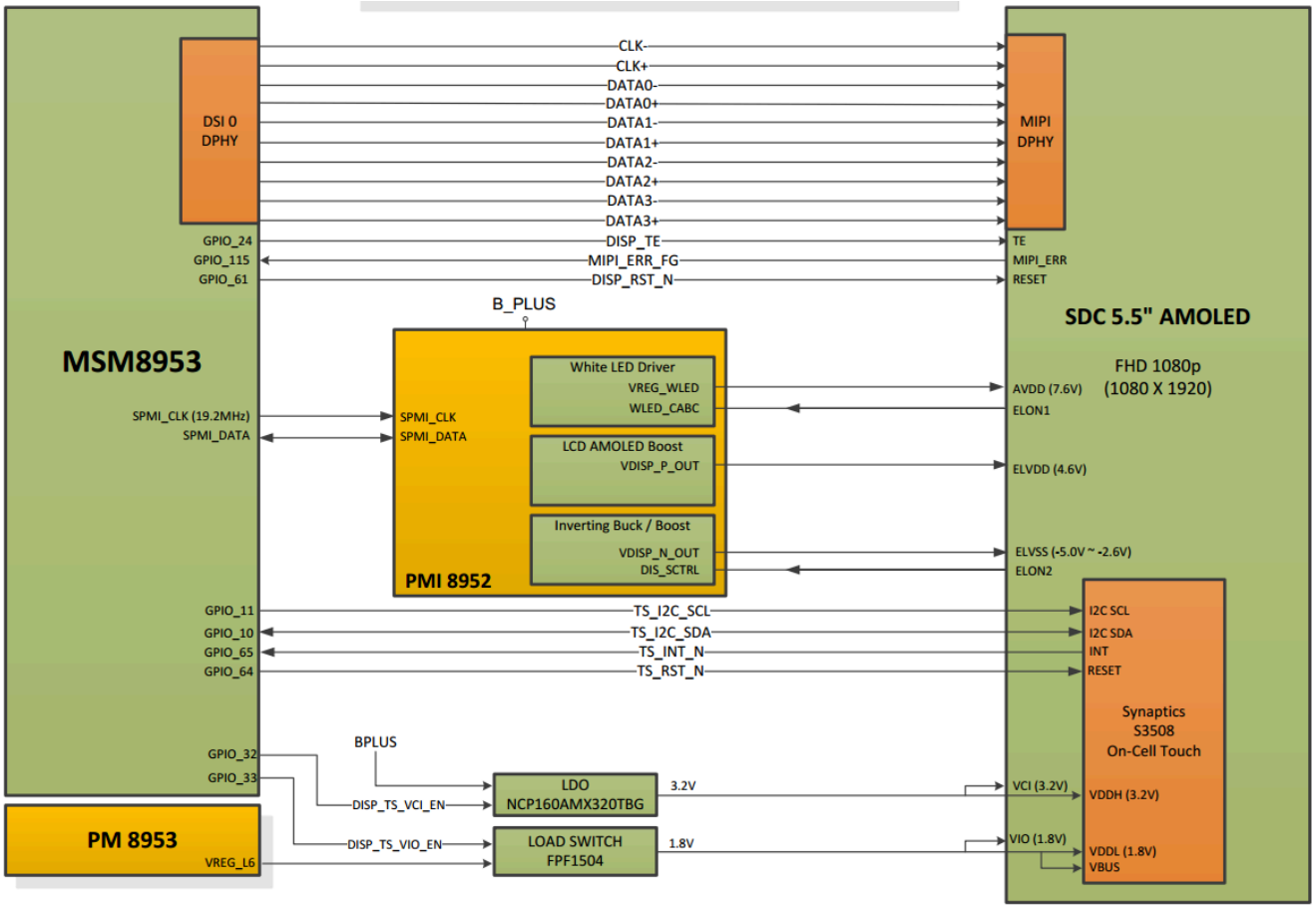
DISPLAY TROUBLESHOOTING

Display Design - Overview

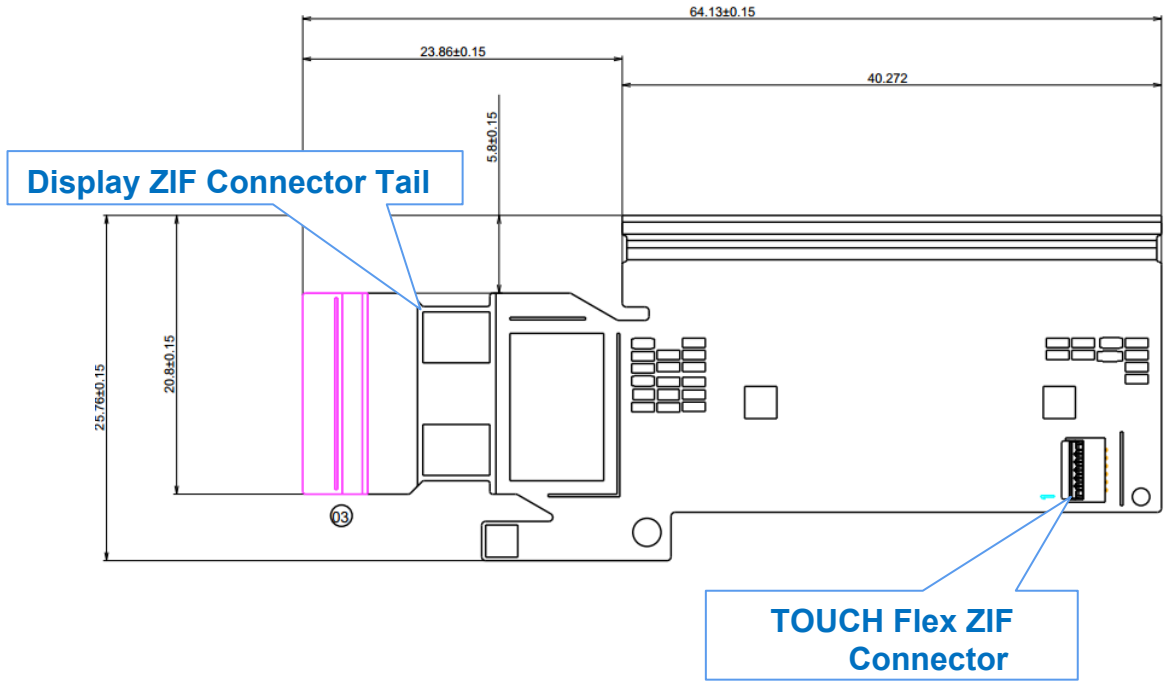
- Display Type : AMOLED
- Vendor : Samsung Display (SDC)
- Resolution : FHD (1920x1080)
- Size : 5.49”



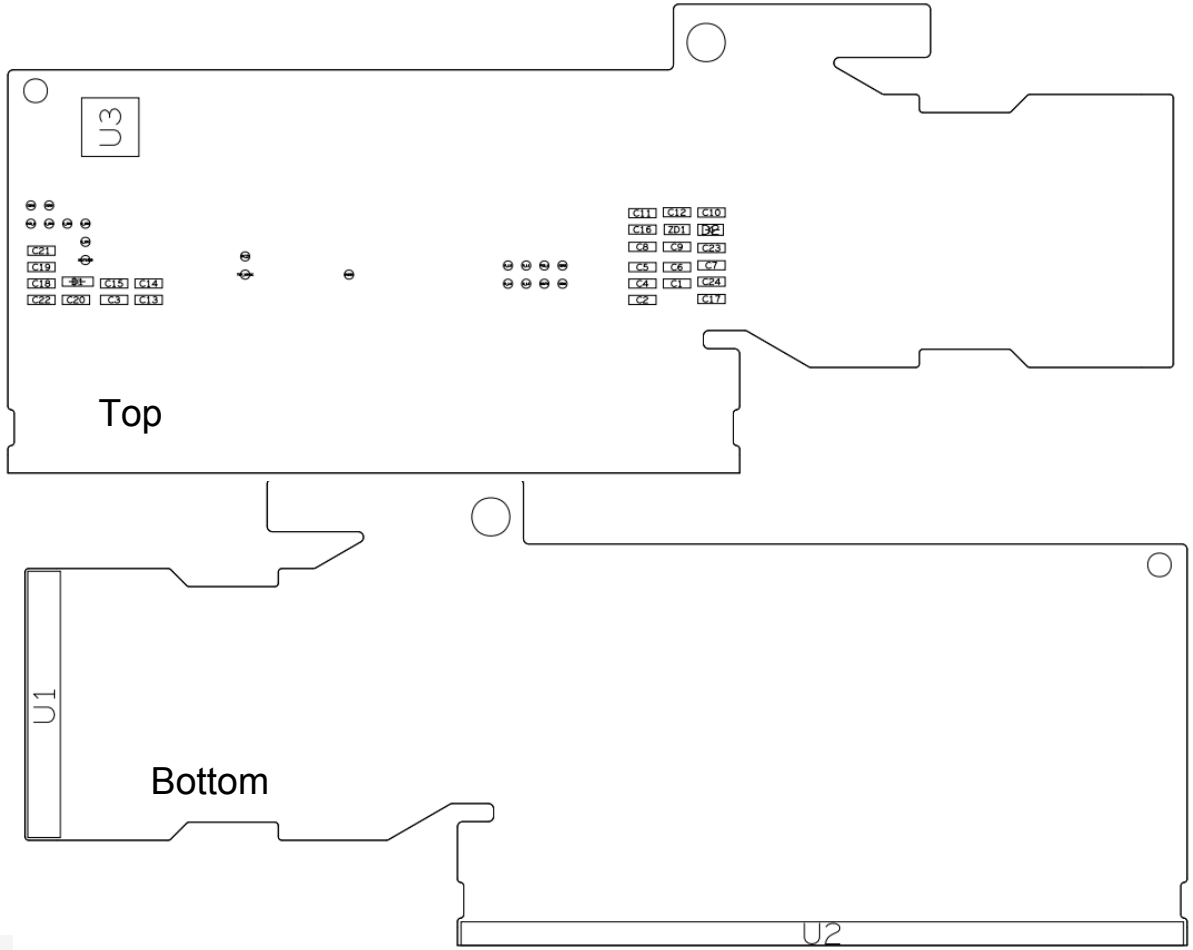
Display Design - Block Diagram



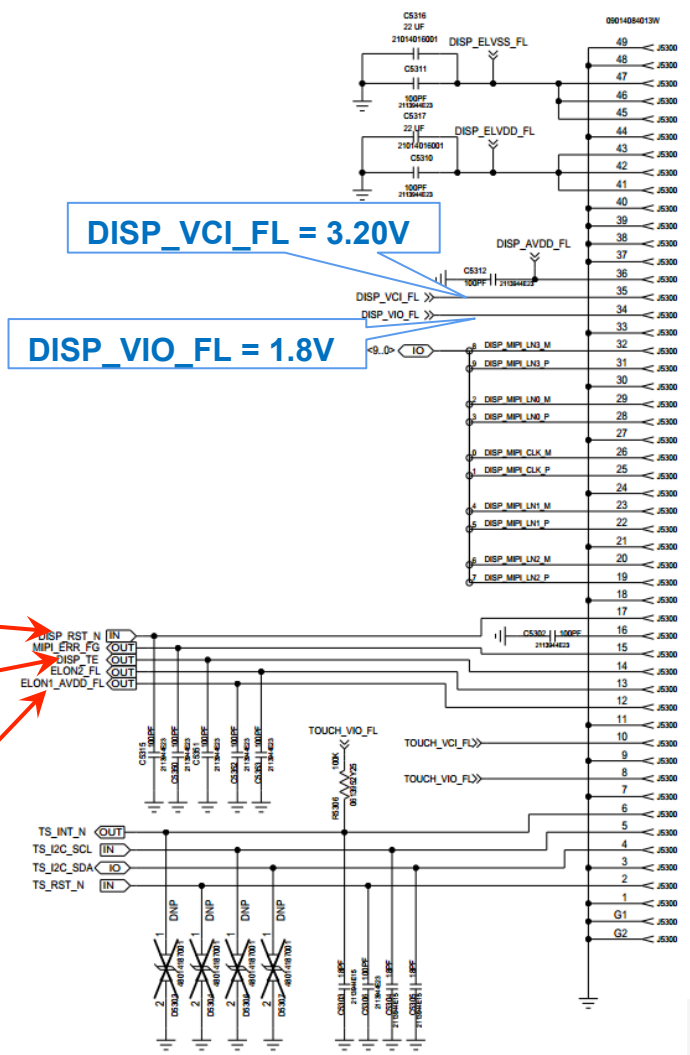
Display Design - Mechanical



Display Design - Flex Layout (Display Flex)



Display Design - Electrical

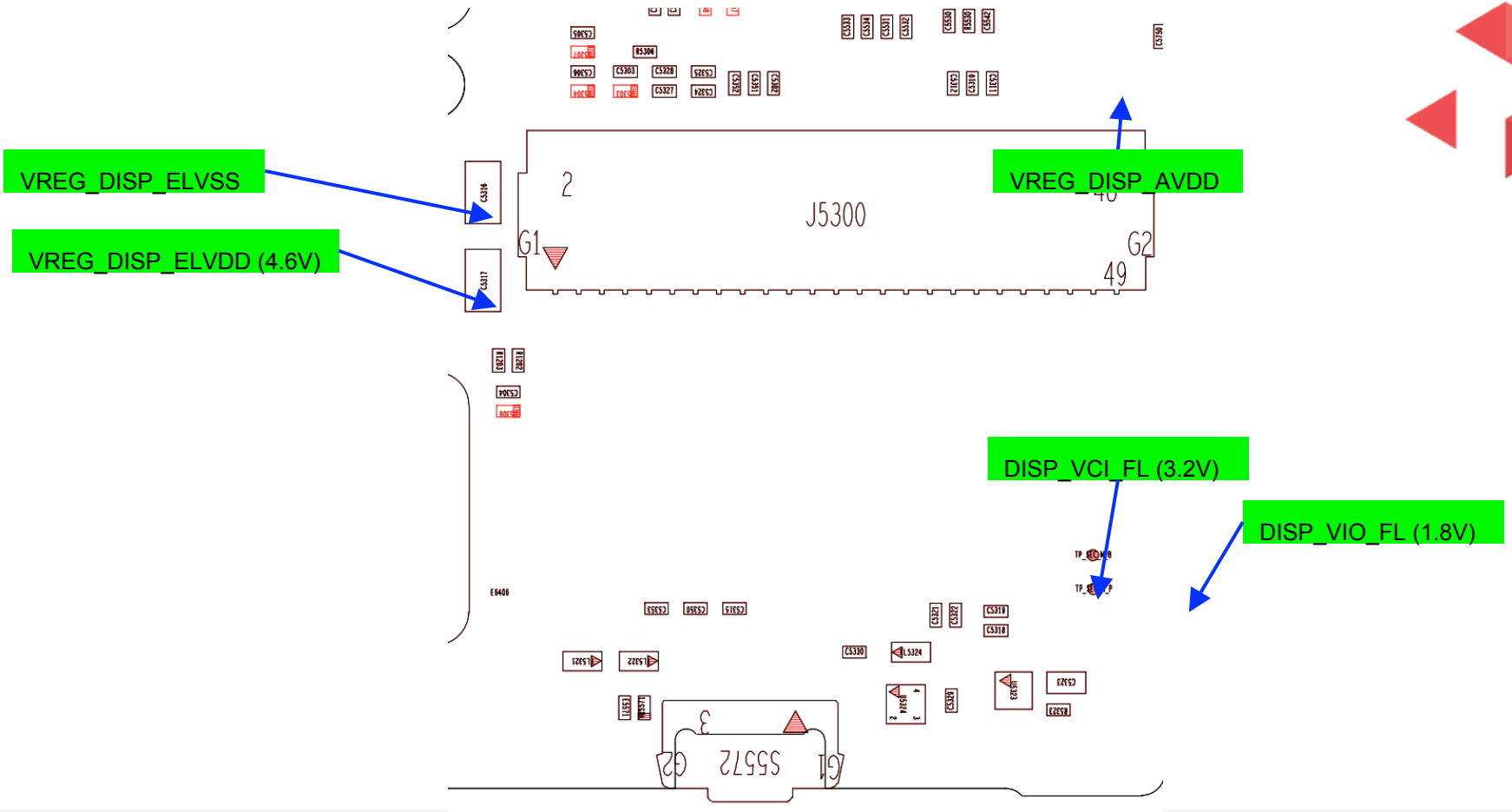


Display Reset from MSM GPIO

Display Tearing Effect Prevention

AVDD Enable Signal from Display

Display Signal Location



Display Design - Troubleshooting

- Check 49pin display ZIF connector
  1. Fully 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
  1. Check of J5300
  2. Check DISP_VIO_FL voltage (1.8VDC) (Refer previous slide)
  3. Check DISP_VCI_FL voltage (3.2VDC) (Refer previous slide)
  4. Check AVDD, ELVDD, and ELVSS after phone power up.
     a. If they are not turned on, check ELON1_AVDD and ELON2.

- If the issue follows display module, replace the module

IMAGER/FLASH TROUBLESHOOTING

Rear Facing Imager Troubleshooting

In the event of No-Preview Issue (ViewFinder):

- Check first if this issue follows rear imager module or main PCB by swap test with known good module.
- In the meantime, check if JIF finger of the flex and JIF connector door are mated properly without poor assembly.
    - If the issue follows rear Imager module - Send the defective module to module supplier for further analysis.
    - If the issue follows main PCB - Please check power supplies level, control signals and MIPI signals as directions on the next slide to find further information about failure.

Rear Facing Imager Troubleshooting (cont'd)

Check sensor analog power level at this point of C5535 or C5536 (CAM_AVDD=2.85V)

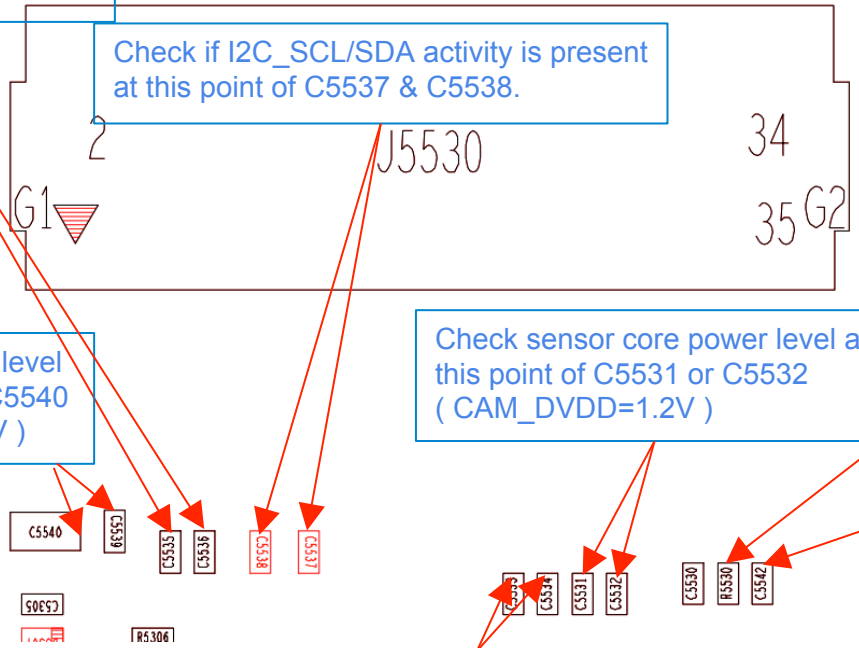
Check if I2C_SCL/SDA activity is present at this point of C5537 & C5538.

Check AF actuator power level at this point of C5539 or C5540 (VREG_L17_2P85=2.85V)

Check sensor core power level at this point of C5531 or C5532 (CAM_DVDD=1.2V)

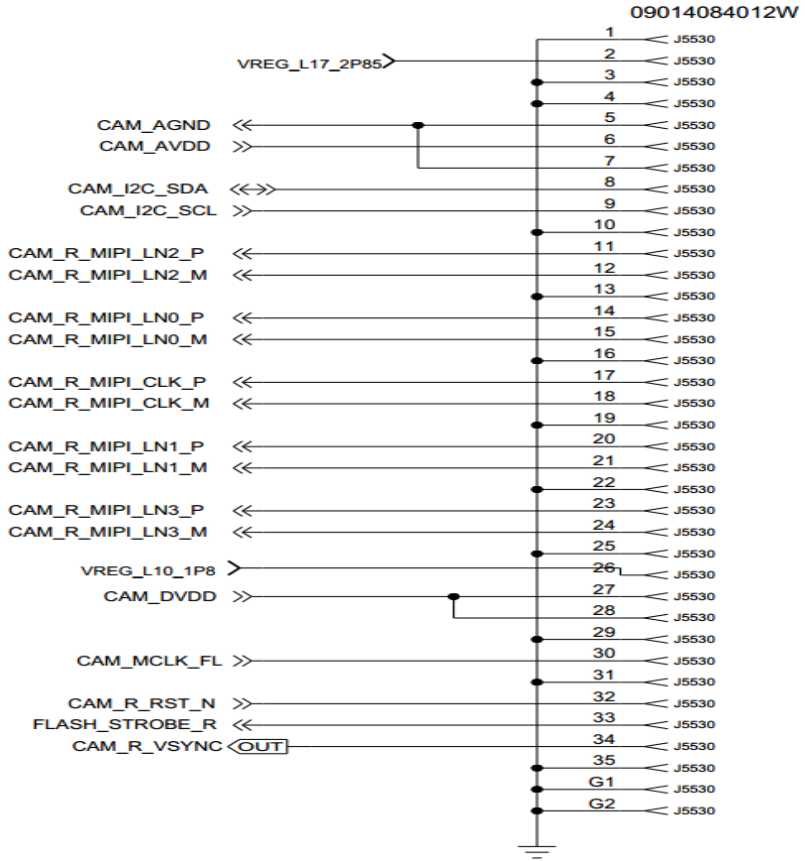
Check CAM_R_MCLK_FL (main clock, 24Mhz) at this point of R5530

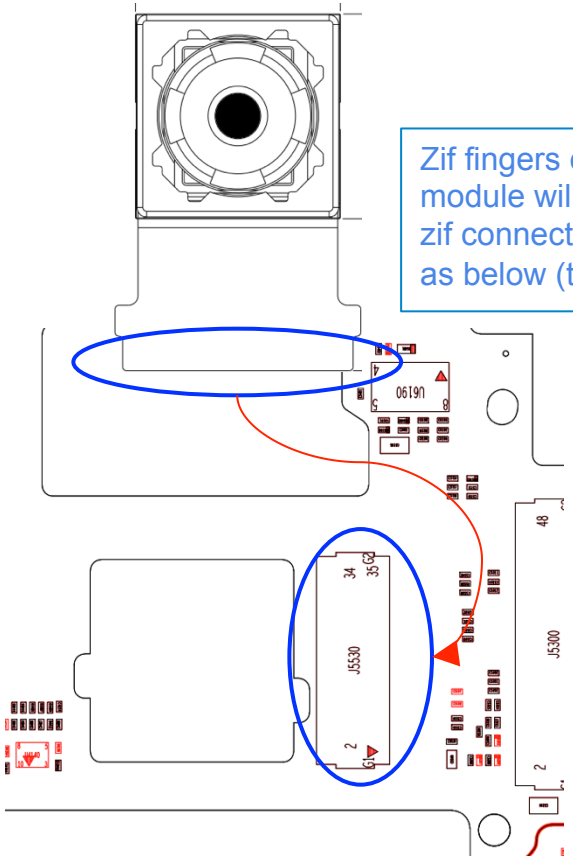
Check if CAM_R_RST is high at this point of C5542. It should be high level.



Check sensor digital power level at this point of C5533 or C5534 (VREG_L10_1P8=1.8V)

Rear Facing Imager Troubleshooting (cont'd)





Zif fingers of rear imager module will be inserted into zif connector on main pcb as below (top contact type)

Front Facing Imager Troubleshooting

In the event of No-Preview Issue:

- Check if this issue follows front imager module or main PCB by swap test with known good module first.
- In the meantime, check if JIF finger of the flex and JIF connector door are mated properly without poor assembly
    - If the issue follows front Imager module - Send the defective module to module supplier for further analysis.
    - If the issue follows main PCB - Please check power supplies level, control signals and MIPI signals as directions on the next slide to find further information about failure.

Front Facing Imager Troubleshooting (cont'd)

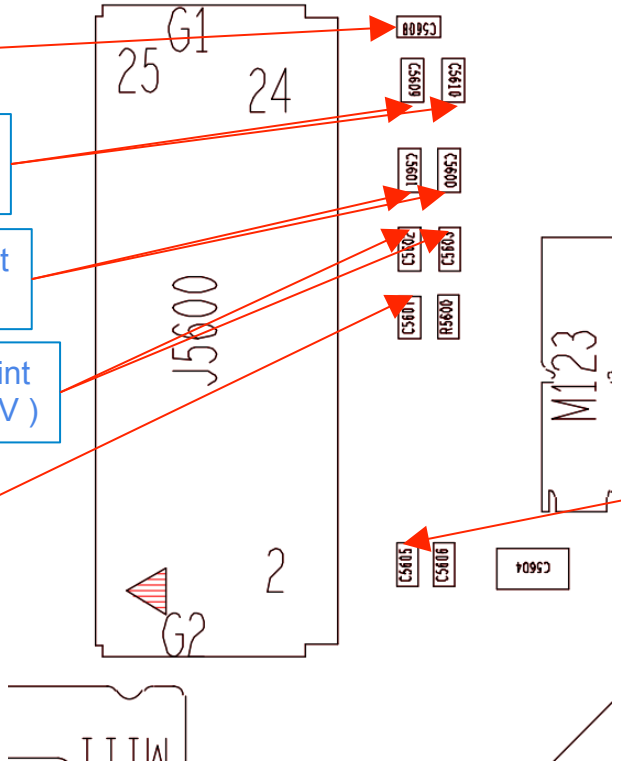
Check if CAM_F_RST is high at this point of C5608. It should be high level.

Check if I2C_SCL/SDA activity is present at this point of C5609 and C5610.

Check sensor core power level at this point of C5600 or C5601(CAM_DVDD=1.2V)

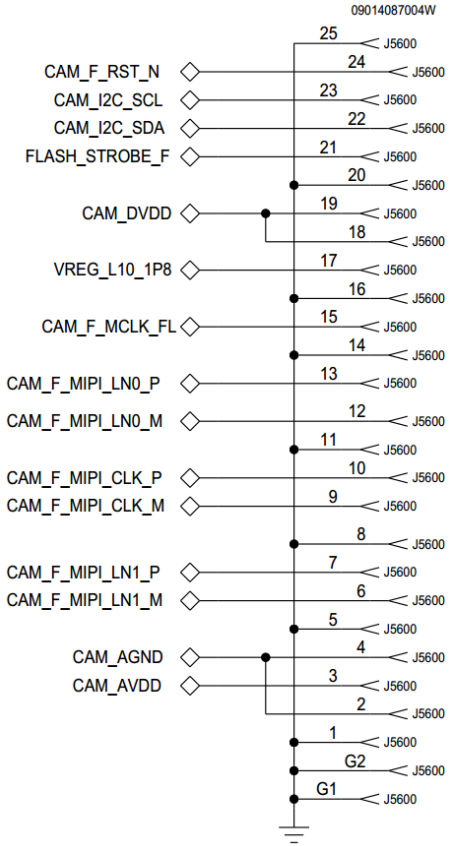
Check sensor digital power level at this point of C5602 or C5603 (VREG_L10_1P8=1.8V)

Check CAM_F_MCLK_FL (main clock, 24Mhz) at this point of C5607

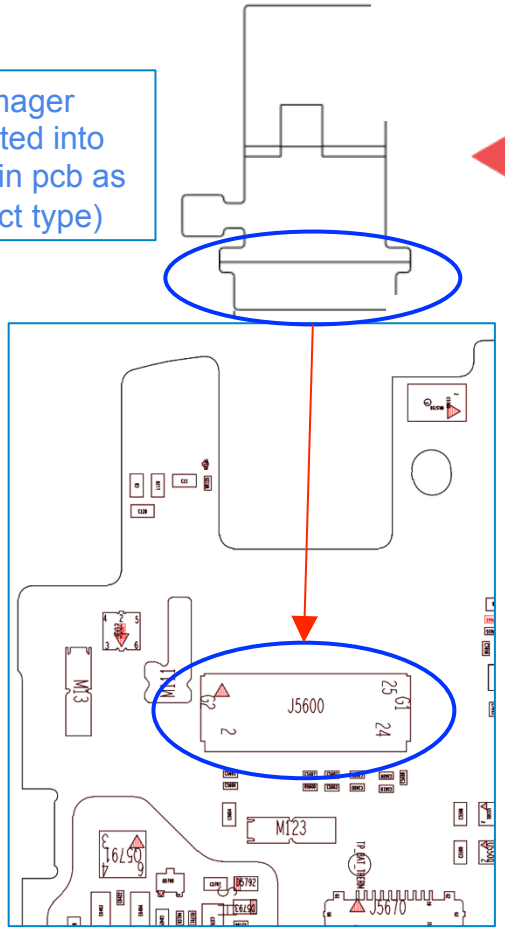


Check sensor analog power level at this point of C5605 (CAM_AVDD=2.85V)

Front Facing Imager Troubleshooting (cont'd)



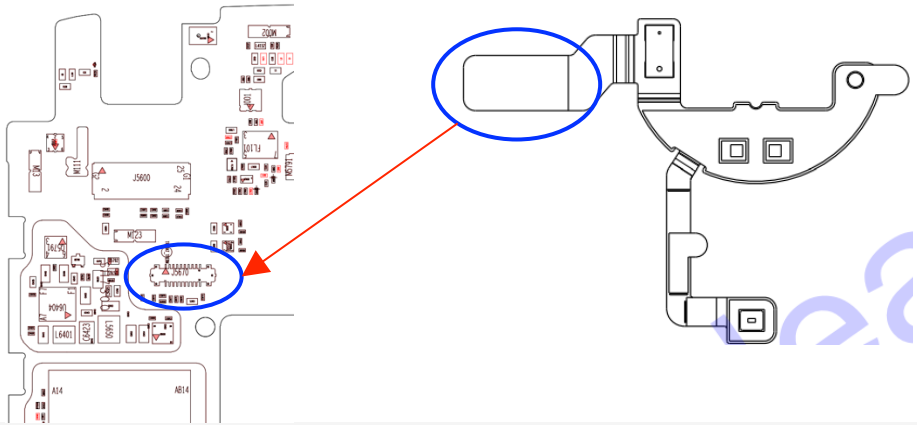
Zif fingers of front imager module will be inserted into zif connector on main pcb as below(bottom contact type)



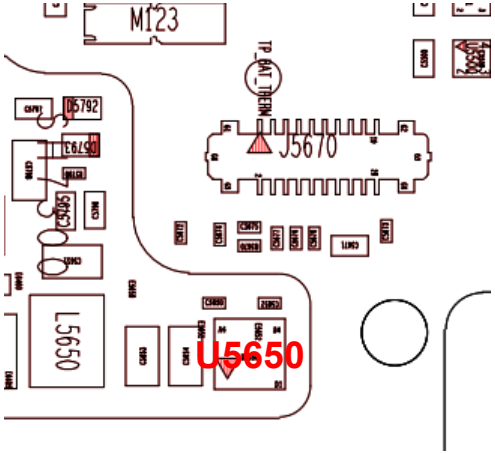
Rear Imager Flash LED

In the event of No turn-on LED Issue:

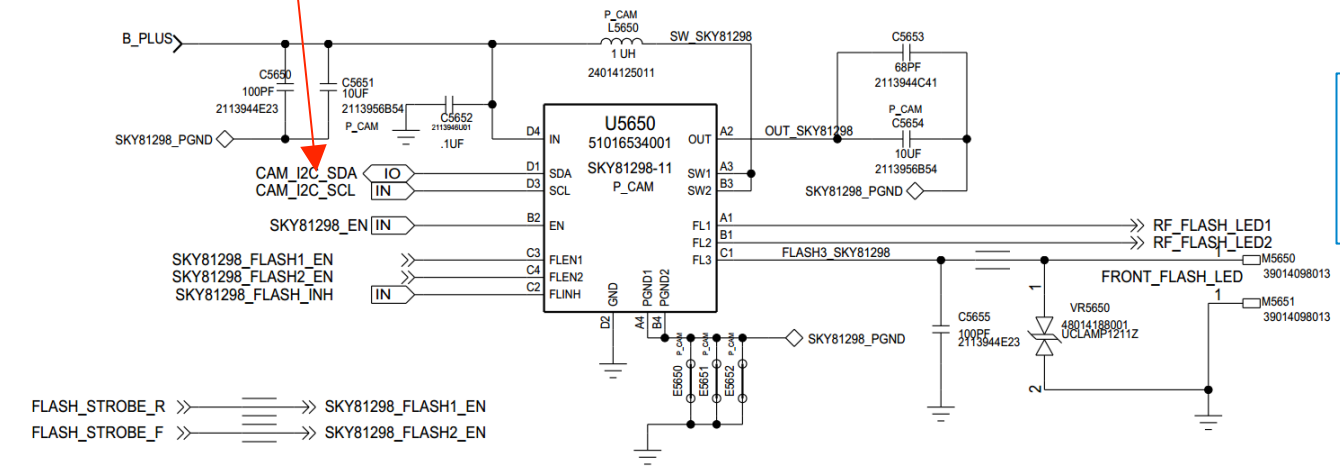
- Check if this issue follows rear imager flash LED flex by swap test with known good flex module first.
- In the meantime, check if receptacle and plug of B-to-B connector are mated properly without poor assembly.
    - If the issue follows rear imager flash LED flex - Check if LED was damaged and send the module to LED supplier without removing LEDs on flexible PCB for further analysis if it is the case.
    - If the issue follows main PCB - Please check the operation of flash driver IC (SKY81298, U5650) on next slide to find further information about the failure.



Rear Imager Flash LED (cont'd)



Check if I2C_SCL/SDA activity is present. Since these signals are being shared with front and rear imagers

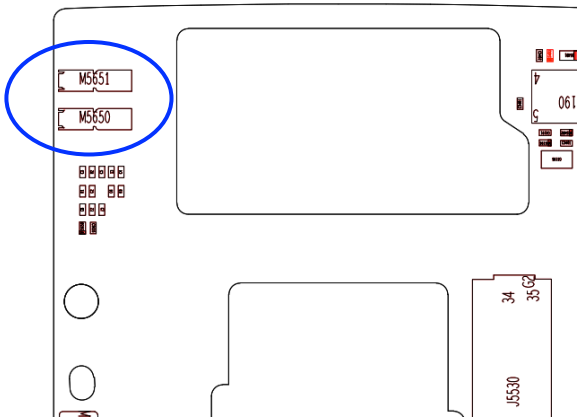


Check the SMT status if there is cold soldering or part damage associated with flash driver IC circuitry on main PCB

Front Imager Flash LED

In the event of No turn-on LED Issue:

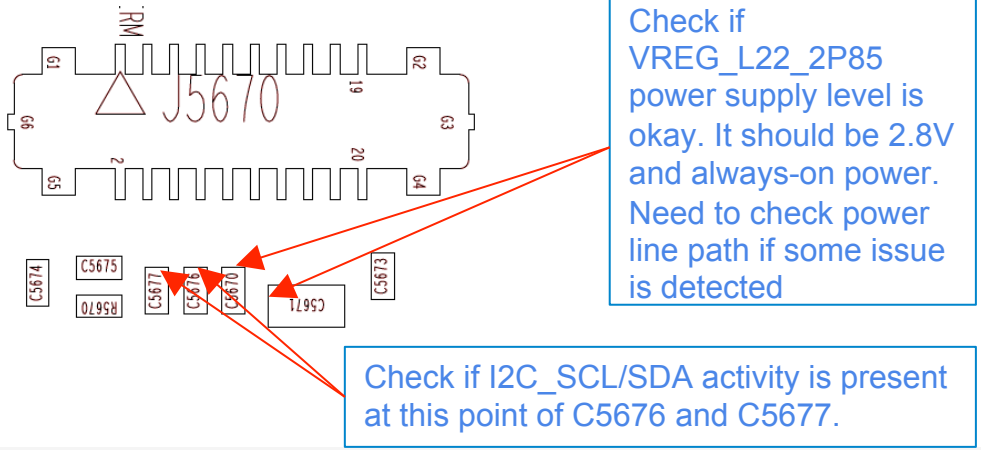
- Check if this issue follows front imager flash flex by swap test with known good PCB module first.
- In the meantime, check if universal contacts (M5650 and M5651) are mated properly without poor assembly.
    - If the issue follows front imager flash PCB - Check if LED was damaged and send the module to LED supplier without removing LEDs on flexible PCB for further analysis if it is the case.



Laser AF module Troubleshooting

In the event of No working laser AF module Issue:

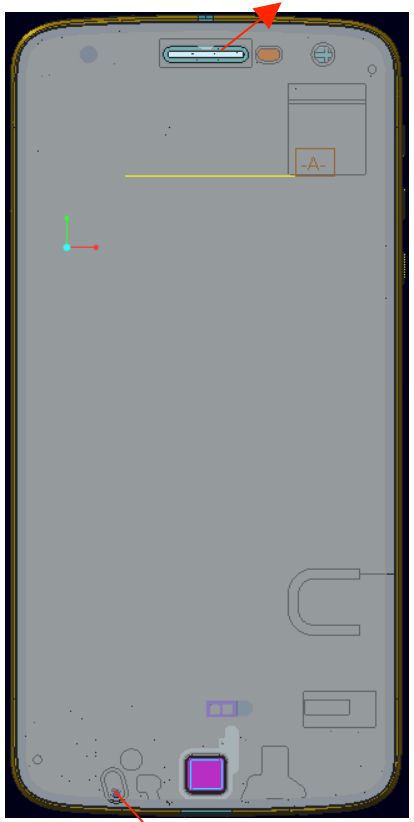
- Check if this issue follows rear flash LED flex by swap test with known good flex module first.
- In the meantime, check if receptacle and plug of B-to-B connector are mated properly without poor assembly.
    - If the issue follows rear flash LED flex - Check if Laser AF module was damaged and send the module to module supplier without removing it on flexible PCB for further analysis if it is the case.
    - As instruction below, check what made issue in the camera mode, if the issue follows main PCB.



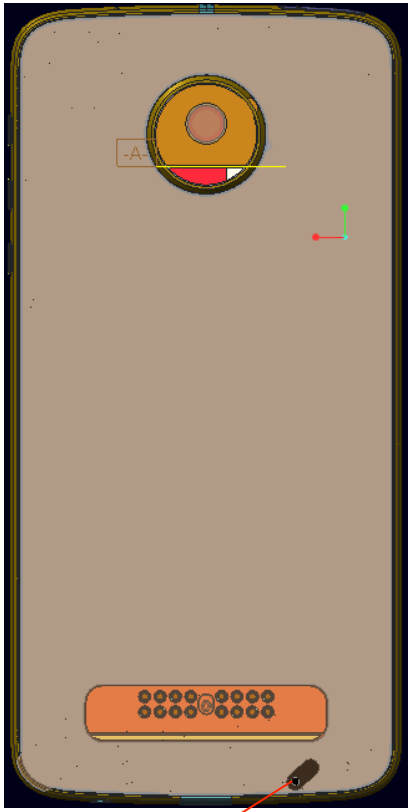
AUDIO & VIBRATOR TROUBLESHOOTING

Audio Port Locations

Speaker and earpiece port

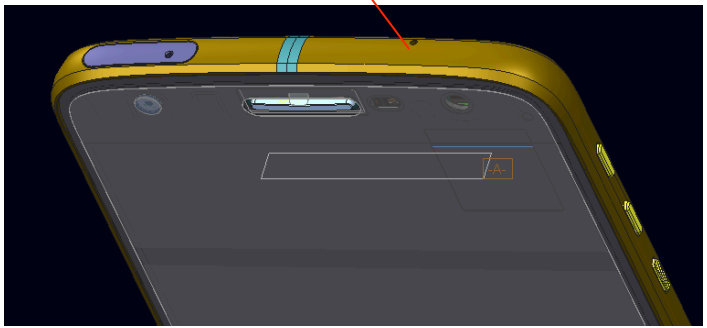


1st MIC port

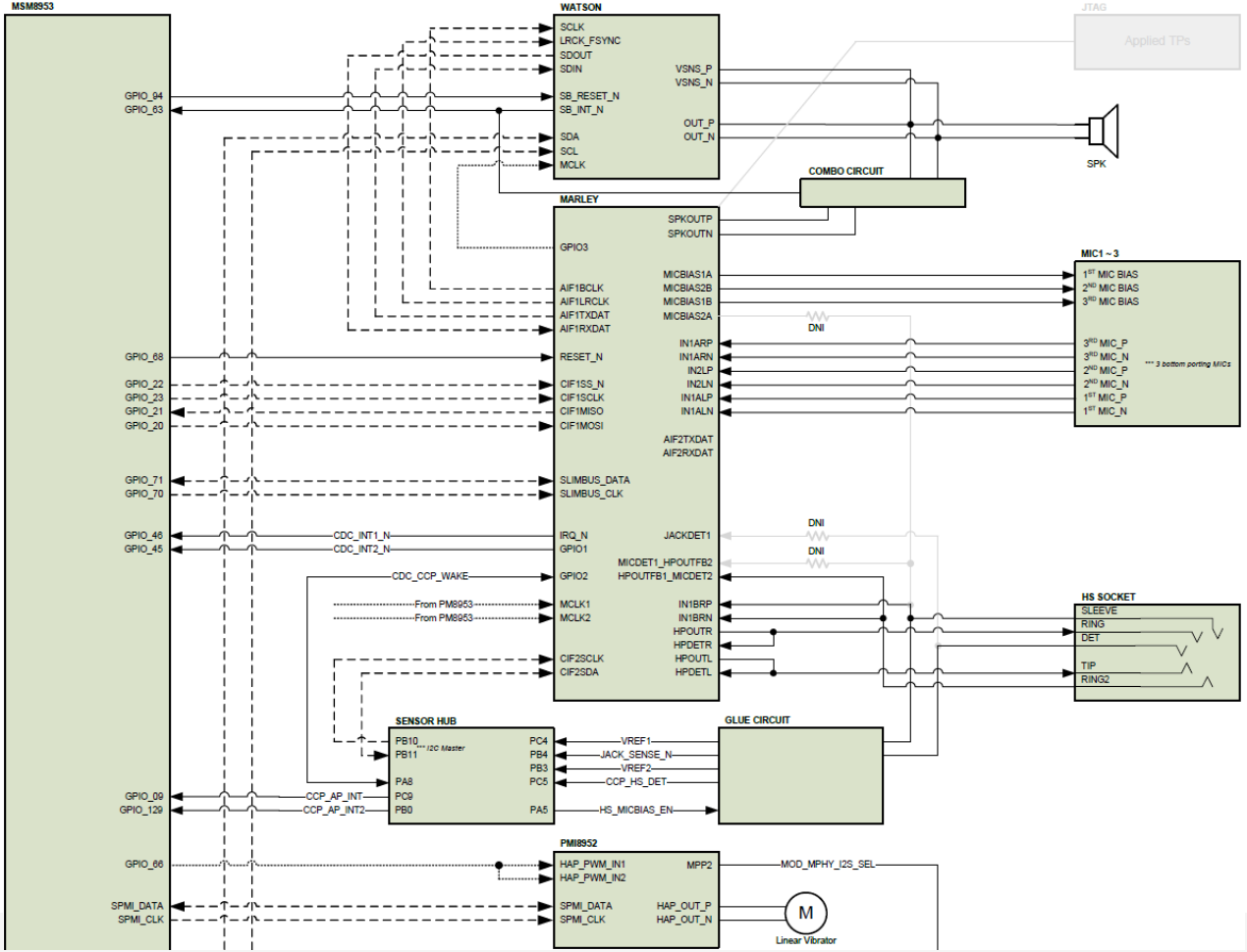


3rd MIC port

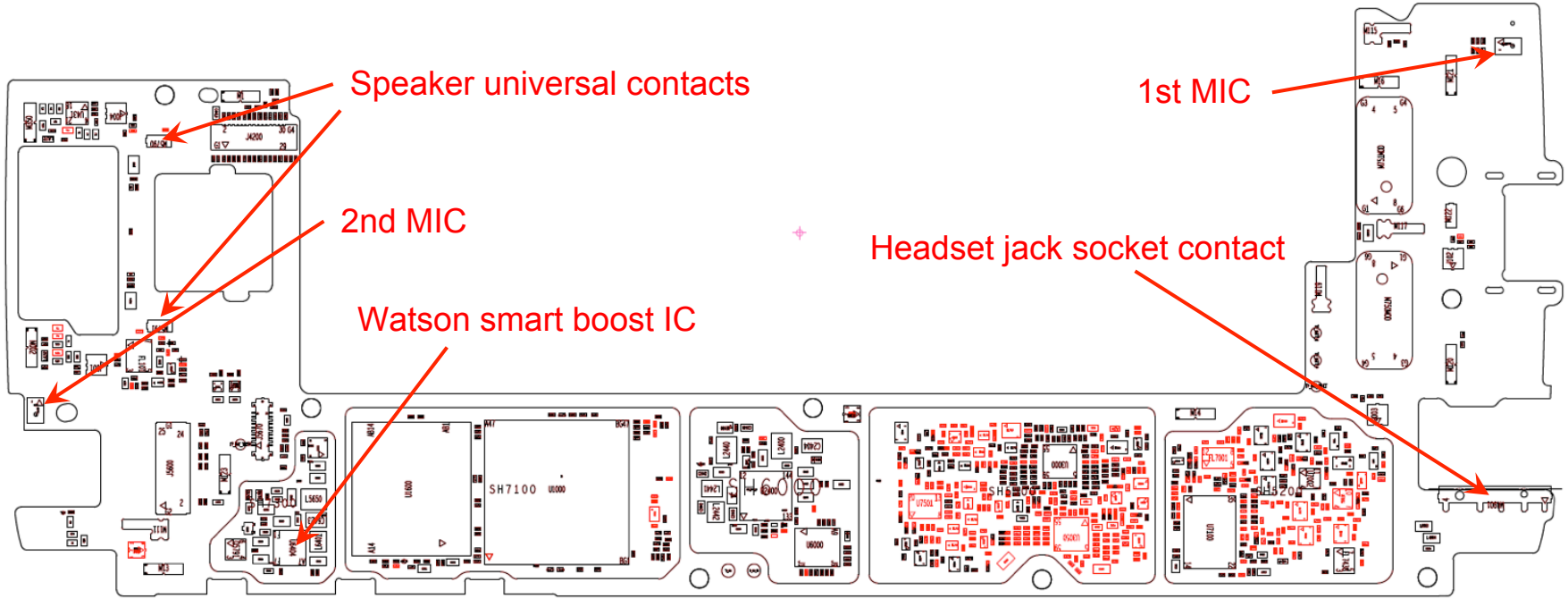
2nd MIC port



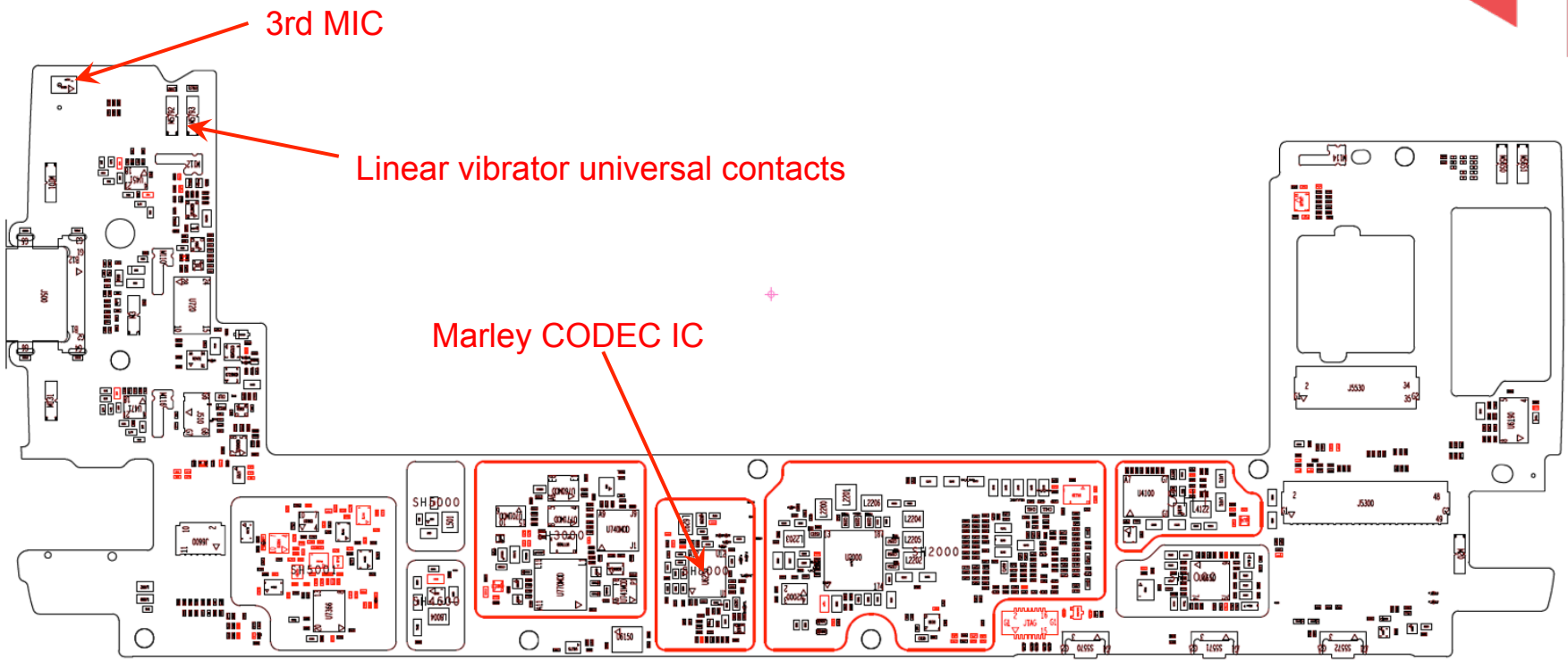
Audio Block Diagram



Audio Part Location (Top)



Audio Part Location (Bottom)



Audio Use Cases

- **Microphone**

1st MIC

- Main microphone for handset mode voice call
- Main microphone for Moto voice

2nd MIC

- Noise cancellation MIC for handset mode voice call
- Recording microphone for stereo camcording

3rd MIC

- Beam forming microphone for Moto voice
- Recording microphone for stereo camcording

HS MIC

- Main microphone for headset mode voice call
- Main microphone for Moto voice

- **Top speaker**
  - Output alert sound
  - Output Rx voice at handset mode voice call

- **Vibrator**
  - Alert vibration
  - Haptic vibration

“No or abnormal Audio” Complaints

The CQA apk can be used to verify all of audio function except ultrasonic function.

For microphone test, under the “Audio” menu, select “Mic Loopback”.

- The “PRIMARY MIC” setting loops 1st MIC to the top speaker in earpiece mode.
- The “SECONDARY MIC” setting loops 2nd MIC to the top speaker in earpiece mode.
- The “TERTIARY MIC” setting loops 3rd MIC to the top speaker in earpiece mode.
- The “HEADSET MIC” setting loops headset MIC to the wired headset earpieces.

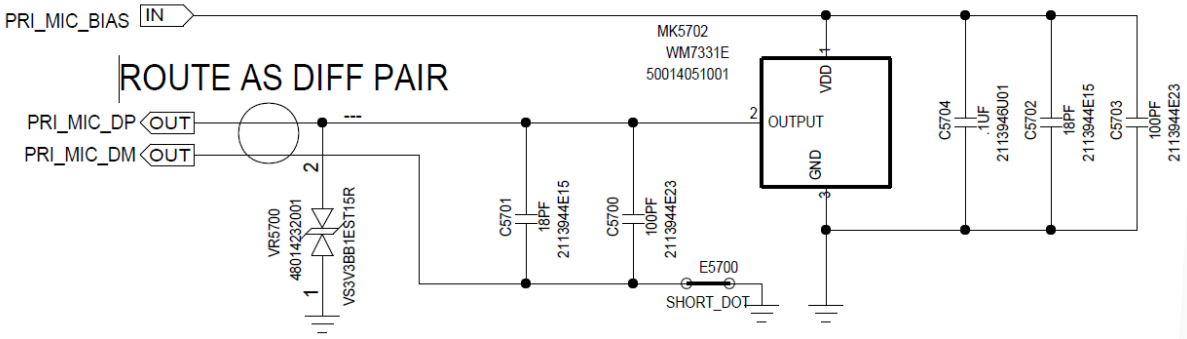
For speaker test, under the “Audio” menu of the CQA apk, select “Ear Speaker”.

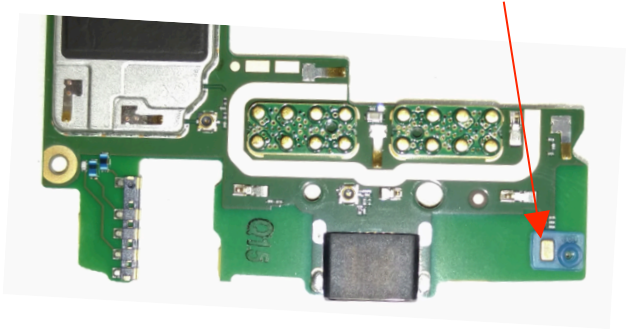
- Output sweep sound can be heard from top speaker in earpiece mode.
- Vertex speaker mode and earpiece mode are same circuit. So the “Ear speaker” test is enough to verify the speaker function.

- The headset audio can be tested by first plugging in a headset with a microphone and then selecting “Mic Loopback”. The headset microphone’s audio should be heard at wired headset earpiece speaker.

- Headset detection can be verified by selecting “Headset Info” under the CQA apk “Headset” menu Information about whether a headset is plugged in and the headset type and MIC information should be displayed. Headset “SEND/END” button press detection status should be displayed as well.

Primary Microphone Circuit

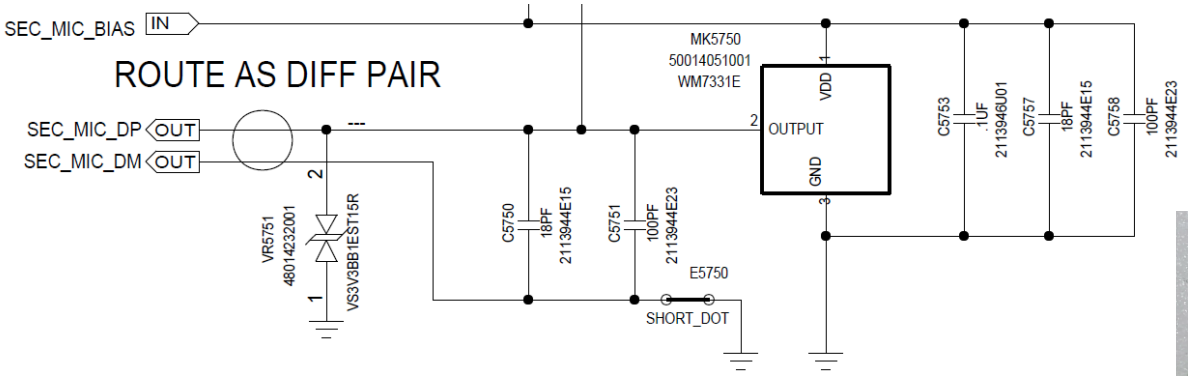


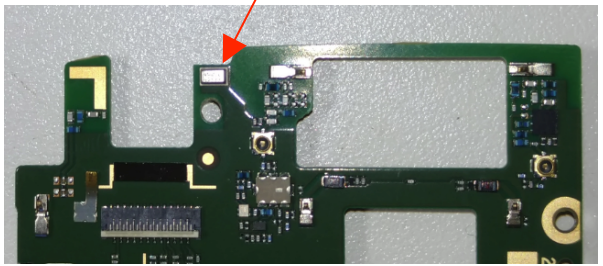


If the Primary MIC is not functioning,

- Check MIC bias at C5702 or C5703 or C5704. Measured level should be almost 1.8V when the microphone is being enabled.
- Check the microphone output at C5700 or C5701. The AC amplitude should be increased (Output DC bias should be around 0.7V), when audio is present.
- If there is no AC amplitude, MIC part should be reworked.

Secondary Microphone Circuit

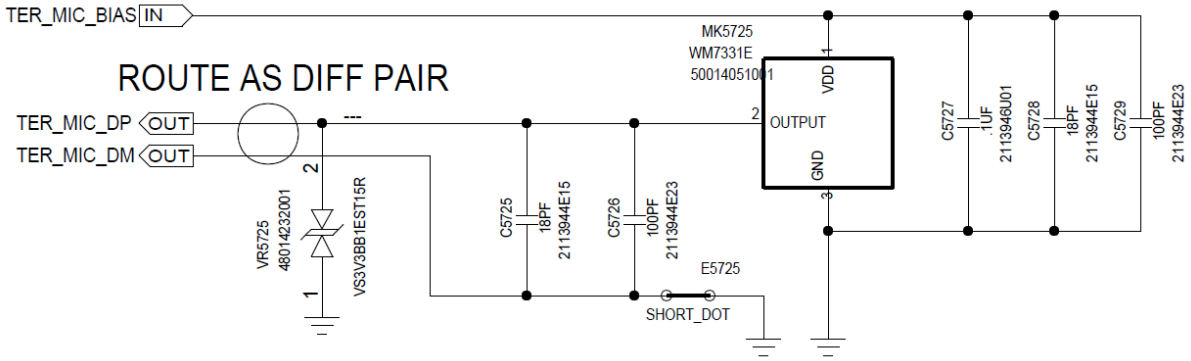


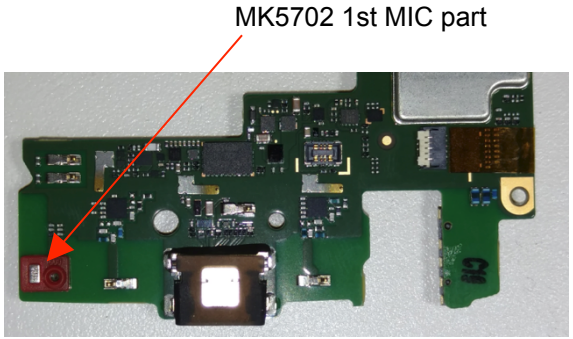


If the secondary MIC is not functioning,

- Check MIC bias at C5753 or C5757 or C5758. Measured level should be almost 1.8V when the microphone is being enabled.
- Check the microphone output at C5750 or C5751. The AC amplitude should be increased (Output DC bias should be around 0.7V), when audio is present.
- If there is no AC amplitude, MIC part should be reworked.

Tertiary Microphone Circuit

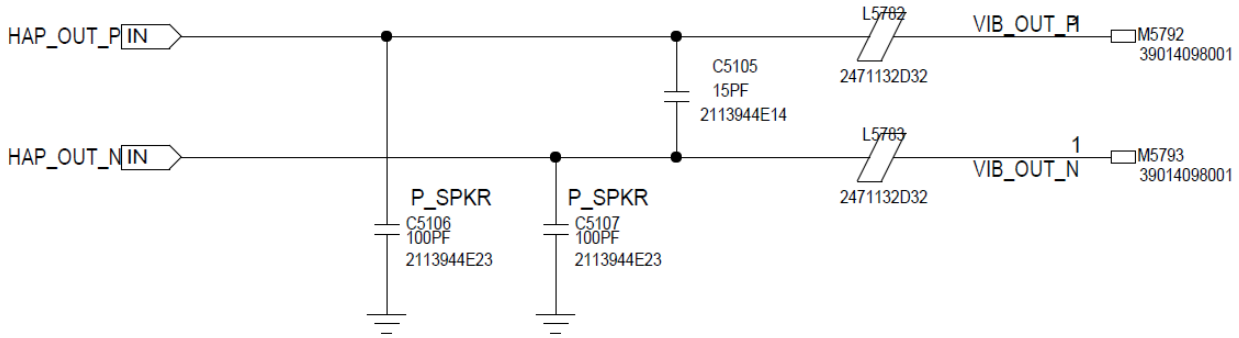


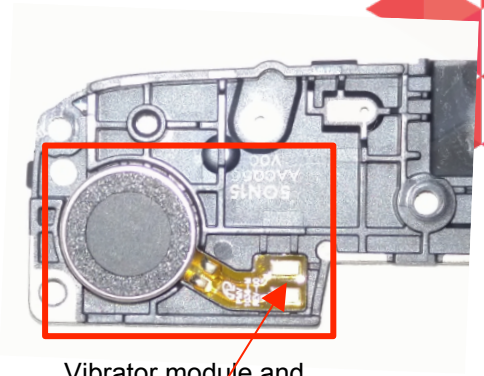


If the secondary MIC is not functioning,

- Check MIC bias at C5727 or C5728 or C5729. Measured level should be almost 1.8V when the microphone is being enabled.
- Check the microphone output at C5725 or C5726. The AC amplitude should be increased (Output DC bias should be around 0.7V), when audio is present.
- if there is no AC amplitude, MIC part should be reworked.

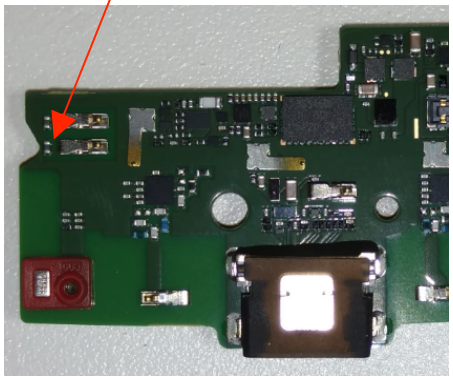
Vibrator Circuit





Vibrator module and contact pucks

M5792 and M5793



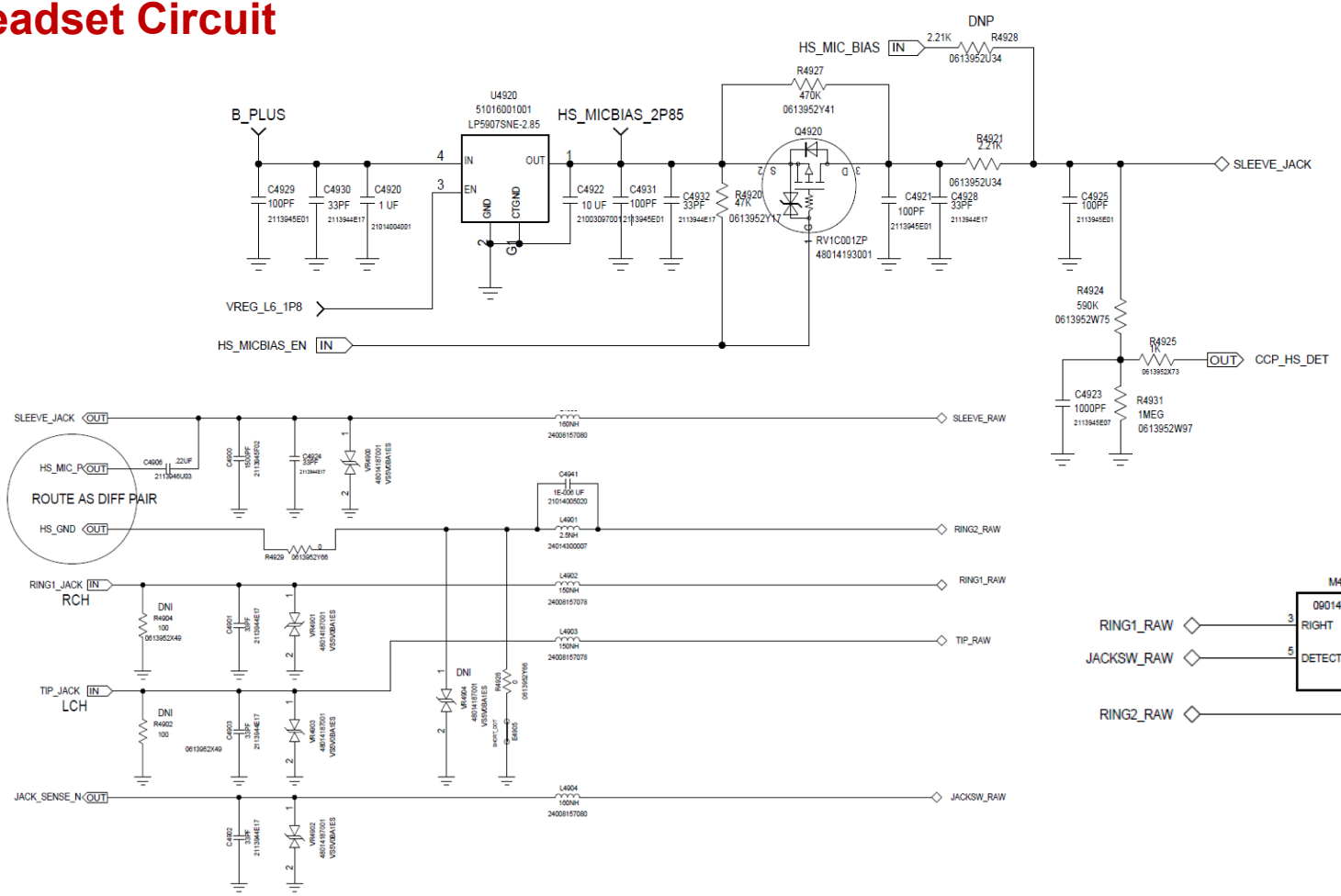
Linear vibrator part has been designed at bottom area. And there is no standalone drive IC. PMI8952 Haptic drive circuit is being used for Haptic and alert vibration.

If the Vibrator is not functioning…

- Inspect physical placement of the L5782, L5783, M5792 and M5793. (See schematic above)
- Check drive level at C5106 and C5107.
- Check DC resistance of L5782 and L5783, it should be around 0.7 ohm.
- Check DC resistance of vibrator part, it should be 24 ~ 32 ohm.

If the problem is vibration noise, the linear vibrator module should be reworked by new one.

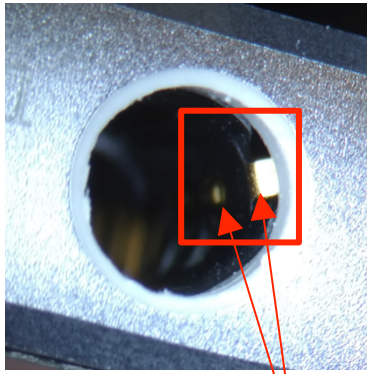
Headset Circuit



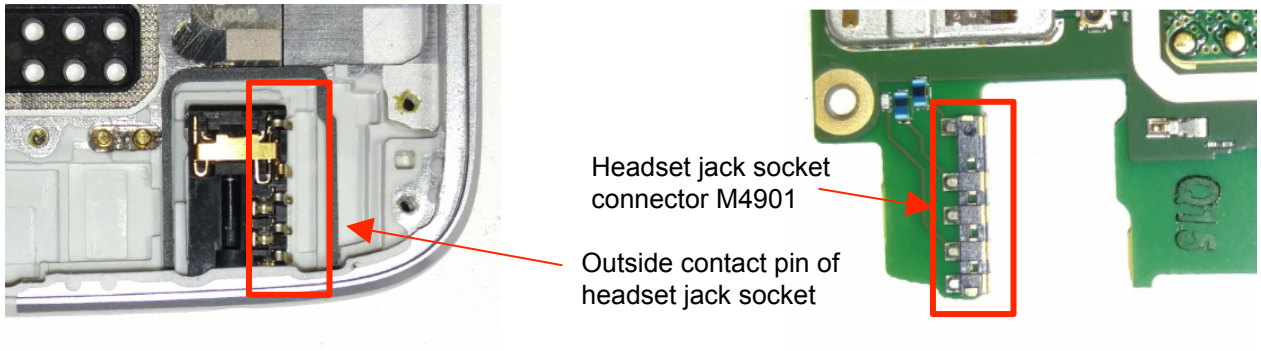
Headset Circuit

If the headset detection is not functioning,
- Inspect physical inside and outside contact pin status of head jack socket part.
- Inspect physical placement of the M4901, L4900 and L4901. (See schematic previous page)
- Check physical connector status of M4901 and headset jack socket part.
- Check DC resistance of L4900 and L4901, They should be around 2 ohm and 0.05 ohm.
- Check MIC bias output voltage with C4922, voltage level should be 2.85Vdc.

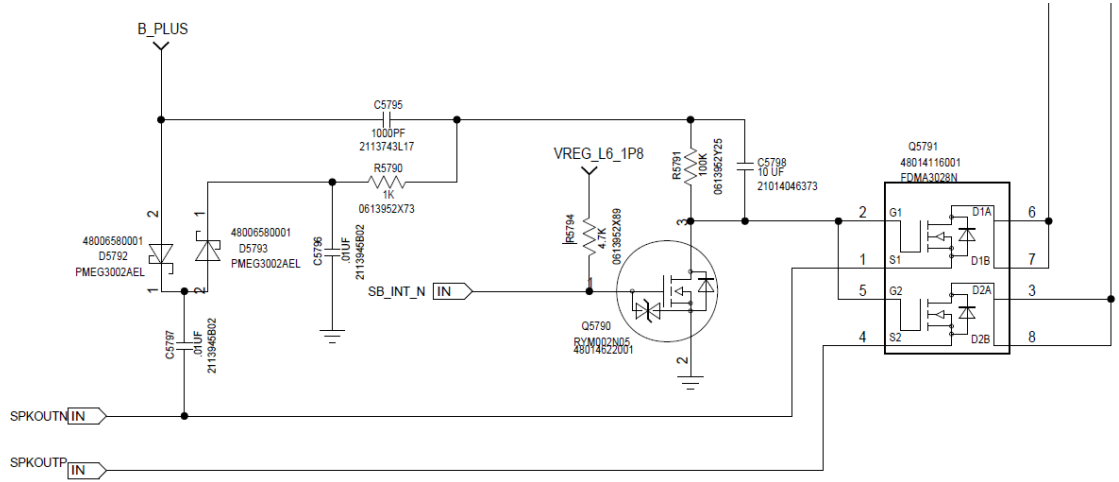
If the problem is left or right channel audio only,
- Inspect physical placement of the M4901, L4902 and L4903. (See schematic previous page)
- Check physical connector status of M4901 and headset jack socket part.
- Check DC resistance of L4902 and L4903, it should be around 2 ohm.



Inside contact pins for detecting accessory



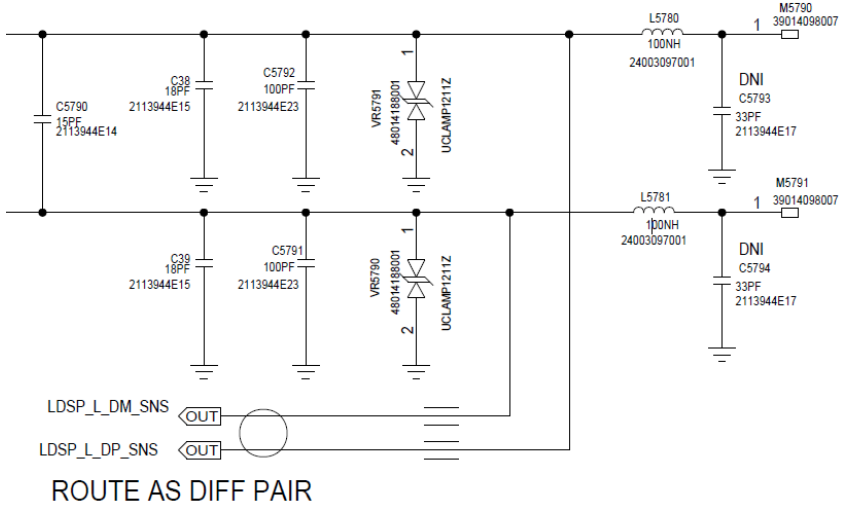
Gesture Detect circuit

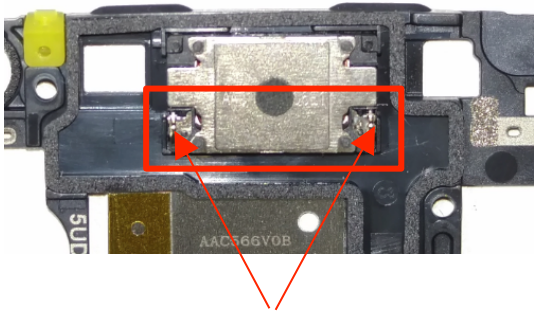


If the headset detection is not functioning, even though the speaker sound is normal while playing audio or voice call.

- Check 1st MIC functionality by CQA App or handset voice call.
- Inspect physical placement of the D5792, D5793, Q5790 and Q5791. (See schematic above)
- Check switch circuit enable signal at R5794 (SB_INT_N).
  : Enable gesture signal output - Status Low (Lower than 0.3Vdc)
  : Disable gesture signal output - Status High (Higher than 1.3Vdc)
- Compare SPKOUTN signal level between C5797 and pin 6 of Q5791 while the gesture detection signal is operating. If the pin 6 of Q5791 level is much lower, Q5791 part should be reworked.

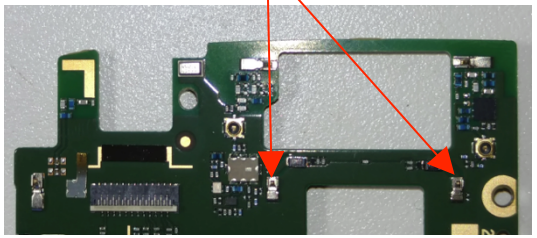
Speaker Output Circuit





Speaker part contacts

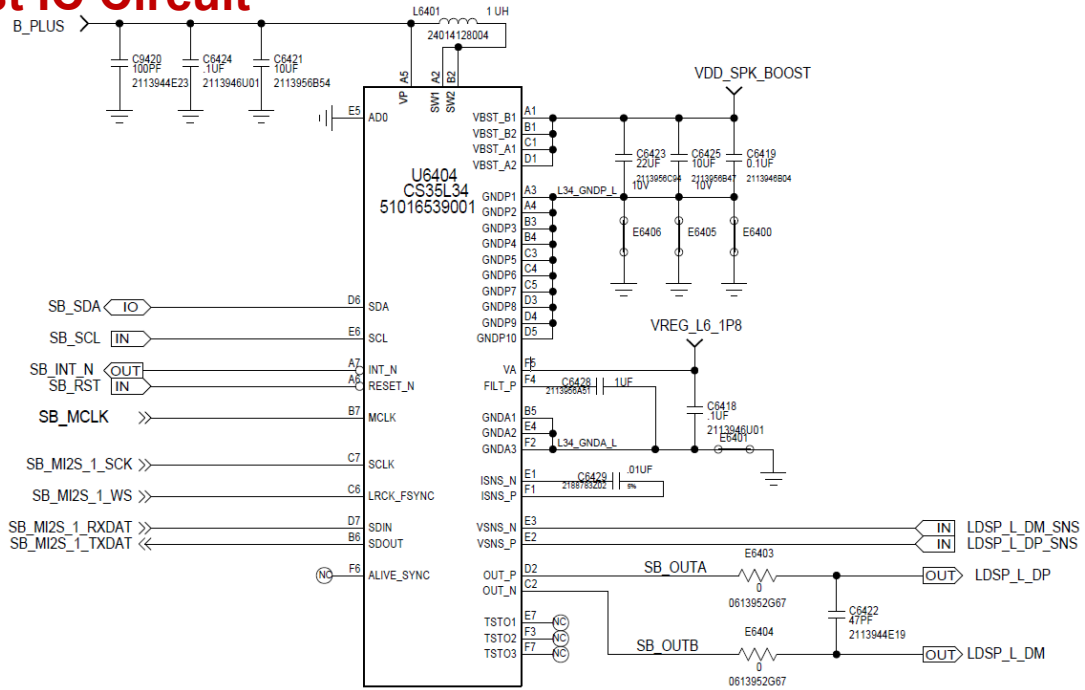
M5790 and M5791
universal contact



If the speaker output sound include handset voice call rx voice is not functioning,

- Check DC resistance of speaker part between speaker part contacts.
- Inspect physical placement of the L5780, L5781, M5790 and M5791 (See schematic above)
- Check L5780 and L5781 DC resistance, it should be around 0.13 ohm.
- If there is no problem, check the smart boost IC circuit (See next page)

Speaker Boost IC Circuit



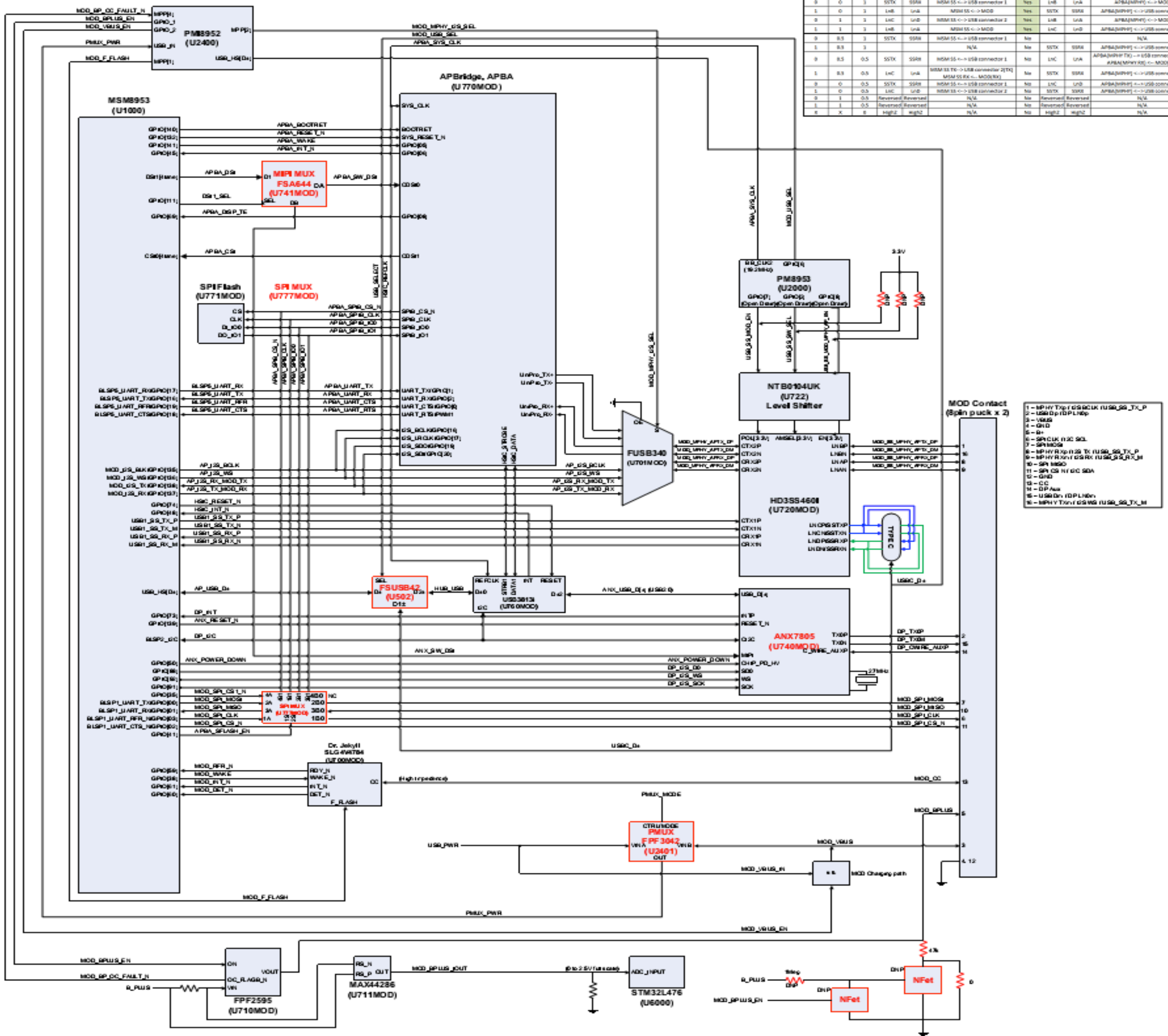
If the speaker output sound include handset voice call rx voice is not functioning, even though the speaker part and circuit is no problem.

- Check input battery voltage at C6421.
- Check input analog power at C6418, it should be 1.8Vdc.
- Check voltage boost output level at C6425 during play audio (Multimedia or voice call), it should be battery voltage to 8.5Vdc.

MODS INTERFACE TROUBLESHOOTING

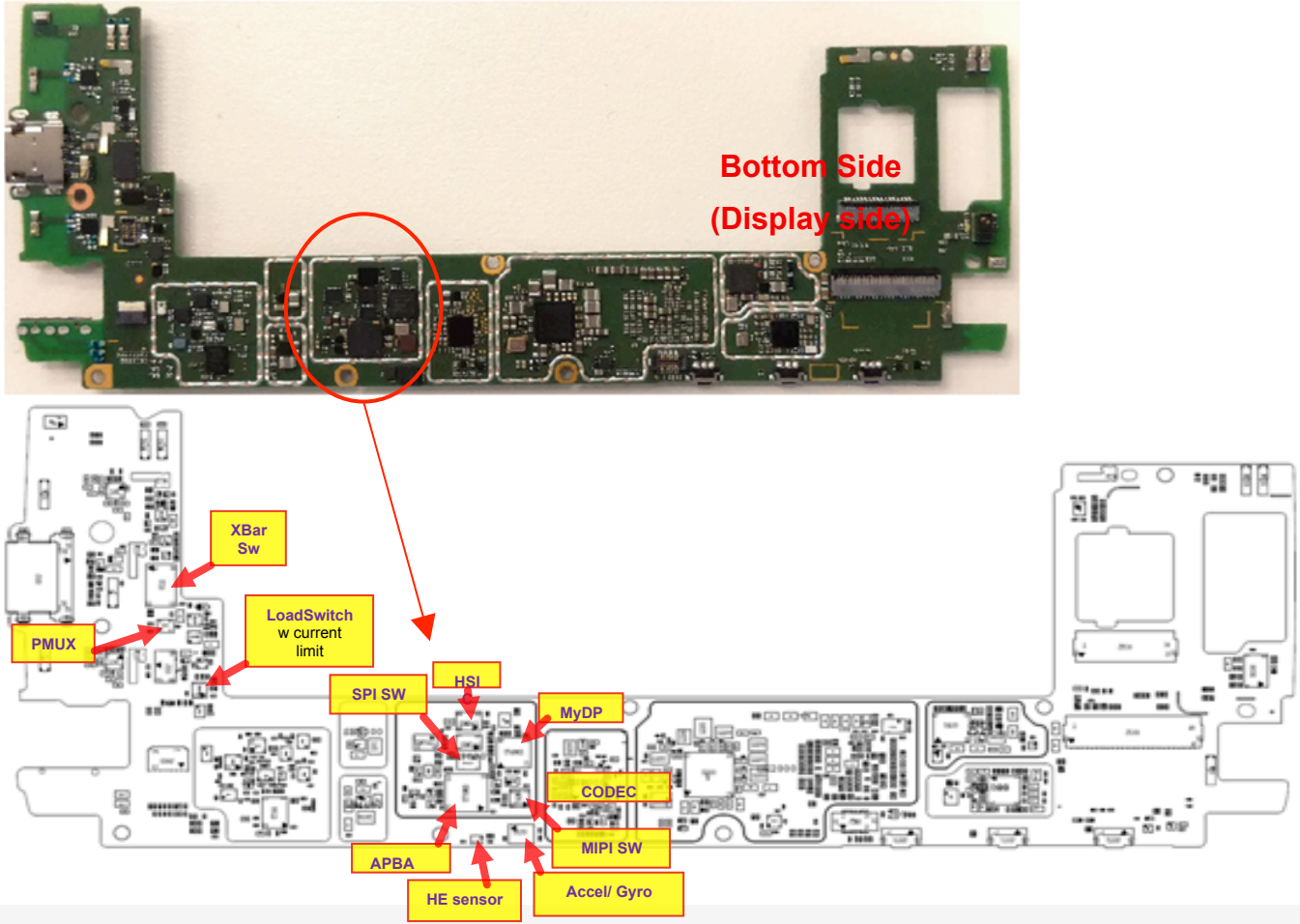
Mods Debug

AMPS Block Diagram (7/12/2016)

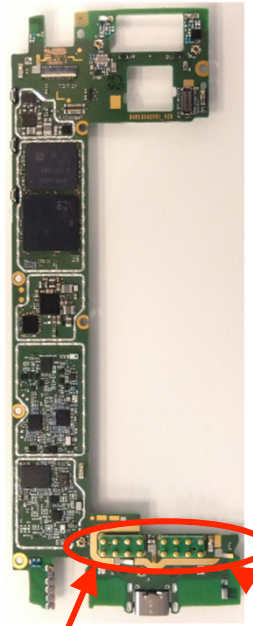


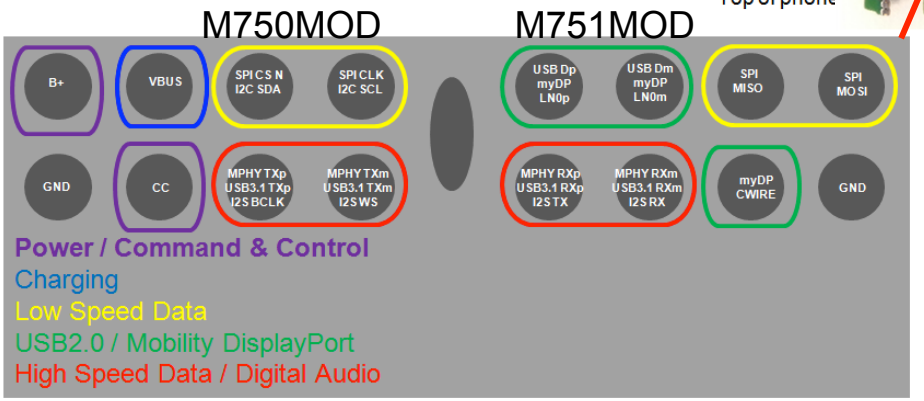
HD3SS460I(U720MOD) MIUX Cofiguration Table										
POL	AMSEL	EN	From/To MSM		Configuration	Use case	From/To APBA		Configuration	Use case
			CTX1	CRX1			CTX2	CRX2		
0	0	1	SSTX	SSRX	MSM SS <--> USB connector 1	Yes	LnB	LnA	APBA(MPHY) <--> MOD	Yes
1	0	1	LnB	LnA	MSM SS <--> MOD	Yes	SSTX	SSRX	APBA(MPHY) <-->USB connector 1	No
0	1	1	LnC	LnD	MSM SS <--> USB connector 2	Yes	LnB	LnA	APBA(MPHY) <--> MOD	Yes
1	1	1	LnB	LnA	MSM SS <--> MOD	Yes	LnC	LnD	APBA(MPHY) <-->USB connector 2	No
0	0.5	1	SSTX	SSRX	MSM SS <--> USB connector 1	No			N/A	No
1	0.5	1			N/A	No	SSTX	SSRX	APBA(MPHY) <-->USB connector 1	No
0	0.5	0.5	SSTX	SSRX	MSM SS <--> USB connector 1	No	LnC	LnA	APBA(MPHY TX) --> USB connector 2 (TX) APBA(MPHY RX) <-- MOD(RX)	No
1	0.5	0.5	LnC	LnA	MSM SS TX--> USB connector 2(TX) MSM SS RX <-- MOD(RX)	No	SSTX	SSRX	APBA(MPHY) <-->USB connector 1	No
0	0	0.5	SSTX	SSRX	MSM SS <--> USB connector 1	No	LnC	LnD	APBA(MPHY) <-->USB connector 2	No
1	0	0.5	LnC	LnD	MSM SS <--> USB connector 2	No	SSTX	SSRX	APBA(MPHY) <-->USB connector 1	No
0	1	0.5	Reversed	Reversed	N/A	No	Reversed	Reversed	N/A	No
1	1	0.5	Reversed	Reversed	N/A	No	Reversed	Reversed	N/A	No
X	X	0	HighZ	HighZ	N/A	No	HighZ	HighZ	N/A	No

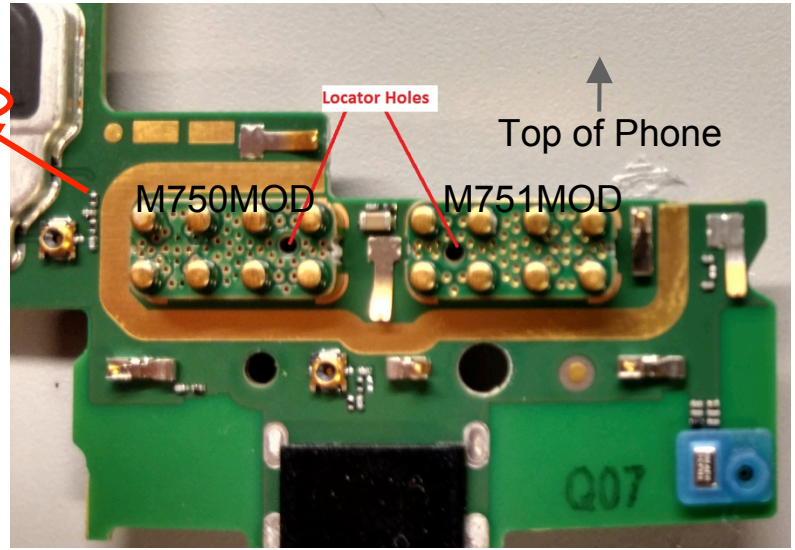
Mods Debug


Bottom Side
(Display side)
XBar Sw
PMUX
LoadSwitch w current limit
SPI SW
HSI
MyDP
CODEC
MIPI SW
APBA
HE sensor
Accel/ Gyro

Mods Connector Pins Orientation

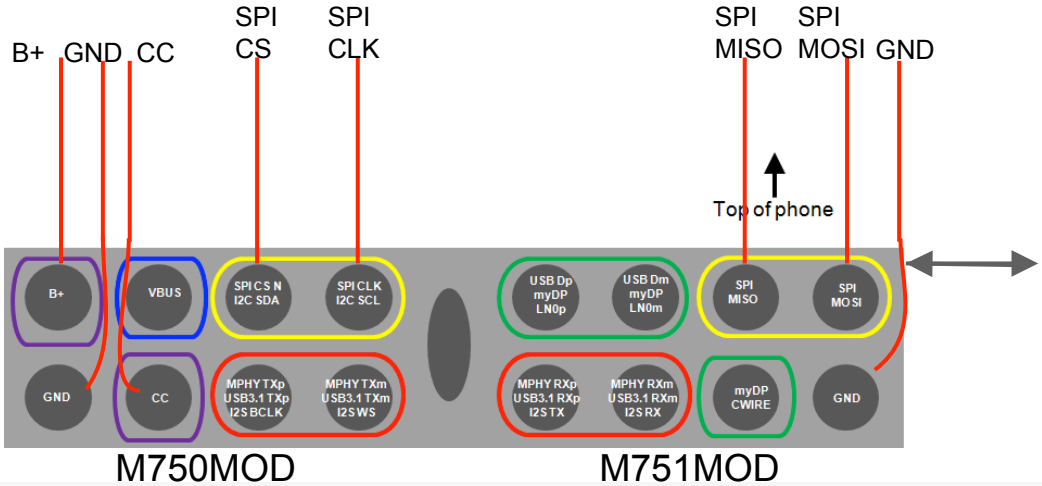


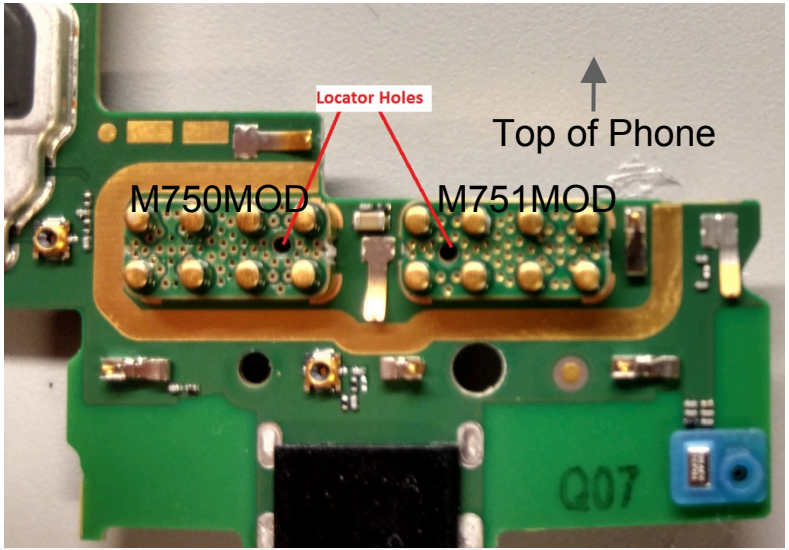




Mods Debug - Detection (common for all Mods)

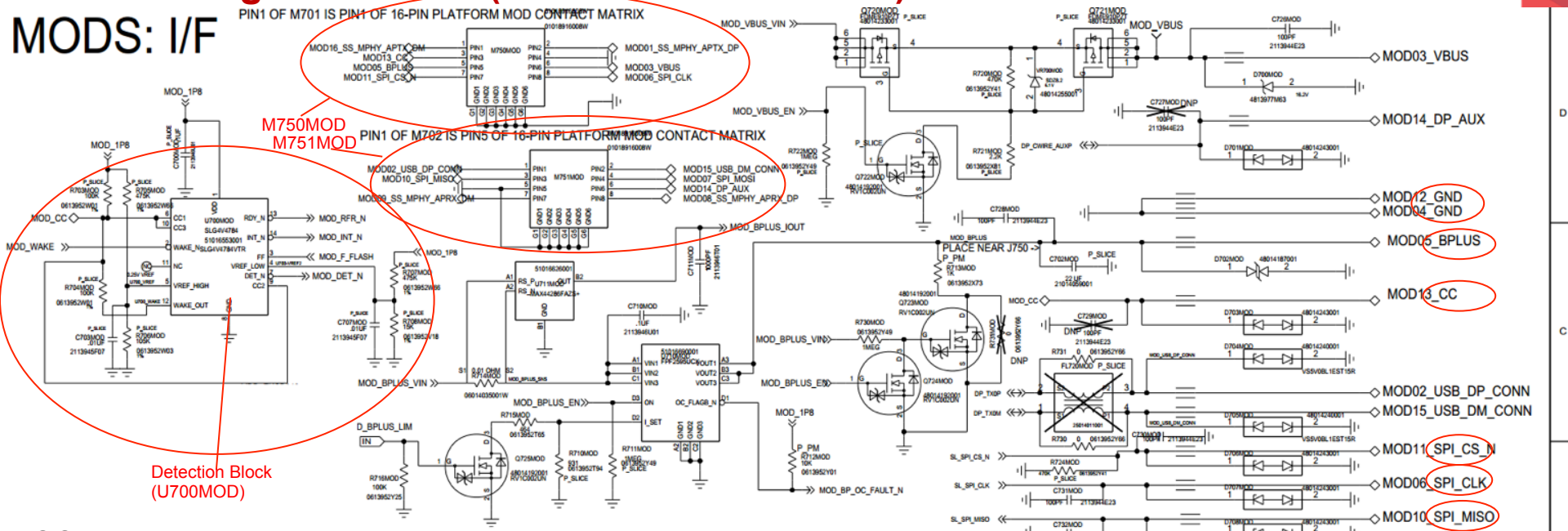
- Signals at 16pin Mods connector utilized during detection: CC pin, SPI CS, SPI CLK, SPI MISO, SPI MOSI, B +, GND
- Reference Mods block diagram provided at beginning of the Mods section
- Visually inspect the 16pins of the Mods connector (M750MOD+M751MOD) confirming they are not blocked or damaged
- Reference schematic areas associated with the Mods detection in next slide
- Probe CC pin to confirm proper voltage level (reference table in the next slide)
- If all supply levels +signals in the detection block measure fine, replace U700MOD.





Mods Debug - Detection (common for all Mods) - Continue

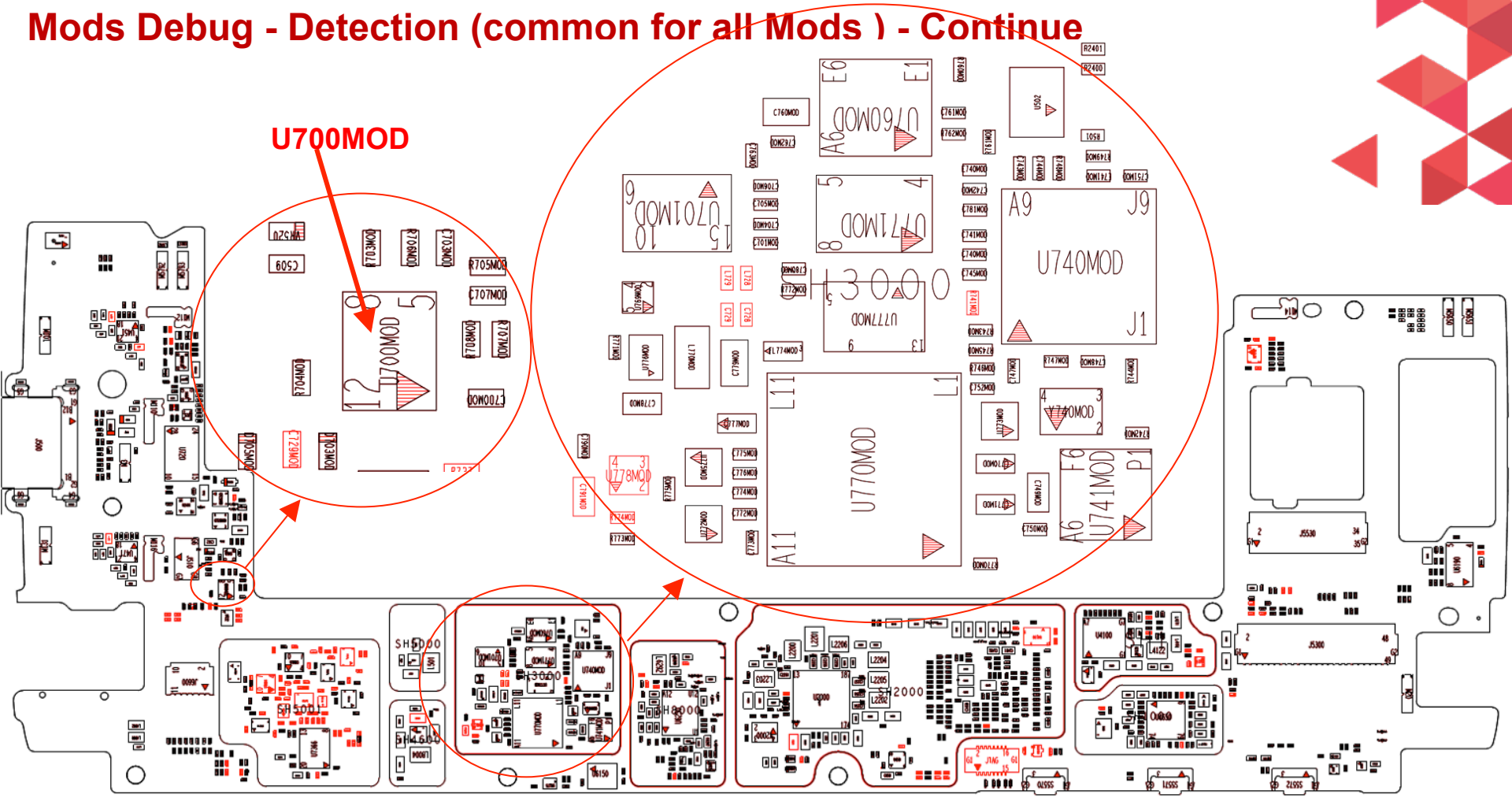
MODS: I/F



CCPin Voltage Levels (by state)

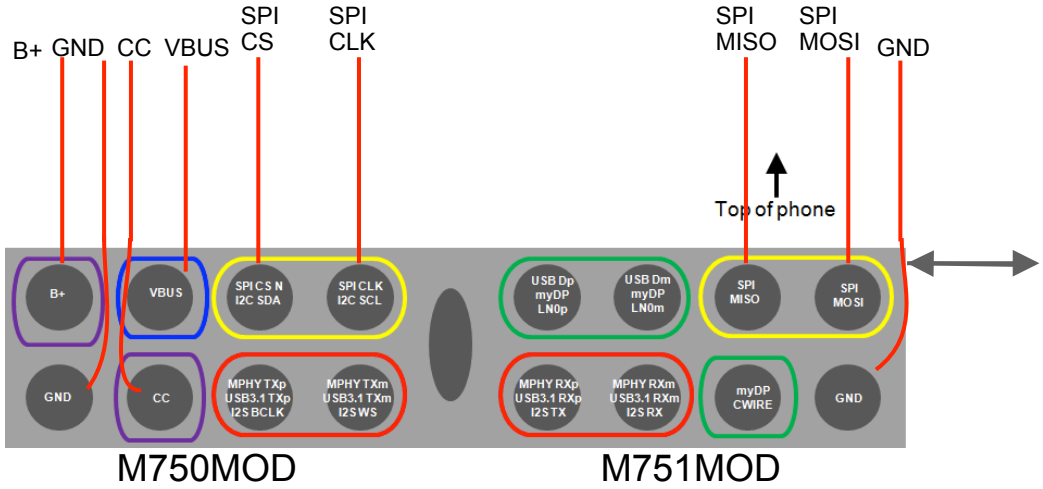
State	WAKE	INT	RFR	Min (V)	Max (V)	Raw Value	Adj. Value
Connected	1	0	0	0.597	0.638	.62085	0.620963
Connected + RFR	1	0	1	0.471	0.490	.48295	0.483063
Connected + INT	1	1	0	0.181	0.195	.187413	0.187413
Wake	0	0	0	0.359	0.386	.37466	0.374773
Wake + RFR	0	0	1	0.267	0.288	.27846	0.278573
Wake + INT	0	1	0	0.095	0.103	.9814	0.098253
RFR + INT	1	1	1	0.000	0.000	-.000113	0.000

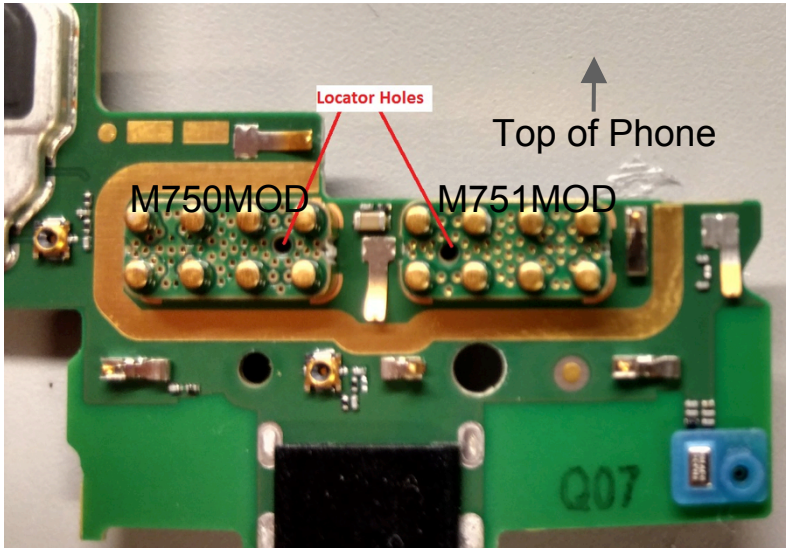
Mods Debug - Detection (common for all Mods) - Continue



Mods Debug - Espresso

- Once the Espresso Mods is detected via common pins CC pin, SPI CS, SPI CLK, SPI MISO, SPI MOSI, B+, GND… in addition VBUS gets utilized for charging
- Reference Mods block diagram provided at beginning of the Mods section
- Reference schematic areas associated with the Mods detection in next slide





Mods Debug - Projector

- Signals at 16pin Mods connector utilized during detection: CC pin, SPI CS, SPI CLK, SPI MISO, SPI MOSI, B+, Cwire, GND
- Reference Mods block diagram provided at beginning of the Mods section
- Reference schematic areas associated with the Mods detection in next slide