SAMSUNG

GPRS TELEPHONE
SGH-D500

SERVICE Manual

GPRS TELEPHONE

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BASIC.

1. SGH-D500 Specification

1. GSM General Specification

	GSM900 Phase 1	EGSM 900 Phase 2	DCS1800 Phase 1	PCS1900
Freq. Band[MHz] Uplink/Downlink	890~915 935~960	880~915 925~960	1710~1785 1805~1880	1850~1910 1930~1990
ARFCN range	1~124	0~124 & 975~1023	512~885	512~810
Tx/Rx spacing	45MHz	45MHz	95MHz	80MHz
Mod. Bit rate / Bit Period	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us
Time Slot Period / Frame Period	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms
Modulation	0.3GMSK	0.3GMSK	0.3GMSK	0.3GMSK
MS Power	33dBm~5dBm	33dBm~5dBm	30dBm~0dBm	30dBm~0dBm
Power Class	5pcl ~ 19pcl	5pcl ~ 19pcl	0pcl ~ 15pcl	0pcl ~ 15pcl
Sensitivity	-102dBm	-102dBm	-100dBm	-100dBm
TDMA Mux	8	8	8	8
Cell Radius	35Km	35Km	2Km	-

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2. GSM TX power class

TX Power control level	GSM900
5	33±3 dBm
6	31±3 dBm
7	29±3 dBm
8	27±3 dBm
9	25±3 dBm
10	23±3 dBm
11	21±3 dBm
12	19±3 dBm
13	17±3 dBm
14	15±3 dBm
15	13±3 dBm
16	11±5 dBm
17	9±5 dBm
18	7±5 dBm
19	5±5 dBm

TX Power control level	DCS1800
0	30±3 dBm
1	28±3 dBm
2	26±3 dBm
3	24±3 dBm
4	22±3 dBm
5	20±3 dBm
6	18±3 dBm
7	16±3 dBm
8	14±3 dBm
9	12±4 dBm
10	10±4 dBm
11	8±4dBm
12	6±4 dBm
13	4±4 dBm
14	2±5 dBm
15	0±5 dBm

TX Power control level	PCS1900
0	30±3 dBm
1	28±3 dBm
2	26±3 dBm
3	24±3 dBm
4	22±3 dBm
5	20±3 dBm
6	18±3 dBm
7	16±3 dBm
8	14±3 dBm
9	12±4 dBm
10	10±4 dBm
11	8±4dBm
12	6±4 dBm
13	4±4 dBm
14	2±5 dBm
15	0±5 dBm

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2. SGH-D500 Circuit Description

1. SGH-D500 RF Circuit Description

1) RX PART

1. ANTENNA SWITCH (U100 SWICHPLEXER)

→ Switching Tx, Rx path for GSM900, DCS1800 and PCS1900 by logic controlling.

2. ANTENNA SWITCH Control Losic (U100) → Truth Table

	VC1	VC2	VC3
Tx Mode (GSM900)	L	H	L
Tx Mode (DCS1800/1900)	L(H)	L	H
Rx Mode (GSM900)	L	L	L
Rx Mode (DCS1800)	L	L	L
Rx Mode (PCS1900)	H	L	L

3. FILTER

To convert Electromagnetic Field Wave to Acoustic Wave and then pass the specific frequency band.

- GSM FILTER (F100) → For filtering the frequency band between 925 and 960 MHz
- DCS FILTER (F102) → For filtering the frequency band between 1805 and 1880 MHz.
- PCS FILTER (F101) → For filtering the frequency band between 1930 and 1990 MHz.

4. VC-TCXO (U101)

This module generates the 26MHz reference clock to drive the logic and RF.
It is turned on when the supply voltage Vcc(SYN) is applied.
After buffering a reference clock of 26MHz is supplied to the other parts of the system through the transceiver pin CLKOUT.

5. TRANSCEIVER (U102)

This chip is fully integrated GSM GPRS quad-band transceiver with transmit baluns, loop filters and most of the passive component in it.
And also fully integrated fractional N RF synthesizer with AFC control possibility, RF VCO with integrated supply regulator. Semi integrated reference oscillator with integrated supply regulator.
RF Receiver front-end amplifies the E-GSM900, DCS1800 and PCS1900 aerial signal, convert the chosen channel down to a low IF of 100kHz.
In IF section, further amplifies the wanted channel output level to the desired value and rejects DC.

2) TX PART

The transmitter is fully differential using a direct up conversion architecture. It consists of a signal side band power up mixer. Gain is controlled by 6 dB via 3-wire serial bus programing. The fully integrated VCO and power mixer achieve LO suppression, quadrature phase error, quadrature amplitude balance and low noise floor specification. Output matching/balun components drive a standard 50 ohms single ended load.

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2. Baseband Circuit description of SGH-D500

1. PCF50603 (U400)

1.1. Power Management

Eight low-dropout regulators designed specifically for GSM applications power the terminal and help ensure optimal system performance and long battery life. A programmable boost converter provides support for 1.8V, 3.0V SIMs, while a self-resetting, electronically fused switch supplies power to external accessories. Ancillary support functions, such as RTC module and High Voltage Charge pump, Clock generator, aid in reducing both board area and system complexity.

I2C BUS serial interface provides access to control and configuration registers. This interface gives a microprocessor full control of the PCF50603 and enables system designers to maximize both standby and talk times.

Supervisory functions. including a reset generator, an input voltage monitor, and a temperature sensor, support reliable system design. These functions work together to ensure proper system behavior during start-up or in the event of a fault condition(low microprocessor voltage, insufficient battery energy, or excessive die temperature).

1.2. Backlight Brightness Modulator

The Backlight Brightness Modulator (BBM) contains a programmable Pulse-width modulator (PWM) and FET to modulate the intensity of a series of LED's or to control a DC/DC converter that drives LCD backlight.

This phone (SGH-D500) use PWM control to contrast the backlight brightness.

1.3. Clock Generator

The Clock Generator (CG) generates all clocks for internal and external usage. The 32.768 kHz crystal oscillator provides an accurate low clock frequency for the PCF50603 and other circuitry.

2. LCD Connector

LCD is consisted of main LCD(color 26K TFT LCD).

Chip select signals in the U305, LCD_CS, can enable LCD. BACKLIGHT signal enables white LED of main LCD. These signal is from U400.

16-bit data lines(LD(0)~LD(15)) transfers data and commands to LCD. Data and commands use "RS" signal. If this signal is high, Inputs to LCD are commands. If it is low, Inputs to LCD are data. The signal which informs the input or output state to LCD, is required. But this system is not necessary this signal. So "L_WR" signal is used to write data or commands to LCD. Power signals for LCD are "VDD_IO_HIGH".

3. IRDA

This system uses IRDA module, HSDL_3209, Agilent's. This has signals, "IRDA_EN"(enable signal), "IRDA_RXD"(input data) and "IRDA_TXD"(output data). These signals are connected to PCF5213EL1 through BT Module.

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4. Key

This is consisted of key interface pins KEY_ROW(0:4) and KEY_COL(0:4) in PCF5213EL1. These signals compose the matrix. Result of matrix informs the key status to key interface in the PCF5213EL1. Power on/off key is seperated from the matrix. So power on/off signal is connected with PCF50603 to enable PCF50603. Key LED is consisted of six white LEDs for sub key and twelve white LEDs for main key. White LED for sub key use the VBAT voltage.

"SLIDER_KEY_ON" signal enables Transistor for sub key backlight.

Main key LED use the 3.3V LDO for a supply voltage. KEY_LED_ON signal enables eight white LED.

"FLIP" informs the status of slide (open or closed) to the PCF5213EL1. This uses the hall effect IC, A3212ELH.

A magnet under LCD enables A3212ELH.

5. EMI ESD Filter

This system uses the EMI ESD filter, U500 to protect noise from IF CONNECTOR part.

6. IF connetor

It is 18-pin connector. They are designed to use VBAT, V_EXT_CHARGE, USB_D+, +VBUS, USB_D-, TXD1, RXD1, AUX_ON, EXT1, EXT2, HFK_SPK, HFK_MIC and GND. They connected to power supply IC, microprocessor and signal processor IC.

7. Battery Charge Management

A complete constant-current/constant-voltage linear charger for single cell lithium-ion batteries.

If TA connected to phone, "V_EXT_CHARGE" enable charger IC and supply current to battery.

When fault condition caused, "CHG_ON" signal level change low to high and charger IC stop charging process.

8. Audio

HFR_P and HFR_N from PCF5213El1 are connected to the main speaker via analog switches. MIC_P and MIC_N are connected to the main MIC as well. EAR1 is the source of External Speaker. YMU765 is a synthesizer LSI for mobile phones. This LSI has a built-in speaker amplifier for outputting sounds that are used by mobile phones in addition to game sounds and ringing melodies that are replayed by a synthesizer.

The synthesizer section adopts “stereophonic hybrid synthesizer system” that are given advantages of both FM synthesizers and Wave Table synthesizers to allow simultaneous generation of up to 32 FM voices and 32 Wave Table voices.

It provides simultaneous generation of up to 64 tones by stereophonic hybrid synthesizer.

YMU765 has built a speaker amplifier of which maximum out is 580 mW at SPVDD=3.6V in this device.

There is Stereophonic analog output for Headphone.

9. Memory

This system uses Samsung's memory, KBJ10KB00M. The KBJ10KB00M is a Multi Chip Package Memory which combines 256Mbit Synchronous Burst Multi Bank NOR Flash Memory and two 512Mbit OneNAND Flash and 128Mbit Synchronous Burst U tRAM.

It has 16 bit data line, HD[1~16] which is connected to PCF5213 and MV319, also has 24 bit address lines, HA[1~24]. There are 3 chip select signals, CS0n_FLASH, CS4n_NAND, and CS1n_RAM.

In the Wrting process, WEn is fallen to low and it enables writing process to operate. During reading process, OEn is fallen to low and it enables reading process to operate. Each chip select signals in the PCF5213 choose different memories.

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10. PCF5213EL1

The PCF5213EL1 is mainly composed of embeded DSP and ARM core. The DSP subsystem includes the Saturn DSP core with embedded RAM and ROM, and a set of peripherals. It has 24kx16 bits PRAM, 104k*16 bits, 32k*16 XYRAM and 63k*16 XYROM in the DSP.

The ARM946E-S consists of an ARM9E-S processor core, 8 kbyte instruction cache and 8 kbyte data cache, tghtly-coupled ITCM(Instruction Tightly Coupled Memory) and DTCM(Data Tightly Coupled Memory) memories, a memory protection unit, and an AMBA(Advanced Microcontroller Bus Architecture) AHB(Advanced High-performance Bus) bus interface with a write buffer.

HD(0:15), data lines and HA(0:23), address lines are connected to KBJ10KB00M (memory), MV319DNQ (image dsp) and YMU765 (melody IC). It has 64 kbyte SC RAM (0.5 Mbit) and 32 kbyte SC program ROM for bootstrap loader in the ARM core.

HD(0:15), data lines and HA(0:23), address lines are connected to memory and YMU765 to communicate.

MV319DNQ(Camera DSP Chip) controls the communication between ARM core and DSP core.

OEn, WEn control the access of memory. KROW, and KCOL recognize the key string input status. The system communicates with IrDA via IrDA_TXD, IrDA_RXD.

It has J-TAG control pins (TDI/TDO/TCK) for ARM and DSP core. J-SEL signal controls different access to ARM and DSP core.

ADC(Analog to Digital Convertor) receives the condition of temperature, battery type and battery voltage.

11. TCO-5871U(26MHz)

This system uses the 26MHz TCXO, TCO-5871U, Toyocom. AFC control signal form PCF5213 controls frequency from 26MHz x-tal. It generates the clock frequency. This clock is connected to PCF5213, YMU765 and UAA3587.

12. Camera DSP(MV319DNQ)

MV319DNQ provides rich video functions up to 30-frame display with minimized tasks in the handset main processor as well as hardware based real-time JPEG compression and decompression. MV319DNQ directly transmits and previews the RGB data to the LCD graphic memory by processing the sensor output data according to the handset's command. It can save the raw RGB data up to VGA resoultion into its image buffer and allows the host processor to download with scalable sized compressed data.

It utilizes 16 bit data bus for communication with the main processor, including bus interface types.

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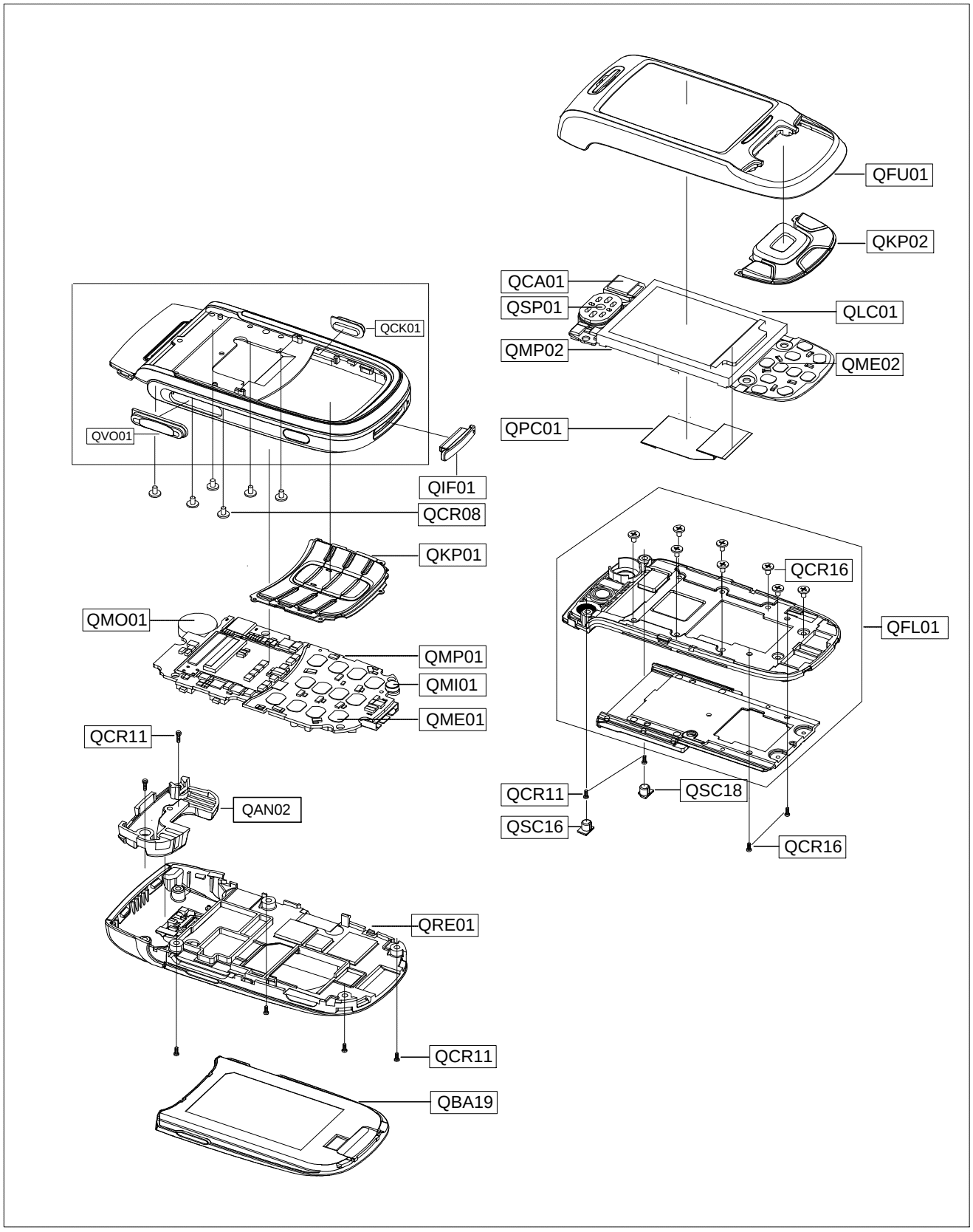
3. SGH-D500 Exploded View and its Parts list

1. Cellular phone Exploded View-1



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2. Cellular phone Parts list

Location NO.		Description	SEC CODE	Remark
QBA19		BATTERY	GH43-01534D	
QMP01		MAIN PBA	GH92-01852A	
QMO01		MOTOR	3101-001411	
QMI01		MICROPHONE ASSY	GH30-00149A	
QME01		UNIT METAL DOME	GH59-01697A	
QSP01		SPEAKER	3001-001636	
QCR08		SCREW	6001-001456	
QCR11		SCREW	6001-001654	
QCR16		SCREW	6001-001878	
QLC01		LCD	GH07-00611A	
QPC01		PCB FPCB	GH41-00700A	
QCA01		UNIT CAMERA	GH59-01635A	
QSC16		PMO-S/L SCREW CAP(L)	GH72-17899A	
QSC18		PMO-S/L SCREW CAP(R)	GH72-17900A	
QFU01		SLIDE UPPER	GH75-05621A	
QFR01		FONT COVER	GH75-05622A	
	QVO01	KEY VOL	GH75-05626A	
	QCK01	CAM	GH75-05627A	
QFL01		SLIDE LOWER	GH75-05623A	
	QCR16	SCREW	6001-001823	
QKP01		KEYPAD MAIN	GH75-05624A	
QKP02		KEYPAD SUB	GH75-05625A	
QMP02		SUB PBA	GH92-01853A	
QME02		UNIT METAL DOME	GH59-01698A	
QCR11		SCREW	6001-001654	
QAN02		INTENNA	GH42-00479A	
QRE01		REAR COVER	GH75-05642A	
QCR11		SCREW	6001-001654	
QIF01		IF COVER	GH72-17901A	

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3. Test Jig (GH80-01909A)

3-1. RF Test Cable
(GH39-00283A)

3-2. Test Cable
(GH39-00337C)

3-3. Serial Cable

3-4. Power Supply Cable

3-5. DATA CABLE
(GH39-00331A]

3-6. TA
(GH44-00482A)

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4. SGH-D500 Electrical Parts List

MAIN	
SEC CODE	Design LOC
0403-001387	ZD500
0403-001427	ZD501
0404-001172	D400
0404-001172	D401
0406-001104	ZD601
0406-001188	U500
0406-001190	ZD600
0407-001002	D600
0504-001113	Q500
0504-001113	Q505
0504-001113	Q506
0504-001151	U506
0505-001332	U306
0505-001518	Q200
0505-001938	U505
0601-001819	LED600
0601-001819	LED601
0601-001819	LED602
0601-001819	LED603
0601-001819	LED604
0601-001819	LED605
0601-001819	LED606
0601-001819	LED607
0601-001819	LED610
0601-001819	LED611
0604-001291	U301
0801-002237	U302
0801-002237	U308
0801-002294	U401
1001-001231	U601
1001-001231	U602
1001-001231	U604
1001-001231	U661
1001-001253	U662
1009-001010	U600
1109-001322	U307
1201-002213	PAM100
1202-001068	U663
1203-002837	U402
1203-003079	U403
1203-003079	U610
1203-003079	U665
1203-003568	U400
1203-003577	U503
1204-002138	U300
1205-002633	U102
1205-002636	U200
1404-001221	V500
1405-001082	TH600
1405-001082	TH601
1405-001082	V300
1405-001082	V301
1405-001082	V302
1405-001082	V303
1405-001082	V400
2007-000137	R510
2007-000138	R622
2007-000140	R602
2007-000140	R604
2007-000143	R210
2007-000143	R315
2007-000143	R316
2007-000147	R216
2007-000148	R101
2007-000148	R111
2007-000148	R201
2007-000148	R212
2007-000148	R300
2007-000148	R304
2007-000148	R312
2007-000148	R504
2007-000151	R314
2007-000152	C500
2007-000160	R515
2007-000162	R206
2007-000162	R207
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2007-000162	R209

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2007-000162	R308
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2007-000162	R508
2007-000162	R509
2007-000162	R520
2007-000162	R600
2007-000162	R608
2007-000162	R621
2007-000162	R627
2007-000170	R516
2007-000170	R517
2007-000171	L200
2007-000171	R100
2007-000171	R112
2007-000171	R113
2007-000171	R114
2007-000171	R115
2007-000171	R120
2007-000171	R202
2007-000171	R310
2007-000171	R318
2007-000171	R320
2007-000171	R325
2007-000171	R404
2007-000171	R411
2007-000171	R412
2007-000172	R103
2007-000242	R204
2007-000242	R205
2007-000566	R102
2007-000566	R104
2007-000758	R500
2007-000758	R502

2007-000831	R313
2007-000831	R620
2007-000932	R116
2007-000932	R118
2007-001217	R610
2007-001217	R611
2007-001217	R612
2007-001217	R613
2007-001217	R616
2007-001217	R617
2007-001217	R623
2007-001217	R624
2007-001217	R625
2007-001217	R626
2007-001288	R106
2007-001303	R305
2007-001313	R107
2007-001313	R108
2007-001325	R307
2007-001333	R511
2007-001339	R609
2007-002796	R413
2007-002796	R605
2007-003001	R117
2007-007009	R328
2007-007009	R329
2007-007014	R303
2007-007014	R326
2007-007090	R409
2007-007100	R403
2007-007107	R506
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2007-007193	R327
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2203-000995	C103
2203-000995	C105
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2203-001201	C109
2203-001201	C319
2203-001259	C618
2203-001437	C628
2203-001437	C629
2203-002443	C604
2203-002525	C313
2203-003054	C407
2203-003054	C409
2203-003054	C630
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2203-005050	C606
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2203-005482	C631
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2203-006053	C310
2203-006053	C400
2203-006053	C401
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2203-006190	C123
2203-006208	C200
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2203-006208	C416
2203-006208	C419
2203-006208	C424
2203-006208	C425
2203-006208	C615
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2203-006257	C414
2203-006257	C417
2203-006257	C418
2203-006257	C426
2203-006257	C427
2203-006257	V700
2203-006474	C429
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2404-001268	C502
2404-001281	C410
2404-001281	C601
2404-001348	C125
2404-001386	C303
2503-001053	C766
2503-001053	C767
2503-001053	C768
2503-001053	C769
2503-001053	C770
2503-001053	C771
2503-001053	C772
2503-001053	C773
2503-001053	C774
2703-001722	L101
2703-001723	L103
2703-001723	L116
2703-001723	R405
2703-001724	L301
2703-001749	L100

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2703-001913	L600
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2703-002204	L102
2703-002268	L110
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2703-002346	L401
2703-002636	L106
2801-003856	OSC400
2809-001294	U101
2901-001254	U103
2901-001315	U501
2904-001537	F101
2904-001540	F102
2904-001552	F100
2904-001553	F103
2909-001269	U100
3301-001120	L400
3301-001534	F600
3301-001729	R119
3404-001152	SW700
3404-001152	SW701
3404-001152	SW702
3705-001347	RFS100
3708-002054	CN701
3709-001355	SIM400
3710-001611	IFC500
3711-005829	BTC500
3722-002269	CN600
4202-001031	ANT300
4302-001180	C408
4709-001349	U304
GH13-00025A	U305
GH71-04302A	ANT104
GH71-04302A	ANT105

SUB	
SEC CODE	Design LOC
0404-001262	ZD801
0501-002440	Q802
0504-001140	Q801
0505-001889	U804
0601-001819	LED801
0601-001819	LED805
0601-001819	LED806
0601-001819	LED807
0601-001819	LED808
0601-001819	LED810
0601-001990	LED811
1203-003328	U802
1203-003564	U803
1405-001082	R829
1405-001082	V800
1405-001082	V801
1405-001082	V802
1405-001082	V803
1405-001128	V804
1405-001128	V805
2007-000140	R826
2007-000151	R812
2007-000162	R814
2007-000162	R824
2007-000170	R825
2007-000171	R811
2007-000171	R822
2007-000172	R819
2007-003029	R828
2007-003030	R800
2007-003030	R801
2007-003030	R802
2007-003030	R803
2007-003030	R806
2007-003030	R807
2007-007200	R820
2007-007200	R821
2007-007529	R827

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2007-007538	R818
2203-000812	C812
2203-005481	C811
2203-005482	C806
2203-005482	C814
2203-005512	C813
2203-006108	C810
2203-006208	C808
2203-006208	C809
2203-006364	C801
2203-006457	C803
2404-001105	C805
2404-001239	C807
2703-001174	L804
2703-001174	L805
2703-002313	L802
2703-002714	L800
2703-002803	L806
3708-001862	CN800
3708-002054	HDC800
3711-005801	CN802

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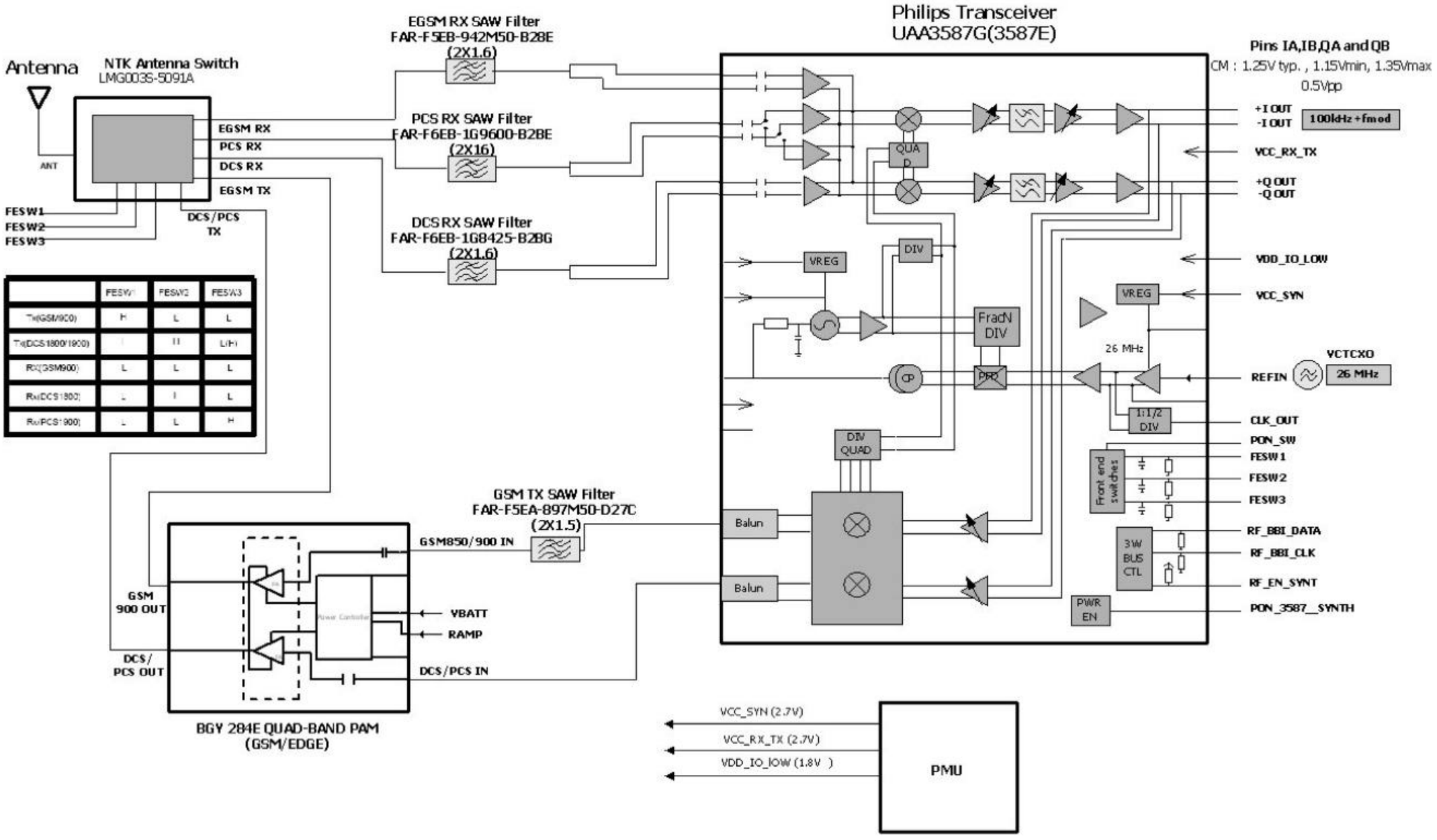
5. SGH-D500 Block Diagrams

1. RF Solution Block Diagram



	FESW1	FESW2	FESW3
Tx(GSM/EGO)	H	L	L
Tx(DCS1800/1900)	H	H	L/H
Rx(GSM900)	L	L	L
Rx(DCS1800)	L	H	L
Rx(PCS1900)	L	L	H

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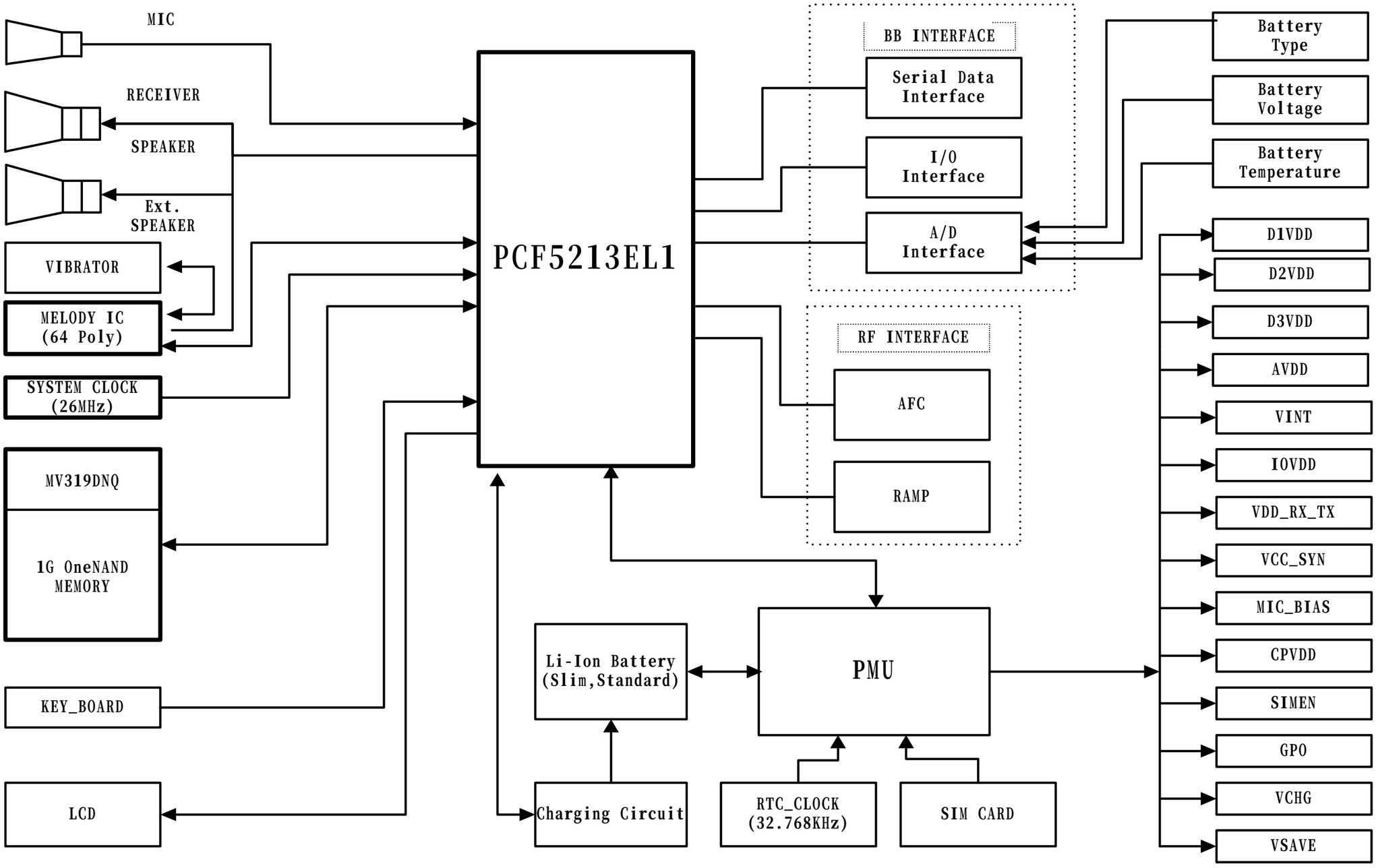
2. Base Band Solution Block Diagram



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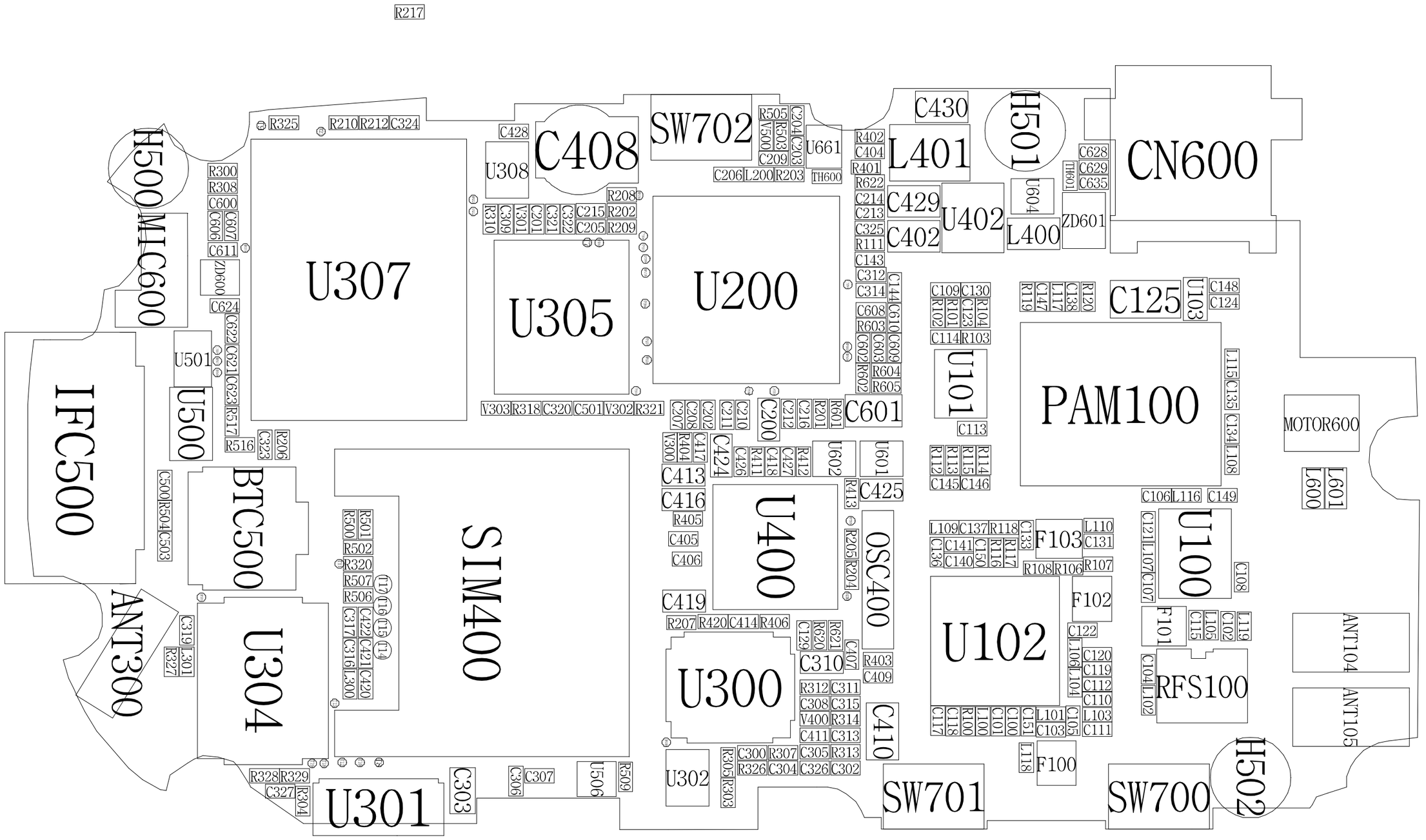
6. SGH-D500 PCB Diagrams

1. Main PCB Top Diagram



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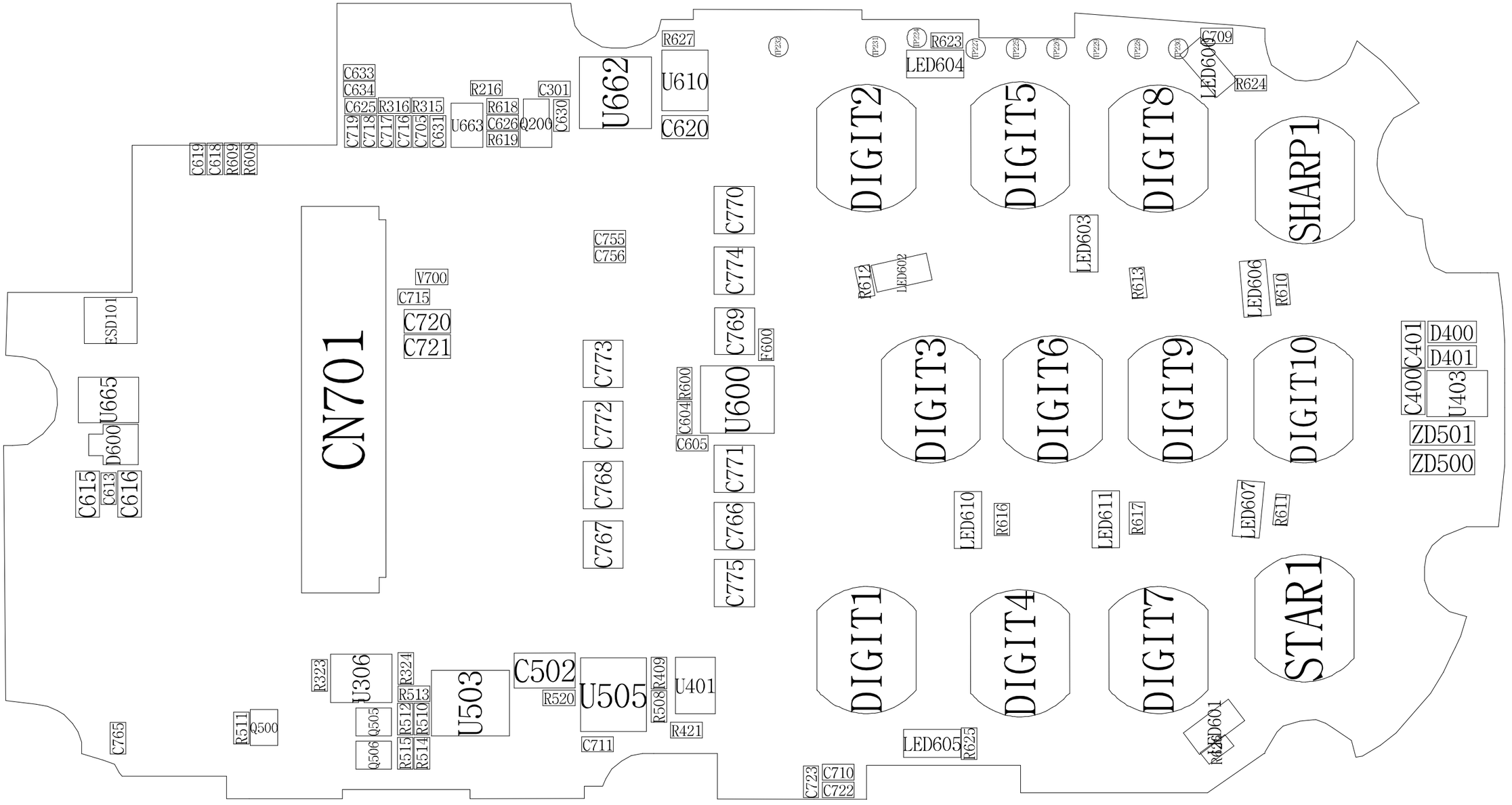
2. Main PCB Bottom Diagram



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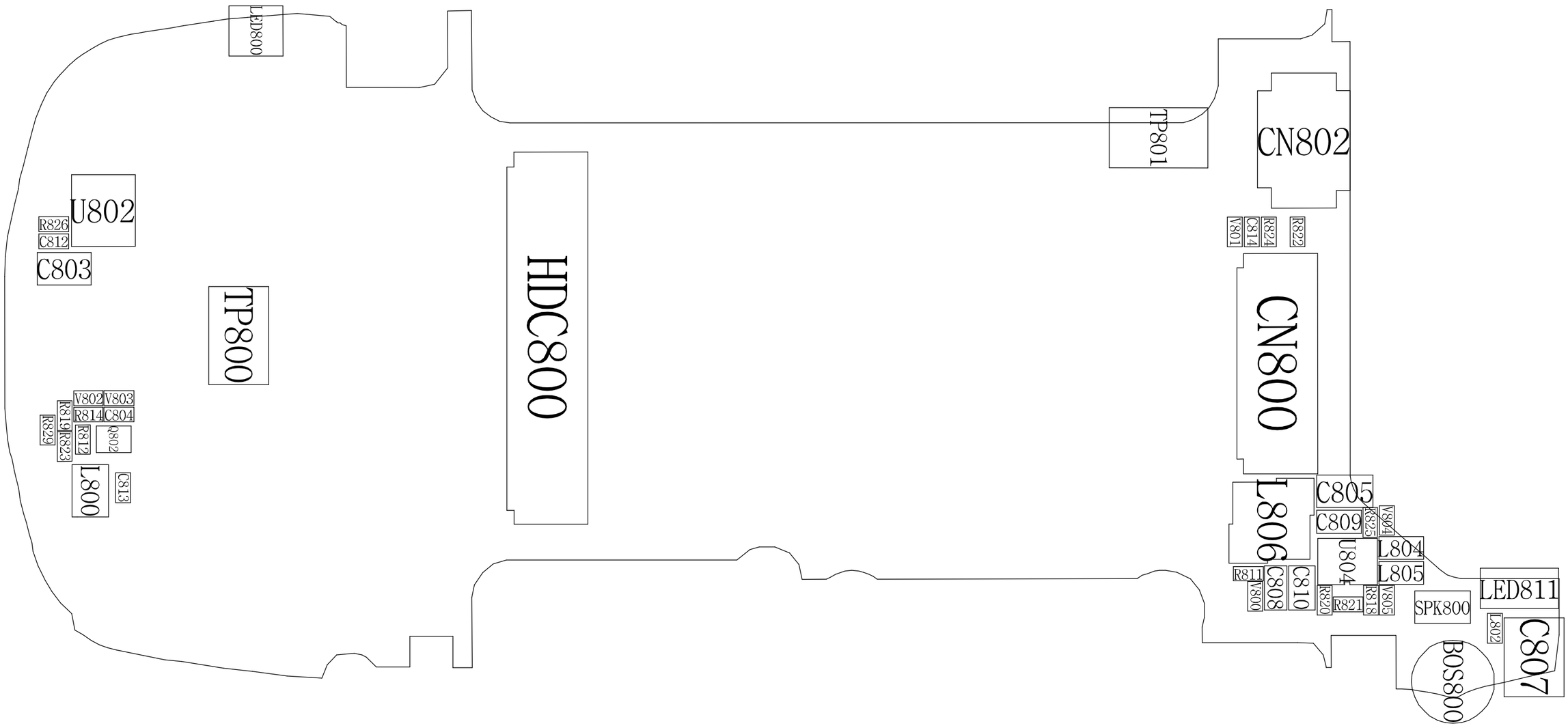
3. Sub PCB Top Diagram



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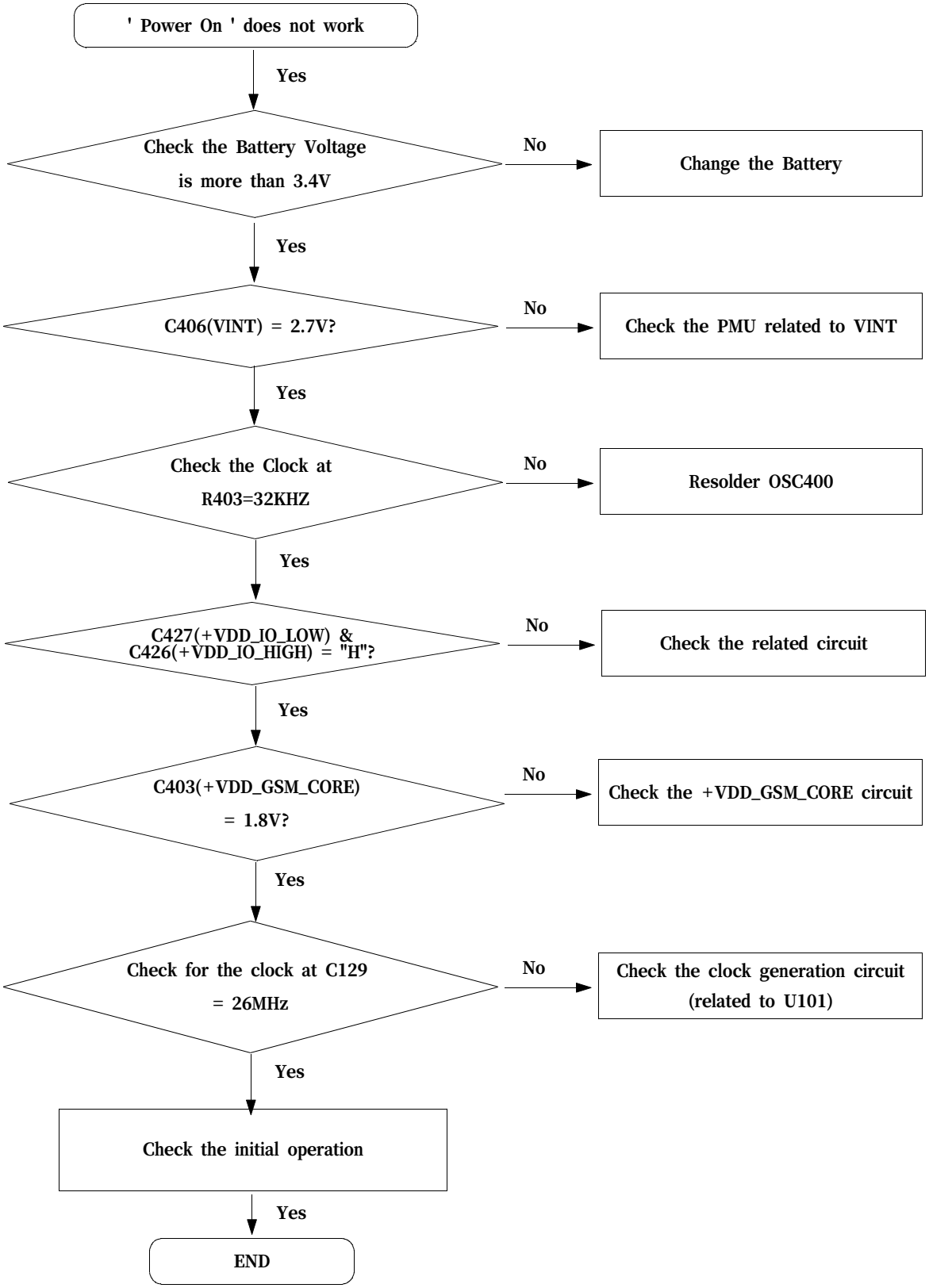
7. SGH-D500 Flow Chart of Troubleshooting

1. Power On



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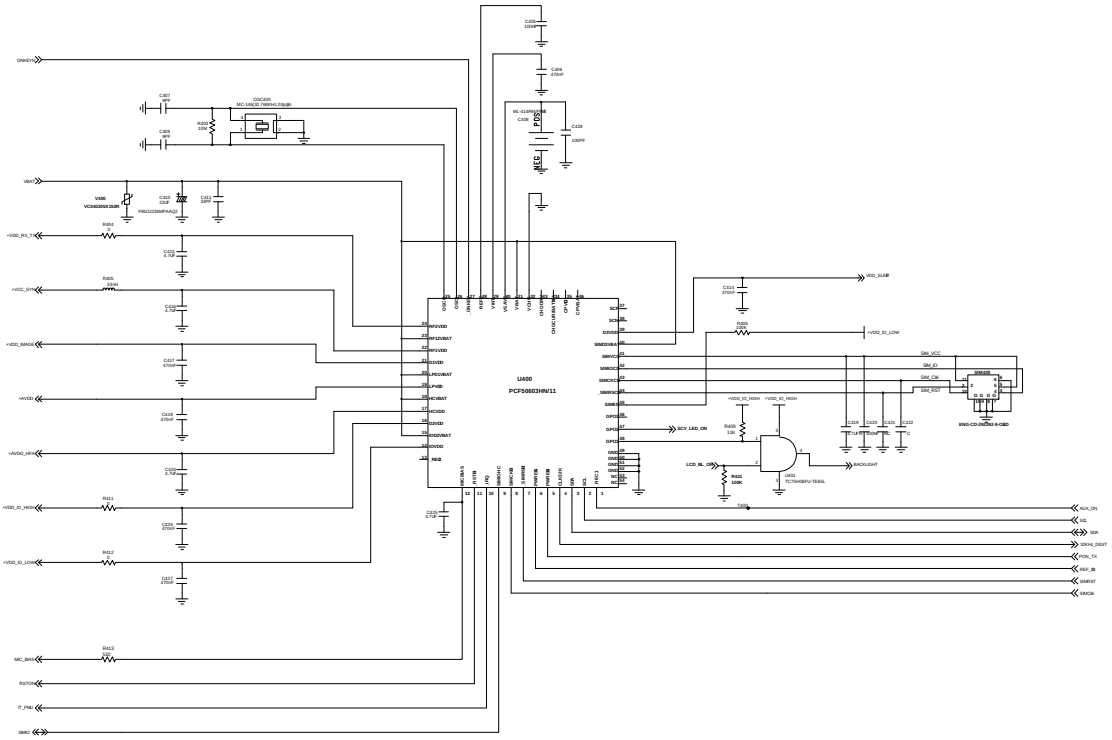

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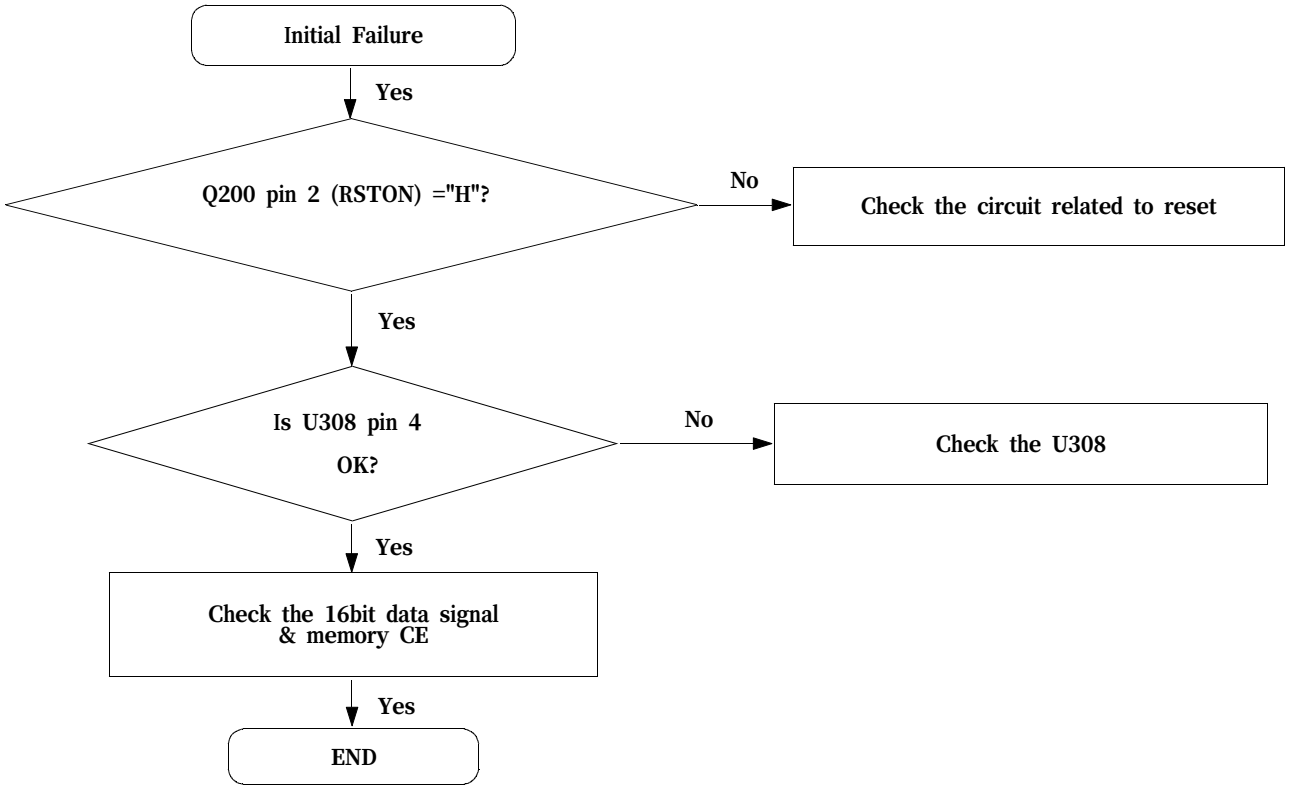
2. Initial



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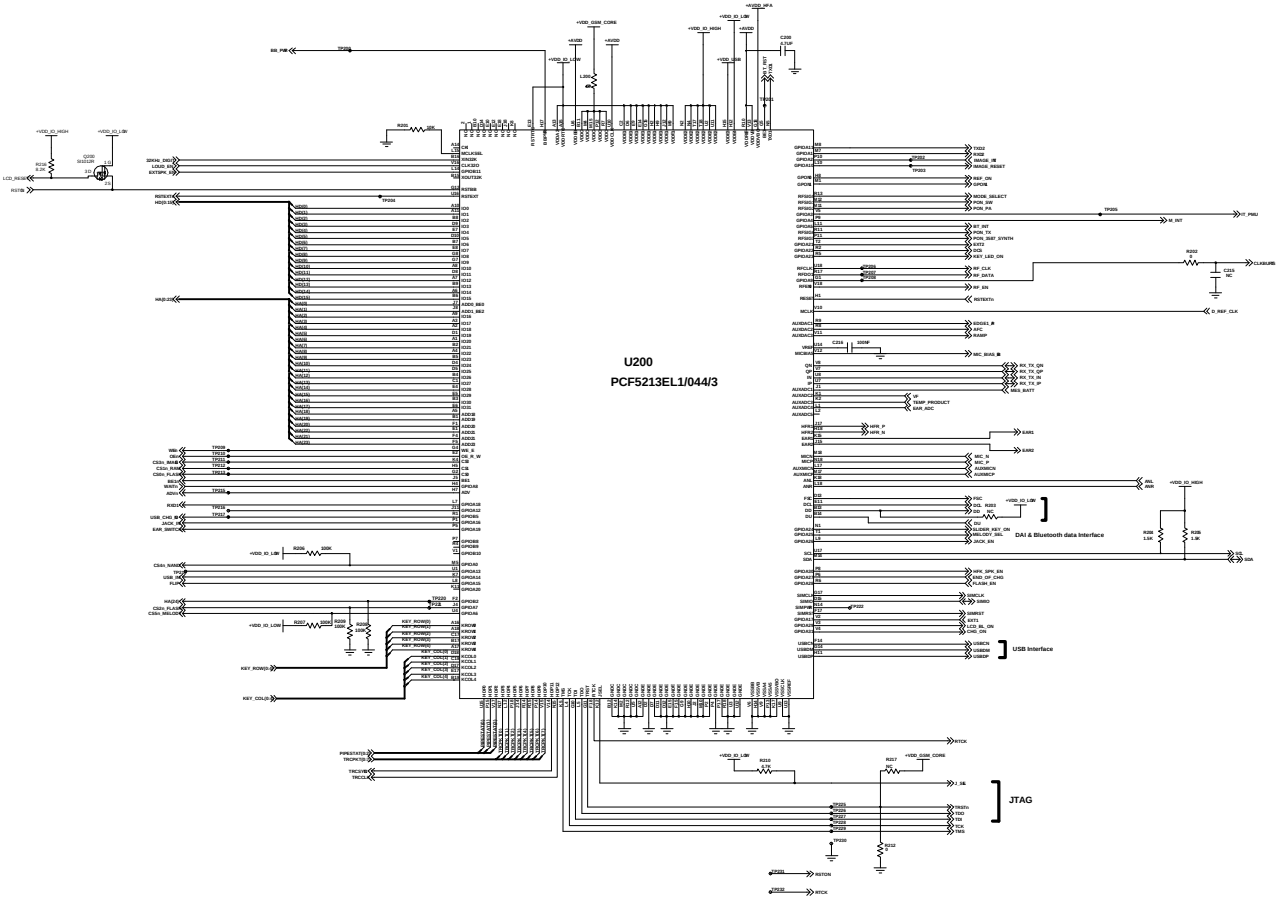

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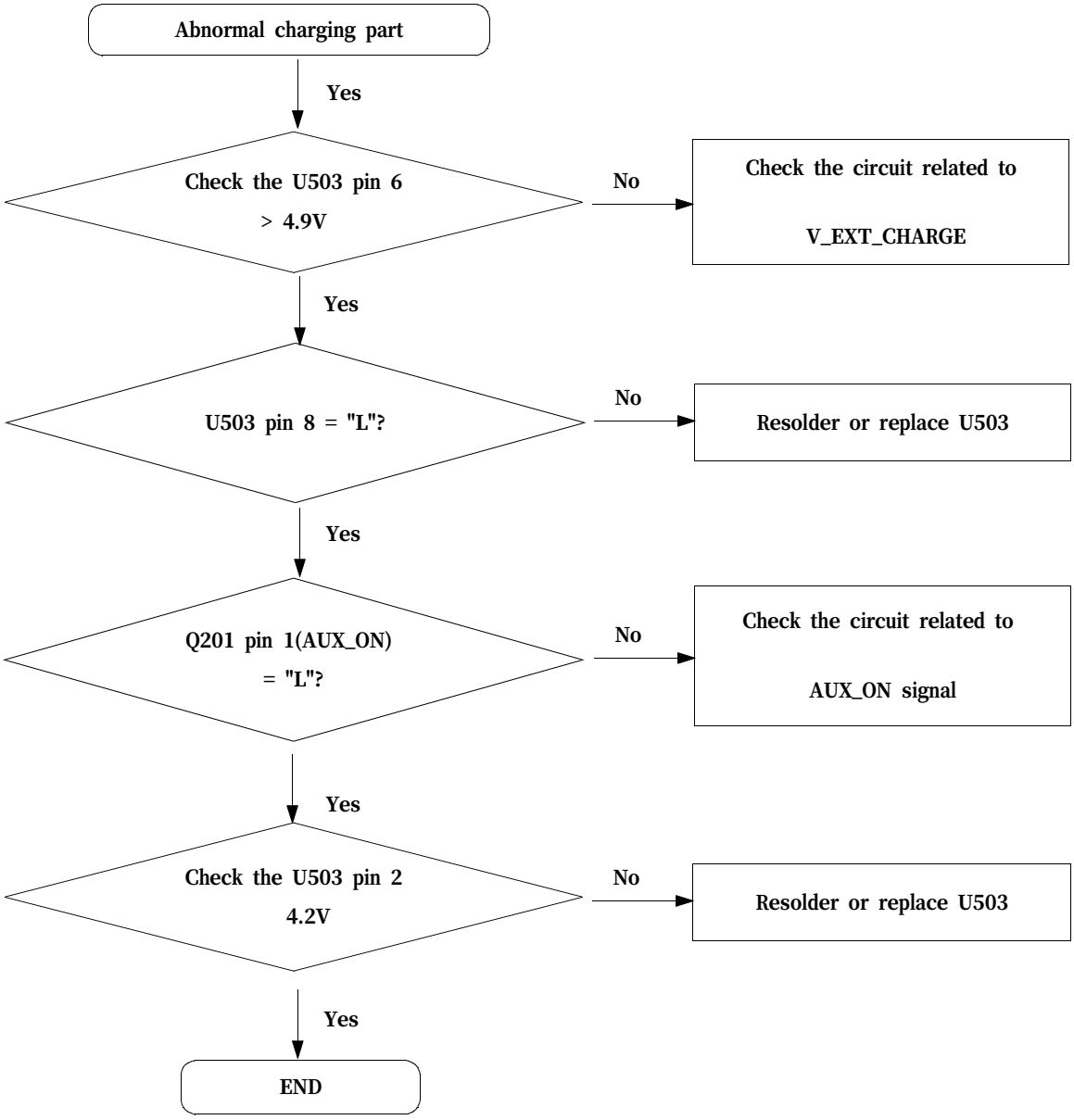
3. Charging Part



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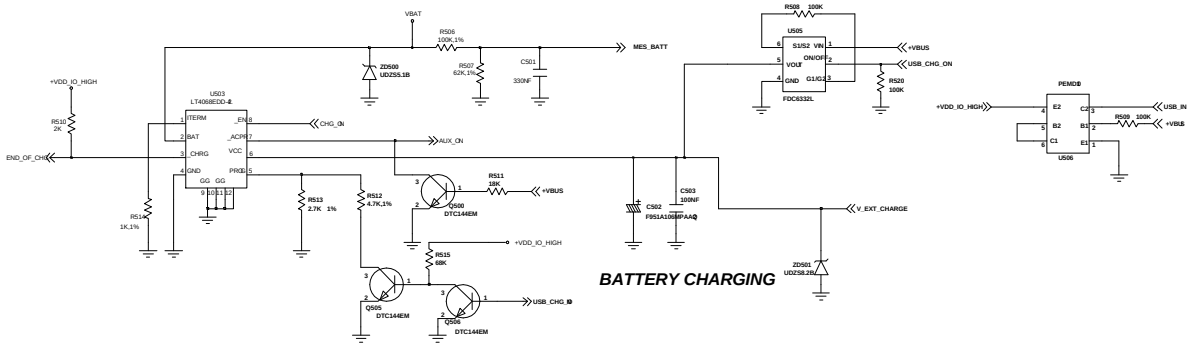

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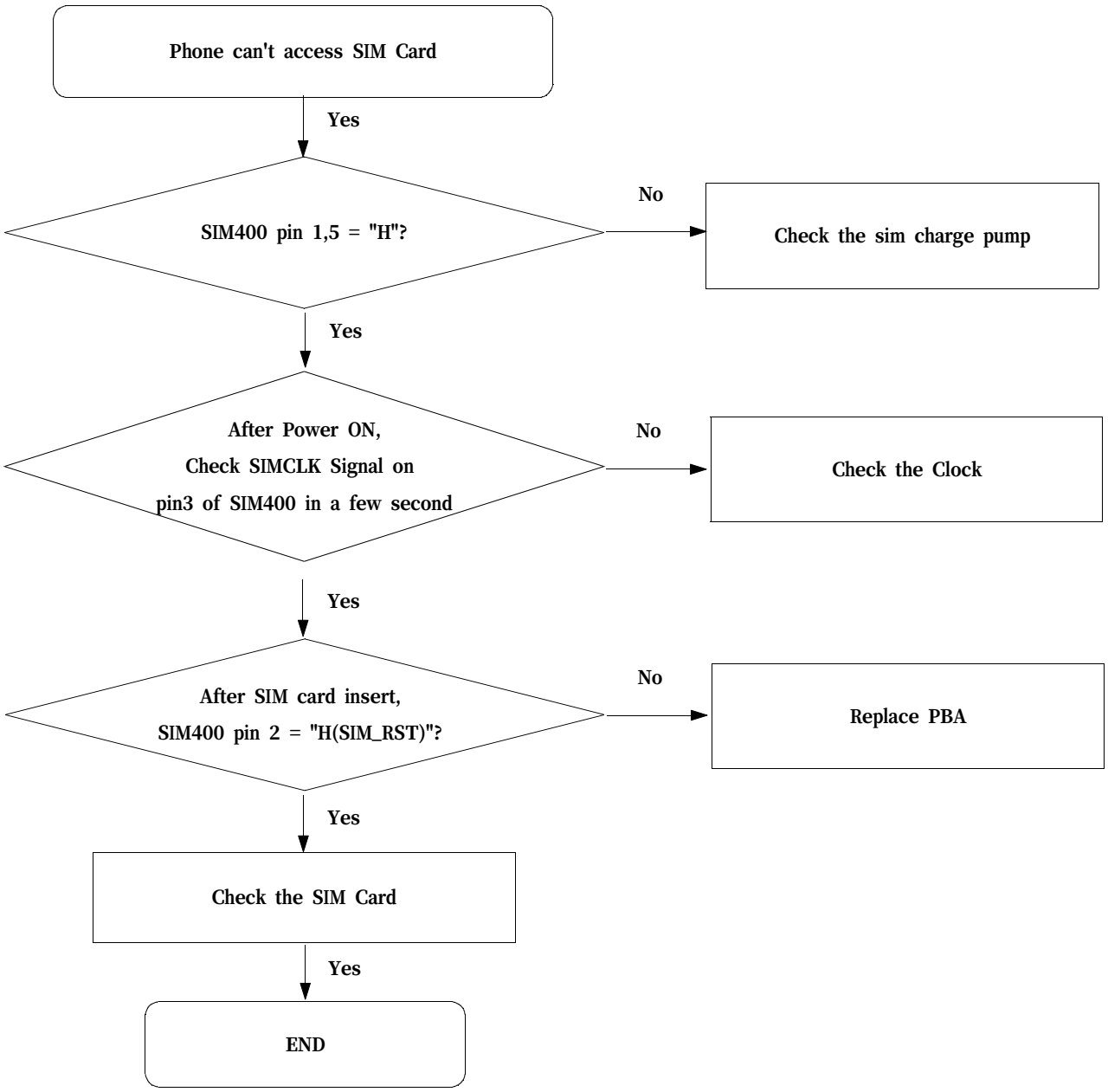
4. Sim Part



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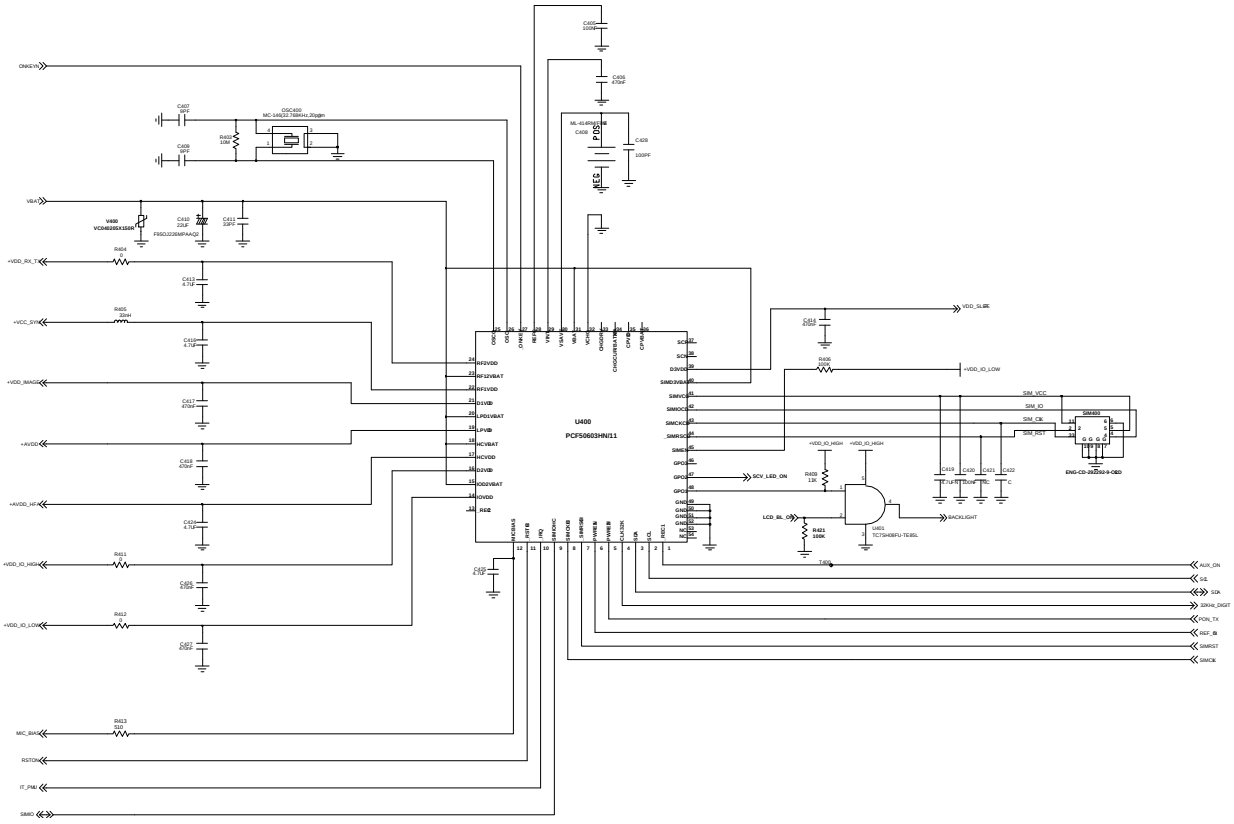

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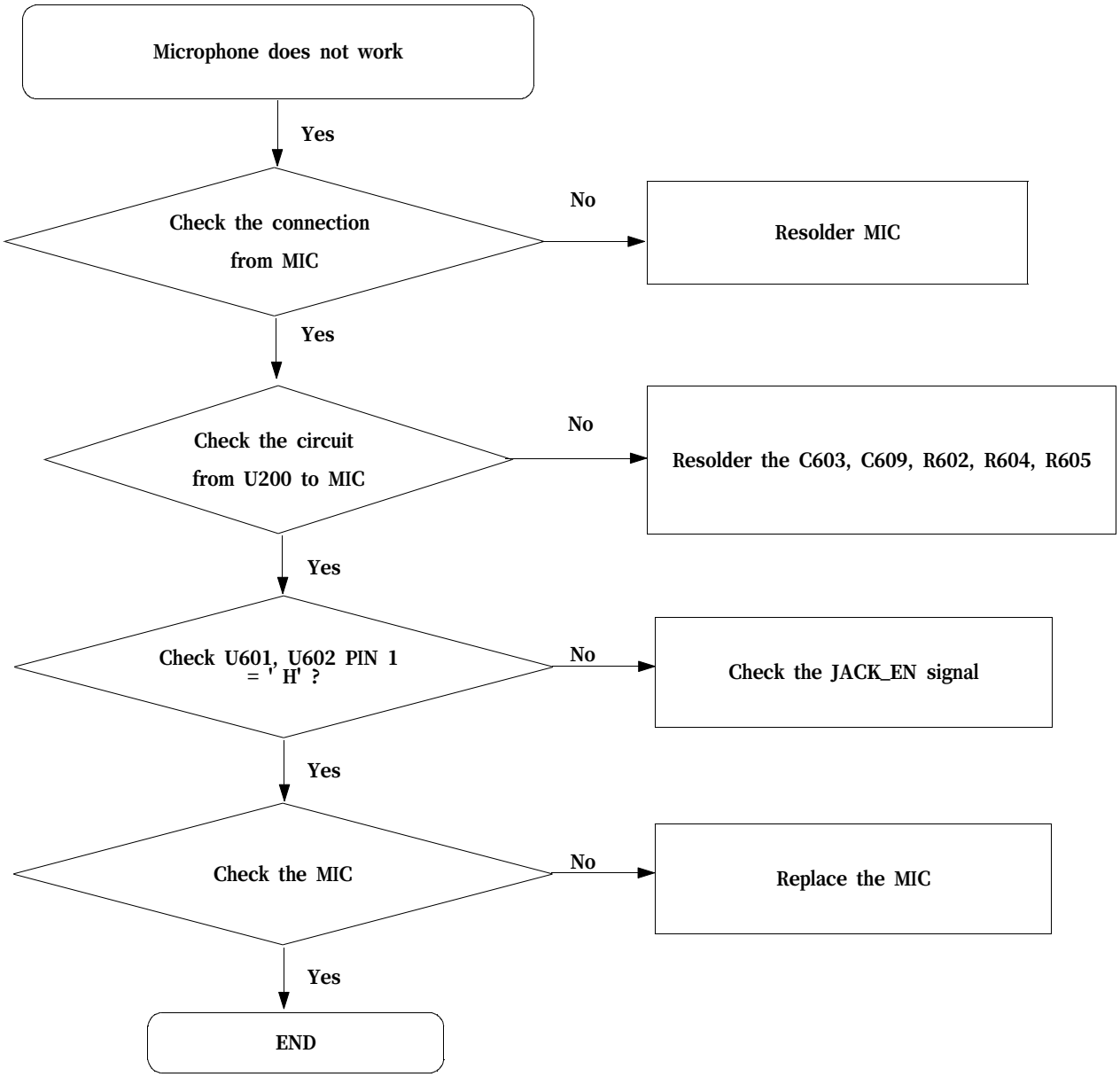
5. Microphone Part



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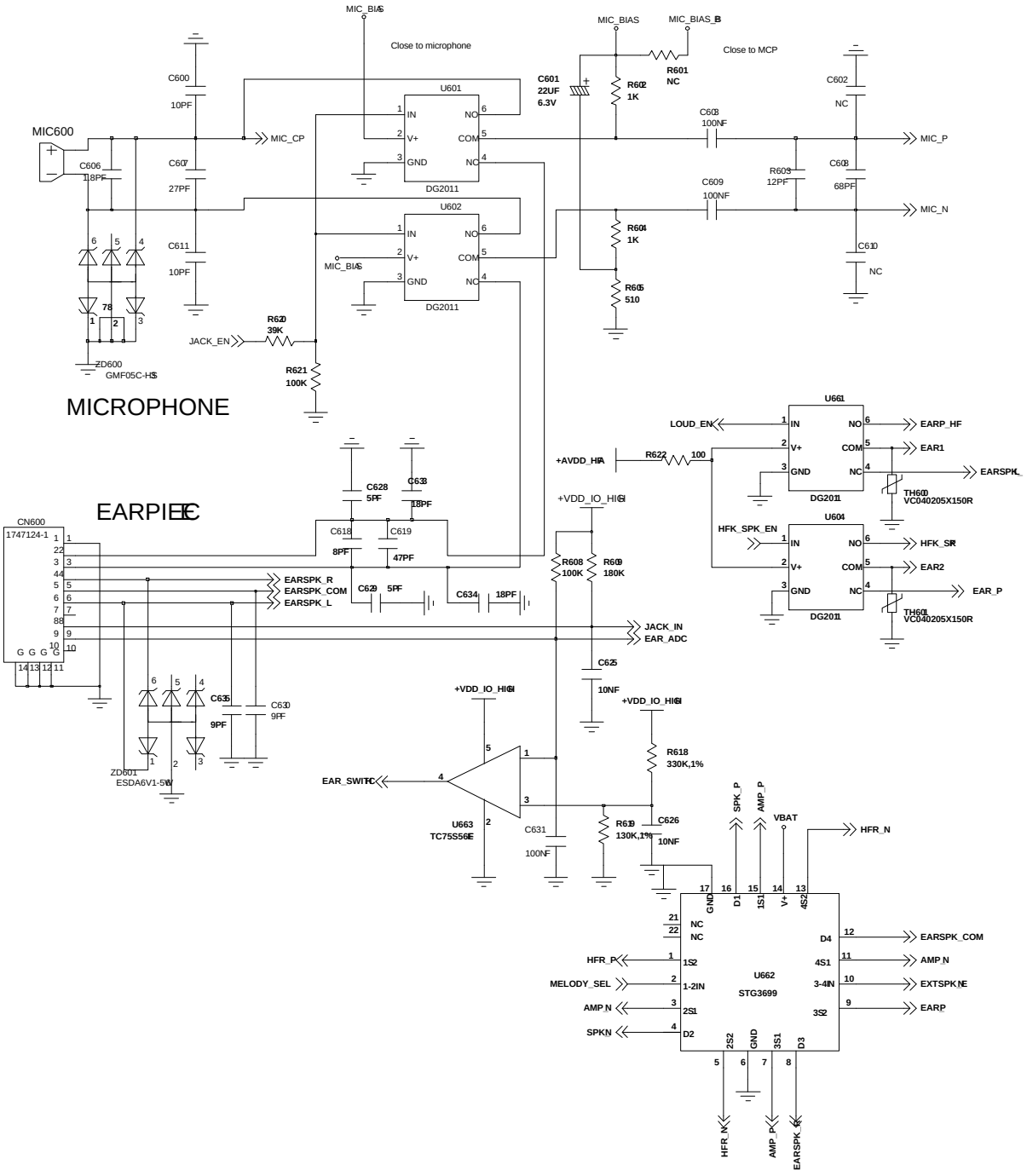

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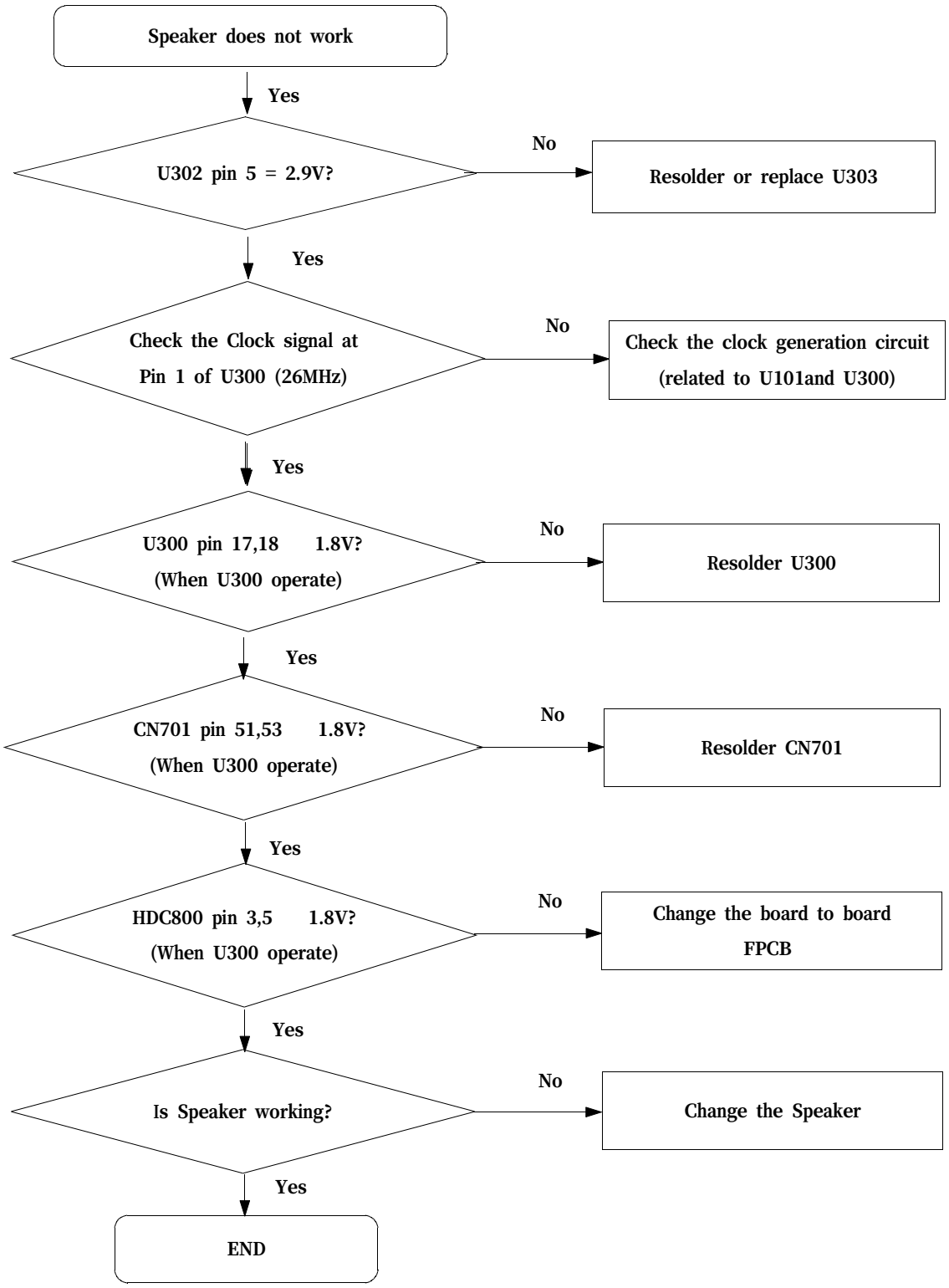
6. Speaker Part(Melody)



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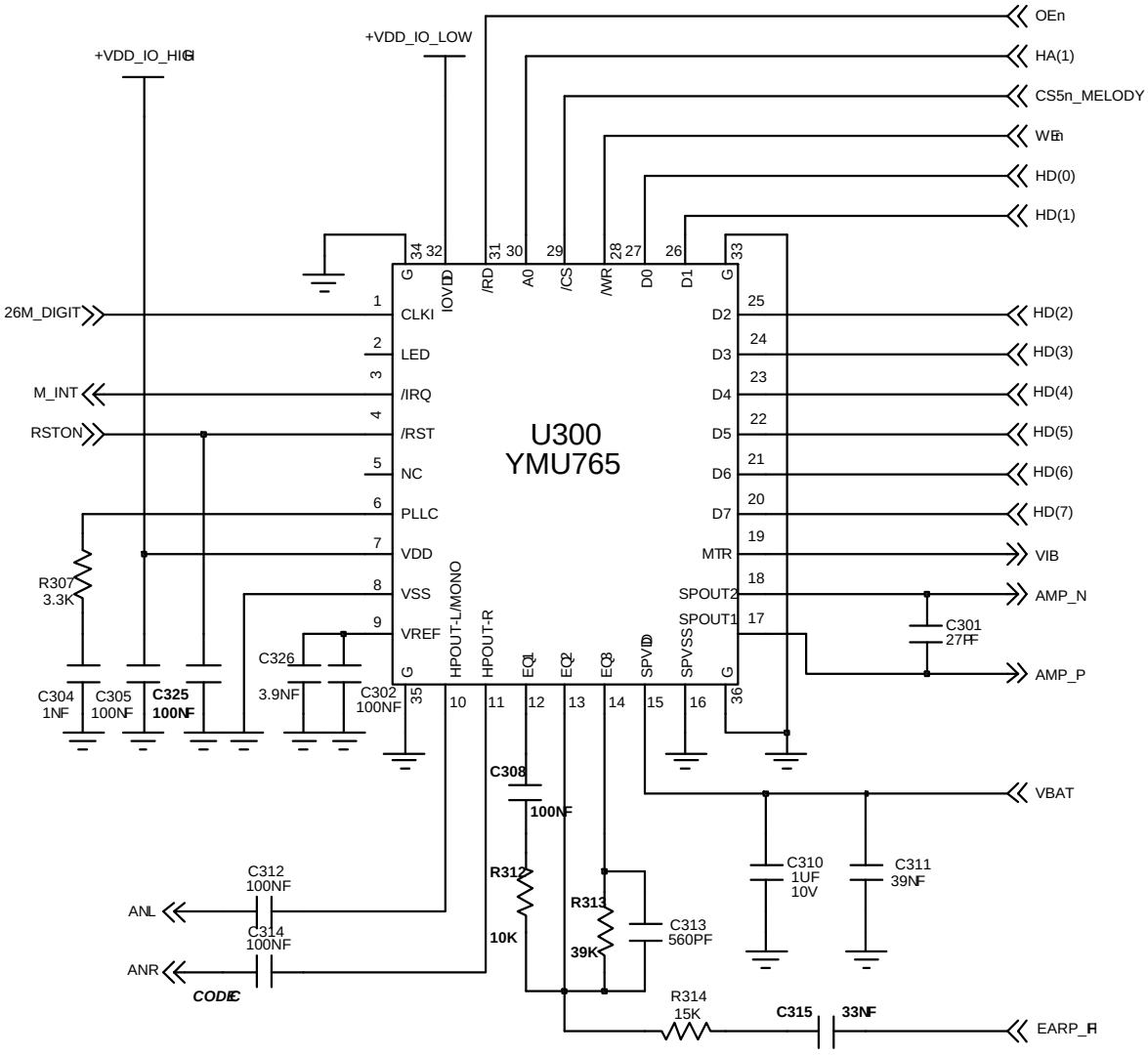

MELODY IC

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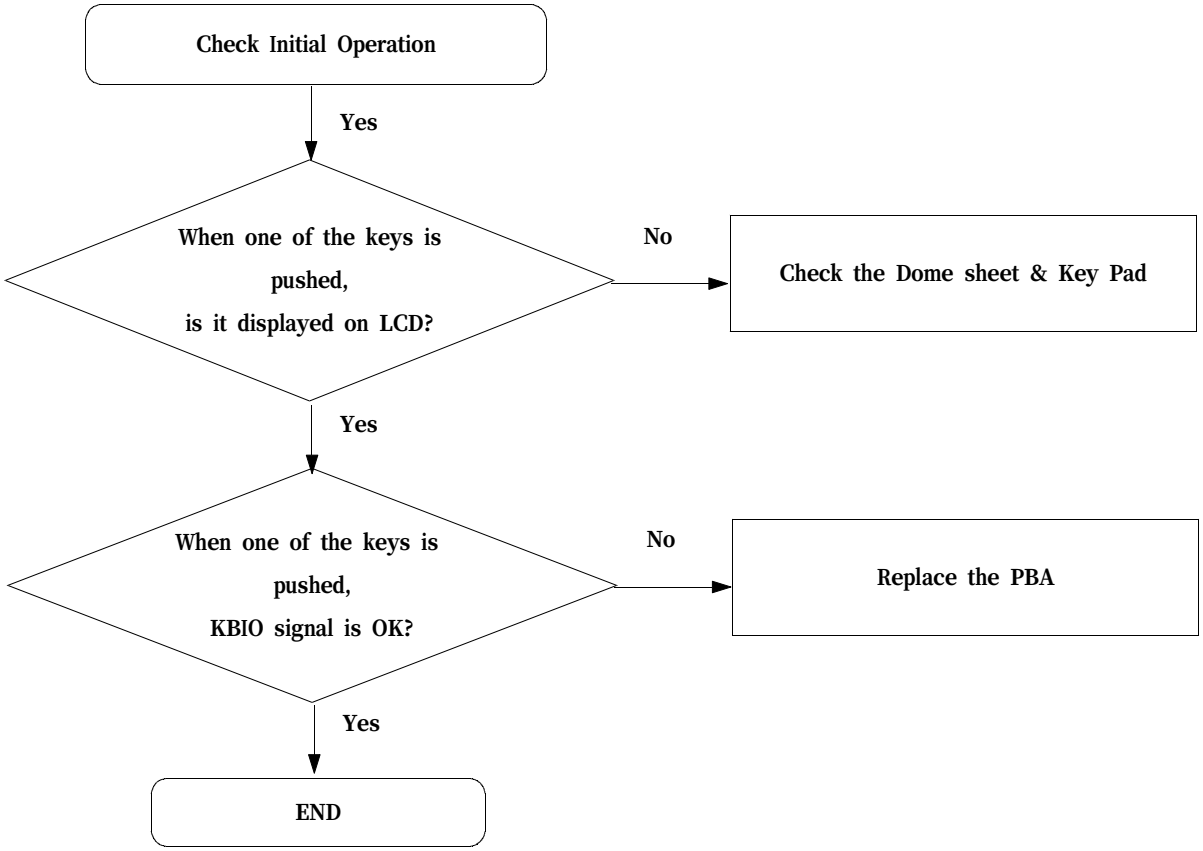
7. Key Data Input



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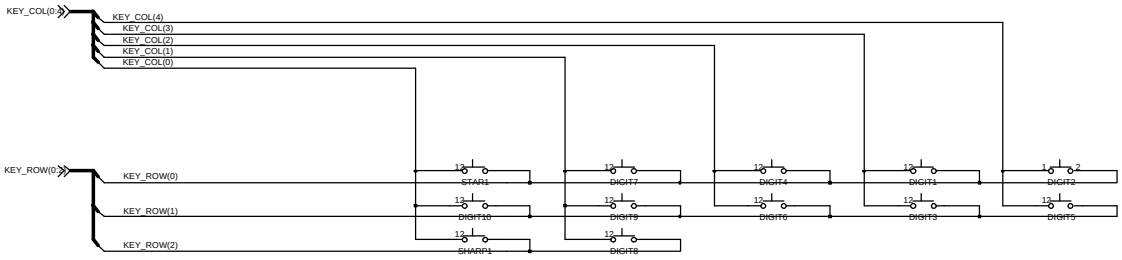
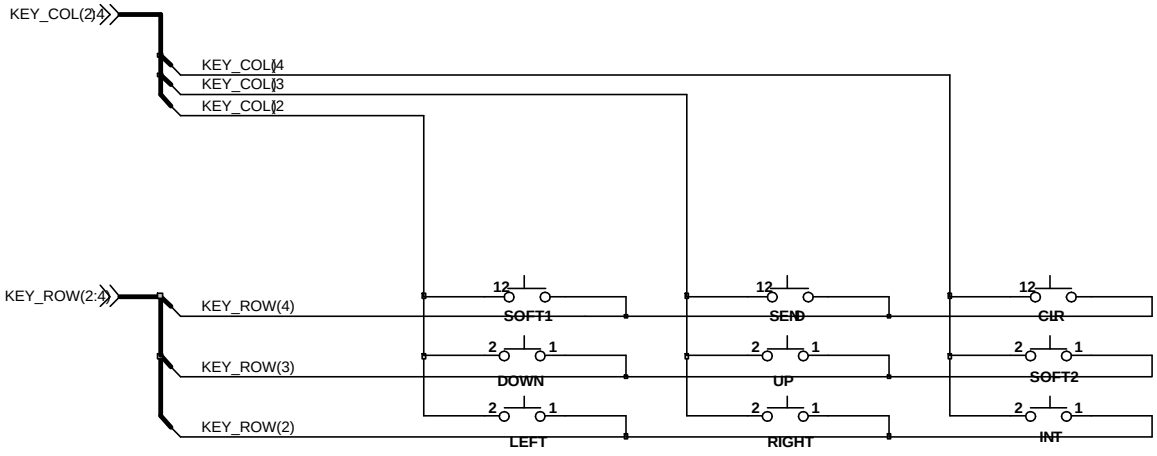


KEY_MAP



KEY_MAP

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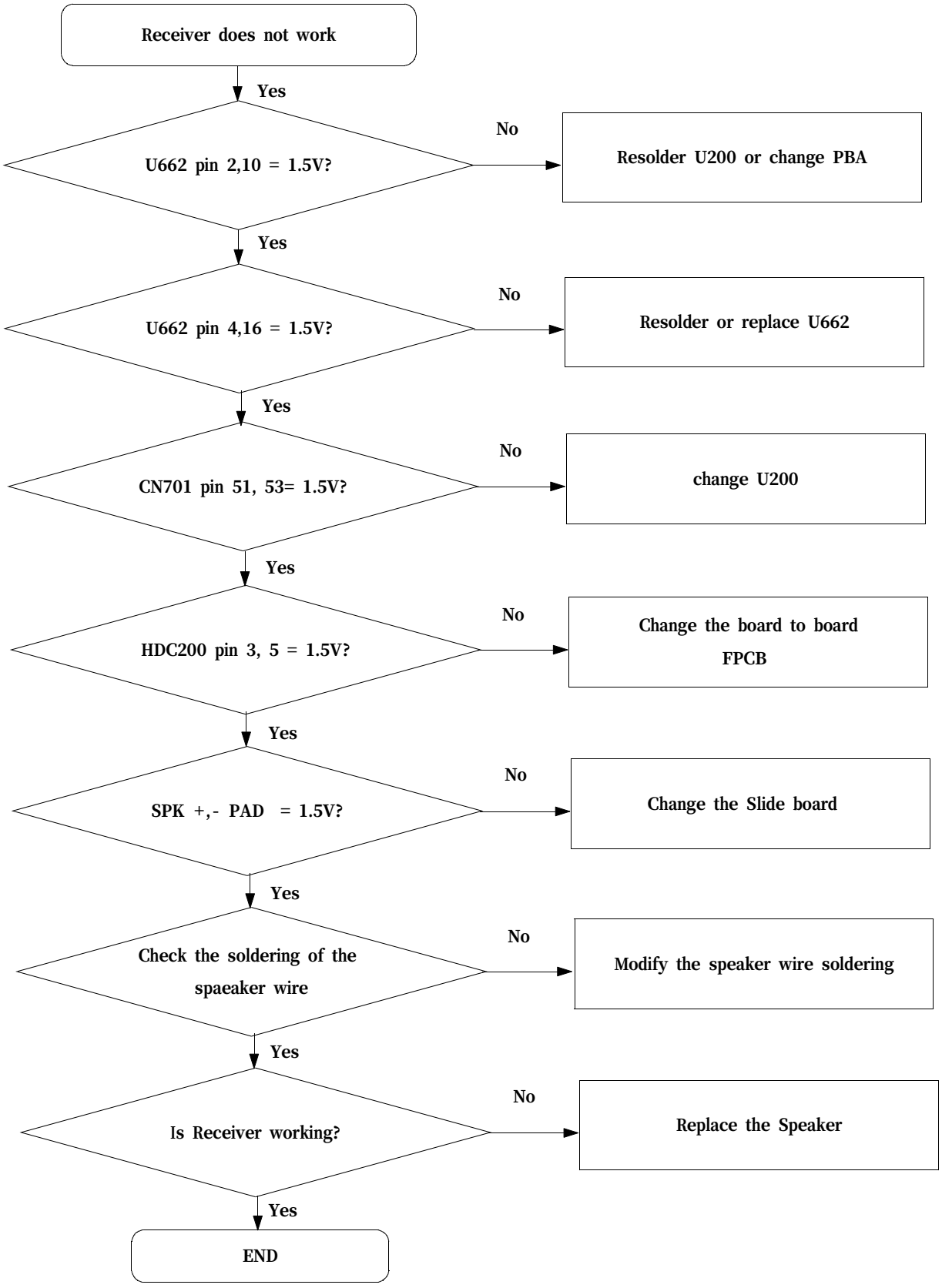
8. Receiver Part



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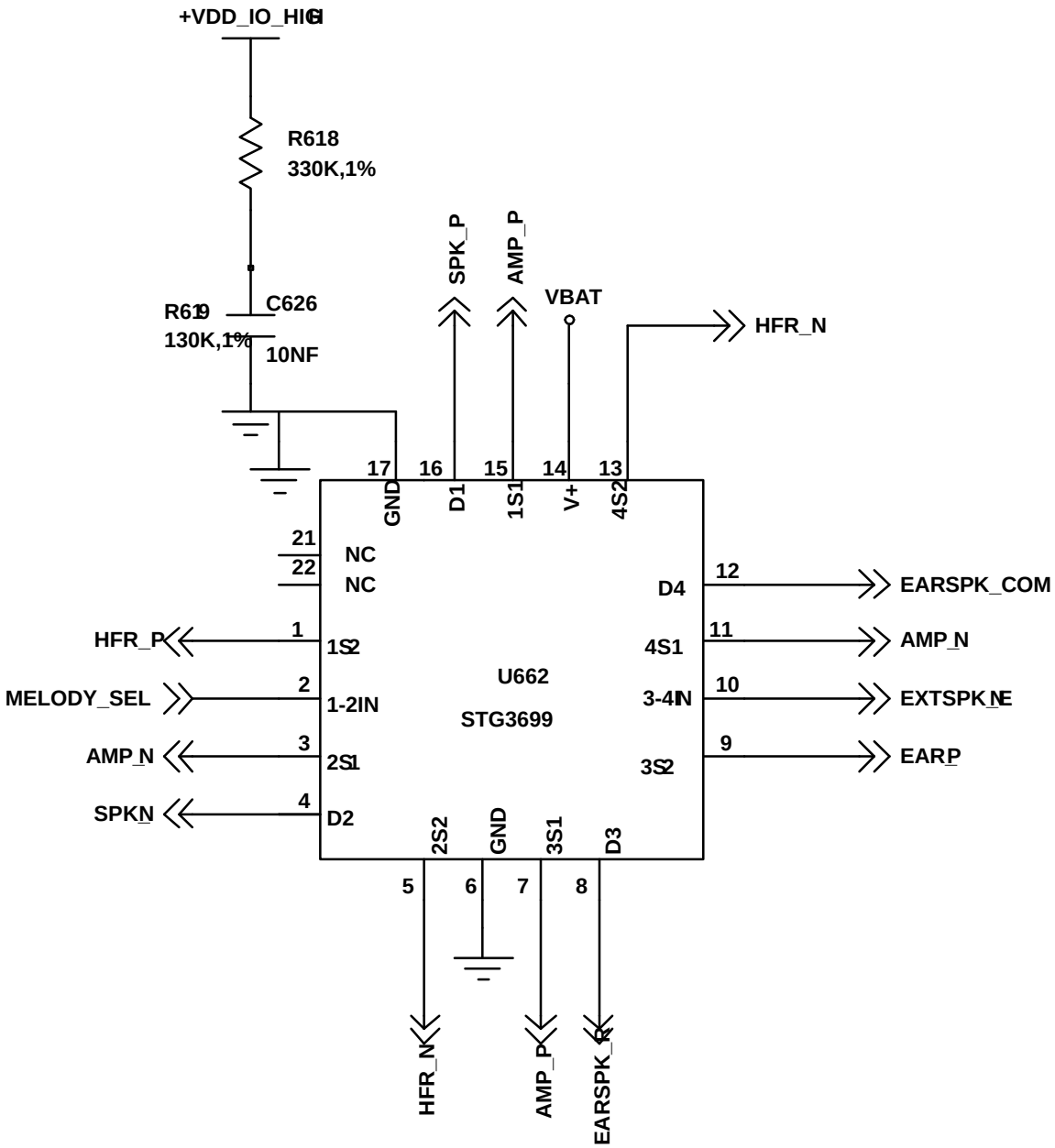

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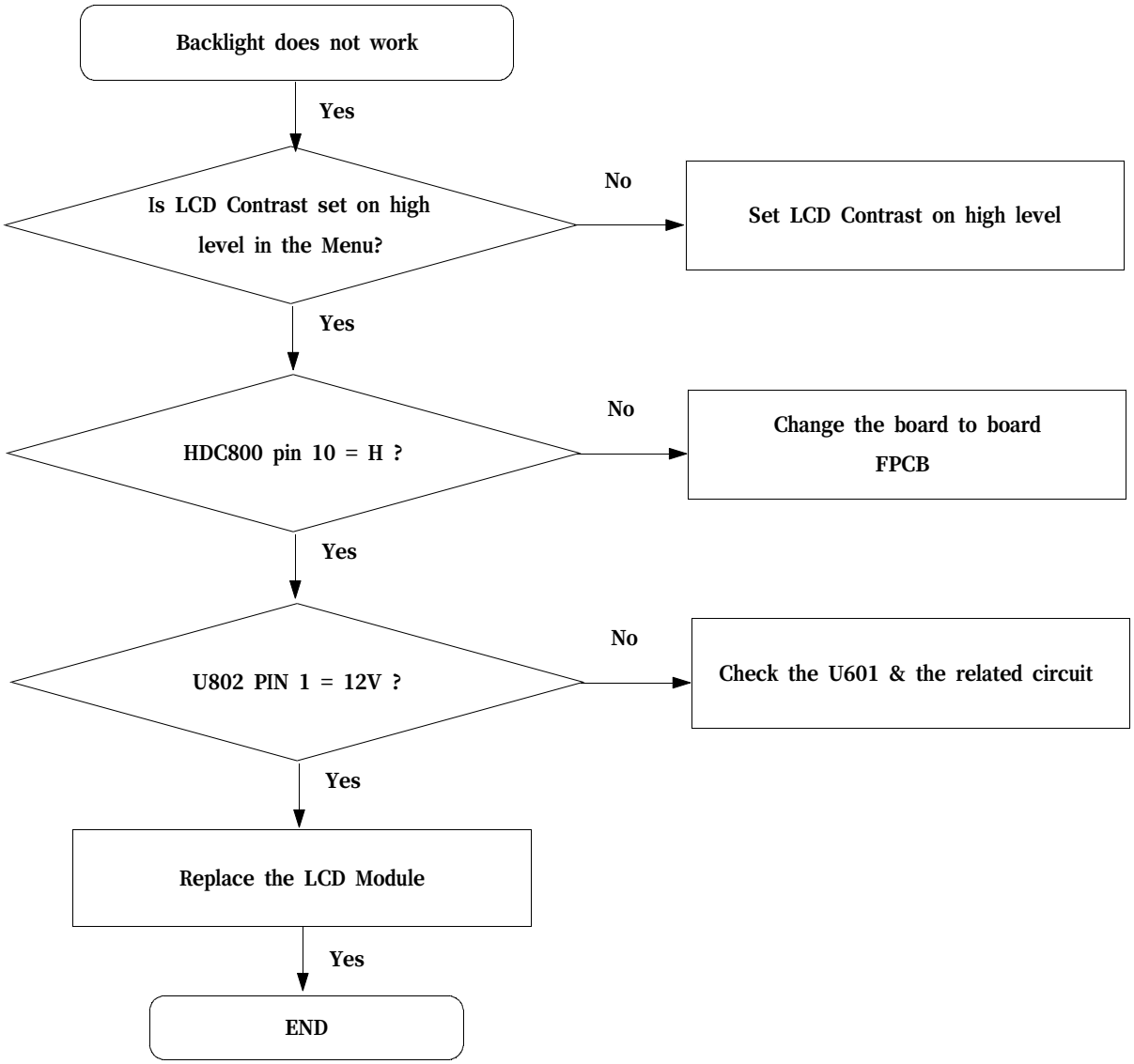
9. Back Light (for Color Main LCD)



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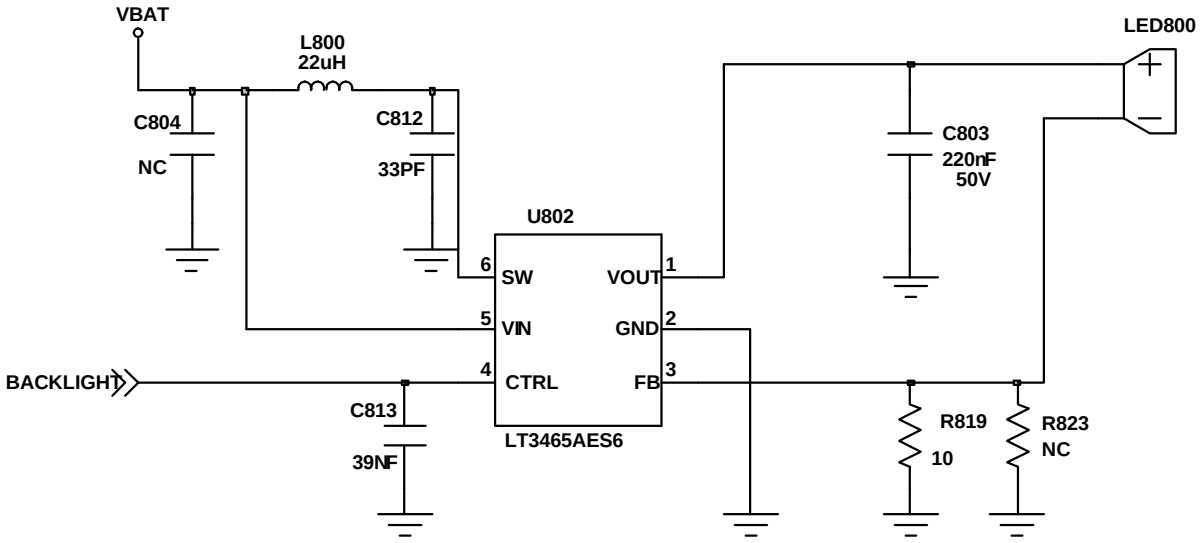

LCD BACKLIGHT

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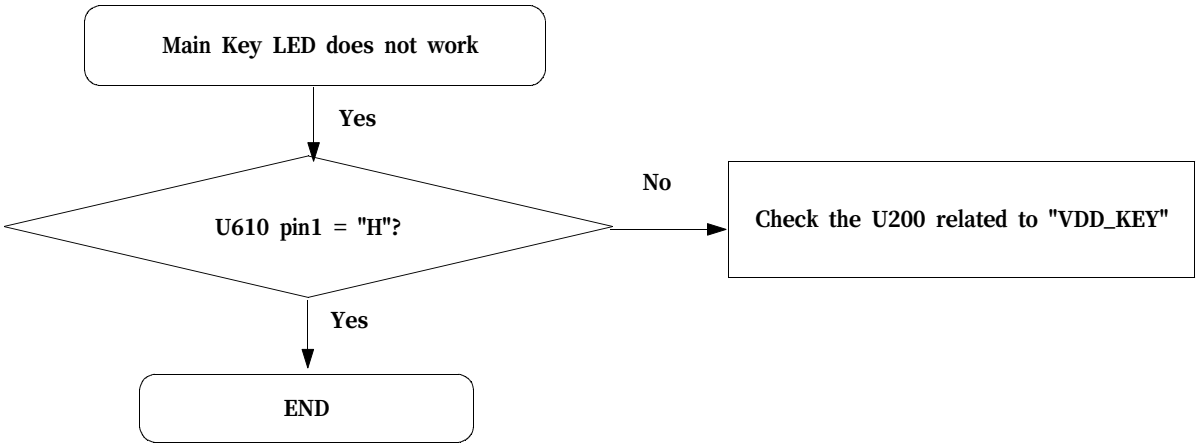
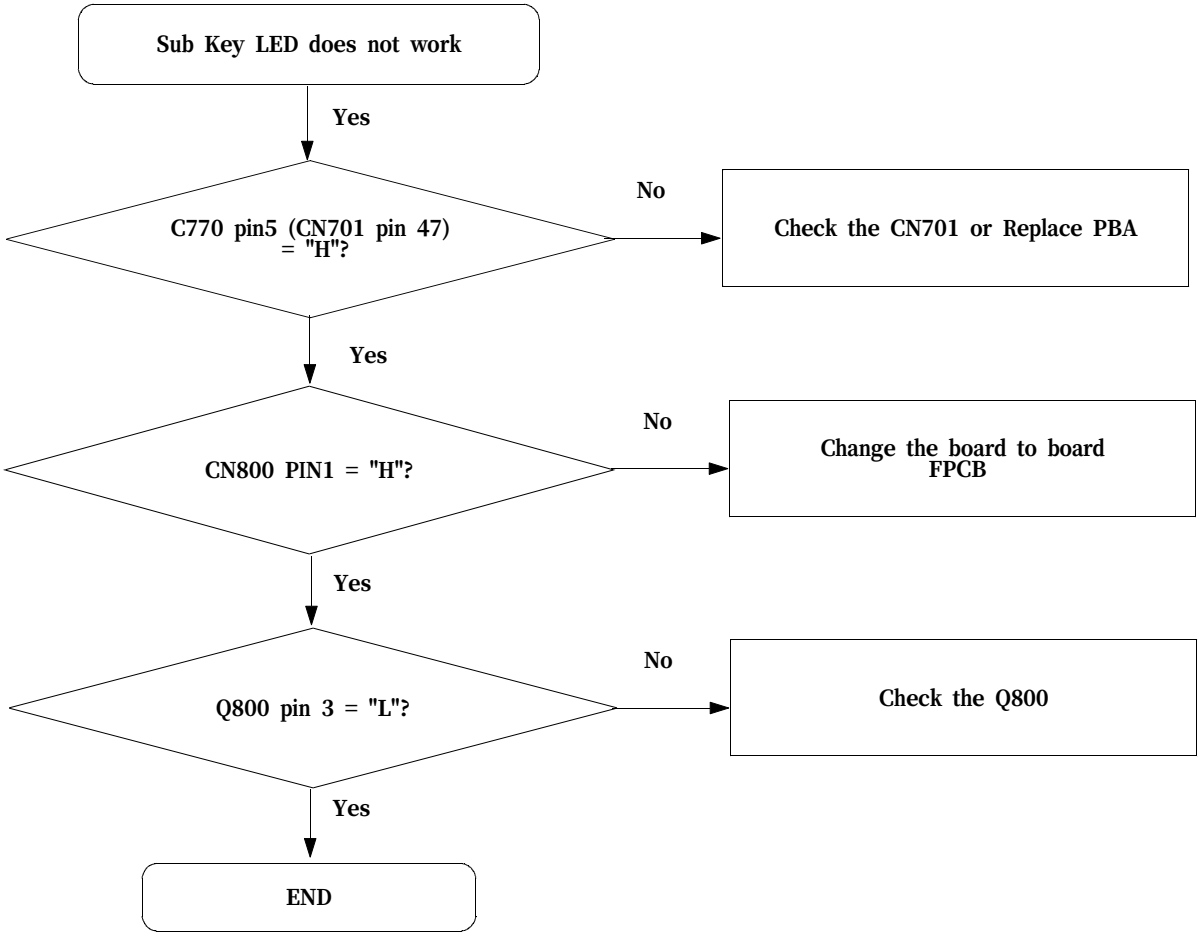
10. Key Back Light

1) Main Key Part



2) Sub Key Part



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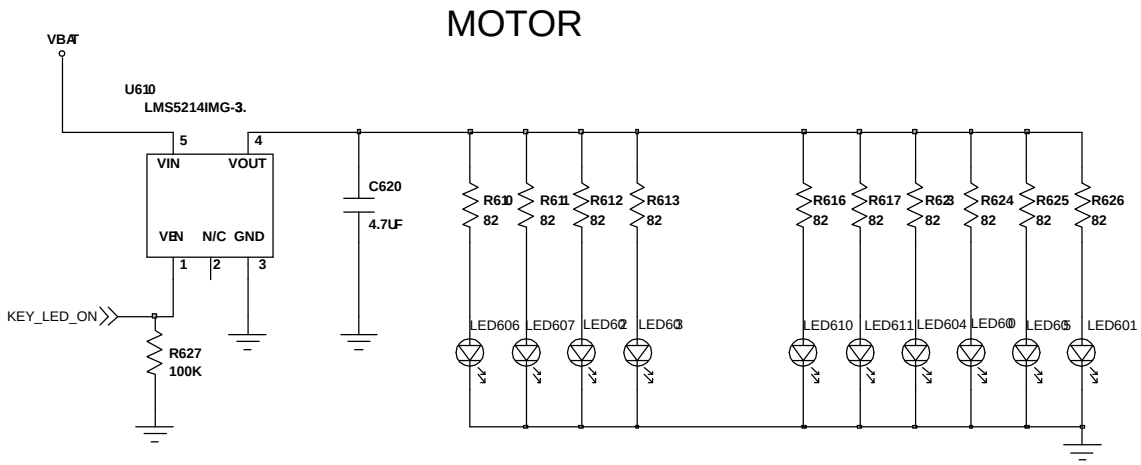

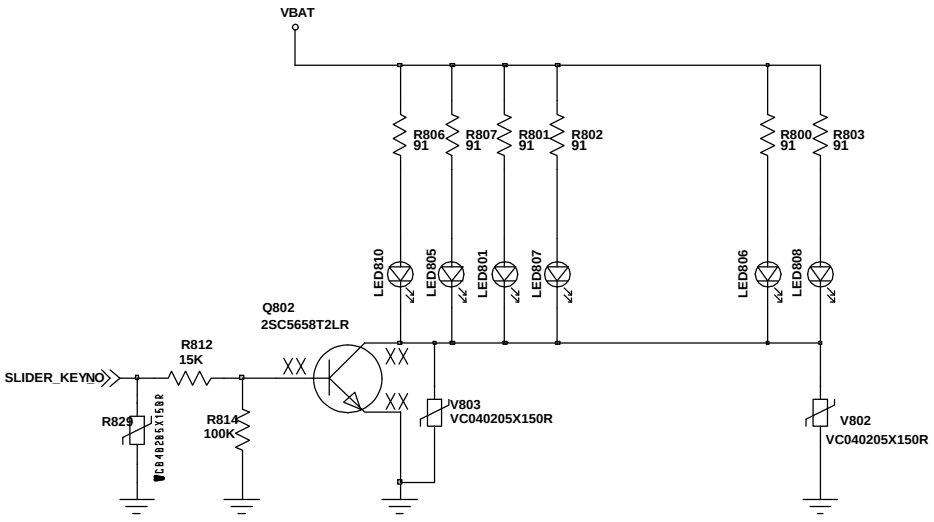

KEY_LED

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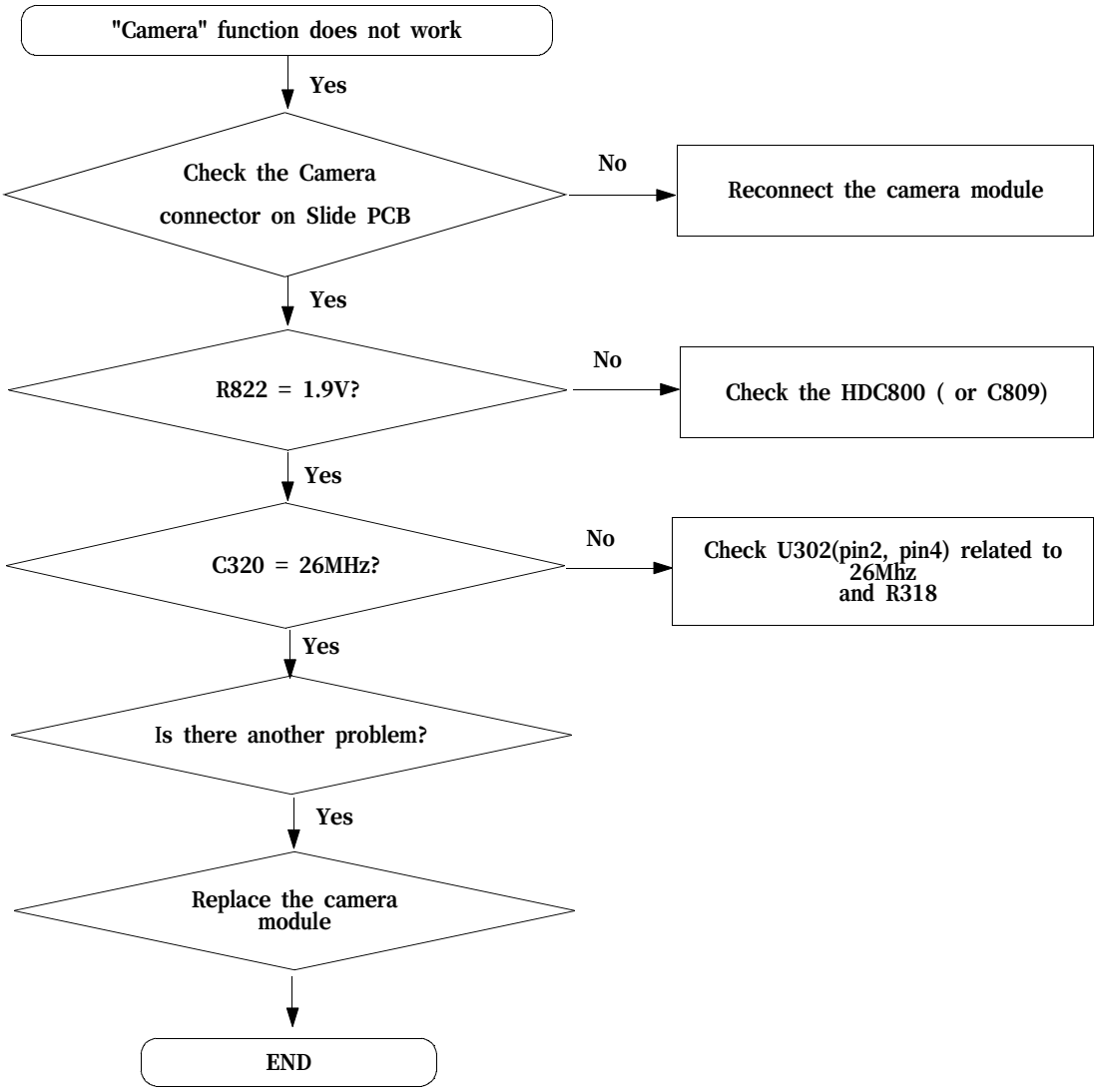
11. Camera part



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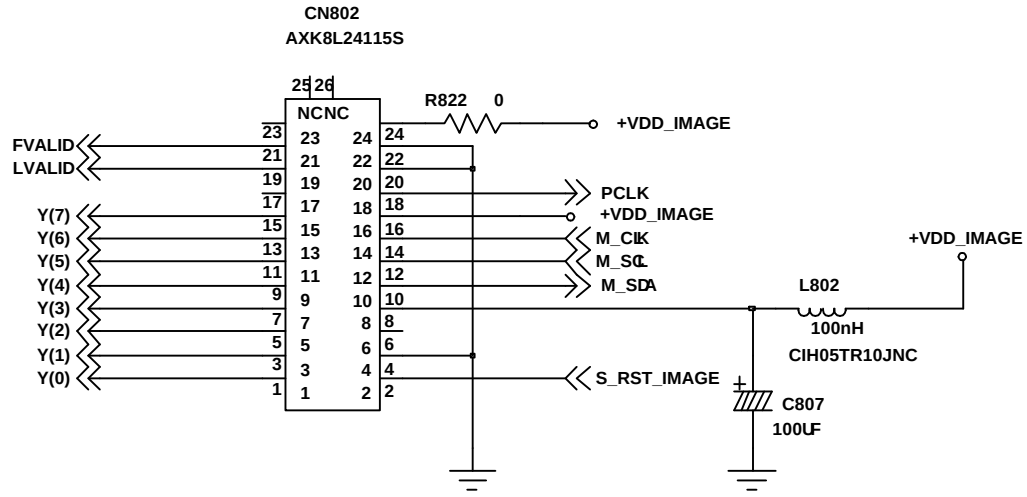
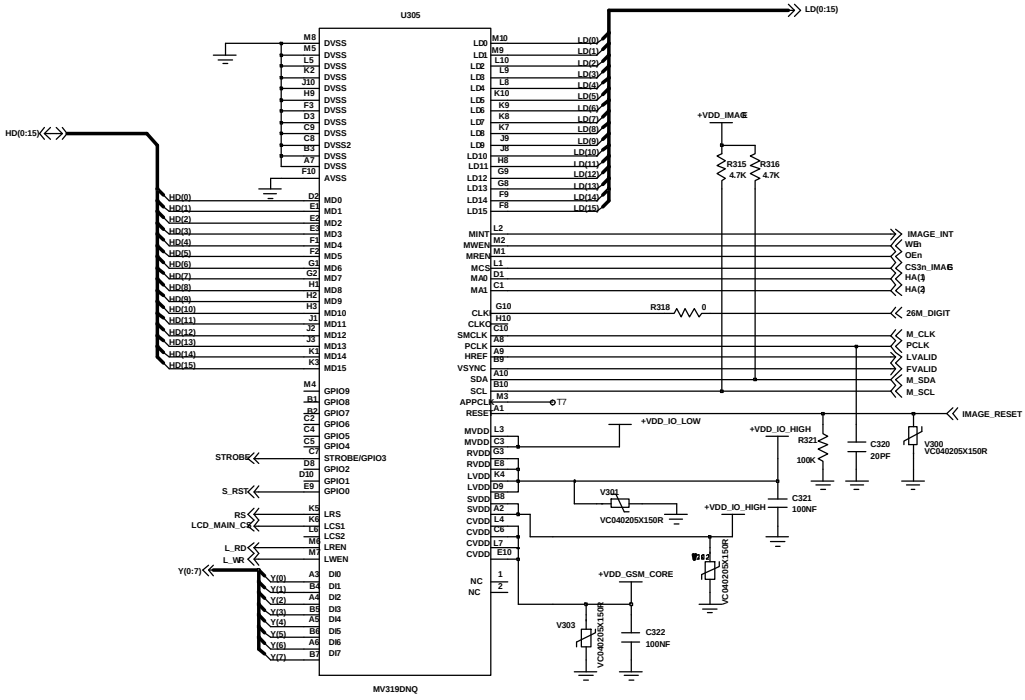


1M CAM



IMAGE_DSP

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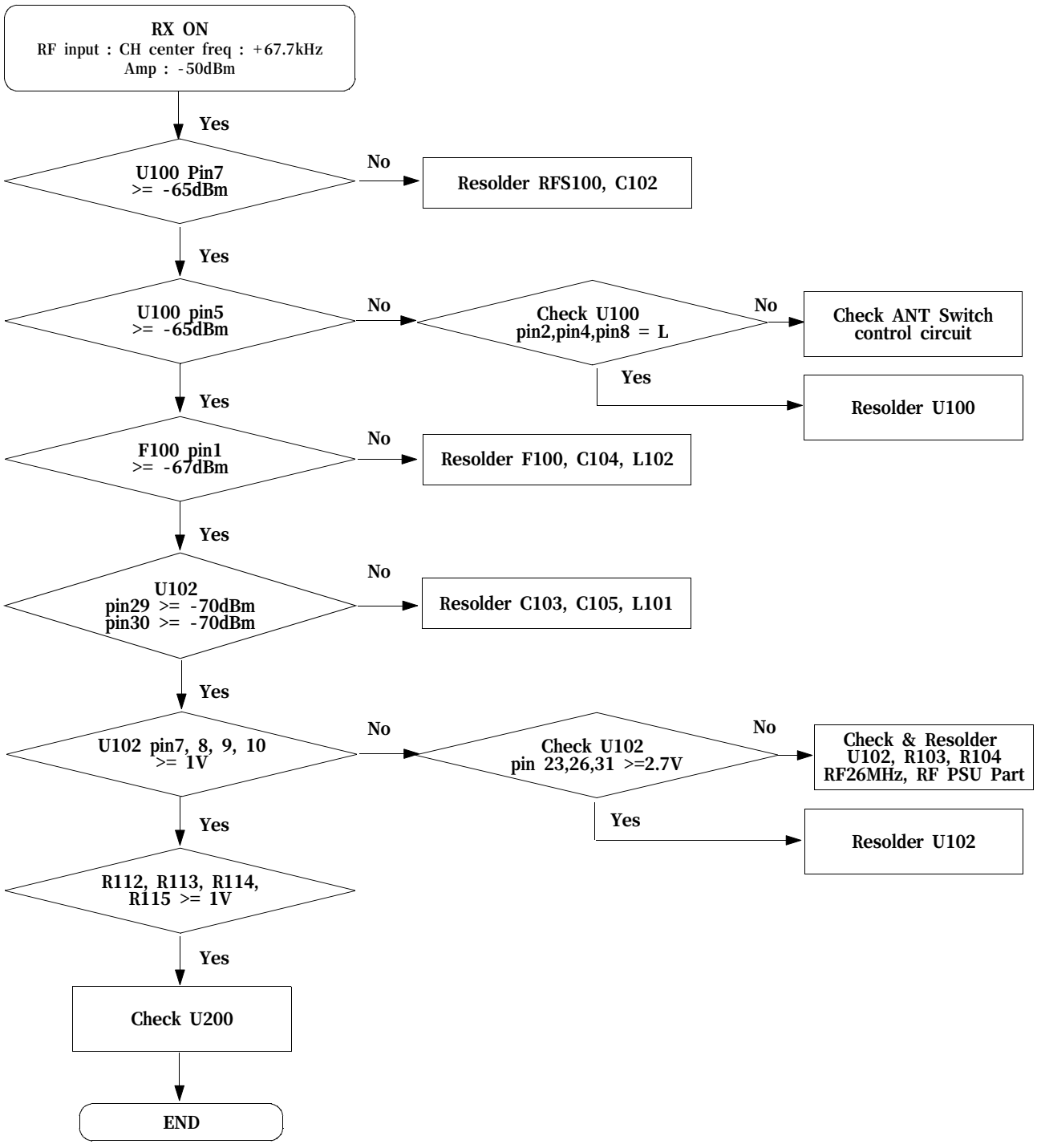
12. GSM Receiver



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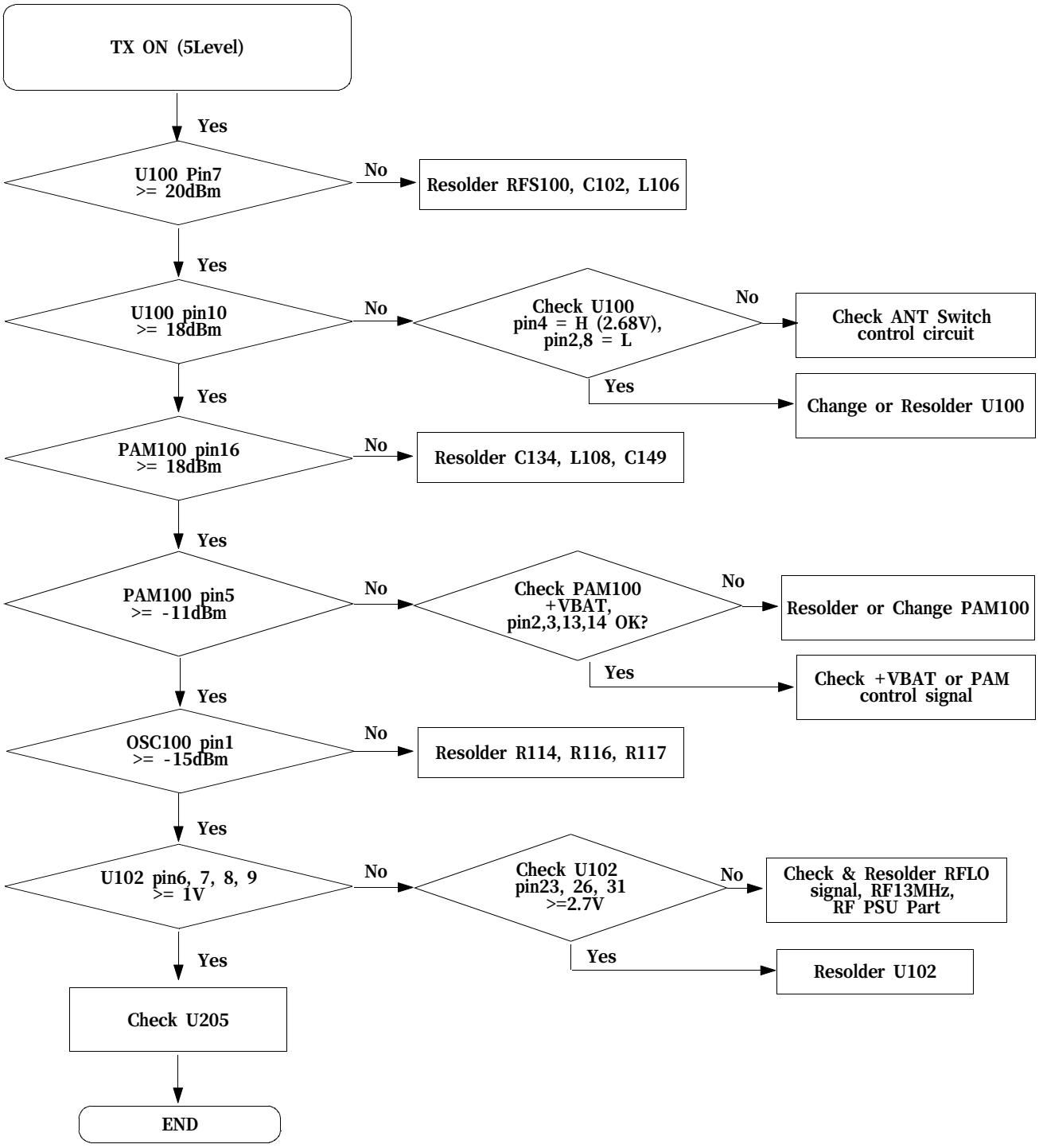
13. GSM Transmitter



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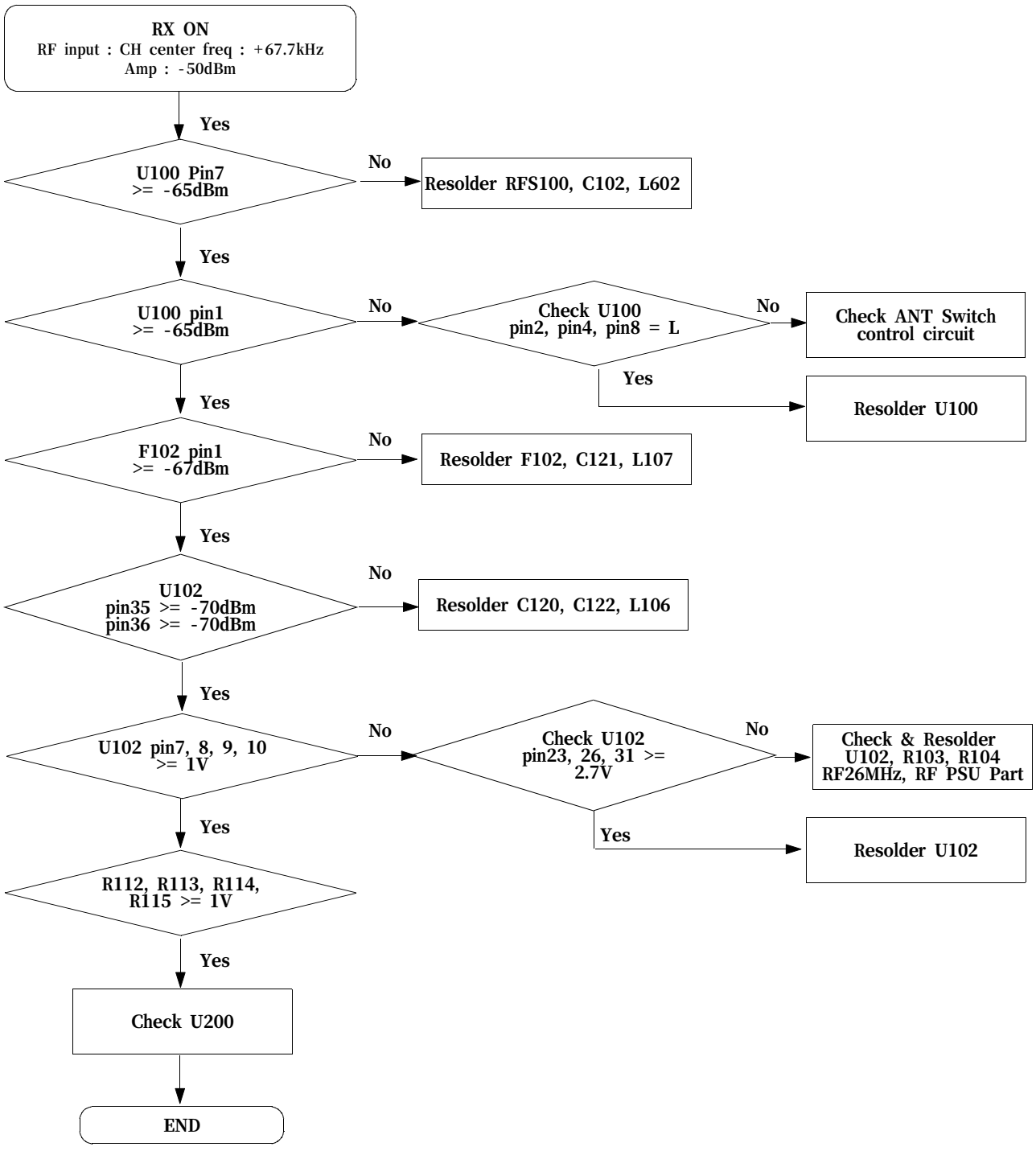
14. DCS Receiver



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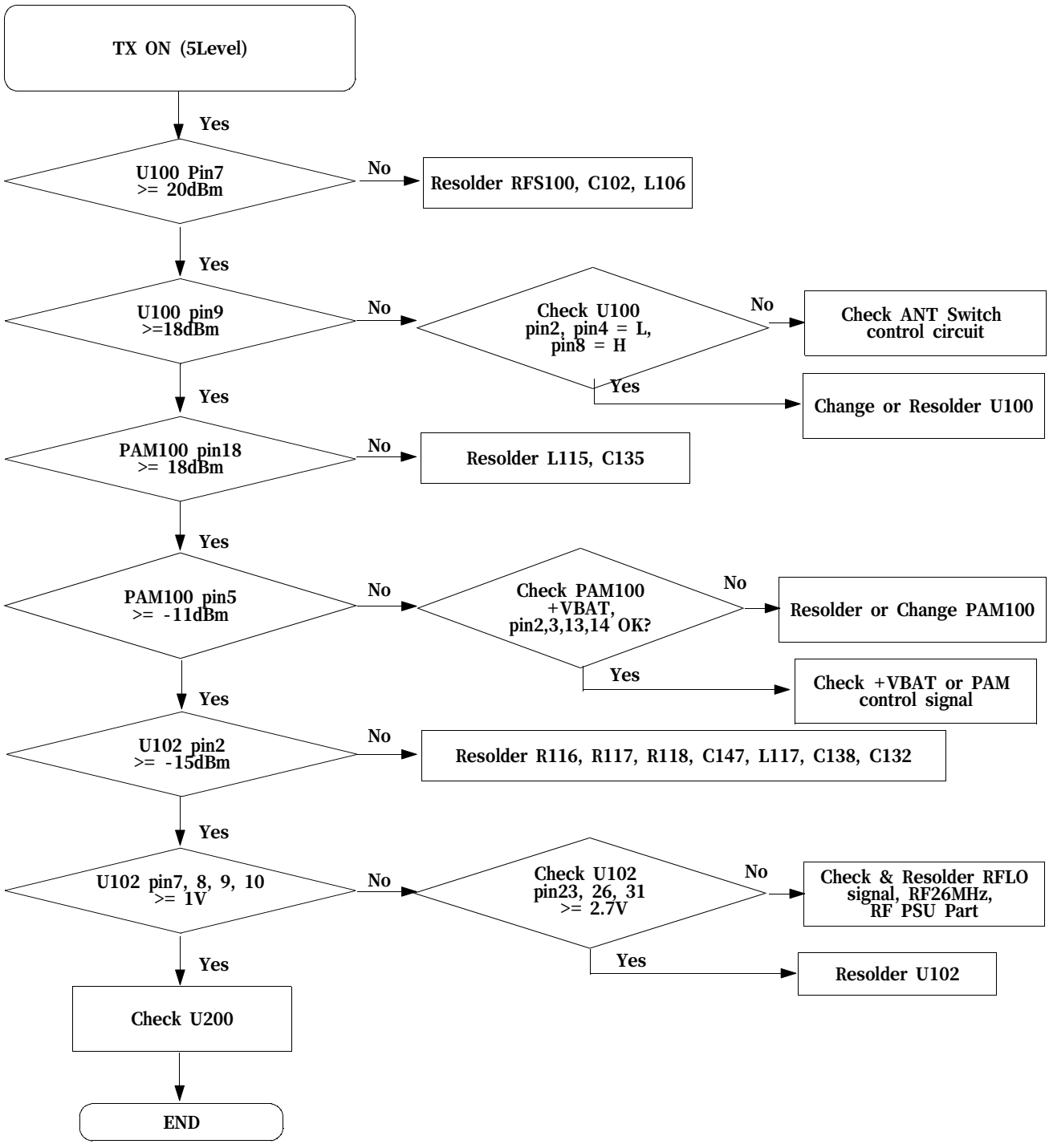
15. DCS Transmitter



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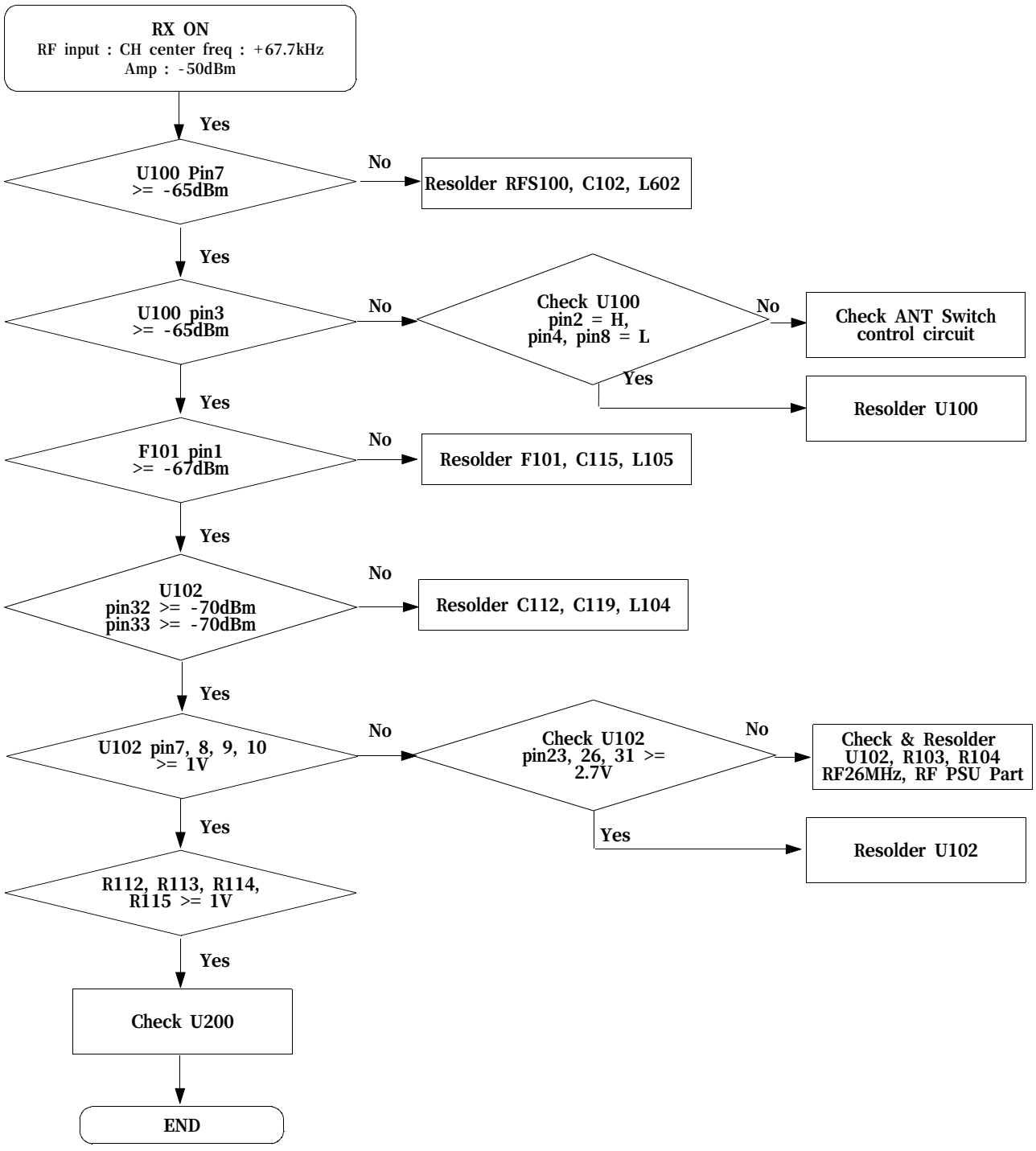
16. PCS Receiver



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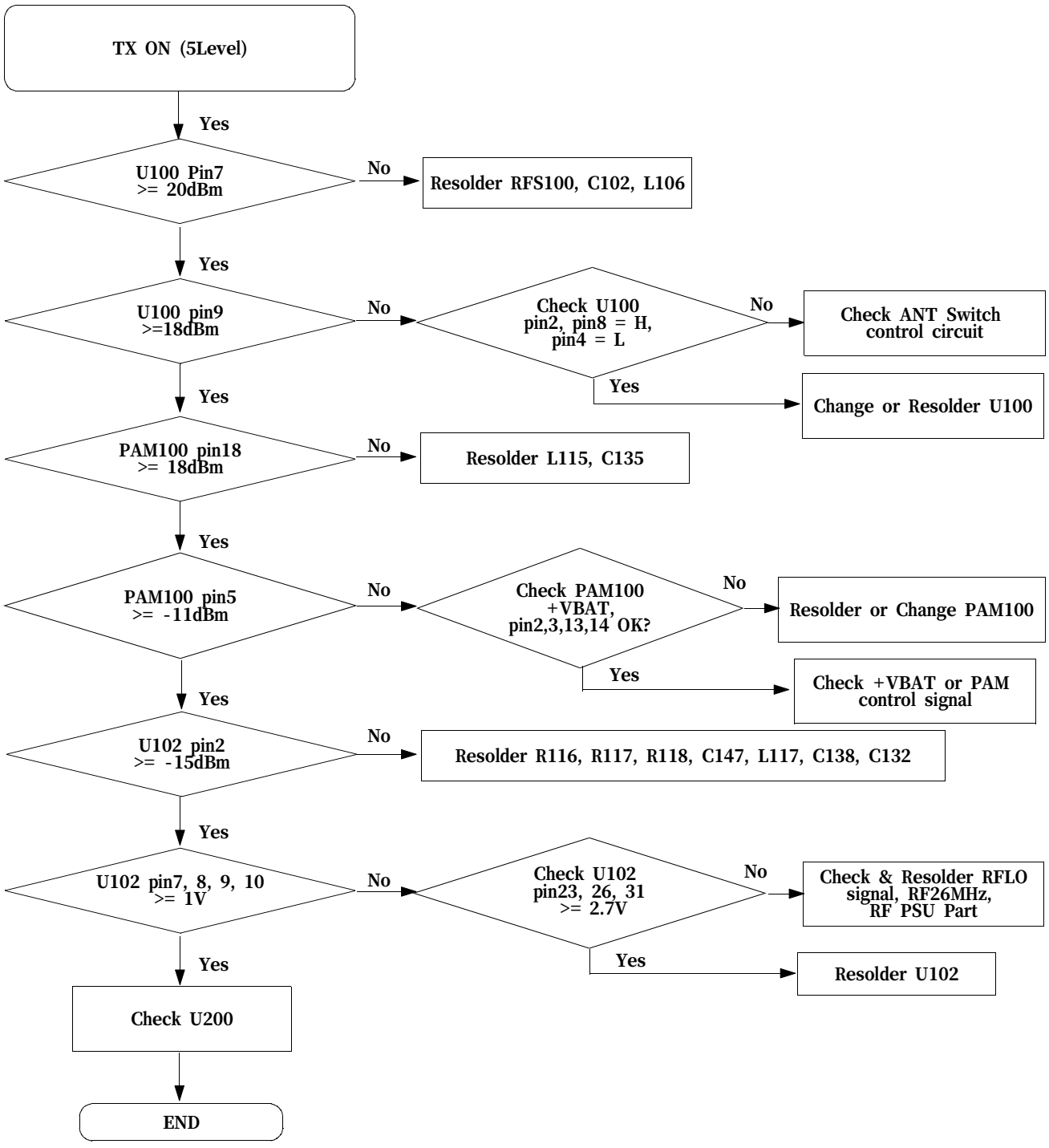
17. PCS Transmitter



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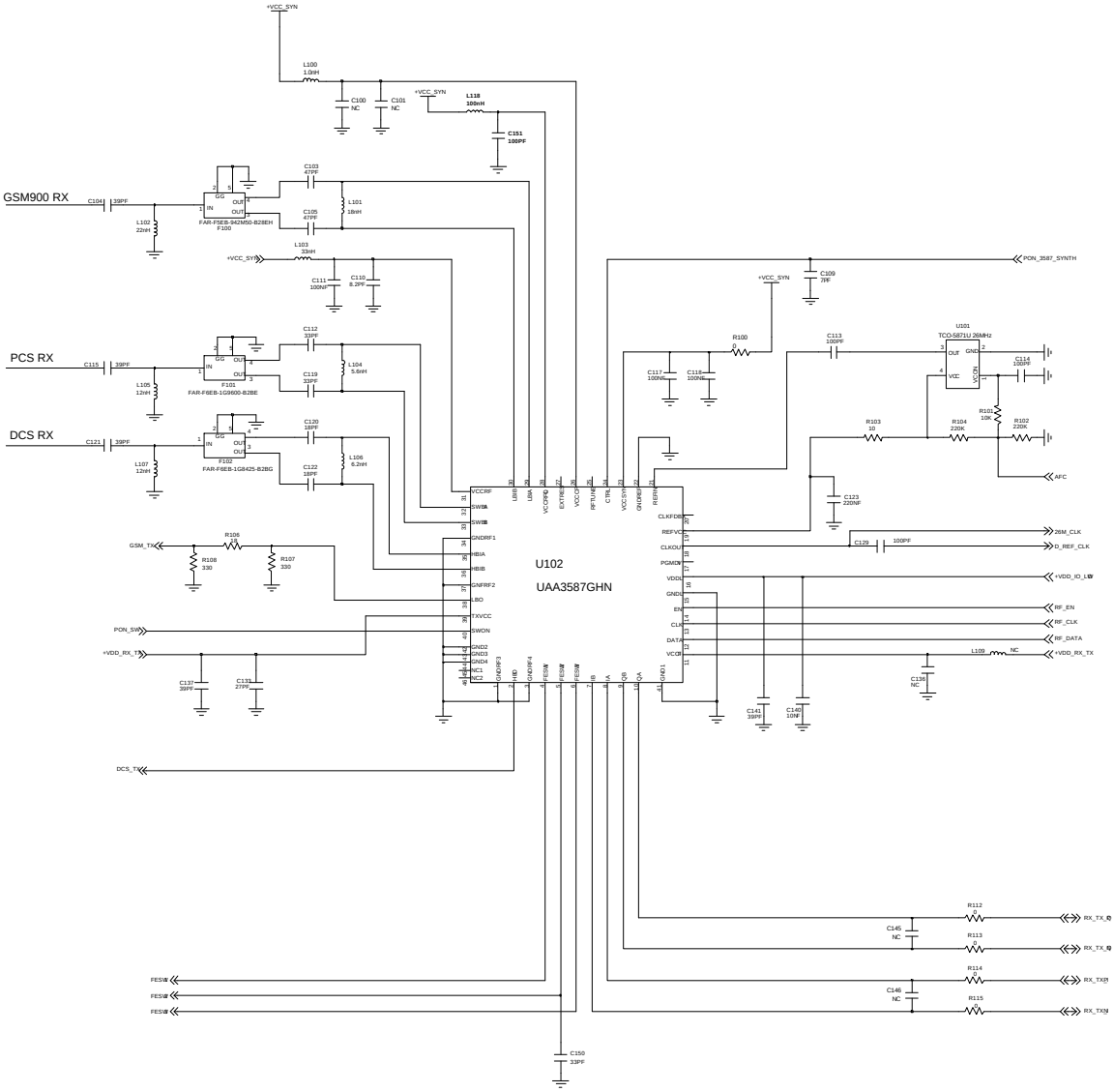

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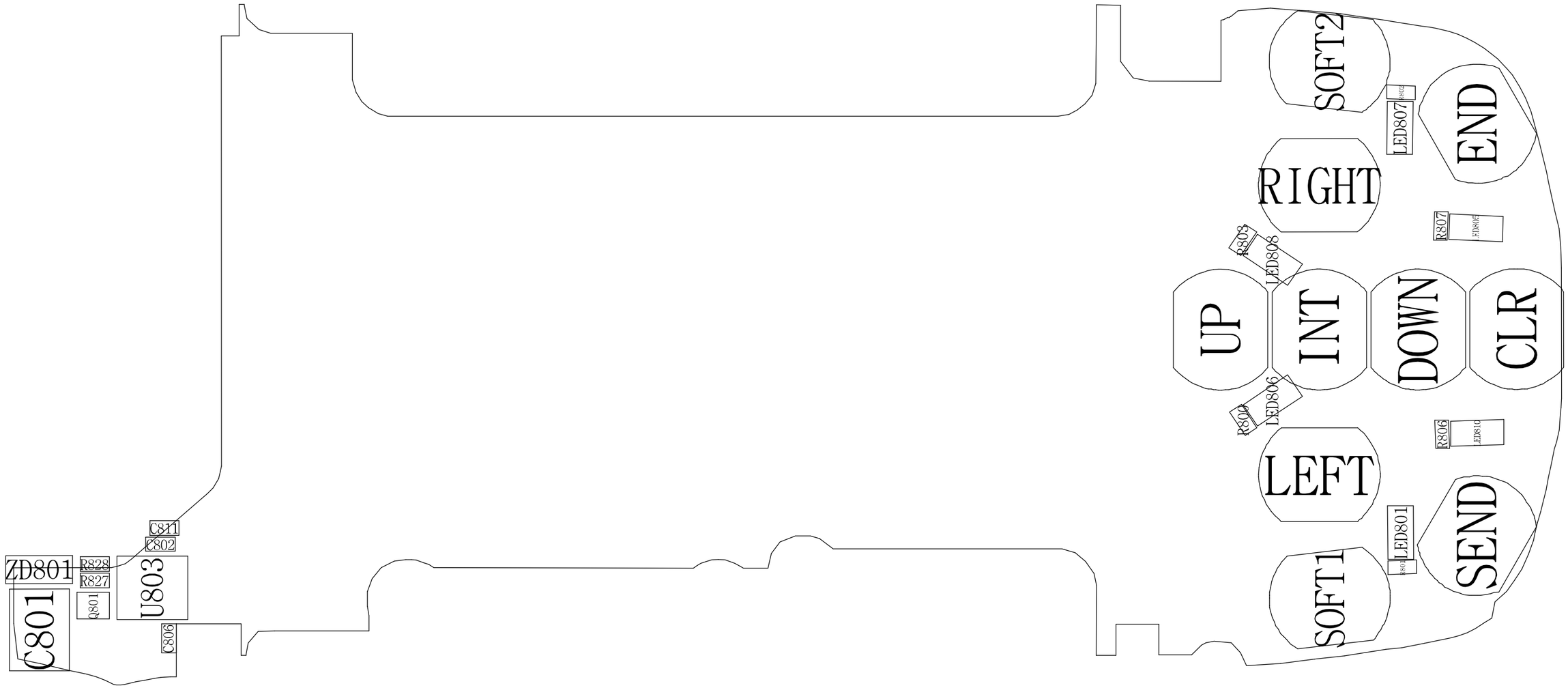
4. Sub PCB Bottom Diagram



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