SAMSUNG

GSM TELEPHONE
SGH-E700

SERVICE Manual

GSM TELEPHONE

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ELECTRONICS

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1. SGH-E700 Specification

1. GSM General Specification

	GSM900 Phase 1	EGSM 900 Phase 2	DCS1800 Phase 1
Freq. Band[MHz] Uplink/Downlink	890~915 935~960	880~915 925~960	1710~1785 1805~1880
ARFCN range	1~124	0~124 & 975~1023	512~885
Tx/Rx spacing	45MHz	45MHz	95MHz
Mod. Bit rate/ Bit Period	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
Modulation	0.3GMSK	0.3GMSK	0.3GMSK
MS Power	33dBm~13dBm	33dBm~5dBm	30dBm~0dBm
Power Class	5pcl ~ 15pcl	5pcl ~ 19pcl	0pcl ~ 15pcl
Sensitivity	-102dBm	-102dBm	-100dBm
TDMA Mux	8	8	8
Cell Radius	35Km	35Km	2Km

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2. GSM TX power class

TX Power control level	GSM900
5	33±2 dBm
6	31±2 dBm
7	29±2 dBm
8	27±2 dBm
9	25±2 dBm
10	23±2 dBm
11	21±2 dBm
12	19±2 dBm
13	17±2 dBm
14	15±2 dBm
15	13±2 dBm
16	11±3 dBm
17	9±3dBm
18	7±3 dBm
19	5±3 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

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2. SGH-E700 Circuit Description

1. SGH-E700 RF Circuit Description

1) RX PART

1. ASM(F101) → Switching Tx, Rx path for GSM900, DCS1800 by logic controlling.
2. ASM Control Logic (U102, U103) → Truth Table

	VC_1	VC_2
GSM Tx Mode	L	H
DCS Tx Mode	H	L
GSM Rx Mode	L	L
DCS Rx Mode	L	L

3. FILTER

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

- GSM FILTER (C105,C107,L101) → For filtering the frequency band between 925 ~ 960 MHz
- DCS FILTER (C110,C113,L103) → For filtering the frequency band 1805 and 1880 MHz.

4. TC-VCXO (OSC100)

To generate the 13MHz reference clock to drive the logic and RF.

After additional process, the reference clock applies to the U101 Rx IQ demodulator and Tx IQ modulator.

The oscillator for RX IQ demodulator and Tx modulator are controlled by serial data to select channel and use fast lock mode for GPRS high class operation.

5. OM5178 (U100)

This chip integrates two differential-input LNAs.

The GSM input supports the E-GSM, DCS input supports the DCS1800. The LNA inputs are matched to the 200 ohm differential output SAW filters through eternal LC matching network.

Image-reject mixer downconverts the RF signal to a 100 KHz intermediate frequency(IF) with the RFLO from VOL1861 frequency synthesizer. The RFLO frequency is between 1801 ~ 1921 MHz.

The Mixer output is amplified with an analog programmable gain amplifier(PGA), which is controlled by AGAIN.

The quadrature IF signal is digitized with high resolution A/D converts (ADC).

2) TX PART

Baseband IQ signal fed into offset PLL, this function is included inside of U100 chip.

OM5178 chip generates modulator signal which power level is about 1.5dBm and fed into Power Amplifier(PAM100).

The PA output power and power ramping are well controlled by Auto Power Control circuit.

We use offset PLL below table.

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Modulation Spectrum	200kHz offset 30 kHz bandwidth	GSM	-35dBc
		DCS	-35dBc
		PCS	-35dBc
	400kHz offset 30 kHz bandwidth	GSM	-66dBc
		DCS	-65dBc
		PCS	-66dBc
	600kHz ~ 1.8MHz offset 30 kHz bandwidth	GSM	-75dBc
		DCS	-68dBc
		PCS	-75dBc

2. Baseband Circuit description of SGH-E700

1. PCF50601

1.1. Power Management

Ten 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, and 5.0V 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 PCF50601 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-E700) is not use PWM, but use DC CONTROL (BL_VDD)

So "BL_VDD" voltage is high value, backlight brigtness is gloomy and "BL_VDD" voltage is low value, backlight is bright.

1.3. **Clock Generator**

The Clock Generator (CG) generates all clocks for internal and external usage. The 32768 Hz crystal oscillator provides an accurate low clock frequency for the PCF50601 and other circuitry.

2. Connector

2-1. LCD Connector

LCD is consisted of main LCD(color 65K TFT LCD) and small LCD(256 EL LCD). Chip select signals in the **U302**, LCD_MAIN_CS and LCD_SUB_CS, can enable Each LCD. LCD_MAIN_CS signal enables white LED of main LCD and LCD_SUB_CS signal enables EL of small LCD. These two signals are from IO part of the DSP in the U302(alpha chip).

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"RESET_2V8" signal initiates the Reset process of the LCD.

16-bit data lines(LD(0)~LD(15)) transfers data and commands to LCD through by pass capacitor. 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 "VBAT" and "VDD2".

"SPK_P" and "SPK_N" from OM6357 are used for audio speaker. And "VDD_VIB" from PCF50601 enables the motor.

2-3. IRDA

This system uses IRDA module, HSDL_3208, Agilent's. This has signals, "IRDA_DOWN"(enable signal), "RXD0"(input data) and "TXD0"(output data). These signals are connected to OM6357. It uses two power signals. "VDD2" is used for circuit and "VBAT" is used for LED.

2-4. Key

This is consisted of key interface pins among OM6357, KBIO(0:7). These signals compose the matrix. Result of matrix informs the key status to key interface in the OM6357. Power on/off key is seperated from the matrix. So power on/off signal is connected with PCF50601 to enable PCF50601. twelve key LED use the "VBAT" supply voltage. "VDD_KEY" signal enables LEDs with current control. "FLIP" informs the status of folder (open or closed) to the OM6357. This uses the hall effect IC, A3210ELH. A magnet under main LCD enables A3210ELH.

2-5. EMI ESD Filter

This system uses the EMI ESD filter, EMIF09 to protect noise from IF CONNECTOR part.

2-6 IF connetor

It is 18-pin connector. They are designed to use VBAT, V_EXT_CHARGE, TXD0, RXD0, RTS0, CTS0, JIG_REC, CHARGER_OK, RXD1, TXD1, AUX_MIC, AUX_SPK and GND. They connected to power supply IC, microprocessor and signal processor IC.

3. 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.

4. Audio

EARP_P and EARP_N from OM6357 are connected to the main speaker. AUXSP is connected to the Hands free kit. MIC_P and MIC_N are connected to the main MIC. And AUX_MIC_P and AUX_MIC_N are connected to the Hands free kit.

YMU762MA3 is a LSI for portable telephone that is capable of playing high quality music by utilizing FM synthesizer and ADPCM decorder that are included in this device.

As a synthesis, YMU762MA3 is equipped 32 voices with differenttones. Since the device is capable of simultaneously generating up to synchronous with the play of the FM synthesizer, various sampled voices can be used as sound effects. Since the play data of YMU762MA3 are interpreted at anytime through FIFO, the length of the data(playing period) is not limited, so the device can flexiblysupport application such as incoming call melody music distribution service.

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The hardware sequencer built in this device allows playing of the complex music without giving excessive load to the CPU of the portable telephones. Moreover, the registers of the FM synthesizer can be operated directly for real time sound generation, allowing, for example, utilization of various sound effects when using the game software installed in the portable telephone.

YMU762 includes a speaker amplifier with high ripple removal rate whose maximum output is 550mW (SPVDD=3.6V). The device is also equipped with conventional function including a vibartor and a circuit for controlling LEDs synchornous with music.

For the headphone, it is provided with a stereophonic output terminal.

For the purpose of enabling YMU762MA3 to demonstarte its full capablities, Yamaha purpose to use "SMAF:Synthetic music Mobile Application Format" as a data distribution format that is compatible wiht multimedia. Since the SMAF takes a structure that sets importance on the synchronization between sound and images, various contents can be written into it including incoming call melody with words that can be used for traning karaoke, and commercial channel that combines texts, images and sounds, and others. The hardware sequencer of YMU762MA3 directly interprets and plays blocks relevant to systhesis (playing music and reproducing ADPCM with FM synthesizer) that are included in data distributed in SMAF.

5. Memory

signals in the OM6357 enable two memories. They use only one volt supply voltage, VDD3 in the PCF50601. This system uses Samsung's memory, KBB06A300M-T402. It is consisted of 128M bits flash NOR memory and 128M bits flash NAND memory and 32M bits UtRAM. It has 16 bit data line, HD[0~15] which is connected to OM6357 and MV317S. It has 23 bit address lines, HA[1~23]. CS_NAND and NCSRAM signals is chip select. Wrting process, HWR_N is low and it enables writing process to flash memory and SRAM. During reading process, HRD_N is low and it enables reading process to flash memory and SRAM. Each chip select signals in the OM6357 select memory among 2 flash memory and UtRAM. Reading or writing procedure is processed after HWR_N or HRD_N is enabled. Memories use reset, which is VDD3 delay from PCF50601. HA[22] signal enables lower byte of SRAM and HA[22] signal enables higher byte of SRAM.

6. OM6357

OM6357 is consisted of ARM core and DSP core. It has **8x1Kword on-chip program/data RAM, 55 Kwords on-chip program ROM** in the DSP. It has 4K*32bits ROM and 2K*32bits RAM in the ARM core. DSP is consisted of KBS, JTAG, EMI and UART. ARM core is consisted of EMI, PIC(Programmable Interrupt Controller), reset/power/clock unit, DMA controller, TIC(Test Interface Controller), eripheral bridge, PPI, SSI(Synchronous Serial Interface), ACC(Asynchronous communications controllers), timer, ADC, RTC(Real-Time Clock) and keyboard interface. KBIO(0:7), address lines of DSP core and HD[0~15]. HA[1~23], address lines of ARM core and HD[0~15], data lines of ARM core are connected to memory, YMU759. MV317S(Camera DSP Chip) controls the communication between ARM core and DSP core.

CS_NAND, NCSRAM, NCSFLASH in the ARM core are connected to each memory. HWR_N and HRD_N control the process of memory. External IRQ(Interrupt ReQuest) signals from each units, such as, PMU need the compatible process. KBIO[0~7] receive the status from key and RXD0/TXD0/irDA_DOWN are used for the communicatios using IRDA and data link cable(DEBUG_DTR/RTS/TXD/RXD/CTS/DSR).

It has JTAG control pins(TDI/TDO/TCK) for ARM core and DSP core. It recieves 13MHz clock in CKI pin from external TCXO. ADC(Analog to Digital Convertor) part receives the status of temperature, battery type and battery voltage.

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7. TCO-9141D(13MHz)

This system uses the 13MHz TCXO, TCO-9141D, Toyocom. AFC control signal form OM6357 controls frequency from 13MHz x-tal. It generates the clock frequency. This clock is connected to OM6357, YMU762 and OM5178.

9.Camera DSP(MV317SA)

Tiger is an Integrated circuit for mobile phone camera. This structure will allow effectiveness for large data management and significantly reduces main processor will get burden.

In hence, Tiger will allow the user to be able to display to LCD direct without burdening the main processor. It also allows to have various kinds of display size on the LCD and snapshot for Jpeg. Digital effect will also be executed on real time base resulting Tiger as being a video co-processor in the mobile platform.

Also,an i80 type processor' s 16bit parallel interface of Tiger makes it available for the CPU to interchange the data with Tiger. As the additional 8Mbit is usable except 2Mbit buffer embedded in Tiger, the diverse UI data processing which is not a **burden to the CPU is available. JPEG encoder and decoder are baseline ISO/IEC 10918-1 JPEG compliance (DCT-based). JPEG decoder supports YUV444, YUV422, YUV420 and YUV411 format standard JPEG image.**

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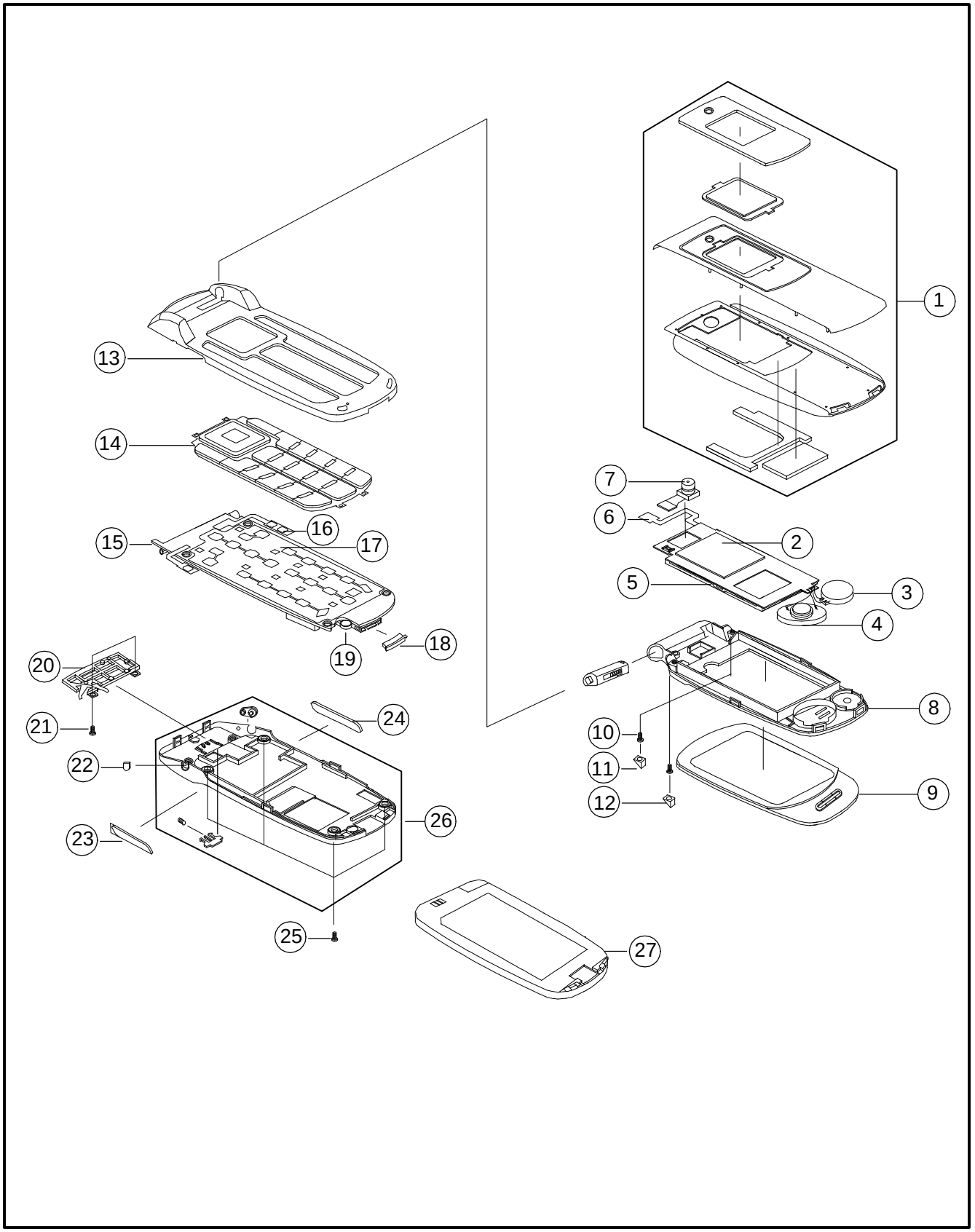
3. SGH-E700 Exploded View and its Parts list

1. Cellular phone Exploded View



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2. Cellular phone Parts list

Location NO.	Description	SEC CODE	Remark
1	FOLDER UPPER	GH75-03647A	
2	DUAL LCD	GH07-00397A	
3	MOTOR	3101-001368	
4	SPEAKER	3001-001444	
5	MAIN LCD	GH07-00190A	
6	CAMERA FPCB	GH59-00903A	
7	CAMERA	GH59-00900A	
8	FOLDER LOWER	GH75-02917A	
9	WINDOW LCD	GH75-02919A	
10	SCREW	6001-001811	
11	SCREW CAP(R)	GH73-01890A	
12	SCREW CAP(L)	GH73-01891A	
13	FRONT COVER	GH75-02912A	
14	KEYPAD	GH75-03646A	
15	MAIN PBA	GH92-01568A	
16	DOME SHEET	GH59-00901A	
17	VOLKEY FPCB	GH59-00902A	
18	CONNECTOR COVER	GH73-01394A	
19	MIC	GH30-00045A	
20	INTENNA	GH42-00315A	
21	SCREW	6001-001812	
22	RF COVER	GH73-01894A	
23	CAMERA KEY	GH75-02915A	
24	SIDE KEY	GH75-02914A	
25	SCREW	6001-001635	
26	REAR COVER	GH75-02918A	
27	BATTERY	GH43-00987A	

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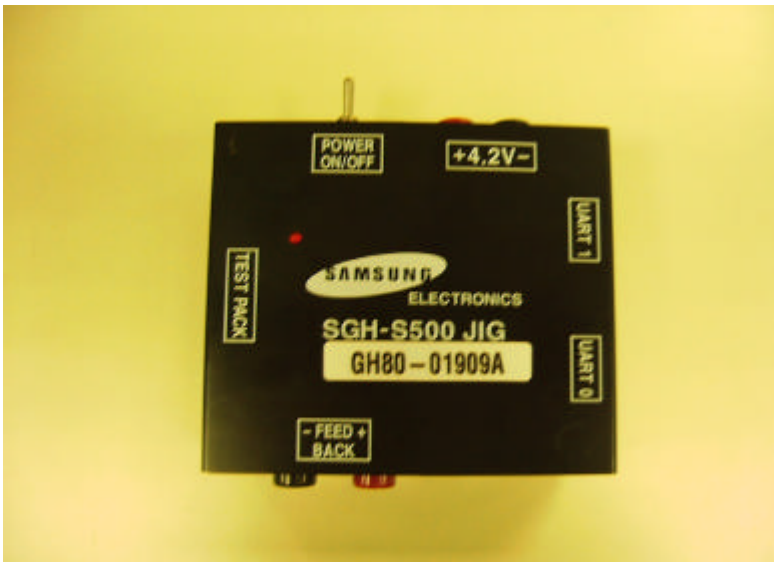
3. Test Jig (GH80-01909A)



3-1. RF Test Cable
(GH39-00172A)

3-2. Test Cable
(GH39-00217A)

3-3. Serial Cable

3-4. Power Supply Cable

3-5. DATA CABLE
(GH39-00219A)

3-6. TA
(GH44-00482A)

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4. SGH-E700 MAIN Electrical Parts List

SEC CODE	Design LOC
0405-001122	D101
0406-001104	ZD600
0406-001104	ZD601
0406-001104	ZD700
0406-001104	ZD701
0501-000225	TR100
0504-001060	U102
0504-001060	U103
0504-001134	TR500
0505-001332	TR501
0505-001423	U601
0506-000107	TR700
0601-001647	LED600
0601-001647	LED601
0601-001647	LED602
0601-001647	LED603
0601-001647	LED611
0601-001647	LED605
0601-001647	LED608
0601-001647	LED607
0601-001819	LED604
0601-001819	LED606
0601-001819	LED609
0601-001819	LED610
0604-001261	IRD600
0801-002237	U300
0801-002529	U411
0801-002882	U305
0801-002882	U202
0801-002882	U201

SEC CODE	Design LOC
1001-001253	U602
1009-001010	U600
1109-001280	UME300
1201-001954	PAM100
1202-001036	U604
1203-002076	U304
1203-002824	U101
1203-002980	U501
1204-001960	U301
1205-002264	U100
1205-002276	UCP200
1205-002350	U400
1404-001221	V500
1405-001082	VR600
1405-001082	VR601
1405-001082	VR602
1405-001082	VR603
1405-001082	VR604
1405-001128	VR700
1405-001128	VR701
2007-000137	R504
2007-000140	R315
2007-000141	R205
2007-000141	R206
2007-000141	R307
2007-000142	R101
2007-000142	R102
2007-000142	R105
2007-000142	R106
2007-000142	R112

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SEC CODE	Design LOC
2007-000146	R306
2007-000148	R130
2007-000148	R131
2007-000148	R201
2007-000148	R212
2007-000148	R400
2007-000148	R605
2007-000148	R621
2007-000148	R700
2007-000148	R701
2007-000148	R119
2007-000151	R115
2007-000151	R110
2007-000153	R309
2007-000153	R114
2007-000155	R122
2007-000157	R208
2007-000157	R209
2007-000157	R207
2007-000162	R308
2007-000162	R310
2007-000162	R311
2007-000162	R313
2007-000162	R317
2007-000162	R318
2007-000162	R500
2007-000162	R501
2007-000162	R502
2007-000162	R503
2007-000162	R601

SEC CODE	Design LOC
2007-000162	R602
2007-000162	R620
2007-000162	R200
2007-000171	R304
2007-000171	R403
2007-000171	R404
2007-000171	R604
2007-000171	R606
2007-000171	R124
2007-000172	R203
2007-000172	R202
2007-000242	R607
2007-000242	R603
2007-000636	R510
2007-000636	R509
2007-000775	R126
2007-000775	R125
2007-000932	R113
2007-000982	R111
2007-001288	R107
2007-001290	R120
2007-001290	R117
2007-001292	R211
2007-001301	R608
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2007-001301	R611
2007-001301	R612
2007-001301	R613
2007-001301	R614

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2007-001301	R617
2007-001301	R618
2007-001301	R619
2007-001301	R600
2007-001313	R301
2007-001313	R127
2007-001319	R305
2007-001325	R402
2007-001325	R303
2007-001339	R512
2007-001339	R511
2007-002796	R312
2007-002797	R118
2007-003001	R100
2007-003019	R104
2007-003019	R103
2007-003030	R121
2007-007001	R204
2007-007008	R109
2007-007008	R108
2007-007009	R123
2007-007014	R302
2007-007014	R300
2007-007100	R401
2007-007100	R314
2007-007156	R506
2007-007334	R624
2007-007334	R508

SEC CODE	Design LOC
2007-007480	R625
2007-007573	R505
2007-007588	R116
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2007-007981	R623
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2203-000374	C137
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2203-000438	C302
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2203-000585	C118
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2203-000836	C116
2203-000836	C132
2203-000854	C134
2203-000885	C147
2203-000885	C700
2203-000995	C145
2203-000995	C607
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2203-001017	C112
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2203-001652	C414
2203-001652	C425
2203-002443	C138
2203-002443	C604
2203-002687	C308
2203-005050	C609
2203-005061	C206
2203-005061	C207
2203-005061	C209
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2203-005061	C211
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2203-005061	C218
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2203-005061	C205
2203-005061	C150
2203-005065	C422
2203-005065	C111
2203-005065	C139
2203-005148	C417
2203-005481	C129
2203-005482	C421
2203-005482	C620
2203-005482	C623
2203-005482	C412
2203-005482	C309
2203-005496	C305
2203-006053	C502
2203-006053	C431
2203-006053	C149
2203-006053	C428
2203-006053	C430
2203-006053	C429
2203-006053	C426
2203-006053	C306
2203-006053	C415
2203-006090	C424

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SEC CODE	Design LOC
2203-006090	C423
2203-006093	C310
2203-006093	C312
2203-006201	C603
2203-006208	C311
2203-006208	C402
2203-006208	C410
2203-006208	C418
2203-006274	C148
2301-001512	C128
2404-001105	C408
2404-001105	C427
2404-001151	C141
2404-001151	C142
2703-001709	L108
2703-002198	L107
2703-002199	L100
2703-002201	L105
2703-002205	L106
2703-002370	L102
2703-002519	L101
2703-002586	L104
2703-002597	L702
2703-002597	L701
2703-002597	L700
2703-002608	L103
2801-004025	OSC400
2801-004285	OSC300
2806-001305	VCO100
2806-001310	VCO101

SEC CODE	Design LOC
2809-001271	OSC100
2901-001246	U500
2904-001417	F100
2904-001424	F102
2909-001197	F101
3705-001242	RFS100
3709-001250	SIM400
3710-001611	IFC500
3711-005159	HDC700
3711-005445	BTC500
3722-001715	EAR600
4302-001119	C411
GH13-00019A	U302

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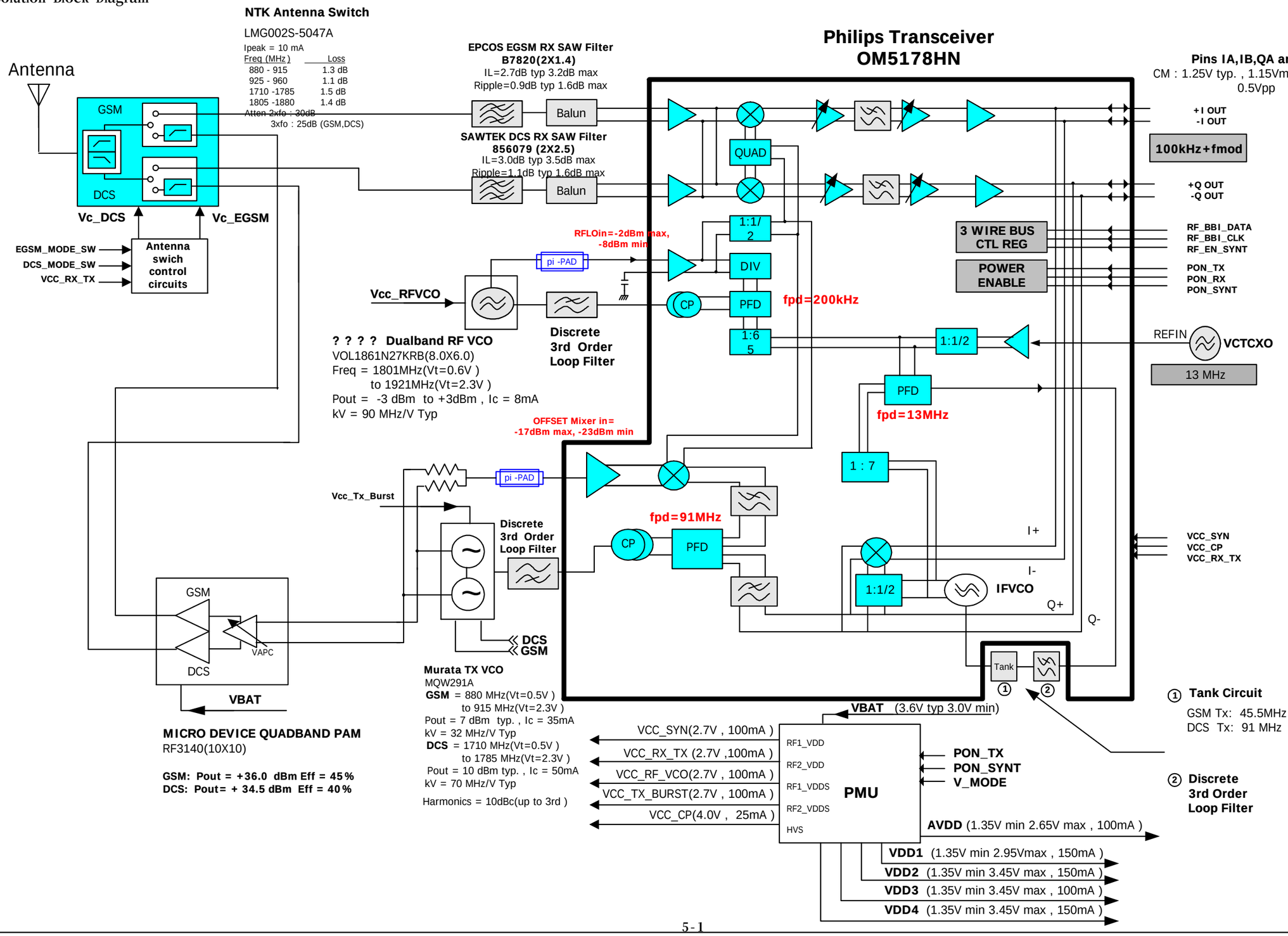
5. SGH-E700 Block Diagrams

1. RF Solution Block Diagram



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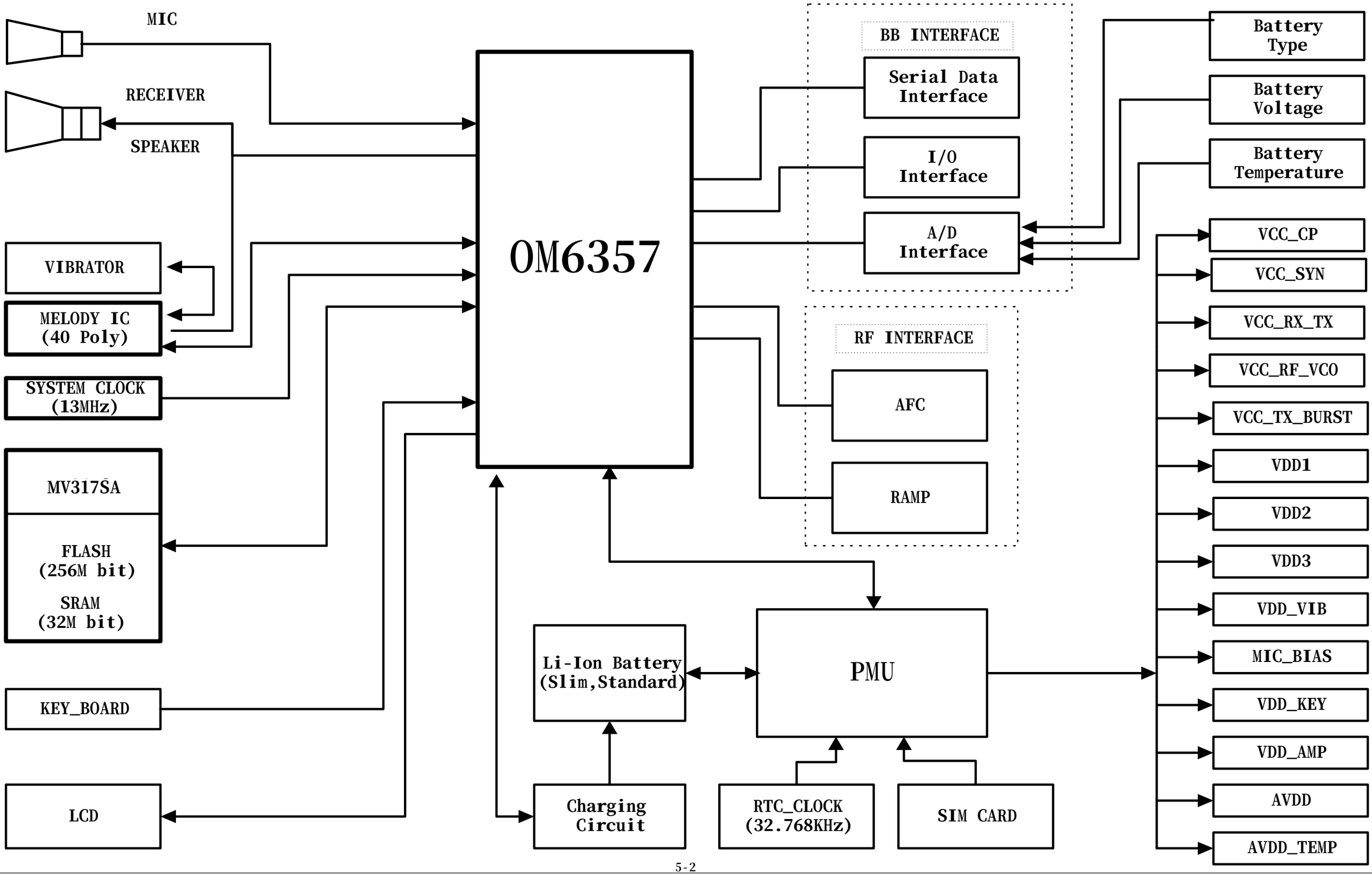
2. Base Band Solution Block Diagram



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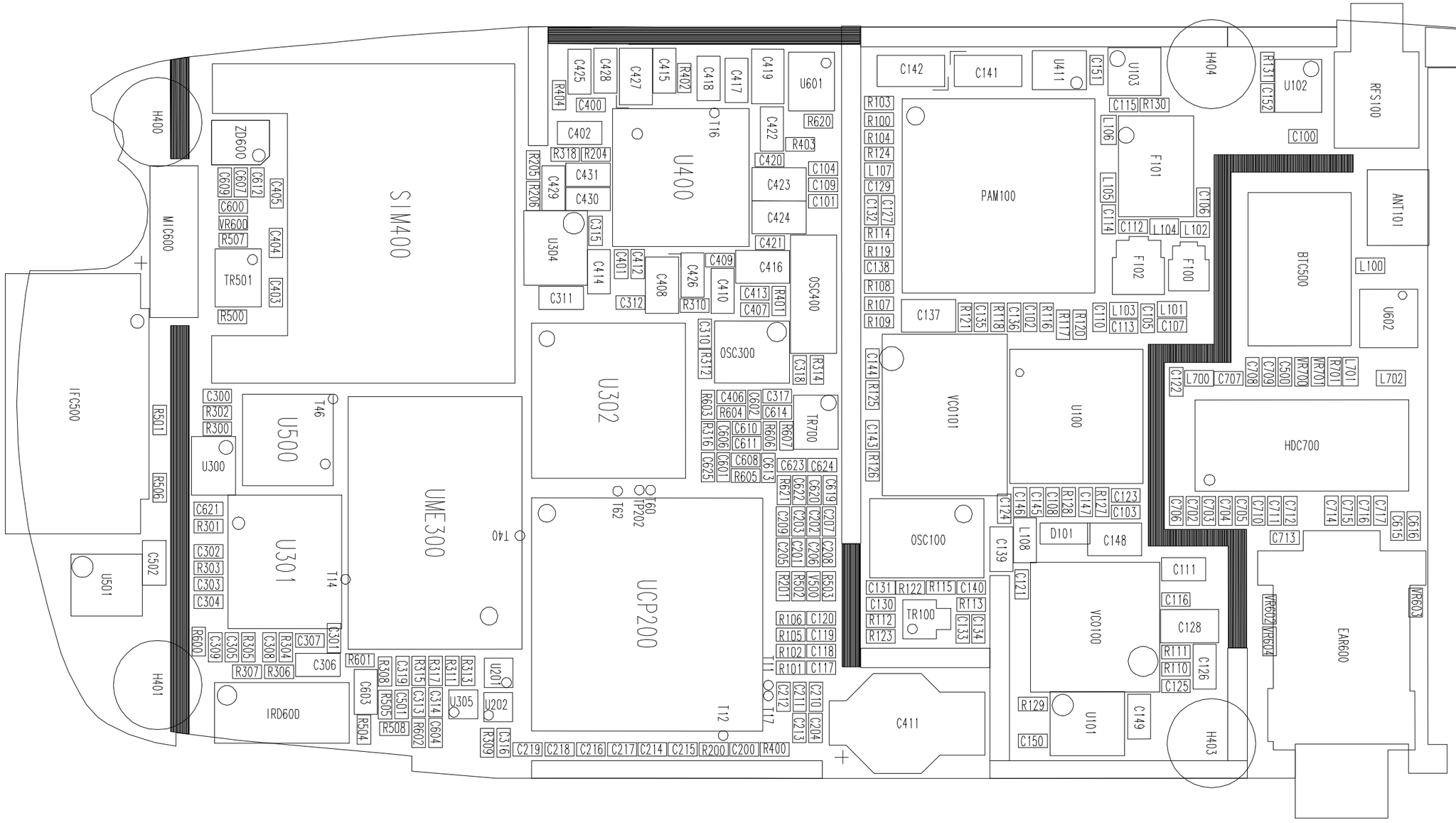
6. SGH-E700 PCB Diagrams

1. Main PCB Top Diagram



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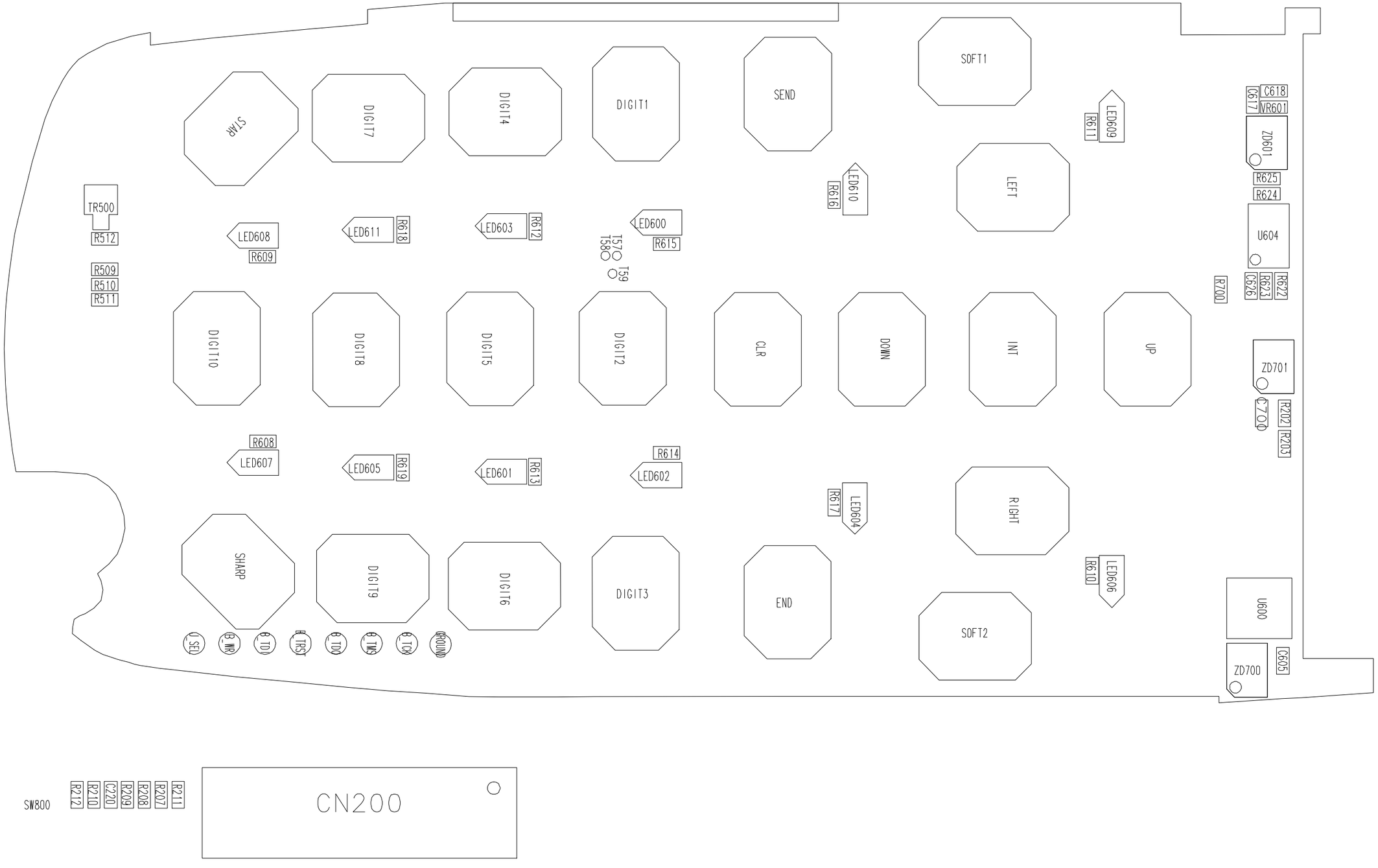
2. Main PCB Bottom Diagram



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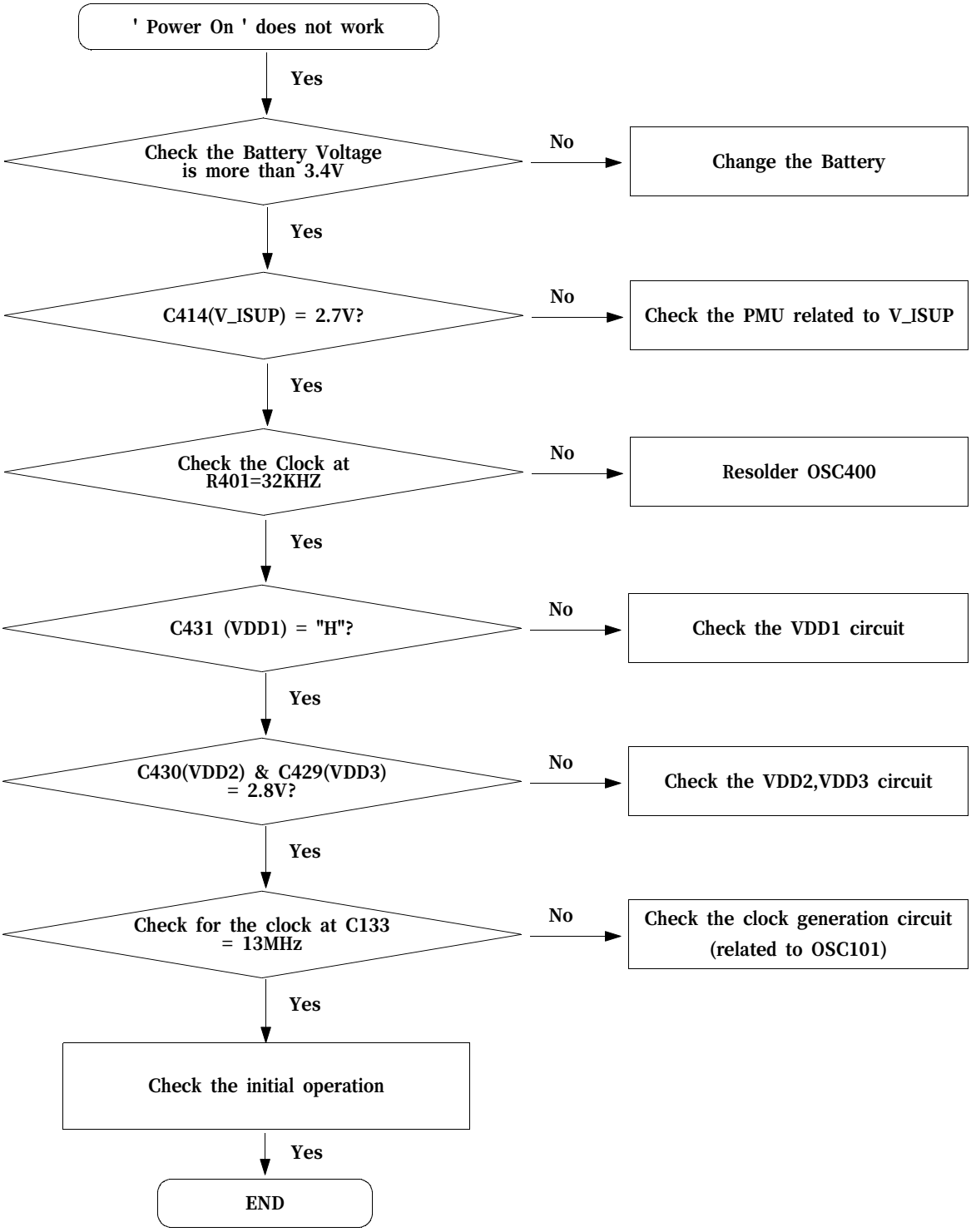
7. SGH-E700 Flow Chart of Troubleshooting

1. Power On



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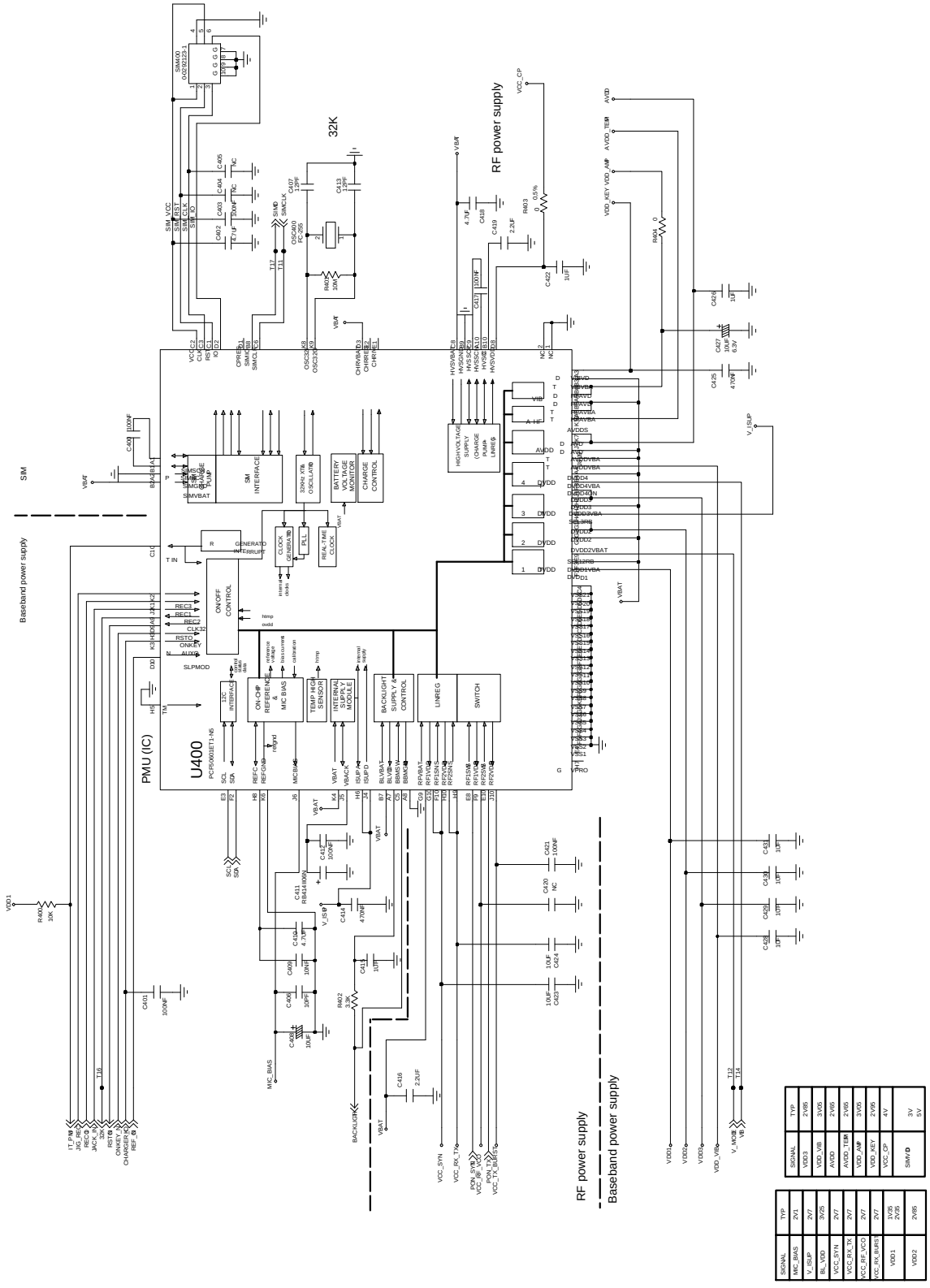
Power On



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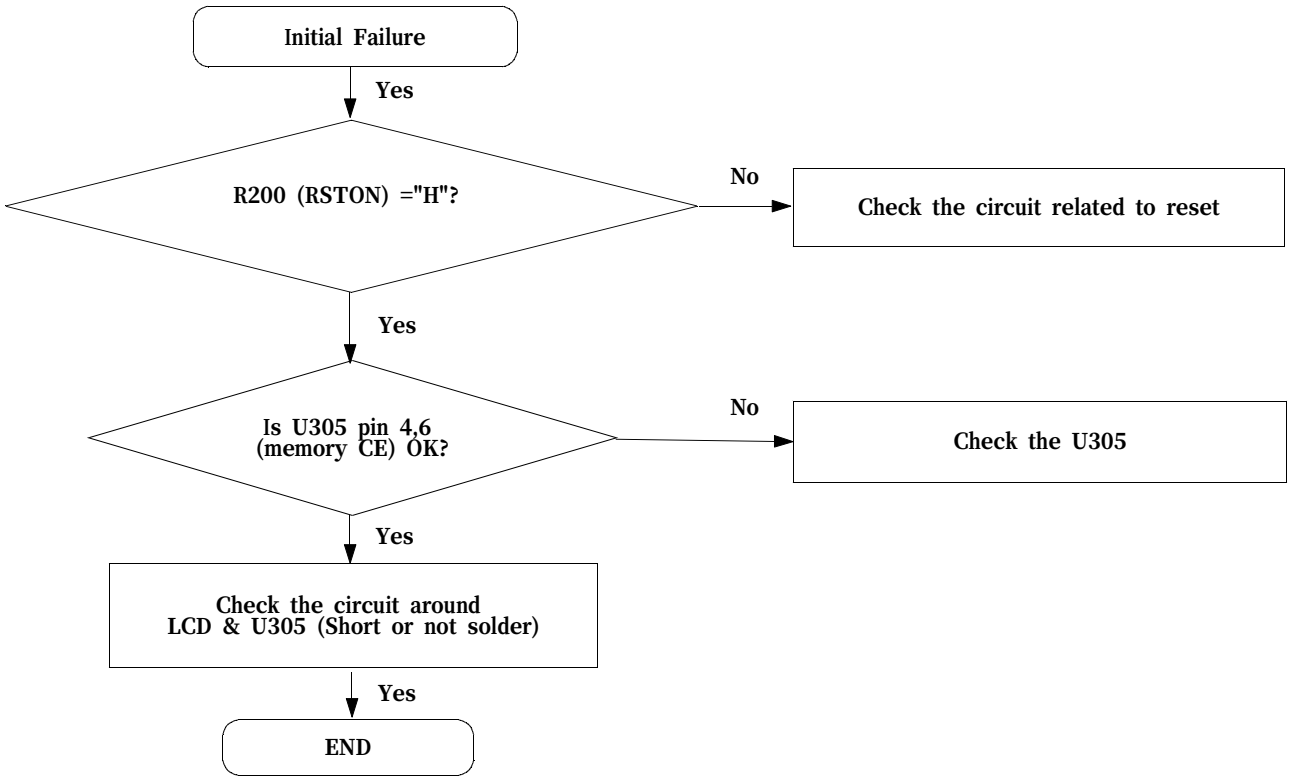
2. Initial



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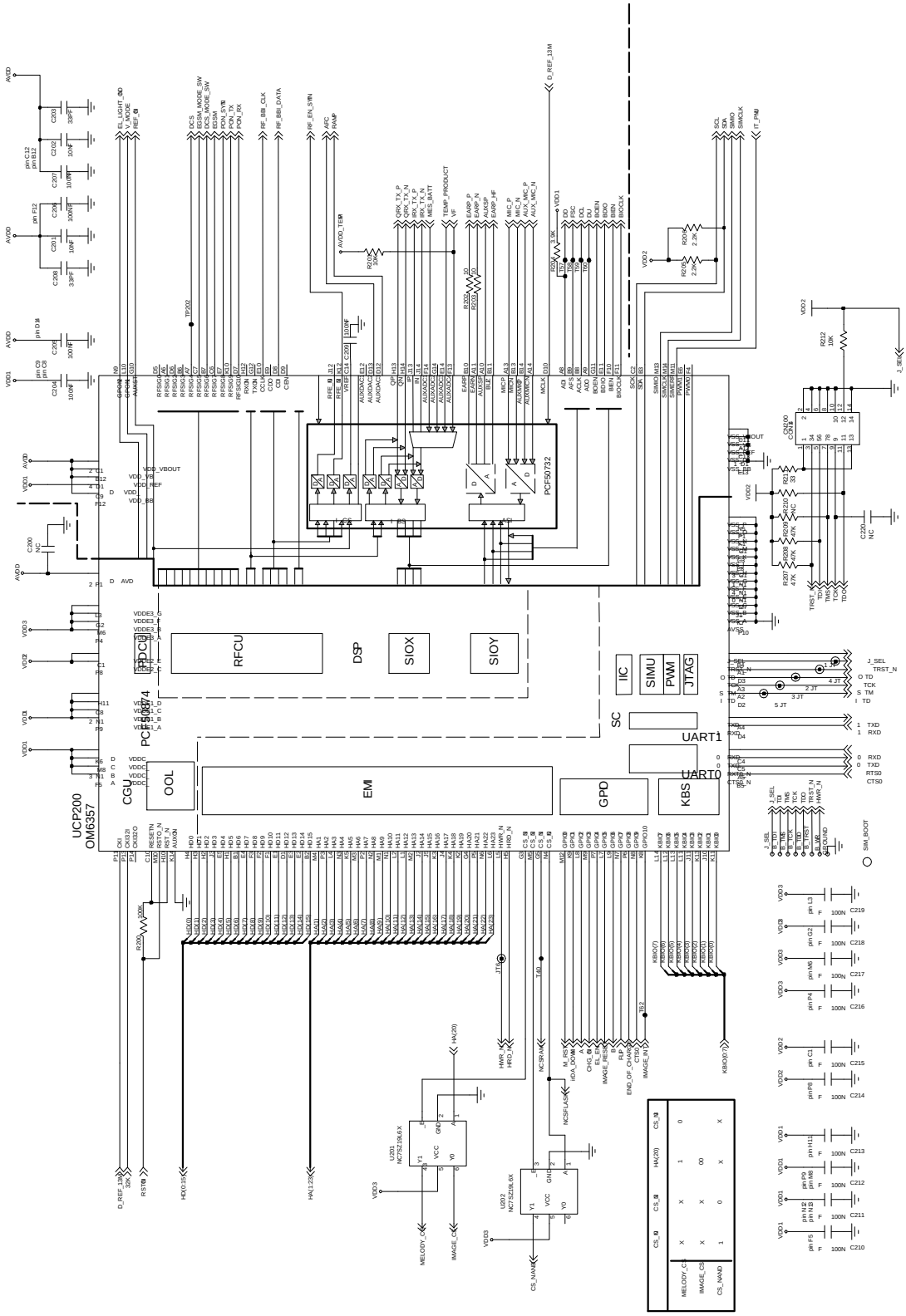
Initial



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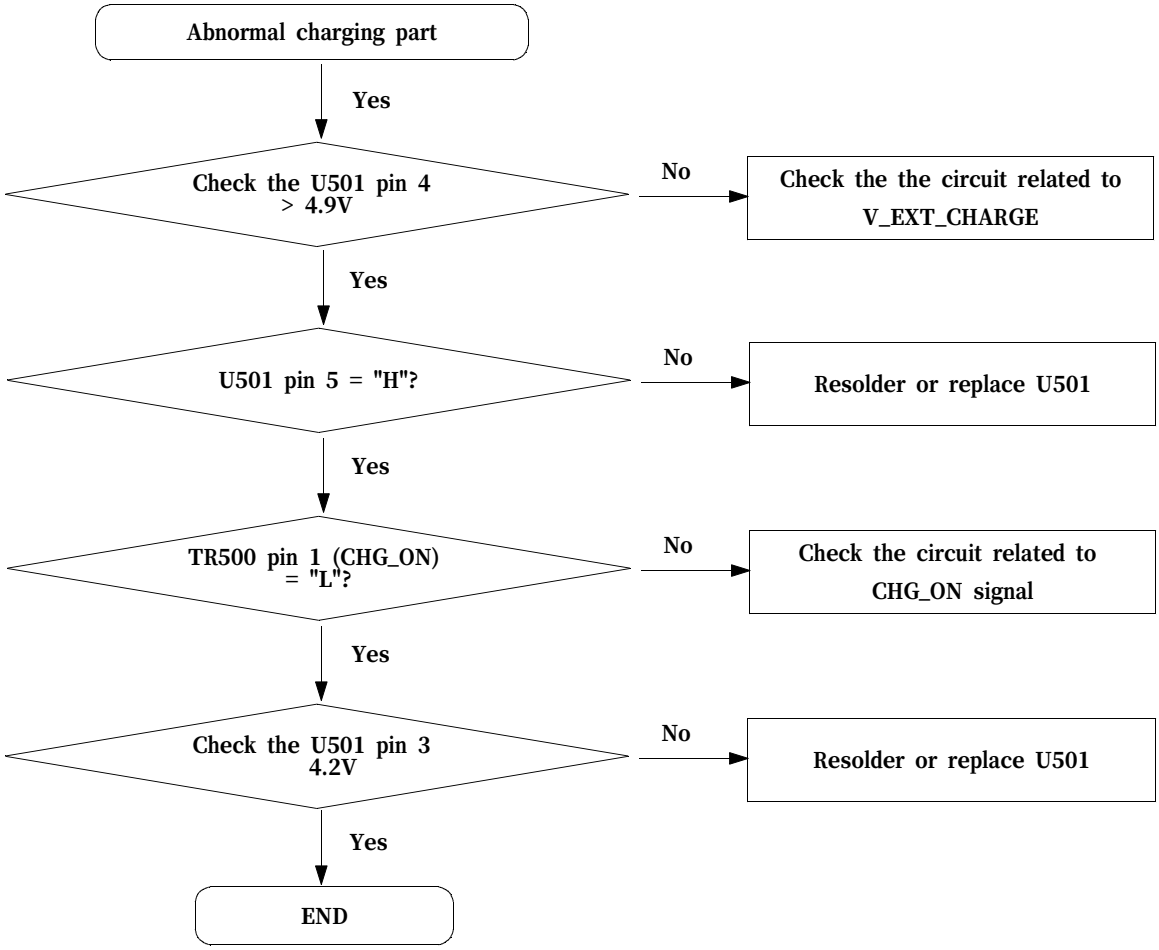
3. Charging Part



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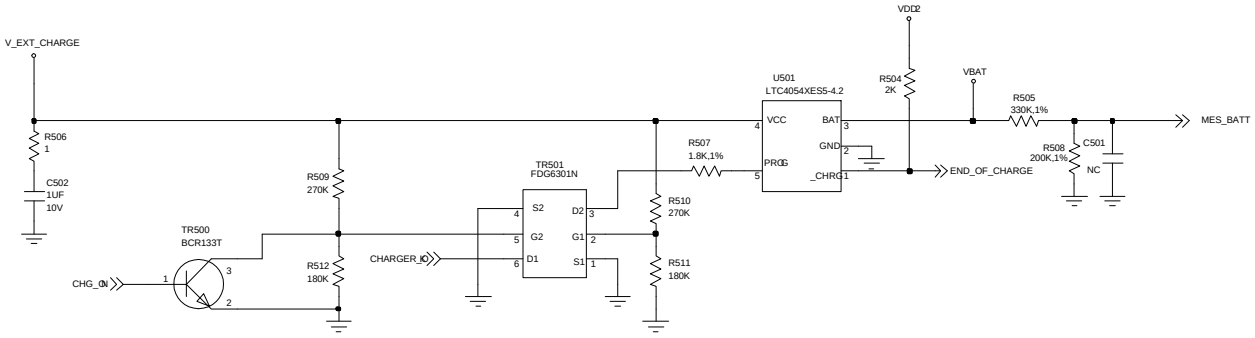
Charging



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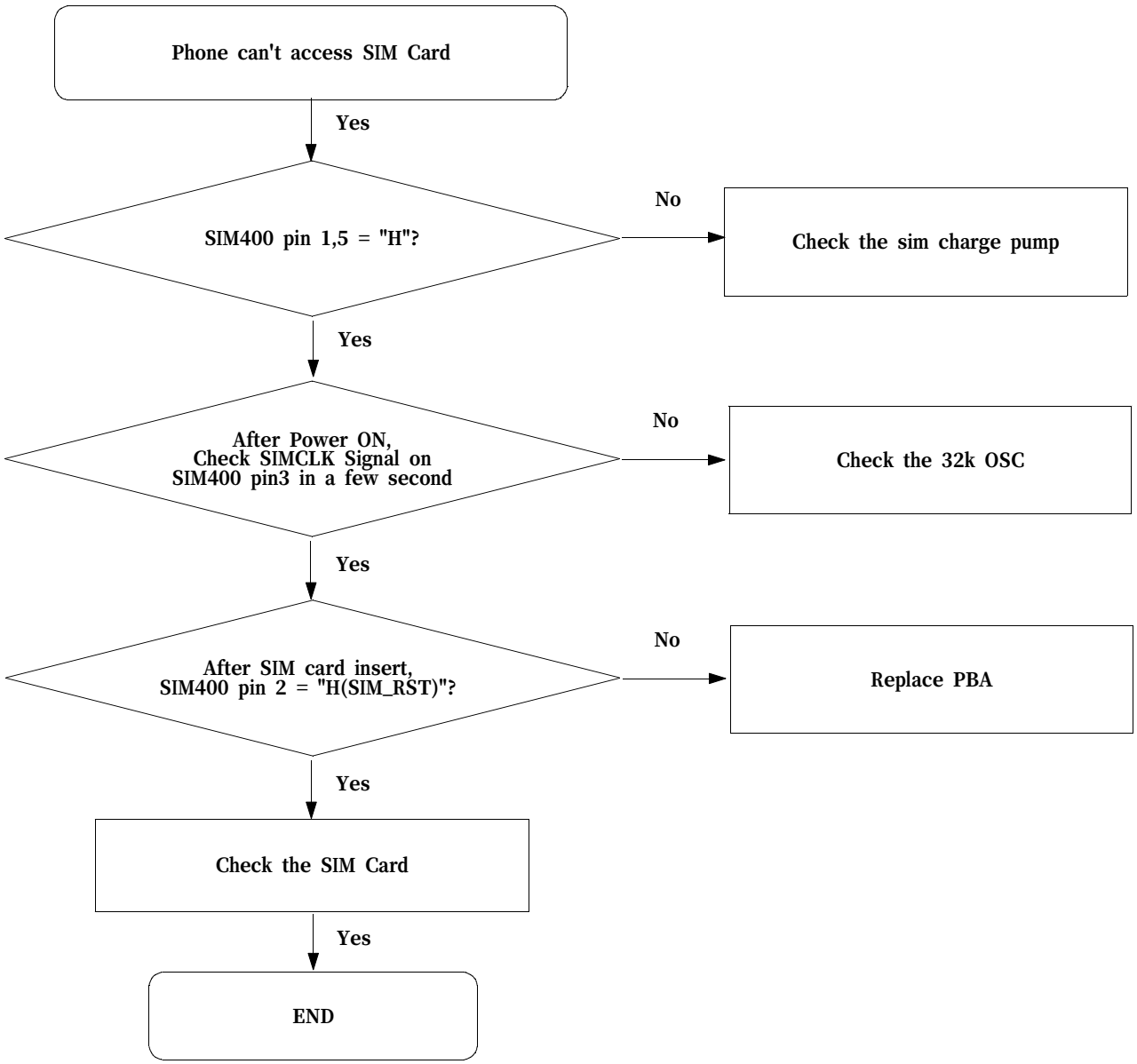
4. Sim Part



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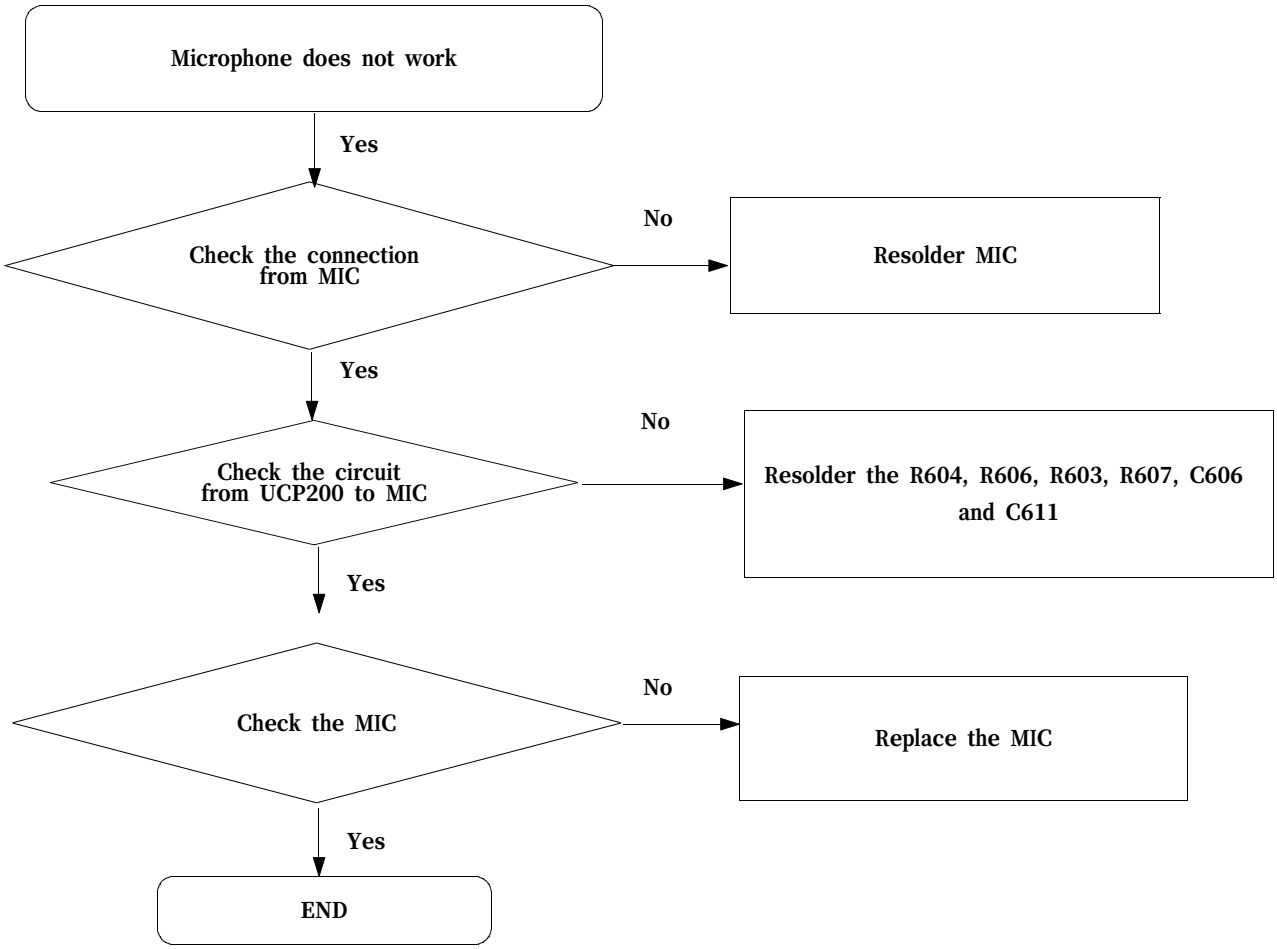
5. Microphone Part



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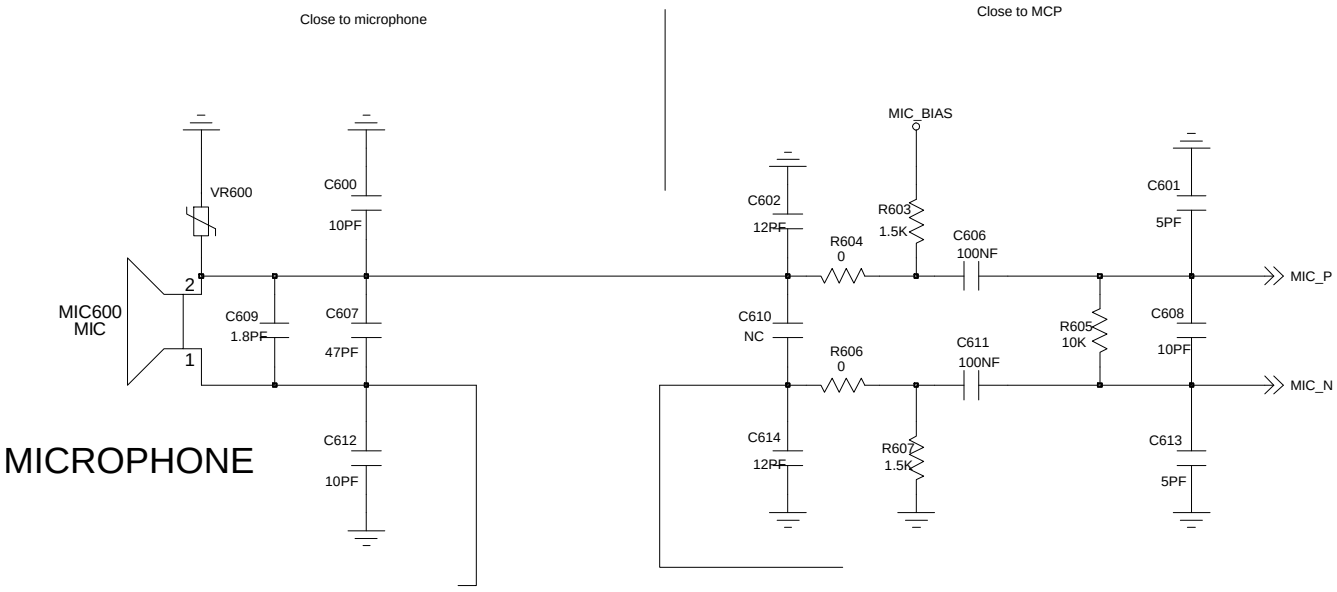
Microphone



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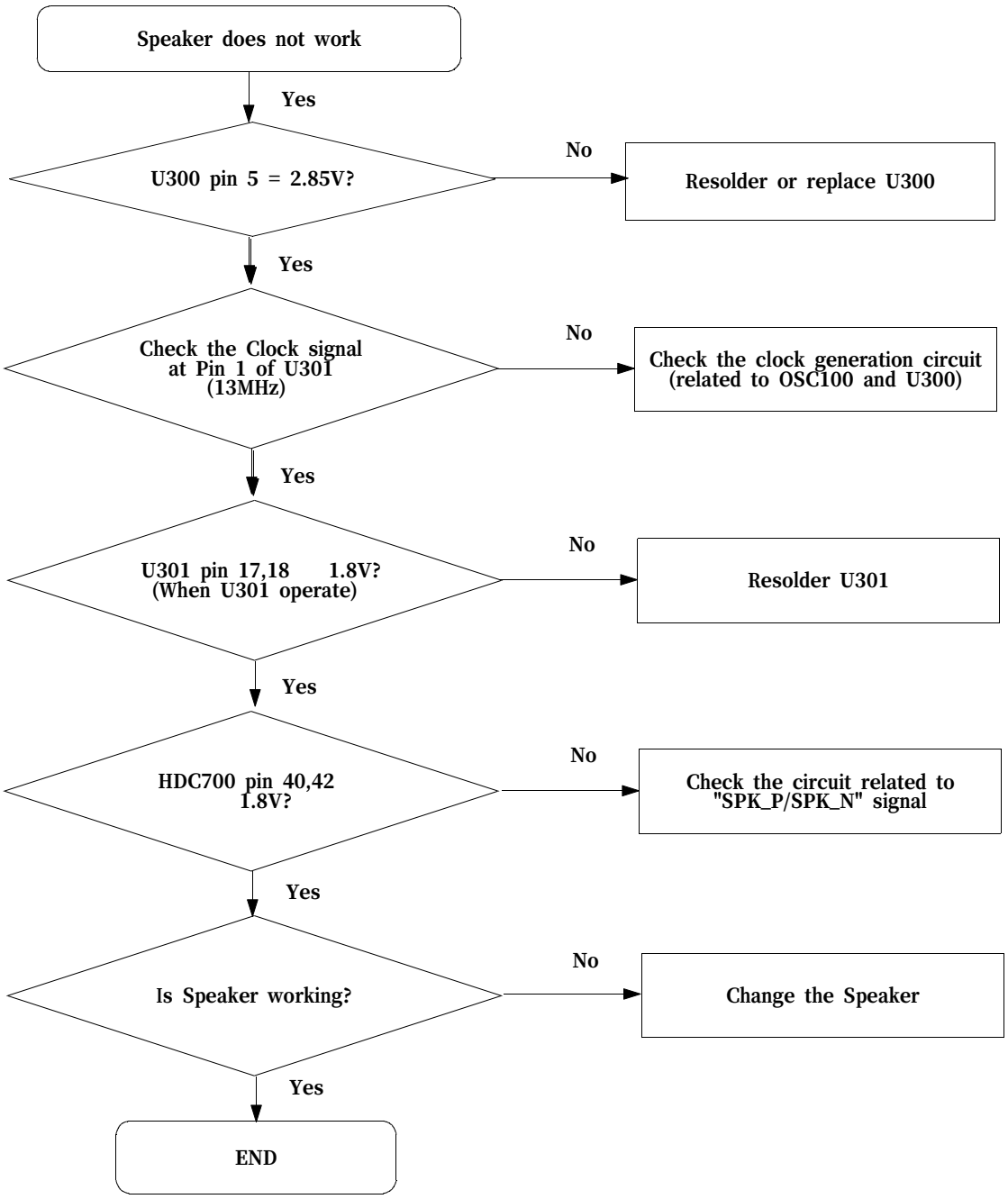
6. Speaker Part(Melody)



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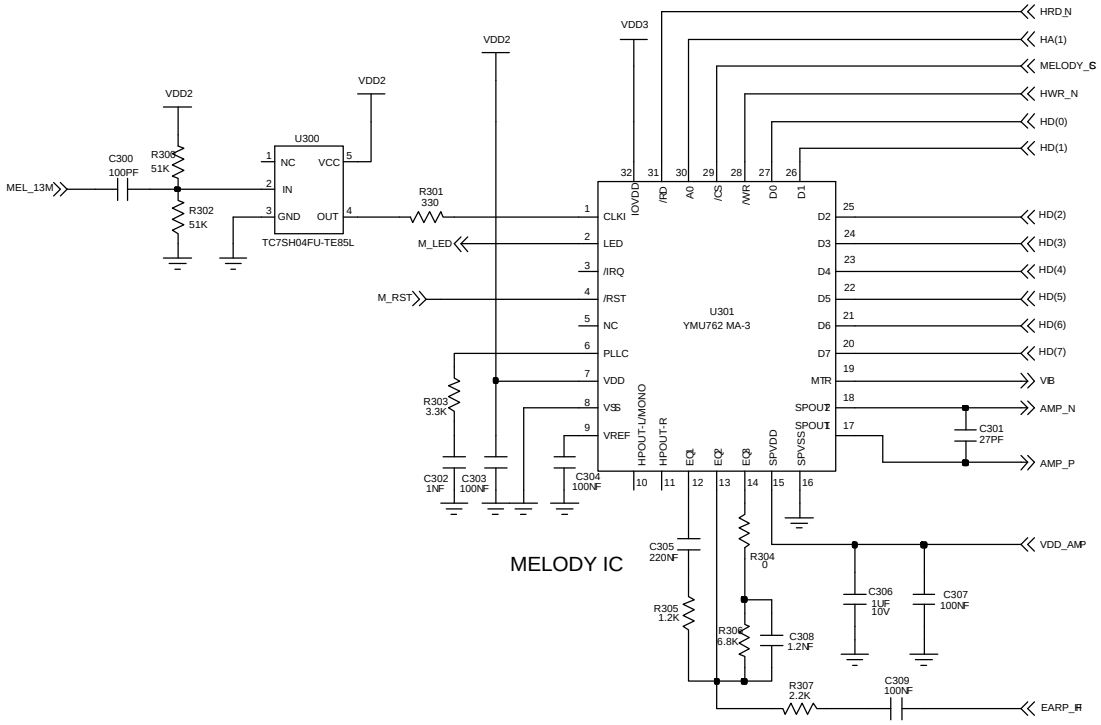
Speaker



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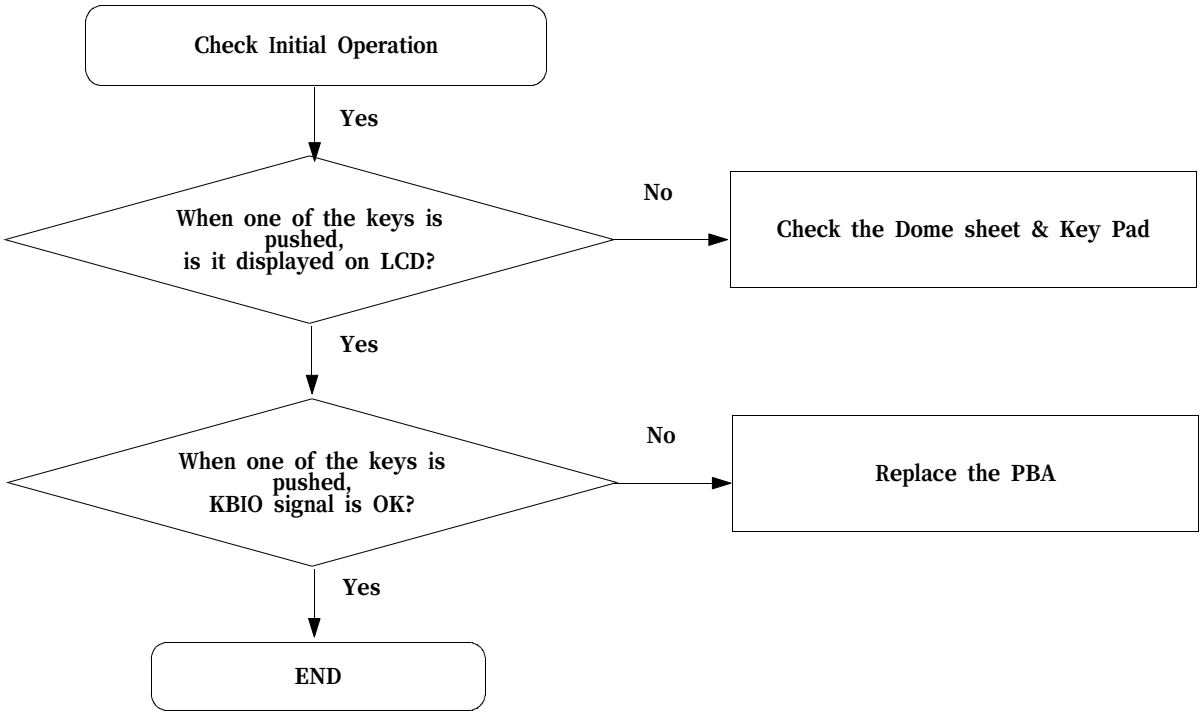
7. Key Data Input



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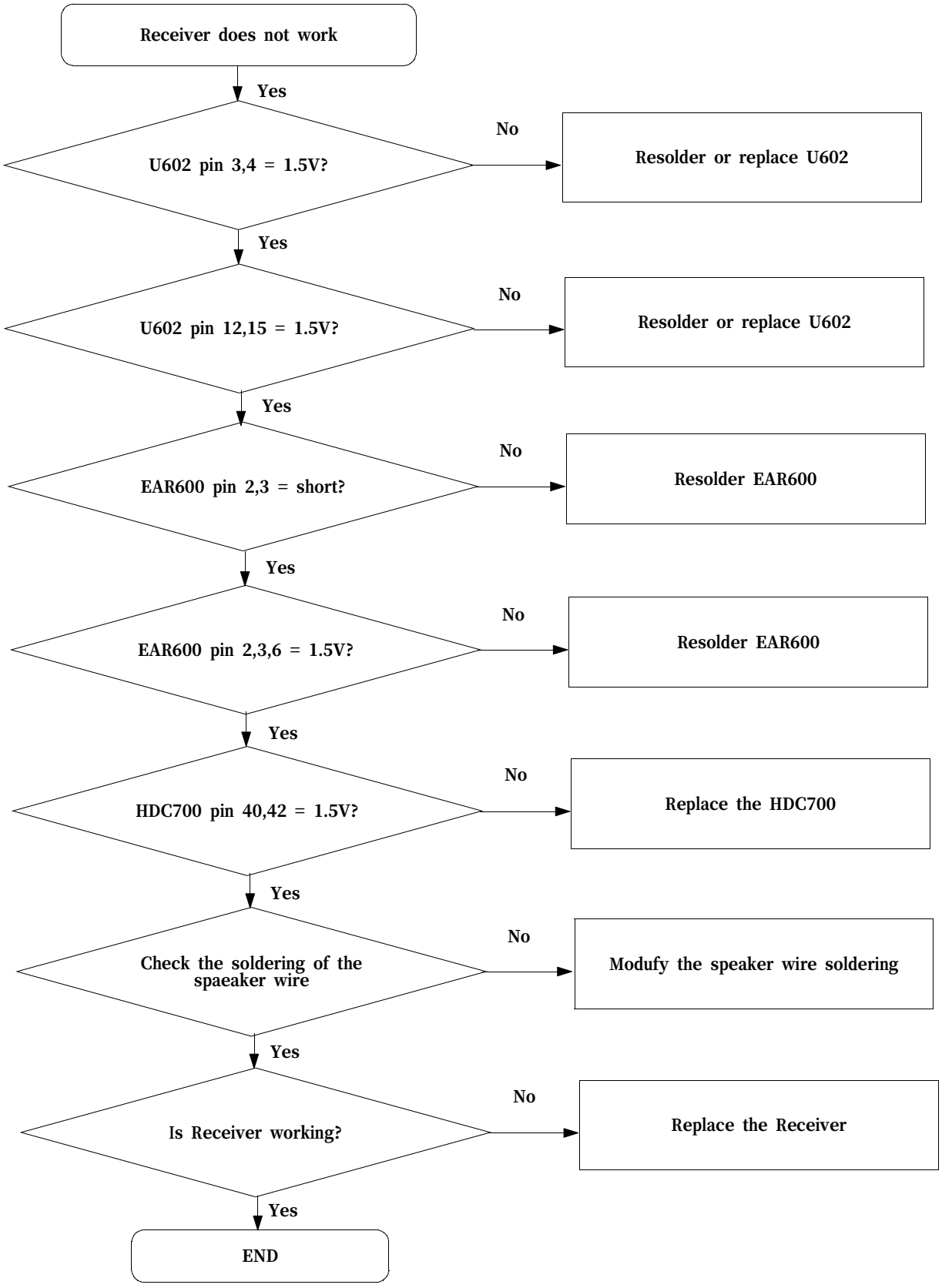
8. Receiver Part



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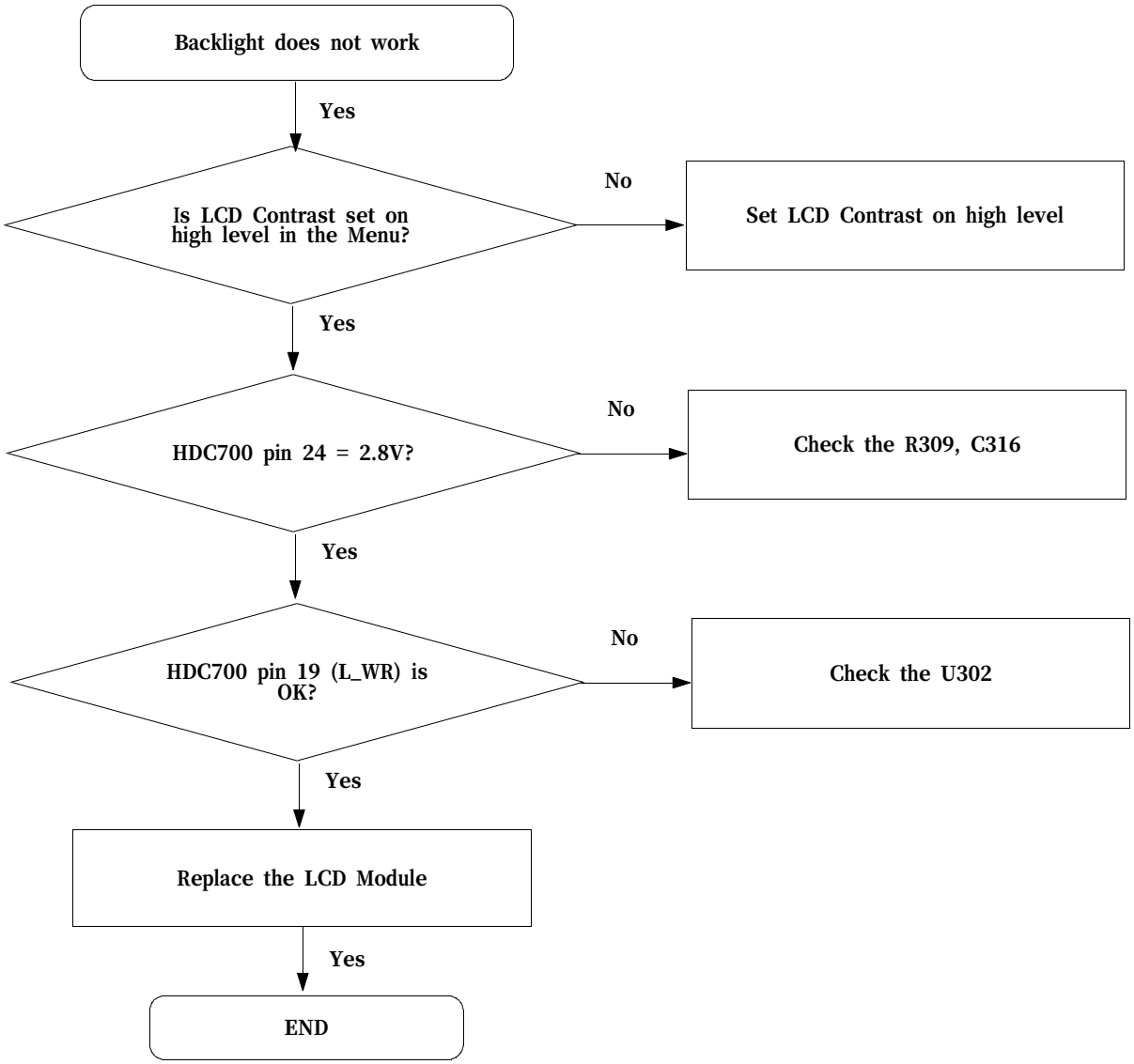
9. Back Light (for Color Main LCD)



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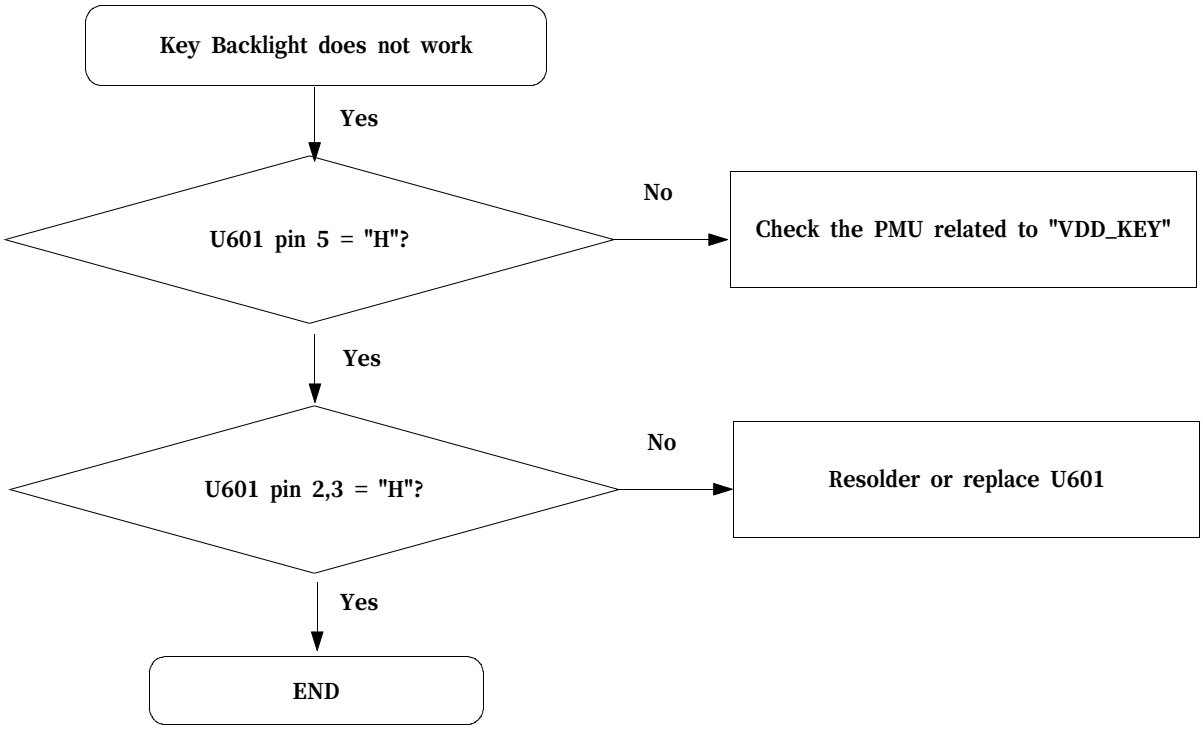
10. Key Back Light



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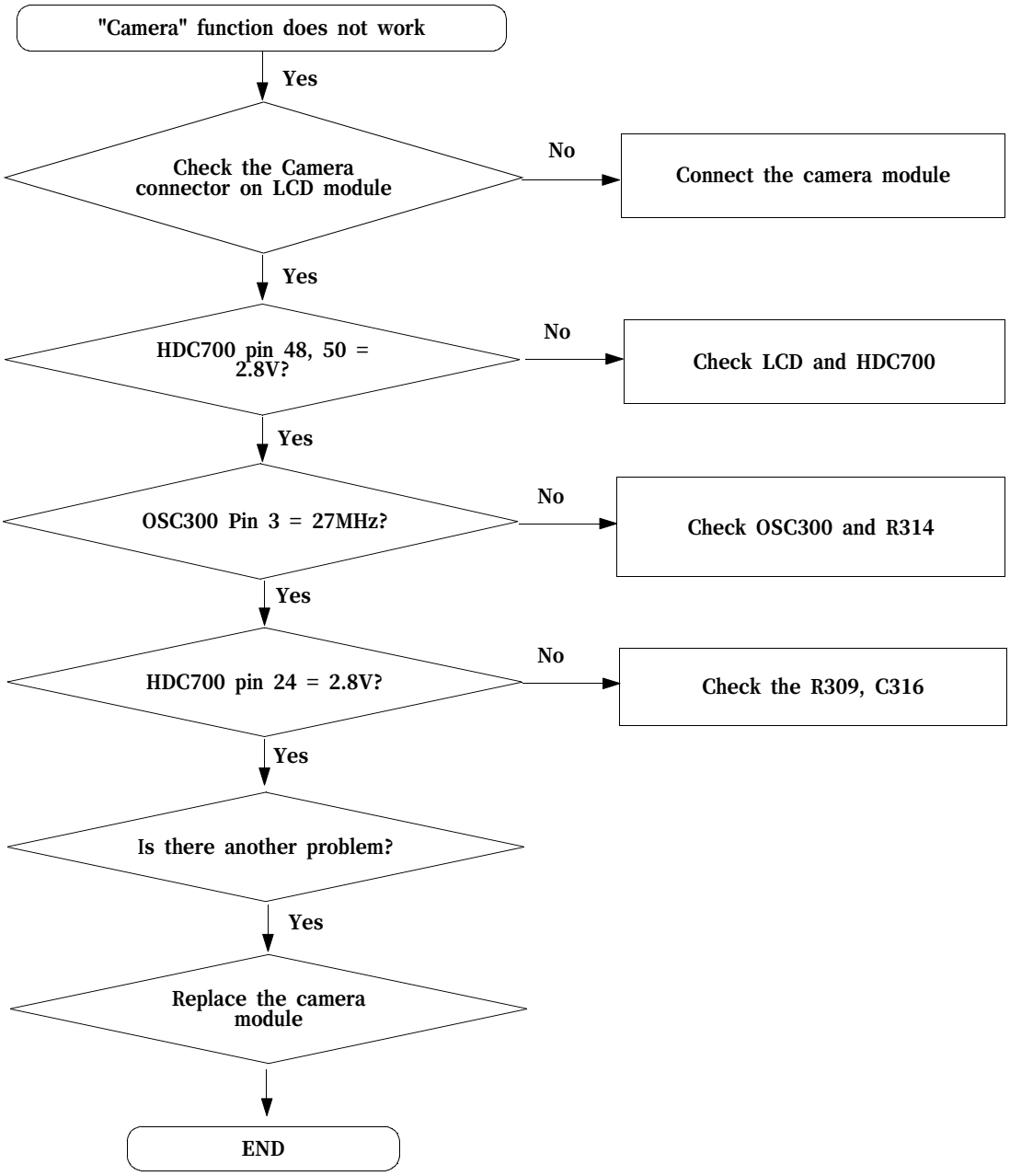
11. Camera part



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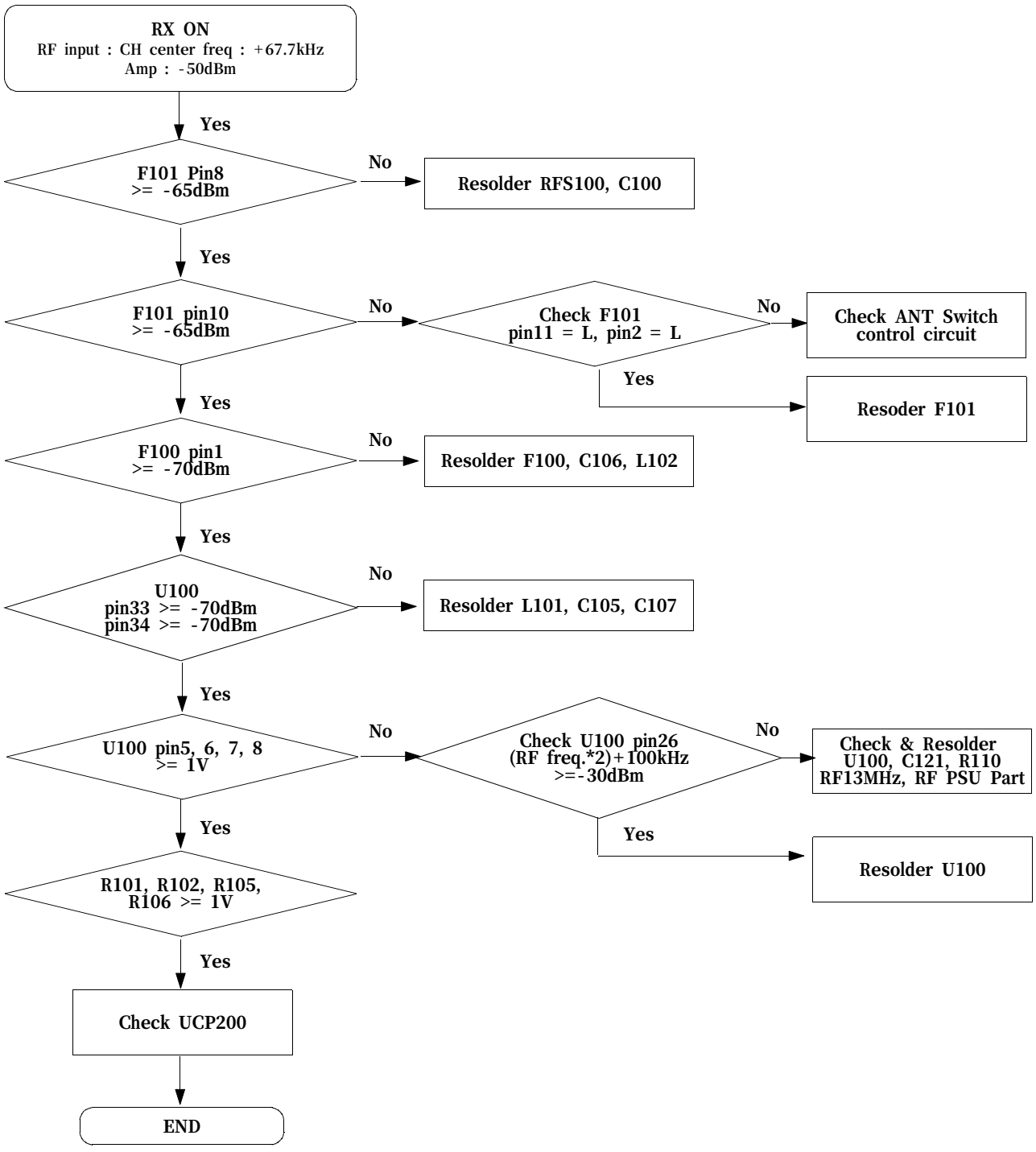
12. GSM Receiver



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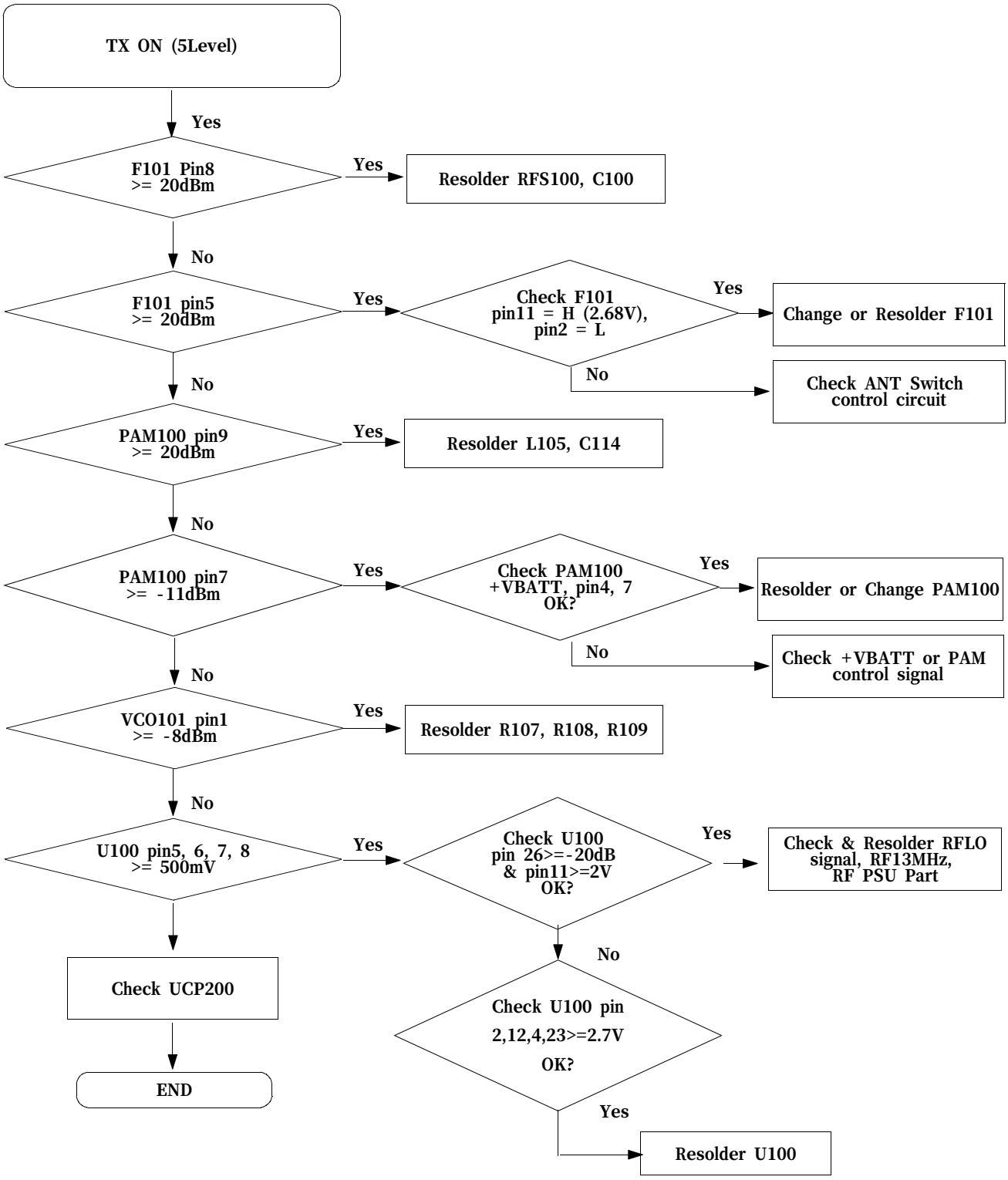
13. GSM Transmitter



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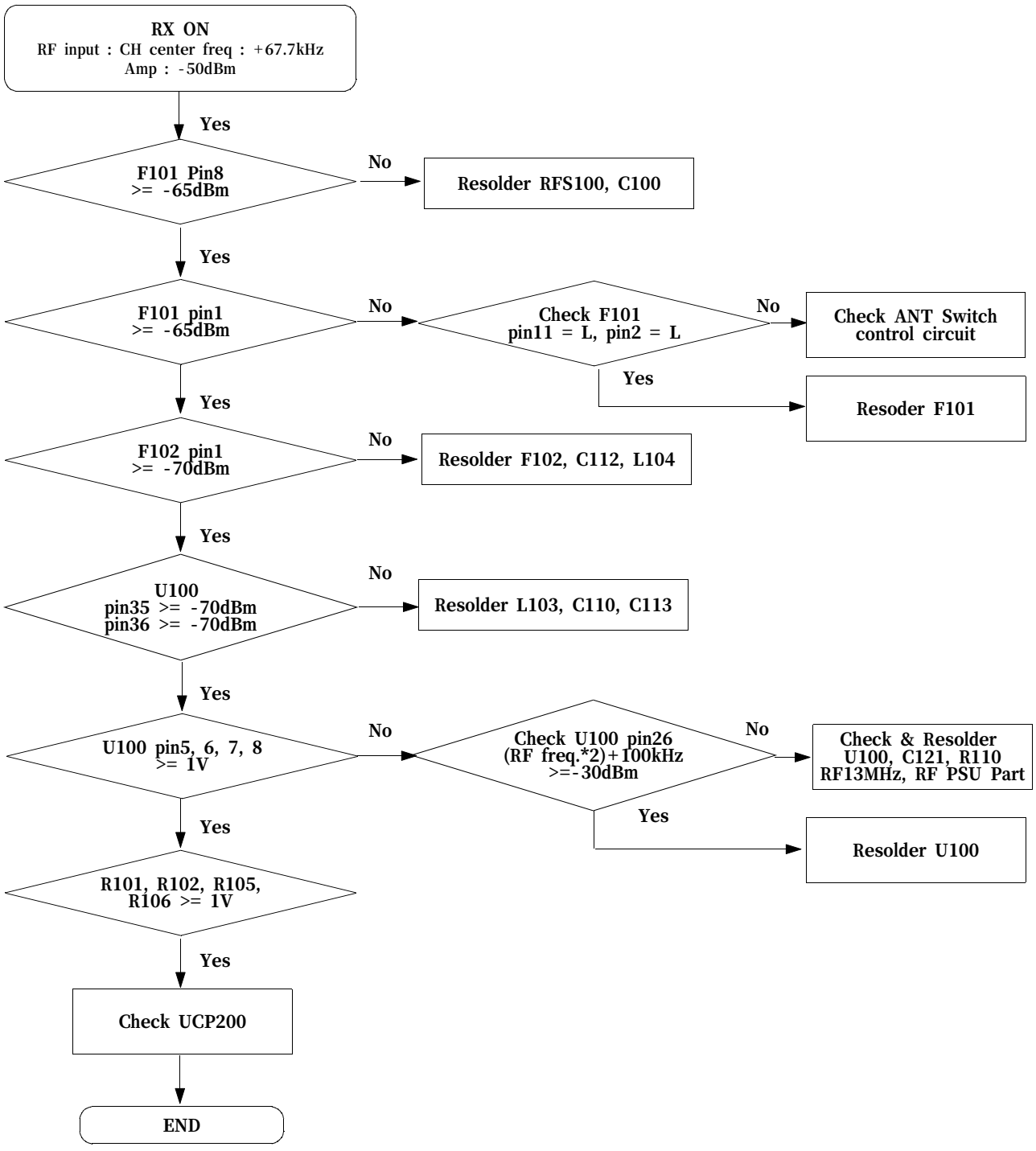
14. DCS Receiver



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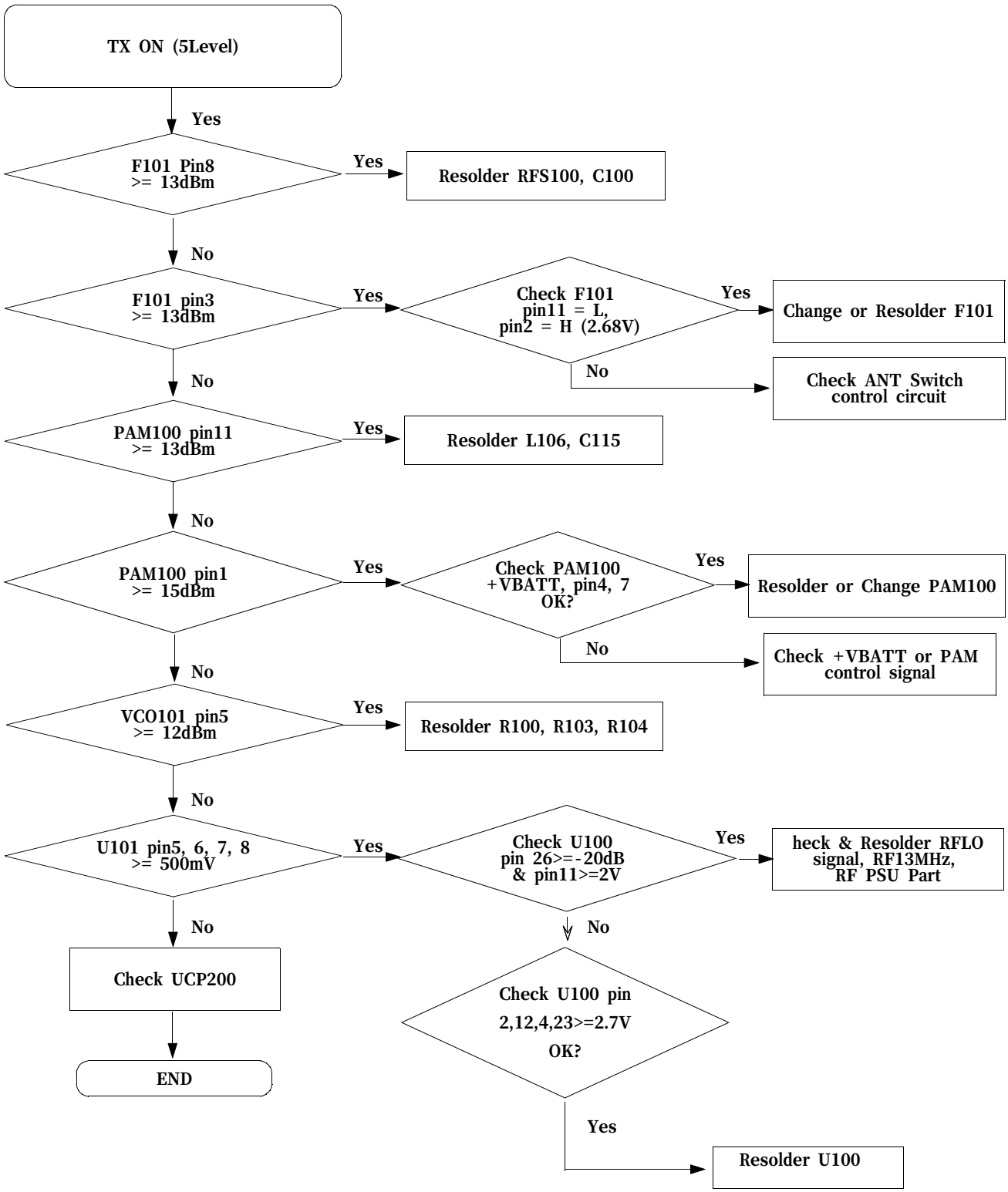
15. DCS Transmitter



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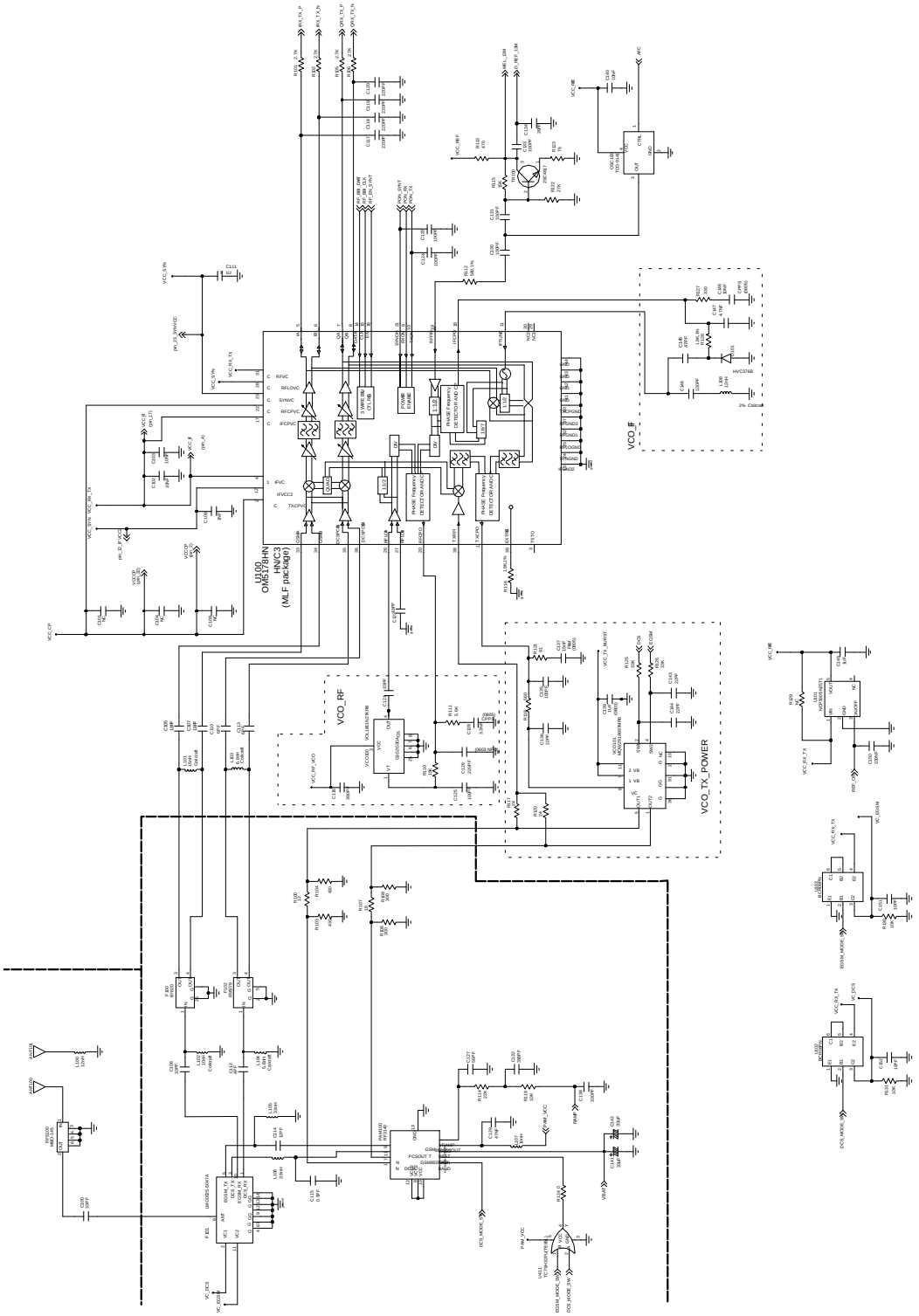
Transmitter



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