

SAMSUNG

GSM TELEPHONE
SGH-X100

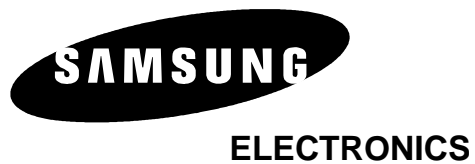
SERVICE *Manual*

GSM TELEPHONE

CONTENTS



1. Specification
2. Circuit Description
3. Exploded Views and Parts List
4. Electrical Parts List
5. Block Diagrams
6. PCB Diagrams
7. Flow Chart of Troubleshooting



This Service Manual is a property of Samsung Electronics Co.,Ltd.
Any unauthorized use of Manual can be punished under applicable
International and/or domestic law.

Samsung Electronics Co.,Ltd. June. 2003
Printed in Korea.

Code No.: GH68-04326A
BASIC.

1. SGH-X100 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

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

2. SGH-X100 Circuit Description

1. SGH-X100 RF Circuit Description

1) RX PART

1. ASM(U100) Switching Tx, Rx path for GSM900, DCS1800 by logic controlling.

2. ASM Control Logic (U104, U106) Truth Table

	VC1	VC2
GSM Tx Mode	H	L
DCS Tx Mode	L	H
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 (F101) For filtering the frequency band between 925 ~ 960 MHz
- DCS FILTER (F102) For filtering the frequency band 1805 and 1880 MHz.

4. VC-TCXO (OSC101)

To generate the 26MHz reference clock to drive the logic and RF. After additional process, the reference clock applies to the U103 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. Transceiver (U103)

The receiver front-end converts the aerial RF signal from EGSM, DCS bands down to a low intermediate frequency (IF) of 100 kHz. The first stages are symmetrical low noise amplifiers (LNAs). They are matched to 50 ohm. The LNAs are followed by an I, Q down-mixer. It consists of two mixers in parallel but driven by quadrature out of phase LO signals. The In phase (I) and Quadrature phase (Q) IF signals are low pass filtered to provide protection from high frequency offset interferes. The low IF I and Q signals are then fed into the channel filter. The front-end low IF I and Q outputs enter the integrated bandpass channel filter with provision for five 8 dB gain steps in front of the filter.

2) TX PART

Baseband IQ signal fed into offset PLL, this function is included inside of U103 chip. OSC100 chip generates modulator signal which power level is about 6.5dBm and fed into Power Amplifier(U101). The PA output power and power ramping are well controlled by Auto Power Control circuit. We use offset PLL below

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

2. Baseband Circuit description of SGH-X100

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 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 or to control a DC/DC converter that drives LCD backlight. This phone (SGH-X100) is not use PWM, but use DC CONTROL (BACKLIGHT). So "BACKLIGHT" voltage is high 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 STN LCD). Chip select signals in the U304, LCD_CS can enable LCD.

LCD_CS signal is LCD select signal. This signal is from ENABLE part of OM6357.

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

16-bit data lines (HD(0)~HD(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 signal for LCD is "VDD3".

2-2. 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 separated from the matrix. So power on/off signal is connected with PCF50601 to enable PCF50601. Ten key LEDs use the "VDD_KEY" supply voltage.

"VDD_KEY" signal enables LEDs with current control.

2. SGH-X100 Circuit Description

2-3. EMI ESD Filter

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

2-4. IF connector

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

REC_P and REC_N from OM6357 are connected to the main receiver. 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 decoder that are included in this device. As a synthesis, YMU762MA3 is equipped 32 voices with different tones. 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 flexibly support application such as incoming call melody music distribution service. 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 vibrator and a circuit for controlling LEDs synchronous with music. For the headphone, it is provided with a stereophonic output terminal. For the purpose of enabling YMU762MA3 to demonstrate its full capabilities, Yamaha purpose to use "SMAF:Synthetic music Mobile Application Format" as a data distribution format that is compatible with 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 training karaoke, and commercial channel that combines texts, images and sounds, and others. The hardware sequencer of YMU762MA3 directly interprets and plays blocks relevant to synthesis (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. It has 23 address lines, HA[1~23]. CS_NAND and NCSRAM signals is chip select. Writing 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[23] 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), peripheral 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.

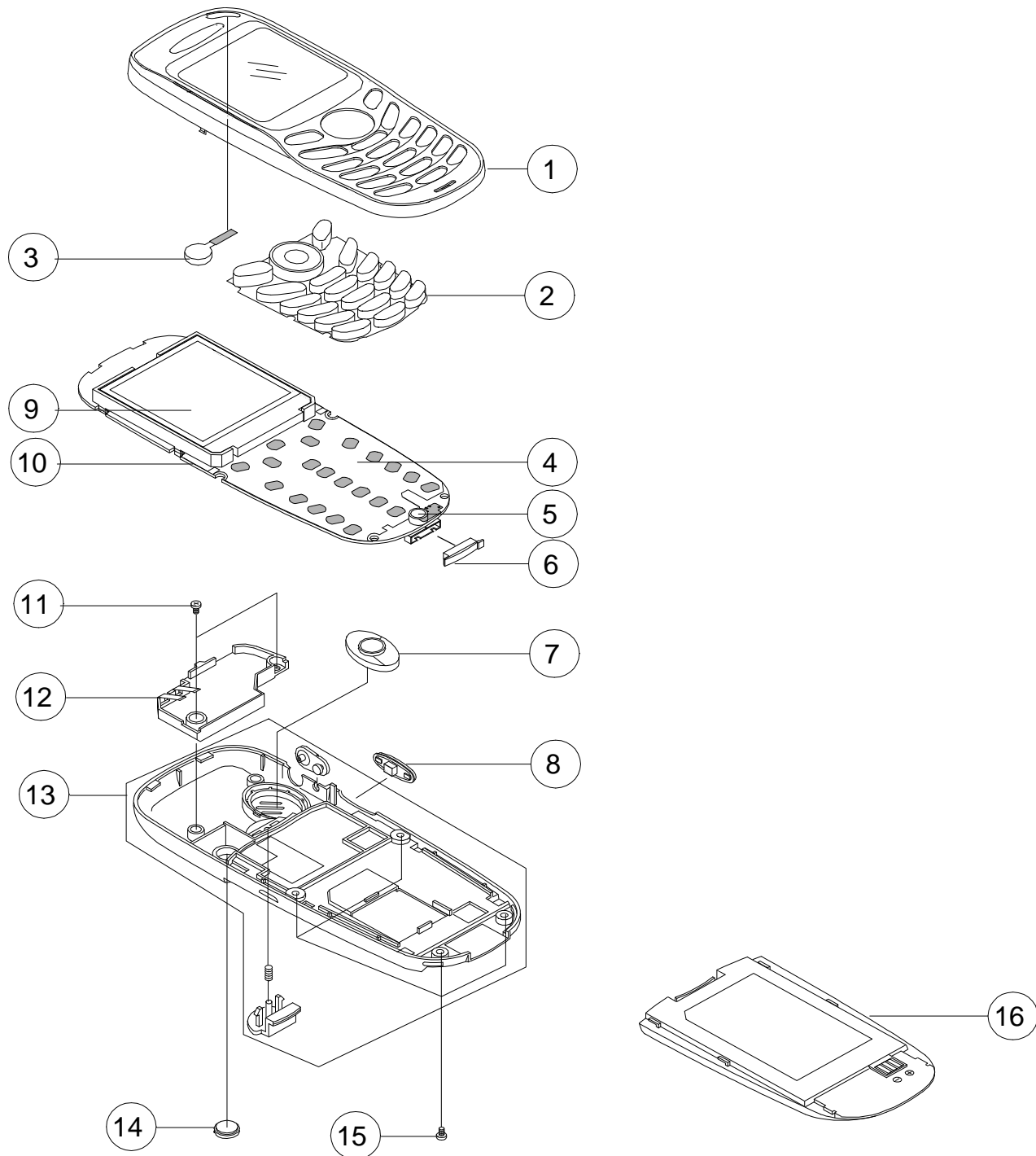
CS_NAND, NCSRAM, NCSFLASH in the ARM core are connected to each memory. HWR_N and HRD_N control the process of memory. External IRQ(Interrupt ReQuest) signals from each units, such as, PMU need the compatible process. KBIO[0~7] receive the status from key and RXD0/TXD for data link cable(DEBUG_DTR/RTS/TXD/RXD/CTS/DSR). It has JTAG control pins(TDI/TDO/TCK) for ARM core and DSP core. It receives 13MHz clock in CKI pin from external TCXO. ADC(Analog to Digital Converter) part receives the status of temperature, battery type and battery voltage.

7) TCO-9141G(26MHz)

This system uses the 26MHz TCXO, TCO-9141G, Toyocom. AFC control signal from OM6357 controls frequency from 13MHz x-tal. It generates the clock frequency. This clock is connected to UAA3536.

3. SGH-X100 Exploded View and its Parts list

1. Cellular phone Exploded View



2. Cellular phone Parts list

NO	DESCRIPTION	SEC CODE	REMARK
1	FRONT COVER	GH75-03497A	
2	KEYPAD	GH75-03518A	
3	MOTOR	GH31-00064A	
4	DOME SHEET	GH59-00929A	
5	MIC	GH30-00044A	
6	IF COVER	GH73-02203A	
7	MICRO SPEAKER	3001-001445	
8	VOLKEY	GH75-03728A	
9	LCD	GH07-00394A	
10	MAIN PBA	GH92-01558A	
11	SCREW	6001-001654	
12	INTENNA	GH42-00308A	
13	REAR COVER	GH75-03496A	
14	RF COVER	GH72-09251A	
15	SCREW	6001-001654	
16	BATTERY	GH43-00994A	

3. Test Jig (GH80-01909A)



3-1. RF Test Cable
(GH39-00140A)



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



3-3. Serial Cable



3-4. Power Supply Cable



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



3-6. TA
(GH44-00482G)



4. SGH-X100 MAIN Electrical Parts List

SEC CODE	Design LOC
0403-001427	ZD601
0403-001446	ZD600
0404-001089	D600
0406-001104	Q400
0504-001012	Q400
0504-001012	Q401
0504-001042	U104
0504-001042	U106
0504-001134	Q301
0505-001332	Q302
0505-001423	U410
0506-000107	U405
0601-001402	RI401
0601-001611	LED402
0601-001611	LED405
0601-001611	LED408
0601-001611	LED409
0601-001647	LED401
0601-001647	LED403
0601-001647	LED404
0601-001647	LED406
0601-001647	LED407
0601-001647	LED410
0801-002237	U300
0801-002540	U210
0801-002540	U303
0801-002540	U304
1001-001183	U212
1003-001440	Q403
1109-001280	U305

SEC CODE	Design LOC
1201-001954	U101
1202-001036	U203
1203-002633	U307
1203-002980	U309
1204-002161	U301
1205-002257	U400
1205-002276	U200
1205-002327	U103
1404-001221	TH200
2909-001204	U100
1405-001082	V202
1405-001082	V204
1405-001082	V205
1405-001082	V207
1405-001082	V211
1405-001082	V212
1405-001082	V400
1405-001082	V402
1405-001082	V403
1405-001082	V404
1405-001121	V405
1405-001121	V407
1405-001121	V506
2007-000137	R434
2007-000138	R132
2007-000140	R123
2007-000140	R124
2007-000140	R305
2007-000140	R324
2007-000141	R105

SEC CODE	Design LOC
2007-000141	R225
2007-000141	R226
2007-000143	R135
2007-000143	R136
2007-000143	R137
2007-000143	R138
2007-000143	R362
2007-000144	R115
2007-000147	R116
2007-000148	R126
2007-000148	R202
2007-000148	R204
2007-000148	R205
2007-000148	R210
2007-000148	R227
2007-000148	U732
2007-000157	R321
2007-000162	R102
2007-000162	R103
2007-000162	R203
2007-000162	R211
2007-000162	R212
2007-000162	R229
2007-000162	R234
2007-000162	R270
2007-000162	R300
2007-000162	R302
2007-000162	R303
2007-000162	R304
2007-000162	R306

SEC CODE	Design LOC
2007-000162	R350
2007-000162	R360
2007-000162	R361
2007-000162	R436
2007-000171	R100
2007-000171	R107
2007-000171	R109
2007-000171	R139
2007-000171	R213
2007-000171	R214
2007-000171	R228
2007-000171	R307
2007-000172	R120
2007-000172	R131
2007-000174	R129
2007-000242	R200
2007-000242	R206
2007-000566	R125
2007-000566	R127
2007-000636	R432
2007-000636	R433
2007-001217	R425
2007-001288	R108
2007-001288	R112
2007-001301	R401
2007-001301	R404
2007-001301	R407
2007-001301	R408
2007-001305	R118
2007-001305	R122

SEC CODE	Design LOC
2007-001305	R230
2007-001305	R231
2007-001308	R110
2007-001308	R111
2007-001308	R113
2007-001308	R114
2007-001313	U735
2007-001325	U734
2007-001339	R430
2007-001339	R431
2007-003025	R328
2007-007001	R218
2007-007001	R219
2007-007008	R426
2007-007009	R400
2007-007009	R402
2007-007009	R403
2007-007009	R405
2007-007009	R406
2007-007009	R409
2007-007100	R415
2007-007107	R201
2007-007107	R209
2007-007136	R311
2007-007137	R310
2007-007137	R313
2007-007148	R104
2007-007311	R128
2007-007334	R215
2007-007480	R220

SEC CODE	Design LOC
2007-007573	R428
2007-007588	R429
2007-007981	R224
2007-008312	R221
2007-008354	R427
2203-000233	C119
2203-000233	C120
2203-000233	C144
2203-000254	C145
2203-000254	C209
2203-000254	C301
2203-000254	C408
2203-000254	U726
2203-000278	C102
2203-000278	C104
2203-000278	C136
2203-000278	C140
2203-000278	C223
2203-000278	C234
2203-000278	C404
2203-000330	C409
2203-000330	C413
2203-000359	C124
2203-000359	C314
2203-000386	C210
2203-000386	C211
2203-000386	C229
2203-000438	C142
2203-000438	C236
2203-000438	C237

SEC CODE	Design LOC
2203-000438	C304
2203-000438	C310
2203-000440	C127
2203-000550	C147
2203-000585	C137
2203-000609	C148
2203-000679	C224
2203-000679	C233
2203-000679	C307
2203-000679	C308
2203-000679	C450
2203-000679	U736
2203-000812	C118
2203-000812	C213
2203-000812	C219
2203-000812	C230
2203-000854	C108
2203-000854	C110
2203-000854	C114
2203-000940	C139
2203-000995	C203
2203-000995	C215
2203-000995	C225
2203-000995	C226
2203-000995	C227
2203-000995	C228
2203-000995	C471
2203-001153	C146
2203-001652	C411
2203-001652	C423

SEC CODE	Design LOC
2203-002443	C135
2203-003054	C220
2203-003054	C231
2203-005054	C201
2203-005054	C217
2203-005056	C222
2203-005057	C112
2203-005057	C115
2203-005057	C122
2203-005057	C134
2203-005057	C150
2203-005057	C156
2203-005061	C113
2203-005061	C116
2203-005061	C121
2203-005061	C133
2203-005061	C149
2203-005061	C155
2203-005061	C204
2203-005061	C205
2203-005061	C206
2203-005061	C207
2203-005061	C208
2203-005061	C212
2203-005061	C221
2203-005061	C242
2203-005061	C243
2203-005061	C244
2203-005061	C245
2203-005061	C246

SEC CODE	Design LOC
2203-005061	C247
2203-005061	C248
2203-005061	C249
2203-005061	C250
2203-005061	C251
2203-005061	C305
2203-005061	C311
2203-005061	C316
2203-005061	C400
2203-005061	C402
2203-005061	C403
2203-005065	C416
2203-005065	C421
2203-005065	C425
2203-005138	C123
2203-005444	C303
2203-005481	C130
2203-005482	C235
2203-005482	C238
2203-005482	C306
2203-005482	C309
2203-005482	C313
2203-005482	C410
2203-005482	C420
2203-005482	C470
2203-005482	C472
2203-005496	C141
2203-005496	C315
2203-005503	C138
2203-005503	C151

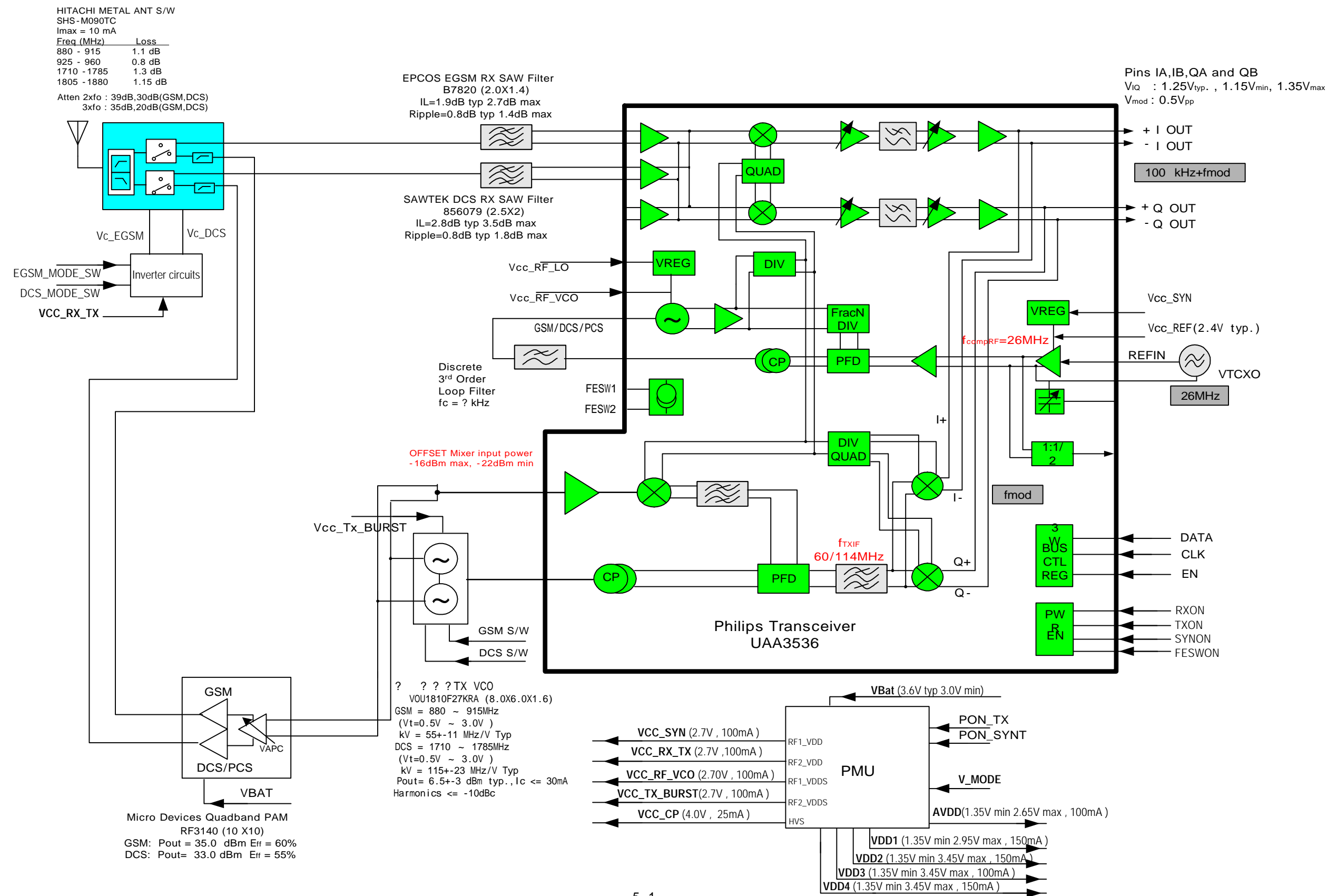
SEC CODE	Design LOC
2203-005503	C152
2203-005503	C153
2203-005503	C154
2203-005840	C350
2203-006053	C126
2203-006053	C412
2203-006053	C424
2203-006053	C426
2203-006053	C427
2203-006053	C428
2203-006053	C429
2203-006053	C476
2203-006090	C418
2203-006090	C419
2203-006105	C312
2203-006105	C401
2203-006105	C407
2203-006105	C415
2203-006105	C422
2203-006201	C414
2203-006201	C417
2301-001197	C125
2301-001213	C128
2404-001020	C132
2404-001086	C319
2404-001101	C318
2404-001225	C406
2404-001239	C129
2404-001239	C131
2503-001053	CA401

SEC CODE	Design LOC
2503-001053	CA402
2503-001053	CA403
2503-001053	CA404
2703-000172	L300
2703-001709	L114
2703-001751	L110
2703-001751	L115
2703-001751	L121
2703-001791	L106
2703-002198	L117
2703-002201	L109
2703-002201	L111
2703-002203	L108
2703-002208	L105
2703-002208	L107
2703-002268	L116
2703-002519	L119
2801-004025	X400
2806-001317	OSC100
2809-001279	OSC101
2901-001246	U302
2901-001254	L120
2904-001417	F101
2904-001424	F102
3301-001105	L400
3404-001152	SW1
3404-001152	SW2
3705-001322	CN100
3709-001244	CN400
3710-001611	CN301

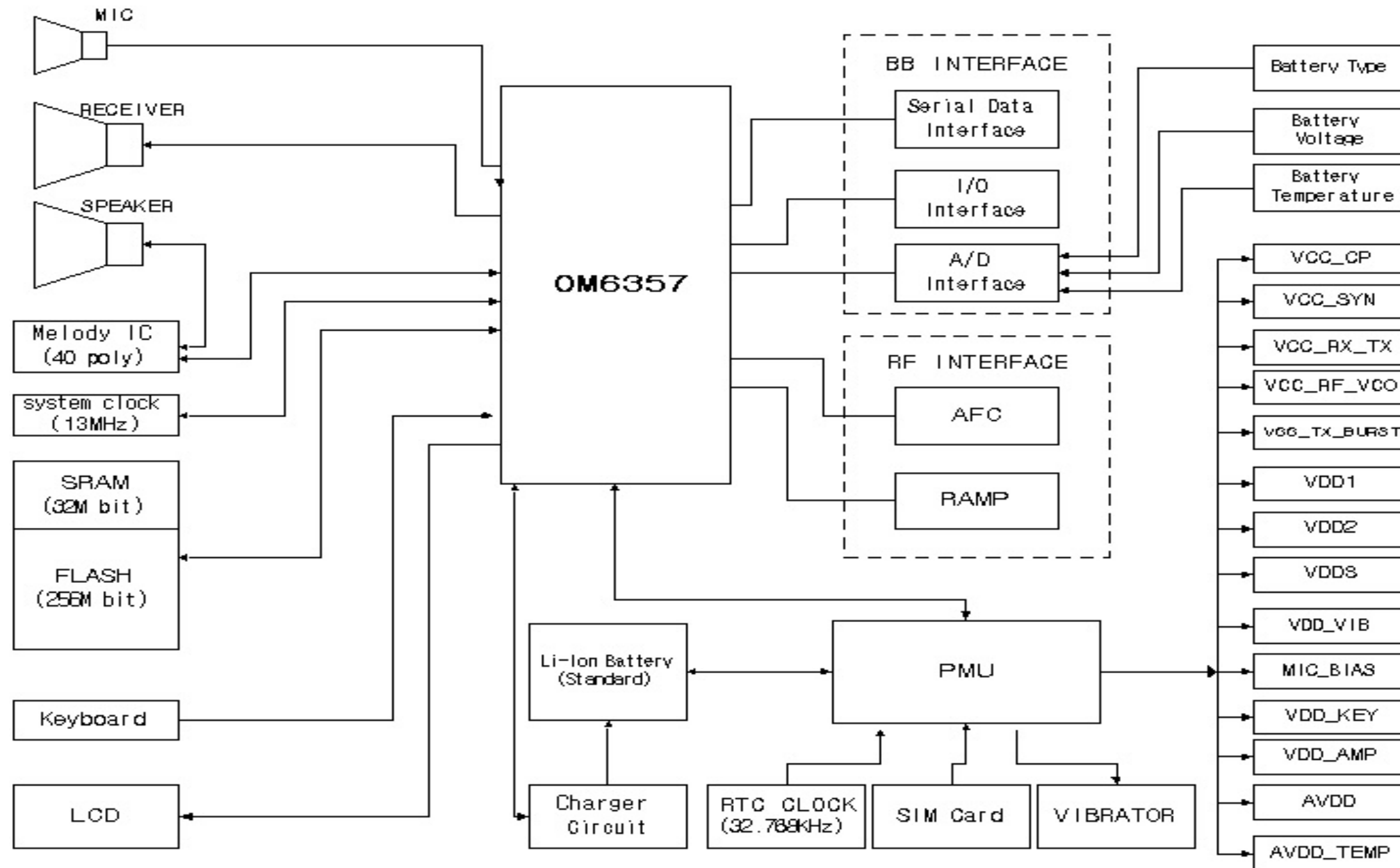
SEC CODE	Design LOC
3710-001853	BAT301
3711-004988	SPK201
3722-001715	EAR201
4302-001130	BAT401

5. SGH-X100 Block Diagrams

1. RF Solution Block Diagram

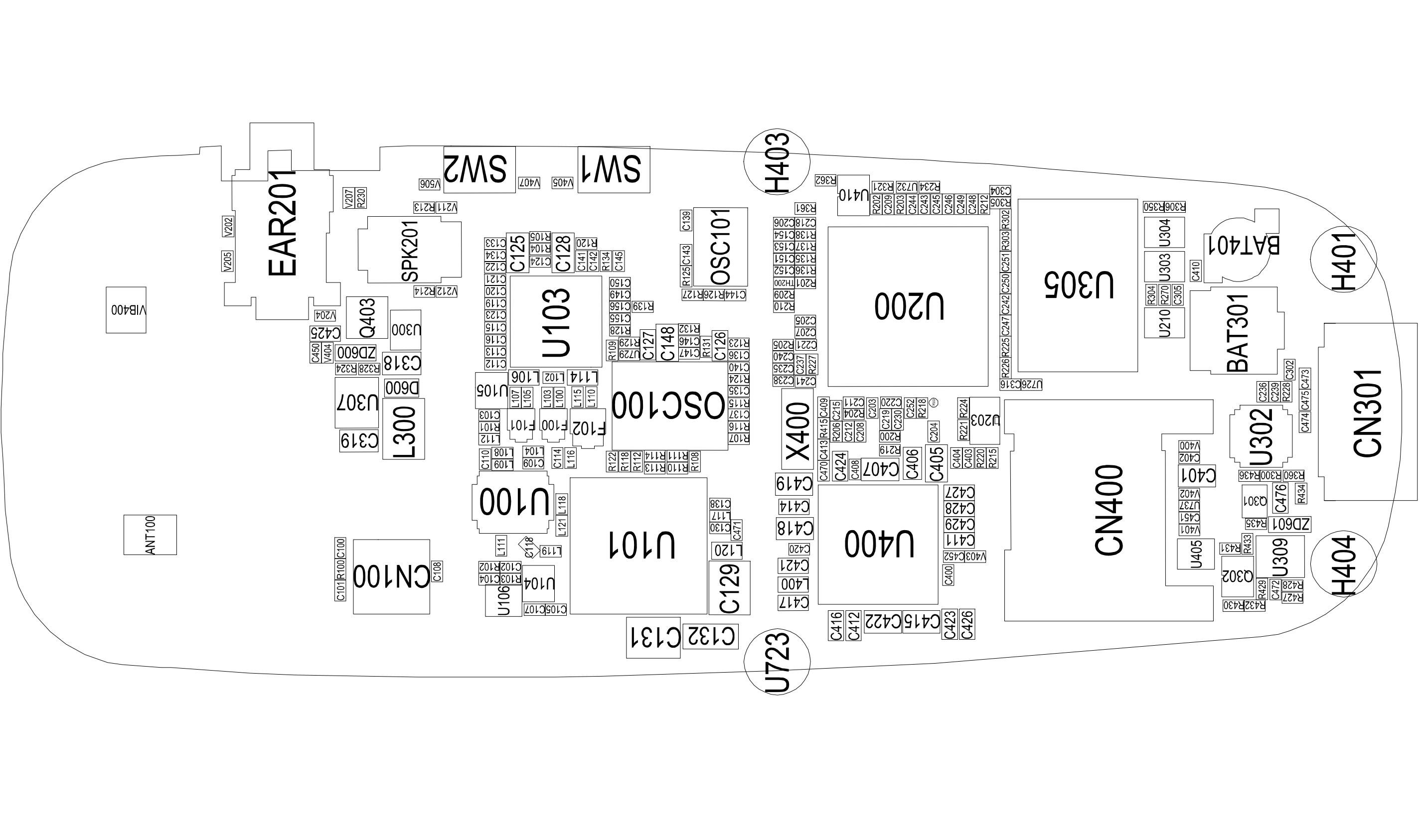


2. Base Band Solution Block Diagram



6. SGH-X100 PCB Diagrams

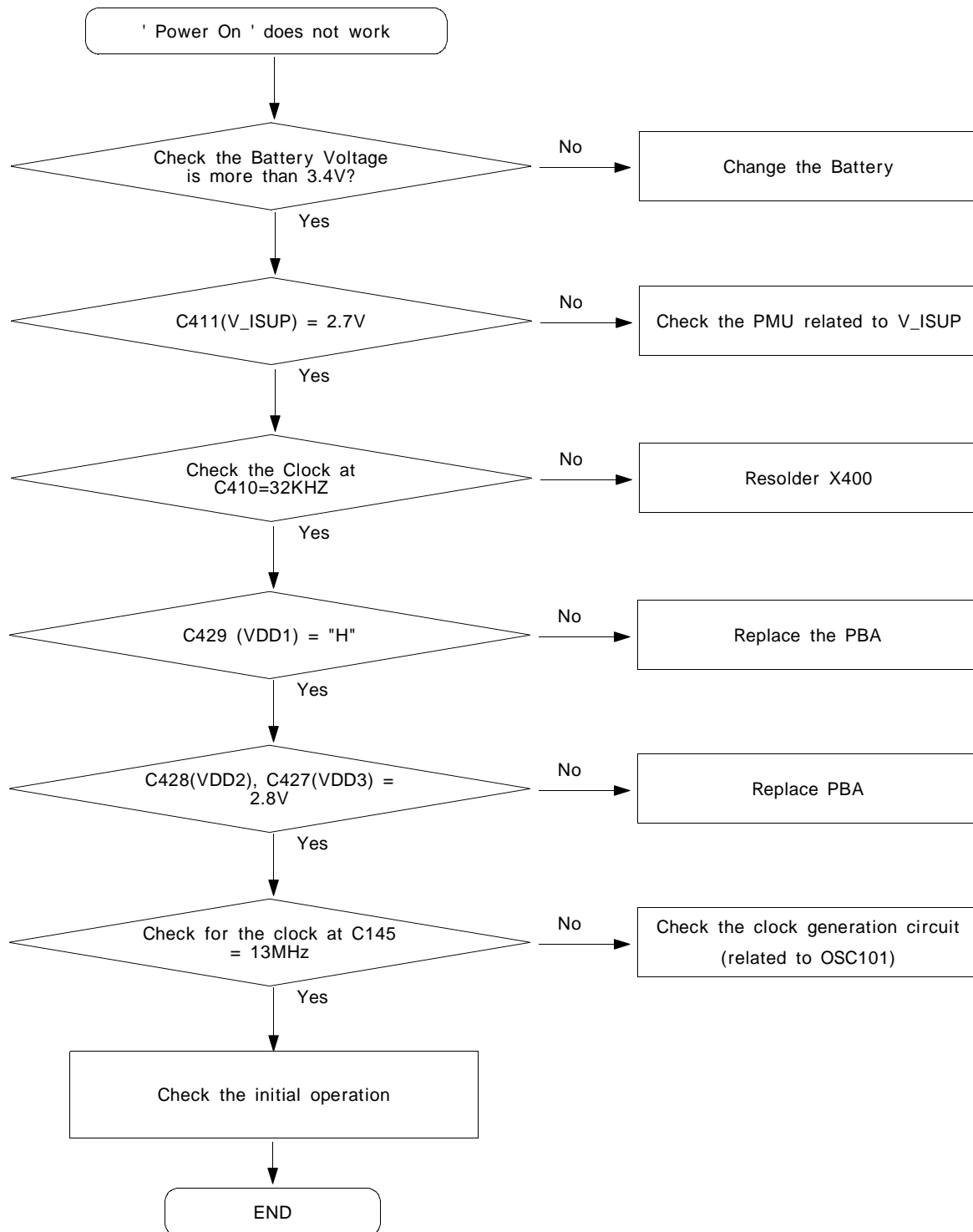
1. Main PCB Top Diagram

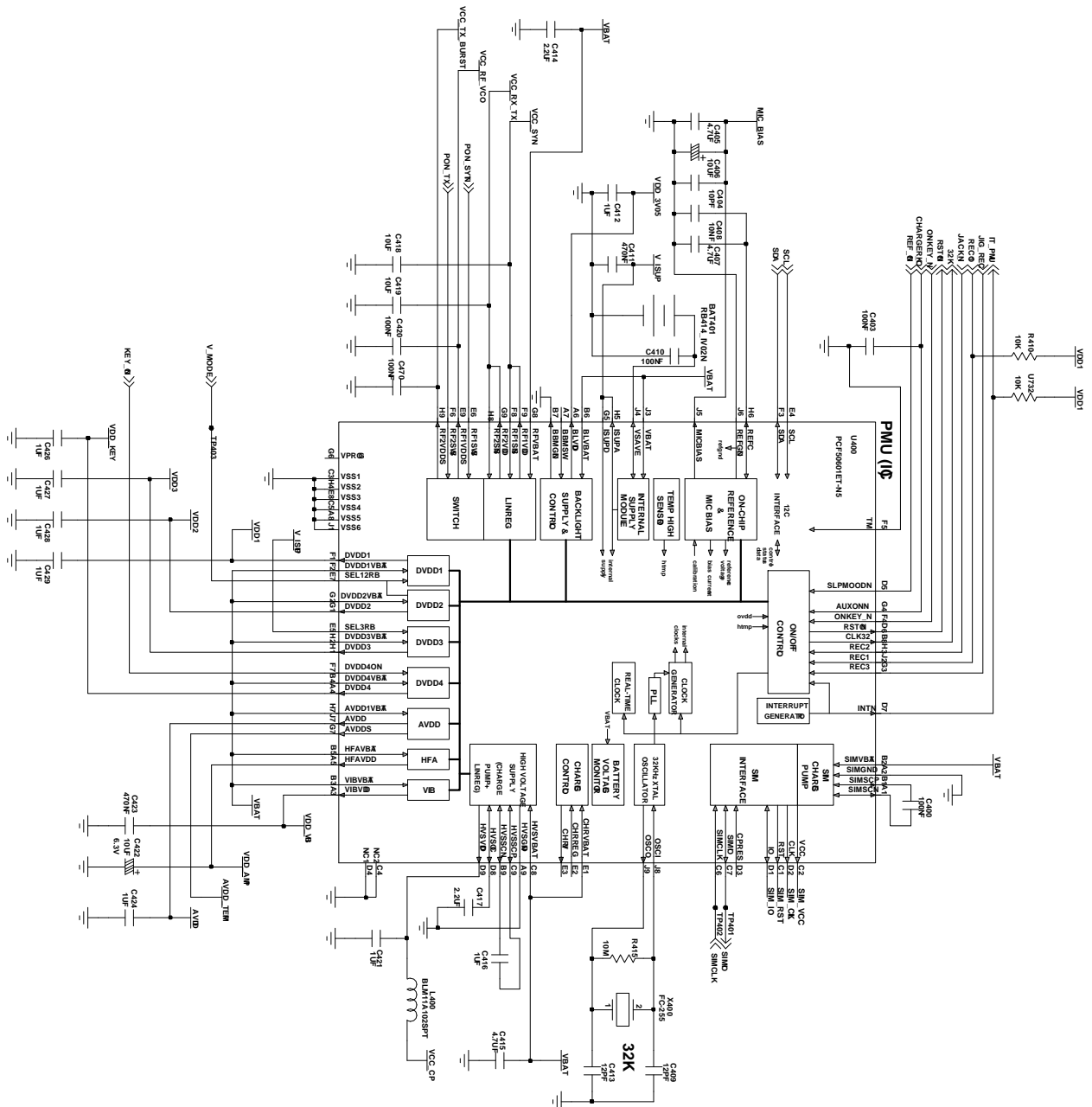




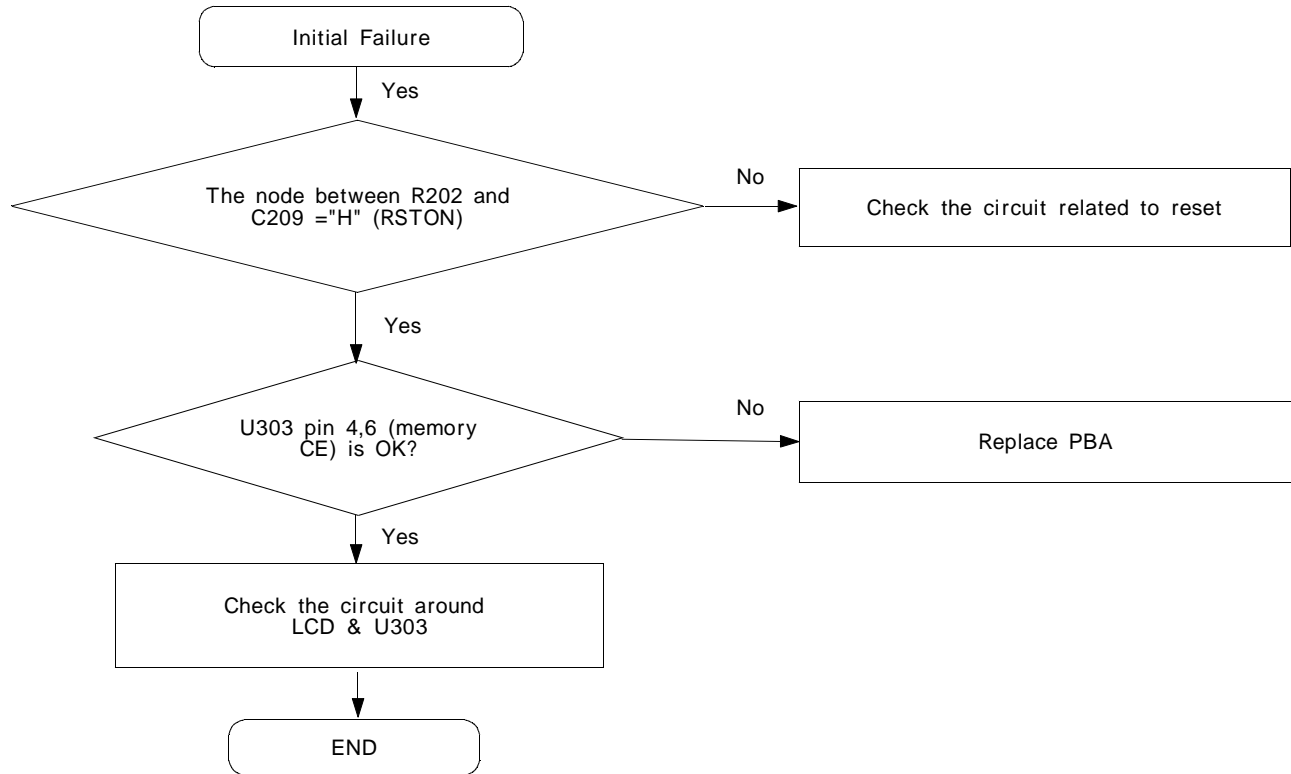
7. SGH-X100 Flow Chart of Troubleshooting

1. Power On

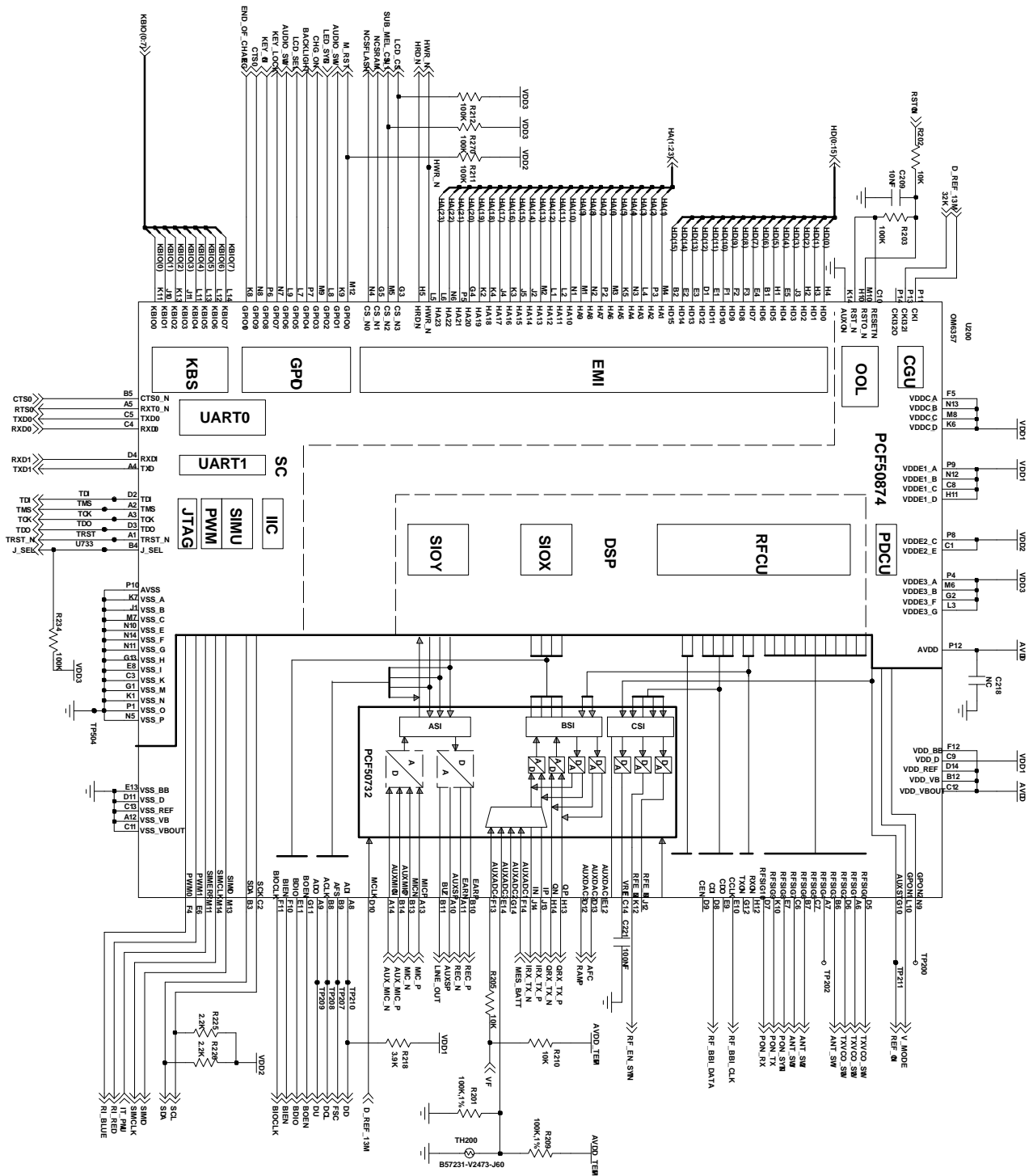




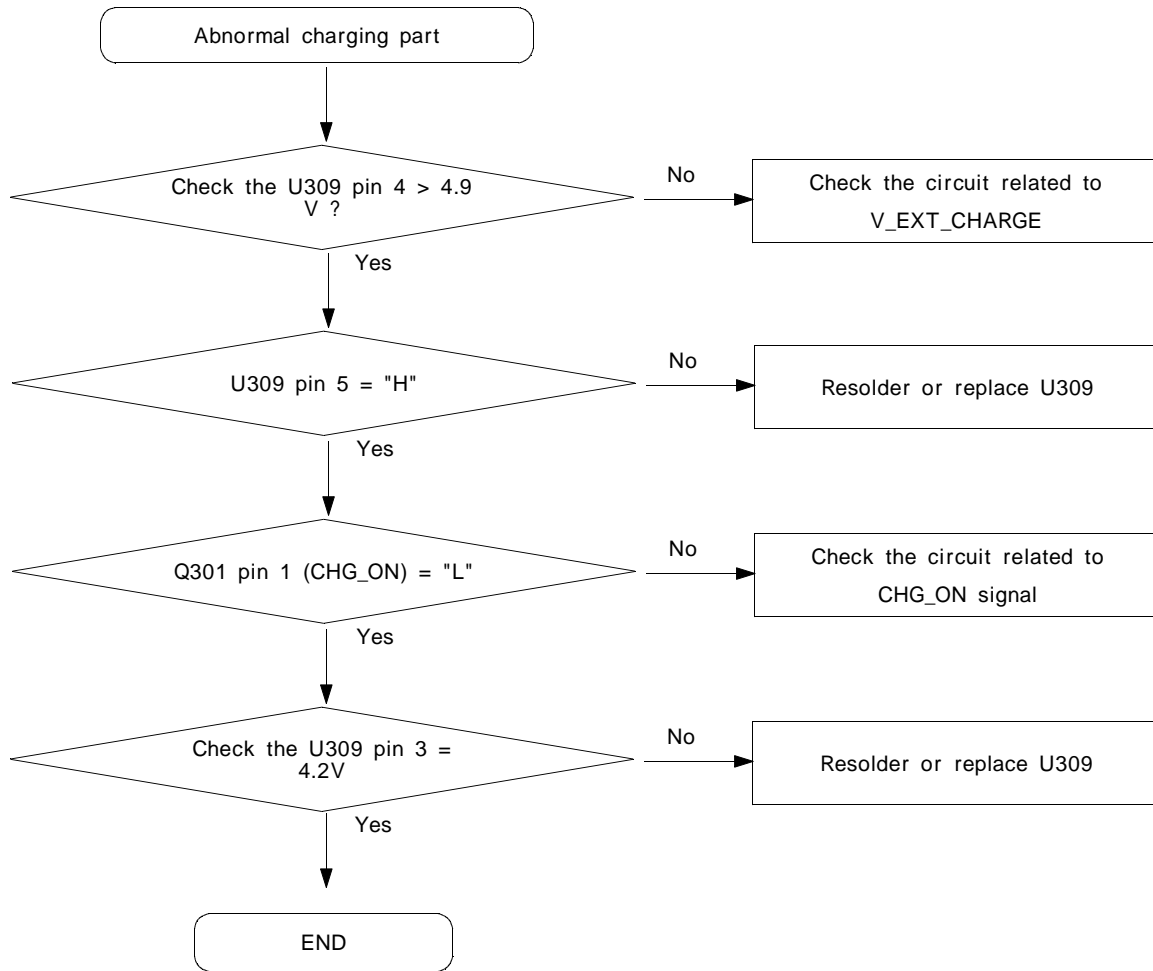
2. Initial



Initial

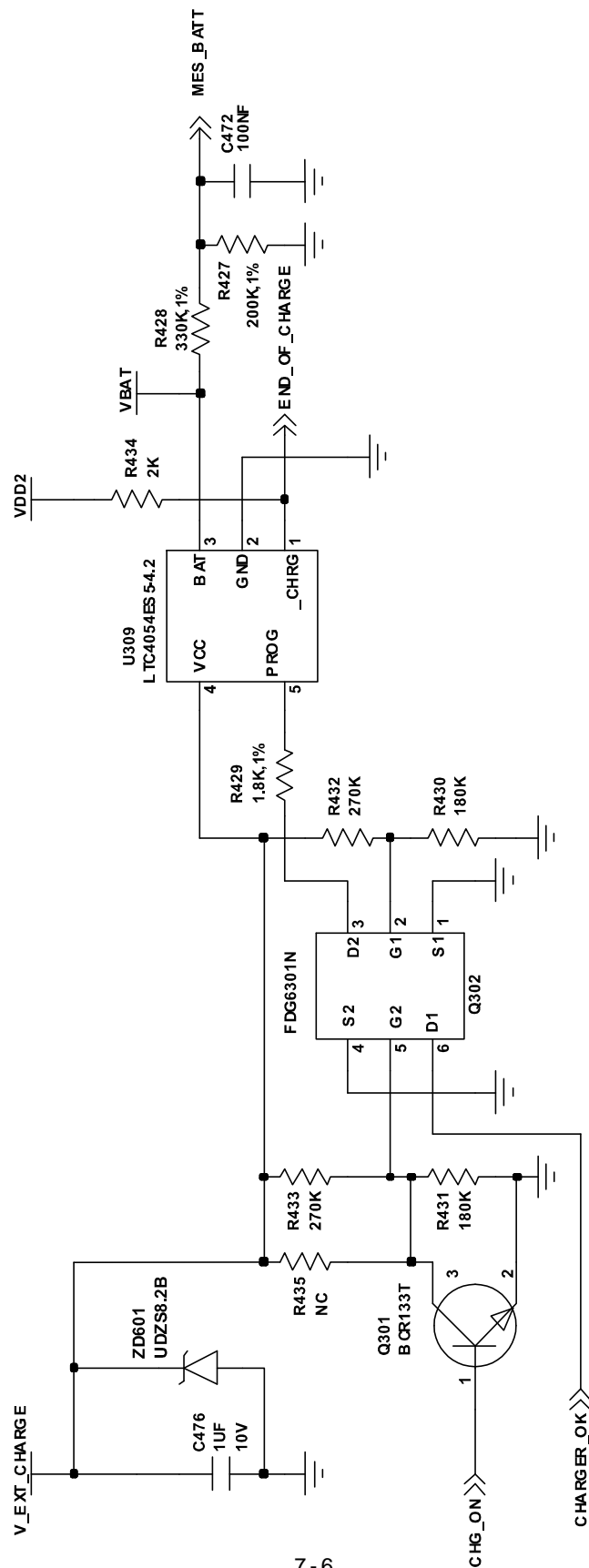


3. Charging Part

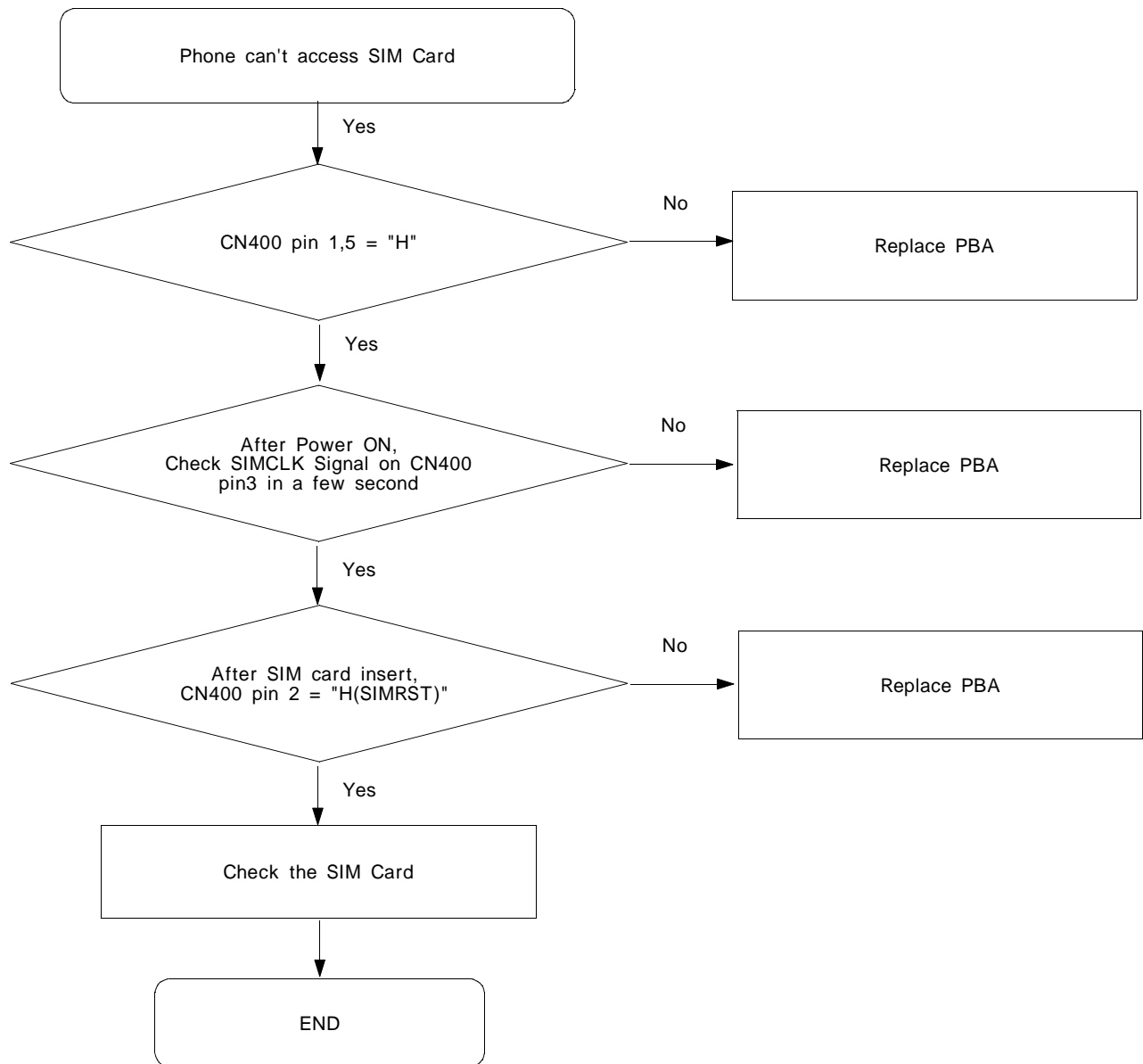


Charging

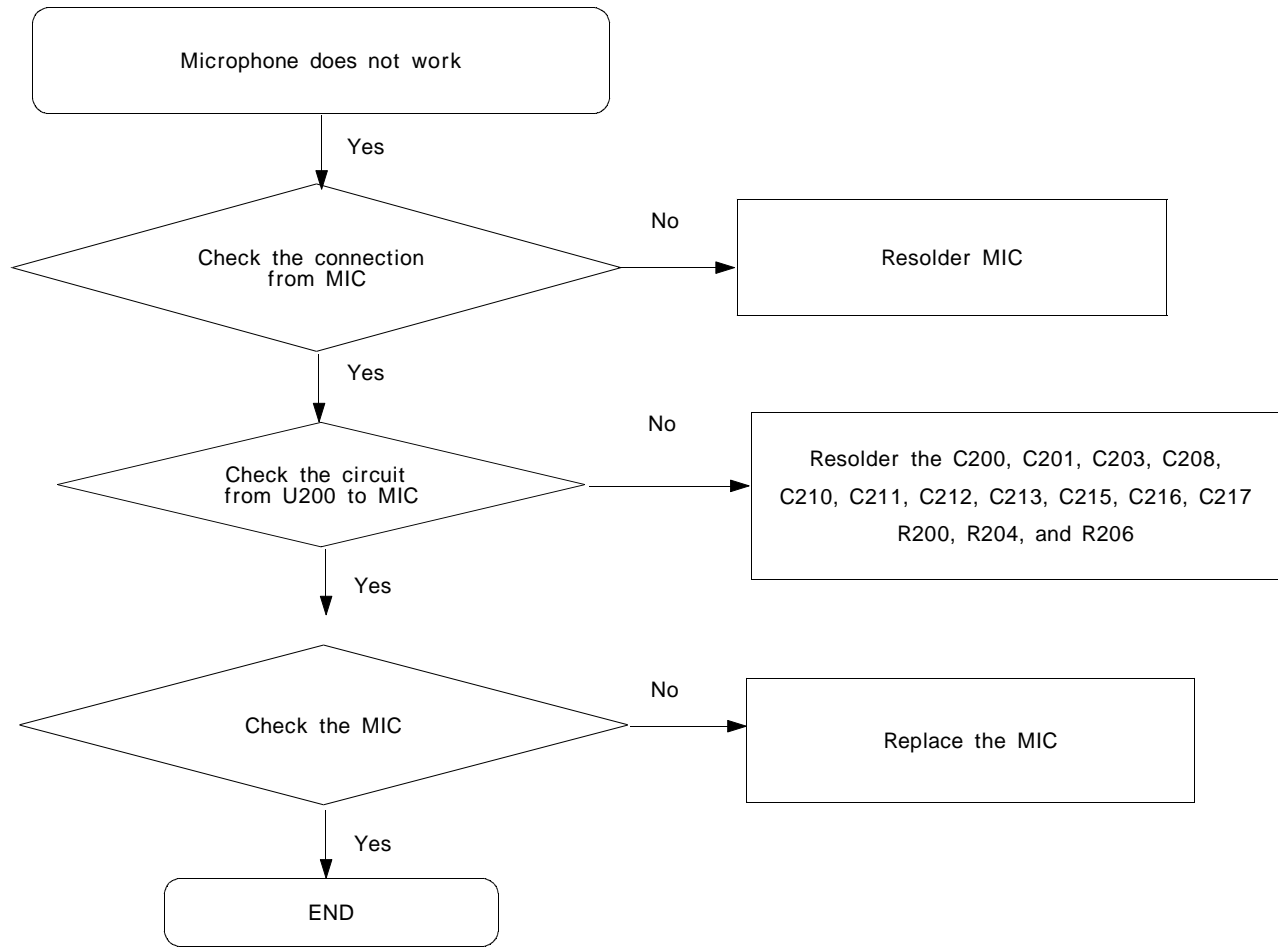
CHARGER

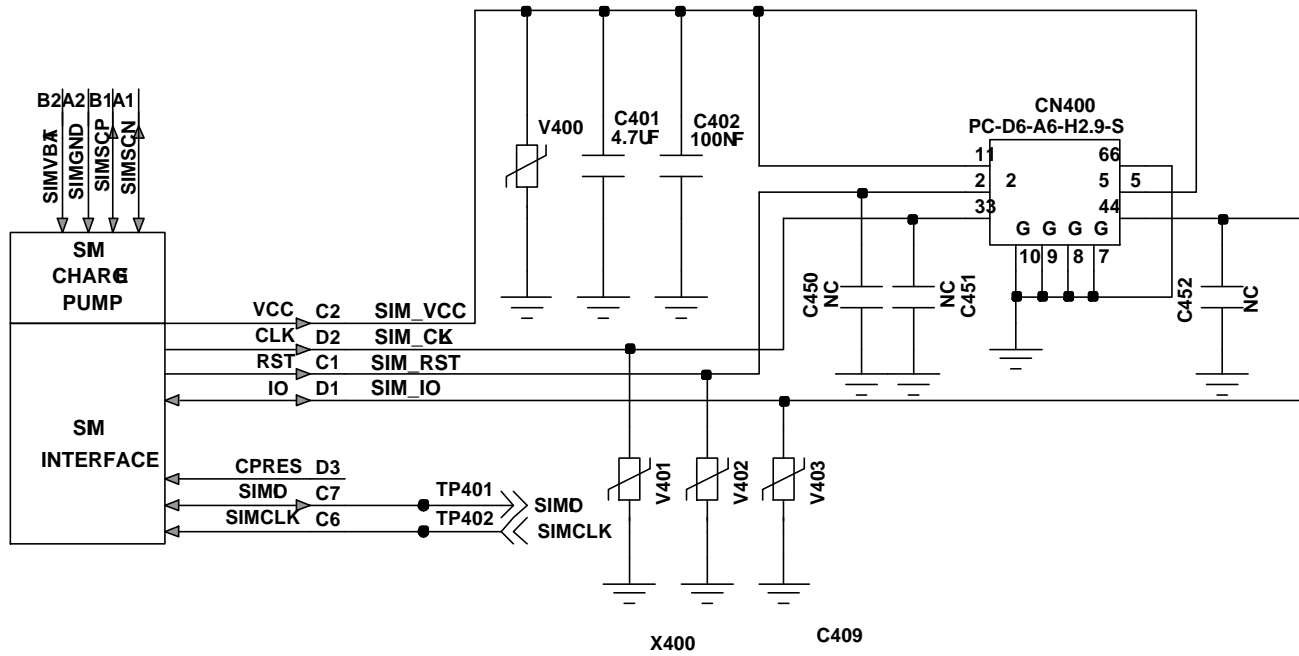


4. Sim Part

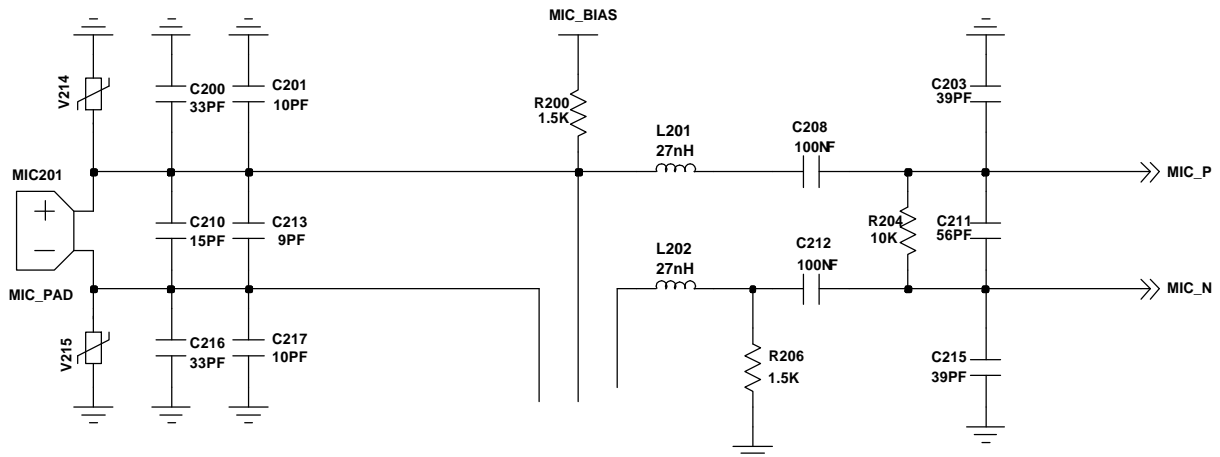


5. Microphone Part

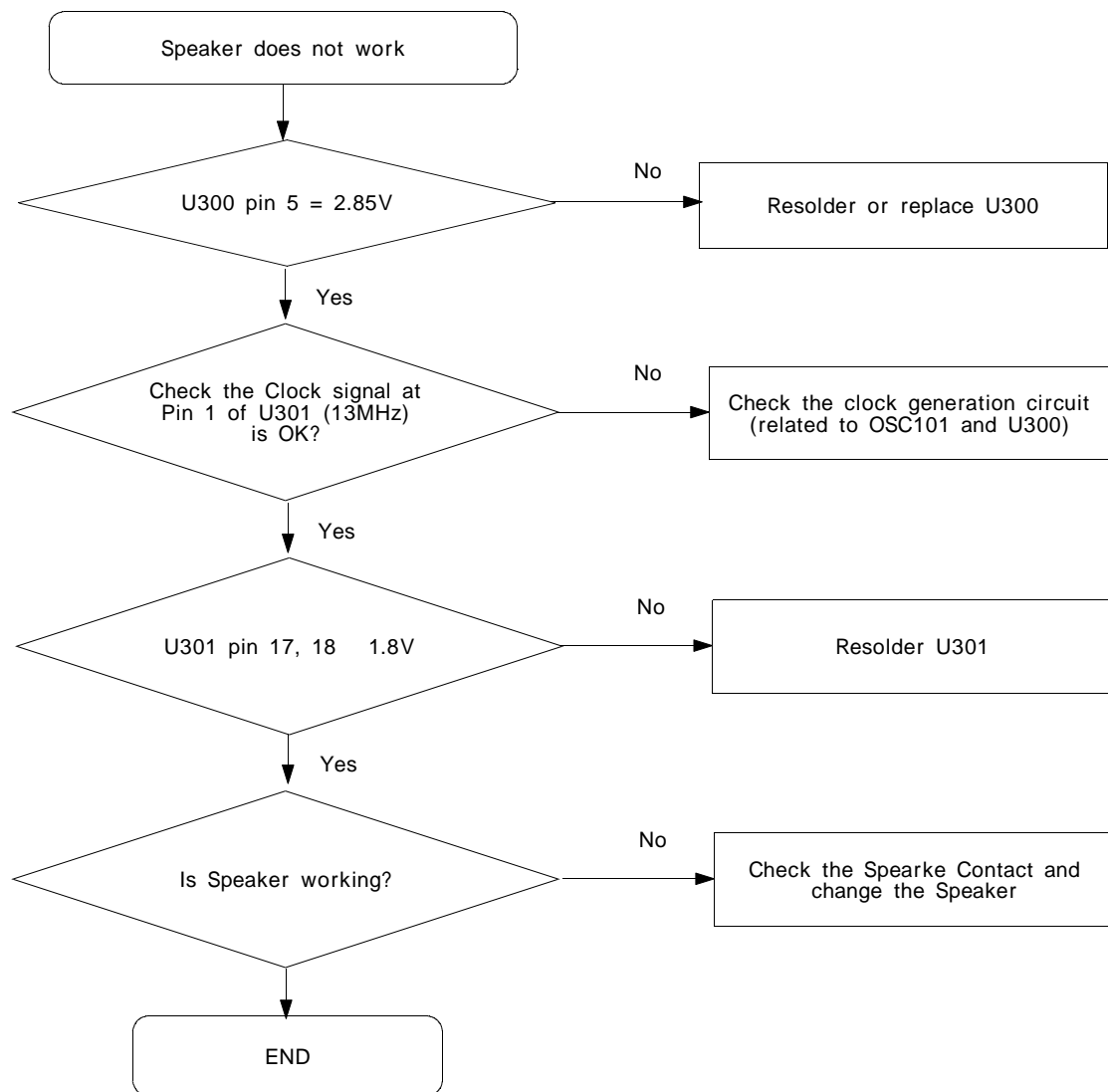




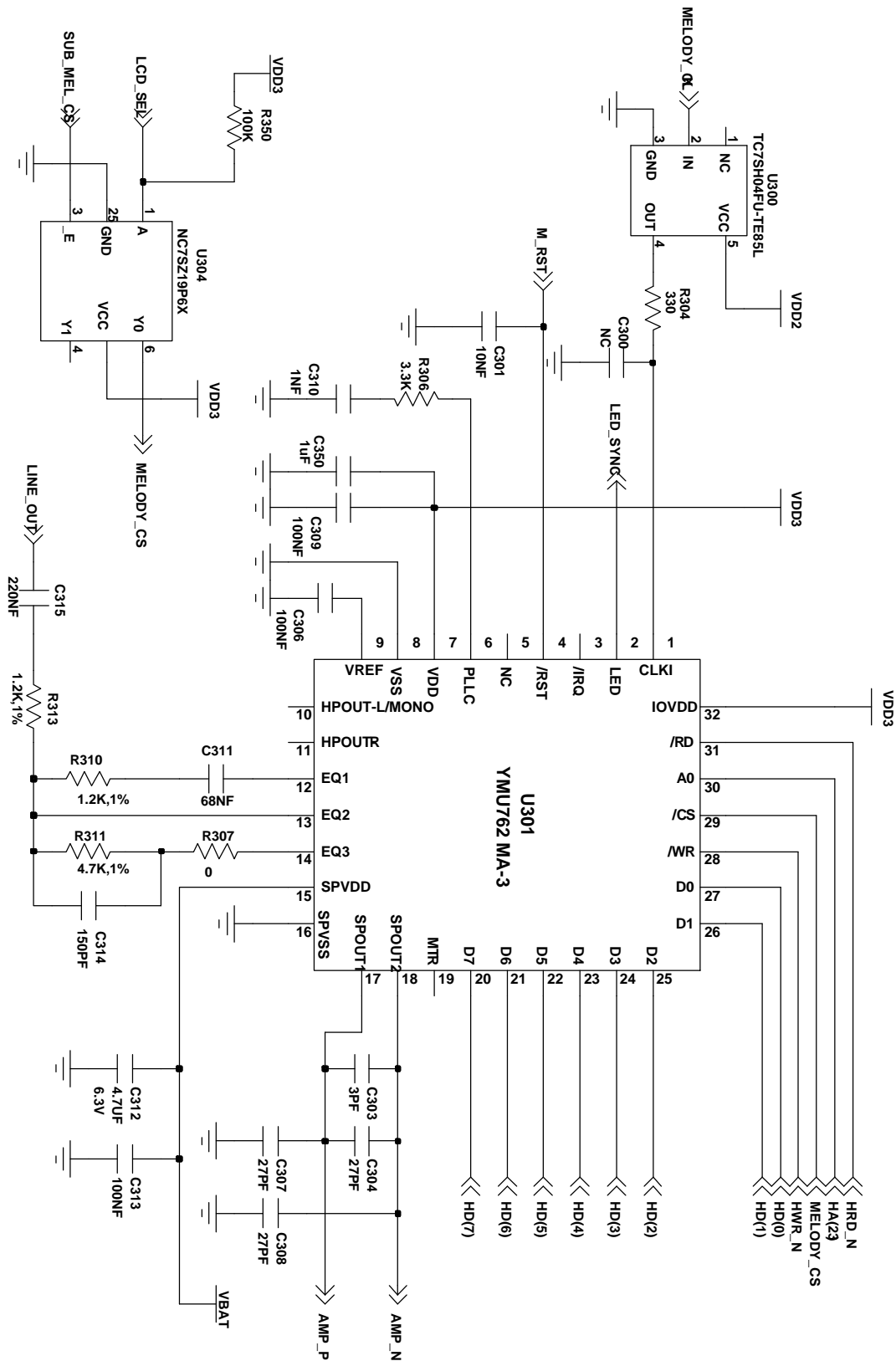
Microphone



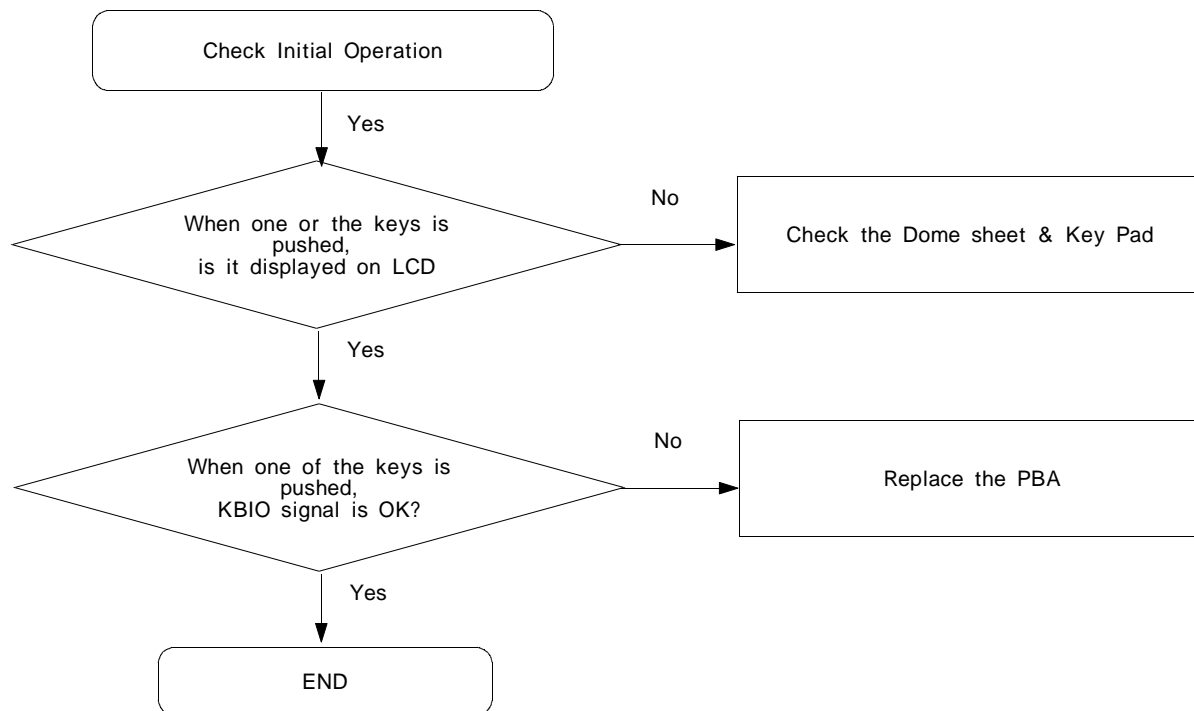
6. Speaker Part(Melody)



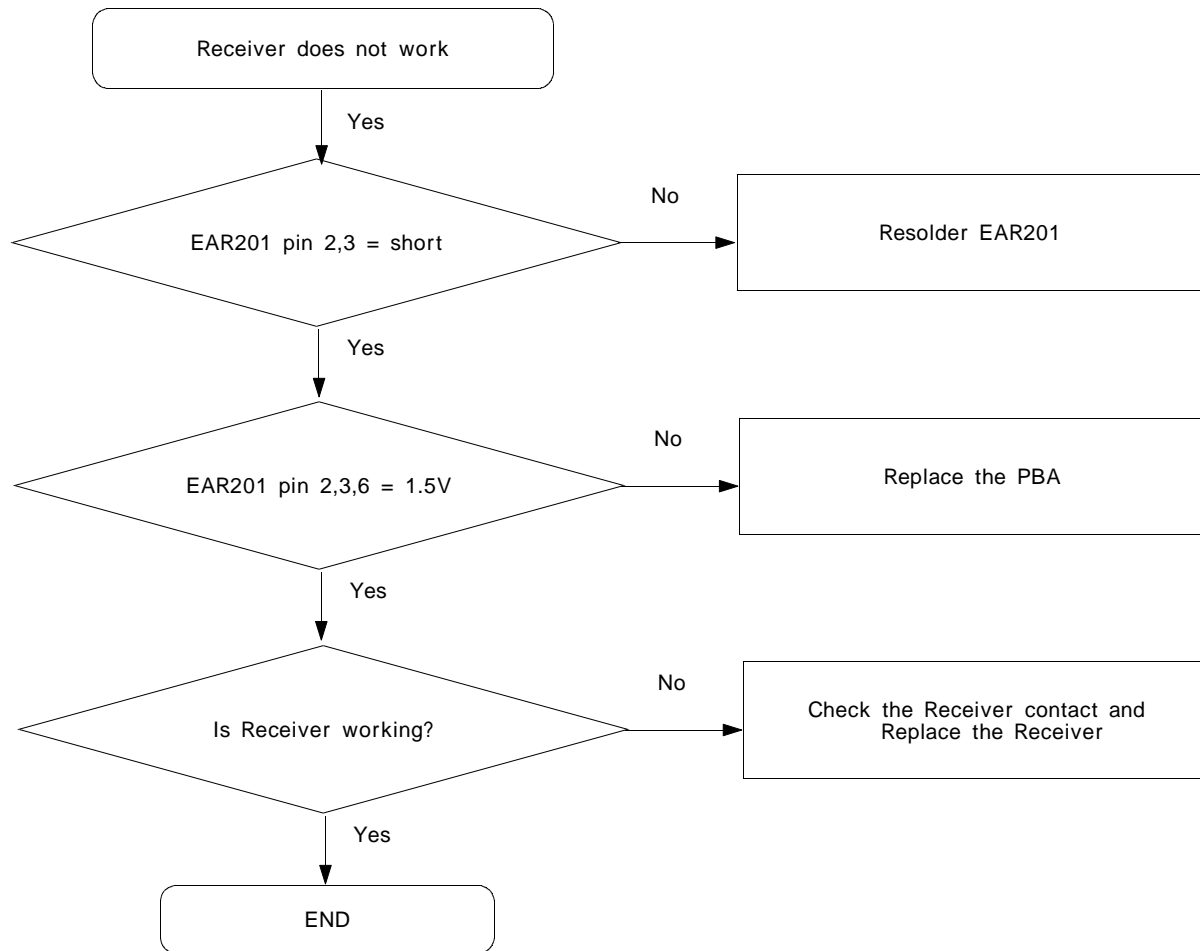
Speaker



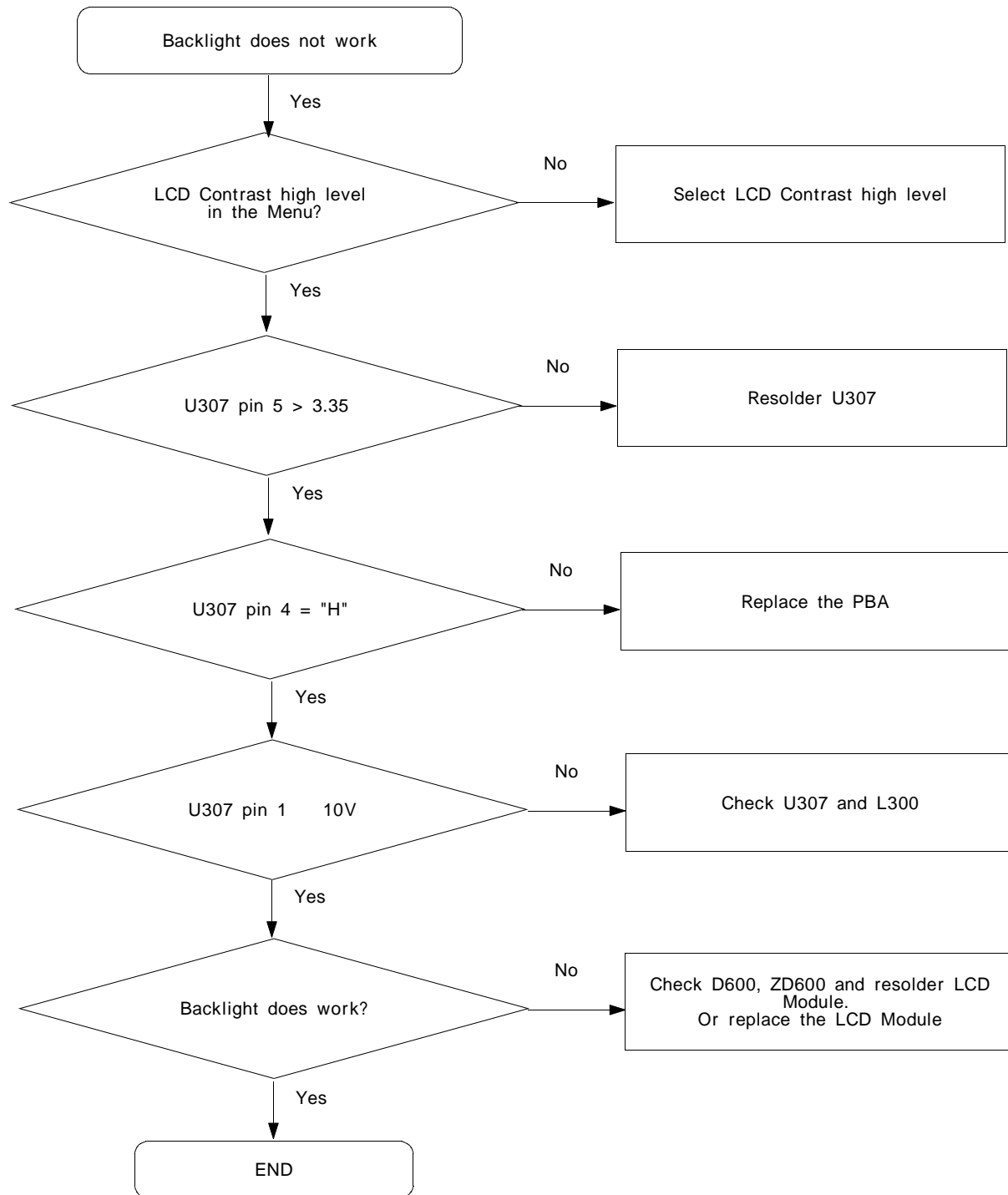
7. Key Data Input



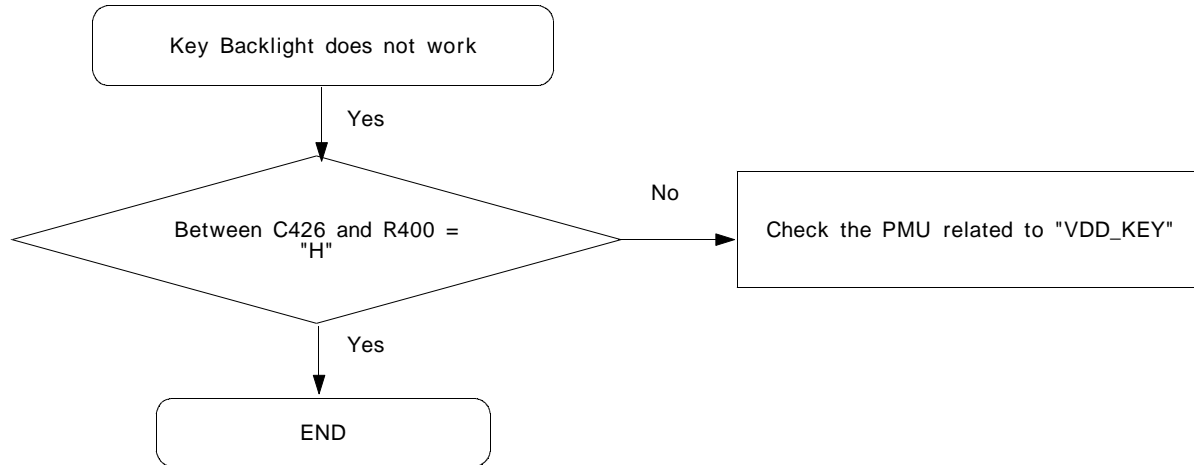
8. Receiver Part



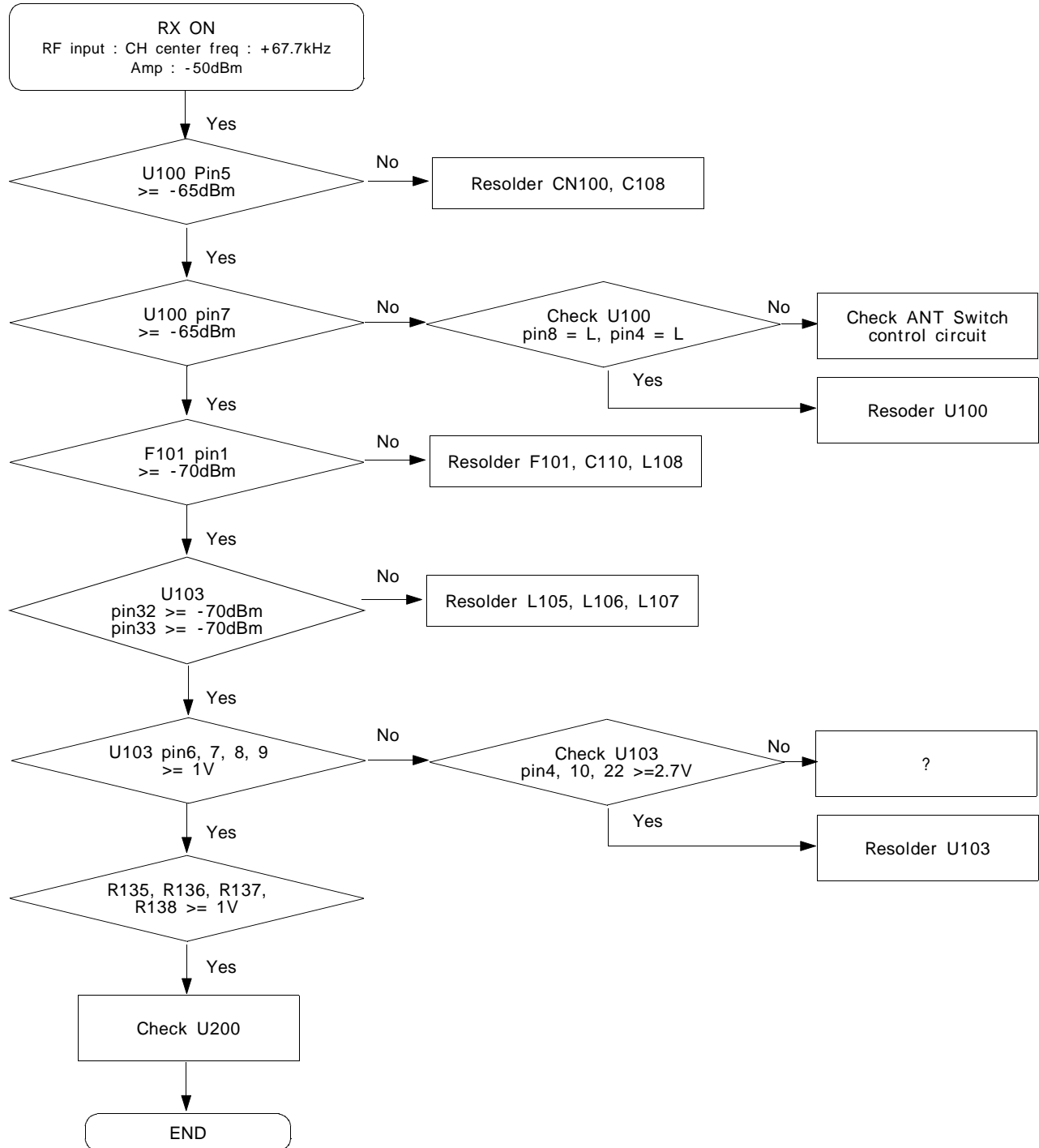
9. Back Light (for Color Main LCD)



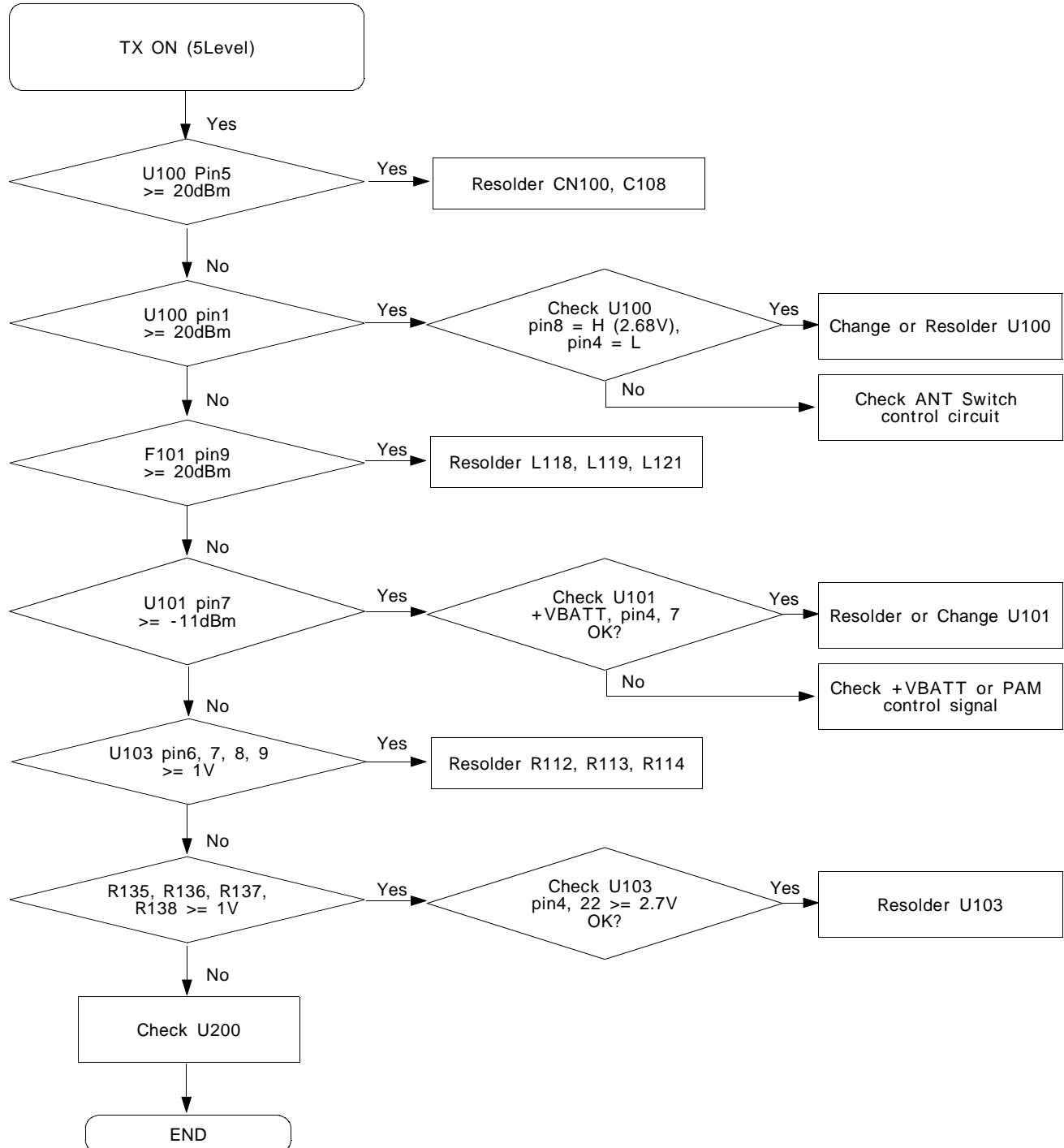
10. Key Back Light



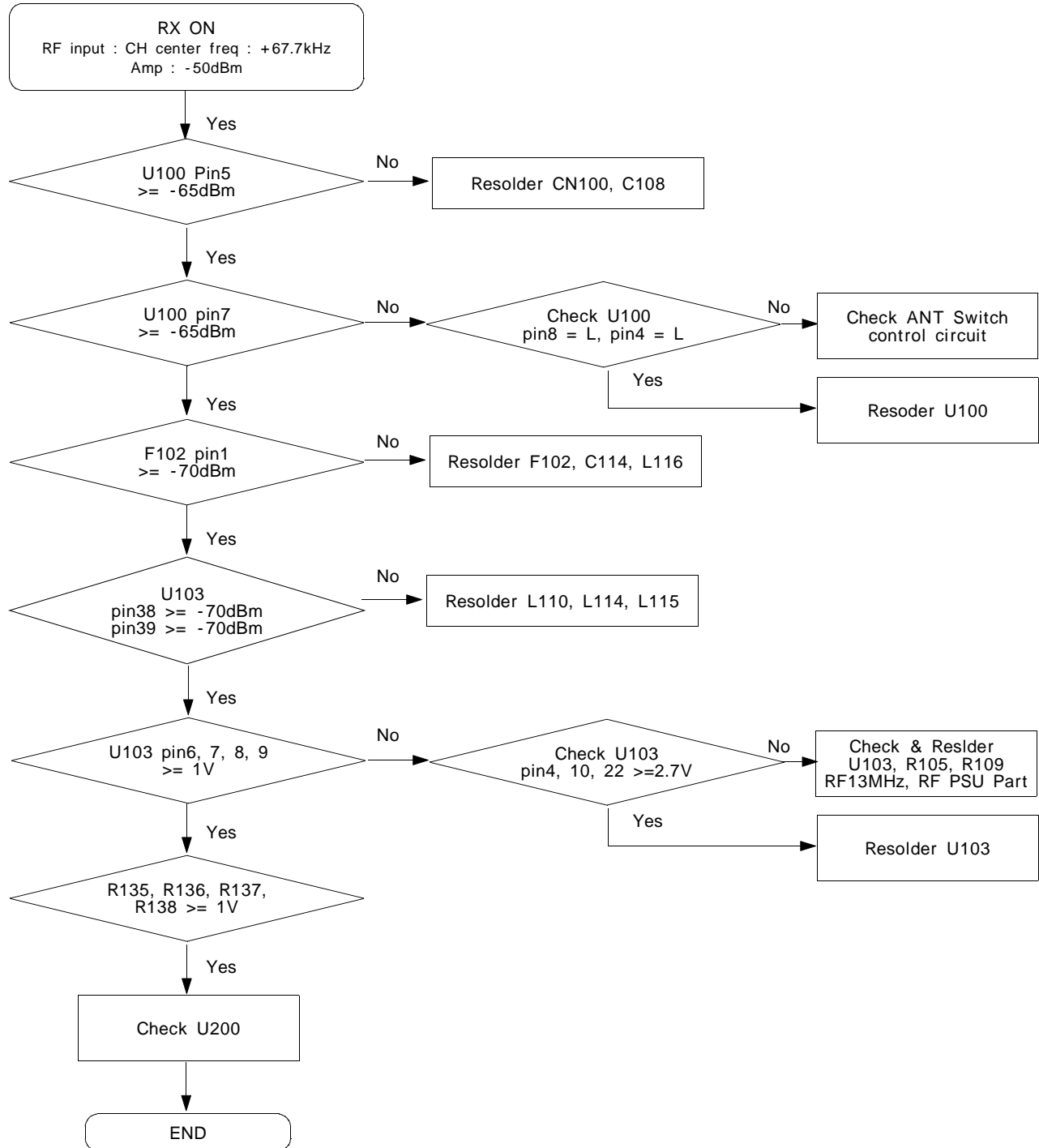
11. GSM Receiver



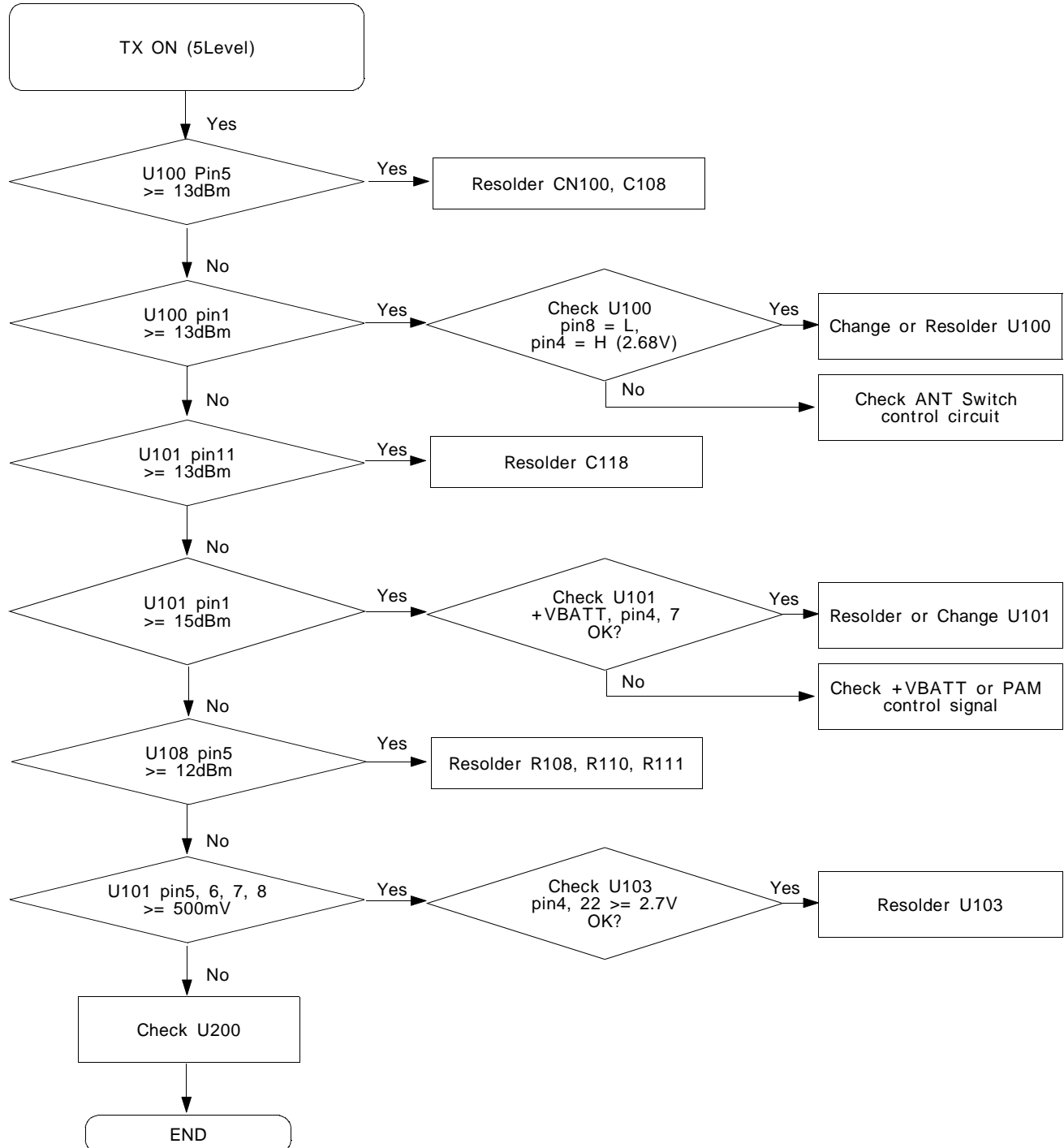
12. GSM Transmitter

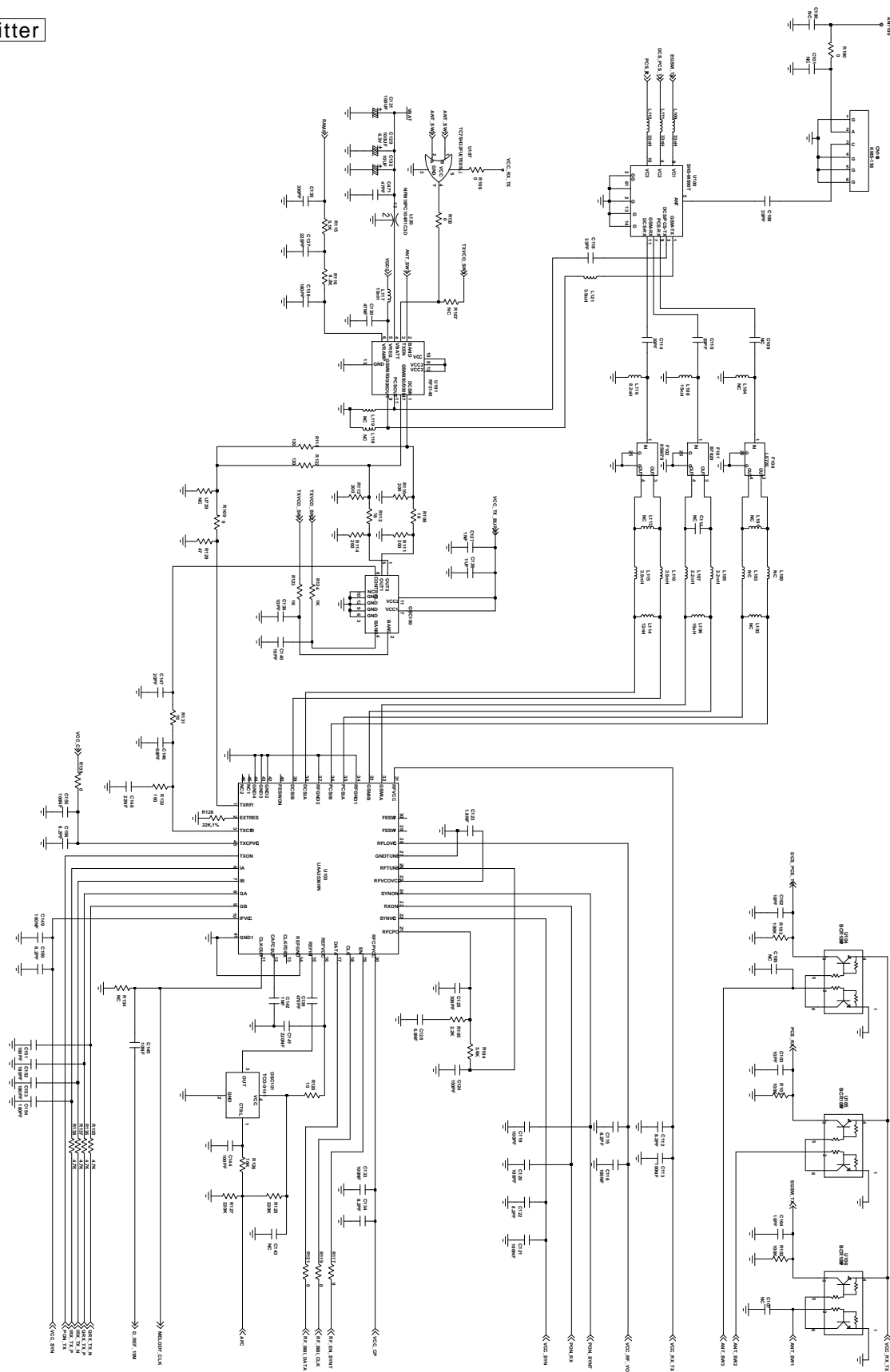


13. DCS Receiver



14. DCS Transmitter





www.s-manuals.com