A35/A36/A40
Level 2.5e

Repair Documentation

V 1.0

Table of Contents:

1. List of available level 2,5e parts A3x

ID-No	Type	Name(function)/Location	Rep-Code	Order No.
V100	Transistor	TXon1/Logic	4SWT	L36840-C4009-D670
D100	IC	Egold+/Logic	4EGO	L36810-G6103-D670
Z100	Quartz	OSC_Egold+/Logic	4OSC	L36145-F102-Y10
V200	Transistor	Charge/Logic	4CHT	L36830-C1064-D670
D200	IC	ASIC/Pow.Supply	4SPA	L36145-J4682-Y23
N201	IC	Volt.Reg./Logic	4REG	L36810-C6062-D670
V193	Transistor	Light/Logic	4LIT	L36830-C1096-D670
V501	Transistor	TX_PA/RF	4PAT	L36840-C4013-D670
V502	Transistor	TX_PA/RF	4PAT	L36840-C4013-D670
V508	Transistor	TX_PA/RF	4PAT	L36840-C4014-D670
N501	IC	Op.Amp/RF	4OPA	L36810-C6053-D670
V435	Transistor	Volt_SW/RF	4SWT	L36840-C4009-D670
V509	Transistor	Diplex_SW/RF	4TDI	L36840-C4035-D670
V510	Transistor	Diplex_SW/RF	4TDI	L36840-C4010-D670
V506	Transistor	Diplex_SW/RF	4TDI	L36840-C4009-D670
V507	Transistor	Diplex_SW/RF	4TDI	L36840-C4009-D670
N430	IC	Volt.Reg./RF	4REG	L36820-C6070-D670
N431	IC	Volt.Reg./RF	4REG	L36820-C6147-D670
Z502	IC	PA/RF	4PAM	L36851-Z2002-A40
D400	IC	Demod/Mod/RF	4DEM	L36820-L6102-D670
Z500	Filter	IF_360/RF	4IFF	L36145-K280-Y127
Z555	Filter	RX_PCN/RF	4FI1	L36145-K280-Y165
Z556	Filter	RX_GSM/RF	4FI3	L36145-K280-Y160
D550	IC	LNA/RF	4LNA	L36820-L6047-D670
Z600	Quartz	13MHz/RF	4VCX	L36145-F220-Y6
Z530	VCO	1LO_VCO	4VC1	L36145-G100-Y50
Z570	VCO	TX/RF	4VCT	L36145-G100-Y32
V530	Transistor	1LO/RF	4TLO	L36820-C6047-D670
V601	Transistor	13_AMP/RF	4T13	L36840-C4039-D670
V230	Transistor	Vibra/Logic	4VIT	L36702-C1340-S67

2. Required Equipment for Level 2,5e A35/36/40

- Ø GSM-Tester (CMU200 or 4400S incl. Options)
- Ø PC-incl. Monitor, Keyboard and Mouse
- Ø Bootadapter 2000 (L36880-N9241-A200)
- Ø Troubleshooting Frame A35/36 (F30032-P81-A2)
- Ø Power Supply
- Ø Spectrum Analyser (Advantest 3221)
- Ø RF-Probe incl. Power Supply (e.g. from Agilent)
- Ø Oscilloscope incl. Probe
- Ø RF-Connector (N<>SMA(f))
- Ø Power Supply Cables
- Ø Dongle (F30032-P28-A1)
- Ø BGA Soldering equipment

Reference: **Equipment recommendation Level 2,5e**

3. Required Software for Level 2,5e A35/36/40

- Ø Windows NT Version4
- Ø Winsui version1.22 or higher
- Ø Winswup
- Ø Windows software for GSM-Tester (Cats or CMU-GO)
- Ø Software for 13MHz adjustment
- Ø Internet unblocking solution for "Service Mode"

4. Radio Part

Notes

The radio part converts the I/Q base band signals supplied, by the logic (EGOLD+) into RF-signals with characteristics as per the GSM recommendation (transmission) which are radiated by the antenna.
Or the radio part converts the received GMSK signal, supplied by the antenna into I/Q base band signals, which can be further processed by the logic (EGOLD+).
The radio part is designed for Dual Band operation and can therefore serve the frequency bands EGSM900 and GSM1800. The radio part can never transmit and receive in both bands simultaneously. However, the monitor time lot can be selected independently of the frequency band.
Transmitter and receiver are of course never operated simultaneously.

The radio part consists of the following blocks:

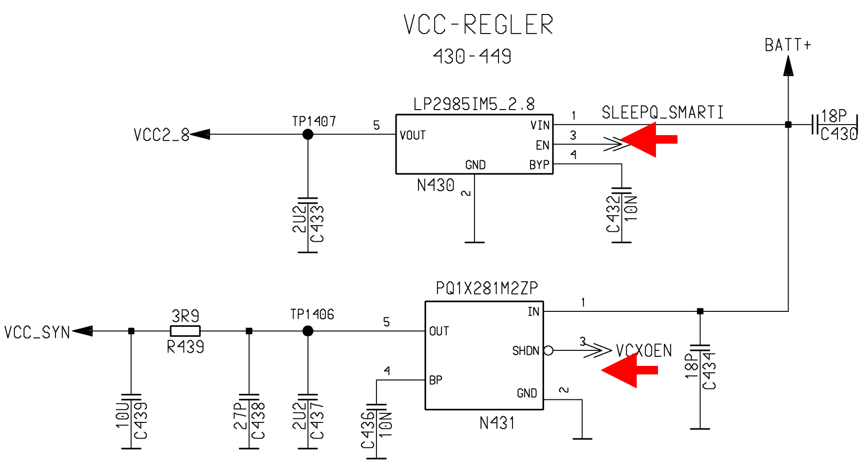
- Power supply (RF-Voltage regulators)
- Synthesizer (partly located in SMARTI)
- Receiver (partly located in SMARTI)
- Transmitter (Up conversion loop partly located in SMARTI)
- Transmitter (Power amplifier)
- Antenna Switch

4.1 Power Supply RF-Part

Two voltage regulators (N430/431) with a nominal output voltage of 2.8V are used, to perform the required "RF-Voltages".
The voltage regulator N430 is activated via SLEEPQ_SMARTI provided by the EGOLD+ (**TDMA-Timer H12**).
The voltage regulator N431 is activated via VCXOEN provided by the EGOLD+ (**Functional P7**).

The name of the voltages are: a) **VCC_SYN** activated by VCXOEN
and b) **VCC2_8** activated by SLEEPQ_SMARTI

For both voltages **BATT+** is required.



4.2 Frequency generation

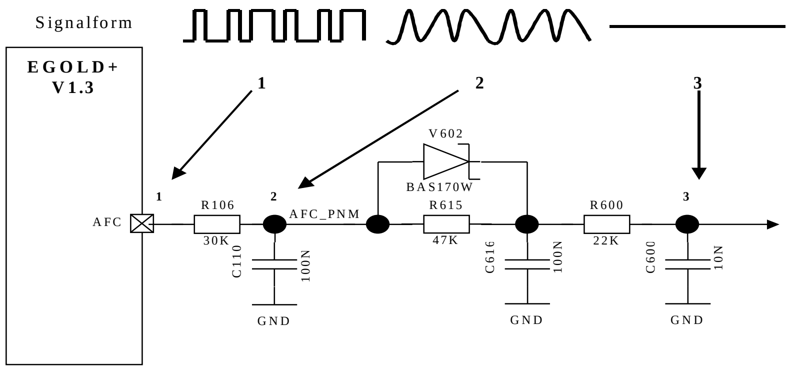
4.2.1 Synthesizer : The discrete VCXO (13MHz)

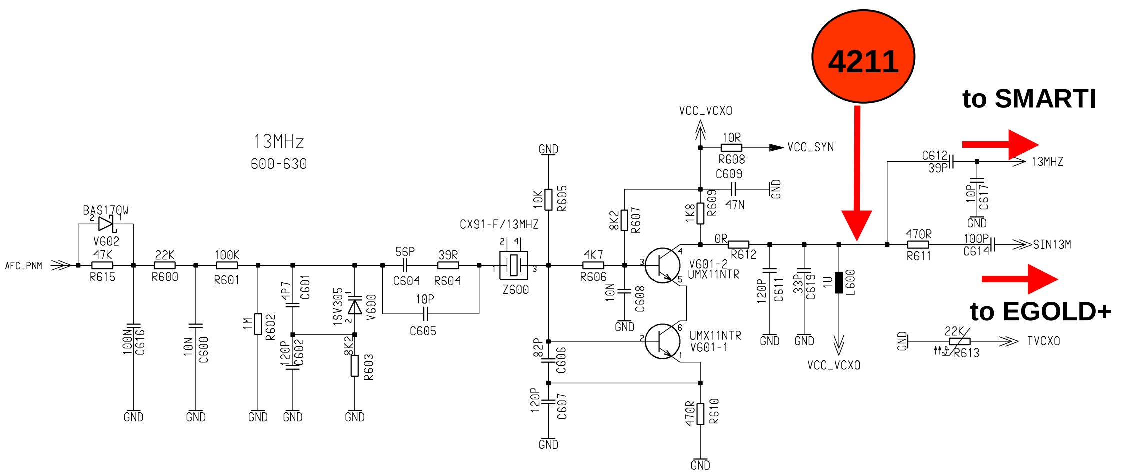
Notes

The Axx 13MHz signal is generated by a discrete VCXO. consisting of a colpitts oscillator with a crystal Z600 and a post-switched buffer stage as oscillator switch. The subsequent oscillating circuit (C611,C619, L600) and the resistor R611 create a de-coupling of the synthesiser from interference signals, coming from the logic (SIN13M **(functional F13M)**).
The oscillator frequency is controlled by the EGOLD+ **(functional R3)** generated AFC_PNM signal, and the capacity diode V600, to ensure that the circuit is working is stable conditions < 7,7ms after switching on the oscillator.
To reduce the charging time of the low pass (R615, C616) the resistor R615 is bridged by the diode V602.
For temperature control a temperature-dependent resistor R613 is placed near the VCXO.

The required voltage VCC_SYN is provided by the N431.

The picture 4211 shows the signal at the collector of transistor V601_2.





4.2.2 Synthesizer : LO1

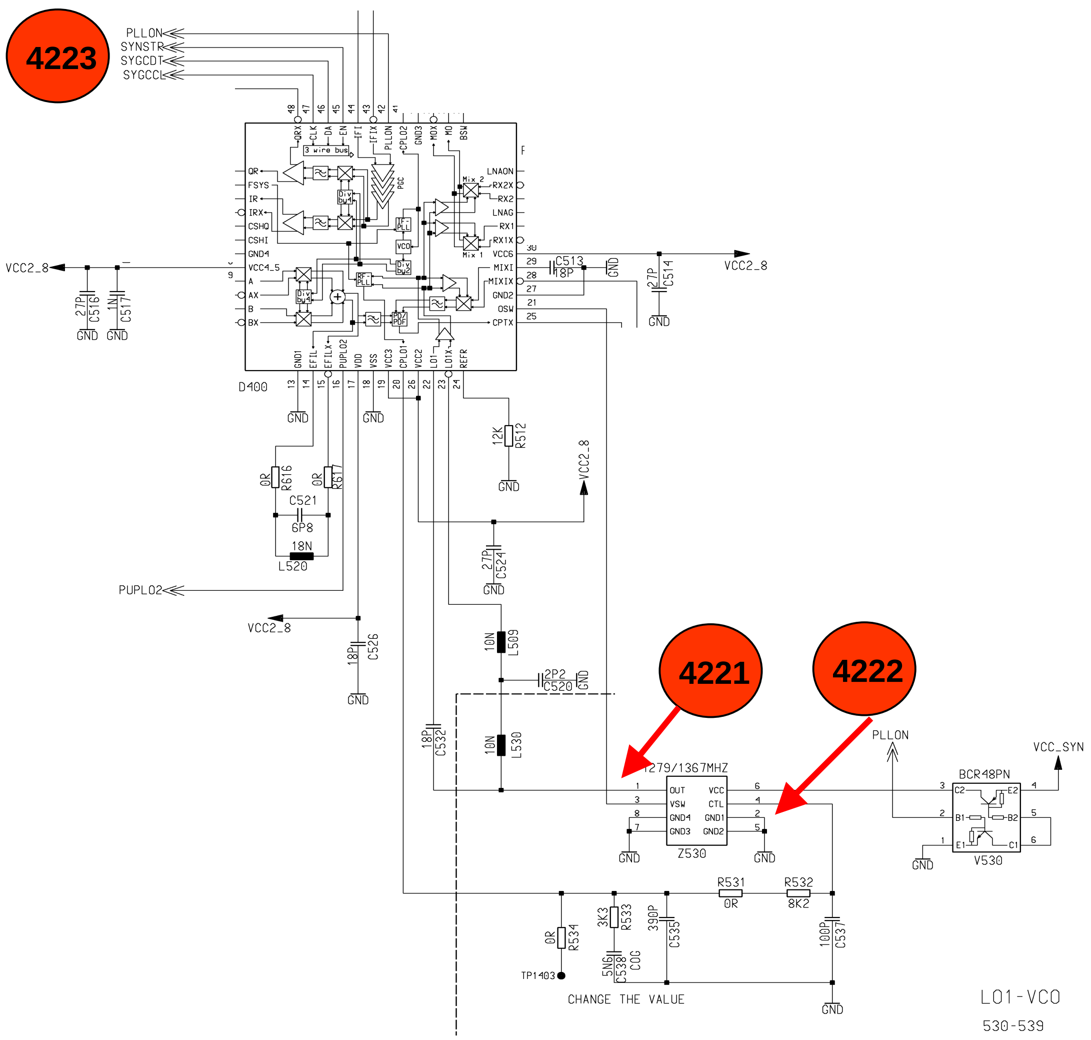
The first local oscillator (LO1) consists of the **D400** PLL part, a loop filter and a VCO (**Z530**) module. This LO1 circuit generates frequencies from 1445MHz to 1520MHz for GSM 1800 RX-operation, and from 1285MHz to 1361MHz for the other operations. The Z530 is switchable to select the channels in stages of 200kHz. The VCO module is activated by the EGOLD+ signal PLLON **(TDMA-Timer J12)** via V530. The switching between GSM900 and GSM1800 is realised by the OSW signal from the SMARTI (D400 pin 21),
The channel programming happens via the EGOLD+. signals SYGCCL, SYGCDT, SYNSTR.
The VCO output signal fulfils three functions:

a) It enables the SMARTI IC to mix the RXIF-Frequency (360 MHz)
b) It enables the SMARTI IC to mix the TXIF-Frequency (424 MHz)
c) It ensures with the help of the 13MHz signal and the SMARTIs PLL part the frequency stability by generating a control voltage at (SMARTI pin 20)

The required voltages are: VCC2_8 for D400 provided by N430.
VCC_SYN for the VCO provided by N431

The picture **4221** shows the VCO output signal
The picture **4222** shows the control voltage
The picture **4223** shows the programming signals for the PLL

Notes



4.2.3 Synthesizer : LO2

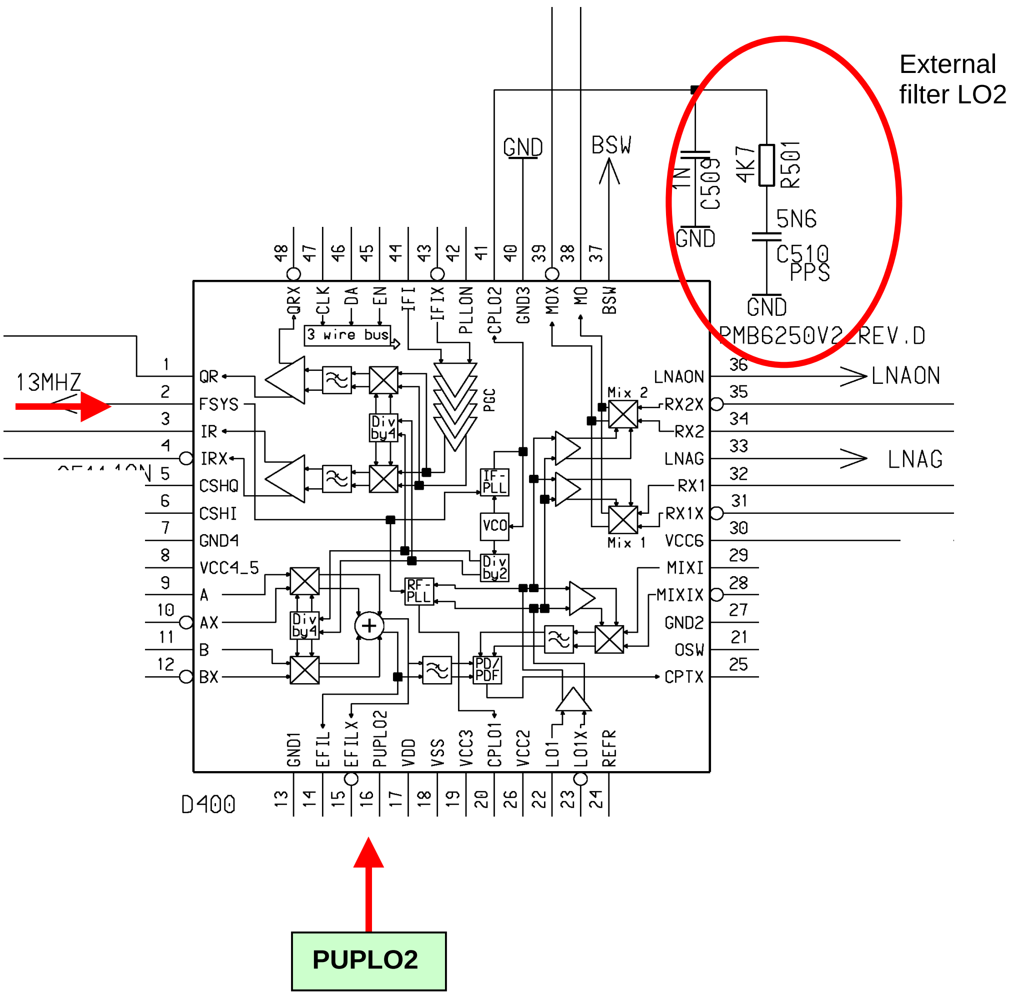
The second local oscillator (LO2) consists of:

a) the SMARTIs (D400) PLL part
b) the 13MHz reference signal
c) a switchable VCO (inside the SMARTi)
d) an external filter (C509,C510,R501).

The VCO generates 2 frequencies (1440MHz for RX-Mode and 1696 MHz for TX-Mode).
Both frequencies are divided by 4, to get the 360MHz demodulator frequency and the 424MHz modulator frequency.
The RX/TX switching is done internally, initiated by the EGOLD+ through the SYGCCL, SYGCDT,SYNSTR signals.
Using the EGOLD+ signal PUPLO2 **(TDMA-Timer L11)** at pin 16, the second local oscillator is switched "ON and OFF"

The required voltage VCC2_8 for D400 is provided by N430

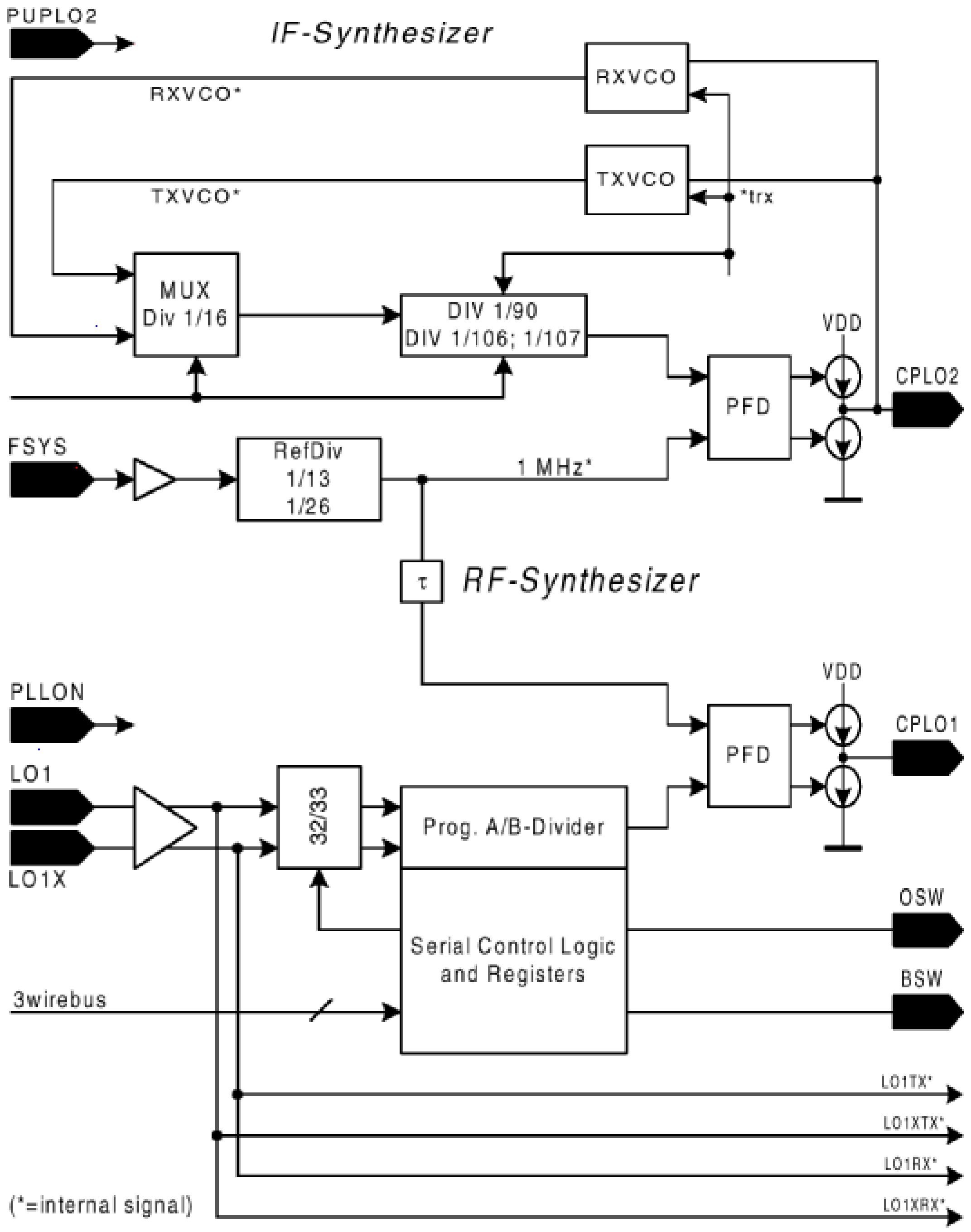
Notes



4.2.4 Synthesizer : PLL

PLL as a part of the PMB6250 (SMARTI) IC D400

Blockdiagramm



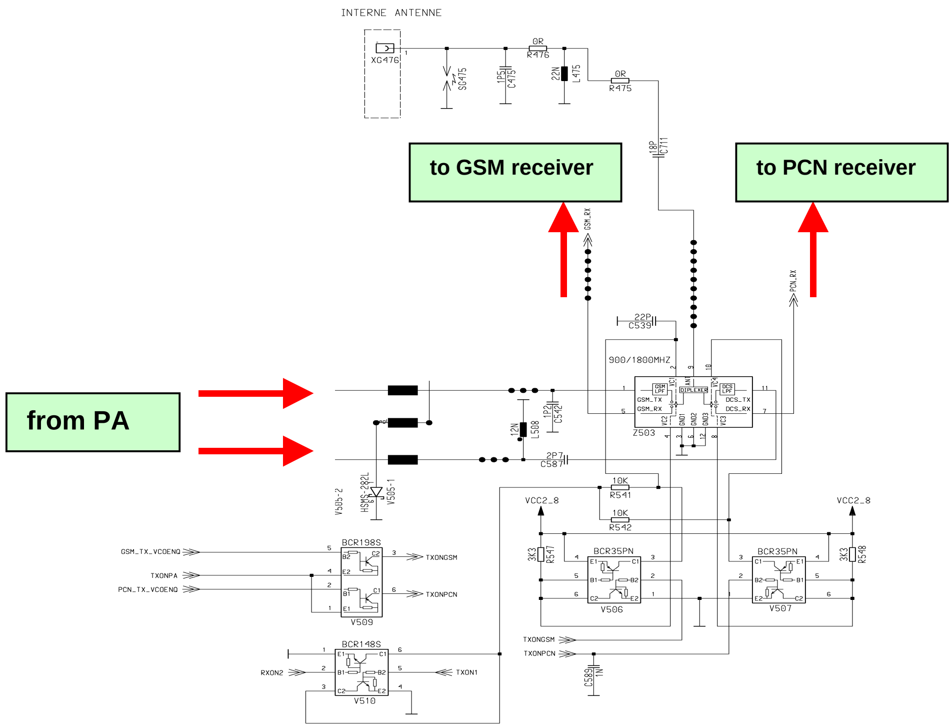
4.3 Antenna switch (electrical)

Internal > Receiver/Transmitter <> GSM900/1800

Notes

The Axx mobile has in opposite to P35 only one antenna switch (electrical).

➞ The electrical antenna switch (Diplexer Z503) is used for the differentiation between the receiving and transmitting signals, just like the differentiation between GSM900 and GSM1800.
To do so the transistors V506,V507,V509 and V510 are used to switch the diplexer signals VC1–VC4 as required.



Please note, that Axx mobiles have no external antenna connector.

The matrix below shows the different conditions at the diplexer and the accompanying signals.

	VC1	VC2	VC3	VC4
GSM Rx	0	1	1	0
Tx	1	0	1	0
PCN Rx	0	1	1	0
Tx	0	1	0	1

4.4 Receivers

4.4.1 Receiver: GSM900/1800 Diplexer > Filter > LNA > Mixer

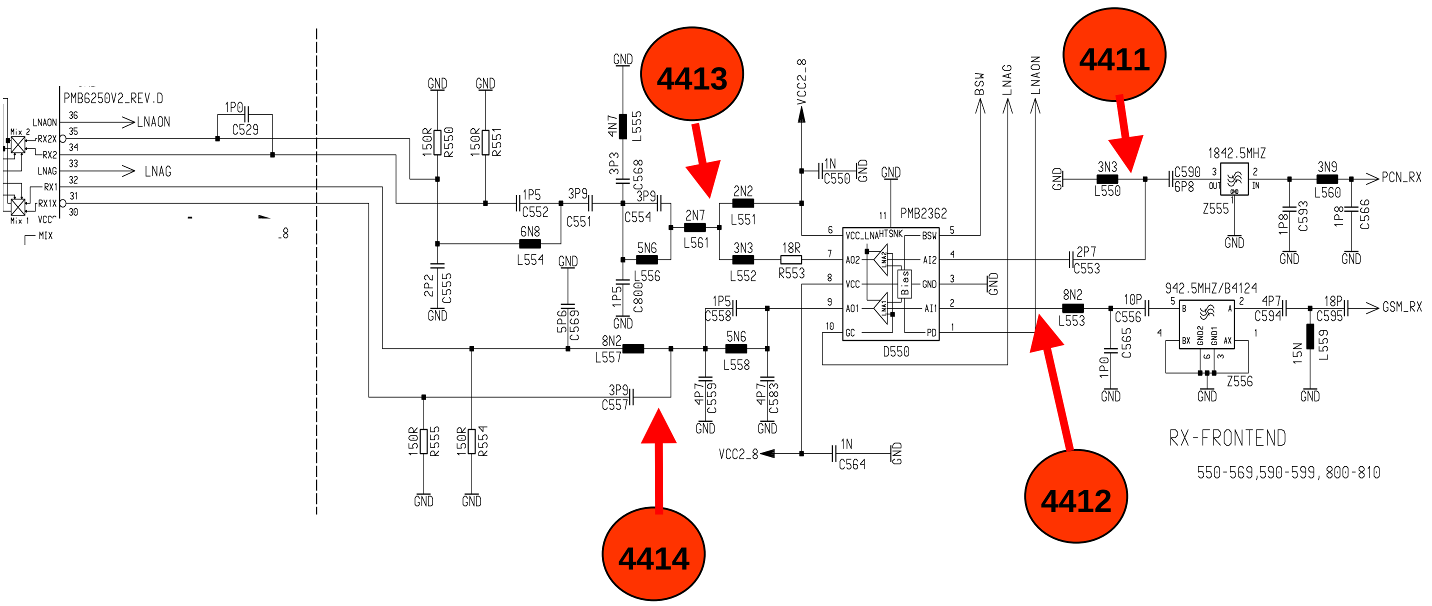
Notes

From the antenna switch up to the IF-Mixer, the GSM1800 receiver circuit consists of:

a) a ceramic front end filter (**Z555**)
b) a LNA (**L**ow **N**oise **A**mplifier **D550**)
c) and a subsequent discrete distortion LC-high-pass-filter.

For GSM900 the signal flow is as follows: From the antenna switch, via a SAW filter (**Z556**), through the LNA (**D550**) and a discrete distortion LC-low-pass-filter to the IF-Mixer..
The amplification of both LNA´s is approx. 20dB with a matched 50 ohm output.
The LNA is switched “On” with the signal LNAON (SMARTI pin 36).
For switching between GSM1800 and GSM900 the signal BSW is generated from the (SMARTI pin 37).
The signal LNAG (SMARTI pin 33) is in use, if the received signal level is too high. with LNAG “active”, the LNA reduces the incoming signal in one step by 20dB
The non-symmetrical LNA output is connected to the IF mixer via a discrete balancing and adaptation circuit. This circuit converts the asymmetrical signal into a symmetrical signal.

The required voltage VCC2_8 is provided by N430



4.4.2 Receiver : Mixer, IF Amplifier and Demodulator

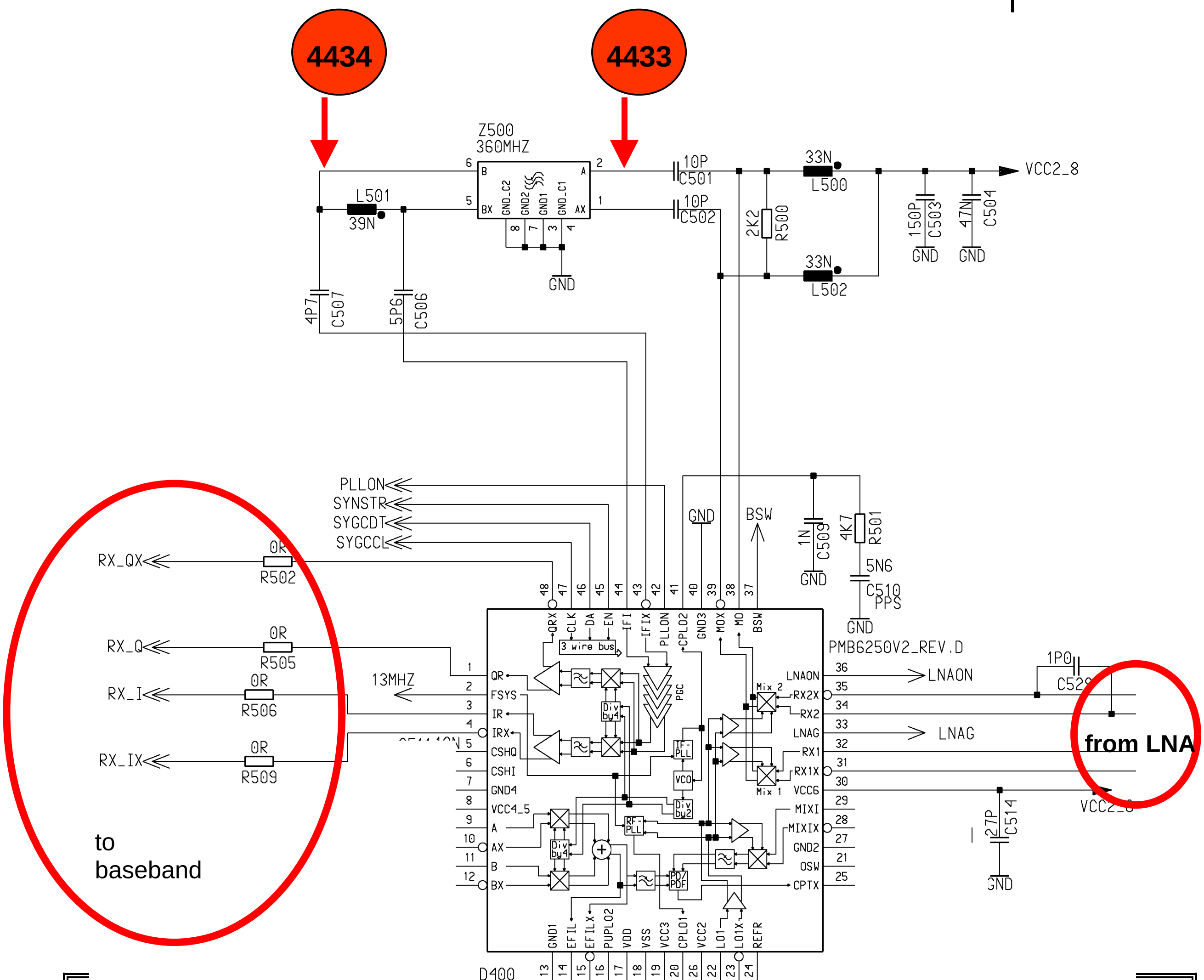
Notes

The symmetrical LNA amplified EGSM900 and GSM1800 signals arrive at the SMARTI pins 31,32,34,35, to be mixed down to the IF frequency of 360MHz..
To do so, the LO1 is guided via the SMARTI pins 22,23 to the different mixers.

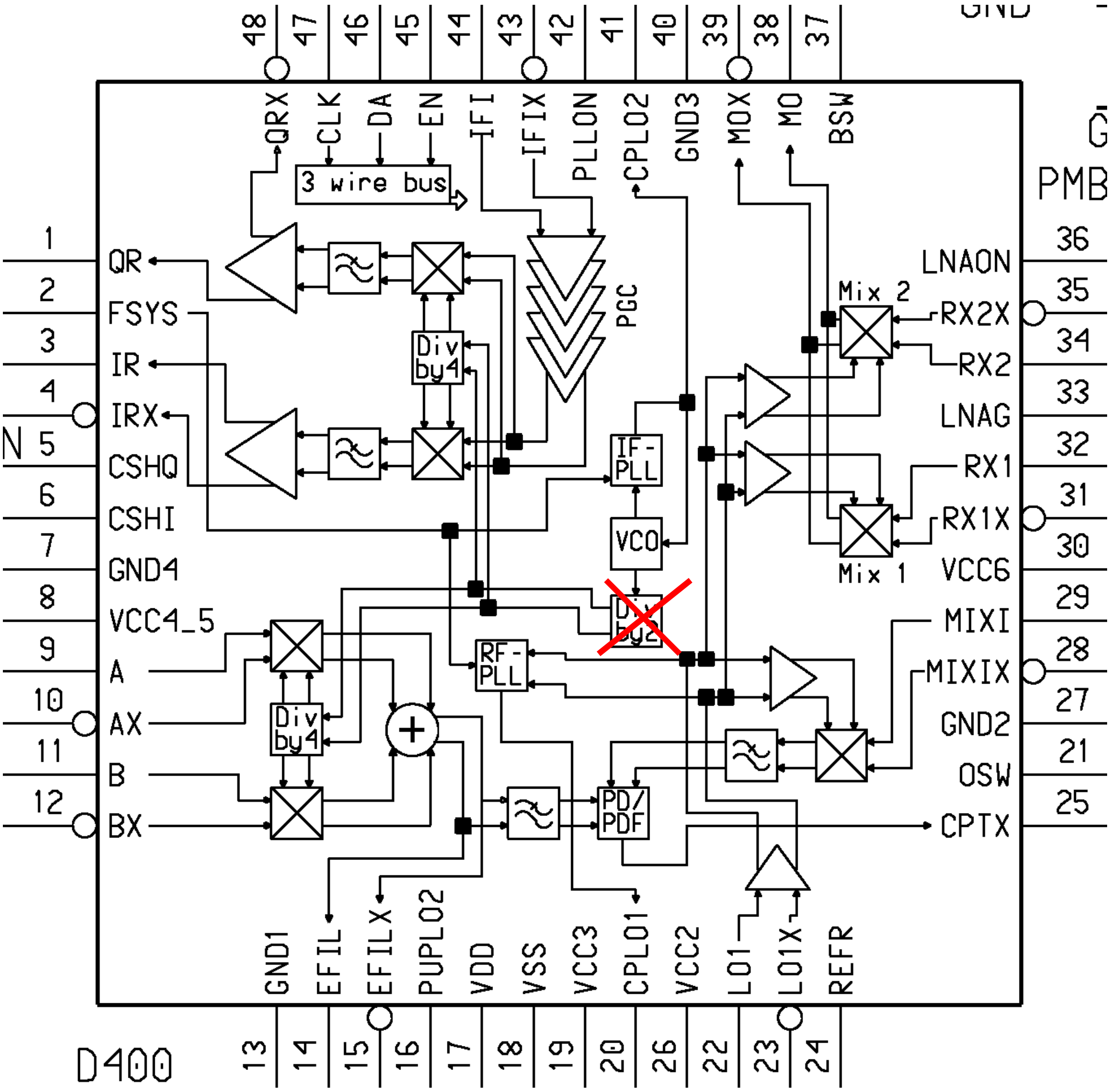
Frequency calculation of the LO1: (Freq.GSM = RF+IF and Freq.PCN = RF-IF)

After mixing, the IF is filtered by an external SAW-Filter (Z500) to arrive again at the SMARTI (input of the PGC-Amplifier).
The programmable PGC-Amplifier ensures an equalized level of the IF-Signal at the input of the I/Q demodulator. To perform this, the PGC-Amplifier is switched in 2 dB steps using the EGOLD+ signals (SYNSTR;SYGCDT;SYGCCL).
The demodulation is realised by the I/Q demodulator. To mix out the IF, the 2[nd] local oscillator frequency (1440MHz) divided by 4, is used.
Finally the “I” and “Q” signals are amplified and ready for further operations through the GAIM part of the EGOLD+ (A/D conversion) as RX_I,RX_IX-RX_Q,RX_QX at the SMARTI pins 1,3,4,48

The required voltage VCC2_8 is provided by N430



4.4.3 SMARTI IC



X **Not active**

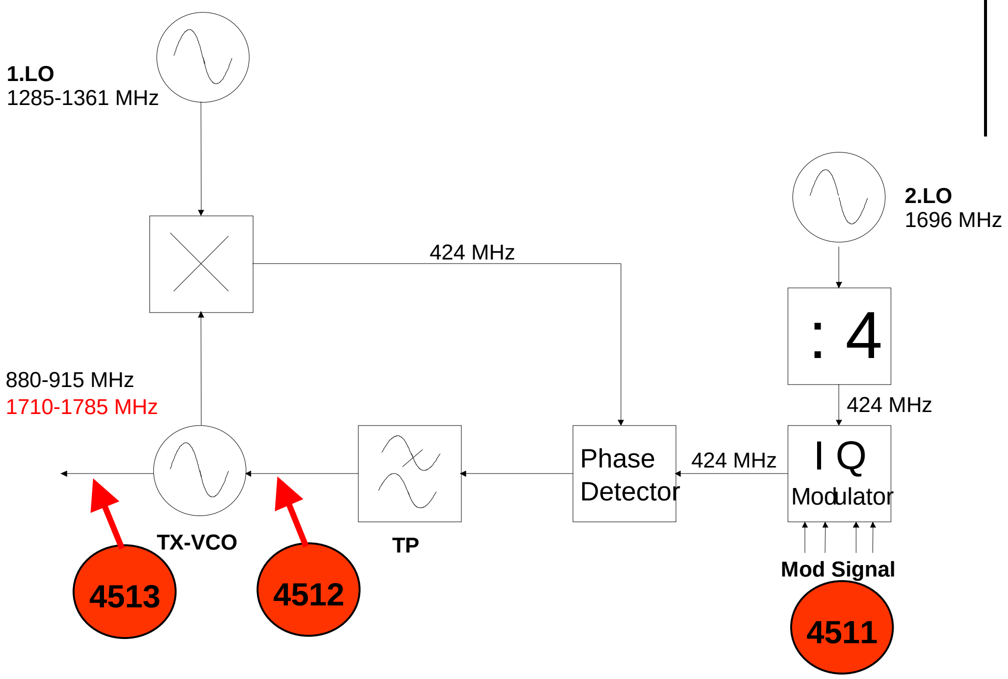
4.5 Transmitter

4.5.1 Transmitter: Modulator and Up-conversion Loop

Notes

The Axx modulation is based on the principle of the up-conversion modulation phase locked loop and is accomplished via the SMARTI(D400).
The 2nd local oszillator provides the quadratic modulator with the TX IF signals (1696MHz divided by 4 = **424MHz**).
This resulting GMSK RF signal is compared in a phase detector with the down mixed GMSK RF signal from the TX-VCO to get a control voltage for the TX-VCO.
Down mixing, is done in an internal mixer.
To close the loop, the control voltage (output of phase detector) is connected to the switchable TX-VCO (Z570) after passing a low pass filter.
The TX-VCO, a "two in one" VCO is switched with the EGOLD+ signals GSM_TX_VCOENQ**(TDMA-Timer J13)** and PCN_TX_VCOENQ**(TDMA-Timer K12)** into the different modes.

The required voltage VCC_2,8 is provided by N430

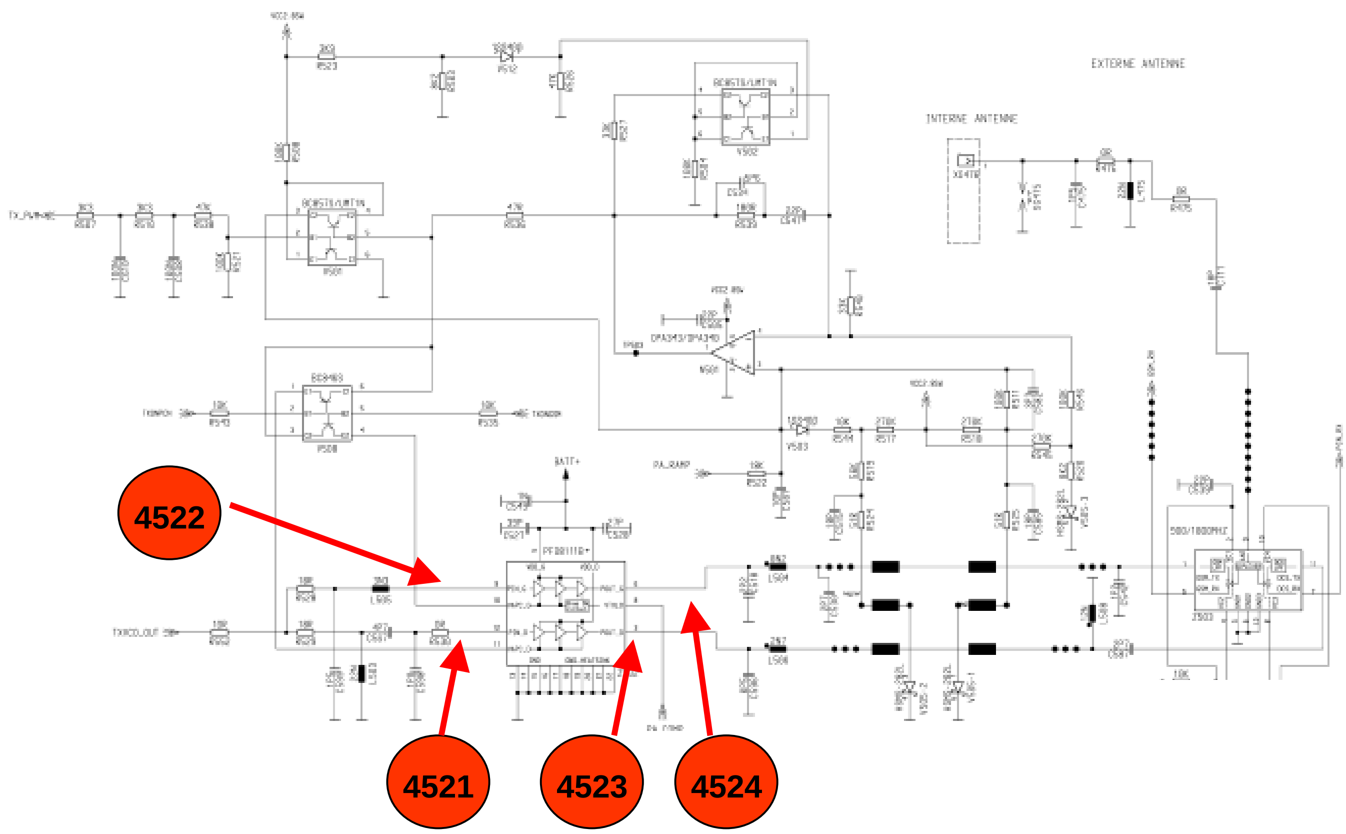


4.5.2 Transmitter : Power Amplifer Amplifier and Antenna Switch

Notes

Splited by a discrete circuit into EGSM900 and GSM1800, the TXVCO output signal arrives at the power amplifier. The dual band power amplifier module (Z502) is assembled on a ceramic substrate in one housing. The module amplifies the output signal of the TXVCO to the required PCL (controlled by the feedback circuit according to settings from the logic) .The different amplifiers are switched on by TXONPCN/TXONGSM via the transistor (V508). The signal PA_Comp is required for the operation point setting of low GSM PCLs. The power amplifier is supplied directly from the battery (BATT+).
After amplification the signal passes on the way to the antenna the diplexer (Z503).
A part of the TX output signal is decoupled via a directional coupler (realised by conductive tracks), is equalised and temperature compensated by a detector diode (V505).
This so gained voltage, is compared through an operation amplifier (N501) with the PA_RAMP signal provided from EGOLD+**(Baseband H2)**. The resulting voltage is switched with the signals TXONPCN and TXONGSM (V509) to the control ports of the PA.

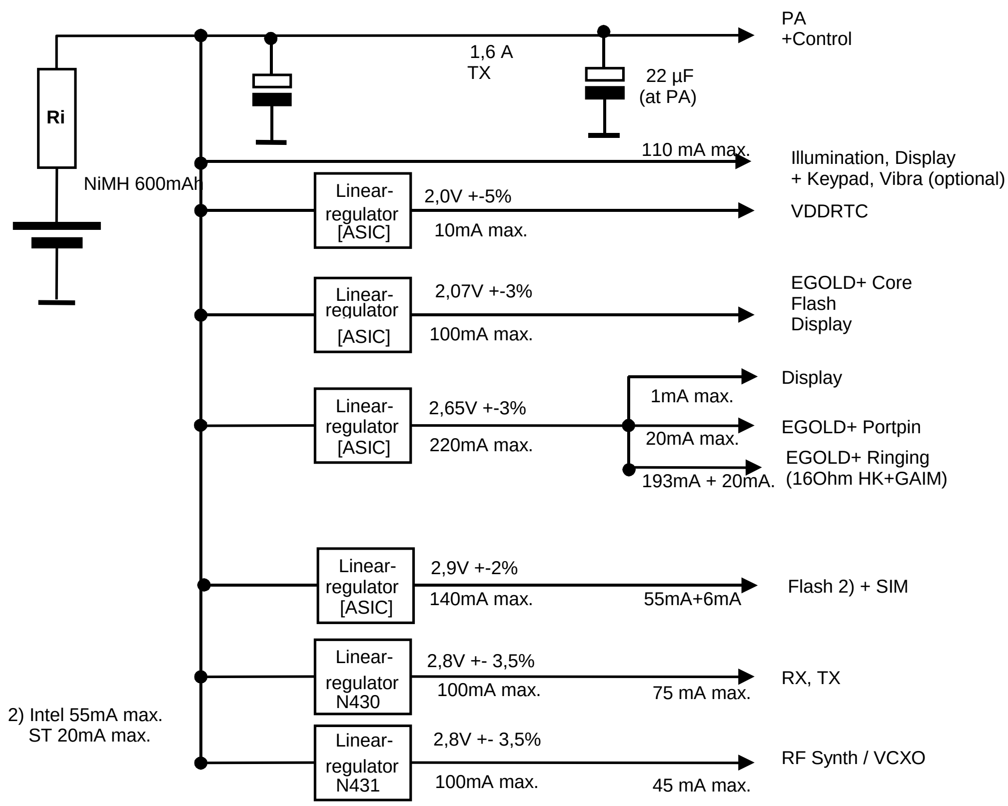
The required voltage BATT+ is provided by the battery.
The required voltage VCC2.8SW is provided by transistor V435 by using TXON1 from the EGOLD+**(TDMA-Timer H14)** and V100.



5. Power Supply

5.1 Overview and Voltages

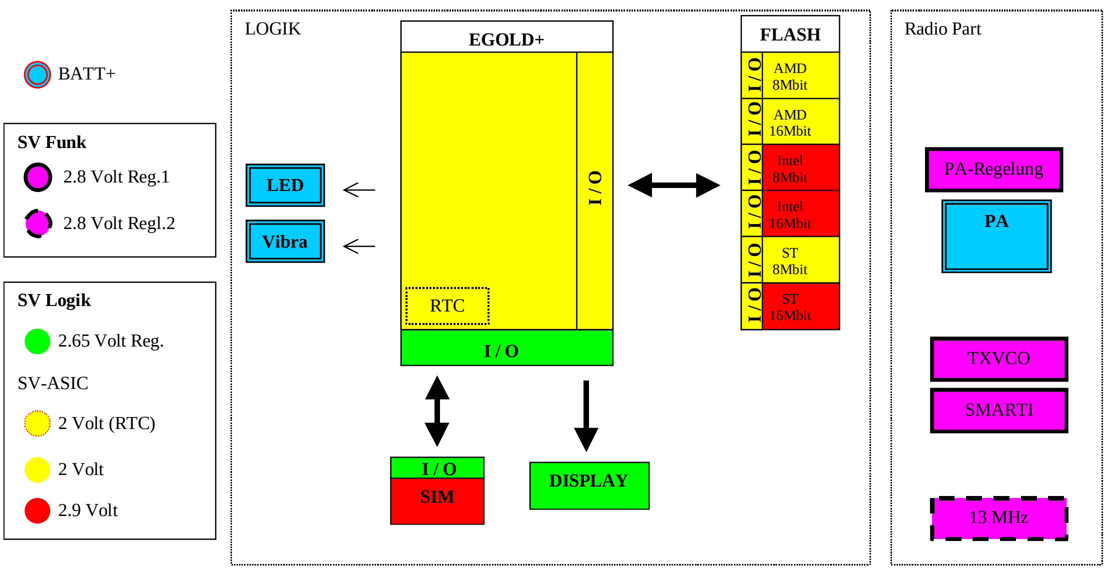
Notes



The following restrictions must be considered:

- The phone cannot be operated without battery.
- The phone will be damaged if the battery is inserted the wrong way round (the mechanics of the phone prevent the battery from being put in the wrong way round). The electric system assumes that the battery as been inserted correctly.

Voltages overview



5.2 STV-ASIC

Notes

The power supply ASIC contains the following functions:

- Control of "**switching on**" the mobile phone via
  1.The ON/OFF Key. (ON_OFF)
  2.The bottom connector with (External Power)
  3.The **R**eal **T**ime **C**lock RTC (ON_OFF2)

- **Watchdog monitoring**
  1.Control of "**switching off**" the mobile phone via WATCHDOG_µP.
  2. Watchdog observation

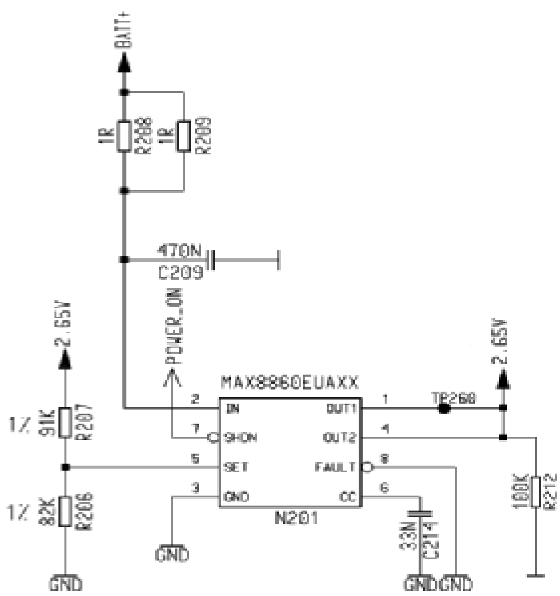
- **"Switching off" of mobile phone in the case of overvoltage at battery connectors**.
- Generation of RESET signal for EGOLD+, Flash and MMI components
- Generation of 2.90 V via linear controller for the logic IC.
- Generation of 2.65 V via linear controller for the logic IC.
- Generation of 2.00 V via linear controller for the logic IC.

- **Battery charge support:**
  1.Normal charging
  2.Trickle charging, if the battery voltage is below 3,2 V

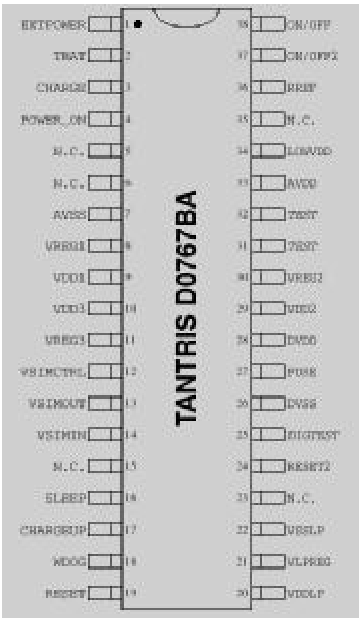
- **Timer generation:**
  All internal timers and pulses are derived from a 900 kHz ± 10% internal oscillator. Responsible for the frequency stability is an external resistor (R213) (1%) at the RREF pin

5.2.1 Switch "ON" sequence

- Generation of the "2,0; 2,65; 2,9" voltages
- Generation of the "RESET_2,0V and RESET_2,65V"
- Generation of the "POWER_ON" through N201
- Generation of the "Watch Dog" signal through the EGOLD+ after "POWER_ON"



Power supply ASIC

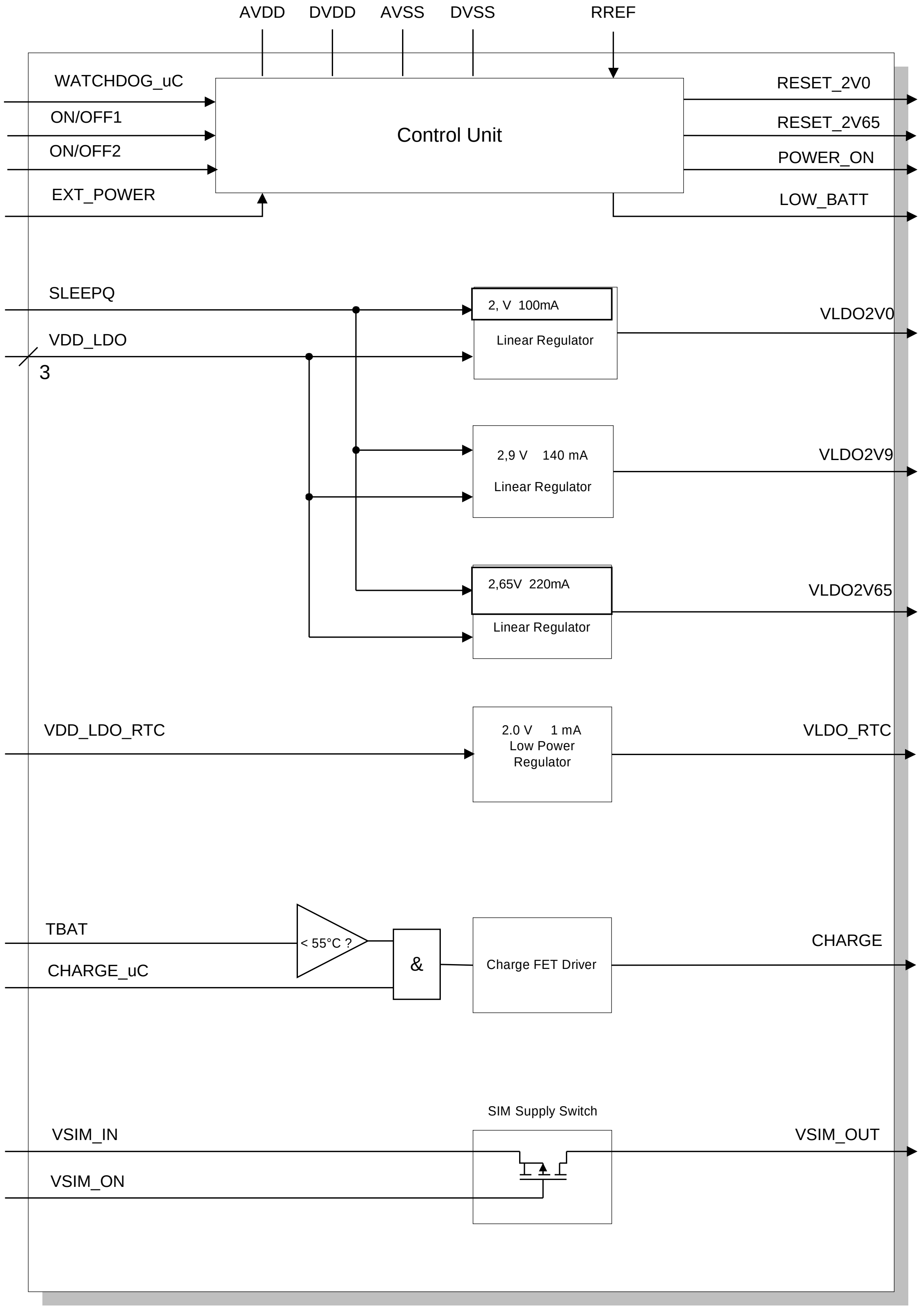


Pin Configuration in accordance with Component Specifications:

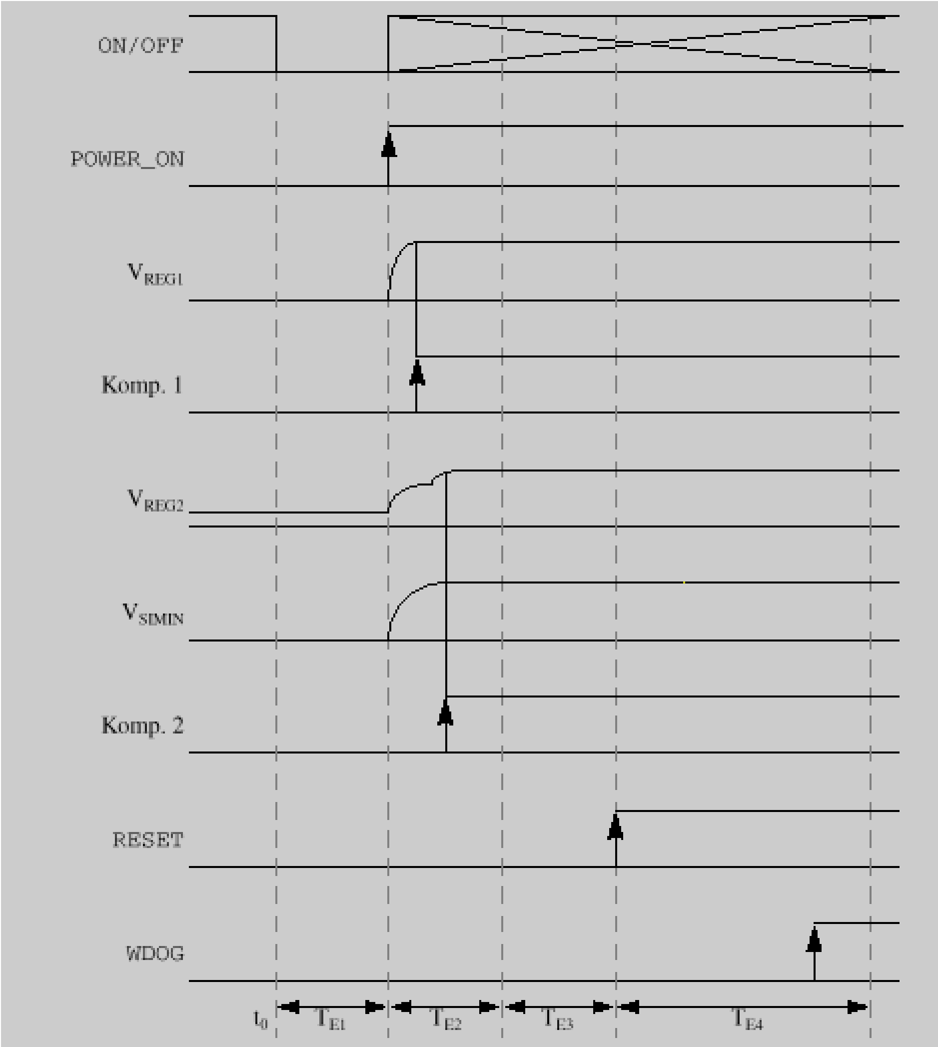
Functions	Pin Requirements	Implementation / Explanation
"**Switching on**" the mobile phone	ON_OFF EXT_POWER ON_OFF2	The following 3 "**switch on**" conditions will be accepted: • Falling slope to ON_OFF • Rising slope to EXT_POWER • Rising slope to ON_OFF2 If one of this 3 conditions is recognised, the ASIC switches into the POWER-Up state and the internal oscillator starts. After T1 (approx. 60ms) the source of the "switch on" signal is checked again. If the required level is no longer present, the mobile phone will not switch on and the ASIC switches to the POWER-DOWN mode. If the required level is still there, the mobile phone will "switch on". To do so VCXOEN (internal SLEEP) will go to HIGH and the 3 voltage regulators VREG1 (2,9V), VREG2 (2,0V)and VREG3 (2,65V) are active. After T2 (approx. 60ms) counted from "switch on" (i.e. 120ms from initial recognition of the "switch on" condition) the supply voltages for 1V9, 2V65 and 2V9 will be checked. If the 1V9 and 2V9 voltages are in order, timer T3 will start and RESET will be enabled after approx. 60ms. To ascertain by what signal the phone was switched on, the E-Gold checks the following signals. **KB7** >>>>>>>>>>> to check the "On-Off Keypad button" **RTC_INT**>>>>>>>> to check the timer "on-off" **EXT_Power**_m**c**>>> to check ON-OFF via accessory

Functions	Pin Requirements	Implementation / Explanation
Watchdog monitoring	WATCHDOG_UP	The first Watchdog Impulse of the EGOLD+ • must be operated at the latest 800ms after the rising edge of the "Reset" signal and • the WD-Signal must have a rising edge. If one of these conditions is not fulfilled, the mobile phone will switch off. If this conditions are fulfilled, rising and falling edges are evaluated alternately and used to reset the WD-Timer. With each edge at the WATCHDOG_UP pin the WD-Timer will be reseted. **Conditions:** The next (inverted to the previous one) edge have to occur within a time of 0.4s...2.6s. If the next edge is recognised before expiry of 0.4s or after an expiry of 2.6s or if the next recognised edge is not inverted, the mobile phone will switch off.
Regular "switch off" of the mobile phone	WATCHDOG_UP	Switching off of the phone is possible, as described in the watchdog monitoring control, if the EGOLD+ is not longer serving the WATCHDOG_UP pin. **"Switching off" means**: RESET to LOW POWER_ON to LOW CHARGE to HIGH-Z. Regulator 1V9, 2V65 and 2V9 are "OFF" The ASIC goes into the POWER-DOWN mode.
Low Voltage Detector	LOWVDD	Not used
Reset Signal	RESET	**Power-Up:** During the entire "switch on" procedure the RESET signal is on "LOW-Level". If the "switch on" conditions are fulfilled the change to "HIGH-Level" is taken place after 180ms. **Power Fail:** In the "unit on" mode the voltage levels of the 1.9V and 2.9V voltage supply shall be monitored. If one of this voltages drops below a certain level for longer than 10µs, the RESET signal switches to "LOW-Level".
Switch off of the phone in the case of overvoltage at the battery	VDD	In the case of a too high voltage at the VDD,(voltage level 5.8V ± 0.2V within 1µs), the mobile phone will switch off.
Voltage Supply for the Logic	VREG2 U2V0	The linear controller is designed for 1.92V(±3%) and a maximum current of 100 mA. It consists basically of an internal operation amplifier, an integrated p-channel output transistor as well as an external capacitor (C = 2.2µF) for stabilising the voltage. This regulated voltage is measured internally. In case of an internally measured voltage >3.1V , the output transistor will switch off.

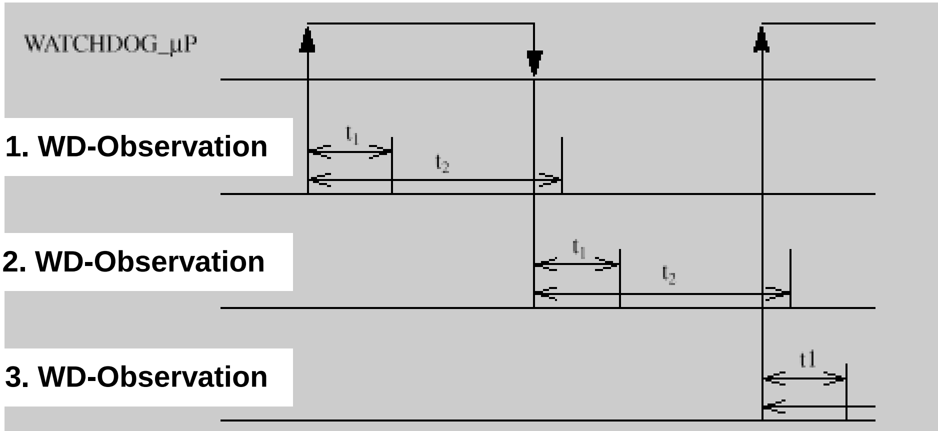
Voltage Supply for the Logic	VREG3 U2V65	Not used
Voltage Supply for the Logic	VREG1 U2V9	The linear controller is designed for 2.92V(±3%) and a maximum current of 140 mA. It consists basically of an internal operation amplifier, an integrated p-channel output transistor as well as an external capacitor (C = 2.2µF) for stabilising the voltage. This regulated voltage is measured internally. In case of an internally measured voltage >3.3V , the output transistor will switch off.
Voltage Supply for SIM-CARD	CCVZQ CCVCC	The voltage supply for the SIM-CARD (**CCVCC**) is switched by the signal CCVZQ from the EGOLD+ via a "LOW" at pin 12 The output signal CCVCC can be measured at pin 13 (2,8V) The picture **5212** shows the CCVCC depending on the signal **5211** CCVCZQ from EGOLD+
Charge Support	CHARGE, CHARGE_uP, TBAT	For controlling the battery charge function, a charge support is integrated in the ASIC. It consists basically of an internal current source, a temperature sensor, an external charge FET with a Pull-Up resistor between the source and the gate of the charge FET. The current source is switched on trough a rising edge of the CHARGE_UP signal and generates an "LOW" at pin 3 (Charge). With this "LOW" the charge FET becomes conducting. **Exceptions**: a) The temperature comparator does give a signal for high temperature b) An overvoltage is present at the VDD. C) A falling edge at the CHARGE_UP.
Low Voltage Regulator for RTC	VDD_RTC	Voltage regulator to provide the Real Time Clock with the required 2V. Current consumption is ~1mA


AVDD
DVDD
AVSS
DVSS
RREF
WATCHDOG_uC
ON/OFF1
ON/OFF2
EXT_POWER
Control Unit
RESET_2V0
RESET_2V65
POWER_ON
LOW_BATT
SLEEPQ
VDD_LDO
3
2, V 100mA
Linear Regulator
VLDO2V0
2,9 V 140 mA
Linear Regulator
VLDO2V9
2,65V 220mA
Linear Regulator
VLDO2V65
VDD_LDO_RTC
2.0 V 1 mA
Low Power
Regulator
VLDO_RTC
TBAT
< 55°C ?
&
CHARGE_uC
Charge FET Driver
CHARGE
SIM Supply Switch
VSIM_IN
VSIM_ON
VSIM_OUT

Example of a timing diagram (switch on by the keypad)



Example of a timing diagram (Watchdog Observation)



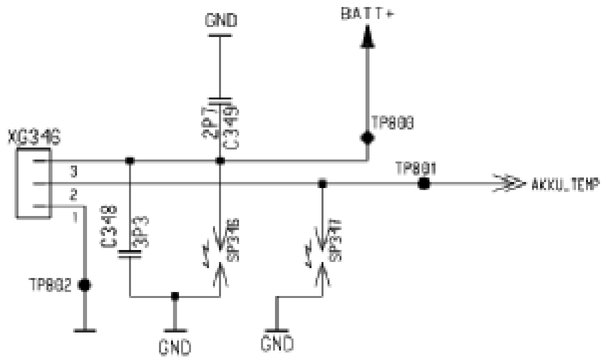
6. Battery and Charging

6.1 Battery

Notes

A NiMH battery with a nominal capacity of 600mAh is used for the Axx series
A temperature sensor (22kΩ at 25°C) is integrated to monitor the battery temperature.

Battery connector:



6.2 Charging Concept

The battery is charged in the unit itself. The hardware and software is designed for for NiMH batteries. The battery will be charged as long as the GAIM part of the EGOLD+ will measure changes in the values of the battery voltages during the charging process.
There are two ways to charge the battery:
1) Normal charging also called “fast charging”
2) Trickle charging

Normal Charging:
As soon as the phone is connected to an external charger, charging starts.
(The “Charge” symbol in the display shows the charging process).
Charging is enabled via a MOS-FET-Switch(V200). This MOS-FET-Switch activates the circuit form the external charger to the battery.
A “low” signal at the gate of this transistor is required. To get this “low” the following conditions must be fulfiled :
a) The CHARGE_UC signal at pin 31 of the ASIC must be “H”
b) The temperature information at pin 2 of the ASIC must be “L” < 55°C
c) The overvoltage detection at pin 22 VDDLP has not to be active < 5,8V

A disable function in the ASIC´s hardware can interrupt charging in case of:
a) A too high temperature >55°C
b) A too high battery voltage >5,8V

For temperature detection, a NTC resistor (22kΩ at 25°) is assembled in the battery pack. Via the pin 2 of the battery connector and a resistor combination R115, R116,R117, the EGOLD+ **(GAIM L3)** is carrying out the measurement.

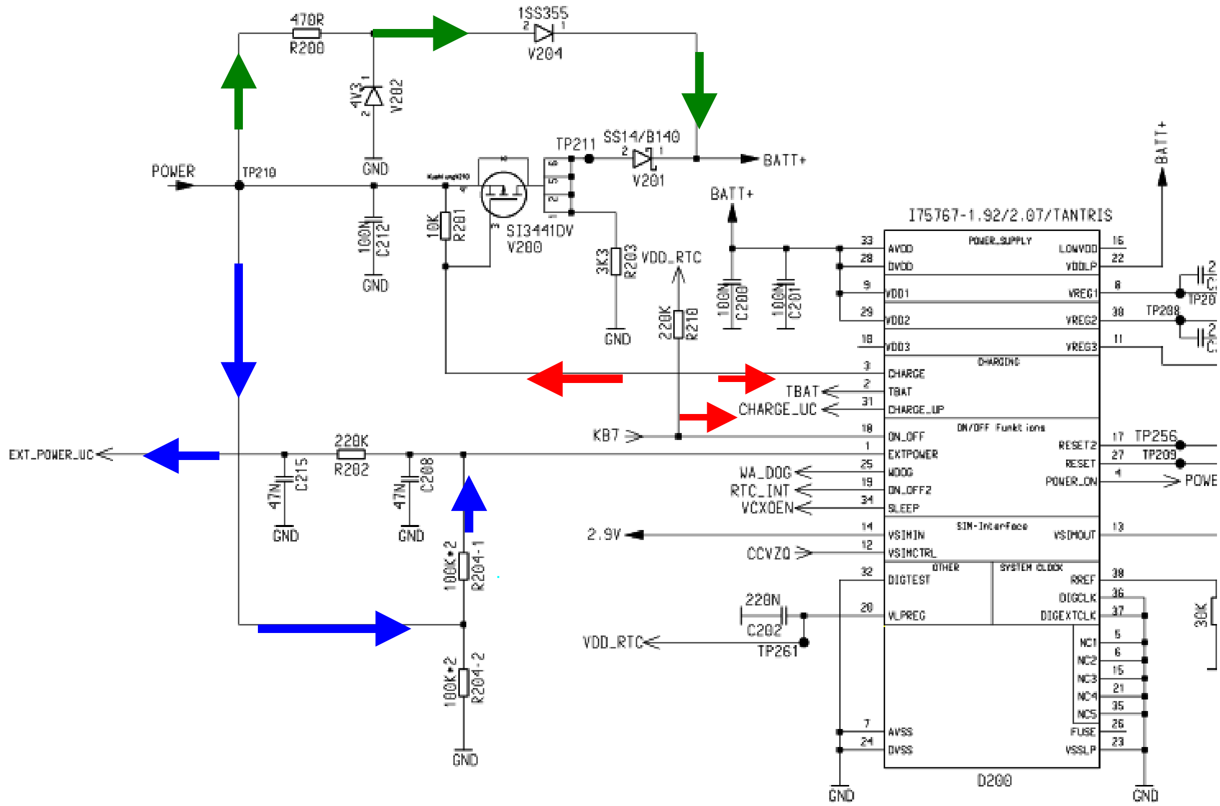
To get the CHARGE_UC **(Miscellaneous E9)** signal, the EGOLD+ needs the information that an external power supply is connected. This is realized by feeding the POWER signal through the voltage divider R204 and the resistor R202 as a EXT_POWER_UC to the EGOLD+ **(Miscellaneous A2)**

Trickle Charging

If the phone has not been used for a longish time (longer than approx. 1 month), the battery could be totally self-discharged (battery voltage is below 3.2 V), so that it is not possible to charge the battery via the normal charging circuit. In this case only trickle charging is possible The charging current for trickle charging is <10mA. After approx. 10 hours of trickle charging the mobile switches to "normal charging"

The trickle charging circuit consists of the resistor R200 and the 2 diodes V202 and V204.

Notes



Charging Circuit

- Trickle charging by pass
- Charging activation
- Power supply recognition

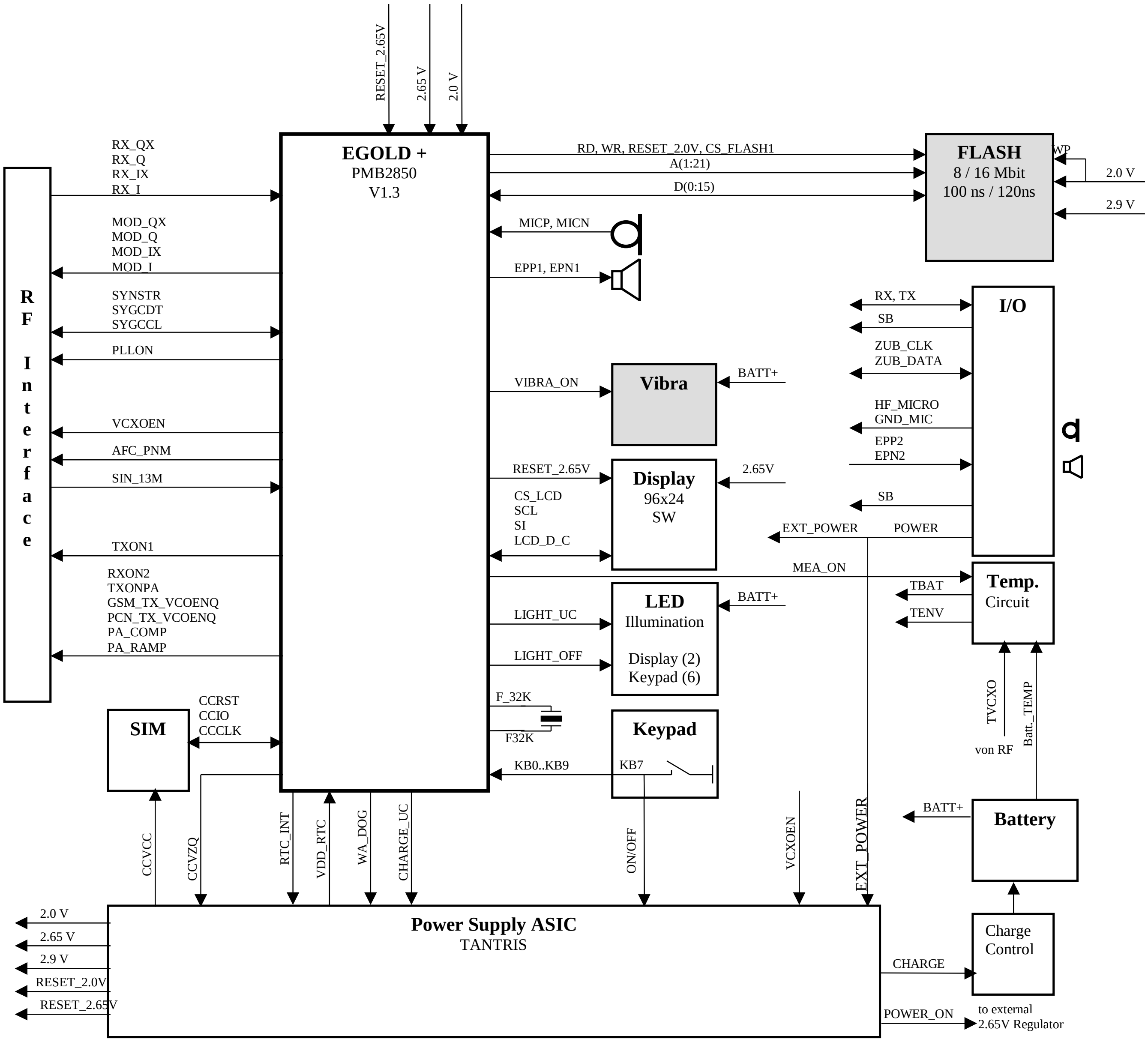
!! Attention!!

⇒ a charger voltage >15V can destroy resistors or capacitors in the charging path

⇒ a charger voltage >20V can destroy the MOS-FET switch transistor in the charging path.

7. Logic Part

7.1 Overview Logic



The logik part of the Axx consists of:

NOTES

1) The EGOLD+
   - Hardware µC-part
     - Mikrocontroller
     - Systeminterfaces for internal and external peripherals
     - Onchip peripherals and memory chips

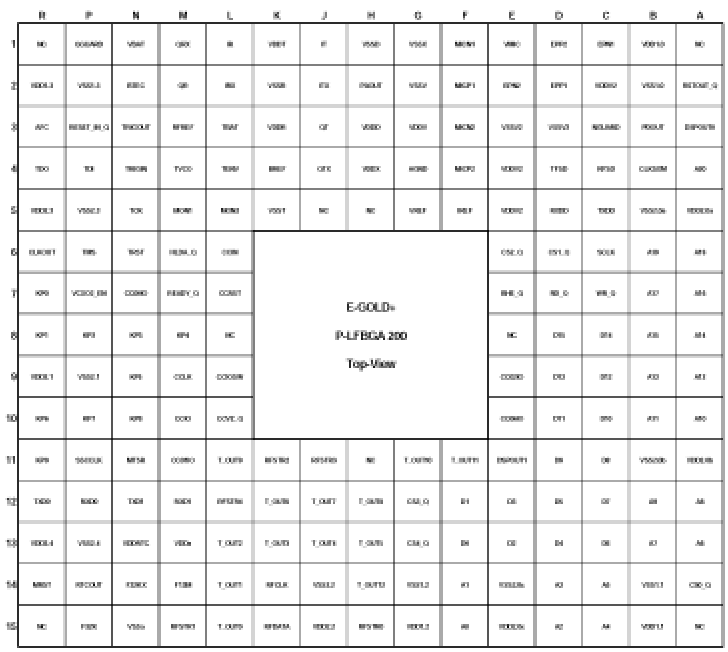
   - Software µC-part
     - Controlling of the MMI (Man Machine Interface) functions (Keypad, LCD, Illumination, ...)
     - GSM Layer 1-3
     - Controlling Radio part (Synthesizer, AGC, AFC, ...),
     - Controlling of the Baseband part (EGAIM)

   - Hardware SP (Signal Processor) part
     - DSP Signalprocessor

   - Software SP (Signal Processor) part Equaliser
     - Channel Coder
     - Channel Decoder,
     - Voice Encoder
     - Voice Decoder

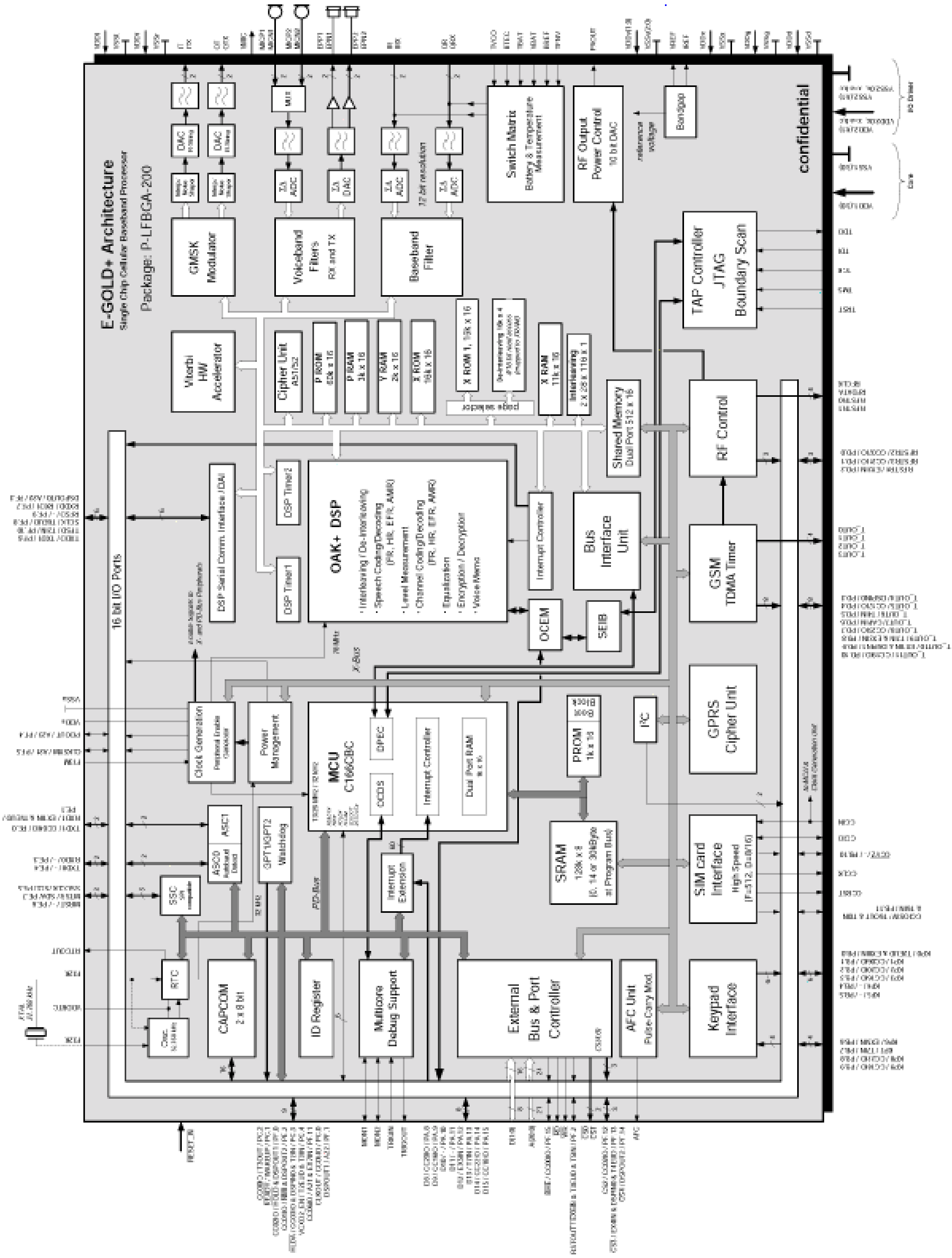
   - EGAIM inside the EGOLD+
     - 2 Sigma Delta A/D-converter for RX/Battery
     - 2 D/A- converter for GMSK TX Inphase- und Quadratursignals,
     - 1 D/A- cverter for the Power Ramping signal,
     - 1 Sigma Delta A/D- and D/A-converter for the voiceband part

   - RTC (Real Time Clock)

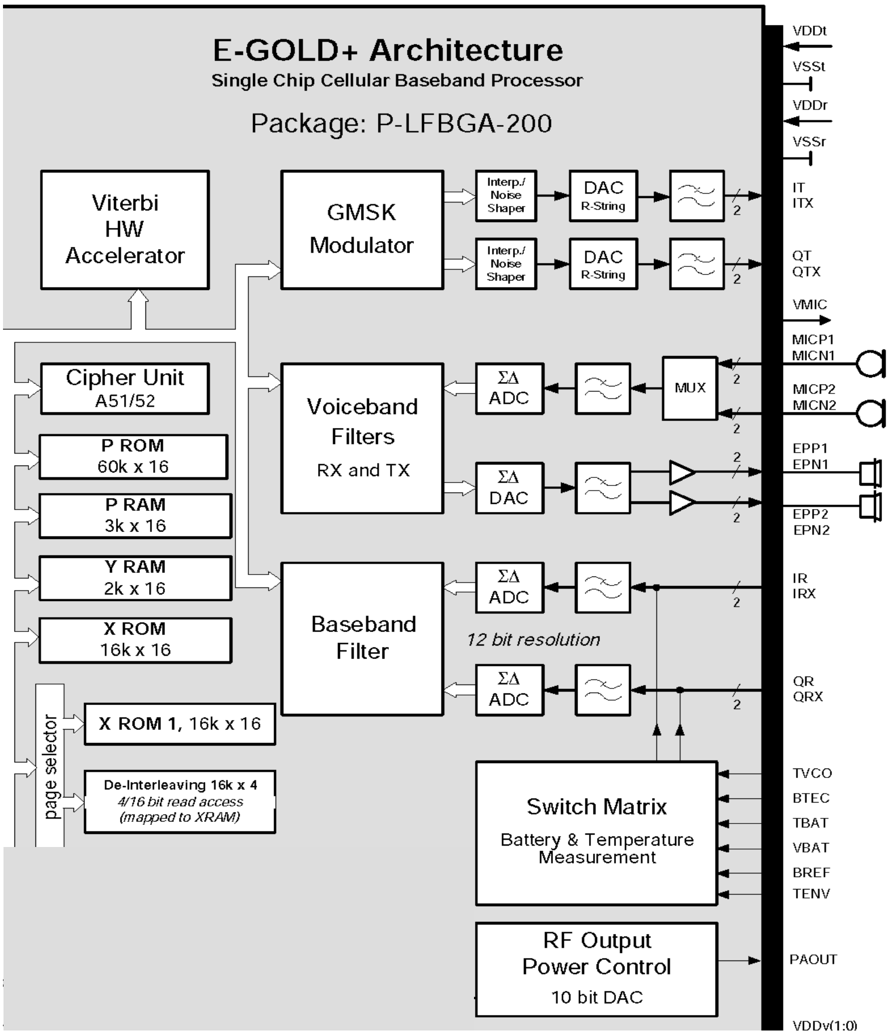


2) The Flash IC

7.2 Overview EGOLD+



7.3 Overview EGAIM inside the EGOLD+



Tasks of the EGAIM inside the EGOLD+

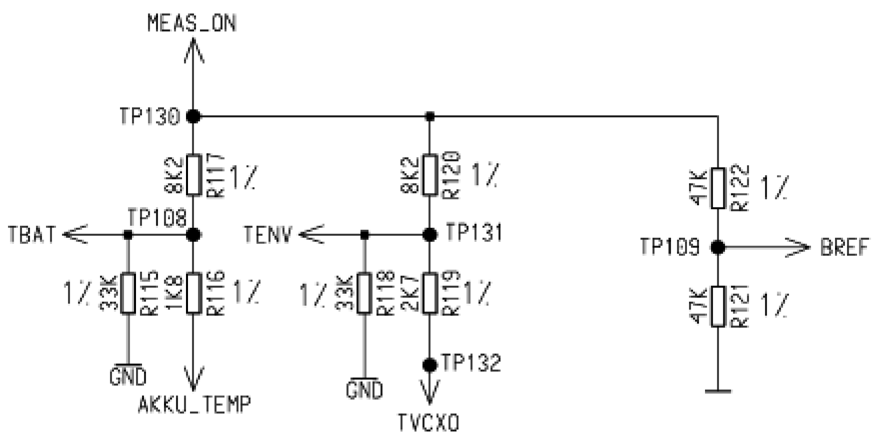
- Measurement of Battery and Ambient temperature
- Measurement of Battery Voltage
- A/D conversion of MIC-Path signals incl. coding
- D/A conversion of EP-Path signals incl. decoding
- Generating of the PA-Control Signal “PA_Ramp”
- Generating of the Ringer Signal on EPP

Notes

a) Measurement of Battery and Ambient Temperature

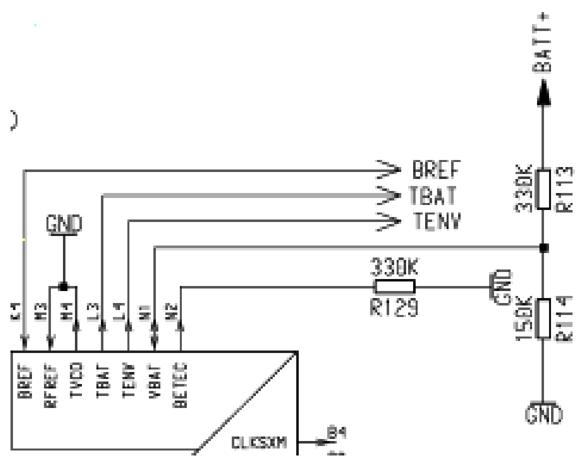
Notes

The temperature is measured as a voltage equivalent of the temperature on the voltage dividers R115,R116,R117 for the battery temperature and R118,R119, R120 for the ambient temperature from the EGAIM.
For this, the integrated ΣΔ converter of the EGAIM of the RX-I base band branch is used. This ΣΔ converter compares the voltage of TBAT and TENV internally with a reference voltage BREF.
Via an analog multiplexer, either the RX-I base band signal, or the TBAT signal and the TENV signal can be switched to the input of the converter.
The signal MEAS_ON from the EGOLD+**(GSM TDMA-TIMER G11)** activates the measurement and is used to generate to BREF by the help of R121,R122



b) Measurement of the Battery Voltage

The measurement of the battery voltage is done in the Q-branch of the EGAIM. For this BATT+ is connected via a voltage divider R113, R114 to the EGOLD+ **(GAIM N2)** (Input limitation 1.33V to 5.91V) .An analog multiplexer does the switching between the baseband signal processing and the voltage measurement.



c) A/D conversion of MIC-Path signals incl. coding

Notes

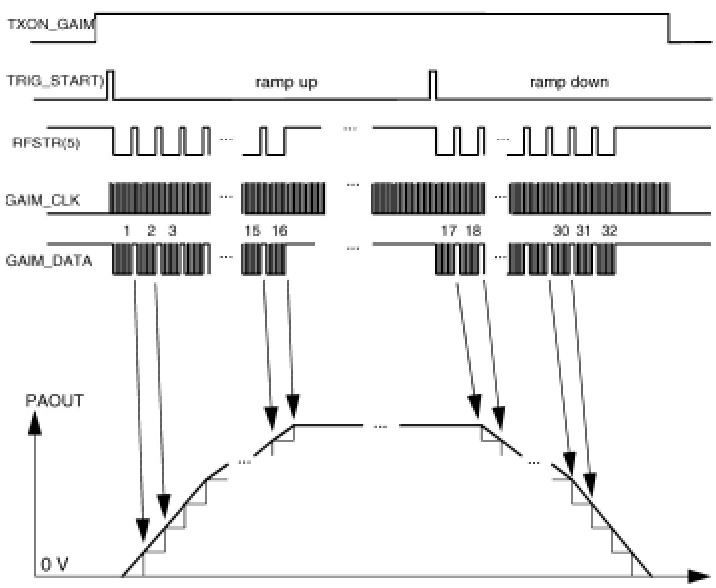
The Microphone signals (HF_MICRO, MICN2, MICP, MICN) arrive at the voiceband part of the EGAIM. For further operations the signals will be converted into digital information, filtered, coded and finally formed into the GMSK-Signal by the internal GMSK-Modulator.
This so generated signals (IT, ITX, QT, QTX) are given to the SMARI IC (pins 9-12) in the transmitter path.

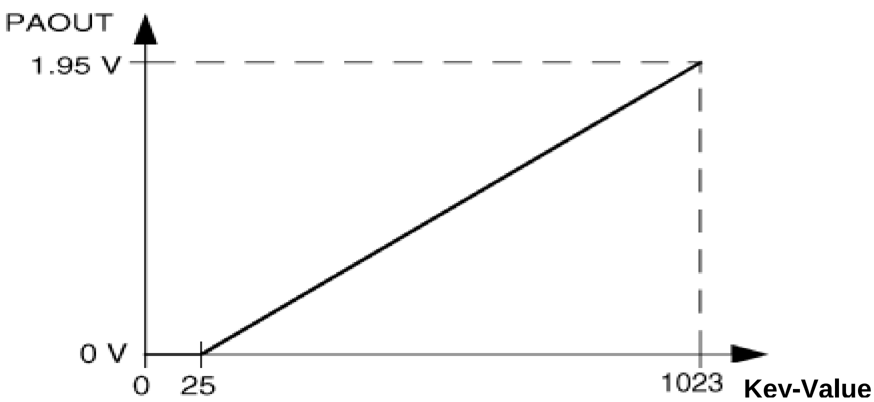
d) D/A conversion of EP-Path signals incl. decoding

Arriving at the Baseband-Part the demodulated signals (RX_I, RX_IX, RX_Q, RX_QX) will be filtered and A/D converted. In the voiceband part after decoding (with help of the uC part) and filtering the signals will be D/A converted amplified and given as (EPP1, EPN1, EPP2, EPN2) to the internal earpiece or the external loudspeaker.

e) Generation of the PA Control Signal (PA_RAMP)

The RF output power amplifier needs an analog ramp up/down control voltage. For this the system interface on EGOLD+ generates 10 bit digital values which have to be transferred serially to the power ramping path. After loading into an 10 bit latch the control value will be converted into the corresponding analog voltage with a maximum of ~2V





8. MMI-Functions

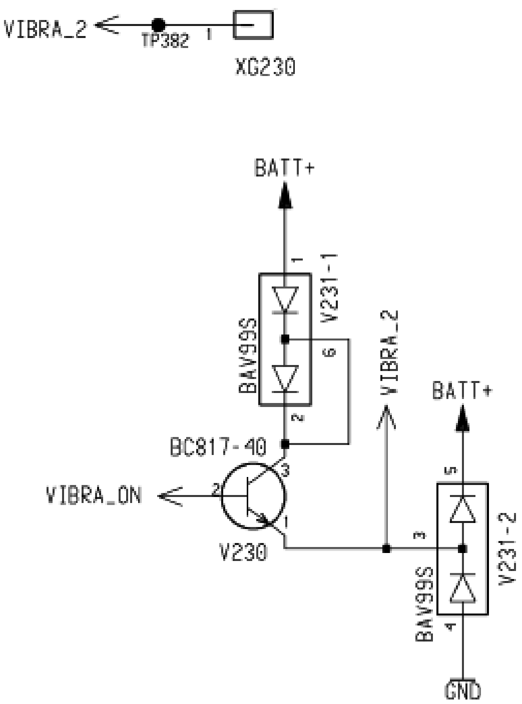
8.1 Acoustics

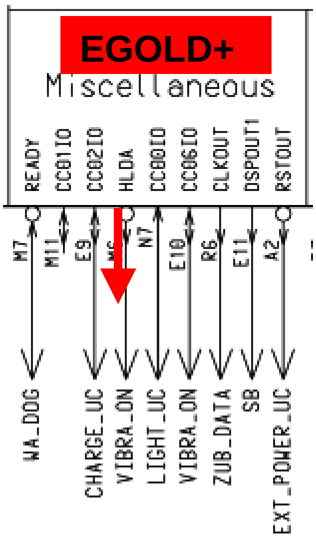
Notes

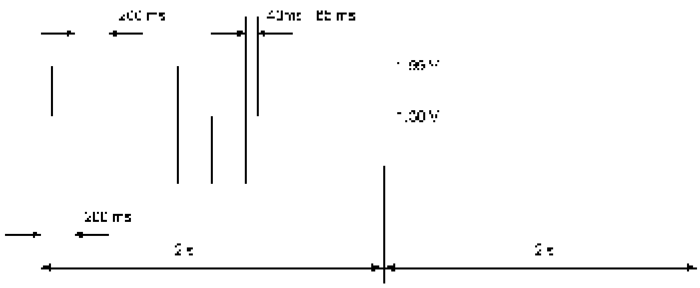
Electro-Acoustic components are:
a) VIBRA
b) Microphone
c) Loudspeaker

8.1.1 VIBRA

The VIBRA is activated and controlled from the EGOLD+**(Miscellaneous E10)** via the signal, VIBRA_ON. For this the VIBRA is connected to XG230 with BATT+. GND is given by the shielding of the RF-Part. With a “H” of the VIBRA_ON signal the transistor V230 is switched on. The signal VIBRA_ON appears also at the EGOLD+**(Miscellaneous M6).** This “second” VIBRA_ON is only used for ~40 to 65ms due to a higher voltage required from the VIBRA in the beginning. The diode V231 is used to protect the circuit against over voltage and switching spikes.



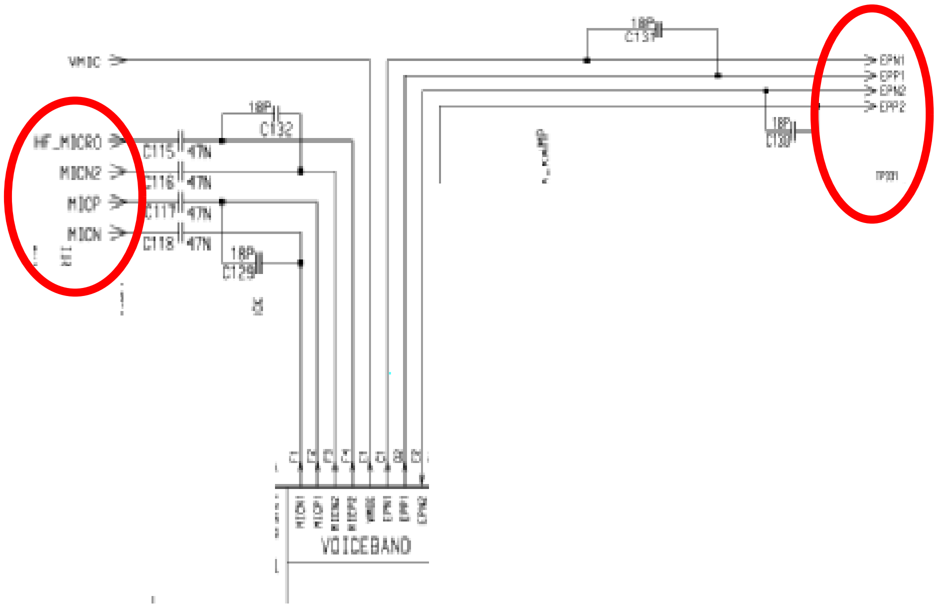




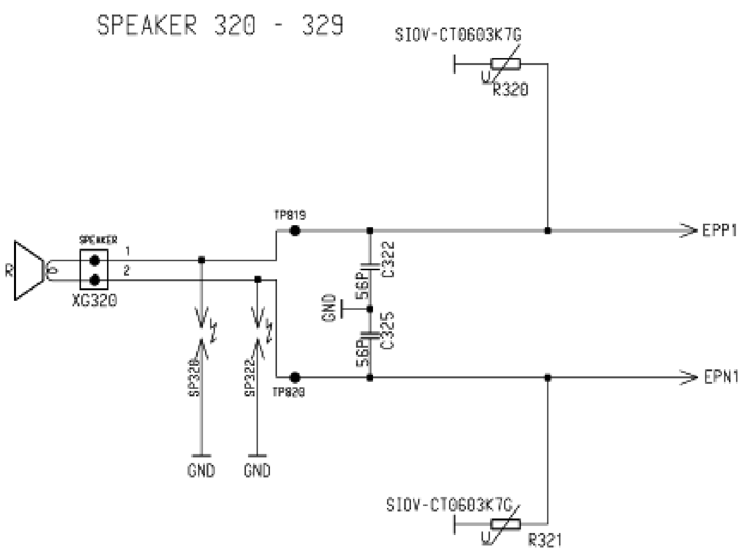
timing of VIBRA_ON signal

8.1.2 Loudspeaker (Ringer) and Microphone

Loudspeaker (EPP1, EPN1, EPP2, EPN2) and Microphone (HF_MICRO, MICN2, MICP, MICN) are connected directly to the Voiceband-Part of EGOLD+



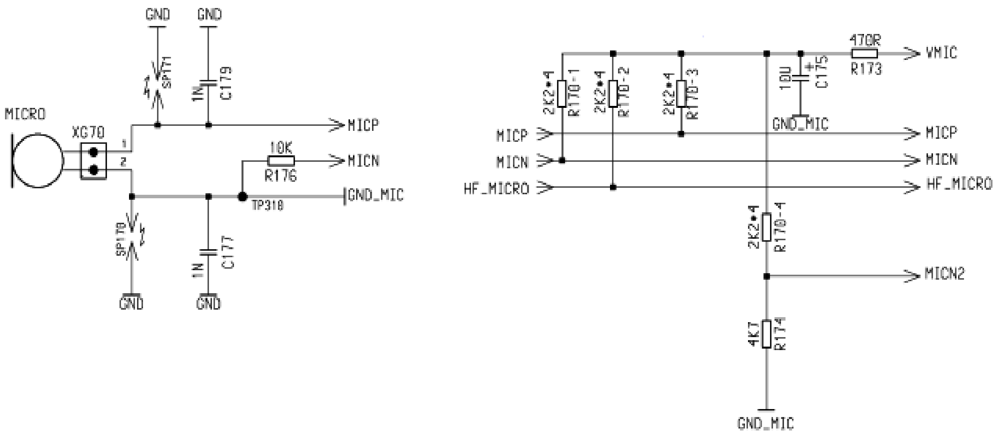
Loudspeaker(Ringer)
Beside the normal Loudspeaker function the Loudspeaker is acting as a Ringer controlled by the EGOLD+
The EGOLD+ ringer function is implemented as a special mode of operation of the earpiece buffer EP1. In ringer mode the output of is connected to a specific driver circuit which guarantees a definite slew rate of the ringer output signal. This feature ensures that excessive load of power supply circuits and overshoots at the ringer output pins due to inductive load are avoided.

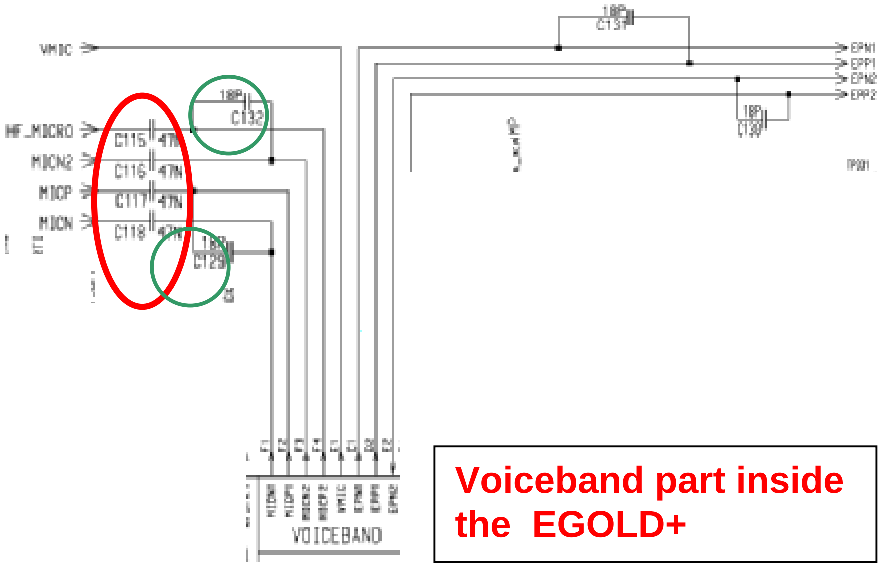


Notes

Microphone

Two Microphones can be connected to the EGOLD+ (external/internal) with the lines HF_MICRO and MICP. Both Microphones are supplied with VMIC from the EGOLD+(Voiceband E1). To avoid LF distortions, VMIC is low pass filtered R173, C175 and grounded (R170-1, R176).
The internal Microphone is connected to XG170. The capacitors C177,C179 are used to suppress HF distortions.
The input ports a the EGOLD+ are protected versus DC voltages with the capacitors C115-C118. An EMC protection is realised by C132,C129.





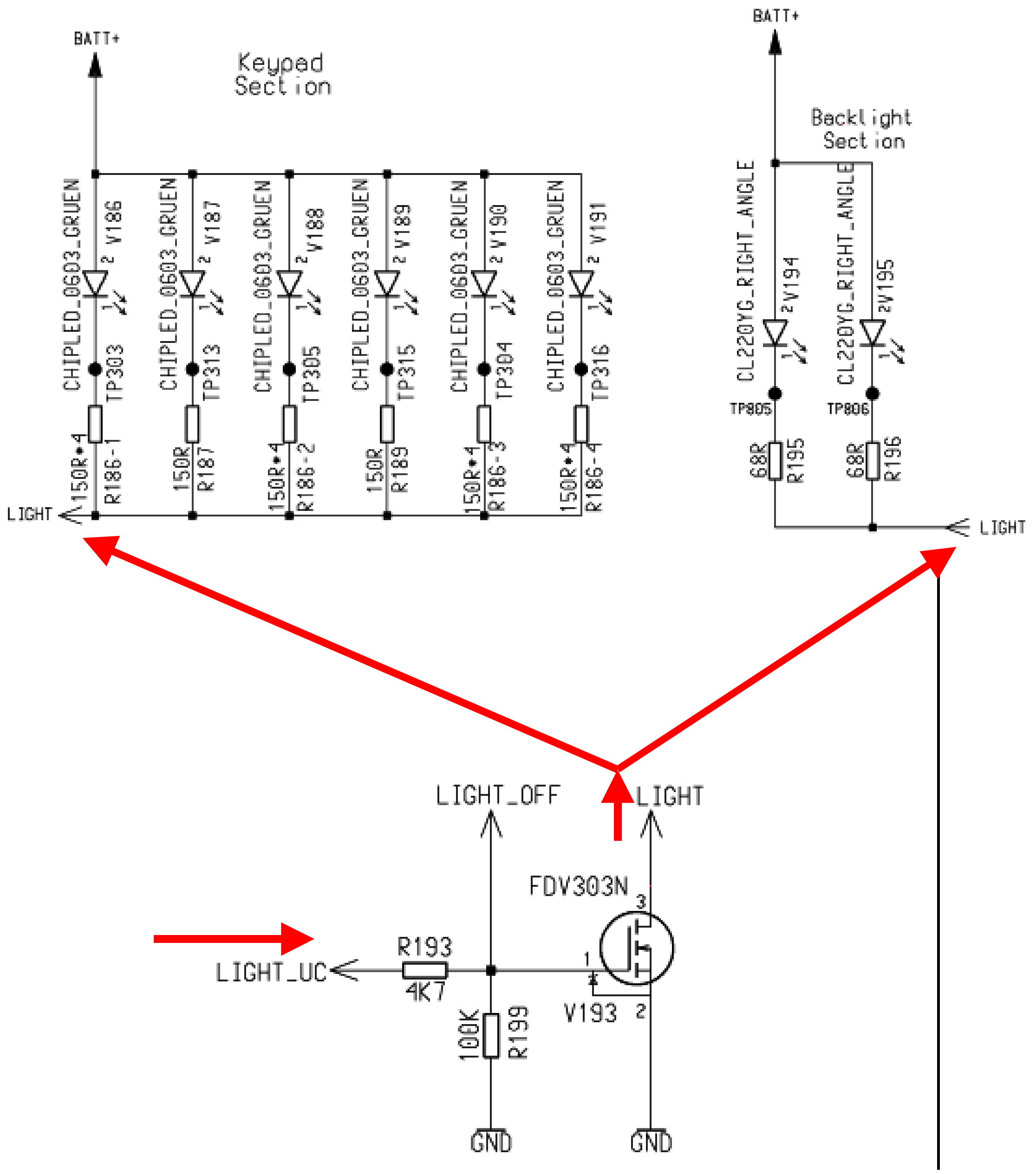
Notes

8.2 Light (keypad and backlight)

All LED´s (Keypad and Backlight) are connected to BATT+. The LED´s are switched on by the EGOLD+ **(miscellaneous N7)** controlled signal LIGHT_ µC via the transistor V193. The signal LIGHT_OFF can be used to switch off the light during the TX-Burst is active.

The Illumination: a) Display
b) Keypad

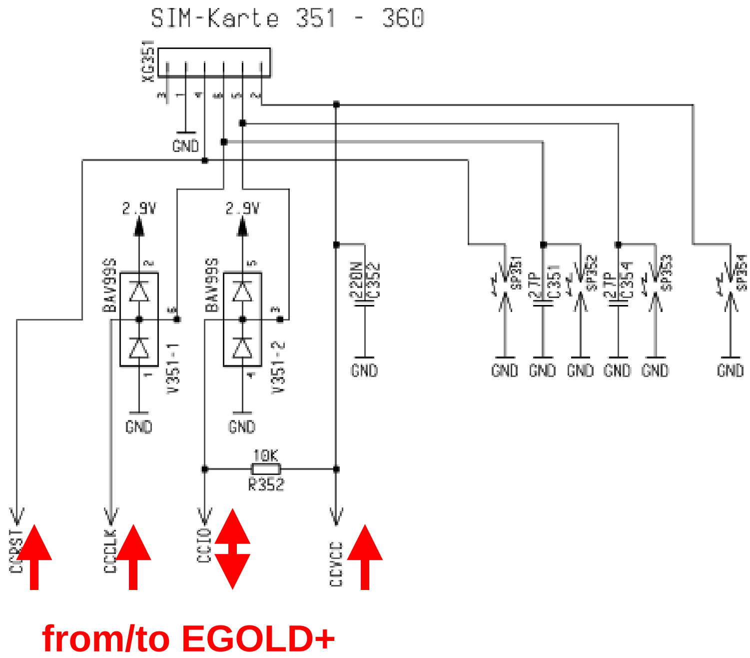
Notes



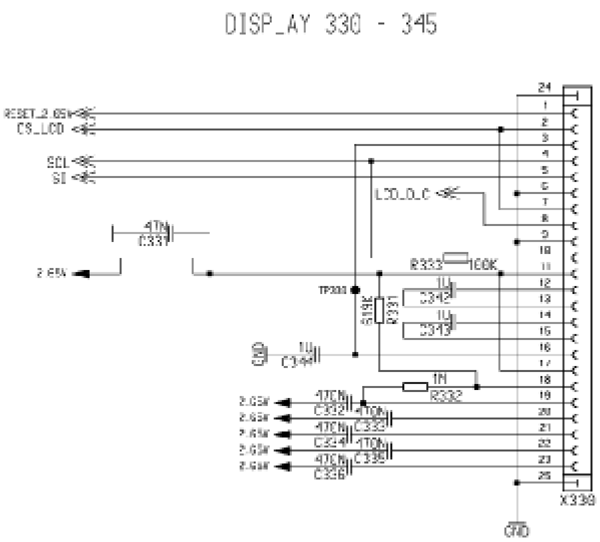
8.3 SIM-Card- and Display Connector

Notes

The SIM-CARD is supplied at pin2 with CCVCC. To get CCVCC (2,9V) the ASIC D200 pin12 is used to switch 2,9V pin 14 to pin 13with the EGOLD+**(SIM L18)** signal CCVZQ. If no SIM-CARD is connected the EGOLD+ tries 3 times to connect the SIM-CARD. After this time the EGOLD+ stops trying.
That means, if the EGOLD+ is losing the connection while normal operation of the mobile phone, the mobile must be switched off and on again.
The communication between the EGOLD+ and the SIM-CARD is done via the CCIO pin5 by using CCCLK pin6 as a clock signal.
The diode V351 is used to protect CCCLK and CCIO versus switching peaks.



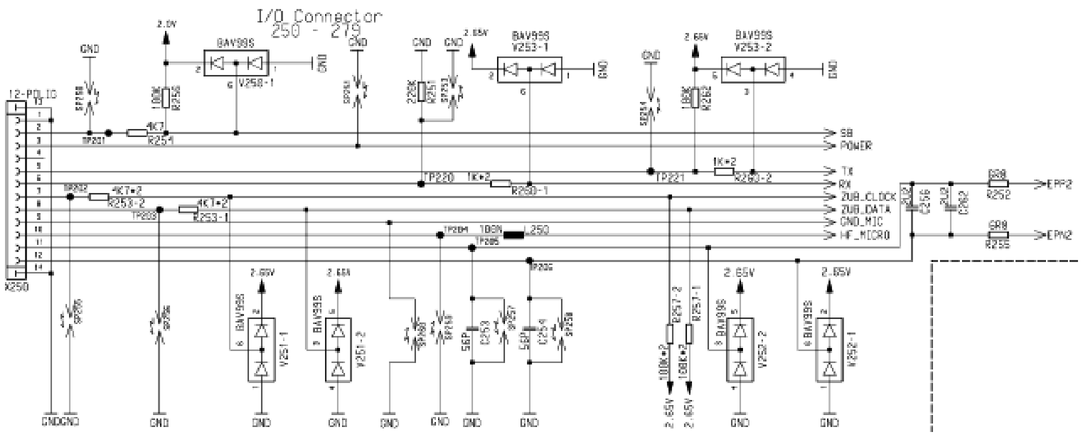
The display is provided with 2,65V from the ASIC D200. The communication with the EGOLD+ is realised via the serial signals SCL and SI



8.4 Connectors

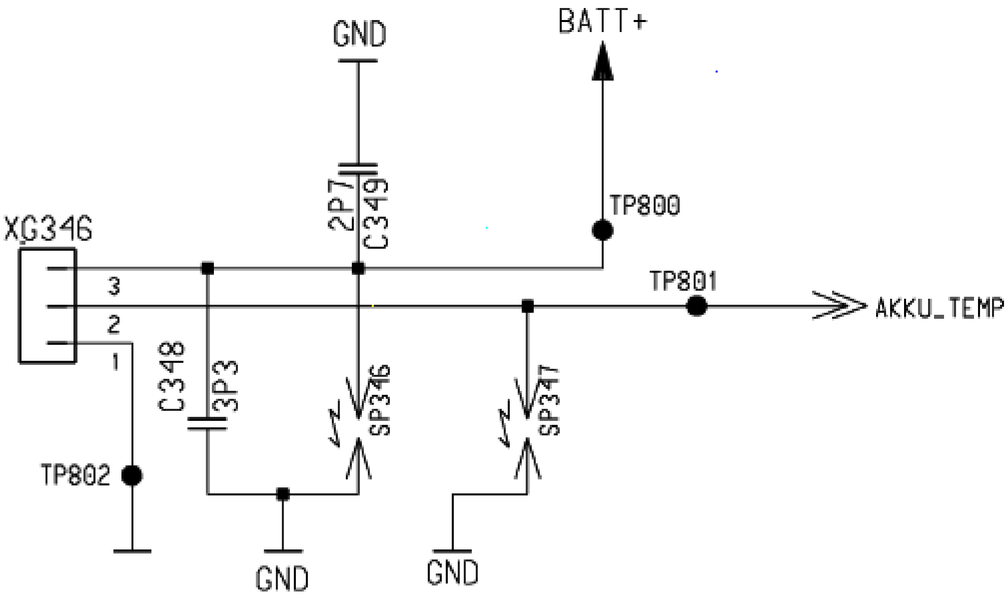
8.4.1 I/O connector

Notes



Pin	Name	IN/OUT	Notes
1	GND		
2	SB	I/O	Charger coding and charger control.
3	POWER	I	Charging Current
4	FBatt+	O	Power supply for the accessories.
5	TX	O	Serial interface
6	RX	I	Serial interface
7	ZUB_CLK	I/O	Clock line for accessory bus Use as DTC In data operation
8	ZUB_DATA	I/O	Data line for accessory bus. Use as CTS in data operation
9	GND_MIC		For external microphone
10	HF_MIC	I	External microphone
11	AUDO	O	Trigger for external loudspeaker
12	GNDA		For external loudspeaker

8.4.2 Battery connector



Pin	Name	IN/OUT	Notes
1	GND		
2	Akku_Temp	O	Temperature control of the battery pack.
3	POWER +	I/O	Battery voltage