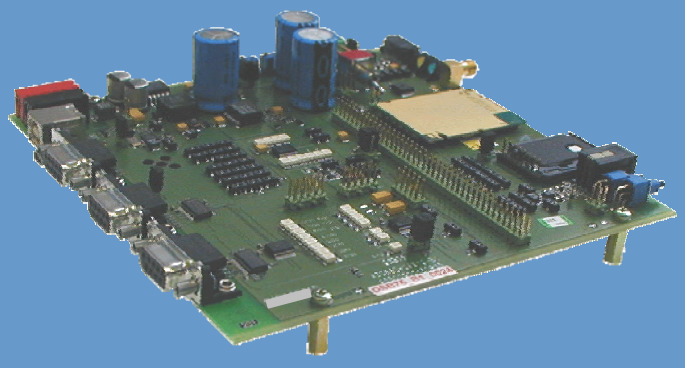
CINTERION
WIRELESS MODULES

DSB75
Development Support Board
Rev. B1

Version: **v12**
DocID: DSB75_hd_v12



Hardware Description

Document Name:	**DSB75 Development Support Board Rev. B1 Hardware Description**
Version:	**v12**
Date:	**August 26, 2008**
DocId:	**DSB75_hd_v12**
Status:	**Confidential / Released**

Contents

Figures

Tables

0 Document History

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v11
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version **v12**

Chapter	What is new
1.1	Added further supported products.
1.3	Added notes on product specific cables.
3.7	Further detail on pin assignment of DAI connector X703 and Master/Slave mode.
6	Added notes on product specific mounting requirements.

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v10
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version v11

Chapter	What is new
1.3	Deleted antenna adapter cable in Table 1 . Added note on extra cables needed for AC75 only.
6	Added note for AC75 only.

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v09
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version **v10**

Chapter	What is new
3.5	Replaced Figure 11
3.9	Table 3: Added remark on recommended pull-up resistor.
3.12	Updated Figure 31 and Table 24 (changed X101/34 to X101/33)
8	Updated min/typical values of I²C pull-up resistor.
9.1	Added ordering number for DSB75.

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v08
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version v09

Chapter	What is new
2.4	Figure 3: Corrected specification of GPIO7 and GPIO8
3.3	Figure 7, Table 9: Corrected descriptions of pins 6 and 8 (X100).
3.12	“Figure 31: Analog interface” and “Table 24: Pin assignment of the analog interface” corrected names of analog input 1and analog input 2
5.1	Table 32: Overview of switch positions – corrected descriptions of switches S456 and S457
9.2	Figure 49, Figure 51, Figure 54 and Figure 55 – changed names of the following signals: • AD1_IN -> ADC1_IN • AD2_IN -> ADC2_IN

Chapter	What is new
	• GPIO7 -> SPICS • GPIO7_I -> SPICS_I • GPIO7_SPI -> SPI1_CS • GPIO8 -> SPIDI • GPIO8_I -> SPIDI_I • GPIO8_SPI -> SPI1_DI

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v07
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version v08

Chapter	What is new
3.6.2	Added description of EPREF.
3.6.2.2, 3.6.3	Added information about required bias voltage for speakerphone operations.
3.7	Table 16: Updated pin description of PCM interface.

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v06
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version v07

Chapter	What is new
7.1	Modified section “Toggling low-high state of DTR”.
8	Table 35: DSB75 technical data: Added Ignition key, Emergency key, Ignition via DTR, Ignition via USB

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v05
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" Version v06

Chapter	What is new
9.2	Figure 56: Schematic sheet 6 – charging interface – corrected value of R604

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v04
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" v05

Chapter	What is new
2.2	Modified Figure 2: Location of the connectors, switches, jumpers, LEDs and adjustable resistors
3.1	Corrected Table 5: Pin assignment of B2B connector X100 and Table 6: Pin assignment – B2B connector X100 and test points X101 Board-to-board connector X100 will be supplied by Molex
3.3	Added note that the status of GPIOs 1 – 6 and 9 – 10 will be indicated by LEDs. Deleted test pin X102 for connecting measurement equipment or an external application. Corrected Table 9: GPIO assignment and switch position
3.5.1	Table 11: Pin assignment of 1st serial interface COM1 (X201) – modified note on DTR line
3.11	Table 22: Alternative configuration of SPI interface lines – deleted GPIO as alternative

Chapter	What is new
	interface Table 23: Pin assignment of the SPI interfaces X510 – corrected pin names
5.1	Table 32: Overview of switch positions – corrected the functions of several switches

Preceding document: "DSB75 Development Support Board Rev B1 Hardware Description", v03
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" v04

Chapter	What is new
1.4	Updated table: “Terms and Abbreviations”
2.5	Deleted “for ORGA test device” in table 2, row “SIM”
3.3	Deleted line: “It is important to switch the used GPIO lines to the LED driver (S450 – S459 pos.3).”
3.6.2	Updated table 12. Added description for pin 1 – 8 (X700), pin 1 – 7, 9 (X701)
3.6.2.2	Added “The plug of “Siemens Car Kit portable HKP-500” is compatible to Lumberg connector X701. The plug of “Siemens Car Kit Portable” is compatible to Lumberg connector X700.
3.6.3	Modified figure: ”Circuit of microphone feeding bridges”
3.8	Corrected switch position for a direct connection of the USB lines to the GSM module. Table 14: deleted column “Remark”
3.9	Deleted section “I2C is a serial, 8-bit oriented data transfer bus for bit rates up to 400 kbps in Fast mode. It consists of two lines: the serial data line I²CDAT and the serial clock line I²CCLK. The electrical characteristics comply with the I²C standard.” Deleted section “A master is the device which initiates a data transfer on the bus and generates the clock signals to permit that transfer. At this time, any device addressed is considered a slave. The master can operate as a master transmitter or as a master receiver.” Changed: VEXT to VDD Modified figure: “I²C interface” Corrected table 15: Pin assignment of the I²C interface X511
3.10	Modified figures: “SD card interface” and “Location of slide switches”
3.11	Modified figure: “SPI interfaces” Corrected figure: “SPI interfaces location and related switches”
3.12	Deleted list item “The filter characteristic depends on the signal frequency range.” Added new figure: “PWM filter characteristics” Modified figures: “Analog interface” and “Analog interface location and related switches”
3.14	Modified figure: “Power supply interfaces”
3.14.1	Corrected Table 25, row “GSM module supply”: 4.7F to 4700µF.
3.14.3.2	Modified figure: “Schematic of charging circuit”
3.14.5	Replaced “slide switches” with “jumpers” Deleted constraints: “The maximum voltage is set only via the slide switches, it cannot be adjusted via the resistors.
4.1	Modified figure: “ASC signal indication circuit”
4.2	Modified figure: “GPIO signal indication circuit”

Chapter	What is new
9.2	Added figures: “Schematic of page signals” and “Schematic of position list” Modified figure: “Schematic sheet 6 – charging interface”

Preceding document: ”DSB75 Development Support Board Hardware Description", v02
New document: "DSB75 Development Support Board Rev. B1 Hardware Description" v03

Chapter	What is new
2.2	Modified figure: “System overview”
2.3	Modified figure: “Placement of connectors, switches, jumpers, LEDs and adjustable resistors”
2.4	Modified figure: “Block diagram”
3.3	Modified figure: “GPIO circuit”
3.5.1	Corrected value of level converter D200 (COM1). Added information: “Therefore the PWR_IND signal is used for enabling and shut down converters.”
3.5.2, 3.5.3	Corrected value of level converter D201 (COM2, COM3). Added information: Therefore the PWR_IND signal is used for enabling and shut down converters.
3.6	Modified figure: “Analog audio interface – overview”; modified figure: “Location of the audio connectors and switches”
3.6.2.2	New speakerphone added.
3.8	Added information about second USB interface X111. Modified figure: “USB device interface”.
3.9	Added information about functionality of LEDs V503, V504. Modified figure: ”I²C interface”.
3.10	Modified figure: ”SD card interface”
3.12	Modified figure: ”Analog interface”
3.14	Modified figure: ”Power supply interface”
3.14.1	Modified information in Table 25, row “Power supply of digital part of DSB75”. Added new row in Table 25: “Digital IO supply (VDD)””
3.14.2	Corrected information about power indication.
3.14.3	Changed information about battery operation. Added recommendations for batteries.
3.14.3.1	Added ordering number and technical data for plug-in charger. Added new table: “Pin assignment of the X701 jack for the plug-in charger”.
3.14.3.2	Corrected: I_{max}=150mV / 0.3Ohm = 500mA @ Jumper X600 open; I_{max} =150mV / 0.15Ohm =1A @ Jumper X600 closed Modified figure: “Schematic of charging circuit”.
3.14.4	New chapter: “Real Time Clock Supply”
4.2	Modified information about indication of GPIO signals. Modified figure: “GPIO signal indication circuit”.
4.3	Corrected information about indication of power.
4.4	New chapter: “Indication of I²C Lines”
5.1	Completely updated table: “Overview of switch positions”.

Chapter	What is new
5.2	Table 33: added jumpers X122, X203, X204, X206, X420, X421 X562, X600 and footnotes 2, 3. Added figure: “Location of jumpers”.
6	Added mounting description and figure: “Mounting GSM module onto the DSB75”.
7.1	Deleted constraints: “Start-up by DTR0 toggling is only effective if the USB host is not active. Start-up by plugging the USB cable is only effective if the RS-232 lines are deactivated by the host application (e.g. if the terminal program is closed). In later releases of DSB75 this problem will be solved.” Modified figure: “Turn on circuit”.
7.2	Added information about automatic restart of the module.
8	Updated technical data.
8.1	More detailed list of cable requirements.
9.2	Modified figures “Schematic sheet1” … “Schematic sheet7”
9.3	Modified figure: “Floor plan top side”; added figure: “Floor plan bottom side”

Preceding document: ”DSB75 Development Support Board Hardware Description", v01
New document: ”DSB75 Development Support Board Hardware Description", v02

Chapter	What is new
Completely revised and updated all chapters and technical specifications. Added new chapters and appendix.	

1 Introduction

This document describes the

DSB75 Development Support Board
Rev. B1

The DSB75 Development Support Board is designed to assist system integrators in developing and evaluating products based on Cinterion Wireless Modules. Furthermore, it is part of the reference equipment submitted for Type Approval GSM modules.

This document describes all interfaces of the DSB75, provides technical specifications and presents guidelines for connecting and operating the GSM modules to be evaluated.

At present, the DSB75 has not been approved to comply with the CE marking regulations and can be used for laboratory purposes only. Also, please note that the DSB75 and the connected GSM module are not ESD protected. Because of these current limitations, take care that the device is only used by authorized staff.

Note: The document is only valid for the DSB75 Rev. B1. DSB75 Rev. A2 boards are no longer considered in the document.

1.1 Supported Products

DSB75 comes as a universal evaluation kit for variety of different Cinterion wireless modules. At present these are the following:

- MC75
- MC75i
- TC63
- TC63i
- TC65
- TC65i
- AC65
- AC75
- XT65
- XT75

The diversity of the supported products implies that, due to hardware or software specific properties, major differences occur regarding the availability of interfaces and the implementation of features. Therefore, please consult the specifications supplied with your module, especially [1] and [2], to make sure whether or not a described interface, signal, operating mode or function offered by the DSB75 is supported.

1.2 Related Documents

[1] Hardware Interface Description of your GSM module
[2] AT Command Set of your GSM module
[3] Application Note 02: Audio Interface Design for GSM Applications, related to your GSM module
[4] Application Note 07: Rechargeable Lithium Batteries in GSM Applications

1.3 Scope of Delivery

1.3.1 Standard package DSB75 Development Support Board

Table 1: Standard package DSB75 Development Support Board

Quantity	Description
1	DSB75 Development Support Board
1	MiniMag antenna (850 MHz – 1990 MHz)
2	RF adapter cable 150mm (Hirose – Hirose)
1	Votronic handset
2	Hexagon nuts (DIN 934 – ISO 4032)
2	Screws M2 (DIN 84 – ISO 1207)
2	Insulating spacers for M2, self-gripping

1.3.2 Product specific accessories

Some products require additional cables which are not part of the standard DSB75 package, but are supplied separately:

AC65, AC75, XT65, XT75:
- Flat flexible cable (100 mm) for connecting the module to the board-to-board connector located on the DSB75 board.

AC65, AC75:
- Special GSM adapter cable (200 mm) with Hirose U.FL-LP-066 and Rosenberger SMP 19K202-270 connectors.

XT65, XT75:
- Active GPS antenna
- Special GPS adapter cable (100 mm) with Hirose connector and female SMA connector to be connected to the module and to the active GPS antenna.

1.4 Terms and Abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ASC	Asynchronous Serial Controller
B2B	Board-to-Board connector
CE	Conformité Européene (European Conformity)
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DAI	Digital Audio Interface
DRX	Discontinuous Reception
DSB	Development Support Board
DSR	Data Set Ready
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
GPIO	General Purpose Input/ Output
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
IGT	Ignition
I/O	Input/Output
kbps	kbits per second
LDO	Low Drop Out Regulator
LED	Light Emitting Diode
Li-Ion	Lithium-Ion
MMC	Multi Media Card
NTC	Negative Temperature Coefficient
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PSU	Power Supply Unit
PTT	Push-To-Talk
PWM	Pulse Width Modulation
RF	Radio Frequency
ROM	Read-only Memory
RTC	Real Time Clock

Abbreviation	Description
RTS	Request to Send
Rx	Receive Direction
SAR	Specific Absorption Rate
SCLK	Serial Clock
SD	Secure Digital
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SMA	RF connector system: SubMiniature version A
SPI	Serial Peripheral Interface
Tx	Transmit Direction
USB	Universal Serial Bus

2 General Overview

2.1 Key Features at a Glance

Table 3: Key features

Feature	Implementation
GSM module interface	• Direct connection and mechanical fixing of GSM module via 80-pin board-to-board connector and screws.
Power supply	• Laboratory PSU (9V…15V) or • Battery 3.3V…4.5V
Battery charging	• Implemented charging circuit (FET) • Operation with plug-in charging adapter
Antenna interface	• Integrated connection between module's Hirose connector and SMA connector
SIM interface	• SIM card connector with front tray loading and card detection • Supported SIM cards: 3V and 1.8V
SD Card interface	• SD card connector with front slot, card detection indication and write protection indication • Supply voltage: 2.9V • Supported modes: SD mode or SPI mode
Audio interfaces	• Two analog audio interfaces (both with microphone supply) for connecting a handset, headset or speakerphone. • One digital audio interface (DAI)
I²C interface	• Host mode • Supports 3V or 5V devices (configurable) • Connected I²C EEPROM (128kBit) with adjustable addresses
SPI interface (option)	• Two interfaces to be used alternatively to other interfaces • Host mode
Serial interfaces	• Three RS-232C interfaces: COM1 - serial interface for data communication COM2 - serial interface for control purposes COM3 - serial interface for debug purposes • Max. baud rate: 460800 bps
USB interfaces	• USB 1.1 Full Speed (12 Mbit/s) device interface at B receptacle (default)
GPIOs	• 10 GPIOs at pins • Switchable pull-up/down resistors (for 8 GPIOs) • LED signaling (for 8 GPIOs)
ADC inputs	• 2 analog inputs • Switchable loop with DAC output at each line

Feature	Implementation
DAC output	• One analog output for DC or AC voltages • Filtered PWM signal
Signal indication	• 23 LEDs are available for signal indication • Two LEDs for on/off indication
Configuration facilities	• Several module signal lines have multiple functions (depending on the GSM module and its configuration). Those lines are switchable to the right interfaces by slide switches and jumpers. • Adjustable module supply voltage
Temperature range	• Normal operation: 15°C to +35°C • Storage: -40°C and +85°C
Physical characteristics	• Size: 177mm x 160mm x 36mm (PCB)

2.2 System Overview

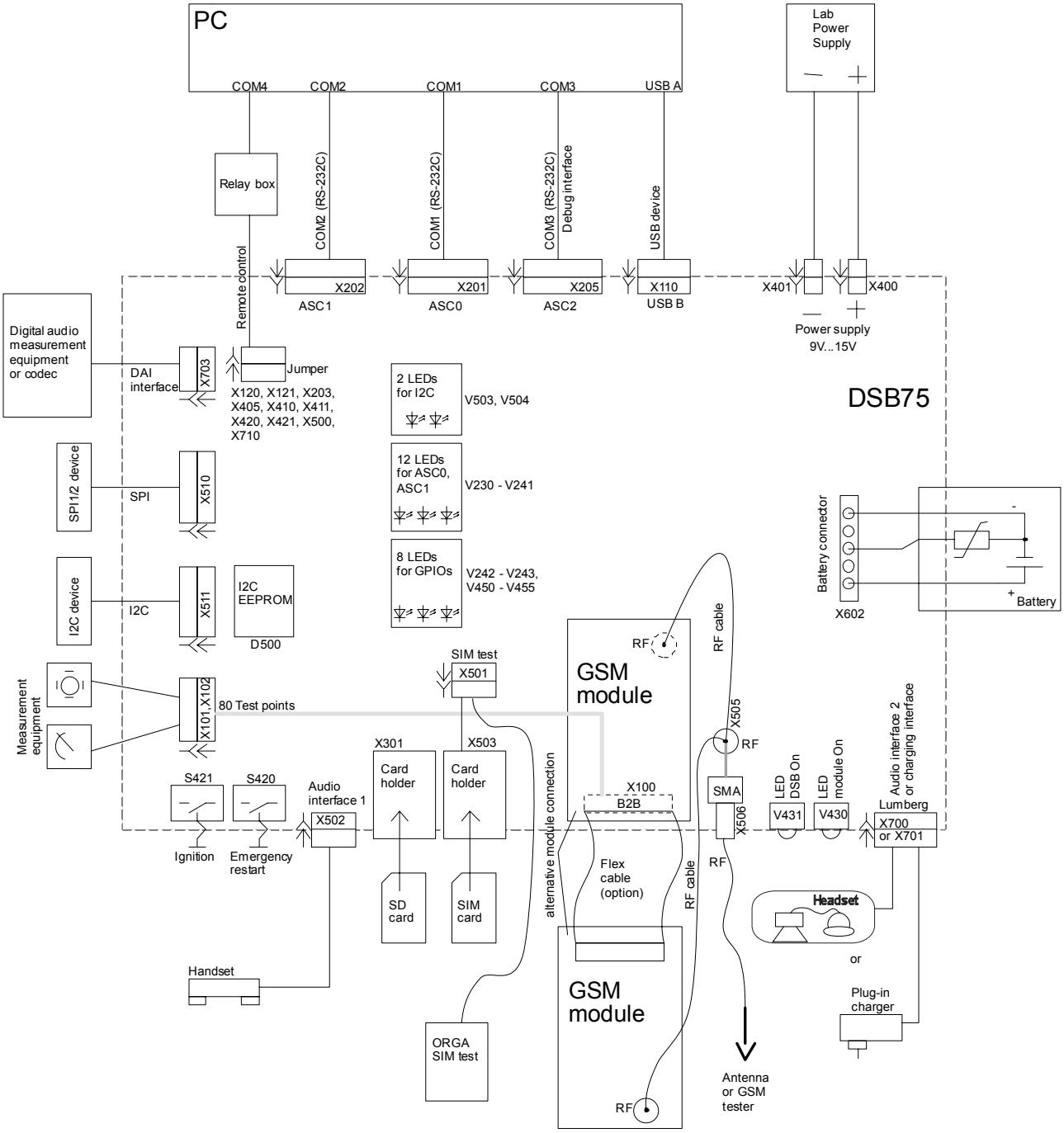


Figure 1: System overview

2.3 Location of Connectors, Switches, Jumpers, LEDs, Adjustable Resistors

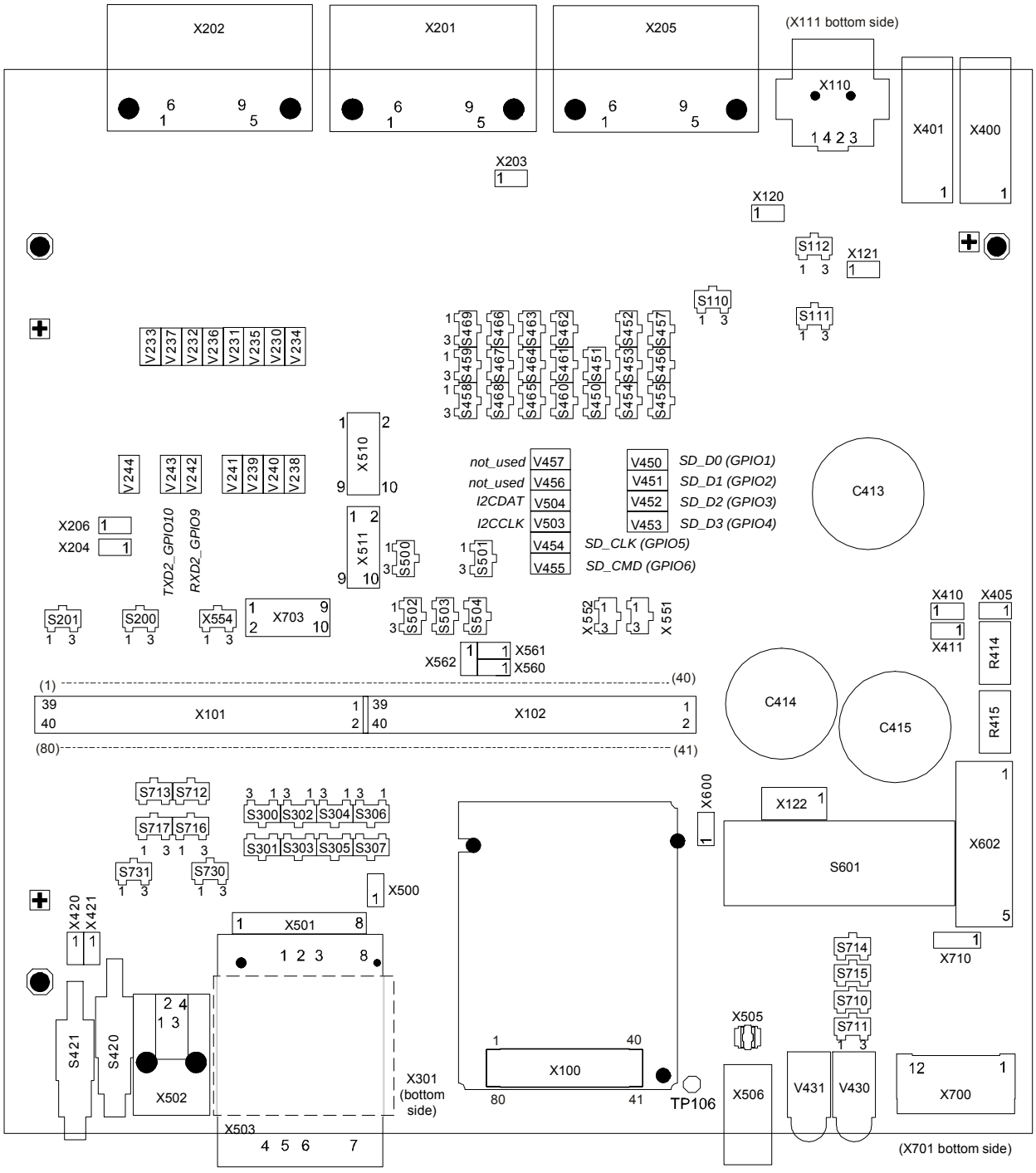


Figure 2: Location of the connectors, switches, jumpers, LEDs and adjustable resistors

2.4 Block Diagram

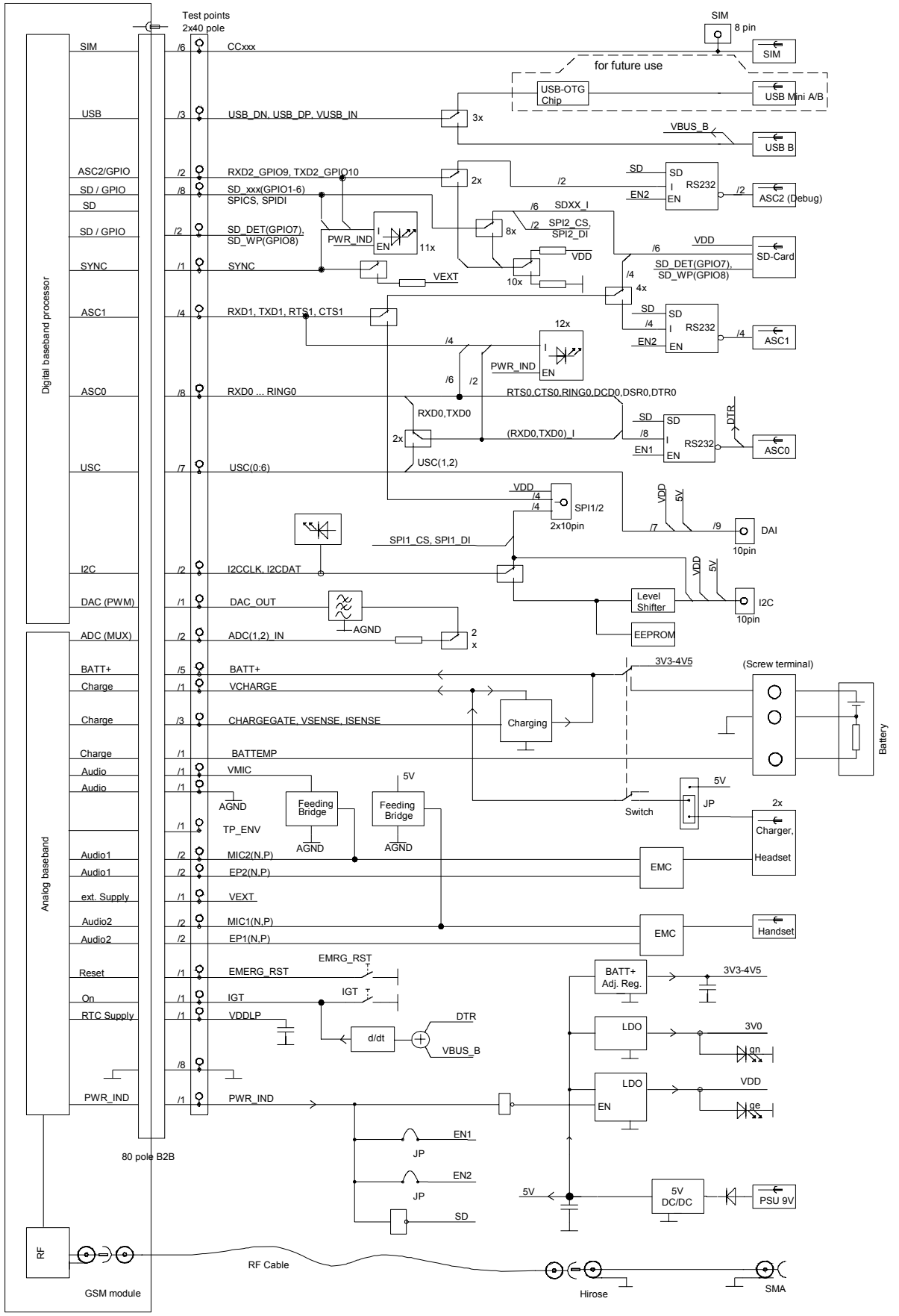


Figure 3: Block diagram

2.5 Interface Overview

Table 4: Interfaces of the DSB75

Interface	Reference number	Description
IGT	S421	Ignition push button
Emergency reset	S420	Emergency reset push button
Handset	X502	Audio interface 1 (4-pin western jack). Intended for connecting a handset.
SIM	X503	SIM card holder
RF	X506	RF signal (SMA connector)
Green LED	V431	DSB ON. Power LED that indicates the operating voltage for the DSB75.
Yellow LED	V430	Module ON. Power LED that indicates the operating voltage for the GSM module.
SD card	X301	SD card holder
Charger, Headset, Carkit	X700, X701	Two different functions provided by the same connector (Lumberg connector): a) Input for plug-in charger b) Audio 2 interface for headset or speakerphone X700 for old, X701 for new accessories.
9V GND	X400 (red) X401 (black)	Supply voltage nominal +9V. Connectors used to attach a laboratory PSU.
COM1	X201	Serial interface 1 (9-pin SubD connector). RS-232C interface with 8 data and modem control lines. Intended for GPRS data, circuit switched data, multiplexed data, AT commands. Connects to the module's serial interface ASC0.
COM2	X202	Serial interface 2 (9-pin SubD connector). RS-232C interface with 2 data and 2 modem control lines: TXD1 and RXD1 plus RTS1 and CTS1 for hardware handshake. Intended for GPRS data and AT commands. Connects to the module's serial interface ASC1.
COM3	X205	Debug interface (9-pin SubD connector). RS-232C interface with 2 data lines: TXD2 and RXD2. Connects to the module's serial interface ASC2 (for internal use only).
USB B	X110, X111	USB device interface (type B receptacle)
GSM module	X100	80 pole board-to-board connector for GSM module
RF	X505	RF connector for connecting GSM module via RF cable
Battery	X602	Battery connector
Test points	X101, X102	80 test pins (80 pole dual strip[1]); 1:1 connection to B2B connector X100, Terminal for GPIOs, ADCn_IN lines

Interface	Reference number	Description
I²C	X511	3V and 5V I²C interface (10 pole dual strip[1])
SPI1/2	X510	SPI interface 1 and 2 (10 pole dual strip[1])
DAI	X703	DAI (digital audio interface) Intended for transferring PCM data and for digital audio measurements.
SIM	X501	SIM test interface (8 pole single strip[1])
Remote control	X120, X121, X203, X405, X410, X411, X420, X421, X500, X710	Jumpers used to connect special PC controlled relay box.
DAC filter	X560 - X562	Jumpers used to insert a customized DAC filter.
BATT+ current	X122	Jumpers used for BATT+ current measurement.

[1] Grid of the strip connectors: 0.1 inch

3 Description of DSB75 Interfaces

3.1 GSM Module Interface (Board-to-Board Connector)

The Molex board-to-board connector X100 on the DSB75 is an 80-pin double-row receptacle. Figure 4 shows the names and positions of the pins on the DSB75. The pin allocation is identical to the GSM module, but pin names may be different.

Several pins have multiple functions depending on the type of GSM module and a variety of alternate configurations.

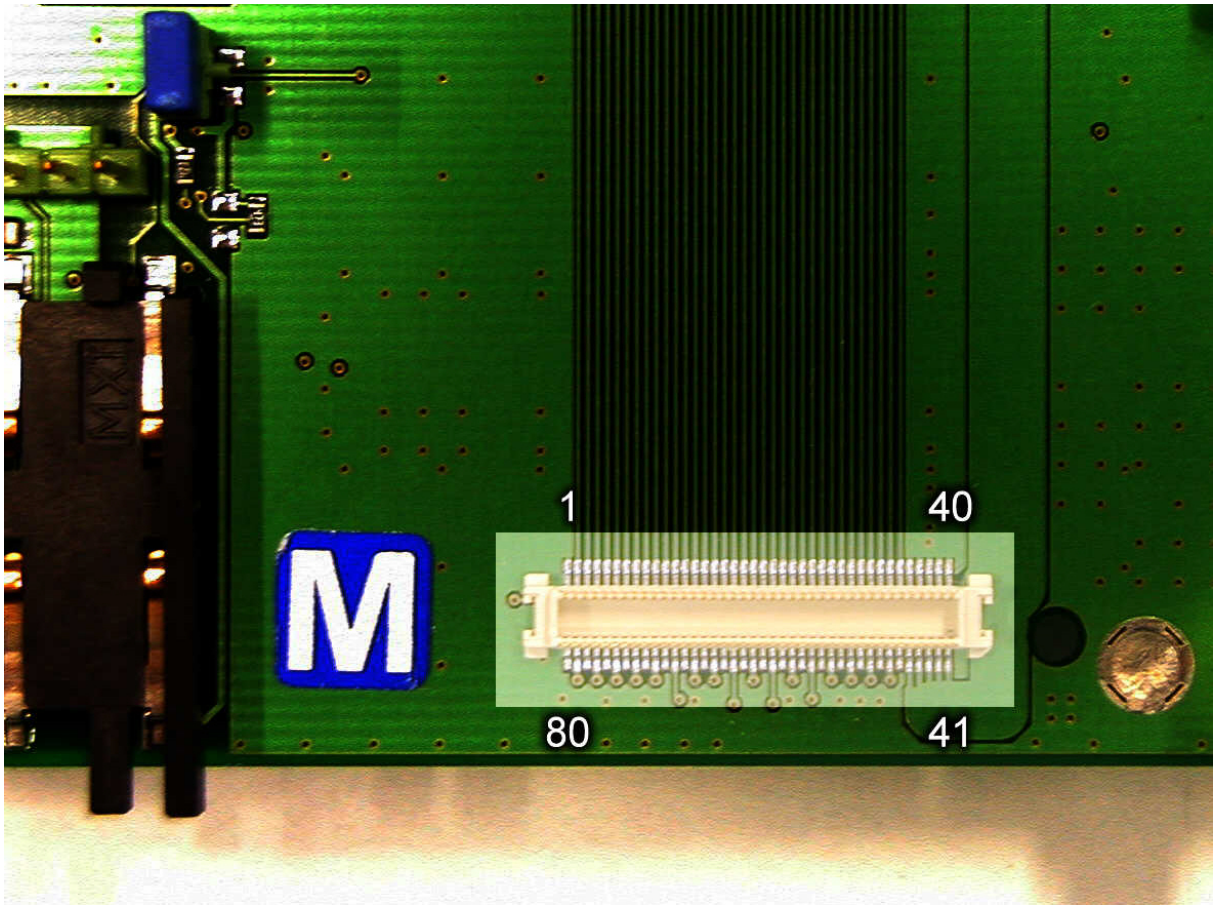


Figure 4: Pin assignment of the B2B connector

Table 5: Pin assignment of B2B connector X100

Pin no.	Signal name		Signal name	Pin no.
80	GND		GND	1
79	DAC_OUT		ADC1_IN	2
78	PWR_IND		ADC2_IN	3
77	TP_ENV		GND	4
76	RXD2_GPIO9		TXD2_GPIO10	5
75	SPICS		SD_WP(GPIO8)	6
74	SD_3(GPIO4)		SPIDI	7
73	SD_2(GPIO3)		SD_DET(GPIO7)	8
72	SD_1(GPIO2)		SD_CMD(GPIO6)	9
71	SD_0(GPIO1)		SD_CLK(GPIO5)	10
70	I2CDAT		I2CCLK	11
69	USB_DP		VUSB_IN	12
68	USB_DN		USC5	13
67	VSENSE		ISENSE	14
66	VMIC		USC6	15
65	EPN2		CCCLK	16
64	EPP2		VSIM	17
63	EPP1		CCIO	18
62	EPN1		CCRST	19
61	MICN2		CCIN	20
60	MICP2		CCGND	21
59	MICP1		USC4	22
58	MICN1		USC3	23
57	AGND		USC2	24
56	IGT		USC1	25
55	EMERG_RST		USC0	26
54	DCD0		BATTEMP	27
53	CTS1		SYNC	28
52	CTS0		RXD1	29
51	RTS1		RXD0	30
50	DTR0		TXD1	31
49	RTS0		TXD0	32
48	DSR0		VDDLP	33
47	RING0		VCHARGE	34
46	VEXT		CHARGEGATE	35
45	BATT+		GND	36
44	BATT+		GND	37
43	BATT+		GND	38
42	BATT+		GND	39
41	BATT+		GND	40

Note:

The electrical characteristics of this interface meet the requirements of GSM module's application interface.

3.2 Test Points

All module pins at the B2B connector X100 are connected 1:1 to the pin headers X101, X102. They may be used for connecting measurement equipment, customized host interfaces or as access points to GPIOs, DAC, ADCs, audio lines, etc.

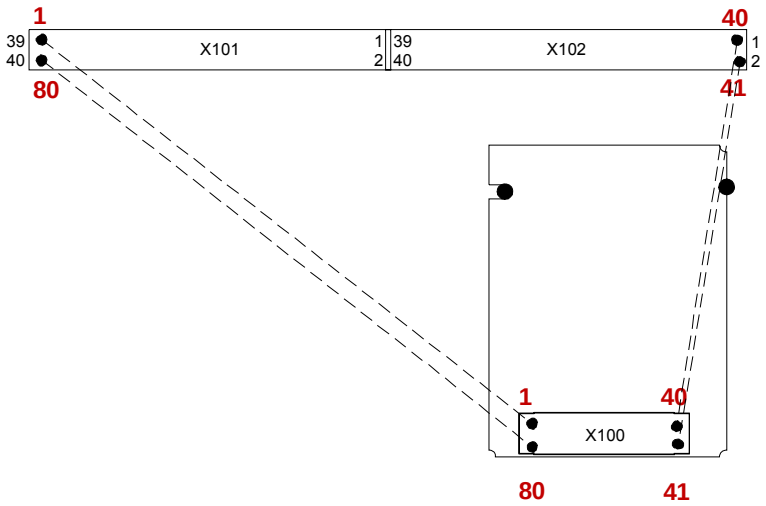


Figure 5: Overview of B2B connector pins and the corresponding test points

Figure 6: Location of the test points

Table 6: Pin assignment – B2B connector X100 and test points X101

X100 pin number	Signal name	X101 test point			Signal name	X100 pin number
80	GND	40		39	GND	1
79	DAC_OUT	38		37	ADC1_IN	2
78	PWR_IND	36		35	ADC2_IN	3
77	TP_ENV	34		33	GND	4
76	RXD2_GPIO9	32		31	TXD2_GPIO10	5
75	SPICS	30		29	SD_WP(GPIO8)	6
74	SD_3(GPIO4)	28		27	SPIDI	7
73	SD_2(GPIO3)	26		25	SD_DET(GPIO7)	8
72	SD_1(GPIO2)	24		23	SD_CMD(GPIO6)	9
71	SD_0(GPIO1)	22		21	SD_CLK(GPIO5)	10
70	I2CDAT	20		19	I2CCLK	11
69	USB_DP	18		17	VUSB_IN	12
68	USB_DN	16		15	USC5	13
67	VSENSE	14		13	ISENSE	14
66	VMIC	12		11	USC6	15
65	EPN2	10		9	CCCLK	16
64	EPP2	8		7	VSIM	17
63	EPP1	6		5	CCIO	18
62	EPN1	4		3	CCRST	19
61	MICN2	2		1	CCIN	20

Note:

The electrical characteristics of this interface meet the requirements of GSM module's application interface.

Table 7: Pin assignment – B2B connector X100 and test points X102

X100 pin number	Signal name	X102 test point			Signal name	X100 pin number
60	MICP2	40		39	CCGND	21
59	MICP1	38		37	USC4	22
58	MICN1	36		35	USC3	23
57	AGND	34		33	USC2	24
56	IGT	32		31	USC1	25
55	EMERG_RST	30		29	USC0	26
54	DCD0	28		27	BATTEMP	27
53	CTS1	26		25	SYNC	28
52	CTS0	24		23	RXD1	29
51	RTS1	22		21	RXD0	30
50	DTR0	20		19	TXD1	31
49	RTS0	18		17	TXD0	32
48	DSR0	16		15	VDDLP	33
47	RING0	14		13	VCHARGE	34
46	VEXT	12		11	CHARGEGATE	35
45	BATT+	10		9	GND	36
44	BATT+	8		7	GND	37
43	BATT+	6		5	GND	38
42	BATT+	4		3	GND	39
41	BATT+	2		1	GND	40

3.3 GPIO Lines

The DSB75 board has 10 GPIO facilities (see Figure 7). Which of them are used depends on the type of GSM module and the software configuration.

If the GPIO lines are configured as input, the level may be set to 0 or 1 by S460 - S469.

The GPIO lines can be connected to measurement equipment or to an external host application via the test pin X101.

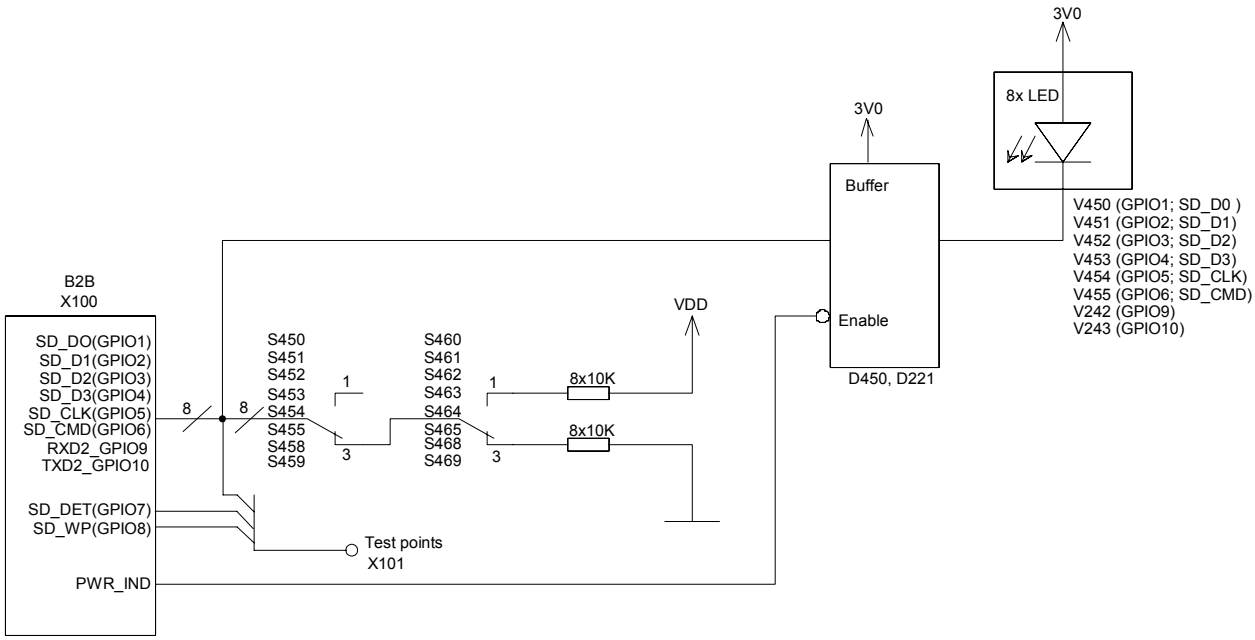


Figure 7: GPIO circuit

GPIO status is indicated by LEDs (for GPIOs 1-6 and 9-10).

Table 8: LED indication of GPIO status

GPIO level	LED status
0 (low)	on
1 (high)	off

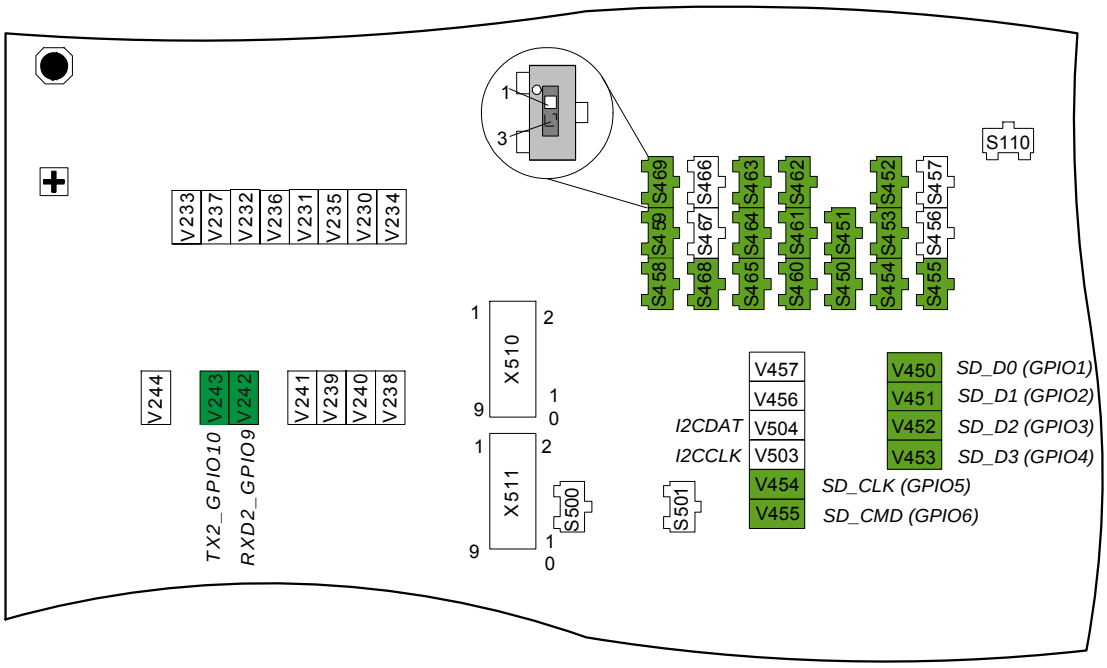


Figure 8: GPIO - location of switches and LEDs

Table 9: GPIO assignment and switch position

X100 pin	Signal name	GPIO	S450-459	S460-469
71	SD_D0	1	S450:3	S460:x[1]
72	SD_D1	2	S451:3	S461:x
73	SD_D2	3	S452:3	S462:x
74	SD_D3	4	S453:3	S463:x
10	SD_CLK	5	S454:3	S464:x
9	SD_CMD	6	S455:3	S465:x
8	SD_DET	7		
6	SD_WP	8		
76	RXD2_GPIO9	9	S458:3	S468:x
5	TXD2_GPIO10	10	S459:3	S469:x

[1] Switch position x may be position 1 or 3.
high level input: x=1
low level input: x=3

Electrical characteristics are specified in section 8.

3.4 SIM Card Interface

The DSB75 has an integrated SIM card interface. An appropriate SIM card (3V or 1.8V) is required to start the GSM module. The SIM card holder X503 placed on the DSB75 is from type Molex. To open the card holder simply press the yellow pin.

In parallel to the SIM card holder X503, the test points X501 are connected, e.g. for SIM test equipment.

In series to the recognition switch (holder pins 7 and 8) there is a jumper X500 connected. It must set for normal operation and may be used for testing the SIM card detection ability from a remote device.

Figure 9 shows the simplified interface schematic.
The pin location of the SIM card holder and SIM test pins is shown in Figure 10.
The pin assignment is given in Table 10.

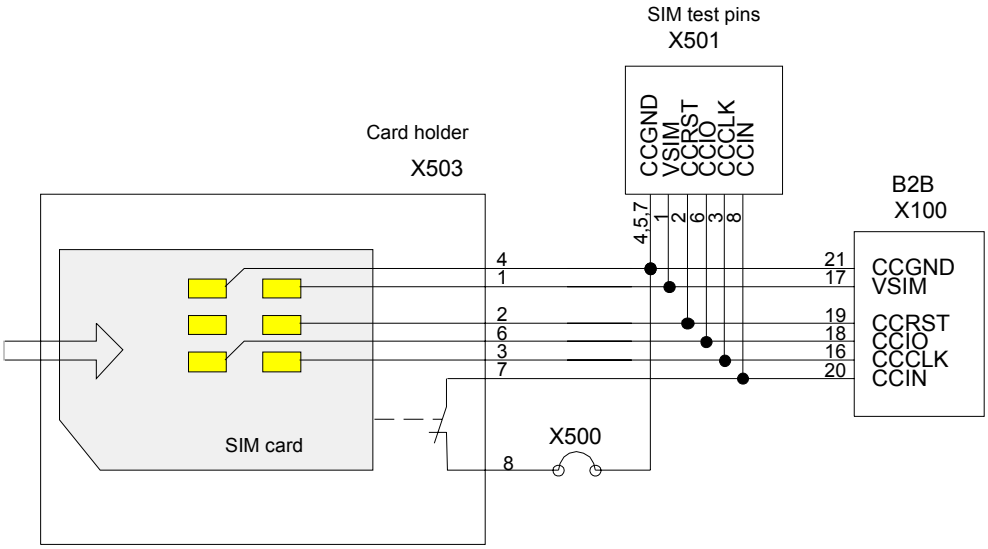


Figure 9: SIM card interface

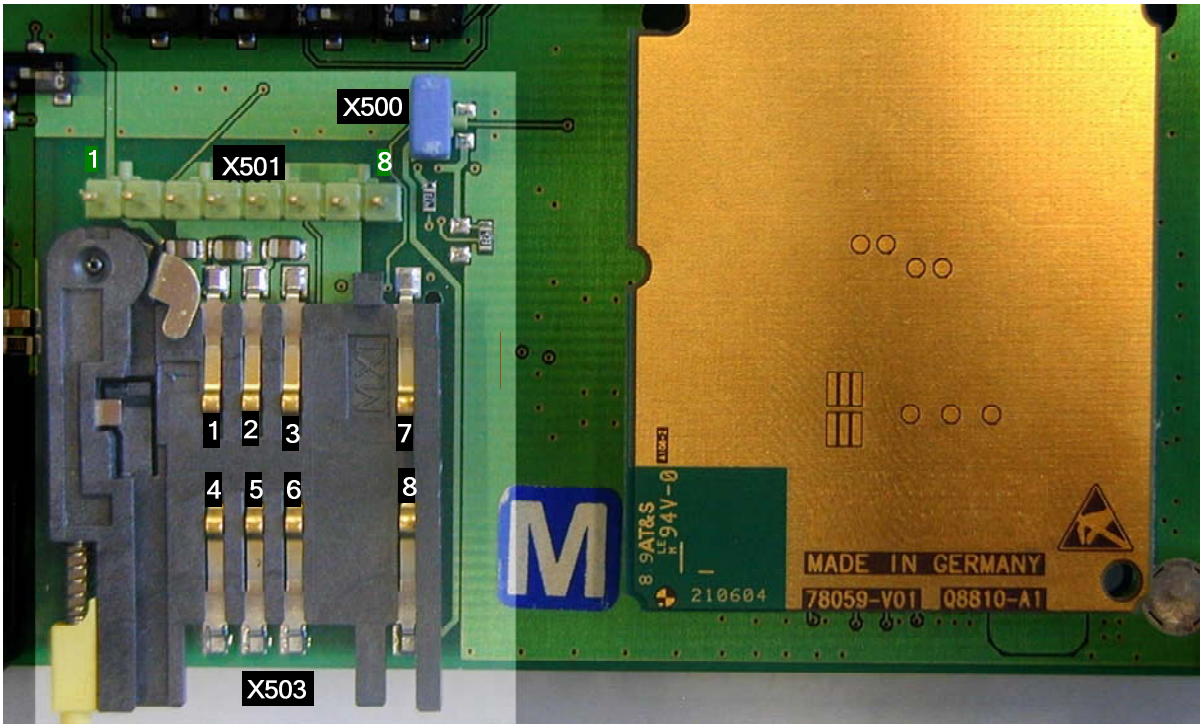


Figure 10: Pin location of the Molex SIM card holder and test pins

Table 10: Pin assignment – SIM card holder X503 and test pins X501

Pin number on holder X503	X501 test points	Signal name	I/O	Function
1	1	VSIM	O	Supply voltage U = 2.93V (typ.) or 1.8V for SIM card, generated by the module.
2	2	CCRST	O	Chip card reset, prompted by the module
3	3	CCCLK	O	Chip card clock
4,8	4, 5, 7	CCGND	-	Separate ground line for the SIM card to improve EMC
5	-	CCVPP	-	Not connected
6	6	CCIO	I/O	Serial data line, bi-directional
7	8	CCIN	I	Chip card detection 0 = Chip card drawer is inserted 1 = Chip card drawer is not inserted

3.5 RS-232 Interfaces

The DSB75 offers three asynchronous RS-232 interfaces:

- COM1 (ASC0)
- COM2 (ASC1)
- COM3 (ASC2)

The status of all interface lines is indicated by LEDs (refer to section 4).
For using ASCx lines on the test pins X101, X102 without the DSB75 level converter please disable receiver outputs by removing jumpers X204 and X206.
Figure 11 shows the simplified interface schematic. Figure 12 shows the placement of the D-sub connectors, switches, jumper and the pin location. Electrical characteristics are specified in section 8.

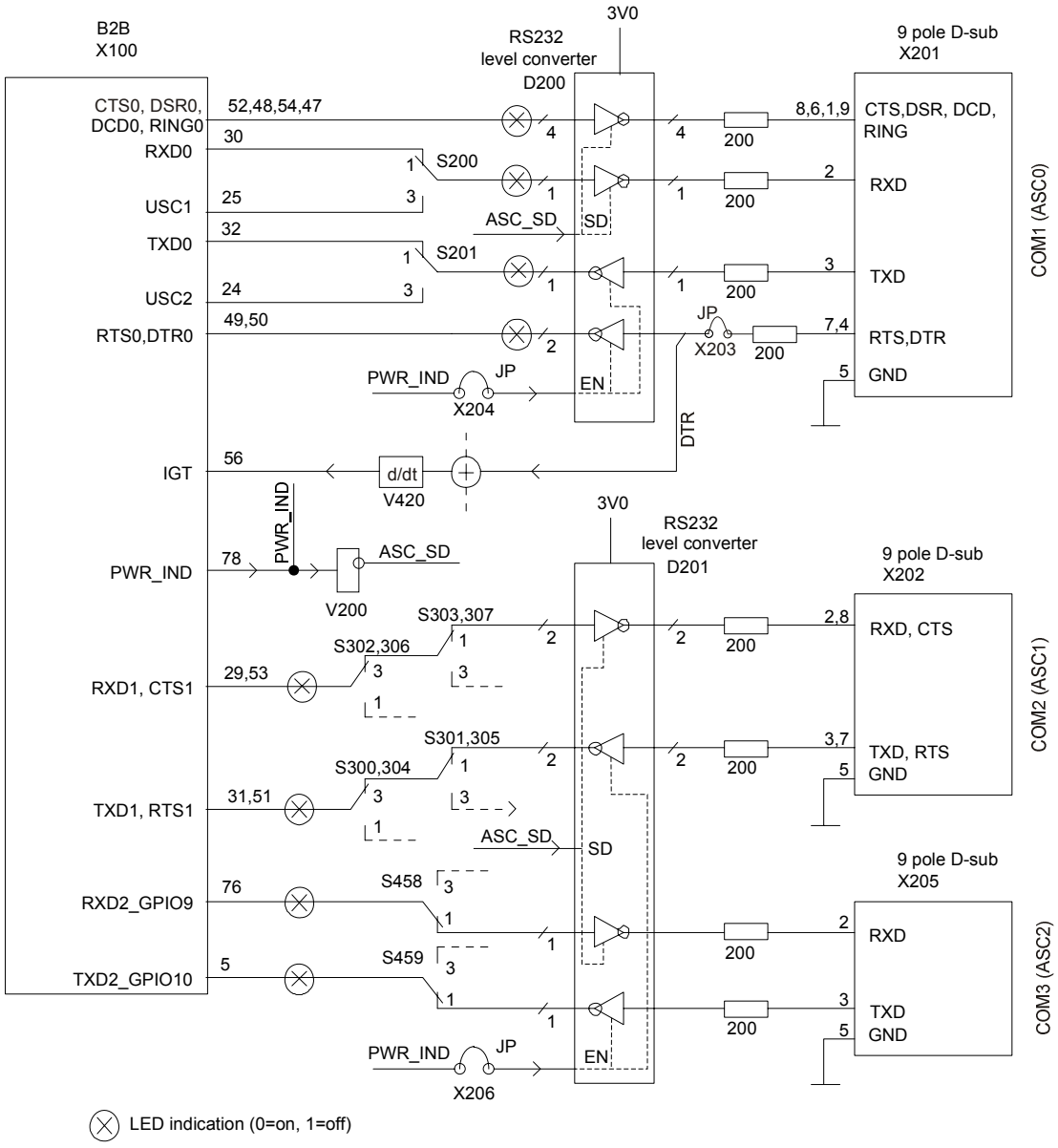


Figure 11: RS-232 interfaces

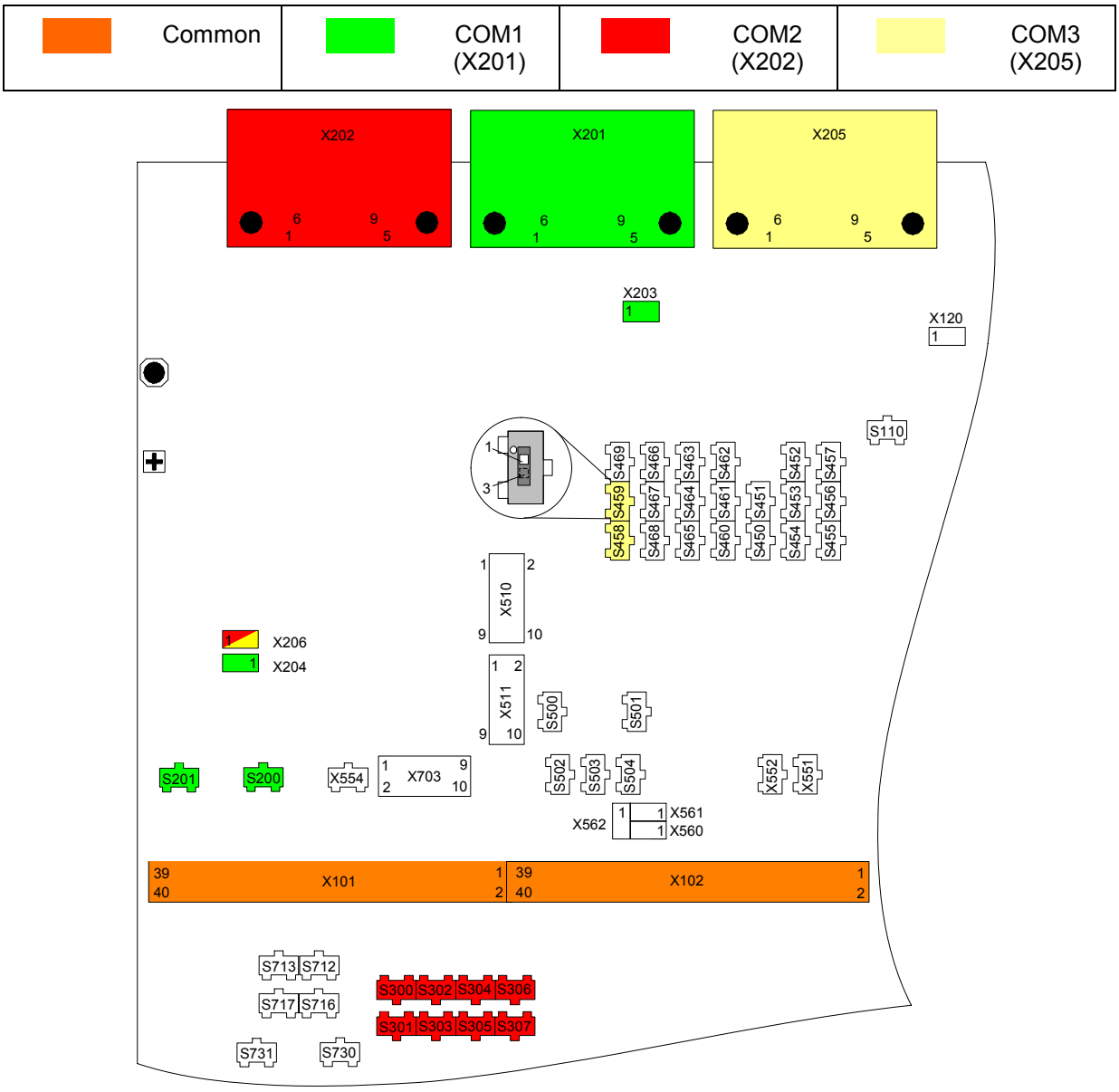


Figure 12: Location of the RS-232 interfaces and switches

3.5.1 Serial Interface 1 (COM1)

The 1st serial interface COM1 (X201) of the DSB75 is intended for the communication between the GSM module and the host application. This RS-232C interface is a data and control interface for transmitting data, AT commands and providing multiplexed channels etc. All modem status lines are available.

A level converter D200 adapts and inverts the V.24 signals (2.9V level) from the GSM module to RS-232C level.

The output lines are switched off (high impedance) while the GSM module is in POWER DOWN mode. Therefore the PWR_IND signal is used to enable and shut down converters.

The rising edge of the DTR line voltage generates an ignition signal (impulse) via the V420 differential circuit so that it is possible to turn on the GSM module from the host, by plugging in the serial cable or by remote control.

The USC lines (USC1, USC2) can be used as an alternative to the standard ASC0 lines (RXD0, TXD0). In this case the switches S200, S201 have to be set to position 3. The usability of the USC lines depends on the software configuration of the GSM module and is for internal use only.

Table 11: Pin assignment of 1st serial interface COM1 (X201)

X201 pin	Name	I/O	Description	X100 signal name	Config. switches	Remark
1	DCD	O	Data Carrier Detected	DCD0		
2	RXD	O	Receive Data	RXD0	S200:1	
				USC1	S200:3	For internal use only
3	TXD	I	Transmit Data	TXD0	S201:1	
				USC2	S201:3	For internal use only
4	DTR	I	Data Terminal Ready **Note:** Low-to-high transition of the DTR line activates the ignition signal of the GSM module.	DTR0		
5	GND	-	Ground	GND		
6	DSR	O	Data Set Ready Attention: Switch DSR0_I (X122) must be set to DSR0_I position.	DSR0		
7	RTS	I	Request To Send	RTS0		
8	CTS	O	Clear To Send	CTS0		
9	RING	O	Ring Indication	RING0		

3.5.2 Serial Interface 2 (COM2)

The 2nd serial interface COM2 (X202) of the DSB75 is intended for the communication between the GSM module and the host application. This RS-232C interface includes only the data lines RXD/TXD for transmitting GPRS data and AT commands, and the two control lines RTS/CTS.

A level converter D201 adapts and inverts the V.24 signals (2.9V level) from the GSM module to the RS-232C level.

The output lines are switched off (high impedance) if the GSM module is in POWER DOWN mode. Therefore the PWR_IND signal is used to enable and shut down converters.

There are two alternative approaches to configure the ASC1 lines:
- as SD card interface (see section 3.10.2)
- as SPI interface (see section 3.10.3)

For using ASC1 lines at the test pins X101/X102 without a RS-232 level shifter, the switches S300, S302, S304 and S306 have to be set to position 1.

Table 12: Pin assignment of 2nd serial interface COM2 (X202)

X202 pin	Name	I/O	Description	X100 signal name	Config. switches	Remark
2	RXD	O	Receive Data	RXD1	S302:3 S303:1	
3	TXD	I	Transmit Data	TXD1	S300:3 S301:1	
5	GND	-	Ground	GND		
7	RTS	I	Request To Send	RTS1	S304:3 S305:1	
8	CTS	O	Clear To Send	CTS1	S306:3 S307:1	
1, 4, 6, 9	nc					

nc= not connected

As the X202 interface has only four lines, you may need a customized adapter cable for the RS-232 connection. This is useful, for example, if your application also requires the lines DSR, DCD, RING. In such a case it is recommended to use the following pin assignment:

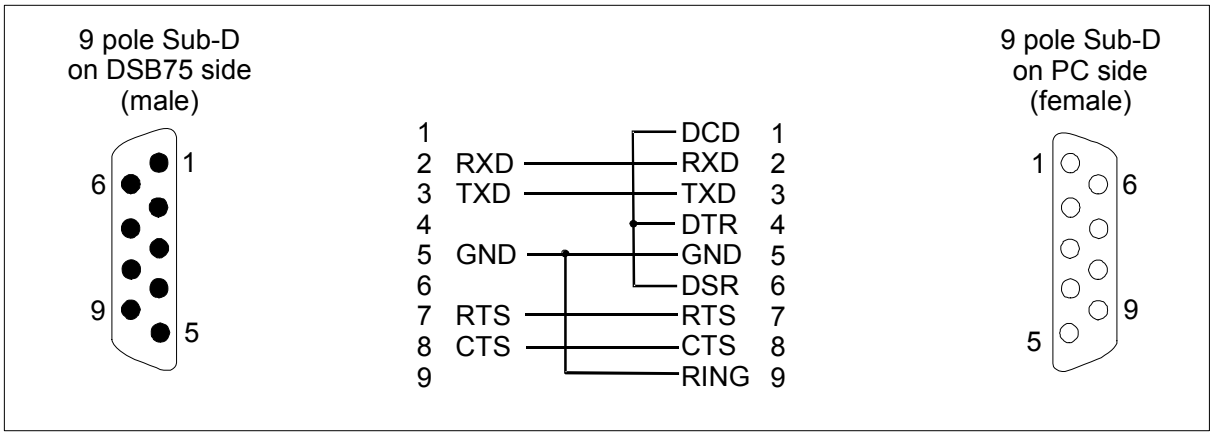


Figure 13: Recommended adapter cable from PC to COM2 on DSB75

3.5.3 Debug Interface (COM3)

The debug interface COM3 (X205) of the DSB75 is reserved for internal software debugging. It is a two wire interface with data lines only.

A level converter D201 adapts and inverts the V.24 signals (2.9V level) from the GSM module to RS-232C level.

The output lines are switched off (high impedance) if the GSM module is in POWER DOWN mode.

The ASC2 lines of the GSM module are used by default as GPIOs (see section 3.3)

Table 13: Pin assignment of debug interface COM3 (X205)

Pin	Name	I/O	Description	X100 signal name	Config. switches	Remark
2	RXD	O	Receive Data	RXD2_GPIO9	S458:1	
3	TXD	I	Transmit Data	TXD2_GPIO10	S459:1	
5	GND	-	Ground	GND		
1, 4, 6, 7, 8, 9	nc					

nc= not connected

3.6 Analog Audio Interfaces

The DSB75 comprises two analog audio interfaces. Both audio interfaces are providing a supply circuit to feed an active microphone.

Figure 14 shows the simplified interface schematic.
Figure 15 shows the location of switches and the pin assignment of the audio connectors.
Electrical characteristics are specified in section 8.

Note: All specified data, e.g. load resistance are valid in TALK mode only.

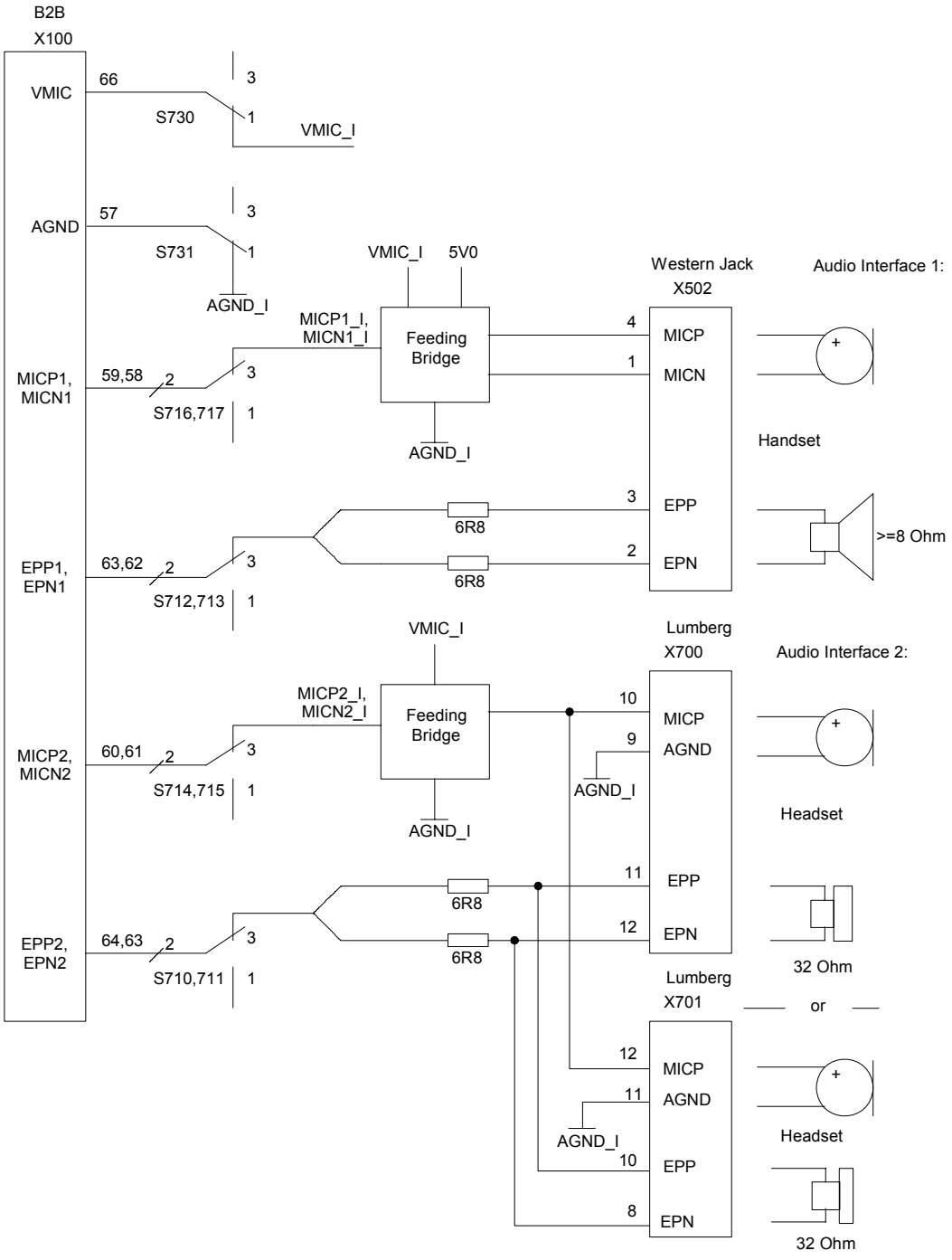


Figure 14: Analog audio interface – overview

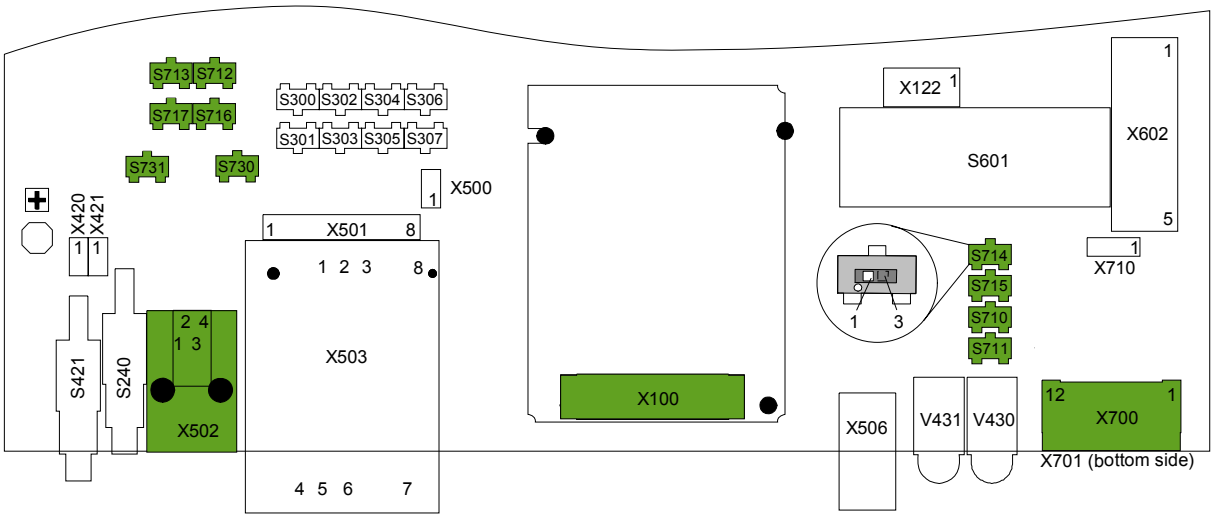


Figure 15: Location of the audio connectors and switches

3.6.1 Audio Interface 1 (Handset)

This balanced interface has been optimized for use with the Votronic handset supplied with the DSB75.

The Votronic handset is a passive handset. Power supply for its microphone is provided by the DSB75.

The handset connects to the 4-pin Western jack X502. The pin assignment of the X502 jack is shown in Table 14.

Table 14: Pin assignment of handset audio interface 1 (X502)

Signal name	Pin	I/O	Description
MICN	1	I	Microphone inverted
EPN	2	O	Loudspeaker inverted
EPP	3	O	Loudspeaker not inverted
MICP	4	I	Microphone not inverted

The Votronic handset is the reference handset used with the DSB75. Acoustic approval of the DSB75 module applies to the reference configuration comprising the Votronic handset and the DSB75. GSM applications that incorporate audio devices other than the reference handset must be submitted for additional type approval.

3.6.2 Audio Interface 2 (Headset or Speakerphone Operation)

The unbalanced audio interface 2 is designed for use with headsets or speakerphones. The interface is available on the 12-pin Lumberg connectors X700 and X701. The pin assignment of the Lumberg jacks is shown in Table 15. The power for the microphone (VMIC) is supplied by the GSM module. EPREF may be used for single ended loudspeaker configurations saving an additional coupling capacitor.

Table 15: Pin assignment of audio interface 2 (X700, X701)

Signal name	X700 pin	X701 pin	I/O	Description
GND	1	2	-	Ground Not relevant for audio.
R	2		-	4.7k resistor to pin 3, necessary for old charger types. Not relevant for audio
V_{Charge}	3	1	I	Supply voltage provided by the plug-in charger. Not relevant for audio
n.c.	4, 6, 7, 8	3, 4, 6, 7	-	Not connected. Not relevant for audio
EPREF	-	9	-	100µF capacitor to AGND. AC coupled loudspeaker ground
GND	5	5	-	5kOhm to GND.
AGND	9	11	-	Microphone and stereo loudspeaker ground
MICP	10	12	I	Microphone not inverted.
EPP	11	10	O	Loudspeaker not inverted.
EPN	12	8	O	Loudspeaker inverted.

3.6.2.1 Recommended Headset

A standard headset interface for mobile applications is the Siemens Headset PTT HHS-510.

Please note that the headset interface has no detections for a device plug or Push-To-Talk key (PTT).

3.6.2.2 Speakerphone Operation

The speakerphones which are currently available for the audio interface 2 are the “Siemens Car Kit Portable” and “Siemens Car Kit Portable HKP-500”.

The plug of “Siemens Car Kit portable HKP-500” is compatible to Lumberg connector X701.

The plug of “Siemens Car Kit Portable” is compatible to Lumberg connector X700.

The required bias voltage for the MICP2 pin of the GSM module has to be achieved by an additional 2.2-kOhm-resistor (see chapter 3.6.3, description of microphone interface 2).

Figure 16: Siemens Car Kit Portable HKP-500

3.6.3 Microphone Circuit (Feeding Bridges)

This section describes the microphone signal path through feeding bridges. The location of the audio connectors can be seen in Figure 14. Figure 17 shows the principal circuit of microphone feeding bridges.

The bridge for the audio interface 1 is optimized for feeding the Votronic headset. The balanced microphone is supplied with filtered 5V.

The bridge for the unbalanced interface 2 is supplied directly from VMIC_I (2.5V). The GSM module requires a bias voltage of 1V…1.6V between MICP2_I and AGND_I. This is normally achieved by the voltage drop of the electret microphone in the case of headset operation. Please note for speakerphone operation, that no voltage drop occurs using the “Siemens Car Kit Portable” or “Siemens Car Kit portable HKP-500”. In this case an additional 2.2 kOhm resistor has to be connected between MICP2_I and AGND_I. It is recommended to connect this resistor between X102, pin 34 (AGND) and X102, pin 40 (MICP2).

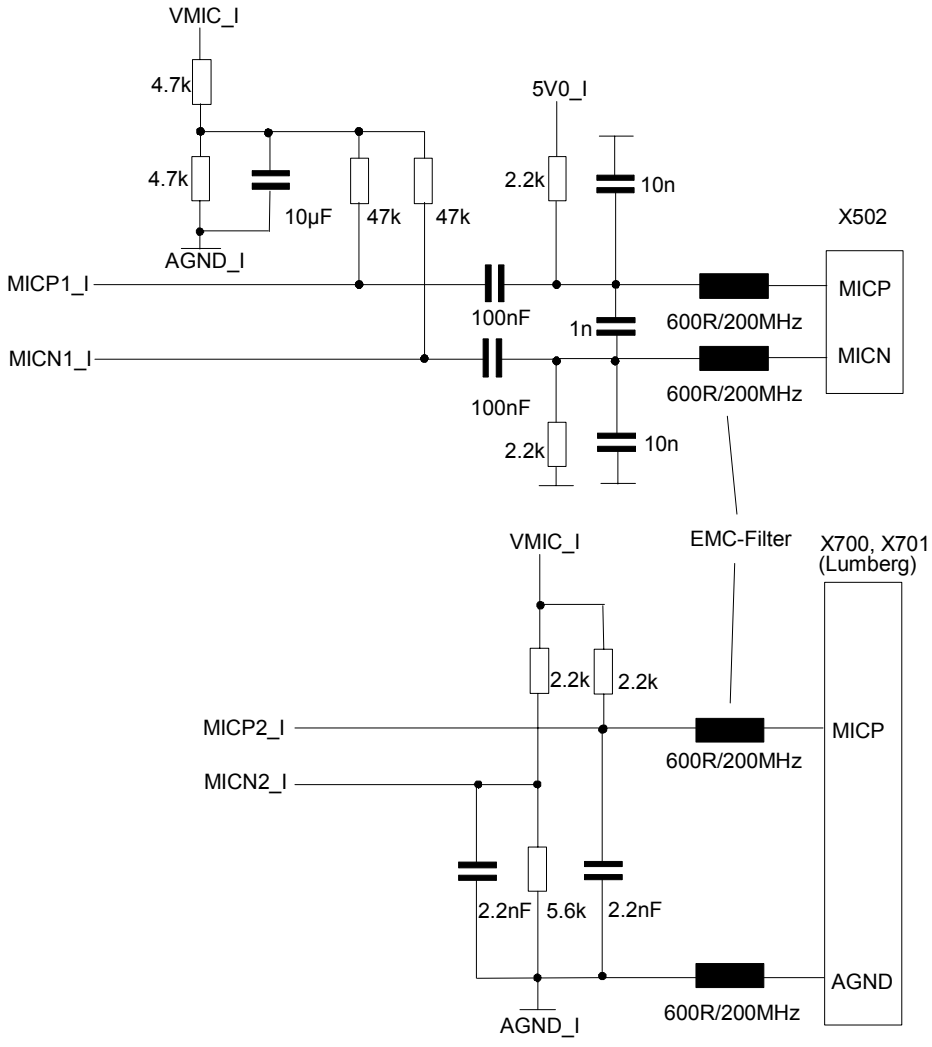


Figure 17: Circuit of microphone feeding bridges

3.7 Digital Audio Interface

The Digital Audio Interface (DAI) can be used for acoustic approval or for transferring PCM digital audio data between the GSM module and the customer application. The DAI of the GSM module is designed for use with a codec or a DSP.

The DSB75 provides different facilities to connect the GSM module and the system environment: the 10 pin DAI connector X703 and the pin headers (X101, X102).

Note: The DAI signals DAI0… DAI6 are connected to the signals USC0… USC6. Table 16 shows the pin assignment of the 10 pin DAI connector X703.

Figure 18 contains a simplified interface schematic. Figure 19 shows the location and the pin assignment of the DAI connector. Electrical characteristics are specified in section 8.

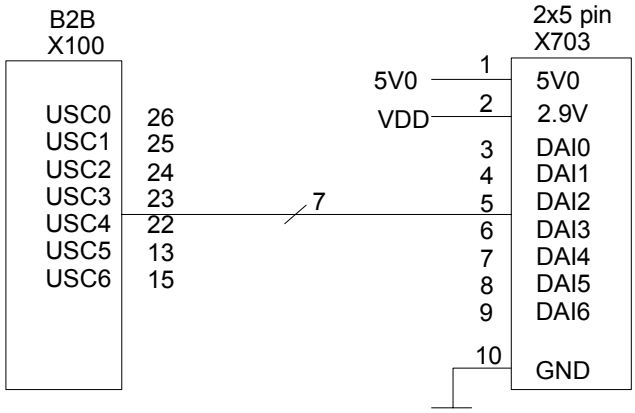


Figure 18: DAI interface

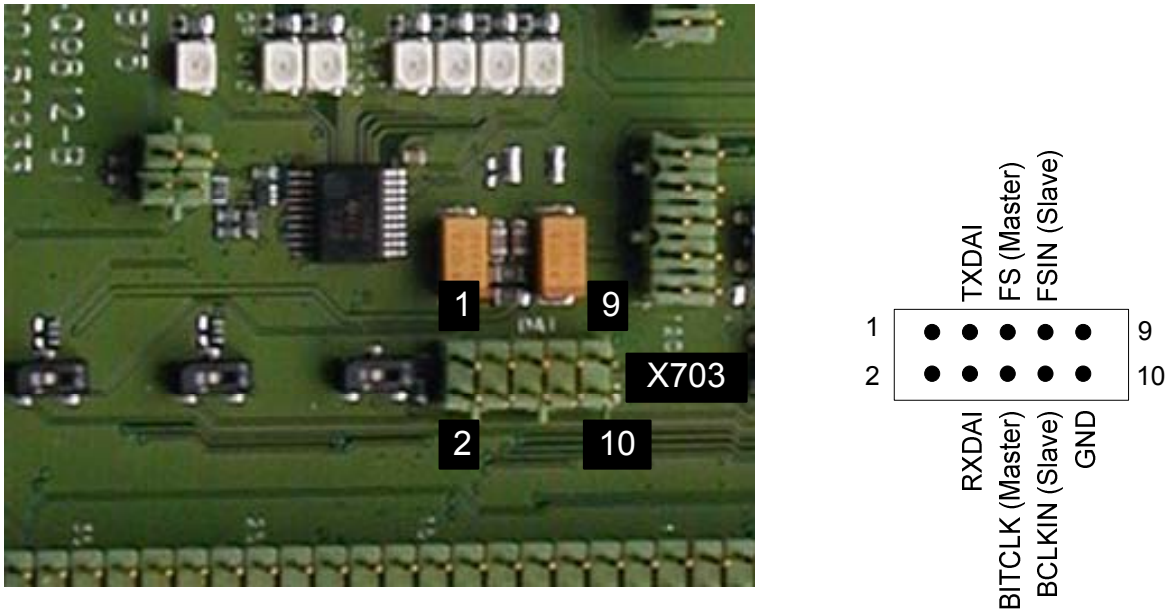


Figure 19: Location and pin assignment of the DAI connector X703

Table 16: Pin assignment of the USC/DAI interface X703

Signal name	Pin	PCM Interface		Type Approval DAI		Remark
			I/O		I/O	
5V0	1		O		O	5.0V supply for external circuit
VDD	2		O		O	2.9V supply for external circuit
DAI0 (USC0)	3	TXDAI (Master/Slave)	O	Clock 104kHz	O	
DAI1 (USC1)	4	RXDAI (Master/Slave)	I	RX	I	Optional: FS_OUT
DAI2 (USC2)	5	FS (Master)	O	TX	O	
DAI3 (USC3)	6	BITCLK (Master)	O	Reset	I	
DAI4 (USC4)	7	FSIN (Slave)	I	Test1	I	
DAI5 (USC5)	8	BCLKIN (Slave)	I	Test2	I	
DAI6 (USC6)	9	nc	I	Reset2	I	
GND	10	-	-	-	-	Ground

Master and Slave capabilities of the DAI are product specific. Please refer to [1], [2] and [3] to make sure whether your GSM module supports these features.

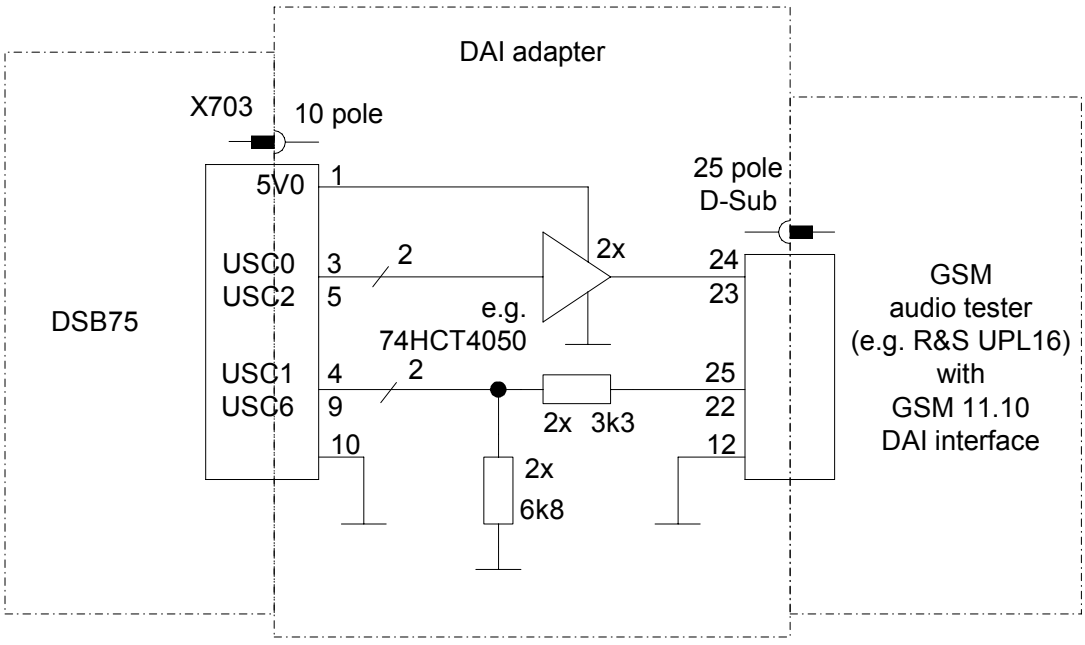


Figure 20: Example for connecting measurement equipment

3.8 USB Device Interface

DSB75 supports a USB 1.1 Full Speed (12 Mbit/s) device interface. It is primarily intended for use as command and data interface and for downloading firmware.

The second USB interface with mini AB connector (X111) is reserved for future use and has been not described.

Figure 21 shows the simplified interface schematic. Figure 22 shows the placement of the USB connectors, switches, jumper and the pin location. Electrical characteristics are specified in section 8.

DSB75 provides a USB B receptacle to connect a host device. The USB lines VBUS, D+, D- are connected directly to the GSM module via slide switches S110 - S112 (position 3).

In series to VBUS line there is a jumper (X120) connected. It is set during normal operation and may be used for remote control facilities.

The rising edge of VBUS voltage generates an ignition signal (impulse) via the differential circuit V420. This way it is possible to turn on GSM module from the host, by plugging in the serial cable or by remote control.

The EMC circuit protects the DSB75 and the GSM module against overvoltage (e.g. ESD).

The USB I/O pins are capable of driving the signal at minimum 3.0V. They are protected from 5V input voltage driven from the host according to the USB specifications.

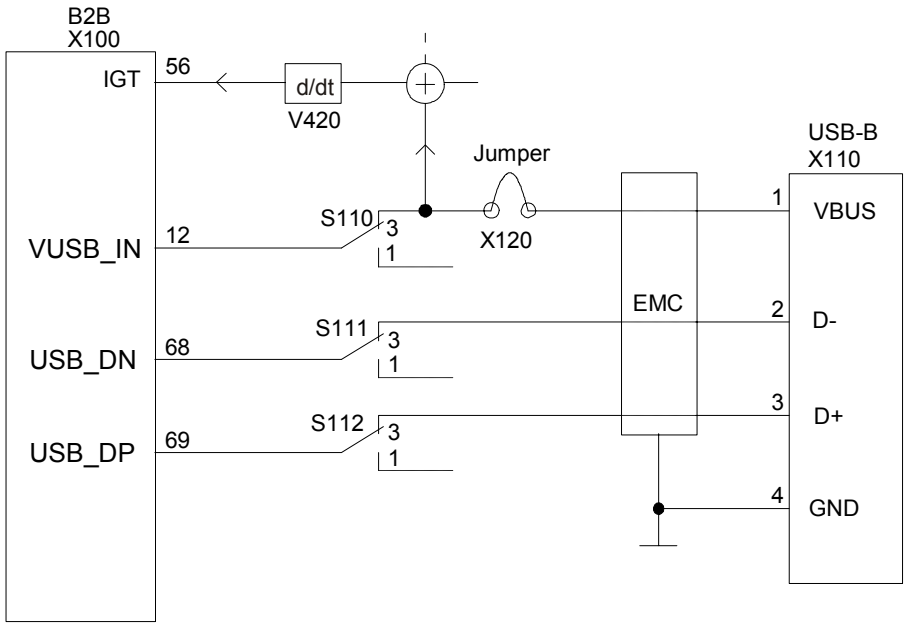


Figure 21: USB device interface

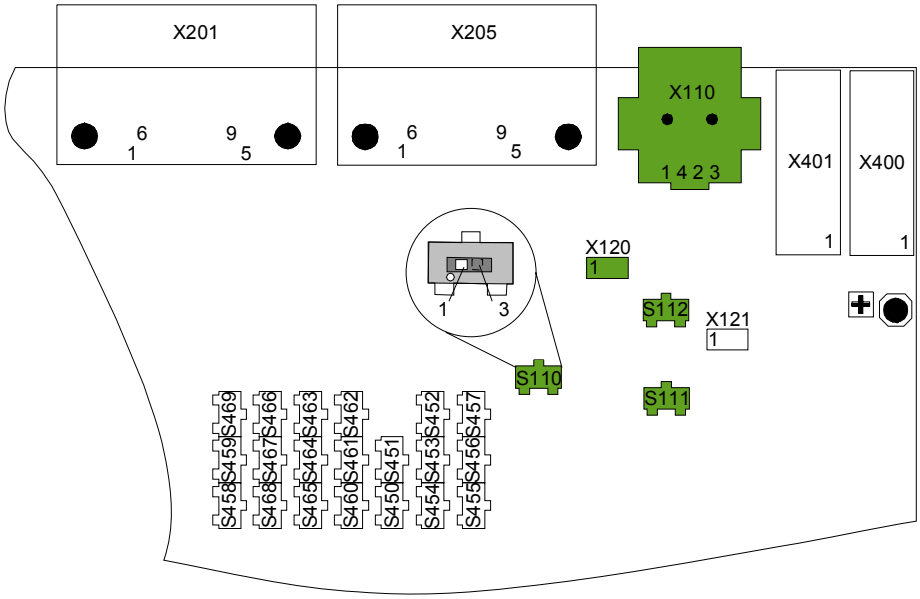


Figure 22: Location of the USB interface, switches and jumper

Table 17: Pin assignment of USB device interface X110

X110 pin	Name	I/O	Description	X100 signal name	Config. switches
1	VBUS	I (Supply)	USB bus voltage	VUSB_IN	S110:3
2	D-	Diff. I/O	Data line minus	USB_DN	S111:3
3	D+		Data line plus	USB_DP	S112:3
4	GND	Supply	GND	GND	

3.9 I²C Interface

The GSM module is the bus master device. The I2CDAT and I2CCLK lines have to be connected on the slave side to a positive supply voltage via a current source or pull-up resistor.

The number of interfaces connected to the bus is only dependent on the bus capacity limit of 400pF.

Each device connected to the bus is software addressable by a unique address, and simple master/slave relationships exist at all times.

On the DSB75 both I²C lines can alternatively be used as SPI interface lines (if supported by the GSM module, see section 3.11).

The I²C interface lines are available on the DSB75 at the 10 pin header X511. A level shifter V500/V501 converts from 3V up to 5V logic. The 3V logic lines are connected directly to the pins of the pin header X511, if switches S500 and S501 are set to position 1.
Attention: Two external pull-up resistors must be installed in the host application. There are no on-board pull-up resistors.
The 5V compliant lines are an alternative to the 3V lines available on the X511 pin header. To use 5V lines, set the switches S500 and S501 to position 3.

The two logic voltages 5V0 and VDD are available at the X511 pin header for supplying the external I²C device driver.

For a simple test facility a 128kBit EEPROM device (D500) with adjustable address area (S502 - S504) is implemented. Accordingly the switches S500 and S501 are set to position 3 (see Figure 23).

The LED V503 indicates that I2CCLK line is active (low).
The LED V504 indicates that I2CDAT line is active (low).

Figure 23 shows the simplified interface schematic.
Figure 24 shows the placement of the I²C switches and the pin location.
Electrical characteristics are specified in section 8.

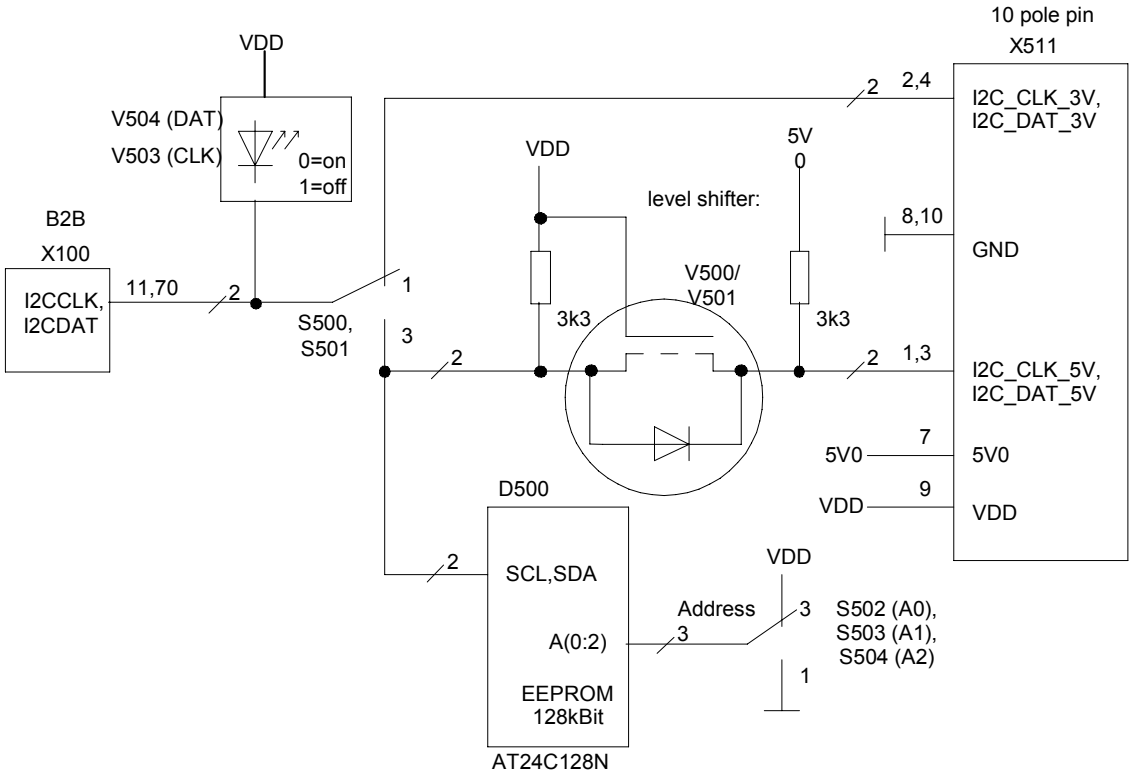


Figure 23: I²C interface

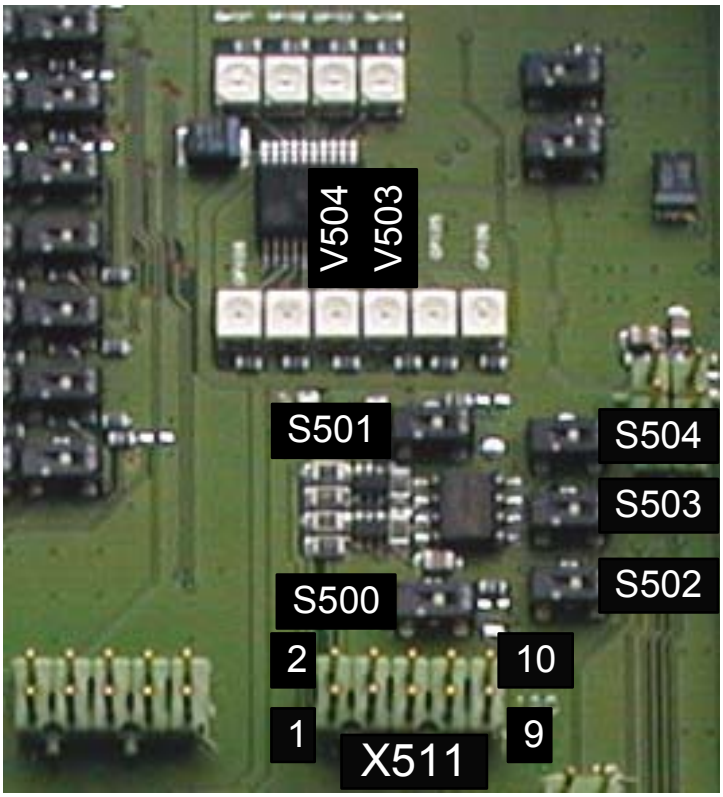


Figure 24: I²C interface location

Table 18: Pin assignment of the I²C interface X511

X511 pin	Name	I/O	Description	X100 signal name	Config. switches	Remark
1	I2C_CLK_5V	O	Clock, (5V logic)	I2CCLK	S500:3	EEPROM accessible External pull-up resistor 3k3 recommended
2	I2C_CLK_3V	O	Clock, (3V logic)	I2CCLK	S500:1	External pull-up resistor ≥750R required
3	I2C_DAT_5V	I/O	Data, (5V logic)	I2CDAT	S501:3	EEPROM accessible External pull-up resistor 3k3 recommended
4	I2C_DAT_3V	I/O	Data, (3V logic)	ISCDAT	S501:1	External pull-up resistor ≥750R required
5	n.c.					
6	n.c.					
7	5V0	O	5V0 supply voltage			ON when DSB75 is supplied
8	GND		Ground			
9	VDD	O	2.9V supply voltage			ON when GSM module is active
10	GND		Ground			

3.10 SD Card Interface

The SD card interface provides a card reader for SD (Secure Digital) memory cards.

It has a smooth push-push mechanism with front cover retention for temper-resistant card insertion. There are two contacts for card detection and write protect detection.

The SD card interface can be operated in three modes:
- SD 4 bit mode
- SD 1 bit mode
- SPI bus mode

The supported operation mode depends on the type of GSM module and the selected configuration (see subsections 3.10.1, 3.10.2 and 3.10.3). Each mode has to be set and configured on the DSB75 by slide switches.

Figure 25 shows the simplified interface schematic.
Figure 26 shows the location of card reader pins and slide switches.
Electrical characteristics are specified in section 8.

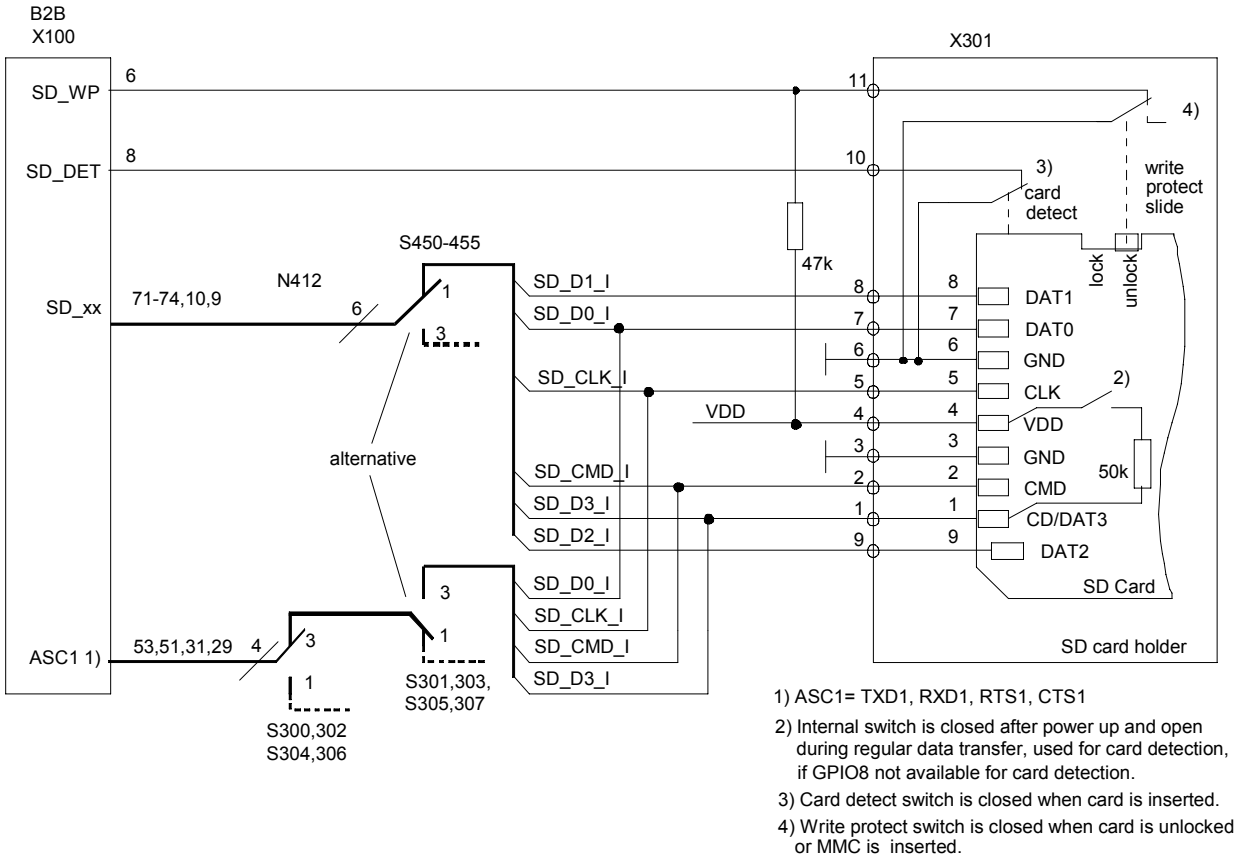
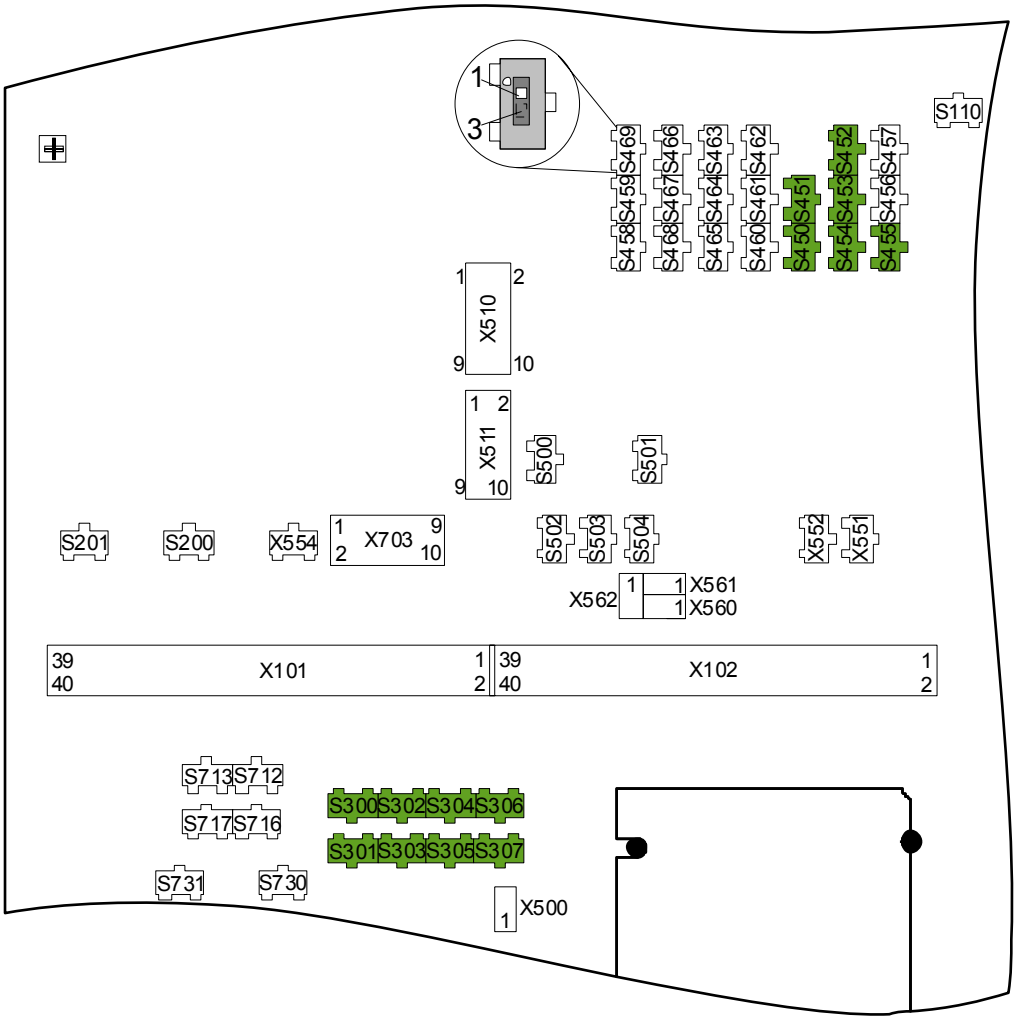


Figure 25: SD card interface



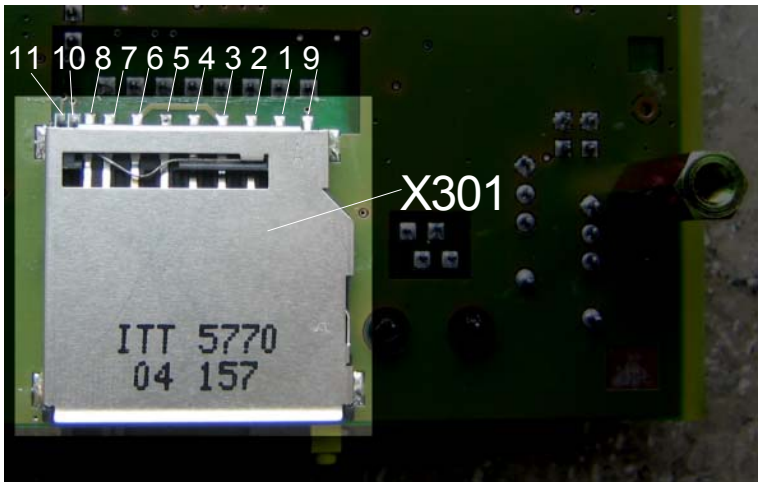


Figure 26: Location of slide switches and card reader pins

3.10.1 SD 4 Bit Mode

Table 19: Pin assignment of SD card interface X301 (SD 4 bit mode)

X301 pin	X301 signal name	I/O	Description	Remark	X100 signal name	Configuration switches
1	CD/DAT3	I/O	Data line bit 3, Card detect	Card detect at power on: 0 or open = card removed 1 or 50k pull-up = card inserted **Note:** This is no removal detection during card operation!	SD_D3	S453:1 S301:1
2	CMD	O	Command / Response		SD_CMD	S455:1 S303:1
3	VSS1	Supply	Ground		GND	
4	VDD	Supply	Supply voltage	2.9V		
5	CLK	O	Clock	25.4kHz …13MHz (depends on SW performance)	SD_CLK	S454:1 S305:1
6	VSS2	Supply	Ground		GND	
7	DAT0	I/O	Data line bit 0		SD_D0	S450:1 S307:1
8	DAT1	I/O	Data line bit 1		SD_D1	S451:1
9	DAT2	I/O	Data bus bit 2		SD_D2	S452:1
10	CD	I	Card detection	0 = card inserted 1 = card removed **Note:** On each edge an interrupt will be generated. Removing the card will stop its operation before disconnecting it.	SD_DET	
11	WP	I	Write protect detection	0 = unlocked 1 = locked	SD_WP	

3.10.2 SD 1 Bit Mode

Table 20: Pin assignment of SD card interface X301 (SD 1 bit mode)

X301 pin	X301 signal name	I/O	Description	Remark	X100 signal name	Configuration switches
1	-	I/O	Not used		SD_D3	S453:3 S301:1
2	CMD	O	Command / Response		SD_CMD	S455:1 S303:1
3	VSS1	Supply	Ground		GND	
4	VDD	Supply	Supply voltage	2.9V		
5	CLK	O	Clock	25.4kHz …13MHz (depends on SW performance)	SD_CLK	S454:1 S305:1
6	VSS2	Supply	Ground		GND	
7	DATA	I/O	Data line		SD_D0	S450:1 S307:1
8	-		Not used			
9	-		Not used			
10	CD	I	Card detection	0 = card inserted 1 = card removed **Note:** On each edge an interrupt will be generated. Removing the card will stop its operation before disconnecting it.	SD_DET	
11	WP	I	Write protect detection	0 = unlocked 1 = locked	SD_WP	

3.10.3 SPI Bus Mode

This interface is an option and an alternative to the ASC1 and SPI2 interfaces. It has to be reconfigured via AT commands as SPI bus mode SD card interface. For further information refer to section 3.11.

Table 21: Pin assignment of SD card interface X301 (SPI bus mode)

X301 pin	X301 signal name	I/O	Description	Remark	X100 signal name	Configuration switches
1	CS	O	Chip select	Active low	TXD1	S300:3 S301:3 S453:3
2	DI	I	Data input	Data out (DO) at SD card side	CTS1	S306:3 S307:3 S450:3
3	VSS1	Supply	Ground		GND	
4	VDD	Supply	Supply voltage	2.9V		
5	SCLK	O	Clock	up to 3.25MHz	RTS1	S304:3 S305:3 S454:3
6	VSS2	Supply	Ground		GND	
7	DO	O	Data output	Data in (DO) at SD card side	RXD1	S302:3 S303:3 S455:3
8	-		Not used			
9	-		Not used			
10	CD	I	Card detection	0 = card inserted 1 = card removed **Note:** On each edge an interrupt will be generated. Removing the card will stop its operation before disconnecting it.	SD_DET	
11	WP	I	Write protect detection	0 = unlocked 1 = locked	SD_WP	

3.11 Serial Peripheral Interfaces

The Serial Peripheral Interface (SPI) system consists of one master device and one or more slave devices.
The master is defined as a microcomputer providing the SPI clock, and the slave as any integrated circuit receiving the SPI clock from the master. The GSM module always operates as a master device in master-slave operation mode.
The SPI has a 4-wire synchronous serial interface. Data communication is enabled with a low active Slave Select or Chip Select wire (CS). Data are transmitted with a 3-wire interface consisting of wires for serial data input (DI), serial data output (DO) and serial clock (SCLK).

The GSM module may provide two different SPI interfaces available alternatively to the I²C-, and ASC1- lines (depending on software configuration). On the DSB75, they are available on the 10 pin X510 pin header.

In order to use the SPI interfaces some switches have to be set (see Figure 27).

The logic voltage VDD is available at the X510 pin header for the supply of the external SPI device driver.

Table 22: Alternative configuration of SPI interface lines

SPI interfaces		Alternative interfaces	
SPI1	CS1		
	DI1		
	DO1	I2C	I2CDAT
	SCLK1		I2CCLK
SPI2	CS2	ASC1	TXD1
	DI2		RXD1
	DO2		CTS1
	SCLK2		RTS1

Figure 27 shows the simplified interface schematic.
Figure 28 shows the placement of the SPI related switches and the pin location.
Electrical characteristics are specified in section 8.

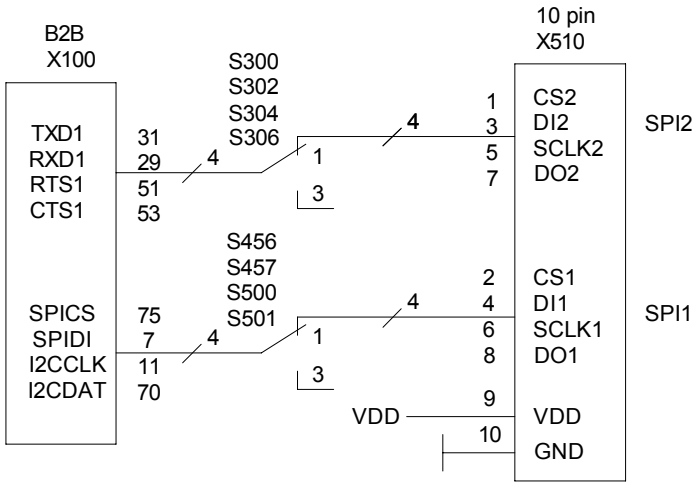


Figure 27: SPI interfaces

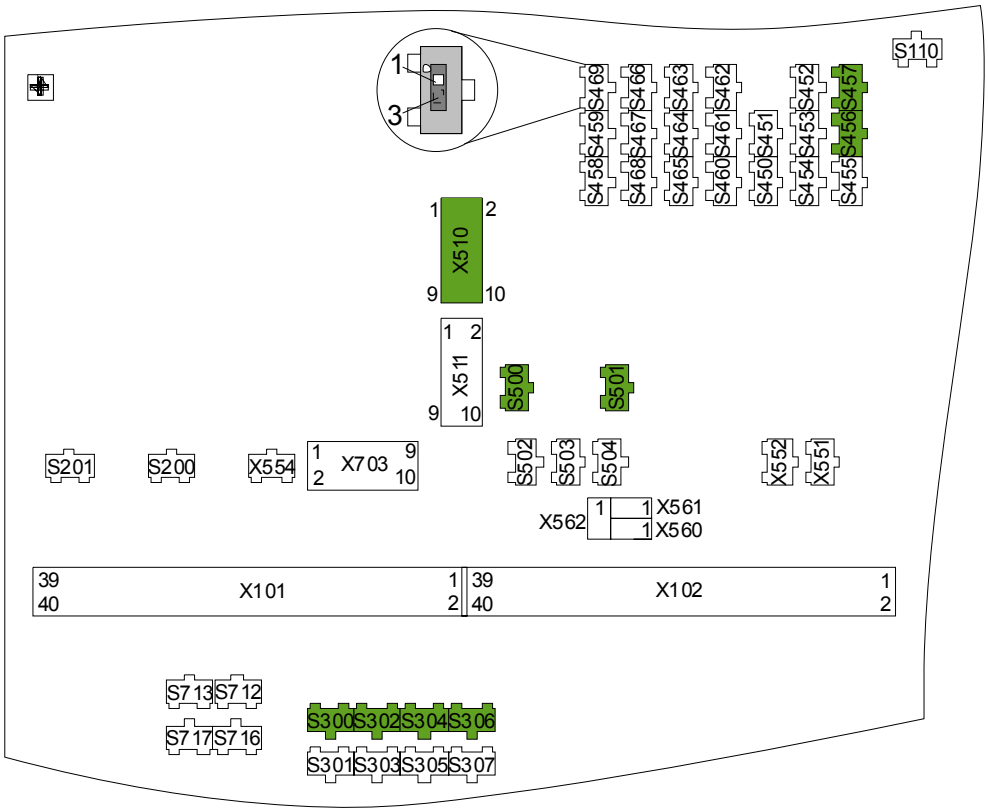


Figure 28: SPI interfaces location and related switches

Table 23: Pin assignment of the SPI interfaces X510

X510 pin	Name	I/O	Description	X100 signal name	Config. switches	Remark
1	CS2	O	Chip select 2	TXD1	S300:1	
2	CS1	O	Chip select 1	SPICS	S456:1	
3	DI2	I	Data in 2	RXD1	S302:1	
4	DI1	I	Data in 1	SPIDI	S457:1	
5	SCLK2	O	Clock 2	RTS1	S304:1	
6	SCLK1	O	Clock 1	I2CCLK	S500:1	
7	DO2	O	Data out 2	CTS1	S306:1	
8	DO1	O	Data out 1	I2CDAT	S501:1	
9	VDD	O	2.9V supply out			
10	GND					

3.12 Analog Interface

The DSB75 provides an analog interface allowing you to efficiently evaluate the characteristics of the analog baseband codec of the GSM module:

- This analog interface has 2 analog inputs and one analog output.
- The analog input lines are available on the pin header X101.
- The analog output is available as a pulse width modulation (PWM) signal on the pin header X101.
- A filter circuit 2nd order smoothes the PWM signal.
- The filter on the DSB75 is optimized for 8.125kHz PWM frequency and can be removed by customer. Therefore the jumpers X560 - X562 have to be replaced by customer circuit.

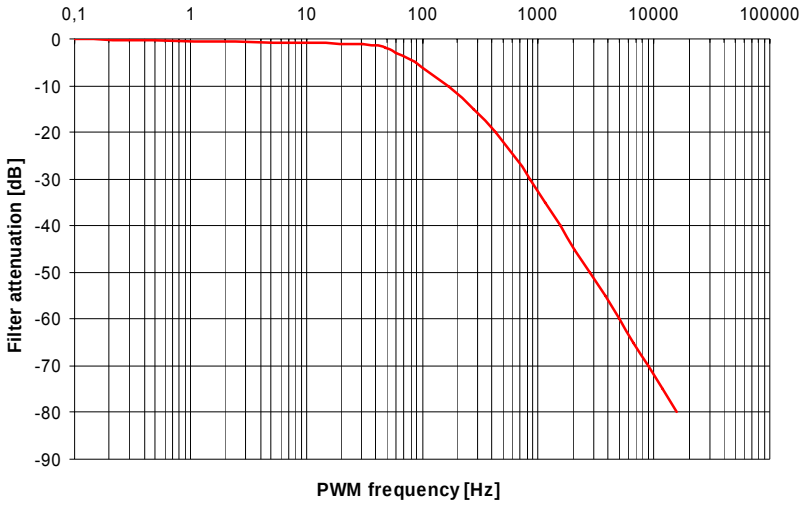


Figure 29 PWM filter characteristics

- For self test facilities it is possible to turn on test loops. Each analog input can be connected to the filter output.

Figure 30 shows the placement of the related switches and the pin location.
Figure 31 shows the simplified interface schematic.
Electrical characteristics are specified in section 8.

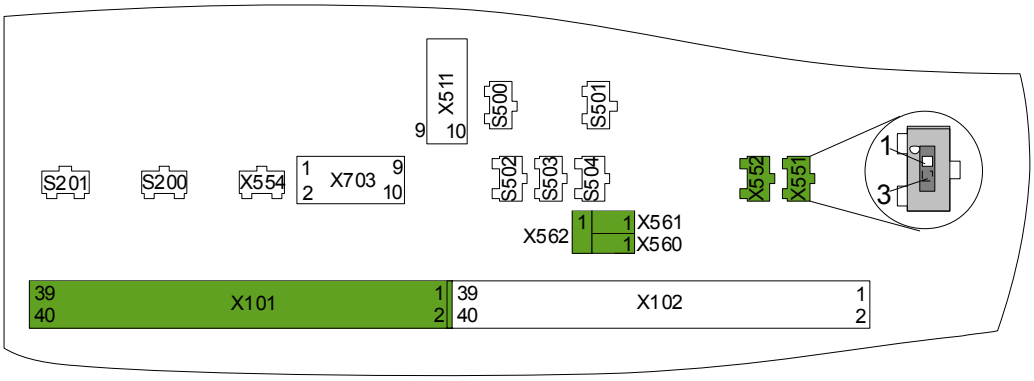


Figure 30: Analog interface location and related switches

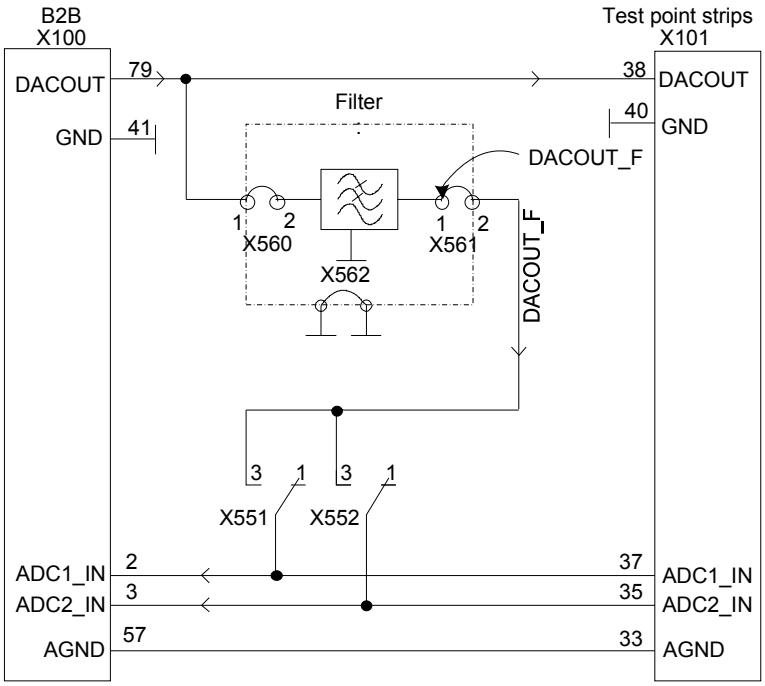


Figure 31: Analog interface

Table 24: Pin assignment of the analog interface

Pin	Name	I/O	Description	X100 signal name	Switch setting for loop	Remark
X101/37	ADC1_IN	I	ADC Input 1	ADC1_IN	X551:3	If no loop required Keep switches in position 1
X101/35	ADC2_IN	I	ADC Input 2	ADC2_IN	X552:3	
X101/33	AGND		Ground for ADC Inputs	AGND		
X101/38	DACOUT	O	DAC Output (PWM)	DACOUT		
X561/1	DACOUT_F	O	DAC Output (filtered)	DACOUT		If no loop required: Jumper bridge X561 can be removed
X101/40	GND		Ground for DAC Output			

3.13 Antenna Interface

The RF signal of the GSM module is connected via the supplied RF adapter cable to the Hirose RF jack X505 located on the DSB75. Furthermore, in order to send or receive data, connect an external RF antenna to the SMA jack X506 which is internally connected to the Hirose RF connector X505. The RF antenna cables are product specific, please refer to Section 1.3.2.

To obtain optimum send and receive performance, a steel grounding plate (at least 300mm x 300mm) should be placed underneath the antenna.

Please consider that the supplied antenna equipment has been chosen to achieve optimum RF performance when operating the GSM module at the DSB75. Cinterion does not accept warranty claims for damage caused by inappropriate equipment connected to the antenna connectors.

Electrical characteristics are specified in section 8.

3.14 Power Supply Interfaces

The constant voltage supply on the PCB provides all the supply voltages required for operating DSB75 and the GSM module. The power supply source can be a 9V…15V laboratory PSU or mains adapter and, in addition, an external battery used to feed only the GSM module.

The DSB75 has three power supply interfaces:

- Interface X400/X401 – connects to a laboratory PSU for supplying the DSB75 itself and the connected GSM module. See section 3.14.2.
- Interface X602 (screw terminal block) - connects to an external battery for supplying only the GSM module, while DSB75 is powered from the laboratory PSU. See section 3.14.3.
- Interface X700 or X701 (Lumberg connector) – input for charging the battery. See section 3.14.3.1.

The S601 toggle switch selects whether to feed the GSM module from the laboratory PSU or a battery. If no battery is connected the S601 switch must be flipped down to supply voltage (BATT+) for the GSM module. Vice versa, if a battery is present, it must be flipped up.

Figure 32 shows the simplified power supply interfaces schematic. Figure 33 shows the placement of the power supply connectors, switches, jumpers and the pin location.

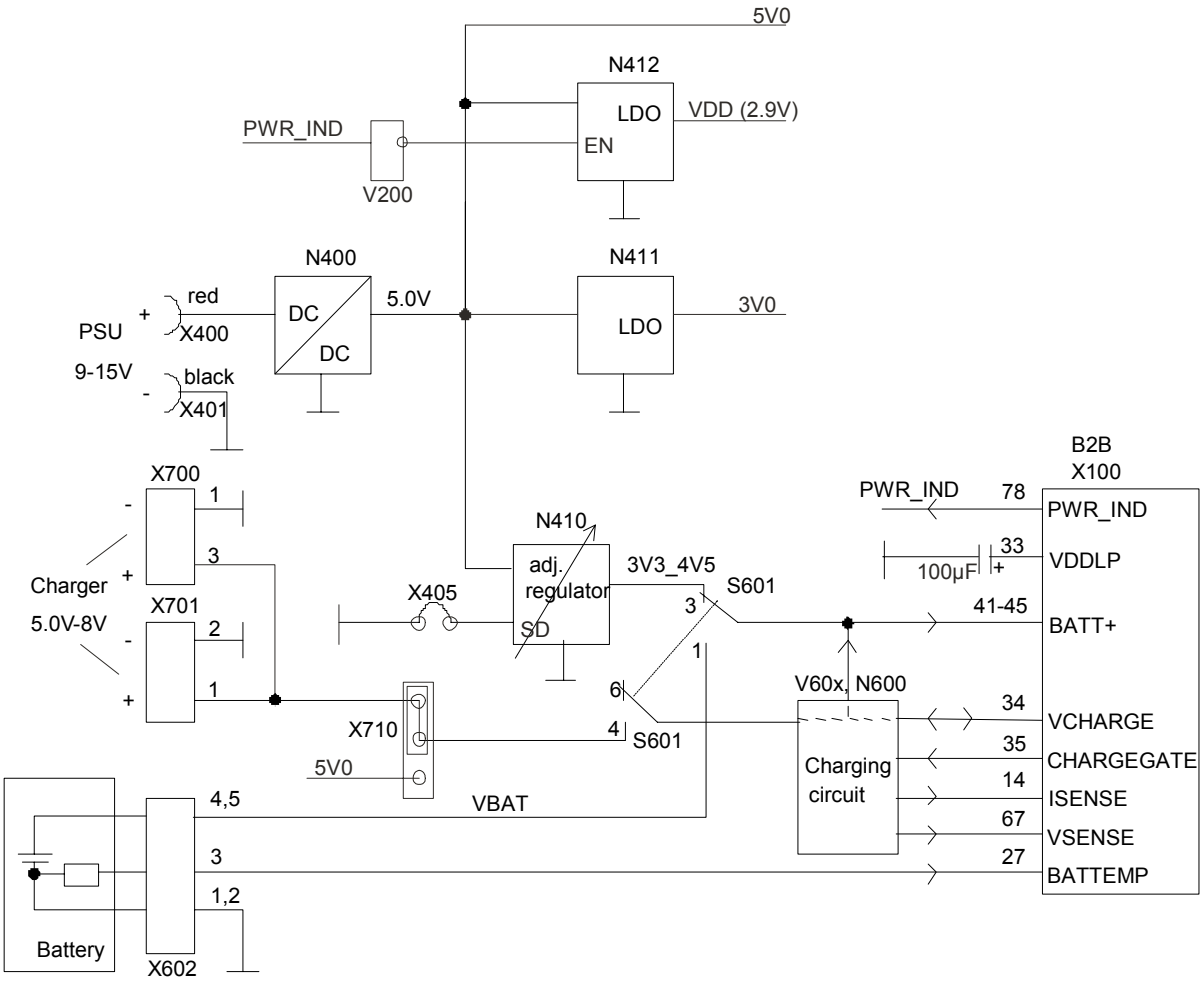


Figure 32: Power supply interfaces

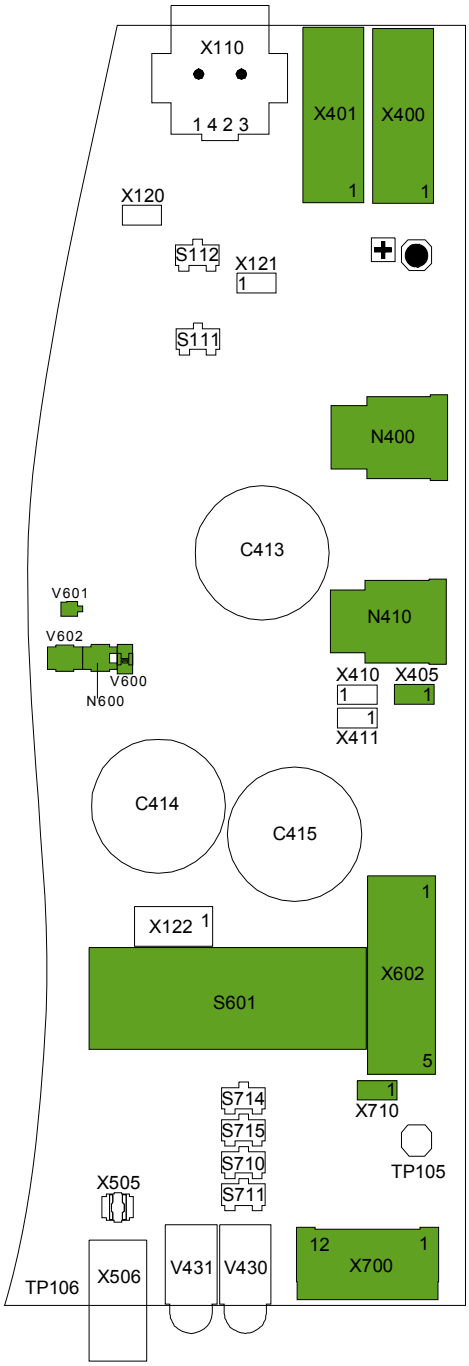


Figure 33: Location of the power supply connectors, switches and jumpers

3.14.1 Internal Supply Voltages

This section describes the internal supply voltages generated by the power supply unit of DSB75. A simplified block diagram of the power supply concept is shown in section 3.14.

Table 25: Description of power supply units

Power Supply Unit	Description
General supply 5V0 (see Figure 34)	DSB75 accepts an input voltage between 9V and 15V DC on jacks X400 and X401. These ports are protected against polarity reversal by a simple diode V400. To reduce power dissipation, a DC/DC converter N400 provides a constant voltage of 5.0V. This voltage is used for supplying 3 LDOs and the audio section with power and is available for battery charging, supplying I2C and DAI interface.
Audio supply (5V0_I) (see Figure 35)	Audio power supply is decoupled with simple low pass filters from 5V0 supply.
GSM module supply (3V3_4V5 or BATT+) (see Figure 36)	For supplying the GSM module with regulated voltage the toggle switch S601 must be flipped down. In addition, the LDO for battery voltage N410 is adjustable for three voltage values (please refer to Table 31 and Figure 39). Two capacitors at 4700µF suppress voltage drops and ripples at GSM burst. For remote control, the jumper X405 has to be set to shut down the voltage.
Power supply to digital part of DSB75 (3V0) (see Figure 32)	The simple LDO (N411) regulates the 5V0 voltage down to 3.0V. This voltage supplies the digital devices (RS232 driver, LED-driver).
Digital IO supply (VDD) (see Figure 32)	The simple LDO (N412) regulates the 5V0 voltage down to 2.9V but this voltage is enabled by inverted PWR_IND signal. Therefore VDD is only present when the GSM module is operating. This voltage supplies the digital IO pull-up resistors, EEPROM, SD card and the digital interfaces: I²C, SPI, DAI.

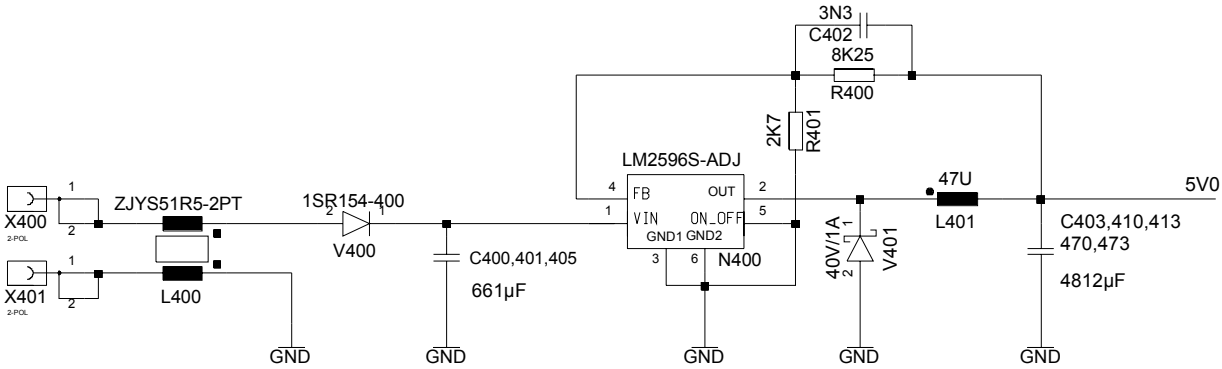


Figure 34: Input circuit schematic (5V DC/DC converter) for power supply

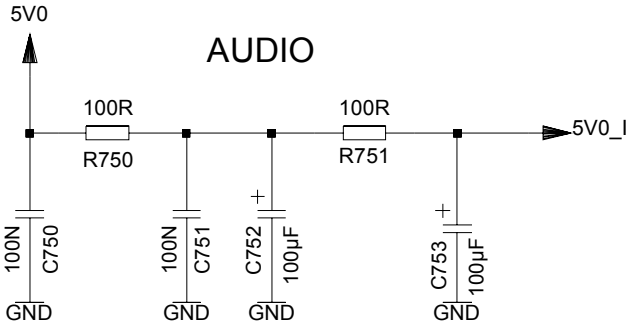


Figure 35: Schematic for audio supply (5V0_I)

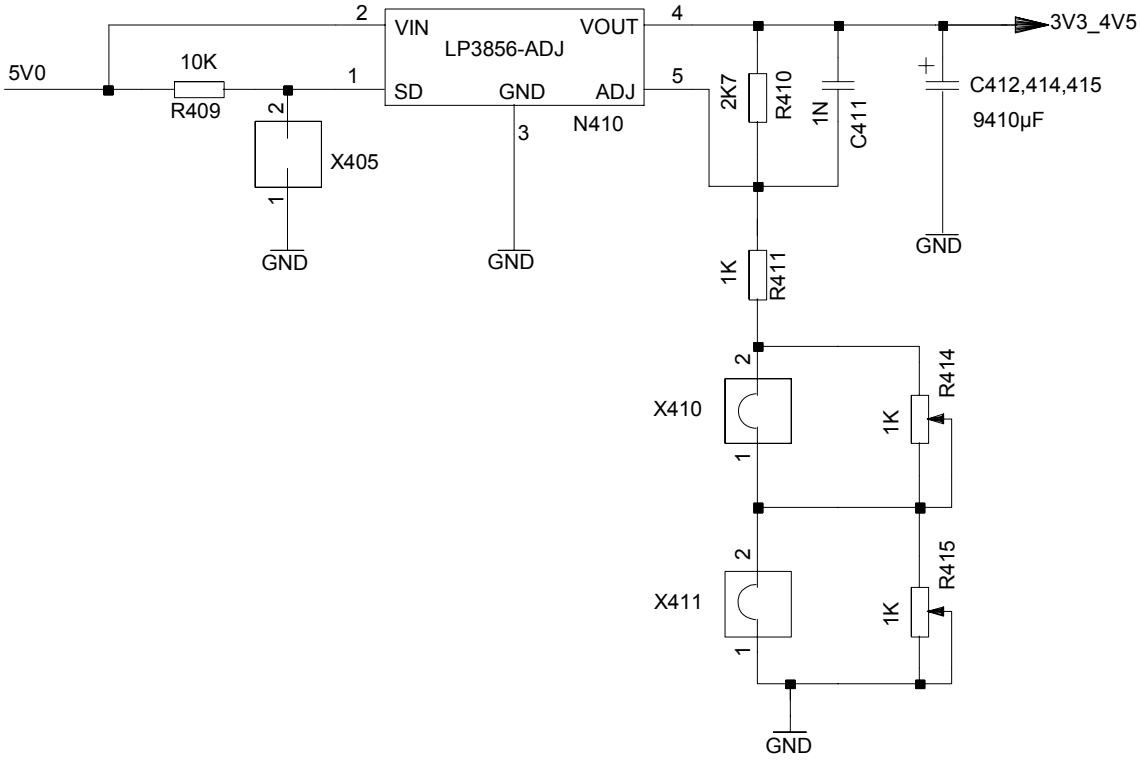


Figure 36: Schematic for GSM module supply (3V3_4V5 or BATT+)

3.14.2 Power Supply for DSB75 and GSM Module

The voltage provided by the 9V…15V PSU generates all supply voltages required for the DSB75 and the connected GSM module when battery operation is disabled.

The output power of the laboratory PSU has to satisfy the SELV requirements in accordance to EN 60950.

Table 26: Recommended specification of the laboratory PSU

Parameters	Value			Unit
	Min.	Typical	Max.	
Output voltage	8.5	12	15.5	V
Output current	1.5			A

Table 27: Connecting the laboratory PSU to X400 and X401

Voltage	Connector	Color
Supply voltage +9V…+15V	4 mm PCB jack	Red (X400)
Ground	4 mm PCB jack	Black (X401)

If no battery is present and the GSM module is powered from the laboratory PSU be sure that the S601 toggle switch is in down position.
The green LED (V431) on the DSB75 is driven by 3V0 voltage and indicates that the DSB75 is supplied with power and switched on. See also 4.3.

3.14.3 Battery Powered Operation of GSM Module

The external battery connects to the screw terminal block X602 (see Figure 37).

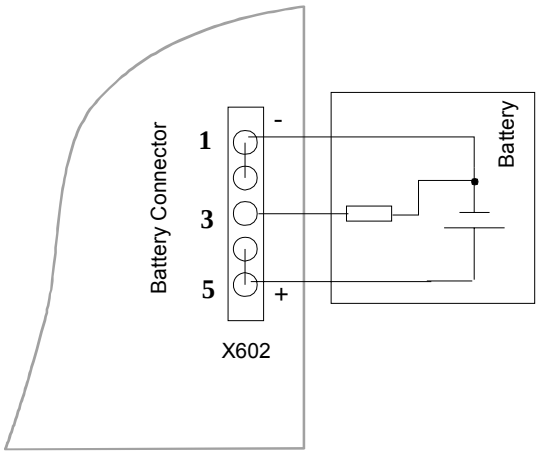


Figure 37: Battery screw terminal

For battery operation, the toggle switch S601 must be flipped up (position 3). In this case, the GSM module is powered only from the battery. Furthermore, it is necessary to keep the laboratory PSU connected for operating parts of the DSB75.

Table 28: Pin assignment of the screw terminal X602

X602 pin.	Function
1, 2	GND
4, 5	VBAT (BATT+)
3	Thermal resistor (NTC)

The following batteries meet the requirements of the GSM module:
- Lithium Ion with 10k NTC
- Lithium Polymer with 10k NTC

See module specification [1] for details.

3.14.3.1 Charging the Battery

The battery charging current should be supplied from an external plug-in charger connected to the Lumberg connector X700 or X701 on the DSB75.
Please note that the plug-in charger is not part of the delivery scope of the DSB75. It is available from Siemens (please ask your local Cinterion contact for support):

Siemens ordering number: A5BHTN00127458 (connector compatible to X701)

Charging can be accomplished regardless whether the battery was deeply or partly discharged.

The charger has to meet the following requirements:
Output voltage: 4.75V … 10V
Output current: ≥550mA or ≥1050mA

Table 29: Pin assignment of the X700 jack for the plug-in charger

Pin no.	Name	I/O	Description
1	GND	-	Ground
2	R	-	4.7k resistor to pin 3 (necessary for old charger types)
3	V_{Charge}	I	Supply voltage provided by the plug-in charger
4 -12	-	-	Not relevant for charger (keep not connected)

Table 30: Pin assignment of the X701 jack for the plug-in charger

Pin no.	Name	I/O	Description
1	V_{Charge}	I	Supply voltage provided by the plug-in charger
2	GND	-	Ground
3 -12	-	-	Not relevant for charger (keep not connected)

3.14.3.2 Charging Circuit

If a battery is used, it is possible to charge the battery by the charger circuitry on the DSB75. The charger circuitry provides trickle charge to the battery when the mobile is in deep discharge lockout or undervoltage lockout (when the battery condition is not suitable), and provides fast charging at normal charging conditions.

This section describes the charging circuit of the DSB75 only. The battery management and charging algorithm is described in [1]. Figure 38 shows the charging circuit of DSB75.

For supplying the GSM module by battery the toggle switch S601 must be flipped up to connect the module's supply voltage pin BATT+ to the battery and to be ready for connecting the external charger.
The jumper X710 selects either the voltage from the external charger or the 5V0 board voltage for battery charging.

Trickle Charging:
The 5.0V LDO regulator N600 protects the VCHARGE line against not allowed voltages >5V. The diode V600 prevents reverse battery discharging if the charger is removed. The GSM module delivers the trickle current back to the battery if a valid battery is recognized chargeable and VCHARGE > V_{BATT+}.
There are two trickle charge currents possible: 5mA (battery is deep discharged) or 30mA (battery has undervoltage).

Fast Charging:
The charge current is controlled by the GSM module (via CHARGEGATE). The CHARGEGATE is a current sink (operation range 0…0.6mA). Because CARGEGATE needs overvoltage protection (>4.5V), FET V601 reduces the control voltage.
$V_{CHARGEGATE} = V_{BATT+} - V_{GS(V601)} = \max 3.5V$

The CHARGEGATE control current flows through the R604. This resistor determines the gate source voltage $V_{GS(V602)}$. The value of R604 is dimensioned for driving the maximal fast charge current of 1A at 0.5mA control current. In this case the fast-charging-FET V602 reaches only the beginning of the saturation region.
The current is measured differentially via the sense lines VSENSE, ISENSE (voltage drop at

shunt resistors R602 and R603).

The battery voltage is measured at the VSENSE line.

The battery temperature is measured at the BATTEMP line (voltage drop at NTC in battery pack).

The diode V603 prevents reverse battery discharging in fast charging path if the power failed.

Current calculation:
The current will be ramped up and down by battery management and reaches the maximum at V_{ISENSE} = 150mV.

I_{max} =150mV / 0.3Ohm = 500mA @ Jumper X600 open
=150mV / 0.15Ohm = 1A @ Jumper X600 closed

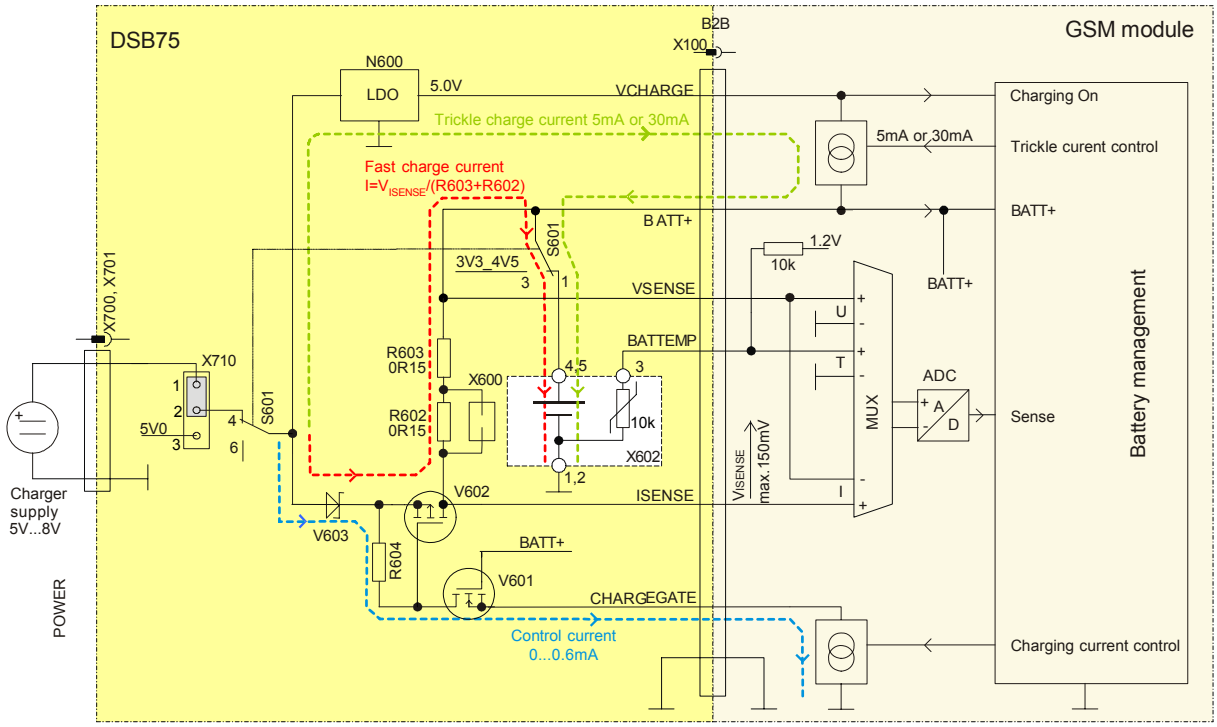


Figure 38: Schematic of charging circuit

3.14.4 Real Time Clock Supply

A 100µF capacitor placed on the DSB75 is charged by the VDDLP line of the GSM module as long as the voltage BATT+ is applied.

In case of power failure, the real time clock of the GSM module is supplied by the capacitor for approx. 40 seconds.

3.14.5 Adjusting the V_{BATT+} Supply Voltage for the GSM Module

For test purposes, the V_{BATT+} voltage supplied to the GSM module can be adjusted using jumpers and variable resistors.

The jumpers X410 and X411 serve to set the V_{BATT+} voltage range, and the variable resistors R414 and R415 are used to adjust the supply voltage within the selected range. Therefore, first set the range (lower limit or normal). Then turn the screw of the associated resistor R414 or R415 to reduce or increase the desired voltage, while measuring the module's input voltage at its test points BATT+ and GND. Take into account that voltage drops and ripples may occur. The maximum voltage is set only via the jumpers, it cannot be adjusted via the resistors.

Figure 39 shows the location of the jumpers and variable resistors on the DSB75. The settings for adjusting the supply voltage of the GSM module are described in Table 31.

Table 31: Adjusting BATT+ voltage (3V3_4V5)

Voltage type	Jumper X410	Jumper X411	Variable Resistor	Voltage range	Default setting
Upper limit	closed	closed	---	4.5V +-5% fixed	
Normal	closed	open	R415	2.85V. to 4.5V	4.1V +- 5%
Lower limit	open	closed	R414	2.85V. to 4.5V	3.5V +- 5%

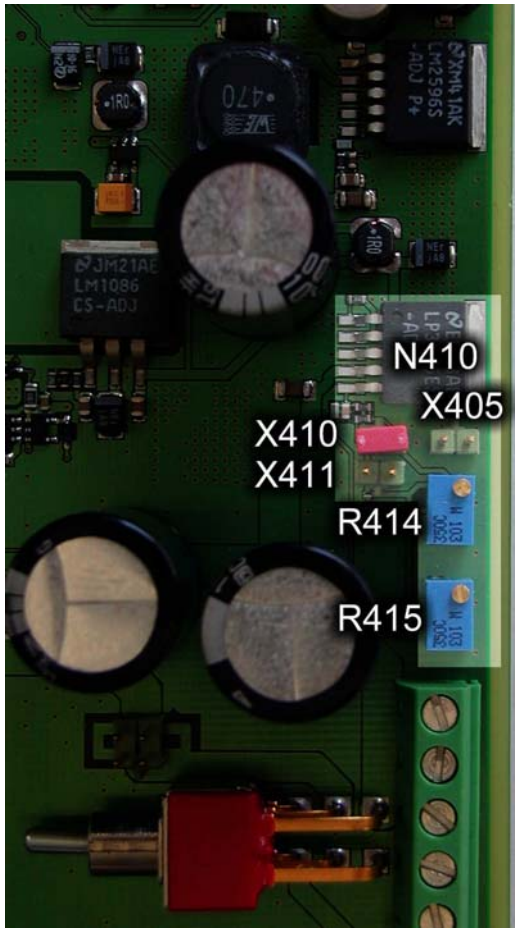


Figure 39: Location of jumpers and resistors for adjusting BATT+ voltage (3V3_4V5)

4 Status LEDs

The DSB75 comprises several status LEDs. The position, the corresponding signal and the color of the LEDs can be seen in Figure 40.

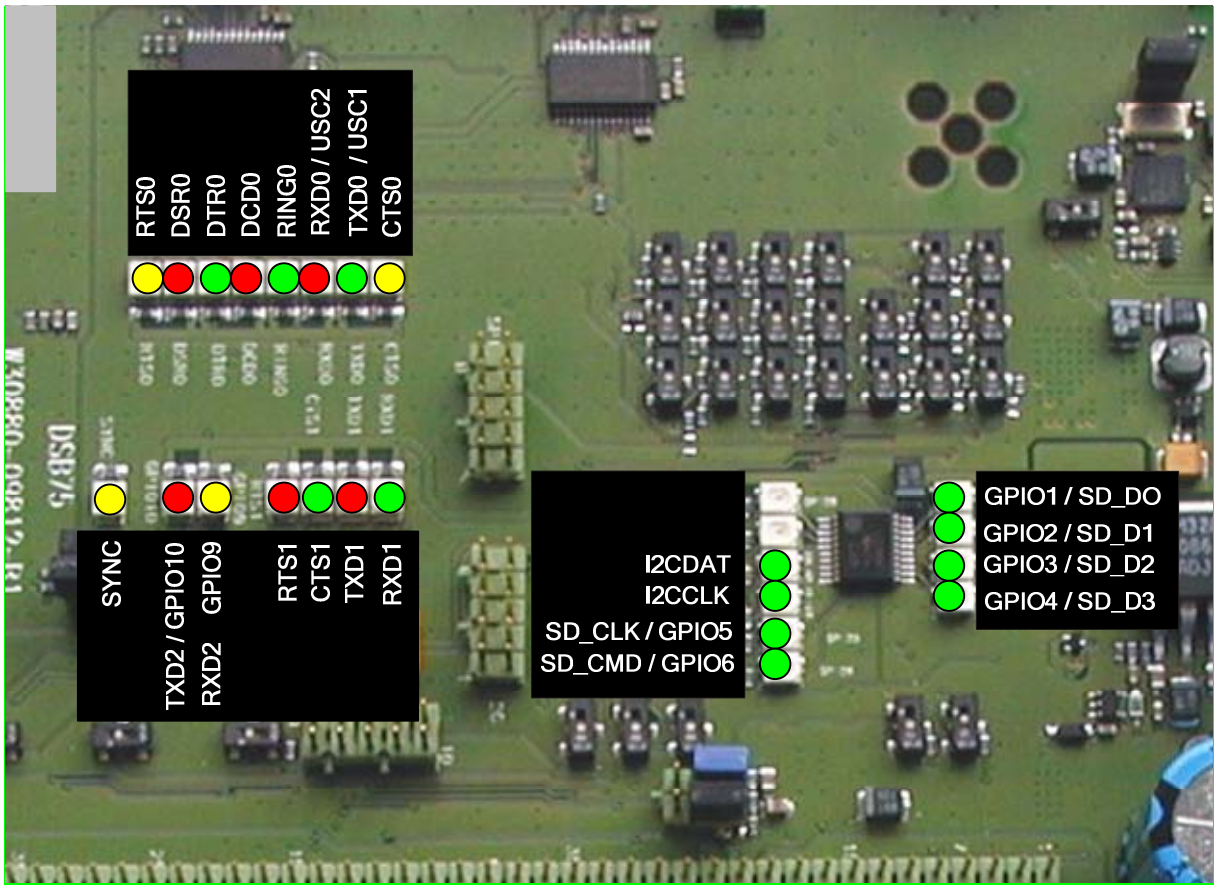


Figure 40: Location of LEDs

4.1 Indication of Asynchronous Serial Interface Signals

All signals of the asynchronous interfaces ASC0, ASC1 and ASC2 are connected to buffers which drive 16 indicator LEDs. These buffers are enabled via the PWR_IND line which is activated by the module. As a result, the indication only is active if the module is turned on.

For all: 0=on, 1=off

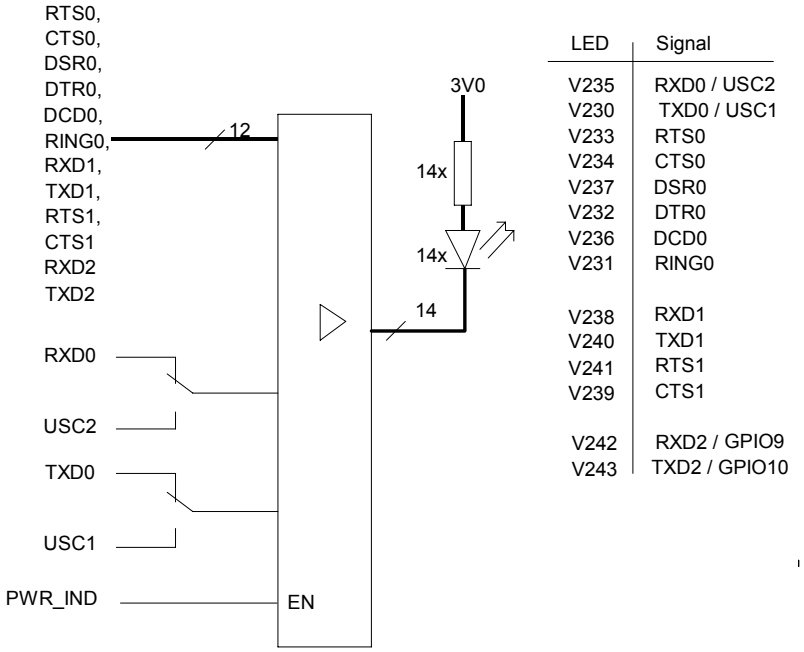


Figure 41: ASC signal indication circuit

4.2 Indication of GPIO Signals and SYNC

If no SD card is in use, the GPIO signals provided at the B2B connector can be used for status indication. Buffers connected to these lines are enabled by the PWR_IND line which is activated by the GSM module. As a result, the indication only is active if the module is turned on.

For all: 0=on, 1=off excepted SYNC signal: 0=off, 1=on

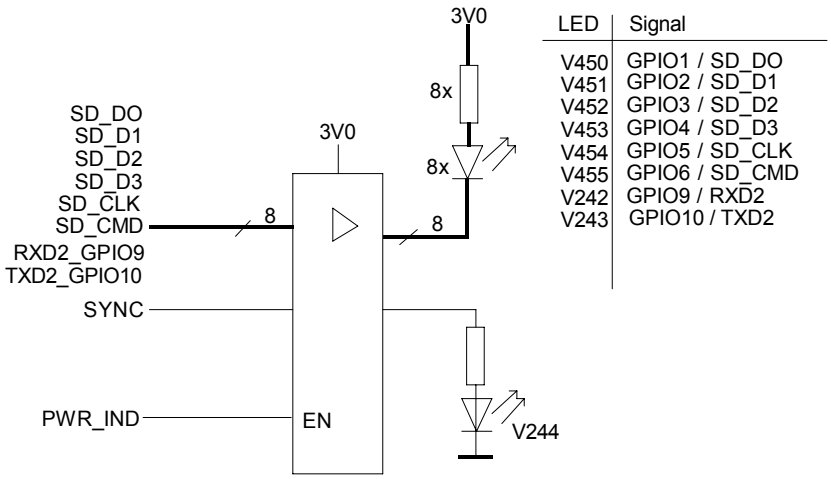


Figure 42: GPIO signal indication circuit

4.3 Indication of Power

There are two power control LEDs on the DSB75.
The green power control LED V431 is connected to the DSB75 supply voltage 3V0 which is always available when the DSB75 receives an input voltage.
The yellow power control LED V430 is driven from the supply voltage VDD that is only active if a module is connected and turned on.

4.4 Indication of I²C Lines

The LED V503 indicates that I2CCLK line is active (low).
The LED V504 indicates that I2CDAT line is active (low).

For detailed information see Figure 23.

5 Overview of Switches and Jumpers

This section provides an overview of all switches and jumpers located on DSB75. The exact location of each switch and jumper is shown in Figure 2 and Figure 43.

5.1 Overview of Switches

Table 32: Overview of switch positions

Reference	Function	
	Switch position 1	**Switch position 3**
S110	*Do not use this position! (reserved for future use)* Source of VUSB_IN voltage is the DSB75 (5V)	*Connects the VUSB_IN line directly to USB connector X110 (VBUS)*
S111	*Do not use this position! (reserved for future use)* Connects the USB_DN line to the USB-OTG interface (D110, X111)	*Connects the USB_DN line directly to USB connector X110 (D-)*
S112	*Do not use this position! (reserved for future use)* Connects the USB_DP line to the USB-OTG interface (D110, X111)	*Connects the USB_DP line directly to USB connector X110 (D+)*
S200	*Using RXD0 line as ASC0-RXD* Connects B2B connector signal RXD0 to the RS-232 transceiver D200 used for asynchronous serial interface ASC0	*Using USC2 line as ASC0-RXD* Connects B2B connector signal USC2 to the RS-232 transceiver D200 instead of RXD0
S201	*Using TXD0 line as ASC0-TXD* Connects B2B connector signal TXD0 to the RS-232 transceiver D200 used for asynchronous serial interface ASC0	*Using USC1 line as ASC0-TXD* Connects B2B connector signal USC1 to the RS-232 transceiver D200 instead of TXD0
S300	*Using TXD1 line as SPI2 chip select* Connects B2B connector signal TXD1 to the signal SPI2_CS at connector X510 pin 1	*Using TXD1 line as ASC1-TXD or SD card chip select (SPI mode)* Connects B2B connector signal TXD1 to S301 pin 2
S301	*Using TXD1 line as ASC1-TXD* Connects B2B connector signal TXD1 to the RS-232 transceiver D201 used for asynchronous serial interface ASC1 if S300 is in position 3	*Using TXD1 line as SD card chip select (SPI mode)* Connects B2B connector signal TXD1 to the card reader connector X301 pin 1 if S300 is in position 3
S302	*Using RXD1 line as SPI2 data in* Switch position 2: Connects B2B connector signal RXD1 to the signal SPI2_DI at connector X510 pin 3	*Using RXD1 line as ASC1-RXD or SD card data in (SPI mode)* Connects B2B connector signal RXD1 to S303 pin 2

Reference	Function	
	Switch position 1	**Switch position 3**
S303	*Using RXD1 line as ASC1-RXD* Connects B2B connector signal RXD1 to the RS-232 transceiver D201 used for asynchronous serial interface ASC1 if S302 is in position 3	*Using RXD1 line as SD card data in (SPI mode)* Connects B2B connector signal RXD1 to the card reader connector X301 pin 2 if S302 is in position 3
S304	*Using RTS1 line as SPI2 clock* Connects B2B connector signal RTS1 to the signal SPI2_SCLK at connector X510 pin 5	*Using RTS1 line as ASC1-RTS or SD card clock (SPI mode)* Connects B2B connector signal TXD1 to S305 pin 2
S305	*Using RTS1 line as ASC1-RTS* Connects B2B connector signal RTS1 to the RS-232 transceiver D201 used for asynchronous serial interface ASC1 if S304 is in position 3	*Using RTS1 line as SD card clock (SPI mode)* Connects B2B connector signal RTS1 to the card reader connector X301 pin 5 if S304 is in position 3
S306	*Using CTS1 line as SPI2 data out* Connects B2B connector signal CTS1 to the signal SPI2_DO at connector X510 pin 7	*Using CTS1 line as ASC1-RCS or SD card data out (SPI mode)* Connects B2B connector signal TXD1 to S307 pin 2
S307	*Using CTS1 line as ASC1-CTS* Connects B2B connector signal CTS1 to the RS-232 transceiver D201 used for asynchronous serial interface ASC1 if S306 is in position 3	*Using CTS1 line as SD card clock (SPI mode)* Connects B2B connector signal CTS1 to the card reader connector X301 pin 7 if S306 is in position 3
S450	*Using SD_D0 line as SD card data0* Connects B2B connector signal SD_D0 to SD card connector X301 pin 7	*Using SD_D0 line as GPIO1* Connects B2B connector signal SD_D0 to S460 pin 2
S451	*Using SD_D1 line as SD card data1* Connects B2B connector signal SD_D1 to SD card connector X301 pin 8	*Using SD_D1 line as GPIO2* Connects B2B connector signal SD_D1 to S461 pin 2
S452	*Using SD_D2 line as SD card data2* Connects B2B connector signal SD_D2 to SD card connector X301 pin 9	*Using SD_D2 line as GPIO3* Connects B2B connector signal SD_D2 to S462 pin 2
S453	*Using SD_D3 line as SD card data3* Connects B2B connector signal SD_D3 to SD card connector X301 pin 1	*Using SD_D3 line as GPIO4* Connects B2B connector signal SD_D3 to S463 pin 2
S454	*Using SD_CLK line as SD card clock* Connects B2B connector signal SD_CLK to SD card connector X301 pin 5	*Using SD_CLK line as GPIO5* Connects B2B connector signal SD_CLK to S464 pin 2
S455	*Using SD_CMD line as SD card command* Connects B2B connector signal SD_CMD to SD card connector X301 pin 2	*Using SD_CMD line as GPIO6* Connects B2B connector signal SD_CMD to S465 pin 2
S456	*Using SPICS line as SPI1 chip select* Connects B2B connector signal SPICS to pin 2 of the SPI connector X510 (signal SPI1_CS)	*Don't use!* Connects B2B connector signal SPICS to S466 pin 2

Reference	Function	
	Switch position 1	**Switch position 3**
S457	*Using SPIDI line as SPI1 data in* Connects B2B connector signal SPIDI to pin 4 of the SPI connector X510 (signal SPI1_DI)	*Don't use!* Connects B2B connector signal SPIDI to S467 pin 2
S458	*Using RXD2 line as ASC2-RXD* Connects B2B connector signal RXD2_GPIO9 to the RS-232 transceiver D201 used for asynchronous serial interface ASC2	*Using RXD2 line as GPIO9* Connects B2B connector signal RXD2_GPIO9 to S468 pin 2
S459	*Using TXD2 line as ASC2-TXD* Connects B2B connector signal TXD2_GPIO10 to the RS-232 transceiver D201 used for asynchronous serial interface ASC2	*Using TXD2 line as GPIO10* Connects B2B connector signal TXD2_GPIO10 to S469 pin 2
S460	*Pulls up GPIO1*	*Pulls down GPIO1*
S461	*Pulls up GPIO2*	*Pulls down GPIO2*
S462	*Pulls up GPIO3*	*Pulls down GPIO3*
S463	*Pulls up GPIO4*	*Pulls down GPIO4*
S464	*Pulls up GPIO5*	*Pulls down GPIO5*
S465	*Pulls up GPIO6*	*Pulls down GPIO6*
S466	*Don't use!*	*Don't use!*
S467	*Don't use!*	*Don't use!*
S468	*Pulls up GPIO9*	*Pulls down GPIO9*
S469	*Pulls up GPIO10*	*Pulls down GPIO10*
S500	*Activates 3 Volt I2CCLK line at connector X511*	*Activates 5 Volt I2CCLK line at connector X511*
S501	*Activates 3 Volt I2CDAT line at connector X511*	*Activates 5 Volt I2CDAT line at connector X511*
S502	*EEPROM address line A0 is low*	*EEPROM address line A0 is high*
S503	*EEPROM address line A1 is low*	*EEPROM address line A1 is high*
S504	*EEPROM address line A2 is low*	*EEPROM address line A2 is high*
X551	*ADC1_IN signal is open*	*ADC1_IN signal is connected to the filtered DAC_OUT signal*
X552	*ADC2_IN signal is open*	*ADC2_IN signal is connected to the filtered DAC_OUT signal*
X554	Module boots from flash (normal operation)	*For Cinterion internal use only!* Module boots from ROM based flash loader (necessary if flash is empty or corrupt)

Reference	Function	
	Switch position 1	**Switch position 3**
S710[1)] S711	Disconnects a speaker connected to the Lumberg connector X700 or X701 (audio interface 2)	Activates a speaker connected to the Lumberg connector X700 or X701 (audio interface 2)
S712[1)] S713	Disconnects a speaker connected to the handset connector X502 (audio interface 1)	Activates a speaker connected to the handset connector X502 (audio interface 1)
S714[1)] S715	Disconnects a microphone connected to the Lumberg connector X700 or X701 (audio interface 2)	Activates a microphone connected to the Lumberg connector X700 or X701 (audio interface 2)
S716[1)] S717	Disconnects a microphone connected to the handset connector X502 (audio interface 1)	Activates a microphone connected to the handset connector X502 (audio interface 1)
S730[1)]	Connects voltage VMIC to the microphone feeding bridges (necessary for using audio inputs)	Disconnects voltage VMIC Audio (microphone) inputs at X502,700,701 doesn't work
S731[1)]	Connects analog ground AGND to the microphone feeding bridges (necessary for using audio inputs)	Disconnects analog ground AGND Audio (microphone) inputs at X502, X700, X701 does not work

[1)] Set the switch to position 3 (disconnect state) using a separate customized audio circuit connected to the pin headers X101, X102.

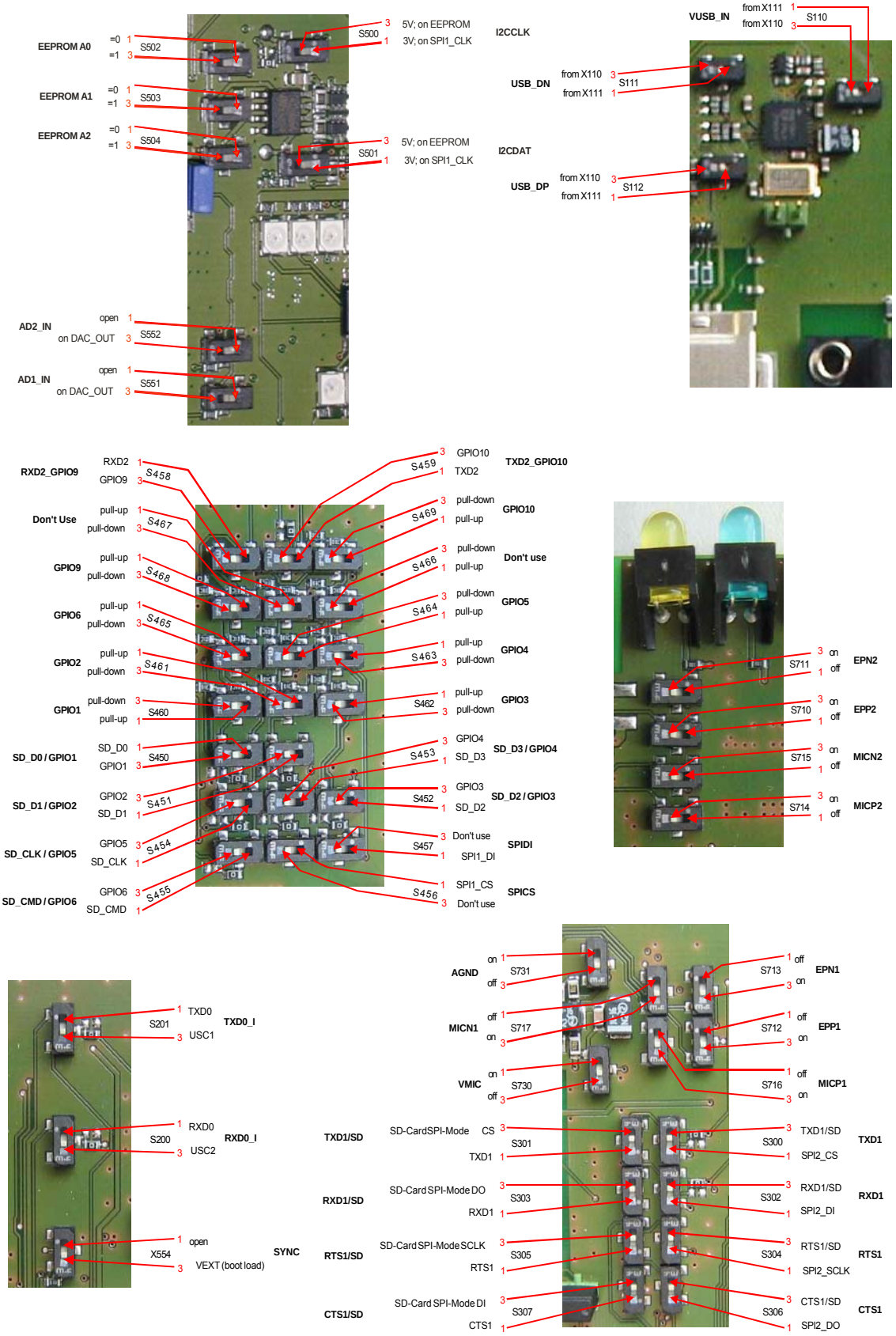


Figure 43: Location, signal names and switch positions of the slide switches

5.2 Overview of Jumpers

Table 33: Overview of jumpers

Reference	Function	
	Jumper set	**Jumper not set**
X120 [1]	Voltage that is delivered by an USB host connected to X110 can be used as source for the module's USB interface, switch S110 must be in position 3	Voltage that is delivered by an USB host is disconnected to the module's USB interface, switch S110 must be in position 1 to deliver that voltage from the 5-volt supply on the DSB75
X121 [1]	Voltage that is delivered by an USB host connected to X111 can be used as source for the module's USB interface	Voltage that is delivered by an USB host connected to X111 cannot be used as source for the module's USB interface
X122	Connects BATT+ voltage to GSM module	Disconnects BATT+ voltage from GSM module Jumper pins can be used for BATT+ current measurements [3]
X203 [1]	Enables DTR at COM1 interface	Disables DTR at COM1 interface [3]
X204	Enables receiver outputs of COM1	Disables receiver outputs of COM1
X206	Enables receiver outputs of COM2	Disables receiver outputs of COM2
X405 [1]	Disables BATT+ generation	Enables BATT+ generation
X410 [1] X411 [1]	Both jumpers set: maximal BATT+ voltage is generated (4.5 Volt) Jumper on X410 set: nominal BATT+ voltage is generated (4.1 Volt) Jumper on X411 set: minimal BATT+ voltage is generated (3.5 Volt)	
X420 [1]	Ignition on	Ignition off
X421 [1]	EMERG_RST on	EMERG_RST off
X500 [1]	Enables SIM card detection	Disables SIM card detection
X560 [2]	Connects signal DAC_OUT to filter circuit	Disconnects signal DAC_OUT from filter circuit
X561 [2]	Enables the loop back of the filtered signal DAC_OUT_F to the ADCx_IN signals	Filtered signal DAC_OUT_F terminates on this jumper pin 1 (access point)
X562 [2]	Ground pins	
X600	Resistor R602 (150mΩ) shorted	Resistor R602 (150mΩ) not shorted
X710 [1]	Jumper set to pin 1 and 2: charger circuit is supplied by external charger interface voltage Jumper set to pin 2 and 3: charger circuit is supplied by internal voltage 5V0	Charger circuit is not supplied

[1] Jumper is intended for controlling the described function from a remote device.
[2] Jumper is intended for replacing DAC-OUT- filter by customer.
[3] Cut the trace of the jumper at the first use (see also Figure 45).

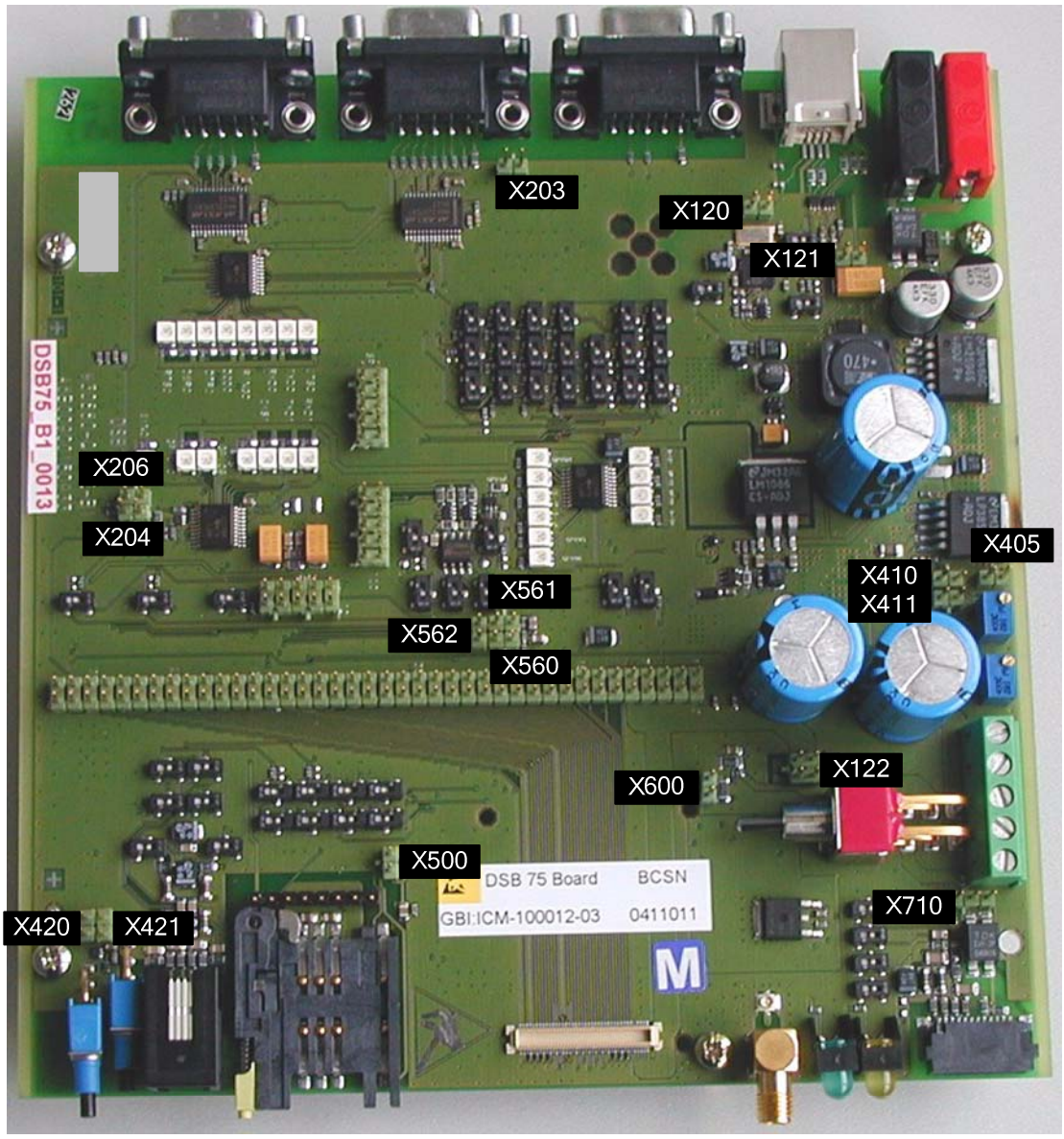


Figure 44: Location of jumpers

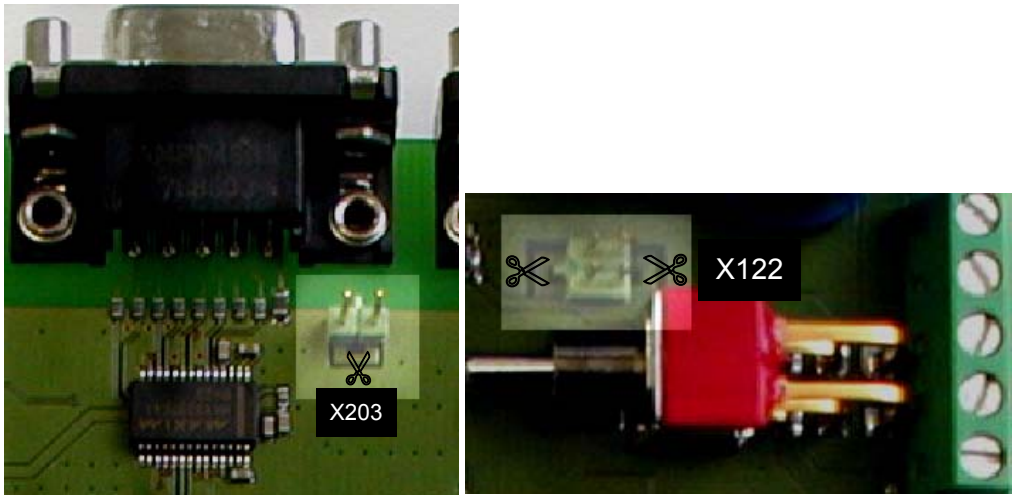


Figure 45: Illustration of positions to cut the trace for jumpers X203 and X122

6 Connecting Antenna and GSM Module to DSB75

To prevent mechanical damage, be careful not to force, bend or twist the module. In order to prevent short-circuits, ensure that the GSM module does not come into contact with any part of the DSB75.

Connecting TC63, TC65 and MC75 modules:

- Connect the supplied RF cable to the appropriate RF connector on the GSM module.
- Plug the opposite end of the RF cable to the Hirose RF jack X505 located on the component side of DSB75.
- Connect the 80-pin board-to-board connector of the GSM module to the 80-pin board-to-board connector X100 of the DSB75.
- Insert the M2 screws (1) from the bottom side into the small holes of the DSB75 (5). Push the self-gripping spacers (3) onto the screws as far as possible.
- Mount the GSM module (4) upside down onto the M2 screws and spacers and secure it with the M2 nuts (2).
- Connect the external antenna to the SMA jack X506 of the DSB75.
- Plug the power cables to the connectors X400 and X401 of the DSB75.

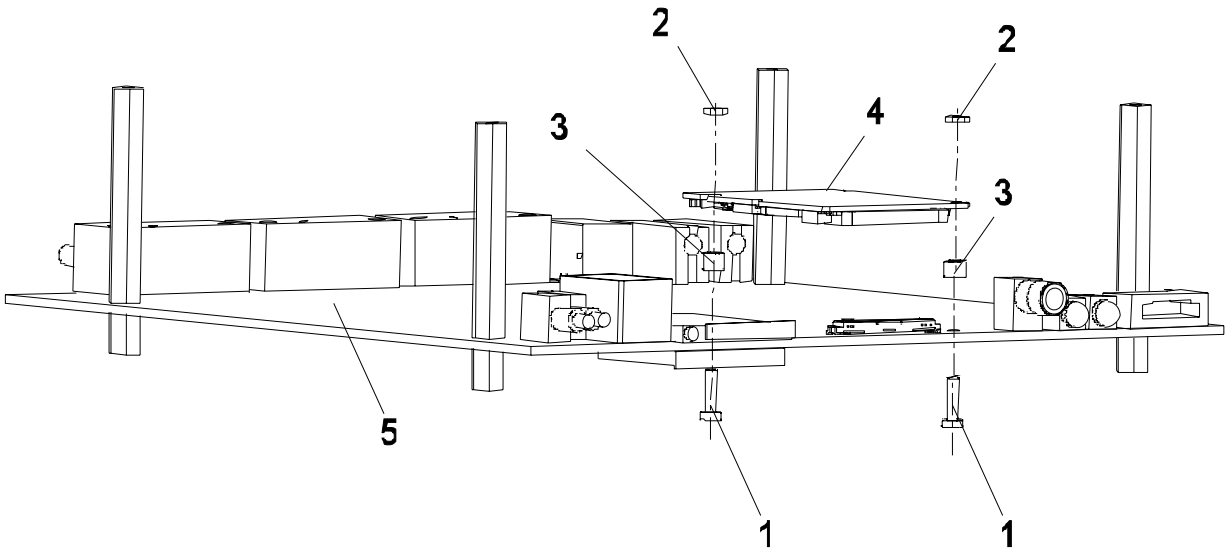


Figure 46: Mounting GSM module (MC75, TC63, TC65) onto the DSB75

The pin assignment of the board-to-board connector can be found in Figure 4 and Table 5. Figure 47 shows a GSM module (MC75, TC63, TC65) directly seated on the board-to-board connector of the DSB75.

Connecting AC65, AC75, XT65, XT75 modules:

- These modules cannot be attached mechanically to the board-to-board connector of the DSB75. Instead, to properly connect the module either use the supplied additional flat flexible cable or another suitable adapter.
- For AC65/AC75 a specific RF antenna cable is necessary.
- For XT65/XT75 a GPS antenna should be available, for example the supplied active GPS antenna connected to the module via the supplied adapter cable.

These cables are not part of the standard DSB75 package, but are supplied separately. The cables for each product type are listed in Section 1.3.2.

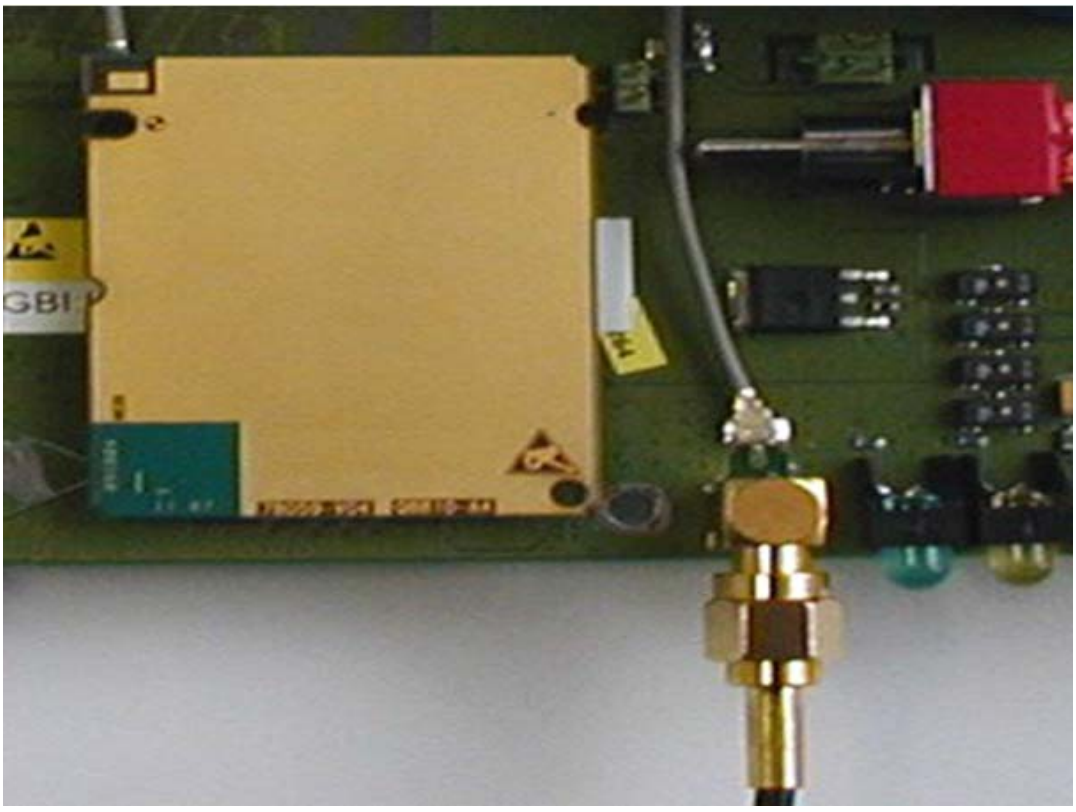


Figure 47: Top view on DSB75 with connected GSM module (MC75, TC63 or TC65) and RF cable

7 Turn on / off the GSM Module

All the hardware driven solutions described in [1] for turning on and off the GSM module are implemented on the DSB75 and can be used by as follows:

7.1 Turn on the GSM Module

There are several ways to turn on the GSM module:

Non-locking ignition key S421:
The major approach is to switch on the connected GSM module by pressing the ignition (IGT) switch S421 for at least 400ms. The ignition switch is located on the component side of the DSB75.
A 2-pin jumper (X420) connected in parallel to switch S421 makes it possible to control the IGT signal from a remote unit.

Toggling low-to-high state of DTR:
As an alternative to the ignition key S421, the GSM module can be activated by toggling the DTR line available on COM1.
The high signal of DTR generates a low pulse on IGT which switches the module on. For this purpose, the DSB75 uses a differentiator circuit comprising the RC combination C420, R420, R421 and the transistor V420.
Note: Before activating DTR keep the lines inactive for at least 500 milliseconds (see chapter 8).

Plugging the USB cable:
Plugging in the USB cable to one of the two USB connectors triggers the IGT signal in the same manner as DTR0. In this case, the USB supply voltage delivered from the USB host starts the GSM module.
The 2-pin jumper (X120) connected in series with the USB voltage lines makes this function remote controllable.

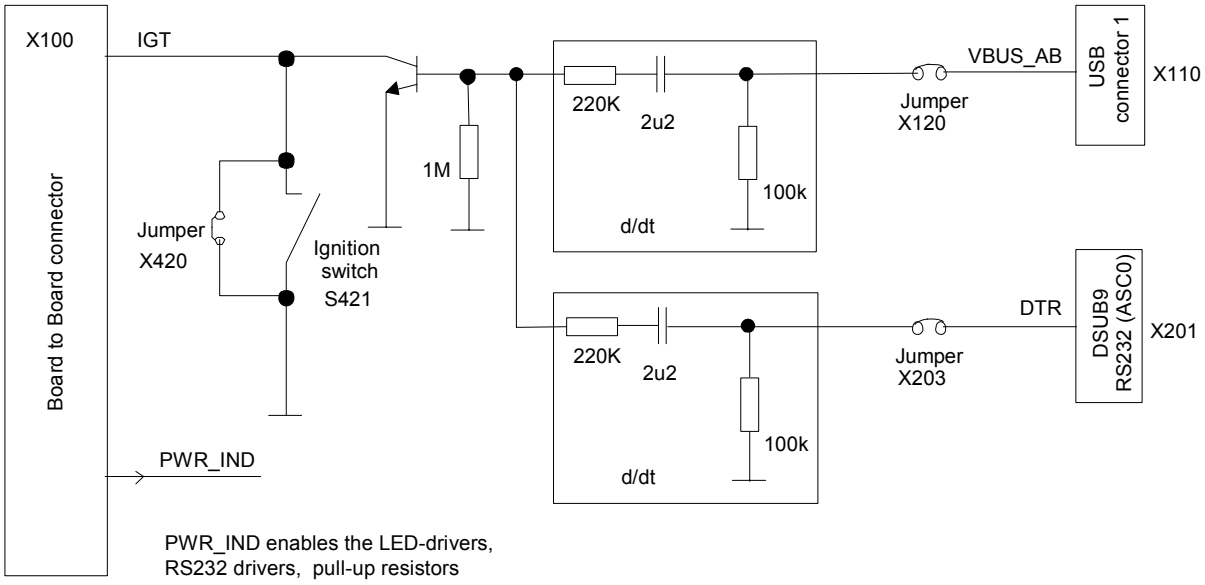


Figure 48: Turn on circuit

7.2 Turn off the GSM Module

Normal Power-off
The best and safest approach to switch off the module is using the AT command AT^SMSO. This procedure lets the GSM module log off from the network and safe data before it shuts down.

Emergency-off
The emergency-off (9V power shut off or battery power off) option is reserved only for use in the case of emergency. It should be used only exceptionally when, due to serious problems, the software is not responding for more than 5 seconds.

After normal power-off or emergency-off, the module can be restarted by pressing the ignition key S421.

If the power supply is restarted within one minute, the module may start automatically.

7.3 Emergency Restart

The emergency restart option is reserved only for use in the case of emergency. It should be used only exceptionally when, due to serious problems, the software is not responding for more than 5 seconds.

Pulling down the module's EMERG_RST pin by pressing the key S420 causes at release a reset of the GSM module (0 -> 1 edge).
This may cause the loss of information stored in the volatile memory since the reset is initialized.

The 2-pin jumper X421 connected in parallel to the key S420 can be used to shut off the module from a remote unit.

8 Technical Data of DSB75

Table 34: DSB75 maximum ratings

Parameter	Condition	Min.	Max.	Unit
Supply voltage	Laboratory PSU	-30	+30	V
Operating temperature		+15	+35	°C
Storage temperature		-40	+85	°C

Table 35: DSB75 technical data

Parameters	Condition	Min.	Typical	Max.	Unit
Supply current peak	Laboratory PSU at 9V requirements during GSM transmission			1	A
Supply current average			300	400	mA
Supply voltage		8.5	9.0	15	V
V_{BATT+} output voltage *) for module MC75, adjusted values dependent on module hardware	Nominal supply voltage for the GSM module (adjustable)	2.85	4.1 *)	4.55	V
	Minimum supply voltage for GSM module (adjustable)	2.85	3.5*)	4.55	V
	Maximum supply voltage for GSM module	4.45	4.5	4.55	V
VEXT Switched logic high level voltage (on if GSM module on)	$I_O$max = 50mA	2.75	2.93	3.05	V
3V0 Supply voltage for DSB75 circuits		2.95	2.975	3.00	V
VDD Supply voltage for the pull-up resistors and external use	$I_O$max = 50mA	2.8	2.9	3.0	V
+5V Audio interface supply voltage	Audio interface supply voltage	4.75	5.0	5.25	V

Parameters	Condition	Min.	Typical	Max.	Unit
Charging interface	Charger voltage	4.75	6.6	10	V
	Fast charging current (Jumper X600 not set)	450	500	550	mA
	Fast charging current (Jumper X600 set)	950	1000	1050	mA
	Trickle charge current (Deep Discharge Lockout)	4	5	7	mA
	Trickle charge current (Undervoltage Lockout)	25	30	35	mA
Battery interface	Battery voltage	3.3	3.8	4.2	V
	NTC to ground at BATTEMP (near battery) @ 25˚C		10 See module specification [1] for detail.		kΩ
	Peak current			2.5	A
RS-232 interfaces COM1 to COM3	Output voltage range (load resistance 5kΩ)	± 4.9	± 5.0	± 5.4	V
	Output short-circuit current		± 19		mA
	Output resistance		520		Ω
	Input voltage range	-25		25	V
	Input resistance	3.2	5.2	7.2	kΩ
	Input threshold low	0.65	1.25		V
	Input threshold high		1.6	2.5	V
I^2C interface 5V	V_{OL}			0.4	V
	V_{OH}	2.8		5.0	V
	V_{IL}			0.8	V
	V_{IH}	2.4		5.3	V
	Internal pull-up resistor		3.3		kΩ
	External pull-up resistor recommended	3.2	3.3		kΩ
I^2C interface 3V	External pull-up resistor required	0.75	1		kΩ
	Voltage levels	See module specification [1] for detail.			

Parameters	Condition	Min.	Typical	Max.	Unit
Audio interface 1 (balanced input) Handset Mode (AT^SNFS=1)	Differential output voltage at full scale sine 1kHz		1.6		Vpp
	Differential input voltage for 0dBm0 (after settling)		30		mV
Audio interface 1 (balanced input) General Information	Maximum differential output voltage, no load			6.0	Vpp
	Differential output resistance		15		Ω
	Differential output load	0			Ω
	Differential input voltage			1.6	V
	Input impedance		4.0		kΩ
	Microphone supply voltage		5.0		V
	Microphone supply DC resistance		4.6		kΩ
Audio interface 2 (single ended input) General Information	Output voltage			3.4	Vpp
	Differential output resistance		15		Ω
	Differential output load	16			Ω
	Input voltage			1.6	V
	Input impedance		2.0		kΩ
	Microphone supply voltage		2.5		V
	Microphone supply DC resistance		2.2		kΩ
SPI interface Digital audio interface SIM interface USB interface SD card interface	The interface lines are connected directly to the GSM module	See module specification [1] for details.			
Ignition (Key) Emergency Restart (Key)					
Ignition via DTR line @COM1	V_I = ±3V…±9V: signal ~~~|_____|~~~~~~~~~~~~~~ | ≥ 1s | ≥ 0.5s | V_I >±9V: signal ~~~|_____|~~~~~~~~~~~~~~ | ≥ 0.5s | ≥ 0.5s | Rise time ≤ 1ms. Low high transition of this signal switches the module on.				

Parameters	Condition	Min.	Typical	Max.	Unit
Ignition via VBUS line @USB-Interface	$V_I$min = 4V signal ~~~|_____|~~~~~~~~~~~~~~~ | ≥ 1s | ≥ 0.5s | Rise time ≤ 1ms Low high transition of this signal switches the module on.				
RF attenuation	Adapter between RF connector X505 (type Hirose U.FL-R-SMT) and RF connector X506 (type SMA)	0.1	0.2	dB	0.1
Antenna Frequency range	GSM 850[1)] GSM 900 GSM 1800 GSM 1900	824 880 1710 1850		894 960 1880 1990	MHz MHz MHz MHz
Antenna VSWR				2:1	
Antenna gain			0		dBd
Dimensions of DSB75 PCB	Depth Width Height with feet		177 160 43		mm mm mm
Weight			240		g

1) Although the provided antenna is rated for a frequency range from 890MHz to 1990MHz (2170MHz), its coverage also includes the 850MHz frequency band, sufficient ground plane and mounting provided.

8.1 Cable Requirements

The DSB75 has been tested and approved for use with a maximum cable length of 3m for following interfaces:

- USB interface (shielded)
- Serial interfaces COM1 to COM3 (RS232)
- Power supply
- Charger
- Analog audio interface
- Antenna interface
- ADC inputs
- DAC output

It is recommended to keep the digital lines for I²C-, SPI- and DAI- interfaces as short as possible.

9 Appendix

9.1 List of Parts and Accessories

Table 36: List of parts and accessories

Description	Supplier	Ordering information
DSB75 Support Board	Cinterion	Ordering number: L36880-N8811-A100
Votronic Handset	VOTRONIC	Votronic HH-SI-30.3/V1.1/0 VOTRONIC Entwicklungs- und Produktionsgesellschaft für elektronische Geräte mbH Saarbrücker Str. 8 66386 St. Ingbert Germany Phone : +49-(0)6 89 4 / 92 55-0 Fax : +49-(0)6 89 4 / 92 55-88 Email : contact@votronic.com
RF Cable	Hirose	http://www.hirose.de Ordering number: U.FL-2LP-066-A(150)
Antenna	KÖBEL Mobile Communication Sesamstrasse 12 D-24632 Lentföhrden	SMARTEQ-MiniMAG Dualband, 0dBd, 2.6m RG174, SMA (m) Ordering number: 1140.26 with crimped SMA connector
Travel Charger	Siemens	Siemens ordering number: A5BHTN00127458
Headset	Siemens	PTT HHS-510
Car Kit	Siemens	Car Kit Portable HKP-500

9.2 Circuit Diagrams of DSB75

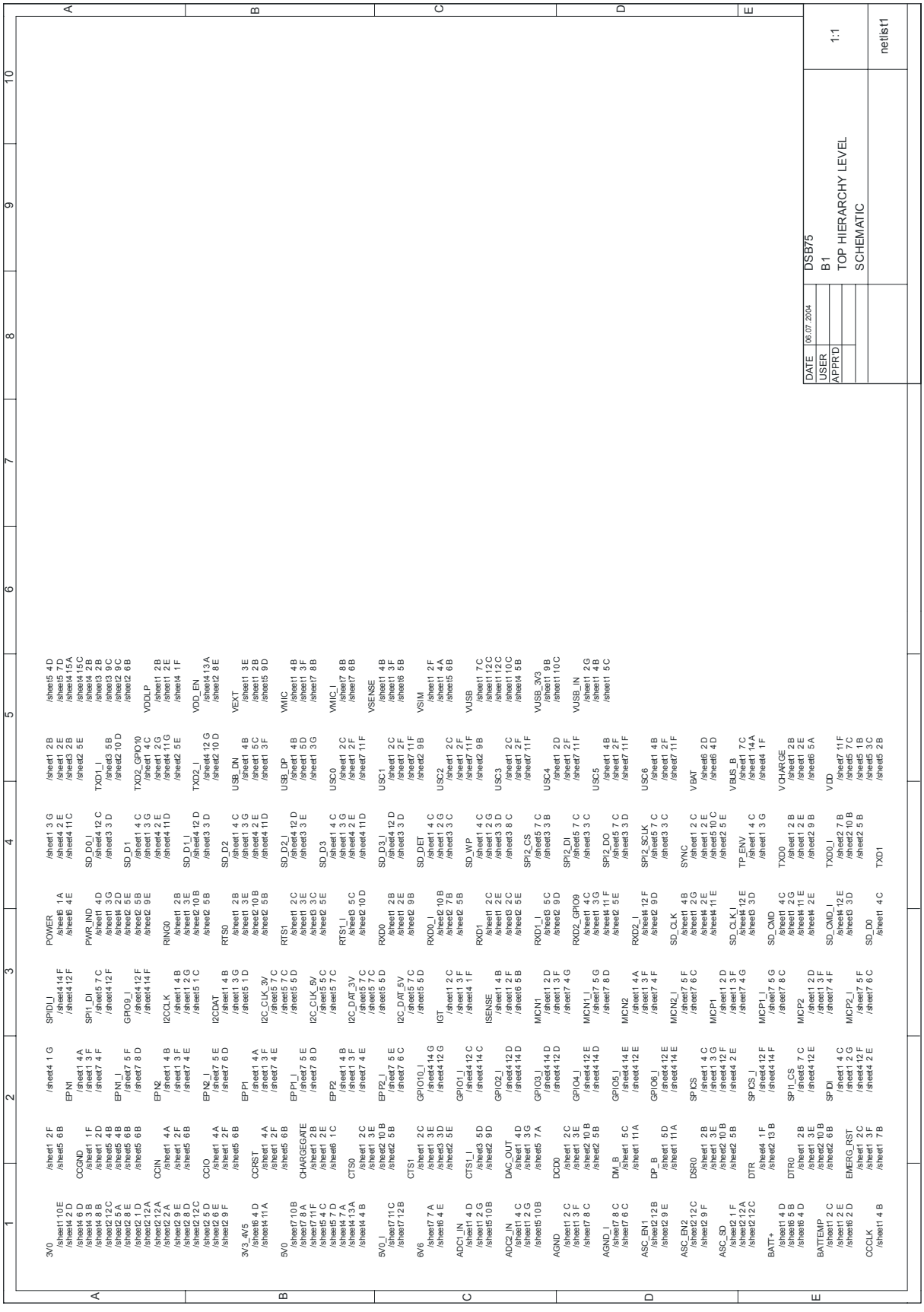


Figure 49: Schematic of page signals

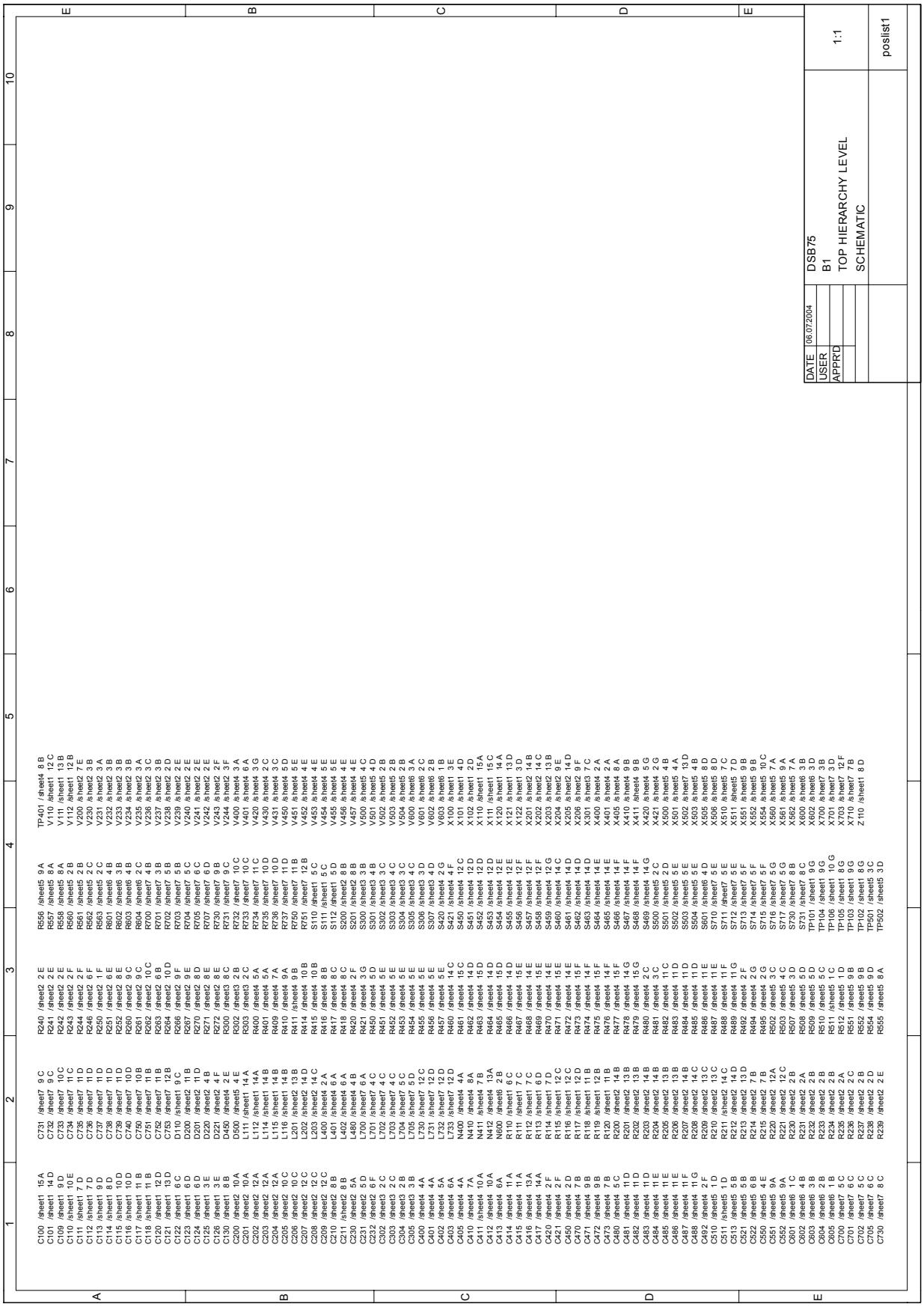


Figure 50: Schematic of position list

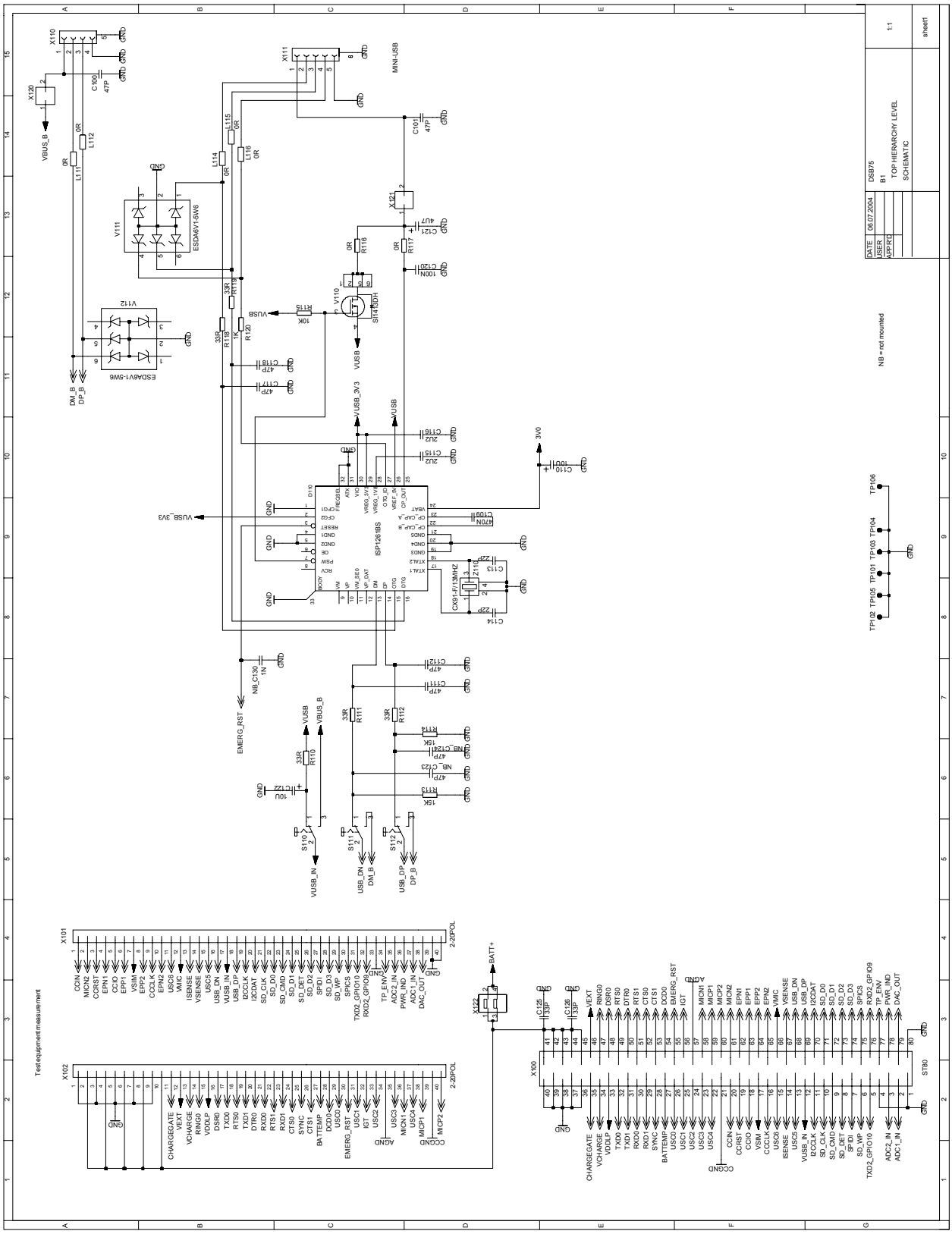


Figure 51: Schematic sheet 1 – B2B connector, test points, USB interface

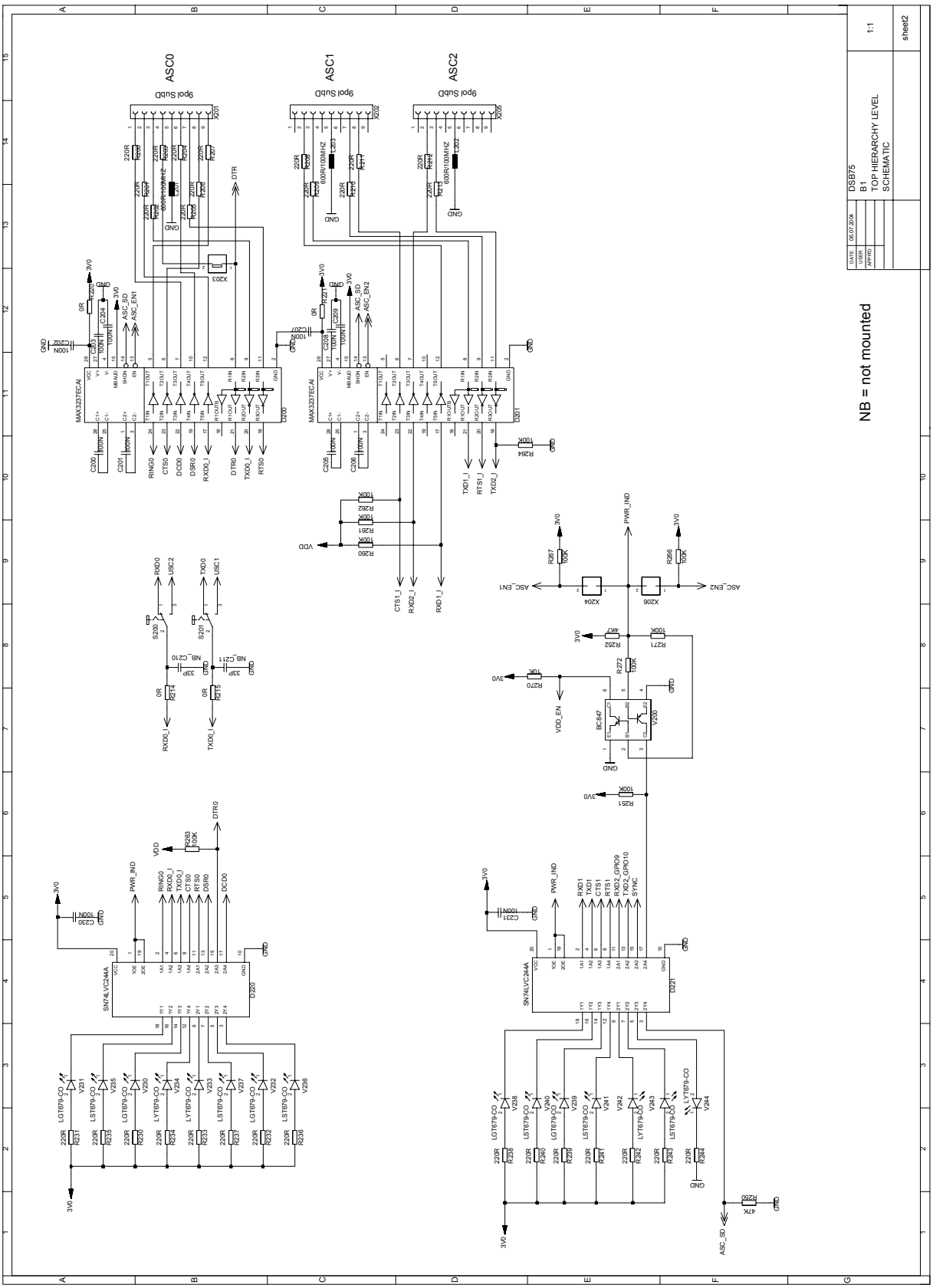


Figure 52: Schematic sheet 2 – ASC0, ASC1 and ASC2 interface

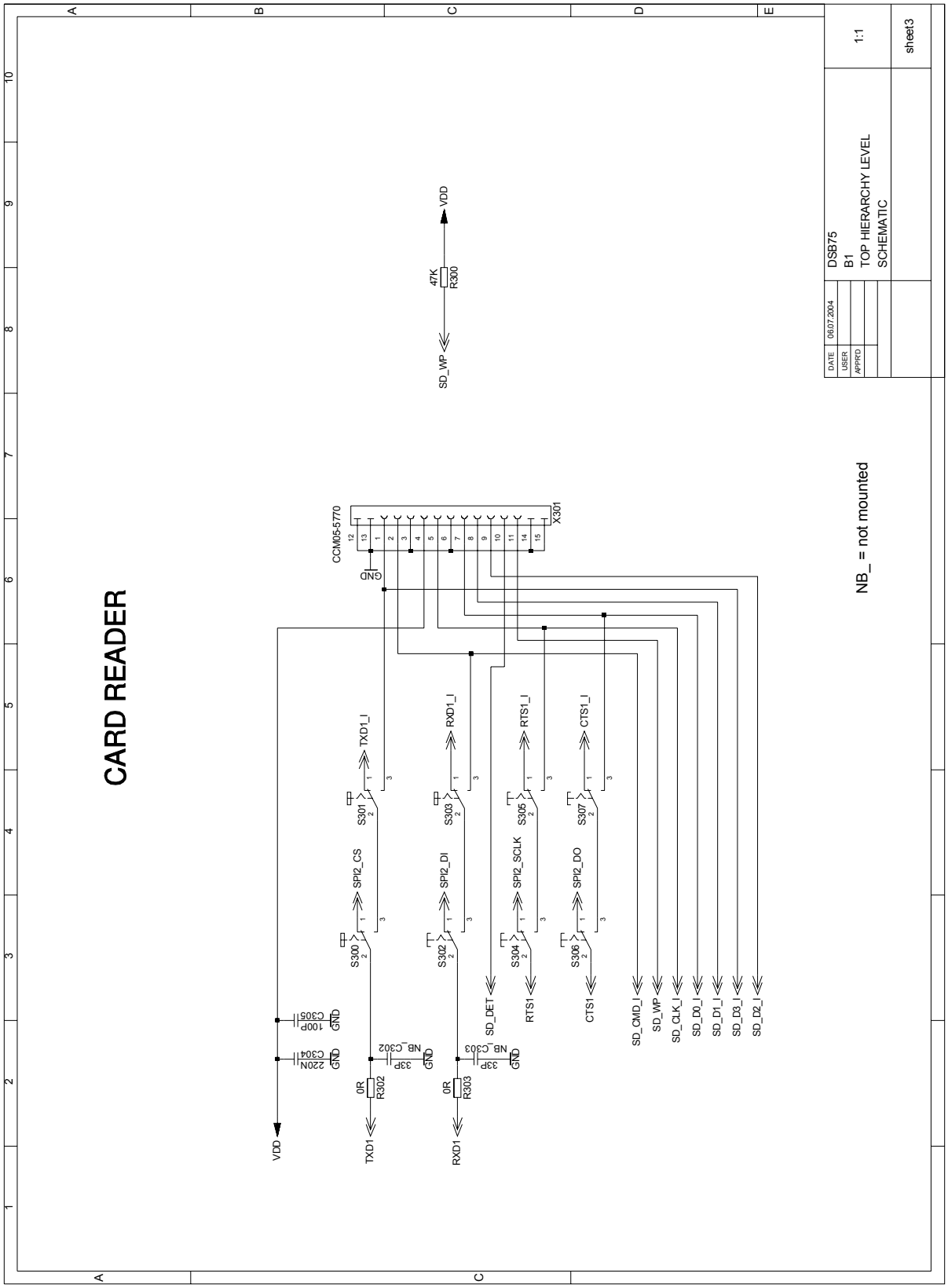


Figure 53: Schematic sheet 3 – SD card reader

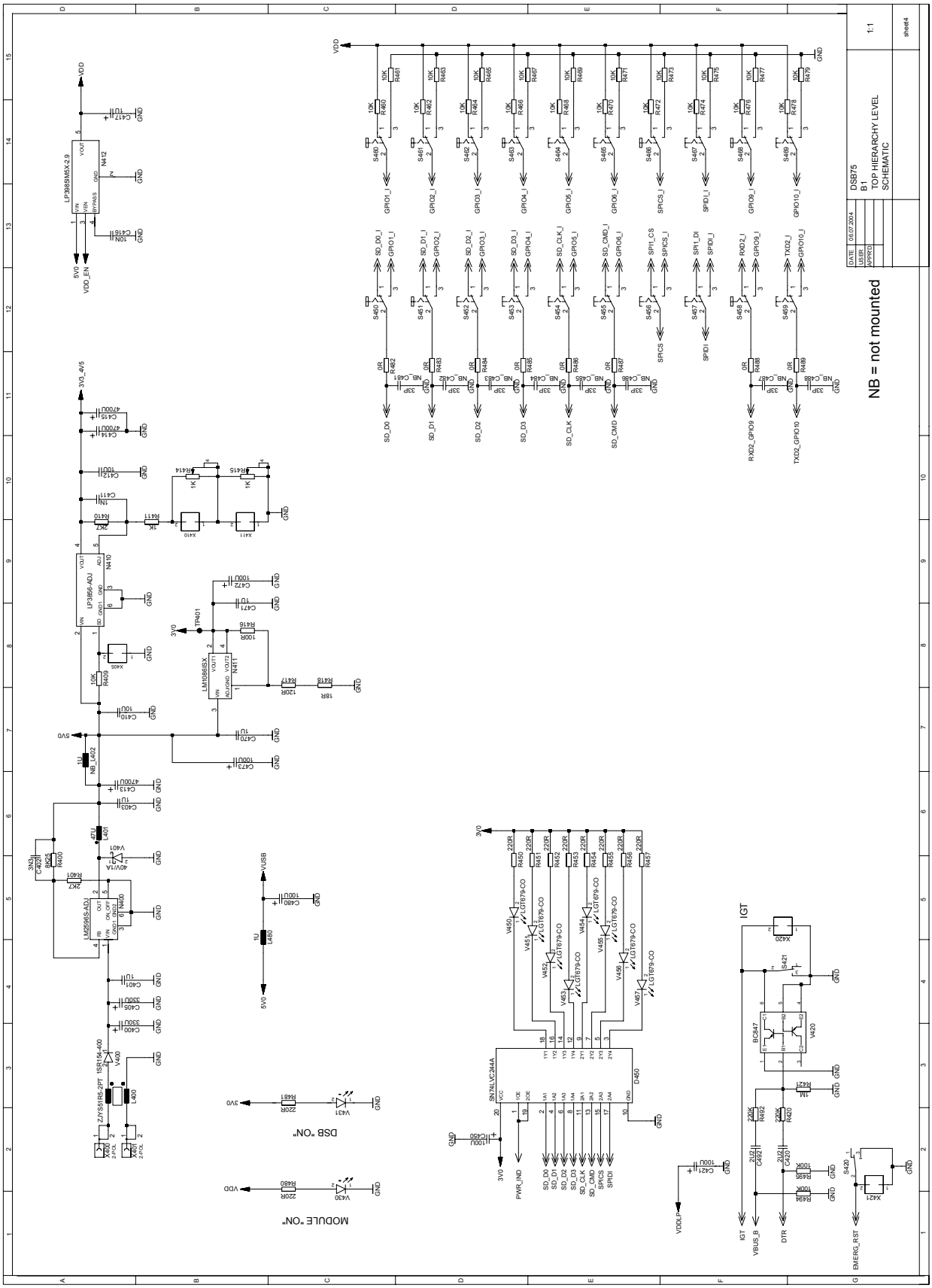


Figure 54: Schematic sheet 4 – GPIOs, power supply

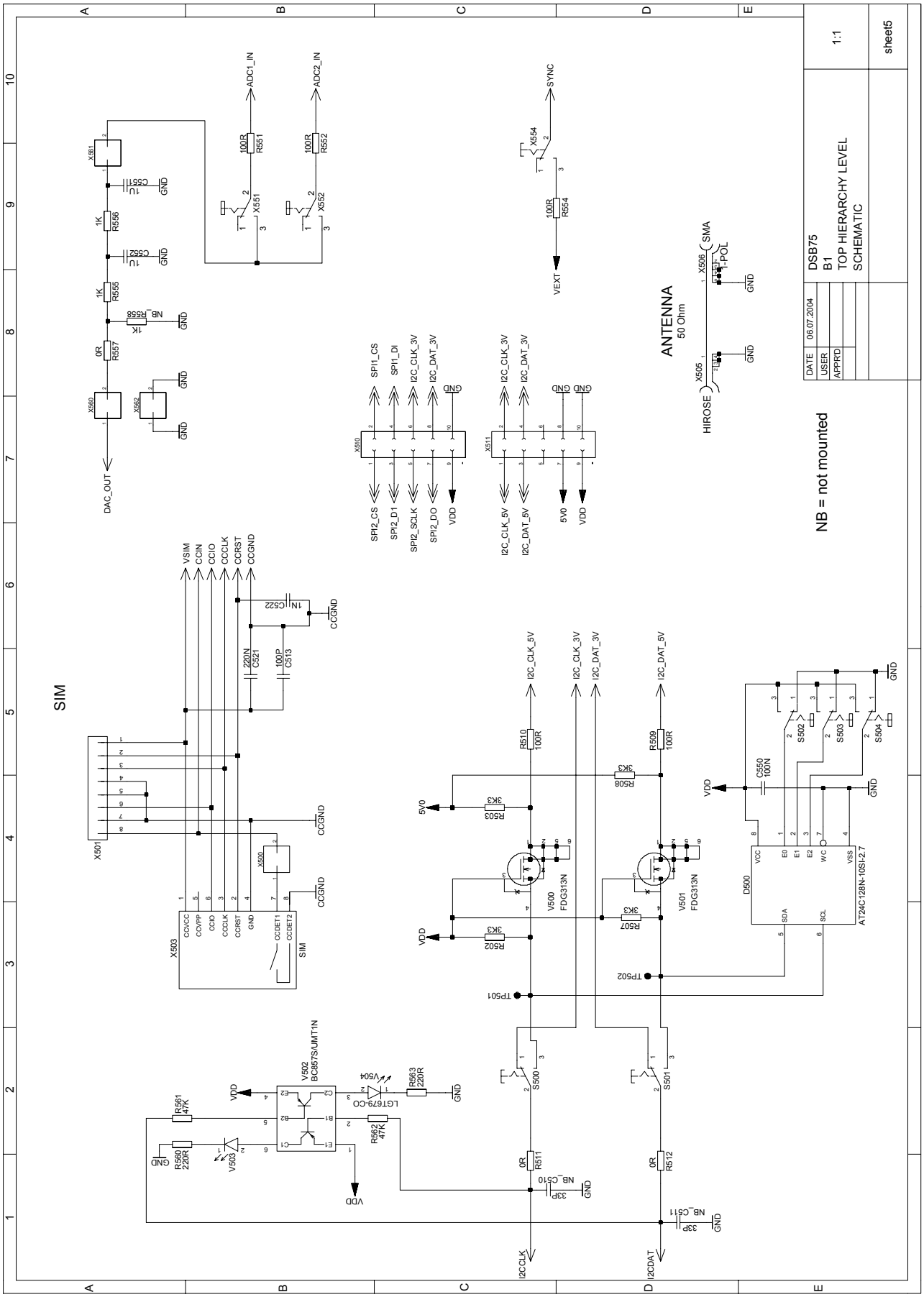

SIM
ANTENNA
50 Ohm
NB = not mounted
DSB75
B1
TOP HIERARCHY LEVEL
SCHEMATIC
DATE 06.07.2004
USER
APPR'D
1:1
sheet5
ADC1_IN
ADC2_IN
SYNC
VEXT
DAC_OUT
SPI1_CS
SPI1_DI
I2C_CLK_3V
I2C_DAT_3V
SPI2_CS
SPI2_D1
SPI2_SCLK
SPI2_DO
I2C_CLK_5V
I2C_DAT_5V
5V0
VDD
GND
VSIM
CCIN
CCIO
CCCLK
CCRST
CCGND
I2CCLK
I2CDAT
HIROSE
SMA
T-POL
AT24C128N-10SI-2.7
FDG313N
BC857S/UMT1N
LG T673-CO

Figure 55: Schematic sheet 5 – SIM card, I2C, SPI, analog and antenna interface

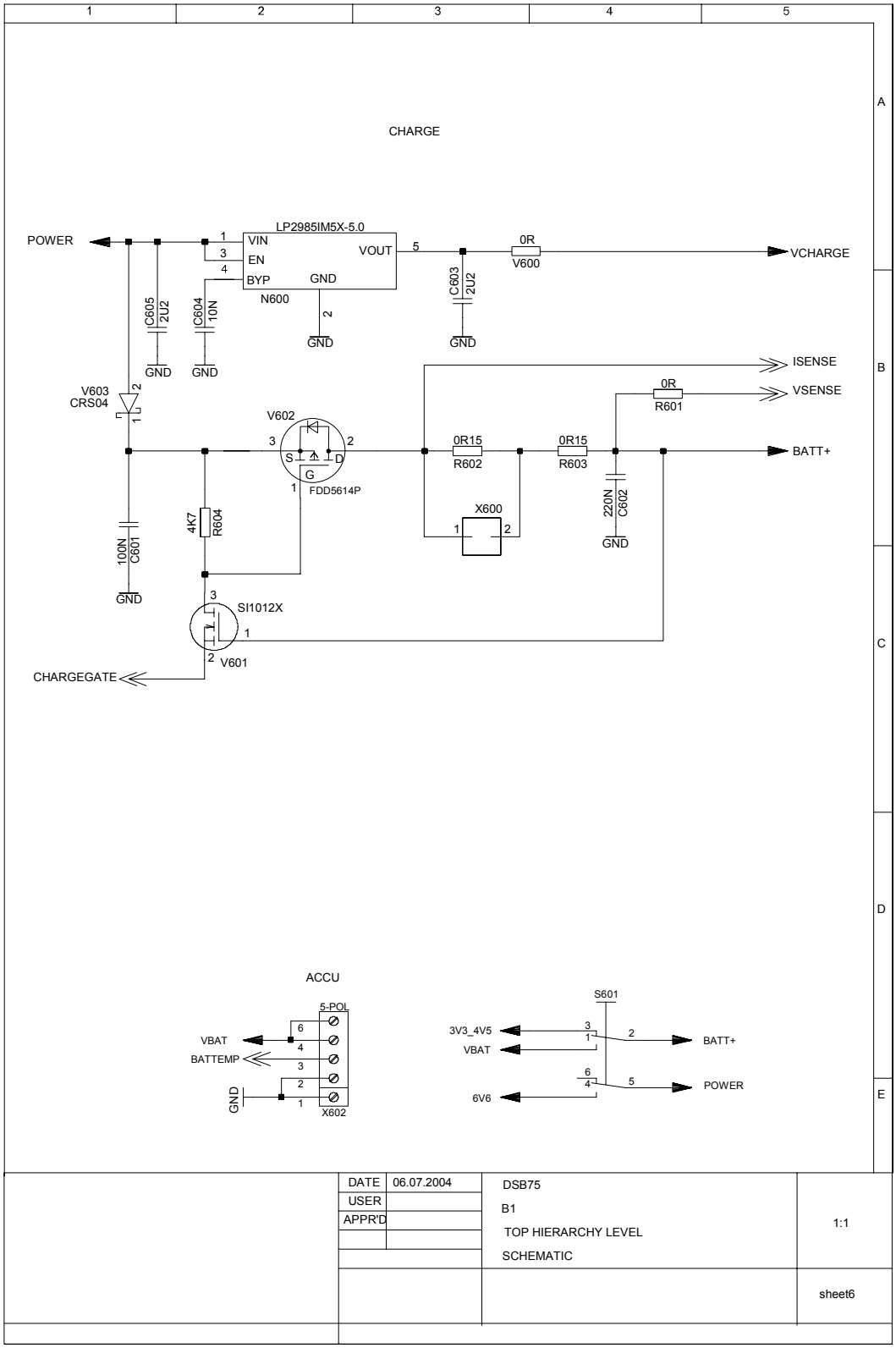


Figure 56: Schematic sheet 6 – charging interface

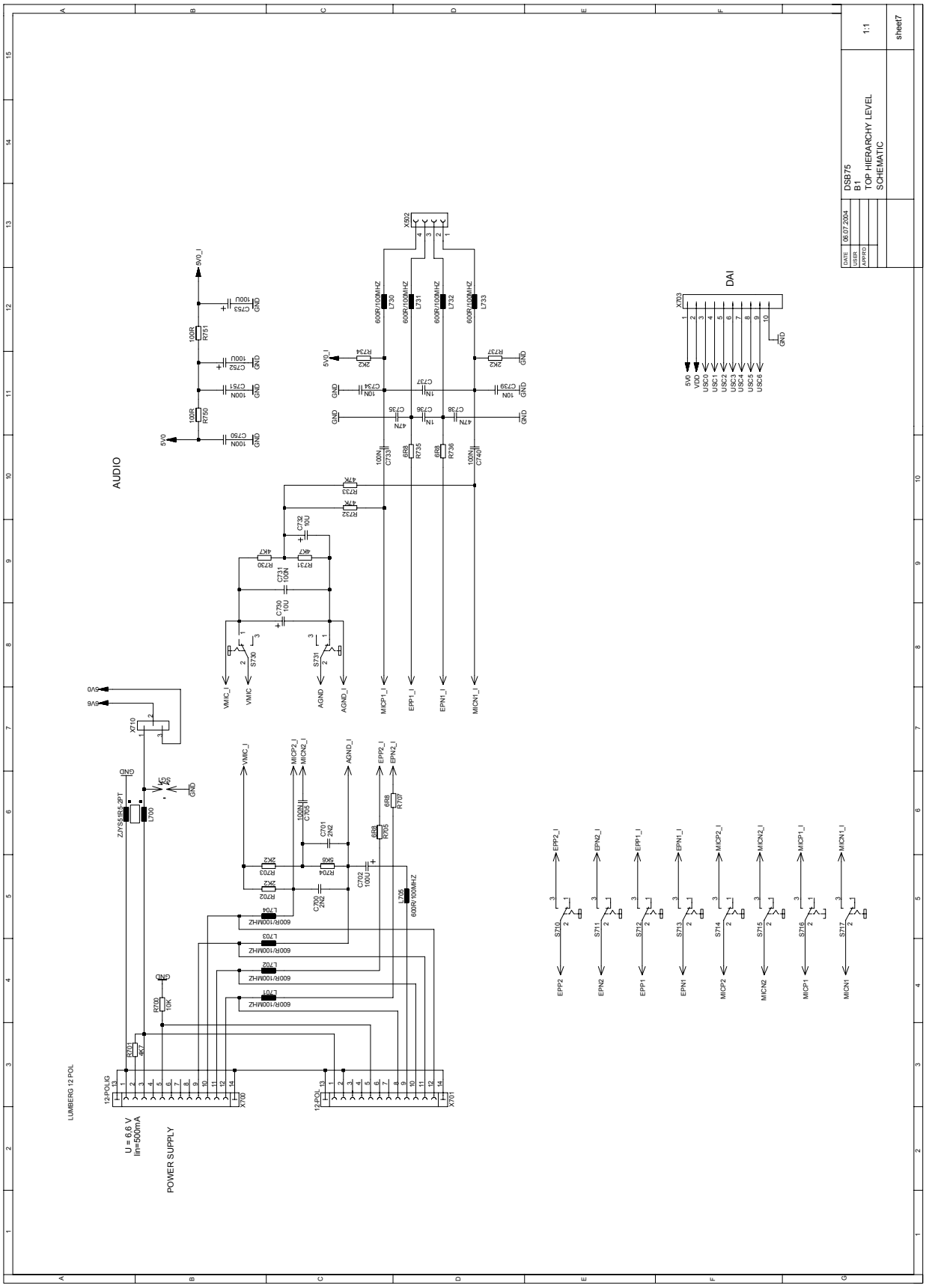


Figure 57: Schematic sheet 7 – audio interface

9.3 Floor Plan of the DSB75

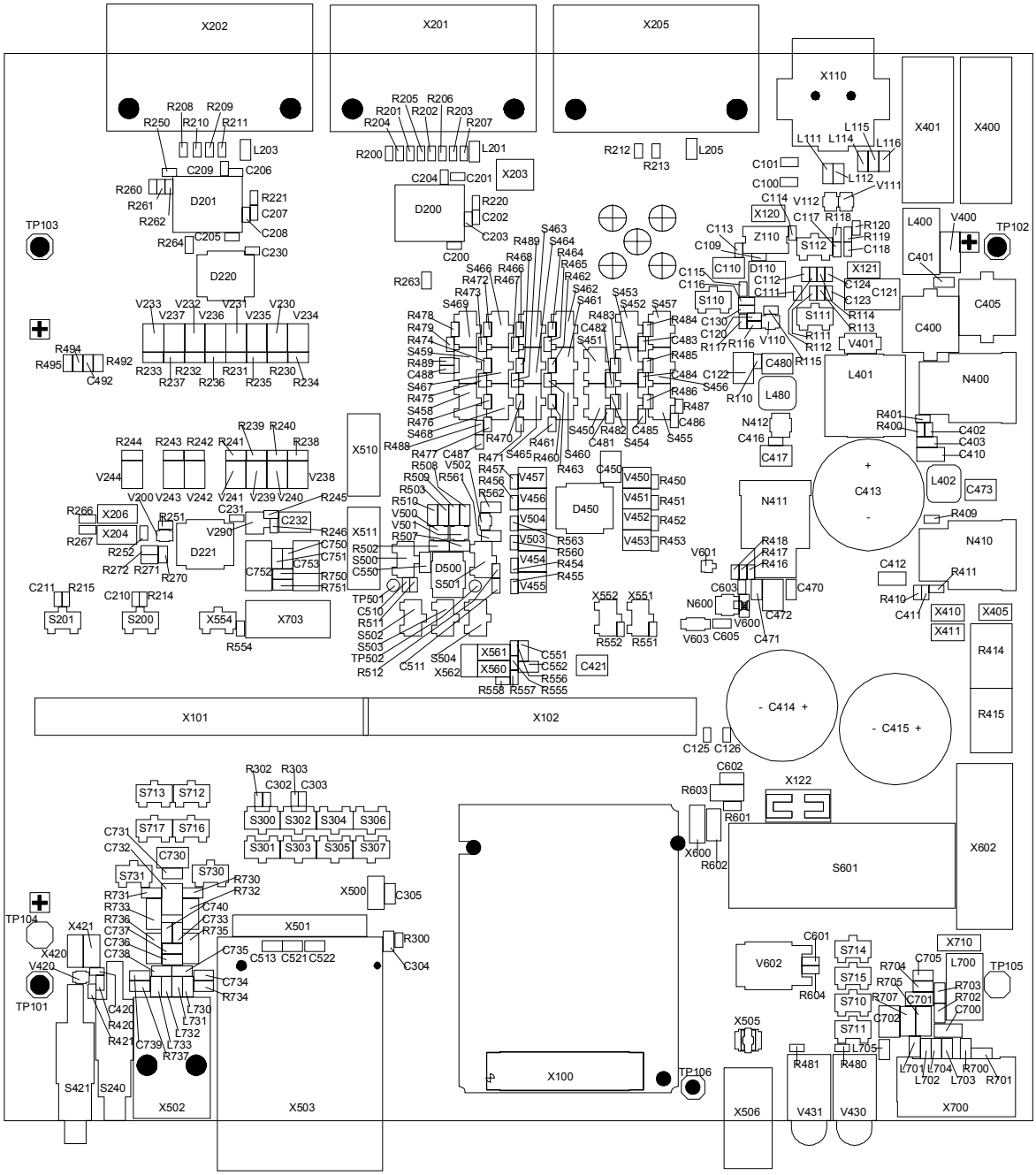


Figure 58: Floor plan top side

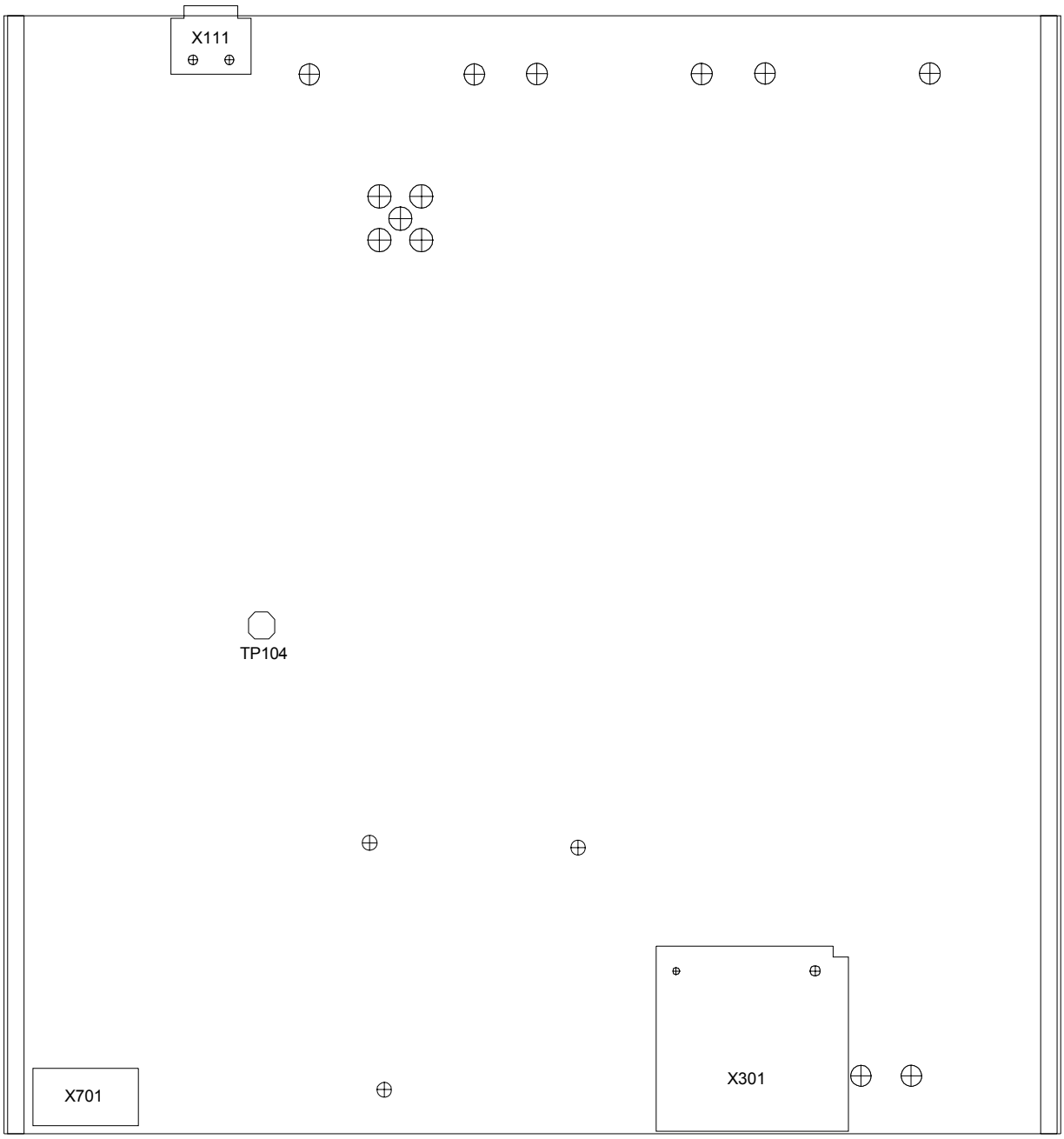


Figure 59: Floor plan bottom side