CINTERION
a Gemalto company

DSB-Mini User Guide

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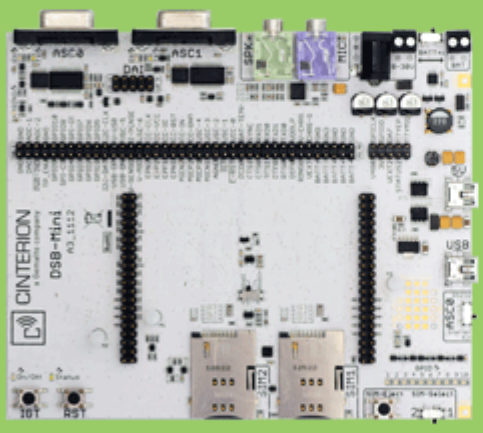

User Guide

User Guide:	**DSB-Mini User Guide**
Version:	**01**
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0 Document History

New document: "DSB-Mini User Guide" Version 01

Chapter	What is new
---	Initial document setup.

1 Introduction

The DSB-Mini is a simple and easy-to-use development support board, designed to assist system integrators in developing and evaluating products based on Cinterion Wireless Modules.

This document describes all interfaces of the DSB-Mini, provides technical specifications and presents guidelines for connecting and operating the Cinterion modules to be evaluated.

Chapter 2 introduces the product concept, including key features and system overview, Chapter 3 describes the DSB-Mini's interfaces in some more detail including the DSB-Mini's connector pin assignments. The Appendix finally contains schematics and placement (see Chapter 4).

Note: The DSB-Mini is not intended for use as reference environment for type approval.

1.1 Supported Products

The DSB-Mini provides two 40-pin connectors to mount the Cinterion Starter Kits B60 and B80 in order to evaluate the full functionality of modules that can be connected to these Starter Kits. Also, the DSB-Mini has an 80-pin connector to mount the Cinterion Multi-Adapter R1 or various other DSB75 product adapter together with their plugged modules. Signals and levels are in each case switched automatically.

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] AT Command Set for the appropriate module
[2] Hardware Interface Description for the appropriate module
[3] DSB75 Development Support Board Rev. B1 Hardware Description
[4] Starter Kit B60 User Guide
[5] Starter Kit B80 User Guide

1.3 Scope of delivery

Table 1: DSB-Mini delivery package

Quantity	Description
1	DSB-Mini

The Cinterion modules, Starter Kits and DSB75 module adapter for use with the DSB-Mini are not included in the scope of delivery.

2 Product Concept

Figure 1 shows the location of the DSB-Mini's interfaces and switches.

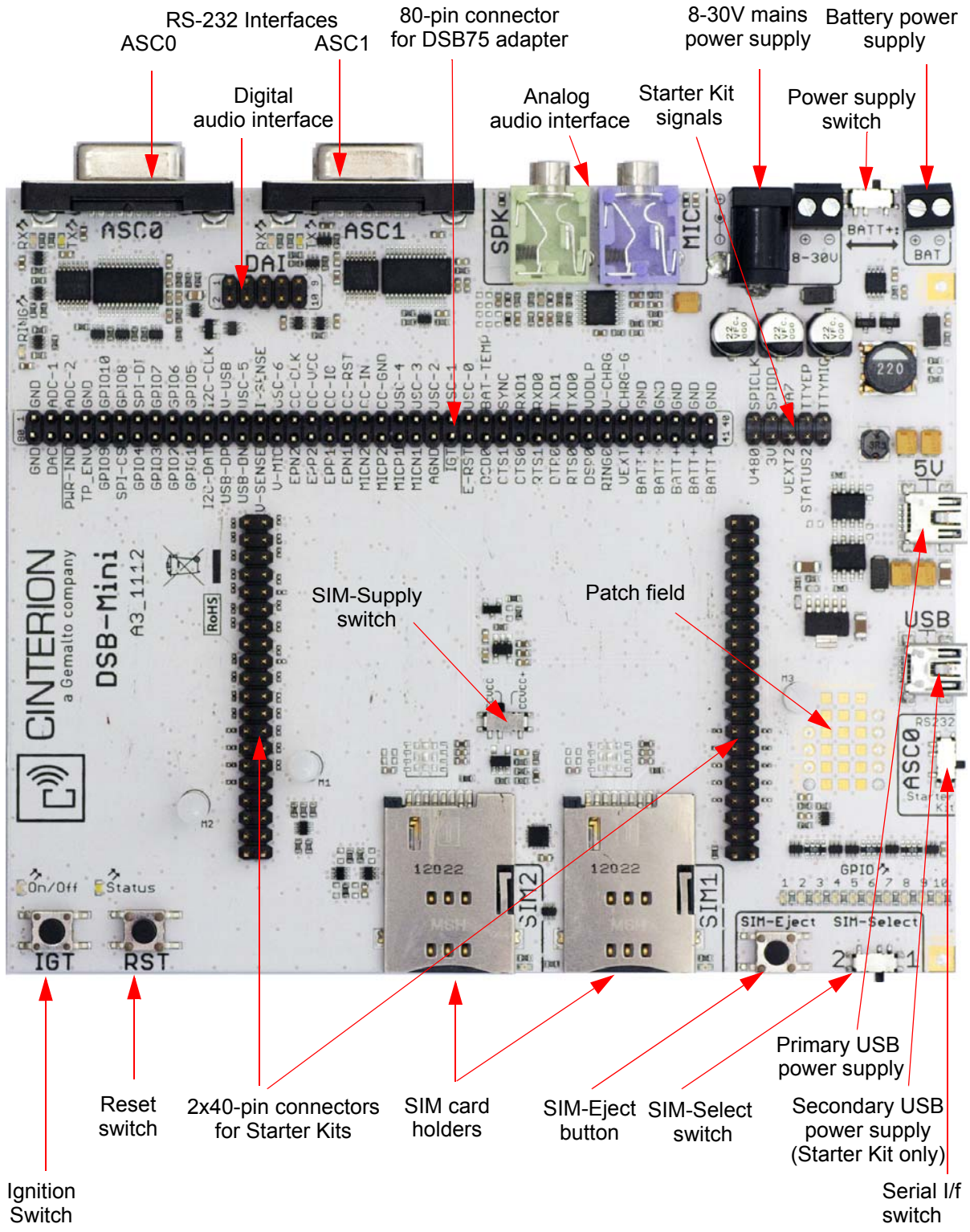


Figure 1: DSB-Mini overview

2.1 Key Features at a Glance

Table 2: Key features at a glance

Feature	Implementation
Module interface	2x40-pin connector to mount Cinterion Starter Kits B60/B80. 80-pin connector to mount Multi-Adapter R1 or other DSB75 module adapter. For module features please refer to [2].
Power supply	8-30V 2x USB 5V / 1A Battery supply for module
Dual SIM	Supported SIM cards: 3V, 1.8V Manual or software controlled dual SIM operation Implemented component SIM land pattern
Serial interfaces	2 serial interfaces (ASC0 - 8 wire; ASC1 - 4 wire)
USB interface	USB connection to Starter Kit
Audio interface	3.5mm jack socket for standard PC headset
Signal/status indication	LEDs for On/Off, Status, Rx/Tx and RING lines, GPIOs
Dimensions	140mm x 125mm (length x width)

2.2 System Overview

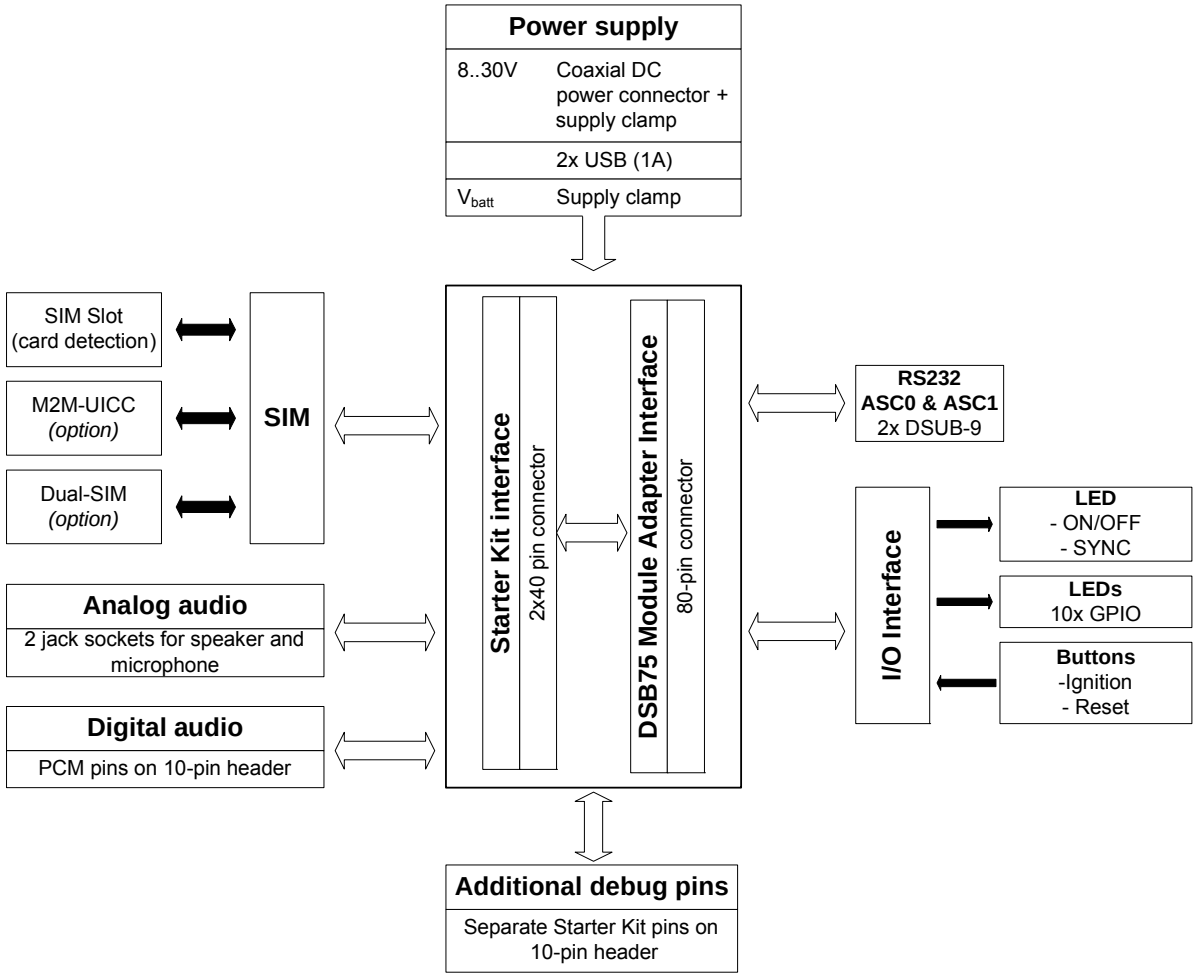


Figure 2: DSB-Mini system overview

3 Interface Description

3.1 Power Supply

To operate the DSB-Mini (including a connected module) a constant voltage supply is required. The following power supply sources may be employed:

- 8-30V mains adapter
  Provides the main power supply for all DSB-Mini functions. An internal DC/DC switching regulator adjusts the voltage down to 5V. Allows common 12V mains supplies and therefore the usage in a car environment for example. A coaxial power connector allows for plugs with common 2.1mm or 2.5mm inside parameters. A reverse polarity protection is included for 8-30V.
  Note: The power supply path does not include a short circuit protection. For usage in a car environment for example the main power supply 8-30V will have to be additionally fused by 1A to prevent overcurrent in case of shorting the 5V or module power supply.
- 5V USB power supply
  The USB power source provides the main power supply for all DSB-Mini functions. A separate external mains supply is not necessarily required.
  Power can be derived from the two USB interfaces (5V / 1A) - the primary USB power supply connector labelled "5V" and the secondary connector labelled "USB". Generally, it is recommended to use both connectors for power supply - unless power consumption is quite low because the RF interface is not being used or only at lower multislot classes with very good reception quality.
  However, the use of both USB power supply connectors is supported for the Starter Kit only. If employing module adapters on the 80-pin connector (e.g. the Multi-Adapter R1), only the primary USB power supply connector delivers the power (i.e., 500mA). In this case a USB Y-cable at the primary USB connector or the mains supply 8-30V will have to be employed in addition to the primary USB connector in order to compensate for a possible increased current consumption during radio transmissions at higher multislot classes.
- Battery power supply
  Provides for a separate power supply source for the module - such as a battery. If the battery power supply is used for the module, either the 8-30V power supply source or the 5V USB power supply source is required to operate the remaining DSB-Mini functions. A charging funtionality is not supported.

3.1.1 Power Path Switch

The DSB-Mini has a switch ("BATT+") to select the module's power supply path:

- 8-30V
  The DSB-Mini is supplied with 5V derived from the 8-30V mains adapter or the 5V USB power supply (see Section 3.1). A post LDO regulates this voltage down to 3.7V to supply the module on the Starter Kit or DSB75 adapter.
- BAT
  Only if the module connected to the Starter Kit or DSB75 module adapter is supplied from an external battery should this switch be set to "BAT".

3.2 Serial Communication Interfaces

The DSB-Mini has two RS-232 interfaces to communicate with the module's serial interfaces ASC0 and ASC1. ASC0 is a full 8-wire UART interface, while ASC1 is a 4-wire UART interface.

If the DSB-Mini is employed together with an adapter like the Multi-Adapter R1 or any other DSB75 module adapter, the RS-232 interfaces (ASC0, ASC1) on the DSB-Mini are automatically enabled and can be used.

However, if the DSB-Mini is used together with a Starter Kit, the switch ("ASC0") has to be set to select whether to use the RS-232 interface on the DSB-Mini or the USB-to-UART bridge on the Starter Kit for ASC0 communication:

- RS232
  If set to "RS232" the module communicates via the RS-232 interfaces on the DSB-Mini. The USB-to-UART bridge on the Starter Kit is reset and releases all ASC0 serial signals.
- Starter Kit
  If set to "Starter Kit" the module's ASC0 interface communicates via the USB-to-UART bridge of the Starter Kit. In this case the RS-232 level shifter on the DSB-Mini releases all ASC0 serial signals. For more information on the USB-to-UART bridge please refer to the appropriate Starter Kit documentation ([4] or [5]).

3.3 Analog Audio Interface

A standard PC headset can be connected via the two 3.5mm jack sockets (SPK=Speaker, MIC=Microphone).

3.4 SIM Interface

The DSB-Mini has a dual SIM interface and provides two SIM card holders or alternatively two land patterns for component SIMs to be soldered. The "SIM-Select" switch can be used to specify the active SIM card. An LED will indicate this SIM card. The SIM card holder supports SIM removal detection.

To manually switch between two inserted SIM cards during module operation please complete the following steps:

- Press and hold the "SIM-Eject" button. This simulates the CCIN signal, indicating to the module that the SIM card has been removed.
- Set the "SIM-Select" switch to configure the active SIM card ("1" or "2").
- Release the "SIM-Eject" button to indicate to the module to restart the SIM software stack and to activate the selected SIM card.

Please note that a combined operation with SIM cards inserted on both the Starter Kit and the DSB-Mini is not supported.

3.4.1 Automatic Dual SIM Operation

To automatically control dual SIM operation, it is necessary to complete the same steps as described above for the manual switch. To do this the two internal signals SIM_SELECT ("SIM-Select" switch) and CCEJECT ("SIM-Eject" button) will have to be connected to the GPIO1 and GPIO2 signals by removing resistor R21 (0Ω) and placing 0Ω resistors for R7 and R14 (for details see Appendix: Figure 6 and Figure 9).

The following functionality then applies for GPIO1 and GPIO2:

Table 3: Automatic dual SIM operation

Module signal	Function	Modification	Description
GPIO1	CCSELECT ("SIM-Select")	Place R14/0Ω instead of R21/0Ω	Select SIM1 or SIM2 Low: SIM1 High: SIM2
GPIO2	CCEJECT ("SIM-Eject")	Place R7/0Ω	Eject the SIM Low: SIM inserted (47k pull-down) High: SIM ejected

Having assigned the internal signals to the GPIO signals it is now possible to change the active SIM card by automatically completing the steps described above for the manual control. The GPIO signals can be configured and controlled by means of AT commands.

3.4.2 CCVCC Adjustment

By default, the "SIM-Supply" switch is set to "CCVCC" and should remain as such, meaning that CCVCC is delivered from the module.

In some cases however, employing the dual SIM feature may require a slightly higher supply level to compensate for possible voltage drops. This can be achieved by setting the "SIM-Supply" switch to "CCVCC+". The SIM supply voltage is then increased by 5%.

Table 4: CCVCC adjustment

Switch setting	CCVCC supply voltage
“CCVCC”	CCVCC (from module)
“CCVCC+”	CCVCC + 5%

3.4.3 Component SIM Card Support

The DSB-Mini provides two land patterns for an optional use of component UICCs (SIM/USIM/MIM). It is possible to solder UICCs for single card or dual card operation. Depending on the manufacturer and package of the used UICC, pin 6 or pin 7 is used for the I/O line. Thus it is necessary to place a 0Ohm resistor either for R31 or R32 for SIM 1, and a 0Ohm resistor for either R34 or R35 for SIM 2. Please refer to the package specification of the UICC as well as to the Appendix: Figure 6 and Figure 9.

It is also necessary to place a 47kOhm resistor as R48 for SIM 1 and a respective 47kOhm resistor as R33 for SIM 2 to bypass the SIM card detection (see Appendix: Figure 6 and Figure 9). Component SIMs are always inserted.

3.5 Status LEDs

The DSB-Mini comprises a number of status LEDs for various module features. The LEDs are marked on the DSB-Mini board with arrows pointing upwards (led↗↗).

Table 5: Status LEDs

Feature	Description
On / Off	LED indicates On state of module
Status	LED indicates operating modes of the module
SIM 1 / 2	LED indicates active SIM card
RX / TX for ASC0	LED indicates RX/TX traffic over ASC0
RX / TX for ASC1	LED indicates RX/TX traffic over ASC1
RING	LED indicates incoming calls and URCs
GPIO 1...10	LED indicates status of GPIO lines

3.6 Application Connectors

The DSB-Mini has a number of connectors for various purposes as described in the sections below.

3.6.1 2x40-Pin Connector for Starter Kits

The 2x40-pin connector can be employed to mount any Cinterion Starter Kit with a plugged module. All module signals are then available at the 80-pin connector (see Section 3.6.2) or the additional 10-pin connector (see Section 3.6.4) for signal measurement or to connect further external applications.

The below table shows the pin assigment for the 2x40 pin connector. Not all of the listed pins will be available with every Cinterion module. Please refer to the "Hardware Interface Description" of your module for the supported signals.

Table 6: 2x40 pin connector pin assignment

Connector A			
DAI7	1	40	DAI0
DAI6	2	39	DAI1
DAI5	3	38	DAI2
DAI4	4	37	DAI3
SPI_DI	5	36	SPI_CLK
SPI_DO	6	35	SPI_CS
I2CDAT	7	34	I2CCLK
N/C	8	33	DCD0
EMERG_RST	9	32	CTS1
RXD1	10	31	CTS0
RXD0	11	30	RTS1
TXD1	12	29	DTR0
TXD0	13	28	RTS0
ADC1	14	27	DSR0
ADC2	15	26	RING0
DAC	16	25	STATUS2
STATUS/SYNC	17	24	VDDLP
PWR_IND	18	23	IGT
GND	19	22	GND
GND	20	21	GND

Connector B			
BATT+	41	80	BATT+
GND	42	79	GND.DETECT
AGND	43	78	GND
USB_DN	44	77	VUSB
USB_DP	45	76	VEXT1
VEXT2	46	75	3V0
5V0	47	74	VMIC
EPP1	48	73	EPN1
EPP2	49	72	EPN2
MICP1	50	71	MICN1
MICP2	51	70	MICN2
TTY_EP	52	69	TTY_MIC
GPIO10	53	68	GPIO1
GPIO9	54	67	GPIO2
GPIO8	55	66	GPIO3
GPIO7	56	65	GPIO4
GPIO6	57	64	GPIO5
CCCLK	58	63	CCRST
CCIO	59	62	CCIN
CCVCC	60	61	CCGND

The following table describes the pin assignment in somewhat more detail and also maps the Starter Kit pins to the DSB75 adapter connector pins, the DAI connector pins and the additional Starter Kit pins.

Table 7: 2x40-pin connector pin description and mapping

Interface		Name	Type / Comments	Starter-Kit connector (2x40 pins)	DSB-75 connector (80 pins)	DAI connector (10 pins)	Additional connector (10 pins)
Communication	ASC0	RXD0	Module signals Connected to USB/UART converter (FTDI) on Starter Kit Automatic level adjustment VEXT1 level for Starter Kit 3V level for DSB75 adapters	11	30		
		TXD0		13	32		
		CTS0		31	52		
		RTS0		28	49		
		DTR0		29	50		
		DCD0		33	54		
		DSR0		27	48		
		RING0		11	47		
	ASC1	RXD1	Module signals Automatic level adjustment VEXT2 level for Starter Kit 3V level for DSB75 adapters	10	29		
		TXD1		12	31		
		CTS1		32	53		
		RTS1		30	51		
	SPI/I²C	SPI_CLK	Module signals	36	-		2
		SPI_DI		5	7		
		SPI_DO		6	-		4
		SPI_CS		35	75		
		I²C_DAT	Module signals	7	70		
		I²C_CLK		34	11		
	USB	VUSB	Module signals VUSB is used as secondary V480 power supply on Starter Kit	77	12		
		USB_DP		45	69		
		USB_DN		44	68		

Table 7: 2x40-pin connector pin description and mapping

Interface		Name	Type / Comments	Starter-Kit connector (2x40 pins)	DSB-75 connector (80 pins)	DAI connector (10 pins)	Additional connector (10 pins)
Audio	Analog audio	EPP1	Module signals TTY signals may be implemented on Starter Kit	48	63		
		EPN1		73	62		
		MICP1		50	59		
		MICN1		71	58		
		EPP2		49	64		
		EPN2		72	65		
		MICP2		51	60		
		MICN2		70	61		
		TTY_EP		52			8
		TTY_MIC		69			10
		VMIC		74	66		
	Digital audio	DAI0	Module signals DAI0-6 are available on DAI connector for DAI adapter, DAI7 on additional connector	40	26	3	
		DAI1		39	25	4	
		DAI2		38	24	5	
		DAI3		37	23	6	
		DAI4		4	22	7	
		DAI5		3	13	8	
		DAI6		2	15	9	
		DAI7		1			6
I/O	GPIO	GPIO1	Module signals 10 LEDs are driven active-high with no current consumption GPIO1 and GPIO2 may be used for dual SIM operation	68	71		
		GPIO2		67	72		
		GPIO3		66	73		
		GPIO4		65	74		
		GPIO5		64	10		
		GPIO6		57	9		
		GPIO7		56	8		
		GPIO8		55	6		
		GPIO9		54	76		
		GPIO10		53	5		

Table 7: 2x40-pin connector pin description and mapping

Interface		Name	Type / Comments	Starter-Kit connector (2x40 pins)	DSB-75 connector (80 pins)	DAI connector (10 pins)	Additional connector (10 pins)
I/O	ADC	ADC1	Module signals	14	2		
		ADC2		15	3		
	DAC	DAC		16	79		
SIM		CCVCC	Module signals and combined Dual-SIM signals CCGND is connected to GND, but can be separated by removing R56, R76 and R77	17	60		
		CCCLK		16	58		
		CCIO		18	59		
		CCRST		19	63		
		CCIN		20	62		
		CCGND		21	61		
Status		/PWR_IND	Module signals Active-low. Polarity is adjusted by Starter Kit and DSB75 adapters /IGT and /EMERG_RST are connected to buttons “IGT” and “RST”	78	18		
		/IGT		56	23		
		/EMERG_RST		55	9		
		STATUS/SYNC	Module signals STATUS/SYNC is indicated by “Status” LED	28	17		
		STATUS2		-	25		7
		GND.DETECT	Used to disable USB/UART converter on Starter Kit	-	79		
		X100.DET	Used to detect DSB75 Adapter placement	36	-		
		TP_ENV	Not used	77	-		
Charging		BATTEMP	Not used	27	-		
		VCHARGE		34	-		
		VSENSE		67	-		
		CHARGEGATE		35	-		
		ISENSE		14	-		

Table 7: 2x40-pin connector pin description and mapping

Interface		Name	Type / Comments	Starter-Kit connector (2x40 pins)	DSB-75 connector (80 pins)	DAI connector (10 pins)	Additional connector (10 pins)
Power	Voltage domain	VDDLP	Module signals	24	33		
		VEXT1		76	46		
		VEXT2		46	-		5
		V480	Supply voltage Supplied from USB power supply (5V), external power supply (8-30V) or from Starter Kit	47	-	1	1
		3V	Generated from 3V when module is on (/PWR_IND=0) Indicated by “On/Off” LED	75	-	2	3
	Supply	BATT+	Module power supply Supplied from Battery supply (“BAT” connector) or generated from V480 as selected by switch “BATT+”	41, 80	41-45		
		GND	GND	19-22, 42, 78	1, 4, 37-40, 80	10	
		AGND	=GND	43	57		
		N/C	Reserved for future use	8			9

3.6.2 80-Pin Connector for DSB75 Module Adapters

The 80-pin connector allows for signal measurement and external application connection in case a Cinterion Starter Kit is mounted to the DSB-Mini.

However, DSB-Mini's 80-pin connector has the same pin assignment as the DSB75's 80-pin connector (see Table 8 and [3]) and thus also allows to mount all existing DSB75 module adapters, e.g., the Multi-Adapter R1.

Table 8: 80-pin connector pin assignment

Pin#	Pin Name	Pin Name	Pin#
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	GPIO8	6
74	GPIO4	SPIDI	7
73	GPIO3	GPIO7	8
72	GPIO2	GPIO6	9
71	GPIO1	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	CCVCC	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

Table 8: 80-pin connector pin assignment

Pin#	Pin Name	Pin Name	Pin#
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

3.6.3 10-Pin Digital Audio Connector

The 10-pin digital audio interface (DAI) connector matches the DSB75's digital audio connector X703 (see [3]). It allows to connect external equipment, such as a codec or a DSP. The following table shows the pin assignment of the DAI connector.

Table 9: 10-pin digital audio connector

1	V480	3V	2
3	DAI0/TX	DAI1/RX	4
5	DAI2/FS	DAI3/BITCLK	6
7	DA4/FSIN	DAI5	8
9	DAI6	GND	10

3.6.4 10-Pin Connector for Starter Kit Signals

The 10-pin additional Starter Kit signals connector provides access to those Starter Kit signals that cannot be accessed via the DSB75's 80-pin module adapter connector. The following table shows the pin assignment of the additional Starter Kit signals connector.

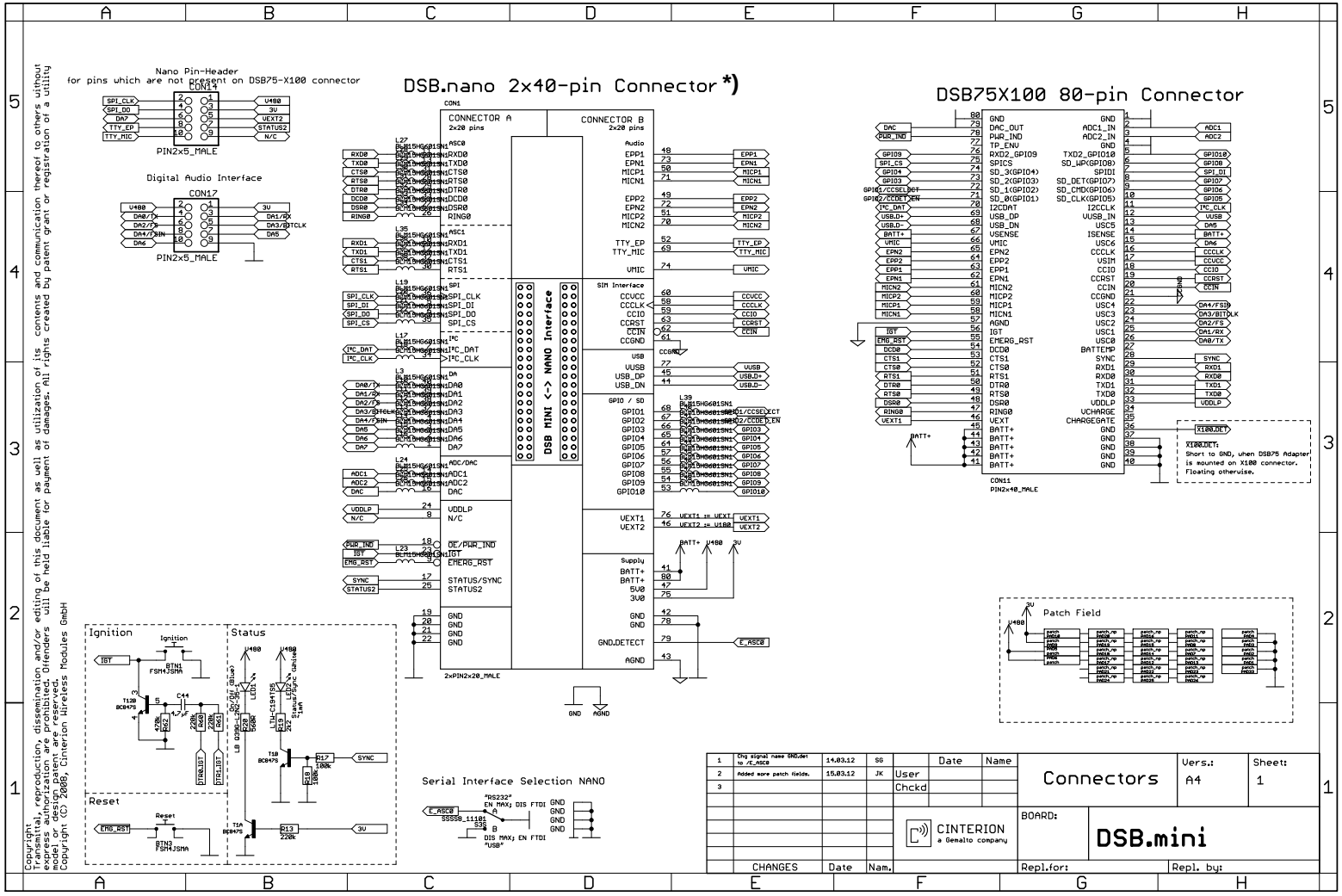
Table 10: 10-pin connector for additional Starter Kit signals

1	V480	SPICLK	2
3	3V	SPIDO	4
5	VEXT2	DA7	6
7	STATUS2	TTYEP	8
9	N/C (Pin 8 of Starter Kit 2x40 pin connector)	TTYMIC	10

3.7 Patch Field

To realize smallish external applications like for instance measurement circuits, the DSB-Mini provides a so-called patch field on board, comprising a number of unconnected solder pads together with GND pads and 3.0V/5V supply pads (see Figure 3).

4 Appendix: Schematics and Placement



***) DSB.nano refers to the Starter Kits B60/B80**

Figure 3: Schematics, Page 1

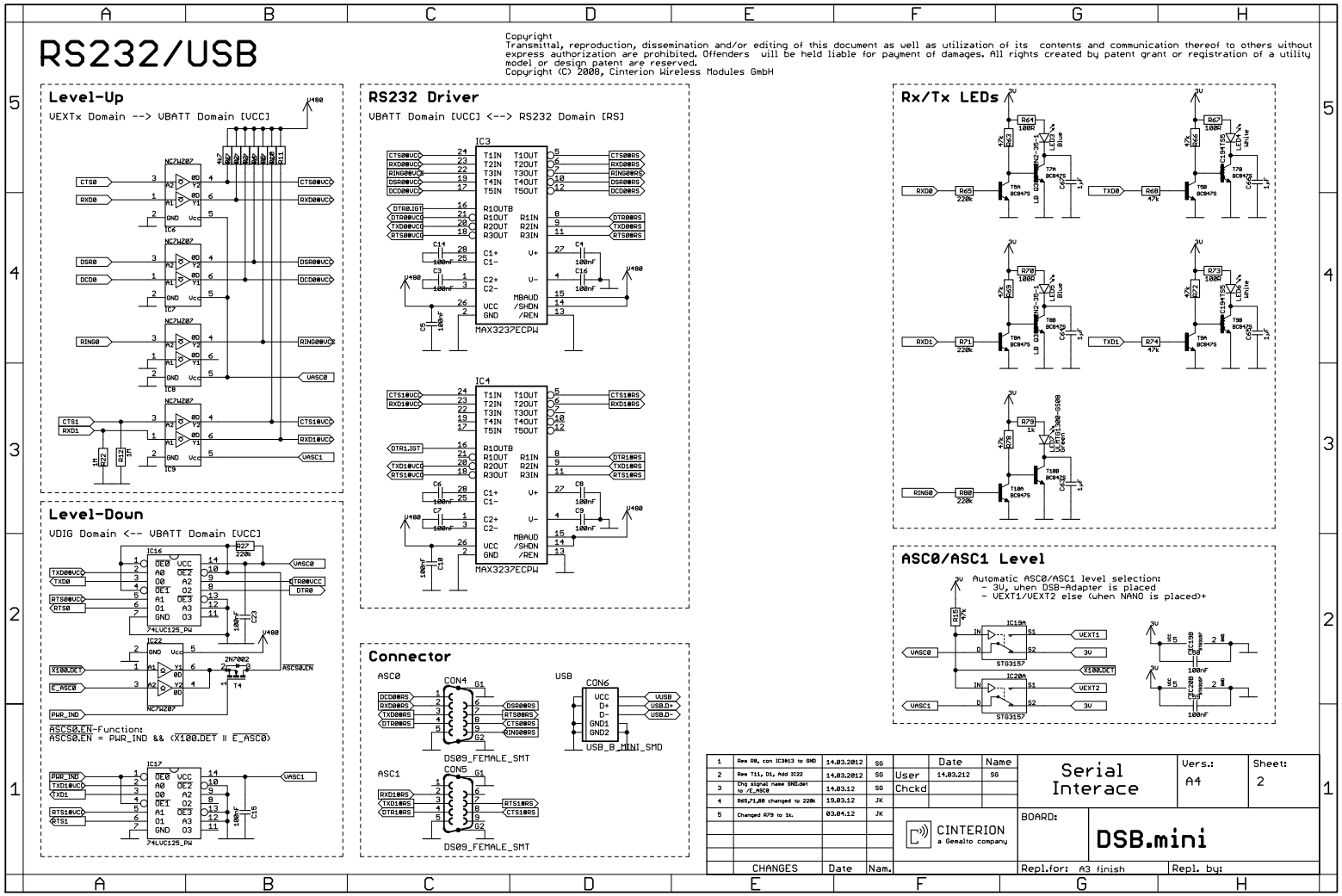


Figure 4: Schematics, Page 2

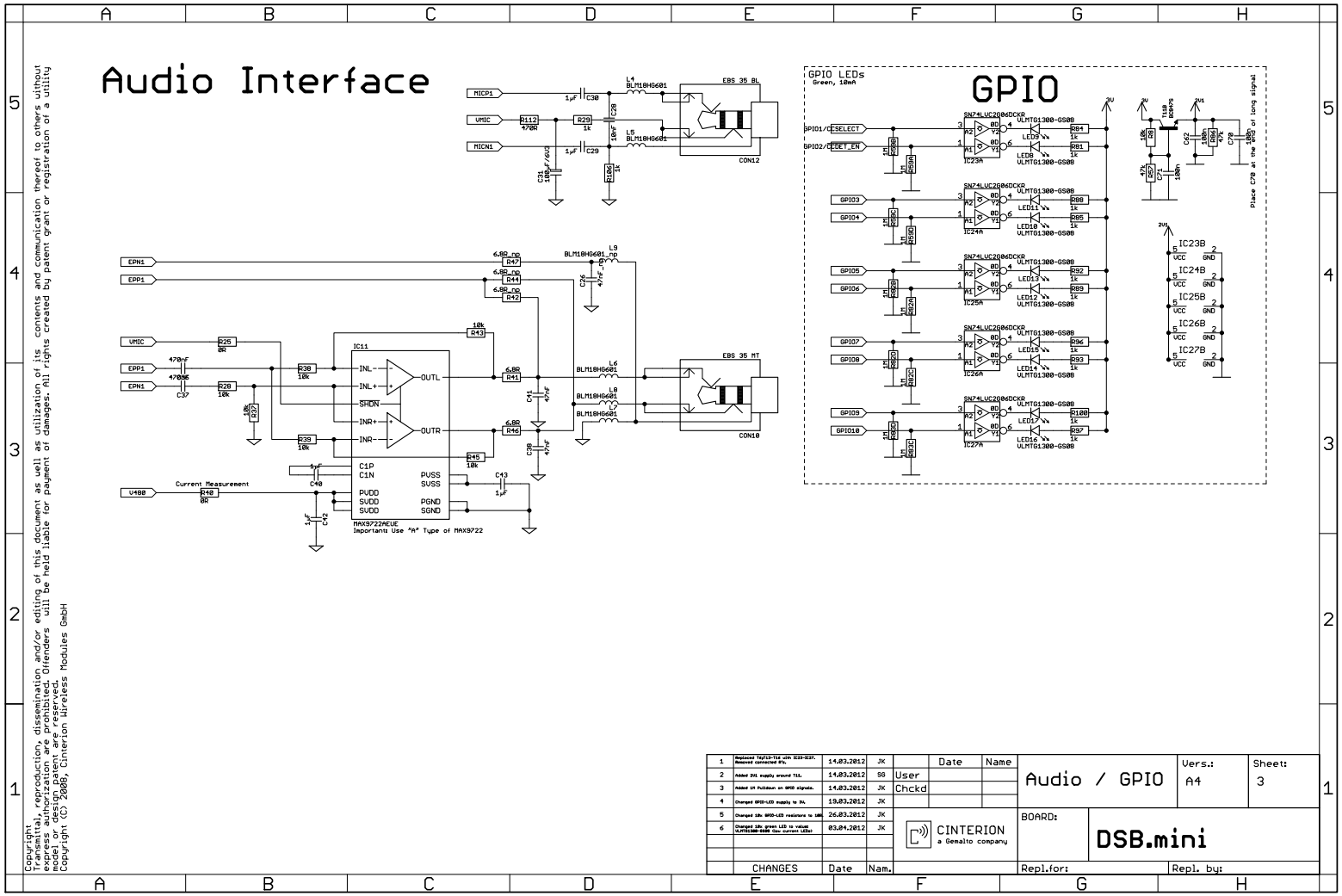


Figure 5: Schematics, Page 3

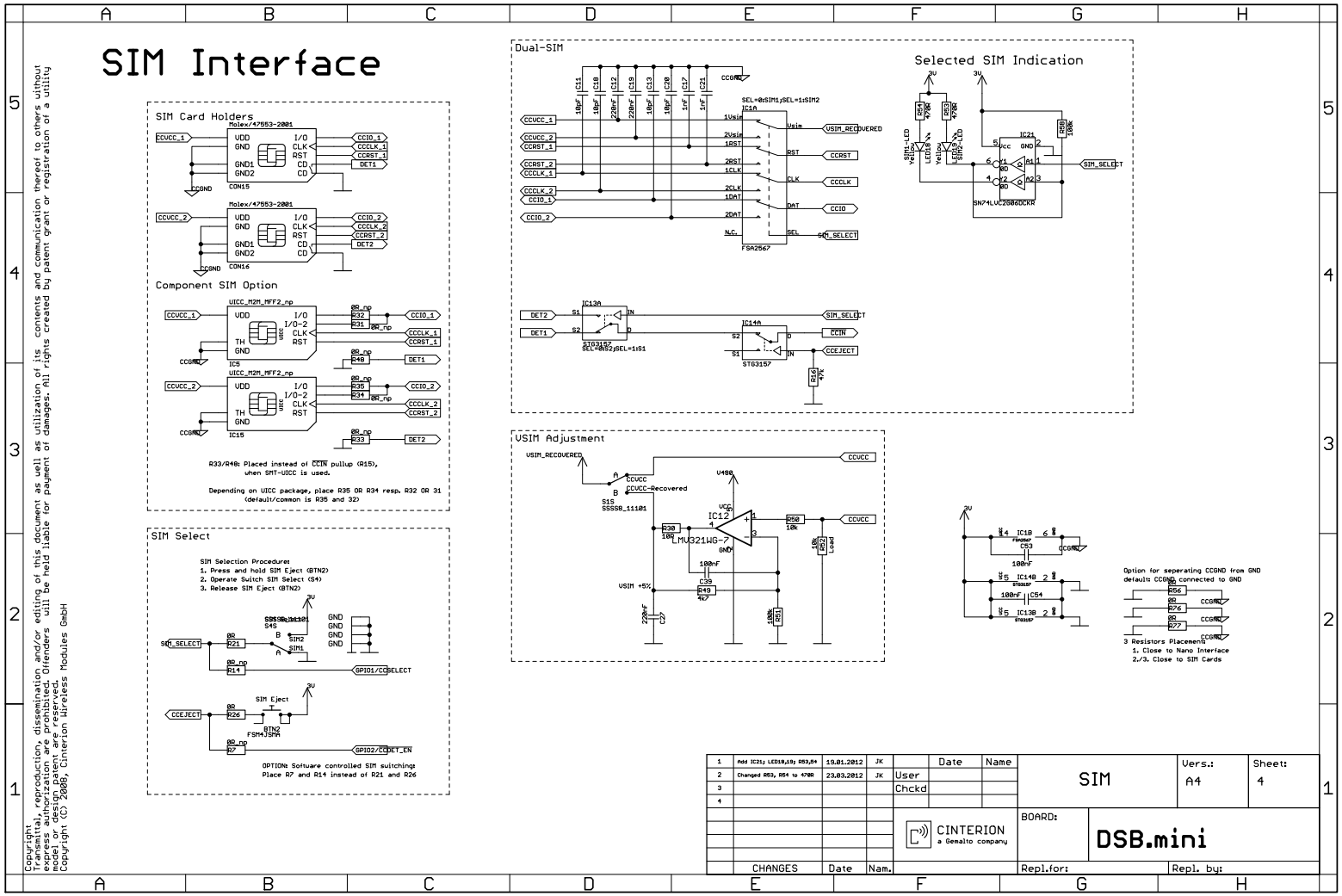


Figure 6: Schematics, Page 4

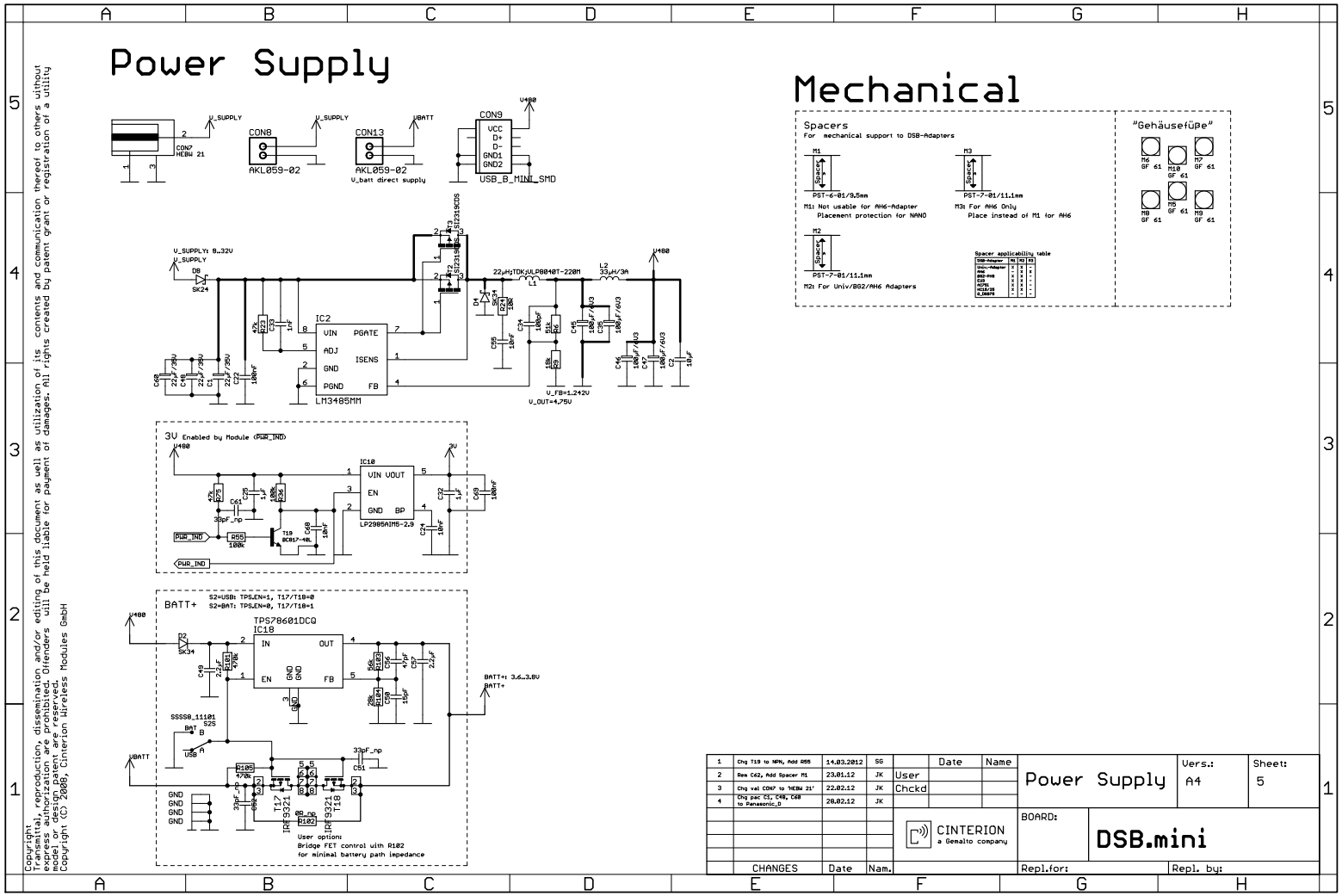


Figure 7: Schematics, Page 5

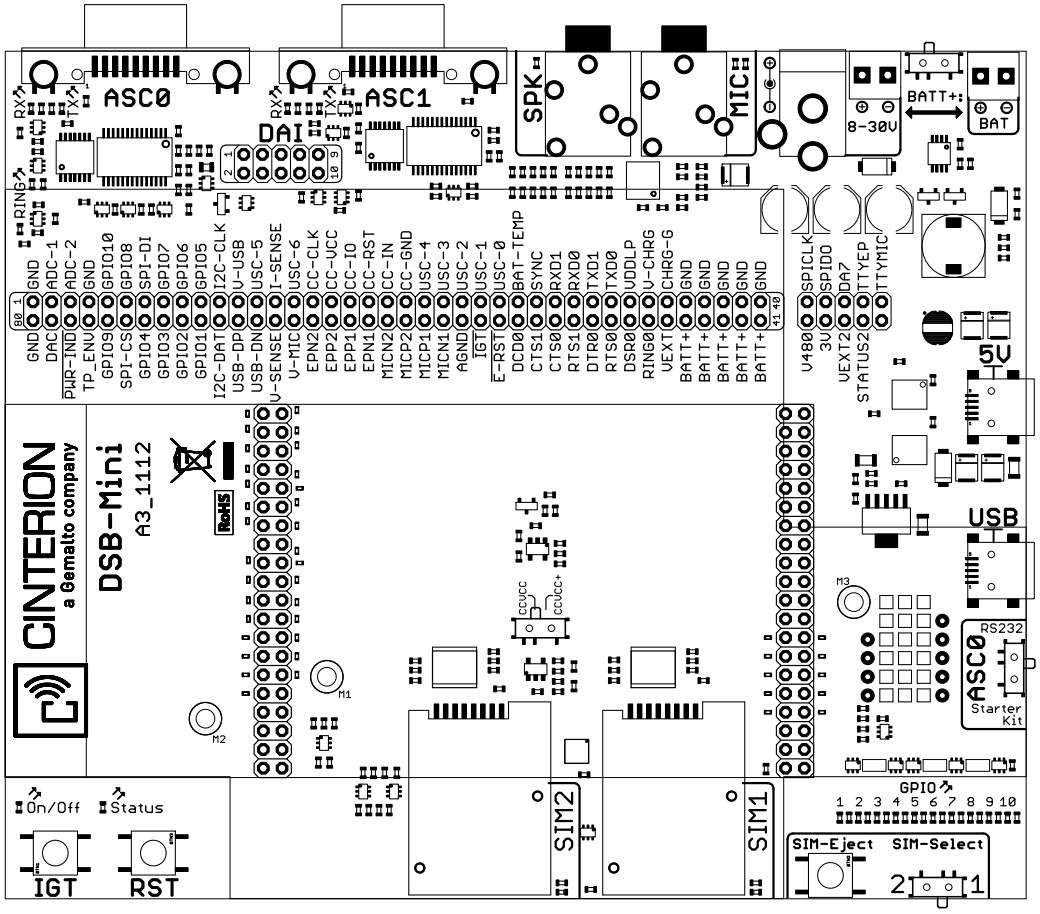


Figure 8: Placement, Page 1 (top)

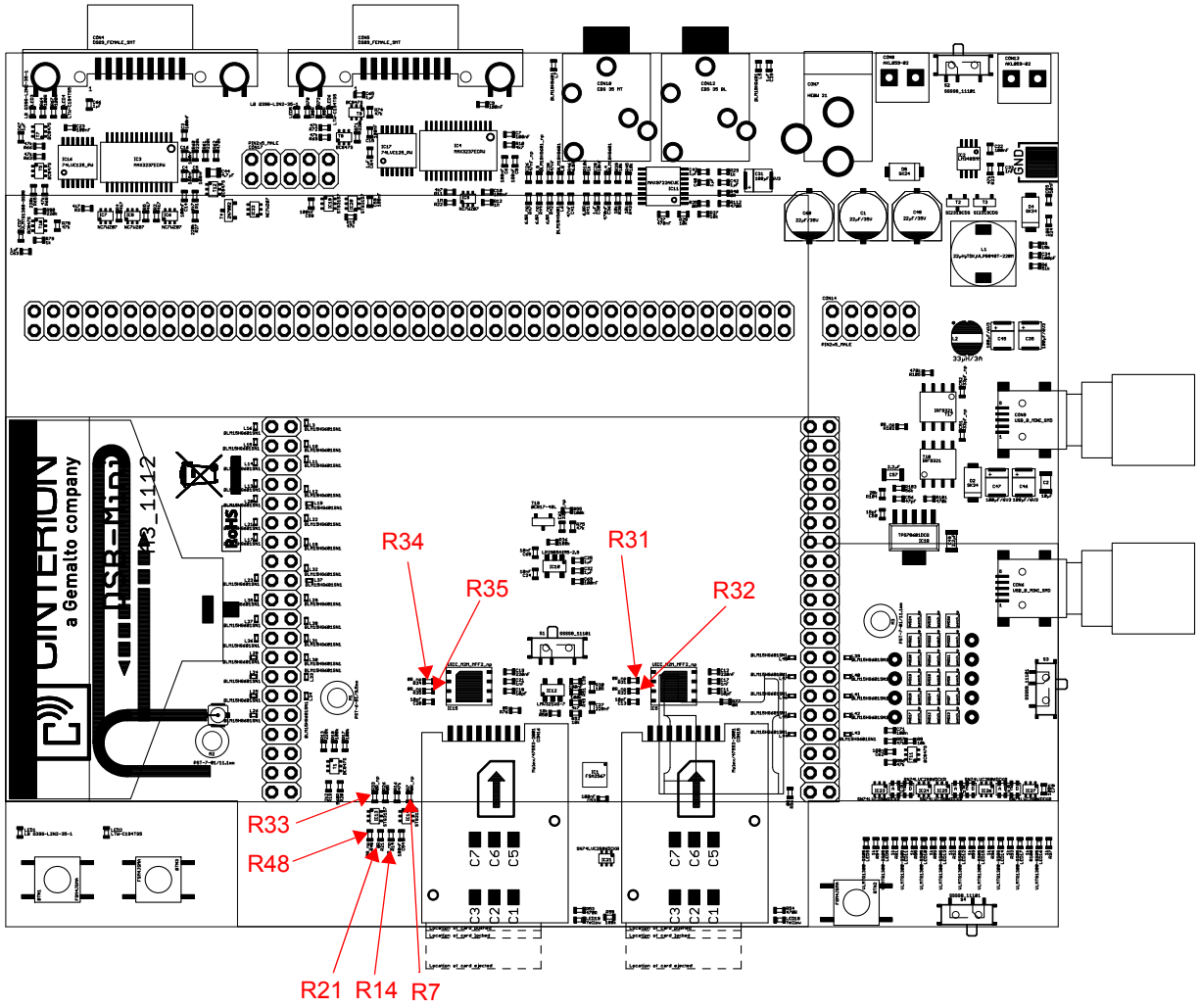


Figure 9: Placement, Page 2 (with Starter Kit mounted)