SIEMENS

Data Book

Siemens Bluetooth™ Module

SieMo-S50037

S50037-Q5-*

SieMo S50037

Bluetooth™ -Module

KEY Features

- Bluetooth V1.1 prequalified
- Input sensitivity –85 dBm
- Point-to-multipoint functionality
- Firmware below HCI embedded, or stand alone operation

- Class 2 Bluetooth device, 2 dBm
- HCI optionally via high-speed UART, BCSP and USB
- Interface data rate UART to 1.5 MBPS, USB high speed 1.1 (12 MBPS)
- Frequency range 2.402 – 2.480 GHz
- Temperature range 0-40° centigrade (qualified)
- Mechanical outline 32.8 x 16.8 x 3 mm³ (34 x 18 x 3 mm³ for sample quantities)
- Power supply 3.25V-6V, Max. 120 mA
- GFSK modulation, frequency hopping, 79 channels spaced by 1 MHz
- Internal Crystal oscillator
- 50 Ohm Antenna connector
- SMD mountable

Description:

The SieMo S50037 is a Class2 Bluetooth Module which can be integrated into various electronic devices to give them Bluetooth functionality.
The connections to the environment consist of a single positive power supply, a 50 Ohm Antenna connector, UART, SPI, BCSP USB and PCM Interface, 6 PIO lines, control signals for an external Power Amplifier and one Pin which allows to switch between two different firmware versions.
SieMo is shipped as an HCI Module, which means that the lower Bluetooth stack up to HCI is included in the Firmware and it can be changed into a stand-alone Module with the complete BT-stack and some simple applications running on the module via a firmware upgrade.
The module supports synchronous voice transmission as well as asynchronous data transfer.

Author	Part of this Document	Department
Canbolant D.	Regulatory Statements, Bluetooth™ Trademark	PSE PRO RCD 3
Jatschka T.	Technical Clauses	PSE PRO RCD 3

General Information

History

Issue	Date	Reason for Changes
01	2002-02-12	Initial issue
02	2002-02-25	Redesign of document structure, inserting of the Clause Regulatory Statements
03	2002-03-13	Enhanced Details in Interface Description
04	2002-03-21	Manufacturing aspects added, minor corrections.
05	2002-03-22	Mechanical Information added, minor corrections
06	2002-04-24	minor corrections

Table 1: History

References

[1] http://www.bluetooth.com
[2] http://www.csr.com

CONTENT

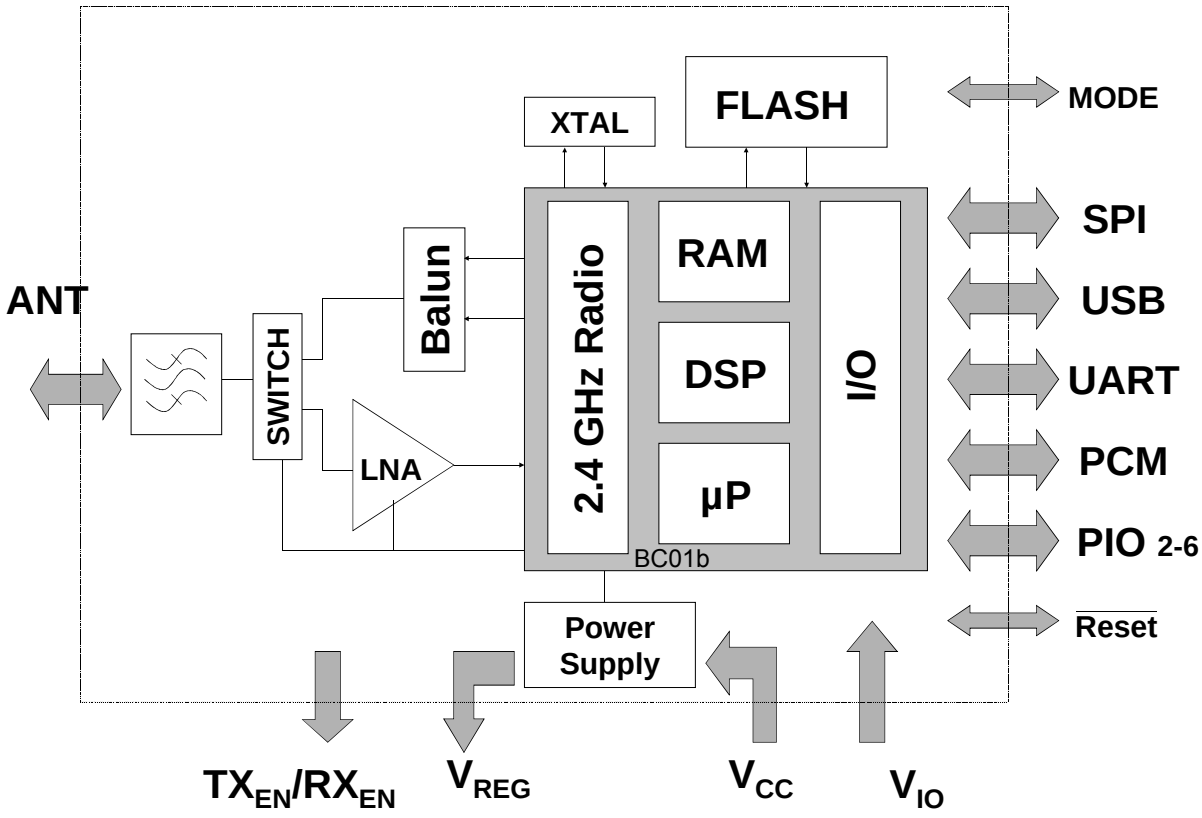


figure 1 Block Diagram

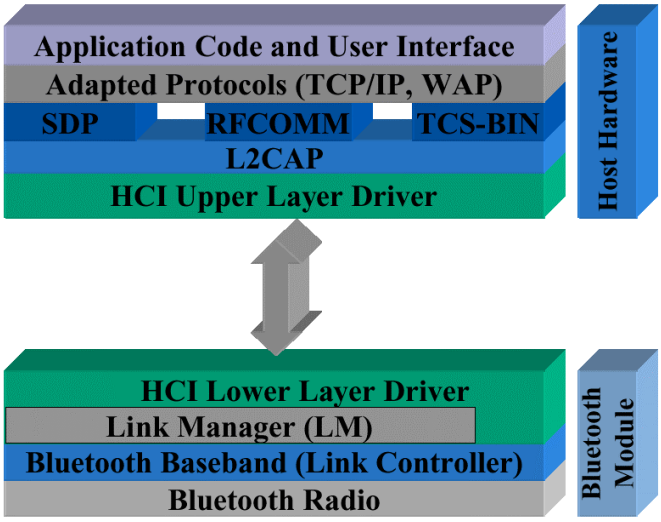
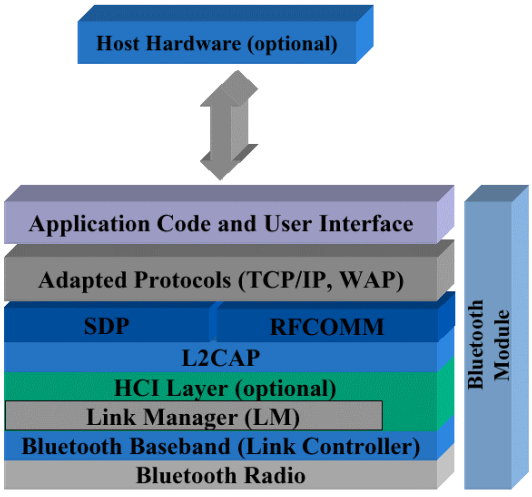


figure 2 Default HCI- FW Stack



optional FW stack for standalone operation

Electrical Characteristics

Absolute Maximum Ratings

Rating	Min.	Max.
Storage Temperature	-30°C	+85°C
Supply Voltage Vcc (no damage)	-7V	+7V
Supply Voltage Vcc-IO	0V	+3.6V
5V Tolerant Terminals	-0.4V	+5.5V
Other Terminals	-0.4V	+3.55V
Input Rf Power, in band		5dBm

Recommended Operating Conditions

Operating Condition	Min.	Max.
Ambient Temperature Range [1]	0°C	+40°C
Supply Voltage, Vcc	+3.2V	+6V
Supply Voltage, Vcc -IO	3V	3.4V

Timing Characteristics

Parameter	Min.	Typ.	Max.	Unit
System start up time from Power on		1230		ms
RESET# signal duration		2		ms

I/O Terminal Characteristics

Vcc = 3.3V unless otherwise stated

Digital Terminals	Min.	Typ.	Max.	Unit
Input Voltage: V_{IL} input logic level low V_{IH} input logic level high	 -0.4 0.7 Vcc_IO	 - -	 0.3 Vcc_IO Vcc_IO + 0.4	 V V
Input Current: CMOS input (V_I =3.3V or 0V) CMOS input + pull-up (V_I =3.3V or 0V) CMOS input + pull-down (V_I =3.3V or 0V)	 -1 -20 20 / 2 [1,2]	 - - -	 1 -125 125	 µA µA µA
Output Voltage: V_{OL} output logic level low (I_O = 4.0mA) V_{OH} output logic level high (I_O = -4.0mA)	 - Vcc_IO-0.2	 - -	 0.2 -	 V V
Tri-state Leakage Current: I_{OZL} (V_I = 0V) I_{OZH} (V_I = 3.3V)	 -1 -1	 - -	 1 1	 µA µA
C_I Input Capacitance	2.5	-	10	pF
Power-on Reset	**Min.**	**Typ.**	**Max.**	**Unit**
Vcc falling threshold Vcc rising threshold Hysteresis	2.35 2.50 130	2.45 2.60 150	2.55 2.70 170	V V mV
USB Terminals				
Input thresholds:				

[1] The module is qualified for this temperature range. Functionality has been tested form –40 to +80° with a small number of samples. Components are specified form –20°C to 70°C. Radio performance decreases with rising temperature.

[2] PIO terminals have weak pull-down resistors (1/10th current of standard pull-down resistors).

V_{IL} input logic level low V_{IH} input logic level high	- 0.7 Vcc_IO	- -	0.3 Vcc_IO -	V V
Input leakage current	-1	-	1	µA
C_I Input Capacitance	2.5	-	10	pF
Output levels (to correctly terminated USB) V_{OL} output logic level low V_{OH} output logic level high	 0 2.8	 - -	 0.2 Vcc_IO	 V V
PIO Port				
Output voltage	Vcc-IO-0.4	-	Vcc-IO	V
Output (source/sink) current	-	-	8	mA

Power Consumption

Vcc = 3.3V, Ta = 20°C unless otherwise stated

Mode	Min.	Typ.	Max.	Unit
SCO connection HV3 (1s interval sniff mode)	-	44	-	mA
SCO connection HV1 (1s interval sniff mode)	-	74	-	mA
ACL data transfer 720kbps USB	-	85	-	mA
Peak current during RF burst	-	-	120	mA
Leakage current (all off)	-	120	-	µA
Idle (after reset or power up) UART, 115.2 KBPS		3		mA
Idle (after reset or power up) UART, 9.6 KBPS		1.5		mA
Idle (after reset or power up) UART, 1382.4 KBPS		20		mA
ACL data transfer 115.2kbps UART MASTER, transmit data	30		43	mA
ACL data transfer 115.2kbps UART SLAVE, transmit data		71		mA
ACL data transfer 115.2kbps UART MASTER, receive data	28		38	mA
ACL data transfer 115.2kbps UART SLAVE, receive data		77		mA
Connected, no data-transfer, MASTER		12		mA
Connected, no data-transfer, SLAVE		61		mA
Inquiery	82		93	mA

Radio Characteristics

Vcc = 3.3V, f = 2.45GHz, Ta = 20°C unless otherwise stated

Receiver	Min.	Typ.	Max.	BT-Spec	Unit
Sensitivity at 0.1% BER [3]	-	-85	-82	-70	dBm
Sensitivity at 0.1% BER [4] Ta = 40°C	-	-80	-77	-70	dBm
Sensitivity at 0.1% BER Ta = 0°C	-	-90	-85	-70	dBm
Maximum received signal [5]	-	13	-	-20	dBm

[3] Measured according to the Bluetooth specification 1.1
[4] Up to five spurious responses within Bluetooth limits are allowed
[5] At carrier –3MHz

C/I Co-channel [6]	-	9	-	11	dB
Adjacent channel selectivity C/I 1MHz [3]	-	-2	-	0	dB
2nd adjacent channel selectivity C/I 2MHz [3]	-	-34	-	-30	dB
3rd adjacent channel selectivity C/I >3MHz [3, 4]	-	-45	-	-40	dB
Image rejection C/I [3, 5]	-	-14	-	-9	dB
Maximum level of intermodulation interferers [3, 6]	-	-30	-	-39	dBm
1dB compression point at 1.9 GHz	-30			-	dBm
Transmitter	**Min.**	**Typ.**	**Max.**	**BT-Spec**	**Unit**
RF transmit power [3]	-2	0	2	-6 to +4	dBm
RF transmit power [3] Ta = 40°C	-4	-1	1	-6 to +4	dBm
RF transmit power [3] Ta = 0°C	+1	+2	+3	-6 to +4	dBm
RF power control range [3]	-	30	-	16	dB
RF power control range resolution	-	4	-	-	dB
20 dB bandwidth for modulated carrier	-	930	-	<1000	kHz
2nd adjacent Channel transmit power [3]	-	-47	-25	<-20	dBc
3rd adjacent Channel transmit power [3]	-	-52	-45	<-40	dBc

Output Spectrum

Modulation Spectrum

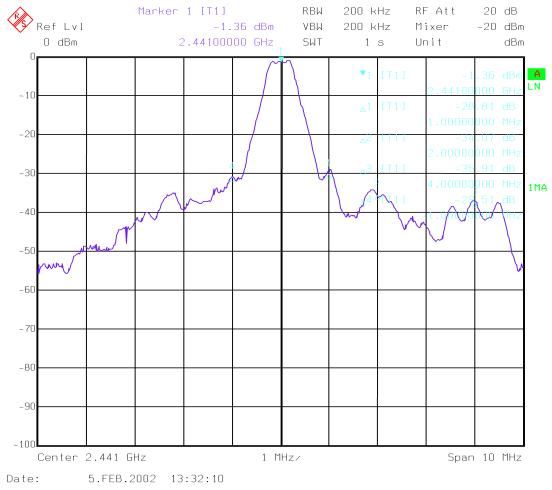


figure 3 Modulation spectrum on single channel with PRBS9 Payload, DH1 packet cable loss (approx. 3dB) not corrected.

[6] Measured at f_1-f_2 = 5MHz

Output spectrum in the whole 2,4 GHz ISM band (Max Hold)

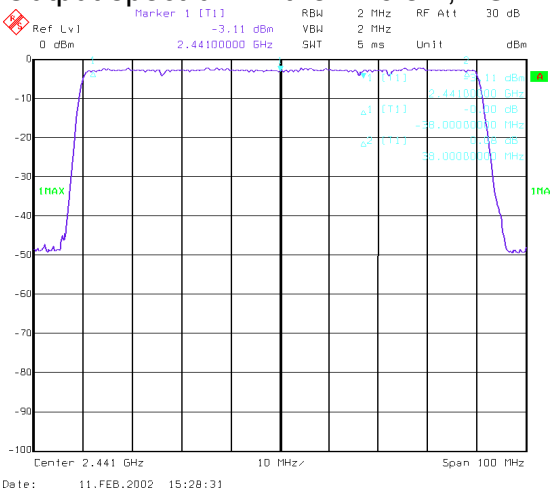


figure 4 Output spectrum with Frequency Hopping measured with MAXHOLD cable loss (approx. 3dB) not corrected.

Flatness of output power Vs time

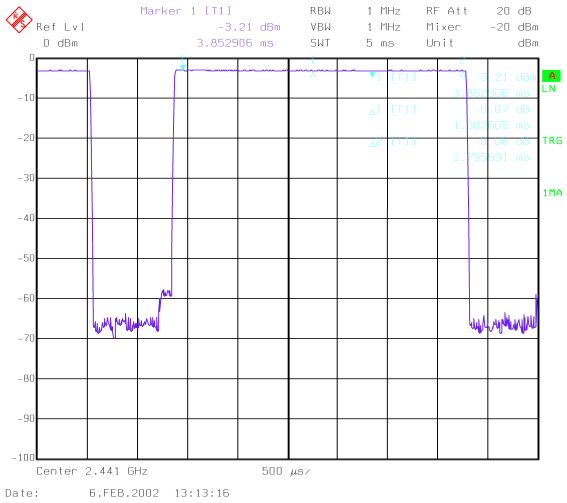


figure 5 output power during a DH5 packet, cable loss (approx. 3dB) not corrected.

Spurious emissions on the antenna port

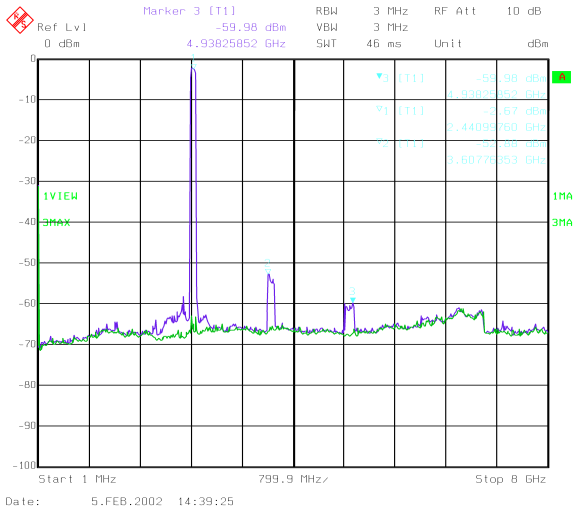


figure 6 Spurious emission up to 8GHz, green line is with DUT offline. Cable loss not corrected.

VCO Settling

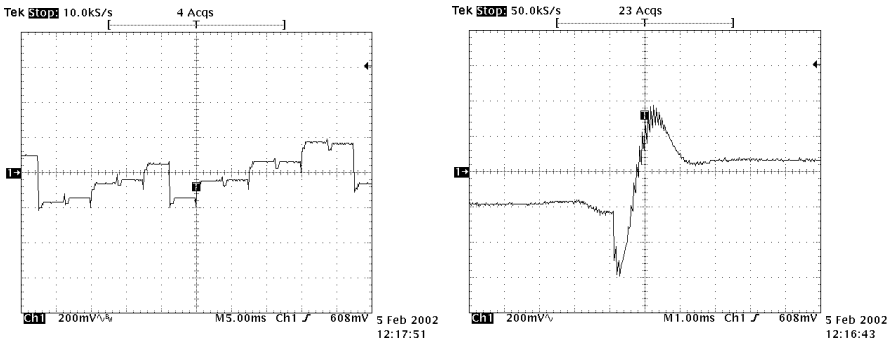


figure 7 VCO settling during FH operation in two different time-scales

S-Parameter of the Antenna port

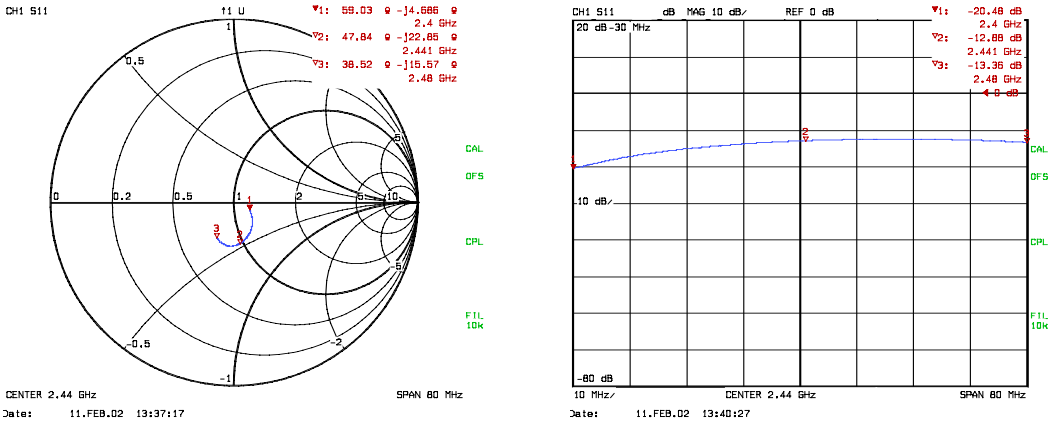


figure 8 S11 on the antenna port in transmit mode

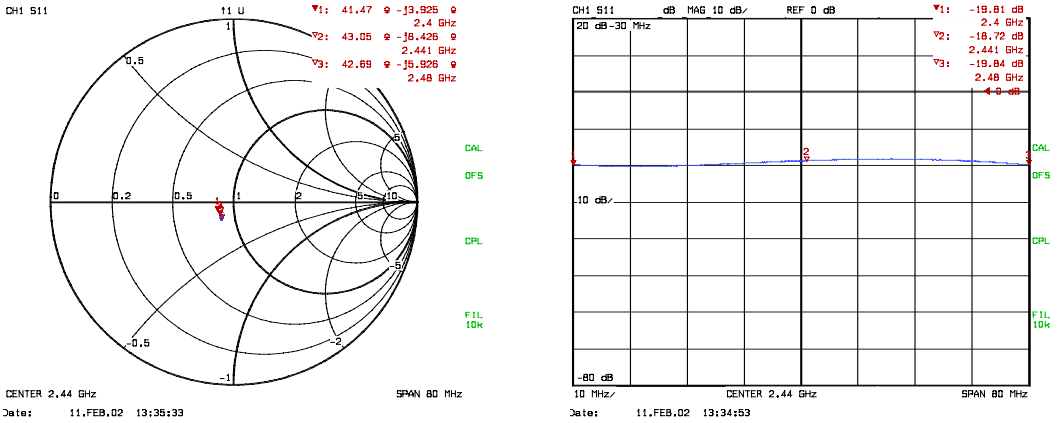


figure 9 S11 on the antenna port in receive mode

Pin Description

Pinout Diagram

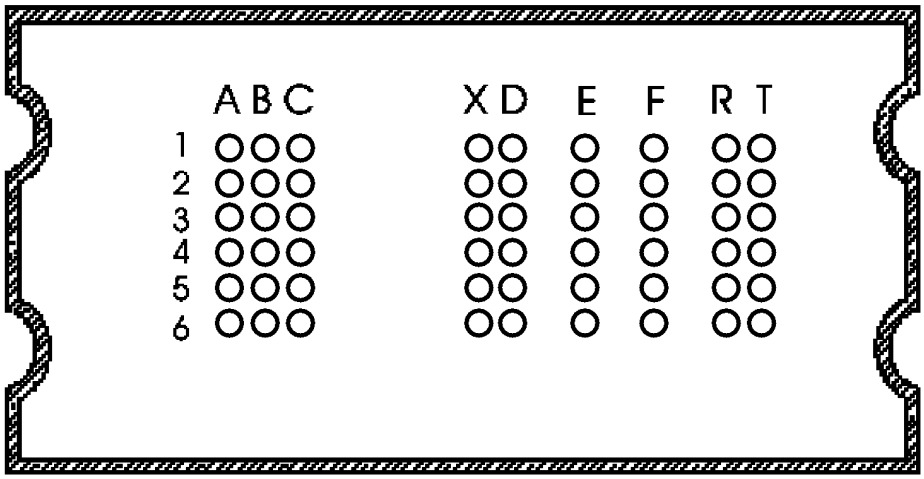


figure 10 SieMo Pinout, bottom view

Pin description table

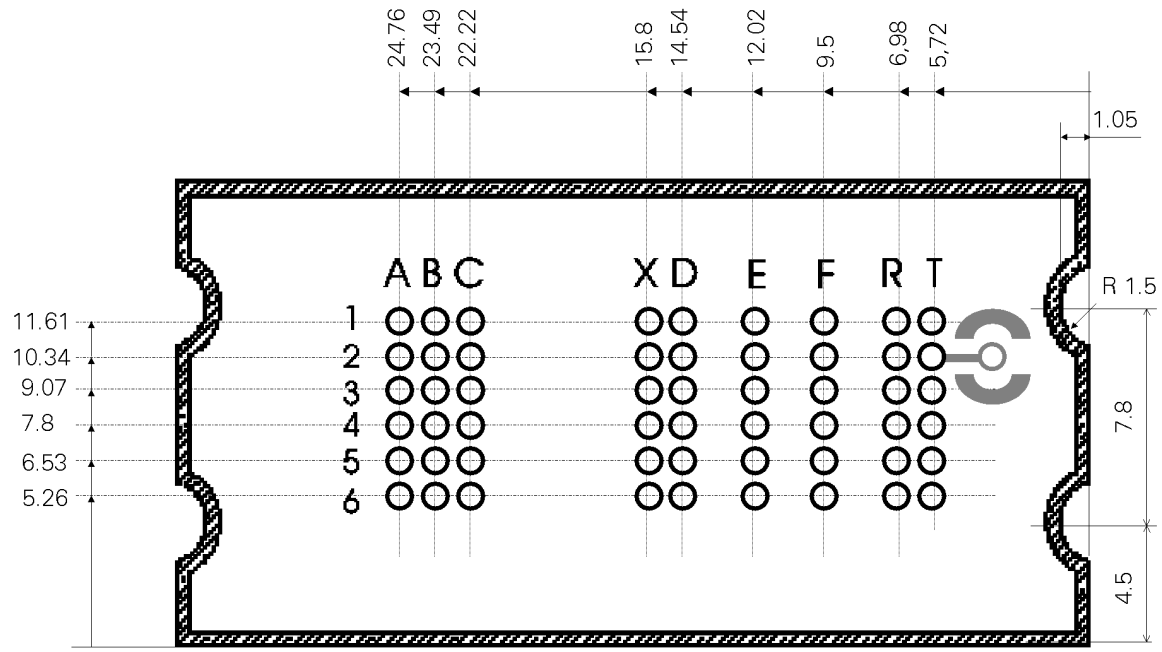
Row X,D,E and F are by default not provided with soldering bumps

Pin Name	Type	Pin	Description
RF			
ANT	Rf in/out	T2	Antenna output, 50Ω; unconditionally stable; DC path to GND
TX-EN	CMOS output, pulled down	F5[7]	Control output for external switch or PA
RX-EN	CMOS output pulled down	F4[7]	Control output for external switch or LNA
TX-PWR	Analogue output	F6[7]	Ramping control output for external PA, need not be used, ramping is done on the module.
Power			
V_{CC}	Power	C6	Power Supply 3.25-6V
V_{CC-IO}	Power	C4	Power Supply for all IO-Pins, 3.0-3.4V, can be connected to V_{REG}
UART-Interface			
TxD	CMOS output, 5V tolerant, pulled down	B5	UART data output
RxD	CMOS input, 5V tolerant, pulled down	A5	UART data input
RTS	CMOS input	A6	UART Ready To Send
CTS	CMOS output	B6	UART Clear To Send
N.C.			
not connected	not connected	X1-X6,F2,F3	Do not connect. Will be used in future versions.
not connected	not connected	C2,C3,C5, R4-6,T4-T6	Do not connect.

[7] No Bump

USB-Interface			
D+	CMOS bi-directional	B1	USB D+
D-	CMOS bi-directional	B2	USB D-
USB_PULL_UP /PIO[2]	CMOS bi-directional, pulled down	D1[8]	USB Pull-up, internally attached to D+, only used with corresponding USB-settings.
USB_WAKE_UP =USB_RESUME/ PIO[3]	CMOS bi-directional, pulled down	B4	Output goes high to wake up PC when in USB mode, only used with corresponding USB-settings.
USB_ON/ PIO[4]	CMOS bi-directional, pulled down	D2[3]	USB On (Input. Senses when VBUS is high wakes SieMo), only used with corresponding USB-settings.
USB_DETACH/ PIO[5]	CMOS bi-directional, pulled down	C1	Chip detaches from USB when this line is high, only used with corresponding USB-settings.
PCM-Interface			
PCM_IN	CMOS input pulled down	A1	Synchronous 8kss^{-1}data input
PCM_OUT	CMOS output pulled down	A2	Synchronous 8kss^{-1}data output
PCM_SYNC	CMOS bi-directional, pulled down	A3	Synchronous data strobe
PCM_CLK	CMOS bi-directional, pulled down	A4	Synchronous data clock
SPI-Interface			
SPI-CSB	CMOS input, 5V tolerant, pulled up	E1[3]	SPI Chip Select
SPI-CLK	CMOS input, 5V tolerant, pulled down	E2[3]	SPI Clock
SPI-MOSI	CMOS input, 5V tolerant, pulled up	E3[3]	SPI Data Input
SPI-MISO	CMOS output, tristate	E4[3]	SPI Data Output
PIO-Interface			
PIO[2]/USB_PULL_UP	CMOS bi-directional, pulled down	D1[3]	Programmable IO line
PIO[3]/USB_WAKE_UP	CMOS bi-directional, pulled down	B4	Programmable IO line
PIO[4]/USB_ON	CMOS bi-directional, pulled down	D2[3]	Programmable IO line
PIO[5]/USB_DETACH	CMOS bi-directional, pulled down	C1	Programmable IO line
PIO[6]/	CMOS bi-directional, pulled down	D5[3]	Programmable IO line
PIO[7]/	CMOS bi-directional, pulled down	D6[3]	Programmable IO line
Special Functions			
RESET#	CMOS input pulled up	R3	Reset# input
V_{REG}	Output	D4	3.15V regulated output. Can be connected to V_{CCIO}
SCAN_ENABLE	CMOS input	F1[3]	For Test only, do not connect
TEST-A	CMOS input	E5[3]	For Test only, do not connect
TEST-B	CMOS input	E6[3]	For Test only, do not connect
MODE	CMOS input pulled down	D3[3]	Selects second Firmware, if programmed
GND			
Main GND		B3	'digital'GND
Antenna (RF) GND		R1,R2, T1,T3	RF-Ground

[8] No Bump



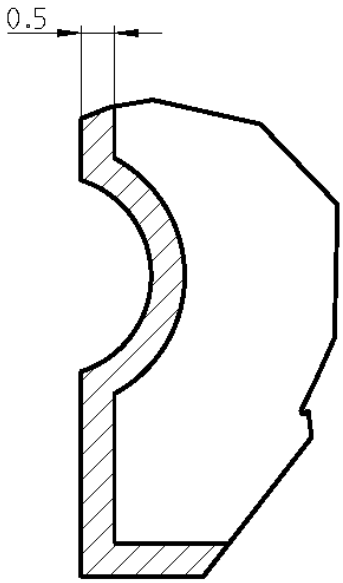


figure 11 dimmensions

Interface Description

PCM Interface

Overview

- PCM Pulse Code Modulation is a standard method used to digitise human voice
- Four-wire, full duplex serial interface used to transfer a single voice channel to an external audio codec
- Maximum of one SCO connection is possible using the PCM interface
- Further SCO channels must use the HCI protocol layer
- Data format is 13 bit linear PCM

Description

Pulse Code Modulation (PCM) is the standard method used to digitise human voice patterns for transmission over digital communication channels. Through its PCM interface, SieMo provides hardware support for continual transmission and reception of PCM data, thus reducing processor overhead for wireless headset applications.
SieMo offers a bi-directional digital audio interface that routes directly into the baseband layer of the on-chip firmware (it does not pass through the HCI protocol-layer). Hardware on SieMo allows the data to be sent to and received from a SCO connection. Only one SCO connection can be supported by the PCM interface at any one time. Any additional SCO connections must receive and transmit their data over the HCI protocol layer. The data format is 13-bit linear PCM. SieMo can operate either as a master (with an output clock of 256kHz) or as a slave (with the input clock varying between 128kHz and 512kHz). When in slave mode and using higher clock rates SieMo can support Motorola's Synchronous Serial Interface (SSI) standard that allows multiple bi-directional audio channels to be multiplexed onto a single physical connection.

Generic PCM Interface

For a generic PCM interface there is one master and one slave device. The master generates the clock and synchronisation signals. The sync signal identifies the start of the sample data and has an 8kHz period. There are two types of frame sync: long and short. In long frame sync mode PCM_SYNC going high indicates the first (and most significant) bit of the sample. It must remain high for at least two clock cycles, but this can be longer. In short frame sync MSB start is signalled by sync going low (normally it only goes high for one clock cycle).
The clock runs at a higher rate than sync: at least 8 x bits_per_sample MHz, although higher rates are common. The sample resolution is 13 bits/sample, uncompressed. Several Motorola CODECs allow their output gain to be controlled via the addition of three extra data bits after the audio data. SieMo supports this feature, effectively raising the bits per sample to 16. Data from both the master and slave is clocked out on the rising clock edge and sampled on the falling edge. Master mode is the default setting. In master mode SieMo generates a 256kHz clock signal (PCM_CLK) and the 8kHz, long format synchronisation signal (PCM_SYNC). Short frame sync is not supported. See PCM Timing Diagrams for more information.
Slave mode is selected by setting a Persistent Store value. In slave mode SieMo clocks output data on the rising edge of the received clock signal and samples incoming data on the falling edge. The incoming clock frequency should be between 128kHz and 512kHz. (Note that 128kHz is 8 x 16 kHz, therefore the absolute minimum possible frequency for the 8ksamples/sec and 16bits/sample (13 audio data plus three gain data). The frame sync must be long format. Short format is not supported (see SSI Mode and Timing Diagrams in this section for more information).

PCM Timing

Symbol	Parameter	Min	Typ	Max	Unit
f_{CLK}	PCM clock frequency		256		kHz
(1)	Clock duty cycle		50		%
$t_{sy:hd}$	Hold time from CLK low to SYNC high		1.95		us
$t_{sy:su}$	Set-up time for SYNC high to CLK low		1.95		us
$t_{sdat:dt}$	Delay time from CLK to valid MSB data			50	ns
$t_{dat:dt}$	Delay time from CLK high to PCM_OUT valid data			50	ns
$t_{fdat:dt}$	Delay time from SYNC or CLK, whichever is later, to PCM_OUT data line high impedance			300[9]	ns
$t_{sy:low}$	Hold time from 2nd CLK to SYNC low			300[1]	ns
$t_{dr:su}$	Set-up time for PCM_IN valid to CLK low	300[1]			ns
tdr:hd	Hold time for CLK low to PCM_IN invalid	300[1]			ns

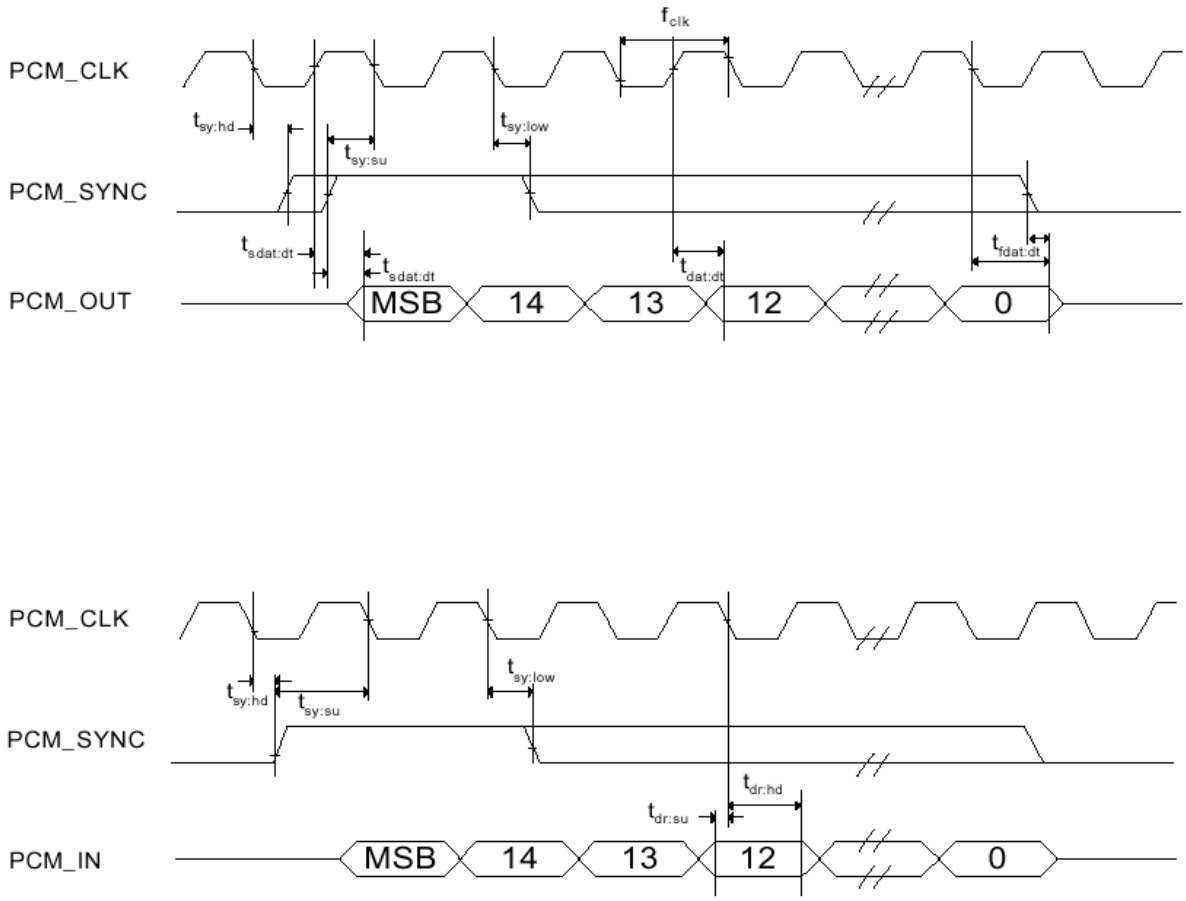


figure 12 PCM Master Timing

[9] Assumes normal system clock operation. Figures may vary during low power modes when system clock speeds are reduced.

Timing graphs

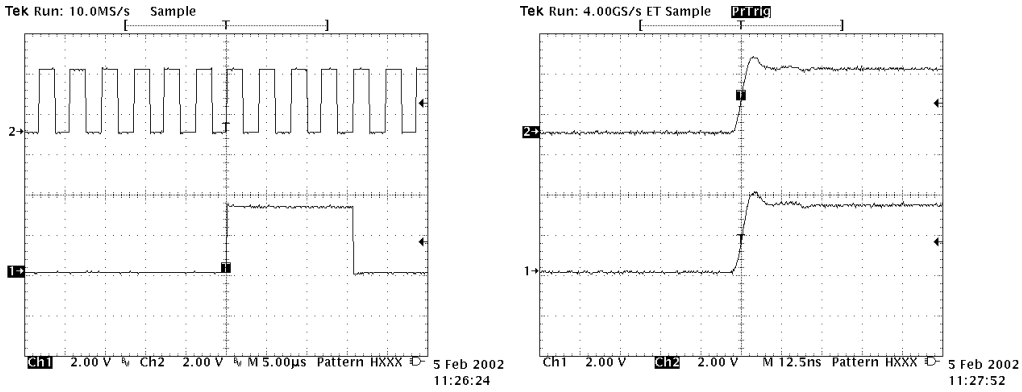


figure 15 PCM clock (upper) Vs PCM sync in 2 different time-scales

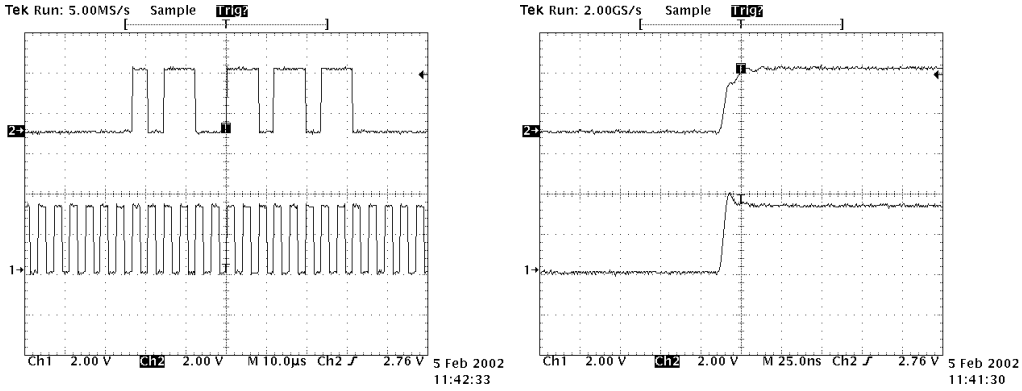


figure 15 PCM OUT Vs PCM CLOCK in two different time-scales

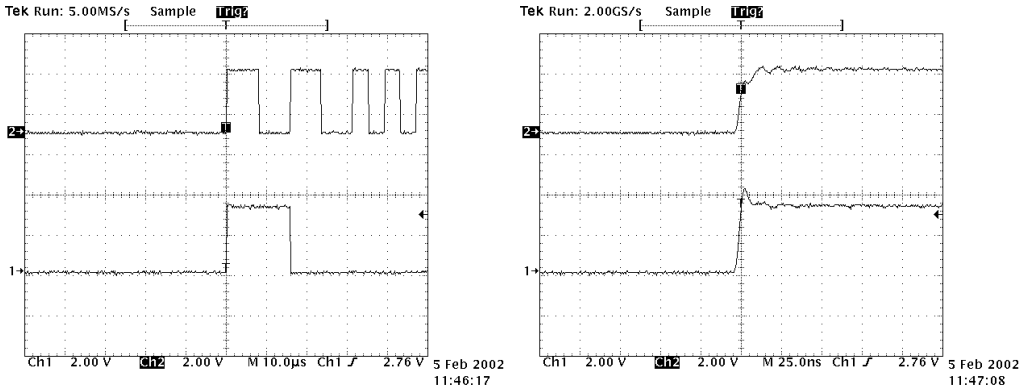


figure 15 PCM OUT Vs PCM SYNC in two different time-scales

UART Interface

Overview

- Universal Asynchronous Receiver Transmitter
- Standard 16550 compatible UART interface
- Min 9600Baud, Max 1.5MBaud
- UART_TX and UART_RX used to transmit data
- UART_CTS and UART_RTS used to implement RS232 hardware flow control

The UART (Universal Asynchronous Receiver Transmitter) provides a simple mechanism to communicate with other devices. The UART uses 4 (or 2 if HW – Handshake is not in use)) lines for serial data transmission.

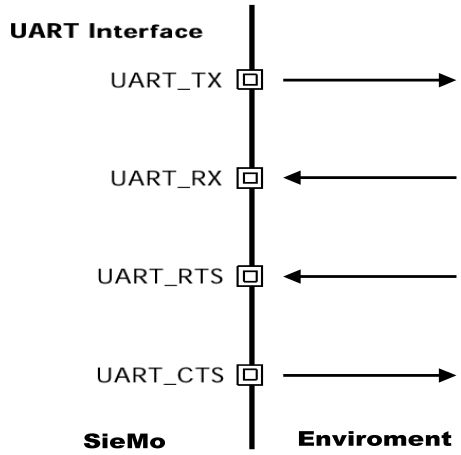


figure 16 UART Directions

UART Settings

Property	Possible Values	Default Setting
Baud Rate	Max 1.536 MBaud Min 9600 baud	115.2 kBaud
Flow Control	RTS/CTS or None[10]	RTS/CTS
Parity	On or Off	Off
Number of Stop Bits	1 or 2	1

Note: To communicate with a standard PC a level-converter is required. SieMo uses 0V and 3V levels. Standard PC usually provide baudrates up to 115.2 kBit/s, if SieMo shall communicate with a PC at higher data rates an accelerated serial port adapter and a appropriate level converter is required. It is strongly recommended to use a level converter with ESD protection. See Application below.

[10] The CTS input must be de-assigned by the host for the duration of at least 4 bits (e.g. 35 ms with a baudrate of 115.2 kBaud). Any shorter period of de-assigning the handshake input can cause incorrect function.

Application: SieMo connected as DCE

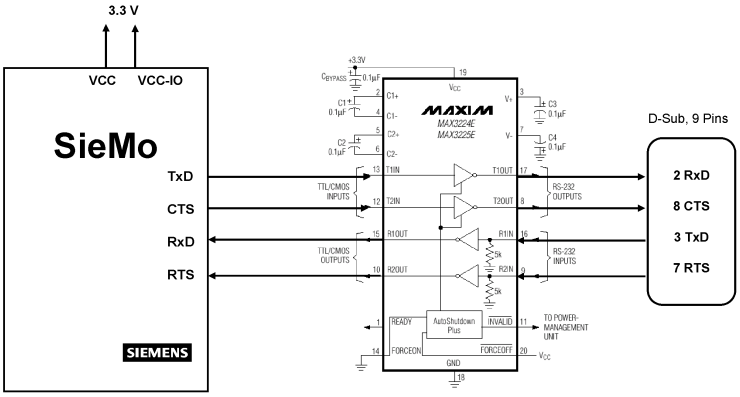


figure 17 Connection to PC via level converter

Timing graphs

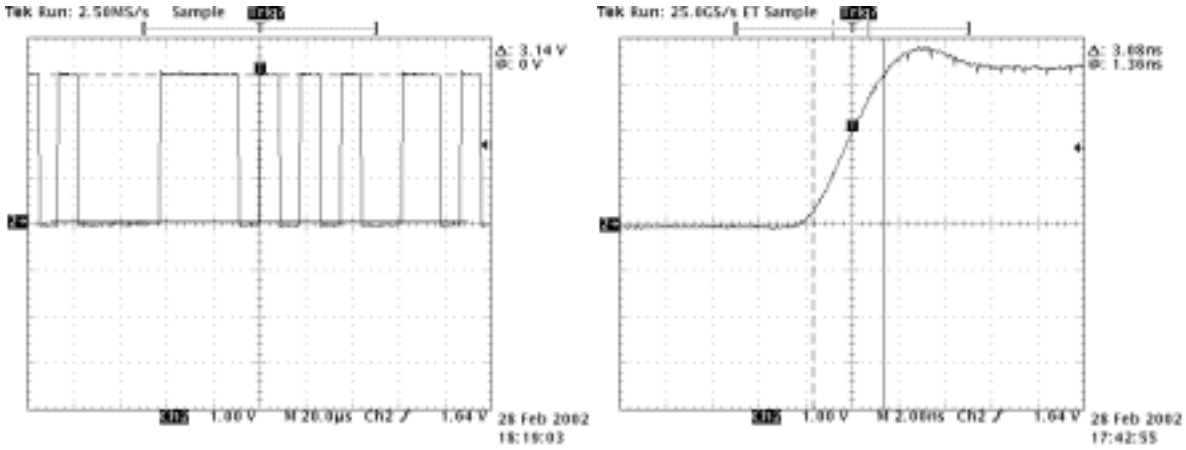


figure 18 UART TxD signal

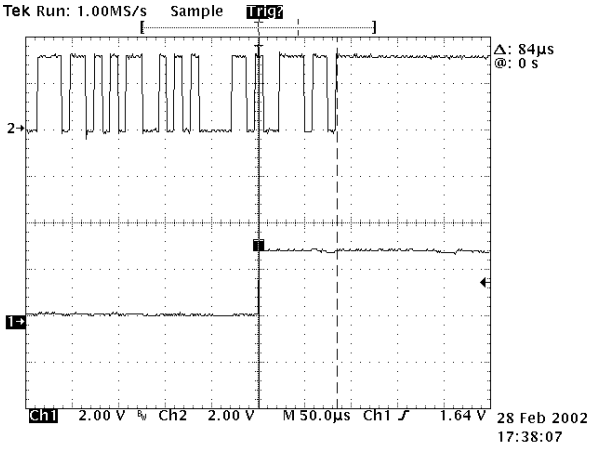


figure 19 data output stopped by handshake input, delay time 84us

USB Interface

Overview

- 12Mbits/s bit rate
- BC01 operates as a peripheral USB device
- Two modes, bus powered and self powered
- Careful product design is required for product to remain USB1.1 compliant
- 4 USB lines are required
- Minimum voltage on VCC_IO terminal is 3.0V for USB operation

The SieMo contains its own full-speed (12Mbits/s) USB interface. To get a product USB 1.1 certified, please visit www.usb.org for further information. The voltage on Vcc-IO must be between 3.0 and 3.4 V for USB operation. It is possible to connect the Vcc-IO to the Vreg output of the module, which provides a regulated voltage of 3.15V.

Although SieMo is capable of meeting the USB 1.1 specification, Siemens cannot guarantee that an application circuit designed around the IC is USB compliant. The choice of application circuit, component choice and PCB layout all affect USB signal quality and electrical characteristics. The information in this document is intended as a guide and should be read in association with the USB 1.1 specification, with particular attention being given to Chapter 7. Independent USB qualification must be sought before an application is deemed USB compliant and can bear the USB logo. Such qualification can be obtained from a USB plugfest or from an independent USB test house.

Disconnect and Resume Signalling

SieMo provides some signalling lines for USB operation. These functions are disabled by default but can be activated via firmware settings.
The USB_DETACH and USB_WAKE_UP terminals provide extra signalling alongside the normal USB data lines. They are not part of the USB specification and full USB functionality can be attained without their use. The Disconnect message may be useful on its own, but it is hard to see an application for USB_RESUME in isolation.
USB_DETACH (Disconnect Signalling)
USB_DETACH is an input, when asserted high, causes SieMo to put USB_PULL_UP, USB_D- and USB_D+ in a high-impedance state. This detaches the device from the bus and is logically equivalent to unplugging the module. When USB_DETACH is taken low, SieMo will connect back to USB and await enumeration by the USB host.

USB_RESUME
USB_WAKE_UP is an active high output used only when USB_DETACH is active to wake-up the host and allow USB communication to recommence. It replaces the function of the USB Resume message, which cannot be sent while SieMo is effectively disconnected from the bus.

Power Modes

SieMo is by default set to be powered from the Bus. It can be set to a self powered Device by changing firmware settings. In this case the USB_ON must be connected to the Vbus line via a 47k/22k

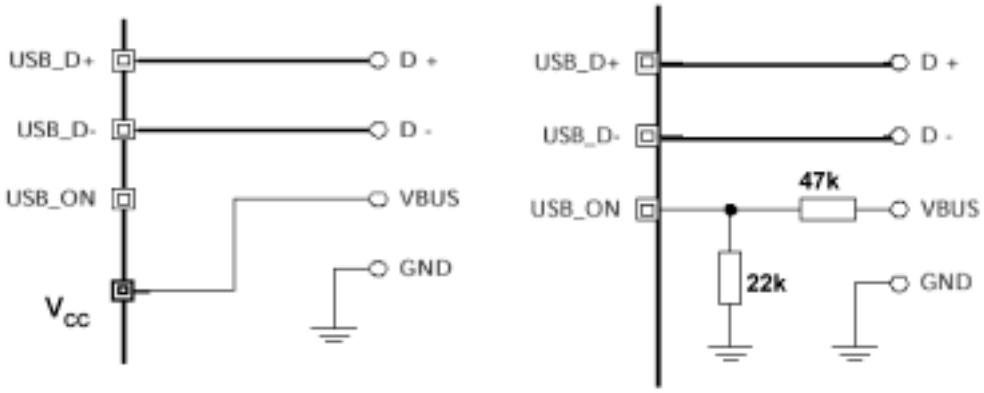


figure 20 USB Power Modes- Applications

USB Timing

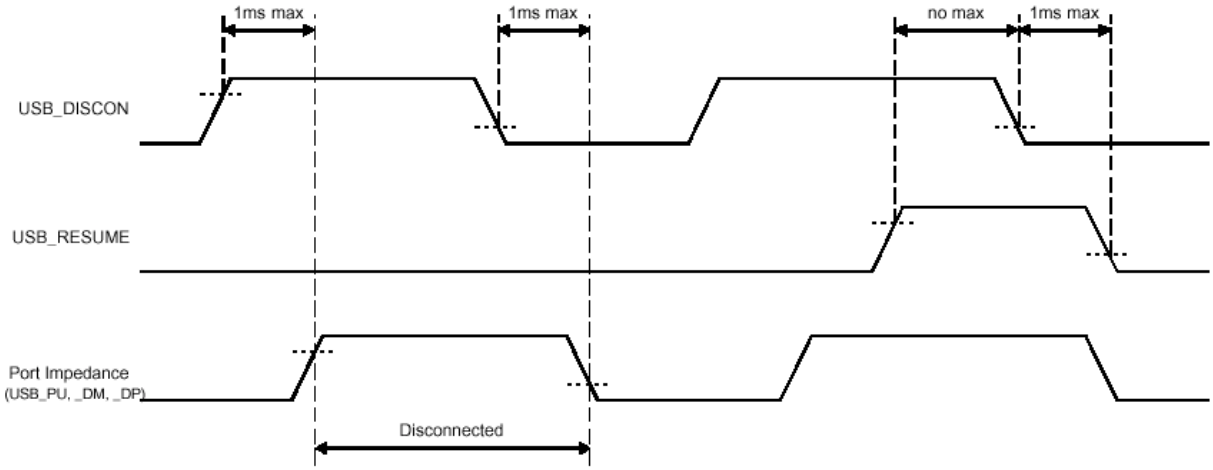


figure 21 USB Disconnect and Resume Signal Timing

Serial Peripheral Interface

Overview

- Consistent with the Motorola SPI standard
- SieMo always acts in slave mode
- SPI_CLK is always generated by the host

SieMo uses 16-bit addresses and 16-bit data during serial peripheral interface transactions. Such transactions will operate regardless of whether the internal processor is running or is stopped. This section details the considerations required when interfacing to SieMo via the four dedicated Serial peripheral interface terminals.

Instruction Cycle

Before SieMo can be addressed, SPI_CSB must be taken low (SPI_CSB = 0). Data on SPI_MOSI is then clocked into the SieMo on the rising edge of the clock-line SPI_CLK. When reading, SieMo will reply to the master on MISO, the data being valid on the falling edge of the SPI_CLK. The master provides the clocking.

Single-Cycle Operation

After a serial peripheral interface transaction finishes, the master toggles SPI_CLK with SPI_CSB high to initiate a new transaction. SPI_CSB must be high for at least two SPI_CLK cycles.

Multi-Slave Operation

SieMo should not be connected in a multi-slave arrangement by simple parallel connection of slave MISO lines. When SieMo is deselected (SPI_CSB = 1), the SPI_MISO line does not float. Instead, SieMo outputs 0 if the processor is running or 1 if it is stopped.

Writing to SieMo

To write to the SieMo, the 8-bit write command (00000010) is sent first (C[7:0] followed by a 16-bit address (A[15:0]). 16 bits of data (D:[15:0]) are sent.

Terminal	Type	Description	Device Terminal	PC Parallel Connector
SPI_CSB	CMOS input	Serial Peripheral Interface Chip Select	E1	2
SPI_CLK	CMOS input	Serial Peripheral Interface SPI Clock	E2	9
SPI_MOSI	CMOS input	Serial Peripheral Interface SPI Data Input	E3	8
SPI_MISO	CMOS output	Serial Peripheral Interface SPI Data Output	E4	10
GND			B3	19

SPI Timing

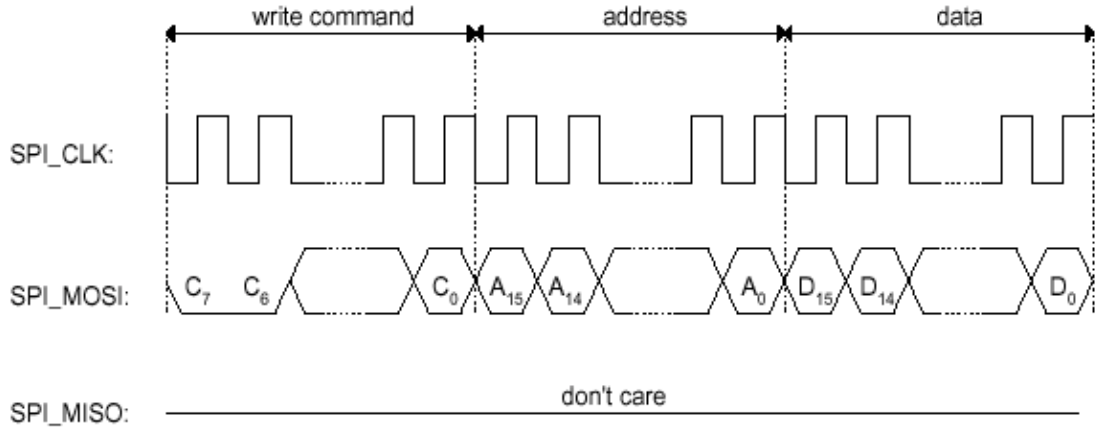


figure 22 SPI write operation a

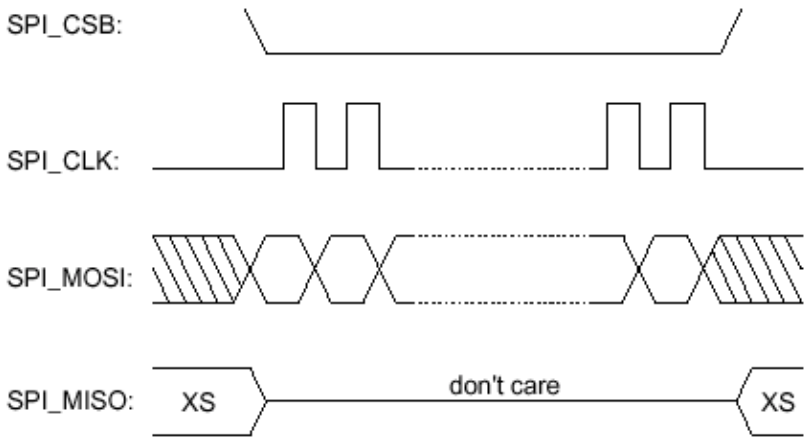


figure 23 SPI write operation b

Reading from SieMo

Reading is similar to writing, in that an 8-bit read command (00000011) is sent first, followed by the address of the location to be read. The SieMo then outputs the 16-bit contents of the location on MISO during bits D[15:0] and a check-word during T[15:0].The check-word is composed of {command, address [15:8]}. The check-word may be used to 'sanity-check' a read operation to a memory location. This overcomes the problem encountered with typical serial peripheral interface slaves, whereby it is impossible to determine whether the data returned by a read operation is valid data, or the result of the slave device not responding.

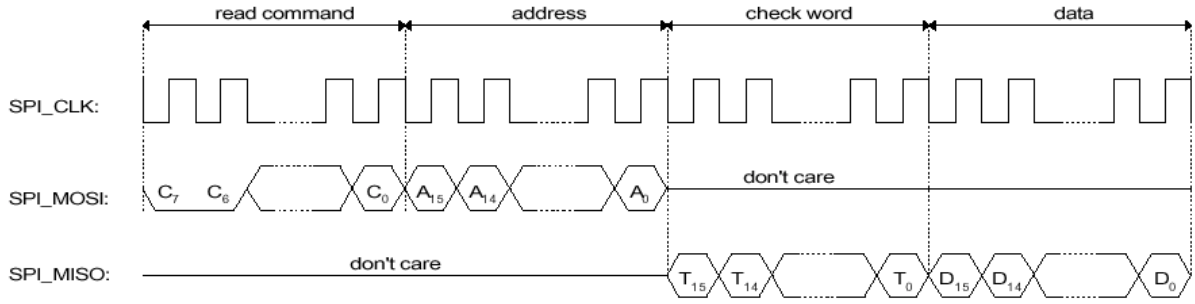


figure 24 SPI read timing a

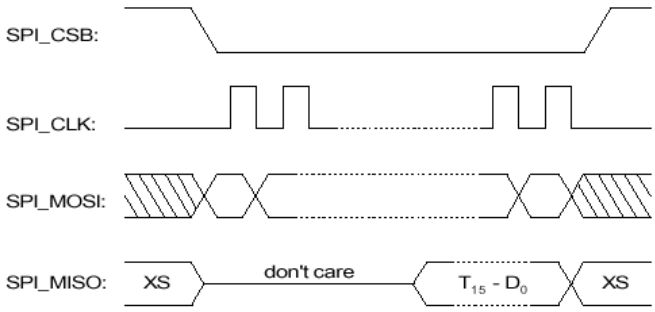


figure 25 SPI read timing b

Auto-Increment Operation

Sending a command word and the address of a register every time it is to be read or written can be a significant overhead, especially when large amounts of data are to be transferred. SieMo offers increased data transfer efficiency via its auto-increment operation. During operation, SieMo increments the address automatically. Only the data is transmitted or received over the serial peripheral interface bus. SieMo keeps the previous command word.

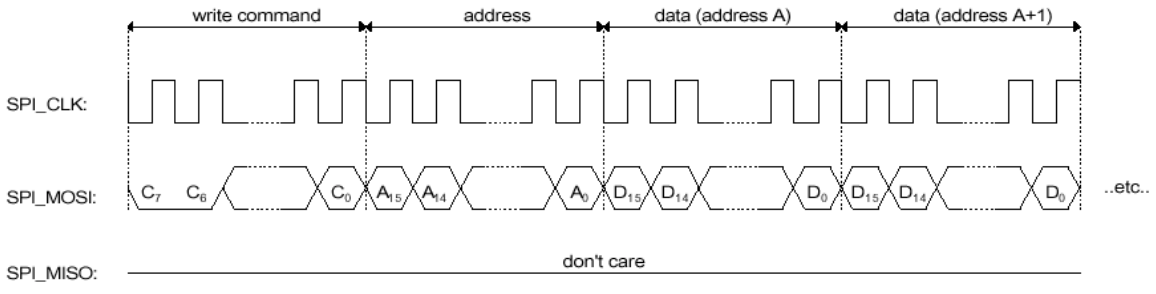


figure 26 Example Auto-Increment Operation

Manufacturing aspects, Handling

The SieMo device is moisture sensitive according to JEDEC / JST Level 4, e.g. should be stored within Dry Pack until used, and exposed to ambient air of max. 30°C / 60% rel. Humidity for a maximum of 72h.

As the device is electrostatic sensitive, standard ESD precautions need to be considered during handling outside shipping container.

Standard Reflow according to JEDEC / JST with a maximum peak temperature of 220 -0 / +5 °C on device top is recommended.

Reference:
http://www.jedec.org

Default packaging consists of up to 5 Trays in one DryPack. Each Tray contains 20pcs of SieMo. Other Packaging by request.

Regulatory Statements

General

- This *Bluetooth* radio module has to be installed and used in accordance with the technical description/installation instructions provided by the manufacturer.
- This *Bluetooth* radio module is intended to be placed on the market in all States, where the Bluetooth™ technology and the used frequency band is released.
- For detail information concerning type approval of this module (e.g. where this module is already pre-approved) please contact the authorised local distributor or the manufacturer.

European Union (EU) and EFTA Member States

This *Bluetooth* module is an assessed radio module in conformity with the R&TTE directive 1999/5/EC and has been provided with the CE mark accordingly.

It is conform to the following specifications/Standards*) :

Applied specifications/Standards	Essential Requirement (Corresponding article of R&TTE)
EN 300 328 (ETS 300 328): Part 1, V1.1.1 and Part 2, V1.2.2 (2000-07) **EN 301 489-17 (ETS 300 826):** V1.1.1 (2000-09)	**Electromagnetic Compatibility** (Art. 3.1b)
EN 300 328 (ETS 300 328): Part 1, V1.1.1 and Part 2, V1.2.2 (2000-07)	**Radio Frequency Spectrum Efficiency** (Art. 3.2)

Note that the radio frequency band used by this equipment is not harmonised throughout the European Community. According to the R&TTE directive 1999/5/EC is this equipment a 'Class 2' equipment and marked accordingly with the assigned Class Identifier.

CE Conformity Marking:

CE 0682

*) Safety requirement according to the article 3.1a of R&TTE Directive are not applicable on this *Bluetooth* radio module, since it is intended to be integrated in final products/applications.

Because this Bluetooth™ radio module is very small and intended to be integrated/installed in final products (OEM products/applications) it is not practicable to place the label including the CE conformity marking on it. Therefore the required labelling information is placed in this technical description/installation manual of this radio module. However the CE conformity marking refereed to in R&TTE Directive, Article 12 is displayed on the packaging of the radio module in an appropriate form.

OEM products/applications, where this Bluetooth™ radio module is integrated/installed in, has to be labelled in accordance with R&TTE Directive, Article 12.

An auxiliary label is included in the packaging of this radio module, which can be used for that purpose and has to be permanently affixed to the OEM product/application or to it's data plate and to it's packaging and to accompanying documents. The label has to be affixed visibly (label data must be visible from the outside of the equipment enclosure) legibly and indelibly.

Note that in case of using the provided auxiliary label, additionally following statement has to be included in the users manual of the final product (OEM product/application):

Note that the radio frequency band used by this equipment is not harmonised throughout the European Community. According to the R&TTE directive 1999/5/EC is this equipment a 'Class 2' equipment and marked accordingly with the assigned Class Identifier.

United States of America (USA)

This *Bluetooth* radio module complies with part 15 of the Federal Communications Commission (FCC) Rules and labelled in accordance with the FCC Rules.

FCC ID: P6L-SieMo-S50037

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Note that any changes or modifications to this equipment not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Because this Bluetooth™ radio module is very small and intended to be integrated/installed in OEM products/applications it is not practicable to place the label including the FCC statement on it. Therefore the required labelling information is placed in this chapter of the technical description/installation manual of this radio module. However the FCC identifier is displayed on the packaging of the radio module in an appropriate form.

OEM products/applications, where this Bluetooth™ radio module is integrated/installed in, has to be labelled in accordance with FCC Rules (section 15.19 and 47 CFR Ch. I: §2.925, §2.926).

An auxiliary label is included in the packaging of this radio module, which can be used for that purpose and has to be permanently affixed to the OEM product/application in a readily visible (label data must be visible from the outside of the equipment enclosure) manner (e.g. on an exterior surface of the equipment).

Note that in case of using the provided auxiliary label, additionally following statement has to be included in the users manual of the final product (OEM product/application):

This device complies with part 15 of the Federal Communications Commission (FCC) Rules.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Note that any changes or modifications to this equipment not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Manufacturer information concerning antenna:

The only antenna(s) approved for use with this Bluetooth™ radio module are those documented in this construction file, and must be installed in the manner specified therein. In all other cases, where the second manufacturer/installer desires to use an antenna with this module that has not been previously approved for use with it, then one of the following procedures has to be followed in order to ensure the compliance of the new antenna:

1. The Manufacturer of this *Bluetooth* radio module files a Class II permissive change to approve the new antenna with the module.
2. The second manufacturer/installer obtains a separate FCC equipment authorisation for the module and the new antenna.

Bluetooth-Trademark

Bluetooth™ is a trademark owned by Bluetooth SIG, Inc., U.S.A, and licensed to Siemens AG.

This product is a qualified Bluetooth™ product and compliant to the Bluetooth™ specifications version 1.1.

Appendix A

List of figures