SAM88 Document for FCC & MIC

Product Name : SAM88

Product Applications : Sostark Wireless Audio Module

Sostark Model Number: SAM88

Manufacturer : Sostark Pte Ltd

Blk20, Sin Ming Lane, #08-52 Midview City Singapore 573968	Office: +65 9478 3438 Mobile: +65 8318 3112 / Nick Guan Email: nick.guan@sostark.com

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Sostark Pte Ltd

(Confidential)

REVISION HISTORY

Ver.	Description	Page	Date	Originator/Modified By
0.0	FCC document		25th Jun 2013	Nick Guan

1, User Guide for SAM88

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(a) This device may not cause harmful interference, and
(b) This device must accept any interference received; including interference that may cause undesired operation.

Product Name : SAM88

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Reference product number from SMSC: (1) Module: DWAM83 TB, (2) IC: DARR83

Manufacturer : Sostark Pte Ltd

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(1) Need to use FPC-26 pin cable connect to main audio board

(2) Work in audio transmitter board

(3) Work in audio receiver board

(4) Pair the transmitter board with the receiver board

(5) Connect the two boards, one transmitter and one receiver at least

(6) Play the music, now have wireless audio stream

2, INTRODUCTION & EE Spec

2.1 Product Description

The **SAM88** Module is an OEM module (35x35mm) based on the SMSC DARR83. It is an uncompressed wireless digital audio transceiver operating in the 2.4GHz, 5.2GHz and 5.8GHz bands. The wireless audio link supports up to 4 stereo audio streams and comes together with additional features such as: data encryption, pairing functionality, bi-directional control data messages, low power audio snooze mode, WLAN detection, Automatic Frequency Allocation and support KleerNet. The DARR83 chip itself provides the basic functions of Audio Processing and buffering, Data Link Layer and Physical Layer. The module integrates all functionality for a wireless digital audio connection, comprising:

- DARR83 Wireless Audio Processor
- 2.4GHz/ 5.2GHz/ 5.8 GHz RF Transceiver
- Embedded Antennas
- Digital audio interfaces (I^2S and/or S/PDIF)
- I^2C control interface
- 26 pins interface connector (FFC) for power, digital audio and control interface and GPIOs
- Built-in SPI interface Flash (Giga-device)

2.2. Basic Feature

High Quality Audio

- Up to four stereo audio channels, fully bidirectional, up to 24-bit/96 ksps uncompressed audio
- Low latency <20ms for real-time audio and lip sync
- Low latency compression algorithm - optimized for voice applications, headphones
- Inter-speaker synchronization; Low-jitter audio clock sync
- Programmable digital audio gain

Networking and Connectivity

- 22Mbps Bandwidth in 2.4GHz, 5.2GHz and 5.8 GHz Bands
- In-room or multi-room network topology
- Point-to-Point and Point-to-Multipoint
- Bidirectional data channel (100 kbps)
- Simple Pairing and Association Function
- 4 I^2S Data pins, each provided with their own pair of BCK/LRCK signals or stereo S/PDIF input/output
- Master and Slave I2C bus for external control functions

Coexistence and Robustness

- Enhanced robustness against both in- and out of band interferers like: WiFi and cordless phones
- Coexistence with 802.11a, b, g and n
- Automatic receiver antenna diversity minimizes fading and multi-path effects
- Link quality monitoring
- Soft audio muting under poor link circumstances

Power Management

- Low power consumption
- Automatic RF output power control
- Power Down Duty Cycle mode: If no link is established, modules (both TX and RX) will enter a power down mode

Integrated 8052 MCU

The DARR83 integrates an 8052 MCU. This includes the following features:

- 45 kByte Code RAM
- 8 kByte Data RAM
- 4 Timer/Counters
- UART

Digital Audio Clock Synchronization

The digital audio clock synchronization is an additional more cost effective method for synchronization of audio samples on the receiving side with respect to the transmitted audio samples. The digital clock synchronization feature works for output audio sample rates of 96 and 48 ksps.

Sample Rate Converter (SRC) + Sample Rate Detector

The SRC can handle the following input sample rates [ksps]:

- 44.1
- 48
- 96
- 192 (using I^2S in slave mode)

KleerNet

KleerNet is SMSC's open wireless audio ecosystem, connecting CE, PC and mobile applications. It offers seamless audio connectivity for a wide range of wireless audio needs, from simple headphones and headsets up to multi-zone and 5.1 audio applications.

- Enabling simple headphone/headset applications up to multi-zone and 5.1 audio network configurations
- Inter-brand connectivity
- Consistent and simple user experience
- KleerNet brand and logo offering end-user recognition
- Adopted by major PC and CE brands
- KleerNet SDK for fast design-in, running on internal MCU

2.3. Module Specifications

System Specifications				
ID	Parameter	Value	Unit	Remarks
RF Characteristics				
	RF frequency range	2400 – 2483.5 5150 - 5250 5725 - 5875	MHz MHz MHz	
	Number of RF channels	3		In each Frequency band.
Air framing				
	Addressing	24	Bit	
	Data message size	32	Byte	Application dependent
	CRC	16, 24 and 32	Bit	Hybrid
Control				
	Control interface	I^2C		Compliant with the I^2C protocol (slave), 0…400kbps. Base address 0x80.
Data				
	Data Bandwidth	100	Kbps	Bi-directional wireless data channel
	Data latency	5	ms	Minimum under good RF link conditions for applications that support the 100kbps data rate.
Interference Robustness				
	Fixed frequency devices (e.g. WLAN, microwave oven)			Fully coexistent[1]
	Frequency hopping devices (e.g. 5.8GHz cordless phones)			Fully coexistent[1]

Audio Interface				
	Available Interface Types	I^2S S/PDIF		Can be used simultaneously Incl. S/PDIF detection.
	Number of stereo audio output channels on Mobile Unit	1, 2, 3 or 4		Bidirectional, incl. audio loop
	Number of stereo audio input channels on Central Unit	1, 2, 3 or 4		Bidirectional, incl. audio loop
Audio Quality				
	Sample rate	44.1, 48 or 96	ksps	
	Sample width	16 or 24	bit	
	Latency	20	ms	Configurable from 10 to 23.6ms, depending on the application.
	Dynamic Range	98 146	dB dB	16 bit 48ksps, A-weighted 24 bit 48ksps, A-weighted
	THD+N	-96 -143	dB dB	16 bit 48ksps 24 bit 48ksps
	Frequency response	0	dB	20Hz…22kHz [2]
Dimensions				
	Module dimensions	35 x 35 x 4.3	mm	

Absolute Maximum Rating

Symbol	Parameter	Min.	Typ	Max	Unit
VCC	Supply Voltage			3.8	V
Tstorage	Storage Temperature	-25	–	85	℃
VESD	ESD Contact Discharge	-2	–	+2	kV

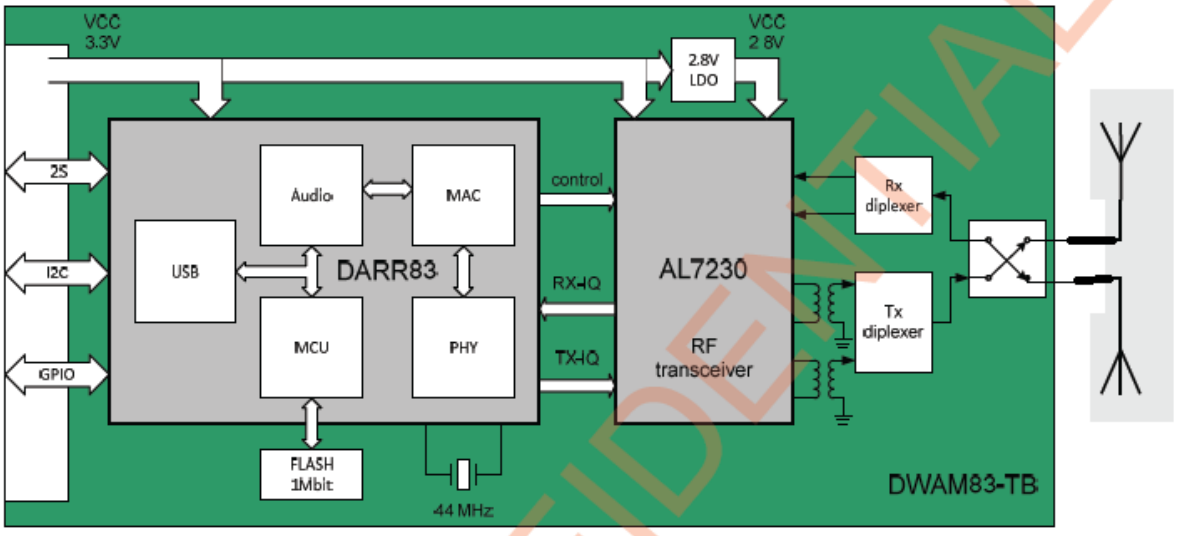
Recommended Operating Conditions

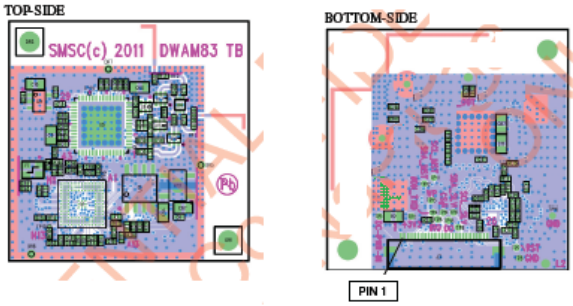
Symbol	Parameter	Min.	Typ	Max	Unit
VCC	Supply Voltage	3.1	3.3	3.5	V
VCC Ripple	Peak to Peak Ripple (in circuit)	–	0	100	mV
Tamb	Operating Temperature	-10	25	60	℃

DC Characteristics

All digital IO levels are 3.3V CMOS. The digital IO ports are not 5V compliant.
Please refer to datasheet of DARR83 for more information.

2.4. SAM88 Module Block Diagram





(PCB Layout: 35mm x 35mm)

2.5. Power Consumption

(Vcc=3.3V, 25℃, Audio Clock:12.288MHz).

Application*	2.4GHz		5.2GHz		5.8GHz	
	MU (in mA)	CU (in mA)	MU (in mA)	CU (in mA)	MU (in mA)	CU (in mA)
Standby mode*	21	21	21	21	21	21
1 Stereo NACK	31	98	36	96	36	96
2-1 Stereo NACK BiDir	81	155	82	145	82	146
2 ACK	60	140	65	124	65	127
TX Continuous mode (peak current)	-	390	-	300	-	300

**Current consumption measurements based on External MCU using EVK. Standby mode can be wake up by CU*

For detailed current consumption for other applications mode, please contact our AE.

Note 1: The ACK applications have automatic RF power control therefore these applications will have variable (lower) power consumption depending on wireless link conditions.

Note 2: The above measurements are under un-interfered circumstances. When retransmissions are required, current consumption will change (e.g. ACK and CU NACK at 30 % and only MU NACK when there is interference)

Note 3: The duration of the peak current is depending on the application. For example, a 2 Stereo ACK CU has a peak power duration of two time slots of 230us in a 2.52ms frame period as depicted here below:

2.6. RF Performance

Vcc=3.3V, 25℃)

Parameter		Condition	Min.	Typ.	Max	Units
RF Frequency Range			2400	–	2483.5	MHz
Number of RF-channels		Carriers in the spectrum	–	3	–	
Transmission Power[3]				14		dBm
Channel Frequency (dynamic or fixed allocation)	CH1 CH2 CH3		–	2412 2438 2464	–	MHz
Channel Spacing			–	26	–	MHz
RF Bandwidth		Null-to-null	–	22	–	MHz
Rx sensitivity			–	-83	–	dBm
Antenna Diversity		TX/RX	–	ON	–	

For 5.2GHz application (Vcc=3.3V, 25℃)

Parameter		Condition	Min.	Typ.	Max	Units
RF Frequency Range			5150	–	5250	MHz
Number of RF-channels		Carriers in the spectrum	–	3	–	
Transmission Power[3]		Depending on antenna design		9		dBm
Channel Frequency (dynamic or fixed allocation)	CH1 CH2 CH3		–	5180 5210 5240	–	MHz
Channel Spacing			–	30	–	MHz
RF Bandwidth		Null-to-null	–	22	–	MHz
Rx sensitivity			–	-81	–	dBm
Antenna Diversity		TX/RX	–	ON	–	

For 5.8GHz application (Vcc=3.3V, 25℃)

Parameter		Condition	Min.	Typ.	Max	Units
RF Frequency Range			5725	–	5875	MHz
Number of RF-channels		Carriers in the spectrum	–	3	–	
Transmission Power[3]		Depending on antenna design		9		dBm
Channel Frequency (dynamic or fixed allocation)	CH1 CH2 CH3		–	5736 5762 5814	–	 MHz
Channel Spacing			–	26	–	MHz
RF Bandwidth		Null-to-null	–	22	–	MHz
Rx sensitivity			–	-81	–	dBm
Antenna Diversity		TX/RX	–	ON	–	.

[3] With DARR83-ADC based Power Control Loop. Output power country/region dependent.

2.7. Pin out of 26pin FPC/FFC Interface Connector (0.50mm Pitch)

Pin Number	Pin Name	I/O	Description
1	VDD	Power	Regulated 3.3V input
2	GND	Ground	Ground
3	MCLK	In	12.288MHz audio clock In
4	DARR83_GPIO_2	I/O	Configurable. Please refer to the DARR83 datasheet
5	DARR83_GPIO_7	I/O	Configurable. Please refer to the DARR83 datasheet
6	DARR83_GPIO_4	I/O	Configurable. Please refer to the DARR83 datasheet
7	DARR83_GPIO_23	I/O	Configurable. Please refer to the DARR83 datasheet
8	DARR83_GPIO_13	I/O	Configurable. Please refer to the DARR83 datasheet
9	DARR83_GPIO_3	I/O	Configurable. Please refer to the DARR83 datasheet
10	DARR83_GPIO_15	I/O	Configurable. Please refer to the DARR83 datasheet
11	I2C_SCL_SLV		Internal use (tied to Pin 18)
12	I2C_SDA_SLV		Internal use (tied to Pin 19)
13	DARR83_GPIO_24	I/O	Configure as MON_TXD
14	DARR83_GPIO_14	I/O	Configure as IRQ
15	DARR83_GPIO_1	I/O	Configure as WP
16	NC		NOT CONNECTED
17	DARR_RST		DARR RESET (external pull up required)
18	I2C_SCL_SLV		I2C SLAVE (SCLK)
19	I2C_SDA_SLV		I2C SLAVE (SDA)
20	DARR83_GPIO_12	I/O	Configure as SDIO Z
21	DARR83_GPIO_11	I/O	Configure as SDIO X
22	DARR83_GPIO_10	I/O	Configure as LRCK W
23	GND	Ground	Ground
24	DARR83_GPIO_8	I/O	Configure as BCK W
25	DARR83_GPIO_6	I/O	Configure as SDIO Y
26	DARR83_GPIO_5	I/O	Configure as SDIO W

RF Module:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules.
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(2) this device must accept any interference received,
including interference that may cause undesired operation.

Integration:

The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module. Appropriate measurements (e.g. 15 B compliance) and if applicable additional equipment authorizations (e.g. Verification, Doc) of the host device to be addressed by the integrator/manufacturer.

This transmitter module is authorized only for use in battery-powered end-products to be used indoor only. Other usage requires compliance to FCC §15.207 AC Powerline Coducted Limits.

Endproduct:

The final end product must be labeled in a visible area with the following: “Contains FCC ID: QLPSAM88”.

This statement “**This device complies with Part 15 of the 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.” should be placed on the end-product itself or due to lack of space inside the user manual.

In addition following statements have to be included in the user manual of the endproduct:
“**Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.”**
and
“The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.”