



USER MANUAL

SOUNDCAST 50RFM WIRELESS AUDIO SYSTEMS

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1. General Description

SoundCast 50RFM is a complete point-to-point and point-to-multipoint wireless audio solution. SoundCast 50RFM takes a 2-channel digital stereo input signal, sends it across a robust radio frequency link, and then converts it back to a stereo analog signal for use at a remote location. SoundCast 50RFM is ideal for home theater rear speakers, headphones, public address systems, and outdoor speakers.

2. Features

- ❖ Stereo Analog In/Analog Out, Digital In/Digital Out;
- ❖ 92.4 dB SNR, 0.065% THD+N;
- ❖ Digital volume control;
- ❖ Auto Mute;
- ❖ Digital Noise Gate;
- ❖ 2.4 GHz wireless link, 1.536 Mbps data rate;
- ❖ 50 m indoor range;
- ❖ Each transmitter supports two receivers with stereo output from both receivers;
- ❖ Up to 6 transmitters in one area;
- ❖ Low latency (15 ms – 64 ms selectable);
- ❖ Low power consumption;
- ❖ Best in Class quality of service (QoS);
- ❖ Duplex utility control channel;
- ❖ Modules come with antenna soldered on for easy integration

3. Electrical Specifications

3.1 Operating Conditions – SoundCast 50RFM Transmitter

Parameter	Symbol	Conditions	Min		Typical		Max		Unit
			25 m	50 m	25 m	50 m	25 m	50 m	
POWER CONSUMPTION									
Digital Power Supply	VCC		3.0		3.3		3.6		V
ADC Power Supply*	AVDD		3.0		3.3		5.5		V
RF Power Supply	RFVCC		3.0		3.3		3.6		V
Digital Current	Ivcc	VCC = 3.3 V			53	48			mA
Analog Current†	Iavdd	AVDD = 3.25 V			18				mA
RF Current	Irfvcc	VCC = 3.4 V			140	121			mA
RF Current Duty Cycle	DCrfvcc	Transmit Mode: Receive Mode:			92 8				% %
LOGIC THRESHOLDS									
Input Low Voltage Threshold	Vil	VCC = 3.3 V					0.8		V
Input High Voltage Threshold	Vih	VCC = 3.3 V	2.0						V
Output Low Voltage Threshold	Vol	VCC = 3.3 V					0.4		V
Output High Voltage Threshold	Voh	VCC = 3.3 V	2.4						V
Input Leakage Current	Iin	VCC = 3.3 V	-10		-1		10		µA
TEMPERATURE									
Operating Temperature	TA	All Power Ranges	0				60		°C
Standard Data Channel									
Raw Data Output Rate		Tx to Rx			1.125				kbps
Two Wire Serial Interface		Tx to Rx			1				kbps
Extended Data Channel									
Raw Data Output Rate		Tx to Rx			72				kbps
Two Wire Serial Interface		Tx to Rx			90				kbps

Note: All Min/Max characteristics and specifications are guaranteed over the Specified operating conditions. Typical performance characteristics and specifications are derived from measurements taken at typical supply voltages and TA=25°C.

3.2 Absolute Maximum Ratings – SoundCast 50RFM Transmitter

Parameter	Symbol	Value	Unit	Note
RFM Power	RFVCC	3.6	V	
Digital Power	VCC	3.63	V	
ADC Power	AVDD	6	V	
Digital Input Pin Absolute Maximum Input Voltage	GPIOx, ID_DATA, ID_CLOCK, /RESET, MISO0, CS0	3.63	V	IO Inputs are not 5 V Tolerant.

3.3 Operating Conditions – SoundCast 50RFM Receiver

Parameter	Symbol	Conditions	Min		Typical		Max		Unit
			25 m	50 m	25 m	50 m	25 m	50 m	
POWER CONSUMPTION									
Digital Power Supply	VCC		3.0		3.3		3.6		V
DAC Power Supply	AVDD		3.0		3.3		5.5		V
RF Power Supply	RFVCC		3.0		3.3		3.6		V
Digital Current	ivcc	VCC = 3.325 V			42	44			mA
Analog Current	ivdd	AVDD = 3.27 V			35.5				mA
RF Current	irfvcc	VCC = 3.4 V			65	70			mA
RF Current Duty Cycle	DCirfvcc	Transmit Mode: Receive Mode:			4 96				%
LOGIC THRESHOLDS									
Input Low Voltage Threshold	VR	VCC = 3.3 V					0.8		V
Input High Voltage Threshold	Vih	VCC = 3.3 V	2.0						V
Output Low Voltage Threshold	Vol	VCC = 3.3 V					0.4		V
Output High Voltage Threshold	Voh	VCC = 3.3 V	2.4						V
Input Leakage Current	in	VCC = 3.3 V	-10		± 1		10		µA
TEMPERATURE									
Operating Temperature	TA	All Power Ranges	0				60		°C
Standard Data Channel									
Raw Data Output Rate		Rx to Tx			2.25				kbps
Two Wire Serial Interface		Rx to Tx			1				kbps
Extended Data Channel									
Raw Data Output Rate		Rx to Tx			6				kbps
Two Wire Serial Interface		Rx to Tx			3.6				kbps

3.4 Absolute Maximum Ratings – SoundCast 50RFM Receiver

Parameter	Symbol	Value	Unit	Note
RFM Power	RFVCC	3.6	V	
Digital Power	VCC	3.63	V	
DAC Power	AVDD	6	V	
Digital Input Pin Absolute Maximum Input Voltage	GPIOx, ID_DATA, ID_CLICK, /RESET, MISOC, CS0	3.63	V	IO inputs are not 5 V Tolerant.

4. Audio Characteristics

Parameter	Symbol	Conditions	Min	Typical	Max	Unit
Signal to Noise Ratio: A-weighted (Note 2) Un-weighted	SNR	Left Channel, 997 Hz		>95 >92		dB FS dB FS
Signal to Noise Ratio: A-weighted (Note 2) Un-weighted	SNR	Right Channel, 997Hz		>95 >92		dB FS dB FS
Line THD+N, Left Channel	THD+N	997 Hz @ -1 dB FS			0.063	%
Line THD+N, Right Channel	THD+N	997 Hz @ -1 dB FS			0.063	%
Audio Bandwidth	BW	@ -1 dB FS	10		20000	Hz
Pass Band Ripple		-1 dB FS 20 Hz - 20 kHz			±0.2	dB
Channel Level Difference		-1 dB FS 20 Hz - 20 kHz		<0.10		dB

Notes:

FS = Full Scale

1. All measurements are for 5 bit MPX encoding.
2. RX line out into a 10 kΩ Load.
3. All Tests Conducted with AES Filter "In" Unless Otherwise Specified.

5. RF Characteristics

The SoundCast 50RFM algorithm is described below paying special attention to include information pertinent to FCC and ETSI regulations. The SoundCast 50RFM software operates by selecting a palette (or group) of 15 random channels out of the total 38 to hop on. For the 15-channel palette, any channels with poor transmission rates are replaced with better channels from the remaining 23 unused channels. The hopping pattern from channel to channel is a random pattern. The following table describes some important aspects of the channel-hopping algorithm:

5.1 RF Characteristics - SoundCast 50RFM Transmitter and Receiver

Parameter	Symbol	Conditions	Min	Typical	Max	Unit
RF CHARACTERISTICS						
Transmission Method			ARQ with Adaptive FHSS			
Raw Data Rate	Rdr				1.536	Mbps
Channel Width	Fw			<2		MHz
Total Channels	CH				38	Ch
Hopping Channels	CHh			20		Ch
RF Coexistence		in range radius			4	sets
TX Output Power	Pout		13	14	15	dBm
DETAILED BANDWIDTH CHARACTERISTICS						
Hopping Rate				187.5		Hz
Frequency Dwell Time				5.333		ms
Audio TX: RF Transmit Time		Tx Node		4.594		ms
Audio RX: RF Transmit Time		Per Each Rx Node		0.219		ms
Frequency Range		FCC Test Method	2.40197		2.48002	GHz
Frequency Range (Total)				78.057		MHz
20 dB Channel BW				1.94		MHz
Distance to upper ISM band limit				3.476		MHz
Distance to lower ISM band limit				1.967		MHz

Center Frequencies			
Channel #	Center Frequency (GHz)	Channel #	Center Frequency (GHz)
0	2.403	19	2.442
1	2.405	20	2.444
2	2.407	21	2.446
3	2.409	22	2.448
4	2.412	23	2.450
5	2.414	24	2.452
6	2.416	25	2.455
7	2.418	26	2.457
8	2.420	27	2.459
9	2.422	28	2.461
10	2.424	29	2.463
11	2.426	30	2.465
12	2.428	31	2.467
13	2.430	32	2.469
14	2.432	33	2.471
15	2.434	34	2.473
16	2.436	35	2.475
17	2.438	36	2.477
18	2.440	37	2.479

6. Pin Description

6.1 Pin Description - SoundCast 50RFM Transmitter

SoundCast 50RFM Transmitter Pinout



Pin#	Pin Name	Analog I/O Function	Digital I/O Function	Description
1	RFVCC	RFVCC	RFVCC	RF Voltage Power Input
2	GND	GND	GND	RF Ground
3	GND	GND	GND	Digital Ground
4	VCC	VCC	VCC	Digital Power Input
5	/RESET	/RESET	/RESET	Reset Input (active low)
6	PB1 (CS0)	PB1	PB1	SPI0 Chip Select (CS0) PB1
7	MISO0	MISO0	MISO0	SPI0 Master Data Input MISO0 (FW default), or General Purpose I/O port PG0
8	MOSI0	MOSI0	MOSI0	SPI0 Master Data Output MOSI0 (FW default), or General Purpose I/O port PG3
9	SCK0	SCK0	SCK0	SPI0 Clock output SCK0 (FW default), or General Purpose I/O port PG2
10	PF0	SBA	SBA	General Purpose I/O port PF0, or Two Wire Serial Data
11	PF1	SCL	SCL	General Purpose I/O port PF1, or Two Wire Serial Clock
12	PC0	LEDB	LEDB	General Purpose I/O port PC0, or LEDB
13	PC1	LEDJ	LEDJ	General Purpose I/O port PC1, or LEDJ
14	PC4	RF Mate Button	RF Mate Button	General Purpose I/O port PC4, or RF Mating Button
15	PC5	PCS	MCLK	General Purpose I/O port PC5, or Master clock MCLK output
16	PC6	Vol. Down Button	Vol. Down Button	General Purpose I/O port PC6, or Volume Down Button
17	PC7	Vol. Up Button	Vol. Up Button	General Purpose I/O port PC7, or Volume Up Button
18	PI0	Mute Button	Mute Button	General Purpose I/O port PI0, or Mute Button
19	PI1	PI1	LCLK	General Purpose I/O port PI1, or Left-Right clock output LCLK
20	PI2	PI2	ADC Reset	General Purpose I/O port PI2, or ADC Reset
21	GND	GND	GND	Ground
22	AINR7 SDIO0	AINR	SDIO0	Audio line-input for Right Channel AINR, or Serial DASH Data Input/output SDIO0
23	AINL7 BCLK	AINL	BCLK	Audio line-input for Left Channel AINL, or Serial DASH Clock Input BCLK
24	GND	GND	GND	Ground
25	AVDD	AVDD	Inc. connect	Analog Power Input

6.2 Pin Description - SoundCast 50RFM Receiver

SoundCast 50RFM Receiver Pinout



Pin#	Pin Name	Analog I/O Function	Digital I/O Function	Description
1	RFVCC	RFVCC	RFVCC	RF Voltage Power Input
2	GND	GND	GND	RF Ground
3	GND	GND	GND	Digital Ground
4	VCC	VCC	VCC	Digital Power Input
5	RESET	RESET	RESET	Reset Input (active low)
6	PB1 (CS0)	PB1	PB1	SPi0 Chip Select (CS0) PB1
7	MISO0	MISO0	MISO0	SPi0 Master Data Input MISO0 (FW default), or GPIO port PG0
8	MOSI0	MOSI0	MOSI0	SPi0 Master Data Output MOSI0 (FW default), or GPIO port PG1
9	SCK0	SCK0	SCK0	SPi0 Clock output SCK0 (FW default), or GPIO port PG2
10	PF0	SDA	SDA	General Purpose IO port PF0, or Two Wire Serial Data
11	PF1	SCL	SCL	General Purpose IO port PF1, or Two Wire Serial Clock
12	PC0	Mute LED	Mute LED	General Purpose IO port PC0, or Mute LED
13	PC1	Bond LED	Bond LED	General Purpose IO port PC1, or Bond LED
14	PC4	PC4	PC4	General Purpose IO port PC4
15	PC5	Mute Button	Mute Button	General Purpose IO port PC5, or Mute Button
16	PC6/ MCLK	PC6	MCLK	General Purpose IO port PC6, or MCLK output
17	PC7	Amp Disable	Amp Disable	General Purpose IO port PC7, or Amp Disable
18	PI0	Vol. Down Button	Vol. Down Button	General Purpose IO port PI0, or Volume Down Button
19	PI1/ LRCK	PI1	LRCK	General Purpose IO PI1, or Left-Right Clock (LRCK)
20	PI2	Vol. Up Button	Vol. Up Button	General Purpose IO PI2, or Vol. Up Button
21	GND	GND	GND	Ground
22	AQUTR/ SDIOD	AQUTR	SENDD	Audio line-out for Right Channel AQUTR, or Serial DASE Data input/output SDIOD
23	AQUTL/ BCLK	AQUTL	BCLK	Audio line-out for Left Channel AQUTL, or Serial DASE Bit Clock output BCLK
24	GND	GND	GND	Ground
25	AVDD	AVDD	(no connect)	Analog Power Input

7. Information to User

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.

This equipment has been tested and found to comply with the limits for Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the



equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

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

8. Human Exposure Compliance Statement

KSC Industries, Inc. certifies that it has determined that the 50RFM complies with the RF hazard requirements applicable to transmitting equipment operating under the authority of 47 CFR Part 15, Subpart C of the FCC Rules and Regulations. This determination is dependent upon installation, operation and use of the equipment in accordance with all instructions provided. The 50RFM is designed for and intended to be used in fixed and mobile applications. "Fixed" means that the device is physically secured at one location and is not able to be easily moved to another location. "Mobile" means that the device is designed to be used in other than fixed locations and generally in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter's antenna and the body of the user or nearby persons. The EUT is not designed for or intended to be used in portable applications (within 20 cm of the body of the user) and such uses are strictly prohibited. To ensure that the 50RFM complies with current FCC regulations limiting both maximum RF output power and human exposure to radio frequency radiation, a separation distance of at least 20 cm must be maintained between the unit's antenna and the body of the user and any nearby persons at all times and in all applications and uses.