



**soundcast**

# **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
<b>POWER CONSUMPTION</b>						
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	I <sub>VCC</sub>	VCC = 3.3 V		53	48	mA
Analog Current <sup>1</sup>	I <sub>AVDD</sub>	AVDD = 3.25 V		18		mA
RF Current	I <sub>RFVCC</sub>	VCC = 3.4 V		140	121	mA
RF Current Duty Cycle	D <sub>C</sub> I <sub>RFVCC</sub>	Transmit Mode: Receive Mode:		92		%
<b>LOGIC THRESHOLDS</b>						
Input Low Voltage Threshold	V <sub>IL</sub>	VCC = 3.3 V			0.8	V
Input High Voltage Threshold	V <sub>IH</sub>	VCC = 3.3 V	2.0			V
Output Low Voltage Threshold	V <sub>OL</sub>	VCC = 3.3 V			0.4	V
Output High Voltage Threshold	V <sub>OH</sub>	VCC = 3.3 V	2.4			V
Input Leakage Current	I <sub>IN</sub>	VCC = 3.3 V	-10	-1	10	µA
<b>TEMPERATURE</b>						
Operating Temperature	T <sub>A</sub>	All Power Ranges	0		60	°C
<b>Standard Data Channel</b>						
Raw Data Output Rate		Tx to Rx		1.125		kbps
Two Wire Serial Interface		Tx to Rx		1		kbps
<b>Extended Data Channel</b>						
Raw Data Output Rate		Tx to Rx		72		kbps
Two Wire Serial Interface		Tx to Rx		30		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 T<sub>A</sub>=25°C.

#### 3.2 Absolute Maximum Ratings – SoundCast 50RFM Transmitter

Parameter	Symbol	Value	Unit	Note
RF Power	RFVCC	3.6	V	
Digital Power	VCC	3.63	V	
ADC Power	AVDD	6	V	
Digital Input Pin Absolute Maximum Input Voltage	I <sub>GPOX</sub> , I <sub>D</sub> _DATA, I <sub>D</sub> _CLK, /RESET, MTS00, CS0	3.63	V	I/O Inputs are not 5 V tolerant.

### 3.3 Operating Conditions – SoundCast 50RFM Receiver

Parameter	Symbol	Condition	Min	Typical	Max	Unit		
			25 m	50 m	25 m	50 m	25 m	50 m
<b>POWER CONSUMPTION</b>								
Digital Power Supply	VCC		3.0	3.3	3.6	V		
DAC Power Supply*	AVDD		3.0	3.3	3.6	V		
RF Power Supply	RFVCC		3.0	3.3	3.6	V		
Digital Current	Idc	VCC = 3.325 V		42 44		mA		
Analog Current*	Avdd	AVDD = 3.27 V		15.5		mA		
RF Current	Irfvcc	VCC = 3.4 V		68 70		mA		
RF Current Duty Cycle	DCCRfvcc	Transmit Mode: Receive Mode:		4 36		%		
<b>LOGIC THRESHOLDS</b>								
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	Pin	VCC = 3.3 V	-10	± 1	10	µA		
<b>TEMPERATURE</b>								
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
RF Power	RFVCC	3.6	V	
Digital Power	VCC	3.63	V	
DAC Power	AVDD	6	V	
Digital Input Pin Absolute Maximum Input Voltage	GPDI <sub>X</sub> , ID_DATA, ID_CLICK, /RESET, MISO0, 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, 997 Hz		>95 >92		dB FS dB FS
Line THD+N, Left Channel	THD+N	997 Hz @ -1 dB FS			0.062	%
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
<b>RF CHARACTERISTICS</b>						
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
<b>DETAILED BANDWIDTH CHARACTERISTICS</b>						
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	SPI1 (CS0)	P8.1	P8.1	SPI1 Chip Select (CS0) #51
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 PG1
9	SCK0	SCK0	SCK0	SPI0 Clock output SCK0 (FW default), or General Purpose I/O port PG2
10	PFO	S0A	S0A	General Purpose I/O port PFO, or Two Wire Serial Data
11	PFI	SCL	SCL	General Purpose I/O port PFI, or Two Wire Serial Clock
12	PC0	LED0	LED0	General Purpose I/O port PC0, or LED0
13	PCI	LED1	LED1	General Purpose I/O port PCI, or LED1
14	PC4	RF Mate Button	RF Mate Button	General Purpose I/O port PC4, or RF Mating Button
15	PC5	P0S	MCLK	General Purpose I/O port PC5, or Mastedclock 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	P10	Mute Button	Mute Button	General Purpose I/O port P10, or Mute Button
19	P11	P11	L8CK	General Purpose I/O port P11, or Left-Right clock output L8CK
20	P12	P12	ADC Reset	General Purpose I/O port P12, or ADE Reset
21	GND	GND	GND	Ground
22	AINR/ SDIO0	AINR	SDIO0	Audio line-input for Right Channel AINR, or Serial DAS-Data Input/Output SDIO0
23	AINL/ SDIO1	AINL	SDIO1	Audio line-input for Left Channel AINL, or Serial DAS-Data Clock Input SDIO1
24	GND	GND	GND	Ground
25	AVDD	AVDD	Not connected	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	PBI (CS0)	PBI	PBI	SPI0 Chip Select (CS0) PBI
7	MISO0	MISO0	MISO0	SPI0 Master Data Input MISO0 (FW default), or GPIO port P00
8	MOSI0	MOSI0	MOSI0	SPI0 Master Data Output MOSI0 (FW default), or GPIO port P01
9	SCK0	SCK0	SCK0	SPI0 Clock Output SCK0 (FW default), or GPIO port P02
10	PFO	SDA	SDA	General Purpose IO port PFO, 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	Board LED	Board LED	General Purpose IO port PC1, or Board 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	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	P10	Vol. Down Button	Vol. Down Button	General Purpose IO port P10, or Volume Down Button
19	P11	P11	LCK	General Purpose IO P11, or Left-Night Clock (LCK)
20	P12	Vol. Up Button	Vol. Up Button	General Purpose IO P12, or Vol. Up Button
21	GND	GND	GND	Ground
22	ACUTR	ACUTR	SDHD0	Audio line-out for Right Channel ACUTR, or Serial DASH-Data Input/Output SDHD0
23	ACUTL	ACUTL	BCLK	Audio line-out for Left Channel ACUTL, or Serial DASH-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.