

# Communications Baseband Transceiver Data Sheet

MSCBT

## Description

The MSCBT IC is a CMOS chip that has the analog signal processing functions required by cellular phones and radio and other full duplex and half duplex devices.

The MSCBT integrated circuit allows bi-directional transmit and receive gain volume and filtering for the voice band. In addition, the MSCBT provides the filter needed for Continuous Tone Control Squelch System (CTCSS) and Continuous Digital Control Squelch System (CDCSS) generation and detection. A comparator in the MSCBT allows for the recovered squelch or DTMF tones to be applied to a microcontroller for decoding.

An internal highpass filter attenuates the tones from the voice band, by 50 dB, preventing voice from effecting tone transmission. A limiter increases the voice signals to be transmitted to 2Vpp for more effective modulation. The transmit output is filtered to a selectable 2.55 or 3kHz bandwidth before gain adjusts. A differential output is provided for interface with a variety of FM transmitter choices.

The MSCBT will operate from 3.3 V to 5.5 VDC. The MSCBT is available in a 32 pin 7x7mm LQFP.

## Features

- Function down to 3.3 VDC
- Low Power Consumption
- 50 CTCSS Squelch Tones filtered
- CDCSS Code filter
- Programmable filter for pre-detection filtering
- Comparator for direct uP interface of detected signals

## Applications

- Family Radio Service (FRS) 2-way Radio
- Land Mobile Radio (LMR) 2 way Radios
- General Mobile Radio Service (GMRS) 2 way Radios
- Low Power Radio Service (LPRS) 2 way Cellular
- Non-standard Voice-band communications
- Wired and Wireless Intercom
- Half-Duplex Speakerphone Analog Signal Processing
- Full-Duplex Speakerphone Analog Signal Processing

## Absolute Maximum Ratings

Power Supply Voltage	+6v
Storage Temperature	-60 to +150°C
Operating Temperature	-20 to +85°C

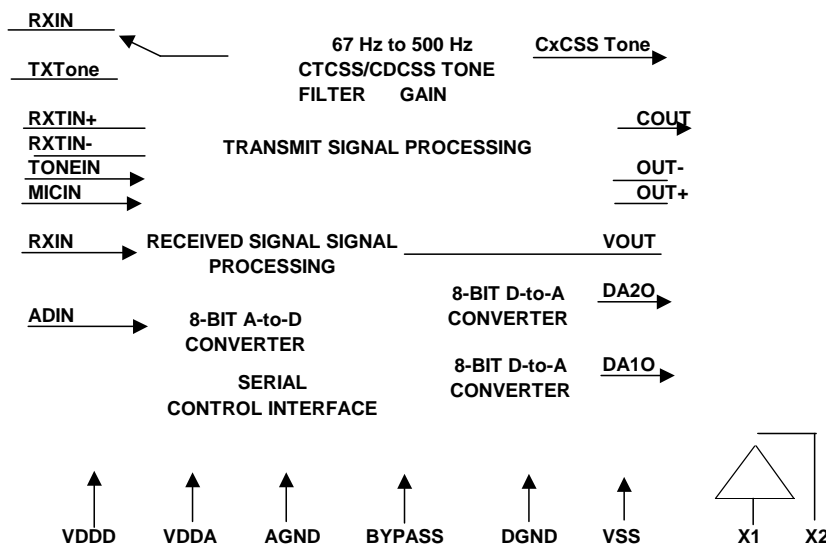


Figure 1: MSCBT Block Diagram

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## Electrical Characteristics

(VDD = +3.3V, T = 25° C)

MSCBT

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC Specifications</b>						
Operating Voltage	VDD		3.3	5.0	5.5	V
Supply Current	IDD				4.0	mA
Power Down Current	IDD <sub>PD</sub>			300	500	uA
Analog Ref. Voltage	VREF			0.5*VDD		V
Input Voltage Low	VIL			0.3*VDD		V
Input Voltage High	VIH			0.7*VDD		V
Output Voltage Low	VOL			0.3		V
Output Voltage High	VOH			0.8*VDD		V
Input Current				10		uA
Output Current High	IOH			200		uA
Output Current Low	IOL			2		mA
<b>AC Specifications</b>						
Serial Data Clock Rate				0.2		MHz
CTCSS Passband Gain		250 Hz	-1		1	dB
CTCSS Stopband Gain		500 Hz			-35	dB
Speech Filter Passband Gain			-1		1	dB
Speech Filter Stopband Gain						
Master Clock Frequency				3.57955		MHz

## Application Information

The MSCBT is controlled by a serial data word which contains both the address and data in a single 16 bit string. Figure 3 shows the timing of the Serial data clock, sync pulse and data I/O. For Analog to Digital conversion, the data port changes from input to output when the ADC is read and with the transition of high to low of ENBL. Figure 4 gives the details. Note that the I/O connected to DATA must switch from output to input after the first cycle after ENBL going low.

Note that to simplify the text the CTCSS and CDCSS filters are referred to as CxCSS filters.

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Block Diagram \_\_\_\_\_

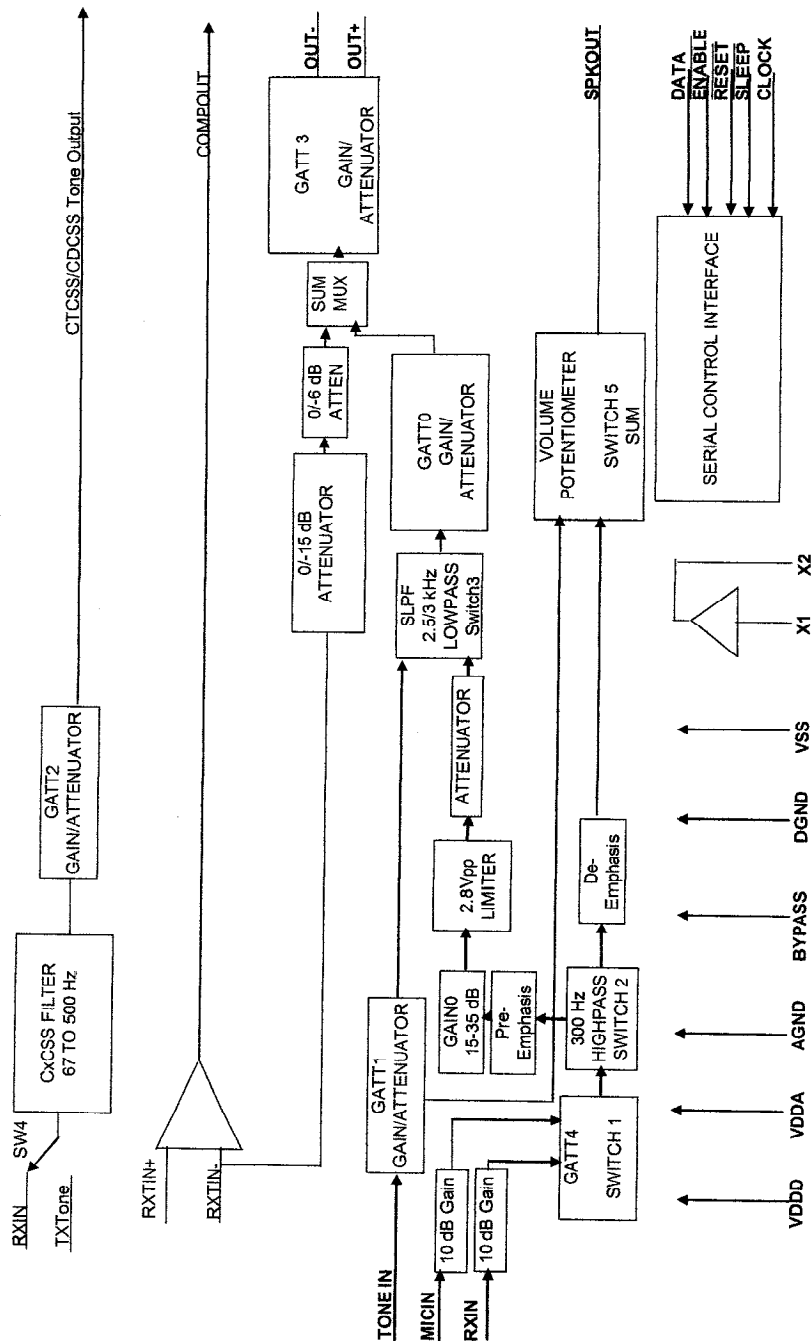


Figure 2: MSCBT Detailed Block Diagram

**MSCBT**

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## MSCBT

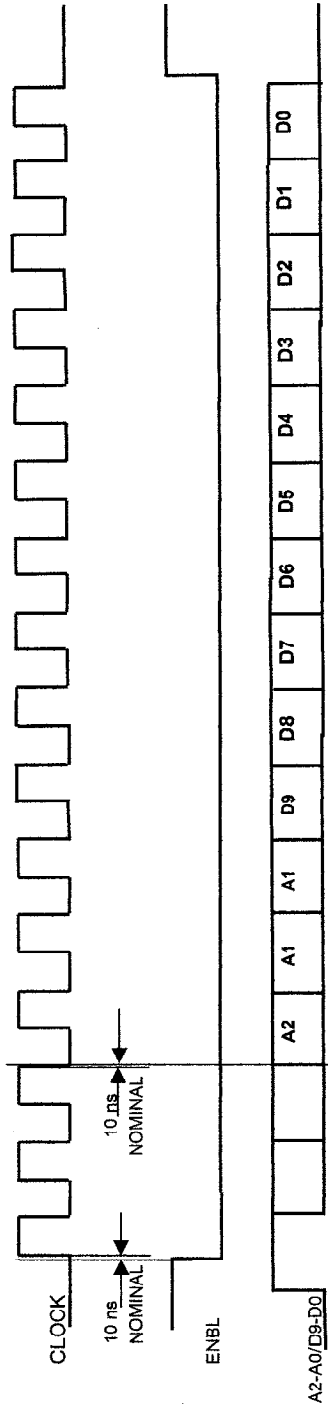


Figure 3: MSCBT Read Timing Diagram

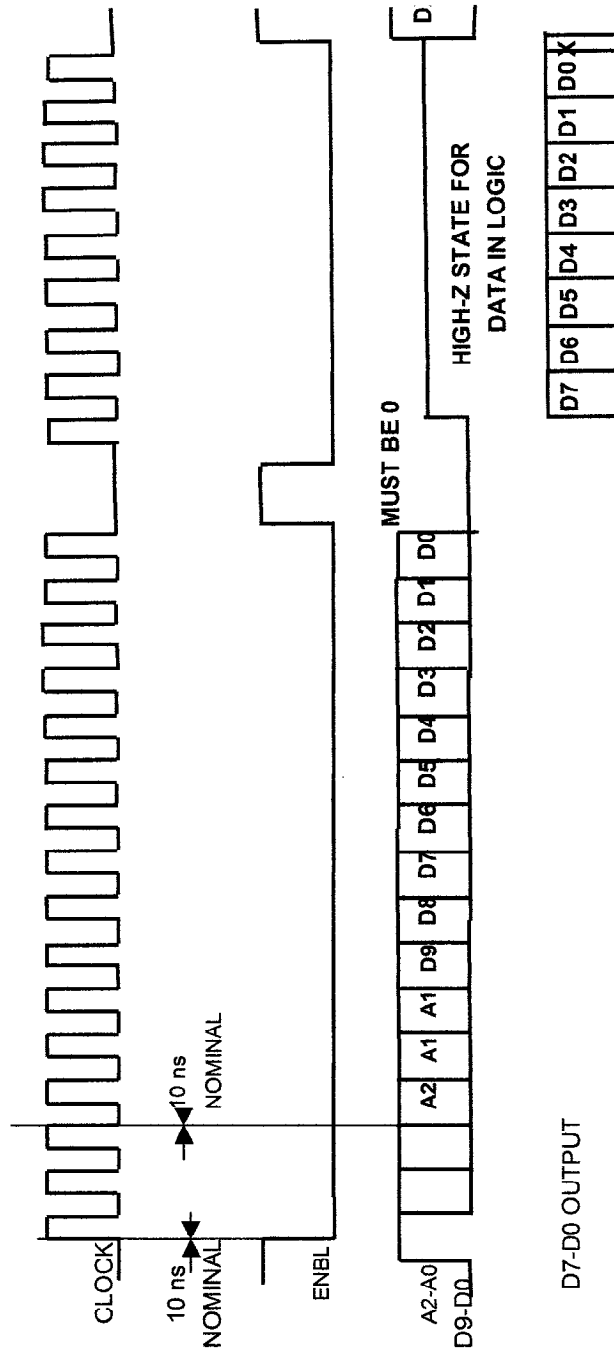


Figure 4: MSCBT Write Timing Diagram

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## Serial Interface Registers \_\_\_\_\_

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ADDRESS						DATA									
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	X	X	0	0	0	GATT4				SW2		SW1	SW5	X	X
1	X	X	0	0	1	GAIN0			LIMITER		POTVOL				X
1	X	X	0	1	0	GATTO				SW3	SLPF	GATT1			
1	X	X	0	1	1	SW4	GATT2				CXCSSFILTER				
1	X	X	1	0	0	X	X	X	X	X	ATTN	TXSUM		X	X
1	X	X	1	0	1	GATT3				X	X	X	X	X	
1	X	X	1	1	0	ADAC	DAC								X
1	X	X	1	1	1	0	0	ANALOG TO DIGITAL CONVERTER WRITE (DON'T CARE)							

	R/W	D7	D6	D5	D4	D3	D2	D1	D0
A/D CONVERTER OUTPUT	0	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA

## Register 0 \_\_\_\_\_

ADDRESS						DATA													
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	GATT4	D5	D4	SWITCH 2	D3	SWITCH 1	D2	SWITCH 5	D1	D0
1	X	X	0	0	0	0	0	0	0	-4.0	0	0	RX with DE	0	OFF	0	OFF	X	X
1	X	X	0	0	0	0	0	0	1	-3.5	0	1	RX FLAT	1	ON	1	ON	X	X
1	X	X	0	0	0	0	0	1	0	-3.0	1	0	TX with PE						
1	X	X	0	0	0	0	0	1	1	-2.5	1	1	TX FLAT						
1	X	X	0	0	0	0	1	0	0	-2.0									
1	X	X	0	0	0	0	1	0	1	-1.5									
1	X	X	0	0	0	0	1	1	0	-1.0									
1	X	X	0	0	0	0	1	1	1	-0.5									
1	X	X	0	0	0	1	0	0	0	-0.0									
1	X	X	0	0	0	1	0	0	1	+0.5									
1	X	X	0	0	0	1	0	1	0	+1.0									
1	X	X	0	0	0	1	0	1	1	+1.5									
1	X	X	0	0	0	1	1	0	0	+2.0									
1	X	X	0	0	0	1	1	0	1	+2.5									
1	X	X	0	0	0	1	1	1	0	+3.0									
1	X	X	0	0	0	1	1	1	1	+3.5									

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**Register 1** \_\_\_\_\_

ADDRESS										DATA									
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	D5	LIMM	D4	D3	D2	D1	POTENTIOMETER VOLUME	D0		
1	X	X	0	0	1	0	0	0	+0.0 dB	0	0	-2.4 dB	0	0	0	MUTE	X		
1	X	X	0	0	1	0	0	1	+15.0	0	1	-4.2	0	0	0	-2.5 dB	X		
1	X	X	0	0	1	0	1	0	+18.3	1	0	-6.0	0	0	1	-5	x		
1	X	X	0	0	1	0	1	1	+21.7	1	1	-7.8	0	0	1	-7.5	x		
1	X	X	0	0	1	1	0	0	+25.0				0	1	0	-10.0	x		
1	X	X	0	0	1	1	0	1	+28.3				0	1	0	-12.5	x		
1	X	X	0	0	1	1	1	0	+31.7				0	1	1	-15.0	x		
1	X	X	0	0	1	1	1	1	+35.0				0	1	1	-17.5	x		
1	X	X	0	0	1	1	0	0					1	0	0	-20.0	x		
1	X	X	0	0	1	1	0	0					1	0	0	-22.5	x		
1	X	X	0	0	1	1	0	1					1	0	1	-25.0	x		
1	X	X	0	0	1	1	0	1					1	0	1	-27.5	x		
1	X	X	0	0	1	1	1	0					1	1	0	-30.0	X		
1	X	X	0	0	1	1	1	0					1	1	0	-32.5	X		
1	X	X	0	0	1	1	1	1					1	1	1	-35.0	X		
1	X	X	0	0	1	1	1	1					1	1	1	-37.5	X		

**Register 2** \_\_\_\_\_

ADDRESS										DATA									
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	GATT0	D5	SWITCH 3	D4	SLPF	D2	D1	D0	GATT1	
1	X	X	0	1	0	0	0	0	0	-4.0	0	LIMITER	0	3kHz	0	0	0	0.0 dB	
1	X	X	0	1	0	0	0	0	1	-3.5	1	GATT1	1	2.55 kHz	0	0	0	0.5	
1	X	X	0	1	0	0	0	1	0	-3.0					0	0	1	1.0	
1	X	X	0	1	0	0	0	1	1	-2.5					0	0	1	1.5	
1	X	X	0	1	0	0	1	0	0	-2.0					0	1	0	2.0	
1	X	X	0	1	0	0	1	0	1	-1.5					0	1	0	2.5	
1	X	X	0	1	0	0	1	1	0	-1.0					0	1	1	3.0	
1	X	X	0	1	0	0	1	1	1	-0.5					0	1	1	3.5	
1	X	X	0	1	0	1	0	0	0	-0.0					1	0	0	4.0	
1	X	X	0	1	0	1	0	0	1	+0.5					1	0	0	4.5	
1	X	X	0	1	0	1	0	1	0	+1.0					1	0	1	5.0	
1	X	X	0	1	0	1	0	1	1	+1.5					1	0	1	5.5	
1	X	X	0	1	0	1	1	0	0	+2.0					1	1	0	6.0	
1	X	X	0	1	0	1	1	0	1	+2.5					1	1	0	6.5	
1	X	X	0	1	0	1	1	1	0	+3.0					1	1	1	7.0	
1	X	X	0	1	0	1	1	1	1	+3.5					1	1	1	7.5	

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**Register 3**

ADDRESS										DATA								
R/W	A4	A3	A2	A1	A0	D9	SW4	D8	D7	D6	D5	GATT2	D4	D3	D2	D1	D0	CxCSS FILTER
1	X	X	0	1	1	0	RDIN	0	0	0	0	-3.0 dB	0	0	0	0	0	50 Hz
1	X	X	0	1	1	1	TDIN	0	0	0	1	-2.5	0	0	0	0	1	59.2
1	X	X	0	1	1			0	0	1	0	-2.0	0	0	0	1	0	69.6
1	X	X	0	1	1			0	0	1	1	-1.5	0	0	0	1	1	80
1	X	X	0	1	1			0	1	0	0	-1.0	0	1	0	0	0	88.9
1	X	X	0	1	1			0	1	0	1	-0.5	0	1	0	0	1	100
1	X	X	0	1	1			0	1	1	0	+0.0	0	1	0	1	0	110.3
1	X	X	0	1	1			0	1	1	1	+0.5	0	1	0	1	1	118.5
1	X	X	0	1	1			1	0	0	0	+1.0	0	1	1	0	0	128
1	X	X	0	1	1			1	0	0	1	+1.5	0	1	0	0	1	139.1
1	X	X	0	1	1			1	0	1	0	+2.0	0	1	0	1	0	150
1	X	X	0	1	1			1	0	1	1	+2.5	0	1	0	1	1	160
1	X	X	0	1	1			1	1	0	1	+12.0	0	1	1	0	0	168.4
1	X	X	0	1	1			1	1	1	0	+12.5	0	1	1	0	1	177.8
1	X	X	0	1	1			1	1	1	0	+13.0	0	1	1	1	0	188.2
1	X	X	0	1	1			1	1	1	1	+13.5	0	1	1	1	1	200
1	X	X	0	1	1								1	0	0	0	0	206.4
1	X	X	0	1	1								1	0	0	0	1	220.7
1	X	X	0	1	1								1	0	0	1	0	228.6
1	X	X	0	1	1								1	0	0	1	1	237
1	X	X	0	1	1								1	0	1	0	0	246.1
1	X	X	0	1	1								1	0	1	0	1	256
1	X	X	0	1	1								1	0	1	1	0	266
1	X	X	0	1	1								1	0	1	1	1	278.3
1	X	X	0	1	1								1	1	0	0	0	290.9
1	X	X	0	1	1								1	1	0	0	1	300
1	X	X	0	1	1								1	1	0	1	0	UNDEFINED
1	X	X	0	1	1								1	1	0	1	1	UNDEFINED
1	X	X	0	1	1								1	1	1	0	0	UNDEFINED
1	X	X	0	1	1								1	1	1	0	1	UNDEFINED
1	X	X	0	1	1								1	1	1	1	0	UNDEFINED
1	X	X	0	1	1								1	1	1	1	1	UNDEFINED

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**Register 4** \_\_\_\_\_

ADDRESS										DATA							
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	D5	D4	ATTN	D3	D2	TXSUM	D1	D0
1	X	X	1	0	0	X	X	X	X	X	0	0	0	0	MUTE	X	X
1	X	X	1	0	0	X	X	X	X	X	1	-6	0	1	TX AUDIO 0dB	X	X
1	X	X	1	0	0	X	X	X	X	X			1	0	SUBAUDIO 0dB	X	X
1	X	X	1	0	0	X	X	X	X	X			1	1	TX AUDIO 0dB	X	X
															SUM SUB AUDIO	-15.6	dB

**Register 5** \_\_\_\_\_

ADDRESS										DATA							
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	D5	GATT3	D4	D3	D2	D1	D0	
1	X	X	1	0	1	0	0	0	0	0	-4.00 dB	X	X	X	X	X	
1	X	X	1	0	1	0	0	0	0	1	-3.75	X	X	X	X	X	
1	X	X	1	0	1	0	0	0	1	0	-3.50	X	X	X	X	X	
1	X	X	1	0	1	0	0	0	1	1	-3.25	X	X	X	X	X	
1	X	X	1	0	1	0	0	1	0	0	-3.00	X	X	X	X	X	
1	X	X	1	0	1	0	0	1	0	1	-2.75	X	X	X	X	X	
1	X	X	1	0	1	0	0	1	1	0	-2.50	X	X	X	X	X	
1	X	X	1	0	1	0	0	1	1	1	-2.25	X	X	X	X	X	
1	X	X	1	0	1	0	1	0	0	0	-2.00	X	X	X	X	X	
1	X	X	1	0	1	0	1	0	0	1	-1.75	X	X	X	X	X	
1	X	X	1	0	1	0	1	0	1	0	-1.50	X	X	X	X	X	
1	X	X	1	0	1	0	1	0	1	1	-1.25	X	X	X	X	X	
1	X	X	1	0	1	0	1	1	0	0	-1.00	X	X	X	X	X	
1	X	X	1	0	1	0	1	1	0	1	-0.75	X	X	X	X	X	
1	X	X	1	0	1	0	1	1	1	0	-0.50	X	X	X	X	X	
1	X	X	1	0	1	0	1	1	1	1	-0.25	X	X	X	X	X	
1	X	X	1	0	1	1	0	0	0	0	-0.00	X	X	X	X	X	
1	X	X	1	0	1	1	0	0	0	1	+0.25	X	X	X	X	X	
1	X	X	1	0	1	1	0	0	1	0	+0.50	X	X	X	X	X	
1	X	X	1	0	1	1	0	0	1	1	+0.75	X	X	X	X	X	
1	X	X	1	0	1	1	0	1	0	0	+1.00	X	X	X	X	X	
1	X	X	1	0	1	1	0	1	0	1	+1.25	X	X	X	X	X	
1	X	X	1	0	1	1	0	1	1	0	+1.50	X	X	X	X	X	
1	X	X	1	0	1	1	0	1	1	1	+1.75	X	X	X	X	X	
1	X	X	1	0	1	1	1	0	0	0	+2.00	X	X	X	X	X	
1	X	X	1	0	1	1	1	0	0	1	+2.25	X	X	X	X	X	
1	X	X	1	0	1	1	1	0	1	0	+2.50	X	X	X	X	X	
1	X	X	1	0	1	1	1	0	1	1	+2.75	X	X	X	X	X	
1	X	X	1	0	1	1	1	1	0	0	+3.00	X	X	X	X	X	
1	X	X	1	0	1	1	1	1	0	1	+3.25	X	X	X	X	X	
1	X	X	1	0	1	1	1	1	1	0	+3.50	X	X	X	X	X	
1	X	X	1	0	1	1	1	1	1	1	+3.75	X	X	X	X	X	



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**Register 6** \_\_\_\_\_

ADDRESS										DATA								
R/W	A4	A3	A2	A1	A0	D9	DAC	D8	D7	D6	D5	D4	D3	D2	D1	DAC2 OUTPUT	DAC1 OUTPUT	D0
1	X	X	1	1	0	0	DAC1	0	0	0	0	0	0	0	0	LAST SETTING	0.0 V	X
1	X	X	1	1	0	0	DAC1	0	0	0	0	0	1	0	0	LAST SETTING	0.052	X
1	X	X	1	1	0	0	DAC1	0	0	0	0	1	0	0	0	LAST SETTING	0.103	X
1	X	X	1	1	0	0	DAC1	0	0	0	1	0	0	0	0	LAST SETTING	0.2063	X
1	X	X	1	1	0	0	DAC1	0	0	1	0	0	0	0	0	LAST SETTING	0.413	X
1	X	X	1	1	0	0	DAC1	0	1	0	0	0	0	0	0	LAST SETTING	0.826	X
1	X	X	1	1	0	0	DAC1	1	0	0	0	0	0	0	0	LAST SETTING	1.60	X
1	X	X	1	1	0	0	DAC1	1	1	1	1	1	1	1	1	LAST SETTING	3.30	X
1	X	X	1	1	0	1	DAC2	0	0	0	0	0	0	0	0	0.0V	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	0	0	0	0	0	1	0	0	0.052	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	0	0	0	0	1	0	0	0	0.103	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	0	0	0	1	0	0	0	0	0.2063	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	0	0	1	0	0	0	0	0	0.413	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	0	1	0	0	0	0	0	0	0.826	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	1	0	0	0	0	0	0	0	1.65	LAST SETTING	X
1	X	X	1	1	0	1	DAC2	1	1	1	1	1	1	1	1	3.3	LAST SETTING	X

**Register 7** \_\_\_\_\_

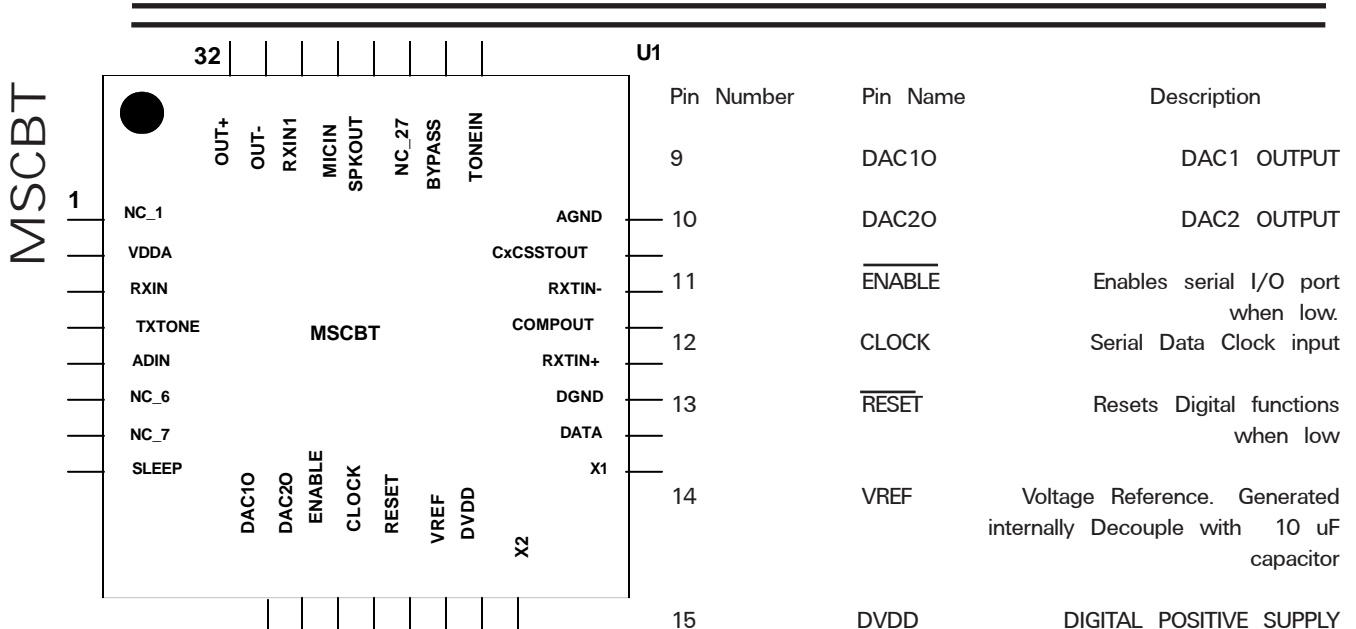
ADDRESS										DATA							
R/W	A4	A3	A2	A1	A0	D9	D8	D7	D6	D5	D4	D3	D2	D1	D1	D0	
1	X	X	1	1	1	0	0	X	X	X	X	X	X	X	X	X	

**Read Analog to Digital Converter** \_\_\_\_\_

OUTPUT/INPUT CONTROL		DATA							
R/W	D7	D6	D5	D4	D3	D2	D1	D1	D0
0	MSB	DATA	DATA	DATA	DATA	DATA	DATA	DATA	LSB

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# Communications Baseband Transceiver Data Sheet



**Pin Descriptions**

Pin Number	Pin Name	Description
1	NC_1	DO NOT CONNECT TO THIS PIN. For testing only
2	VDDA	Positive Analog Supply. Nominally 3.30 VDC. Decouple with 0.1 uF cap.
3	RXIN	Receive signal pin input. This is the input for CTCSS or CDCSS filtering.
4	TXTONE	Transmit modulation signal input Squarewave CTCSS or CTCSS data filter input.
5	ADIN	Analog to Digital converter input
6	NC_6	DO NOT CONNECT TO THIS PIN. For testing only
7	NC_7	DO NOT CONNECT TO THIS PIN. For testing only
8	SLEEP	Power down when Low
9	DAC10	DAC1 OUTPUT
10	DAC20	DAC2 OUTPUT
11	ENABLE	Enables serial I/O port when low.
12	CLOCK	Serial Data Clock input
13	RESET	Resets Digital functions when low
14	VREF	Voltage Reference. Generated internally Decouple with 10 uF capacitor
15	DVDD	DIGITAL POSITIVE SUPPLY A 0.1 uF decoupling capacitor is needed. nominally 3.3VDC
16	X2	CRYSTAL OSCILLATOR OUTPUT 3.579545 MHz crystal is tied to this pin
17	X1	CRYSTAL OSCILLATOR INPUT 3.579545 MHz crystal is tied to this pin
18	DATA	SERIAL DATA I/O This input becomes an output when reading A/D converter
19	DGND	DIGITAL GROUND. Tie to OVdc
20	RXTIN+	POSITIVE COMPARATOR INPUT
21	COMPOUT	COMPARATOR OUTPUT
22	RXTIN-	NEGATIVE COMPARATOR INPUT
23	CxCSSTOUT	TONE FILTER OUTPUT
24	AGND	ANALOG GROUND (OVdc)
25	TONEIN	CxCSS or DTMF TONE TRANSMISSION INPUT
27	AGND	ANALOG GROUND (OVdc)
28	BYPASS	TIE 10 uF CAPACITOR TO AGND





## Communications Baseband Transceiver Data Sheet

MSCBT

Mixed Signal Integration  
2157-50 O'Toole Avenue  
San Jose, California 95131-1332  
Phone: (408)-434-6305  
Fax: (408)-434-6417

IF YOUR STATE OR COUNTRY IS NOT LISTED BELOW, PLEASE CONTACT MSI DIRECTLY

In Mississippi, Alabama, Georgia  
South Carolina, North Carolina, and  
Tennessee contact:

AdeptRep  
280 Metaire Lane  
Madison, Alabama 35758  
Telephone: 256-772-1922  
Facsimile: 256-325-2841  
Toll Free: 1-888-419-2563  
Web site: www.adeptrep.com

In Arizona, Utah, Colorado, Montana,  
Wyoming, New Mexico  
contact:

Mountain View Technical Sales  
21744 Saddlebrook Drive  
Parker, CO 80130  
Telephone: 303-888-2935  
E-mail: Greg@mvts.co  
Web Site: www.mvts.co

In Hong Kong and the People's  
Republic of China contact:

Alphatron  
282, King's Rd.,  
13th Floor, Flat C2,  
North Point Centre, North Point  
Hong Kong  
H.K. Telephone: 852-9453-2305  
China Telephone: 86 1392 3826 400  
Facsimile: 852-22491-1365 or  
852-2900-3616

In Korea contact:

H. B. Corp.  
#1809, Seocho World Officetel 1355-3  
Seocho-Dong, Seocho-Gu,  
Seoul, Korea 137-070  
Telephone: (02)3472-3450  
Facsimile: (02)3472-3458  
Website: www.hbcorp.co.kr

In Singapore, Indonesia and  
Malaysia contact:

EXER Technologies (S) PTE LTD  
7030 Ang Mo Kio Avenue 5 #03-61  
Northstar @ AMK Singapore 569880  
Telephone: (65)-6-747-9669  
Facsimile: (65)-6-749-9669

In Israel contact:

Phoenix Technologies Ltd.  
3 Gavish St.  
Kfar-Saba, 44424  
Israel  
Telephone: 09-764-4800  
Facsimile: 09-764-4801  
Website: www.phnx.co.il

In Taiwan contact

Maxtek Technology Co., Ltd.  
5F, No. 13-20, Sec. 6, Min Chian E Road, Nei Hu  
Taipei, 114 R.O.C.  
Telephone: 886-2-2794-6060  
Facsimile: 886-2-2879-8922

In the United Kingdom contact:

Broadband Technology 2000 Ltd  
Victory House  
Marino Way  
Finchampstead  
Berkshire  
RG40 4RF  
U. K.  
Telephone: +44 (0) 118 932 4600  
Facsimile: +44 (0) 118 973 0571  
E-mail: sales@bt2000.co.uk  
Web site: www.bt2000.co.uk

In Germany, Austria and Switzerland

Marbach Elektronik GmbH  
Landingstr. 28/30  
D-63739 Aschaffenburg  
Germany  
Telephone: 49 6021 581786 -0  
Facsimile: 49 6021 581786 -3  
Email: info@marbach-elektronik.de  
Web site: www.marbach-elektronik.de

Catch our web site at "<http://www.mix-sig.com>"

Send us e-mail at "[info@mix-sig.com](mailto:info@mix-sig.com)"

