

# DATA SHEET

## **SA9503**

Dual-band, CDMA/AMPS LNA  
and downconverter mixers

Objective specification  
Supersedes data of 1999 Jul 06

1999 Jul 29

# Dual-band, CDMA/AMPS LNA and downconverter mixers

SA9503

## DESCRIPTION

The SA9503 is an integrated CDMA/AMPS low noise amplifier (LNA) plus a downconverter, for both the 900 MHz Cellular band and the 1.9 GHz PCS band. The LNA incorporates 5 settings of digitally selected stepped gain in the Cellular band and in the PCS band. One of the modes (high linearity mode) in each of the Cellular and PCS bands, includes a high IP3 setting in order to meet the 1-tone CDMA desensitization test. The gain, noise figure and IP3 for the remaining 4 low current modes in the Cellular band, are designed in order to have sufficient separation between the antenna power levels at which the LNA gains are changed, based on multi-tone interference levels. A 3 dB overlap is allowed in the antenna power levels for the adjacent modes. Table 1 indicates a typical scenario.

The downconverter portion is based on our SA9502 and is designed to meet all the stringent spurious rejections that are required in the Cellular and PCS bands. There are three individual mixer blocks, each optimized for high linearity with low power consumption for operation in one of the following modes: 1900 MHz PCS CDMA, 800 MHz Cellular CDMA, or 800 MHz analog FM AMPS/TACS modes.

The circuit has been designed in our advanced QUBiC3 BiCMOS process with 30 GHz  $f_T$ .

## FEATURES

### Versatile step gain LNA

- Can meet single tone CDMA desensitization requirements
- Can meet CDMA two tone interference requirements
- Cellular

PARAMETER	MODE				
	CEL_L	CEL_1	CEL_2	CEL_3	CEL_4
Gain (dB)	17	15.5	9	3	-4
Noise figure (dB)	2	1.6	1.9	4.5	11
Input IP3 (dBm)	5.5	-2	-3.5	2	15
Current (mA)	13.2	4.9	4.9	4.9	3.7

- PCS

PARAMETER	MODE				
	PCS_L	PCS_1	PCS_2	PCS_3	PCS_4
Gain (dB)	15.2	14.3	8	2	-4.5
Noise figure (dB)	2.5	2	2.5	3.7	11.5
Input IP3 (dBm)	4.5	1	-2	-1	16
Current (mA)	13.3	5.9	5.9	5.9	3.7

## Downconverter typical performance

PARAMETER	Cellular FM	Cellular CDMA	PCS CDMA
Gain (dB)	7.5	11.5	12.5
Noise Figure (dB)	10	9	9
Input IP3 (dBm)	5	3.5	4
Current (mA) (Tx) LO output buffer off	6.8	13	16

- Separate, selectable IF outputs to suit FM and CDMA bandwidths
- Buffered Cellular and PCS LO inputs
- Integrated frequency doubler for PCS mixer LO
- Differential (Tx) LO output buffer (can be switched on or off)
- Low voltage operation down to 2.7 volts
- Mixers current consumption with (Tx) LO buffer on:
  - Cellular FM: 16.8 mA
  - Cellular CDMA: 23 mA
  - PCS: 26 mA
- Low standby current in sleep mode: <50  $\mu$ A
- BCC32++™ package

## APPLICATIONS

- 800 MHz analog FM and CDMA digital receivers
- 1900 MHz PCS band CDMA digital receivers
- Supports dual-band and triple-mode operation
- Digital mobile communications equipment
- Portable, low power radio equipment

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### BLOCK DIAGRAM

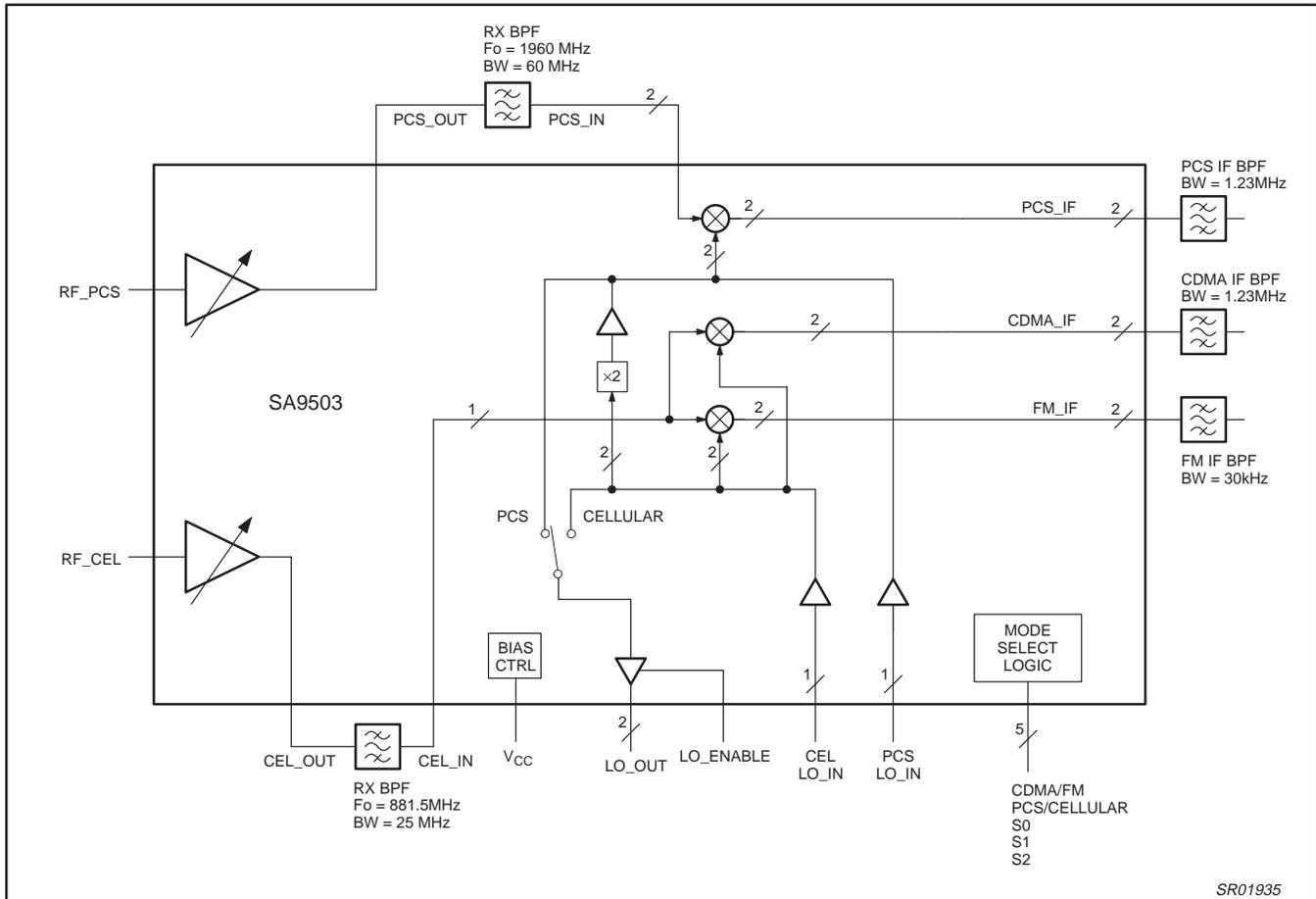


Figure 1. SA9503 Block Diagram

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATINGS	UNIT
Supply voltage (V <sub>CC</sub> )	-0.3 to +3.6	V
Gain control voltage	+3.6	V
Logic input voltage	-0.3 to V <sub>CC</sub> +0.3	V
Maximum power input	+20	dBm
Power dissipation (T <sub>amb</sub> = 25°C)	800	mW
Storage temperature range	-65 to +150	°C

### RECOMMENDED OPERATING CONDITIONS

PARAMETER	TEST CONDITIONS	LIMITS			UNIT
		MIN	TYP	MAX	
Supply voltage (V <sub>CC</sub> )		2.7	2.85	3.3	V
Operating ambient temperature range (T <sub>amb</sub> )		-40		+85	°C
Logic input signal levels					
LOW level input voltage range (V <sub>IL</sub> )	At logic 0	-0.3		0.2V <sub>CC</sub>	V
HIGH level input voltage range (V <sub>IH</sub> )	At logic 1	0.5V <sub>CC</sub>		V <sub>CC</sub> +0.3	V
Input bias current (I <sub>bias</sub> )	At logic 1 or logic 0	-5		+5	µA

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## FUNCTIONAL DESCRIPTION

### Mode selection

The SA9503 has several modes of operation for which the selection logic is defined in Tables 2 and 3. Different mode selections require different portions of the circuit to be active. Modes from unlisted combinations of logic pins are not permitted. The LNA and downconverter together can be programmed to operate in the PCS or cellular bands using the PCS/CEL logic input pin, and in CDMA or FM modes using the CDMA/FM logic input pin.

The LNA can be set to four different gain values and one special high linearity setting. Thus, the LNA can be programmed into five different modes with associated gain, noise figure, and input IP3, using the S0, S1, and S2 control lines. The whole circuit (LNAs and mixers) is powered down when control lines S0 = 1, S1 = 0, and S2 = 0. It is also possible to independently switch off the LNAs and keep the mixers on, as shown in Table 3.

### LNA

External components can be used to match the LNA inputs, and if required, the outputs, for the Cellular and PCS bands. The input and output return loss of better than 10 dB can be achieved in all modes. For Cellular band FM, only the CEL\_1 mode is required for the LNA.

For CDMA, LNA modes CEL\_1 and PCS\_1 are used for normal operation, as they have the highest gains and lowest noise figures. For higher levels of multi-tone interference, other modes with lower gains are to be used. The high linearity CEL\_L and PCS\_L modes are used when there is a very strong adjacent channel interference, while at the same time the mobile is transmitting close to its full power. The high linearity is required in order to reduce the cross modulation of the LNA from the mobile's transmitter, in the presence of strong adjacent channel interferer. The maximum transmitter power leakage which can be tolerated at the LNA input is approximately -30dBm to meet the single tone desensitization requirements. The cross modulation power can be derived from:

$$\text{Cellular band: } (2 \times P_{TX} + P_{JAMMER} - 8) \text{ dBm}$$

$$\text{PCS band: } (2 \times P_{TX} + P_{JAMMER} - 10.5) \text{ dBm}$$

The LNA requires less than one hundred microseconds to settle when it changes from one mode to another. This is expected to have insignificant impact on the CDMA frame error rate.

### Downconverter

The SA9503 has three mixers, one for Cellular FM, one for Cellular CDMA, and one for PCS CDMA. Each one is individually optimized for their specific requirements. The Cellular CDMA and FM mixers have a common single-ended RF input.

The PCS mixer's RF input port is differential, and requires an external balun when used with a single-ended source. Both the PCS and the Cellular mixer RF inputs should be AC coupled.

Local oscillator drive for the mixers is provided through pins CEL LO\_IN and/or PCS LO\_IN. The local oscillator inputs are single-ended, AC-coupled. The CEL LO\_IN signal is internally buffered to drive the following:

- (Tx) LO output buffer,
- cellular FM mixer,
- cellular CDMA mixer,
- PCS LO frequency doubler.

In the PCS mode, mixer LO drive can be either direct (PCS LO\_IN) or through the frequency doubler after CEL LO\_IN. The mixer local oscillator signal is made available externally via the (Tx) LO output buffer for potential use elsewhere in the radio. For example, this signal typically can be used with the transmitter circuitry. The (Tx) LO output buffer can be powered down independently, using the (Tx) LO\_ENABLE logic input. The (Tx) LO output buffer has open collector differential outputs which are internally biased to V<sub>CC2</sub> supply rail.

The PCS and Cellular CDMA mixers have open collector differential IF outputs. The two IF outputs can either supply two separate IF filters, or they can be connected together externally for use with one common receive IF filter. The differential IF outputs must be biased at the supply voltage through external inductors that may also be part of the matching circuit to the SAW filter. The cellular band FM mixer also has a differential open collector IF output.

**Table 1. Typical Cellular Mode LNA Gain Change Points for 2-tone CDMA Interference Test**

GAIN, dB	MAXIMUM ANTENNA IN-BAND POWER, dBm	MINIMUM ANTENNA IN-BAND POWER, dBm
16.5	-95	< -104
9	-90.5	-98.5
3	-86.7	-93.5
-3	> -79	-89.7

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## MODE SELECT LOGIC AND DC CHARACTERISTICS

The SA9503 chip has several modes of operation for which the selection logic is defined in the following two tables. Different mode selections require different portions of the circuit to be active. Modes from unlisted combinations of logic pins, are not valid. Total current consumption of the device is the sum of the currents for the mixer portion (Table 2) and the LNA portion (Table 3).

**Table 2. Mode logic definition for Downconverter mixers**

$V_{CC} = 2.7\text{ V to }3.3\text{ V}$ , 2.85 V typical;  $T_{amb} = -40\text{ to }+85\text{ }^{\circ}\text{C}$

	MODES	(Tx) LO BUFFER	(Tx) LO BUFFER OUTPUT	DOUBLER	LOGIC INPUT PINS				CURRENT (mA)	
					POWER DOWN <sup>1</sup>	PCS/CEL	CDMA/FM LO DOUBLER	(Tx) LO ENABLE	TYP	MAX
<b>PCS</b>										
1	PCS1	On	2 GHz	Off	1	1	0	1	26	29.9
2	PCS1 Idle	Off	—	Off	1	1	0	0	16	18.4
3	PCS2	On	2 GHz	On	1	1	1	1	30	34.5
4	PCS2 Idle	Off	—	On	1	1	1	0	20	23
<b>Cellular CDMA</b>										
5	CDMA	On	1 GHz	Off	1	0	1	1	23	26.5
6	CDMA Idle	Off	—	Off	1	0	1	0	13	15
7	FM	On	1 GHz	Off	1	0	0	1	16.8	19.3
8	FM Idle	Off	—	Off	1	0	0	0	6.8	7.8
<b>Power Down</b>										
9	Sleep <sup>1</sup>	x	x	Off	0	x	x	x	1 $\mu\text{A}$	50 $\mu\text{A}$

### NOTES:

x = Don't care

- The device will be in the Power Down mode (sleep) when control lines  $S0 = 1$ ,  $S1 = 0$ , and  $S2 = 0$ .

**Table 3. Mode logic definition for LNA**

$V_{CC} = 2.7\text{ V to }3.3\text{ V}$ , 2.85 V typical;  $T_{amb} = -40\text{ to }+85\text{ }^{\circ}\text{C}$

	MODES	LOGIC INPUTS				CURRENT CONSUMPTION (mA)	
		PCS/CEL	S0	S1	S2	TYP	MAX
1	CEL_L (High linearity)	0	1	1	1	13.2	15.0
2	CEL_1 (High gain)	0	0	1	1	4.9	6.0
3	CEL_2 (Next lower gain)	0	0	1	0	4.9	6.0
4	CEL_3 (Next lower gain)	0	0	0	1	4.9	6.0
5	CEL_4 (Next lower gain)	0	0	0	0	3.7	4.5
6	PCS_L (High linearity)	1	1	1	1	13.3	15.0
7	PCS_1 (High gain)	1	0	1	1	5.9	7.2
8	PCS_2 (Lower gain)	1	0	1	0	5.9	7.2
9	PCS_3 (Next lower gain)	1	0	0	1	5.9	7.2
10	PCS_4 (Next lower gain)	1	0	0	0	3.7	4.5
11	Mixers ON (LNA portion OFF)	x	1	1	0	1 $\mu\text{A}$	50 $\mu\text{A}$
12	Reserved (Sleep)	x	1	0	1	(Note 1)	(Note 1)
13	Sleep	x	1	0	0	(Note 1)	(Note 1)

### NOTES:

x = Don't care

- The device will be in the Power Down mode (sleep) when control lines  $S0 = 1$ ,  $S1 = 0$ , and  $S2 = 0$ .

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## LNA

### AC ELECTRICAL CHARACTERISTICS

 $V_{CC} = 2.7 \text{ V to } 3.3 \text{ V}; T_{amb} = 25^{\circ}\text{C}$ 

PARAMETER	TEST CONDITIONS	LIMITS					UNIT
		MIN	-3 $\sigma$	TYP	+3 $\sigma$	MAX	
<b>Cellular Band LNA</b>							
RF input frequency range		869				894	MHz
S11	50 $\Omega$ with external matching			-10			dB
S22	50 $\Omega$ with external matching			-15			dB
Basic Gain Spread, $\Delta G_c$	Common to all cellular modes		-1	0	1		dB
<b>CEL_L Mode</b>							
Gain, S21				$17 + \Delta G_c$			dB
Noise Figure				2.0	2.5		dB
Input IP3	2 tones of -30 dBm each, $\Delta f=800$ kHz		4	5.5			dBm
	2 tones of -30 dBm each, $\Delta f=60$ kHz		1	2			dBm
S12				-40			dB
<b>CEL_1 Mode</b>							
Gain, S21				$15.5 + \Delta G_c$			dB
Noise Figure				1.6	1.9		dB
Input IP3	2 tones of -30 dBm each, $\Delta f=800$ kHz		-3	-2			dBm
	2 tones of -30 dBm each, $\Delta f=60$ kHz		-7	-6			dBm
S12				-40			dB
<b>CEL_2 Mode</b>							
Nominal Gain, S21				$9 + \Delta G_c$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				1.9	2.2		dB
Input IP3	2 tones of -30 dBm each, $\Delta f=800$ kHz		-4.5	-3.5			dBm
S12				-40			dB
<b>CEL_3 Mode</b>							
Nominal Gain, S21				$3 + \Delta G_c$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				4.5	5.5		dB
Input IP3	2 tones of -30 dBm each, $\Delta f=800$ kHz		1	2			dBm
S12				-40			dB
<b>CEL_4 Mode</b>							
Nominal Gain, S21				$-4 + \Delta G_c$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				11	11.5		dB
Input IP3	2 tones of -20 dBm each, $\Delta f=800$ kHz		14	15			dBm
S12				-33			dB
LO (input and output) to LNA input isolation	LO single-ended in, differential out, with and without doubler. 0 dBm LO in, (Tx) LO buffer ON, when in active modes. External Cellular and PCS filters connected, with 30 dB LO rejection from them.			40			dB
All modes							
Settling time	Change of mode				100		$\mu\text{s}$

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PARAMETER	TEST CONDITIONS	LIMITS					UNIT
		MIN	-3 $\sigma$	TYP	+3 $\sigma$	MAX	
<b>PCS Band LNA</b>							
RF input frequency range		1810				1990	MHz
S11	50 $\Omega$ with external matching			-9			dB
S22	50 $\Omega$ with external matching			-12			dB
Basic Gain Spread, $\Delta G_p$	Common to all PCS modes		-1	0	1		dB
<b>PCS_L Mode</b>							
Gain, S21				15.2 + $\Delta G_p$			dB
Noise Figure				2.5	3		dB
Input IP3	2-tones of -30 dBm each. $\Delta f=800$ kHz		3.5	4.5			dBm
S12				-40			dB
<b>PCS_1 Mode</b>							
Gain, S21				14.3+ $\Delta G_p$			dB
Noise Figure				2.0	2.4		dB
Input IP3	2-tones of -30 dBm each. $\Delta f=800$ kHz		0	1			dBm
S12				-40			dB
<b>PCS_2 Mode</b>							
Nominal Gain, S21				8 + $\Delta G_p$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				2.5	2.9		dB
Input IP3	2-tones of -30 dBm each. $\Delta f=800$ kHz		-3	-2			dBm
S12				-40			dB
<b>PCS_3 Mode</b>							
Nominal Gain, S21				2 + $\Delta G_p$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				3.7	4.1		dB
Input IP3	2-tones of -30 dBm each. $\Delta f=800$ kHz		-2	-1			dBm
S12				-40			dB
<b>PCS_4 Mode</b>							
Gain, S21				-4.5 + $\Delta G_p$			dB
Additional Gain spread	Relative to nominal gain		-2		2		
Noise Figure				11.5	12		dB
Input IP3	2-tones of -20 dBm each. $\Delta f=800$ kHz			16			dBm
S12				-30			dB
LO (input and Output) to LNA input isolation.	LO single-ended in, differential out, with and without doubler. 0 dBm LO in, (Tx) LO buffer ON, when in active modes. External Cellular and PCS filters connected, with 30 dB LO rejection from them.			36			dB
All modes.							
Settling time	Change of mode				100		$\mu$ s

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## TYPICAL LNA SPECIFICATIONS WITH TEMPERATURE VARIATION AT -40°C AND +85°C

V<sub>CC</sub> = 2.7 V to 3.3 V

SPECIFICATION	CONDITIONS	TEMPERATURE			UNIT	
		-40°C	0°C	+85°C		
<b>Cellular band LNA</b>						
Supply current variation	All modes		-100	0	-100	μA
Gain variation	CEL_L		0.7	0	-0.7	dB
	CEL_1		1	0	-1	dB
	CEL_2		1	0	-1	dB
	CEL_3		0.8	0	-0.8	dB
	CEL_4		0.6	0	-0.5	dB
Noise Figure variation	CEL_L		-0.2	0	0.2	dB
	CEL_1		-0.3	0	0.3	dB
	CEL_2		-0.4	0	0.4	dB
	CEL_3		-0.7	0	0.7	dB
	CEL_4		-1	0	0.7	dB
Input IP3 variation	CEL_L		-1.4	0	0	dBm
	CEL_1	Δf = 800 kHz	0.35	0	-0.25	dBm
		Δf = 60 kHz	-0.35	0	0.3	dBm
	CEL_2		0.25	0	0	dBm
	CEL_3		0.75	0	-0.9	dBm
CEL_4		1	0	-1.2	dBm	
<b>PCS band LNA</b>						
Supply current variation	All modes		-40	0	-40	μA
Gain variation	PCS_L		0.8	0	-0.8	dB
	PCS_1		0.8	0	-1	dB
	PCS_2		0.9	0	-0.8	dB
	PCS_3		0.9	0	-0.8	dB
	PCS_4		0.5	0	-0.5	dB
Noise Figure variation	PCS_L		-0.3	0	0.3	dB
	PCS_1		-0.4	0	0.4	dB
	PCS_2		-0.6	0	0.5	dB
	PCS_3		-1	0	0.8	dB
	PCS_4		-1	0	0.8	dB
Input IP3 variation	PCS_L		0.4	0	-1	dBm
	PCS_1		0.9	0	-1	dBm
	PCS_2		0.3	0	-0.7	dBm
	PCS_3		0.7	0	-0.7	dBm
	PCS_4		1.3	0	-0.4	dBm

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## DOWNCONVERTER

### AC ELECTRICAL CHARACTERISTICS

$V_{CC} = 2.7\text{ V to }3.3\text{ V}$ ;  $T_{amb} = 25^\circ\text{C}$ ,  $P_{I0} = -3\text{ dBm}$ .

$f_{IF} = 130\text{ MHz}$ , output differential load of  $1\text{ k}\Omega$  for CDMA, and  $850\Omega$  for FM, as per application.

PARAMETER	TEST CONDITIONS	LIMITS					UNIT
		MIN	-3 $\sigma$	TYP	+3 $\sigma$	MAX	
<b>Cellular Band Downconverter</b>							
RF input frequency range		869				894	MHz
LO input frequency range		950				1030	MHz
IF output frequency range (CDMA)		50				300	MHz
IF output frequency range (FM)		50				300	MHz
IF Output Load Impedance	CDMA, differential			1000			$\Omega$
	FM, Single-ended, with ext. balun			850			$\Omega$
Conversion Gain	CDMA		10.5	11.5	12		dB
	FM		6.5	7.5	8.0		dB
Noise Figure	CDMA mode, SSB			9.0	10.0		dB
	FM mode, SSB			10	11		dB
Input IP3	CDMA mode $\Delta f_1 = 900\text{ kHz}$ , $\Delta f_2 = 1700\text{ kHz}$ P1, P2 = -30 dBm Tone spacing = 800 kHz		3.5				dBm
	FM mode. P1, P2 = -24 dBm. Tone spacing = 60 kHz, 330 kHz		5.0				dBm
RF Input Return Loss	$Z_S = 50\Omega$ with external matching			11.0			dB
LO Input Return Loss	$Z_S = 50\Omega$			10.0			dB
(Tx) LO Output Return Loss	$Z_S = 100\Omega$ differential			10			dB
LO Input Power Range			-9.0	-6.0	0.0		dBm
(Tx) LO Output Power Range	$Z_L = 100\Omega$ differential; (Tx) LO buffer ON.		-10.0	-6.0	-3.0		dBm
LO (Input and Output) to RF Leakage	CDMA				-35		dBm
	FM				-30		dBm
LO (Input and Output) to IF Leakage	CDMA				-30		dBm
	FM				-20		dBm
RF to LO (Input) Isolation			30				dB
RF to IF Isolation	Single-ended in, differential out						
	CDMA		17				dB
	FM		10				dB
(Tx) LO Output to LO Input Isolation			30				dB
Leakage conversion gain	$f_1 = f_{RX} \pm 40\text{ MHz}$ at LNA input. P1 = -70 dBm.  All LNA cellular modes.  Measured through conversion gain in stop-band, without SAW filters being connected. Pins terminated with resistive equivalent load.		-40				dBc

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## AC ELECTRICAL CHARACTERISTICS (continued)

$V_{CC} = 2.7 \text{ V to } 3.3 \text{ V}$ ;  $T_{amb} = 25^\circ\text{C}$ ,  $P_{Io} = -3 \text{ dBm}$ .

$f_{IF} = 130\text{MHz}$ , output differential load of  $1\text{k}\Omega$  for PCS.

PARAMETER	TEST CONDITIONS	LIMITS					UNIT
		MIN	-3 $\sigma$	TYP	+3 $\sigma$	MAX	
<b>PCS Downconverter</b>							
RF input frequency range		1810				1990	MHz
LO input frequency range	Without doubler	1720				2120	MHz
	With doubler	860				1050	MHz
IF output frequency range		50				300	MHz
IF Output Load Impedance	Differential			1000			$\Omega$
Conversion Gain	@ $f_{IF}$ , over RF/LO frequency ranges		11.5	12.5	13		dB
Noise Figure	@ $f_{IF}$ , over RF/LO frequency ranges, SSB			9.0	10		dB
Input IP3	@ $f_{IF}$ , over RF/LO frequency ranges $\Delta f_1 = 1.25 \text{ MHz}$ , $\Delta f_2 = 2.05 \text{ MHz}$ P1, P2 = -30 dBm Tone spacing = 800 kHz		3	4			dBm
RF Input Return Loss	$Z_S = 50\Omega$ , with external matching			10			dB
LO Input Return Loss	$Z_S = 50\Omega$			10			dB
(Tx) LO Output Return Loss	$Z_S = 100\Omega$ differential			10			dB
LO Input Power Range			-9	-6	0		dBm
(Tx) LO Output Power Range	$Z_L = 100\Omega$ differential; (Tx) LO buffer ON		-10	-9	-6		dBm
LO (Input and Output) to RF Leakage	With and without doubler				-35		dBm
LO (Input and Output) to IF Leakage	With and without doubler				-35		dBm
RF to LO (Input) Isolation	With and without doubler		30				dB
RF to IF Isolation	Single-ended in, differential out		20				dB
(Tx) LO Output to LO Input Isolation	Without doubler		30				dB
Leakage conversion gain	$f_1 = f_{RX} \pm 80 \text{ MHz}$ at LNA input. P1 = -70 dBm. All LNA PCS modes. Measured through conversion gain in stop-band, without SAW filters being connected. Pins terminated with resistive equivalent load.		-40				dBc

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**TYPICAL DOWNCONVERTER SPECIFICATIONS WITH TEMPERATURE VARIATION FROM -40°C TO +85°C**  
V<sub>CC</sub> = 2.7 V to 3.3 V

SPECIFICATION		TEMPERATURE			UNIT
		-40°C	25°C	85°C	
<b>Cellular Band</b>					
Conversion Gain Variation		1	0	-1	dB
IP3 Variation	FM	0	0	-1	dB
	CDMA	0.5	0	-1	dB
Noise Figure Variation	FM	-1.5	0	0.8	dB
	CDMA	-1.1	0	0.8	dB
<b>PCS Band</b>					
Conversion Gain Variation		1	0	-1	dB
IP3 Variation		0.5	0	-1	dB
Noise Figure Variation		-1.4	0	0.8	dB

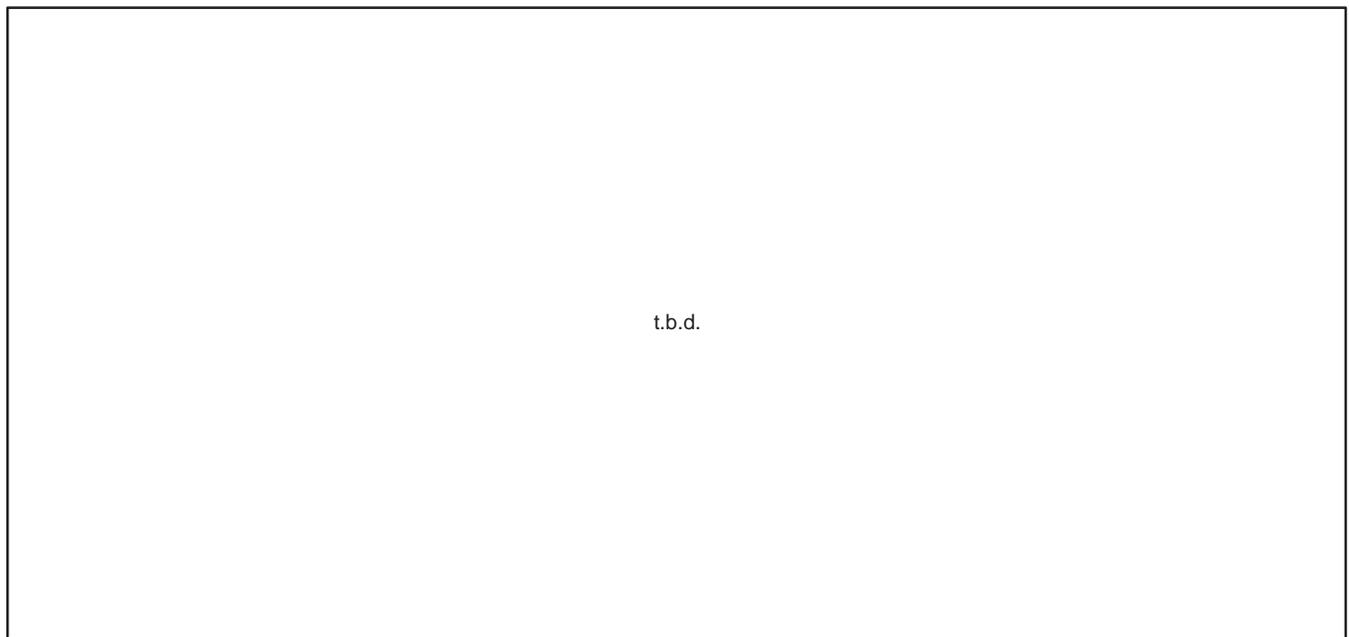
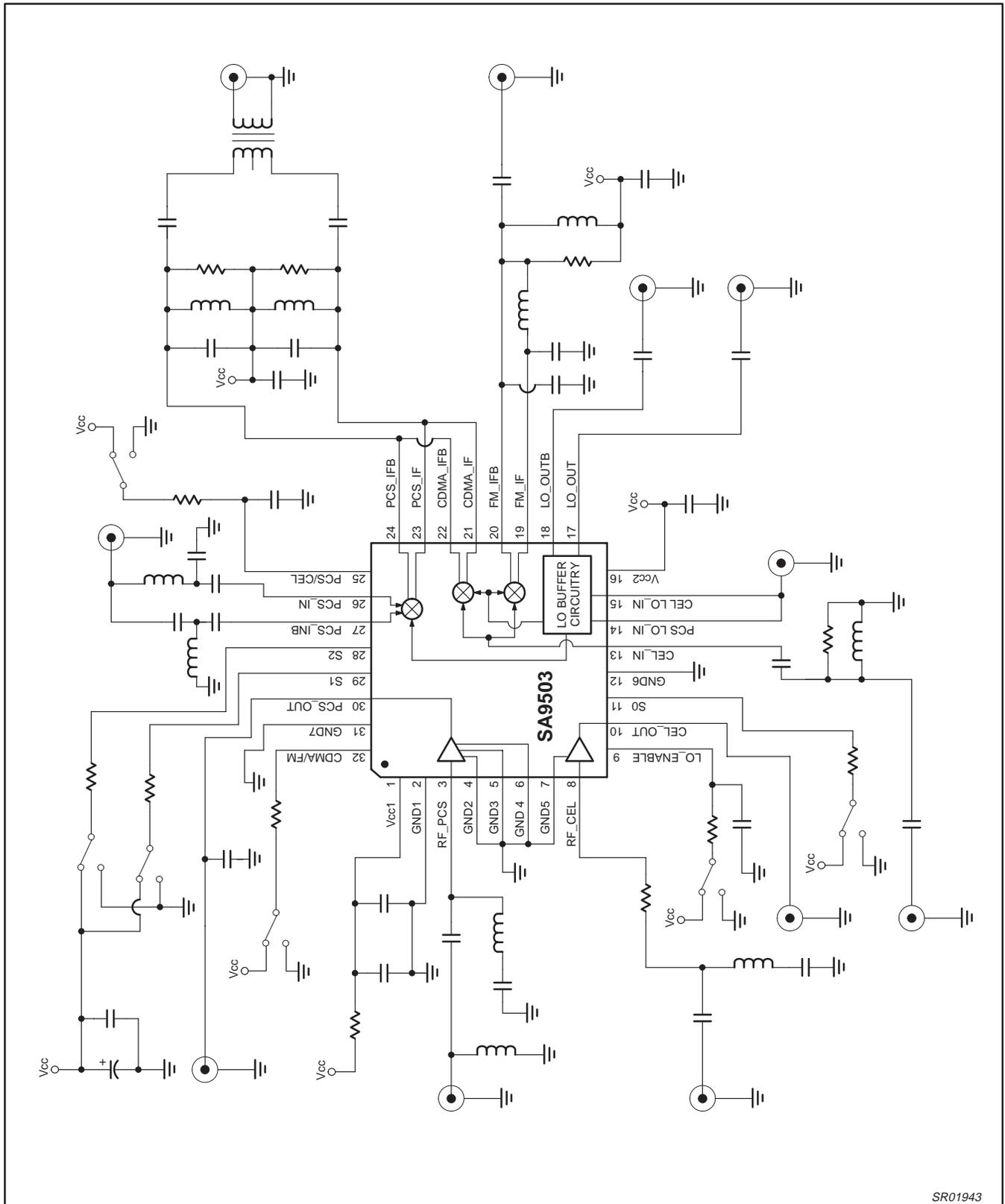


Figure 2. Typical Radio Architecture using SA9503

Table 4. Typical S-Parameters  
TBD

# Dual-band, CDMA/AMPS LNA and downconverter mixers

## SA9503



SR01943

Figure 3. Preliminary Demonstration Board Diagram

# Dual-band, CDMA/AMPS LNA and downconverter mixers

SA9503

## PINNING

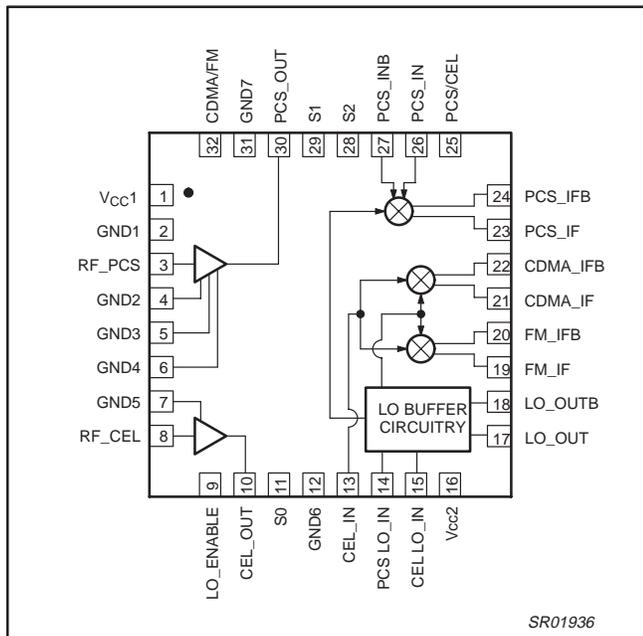


Figure 4. Pin-Out Block Diagram

**NOTE:**

The ground plane/heatsink area of the BCC32++ package needs to be soldered to ground for proper functioning of this device.

Table 5. Pin function definition

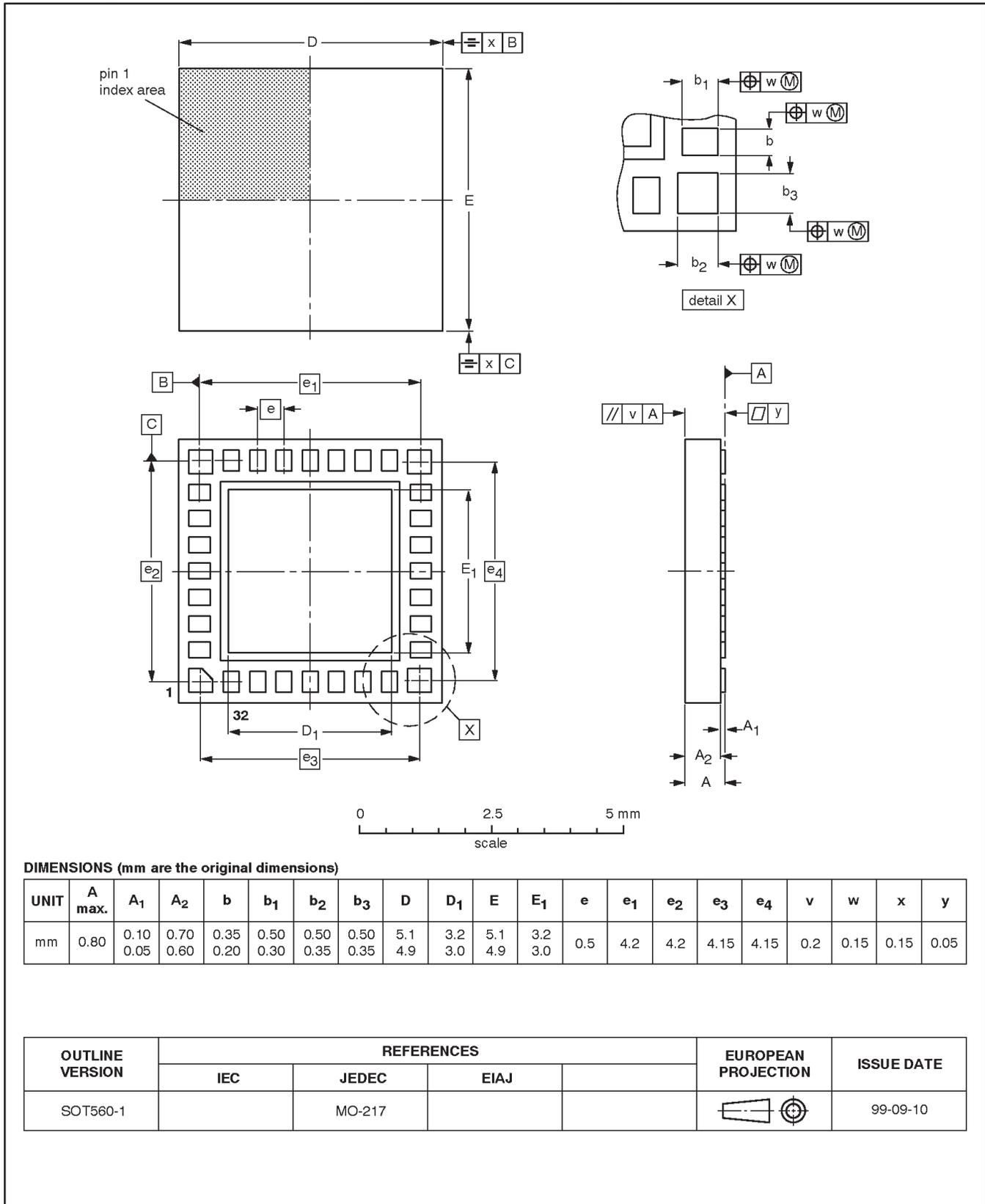
PIN	NAME	DESCRIPTION
1	V <sub>CC</sub> 1	Power supply
2	GND1	Ground
3	RF_PCS	PCS LNA input
4	GND2	Ground
5	GND3	Ground
6	GND4	Ground
7	GND5	Ground
8	RF_CEL	Cellular LNA input
9	LO_ENABLE	(Tx) LO buffer enable
10	CEL_OUT	Cellular LNA output
11	S0	Control signal S0
12	GND6	Ground
13	CEL_IN	Cellular RF mixer input
14	PCS LO_IN	PCS LO input
15	CEL LO_IN	Cellular LO input
16	V <sub>CC</sub> 2	(Tx) LO buffer supply
17	LO_OUT	Non-inverting (Tx) LO output
18	LO_OUTB	Inverting (Tx) LO output
19	FM_IF	Non-inverting FM IF output
20	FM_IFB	Inverting FM IF output
21	CDMA_IF	Non-inverting CDMA IF output
22	CDMA_IFB	Inverting CDMA IF output
23	PCS_IF	Non-inverting PCS IF output
24	PCS_IFB	Inverting PCS IF output
25	PCS/CEL	PCS and cellular band select
26	PCS_IN	Non-inverting PCS RF mixer input
27	PCS_INB	Inverting PCS RF mixer input
28	S2	Control signal S2
29	S1	Control signal S1
30	PCS_OUT	PCS LNA output
31	GND7	Ground
32	CDMA/FM	CDMA and FM mode select

# Dual-band, CDMA/AMPS LNA and downconverter mixers

SA9503

**HBCC32: plastic, heatsink bottom chip carrier; 32 terminals; body 5 x 5 x 0.65 mm**

**SOT560-1**



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Dual-band, CDMA/AMPS LNA  
and downconverter mixers

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SA9503

**NOTES**

# Dual-band, CDMA/AMPS LNA and downconverter mixers

SA9503

## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

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