Product Specifications
July 1995 *(1 of 4)*

2.4 to 2.5 GHz Integrated Converter

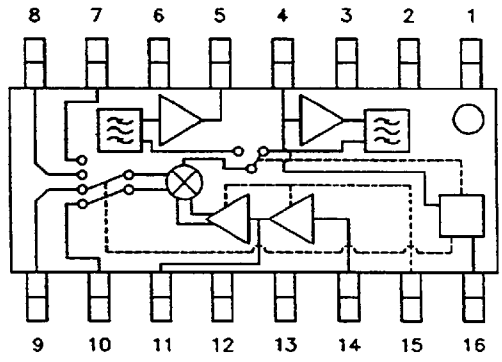
Features

- ❑ Meets FCC ISM Band Regulations
- ❑ PCMCIA Compatible 16 Pin SOIC Package
- ❑ Low Power Consumption With Standby Mode for Battery Powered Applications

Applications

- ❑ Wireless LANs
- ❑ Wireless PABXs
- ❑ 2.4 GHz ISM Band Radios

Functional Block Diagram



Description

The CCV2501 is a frequency converter with an integrated LNA, PLL buffer, and IF switches. Together with the CAS 2403 Power Amplifier-Switch, a VCO, and filters, it provides a complete RF front end for a 2.4 GHz ISM band radio. The CCV2501 has been designed to operate both with a fixed frequency in direct sequence spreading systems or as part of a frequency-hopping spread spectrum synthesizer. The receive chain has a noise figure of less than 5 dB and an input P1dB of -16 dBm. A single converter architecture provides low active power dissipation. In addition, the CCV2501 has a standby mode to prolong battery life.

Absolute Maximum Ratings

Parameter	Rating	Parameter	Rating	Parameter	Rating
Storage Temperature	-65°C to +150°C	Channel Temperature	175°C	Operating Temperature	-20°C to +70°C
Soldering Temperature	260°C for 5 Sec	Positive Supply	+6V*	Negative Control Voltage	-5.5V*

* Maximum potential difference across the device: (+V) – (-V) = 11.5 V.

Recommended Operating Conditions

Parameter	Typ	Units	Parameter	Typ	Units
Positive Supply (+V)	4.75 to 5.25	Volts	Positive Control Voltage	0 to +0.2	Volts
Negative Control Voltage	-4.0 to -4.5	Volts			

Electrical Characteristics

The following specifications are guaranteed at +25°C with supply voltage (+V) = +5.0 V ±5%, negative control voltage (-V) = -4.1 V ±5%, Rx P_{IN} = -20 dBm, Tx P_{IN} = -3.5 dBm, IF = 350 MHz, LO = 2.05 - 2.15 GHz, LO input power = -3 dBm.

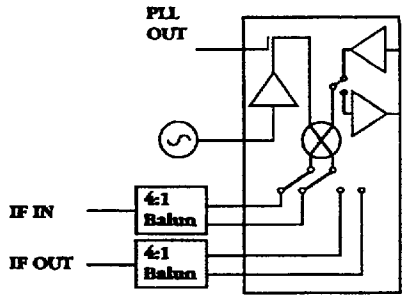
Parameter		Condition	Min	Typ	Max	Units
RF Frequency Range			2.4		2.5	GHz
LO Frequency Range			1.5	2.03-2.17	3.0	GHz
IF Frequency Range			100	350	500	MHz
Noise Figure		Rx Mode		5		dB
Rx Conversion Gain		Rx Mode	3	6	10	dB
Input P-1dB		Rx Mode		-16		dBm
Input VSWR		Rx Mode, Pin 4		2:1		
IF Load Impedance, Differential		Pins 9 & 10, Pins 7 & 8		200		ohms
IF Input Power		Tx Mode		-3.5	-3.0	dBm
Tx Output Power		Tx Mode	-4.5	-3.5		dBm
Spurious (excluding LO Harmonics)		2.4 to 2.5 GHz		-50		dBc
Positive Supply Current		Tx, Rx Modes Standby Modes		50 2	60 5	mA mA
Control Line Current:	LNA IN T/R- OSC BFR CNTL	Negative Control Voltage (-V) = -4.5 V		400 700 50	480 780 100	µA µA µA
LO Input Power		Pin 14	-5	-3	-2	dBm
LO Leakage		Tx Mode, Pin 5		-23		dBm
Oscillator Output Power (PLL Out)		LO = 2.03 to 2.17 GHz, Pin 11	-9	0	5	dBm

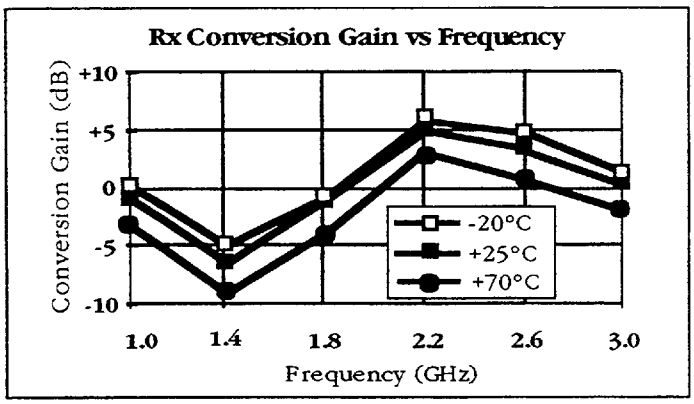
Typical Performance

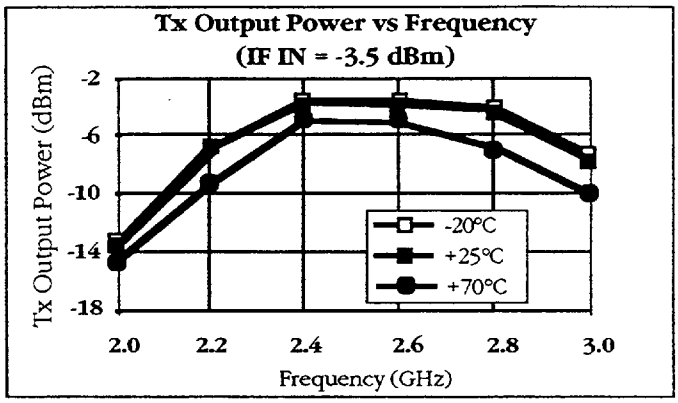
Characterization was performed using 4:1 Balun transformers to provide 200 Ω differential impedance to the IF ports (as shown in diagram). A more detailed description of this implementation is outlined in Celeritek Application Note AP-0005 which may be obtained by contacting the factory.

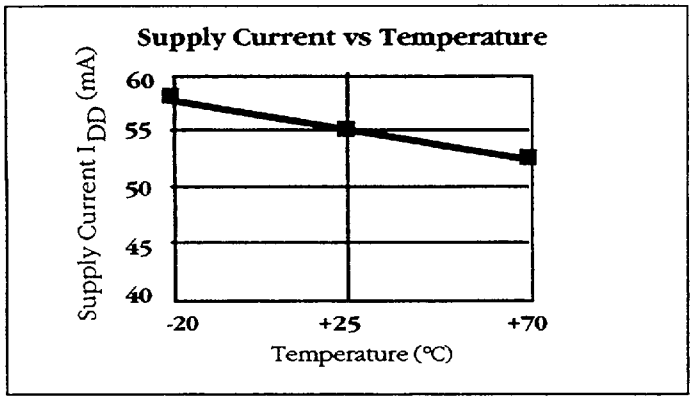
The following typical performance was tested at room temperature with positive supply voltage (+V) = 5V ±5%, negative control voltage (-V) = -4.1V ±5%, Tx P_{IN} = -3.5 dBm, and Rx P_{IN} = -20 dBm.

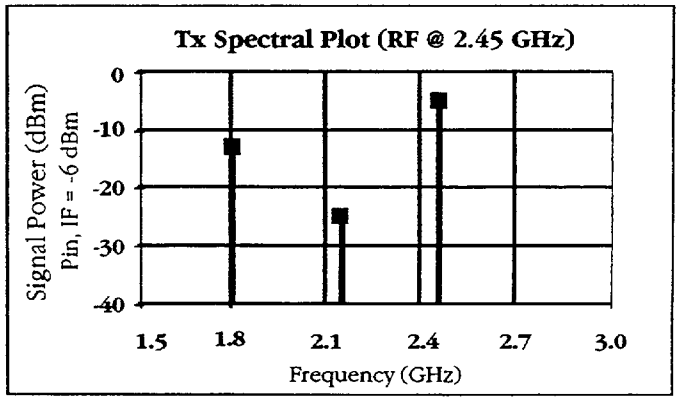
CCV2501

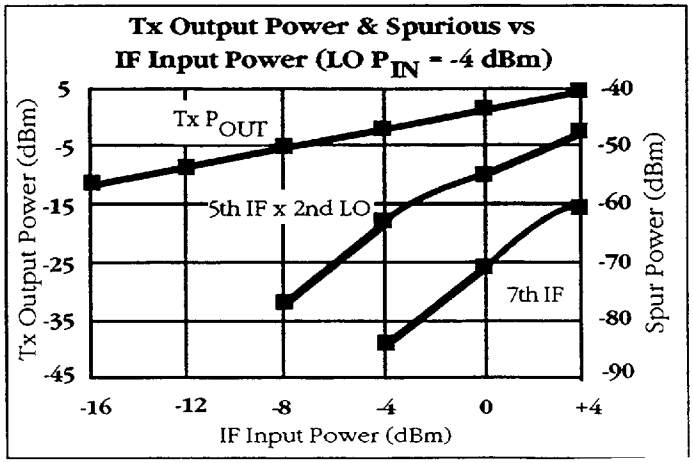


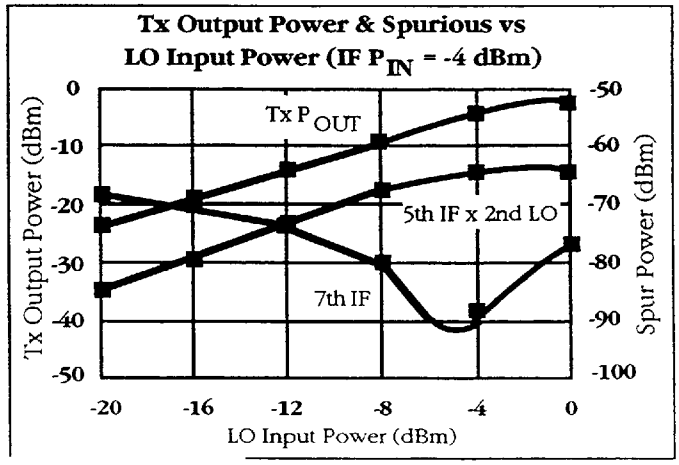












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Connection Diagram and Pin Description

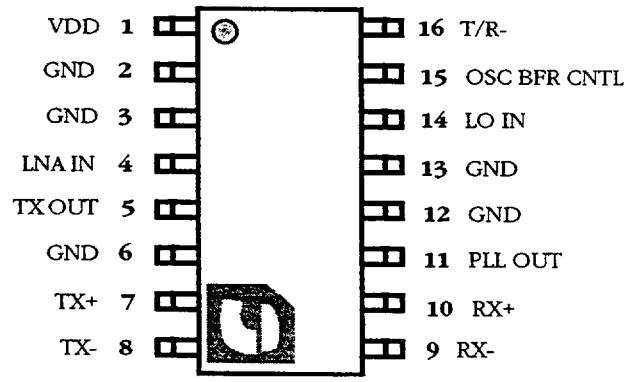


Table 1. Control Logic Table

Pin #	Pin	Receive Mode	Transmit Mode	Standby Mode
4	LNA IN	High	Low	Low
16	T/R-	Low	High	Low
15	OSC CNTL	High	High	Low

Logic High = 0 to 0.2 Volts, Logic Low = -4.0 to -4.5 Volts

Device Operation

The CCV2501 is an integrated converter intended for use in 2.4 GHz voice and/or data radio systems. The device consists of two pairs of IF switches, a ring balanced mixer, a VCO buffer amplifier, an RF switch, a transmit filter with buffer amplifier, and a receive LNA with image reject filter.

Transmit Path A 350 MHz signal enters the transmit IF input at pins 7 and 8. This is a balanced, 200 Ω port and the signal level is expected to be approximately -4 dBm. The signal is applied to the mixer where it is up-converted by the local oscillator to generate the RF signal. The up-converted signal is switched through the RF switch and passes through an internal bandpass filter selecting the upper sideband of the signal. The output of the internal bandpass filter is applied to an RF pre-amp which boosts the signal level back up to -4 dBm where it exits the device at pin 5 in 50 Ω environment for further filtering and amplification by a transmit power amplifier.

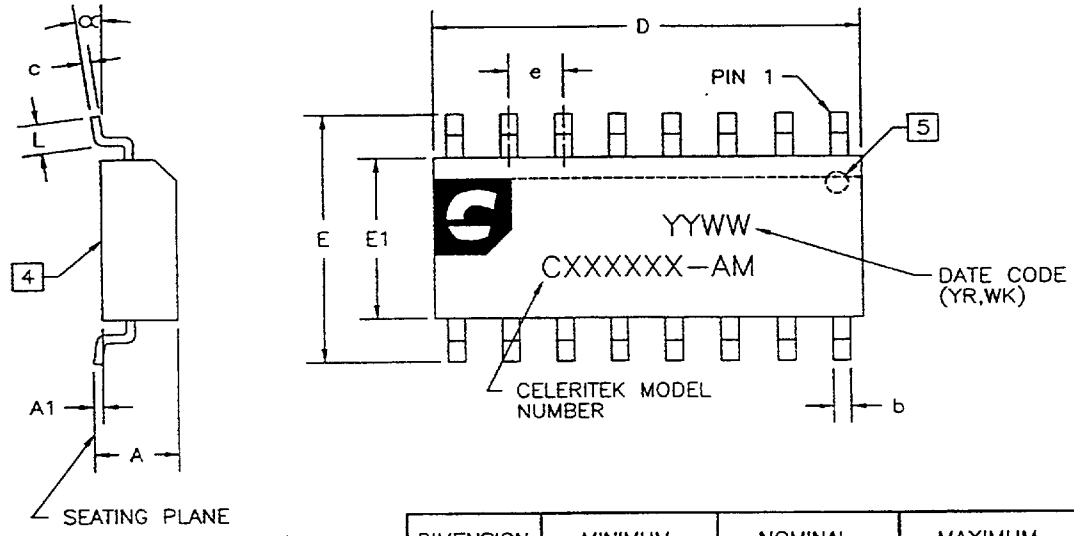
Receive Path The received signal enters the LNA input at pin 4. The LNA boosts the signal by approximately 15 dB and passes it to an internal image rejection filter prior to the RF T/R switch. Once out of the switch, the signal is applied to the mixer where it is downconverted to 350 MHz. Following the mixer, the signal passes through the IF switches and out of the device through balanced RX IF pins at pins 9 and 10.

Oscillator Operation An external VCO is used to provide the LO to the mixer. The VCO input is applied to a buffer amplifier which exits the chip through pin 11 to interface with an externally provided prescaler to form the phase-locked loop. The oscillator buffer output also drives a second buffer amplifier which converts the oscillator signal into a balanced differential output applied to the mixer.

Control Signals The CCV2501 has three operating modes: transmit, receive, and standby. The device is configured into each of these modes by the application of a 0 Volt or -4.1 Volt signal to each of three pins: T/R-, OSC BFR CNTL, and LNA IN. The LNA IN pin serves two functions: the AC input for the received signal and the DC input for part of the transmit/receive control. The DC level on the LNA IN pin works in conjunction with the T/R- pin to switch the CCV2501 between transmit and receive modes. If the voltage level on these two pins is 0 Volts at the same time, the device will enter an undefined mode (although no damage will occur to the device). Refer to Table 1 for control logic and details of the voltages that should be applied. The standby mode is generated by the application of a -4.1 Volt signal to OSC BFR CNTL, T/R-, and LNA IN pins. It is important to apply the voltage levels specified in the table to all three of these control pins in order to obtain proper device operation.

Pin #	Name	Description
1	VDD	Positive power supply input: +5V ± 5%
2	GND	Ground
3	GND	Ground
4	LNA IN	LNA input. This pin serves two purposes and it must be DC coupled for proper device operation. In addition to being the LNA input port it is also an input for one of the DC control voltages that switches the CCV2501 between the transmit and receive mode. See Table 1. During the receive mode, the received AC signal rides on top of a 0 Volt DC level at this pin. During transmit operation, a -4.1 Volt DC level is applied to this pin.
5	TX OUT	Transmit buffer output. This pin connects to the transmit power amplifier usually through a band pass filter. Assuming an IF input level of -4 dBm, the signal level at this pin will be approximately -4 dBm. It is a 50Ω port that requires a filter with an in-band VSWR of 2:1 or better.
6	GND	Ground
7	TX+	Transmit IF input. This pin (and pin 8) form a 200 Ω balanced input for the transmit IF.
8	TX-	Transmit IF input. This pin (and pin 7) form a 200 Ω balanced input for the transmit IF.
9	RX-	Receive IF input. This pin (and pin 10) form a 200 Ω balanced input for the receive IF.
10	RX+	Receive IF input. This pin (and pin 9) form a 200 Ω balanced input for the receive IF.
11	PLL OUT	PLL Output. This pin is the oscillator output port that connects to the prescaler input in the phase locked loop.
12	GND	Ground
13	GND	Ground
14	LO IN	LO input port for the VCO.
15	OSC BFR CNTL	Oscillator Buffer Control. This pin controls the operation of the oscillator buffers. When a 0 Volt DC level is applied to this pin, the buffers will operate. When a -4.1 Volt DC level is applied to this pin, the buffers will be powered down.
16	T/R-	Transmit/Receive Control Port. The signal applied to this pin works in tandem with the DC level that is applied to the LNA IN pin. Refer to Table 1. When there is a -4.1 Volt level applied to this pin and a 0 Volt DC level applied to the LNA IN pin, then the switches in the CCV2501 will be in the receive mode. When there is a 0 Volt level applied to T/R- pin and a -4.1 Volt level applied to the LNA IN pin, then the CCV2501 will be in the transmit mode.

Physical Dimensions



NOTES:(UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN MILLIMETERS[INCHES].
2. LEAD MATERIAL: COPPER
3. BODY MATERIAL: PLASTIC (EPOXY).
4. COUNTRY OF ORIGIN, IF OTHER THAN U.S., SHALL BE MARKED ON THIS SURFACE.
5. PIN 1 IDENTIFICATION IS A DOT OR BEVELED EDGE.

DIMENSION	MINIMUM	NOMINAL	MAXIMUM
A	1.35[0.053]	1.63[0.064]	1.75[0.069]
A1	0.10[0.004]	0.15[0.006]	0.20[0.008]
b	0.35[0.014]		0.45[0.018]
c	0.19[0.007]		0.22[0.009]
D	9.80[0.385]	9.90[0.390]	10.00[0.394]
E	5.80[0.228]	5.99[0.236]	6.20[0.244]
E1	3.80[0.150]	3.91[0.154]	4.00[0.158]
e		1.27[0.050]	
L	0.508[0.020]	0.64[0.025]	1.143[0.045]
α	0°		8°

Ordering Information

The CCV2501 is available in a surface mount SOIC-16 plastic package (physical dimensions shown above).

Part Number for Ordering	Package/Options
CCV2501-AM	**SOIC-16 surface mount narrow body plastic package**
CCV2501-AM-000T	**SOIC-16 package in tape and reel**

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