SatDump

SatDump X-Band LNC Datasheet

General Description

Low cost, low noise frequency converter for reception of X-Band satellites. Converts and amplifies X-Band signals (7500 MHz to 8800 MHz) to SDR compatible frequencies (500 MHz to 1200 MHz). Can be controlled locally via a switch or remotely via UART. A high quality internal TCXO allows for high LO frequency stability. An external reference (10 MHz to 250 MHz) can be used to increase performance further. Thanks to an integer-n based PLL design, the unit features good spurious behaviour and low LO phase noise.

When powered via Bias-T, the VCC pin from Fig. 3 can be configured as an output to power external accessories such as GPSDO's or LNAs without having to run extra DC cables.

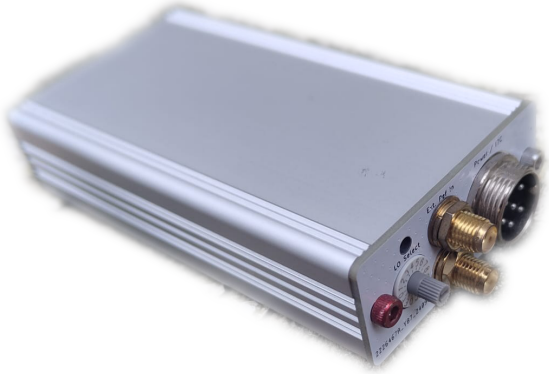


Figure 1: Product image

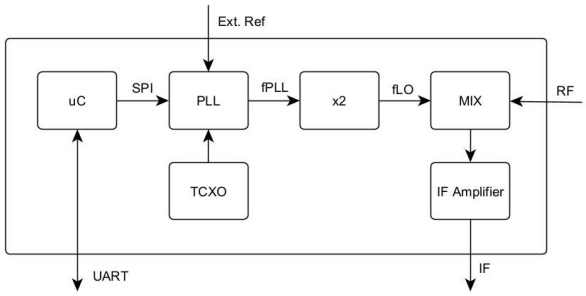


Figure 2: Block diagram of the LNC

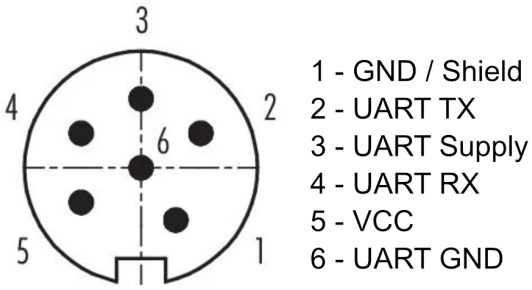


Figure 3: Pin assignment

Features

- 16 position rotary switch for LO control
- UART interface for remote configuration
- Excellent phase noise performance
- High conversion gain, -3 dB to +9 dB
- Superior spurious performance
- Improved thermal performance
- Bias-T support
- Wide input voltage range of 6-16V

Accessories

- Requires an external RF amplifier between feed and RF input for best performance. Atleast 20 dB gain, NF below 1.5 dB (better 1 dB).
- UART to USB-C converter is available. Includes a C2102 USB to UART converter, EMI filtering and a line driver to allow for longer cables.

Electrical Specifications

Table 1: RF specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions / Annotation
LO Frequency Range	f_{LO}	6800		8300	MHz	Must be multiple of $2 \cdot f_{PFD}$
RF Frequency Range	f_{RF}	7300		8900	MHz	
IF Frequency Range	f_{IF}	500		1200	MHz	
External Reference[1]	f_{REF}	10	50	250	MHz	Requires 3.3V HCMOS clock
Phasedetector freq	f_{PFD}	10	25	45 (90)	MHz	Default is 25 MHz
LO Frequency Precision		-210		+20	PPM	
LO Phasenoise	PN		-96		dBc/Hz	$f_{PLL} = 4000\,\text{MHz}$, $f_{off} = 100\,\text{kHz}$
Conversion gain		-2.3		9.1	dB	
Noise figure	NF	10	11	12	dB	
Matching at RF port	S_{11}	-10.3		-7.4	dB	
Spurious behaviour[2]			-45		dBc	$f_{LO} = 8000\,\text{MHz}$, $f_{PFD} = 25\,\text{MHz}$
LO/2 to RF isolation			-73		dB	$f_{LO} = 8000\,\text{MHz}$, measured at f_{PLL}
LO to RF isolation			-54		dB	$f_{LO} = 8000\,\text{MHz}$, measured at f_{LO}
LO/2 to IF isolation			-53		dB	$f_{LO} = 8000\,\text{MHz}$, measured at f_{PLL}
LO to IF isolation			-45		dB	$f_{LO} = 8000\,\text{MHz}$, measured at f_{LO}
RF to IF isolation					dB	$f_{RF} = 8000\,\text{MHz}$
IF to RF isolation					dB	$f_{IF} = 1000\,\text{MHz}$

[1] Can be extended to 5 MHz - 500 MHz. Please contact reseller.
[2] First integer boundary spur at $f_{LO} \pm f_{PFD}$ related to main carrier at IF port.

Table 2: DC specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions / Annotation
Supply Voltage	V_{DD}	6	12	16	V	
Supply current	I_{DD}	240	280	320	mA	$V_{DD} = 12\,\text{V}$, fused at 600 mA
UART supply voltage[3]	V_{UART}	2.8	3.3	3.5	V	For $3.3\,V$ logic level
UART supply current	I_{UART}	1.5	2	2.5	mA	
UART baud rate			9600		Baud	

[3] Only needed when UART communication is wanted. Unit can operate without in standalone mode.

Absolute Maximum Ratings

Table 3: Absolute maximum ratings

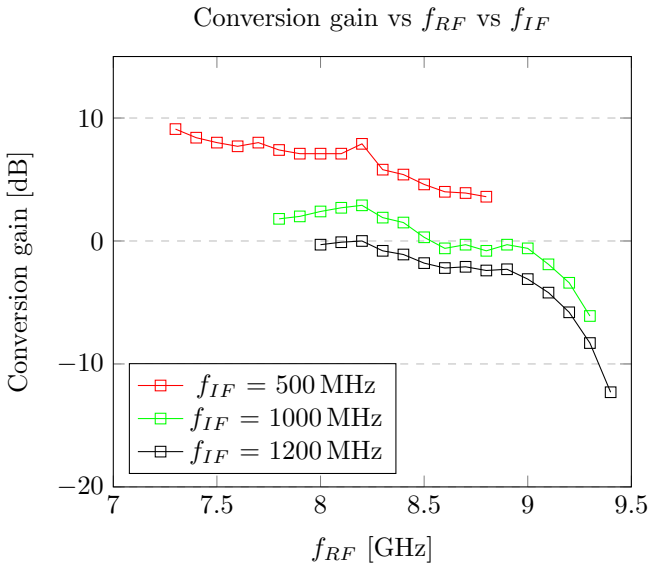
Parameter	Rating
RF Input power	+10 dBm
V_{DD}	+18 V
V_{UART}	+5.1 V

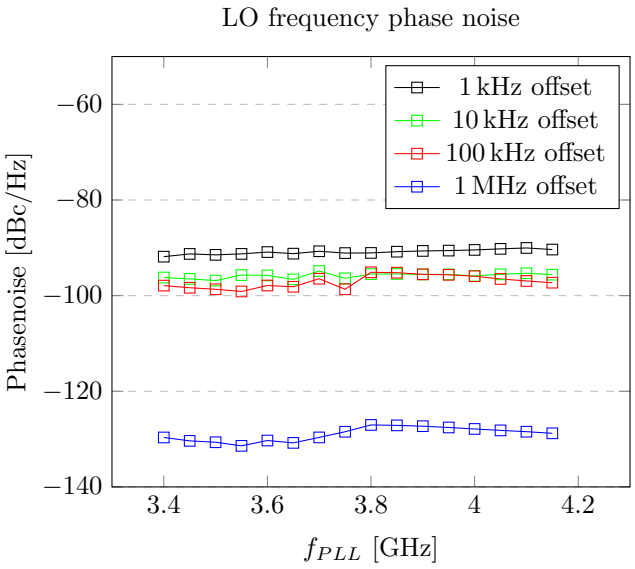
Note: Stresses above those listed under Absolute Maximum Ratings can cause permanent damage to the device. This is a stress rating only. Functional operation of the device is not implied in any conditions above those indicated in the Electrical Specifications section.

Disclaimer

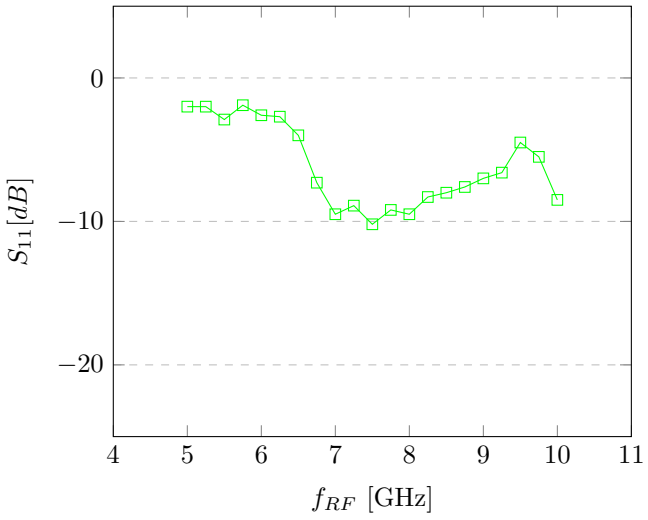
All values given in this datasheet are specified to the best of my abilities. This datasheet is a draft and does not claim to be accurate or complete. Subject to change.

Plots

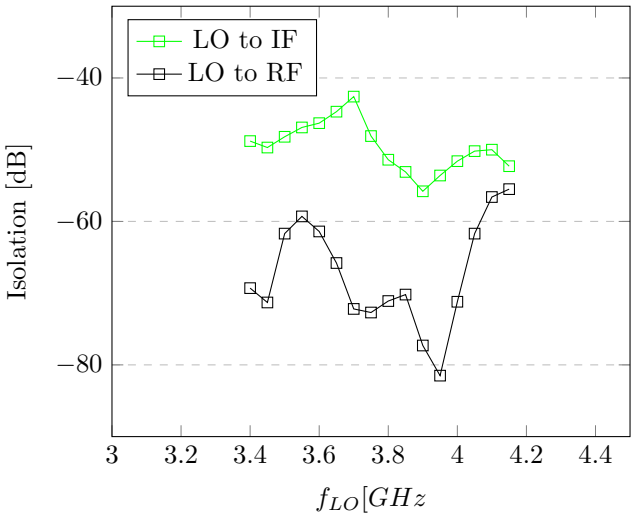




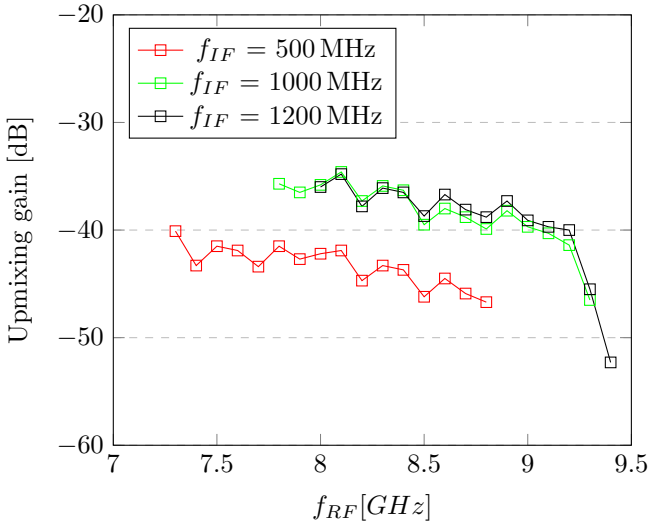
Input reflection S_{11} at $f_{LO} = 6800\,MHz$



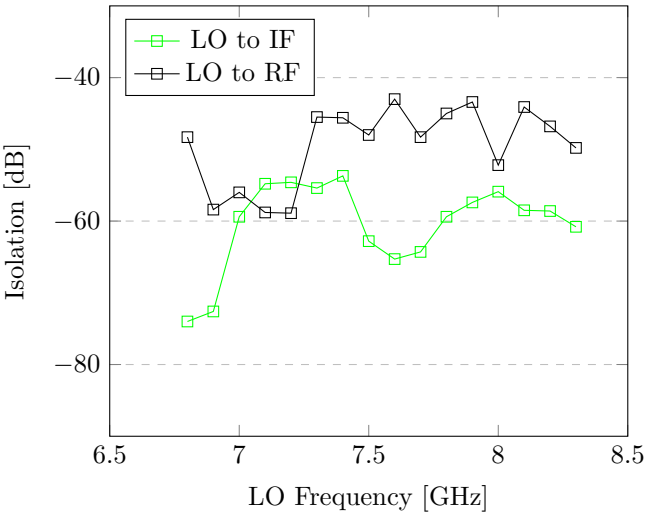
Isolation LO to RF/IF before doubler



Reverse upmixing gain vs f_{RF} vs f_{IF}



LO power at RF/IF ports after doubler



UART command reference

Table 4 contains all supported UART commands, used for remote control of the device. Communications can be either handled manually through a serial monitor of choice (e.g. PuTTY) or through a Python based device driver - please contact reseller to gain access. A UART to USB converter with included line driver is available.

Table 4: UART commands

Command	Function	Explanation
*IDN?	Getter	Returns the devices identification string
PLL:FREQ?	Getter	Returns the current LO frequency in Hz. Must be a multiple of f_{PFD}
PLL:FREQ *value*	Setter	Sets the desired LO frequency in Hz
PLL:LOCK?	Getter	Returns 1 when PLL is locked, 0 when unlocked
PLL:STAT?	Getter	Returns the PLL status. 1: PLL active, 0: PLL inactive
PLL:STAT *value*	Setter	Shuts down / activates the PLL
REF:FREQ?	Getter	Returns the reference frequency in Hz
REF:FREQ *value*	Setter	Sets the reference frequency in Hz. Must be a multiple of 25 MHz
228:PLL:INT?	Getter	Returns the current integer value of the PLL
228:PLL:FPFD?	Getter	Returns the current f_{PFD}

LO switch assignments

The switch is preconfigured for LO frequencies between 6800 MHz to 8300 MHz, selectable in 100 MHz steps. If finer stepping is needed, consider programming the device via UART.

Table 5: LO switch assignments

Position	LO frequency
0	6800 MHz
1	6900 MHz
2	7000 MHz
3...9	7100 MHz...7700 MHz
A	7800 MHz
B...F	7900 MHz...8300 MHz

Harware dimensions

All units in mm, unless noted otherwise. RF connectors are SMA.