UDC400

Ka-Band Up/Down Converter 17-21 & 27.5-30.2 GHz

Product Datasheet

UDC400

Ka-Band Up/Down Converter

Overview

The UDC400 is a fully integrated Ka-band up/down converter designed for satellite communication systems. The UDC400 supports up to 250 MHz of instantaneous bandwidth. The onboard frequency synthesisers use internal 100 MHz references on the TX and RX boards and can also lock to an external 10 MHz or 100 MHz reference. The onboard internal references provide frequency stability of ±0.05 ppm (±50 ppb) from -40°C to +85°C. When an external reference is used, system stability depends on the performance of the external reference source.

The unit is housed in an aluminium enclosure and uses SMP and SMPM RF connectors, DC flying leads for power, and 6-pin Pico-Lock connectors for power enable, PLL lock, current sensing and temperature sensing.

Features

- TX output frequency 17-21 GHz
- RX input frequency 27.5-30.2 GHz
- TX IF frequency 1-5 GHz
- RX IF frequency 1.5-4.2 GHz

Applications

- Satellite communications
- High-speed data communications
- IoT
- Security
- 5G

Space Heritage 20th January 2021

Rocket Labs Mission 18, OHB SatComm

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Electrical Specifications

Transmitter

Unless otherwise stated, typical performance values are measured at 25°C ambient.

Parameter	Specification / Typical Performance	Unit
TX Output Frequency Range	17-21	GHz
TX Saturated Output Power (Pin = -15 dBm)	≥27; 29 typical	dBm
TX Output Power at P1dB Compression (Pin = -14 dBm)	26 typical	dBm
IF Input Frequency Range	1-5	GHz
IF Input Power Range	-40 to -15	dBm
Reference Frequency	100 (internal); 10 or 100 (external)	MHz
Internal Reference Stability	±0.05 from -40°C to +85°C	ppm
Conversion Gain - 17-17.7 GHz	45 typical	dB
Conversion Gain - 17.7-20.2 GHz	43 typical	dB
Conversion Gain - 20.2-21 GHz	38 typical	dB
Gain Flatness - Nominal Performance Band, 17.7-20.2 GHz	±3.5 typical	dB
Gain Flatness - Extended Coverage, 17-21 GHz	±6 typical	dB
Gain Flatness over 250 MHz Channel	±2 typical	dB
Typical Phase Noise - Internal 100 MHz Reference		dBc/Hz
1 kHz	-83.1	dBc/Hz
10 kHz	-88.8	dBc/Hz
100 kHz	-86.5	dBc/Hz
1 MHz	-119	dBc/Hz
Spurious - 1 to <3 GHz	-30 typical	dBc
Spurious - 3 to 5 GHz	-50 typical	dBc
Supply Voltage Range	7-42	Vdc
DC Power at 15 Vdc	<15	W
DC Current at 15 Vdc	0.73 typical; <1 peak	A

Notes:

Internal reference stability applies to the onboard references on both the TX and RX boards. When an external reference is used, frequency stability depends on the external reference source.

Phase-noise values represent average Batch 2 performance measured using the UDC400 onboard internal 100 MHz reference at 25°C ambient.

For onboard internal 100 MHz reference phase-noise performance, see the Internal 100 MHz Reference Phase Noise table on page 4.

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Electrical Specifications

Receiver

Unless otherwise stated, typical performance values are measured at 25°C ambient.

Parameter	Specification / Typical Performance	Unit
RX Input Frequency Range	27.5-30.2	GHz
RX Input Power Range	-120 to -30	dBm
IF Output Frequency Range	1.5-4.2	GHz
IF Output Power Range	-90 to 0	dBm
Reference Frequency	100 (internal); 10 or 100 (external)	MHz
Internal Reference Stability	±0.05 from -40°C to +85°C	ppm
Conversion Gain	37 typical	dB
Gain Flatness Across Full 1.5-4.2 GHz IF Band	±2.5	dB
Gain Flatness over 250 MHz Channel	±2 typical	dB
Typical Phase Noise - Internal 100 MHz Reference		dBc/Hz
1 kHz	-79.2	dBc/Hz
10 kHz	-84.7	dBc/Hz
100 kHz	-83.1	dBc/Hz
1 MHz	-110.2	dBc/Hz
Spurious - In Band 1.5-4.2 GHz	-60	dBc
Image Rejection	62	dB
Noise Figure	<2.5	dB
Supply Voltage Range	7-42	Vdc
DC Power at 15 Vdc	<8	W
DC Current at 15 Vdc	0.49 typical; <0.55 maximum	A

Notes:
Phase-noise values represent average Batch 2 performance measured using the UDC400 onboard internal 100 MHz reference at 25°C ambient.
For onboard internal 100 MHz reference phase-noise performance, see the Internal 100 MHz Reference Phase Noise table on page 4.

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Internal 100 MHz Reference Phase Noise

The UDC400 TX and RX boards use an onboard SiT5349 100 MHz internal reference. The phase noise performance of the internal reference contributes to the overall measured phase noise of the TX, RX and Repeater paths.

Offset	Typical	Maximum	Unit
1 kHz	-128	-124	dBc/Hz
10 kHz	-133	-131	dBc/Hz
100 kHz	-133	-130	dBc/Hz
1 MHz	-150	-146	dBc/Hz

Notes:
Source: SiTime SiT5349 Rev 1.1, Table 4. Values shown for Fnom = 100 MHz, -40°C to +85°C.

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Mechanical and Environmental Specifications

Mechanical

Parameter	Specification	Unit
PCB Dimensions	95.89 x 90.17 x 1	mm
Enclosure	Integrated aluminium enclosure	
Enclosure Dimensions	95.89 x 90.17 x 38.15	mm
Total Mass	Approx. 0.43	kg
Form Factor	CubeSat	
Enclosure Material	Aluminium	
RF Connector Type	SMPM edge mount	
IF Connector Type	SMP edge mount	
DC Power Connection	DC flying leads	
Control and Monitoring Connection	6-pin Pico-Lock connector	

Notes:
The control and monitoring connection provides DC power enable, PLL lock, current sensing and temperature sensing.

Environmental

Parameter	Specification
Operating Temperature Range	-40 °C to +85 °C
Applicable Standards	ECSS-Q-ST-70, ECSS-E-ST-10-03

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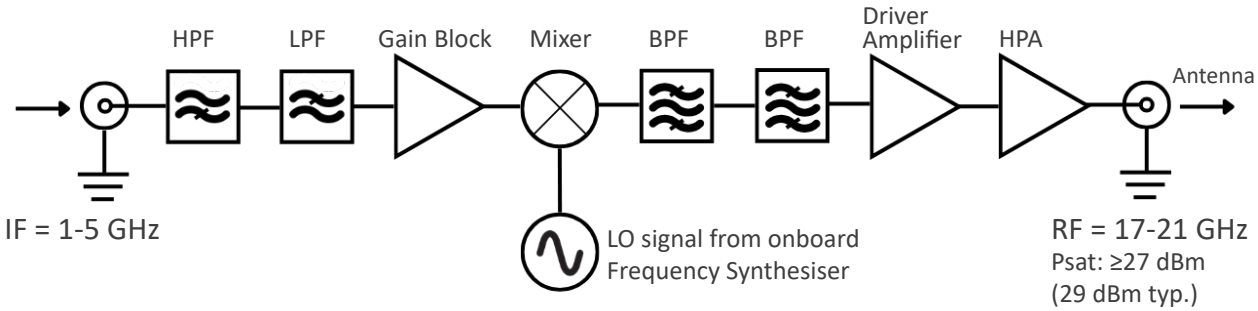
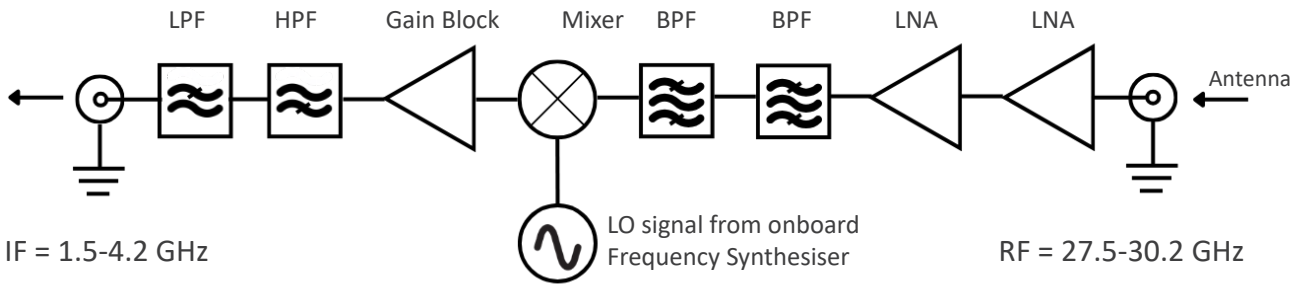
Simplified Schematic Diagram

Upconverter Ka-band 17-21 GHz



Downconverter Ka-band 27.5-30.2 GHz



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Repeater Performance

Unless otherwise stated, values represent typical Batch 2 characterisation at 25°C and are not guaranteed acceptance limits.

Parameter	Typical Performance	Unit
RX Input Frequency Range - Nominal	27.5-30.2	GHz
RX Input Frequency Range - Extended Repeater Coverage	30.2-31	GHz
TX Output Frequency Range	17.5-21	GHz
Repeater Input Power Range	-60 to -40	dBm
Conversion Gain at -60 dBm Input	78.1 typical	dB
Conversion Gain at -50 dBm Input	76.3 typical	dB
Conversion Gain at -40 dBm Input	68.1 typical	dB
Repeater Output P1dB	26.5 typical	dBm
Typical Phase Noise - Internal 100 MHz Reference		dBc/Hz
1 kHz	-77.6	dBc/Hz
10 kHz	-83.6	dBc/Hz
100 kHz	-81.5	dBc/Hz
1 MHz	-107.6	dBc/Hz
Spurious - 27.5-29 GHz	-30 typical	dBc
Spurious - 29.1-31 GHz	-50 typical	dBc
Tested Supply Voltage	Approx. 24	Vdc
DC Power	20.3-21.9	W

Notes:
Extended coverage from 30.2-31 GHz is available in Repeater operation but is outside the nominal RX performance range and may provide reduced performance.
Phase-noise values represent average Batch 2 performance measured using the UDC400 onboard internal 100 MHz reference at 25°C ambient.
For onboard internal 100 MHz reference phase-noise performance, see the Internal 100 MHz Reference Phase Noise table on page 4.

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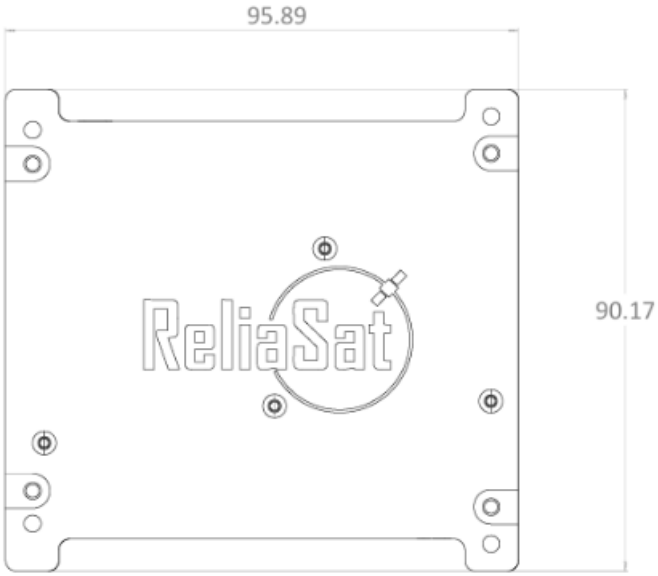
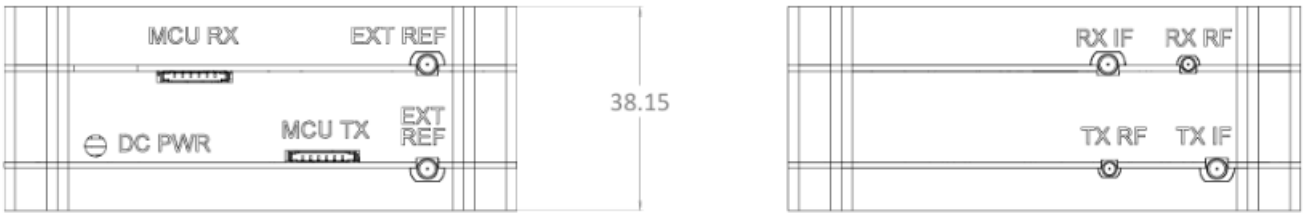
Mechanical Enclosure Dimensions





All dimensions in mm

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