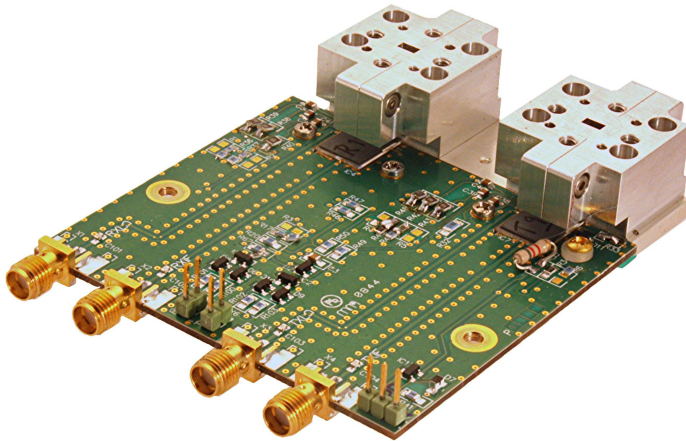


# 60 GHz converter

# FC1001V/00



## *Applications*

- Point to point or multipoint radio
- EW applications
- Secure communication
- Measurement

## *Features*

- 57 to 63 GHz RF bandwidth
- >1 GHz IF bandwidth
- +10 dBm typical output power
- WG flange or horn antennas
- External LO control
- High speed ON/OFF control

FC1001V/00

## **General**

This converter is a broadband and very versatile building block for 60 GHz applications. It consists of one up- and one downconverter in a single unit. The up- and downconverter works independently, and can thus be used in both frequency multiplexed and time multiplexed applications.

## **FC 1001 features**

By choice of external LO sources the user has full control of frequency selection. Frequency multipliers (x8) are integrated in both up- and downconverter. The LO injection is done at 7 GHz with +0 dBm power. The user has full control of phase noise and frequency selection.

A set of two identical FC1001V/00 can be used in a full duplex configuration by appropriate choice of LO signals for the up- and downconverter modules respectively.

The user also has access to a bias control input for both up- and downconverter. This feature enables TDD operation and power save modes by independently turning OFF the up- and downconverter when not in use. The bias can be turned ON and OFF in less than 100 ns from a CMOS gate, operational amplifier or comparator. For continuous operation the bias control is simply strapped to ground.

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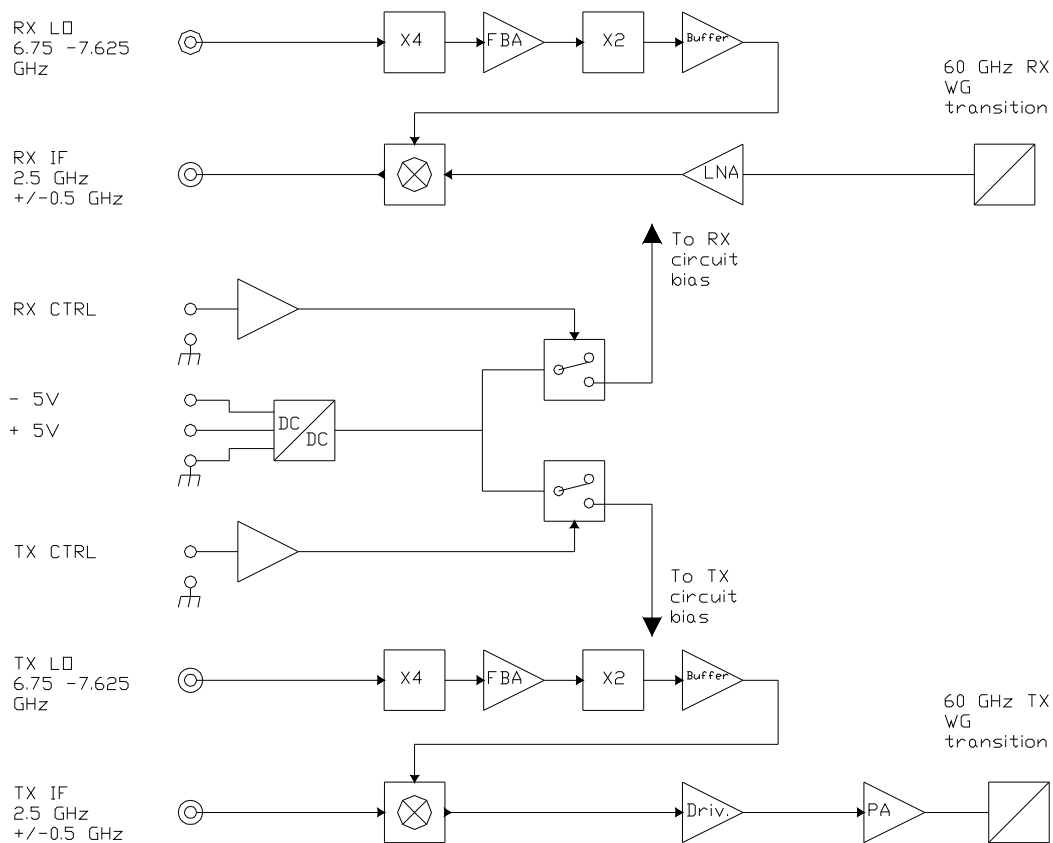
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# 60 GHz converter

# FC1001V/00

The FC1001V/00 converter can also be integrated in a box for dust and weather protection. The box can be designed according to the needs of the customer. Please contact Siverts IMA for details. Siverts IMA can on request also supply a bias circuit board with single +10 to +18 V input raw power. Please contact Siverts IMA for details.

## BLOCK DIAGRAM



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## RF interface options

The FC1001V/00 is intended as a sub-unit to be integrated into a user application. For easy handling, the unit is furnished with standard SMA connectors for IF and LO signals. The output is a waveguide flange UG385/U for easy connection to other equipment or antennas. It is also possible for the user to remove the waveguide adapter flange and use the waveguide excitors (=probes) as low gain antennas.

Optionally, the unit can be equipped with a + 10 dBi horn antenna, in this configuration the product number is FC1001V/01.

## Handling and precautions

Although the construction praxis is of highest standard and sensitive parts as MMIC:s and RF circuits are packaged, the unit must be handled with some care. All semiconductor electronics is ESD sensitive, and this is of course also true for delicate 60 GHz structures. Normal handling with ESD protection is recommended and special care is advised before the unit is integrated into a protective case.

The RF circuits will develop some heat during operation, both up- and downconverter chips are mounted on an alumina heat sink. This heat sink is not intended for continuous operation but is merely a heat transfer device. The heat sink is intended to be mounted on a structure with a thermal resistance of no more than 5 K / W to ambient. It is normally not necessary to use heat conducting paste between the FC1001V/00 heat sink and the mating surface. The heat sink has four holes with M2 threads for mounting, do not use excessive force when attaching the heat sink.

When powering up the unit, special precaution is advised for sequencing the bias voltages. There are two voltages, +5 and -5V, and it is necessary to apply the -5V first in order to avoid over current. Sivers IMA can on request supply a bias circuit board, with single +10 to +18 V input raw power.

If the user so wishes, the waveguide flanges on FC1001V/00 can be removed in order to use the microstrip-to-waveguide transition as a simple broad beam antenna. Care must be exercised when removing and installing details in this area, the exposed microstrip circuit is very delicate.

SMA connectors for IF and LO should first be torque finger tight, and then using a torque wrench to a maximum torque of 0.45 Nm (4 inch pound ).

## LO use and selection

The unit has two separate inputs for the LO signal, one for the upconverter and one for the downconverter. Each input accepts an input signal in the range between 6.75 GHz and 7.625 GHz. With this input range, it is possible to fully cover operation from 57 GHz to 63 GHz maintaining full operational IF bandwidth of 1 GHz centered around 2.5 GHz.

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The up- and downconverter accepts LO power levels from -4 dBm to +10 dBm, however a nominal level of +2 dBm +/-2 dB is recommended for best performance.

The LO signal determines much of how the converter is implemented in a system. Some systems require very low phase noise, other must be frequency agile, FDD requires different LO for up- and downconverter, etc.

The user needs to select the output or input operating frequency and choose a LO source with 1/8:th of that frequency. The phase noise at 60 GHz band is readily calculated as Phase noise @ LO frequency + 18.1 dB, due to the frequency multiplication within the converter.

Sivers IMA also makes excellent VCO:s, PLL:s and synthesizers that is suitable for this converter, please contact Sivers IMA AB or visit our homepage at [www.siversima.com](http://www.siversima.com)

## Electrical specification

### Transmitter upconverter:

Parameter	Min.	Typ.	Max.	Unit
Nominal gain IF/ RF		15		dB
Output power		+10	+12	dBm
1 dB compression point		+10		dBm
ON/OFF ratio		40		dB
LO rejection		20		dB
LO input power	-4	+2	+10	dBm
Added phase noise over LO @ 7GHz		18.1		dB
RF output frequency range	57		63	GHz
IF input frequency range	2		3	GHz
IF Input return loss		-10		dB
Switching delay, bias control			100 ns	
Bias current ON state			350	mA
Bias current OFF state			50	mA
all data given for ambient temperature of +25 °C				

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# 60 GHz converter

# FC1001V/00

**Receiver downconverter:**

Parameter	Min.	Typ.	Max.	Unit
Nominal gain RF/ IF		5		dB
Noise figure (on RX input port)		11		dB
Image rejection	10	20		dB
1dB compression point input		-18		dBm
RF input frequency range	57		63	GHz
IF output frequency range	2		3	GHz
Bias current ON state			350	mA
Bias current OFF state			50	mA
all data given for ambient temperature of +25 °C				

**Interface/environmental specification**

Parameter	Min	Max	Unit/Remark
Bias voltage Vdd	4.8	5.2	V *
Bias voltage Vgg	-4.8	-5.2	V*
Bias current	-	-	See electrical spec
Output port (R620, WR15)			UG-385/U
Operating temperature	0	+45	°C
Storage temperature	-50	+100	°C

\* Note, sequencing of bias is recommended. Apply first Vgg , then Vdd

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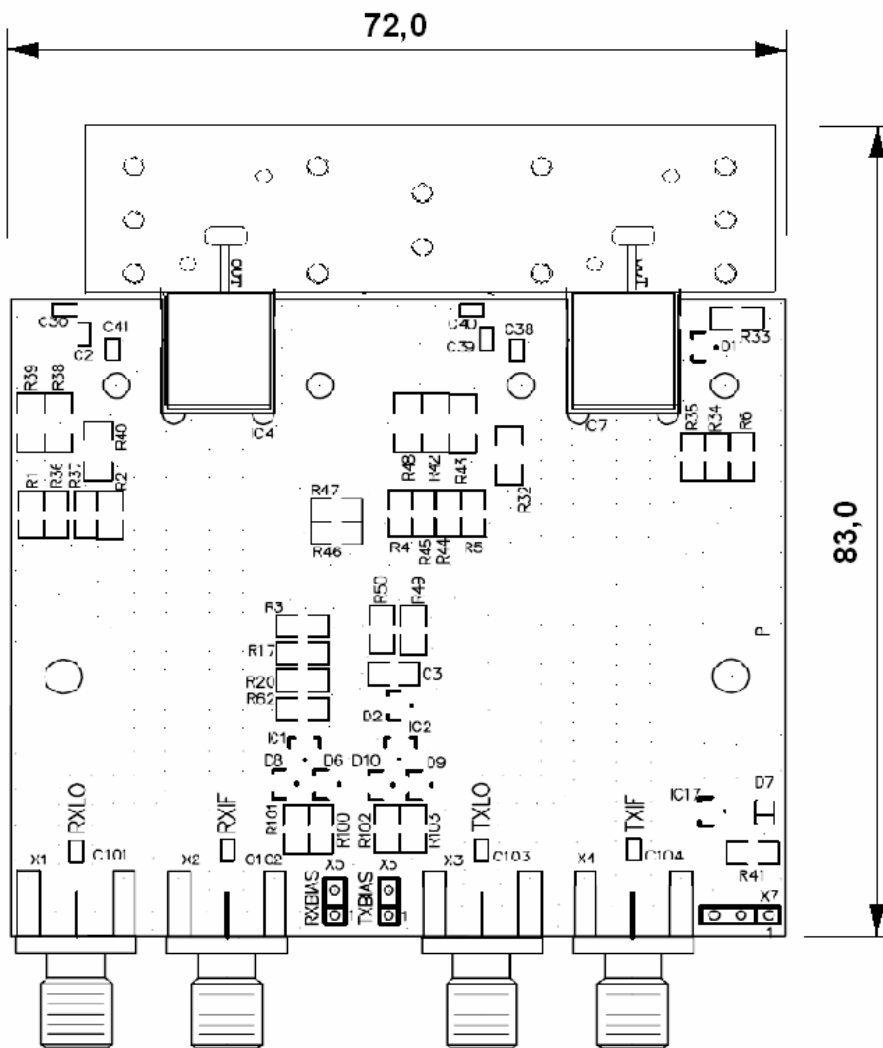
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## Outline drawing



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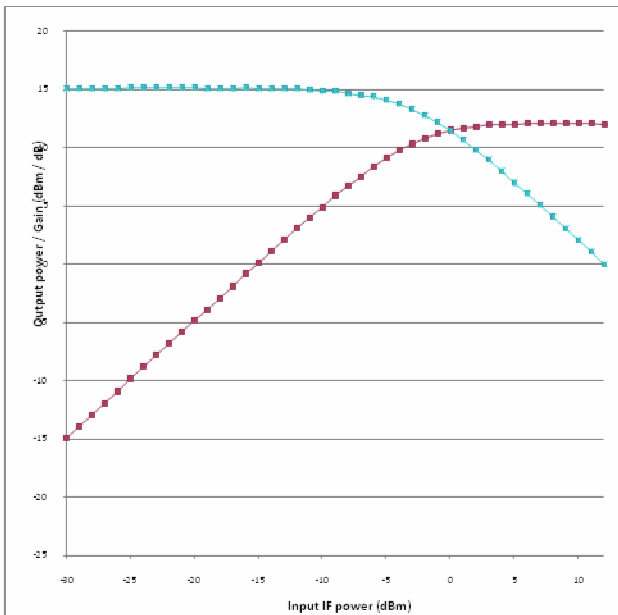
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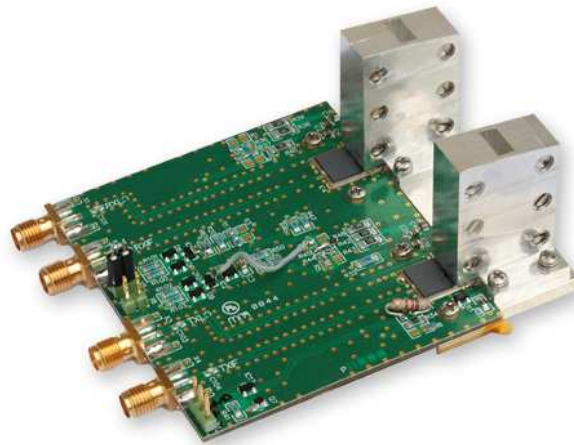
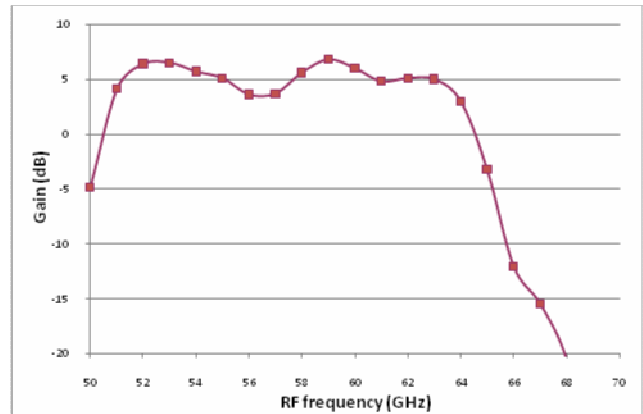
# 60 GHz converter

# FC1001V/00

TYPICAL GAIN AND COMPRESSION  
UPCONVERTER



TYPICAL CONVERSION GAIN  
DOWNCONVERTER



The optional FC1001V/01 shown with +10 dBi horn antennas

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