COM-4004 70 MHz (0.2-80 MHz) IF MODULATOR

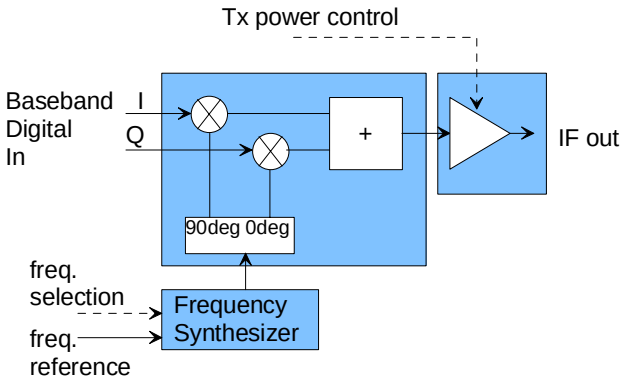
Key Features

- Quadrature modulator 0.2 - 80 MHz center frequency.
- Extremely low-phase noise frequency synthesizer can be tuned over entire range by steps of 0.05Hz.
- Input: 50 Msamples/s 14-bit precision complex samples.
- 8-bit output amplitude control
- Selectable internal / external 10 MHz frequency reference for the frequency synthesizer.
- Single 5V supply
- Connectorized 3"x 3" module for ease of prototyping. SMA connectors.

For the latest data sheet, please refer to the **ComBlock** web site: www.comblock.com/download/com4004.pdf. These specifications are subject to change without notice.

For an up-to-date list of **ComBlock** modules, please refer to www.comblock.com/product_list.htm .

Block Diagram



Electrical Interface

Inputs / Outputs

Input Module Interface	Definition
DATA_IN[13:0]	Input. Quadrature baseband samples, 14-bit precision, 2's complement format. Bit 13 is the most significant bit. The in-phase (I) and quadrature (Q) samples alternate.
SAMPLE_CLK_REQ	Output. Input samples are clocked at the rising edge of SAMPLE_CLK_REQ. I & Q samples alternate at each request. SAMPLE_CLK_REQ is a 100 MHz clock.
TX_ENABLE	Input. Transmit enable. Active high. The first sample after TX_ENABLE becomes active is an in-phase (I) sample.
EXT_REF_CLK	External 10 MHz frequency reference for frequency synthesis. Square-wave generally yields better output phase noise.

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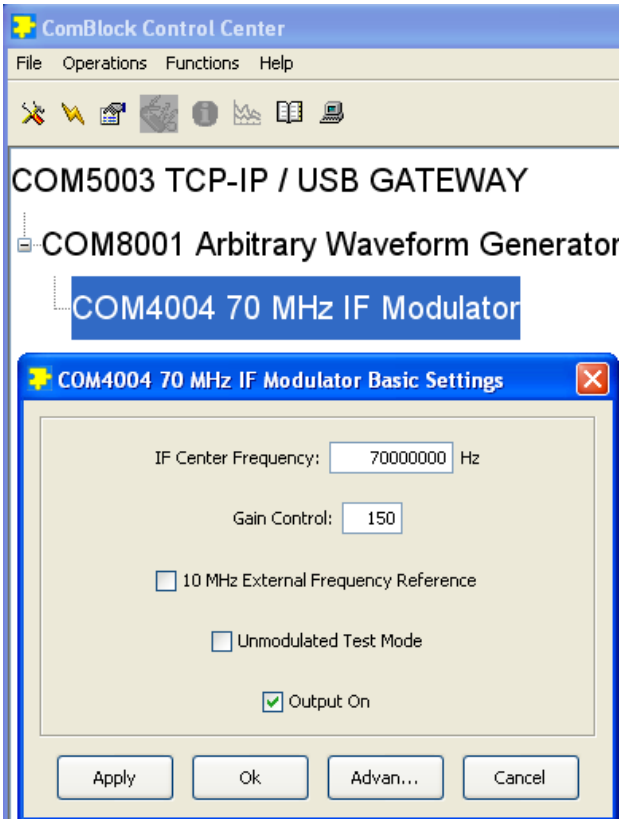
	Sinewave and clipped sinewave are also acceptable inputs. Minimum level 0.5Vpp. Maximum level: 3.3Vpp. SMA connector J2.
Analog Output Signals	**Definition**
IF_OUT	Modulated IF output. 0.2 – 88 MHz Maximum output level: -10 dBm (0.2-80 MHz). See gain flatness performance for details. Impedance: 50 Ohms. SMA connector J5.
Serial Monitoring & Control	DB9 connector J8. 115 Kbaud/s. 8-bit, no parity, one stop bit. No flow control.
Power Interface	4.75 – 5.25VDC. Terminal block. Power consumption is 700mA max.

Configuration

Complete assemblies can be monitored and controlled centrally over a single serial connection or, when available through adjacent ComBlocks, over a LAN, PCMCIA/CardBus or USB connection.

The module configuration parameters are stored in non-volatile memory and loaded automatically at power-up.

Configuration can be done over a user-friendly interface or using the API.



Programmers developing custom applications (using the ComBlock API instead of the supplied ComBlock control center graphical user interface) should know that frequency and level changes are enacted upon (re-)writing to the last register (REG6).

Parameters	**Configuration**
IF center frequency ($\mathbf{f_c}$)	Range 0.2 MHz to 88 MHz, expressed as $\mathbf{f_c}$/200MHz*2^{32}. Increment 0.046 Hz REG0: bit 7:0 (LSB) REG1: bit 15:8 REG2: bit 23:16 REG3: bit 31:24 (MSB)
Gain control	Range : 1 to 2^8-1 8-bit amplitude control. REG4: bit 7-0
Reserved	Always 0x04 REG5: bit 7-0
External/Internal frequency reference	0 = internal 1 = external. REG6: bit 0
Operating mode	0 = quadrature modulator 1 = unmodulated carrier REG6: bit 1
Output on/off	0 = output off 1 = output on REG6: bit 2

Baseline configurations can be found at www.comblock.com/tsbasic_settings.htm and imported into the ComBlock assembly using the ComBlock Control Center File | Import menu.

Operations

Internal vs External Frequency Reference

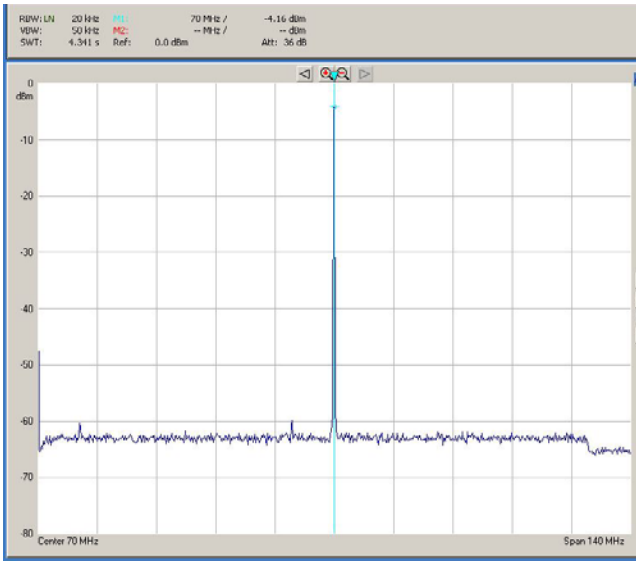
In order to use the external frequency reference, connect a 10 MHz sinewave, clipped sinewave or square wave to the SMA connector J2. Then select external frequency reference by software command from the ComBlock control center.

In order to use the internal frequency reference, either physically disconnect the external 10 MHz signal at SMA connector J2, or place the external input signal in high impedance mode. Then select internal frequency reference by software command from the ComBlock control center.

Unmodulated Carrier Test Mode

The COM-4004 IF modulator can be used as sinewave generator for test purposes. Set REG6 bit 1 to activate this test mode.

Note: for best performances, the gain control values in REG4 should be reduced when in this test mode, so as to minimize intermodulation products. A maximum setting of 0x80 is recommended.



Unmodulated carrier test mode (70 MHz, gain 150)

Test Points

Test points are provided for easy access by an oscilloscope probe.

Test Point	Definition
TP1	Internal / External reference clock

Schematics

The schematics are available on the ComBlock CD shipped with every module.

Performance

Quadrature phase error: < 1. deg rms.
I/Q amplitude balance error: < 0.2 dB.

LO leakage: -38 dBc (typ).

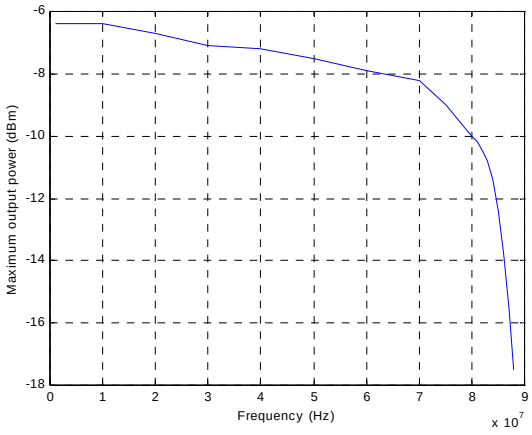
Sideband suppression: -48 dB typ.

Phase noise:
-90 dBc/Hz @ 1 KHz, typ.
-95 dBc/Hz @ 10 KHz, typ.

On/Off isolation: > 70 dB.

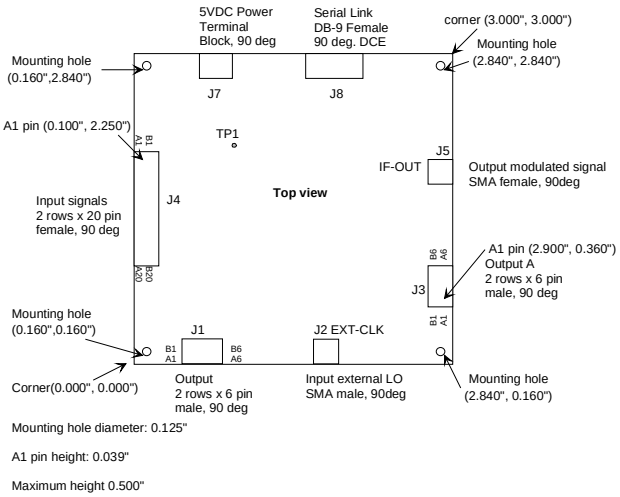
Out-of-band spectral spurious lines: < - 60 dBc

Gain flatness:



The modulator includes an output filter for rejection of the image frequency 100 MHz – fc, where fc is the center frequency of the modulated signal. The filter reduces the maximum power available at the output for signals above 80 MHz.

Mechanical Interface



Mounting hole diameter: 0.125"

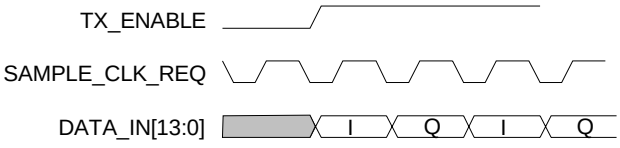
A1 pin height: 0.039"

Maximum height 0.500"

Timing

Input Samples

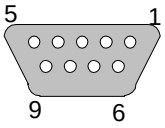
I and Q Input samples are multiplexed over the same 14-bit interface. The samples are read at the rising edge of SAMPLE_CLK_REQ. The first sample read when TX_ENABLE = '1' is an I sample.



Pinout

Serial Link J8

The DB-9 connector is wired as data circuit terminating equipment (DCE). Connection to a PC is over a straight-through cable. No null modem or gender changer is required.

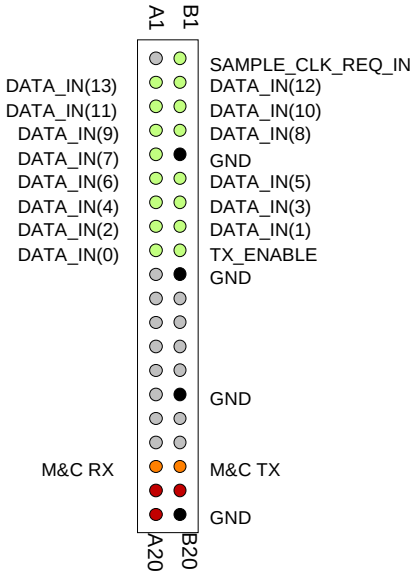


DB-9 Female

2 Transmit
3 Receive
5 Ground

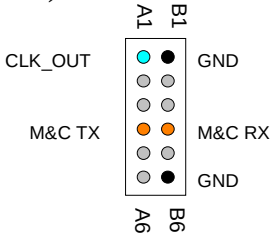
Input Connector J4

40-pin (2 rows x 20) 2mm female connector.



Output Connectors J1,J3

12-pin (2 rows x 6) 2mm male connector.



This connector is to forward GND and other monitoring and control signals to subsequent analog modules.

I/O Compatibility List

(not an exhaustive list)

Input
COM-1202 PSK/QAM/APSK modem
COM-1402 PSK/QAM/APSK modulator
COM-1019 DS spread-spectrum modulator
COM-1028 FSK/MSK/GFSK/GMSK modulator
COM-8001 Arbitrary Waveform Generator

Potential incompatibilities:
The COM-4004 should NOT be used with COM-900x adapters. Direct connection between the J4 input connector and an FPGA-based ComBlock data source is strongly advised to maintain the high-speed clock integrity.

Configuration Management

This specification is to be used in conjunction with Atmel microcontroller software revision 5.

ComBlock Ordering Information

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