ComBlock

# COM-4103 L/S-band 10W Power Amplifier + LNA

`Key Features

- 10W power amplifier,
  Frequency range: 1.7 – 2.2 GHz
  Automatic level control (ALC)

- 0.9dB noise figure LNA
  Frequency range: 1.5 – 2.7 GHz
  Custom frequency band at no extra charge.

- Can be configured as half-duplex (with tx/rx switch included) or full-duplex (diplexer not included)

- Single 26-30V DC power supply.
  Includes 5V 3A power supply output to power other modules (such as transceiver and modem).

- Transmit gain: > 40 dB
  Receive gain: > 35 dB

- Temperature and transmit power reported as analog signals and digital measurements.

- Half-duplex Tx/Rx switch time < 2µs

- RF interfaces:
  50 Ohm SMA connectors (antenna side)
  50 Ohm UMCC connectors (transceiver side)

- Monitoring and Control through asynchronous serial (LVTTL) or USB.

Applications Example
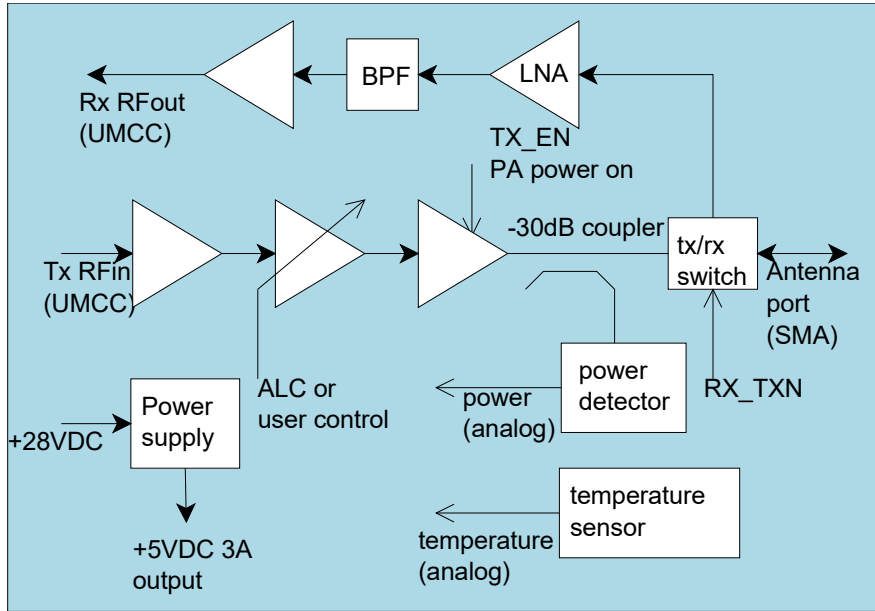
3-module satellite modem
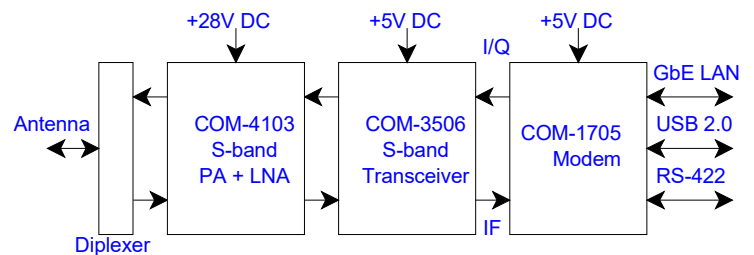
For the latest data sheet, please refer to the **ComBlock** web site: comblock.com/com4103.html.
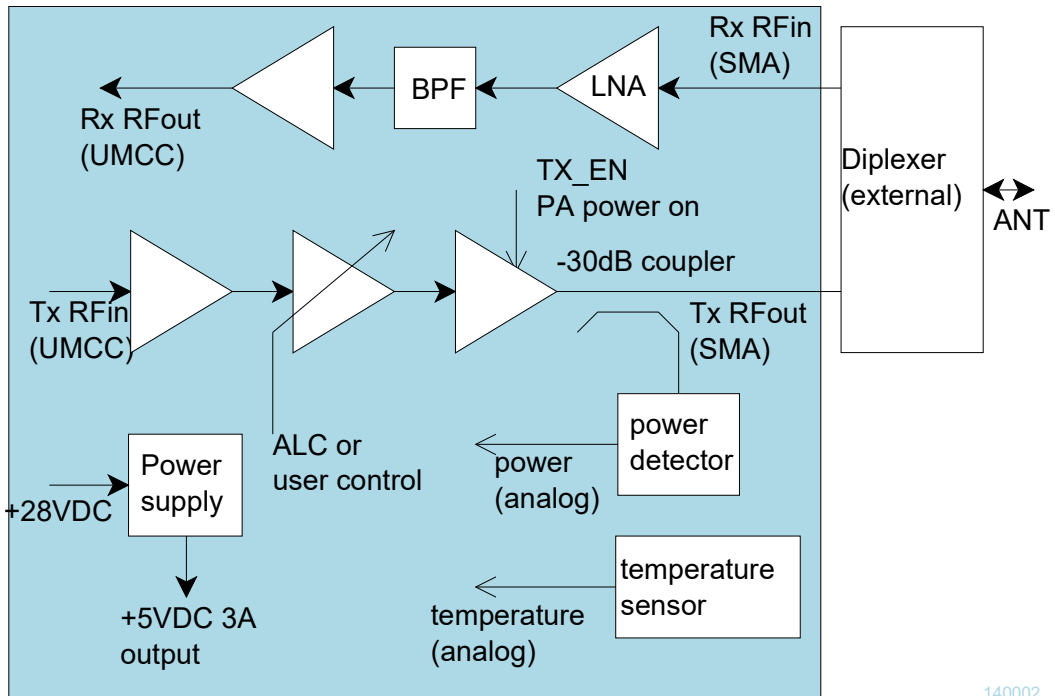These specifications are subject to change without notice.

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

Block Diagram

Half-Duplex configuration (-**A** option)

Full-Duplex configuration (-**B** option)

Electrical Interface

RF	Definition
TX_IN	Power amplifier input. (J7) UMCC [1] connector, 50Ohm. AC coupled. -12 dBm max operational. +20 dBm max no damage.
Antenna port / TX_OUT/ANT	Antenna port (when configured as half-duplex), or power amplifier out (when configured as full duplex) Maximum no damage input level: + 20 dBm (J8) SMA right-angle female connector, 50Ohm.
RX_IN	LNA input (when configured as full-duplex) Maximum no damage input level: + 20 dBm (J6) SMA right-angle female connector, 50Ohm.
RX_OUT	LNA output (J3) UMCC connector, 50Ohm.

Controls Flat flexible cable	Definition
RX_TXN	Half-duplex receive/transmit# control signal. '0' = transmit '1' = receive. Ignored when configured for full duplex. In half-duplex, the transmit output is muted when RX_TXN = '1'. LVTTL input. Recommended guard time: 5us. Flat flexible cable connector pin 8
TX_EN	Binary transmit section enable. Active high. '1' = to power the transmit section '0' = to save power in a receive-only configuration. Unlike the fast RX_TXN switch signal, this signal cannot be switched dynamically because of the power supply slow rise time. LVTTL input. Flat flexible cable connector pin 7
RFOUT_ENB	Binary transmit section enable. Active low. '0' = to enable the transmit RF path '1' = to mute the power amplifier. This control signal is fast. LVTTL input. Flat flexible cable connector pin 6
TX_GAIN_CTRL_EXT	Analog 0 – 3.3V Controls the transmitter gain when enabled. Flat flexible cable connector pin 4

Status Flat flexible cable	Definition
Transmitted power	Analog monitoring signals Flat flexible cable connector pin 2 Range 0 – 2.5V
Board temperature	Analog monitoring signals Flat flexible cable connector pin 3 Range 0 – 2.5V

Monitoring & Control	
USB	Mini-USB connector Type AB Full speed / Low Speed
Async. Serial	LVTTL-level (NOT RS232!) asynchronous serial, 115.2 Kbaud. Through the flat flexible cable and card edge.

Power	
Power supply input	26-30V_{DC}; Solder pads. Power consumption is 1.2A typ.
5VDC output	5VDC to power other modules. 3A maximum output. Solder pads.

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[1] Ultra-Miniature Coaxial Connector to SMA adapter is supplied.

Absolute Maximum Ratings

Supply voltage	-0.3V min, +36V max
Control signals	-0.3V min, +5.5V max
RF inputs	+20 dBm

Configuration

An entire ComBlock assembly comprising several ComBlock modules can be monitored and controlled centrally over a single connection with a host computer. Connection types include built-in types:

- USB
- Asynchronous serial (LVTTL levels)

or connections via adjacent ComBlocks.

The module configuration is stored in non-volatile memory.

Configuration (Basic)

The easiest way to configure the COM-4103 is to use the **ComBlock Control Center** software supplied with the module on CD. In the ComBlock Control Center window detect the ComBlock module(s) by clicking the 🗲 *Detect* button, next click to highlight the COM-4103 module to be configured and click the ⬛ *Settings* button to display the *Basic Settings* window shown below.
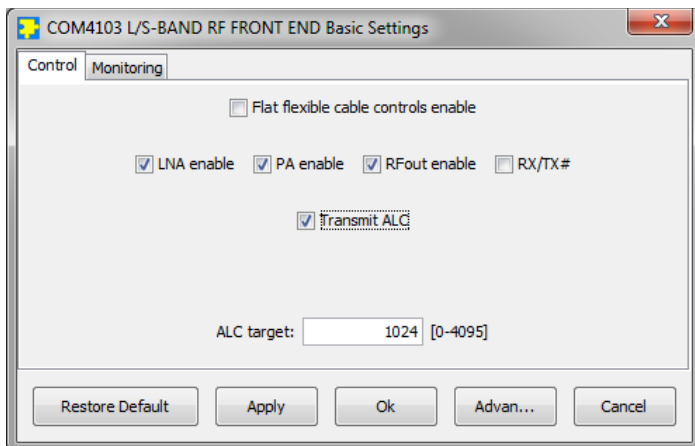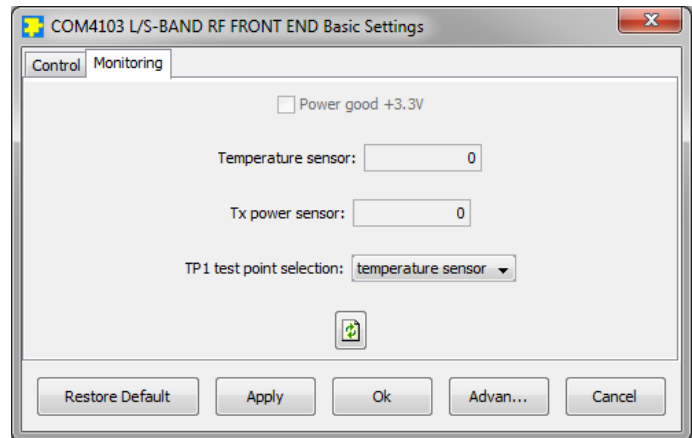
Configuration (Advanced)

Alternatively, users can access the full set of configuration features by specifying 8-bit control registers as listed below. These control registers can be set manually through the ComBlock Control Center or by software using the ComBlock API (see www.comblock.com/download/M&C_reference.pdf)

The module configuration parameters are stored in non-volatile memory. All control registers are read/write.

Parameters	Configuration
LNA enable/disable	Enable(1) / Disable (0) LNA. The objective is to reduce power consumption when the receive path is unused. REG0(0)
Power amplifier enable/disable	Enable(1) / Disable(0) the power amplifier. The objective is to reduce power consumption when the transmit path is unused. As the command switches the PA_+28V power supply on/off, it is relatively slow. REG0(1)
Fast power amplifier enable/disable	Enable(1) / Disable(0) the power amplifier at the gate. Controls the power amplifier gates. Switching is fast, but the biasing remains enabled. REG0(2)
RX/TX switch	Controls the RX/TX switch position when the board is configured for half-duplex. 0 = receive path open 1 = transmit path open In the full duplex option –B, this control signal is ignored. The rx/tx switch opens the transmit path when the power amplifier is turned on and switches the transmit path off otherwise. REG0(3)

Flat flexible cable signals enabled/disabled	The above commands can be overruled by signals received from an external module over a flat flexible cable (J4 connector). Enable(1) or disable(0) REG0(7)
Transmitter ALC loop	0 = open loop. Transmitter gain is fixed by control registers below. 1 = internal ALC loop. This feature is disabled when the board is configured for external transmit gain control. REG1(0)
Fixed transmitter gain	Transmitter gain when ALC is disabled (open loop transmit gain). 10-bit: 0 for the minimum gain, 1023 for the maximum gain. The transmitter gain change is enacted upon writing to REG3. REG2: bits 7:0 (LSB) REG3(1:0): bits 9:8
ALC target transmitted power	Expressed in the same units as the 12-bit value from the transmit power detector. (see Monitoring section). Any change in ALC target transmitted power is enacted upon writing to REG5. REG4: bits 7:0 (LSB) REG5(3:0): bits 11:8
Analog test point selection	Select which analog signal is to be monitored at the TP1 test point 0= disabled 1 = temperature sensor 2 = transmit power sensor REG6(1:0)

Monitoring ℹ️

The monitoring panel opens by clicking on the 🖼️ S*ettings* button and the "Monitoring" tab. Alternatively hexadecimal values are shown by clicking on the ℹ️ S*tatus* button.

Parameters	Monitoring
Power supply check	SREG0(0): power good1 +3.3V
Board temperature	Thermistor output SREG1 = LSB SREG2(3:0) = MSB
RF output power	Power detection between the power amplifier and the tx/rx switch. See TX_POWER_DET in schematic. SREG3 = LSB SREG4(3:0) = MSB

Test Points

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

Test Point	Definition
TP1	Analog test point (temperature sensor or transmit power sensor as selected by the user)
Red LED	Red when one of these conditions occur: a) 3.3V supply voltage too low

Operations

Heat Sink

One side of the board consists of a ground plane without any component or exposed non-ground vias. It is designed to be tightly connected to a heat radiating surface such as a metal enclosure or the supplied heat sink. Four mounting holes sized for 4-40 screws are located (0.160,0.160) from the four corners of the 3"x3" board.

Heat sink dimension: 3" x 3.5" x 1.05"

The transmitter should never be enabled if the heat sink is not assembled tightly on the ground side of the board.

Use of thermal grease (thermal compound) between the board and the heat sink is recommended for optimized heat transfer.

Controls

This module can be controlled through USB (using the user-friendly ComBlock control center GUI or API) or through a 10-signal flat flexible cable.

To insert the FFC, pull out the black section of the zero-insertion force connector J4, insert the FFC end with the contacts down and lock the connector by pushing the black section back. Be sure to properly align the FFC with the connector.

Internal vs external transmit gain control

The transmit path gain can be controlled either internally under software control or externally via the TX_GAIN_CTRL_EXT signal on pin 8 of the flat flexible cable connector.

The selection of internal versus external is done by soldering one of two surface-mount resistors:
- Internal control: R54 = 0R, R62 = open
- External control: R54 = open, R62 = 0R

Internal software control is configured by default. Please select internal/external transmit gain control at the time of ordering.
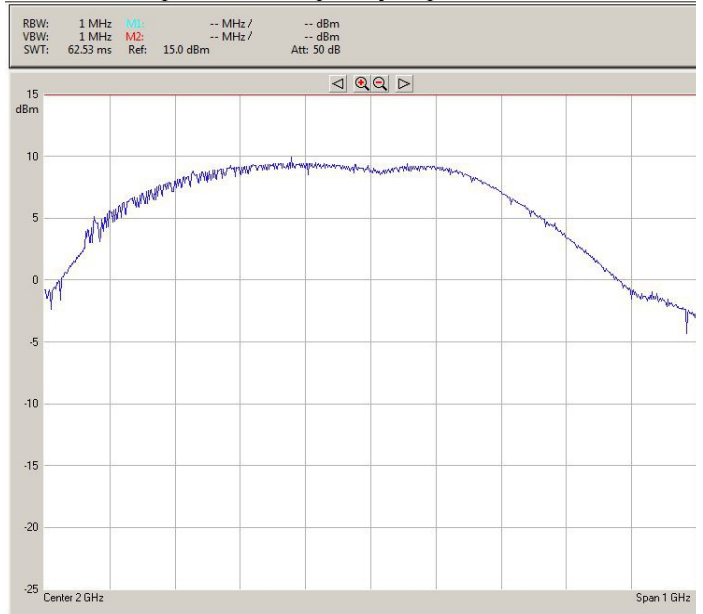
Schematics

The schematics are available on the ComBlock CD shipped with every module (in the "Hardware schematics" folder).

Performance

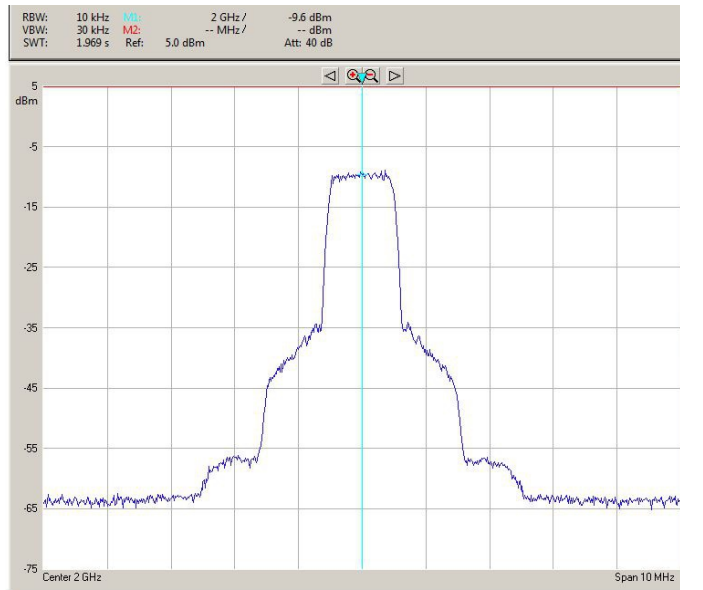## Transmit power

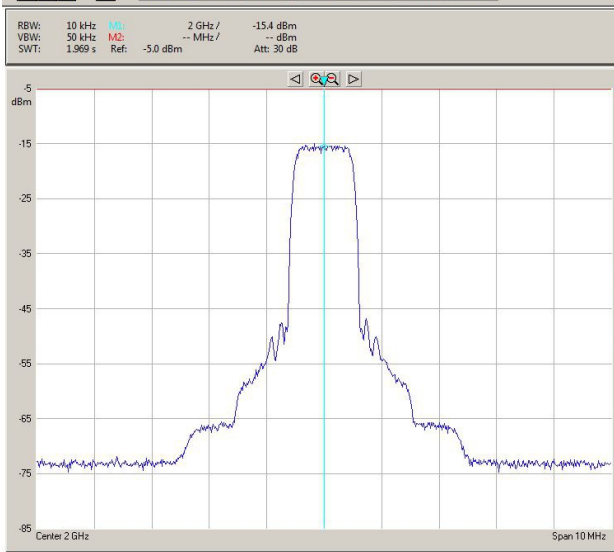The transmit power vs frequency is plotted below.

RBW:	1 MHz	M1:	-- MHz /	-- dBm
VBW:	1 MHz	M2:	-- MHz /	-- dBm
SWT:	62.53 ms	Ref: 15.0 dBm		Att: 50 dB

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15 dBm

10

5

0

-5

-10

-15

-20

-25 Center 2 GHz   Span 1 GHz

Reference: 9.2 dBm = 10W

Transmitted modulated signal

Input: 1 MHz QPSK signal, +2 dBm
Output (after 30.8 dB attenuation): +41.2 dBm

RBW:	10 kHz	M1:	2 GHz /	-9.6 dBm
VBW:	30 kHz	M2:	-- MHz /	-- dBm
SWT:	1.969 s	Ref: 5.0 dBm		Att: 40 dB

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5 dBm

-5

-15

-25

-35

-45

-55

-65

-75 Center 2 GHz   Span 10 MHz

Input: 1 MHz QPSK signal, -7 dBm
Output (after 30.8 dB attenuation): +35.4 dBm

ALC

An automatic Level Control (ALC) can be enabled for the transmitter. The ALC dynamic range is approximately 20 dB, so it is important to position the input level and target output level so that the ALC does not reach its min/max boundaries. The ALC response time is captured below for input steps of 10 dB (horizontal time scal is 2.5s/division)
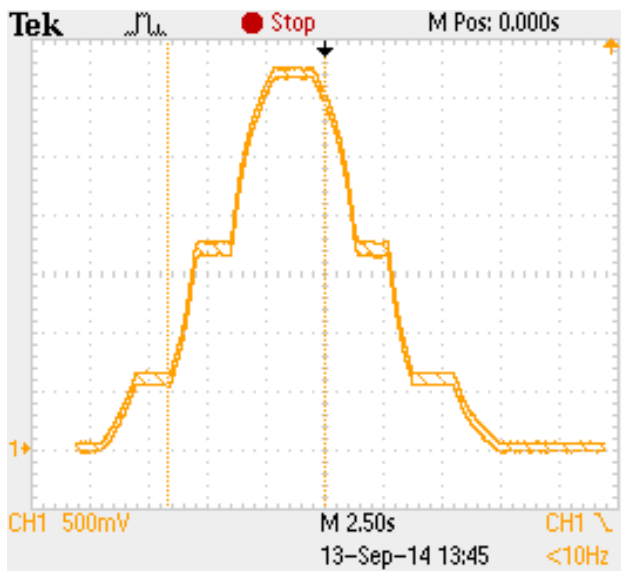
Receiver gain (full duplex –B option)

100 MHz: 46 dB
500 MHz 49 dB
1 GHz: 45 dB
1.5 GHz: 40 dB
2 GHz: 37 dB
2.5 GHz: 37 dB

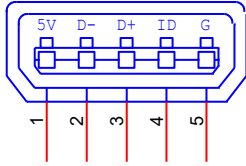3 GHz: 35 dB

Receiver frequency response example: configured with BFCN-2275+ bandpass filter, input –50dBm.

Mechanical Interface
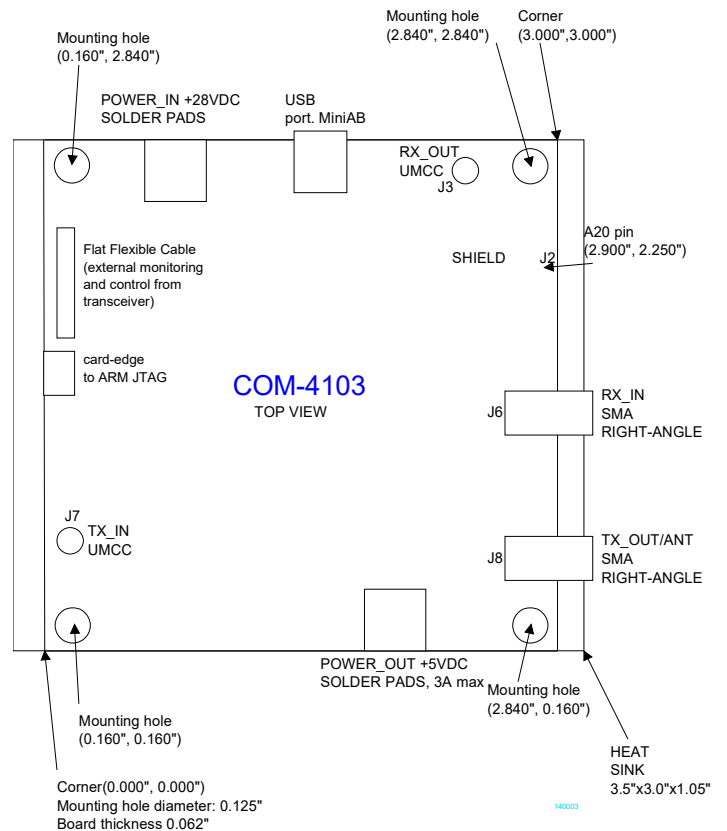
Pinout

Mini USB Connector, J1

The COM-4103 is a USB device with a mini type AB connector. (G = GND)

Flat Flexible Cable Connector, J4

In addition to USB, the COM-4103 can also be monitored and controlled through a flat flexible cable connected to the J4 ZIF board-mount connector, 10 positions, 1mm pitch, right angle.

Compatible flat flexible cables:
1mm pitch, 0.3mm thickness, 10 positions.
Parlex USA 100R50-152B
Molex Inc 0210390255
Wurth Electronics Inc 686610152001

I/O Compatibility List

(not an exhaustive list)

I/O
COM-3506 [400MHz - 3GHz] Transceiver
COM-4410 [70 MHz – 2.2 GHz] 4-channel quadrature RF modulators
COM-400x quadrature modulators

Accessories

Included

- Heat sink
- USB cable
- UMCC to SMA stubs (2)

Recommended

- Thermal grease for better contact between board and heat sink
- Flat flexible cable

ComBlock Ordering Information

COM-4103-A
L/S-band 10W Power Amplifier / LNA, half-duplex

COM-4103-B
L/S-band 10W Power Amplifier / LNA, full-duplex (diplexer not included)

At the time of ordering, please select:
- Option –A (half-duplex) or –B (full duplex)
- Internal/external transmit gain control
- Receive frequency band (for LNA filtering)

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