jetvision

Günter Köllner Embedded Development GmbH
Am Rain 24
85256 Vierkirchen, Germany

Datasheet

Mode-S Beast Module

The Mode-S Beast Module is a receiver for Mode-S, ADS-B and Mode-A/C signals. As such it contains a receiver for pulse modulated signals on 1090MHz, a FPGA based decoder with serial output and USB CDC class serial output.

It features a

- 3.3V TTL based serial output
- GPS reception using built in uBlox M8W
- NMEA and 1PPS input from external source [1)]
- Combined ADS-B/GNSS antenna port
- Separate GNSS antenna input [2)]

Configuration can be done with serial commands.

[1)] Requires special FPGA firmware.
[2)] Requires changes in component assembly.

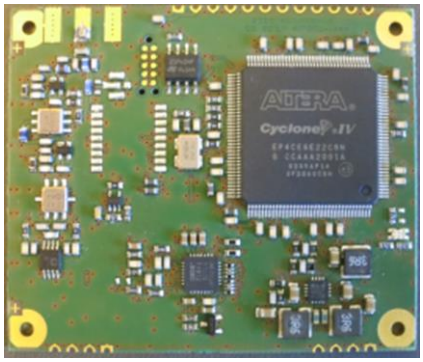
Technical Data

Antenna Input

Description	Data	Value
Impedance		50Ω
Connector		SMA female

Power Supply

Description	Data	Value
Operating Voltage		5V +/- 5%
Operating Current	Installed GNSS module	275mA
Operating Current	Without GNSS module	200mA



Mode-S Beast Series

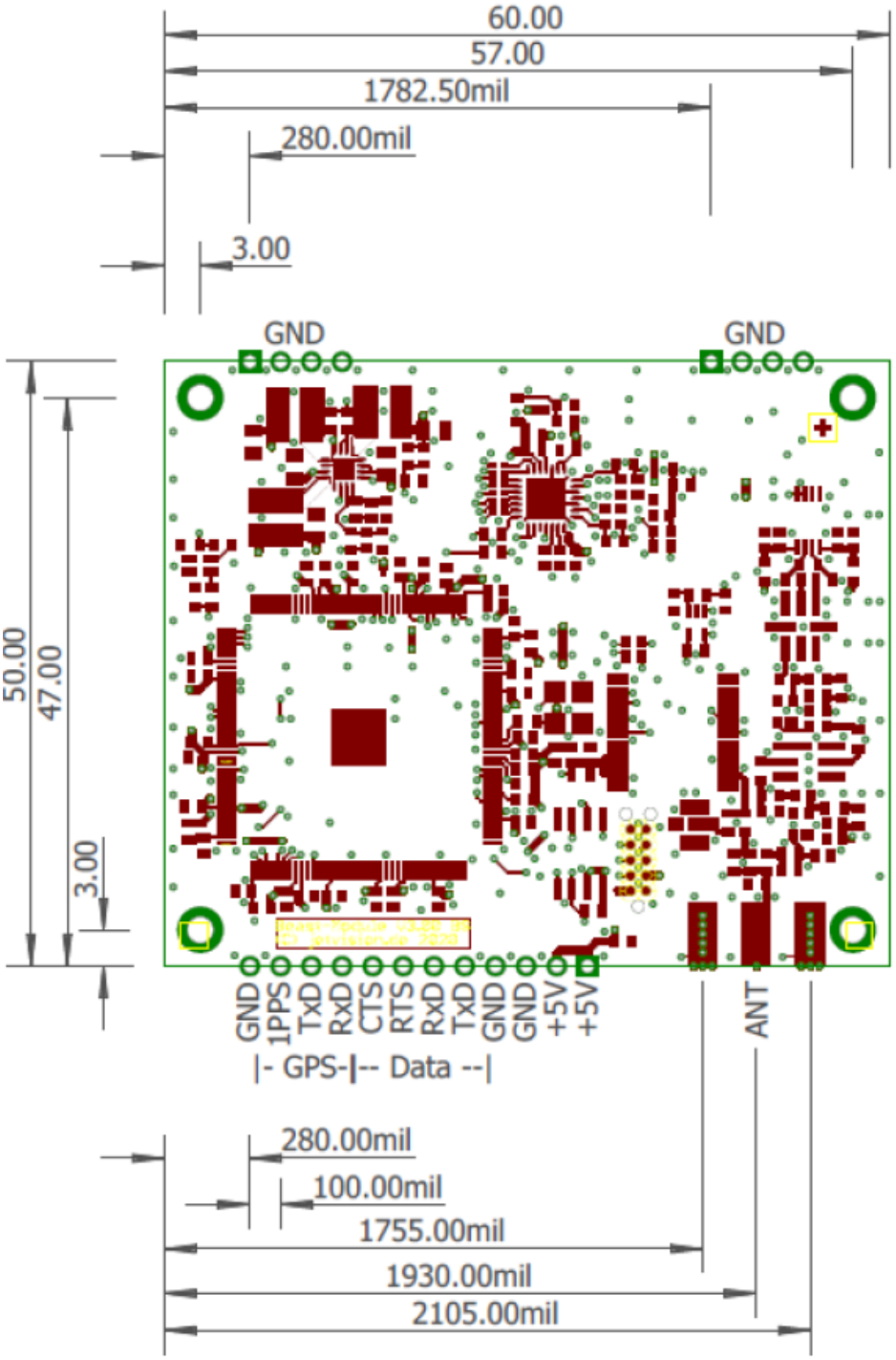
Mode-S Beast Module

Product Number: 41100

Usage:

Highly sensitive Mode-A/C, Mode-S and ADS-B modem with raw data output on a 3.3V TTL serial channel.

Dimensions


60.00
57.00
1782.50mil
280.00mil
3.00
GND
GND
50.00
47.00
3.00
GND
1PPS
TxD
RxD
CTS
RTS
RxD
TxD
GND
GND
+5V
+5V
ANT
|- GPS-|-- Data --|
280.00mil
100.00mil
1755.00mil
1930.00mil
2105.00mil

Decoded Data Output

Description	Data	Value
Baudrate	Bits/sec	1000000
Bits		8
Parity		none
Format		Beast Binary AVR

Other specifications are available on customer's demand

Firmware options

The precision timestamp timestamp information, if at all required, can be provided from different sources

- Internal uBlox M8W GPS module
- External uBlox UBX format device
- External Trimble TSIP device
- External NMEA input

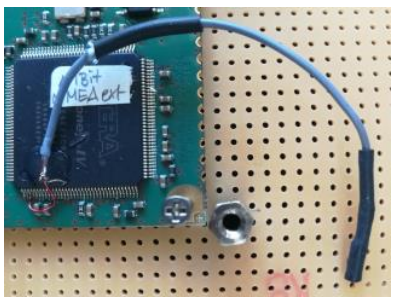
Each of them requires a special FPGA firmware. Please contact supplier for more information

Connector

Pin	Pin Group	Direction	Signal
1	Power	n.a.	+5V
2	Power	n.a.	+5V
3	Power	n.a.	GND
4	Power	n.a.	GND
5	Mode-A/C, Mode-S		TxD
6	Mode-A/C, Mode-S		RxD
7	Mode-A/C, Mode-S		RTS
8	Mode-A/C, Mode-S		CTS
9	GNSS		RxD
10	GNSS		TxD
11	GNSS	in / out [1)]	1PPS [2)]
12	Power	-	GND

[1)] Pin direction depends on installed firmware, wether GNSS is sourced from on board GNSS module or provided by external GNSS.

[2)] For hardware version 2.0 supplied in February 2020 the 1PPS pin is routed to a wire connector
Removed for all later versions.



NMEA Message Requirement and Use

NMEA External Interface Settings

Description	Data	Value
Baudrate	Bits/sec	115200
Bits		8
Parity		none
Format	optional, requires FPGA firmware change	NMEA uBlox UBX Trimble TSIP

Other specifications are available on customer's demand

Without these settings the FPGA is unable to read required NMEA/TSIP/UBX messages and by that cannot generate a synchronized timestamp.

A flashing red LED indicates missing NMEA/GNSS data.
A fast flashing red LED indicates missing 1PPS pulse.

Preliminary Requirements

- Time reference to GPS or UTC time (in other words, the 18sec offset between both at the time of writing) must be initialized and supervised by customer high level software when using GNSS data, no matter if the GNSS module is internal or external. The FPGA does not send any commands to the GNSS module.
- Antenna connection monitoring is not part of the NMEA protocol and so has to be supervised by customer high level software. The Mode-S Beast module in NMEA mode always assumes the antenna is connected and outputs antenna bit as '1'.

1PPS Pulse Requirements (external GPS)

Description	Data	Value
Pulse width	Minimum	1µs
Signal reference	Edge	Rising

Required NMEA Messages

NMEA Message	Time of Day (time)	Number of Satellites (numSV)	Data validty status (status)
GxRMC [1)]	•		• [3)]
GxGGA	•	• [2)]	
GxGNS	•	• [2)]	
GxGLL	•	-	• [3)]

Each dot must be fulfilled with at least one message, e.g. GNRMC and GNGLL will be sufficient.

[1)] With respect to document "*u-blox_ZED-F9P_InterfaceDescription_(UBX-18010854).pdf*", in GxYYY the 'x' stands for one of the letters P, L, A, B or N.

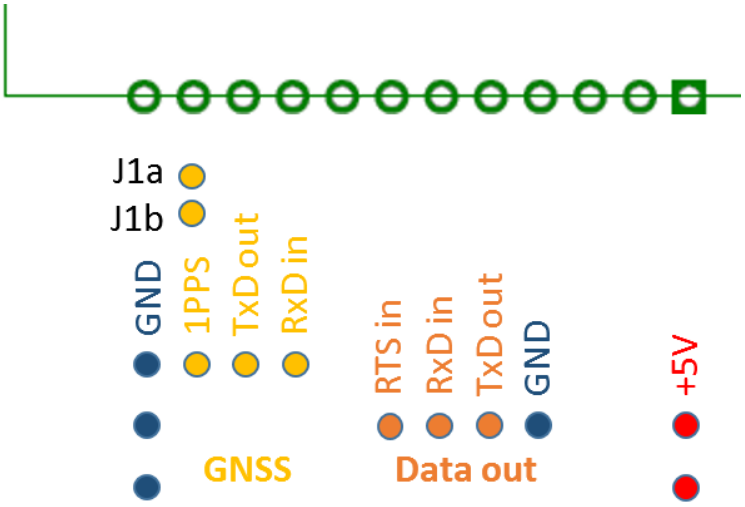
[2)] Minimum number of satellites is 3. A FPGA firmware change is required if a timing module with a lower required number should be used

[3)] The information *"'A' = Data valid"* is required to detect lock on satellites

Demo Board Pin Layout

The signal direction of GNSS signal is reversed for external GNSS version and internal GNSS version.

External GNSS Input



USB serial cable (eBay):

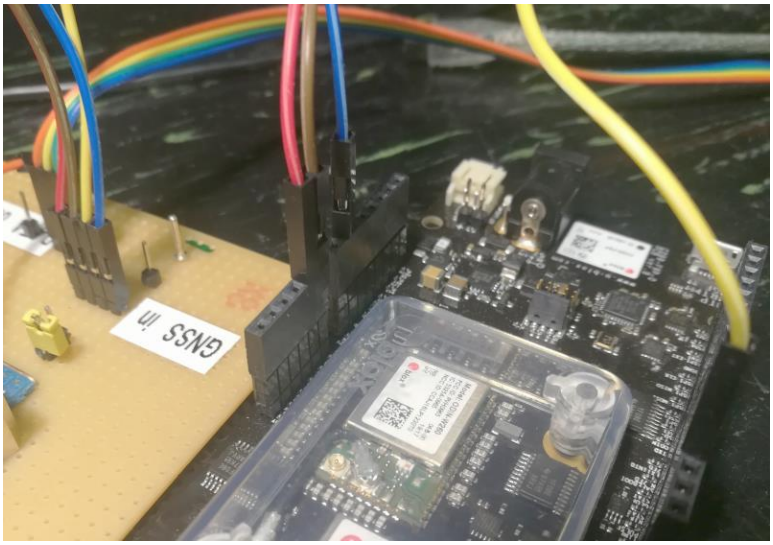
Data out:

GNSS:
TxD out → green
RxD in → white

J1:	uninstall for the V1.00 boards, install for all later versions
J1b:	connect to extra1PPS signal line for V1.00 boards (edge connector is GND for V1.00)
GNSS TxD out	unused for external GNSS input version USB serial cable (eBay):

uBlox F9P wiring for UART2 to external NMEA input

uBlox F9P Demoboard	Color	Signal
J9, Arduino D, Pin 4	Yellow	1PPS
J3, Arduino B, Pin 1	Brown	TxD2 out
J3, Arduino B, Pin 2	Red	RxD2 in
J2, Arduino A, Pin 6 + 7	Blue	GND



History of changes

Version	Date	Name	Description
1.0	2020-02-06	G. Köllner	Creation for engineering samples V2.00 (total 8 pieces)
2.0	2020-03-16	G. Köllner	Fixed inverse pin numbering in connector pinning
3.0	2020-07-06	G. Köllner	Renewed dimension drawing
4.0	2020-09-19	G. Köllner	Update programming interface
5.0	2020-11-19	G. Köllner	New product photo in title page sidebar