SYNC25104HR/SYNC35104HR

GPS Disciplined Oscillator with Frequency Synthesizer

User's Manual

BDM-610020154 Rev. B

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AS9100 and ISO 9001 Certified

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Revision History

Rev A	Initial Release
Rev B	Changed Antenna voltage. Added antenna cable kit. Changed ordering options to remove letter S at end of model number.

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1 Introduction

1.1 Product Overview

The SYNC25104HR/SYNC35104HR is a GPS disciplined oscillator board which is designed to provide high accuracy frequency and time reference signals to PC/104 systems and external devices. This board utilizes the u-blox LEA-M8F GPS Receiver which locks the output signal of a low noise, high precision oven-controlled crystal oscillator (OCXO) to the GNSS satellites. The 10MHz signal from the OCXO is available on the SyncBus connector, two MMCX connectors and is fed into a low noise synthesizer (SI5395). The synthesizer can generate signals up to the gigahertz range. The board connects to the CPU via USB. An additional RS232 serial port is also provided to the GPS receiver which can be used for synchronizing the CPU clock the GNSS. This module can provide +3.3V to active antennas or can be used with passive antennas.

1.2 Timing Accuracy Information

The board provides time and frequency reference which are based on the GNSS system. When the system is powered up, the board synchronizes itself to the GNSS. Note that the receiver is only functional, when the normal 5V is available, ie. it is not powered from 5V standby or other power source (eg. battery). After the synchronization process is complete (this may take minutes) the time and frequency accuracy will be within the specs below. If GNSS signals are lost, the board enters into holdover mode. In this mode, the internal OCXO provides reference signal to the receiver, therefore the accuracy will be determined by the OCXO. Table 1 summarizes the accuracy of time and frequency outputs of SYNC25104HR/SYNC35104HR.

Table 1: Accuracy

Parameter	Condition	Value
Time pulse accuracy	clear sky	≤20ns
	Indoor	≤500ns
Frequency accuracy	GNSS locked	≤5ppb
	hold-over (-20 to 70C°)	±10ppb
OCXO short term stability (Alan variance)		2×10^{-10} 1/s
OCXO aging	Daily	±1ppb
	First year	±100ppb
	10-years	±500ppb

1.3 Board Features

- PC/104 form factor
- Bus Structure Options:
  - **PCIe/104 (SYNC35104HR)**
    - PCIe universal expansion bus (Type 1 or Type 2)
  - **PCI/104-Express (SYNC25104HR)**
    - PCIe universal expansion bus (Type 1 or Type 2)
    - PCI pass-through expansion bus
- USB 2.0 interface
  - GNSS receiver is accessible via a USB serial converter
  - Synthesizer is accessible via a USB SPI converter
- u-blox LEA-M8F GNSS engine
  - L1 1575.42MHz, C/A code
  - L1OF 1602MHz
  - BeiDou B1 1561.098MHz
  - Galileo E1B/C
  - 72-channel satellite tracking
  - Position accuracy: 2.5m
  - Time accuracy of 20ns
  - 1Hz update rate
  - Tracking sensitivity down to -165 dBm
  - Supported protocols: NMEA-0183 ver. 2.3, 4.0 or 4.1 configurable, UBX, RTCM 2.3
  - Constellation System Support:
    - GPS
    - GLONASS
    - GALILEO
    - BeiDou
    - QZSS
  - DGPS support:
    - (SBAS) Satellite-Based Augmentation System
    - (RTCM) Radio Technical Commission for Maritime Services
    - (WAAS) Wide-Area Augmentation System
    - (EGNOS) European Geo-Stationary Navigation System
    - (MSAS) MTSAT Satellite-Based Augmentation System
    - (GAGAN) GPS-Aided Geo-Augmented Navigation
- Supports active (+3.3V) and passive antennas
- SI5395 ultra low jitter clock multiplier
  - 8 any frequency outputs
    - 4 differential outputs on a 100mil header
    - 2 single ended outputs on MMCX connectors
    - 2 differential outputs on the SyncBus connector (Bus LVDS)
  - Software configurable output standard and frequency
    - Differential: 100Hz-1028MHz
    - LVCMOS (single-ended): 100Hz-250MHz
- Requires only +5 VDC for operation

1.4 Ordering Information

The SYNC35104/SYNC25104 is available with the following options:

Table 2: Ordering Options

Part Number	Description
SYNC35104HR	PCIe/104 GPS disciplined oscillator with frequency synthesizer
SK-SYNC35104HR	Starter Kit including SYNC35104HR, adapter cable, and antenna (XK-CM##)
SYNC25104HR	PCI/104 Express GPS disciplined oscillator with frequency synthesizer
SK- SYNC25104HR	Starter Kit including SYNC25104HR, adapter cable, and antenna (XK-CM##)
IDAN- SYNC35104HR	PCIe/104 GPSDO module in modular IDAN frame
IDAN- SK-SYNC35104HR	PCIe/104 GPSDO module in modular IDAN frame; with cables and antennae kit (IDAN-XKCM34)
IDAN- SYNC25104HR	PCI/104 Express GPSDO module in modular IDAN frame
IDAN-SK- SYNC25104HR	PCI/104 Express GPSDO module in modular IDAN frame; with cables and antennae kit (IDAN-XKCM34)

The Intelligent Data Acquisition Node (IDAN™) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN™ or HiDANplus® High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4.1 Cable Kits

XK-CM126

The XK-CM126 is a GPS antenna for use with the stand-alone SYNC25104HR/SYNC35104HR.

- 50-Ohm MMCX Plug connector
  - 1.575 GHz Magnetic
  - +3.3 VDC Active Antenna
  - Magnetic Base Mount
- Dimensions
  - Cable length: 16 feet
  - Height: 0.5 inches
  - Base: 1.8 inches square
- Weight: < 1 lbs.
- Operating temperature, 90% humidity non-condensing: -40 to +85C
- Storage temperature, -40 to +85C

IDAN-XKCM34

The IDAN-XKCM34 is a GPS antenna for use with the IDAN-SYNC25104HR and IDAN-SYNC35104HR.

- 50-Ohm SMA connector
  - 1.575 GHz Magnetic
  - +3.3 VDC Active Antenna
  - Magnetic Base Mount
- Dimensions
  - Cable length: 16 feet
  - Height: 0.5 inches
  - Base: 1.8 inches square
- Weight: < 1 lbs.
- Operating temperature, 90% humidity non-condensing: -40 to +85C
- Storage temperature, -40 to +85C

1.5 Contact Information

1.5.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.5.2 Technical Support

If you are having problems with you system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 3: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		TBD	Hours

2.2 Electrical Characteristics

Table 4: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typical	Max	Unit
P	Power Consumption	V_{cc5} = 5.0V		TBD		W
I_{cc5}	5V Input Supply Current	Active		TBD		A
CN5: SyncBus (M-LVDS)						
f_{max}	Maximum operating frequency		125			MHz
C_A, C_B	Transceiver IO capacitance			7.8		pF
C_{AB}	Transceiver IO differential capacitance			3		pF
Driver mode						
V_{OUT_D}	Differential output voltage	R_L=50Ω, C_L=5pF	480		650	mV_{p-p}
V_{OUT_CM}	Common-mode output voltage	R_L=50Ω, C_L=5pF	0.3	1.6	2.1	V
Receiver mode						
V_{IT+}	Positive-going differential input voltage threshold			16	50	mV
V_{IT-}	Negative-going differential input voltage threshold		-50	20		mV
CN6: Any frequency output (Differential)						
V_{OUT_D}	Differential output voltage	LVDS	700	900	1060	mV_{p-p}
V_{OUT_D}	Differential output voltage	LVPECL	1260	1560	1900	mV_{p-p}
V_{OUT_CM}	Common-mode output voltage	LVDS	1.1	1.2	1.3	V
V_{OUT_CM}	Common-mode output voltage	LVPECL	1.9	2	2.1	V
R_{OUT}	Differential output impedance			100		Ω
t_{RISE}/t_{FALL}	Output rise and fall time	f_{out}>100MHz, 20 to 80%		0.1	0.2	ns
CN7: GPS antenna input						
V_{ANT}	Antenna bias voltage	I_{ANT}=0		3.3		V
I_{ANT}	Antenna bias current				50	mA
NF	Receiver noise figure	GPS band		2.6		dB
CN8: Time mark input						
V_{IH}	Input high voltage		2.3		3.3	V
V_{IL}	Input low voltage		0		0.66	V
CN9: 1PPS output (LVCMOS 3.3V)						
V_{OH}	Output high voltage	I_{OH}=1mA	2.8			V
V_{OL}	Output low voltage	I_{OL}=1mA			0.2	V
R_{OUT}	Output impedance			50		Ω
t_{RISE}/t_{FALL}	Output rise and fall time	C_L=5pF		0.35	0.7	ns
$V_{(ESD)}$	Electrostatic discharge	HBM ANSI/ESDA/JEDEC JS-001			±6000	V
$V_{(ESD)}$	Electrostatic discharge	CBM JESD22-C101			±1500	V
CN10, CN11: Any frequency output (LVCMOS 3.3V)						
V_{OH}	Output high voltage		2.8			V

Table 4: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typical	Max	Unit
V_{OL}	Output low voltage				0.5	V
R_{OUT}	Output impedance		44	52	60	Ω
t_{RISE}/t_{FALL}	Output rise and fall time	C_L=4.7pF, 20 to 80%		0.4	0.6	ns
CN12: 10MHz output						
V_{OH}	Output high voltage	I_{OH}=1mA	3.2			V
V_{OL}	Output low voltage	I_{OL}=1mA			0.1	V
R_{OUT}	Output impedance			50		Ω
t_{RISE}/t_{FALL}	Output rise and fall time	C_L=10pF		0.315		ns
CN13: RS232 interface						
	Maximum data rate			250		kbit/s
V_{OH}	High-level output voltage	R_L = 3 kΩ to GND	5	5.4		V
V_{OL}	Low-level output voltage	R_L = 3 kΩ to GND	-5	-5.4		V
V_{IT+}	Positive-going input voltage threshold			1.5	2.4	V
V_{IT-}	Negative-going input voltage threshold		0.6	1.2		V
V_I	Input voltage range		-25		25	V

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 80 g (0.18 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (4.570 in L x 3.775 in W)

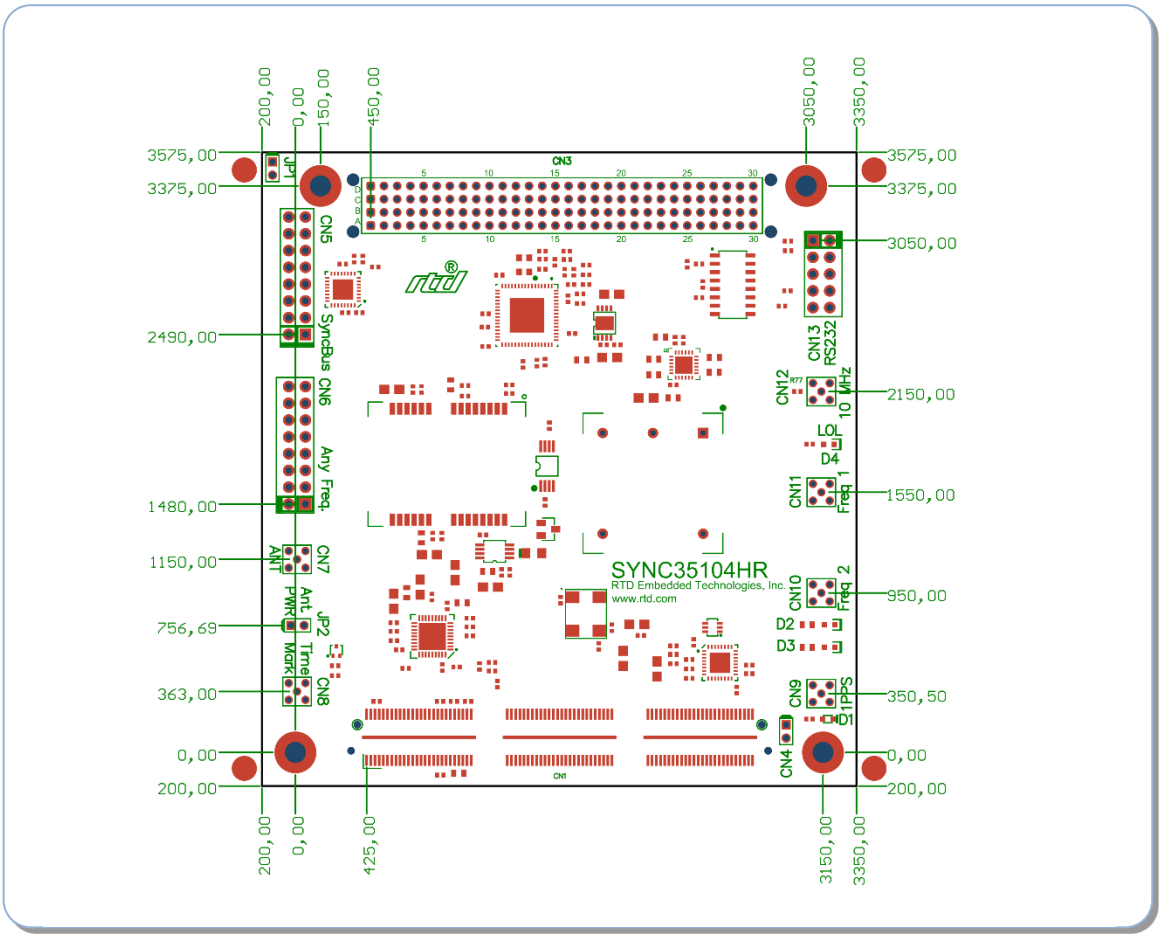

Figure 1: Board Dimensions

3.3 Connectors and Jumpers

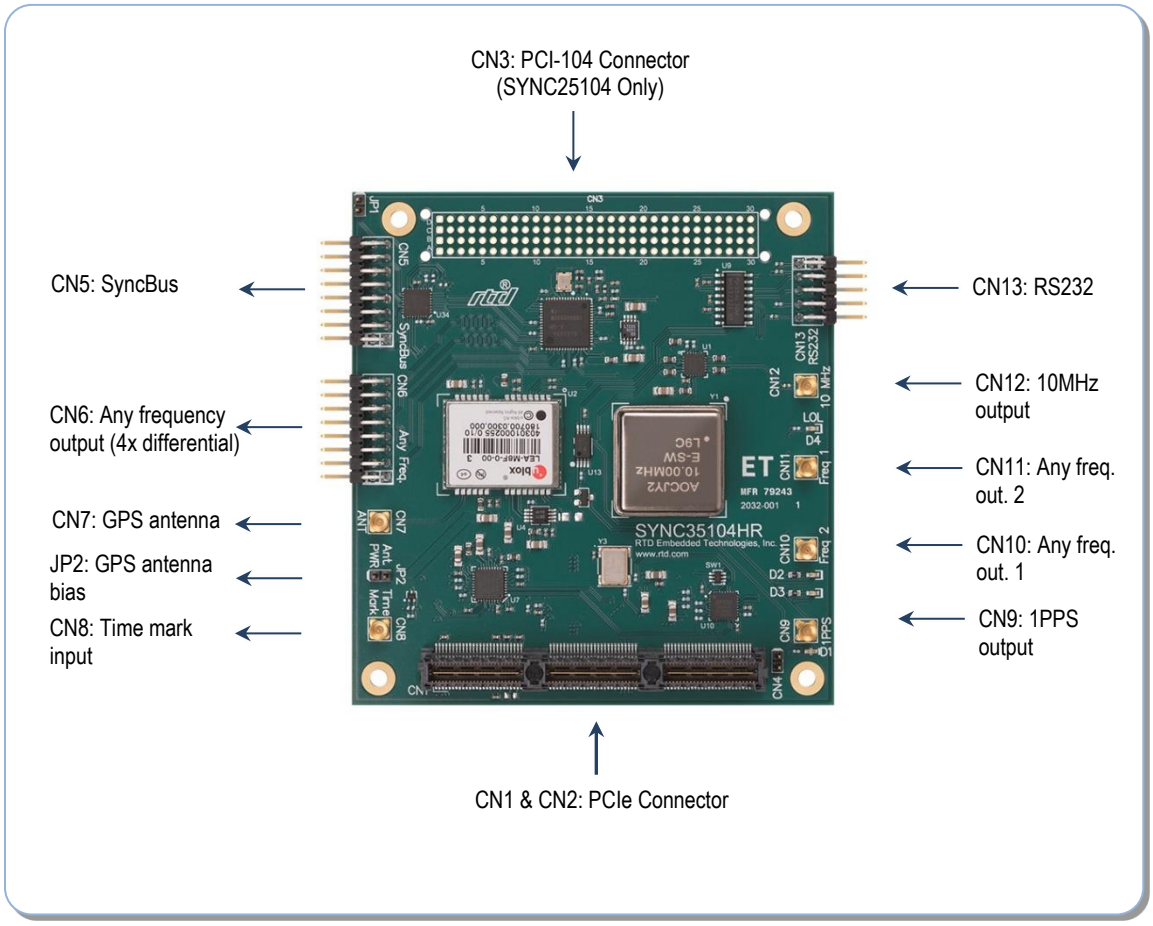

Figure 2: Board Connections

3.3.1 Bus Connectors

CN1(Top) & CN2(Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 29)

The SYNC35104/25104 is a "Universal" board and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN3: PCI Connector (SYNC25104HR Only)

The PCI connector is the connection to PCI peripheral modules. This connector is used only as a pass-through connector on this board.

3.3.2 External I/O Connectors

CN4: Factory Use Only

Do not connect anything to this header.

CN5: SyncBus Connector

CN5 is a proprietary 16-pin header that is used for synchronizing RTD data acquisition and signal processing boards. The SyncBus Connector is a 2 x 8, 0.1" spacing right-angle connector. The lane assignments are shown in Table 5. A typical mating connector is an FCI 65043-029LF. Pin 1 is indicated by a square solder pad. SyncBus is based on bus-LVDS technology, appropriate termination of the bus is necessary at the two ends. If this board is on either end of the bus JP1 should be fitted.

Table 5: SyncBus lane assignments

SyncBus lane	Description
0	1 PPS signal
1	SI5395 output 1
2	SI5395 output 0
3	10MHz

CN6: Any Frequency Output

CN6 is a 16-pin header which connects to 4 outputs of the SI5395 clock synthesizer chip. The outputs can be configured by the Silabs CBPro software and the configuration file can be downloaded to the chip by the supplied software. The outputs are DC coupled. Note that it is theoretically possible to use these outputs as single ended, it is recommended to use them for differential signaling only. For single-ended signals use CN10 and CN11. Table 6 lists the pinout of the connector, the names correspond to the outputs of SI5395. When interfacing to this connector it is recommended to minimize the length of cable and route it inside a shielding metal enclosure. If it is necessary to run the cable several feet or further, it is recommended to use shielded cable (eg. SFTP).

Table 6: CN6 Any frequency output

Pin Name	Pin #	Pin #	Pin Name
Output 5-	2	1	Output 5+
GND	4	3	GND
Output 4-	6	5	Output 4+
GND	8	7	GND
Output 3-	10	9	Output 3+
GND	12	11	GND
Output 2-	14	13	Output 2+
GND	16	15	GND

CN7: GPS Antenna Connector

The SYNC35104HR/25104HR provides an MCX connector for the GPS antenna. The 3.3V antenna bias can be turned on or off using JP2.

CN8: Time Mark Input

The LEA-M8F module can also be used for precise time measurements using the Time mark input. Rising edges of these signals are time-stamped with respect to the receiver's active time-base. Time-stamps are reported in the UBX-TIM-TM2 message. CN8 connects to FREQ_PHASE_IN1 of the u-blox GNSS receiver module.

CN9: 1PPS Output

CN9 is a 1PPS output which is buffered by a low propagation delay buffer. The output is DC coupled, has 50Ω impedance, its level is 3.3Vpp. The total delay from the GNSS receiver's output pad to the connector is 1.94ns typical 2.44ns maximum.

CN10 and CN11: Any Frequency Outputs

CN10 and CN11 are coaxial sockets which connect to SI5395 clock synthesizer chip. The outputs can be configured by the Silabs CBPro software and the configuration file can be downloaded to the chip by the supplied software. The outputs are DC coupled and the level is 3.3Vpp when using LVCMOS output buffer setting (recommended) and the output is not terminated. If differential signaling is required use CN6.

CN12: 10MHz Output

CN12 is a buffered output of the oven-controlled crystal oscillator (OCXO). This output is DC coupled, has 50Ω impedance, and the level is 3.3Vpp.

CN7-CN12 are MMCX connectors:

Connector Part #: Amphenol 908-22106 **Example Mating Connector:** Amp 901-9877-RFX

CN13: Serial I/O Connector

CN12 is an RS-232 interface that is connected to the GPS receiver. Table 7 has the pin-out. RX and TX lines are connected according to the DCE pinout (ie. RX is a driven output, TX is an input). RI, DCD and DSR pins are connected together and driven by 1pps signal. This can be used by various software to synchronize the internal clock of the CPU. This serial port is also routed to the USB-serial converter. The TX output of the GPS receiver is permanently connected to the RX input of the USB-serial converter, and the RX pin of CN12. The GPS RX however has a signal switch which is activated whenever a byte is transmitted from the USB. When there is no transmission from the bus, the RX is switched to the RS232 TX input. RTS and DTR pins are not used and are pulled to GND with 10k. CTS is not connected.

Table 7: CN13 RS-232 interface

Pin Name	Pin #	Pin #	Pin Name
DSR (1PPS)	2	1	DCD (1PPS)
RTS (PD)	4	3	RxD
CTS (NC)	6	5	TxD
RI (1PPS)	8	7	DTR (PD)
GND	10	9	GND

3.3.3 JUMPERS

JP1: SyncBus Termination

JP1 is used to enable termination resistor on SyncBus lanes.

JP2: GPS Antenna Bias

JP2 is used to switch antenna bias on or off. Table 8.

Table 8: JP2 Settings

Setting	Description	Notes
1 – 2	3.3V Bias Antenna	Factory default
Open	Passive Antenna	

3.3.4 LEDS

D1: 1PPS LED

D1 shows the status of the GPS's 1PPS signal.

D2: TBD

Function TBD.

D3: TBD

Function TBD.

D4: Loss of Lock LED

Indicates the lock status of SI5395.

3.4 Steps for Installing

1. Always work at an ESD protected workstation and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

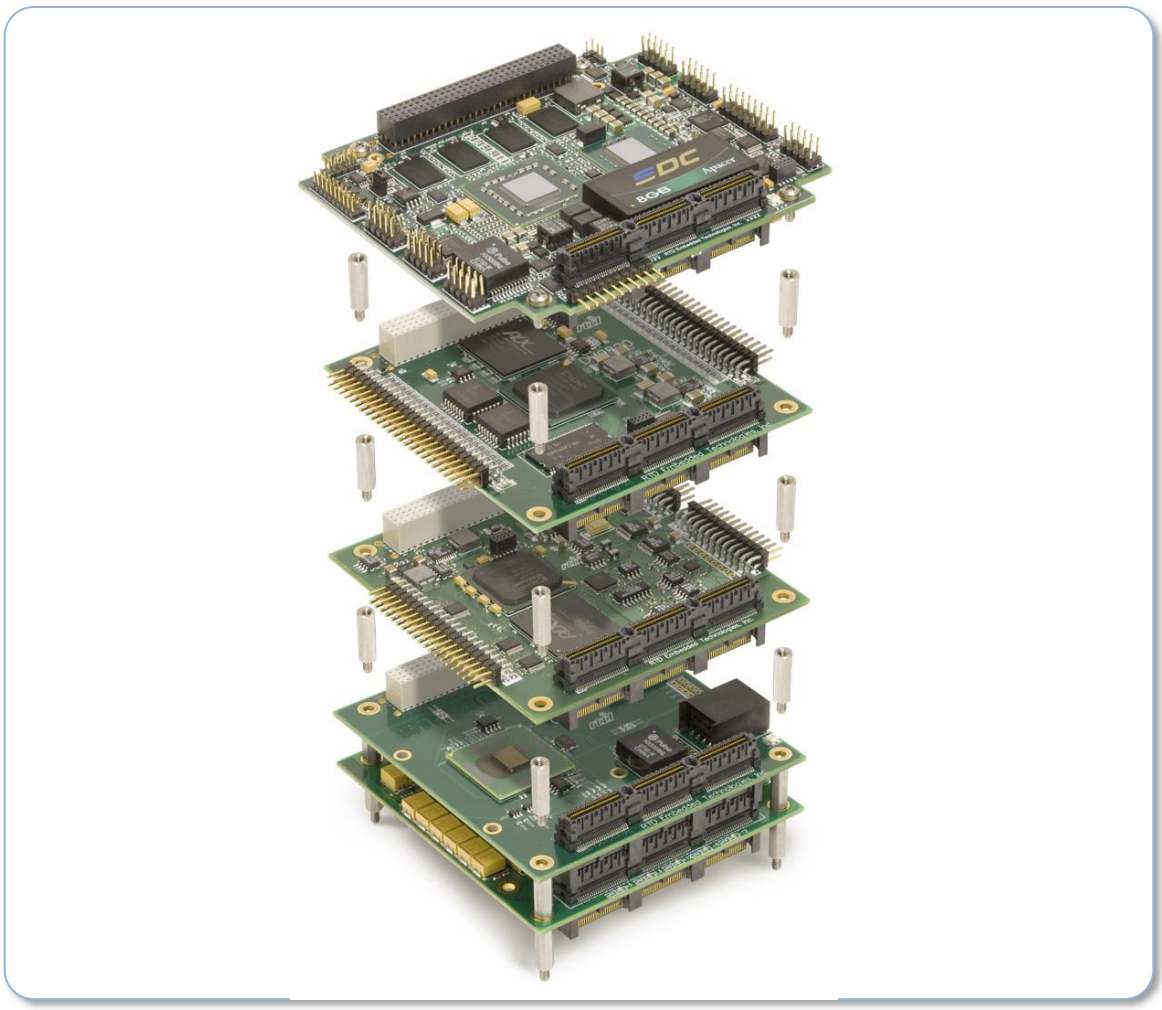

Figure 3: Example 104™ Stack

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 0.21 Kg (0.46 lbs.)
- Dimensions: 152.0 mm L x 130.0 mm W x 23.7 mm H (5.98 in L x 5.12 in W x 0.94 in H)

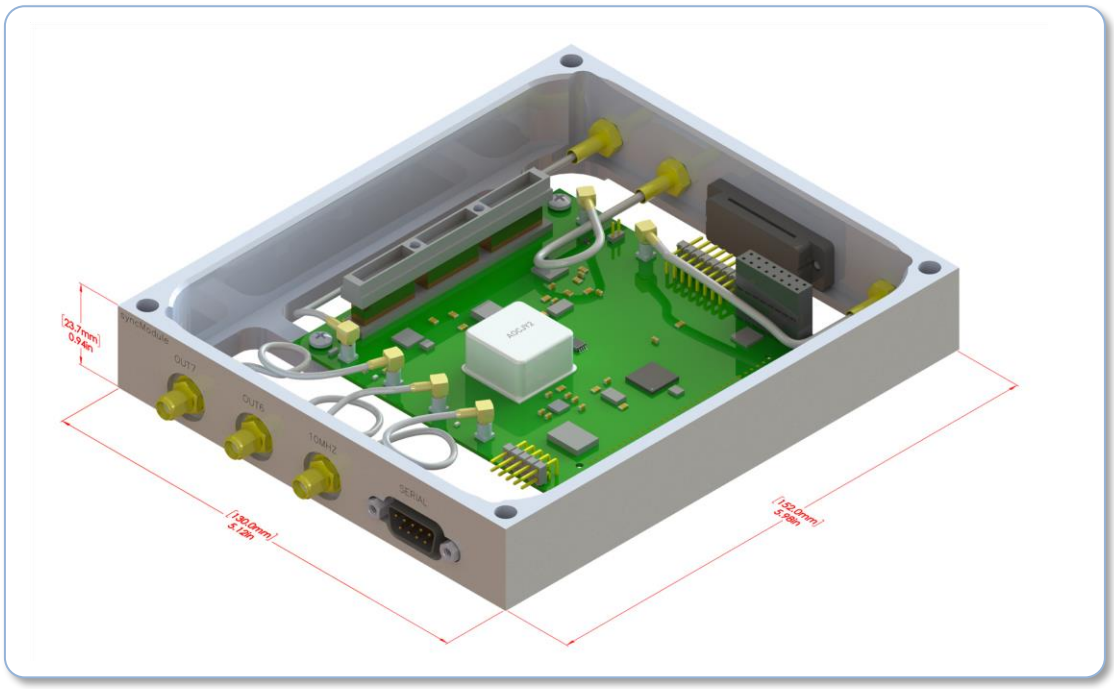

Figure 4: IDAN Dimensions

4.3 Connectors

4.3.1 Bus Connectors

CN1(Top) & CN2(Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 29)

The SYNC25104HR is a "Universal" board and can connect to either a Type 1 or Type 2 PCIe/104 connector.

4.3.2 EXTERNAL I/O CONNECTORS

The figure below shows the pin orientation of the connectors on the IDAN-SYNC35104HR.

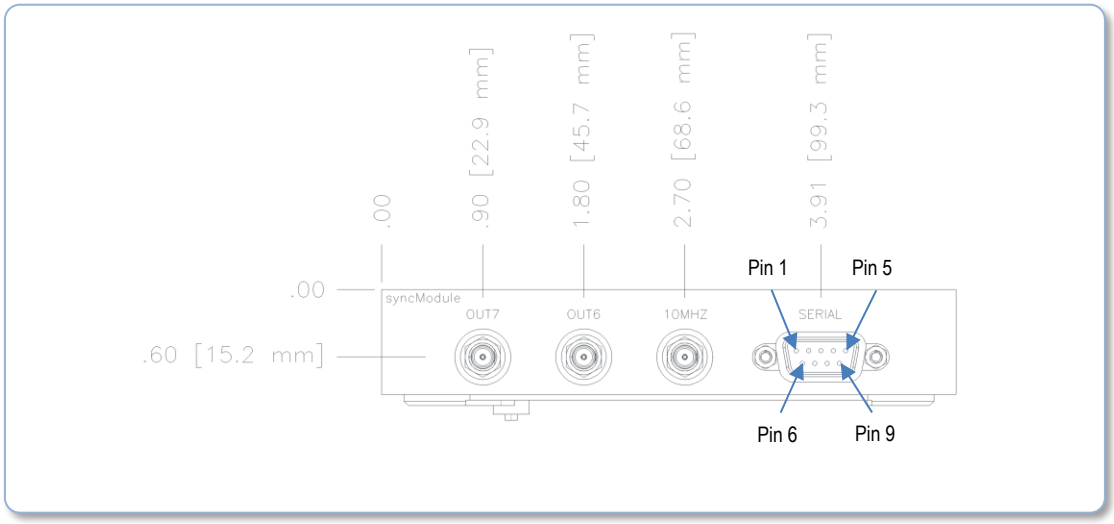

Figure 5: IDAN Front Panel

Serial Connector - 9-pin "D" PIN Connector

Connector Part #: VALCON DF-9P-CN **Example Mating Connector:** Amp 1658610-4

Table 9: IDAN-SYNC35104HR Serial Connector

IDAN Pin#	Signal(RS-232)	(RS-232)	SYNC25104HR Pin #	
1	DCD	-	CN13	1
2	RxD	RxD-	CN13	3
3	TxD	TxD-	CN13	5
4	DTR	-	CN13	7
5	GND	GND	CN13	9
6	DSR	-	CN13	2
7	RTS	TxD+	CN13	4
8	CTS	RxD+	CN13	6
9	RI	-	CN13	8

GPS, OUT6, OUT7, 10MHZ, 1PPS & TIME IN Antenna - SMA Female Connector

Connector Part #: SPC Technology 8589-0853 **Example Mating Connector:** Amp 901-9877-RFX

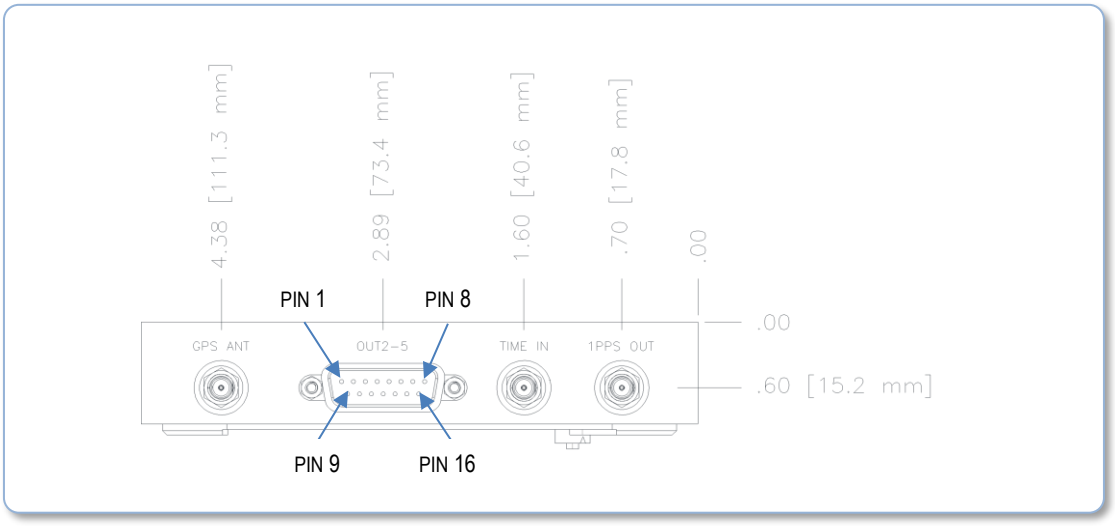

Figure 6: IDAN Back Panel

OUT2-5 Connector - 15-pin "D" Socket Connector

Connector Part #: Amp 1658610-3 **Example Mating Connector:** Amp 1-747956-5

Table 10: IDAN-SYNC35104HR OUT2-5 Connector

IDAN Pin#	Signal	SYNC25104HR Pin #	
1	Output 5+	CN6	1
2	GND	CN6	3
3	OUTPUT 4+	CN6	5
4	GND	CN6	7
5	OUTPUT 3+	CN6	9
6	GND	CN6	11
7	OUTPUT 2+	CN6	13
8	GND	CN6	15
9	Output 5-	CN6	2
10	GND	CN6	4
11	OUTPUT 4-	CN6	6
12	GND	CN6	8
13	OUTPUT 3-	CN6	10
14	GND	CN6	12
15	OUTPUT 2-	CN6	14
16	GND	CN6	16

4.4 Steps for Installing

1. Always work at an ESD protected workstation and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

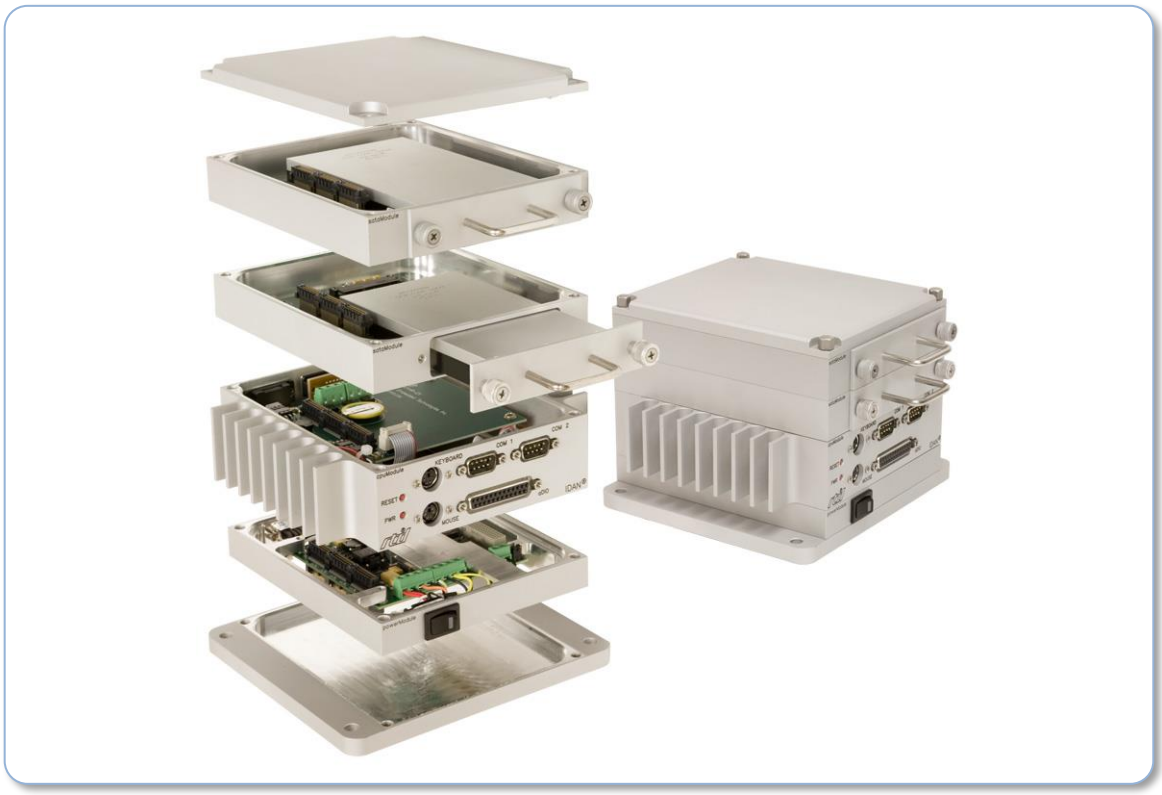

Figure 7: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the SYNC35104HR. The various parts of the block diagram are discussed in the following sections.

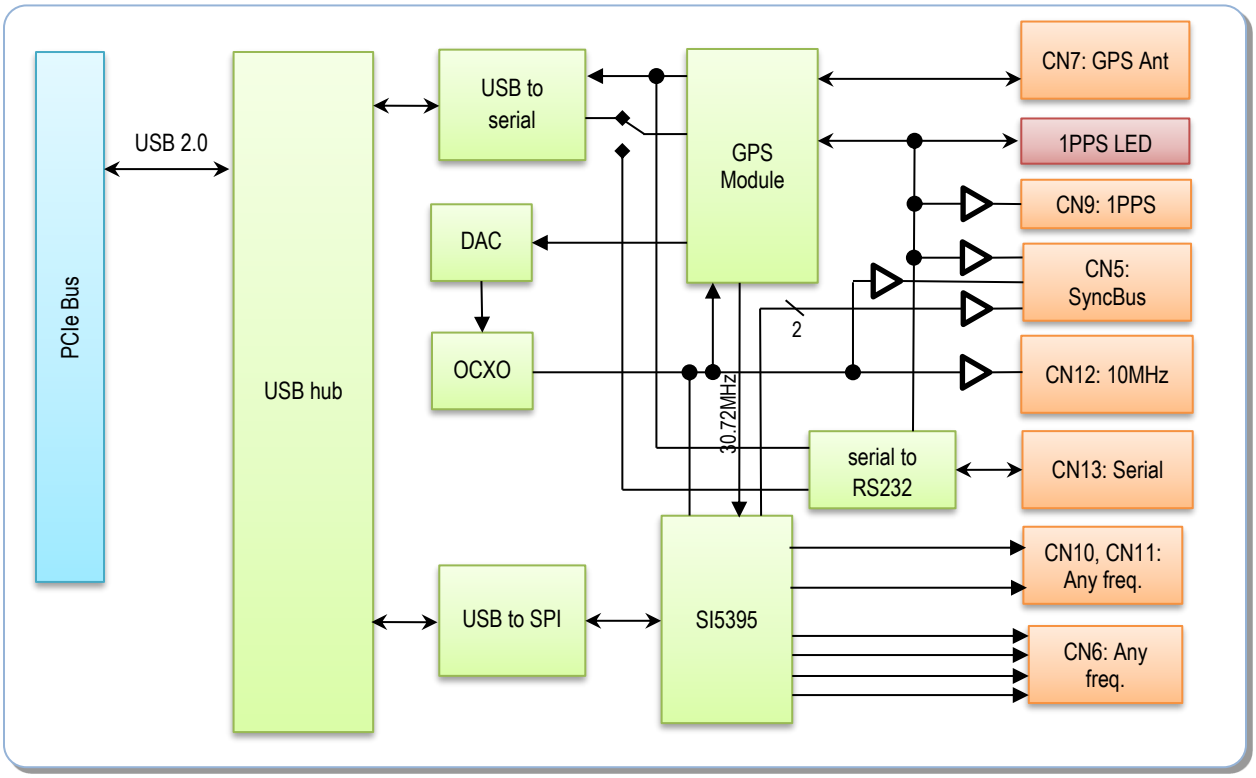

Figure 8: SYNC35104 Block Diagram

5.2 Main Modules

The SYNC35104 connects to the host CPU module via the Universal Serial Bus. A USB hub provides two downstream ports for two devices, a USB to serial converter and a USB to SPI converter chip. The GPS receiver is interfaced using the serial port, while the SI5395 is interfaced using the SPI.

5.2.1 GPS Module Interface

The host can connect to the u-blox LEA-M8F GNSS receiver module by either using the USB to serial converter or the RS232 interface. Whenever a byte is transmitted from the USB-serial converter, the TX line of the converter is connected to the GPS module's RX input. Otherwise, the module RX is connected to the RS232 TX. The module TX signal is permanently connected to both ports, therefore the data can be received on both. 1 PPS signal is available on the RI pin of the USB to serial converter and the RI, DCD, and DSR pins of the RS232. Due to the nature of the USB protocol, interrupts caused by the 1 pps signal can have significant jitter and latency from the USB, therefore use of the RS232 for timing purposes is highly recommended. The default configuration for the serial ports are:

- 9600 Baud
- 8 Data bits
- No parity
- 1 Stop bit
- No Flow Control

NOTE: If the number of messages sent by the GPS receiver in every second is increased, it is recommended to use a higher baud rate because the low speed connection can easily be filled up with messages.

GPS Antenna

Most GPS antennas are "active" which means they have a low noise amplifier (LNA) built into the antenna that requires a power source for the GPS module. While the SYNC35104HR/25104HR will work with a passive antenna, better performance will be achieved with an active antenna. The SYNC35104HR/25104HR provides +3.3V/ for active GPS antennas.

COCOM Limits

The GPS module disable tracking when both altitude (18,000m) and speed (515 m/s) limits are exceeded. However, the module has an acquisition altitude limit of 10,000m. So, it cannot be powered on and acquire a position above 10,000m, but it will continue tracking if a position is acquired below 10,000m and then the module goes higher.

LEA-M8F GNSS Receiver Documentation

The up to date documentation of the GNSS receiver can be found on the manufacturer's website. See the links below:

Datasheet: https://www.u-blox.com/en/docs/UBX-14001772

Receiver description: https://www.u-blox.com/en/docs/UBX-13003221

5.2.2 SI5395 Frequency Synthesizer

The SYNC35104HR/25104HR combines the GPS disciplined oscillator with an ultra-low jitter, multiple output frequency synthesizer. The generated output frequencies can range from 100Hz-1028MHz and the RMS phase jitter can go as low as 69fs. The synthesizer chip can be programmed by the Clock Builder Pro software, the configuration can be stored in the on-chip non-volatile memory. For detailed descriptions and further information please refer the following manuals:

Datasheet: https://www.silabs.com/documents/public/data-sheets/si5395-94-92-a-datasheet.pdf

Reference Manual: https://www.silabs.com/documents/public/reference-manuals/si5395-94-92-family.pdf

SI5395 Block Diagram

The block diagram of SI5395 can be seen on Figure 9. The 4 inputs of the chip are connected as follows:

- IN0: 10MHz onboard OCXO
- IN1: 30.72MHz GPS clock
- IN2: not connected
- IN3/FB_IN: connected to OUT9A (to enable Zero Delay Mode operation)

The DSPLL block has an on-board 48MHz crystal oscillator.

The outputs are connected according to Table 11:

Table 11: SI5395 outputs

Output	Destination	Output standard
OUT0A	not connected	
OUT0	SyncBus lane 2	LVCMOS 3.3V
OUT1	SyncBus lane 1	LVCMOS 3.3V
OUT2	CN6 pin 13 (+), 14 (-)	any differential
OUT3	CN6 pin 9 (+), 10 (-)	any differential
OUT4	CN6 pin 5 (+), 6 (-)	any differential
OUT5	CN6 pin 1 (+), 2 (-)	any differential
OUT6	CN10	LVCMOS 3.3V

Table 11: SI5395 outputs

Output	Destination	Output standard
OUT7	CN11	LVCMOS 3.3V
OUT8	not connected	
OUT9	not connected	
OUT9A	connected to IN3/FB_IN	

Each LVCMOS driver has a configurable output impedance to accommodate different trace impedances. The chip is powered from 3.3V and there is a 22Ω resistor in series with each single ended output of the chip. The resulting output impedances are 38+22=60Ω, 30+22=52Ω and 22+22=44Ω. For best performance 52Ω setting is recommended. For details refer SI5395 datasheet p. 21 section 4.9.6.

Out 9A is connected to IN3/FB_IN which is an external feedback path. By using this feature, it is possible to generate signals that have well defined phase relationship with the input reference signal. Otherwise, the initial phase of the output signals relative to the input signal will be random (obviously when the PLL is locked the phase difference will be constant, but random).

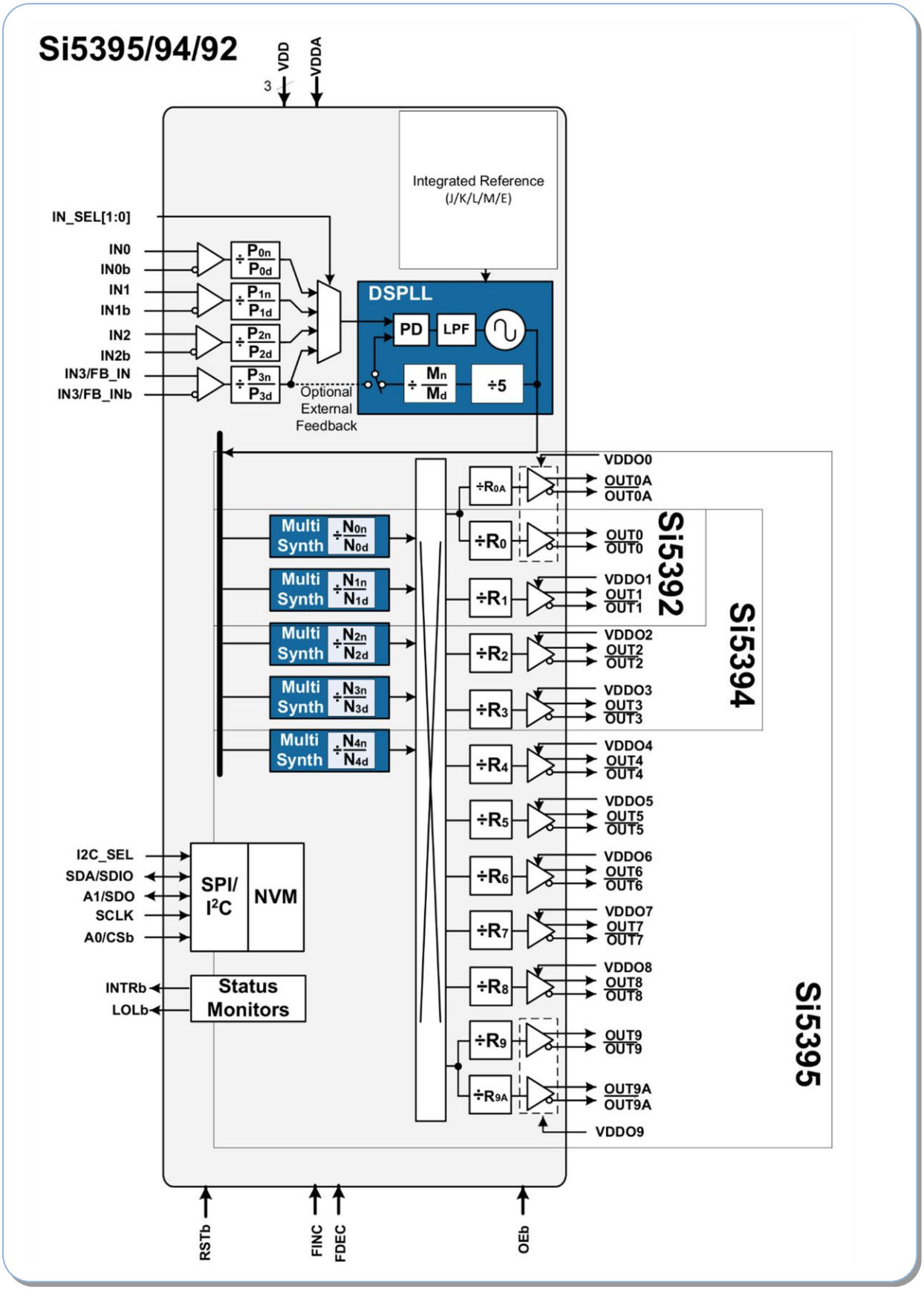

Figure 9: SI5395 block diagram

6 Software

6.1 Installing the Software

The software package is provided on the SYNC35104HR companion CD and are also available on the RTD web site (http://www.rtd.com) for download.

To install the software package please follow the detailed instructions found in the readme.txt file.

6.2 Software Package Contents

6.2.1 GNSS Receiver Software

The SYNC35104 uses a serial port or an FT232 USB-UART controller to communicate with the GNSS receiver. The required driver is available in both Windows and Linux operating system.

For testing and configuring the LEA-M8F GNSS receiver it is recommended to use the software provided by the manufacturer: u-center. It can be downloaded from the u-blox website:

https://www.u-blox.com/sites/default/files/u-centersetup_v20.01.zip

The documentation for the software can be found at:

https://www.u-blox.com/sites/default/files/u-center_Userguide_%28UBX-13005250%29.pdf

Detailed description of the receiver's protocol can be found at:

https://www.u-blox.com/en/docs/UBX-13003221

Since the GNSS receiver is seen be the operating system as a standard serial port, it can be interfaced to any other software easily.

NOTE: When using under Windows, the GPS may be incorrectly detected as a Serial Mouse, causing erratic mouse cursor behavior. This issue has been documented by Microsoft. For more information, refer to Microsoft Knowledge Base Article 283063.

The software package provides utilities to configure the GNSS receiver with a config file without the U-center utility: ubx_config.

There is also an example program that sends/receives UBX nor NMEA packets to the receiver which can serve as a starting point for customized GNSS applications: ubx_monitor.

6.2.2 SI5395 Software

The FT4222H USB-SPI controller driver is needed to compile and run the SI5395 programmer utility. The drivers are in the software package and can also be downloaded from the manufacturer website:

https://ftdichip.com/products/ft4222h/

The configuration data for the synthesizer can be generated by the manufacturer's software: ClockBuilder Pro. It is available for download from the manufacturer's website:

https://www.silabs.com/products/development-tools/software/clockbuilder-pro-software

The software package contains an example ClockBuilder Pro project that can be uploaded to the module with the si5395_prog utility.

6.2.3 SYNCBUS SOFTWARE

The syncbus outputs can be controlled with the syncbus_prog utility.

7 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

8 Additional Information

8.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

8.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

9 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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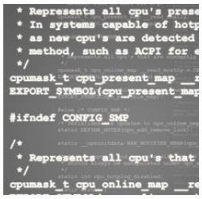

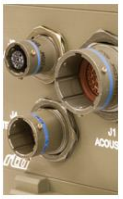
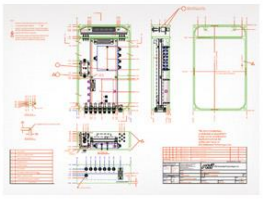

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