



# **INVENTEK SYSTEMS**

## **ISM3333**

### **GPS Module**

All-In-One Multi-GNSS (Global Navigation Satellite System),  
Module Supports Multiple Location and Navigation Applications, including  
Autonomous GPS, GLONASS, GALILEO, BEIDOU, SBAS ranging  
(WAAS, EGNOS, GAGAN, and MSAS), QZSS, DGPS (RTCM) and AGPS

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# 1 General Description

The ISM3333, is a 5V tolerant GPS module based on the MediaTek MT3333 All-In-One multi-GNSS SoC and includes an on-chip CMOS RF, digital baseband, ARM7 CPU and embedded flash. The ISM3333 can achieve the industry's highest level of sensitivity, accuracy, and Time-to-First-Fix (TTFF) with the lowest power consumption in a small-footprint lead-free package.

The ISM3333 acquires and tracks satellites in the shortest time even at indoor signal levels. The ISM3333 supports various location and navigation applications, including autonomous GPS, GLONASS, GALILEO, BEIDOU, SBAS ranging (WAAS, EGNOS, GAGAN, and MSAS), QZSS, DGPS (RTCM) and AGPS.

The Inventek ISM3333 is ideal for a wide range of mobile and personal tracker, drone and industrial applications. The ISM3333 features high sensitivity (-165dBm tracking sensitivity), for enhanced performance in dense urban environments.

The ISM3333 firmware can be programmed to support either GPS and Galileo or GPS and GLONASS simultaneously. This module has the ability to supports any two: GPS + GLONASS + Galileo significantly improving on performance and GPS sensitivity.

The ISM3333 is suitable for a wide range of target applications, including the following:

- Wearable devices
- Portable Devices
- Asset Tracking / Personal Safety
- Sport Cameras / Equipment
- Smart Watches
- Navigation Devices
- Fleet Management
- Asset Tracking

The ISM3333's world class performance suits it to navigating urban canyons, as well as wide-open spaces.

## 2 Part Number Detail Description

### 2.1 Ordering Information

ISM3333-CX.X

**SW Version**

C and 2-digit Firmware version number: X.X

Part Number	Description
ISM3333-C6.1	4800 Baud UART with GPS and GLONASS enabled.  1PPS output enabled  1 Hz update rate
EZ-GPS Evaluation Board	EZ-GPS_G USB Stick

### 3 General Features

- Based on the MediaTek Multi-GNSS MT3333
- Supports MediaTek SDK.
- Host interface: UART
- Inputs +5 V tolerant
- -40 to +85 °C temperature range.
- Power-saving mode allows the design of low-power applications.
- Lead Free Design which is compliant with RoHS requirements.
- EMI/EMC Metal Shield for best RF performance in noisy environments

#### 3.1 Limitations

Inventek Systems products are not authorized for use in safety-critical applications (such as life support) where a failure of the Inventek Systems product would reasonably be expected to cause severe personal injury or death.

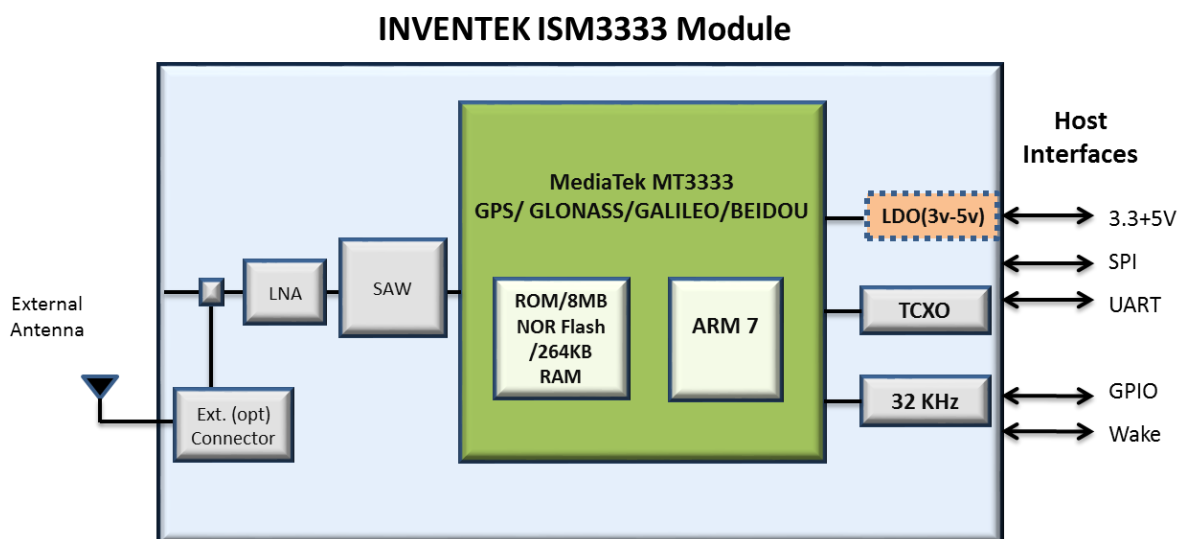
### 4 Complementary Documentation

#### 4.1 Inventek Systems

- EZ\_GPS-G Evaluation Boards:  
<http://www.inventeksys.com/products-page/usb-gps/ez-gps-usb-gps-dongle/>
- Firmware - Contact Inventek

## 5 Specification

### 5.1 Module Architecture



**Figure 1 Inventek's ISM3333 General Block Diagram**

Note: 1. Antenna Options: Integrated microstrip antenna or U.FL connector for an external antenna.  
2. Standard hardware and firmware is configured at 4800 Baud UART.

### 5.2 External Antenna Connections

The ISM3333 module is designed for use with an external antenna via a connection using the U.FL connector or Pin 1. The ISM3333 is designed for use with an active antenna or passive antenna.

Item	Description
Connector	U.FL series
Manufacturer	I-PEX Co., Ltd.
Part No.	20279-001E-01
Height	1.25 mm
Width	2 mm
DC	3.0 – 5.0 V

**Table 1 On-Board Antenna Connector**

Inventek Systems offers several antennas that are compatible with the on-board connector. If you choose to use an external RF connector, refer to Figure 3 for the pin 1 (RF\_IN) circuitry. Follow these guidelines:

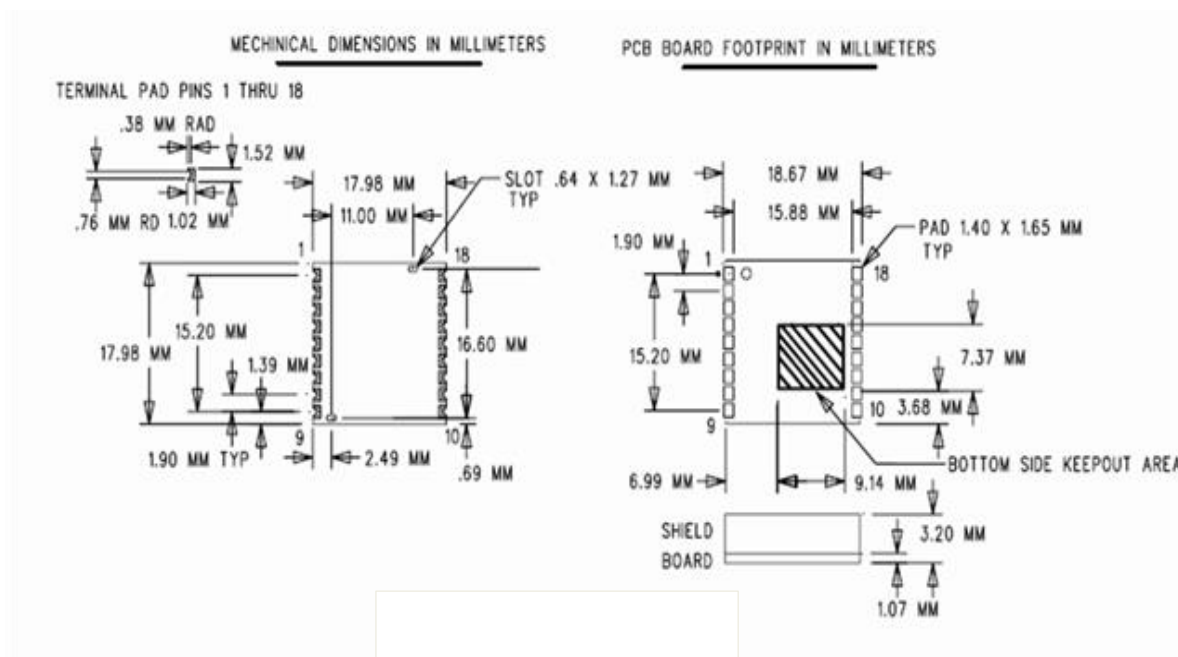
- Use a standard 50 ohm SMA or similar connector.
- Make RF\_IN on your PCB a 50 ohm transmission line (microstrip). This matches the impedance of the connector pin for minimal transmission loss.
- Keep switching circuits as far away from RF\_IN as possible.
- Protect the ISM3333 from a short circuit with a coil (or fuse) between it and the antenna power source.

Whether using the on-board connector or your own, you must supply VCC to pin 1 (and protect with a coil or fuse, as mentioned above). Make sure the module is powered down while attaching or detaching the antenna. Choose an active antenna with a gain between 20 dB – 28 dB of gain and 1.2 dB NF.

NOTE: Please see reference design for L/C circuit for external antenna

### 5.3 Mechanical Specifications

The Physical dimensions of this GNSS Module are as follow:



PARAMETER	ISM3333
Length	18.0±0.1 mm
Width	18.0±0.1 mm
Height	3.1±0.05 mm
Weight	3.5g

### 5.4 Environmental Specifications

Item	Description
Operating temperature range	-40 deg. C to +85 deg. C
Storage temperature range	-55 deg. C to +100 deg. C
Humidity	95% max non-condensing



## 6 ISM3333 Environmental

The ISM3333 complies with the European Union's RoHS (Restriction of Hazardous Substances) directive (lead free) and meets FCC/CE standards for EMI/EMC. Table 6 provides other environmental parameters of interest.

Parameter	Value
Operating temp.	-40 deg. C to +85 deg. C
Storage temp.	-55 deg. C to +100 deg. C
Humidity	95% max. non-condensing
Altitude	18,000 m (60,000 ft) max.
Velocity	515 m/s (1000 knots) max.
Jerk	20 m/s <sup>3</sup> (max.)
Acceleration	4 g (max.)

**Environmental  
Parameters**

### 6.1 ISM3333 Input / Output UART Protocols

The ISM3333 features one serial port, but two sets of UART pins that are connected internally through a level shifter. This was done to ensure that this GNSS module is backward compatible to the Inventek SiRFstar III module pinout for the ISM300F2. Only connect one UART and leave the other set of pins floating. See Table 5.

TX Pin	RX Pin	UART	Protocol	Description
5	14	A	NMEA 0183	GGA, GSA, GSV, GLL, RMC, VTG
7	12	B	NMEA-0183	GGA, GSA, GSV, GLL, RMC, VTG

**Host Interface Options  
( A or B )**

Each port is implemented with a UART (universal asynchronous receiver/transmitter). The signal level on the related pins (14, 5, 12 and 7) is 3V to 5 V tolerant.

## 7 ISM3333 Performance

The ISM3333 has a tracking sensitivity of -159 dBm and an acquisition sensitivity of -142 dBm. It can receive SBAS (satellite-based augmentation system) differential corrections (both WAAS (Wide-Area Augmentation System) and EGNOS (European Geostationary Navigation Overlay Service)).

SBAS improves horizontal position accuracy by correcting GPS signal errors caused by ionosphere disturbances, timing, and satellite orbit errors. This can cut 2DRMS<sup>1</sup> in half.

Performance parameters of interest:

Parameter	Value
Position	10 m, 2DRMS <sup>1</sup> (Autonomous) 5 m, 2DRMS <sup>1</sup> (SBAS Corrected)
Velocity	0.1 m/s
Time	1 $\mu$ s synchronized to GPS time
TTFF <sup>2</sup> Hot (valid almanac, position, time, and	1 s
TTFF <sup>2</sup> Warm (valid almanac, position, and time)	<35 s
TTFF <sup>2</sup> Cold (valid almanac)	<35 s
Reacquisition (<10 s obstructed with valid almanac, position, time, and ephemeris)	100 ms
Sensitivity	-159 dBm (Tracking Mode) -142 dBm (Acquisition Mode)

<sup>1</sup> Twice the distance root mean squared: The radius from the actual location containing 98% of the computed locations.

<sup>2</sup> Open sky and stationary

## 8 Hardware Electrical Specification

### 8.1.1 Absolute Maximum Ratings

Symbol	Description	Min	Max	Unit
VDD	Input Supply Voltage	-0.4	5	V
VBAT	Battery Backup	-0.4	5	V

### 8.1.2 Recommended Operating Ratings

Symbol	Min.	Typ.	Max.	Unit.
VDD	3.0	3.3	5	V
VBAT	3.0	3.3	5	V

## 9 Detailed Pin Description

Pin #	Name	Description
1	RF_IN	Antenna input. You must supply VCC to this pin. If using VCC to power an active antenna, make sure your circuit includes a coil or fuse to protect the ISM3333 from a short circuit at the antenna or its cable.
2	VBAT	+3–5 V dc
3	N/C	No Connect
4	N/C	No Connect
5	TXA	Transmit (UART A). This is an LVCMOS-level output with maximum logical high of 5 V. (Note: Use only UART A or B , ( Float the unused UART.)
6	N/C	No Connect
7	TXB	<b>TXB</b> – Transmit (UART B). This is an LVCMOS-level output with maximum logical high of 5 V. (Note: Use only UART A or B ,)
8	GPS Force On	This is an internal PMU enabled control pin. When GPS enters backup up mode with PMTK software command via UART, the internal PMU will turn off. Host can pull high to force on to enable internal PMU, Then GPS is back in normal mode
9	GND	Ground
10	GND	Ground
11	GPIO_15	N/C
12	RXB	Receive (UART B). This is an LVCMOS-level input with maximum logical high of 5.0 V. This is the NMEA-0183 input port. (Note: Use only UART A or B ,Float if not used.)
13	GPIO 13	N/C
14	RXA	Receive (UART A). This is an LVCMOS-level input with maximum logical high of 5.0 V. (Note: Use only UART A or B ,Float if not used.)
15	PWR Check	LED Output is Firmware enabled
16	GPS_HRST	This is a hardware control pin that lets the ISM3333 enter/exit Standby mode. This pin is level triggered control. Standby mode is RF and BB enter low power modes
17	TimeMark	1PPS
18	VCC	+3–5 V dc

## 10 Serial Host Interface

ISM3333 supports UART host interfaces. The interface speed can be changed with different firmware options.

### 10.1 UART (Universal Asynchronous Receiver/Transmitter).

There are several functions in the ISM3333 related to UART communication, such as UART data transmission/receive and NMEA sentences input/output. Standard firmware (C6.1) is set for UART NMEA 4800 baud output.

#### RS-232 interface timing

Baud Rate Required (bps)	Programmed Baud Rate (bps)	Baud Rate error (%)	Baud Rate error (%) <sup>3</sup>
4,800	4,800.000	0.0000	0.002
9,600	9,600.000	0.0000	0.002
14,400	14,408.451	0.0587	0.0567
19,200	19,164.319	0.0587	0.0567
38,400	38,422.535	0.0587	0.0567
57,600	57,633.803	0.0587	0.0567
115,200	115,267.606	0.0587	0.0567
230,400	230,535.211	0.0587	0.0567
460,800	454,666.667	-1.3310	-1.3330
921,600	909,333.333	-1.3310	-1.3330

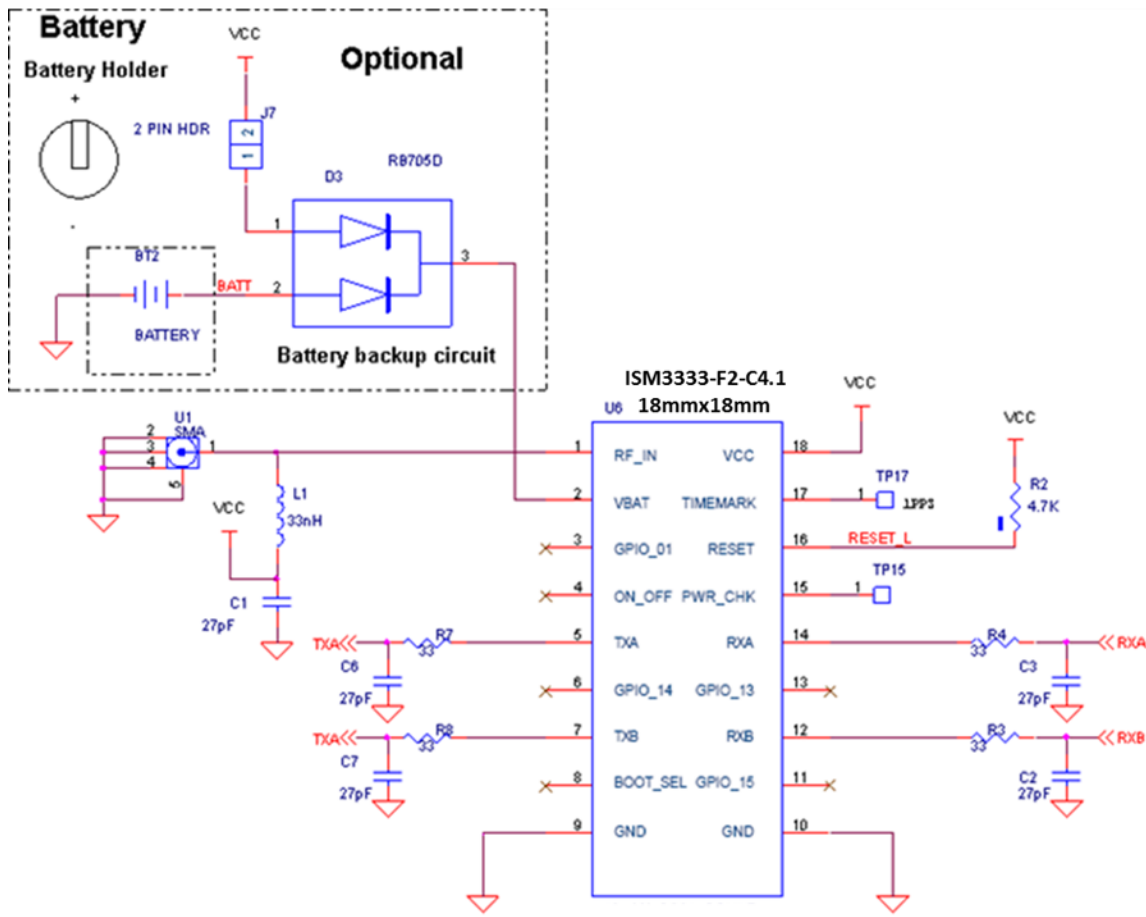
Notes:

<sup>3</sup> The baud rate error is optimized. Each baud rate needs to adjust counter to obtain the optimized value.

## 11 Typical Application Circuit

This is the minimum number of wires required to be connected to a host microcontroller for operation in UART mode. It is recommended that the JTAG and BOOT0 lines are also brought out for future firmware upgrades.

### ISM3333-F2-C4.1



## 12 Product Compliance Considerations

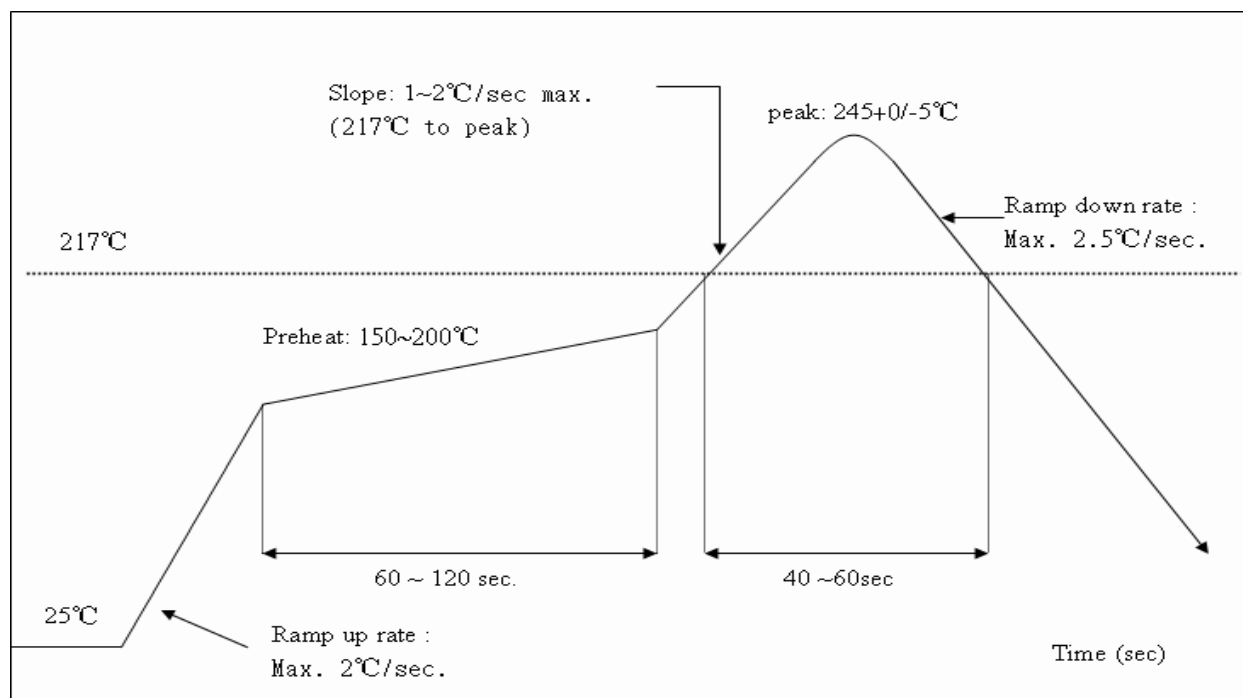
**RoHS:** Restriction of Hazardous Substances (RoHS) directive has come into force since 1st July 2006 all electronic products sold in the EU must be free of hazardous materials, such as lead. Inventek is fully committed to being one of the first to introduce lead-free products while maintaining backwards compatibility and focusing on a continuously high level of product and manufacturing quality.

**EMI/EMC:** The Inventek module design embeds EMI/EMC suppression features and accommodations to allow for higher operational reliability in noisier (RF) environments and easier integration compliance in host (OEM) applications.

**FCC/CE:** The module will be in compliance with FCC/CE requirements.


## 13 Reflow Profile

- Reference the IPC/JEDEC standard.
- Peak Temperature:  $<250^{\circ}\text{C}$
- Number of Times:  $\leq 2$  times



## 14 Packaging Information

### 14.1 MSL Level / Storage Condition

	<b>Caution</b> This bag contains <b>MOISTURE-SENSITIVE DEVICES</b>	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block;">4</div>
	Do not open except under controlled conditions	
1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)		
2. Peak package body temperature:      225°C   240°C   250°C   260°C <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: 48 hours of factory conditions <30°C/60% RH, OR		
b) Stored at <10% RH		
4. Devices require bake, before mounting, if:		
a) Humidity Indicator Card is >10% when read at 23±5°C		
b) 3a or 3b not met		
5. If baking is required, devices may be baked for 24 hours at 125±5°C		
Note : If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure		
Bag Seal Date: <b>See-SEAL DATE LABEL</b>		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

### 14.2 Device Baking Requirements Prior to Assembly

***Boards must be baked prior to rework or assembly to avoid damaging moisture sensitive components during localized reflow. The default bake cycle is 11 hours at 125C.***

Maintaining proper control of moisture uptake in components is critical.

Before opening the shipping bag and attempting solder reflow, you should maintain a minimal out-of-bag time and ensure the highest possible package reliability for the final product.



## 15 Revision Control

Document : ISM3333	GPS module
External Release	DOC-DS-200277A

Date	Author	Revision	Comment
12/5/2017	FMT	1.0	Preliminary

## 16 Contact Information

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