



# ORG4572-MK05

## GPS / GNSS RECEIVER MODULE

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Datasheet

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Ver. #	Description	Author/s	Date
1.0	First Release	Igor M.	November 3, 2021

## ABBREVIATIONS

Abbreviation	Description
A-GPS	Assisted GPS
AC	Alternating Current
ADC	Analog to Digital Converter
AGC	Automatic Gain Control
BPF	Band Pass Filter
C/N <sub>0</sub>	Carrier-to-Noise density ratio [dB-Hz]
CDM	Charged Device Model
CE	European Community conformity mark
CEP	Circular Error Probability
CMOS	Complementary Metal-Oxide Semiconductor
CPU	Central Processing Unit
CTS	Clear-to-Send
CW	Continuous Wave
DC	Direct Current
DOP	Dilution of Precision
DR	Dead Reckoning
DSP	Digital Signal Processor
ECEF	Earth-Centered Earth-Fixed
ECHA	European Chemical Agency
EGNOS	European Geostationary Navigation Overlay Service
EIA	Electronic Industries Alliance
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ENIG	Electroless Nickel Immersion Gold
ESD	Electro-Static Discharge
ESR	Equivalent Series Resistance
EU	European Union
EVB	Evaluation Board



Abbreviation	Description
EVK	Evaluation Kit
FCC	Federal Communications Commission
FSM	Finite State Machine
GAGAN	GPS Aided Geo-Augmented Navigation
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input or Output
GPS	Global Positioning System
HBM	Human Body Model
HDOP	Horizontal Dilution of Precision
I <sup>2</sup> C	Inter-Integrated Circuit
I/O	Input or Output
IC	Integrated Circuit
ICD	Interface Control Document
IF	Intermediate Frequency
ISO	International Organization for Standardization
JEDEC	Joint Electron Device Engineering Council
KA	Keep Alive
KF	Kalman Filter
LDO	Low Dropout regulator
LGA	Land Grid Array
LNA	Low Noise Amplifier
LP	Low Power
LS	Least Squares
LSB	Least Significant Bit
MID	Message Identifier
MM	Machine Model
MSAS	Multi-functional Satellite Augmentation System
MSB	Most Significant Bit
MSL	Moisture Sensitivity Level
NFZ™	Noise-Free Zones System

Abbreviation	Description
NMEA	National Marine Electronics Association
NVM	Non-Volatile Memory
PCB	Printed Circuit Board
PLL	Phase Lock Loop
PMU	Power Management Unit
POR	Power-On Reset
PPS	Pulse per Second
PRN	Pseudo-Random Noise
PSRR	Power Supply Rejection Ratio
PTF™	Push-to-Fix
QZSS	Quasi-Zenith Satellite System
RAM	Random Access Memory
REACH	Registration, Evaluation, Authorization, and Restriction of Chemical substances
RF	Radio Frequency
RHCP	Right-Hand Circular Polarized
RMS	Root Mean Square
RoHS	Restriction of Hazardous Substances directive
ROM	Read-Only Memory
RTC	Real-Time Clock
RTS	Ready-to-Send
SAW	Surface Acoustic Wave
SBAS	Satellite-Based Augmentation Systems
SID	Sub-Identifier
SIP	System in Package
SMD	Surface-Mounted Device
SMPS	Switched-Mode Power Supply
SMT	Surface-Mount Technology
SOC	System-On Chip
SPI	Serial Peripheral Interface
SV	Satellite Vehicle

Abbreviation	Description
TCXO	Temperature-Compensated Crystal Oscillator
TTF	Time to First Fix
TTL	Transistor-Transistor Logic
UART	Universal Asynchronous Receiver/Transmitter
VCCI	Voluntary Control Council for Interference by information technology equipment
VEP	Vertical-Error Probability
VGA	Variable-Gain Amplifier
WAAS	Wide Area Augmentation System

## RELATED DOCUMENTS

Ver. #	Description
1	Spider – ORG4572-MK05 Evaluation Kit Datasheet
2	MTK NMEA Manual Packet

## SCOPE

This document describes the features and specifications of the ORG4572-MK05 GNSS module.

## DISCLAIMER

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Performance characteristics listed in this document do not constitute a warranty or guarantee of product performance. OriginGPS assumes no liability or responsibility for any claims or damages arising out of the use of this document, or from the use of integrated circuits based on this document. OriginGPS assumes no liability or responsibility for unintentional inaccuracies or omissions in this document. OriginGPS reserves the right to make changes in its products, specifications, and other information at any time without notice.

OriginGPS reserves the right to conduct, from time to time, and at its sole discretion, firmware upgrades.

As long as those FW improvements have no material change on end customers, PCN may not be issued.

OriginGPS navigation products are not recommended to use in life-saving or life-sustaining applications.

## SAFETY INFORMATION

Improper handling and use can cause permanent damage to the product.

## ESD SENSITIVITY

This product is ESD sensitive device and must be handled with care.



## CONTACT INFORMATION

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[www.origingps.com](http://www.origingps.com)

## 1. ABOUT SPIDER MODULES

Spider modules are a complete SiP featuring miniature LGA SMT footprint designed to commit unique integration features for high volume, cost sensitive applications.

Designed to support compact and traditional applications such as smart watches, wearable devices, asset trackers, the Spider module ORG4572-MK05 is a miniature multi-channel GPS, Galileo and GLONASS/BEIDOU, SBAS, and QZSS overlay systems receiver that continuously tracks all satellites in view, providing real-time positioning data in industry-standard NMEA format.

The Spider module ORG4572-MK05 offers superior sensitivity and outstanding performance, achieving rapid TTFF in less than one second, with accuracy of approximately two meters, and tracking sensitivity of -165dBm.

Sized at only 7mm x 7mm, the Spider module ORG4572-MK05 is the industry's small sized, record-breaking solution.

The Spider module ORG4572-MK05 introduces industry's lowest energy-per-fix ratio, unparalleled accuracy, and extremely fast fixes even under challenging signal conditions, such as in built-up urban areas, dense foliage, or even indoors.

The integrated GPS SoC incorporating high-performance microprocessor and sophisticated firmware keeps positioning payload off the host, enabling the integration in embedded solutions with low computing resources.

Innovative architecture can detect changes in context, temperature, and satellite signals to achieve a state of near continuous availability by maintaining and opportunistically updating its internal fine time, frequency, and satellite ephemeris data, while consuming mere microwatts of battery power.

## 2. **ABOUT ORIGINGPS**

OriginGPS develops, manufactures, and supplies the world's smallest GNSS and cellular IoT solutions.

Our high-performance miniature GNSS products provide multiple constellation support to help you track everything valuable to you and your business. The OriginIoT™ makes IoT-enabling devices affordable and accessible by eliminating the need for additional embedded software and RF engineering knowhow. The low power cellular IoT system reduces project costs and dramatically shortens time-to-market when you develop cellular IoT devices.

OriginGPS miniature products are ideal for market verticals, such as asset tracking, fleet management, industrial IoT, law enforcement, pet/people tracking, precision agriculture, smart cities, sports, and wearables.

## 3. DESCRIPTION

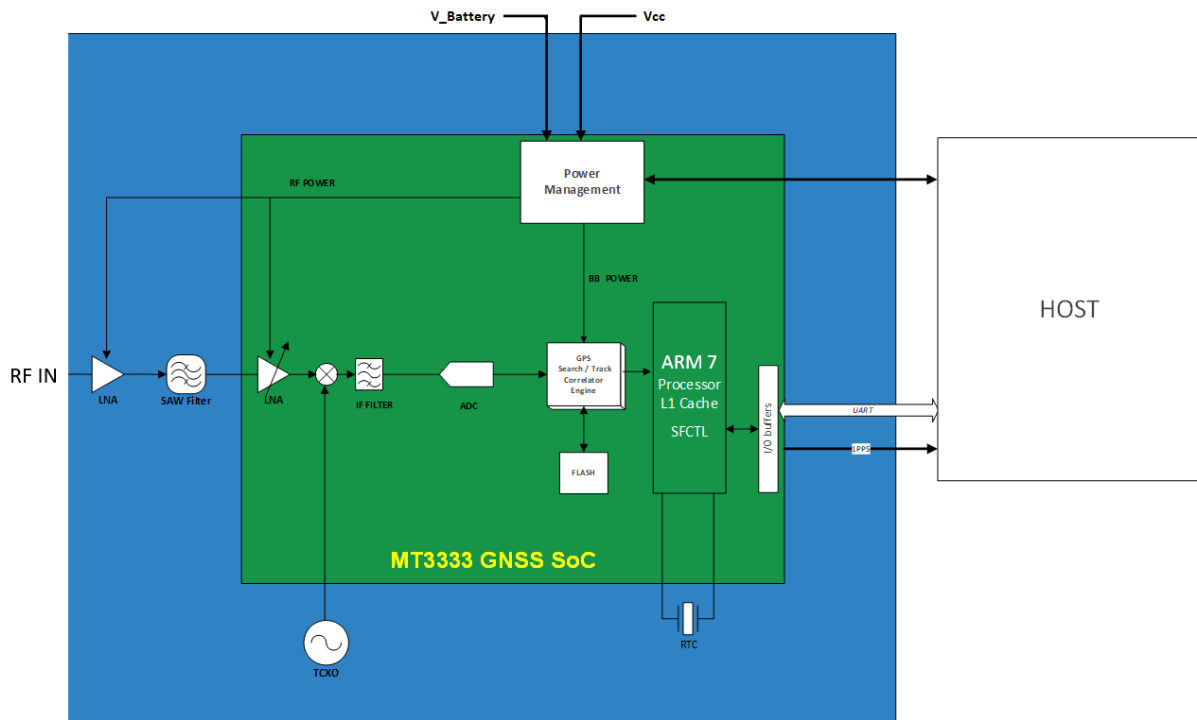
### 3.1. Features

- Autonomous operation
- OriginGPS Noise Free Zone System technology
- Active or passive antenna support
- Fully integrating:  
Dual-stage LNA, SAW filter, TCXO, RTC crystal, GNSS SoC, LDO regulator, RF shield, PMU
- Concurrent tracking of multiple constellations
- Uses GPS, Galileo and GLONASS/BEIDOU, QZSS constellations.
- GPS & Galileo L1 1575.42 frequency, C/A code
- GLONASS L1 FDMA 1598-1606MHz frequency band, SP signal
- BEIDOU B1 1561.098MHz frequency band
- SBAS (WAAS, EGNOS, MSAS and GAGAN)
- Concurrent tracking of multiple constellations
- DGPS capability
- 99 search channels and 33 simultaneous tracking channels
- Ultra-high sensitivity down to -165dBm enabling indoor tracking
- TTFF of < 1s in 50% of trials under hot start conditions
- Low power consumption of  $\leq 15\text{mW}$
- High accuracy of < 2.5m in 50% of trials
- AGPS support: Embedded Assist System (EASY) and Extended Prediction Orbit (EPO) and Hot Still
- Indoor and outdoor multipath and cross-correlation mitigation
- Jamming Rejection – 12 multi-tone Active Interference Cancellation (AIC)
- 8 Megabit built-in flash
- Power management modes: Full Power Continuous, Standby, Periodic, and AlwaysLocate™
- NMEA commands and data output over UART serial interface
- High update messages rate of 1, 2, 5, and 10Hz
- 1PPS output
- Static navigation
- Single voltage supply 3.3V and backup input
- Ultra-small LGA footprint of 7mm x 7mm
- Ultra-low weight of 0.2g
- Surface Mount Device (SMD)
- Optimized for automatic assembly and reflow equipment



- Operating from -40°C to +85°C
- FCC, CE, VCCI compliant
- RoHS II/REACH compliant

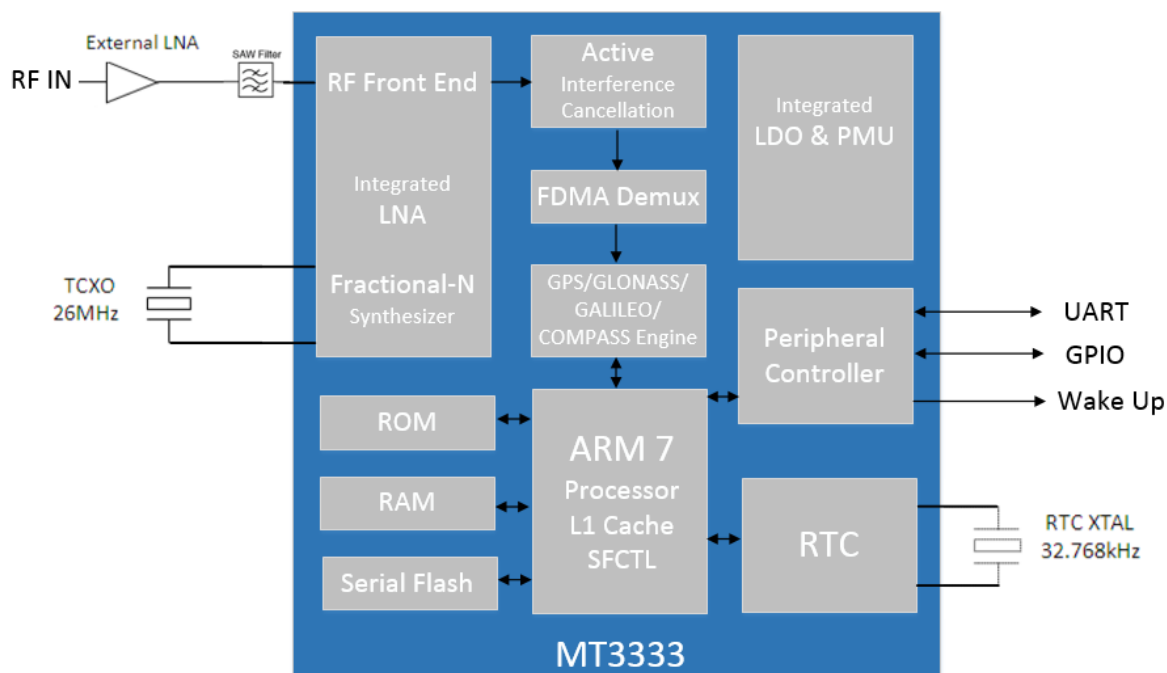
## 3.2. Architecture



**Figure 1. ORG4572-MK05 Architecture**

- **GNSS SAW Filter**  
Band-Pass SAW filter eliminates out-of-band signals that may interfere with GNSS reception.  
GNSS SAW filter is optimized for low Insertion Loss in GNSS band and low Return Loss outside it.
- **GNSS LNA**  
Dual-stage, cascaded LNAs amplify GNSS signals to meet RF down converter input threshold.  
Noise Figure optimized design was implemented to provide maximum sensitivity.
- **TCXO**  
Highly stable 26MHz oscillator controls down conversion process in RF block of the GNSS SoC.  
Characteristics of this component are important factors for higher sensitivity, shorter TTFF, and better navigation stability.

- RTC Crystal**  
 RTC 32.768 KHz quartz crystal with very tight specifications is necessary for maintaining Hot Start and Warm Start capabilities of the module.
- RF Shield**  
 RF enclosure avoids external interference from compromising sensitive circuitry inside the module.  
 RF shield also blocks the module's internal high frequency emissions from being radiated.
- MT3333 GNSS SoC**  
 The MT3333, multi-GNSS System on Chip is designed by MediaTek, which is the world's leading digital media solution provider and largest fab-less IC Company in Taiwan.  
 It is a hybrid positioning processor that combines GPS, GLONASS, GALILEO, BEIDOU, SBAS, QZSS, DGPS, and AGPS to provide a high-performance navigation solution.  
 MT3333 is a full SoC built on a low-power RF CMOS, incorporating GNSS RF, GNSS baseband, integrated navigation solution software, ARM® processor, and serial flash.



**Figure 2. MT3333 System Block Diagram and Peripheral**

MT3333 SoC includes the following units:

- GNSS radio subsystem which includes single input, dual receive paths for concurrent GPS, Galileo and GLONASS/BEIDO, mixer with current mode interface between the mixer and multi-modes low pass filter, fractional-N synthesizer, integrated self-calibrating filters, IF VGA with AGC, and high-sample rate ADCs with adaptive dynamic range.
- Measurement subsystem including DSP core for GNSS signals acquisition and tracking, interference scanner and detector, interference removers, multipath and cross-correlation detectors, dedicated DSP code ROM, and DSP cache RAM.
- Measurement subsystem which interfaces the GNSS radio subsystem.
- Navigation subsystem comprising an ARM7® microprocessor system for position, velocity and time solution, program ROM, data RAM, cache and patch RAM, and SPI flash.
- Peripheral Controller subsystem which includes UART Host interface, RTC block, wake up signal option, and GPIO.
- Peripheral Controller subsystem which interfaces a navigation subsystem, and PLL and PMU subsystems.
- Navigation subsystem which interfaces a measurement subsystem.
- PMU subsystem which includes voltage regulators for RF and baseband domains.

### 3.3. ORG4572-MK05 Features Description:

#### 3.3.1. Constellation Configuration

- GPS, Galileo and GLONASS—default.
- GPS and BEIDOU—available.

#### 3.3.2. 1PPS

1PPS (Pulse per Second) signal output available on configuration:

- At 2D Fix only
- At 3D Fix only
- After the first Fix
- **Always on—default configuration.**

The pulse is configurable for required duration, frequency, and active high/low via command.

The pulse may vary 30nS (1  $\sigma$ ). The relationship between the PPS signal and UTC is unspecified.

### **3.3.3. Static Navigation**

Static Navigation is an operational mode in which the receiver freezes the position fix when the speed falls below a threshold (indicating that the receiver is stationary). The course is also frozen, and the speed is reported as zero. The navigation solution is then unfrozen when the speed increases above a threshold. The speed threshold can be set via a command (PMTK 386).

Static Navigation is disabled by default but can be enabled by command. This feature is useful for applications in which very low dynamics are not expected, the classic example being an automotive application.

### **3.3.4. Assisted GPS (AGPS)**

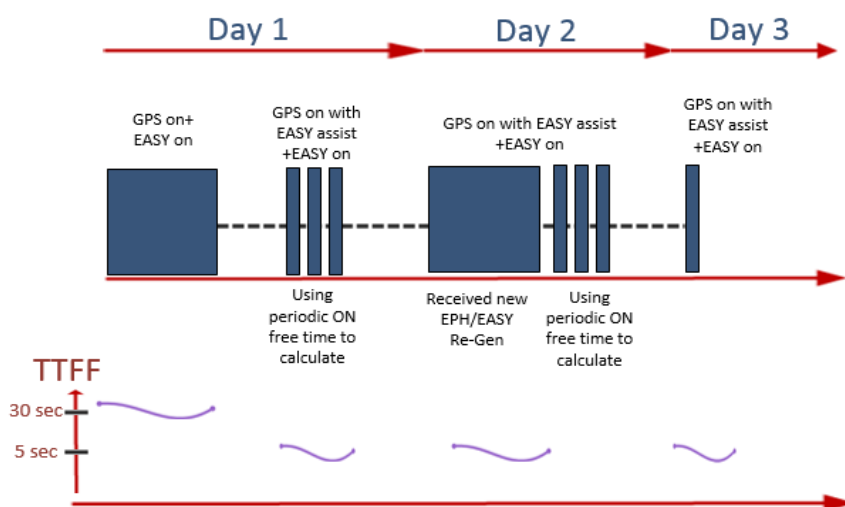
Assisted GPS (or Aided GPS) is a method by which TTFF is reduced using information from a source other than broadcast GPS signals. The necessary ephemeris data is calculated either by the receiver itself (locally generated ephemeris) or a server (server-generated ephemeris) and stored in the module.

ORG4572-MK05 has EASY, EPO, and HotStill technology to enable Hot Starts even in weak signal conditions and moving state. EPO (Extended Prediction Orbit) is one of MediaTek's innovative proprietary off-line server-based AGPS solutions. The Host is able to use an application to store and load the EPO files into the device. With multi-constellation EPO, the user experience is enhanced by the improved Time-to-First Fix (TTFF) and better first fix accuracy.

#### **3.3.4.1. Locally-generated AGPS (Embedded Assist System – EASY)**

The EASY™ is an embedded assist system for quick positioning, where the GPS engine calculates and automatically predicts the single emperies (max. up to 3 days), when power is on, and stores the predicted information in the memory. The GPS engine uses this information for positioning if there is not enough information from satellites, so the function is helpful for positioning and TTFF improvement under indoor or urban condition. Backup power (V\_BACKUP) is necessary.

Up to three days' extension for single received ephemeris:



**Figure 3. Easy™ TTFF Timing**

### 3.3.4.2. Server-generated AGPS (Extended Prediction Orbit—EPO)

The AGPS (EPO™) supplies the predicted Extended Prediction Orbit data to speed the TTFF. Users can download the EPO data to the GNSS engine from the FTP server through the Internet or a wireless network. The GNSS engine uses the EPO data to assist position calculations when the navigation information of satellites is not sufficient, or the operation occurs in a weak signal zone.

The Host could use an application to store and load the EPO files into a device with the improved Time-to-First Fix (TTFF) and better first fix accuracy.

The predicted ephemeris file is obtained from the AGPS server and is injected into the module over serial port 1 (RX1). These predictions do not require local broadcast ephemeris collection and are valid for up to 14 days.

### 3.3.4.3. HotStill (Extended Prediction Orbit)

HotStill is one of MTK's innovative proprietary offline, client-based A-GPS solutions, capable of dramatically accelerating GPS TTFF (Time-to-First Fix) in urban canyons or weak signal environments from several minutes to only a few seconds. It works as a background software running on the host processor to predict satellite orbit navigation data and generate Broadcast Ephemeris Extension (BEE) from received broadcast ephemeris as well as no network connection requirements.

### **3.3.5. Quasi-Zenith Satellite System (QZSS)**

The three satellites of the Japanese SBAS are in a highly inclined elliptical orbit, which is geosynchronous (not geostationary) and has analemma-like ground tracks. This orbit provides continuous coverage over Japan using only three satellites. Their primary purpose is to provide augmentation to the GPS system, but the signals may also be used for ranging. NMEA reporting for QZSS may be enabled/disabled by the user.

### **3.3.6. Satellite-Based Augmentation System (SBAS)**

The ORG4572-MK05 receiver can use Satellite-Based Augmentation System (SBAS) satellites as a source of both differential corrections and satellite range measurements. These systems (WAAS, EGNOS, MSAS, and GAGAN) use geostationary satellites to transmit regional differential corrections via a GNSS-compatible signal. The use of SBAS corrections can significantly improve position accuracy and is enabled by default.

### **3.3.7. Differential GPS (DGPS)**

DGPS is a Ground-Based Augmentation System (GBAS) for reducing position errors by applying corrections from a set of accurately surveyed ground stations located over a wide area. These reference stations measure the range to each satellite and compare it to the known-good range. The differences can then be used to compute a set of corrections which are transmitted to a DGPS receiver, either by radio or over the Internet. The DGPS receiver can then send them to the serial port 1 (RX1) using the RTCM SC-104 message protocol. The corrections can significantly improve the accuracy of the position reported to the user. The receiver can accept and apply either the RTCM SC-104 messages or SBAS differential data.

### **3.3.8. Jamming Rejection – Active Interference Cancellation (AIC)**

The ORG4572-MK05 detects, tracks, and removes narrow-band interfering signals (jamming signals) without the requirement for external components or tuning. It tracks and removes up to 12 CW (Continuous Wave)-type signals up to  $-80$  dBm (total power signal levels). By default, the jamming detection is enabled but can be disabled by command. This feature is useful both in the design stage and during the production stage for uncovering issues related to unexpected jamming. When enabled, AIC increases current consumption by about 1 mA. The impact on GNSS performance is minimal at low jamming levels. However, at high jamming levels (e.g.,  $-90$  to  $-80$  dBm), the RF signal sampling ADC starts to become saturated, after which the GNSS signal levels start to diminish.

### 3.3.9. Power Management Modes

The ORG4572-MK05 supports operational modes that enable them to provide positioning information at reduced overall current consumption. The availability of GNSS signals in the operating environment is also a factor in the choice of power management modes. The designer can choose a mode that provides the best tradeoff between performance and power consumption.

The power management modes are described below, and can be enabled via command:

- **Full Power Continuous—for best GNSS performance**
- **Power save mode to optimize power consumption:**
  - ◆ **Standby**
  - ◆ **Periodic**
  - ◆ **AlwaysLocate™**

#### 3.3.9.1. Full Power Continuous Mode

The modules start up in full power continuous mode. This mode uses the acquisition engine at full performance, resulting in the shortest possible TTFF, and the highest sensitivity. It searches for all possible satellites. The receiver then switches to the tracking engine to lower the power consumption when:

- A valid GPS/GNSS position is obtained
- The ephemeris for each satellite in view is valid

To return to Full Power mode (from a low power mode, excluding Backup mode), send the following command: **PMTK225,0** [Just after the module wakes up from its previous sleep cycle].

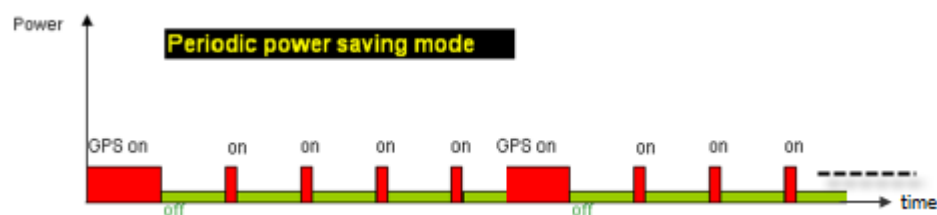
#### 3.3.9.2. Standby Mode

In this mode, the receiver stops navigation, the internal processor enters standby state, and the current drain at main supply (VCC) is reduced. Standby mode is entered by sending the following command: **PMTK161,0**

The host can then wake up the module from Standby mode to Full Power mode by sending any byte to the serial port.

#### 3.3.9.3. Periodic Mode

This mode provides autonomous power on/off with a reduced fix rate to reduce average power consumption. In Periodic Mode, the main power supply VCC is still powered, but power distribution to internal circuits is controlled by the receiver.



**Figure 4. Periodic Power Saving Mode**

Enter Periodic Mode by sending the following command:

`PMTK225,<Type>,<Run_time>,<Sleep_time>,<2nd_run_time>,<2nd_sleep_time>*<checksum>`

Where:

- Type = 1 for Periodic backup mode,
- Type = 2 for Periodic standby mode
- Run\_time = Full Power period (ms)
- Sleep\_time = Standby period (ms)
- 2nd\_run\_time = Full Power period (ms) for extended acquisition if GNSS acquisition fails during Run\_time
- 2nd\_sleep\_time = Standby period (ms) for extended sleep if GNSS acquisition fails during Run\_time

Example: **PMTK225,2,3000,12000,18000,72000**

for periodic mode with 3 s navigation and 12 s sleep. The acknowledgement response for this command is: **PMTK001,225,3**

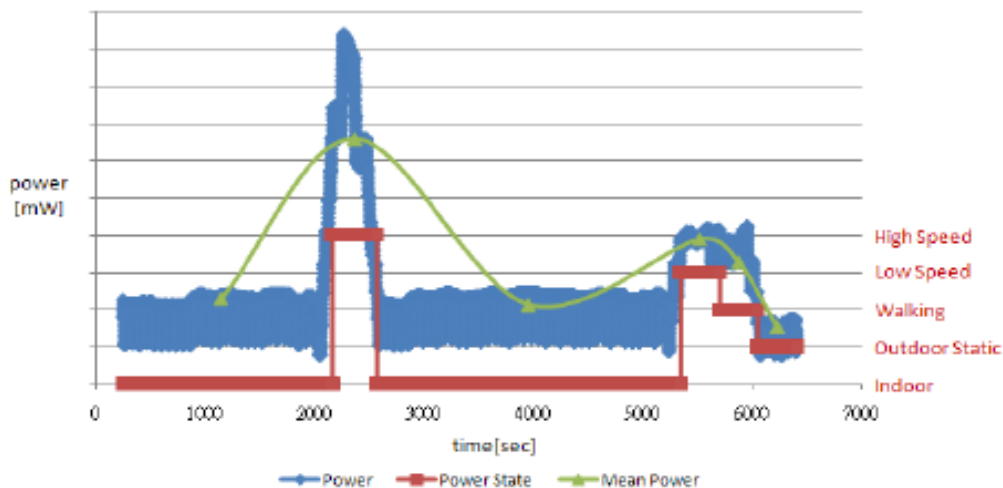
Periodic mode is exited and switched back to Full Power Continuous Mode by sending the command: **PMTK225,0**

just after the module wakes up from a previous sleep cycle.

#### 3.3.9.4. AlwaysLocate™ Mode

AlwaysLocate™ is an intelligent controller of the Periodic Mode. The main power supply VCC is still powered up, but power distribution is internally controlled. Depending on the environment and motion conditions, the module can autonomously and adaptively adjust the parameters of the Periodic Mode, e.g. ON/OFF ratio and fix rate to achieve a balance in positioning accuracy and power consumption. The average current can vary based on conditions.





**Figure 5. AlwaysLocate™ Mode: Power vs. Time**

Enter AlwaysLocate™ mode by sending the following NMEA command:  
**PMTK225,<mode>\*<checksum><CR><LF>**

Where: mode=9 for AlwaysLocate™

Example:

**PMTK225,9**

The acknowledgement response for the command is:

**PMTK001,225,3**

The user can exit low power modes to Full Power by sending NMEA command:

**PMTK225,0**

just after the module wakes up from its previous sleep cycle.

### 3.3.9.5. Backup Mode

Backup Mode means a low quiescent power state where receiver operation is stopped.

V\_backup is powered on, but the current consumption is minimal.

After waking up, the receiver uses all internal aiding, including GNSS time, Ephemeris, and Last Position, resulting in the fastest possible TTFF in either hot or warm start modes. During Backup State, the I/O block is powered off. The suggestion is that the host forces its outputs to a low state or to a high-Z state during the Backup State to minimize small leakage currents at the receiver's input signals.

The Current consumption is ~12uA in BACKUP mode (VCC & V\_BACKUP).

#### Entering Backup Mode:

##### First Option

Entering to backup mode is performed using a NMEA software command – PMTK225,4 (+checksum).

**Important:** Before sending the command the FORCE\_ON pin must be tied to ground.

While in Backup mode, the module consumes ~12uA from VCC and V\_BACKUP.

In case the command is sent while the FORCE\_ON is not tied to the ground, the module would enter into an idle state, but not BACKUP mode, and the current consumption would be significantly higher.

The Current consumption is ~12uA in BACKUP mode when FORCE\_ON pin of the module is tied to ground with a jumper. In real life cases, the FORCE\_ON pin is grounded by an active device with the residue resistance different from zero, so the current consumption may be 2-3 times higher i.e. 25uA.

FORCE\_ON must be tied to ground if you want to stay in BACKUP mode.

Example:

#### **PMTK225,4 Enter backup mode**

NMEA Return feedback:

**PMTK001,225,3**

The module remains in BACKUP mode while FORCE\_ON is tied to ground.

To exit from BACKUP mode, disconnect FORCE\_ON from the ground and pull the FORCE\_On to the high level, wait about 1 second, and then release it to the logic low level again.

**Important:** It is not possible to wake up the module from backup mode using a software command.

#### **Second Option**

Entering the BACKUP mode is performed by disconnecting the VCC and keeping the V\_backup connected. The module will consume 7uA from V\_backup. Once the VCC is connected again, wait about 1 second, and then release it to logic low again. The module will switch to an active state and acquire a hot start.

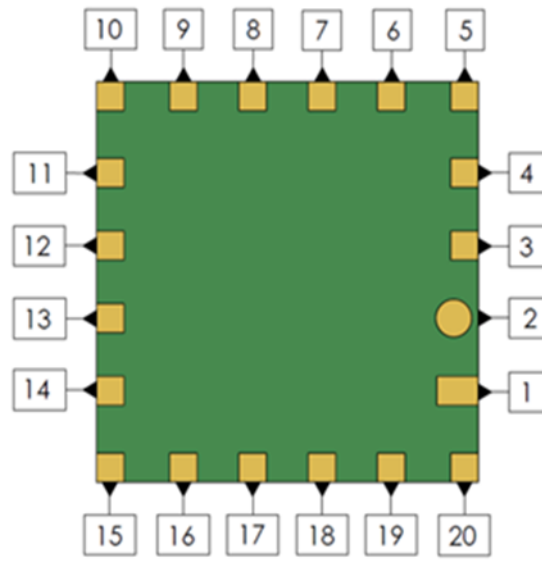
### **3.3.10. Configuration Settings**

Currently, the configuration settings are erased after turning down the power. Be aware to this issue on power cycles while shutting down the module.

## 3.4. Pad Assignment

Table 1. Pin-Out

PAD	NAME	FUNCTION	DIRECTION	LOGIC LEVEL
1	GND	System Ground	Power	
2	RF IN	RF input	Input	50Ω
3	GND	System Ground	Input power	
4	WAKEUP	WAKEUP	Output	2.8V
5	MISO	SPI Data In	Input	2.8V
6	RESET	System Reset— Active Low	Input	2.8V
7	SCK	SPI Clock	Bi-directional	2.8V
8	SCS	SPI Chip Select	Input	2.8V
9	RX	UART Receive (Serial Input)	Input	2.8V
10	MOSI	SPI Data Out	Output	2.8V
11	FORCE ON	Forced full- power mode signal – Active Low	Input	2.8V
12	1PPS	UTC Time Mark	Output	2.8V
13	TX	UART Transmit (Serial Output)	Output	2.8V
14	VCC	System Power	Power	3.3V
15	V_BACKUP	Input for battery backup	Input power	2.8-4.2V
16	EINT	External Interrupt for I2C/SPI	Output	2.8V
17	GND	System Ground	Power	
18	CTS	UART Clear to Send/ I2C Clock	Input	2.8V
19	RTS	UART Ready to Send/ I2C Data	Output	2.8V
20	NC	Reserved— Do not connect		



**Figure 6. ORG4572-MK05 Top View**

## 4. MECHANICAL SPECIFICATIONS

- ORG4572-MK05 module has miniature LGA SMD packaging sized at 7mm x 7mm.
- ORG4572—MK05 is built on a PCB assembly enclosed with a metallic RF shield box.
- On the bottom side there are 16+4 SMT pads with a Cu base and ENIG plating.
- The ORG4572—MK05 module supports automated pick and place assembly and reflow soldering processes.

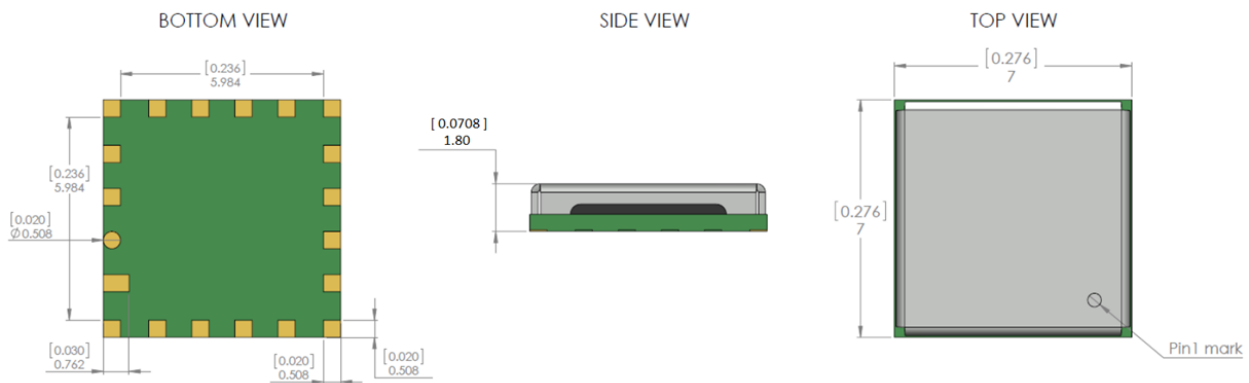


Figure 7. Mechanical Drawing

Table 2. Mechanical Summary

Dimensions	Length	Width	Height	Weight	
mm	7.0 + 0.2 / -0.05	7.0 + 0.2 / -0.05	1.8 + 0.1 / -0.05	gr	0.2
inch	0.276 + 0.008 / -0.002	0.276 + 0.008 / -0.002	0.0708 + 0.008 / -0.02	oz	0.01

## 5. ELECTRICAL SPECIFICATIONS

### 5.1. Absolute Maximum Ratings

Stresses exceeding Absolute Maximum Ratings may damage the device.

**Table 3. Absolute Maximum Ratings**

PARAMETER	SYMBOL	MIN	MAX	UNIT
Power Supply Voltage	$V_{CC}$	-0.30	+4.3	V
Backup Battery Supply Voltage	$V_{backup}$	-0.30	+4.3	V
Power Supply Current <sup>1</sup>	$I_{CC}$		120	mA
RF Input Voltage <sup>2</sup>	$V_{RF}$	-0.30	+3.6	V
I/O Voltage	$V_{IO}$	-0.30	+3.6	V
I/O Source/Sink Current	$I_{IO}$		+8	mA
ESD Voltage	$V_{IO/RF, HBM Model}^3$	(-/+ ) 1000	(-/+ ) 3000	V
	$V_{IO/RF, MM Model}^4$	(-/+ ) 100	(-/+ ) 300	V
RF Power <sup>5</sup>	$f_{IN} = 1560MHz \div 1630MHz$		+10	dBm
	$f_{IN} < 1560MHz, > 1630MHz$		+30	dBm
Operating Temperature	$T_{AMB}$	-45	+90	°C
Storage Temperature	$T_{ST}$	-50	+125	°C
Lead Temperature <sup>6</sup>	$T_{LEAD}$	-5	+260	°C

#### Notes:

1. Inrush current of up to 100mA for about 20 $\mu$ s duration.
2. Voltage applied on antenna element.
3. Human Body Model (HBM) contact discharge per EIA/JEDEC JESD22-A114D. Step: 500V (+/-).
4. Machine Model (MM) contact discharge per EIA/JEDEC JESD22-A115C. Step: 50V (+/-).
5. Power is delivered to the antenna element.
6. Lead temperature at 1mm from case for 10s duration.

## 5.2. Recommended Operating Conditions

Exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Table 4. Recommended Operating Conditions**

PARAMETER	SYMBOL	MODE /	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Power supply voltage	V <sub>CC</sub>	V <sub>CC</sub>		+3.00	+3.3	+3.60	V	
Backup Battery supply voltage	V <sub>backup</sub>	V <sub>backup</sub>		+2.80	+3.60	+4.20	V	
Digital IO Pin Low level input	V <sub>il</sub>			-0.3		+0.7	V	
Digital IO Pin High level input	V <sub>ih</sub>			+2.1		+3.6	V	
Digital IO Pin Low level output	V <sub>ol</sub>		I <sub>ol</sub> =2mA	-0.3		+0.4	V	
Digital IO Pin High level output	V <sub>oh</sub>		I <sub>oh</sub> =2mA	+2.4	+2.8	+3.1	V	
Power Supply Current <sup>1</sup>	I <sub>CC</sub>	Acquisition	GPS		40		mA	
			GPS+GLONASS		45		mA	
		Tracking	GPS		28		mA	
			GPS+GLONASS		35		mA	
		Standby				0.5		mA
		Backup			7	12	25	μA
Input Impedance	Z <sub>IN</sub>	RF Input	f <sub>IN</sub> = 1575.5MHz		50		Ω	
Input Return Loss	R <sub>LIN</sub>			-7			dB	
Input Power Range	P <sub>IN</sub>		GPS or GLONASS	-165		-110	dBm	
Input Frequency Range	f <sub>IN</sub>			1560		1607	MHz	
Operating Temperature	T <sub>AMB</sub>			-40	+25	+85	°C	
Storage Temperature <sup>2</sup>	T <sub>ST</sub>			-50	+25	+125	°C	
Relative Humidity <sup>3</sup>	R <sub>H</sub>		T <sub>AMB</sub>	5		95	%	

### Notes:

1. Typical values under signal conditions of -130dBm and ambient temperature of +25°C and low gain configuration.  
Tested on the EVB with 12x12mm passive antenna
2. A longer TTFF is expected while operating below -30°C to -40°C.
3. Relative Humidity is within Operating Temperature range.

## 6. PERFORMANCE

### 6.1. Acquisition Time

TTF (Time to First Fix)—is the period of time from the module's power-up until the valid position estimation.

#### 6.1.1. Hot Start

Hot Start results either from a software reset after a period of continuous navigation or a return from a short idle period that was preceded by a period of continuous navigation.

During Hot Start, all critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in RAM.

#### 6.1.2. Signal Reacquisition

Reacquisition follows temporary blocking of GNSS signals.

Typical reacquisition scenario includes driving through a tunnel.

#### 6.1.3. Aided Start

Aided Start is a method of effectively reducing TTF by providing valid satellite ephemeris data.

Aiding can be implemented using Embedded Assist System (EASY), Extended Prediction Orbit (EPO), and HotStill.

#### 6.1.4. Warm Start

Warm Start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available in RAM.

In this state, position and time data are present and valid, but satellite ephemeris data validity has expired.

#### 6.1.5. Cold Start

Cold Start occurs when satellite ephemeris data and position and time data are unknown.

A typical Cold Start scenario includes first power application.



**Table 5. Acquisition Time**

OPERATION <sup>1</sup>	MODEM	VALUE	UNIT
Hot Start		< 1	s
Aided Start		< 3	s
Warm Start	GPS + GLONASS	< 26	s
	GPS	< 29	s
Cold Start	GPS + GLONASS	< 23	s
	GPS	< 31	s
Signal Reacquisition		< 3	s

**Notes:**

1. EVK is 24-hrs. Static under signal conditions of -130dBm and ambient temperature of +25°C.
2. Outage duration ≤ 30s.
3. Dependent on aiding data connection speed and latency.
4. Tested on the EVB with 12x12mm passive antenna.

## 6.2. Sensitivity

### 6.2.1. Tracking

Tracking is an ability of the receiver to maintain valid satellite ephemeris data. During tracking, the receiver may stop outputting valid position solutions. Tracking sensitivity is defined as the minimum GNSS signal power required for tracking.

### 6.2.2. Reacquisition

Reacquisition follows the temporary blocking of GNSS signals. Reacquisition sensitivity is defined as the minimum GNSS signal power required for reacquisition.

### 6.2.3. Navigation

During navigation, the receiver consequently outputs valid position solutions. Navigation sensitivity is defined as the minimum GNSS signal power required for reliable navigation.

### 6.2.4. Hot Start

Hot Start sensitivity is defined as the minimum GNSS signal power required for a valid position solution under Hot Start conditions.

### 6.2.5. Aided Start

Aided Start sensitivity is defined as the minimum GNSS signal power required for a valid position solution following the aiding process.

### 6.2.6. Cold Start

Cold Start sensitivity is defined as the minimum GNSS signal power required for valid position solution under Cold Start conditions. It is sometimes referred to as the ephemeris decode threshold.

**Table 6. Sensitivity**

OPERATION1	MODE	VALUE	UNIT
Tracking	GPS	-165	dBm
	GLONASS	-165	dBm
Navigation	GPS	-163	dBm
	GLONASS	-163	dBm
Reacquisition <sup>2</sup>	GPS+GLONASS	-160	dBm
Hot Start*	GPS+GLONASS	-163	dBm
Aided Start	GPS+GLONASS	-160	dBm
Cold Start	GPS+GLONASS	-148	dBm

\*\* The above values have been tested at an update rate of 1 Hz.

While working at a higher update rate there is some signal degradation.

## 6.3. Received Signal Strength

**Table 7. Received Signal Strength**

PARAMETER4	VALUE	UNIT
C/NO	45	dB-Hz

**Notes:**

1. EVK is static, ambient temperature is +25°C, and RF signals are conducted.
2. Outage duration  $\leq$  30s.
3. Aiding using Broadcast Ephemeris (Ephemeris Push™) or Extended Ephemeris (CGEE™ or SGEE™).
4. Average C/No reported for 4 SVs, EVK is 24-hrs. Static, outdoor, ambient temperature is +25°C.

## 6.4. Power Consumption

**Table 8. Power Consumption**

OPERATION1	MODE	VALUE	UNIT
Acquisition	GPS	132	mW
	GPS + GLONASS	148.5	mW
Tracking	GPS	92.4	mW
	GPS + GLONASS	115.5	mW
Standby State		1.65	mW
Backup State		39.6	uW

**Note:**

1. Typical values under conducted signal conditions of -130dBm and ambient temperature of +25°C. Measured voltage is 3.28V.

## 6.5. Position Accuracy

**Table 9. ORG4572-MK05 Position Accuracy**

PARAMETER	CONSTELLATION	CEP (m)
Horizontal Position Accuracy	GPS	2.5
Horizontal Position Accuracy	Glionass	2.6
Horizontal Position Accuracy	BeiDou	10.2
Horizontal Position Accuracy	GPS + Glionass	2.5
Horizontal Position Accuracy	GPS + BeiDou	2.5

**Notes:**

1. Module is static under signal conditions of -130dBm. Ambient temperature is +25°C.
2. EVK is 24-hrs. Static, ambient temperature is +25°C.
3. Speed over ground  $\leq$  30m/s.

## 6.6. Dynamic Constraints

**Table 10. Dynamic Constraints**

PARAMETER	METRIC	IMPERIAL
Velocity	515m/s	1,000 knots
Altitude	10,000m	32,808 ft
Altitude Balloon Mode	80,000m	262,467 ft
Acceleration	4g	

**Note: 1.** Standard dynamic constraints according to regulatory limitations.

## 7. INTERFACE

### 7.1. Power Supply

It is recommended to keep the power supply on all the time in order to keep the RTC block active and keep satellite data in RAM for fastest possible TTFF. When the VCC is removed, settings are reset to factory default and the receiver performs a Cold Start on the next power up.

#### 7.1.1. Nominal VCC = 3.3V

VCC is 3.3v DC and must be provided from a regulated power supply.

During tracking, the processing is less intense compared to acquisition, therefore power consumption is lower.

Filtering is important to manage high alternating current flows on the power input connection. An additional LC filter on ORG4572-MK05 power input may be required to reduce system noise.

The high rate of ORG4572-MK05 input current change requires low ESR bypass capacitors.

Additional higher ESR output capacitors can provide input stability damping.

The ESR and size of the output capacitors directly define the output ripple voltage with a given inductor size. Large low ESR output capacitors are beneficial for low noise.

#### 7.1.2. Ground

A ground pad must be connected to the host PCB Ground with the shortest possible trace or via multiple VIAs.

### 7.2. Control Interface

#### 7.2.1. UART—Host Interface

The ORG4572-MK05 module has the following standard UART ports:

##### 7.2.1.1. TX

TX used for GPS data reports. Output logic high voltage level is 2.8V.

The TX serial data line outputs NMEA serial data at a default bit rate of 9600 bps.

When no serial data is output, the TX data line idles high.

### 7.2.1.2. **RX**

RX is used for receiver control. The Input logic high voltage level is 2.8V. The RX data line accepts NMEA commands at a default bit rate of 9600 bps. When the receiver is powered down, do not back drive this or any other GPIO line.

The idle state for serial data from the host computer is logic 1.

### 7.2.1.3. **I2C**

The I2C interface is enabled by default starting from F.W. version 5.1.1.

I2C host interface features are:

- I2C Slave mode—host initiates clock and data, operating speed 400kbps.
- ORG4572-MK05 supports 7-bit I2C address.
- I2C default slave address '0x10'.
- Individual Tx FIFO buffer length of 255 bytes. Master can read one I2C data packet of max. 255 bytes at a time.
- In order to read entire NMEA packet of one second, the master must read several I2C data packets and extract valid NMEA data. After reading one I2C data packet, it sleeps for 2ms before reading the next packet. In the event that the entire packet of 1 second was read, wait for a longer period for the next NMEA packet.

## 7.2.2. **Data Interface**

### 7.2.2.1. **Force-On**

Force-ON is an input signal that can be used to wake up the ORG4572-MK05 from sleep mode.

It has active-low logic, i.e. the module wakes up when FORCE\_ON is tied to the ground.

When inactive, it should be floating.

Keeping FORCE\_ON tied to the ground does not prevent the ORG4572-MK05 from going into sleep mode. since this signal is sensitive only to the high-low transition.

### 7.2.2.2. **RESET**

In addition, to the NMEA command for reset—\$PMTK104\*37, external reset is available through the ("RESET") pad. Active low signal. Signal logic level of 2.8V.

The module continuously monitors the VCC supply and issues an internal hardware reset if the voltage drops below 2.7 ( $\pm 0.1$ ) V. This reset protects the memory from accidental writes during a power down condition. To prevent this, the supply must be regulated to be within the 2.8-4.3 voltage range, inclusive of load regulation and power supply noise and ripple. Noise and ripple outside of these limits can affect positioning sensitivity and risks

tripping the internal voltage supervisors, thereby shutting down the module unexpectedly.

Regulators with good load regulation are recommended to prevent power supply glitches as the receiver transitions between power states.

### 7.2.2.3. 1PPS

Pulse-Per-Second (PPS) output provides a pulse signal for timing purposes.

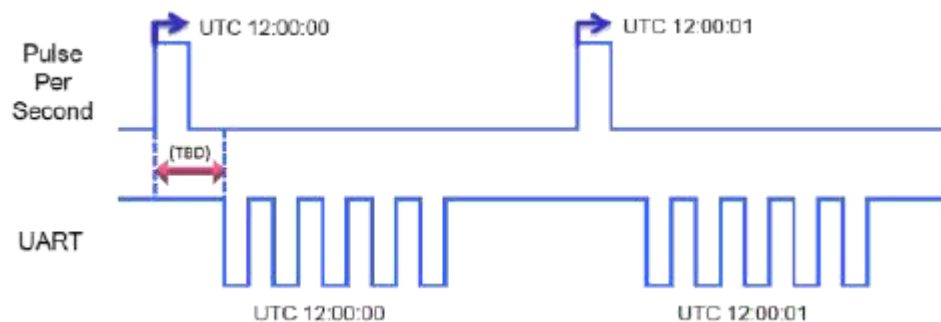
The pulse is configurable for required duration, frequency and active high/low via command.

The pulse may vary 30 nS (1  $\sigma$ ). The relationship between the PPS signal and UTC is unspecified.

To enable or disable this functionality, use the Proprietary Mediatek command PMTK255:

**PMTK255,1 => enable PPS**

**PMTK255,0 => disable PPS**



**Figure 8. 1PPS and UTC**

1PPS supports a 1Hz NMEA output, but at a baud rate of 9600 bps, if there are many NMEA sentences output, per second transmission may exceed one second.

### 7.2.2.4. Wakeup

When the ORG4572-MK05 is on (full power), the output is high, at the 3.3V level.

When the ORG4572-MK05 is on Standby or backup mode the output is low (ground).

The typical output voltage is 3.3V.

On low power modes (Periodic and AlwaysLocate), when the ORG4572-MK05 is off, the wakeup level is low (and the wakeup returns to high level when the module returns to full power).

## 8. TYPICAL APPLICATION CIRCUIT

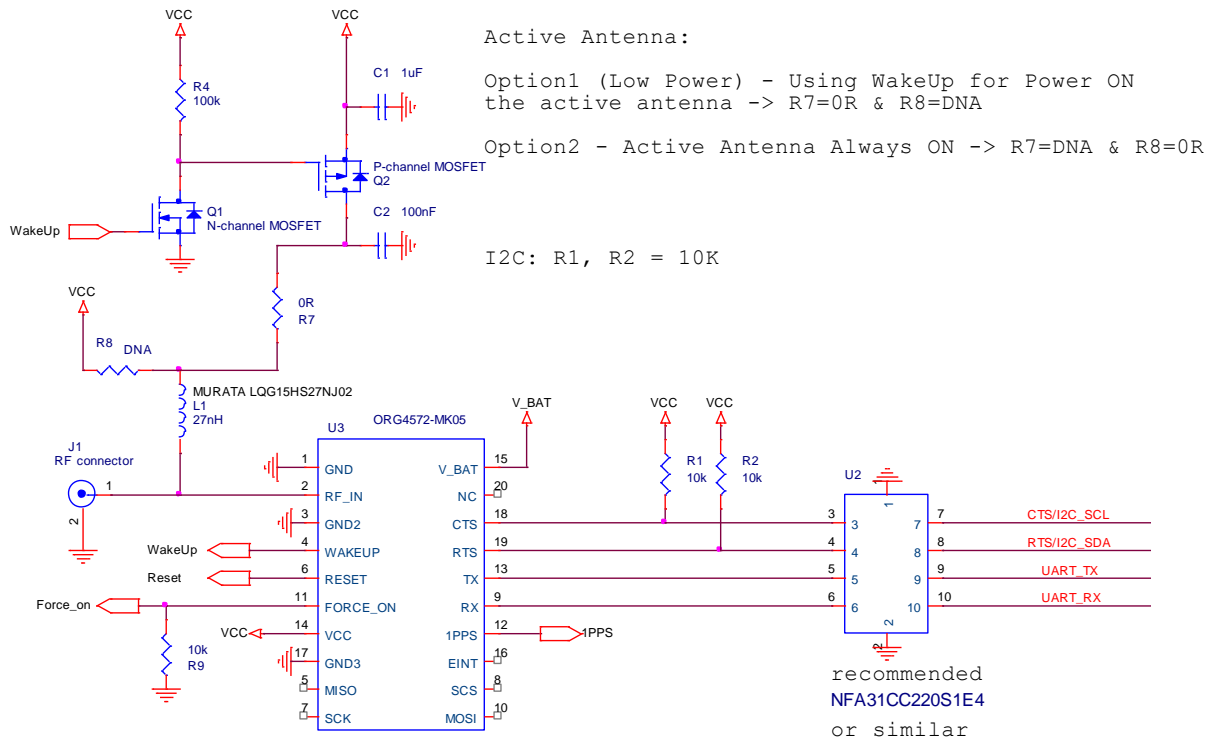
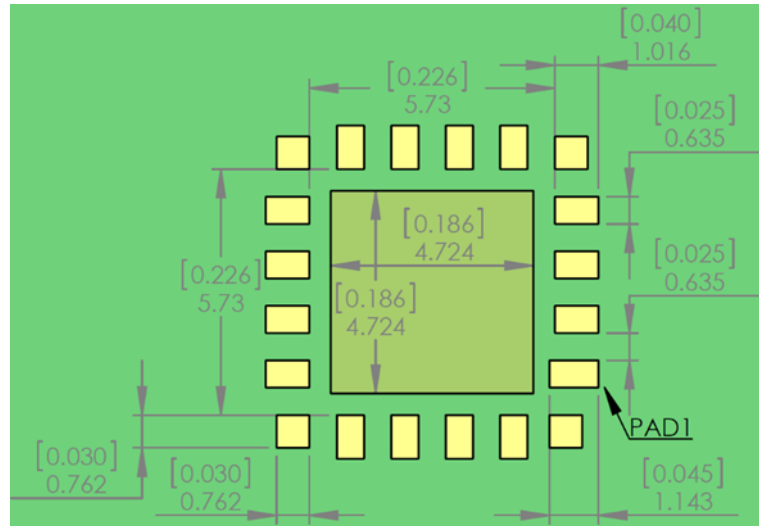


Figure 9. Reference Schematic Diagram

## 9. RECOMMENDED PCB LAYOUT

### 9.1. Footprint

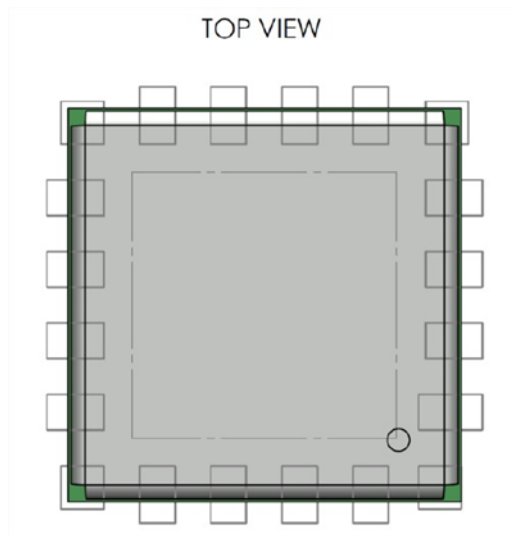


**Figure 10. Footprint**

The Ground paddle at the middle should be connected to the main Ground plane by multiple VIAs.

The Ground paddle at the middle must be solder-masked.

The Silk print of the module's outline is highly recommended for SMT visual inspection.



**Figure 11. Module Hosted on Footprint**



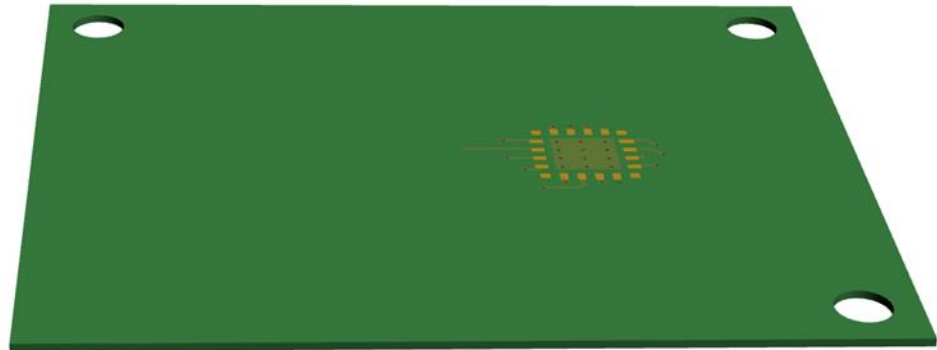


Figure 12. Host PCB

## 9.2. RF Trace

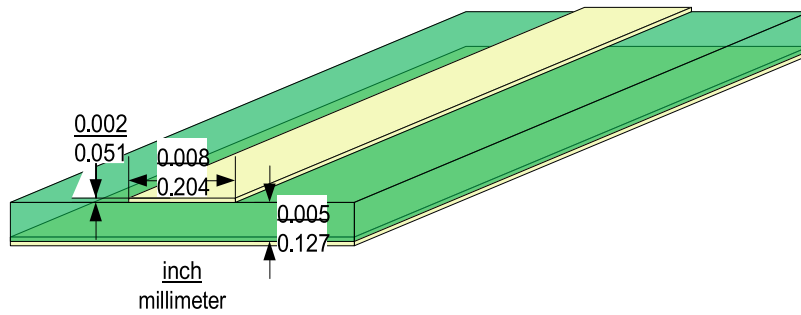


Figure 13. Typical Microstrip PCB Trace on Fr-4 Substrate

## 9.3. PCB Stack-Up

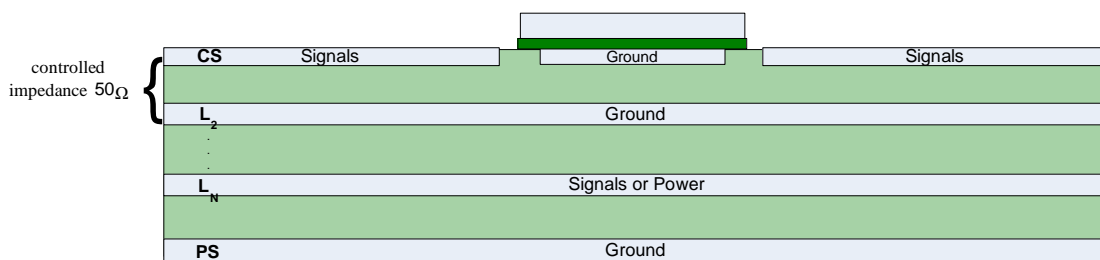


Figure 14. Typical PCB Stack-Up

## 9.4. PCB Layout Restrictions

Switching and high-speed components, traces, and VIAs must be kept away from the ORG4572-MK05 module.

Signal traces to/from module must have minimum length.

The recommended minimal distance from adjacent active components is 3mm.

Ground pads must be connected to the host PCB Ground with the shortest possible traces or VIAs.

In the event of a tight integration constraint or co-location with adjacent high-speed components like CPU or memory, high frequency components like transmitters, clock resonators or oscillators, LCD panels or CMOS image sensors, contact OriginGPS for application-specific recommendations.

## 10. DESIGN CONSIDERATIONS

### 10.1. Antenna

Antennas for GPS, Galileo, and GLONASS have a wider bandwidth than pure GPS antennas.

Some wideband antennas may not have a good axial ratio to block reflections of RHCP GPS, Galileo, and GLONASS signals. These antennas have lower rejection of multipath reflections and tend to degrade the overall performance of the receiver.

#### 10.1.1. Passive Antenna

A design with a passive antenna requires RF layout skills and can be challenging.

#### 10.1.2. Active Antenna

While designing with active antenna, consider using WAKEUP output to control auxiliary DC bias.

### 10.2. RF

The ORG4572-MK05 Spider module operates with received signal levels down to -167dBm and can be affected by high absolute levels of RF signals, moderate levels of RF interference near the GNSS bands, and by low levels of RF noise in GNSS band.

RF interference from nearby electronic circuits or radio transmitters can contain enough energy to desensitize ORG4572-MK05. These systems may also produce levels of energy outside of GNSS band, high enough to leak through RF filters and degrade the operation of the radios in ORG4572-MK05.

This issue becomes more critical in small products, where there are industrial design constraints. In that environment, transmitters for Wi-Fi, Bluetooth, RFID, cellular and other radios may have antennas physically close to the GNSS receiver antenna.

To prevent degraded performance of ORG4572-MK05, OriginGPS recommends performing EMI/jamming susceptibility tests for radiated and conducted noise on prototypes and assessing risks of other factors.

Contact OriginGPS for application-specific recommendations and design review services.

**Table 11. NMEA Input Commands**

Command ID	Description
PMTK000	Test. This command will be echoed back to the sender (for testing the communications link).
PMTK101	Perform a HOT start
PMTK102	Perform a WARM start
PMTK103	Perform a COLD start
PMTK104	Perform a system reset (erasing any stored almanac data) and then a COLD start
PMTK120	Erase aiding data stored in flash memory
PMTK127	Erase EPO data stored in flash memory
PMTK161,0	Standby - Stop mode
PMTK161,1	Standby - Sleep mode
PMTK251,Baudrate	Set NMEA Baudrate
PMTK313,0	Disable SBAS feature
PMTK313,1	Enable SBAS feature
PMTK353,1,0,0,0,0	Enable GPS only mode
PMTK353,0,1,0,0,0	Enable GLO only mode
PMTK353,0,0,0,0,1	Enable BDS only mode
PMTK353,1,1,0,0,0	Enable GPS and GLO mode
PMTK353,1,0,0,0,1	Enable GPS and BDS mode

## **11. FIRMWARE UPDATES**

The FW stored in the internal Flash memory may be upgraded via the serial port TX/RX pads. In order to update the FW, the following steps should be taken to perform reprogramming:

1. Remove all power to the module.
2. Connect the serial port to a PC.
3. Apply main power.
4. Run the software utility to re-flash the module. Clearing the entire flash memory is strongly recommended prior to programming.
5. Upon successful completion of re-flashing, remove the main power to the module for a minimum of 10 seconds.
6. Apply the main power to the module.
7. Verify the module has returned to the normal operating state.

## 12. HANDLING INFORMATION

### 12.1. Moisture Sensitivity

ORG4572-MK05 modules are MSL 3 designated devices according to IPC/JEDEC J-STD-033B standard.

The Module in a sample or bulk package must be baked prior to assembly at 125°C for 48 hours.

### 12.2. Assembly

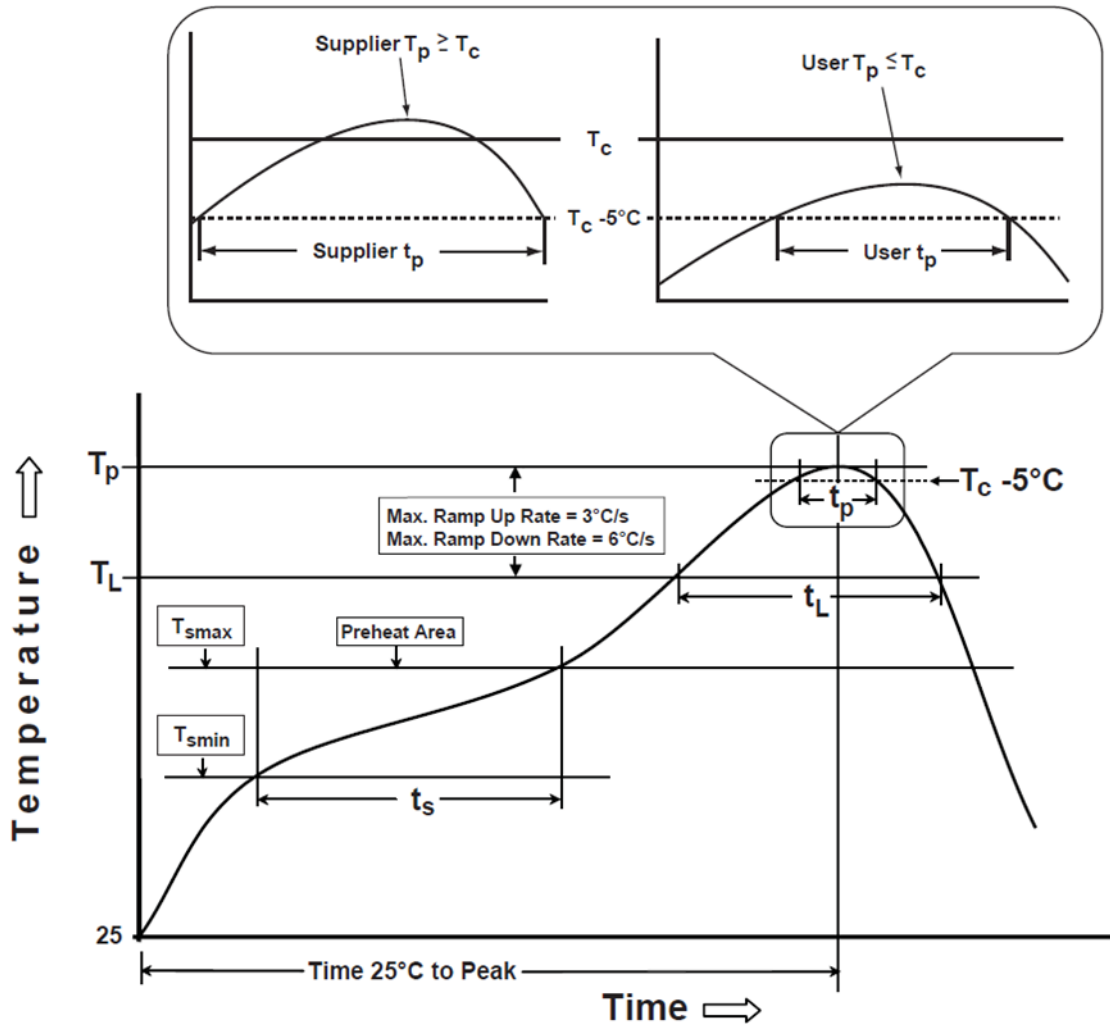
The module supports automatic pick-and-place assembly and reflow soldering processes.

The suggested solder paste stencil is 5 mil to ensure sufficient solder volume.

### 12.3. Soldering

Reflow soldering of the module always on the component side (Top side) of the host PCB according to standard IPC/JEDEC J-STD-020D for LGA SMD.

Avoid exposure of ORG4572-MK05 to a face-down reflow soldering process.



**Figure 15. Recommended Soldering Profile**

Referred temperature is measured on the top surface of the package during the entire soldering process.

The suggested peak reflow temperature is 245°C for 30 sec. for Pb-Free solder paste.

The actual board assembly reflow profile must be developed individually per furnace characteristics.

Reflow furnace settings depend on the number of heating/cooling zones, type of solder paste/flux used, board design, component density, and packages used.

**Table 12. Soldering Profile Parameters**

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
TC	Classification Temperature		245		°C
TP	Package Temperature			245	°C
TL	Liquidous Temperature		217		°C
TS	Soak/Preheat Temperature	150		200	°C
tS	Soak/Preheat Time	60		120	s
tL	Liquidous Time	60		150	s
tP	Peak Time		30		s

## 12.4. Cleaning

If flux cleaning is required, the module is capable of withstanding a standard cleaning process in a vapor degreaser with the Solvon® n-Propyl Bromide (NPB) solvent and/or washing in DI water.

Avoid a cleaning process in an ultrasonic degreaser since specific vibrations may cause performance degradation or destruction of internal circuitry.

## 12.5. Rework

If localized heating is required to rework or repair the module, precautionary methods are required to avoid exposure to solder reflow temperatures that can result in permanent damage to the device.

## 12.6. ESD Sensitivity



This product is an ESD sensitive device and must be handled with care.

## 12.7. Safety Information

Incorrect handling and use can cause permanent damage to the product.

## 12.8. Disposal Information

This product must not be treated as household waste.

For more detailed information about recycling electronic components contact your local waste management authority.





## 13. COMPLIANCE

The following standards are applied on the production of ORG4572-MK05 modules:

- IPC-6011/6012 Class2 for PCB manufacturing
- IPC-A-600 Class2 for PCB inspection
- IPC-A-610D Class2 for SMT acceptability

ORG4572-MK05 modules are manufactured in ISO 9001:2008 accredited facilities.

ORG4572-MK05 modules are manufactured in ISO 14001:2004 accredited facilities.

ORG4572-MK05 modules are manufactured in OHSAS 18001:2007 accredited facilities.

ORG4572-MK05 modules are designed, manufactured, and handled in compliance with the Directive 2011/65/EU of the European Parliament and of the Council of June 2011 on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment, referred as RoHS II.



ORG4572-MK05 modules are manufactured and handled in compliance with the applicable substance bans as of Annex XVII of Regulation 1907/2006/EC on Registration, Evaluation, Authorization and Restriction of Chemicals including all amendments and candidate list issued by ECHA, referred as REACH.



ORG4572-MK05 modules comply with the following EMC standards:

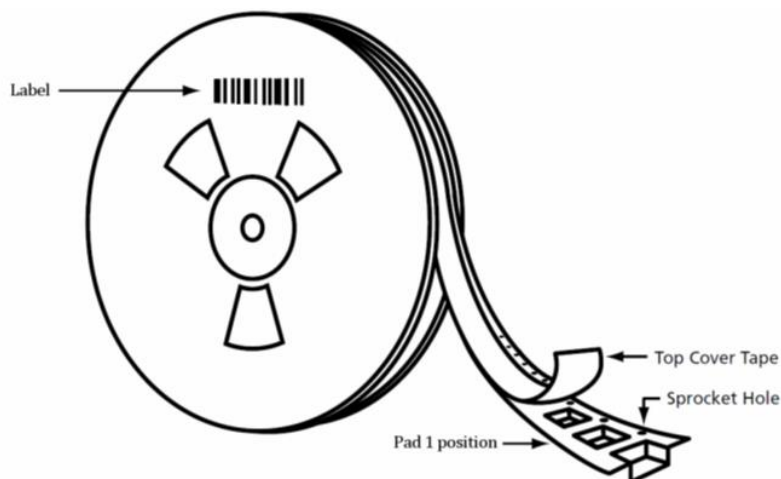
- EU CE EN55022:06+A1(07), Class B
- US FCC 47CFR Part 15:09, Subpart B, Class B
- JAPAN VCCI V-3/2006.04



## 14. PACKAGING AND DELIVERY

### 14.1. Appearance

ORG4572-MK05 modules are delivered in reeled tapes for an automatic pick-and-place assembly process.



**Figure 16. Module Position**

ORG4572-MK05 modules are packed in two different reel types (TR1 and TR2).

**Table 13. Reel Quantity**

SUFFIX	TR1	TR2
Quantity	500	2000

Reels are dry-packed with a humidity indicator card and desiccant bag according to IPC/JEDEC J-STD-033B standard for MSL 3 devices.

Reels are vacuum-sealed inside anti-static moisture barrier bags.

Sealed reels are labeled with an MSD sticker providing information about:

- MSL
- Shelf life
- Reflow soldering peak temperature
- Seal date

Sealed reels are packed inside cartons.

Reels, reel packs, and cartons are labeled with a sticker providing information about:

- Description
- Part number
- Lot number
- Customer PO number
- Quantity
- Date code

## 14.2. Carrier Tape

Carrier tape material—polystyrene with carbon (PS+C).

Cover tape material—polyester-based film with a heat-activated adhesive coating layer.

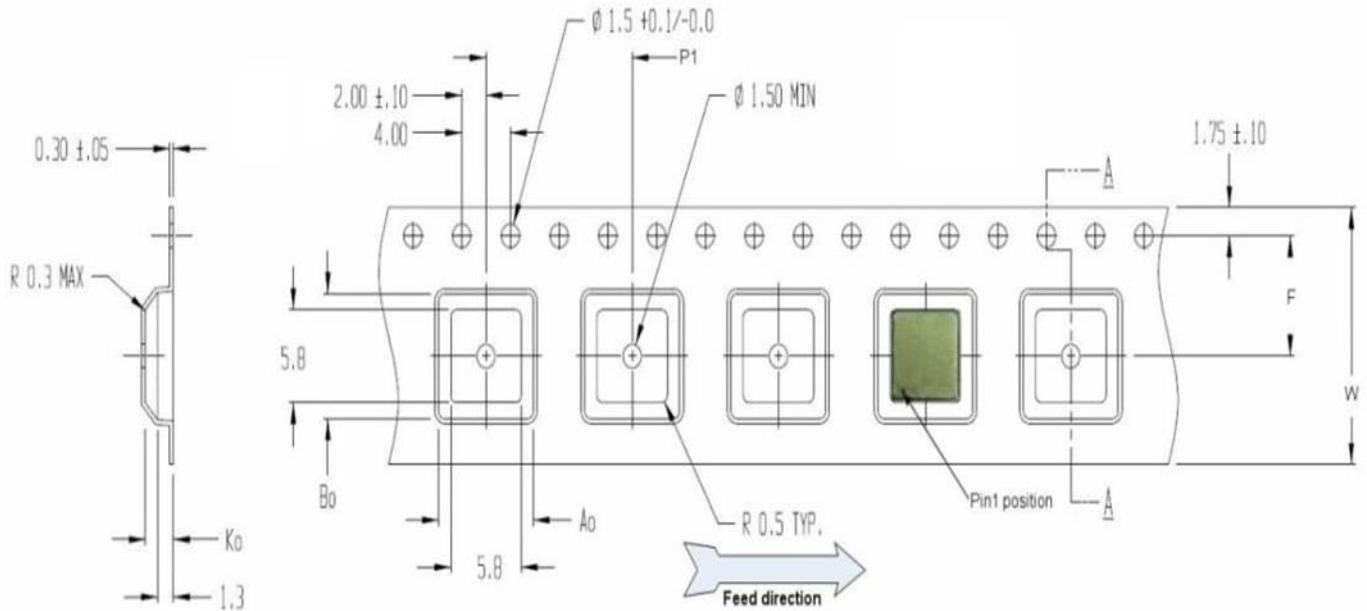


Figure 17. Carrier Tape

Table 14. Carrier Tape Dimensions

	MM	INCH
A0	8.3 ± 0.1	0.327 ± 0.004
B0	8.3 ± 0.1	0.327 ± 0.004
K0	2.7 ± 0.1	0.106 ± 0.004
F	7.5 ± 0.1	0.295 ± 0.004
P1	12.0 ± 0.1	0.472 ± 0.004
W	16.0 ± 0.3	0.630 ± 0.012

### 14.3. Reel

Reel material—antistatic plastic.

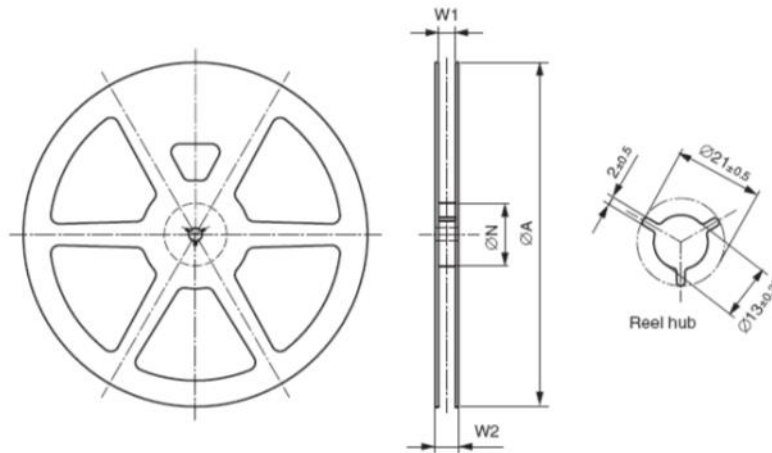


Figure 18. Reel

Table 15. Reel Dimensions

SUFFIX	TR1		TR2	
	MM	INCH	MM	MM
ØA	178.0 ± 1.0	7.00 ± 0.04	330.0 ± 2.0	13.0 ± 0.08
ØN	60.0 ± 1.0	2.36 ± 0.04	102.0 ± 2.0	4.02 ± 0.08
W1	16.7 ± 0.5	0.66 ± 0.02	16.7 ± 0.5	0.66 ± 0.02
W2	19.8 ± 0.5	0.78 ± 0.02	22.2 ± 0.5	0.87 ± 0.02

## 15. ORDERING INFORMATION

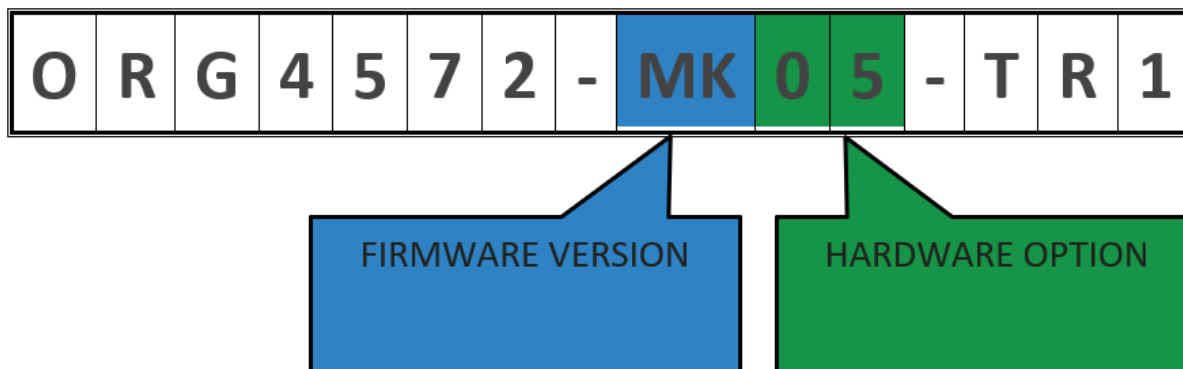


Figure 19. Ordering Options

Table 16. Orderable Devices

PART NUMBER	FW VERSION	HW OPTION	VCC RANGE	PACKAGING	SPQ
ORG4572-MK05-TR1	MK	05	3.3V	REELED TAPE	500
ORG4572-MK05-TR2	MK	05	3.3V	REELED TAPE	2000
ORG4572-MK05-UAR	MK	05	5V USB	EVALUATION KIT	1
ORG4572-MK05-USB	MK	05	5V USB	GNSS ON A STICK KIT	1

The default constellation is GPS, GLONASS, and Galileo.  
GPS and BEIDOU constellations are also available.

## Appendix A. ORG4572-MK05

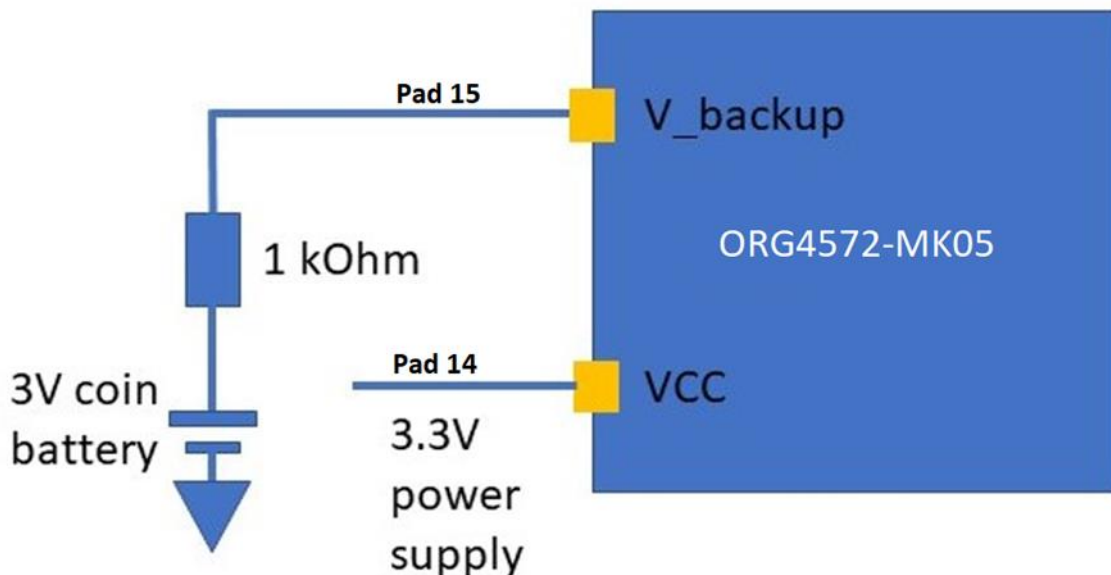
The ORG4572-MK05 version has an option to connect a coin battery (for example ECR2025 coin battery) to provide power in Backup Mode. The minimum voltage that the backup battery can support is 2.8V.

With a battery connection, after waking up, the receiver uses:

1. All internal aiding, including RTC time, Ephemeris, and Last Position, resulting in the fastest possible TTFF in either hot or warm start modes.
2. Configuration settings stored in flash after turning power off.

To keep alive the RTC time, the following circuit implementation using a 3V coin battery, can be used.

In addition, consider using a charger for the battery or separating the VCC and V\_BACKUP by using a controlled LDO for each one.



**Figure 20. Battery Backup Implementation**

**If a battery is not connected to pad 15 in ORG4572-MK05, connection between pads 14 and 15 is essential in order to operate the module.**