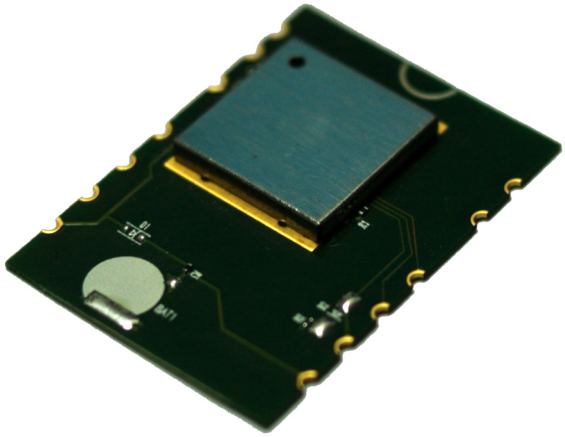

66-Channel GPS Module

with MTK Chipset

FM312

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History		
Date	**Rev.**	**Description**
2009/10/08	**A00**	**First Release**
2012/07/23	**A01**	**Remove RTCM function**

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Description

The FM312 is a high performance GPS module. It is a GPS receiver providing a solution that high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban conditions. This mini module has small size **(only 20mm x 27.9mm area)**. The GPS chipsets inside the module are designed by **MediaTek Inc**., which is the world's leading digital media solution provider and largest fab-less IC company in Taiwan. The module can support up to **66 channels**. The GPS solution enables small form factor devices. They deliver major advancements in GPS performances, accuracy, integration, computing power and flexibility. They are designed to simplify the embedded system integration process.

FM03 Features

- Based on **MediaTek** Single Chip Architecture (MT3329).
- ARM7 based application processor
- High sensitivity: -165dBm tracking
- L1 frequency, C/A code
- Channels: 66 acquisition, 22 simultaneous tracking
- Low power consumption: 40mA @ acquisition, 30mA @ tracking
- Cold/Warm/Hot start time: <35/<34/<1 seconds
- Maximum update rate up to 10Hz
- 1PPS GPS time reference
- GPS data interface: TTL level serial port
- Support NMEA 0183 standard V3.01 and backward compliance
- Support SBAS – WAAS, EGNOS, GAGAN and MSAS
- Dimension：**20mm x 27.9mm x 2.05mm**
- SMD TYPE
- RoHS compliant

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Chipset Characteristics

General	
Chipset	MTK MT3329
Frequency	L1, 1575.42MHz
C/A Code	1.023 MHz
Channels	66 channels
SBAS	WAAS, EGNOS, GAGAN,MSAS Supported
Datum	WGS84(Default), Tokyo-M, Tokyo-A, User Define
CPU	ARM7EJ-S
Dimensions	
Length/Width/Height	20*27.9*2.05 mm
Weight	2 g
Performance Characteristics	
Position Accuracy	Without aid：3.0m 2D-RMS
	< 3m CEP (50%) without SA (horizontal)
	DGPS (SBAS (WAAS, EGNOS, MSAS))：2.5m
Velocity Accuracy	Without aid：0.1 m/s
	DGPS (SBAS (WAAS, EGNOS, MSAS))：0.05m/s
Acceleration Accuracy	Without aid：0.1 m/s^2
	DGPS (SBAS (WAAS, EGNOS, MSAS))：0.05m/s^2
Timing Accuracy	100 ns RMS
Sensitivity	Acquisition：-148dBm (Cold Start)
	Reacquisition：-157dBm
	Tracking：-165dBm
Maximum Update Rate	Up to 10Hz(Default: 1Hz)
Acquisition (Open sky, stationary)	
Reacquisition Time	Less than 1 second
Hot start	1.0s (Typical)

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Warm start	34s (Typical)
Cold start	35s (Typical)
Dynamic	
Altitude	Maximum 18,000m
Velocity	Maximum 515m/s
Acceleration	Maximum 4G
Power	
Input Voltage	DC 3.3V Typical
Power Consumption @ 3.3V	Acquisition：40mA Typical
	Tracking：30mA Typical
I/O	
Signal Output	8 data bits, no parity, 1 stop bit
Available Baud Rates	4800/9600/38400/57600/115200 bps(Default：9600)
Protocols	NMEA 0183 v3.01 (Default：GGA,GSA,GSV,RMC,VTG) MTK NMEA Command Network Assistance Messages
Data output Interface	
Protocol messages	9600 bps/8/N/1 (Default)
Output format	GGA(1sec),GSA(1sec),RMC(1sec),VTG(1sec), GSV(5sec) (Default)
Environment	
Operating Temperature	-30 ℃ to 85 ℃
Storage Temperature	-40 ℃ to 125 ℃
Operating Humidity	5% to 95% (no condensing)

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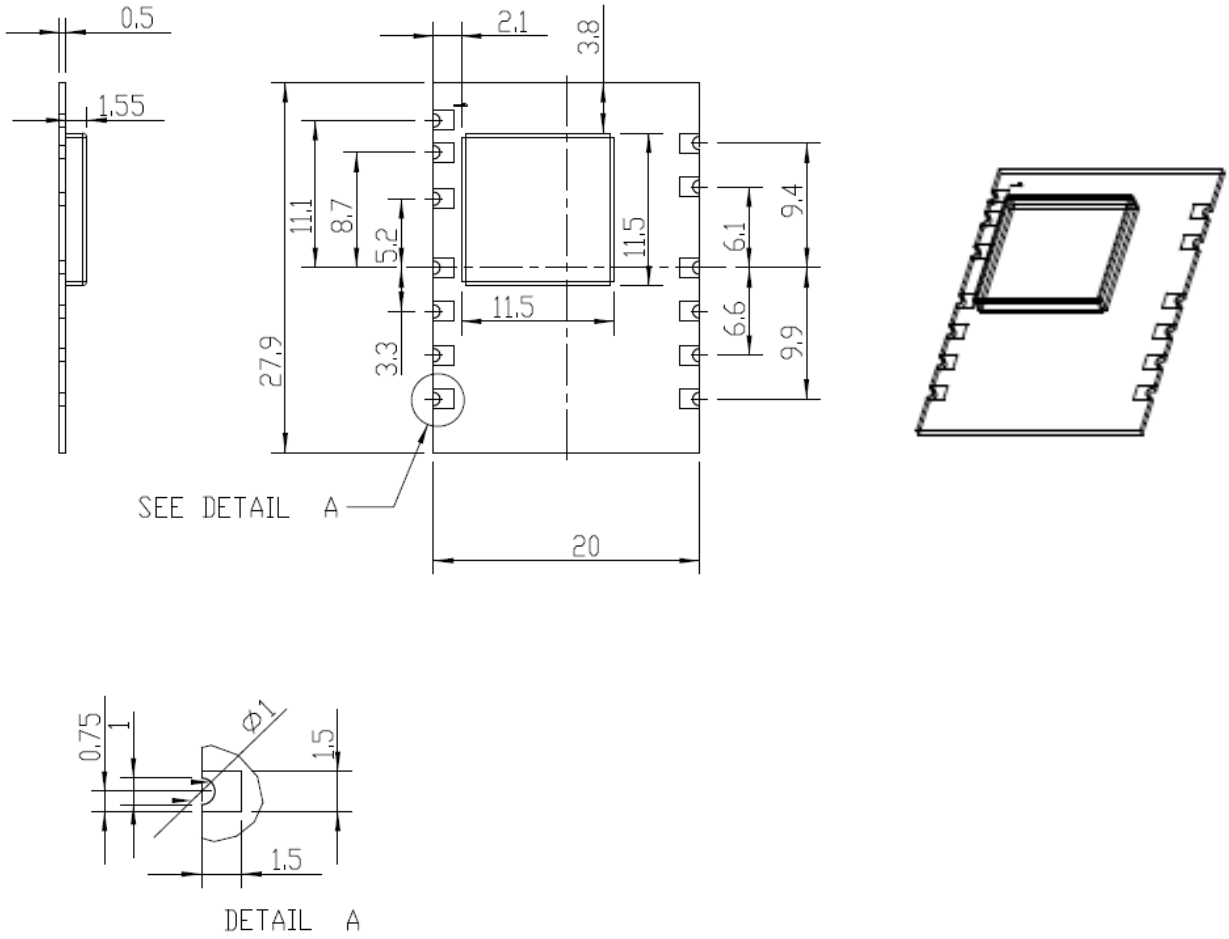
Mechanic Dimension



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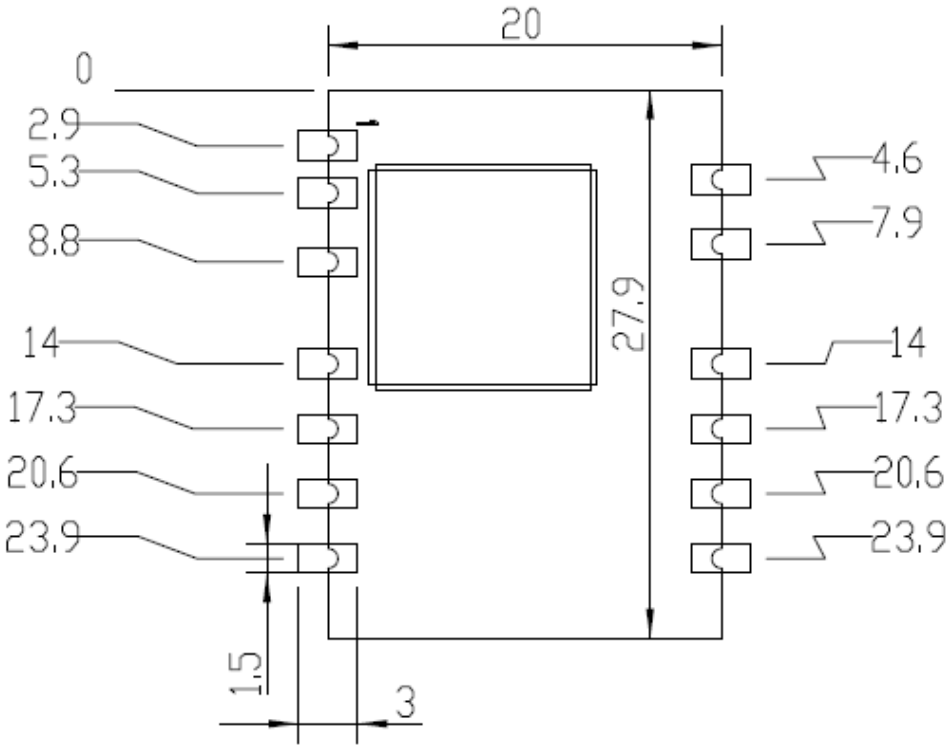
Recommended PCB Layout



Unit: mm

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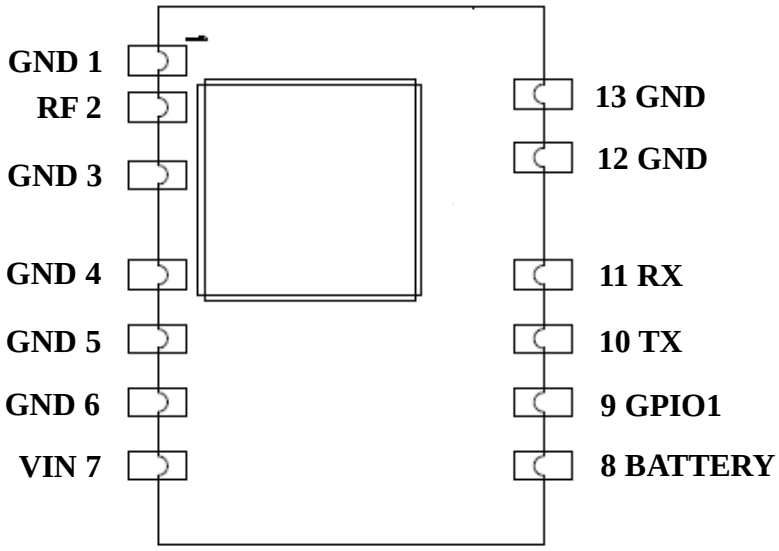
Pin Configuration



Pin Definition

Pin	Name	I/O	Description
1	GND	P	Ground
2	RF	I	Antenna Signal Input
3	GND	P	Ground
4	GND	P	Ground
5	GND	P	Ground
6	GND	P	Ground
7	VIN	P	3.3V ± 10% DC Power Supply Input
8	BATTERY	P	RTC Backup Power Input, DC2 to 4.3V
9	GPIO1	O	fixed flag output
10	TX	O	Serial Data Output
11	RX	I	Serial Data Input
12	GND	P	Ground
13	GND	P	Ground r

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Description of I/O Pin

GND (Pin 1, 3, 4, 5, 6, 12, 13)

The ground of the module.

RF (Pin 2)

GPS RF signal input. Connect to the external antenna. While using an external active antenna, the external power source is needed.

VIN (Pin 7)

3.3V ± 10% DC power supply input.

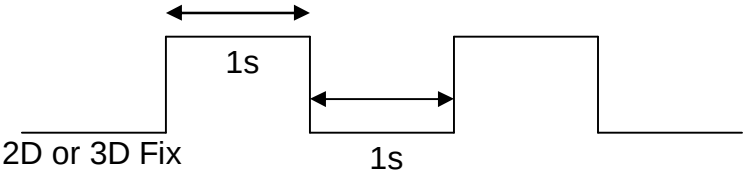
BATTERY (Pin 8)

This is the backup power for GPS chipset to keep RTC running when main power is removed. For normal operation, the input voltage must be kept from 2.0V to 4.3V.

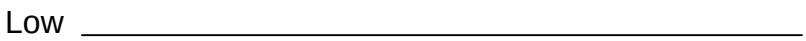
GPIO1 (Pin 9)

The GPIO_1 was assigned as fixed flag output. If not used, keep floating.

- **n** Before 2D Fix
  The GPIO_1 should continuously output one-second high-level with one-second low-level signal.



- **n** After 2D or 3D Fix
  The GPIO_1 should continuously output low-level signal.



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TX (Pin 10)

This is the UART transmitter of the module. It is used for aiding. If not used, keep floating.

RX (Pin 11)

This is the UART receiver of the module. It is used for aiding. If not used, keep floating.

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GPS External Antenna Specification (Recommended)

It is important that the antenna gets a clear view of the sky and is positioned on a surface level to the horizon for best results. The following specification has to meet for the use reference design.

Characteristic	Specification
Polarization	Right-hand circular polarized
Central Frequency	1.57542GHz
Band Width @ Return Loss≦-10dB	≧7MHz
VSWR @ Central Frequency	≦1.5
Impedance	50ohm

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NMEA Output Sentence

Table-1 lists each of the NMEA output sentences specifically developed and defined by MTK for use within MTK products

NMEA Output Sentence	**Table-1**
Option	**Description**
GGA	Time, position and fix type data.
GSA	GPS receiver operating mode, active satellites used in the position solution, and DOP values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation, azimuth, and SNR values.
RMC	Time, date, position, course and speed data. Recommended Minimum Navigation Information.
VTG	Course and speed information relative to the ground.

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GGA—Global Positioning System Fixed Data. Time, Position and fix related data for a GPS receiver

Table-2 contains the values for the following example：

$GPGGA,064951.000,2307.1256,N,12016.4438,E,1,8,0.95,39.9,M,17.8,M,,*65

GGA Data Format **Table-2**

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	064951.000		hhmmss.sss
Latitude	2307.1256		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4438		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See **Table-3**
Satellites Used	8		Range 0 to 14
HDOP	0.95		Horizontal Dilution of Precision
MSL Altitude	39.9	meters	Antenna Altitude above/below mean-sae-level
Units	M	meters	Units of antenna altitude
Geoidal Separation	17.8	meters	
Units	M	meters	Units of geoidal separation
Age of Diff. Corr.		second	Null fields when DGPS is not used
Checksum	*65		
<CR> <LF>			End of message termination

Position Fix Indicator **Table-3**

Value	Description
0	Fix not available
1	GPS fix
2	Differential GPS fix

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GSA—GNSS DOP and Active Satellites

Table-4 contains the values for the following example：

$GPGSA,A,3,29,21,26,15,18,09,06,10,,,,,2.32,0.95,2.11*00

GSA Data Format			**Table-4**
Name	**Example**	**Units**	**Description**
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See **Table-5**
Mode 2	3		See **Table-6**
Satellite Used	29		SV on Channel 1
Satellite Used	21		SV on Channel 2
....	….	….	....
Satellite Used			SV on Channel 12
PDOP	2.32		Position Dilution of Precision
HDOP	0.95		Horizontal Dilution of Precision
VDOP	2.11		Vertical Dilution of Precision
Checksum	*00		
<CR> <LF>			End of message termination

Mode 1	**Table-5**
Value	**Description**
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

Mode 2	**Table-6**
Value	**Description**
1	Fix not available
2	2D (＜4 SVs used)
3	3D (≧4 SVs used)

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GSV—GNSS Satellites in View

Table-7 contains the values for the following example：

$GPGSV,3,1,09,29,36,029,42,21,46,314,43,26,44,020,43,15,21,321,39*7D

$GPGSV,3,2,09,18,26,314,40,09,57,170,44,06,20,229,37,10,26,084,37*77

$GPGSV,3,3,09,07,,,26*73

GSV Data Format **Table-7**

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages	3		Range 1 to 3 *(Depending on the number of satellites tracked, multiple messages of GSV data may be required.)*
Message Number1	1		Range 1 to 3
Satellites in View	09		
Satellite ID	29		Channel 1 (Range 1 to 32)
Elevation	36	degrees	Channel 1 (Maximum 90)
Azimuth	029	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, (null when not tracking)
....	….	….	....
Satellite ID	15		Channel 4 (Range 1 to 32)
Elevation	21	degrees	Channel 4 (Maximum 90)
Azimuth	321	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	39	dBHz	Range 0 to 99, (null when not tracking)
Checksum	*7D		
<CR> <LF>			End of message termination

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RMC—Recommended Minimum Navigation Information

Table-8 contains the values for the following example：

$GPRMC,064951.000,A,2307.1256,N,12016.4438,E,0.03,165.48,260406,,,A*55

RMC Data Format **Table-8**

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	064951.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2307.1256		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4438		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.03	knots	
Course Over Ground	165.48	degrees	True
Date	260406		ddmmyy
Magnetic Variation		degrees	E=east or W=west *(MTK does support magnetic declination)*
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*65		
<CR> <LF>			End of message termination

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VTG—Course and speed information relative to the ground.

Table-9 contains the values for the following example：

$GPVTG,165.48,T,,M,0.03,N,0.06,K,A*37

VTG Data Format **Table-9**

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	165.48	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic *(MTK does not support magnetic declination.)*
Speed	0.03	knots	Measured horizontal speed
Units	N		Knots
Speed	0.06	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*06		
<CR> <LF>			End of message termination

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