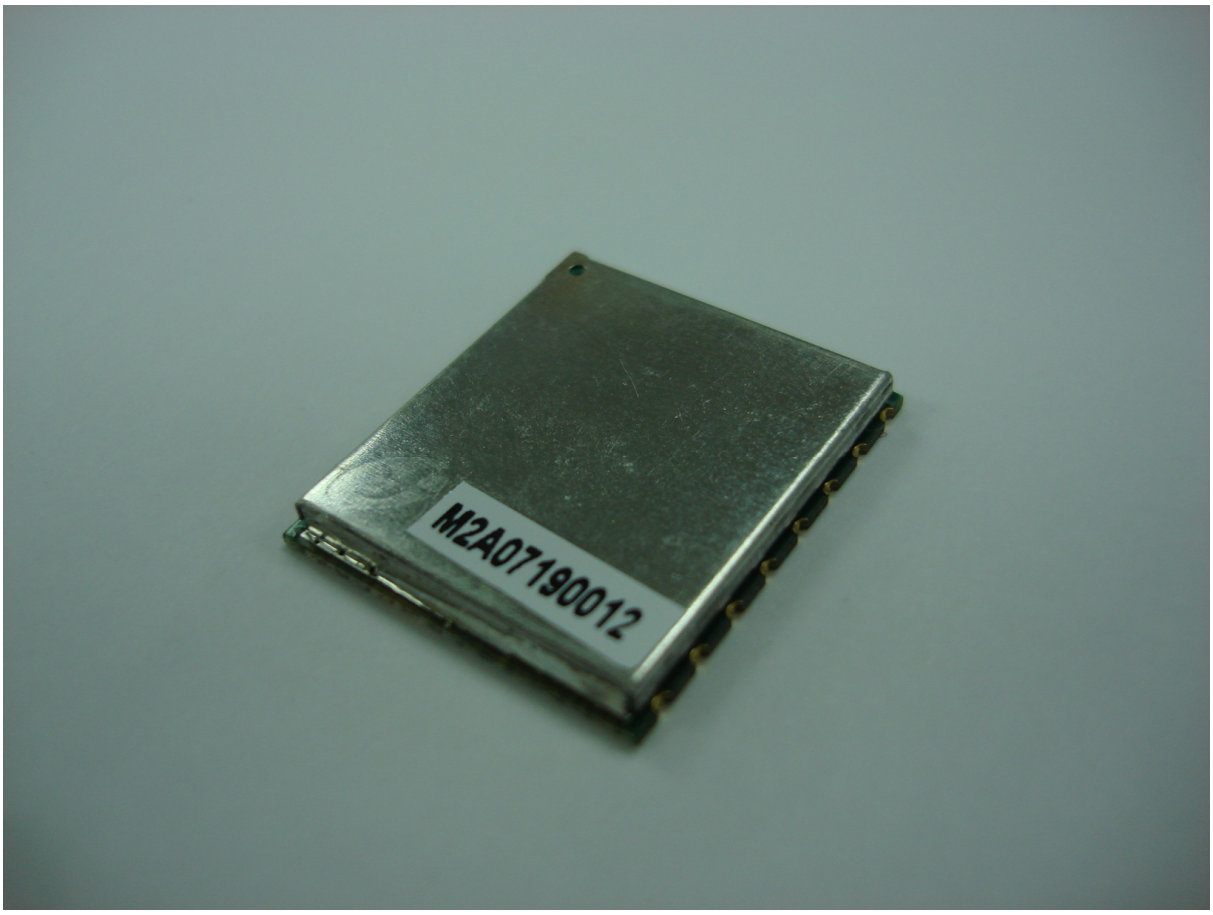
FGPMMOSL1 / FM01
Datasheet

Rev.A05



GPS Engine Board

with MTK Chipset

FGPMMOSL1 / FM01

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History		
Date	**Rev.**	**Description**
2006/05/05	**A00**	**First Release**
2006/05/30	**A01**	**Add recommended solder pad layout**
2006/06/08	**A02**	**Revise the power consumption**
2007/05/25	**A03**	**Modify Specifications**
		Add DC characteristics
2007/08/08	**A04**	**Pin Description Update**
		Add GPS Antenna Specification(Recommended)
2009/06/16	**A05**	**Plus replacement model name FM01 to complete new naming rule**

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Description

The FM01 GPS Receiver Module is a GPS receiver providing a solution that has high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban conditions. The GPS chipsets inside FM01 are designed by **MediaTek Inc**., which is the world's leading digital media solution provider and largest fab-less IC company in Taiwan. The FM01 can support up to 51 **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.

Features

- Based on **MediaTek Inc.** Architecture.
- L1 Frequency, C/A code, 51**-channel**.
- High Sensitivity：Up to -158 dBm tracking, superior urban performances
- Position Accuracy：< 3m CEP (50%) without SA (horizontal)
- Cold Start is Under 36 seconds (Typical)
- Hot Start is Under 1 second (Typical)
- Embedded ARM7TDMI
- Small Form Factor and Low Cost Solution
- On-board Flash for GPS Navigation Data
- GPS Data Interface：TTL level serial port, 9600 bps
- GPS Data Protocol：NMEA-0183 Ver. 3.01
- Max. Update Rate：5 Hz, default 1Hz
- RoHS Compliant

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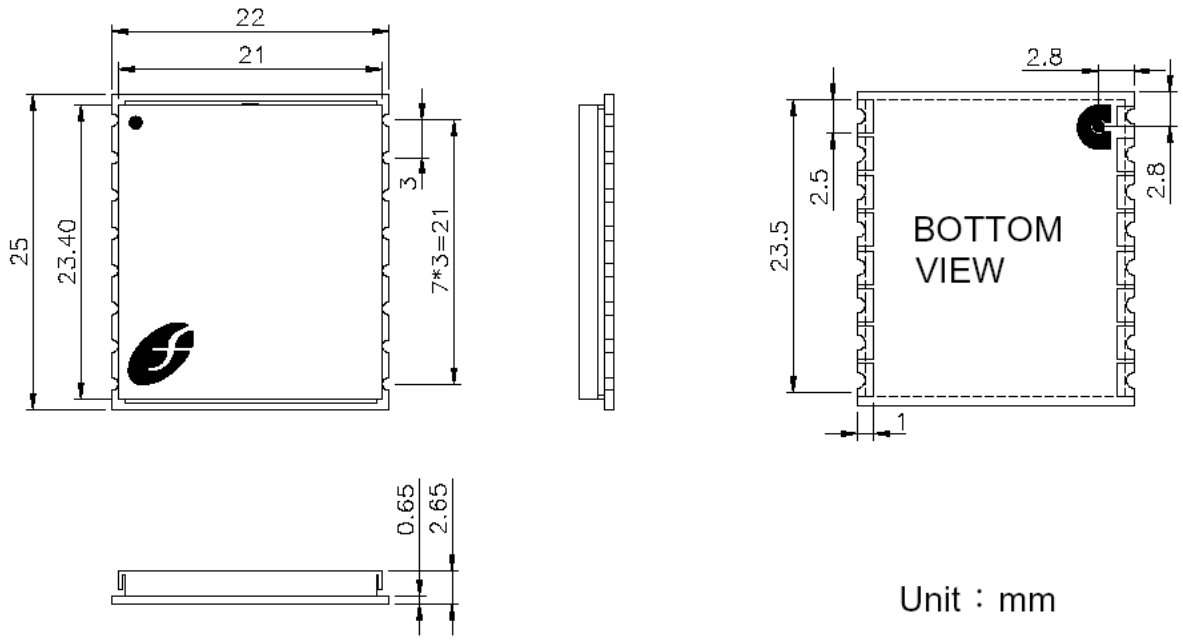
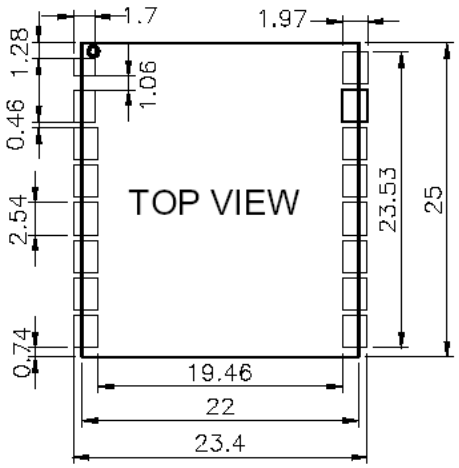
Dimensions



Unit：mm



Recommended
Solder Pad Layout

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I/O Pin Definition

Pin	Name	Description	Note
1	Antenna_In	Antenna Input	
2	GND	Ground	GND for RF
3	GPIO_A	General Purpose I/O A	3D-fix indicator
4	GPIO_B	General Purpose I/O B	Normally high
5	AOK	Active Antenna detection	High=Active Antenna detected
6	VDD_AA	3.0V output from the module	
7	1PPS	1PPS Time Mark Output	2.8V CMOS Level
8	BOOTSET	Not used	
9	TXDA	Serial Data Output A	NMEA output
10	RXDA	Serial Data Input A	Firmware update
11	TXDB	Serial Data Output B	Not used
12	RXDB	Serial Data Input B	Not used
13	NRESET	Reset Input, Active Low	
14	BACKUP_PWR	Backup Power DC 1.2 V	Regulated 1.2V ±10%
15	GND	Ground	GND for digital
16	VCC	+3.0 ~ 3.3V DC Power Input	Regulated DC supply from mother board

1	Antenna_In	(FM01)	16	VCC
2	GND		15	GND
3	GPIO_A		14	BACKUP_PWR
4	GPIO_B		13	NRESET
5	AOK		12	RXDB
6	VDD_AA		11	TXDB
7	1PPS		10	RXDA
8	BOOTSET		9	TXDA

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Description of I/O Pin

Antenna_In (Pin1)

GPS RF signal input.

GND (Pin2, Pin15)

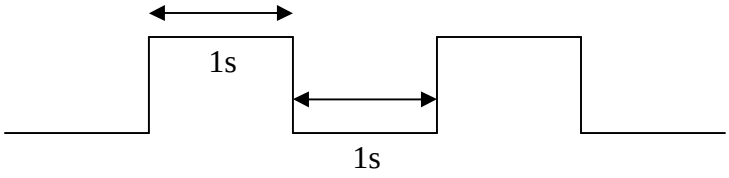
The ground of the module.

GPIO_A (Pin3)

The GPIO_A was assigned as fix flag output. If not used, keep floating.

- **n** Before 2D Fix

  The GPIO_A should continuously output one-second high-level with one-second low-level signal.



- **n** After 2D or 3D Fix

  The GPIO_A should continuously output low-level signal.

GPIO_B (Pin4)

Reserved for customized purpose. If not used, keep floating.

AOK (Pin5)

This pin is used to determine the status of the external active antenna. When an external active antenna connected to VDD_AA (Pin6) with the current exceeds 2mA, the AOK pin would output a high-level logic.

VDD_AA (Pin6)

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The DC power output of 2.8V to active antenna. The current is limited to 30mA.

1PPS (Pin7)

This pin provides one pulse-per-second output from the module, which is synchronized to GPS time. If not used, keep floating.

BOOTSET (Pin8)

Not used, keep floating.

TXDA (Pin9)

This is the UART transmitter of the module. It outputs the GPS information for application.

RXDA (Pin10)

This is the UART receiver of the module. It is used to receive software commands and firmware update.

TXDB (Pin11)

Not used, keep floating.

RXDB (Pin12)

Not used, keep floating.

NRESET (Pin13)

With a low level, it causes the module to reset. If not used, keep floating.

BACKUP_PWR (Pin14)

This is the backup power for GPS chipset to keep RTC running when main power is removed. The voltage should be kept between 1.2 V ±10%.

VCC (Pin16)

The main DC power supply for the GPS module. The voltage should be kept between from 3.0V to 3.6V.

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Specifications

General	
Chipset	MTK MT3301+MT3179
Frequency	L1, 1575.42 MHz
C/A Code	1.023 MHz
Channels	51 channels
DGPS	RTCM protocol WAAS, EGNOS, MSAS
Datum	WGS84 (Default), Tokyo-M, Tokyo-A, User Define Total 219 Datum
CPU	ARM7TDMI
Dimensions	
Length/Width/Height	25/22/2.6 mm
Weight	4 g
Performance Characteristics	
Position Accuracy	Without aid：3.0 m 2D-RMS
	< 3m CEP (50%) without SA (horizontal)
	DGPS (RTCM, SBAS (WAAS, EGNOS, MSAS))：2.5 m
Velocity Accuracy	Without aid：0.1 m/s
	DGPS (RTCM, SBAS (WAAS, EGNOS, MSAS))：0.05 m/s
Acceleration	Without aid：< 4 g
	DGPS (RTCM, SBAS (WAAS, EGNOS, MSAS))：< 4 g
Timing Accuracy	100 ns RMS
Sensitivity	Acquisition：-146 dBm (Cold Start)
	Reacquisition：-156 dBm
	Tracking：-158 dBm
Maximum Update Rate	5 Hz
Acquisition (Open sky, stationary)	

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Reacquisition Time	Less than 1 sec
Hot start	1 sec (Typical)
Warm start	33 sec (Typical)
Cold start	36 sec (Typical)
Dynamic	
Altitude	Maximum 18,000 m
Velocity	Maximum 515 m/s
Acceleration	Maximum 4 g
I/O	
Signal Output	8 data bits, no parity, 1 stop bit
Available Baud Rates	9600 bps (4800/14400/19200/38400/57600/115200 is also available)
Protocols	NMEA 0183 v3.01 (Default：GGA,GSA,GSV,RMC,VTG) RTCM 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 ℃ ~ 85 ℃
Storage Temperature	-40 ℃ ~ 125 ℃
Operating Humidity	5% ~ 95% (no condensing)

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DC Characteristics

Power	
Input Voltage	DC 3.0V ~ 3.6V
Backup Voltage	DC 1.2V ±10%
Backup Power Consumption@ 1.2V	4uA at 25℃
Power Consumption @ 2.8V	Acquisition：55mA Typical
	Tracking：38mA Typical

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
Receive frequency	1.57542GHz +/-1.023MHz
Power supply	2.8V
DC current	<30mA at 2.8V
Total gain	+15dBi
Output VSWR	<2.5
Impedance	50ohm
Noise Figure	<1.5dB

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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.

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,064951.000,2307.125647,N,12016.443856,E,1,8,0.95,39.944,M,17.806,M,,*65

GGA Data Format			**Table-2**
Name	**Example**	**Units**	**Description**
Message ID	$GPGGA		GGA protocol header
UTC Time	064951.000		hhmmss.sss
Latitude	2307.125647		ddmm.mmmmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.443856		dddmm.mmmmmm
E/W Indicator	E		E=east or W=west
Position Fix	1		See **Table-3**

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Indicator			
Satellites Used	8		Range 0 to 14
HDOP	0.95		Horizontal Dilution of Precision
MSL Altitude	39.944	meters	Antenna Altitude above/below mean-sea-level
Units	M	meters	Units of antenna altitude
Geoidal Separation	17.806	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,2307.125647,N,12016.443856,E,0.036,165.48,260406,,,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	2307.125647		ddmm.mmmmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.443856		dddmm.mmmmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.0036	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,0.036,N,0.067,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	0.036	knots	Measured horizontal speed
Units	N		Knots
Speed	0.067	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

MTK NMEA Command Protocol

Packet Type：

103 PMTK_CMD_COLD_START

Packet Meaning：

Cold Start：Don’t use Time, Position, Almanacs and Ephemeris data at re-start.

Example：

$PMTK103*30<CR><LF>

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