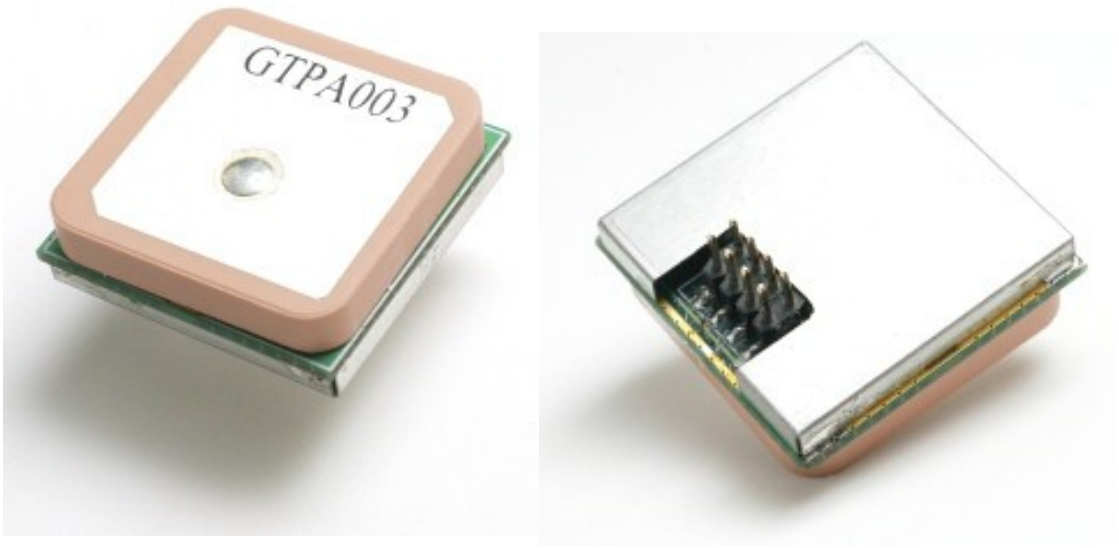
FGPMMOPA4
Datasheet

Rev.A08



51-channel GPS Engine Board SmartAntenna

with MTK Chipset

FGPMMOPA4

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History		
Date	**Rev.**	**Description**
2008/05/22	A00	First Release
2008/08/14	A01	Add Appendix A: Add connector information
2008/12/15	A02	Modify Operating Temperature Range
2009/03/02	A03	Change Channels to 51 channels Add description about pin 7
2010/01/28	A04	Add description about external antenna current limit.
2010/03/23	A05	Add Packing and Handling Section
2010/4/30	A06	Page15: Modify for RMC Magnetic Variation data
2011/05/13	A07	Update company contact information
2011/08/03	A08	Remove RTCM description

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Description

The FGPMMOPA4 is a POT (Patch On Top) GPS third generation module. This POT GPS receiver provides a solution that is high in position and speed accuracy performances, with high sensitivity and tracking capabilities in urban conditions. The GPS chipset inside the module is designed by MediaTek Inc., the world's leading digital media solution provider and largest fab-less IC company in Taiwan. This module can support up to 51 channels. The GPS solution enables small form factor devices. It delivers major advancements in GPS performances, accuracy, integration, computing power and flexibility. FGPMMOPA4 is designed to simplify the embedded system integration process.

Features

- Based on MediaTek Single Chip Architecture
- Dimension: 26mm x 26mm x 11.7mm
- Patch Antenna Size: 25mm x 25mm x 4mm
- Low Power Consumption:5 5mA @ acquisition, 40mA @ tracking
- L1 Frequency, C/A code, 51-channel
- High Sensitivity: Up to -158 dBm tracking, superior urban performances[1]
- Position Accuracy: Without aid: 3m 2D-RMS
  DGPS (SBAS(WAAS,EGNOS,MASA)):2.5m 2D-RMS
- Cold Start is under 36 seconds (Typical) [1]
- Warm Start is under 34 seconds (Typical) [1]
- Hot Start is under 1 second (Typical) [1]
- Data output Baud rate: **9600 bps (Default)**
- Max. Update Rate: 5Hz **(Default: 1 Hz)**
- Pin header Connection for easy to assemble
- RoHS Compliant

[1] Reference to GPS chipset specification

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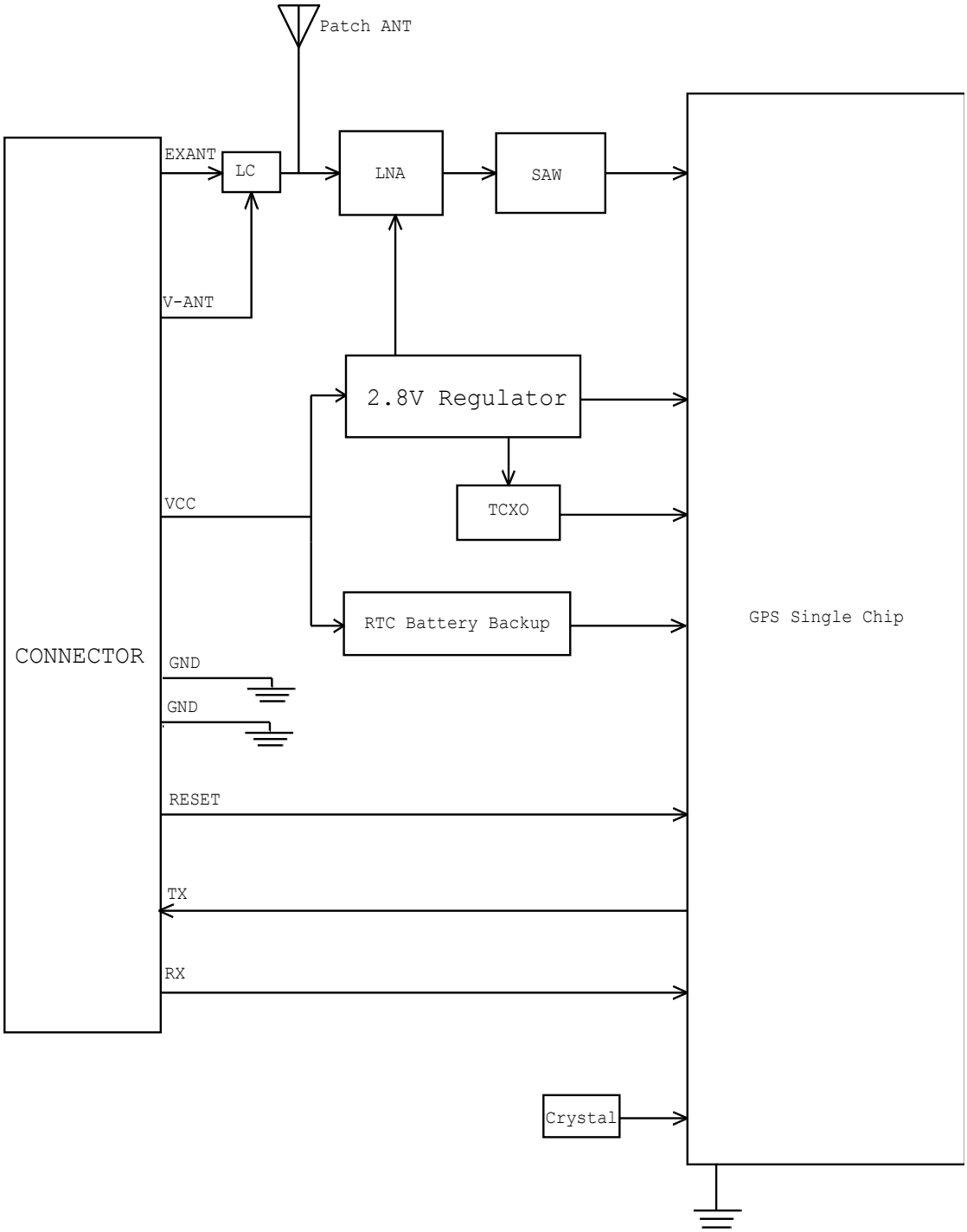
System Block



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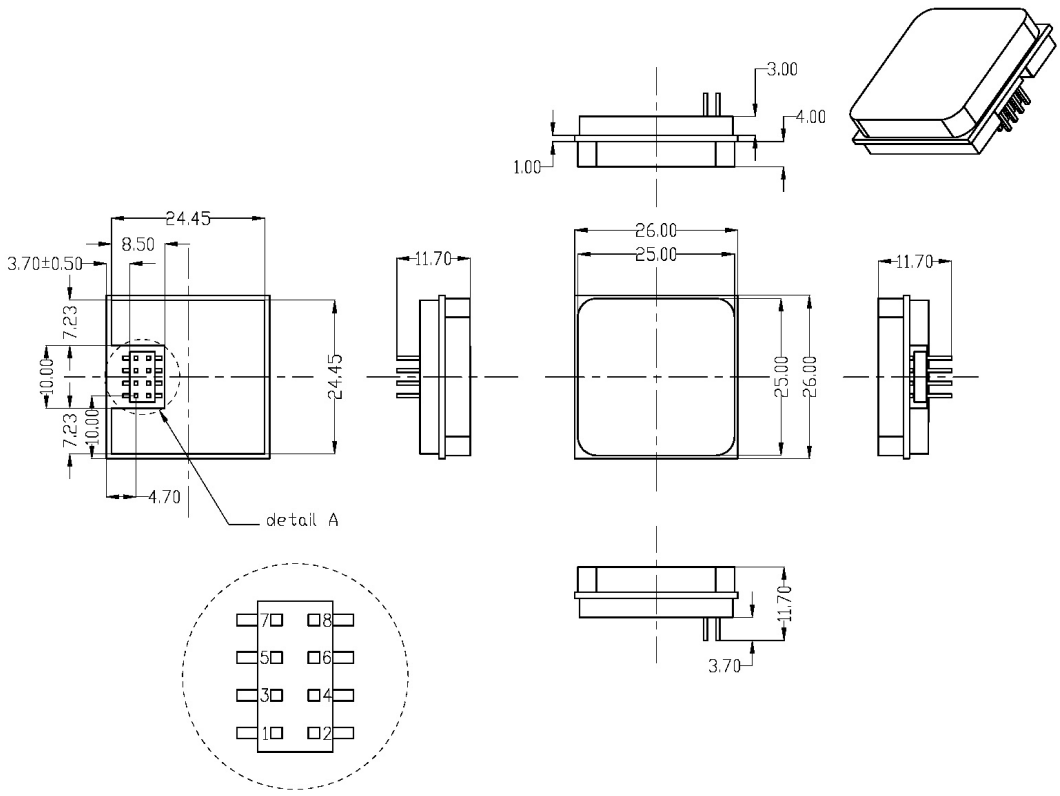
Mechanical and Pin Configuration

Item	Model Name	Description
1	FGPMMOPA4	Pin Header, Dual Row, SMT TYPE

1. **Model Name: FGPMMOPA4**



Detail A (Please refer to Appendix A)

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Pin Definition

Pin	Name	I/O	Description
1	VCC	P	DC Power Input
2	GND	P	Ground
3	RX	I	Serial Data Input
4	TX	O	Serial Data Output
5	V-ANT	P	External Antenna power input
6	GND	P	Ground
7	RESET	I	Reset
8	EXANT	I	External Antenna input

Description of I/O Pin

VCC (Pin1)

The main DC power supply is DC 3.3V±5% for the module.

GND (Pin2)

The analog ground and digital ground for the module.

RX (Pin3)

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

TX (Pin4)

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

V-ANT (Pin5)

The power supply is DC 2.7V to 3.3V for the External Antenna input pin(Pin8).
The maximum consumption current for the GPS antenna is limited to 30mA.

GND(Pin6)

The analog ground and digital ground for the module

RESET(Pin7)

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This pin is Reset pin, the pin is active Low, the pin will keep high when power on. If you don't want to control the pin , please keep no connection (N/C)

EXANT(Pin8)

This pin is External Antenna input pin.

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Specifications

General	
Chipset	MTK MT3318
Frequency	L1, 1575.42MHz
C/A Code	1.023 MHz
Channels	51 channels
DGPS	WAAS, EGNOS, MSAS
Datum	WGS84(Default), Tokyo-M, Tokyo-A, User Define
CPU	ARM7TDMI
Dimensions	
Length/Width/Height	26mm x26mm x 11.7mm
Weight	12.5g
Performance Characteristics	
Position Accuracy	Without aid: 3m 2D-RMS
	DGPS(SBAS(WAAS,EGNOS,MASA)):2.5m 2D-RMS
Velocity Accuracy	Without aid:0.1 m/s
	DGPS (SBAS (WAAS, EGNOS, MSAS)):0.05m/s
Acceleration	Without aid:< 4g
	DGPS (SBAS (WAAS, EGNOS, MSAS)):< 4g
Timing Accuracy	100 ns RMS
Sensitivity[1]	Acquisition:-146dBm (Cold Start)
	Reacquisition:-156dBm
	Tracking:-158dBm
Max. Update Rate	5Hz **(Default: 1 Hz)**

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Acquisition (Open sky, stationary)	
Reacquisition Time[1]	Less than 1 second
Hot start[1]	1 second (Typical)
Warm start[1]	34seconds (Typical)
Cold start[1]	36 seconds (Typical)
Dynamic	
Altitude	Maximum 18,000m
Velocity	Maximum 515m/s
Acceleration	Maximum 4g
I/O	
Signal Output	8 data bits, no parity, 1 stop bit
Available Baud Rates	**9600 bps(Default),**4800/9600/14400/19200/38400/57600/ 115200 is also available
Protocols	NMEA 0183 v3.01, MTK NMEA Command
Data output Interface	
Protocol messages	9600 bps/8/N/1 (Default)
Output format (Default)	GGA(1sec),GSA(1sec),RMC(1sec),VTG(1sec),GSV(5sec)
Environment	
Operating Temperature	-40°C to 85 °C (without coin battery) -20°C to 60 °C (with coin battery)
Storage Temperature	-50°C to 90 °C (without coin battery) -20°C to 60 °C (with coin battery)
Operating Humidity	5% to 95% (no condensing)

[1] Reference to GPS chipset specification

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Recommendation External Antenna Specification

MODEL: FGPANExxxxx	
Center Frequency fo	1575.42MHz ± 2MHz
Bandwidth (min.)	9MHz
Operating Temperature	-40 ~ +85°C
Storage Temperature	-50 ~ +120°C
Relative Humidity	0% ~ 100%
Antenna + Pre-amplifier:	
System Gain at fo Without Cable Loss	30dBi at 90° Zenith
Output VSWR at fo (max.)	2
Impedance (typ.)	50ohm
Cable Loss RG-174/3,5,10meters at fo (typ.)	4dB, 7dB, 14dB
Mounting	Magnet
Patch Antenna:	
Polarization	R.H.C.P.
Gain at fo (typ.)	3dBi at Zenith
VSWR at fo (max.)	2
Impedance (typ.)	50ohm
Pre-amplifier:	
Gain at fo	27dB ± 1dB
Noise Figure at fo (typ.)	1.15dB
VSWR at fo (max.)	2
Impedance (typ.)	50ohm
Input Voltage	2.7V ~ 3.6V
Current Consumption (typ.)	18mA@3V
Test Environment Condition : 25°C /60RH	

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DC Characteristics

Parameter	Condition	Min.	Typ.	Max.	Unit
Operation supply Voltage	VCC	3.135	3.3	3.465	V
Operation supply Ripple Voltage	—	—	—	50	mVpp
RXA TTL H Level	VCC=5.0V	2.1	—	VCC	V
RXA TTL L Level	VCC=5.0V	0	—	0.9	V
TXA TTL H Level	VCC=5.0V	2.1	—	2.8	V
TXA TTL L Level	VCC=5.0V	0	—	0.8	V
Backup Battery Voltage	—	—	3.0	—	V
Power Consumption @ 3.3V	Acquisition	50	55	60	mA
	Tracking	35	40	45	mA

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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,035238.000,2307.1219,N,12016.4423,E,1,9,0.89,23.6,M,17.8,M,,*69

GGA Data Format			Table-2
Name	**Example**	**Units**	**Description**
Message ID	$GPGGA		GGA protocol header
UTC Time	035238.000		hhmmss.sss
Latitude	2307.1219		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4424		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Satellites Used	9		Range 0 to 14
HDOP	0.89		Horizontal Dilution of Precision
MSL Altitude	17.3	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

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Age of Diff. Corr.		second	Null fields when DGPS is not used
Checksum	*69		
<CR> <LF>			End of message termination

GSA—GNSS DOP and Active Satellites

Table-3 contains the values for the following example:

$GPGSA,A,3,29,21,09,18,10,26,12,24,15,,,,1.20,0.89,0.80*04

GSA Data Format			**Table-3**
Name	**Example**	**Units**	**Description**
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See **Table-4**
Mode 2	3		See **Table-5**
Satellite Used	29		SV on Channel 1
Satellite Used	21		SV on Channel 2
....	….	….	....
Satellite Used			SV on Channel 12
PDOP	1.20		Position Dilution of Precision
HDOP	0.89		Horizontal Dilution of Precision
VDOP	0.80		Vertical Dilution of Precision
Checksum	*04		
<CR> <LF>			End of message termination

Mode 1	**Table-4**
Value	**Description**
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

Mode 2	**Table-5**
Value	**Description**
1	Fix not available
2	2D (＜4 SVs used)
3	3D (≧4 SVs used)

GSV—GNSS Satellites in View

Table-7 contains the values for the following example:

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$GPGSV,3,1,10,24,76,195,48,09,62,173,48,21,50,308,48,15,45,021,48*73
$GPGSV,3,2,10,26,33,031,46,18,29,319,46,10,21,092,45,29,18,221,44*7D
$GPGSV,3,3,10,12,05,167,24,05,03,181,*76

GSV Data Format			Table-6
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	10		
Satellite ID	24		Channel 1 (Range 1 to 32)
Elevation	76	degrees	Channel 1 (Maximum 90)
Azimuth	195	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	48	dBHz	Range 0 to 99, (null when not tracking)
....	….	….	....
Satellite ID	15		Channel 4 (Range 1 to 32)
Elevation	45	degrees	Channel 4 (Maximum 90)
Azimuth	021	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	48	dBHz	Range 0 to 99, (null when not tracking)
Checksum	*73		
<CR> <LF>			End of message termination

RMC—Recommended Minimum Navigation Information

Table-7 contains the values for the following example:

$GPRMC,035242.000,A,2307.1220,N,12016.4420,E,0.06,0.00,140508,3.05,W,A*63

RMC Data Format			Table-7
Name	**Example**	**Units**	**Description**
Message ID	$GPRMC		RMC protocol header
UTC Time	035242.000		hhmmss.sss
Status	A		A=data valid or V=data not valid

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Latitude	2307. 1220		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4420		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.06	knots	
Course Over Ground	0.00	degrees	True
Date	140508		ddmmyy
Magnetic Variation	3.05, W	degrees	E=east or W=west **(Need GlobalTop customization service)**
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*63		
<CR> <LF>			End of message termination

VTG—Course and speed information relative to the ground.

Table-8 contains the values for the following example:

$GPVTG,0.00,T,,M,0.06,N,0.11,K,A*3B

VTG Data Format **Table-8**

Name	**Example**	**Units**	**Description**
Message ID	$GPVTG		VTG protocol header
Course	0.00	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic *(Need Global Top customization service)*
Speed	0.06	knots	Measured horizontal speed
Units	N		Knots
Speed	0.11	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*3B		
<CR> <LF>			End of message termination

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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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Packing and Handling

GPS modules, like other electronic components, are sensitive electrostatic discharges and temperature. By following the standards outlined in this document for GlobalTop GPS module storage and handling, it is possible to reduce the chances of them being damaged during production set-up. This document will go through the basics on how GlobalTop packages its modules to ensure they arrive at their destination without any damages and deterioration to performance quality.

⚠ **Please read the sections II to V carefully to avoid damages permanent damages due to moisture intake**

⚠ **GPS receiver modules contain highly sensitive electronic circuits and are electronic sensitive devices and improper handling without ESD protections may lead to permanent damages to the modules. Please read section VI for more details.**

Packing

GlobalTop GPS modules are packed in such a way to ensure the product arrives to SMD factory floor without any damages.
GPS modules are placed individually on to the packaging tray. The trays will then be stacked and packaged together.
Included are:

1. Two packs of desiccant for moisture absorption
2. One moisture level color coded card for relative humidity percentage.

Each package is then placed inside an antistatic bag (or PE bag) that prevents the modules from being damaged by electrostatic discharge.

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Figure 1: One pack of GPS modules

Each bag is then carefully placed inside two levels of cardboard carton boxes for maximum protection.

Figure 2: Box protection

The moisture color coded card provides an insight to the relative humidity percentage (RH). When the GPS modules are taken out, it should be around or lower than 30% RH level.

Outside each electrostatic bag is a caution label for moisture sensitive device.

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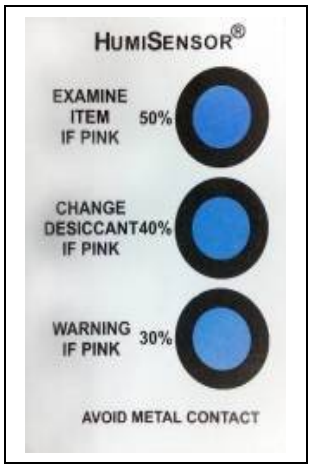

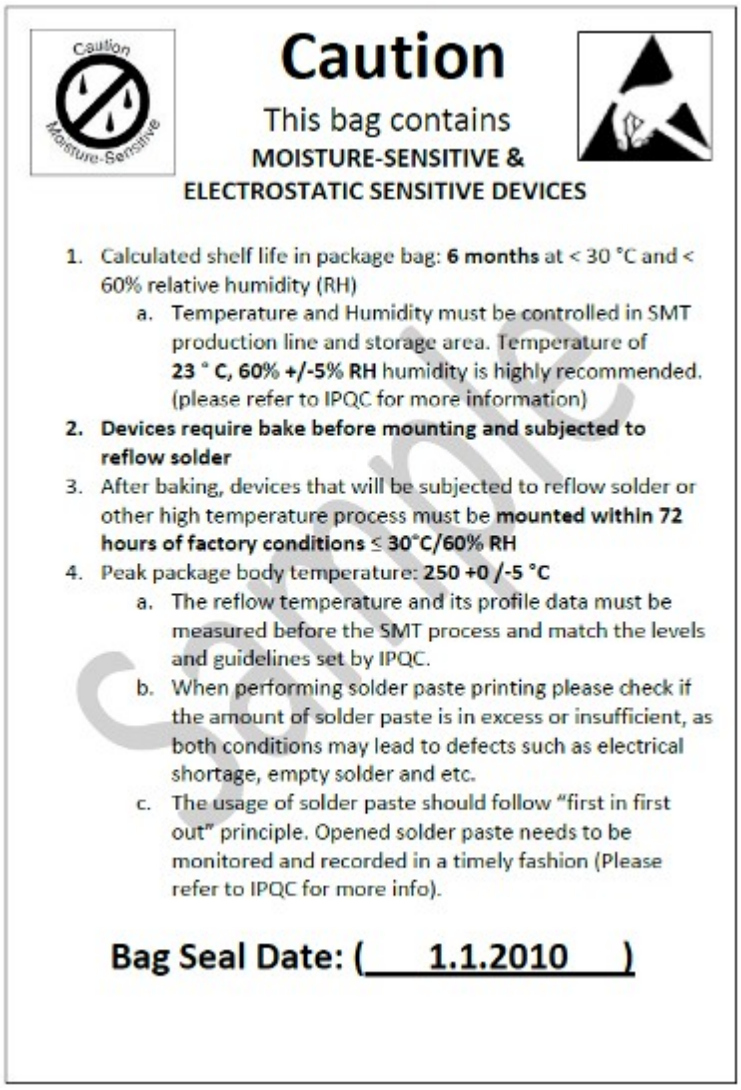

Figure 3: Example of moisture color coded card and caution label

Storage and Floor Life Guideline

The approximate shelf life for GlobalTop GPS modules packages is 6 months from the bag seal date, when store in a non-condensing storage environment (<30°C/60% RH)

⚠ **It is important to note that it is a required process for GlobalTop GPS modules to undergo pre-baking procedures, regardless of the storage condition.**

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ESD Handling

Please carefully follow the following precautions to prevent severe damage to GPS modules.

GlobalTop GPS modules are sensitive to electrostatic discharges, and thus are Electrostatic Sensitive Devices (ESD). Careful handling of the GPS modules and in particular to its patch antenna (if included) and RF_IN pin or connector, must follow the standard ESD safety practices:

- ✓ Unless there is a galvanic coupling between the local GND and the PCB GND, then the first point of contact when handling the PCB shall always be between the local GND and PCB GND.
- ✓ Before working with RF_IN pin or connector, please make sure the GND is connected
- ✓ When working with RF_IN pin or connector, do not contact any charges capacitors or materials that can easily develop or store charges such as patch antenna, coax cable, soldering iron.
- ✓ Please do not touch the mounted patch antenna to prevent electrostatic discharge from the RF input.

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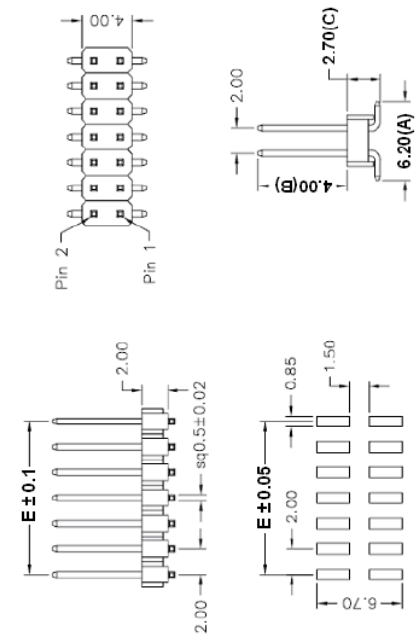
Appendix A:

PART NO: PH2M20-204-GB-LF+CAP-T-6.2/4/2.7 Connector

Manufacturer:CHU YUEN ELECTRONIC CO., LTD.

E-mail:chu.yuen@msa.hinet.net

Ps. The module use 4 contacts per row.



MATERIAL

Contact Pin: Brass

SPECIFICATION

Currant Rate: 1 AMP

Insulation Resistance: 5000MΩMin. at DC 500V

Contact Resistance: 20mΩMax. at DC 100mA

Dielectric Voltage: AC 500V for one minute

Operation Temperature: - 40°C to + 105°C

PH2M20-204-GB-LF+CAP-T-6.2/4.0/2.7

1 2 3 4 5 6 7 8 9

1. Pitch=2.0 mm
2. M : SMT Type
3. Height=2.0mm
4. No. of contacts per row
5. G : Gold flash
6. B : Black Insulator
7. LF : Lead Free
8. T : 管裝
9. DIM A/B/C=6.2/4.0/2.7

Recommended P.C.B Layout

Poles	DIM E	Poles	DIM E	Poles	DIM E	Poles	DIM E	Poles	DIM E	Poles	DIM E
2	2.00	9	16.00	16	30.00	23	44.00	30	58.00	37	72.00	44	86.00
3	4.00	10	18.00	17	32.00	24	46.00	31	60.00	38	74.00	45	88.00
4	6.00	11	20.00	18	34.00	25	48.00	32	62.00	39	76.00	46	90.00
5	8.00	12	22.00	19	36.00	26	50.00	33	64.00	40	78.00	47	92.00
6	10.00	13	24.00	20	38.00	27	52.00	34	66.00	41	80.00	48	94.00
7	12.00	14	26.00	21	40.00	28	54.00	35	68.00	42	82.00	49	96.00
8	14.00	15	28.00	22	42.00	29	56.00	36	70.00	43	84.00	50	98.00

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