INSTALLATION AND OPERATION

USER MANUAL

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UM681A

Multi-System Dual-Frequency High Precision RTK Integrated Positioning Module

Revision History

Version	Revision History	Date
R1.0	First release	Dec., 2024

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Foreword

This document describes the information of the hardware, package, specification and the use of Unicore UM681A modules.

Target Readers

This document applies to technicians who are familiar with GNSS receivers.

Contents

1 Introduction

UM681A is an automotive-grade high precision GNSS + INS integrated navigation module designed for intelligent driving field.

Based on the multi-system dual-frequency SoC UC6580A and the built-in six-axis IMU, UM681A can achieve centimeter-level positioning accuracy, and it can realize continuous positioning even in the environment without satellite signals such as tunnels and underground garages.

The GNSS chip inside the UM681A module conforms to the requirements of AEC-Q100, and the manufacturing process is in line with IATF 16949.

Figure 1-1 UM681A High Precision Positioning Module

Main Model	Sub-model	Operating Temperature	System							Interface				Data Update Rate
		-40 °C to +85 °C	GPS	BDS	GLONASS*	Galileo	NavIC*	QZSS	SBAS*	UART1	UART2	I2C**	SPI**	
UM681A	12	•	•	•	•	•	•	•	•	•	•			1Hz/ 5Hz/ 10 Hz

* Supported by specific firmware.

** Reserved interfaces, not supported currently

1.1 Key Specifications

Table 1-1 Technical Specifications

Power	
Voltage	+2.7 V to +3.6 V DC
LNA Feed Voltage	+2.7 V to +3.3 V, <100 mA
Power Consumption	240 mW
RF Input	
Constellation	GPS/GLONASS*/BeiDou/Galileo/QZSS/NavIC*
VSWR	≤ 2.5
Input Impedance	50 Ω
Antenna Gain	15 dB to 30 dB
Physical Characteristics	
Dimensions	54 pin LGA
Weight	22.0 mm × 17.0 mm × 2.6 mm
Interface	
UART × 2	TTL; baud Rate: 115200 bps to 921600 bps
I^2C × 1	Reserved; address: 7 bit; working mode: slave; supports up to 400 Kbps
SPI × 1	Reserved; Alternate function of Pin 42 to 45 working mode: slave; supports up to 4 Mbps
GNSS Performance	
Frequency	GPS L1 C/A, L1C*, L5 GLONASS G1* BeiDou B1I, B1C*, B2a Galileo E1, E5a NavIC L5* QZSS L1, L5 SBAS*

* Supported by specific firmware

TTFF	Cold start: 26 s Hot start: 2s Reacquisition: 2s	
Single Point Positioning (RMS)	Horizontal: 1.5 m (open sky) Vertical: 2.5 m (open sky)	
RTK (RMS)	Horizontal: 1 cm + 1ppm (open sky) Vertical: 2 cm + 1ppm (open sky)	
Velocity Accuracy (RMS) [1]	0.05 m/s	
INS Positioning Error	< 1% of the driving distance without GNSS signals	
Sensitivity		GNSS
	Tracking	-162 dbm
	Cold start	-147 dbm
	Hot start	-157 dbm
	Reacquisition	-158 dbm
GNSS Data Update Rate	1 Hz/5 Hz/10 Hz	
INS Data Update Rate	10 Hz	
1PPS Accuracy (RMS)	20 ns	
Data Format	NMEA 0183, Unicore Protocol, RTCM	
Environmental Specifications		
Operating Temperature	-40 °C to +85 °C	
Storage Temperature	-40 °C to +85 °C	
Humidity	95% No condensation	
Vibration	GB/T 28046.3, ISO 16750.3	
Shock	GB/T 28046.3, ISO 16750.3	

[1] 68% at 30 m/s for dynamic operation, open sky

1.2 Block Diagram

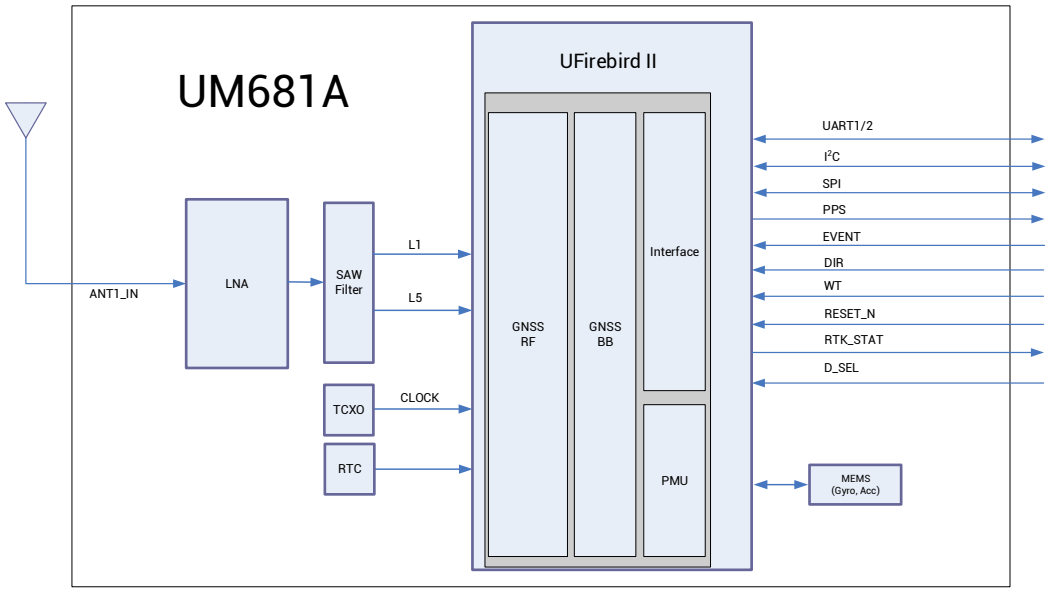


Figure 1-2 UM681A Block Diagram

1. RF Part

The receiver gets filtered and enhanced GNSS signals from the antenna via a coaxial cable. The RF part converts the RF input signals into the IF signals, and converts IF analog signals into digital signals required for UFirebird II chip.

2. UFirebird II SoC (UC6580A)

UFirebird II is the new generation RF-baseband and high-precision algorithm integrated SoC developed by Unicore. It adopts 22 nm technology and low power consumption design, supporting multi-path mitigation, anti-jamming and high precision GNSS joint positioning, providing up to 10 Hz RTK positioning solution, especially suitable for the applications which are sensitive to power and size.

3. MEMS

UM681A integrates six-axis MEMS (three-axis gyro and three-axis accelerator). MEMS provides information on carrier attitude and speed changes, combined with GNSS data to output integrated positioning and navigation solution. The combination of GNSS+MEMS ensures better positioning performance than standalone GNSS, providing continuous and uninterrupted positioning, especially in the conditions with poor signals, such as tunnels, underground garages and urban canyons.

4. Interfaces

UM681A has interfaces such as UART, I^2C*, SPI*, PPS, EVENT*, RTK_STAT* and RESET_N.

There are two UARTs. UART1 is the master serial port, supporting data transmission and firmware upgrade, and the I/O signal type is LVTTL. The baud rate can be configured by users. UART2 is a backup and only supports data transmission. It cannot be used for firmware upgrade.

* Reserved interfaces, not supported currently.

2 Product Installation

2.1 Preparations

UM681A is Electrostatic Sensitive Devices (ESD) and must be installed with special precautions when handling. Please take the following protective measures before opening the anti-static plastic box.

- Electrostatic discharge (ESD) may cause damage to the device. All operations mentioned in this chapter should be carried out on an antistatic workbench using an antistatic wrist strap and conductive foam pad. If there is no antistatic workbench, wear an antistatic wrist strap and connect the other end of the strap to the metal frame to avoid electrostatic damages.
- Hold the edge of the evaluation board, and do NOT touch the components directly.

Carefully check the board to make sure that there is no apparent loose or damaged components. If you have any questions, please contact Unicore or the local distributors.

Figure 2-1 shows the typical installation of UM681A evaluation kit (EVK).

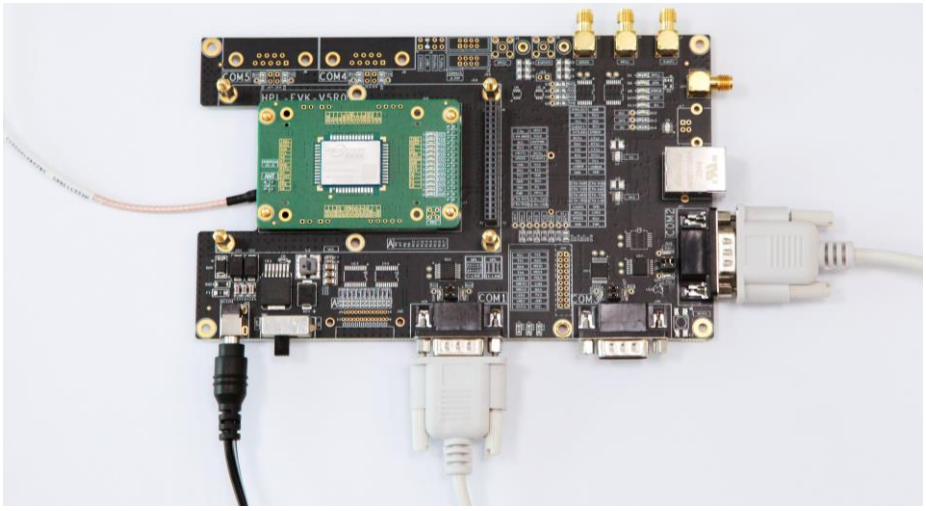


Figure 2-1 Typical Installation of UM681A EVK

Please prepare the following items before installing the UM681A.

- UM681A EVK (with AC Adapter)
- UM681A *User Manual*
- Unicore UPrecise software package
- Accessory GNSS antenna
- USB-to-RS232 cable and straight through serial cable

- PC with USB interfaces or serial ports (Windows 7 and above)

☞ Please keep the packing box and anti-static plastic box for storage and handling.

2.2 Installation of EVK

After the above preparations, please follow the steps below to install, which is used for satellite navigation test only.

Step 1: Make sure to take full anti-static measures, such as wearing an anti-static wristband and grounding the workbench.

Step 2: Open the UM681A evaluation kit and take out the evaluation board.

Step 3: Use the GNSS antenna with appropriate gain and fix it in a non-blocking area; use the appropriate cable to connect the antenna with UM681A evaluation board.

Step 4: Connect a PC to the EVK serial port through the USB-to-RS232 cable or straight through serial cable.

Step 5: Open UPrecise software on the PC.

Step 6: Control the receiver through UPrecise to display constellations view, log messages, and receiver status, etc.

2.3 Installation of the Module

UM681A must be rigidly connected to the vehicle body and firmly fixed.

☞ The antenna should be installed with the front facing up as much as possible and firmly fixed; ensure that the elevation angle of the environment where the antenna is located is greater than 15° and the space is unobstructed.

☞ Ensure that there is no strong interference source within the frequency of 1568 ± 20 MHz in the environment where the antenna is located.

2.3.1 Installation Instructions

The UM681A must be firmly connected to the vehicle to prevent any offsets or vibrations between the module and the vehicle. UM681A should not be installed in the suspension part (elastic part) of the vehicle. When the vehicle is moving, any change of position relative to the vehicle coordinate system will seriously affect the UM681A and prevent it from working normally.

2.3.2 Installation Angle

The vehicle coordinate system is XYZ, and the module coordinate system is xyz, as shown in Figure 2-2 and Figure 2-3. The module's installation angle angleX, angleY and angleZ are defined as below:

1. Align the initial state of xyz coordinate system with that of XYZ coordinate system
2. Rotate γ angle of the module around the z axis
3. Rotate α angle of the module around the new x axis
4. Rotate β angle of the module around the new y axis
5. The module is now in the same state as the actual installation, with that, angleX=α, angleY=β, angleZ=γ

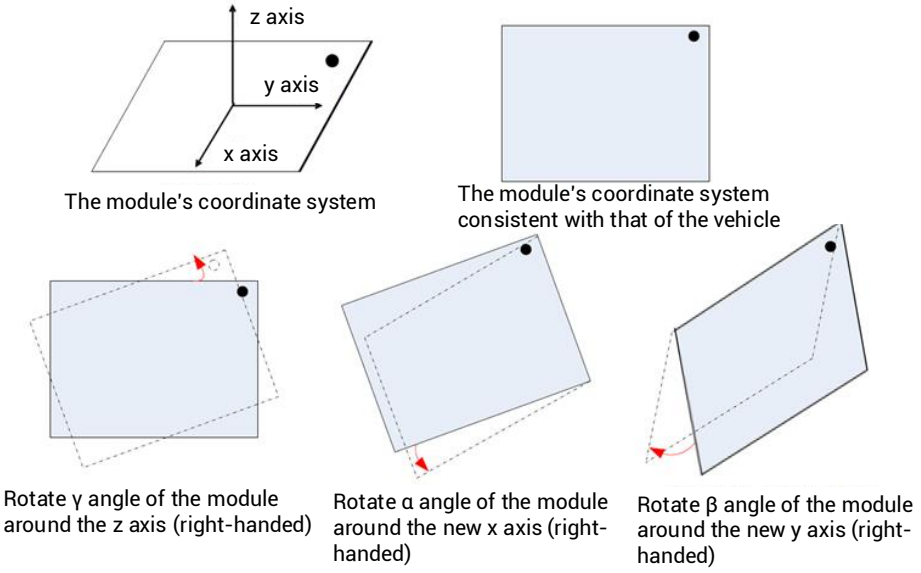


Figure 2-2 Coordinate System of the Module

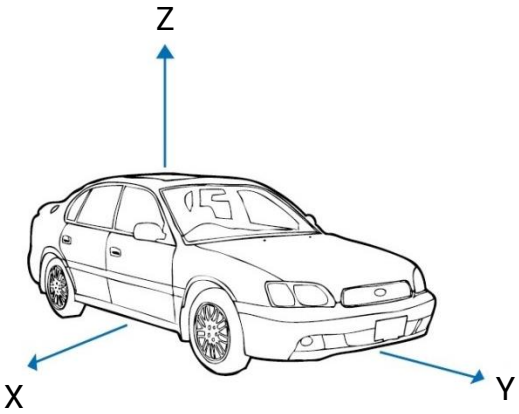


Figure 2-3 Coordinate System of the Vehicle

☞ The coordinate system of the module must be consistent with that of the vehicle, which means: x-axis and X-axis are parallel in the same direction, y-axis and Y-axis are parallel in the same direction, and z-axis and Z-axis are parallel in the same direction.

2.3.3 Installation Mode

- **Free Installation (Default Mode)**

UM681A integrate a three-axis gyroscope and a three-axis accelerometer, with the built-in self-calibration algorithm, which supports the free installation of the module with respect to any installation angle of the vehicle coordinate system, such as, the completely horizontal installation, inclined installation at a certain angle, and flip installation.

- **Fixed Installation**

According to the definition of installation angle, the accurate installation angle is manually configured into the module. This installation method takes a shorter calibration time. When configuring the installation angle manually, the maximum error is limited to ±5 degrees.

2.3.4 Reference Messages

1. CFGROTAT

Message format: $CFGROTAT,angleX,angleY,angleZ,mode

Description: Set or output the installation angle of the module with respect to the vehicle coordinate system.

Parameters:

- angleX, angleY and angleZ are defined in section 2.3.2, with the unit of 0.01°
- mode stands for the installation mode:
  0 – General installation mode, the input value of the installation angle is relatively coarse (within 10 degrees)
  2 – Automatic installation mode, no need to input the installation angle, only calibration is required.

Note:

1) Choose 0 for fixed installation mode and 2 for free installation mode;
2) Input the actual installation angles including angleX, angleY, and angleZ into the module. After the configuration is completed, save the configuration to the flash using the CFGSAVE command, otherwise it needs to be identified again at the next boot.
3) Any configuration on the INS will cause the module to be re-initialized during normal operation or after power-off and restart, and the previously completed or ongoing calibration operations will be reset.

2. SNRSTAT

Message format: $SNRSTAT,insstatus,odostatus,InstallState,Mapstat

Description: Output initial status (applicable for both fixed installation mode and free installation mode)

Parameters:

- insstatus: Initialization status of INS
  -1: IMU device failure
  0: Disabled
  1: Initialization starts
  2: The installation angle is known
  3: Initialization is completed
- odostatus: Odometer initialization status
  -1: Odometer device failure
  0: Disabled
  1: Initialize the scale factor
  2: The scale factor initialization is completed
  3: The scale factor calibration is completed
- InstallState：

  -1: IMU device failure, unable to estimate the installation angle
  0: Calibration in progress
  1: The current quality of satellite information is insufficient and better satellite conditions are required
  2: The current vehicle motion is insufficient and acceleration is required
  3: The current speed of the vehicle is too low and it's required to be increased.
- Mapstat:
  -1: No serial port is configured to enter MAP information
  -2: The MAP information is abnormal
  0: No MAP message is received by the serial port or the MAP message is timeout
  1: MAP information is received but not applied to the integrated navigation
  2: MAP information is received and applied to the integrated navigation

Fully Free Installation Test

1) Install the module completely freely
2) Input the command $CFGROTAT,0,0,0,2 (no configuration is required for the factory mode)
3) Input the command $CFGSAVE (no configuration is required for the factory mode)
4) The process of self-calibration should satisfy the conditions of parking, satellite quality, vehicle motion, etc. mentioned in 2.3.5. Confirm whether the self-calibration is completed using the $SNRSTAT command, and when the insstatus becomes 3, the self-calibration is completed.
5) Make sure the self-calibration is completed before entering the road with poor satellite quality.
6) If hot start is needed in underground garages, please provide continuous power to the V_BCKP pin.

2.3.5 Module Calibration and Notice

- **Self-Calibration**

After the installation of the UM681A, self-calibration is required to ensure the accuracy of the module output. In the process of the self-calibration, the module estimates installation status parameters and sensor parameters. The module is in GNSS navigation mode before the self-calibration is completed, and is in GNSS + INS integrated navigation mode after the self-calibration is completed.

- **Conditions of Completing Self-Calibration**

– The self-calibration is triggered after power on, and it's required to stop the car for more than three minutes;
– Good satellite visibility is required during the process of the self-calibration (the number of visible satellites is not less than six, and CN0 is above 30 dB). The better the satellite observation quality is, the faster the calibration will be.
– It's required to make 90-degree turns for more than five times while the vehicle is running normally (this step is unnecessary for fixed installation mode).
– Keep the forward driving speed above 36 km/h on the premise of normal driving. The more times of acceleration (it's recommended to drive at the acceleration greater than 0.5 m/s^2 for no less than 10 times) and the longer the driving time is, the faster the calibration will be.

After the first calibration (insstatus 3), it is still necessary to drive for about 15 minutes in the open environments to train the IMU adequately. Otherwise, the navigation accuracy may be slightly worse if the vehicle enters a complex environment such as a tunnel and garage immediately after the first calibration.

Note:

1) The normal use of the module only requires one self-calibration process.
2) After the INS module is calibrated, it can be moved only after the power is completely cut off, including the main power VCC and the backup power V_BCKP.

3 Technical Specifications

3.1 Pin Definition

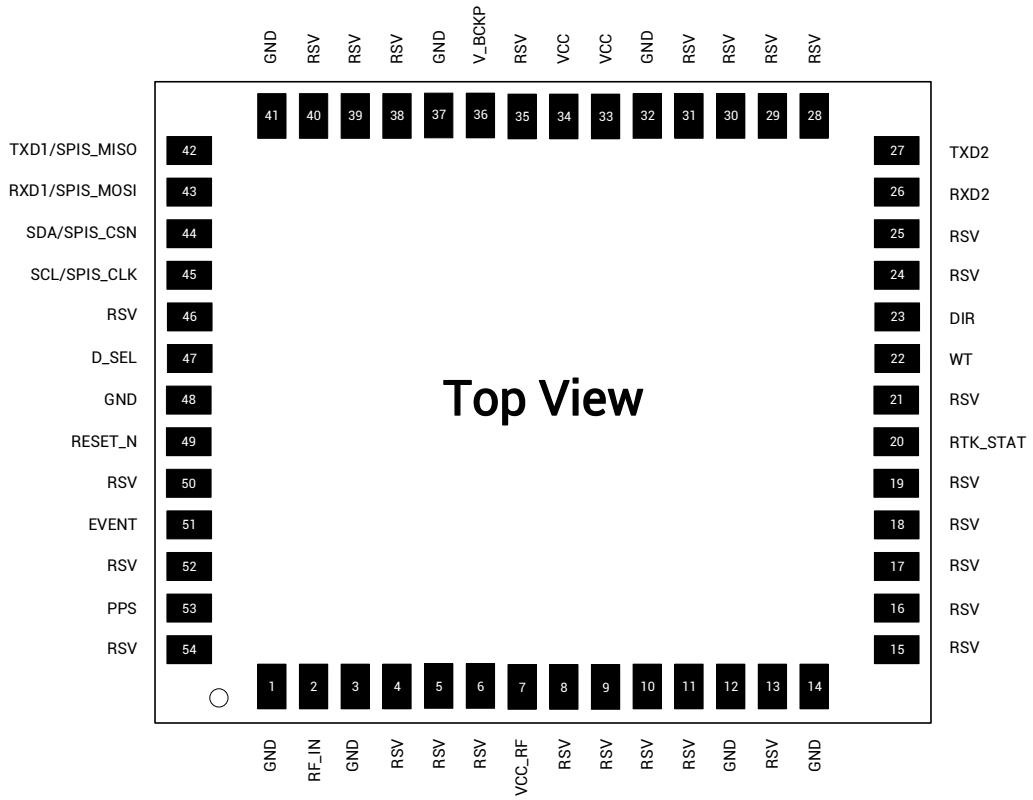


Figure 3-1 UM681A Pin Definition

Table 3-1 Pin Definition

No.	Pin	I/O	Description
1	GND	—	Ground
2	RF_IN	I	GNSS antenna signal input
3	GND	—	Ground
4	RSV	—	Reserved, leave floating
5	RSV	—	Reserved, leave floating
6	RSV	—	Reserved, leave floating
7	VCC_RF[2]	O	Antenna feed output
8	RSV	—	Reserved, leave floating

[2] Not recommended to use VCC_RF to feed the antenna (VCC_RF has not been optimized for the anti-lightning strike and anti-surge due to the compact size of the module).

No.	Pin	I/O	Description
9	RSV	—	Reserved, leave floating
10	RSV	—	Reserved, leave floating
11	RSV	—	Reserved, leave floating
12	GND	—	Ground
13	RSV	—	Reserved, leave floating
14	GND	—	Ground
15	RSV	—	Reserved, leave floating
16	RSV	—	Reserved, leave floating
17	RSV	—	Reserved, leave floating
18	RSV	—	Reserved, leave floating
19	RSV	—	Reserved, leave floating
20	RTK_STAT*	O	RTK positioning indicator: active high; outputs high for RTK fixed solution, and low for other status.
21	RSV	—	Reserved, leave floating
22	WT	I	Odometer speed pulse input. Keep it floating if not in use. It is strongly recommended to use this pin. The maximum pulse frequency is 5K Hz, and the minimum pulse width is greater than 100 μs. **Note: Incorrect signals of the odometer will lead to serious problems in the use of the product. Please make sure the signal is correct.**
23	DIR	I	Odometer direction input. Keep it floating if not in use. It is strongly recommended to use it. High level = forward Low level = reverse **Note: Incorrect signals of the odometer will lead to serious problems in the use of the product. Please make sure the signal is correct.**
24	RSV	—	Reserved, leave floating

* RTK_STAT is a reserved interface, not supported currently.

No.	Pin	I/O	Description
25	RSV	—	Reserved, leave floating
26	RXD2	I	UART2 receiving data, LVTTL level
27	TXD2	O	UART2 transmitting data, LVTTL level
28	RSV	—	Reserved, leave floating
29	RSV	—	Reserved, leave floating
30	RSV	—	Reserved, leave floating
31	RSV	—	Reserved, leave floating
32	GND	—	Ground
33	VCC	I	Power supply (+3.3 V)
34	VCC	I	Power supply (+3.3 V)
35	RSV	—	Reserved, leave floating
36	V_BCKP	I	When the main power supply VCC is cut off, V_BCKP supplies power to RTC and relevant register. Supply voltage: 2.0 V to 3.6 V, and the working current is less than 10 μA at 25 °C. If you do not use the hot start function, connect V_BCKP to VCC or a standalone power source. Do NOT connect it to ground or leave it floating.
37	GND	—	Ground
38	RSV	—	Reserved, leave floating
39	RSV	—	Reserved, leave floating
40	RSV	—	Reserved, leave floating
41	GND	—	Ground
42	TXD1/SPIS_MISO*	O	UART1 output (D_SEL=VCC or floating); Master In/Slave Out of SPI slave (D_SEL=GND)
43	RXD1/SPIS_MOSI*	I	UART1 input (D_SEL=VCC or floating); Master Out/Slave In of SPI slave (D_SEL=GND)
44	SDA*/SPIS_CSN*	—	I²C data (D_SEL=VCC or floating); SPI slave chip select (D_SEL=GND)
45	SCL*/SPIS_CLK*	—	I²C clock (D_SEL=VCC or floating); SPI slave clock (D_SEL=GND)

* I²C and SPI are reserved interfaces, not supported currently.

No.	Pin	I/O	Description
46	RSV	—	Reserved, leave floating
47	D_SEL	I	Interface select pin; Use pin 42 to 45 as a SPI slave when D_SEL = GND, as UART1 and I^2C When D_SEL=VCC or floating
48	GND	—	Ground
49	RESET_N	I	System reset; active low; the active time should be no less than 5 ms
50	RSV	—	Reserved, leave floating
51	EVENT*	I	Event mark input with adjustable frequency and polarity
52	RSV	—	Reserved, leave floating
53	PPS	O	Pulse per second with adjustable pulse width and polarity
54	RSV	—	Reserved, leave floating

* EVENT is a reserved interface, not supported currently.

3.2 Electrical Specifications

3.2.1 Absolute Maximum Ratings

Table 3-2 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply	VCC	-0.2	3.6	V	
Backup Battery	V_BCKP	-0.2	3.6	V	
Digital Pin Voltage		-0.2	3.6	V	
Antenna RF Input Power	RF_IN	-	-3	dBm	
Storage Temperature	T_{STG}	-40	+85	°C	
Reflow Soldering Temperature	T_{SLDR}	-	+245	°C	

3.2.2 Operational Conditions

Table 3-3 Operational Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Power Supply	VCC	2.7	3.3	3.6	V	
VCC Ripple	Vp-p			50	mV	
Peak Current	Iccp			200	mA	VCC = 3.0 V
Average Tracking Current[3]	I_{ACQ}	70	80	100	mA	VCC = 3.0 V
Low Level Input Voltage	V_{IL}	-0.3		0.2 × VCC	V	
High Level Input Voltage	V_{IH}	0.7 × VCC		3.6	V	
Low Level Output Voltage	V_{OL}	0		0.4	V	I_{out} = -2 mA
High Level Output Voltage	V_{OH}	VCC – 0.4		VCC	V	I_{out} = 2 mA
Antenna Gain	G_{ANT}	15	20	30	dB	

[3] Since the product has capacitors inside, inrush current occurs during power-on. You should evaluate in the actual environment in order to check the effect of the supply voltage drop caused by inrush current in the system. These reference values are tested from samples after cold start, and the actual values may vary depending on the factors such as firmware version, external circuit, number of the satellites tracked, signal strength, start type and time, duration, and test conditions.

3.3 Dimensions

Table 3-4 Dimensions

Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	21.80	22.00	22.50
B	16.80	17.00	17.50
C	2.40	2.60	2.80
D	3.75	3.85	3.95
E	0.95	1.05	1.15
F	1.80	1.90	2.00
G	1.00	1.10	1.20
H	0.70	0.80	0.90
K	1.40	1.50	1.60
M	3.55	3.65	3.75
N	3.15	3.25	3.35
P	2.00	2.10	2.20
R	1.00	1.10	1.20
X	0.72	0.82	0.92

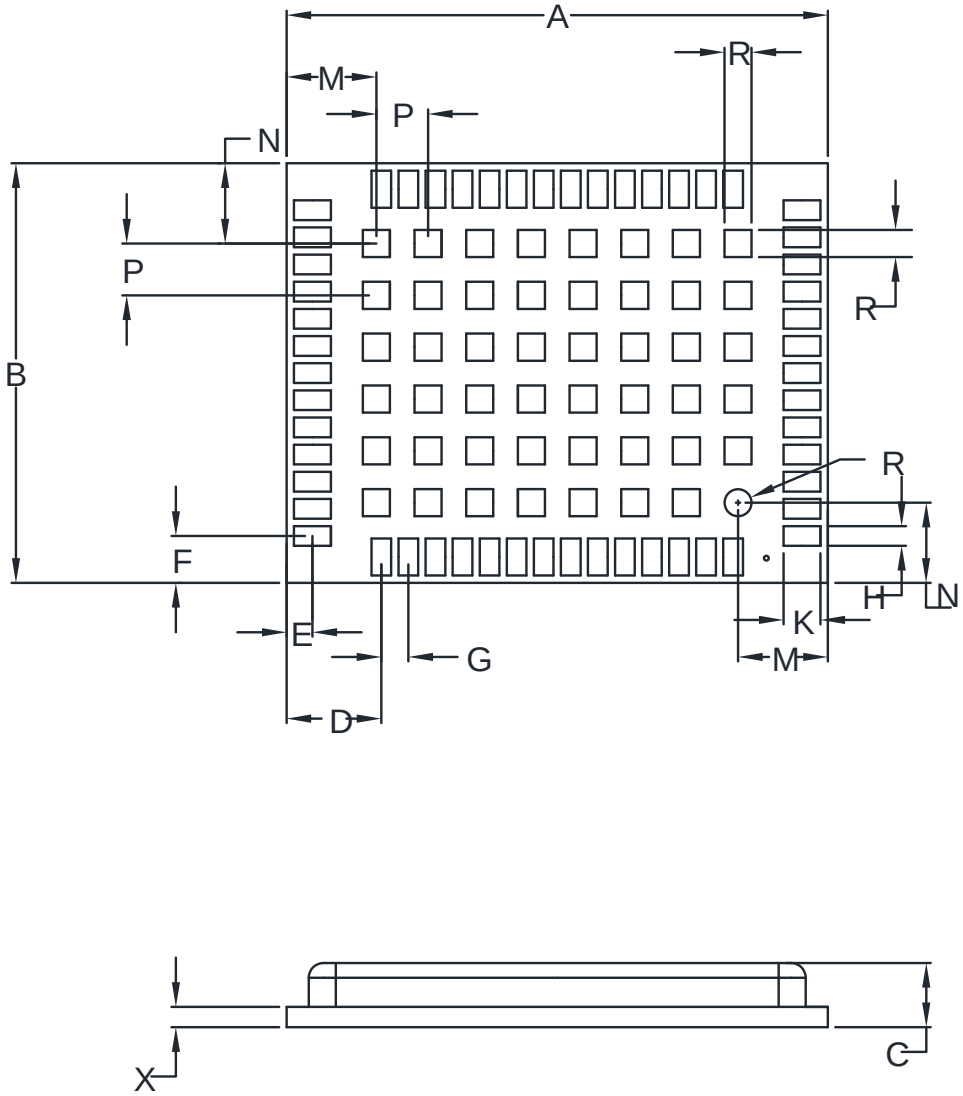


Figure 3-2 UM681A Mechanical Dimensions

4 Hardware Design

4.1 Recommended Minimal Design

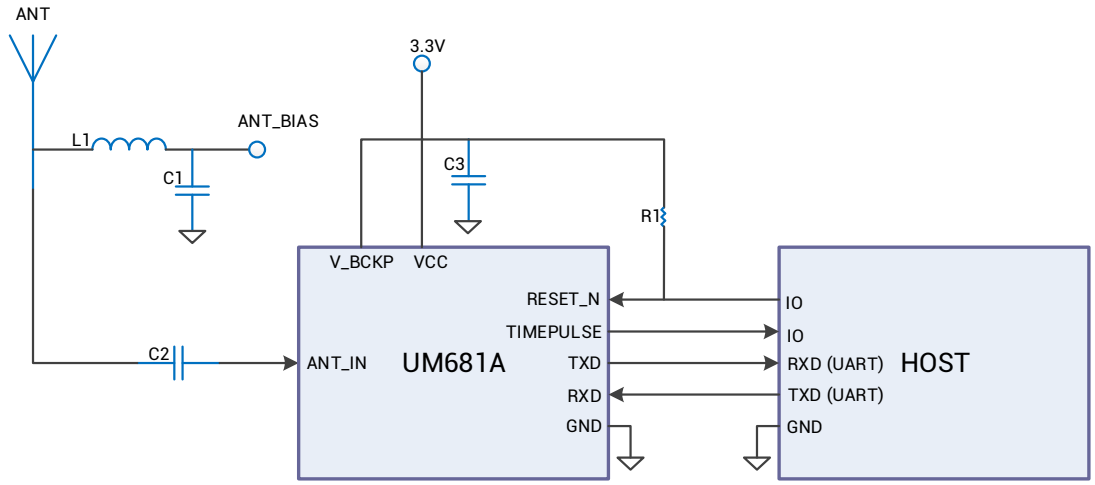


Figure 4-1 UM681A Minimal Design

Remarks:

- L1: 68 nH RF inductor in 0603 package is recommended
- C1: 100 nF + 100 pF capacitors connected in parallel is recommended
- C2: 100 pF capacitor is recommended
- C3: Several 10 μF + 100 nF capacitors connected in parallel is recommended
- R1: 10 kΩ resistor is recommended

4.2 Antenna Feed Design

UM681A supports feeding the antenna from the outside of the module rather than from the inside. It is recommended to use devices with high power and that can withstand high voltage. Gas discharge tube, varistor, TVS tube and other high-power protective devices may also be used in the power supply circuit to further protect the module from lightning strike and surge.

☞ the antenna feed supply ANT_BIAS and the module's main supply VCC use the same power rail, the ESD, surge and overvoltage from the antenna will affect the VCC, which may cause damage to the module. Therefore, it is recommended to design an independent power rail for the ANT_BIAS to reduce the possibility of module damage.

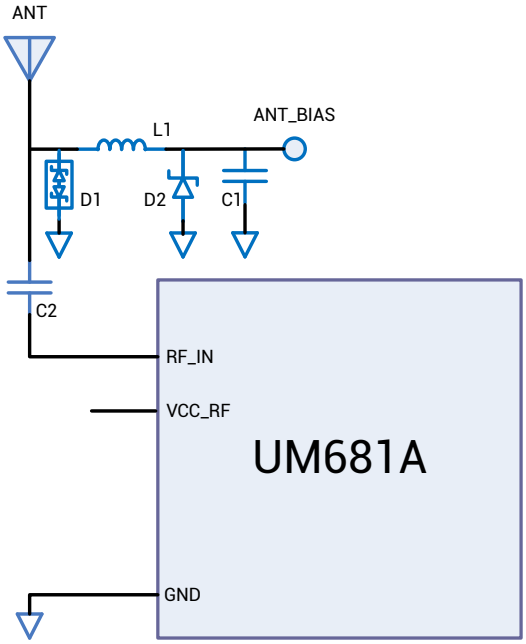


Figure 4-2 UM681A External Antenna Feed Reference Circuit

Remarks:

- L1: feed inductor, 68nH RF inductor in 0603 package is recommended;
- C1: decoupling capacitor, it is recommended to connect two capacitors of 100nF/100pF in parallel;
- C2: DC blocking capacitor, recommended 100pF capacitor;
- Not recommended to use VCC_RF as ANT_BIAS to feed the antenna (VCC_RF has not been optimized for the anti-lightning strike and anti-surge due to the compact size of the module)
- D1: ESD diode, choose the ESD protection device that supports high frequency signals (above 2000 MHz)
- D2: TVS diode, choose the TVS diode with appropriate clamping specification according to the requirement of feed voltage and antenna withstand voltage

4.3 Power-on and Power-off

VCC

- The VCC initial level when power-on should be less than 0.4 V.
- The VCC ramp when power-on should be monotonic, without plateaus.
- The voltages of undershoot and ringing should be within 5% VCC.
- VCC power-on waveform: The time interval from 10% rising to 90% must be within 100 μs to 10 ms.
- Power-on time interval: The time interval between the power-off (VCC < 0.4 V) to the next power-on must be larger than 500 ms.

V_BCKP

- The V_BCKP initial level when power-on should be less than 0.4 V.
- The V_BCKP ramp when power-on should be monotonic, without plateaus.
- The voltages of undershoot and ringing should be within 5% V_BCKP.
- V_BCKP power-on waveform: The time interval from 10% rising to 90% must be within 100 μs to 10 ms.
- Power-on time interval: The time interval between the power-off (V_BCKP < 0.4 V) to the next power-on must be larger than 500 ms.
- When the hot start function is not used, connect V_BCKP to VCC or a backup power source. Do not connect it to ground or leave it floating.

4.4 Grounding and Heat Dissipation

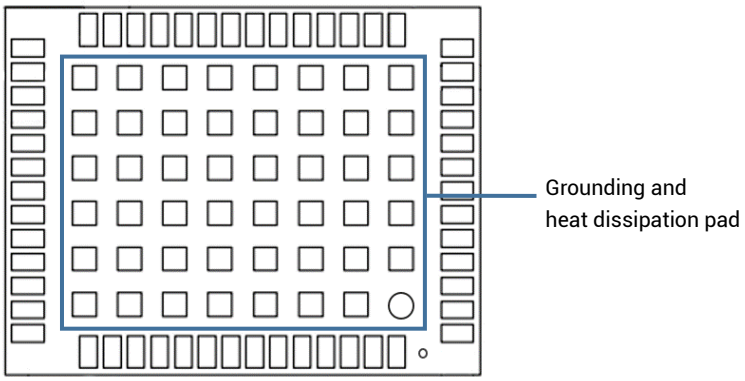


Figure 4-3 Grounding and Heat Dissipation Pad

The 48 pads in the rectangle in Figure 4-3 are used for grounding and heat dissipation. In the PCB design, it is recommended to connect them to a large sized ground to strengthen the heat dissipation.

4.5 Recommended PCB Package Design

See the following figure for the recommended PCB package design of the module UM681A.

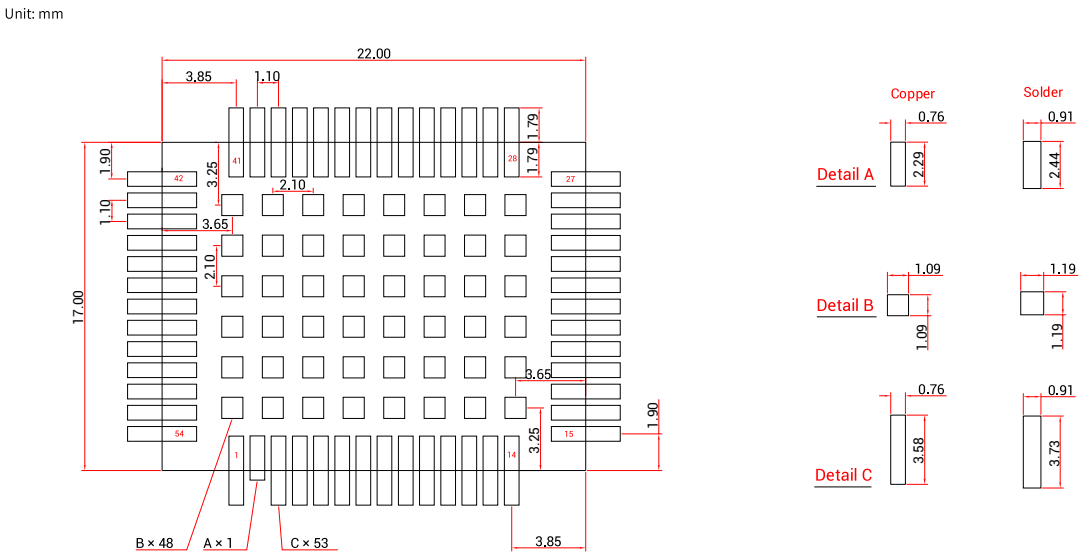


Figure 4-4 Recommended PCB Package Design

Remark:

For the convenience of testing, the soldering pads of the pins are designed long, exceeding the module border much more. For example:

- The pads denoted as detail C are 1.79 mm longer than the module border.
- The pad denoted as detail A is 0.50 mm longer than the module border. It is relatively short because it is an RF pin pad, so the trace on the surface should be as short as possible to reduce the impact of interference.

5 Odometer Interfaces

Odometer data can be input to the UM681A module via hardware interface or software interface.

☞ The two ways cannot be used at the same time.

5.1 Hardware Interface

The pin 22 (WT) of the UM681A module is used to receive the speed pulse signal (WHEELTICK) from the odometer, and the pin 23 (DIR) is used to receive the direction signal (FWD) from the odometer.

The odometer signal of vehicles is generally 12 V and the signal quality is poor. Therefore, signal filtering, optocoupler isolation and level conversion are required before transferring the odometer signal to the UM681A module for use.

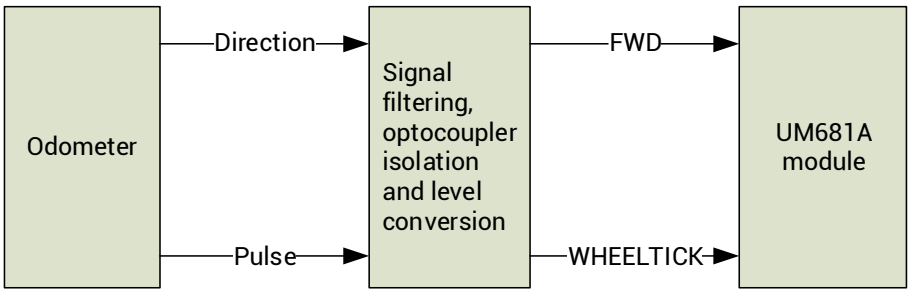


Figure 5-1 Odometer Connection

For more information about the odometer signals and reference circuit, please refer to *UM681 Series_Hardware Reference Design*.

The direction signal can be configured using the following command:

- $CFGODOFWD,1 *forward at high level and reverse at low level (by default)*
- $CFGODOFWD,0 *forward at low level and reverse at high level*

5.2 Software Interface

Speed and direction information can be input to the UM681A module via UART1 or UART2, which can be configured by the following command.

Syntax: $ODODATA,time,speed,forward,RSV,RSV,RSV

Example: $ODODATA,091649.00,10000,1,,,

Table 5-1 Parameter Description of ODODATA

Parameter	Format	Description
time	STR	UTC time; in the format of hhmmss.ss hh - Hour mm - Minute ss.ss - Second
speed	UINT	Driving speed; unit: 1e-3 m/s
forward	UINT	Driving direction: 0 - Forward 1 - Reverse
RSV		Reserved
RSV		Reserved
RSV		Reserved

6 Production Requirement

6.1 Clean

Do NOT use alcohol or other organic solvents to clean the module, otherwise it may lead to flux residues entering into the shielding shell, causing mildew and other problems.

6.2 Soldering

Recommended soldering temperature curve is as follows:

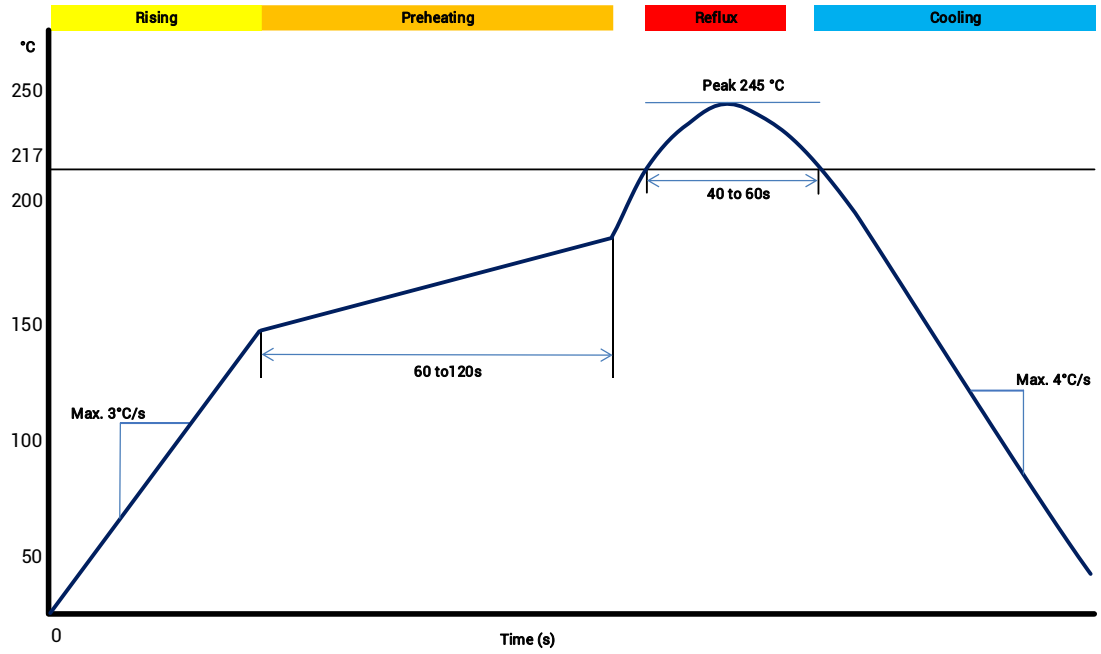


Figure 6-1 Soldering Temperature (Lead-free)

Temperature Rising Stage

- Rising slope: Max. 3 °C/s
- Rising temperature range: 50 °C to 150 °C

Preheating Stage

- Preheating time: 60 s to 120 s
- Preheating temperature range: 150 °C to 180 °C

Reflux Stage

- Over melting temperature (217 °C) time: 40 s to 60 s
- Peak temperature for soldering: no higher than 245 °C

Cooling Stage

- Cooling slope: Max. 4 °C/s

In order to prevent falling off during soldering of the module, do not solder it on the back of the board during design, and better not go through soldering cycle twice.

The setting of soldering temperature depends on many factors of the factory, such as board type, solder paste type, solder paste thickness, etc. Please also refer to the relevant IPC standards and indicators of solder paste.

6.3 Stencil Thickness

The opening of the stencil needs to meet your design requirement and comply with the examine standards. The thickness of the stencil is recommended to be 0.15 mm.

7 Packaging

7.1 Label Description

Figure 7-1 Label Description

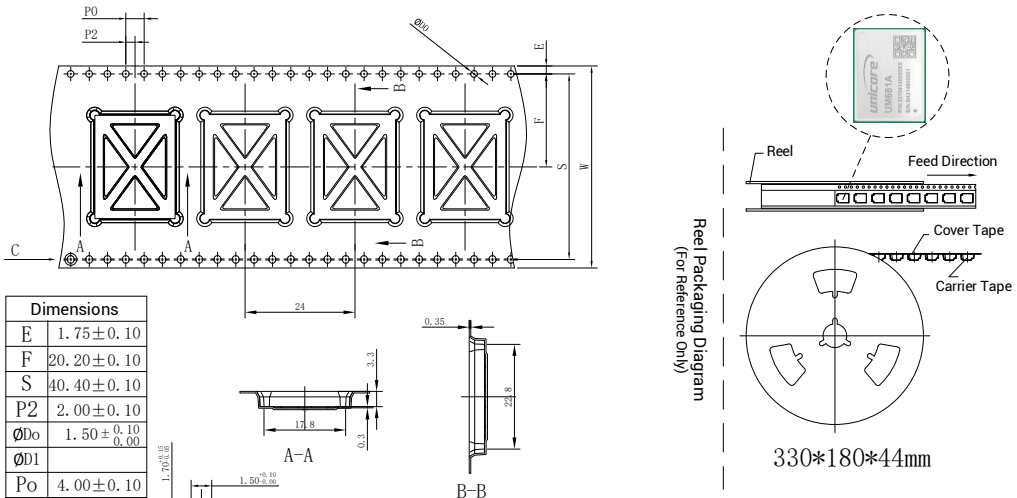
7.2 Ordering Information

Main Model	Sub-model	Description
UM681A	12	Automotive grade; dual-frequency RTK integrated positioning module; operating temperature: -40 °C to +85 °C; supporting firmware upgrade; 22 mm x 17 mm; 250 pieces/reel

7.3 Product Packaging

The UM681A module uses carrier tape and reel (suitable for mainstream surface mount devices), packaged in vacuum-sealed aluminum foil antistatic bags, with a desiccant inside to prevent moisture. When using reflow soldering process to solder modules, please strictly comply with IPC standard to conduct temperature and humidity control. As packaging materials such as the carrier tape can only withstand the temperature of 55 °C, modules shall be removed from the package during baking.

Figure 7-2 UM681A Package



Dimensions	
E	1.75±0.10
F	20.20±0.10
S	40.40±0.10
P2	2.00±0.10
ØDo	1.50 +0.10 0.00
ØD1	
Po	4.00±0.10
10Po	40.00±0.20
W	44.00±0.30
P	24.00±0.10
Ao	17.80±0.10
BO	22.80±0.10
KO	3.30±0.10
t	0.35±0.05

Note:

1. The cumulative tolerance of 10 side holes should not exceed ± 0.2 mm.
2. Material of the tape: Black antistatic PS (surface impedance 10^5-10^{11}) (surface static voltage <100 V), thickness: 0.35 mm.
3. Total length of the 13-inch reel package: 6.816 m (Length of the first part of empty packets: 0.408 m, length of packets containing modules: 6 m, length of the last part of empty packets: 0.408 m).
4. 4. Total number of packets in the 13-inch reel package: 284 (Number of the first part of empty packets: 17; actual number of modules in the packets: 250; number of the last part of empty packets: 17).
5. All dimension designs are in accordance with EIA-481-C-2003.
6. The maximum bending degree of the carrier tape within the length of 250 mm should not exceed 1 mm (see the figure below).

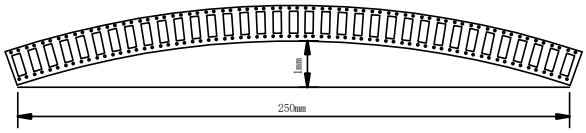


Figure 7-3 UM681A Reel Package Diagram

Table 7-1 Package Description

Item	Description
Module Number	250 pieces/reel
Reel Size	Tray: 13" External diameter: 330 ± 2 mm Internal diameter: 180 ± 2 mm Width: 44.5 ± 0.5 mm Thickness: 2.0 ± 0.2 mm
Carrier Tape	Space between (center-to-center distance): 24 mm

Before surface mounting, make sure that the color of the 30% circle on the HUMIDITY INDICATOR is blue (see Figure 7-4). If the color of the 20% circle is pink and the color of the 30% circle is lavender (see Figure 7-5), you must bake the module until it turns to blue. The UM681A is rated at MSL level 3. Refer to the relevant IPC/JEDEC J-STD-033 standards for the package and operation requirements. Users may access to the website www.jedec.org to get more information.

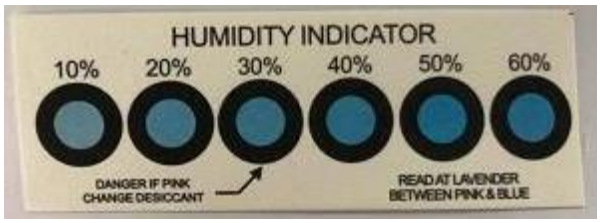


Figure 7-4 Normal Humidity Indication

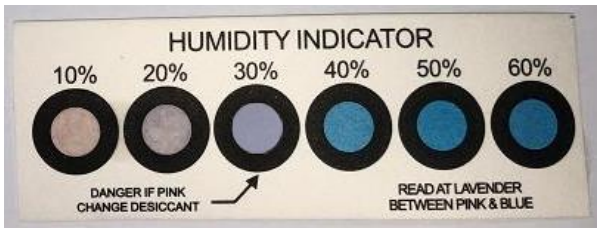


Figure 7-5 Abnormal Humidity Indication

The shelf life of the UM681A module packaged in vacuum-sealed aluminum foil antistatic bags is one year.

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