HARDWARE

REFERENCE DESIGN

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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 provides the hardware reference design of Unicore UM681A module.

Target Readers

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

Contents

1 Block Diagram

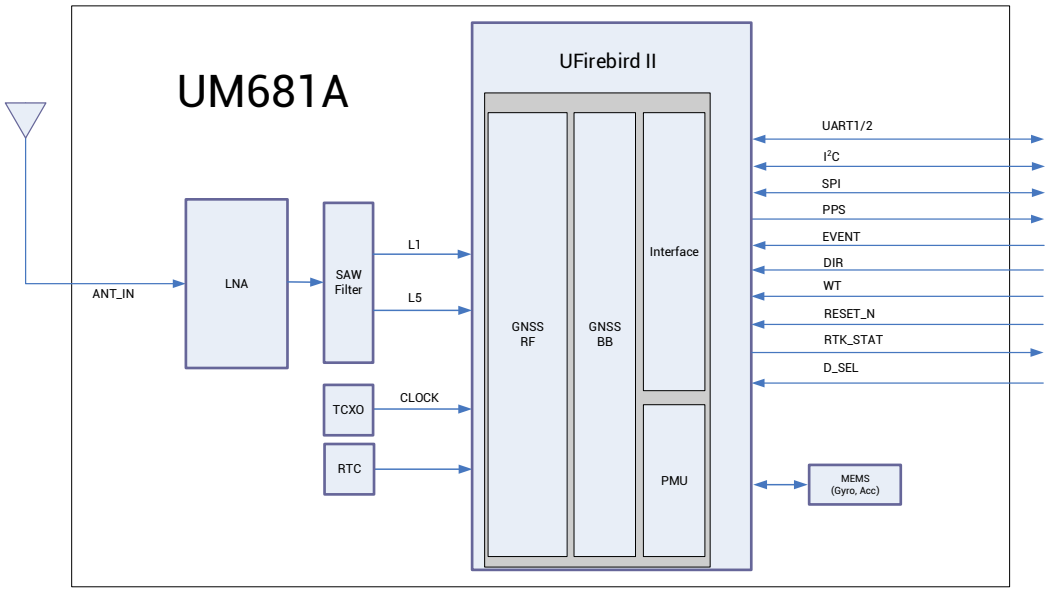


Figure 1-1 UM681A Block Diagram[1]

[1] I²C, SPI, EVENT and RTK_STAT are reserved interfaces, not supported currently. SPIS and I²C/UART1 share the same pins.

2 UM681A Peripheral Design

- Connect the ANT_IN signal to the antenna, and note the 50 Ω impedance matching.
- Connect all the GND pins to the ground.
- Leave the IO pins open if not used.
- Recommended to add TVS anti-surge protection at the power input of the module. Add ESD protection at all the used pins.

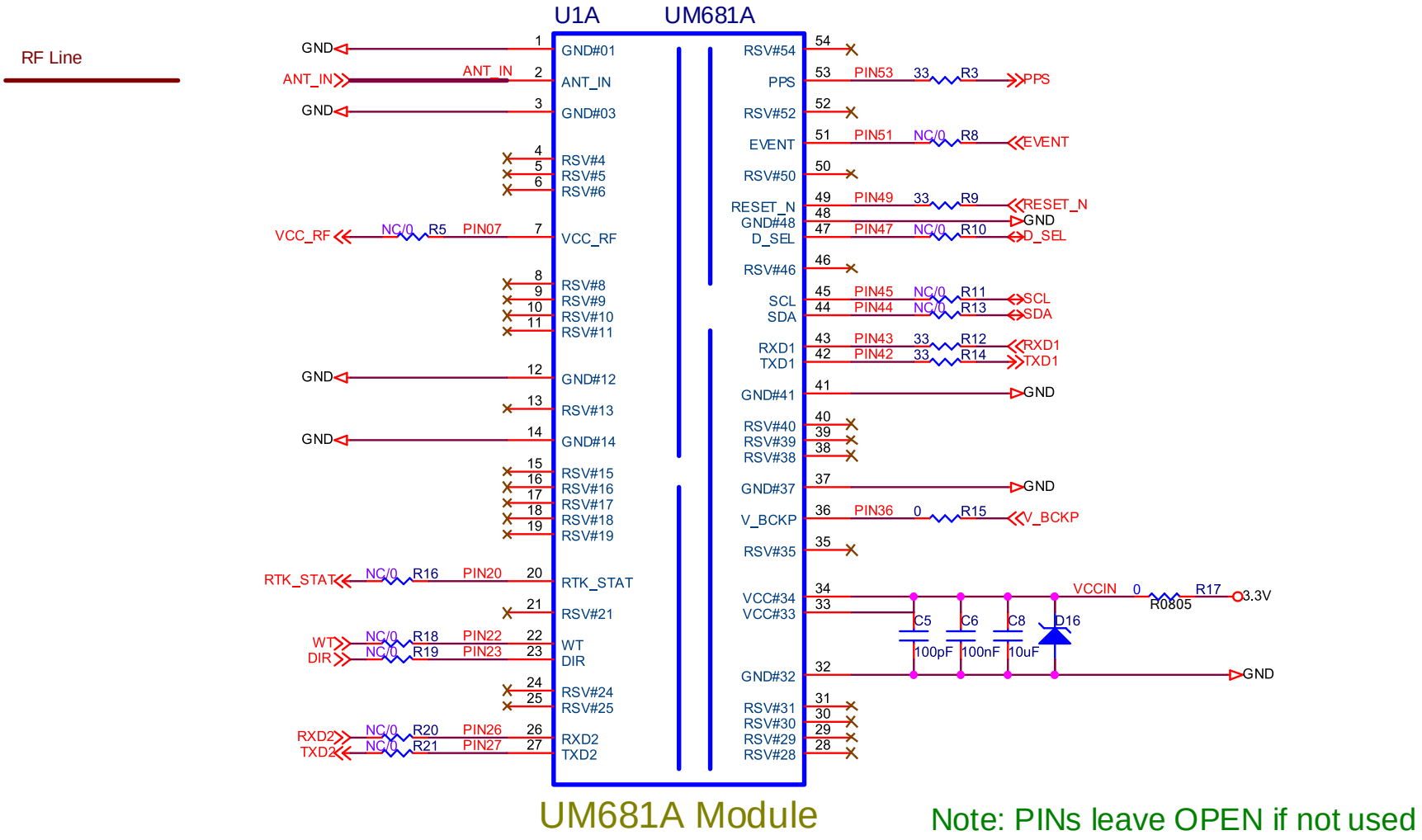


Figure 2-1 UM681A Peripheral Design[1]

The GND pads at the bottom of the module should be grounded to ensure heat dissipation.

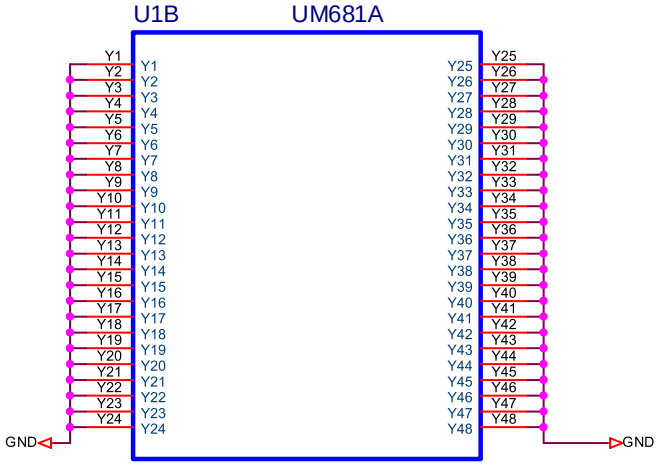


Figure 2-2 UM681A GND Pads

2.1 Main Power VCC

The working voltage range of VCC is 2.7 V to 3.6 V.

Note:

- 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.

2.2 Backup Power V_BCKP

When using the hot start function, you need to provide backup power for the module. The input range of V_BCKP is 2.0 V to 3.6 V.

Note:

- 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.

2.3 Active Antenna Feed Circuit

The antenna feed circuit consists of the anti-surge design, filter inductors, and ESD protection. The ESD protection diode should support high-frequency signals (above 2000 MHz).

☞ It is 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.

☞ If 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.

Connect the ANT_IN signal to the antenna, and note the 50 Ω impedance matching.

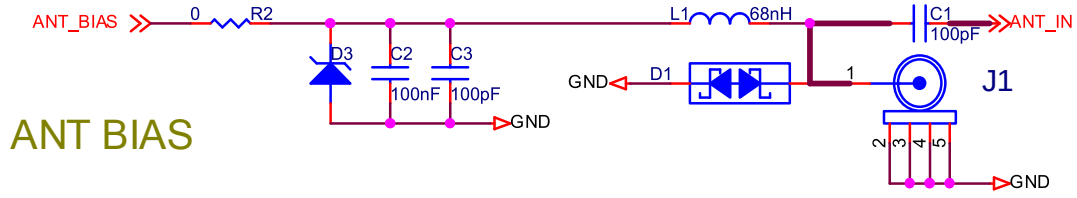


Figure 2-3 Antenna Feed Circuit

2.4 Reset Circuit

UM681A supports system reset. The pin RESET_N is active low and the active time should be no less than 5 ms.

3 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.

3.1 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.

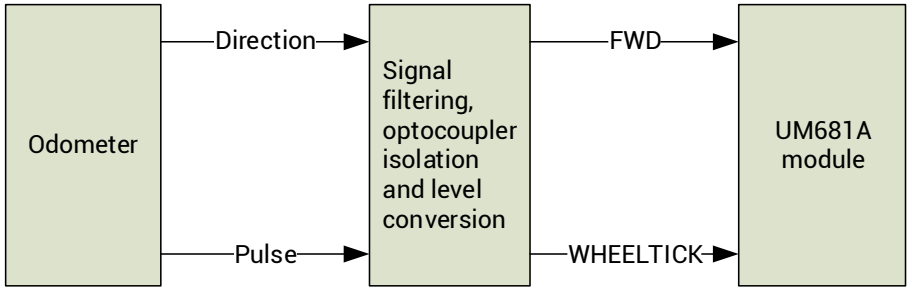


Figure 3-1 Odometer Connection

3.1.1 Odometer Reference Circuit and Waveform Diagram

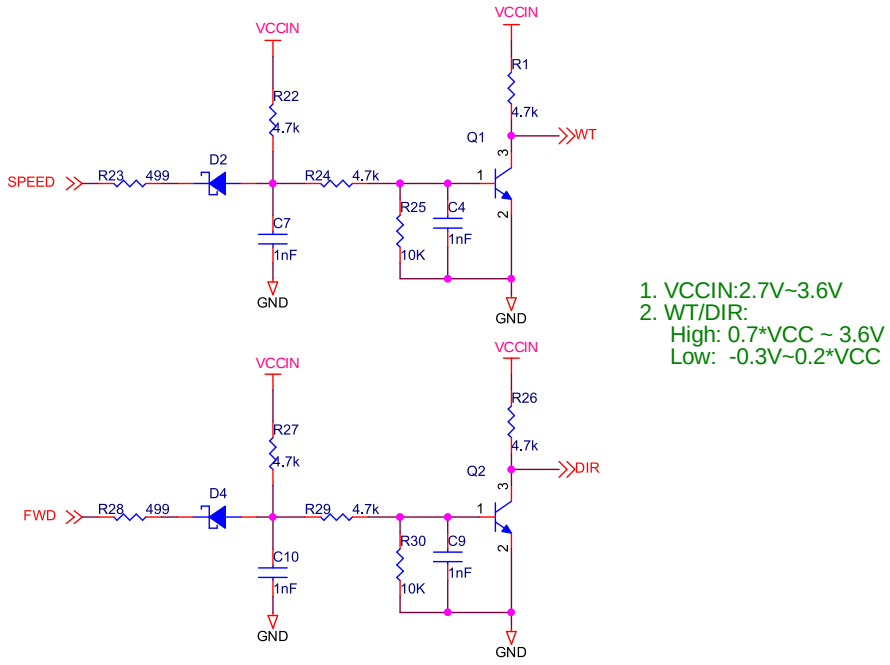


Figure 3-2 Reference Circuit for Odometer

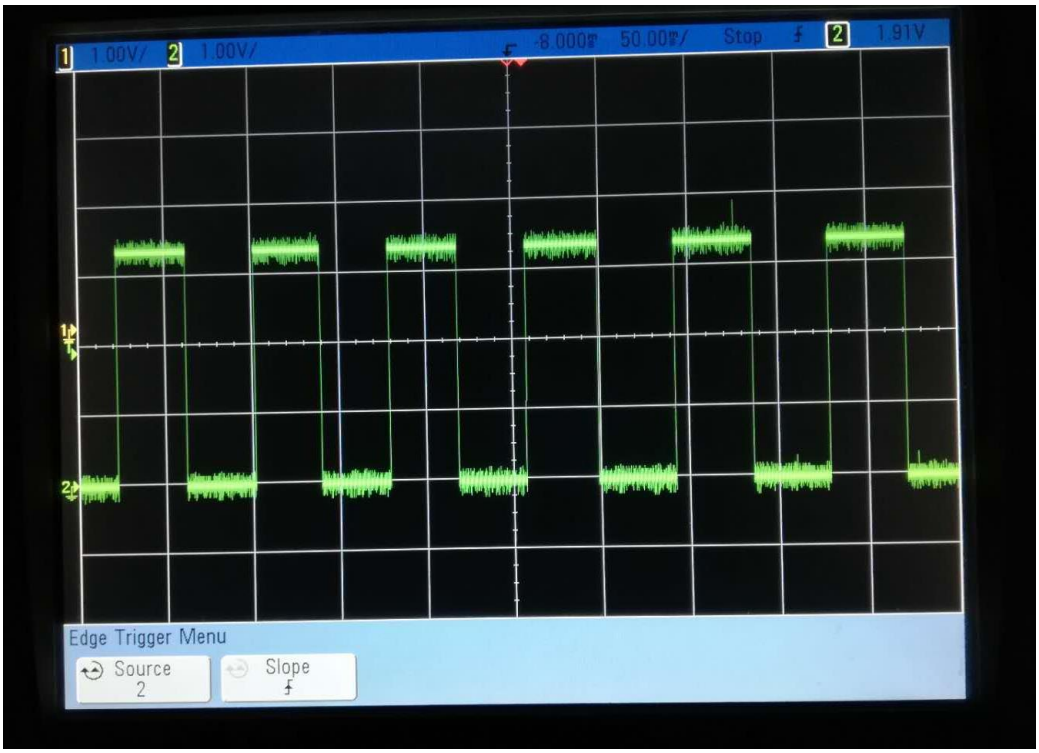


Figure 3-3 Odometer Waveform Diagram

3.1.2 Odometer Speed and Direction Signals

3.1.2.1 Voltage Requirements

The voltage requirements of VCC, V_BCKP, WT and DIR are shown in the table below.

Table 3-1 Voltage Requirements

Item	Symbol	Min.	Typ.	Max.	Unit
Main Supply	VCC	2.7	3.3	3.6	V
Backup Supply	V_BCKP	2.0		3.6	V
Ripple Voltage	V_{p-p}			50	mV
WT/DIR Low Level Input Voltage	V_{IL}	-0.3		0.2*VCC	V
WT/DIR High Level Input Voltage	V_{IH}	0.7*VCC		3.6	V

3.1.2.2 Speed Signal (WHEELTICK)

1. The speed signal input to the module is required to be a square wave signal, and the frequency shall not exceed 5 KHz.
2. The pulse width of a square wave signal is required to be between 1 cm and 40 cm. For example, if the pulse width is 20 cm, the output frequency is

   $$f = [(1000/20) * V/36] Hz$$

   where V is the velocity of the vehicle and its unit is km/h.
3. The chip detects the number of rising edges of the square wave signal, and the time of high level and low level shall be no less than 100 μs.
4. If the vehicle is still (for example, parking), the level of the WT pin must remain constant.

3.1.2.3 Direction Signal (FWD)

The module defaults to forward at high level and reverse at low level.

It can be configured through the commands as shown below. For more information, please refer to the protocol manual.

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

3.2 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.

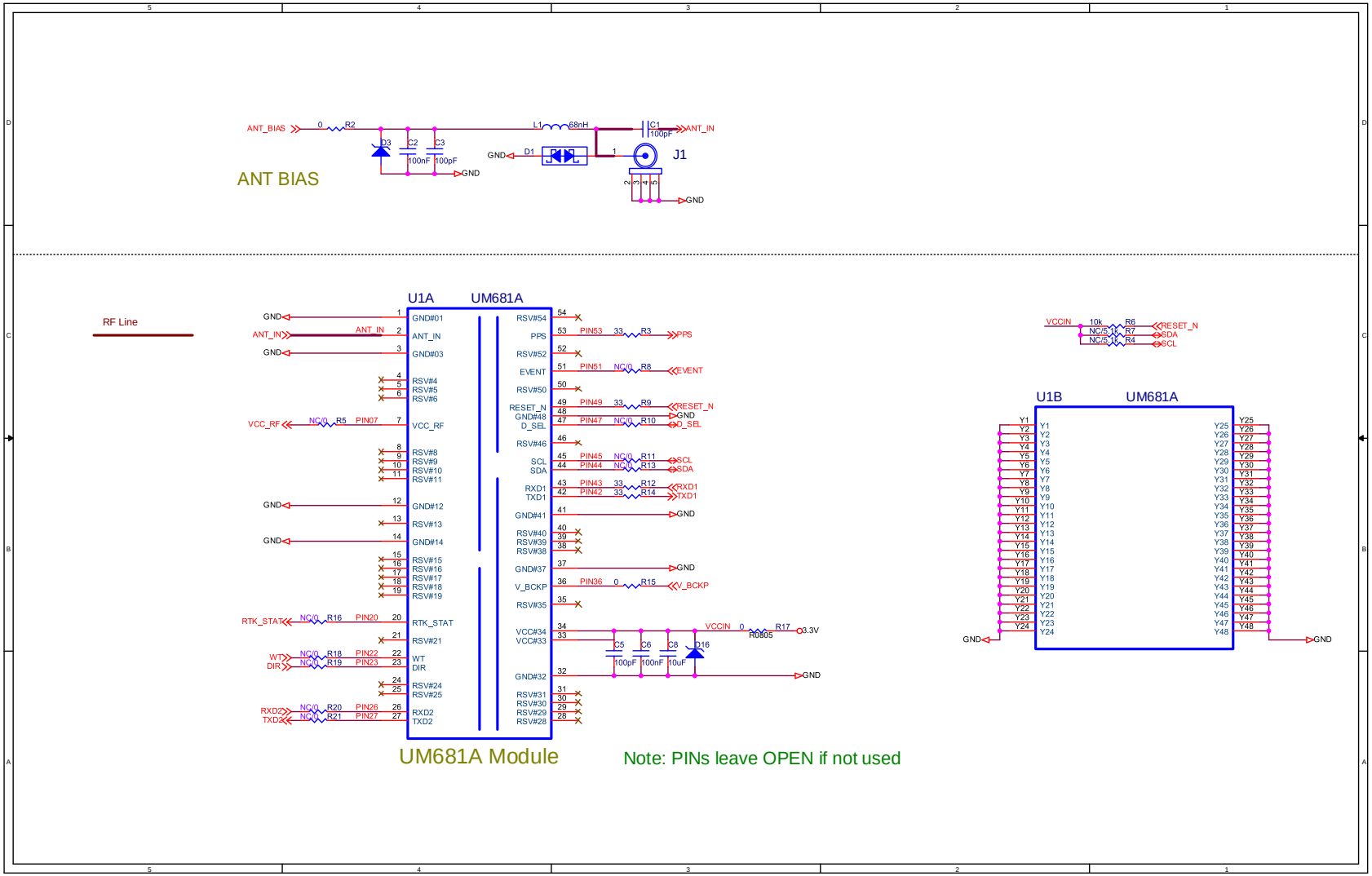
Syntax: $ODODATA,time,speed,forward,RSV,RSV,RSV

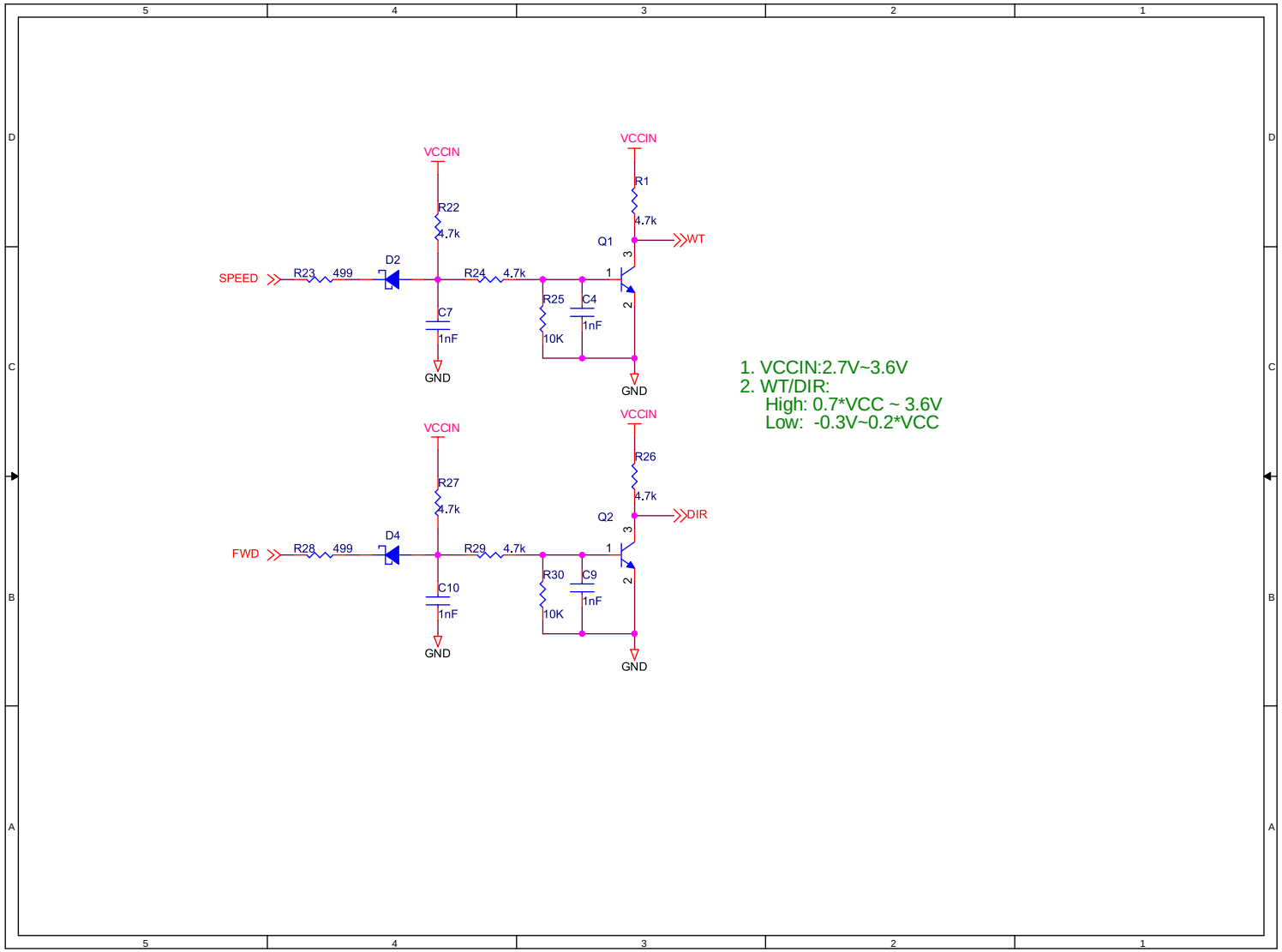
Example: $ODODATA,091649.00,10000,1,,,

Table 3-2 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

4 Appendix: Schematics of Reference Design


ANT BIAS
ANT_BIAS
R2
L1
68nH
C1
100pF
ANT_IN
D3
C2
100nF
C3
100pF
GND
D1
J1
RF Line
U1A
UM681A
VCC_RF
RTK_STAT
WT
DIR
RXD2
TXD2
RESET_N
SCL
SDA
RXD1
TXD1
V_BCKP
D_SEL
EVENT
PPS
VCCIN
3.3V
U1B
UM681A
UM681A Module
Note: PINs leave OPEN if not used


VCCIN
R22
4.7k
D2
SPEED
R23
499
R24
4.7k
C7
1nF
GND
VCCIN
R1
4.7k
Q1
WT
R25
10K
C4
1nF
GND
VCCIN
R27
4.7k
D4
FWD
R28
499
R29
4.7k
C10
1nF
GND
VCCIN
R26
4.7k
Q2
DIR
R30
10K
C9
1nF
GND
1. VCCIN:2.7V~3.6V
2. WT/DIR:
High: 0.7*VCC ~ 3.6V
Low: -0.3V~0.2*VCC

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