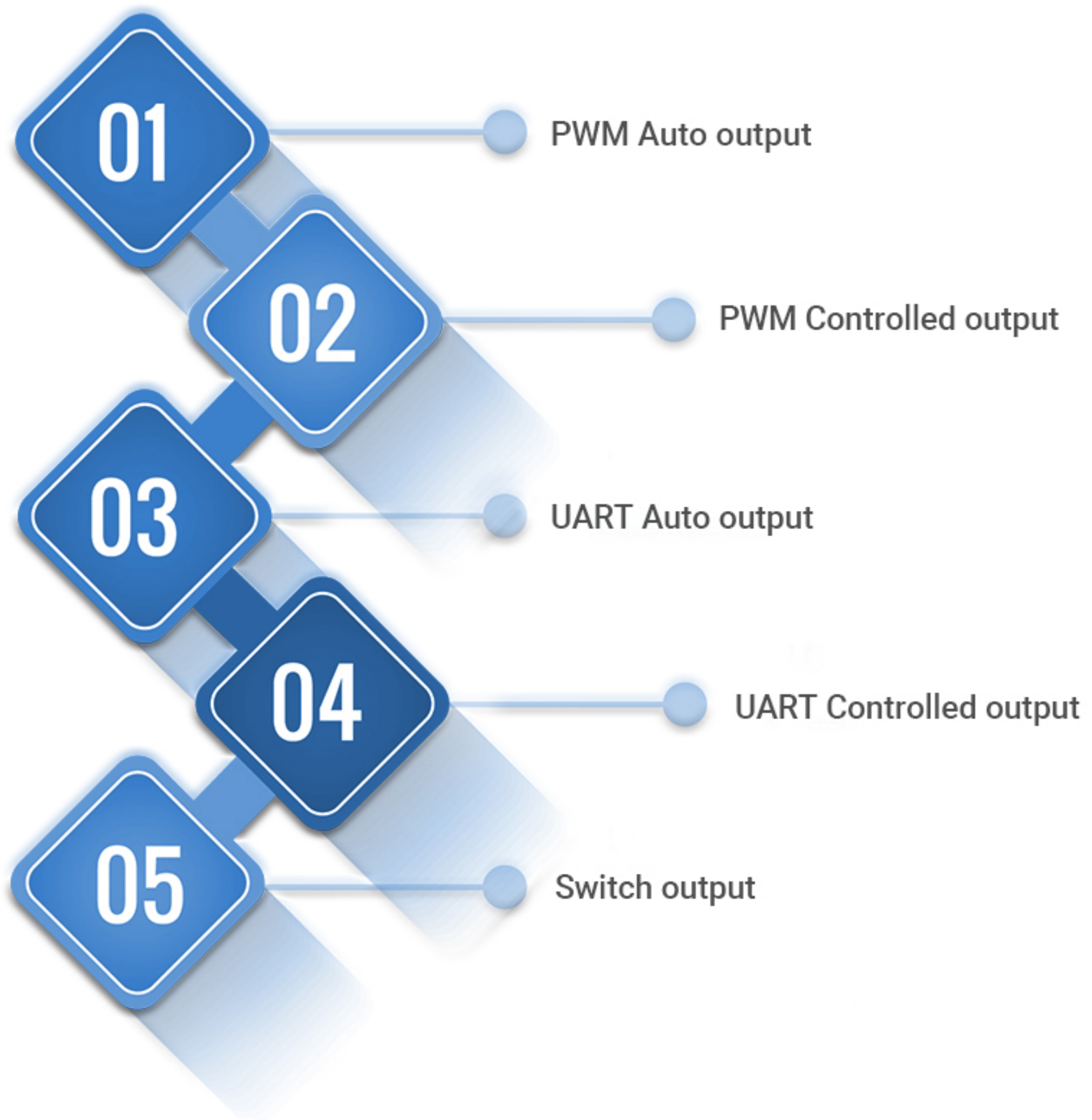


A09 Module Output Interface



1. PWM Auto output

The PWM automatic output mode outputs the measured distance value according to the pulse width duration. This mode does not require an external trigger signal and can be automatically measured by every 100ms. The measured distance value is output on the TX pin after each measurement is completed. This output mode can reduce the user's single-chip I/O port usage, and distance measurement can be achieved with only one I/O port.

(1) Pin definition

Pin No.	Mark	Pin description	Remark
③	RX	N/A	
④	TX	PWM output	

(2) Instruction

Pin4(TX) will output a high-level pulse width signal after detect an object, the high-level duration of pin4(TX) corresponds to the distance between the detection target and the module. Automatic detection by every 100ms. Pin4(TX) will output a fixed 37ms pulse width if module does not detect an object.

(3) Formula

Formula : $S = T \cdot V / 2$ (S is the distance value, T is duration time of PWM high-level pulse width, V is sound travel speed in the air)

Because of internal temperature compensation, V is directly calculated at speed of 348m/S at room temperature. The simplified formula is $S = T / 57.5$ (unit of S in centimeters and us of time T)

For example: The duration time T of PWM high-level pulse width is 10000us, the $S = T / 57.5 = 10000 / 57.5 \approx 173.9(\text{cm})$, means 173.9cm distance value.

2. PWM Controlled output

PWM output interface is simple and flexible, can be connected to digital or analog circuits to realize distance measurement.

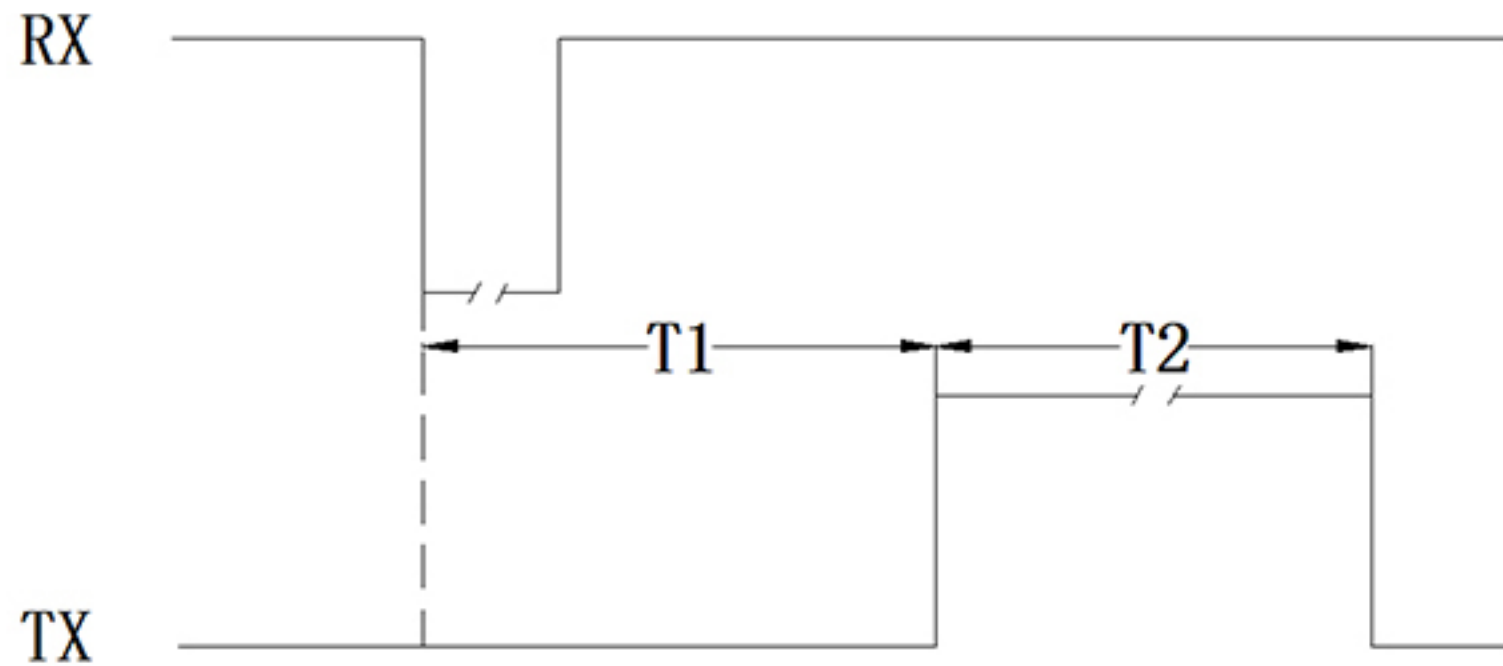
(1) Pin Definition

Pin No.	Mark	Pin description	Remark
③	RX	Signal input	
④	TX	PWM output	

(2) Instruction

When Pin 3(RX) receives a falling edge pulse, the module will start detecting. After the detection is completed, pin4(TX) will output a high-level pulse width signal, the high-level duration of pin4(TX) corresponds to the distance between the detection target and the module. The period must be greater than 100ms, Pin4(TX) will output a fixed 37ms pulse width if module does not detect an object. The module is in the standby state, will be activated every 2 seconds. When the RX pin receives the falling edge pulse time period of less than 2 seconds, it will not be activated in the standby state.

(3) Timing Diagram



Remark: $T1 \approx 45\text{ms}$ $T2 = 1.4 \sim 37.4\text{ms}$ (Plane mode), $T2 = 1.6 \sim 37.4\text{ms}$ (Human body mode)

(4) Formula

Formula: $S = T \cdot V / 2$ (S is the distance value, T is duration time of PWM high-level pulse width, V is sound travel speed in the air)

Because of internal temperature compensation, V is directly calculated at speed of 348m/S at room temperature. The simplified formula is $S = T / 57.5$ (unit of S in centimeters and us of time T)

For example: The duration time T of PWM high-level pulse width is 10000us, the $S = T / 57.5 = 10000 / 57.5 \approx 173.9(\text{cm})$, means 173.9cm distance value.

3. UART Auto output

UART auto output mode outputs measured distance value(Hexadecimal) according to UART communication format. This mode does not require an external trigger signal, automatic measurement by every 100ms. Pin(TX) output distance value, only one I/O port is needed

(1) Pin Definition

Pin No.	Mark	Pin description	Remark
③	RX	Processing value and real time value output	
④	TX	UART output	

(2) UART communication instruction

When the pin(RX)is suspended or the input high level, the module outputs processed value, and the data is more stable. The response time of is 100~300ms. When the pin(RX)is input low level, the module outputs real-time value. Response time of is 100ms.

Interface	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL level	8	1	No	9600bps

(3) UART Output format

Data Frame	Description	Byte
Start Bit	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

(4) UART Output format

Start Bit	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: Parity sum only remain low8 value.

SUM =(start bit+ Data_H+ Data_L)&0x00FF
 =(0XFF + 0X07 + 0XA1)&0x00FF
 =0XA7

Distance value= Data_H*256+ Data_L=0X07A1;

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

4. UART Controlled Output

UART controlled mode outputs measured distance value(Hexadecimal) according to UART communication format. When pin(RX) receives a falling edge pulse, the module will perform a measurement, measured distance value output through pin(TX) after completed. Such output method can set measuring cycle to drop power consumption. Recommend for battery power supply use.

The module in standby state under UART controlled mode, will be activated every 2 second. When time cycle of Pin(RX) receive falling edge pulse less than 2 seconds, it will not be activated.

(1) Pin Definition

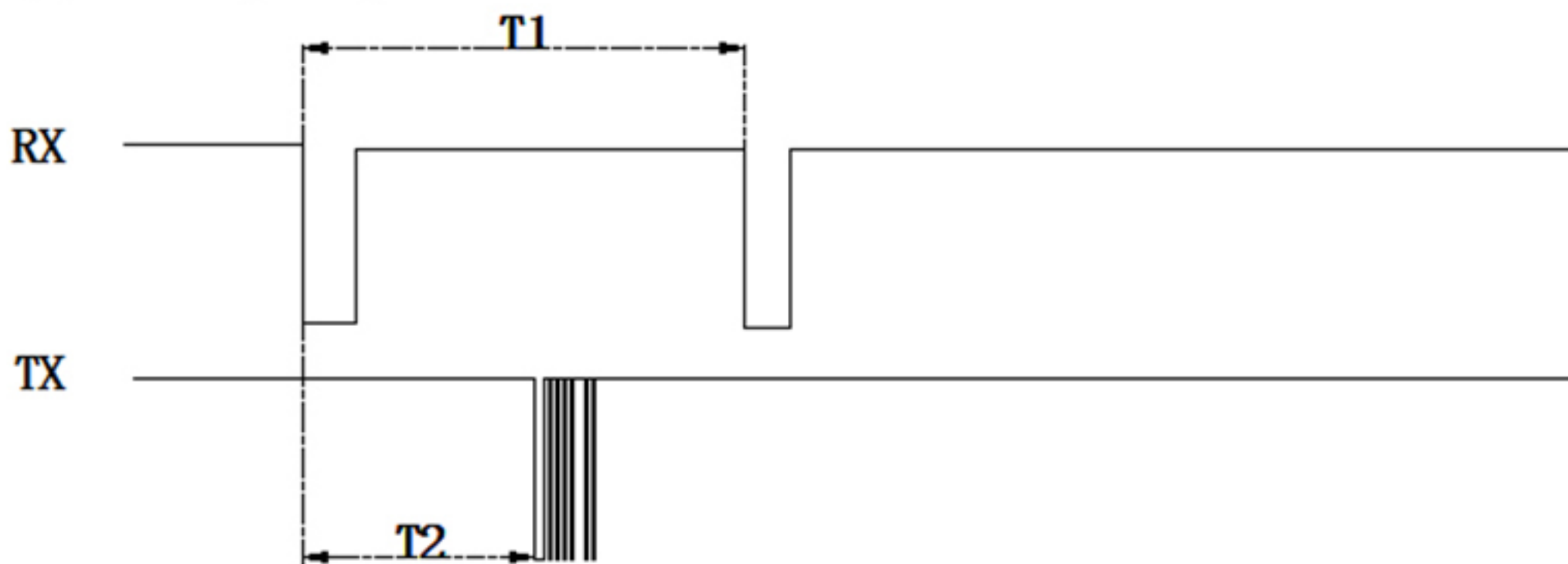
Pin No.	Mark	Pin description	Remark
③	RX	Trigger signal input	
④	TX	UART output	

(2) UART Communication instruction

The module will perform a distance detection after Pin(RX) receives a falling edge pulse.

UART	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL level	8	1		9600bps

(3) Timing Diagram



Remark: $T1 > 100\text{ms}$, $T2 = 46 \sim 48\text{ms}$

(4) UART Output Format

Data Frame	Description	Byte
Start Bit	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

(5) Example of UART Output

Start Bit	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: Parity sum only remain low8 value.

$$\text{SUM} = (\text{Start bit} + \text{Data_H} + \text{Data_L}) \& 0x00FF$$

$$= (0XFF + 0X07 + 0XA1) \& 0x00FF$$

$$= 0XA7$$

$$\text{Distance value} = \text{Data_H} \times 256 + \text{Data_L} = 0X07A1$$

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

5. Switch Output

The switch output interface is simple, the distance can be measured only by simple connect to analog or digital circuit.

(1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	RX	Switch negative output	
④	TX	Switch positive output	

(2) Instruction

Factory setting a thresholds of 1 meter. The module performs distance measurement every 100ms. When the distance value less than threshold, the Pin(TX) output high level, Pin(RX) output low level. When the value greater than threshold, pin(TX) output low level and Pin(RX) output high level. In order to improve stability, the factory defaults that when the distance value of the target is detected 5 times in a row is less than the set thresholds, it is determined that the detected target distance is less than the set thresholds. The distance value of the target detected 10 times in a row is greater than the set thresholds. It is determined that the detected target distance is greater than the set threshold value. The Pin(TX) of the module only outputs high and low level signals without driving capability