CS100A Ultrasonic Distance Measuring Chip Manual V2.0

1. summarize

CS100A is an industrial-grade ultrasonic distance measuring chip introduced by Suzhou ShunGuiZhiLian New Material Technology Co., Ltd (www.100sensor.com). CS100A integrates ultrasonic transmitting circuitry, ultrasonic receiving circuitry, digital processing circuitry, etc., which enables ultrasonic distance measuring to be accomplished by a single chip, and the distance measuring results are outputted through the way of pulse width. The communication interface is compatible with existing ultrasonic modules.

The CS100A uses a 40KHZ open ultrasonic probe and requires only a 15MR pull-down resistor (5.1MR~22MR recommended) and an 8M crystal for high performance ranging.

The use of fewer devices can significantly reduce the board area and improve reliability; at the same time, fewer peripheral devices make the wiring more simple, in the cost-sensitive references to the scene, the use of a single-sided PCB can be realized ultrasonic ranging function, significantly reducing costs.

The ultrasonic distance measurement module fabricated using this chip is shown in Fig. 1 and Fig. 2 (refer to Fig. 4 for the schematic diagram)

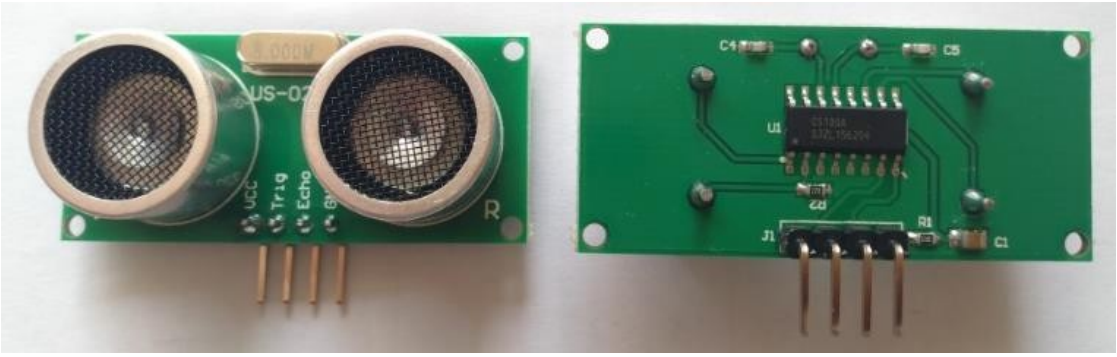


Figure 1: Ultrasonic Ranging Module using CS100A (reference US-025A)

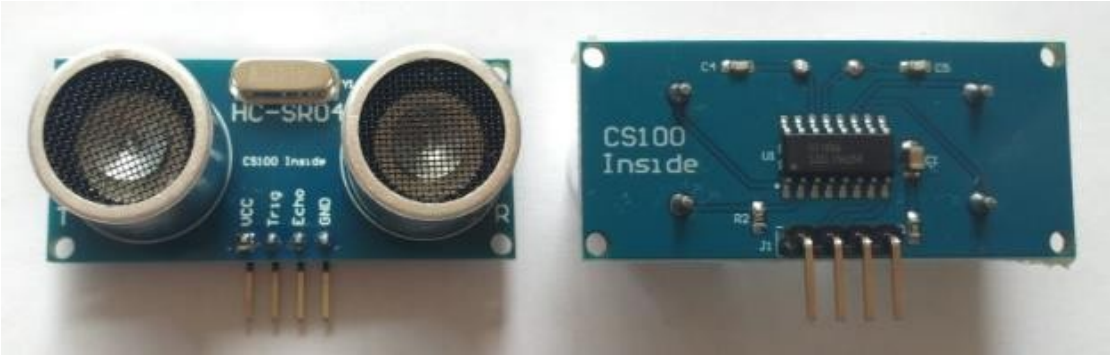


Figure 2: Ultrasonic Range Module using CS100A (Ref. HC-SR04)

As can be seen from the figure: the entire circuit requires only a very small number of peripheral devices, can also be used as a single-sided PCB, in order to ensure high performance on the basis of the cost can be significantly reduced.

2. Pin Definitions

The CS100A is available in a SOP16 package as shown in Figure 3:

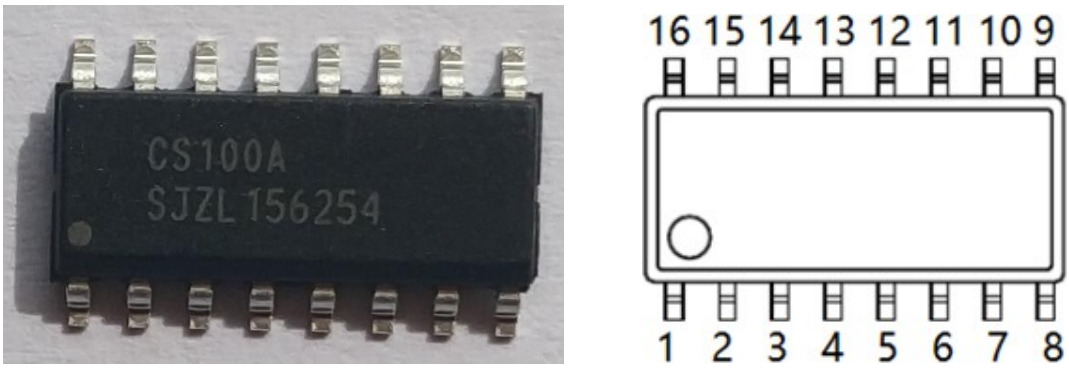


Figure 3: CS100A Package Diagram

Pin definitions are shown in Table 1:

pinout serial number	pinout steelyard	IO	Functional Description
1	RN	I	Receive probe inverting input
2	RP	I	Receive probe in-phase input
3	AVSS	-	analogically
4	AVDD	-	Analog Power Supply, 3V-5.5V
5	TEST1	o	Amplifier output test point; when not in use, just leave it hanging.
6	COMP0	o	Comparator output test point; when not in use, just leave it hanging.
7	ECHO	o	Ranging pulse width output, the width of ECHO high is the ultrasonic round trip time.
8	TRIG	I	Trigger ranging by inputting a high level pulse greater than 10uS to start ranging.
9	DVDD	-	Digital Power Supply, 3V-5.5V
10	TP	o	Ultrasonic in-phase transmitter
11	TN	o	Ultrasonic Inverted Transmitter
12	DVSS	-	digital land
13	XI	-	Connected to 8MHZ crystal
14	XO	-	Connect 8MHZ crystal, or external 8MHZ clock signal.
15	BLIND2	I	Not used, just hover.
16	PD	I	Power down can be realized by connecting the high level; when not in use, it can be suspended.

Table 1: CS100A Pin Definitions

3. reference schematic

The reference schematic is shown in Figure 4:

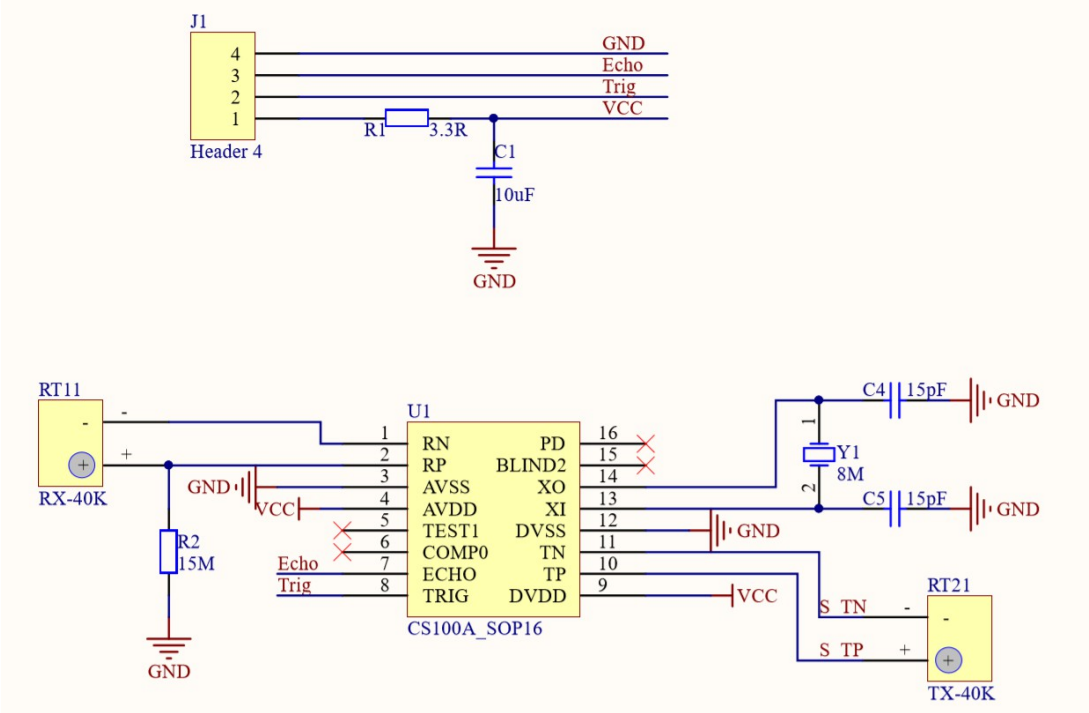


Figure 4: Reference Schematic

R1 and C1 form the power supply filter circuit, Y1 is an 8MHZ crystal oscillator, RT21 is a 40KHZ transmitter probe, and RT11 is a 40KHZ receiver probe.

R2 is a 15 megohm pull-down resistor that adjusts the range sensitivity. Decrease this resistance, you can enhance the anti-interference ability, but will also reduce the sensitivity, reduce the range; increase this resistance, you can get a longer measuring distance, but will also be more sensitive to the echo signal of the surrounding small objects. Generally it is recommended to choose 10MR~22MR.

When there are other small objects around in individual cases, or interference, and the measurement is not permitted at long distances, the value of R2 can be appropriately reduced to improve the anti-interference ability.

Phenomenon: When measuring a long distance, (occasionally) the measurement result will be tens of centimeters to more than one meter. Solution: The value of R2 (R2 value range recommended 5.1MR~22MR) can be reduced appropriately.

4. Working Principle

By inputting a high level of 10US or more into the TRIG pin (50US or so is recommended) the chip (TP, TN pins) will send out 8 ultrasonic pulses of 40KHZ, and then (RP, RN) will detect the echo signals. When the echo signal is detected, it will be output through the ECHO pin, as shown in Figure 5.

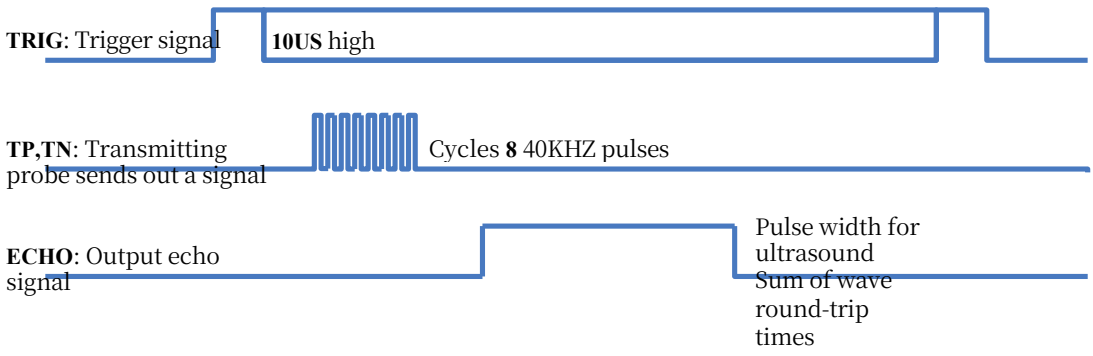


Figure 5: Ranging Timing Diagram

The distance value can be calculated based on the duration of the high level output from the ECHO pin. That is, the distance value is: (high level time *340m/s)/2.

When the measuring distance exceeds the measuring range, the CS100A still outputs a high level signal through the ECHO pin, with a high level width of about 33ms, as shown in Figure 6:

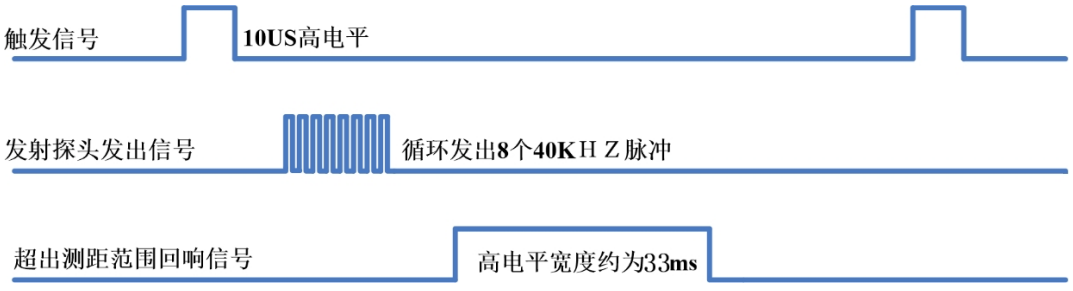


Figure 6: Out-of-measurement-range timing diagram

Measurement cycle: When the chip passes the high level pulse output from the ECHO pin, then the next measurement can be performed, so the The measurement period depends on the measurement distance, when the measurement distance is very close, the pulse width returned by ECHO is narrower, the measurement period is very short; when the measurement distance is farther away, the pulse width returned by ECHO is wider, the measurement period becomes longer accordingly.

In the worst case, the measured object is out of the measuring range, and the pulse width returned is the longest, about 33ms, so the worst case measuring period is greater than 33ms (e.g. the measuring period can be 50ms)

5. Performance indicators

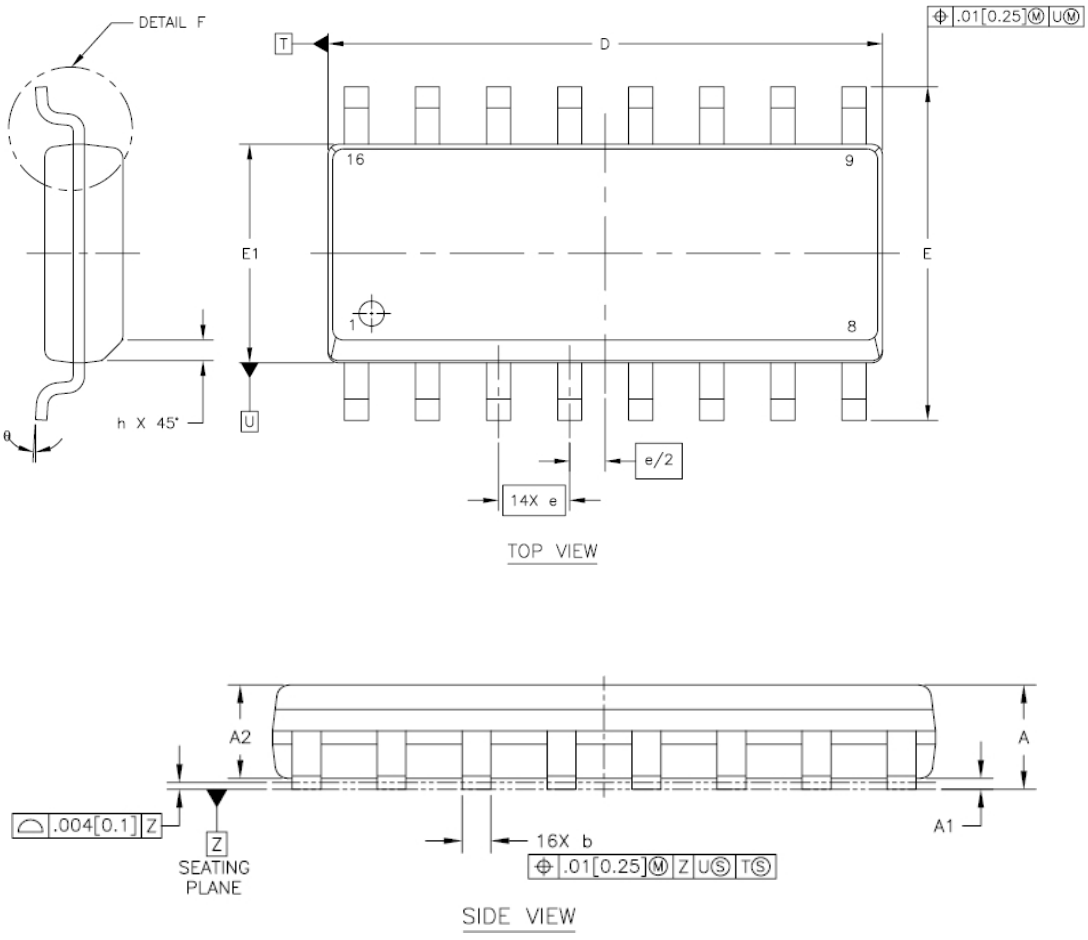
The performance indicators are shown in Table 2:

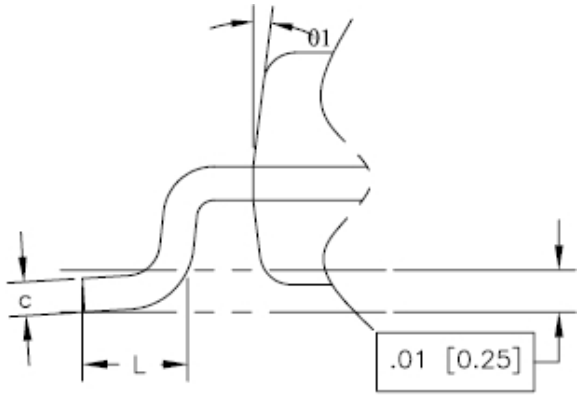
Supply voltage (AVDD, DVDD)	3V-5.5V
operating temperature	-40℃-85℃
Operating Current	5.3mA
Sleep current (power down)	0.3mA
Measuring range	5.6 meters
Ultrasonic emission frequency	40KHZ
Detection accuracy	0.3cm + 1%
Measurement blindness	Less than 2cm

Table 2: CS100A Performance Specifications

6. Package Size

The CS100A is available in a SOP16 package and the dimensional drawing is shown below:





DETAIL F
ROTATED 90° CCW
SCALE: 20/1

DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NOM	MAX	MIN	NOM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		---	1.25		---
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	c	.007		.010	0.19		0.25
BODY SIZE	D	.386		.394	9.80		10.00
	E1	.150		.157	3.80		4.00
	E	.228		.244	5.80		6.20
LEAD PITCH	e	.050 BSC			1.27 BSC		
	L	.016		.049	0.40		1.25
	h	.010		.020	0.25		0.50
	θ	0°		7°	0°		7°
	θ1	5°		15°	5°		15°

NOTES

1. CONTROLLING DIMENSION: MILLIMETER.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSION D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (.006) PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAM BAR PROTRUSION. ALLOWABLE DAM BAR PROTRUSION SHALL BE 0.127 (.005) TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.