Freetech CVR10 Radar Owner's Manual

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CVR10 Radar Product Specification

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Contents

CVR10 Radar

Version	Revised date	Author	Revised contents
V1.0	2020.7.1	Lv Wei	Created the first version.
V1.1	2021.4.23	Gao Shimeng	Edit English version
V1.2	2021.4.25	Gao Shimeng	Modify the condition of BSD/LCA function
V1.3	2021.5.20	Gao Shimeng	Update the maximum detection range and the diagram of FOV

Overview

This document is Freetech CVR10 millimeter wave radar product specification, which mainly illustrates CVR10 radar structure, technical indicator, and functions that can be realized.

Hardware

2.1 Structure design

CVR10 radar structure is designed as a single-box system, consisting of housing, heatsink, PCBA, shielding case, antenna cover, and etc. As shown in the figure below. Antenna cover and housing are connected by laser welding technology, forming a sealed space to protect electronic device inside, and also provides a terminal interface connector to the vehicle.

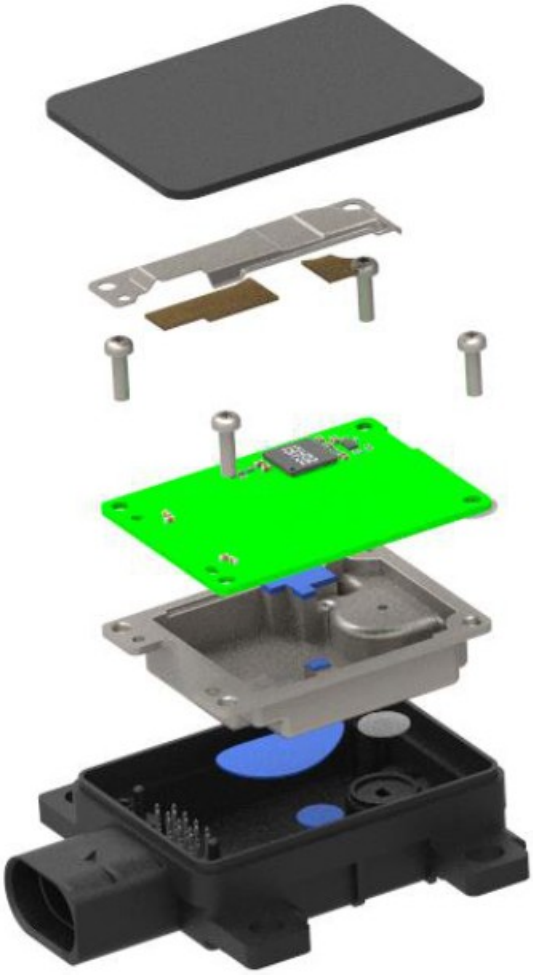

Figure 1: Structure

2.2 Circuit design

CVR10 radar uses TI's high performance radar SOC AWR1642. The hardware block diagram is shown as the figure below.

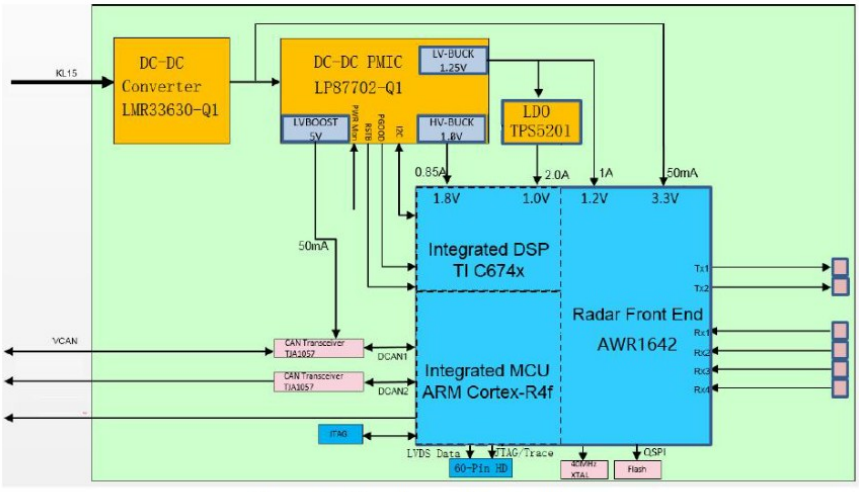

Figure2: Hardware block diagram

Dimension and Weight

CVR10 radar basic dimensions are: 91 x 78 x 20 mm. Weight is less than 100g. Specific dimension is shown as the figure below (in mm).

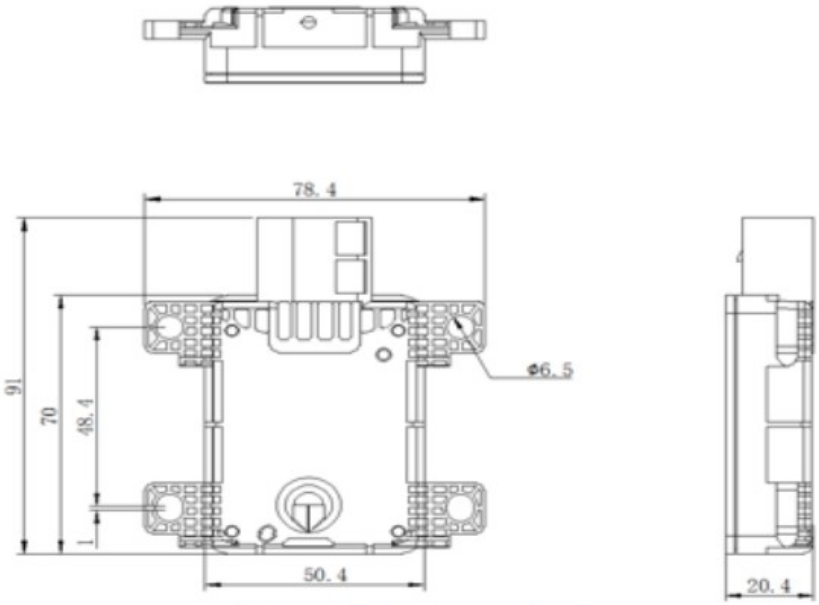

Figure 3: Dimension drawing

Interface

CVR10 radar uses 8-pin interface, and the pin positons are shown as the figure below:

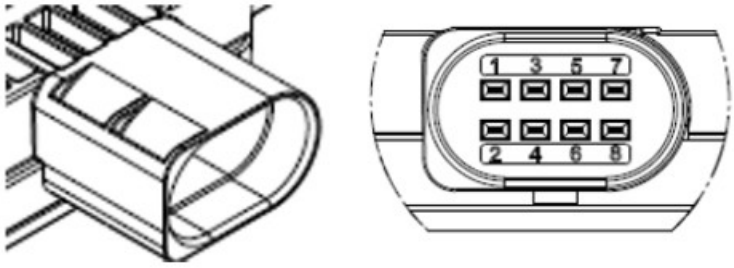

Figure 4: Interface drawing

Detailed radar connector pin definition is as below:

No.	Definition	Function Description
1	LED	LED driver (high side switch)
2	MS_SL	Master and Slave selection
3	VCAN_H	Vehicle CAN High
4	VCAN_L	Vehicle CAN Low
5	GND	Ground
6	PCAN_H	Private CAN High
7	PCAN_L	Private CAN Low
8	PWR	Power supply

Note: vehicle CAN supports standard CAN communication, and private CAN supports both standard CAN communication and CAN-FD communication.

Electrical and Environment Parameters

5.1 Power dissipation

With 12V power supply, CVR10 radar current and power dissipation are shown as the table

	Sleep state	Normal	Max Value
Current	<100uA	220mA	260mA
Power		2.7W	<3W

Table2: Current and power

5.2 Working state under different voltages

Under different voltages, CVR10 radar working states are shown as the table below:

Voltage	Communication state	Hardware monitor
6.5V	Unable to communicate	Unable to monitor
6.5V~9V	Normal	Normal (DCT 'undervoltage' being stored)
9V~16V	Normal	Normal
16V~32V	Normal	Normal DCT 'overvoltage' being stored
32V	Unable to communicate	Unable to monitor

Table3: Working state table

5.3 Environment parameters

CVR10 radar related environment parameters are as below:

1. Storage temperature: -40℃ ~ 105℃
2. Operating temperature: -40℃ ~ 85℃
3. Function limited operating temperature: 85℃ ~ 95℃

Radar perception performance

CVR10 radar can detect object with RCS (radar cross-section) between – 10~+ 40dBsm.
Perception performance parameter table is shown as below:

Parameter		Value
Period		50ms
Objects number		64
Distance	Max distance	110m
	Min distance	0.36m
	Accuracy	0.09m
	Resolution	0.36m
Velocity	Relative velocity	-55m/s—+55m/s
	Accuracy	0.05m/s
	Resolution	0.28m/s
FOV	Azimuth	-75~75°
	Accuracy	0.2°@0° 1 °@±45°
	Resolution	7°
	Elevation	None
Self-calibration		±3° Azimuth

Table 4: Performance parameter table

Maximum detect distance for variant type objects in different FOV is shown as the table below:

Azimuth	**Sedan**	**Motorcycle**	**Bicycle**	**Pedestrian**
	10dBsm	**5dBsm**	**0dBsm**	**-7dBsm**
0°	110m	81m	70m	60m
+/-9°	110m	81m	65m	55m
+/-20°	110m	81m	60m	50m
+/-45°	110m	65m	55m	40m

Table5: Maximun detected range for variant objects

FOC is shown as the figure below:

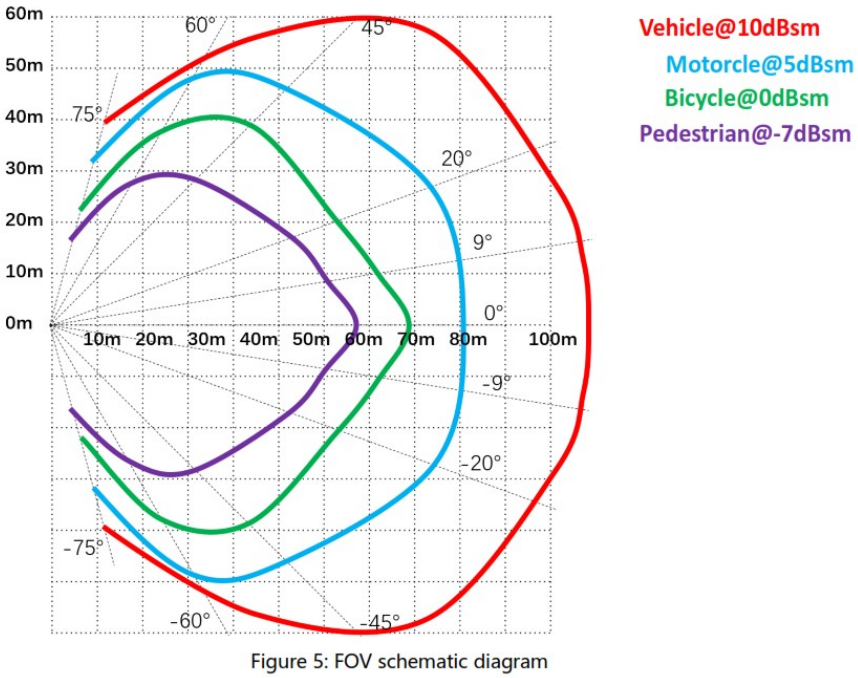

Figure 5: FOV schematic diagram

Figure 5: FOV schematic diagram

Radar application function

CVR10 radar can realize DOW, BSD, LCA, RCTA, RCW and etc. Function false positive rate and false negative rate are both less than 1%.

7.1 DOW

During ego vehicle being standstill or driving in very low velocity, when object is approaching ego vehicle rapidly from the rear direction, this function will trigger warning level 1. When vehicle door is opened, this function will trigger warning level 2. AUTOSAR network management is supported, and DOW function can work continuously for several minutes after ignition off.

Triggering condition is as below:

- 0≤Ego vehicle≤5kph
- TTC<3s
- Object velocity>1m/s
- The intersection angle between object vehicle trajectory and ego vehicle < 30°
- The vehicle door status is unlocked

7.2 BSD/LCA

When object is entering blind spot zone or approaching ego vehicle rapidly from side rear direction, this function can trigger level 1 warning. When level 1 warning condition is satisfied, the level 2 warning will be triggered if the driver enable the turn indicator light.

Triggering condition is as below:

- Gear position: Drive gear
- 0≤Ego vehicle≤150kph
- For BSD function, object is in blind spot zone; For LCA function, TTC<3.5s, and object is in alert zone
- Turning radius>125m
- Object velocity>1m/s

7.3 RCTA

During ego vehicle driving in reverse direction, while object is crossing in side rear direction, if there is collision risk, RCTA will be triggered. This function can support sidelong parking scenario, with angle up to 45°.

Triggering condition is as below:

- Gear position: Reverse gear
- 0≤Ego vehicle≤150kph
- TTC<3.5s
- Object velocity>1m/s
- 2m<collision point<-4m
- The object is in the alert zone

7.4 RCW

When object is approaching ego vehicle rapidly from rear direction, this function can trigger warning, supporting level 1 and level 2 warning.

Triggering condition is as below:

- Gear position: Drive gear
- 0≤Ego vehicle≤150kph
- TTC<1.4s (warning level 1), TTC<0.8s (warning level 2)
- Relative velocity between ego vehicle and object vehicle is more than 10kph
- Overlap ratio for ego vehicle and object vehicle is more than 0.9m

Appendix

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Freetech Intelligent Systems Co., Ltd.

Documents / Resources

	**Freetech CVR10 Radar** [pdf] Owner's Manual CVR10 Radar, CVR10, Radar

References

- **User Manual**