Freetech
Intelligent Systems Co.,Ltd.

CVR10 雷达产品规格书

CVR10 Radar Product Specification

V1.3

目　　录 Contents

修订记录 Revised Record

版本号 Version	修订日期 Revised date	修订人 Author	修订内容 Revised contents
V1.0	2020.7.1	吕威 Lv Wei	初始建立. Created the first version.
V1.1	2021.4.23	高仕猛 Gao Shimeng	建立中英对照 Edit English version
V1.2	2021.4.25	高仕猛 Gao Shimeng	修改 BSD/LCA 功能触发条件的翻译文本。 Modify the condition of BSD/LCA function
V1.3	2021.5.20	高仕猛 Gao Shimeng	更新最大探测距离，更新 FOV 示意图。 Update the maximum detection range and the diagram of FOV

1 概述 Overview

本文档是福瑞泰克 CVR10 毫米波雷达产品规格书，主要是说明 CVR10 雷达的产品结构、技术指标和实现功能等信息。

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

2 硬件 Hardware

2.1 结构设计 Structure design

CVR10 雷达产品结构设计为一个单箱系统，雷达由外壳、散热器、PCBA、屏蔽壳、天线罩等组成，如下图所示。其中，天线罩与外壳通过激光焊接工艺连接，形成密闭空间保护内部电子器件，并提供了一个与整车相连的接插件端子接口。

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.

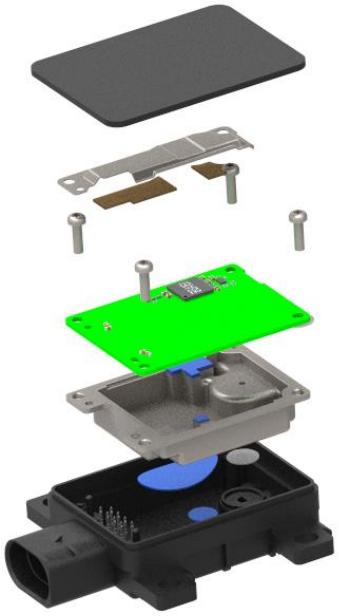

图 1：结构图

Figure 1: Structure

2.2 电路设计 Circuit design

CVR10 雷达主芯片采用 TI 高性能雷达 SOC AWR1642，硬件框图如下所示。

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

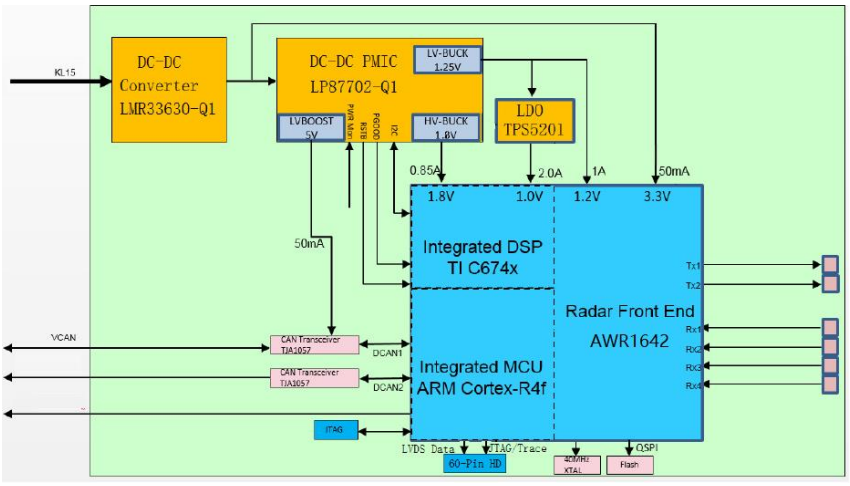

图 2：硬件框图

Figure2: Hardware block diagram

3 尺寸及重量 Dimension and Weight

CVR10 雷达基本尺寸为: 91 x 78 x 20 mm。重量＜100g。具体尺寸如下图所示（单位 mm）。

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).

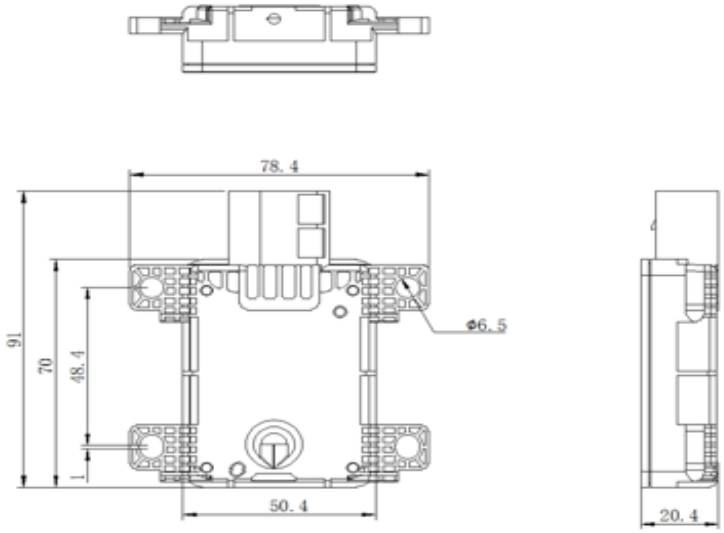

图 3：尺寸图

Figure 3: Dimension drawing

4 接口 Interface

CVR10 雷达采用 8pin 接口，位置如下所示：

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

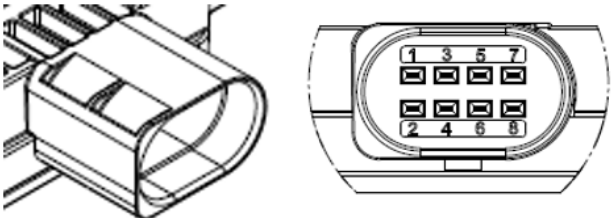

图 4：接口图

Figure 4: Interface drawing

雷达连接器针脚详细定义如下：

Detailed radar connector pin definition is as below:

编号 **No.**	**定义** **Definition**	**功能描述** **Function Description**
1	LED	LED 驱动（高边驱动） LED driver (high side switch)
2	MS_SL	主从区分 Master and Slave selection
3	VCAN_H	整车 CAN High Vehicle CAN High
4	VCAN_L	整车 CAN Low Vehicle CAN Low
5	GND	地 Ground
6	PCAN_H	私有 CAN High Private CAN High
7	PCAN_L	私有 CAN Low Private CAN Low
8	PWR	电源 Power supply

表 1:引脚定义表

Table1: Pin defination

其中，整车 VCAN 支持标准 CAN 通信，私有 PCAN 同时支持标准 CAN 通信和 CAN-FD 通信。

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

5 电气及环境参数 Electrical and Environment Parameters

5.1 功耗 Power dissipation

CVR10 雷达在 12V 供电时，电流和功耗如下表：

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

below:

	休眠状态 Sleep state	正常状态 Normal	最大值 Max Value
电流 Current	<100uA	220mA	260mA
功率 Power	-	2.7W	<3W

表 2：电流和功耗表

Table2: Current and power

5.2 不同电压工作状态 Working state under different voltages

CVR10 雷达在不同电压下的工作状态如下表：

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

电压 Voltage	通信 Communication state	硬件监控 Hardware monitor	过压保护 Over-voltage protection
＜6.5V	无法通讯 Unable to communicate	无法监控 Unable to monitor	不激活 Inactive
6.5V~9V	正常 Normal	正常（存储故障“欠压”） Normal (DCT ‘undervoltage’ being stored)	不激活 Inactive
9V~16V	正常 Normal	正常 Normal	不激活 Inactive
16V~32V	正常 Normal	正常（存储故障“过压”） Normal （DCT ‘overvoltage’ being stored)	不激活 Inactive
＞32V	无法通讯 Unable to communicate	无法监控 Unable to monitor	激活 Active

表 3：工作状态表

Table3: Working state table

5.3 环境参数 Environment parameters

CVR10 的相关温度参数如下：

CVR10 radar related environment parameters are as below:

1) 存储温度：-40℃ ~ 105℃
   Storage temperature: -40℃ ~ 105℃
2) 工作温度：-40℃ ~ 85℃
   Operating temperature: -40℃ ~ 85℃
3) 功能限制工作温度：85℃ ~ 95℃
   Function limited operating temperature: 85℃ ~ 95℃

6 雷达感知性能 Radar perception performance

CVR10 雷达可以探测 RCS（雷达反射截面积）在- 10~+ 40dBsm 的目标。

CVR10 radar can detect object with RCS (radar cross-section) between - 10~+ 40dBsm.

探测性能参数表如下所示：

Perception performance parameter table is shown as below:

参数 Parameter		指标 Value
周期 Period		50ms
目标数 Objects number		64
距离测量 Distance	最大距离 Max distance	110m
	最小距离 Min distance	0.36m
	精度 Accuracy	0.09m
	分辨力 Resolution	0.36m
速度测量 Velocity	相对速度 Relative velocity	-55m/s~+55m/s
	精度 Accuracy	0.05m/s
	分辨力 Resolution	0.28m/s
视场 FOV	水平 Azimuth	-75°~+75°
	精度 Accuracy	0.2°@0° 1°@±45°
	分辨力 Resolution	7°
	垂直 Elevation	无 None
自标定 Self-calibration		±3° 水平 ±3° Azimuth

表 4：性能指标参数表

Table 4: Performance parameter table

不同类型目标在不同方位的最大探测范围如下表：

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

水平角度 Azimuth	轿车 Sedan	摩托车 Motorcycle	自行车 Bicycle	行人 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

表 5：不同类型目标最大探测范围

Table5: Maximun detected range for variant objects

FOV 如下图所示：

FOC is shown as the figure below:

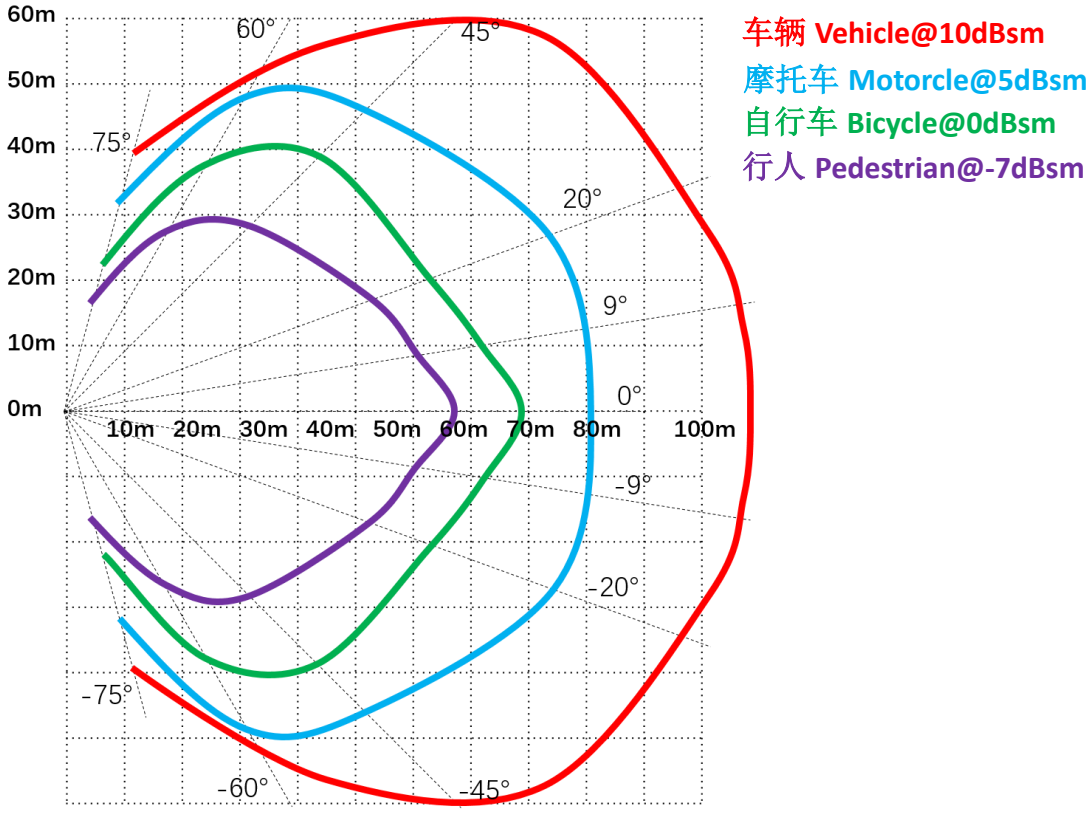

图 5：FOV 示意图

Figure 5: FOV schematic diagram

7 雷达应用功能 Radar application function

CVR10 雷达可以实现 DOW、BSD、LCA、RCTA、RCW 等功能，功能的误报和漏报率<1%。

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

主车静止或者速度极低时，当目标从侧后方快速接近时，该功能会触发一级报警。当车门被打开后，触发二级报警。支持 AUTOSAR 网络管理，下电后，DOW 可继续工作数分钟。

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.

触发条件如下：

Triggering condition is as below:

- 0≤主车速度≤5kph
  0≤Ego vehicle≤5kph
- TTC<3s
- 目标速度>1m/s
  Object velocity>1m/s
- 目标车轨迹与主车夹角<30°
  The intersection angle between object vehicle trajectory and ego vehicle < 30°
- 车门处于解锁状态
  The vehicle door status is unlocked

7.2 BSD/LCA

当目标进入盲区或者从侧后方快速接近时，该功能一级报警会触发。当满足一级报警时，驾驶员打同侧转向灯，会触发二级报警。

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.

触发条件如下：

Triggering condition is as below:

- 挡位：D 档
  Gear position: Drive gear
- 15≤主车速度≤150kph
  0≤Ego vehicle≤150kph

- 目标在盲区（BSD）/TTC<3.5s 且在报警区域(LCA)
- For BSD function, object is in blind spot zone; For LCA function, TTC<3.5s, and object is in alert zone
- 转弯半径>125m
  Turning radius>125m
- 目标速度>1m/s
  Object velocity>1m/s

7.3 RCTA

主车倒车时，当目标在主车侧后方横穿时，如果存在碰撞风险，该功能会触发。可支持斜停场景，角度达到 45°。

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°.

触发条件如下：

Triggering condition is as below:

- 挡位：R 档
  Gear position: Reverse gear
- 0≤主车速度≤15kph
  0≤Ego vehicle≤150kph
- TTC<3.5s
- 目标速度>1m/s
  Object velocity>1m/s
- 2m<碰撞点<-4m
  2m<collision point<-4m
- 目标在报警区域内
  The object is in the alert zone

7.4 RCW

当目标从正后方快速接近主车时，该功能会触发报警，支持一级报警和二级报警。

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

触发条件如下：

Triggering condition is as below:

- 挡位：D 档
  Gear position: Drive gear
- 0≤主车速度≤150kph
  0≤Ego vehicle≤150kph

- TTC<1.4s（一级报警）， TTC<0.8s（二级报警）
  TTC<1.4s (warning level 1), TTC<0.8s (warning level 2)
- 自车与目标车相对速度大于 10kph
  Relative velocity between ego vehicle and object vehicle is more than 10kph
- 目标车与自车重合度大于 0.9m
- Overlap ratio for ego vehicle and object vehicle is more than 0.9m

8 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.