

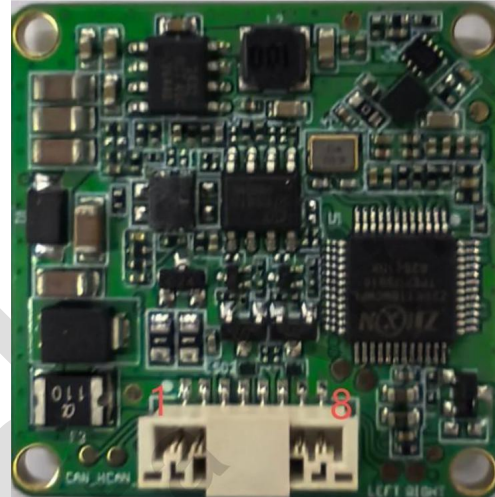
BD4104B-C01

Data Sheet 规格书

BD4104B-C01

BSD Radar Module Specification

盲区检测雷达模块规格书



Description / 功能概述

BD4104B-C01 is a 77–81GHz FMCW radar module designed for blind spot detection (BSD) applications. The module integrates RF transceiver, 2T2R PCB antenna, radar signal processing unit, and a high-performance automotive-grade MCU.

BD4104B-C01 是一款工作于 77–81GHz 的 FMCW 毫米波雷达模块，专为盲区检测（BSD）应用设计。模块集成射频收发系统、2T2R PCB 微带天线、雷达信号处理单元以及高性能车规级 MCU。

With advanced FMCW signal processing and target detection algorithms, it provides high-sensitivity detection for low-speed vehicles and vulnerable road users.

The module supports multiple communication interfaces including CAN, RS485, and TTL UART, and provides direct LED driver outputs for left/right warning indication.

Installed at the rear of the vehicle, it can effectively detect moving targets within the rider's blind spot area and provide real-time safety assistance during driving.

基于 FMCW 调频连续波体制及目标检测算法，可实现对低速车辆及弱目标的高灵敏度探测。

模块支持 CAN、RS485 及 TTL UART 等多种通信接口，并提供左右 LED 报警灯直接驱动输出。

产品安装于车辆尾部，可对骑行者视野盲区内的运动目标进行实时检测，为行驶安全提供辅助保障。

Features / 产品特性

- 77–81GHz FMCW radar technology for precise motion detection
采用 77–81GHz FMCW 毫米波雷达技术，实现精准运动检测
 - Integrated RF transceiver, 2T2R antenna, and signal processing unit
集成射频收发系统、2T2R 天线及信号处理单元
 - High sensitivity and reliable detection for low-speed vehicles and vulnerable road users
对低速车辆及弱目标具备高灵敏度与高可靠性检测能力
 - Wide detection coverage: $\pm 60^\circ$ horizontal, $\pm 15^\circ$ vertical
探测范围广：水平 $\pm 60^\circ$ ，俯仰 $\pm 15^\circ$
 - Long detection range with stable performance in complex environments
探测距离远，在复杂环境下性能稳定
 - High accuracy in distance, speed, and angle measurement
距离、速度及角度测量精度高
 - Multi-interface support: CAN, RS485, and TTL UART
支持 CAN、RS485、TTL UART 多种通信接口
 - Built-in left/right LED driver outputs for direct warning indication
内置左右 LED 报警灯驱动，可直接输出指示信号
 - Compact size for easy system integration
模块体积小，便于系统集成
 - Strong resistance to environmental interference (light, dust, temperature, humidity)
抗环境干扰能力强（不受光照、灰尘、温湿度等影响）
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Applications / 应用领域

The BD4104B-C01 radar module is designed for blind spot detection and rear safety applications, providing reliable target detection for low-speed and urban mobility vehicles.

BD4104B-C01 雷达模块主要用于盲区检测及后向安全应用,可为低速车辆及城市出行设备提供可靠的目标检测能力。

Typical applications include:

典型应用包括:

- Low-speed vehicles (electric bicycles, scooters, tricycles)

低速车辆 (电动自行车、滑板车、电动三轮车)

- Light motorcycles and urban mobility vehicles

轻型摩托车及城市出行车辆

- Blind spot detection (BSD) systems

盲区检测系统 (BSD)

- Lane change assist (LCA) systems

并线辅助系统 (LCA)

- Rear collision warning (RCW) systems

后向防碰撞预警系统 (RCW)

- Smart transportation and safety systems

智能交通及安全感知系统

- Special-purpose vehicles and industrial equipment

特种车辆及工业设备

Product Specification / 产品规格

- Functional Specifications / 功能参数

The following table summarizes the key functional parameters of the radar module.

下表列出了该雷达模块的主要功能参数。

Parameter / 参数	Specification / 指标
Operating Mode / 工作模式	FMCW

Operating Frequency / 工作频率		77-81 GHz
Antenna Configuration / 天线通道		2Tx, 2Rx
Detection Range/ 测距离	Vehicle 10 dBsm/汽车	40 m
	E-bike 0 dBsm/电动自行车	25 m
	Pedestrian -7 dBsm/行人	15 m
Speed Detection Range / 探测速度范围		-144 km/h ~ +144 km/h
EIRP / 等效全向辐射功率		< 22 dBm
Detection Angle (Horizontal) 探测角度（水平）		-60° ~ +60°
Distance Accuracy / 距离测量精度		±0.5 m
Speed Accuracy / 速度测量精度		±0.5 m/s
Angle Accuracy / 角度测量精度		±3°
Range Resolution / 距离分辨率		1.5m
Max Target Number / 最大目标数量		16
Data Refresh Rate / 数据刷新时间		100 ms
Interface / 通讯接口		CAN

• Electrical Specifications / 电气参数

Parameter / 参数	Min/最小	Typ/典型	Max/最大	Unit/单位
Operating Voltage (VCC) 工作电压（VCC）	9	12	16	v
Operating Current (ICC) 工作电流（ICC）			600	mA
Operating Temperature (TOP)	-20		85	°C

工作温度 (TOP)				
Storage Temperature (TST) 存储温度 (TST)	-45			°C

• RF Specifications / 射频参数

Parameter / 参数	Min/最小	Typ/典型	Max/最大	Unit/单位
Operating Frequency 工作频率	77		81	GHz
Output Power (Pout) 发射功率		12		dBm
Antenna Gain 天线增益		9		dBi
Horizontal Beamwidth (-3 dB) 水平波束 (-3 dB)	-60		60	°
Vertical Beamwidth (-3 dB) 垂直波束 (-3 dB)	-15		15	°

Functional Characteristics / 功能特性

1. Radar Operating Principle / 雷达工作原理

The module operates based on FMCW (Frequency Modulated Continuous Wave) radar

technology. By transmitting and receiving modulated signals, the system calculates target distance, speed, and angle through signal processing algorithms.

本模块基于 FMCW（调频连续波）雷达体制工作，通过发射与接收调制信号，结合信号处理算法，实现对目标距离、速度及角度的测量与识别。

2. Target Detection Capability / 目标检测能力

The radar module provides high-sensitivity detection for moving targets within the coverage area, including vehicles, two-wheelers, and pedestrians, even under complex environmental conditions.

该雷达模块可在覆盖范围内对运动目标进行高灵敏度检测，包括车辆、两轮车及行人，并可在复杂环境下保持稳定性能。

3. Multi-Target Tracking / 多目标检测能力

The system supports simultaneous detection and tracking of multiple targets, providing real-time updates of target position, speed, and movement direction.

系统支持多目标同时检测与跟踪，可实时输出目标的位置、速度及运动方向信息。

4. Interface & Output Function / 接口与输出功能

The module supports CAN, RS485, and TTL UART communication interfaces for data transmission. It also provides direct left/right LED driver outputs for visual warning indication.

模块支持 CAN、RS485 及 TTL UART 通信接口，用于数据传输，同时提供左右 LED 报警灯驱动输出，可直接用于警示提示。

5. Environmental Adaptability / 环境适应能力

The radar module is insensitive to environmental factors such as lighting, dust, temperature, and humidity, ensuring stable performance in various operating conditions.

该雷达模块不受光照、灰尘、温湿度等环境因素影响，可在多种复杂工况下稳定工作。

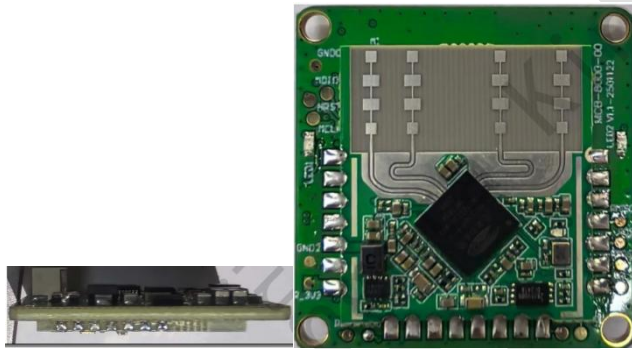
Mechanical Dimensions / 机械尺寸

1. Dimensions/外形尺寸

Mechanical dimensions are shown as follows. All dimensions are in millimeters unless otherwise specified.

产品机械尺寸如下，除特别说明外，单位均为毫米。

Size/尺寸: 32*32*9mm



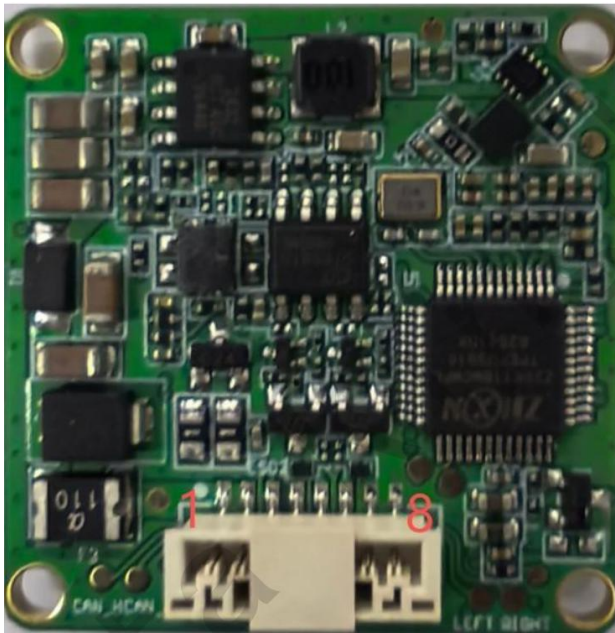
2. Pin Definition / 引脚定义

Connector Type: Board-to-wire connector

接口类型: 板对线连接器

Pin/引脚	Name/名称	Description/描述	Remark/备注
1	VCC	12V Power Input / 12V 电源输入	
2	VCC	12V Power Input / 12V 电源输入	
3	CAN_H	CAN High Signal / CAN 高电平信号线	
4	CAN_L	CAN Low Signal / CAN 低电平信号线	
5	LEFT	Left-side warning output, +12V high-side driver, 右侧报警输出, +12V 阳极驱动	can directly drive indicator LED 可直接驱动指示灯

6	RIGHT	Right-side warning output, +12V high-side driver, 右侧报警输出, +12V 阳极驱	can directly drive indicator LED 可直接驱动指示灯
7	GND	Power Ground / 电源地	
8	GND	Power Ground / 电源地	



Functional Definition / 功能定义

1. Self-Test Function / 自检功能

After power-on and initialization, the radar module performs a self-test procedure. A “Self-test OK” message will be reported once the system is ready, after which the module starts normal detection.

雷达上电初始化完成后，会自动执行自检流程。

系统正常时将输出“自检 OK”报文，随后进入正常探测状态。

2. Detection Area Definition / 探测区域定义

The detection area is defined relative to the rear center of the host vehicle.

探测区域以本车车尾中心为参考坐标原点：

X: Horizontal distance (left is negative, right is positive)

X: 横向距离（左侧为负，右侧为正）

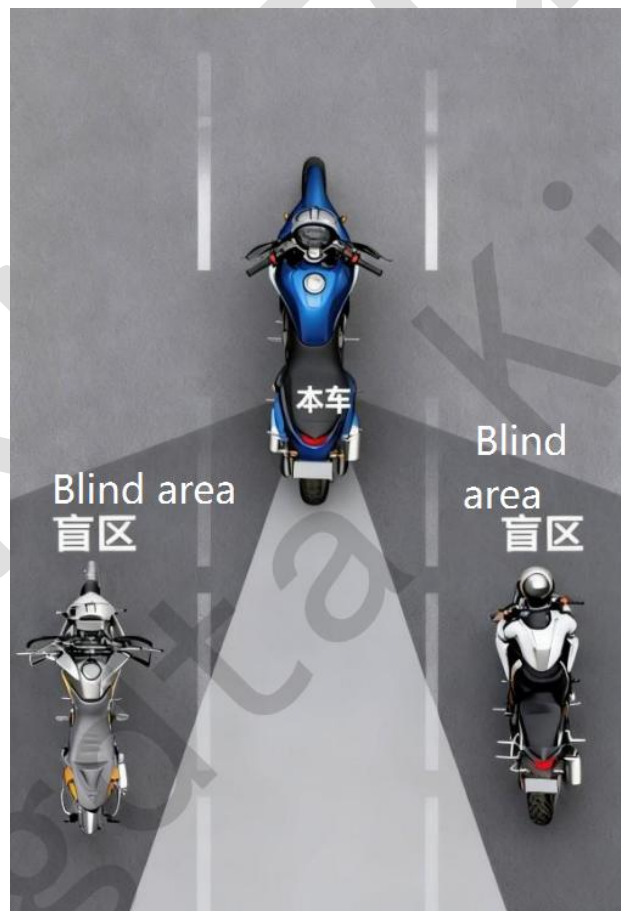
Y: Longitudinal distance (rearward direction is positive)

Y: 纵向距离（车后方向为正）

3. Blind Spot Detection (BSD) / 盲区监测功能

The BSD function detects targets in the blind spot area and provides warning signals to assist safe driving.

BSD 功能用于检测车辆盲区内的目标，并提供预警信息以辅助安全驾驶。



- Activation speed: $V \geq 10$ km/h

启动速度: $V \geq 10$ km/h

- Detection range 探测范围:

- Horizontal 横向: $1 \text{ m} \leq |X| \leq 4.4 \text{ m}$

- Longitudinal 向: $0 \text{ m} \leq Y \leq 10 \text{ m}$

- Detection logic 探测逻辑:

Moving targets within the detection zone will trigger warnings

区域内存在运动目标即触发报警

- Warning strategy (requires vehicle system cooperation)报警策略（需车机协同）:

- Level 1 Warning 一级报警:

When a target is detected, left/right indicator outputs fast flashing signals

检测到目标时，对应方向指示灯快速闪烁

- Level 2 Warning 二级报警:

When a target is detected and the turn signal is activated, the corresponding indicator flashes rapidly to alert the driver

检测到目标且开启转向灯时，对应方向指示灯快速闪烁提醒

- Function description 功能说明:

Provides warning when vehicles approach from adjacent lanes or during overtaking,

helping prevent unsafe lane changes.

当相邻车道后方有车辆接近或处于盲区时，提醒驾驶者避免危险变道。

4. Lane Change Assist (LCA) / 并线辅助功能

The LCA function monitors fast-approaching targets from rear lanes and provides early warnings.

LCA 功能用于检测后方快速接近的目标，并提供提前预警。

- Detection range 探测范围:

- Horizontal 横向: $1 \text{ m} \leq |X| \leq 4.4 \text{ m}$

- Longitudinal 纵向: $0\text{ m} < Y \leq 40\text{ m}$



- Warning condition: $TTC \leq 6.0\text{ s}$ (requires vehicle system cooperation)

预警条件: $TTC \leq 6.0\text{ s}$ (需车机协同)

- Warning strategy 报警策略: :

- Level 1 Warning 一级报警:

slow flashing indicator when a target is detected 检测到目标时, 指示灯慢闪提示

- Level 2 Warning 二级报警:

rapid flashing when turn signal is activated 开启转向灯时, 指示灯快速闪烁

- Function description 功能说明:

Provides warning when vehicles are approaching quickly from adjacent lanes,

helping prevent unsafe lane changes.

当后方车辆快速接近时, 提醒驾驶者避免变道风险。

5. Rear Collision Warning (RCW) / 后向防碰撞功能

The RCW function detects targets approaching directly from behind and provides collision warning.

RCW 功能用于检测车辆正后方接近目标, 并提供防碰撞预警。



- Detection range 探测范围:

- Horizontal 横向: $-1\text{ m} \leq |X| \leq 1\text{ m}$

- Longitudinal 纵向: $0\text{ m} < Y \leq 40\text{ m}$

- Warning condition 预警条件:

TTC $\leq 6.0\text{ s}$ (requires vehicle system cooperation)

TTC $\leq 6.0\text{ s}$ (需车机协同)

- Warning strategy 报警策略:

When a target is detected, warning indicators flash simultaneously to alert the driver.

检测到目标时，警示灯双闪提醒

- Function description 功能说明:

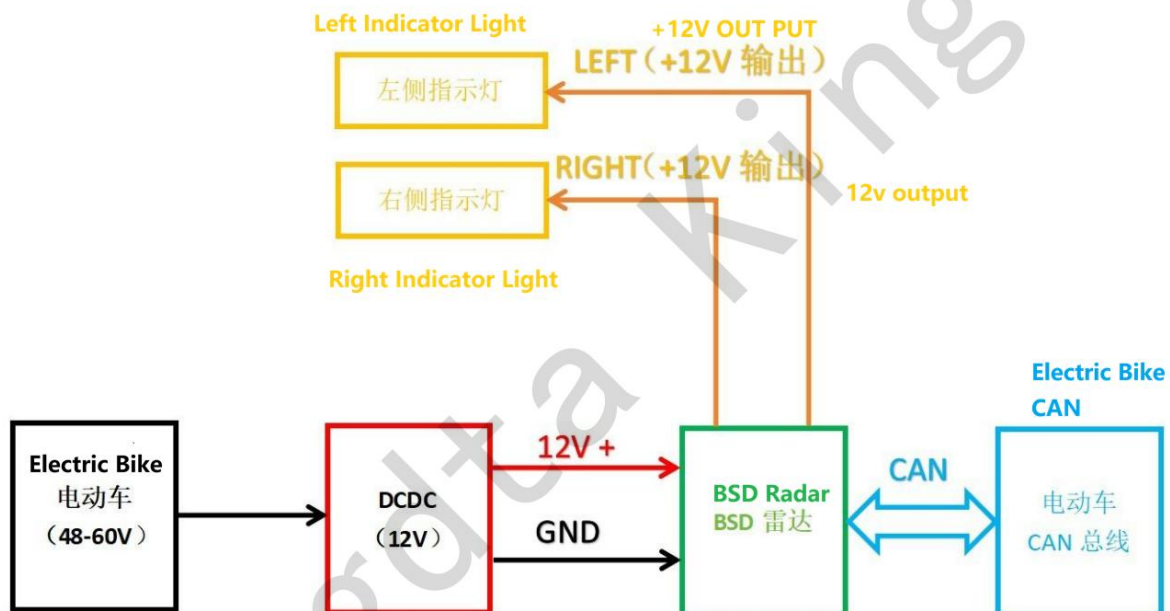
Provides warning when a rear vehicle is approaching rapidly, helping reduce the risk of rear-end collision.

当后方车辆快速接近时，提醒驾驶者降低追尾风险。

Installation / 安装说明

The radar module should be installed at the rear of the vehicle, facing backward, to ensure proper blind spot detection performance.

雷达模块应安装在车辆尾部，朝向车辆后方，以保证盲区检测效果。



- Installation position 安装位置:
Rear side of the Bike 车辆后侧
- Installation height 安装高度:
30 cm to 100 cm above ground 距地面 30 cm~100 cm
- Installation orientation 安装方向:
Horizontal alignment recommended 建议水平安装
- Angle tolerance 安装角度公差:
 - Azimuth (horizontal): $\leq \pm 5^\circ$
方位角（水平）： $\leq \pm 5^\circ$

- Elevation (vertical): $\leq \pm 5^\circ$
俯仰角（垂直）： $\leq \pm 5^\circ$
 - Installation requirements 安装要求:
 - The radome (cover in front of the radar) must be made of non-metallic materials
雷达前方罩盖必须为非金属材料
 - No metal coating is allowed on the cover
罩盖表面不得含金属涂层
 - No metal objects (e.g., frame, wiring harness) should be present between radar and cover
雷达与罩盖之间不得有金属物体（如车架、线束等）
 - Radome distance 罩盖距离要求:
 - Recommended distance between radar and cover: multiples of 1.94 mm
雷达与罩盖之间距离建议为 1.94 mm 的整数倍
 - Optimal distance: 1×1.94 mm
最佳距离为 1×1.94 mm
 - Maximum distance: ≤ 10 mm
最大不超过 10 mm
-

Notes & Safety Instructions/注意事项

1. The detection range may vary depending on target characteristics (RCS) and environmental conditions. Variation within a certain range is normal.

探测距离受目标反射特性（RCS）及环境因素影响，在一定范围内波动属于正常现象。

2. The module requires a stable power supply. Recommended input voltage: 9–16V, with current capability ≥ 1 A.

雷达对电源要求较高，建议输入电压 9–16V，电流能力 ≥ 1 A。

3. The radar module can be installed inside the vehicle body, but the covering material must meet RF transmission requirements.

雷达可安装于车体内部，但罩盖材料需满足电磁波透过要求

4. Avoid placing metal objects in front of the antenna area, as it may affect detection performance.

雷达天线前方应避免金属遮挡，否则会影响探测性能。

5. Ensure correct installation angle and position to achieve optimal performance.

请确保安装角度与位置符合要求，以保证最佳检测效果

6. Improper installation may result in degraded detection accuracy or missed detection.

不规范安装可能导致检测精度下降或漏检。