Nova IOT

Specification

Product Name/产品名称: NOVA77GB-T

Description/描述: BSD & LCA & DOW & RCTA & RCW function of 77GHz millimeter-wave radar

Version/版本: A0

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Revision History 修订历史

Revision 修订	*Draft Date 改动日期*	*History 历史*
A0	2021/11/23	The first edition/初版

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目录

1. Overview/概况 4
1.1 Purpose/目的 4
1.2 Scope/范围 4
1.3 Glossary and Abbreviations/术语和缩略语 4
1.4 Design Standard/设计标准 5
1.4.1 Design Standard/设计标准 5
1.4.2 Test Standard/测试标准 6
2 System Description/系统概述 11
2.1 System composition and parts function/系统组成及零部件功能简述 11
2.2 Connector Description/接插件说明 15
2.2.1 ECU Connector Schematic Diagram/ ECU 端接插件示意图 15
2.2.2 ECU Connector Definition/ECU 端接插件定义 16
2.3 Operating Voltage/工作电压 17
3 Function Description/功能说明 18
3.1 Functions/功能 18
3.1.1 Functions description/功能说明 18
3.1.2 Functional Requirements/功能描述 18
3.2 Communication/通讯 30
3.2.1 CAN Communication Description/ CAN 总线功能说明 30
3.2.2 LIN Communication Description/ LIN 总线功能说明 31
4 Performance Index/性能指标 31
4.1 Electrical Performance Requirements/电气性能要求 31
4.1.1 Power Supply/电源 31
4.1.2 Ground Connection Requirements/接地要求 31
4.1.3 Bus Connection/总线连接 31
4.2 Environment Requirements/环境要求 32
4.3 Weight/重量 32
5 Design Service Life/设计使用寿命 32

1. Overview/概况

1.1 Purpose/目的

The purpose of this document should be used for functional design and validation of the product Radar Sensor.
本文档的目的应用于产品雷达传感器的功能设计和验证。

1.2 Scope/范围

This document is applicable for the whole life cycle of RADAR SENSOR.
本文档适用于雷达传感器的整个生命周期。

1.3 Glossary and Abbreviations/术语和缩略语

No./序号	Abbreviations/缩写	Description/释义
1	ASIC	Application Specific Integrated Circuit/专用集成电路
2	BIST	Built In Self-Tes/内部自测试
3	BSD	Blind Spot Detection/盲点检测
4	CAN	Controller Area Network/控制器局域网络
5	DIN	Deutsches Institut für Normung e.V. German Institute for standardization/德国标准化学会
6	DOW	Door Open Warning/开门预警
7	ECU	Electronic Control Unit/电控单元
8	EMC	Electro Magnetic Compatibility/电磁兼容性
9	ESP	Electronic Stability Program/电子稳定程序
10	FMCW	Frequency-Modulated Continuous Wave/调频连续波
11	FOV	Field of View/视野
12	HBA	Hydraulic Braking Assist/液压制动辅助
13	HMI	Human Machine Interface/人机接口
14	ISO	International Standard Organized/国际标准化组织
15	LCA	Lane Change Assist/变道辅助
16	MRR	Medium Range Radar/中距离雷达
17	MMIC	Monolithic Microwave Integrated Circuit/单片微波集成电路

No./序号	Abbreviations/缩写	Description/释义
18	PCB	Printed Circuit Board/印刷电路板
19	RCS	Radar Cross-Section/雷达散射截面
20	RCTA	Rear Cross Traffic Alert/后方交通预警
21	RCW	Rear Collision Warning/后碰撞预警
22	SAE	Society of Automotive Engineers/汽车工程师学会
23	SCU	Sensor and Control Unit/传感器控制单元
24	SRR	Short Range Radar/短距离雷达
25	USRR	Ultra Short Range Radar/超短程雷达
26	VCO	Voltage Controlled Oscillator/压控振荡器
27	V+SCU	Supply Voltage of SCU/传感器控制单元供电电源

1.4 Design Standard/设计标准

1.4.1 Design Standard/设计标准

1.4.1.1Design Standard- No Regulations /设计标准-非法规类

N.A

1.4.1.2Design Standard- Regulations/设计标准-法规类

Name/名称	Item/条款
Radio regulations/ 无线电法规	EN301091 V1.3.3 (2006-11)
	CHINA Technical Specification for Micropower radio Equipments/中国微功率(短距离)无线电 设备的技术要求
CAN communication/ CAN 通信规范	ISO 11898 part 2/ part 5
	SAE J 22284
	ES-XS4T-12K259-Cx
Diagnostics regulation/ 诊断规范	ISO 14229 UDS
BSD function standards/ BSD 功能标准	SAE J 2802
LCA function standards/ LCA 功能标准	ISO 17387

1.4.2 Test Standard/测试标准

1.4.2.1 Test Standard- No Regulations/试验标准-非法规类

N.A

1.4.2.2 Test Standard- Regulations/试验标准-法规类

Test/测试	Continental Platform		
	Standard/标准	Section/部分	Test Condition/测试条件
Artificial ageing/人工老化			
Thermal Shock/ 热冲击试验	DIN EN 60068	2-14 Na	Temperature range: -40°C ~ 90°C, 35 cycles, 60mins / 温度范围：-40 °C ~ 90 °C, 35 个循环,60min。
Mechanical loads/机械负载			
Vibration/ 振动试验	DIN EN 60068	2-64	Test duration: 8h, axis (3x) Acceleration: 27,8 m/s² Frequency range: 10 Hz ~ 1000Hz Operating condition: Active mode / 测试周期：8h,3 轴向 加速度：27.8 m/s² 频率：10~1000Hz 工作条件：上电
Temperature cycles/ 高温循环试验	DIN EN 60068	2-14 Nb	Test duration: 60h (10 cycles x 6h) Temperature: -40 °C~+85°C / 温度范围：-40°C ~ 85°C，每个循环 6 小时，共进行 10 个周期，60 小时 Operating condition: Active mode, non-powered/ 工作条件：工作，非上电
Mechanical Shock/ 机械冲击实验	DIN IEC 68	2-29	Pulse shape: half-sinusoidal Acceleration: 500 m/s² Shock duration: 6ms Number of shocks: 10 per test direction (6x10) non-powered, room temperature/ 加速度 500 m/s²，冲击时间 6ms，X, Y, Z 三个坐标六个方向，每个方向冲击 10 次，非上电，室温

Drop Test/ 跌落测试	DIN EN 60068	2-32	Test surface: concrete Drop distance: 1 m Number of DUT: 3 Number of drops: min. 2 per DUT on two different sides X + Z; Y + (Z-); (X-) + (Y-) (according to Fig. C) Operating condition: Non-powered 测试表面：混凝土 掉落距离：1 m 被测件数：3 跌落次数：每分钟两次， 每个 DUT 在两个不同的侧面 X + Z; Y +（Z-）;（X-）+（Y-）（根据图 C）
Climatic loads/气候负载			
Thermal capability/ 热承受力试验	DIN IEC 68	2-2 Be	Temperature: 85 °C Test duration: 1h until reaching temperature balance Operating condition: Active mode, maximum electrical function (worst-case)/ 温度：85° C 测试时间：稳定温度 1 小时 工作条件：活动模式，最大电气功能（最坏情况）
Function at high temperature/ 高温功能试验	DIN EN 60068	2-2	Temperature: 85 °C Test duration: 24 h Operating condition: Non-powered + functional tests in active mode/ 温度：85° C 测试时间：24 小时 操作条件： 雷达处于正常工作模式

Function at low temperature/ 低温功能试验	DIN EN 60068	2-21	Temperature: -40 °C Test duration: 24 h Operating condition: non-powered + functional tests in active mode/温度：-40° C 测试时间：24 小时 操作条件： 雷达处于正常工作模式
Temperature step test/ 温阶实验	ISO 16750-4	5.2.2	Temperature range: -40 °C ... + 85 °C Temperature steps: every 5°C Temperature gradient: 1°C/min. Test duration: 1 cycle Operating condition: functional test at every temperature step 温度范围 - 40 ° C~+85 ° C，温度阶梯为 5° C，温度变化梯度为 1° C/min，在每一个温度阶梯测量雷达是否正常工作
Temperature shock air/温度冲击试验	DIN EN 60068	2-14 Na	Temperature range: -40 °C~ + 90 °C Soak time: 1h at - 40 °C and + 90 °C Transition time: < 10s Test duration: 5 cycles Operating condition: non-powered 温度范围-40 °C~+90 °C，每个周期内在最高和最低温度点分别保持 1h，然后在 10s 内完成切换，共进行 5 个周期的试验
Composite salt spray/humidity/混合盐雾湿度试验	ISO 16750-4	5.5.1	Test duration: 8cycles (56days) Cycle description: Salt spray: 2h Humidity (40°C/92%r.h): 22h 4 iterations (=4 days) Constant room climate: 3 days Operating condition: non-powered 每个周期 2h 盐雾，22h 潮湿环境（40°C/92%r.h）循环 4 天及 3 天常规环境的试验，共进行 8 个周期（56 天）

Salt spray corrosion test/盐雾腐蚀试验	DIN EN 60068	2-11	Test duration: 144h (5 cycles x 24h) Temperature: 35°C Operating condition: non-powered, active mode between 4th and 6th hour of the cycle Salt spray application: during 1st 8h of each cycle 温度+35 °C，每个周期共 24h，其中前 8h 进行盐雾腐蚀，共进行 5 个周期的试验
Other loads 其他负载			
Dust protection 防尘试验	DIN 40050-9, DIN EN 60068-2-18		Protection code: IP6Kx Test duration: 12h Operating condition: non-powered 防护代码：IP6Kx 测试时间：12h 工作条件：非上电
Water protection 防水试验	DIN 40050-9, DIN EN 60068-2-18		IPx6K,IPx7,IPx9K
Chemical resistance/化学品防护	ISO 16750-5		ISO 16750-5
EMC/电磁兼容性			
Electrostatic discharge (ESD) ／ 静电释放	ISO TR 10605 (12/2008)		Air: 15 kV,2000 , 330 pF Contact: 6 kV,150 ,330 pF
Conducted transient Immunity/ 瞬态传导抗干扰	ISO 7637-2 (2015).		Test pulse 1a,2,3a,3b,4,5b
Couple/Inductive Transient Immunity 耦合/感应传导抗干扰	ISO 7637-1、ISO 7637-3 (2015).		Test pulse A and B, wiring harness 1.5m 测试脉冲 A 和 B，线束 1.5m
Overvoltage/ 过电压	ISO 16750-2		+24V @1min, +18V @1h
Sinusoidal ripple/ 正弦波	ISO 16750-2		Voltage：13.5V 20Hz to 20kHz, sweep time 5min 电压：13.5V 20Hz 至 20kHz，扫描时间 5 分钟

Micro cutoff (dropouts) /电压瞬时跌落	ISO 16750-2		Voltage：13.5V Switch off time: 100ms 电压：13.5V 掉电时间：100ms
Voltage ramps/ 电压渐变	ISO 16750-2		Voltage：0V - 20V,20V-0V 电压：0V-20V，20V - 0V
Reverse voltage/ 反向电压	ISO 16750-2		Voltage：-14V 电压：-14V
Conducted emission/传导发射试验	CISPR 25 3rd edition		Max. power supply length 20cm 最高 电源线长度 20cm
Radiated immunity-absorber lined chamber/吸波室辐射抗扰度实验	ISO 11452-2 (2015)		Voltage：13.5 V±0.2 V Wireless length: 1.5m 电压：13.5 V±0.2 V 线束长：1.5m
Radiated immunity-Bulk Current Injection (BCI) ／大电流注入辐射抗扰度实验	ISO 11452-2 (2015)		Voltage：13.5 V±0.2 V Wireless length：1.5m 电压：13.5 V±0.2 V 线束长：1.5m
Radiated emission-absorber lined chamber/ 吸波室辐射抗扰度实验	ISO 11452-2 (2015)		Voltage：13.5 V±0.2 V Wireless length：1.75m 电压：13.5 V±0.2 V 线束长：1.75m

2 System Description/系统概述

2.1 System composition and parts function/系统组成及零部件功能简述

Radar is an object detection system which uses radio waves to determine information of objects like distance, relative speed, direction, etc. /

雷达是利用电磁波探测目标的电子设备。发射电磁波对目标进行照射并接收其回波，由此获得目标至电磁波发射点的距离、相对速度、方位等信息。

TI medium range Radar Sensor and control unit (SCU) for NOVA77GB-T use contains a FMCW radar transceiver operating in the globally harmonized frequency range of 76.0 – 81.0 GHz.

用于 NOVA77GB-T 的 TI 中程雷达传感器和控制单元（SCU）包含一个 FMCW 雷达收发器，该收发器在全球统一的 76.0 – 81.0 GHz 频率范围内运行。

Targets behind the sensor are reflecting the radar signal, the relative speed and distance is determined via Doppler-effect and beat frequency. The angular information of the target is determined by use of the normalized antenna diagram.

在雷达后方的物体反射雷达信号，相对速度和距离可以通过多普勒效应和差频算出。物体的方位则通过使用规格化的天线图来计算实现。

RADAR SENSOR/雷达传感器

Special Properties: /特性：

- One of the smallest Radar Sensors with integrated control unit on the market/市场上尺寸最小、集成了传感器和控制器的一种雷达传感器
- Direct measurement of distance and relative velocity/直接测量距离和相对速度
- Extended field of view/扩展的视野
- High measurement rate/高的测量速率
- BIST (build-in-self-test) for high frequency components suitable for monitoring functions. Low cost and high quality design for high volume market/高频原器件的内部自检测功能可以监测系统功能低价和高质量的设计适合 大批量生产
- Robust weather behavior (snow, fog, rain, dust, illumination)/ 稳定的天气特性（雪，雾，雨，灰尘，光）
- Flexible vehicle integration with fast and easy alignment procedures/快速和简单的校准步骤，灵活的车辆集成

RADAR SENSOR COMPONENT/雷达传感器组件

The RADAR SENSOR is a highly integrated ECU consisting of 2 printed circuit boards with a small set of electronic parts.雷达传感器是由两块PCB 和一些小的电子原器件组成的高集成度的控制单元。

Radar – PCB:/雷达-PCB：

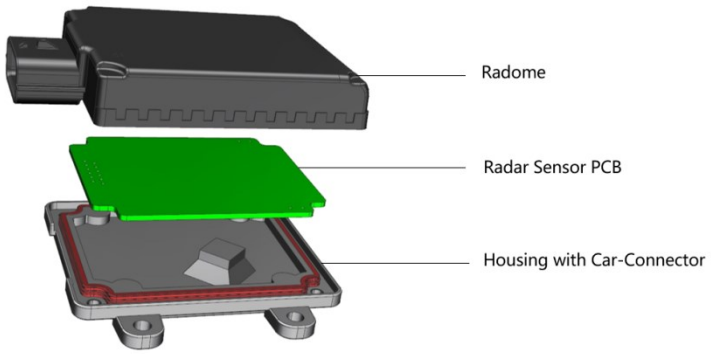
- Floating-Point Microcontroller with three-core/三核浮点运算微处理器

Radar: ASIC includes separate front-end amplifiers for each channel, control and self-diagnosis modules, and PLL units used to generate high linear frequencies. /雷达ASIC， 包括每个频道单独的前端放大器，控制和自诊断模块，以及用来生成高线性频率的锁相环单元

Fully integrated RFCMOS radar transceiver, use for 76-81GHz radar. /完全集成的 RFCMOS 雷达收发器，用于 76-81G 雷达

- 4 Tx channels,4 Rx channels, suitable for fast linear frequency modulation/4个TX,4个RX通道，适用于快速线性调频调制
- Planar antenna array/平面天线阵列

Components definition/部件定义



RADAR SENSOR COMPONENTS/雷达传感器部件

RADAR SENSOR key technical parameters/雷达传感器关键技术参数

Remark: All the following radar data are obtained under ideal conditions to ensure the repeatability of the data. Therefore, the data are measured without cover in front of the radar. 备注： 以下所有雷达数据都是在理想条件下获得的，以确保数据的可重复性。 因此，在雷达前无遮挡的情况下测量数据。

NOVA77GB-T

Distance Normal Mode

Range	0.2	m	to	120	m
Accuracy	±0.1	m			
Resolution	0.5	m			

Velocity

Range	-234	km/h	to	+200	km/h
Accuracy	±0.2	km/h			
Resolution	0.72	km/h			

Azimuth Angle

Range	±75°	(Target < 60m)
Accuracy	±1°	(±60°)
	±3°	(±75°)
Resolution	6°	(@0°)

Elevation Angle

Range	±15°	(Target < 45m)
Accuracy	3°	One Target

Sensitivity

+10dBsm	±75°	(35m)
	±60°	(100m)

Cycle time

	50	ms

Housing

Without connectors	83x91x21 mm
With connectors	99.5x91x21 mm
Weight	120 g
Material	PBT GF30 Black

Interface

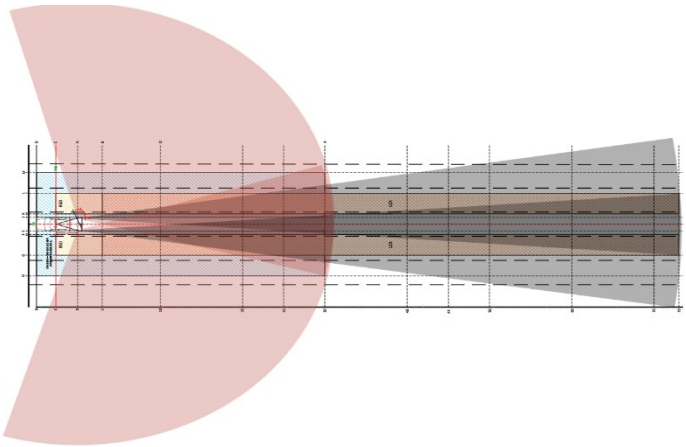
CAN high-speed 500kbit/s	X2	(CAN FD Optional)
LED Driver	X1	

Operating conditions

Mains power supply	12 V DC / 24 V DC
Power consumption	⩽4W

Field of view/视野范围

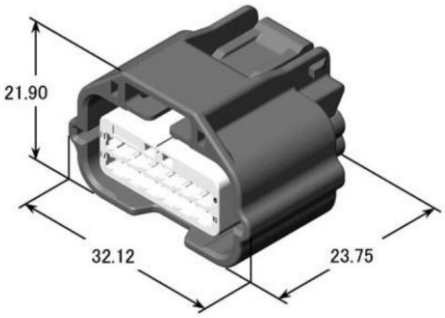
The field of view is the complete viewing range of the sensor. Within this range obstacles can be detected. Due to antenna characteristic, the field of view has not necessarily the same as opening angle over the whole distance range. Hence the FOV might be described by opening angles in several distances. 视野是传感器的探测范围，在此范围内的障碍物会被探测到。由于天线的特性，在同样的张开角度下，视野不需要覆盖全部的距离。因此视野范围只能根据开度角和几个典型的距离来描述。



RADAR SENSOR Field of view/雷达传感器的视野范围

2.2 Connector Description/接插件说明

2.2.1 ECU Connector Schematic Diagram/ ECU 端接插件示意图



RADAR SENSOR connector/雷达传感器接插件

The plug is designed according to the MQS (Micro Quad lock System) from TE.

- The SCU plug is according to YAZAKI No.: 7283-8854-30 12 pins
- The harness wiring plug is according to YAZAKI No.: 7282-8854-30

2.2.2 ECU Connector Definition/ECU 端接插件定义

NO./编号	Description/描述
1	LED_POWER_OUT/LED 输出
2	Positon0（雷达 ID 识别）
3	CAN2 Low/ CAN2 低
4	KL15
5	CAN1 Low/ CAN1 低
6	KL30
7	*NC*
8	Positon1（雷达 ID 识别）
9	CAN2 High/ CAN2 高
10	NC
11	CAN1 High/ CAN1 高
12	Sensor ground /地

2.3 Operating Voltage/工作电压

Description of function in different voltage range/描述不同工作电压下系统的功能执行

Voltage Range 电压范围	**Status/工作状态**	**System Function/系统功能操作**
6.5V - 18V	RADAR SENSOR power on CAN communication RS 上电，CAN 通信正常	Supply voltage range on V+SCU/ V+SCU 供电电压
7V - 18V	RADAR SENSOR RF Module on， LCA and BSD function worked/ RS 射频模块开启，LCA 和 BSD 功能正常工作	Active mode (RF Module on) is limited to this voltage An external fuse has to be provided (recommended 5A)/工作模式（射频模块开启）需要电压，必须提供外部保险丝（推荐 5A）
-14V	Exceed the time limit， RADAR SENSOR could be damaged/超过规定时间，RS 会损坏	Reverse polarity voltage protection (Pin V+SCU) is only guaranteed at this voltage (t≤60 s) /反向电压保护（电源针脚）可以保证承受的最大电压（持续时间不大于60 秒）
24V	Exceed the time limit， RADAR SENSOR could be damaged/超过规定时间，RS 会损坏	The SCU (Pin V+SCU and Radome Heating) can withstand a supply voltage of 24V (t ≤5 min), 5°C) At room temperature (23°C ± 5°C) /SCU（引脚 V + SCU 和天线罩加热）可以承受的电源电压为 24V（t 5 分钟），5° C） 在室温下（23° C±5° C）
35V	Exceed the time limit， RADAR SENSOR could be damaged/超过规定时间，RS 会损坏	The SCU can withstand at every pin a load dump impulse (ISO Pulse 5b) of 35V; time should be no longer than 400ms Maximum number of pulses is 10/t / SCU 可以在每个引脚上承受 35V 的负载突降脉冲（ISO 脉冲 5b）。 时间应该不超过 400ms 最大脉冲数为 10 / t

3 Function Description/功能说明

3.1 Functions/功能

3.1.1 Functions description/功能说明

RADAR sensor supports Blind Spot Detection (BSD), Lane Change Assist (LCA) functions, Dow Open Warning(DOW), Rear cross Traffic Alert(RCTA) and Rear Collision Warning(RCW). Detail descriptions can be found in the section 3.1.2. /

雷达传感器支持盲区监测（BSD），变道辅助（LCA），开门预警（DOW），后向交通预警（RCTA）和后向碰撞预警（RCW）功能，具体描述见3.1.2 章。

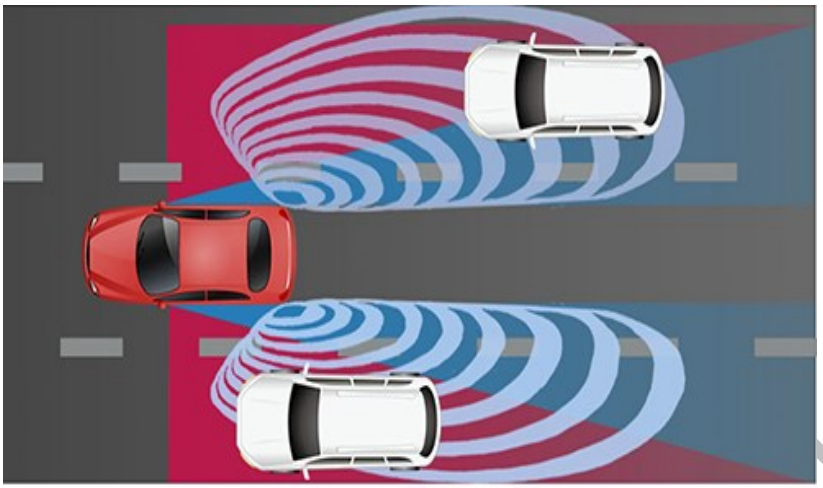
3.1.2 Functional Requirements/功能描述

3.1.2.1 BSD/盲点监测

（1） BSD Function Description / BSD 功能描述

- The main function of BSD (Blind Spot Detection) is to eliminate the Blind area of rearview mirror, to detect whether there is a vehicle behind the adjacent lane. When the car is near or in the blind area, the monitoring system alerts the driver by sounds, lights, etc./

  盲点检测（BSD, Blind Spot Detection）的主要功能是利用雷达监测相邻车道后方盲区车辆，弥补后视镜的盲区。当有车子进入或者位于盲区时，BSD 系统就会发出报警，通过声音、灯光等方式提醒驾驶员。



Radar waves/雷达波示意图

- A Radar Sensor monitors the driving situation behind of the vehicle. The sensor transmits radar waves that are reflected by objects behind of the vehicle. Based on the reflected signals, BSD can detect target vehicles by calculating distance, angle and relative speed of the vehicle behind. BSD systems uses the algorithm at this moment, to exclude relative static and far away from the object , when detected relative near from the object blind area in the diver's view, the indicator light flashing, at this time the driver can't see the vehicle in the blind area, but also can know the rear coming vehicles by light, change lanes are in danger of collision, if the driver do not notice the light is still flashing, the turn signal, prepares to change lanes, then system will beep voice alarm, once again to remind the driver is in danger, the diver at this time should not change lanes. Through the whole process of driving, continuously detect and remind, prevent the driving process because of bad weather, driver negligence, rearview mirror blind area, novice road and other potential hazards and cause traffic safety accidents./

  雷达传感器可监测后方的交通情况。传感器通过发送电磁波，并对反射回来的雷达波中的信息，计算出后方车辆的距离，方位及相对速度。这时 BSD 系统通过算法，排除固定物体和远离的物体，当探测到盲区内有车时，指示灯闪烁，此时驾驶员看不到盲区内的车辆，但是也能通过指示灯知道后方有车，变道有碰撞的危险，如果此时驾驶员仍然没有注意到指示灯闪烁，打了转向灯，准备变道，那么系统就会发出哔哔的语音警报声，再次提醒驾驶员此时变道有危险，不宜变道。通过整个行车过程中，不间断地探测和提醒，防止行车过程中因恶劣天气，驾驶员疏忽，后视镜盲区，新手上路等潜在危险而造成交通安全事故。

（2） BSD Activation Conditions / BSD 激活条件

- BSD function will be active under the following conditions:
  1. Radar Power on. / 雷达上电
  2. System available. /系统可用
  3. BSD function enabled. / BSD 功能使能
  4. Gear D. / 挡位是 D 挡
  5. The vehicle drives above activation speed (15km/h). /车辆速度在激活速度(15km/h)以上

（3） BSD Warning Conditions / BSD 报警条件

- The following lines are illustrated in the following Figure, it is necessary for the description of the blind spot warning requirements. The designations left right and behind refer to the driving direction of the subject vehicle. The lane markings in the Figure are shown for reference only. All dimensions are given with respect to the subject vehicle.

  B: parallel to the trailing edge and 3.0 m behind it.

  C: parallel to the leading edge and center of the 95th percentile eyellipse.

  F: parallel to centerline and 0.5 m to the left of the left outermost edge.

  G: parallel to centerline and 3.0 m to the left of the left outermost edge.

  K: parallel to centerline and 0.5 m to the right of the right outermost edge.

  L: parallel to centerline and a 3.0 m to the right of the right outermost edge.

  为了描述盲点警告要求，需要如下图所示的线条。左、右、后是指主体车辆的行驶方向。图中的车道标记仅供参考。所有的尺寸都是关于主体车辆的。

  B:平行于车的后缘，距车的后缘 3.0 米。

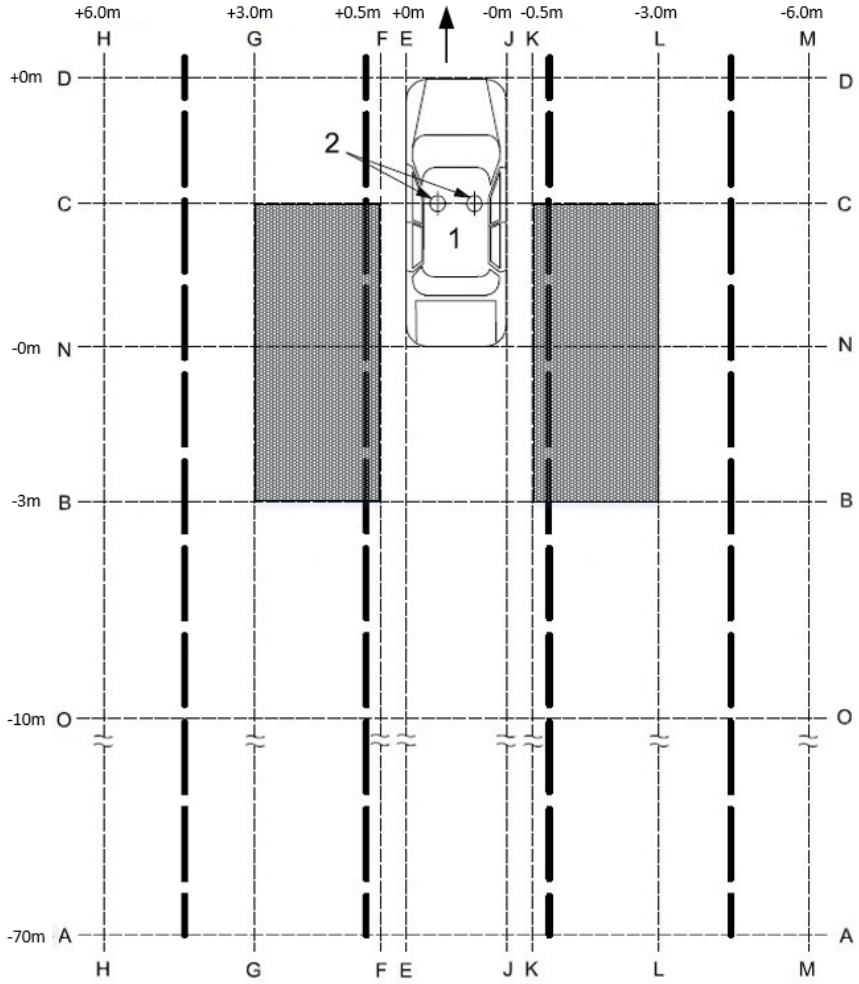
  C:平行于车的前缘，位于 95%视野区域的中心位置。

  F:平行于车的中心线，在车的最外侧左边缘左侧 0.5 米。

  G:平行于车的中心线，在车的最外侧左边缘左侧 3.0 米。

  K:平行于车的中心线，在车的最外侧右边 0.5 米处。

  L:平行于车的中心线，在车的最外侧右边向右 3.0 米。



BSD warning area/BSD 报警区域

- Referring to the Figure, a left side blind spot warning shall be issued to the subject vehicle driver if a target vehicle satisfies all of the following conditions:

  – any part of the target vehicle is forward of line B;

  – the target vehicle is entirely behind line C;

  – the target vehicle is entirely to the left of line F;

  – any part of the target vehicle is to the right of line G.

  根据上图可知，如果目标车辆全部满足以下条件，左侧盲点警告应该告知主体车辆驾驶员：

  -目标车辆任意部分越过线 B；

  -目标车辆完全在线 C 后；

  -目标车辆完全在线 F 左侧；

  -目标车辆任意部分在线 G 右侧。

- Referring to the Figure, a right side blind spot warning should be issued to the subject vehicle driver if a target vehicle satisfies all of the following conditions:

  – any part of the target vehicle is forward of line B;

  – the target vehicle is entirely behind line C;

  – the target vehicle is entirely to the left of line K;

  – any part of the target vehicle is to the right of line L.

  如果目标车辆全部满足以下条件，右侧盲点警告应该告知主体车辆驾驶员：

  -目标车辆任意部分越过线 B；

  -目标车辆完全在线 C 后；

  -目标车辆完全在线 K 右侧；

  -目标车辆任意部分在线 L 左侧。

- BSD classifies moving objects, stopped objects (From moving to stop) and stationary objects. BSD has no reaction to stationary objects. /

  BSD 系统区分运动目标、运动到静止的目标和静止目标，BSD 对静止目标没有反应；

- If the subject vehicle is overtaking the target vehicle and the target vehicle has entered the adjacent zone from the front, the blind spot warning might be suppressed for a period of no more than 2 s after the blind spot warning is first required. /

  备注：如果主体车辆正在超越目标车辆（主体车辆加速前行），并且目标车辆的前部已经进入盲点检测区域，那么当第一次需要盲点警告时，可能抑制至多两秒。

（4） BSD Warning Level / BSD 报警等级

- Warning level I: When vehicle meets the warning conditions and turn signal lamp on the warning side is OFF. The indicator light is always on in this level. /

  一级报警：车辆满足报警条件并且该侧的转向灯关闭，对应侧报警灯常亮。

- Warning level II: When vehicle meets the warning conditions and turn signal lamp on the warning side is ON, the level 2 warning shall be issued. The indicator light flashes in this level. /

  二级报警：车辆满足报警条件并且同侧的转向灯打开，对应侧报警灯闪烁。

3.1.2.2 Lane Change Assist/变道辅助

（ 1） LCA Function Description /LCA 功能描述

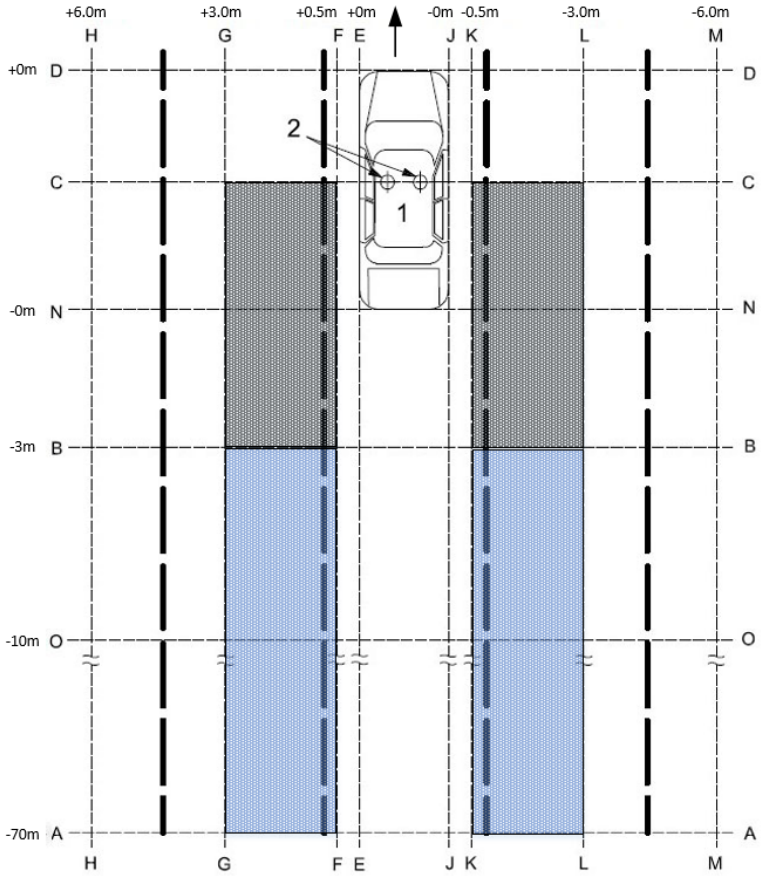
- The Lane Change Assist application is intended to assist the subjective vehicle driver to make a lane change operation. The system detects the zone behind the BSD detection zone and provides the warning if any target vehicle approaches fast from the rear in the adjacent lane.
  变道辅助功能旨在帮助自车驾驶员进行变道操作。系统监测位于 BSD 探测区域后面区域的目标，并且当有目标车辆从相邻车道后方快速靠近时提供报警。

（2） LCA Activation Conditions /LCA 激活条件

- LCA function will be active under the following conditions:
  1. Radar Power on. / 雷达上电
  2. System available. /系统可用
  3. LCA function enabled. / LCA 功能使能
  4. Gear D. / 挡位 D
  5. The vehicle drives above activation speed (15km/h). /车辆速度在激活速度(15km/h)以上

（3） LCA Warning Conditions /LCA 报警条件

- The LCA warning area (the blue area of the figure) consist of the rear zones at both sides of the subjective vehicle. /
  LCA 报警区域（图中蓝色区域）包含自车后方两侧的区域。
- The warning area is defined by parameters and can be adapted according to the customer's needs.
  报警区域是通过参数定义的，可以根据客户的需求进行适配。



LCA warning area/LCA 报警区域

- LCA warning shall be issued when closing target vehicle in the LCA warning area and the time to collision is less than or equal to the value given in following Table./

  当靠近车辆处在 LCA 报警区域，并且碰撞时间小于等于表中的值时，LCA 发出报警。

Type	Maximum target vehicle closing speed for full performance m/s	Time to collision s
A	10	2.5
B	15	3.0
C	20	3.5

（4） LCA Warning Level / LCA 报警等级

- Warning level I: When vehicle meets the warning conditions and turn signal lamp on the warning side is OFF. The indicator light is always on in this level. /

  一级报警：车辆满足报警条件并且该侧的转向灯关闭，对应侧报警灯常亮。

- Warning level II: When vehicle meets the warning conditions and turn signal lamp on the warning

side is ON, the level 2 warning shall be issued. The indicator light flashes in this level. /

二级报警：车辆满足报警条件并且同侧的转向灯打开，对应侧报警灯闪烁。

3.1.2.3 Door Open Waring/开门预警

（1） DOW Function Description /DOW 功能描述

- DOW can help driver or passenger to prevent accidents when they try to open the door, that an oncoming rear object vehicle enters the right or left side zone of the subject vehicle.

  DOW 可以帮助驾驶员或乘客在开门，左右两侧有车辆驶来时，避免事故发生。

（2） DOW Activation Conditions /DOW 激活条件

- DOW function will be active under the following conditions:
  1. Radar Power on. / 雷达上电
  2. System available. /系统可用
  3. DOW function enabled. / DOW 功能使能
  4. Gear P. / 挡位 P
  5. Subject vehicle has stopped. /自车停车

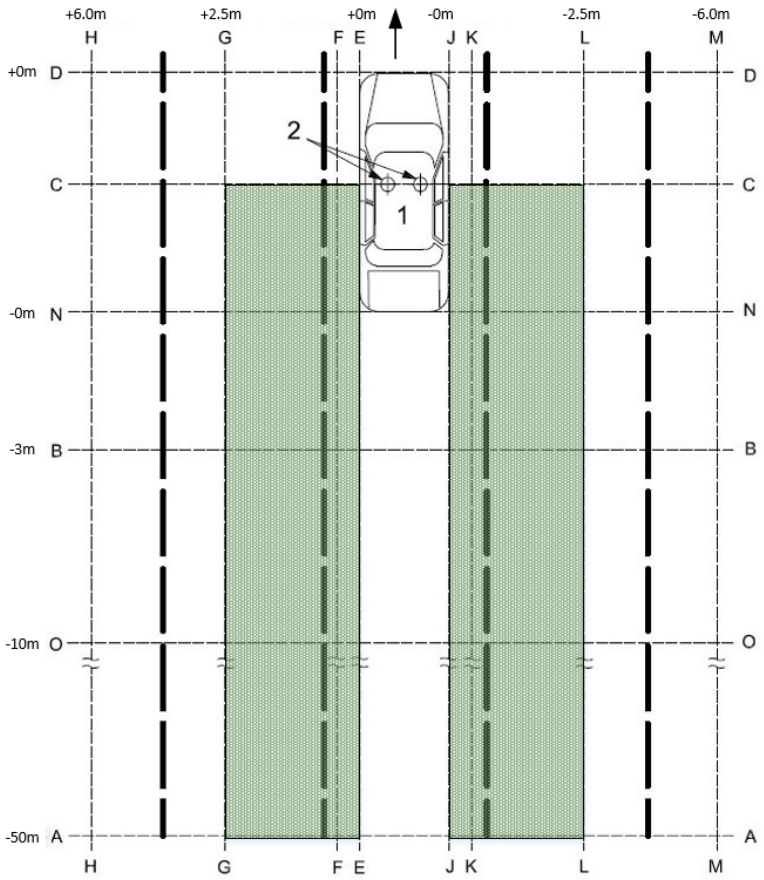
（3） DOW Warning Conditions /DOW 报警条件

- The DOW warning area (the green area of the figure) consist of the right and the left zones of the subjective vehicle.

  DOW 报警区域（图中绿色区域）包含自车左右两侧的区域。

- The warning area is defined by parameters and can be adapted according to the customer's needs.

  报警区域是通过参数定义的，可以根据客户的需求进行适配。



DOW warning area/DOW 报警区域

- DOW warning shall be issued when closing target vehicle in the DOW warning area and the time to collision is less than or equal to 3.5s.

  当靠近车辆处在 DOW 报警区域，并且碰撞时间小于等于 3.5s，DOW 报警应该发出。

（4） DOW Warning Level / DOW 报警等级

- Warning level I: When vehicle meets the warning conditions and doors on the warning side is not opened. The indicator light is always on in this level. /

  一级报警：车辆满足报警条件并且该侧的车门均未打开，对应侧报警灯常亮。

- Warning level II: When vehicle meets the warning conditions and any door on the warning side is opened, the level 2 warning shall be issued. The indicator light flashes in this level. /

  二级报警：车辆满足报警条件并且同侧的任一车门打开，对应侧报警灯闪烁。

3.1.2.4 Rear Cross Traffic Alert/后方交通预警

（ 1 ） RCTA Function Description / RCTA 功能描述

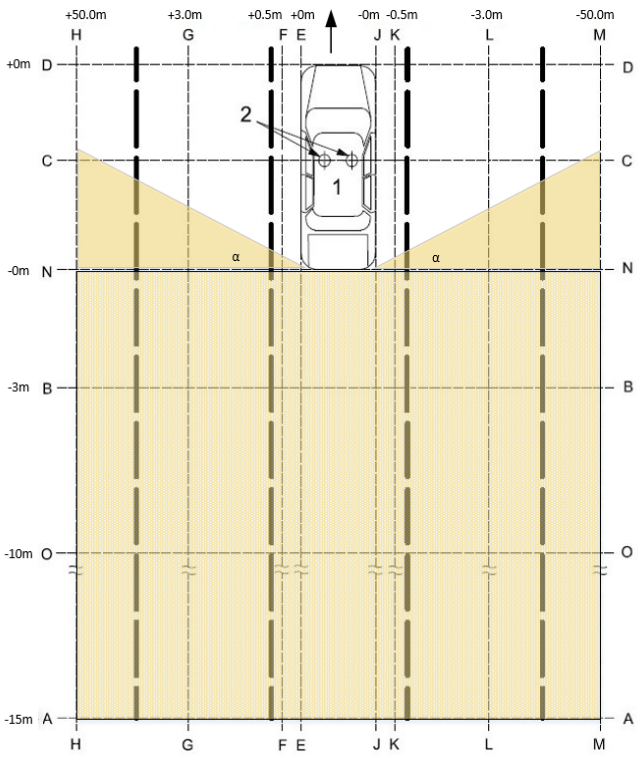
- The RCTA Function supports the driver when reversing out of a parking spot by detecting vehicles that might cross the subjective vehicle's path. /
  RCTA 可以辅助驾驶员在倒车时，对于可能横穿倒车路径的车辆进行监测并向驾驶员提供报警。

（2） RCTA Activation Conditions / RCTA 激活条件

- RCTA function will be active under the following conditions:
  1. Radar Power on. / 雷达上电
  2. System available. /系统可用
  3. RCTA function enabled. / RCTA 功能使能
  4. Gear R. / 挡位 R

（3） RCTA Warning Conditions / RCTA 报警条件

- The RCTA warning area refer to the yellow area of the figure. /
  RCTA 报警区域是指图中黄色区域。
- The warning area is defined by parameters and can be adapted according to the customer's needs.
  报警区域是通过参数定义的，可以根据客户的需求进行适配。



RCTA warning area/RCTA 报警区域

- RCTA warning shall be issued when closing target vehicle in the RCTA warning area and the time to collision is less than or equal to 3.5s. /

  当靠近车辆处在 RCTA 报警区域，并且碰撞时间小于等于 3.5s，RCTA 发出报警。

（4） RCTA Warning Level / RCTA 报警等级

- Warning level I: When vehicle meets the warning conditions and vehicle stopped. The indicator light is always on in this level. /

  一级报警：车辆满足报警条件并且自车停车，对应侧报警灯常亮。

- Warning level II: When vehicle meets the warning conditions and vehicle is moving, the level 2 warning shall be issued. The indicator light flashes in this level. /

  二级报警：车辆满足报警条件并且自车运动，对应侧报警灯闪烁。

3.1.2.5 Rear Collision Warning/后碰撞预警

（1） RCW Function Description / RCW 功能描述

- The RCW Function can monitor the rear zones right behind subjective vehicle and issue a warning when rear target vehicle will collide with subjective vehicle. /

  RCW 可以监测自车后方车辆，并在后方车辆将会与自车发送碰撞时产生报警。

（2） RCW Activation Conditions / RCW 激活条件

- RCW function will be active under the following conditions:

  1. Radar Power on. / 雷达上电
  2. System available. /系统可用
  3. RCW function enabled. / RCW 功能使能
  4. Forward Gear. / 前进挡
  5. The vehicle drives above activation speed (30km/h). /车辆速度在激活速度(30km/h)以上

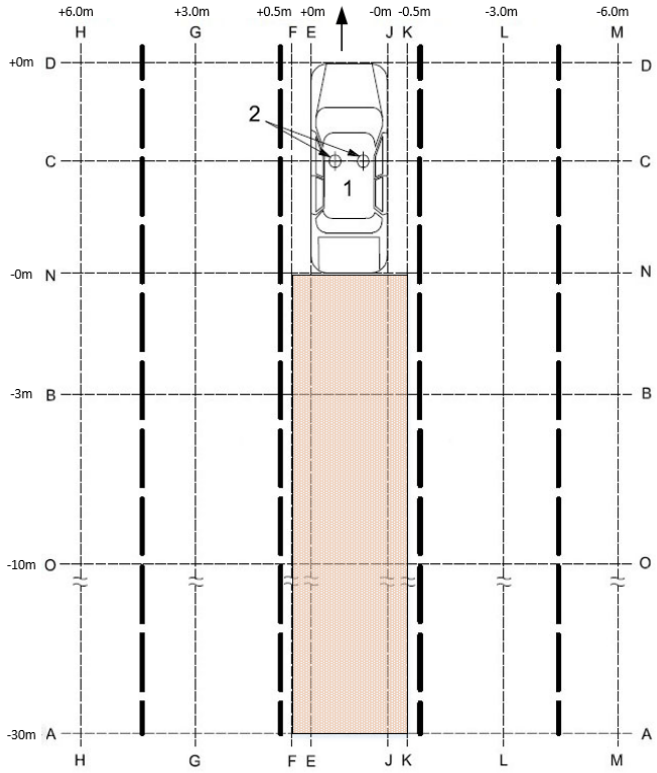
（3） RCW Warning Conditions / RCW 报警条件

- The RCW warning area refer to the orange area of the figure. /

  RCW 报警区域是指图中橙色区域。

- The warning area is defined by parameters and can be adapted according to the customer's needs.

报警区域是通过参数定义的，可以根据客户的需求进行适配。



RCW warning area/RCW 报警区域

- RCW warning shall be issued when closing target vehicle in the RCW warning area and the time to collision is less than or equal to 3.5s.

  当靠近车辆处在 RCW 报警区域，并且碰撞时间小于等于 3.5s，RCW 发出报警。

（4） RCW Warning Level / RCW 报警等级

- Warning level I: When vehicle meets the warning conditions, stoplights will be flash to warn the driver of the target vehicle. /

  一级报警：车辆满足报警条件，刹车灯闪烁，警告目标车驾驶员。

3.2 Communication/通讯

3.2.1 CAN Communication Description/ CAN 总线功能说明

3.2.1.1 Physical Layer/物理层说明

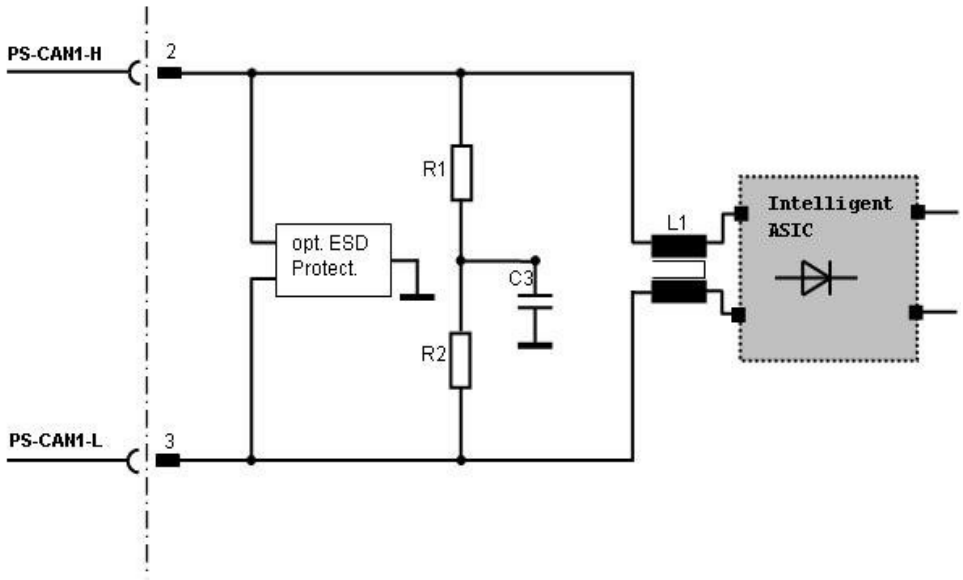
（1） Standard ISO 11898 part 2/ part 5 SAE J 22284 ES-XS4T-12K259-Cx /
遵循的标准 ISO 11898 part 2/ part 5 SAE J 22284 ES-XS4T-12K259-Cx

（2） Communication Rate 500K bps / 通讯速率 500K bps

（3） Terminal Resistance（If no terminal resistance, full in resistance value）/终端电阻（非终端则填写阻抗值）

（4） Bit Timing /位定时参数

（5） Interface circuit and electronic components parameters /接口电路及电子元件参数



Interface circuit/接口电路

C3: 100nF (split termination capacitor)
R1,R2 = 60.4 (±1% tolerance, 250mW)
L: Choke 2 x 51µH (TDK ACT45B-510-2P-TL003)
ESD Protection:
opt. Dual Common Cathode Z-Suppressor-Diode (MMBZ15VDLT1G ON)

（6） Fault recovery function description/故障恢复功能描述

N.A

3.2.2 LIN Communication Description/ LIN 总线功能说明

N.A

4 Performance Index/性能指标

4.1 Electrical Performance Requirements/电气性能要求

4.1.1 Power Supply/电源

4.1.1.1 Voltage Supply/电源电压

（1） Rated Voltage：7~18V/额定电压

（2） Test Voltage：14V/测试电压

（3） Protection Voltage：24V/保护电压

4.1.1.2 Current/电流

（1） Maximal operating current：300mA/最大工作电流

（2） Maximal over current：1A/最大过电流

（3） Dark current：＜1mA/静态电流

4.1.2 Ground Connection Requirements/接地要求

Connect with KL31/与 KL31 相连

4.1.3 Bus Connection/总线连接

CAN1-H and CAN1-L：wire size 0.35mm2

4.2 Environment Requirements/环境要求

（1） Operating Temperature：-40 °C ~ +85 °C /工作温度

（2） Storage Temperature：-40 °C ~ +90 °C /储存温度

（3） Relative Humidity：/相对湿度：

（4） Special Requirements：（Sensitivity, positioning accuracy, operating frequency etc.）/特殊要求：（如灵敏度、定位精度、工作频率等）

4.3 Weight/重量

<100g （Without bracket/不含支架）

5 Design Service Life/设计使用寿命

15 years, 300000km/15 年，300000 公里