YKS6 Smart Camera Datasheet

Contents

1 Scope

This document mainly describes the technical parameters and performance of an ADAS camera for commercial vehicles.

2 Term Definition

Abbr.	Description
LDW	Lane Departure Warning
FCW	Forward Collision Warning
HMW	Headway Monitoring and Warning
ADAS	Advanced Driver Assistance System
SLI	Speed Limit Indication
TTC	Time to Collision

3 System Intro

YKS6 is based on high performance camera and is capable of reducing collision accidents with early warnings during driving.

Figure 1. Camera and Display Unit

The system includes a camera and a display unit (optional), and main features include:

1) Lane Departure Warning

The system supports lane departure warning. When the vehicle departs from current lane without turn signals on, the system will issue visual and audible alerts indicating that the driver has moved out of current lane.

The system will not issue alerts when:

- The vehicle departs from current lane with turn signals.
- The vehicle speed has not reached the default threshold (50km/h).

2) Forward Collision Warning

When the system detects an imminent collision danger with vehicles ahead (in case of sudden brake or cut in), it will issue audible and visual alerts.

The system will issue warnings up to 2.7 seconds in advance.

3) Headway Monitoring and Warning

When the vehicle fails to keep headway and is too close to cars ahead, the system will issue warnings.

The system will not issue alerts when:

- Current vehicle speed has not reached default threshold (40km/h).

4) Pedestrian Collision Warning

When the system detects pedestrian collision danger, it will issue warnings.

5) Automatic Emergency Brake Perception

The system could detect the distance and relative speed between the vehicle and obstacles like vehicles and pedestrians and will issue braking requests to the vehicle to implement automatic brake via the actuator when there are potential collision dangers.

As shown below, the camera should be fixed to the bottom-center of the windshield, and the display unit can be placed anywhere easy for the driver to check.

Figure 2. Installation Indication

4 Technical Specs

The camera system is based on automotive grade hardware platform, and comes with following interfaces:

- 2 channels CAN.
- 1 channel RS232.
- 1 channel USB/OTG debugging and calibration.
- 1 channel 720P HD camera.
- 1 channel audio output.

4.1 Interface Definitions

The interfaces include:

- External interface.
- Calibration communication interface.

Interfaces	NO.	Signals	Description
Calibration	1	VCC	USB 5V power
	2	USB_DN	USB negative
	3	USB_DP	USB positive
	4	USB_OTG_ID	Master-Slave indication（high level is slave）
	5	GND	GND
External Interfaces	1	CAN1_L	/
	2	CAN1_H	/
	3	VCC24V	/
	4	GND	/
	5	GND	Ground, to connect the vehicle
	6	VCC_OUT	24V output, to power the display unit
	7	RS232_RX	UART receive (to connect display TX)
	8	RS232_TX	UART transmit (to connect display RX)
	9	CAN_L	CAN L，to connect the vehicle
	10	CAN_H	CAN H，to connect the vehicle
	11	CAN_GND	CAN GND/ Serial port GND (to connect display GND)
	12	VCC_IN	24V input，to connect the vehicle

Table 1. Interfaces Definitions

The calibration interface is a Micro USB port, which can be used for manufacturing testing and debugging, and parameter calibration, default to be hidden.

The vehicle adopts the TE car special connector externally, and its port definition and schematic diagram are shown below. The vehicle supplies 12/24V voltage to the device through VCC_IN, and the device can support a voltage range of 9V-36V. The camera communicates with the vehicle through the CAN interface to obtain information such as speed, steering, braking, etc., and to transmit the alarm information to the vehicle through the CAN network. The RS232 interface and the VCC_OUT interface is connected to the display unit to provide power and alarm information.

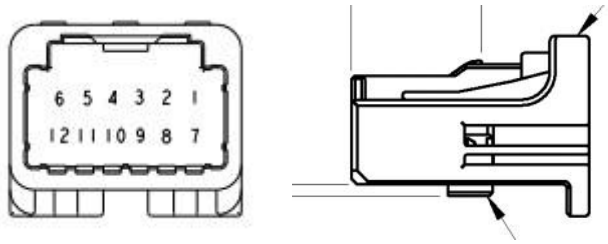

Figure 3. Interface Connectors

4.2 Camera Structure

The camera structure is shown below:

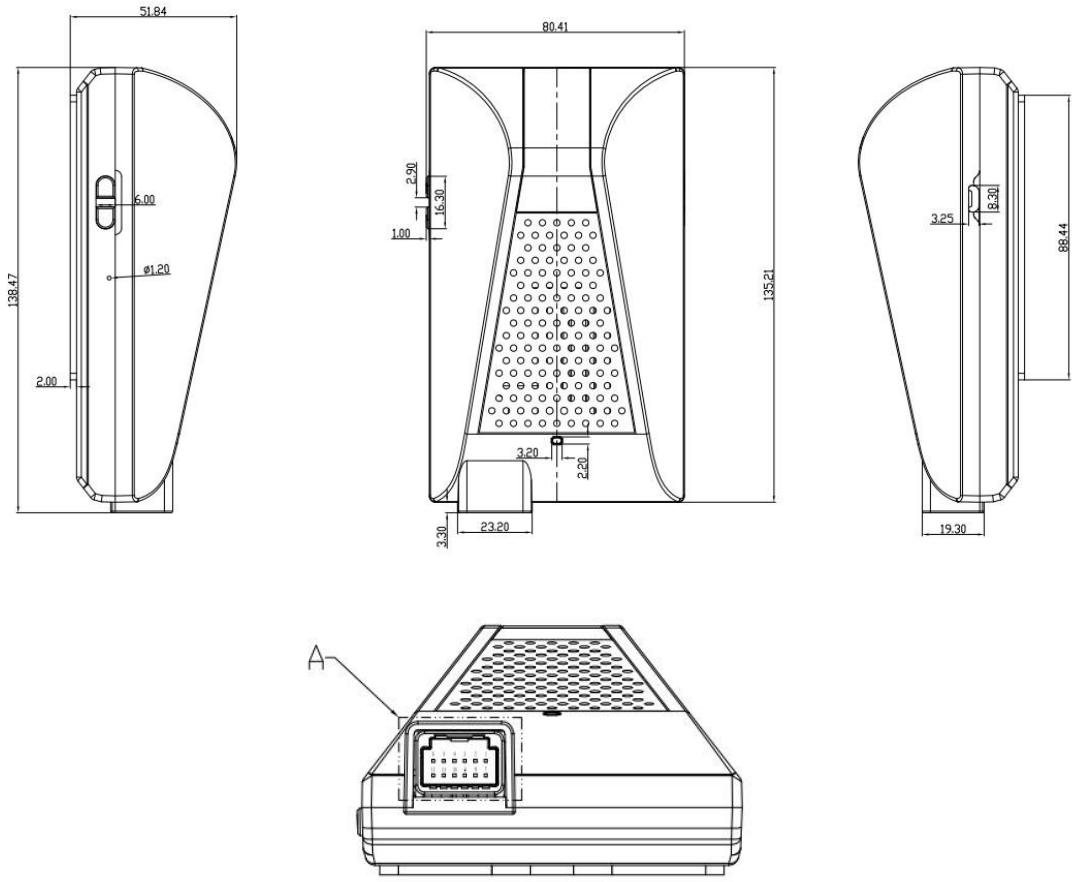

Figure 4. Camera Structure

4.3 Specifications

No	Categories	Description
1	Dimension	138.5mm * 79.4mm * 49.7mm
2	Weight	236g
3	Interfaces	RS232 * 1、Micro USB * 1、CAN * 1
4	Lens	F1.6 aperture, 6G+IR
5	CMOS	1/3'size, pixel size 3.75um， support HDR
6	Power	Forward voltage： 9~36V Reverse voltage： <= 36V
7	Power consumption	4W (typical) 6W (peak)
8	Operation Temp.	-40 ~ 85 ℃
9	Storage Temp.	-40 ~ 105 ℃
10	Operation humidity	<= 95%

Table 2. Specifications

4.4 Display

The display is an optional accessory that visually alerts the driver to the alarm messages. If the alarm display information is displayed through the dashboard, the display can be omitted.

4.4.1 Interface Definition

The alarm display mainly communicates with the camera through the RS232 interface, and displays the alarm information of the camera. It has a power supply interface and supports 12/24V power supply.

The external interface of the alarm display is the TE 4 PIN connector. The connector information is shown below.

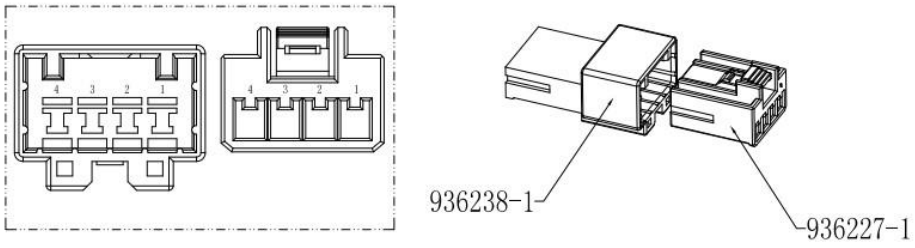

Figure 5. Display Connector

No.	Signal Name	Description
1	VCC	The display power supply, support 9V-36V
2	TX	RS232 transmit
3	RX	RS232 receive
4	GND	Ground

Table 3. Display Interface Definitions

4.4.2 Display Structure

The structure and interfaces of the display are shown below:

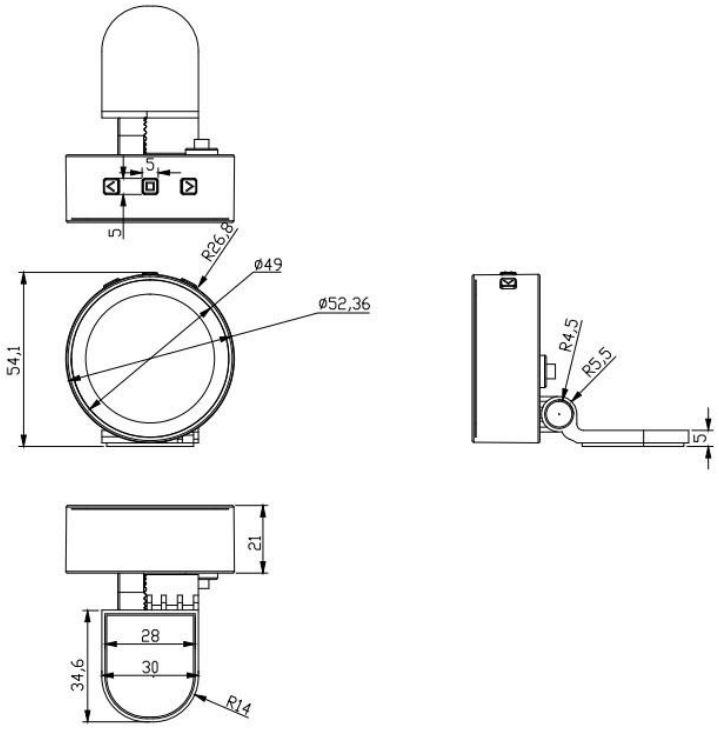

Figure 6. Display Unit Dimension

4.4.3 Display Alarm Information Description

The alarm display will display corresponding warning information, including icons such as left and right lane lines, vehicles, and collision time.

Figure 7. The Alarm Display

Icon Description

- The green vehicle sign indicates that the preceding vehicle is detected, and will not be displayed if there is no car in front or the vehicle is far away
- The green number indicates the collision time with the preceding vehicle. If the collision time is greater than 3.0 seconds, it will not be displayed.
- The vehicle or collision time icon may appear in different colors depending on the type of alarm or urgency: green indicates relative safety and red indicates emergency.
- The white vertical line marks on both sides represent the left and right lane lines. When the vehicle deviates from the lane without turning the turn signal, the corresponding lane line will be displayed. If the lane line is not clear or not detected, the lane line icon will not be displayed.

1) Safe Driving Conditions

When the system is working properly and no rear-end collisions and unintentional sideways dangers are detected, a small green dot will appear on the display.

Figure 8. Self-Driving Conditions

2) Lane Departure

A lane departure warning occurs when the vehicle changes lanes without turn signals on and the vehicle speed is greater than 50 km/h. When the alarm occurs, the system will have a buzzer alarm sound, and the display will have a lane line flashing. The following is the status of the display for left lane deviation.

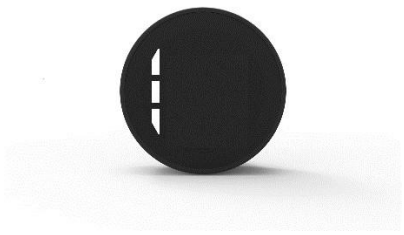

Figure 9. Lane Departure Warning Note

- When the vehicle speed is lower than 50Km/h (the speed can be configured), the lane departure warning function will not operate.
- When the lane line is not clear or defective, the lane departure warning function will not operate.
- The lane departure warning is only for the lane change without turn signal.
- When the vehicle deviates from the left lane, the left lane line icon on the display will light up and flash alternately to flash, and the right lane deviation alarm is similar.

3) Headway Monitoring and Warning

When there is a vehicle ahead and the distance between the vehicle and the preceding vehicle is too close, and the driving speed of the vehicle is greater than 40Km/h, the vehicle icon and the collision time will be displayed. When the collision time is less than 0.7s, the color of these icons will change from green to red, and the system will give an audible warning.

Figure 10. Headway Monitoring and Warning

Notes:

- When the vehicle speed is lower than 40Km/h (the speed can be configured), the HMW function will not operate.

- If the distance of the preceding vehicle is too far or outside the detection range, the HMW function will not operate.
- When the collision time is higher than 0.7 seconds, the corresponding icon prompt will be displayed on the display, but the system will not give an audible warning.

4) Forward Collision Warning

When an emergency collision risk is detected, such as a sudden cut-in of a side lane vehicle or a situation where the front and rear vehicle speed difference is too large, the system will issue a forward collision warning, and the alarm display will flash a red vehicle icon accompanied by a rushing warning sound.

Figure 11. Forward Collision Warning

Notes:

- Different from headway monitoring and warning which is based on the vehicle speed, the forward collision warning is based on TTC (Time to Collision), which is the relative speed of the vehicle and the preceding vehicle.
- When the TTC is less than 2.7 seconds, the system will give a rushing sound warning, and the red vehicle icon will flash on the display.

5) Pedestrian Collision Warning

The system detects the pedestrians during driving, and it will issue warnings in advance after detecting potential pedestrian collision dangers.

Figure 12. Pedestrian Collision Warning

4.5 System Performance

4.5.1 Warning Strategies

Warning Types	Strategies	Description
Lane departure	• Speed >= 50km/h • The wheel is on the lane • No turn signals on	Lane departure with turn signals will not trigger the warnings
Headway monitoring	• Speed >= 40km/h • Level 1: collision time ≤0.8s • Level 2: collision time ≤0.4s	Collision time: Distance / the vehicle speed
Forward Collision	• TTC（Time to Collision）≤3.0s	TTC: Distance / relative speed of two vehicles
Pedestrian Collision	• Level 1: TTC ≤ 4.0s; • Level 2: TTC ≤ 3.2s; • Level 3: TTC ≤ 2.7s	TTC: Distance /relative speed of the vehicle and pedestrian

Figure 13. Warning Strategies

4.5.2 System Performance

1) Lane Detection

Lane Geometry	Straight line, Curve line(Radius >250m)
Lane Type	Dash line, Solid line, Double Solid line
Lane Color	White, Yellow, Blue
Max. Detection Range	>60m
Lateral Range Accuracy	Distance 0m-30m, Error <10cm Distance >30m, Error<20cm

Table 4. Lane Detection Specs

2) Vehicle Detection

Maximum Detection Range	Over 150m (normal daytime)
Detection Range	Distance 0m-100m, Error ≤ 5%; Distance 100-150m, Error≤ 10%;
Detection Rate	Over 99%
Vehicle Types	Normal Vehicle, Special-shape Vehicle, Tricycle, Motorcycle, Bicycle, Electronic Bicycle, Minivan, Truck, Engineering Working Vehicle, Special-used Vehicle

Table 5. Vehicle Detection Specs

3) Pedestrian Detection

Pedestrian Types	Adult, Children
Maximum Detection Range	> 100m
Detection Rate	Around 95%

Table 6. Pedestrian Detection

4) Speed Limit Sign Detection

Maximum Detection Range	> 60m
Distance Detection Error	≤10%

Table 7. Speed Limit Sign Detection

4.6 System Reliability

1) Environmental Adaptability

Operating temperature range: -40 ~ 85 degrees Celsius.

2) Mechanical Test

Passes vibration test, drop test.

3) Salt spray test

Passed

4) EMC Test

Radiation emission, conducted emission, radiated immunity, conducted disturbance immunity, ESD test passed.

5 Tech Standards

The product development follows following standards:

No.	Standards
1	JT/T 883-2014 (Technical Requirements and Experimental Methods for Operational Vehicle Warning System)
2	GB/T26773-2011 (Intelligent Transportation System Lane Departure Alarm System Performance Requirements and Detection Methods)
3	ISO15623-2013 (Automobile Front Collision Warning System)
4	CAN2.0B Bus Protocol (Extended Frame)
5	GB 2423 Basic Environmental Test Procedures for Electrical and Electronic Products
6	GB/T 28046.2-2011 Environmental Conditions and Tests for Electrical and Electronic Equipment for Road Vehicles
7	QCT 413-2002 Basic Technical Conditions for Automotive Electrical Equipment
8	QCT727-2007-4.21 (High and Low Temperature Test Standards)
9	QCT727-2007-4.15 (Vibration Test Standard)
10	QCT727-2007-4.21 (Salt Fog Test Standard)
11	GB/T 17619-1998 Electromagnetic Radiation Immunity Limits and Measurement Methods for Automotive Electrical and Electronic Components
12	GB/T17626.2-2006 Electromagnetic Compatibility Test and Measurement Technology Electrostatic Discharge Immunity Test
13	JT/T 794-2011 Technical requirements for vehicle terminal of satellite transportation system for road transport vehicles