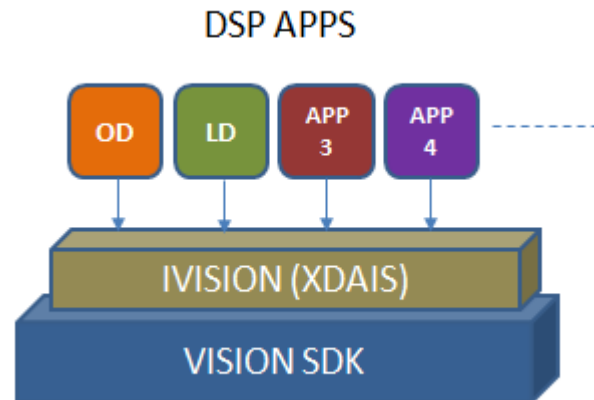




- IVISION (XDAIS) interface compliant
- Validated on TDA2x EVM
- Supports lane detection and lane departure warning
- Supports Canny edge detection, detecting upto 10000 edges in the ROI
- Supports Hough transform for lines between two different theta ranges for the right and left lanes respectively
- Kalman filter based tracking supported
- Supports user controlled thresholds to control the accuracy (False positive vs True Negative)



## Description

Lane detection module is TI's proprietary Vision and Imaging algorithm implemented on TMS320C66x DSP. Lane detection module is validated with Code Composer Studio version 5.1.0.09000 and code generation tools version 7.4.2.





## Performance and Memory Summary

Table 1: Configuration Table

CONFIGURATION	ID
Lane Detection	LANDET_001

Table 2: Performance Statistics

CONFIGURATION ID	TEST DESCRIPTION	TI C66X DSP PERFORMANCE STATISTICS	
		MIN (MEGA CYCLES)	MAX (MEGA CYCLES)
LANDET_001	img0.y, img1.y,...img9.y ROI (576x240), maxRho – 624, Canny edge Th (20,30), Theta range(left –150, right– 150), theta Step Size – 1, tracking method – Kalman, Hough Maximas (detected – 6, tracked – 3)	2	2.6

<sup>1</sup> Performance is validated by running on TDA2x platform. DDR-532Mhz, DSP-600Mhz

Table 3: Memory Statistics

CONFIGURATION ID	RESOLUTION	MEMORY STATISTICS <sup>1</sup>						
		PROGRAM MEMORY	INTERNAL	DATA MEMORY			STACK	TOTAL
				PERSISTENT	SCRATCH	CONST		
LANDET_001	640x360	14.4	23	3	1046	0.72	9	1096.1

All memory requirements are expressed in kilobytes (1 K-byte = 1024 bytes) and there could be a variation of around 1-2% in the numbers.

Table 4: Internal Data Memory Split-up

CONFIGURATION ID	DATA MEMORY – INTERNAL <sup>2</sup>		
	SHARED		INSTANCE <sup>3</sup>
	CONSTANTS	SCRATCH	
LANDET_001	0	23	-

<sup>2</sup> Internal memory refers to on chip memory. All memory requirements are expressed in kilobytes and there could be a variation of around 1-2% in numbers. LD requires 23kb of L1D-SRAM memory. This puts L1D cache to 8kb. Executing lane detection module along with other DSP algorithm which requires different L1D configuration could hinder performance.

<sup>3</sup> I/O buffers are not included. Some of the instance memory buffers could be scratch.



### notes

- I/O buffers:
  - Input buffer size = 225 K-bytes (For 640x360 resolution)
  - Output buffer size = 39.1 K-bytes (For a maximum of 10000 points on lane per frame)
  - Total data memory for N non pre-emptive instances = Constants + Runtime Tables + Scratch + N \* (Instance + I/O buffers + Stack)
- Total data memory for N pre-emptive instances = Constants + Runtime Tables + N \* (Instance + I/O buffers + Stack + Scratch)

### references

- LaneDetection\_DSP\_UserGuide.pdf

### glossary

Constants	Elements that go into .const memory section
Scratch	Memory space that can be reused across different instances of the algorithm
Shared	Sum of Constants and Scratch
Instance	Persistent-memory that contains persistent information - allocated for each instance of the algorithm



## acronyms

CIF	Common Intermediate Format
DMA	Direct Memory Access
DMAN3	DMA Manager
EVM	Evaluation Module
MV	Motion Vector
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
SQCIF	Sub Quarter Common Intermediate Format
UMV	Unrestricted Motion Vectors
VGA	Video Graphics Array

PRODUCT PREVIEW

**IMPORTANT NOTICE**

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer’s risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

**Products**

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

**Applications**

Automotive & Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications & Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers & Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energyapps">www.ti.com/energyapps</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

**TI E2E Community** [e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright© 2017, Texas Instruments Incorporated