Digital Video Recorder/Digital Video Server

A digital video recorder (DVR) and digital video server (DVS) are appliances used in video surveillance. These appliances take the analog video signals from multiple analog surveillance cameras and digitize them. A processing engine encodes the video streams in digital formats such as H.264, motion JPEG, MPEG-4 or proprietary codecs to allow for data storage or transmission.

While the DVR is designed to store and view this video stream locally, the DVS sends the encoded video to the larger security network using the TCP/IP protocol. Higher performance systems also have video analysis (VA) capabilities allowing for the automatic detection of motion, crossing of virtual fences, etc.

DVRs and DVSs are used to upgrade existing security systems, which are based on analog surveillance cameras. Replacing tape-based VCRs, the DVR/DVS automates the storage of surveillance data and enables remote access to surveillance installations via TCP/IP networks. DVRs/DVSs typically have 4-, 8- or 16-input channels. With further integration, the channel count will increase to 32, 64 and beyond.

With the advent of IP cameras, systems that accept both analog and digital formats are advantageous as the installed analog camera market base still dominates. For this reason, hybrid DVRs are available today. These appliances are versatile video recording devices that also must have the capability to perform storage and VA functions.

For more specific information about digital video recorder solutions, see **www.ti.com/dvr**.

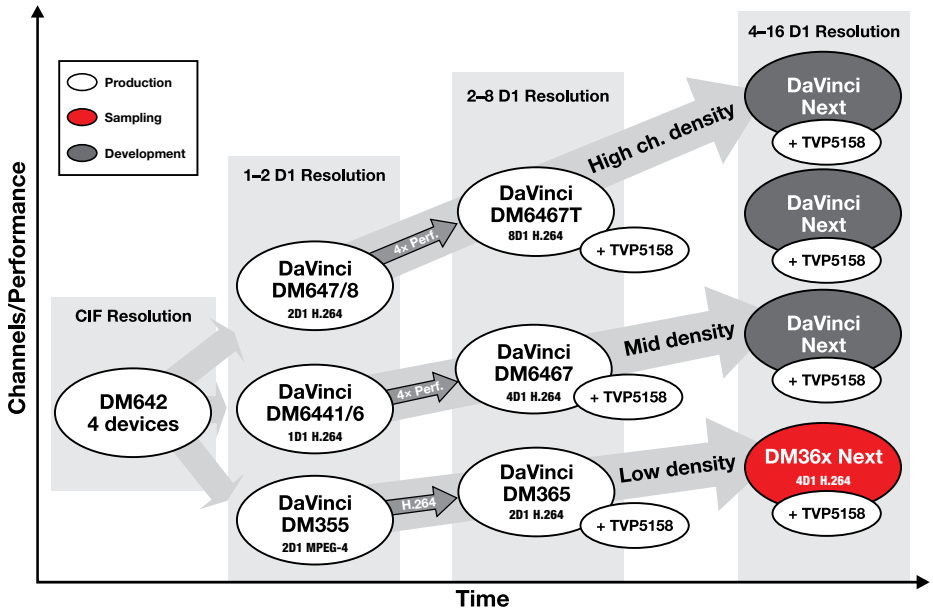
TI has brought to market a single-platform H.264 reference design based on the TMS320DM365 digital video processor with DaVinci™ technology and the TI TVP5158 multi-channel video decoder for faster development at a reduced cost.

Hardware features

- TI TMS320DM365 digital video processor based on DaVinci technology
- TI TVP5158, new multi-channel video decoder with integrated audio
- Storage of compressed input (SATA and USB)
- Streaming of compressed input (Ethernet)
- Local display support up to 800×600 resolution
- Local user interface support
- Pan, tilt and zoom camera support

Software features

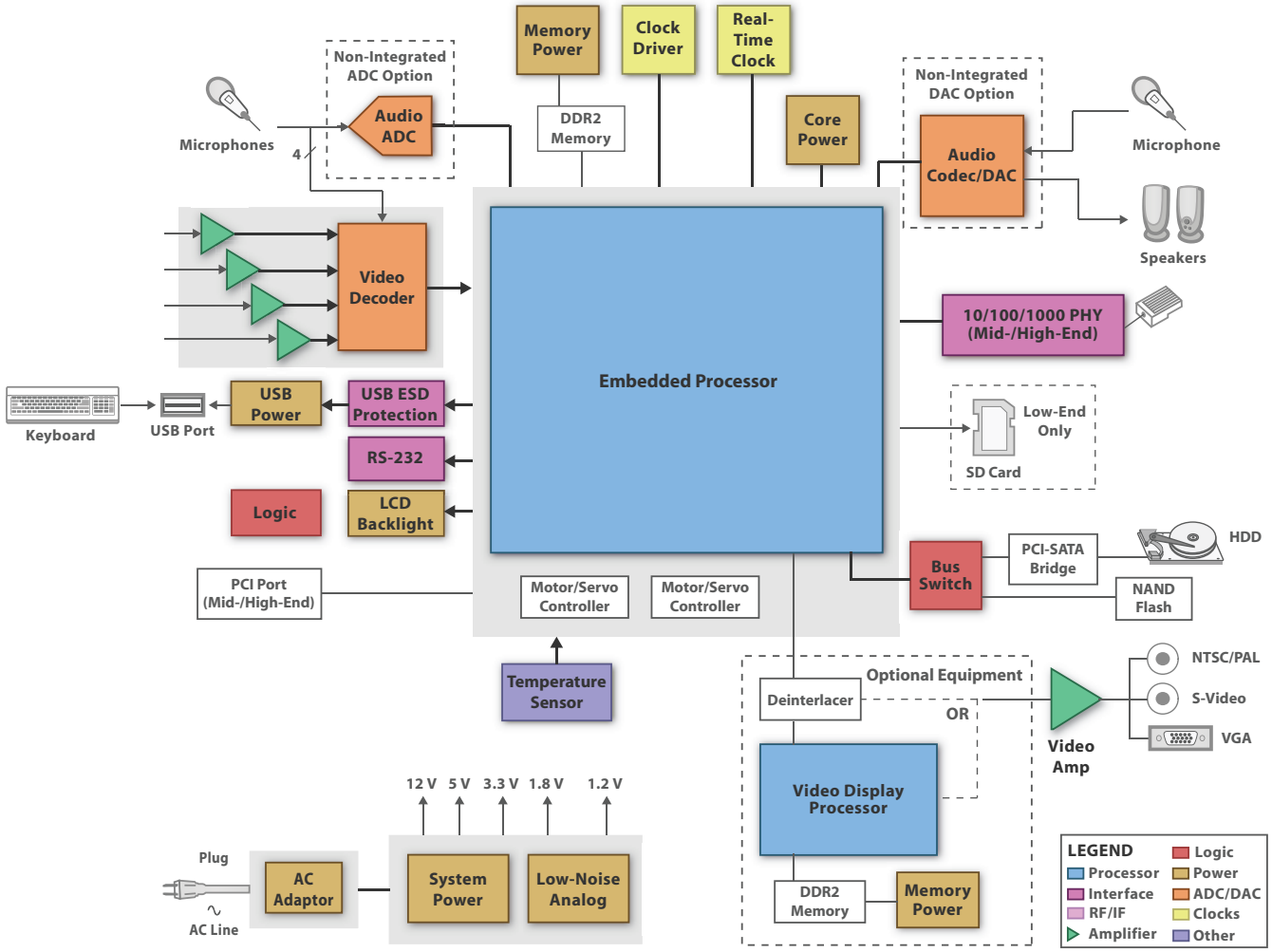
- Multi-codec system allows triple streams per channel (H.264, MPEG-4 and MJPEG) for real-time signal processing
- Simultaneous D1 record (65 fps), playback (30 fps), storage, streaming and display
- Audio/video adjustment tools
- Video timestamp support
- Software Development Kit (SDK) provided for easy customization



DaVinci multi-channel processor roadmap – Complete video security portfolio

Digital Video Recorder/Digital Video Server

High-End Digital Video Recorder/Digital Video Server/Video Encoder System Block Diagram



*Visit page 67 or **power.ti.com** for information on TI's power management products.*

Featured Products

Product	TI Part #	Page
Core Power	TPS54386	67
	TPS62350	69
	TPS62400	69
	PTH04T240W	68
	TPS65053	69
	TPS75003	67
Clock Driver	CDCE913	51
	CDCE949	51
	CDCS502	51
Logic	SN74AVC8T245	55
Processor	TMS320DM365	31
	TMS320DM6467	31
RS-232	TRS3232E	54
Temperature Sensor	TMP100	65
	TMP302	65
	TMP75	65

Product	TI Part #	Page
USB Power	TPS2061	66
	TPS2065	66
	TPS2066	66
Video Amplifier	OPA3695	39
	OPA360	39
	THS7303	39
	THS7373	39
	THS7365	39
	THS7368	39
	THS7314	39
	THS7316	39
Video Decoder	TVP5154A	36
	TVP5158	36

*Device specifications can be found in the Selection Guide section of this document, pages 30–69. For additional information on each product, please visit **www.ti.com** and search by TI part number.*

IP Camera

The world of video surveillance is moving toward the IP network. An IP network camera can be defined as a camera with networking and video processing combined into one unit. A network camera has its own IP address and the computing functions necessary to handle network communication. It captures and transmits live images over the network, enabling remote viewing and user control from anywhere, anytime.

TI's DSPs are used to compress the image in a variety of standard and nonstandard video formats. Additionally, TI DSPs offer the ability to use intelligent image analysis functions and various types of networking protocol support.

Digital video transmission is fast becoming the standard requirement for security and surveillance systems. Both wired and wireless links are of interest for security and surveillance architects.

For more specific information about IP camera solutions, see **www.ti.com/ipcamera**.

Multiple IP Camera Solutions Enable Quick Product Development at Low Analog Camera Price Points

Texas Instruments offers multiple highly optimized reference designs based on the TMS320DM3x digital video processors with DaVinci™ technology for the IP camera market to enable developers to speed through the design process as well as reduce overall bill-of-materials (BOM) costs. These reference designs:

- Reduce development time by 98 percent
- Deliver higher quality, wider field-of-view HD images
- Decrease electronic bill of materials
- Empower customers to bring U.S. $150 HD IP cameras to the market

These solutions reduce development to under four months by including:

- Complete and optimized schematics
- Gerber files
- Free Linux application source code, including:
  - Integrated auto white balance and auto exposure
  - Simple motion detection
  - Dual-stream HD MPEG-4 and MJPEG video codecs to support recording and monitoring needs at full frame rates
  - DaVinci IP camera software framework including I/O application programming interfaces (APIs), media APIs and DaVinci Codec Engine

Multiple Reference Designs Available Based on TI Technology:

TI's DM3x-based IP camera solutions include:

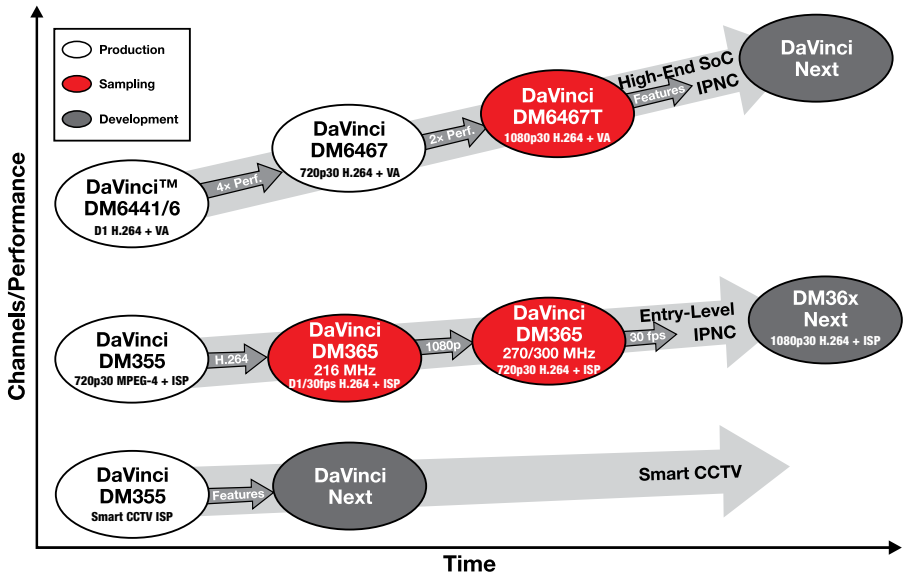
- **New DM36x IP Camera Reference Design (part #: DM368IPNC-MT5):** Single-platform solution provides 1080p at 30 fps
- **DM365 IP Camera Reference Design (part #: DM365IPNC-MT5):** Single-platform solution provides H.264 in HD
- **Video Content Analytics (VA) IP Camera Reference Design (part #: DM355IPNC-VCA1):** includes base version plus VA technology from Object Video
- **DM355 IP Camera Reference Design (part #: DM355IPNC-MT5):** supports high definition (HD) at 1.3 MPixel CMOS sensor technologies from Aptina

DM365 IP Camera Reference Design: H.264 main profile 1080p at 30 fps DM368IPNC-MT5 @ U.S. $995

TI's latest reference design provides full HD video with a 30 percent boost in host processing performance, advanced software for image signal processing tuning and encryption.

Hardware features

- TI's TMS320DM36x DaVinci™ video processor includes an ARM926 and H.264 hardware video coprocessor, EMAC, RTC and integrated voice codec for BOM savings



DaVinci IP camera processor roadmap – Complete video security portfolio

- Aptina 5-MP sensor CMOS imager optimized for low-light performance
- Board size: 65×50-mm, low power (3W)
- Power over Ethernet, audio, SD storage

Software features

- Complete Linux-based IP camera application including free source code
- Encode up to H.264 main profile 1080p at 30 fps or 720p at 60 fps; MPEG-4 up to 720p at 60 fps; MJPEG at 5 Megapixels at 15 fps
- Triple stream per channel (H.264, MPEG-4, MJPEG)
- Integrated auto white balance and auto exposure
- Royalty-free, production-ready codecs included
- Software framework includes input/output and media APIs, codec engine
- Ability to add video analytics with DaVinci™ TMS320DM643x DSP

DM365 IP Camera Reference Design: DM365IPNC-MT5 @ U.S. $795

TI and Aptina Imaging (a division of Micron) have come together again to bring to market a single platform, H.264 reference design for faster development at a reduced cost.

Hardware features

- TI TMS320DM365 DaVinci video processor includes ARM926 and H.264 hardware video coprocessor, EMAC, RTC and integrated voice codec for BOM savings
- Aptina 5-MP sensor CMOS imager optimized for low-light performance
- Board size 65×50 mm, low-power (3W)
- Power over Ethernet, audio, SD storage

Software features

- Complete Linux-based IP net camera application including free source code
- Encode up to H.264/MPEG-4 HD 1080p at reduced frame rate or 720p full frame rate
- Triple stream per channel (H.264, MPEG-4, MJPEG)
- Integrated auto white balance and auto exposure
- Royalty-free, production-ready codecs included
- Software framework includes input/output and media APIs, codec engine
- Ability to add video analytics with DaVinci TMS320DM643x DSP
- PSIA standard support

Video Analysis (VA) DM355 IP Camera Reference Design: DM355IPNC-VCA1 @ U.S. $995

TI and Object Video have brought to market the VA version of the DM355-based IP camera which supports Object Video intelligent video analytics. The analytics software provides simple monitoring and notification of security events through a web browser. This reference design builds on the base solution (DM355IPNC-MT5) with a VA daughter board.

Hardware features

- TMS320DM6435 DaVinci video processor
- DaVinci TMS320DM355 SoC, ARM926 and hardware video coprocessor
- Aptina 5 MP sensor (2×2 binning ~1.3 MP)
- VA daughter board size: 41×40 mm

Software features

- Complete Linux-based IP network camera application including free source code
- Dual-stream capabilities
  - MPEG-4 HD 720p + MPEG-4 CIF + G.711
- Triple-stream capabilities
  - MPEG-4 HD 720p + MJPEG VGA + MJPEG CIF + G.711
- Integrated auto white balance and auto exposure
- Field-proven, robust, royalty-free bundled MPEG-4 and MJPEG video codecs
- DaVinci IP camera software framework including I/O APIs, media APIs and DaVinci Codec Engine

TMS320DM355 IP Camera Reference Design: DM355IPNC-MT5 @ U.S. $795

TI and Aptina Imaging (a division of Micron) have brought to market the original DM355-based IP camera highly optimized reference design.

Hardware features

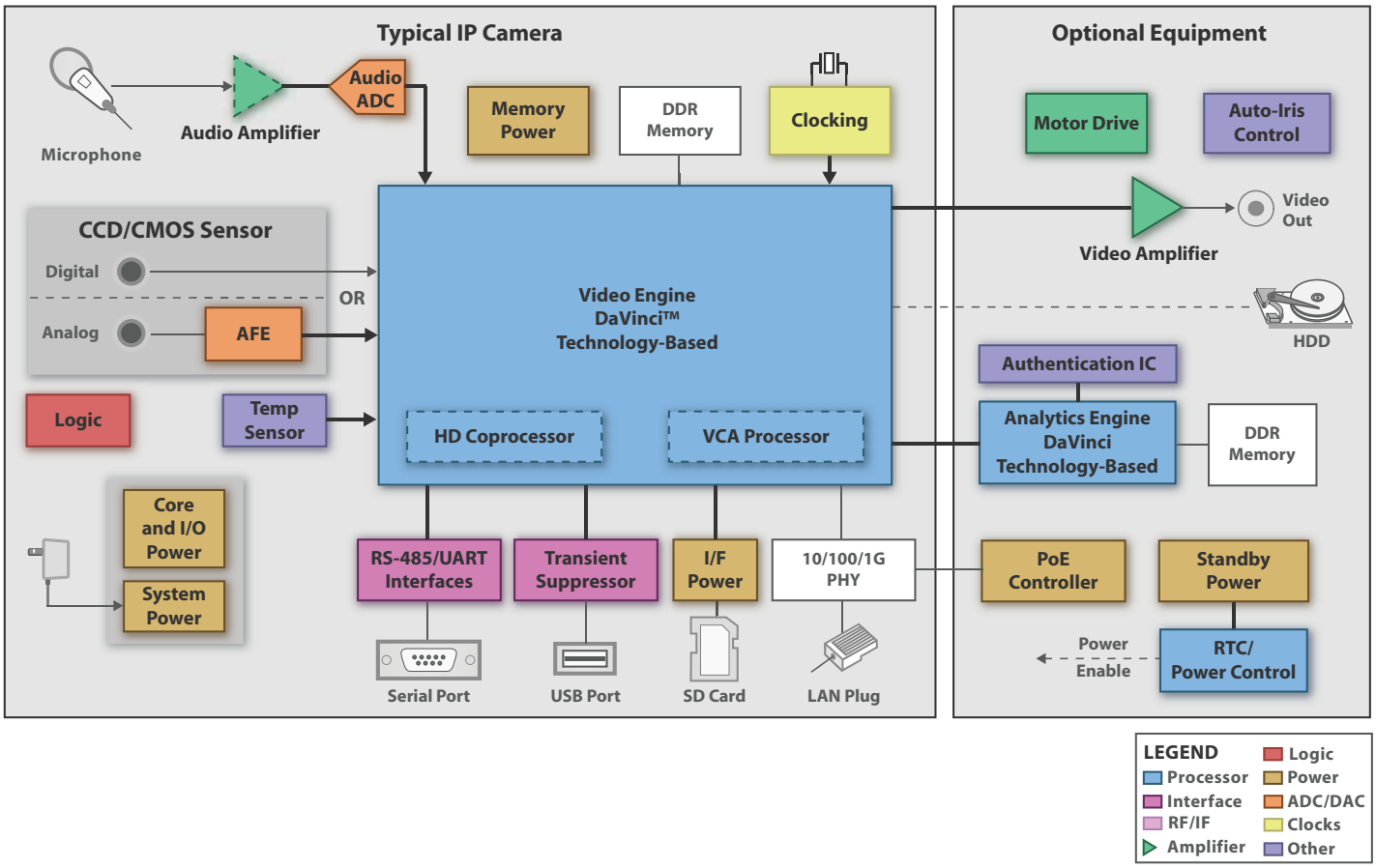
- TMS320DM355 SoC, ARM926 and hardware video coprocessor
- Aptina 5 MP sensor (2×2 binning ~1.3 MP)
- CMOS imager optimized for low-light performance
- Board size 65×50 mm
- Low power (< 3W)

Software features

- Complete Linux-based IP camera application including free source code
- Dual-stream capabilities
  - MPEG-4 HD 720p + MPEG-4 CIF + G.711
  - MPEG-4 HD 720p + MJPEG CIF + G.711
- Integrated auto white balance and auto exposure
- Field-proven, robust, royalty-free bundled MPEG-4 and MJPEG video codecs
- DaVinci IP camera software framework including I/O APIs, media APIs and DaVinci Codec Engine
- Ability to add video analytics with TMS320DM643x DaVinci video processors

IP Camera

High-End IP Network Camera System Block Diagram



*Visit page 67 or **power.ti.com** for information on TI's power management products.*

Featured Products

Product	TI Part #	Page
AFE	VSP01M01	37
	VSP2582	37
	VSP2590	37
Audio ADC	PCM1870A	41
	PCM3006	40
	TLV320AIC3101	40
	TLV320AIC3104	40
Audio Codec	PCM3006	40
	TLV320AIC3101	40
	TLV320AIC3104	40
Auto-Iris Control	OPA2357	39
Clocking	CDCE906	51
Core and I/O Power	TPS65053	69
Memory Power	TPS51020	67
	TPS51200	68
Power over Ethernet Controller	TPS23750	66
	TPS23753A	66

Product	TI Part #	Page
Power over Ethernet Controller (cont'd)	TPS23754	66
	TPS23757	66
Processor	TMS320DM365	31
	TMS320DM6437	30
	TMS320DM6467	31
	TMS320DM355	31
Temperature Sensor	TMP100	65
	TMP175	65
	TMP20	65
	TMP75	65
USB Power Switch	TPS2041B	66
	TPS2052B	66
	TPS2061	66
	TPS2553	66
Video Amplifier	OPA361	39
	THS7315	39

*Device specifications can be found in the Selection Guide section of this document, pages 30–69. For additional information on each product, please visit **www.ti.com** and search by TI part number.*

Video Analytics Server

Video analytics servers handle multiple camera inputs, digitize, compress and stream digital media content over an IP network such as a LAN, intranet or the Internet, turning an analog video system into a network video system. Users can view live images using Web browsers or application software on any local or remote computer on a network. User configuration and control can also be done remotely.

Video analytics servers allow authorized viewers from different locations to simultaneously access images from the same analog camera(s), as well as network cameras if they are added to the system. These devices can also store video as an option and typically operate as stand-alone units.

Digital video transmission is fast becoming the standard requirement for security and surveillance systems. TI's DSPs provide developers the flexibility to design a wide range of digital surveillance products. By leveraging the DSP programmability, processing performance, video-specific peripherals and support for all major multimedia codecs, developers can design differentiated products with customized features to meet changing market needs.

For more specific information about IP video node, video server and matrix solutions, see **www.ti.com/videoanalyticsserver**.

VLIB 2.0: Video Analytics & Vision Library

VLIB 2.0 supports:

- Video analytics
- Automotive vision and advanced driver assistance systems (ADAS)
- Embedded vision
- Game vision
- Machine vision
- Consumer electronics vision

VLIB 2.0 consists of 50+ royalty-free kernels:

- Background modeling and subtraction
- Object feature extraction
- Tracking, recognition
- Low-level pixel processing

New in VLIB 2.0:

- Optimized functions for TMS320C64x™ DaVinci™ DSP core support (example: TMS320DM642 processor)
- Simulink™ blocks to enable MathWorks model-based design
- Bit-exact version for testing on a PC
- Six additional functions including bit mask packing/unpacking, 16-bit IIR filter, L1 distance

VLIB 2.0 function list

- Background subtraction
  - Exponentially and uniformly weighted mean
  - Exponentially and uniformly weighted variance
  - Mixture of Gaussians
- Canny edge detection
  - Non-maxima suppression
- Hough transform for lines
- Integral image
- Image pyramid
- Legendre moments

Getting started with VLIB is as easy as one, two, three . . .

Step 1: A TMS320C64x+™ or C64x™-based development tool is required to view and access the VLIB software. If needed, TI recommends the TMS320DM6437 Digital Video Development Platform (part number TMDSVDP6437, U.S. $495).

Step 2: Get approval from TI. Visit **www.ti.com/vlibrequest** to fill out the VLIB Approval Request form.

Step 3: Upon approval, download the VLIB at no cost and receive:

- Library of 50+ kernel library and header files
- Simulink blocks
- PC library
- Documentation: User's Guide
- Demo (for use on TMS320DM6437 DVDP only)
- Test scripts

Advanced software features on TMS320DM3xx processors

The advanced software features on the TMS320DM3xx digital video processors allow customers to differentiate their video surveillance applications by providing better image improvements and added intelligent video processing.

Problems encountered

- Camera shakes due to weather, traffic or vehicle shaking degrades video quality.
- Detect and recognize face for identification, access control, privacy mask ...
- Image noise degrades low-light image quality. Increased sensor gain will increase noise and the use of a larger sensor will increase cost and size.

TI advanced software features solutions

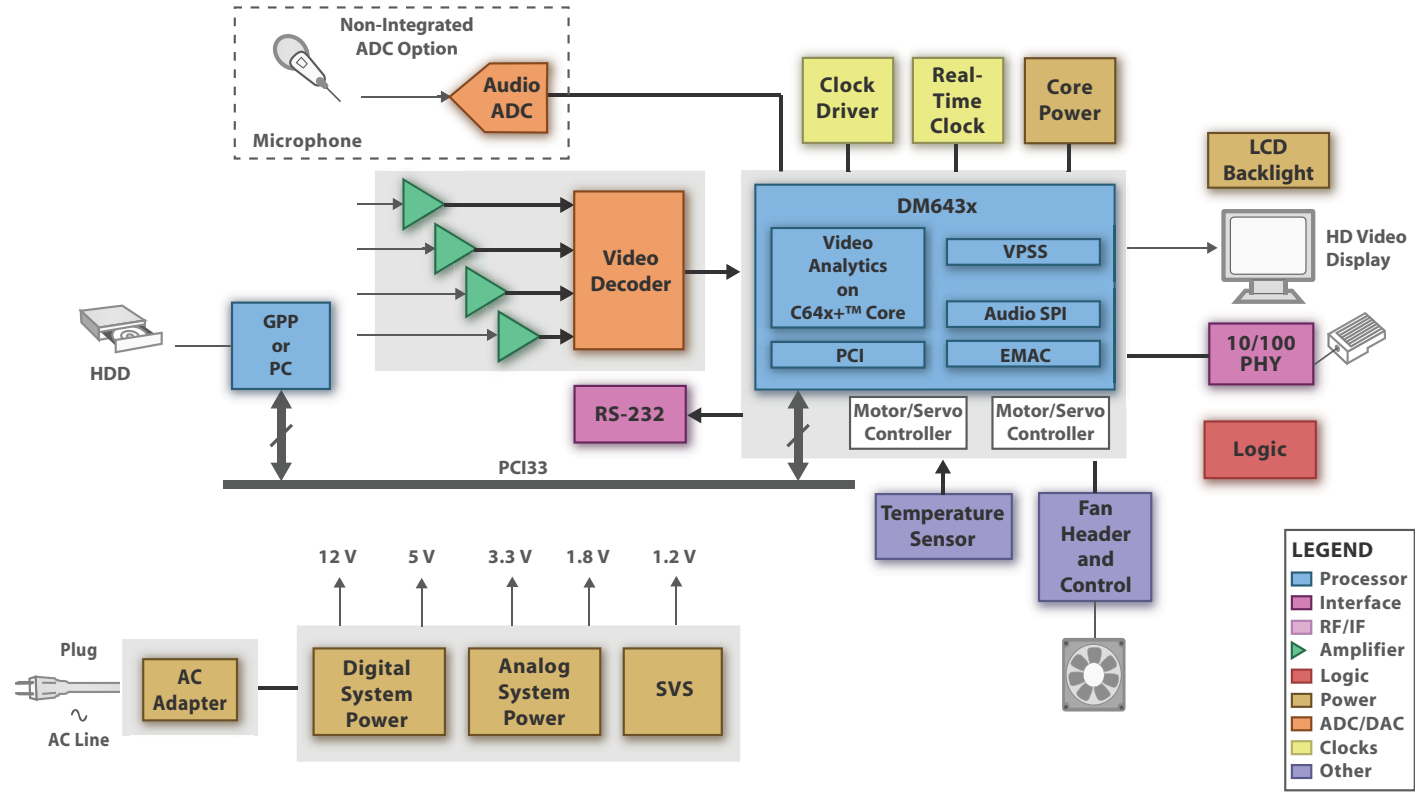
- **TI video stabilization** reduces jitter, improves visual quality and improves video bit rate.
- **TI face detection** detects face in <20 ms (with glasses, partially obscured, blurred, black & white, with night vision ...) and will handle multiple face tracking (>30 faces) at >30 fps.
- **TI video noise filters** include spatial and temporal noise filtering capabilities to:
  - Enhance visual quality, without removing detail with TI KATANA Noise Reduction (2D-NF)
  - Enable low-light imaging
  - Increase video coding efficiency – compression quality can be improved for same bit rate improving total end-to-end video quality
- TI motion compensated de-interlacing algorithm
  - User-selectable threshold value (to be specified in ARM® code)
  - YUV422 interleaved and YUV420 semi-planar support
  - ARM side function call for easy system integration

Video Analytics Server

Get started today

- **Evaluation model** – For demos and evaluation only (cannot be used in practical customer applications)
  - Included in the TI IP Camera Reference Design v2.1 software release
  - Works only for 10 minutes at a time and can be restarted
  - Watermark demo video with OSD
- **Working model** – Click-wrap production license agreement with TI to receive complete production library on six pre-defined packages.

Video Analytics Server System Block Diagram



*Visit page 67 or **power.ti.com** for information on TI's power management products.*

Featured Products

Product	TI Part #	Page
Clock Driver	CDCE949	51
Core Power	TPS40041	67
	TPS54386	67
	TPS62400	69
Processor	TMS320C6472	34
	TMS320C6474	34
	TMS320DM6435	30
	TMS320DM6437	30
	TMS320DM6433	30
	TMS320DM6431	30

Product	TI Part #	Page
RS-232	TRS3232E	54
Temperature Sensor	TMP100	65
	TMP124	65
	TMP302	65
	TMP422	65
	TMP431	65
	TMP432	65
Video Decoder	TVP5154	36
	TVP5158	36

*Device specifications can be found in the Selection Guide section of this document, pages 30–69. For additional information on each product, please visit **www.ti.com** and search by TI part number.*

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265