End-to-end video infrastructure solutions

Texas Instruments

Any content on any screen, anytime, anywhere. It's one of the key challenges that broadcasters, networks and other video content providers face as audiences expand their viewing across TVs, PCs and mobile phones. Not only are consumers viewing video on more devices, they are creating more content themselves and distributing that content to the global masses.

Hence the importance of taking an end-to-end view of video from creation to delivery and consumption. Texas Instruments takes that view by providing a suite of video solutions that span virtually every application and device, from studios and live trucks out to headends, then to set-top boxes and mobile phones.
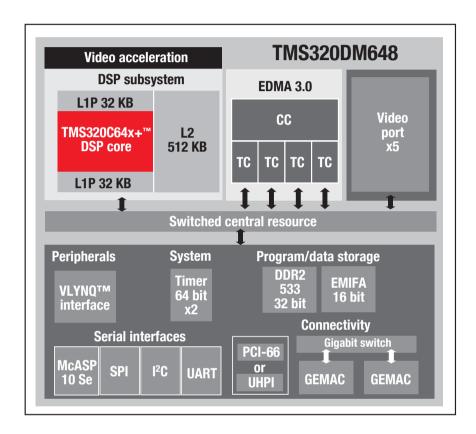
Content creation	Content management	Content commerce	Content distribution and delivery	Content consumption
Format conversion	Format conversion	Content aggregators	Advertising and media insertion	Set-top boxes
News/weather/ traffic service	Mastering and duplication	News/weather/ traffic service	Broadband connectivity	
Stock footage	Video processing	Stock footage	Headend equipment	
Subtitle, close captioning	Video content server	User generated contents	Set-top boxes	
Video capture devices		Interactive TV	IPTV/IP video	
			Mobile TV solutions	
			Satellite	
			Streaming and encoding	
			Webcasting	
			Video on demand	

The foundation of TI's video solutions is digital signal processing (DSP), which is ideal not only for today's video applications but tomorrow's, too. That's because unlike rigid application-specific integrated circuits (ASICs), DSPs are flexible enough to be upgraded in the field to support new technologies and compression standards, such as the latest codecs. That flexibility is particularly important for equipment vendors and their customers at times when standards are still in flux, yet market conditions propel them toward the latest technology available.

This brochure provides an overview of the challenges that broadcasters and other video content providers face in five major areas: creation, management, commerce, distribution and delivery, and consumption. Each section also includes TI's solutions for these areas.
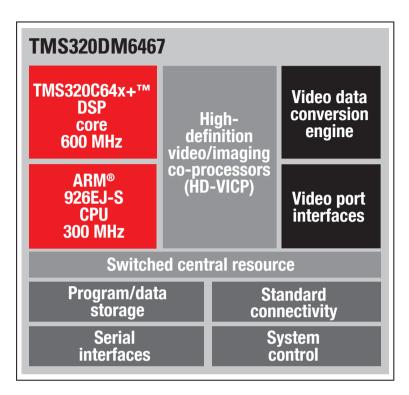
The **TMS320DM648 DSP** is designed for the most demanding digital media applications, with performance as high as 7,200 million instructions per second (MIPS) at a clock rate of 900 MHz. The DM648 device has five configurable 16-bit video port peripherals, providing a glueless interface to common video decoder and encoder devices. The video port peripherals also support multiple resolutions and video standards. In addition, the video port peripherals are configurable and can support either video capture and/or video display modes.
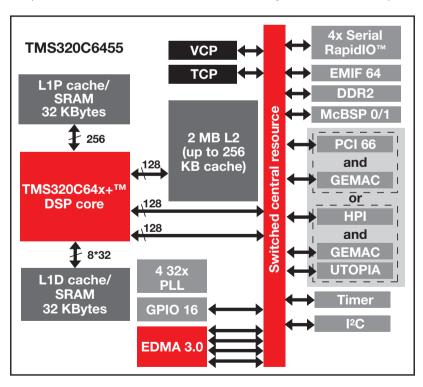

The **TMS320DM6467 DSP-based system-on-chip (SoC)** supports a variety of HD video processing and multichannel applications, such as video transcoding. It includes a 600-/675-MHz TMS320C64x+™ DSP core paired with an HD video coprocessor, conversion engine and targeted video port interfaces – a package that delivers 10 times the performance of previous generation processors while adding high-definition processing.

The DM6467 handles tasks such as simultaneous, multiformat HD encode, decode and transcoding up to MPEG-2 HP and H.264 HP@L4. That flexibility allows broadcasters, networks and other content providers to deliver video on myriad devices, from TVs to PCs to mobile phones, in formats that best match each device's capabilities.
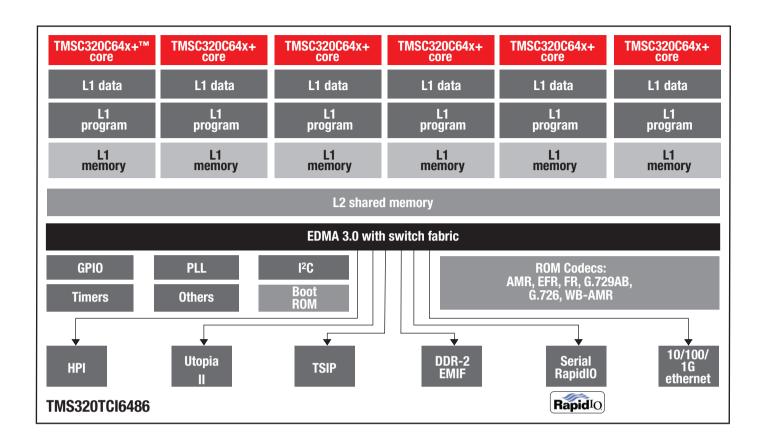
The DM6467's flexibility also helps content providers monetize these various applications by transcoding their assets for the online and mobile worlds. All of this is key for providing both a superior development platform and targeting the widest possible audience.

TMS320DM6467

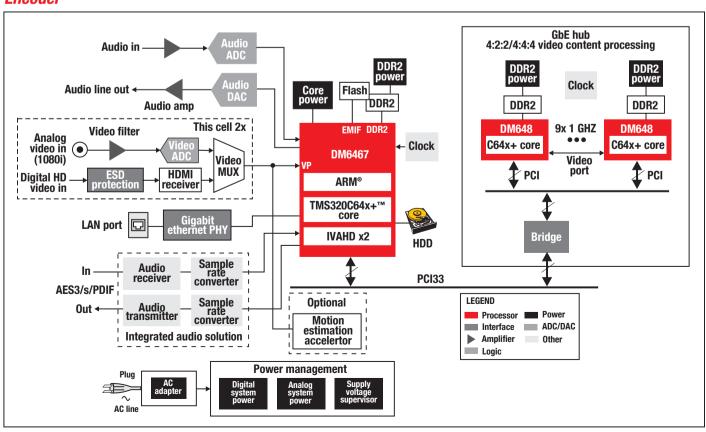| TMS320C64x+™ DSP core 600 MHz | High-definition video/imaging co-processors (HD-VICP) | Video data conversion engine |
ARM® 926EJ-S CPU 300 MHz		Video port interfaces
Switched central resource		
Program/data storage	Standard connectivity	
Serial interfaces	System control	

The **TMS320C6455 DSP** has proven itself in demanding applications, including video and telecom infrastructures. Using 90-nm process technology, the C6455 supports as many as 9,600 MIPS at a 1.2-GHz clock rate. The C6455 also features Serial RapidIO™ for high-speed, low latency interprocessor communications, critical in real-time systems such as video processing equipment.

TMS320C6455

- VCP
- TCP
- L1P cache/ SRAM 32 KBytes
- 256
- 2 MB L2 (up to 256 KB cache)
- 128
- TMS320C64x+™ DSP core
- 128
- 128
- 8*32
- L1D cache/ SRAM 32 KBytes
- 4 32x PLL
- GPIO 16
- EDMA 3.0

Switched central resource

- 4x Serial RapidIO™
- EMIF 64
- DDR2
- McBSP 0/1
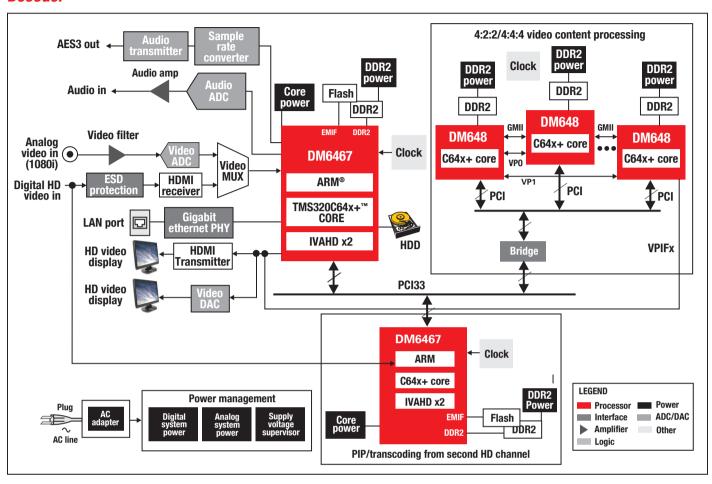- PCI 66 and GEMAC
- or
- HPI and GEMAC UTOPIA
- Timer
- I²C

The **TMS320TCI6486 DSP** is a multicore device with large, on-chip shared memory, a DDR interface and Serial RapidIO for inter-DSP communications. Gigabit Ethernet is embedded for native connectivity to IP-based systems. The TCI6486 is ideal for high-density transcoding in mobile video distribution systems.

TMS320TCI6486

TMSC320C64x+™ core	TMSC320C64x+ core	TMSC320C64x+ core	TMSC320C64x+ core	TMSC320C64x+ core	TMSC320C64x+ core
L1 data	L1 data	L1 data	L1 data	L1 data	L1 data
L1 program	L1 program	L1 program	L1 program	L1 program	L1 program
L1 memory	L1 memory	L1 memory	L1 memory	L1 memory	L1 memory

L2 shared memory

EDMA 3.0 with switch fabric

GPIO	PLL	I²C	**ROM Codecs:**
Timers	Others	Boot ROM	AMR, EFR, FR, G.729AB, G.726, WB-AMR

HPI	Utopia II	TSIP	DDR-2 EMIF	Serial RapidIO	10/100/1G ethernet

RapidIO

Encoder

LEGEND

Processor		Power	
Interface		ADC/DAC	
Amplifier		Other	
Logic			

Decoder

AES3 out ← Audio transmitter ← Sample rate converter

Audio amp

Audio in ← ◁ ← Audio ADC

Analog video in (1080i) ● → ▷ Video filter → Video ADC → Video MUX

Digital HD video in → ESD protection → HDMI receiver → Video MUX

LAN port → Gigabit ethernet PHY

HD video display ← HDMI Transmitter

HD video display ← Video DAC

Core power | Flash | DDR2 power | DDR2

DM6467
- ARM®
- TMS320C64x+™ CORE
- IVAHD x2

EMIF DDR2

Clock

HDD

4:2:2/4:4:4 video content processing

DDR2 power | DDR2

Clock | DDR2 power | DDR2

DDR2 power | DDR2

DM648 — C64x+ core
DM648 — C64x+ core
DM648 — C64x+ core

GMII GMII

VPO VP1

PCI PCI PCI

Bridge

VPIFx

PCI33

DM6467
- ARM
- C64x+ core
- IVAHD x2

Clock

Core power | EMIF | Flash | DDR2 Power
DDR2 | DDR2

PIP/transcoding from second HD channel

Plug → AC adapter

AC line ~

Power management
| Digital system power | Analog system power | Supply voltage supervisor |

LEGEND
- Processor (Red)
- Interface
- Amplifier ▶
- Logic
- Power (Black)
- ADC/DAC
- Other

Transcoder

Additional interface DM6467 allows modular design to support H.264, H.264 HD transcoding

Audio codec → McASP
I²C

Video filter — This cell 2x

Analog video in (1080i) ● → ▷ → Video ADC → Video MUX → VP

Digital HD video in → ESD protection → HDMI receiver → Video MUX

Core power | Flash | DDR2 power | DDR2

DM6467
- ARM
- C64x+ core
- IVAHD x2

EMIF DDR2

Clock

HDD

GMII

Optional

Core power | Flash | DDR2 power | DDR2

DM6467
- ARM
- C64x+ core
- IVAHD x2

EMIF DDR2

LAN port → Gigabit ethernet PHY

PCI33

Plug → AC adapter

AC line ~

Power management
| Digital system power | Analog system power | Supply voltage supervisor |

General purpose logic | Sensing and monitoring | RTC

LEGEND
- Processor (Red)
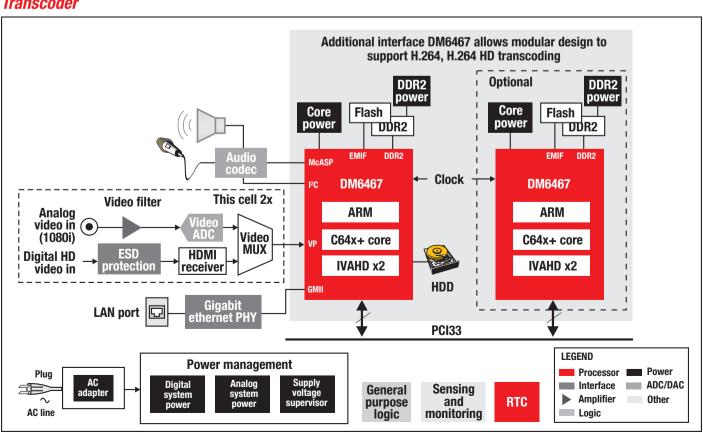- Interface
- Amplifier ▶
- Logic
- Power (Black)
- ADC/DAC
- Other

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Content creation

Applications: A high-quality video experience begins with high-quality production, whether the source is sports, news, weather and traffic services, subtitles, closed captioning, or stock footage. This type of content requires compression, stabilization and image-quality enhancements.

Concerns and challenges: Broadcasters and other content producers need flexibility to leverage technological advances – such as new compression schemes – without replacing equipment. Because of their inherent flexibility and field upgradeability, DSPs are ideal for applications where existing codecs are upgraded, or when new ones emerge to accommodate the latest applications. As a result, DSP-based designs extend the life of video infrastructure equipment.

TI solutions:
- TMS320DM648 DSP • TMS320TCI6486 DSP

Content management

Applications: Once content is created, it must be managed, including format conversion, mastering and duplication, and video processing. Video content servers, media gateways and radio network controllers are on the front line of this critical function.

Concerns and challenges: The more video that stations and networks add to their archives, the more challenging it becomes to index that content and quickly find relevant clips – particularly in fast-paced situations such as breaking news coverage.

Although having good content is key, having a flexible content management platform is critical to efficient operations. The explosion in user-generated content and increased channels pose a daunting challenge for content asset management. Efficiently handing video content, as well as adding metadata, allows subscribers to select their preferred content to watch on their preferred device. Evolving compression and metadata management standards require a flexible DSP solution to meet ever-changing requirements.

TI solutions:
- TMS320DM648 DSP • TMS320TCI6486 DSP

Content commerce

Applications: This emerging area includes new applications such as content aggregation, inclusion of stock footage, logo insertion, imported user-generated content, purchase-enabled interactive TV and informational scrolls.

Concerns and challenges: Broadcasting is no longer a one-way medium. Today's audiences increasingly expect to interact not only with content providers but with their fellow viewers as well. For broadcasters, this means adding capabilities such as viewer-generated tickers, which display comments submitted via e-mail, instant message (IM) or short message service (SMS).

Advertisers, meanwhile, want new options for placing their messages on the valuable screen real estate. Broadcasters adding such capabilities will create new revenue opportunities. A solution based on DSPs allows the needed flexibility to include next-generation content commerce methods.

TI solutions:
- TMS320DM6467 SoC • TMS320DM648 DSP
- TMS320TCI6486 DSP

Content distribution and delivery

Applications: Once content is captured, groomed and ad-infused, the task of distribution begins. Distribution is available through sources including broadband, IP-based systems, satellite, wireless and fiber.

Concerns and challenges: Audiences want to watch content on their terms: on-demand and on devices such as high- or standard-definition TVs, PCs, mobile phones or handheld devices. Broadcasters and other content providers must address these preferences within the network through equipment that includes cable headends or edge-located base stations, remote radio headends, and video servers.

As broadcast providers deliver more programming in MPEG-4/H.264 AVC, network equipment must add transcoding capability to convert content to MPEG-2, especially if providers do not plan on migrating their installed base of MPEG-2 set-top boxes to hybrid units in the near future.

Considering that more than 50 million MPEG-2 set-top boxes are deployed with an average lifecycle of more than five years, the challenge of balancing the two technologies will continue for at least the rest of this decade. Transcoding solutions based on DSPs provide the flexibility to handle many standards and resolutions. More importantly, manufactures can offer solutions while standards are in flux, and as new formats and devices enter the market at a rapid pace.

TI solutions:
- TMS320DM648 DSP
- TMS320DM6467 SoC
- TMS320TCI6486 DSP

Content consumption

Applications: Consumers want to experience video content in living rooms, work environments and on the move – regardless of the transmission medium – on devices such as TVs, PCs, smart-phones and handheld devices.

Concerns and challenges: The wide variety of video consumption devices is both a challenge and an opportunity. On one hand, broadcasters and other content providers have more ways to reach more audiences. On the other, those devices each have different capabilities in terms of screen size, resolution and codecs.

As networks deliver contents in MPEG-2 and H.264 formats, solutions based on DSPs allow manu-facturers to offer solutions that are flexible and able to respond to the needs of emerging devices.

TI solutions:
- TMS320DM6467 SoC

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