TMS320C66x high-performance multicore DSPs for video surveillance

Delivering industry-best performance-per-watt, scalable multicore DSPs to enable advanced analytics at the edge and in the server

Texas Instruments

Texas Instruments' TMS320C66x multicore DSPs provide real-time performance to implement advanced analytics for surveillance and security applications. With a scalable roadmap that has both low-power and high-performance targeted devices, these surveillance and security applications include equipment such as:

- Smart IP cameras
- Digital video recorders (DVRs)
- Networked video recorders (NVRs)
- Video analytics servers

The needs of businesses, governments, financial institutions and transportation hubs, to name a few, are driving new uses for video surveillance and security systems beyond crime prevention and into areas of information gathering, asset management, safety and risk mitigation. This is forcing the end equipment to evolve through increased analytics, pushing the need for the additional processing power provided by TI's multicore devices.

To meet these needs, video surveillance and security manufacturers can choose a range of solutions from TI's scalable family of multicore DSPs, including the TMS320C667x devices that have from one to eight C66x DSP cores, and the TMS320C665x devices that have been designed for low power and have either a single- or dual-C66x DSP. The breadth of TI's multicore DSP portfolio enables the development for surveillance applications that keep up with the demanding needs of the market.
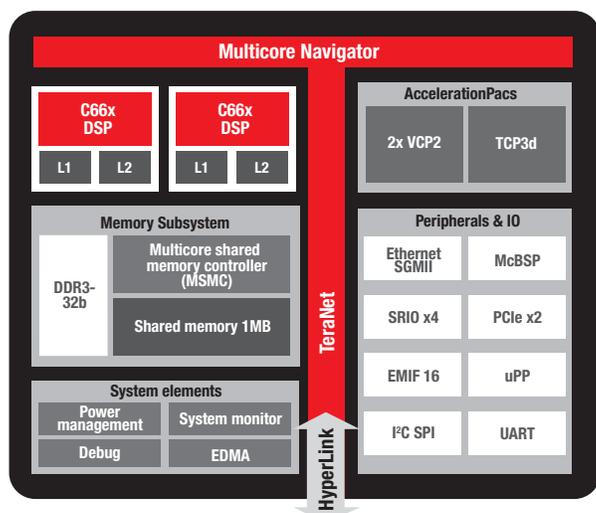
Adding intelligence to the edge

The need to add analytics to the edge, or at the cameras, comes with its own set of challenges. At the edge, size and power restrictions exist which have traditionally limited the addition of higher-level analytics. TI's new TMS320C6654, TMS320C6655 and TMS320C6657 multicore devices are power optimized and deliver high performance along with high-speed peripherals in a small 21×21-mm package (Figure 1). These devices are also in a lower profile (2.99-mm height) package, enabling minimal overall product packaging size and weight.

The full-featured dual-core C6657 DSP uses just 3.5 W at 1 GHz while the more specialized single-core C6654 DSP needs less than 2 W at 850 MHz.

▲ Figure 1. TMS320C6657/55 block diagram

Key Features

- Family of high-performance, pin-compatible C667x DSPS comprising of one, two, four or eight C66x cores running at 1.25 GHz and delivering up to 320 GMACS/160 GFLOPS of fixed- and floating-point performance.
- Family of power-optimized, pin-compatible C665x DSPs comprising of single or dual C66x cores running at up to 1.25 GHz and delivering up to 80 GMACS/40 GFLOPS of fixed- and floating-point performance.
  - TMS320C6657 @ 1 GHz – 3.5 W
  - TMS320C6655 @ 1 GHz – 2.5 W
  - TMS320C6654 @ 850 MHz – <2 W
  - Package: 21×21-mm FC-BGA
- Large on-chip memory and multiple high-speed interfaces
- Free multicore software development kit (MCSDK) enabling easier programming
- Low-cost evaluation modules starting at U.S. $349
- Extensive third-party network providing hardware and software support

These devices have both fixed-and floating-point capability with the 1.25-GHz C6657 DSP delivering 80 GMACS, 40 GFLOPS of processing, enabling intelligence at the edge with advanced features such as stereo-vision based algorithms or the tracking of multiple simultaneous events including:

- Motion detection
- Trip zone detection

- Object counting
- Object recognition
- Vehicle detection
- License plate recognition
- Behavior analysis

Improving recorders and servers

DVRs, NVRs and video analytic servers are, similar to the smart cameras at the edge, looking to add more advanced analytics in a cost- and power-efficient way. TI's TMS320C6674 and TMS320C6678 multicore DSPs provide, respectively, four or eight C66x fixed- and floating-point DSP cores. The flagship C6678 DSP, the industry's highest-performing multicore DSP solution, features eight 1.25-GHz cores, effectively providing a 10-GHz DSP delivering 320 GMACS, 160 GFLOPS of combined fixed- and floating-point performance. This benchmark-busting performance enables developers to simultaneously run multiple advanced analytics in their DVRs, NVRs and servers on more streams of higher-resolution video.

Based on the same C66x cores, the C667x and C665x multicore DSPs are code compatible with each other, as well as backwards compatible to previous generations, providing a scalable solution base from previous generations of surveillance and security equipment to today's advanced smart cameras and to DVRs, NVRs and servers, ensuring maximal code reuse.

By leveraging the DSP programmability, processing performance, high-speed peripherals and support for all major multimedia codecs, developers can design differentiated products with customized features to meet the evolving needs of the video surveillance and security market.

Easing development with multicore software and tools

TI offers optimized libraries, support for the OpenMP programming model, SYS/BIOS™ real-time operating system and Linux™ support in a free multicore software development kit (MCSDK) to developers working with its C66x multicore DSPs. The free IMGLIB and VLIB optimized libraries provide common building blocks used in many video surveillance and security algorithms, and the DSPLIB and MATHLIB libraries aide in developing optimized real-time signal processing. TI's MCSDK also includes demo software showing a multicore image-processing example and a fast Fourier transform (FFT) based signal-processing example.

TI also offers all major multimedia codecs on the C66x architecture. TI codecs are free, come with production licensing and are available for download now. All are production tested for easy integration.

TI provides a full suite of best-in-class Eclipse-based development and debug tools for the C667x and C665x devices, including a new C compiler, an assembly optimizer to

▲ *Figure 2. TMS320C6678 Lite Evaluation Module*

simplify programming and scheduling, and a Windows® debugger interface for visibility into source code execution. TI's compiler generates highly efficient code that is "first pass efficient" so there is less need to optimize it. TI's debug tools help developers to visualize problems and resolve them quickly, helping designers get products to the field faster while saving development resources.

To further ease development, TI offers low-cost evaluation modules (EVMs) for each of these devices. The C6678 Lite EVM starts at U.S. $399 (Figure 2) and the C6657 Lite EVM starts at U.S. $349. Both EVMs include TI's MCSDK and Code Composer Studio™ integrated development environment, allowing programmers to quickly come up to speed on the TMS320C66x platform.

For additional information on TI's multicore DSPs, software and low-cost EVMs, please visit **www.ti.com/multicore**.

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