

# 66AK2Hx KeyStone™ Multicore DSP+ARM® System-on-Chips



## Overview

The 66AK2Hx platform is TI's first to combine quad ARM® Cortex™-A15 MPCore™ processors with up to eight TMS320C66x high-performance DSPs using the KeyStone II multicore architecture. Unlike previous Cortex-A15-based devices that were designed for consumer products, the 66AK2Hx platform provides up to 5.6 GHz of ARM and 9.6 GHz of DSP processing coupled with security and packet processing and Ethernet switching, all at lower power than multi-chip solutions. This makes these devices optimal for embedded infrastructure applications like cloud computing, media processing, high-performance computing, transcoding, security, gaming, analytics and virtual desktop.

## Power and Performance

The combined floating-point processing power of the Cortex-A15 processors and the C66x DSP cores is more than 63 GFLOPS of double-precision performance and more than 198 GFLOPS of single-precision performance – providing the best embedded performance per watt in the industry. Combining this real-time performance with a general-purpose embedded processor yields new opportunities for bringing powerful analytics to emerging applications.

## Fast and Wide Packet Interfaces

Processing performance alone does not differentiate infrastructure from consumer applications. High-

### Key Features

Key features of 66AK2Hx devices include:

#### CorePac Processors

- Up to four Cortex-A15 processors, 19600 Dhrystone MIPS
- Up to eight C66x DSP cores, 352 GMACS/198 GFLOPS

#### Network AcceleratorPac

- Packet coprocessor (IPv4/IPv6) for Layer 2–4
- Security coprocessor IPsec/SRTP
- Five-port 1-Gb Ethernet switch

#### Memory

- Cache-coherent Multicore Shared Memory Controller (MSMC)
- 1MB per core Level 2 RAM/cache
- 6MB shared memory with ECC and cache coherency
- Two DDR3/3L 1600 interfaces with ECC

performance networking interfaces are critical to deliver data to processors fast enough. The addition of an on-chip five-port 1G Ethernet switch, three-port 10G Ethernet switch, packet coprocessor and security coprocessor provides carrier-grade Ethernet throughput without the increase in ARM® or DSP processor loading that normally comes from layer 2–4 processing, encryption and decryption. Other high-performance SerDes interfaces, like Serial RapidIO® and PCIe, deliver data to processors at infrastructure speeds, enabling the 66AK2Hx platform to handle tremendous data throughput.

### KeyStone II Architecture

- Multicore Navigator; brings single-core programming simplicity to multicore SoCs
- 16,000 atomic hardware queues
- TeraNet – on-chip interconnect providing more than two terabits per second throughput
- Low power – 9–14 Watts at 55°C case temperature, 11 Watts typical for 66AK2H06 SoC

### High speed I/O

- 10 Gigabit Ethernet – up to 20 Gbps
- PCI Express Gen2—up to 10 Gbps
- Serial RapidIO V2.1—up to 20 Gbps
- USB 3.0
- HyperLink – up to 100 Gbaud for chip-to-chip interconnect

For more technical detail see the [data manual](#).

The TeraNet is a multilevel interconnection of high-speed non-blocking channels that deliver more than two terabits per second of concurrent throughput – enabling full multicore entitlement where every processing element can operate near full capacity all of the time.

The two 50-Gbaud HyperLinks use a low-overhead protocol that extends the TeraNet off the device to other KeyStone SoCs and third-party devices making them appear as one larger device while simplifying software development, reducing latency and improving system performance.

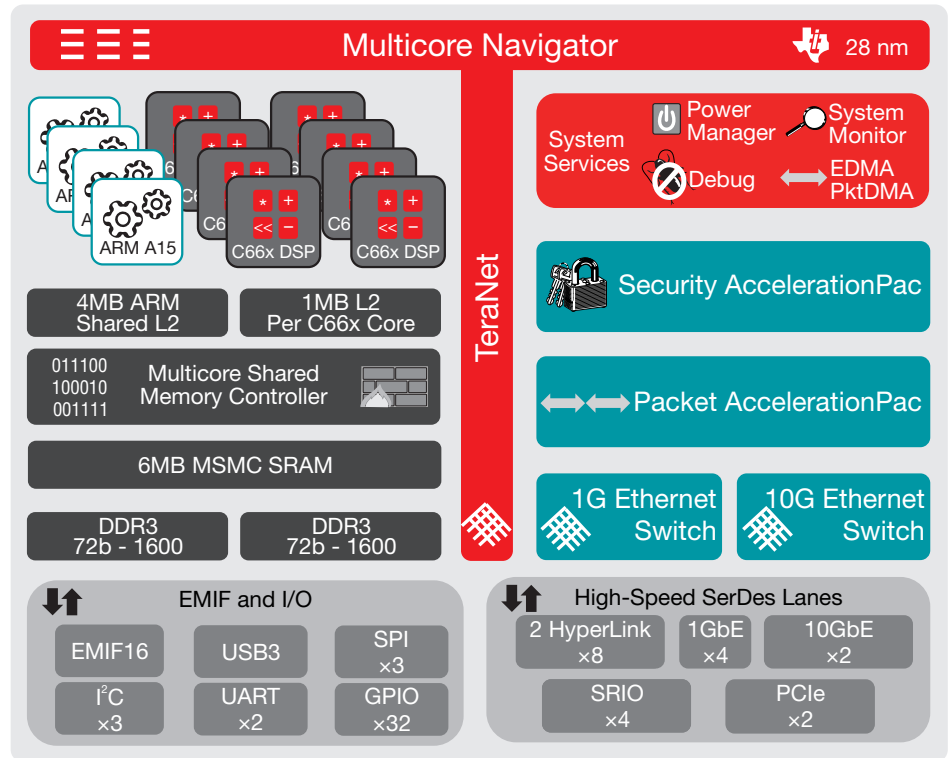
## High-Speed Memory for Demanding Applications

Infrastructure applications demand non-blocking, high-performance memory with error correction. For KeyStone II, TI upgraded the multicore shared memory controller (MSMC) so that memories can operate at the speed of the processor cores which reduces latency and contention while providing high-bandwidth interconnections between processor cores and shared internal and external memory. The 72-bit DDR3/3L controllers run at 1600 MT/s with optional error correction (ECC) support and hardware-based cache coherency, enabling more than 20 GB/s data transfers between external and internal memory. The devices provide a second DDR3/3L controller dedicated to maximizing I/O performance.

## Tools and Software to Reduce Development Time

TI's development tools and runtime software support make migration and development for heterogeneous platforms simpler than ever.

The Multicore Software Development Kit (MCSDK) provides support for open source Linux™ and TI's SYS/BIOS operating system for ARM and C66x DSP cores. Evaluation modules (EVMs) will be available with the MCSDK and preloaded example projects. TI also provides optimized single and multicore DSP libraries for FFT, image



▲ TI's KeyStone 66AK2H14 SoC

and video analytics, matrix math and other commonly used algorithms.

TI was the first to support the OpenMP® API for multicore DSPs and will continue to advance OpenMP support for KeyStone II platforms. TI's OpenMP software uses a packet-based network-on-chip interconnect called Multicore Navigator to get the best multicore performance. The combination of OpenMP and Multicore Navigator frees developers from complex queue management and allows developers to use industry-standard APIs for programming TI's devices. Support

for OpenCL is coming soon.

Code Composer Studio™ Integrated Development Environment provides a development environment that reduces porting time and can be used as a plug-in to the open-source Eclipse Integrated Development Environment. TI also plans to support Open Source development and profiling tools for KeyStone II-based SoCs.

For more information about the 66AK2Hx platform and TI's portfolio of KeyStone multicore devices please visit [www.ti.com/multicore](http://www.ti.com/multicore).

The platform bar, Code Composer Studio, KeyStone and SmartReflex are trademarks of Texas Instruments. All other trademarks are the property of their respective owners.

## 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 and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and 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/energy">www.ti.com/energy</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 and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)