Arm Ethos-U Processor Series

**Key Features and Benefits**

- **Performance Efficiency**
  Unlock new edge AI use cases with minimal impact to existing design across a wide range of ML performance requirements (GOP/s to TOP/s).

- **Flexible Integrations**
  Build low-cost, highly efficient systems in high-performance Cortex-A, and low-power Cortex-M embedded systems.

- **Optimized Design**
  Highly optimized with integrated DMA, MAC array, and element wise engines.

- **Unlock a New World of Edge AI Applications**
  Build low-cost, highly efficient AI solutions in a wide range of embedded devices with Arm’s Ethos-U NPUs which enable systems based on Arm Cortex and Arm Neoverse. Ethos-U provides a scalable range of performance and memory interfaces and integrates low-power Cortex-M SoCs, as well as SoCs based on high-performance Arm Cortex-A, Cortex-R, and Arm Neoverse. Develop, deploy, and debug AI applications using a common toolchain across Arm Cortex and Ethos-U processors.
PRODUCT BRIEF

HIGHLIGHTS

+ Energy Efficient
  Provides up to 90% energy reduction for ML workloads, such as ASR, compared to previous Cortex-M generations.

+ Network Support
  Flexible design supports a variety of popular neural networks, including CNNs and RNNs, for audio processing, speech recognition, image classification, and object detection.

+ Future-Proof Operator Coverage
  Heavy compute operators run directly on the NPU, such as convolution, transformer, LSTM, RNN, pooling, activation functions, and primitive element-wise functions. Other kernels can run automatically on the tightly coupled Cortex-M using CMSIS-NN or Arm Compute Library on Cortex-A.

+ Reduce Memory Footprint
  Up to 70% reduction in model size with compression allows for the execution of larger networks and speeds up the execution of networks.

+ Offline Optimization
  Offline compilation and optimization of neural networks, performing operator, and layer fusion, as well as layer reordering to increase performance and reduce system memory requirements by up to 90%. Delivers increased performance and lower power compared to non-optimized ordering.

+ Develop Multiple Products
  Products Target multiple markets with a single processor IP architecture that provides the system flexibility to configure the performance and desired memory system and OS.

+ Quickly Create Applications
  Accelerate time to market by leveraging the Arm AI ecosystem with partners developing optimized algorithms ahead of hardware availability.

Ethos-U85 can target numerous different applications with use in high-performance Cortex-A or low power Cortex-M based embedded devices.

Unified Software and Tools
Develop, deploy, and debug AI applications using a common toolchain across Arm Cortex and Ethos-U processors.

Ethos-U85 can target numerous different applications with use in high-performance Cortex-A or low power Cortex-M based embedded devices.
Key Use Cases for the Ethos-U Processor Series

- Object classification
- Object detection
- Face detection/identification
- Human pose estimation
- Image segmentation
- Image beautification
- Super resolution
- Speech recognition
- Sound recognition
- Noise cancellation
- Speech synthesis
- Language translation
- Natural language processing

Specifications

<table>
<thead>
<tr>
<th>Key Features</th>
<th>Ethos-U55</th>
<th>Ethos-U65</th>
<th>Ethos-U85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>64 to 512 GOP/s</td>
<td>512 GOP/s to 1 TOP/s</td>
<td>256 GOPS/s to 4 TOP/s</td>
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<tr>
<td>(At 1 GHz)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MACs (8x8)</td>
<td>32, 64, 128, 256</td>
<td>256, 512</td>
<td>128, 256, 512, 1024, 2048</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Memory System</th>
<th>Internal SRAM</th>
<th>System Interfaces</th>
<th>External Memory</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>18 to 50 KB</td>
<td>Two 64-bit AXI</td>
<td>SRAM and Flash</td>
</tr>
<tr>
<td></td>
<td>55 to 104 KB</td>
<td>Two 128-bit AXI</td>
<td>SRAM, DRAM, and/or FLASH</td>
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<tr>
<td></td>
<td>29 to 267 KB</td>
<td>Up to six 128-bit AMBA 5 AXI</td>
<td>SRAM, DRAM and/or FLASH</td>
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Development Platforms

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<thead>
<tr>
<th>Recommended</th>
<th>Host CPU</th>
<th>Operating Systems</th>
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</thead>
<tbody>
<tr>
<td>Host CPU</td>
<td>Cortex-M55, Cortex-M7, Cortex-M4, Cortex-M33</td>
<td>Bare-metal or RTOS</td>
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<tr>
<td></td>
<td>Cortex-M55, Cortex-M7</td>
<td>Bare-metal, RTOS, or Linux</td>
</tr>
<tr>
<td></td>
<td>Cortex-M85, Cortex-M55, Cortex-M7</td>
<td>RTOS, Bare-metal, or Linux</td>
</tr>
</tbody>
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To find out more about the Ethos-U processor series, visit developer.arm.com/ethos-u