Contact: Mariel Santos
               408-601-3145
               Mariel.Santos@maximintegrated.com

Maxim Integrated's Neural Network Accelerator Chip Enables IoT Artificial Intelligence in Battery-Powered Devices

MAX78000 reduces energy consumption and latency by a factor of over 100 to enable complex embedded inference decisions at the IoT edge

SAN JOSE, Calif.—Oct. 7, 2020—The **MAX78000** low-power neural network accelerated microcontroller from Maxim Integrated Products, Inc. (NASDAQ: MXIM) moves artificial intelligence (AI) to the edge without performance compromises in battery-powered internet of things (IoT) devices. Executing AI inferences at less than $1/100^{th}$ the energy of software solutions dramatically improves run-time for battery-powered AI applications, while enabling complex new AI use cases previously considered impossible. These power improvements come with no compromise in latency or cost: the MAX78000 executes inferences 100x faster than software solutions running on low power microcontrollers, at a fraction of the cost of FPGA or GPU solutions.

- For details about Maxim Integrated's Artificial Intelligence solutions, visit http://bit.ly/Maxim_AI
- To order MAX78000 or learn more, visit http://bit.ly/MAX78000_Product
- For a hi-res image, visit http://bit.ly/MAX78000_Image
- For a quick-start video and more about the MAX78000 development tools, visit http://bit.ly/MAX78000_Video

AI technology allows machines to see and hear, making sense of the world in ways that were previously impractical. In the past, bringing AI inferences to the edge meant gathering data from sensors, cameras and microphones, sending that data to the cloud to execute an inference, then sending an answer back to the edge. This architecture works but is very challenging for edge applications due to poor latency and energy performance. As an alternative, low-power microcontrollers can be used to implement simple neural networks; however, latency suffers and only simple tasks can be run at the edge.

By integrating a dedicated neural network accelerator with a pair of microcontroller cores, the MAX78000 overcomes these limitations, enabling machines to see and hear complex patterns with local, low-power AI processing that executes in real-time. Applications such as machine vision, audio and facial recognition can be made more efficient since the MAX78000 can execute inferences at less than 1/100th energy required by a microcontroller. At the heart of the MAX78000 is specialized hardware designed to minimize the energy consumption and latency of convolutional neural networks (CNN). This hardware runs with minimal intervention from any microcontroller core, making operation extremely streamlined. Energy and time are only used for the mathematical operations that implement a CNN. To get data from the external world into the CNN engine efficiently, customers can use one of the two integrated microcontroller cores: the ultra-low power Arm® Cortex®-M4 core, or the even lower power RISC-V core.

AI development can be challenging, and Maxim Integrated provides comprehensive tools for a more seamless evaluation and development experience. The **MAX78000EVKIT#** includes audio and camera inputs, and out-of-the-box running demos for large vocabulary keyword spotting and facial recognition. Complete documentation helps engineers train networks for the MAX78000 in the tools they are used to using: TensorFlow or PyTorch.

Key Advantages

- **Low Energy**: Hardware accelerator coupled with ultra-low-power Arm Cortex M4F and RISC-V microcontrollers moves intelligence to the edge at less than 1/100th the energy compared to closest competitive embedded solutions.

- **Low Latency**: Performs AI functions at the edge to achieve complex insights, enabling IoT applications to reduce or eliminate cloud transactions and cuts latency over 100x compared to software.
- **High Integration**: Low-power microcontroller with neural network accelerator enables complex, real-time insights in battery-powered IoT devices.

Commentary

- "Artificial intelligence is frequently associated with big data cloud-based solutions," said Kelson Astley, research analyst at Omdia. "Anything that can cut the power cord and reliance on big Lithium-Ion battery packs will help developers build AI solutions that are nimbler and more responsive to environmental conditions in which they operate."
- "We've cut the power cord for AI at the edge," said Kris Ardis, executive director for the Micros, Security and Software Business Unit at Maxim Integrated. "Battery-powered IoT devices can now do much more than just simple keyword spotting. We've changed the game in the typical power, latency and cost tradeoff, and we're excited to see a new universe of applications that this innovative technology enables."

Availability and Pricing

- The MAX78000 is available from authorized distributors; pricing available upon request.
- The [MAX7800EVKIT#](#) evaluation kit is available for $168.

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About Maxim Integrated

Maxim Integrated develops innovative analog and mixed-signal products and technologies to make systems smaller and smarter, with enhanced security and increased energy efficiency. We are empowering design innovation for our automotive, industrial, healthcare, mobile consumer and cloud data center customers to deliver industry-leading solutions that help change the world. Learn more at https://www.maximintegrated.com.