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Akida Neuromorphic System on a Chip (NSoC) Product Brief

Key Benefits

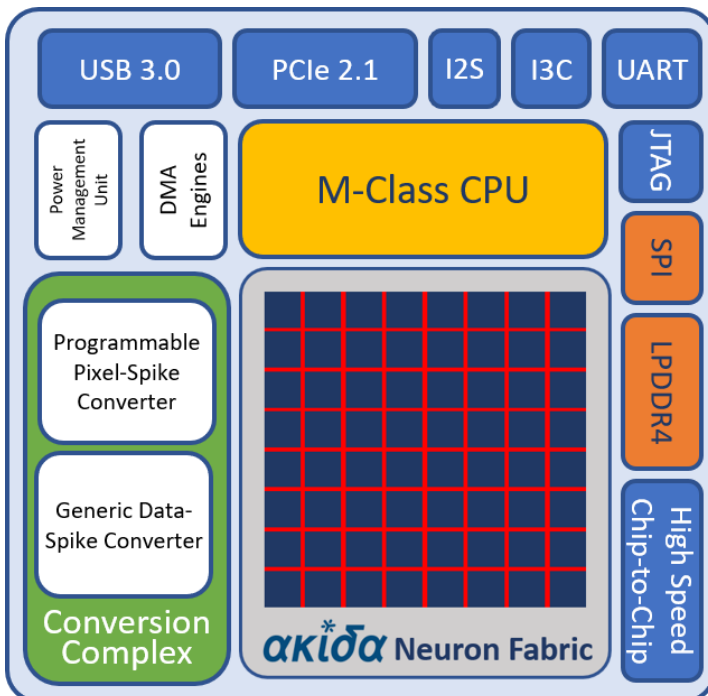
- Designed for Low-Power Neural Network Processing
 - Complex neural networks (example: MobileNet V1)
 - Unsurpassed images/second/watt with superior accuracy
- On-Chip Learning
- Industry Standard Development Environment
 - TensorFlow and Keras APIs
- Expansive Neuron Fabric - Industry Leader
 - Up to 1.2 million neurons/10 billion synapses
 - Fits complex networks on-chip, with optional external weight storage - lower system cost
- Cost Effective
 - Reliable 28nm CMOS digital logic process
 - Small FCBGA package

Applications

- Personalized Edge AI systems - Learn on the edge
- Edge AI Vision Systems
 - ADAS/AV
 - Vision Guided Robotics
 - Drones
 - Video Surveillance
- Industrial Internet of Things
 - Environmental monitoring/control
 - Predictive maintenance
- Smart Home
 - Appliances
 - Speakers
 - Remote Controls

The **Akida Neuromorphic System-on-Chip (NSoC)** is the first in a revolutionary new breed of event domain neural processing devices. Integrated on a pure digital 28nm logic process, this event-based neural processor is inherently lower power than traditional deep learning accelerators. Perform incremental and 1-shot learning on chip for applications where personalization, privacy and security are essential. When using the unique BrainChip Akida Development Environment flow, standard convolutional neural networks (CNN) are converted to run on the Akida event domain processor with very low power consumption and high throughput. The Akida NSoC contains all the needed interfaces and data-to-event converters for embedded systems or can be scaled to multiple devices for edge computing applications.

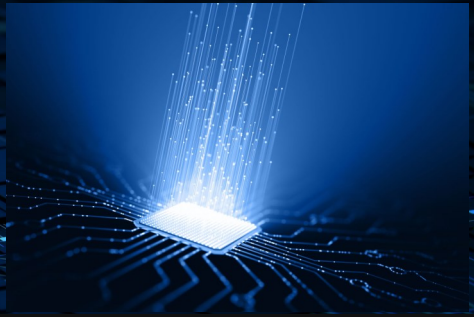
Akida SoC Block Diagram



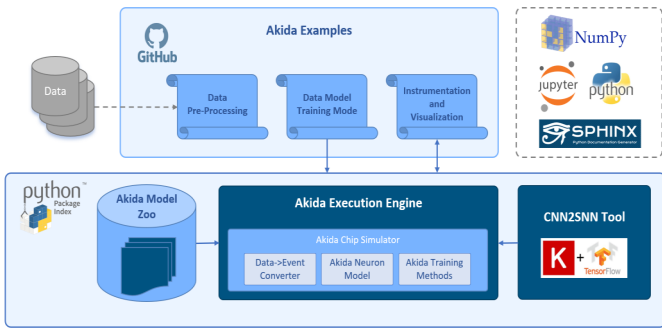
Specifications

- Akida Neuron Fabric
 - Array of flexible Neural Processing Cores
 - Interconnect network for spike transmission
- On-Chip Conversion Complex
 - Flexible pixel-spike converter for grey scale or RGB data
 - Programmable data-spike converter for all other datatypes
- On-Chip Processor ARM Cortex M4
 - FPU and DSP for pre and post-processing of data
- Industry standard interfaces
 - PCIe 2.1 2-lane endpoint
 - USB 3.0 slave
 - I3C, I2S, UART, JTAG
- High-Speed Serial Chip-to-Chip Interconnect
 - PCIe PHY 2-lane
 - Enables expansion up to 32 devices
- Memory Interfaces
 - SPI for boot/program/configurations
 - LPDDR4 for intermediate data and additional weights
- Clock speed: 100—300MHz

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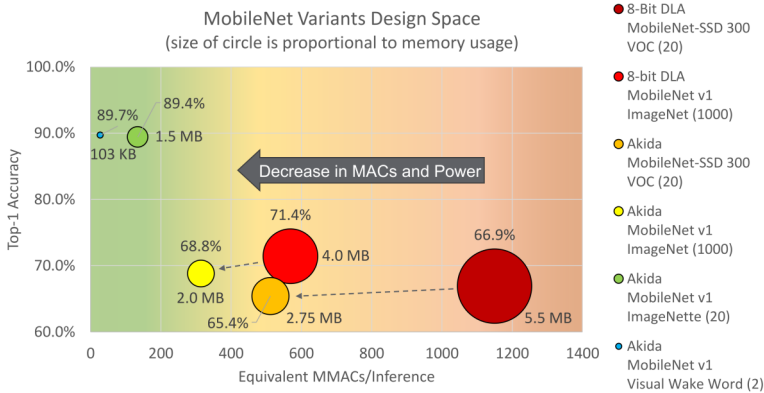


Features

- **Akida Simulator**
 - Contains Akida Models, training methodologies, and data-to-event converters
 - Controlled using API calls in Python
- **CNN-to-SNN Conversion - use your existing CNN's**
 - Familiar TensorFlow environment with Keras APIs
 - Programmable quantization-aware training
- **BrainChip Edge Learning**
 - One-shot learning to learn new classes on the field

The **Akida Development Environment** is a machine learning framework that enables users to develop, train and implement their CNN or SNN solution to run on the Akida event domain neural processor. doc.brainchipinc.com

AKIDA Design Space



The **Akida NSoC** offers unsurpassed performance on a performance-per-watt basis. Entire neural networks can be placed into the fabric, removing the need to swap weights in and out of DRAM, which reduces power and increases throughput. Optionally, network layers and weights can be loaded from DRAM to support larger networks.

Akida is an event-based neural networks processor, it is therefore taking advantage of activation sparsity, further reducing power consumption. CNNs converted to SNNs become event-based and benefit from this sparsity.

The **Akida Neuron Fabric** enables SNNs to be placed in either a parallelized manner for ultimate performance or space-optimized to reduce silicon utilization and power consumption. Users can also modify the clock frequency, further optimizing performance and power consumption.

The **Akida NSoC** will be available in a low-cost FCBGA plastic package for designing into embedded systems on the edge. Additionally, BrainChip will provide the Akida NSoC device on development boards, M.2 PCIe card and a USB stick.



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