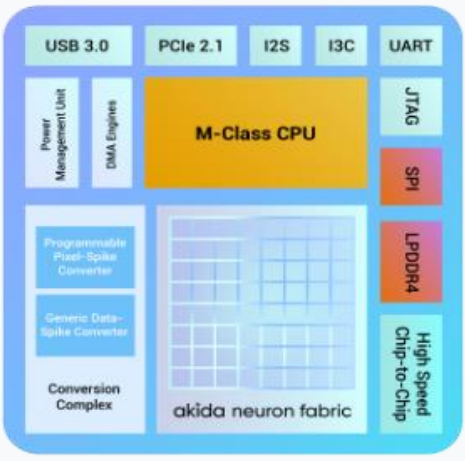
AKD1000 Akida System-on-Chip

Product Brief

The Akida AKD1000 System-on-Chip (NSoC) is the first in a 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 neural networks are converted to run on the Akida event domain processor with very low power consumption and high throughput. The Akida AKD1000 contains all the needed interfaces and data-to-event converters for embedded systems or can be scaled to 32 devices for edge computing applications.

Key Benefits

* **Designed for Low-Power Neural Network Processing**
  - Highly efficient images/second per watt with superior accuracy
* **On-Chip Learning**
  - Enables customization
* **Industry Standard Development Environment**
  - TensorFlow and Keras APIs
* **Cost Effective**
  - Reliable 28nm CMOS digital logic process
  - Small FCBGA package



Akida AKD1000 SoC

Example Applications areas

* **Personalized Learning Edge AI systems -**
* **Edge AI Vision Systems**
  - ADAS/AV
  - Vision Guided Robotics
  - Drones
  - * **Industrial Internet of Things**
  - Environmental monitoring/control
  - Predictive maintenance
* **Smart Home**
  - Appliances
  - Speakers
  - Voice Control

Specifications

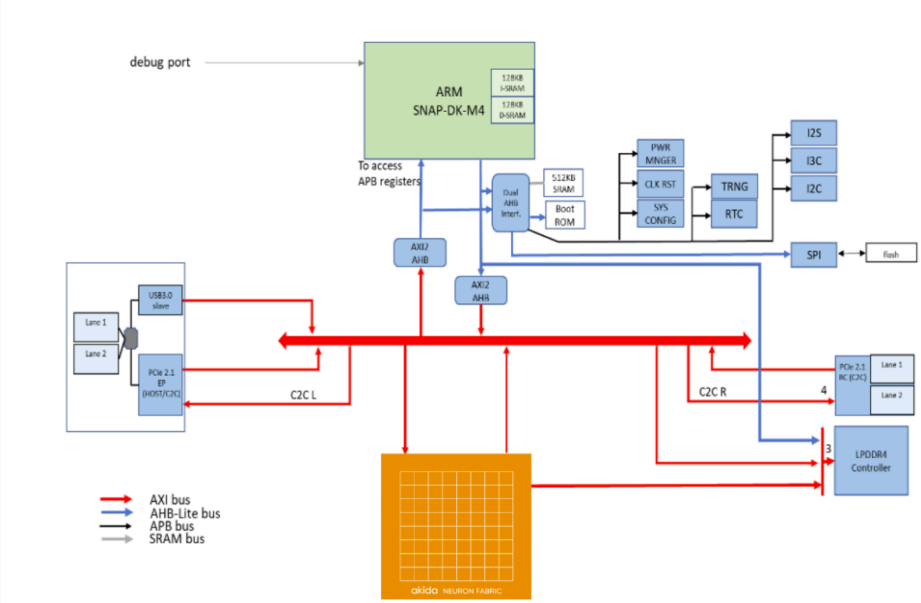
- **ARM Cortex M4 On-Chip Processor**
- FPU and DSP for pre/post-processing of data

Akida Neuron Fabric

- Array of 20 Neural Processing Cores
- 2560 4x4 bit MACs @300MHz for 0.7 TOPS
- Interconnect network for spike transmission

* **On-Chip Conversion Complex**
  - Flexible pixel-spike converter for grey scale or RGB data
  - Programmable data-spike converter
  - * **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: Up to 300MHz**

AKD1000 Akida System-on-Chip
Product Brief



AKD1000 Block Diagram

Parameter	Symbol	Rating			Units
		Min	Typ	Max	
	VVDD09	0.855	0.9	0.945	V
Core - VDDI Power Supply (Dig)	IVDD09		1 .5	2.3	A
LVCMOS 1.8V IO	VVDE18	1.71	1.8	1.89	V
Clock		0		400	MHz

Thermal	Junction to Ambient			14	°C/W
			H	**W**	
Package Type	FCBGA-324		15	15	mm

AKD1000 Device Specification

The Akida AKD1000 is a single chip system that offers support for complex neural processing with compelling performance-per-watt at the Edge with an M.4 host processor and LPDDR. Akida is an event-based neural networks processor, it is therefore taking advantage of activation sparsity, further reducing power consumption. It supports today's models and networks and leverages the benefits of event-based processing. Entire neural networks can be placed into the fabric, removing or minimizing the need to swap weights in and out of DRAM, which reduces power and increases throughput. The on-board DRAM can help extend the support for larger networks.

The Akida AKD1000 is available in a low-cost FCBGA package for designing into embedded systems on the edge. BrainChip also provides development boards, M.2, PCIe cards and integrated AI Edge Box running Linux.