brainchip™ Akida Pico Product Brief

The Akida™ Pico is an Edge AI acceleration co-processor or stand-alone core built on the Akida Event-based processing platform.

Akida Pico accelerates a set of highly optimized temporal event-based neural network models to create an ultra energy-efficient, and purely digital, event-based processing architecture. Akida Pico features built in capabilities to execute these networks without a host CPU, enabling stand-alone operation for always-on ultra-low power. **BrainChip's unique MetaTF™ software flow enables developers to compile and optimize their chosen models for the Akida Pico.**

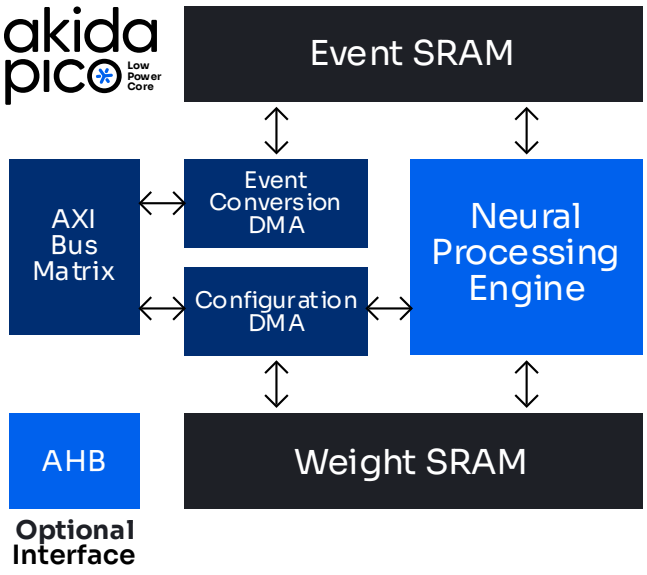
The Akida Pico can be paired to wake up an MCU or CPU via a low-power interrupt to create very compact, ultra-low-power, portable and intelligent devices for wearables, remote sensors, always on wake-up devices, Healthcare, Consumer, Smart Home and AIoT applications. The Akida Runtime software manages network processing to fully utilize available resources.

Key Benefits

- **Ultra-low power standalone NPU core**
- **Micro-watts (uW) active power**
- **Supports power island for minimal standby power**
- **Industry Standard Development Environment**
  - TensorFlow/Keras and Pytorch APIs
- **Small die area for low cost**
  - Base 160K gate configuration
  - Base 74K word local RAM can be minimized for use case(s)
  - 0.145mm² die area @ 22nm process

Applications

- **Edge AI Speech and Audio Systems**
  - Voice Wake Detect
  - Key Word Spotting
- **Medical**
  - Patient vitals anomaly detection
- **Industrial Internet of Things**
  - Industrial anomaly detection
- **Smart Home**
  - Activate voice assistant
- **Sensor Integration**
  - Combine with a wide variety of sensors



Akida Pico Block Diagram

Specifications

- **Akida NPU Core**
  - Single Neural Processing Engine
  - Minimal core focused on performing Temporal Event-Based Neural Networks (TENNs)
- **Core subsystems and interfaces**
  - 4-bit and 8-bit precision arithmetic support
  - DMA with integrated event converter for 8-bit data
  - Configuration DMA for model weights
- **Configurable On-Chip Local memory for temporary storage**
- **Industry standard interfaces**
  - AXI-4 bus matrix master, optional AHB interface
  - Add SPI to directly receive data samples
  - Add SPI to Flash for network parameters
  - GPIO for software programmable interrupt to host
- **Clock frequency range:**
  - 1-500 MHz (process/voltage dependent)
  - Static clock for clock gating

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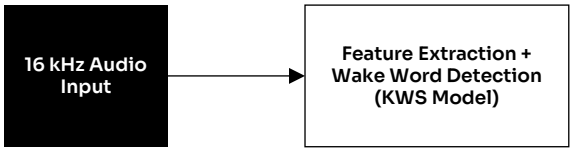
Akida Pico Development Tools – MetaTF

MetaTF is a complete Akida machine learning framework enabling the seamless creation, training, and testing of neural networks on the Akida Pico Processor. With MetaTF's support for models created with TensorFlow/Keras and Pytorch, users avoid the need to learn a new ML framework while rapidly developing and deploying AI Applications for the Edge. Support for ONNX allows MetaTF users to leverage models developed **in BrainChip's TENNs compatible framework**.

MetaTF supplies tools to convert a model with floating point weights and activations to a model with low bit-width weights and activations while maintaining model performance. These tools also convert quantized models trained using traditional deep learning methods to event-domain models for execution with low-latency and low-power on the Akida Pico Processor.

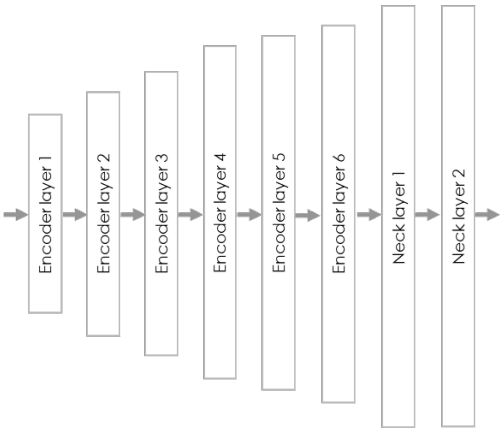
MetaTF provides the platform-agnostic **Akida Runtime with a Hardware Abstraction Layer (HAL)** for execution of models on **Akida hardware**. The Akida runtime also contains a software simulator for model evaluation without Akida hardware.

Speech Use Case Flow



Data Flow for Key Word Spotting (KWS)

KWS NODE Data Flow (Encoder only) BIDMC and Other Time series data



The Akida Development Platform is the foundation supporting multiple AI Application development and deployment scenarios for users with different levels of AI expertise and network model customization needs**. BrainChip supports a range of AI application development platforms** - all of which ultimately deploy on the Akida event-based processing engine.

The QuantizeML & Compilation python packages provide tools to quantize Tensorflow/Pytorch models and convert models to the event domain for inference on the **Akida Event-Based Processor Platform.**

Options for AI Application Development and Deployment on the Akida Platform:

- Low-code/No-code Tools for Limited AI Expertise
- Native MetaTF for Customized AI Modeling
- Turnkey AI Application Providers for Optimized complete applications

The steps to generate an Akida compatible model include:

- **Create & Train** a Tensorflow/Pytorch model using standard development frameworks
- **Quantize (PTQ)** a trained Tensorflow/Pytorch model using the QuantizeML toolkit
  - Optional QAT to maintain maximum performance
- **Compile** a model to Akida format using the CNN2SNN toolkit
- **Model** Library for reference NNs with performance data

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