Okika Technologies
Field Programmable Analog Array
Introduction

Okika
WIRELESS SOLUTIONS

Company Profile

- Name: Okika Technologies Corp.
- Founded: July 3, 2013
- Founded By: William W. Staunton III
  Douglas D Moran
- Headquartered: Carlsbad, CA 92011
- Website: www.okikatechnologies.com
- Business Description:
  Semiconductor Products, Design Services
  Fiscal Year: January – December
- Board Members: Chairman, CEO William W. Staunton III
  Director, CTO Douglas D. Moran
  Director Jim Doran
  Director L.B. Day
- Veteran Owned Business

Okika TECHNOLOGIES

Okika Technologies

Field Programmable Analog Array
Technology Overview

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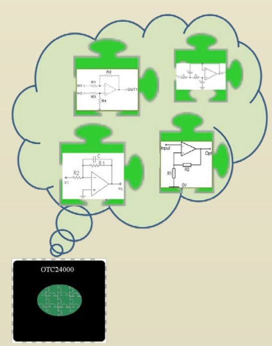
DynAMx™

- Dynamically Reconfigurable Analog Matrix
  - DynAMx™ is an integrated array of analog functions that can be dynamically configured during system operation.
  - Different configurations enable DynAMx chips to perform a wide variety of analog functions.
  - The real power of the DynAMx is the ability to change the configuration, analog parameters, or even complete functionality ***on-the-fly under software control.***



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FPAA - the analog FPGA Equivalent

- The Okika programmable analog solution is equivalent to FPGA in many ways
  - Predefined silicon architecture
  - Programmable fabric
  - Soft function library
  - EDA tools that capture the design, allow parameter setting then create the configuration file and API that will be loaded to the programmable device
- Silicon Architecture & Programming Fabric
  - Configurable I/O, configurable analog blocks
  - Configuration is via CMOS switches:
    - Steering switches (routing)
    - Function switches (Op-amp structure)
    - Equivalent resistors (switched capacitors)
  - Switch state is saved a double-buffered memory – equivalent SRAM

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Silicon Architecture & Programmable Fabric

- Fundamentals
  - Configurable I/O – analog, digital, continuous analog functions
  - Configurable analog Block (CAB) – opamps, comparators, SAR & LUT
  - Programmable fabric – SRAM, shadow SRAM and steering switches (actually individual FF's and CMOS switches)
  - Predisposition for simple download to, and configuration of, any single element, function or connection in the architecture

- Configurable Analog Modules (CAMs) combine CAB functions to create more complex systems.
  - Built-in library of CAMs creates an extremely flexible and easy to use analog design environment

- Tools and Software
  - Internal tools to support CAM development
  - EDA tools to support straight-forward, high level analog design – schematic capture
  - Time domain simulation – waveform input and waveform measurement
  - Instant download to silicon for "trail and error" design evaluation
  - Code generation tools – configuration files and C source code for inclusion in MCU application

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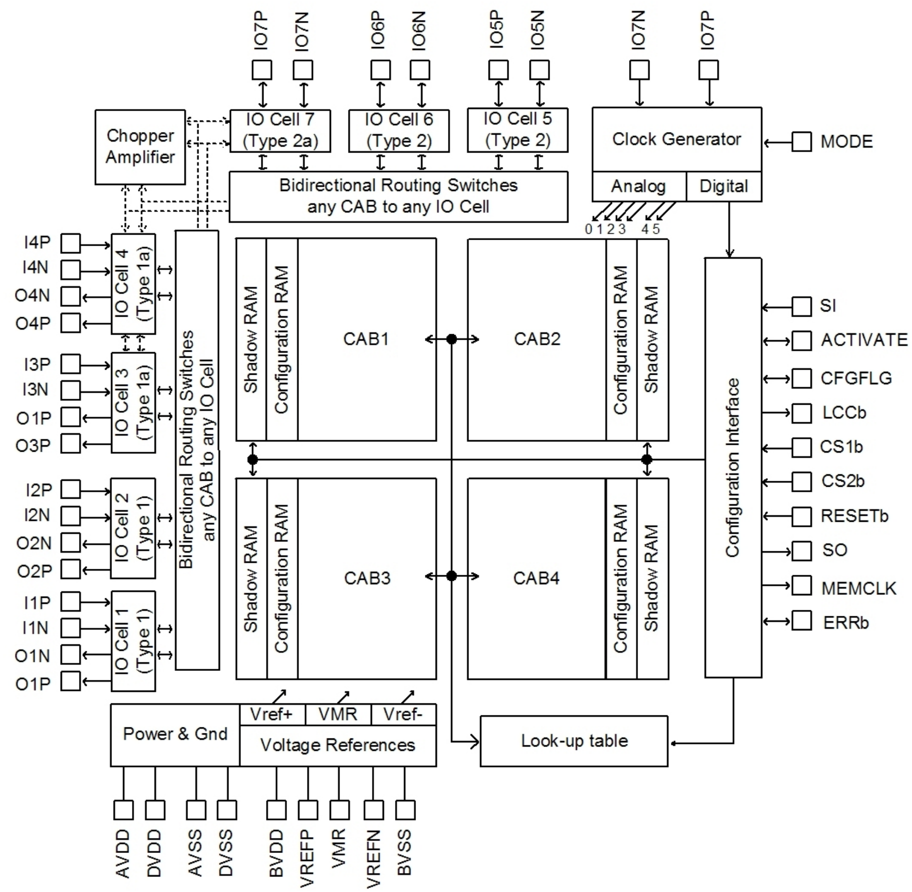
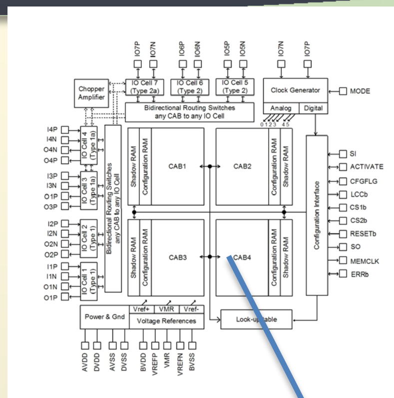
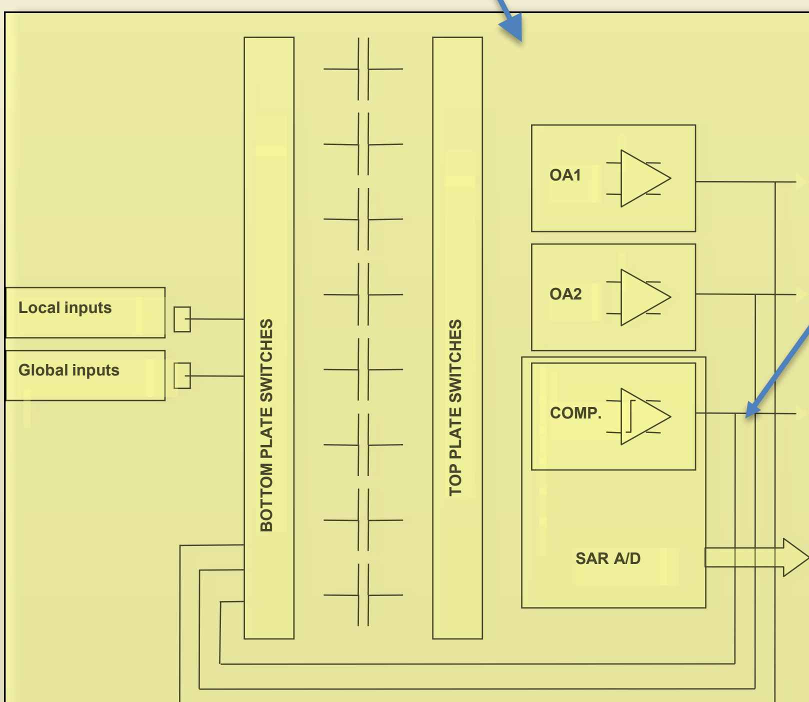
Okika's Dynamically Programmable FPAA Architecture



Okika's Dynamically Programmable FPAA Architecture





- A Configurable Analog Block (CAB) is the basic analog array element
  - 2 differential op-amps
  - 1 differential comparator
  - 1 Successive Approximation Register ADC Logic
  - Bank of eight matched, size programmable capacitors or switched capacitors

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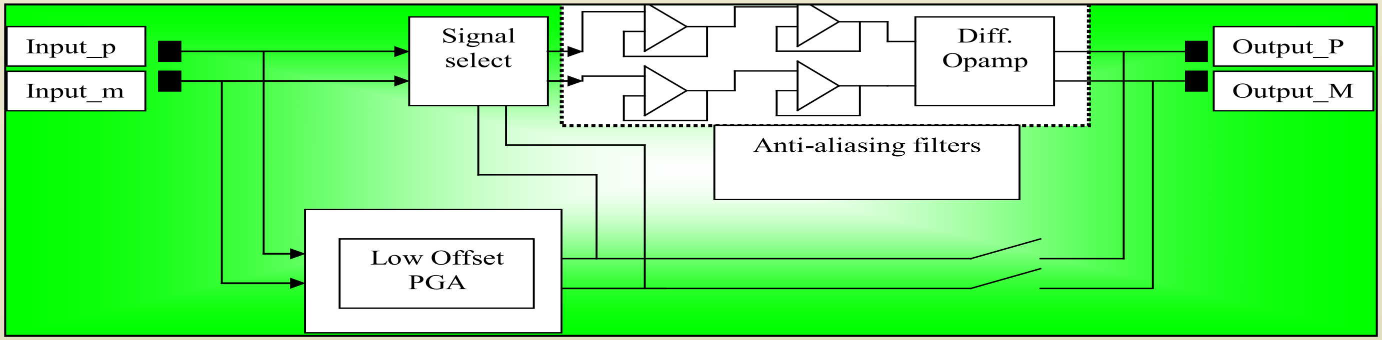
Input/Output Cells Structure

- **Each I/O cell can be configured a number of ways**
  - Input or Output Modes
  - In bypass mode
  - A chopper amplifier
  - A variable gain buffer
  - A continuous time low pass filter
  - As a single ended to differential converter
  - Certain combinations of these modes

- Input Configuration Diagram



Design Automation:
DynAMx Design Lab Software

- **Combined with Okika FPAA chips, DynAMx Design Lab software vastly simplifies the design process**
    - Design is captured in block diagram or scripting language
    - Circuit parameters are set by simple forms or software API
    - Built-in simulator is WYSIWYG accurate
    - Revisions or dynamic changes are instantaneous
- **Designers don't have to worry about:**
    - Offsets
    - On-chip Reference levels
    - Routing parasitics
    - Stability & Compensation
    - Environmental effects (temp, supply voltage, etc).
- **Enables designers to focus on the analog system design**

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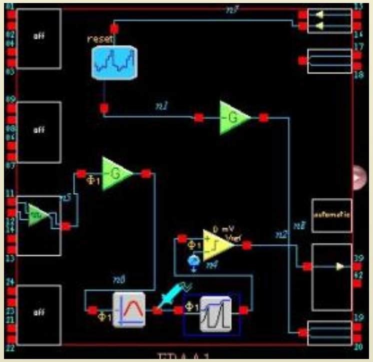
DynAMx Design Flow

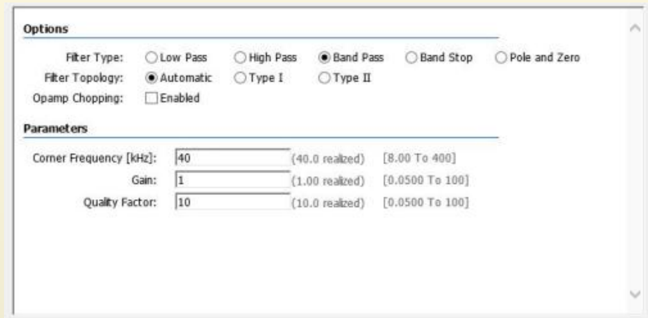
Start Here

Capture



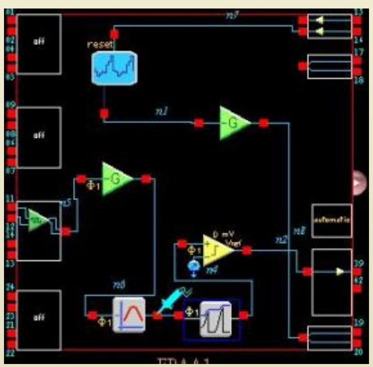
DynAMx Design Flow

Specify



Start Here

Capture



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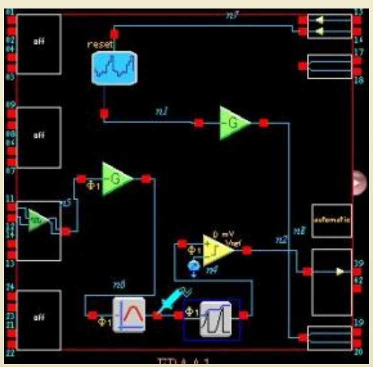
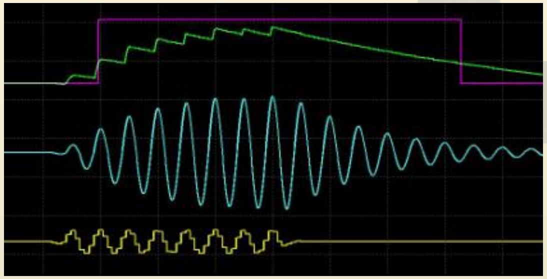
DynAMx Design Flow

Specify

Start Here

Capture





Simulate

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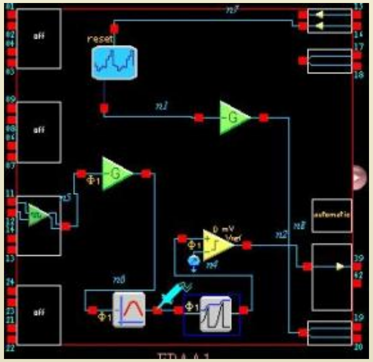
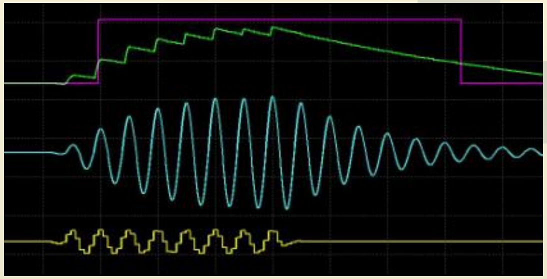
DynAMx Design Flow

Specify

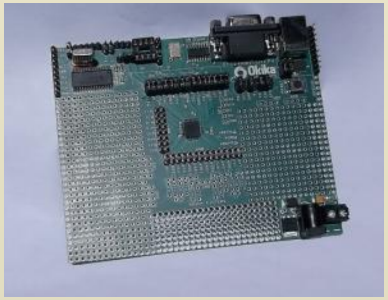
Start Here

Capture





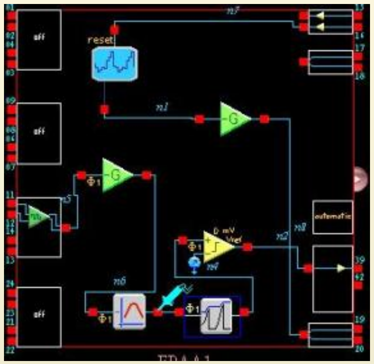
Simulate



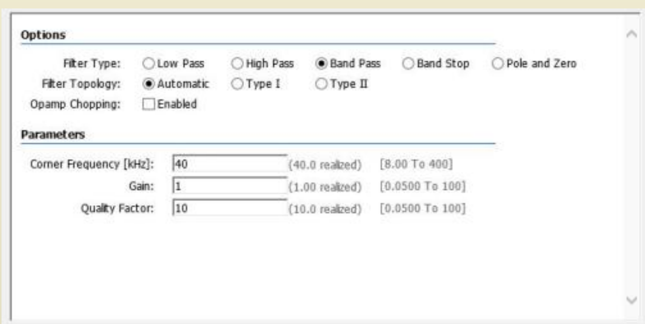
Evaluate

Repeat

DynAMx Design Lab



- Capture
  - Built in analog functions are connected together.
  - Example shows an Ultrasonic transceiver



- The parameters of each analog function are set in its dialog box

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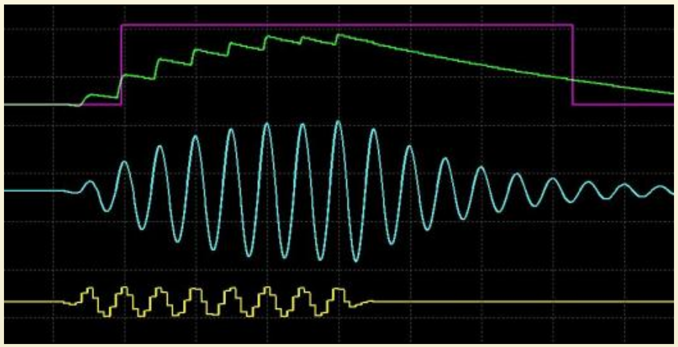
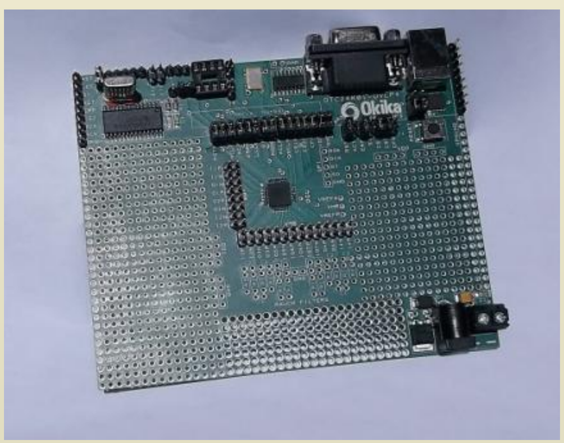
DynAMx Design Lab



- Simulate
  - DynAMx features a simulator allowing engineers to stimulate the circuit with inputs and verify the outputs are within spec.
  - Use a virtual scope probe for debugging.



- Validation
  - The Okika evaluation board allows engineers to quickly connect a DynAMx device to the real world.

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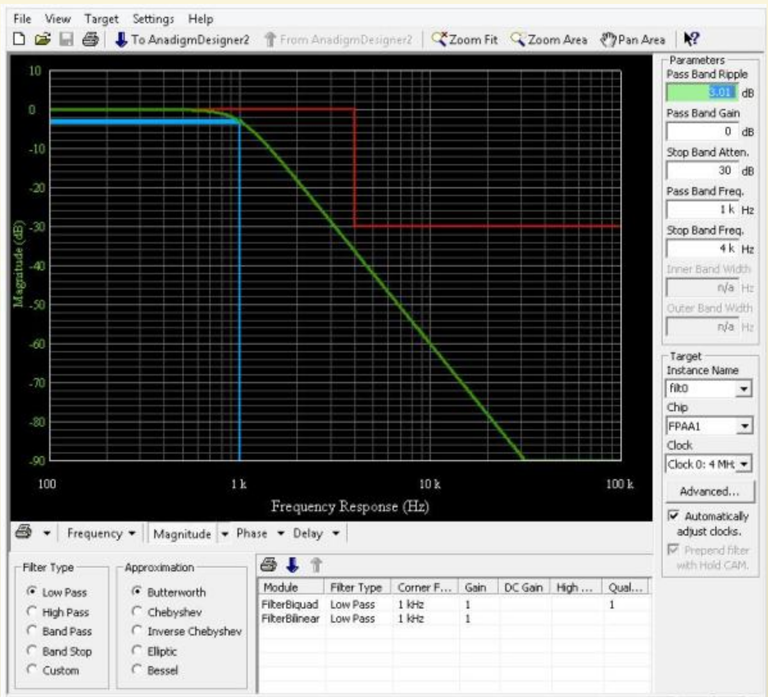
DynAMx Filter Lab



- If you need a filter then Okika provides a special tool
  - Built in to DynAMx Design Lab
- Draw the frequency response you need (or enter as parameters in the table) and the tool will generate the filter to meet your requirements
- Choose the filter type
  - Low-pass, band-pass, high-pass, Butterworth, Bessel etc
- Or just set filter parameters (stop band attn, cut-off frequencies) and let the tool do the work!

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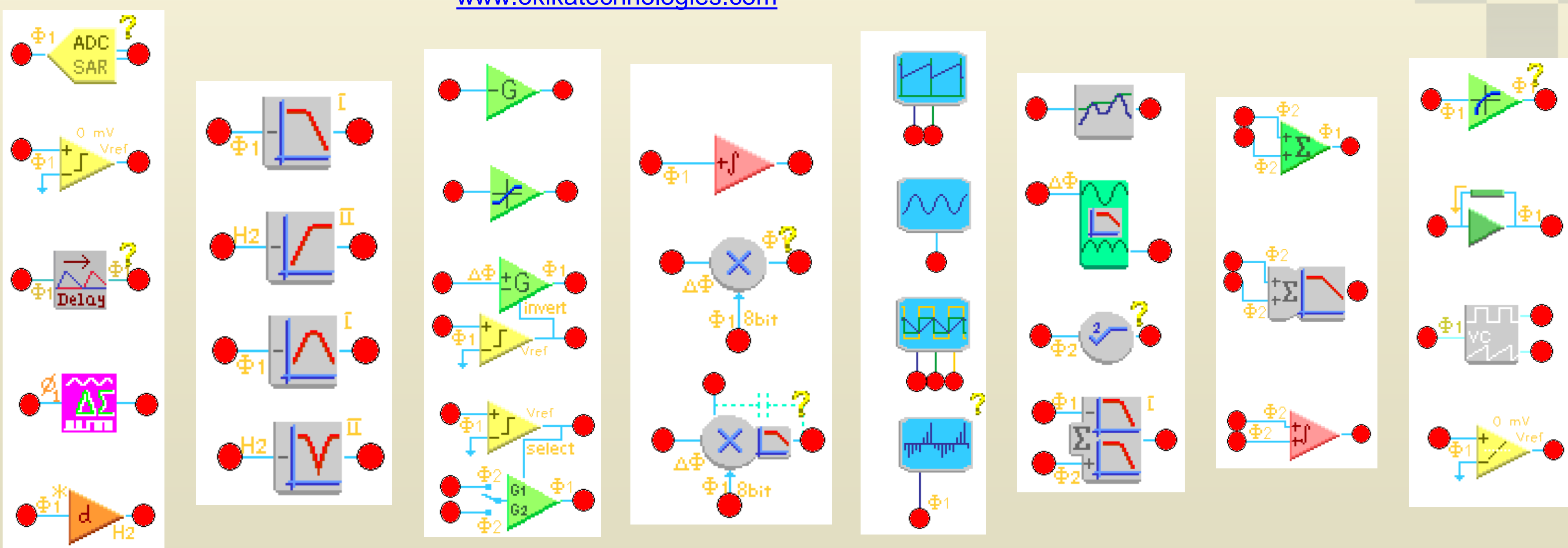
DynAMx Design Lab CAM Design Library

Rich pre-built library

Complete list with specifications, datasheets, and examples are available within the DynAMx Design Lab software Help files. Download at www.okikatechnologies.com



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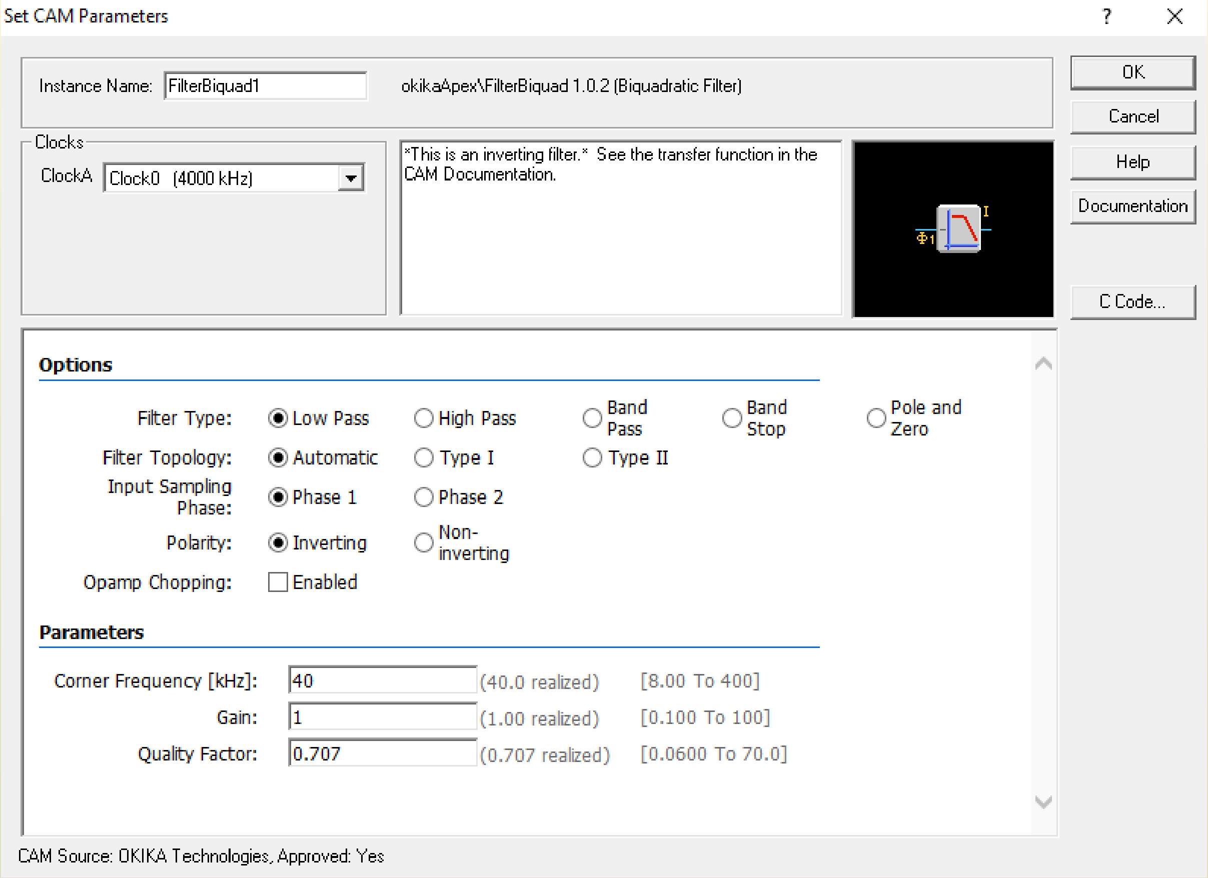
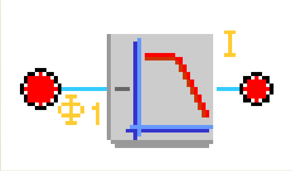
CAM Example

CAM Parameters Example: Biquadratic Filter





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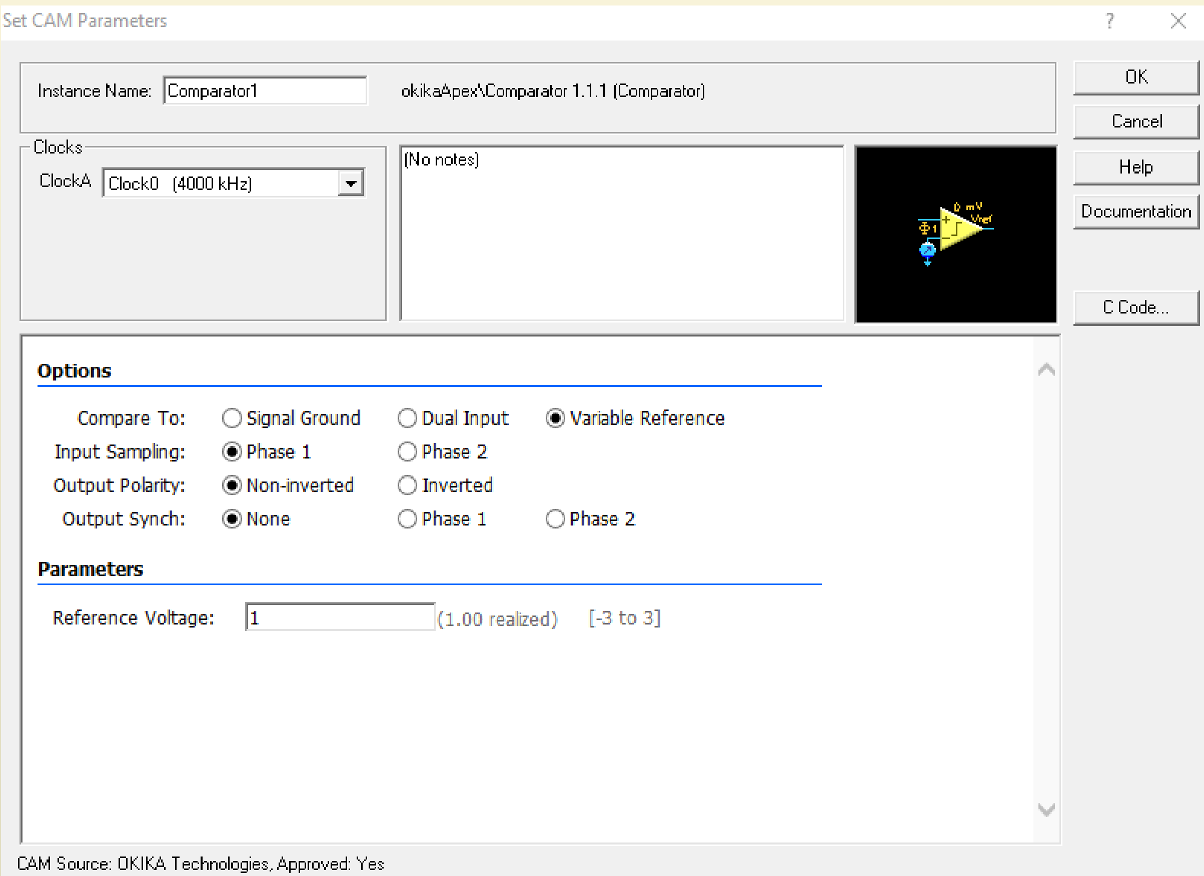
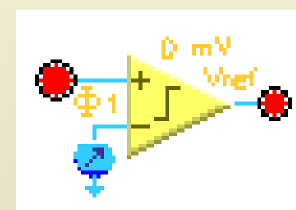
CAM Example

CAM Parameters Example: Comparator





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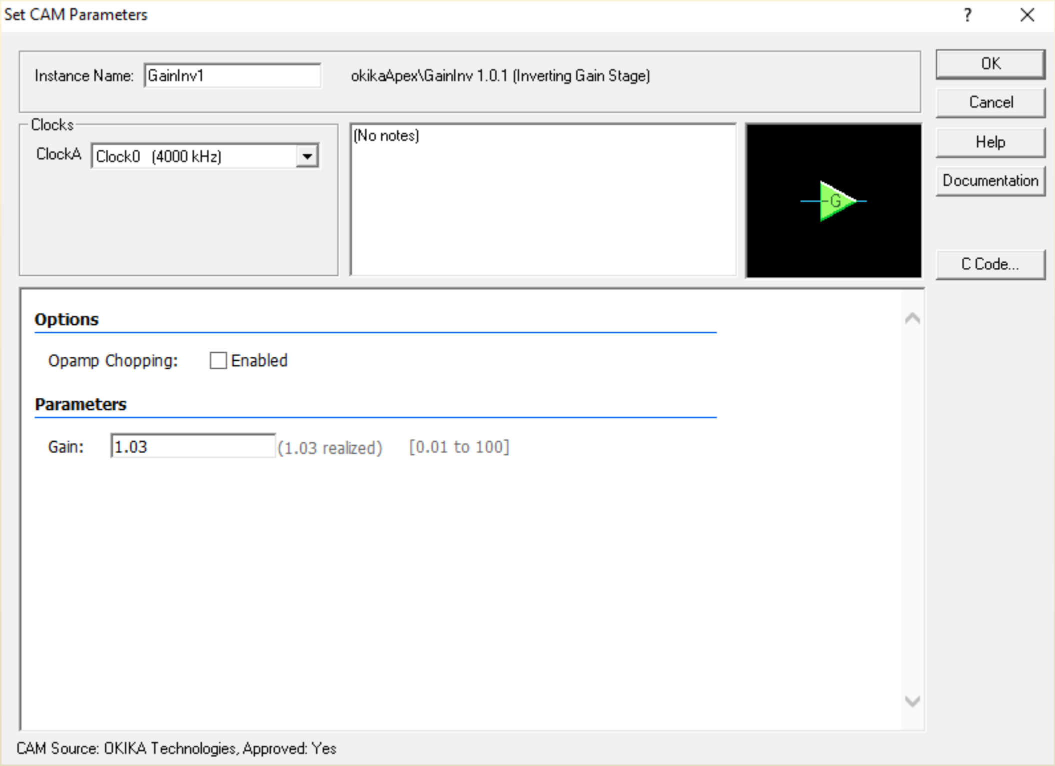
CAM Example

CAM Parameters Example: Inverting Amplifier



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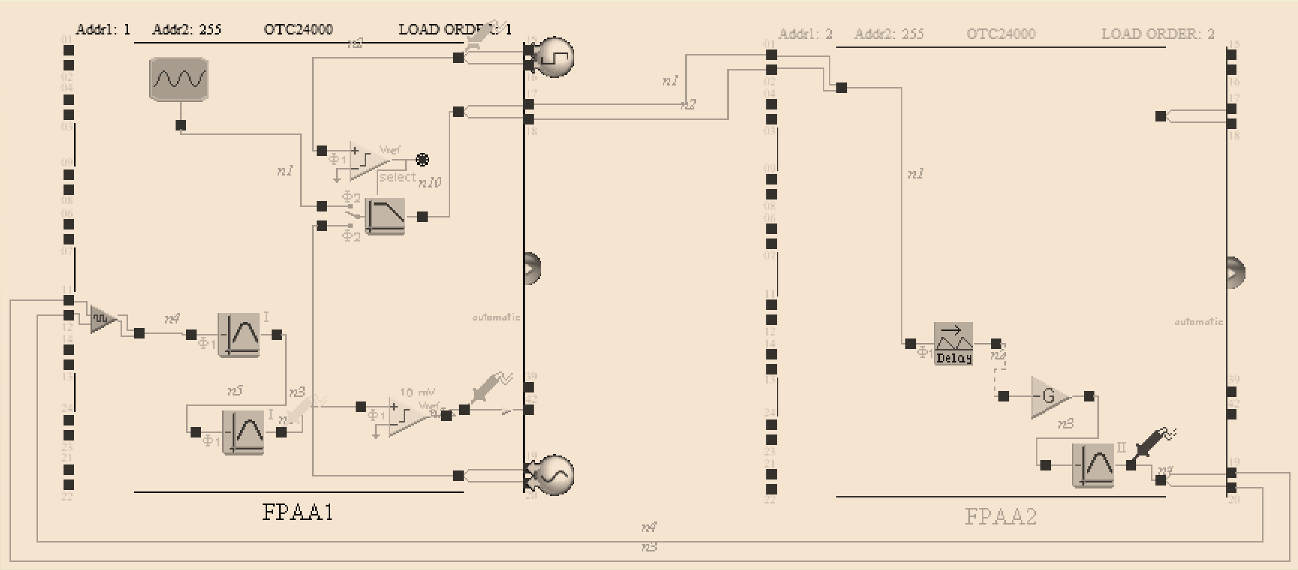
Design Automation

Multi Chip and Multi CAB Support

Arbitrary number of chips can be connected and the tools will automatically configure all of them. Shown below: ultrasonic transceiver (FPAA1) with simulated delay and attenuation (FPAA2). Contact Okika Technologies for complete technical specifications.



Configuring and Reconfiguring Okika FPAA

- Static reprogramming (re-purposing) is fundament, but.....
- DYNAMIC, “on the fly” programmability is essential
  - Addresses the calibration, conditioning and fine tuning challenges of sensors and control applications in the field
  - **Supports adaptive analog signal processing**
- Okika’s FPAA architecture
  - Allows complete “on the fly” dynamic programming while the device is operational – without interruption to the outputs
- Okika’s DynAMx Design Lab software automates the configuration bitmap and C-code generation
  - Sophisticated software suite, automatically generates C-code for inclusion in the programming of embedded microcontroller applications

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3 Methods to Configure Okika FPAA

- Static
  - FPAA reads configuration from EEPROM at power up.
  - Configuration bitmap and EEPROM files generated automatically by Okika software based on the designers schematic and CAM parameter settings.
- Dynamic with multiple Configuration Files
  - Multiple configuration files stored in MCU memory.
  - MCU loads whichever configuration is needed at the time.
  - Enables dynamic reload of configuration to change low level parameters (gain, etc) or to load a completely new design (change a transmitter to a receiver, switch between multiple sensor types, change a filter bank from low pass to high pass, etc).
- Dynamic Configuration with Okika API
  - Okika DynAMx Design Lab software automatically generates C source code and API
  - Code and API are integrated into embedded system controller MCU code
  - MCU calls API functions to change FPAA parameters (for example, SetFilterParam(Gain, CutOffFreq, QualityFactor)

The same tools and processes can be used for integration of FPAA IP into SoC designs.

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Demonstration

Thank You

For more information, contact:

- Doug Moran, CTO
  - doug.moran@okikatechnologies.com

Or

- William Staunton, CEO
  - bstaunton@okikatechnologies.com

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