

## AIEC9 SoC Development Board (AIEC9DVB)

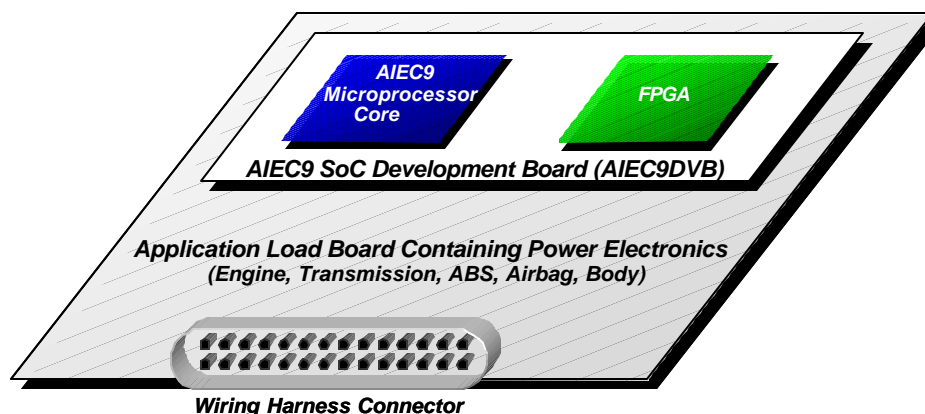
### Product Overview

The AIEC9 System on Chip (SoC) Development Board (AIEC9DVB) provides an environment for developing production intent, custom SoCs that are based on the AIEC9 microprocessor ( $\mu$ P) core. Typically, an SoC contains a  $\mu$ P core, associated memory, digital peripherals, and an analog to digital converter. The AIEC9DVB provides provisions for all of these functions such that the SoC can be completely prototyped before committing to silicon. In this way, a custom SoC can be developed to meet the requirements of a specific application while optimizing the system for performance and cost. Customization of the prototype SoC is accomplished through a Field Programmable Gate Array (FPGA), which allows the user to exactly specify the peripherals required for a given application as opposed to a standard product that has fixed general purpose peripherals. A large selection of pre-qualified peripherals are available through AIEC's peripheral library as well as third party suppliers including automotive specific functions such as CAN and J1850 peripherals. In addition, custom peripherals can be designed for specific control functions that significantly offload the controlling  $\mu$ P. This effectively frees the  $\mu$ P core and provides additional throughput for higher complexity control algorithms and thus, better system performance. Furthermore, custom peripherals tend to simplify software development through the removal of many low-level routines normally required to control less intelligent general purpose peripherals, which reduces software development times and code memory sizes providing further cost savings.

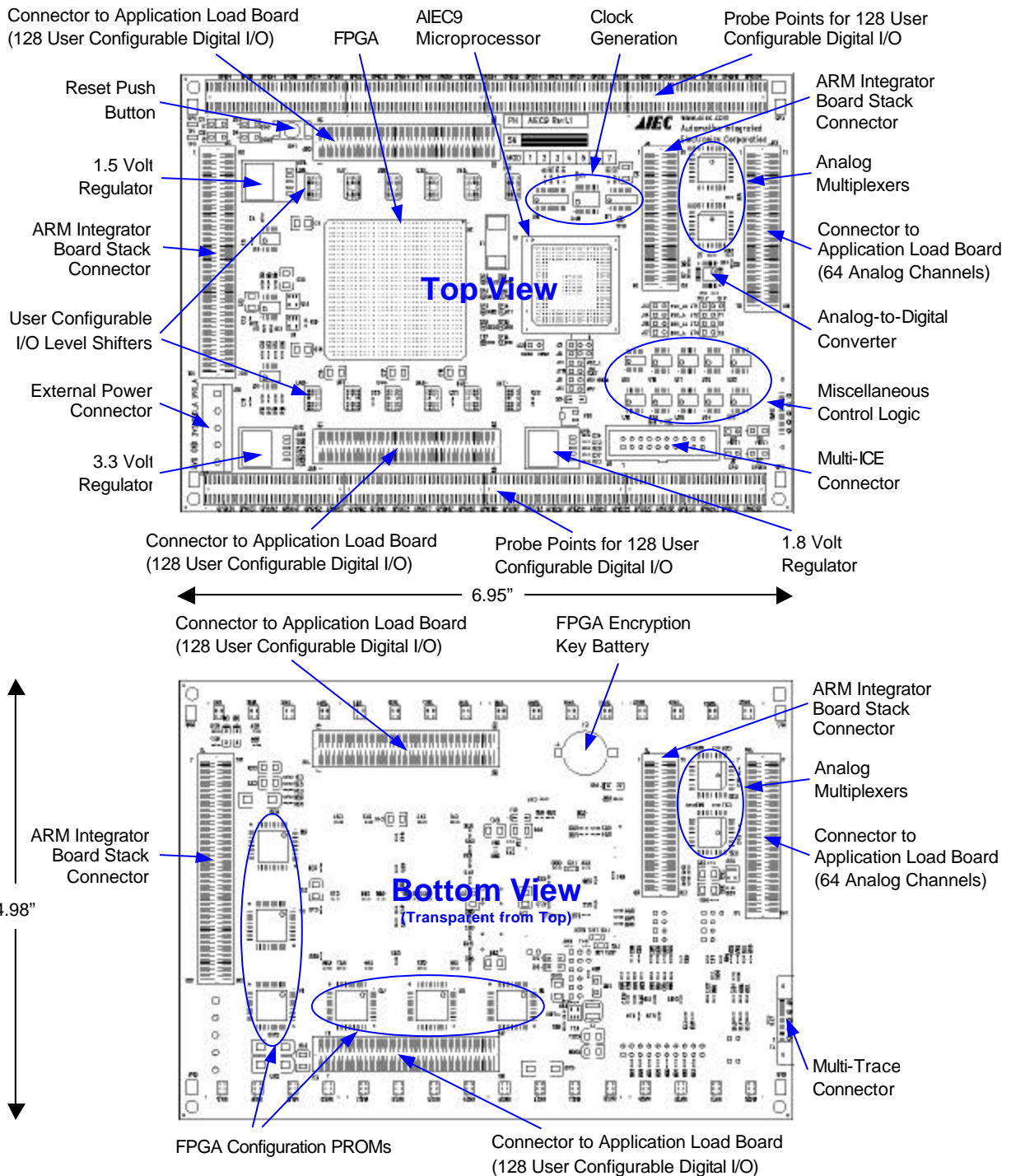
Most importantly, the AIEC9DVB provides a prototype environment where system level architecture can be refined through co-design of the hardware and software. Hardware and software components can be readily added to the system and quickly verified using the actual application running in real time. The AIEC9DVB allows the software and hardware teams to work concurrently throughout the design cycle to minimize development times for reduced time to market.

### Features

- *AIEC / ARM966E-S™ Microprocessor Core (AIEC9) with Integrated Instruction Store (1.25MBytes Flash) and Data Store (64kBytes SRAM) Allows at Speed Prototyping (100MHz)*
- *AIEC9 Microprocessor Core Based on Member of ARM® Family of Microprocessors Supported by the Industry's Largest Selection of Development Tools*
- *IEEE 754 Compliant Floating Point (VFP9) with Vectored Instructions that Overlap Load/Store Operations for Superscalar Performance (200 FIR Filter MFlops @ 100MHz)*
- *DSP Extensions to Instruction Set Include Single Cycle MAC and Saturating Arithmetic*
- *Embedded ICE Software Debug Facilities through JTAG Interface*
- *Embedded Trace Macrocell Monitors Internal Busses and Passes Compressed Data to Trace Port for Real Time Hardware/Software Debug*
- *Non-Intrusive RAM Overlay Calibration (NIROC) Completely Independent of CPU*
- *Advanced High-performance Bus (AHB) Interfaces to Six Million Gate FPGA for Custom Peripheral Set Development*
- *256 User Configurable Digital I/O for Interconnection to Application Load Board*
- *64 Analog Channels and High Speed A-to-D's for Complete Data Acquisition System*
- *AIEC9DVB is Stackable to Accommodate Multiprocessor SoC Development (e.g., Single Chip Multiprocessor Engine/Transmission Controller)*
- *Compatible with ARM® Integrator Development Boards, Tools, and Software*



**AIEC9 SoC Development Board Shown in Prototype Electronic Control Unit (ECU)**



### AIEC9DVB / Application Load Board Interface

The AIEC9DVB contains all of the electronics that will eventually be integrated onto a single chip or SoC. This includes the AIEC9 microprocessor core and associated instruction memory (flash) and data memory (SRAM) as well as the digital peripheral set that may include the analog-to-digital converter. The application load board is then constructed specifically to address the given application and includes all of the electronics except the digital core or eventual SoC. Two connectors provide the digital signals interface while a single connector provides the analog signals interface.

### 256 User Configurable Digital I/O

Two connectors (128 channels per connector) provide the 256 digital I/O signals, which are completely user configurable allowing virtually any digital function to be implemented in the FPGA and routed to any one of the 256 pins.

### 64 Analog Channels

Analog sensor voltages from the application load board are brought onto the AIEC9DVB through a single connector and routed through a multiplexor to an A-to-D converter, which is connected to the FPGA. This provides for a complete data acquisition capable system.

## SoC Development Platform

The intent of the AIEC9DVB is to provide an environment where an SoC can be rapidly developed for a specific application while being optimized from both a cost and performance standpoint. To accomplish these objectives, the AIEC9DVB fully supports a co-design environment where the software and hardware can be concurrently developed throughout the design cycle. Software and hardware components can be rapidly developed and quickly verified using the actual application running in real time.

## Software Development

The AIEC9 microprocessor core found on the AIEC9DVB is compatible with the ARM family of microprocessor cores and is supported by the industry's largest selection of software development tools. The AIEC9DVB supports the use of these software development tools by providing the necessary hardware hooks and connections.

### Code Generation

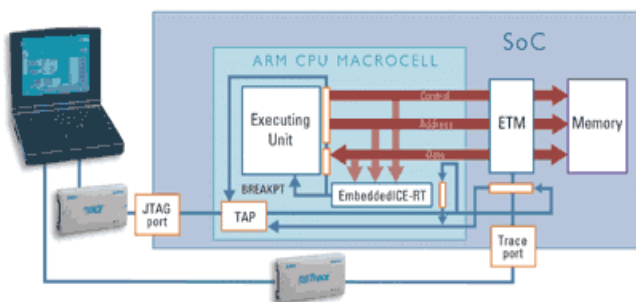
- Integrated Development Environment
- C and C++ Compilers
- Assembler and Linker
- Instruction Set Simulators
- Firmware Suite (System Init, IRQ Support, etc.)
- On-line Documentation

### Code Debug

- Simple and Complex Breakpointing
- Watchpointing
- Supports Both Hardware and Software Targets
- Stack Rewinding
- Fully Integrated Command-Line Interface

### Real Time Debug

- Non-Intrusive Trace and Debug
- Trace Capture Target System Running Full Speed
- Traces Both Instructions and Data
- Cycle-Accurate Trace
- Time-Stamped Data Capture for Later Analysis and Profiling
- Comprehensive Trigger Facility Allowing Trace to be Captured on Complex Sequential Conditions
- Debug Foreground Tasks While Interrupts Continue
- Access Memory Without Stopping Application



## Hardware Development

The AIEC9DVB supports hardware development through rapid prototyping of the peripherals using a Field Programmable Gate Array (FPGA). Many pre-characterized peripherals are available through AIEC, third parties, or can be developed specifically for the application.

## AIEC Peripherals

AIEC provides a set of pre-qualified peripherals for implementation into FPGA or production intent technology. Most of the peripherals have been used in high volume production with proven operating characteristics and are ready for rapid deployment of high quality peripherals. All of AIEC's peripherals have been productized using a Hardware Description Language (HDL), which allows the peripherals to be easily ported to a target technology (e.g., FPGA for prototype or cell based for production intent). Additionally, the peripherals include comprehensive validation suites and extensive documentation.

### Application Specific Peripherals

- RTEC – Real Time Engine Controller (Powertrain)
- WSAJ – Wheel Speed / Acceleration / Jerk (ABS)

### Miscellaneous Peripherals

- APIC – ARM Processor Interrupt Controller
- QDA – Queued Data Acquisition

### Communication Protocol Peripherals

- SCI – Serial Communication Interface (LIN)
- J1850 – Protocol Controller (DC/GM Compatible)
- FlexRay – In Development
- I<sup>2</sup>C – Inter Integrated Circuit
- SPI – Serial Peripheral Interface

### General Purpose Peripherals

- GPT – General Purpose Timer
- GPIO – General Purpose Input/Output
- EDGE – Edge Detect
- PWM – Pulse Width Modulator

## Third Party Peripherals

As a full service design center, AIEC has the ability to integrate third party peripherals as part of an SoC. The following list is a small sampling of the third party peripherals available for integration.

- Bosch A-CAN, C-CAN, TTCAN
- Ericsson Bluetooth Baseband

## Customer / Application Specific Peripherals

AIEC's background includes many years of developing Application Specific Integrated Circuits (ASICs) to the exacting standards of its automotive customers. AIEC's unparalleled success at ASIC design means that custom specific peripherals can be developed with confidence allowing higher levels of performance and product differentiation.

Automotive Integrated Electronics Corporation (AIEC)  
9034 N. 23<sup>rd</sup> Avenue Suite 13  
Phoenix, AZ 85021  
Phone: (602) 943-7499 Facsimile: (602) 861-1777  
Email: [sales@aiec.com](mailto:sales@aiec.com) <http://www.aiec.com>

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