ZETA Ultra-Small SBC Using COM Express Type 10 CPU Modules

**DIAMOND SYSTEMS**

COM Express® 2 in 1

Complete Zeta SBC
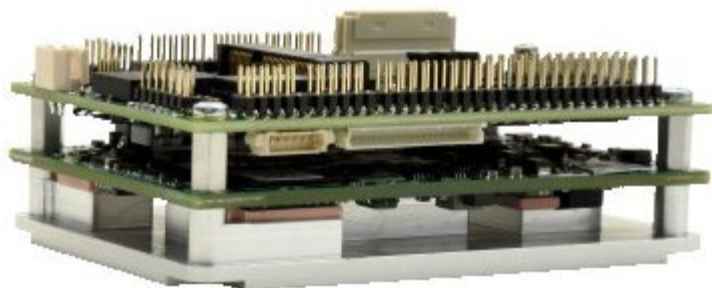
Side view

FEATURES

- Ideal solution for airborne and other vehicle applications
- Interchangeable industry standard COMs support long product lifecycles
- Intel E3940 / E3950 "Apollo Lake" processor options
- 2x Gigabit Ethernet ports
- 4x RS-232/422/485 serial ports
- 4x USB 2.0 ports + 1x USB 3.0 port
- VGA and single-channel LVDS display
- PCIe MiniCard / mSATA socket
- Micro SD socket
- 16 single-ended / 8 differential analog inputs
- 16-bit A/D resolution
- 100KHz max A/D sample rate
- 4 16-bit analog outputs
- 27 digital I/O configurable as counter/timers and PWM
- Expansion connector with PCIe, SATA and audio interfaces
- 6-36VDC input range
- COM Express Mini form factor: 3.3 x 2.2 in / 84 x 55mm
- Operating temperature: -40°C to +85°C / -40 to +185°F
- Bottom-mounted heat spreader cooling
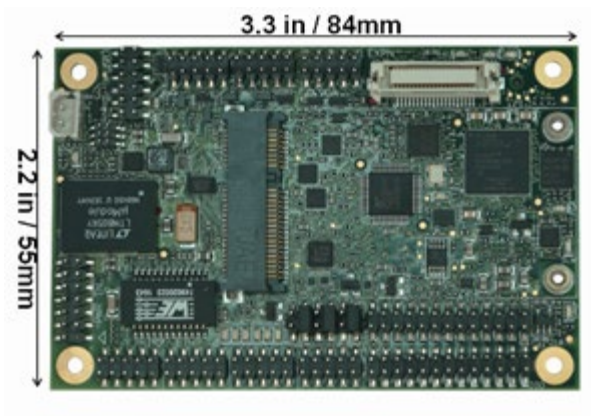
Zeta Carrier Board top, with data acquisition
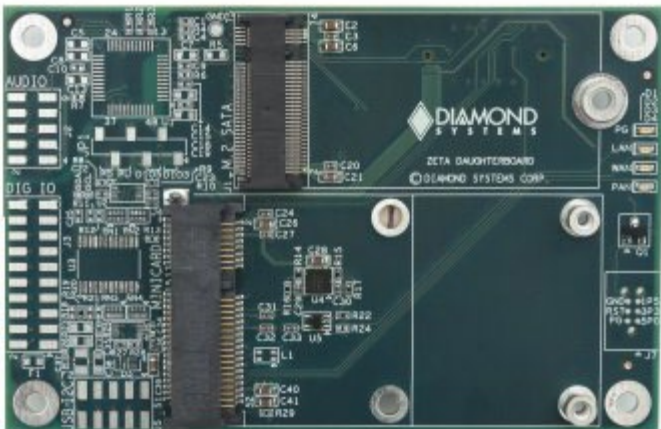

Zeta with mSATA flashdisk installed

Zeta with I/O daughterboard, Minicard, and M.2

flashdisk

Zeta-DB-01 daughterboard

Zeta-DB-02 daughterboard

The **Zeta** COM Express SBC family of ultra-small embedded computer boards combines a COM Express Mini CPU module with a same-size carrier board to create a complete embedded PC. Designed in the COM Express Mini Type 10 form factor (84 x 55mm/ 3.3 x 2.2 in), Zeta provides an ultra-compact, industry-standard form factor solution.

3 key components pre-assembled:

◆ A Computer on Module (COM) providing the core CPU functionality

◆ A carrier board providing the I/O transceivers and connectors, power supplies, and expansion sockets

◆ A heat spreader with a flat exterior surface for direct mounting and heat transfer to the system enclosure

This layered architecture offers the highest functional density for any given footprint. As a comparison, Zeta

offers functionality and performance equivalent to Diamond's top-selling **Aries SBC** at just 40% of the size.

Zeta currently supports three processor options:

◆ Intel Bay Trail E3845 1.91GHz Quad Core CPU with 4GB RAM

◆ Intel "Apollo Lake " E3940 1.6GHz quad-core CPU with 8GB RAM and 64GB eMMC

◆ Intel "Apollo Lake " E3950 1.6GHz quad-core CPU with 8GB RAM and 128GB eMMC

Zeta's small size and high feature density make it an ideal choice for mobile applications. It stands ready to meet the challenges of these environments with a wide range 6-36VDC input voltage, a -40 to +85C operating temperature range, and fanless heat spreader cooling (heat sink options are available).

Benefits of COM-based SBCs
The use of interchangeable industry-standard CPU modules on Zeta offers two important system designer benefits:

◆ Performance scalability: You can design multiple applications based on a consistent hardware platform and select the CPU that best fits the price / performance / power requirements of each one. In addition, as time goes on and your application needs more horsepower to support increased functionality, you can simply upgrade to a newer CPU with minimal to no redesign effort.

◆ Long product life: The majority of today's x86 embedded processors offer limited lifecycles of 5-7 years, so any long-life product dependent on an x86 single-board computer (SBC) is likely to require redesign sometime during its lifecycle. Using industry-standard COMs lets you easily migrate to a new generation CPU module in the exact same form factor and containing the same feature set, with virtually no hardware or physical redesign efforts. Zeta is ideal for long-life applications such as Military, Medical, and Transportation.

◆ **Block Diagram**
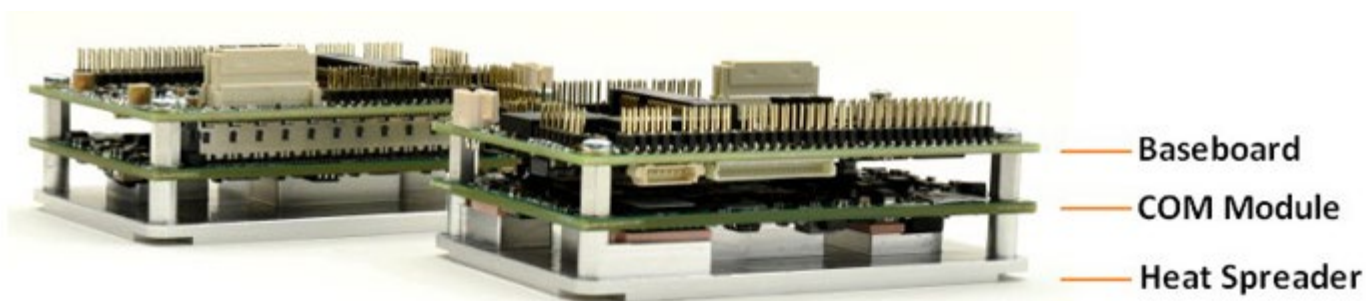
ZETA System Block Diagram
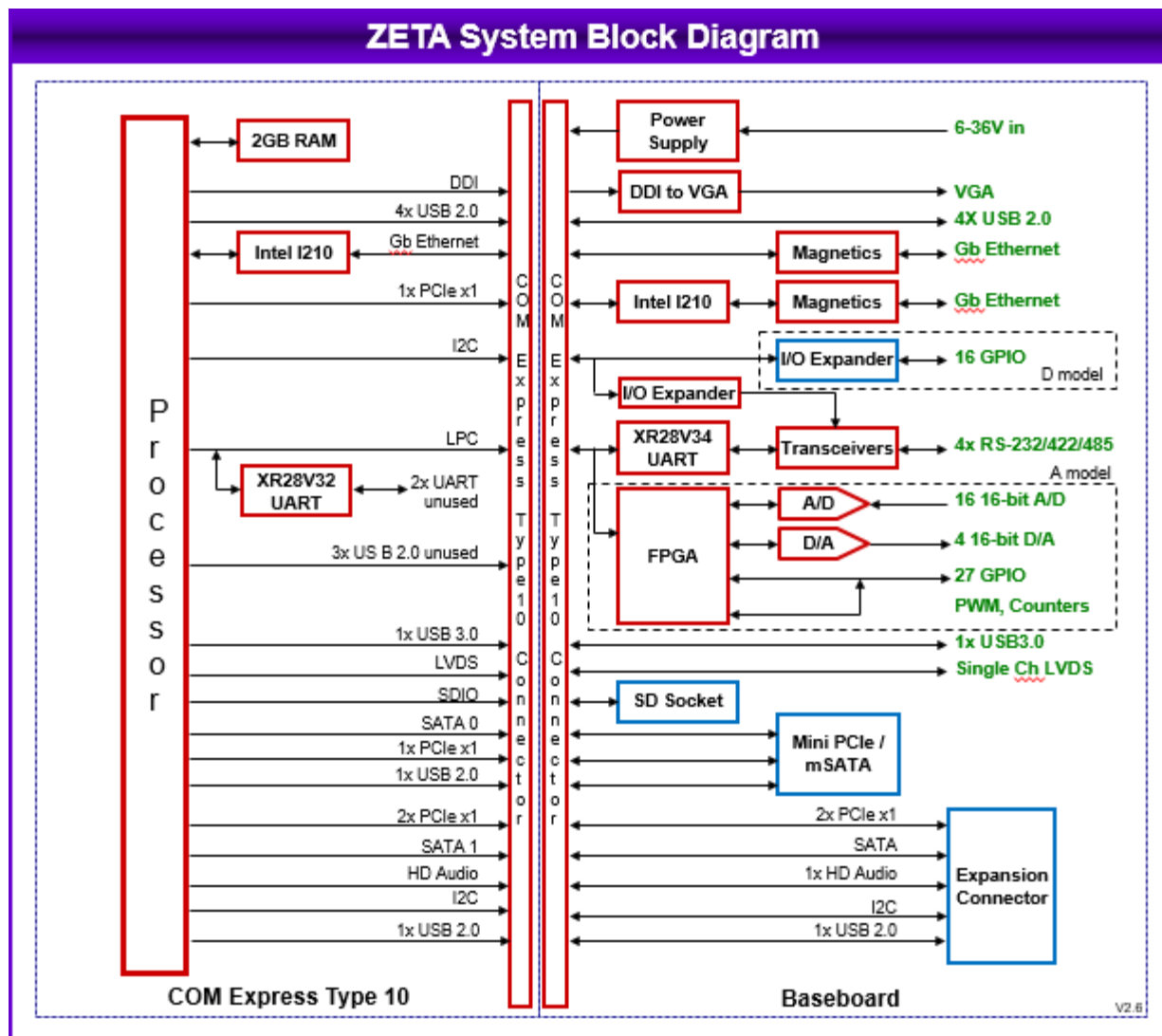
◆ Conduction Cooling

The bottom side heat spreader on Zeta provides the most efficient cooling solution in a size-optimized design, enabling Zeta to run reliably at up to 85 degrees C. The heat spreader conducts heat directly to the system chassis for maximum heat dissipation to the ambient environment and minimum radiation into the enclosure interior. By reducing the interior temperature, Zeta helps to improve overall system reliability. In addition the bottom side heat spreader leaves the entire top side of the board free for expansion and simplifies system configuration and maintenance.

ZETA Carrier board

COM Express

Heat Spreader

◆ Available Models

Zeta is available with 3 different processor options. Each CPU may be paired with both the digital I/O baseboard and the full analog/digital I/O baseboard.

| Model	Processor / Speed / Memory	I/O
ZETA-E3845-4GA	E3845 1.91GHz CPU, 4GB RAM, 0GB eMMC	Data acquisition circuit
ZETA-E3845-4GD	E3845 1.91GHz CPU, 4GB RAM, 0GB eMMC	Digital I/O circuit
ZETA-E3940-8G064A	E3940 1.6GHz CPU, 8GB RAM, 64GB eMMC	Data acquisition circuit
ZETA-E3940-8G064N	E3940 1.6GHz CPU, 8GB RAM, 64GB eMMC	Digital I/O circuit
ZETA-E3950-8G128A	E3950 1.6GHz CPU, 8GB RAM, 128GB eMMC	Data acquisition circuit
ZETA-E3950-8G128A	E3950 1.6GHz CPU, 8GB RAM, 128GB eMMC	Digital I/O circuit

◆ Operating System Support

Operating system support is available for Linux (Ubuntu 16.04 LTS) and Windows 10 IoT Enterprise LTSB. Drivers and instructions are available for free download on the Diamond website. Software development kits / board support packages are available as well and consist of the selected operating system installed and pre-configured on a solid state flashdisk (SSD).

◆ Development Kits

Zeta is available in a complete development kit that includes a full set of I/O cables and the selected SDK. Simply install the pre-configured flashdisk, attach cables / keyboard / mouse / monitor, power up, and the system is ready to run.

◆ Cable Kit

The Zeta cable kit includes cables for all I/O features on Zeta except LCD. Details are provided below. Individual cables are available as a special order item; minimum order quantities and leadtimes may apply.
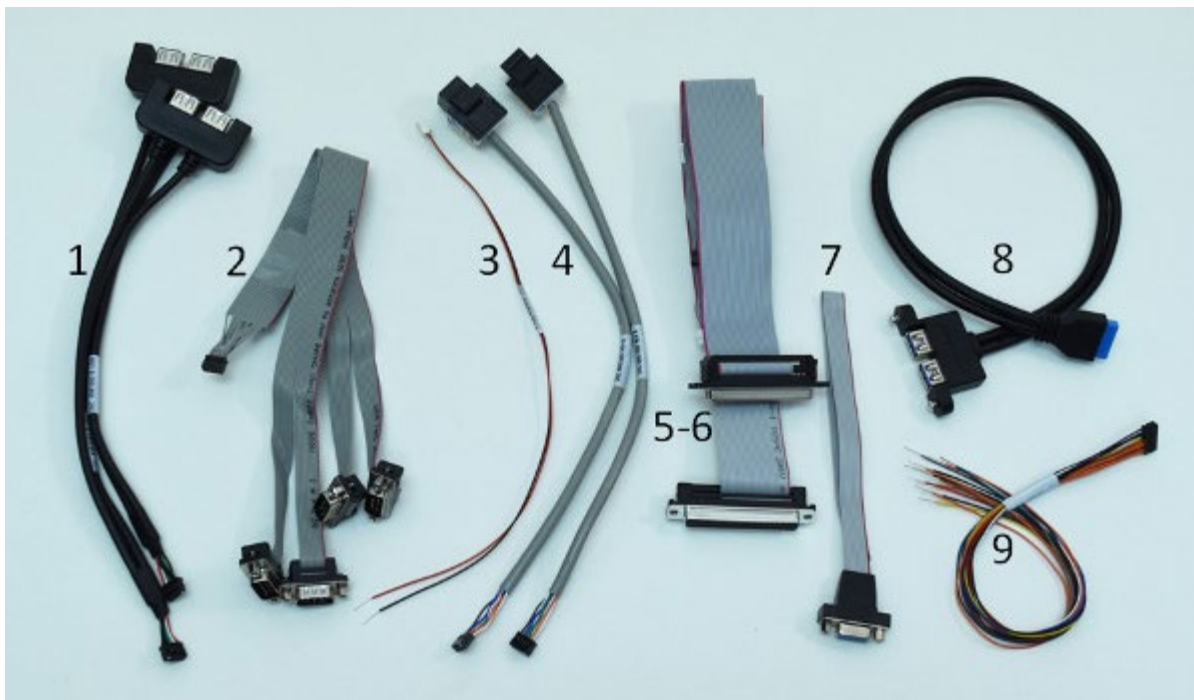

CK-ZETA-01 includes the following cables:

No.	Qty	Cable	Description	Drawing
1	2	6981082	Dual USB 2.0 type A	Show

2	2	6981075	Dual serial port DB9M	Show
3	1	6980524	External battery cable, discrete wires	Show
4	2	6981080	Gigabit Ethernet cable, RJ-45 socket, 10 pin board connector	Show
5-6	2	6980516	Analog I/O and Digital I/O cables	Show
7	1	6981084	VGA, 2x5 2mm latching to DD15F	Show
8	1	6980102	Cable, Single USB3.0 Type A to 2mm 2x6	Show
9	1	6981070	Power input cable	Show

◆ I/O Features
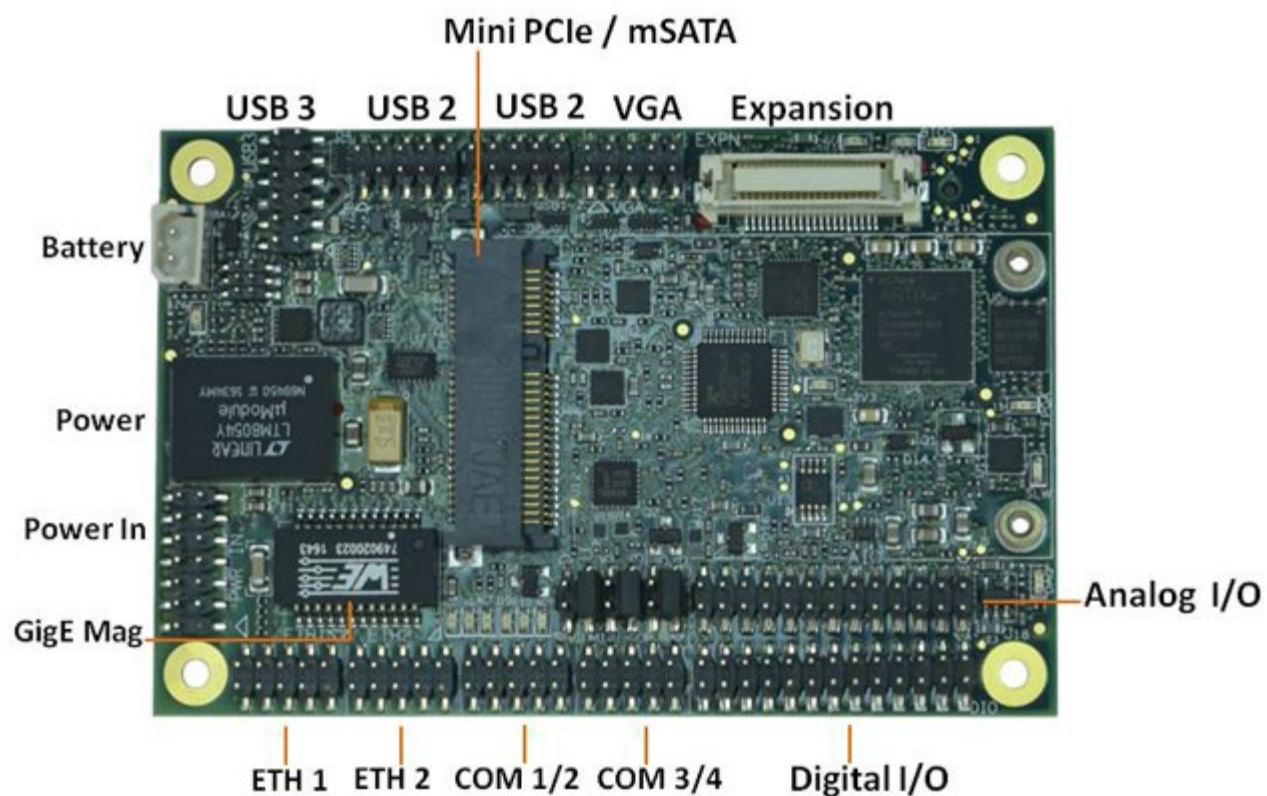
Zeta (top) "A" Model baseboard layout and baseboard bottom (below).
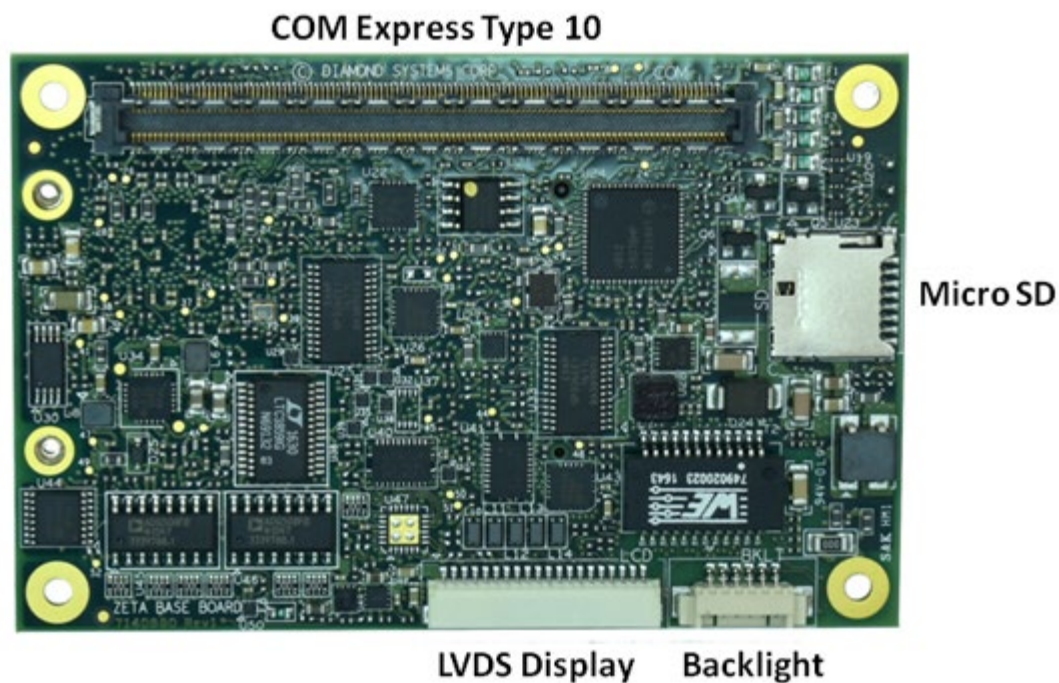
Zeta provides a wide variety of on-board PC-type I/O, including:

- 2 Gigabit Ethernet ports
- 4 RS-232/422/485 serial ports with programmable protocol selection port-by-port and programmable 120-ohm line termination for RS-422/485
- 4 USB 2.0 ports + 1 USB 3.0 port
- VGA and LVDS display outputs
- 16-27 GPIO lines with 3.3V/5V logic level configurability
- Wide range 6-36V input power supply

A PCIe minicard socket and an expansion connector (see below) provide the ability for further I/O expansion using industry standard I/O modules.

- **Data Acquisition**
- **Data Acquisition Circuit**
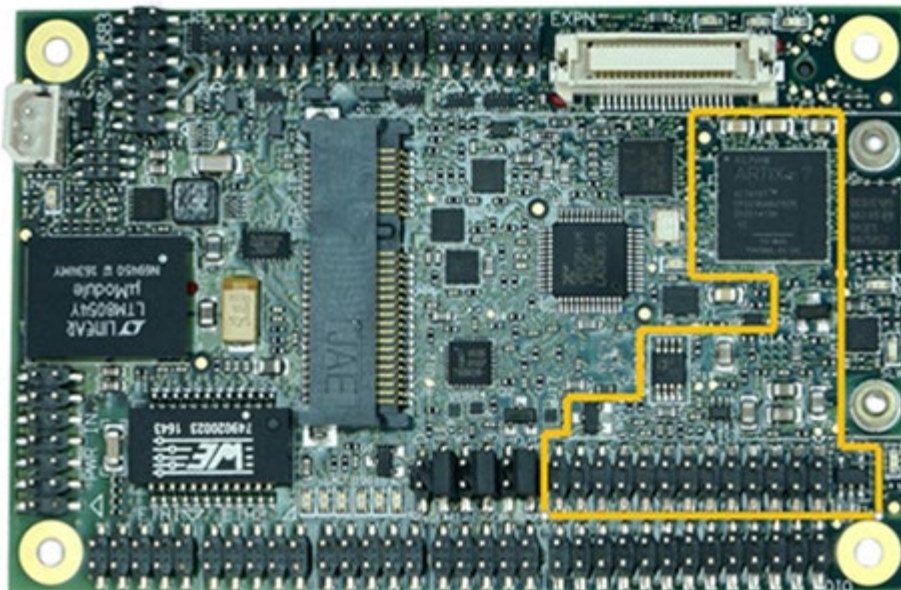
Zeta baseboard with integrated analog and digital data acquisition circuit

Zeta is available with two different data acquisition circuits, denoted by either A or D in the model number. Both circuits are available with any processor option.

All digital and analog I/O features are supported by Diamondï¿½s industry-leading Universal Driver software, which provides a C language programming library that supports all features in an easy-to-use, high-level fashion. Demo programs with source code and executables are included to demonstrate the use of each library function. A graphical monitor and control program provides easy access to all the I/O features and lets you prototype your application quickly as well as debug problems. Universal Driver is available as a free download from our website upon acceptance of our software license agreement.

◆ "A" Model Full Data Acquisition

Zeta "A" models include a complete data acquisition circuit with a combination of analog and digital I/O features. The circuit controller is an FPGA that interfaces to the host CPU via the LPC bus.

A/D Features

- 16 analog voltage inputs
- 16-bit resolution (1 part in 65536)
- Programmable input ranges: 0-5V, 0-10V, +/-5v, +/-10V
- Single-ended and differential input configuration options
- Precision, low-drift 2.5V reference voltage
- 100KHz maximum total A/D sample rate (all active channels combined)
- Integrated 2048-sample FIFO and interrupt service for efficient high-speed sampling
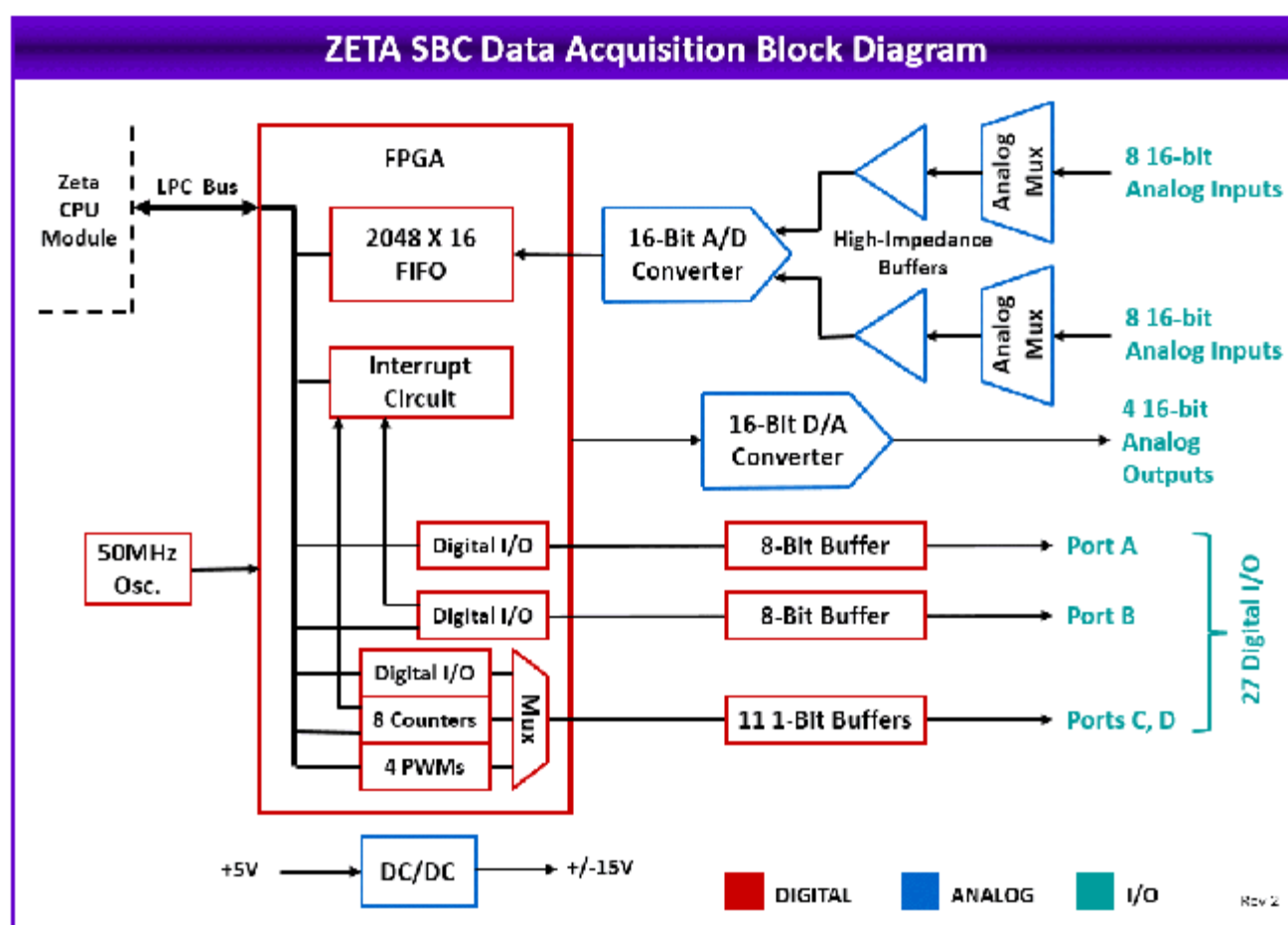
D/A Features

- 4 analog voltage outputs
- 16-bit resolution (1 part in 65536)
- Single-channel and multi-channel simultaneous update modes
- Programmable output range: 0-5V, 0-2.5V
- 30KHz update rate capability

- Waveform generator on 1 to 4 outputs with user-defined waveforms and 2048-sample waveform buffer

Digital I/O features

- 27 digital I/O lines
- User-selectable 3.3V / 5V logic levels
- User-selectable 10K pull-up / pull-down resistors
- Programmable direction in 8-bit and 1-bit groups
- 8-bit programmable edge detection circuit
- Buffers for protection and higher current drive
- 8 32-bit counter/timers with up counting, down counting, pulse output, and interrupt features
- 4 24-bit pulse-width modulators with programmable duty cycle and output polarity
- Interrupt support on ISA bus for A/D, digital I/O, and counter/timer circuits

ZETA SBC Data Acquisition Block Diagram

◆ "D" Model Digital I/O

Zeta "D" models include a digital I/O (GPIO) circuit based on the popular PCA9535 GPIO expander chip with the following features:

- 16 digital I/O lines
- User-selectable 3.3V / 5V logic levels
- User-selectable 10K pull-up / pull-down resistors
- Programmable direction in 8-bit groups

Buffers for protection and higher current drive

◆ Mass Storage and Expansion

◆ Mass Storage Options

Systems which do not require any additional I/O beyond the baseboard features may use the baseboardï¿½s MiniCard/mSATA socket to contain the system bootable mass storage. For Linux operation, the Micro SD socket may also be used for bootable mass storage, leaving the MiniCard socket available for expansion. A system running Windows which requires additional I/O must use the optional daughterboard. In this case the designer has the choice of either the baseboard mSATA socket or the daughterboardï¿½s M.2 socket for the bootable mass storage. If the M.2 socket is used,then both the baseboard and the daughterboard minicard sockets are available for I/O module installation.

◆ Zeta Daughterboard

Zeta includes an expansion connector which supports the installation of a daughterboard with additional I/O and expansion features:

- ◆ Full/half-size MiniCard socket with PCIe x1 and USB2.0 connectivity

- ◆ M.2 M-keying SSD connector for 2242 size M.2 SATA flashdisk

- ◆ HD Audio with Line In, Mic In, Line Out

- ◆ 16 Digital IO lines with configurable 3.3V/ 5V logic levels and Pull-up/down resistors
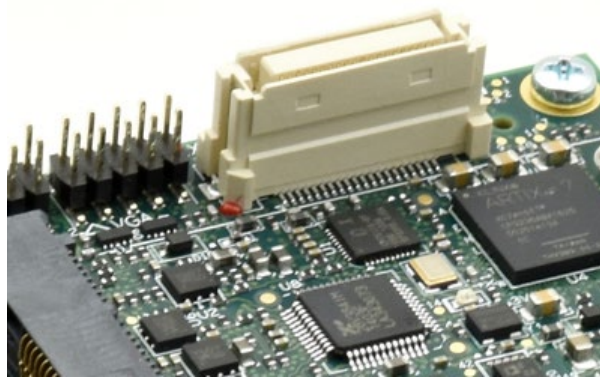
Zeta daughterboard expansion connector
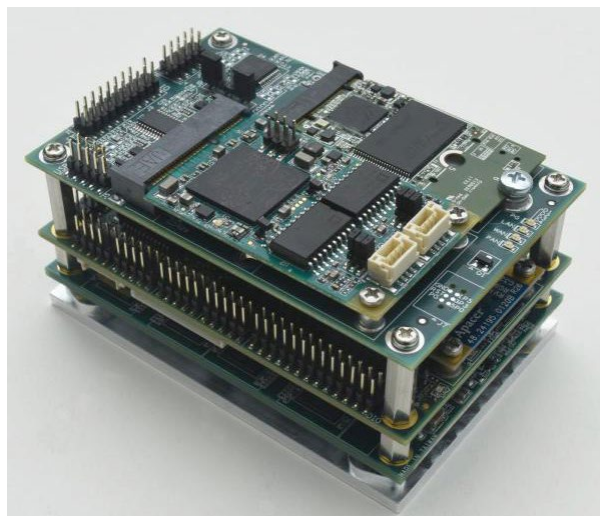
Zeta SBC with full-feature daughterboard and modules installed

ZETA-DB-01 full-feature daughterboard with expansion sockets, audio and GPIO

ZETA-DB-02 low-cost daughterboard with minicard and M.2 sockets only

◆ **Block Diagram**
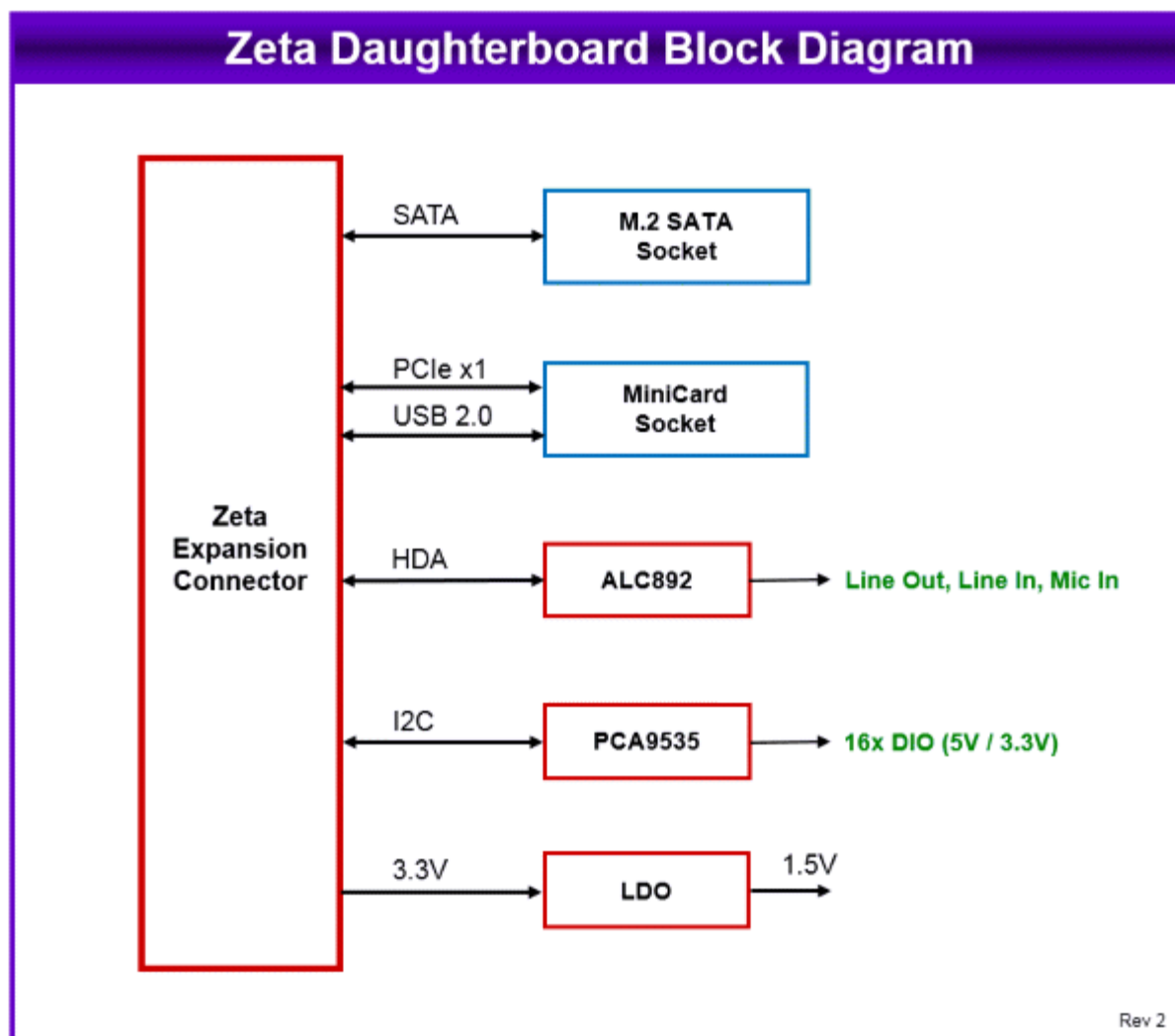
Specifications

Core CPU Features	
Processor/memory options	E3940 1.6GHz CPU, 8GB RAM, 64GB eMMC
	E3950 1.6GHz CPU, 8GB RAM, 128GB eMMC
System I/O Interfaces	
Serial Ports	4 RS-232/422/485 ports
USB	1x USB 3.0; 4 x USB 2.0
Networking	2 Gigabit Ethernet ports
Keyboard/Mouse	USB keyboard/mouse
Display	VGA and LVDS
Audio	HDA audio on expansion connector
Watchdog timer	Reset mode; Programmable interval 0-255 seconds
Mass Storage	1 Mini PCIe /mSATA socket; 1 Micro-SD socket
Data Acquisition Features	
Analog Inputs	16 Single-Ended / 8 Differential voltage inputs
Input ranges	+/-10V, +/-5V, 0-10V, 0-5V
Maximum Sample Rate	100,000 samples/sec aggregate
On-board FIFO	2048 samples, programmable threshold
DAQ Calibration	No calibration required

Analog Outputs	4 16-bit voltage outputs
Output ranges	0-5V, 0-2.5V programmable
A Model Digital I/O	27 lines independently programmable
D Model Digital I/O	16 lines independently programmable for input/output
PWM	4 24-bit pulse width modulators
Counter / timers	8 32-bit counter/timers
Logic signal voltage levels	3.3V/5V logic levels jumper-selectable

Expansion Buses

MiniCard	1 socket combining PCIe x1, mSATA, and USB 2.0 interfaces
SATA	1 port on expansion connector
PCIe	2x PCIe x1 links on expansion connector
USB	1 USB 2.0 port on expansion connector

Physical and Mechanical

Power input	6V to 36V option
Cooling	Heat spreader standard, no fan
Power Consumption	TBD
Operating Temperature	-40℃ to +85℃ (-40℉ to +185℉)
Form Factor	COM Express Mini Type 10
Dimensions	84 x 55mm / 3.3 x 2.2in
Weight	1.30 oz baseboard; TBD COM module; TBD SBC complete
RoHS	Compliant

◆ Models and Accessories

Zeta		
available models:		
ZETA-E3940-8G064A	Zeta SBC, E3940 CPU, 8GB RAM, 64GB eMMC, With DAQ	Available
ZETA-E3940-8G064D	Zeta SBC, E3940 CPU, 8GB RAM, 64GB eMMC, With DIO	Available
ZETA-E3950-8G128A	Zeta SBC, E3950 CPU, 8GB RAM, 128GB eMMC, With DAQ	Available
ZETA-E3950-8G128D	Zeta SBC, E3950 CPU, 8GB RAM, 128GB eMMC, With DIO	Available
DK-ZETA-E3940-8G064A-LNX64	Dev Kit, Zeta SBC, E3940 CPU, 64GB eMMC, Linux 64-bit OS	Available
DK-ZETA-E3940-8G064A-WE1064	Dev Kit, Zeta SBC, E3940 CPU, 64GB eMMC, Windows 10 64-bit OS	Available
DK-ZETA-E3950-8G128A-LNX64	Dev Kit, Zeta SBC, E3950 CPU, 128GB eMMC, Linux 64-bit OS	Available
DK-ZETA-E3950-8G128A-WE1064	Dev Kit, Zeta SBC, E3950 CPU, 128GB eMMC, Windows 10 64-bit OS	Available
SDK-ZETA-E3940-8G064A-LNX64	Software Dev Kit, Zeta SBC, E3940 CPU, 64GB eMMC, Linux 64-bit OS	Available
SDK-ZETA-E3940-8G064A-WE1064	Software Dev Kit, Zeta SBC, E3940 CPU, 64GB eMMC, Windows 10 64-bit OS	Available
SDK-ZETA-E3950-8G128A-LNX64	Software Dev Kit, Zeta SBC, E3950 CPU, 128GB eMMC, Linux 64-bit OS	Available
SDK-ZETA-E3950-8G128A-WE1064	Software Dev Kit, Zeta SBC, E3950 CPU, 128GB eMMC, Windows 10 64-bit OS	Available
ZETA-DB-01	Zeta daughterboard with MiniCard and M.2 sockets, audio, and GPIO	Available
ZETA-DB-02	Zeta daughterboard with MiniCard and M.2 sockets	Available

Please login or signup for an online quote request.

Cables and accessories	
available models:	

CK-ZETA-01	Zeta SBC cable kit
6981082	Dual USB 2.0 type A
6981075	Dual serial port DB9M
6980524	External battery cable, discrete wires
6981080	Gigabit Ethernet cable, RJ-45 socket, 10 pin board connector
6980516	Analog I/O and Digital I/O cables
6981084	VGA, 2x5 2mm latching to DD15F
6980102	Cable, Single USB3.0 Type A to 2mm 2x6
6981070	Power input cable

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