

General Description

The CDK-8DUART is a low cost CobraNet® interface module that provides OEM product developers a simple and cost effective means of adding CobraNet® audio networking capability to their products. The CDK-8DUART supports 8 bi-directional audio transport and has a user configurable DSP for audio processing. It also includes a Serial Host Management Interface Port (SHMI) for control by a host processor.

Applications

- Powered loudspeakers
- Multi-channel paging systems
- Security systems
- Two-channel and multi-channel power amplifiers
- Residential multi-zone audio networking

Features

- 100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u
- Support for 48/96kHz sampling rates at up to 24 bits
- Serial bridging supported for transmission of control and metadata over the audio network
- High quality, low jitter clock source
- SNMP agent for control, monitoring, and remote management
- TFTP support for firmware updates over the network
- Can be powered through the RJ-45 jack (external regulation required)
- Status LEDs for CobraNet® conductor and CobraNet® activity as well as error reporting
- Compact 3"x 3.5" for factor
- All logic levels are 3.3V and signal inputs are 5V tolerant.

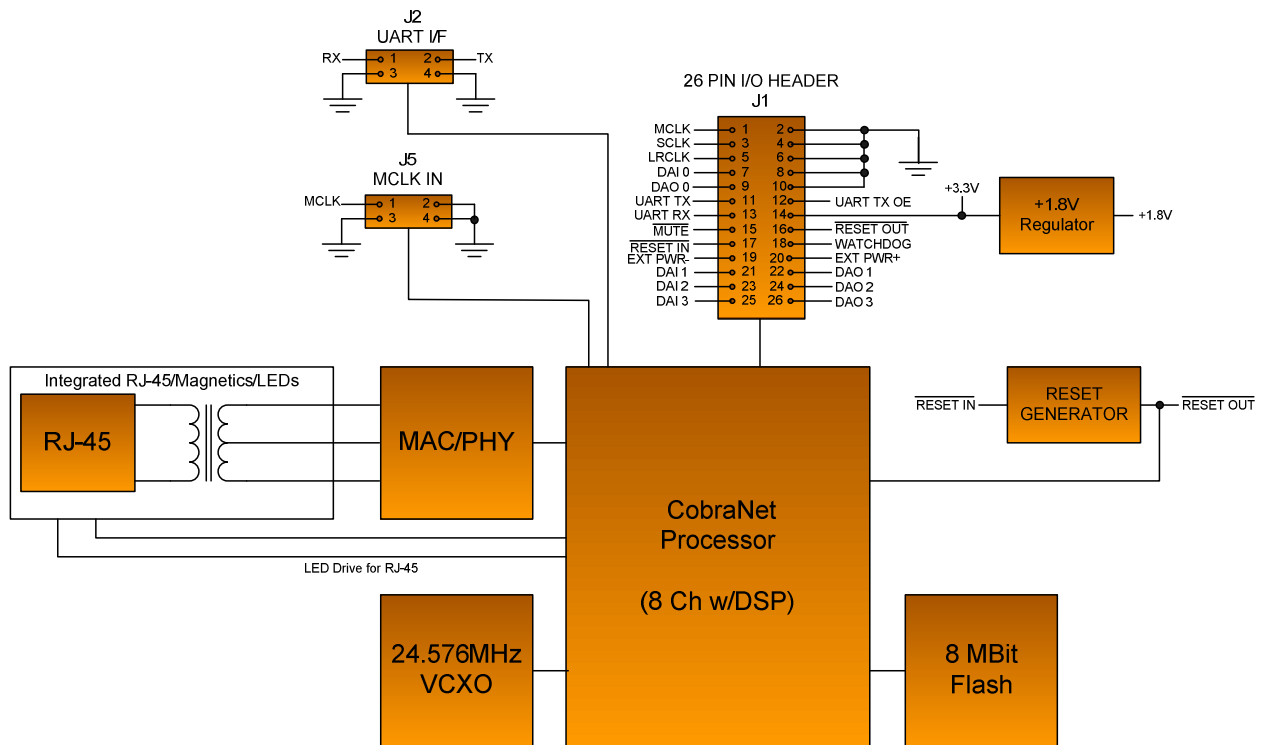


Figure 1 - Block Diagram

CobraNet® is a trademark of Cirrus Logic, Inc

Overview

The CDK-8DUART is a complete CobraNet® node. It is powered from 3.3V and supports with 8 digital audio inputs¹ and 8 digital audio outputs². It has an Ethernet connection for the CobraNet connection and a user configurable DSP, which, by default, contains no processing and passes the audio straight through but can be modified, if needed, to suit the application.

As with many CobraNet devices, remote control is accomplished via SNMP through the Ethernet connection. The CDK-8DUART also has the possibility of local control and monitoring by using a host microcontroller hooked up to the Serial Host Management Interface (SHMI). The SHMI interface is a standard serial connection running the SHMI protocol.

Recommended Operating Conditions

Parameter	Symbol	Nominal
DC supply	V	3.3 V
Input Current	I _{in}	600 mA
Temperature (Ambient)	T _A max	40 °C

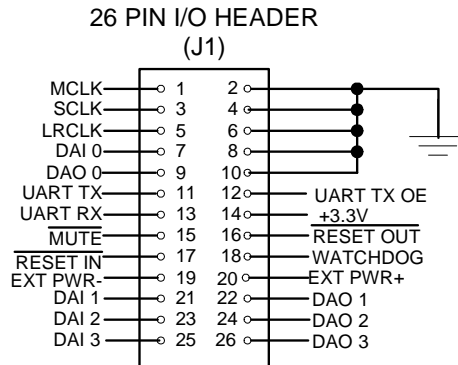
¹ There are 4 digital input pins but each support 2 channels giving 8 input channels in total.

² There are 4 digital output pins but each support 2 channels giving 8 output channels in total.

Digital Audio Interfacing

Access to the audio signals and clocks as well as various control signals on all three devices is via a 26-way 0.1" female header.

Pin Descriptions for J1



Pin	Signal	Direction	Notes
14	+3.3V	PWR	+3.3V power input
2,4,6,8,10	GND	GND	GND
19	EXT PWR-	OUT	Connected to unused pair on Ethernet RJ-45 connector. Can be used to remotely power device connected to header. (Negative)
20	EXT PWR+	OUT	Connected to unused pair on Ethernet RJ-45 connector. Can be used to remotely power device connected to header. (Positive)
15	MUTE	OUT	Active low during initialization and when faults are detected
16	RESET OUT	OUT	Active low reset signal generated by the CDK-8 module
17	RESET IN	IN	Active low reset signal generated by external circuitry
18	WATCHDOG	OUT	Toggles at 750 Hz indicating proper operation. If the period exceeds 200ms, this indicates hardware or software malfunction and the module needs to be reset.
1	MCLK	OUT	24.576 MHz Master Audio Clock
3	SCLK	OUT	Serial Audio Bit Clock (64 FS)
5	LRCLK	OUT	Audio Word Clock (FS)
7	DAI 0	IN	I2S Synchronous Serial Audio Data Input CDK-8 = Channels 1 & 2
21	DAI 1	IN	I2S Synchronous Serial Audio Data Input CDK-8 = Channels 3 & 4

23	DAI 2	IN	I2S Synchronous Serial Audio Data Input CDK-8 = Channels 5 & 6
25	DAI 3	IN	I2S Synchronous Serial Audio Data Input CDK-8 = Channels 7 & 8
9	DAO 0	OUT	I2S Synchronous Serial Audio Data Output CDK-8 - Channels 1 & 2
22	DAO 1	OUT	I2S Synchronous Serial Audio Data Output CDK-8 = Channels 3 & 4
24	DAO 2	OUT	I2S Synchronous Serial Audio Data Output CDK-8 = Channels 5 & 6
26	DAO 3	OUT	I2S Synchronous Serial Audio Data Output CDK-8 = Channels 7 & 8
11	UART TX	OUT	Serial bridge asynchronous serial transmit data line. Transmits data received by this node from other CobraNet® devices on the CobraNet® network.
12	UART TX OE	OUT	Serial bridge asynchronous serial transmit output enable
13	UART RX	IN	Serial bridge asynchronous serial receive data line. Receives data that will be transmitted across the CobraNet® network to other CobraNet® devices. Pull up to 5V if not used.

The format of the synchronous serial audio interface can be changed with customized firmware. The formats supported are I2S, Cirrus Standard Mode and Normal Mode.

Power Requirements

The CDK-8DUART requires a regulated +3.3V DC supply at 600mA and power consumption is approximately 2W.

The EXT PWR connections are connected to the unused pairs on the Ethernet cable and cannot be used to power the unit directly. However, they can be used to power the module from a remote source using additional circuitry on the host circuit board allowing the unit to be made PoE capable.

However the unit is powered, it is recommended that the incoming power be regulated locally on the host board before being supplied to the module.

Clocking Notes

The CDK-8DUART module generates its own master clock but the module also has the facility to synchronize with an external master audio clock through the MCLK_IN pin. However, in order to do so, a firmware change will be required. Contact ProductSupport@atterotech.com for more details.

It should be noted that the MCLK output signal (J1 - Pin 1) is generated from the VCXO on the CDK-8DUART module and thus will differ from the MCLK_IN clock signal. As a result, if an external MCLK is used, all components (ADCs, DACs, etc.) on the target hardware that are driven by the master clock should use the same clock supplied to the MCLK_IN pin of the CDK-8DUART module and not the MCLK output from the module.

Digital Audio Timing Diagrams

There are four synchronous serial input and output interfaces coming from the CDK-8DUART module. Each interface contains two channels in one sample period of the LRCLK audio word clock. The following diagram shows the timing characteristics. The characteristics are the same at both 48 kHz and 96 kHz sample rates. The CDK-8DUART supports all four serial interfaces.

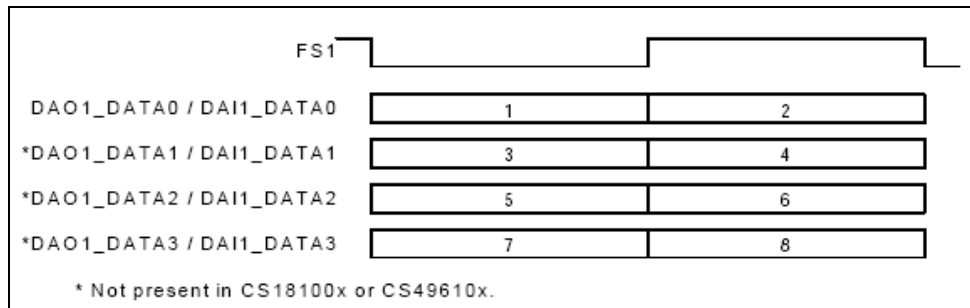


Figure 2 - Channel Structure for Synchronous Serial Audio at 64FS (One Sample Period)

Default channel ordering is shown above. Note that the first channel always begins after the rising or falling edge of FS1 (depending on the mode). DAI1_SCLK period depends on the sample rate selected. Up to 32 significant bits are received and buffered by the module for synchronous inputs. Up to 32 significant bits are transmitted by the module for synchronous outputs. Bit 31 is always the most significant (sign) bit. A 16-bit audio source must drive to bit periods 31-16 with audio data and bits 15-0 should be actively driven with either a dither signal or zeros. Cirrus Logic recommends driving unused LS bits to zero. Although data is always transmitted and received with a 32-bit resolution by the synchronous serial ports, the resolution of the data transferred to/from the Ethernet may be less. Incoming audio data is truncated to the selected resolution. The unused least significant bits on outgoing data are zero filled.

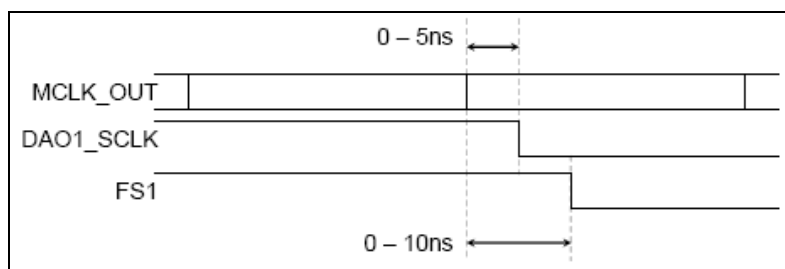


Figure 3 - Timing Relationship between FS512_OUT, DAO1_SCLK and FS1

A DAO1_SCLK edge follows an MCLK_OUT edge by 0.0 to 5.0ns. An FS1 edge follows a MCLK_OUT edge by 0.0 to 10.0ns.

Note: The DAO1_SCLK and FS1 might be synchronized with either the falling edge or the rising edge of MCLK_OUT. Which edge is impossible to predict since it depends on power up timing.

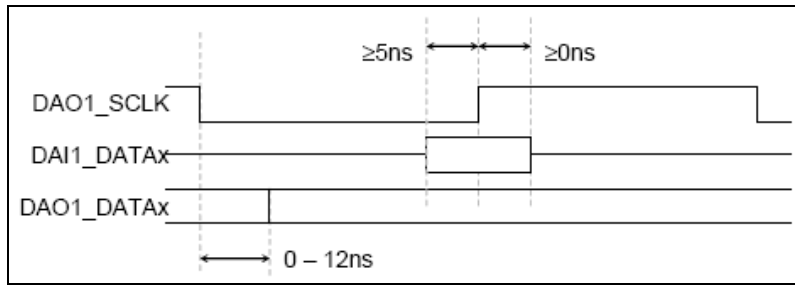


Figure 4 - Serial Port Data Timing Overview

Setup times for DAI1_DATAx and FS1 are 5.0ns with a hold time of 0.0 ns with respect to the DAI1_SCLK edge. Clock to output times for DAO1_DATAx is 0.0 to 12.0ns from the edge of DAO1_SCLK.

Normal Mode Data Timing

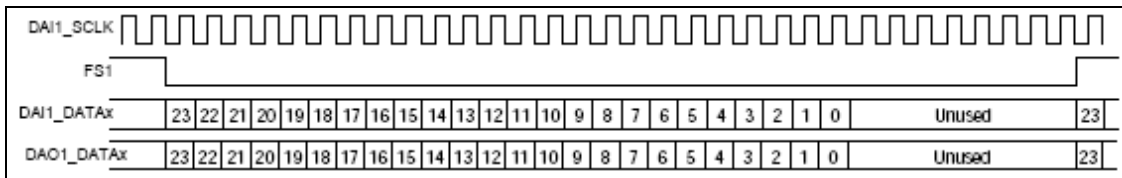


Figure 5 - Audio Data Timing Detail - Normal Mode, 64FS

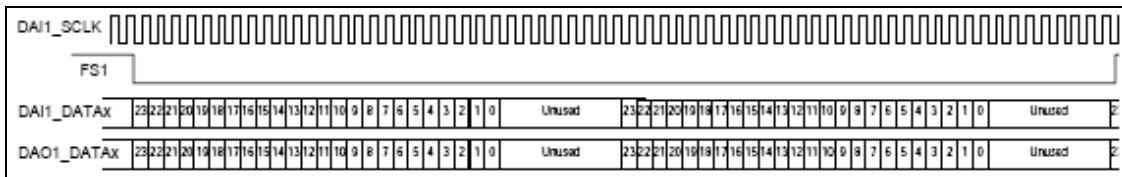


Figure 6 - Audio Data Timing Detail - Normal Mode, 128FS

Each audio channel is comprised of 32 bits of data, regardless of audio sample size. The figure above shows 24-bit audio data. The MSB is left justified and is aligned with FS1. Data is sampled on the rising edge of DAI1_SCLK and data changes on the falling edge.

I²S Mode Data Timing

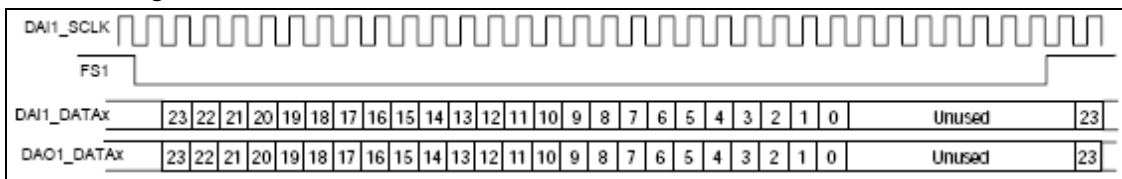


Figure 7 - Audio Data Timing Detail - I2S Mode, 64FS

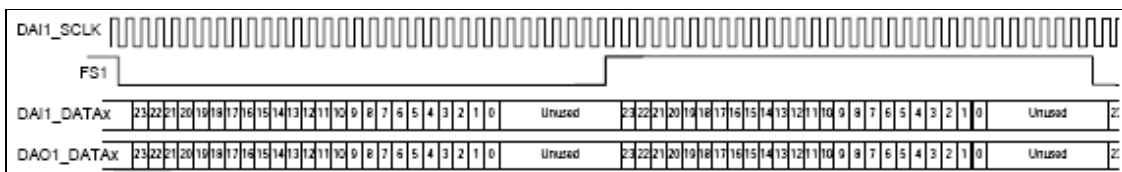


Figure 8 - Audio Data Timing Detail - I2S Mode, 128FS

Each audio channel is comprised of 32 bits of data, regardless of audio sample size. Figure 8 shows 24-bit audio data. The MSB is left justified and arrives one bit period following FS1. Data is sampled on the rising edge of DAI_SCLK and data changes on the falling edge.

Standard Mode Data Timing

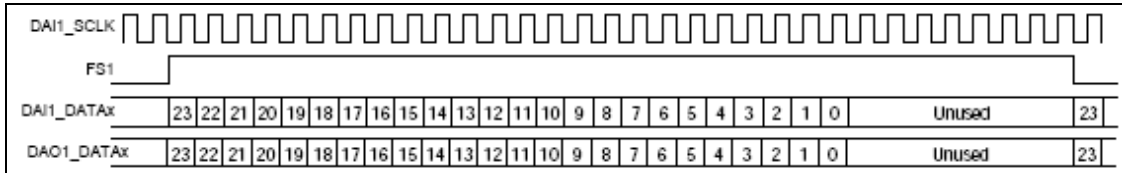


Figure 9 - Audio Data Timing Detail - Standard Mode, 64FS

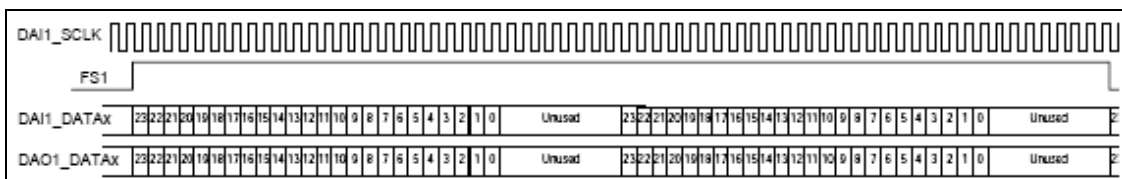


Figure 10 - Audio Data Timing Detail - Standard Mode, 128FS

Each audio channel is comprised of 32 bits of data, regardless of audio sample size. The figure above shows 24-bit audio data. The MSB is left justified and is aligned with FS1. Data is sampled on the rising edge of DAI_SCLK and data changes on the falling edge.

Serial Bridge Interface

CobraNet® also has a serial bridge feature which allows devices connected on a CobraNet® network to send serial data to one another. There are three pins available for this purpose. All the signals use 3.3V logic levels but are 5V tolerant. The format and baud rate are set within the CobraNet® device itself. In addition to RX and TX, there is a TX Enable output for use in multi-drop systems.

Network connection

The CDK provides a single RJ45 Ethernet jack for connection to the CobraNet network. When in use, LEDs on the connector provide status of the network as seen by the CDK-8. The LEDs will be on, off, or flashing depending on the current state of the network connection. Below is a table showing the states of the LEDs and what device status they represent.

LED status	Device Status
Left LED on permanently. Right LED off	No Ethernet Connection
Left LED on permanently. Right LED on but flashes off every 4 seconds	Ethernet connected but no other CobraNet devices found
Left LED on permanently. Right LED flashing 3 times a second	Connected and CobraNet devices found. Device is a performer.
Left LED on flashing 3 times a second Right LED flashing 3 times a second	Connected and CobraNet devices found. Device is the conductor.

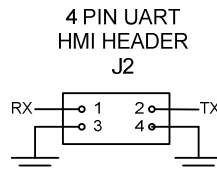
Table 1 - CobraNet Interface LED Status

**Note: The LED's are also used, under certain circumstances, to indicate a fault condition. Each condition has a unique repeating 3-part flash pattern with short pauses between each part and a longer pause at the end. The key is number of times the LED flashes in each part. A list of the flash codes and their meaning is listed in the CobraNet Programmers Guide which is available from the Cirrus website.*

SHMI Port Interfacing

Aside from the digital audio I/O connector, there are two additional connectors on a CDK-8DUART module. J2 contains the SHMI serial interface connections and J5 has an MCLK_IN connection for synchronization with an external master clock. The serial interface uses TTL level logic so no driver chip is required if it is connected directly to a microcontroller. The pins use 3.3V logic levels but the inputs are 5V tolerant.

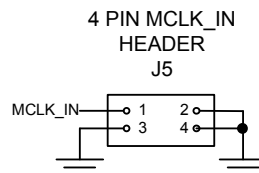
Pin Descriptions for J2



Pin	Signal	Direction	Notes
1	RX	In	HMI UART receive pin
2	TX	Out	HMI UART transmit pin
3,4	GND	GND	GND

Pin Descriptions for J5

This is the second additional connector available on a UART HMI device. This connector is in the same physical location and uses the same connections on the UART board as pins 1 through 4 of J4 on the HMI version of the module.



Pin	Signal	Direction	Notes
1	MCLK IN	IN	For systems featuring multiple CobraNet® interfaces operating off a common master clock.
2,3,4	GND	GND	GND

Interfacing Notes

The CDK-8DUART will receive messages from any source capable of communicating serially using 8 data bits, no parity bit, 1 stop bit, and no flow control with a default baud rate of 57600 bits per second (bps). The baud rate is configurable but the data bits, stop bits, flow control, and parity are not.

For details on how to change the UART's baud rate as well as all the details on how to control all the various CobraNet® aspects of the module, see the CDK-8 Design Guide.

Mounting the module

The CDK-8DUART module has been designed for easy integration into other products. The only connection required between the CDK-8DUART and the target hardware is via J1, the mating 26-pin 0.1" header. This gives the minimum connection to get audio into and out of the unit and also supplies the power to it as well. If an external clock is needed then a matching header for J5 will be needed. If local control using a host processor via the SHMI interface is required, a mating header for J2 will be needed.

There are three mounting holes available for securing the module, one of which also has a connection to chassis ground. To secure the module to the main board use a 0.1" pitch header (Samtec #MTLW-113-07-G-D-230) and a 0.375in (9.52mm) spacer or pillar.

For details on specific integration recommendations, see the CDK-8 Design guide.

Software Tools

There are a number of CobraNet® software tools available to assist in the development, control and maintenance of CobraNet® enabled products.

Attero Tech Control Center – CobraNet® monitoring and Attero Tech product setup

CobraNet® Discovery – Monitoring and Firmware Updates

CobraCAD – CobraNet® network design tool

DSP Conductor – Drag and Drop user DSP configuration software

Attero Tech Control Center is available on our website, www.atterotech.com. The remaining software is available from Cirrus Logic at <http://www.cobranet.info>.

Firmware Updates

Each CDK-8DUART is preloaded with a customized version of the most current version of CobraNet® firmware. If a newer version of CobraNet® firmware is released after receiving the CDK-8DUART module, an update will be made available on the Attero Tech website. If you cannot find the update you require, contact product.support@atterotech.com.

It is important to stress that the initial firmware in the CDK-8DUART module is a customized version of the CobraNet® base firmware. Be wary of using the latest firmware versions available from the Cirrus website as they will be generic CobraNet® firmware and this will affect the interface between the CDK-8DUART and the hardware it resides in. The most notable potential problem is the digital audio interface. The generic versions of the CobraNet® firmware set the serial audio format to "Normal" mode where as the CDK-8DUART uses "I2S" mode.

If any firmware customization is required, contact sales@atterotech.com for more details.

Module Photograph

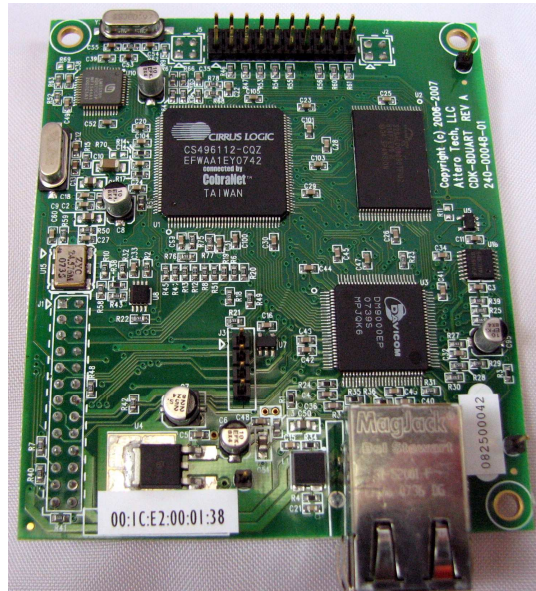
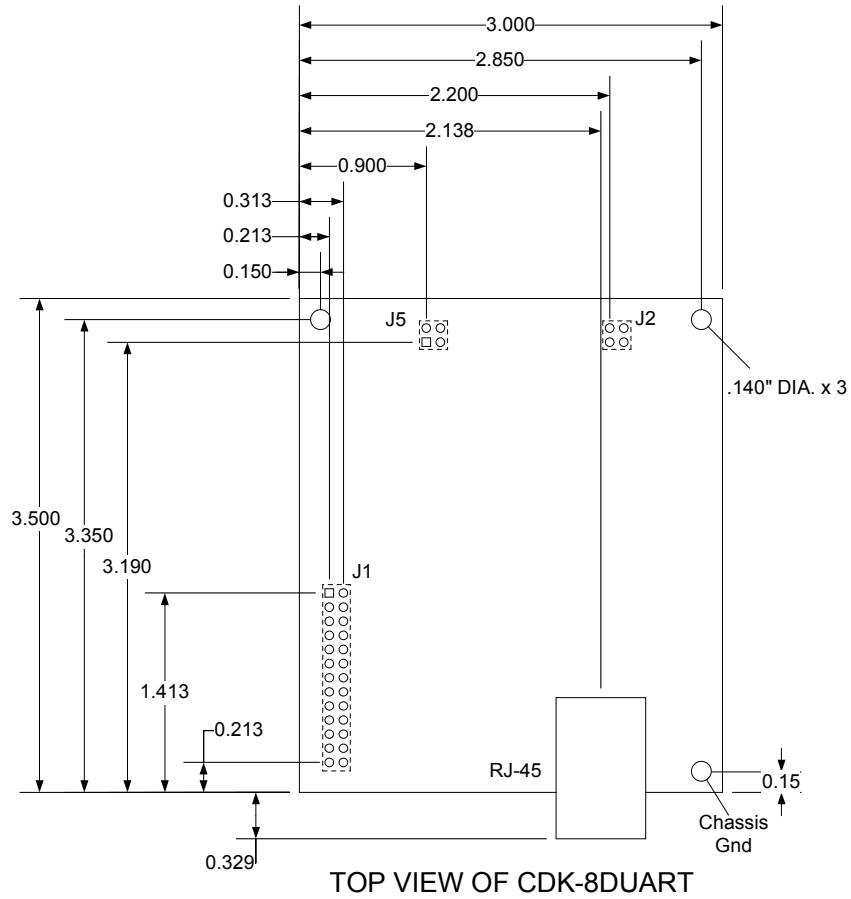
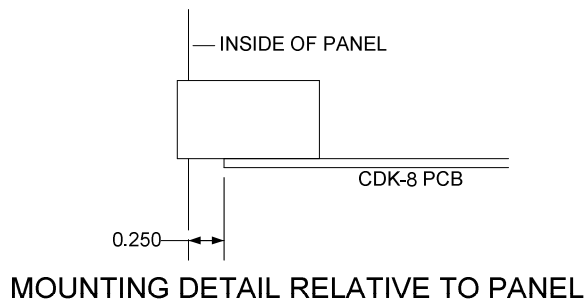
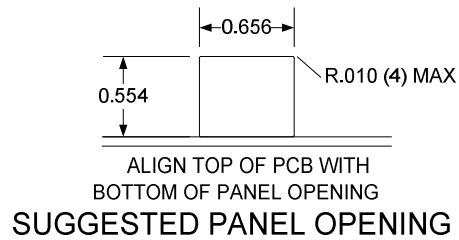
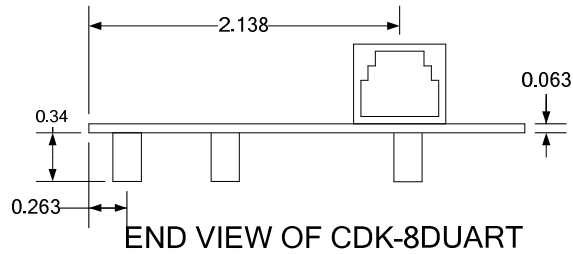


Figure 11 - CDK-8DUART

Mechanical Outline





Ordering Information

Part Number	Description
CDK-8DUART	8-channel interface with UART serial HMI port and user DSP