Cyan Technology

eCOG1X Low Cost Development Kit

User Manual

V1.0

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Revision History

Version	Date	Notes
V1.0	22/01/2008	First release.

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List of Tables

1 Introduction

This document describes the eCOG1X Low Cost Development Kit.

1.1 Development Kit Contents

- Low cost development board, fitted with an eCOG1X1A5 or an eCOG1XE01A6 device.
- Cyan eCOG1X USB eICE adaptor
- USB cable (A to mini-B)
- CD-ROM containing CyanIDE development software and documentation

1.2 Requirements

- A Windows-based PC system.
(minimum 1GHz CPU speed, higher speed recommended).
- Windows 2000 or Windows XP operating system.
- 100MB free disk space.
- 512MB memory (1GB recommended).
- A spare USB port.
- A spare serial port (optional).
- System administrator privileges are required for software installation.

1.3 Additional Documents

1. eCOG1X or eCOG1XE01 User Manual
2. CyanIDE User Manual
3. eCOG1X USB eICE Programming Adaptor User Manual

1.4 Part Identification

In this document, any reference to eCOG1 means the generic chip and is applicable to all versions. All eCOG1 devices are suffixed according to their version; any reference to a particular version such as eCOG1XE01A6 is specific to that version.

2 Quick Start

Please also read *Appendix A Important Notes*.

2.1 Set Up System

- Unpack and check contents of kit.
- Install CyanIDE V1.4.3 or later development software and USB device drivers.
  See section 4 *Installing CyanIDE* for more details.
- Connect the Cyan eCOG1X USB eICE adaptor to socket S1 on the development board.
- Connect the USB cable between the eICE adaptor and the host PC.

2.2 Copy the Example Projects

CyanIDE includes a range of example projects for the development kits, copied during installation into the <*examples*> directory under the CyanIDE install directory, usually <*C:\Program FIles\Cyan Technology\CyanIDE*>. The installation process also creates a <*CyanIDE Projects*> directory in the user's *My Documents* folder.

The eCOG1X low cost development board is described in CyanIDE as the eCOG1XE01 development board. It is recommended that the examples for this board are copied from the the <*examples\eCOG1XE01 dev board*> directory into the user's projects directory before use, to avoid making any changes to the original examples.

- Open the *My Documents* directory and browse into the *CyanIDE Projects* directory. This includes a shortcut to the CyanIDE examples directory.
- Open the <*CyanIDE Examples*> shortcut and then the <*eCOG1XE01 dev board*> directory.
- Type **ctrl-A** or click **Edit->Select All** to select all the eCOG1XE01 example projects, then type **ctrl-C** or click **Edit->Copy** to copy them to the clipboard.
- Click the **Back** button twice to return to the CyanIDE Projects directory.
- Type **ctrl-V** or click **Edit->Paste** to paste the example projects from the clipboard into the current directory.

2.3 Running an Example Project

As an introduction, try the FlashLEDs example project located in the GPIO\FlashLEDs directory.

- Start CyanIDE.
- From the main menu, select **Project->Open** and browse to the LCD example directory <*CyanIDE Projects\GPIO\FlashLEDs*>. Select the project file <**.cyp*> and click **Open**. CyanIDE loads the project and displays the files included in the project in the navigator pane at the left of the main window.
- Select **Build->Rebuild All** from the main menu. This compiles the project source files and links the object code into a download image file.
- Select **Debug->Run**. CyanIDE connects to the target processor on the development board, downloads the application code and begins execution.

3 Software

3.1 CyanIDE

The CyanIDE V1.4.3 or later software development package supports the eCOG1X family of microcontrollers, providing project management, source code editor, C compiler, assembler, linker, source level debugger, and online help files. It is available on CD-ROM, or as a download to registered users on the Cyan web site at www.cyantechnology.com.

CyanIDE communicates with the eCOG1X microcontroller on the target system via the eICE debug port. The host PC requires a simple eICE adaptor that connects to the 10-way header P3 on the development board. The development kit includes the Cyan eCOG1X USB eICE adaptor.

CyanIDE includes a range of example applications for the various development boards. These can provide a good starting point for customer applications, or just as examples showing how to set up a software project. Further application examples including CyanIDE project files with source code are available on the web site support pages.

3.2 USB eICE Drivers

The software drivers for the eCOG1X USB eICE adaptor are included in the CyanIDE development package. CyanIDE V1.4.3 or later includes the required version of the driver files as standard.

To ensure that the driver files are present, install the CyanIDE software and any necessary updates before connecting the eICE adaptor to the host PC. Further details about the software installation are shown later in this document.

Note that any previous version of CyanIDE should be uninstalled before the latest version is installed. This includes any USB device drivers for Cyan products such as the evaluation board, which should be removed via the Device Manager. Installing the new version of CyanIDE also reinstalls the USB eICE device driver.

4 Installing CyanIDE

4.1 From the Cyan Tools CD-ROM

Insert the CD into the CD-ROM drive. The html start page should load automatically in the default browser.

If the start page does not load automatically, or Autorun is disabled for the CD-ROM drive, then Browse the Cyan CD in a file manager or explorer window, and open the file <*index.htm*>.

When the start page is displayed, click on the **Menu** button, then select the **Install CyanIDE** item to begin installation of the development software. Follow the instructions presented by the installation program.

4.2 From the Cyan Website

- Navigate to the software downloads page on the website, located at http://www.cyantechnology.com/support/updates.php.
- Download the CyanIDE full version installation file to a temporary directory.
  Please note that users must log in to the website with their registered account name and password for the support forum to download this file.
- Execute the downloaded file to install the development software. Follow the instructions presented by the installation program.

4.3 Installing the USB eICE Driver

CyanIDE V1.4.3 includes the driver files for the eCOG1X USB eICE adaptor as standard, and it is not necessary to install them separately.

When an eICE adaptor is connected to a PC for the first time, the USB enumeration process identifies it as new hardware, and Windows starts the *Found New Hardware* process. Driver installation under Windows 2000 and Windows XP is fully automatic and does not require any user interaction.

5 CyanIDE Examples

CyanIDE includes a number of example software projects, pre-configured for use with the eCOG1X development boards, the eCOG1k development and evaluation boards, or the eCOG1 simulator. The examples for the eCOG1X low cost development board are described briefly in the table below.

5.1 Development Board Examples

The following example applications for the eCOG1X low cost development board (eCOG1XE01 development board) are included as standard with CyanIDE V1.4.3.

Example	Comments
Analogue	**Examples showing the use of the analogue peripheral**
CounterTrigger	Using the CNT1 counter to trigger ADC conversions
SoftwareTrigger	Triggering ADC conversions in software
General	**General purpose examples**
Timers	Shows the use of all the eCOG1X timers
GPIO	**Examples using the GPIO connections**
FlashLEDs	Flashes LEDs in sequence on the development board
Serial	**Serial port example**
DuartEcho	Echoes received characters on UART1A

5.2 Serial Port Configuration

Many examples use one of the serial ports to report results or display messages. Use a terminal program such as 'HyperTerminal' to communicate with the application. The default serial port configuration is shown below.

- 9600 Baud
- 8 data bits
- no parity bits
- one stop bit
- no flow control

5.3 Analogue Examples

5.3.1 Counter Trigger

This example uses CNT1 to trigger ADC conversions. This is performed in the background while the application waits for the user to press a key (a blocking operation). It uses UART1A to output text to a terminal and receive keyboard input.

File	Comments
CounterTrigger-eCOG1XE01A.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
eCOG1XE01A.cfg	Peripheral configuration file
internal.map	Memory map
main.c	Application code

5.3.2 Software Trigger

This example performs ADC conversions by triggering the conversion from software. It uses UART1A to output text to a terminal.

File	Comments
SoftwareTrigger-eCOG1XE01A.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
eCOG1XE01A.cfg	Peripheral configuration file
internal.map	Memory map
main.c	Application code

5.4 General Examples

5.4.1 Timers

This example demonstrates the use of the timers available in the eCOG1X. It uses UART1A to output text to a terminal.

File	Comments
Timers-eCOG1XE01A.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
eCOG1XE01A.cfg	Peripheral configuration file
internal.map	Memory map
main.c	Application code

5.5 GPIO Examples

5.5.1 Flash LEDs

This application flashes the LEDs on the development board in sequence. It uses UART1A to output text to a terminal.

File	Comments
FlashLEDs-eCOG1XE01A.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
eCOG1XE01A.cfg	Peripheral configuration file
internal.map	Memory map
main.c	Application code

5.6 Serial Examples

5.6.1 DUART Echo

This example echoes back out any incoming characters from the UART1A serial port. It uses the *serial_lib* routines to provide circular buffering and interrupt support.

File	Comments
DuartEcho-eCOG1XE01A.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
eCOG1XE01A.cfg	Peripheral configuration file
internal.map	Memory map
main.c	Application code

5.7 Simulator Examples

The following example simulator applications are also included with CyanIDE. They can be found in the *<examples\simulator>* directory located below the CyanIDE installation directory.

Example	Comments
primes	Searches for prime numbers
oscillator	Example of using a simulated memory-mapped device

5.7.1 primes

The 'primes' application searches for prime numbers and displays results in the Debug Output Window. The results are displayed using an implementation of `putchar()` that includes the assembler PRINT instruction. The simulator interprets this instruction according to the Print mode option in Project Properties: printing a character, a hexadecimal value, or raising an exception.

File	Comments
primes.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
irq.asm	Entry point and interrupt vectors
primes.c	Application code
putchar.c	Character output routine
simulator.map	Memory map

5.7.2 oscillator

The 'oscillator' application reads a simulated ADC which is generating data representing a sine wave, and writes a filtered value back to a memory location. The filtered value is logged to a file.

File	Comments
oscillator.cyp	CyanIDE project file
cstartup.asm	C environment initialisation
pack.asm	C const and init data segments
irq.asm	Entry point and interrupt vectors
oscillator.c	Application code
putchar.c	Character output routine
oscillator.py	Simulated ADC written in Python. The **Run on project load** option for this file is set.
simulator.map	Memory map - includes CUSTOM entry

6 Development Board

6.1 Overview

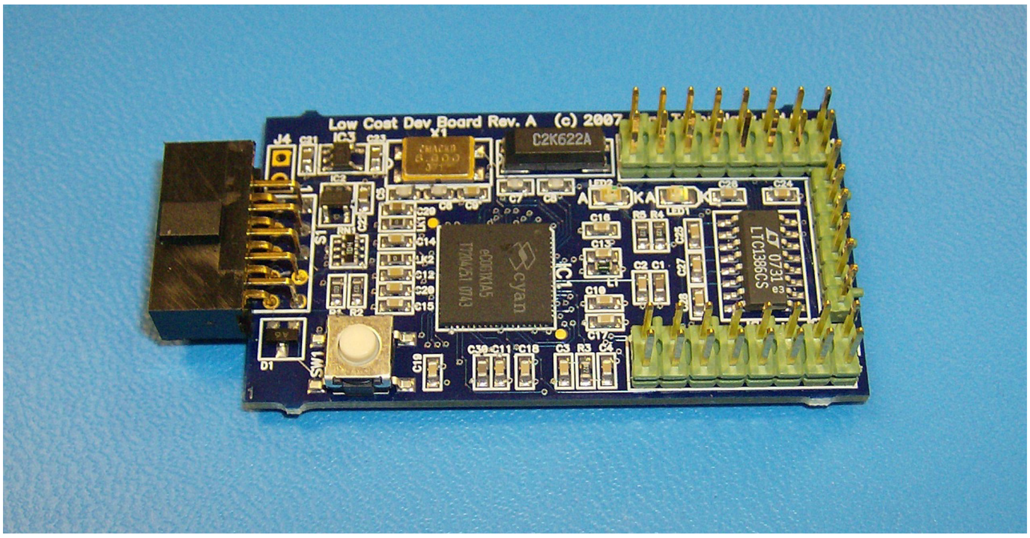


Figure 1: eCOG1X low cost development board

The eCOG1X low cost development board has the following major features.

- eCOG1X1A5 microcontroller with 512Kbytes flash memory and 24Kbytes SRAM
  or
  eCOG1XE01A6 microcontroller with 64Kbytes flash memory and 8Kbytes SRAM.
- 10 way right angle socket for the eICE debug port (S1).
- Four serial ports, two with optional EIA/TIA-562 transceiver.
- Four 12-bit analogue inputs.
- Two user/status LEDs.
- Hardware reset pushbutton.
- Free pads or pin headers for input and output port connections.
- Powered from the eICE adaptor or from an external 5V d.c. power supply.

6.2 Description

The eCOG1X microcontroller has a 16-bit CPU architecture and a wide range of on-chip peripherals. It operates at clock speeds of up to 70MHz internally from an 8MHz crystal or 32.768kHz watch crystal. Refer to the eCOG1X User Manual for further details.

The board is fitted with a 10-way right angle socket (S1) for the eICE debug port. This port connects directly to the processor core, and is used for downloading and debugging applications code. A Cyan USB eICE adaptor is supplied with the Development Board, although any external eICE adaptor may be used. The eICE adaptor connects directly to socket S1.

Four serial ports are available on the Development Board. Two of these may be buffered by an external LTC1386CS transceiver device. The unbuffered serial port signals (3.3V) are available on header J1, and the buffered EIA/TIA-562 level signals are available on header J3.

Four 12-bit analogue inputs on the eCOG1X device are available on header J2.

The Development Board can be powered from an external 5V d.c. power supply, connected via header J4, or from the USB 5V via the eICE debug connection on S1.

7 eCOG1X USB eICE Adaptor

7.1 Overview

The USB eICE adaptor provides a connection from the host PC to the target eCOG1 family device. A number of different eICE adaptors are available from Cyan Technology. The device driver software for the host PC is included in the CyanIDE installation.

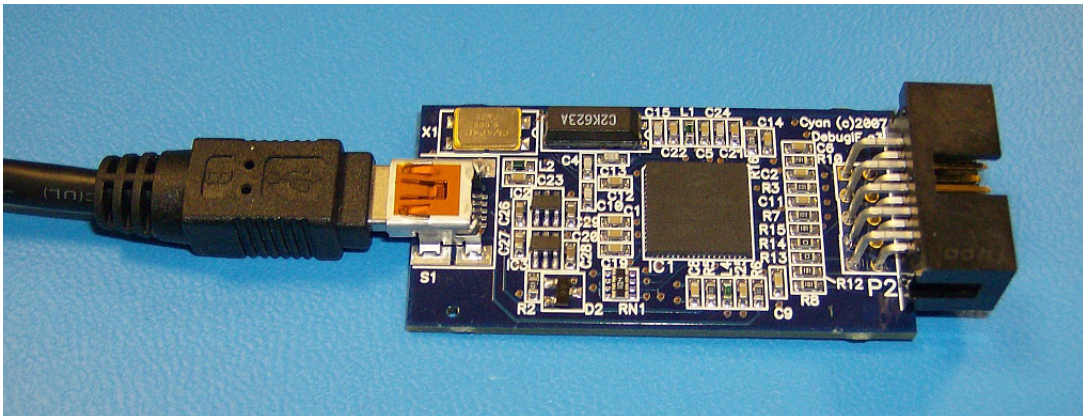


Figure 2: eCOG1X USB eICE adaptor

The Cyan eCOG1X USB eICE adaptor has the following major features.

- Cyan eCOG1X5A5 device providing USB interface to host PC.
- Local control of eICE debug interface transactions gives higher performance.
- USB mini-B socket.
- USB cable (A to mini-B) for host PC connection.
- 10 way boxed header for eICE debug port.
- Powered from USB +5V supply.
- 5V supply connection available for low-power target systems.

7.2 Description

This adaptor uses the Cyan eCOG1X5A5 device to implement the USB interface to the host PC system. A standard USB cable connects to the host side of the unit via a mini-B USB socket. The PC end of the cable has a type A USB connector fitted. The eICE connection to the eCOG1X1A5 or eCOG1XE01 target device is via a 10 way boxed header that connects directly into the 10 way socket on the development board. The eCOG1X5A5 device provides the USB interface to the host PC and digital inputs and outputs for the eICE signals.

Configuration data including serial numbers, USB PID and VID numbers, and identifier strings is stored in the eCOG1X internal flash memory. This configuration data is required to allow the unit to identify itself to the host PC during the USB device enumeration process, and for the PC then to select the correct device driver files. The Cyan USB eICE adaptors are loaded with the required configuration data during functional test.

The adaptor is powered from the +5V supply available on the host USB connection. Local on-board regulators provide 3.3V and 1.8V for the eCOG1X device, and for the I/O connections to the target eCOG1X device.

All signals to the target device eICE conection include 100Ω series resistors. The LOADB signal also includes a 1kΩ pull-up resistor. The USB +5V supply is also connected to the 10 way header; this may be used to power small target systems provided the total current drawn is within the 500mA limit available from a standard USB host.

8 Peripheral Functions and Connections

8.1 Power Supply

The eCOG1X low cost development board can be powered from an external 5V d.c. supply via header J4, or from the USB 5V via the eICE adaptor connection on socket S1. The 5V power supply input is regulated down by two low dropout regulators to provide the 3.3V and 1.8V power supplies for the eCOG1X device.

8.2 eICE Debug Port

The pin connections for the eICE signals on the 10 way right angle socket S1 are shown in the table below.

Pin	Name	Description
1	eICE_MOSI	Master Out Slave In, input from the eICE adaptor.
2	VDD_EICE	5V power supply input from the eICE adaptor.
3	NC	No connection.
4	GND	
5	eICE_LOADB	eICE LoadB signal, open-collector, bidirectional.
6	GND	
7	eICE_CLOCK	eICE serial clock, input from the eICE adaptor.
8	GND	
9	eICE_MISO	Master In Slave Out, output to the eICE adaptor.
10	eICE_nRESET	Active low reset, connected in parallel with the reset switch.

Table 1: S1: eICE connections

The Cyan USB eICE adaptor provides 5V d.c. on the VDD_EICE pin, from the USB hub on the host PC.

8.3 Serial Ports

Four UART serial ports are available. The unbuffered serial port signals are provided on header J1. Two of the serial ports may be buffered to EIA/TIA-562 levels by an external LTC1386CS transceiver device. The buffered signals for these two serial ports are provided on header J3.

8.4 Analogue Inputs

Connections to four analogue inputs on the eCOG1X on-chip 12-bit analogue-to-digital converter are provided on header J2.

8.5 I2C

The eCOG1X processor on the development board has an I2C compatible serial port. The I2C SCL and SDA signals are available on header J1.

8.6 SPI

The eCOG1X processor has an SPI compatible serial port, using a standard four wire connection. The SPI SCLK, MOSI, MISO and CS signals are available on header J2.

8.7 Timers and Counters

The eCOG1X device has a total of five general-purpose timers and counters available. Four timer/counter input and output signals are available on header J2.

8.8 Input/Output Connections

8.8.1 J1

Pin	Name	Description	Port	Function
1	+3.3V	+3.3V supply		
2	+3.3V	+3.3V supply		
3	I2C_SCL	I2C serial clock	PortD_0	I2C_SCL
4	I2C_SDA	I2C serial data	PortD_1	I2C_SDA
5	UART1_TX	Transmit data output	PortA_0	UART1A_TX
6	UART1_RX	Receive data input	PortA_1	UART1A_RX
7	UART2_TX	Transmit data output	PortA_2	UART1B_TX
8	UART2_RX	Receive data input	PortA_3	UART1B_RX
9	UART3_TX	Transmit data output	PortA_4	UART2A_TX
10	UART3_RX	Receive data input	PortA_5	UART2A_RX
11	UART4_TX	Transmit data output	PortA_6	UART2B_TX
12	UART4_RX	Receive data input	PortA_7	UART2B_RX
13	LED1		PortB_0	GPIOB_0
14	LED2		PortB_1	GPIOB_1
15	GND	0V supply		
16	GND	0V supply		

Table 2: J1 connections

8.8.2 J2

Pin	Name	Description	Port	Function
1	+3.3V	+3.3V supply		
2	+3.3V	+3.3V supply		
3	ADC_Vin1	Analogue input 1	ADC1_Vin2	
4	ADC_Vin2	Analogue input 2	ADC1_Vin3	
5	ADC_Vin3	Analogue input 3	ADC2_Vin2	
6	ADC_Vin4	Analogue input 4	ADC2_Vin3	
7	UCCT1	Counter clock input Capture timer input	PortT_0	CNT1/CAP1
8	UCCT2	Counter clock input Capture timer input	PortT_1	CNT2/CAP2
9	UCCT3	PWM timer output Capture timer input	PortT_2	PWM1/CAP1
10	UCCT4	PWM timer output Capture timer input	PortT_3	PWM2/CAP2
11	SPI_SCLK	SPI serial clock	PortE_0	ESPI_SCLK
12	SPI_MOSI	SPI master out slave in	PortE_1	ESPI_MOSI
13	SPI_MISO	SPI master in slave out	PortE_2	ESPI_MISO
14	SPI_CS	SPI chip select	PortE_3	ESPI_CS
15	GND	0V supply		
16	GND	0V supply		

Table 3: J2 connections

8.8.3 J3: Buffered Serial Ports

Pin	Name	Description	Port	Function
1	GND	0V supply		
2	UART1_TX	Transmit data output	PortA_0	UART1A_TX
3	UART1_RX	Receive data input	PortA_1	UART1A_RX
4	UART2_TX	Transmit data output	PortA_2	UART1B_TX
5	UART2_RX	Receive data input	PortA_3	UART1B_RX
6	GND	0V supply		

Table 4: J3 connections

8.8.4 J4: Power

Pin	Name	Description	Notes
1	PWR	+5V supply	Square pad next to J4 label
2	GND	0V supply	Round pad

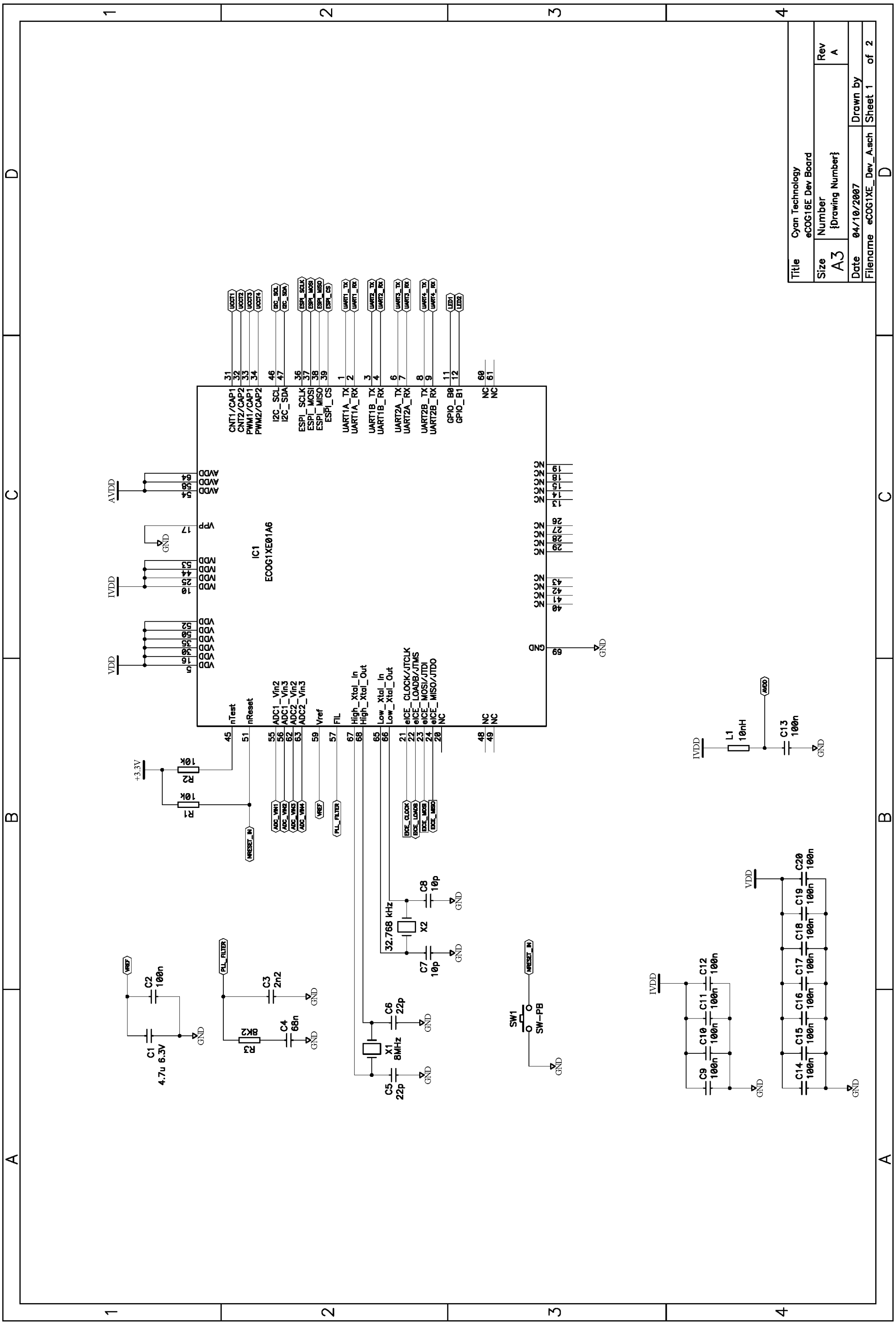
Table 5: J4 connections

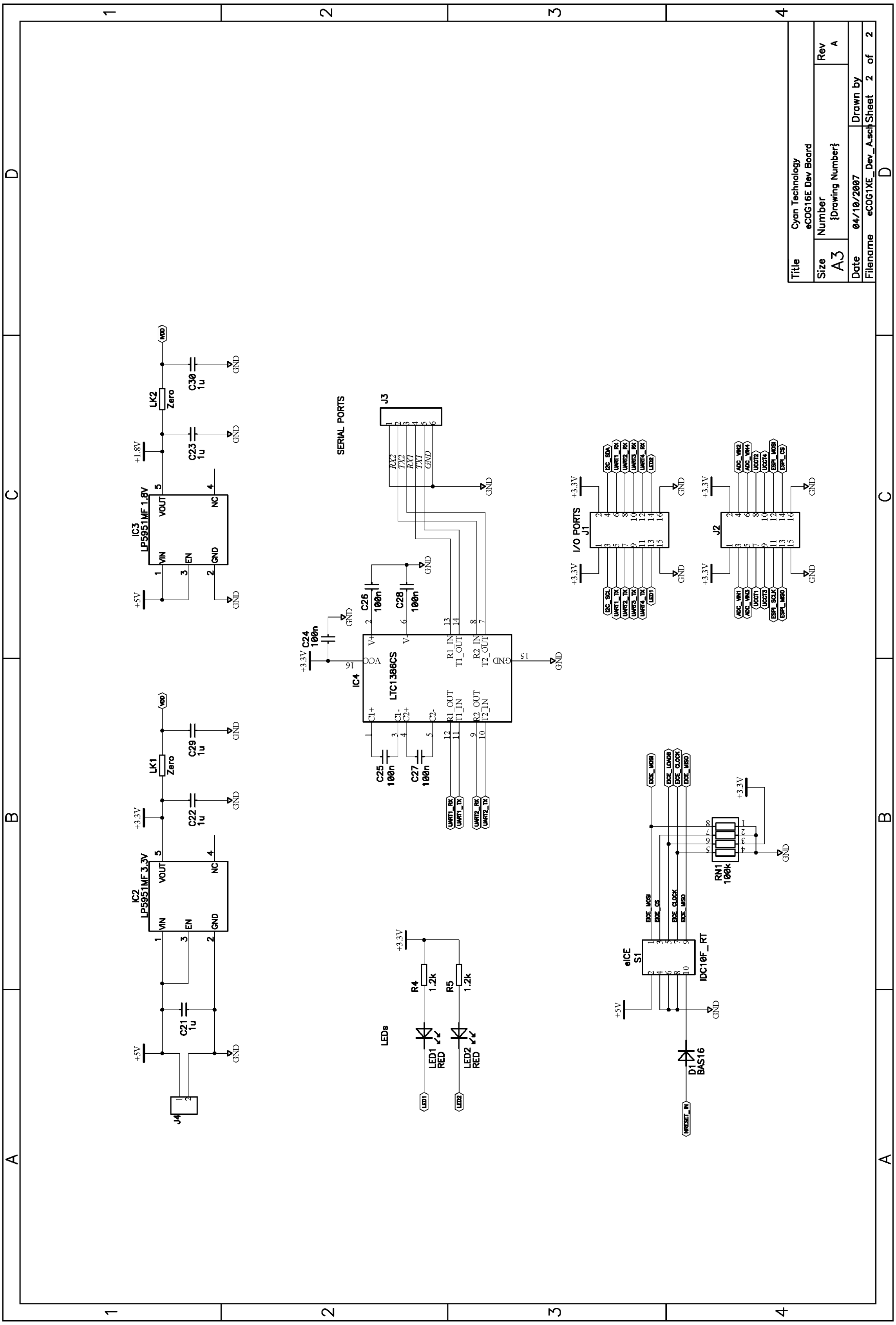
Appendix A Important Notes

The following recommendations should be observed when using the USB eICE adaptor.

- Connect the USB cable from the eICE adaptor directly to the host PC, not via an external hub. CyanIDE can fail to restart the eICE debug connection after any errors if the USB device is connected via an external hub.
- The memory window in CyanIDE can be quite slow to refresh across the USB eICE link. Close the memory window when it is not required to improve the speed of response to commands.
- Do not disconnect the USB eICE cable or power down the target system while CyanIDE is running. This can cause CyanIDE to hang up on the next attempt to connect to the target system via eICE.
  Ensure that CyanIDE is closed down before disconnecting the USB cable or powering down the target system.
- CyanIDE may report an error message on its first attempt to connect to the target system via eICE. This occurs when it tries to find a connection to a target system on the parallel port instead of the USB port. Repeat the command and CyanIDE should connect to the USB eICE target system successfully.
  If the debugger still does not start, check that power is present on the target system, that all required jumper links are fitted, and that the USB cable is connected correctly to the host PC.

Appendix B Circuit Diagram

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eCOG16E Dev Board
Size A3
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Rev A
Date 04/10/2007
Drawn by
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IC3 LP5951MF 1.8V
IC2 LP5951MF 3.3V
VIN EN GND VOUT NC
LK1 Zero
LK2 Zero
C21 1u
C22 1u
C23 1u
C29 1u
C30 1u
J4
SERIAL PORTS
J3
RX2 TX2 RX1 TX1 GND
IC4
LTC1386CS
C24 100n
C25 100n
C26 100n
C27 100n
C28 100n
I/O PORTS
J1
J2
LEDs
R4 1.2k
R5 1.2k
LED1 RED
LED2 RED
eICE
S1
IDC10F_RT
RN1 100k
D1 BAS16
+3.3V
+5V
+1.8V
GND
VDD

Appendix C Board Layout