CDK2000 Clocking Device Development Platform

Features

♦ Modular Design
- Motherboard/Daughter Card Design Allows Flexible Use and Evaluation of All Members of the CS2000 Device Family

♦ Software and Hardware Control
- USB Connector for Use with CDK2000 Configuration Wizard Windows® PC-based Software
- Dip Switches for Stand-Alone Control in Hardware Mode

♦ Dual Clock Inputs
- Industry Standard BNC Connectors for REF_CLK and CLK_IN with Input Buffers

♦ Dual Clock Outputs
- Industry Standard BNC Connectors for CLK_OUT and AUX_OUT with Output Buffers

♦ USB Powered
- Evaluation Platform is Entirely USB-Powered; No Separate Power Supply Necessary
- Onboard Boost Converter Generates Programming Voltage

Description

The CDK2000 ia a flexible modular development platform designed to allow evaluation of all members of the CS2000 clocking device family, including all members of the CS2000, CS2100, CS2200, and CS2300 device sub-families. For one-time programmable (OTP) parts, the CDK2000 platform also allows for the development, test, and production programming of custom device configurations.

The on-board firmware handles all aspects of programming the DUT and transitioning it between modes. Furthermore, the CDK2000 Configuration Wizard software is available for real-time control of DUTs that can run in Control Port mode.
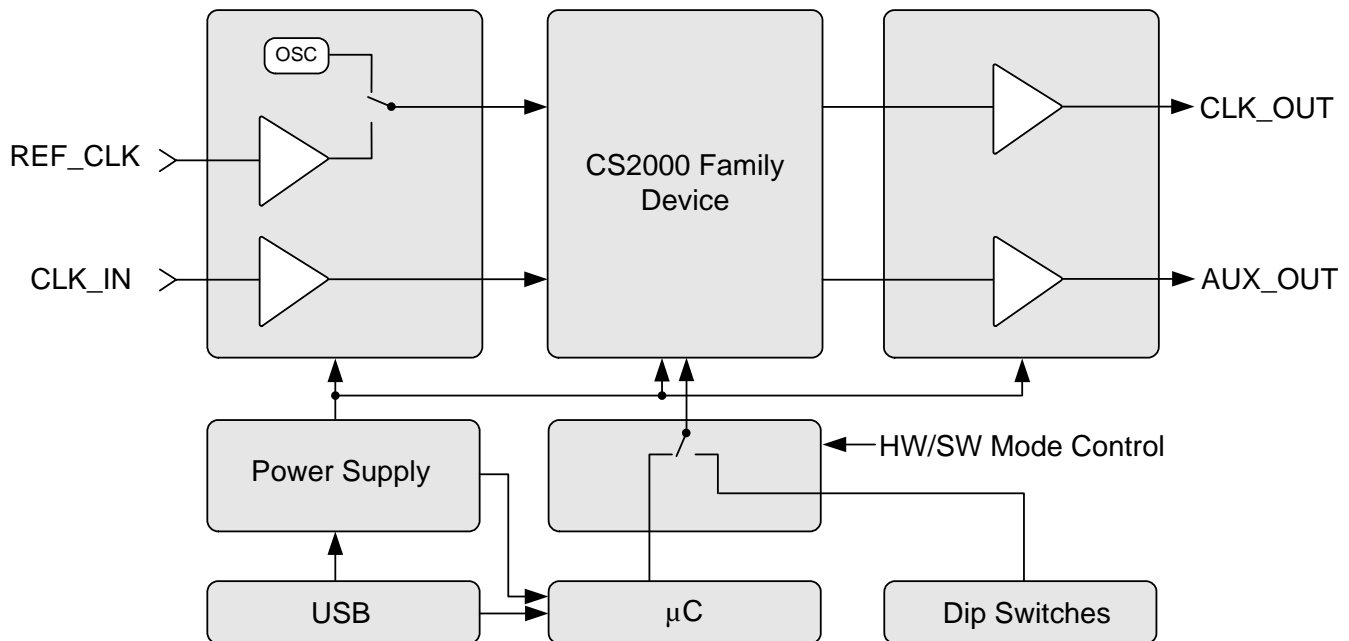
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1. DEVELOPMENT PLATFORM OVERVIEW

1.1 Hardware Components

The CDK2000 clocking device development platform hardware components consist of a motherboard and a number of individual daughter cards that, when connected, make a complete development system.

The CDB2000-MB is the motherboard of the development system. This board houses all clock I/O connectors, control switches, power supplies, and PC interface hardware. Two single-row sockets are provided for connections to any of the available daughter cards. The motherboard facilitates PC assisted development and evaluation, as well as stand-alone production environment programming capabilities.

The CDB2000-PC represents a family of socketed daughter cards for use with the CDB2000-MB motherboard. Each daughter card features an open-top push-down socket to quickly insert and remove DUTs at will, and is suitable for programming and testing multiple DUTs in a production environment. The CDB2000-PC family daughter cards are capable of supporting both control port and one-time-programmable devices. Two population options are available, each designed to support a specific frequency reference source for the DUT.

Daughter Card	Frequency Reference Source	Sub-Family Devices Supported
CDB2000-PC-CLK	Oscillator or BNC connector on motherboard.	CS2000, CS2100, CS2200
CDB2300-PC-LCO	Internal LC oscillator.	CS2300

Table 1. CDB2000-PC Family Daughter Cards

The CDB2000-PC-CLK can be easily modified to support an on-card crystal as the REF_CLK source. A few population changes are all that is required. See the CDB2000-PC Schematics in Figure 18 on page 24 for population change details.

The CDB2000-DC represents a family of soldered-down device daughter cards for use with the CDB2000-MB. Each daughter card features a soldered-down DUT for optimal performance and is most suitable for prototyping and performance evaluation. The CDB2000-DC family daughter cards are capable of supporting both control port and one-time-programmable devices. Two population options are available, each with a specific CS2000 family device soldered-down, and each designed to support a specific frequency reference source for the DUT.

Daughter Card	Frequency Reference Source	Sub-Family Devices Supported
CDB2000-DC-CLK	Oscillator or BNC connector on motherboard.	CS2000, CS2100, CS2200
CDB2300-DC-LCO	Internal LC oscillator.	CS2300

Table 2. CDB2000-DC Family Daughter Cards

The CDB2000-DC-CLK can be easily modified to support an on-card crystal or oscillator as the REF_CLK source. A few population changes are all that is required. See the CDB2000-DC Schematics in Figure 12 on page 22 for population change details.

The complete ordering number of a CDB2000-DC daughter card will indicate the specific device soldered-down by substituting the soldered-down device number in place of '2000' and appending either '-CP' for control port device, or '-OTP' for a one-time programmable device. For example, a CDB2000-DC-CLK with a CS2100-CP soldered-down would be ordered as CDB2100-DC-CLK-CP.

Development kits best suited for evaluation of particular sub-family devices are available; each contains one motherboard and various combinations of the most appropriate daughter cards. See "Ordering Information" on page 26 for complete details of the available kits.

1.2 Software Components

The CDK2000 software tools, known as 'Configuration Wizard', facilitate the virtual configuration and hardware control of any CS2000 family device, including all devices in the CS2100, CS2200, and CS2300 sub-families.

The CS2000 Family Configuration Wizard is available for download from the CS2000 family product pages on http://www.cirrus.com. This software tool presents an intuitive user interface to all configuration options of the CS2000 family devices. The software offers two modes of operation: Demo mode and Live mode.

The Wizard will start up in demonstration (Demo) mode regardless of the presence of USB connection to a CDK2000 (Noted by the text "CS2000 Wizard is running in DEMO Mode" in the bottom left and "DISCON-NECTED" in the menu bar). In Demo mode the different devices in the CS2000 family may be selected from the 'Device Select' menu. Once the desired device is selected, changes can be made to the GUI which correspond to the selectable configuration options of the selected device. Demo mode is exited by selecting 'Connect to CDK2000' from the 'CDK Controls' menu.

A screen capture of the Configuration Wizard in Demo Mode is shown below.
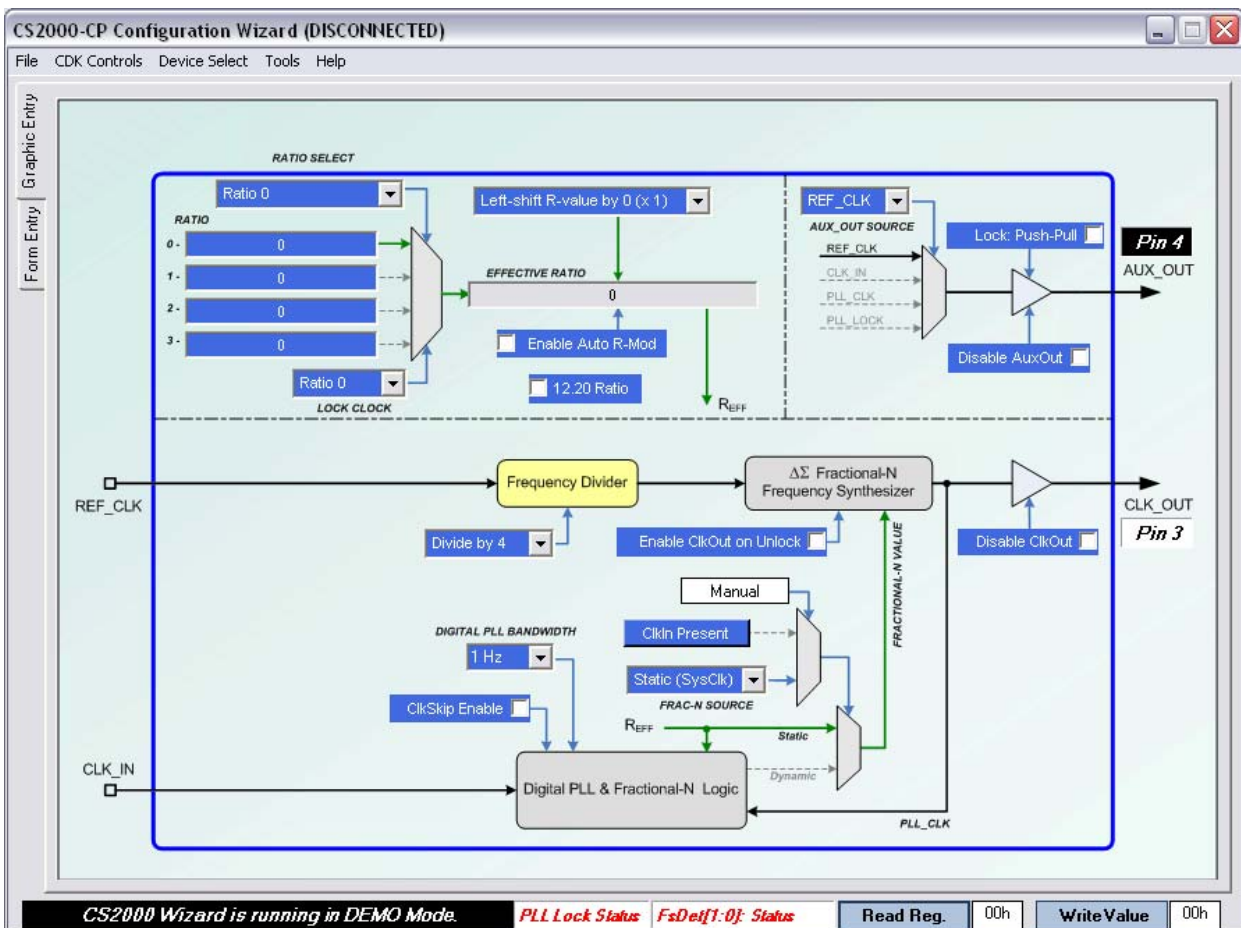

Figure 1. CS2000 Family Configuration Wizard, CS2000-CP Device Selected in Demo Mode

The Wizard offers a calculator tool located in "Tools -> Calculator". This allows easily calculation of ratio values based off of desired input and output frequencies. The Calculator can be re-configured to solve for output or input frequency when given a specific ratio using the radio buttons at the left. A screen capture of the Calculator is shown below.
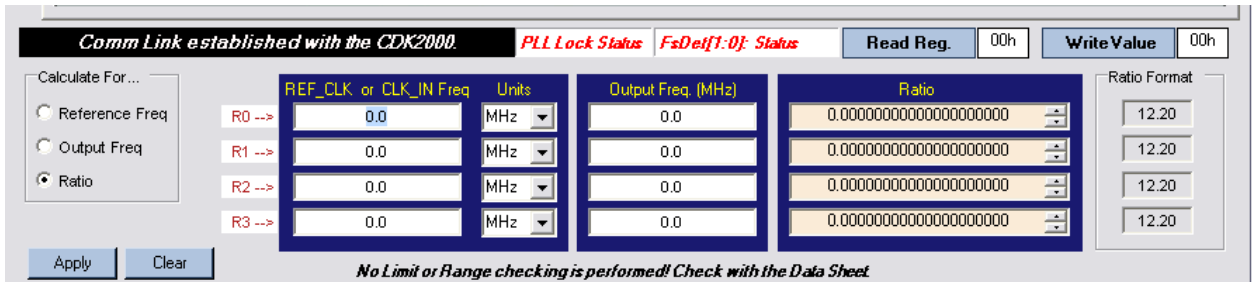
Figure 2. Calculator Tool

The interface for a One-Time-Programmable device is slightly different. The maroon/dark red drop down menus correspond to the Modal Configuration Parameters (see the CS2x00-OTP datasheet for details). The "Mode Select" drop down at the top allows simulation of the M1:0 pins as well as configuration of the 4 modal configuration sets. The M2 Low/High button simulates the usage of the M2 pin. The bright red drop down selects the M2 global config parameter and the associated control will be outlined in red. A screen capture of the Configuration Wizard configured for -OTP is shown below.
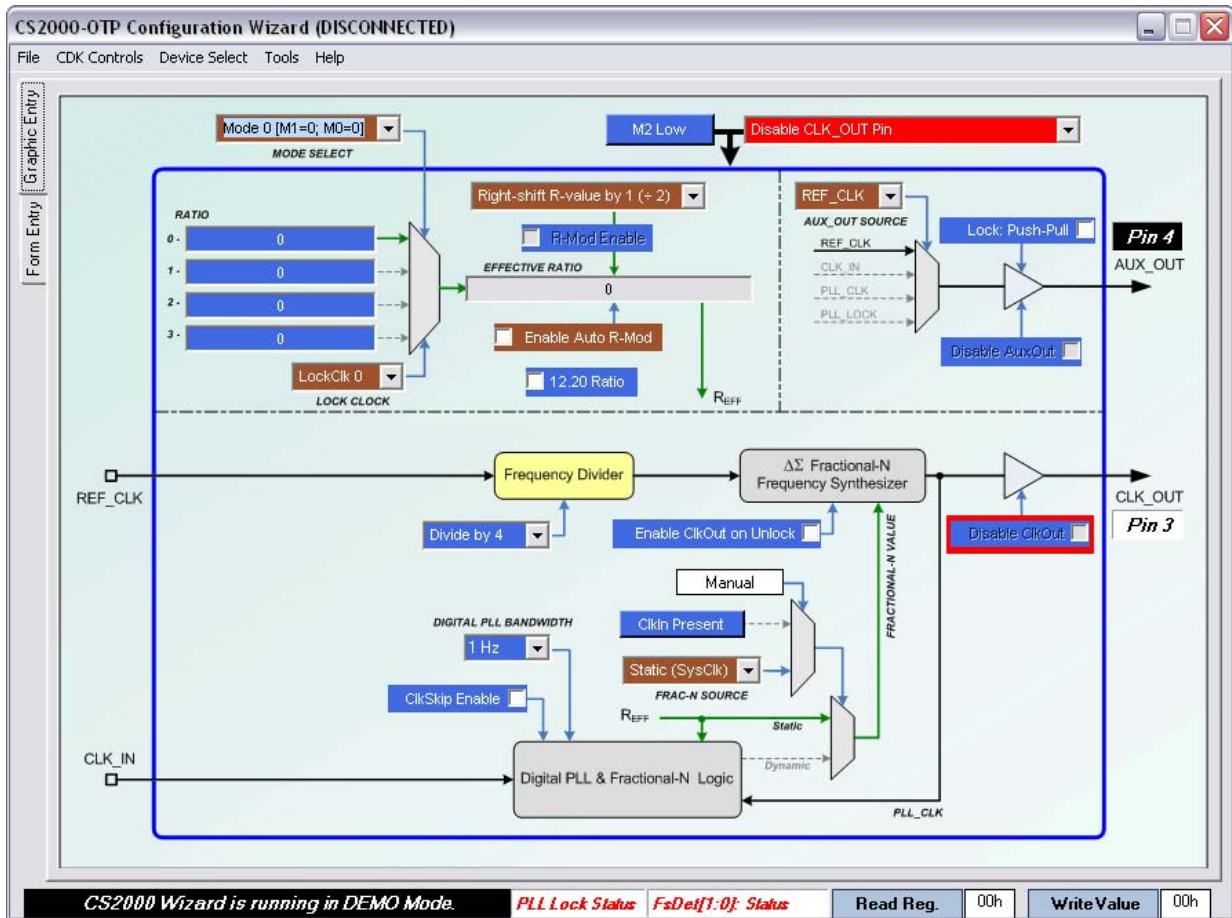
Figure 3. CS2000 Family Configuration Wizard, CS2000-OTP Device Selected in Demo Mode

Alternately the form entry mode can be used to evaluate the -OTP when referencing the form found in the CS2x00-OTP family datasheet. This also allows the view of all 4 modal configuration sets at once for quicker setup and for verification of settings. A screen capture of the Configuration Wizard configured for -OTP is shown below.

Figure 4. CS2000 Family Configuration Wizard, CS2000-OTP Device Selected in Form Entry Mode
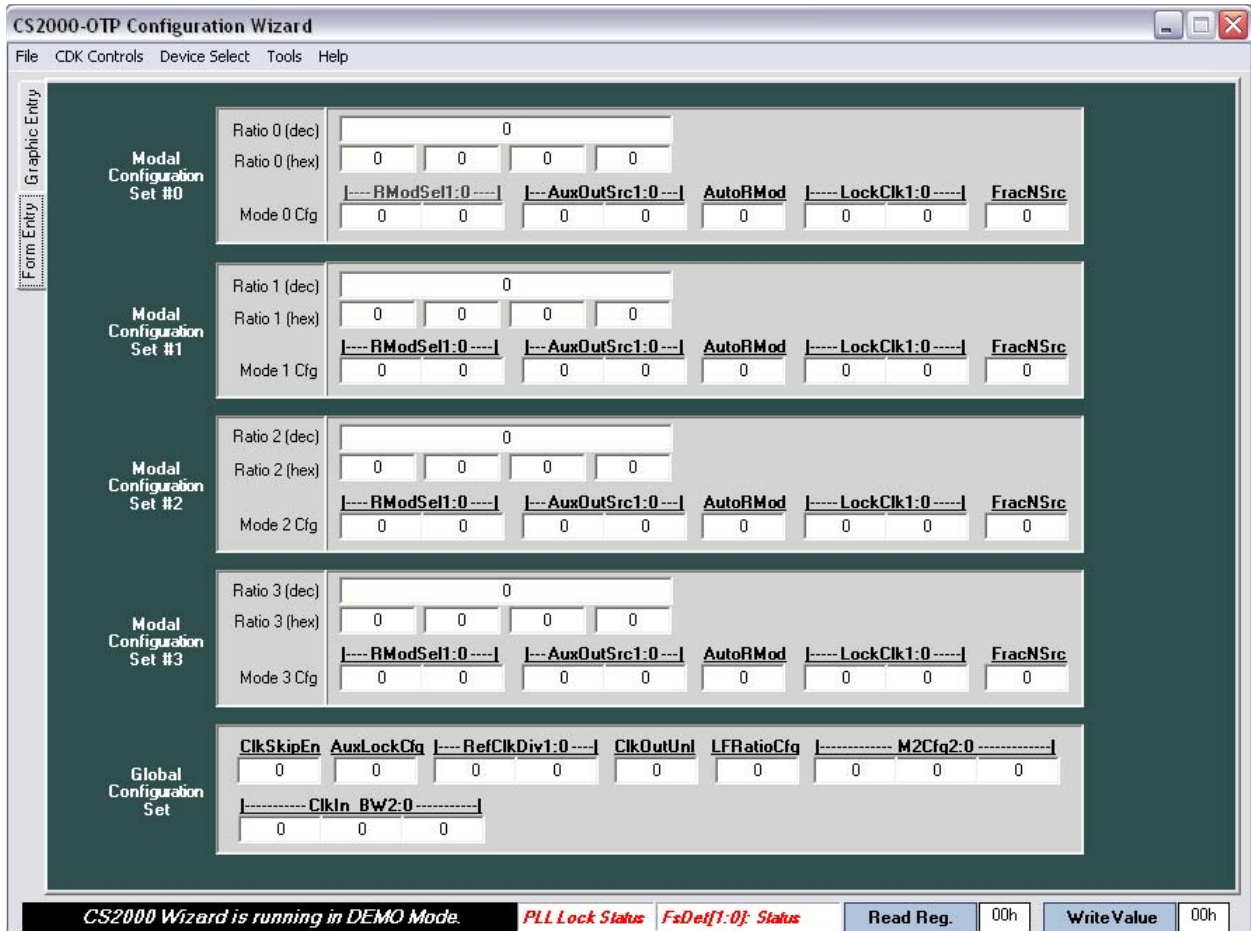
2. QUICK-START GUIDE

2.1 Software Installation

IInstalling the CS2000 Family Configuration Wizard Software

1. Browse to http://www.cirrus.com and navigate to a CS2000 family product page.

2. Click the "CS2000 Family Configuration Wizard" link under the "Tools and Software" heading. A page containing the software licensing agreement will be loaded.

3. Click "Agree" to begin the download process. Allow the download to complete.

4. Unzip the package and launch the installer to begin the installation process.

5. Click "Finish" to complete the installation process.

2.2 Control Port Device Evaluation

1. Connect a CDB2000-DC or CDB2000-PC family board to a CDB2000-MB.

2. Ensure that an appropriate CS2000 family control port (-CP) device is soldered to the CDB2000-DC family board, or insert an appropriate CS2000 family control port (-CP) device into the socket on the CDB2000-PC family board.

3. Connect your PC's USB port to the CDB2000-MB.

4. Launch the CS2000 Family Configuration Wizard.

5. Using the "CDK Controls" menu, select "Connect to CDK2000".

6. Click "yes" to establish a connection with the board; Then press "OK" on the USBXpress success message.

7. If the device in the socket does not match the current GUI configuration you will get the "Warning! Device mismatch!" message. Click "Yes" to allow the GUI to configure itself according to the device found on the CDK2000. If this is not the device you intended to evaluate then click "No" which powers down the device and you may then change the daughter card to the appropriate device.

8. Use the graphical user interface to define the device's operation. Alternatively, choose "File -> Load Configuration" to load a pre-configured device configuration.

9. Registers may be manipulated using the "Read Register" and "Write Register" buttons in the bottom right of the window.

10. To power-off the evaluation platform, simply close the Wizard application and remove the USB cable from the CDB2000-MB.

2.3 One-Time-Programmable Device Evaluation and Programming

OTP devices are shipped from the factory un-programmed. The device settings can be evaluated prior to programming by the use of Preview Mode (see "Programming -OTP Devices" on page 13). Once evaluated, the devices can be programmed with the CDK in one of two modes: Development and Production. Development mode provides a variety of debugging options, while Production Mode allows for faster programming cycle times. See "Development and Production Modes" on page 13 for more information.

2.3.1 Device Evaluation

1. Connect a CDB2000-DC or CDB2000-PC family board to a CDB2000-MB.

2. Ensure that an appropriate CS2000 family one-time-programmable (-OTP) device is soldered to the CDB2000-DC family board, or insert an appropriate CS2000 family one-time-programmable (-OTP) device into the socket on the CDB2000-PC family board.

3. Connect your PC's USB port to the CDB2000-MB.

4. Launch the CS2000 Family Configuration Wizard.

5. Using the "CDK Controls" menu, select "Connect to CDK2000".

6. Click "yes" to establish a connection with the board; Then press "OK" on the USBXpress success message.

7. If the device in the socket does not match the current GUI configuration you will get the "Warning! Device mismatch!" message. Click "Yes" to allow the GUI to configure itself according to the device on the CDK2000. If this is not the device you intended to evaluate then click "No" which powers down the device and you may then change the daughter card to the appropriate device.

8. Use the graphical user interface to define the device's operation. Alternatively, choose "File -> Load Configuration" to load a pre-configured device configuration.
Note: The settings will not yet be programmed into the one-time-programmable memory. The Wizard presents the user with a graphical controls over an internal virtual representation of the M2, M1, and M0 pins. The purpose of these controls is to facilitate the evaluation of the device's currently previewed configuration. These graphical controls can be toggled, and the device will respond exactly as it will once the configuration is programmed into one-time-programmable memory and the M2, M1, and M0 pins are toggled.

9. Evaluate the current configuration by toggling the state of the "Mode Select" drop down and by pressing the M2 Low/High button, checking the device's functionality for the desired response.

10. Repeat steps 8- 9 until the desired configuration is achieved.

11. Once the desired configuration is achieved select "CDK Controls -> Write Preview Data to MCU..." from the Wizard to save the current configuration to memory within the microcontroller on the CDB2000-MB
This step downloads the current configuration into Flash memory within the microcontroller. Once this step is complete, a one-time-programmable memory programming sequence can be initiated by either software control through the Wizard or hardware control through a push-button on the CDB2000-MB.

2.3.2 Device Programming - Development Mode

12. To program the one-time-programmable memory in the CS2000 family device using the Wizard software, select "CDK Controls -> Initiate OTP Sequence...".

13. To program the one-time-programmable memory in the CS2000 family device using the hardware controls on the CDB2000-MB
a) Close the Wizard software.
   The following steps reference the CDB2000-MB hardware.
b) Verify that D9 is lit, indicating that the CS2000 family device is in hardware mode.
c) Place DIP switch position 5 into the upper (or opened) position to select Development mode.
d) Press and hold the on-board push-button (S1) for more than 1 second to program the OTP memory.

14. After the programming sequence is complete, the CS2000 family device will be able to operate in hardware mode as defined by the programmed configuration. Simply ensure that the CDK2000 Configuration Wizard application is closed, and verify that D9 is lit indicating that the CS2000 family device is in hardware mode. The M2, M1, and M0 switches on the CDB2000-MB will control its operation.

15. To power-off the evaluation platform, ensure that the CDK2000 Configuration Wizard application is closed and remove the USB cable from the CDB2000-MB.

2.3.3 Device Programming - Production Mode

12. To program the one-time-programmable memory in the CS2000 family device using the Wizard software, select "CDK Controls -> Initiate OTP Sequence...".

13. To program the one-time-programmable memory in the CS2000 family device using the hardware controls on the CDB2000-MB
    a) Close the Wizard software.
       The following steps reference the CDB2000-MB hardware.
    b) Verify that D9 is lit, indicating that the CS2000 family device is in hardware mode.
    c) Place DIP switch position 5 into the lower (or closed) position to select production mode.
    d) Press and hold the on-board push-button (S1) for more than 1 second to program the OTP memory.

14. After the programming sequence is complete, the CS2000 family device will be powered down (indicated by D3 "VDUT" LED off) so that the device can be removed from the socket and the next blank part can be inserted.

15. Insert the next blank part into the socket.

16. Briefly press the push button S1 to power up the device

17. Repeat steps 13d -16 (of Section 2.3.3) until the desired number of parts are programmed.

3. HARDWARE SYSTEM OVERVIEW

3.1 Power Supply

The entire CDK2000 platform is powered via the USB connector from a self-powered USB hub, which provides a voltage between 4.75 and 5.25 V. Other USB compliant power supplies, such as an AC (wall) adapter or a DC (car) adapter, may be used as well. Whenever a suitable USB power supply is connected, D13 will be lit to indicate such.

A fixed voltage regulator (U10) provides the 3.3 V supply for the micro-controller, status LEDs, and three of the four clock buffers.

An integrated Zetex™ boost converter, consisting of a controller (U9) and a rectifier (U8), generates an intermediate 7.2 V supply that feeds into an adjustable linear regulator (U5). The feedback network of the linear regulator is designed such that U5 generates either 3.3 V (with Q3 in the "on" state) or 6.5 V (with Q3 in the "off" state). This supply powers the DUT and the fourth clock buffer (U3). The selection between the two output voltages is made via the VDUT.PROG.$\overline{EN}$ signal generated by the micro-controller. D4 is lit when the higher (programming) voltage is applied to the DUT.

Furthermore, the adjustable linear regulator may be shut down in order to cut off the power supply to the DUT when VDUT.$\overline{EN}$ is low (via inverter U4-C). Q2, in conjunction with R34, discharges the bulk decoupling cap (C14) when the supply is powered down. The power-up/down state of U5 is controlled via the VDUT.EN signal generated by the micro-controller. D3 indicates whether power is currently supplied to the DUT.

D11 indicates an error condition (overload) of the boost controller. In order to prevent damage to the boost converter, the USB supply should be removed immediately when such an error occurs. Check the board and connectors for shorts before proceeding.

3.2 Daughter Card Interface Headers

The CS2000 family device must be attached to the motherboard via one of the daughter cards described in Section 1 on page 4. The desired daughter card plugs into the receptacles J1 and J8 on the motherboard. Make sure to align the large white triangle on the daughter card with the corresponding triangle on the motherboard before inserting to ensure proper orientation.

A header (J2) is provided for current measurements. For normal operation, R1 is shorted by a shunt on J2. If the shunt is removed, the current passes through R1 and a volt meter may be attached to J2. The current consumed by the CS2000 family device is proportional to the voltage that drops over R1 and can be easily calculated by dividing the voltage measured on J2 by the resistance of R1 (1 Ω).

3.3 Clock Inputs

The DUT (depending on the particular variant used) requires up to two clock inputs, REF_CLK and CLK_IN. Note that the REF_CLK and CLK_IN BNC inputs are terminated with 50 Ohms by R23 and R14.

The CS2000, CS2100, and CS2200 sub-family devices require an external REF_CLK to be supplied and can all be used with either the -XTL, -OSC, or -CLK daughter cards. The CS2300 sub-family generates REF_CLK internally and must be used with an -LCO daughter card.

There are several options to generate REF_CLK (see Table 1 and Table 2 on page 4). If a -XTL or -OSC daughter card is used, REF_CLK is generated on the daughter card by a local crystal or a local oscillator, respectively.

If a -CLK daughter card is used, REF_CLK will be supplied from the motherboard via the header (J8). On the motherboard, there are two possible sources for REF_CLK, the right-angled BNC connector (J6) or the on-board oscillator (Y1). The selection between the two is made via DIP switch position 1, which generates the OSC.REFCLK.EN signal. U2-C is used as an inverter for OSC.REFCLK.EN and generates the BNC.REFCLK.EN signal. If the switch is in the lower (closed) position, OSC.REFCLK.EN is pulled low and powers up the oscillator via Q1. It also enables the tri-statable buffer U3-C to pass the oscillator output to the DUT. If the switch is in the upper (open) position, OSC.REFCLK.EN is pulled high (via R61), which powers down the oscillator and tri-states U3-C. BNC.REFCLK.EN is then low, which enables the tri-statable buffer U3-B to pass the BNC input from J6 to the DUT. D1 and D2 visually indicate which REF_CLK source is currently selected via the DIP switch.

CLK_IN is always routed from the BNC connector (J3) to the DUT via a buffer (U2-B) and header J1. CLK_IN is required for the CS2100 and the CS2300 sub-families. It is optional for the CS2000 sub-family and not supported on the CS2200 sub-family.

If it is not desirable to buffer the input clocks to the DUT, U2-B may be bypassed by moving the 22 Ω resistor from position R6 to position R5. Likewise, U3-B may be bypassed by moving the 22 Ω resistor from position R26 to position R25.

3.4 Clock Outputs

The DUT supports two outputs, CLK_OUT and AUX_OUT.

CLK_OUT is routed from the DUT to the output buffer U4-B via header J1 and on to the BNC connector J7.

AUX_OUT is routed from the DUT to the output buffer U1-B via header J1 and on to the BNC connector J4.

If it is not desirable to buffer the output clocks from the DUT, U4-B may be bypassed by moving the 22 Ω resistor from position R30 to position R27. Likewise, U1-B may be bypassed by moving the 22 Ω resistor from position R8 to position R9.

U4-C and U1-C are used to invert miscellaneous control signals that are needed by other functional blocks.

3.5 Micro-Controller

The CDB2000-MB utilizes a SiLabs® 8051-compatible micro-controller with integrated USB PHY for convenient interconnect to a PC. The micro-controller comes pre-programmed with custom firmware that allows it to interact with the CDK2000 Configuration Wizard as well as operate in Stand-Alone mode without a PC.

If the CDB2000-MB platform is connected to a PC via USB and the CDK2000 Configuration Wizard host software has established communications with the board, D8 will be lit to indicate micro-controller software mode. (Note that micro-controller software mode doesn't mean the DUT operates in software mode, which is entirely independent. It just means that the micro-controller is communicating with the CDK2000 Configuration Wizard software on a PC.)

The micro-controller interfaces with other blocks on the board via various logic signals. It receives input from push-button S1 and DIP switch positions 5 and 6. It also generates various control and status signals. VDUT.PROG.EN and VDUT.EN control the power supply to the DUT. DUT.PROG.RUN, DUT.PROG.SUCC, and DUT.PROG.FAIL indicate various status and error conditions via LED D5/6/7. DUT.HW/$\overline{\text{SW}}$ controls the board-level logic to correspond with the operational mode of the DUT.

3.6   DUT Software Mode Control

In software mode, the DUT communicates with the micro-controller via I²C®. The I²C clock and data lines are routed through Q5/Q7 and Q8/Q4, respectively, which are all "on" when DUT.SW/$\overline{\text{HW}}$ is high (via inverter U1-C). D10 is lit to indicate that the DUT is in software mode. (Note that DUT software mode is independent of micro-controller software or hardware mode. The DUT automatically enters software mode when it detects a valid I²C transaction on its control port and must be reset to enter hardware mode. The micro-controller transitions the board-level logic between hardware and software modes as needed to match the DUT hardware/software mode.)

3.7   Hardware Mode Control

When the DUT is in hardware mode, its operational state is determined by the three mode pins (M2:0). In this case DIP switch positions 2, 3, and 4 directly connect to the mode pins since Q9/10/11 are "on" due to the micro-controller driving DUT.HW/$\overline{\text{SW}}$ high, and Q4/5/7/8 are "off" due to DUT.SW/$\overline{\text{HW}}$ being low (via inverter U1-C). When a DIP switch is in the lower (closed) position, the corresponding mode pin is logic 0; when a DIP switch is in the upper (open) position, the corresponding mode pin is logic 1 (via pull-up resistors R52/53/54). D9 is lit to indicate that the DUT is in hardware mode.

4. HARDWARE USAGE AND OPERATION

4.1   General Considerations

4.1.1   Power Supply

A USB connection is required to power the CDK2000 platform and the DUT. If the board is to be used in software mode, it must be connected to a PC, either directly or via a self-powered hub. If board operation in software mode is not required, an alternate USB power supply (such as a wall adapter) may be used instead. The latter is useful for DUTs that only operate in hardware mode or in a production environment where multiple DUTs are to be programmed on an assembly floor and a PC is not available for each workstation.

4.1.2   Input and Output Clocks

Connect the desired input clock sources as described in . If REF_CLK is sourced from the motherboard (-CLK daughter card option), use DIP switch position 1 to toggle the REF_CLK source between the BNC connector (J6) and the on-board oscillator (Y1). If REF_CLK is generated locally (-XTL, -OSC, and -LCO daughter card options), set DIP switch position 1 to the open (BNC) position and disconnect any external clock sources from J6 in order to minimize clock interferences.

Observe the desired clock outputs on J7 and J4 as described in .

4.1.3   Push-Button Operation

When the board is in hardware mode (USB is powered but the software is not invoked), the on-board push-button (S1) allows for the invocation of various actions with the board in hardware mode. Pressing S1 briefly (less than one second) will toggle V_{DUT} on and off. D3 indicates the current V_{DUT} enable status. If V_{DUT} is on, briefly pressing S1 twice in a row will reset the DUT. Pressing and holding S1 for more than a second will initiate the programming sequence (see Section 4.4.1 on page 13), regardless of the power on/off state of the DUT. If the board is operating in software mode, those actions may only be invoked via the Configuration Wizard software interface and the board will not respond to any push-button interactions.

4.2   Pre-Programmed Devices

Fully pre-programmed DUTs can only operate in hardware mode. To utilize the CDK2000 platform with the DUT in hardware mode, use DIP switch positions 2, 3, and 4 to apply the desired logic level to the M2:0 pins of the DUT. D9 indicates that the DUT is running in hardware mode.

4.3   Control Port Devices (-CP)

Control port devices can only operate in software mode. Use a PC running the CDK2000 Configuration Wizard software to adjust all functional parameters in real-time. D10 indicates that the DUT is running in software mode.

4.4   One-Time Programmable Devices (-OTP)

One-time programmable devices initially (prior to programming) operate in Preview mode. After programming, they may operate in either Preview or hardware mode. To operate a device in Preview mode, use a PC running the CS2000 Family Configuration Wizard to adjust the modal and global parameters in real-time. To operate a device in hardware mode see Section 4.2 on page 13.

4.4.1   Programming -OTP Devices

In order to program a device, a configuration file must first be transferred to the micro-controller via the configuration wizard. See "One-Time-Programmable Device Evaluation and Programming" on page 8 for details on how to achieve this. Once a configuration file has been uploaded to the board it is stored in flash memory and will be retained, even if power is disconnected or lost, and any number of DUTs may be programmed with this configuration. It is therefore possible to develop and test the configuration file on a PC, and then transfer the CDK2000 platform into a production environment to program a large quantity of devices without requiring a PC.

4.4.2   Development and Production Modes

Programming the DUT may be done in either Development or Production mode, which are selected via DIP switch position 5. The difference between the two is how mismatches (if any) between the content of the configuration file and the content of the pre-programmed OTP in the DUT will be handled. Due to the architecture and design of the OTP, each bit position can only be transitioned from a '0' to a '1'. Once a '1' has been programmed into a particular bit position, it can never be returned to a '0'. In addition, certain bit positions will be locked at the factory such that a transition from '0' to '1' is also prohibited.

In Development mode (DIP switch position 5 in the upper (or open) position), if any violations occur, the programming sequence will continue and only flag a warning at the end. Programming will proceed on a best-effort basis; that is, any violations are disregarded (and the affected bit positions left unchanged) while all other bit positions will be programmed as requested. This mode is most suitable for a prototyping environment when strict error enforcement of mismatches is not desirable.

In Production mode (DIP switch position 5 in the lower (or closed) position), if any violations occur, the programming sequence is terminated immediately (before writing to the OTP on the DUT) and an error condition will be flagged. This mode is most suitable for a production environment where strict enforcement of mismatches is desired, for instance to detect a situation where a configuration file was designed for a different base part than what's currently present on the board, and thereby preventing a large batch of parts from being mis-programmed.

Furthermore, in Development mode, at the end of the programming sequence, the DUT will be reset and remain in a powered-on state to allow for verification and continued development; whereas in Production mode, at the end of the programming sequence the DUT will be powered-down to allow for removal from the socket and insertion of another DUT.

4.4.3 Program Sequence Execution and Result Codes

After a configuration file has been downloaded and the board has been properly configured for either Development or Production mode, the actual programming sequence may then be initiated via the push-button (S1) or via the host software (see Section 4.1.3 on page 13 for details). D5 (PROG.RUN) will be lit while the programming sequence is in progress. During the execution of the programming sequence, D3 (V_{DUT}), D4 (V_{PROG}), D9 (DUT.SW), and D10 (DUT.HW) will turn on and off repeatedly as the micro-controller goes through the various steps necessary to program the device. At the end of the programming sequence, D5 (PROG.RUN), D6 (PROG.SUCCESS), and D7 (PROG.FAIL) will indicate one of several possible result codes as outlined in Table 3 below.

Error Code	Result/Status	D5 (RUN)	D6 (SUCC)	D7 (FAIL)
0	Programming in progress	ON	OFF	OFF
1	Success: no error encountered	OFF	ON	OFF
2	Warning: attempt to clear a '1' in OTP	OFF	ON	FLASH
3	Warning: attempt to set a locked '0' in OTP	FLASH	ON	OFF
4	Warning: attempt to clear a '1' and set a locked '0' in OTP	FLASH	ON	FLASH
5	Invalid: no configuration file present	FLASH	FLASH	FLASH
6	Invalid: no DUT found	OFF	OFF	FLASH
7	Invalid: DUT is not a member of the CS2000 family	FLASH	OFF	FLASH
8	Invalid: unsupported revision of CS2000 family device	OFF	FLASH	FLASH
9	Error: register read error	FLASH	FLASH	ON
10	Error: attempt to clear a '1' in OTP	OFF	FLASH	ON
11	Error: attempt to set a locked '0' in OTP	FLASH	OFF	ON
12	Error: attempt to clear a '1' and set a locked '0' in OTP	FLASH	FLASH	ON
13	Error: OTP read-back error	OFF	OFF	ON
14	Error: general or unknown error	FLASH	FLASH	ON

Table 3. Error Codes

The LED pattern for each result code has been carefully designed to convey as much information as possible without being confusing or overwhelming. In all cases, at most one of the three LEDs will be lit in a solid on state:

• If the yellow RUN LED is lit solid, programming is in progress, pending results.

• If the green SUCC LED is lit solid, the programming sequence concluded without errors. The other two status LEDs indicate warnings, if any.

- If the red FAIL LED is lit solid, the programming sequence concluded with one or more errors. The other two status LEDs indicate the nature of the error(s).

- If no LED is lit solid and the red FAIL LED is flashing, the micro-controller encountered an invalid condition that must be corrected before proceeding.

Great care has been taken to choose very simple LED patterns for those result codes that are exceedingly likely to occur in a production environment, that is result codes 0, 1, and 13. All three of these results are indicated by a single lit LED with the other two status LEDs in the off state. This way, a production floor operator can quickly glance at the board and immediately classify the result as WAIT, FAIL, or PASS. The other error codes are either limited to Development mode, setup errors (which would be caught prior to an operator taking over), or are rather unlikely to occur.

4.4.4 Result Code Details

- 0 (Programming in progress) - This result code really means that programming is not finished, and no result is available quite yet. The board should only remain in this state for a few seconds. If this condition persists for more than 20 seconds, the micro-controller should be reset via push-button S2.

- 1 (Success: no error) - The DUT was programmed successfully and no errors were encountered.

- 2/3/4 (Warning: OTP configuration violation) - DEVELOPMENT MODE ONLY - One or more OTP configuration violations were encountered, but programming continued on a best-effort basis. The offending bit positions were left unchanged, while all others were programmed as desired.

- 5 (Invalid: no configuration file found) - The micro-controller has not received a valid configuration file. Refer to the software documentation and upload a valid configuration file to the board before proceeding.

- 6 (Invalid: no DUT found) - The micro-controller was unable to find a DUT on the board. This means either no DUT is present, or the DUT is defective. Replace the DUT before proceeding.

- 7 (Invalid: DUT is not a CS2000 family device) - A DUT was found on the board, but it doesn't appear to be a CS2000 family device. The CDK2000 platform only supports CS2000 family devices. Replace the DUT before proceeding.

- 8 (Invalid: unsupported revision) - The revision of the CS2000 family device found is not supported. The firmware can only program CS2000 family devices of revision B2 or above. Revisions B1 and below are not supported. Replace the DUT before proceeding.

- 9 (Error: register read error) - The firmware encountered a register read error. Most likely, this indicates a defective DUT. You may try to invoke the programming sequence again. If the error persists, replace the DUT before proceeding.

- 10/11/12 (Error: OTP configuration violation) - PRODUCTION MODE ONLY - One or more OTP configuration violations were encountered, and the DUT was not programmed. This error indicates either an invalid configuration file or a configuration file that doesn't match the DUT variant currently present on the board. Make sure the configuration file was created for the proper target DUT, and verify the correct DUT variant is present.

- 13 (Error: OTP read-back error) - The DUT was programmed, but OTP read-back verification failed. This error indicates a defective DUT that must be replaced.

- 14 (Error: general or unknown error) - A miscellaneous error occurred. This could indicate a defective DUT or a problem with the board hardware or the micro-controller firmware. You may wish to try again, first with the same and then with a different DUT. If the error still persists, a hardware problem is possible.

5. USER INTERFACE ELEMENTS OVERVIEW

Table 4 below serves as a quick reference to all user interface elements and Table 5 outlines the various DIP switch position.

Reference Designator	Silkscreen Label	Description
D1	BNC	REF_CLK source set to BNC connector
D2	OSC	REF_CLK source set to on-board oscillator
D3	VDUT	DUT is powered up
D4	VPROG	DUT supply set to high (programming) voltage
D5	PROG.RUN	Programming sequence in progress (see Section 4.4.3 on page 14 for details)
D6	PROG.SUCC	Programming sequence successful (see Section 4.4.3 on page 14 for details)
D7	PROG.FAIL	Programming sequence failed (see Section 4.4.3 on page 14 for details)
D8	MICRO.SW	Micro-controller is operating in software mode
D9	DUT.HW	DUT is operating in hardware mode
D10	DUT.SW	DUT is operating in software (control port or preview) mode
D11	EOR	Boost converter overload - **unplug USB power supply immediately!**
D13	USB	Board is connected to USB power supply
J1/J8	-	Daughter card receptacles
J2	IDUT	Place shunt or measure voltage to determine DUT supply current
J3	CLK_IN	CLK_IN input for CS2000, CS2100, and CS2300 sub-family devices
J4	CLK_OUT	CLK_OUT output
J5	-	Input for external control signals (not supported)
J6	REF_CLK	REF_CLK input for CS2000, CS2100, and CS2200 sub-family devices
J7	AUX_OUT	AUX_OUT output
J9	CDB2000	Interface to CDB2000 (not supported)
J10	USB I/O	USB connector
J11	C2	Header for programming the micro-controller (factory use only)
S1	PROG DUT	Initiates various commands (see Section 4.1.3 on page 13 for details)
S2	MICRO RST	Reset micro-controller
S3	MODE CTRL	Controls various board configuration aspects (see Table 5 below for details)
Y1	-	Supports a DIP-8 or DIP-14 canned oscillator

Table 4. User Interface Elements

DIP switch position	Label	Switch down (closed)	Switch up (open)
1	BNC/OSC	On-board OSC active	BNC input active
2	M0	M0 on DUT driven logic 'low'	M0 on DUT driven logic 'high'
3	M1	M1 on DUT driven logic 'low'	M1 on DUT driven logic 'high'
4	M2	M2 on DUT driven logic 'low'	M2 on DUT driven logic 'high'
5	PROG.MSEL	Production mode active	Development mode active
6	MICRO.MSEL	Standard operation	Reserved (factory use only)

Table 5. Dip Switch Positions

6. CDB2000-MB SCHEMATICS AND LAYOUT
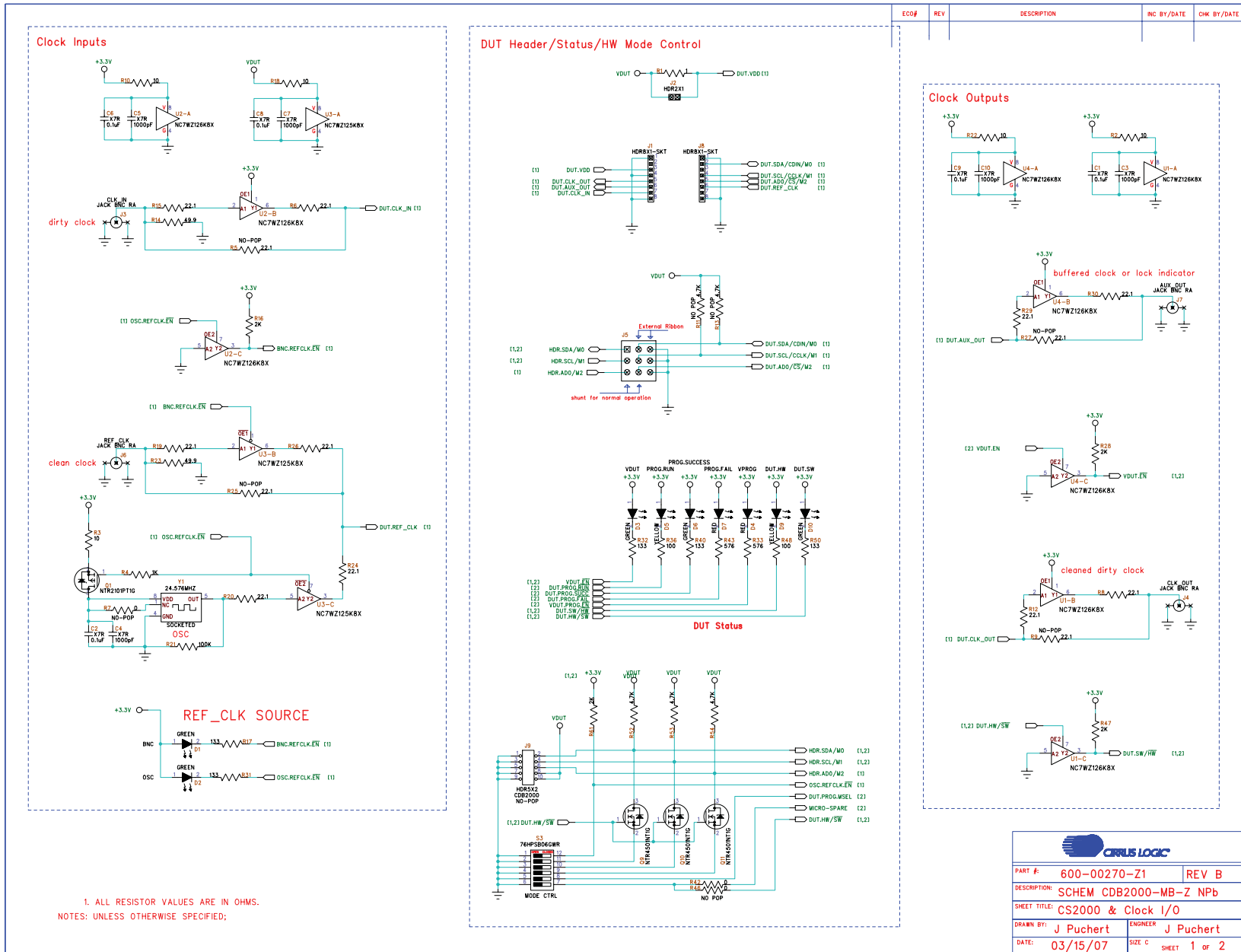
Figure 5. CDB2000-MB Schematic Page 1

USB I/O

USB to VDUT boost converter and adjustable linear regulator w/ shutdown

Micro Reset and C2 Header

I2C Level Shifting & Mux

Microcontroller

USB to 3.3 V regulator

Serial EEPROM for Board ID

DOCUMENTATION
SCH DWG- 600-00270-Z1
PCB DWG- 240-00270-Z1
ASSY DWG- 603-00270-Z1

AUXILIARY HARDWARE
SCREW-PHILIPS-4-40THR-PH-5/16-L-Z PMSSS 440 0031 PH
SOCKET 1P- 8134-HC-5P2
SHUNT_2P- 15-29-1025

FIDUCIALS

STANDOFFS

Ground Test Points

PART #:	600-00270-Z1	REV B
SHEET TITLE:	Micro Contr. & Power Suppl.	
DATE: 03/15/07	SIZE C	SHEET 2 OF 2
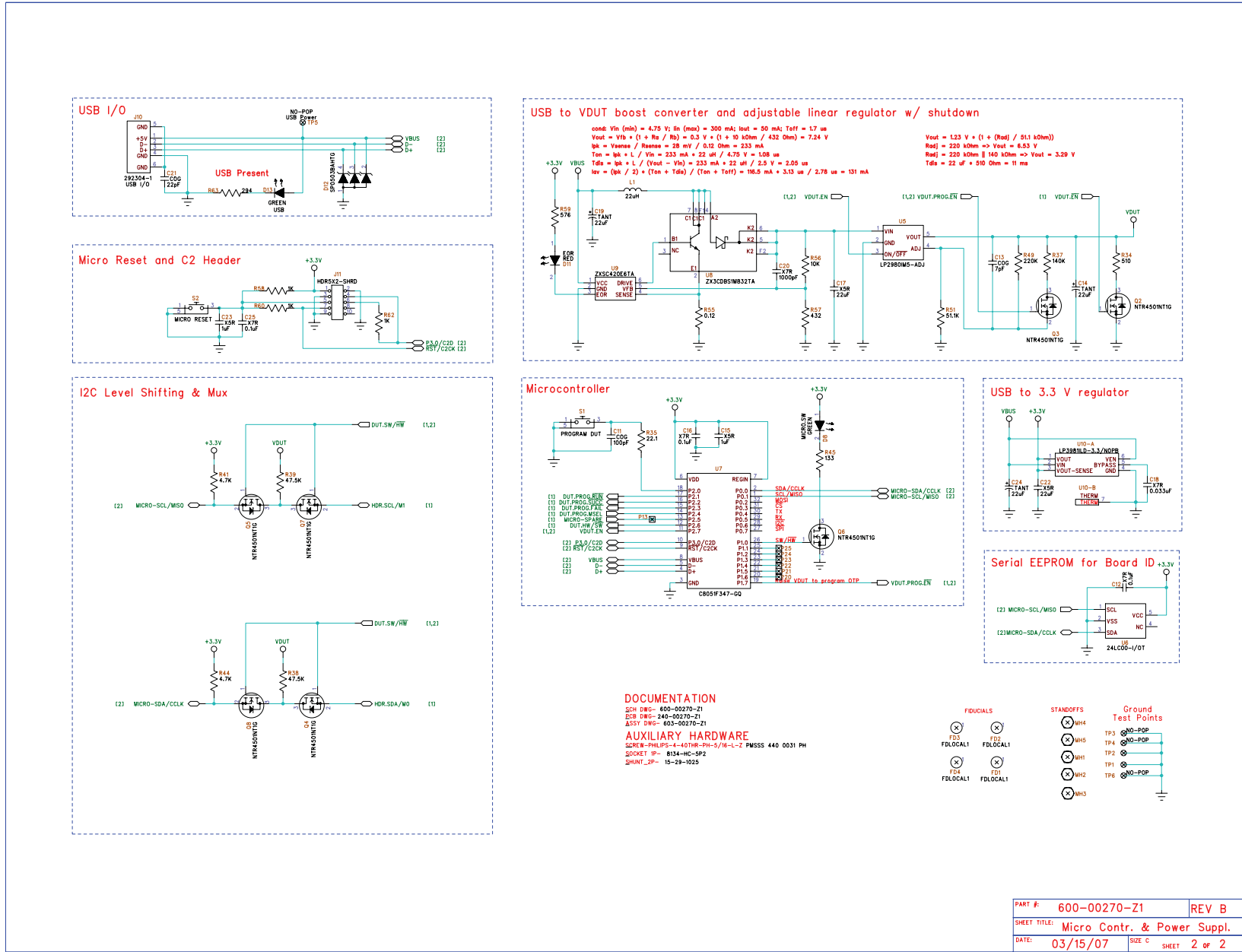
Figure 6. CDB2000-MB Schematic Page 2
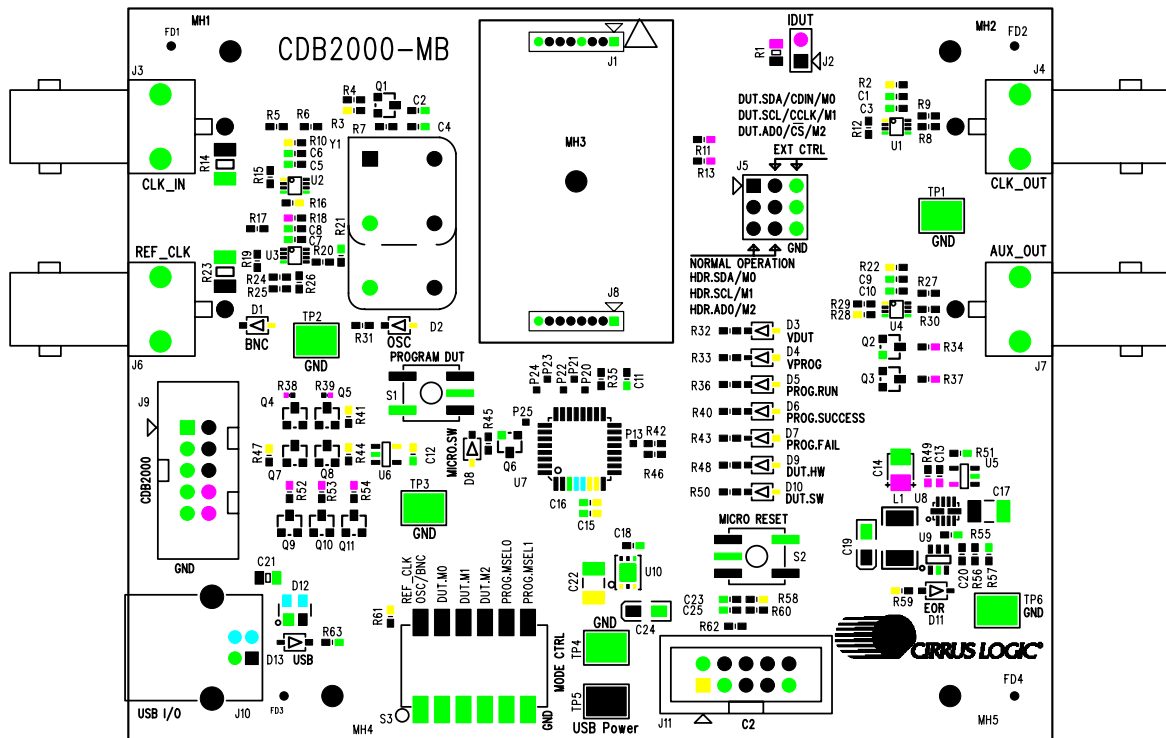
Figure 7. CDB2000-MB Component Map
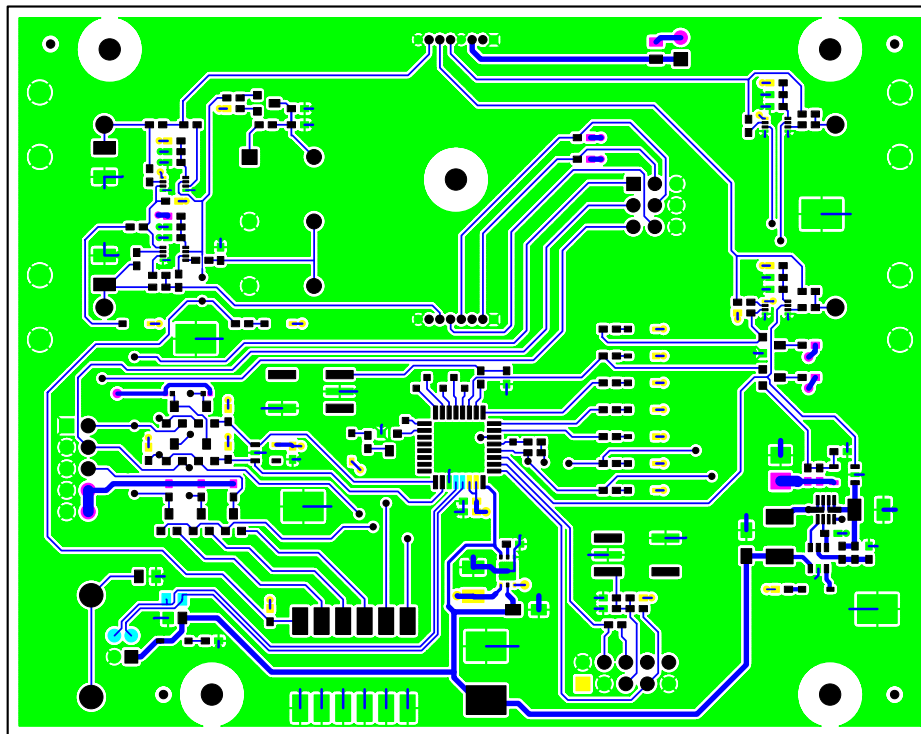
Figure 8. CDB2000-MB Top Layer
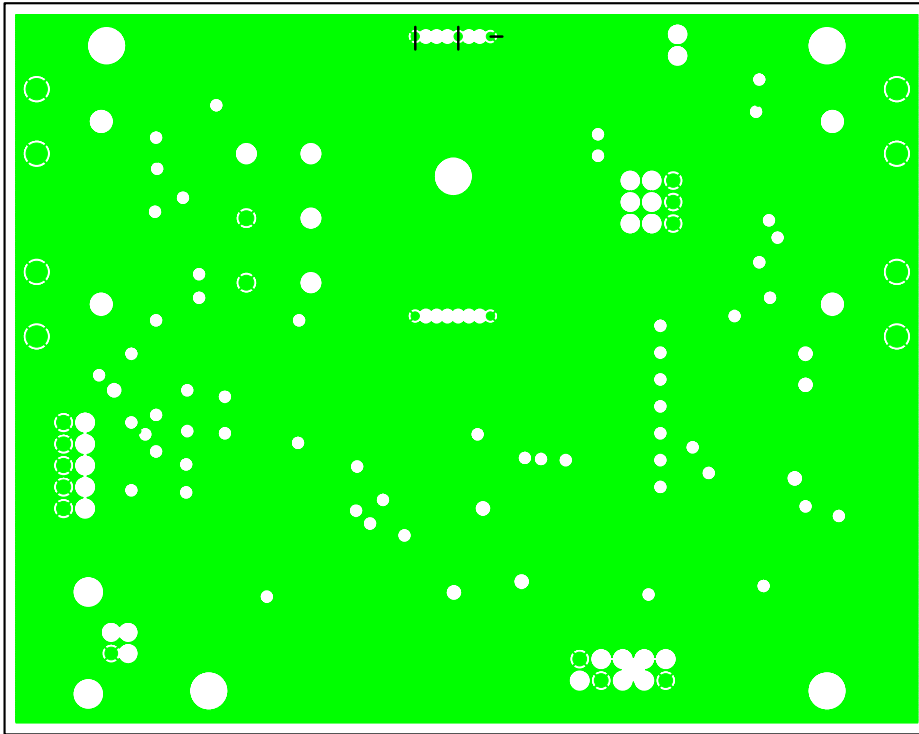
Figure 9. CDB2000-MB Inner Layer 1 - Ground
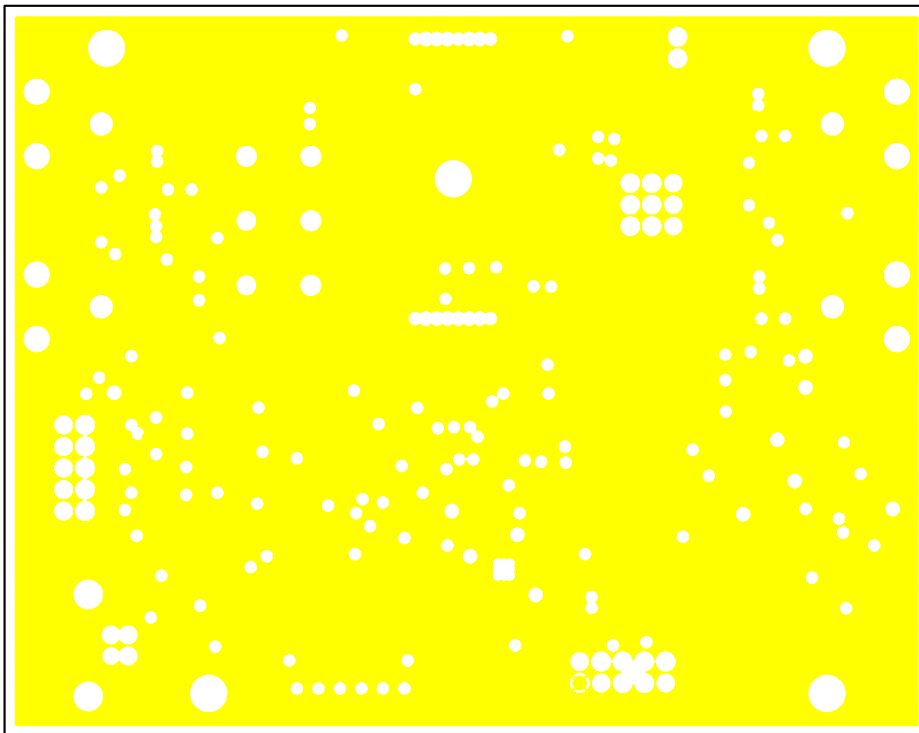
Figure 10. CDB2000-MB Inner Layer 2 - Power
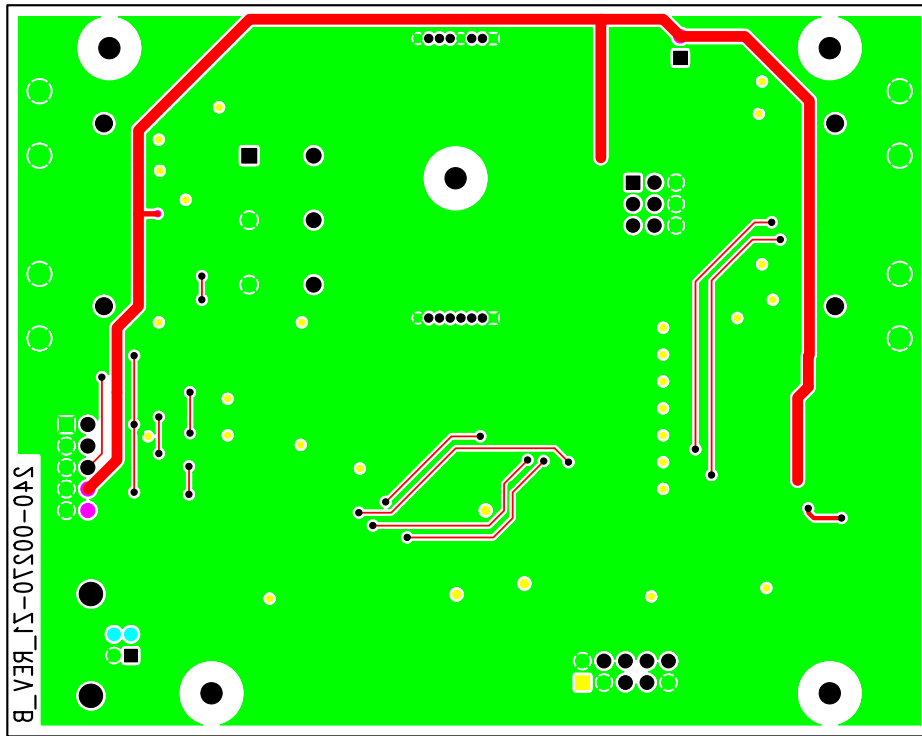
Figure 11. CDB2000-MB Bottom Layer

7. CDB2000-DC SCHEMATICS AND LAYOUT
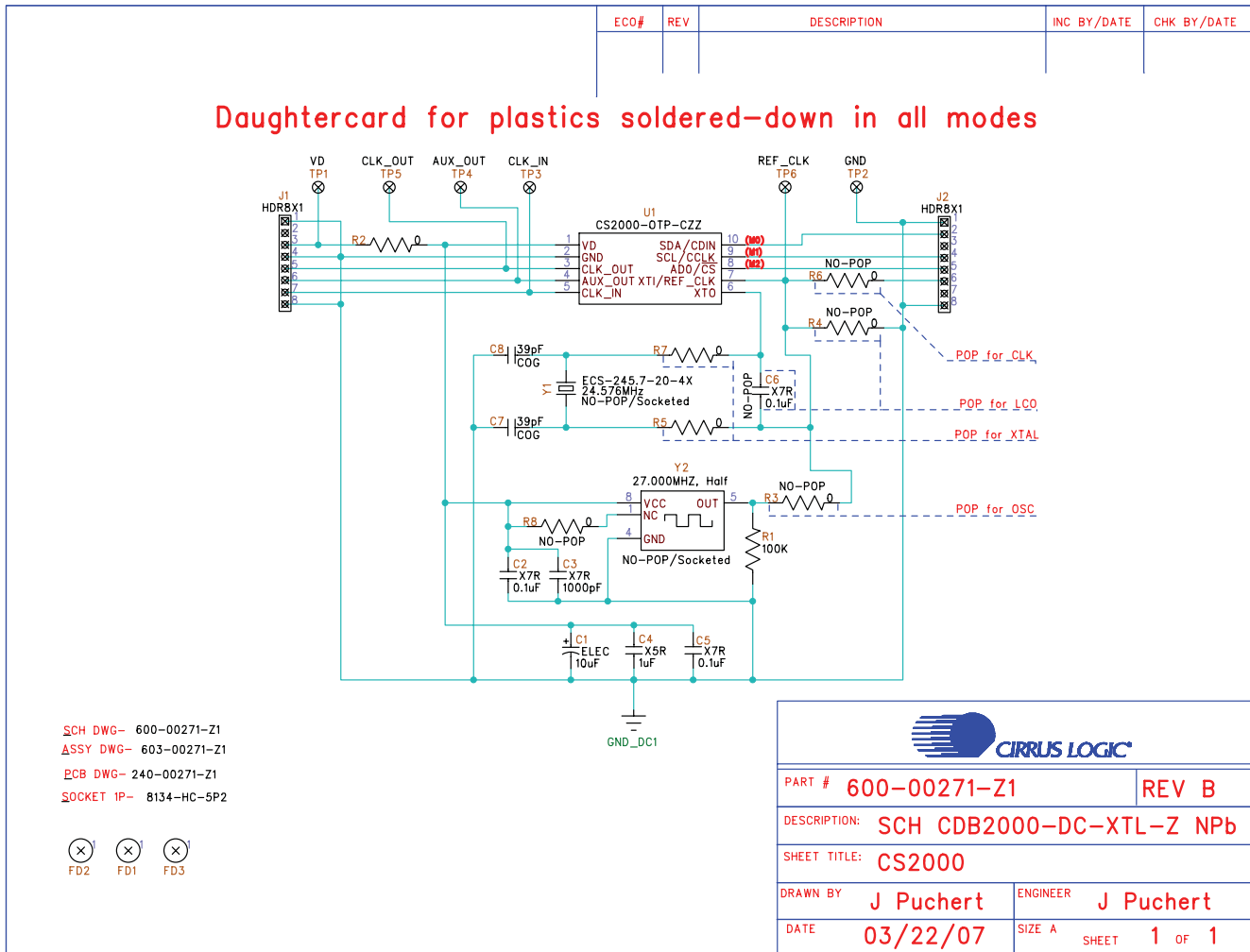
Figure 12. CDB2000-DC Schematics
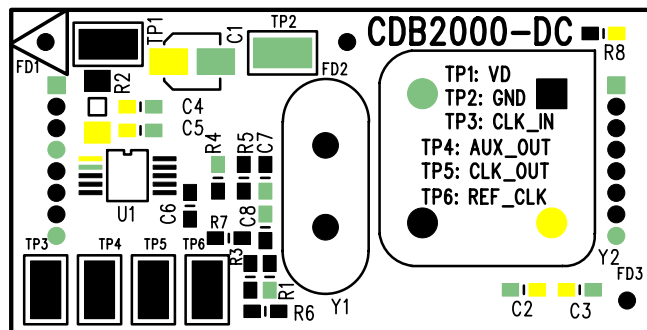
Figure 13. CDB2000-DC Component Map
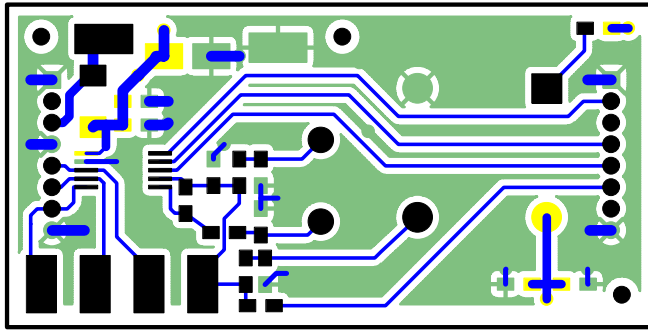
Figure 14. CDB2000-DC Top Layer
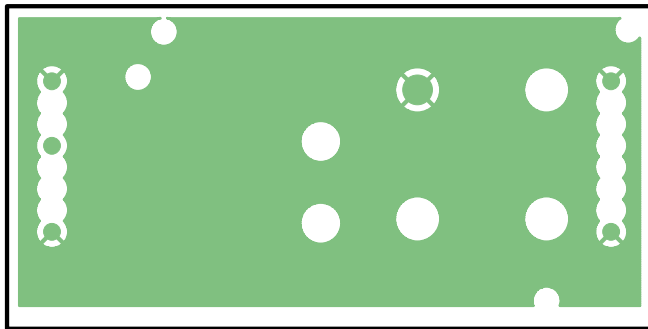
Figure 15. CDB2000-DC Inner Layer 1 - Ground
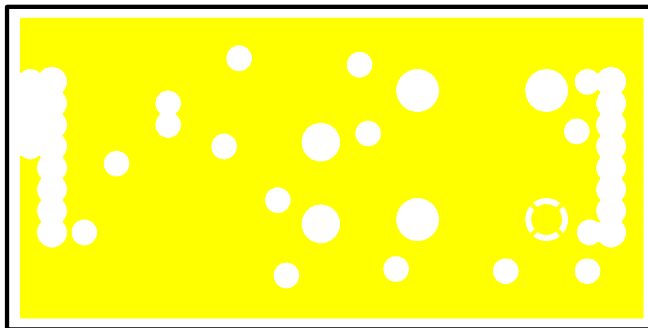
Figure 16. CDB2000-DC Inner Layer 2 - Power
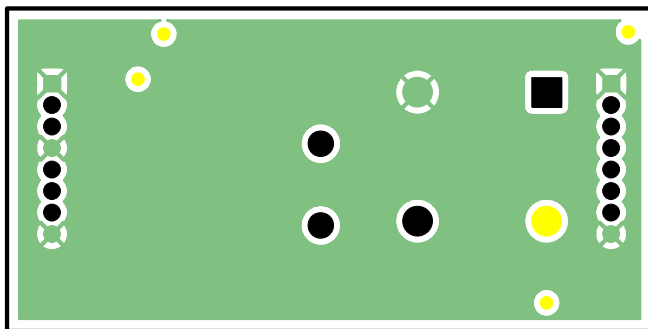
Figure 17. CDB2000-DC Bottom Layer

8. CDB2000-PC SCHEMATICS AND LAYOUT
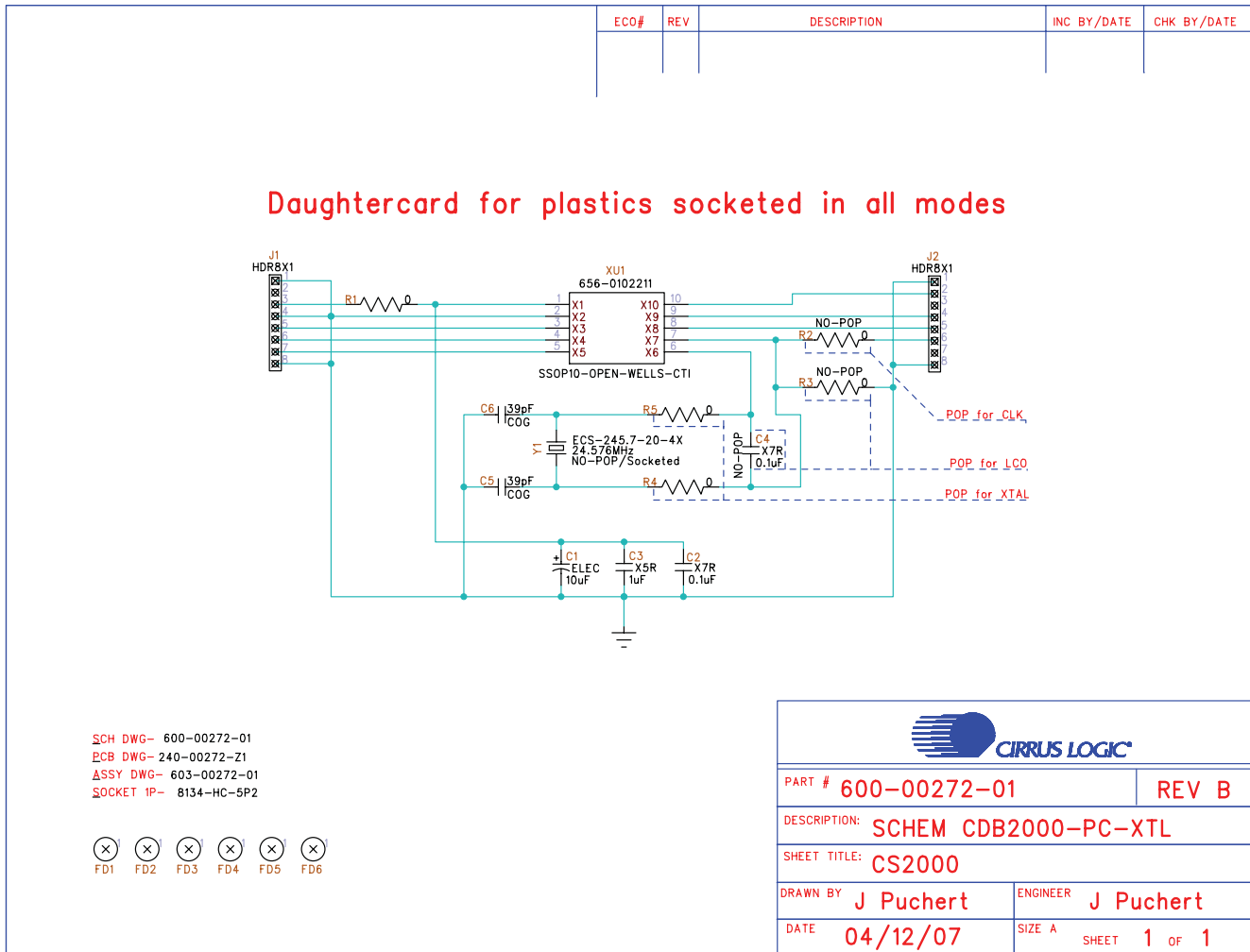
Figure 18. CDB2000-PC Schematics
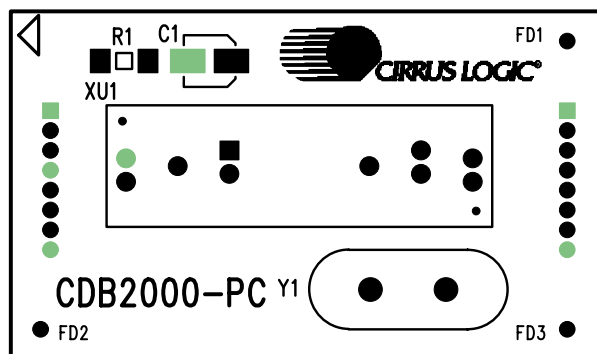
Figure 19. CDB2000-PC Component Map
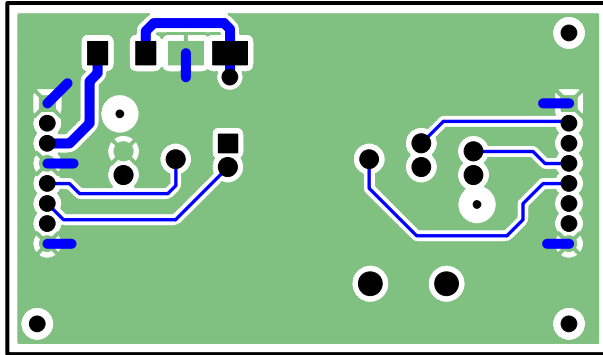
Figure 20. CDB2000-PC Top Layer
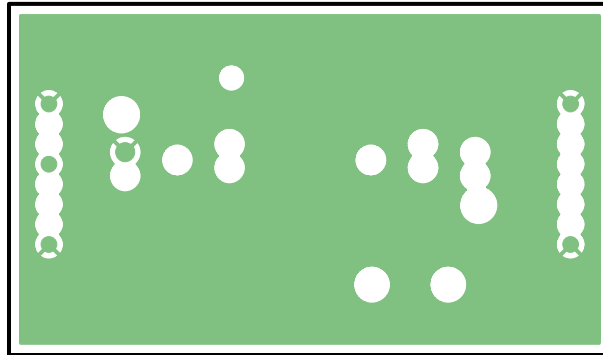
Figure 21. CDB2000-PC Inner Layer 1 - Ground
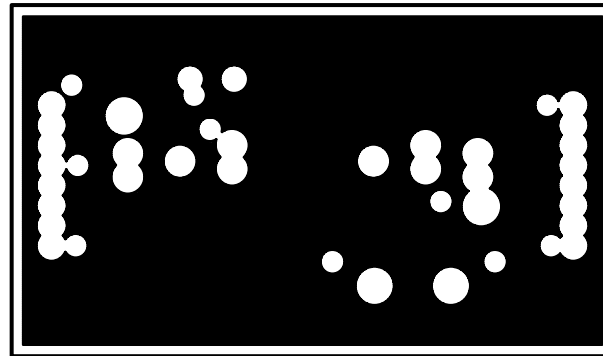
Figure 22. CDB2000-PC Inner Layer 2 - Power
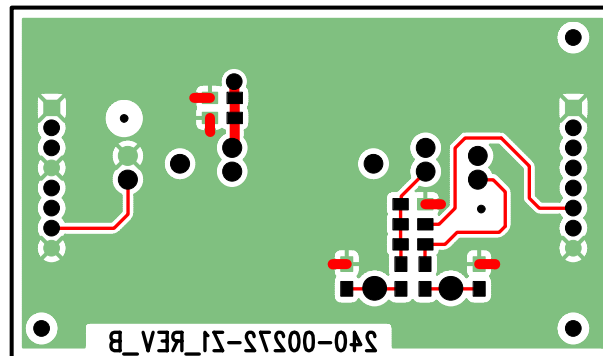
Figure 23. CDB2000-PC Bottom Layer

9. ORDERING INFORMATION

Product	Description	Included Hardware	Order #
CDK2000-CLK	CS2000-CP Evaluation & Prototyping Kit	1 x CDB2000-MB 1 x CDB2000-PC-CLK 1 x CDB2000-DC-CLK-CP	CDK-2000-CLK
CDK2000-LCO	CS2300-CP Evaluation & Prototyping Kit	1 x CDB2000-MB 1 x CDB2000-PC-LCO 1 x CDB2300-DC-LCO-CP	CDK-2000-LCO

10. REVISION HISTORY

Release	Changes
DB1	Initial Release

Contacting Cirrus Logic Support

For all product questions and inquiries, contact a Cirrus Logic Sales Representative.

To find the one nearest you, go to www.cirrus.com.