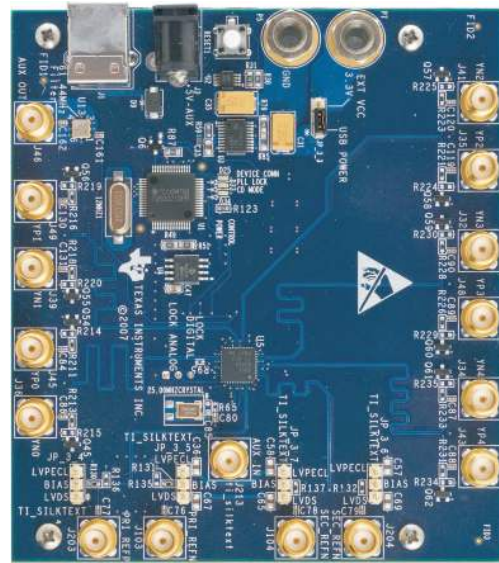


# Low Phase Noise Clock Evaluation Module — up to 1.5 GHz

## 1 Features

- Easy-to-use evaluation module to generate low phase noise clocks up to 1.5 GHz
- Easy device programming via host-powered USB port
- Rapid configuration through provided EVM Control Software
- Can be powered from the USB port, or by an external 3.3V power supply
- Single-ended or differential input; external crystal can be used with on-chip oscillator
- Footprint for optional crystal filter on one output



**Figure 1. CDCE18005EVM Evaluation Board**

## 2 General Description

The CDCE18005 is a high performance 3-input / 10-output mixed mode clock buffer chip with low additive jitter. It has three selectable inputs, and provides up to five differential or ten single-ended, low additive jitter, mixed-mode outputs.

The CDCE18005 features single-ended and differential inputs. An integrated crystal oscillator circuit that operates in conjunction with an external AT-cut crystal is also provided.

The CDCE18005 is programmed through an SPI interface using the supplied EVM programming graphical user interface (GUI).

The evaluation module (EVM) demonstrates the electrical performance of the device. This fully-assembled, factory-tested evaluation board allows complete validation of all device functions. For optimum performance, the board is equipped with 50Ω SMA connectors and well-controlled 50Ω impedance microstrip transmission lines.

### 3 Signal Path and Control

The CDCE18005 provides support for selecting from among three inputs – PRI IN, SEC IN, and AUX IN. The PRI IN and SEC IN inputs can accept up to 1500 MHz in the fan-out mode. AUX IN can use a crystal in the frequency range of 3.25MHz to 42MHz. The CDCE18005EVM provides support for generating the AUX IN signal from an on-board 5mm x 3.2mm SMD crystal. Alternatively, If AUX IN is driven by the SMA, the on-board crystal must be removed and R65 populated with a 0 ohm resistor. The CDCE18005EVM also provides space for mounting an optional 5mm x 7mm crystal oscillator. The location for this oscillator is located on the bottom side of the CDCE18005EVM (U12).

The CDCE18005 supports up to five differential (LVDS or LVPECL) or ten single-ended (LVCMOS) or any combination of outputs at frequencies up to 1.5 GHz (LVPECL). An optional single-ended output (AUX OUT) provides an LVCMOS copy of either the third or fourth output. On the CDCE18005EVM, the AUX OUT signal path has a footprint for an optional crystal filter (U13).

The CDCE18005 options are selected by programming the on-chip registers. The CDCE18005 datasheet provides the detailed information needed to configure and use this device.

Each of the five outputs of the CDCE18005 may be configured as an LVPECL, LVDS, or LVCMOS type. The CDCE18005 select/deselect the the 150Ω load resistor required by the LVPECL output. The corresponding load resistor must be selected in the software interface when an output is configured as LVPECL.

The LVCMOS outputs can operate at frequencies up to 250MHz. The LVPECL outputs operate at up to 1.5GHz (fan-out mode). The LVDS outputs operate at up to 800MHz.

### 4 Software Selectable Options

The provided EVM Control Software (EVMCS) communicates with the CDCE18005 through a USB interface through the CDCE18005 SPI port. The USB controller is normally powered over the USB cable, but can be optionally be powered by an external 5V DC adapter that is plugged into the additional power connector on the EVM. When the USB/SPI programming interface is available for use, the on-board LED D25 is illuminated.

In addition to writing commands to the CDCE18005 SRAM while the board is powered, configurations can also be stored in the on-chip EEPROM. This allows the EVM to start up in the desired configuration upon powerup.

The CDCE18005 has a mode which permanently locks the EEPROM. After this mode is selected, the EEPROM contents within the CDCE18005 cannot be changed. This is useful when setting final configurations.

The CDCE18005 EVMCS also allows device configurations to be saved into a configuration file (.INI), which can be loaded by the EVMCS at a later time to restore the saved settings.

### 5 Installing the EVM Control Software and USB Driver

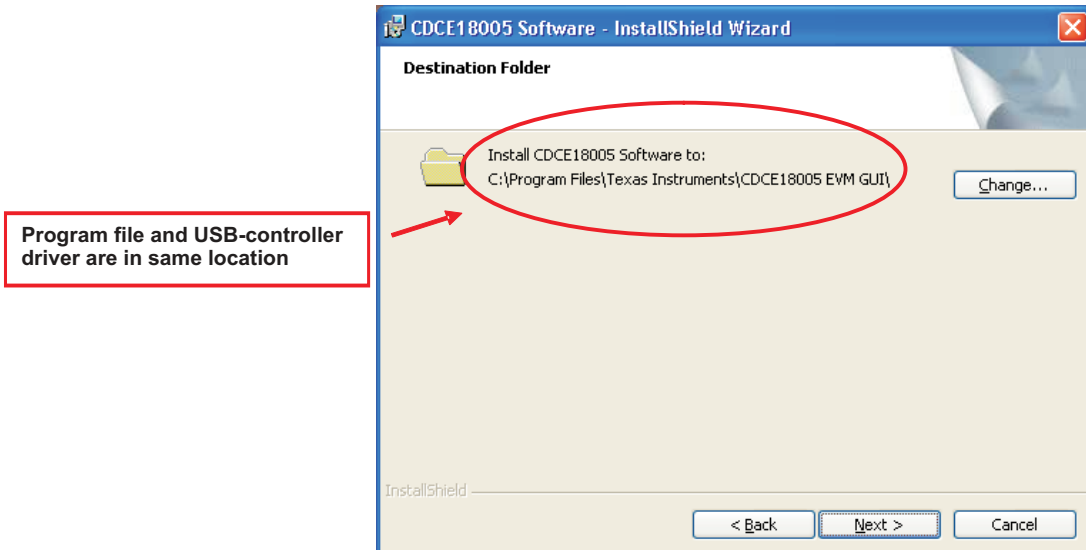
The CDCE18005 EVMCS requires a Java Runtime Environment (JRE) to be installed. The latest JRE is available as a free download at <http://java.com>. Install the JRE first, before attempting to install the CDCE18005 EVMCS. To start the installation of the EVM software, double-click on the file named “CDCE18005EVM-n\_n\_n-install.exe”, where n\_n\_n is the current software version number.

Note that the USB driver must be installed in the same installation folder as the EVMCS program file after the setup completes and the USB cable is connected (first time only).

After the setup wizard completes start the EVMCS from the start menu (Start → Texas Instruments Inc → CDCE18005 Software & Driver → CDCE18005).

Connect the USB cable to the EVM. If a box appears asking for an appropriate driver, **Do not use the automatic search option!** Select a manual installation and when prompted for the driver location browse to the CDCE18005EVM program file folder that was used during installation. If Windows does not ask for a driver, no action is needed.

After USB driver installation, the EVM software should connect properly and be ready for use. A green light in the USB Status and SPI Bus Status boxes indicates a good USB connection, and a dark light indicates a faulty USB connection or a faulty SPI bus.



## 5.1 CDCE18005 Control User Interface

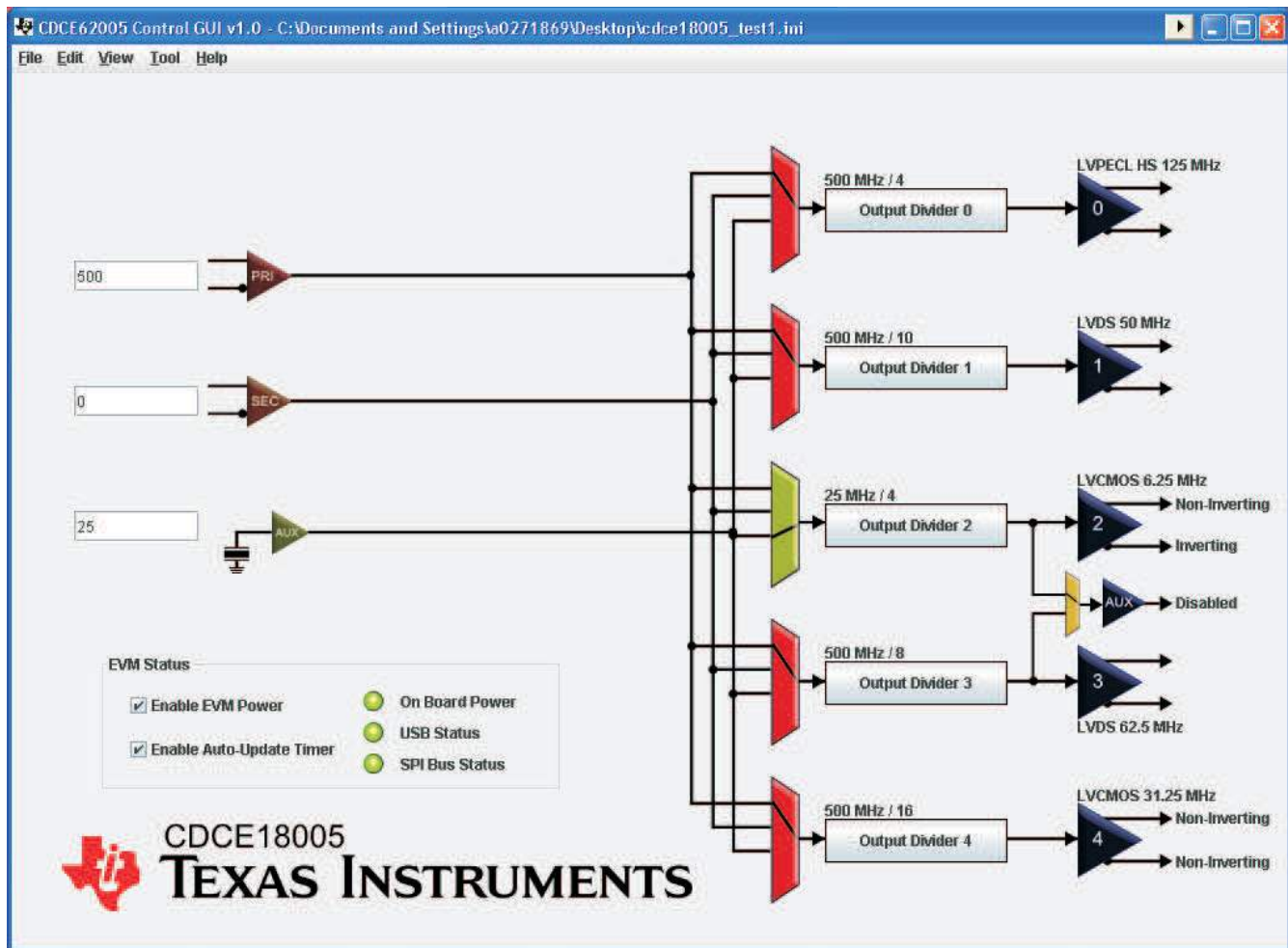


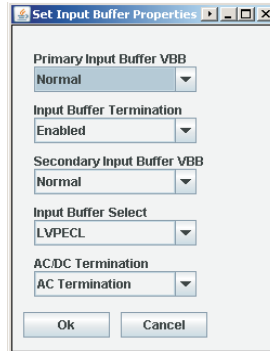
Figure 2. TI CDCE18005 EVMCS Display

## 5.2 Using the EVM Control Software

The graphical layout of the EVMCS is based on the functional structure of the CDCE18005. Using the EVMCS, the system designer can change the Input Frequency, Input selection, Output MUX selection, Output Divider, and Output type. Other configurations are selected by the software with user-selectable options as described in the steps below. If the CDCE18005EVM is USB powered, the “Enable EVM Power” check box must be checked. If the CDCE18005 is powered from an external source, the “Enable EVM Power” check box must be unchecked.

**1. Primary/Secondary Reference**

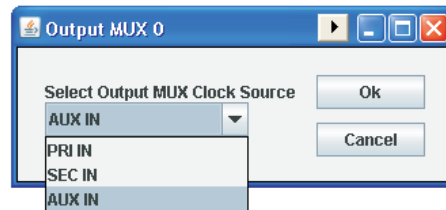
The primary or the secondary reference input buffer section on the EVMCS can be clicked for a popup window that opens, as shown in Figure 3, showing selections on the external input signal type (differential or single ended), the external signal connection to the CDCE18005 primary/secondary inputs (AC or DC termination), input-buffer internal termination (enabled or disabled), and the input-buffer VBB voltage polarity (normal or inverted).



**Figure 3. Input Buffer Properties**

**2. Output MUX Selection**

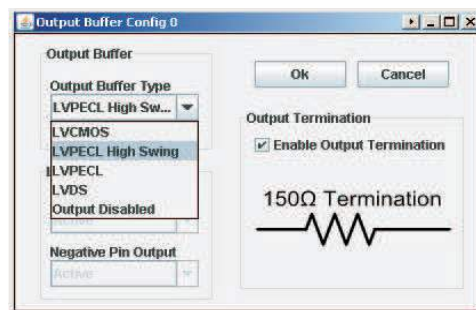
The Output MUX section of the EVMCS for each of the five outputs can be clicked to open a popup window, shown in , showing each Output MUX clock source. These are selectable between the primary input, secondary input, or Aux input.



**Figure 4. Output MUX (each output channel)**

**3. Output Type Selection**

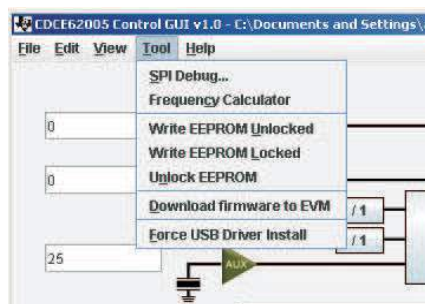
The Output buffer section of the EVMCS for each of the five outputs can be clicked to open a popup window that shows options for each output clock source. These are selectable between LVPECL, High Swing LVPECL (in which cases the output 150Ω termination is automatically enabled), Reduced Range Link LVDS, General Purpose Link LVDS, LVCMOS (in which case each of the P and N act as two separate LVCMOS outputs with the same frequency that can either be active, inverting, tri-state or low) or each output can be disabled.



**Figure 5. Output Buffer Config (each output)**

**4. Write to CDCE18005 EEPROM**

To write any particular setting to the EEPROM (locked or unlocked), the menu item at the top of the EVMCS titled “Tool” must be clicked. This highlights the items “Write EEPROM Unlocked” and “Write EEPROM Locked” as part of a drop-down menu. Choosing the appropriate one after setting the desired PLL configurations writes to the EEPROM in its appropriate mode.



**Figure 6. Tools – Write to EEPROM**

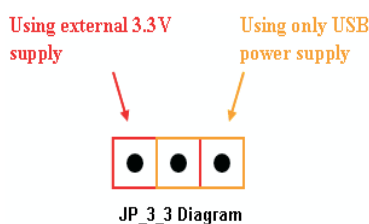
## 6 Configuring the Board

### Configuration for Programming and Testing (with USB cable attached) (Default Configuration)

The CDCE18005EVM is configured by default to operate with the USB cable attached and a 3.3V power supply added to EXT VDD and GND. In this configuration the USB microcontroller is powered by the USB port 5V supply, while the CDCE18005 is powered by the 3.3V external supply. This configuration is best for programming the CDCE18005 while also taking measurements. This configuration removes the power variation found in USB power supplies by isolating the CDCE18005 from the USB supply.

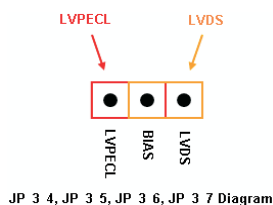
### Configuration for Programming (using USB power)

The CDCE18005EVM can use power supplied through the USB cable as its sole power source. (Not recommended for measurements) This capability is intended for saving configuration settings to the CDCE18005 and later powering the device from its internal memory (useful during performance testing of the device). In this configuration JP\_3\_3 must be moved from its default position to the new position shown below. Also the “Enable EVM Power” box must be checked on the EVM display.

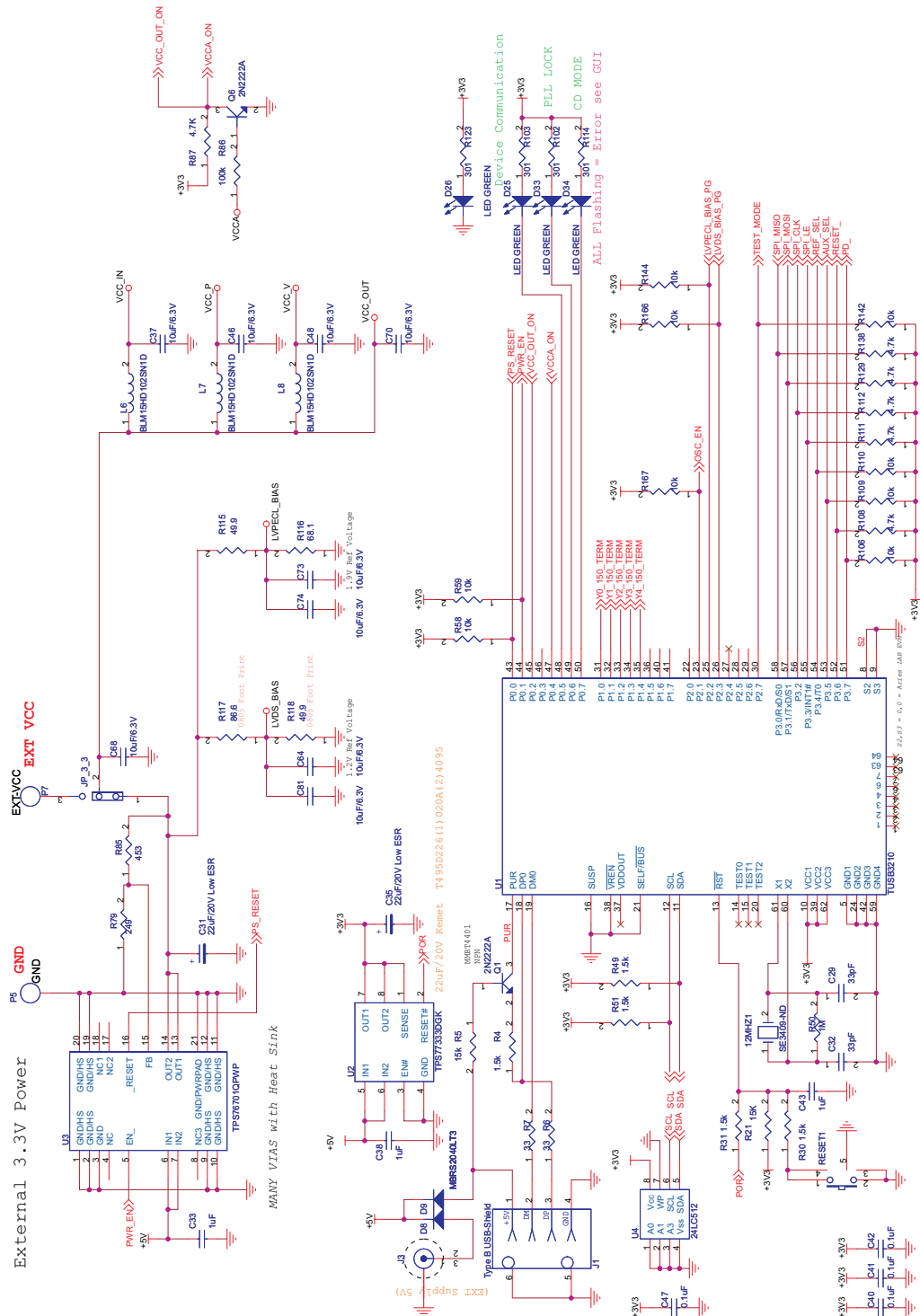


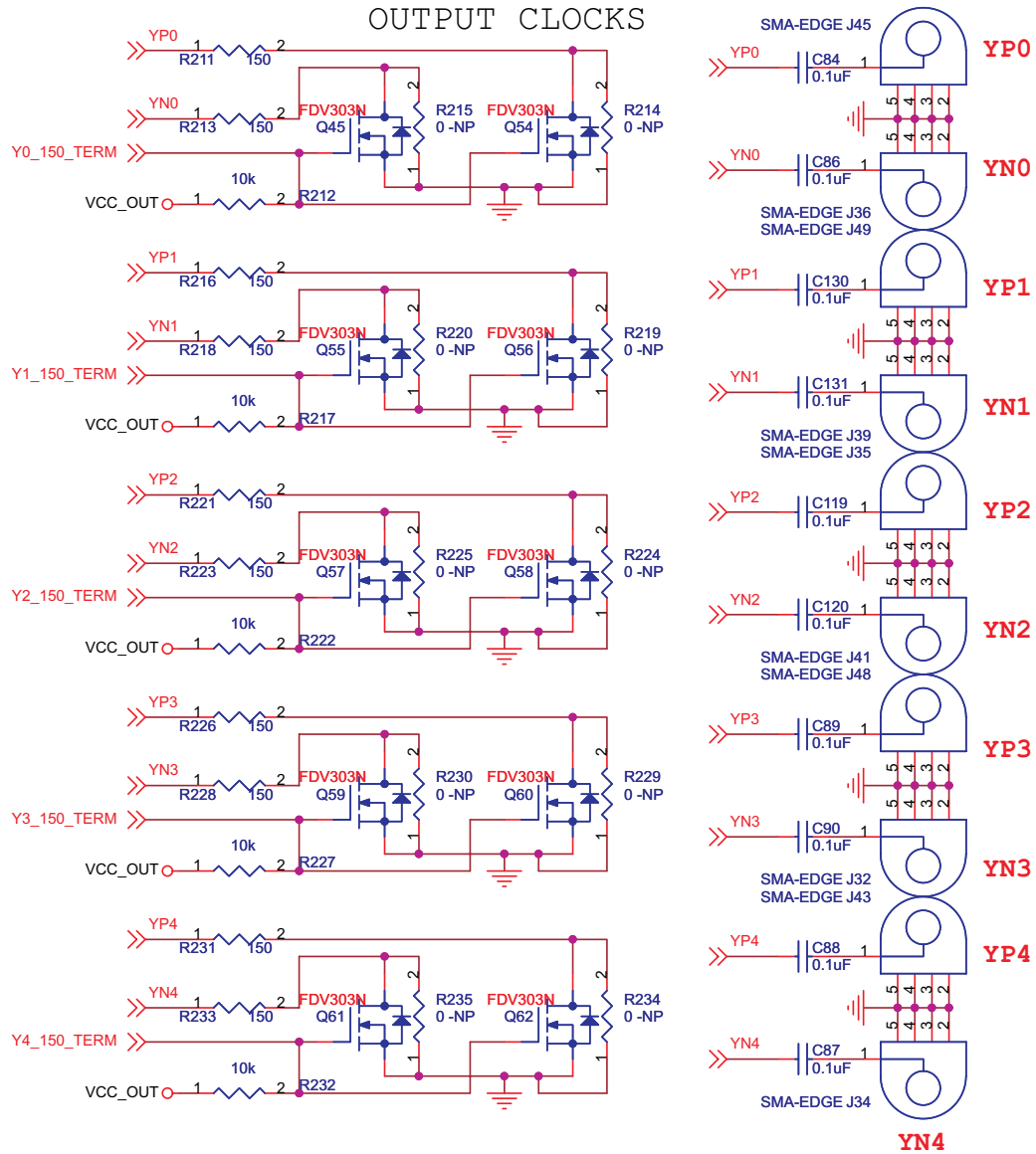
### Configuration for On-board Reference Input Biasing

If the CDCE18005 on-chip biasing is not used for AC-coupled reference input signals for PRI\_REF or SEC\_REF, the CDCE18005EVM can alternately be set up to provide on-board biasing for LVPECL or LVDS inputs. These bias voltages of 1.2V for LVDS and 1.9V for LVPECL are derived from the on-board voltage regulator (U3). The bias points are available for every leg of the differential signals at both PRI\_REF and SEC\_REF and can be enabled by using the jumpers on the CDCE18005EVM, JP\_3\_4 and JP\_3\_5 for PRI\_REF and JP\_3\_6 and JP\_3\_7 for SEC\_REF. Each of these jumpers can be configured as shown below for either LVPECL or LVDS bias.

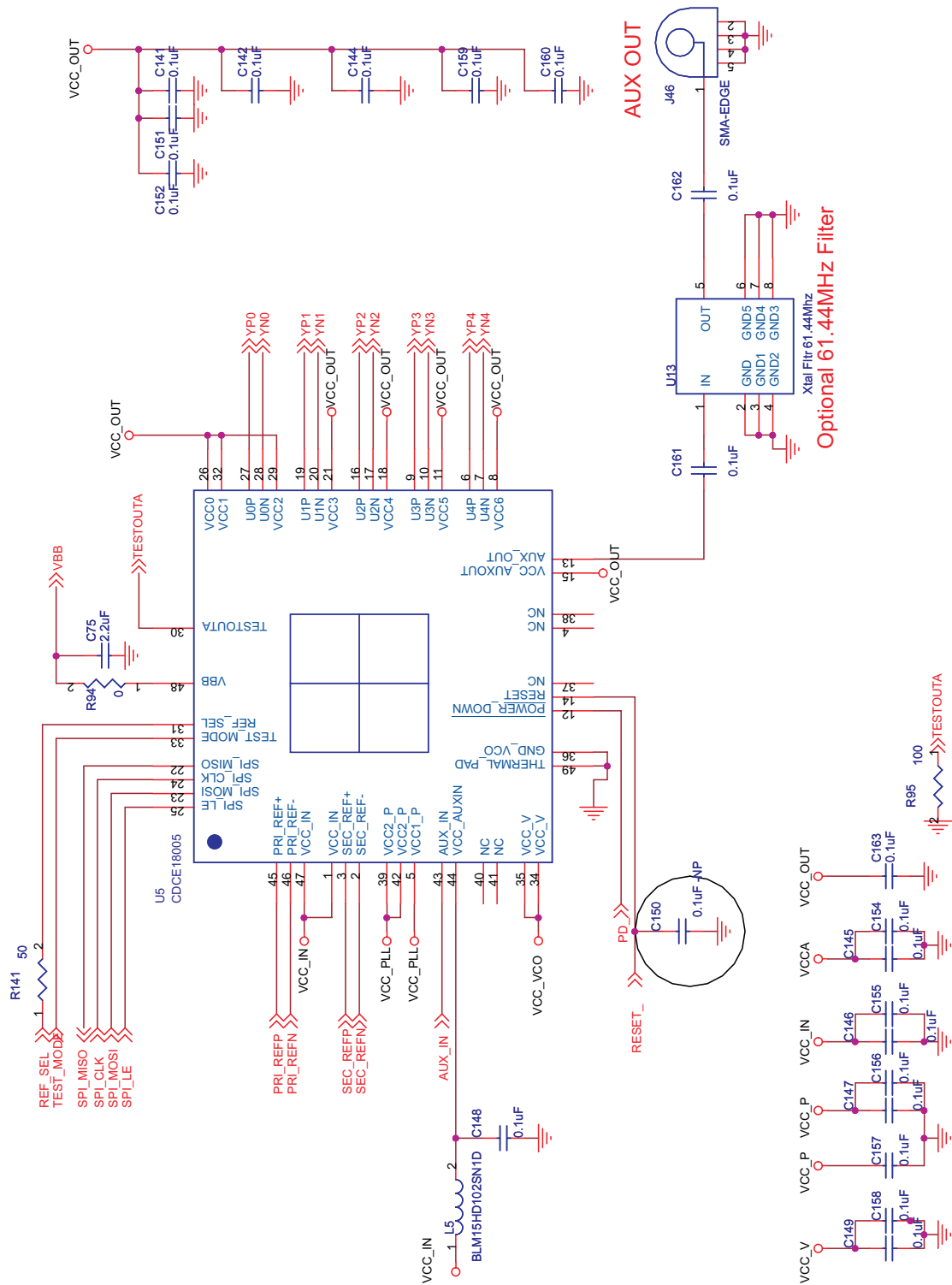


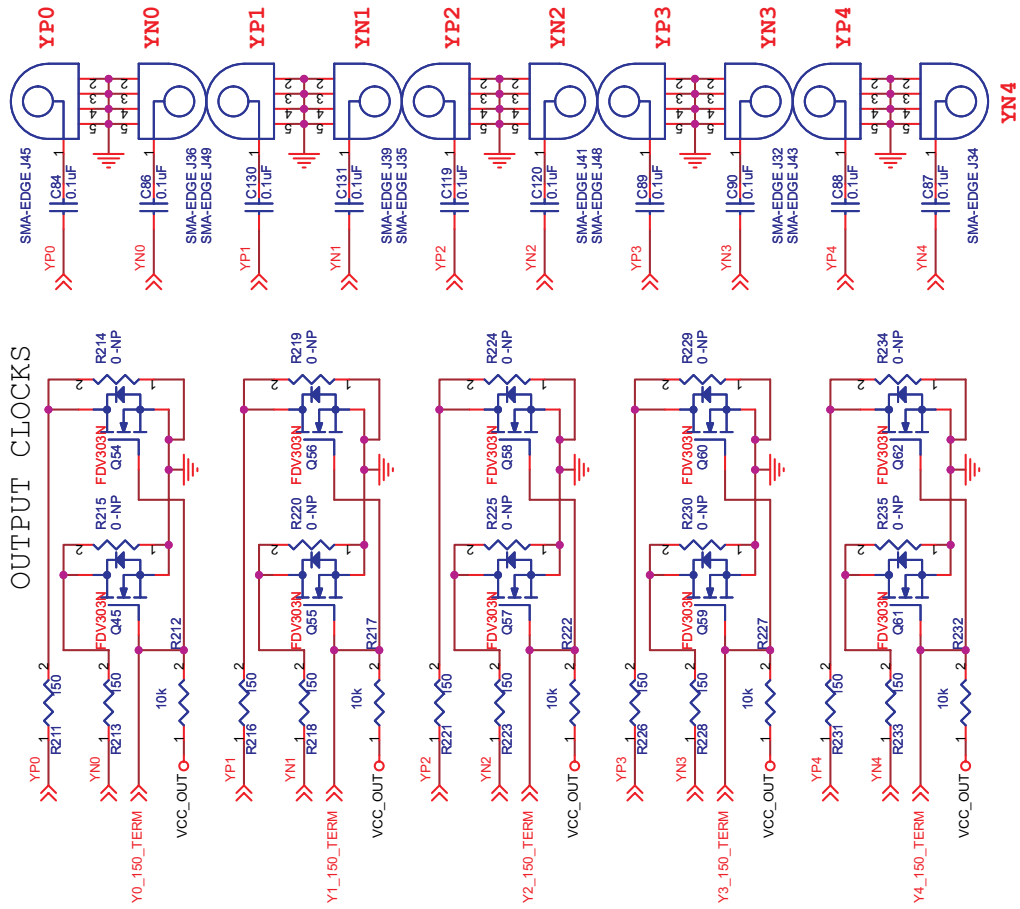
7 CDCE18005EVM Board Schematic Diagram











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## EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 3 V to 3.6 V and the output voltage range of 0 V to 3.6 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 120°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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