Important Note

Restrictions in Use

The hardware and the software for the cLite™ SSC Modular Evaluation Kit are designed for IC evaluation, laboratory setup, and module development only.

The hardware and the software for the cLite™ SSC Modular Evaluation Kit must not be used for module production or production test setups.

Disclaimer

IDT shall not be liable for any damages arising out of defects resulting from:

(i) delivered hardware and software

(ii) non-observance of instructions contained in this manual, or

(iii) misuse, abuse, use under abnormal conditions or alteration by anyone other than IDT.

To the extent permitted by law, IDT hereby expressly disclaims and user expressly waives any and all warranties, whether express, implied, or statutory, including, without limitation, implied warranties of merchantability and of fitness for a particular purpose, statutory warranty of non-infringement and any other warranty that may arise by reason of usage of trade, custom, or course of dealing.

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1 Kit Contents

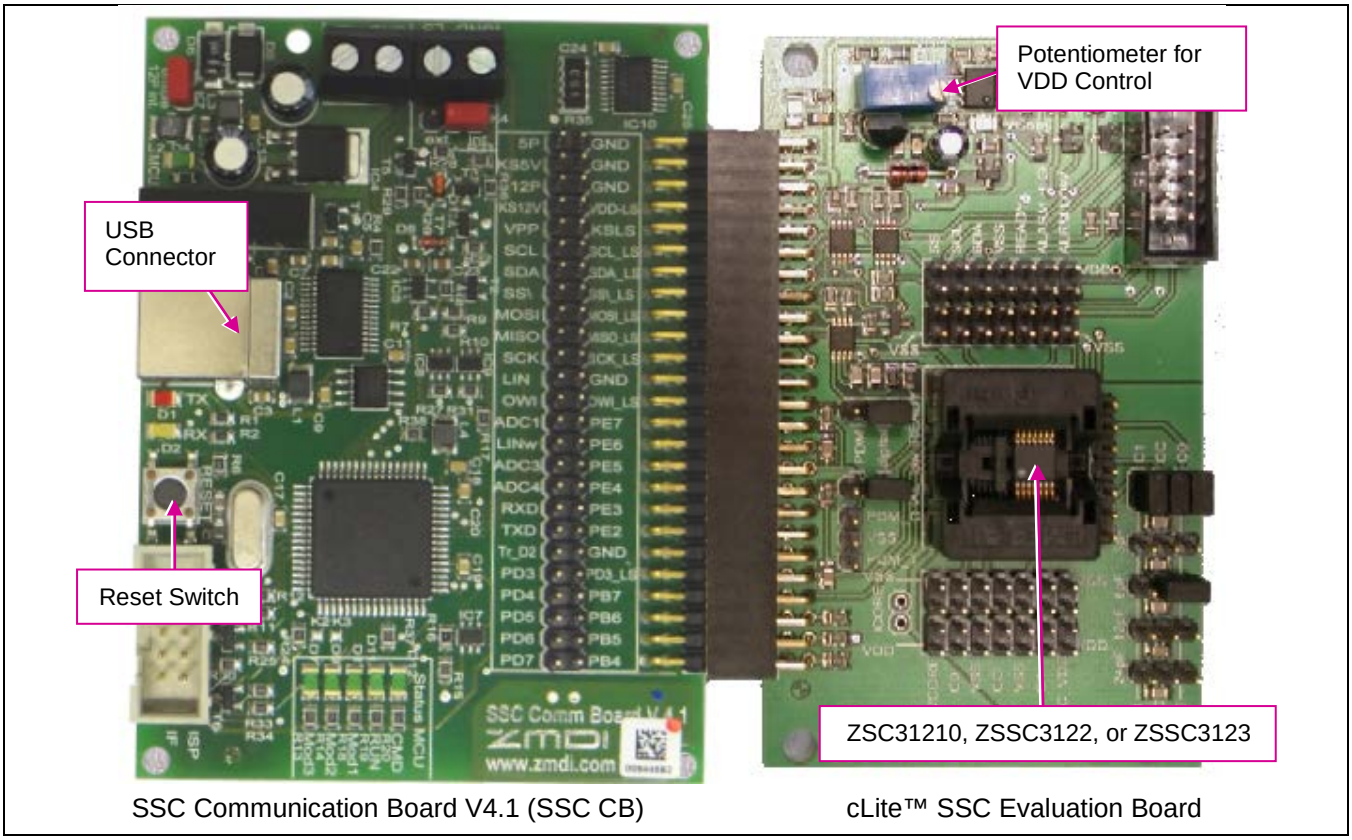
a) SSC Communication Board V4.1 with cable (USB cable)*

b) ZSC31210 cLite SSC Evaluation Board with TSSOP-14 samples—operates with the ZSC31210, ZSSC3122, and ZSSC3123

c) SSC Test Board V1.0 (a small unpopulated circuit board for facilitating user prototypes)

d) SSC Kit Start Up Information

Figure 1.1 cLite™ SSC Evaluation Kit



The cLite™ SSC Modular Evaluation Kit contains the hardware needed for communication and calibration of a cLite™ family sensor signal conditioning IC, including the ZSC31210, ZSSC3122, and ZSSC3123. A PC can communicate with the cLite™ socketed on the cLite™ SSC Evaluation Board via the SSC Communication Board (SSC CB) through a USB connection. The kit does not include the cLite™ SSC Evaluation Software, which must be downloaded from the IDT website (*www.IDT.com*) to ensure receiving the latest release, as described in section 4. The software should function on any Windows® 2000 / XP / Vista / Windows® 7/ Windows® 8 system. The cLite™ SSC Evaluation Board can connect to a capacitive sensor or provide on-board capacitors for simulating input from a capacitive sensor. (See Figure 3.1.)

* This document applies to cLite™ SSC Modular Evaluation Kits with the SSC Command Board V4.1 with firmware version 4.04 or higher. See section 4.13 regarding the "GetRevision" command. Periodically check IDT's website (www.IDT.com/SSC-COMM-BD) for updates to the firmware.

2 USB Drivers

If using Windows®7 or Windows®8, the user's system will automatically download and use the latest approved USB driver from Microsoft, so the following procedures to install the USB drivers are not applicable. In this case, ensure that a connection to the internet is established before connecting the SSC Communication Board V4.1 to a free USB port.

For the Windows® 2000, XP, or Vista operating systems, the cLite™ SSC Modular Evaluation Kit requires installation of two USB drivers. To install the drivers, the user's system must meet these requirements:

- x86-compatible PC
- 64 MB RAM
- Hard drive with 20MB free space
- USB port

The two USB device drivers are available on the IDT website (see www.IDT.com/SSC-COMM-BD). These drivers will make the PC's USB port appear as a virtual COM port (typically COM3 or COM4 on most computers). The SSC Evaluation Kit software accesses the SSC Evaluation Board through the SSC CB as if it were a COM (RS232) port. These drivers will not affect the operation of any other USB peripherals.

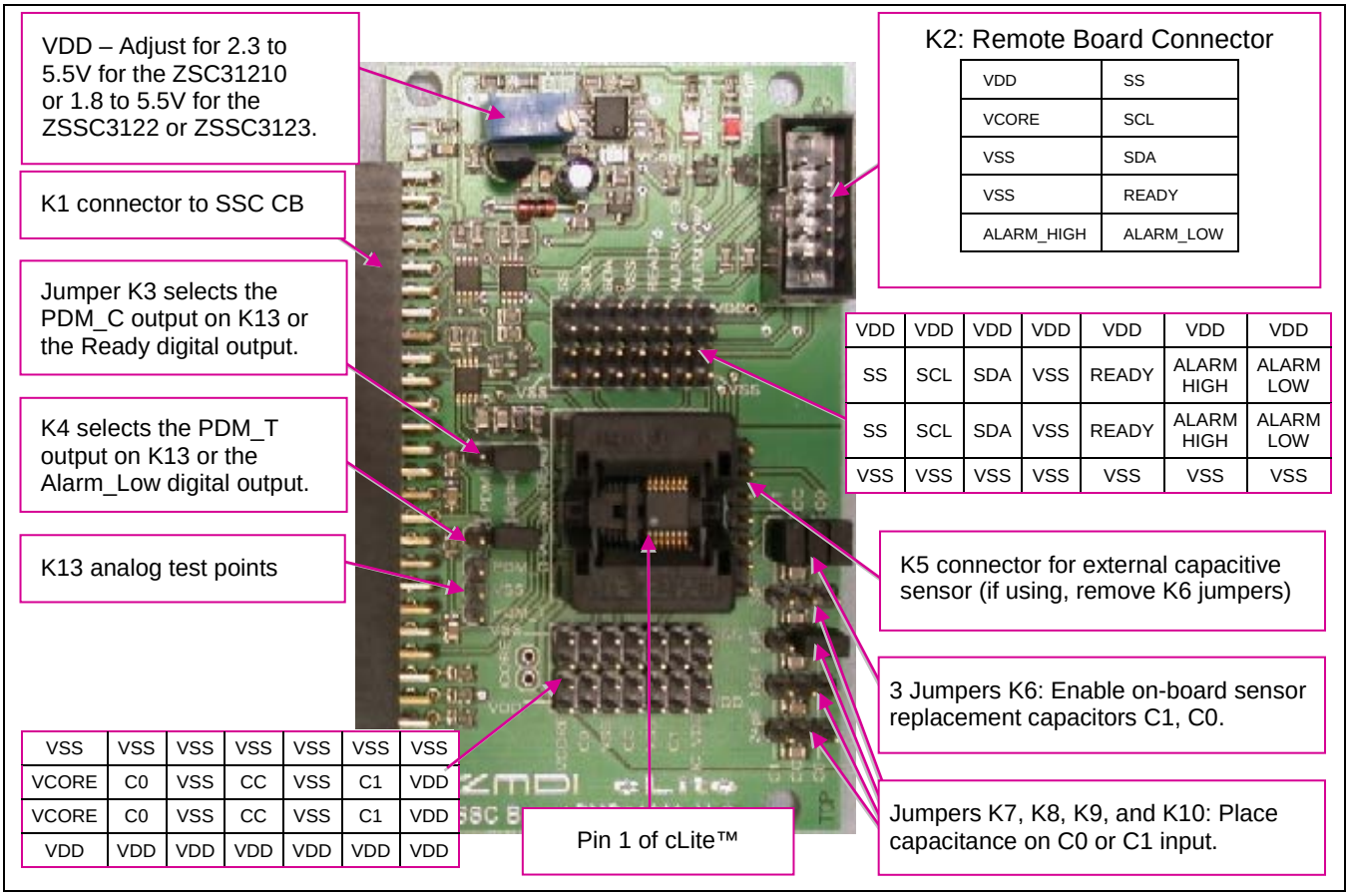
Refer to *SSC_AN_CommunicationBoard_Driver_Installation_Rev_X_x.pdf* for instructions on installing these two drivers and for determining the virtual COM port for the SSC Evaluation Kit, which is needed for setting up the kit.

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3 cLite™ SSC Evaluation Board

3.1 Overview

Figure 3.1 SSC Evaluation Board Overview



The main purpose of the cLite™ SSC Modular Evaluation Kit is communication between the PC and the cLite™. The PC sends commands and data via the USB / SSC CB (virtual COM port). The microcontroller on the SSC CB interprets these commands and relays them to the cLite™ in the I²C™[†] bus standard format (K1 Pin 11 / SCL; Pin 13/ SDA). The microcontroller will also forward any data bytes from the cLite™ chip back to the PC via the USB connection. These bytes can be sensor and temperature readings to be displayed by the PC software; raw ADC readings used during calibration; or EEPROM content bytes.

[†] I²C™ is a trademark of NXP.

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3.2 Installing the Communication and Calibration Software

The cLite™ SSC Modular Evaluation Kit does not include the software, which must be downloaded from the IDT website (*www.IDT.com*) to ensure receiving the latest release. To download the software, navigate to either of the following product pages (same software applies to the ZSC31210, ZSSC3122, and ZSSC3123):

- ZSSC3122: www.IDT.com/ZSSC3122
- ZSSC3123: www.IDT.com/ZSSC3123

On the product page, click on the link titled "cLite Evaluation Software Rev. X" (where X is the current revision) and follow the dialog instructions as needed to download the zip file for the software.

Open the zip file and extract the *cLiteSSC_Setup_vX.exe* file.

To install the cLite™ SSC Evaluation Kit software on the user's PC hard drive, double-click on the downloaded *cLiteSSC_Setup_vX.exe* file. Respond to the dialog box to select the installation directory, and the software will complete the installation, which results in a program shortcut on the desktop of the PC.

Note: When the cLite™ SSC Evaluation Kit software is activated for the first time, the kit type ("HW type") and product type (ZSC31210, ZSSC3122, or ZSSC3123) must be selected and the COM port must be entered as described in sections 4.2 and 4.3.

3.3 Connections to the cLite™

The SSC Evaluation Board has a TSSOP-14 socket for inserting the cLite™. There is an additional 10-pin header socket (K2; see Figure 3.1) for connection to a customer-supplied remote board.

The board can be used for in-circuit programming of the cLite™ in the user's calibration fixture using the VDD, VSS, SDA, SCL and READY connections on the K2 connector on the SSC Evaluation Board.

Note: Only one cLite™ IC connection option can be used at a time.

3.4 Power Supply to the Board

The K1 connector to the SSC CB provides the power supply from the SSC CB's USB port to the SSC Evaluation Board. Using the power via the USB port, the maximum current that can be provided is 40mA. All functions of the board are operative down to 1.8V. The blue potentiometer regulates the supply voltage in a range from 1.8 to 5.5V.The board has a green LED labeled VSupply, which lights if the board has power.

3.5 Reset Switch

Use the push button on the SSC CB (see Figure 1.1) to reset communications if needed. When the SSC CB is reset using the push button, the COM port in the cLite™ SSC Evaluation Software must be reopened (see section 4.3).

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4 cLite™ SSC Evaluation Software

4.1 Overview

The cLite™ SSC Modular Evaluation Kit is intended for demonstration purposes and calibration of single units. The installation folder is (*C:\program files\ZMDI\cLite SSC Evaluation Software*). IDT can provide the user with algorithms and assistance in developing full production calibration software. Figure 4.1 shows the main dialog window of the cLite SSC Evaluation Software.

The six types of text files that support the software user are described in sections 4.1.1 and 4.1.2.

4.1.1 User Files

User files are saved in [*My Documents*]*ZMDI\cLite SSC Evaluation Software* and consist of status files, log files, and EEPROM files.

- A *StatusLog.txt* file lists all commands sent to the cLite™, responses, and error messages. If software problems occur, this file can be used for detecting the root cause of the problem.
- When the software is activated, a *CommunicationLog.txt* file is saved. This file is a log of the communication to the cLite™ during the software session and can be saved after closing the software by renaming the file. Otherwise, it is overwritten the next time the software is opened.
- In Command Mode (CM), the user can save/load the EEPROM contents from an **.eep* file to the EEPROM and vice versa.
- In Normal Operation Mode (NOM), the user can log capacitance and temperature readings to a text file (.txt) of the user's choice.
- The calibration is documented in the *CalibrationLog_ddMMMYYYY.txt* file. These files are cumulative, with a new file for each day to prevent them from getting too long.

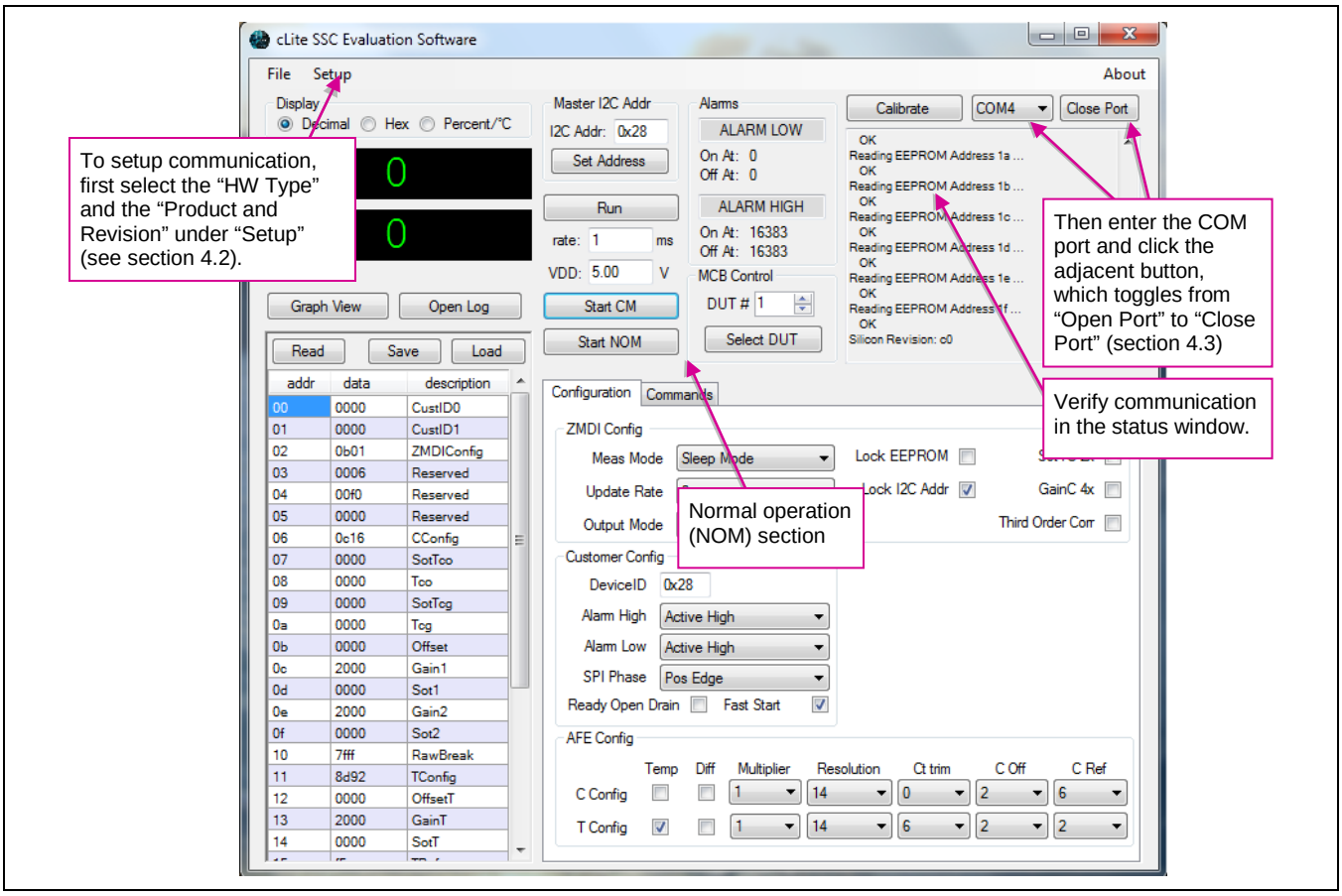
4.1.2 Data File *calibration.db*

The *calibration.db* file is used by the software for calibration. Where the file is saved depends on the Windows system:

- For Windows 2000 and Windows XP, it is saved in C:\Documents and Settings\All Users\Application Data\ZMDI\cLite SSC Evaluation Software.
- For Windows® Vista, Windows® 7, and Windows® 8, it is saved in C:\ProgramData\ZMDI\cLite SSC Evaluation Software.

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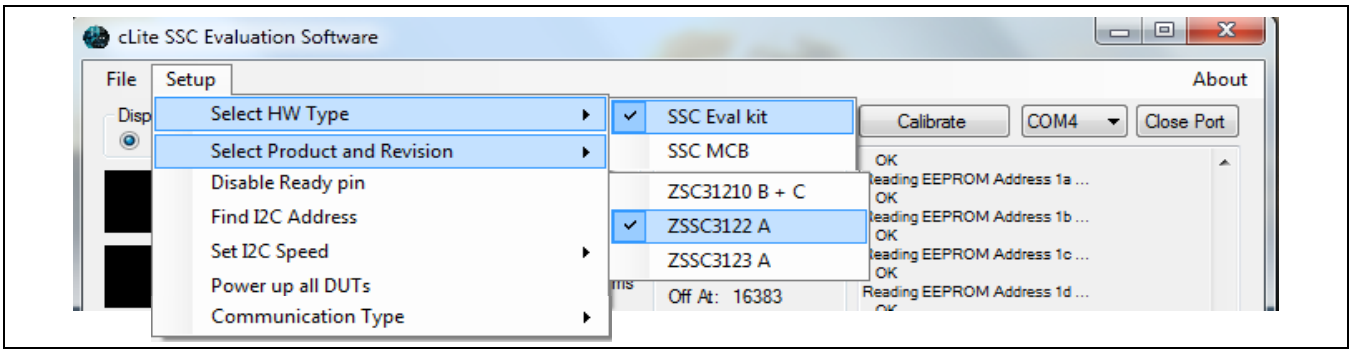
Figure 4.1 cLite™ Software Main Menu



4.2 “Setup” Menu

After opening the cLite™ SSC Evaluation Software, the connected board type and the correct product and silicon revision must be selected under “Setup.”

Figure 4.2 Setup Selection (Example for ZSSC3122)



4.2.1 Special Feature “Set I2C Speed”

The “Set I2C Speed” feature sets the I^{2}C™ speed to a different frequency (default value: 100kHz).

4.2.2 Special Feature “Find I2C Address”

The “Find I2C Address” feature determines the I^{2}C™ address of the cLite™. This can be used if the address was accidentally changed and communication is locked.

4.2.3 Special Feature “Power up all DUTs”

This feature is only used for the Mass Calibration Board and is not applicable to the cLite™ SSC Modular Evaluation Kit.

4.2.4 Special Feature “Communication Type”

This feature allows the selection of the communication type. By default, this is set to “Automatic,” which will select I^{2}C™, SPI negative edge, or SPI positive edge based on the contents in the EEPROM of the cLite™ under test (DUT).

4.3 “Open Port” Button

The cLite™ SSC Evaluation Software provides a drop-down menu for selection of all available COM ports on the PC. Select the correct COM port from the drop-down menu (see section 2). To set up communication with the SSC CB, click on “Open Port” (see Figure 4.1), which then toggles to “Close Port.” If the port is opened successfully, “Opened port COMx” will appear in the status window.

4.4 Display Selection

During normal operation, it is possible to display the sensor and temperature data output in one of three different formats. The “Display” section at the top left allows the user to select decimal, hexadecimal, or percent and degrees Celsius. The selected format is displayed in the sensor and temperature display boxes below the “Display” section (see section 4.6).

4.5 “Master I2C Addr” Section

Use the “I2C Addr” field at the top to enter the address that the SSC CB uses to communicate with the cLite™ installed in the socket on the SSC Evaluation Board. Then click “Set Address.” Valid settings are 00_{HEX} to $7F_{HEX}$. The default is 28_{HEX}. See important notes in section 4.12.2 regarding settings when the communication address is locked.

4.6 Sensor and Temperature Display

The software displays two large readout windows for sensor and temperature values at the top left. The upper display window is the cLite™ temperature reading in decimal/hexadecimal/^{o}C. The window below the temperature is the sensor reading in decimal/hexadecimal/%. To adjust the rate at which data is read from the cLite™, use the rate adjustment (see section 4.8).

If the cLite™ has not been temperature calibrated, the displayed temperature is invalid.

The different colors of the display field indicate the cLite™ mode:

Color	Green	Blue	Red	Yellow
IC Mode/State	Valid value in Normal Operating Mode (NOM)	Valid in Command Mode (CM)	Diagnostic	Stale Data (NOM)[‡]

4.7 “Log File” Field

Sensor and temperature readings can be logged to a PC file. Use the “Open Log” button (below the sensor reading display window in Figure 4.1) to select the filename and directory where the file will be stored. Click the “Save” button to log every data sample displayed in the selected file with the date and time the sample was collected.

The resulting text file is a comma-delimited ASCII file (CSV) and can be imported into spreadsheet applications such as Microsoft Excel®.

4.8 Normal Operation Section

The normal operation section (below the “Master I2C Addr” section) controls the collection of data when the cLite™ is in Normal Operation Mode (NOM).

[‡] For more details, refer to the appropriate datasheet (*ZSC31210_cLite_Data_Sheet.pdf, ZSSC3122_cLite_ Data_Sheet.pdf,* or *ZSSC3123_cLite_ Data_Sheet.pdf*).

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4.8.1 “Run” Button

To start a continuous readout of sensor and temperature data, click the “Run” button. The button text will change to “Stop.” Click again to stop data collection.

4.8.2 “Rate” Field

This field sets the period (ms) for the sample rate of the continuous read out. Valid settings are 10ms or longer. If this setting is less than the conversion time, stale data will occasionally be fetched (see section 4.6).

4.8.3 “VDD” Field

This field should be set match the VDD level used for powering the cLite™ DUT. The value is used to properly scale the A2D readings for display when using PDM output mode. If not using PDM, this field can be ignored.

4.9 “Start CM” Button

To communicate with the cLite™, start the Command Mode (CM) by clicking “START CM” (see Figure 4.1). In this mode, the measurement cycle is stopped and the full command set is available.

4.10 “Start NOM” Button

To exit Command Mode and return the cLite™ to Normal Operation Mode (NOM), click “START NOM” (see Figure 4.1). In this mode, the cLite™ continually performs the measurement cycle: reading, conditioning, and transmitting sensor data.

4.11 EEPROM Editor Section

The EEPROM editor section (lower left in Figure 4.1) provides read and write access to all of the EEPROM locations within the cLite™ DUT. To read the EEPROM, click the “Read” button when the cLite™ is in Command Mode. To write to an individual EEPROM address, click on the data row of the desired address, type in the new EEPROM contents, and press the ENTER key on the keyboard. Newly written data will be displayed in gray, indicating that the Error Checking and Correction codes (ECC) have not yet been checked. To check the codes, perform an EEPROM read.

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4.11.1 "Read" Button

To read EEPROM settings, click the "Read" button while in Command Mode. The "EEPROM" section displays all of the fields currently stored in the cLite™ EEPROM (non-volatile memory). Data that is read from EEPROM is displayed in one of four colors depending on the status of the ECC [§] check.

Color	Black	Gray	Orange	Red
ECC Status	Correct data	Data has not been checked	Corrected single-bit error	Uncorrectable double-bit error

4.11.2 "Save" Button

The EEPROM contents can be saved to a file in the [*My Documents*]*ZMDI**cLite SSC Evaluation Software* directory by clicking the "Save" button. The standard Windows® dialog box for file saving results. All files will be saved with an "*.eep*" file extension.

4.11.3 "Load" Button

EEPROM contents that have been previously saved to a file can be written to the current EEPROM by clicking the "Load" button. The standard Windows® dialog box for loading a file results. The default folder for the saved file is [*My Documents*]*ZMDI**cLite SSC Evaluation Software.*

Note: The first byte of the data in the EEPROM address 04_{HEX} is masked to prevent overwriting required IDT factory settings.

4.12 "Configuration" Section

This section is used to expedite programming configuration and communication settings in the EEPROM of the cLite™ DUT (see Figure 4.1). Each of the group boxes (*ZMDI_Config, Customer_Config, AFE_Config*) maps to an EEPROM address. The dialog items within the box represent individual bits within the configuration fields.

[§] For more details, refer to the appropriate datasheet (*ZSC31210_cLite_Data_Sheet.pdf, ZSSC3122_cLite_Data_Sheet.pdf,* or *ZSSC3123_cLite_Data_Sheet.pdf*)

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4.12.1 IDT Config

"Meas Mode" Menu

This allows the user to select between Update Rate and Sleep Mode. Sleep Mode significantly reduces power consumption of the cLite™ by "sleeping" until a measurement request is received. Note that in Sleep Mode, PDM cannot be used.

"Update Rate" Menu

When operating in Update Mode, the update rate determines power consumption and response time. Select the update rate by clicking on one of the four update rates on the "Update Rate" drop-down menu.

Note: In Sleep Mode, this setting has no effect.

"Output Mode" Menu

Three output options are available on the "Output Mode" drop-down menu:

- I^2C™
- SPI
- PDM

Note: If the "Communication Type" setting in the "Setup" menu is set to "Automatic" the communication protocol of the SSC Communication board will be adjusted automatically to match the cLite™ DUT setting.

"Lock EEPROM" Checkbox

If "Lock EEPROM" is checked, EEPROM locations 0 through 15_{HEX} are permanently locked preventing any future changes.

"Lock I2C Addr" Checkbox

If needed, lock the slave I^2C™ address selection by clicking the "Lock I2C Addr" checkbox. Without this lock, the cLite™ will respond to all I^2C™ addresses. If the address is locked, the "I2C Addr" setting (see section 4.5) must match the "DeviceID" programmed in EEPROM.

"SotTC 2x"

If "SotTC 2x" is checked, the *SOT_tcg* and *SOT_tco* values (EEPROM words 09_{HEX}, 07_{HEX}) are multiplied by a factor of 2. The check box is set by the calibration DLL as a result of the calculated calibration coefficients stored in the EEPROM.

"GainC 4X" Checkbox

If "GainC 4X" is checked, the *Gain_1* and *Gain_2* values (EEPROM words $0C_{HEX}$, $0E_{HEX}$) are multiplied by a factor of 4. The check box is set by the calibration DLL as a result of the calculated calibration coefficients stored in the EEPROM.

"Third Order Corr" Checkbox

If "Third Order Corr" is checked, the third order nonlinearity correction is selected instead of piece-wise correction with breakpoint math. Otherwise the piece-wise correction with break point math is enabled.

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4.12.2 Customer Config

"Device ID" Field

When the cLite™ is in I²C™ communication mode, the default slave address is 28_{HEX}. If a different slave address is required, program the part for the new address by entering the hexadecimal value of the new address in the "Device ID" field. The value is written to EEPROM when the field is unselected. The valid address range is 00_{HEX} to $7F_{HEX}$. The new I²C™ address will take effect on cycling power or entering Normal Operation Mode ("Start NOM").

Note: If "Lock I2C Addr" is on (see section 4.12.1), "DeviceID" must match the "I2C Addr" setting (see section 4.5).

"Alarm High" Menu

The "Alarm High" drop-down menu configures the Alarm High pin to be active low or active high and sets whether it is full push-pull or open drain.

"Alarm Low" Menu

The "Alarm Low" drop-down menu configures the Alarm Low pin to be active low or active high and sets whether it is full push-pull or open drain.

"SPI Phase" Menu

The "SPI Phase" drop-down menu configures whether the SPI master samples data on the negative edge or on the positive edge when using SPI communication.

"Ready Open Drain" Checkbox

If checked, "Ready Open Drain" configures the Ready pin to be an open-drain style driver instead of full push-pull.

"Fast Start Up" Checkbox

If checked, "Fast Start Up" sets the Command Window length to 3ms instead of 10ms.

4.12.3 AFE Config Section

The "AFE Config" section configures the analog front-end for both the sensor and internal temperature measurement. See the datasheet for details on how to configure this section properly.

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4.13 “Commands” Section

The “Commands” section allows issuing commands to the cLite™. Click “START CM” first (Start Command Mode) before sending any commands to the cLite™. Note that EEPROM contents displayed in the main menu are not updated automatically if changed in this section. Figure 4.3 shows an example of an EEPROM read. A “DataFetch” must be sent next as shown in Figure 4.4. For more details, refer to section 4 of the data sheet regarding Command Mode and section 8.2 in this document.

Figure 4.3 Send EEPROM Read Command (Example for Address 02)

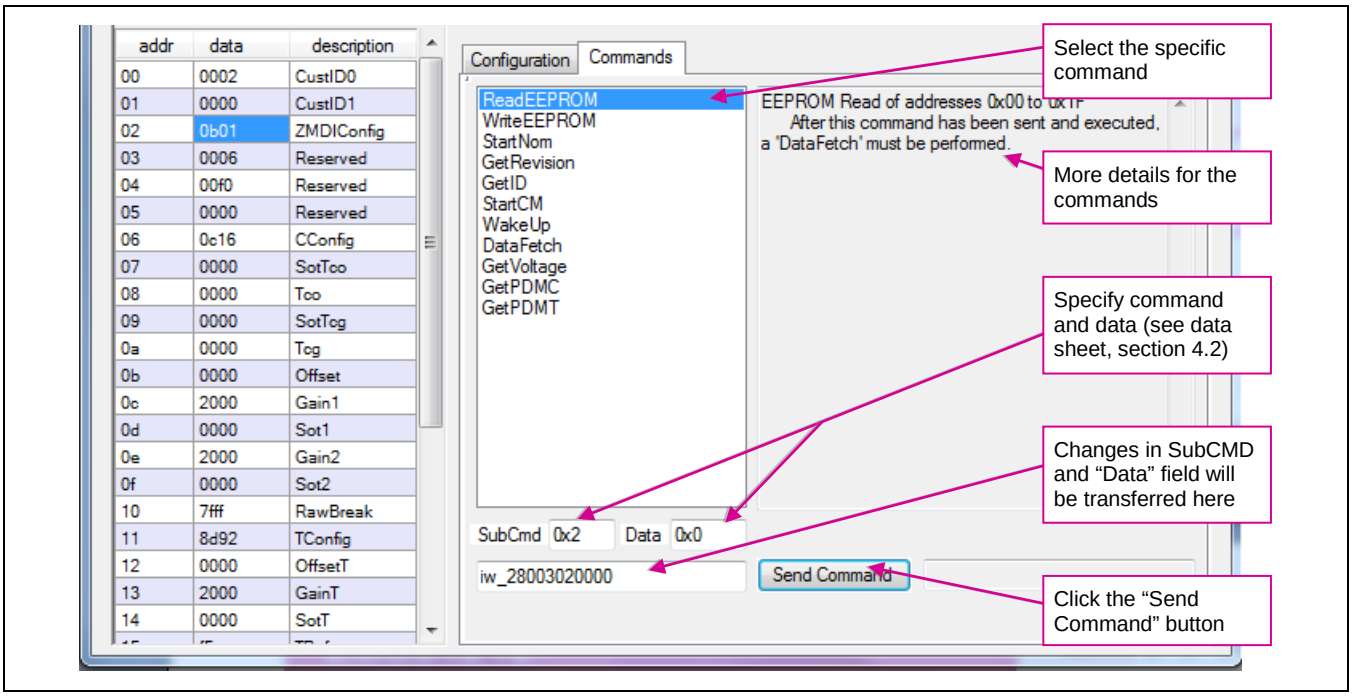
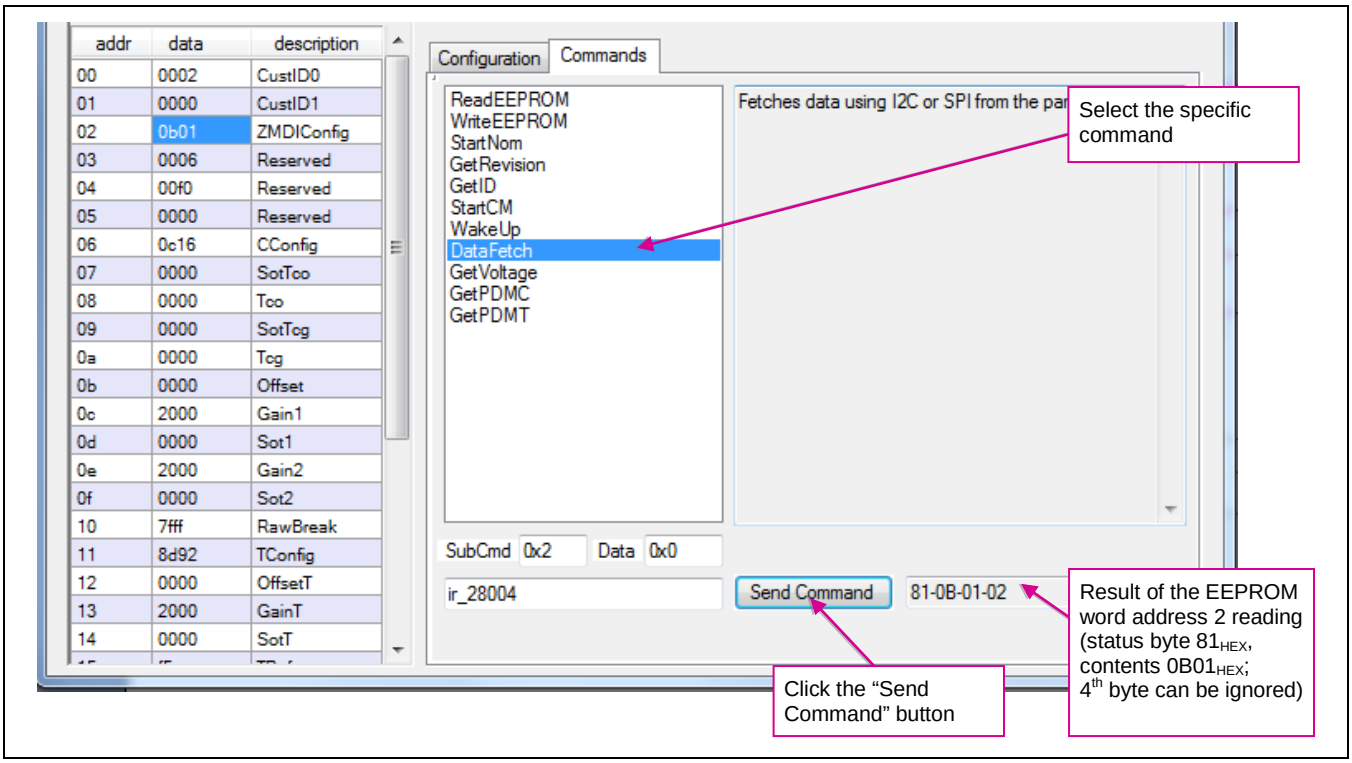


Figure 4.4 Send DataFetch Command



5 Dry Run Calibration

The following directions perform an example of a simple 3-point nonlinear calibration using the sensor replacement C0 (3pF, 6pF, 3+6pF) on the SSC board. The calibrated I²C™output will be displayed as the calibration result (see section 4.6).

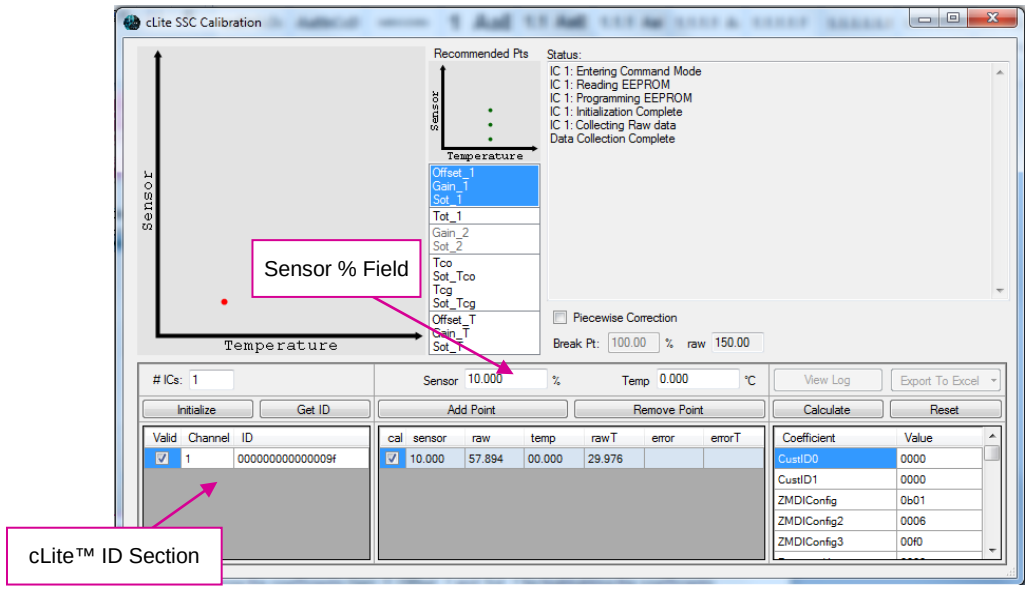
5.1 Steps for the Dry Run Calibration

1) Connect the SSC Communication (SSC CB) and cLite™ SSC Evaluation Board. Insert the cLite™ DUT in the 14-pin TSSOP socket taking care to align pin 1 as indicated in Figure 3.1).
2) Connect a USB cable from the USB connector on the SSC CB to an available USB port on the PC. In the PC's Device Manager, check which COM port is connected to "ZMDI SSC Evaluation Kit." Verify that the green PWR LED is lit on the SSC CB.
3) Start the *cLite™ SSC Evaluation Software*.
4) Select the proper "HW type" (SSC Eval Kit) and "Product" under the setup menu (see section 4.2)
5) Select the proper COM port. Click on "Open Port" (see section 4.3).
6) Click on "START CM." If the setup is correct, the current EEPROM contents are displayed in the "Response" field at the right and in the EEPROM section in the lower left bottom.
7) Click on the "Load" button and browse as needed to locate and load any **.eep* file (see section 4.1). Using the capacitance on the cLite™ SSC Evaluation Board for this example, load the default EEPROM file provided with the software installation for the product and revision used (*ZSC31210 Rev C Default.eep, ZSSC3122 Rev A Default.eep, or ZSSC3123 Rev A Default.eep*)[**].
8) Click on "Calibrate." The calibration window appears (see Figure 5.1).

[**] The cLite™ software prevents overwriting reserved factory settings when loading this file.

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Figure 5.1 **Calibration Window with 3-Point Calibration Example**

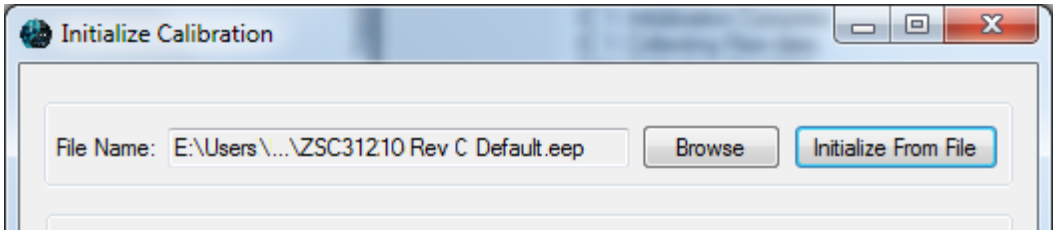


9) For the 3-point calibration, choose the coefficients Gain_1, Offset_1 and Sot_1 by highlighting the coefficients in the upper middle section of the calibration window. The smaller graph above the coefficient list indicates the recommended pattern of three capacitive sensor readings at the same temperature.

10) For calibrations using a piece-wise correction, check “Piecewise Correction” and set a break point in the “Break Pt” field. For this example, no breakpoint is used, so leave the default value 100% as the setting.

11) Click on “Initialize” in the cLite™ ID section (lower left corner). The “Initialize Calibration” window appears (see Figure 5.2). Click “Browse” and select the same default EEPROM file as used in step 7). Click on “Initialize From File.”

Figure 5.2 **– Initialize Calibration Window (Example for the ZSC31210)**



12) Next start data collection. Normally this would be done with a real capacitive sensor attached to the cLite™ on a remote board in a controlled chamber. Instead, this dry run calibration uses the C0 sensor replacement as the input.

    Note: The minimum number of calibration points is equal to the number of coefficients to be calculated. The software allows the user to collect more than the required number of calibration points. The user can select which points are used for calculating the calibration coefficients by checking the “Cal” column. Data points that are not selected in the “Cal” column will be used for validation of the output error shown the “Error” column.

    a) On jumper K7 on the SSC Evaluation Board, shunt C0 to CC for a 3pF capacitance input (see Figure 3.1).

    b) Enter 10% in the “Sensor %” field.

    c) Click on “Add New Point.” The software obtains a raw reading from the part, graphs the new data point, and displays the values in the middle bottom section.

    d) Remove the 3pF shunt on K7. Shunt C0 to CC on the K8 jumper for a 6pF capacitance input.

    e) Enter 50% in the “Sensor %” field.

    f) Click on “Add New Point” again. The software obtains a new raw reading from the part and graphs the new data point.

    g) Add the 3pF shunt back onto K7 for a total of 9pF capacitance input.

    h) Enter 90% in the “Sensor %” field.

    i) Click on “Add New Point” again. The software obtains a new raw reading from the part and graphs the new data point.

13) Because this is a 3-point calibration, the software has all the necessary data for calculating and writing the coefficients. Click on “Calculate,” which should now be active.

14) Close the calibration window. Click on “Start NOM” and then “Run” to display the digital output values in the lower display section.

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6 Verify Calibration with PDM_C Output

In PDM mode, the cLite™ must be programmed to be in Update Mode. A simple first-order RC filter is provided on the SSC Evaluation Board for creating an analog output by filtering the PDM signal (for more details refer to the data sheet, section 3.7). The analog output voltage can be measured in two different ways supported by the cLite™ SSC Modular Evaluation Kit as described below. The calibration steps explained in section 5 are also valid for applications using the PDM_C output.

6.1 Measuring the PDM_C Output using the cLite™ Software

For this check, the 10-bit ADC of the microcontroller on the SSC CB reads the PDM_C voltage and displays the ratio of the measured output voltage to the supply voltage of the SSC CB (5V). In order to get an accurate reading, the VDD voltage on the cLite™ SSC Evaluation Board must be known (the voltage can be adjusted via the blue potentiometer on the board). Record the voltage into the VDD field in the main window of the cLite™ SSC Evaluation Software.

Follow the instructions in steps 1) through 14) of section 5, and then complete these additional steps.

15) Change the output mode selection in the main menu to PDM_C.

16) Enable PDM_C/PDM_T via the K3/K4 jumpers on the cLite™ SSC Evaluation Board.

17) Click on “Start NOM” and then “Run” to display the output voltage in [%] of the supply voltage.

7 Calculation of Calibration Coefficients Off-Line

Note This calculation is possible without connecting the kit boards to the PC. Raw and target values can copied using the copy and paste function of any spreadsheet program.

Steps for the Off-Line Calibration Coefficient Calculation:

1) Start the cLite™ SSC Evaluation Software.

2) Click on “Calibrate.” The calibration window appears (see Figure 5.1).

3) Select the coefficients for the desired calibration method by highlighting the coefficients in the upper middle section of the calibration window. The smaller graph above the coefficient list indicates the recommended pattern of capacitive sensor readings and temperature readings.

4) For calibrations using a piece-wise correction, check “Piecewise Correction” and set a break point in the “Break Pt” field.

5) Click on “Initialize” in the cLite™ ID section (lower left corner). The “Initialize Calibration” window appears (see Figure 5.2). Click “Browse” and select any *xxx.eep* file stored in the folder *[My Documents]\ZMDI \cLite SSC Evaluation Software*. Click on “Initialize From File.”

   Note: This is a “blind” initialization because no part is connected.

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6) Start data collection. The target and raw values can be written/copied in the related fields. The values are [%] for the capacitance target and raw readings and [°C] for the temperature target and raw readings.

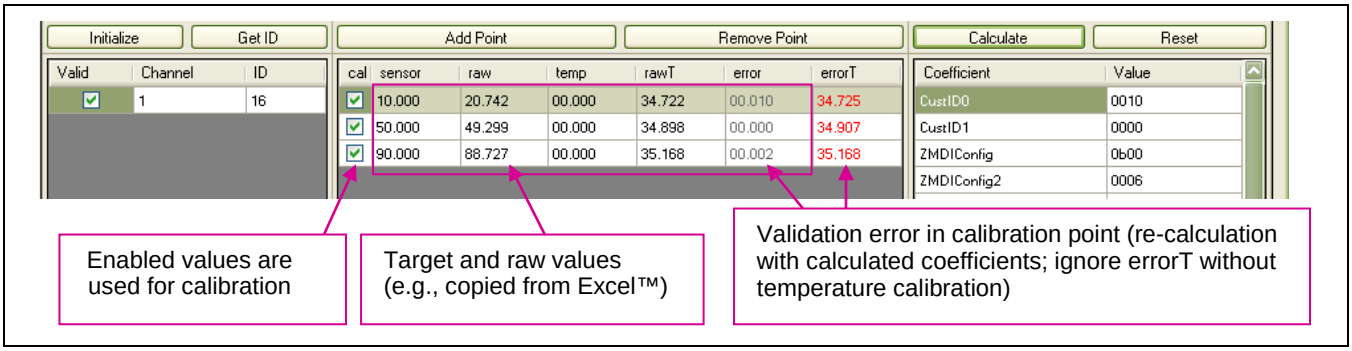
   a) Click on “Add New Point.”

   b) Enter the first target capacitance reading [%] in the “sensor” field and enter the raw value [%] in the “raw” field. For calibration with temperature compensation, also add the chamber temperature in the “temp” field and raw readings in the “rawT” fields.

   c) Repeat a) and b) as needed until all calibration points are entered.

Note: See step 12) in section 5.1 for use of the “Cal” column shown in Figure 7.1.

Figure 7.1 Fields for Manually Entering Target and Raw Values



7) Check the “Valid” check box in the cLite™ ID section, and click on the “Calculate” button. The coefficients are stored in the *CalibrationLog.txt* file.

8) Click the “View Log” button to open this file. For each calibration point, the error for the point is calculated in the same file.

9) The calibration information can be exported to Microsoft Excel™ or to a CSV file by clicking on the “Export” button. (Use the drop-down arrow to switch between Excel™ and CSV file)

Note Instead of entering the raw and target values for the capacitance and temperature target and raw values, the user can transfer these values from an Excel™ file using the copy/paste feature. The number of rows in the Excel™ table must match the number of rows in the software. Ensure that the Excel™ table includes only numbers in the correct format (Category: Number). Copying from formula results is not possible.

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8 cLite™ SSC Evaluation Software with the IDT SSC Terminal

8.1 Protocol

The microcontroller (type ATmega32) on the SSC Communication Board (SSC CB) enables communication with the cLite™ SSC Evaluation Board/ cLite™ using the *cLite™ SSC Evaluation Software* running on the PC. The standard I^{2}C™ protocol is implemented in the microcontroller's software. The USB_UART IC on the SSC CB transfers the signals from the microcontroller to the USB port of the PC.

For more details, see the *SSC Communication Board Data Sheet.*

8.2 IDT SSC Terminal

The IDT SSC Terminal is the lowest level of communication for transferring commands from the PC to the microcontroller on the SSC CB. Refer to the *SSC Communication Board Data Sheet* for instructions for downloading this program from the SSC Evaluation Tools web page on IDT's web site (www.IDT.com/SSC-COMM-BD). A full summary and detailed command description of the applicable controller commands are given in the *SSC Command Syntax Spreadsheet* and the *SSC Communication Board Data Sheet.*

For the cLite™ communication mode, use the setting explained for I^{2}C™ or SPI.

Table 8.1 Character Order for IDT SSC Terminal

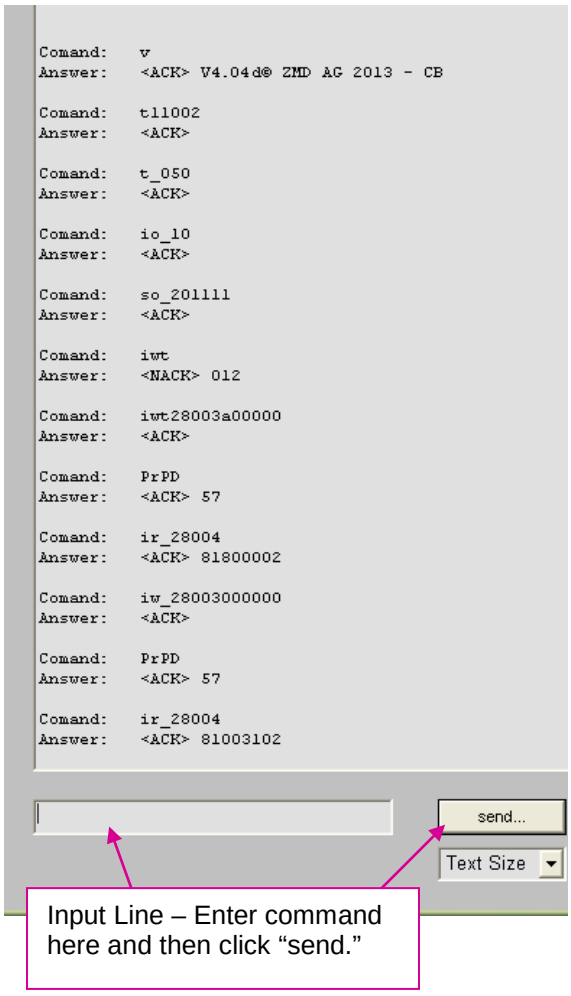
	Character Order					
	1	**2**	**3**	**4,5**	**6,7,8**	**<d…d>**
cLite™	***I***	***R*** or ***W***	***T*** or _			
Comments		Read or Write	Trigger Power Cycle or Not	Slave address) (28_{HEX} default)	Number of Bytes to Read and Write	Blank for Read; Data Bytes to Write
Examples	***I***	***W***	***T***	***28***	***003***	***500000***
	I	***R***	_	***28***	***002***	

Note: If "T" is sent for the 3rd position (instead of "_"), the cLite™ is powered off and then on. "T" should be used only if power cycling is necessary for operation (i.e., "Start Command Mode").

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Figure 8.1 below shows a communication example. Write the command in the input line and press ENTER on the keyboard or click on “Send.”

Figure 8.1 SSC Terminal Program Sample



v	Readout of SSC CB’s firmware version. NOTE: The actual firmware version read might differ from version shown in Figure 8.1.
t11002	Switch on both supplies with 20ms delay between power on and first command.
t_050	Set timing for switch supply off to 50ms off before triggering the SSC.
io_10	Set communication speed to 100kHz.
so_201111	Open SPI interface with specific configuration[††].
iwt	Turn on the SSC board.
iwt28003a00000	Start Command Mode w/ power on using defined delay between power-on and communication start.
PrPD	Read Port D (Ready pin/ PDM_C).
ir_28004	Read 4 bytes (1 status byte and 3 data bytes).
iw_28003000000	I^2C™ Send command 00 0000 to slave address 28_{HEX}. Read EEPROM address 00.
PrPD	Read Port D (Ready pin/ PDM_C).
ir_28004	Read 4 bytes. (1 status byte and 3 data bytes)

Note: The selected command sequence shows how the kit software is programmed. For an EEPROM reading, a data fetch for 3 bytes (ir_28003) reads the status byte and the 2-byte EEPROM contents. The Ready pin high status indicates that new data at the digital interface are ready to fetch.

[††] For more details, refer to the *SSC Command Syntax Spreadsheet.*

9 Pin Configuration and Package – TSSOP14 Samples

The ZSSC3122 and ZSSC3123 are available with production parts in the TSSOP14 package (4.4mm±0.1mm body wide with lead-pitch 0.65mm). The ZSC31210 is available in this package for samples only. The ZSC31210, ZSSC3122, and ZSSC3123 are pin compatible. See the notes in Table 9.2 regarding connection requirements.

Table 9.1 Storage and Soldering Condition

Storage and Soldering TSSOP14						
Parameter	**Symbol**	**Conditions**	**Min**	**Typ.**	**Max**	**Units**
Maximum Storage Temperature	$T_{max_storage}$	Less than 10hrs, before mounting			150	°C
Minimum Storage Temperature	$T_{min_storage}$	At original packing only	-55			°C
Maximum Dry Bake Temperature	$T_{drybake}$	Less than100hrs in summary, before mounting			125	°C
Soldering Peak Temperature	T_{peak}	Less than 30s (IPC/JEDEC-STD-020 Standard)			260	°C

Figure 9.1 ZSC31210, ZSSC3122, and ZSSC3123 cLite™ Pin-Out Diagram – TSSOP14

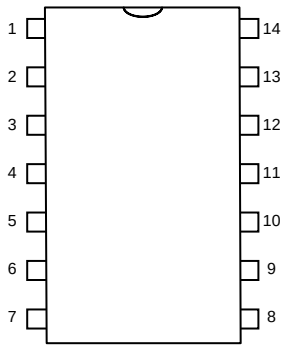


Table 9.2 ZSC31210, ZSSC3122, and ZSSC3123 cLite™ Pin Assignments – TSSOP14

Pin	Name	Description	Notes
1	VCORE	Core voltage	Always connect to an external capacitor to Gnd that is within the specifications given in data sheet section 1.3 for C_{VCORE_SM} and C_{VCORE_UM}. This is the only internal module pin. Refer to section 8 for ESD details.
2	C0	Capacitor input 0	
3	VSS	Ground supply	Connecting to GND for shielding is strongly recommended.
4	CC	Common capacitor input	
5	VSS	Ground supply	Connecting to GND for shielding is strongly recommended.
6	C1	Capacitor input 1	If not used, must be unconnected.
7	VDD	Supply voltage (2.3V to 5.5V for ZSC31210) (1.8V to 5.5V for ZSSC3122 and ZSSC3123)	Must connect to Vsupply.
8	Alarm_Low/ PDM_T	Low alarm output Temperature PDM (see data sheet for details)	If not used, must be unconnected.
9	Alarm_High	High alarm output	If not used, must be unconnected.
10	Ready/ PDM_C	Ready signal (conversion complete output) Capacitance PDM (see data sheet for details)	If not used, must be unconnected.
11	VSS	Ground supply	Must connect to GND.
12	SDA/MISO	I^2C™ data if in I^2C™ Mode Master-In-Slave-Out if in SPI Mode (see Table 3.8)	If not used, must connect to VDD.
13	SCL/SCLK	I^2C™ clock if in I^2C™ Mode Serial clock if in SPI Mode (see data sheet for details)	If not used, must connect to VDD.
14	SS	Slave Select (input) if in SPI Mode (see data sheet for details)	If not used, must be unconnected.

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10 Related Documents

Document
ZSC31210, ZSSC3122, and ZSSC3123 Common Documents
*SSC Communication Board Data Sheet**
*SSC Command Syntax Spreadsheet**
SSC Evaluation Kits Feature Sheet (includes ordering codes)*
*SSC Communication Board Application Note—Driver Installation Instructions**
ZSC31210 cLite™ Data Sheet
ZSSC3122-Specific Documents
ZSSC31222 cLite™ Data Sheet
ZSSC3123-Specific Documents
ZSSC3123 cLite™ Data Sheet

Visit the product page for the ZSC31210, ZSSC3122, or ZSSC3123 on IDT's website www.IDT.com or contact your nearest sales office for the latest version of these documents. Documents marked with an asterisk are available at (www.IDT.com/SSC-COMM-BD).

11 Definitions of Acronyms

Term	Description
ADC	Analog-to-Digital Converter
CM	Command Mode
ECC	Error Checking and Correction Codes
NOM	Normal Operation Mode
SSC CB	SSC Communication Board
SSC	Sensor Signal Conditioner

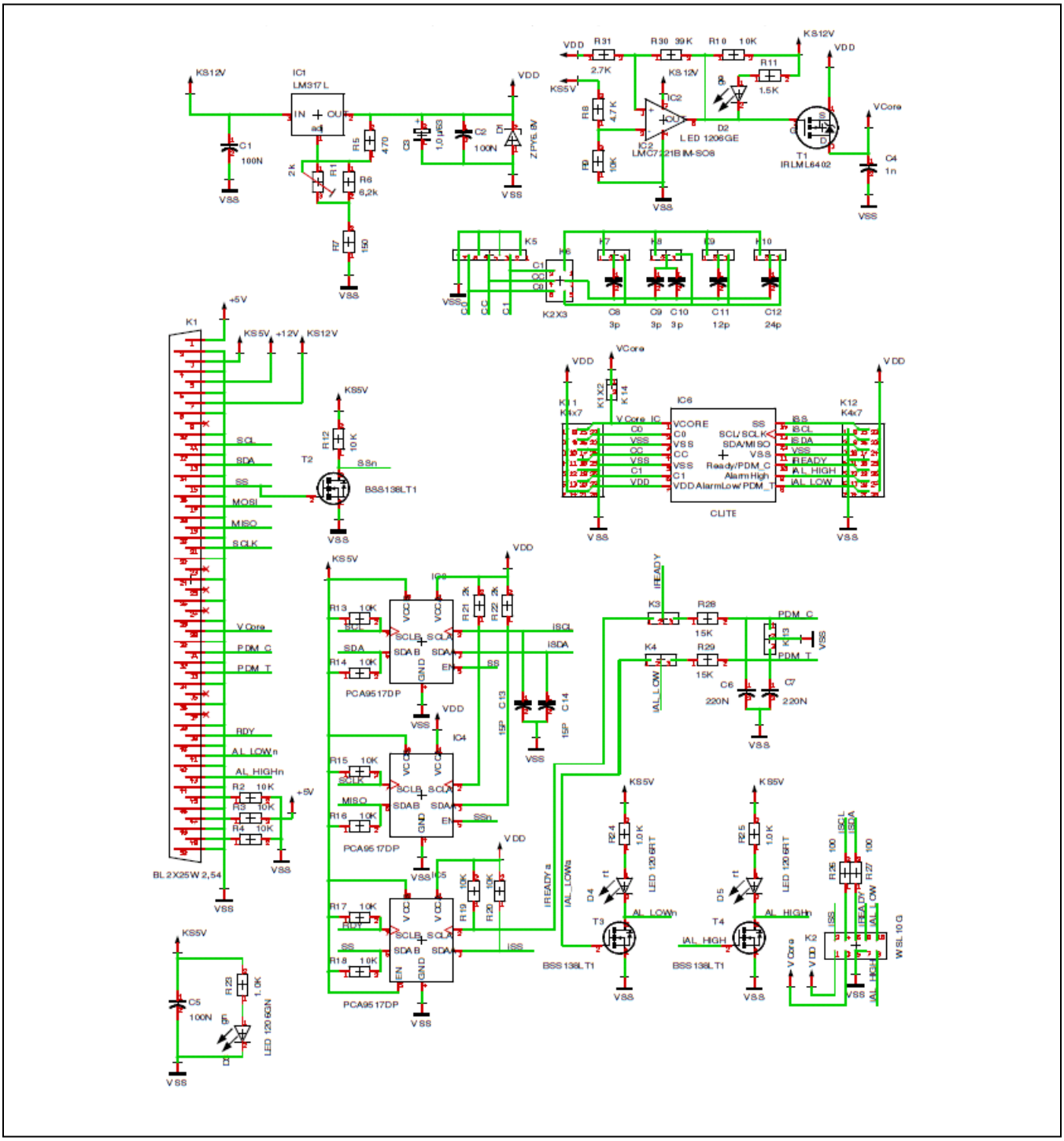
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12 Document Revision History

Revision	Date	Description
1.00	November 11, 2010	First release of document.
1.10	June 30, 2011	Updates for new version of software. Revision to add section 9, which provides the pin assignments for the TSSOP-14 package used for the ZSC31210 samples (TSSOP-14 package is only available as samples with the Evaluation Kit; production parts are only available as die). Revision to Table 9.2 for the V_{CORE} pin. Revision to add the ZSSC3122 and ZSSC3123.
1.20	November 19, 2013	Updates for new version of the software. SSC Communication board was updated to V4.1. Updates to contact information and imagery for cover and header. Minor updates for clarity.
	April 26, 2016	Changed to IDT branding.

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Appendix A: Schematic cLite™ SSC Evaluation Board



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