ISL45041EVAL1Z User's Manual

Application Note   **October 16, 2006**   **AN1275.0**

Description

The ISL45041EVAL1Z is the evaluation board for the ISL45041 I^2C LCD Module Calibrator. All materials of the kit are RoHS compliant. The evaluation kit comes complete with: ISL45041EVAL1Z board, USB to I^2C converter board, USB cable to connect the converter board to a PC, Power and I^2C cables for the ISL45041EVAL board. The Software and related documentation for the eval kit are downloadable from Intersil's website at www.intersil.com.

The USB to I^2C converter board (USB-I2CIO Rev B2) allows the user to adjust and program the ISL45041 V_{COM} voltage using a PC.

This application note will guide the user through the process of installing the USB to I^2C drivers, ISL45041 Graphical User Interface (GUI) and configuring the ISL45041EVAL1Z board for evaluation of the ISL45041.

Additional equipment required are two power supplies, one volt meter and a PC (Windows 98/XP/2000 machine with a standard USB port). The board is designed to operate from an AVDD supply (5V to 18V), and VDD supply (2.5V to 3.6V).

Installing the ISL4504x Software

1. Log on to www.intersil.com/cda/home.

2. In the upper right corner of the webpage, type in ISL45041 in the white box and click search. This will bring you to the product information page. Click on the data sheet link Datasheets, Related Docs & Simulations. Now

click on the Design Model(s) link Intersil ISL4504x I^2C DCP Installer V201.

3. Click on Run. If another screen pops up with the message "The publisher could not be verified. Are you sure you want to run this software?" Click Run. A software setup wizard will appear, click: next, next, next, install. The install will create a directory call "Intersil" in the "C:\Program Files" Windows (All Programs) directory. Then a sub directory called ISL4504x is created in the Intersil directory. All files needed, including an Uninstall program, will be placed there. The USB installation is self-registering. However, should a "New USB Device Detect: screen appear when the USB controller is connected, then select "Have Disk" and browse to the same directory and the application "C:\Program Files\Intersil\ISL4504x" This directory will contain the needed files the USB installer needs."

4. Before initializing the software GUI, you need to connect the hardware. Reference the section titled "Connecting the Hardware" on page 4 and "Warning/Status LEDs" on page 5. Once the hardware is connected, Click Start->All Programs->Intersil->ISL4504x ->ISL4504x (Figure 2) to initialize the software GUI. The user screen will appear as shown in Figure 3. (Note if the USB Contoller is not connected, you will see two message boxes. The first informs of the inability to get device information from the controller. The second message box tells you to click OK then connect the USB controller and re-start the application. Click Start->All Programs->Intersil->ISL4504x -> ISL4504x).
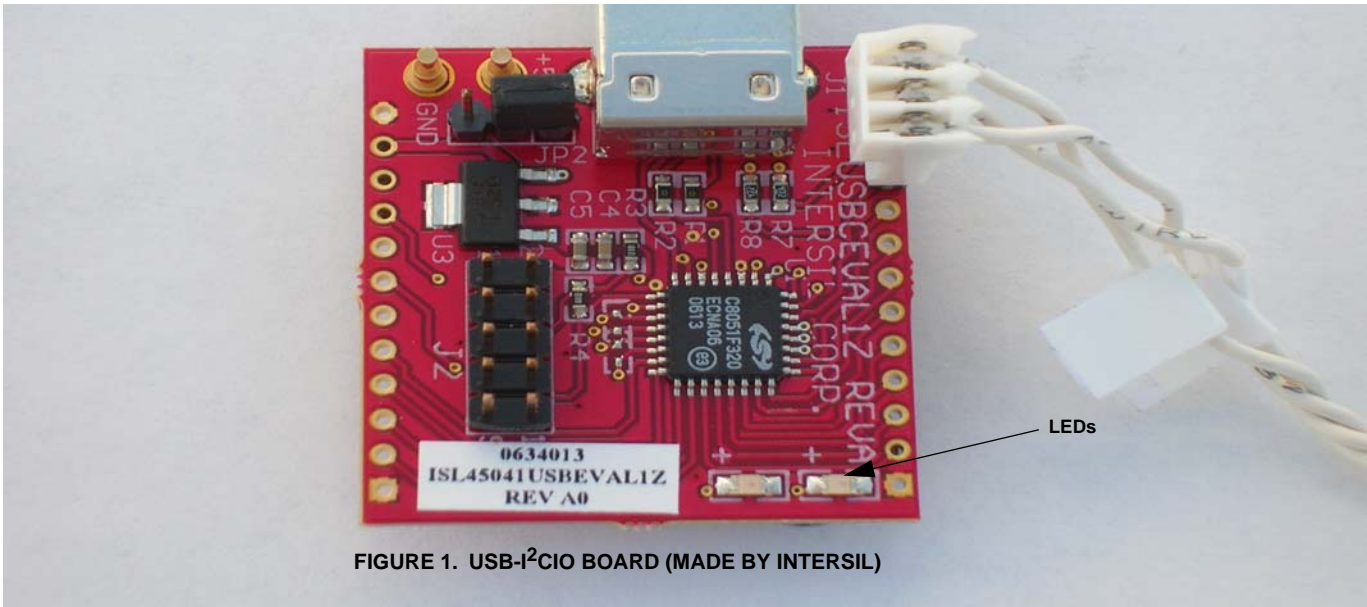

FIGURE 1. USB-I²CIO BOARD (MADE BY INTERSIL)

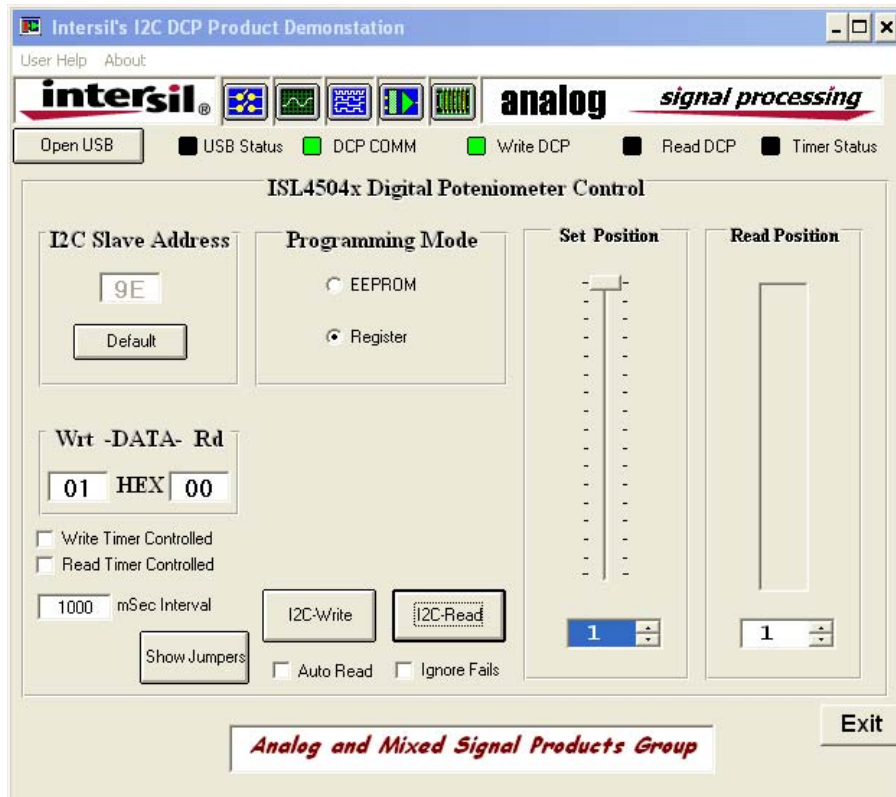FIGURE 2. INSTALLING ISL4504x EVALUATION SOFTWARE
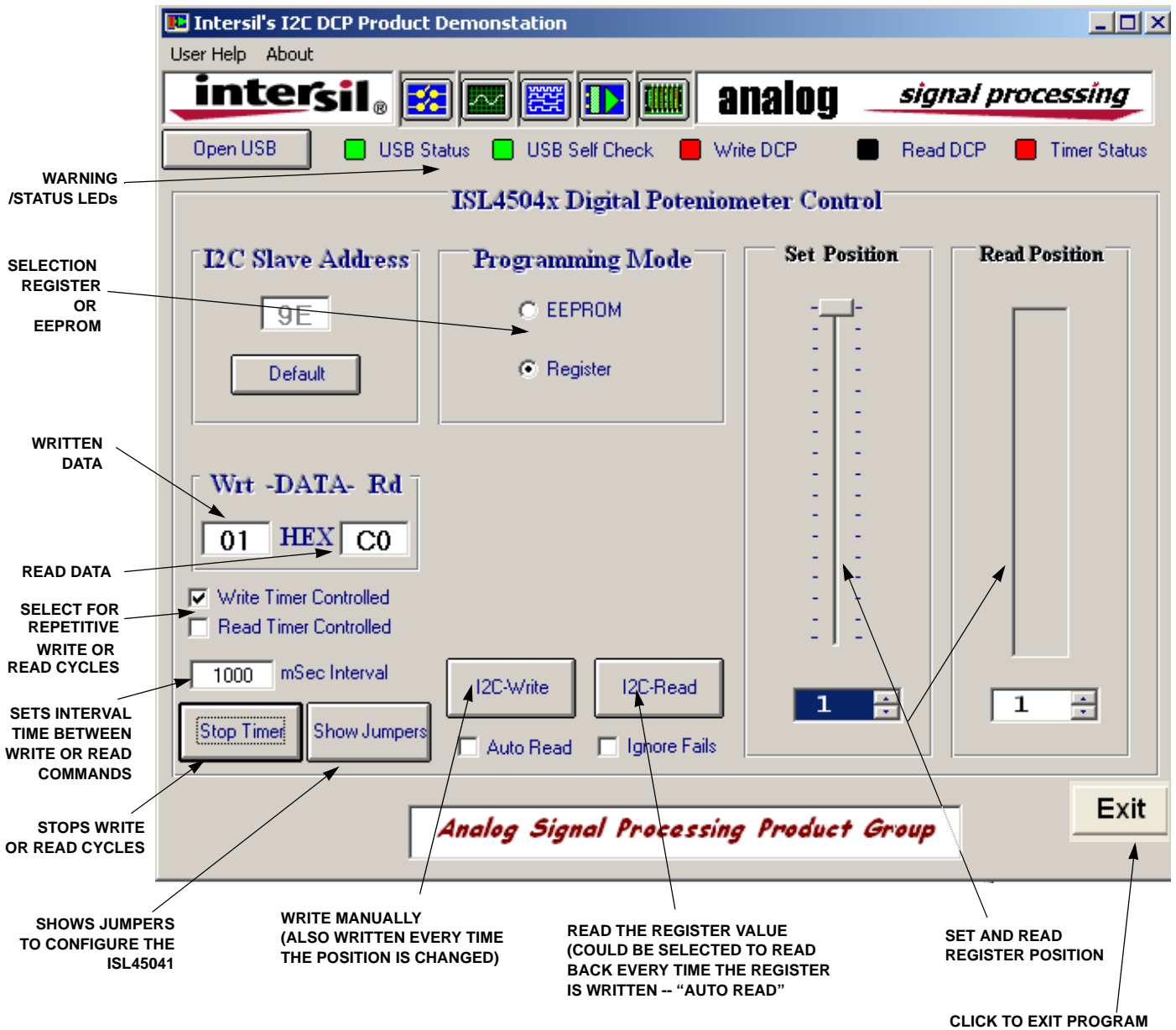

FIGURE 3. GUI SCREEN AT START-UP

FIGURE 4. GUI SCREEN TO PROGRAM ISL45041

Connecting the Hardware

1. Connect the ISL45041EVAL1Z board to the Intersil USB controller board as shown in Figure 5. Note: Connect the I^{2}C cable as shown in Figure 5.

2. Set the VDD power supply (green wire) to 3.0V. Set the AVDD power supply (red wire) to 10.0V.

3. Connect the power supply cable to the ISL45041EVAL1Z board. Note: Connect the power cable as shown in Figure 5. Turn on the power supplies to power up the ISL45041EVAL1Z board (make sure the cables are connected properly -- **RED = AVDD; GREEN = VDD; BLACK = GND**).
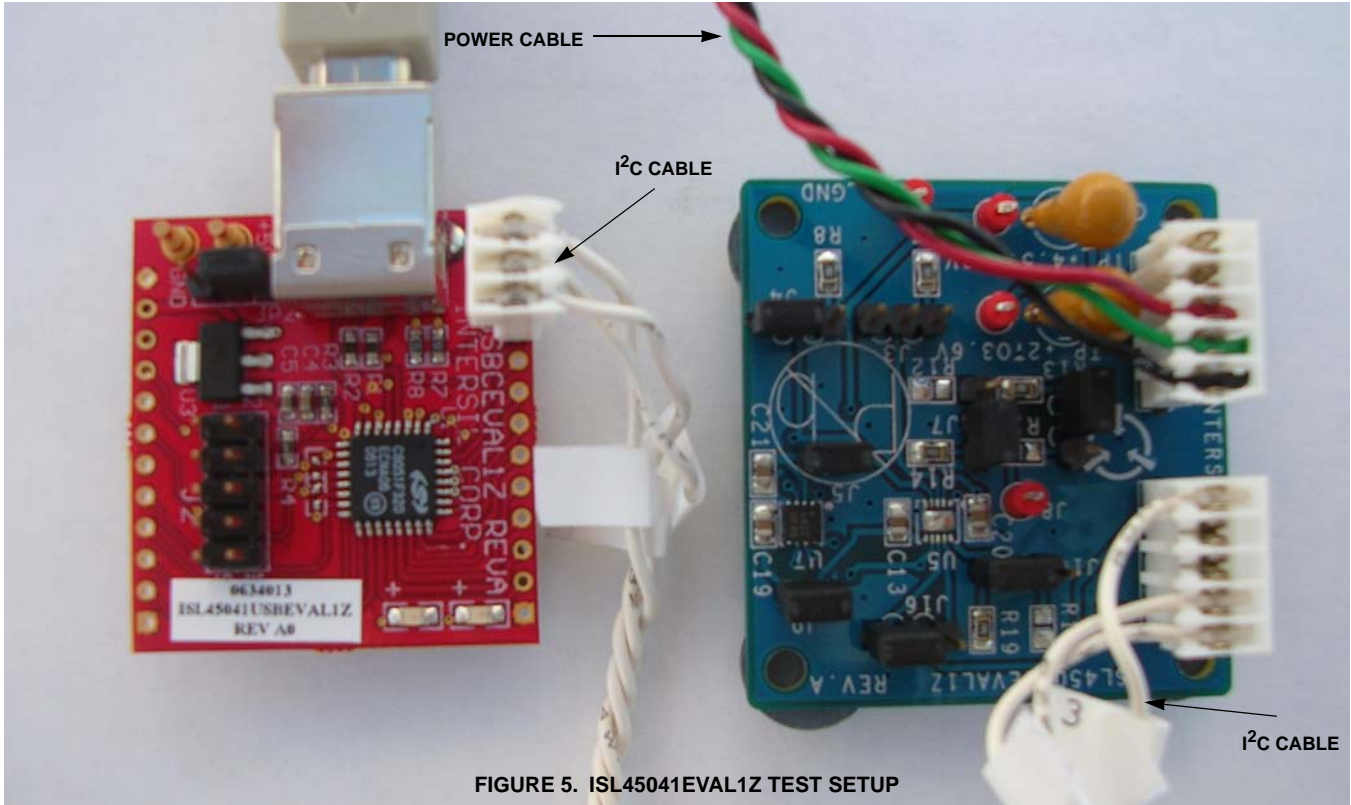

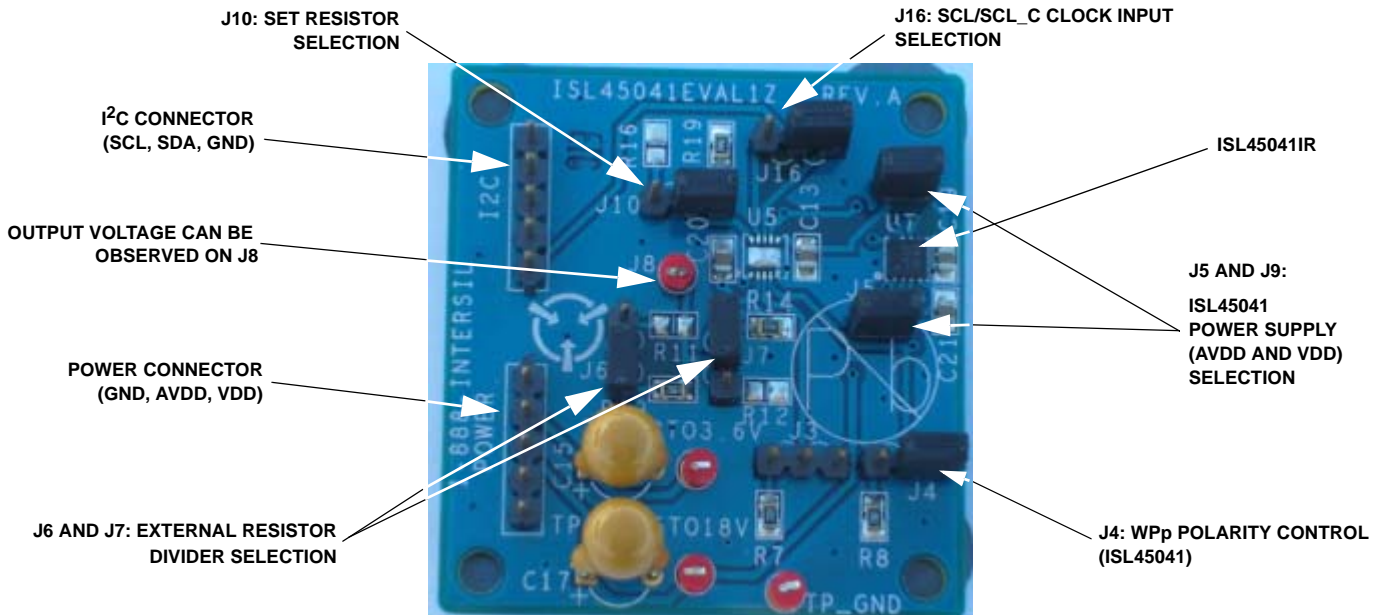**FIGURE 5. ISL45041EVAL1Z TEST SETUP**

FIGURE 6. JUMPER SETTINGS FOR THE ISL45041EVAL1Z BOARD

Warning/Status LEDs

USB Status - Green = Communications with the USB Controller board is working

DCP Comm - Green = I^{2}C Communications between controller and the DCP is working

(Clicking the "**Open USB**" button tests both of these conditions)

Note: (USB communications is opened and closed for each DCP access. The controller may be removed and reconnected between operations. Do not disconnect controller if the Write/Read TImer is running.)

Write DCP - Green/Dark Green = Toggles between colors every time a write to the DCP is performed.

Read DCP - Green/Dark Green = Toggles between colors every time a read from the DCP is performed.

(Both Write and Read LEDs will turn red if an error is detected. The DCP COMM will also turn red if an error is detected.)

Timer Status - Changes color every time a timer controlled Write and/or Read is performed

Configuring the ISL45041EVAL1Z Jumpers

Jumpers

The board is equipped with jumpers to enable the user to adjust the SET current limit and values of output voltage with different values of R1 and R2 (reference schematic in Figure 7). Jumpers not used for the ISL45041 are J3, J6 and J16. These jumpers should be left open.

J4 is used for the Write Protect function test. To be able to program the part, J4 needs to be in the 1-2 position connecting the WP pin to VDD. The WP pin of the ISL45041 has an internal pull-down resistor. If J4 is open or in the 2-3 position (connecting this pin to GND) the part is write protected.

J6 and J7 enable the user to change the external resistor values on the OUT voltage divider. To use the on board resistors (R13, R14) J6 and J7 need to be in the 2-3 position. To customize the output voltage the user can populate R11 and R12 with their desired resistor values and move J6 and J7 to the 1-2 position.

J8 provides a convenient connection to monitor the V$_{COM}$ output voltage.

J10 enables the user to program the output current limit of the part. J10 needs to be in the 2-3 position to use the on board resistor R19. To customize the output current limit the user can populate R16 with their desired resistor value and move J10 to the 1-2 position.

J5 and J9 provide the power to the ISL45041.

You are now ready to adjust the V$_{COM}$ output voltage using the ISL45041EVAL1Z GUI.

Using the GUI to Control the V$_{COM}$ Output Voltage

Expected Output Voltage

The ISL45041 provides an output sink current which lowers the voltage on the external voltage divider (V$_{COM}$ output voltage). Equation 1 and Equation 2 can be used to calculate the output current (IOUT) and output voltage (VOUT) values.

$$IOUT = \frac{Setting}{128} X \frac{AVDD}{20(RSET)} \qquad \text{(EQ. 1)}$$

$$VOUT = \left(\frac{R2}{R1+R2}\right)AVDD\left(1 - \frac{Setting}{128}X\frac{R1}{20(RSET)}\right) \qquad \text{(EQ. 2)}$$

NOTE: Where setting is an integer between 1 and 128.

Table 1 gives the calculated value of VOUT for the eval board using the on board resistors values of: RSET = 24.9k, R1 = 200k, R2 = 243k, and VADD = 10V. Also provided in Table 1 are the HEX values for several settings when writing to either the Register or EEPROM.

TABLE 1.

SETTING VALUE	VOUT	HEX VALUE WRITING TO REGISTER	HEX VALUE WRITING TO EEPROM
1	5.468	01	00
10	5.313	13	12
20	5.141	27	26
30	4.969	3B	3A
40	4.797	4F	4E
50	4.625	63	62
60	4.453	77	76
70	4.281	8B	8A
80	4.109	9F	9E
90	3.936	B3	B2
100	3.764	C7	C6
110	3.592	DB	DA
128	3.282	FF	FE

Controlling the Output V$_{COM}$ Voltage Using the GUI

Figure 4 shows the Graphical User Interface for controlling the ISL45041EVAL1Z board V$_{COM}$ output voltage on jumper J8.

The brief definition of the GUI's application screen follows:

I^{2}C Slave Address

The I^{2}C 8 bit Slave Address for this part is HEX code 9E or 9F. The I^{2}C 7 bit Save Address for this part is HEX code 4F. Note the LSB sets the condition for writing to EEPROM (0) or Register (1). Reference Figure 8.

Wrt - DATA - Rd

The Hex number displayed on the left is the logic string written to the ISL45041. The Hex number displayed on the right is the logic string read from the ISL45041. Once again, the LSB sets the condition for writing to EEPROM (0) or Register (1). This results in the first address being HEX 01 and the last being HEX FF when writing to the Register and 00 and FE when writing to the EEPROM (see Table 2).

Clicking in the box to the left of the "Write Timer Controlled" or the "Read Timer Controlled", will enable the user to select a time interval between Write or Read commands. Once you check the box the Stop Timer tab will appear. This will enable the automatic Write or Read cycle to stop. This feature is handy when evaluating the operation with a scope. For single Write or Read cycles click on the I^2C-Write button or the I^2C-Read button in the middle of the screen.

Programming Mode

Selects either the EEPROM or the Register to write to or read from.

Set Position

This is how you adjust the ISL45041 output V_{COM} voltage. Placing your curser on top of the slide bar, click and hold then drag the mouse to adjust the V_{COM} voltage. When you release the mouse, the new HEX value will appear in the Wrt window.

The window directly below the slide bar shows the set bar position. The true decimal value of the logic code being written is one less than the number shown. This results because the ISL45041 has 128 resistive taps for programming. The digital logic designates 0 to 127 for the possible 128 steps. The slide bar starts at 1 and ends at 128.

Read Position

To read the value of the Register or EEPROM click on the I^2C-Read button in the middle of the screen. This gives a visual representation of the either the EEPROM or Register value.

The window directly below the slide bar shows the bars position read from either the Register or EEPROM. The true decimal value of the logic code being read is one less than the number shown, for the same reason as above.

Click on the auto read box in the bottom middle of the screen to automatically read any value selected.

I^2C Timing Diagram

Figure 8 shows the I^2C timing diagram and expected scope photos of SCL and SDA when writing all zeros or all ones.

ISL45041EVAL1Z Bill of Materials

TABLE 2. ISL45041EVAL1 BOM

PART NUMBER	REF. DES.	QTY	VALUE	TOLERANCE	POWER	PACKAGE	JEDEC	MANUF.	DESCRIPTION
H1046-00104-25V20	C13, C19-21	4	0.1µF	20%		SMD-10%	SM0805	Kemet	Multilayer Cap
T353K106K050AS	C15, C17	2	10µF	10%		Radial-10%	TANT-200	Kemet	Tantulum Cap
5000	TP	4				SIP	CONN-GEN	Keystone	Mini Test Point
68000-236-1X3	J3-4 , J6-7, J10, J16	4				1X3		Berg/FCI	Connector/Header
68000-236-1X5	Power, I^2C	2				1X5		Berg/FCI	Connector/Header
69190-202	J5, J9	2				1X2		Berg/FCI	Connector/Header
H2512-01002-1/10W1-T	R7-8	2	10k	1%	1/10W	SMD-1%	SM0805	Generic	TFC Resistor
H2512-02003-1/10W1-T	R13	1	200k	1%	1/10W	SMD-1%	SM0805	Generic	TFC Resistor
H2512-02433-1/10W1-T	R14	1	243k	1%	1/10W	SMD-1%	SM0805	Generic	TFC Resistor
H2512-02492-1/10W1-T	R19	1	24.9k	1%	1/10W	SMD-1%	SM0805	Generic	TFC Resistor
ISL45041IR	U7	1				TDFN	8DFN-3X3A	Intersil	V_{COM}
Three Twisted Wire		1	1'			Red, Green, Black			
Male Banana Jack	+10V, +3V, GND	3				Red, Green, Black			

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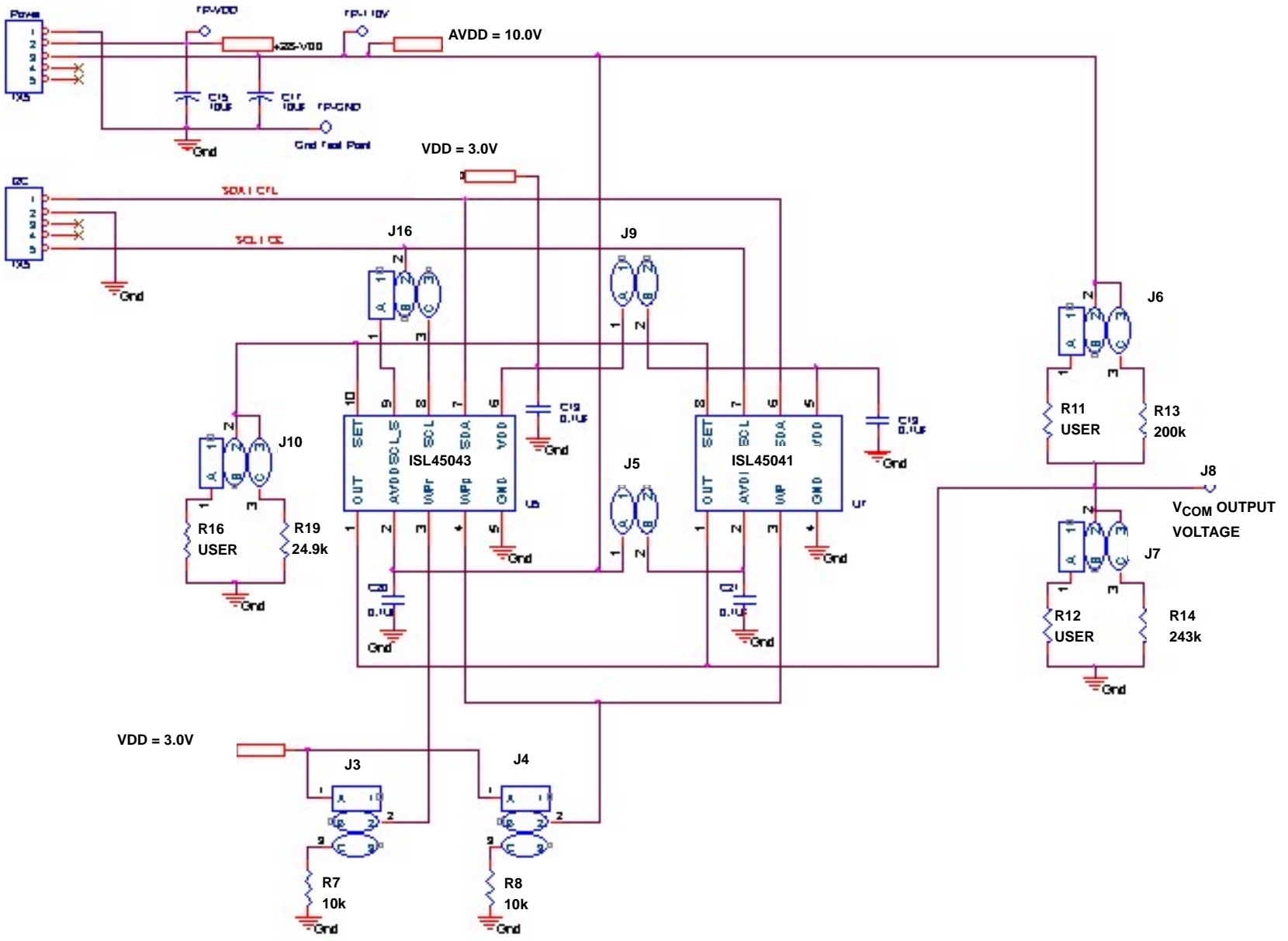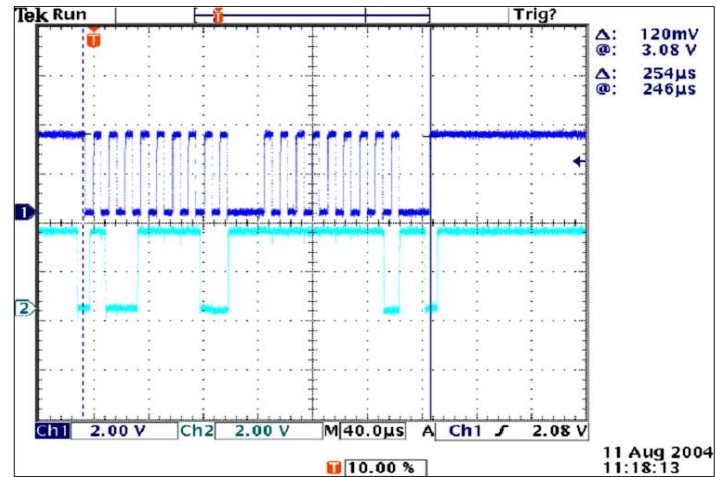
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FIGURE 7. ISL45041EVAL1Z SCHEMATIC

I²C Diagrams

intersil®

7 BIT ADDRESS   4   F

8 BIT ADDRESS   9   E   **0 TO WRITE TO EEPROM**

Start				I2C Slave Address				R/W	ACK				Data				Program	ACK	STOP
	1	0	0	1	1	1	1	R/W	ACK	D6	D5	D4	D3	D2	D1	D0	P		

SCL

SDA   A6   A5   A4   A3   A2   A1   A0   R/W   A   D6   D5   D4   D3   D2   D1   D0   P   Ack

An SDA transition from high to low while SCL is high signals a "Start" condition.

During Slave Address Transmission, IC2 Master designates operation to be a read or write operation.

During Slave Address Transmission, the addressed slave must drive the SDA low during the ACK time. If no Ack is receive, Master will abort and Retry.

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When Read operation, P is don't care
P = 1 : Register writing
P = 0 : EEPROM writing (program)
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An SDA transition from low to high while SCL is high signals a "Stop" condition.

Writing data = 00 to slave 4F (9E)

Writing data = FF to slave 4F (9E)

FIGURE 8. ISL45041EVAL1Z TIMING DIAGRAM

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