Application Note   **September 12, 2005**   **AN1207.0**

Description

The ISL45041EVAL1 is the evaluation board for the ISL45041 I^2C LCD Module Calibrator. The evaluation kit comes complete with: ISL45041EVAL 1 board, DeVaSys 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 and Software for both boards.

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. For any help with the USB-I2CIO board please contact the manufacturer at http://www.devasys.com/usbi2cio.htm.

This application note will guide the user through the process of installing the USB to I^2C drivers, installing the ISL45041 Graphical User Interface (GUI) and configuring the ISL45041EVAL1 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-18V), and VDD supply (2.5V-3.6V).

Installing the USB to I^2C Drivers

USB-I2CIO Board Driver Installation

1. The evaluation kit comes with a CD containing the software and drivers to control the I^2C bus. Create a folder on your C drive called I2C_DCP and copy the contents of the CD to this folder.

2. After the files are copied, connect the USB cable to the USB port of a PC (it will power up the board).

3. Windows should detect the new USB device and the "Found New Hardware Wizard" should begin (as shown in Figure 2). This will help you install the drivers. Follow the directions on the screen until it asks you where to search for the drivers. At this point, you should select the "Search for a suitable driver for my device (recommended)" option and browse to the C:\I2C_DCP folder created in step one and select the drivers folder (.INF file).

4. Follow the remaining directions and the driver should be installed and the USB-I2CIO detected by your PC. Click finish.

5. Once the drivers are installed and the USB cable connected between the DeVaSys (USB-I2CIO) board and the PC, both LED's on the board should be on (See Figure 1).

Installing the ISL45041EVAL1 GUI

1. Open directory (C:\I2C_DCP), the one generated in the previous step.

2. Launch the "Intersil_IC2_DCP_ISL45041Eval.exe" File (as shown in Figure 2). When the first screen appears, click on the "Open USB" tab (as shown in Figure 3).

3. If the communication is established, the window should look like Figure 4 after clicking on the Open USB tab. In case of failed communication, the warning window will appear.
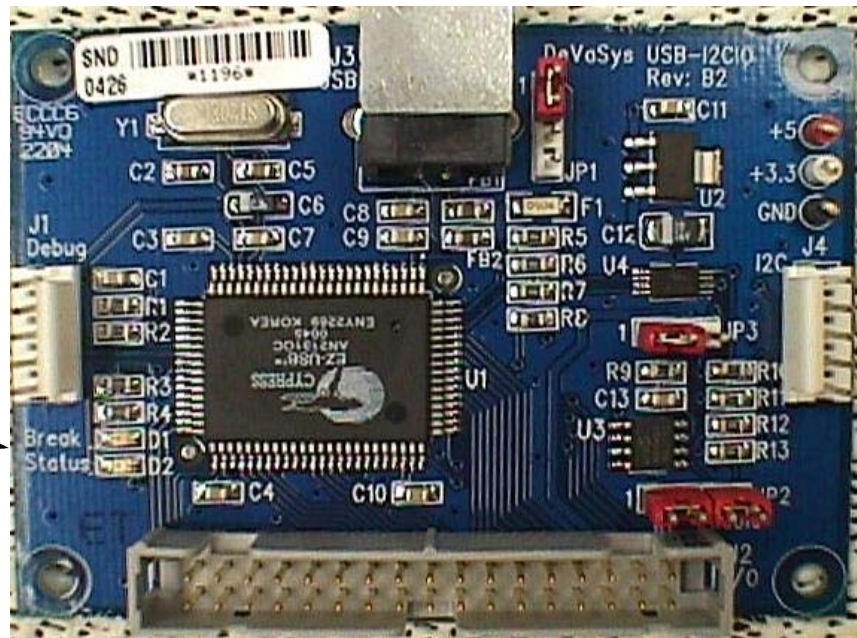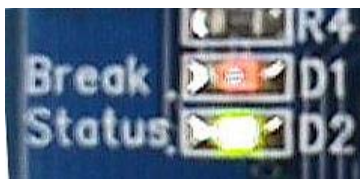

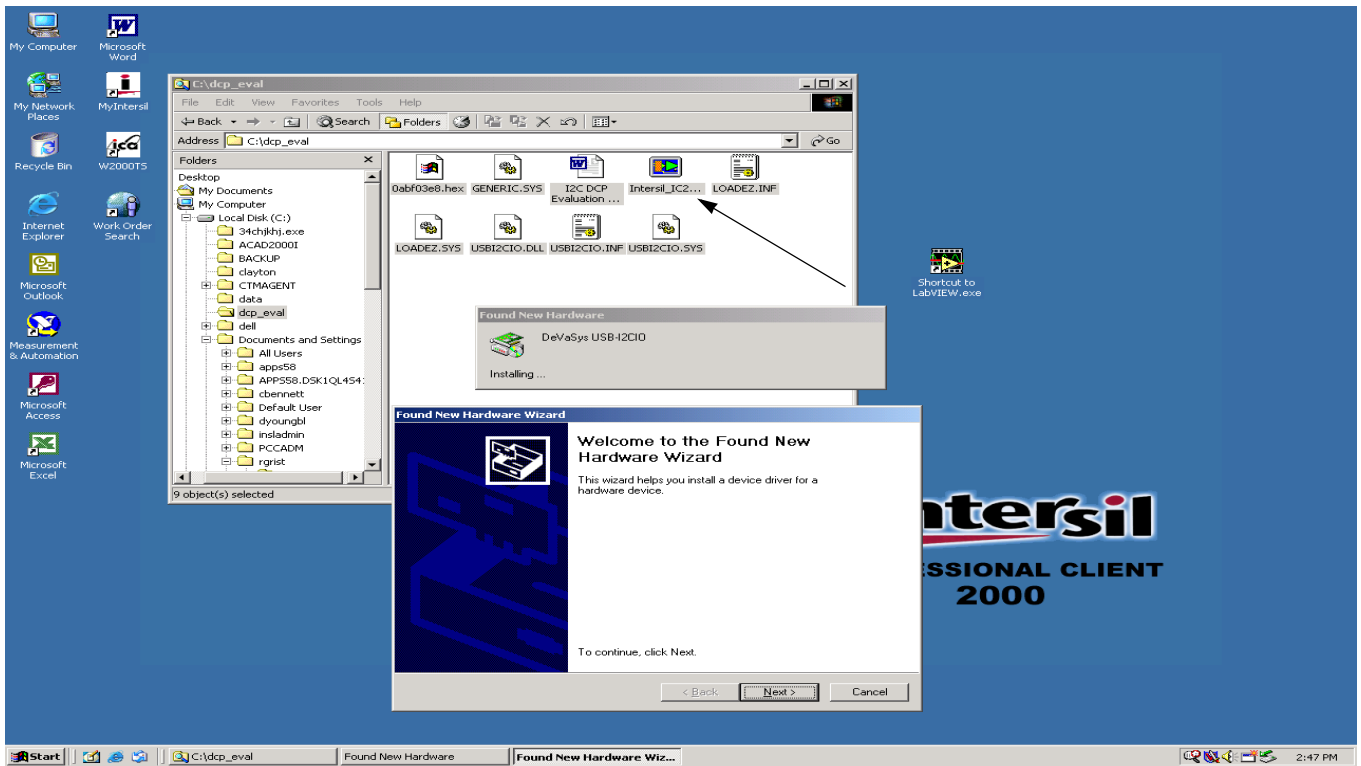**FIGURE 1. USB-I^2CIO BOARD (MADE BY DeVaSys)**

FIGURE 2. INSTALLING DeVaSys DRIVERS

FIGURE 3. GUI SCREEN AT START-UP

WARNING SIGNALS

SELECTION REGISTER OR EEPROM

WRITTEN DATA

READ DATA

SELECT FOR REPETITIVE WRITE OR READ CYCLES

SETS INTERVAL TIME BETWEEN WRITE OR READ COMMANDS

STOPS WRITE OR READ CYCLES

SHOWS JUMPERS TO CONFIGURE THE ISL45041

WRITE MANUALLY (ALSO WRITTEN EVERY TIME THE POSITION IS CHANGED)

READ THE REGISTER VALUE (COULD BE SELECTED TO READ BACK EVERY TIME THE REGISTER IS WRITTEN -- "AUTO READ"
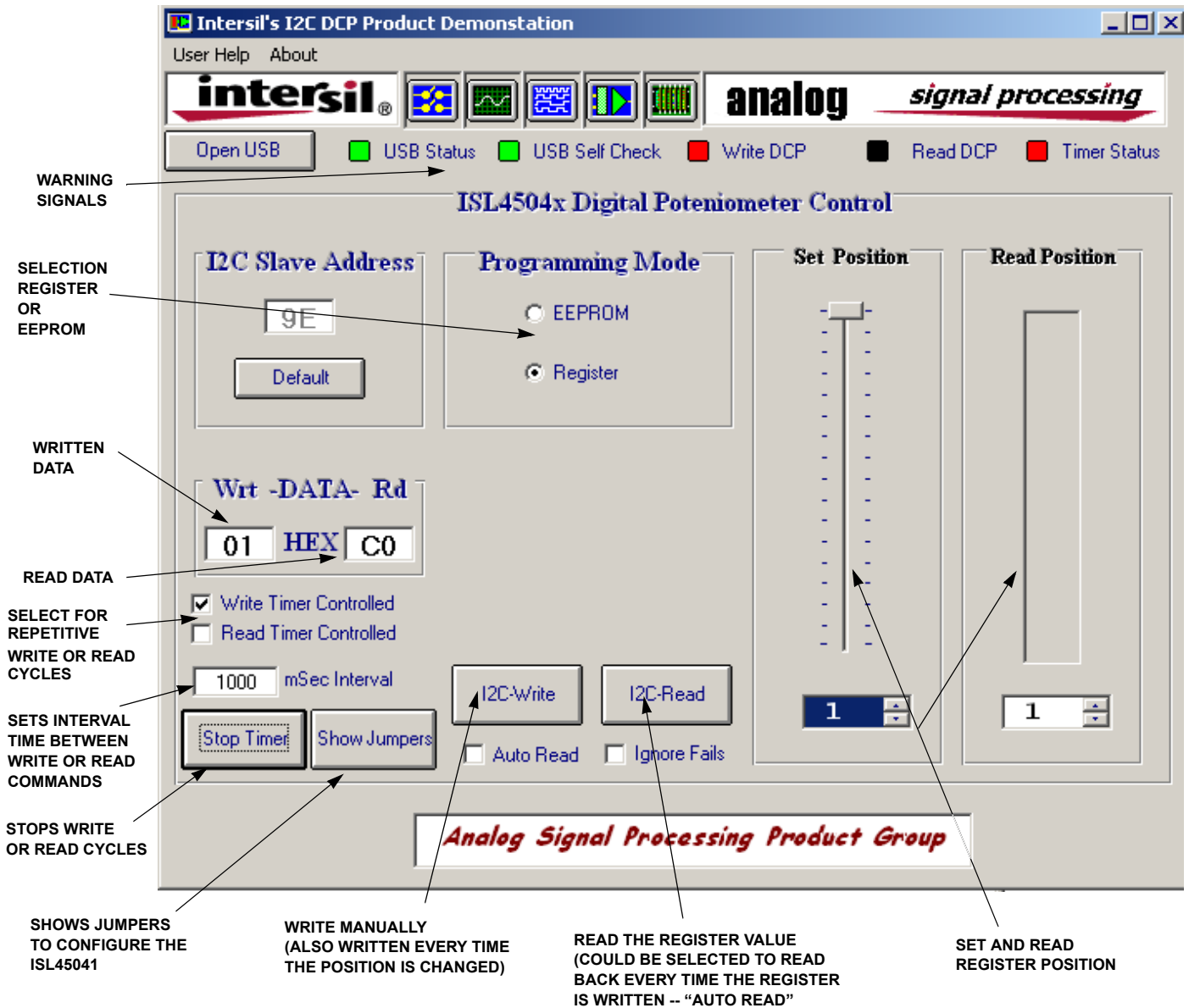
SET AND READ REGISTER POSITION

FIGURE 4. GUI SCREEN TO PROGRAM ISL45041

Connecting the Hardware

1. Connect the ISL45041EVAL1 board to the DeVaSys 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 ISL45041EVAL1 board. Note: Connect the power cable as shown in Figure 5. Turn on the power supplies to power up the ISL45041EVAL1 board (make sure the cables are connected properly -- **RED = AVDD; GREEN = VDD; BLACK = GND**).
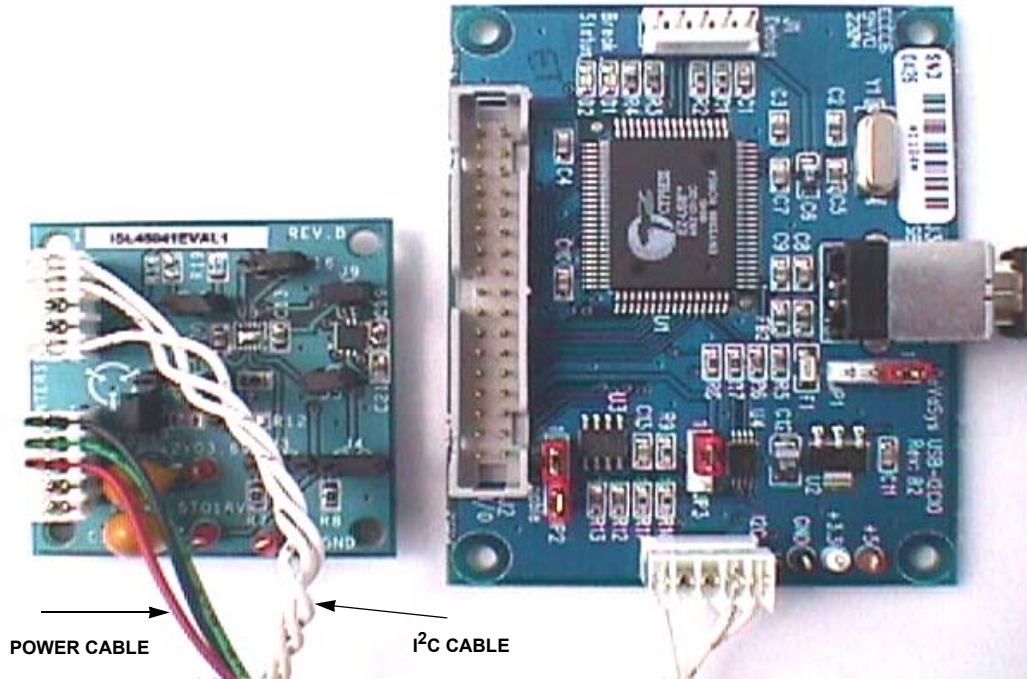
POWER CABLE

I^{2}C CABLE

FIGURE 5. ISL45041EVAL1 TEST SETUP

J10: SET RESISTOR SELECTION

J16: SCL/SCL_C CLOCK INPUT SELECTION

I^{2}C CONNECTOR (SCL, SDA, GND)

ISL45041IR

OUTPUT VOLTAGE CAN BE OBSERVED ON J8

J5 AND J9:

ISL45041 POWER SUPPLY (AVDD AND VDD) SELECTION

POWER CONNECTOR (GND, AVDD, VDD)

J6 AND J7: EXTERNAL RESISTOR DIVIDER SELECTION

ISL45043 SOCKET
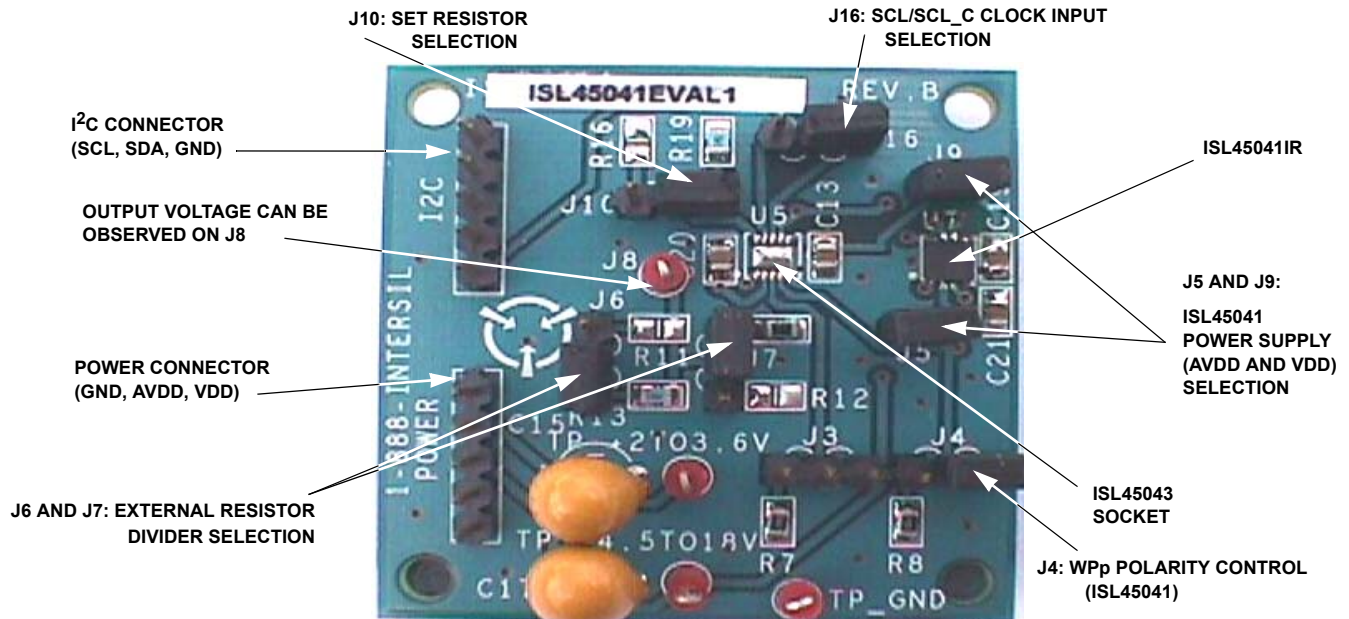
J4: WPp POLARITY CONTROL (ISL45041)

FIGURE 6. JUMPER SETTINGS FOR THE ISL45041EVAL1 BOARD

Configuring the ISL45041EVAL1 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 ISL45041EVAL1 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 ISL45041EVAL1 board V_{COM} output voltage on jumper J8.

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

I^2C Slave Address

The I^2C 8 bit Slave Address for this part is HEX code 9E or 9F. The I^2C 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 right 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.

ISL45041EVAL1 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 Capacitor
T353K106K050AS	C15, C17	2	10µF	10%		Radial-10%	TANT-200	Kemet	Tantulum Capacitor
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			
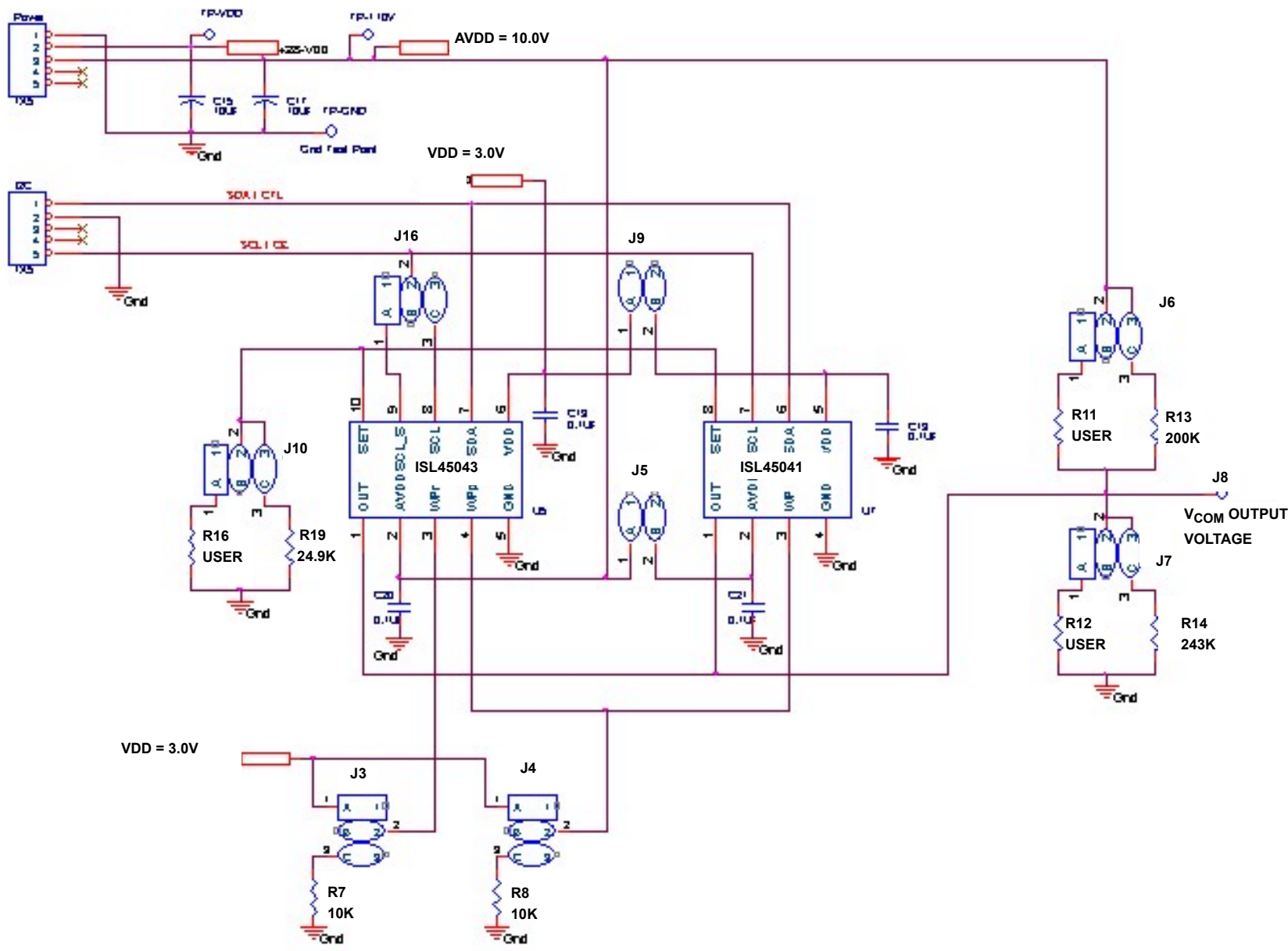
FIGURE 7. ISL45041EVAL1 SCHEMATIC

Application Note 1207

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7 BIT ADDRESS   4   F

8 BIT ADDRESS   9   E

0 TO WRITE TO EEPROM

Start	I2C Slave Address			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.

When Read operation, P is don't care
P = 1 : Register writing
P = 0 : EEPROM writing (program)

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

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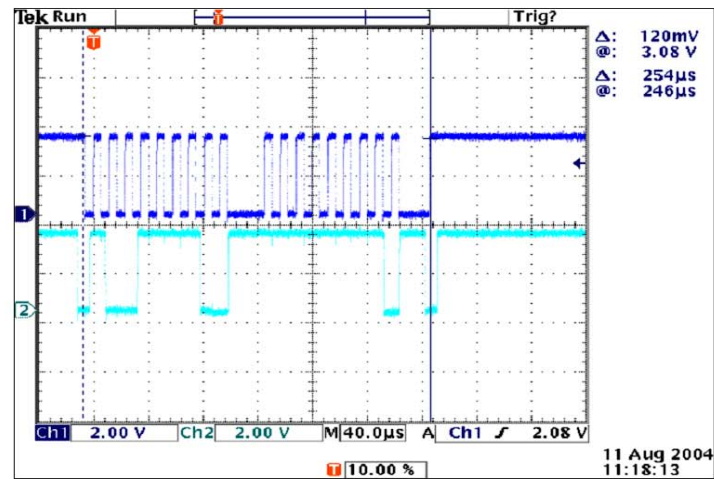
Writing data = FF to slave 4F (9E)

FIGURE 8. ISL45041EVAL1 TIMING DIAGRAM

For information regarding Intersil Corporation and its products, see www.intersil.com