



LMH6586 32X16 Analog Video Crosspoint Switch

Device Revision 2.0
PCB Revision 2.0
Software Application Version 1.0

Evaluation Board and Software User Guide Rev. 1.0

1. LMH6586 Evaluation Board User Guide

The LMH6586 evaluation board is designed by National Semiconductor to demonstrate the performance of the LMH6586 32X16 video Crosspoint switch. The board provides BNC connectors for all 32 inputs and 16 outputs, potentiometers to adjust the clamp reference voltage and the sync detect threshold voltage. On-board jumpers allow the user to control the gain setting for the LMH6586 and to define logic inputs for device reset, power save and device address.

Refer to the Evaluation Board Schematic, Layout, and Bill of Materials sections, as well as the documents listed in the References section at the end of this user guide.

2. Evaluation Board Setup

2.1 USB Board

A USB board, also designed by National Semiconductor, plugs into the evaluation board providing a graphical user interface (GUI) with a PC to program the LMH6586's internal registers via I²C protocol. The block diagram shows the connections between the PC, USB board, and LMH1982 demo board. I²C data transfer is indicated when the two LED's *D36 (RED)* and *D35 (GREEN)* are on.

2.2 Power Supplies

The evaluation board requires a 5V power supply and a ground connection to power the device.

2.3 Video Inputs and Outputs

The evaluation board is populated with 32 BNC connectors for all the 32 inputs from VIN0 – VIN31 and 16 BNC connectors for all the 16 outputs from OUT0 – OUT15. There is an additional BNC connector coming from OUT16 of the LMH6586 which can be given to an external sync separator such as the LMH1980.

The inputs to the LMH6586 are AC coupled through a 0.01uF capacitor. Since the inputs are AC coupled, the CLAMP EN jumper (*JP4*) should be shorted to enable the clamp

voltage for DC restoration. The LMH6586 can accept input video signals in the range of 0V to 1.5V. The input circuit for each input is shown below.

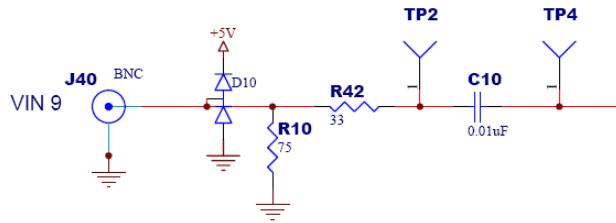


Figure 2: Input Circuit Schematic

The LMH6586 can provide output signals in the range of 0V to 3V depending on the gain setting determined by the GAIN jumper (JP3). The output circuit for each output is shown below.

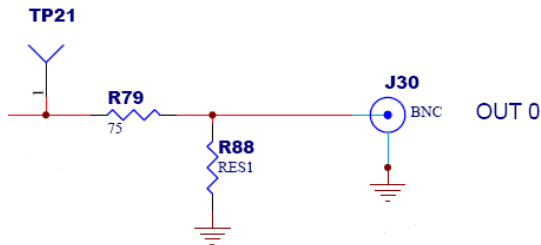


Figure 3: Output Circuit Schematic

2.4 Jumper Settings

| JUMPER | POSITION | FUNCTION |
|--------|----------|---------------------------------------|
| JP1 | OPEN | DVDD not connected to +5V |
| | SHORTED | DVDD connected to external +5V supply |
| JP2 | OPEN | LMH6586 is active |
| | SHORTED | LMH6586 is in power save mode |
| JP3 | OPEN | LMH6586 gain is set to 1V/V |
| | SHORTED | LMH6586 gain is set to 2V/V |
| JP4 | OPEN | Clamp is disabled |
| | SHORTED | Clamp is enabled |
| JP5 | OPEN | LMH6586 is active |
| | SHORTED | LMH6586 is reset |

Table 1: Jumper Settings

| JP7 (ADDR SEL 1) | JP6 (ADDR SEL 0) | FUNCTION |
|------------------|------------------|--------------------------|
| OPEN | OPEN | Device address set to 00 |
| OPEN | SHORTED | Device address set to 01 |
| SHORTED | OPEN | Device address set to 10 |
| SHORTED | SHORTED | Device address set to 11 |

Table 2: Device Address Jumper Settings

2.4.1 Clamp Enable Feature

When jumper JP4 is shorted the clamp enable feature of the LMH6586 is enabled. Since the inputs to the LMH6586 are AC coupled, DC restoration is required. This is set up using the clamp enable feature. The clamp enable feature clamps the sync tip of the input signal to the set level. The clamp voltage is set at the VCLAMP pin (*PIN 66*) using potentiometer *R73*. The clamp voltage can be measured at *TP36*. For optimum performance the clamp voltage should be fixed at 0.3V.

The clamp enable circuit is shown below.

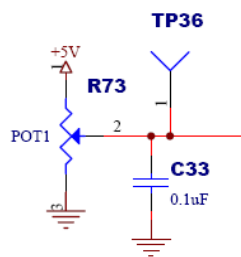


Figure 4: Clamp Enable Circuit

2.5 Video Detect

The LMH6586 can be setup to detect the presence or absence of video on each input by setting the appropriate bits in the video detect enable register and the video detect invert register for the respective inputs. The video detect threshold can be adjusted to eight different levels with a 3 bit programmable register. Each of the 32 video input channels can be configured individually to detect video or the loss of video using the accompanying software provided. The software is also used to set up the appropriate video detect threshold level.

The default video detect level at power on is blacker than black. So at power on the video detect level should be adjusted to a suitable value.

2.6 Sync Detect

The LMH6586 can be setup to detect the loss of sync by setting the appropriate bits in the sync detect enable register for the respective inputs. The sync detect threshold level is adjusted using the potentiometer *R120* connected to the SSR pin (*PIN 65*). The sync

detect threshold voltage can be measured at *TP84*. For optimum performance the sync detect threshold voltage should be adjusted to 0.35V.

The sync detect threshold circuit is shown below.

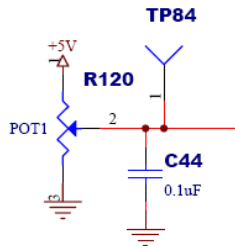


Figure 5: Sync Detect Threshold Circuit

2.7 External Video Detect FLAG

When there is a loss of sync or video (or a presence of video, depending on the setting of the respective bits in the video detect invert register) on any one of the 32 inputs, an external flag (*PIN 75*) is asserted and the two color video detect LED *D34* glows red. Under normal operation *D34* is green.

The video detect flag circuit is shown below.

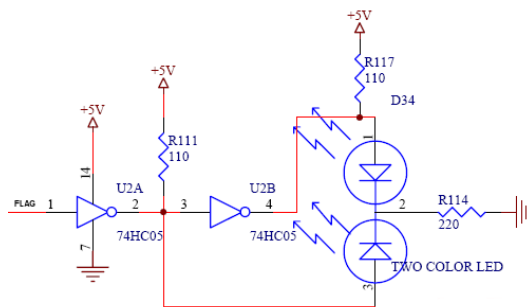


Figure 6: Video Detect FLAG Circuit

2.8 Individual Channel Power Save

Each input and each output channel of the LMH6586 can be individually placed in power save mode by programming the appropriate bits in the registers 0x18h – 0x1Bh for the inputs and the registers 0x1Eh – 0x1Fh for the outputs. The accompanying software is used for this programming.

2.9 LMH6586 Evaluation Board Schematic

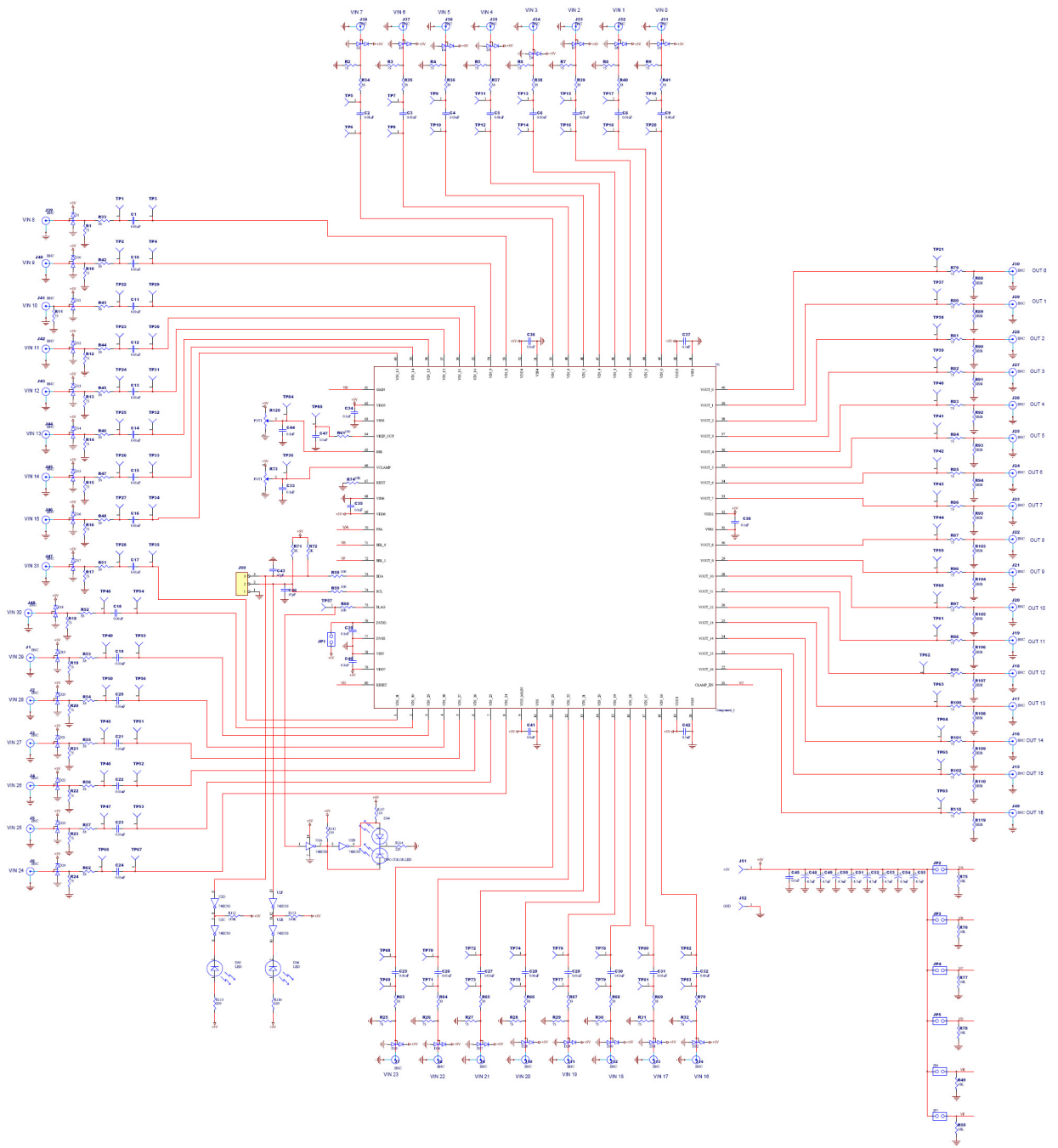


Figure 7: LMH6586 Board Schematic

2.10 LMH6586 Evaluation Board Layout

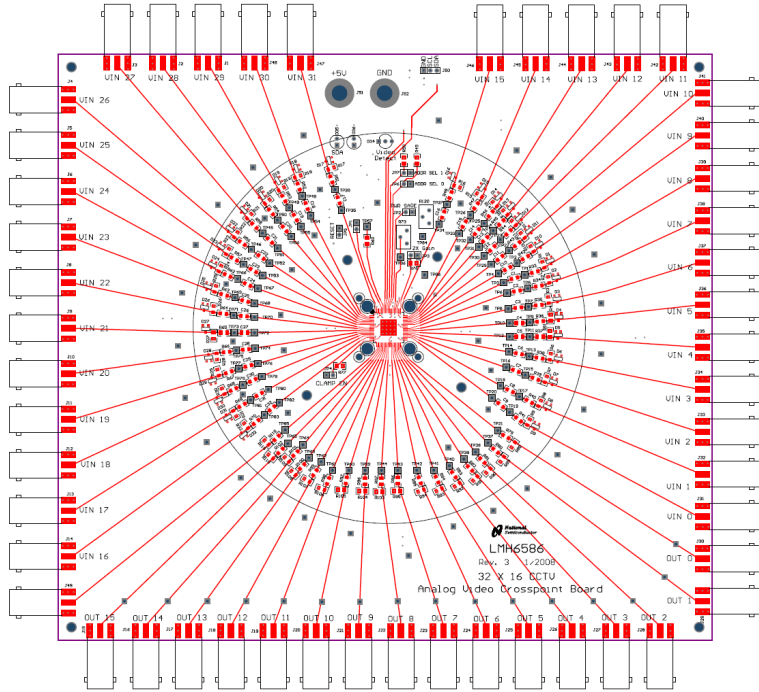


Figure 8: LMH6586 Layout Top Layer

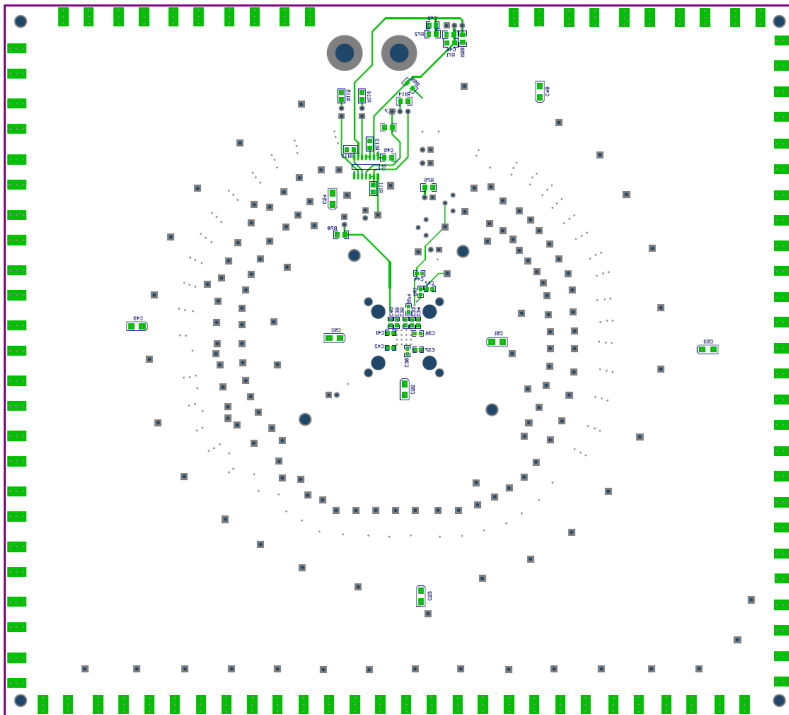


Figure 9: LMH6586 Board Layout Bottom Layer

2.11 LMH6586 Evaluation Board Bill of Materials

| Part Type | Part Designator | QTY | PART # |
|----------------------------------|---------------------------------|-----|---------------------------------|
| RED BANANA | J51 | 1 | 79K4950 |
| BLACK BANANA | J52 | 1 | 79K4944 |
| CAPACITOR, 100nF, X7R, 25V, 0805 | C45 | 1 | PCC1828CT-ND |
| CAPACITOR, 100nF, X7R, 25V, 0603 | C33-42, C44, C47 | 12 | PCC2277CT-ND |
| CAPACITOR, 10nF, X7R, 25V, 0603 | C1-C32 | 32 | PCC1763CT-ND |
| RESISTOR, 2K, 1%, 0805 | R71, R72 | 2 | P2.00KCCT-ND |
| CAPACITOR, 4.7uF, TANT, SIZE A | C48-C55 | 8 | 495-2197-1-ND |
| RESISTOR, 10K, 1%, 0603 | R74 | 1 | RHM10.0KHCT-ND |
| RESISTOR, 10K, 1%, 0805 | R49, R50, R75-R78 | 6 | P10.0KCCT-ND |
| RESISTOR, 33ohm, 1%, 0805 | R34-R48, R51-R57, R62-R70 | 32 | P33.0CCT-ND |
| CAPACITOR, 47pF, NPO, 50V, 0805 | C43, C46 | 2 | PCC470CGCT-ND |
| 74HC05 | U2 | 1 | 296-1190-5-ND |
| RESISTOR, 75, 1%, 0805 | R1-R32, R79-R87, R96-R102, R118 | 49 | P75.0CCT-ND |
| RESISTOR, 100, 1%, 0603 | R61 | 1 | P100HCT-ND |
| RESISTOR, 100, 1%, 0805 | R58-R60 | 3 | P100CCT-ND |
| RESISTOR, 110, 1%, 0805 | R111, R117 | 2 | P110CCT-ND |
| RESISTOR, 110K, 1%, 0805 | R112, R113 | 2 | P110KCCT-ND |
| RESISTOR, 220, 1%, 0805 | R114-R116 | 3 | P220CCT-ND |
| EDGE MOUNT BNC | J1-J49 | 49 | 22C4690 |
| LMH6586 | U1 | 1 | MMBD4148SECT-ND |
| MMBD4148SE | D1- D32 | 32 | ND |
| 3 PIN HEADER | J50 | 1 | WM6503-ND |
| 2 PIN HEADER | JP1-JP7 | 7 | WM6502-ND |
| RED LED | D35 | 1 | P559-ND |
| GREEN LED | D36 | 1 | P560-ND |
| 5K POT | R73, R120 | 2 | 3299Y-502LF-ND |
| NOT STUFFED | R93, R107, R108 | 3 | |

3. Graphical User Interface (GUI) Software User Guide

The LMH6586 software application was designed by National Semiconductor (NSC) to support the evaluation of the LMH6586. The application runs on a PC and uses a graphical user interface (GUI) to facilitate programming of the LMH6586 features.

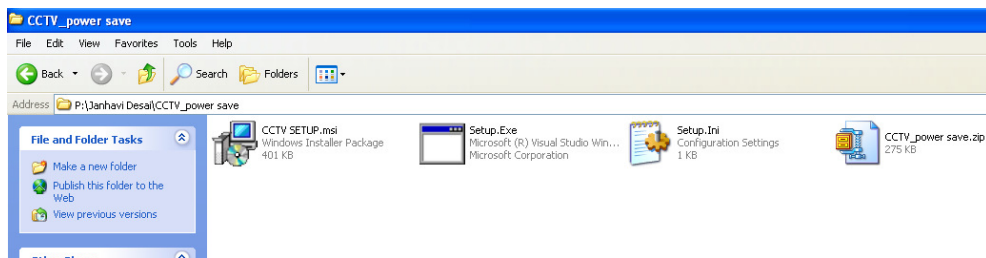
Refer to the LMH6586 datasheet for more information about the device features and operation.

Prior to installing the LMH6586 application software, you must install Microsoft .NET Framework version 2.0. The .NET Framework installation file, dotnetfx.exe, can be downloaded from Microsoft's Download Center website: <http://www.microsoft.com/downloads/details.aspx?familyid=0856eacb-4362-4b0d-8edd-aab15c5e04f5&displaylang=en>

The LMH6586 software installation files, setup.exe and LMH6586 Setup.msi, are provided in a zip file. Both files should be placed in the same source folder prior to installation.

3.1 GUI Installation

1. Run dotnetfx.exe to install Microsoft .NET Framework v2.0 and follow the installation procedure. Ensure it is installed before proceeding to the next step.
2. Create a folder in the local drive and place the contents of the Zip file in the folder.



3. Run setup.exe to install the LMH6586 software and follow the installation procedure.
4. When the LMH6586 software installation completes, a shortcut icon for the LMH6586 application should appear on your desktop.



Figure 10: GUI Shortcut

3.2 Starting the Application

The setup requires the NSC LMH6586 evaluation board with the USB interface board and a PC with the LMH6586 GUI application.

The following steps should be taken before starting the application:

1. Ensure the USB board is properly connected to the LMH6586 evaluation board.
2. Connect a USB cable between the PC and the USB board.
3. Ensure the LMH6586 evaluation board is powered prior to starting the application.
4. Run the LMH6586 application on your PC by double-clicking the icon on your desktop.
5. When the application is running, you should see “USB Connected All ACK” in the Status Bar at the bottom-left; otherwise, refer to the Status Bar section in this user guide.

3.3 Programming Overview of the LMH6586

After powering the LMH6586, its device registers will load with default values that determine its initial condition. To operate the LMH6586 in any other condition, you must program the features of the device such as:

- Input to Output routing
- Video Detect Enable
- Video Detect Invert
- Sync Detect Enable
- Individual Channel Power Save

3.4 Using the LMH6586 GUI

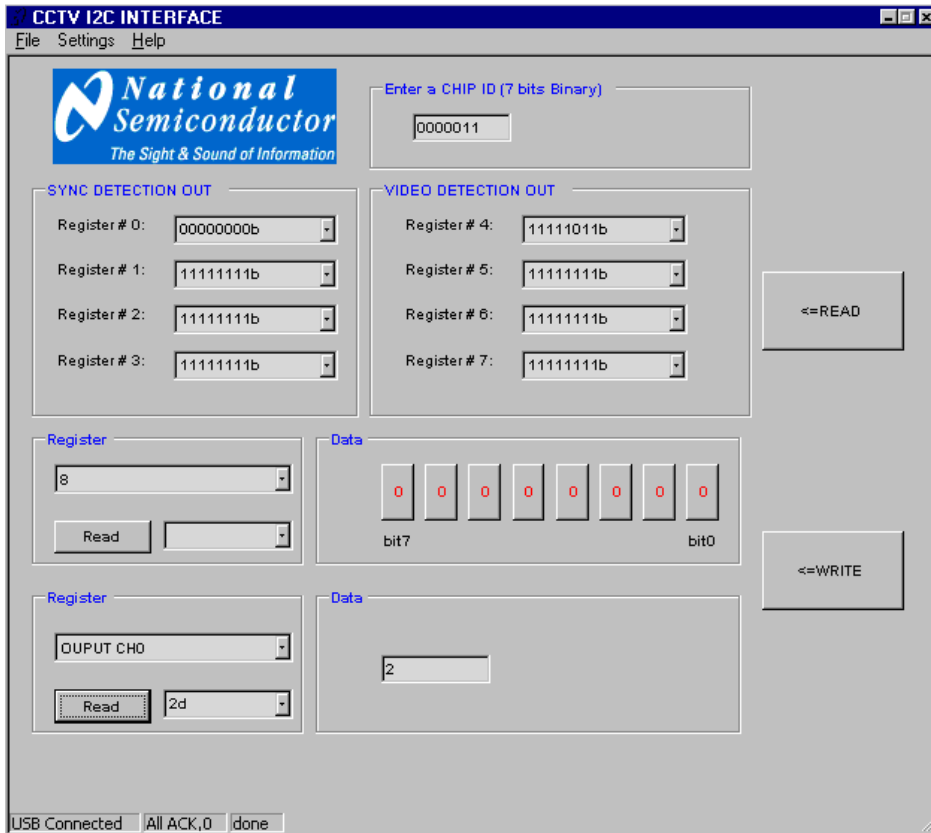
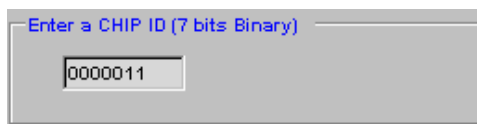


Figure 11: LMH6586 GUI

The GUI is divided into the following sections:

- **Chip ID:**

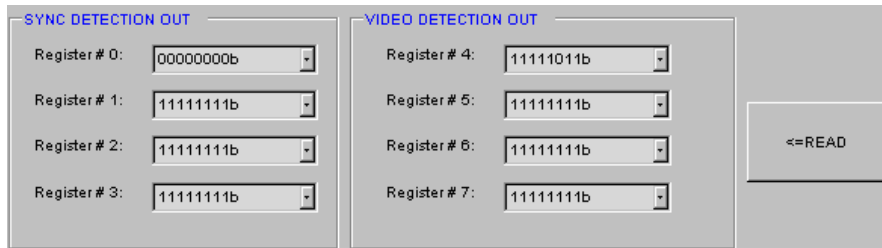
In this section enter the chip ID depending on the positions of jumpers *JP6* and *JP7* (refer to Table 2 above). So if the device address is set to 01, the chip ID should be set to 0000001. In the figure below the chip ID is set to 0000011, which mean that the device address is 11.



- **Sync Detection Out/ Video Detection Out**

This is a read only field and is used to detect sync and video on each input. In the presence of sync or video, the respective bit in each register is 0. In the absence of sync or video, the bit is 1. For ex. in the Register #4 field, bit 2 is 0 which implies

that there is a video input on VIN 2. To read, hit the READ button on the right. Refer to the LMH6586 datasheet *Table 2* for more information on the Video and Sync detection output registers.



- **Register Programming**

This field is used to program the video and sync detect enable registers, the video detect invert registers, the video detect threshold level and the input and output power save registers. In the register selection box, select the register to write to or read from. To read from the register, hit the Read button and the register value will be seen in the box below. To write to the register, set the bit values in the data field using the respective bit buttons and then hit the WRITE button.



To enable video or sync detect for any input, the enable bit corresponding to that input should be set to 1. To detect presence of video on any input, set the corresponding video detect invert bit to 1. To detect loss of video or sync on any input, set the corresponding invert bit to 0. Refer to the LMH6586 datasheet *Table 3* for more information on the Video and Sync detection control registers.

The video detect threshold level is set by programming the appropriate value in register 0x1Ch (*Register 29*). Refer to the LMH6586 datasheet *Table 4* and *Table 1* for more information on the Video detect threshold level.

To place individual input or output channels in power save mode, the power save bit corresponding to that input or output should be set to 1. Refer to the LMH6586

datasheet *Table 5* for more information on the Video shutdown/power save registers.

- **Input to Output Routing**

This field is used to route an input to an output. In the register field, select the Output channel. To read which input is currently routed to that output, hit the Read button and the input channel will display in the box below. To route an input to the selected output, **enter the input number in the Data field, highlight the entered number and hit Enter**. Then hit the WRITE button.

For ex. if VIN15 is to be routed to OUT CH0, select OUT CH0 in the register field. In the data field enter the number 15, select it, hit Enter, and then hit the WRITE button.

Refer to the LMH6586 datasheet *Table 6* for more information on input to output routing.



- **Status Bar**

The following table lists the possible Status Bar messages with associated user actions. You may disregard the numbers that follow these messages in the Status Bar.

| Status Bar Message | Status / User Action |
|--------------------------------|--|
| USB Connected All ACK | Normal. Proceed to use the application. |
| USB Connected I2C ACK2 missing | The I ² C interface is not functioning properly. Verify the LMH6586 is powered on. Click the READ button and confirm that All ACK appears in the Status Bar, and then proceed to use the application. |
| USB I/O Error,132 | The USB interface is not functioning properly. Verify the USB cable is connected between the PC and the USB board. If the USB board is functioning properly, the Operating System should identify it as a Human Interface Device (HID) in the Device Manager. Re-start the application and confirm a normal status bar appears before proceeding to use the application. |

Table 4: Possible Status Bar Messages