

## Introduction

The ISL59481EVAL1Z evaluation board contains the ISL59481 Dual 4:1 RGB MUX amp and associated components needed to implement an 8:1 RGB+H/V sync video multiplexer. The 8 video input ports, and single output port are accessed using standard 15 pin VGA female connectors. The I/O connectors are compatible with most VGA, SVGA and XGA video sources and video monitors with VGA cable interfaces. A typical application would use the ISL5948XEVAL1Z board to multiplex anywhere from 2 to 8 PC's or laptops to a single video monitor or projector.

## Evaluation Board Description and Key Features

The multiplexing of the RGB video is performed by the ISL59481. Multiplexing the H and V sync signals is accomplished using two ISL84051 8:1 analog switches. The ISL59481 Video MUX and the analog H and V sync multiplexers have the same input channel select logic coding, and are parallel-connected to form a single 3 input binary coded interface (S0, S1, S2). An additional ISL84051 8:1 analog switch and channel-select LED indicators are included to identify the selected input channel. The evaluation board contains three different channel select options via jumpers on the board. Switches on the board enable direct logic control in binary format. The on-board oscillator and 4-bit counter can be connected to provide a

continuous channel-by-channel scan of as few as 2 input channels and as many as 8 input channels (Table 2). A jumper option allows the user to disconnect the auto-scan oscillator and use the on-board momentary-contact switch to manually scan through the selected channels.

## Reference Documents

- Data Sheet FN6394 "Dual, 500MHz Triple, Multiplexing Amplifiers"

## Getting Started

The evaluation board should have the same appearance as the silk screen shown in Figure 1. Prior to applying power, connect the source input VGA cables and the evaluation board output VGA cable to the respective video components. The evaluation board, as supplied, is designed for 75Ω source impedances and requires a 75Ω termination impedance in the output display device.

## Applying Power to the Evaluation Board

The following safeguards will ensure correct power-up.

- Limit the current on ±5V supplies to 250mA.
- Turn on the power supplies after the power cables are attached to the evaluation board.

Power supply protection Schottky diodes are included on the ±5V supplies to prevent damage due to reverse polarity.

## Evaluation Board Jumper, Cable Header, and Switch Descriptions

| COMPONENT       | DESCRIPTION   |
|-----------------|---|
| <b>JUMPERS</b>  |   |
| J1              | Selects channel select via single-step momentary contact switch S4, or auto mode using on-board oscillator            |
| J-S0            | Selects S0 logic input to manual control via switch S0 or through external control ribbon cable header                |
| J-S1            | Selects S1 logic input to manual control via switch S1 or through external control ribbon cable header                |
| J-S2            | Selects S2 logic input to manual control via switch S2 or through external control ribbon cable header                |
| <b>HEADERS</b>  |   |
| EN              | External MUX enable: Internal pull-down (logic 0) enables RGB+H/V output, logic high disables RGB and H/V sync output |
| S0              | External S0 channel select logic input  |
| S1              | External S1 channel select logic input  |
| S2              | External S2 channel select logic input  |
| <b>SWITCHES</b> |   |
| S0              | Manual channel select logic input S0  |
| S1              | Manual channel select logic input S1  |
| S2              | Manual channel select logic input S2  |
| S3              | Momentary contact channel select step control   |

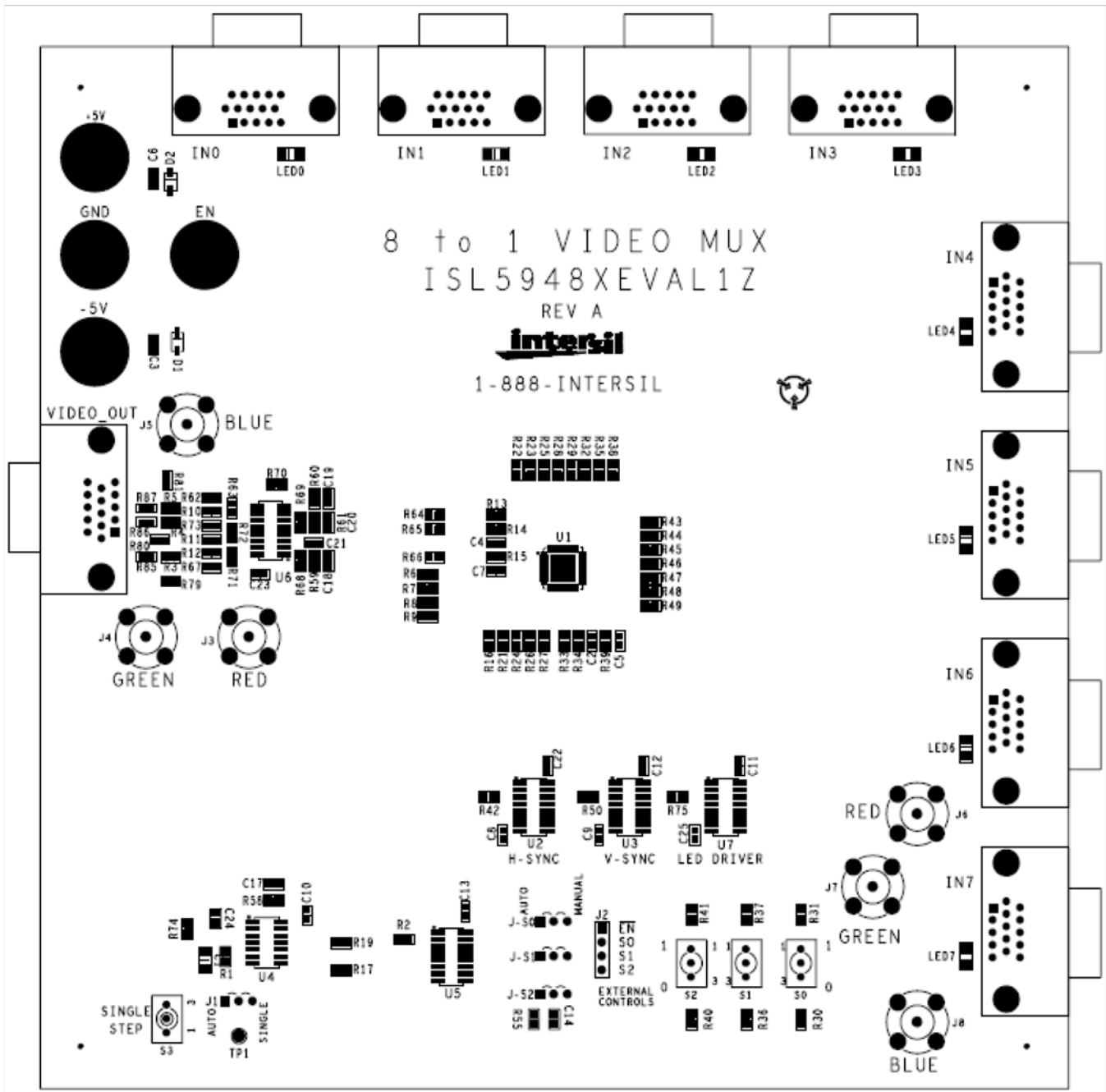


FIGURE 1. ISL5948xEVAL1Z TOP VIEW

## Testing the Evaluation Board

Testing the video and sync signal paths is accomplished using 1 or more RGB+H/V test video sources and a video monitor as the measurement device. Before powering the board, connect the jumpers as follows:

1. Connect jumpers J-S0, J-S1 and J-S2 to the MANUAL position (center to right post).
2. Connect jumper J1 to the single-step position (center to left post).

The following tests should be performed in the order shown.

### Power Supply Tests

1. Connect an ammeter in series with the +5V and -5V supply.
2. Connect power supplies to the respective +5V, -5V and ground banana jacks.
3. Set supplies to +5V;  $\pm 50\text{mV}$  and -5V;  $\pm 50\text{mV}$ . Supply power to the board.
4. Measure +5V supply current =  $+110\text{mA} \pm 20\text{mA}$
5. Measure -5V supply current =  $-100\text{mA} \pm 20\text{mA}$

### CHANNEL SELECT LOGIC AND VIDEO PERFORMANCE TEST

1. Calibrate the video test source with the video monitor by connecting the source(s) to the video monitor and selecting a display suitable for verifying correct luminance, display resolution and H/V sync lock. The test display in the following evaluation board tests should be identical to the test display.
2. Re-connect the video monitor to the VIDEO\_OUT VGA connector on the evaluation board.
3. Connect the video test source to IN0. Additional video sources can speed up the verification process. If more than 1 test source is available connect each in sequential fashion to IN1, IN2 etc.
4. Set switches S0, S1 and S2 to the GND position and apply power.
5. After  $\sim 3\text{s}$  the test display supplied to IN0 should appear on the test monitor exactly as it appeared in step 1.

NOTE: The  $\sim 3\text{s}$  delay is a built in delay common in many display devices to lock onto the H/V sync signals and adjust the picture prior to enabling the display screen.

6. Perform the display test on the remaining video inputs by moving the video input source to the appropriate input according to the truth table in Table 1.
7. Signal calibration can also be performed using the RGB BNC connectors J6, J7 and J8 to connect an external signal into IN7 input, while monitoring the RGB outputs using BNCs J3, J4 and J5. To connect the BNCs, the open resistor placements  $R_{76}$  through  $R_{81}$  must be populated with  $0\Omega$  resistors.

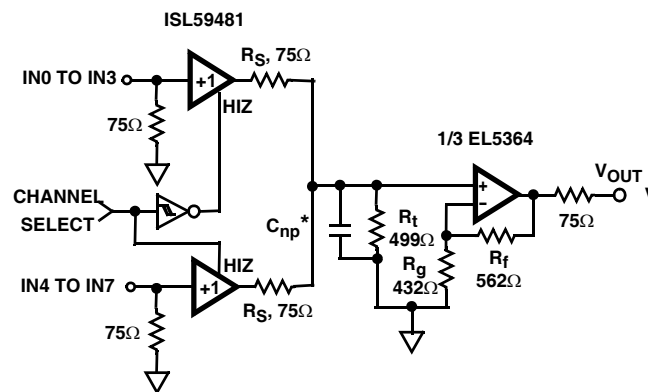
### AUTO-SCAN TEST

1. Connect scope probe to the J1 AUTO pin and observe a logic level (0V to +5V) square wave with  $\sim 3\text{s}$  period.
2. Connect jumpers J-S0, J-S1, and J-S2 to the AUTO position (center to left post).
3. Connect jumper J1 to the AUTO position and observe that the display scans all the test sources connected to the input channels (center to right post).
4. Connect jumper J1 to the single-step position and use the momentary contact switch S4 to manually test all the sources.

Test completed.

### RGB Video Signal Path

The video inputs are terminated with  $75\Omega$  resulting in an overall RGB video path gain of 1 when using  $75\Omega$  video source impedance and load terminations (Figure 2). The RGB outputs contain series-connected  $75\Omega$  back-termination resistors for cable driving. The ISL59481 operates with a gain of +1. Provision for additional gain is provided by triple op amp U6 (EL5364), gain resistors  $R_{62}$ ,  $R_{63}$ ,  $R_{67}$ , and  $R_{71}$  thru  $R_{73}$ . The  $0\Omega$  resistors  $R_{68}$ , thru  $R_{70}$  must be removed when using the triple op amp. Gain reduction is best achieved using the divider network  $R_S$  and  $R_t$ . Capacitor pads ( $C_{np}$ ) are provided to adjust the frequency response of the amplifier.



\*  $C_{np}$  IS NOT POPULATED AND IS PROVIDED FOR FREQUENCY RESPONSE ADJUSTMENT

FIGURE 2. VIDEO SIGNAL PATH

### Channel Select Logic

The ISL59481 RGB MUX and the H/V sync MUX share the same 1 of 8 input channel select logic inputs (S0, S1, S2). The channel select logic is shown in Table 1. Three methods of channel select logic control are provided using jumpers.

TABLE 1. CHANNEL SELECT TRUTH TABLE

| S2 | S1 | S0 | VIDEO OUT |
|----|----|----|-----------|
| 0  | 0  | 0  | IN0       |
| 0  | 0  | 1  | IN1       |
| 0  | 1  | 0  | IN2       |
| 0  | 1  | 1  | IN3       |
| 1  | 0  | 0  | IN4       |
| 1  | 0  | 1  | IN5       |
| 1  | 1  | 0  | IN6       |
| 1  | 1  | 1  | IN7       |

### Auto Sequencing Using the On-Board Oscillator

An on-board 0.3Hz R-C oscillator (Figure 3) drives the master clock of the 4-bit binary counter, which generates the channel select logic inputs S0, S1 and S2. The default 6s channel scan rate provides the time needed by the display to sync-lock and adjust the picture prior to enabling the display. The 2.2M $\Omega$  (R1) resistor value can be reduced to speed up the channel scan time. Jumper J1 is provided to select either the 6s auto-step timer, or the momentary contact switch for manual stepping.

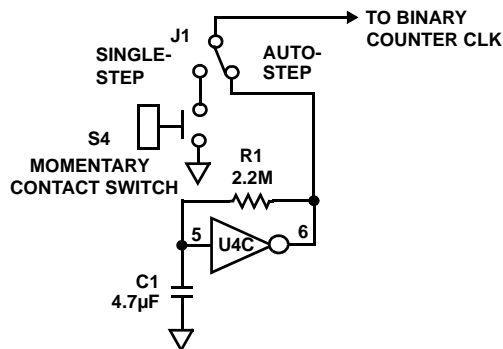


FIGURE 3. CHANNEL SCAN OSCILLATOR

### Internal and External Channel Select Logic

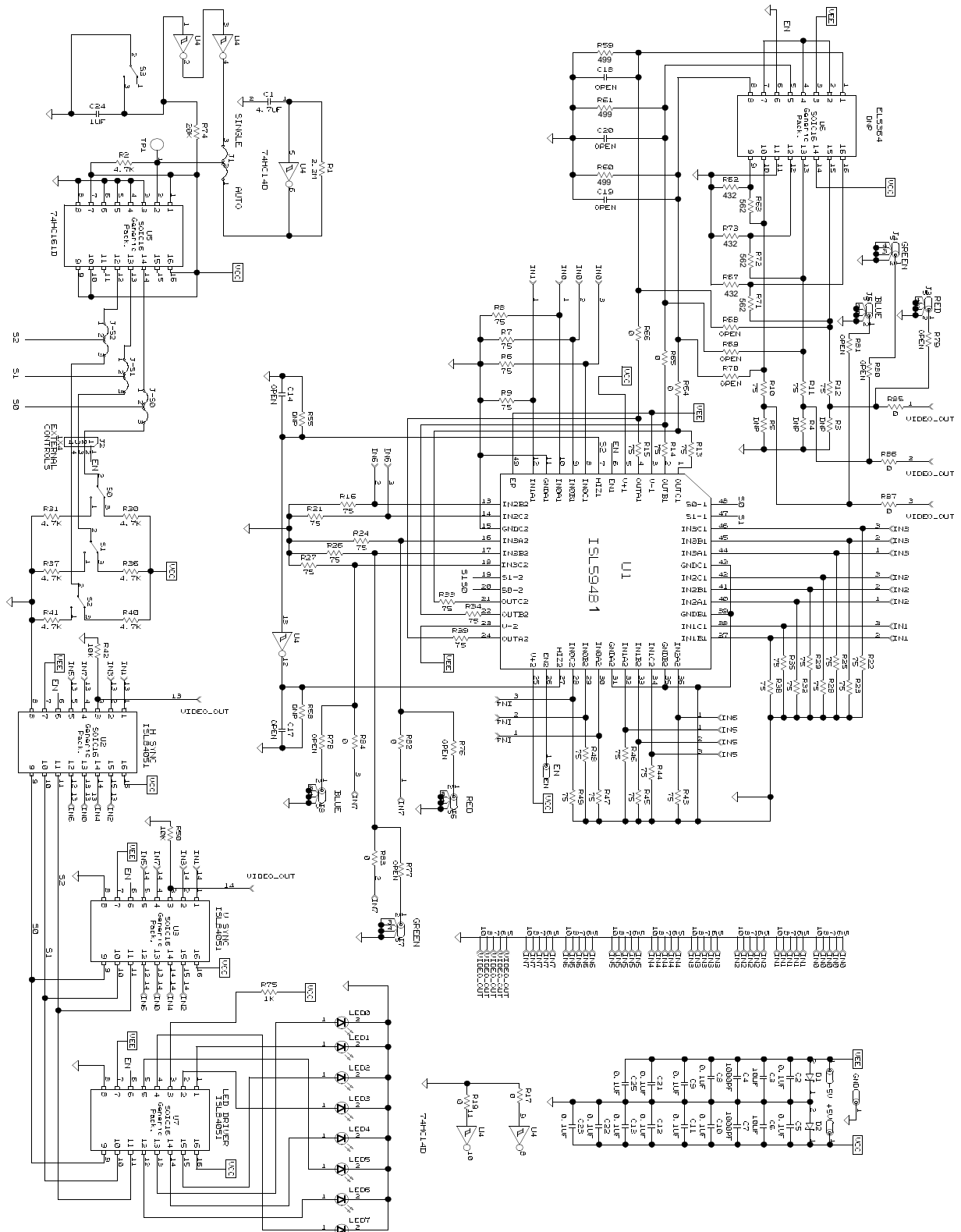
J-S0, J-S1 and J-S2 are two-position jumpers that control the method of channel selection. In the AUTO position, the internal channel scan is enabled. The MANUAL position connects the on-board SPDT switches (S0, S1, and S2) for manual selection. A parallel-connected EXTERNAL CONTROL ribbon cable header is provided for external channel select control.

A wide range of auto-scan options can be selected by connecting only 1 or 2 of the 3 jumpers to the internal logic, with the remainder connected to the switch. For example, connecting jumper J-S0 to the AUTO position and connecting jumpers J-S1 and J-S2 to the MANUAL position with the switches S1 and S2 to the logic 0 state limits the channel scan to only 2 of the 8 channels (IN0 and IN1). Moving a second jumper from the MANUAL position to the AUTO position, increases the number of channels scanned from 2 to 4. The complete list of channel scan jumper options are shown in Table 2.

**TABLE 2. CHANNEL SCAN SELECT LOGIC TABLE**

| CHANNELS<br>SCANNED | JUMPER POSITION |        |        | SWITCH POSITION |    |    | CHANNELS SELECTED |     |     |     |     |     |     |     |
|---------------------|-----------------|--------|--------|-----------------|----|----|-------------------|-----|-----|-----|-----|-----|-----|-----|
|                     | J-S2            | J-S1   | J-S0   | S2              | S1 | S0 | IN0               | IN1 | IN2 | IN3 | IN4 | IN5 | IN6 | IN7 |
| 8                   | Auto            | Auto   | Auto   | -               | -  | -  | X                 | X   | X   | X   | X   | X   | X   | X   |
| 4                   | Manual          | Auto   | Auto   | 0               | -  | -  | X                 | X   | X   | X   |     |     |     |     |
|                     | Manual          | Auto   | Auto   | 1               | -  | -  |                   |     |     |     | X   | X   | X   | X   |
|                     | Auto            | Manual | Auto   | -               | 0  | -  | X                 | X   |     |     | X   | X   |     |     |
|                     | Auto            | Manual | Auto   | -               | 1  | -  |                   |     | X   | X   |     |     | X   | X   |
|                     | Auto            | Auto   | Manual | -               | -  | 0  | X                 |     | X   |     | X   |     | X   |     |
|                     | Auto            | Auto   | Manual | -               | -  | 1  |                   | X   |     | X   |     | X   |     | X   |
| 2                   | Manual          | Manual | Auto   | 0               | 0  | -  | X                 | X   |     |     |     |     |     |     |
|                     | Manual          | Manual | Auto   | 0               | 1  | -  |                   |     | X   | X   |     |     |     |     |
|                     | Manual          | Manual | Auto   | 1               | 0  | -  |                   |     |     |     | X   | X   |     |     |
|                     | Manual          | Manual | Auto   | 1               | 1  | -  |                   |     |     |     |     |     | X   | X   |
|                     | Auto            | Manual | Manual | -               | 0  | 0  | X                 |     |     |     | X   |     |     |     |
|                     | Auto            | Manual | Manual | -               | 0  | 1  |                   | X   |     |     |     | X   |     |     |
|                     | Auto            | Manual | Manual | -               | 1  | 0  |                   |     | X   |     |     |     | X   |     |
|                     | Auto            | Manual | Manual | -               | 1  | 1  |                   |     |     | X   |     |     |     | X   |
|                     | Manual          | Auto   | Manual | 0               | -  | 0  | X                 |     | X   |     |     |     |     |     |
|                     | Manual          | Auto   | Manual | 0               | -  | 1  |                   |     |     |     | X   |     | X   |     |
|                     | Manual          | Auto   | Manual | 1               | -  | 0  |                   | X   |     | X   |     |     |     |     |
|                     | Manual          | Auto   | Manual | 1               | -  | 1  |                   |     |     |     |     | X   |     | X   |

### ISL59481EVAL1Z Schematic Diagram



**ISL5948xEVAL1Z Components List**

| COMPONENT   | P/N, VALUE   | MANUFACTURER   | RATING     |
|---|--|----------------|------------|
| PWB   | ISL5948xEVAL1Z REV A PCB, ROHS   | Intersil Corp. | N/A        |
| U <sub>1</sub> - 8:1 RGB Video MUX  | ISL59481IRZA QFN48 Pb-Free   | Intersil Corp. | N/A        |
| U <sub>2</sub> , U <sub>3</sub> , U <sub>7</sub> - 8:1 Analog MUX         | ISL84051IBZ SOIC16 Pb-Free   | Intersil Corp. | N/A        |
| U <sub>4</sub> - Hex Inverter   | SN74HC14D SOIC14   | TI             | N/A        |
| U <sub>5</sub> - 4-Bit Binary Counter                                     | SN74HC161D SOIC16  | TI             | N/A        |
| U <sub>6</sub> - Triple 600MHz Op Amp                                     | EL5364ISZ SOIC16 Pb-Free   | Intersil Corp. | N/A        |
| C4, C7  | CAP, SMD, 0603 1000pF  | 10%, X7R       | 25V        |
| C2, C5, C8 to C13, C21, C23, C25  | CAPACITOR, SMD, 0603, 0.1μF  | N/A            | 25V        |
| C3, C6  | CAPACITOR, SMD, 0805, 10μF   | 10%, X5R       | 6.3V       |
| C1  | CAPACITOR, SMD, 0805, 4.7μF  | 10%, X5R       | 16V        |
| C14, C17 to C20   | CAPACITOR, SMD, 0805, DNP  | N/A            | DNP        |
| IN0 TO IN7, VIDEO_OUT   | 181-015-213R171<br>CONN-SUB MINI D, 15 PIN, RECEPTACLE, RT ANGLE,<br>FRONT METAL SHELL | NORCOMP        | N/A        |
| +5V, -5V, EN, GND   | CONN-JACK, BANA-SS-SDRLESS, VERTIC   | N/A            | N/A        |
| J2  | CONN-HEADER, 4 PIN, BRKAUWY, 2.54mm, VERT  | J2             |            |
| J-S0, J-S1, J-S2, J1  | CONN-HEADER, 1x3, BRKAUWY 1x36, 0.1  | N/A            | N/A        |
| D1, D2  | MBR0540T1-T<br>DIODE-RECTIFIER, SMD SOD-123, 2 PIN                                     | SEMICON        | 40V, 0.5A  |
| LED0 to LED7  | 597-3111-407F<br>LED, SMD, 1206, RED, 30mA, 60mW, 17mcd, ROHS                          | DIALIGHT       | N/A        |
| R68 to R70, R76 to R81  | RESISTOR, SMD, 0603, 0Ω, DNP   |                | DNP        |
| R3 to R5, R55 to 58   | RESISTOR, SMD, 0805, DNP, TF   | N/A            | DNP        |
| R82 to R87  | RESISTOR, SMD, 0603, 0Ω  | N/A            | N/A        |
| R62, R67, R73   | RESISTOR, SMD, 0603, 432Ω  | 1%             | 1/10W      |
| R63, R71, R72   | RESISTOR, SMD, 0603, 562Ω  | 1%             | 1/10W      |
| R6 to R9, R10 to R12, R13 to R16, R21 to R29, R32 to R35, R39, R43 to R49 | RESISTOR, SMD, 0805, 75Ω   | 1%             | 1/10W      |
| R13 to R15, R17 to R20, R33, R34, R39,                                    | RESISTOR, SMD, 0805, 0Ω  | N/A            | 1/10W      |
| R42, R50  | RESISTOR, SMD, 0805, 10k   | 5%             | 1/10W      |
| R74   | RESISTOR, SMD, 0805, 20kΩ,   | 5%             | 1/10W      |
| R1  | RESISTOR, SMD, 0805, 2.2M  | 5%             | 1/8W       |
| R2, R30, R31, R36, R37, R40, R41  | RESISTOR, SMD, 0805, 4.7k  | 5%             | 1/10W      |
| R59 to R61  | RESISTOR, DNP, SMD, 0805, 499, DNP   | 5%             | DNP        |
| R75   | RESISTOR, SMD, 0603, 1kΩ   | 5%             | 1/10W      |
| S0 to S2  | SWITCH-TOGGLE, THRU, SPDT, 5P, ON-N  | N/A            | N/A        |
| S3  | SWITCH-PUSHBUTTON, TH, 6mm, 4P, ON/OFF,  | N/A            | 12V, 0.05A |

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