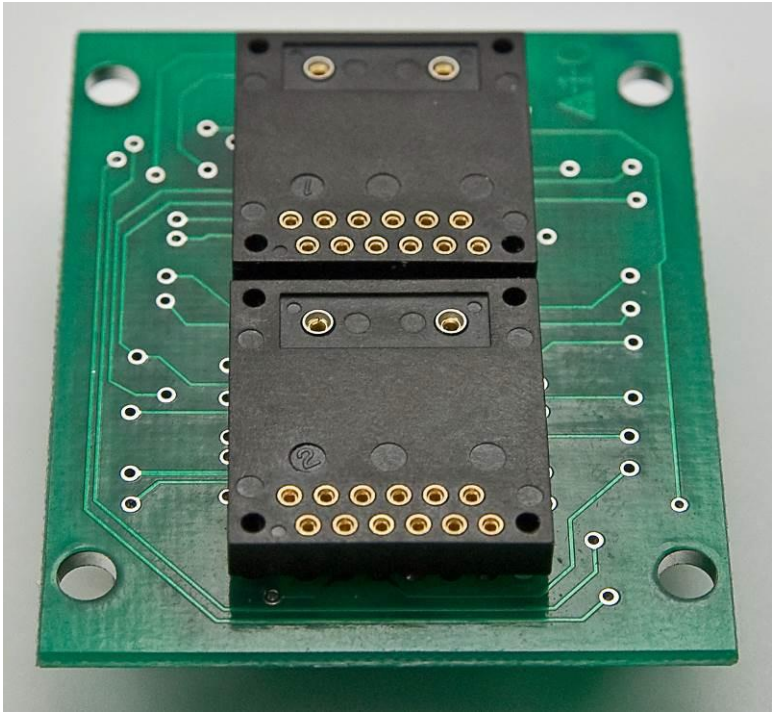
LCD 36x24 Logic Boards User Manual

Revision H



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1. What are Logic Boards?

Logic boards are switch panels that have glue logic to convert addressing and switch scanning to serial. A logic board can be designed for any number of switches. Logic boards can be daisy-chained using a 14-pin ribbon cable allowing for a variable number of switches to be controlled from one port of a controller. The daisy-chain capability allows switches to be mounted at any desired location on a control panel. Switches/displays can be soldered directly to the logic boards or mounted on sockets for removability.

2. Standard Part Numbers

The logic boards listed below are standard production parts. There are additional prototype boards that are not listed. NKK Switches will work with customers to design and build custom logic boards in any desired specification.

Item	Part number with socket and switch	Part number with switch	Description
1	-	IS-L0107-IS15BBFB4PRGB	Logic Board, LCD 36x24 RGB, 1SW. Panel Mount
2	IS-L0204-CS	IS-L0204-S	LOGIC BOARD, 1x2, LCD 36x24 RGB, 2SW. Side by side stackable
3	IS-L0271-CS	IS-L0271-S	LOGIC BOARD, 1x2, Compact LCD 36x24 RGB, 2SW. Side by side stackable
4	IS-L0403-CS	IS-L0403-S	LOGIC BOARD, 2x2, LCD 36x24 RGB, 4SW. Side by side stackable
5	IS-L1602-CS	IS-L1602-S	LOGIC BOARD, 4x4, LCD 36x24 RGB, 16SW. Side by side stackable

There is a signal booster for when too many logic boards are connected in a daisy-chain or when very long cables are used for interconnecting.

Item	Part#	Description
1	IS-LBUF01	Signal booster for both LCD36x24 and LCD64x32

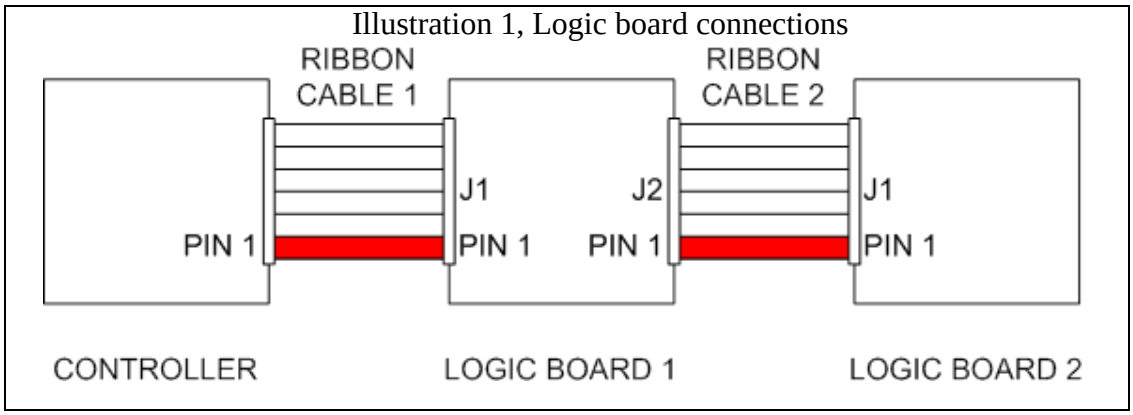
Note: Make sure the power is off when connecting or disconnecting logic boards to or from a controller or each other.

Note: Connecting logic boards improperly could damage either/both the logic boards and controller.

3. Connectors

The SmartDisplay controller connects to the J1 header of the first logic board via a 14-pin ribbon cable. The J2 header of the first logic board connects to the J1 header of the second logic board and so on. The switch numbering starts with switch one on the first logic board. The first switch of the next logic board will be one number higher than the last switch of the previous logic board and so on.

Illustration 1, Logic board connections



Note: Attaching the ribbon cable without the red line on pin 1 on each of the headers may cause damage to the controller or the logic board.

Ribbon Cables

These cables are used for logic board connections. Custom length cables can be made to order.

Item	Part#	Length	Description
1	ISDCB81.2	1.2”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"
2	ISDCB83	3”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"
3	ISDCB88	8”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"
4	ISDCB812	12”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"
5	ISDCB824	24”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"
6	ISDCB836	36”	RIBBON CABLE, 14 CONDUCTORS, 28AWG, .050"

The logic boards have two connectors:

J1 Input port: 7x2 male header with 0.1” x 0.1” spacing.
This connector connects to a controller port or J2 of the previous logic board in the daisy chain.

Pin	Function	
1	LP	Connected to latch pulse of smart switches and J2
2	GND	Ground
3	FLM	Connected to first line marker of smart switches and J2
4	GND	Ground
5	SCP1	Connected to clock of shift register and J2
6	Vsup	7V to 12V
7	LP1	Connected to LP of LED driver and J2
8	LED disable	Connected to LED driver enable (active low)
9	SCP	Connected to SCP of smart switches and J2
10	VLC	Connected to VLC of smart switches and J2
11	Din	Connected to Din of the first smart switch
12	Vsup	7V to 12V
13	Din1	Connected to data in of the first shift register
14	SWREAD	Switch Read bus for all SmartDisplays

J2 Output port: 7x2 male header with 0.1” x 0.1” spacing.
This connector connects to J1 of the next logic board in the daisy chain.

Pin	Function	
1	LP	Connected to Dout of the last SmartDisplay
2	GND	Connected to J1
3	FLM	Connected to J1
4	GND	Connected to J1
5	SCP1	Connected to J1
6	Vsup	Connected to J1
7	LP1	Connected to J1
8	LED disable	Connected to J1
9	SCP	Connected to J1
10	VLC	Connected to J1
11	Dout	Connected to Dout of the last SmartDisplay
12	Vsup	Connected to J1
13	Dout1	Connected to last shift register bit used
14	SWREAD	Connected to J1

4. How to Control Logic Board Mounted LCD 36x24 Switches

If you are using NKK controllers, you can skip this section. This section covers details on how to control LCD 36x24 switches mounted on logic boards.

Please note the controller with the same port can control LCD 64x32 switches. If you want the same design to have the capability to control both type of LCDs, please check the LCD 64x32 logic board user manual as some of the indicated ground in the below table needs to be changed to meet LCD 64x32 logic board requirements.

Pin	J1 of the first logic board	Controller connection
1	LP	Microcontroller pin (output)
2	GND	GND
3	FLM	Microcontroller pin (output)
4	GND	GND
5	SCP1	Microcontroller pin (output)
6	Vsup	7V to 12V. Closer to 7V is better
7	LP1	Microcontroller pin (output)
8	LED Disable	Microcontroller pin (output)
9	SCP	Microcontroller pin (output)
10	VLC	7.2V
11	Din	Microcontroller pin (output)
12	Vsup	7V to 12V. Closer to 7V is better
13	Din1	GND
14	SWRD	Microcontroller pin (input) and 2K pull down resistor to GND

Clock and data can be connected to SPI/UART mode 0 or any pin of a microcontroller. For SCP, Din, LP, and FLM signals, please refer to the application notes for LCD 36x24 switches.

Switch Numbering
On each logic board the first switch is in the upper left-hand corner and continues row by row with the last switch in the lower right-hand corner. The switch numbering starts with switch one of the first logic board, then the first switch of the next logic board will be one number higher than the last switch of the previous board. Please note that if a switch is missing, data cannot get to any switch connected after the missing switch.

Selecting a Switch

Four bits are used to control each switch backlight. The bits are shifted by SCP1 and Din1. The first bit shifted is for red backlight, the second bit shifted is for green backlight, the third bit shifted is for blue backlight, and the fourth bit shifted is a dummy bit. The last 4 bits shifted are for switch #1. Once all the backlight data is shifted, the LP1 is taken high and then low. A bit=0 turns the backlight ON state and a bit=1 turns the backlight OFF state. The LED Disable must be low for the backlight to go into effect. The LED Disable can be used for brightness control and disabling/enabling the backlights.

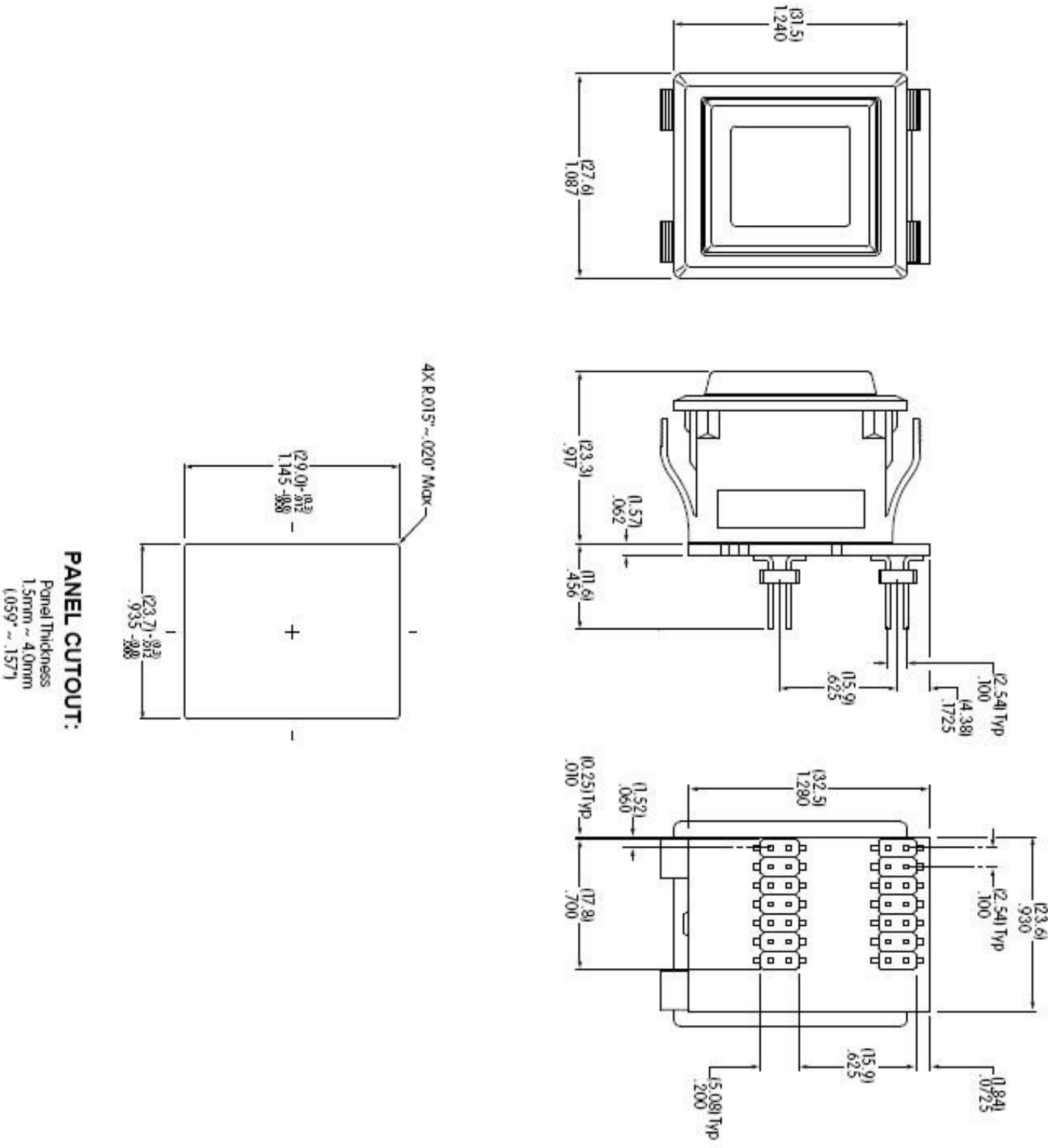
Switch Scan

One terminal of each switch is connected to the SWRD (switch read). The output of the serial to parallel shift register is connected to another switch terminal via a diode. Four bits are shifted for each switch using Din and CLK. The third bit of the 4 bits shifted is used for the switch scan. The last 4 bits shifted will be for switch #1.

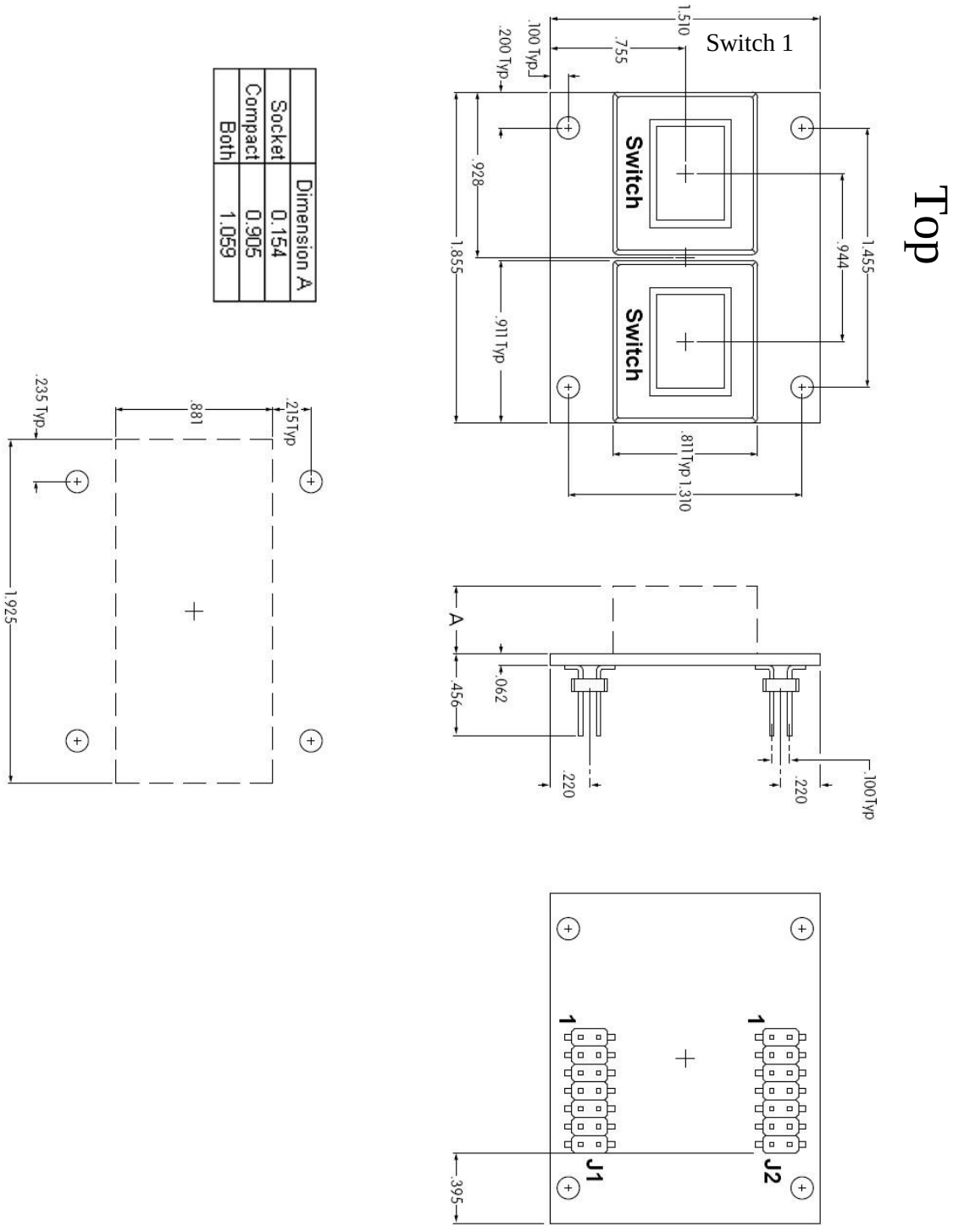
Switch scan is accomplished by sending low bits via Din and CLK for all the switches except the switch being scanned, then the SWRD is checked. If the SWRD is low, the switch is not pressed. If the SWRD is high, the switch is pressed. The switch scans should be more than 10ms apart to prevent de-bouncing reads, and less than 80ms to prevent missing a read.

5. Board Dimensions

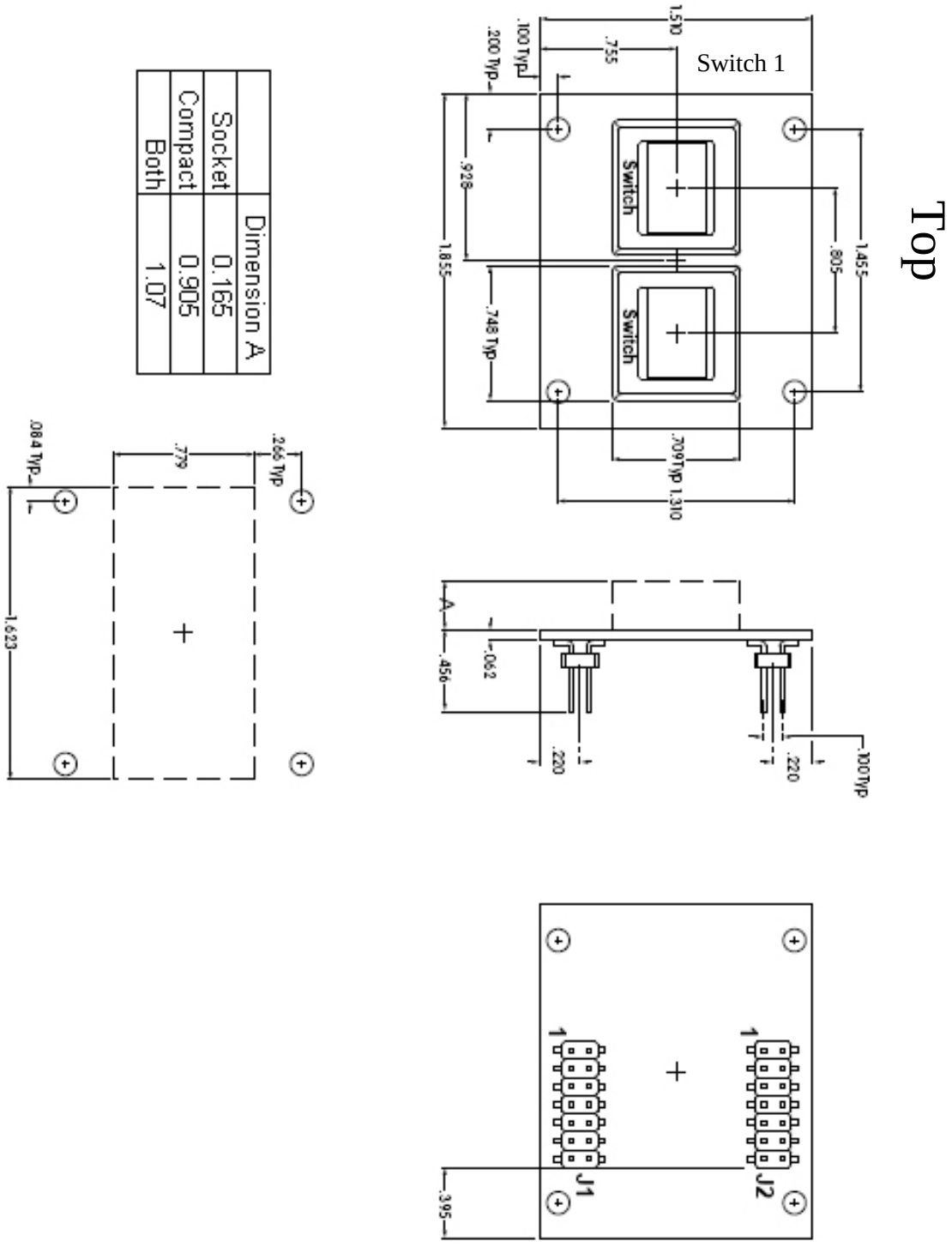
Logic board dimensions for IS-L0107-IS15BBFB4PRGB:



Logic board dimensions for L0204:

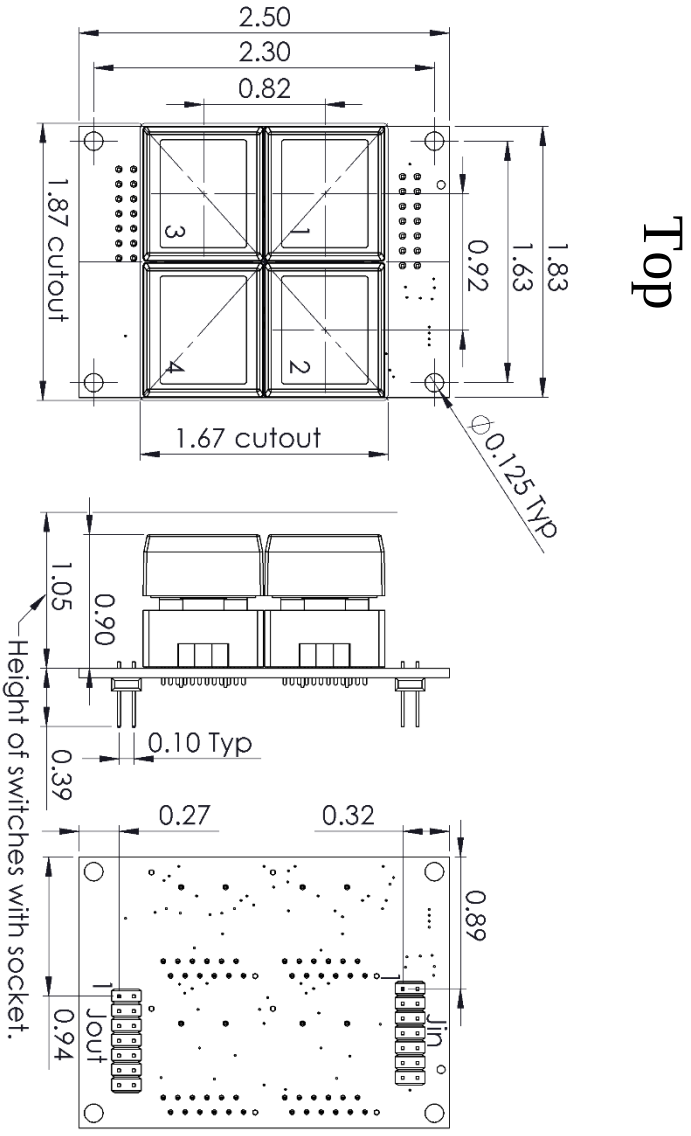


Logic board dimensions for L0271:

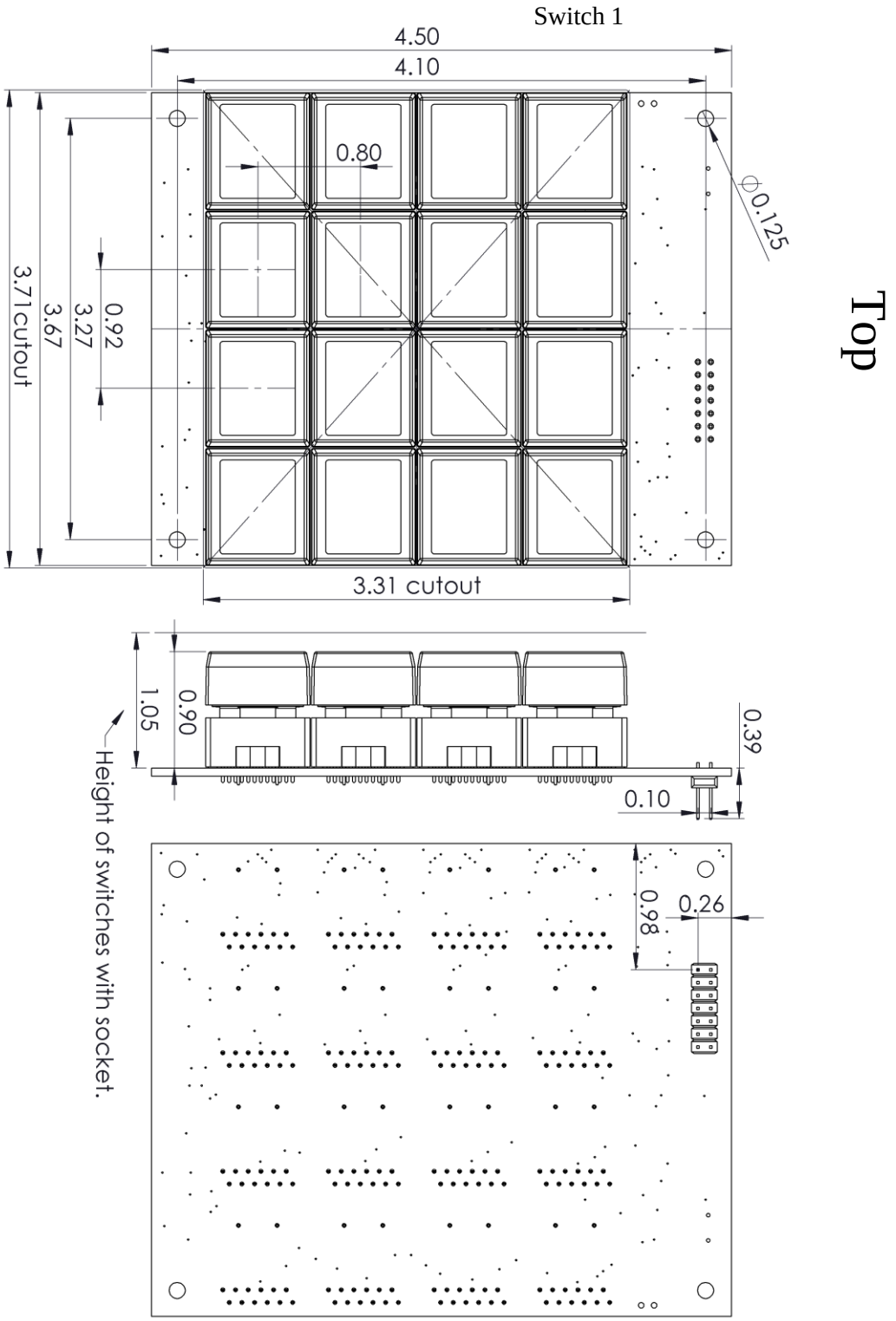


	Dimension A
Socket	0.165
Compact	0.905
Both	1.07

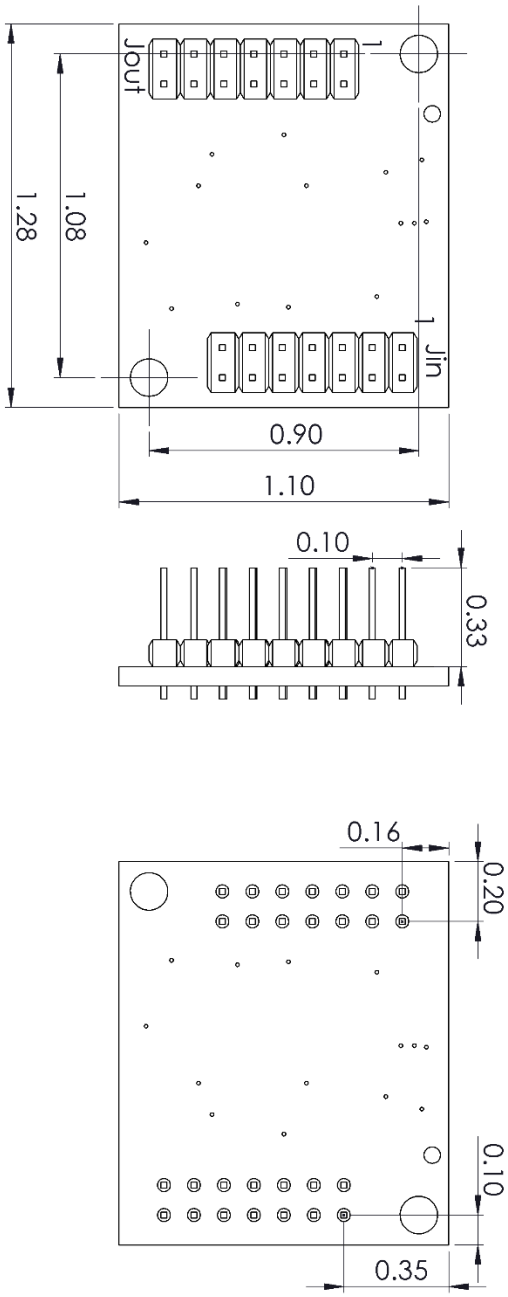
Logic board dimensions for L0403:



Logic board dimensions for L1602:

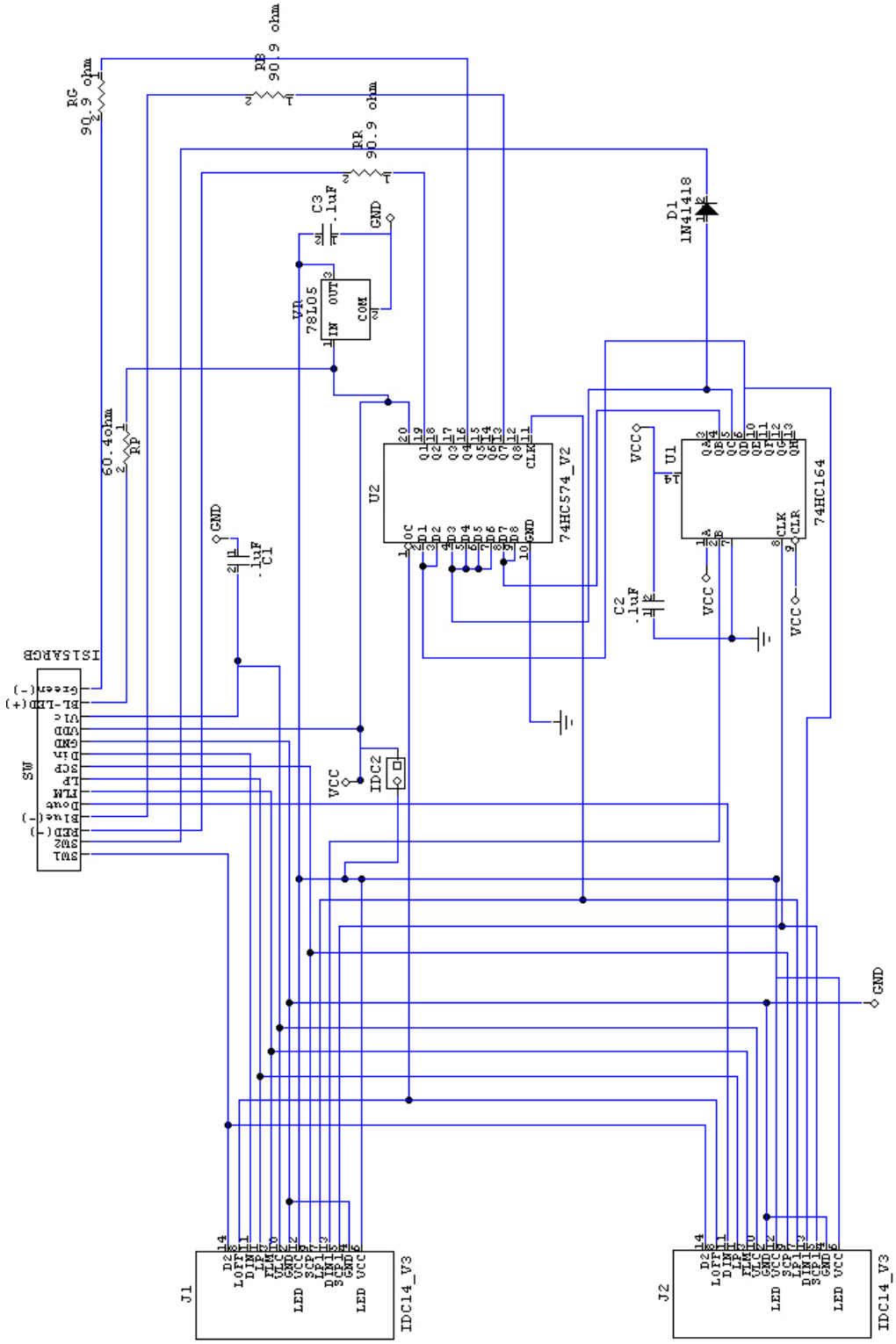


Logic board dimensions for LBUF01:

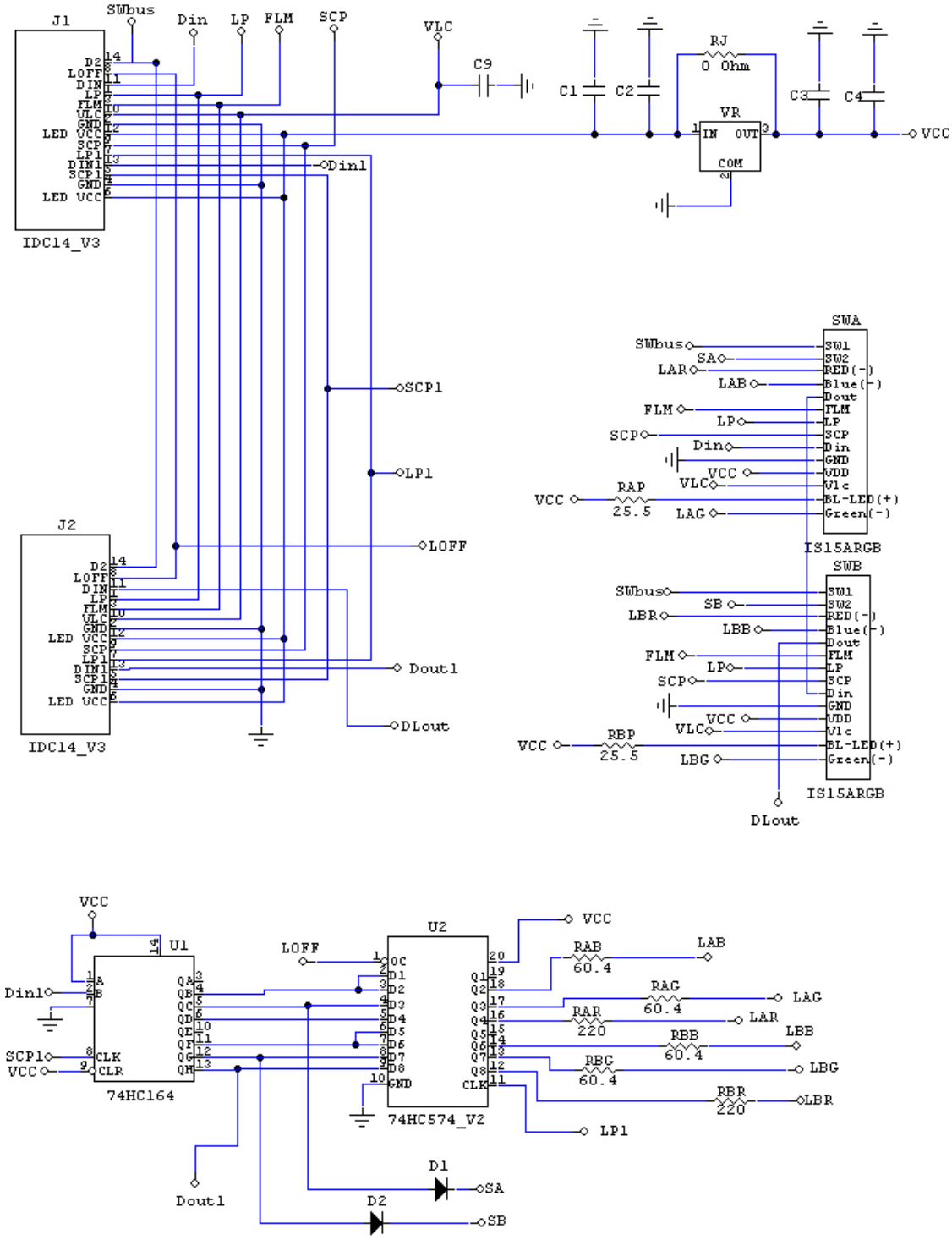


6. Schematics

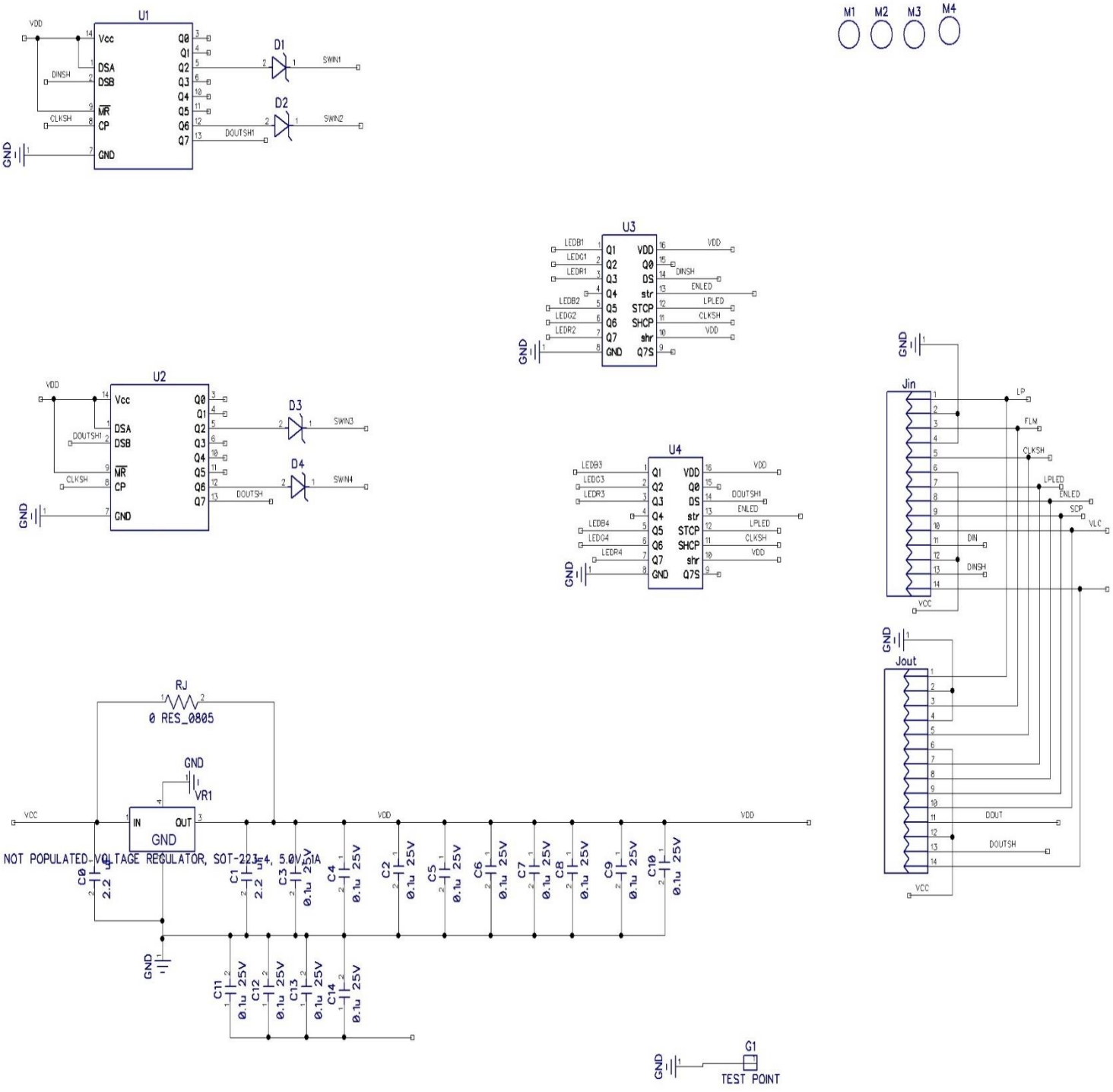
Schematic for IS-L0107-IS15BBFP4RGB Rev A:



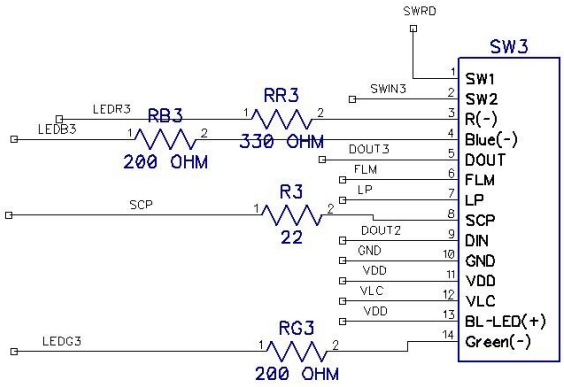
Schematic for IS-L0204 Rev A and L0271 Rev A:

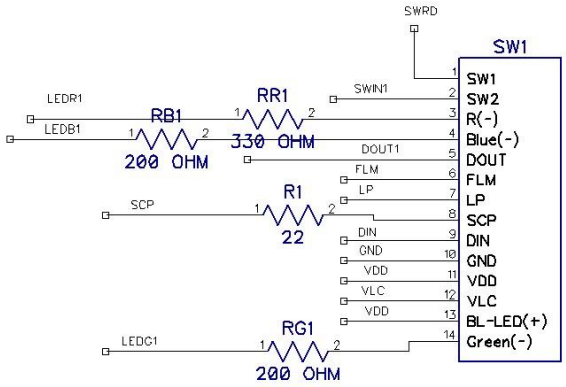


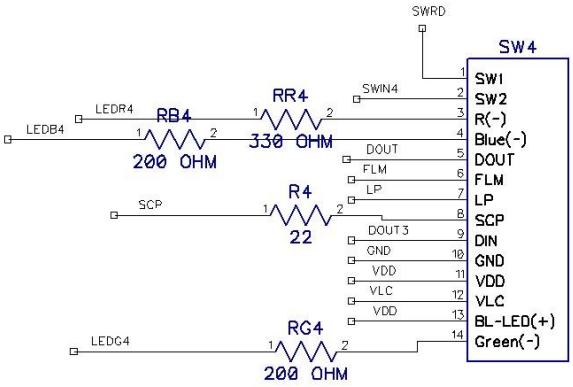
Schematic for IS-L0403 Rev A, page 1:

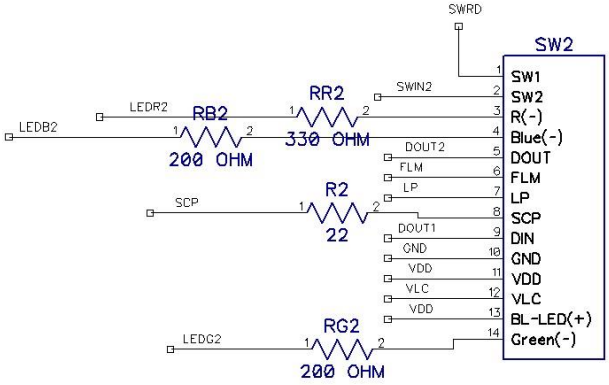


Schematic for IS-L0403 Rev A, page 2:

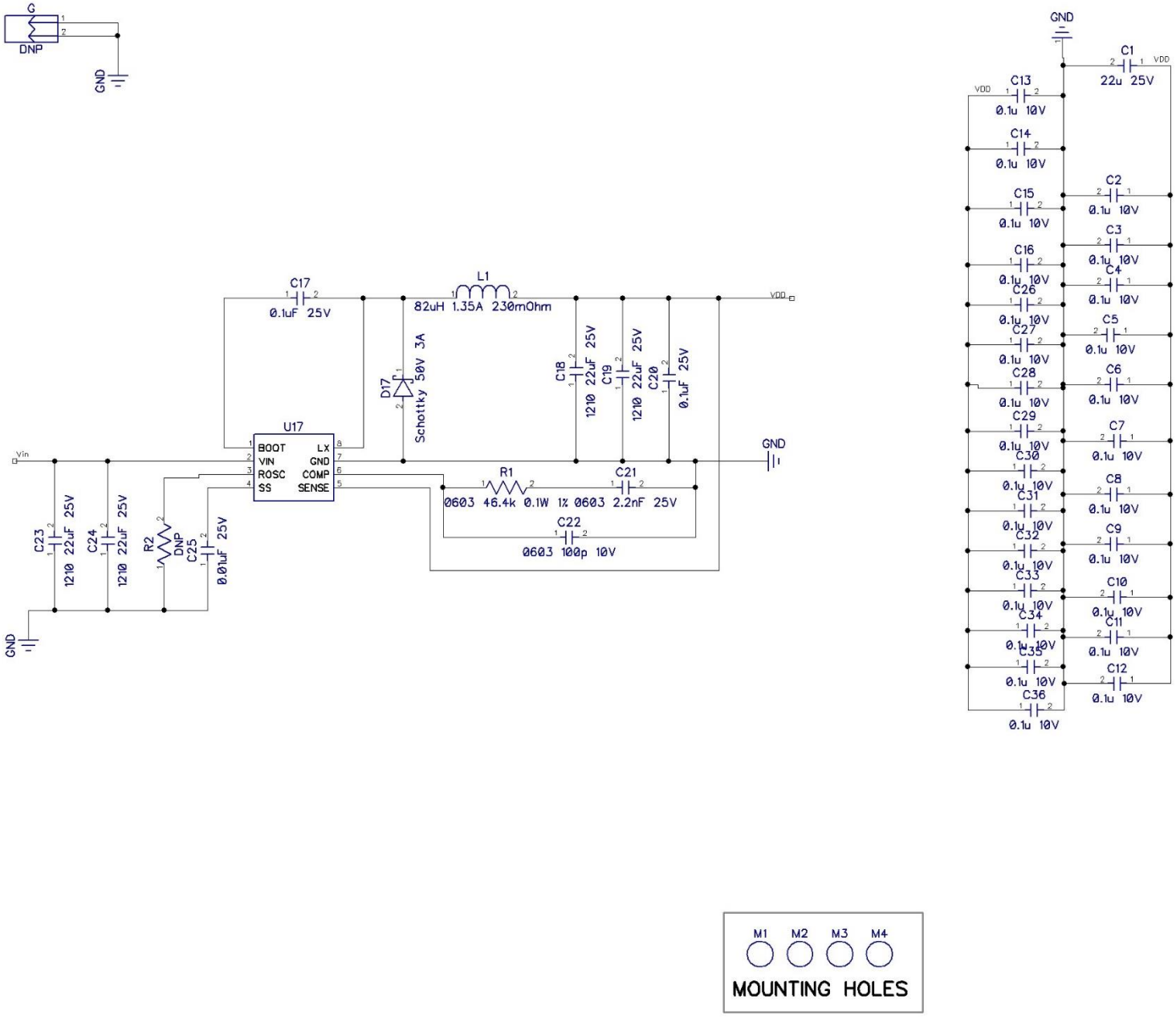




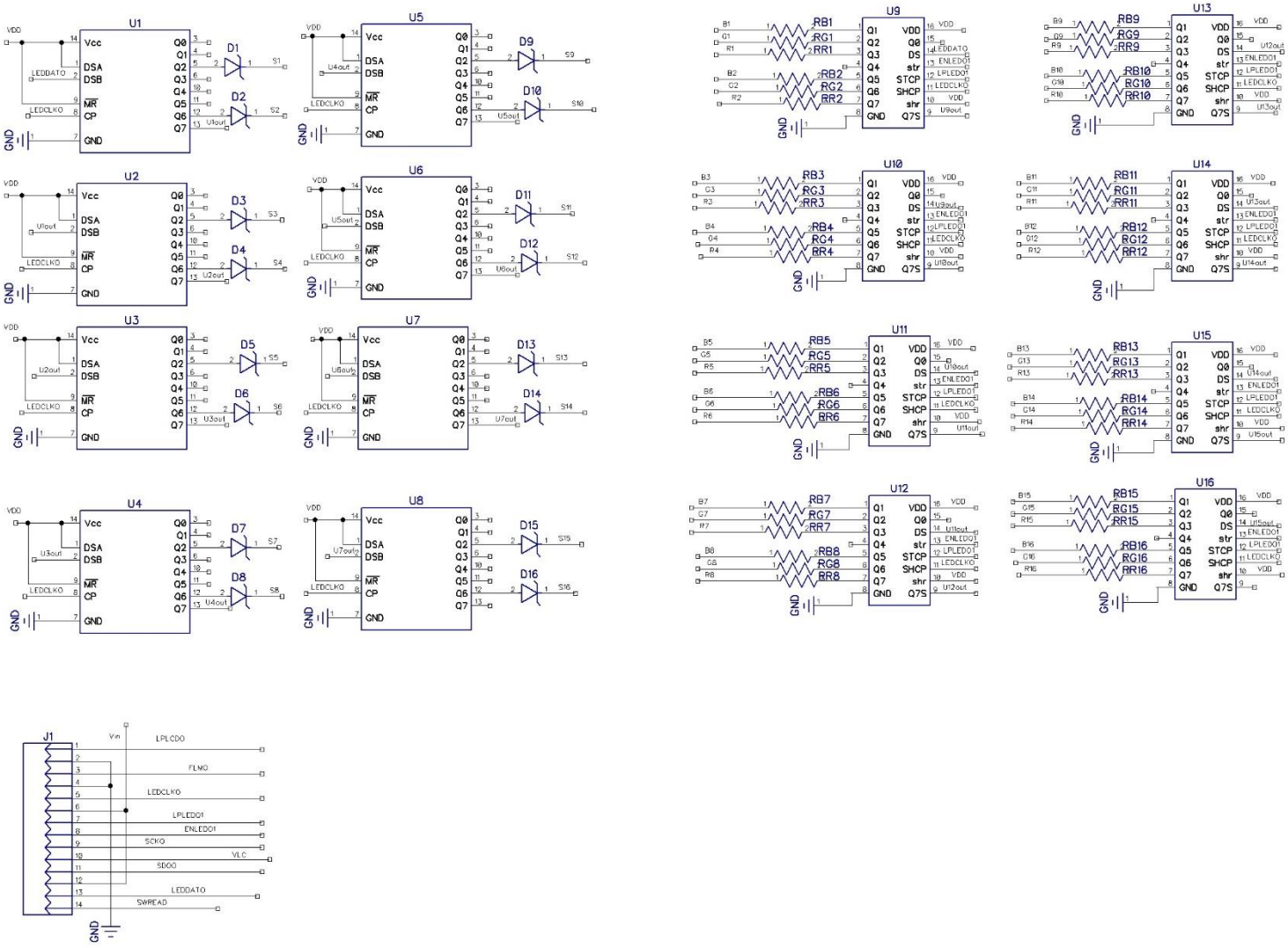




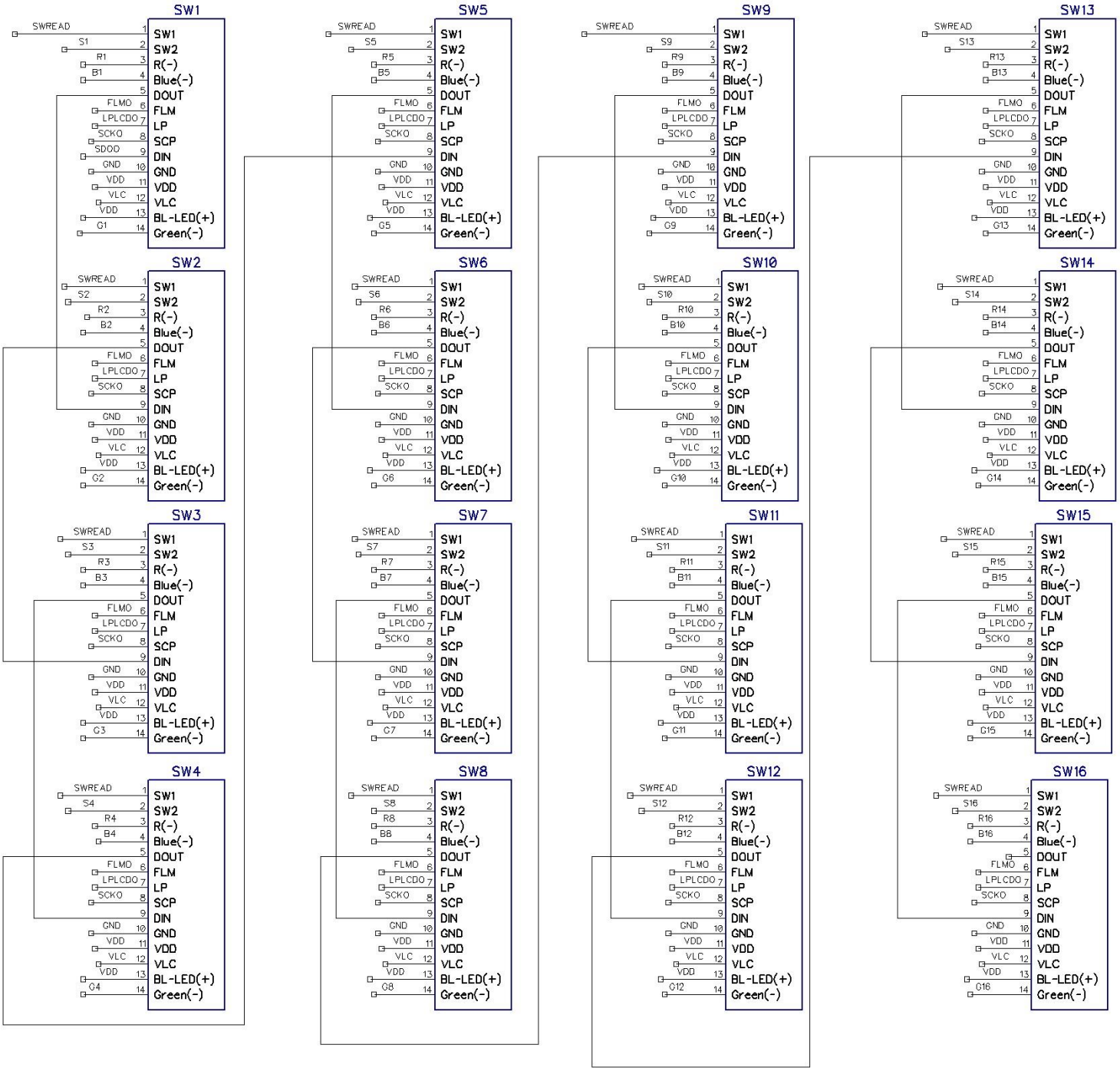
Schematic for IS-L1602 Rev A, page 1:



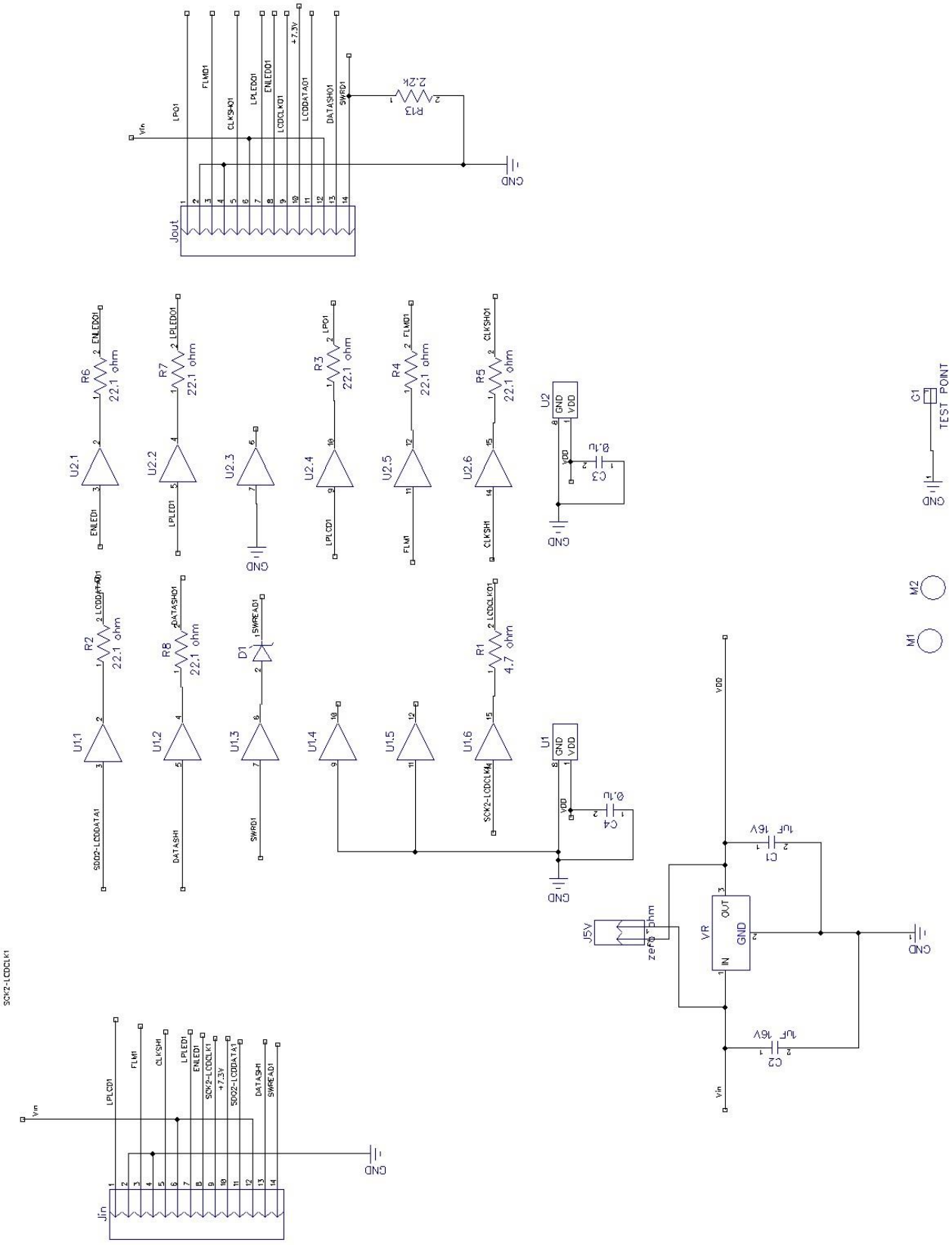
Schematic for IS-L1602 Rev A, page 2:



Schematic for IS-L1602 Rev A, page 3:



Schematic for IS-LBUF01 Rev B:



7. Key Terms & Definitions

Host:

Any computer, terminal, or other device that sends commands over USB, RS232, or RS422.

Controller:

A PCB with a microcontroller that controls one or more logic boards

Logic board:

A PCB with one or more SmartDisplays that can be daisy chained

Byte:

An eight-bit hex value ranging from 00H to FFH (Decimal 0 to 255). The bit format of a byte is: (B7 B6 B5 B4 B3 B2 B1 B0) where B7 is most significant and bit B0 is least significant bit.

Nibble/Hex digit:

A four-bit value ranging from 0H to FH. A byte consists of two nibbles.

Communication format:

There are two formats to transmit a byte:

1. Hex format - A hex byte is transmitted without any change to it. [xxH] will be used to denote this. All commands and some data are sent by using this format.

2. ASCII HEX format - Each nibble of the byte is converted to ASCII code and sent as a byte. [xxAH] will be used to denote this.

For example, the hex byte 5AH is transmitted in two bytes, 35H and 41H. The ASCII value for 5 is 35H and the ASCII value for A is 41H.

All addresses and most data are sent using this format.

Warranty

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