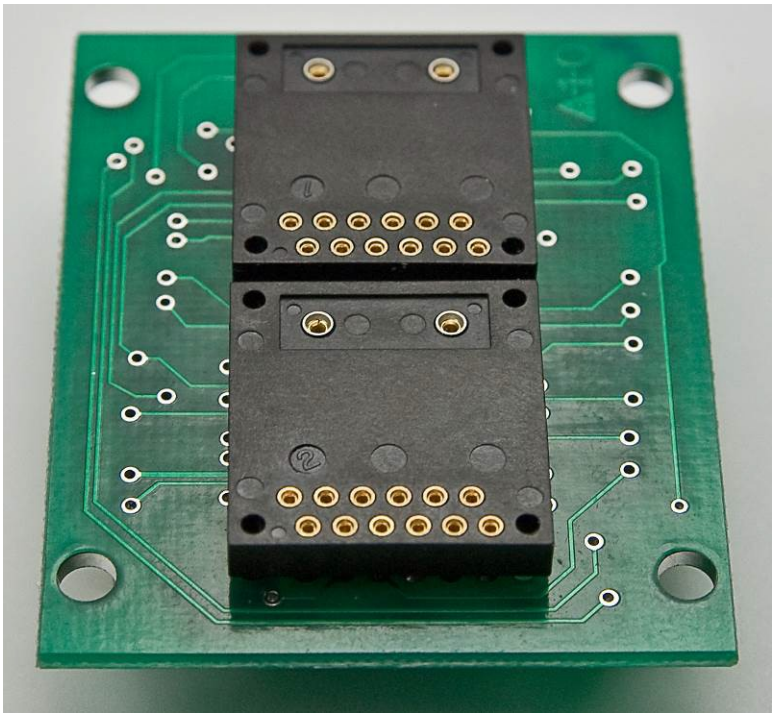
LCD 36x24 Logic Boards User Manual

Revision G



7850 East Gelding Drive • Scottsdale, AZ 85260-3420

TABLE OF CONTENTS

Contents

7850 East Gelding Drive • Scottsdale, AZ 85260-3420

1. What are Logic Boards?

Logic Boards are switch panel that have glue logic to convert addressing and switch scanning to serial. A Logic Board can be designed for any number of switches. The Logic Boards can be daisy-chained using 14 pin ribbon cable hence allowing variable number of switches to be controlled via one port from a controller.

Logic Board with any number of switches can be designed. Daisy-chain capability of the Logic Boards allow the switches to be mounted at desire locations on the control panel.

The switches/displays can be soldered directly to the Logic Board or mounted on a sockets.

2. Standard Part Numbers

The Logic Boards listed below are production parts. There are prototype boards that are not listed. Additionally, NKK Switches will work with customers to design and build custom logic boards.

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 Board are used in a daisy chain or very long cable are used for interconnect.

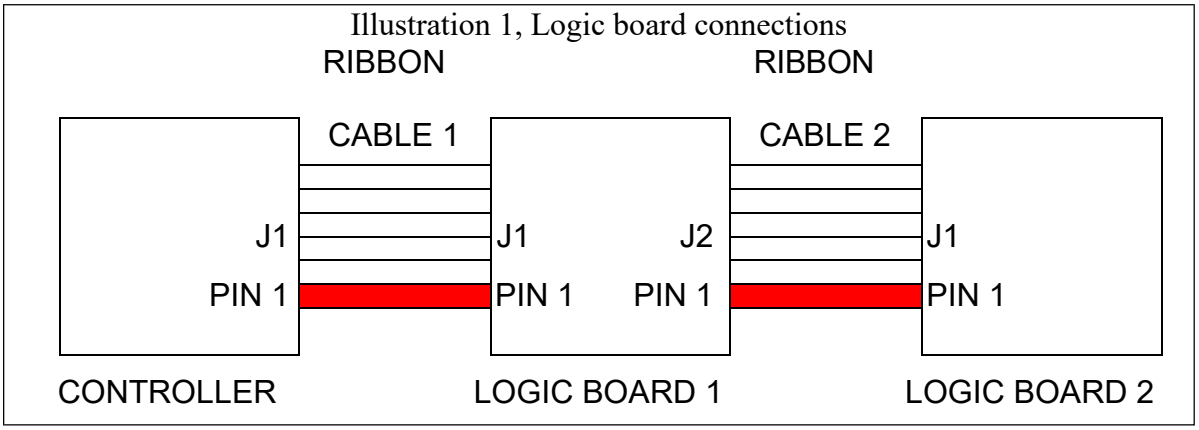
Item	Part#	Description
1	IS-LBUF01	Signal booster for both LCD36x24 and LCD64x32

Note: Make sure the power is off when connecting or disconnecting the Logic Boards to or from the controller or each other.
Note: Connecting the Logic Boards improperly could damage either/both the Logic Boards and controller.

3. Connectors

The SmartDisplay Controller connects to the J1 of the first logic board via 14 pin ribbon cables. The J2 of the first logic board connect to J1 of the second logic board and so on. The switch numbering start with switch one of the first Logic Board. The first switch of the next Logic Board will be one higher than the last switch of the previous Logic Board.

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 connecting Logic Boards and the controller

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 .1"x.1" spacing.

This connector connects to the controller port or J2 of the previous logic board in the daisy chain.

Pin	Function	
1	LP	Connected to LP of smart switches and J2
2	GND	Ground
3	FLM	Connected to FLM 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 .1"x.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 SmartSwitch
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 SmartSwitch
12	Vsup	Connected to J1
13	Dout1	Connected to last shift register bit used
14	SWREAD	Connected to J1

7850 East Gelding Drive • Scottsdale, AZ 85260-3420

4. How to control the Logic Board mounted LCD64x32 switches

If you are using NKK controllers, you can skip this section. This section cover detail on how to control LCD 64x32s mounted on the Logic Boards.
Please note the controller with the same port can control the LCD36x24. If you want the same design have capability to control both type of the LCDs Please check the LCD36x24 Logic Board user manual as some of indicated ground in below table need to be changed to LCD36x24 Logic Boards requirement.

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 to GND

Clock and data can be connected to SPI/UART mode 0 or any pin of microcontroller. For SCP and Din, LP, FLM signal please refer to the application note for LCD64x32 switches.

Switch Numbering

On each Logic Board the first switch is in the upper left-hand corner. 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. The first switch of the next Logic Board will be one higher than the last switch of the previous Logic Board. Please note if a switch is missing the data does not get to any switch after missing switch.

Controlling Backlighting

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, the fourth bit shifted is dummy bit. The last 4 bits shifted are for switch #1. Once the all the backlight data are shifted The LP1 is taken high and then low. A bit =0 turn backlight ON and a bit=1 Turn the backlight OFF. The LED Disable has to be Low for the backlight to go to effect. The LED Disable can be used for brightness control disabling/Enabling the backlights.

Switch Scan

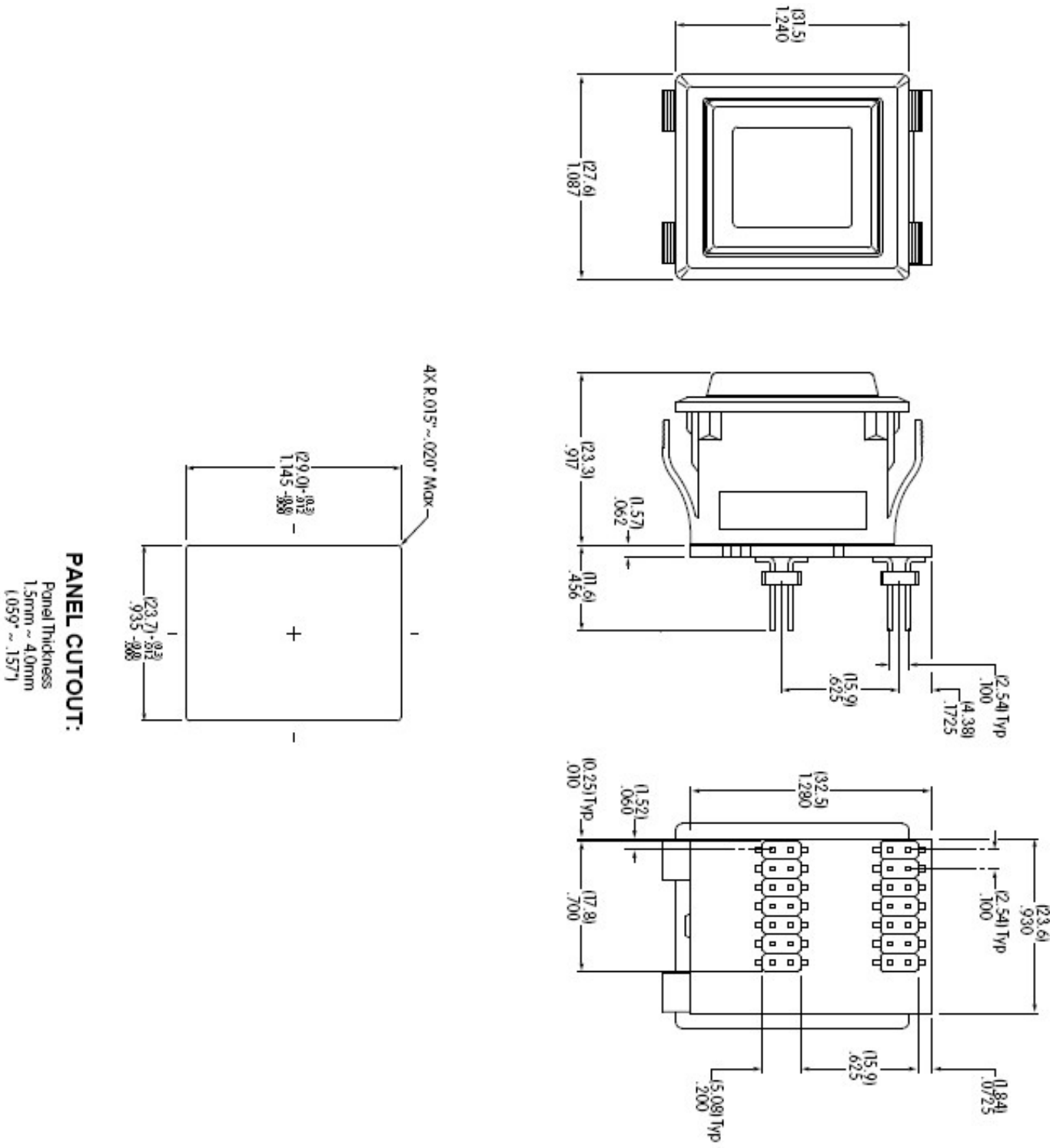
One terminal of each switch is connected to the SWRD (switch Read). The output of the serial to parallel shift register is connected to another switch terminal via a diode. Four bit is shifted for each switch using Din and CLK. The third bit of 4 bits shift is used for the switch scan. The last 4 bits 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 read and less than 80ms to prevent missing a read.

7850 East Gelding Drive • Scottsdale, AZ 85260-3420

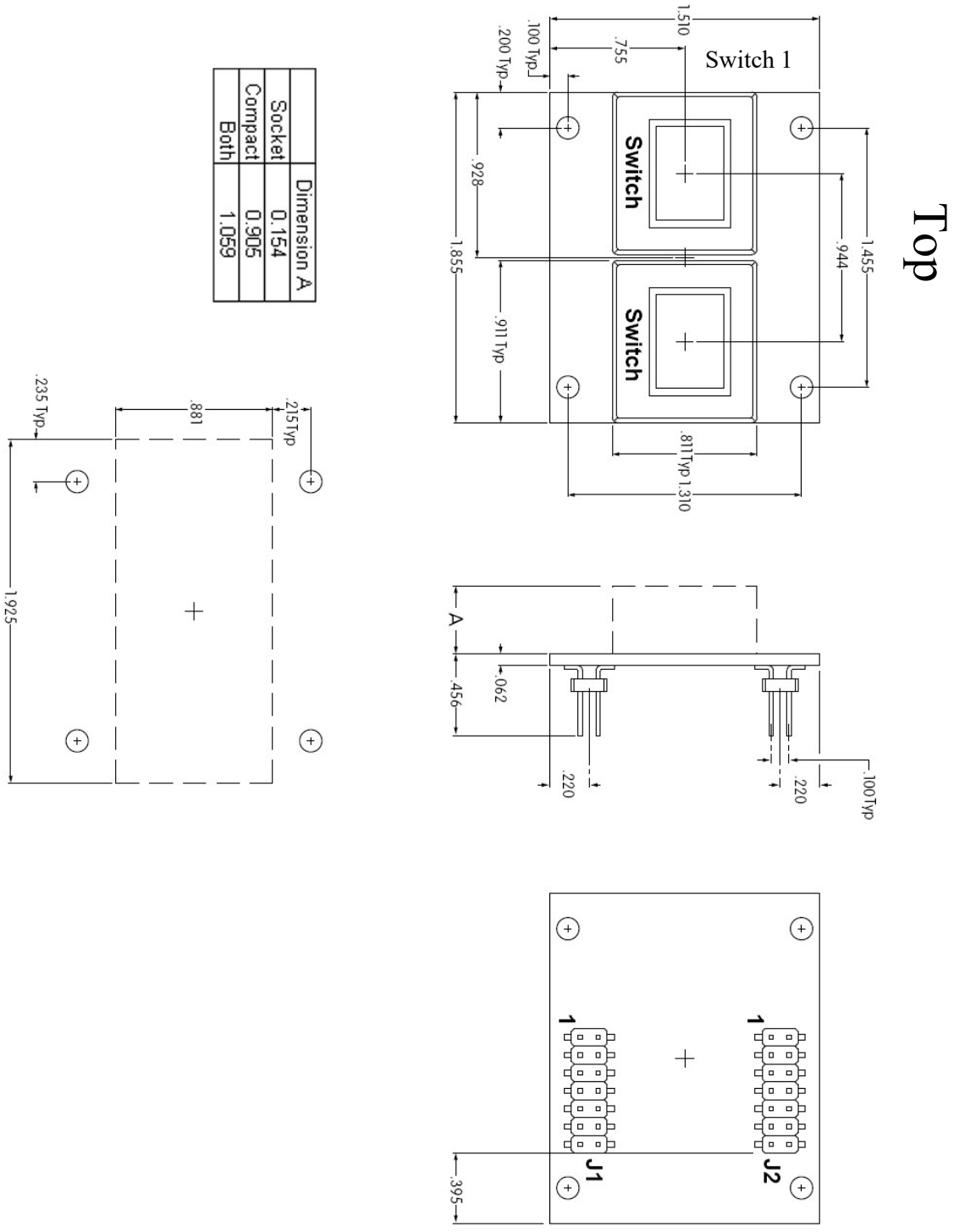
5. Board Dimensions

Logic Board Dimensions for IS-L0107-IS15BBFB4PRGB:



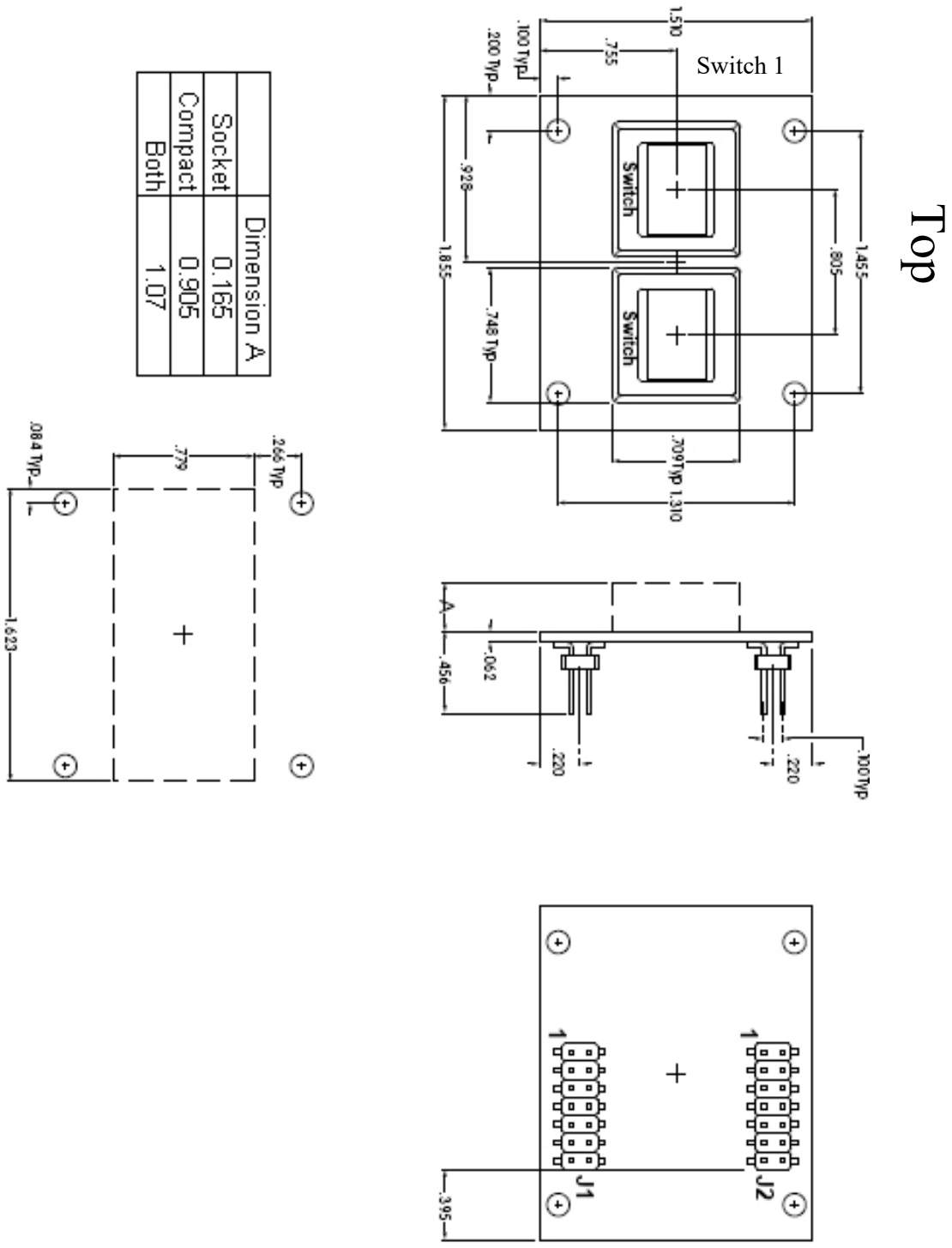
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Logic Board Dimensions for L0204:



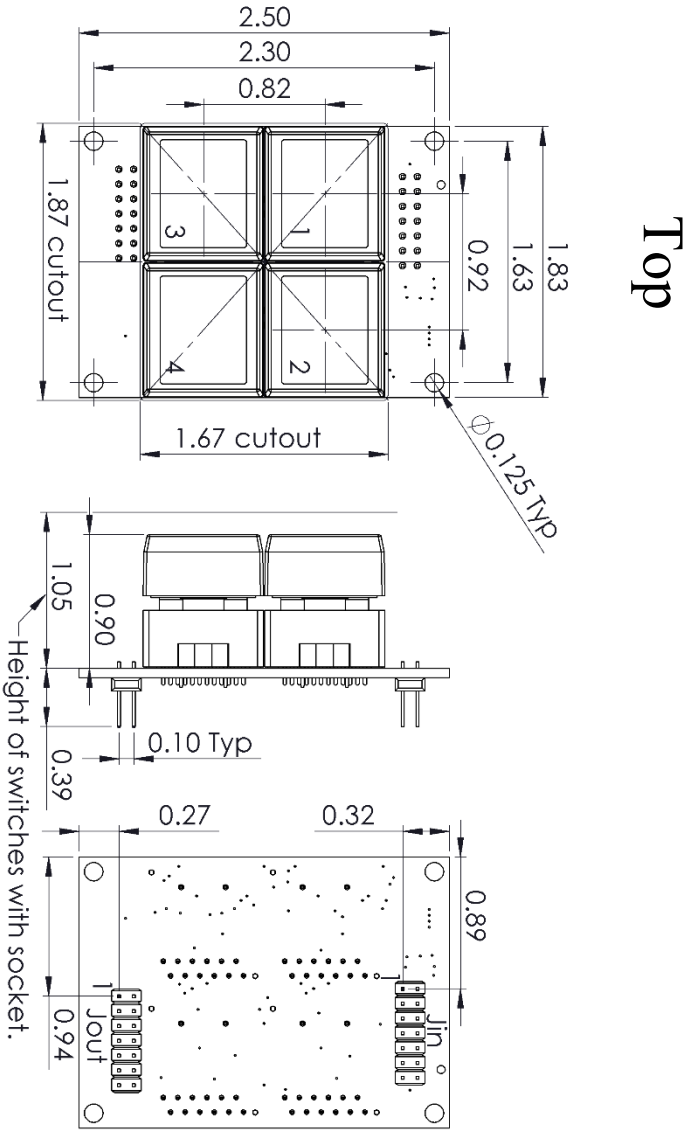
	Dimension A
Socket	0.154
Compact	0.905
Both	1.059

Logic Board Dimensions for L0271:



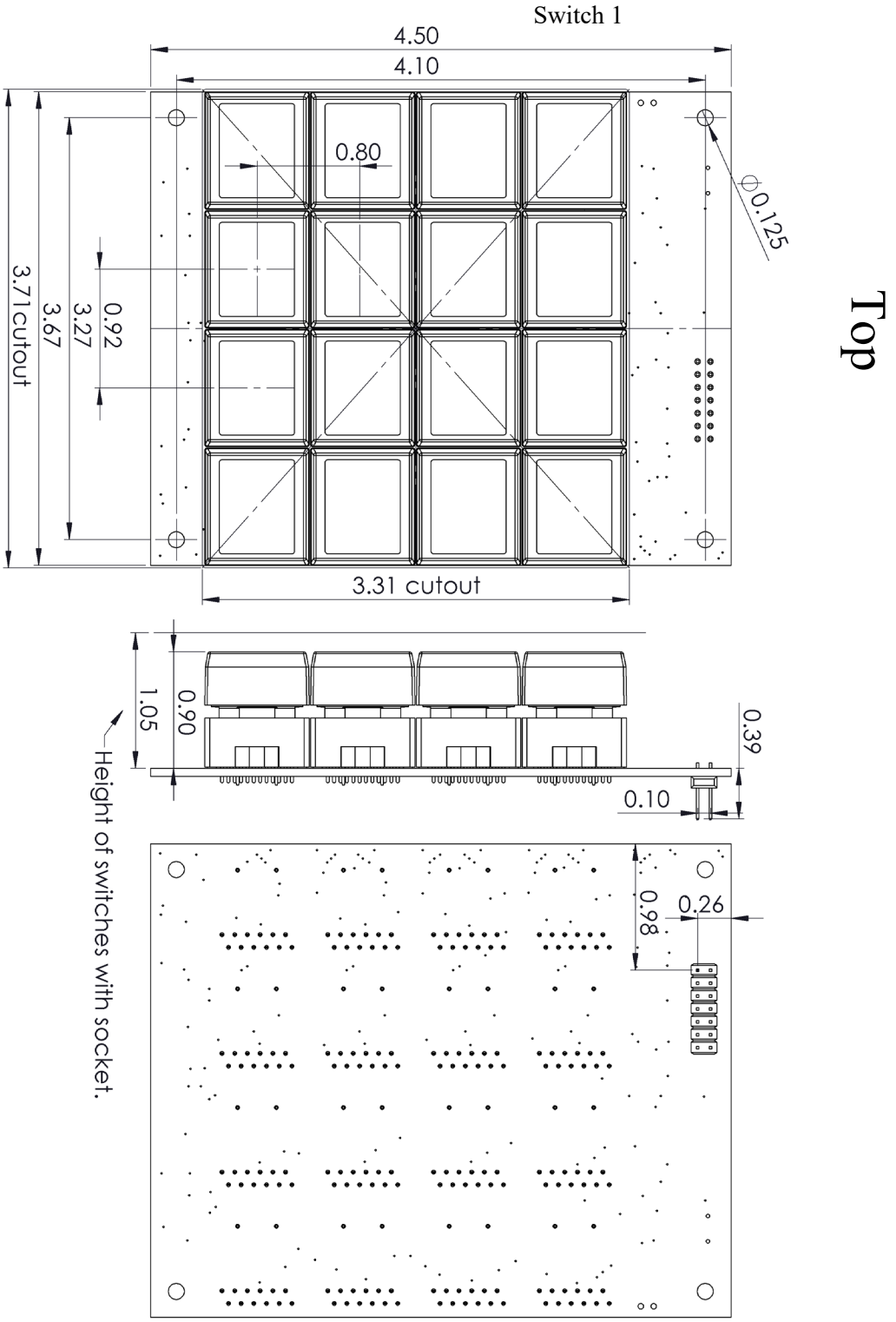
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Logic Board Dimensions for L0403:



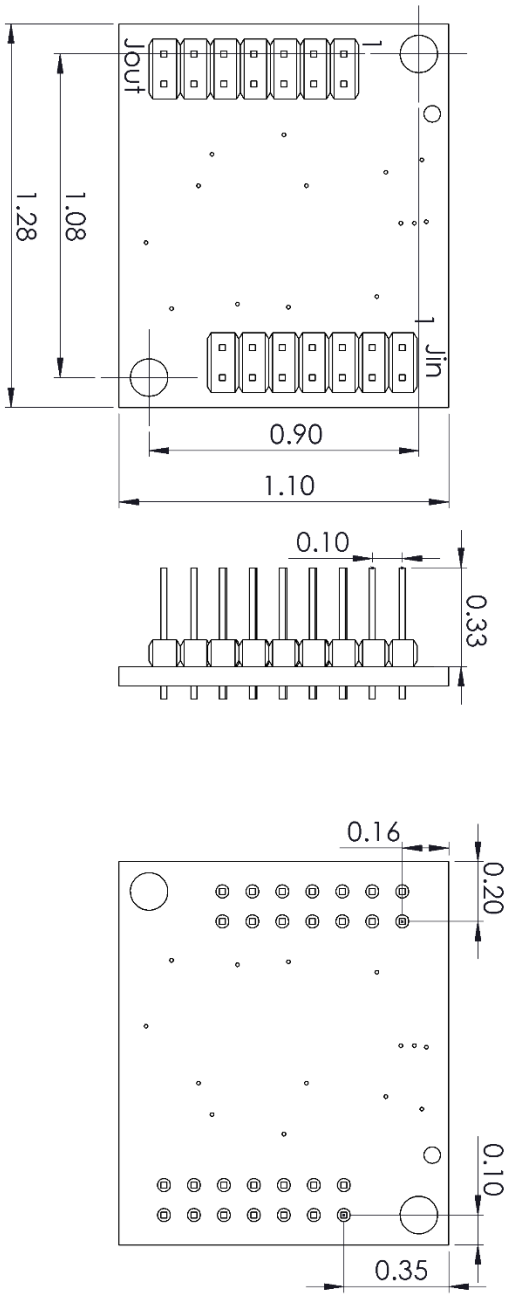
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Logic Board Dimensions for L1602:



7850 East Gelding Drive • Scottsdale, AZ 85260-3420

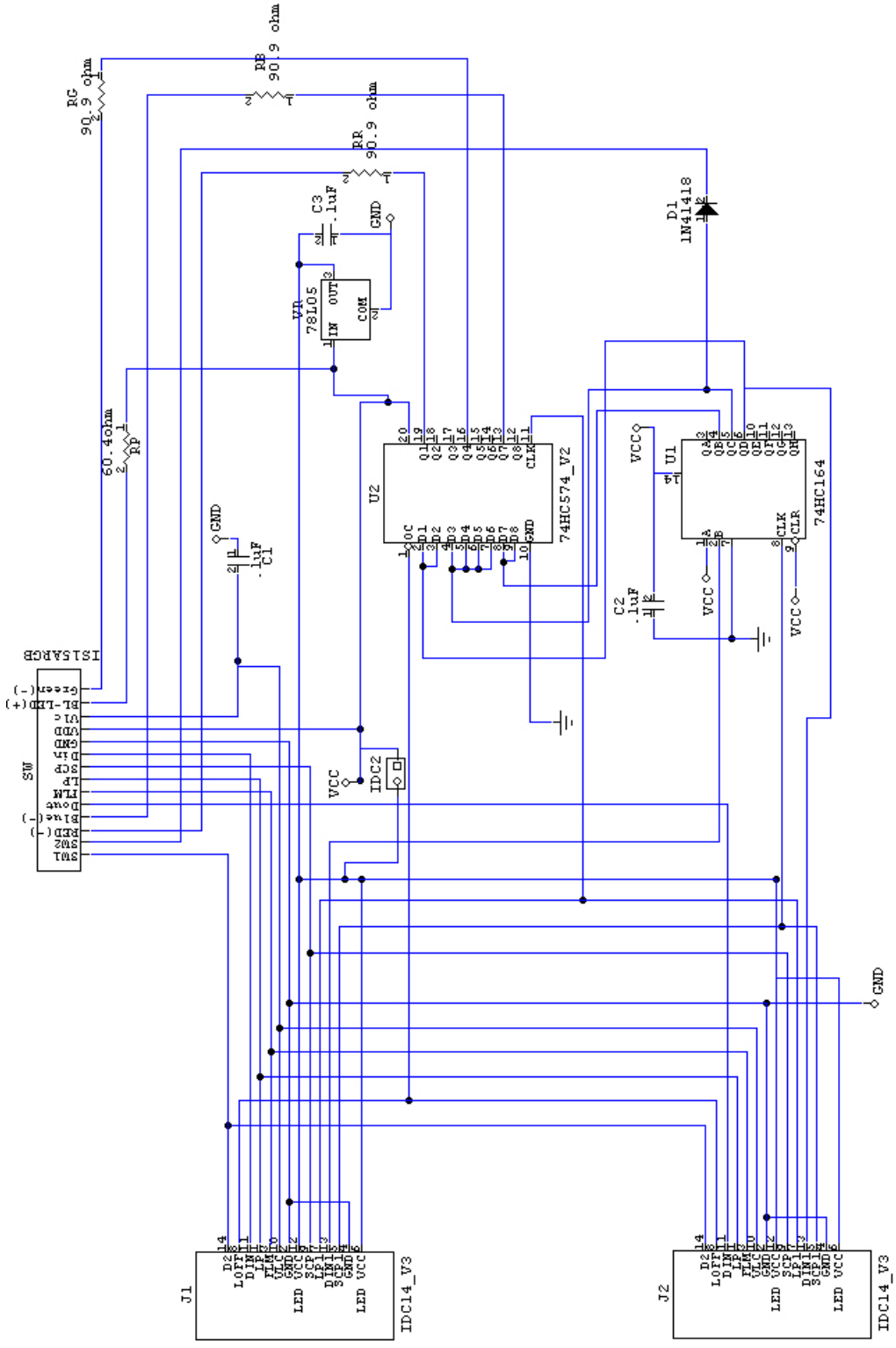
Logic Board Dimensions for LBUF01:



7850 East Gelding Drive • Scottsdale, AZ 85260-3420

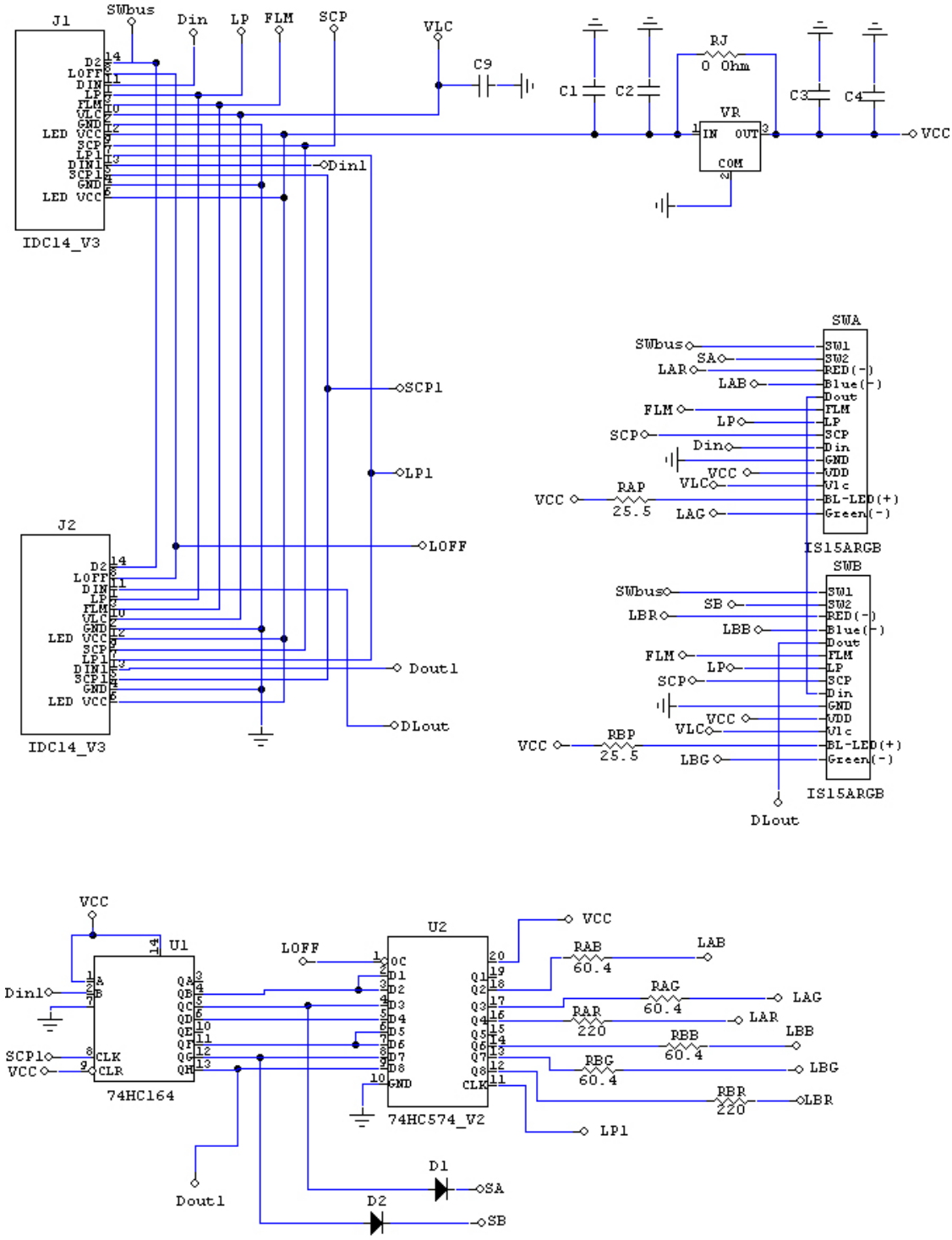
6. Schematics

Schematic for IS-L0107-IS15BBFP4RGB Rev A:



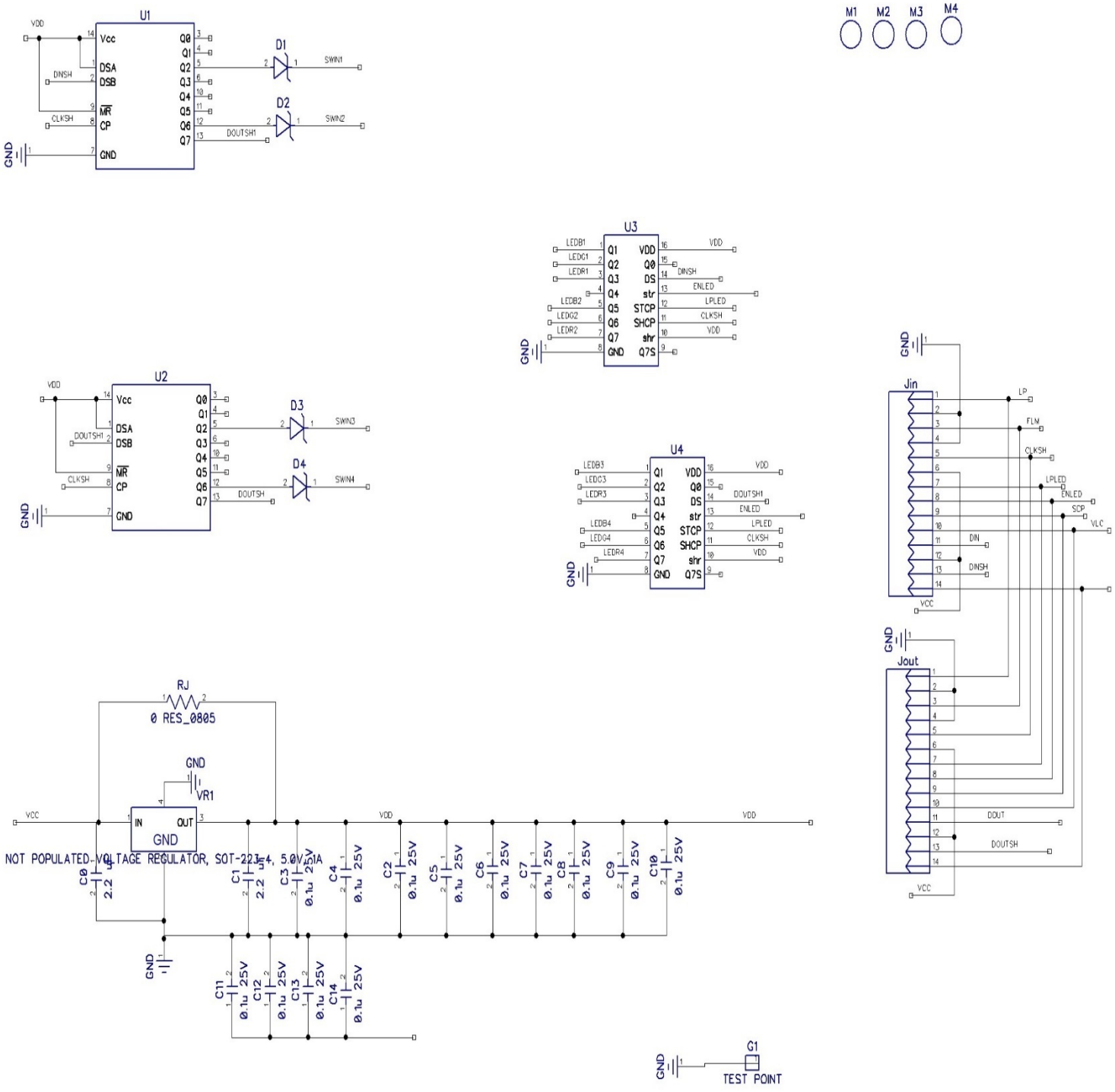
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

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



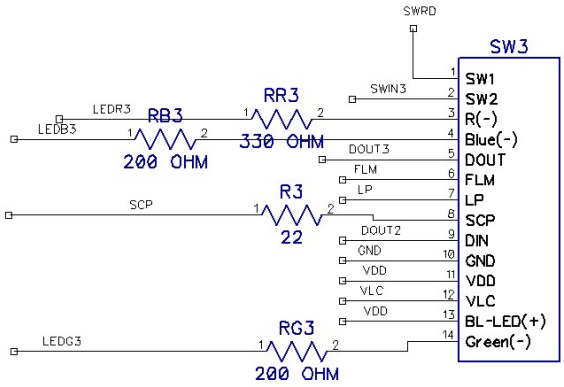
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

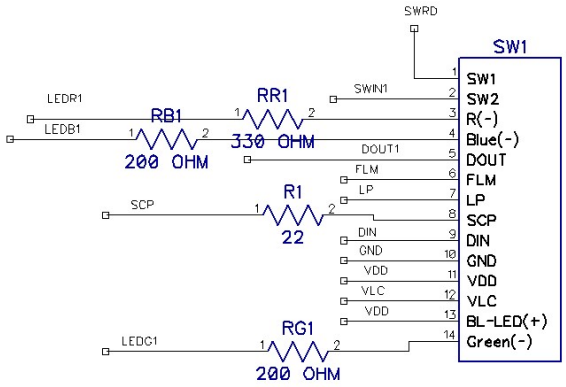
Schematic for IS-L0403 Rev A, page 1:

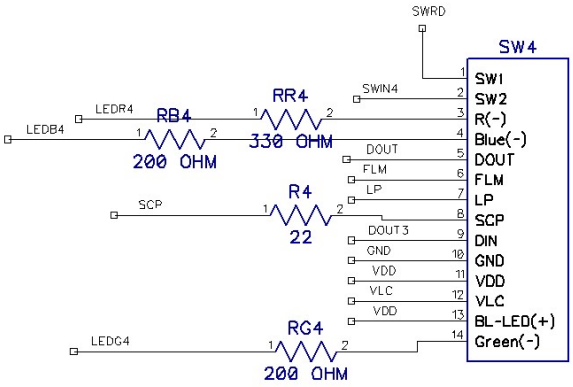


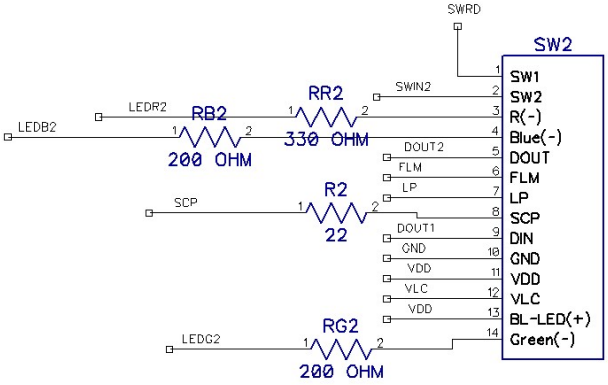
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Schematic for IS-L0403 Rev A, page 2:



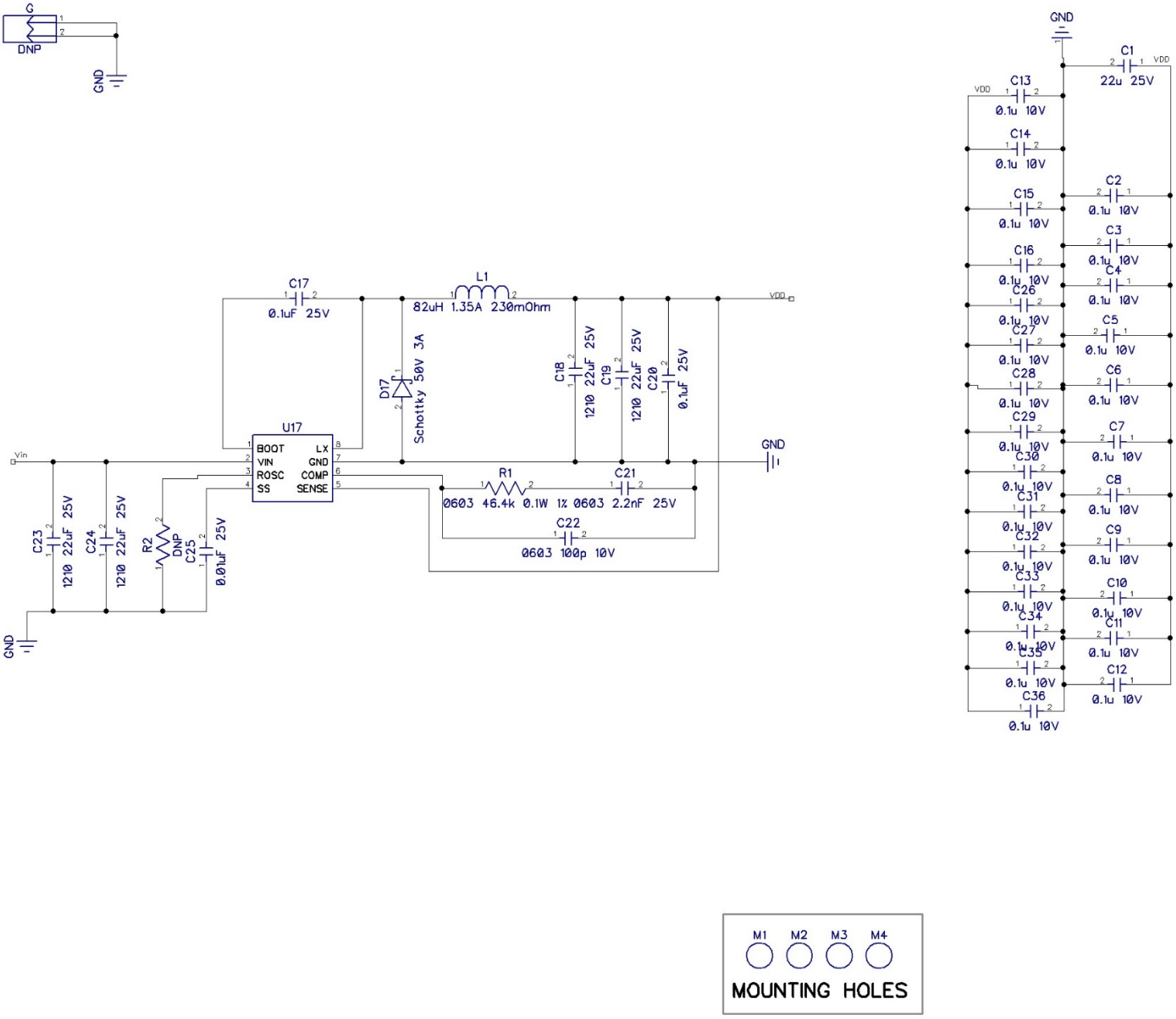






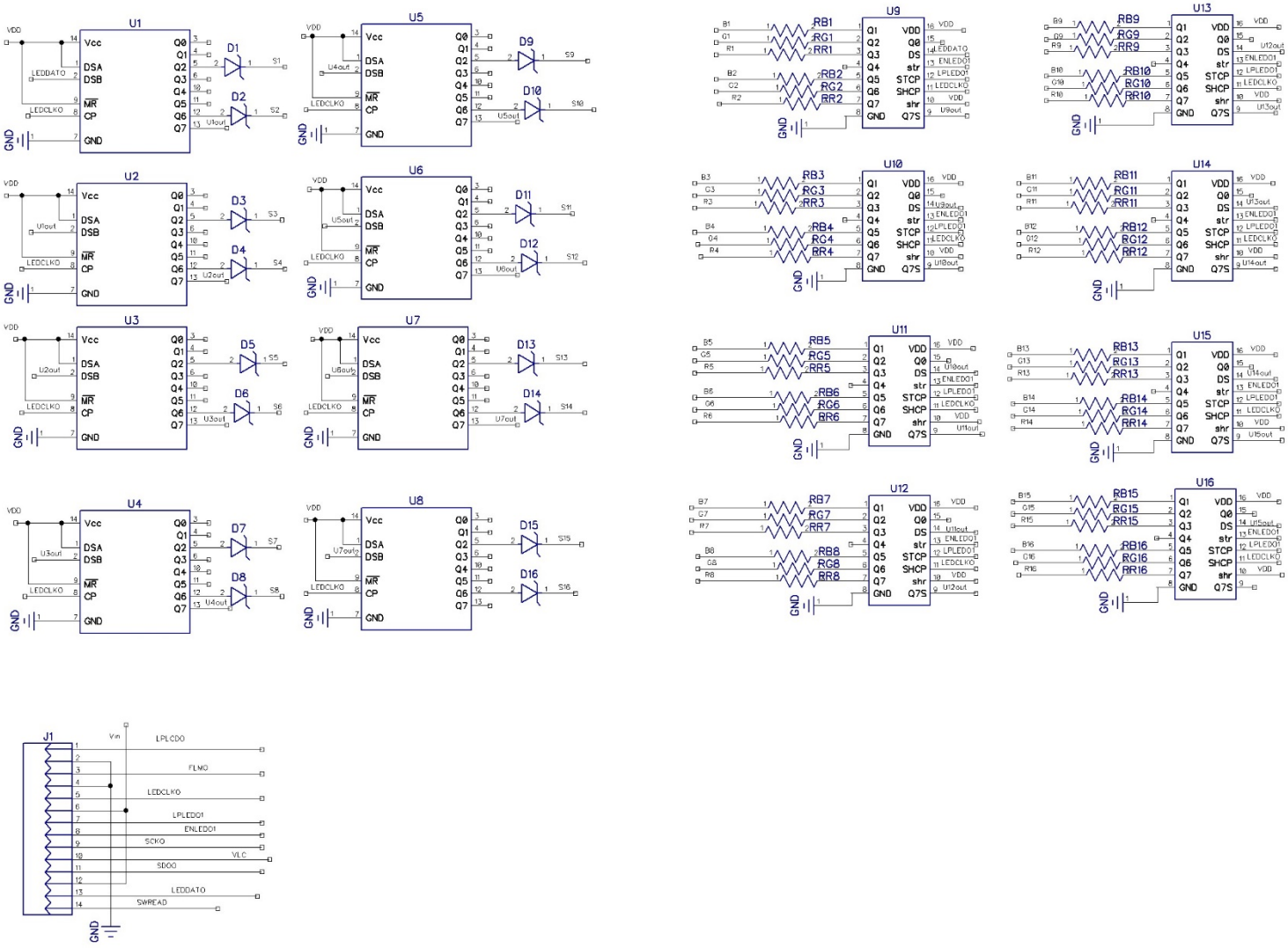
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Schematic for IS-L1602 Rev A, page 1:



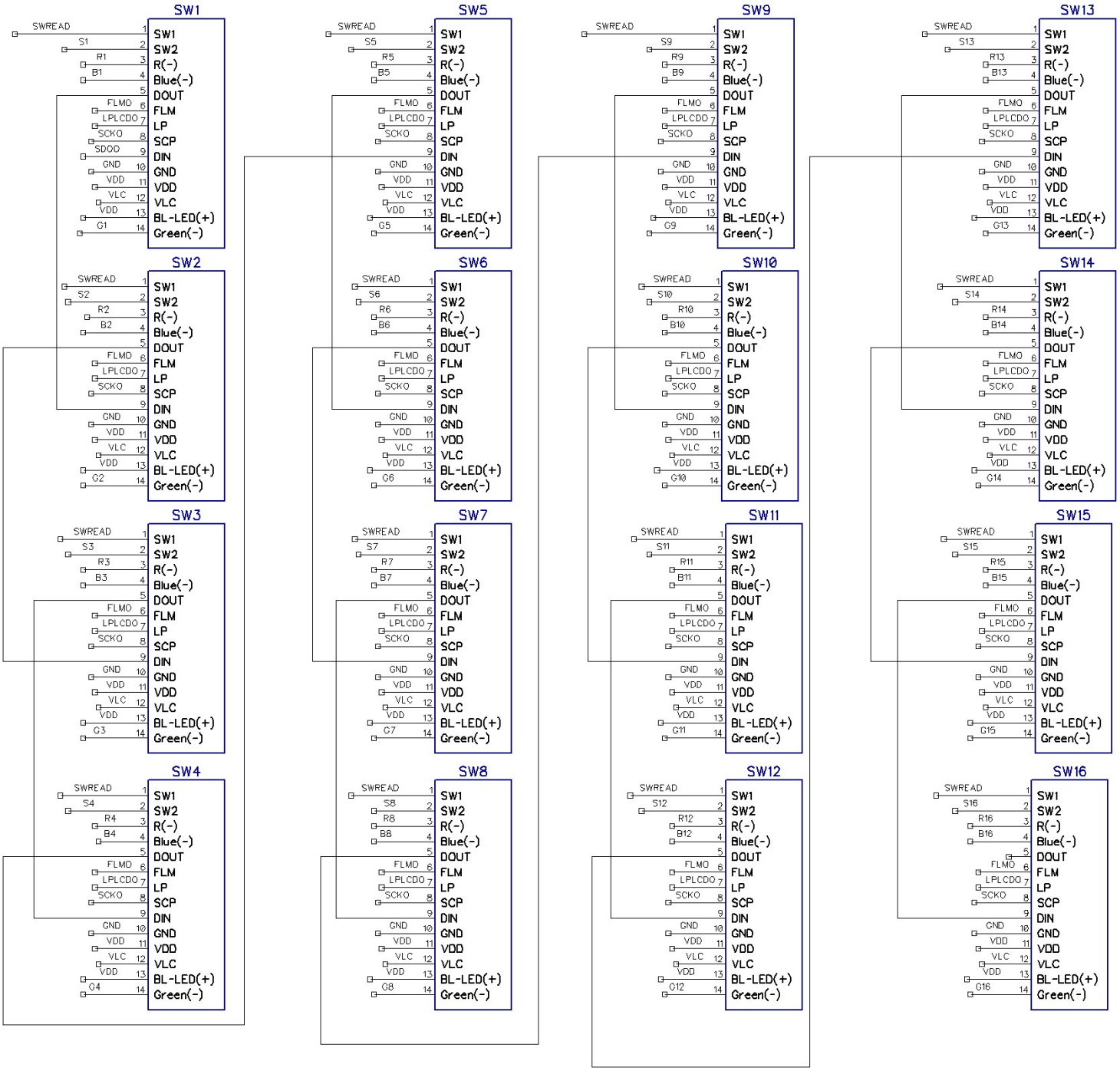
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Schematic for IS-L1602 Rev A, page 2:



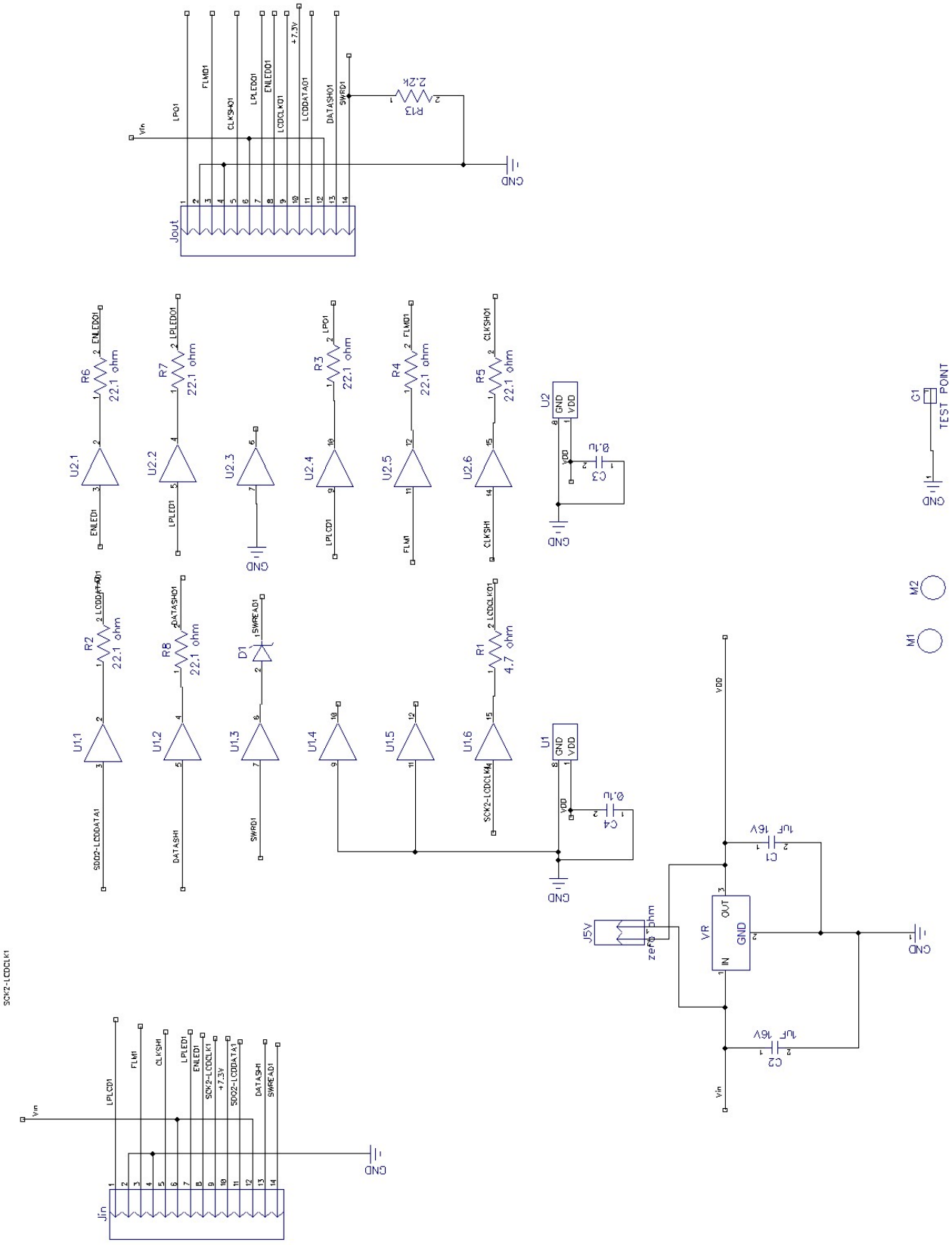
7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Schematic for IS-L1602 Rev A, page 3:



7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Schematic for IS-LBUF01 Rev B:



7850 East Gelding Drive • Scottsdale, AZ 85260-3420

7. Key Terms & Definitions

Module — NKK Switches' LCD SmartSwitches and SmartDisplays.

Host — Any computer, terminal, or other device that can communicate over the USB line.

Controller — A PCB assembly that controls one or more logic boards and the switches associated with them. It communicates with a host over the USB line.

Logic Board — A PCB assembly with "glue logic" for mounting switches. It is controlled by a controller.

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.

ASCII — A byte value representing a symbol.

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.

Address — A one byte value ranging from 01H to FFH representing the 255 memory.

7850 East Gelding Drive • Scottsdale, AZ 85260-3420

Warranty

NKK SWITCHES LIMITED WARRANTY AND LIMITATION OF LIABILITY

The following limits our liability. Please read.

NKK Switches hereby warrants this product against any and all manufacturing defects for a period of one year from the date of sale of this product to the original end user. NKK Switches' liability in the event of such defect is limited to repair or replacement of the defective products. NKK Switches disclaims any liability or warranty obligation with respect to any product that is misused, damaged by any user, or not used in conformity with all applicable product specifications.

NKK SWITCHES HEREBY DISCLAIMS ANY WARRANTY, EXPRESS OR IMPLIED, OTHER THAN THAT CONTAINED HEREIN. NKK SWITCHES EXPRESSLY DISCLAIMS THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND SHALL HAVE NO LIABILITY BASED ON OR ARISING FROM ANY CLAIM OF SUCH WARRANTY.

NKK Switches shall have no liability to any person for any incidental, consequential, special, punitive, or other damages of any kind whatsoever relating to any use of this product.

USE OF THIS PRODUCT IN CONNECTION WITH ANY LIFE CRITICAL APPLICATION IS NOT RECOMMENDED.