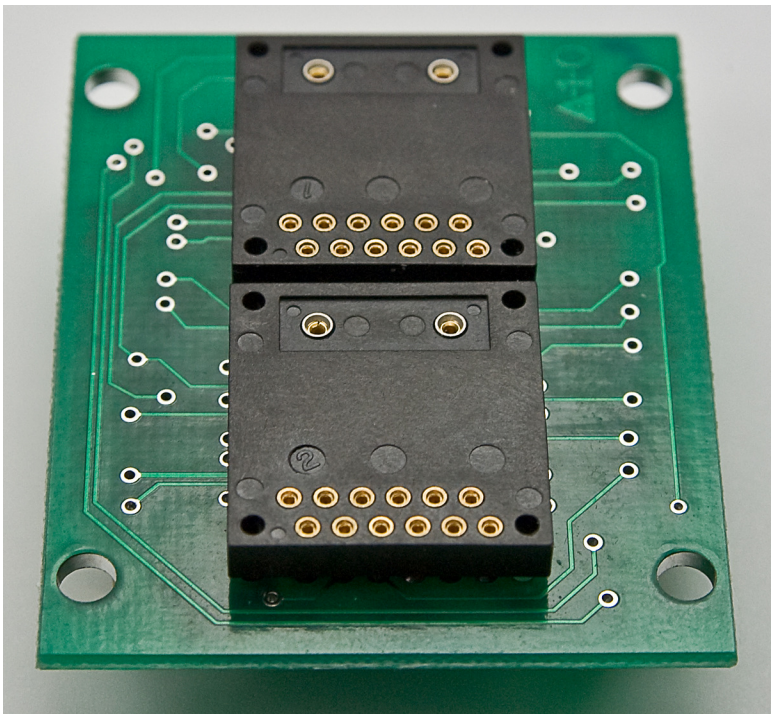
# LCD 36x24 Logic Boards Users Manual

Revision C



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# 1. Preface

The LCD 36x24 logic boards are used for mounting LCD 36x24 SmartSwitches or SmartDisplays into panels and system assemblies. The 2 switch versions are also used in the SmartSwitch Dev Kits as demonstration platforms for the SmartSwitch and SmartDisplays. This user manual will go through general features. The NKK Switches' SmartSwitch web site is http://www.nkksmartswitch.com/.

# 2. General Logic Control Features

The LCD 36x24 logic boards are PCB's that have mount positions for one or more LCD 36x24 SmartSwitches or SmartDiplays. The switches/displays can be mounted directly on the logic board or on a socket mounted on the board. One or two switch boards are the most common but logic boards with other configurations are available as well as custom designs. They have some "glue logic" for converting the backlight addressing and switch scanning to serial, and therefore many logic boards can be daisy-chained via 14-pin ribbon cables. The switch numbering is according to their order in the daisy-chain, where the switch number one is on the logic board connected directly to the controller. The LCD 36x24 logic boards are 4-bit logic except IS-L0102-IS15ABCP4CF which is 2-bit. Many controllers are designed to work either with 4-bit or 2-bit logic boards.

There are four types of LCD 36x24 logic boards; Bicolor/Monocolor pushbutton, RGB pushbutton, Bicolor/Monocolor/RGB display, and Bicolor/Monocolor/RGB compact.

# 3. Part Number Configuration

The logic board part numbers are divided up by their attributes.

| 1 | | 2 | | 3 | 4 | | 5 |
|---|---|---|---|---|---|---|---|
| IS | - | L0205 | - | 5 | C | - | IS15ANCP4CF |

1. IS Prefix.
2. The Logic Board base part number. The first number is the quantity of switch positions on the board. The second number is the version.
3. No code = Standard 9 to 12 V voltage.
   5 = 5 V voltage
4. No code = No socket for IS switches.
   C = Socket are soldered to the PCB for IS switches
5. No code = No IS switches.
   IS15… = The logic board is populated by the IS Switches.
   Mxxx = The multi switch logic board is populated by different types of IS switches.

**Logic boards can be customized based on customer requirements.**


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# Standard Part Numbers

One or two switch boards are the most common but logic boards with other configurations are available as well as custom designs. NKK Switches will work with customers to design and build custom logic boards to fit customer requirements.

**Part number examples used in IS Dev Kits:**

| SmartSwitch Configuration | Part Number | Description |
|---|---|---|
| Two LCD 36x24 Bicolor, or Monocolor Pushbutton | IS-L0205-C | With socket |
| | IS-L0205-(Switch part number) | With switches mounted directly |
| | IS-L0205-C-(Switch part number) | With switches mounted on sockets |
| Two LCD 36x24 RGB Pushbutton | IS-L0204-C | With socket |
| | IS-L0204-(Switch part number) | With switches mounted directly |
| | IS-L0204-C-(Switch part number) | With switches mounted on sockets |
| Two LCD 36x24 RGB, Bicolor, or Monocolor Display | IS-L0251-C | With socket |
| | IS-L0251-(Switch part number) | With switches mounted directly |
| | IS-L0251-C-(Switch part number) | With switches mounted on sockets |
| Two LCD 36x24 RGB, Bicolor, or Monocolor Compact | IS-L0271-C | With socket |
| | IS-L0271-(Switch part number) | With switches mounted directly |
| | IS-L0271-C-(Switch part number) | With switches mounted on sockets |

**Single switch part number examples:**
Not available with sockets.

| SmartSwitch Configuration | Part Number | Description |
|---|---|---|
| Single LCD 36x24 Bicolor Pushbutton (2 bit) | IS-L0102-IS15ABCP4CF | Base part number with switches mounted directly |
| Single LCD 36x24 RGB Pushbutton | IS-L0107-IS15ABFP4RGB | Base part number with switches mounted directly |


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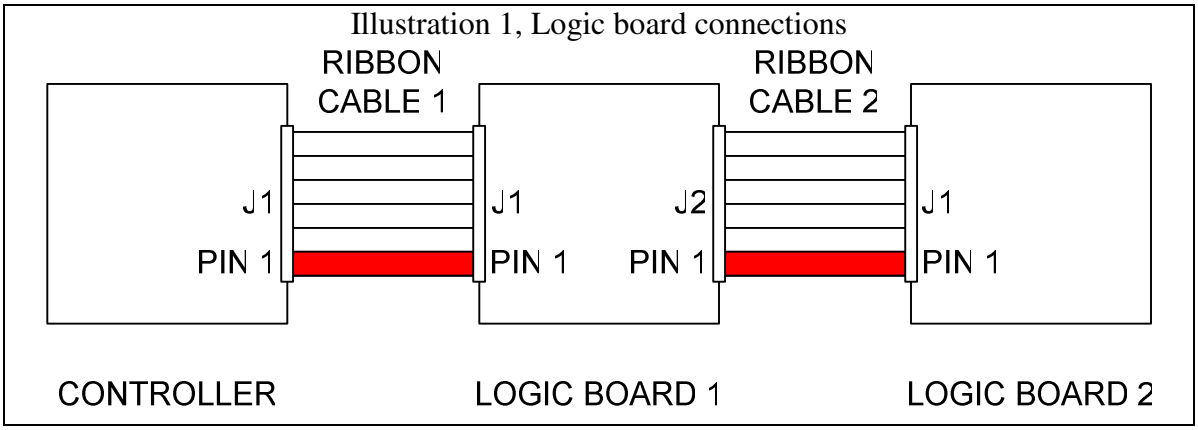
# 4. Connectors

The SmartSwitch 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.

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.**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**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 | +9V | This will be 9V or 5 V depending on the type of LB |
| 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 | +9V | This will be 9V or 5 V depending on the type of LB |
| 13 | Din1 | Connected to data in of the first shift register |
| 14 | SWREAD | Connected to one of the switches pin and J2 |

**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 | +9V | 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 | +9V | Connected to J1 |
| 13 | Dout1 | Connected to last shift register bit used |
| 14 | SWREAD | Connected to J1 |


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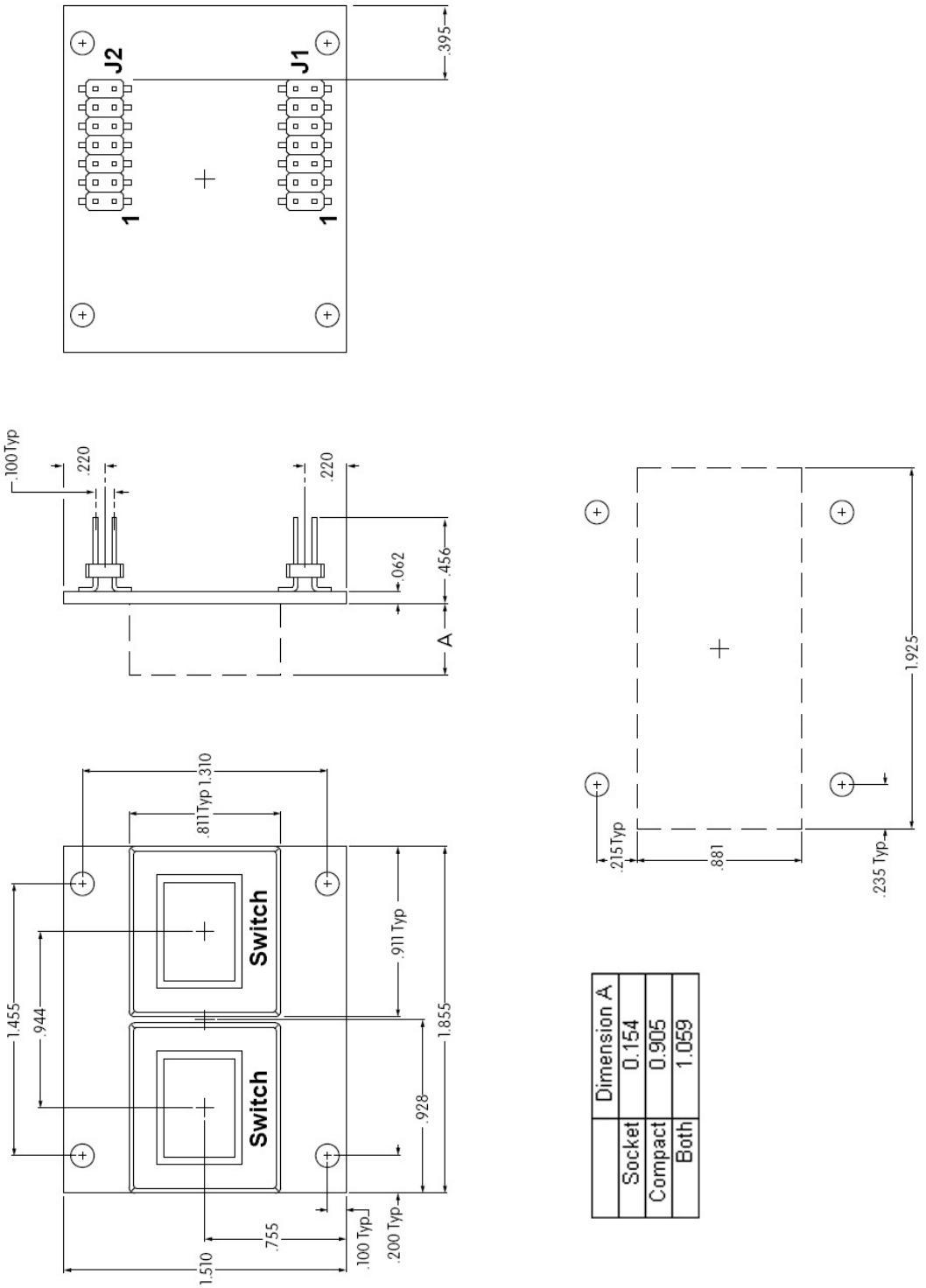
# 5. Board Dimensions

Logic Board Dimensions for IS-L0204 and IS-L0205:




| | Dimension A |
|---|---|
| Socket | 0.154 |
| Compact | 0.905 |
| Both | 1.059 |



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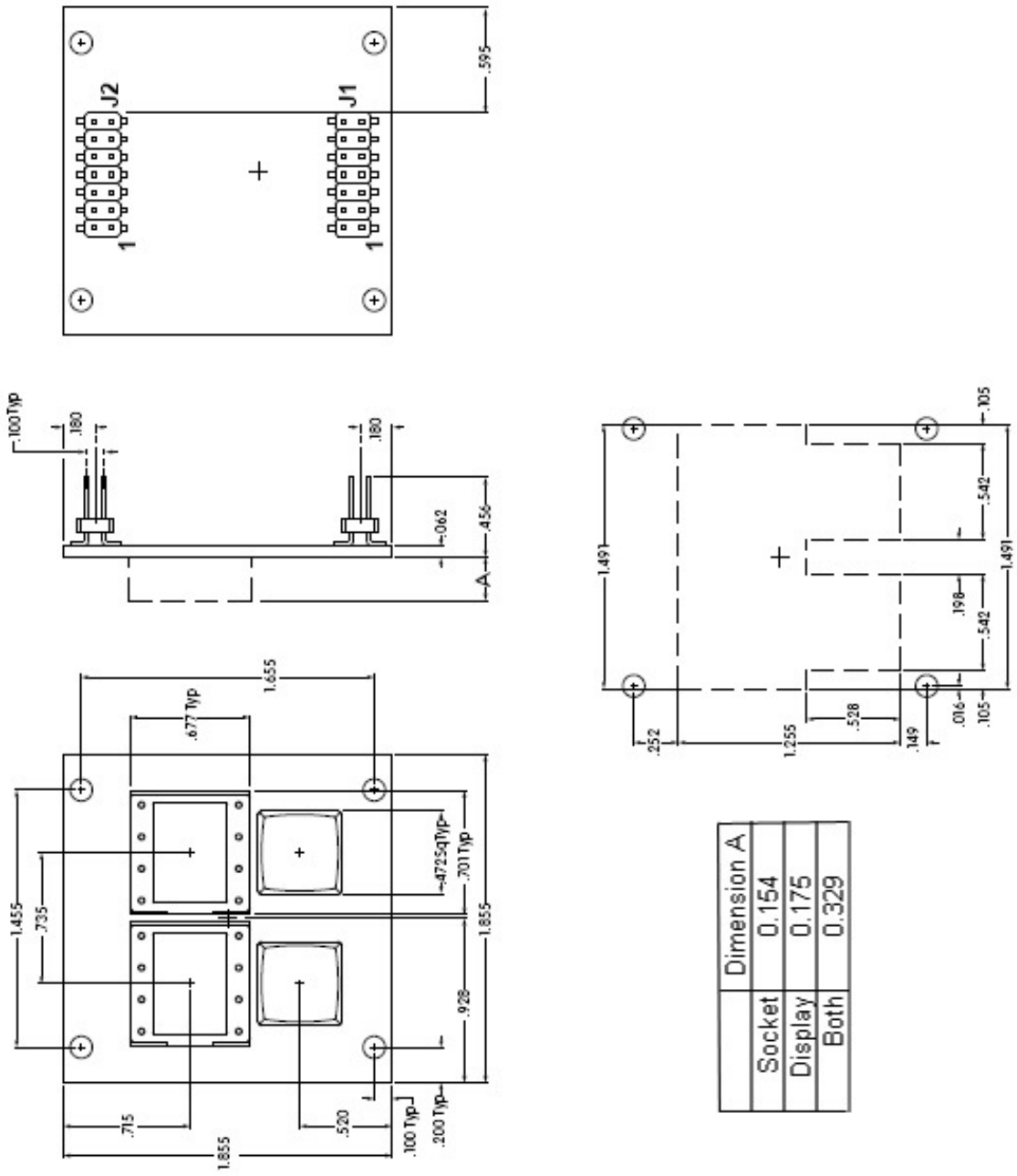
Logic Board Dimensions for IS-L0251:





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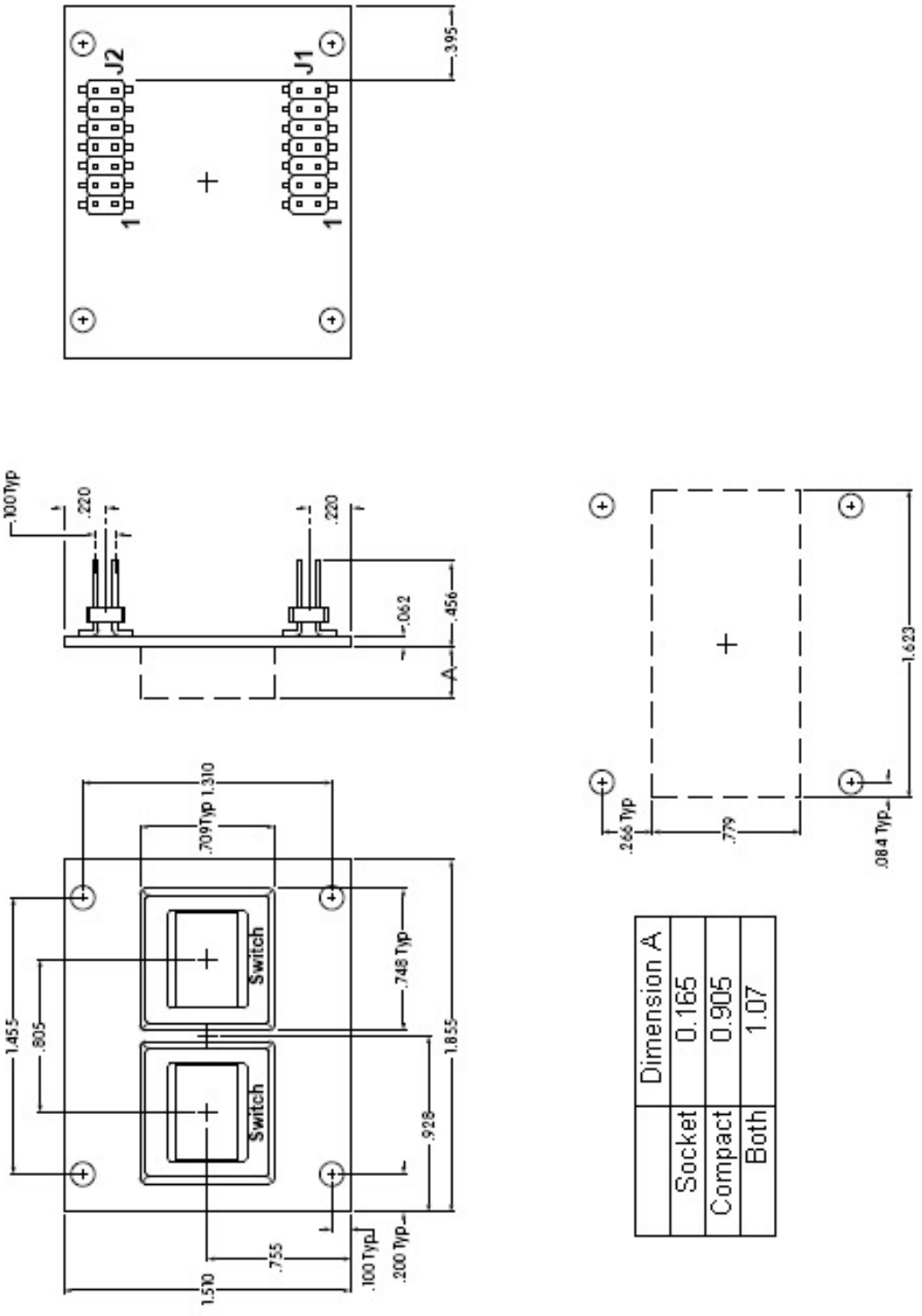
Logic Board Dimensions for IS-L0271:




| | Dimension A |
|---|---|
| Socket | 0.165 |
| Compact | 0.905 |
| Both | 1.07 |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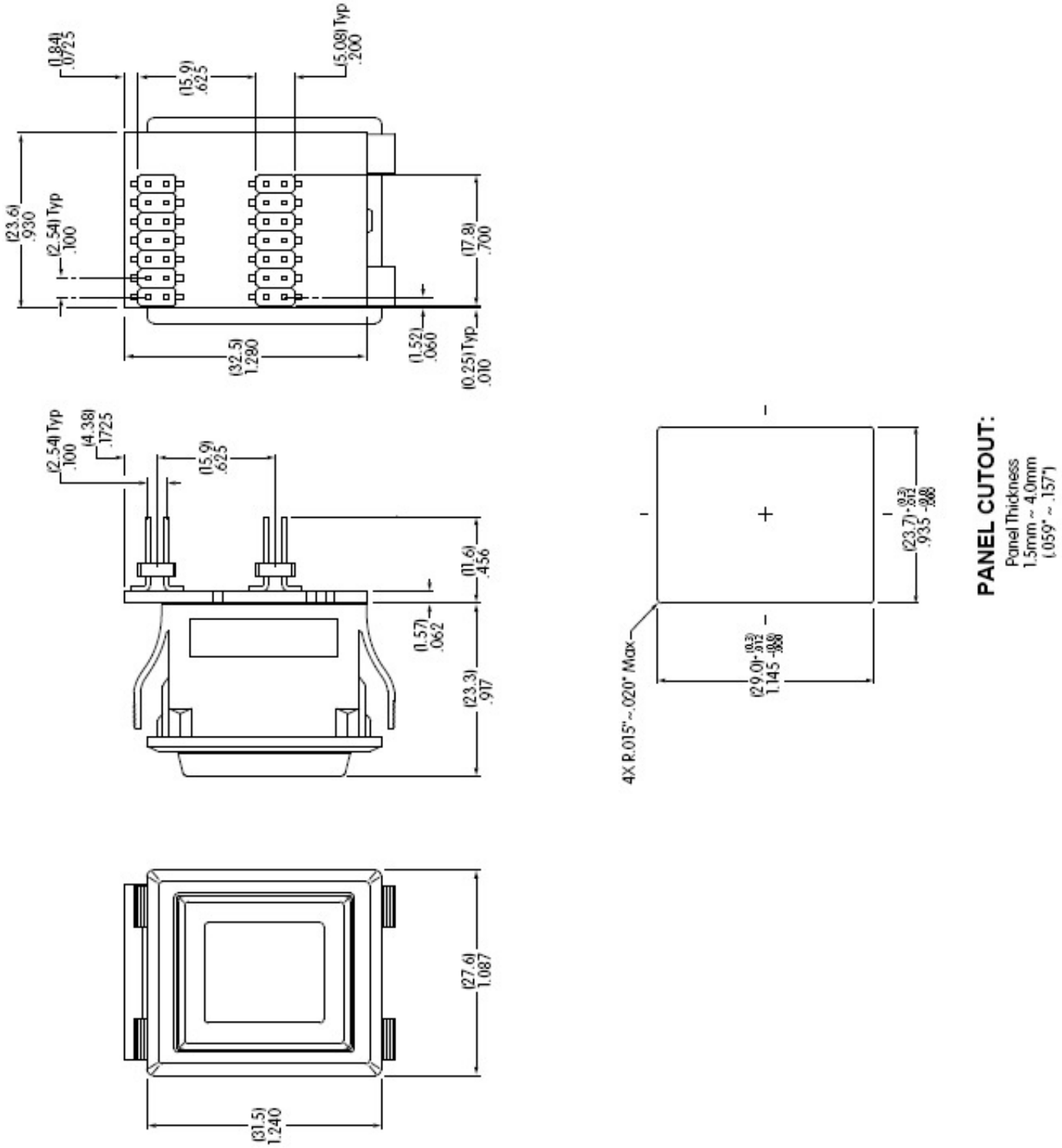
Logic Board Dimensions for IS-L0102-IS15ABCP4CF and IS-L0107-IS15ABFP4RGB:



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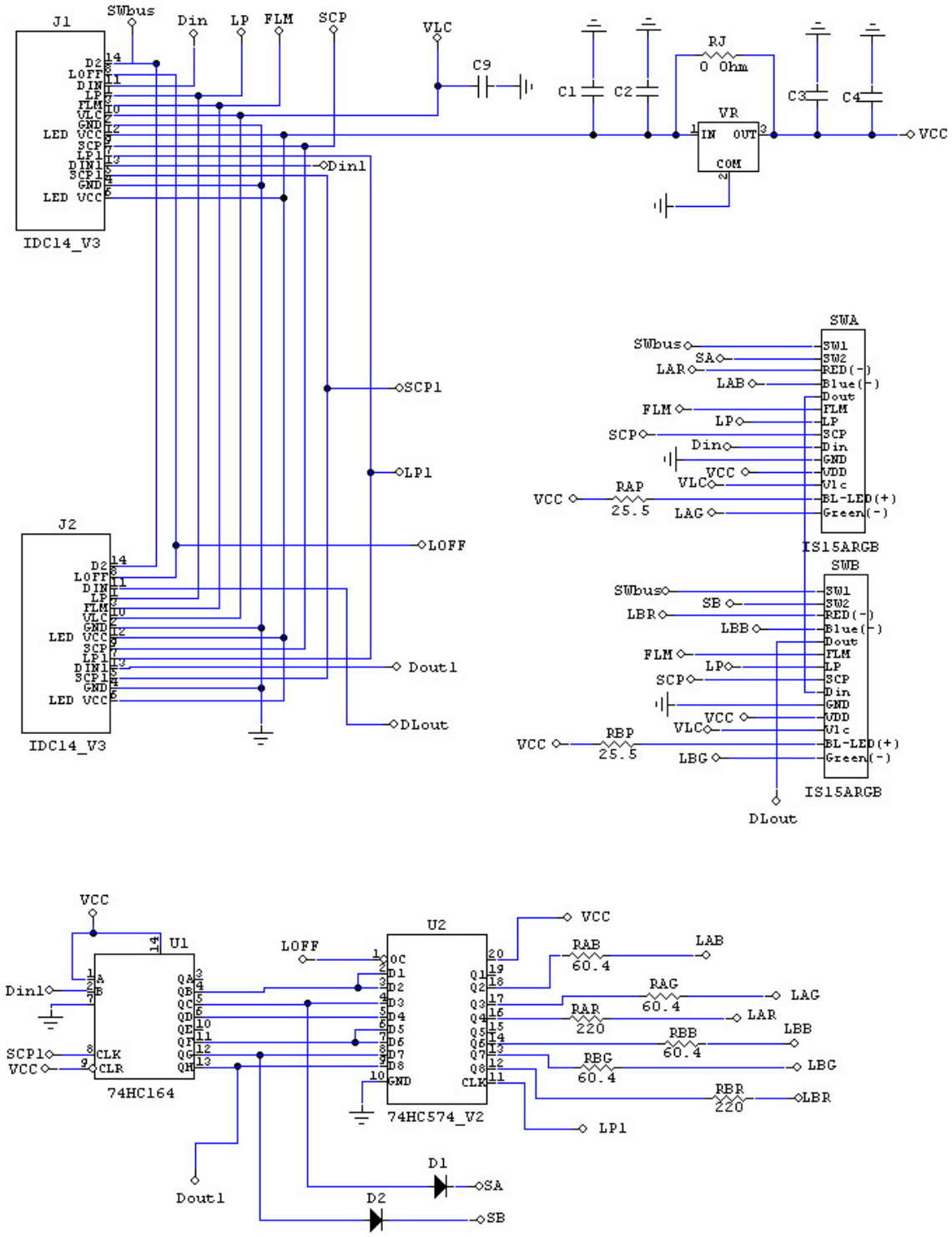
# 6. Schematics

Schematic for IS-L0204 and IS-L0271:



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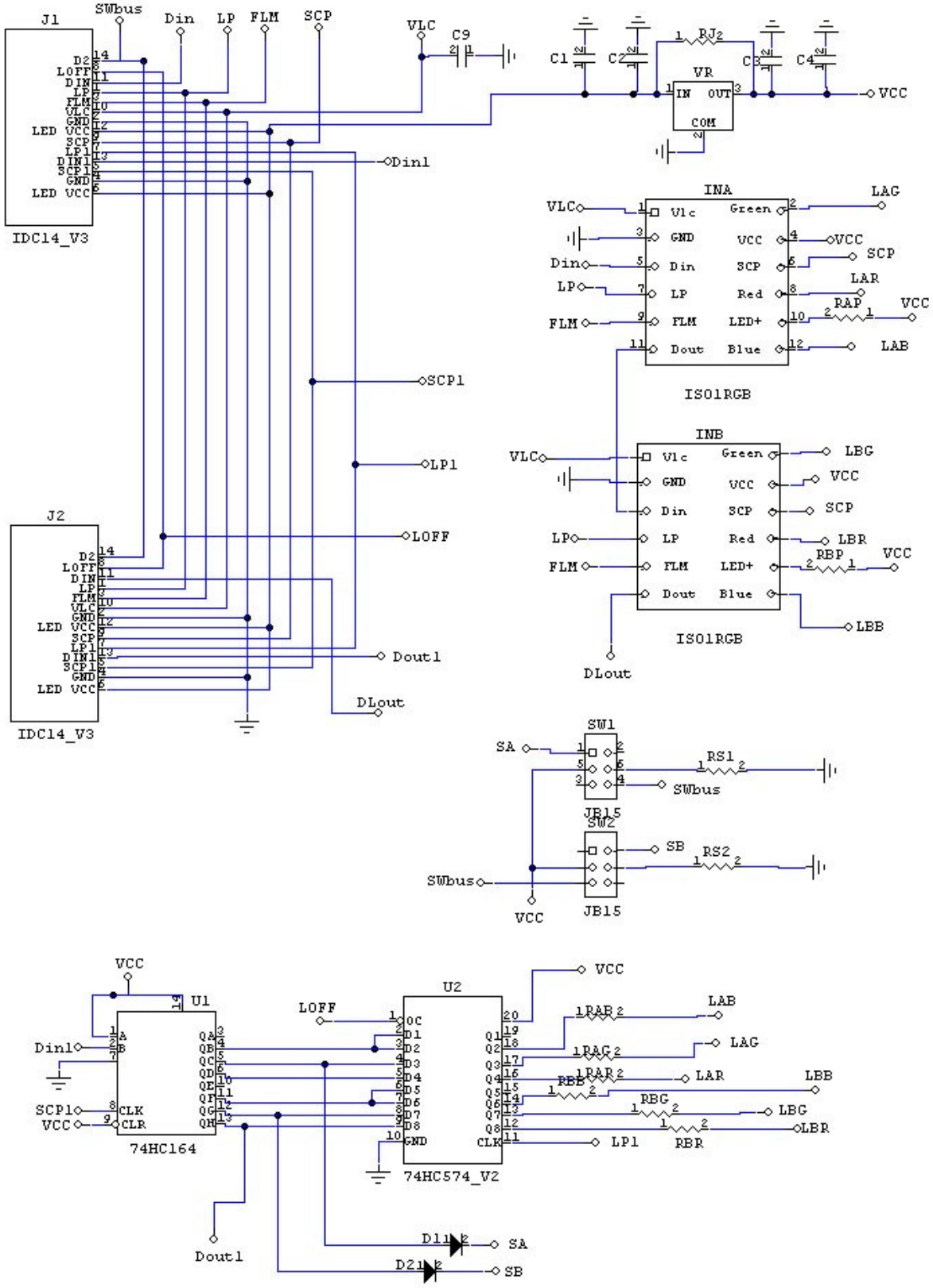
Schematic for IS-L0251:



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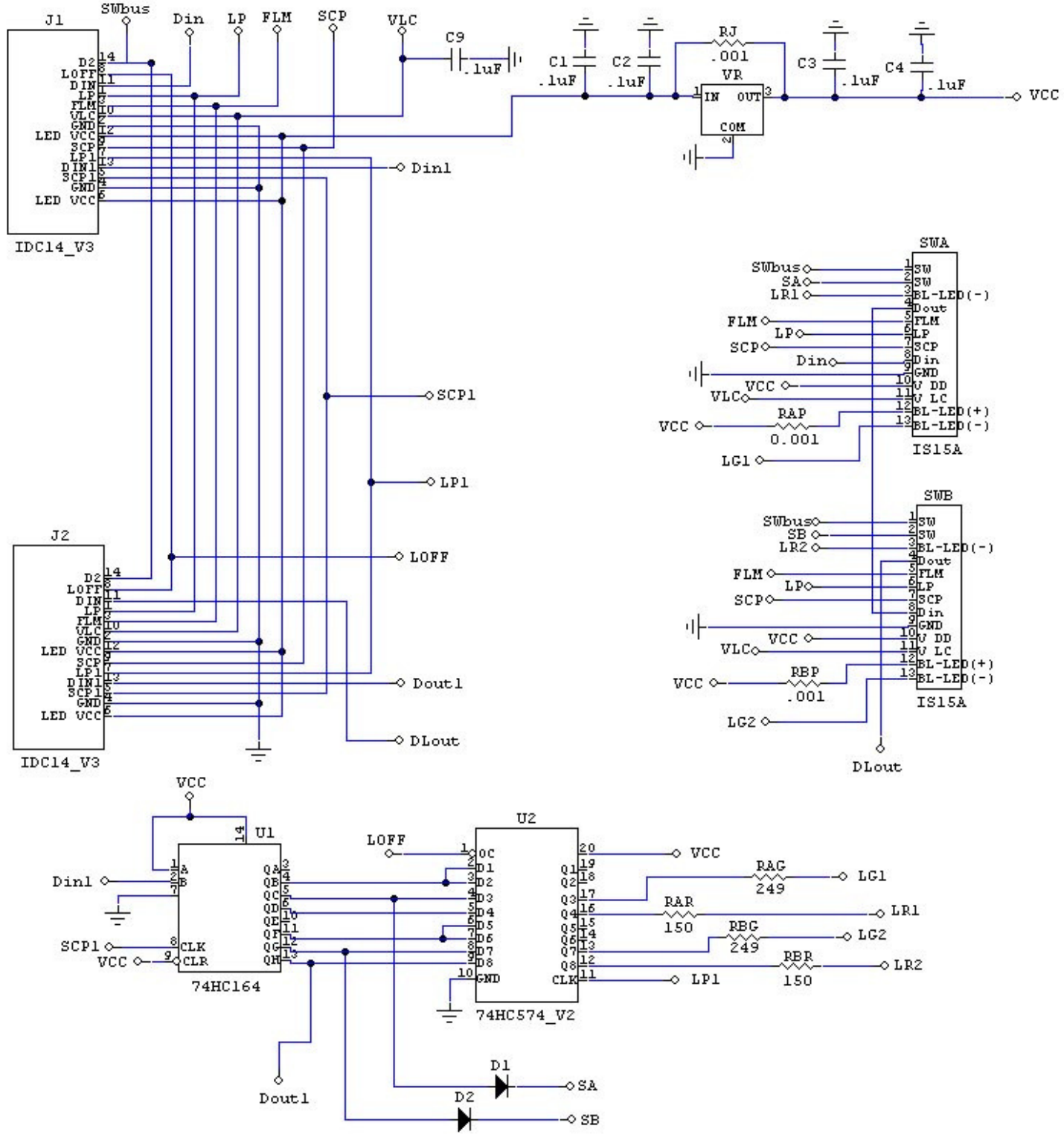
Schematic for IS-L0205:



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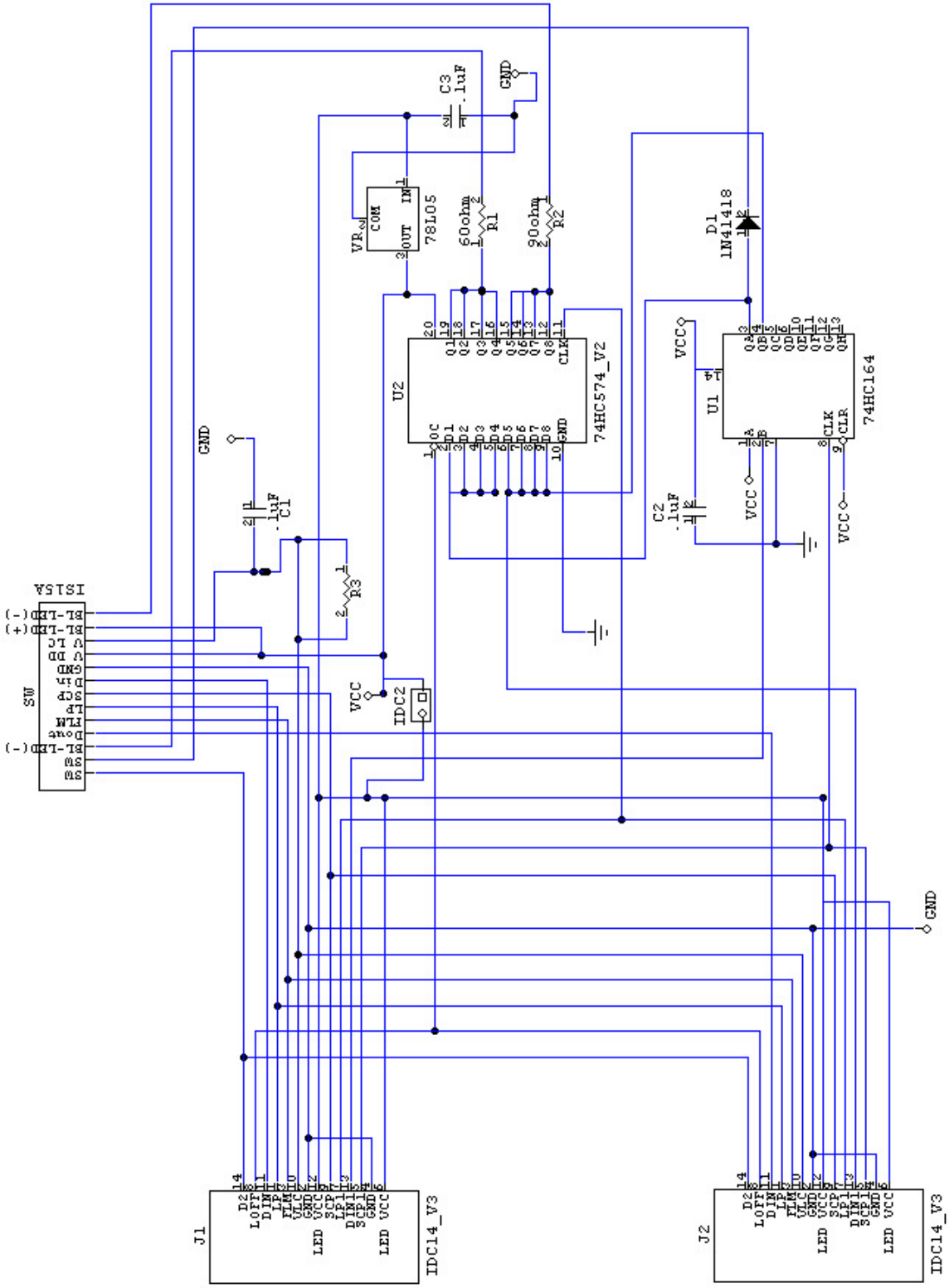
Schematic for IS-L0102-IS15ABCP4CF:



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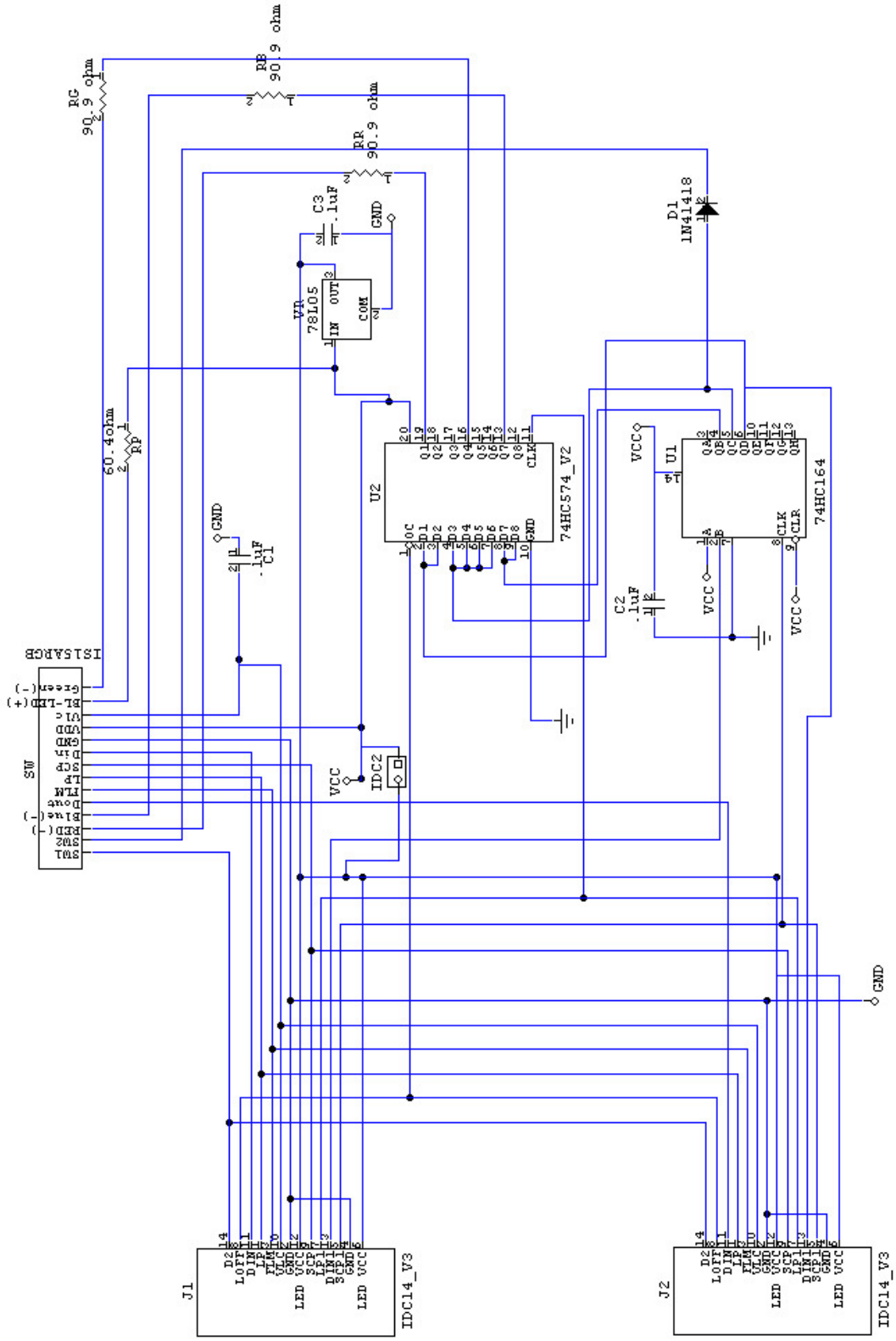
Schematic for IS-L0107-IS15ABFP4RGB:



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# 7. Key Terms & Definitions

**Module** — NKK Switches' LCD SmartSwitches and SmartDisplays.

**Host** — Any computer, terminal, or other device that can communicate over the RS232 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 RS232 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.


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