

## NOTE TO READER:

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# VGA 8:1 multiplexer reference design using the MAX4885

## General Description

This reference design (RD) features a fully assembled and tested surface-mount printed circuit board (PCB). The RD board utilizes the MAX4885 1:2 or 2:1 multiplexer and other ICs to implement a complete video graphics array (VGA) 8:1 multiplexer.

VGA input/output connections are provided to easily interface the MAX4885 RD board with VGA-compatible devices. The RD board gives the option to use a single 5V DC power supply (V+), or this RD board can be powered from any one of the eight VGA sources.

## Features

- Complete 8:1 VGA Multiplexer
- Self-Powered or Single 5V Power Supply
- VGA Inputs and Output
- Surface-Mount Construction
- Jumper-Selectable VGA Source
- Fully Assembled and Tested

## Component List

| DESIGNATION                | QTY | DESCRIPTION  |
|----------------------------|-----|--|
| C1-C5, C26                 | 6   | 22uF ±10% X7R ceramic capacitors (1206)                  |
| C6-C23, C27, C28, C31, C32 | 22  | 0.1uF±10% X7R ceramic capacitors (0603)                  |
| C24, C25, C33              | 3   | 1.0uF ±10% ceramic capacitors (0603)                     |
| C29, C30                   | 2   | Do not insert  |
| D1-D9                      | 9   | 20V 500mA Schottky diodes (SOD-123)<br>Central CMHSH5-2L |
| JP1-JP4                    | 4   | 3-pin headers  |
| P1-P9                      | 9   | 15-pin HD sub-D female VGA ports<br>Tyco® 1734530-3      |
| P10                        | 1   | Test point loop, red                                     |

|                |   |                           |
|----------------|---|---------------------------|
| P11            | 1 | Test point loop, black    |
| R1-R3, R12-R17 | 9 | 75Ω ±1% resistors (0603)  |
| R4             | 1 | Do not insert             |
| R5             | 1 | Zero ohm resistor (0603)  |
| R6-R11         | 6 | 10kΩ ±5% resistors (0603) |

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|                                  |   |  |
|----------------------------------|---|--|
| U1-U4                            | 4 | Complete VGA 1:2 or 2:1 multiplexer (32-pin TQFN-EP)<br>Maxim MAX4885ETJ+  |
| U5                               | 1 | Triple 2:1 video multiplexer-amplifier (14-pin narrow SO)<br>Maxim MAX4024ESD  |
| U6                               | 1 | EMI-friendly ultra-small charge pump (6-pin SOT23)<br>Maxim MAX1697UEUT  |
| U7-U8***<br>*** See Note. page 3 | 2 | Single noninverting buffer, TTL Level (5-pin SC70)<br>On MC74VHC1GT50  |
| U9                               | 1 | ±15kV ESD-protected, high-drive current, dual level translators with speed-up circuitry (8-pin TDFN-EP)<br>Maxim MAX3394EETA |
| U10                              | 1 | Hex, high-speed differential ESD-protection IC (16-pin TQFN-EP 3mm x 3mm)<br>Maxim MAX3205EATE                               |

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### **Quick Start**

#### **Recommended Equipment**

Before beginning, the following equipment is needed:

- From one to eight VGA inputs (e.g., notebook computers)
- VGA-compatible output (e.g., monitor or projector)

#### **Procedure**

The MAX4885 8-to-1 reference design (RD) board is a fully assembled and tested surface-mount PCB. Follow the steps below to verify board operation:

- 1) Verify that all jumpers are configured as shown below:

|            |             |
|------------|-------------|
| <b>JP1</b> | <b>3,4</b>  |
| <b>JP2</b> | <b>5,6</b>  |
| <b>JP3</b> | <b>1-4</b>  |
| <b>JP4</b> | <b>EVEN</b> |

- 2) Connect a VGA source to P4 (VGA4).
- 3) Connect a VGA-compatible output to P9 (VGA OUT).
- 4) Enable the VGA source.
- 5) Verify the output at VGA OUT.

#### **Detailed Description**

The MAX4885 8-to-1 reference design (RD) board is a fully assembled and tested surface-mount printed circuit board (PCB) that utilizes the MAX4885 IC, among others, to implement a complete video graphics array (VGA) 8:1 multiplexer.

VGA input/output connections are provided to easily interface the MAX4885 8-to-1 RD board with VGA-compatible devices. The evaluation board gives the option to use a single 5V DC power supply (V+), or this evaluation board can be powered from any one of the eight VGA sources.

The RD board provides jumpers to control which source connects to the output. Test points are also provided to allow powering of this evaluation board from an external source.

### **Input Power Supply**

The MAX4885 8-to-1 RD board has the flexibility of accepting a single 5V input power supply (V+). To power from an external source, set a power supply to between 5.2V and 5.3V. Connect the positive terminal to P10 EXT 5V, and connect the negative terminal to P11 GND.

Schottky diodes select the power source with the greatest voltage. If the power supply is set too low, power from a VGA source will be used by this evaluation board instead. If the power supply is set too high, circuitry will be overstressed.

#### **Selecting a VGA Source**

By setting JP1 through JP4 according to Table 1, the MAX4885 8-to-1 RD board routes one of the VGA sources (P1 through P8) to VGA OUT (P9).

#### **Theory of Operation**

Four MAX4885ETJ ICs each connect a pair of VGA sources, for a total of eight VGA sources. Subsequent handling depends of the VGA signal.

Because the switch tree ensures that no more than one of the four MAX4885ETJ devices is enabled at any given time, the DDCA and DDCB signals can be commoned to a MAX3394EETA I<sup>2</sup>C buffer for conveyance to the VGA OUT connector.

The VGA H and V signals likewise buffer through two MC74VHC1GT50 TTL buffers.

To help ensure signal quality, each MAX4024ESD signal input only connects to one pair of MAX4885 ICs. The MAX4024ESD buffers the analog R, G, and B signals. To ensure proper operation, the MAX4024ESD VEE input derives from a MAX1697UEUT charge-pump inverter. This guarantees that the R, G, and B outputs will remain at zero volts for black.

A MAX3205EATE enhances ESD protection on signals going through the VGA OUT connector.

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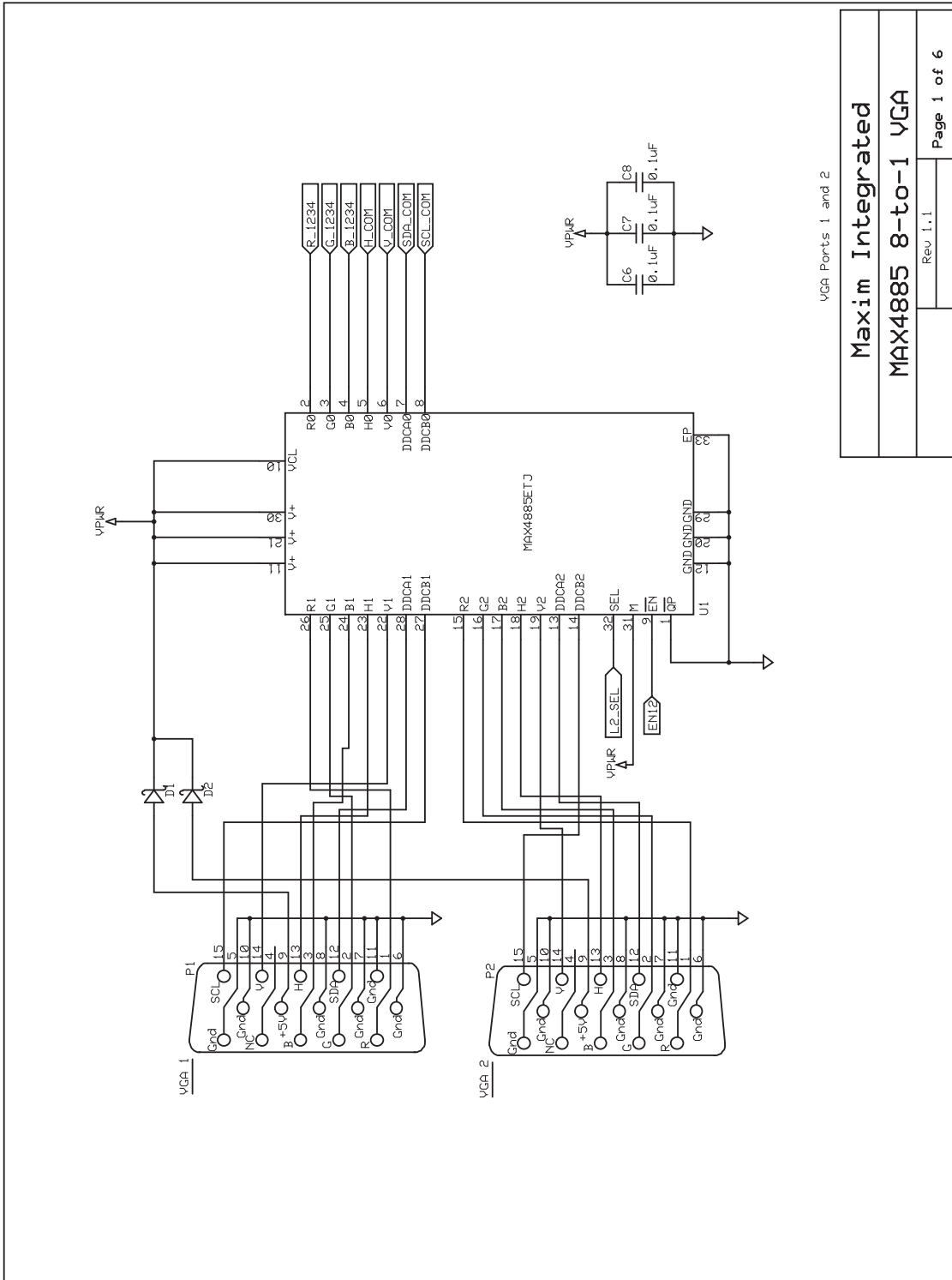
### Table 1. Jumper JP1 Through JP4 Functions

| JP1 SHUNT POSITION | JP2 SHUNT POSITION | JP3 SHUNT POSITION | JP4 SHUNT POSITION | SIGNAL PATH     |
|--------------------|--------------------|--------------------|--------------------|-----------------|
| 1,2                | Don't Care         | 1-4                | ODD                | VGA1 to VGA OUT |
| 1,2                | Don't Care         | 1-4                | EVEN               | VGA2 to VGA OUT |
| 3,4                | Don't Care         | 1-4                | ODD                | VGA3 to VGA OUT |
| 3,4                | Don't Care         | 1-4                | EVEN               | VGA4 to VGA OUT |
| Don't Care         | 5,6                | 5-8                | ODD                | VGA5 to VGA OUT |
| Don't Care         | 5,6                | 5-8                | EVEN               | VGA6 to VGA OUT |
| Don't Care         | 7,8                | 5-8                | ODD                | VGA7 to VGA OUT |
| Don't Care         | 7,8                | 5-8                | EVEN               | VGA8 to VGA OUT |

**Rev 1.1 note:** For U7 and U8, one could substitute the SN74AHCT1G08. In this case, rework the board so that U7 pin 1 connects to pin 2 and U8 pin 1 connects to pin 2.

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VGA Ports 1 and 2

Maxim Integrated

MAX4885 8-to-1 VGA

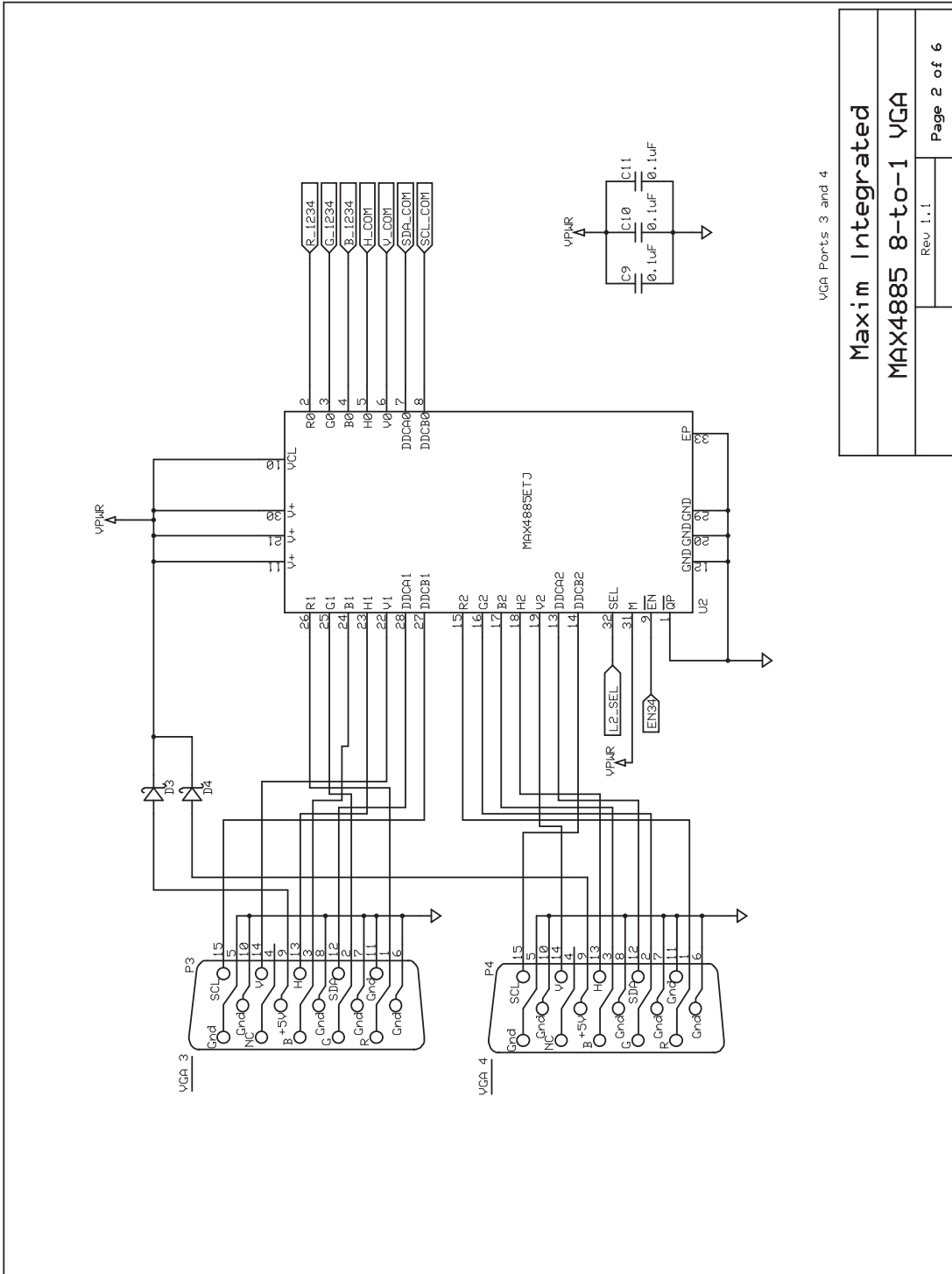
Rev 1.1

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Figure 1. MAX4885 8-to-1 RD board schematic page 1: VGA ports 1 and 2.

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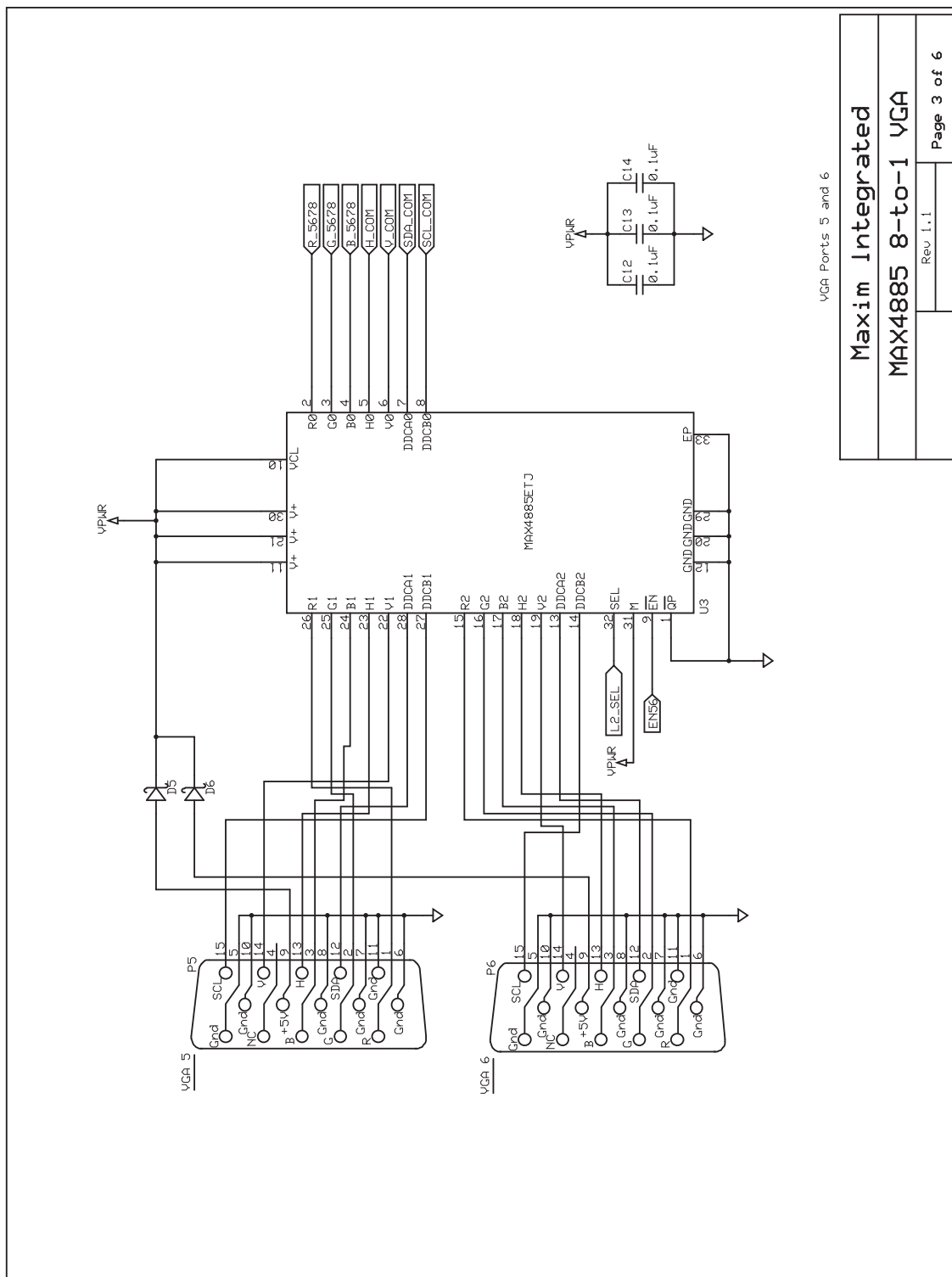
VGA Ports 3 and 4

|                    |             |
|--------------------|-------------|
| Maxim Integrated   |             |
| MAX4885 8-to-1 VGA |             |
| Rev 1.1            | Page 2 of 6 |

Figure 2. MAX4885 8-to-1 RD board schematic page 2: VGA ports 3 and 4.

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VGA Ports 5 and 6

|                           |             |
|---------------------------|-------------|
| <b>Maxim Integrated</b>   |             |
| <b>MAX4885 8-to-1 VGA</b> |             |
| Rev. 1.1                  | Page 3 of 6 |

Figure 3. MAX4885 8-to-1 RD board schematic page 3: VGA ports 5 and 6.

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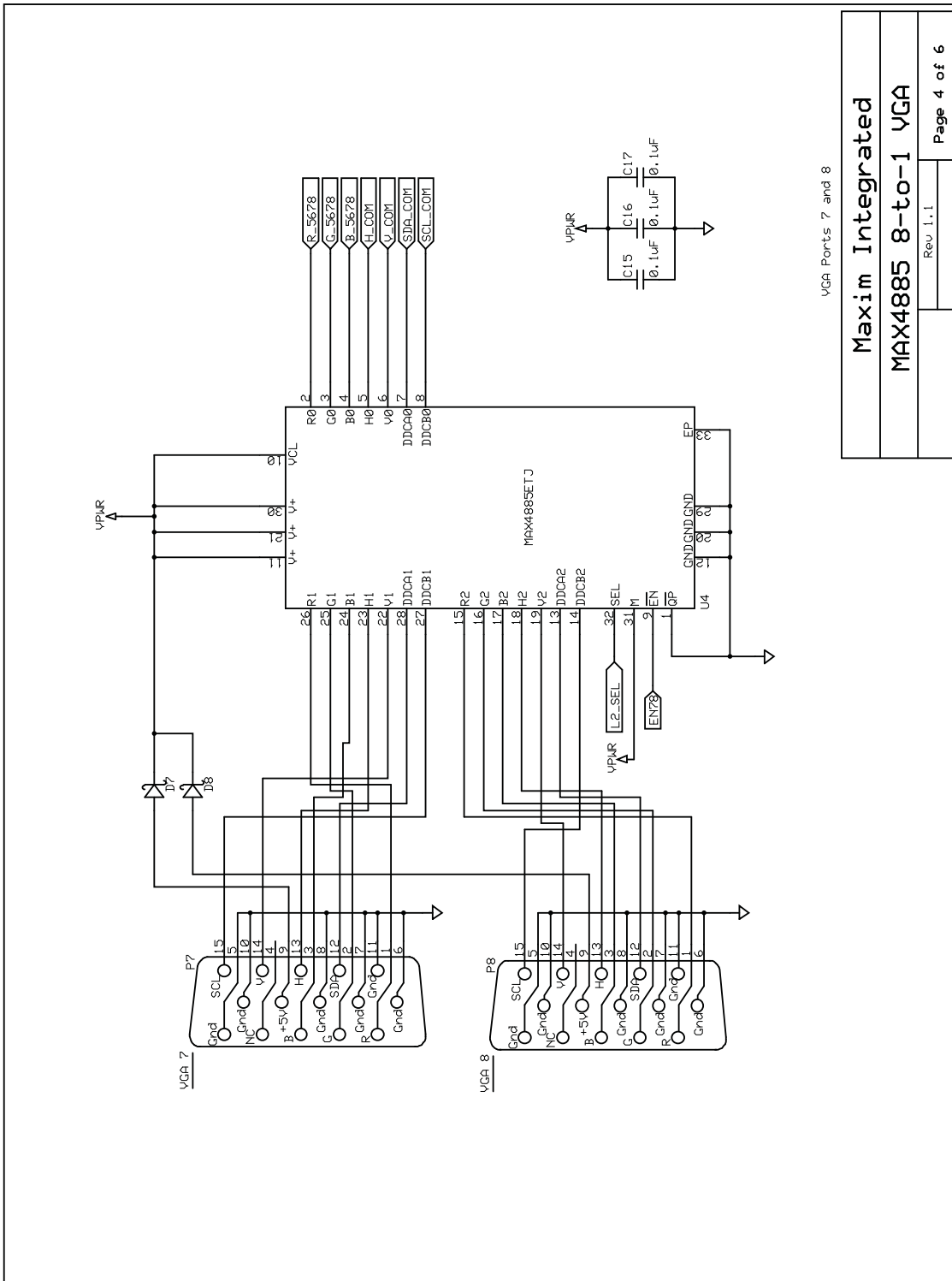


Figure 4. MAX4885 8-to-1 RD board schematic page 4: VGA ports 7 and 8.



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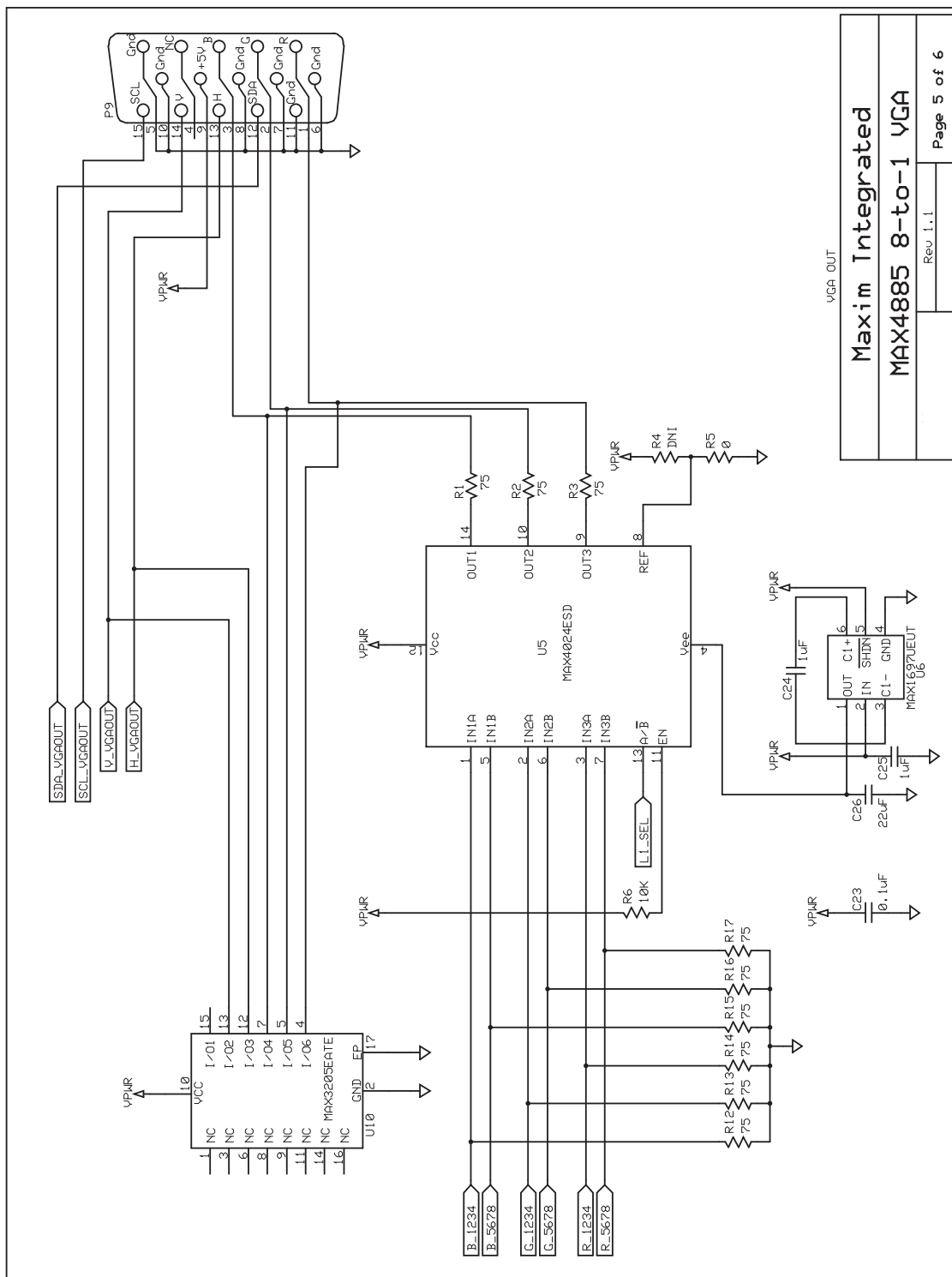
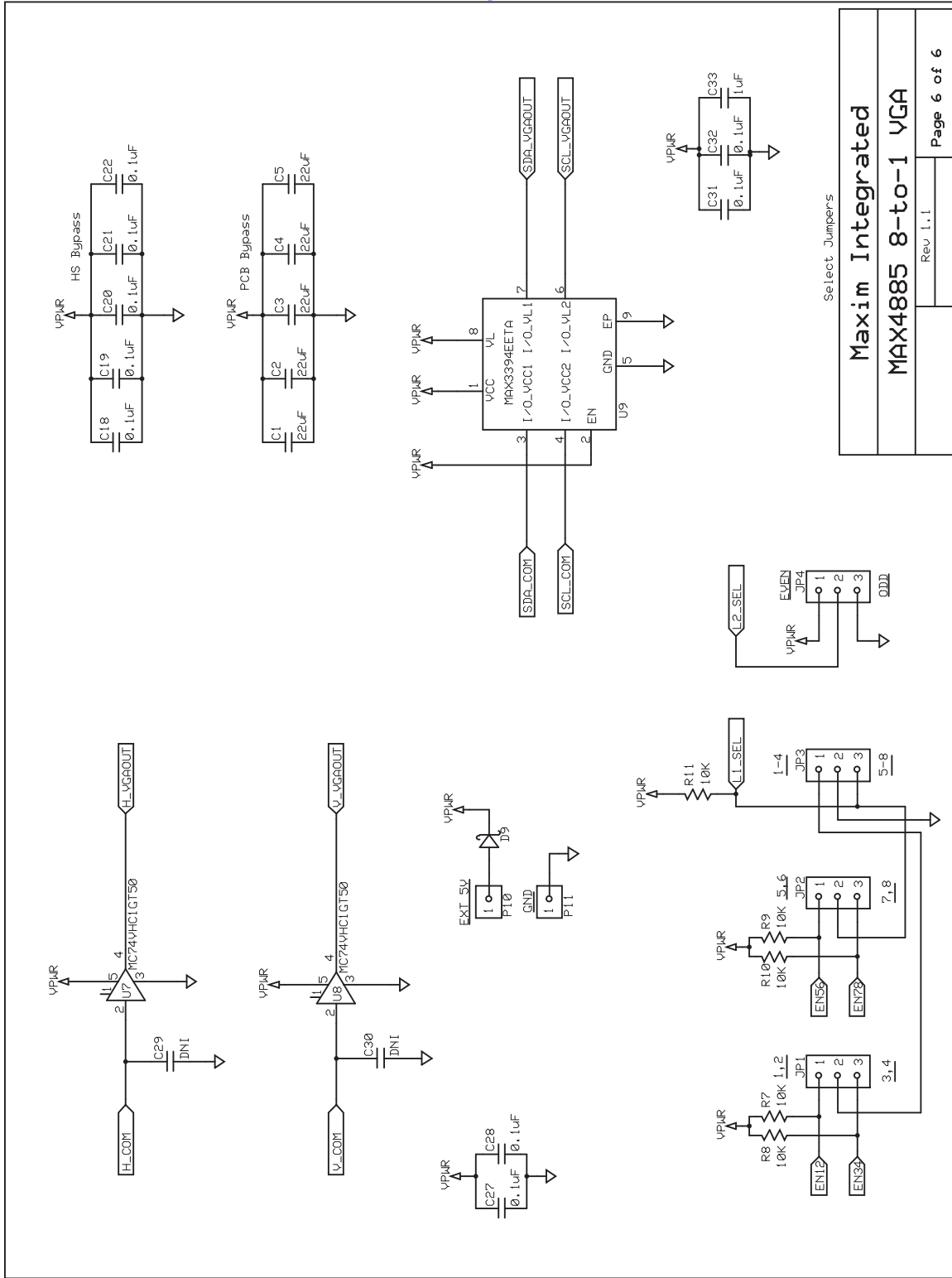


Figure 5. MAX4885 8-to-1 RD board schematic page 5: VGA out.

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Select Jumpers

**Maxim Integrated**

**MAX4885 8-to-1 VGA**

Rev 1.1

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Figure 6. MAX4885 8-to-1 RD board schematic page 6: select jumpers.

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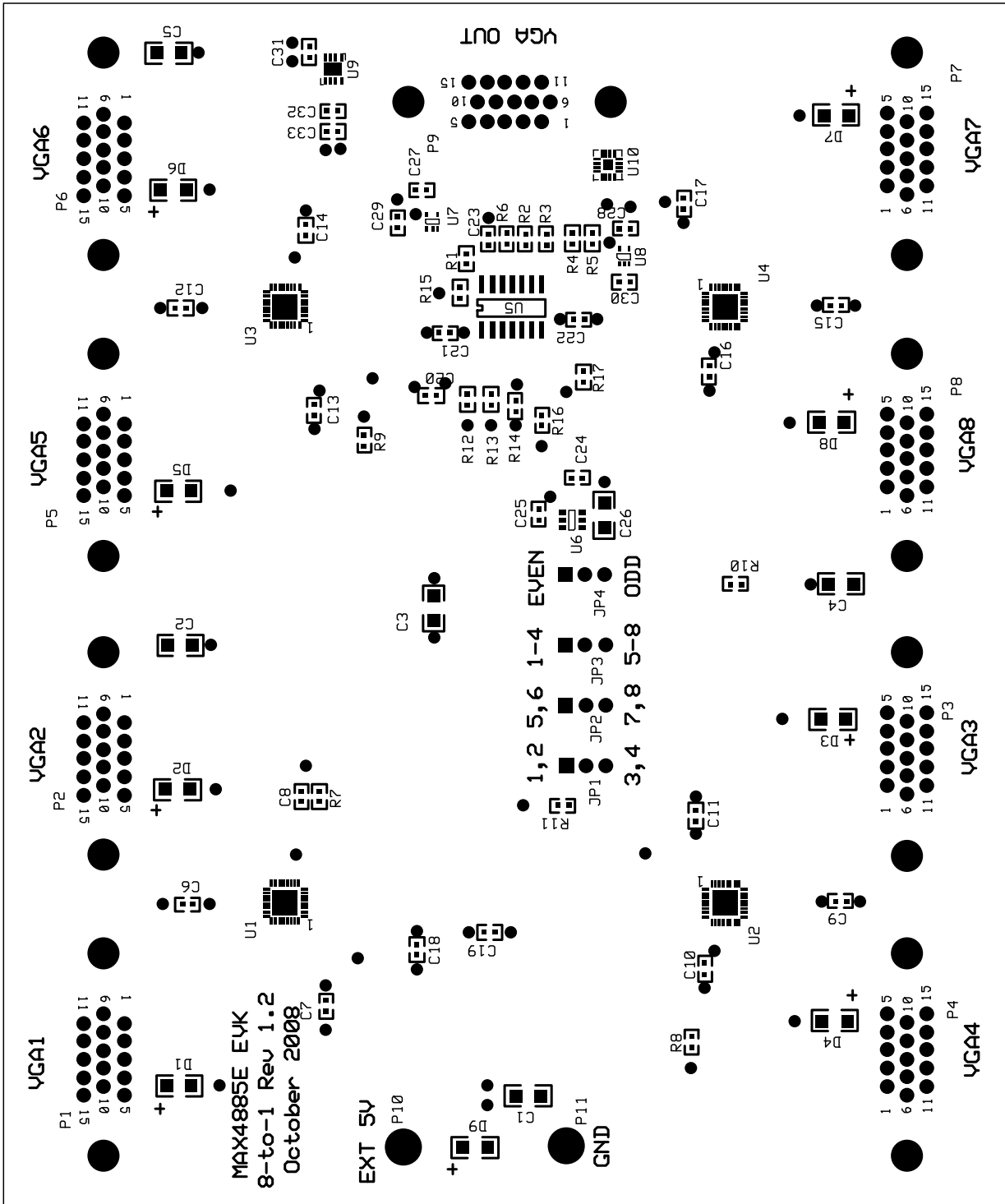


Figure 7. MAX4885 8-to-1 RD board component placement guide: top silkscreen.

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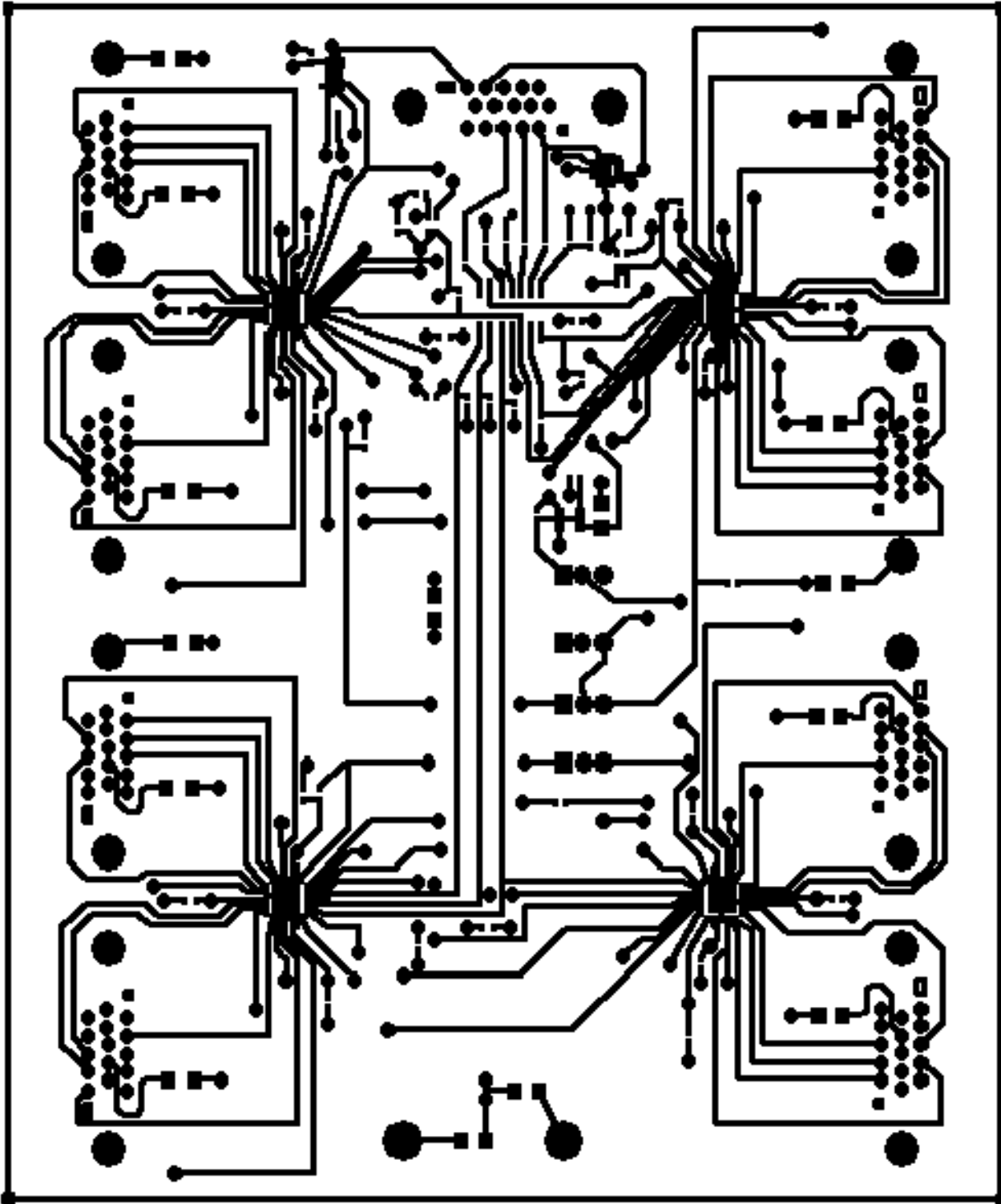


Figure 8. MAX4885 8-to-1 RD board PCB layout: component side.

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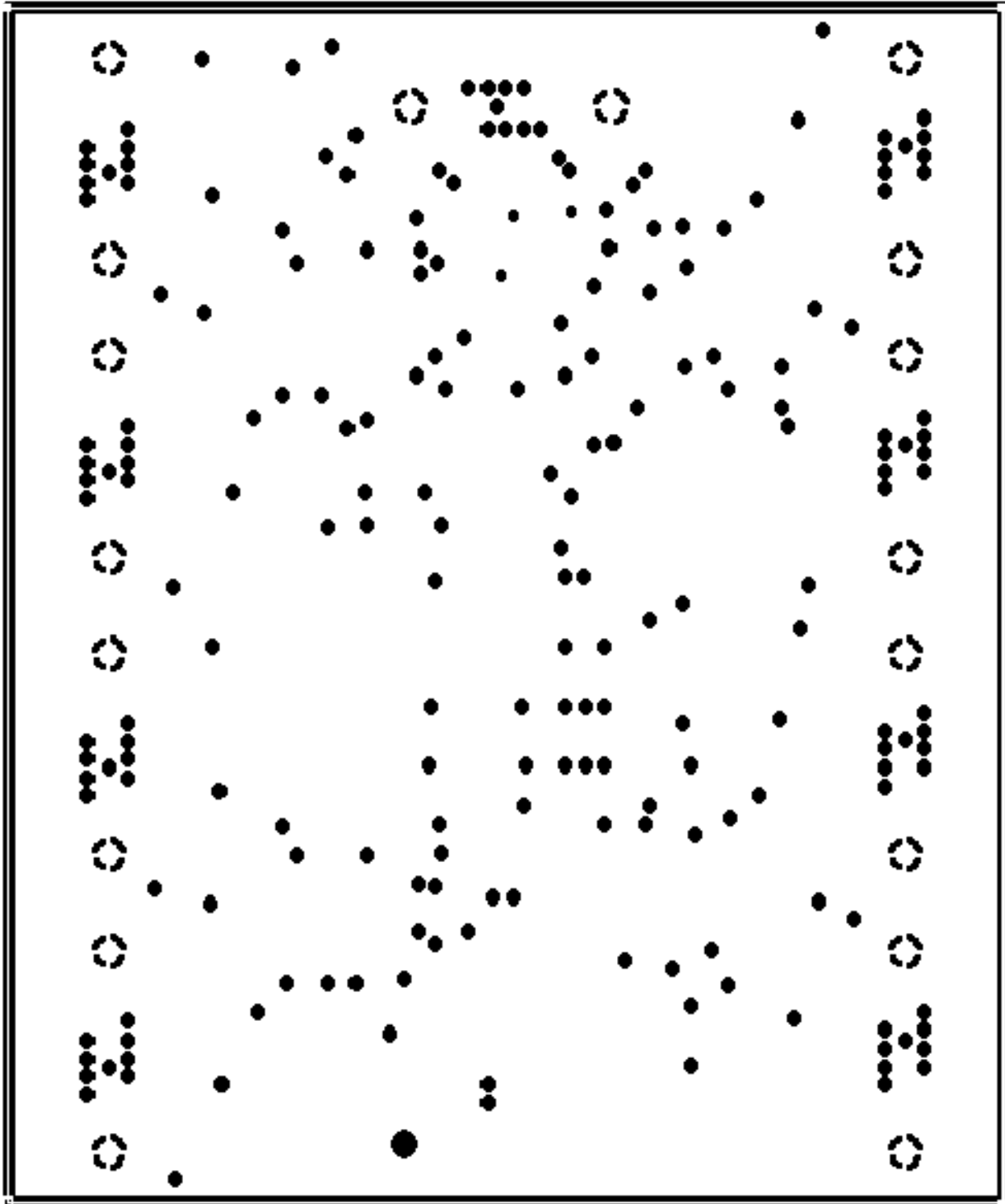
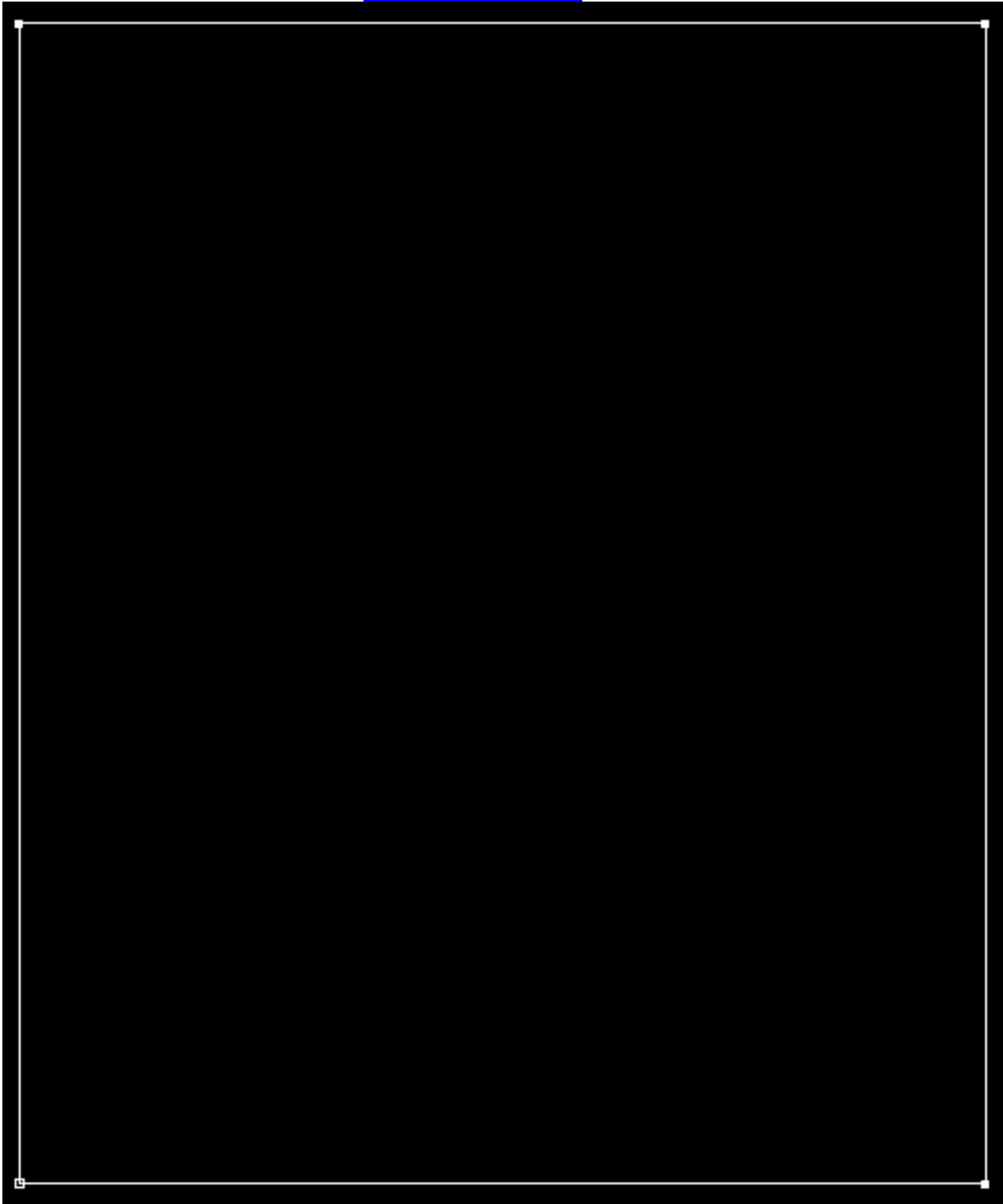


Figure 9. MAX4885 8-to-1 RD board PCB layout: GND layer 2.

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*Figure 10. MAX4885 8-to-1 RD board PCB layout: VCC layer 3.*

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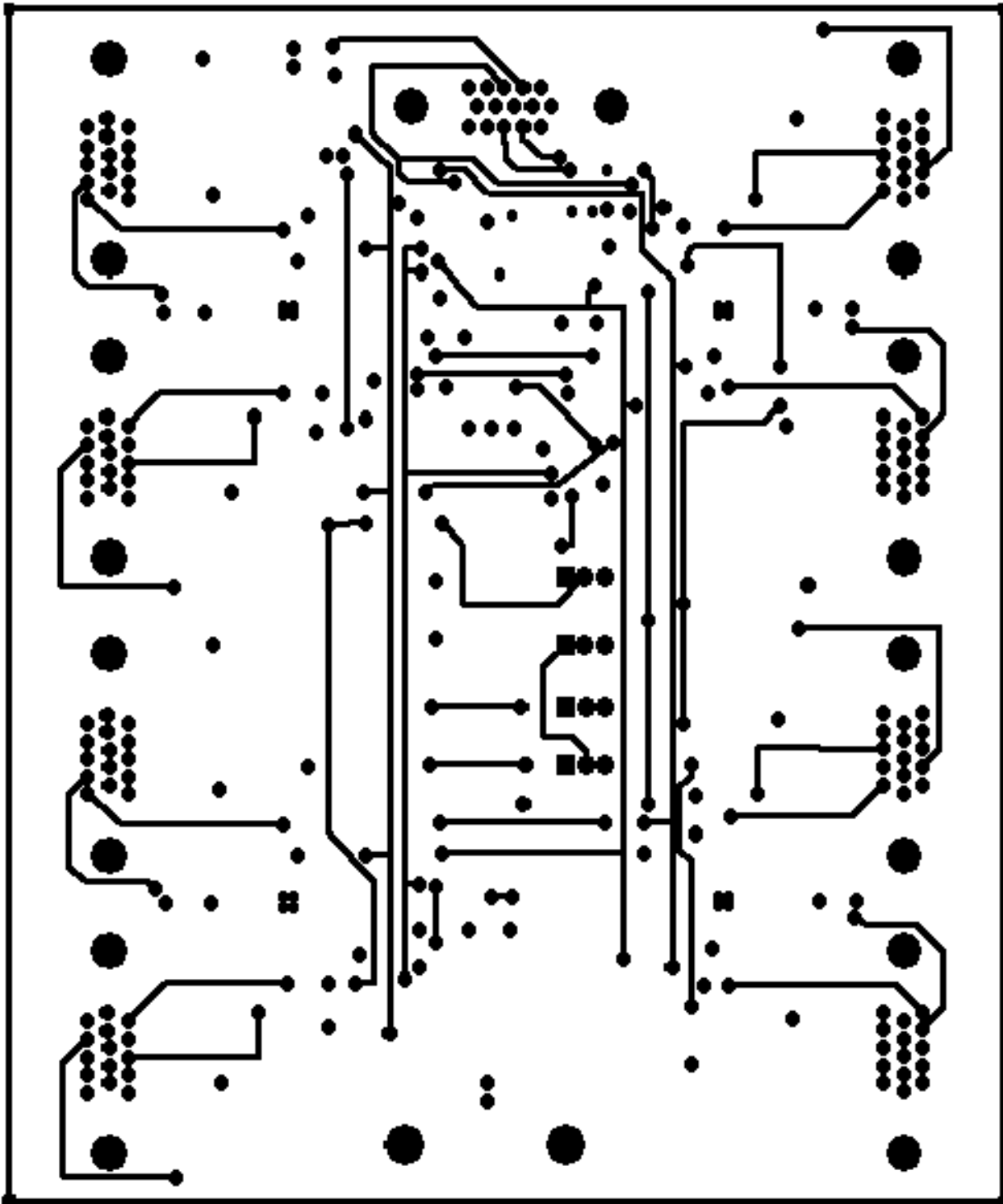


Figure 11. MAX485 8-to-1 RD board PCB layout: solder side