

# **73S1209F**

## **Evaluation Board User Guide**

**August 19, 2009**  
**Rev. 1.3**  
**UG\_1209F\_034**

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## 1 Introduction

The Teridian Semiconductor Corporation (TSC) 73S1209F Evaluation Board is used to demonstrate the capabilities of the 73S1209F Smart Card Controller device. It has been designed to operate either as a standalone or as a development platform.

The 73S1209F Evaluation Board can be programmed to run any of the Teridian turnkey applications or a user-developed custom application. Teridian provides its USB CCID application preloaded on the board and an EMV testing application on the CD.

Applications can be downloaded through the In-Circuit-Emulator (ICE) or through the TSC Flash Programmer Model TFP2. As a development tool, the evaluation board can operate in conjunction with an ICE to develop and debug 73S1209F based embedded applications.



The 73S1209F Evaluation Board uses the same PWB as the 73S1215F. The 73S1215F has some features that the 73S1209F does not contain. These include the 32 kHz oscillator, USB interface, LED2 and LED3. These features are depopulated on the 73S1209F.

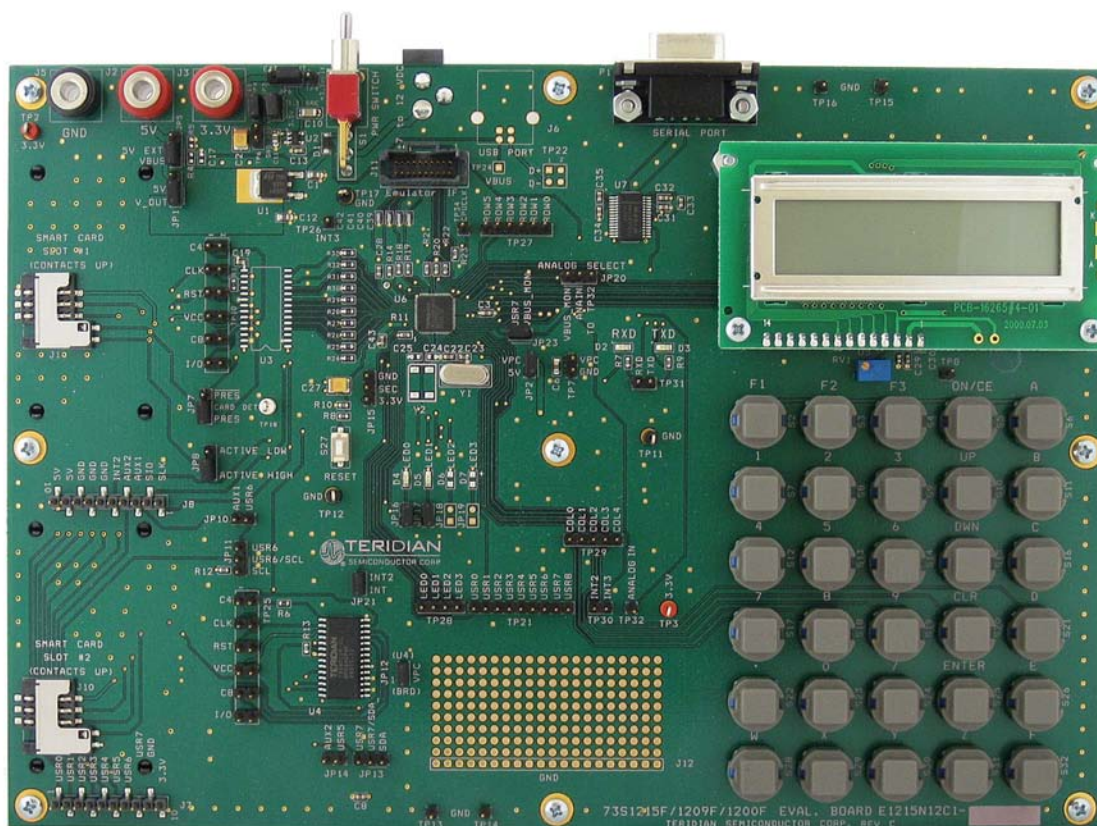


Figure 1: 73S1209F Evaluation Board

## 1.1 Evaluation Kit Contents

The 73S1209F Evaluation Kit contains the following:

- 73S1209F Evaluation Board: 4-layer, rectangular PWB as shown in [Figure 1](#) (identification number E1215N12C1 Rev C), containing the 73S1209F with the preloaded turnkey program PCCID.
- 12 VDC/1,000 mA universal wall transformer with 2.1 mm plug ID (CUI Inc. – EPAS-101W-12).
- Serial cable: DB9, male/female, 2 meter length (Digi-Key AE1379-ND).
- CD containing documentation (data sheet, and user guides), Software API libraries, evaluation code, and utilities.

## 1.2 Evaluation Board Features

The 73S1209F Evaluation Board (see Figure 1) includes the following:

- RS-232 interface
- Dual smart card interface
- ICE/Programmer interface
- 2 line x 16 character LCD module
- 6 x 5 Keypad
- 2 LEDs

## 1.3 Recommended Equipment and Test Tools

The following equipment and tools (not provided) are recommended for use with the 73S1209F Evaluation Kit:

- For functional evaluation: PC with Microsoft® Windows® XP or Vista®.
- For software development (MPU code)
  - Signum™ ICE (In Circuit Emulator): ADM-51. Refer to <http://signum.temp.veriohosting.com/Signum.htm>.
  - Keil™ 8051 C Compiler Kit: CA51. Refer to <http://www.keil.com/c51/ca51kit.htm> and <http://www.keil.com/product/sales.htm>

## 2 Evaluation Board Setup

Figure 2 shows the basic connections of the evaluation board with the external equipment.

The power supply can come from two sources:

- A regulated lab power supply connected to the banana plugs J2, J3 and J5. In this case, the board main switch S1 has no effect.
- Any AC-DC converter block (default), able to generate a DC power supply of 7 V min / 12 V max / 400 mA. In this case, the board main switch S1 connects or disconnects the supply to the board.

The communication with an external host is accommodated via a standard RS-232 serial interface (TX/RX only).

The board is loaded by default with the PCCID application. It requires a PC to be connected through its serial port. When powered-up, the board is able to run with the PC Exerciser host application. Refer to the *73S1209F Evaluation Board Quick Start Guide* to setup and run the PCCID application.

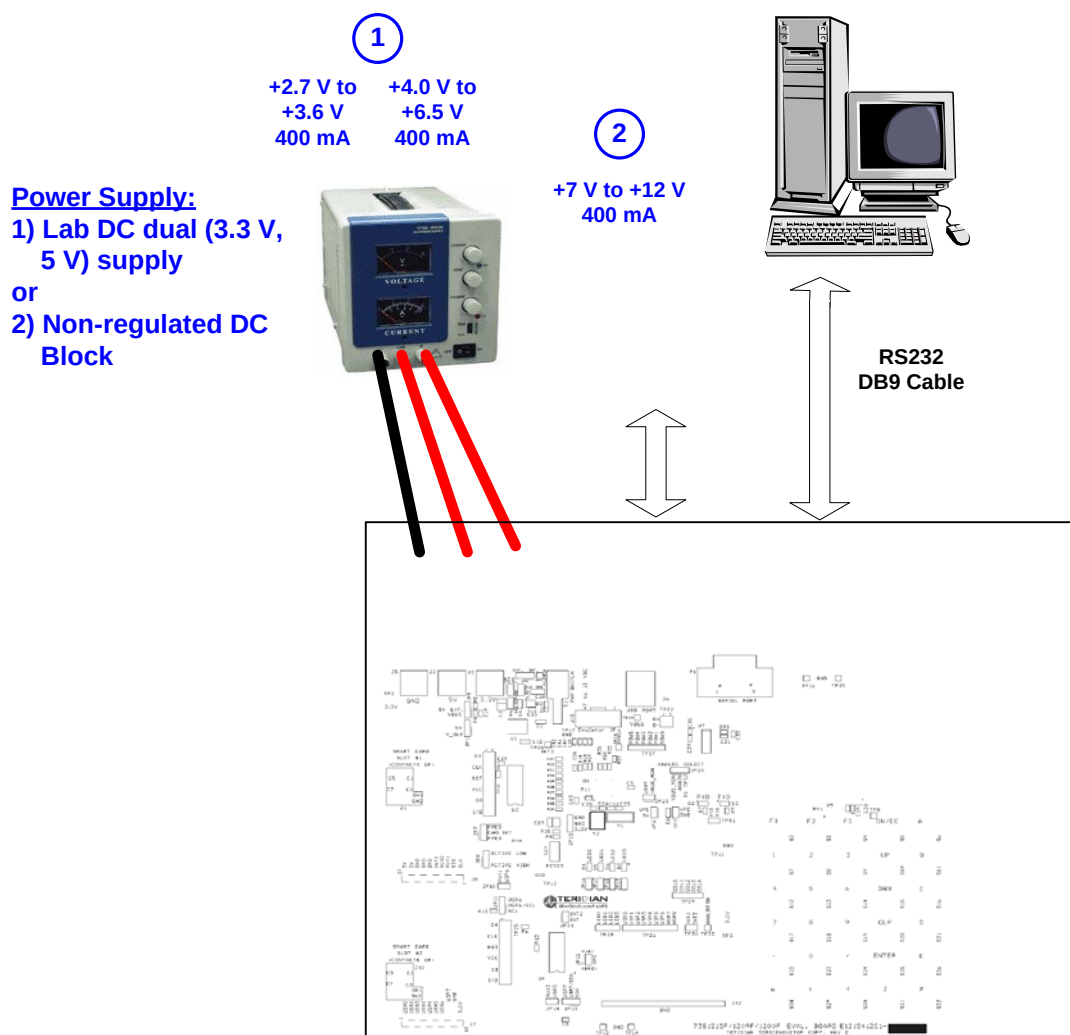


Figure 2: 73S1209F Evaluation Board Basic Connections

## 2.1 Connecting the Evaluation Board with an Emulation Tool

The 73S1209F Evaluation Board has been designed to operate with an In-Circuit-Emulator (ICE) from Signum Systems (model ADM-51). [Figure 3](#) shows the connections between the ICE and the evaluation board. The Signum System POD has a ribbon cable that must be directly attached to connector J11.

Signum Systems offers different POD options depending on user needs. The standard pod allows users to perform typical emulator functions such as symbolic debugging, in-line breakpoints, memory examination/modification, etc. Other pod options enable code trace capability and/or complex breakpoints at an additional cost.

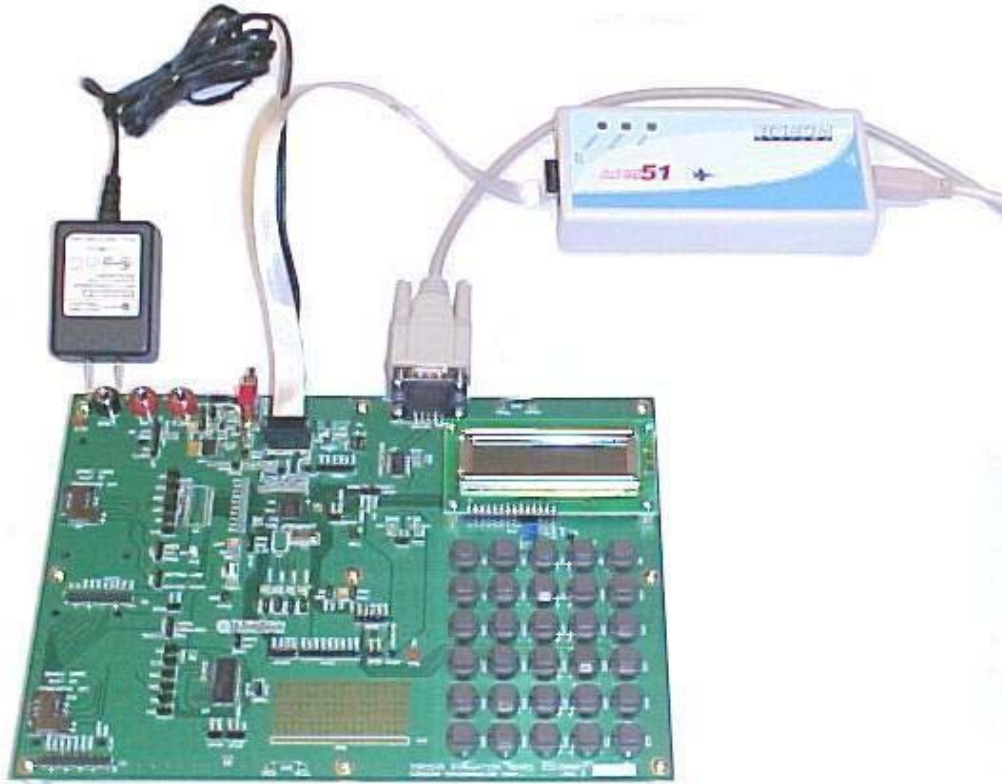


Figure 3: 73S1209F Evaluation Board Basic Connections with ADM-51 ICE

## 2.2 Loading User Code into the Evaluation Board

### Hardware Interface for Programming

The signals listed in [Table 1](#) are necessary for communication between the TFP2 or ICE and the 73S1209F.

**Table 1: Flash Programming Interface Signals**

| Signal                                                                                                                                                 | Direction            | Function                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------|
| E_TCLK                                                                                                                                                 | Output from 73S1209F | Data clock                          |
| E_RXTX                                                                                                                                                 | Bi-directional       | Data input/output                   |
| E_RST <sup>1</sup>                                                                                                                                     | Bi-directional       | Flash Downloader Reset (active low) |
| <sup>1</sup> The E_RST signal should only be driven by the TFP2 when enabling these interface signals. The TFP2 must release E_RST at all other times. |                      |                                     |

These signals, along with 3.3 V and GND are available on the emulator header J11. Production modules may be equipped with much simpler programming connectors, e.g. a 5x1 header.

Programming of the flash memory requires either the Signum Systems ADM51 in-circuit emulator or the TSC Flash Programmer Model TFP2 provided by Teridian.

### Loading Code with the In-Circuit Emulator

If firmware exists in the 73S1209F flash memory, the memory must be erased before loading a new file into memory. In order to erase the flash memory, the RESET button in the emulator software must be clicked followed by the ERASE button (see [Figure 4](#)).

Once the flash memory is erased, the new file can be loaded using the Load command in the File menu. The dialog box shown in [Figure 5](#) makes it possible to select the file to be loaded by clicking the Browse button. Once the file is selected, pressing the OK button loads the file into the flash memory of the IC.

At this point, the emulator probe (cable) can be removed. Once the 73S1209F device is reset using the reset button on the evaluation board, the new code starts executing.

### Loading Code with the TSC Flash Programmer Model TFP2

Follow the instructions given in the *TSC Flash Programmer Model TFP2 User's Manual*.



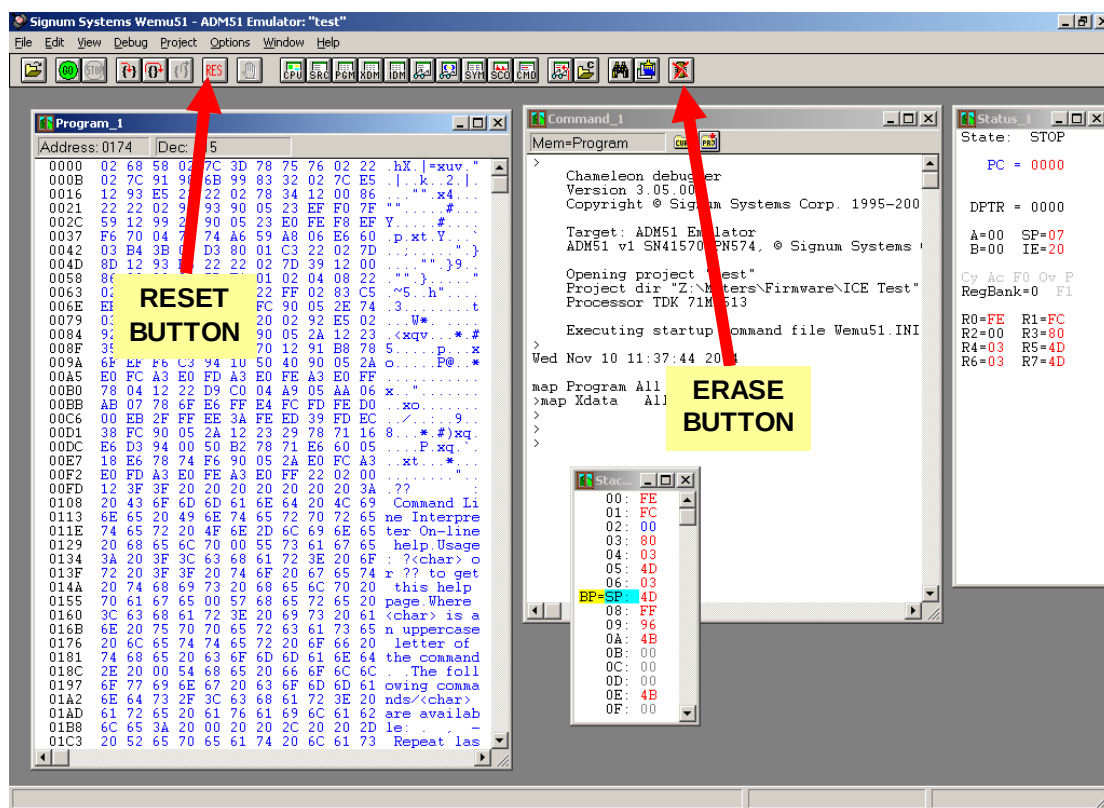


Figure 4: Emulator Window Showing RESET and ERASE Buttons

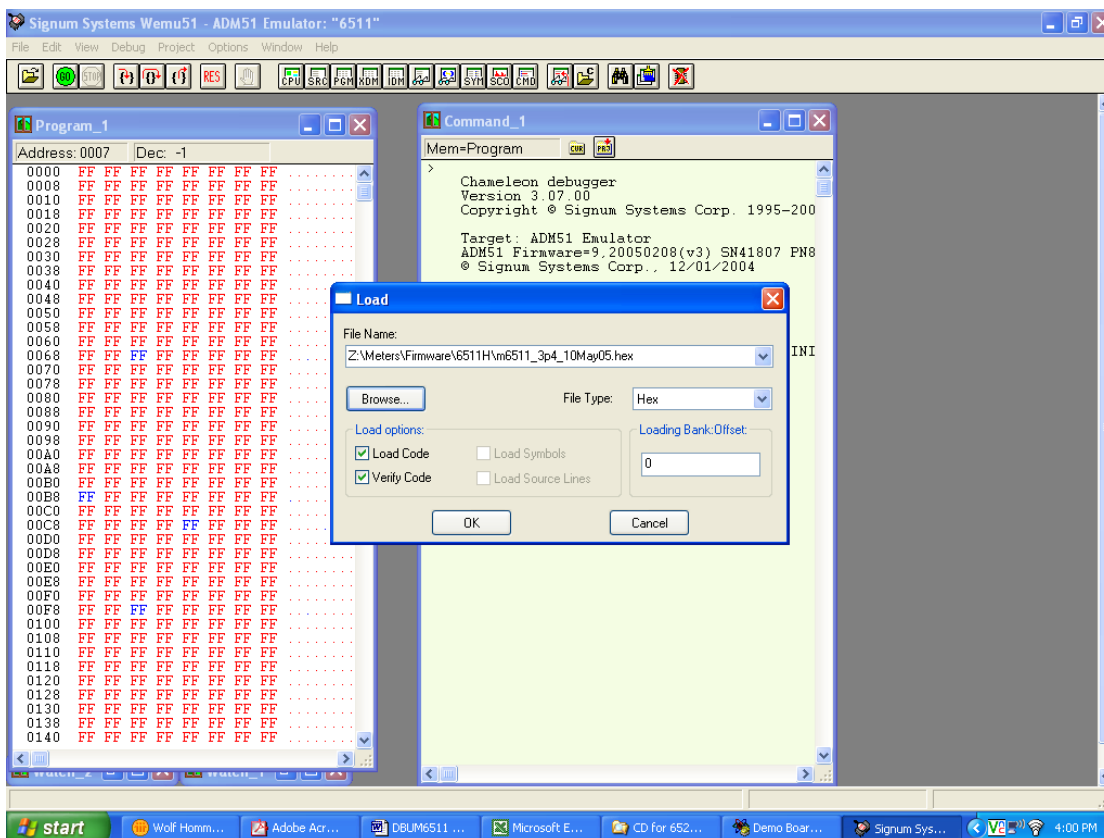


Figure 5: Emulator Window Showing Erased Flash Memory and File Load Menu

### 3 Using the PCCID Application

The PCCID firmware is pre-installed on the 73S1209F Evaluation Board. It requires a PC with the serial RS-232 port. When powered-up, the board is able to run the PCCID demonstration host application which allows:

- Smart card activation and deactivation, in ISO or EMV mode.
- Smart card APDU commands to be exchanged with the smart card inserted in the board.
- Starting a test sequence in order to test and evaluate the board performance against an EMV test environment.

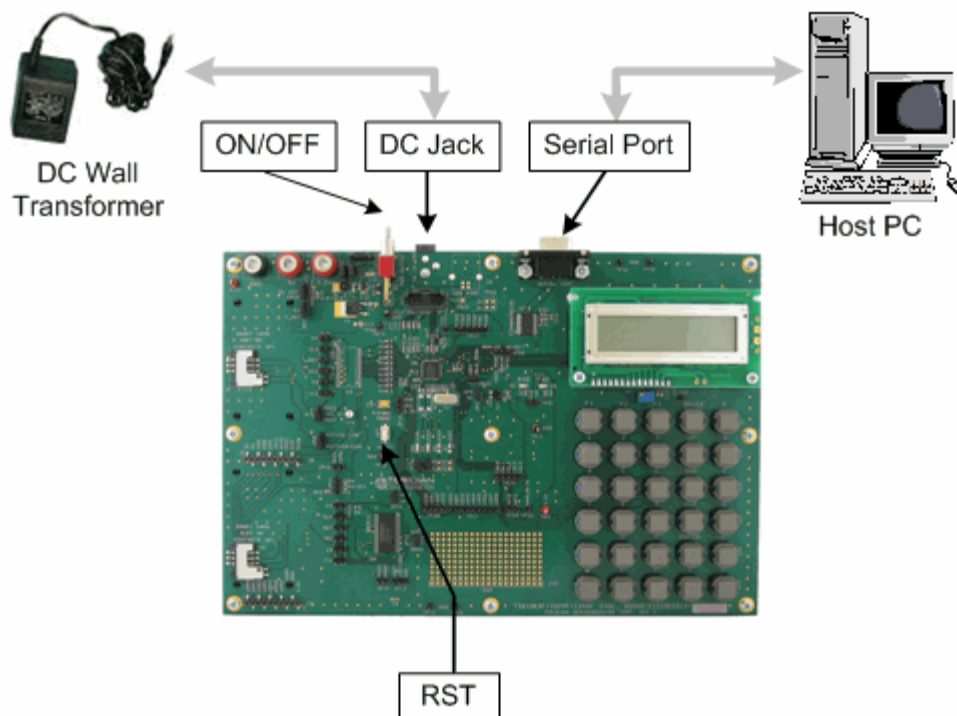
#### 3.1 Host Demonstration Software Installation

##### Installation on Windows XP

Follow these steps to install the software on a PC running Windows XP:

- Extract “PCCID Vz.zz Release.zip” (where **z.zz** is the latest version of the firmware release).
  - o Create an install directory. For example: “C:\TSC\”.
  - o Unzip “PCCID Vz.zz Release.zip” to the just created folder. All applications and documentation needed to run the board with a Windows PC will be loaded to this folder.
- Plug the supplied adapter into the 5V DC jack and a wall outlet.
- Connect the serial cable between the host system and the 73S1209F Evaluation Board.
- Press the ON/OFF switch to turn the board on.
- Run “TSCP-CCID.exe” (located in the path - **x:\yyy\** PCCID Vz.zz Release\Host Applications\Windows App\App\Bin\Release) on the host system to execute the host demonstration application (where **x** refers to the drive, **yyy** refers to the directory the installation .zip file was expanded to and **z.zz** is the latest version of the firmware release).

At this point the application window should appear. For additional information regarding the use of the Teridian Host application, refer to the *Pseudo-CCID Host GUI Users Guide* (UG\_12xxF\_037).



## 4 Evaluation Board Hardware Description

### 4.1 Jumpers, Switches and Modules

Table 2 describes the 73S1209F Evaluation Board jumpers, switches and modules. The Item # in Table 2 references Figure 6. The default setting refers to setup for running USB-CCID application.

**Table 2: Evaluation Board Jumper, Switch and Module Description**

| Item #                                                                                                                                                                                                                                                                                                                                                                                                                         | Schematic and Silkscreen Reference | Default setting | Name                                             | Use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                              | J2, J3, J5                         | No Connect      | Banana plugs for external regulated power supply | <p>Must be used to connect an external regulated power supply. These inputs are intended to allow control of the input supply voltage of the board (e.g. different than 5.0 V and 3.3 V on-board regulators).</p> <p>JP5 must be in position "5V EXT" and JP1 must be in position "5V "when using this 5 V power supply input. JP6 must be in position "EXT" "when using this 3.3 V power supply input.</p>                                                                                                                                                                                                                                                                                       |
| <div style="display: flex; align-items: center;">  <p>The evaluation board is sensitive to the polarity: One red plug is +3.3 V nominal and the other red plug is +5.0 V. The black plug is ground. The voltage supply input should be in the range +2.7 V to +3.6 V and 4.75 V to 5.5 V respectively.</p> </div> |                                    |                 |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                              | JP4                                | Inserted        | VDD jumper                                       | In normal use, a jumper must be inserted in this header, to connect the +3.3 V power supply of the board to the VDD pins of the 73S1209F. This jumper can be replaced by a $\mu$ A / mA-meter to measure the actual current drawn by the 73S1209F.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                              | JP3                                | Inserted        | 3.3 V jumper                                     | In normal use, a jumper must be inserted in this header, to connect the +3.3 V power supply of the RS-232 transceiver and the 73S8010R. This jumper can be removed to minimize power consumption if these devices are not used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                              | JP6                                | 'INT'           | Jumper: power supply selection (#1)              | <p>A jumper must be inserted to select one of the following settings:</p> <ul style="list-style-type: none"> <li>In position "EXT", the evaluation board 3.3 V is supplied from the external power supply inputs (banana plug J3). In this case, the voltage <u>must be externally regulated</u>. The power supply line is directly applied to the board power supply. This external power supply must not exceed 3.6 V.</li> <li>In position "INT", the evaluation board is powered from the 3.3 V voltage regulator U1. The regulator can be powered either from the USB bus power supply (USB-powered application), or from an external non-regulated power supply (connector PJ1).</li> </ul> |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                              | S1                                 |                 | Main switch                                      | This switch turns the power On / Off to the evaluation board, when the jumper JP1 is in position "VOUT". When using a lab regulated power supply connected to the banana plugs J2 and J3, this switch has no effect.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Item # | Schematic and Silkscreen Reference | Default setting | Name                                                    | Use                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------|------------------------------------|-----------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6      | PJ1                                | Connect         | DC jack                                                 | Plug to connect an external DC block. Must be used in conjunction with appropriate settings of S1, JP1 and JP6 (see details above).<br>Power supply features are:<br>Voltage: 7 V min; 12 V max<br>Current: 400 mA                                                                                                                                                                                                                                     |
| 7      | J11                                | No Connect      | In-Circuit Emulator connector                           | This connector must be used when using an external In-Circuit Emulator (SIGNUM 8052 ADM51 ICE). Refer to the Electrical Schematic for pin assignment.                                                                                                                                                                                                                                                                                                  |
| 8      | JP20                               | Not Inserted    | Jumper: analog in                                       | Jumper will select between the VBUS or analog in test point for the analog input. Using VBUS on the analog input will free up the USR7 interrupt for other uses. The analog input can be set up to use the compare to detect when the USB cable is inserted/removed.                                                                                                                                                                                   |
| 9      | P1                                 | No Connect      | DB9 RS232 female socket                                 | This socket allows connection of an RS232 cable to a computer. Use a crossed wires (RX/TX) cable. The evaluation board has an on-board level shifter (U7) to allow direct connection to a computer.<br>Connection of a RS232 link is required when using the pre-downloaded application.                                                                                                                                                               |
| 10     | D2, D3, D4, D5                     |                 | LEDs: Serial link activity and four dedicated LED pins. | These LEDs (D2, D3) reflect the activity on the serial link (RS232 or serial), and the others are used for general purpose indicators without the need for current limiting resistors. <ul style="list-style-type: none"> <li>• D2 reflects the activity on the RX line (Data going TO the 73S1209F)</li> <li>• D3 reflects the activity on the TX line (Data coming FROM the 73S1209F)</li> <li>• D4 to D5 are the LED0-LED1 output pins .</li> </ul> |
| 11     | U5                                 |                 | LCD Module                                              | On-board LCD module: <ul style="list-style-type: none"> <li>• 2 lines of 16 characters, each character dot matrix is 5x7.</li> <li>• Includes an embedded Hitachi HD44780 LCD driver, controlled from the on-board 73S1209F USR interface.</li> </ul>                                                                                                                                                                                                  |
| 12     | RV1                                |                 | Adjustable resistor to adjust LCD brightness            | Can be used to adjust the brightness of the on-board LCD module.                                                                                                                                                                                                                                                                                                                                                                                       |
| 13     | S2 to S31                          |                 | On-board keypad                                         | 5x6 keyboard directly connected to the on-board 73S1209F IC. The assignment of the keys, as silk-printed on the PCB is the one supported by the TSC Application Programming Interface.                                                                                                                                                                                                                                                                 |
| 14     | –                                  |                 | Board reference and serial number                       | Should be mentioned in any communication with TSC Application Engineers when requesting support.                                                                                                                                                                                                                                                                                                                                                       |

| Item # | Schematic and Silkscreen Reference | Default setting | Name                                       | Use                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------|------------------------------------|-----------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15     | JP2                                | Inserted        | Jumper VPC                                 | In normal use, a jumper must be inserted in this header to connect the +5.0 V power supply of the board to the VPC pins of the 73S1209F. This jumper can be replaced by a $\mu$ A / mA-meter to measure the actual current drawn by the 73S1209F.                                                                                                                                                            |
| 16     | –                                  |                 | Breadboard area                            | This breadboard area allows engineers to add their own circuitry / connection of peripherals, when prototyping and developing a 73S1209F based application. User I/Os, GPIOs, interrupt pins and power supply pins are located close to this area to allow easy connection.                                                                                                                                  |
| 17     | JP16, JP17                         | Inserted        | Jumper: LED pins                           | In normal use, a jumper must be inserted in this header, to connect the LEDs to the LED pins of the 73S1209F. This jumper can be replaced by a $\mu$ A / mA-meter to measure the actual current drawn by the LED outputs of the 73S1209F.                                                                                                                                                                    |
| 18     | JP12                               | Inserted        | Jumper: 73S8010R VPC connect               | Insertion of the jumper will provide 5.0 V to the 73S8010R VPC pin. If the 73S8010R is not used, the jumper can be removed.                                                                                                                                                                                                                                                                                  |
| 19     | JP13                               | Not Inserted    | Jumper: USR7/SDA select                    | This jumper selects which signal is connected to the daughter board connector pin USR7: <ul style="list-style-type: none"> <li>In position “USR7”, the 73S1209F USR7 signal is connected to the daughter card pin USR7.</li> <li>In position “SDA”, the I2C SDA signal is connected to the daughter card pin USR7. This allows the SDA line to connect to an SDA pin on a 73S8010R daughter card.</li> </ul> |
| 20     | JP14                               | Not Inserted    | Jumper: USR5/AUX2 select                   | This jumper allows the on board 73S8010 AUX2 pin to be connected to USR5 if needed. If not needed the jumper should be removed.                                                                                                                                                                                                                                                                              |
| 21     | U4                                 |                 | On board 73S8010R                          | The board contains a built-in 73S8010R that is connected to the external smart card interface of the 73S1209F. If not used, this device can be disconnected from the 73S1209F by removing jumpers JP12 and JP21.                                                                                                                                                                                             |
| 22     | JP21                               | Inserted        | Jumper: 73S8010R interrupt                 | This jumper will allow the on-board 73S8010 interrupt output to connect to INT2 on the 73S1209F. Remove this jumper if the on-board 73S8010 is not used.                                                                                                                                                                                                                                                     |
| 23     | J7,J8                              | Not Inserted    | Optional 73S80xxX Daughter Board interface | When developing applications that require more than 2 smart card interfaces, an optional daughter board can be populated to use the 73S1209F external smart card interface (lines SCIO and SCK), in conjunction with the USR(0:7) port and the INT2 interrupt input of the 73S1209F). Refer to the Electrical Schematic for pin assignment.                                                                  |

| Item # | Schematic and Silkscreen Reference | Default setting | Name                                                                                              | Use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|------------------------------------|-----------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24     | J9, J10                            |                 | SIM / SAM and Smart Card connectors – external interface (#2)                                     | Allows the evaluation board to communicate with a smart card using either the standard (credit card size) or SIM/SAM format. This slot is connected to the 73S1209F external card interface # 2.<br>Note that J10 is wired in parallel to the smart card connector J9 (underneath the PCB). Both connectors cannot be populated at the same time.                                                                                                                                                                                                                                                                                                                                                                                 |
| 25     | JP11                               | Not Inserted    | Jumper: USR6/SCL select                                                                           | This jumper selects which signal is connected to the daughter board connector pin USR6: <ul style="list-style-type: none"> <li>In position “USR6”, the 73S1209F USR6 signal is connected to the daughter card pin USR6.</li> <li>In position “SCL”, the I2C SCL signal is connected to the daughter card pin USR6. This allows the SCL line to connect to an SCL pin on a 73S8010R daughter card.</li> </ul>                                                                                                                                                                                                                                                                                                                      |
| 26     | JP10                               | Not Inserted    | Jumper: USR6/AUX1 select                                                                          | This jumper allows the on board 73S8010 AUX1 pin to be connected to USR6 if needed. If not needed the jumper should be removed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 27     | JP8                                | ‘Active High’   | Jumper: Selection of the polarity of the card detection switches of internal smart card connector | On-board smart card connectors and SIM/SAM connectors are equipped with card presence switches, normally open when no card is inserted. When the switches are closed (card inserted), the polarity must be selected by a jumper on JP8: <ul style="list-style-type: none"> <li>In position “ACTIVE HIGH”, the card detection switches connect +3.3 V to the card detection inputs of the 73S1209F.</li> <li>In position “ACTIVE LOW”, the card detection switches connect ground to the card detection inputs of the 73S1209F.</li> </ul> The 73S1209F firmware can handle both polarities for card detection. Therefore, this setting is firmware dependent. The default firmware settings are JP8 = ACTIVE HIGH and JP7 = PRES. |
| 28     | S27                                |                 | Reset button                                                                                      | Evaluation board main reset: Asserts a hardware reset to the on-board 73S1209F IC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 29     | JP7                                | ‘PRES’          | Jumper: Selection of the PRES and PRESB inputs                                                    | Selects the card detect input PRES or PRESB. PRES is the active high input and PRESB is the active low input.<br>See item 29 for more detail.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 30     | JP15                               | ‘GND’           | Jumper: security fuse control                                                                     | This jumper should be removed at all times. Connecting the jumper will allow the security fuses to be blown under firmware control. Refer to the <i>73S1209F Data Sheet</i> for further information about the security fuse.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

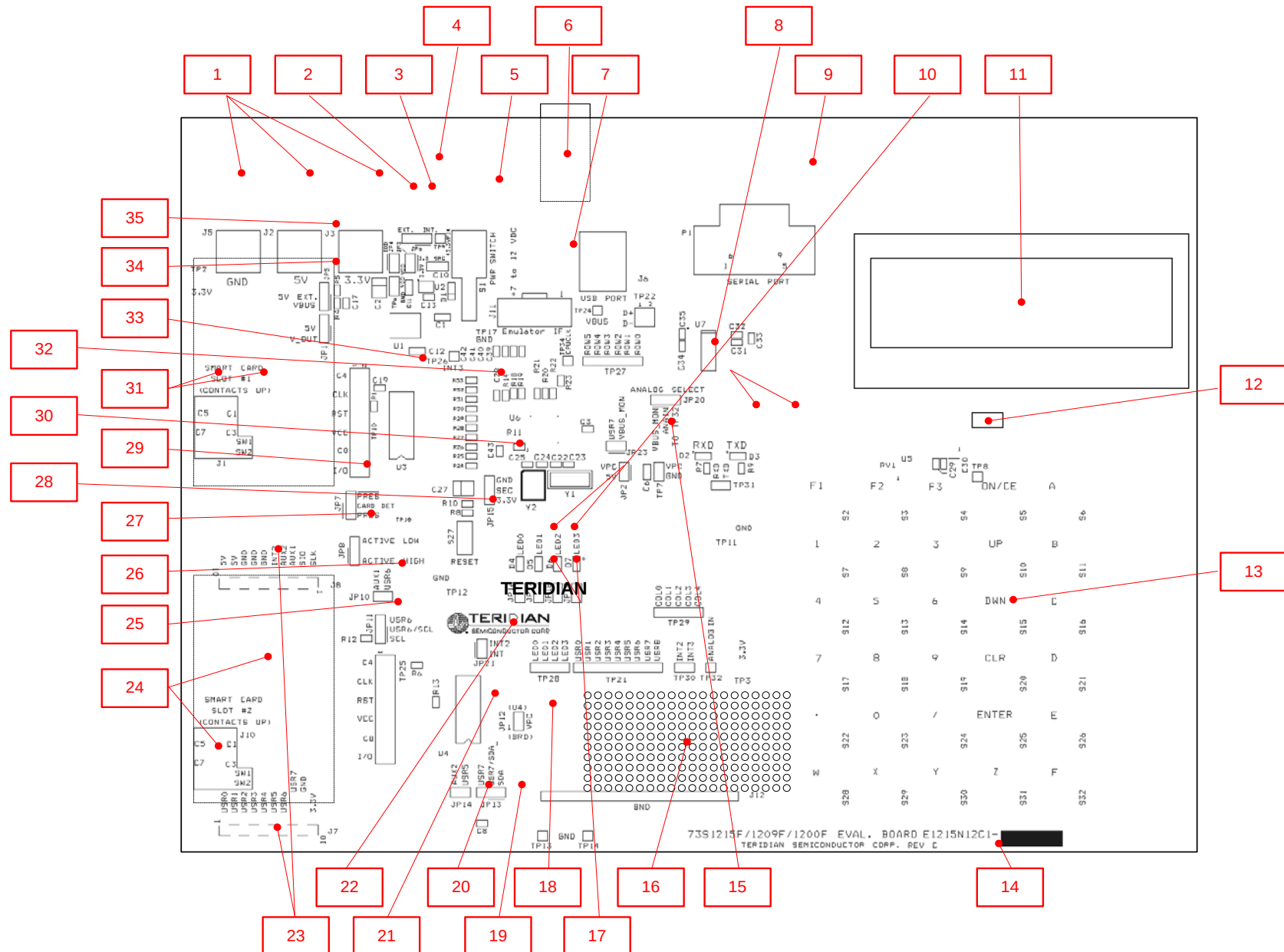


Figure 6: 73S1209F Evaluation Board Jumper, Switch and Module Locations

## 4.2 Test Points

The test point numbers listed in [Table 3](#) refer to the test point numbers shown in the electrical schematic and in the silkscreen of the PCB.

**Table 3: Evaluation Board Test Point Description**

| Test Point # | Name                               | Use                                                                                                                                                                                                                                                                     |
|--------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TP2, TP3     | +3.3V                              | +3.3 V main board power supply, coming from the internal or external source, as defined from the jumpers JP3 and JP6. TP3 and TP4 are close to the breadboard area for easy wiring of the power supply.                                                                 |
| TP6<br>TP7   | VDD<br>VPC                         | 2-pin test point, with one ground and one VDD signal directly connected to the 73S1209F and its decoupling capacitors. Can be used to measure the integrity of the digital power supply of the 73S1209F, or to add a decoupling capacitor.                              |
| TP8          | +5V                                | +5 V coming from the external DC block (connected to JP5), as selected with jumper on JP1. Can be used to test voltage presence.                                                                                                                                        |
| TP9          | +3.3VFIX                           | +3.3 V coming from the on-board regulator (powered up from the external DC block). Can be used to test voltage presence.                                                                                                                                                |
| TP10         | Smart Card Contacts – Interface #1 | Header for measurement of the card signals, close to the card connectors. Contains the card signals VCC1, RST1, CLK1, C81 and C41. Each contact has its own ground pin on the header.                                                                                   |
| TP11 to TP17 | GND                                | Ground test points. Can be used for grounding of lab equipment probes.                                                                                                                                                                                                  |
| TP18         | Card Detect – Interface #1         | Card detect signal coming directly from the card connectors.                                                                                                                                                                                                            |
| TP21         | USR(7:0)                           | Standard 8-bit user I/O port of the 73S1209F.<br> Some of the user I/Os are shared by the extension 73S80xx daughter board and the LCD interface. Only one should be used at a time. |
| TP22         | USB – N/A                          | TP22 is not populated with the 73S1209F.                                                                                                                                                                                                                                |
| TP24         | VBUS – N/A                         | TP24 is not populated with the 73S1209F.                                                                                                                                                                                                                                |
| TP25         | Smart Card Contacts – Interface #2 | Header for measurement of the card signals, close to the card connectors. Contains the card signals VCC2, RST2, CLK2, C42 and C82. Each contact has its own ground pin on the header.                                                                                   |
| TP26         | INT3                               | Interrupt input #3 secondary test points.                                                                                                                                                                                                                               |
| TP27         | ROW[0:5]                           | The row pins used for the keypad interface.                                                                                                                                                                                                                             |
| TP28         | LED0-1                             | The LED outputs from the 73S1209F. (LED2 and LED3 are N/C on the 73S1209F)                                                                                                                                                                                              |
| TP29         | COL[0:4]                           | The column pins used for the keypad interface.                                                                                                                                                                                                                          |
| TP30         | INT2-3                             | Interrupt input #2 and #3 of the 73S1209F. This header is close to the breadboard area for easy wiring.                                                                                                                                                                 |
| TP31         | RX, TX                             | The TX and RX serial UART I/O signals (3.3 V digital logic level).                                                                                                                                                                                                      |
| TP32         | ANALOG IN                          | Analog input test point. Analog voltage can be connected to this test point for voltage comparison.                                                                                                                                                                     |
| TP34         | CPUCLK                             | This pin outputs the oscillator clock of the 73S1209F device. Can be used as a clock source for any purpose.                                                                                                                                                            |



### Figure 7: 73S1209F Evaluation Board Electrical Schematic

## 4.4 PCB Layouts

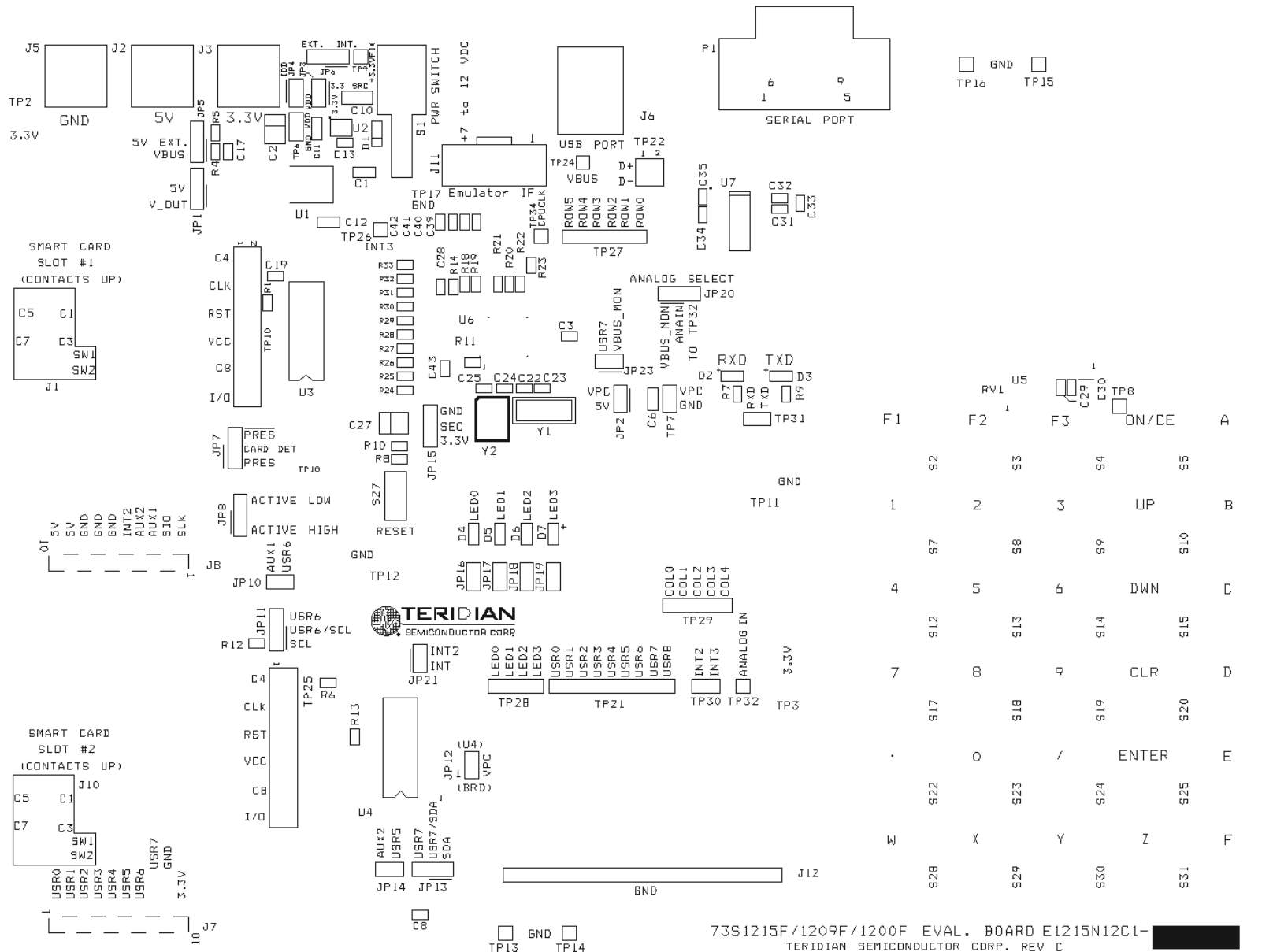
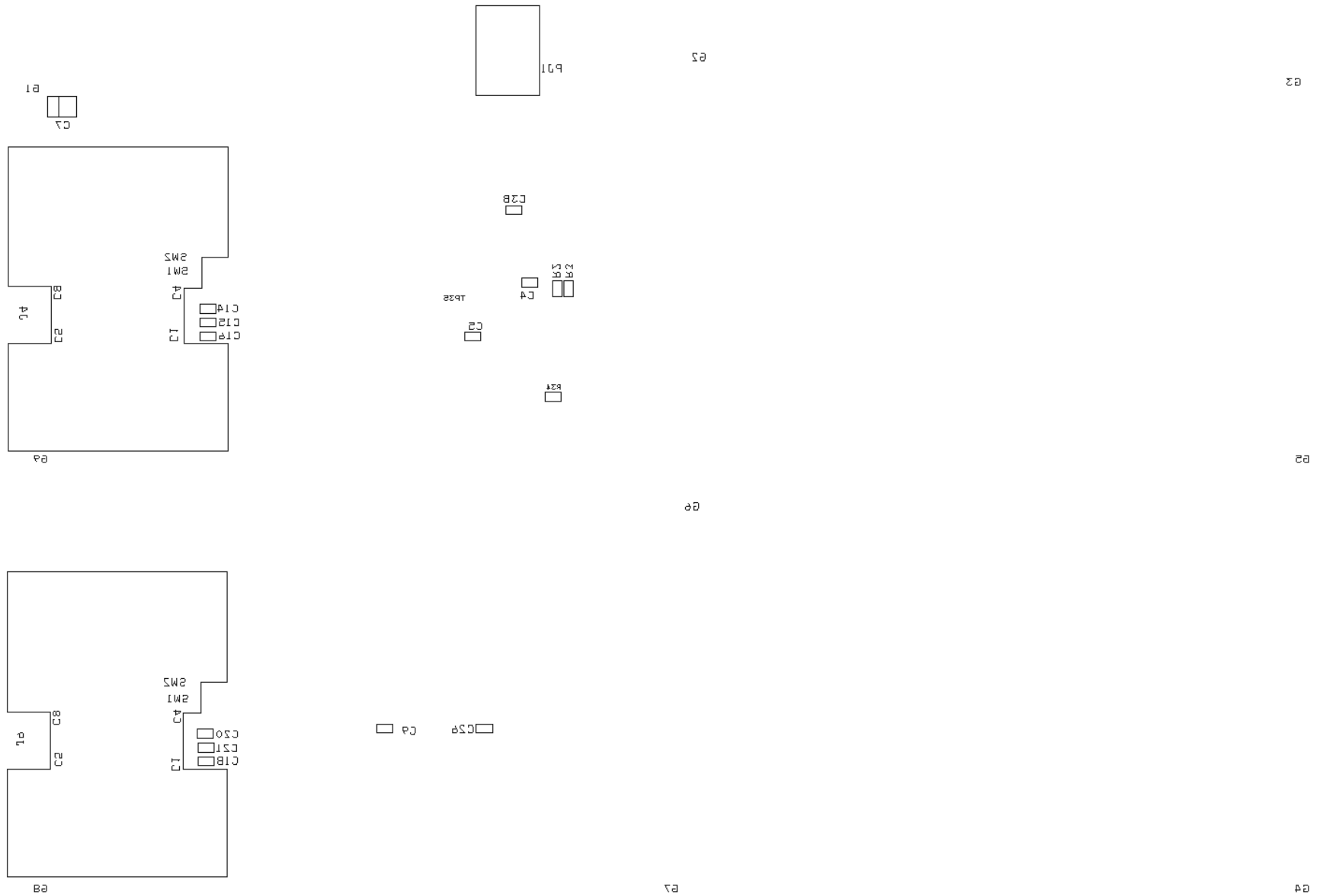


Figure 8: 73S1209F Evaluation Board Top View (Silkscreen)



**Figure 9: 73S1209F Evaluation Board Bottom View (Silkscreen)**

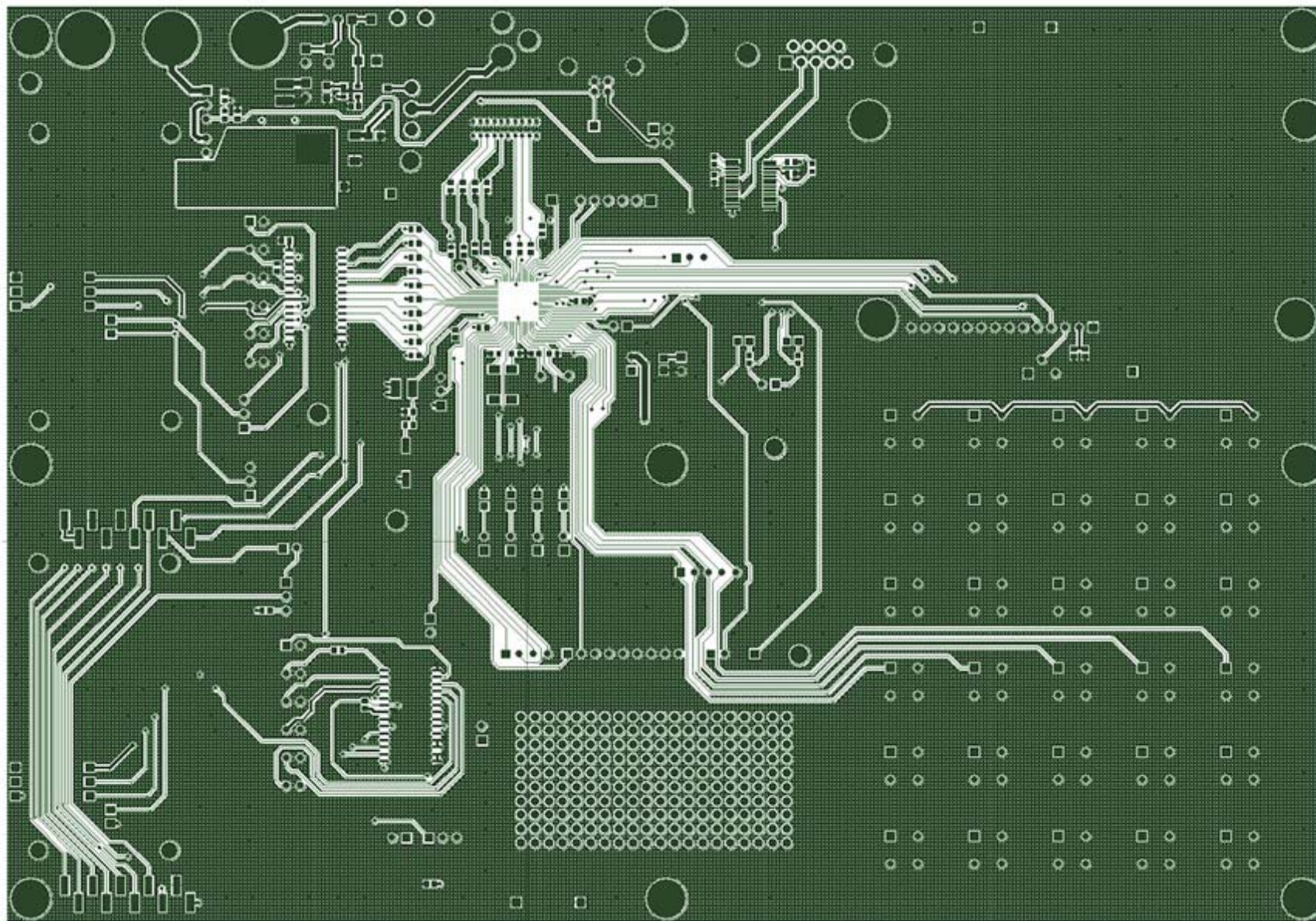


Figure 10: 73S1209F Evaluation Board Top Signal Layer



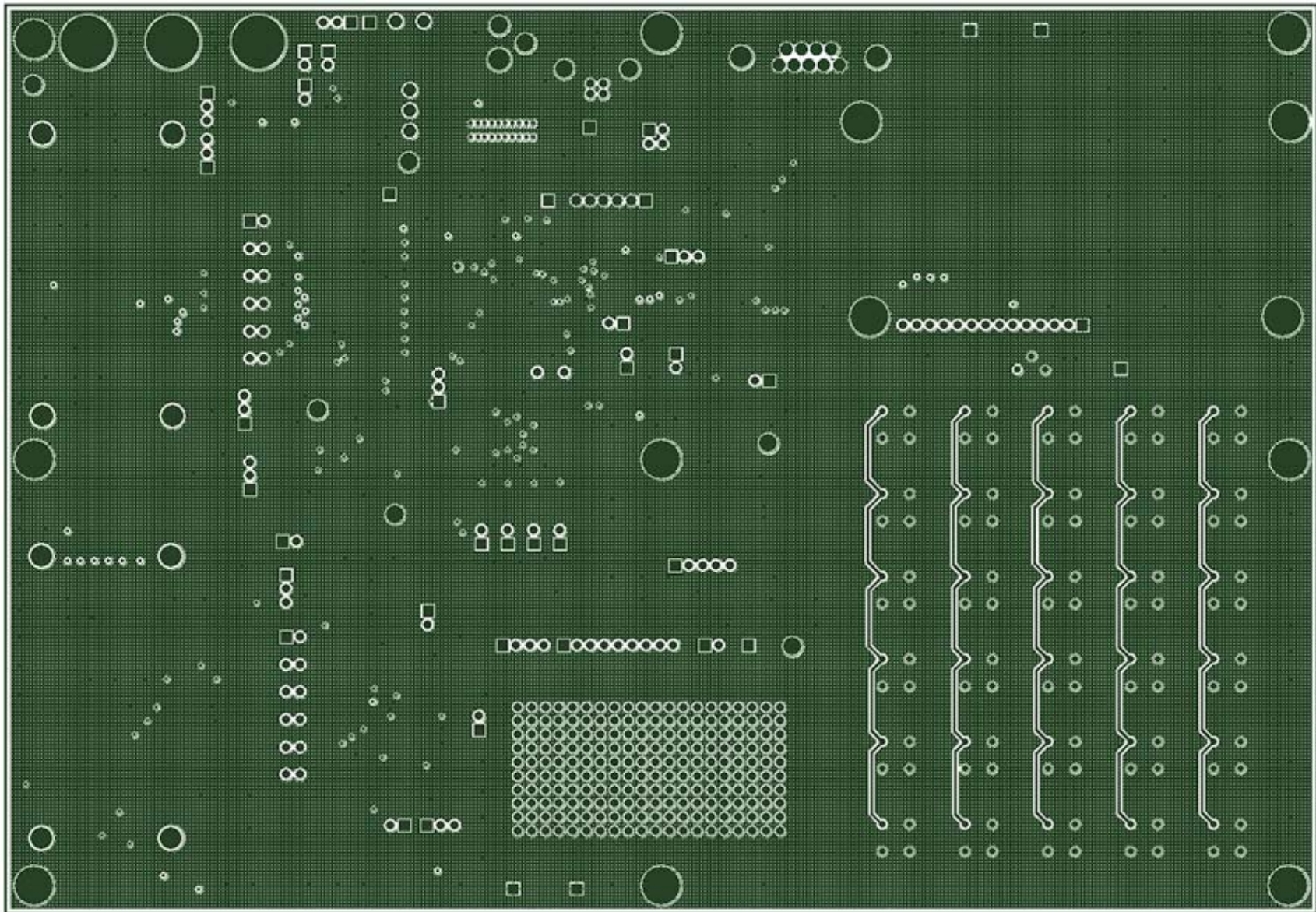


Figure 11: 73S1209F Evaluation Board Middle Layer 1 – Ground Plane



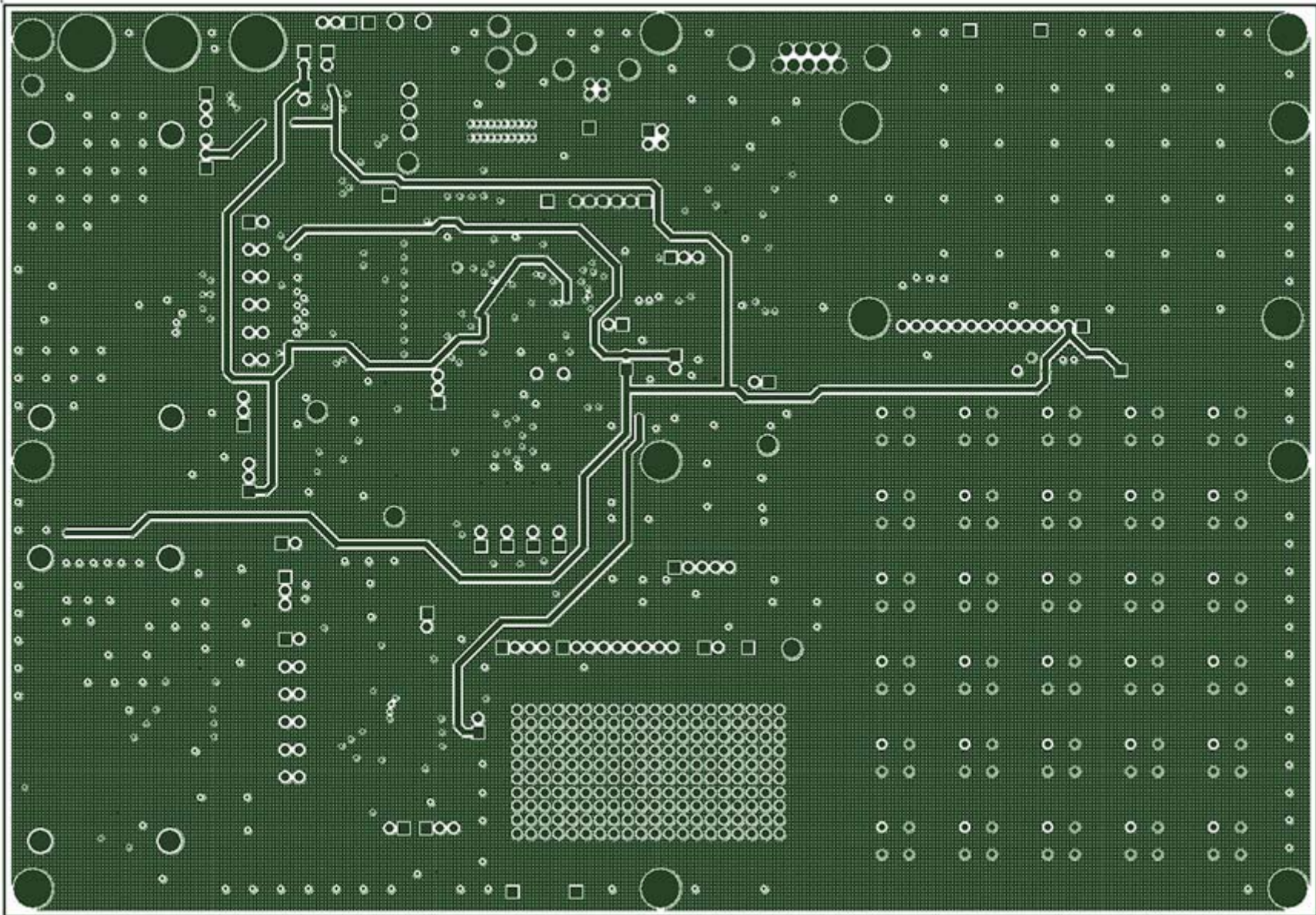


Figure 12: 73S1209F Evaluation Board Middle Layer 2 – Supply Plane



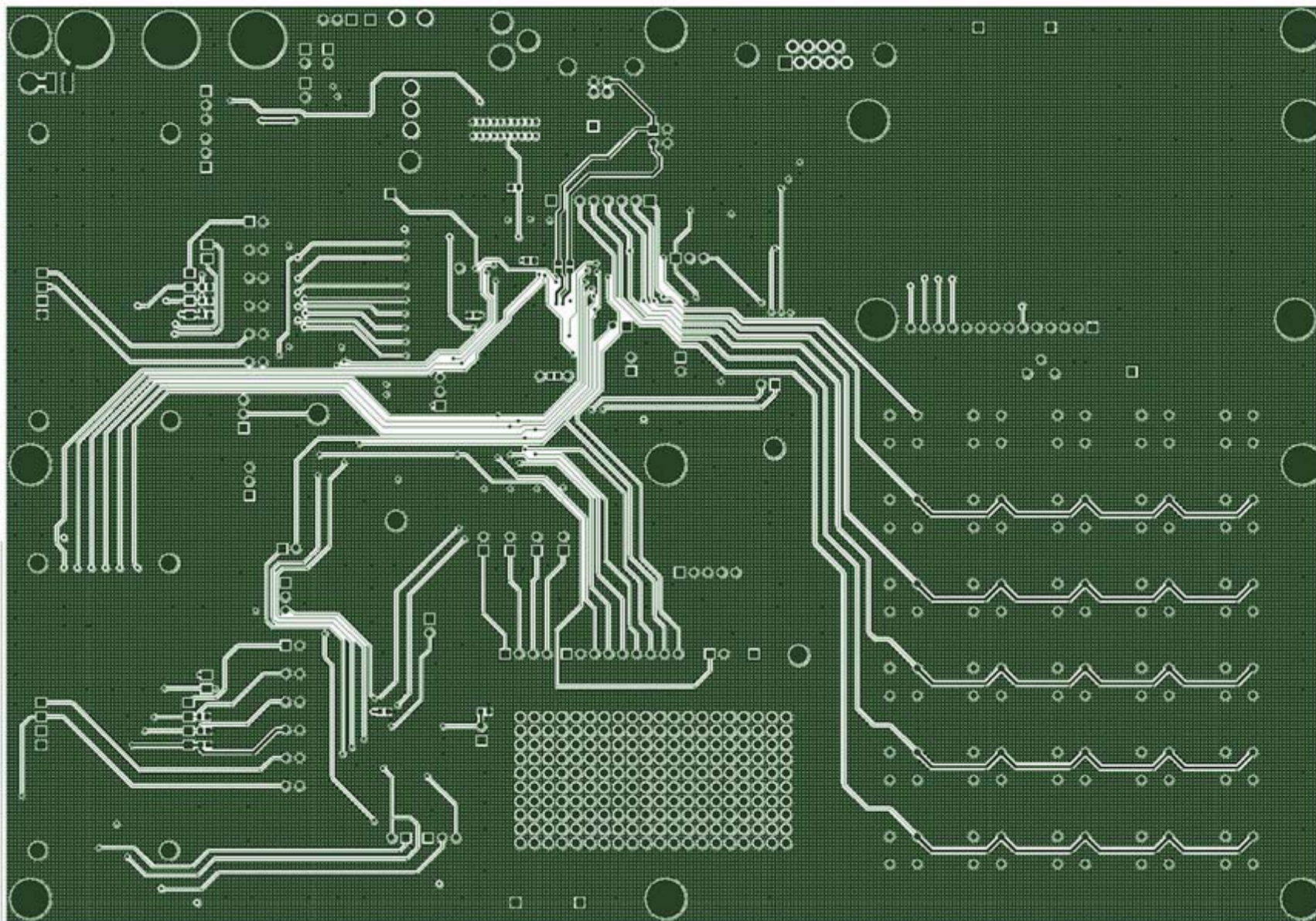


Figure 13: 73S1209F Evaluation Board Bottom Signal Layer

## 4.5 Bill of Materials

Table 4 provides the bill of materials for the 73S1209F Evaluation Board schematic provided in Figure 7.

**Table 4: 73S1209F Evaluation Board Bill of Materials**

| Item | Qty. | Reference                                                   | Part                 | PCB Footprint   | Digi-key Part Number | Part Number     | Manufacturer         |
|------|------|-------------------------------------------------------------|----------------------|-----------------|----------------------|-----------------|----------------------|
| 1    | 3    | C2,C7,C27                                                   | 10 $\mu$ F           | 3528-21 (EIA)   | 478-1672-1-ND        | TAJB106K010R    | AVX Corporation      |
| 2    | 3    | C1, C6,C12                                                  | 10 $\mu$ F           | 805             | PCC2225CT-ND         | ECJ-2FB0J106M   | Panasonic            |
| 3    | 14   | C3,C4,C5,C8,C9,C19,<br>C26,C28,C30,C31,C32,<br>C33, C34,C35 | 0.1 $\mu$ F          | 603             | PCC1762CT-ND         | ECJ-1VB1C104K   | Panasonic            |
| 4    | 1    | C10                                                         | 4.7 $\mu$ F          | 603             | PCC2396CT-ND         | ECJ-1VB0J475K   | Panasonic            |
| 5    | 1    | C11                                                         | 2.2 $\mu$ F          | 805             | PCC1923CT-ND         | ECJ-2YB0J225K   | Panasonic            |
| 6    | 1    | C13                                                         | 0.01 $\mu$ F         | 603             | 445-1311-1-ND        | C1608X7R1H103K  | TDK Corporation      |
| 7    | 4    | C14,C15,C20,C21                                             | 27 pF                | 603             | PCC270ACVCT-ND       | ECJ-1VC1H270J   | Panasonic            |
| 8    | 3    | C16,C18,C29                                                 | 1 $\mu$ F            | 603             | PCC2174CT-ND         | C1608X5R1A105K  | TDK Corporation      |
| 9    | 2    | C22,C23                                                     | 22 pF                | 603             | PCC220ACVCT-ND       | ECJ-1VC1H220J   | Panasonic            |
| 10   | 5    | C38, C39, C40, C41, C42                                     | 20 pF                | 603             | PCC200ACVCT-ND       | ECJ-1VC1H200J   | Panasonic            |
| 11   | 1    | C43                                                         | 1000 pF              | 603             | PCC2151CT-ND         | ECJ-1VC1H102J   | Panasonic            |
| 12   | 1    | D1                                                          | MBR0520L             | SOD-123         | MBR0520LCT-ND        | MBR0520L        | Fairchild            |
| 13   | 4    | D2,D3,D4,D5                                                 | LED                  | 805             | 160-1414-1-ND        | LTST-C170FKT    | LITE-ON INC          |
| 14   | 9    | JP1,JP5,JP6,JP7,JP8,<br>JP11, JP13,JP15, JP20               | HEADER 3             | 1 x 3 pin       | S1011E-36-ND         | PBC36SAAN       | Sullins Electronics  |
| 15   | 9    | JP2,JP3,JP4,JP10,JP12,<br>JP14, JP16,JP17,JP21              | HEADER 2             | 1 x 2 pin       | S1011E-36-ND         | PBC36SAAN       | Sullins Electronics  |
| 16   | 2    | J1,J10                                                      | SIM/SAM Connector    | ITT_CCM003_3754 | CCM03-3754CT-ND      | CCM03-3754CT-ND | C&K                  |
| 17   | 2    | J2,J3                                                       | Banana (red)         | Banana          |                      | 16BJ381         | Mouser               |
| 18   | 1    | J5                                                          | Banana (black)       | Banana          |                      | 16BJ382         | Mouser               |
| 19   | 2    | J9,J4                                                       | Smart Card Connector | ITT_CCM002-2504 | CCM02-2504-ND        | CCM02-2504-ND   | C&K                  |
| 20   | 2    | J8,J7                                                       | TSM_110_01_L_SV      | TSM_110_01_L_SV |                      | TSM_110_01_L_SV | Samtec               |
| 21   | 1    | J11                                                         | Emulator IF          | 10 X 2 pin      | A3210-ND             | 104068-1        | AMP/Tyco Electronics |



| Item | Qty. | Reference                                                                                                                          | Part          | PCB Footprint | Digi-key Part Number | Part Number    | Manufacturer         |
|------|------|------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|----------------------|----------------|----------------------|
| 22   | 1    | PJ1                                                                                                                                | +12VDC        | RAPC722       | SC1153-ND            | RAPC722        | Switchcraft          |
| 23   | 1    | P1                                                                                                                                 | DB9_RS232     | AMP_745781    | A2100-ND             | 745781-4       | AMP/Tyco Electronics |
| 24   | 1    | RV1                                                                                                                                | 10 k $\Omega$ | 3266W         | 3266W-103-ND         | 3266W-1-103    | Bourns               |
| 25   | 12   | R1,R6,R24-33                                                                                                                       | 0 $\Omega$    | 603           | P0.0GCT-ND           | ERJ-3GEY0R00V  | Panasonic            |
| 26   | 2    | R7,R9                                                                                                                              | 470 $\Omega$  | 603           | P470GCT-ND           | ERJ-3GEYJ471V  | Panasonic            |
| 27   | 1    | R8                                                                                                                                 | 10 $\Omega$   | 603           | P10GCT-ND            | ERJ-3GEYJ100V  | Panasonic            |
| 28   | 1    | R10                                                                                                                                | 10 k $\Omega$ | 603           | P10KGCT-ND           | ERJ-3GEYJ103V  | Panasonic            |
| 29   | 8    | R11,R14,R18,R19,R20,<br>R21, R22,R23                                                                                               | 62 $\Omega$   | 603           | P62GCT-ND            | ERJ-3GEYJ620V  | Panasonic            |
| 30   | 2    | R12,R13                                                                                                                            | 3 $\Omega$ k  | 603           | P3.0KGCT-ND          | ERJ-3GEYJ302V  | Panasonic            |
| 31   | 1    | R34                                                                                                                                | 1 M $\Omega$  | 603           | P1.0MGCT-ND          | ERJ-3GEYJ106V  | Panasonic            |
| 32   | 1    | S1                                                                                                                                 | POWER_SWITCH  | POW_SW        | EG2364-ND            | 100SP1T2B4M7RE | E-Switch             |
| 33   | 30   | S2,S3,S4,S5,S6,S7,S8,<br>S9,S10,S11,S12,S13,<br>S14S15,S16,S17,S18,<br>S19,S20,S21,S22,S23,<br>S24,S25,S26,S28,S29,<br>S30,S31,S32 | SW_MOM        | Pushbutton SW | 401-1885-ND          | D6 C 10 LFS    | ITT Industries       |
| 34   | 1    | S27                                                                                                                                | SW            | Panasonic EVQ | P8051SCT             | EVQ-PJX05M     | Panasonic            |
| 35   | 11   | TP8,TP9,TP13,TP14,<br>TP15,TP16,TP17,TP26,<br>TP32, TP34, TP35                                                                     | TP            | 1 Pin         | S1011E-36-ND         | PZC36SAAN      | Sullins Electronics  |
| 36   | 1    | TP18                                                                                                                               | TP            | 1 pin White   | 5012K-ND             | 5012           | Keystone Electronics |
| 37   | 2    | TP2,TP3                                                                                                                            | TP            | 1 pin Red     | 5010K-ND             | 5010           | Keystone Electronics |
| 38   | 2    | TP11,TP12                                                                                                                          | TP            | 1 pin Black   | 5011K-ND             | 5011           | Keystone Electronics |
| 39   | 4    | TP6,TP7,TP30,TP31                                                                                                                  | TP2           | 1 x 2 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |
| 40   | 2    | TP10,TP25                                                                                                                          | HEADER 2 x 4  | 6 x 2 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |
| 41   | 1    | TP21                                                                                                                               | HEADER 9      | 1 x 9 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |
| 42   | 1    | TP27                                                                                                                               | HEADER 6      | 6 x 1 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |
| 43   | 1    | TP28                                                                                                                               | HEADER 4      | 4 x 1 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |
| 44   | 1    | TP29                                                                                                                               | HEADER 5      | 5 x 1 pin     | S1011E-36-ND         | PBC36SAAN      | Sullins Electronics  |

| Item | Qty. | Reference | Part         | PCB Footprint | Digi-key Part Number | Part Number     | Manufacturer           |
|------|------|-----------|--------------|---------------|----------------------|-----------------|------------------------|
| 45   | 1    | U1        | LM1117DT-5.0 | TO-252-3      | LM1117DT-5.0-ND      | LM1117DT-5.0    | National Semiconductor |
| 46   | 1    | U2        | LP2985       |               | LP2985IM5-3.3CT-ND   | LP2985IM5-3.3   | National Semiconductor |
| 47   | 1    | U4        | 73S8010R     |               | 73S8010R             |                 | Teridian Semiconductor |
| 48   | 1    | U5        | MDL-16265    |               | 153-1078-ND          | MDL-16265-SS-LV | Varitronix             |
| 49   | 1    | U6        | 73S1209F     | 68 QFN        |                      | 73S1209F        | Teridian Semiconductor |
| 50   | 1    | U7        | MAX3237CAI   |               | MAX3237CAI-ND        | MAX3237CAI      | Maxim                  |
| 51   | 1    | Y1        | 12.000 MHz   |               | X1116-ND             | ECS-120-20-4XDN | ECS                    |

## 4.6 Schematic Information

This section provides recommendations on proper schematic design that will help in designing circuits that are functional and compatible with the PCCID software library APIs.

### 4.6.1 Reset Circuit

The 73S1209F Evaluation Board provides a reset pushbutton that can be used when prototyping and debugging software. The RESET pin should be supported by the external components shown in [Figure 14](#). R8 should be around 10  $\Omega$ . The capacitor C27 should be 10  $\mu$ F. R8 and C27 should be mounted as close as possible to the IC.



C43 (1000 pF) is shown for EFT protection and is optional.

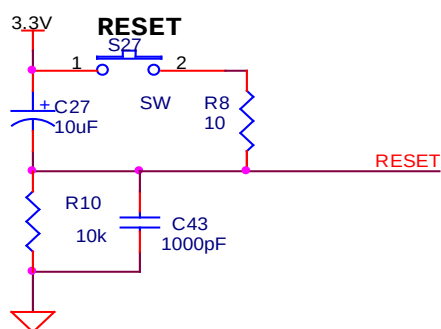


Figure 14: External Components for RESET

### 4.6.2 Oscillators

The 73S1209F contains an oscillator for the primary system clock. The system clock should use a 12 MHz crystal to provide the proper system clock rates for the serial and smart card interfaces. The system oscillator requires a 1 M $\Omega$  parallel resistor to insure proper oscillator startup ([Figure 15](#)).

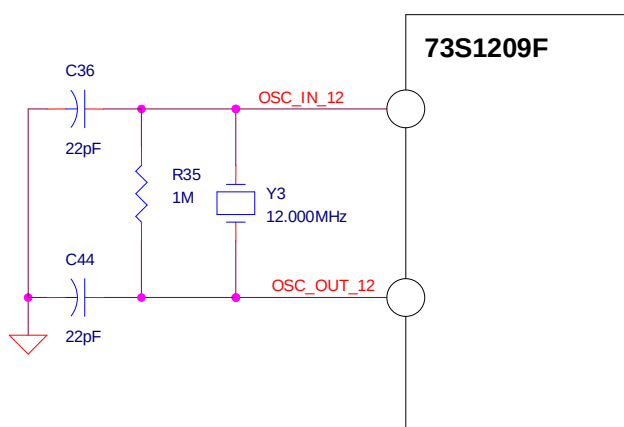


Figure 15: Oscillator Circuit

### 4.6.3 LCD

The 73S1209F does not contain an on-chip LCD controller. However, an LCD module (with built-in controller) can be used with the 73S1209F via use of specific USR (GPIO) pins. The LCD API libraries support up to a 2 line/16 character display. [Figure 16](#) shows the basic connection for this type of LCD. The LCD module must connect to the USR pins as shown and it requires an external brightness adjust circuit.

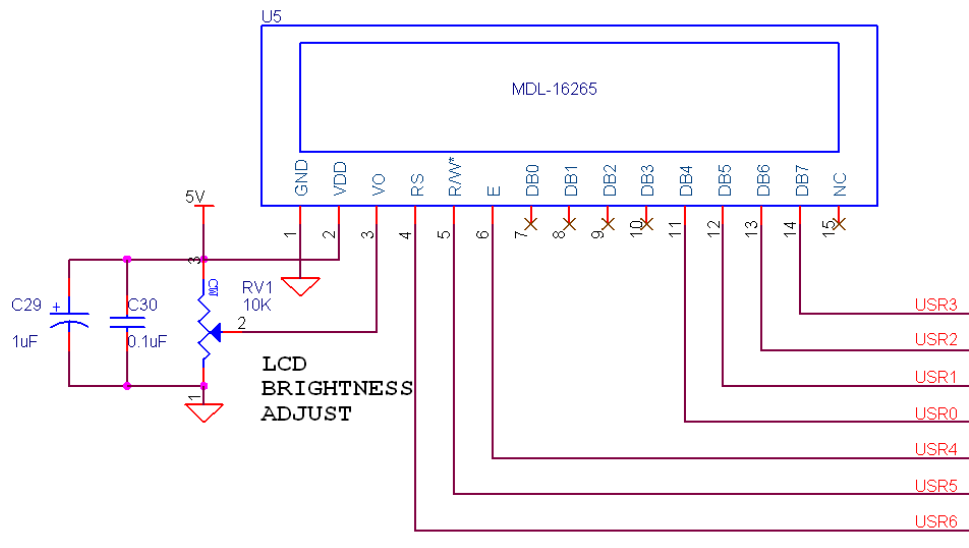


Figure 16: LCD Connections



#### 4.6.4 Smart Card Interface

The smart card interface on the 73S1209F requires few external components for proper operation.

Figure 17 shows the recommended smart card interface connections.

- The RST and CLK signals should have 27 pF capacitors at the smart card connector.
- It is recommended that a 0  $\Omega$  resistor be added in series with the CLK signal. If necessary, in noisy environments, this resistor can be replaced with a small resistor to create a RC filter on the CLK signal to reduce CLK noise. This filter is used to soften the clock edges and provide a cleaner clock for those environments where this could be problematic.
- The VCC output must have a 1.0  $\mu$ F capacitor at the smart card connector for proper operation.
- The VPC input is the power supply input for the smart card power. It is recommended that both a 10  $\mu$ F and a 0.1  $\mu$ F capacitor are connected to provide proper decoupling for this input.
- The PRES input on the 73S1209F contains a very weak pull down resistor. As a result, an additional external pull down resistor is recommended to prevent any system noise from triggering a false card event. The same holds true for the  $\overline{\text{PRES}}$  input, except a pull up resistor is utilized as the logic is inverted from the PRES input.

The smart card interface layout is important. The following guidelines should be followed to provide the optimum smart card interface operation:

- Route auxiliary signals away from card interface signals
- Keep CLK signal as short as possible and with few bends in the trace. Keep route of the CLK trace to one layer (avoid vias to other plane). Keep CLK trace away from other traces especially RST and VCC. Filtering of the CLK trace is allowed for noise purpose. Up to 30 pF to ground is allowed at the CLK pin of the smart card connector. Also, the zero ohm series resistor, R7, can be replaced for additional filtering (no more than 100  $\Omega$ ).
- Keep VCC trace as short as possible. Make trace a minimum of 0.5 mm thick. Also, keep VCC away from other traces especially RST and CLK.
- Keep CLK trace away from VCC and RST traces. Up to 30 pF to ground is allowed for filtering
- Keep 0.1  $\mu$ F close to VDD pin of the device and directly take other end to ground
- Keep 10  $\mu$ F and 0.1  $\mu$ F capacitors close to VPC pin of the device and directly take other end to ground
- Keep 1.0  $\mu$ F close to VCC pin of the smart card connector and directly take other end to ground

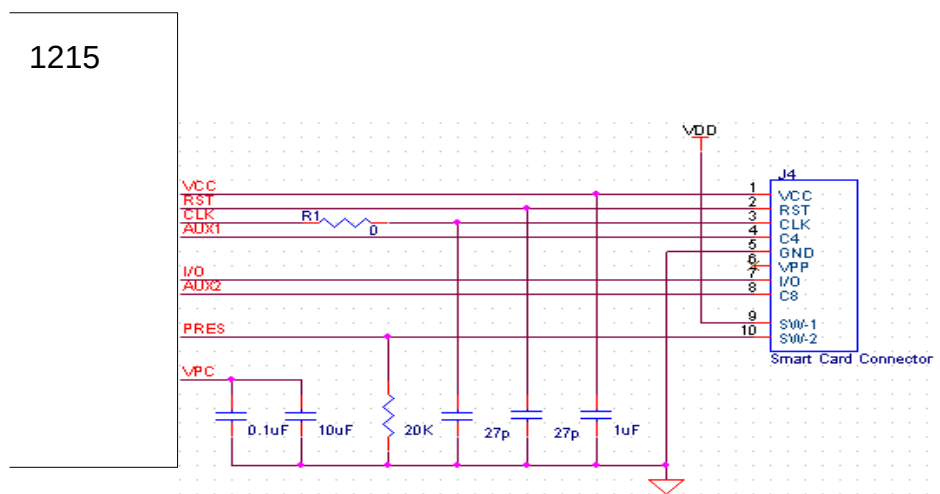


Figure 17: Smart Card Connections

## 5 Ordering Information

| Part Description                     | Order Number |
|--------------------------------------|--------------|
| 73S1209F 68-Pin QFN Evaluation Board | 73S1209F-EB  |

## 6 Related Documentation

The following 73S1209F documents are available from Teridian Semiconductor Corporation:

*73S1209F Data Sheet*

*73S1209F Evaluation Board Quick Start Guide*

*TSC Flash Programmer Model TFP2 User's Manual*

## 7 Contact Information

For more information about Teridian Semiconductor products or to check the availability of the 73S1209F contact us at:

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Suite 100  
Irvine, CA 92618-5201

Telephone: (714) 508-8800  
FAX: (714) 508-8878  
Email: [scr.support@teridian.com](mailto:scr.support@teridian.com)

For a complete list of worldwide sales offices, go to <http://www.teridian.com>.

## Revision History

| Revision | Date             | Description                                                                         |
|----------|------------------|-------------------------------------------------------------------------------------|
| 1.0      | January 22, 2007 | Document Creation.                                                                  |
| 1.1      | April 2, 2007    | Update BOM and change to Rev C PWB. Remove board errata section.                    |
| 1.2      | August 8, 2007   | Modify incorrect part number for S1 in BOM.                                         |
| 1.3      | August 19, 2009  | Remove 44-pin board and LAPIE references.<br>Miscellaneous editorial modifications. |