TERIDIAN SEMICONDUCTOR CORP.

Simplifying System Integration™

73S1217F
Evaluation Board User Guide

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1 Introduction

The Teridian Semiconductor Corporation (TSC) 73S1217F Evaluation Board is used as a platform to demonstrate the capabilities of the 73S1217F Smart Card Controller devices. It has been designed to operate either as a standalone or a development platform.

The 73S1217F 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 has been designed to operate in conjunction with an ICE to develop and debug 73S1217F based embedded applications.

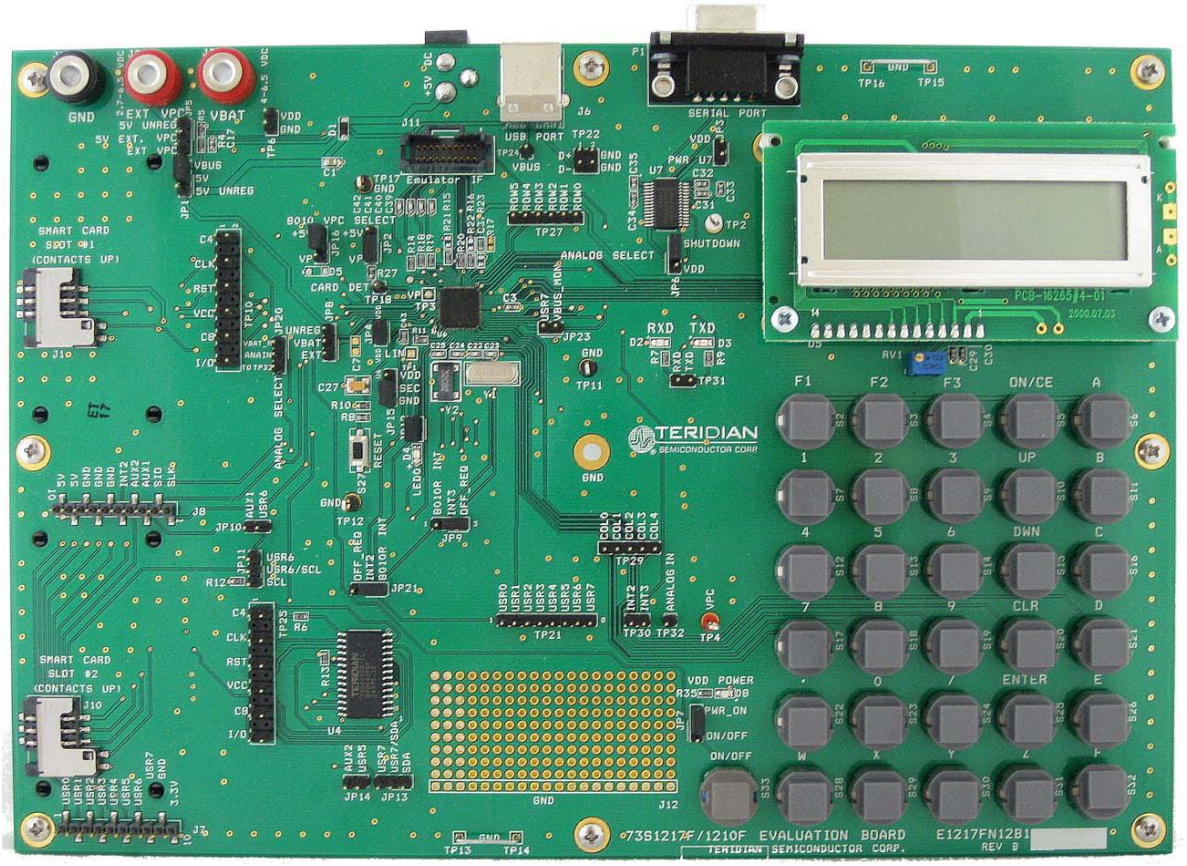


Figure 1: 73S1217F / 1210F Evaluation Board

1.1 Evaluation Kit Contents

The 73S1217F Evaluation Kit contains the following:

- 73S1217F Evaluation Board: 4-layer, rectangular PWB as shown in Figure 1 (identification number E1217FN12B1 Rev B), containing the 73S1217F with the preloaded USB CCID application.
- USB cable, A-B, male/male, 2 meters (Digi-key AE9932-ND).
- 5 V DC power supply.
- CD containing documentation (data sheet, and user guides), Software API libraries, evaluation code and utilities.

1.2 Evaluation Board Features

The 73S1217F Evaluation Board (see Figure 1) includes the following:

- USB 2.0 full speed interface
- RS-232 interface
- Dual smart card interface
- ICE/Programmer interface
- 2 line x 16 character LCD module
- 6 x 5 keypad
- Real Time Clock (RTC) capability
- 1 LED

1.3 Recommended Equipment and Test Tools

The following equipment and tools (not provided) are recommended for use with the 73S1217F Evaluation Kit:

- For functional evaluation: PC with Microsoft® Windows® XP or Vista®, or a workstation with Linux®, equipped with a USB and or serial (RS-232) port.
- 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 Basic Setup

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

The power supply can come from three sources:

- A regulated lab power supply connected to the banana plugs J2, J3 and J5.
- Any AC-DC converter block, able to generate a DC power supply of 2.7 V min / 6.5 V max / 400 mA.
- The +5 V coming from the USB bus when connected to a computer or hub, able to support USB-powered devices. In this case the ON/OFF switch, S33, has no effect and power is always on. When the board is powered from the USB bus, the application is bus-powered and the embedded application must be designed for this.

The communication with an external host can be accommodated by either:

- A standard USB2.0 full speed interface or
- A standard RS-232 serial interface (TX/RX only).

The board is loaded by default with the USB CCID application. Refer to Section 3 for information on setting up and running this application.

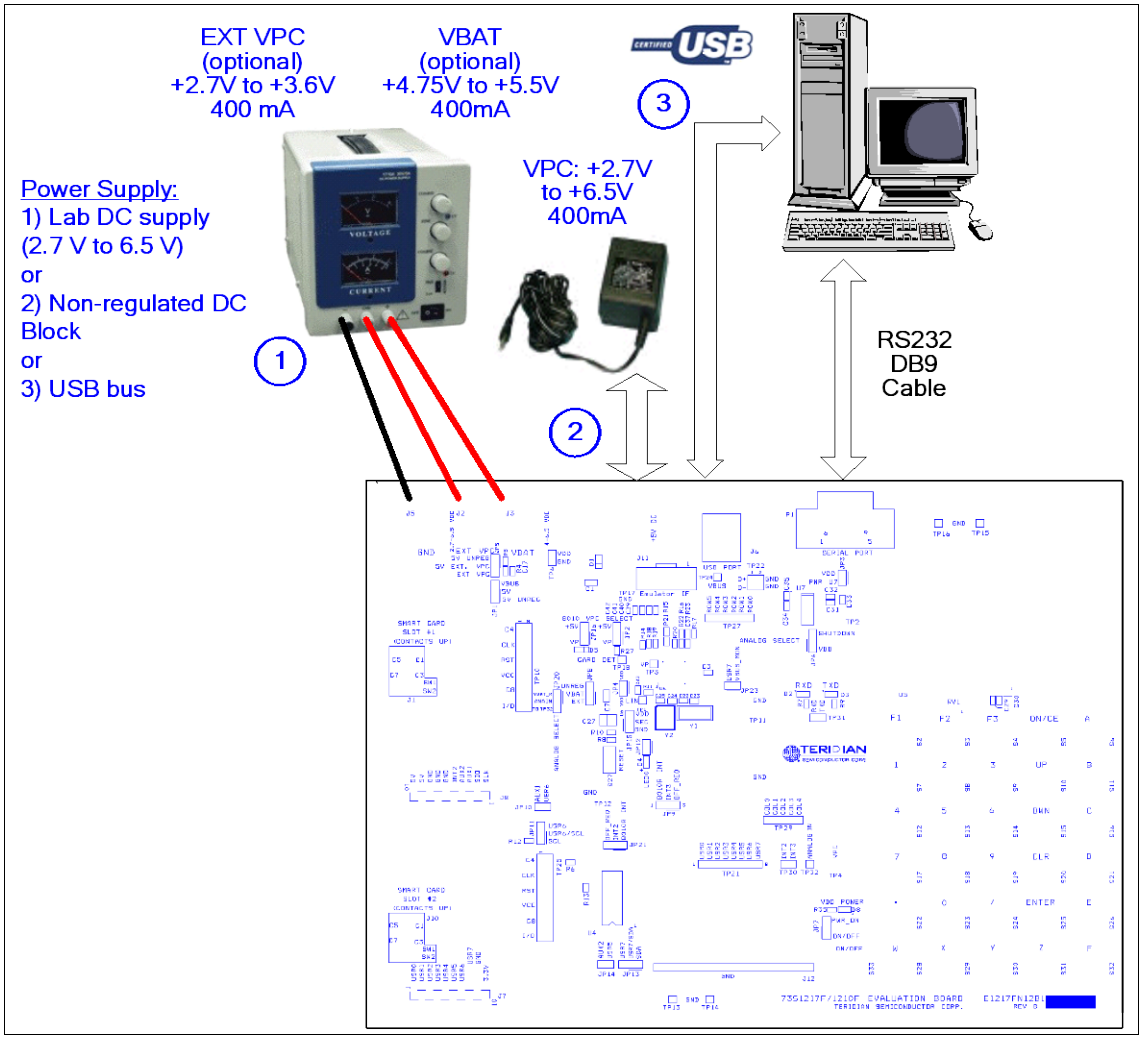


Figure 2: 73S1217F Evaluation Board Basic Connections

2.1 Connecting the Evaluation Board with an Emulation Tool

The 73S1217F 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.

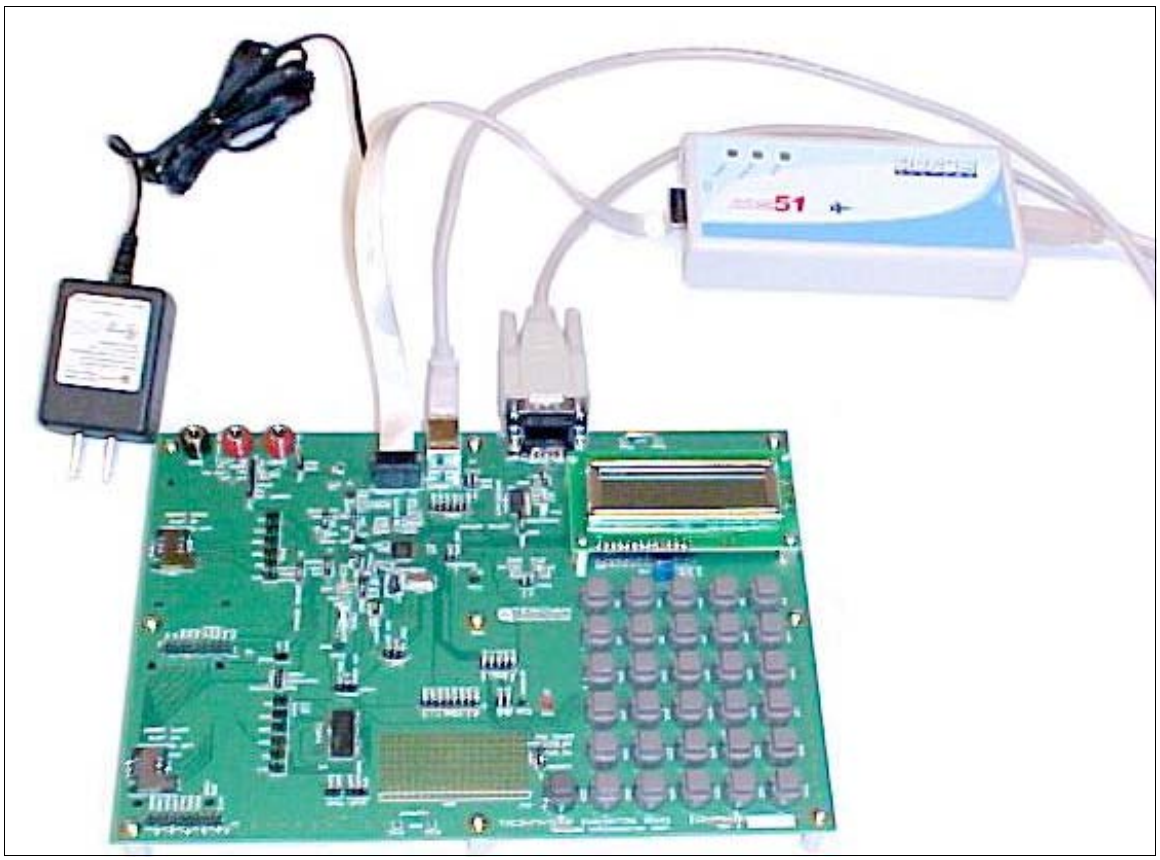


Figure 3: 73S1217F Evaluation Board Basic Connections with ADM-51 ICE

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 73S1217F.

Table 1: Flash Programming Interface Signals

Signal	Direction	Function
E_TCLK	Output from 73S1217F	Data clock
E_RXTX	Bi-directional	Data input/output
E_RST[1]	Bi-directional	Flash Downloader Reset (active low)
[1] 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.		

The signals in Table 1, 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 73S1217F 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, a 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 73S1217F 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*.

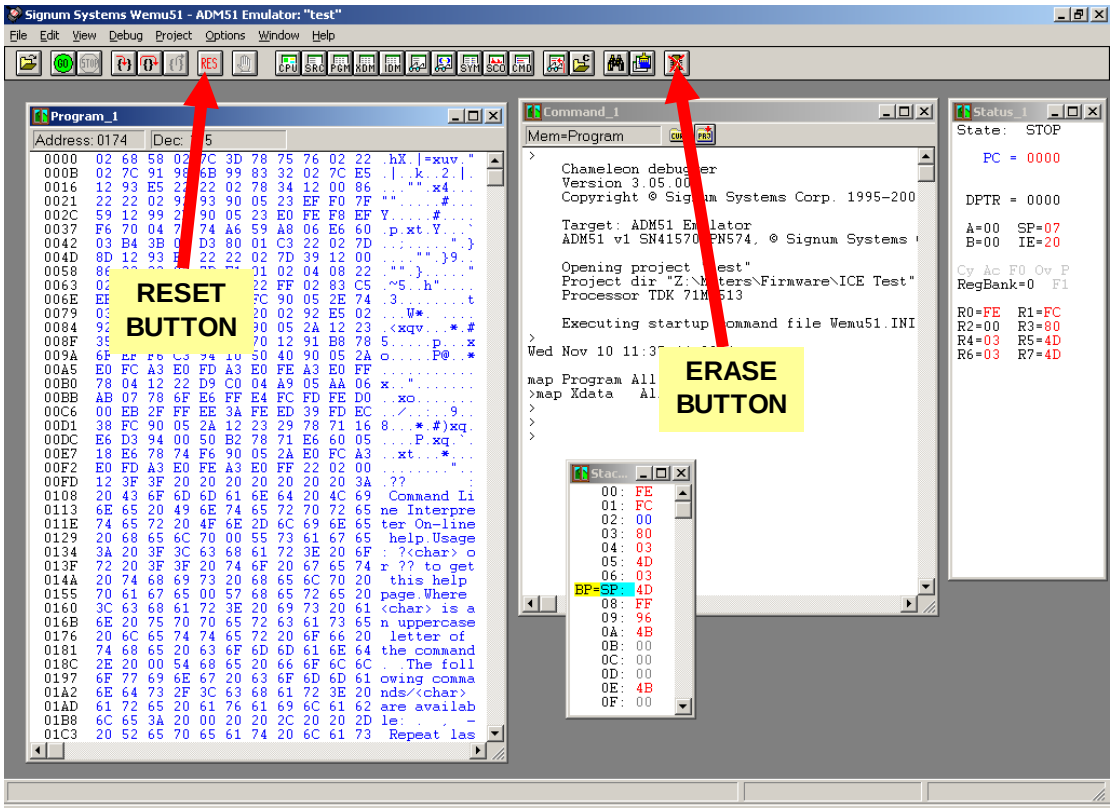


Figure 4: Emulator Window Showing RESET and ERASE Buttons

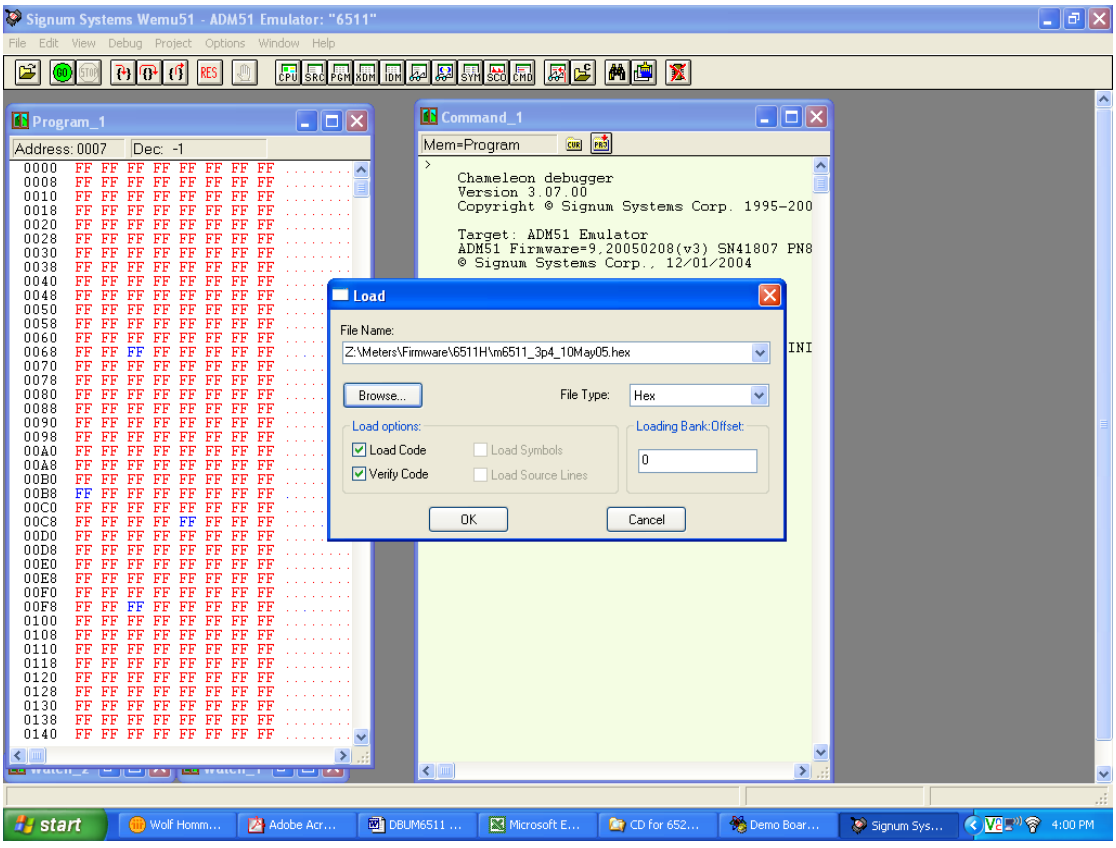


Figure 5: Emulator Window Showing Erased Flash Memory and File Load Menu

3 Using the USB CCID Application

The USB CCID firmware is pre-installed on the 73S1217F Evaluation Board. To operate correctly, it requires a PC with the appropriate driver to be connected through its USB port. When powered-up, the board is able to run the CCID-USB 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 Driver and Host Demonstration Software Installation

Installation on Windows XP

Two drivers are available for use with Windows XP:

- The standard Microsoft Windows XP driver and
- The Teridian provided driver that adds additional features beyond the capabilities of the Microsoft driver.

See the *73S1215F, 73S1217F CCID Application Note* for further details on the differences between the two drivers.

When using the 73S1217F transparent reader – dual slot with keypad and LCD evaluation board, the Microsoft provided driver should not be used as this driver does not support the second slot nor the LCD display and keypad.

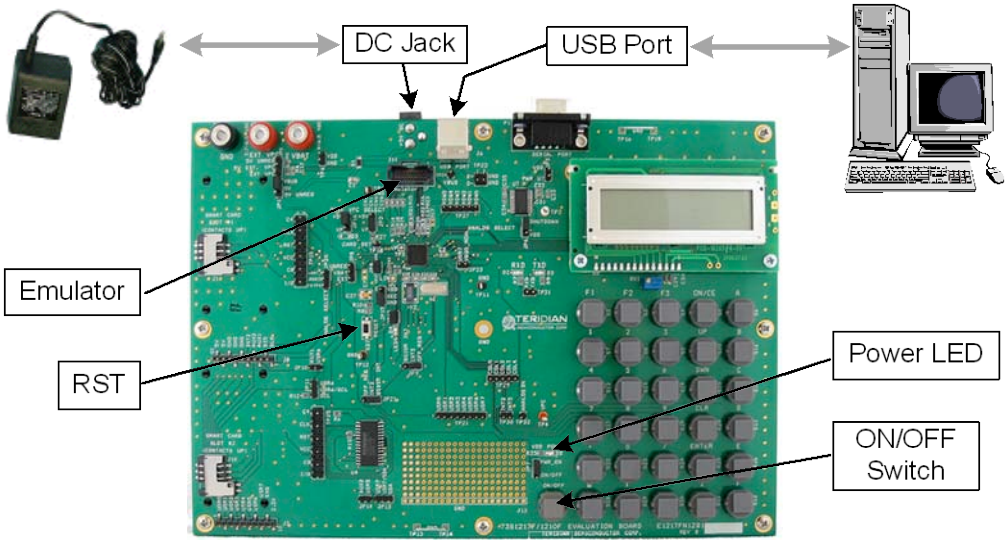
The Microsoft CCID driver included in the CD is used by Teridian for testing. Check with Microsoft for the latest driver upgrades.

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

- Extract “12xxF CCID+DFU V***y.yy*** Release.zip” (where ***y.yy*** is the latest version of the firmware release).
  - Create an install directory. For example: “C:\TSC\”.
  - Unzip “12xxF CCID+DFU V***y.yy*** 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.
- Connect the USB cable between the host system and the 73S1217F Evaluation Board. The power LED light should now come on.
- The host system should recognize the board and start the Add New Hardware Installation Wizard. When the wizard prompts, select the Teridian driver file.
  - To use the Teridian supplied driver, select the ccidtsc-xp.inf file located in the “C:\TSC\12xxF CCID+DFU V***y.yy*** Release\USB-CCID Firmware\CCID USB\CCID+DFU USB Drivers\XP 32 - CCID” subdirectory. The ccistsc-xp.inf and ccidtsc-xp.sys files must be in the same directory on the host.
- Follow the prompts until the process is completed.
- Run “CCID-DFU_USB_v***y.yy***.exe” (located in the path - C:\TSC\12xxF CCID+DFU C:\TSC\12xxF CCID+DFU V2.00 Release\Host Applications\Windows App\Bin\Release Release\Host Applications\Windows App\Bin\Release) on the host system to execute the host demonstration application.

At this point the application window should appear. For additional information regarding the use of the Teridian Host application, refer to the *73S12xxF USB-CCID Host GUI Users Guide* (UG_12xxF_037).

To use the Windows standard driver, select the usbccid.inf file located in the "CCID USB XPDriver" subdirectory. The uscccid.inf and usbccid.sys files must be in the same directory on the host.



3.1.1 Driver and Software Installation on a Linux System

Teridian has tested the 73S1217F Evaluation Board with Linux CCID driver v1.3.2 and PCSC-Lite v.1.4.4 (middleware) on two distributions of Linux: Slackware® 6 with kernel 2.4.16, and Fedora® 7 with kernel 2.6.23. Refer to the *73S1215F, 73S1217F CCID USB Linux Driver Installation Guide* (UG_12xxF_041) for details on installation and usage on a Linux system.

3.2 Frequently Asked Questions

Windows

Q The PC/SC application starts but it shows a "No Reader Found" message.

A: Follow these steps to make sure:

1. The board has powered up properly (USB is securely connected and there is power applied to the board).
2. Control Panel – System – Hardware – Device Manager – Smart Card Readers shows: "Teridian Semiconductors USB CCID Smart Card Reader..." And there is no yellow "!" or red "X".
3. Smart Card Service has started by going to 'Control Panel – Administrative Tools – Services – Smart Card'. Look under the "status" column and if it shows "stopped", hit the restart or start button to start it.
4. If all of the above look ok, hit the refresh button on the CCIDUSB.exe application.

Q: There is a yellow "!" on the Teridian driver shown on the Device Manager menu.

A: This usually means the driver did not complete the driver enumeration process. Push the reset button on the evaluation board a few times. If the board is connected to the host via a USB HUB, remove the HUB and try connecting the board directly to the PC USB port to make sure the driver and the board can enumerate with the USB host. If the problem persists, check the driver on the PC to make sure it is at least version 6.0.0.2. Contact your Teridian Sales Representative for the latest version of the driver. Sometimes, rebooting the PC Host to clear up any previous USB problem will help.

Q: There is a red "X" on the Teridian driver shown on the Device Manager menu.

A: This usually means the smart card driver has been disabled. Highlight and right click on the driver to re-enable.

Q: The Teridian Smart Reader is nowhere to be found on the Device Manager menu and there is an "unknown USB device" found where the Teridian evaluation board should be.
A: This usually means the demo board is properly powered up but there is no enumeration taking place. If the board is connected to a USB HUB, remove the HUB and connect the board directly to the PC USB port. Or move it to a different USB port on the system. If the problem persists and it is absolutely sure that the evaluation board is properly powered up, it is possible that there is no firmware in the part. Contact a Sales Representative for reprogramming of Flash.

Q: The Teridian driver is loaded. What to do to replace it with the Microsoft Generic USB CCID driver?
A: Right click on the Teridian Driver in the Device Manager Menu, select "Update Driver..". Select "No, Not this time" on the next menu, "Install from a list or specific location", "Don't Search, I will choose the driver to install". If the next menu does not show the Microsoft Generic USB CCID driver, select "Have Disk" and browse to where the driver file resides (usually in the "CCID USB XPDriver" folder) and select the file. Follow through with the installation wizard.

Linux

Q: How can I see debug messages from PCSC-Lite when I run pcscd from the command line?
A: Before invoking pcscd, open the file /usr/local/pcsc/drivers/ifd-ccid.bundle/Contents/Info.plist in an editor, and set ifdLogLevel to 7. Save the change. Then run the command "pcscd –f –d" in a console. Now pcscd runs in foreground and should display many messages in the console. These messages show information about the smart card readers that have been detected, and whether or not a smart card is present in the reader. Also shown in the messages are the data exchanges between the host (Linux) and the smart card reader. The most important messages are the error messages that pcscd displays when a critical error has occurred. If fewer messages are desired, set IfdLogLevel to 3 or 1.

Q: When I run command "pcscd –f –d", I get an error message that says "file /var/run/pcscd.pub already exists. Another pcscd seems to be running".
A: Only one instance of pcscd (PCSC-Lite Daemon) should be running at any time. If you receive this error message when invoking the pcscd program, pcscd is probably running already. If your intention is to restart pcscd, first terminate the pcscd that is currently running. Run the command "ps aux | grep pcscd" to obtain the PID (Process ID) of the currently running pcscd. For example, you may see output similar to the following:

```
[root@localhost ~]# ps aux | grep pcscd
root 3380  0.1  0.0    74588   1752    pts/2     Sl+       16:06    0:02 pcscd –f –d
[root@localhost ~]#
```

The PID of the currently running pcscd in this case is 3380. Next run the command "kill 3380" to stop pcscd. Now start pcscd again by entering the command "pcscd –f –d".

Q: When I start the program pcsc_scan, I receive an error message saying "PCSC Not Running".
A: The pcsc_scan program requires the services provided by pcscd. Hence the PCSC-Lite daemon pcscd should be already running before pcsc_scan can start. Run pcscd first, and then invoke pcsc_scan.

4 Evaluation Board Hardware Description

4.1 Jumpers, Switches and Modules

Table 2 describes the 73S1217F Evaluation Board jumpers, switches and modules. The Item # in Table 2 references Figure 11.

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	Must be used to connect an external power supply. These inputs are intended to allow control of the input supply voltage of the board. JP5 must be in position "EXT VPC" when using VPC and JP8 must be in position "EXT" when using the VBAT power supply inputs.
				 The evaluation board is sensitive to the polarity: One red plug is +2.7/6.5 V for external VPC and the other red plug is +4.0/6.5 V for VBAT. The black plug is ground.
2	JP2	VP	73S8010R VPC select	Selects VPC power supply source for the 73S8010R device between VP on the 73S1217F and +5 V from JP1 pin 2.
3	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.
4	PJ1	No 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). Power supply features are: Voltage: 2.7 V min / 6.5 V Max Current: 400 mA
5	J6	Connect	USB connector	Standard USB socket. Requires a standard USB 1.1 or 2.0 device cable to connect to a computer.
6	JP23	Inserted	USB interrupt jumper	Jumper allows the VBUS (after level conversion) to connect to USR7 (configured for interrupt). Remove this jumper if not needed and USR7 can be used for another purpose.
7	JP6	Shutdown	RS-232 Xcvr enable jumper	Selects between VDD (always enabled) and a test point (with pull down) to allow the RS232 transceiver chip to be shut down.
8	P1	No Connect	DB9 RS232 female socket	This socket allows connection of an RS232 cable to a computer. Use a crossed wired (RX/TX) cable. The evaluation board has an on-board level shifter (U7) to allow direct connection to a computer. Connection to an RS232 link is required when using the pre-downloaded USB CCID application.

Item #	Schematic and Silkscreen Reference	Default setting	Name	Use
9	JP3	Not Inserted	RS-232 Xcvr power	Power supply jumper for the RS232 transceiver chip. Can be removed to obtain accurate power measurements.
10	D2, D3		LEDs: Serial link activity	These LEDs (D2, D3) reflect the activity on the serial link (RS232 or serial). D2 reflects the activity on the RX line (Data going TO the 73S1217F) D3 reflects the activity on the TX line (Data coming FROM the 73S1217F)
11	U5		LCD Module	On-board LCD module: • 2 lines of 16 characters, each character dot matrix is 5x7. • Includes an embedded Hitachi HD44780 LCD driver, controlled from the on-board 73S1217F USR interface.
12	RV1		Adjustable resistor to adjust LCD brightness	Can be used to adjust the brightness of the on-board LCD module.
13	S2 to S26, S27 to S32		On-board keypad	5x6 keyboard directly connected to the on-board 73S1217F IC (68-pin only). 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 Teridian when requesting support.
15	D8		VDD power indicator	Indicates when the 73S1217F is turned on (VDD = 3.3 V).
16	S33		ON/OFF switch	Switch used to turn on and off the 73S1217F. The switch is overridden when VBUS is applied (VDD is always on). When VDD is on and the switch is pressed, the 73S1217F will activate the OFF_REQ signal and the 73S1217F must set the SCPWRDN or PWRDN bits to shutoff VDD.
17	JP7	ON/OFF	Power ON/OFF select jumper	This jumper will select between the ON/OFF switch and ground. When the switch is selected, the VDD power will toggle between on and off (see item #16). When ground is selected, the VDD will turn on automatically upon application of VPC to the 73S1217F.
18	–		Breadboard area	This breadboard area allows engineers to add their own circuitry / connection of peripherals when prototyping and developing a 73S1217F based application. User I/Os, GPIOs, interrupt pins and power supply pins are located close to this area to allow easy connection.
19	JP9	OFF_REQ	INT3 select	Selects the source for INT3 between the 73S8010R and the OFF_REQ pin on the 73S1217F. Should be set opposite of JP21.

Item #	Schematic and Silkscreen Reference	Default setting	Name	Use
20	JP21	8010R INT	INT2 select	Selects the source for INT2 between the 73S8010R and the OFF_REQ pin on the 73S1217F. Should be set opposite of JP9.
21	JP13	Not Inserted	Jumper: USR7/SDA select	This jumper selects which signal is connected to the daughter board connector pin USR7: • In position "USR7", the 73S1217F USR7 signal is connected to the daughter card pin USR7. • 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.
22	JP14	Not Inserted	Jumper: USR7/SDA select	This jumper allows the on board 73S8010R AUX2 pin to be connected to USR5 if needed. If not needed, the jumper should be removed.
23	U4		On board 73S8010R	The board contains a built-in 73S8010R that is connected to the external smart card interface of the 73S1217F. This device can be disconnected from the 73S1217F if not used, by removing jumpers JP12 and JP21.
24	J7,J8		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 73S1217F external smart card interface (lines SCIO and SCK), in conjunction with the USR(0:7) port and the INT2 interrupt input of the 73S1217F). Refer to the electrical schematic for pin assignment.
25	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 73S1217F external card interface # 2. Note that J10 is wired is parallel to the smart card connector J9 (underneath the PCB). Both connectors cannot be populated at the same time.
26	JP11	Not Inserted	Jumper: USR6/SCL select	This jumper selects which signal is connected to the daughter board connector pin USR6: • In position "USR6", the 73S1217F USR6 signal is connected to the daughter card pin USR6. • 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.
27	JP10	Not Inserted	Jumper: USR6/AUX1 select	This jumper allows the on board 73S8010R AUX1 pin to be connected to USR6 if needed. If not needed the jumper should be removed.

Item #	Schematic and Silkscreen Reference	Default setting	Name	Use
28	S27		Reset button	Evaluation board main reset: Asserts a hardware reset to the on-board 73S1217F IC.
29	JP12	Inserted	LED0 jumper	In normal use, a jumper must be inserted in this header to connect the LEDs to the LED pins of the 73S1217F. This jumper can be replaced by a µA / mA-meter to measure the actual current drawn by the LED output of the 73S1217F.
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 *73S1217F Data Sheet* for further information about the security fuse.
31	JP20	Not Inserted	Analog select	Selects the analog input between TP32 and the VBAT input voltage (via resistor divider).
32	JP8	Not Inserted	VBAT select	Selects the VBAT input between an external supply on J3 or the unregulated 5 V on PJ1.
33	J1, J4		SIM / SAM and Smart Card connectors – internal interface (#1)	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 73S1217F built-in card interface # 1. J1 is wired in parallel to the smart card connector J4 (underneath the PCB). Both connectors cannot be used at the same time.
34	JP4	Inserted	VDD jumper	The VDD supply jumper can be replaced with a current meter to measure the power consumption on VDD.
35	JP1	VBUS	Jumper: 5V power supply selection	This jumper selects the 5.0 V power supply. It selects either the unregulated 5 V supply from PJ1 or the 5.0 V from the USB VBUS: • In position “5V UNREG”, the evaluation board 5.0 V is powered from the PJ1 connector. • In position “VBUS”, the evaluation board is powered from the USB VBUS.
36	JP5	Not Inserted	Jumper: VPC power supply selection	This jumper selects the VPC power supply. It selects either the power supply connected to plug J2 or the 5 V unregulated supply on the PJ1 connector. • In position “5V UNREG”, the evaluation board VPC is connected to 5 V coming in on PJ1. • In position “EXT VPC”, the evaluation board VPC is powered from the voltage applied on the plug J2.

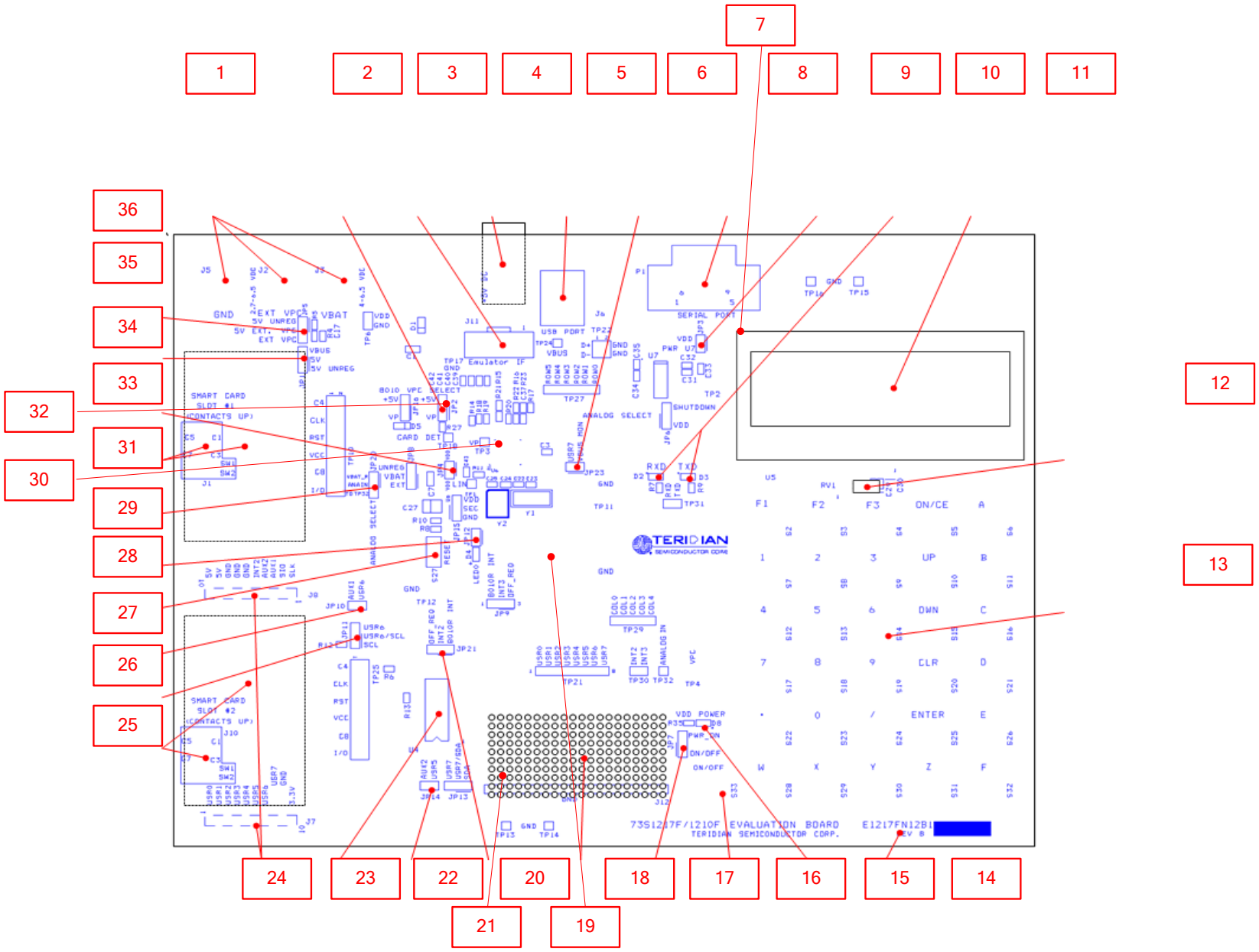


Figure 6: 73S1217F Evaluation Board Jumper, Switch and Module Locations

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 (see Section 5 73S1217F Evaluation Board Schematics, PCB Layouts and Bill of Materials).

Table 3: Evaluation Board Test Point Description

Test Point #	Name	Use
TP1	LIN	Test point to monitor Inductor operation.
TP2	Shutdown	Test point to control the enable input on the RX-232 transceiver chip.
TP4	VPC	Single-pin test point. VPC signal directly connected to the 73S1217F and its decoupling capacitors. Can be used to measure integrity of the power supply of the DC-DC converters of the 73S1217F.
TP6	VDD	2-pin test point, with one ground and one VDD signal directly connected to the 73S1217F and its decoupling capacitors. Can be used to measure the integrity of the digital power supply of the 73S1217F, or to add a decoupling capacitor.
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 9/8-bit user I/O port of the 73S1217F. Some of the user I/Os are shared by the extension 73S80xx daughter board when using an external smart card interface, and the LCD interface. Only one should be used at a time.
TP22	USB	TP22 has 4 pins, connected to the USB D+ and D- wires, as well as 2 grounds.
TP24	VBUS	+5 V USB bus. Can be used as a test point for USB voltage presence.
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.
TP27	ROW[0:5]	The row pins used for the keypad interface.
TP29	COL[0:4]	The column pins used for the keypad interface.
TP30	INT2 INT3	Interrupt input #2 and #3 of the 73S1217F. 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).

4.3 Schematic

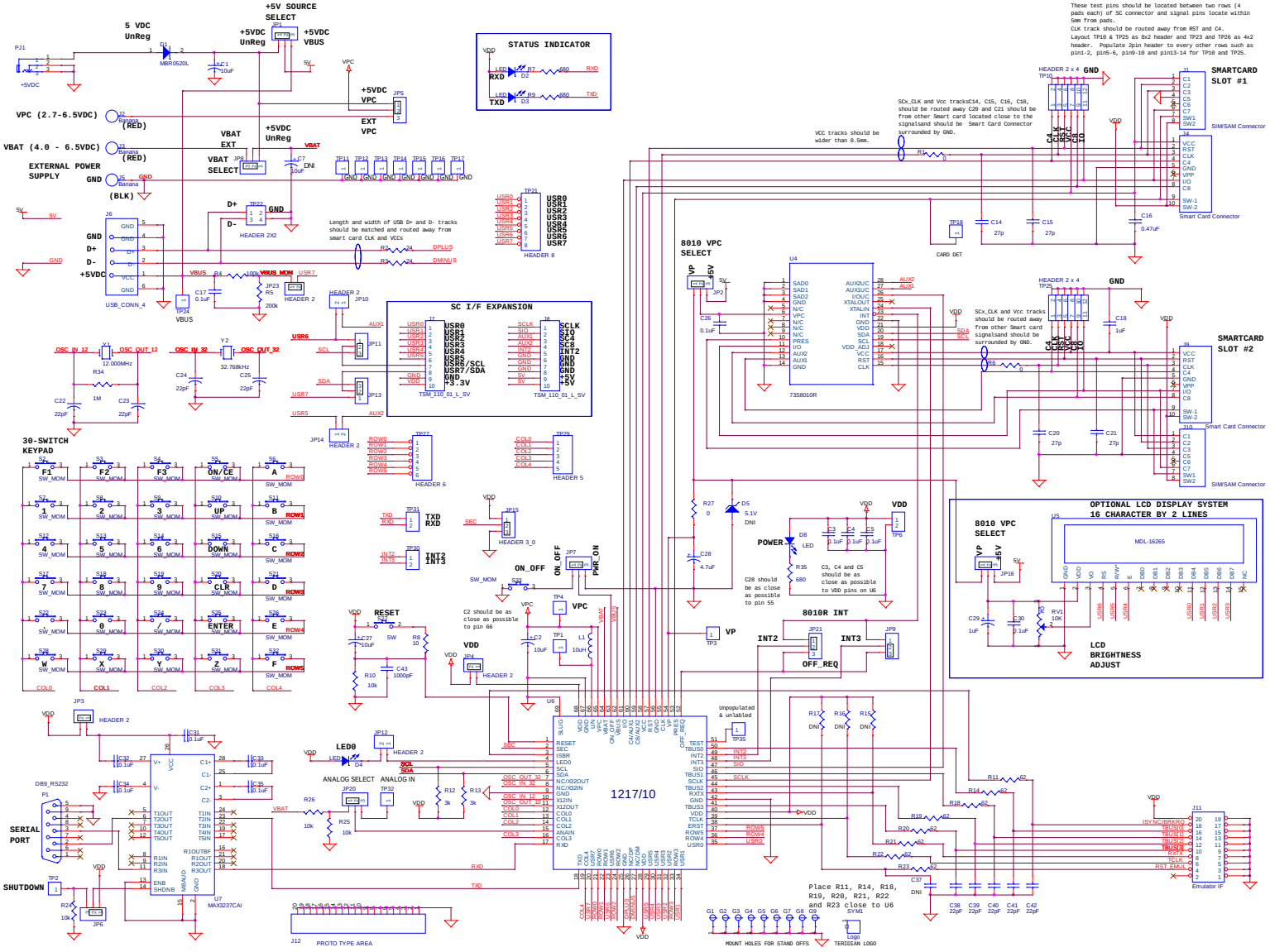


Figure 7: 73S1217F Evaluation Board Electrical Schematic

4.4 PCB Layouts

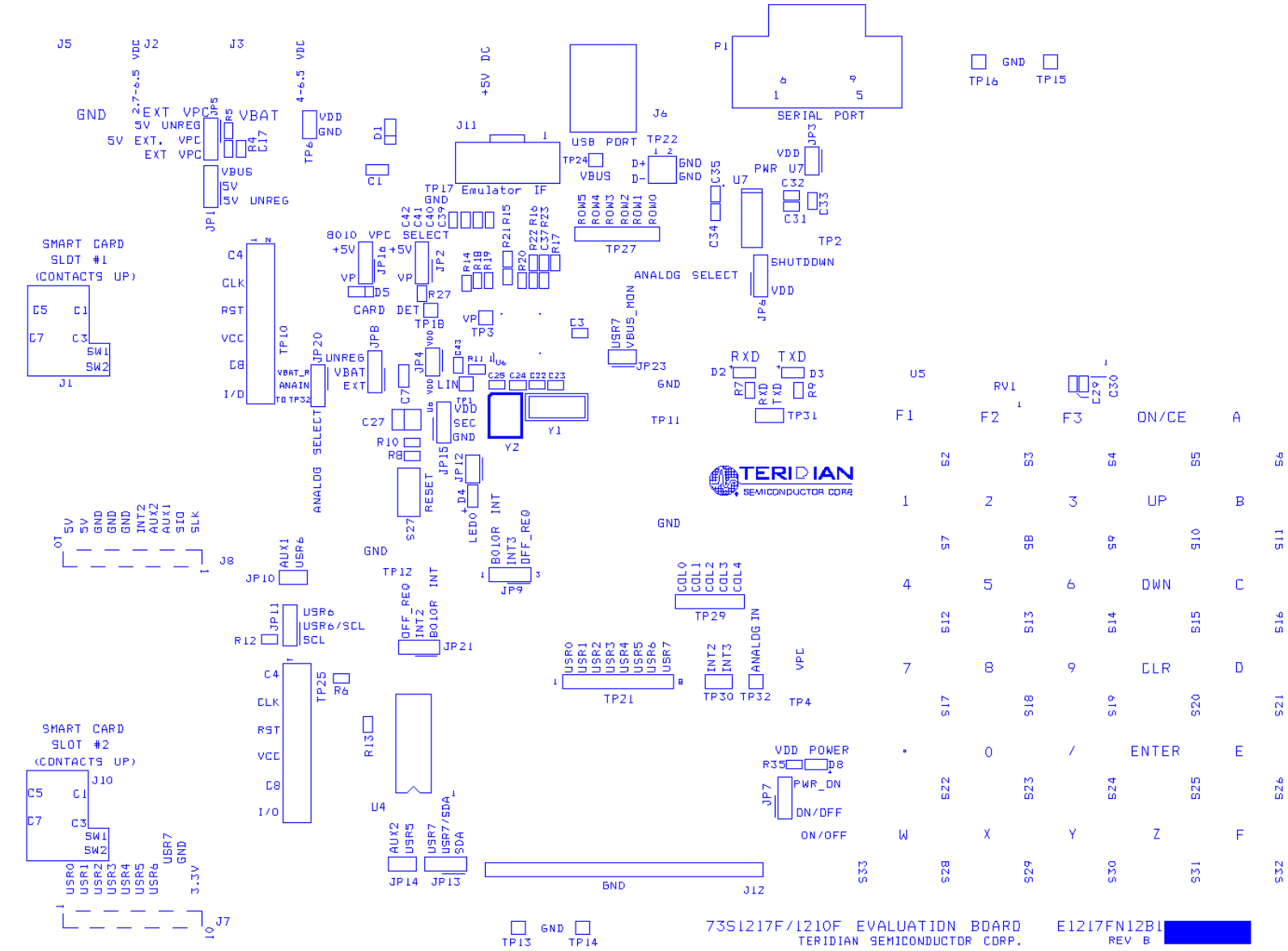


Figure 8: 73S1217F Evaluation Board Top View (Silkscreen)

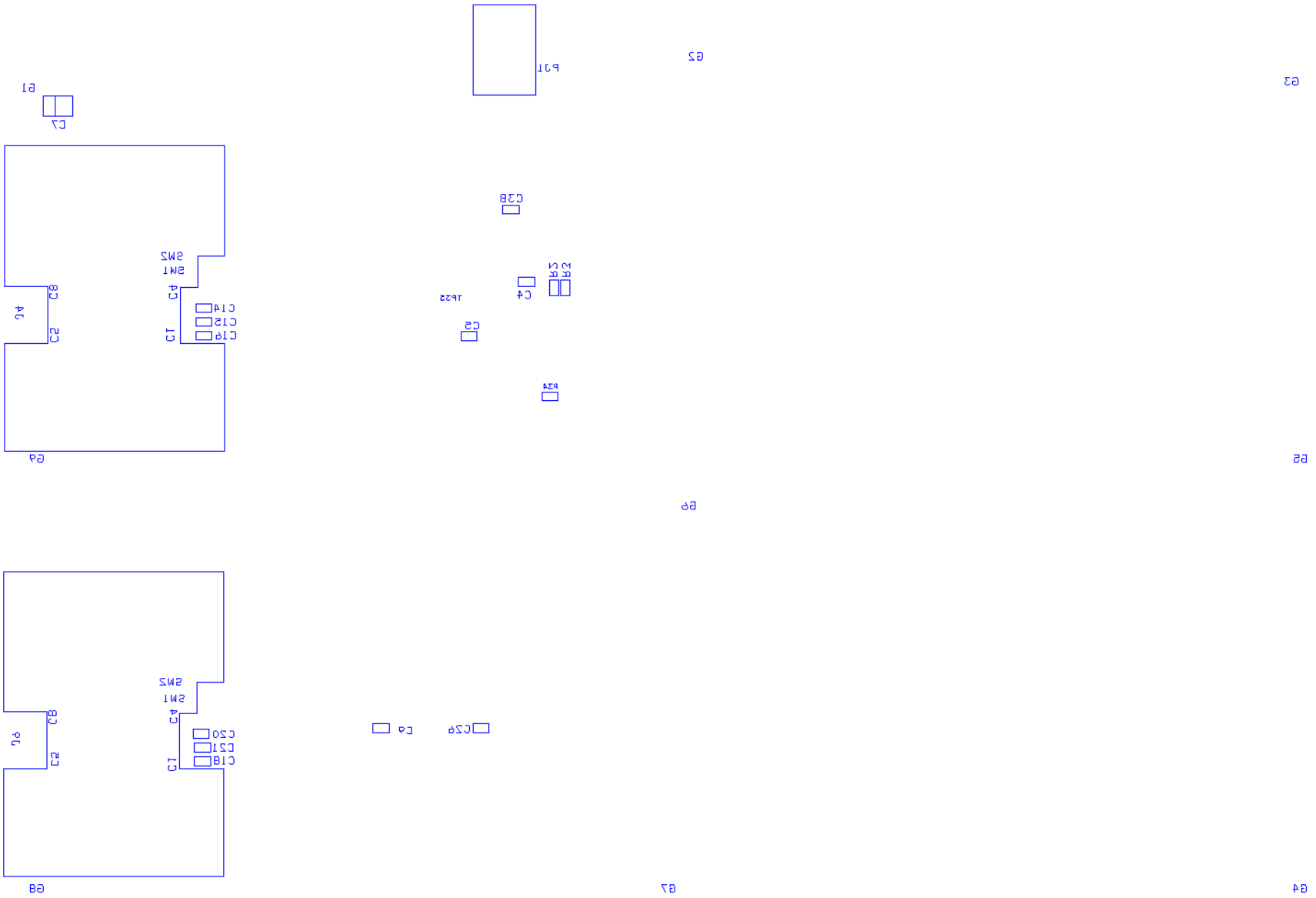


Figure 9: 73S1217F Evaluation Board Bottom View (Silkscreen)

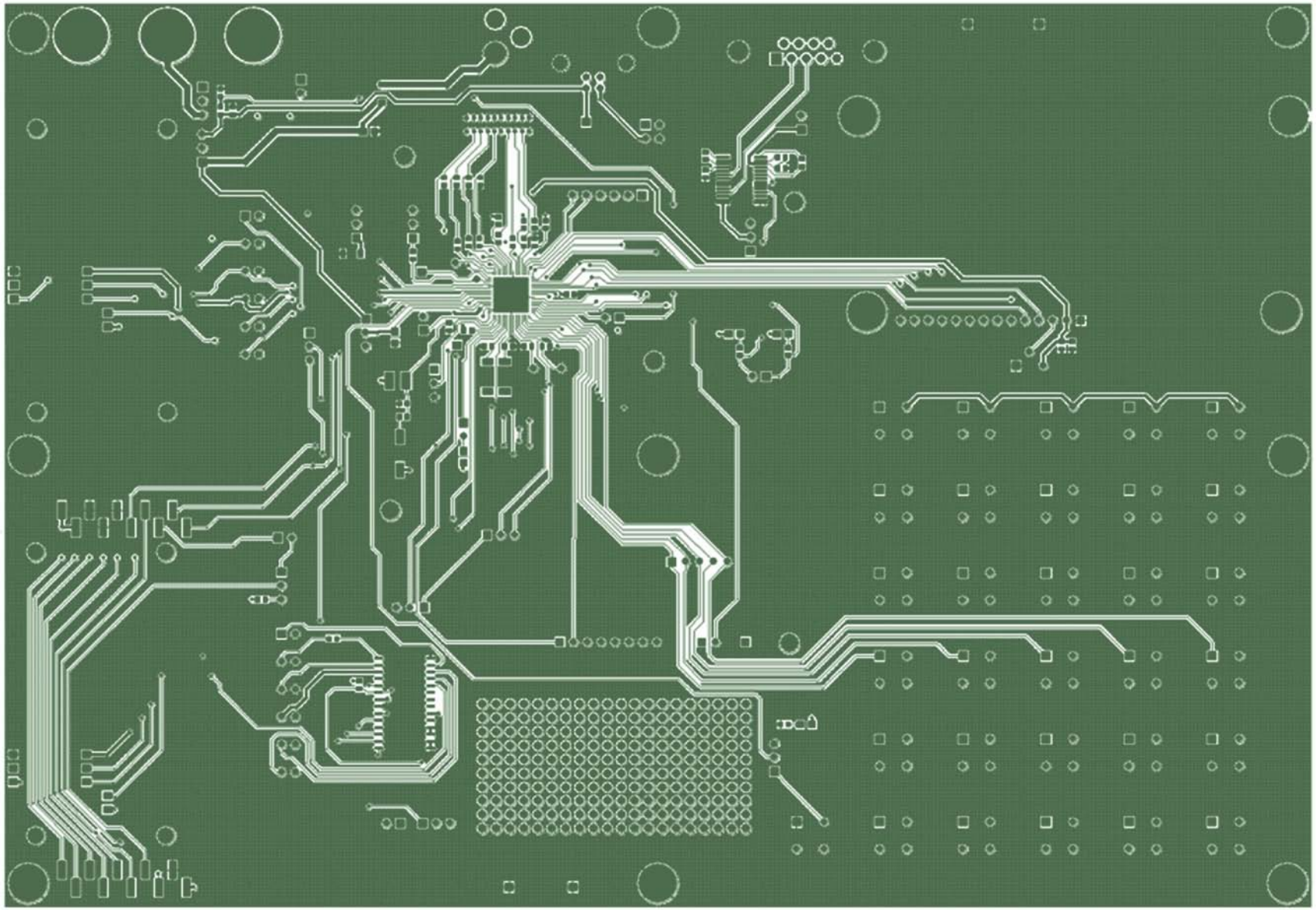


Figure 10: 73S1217F Evaluation Board Top Signal Layer

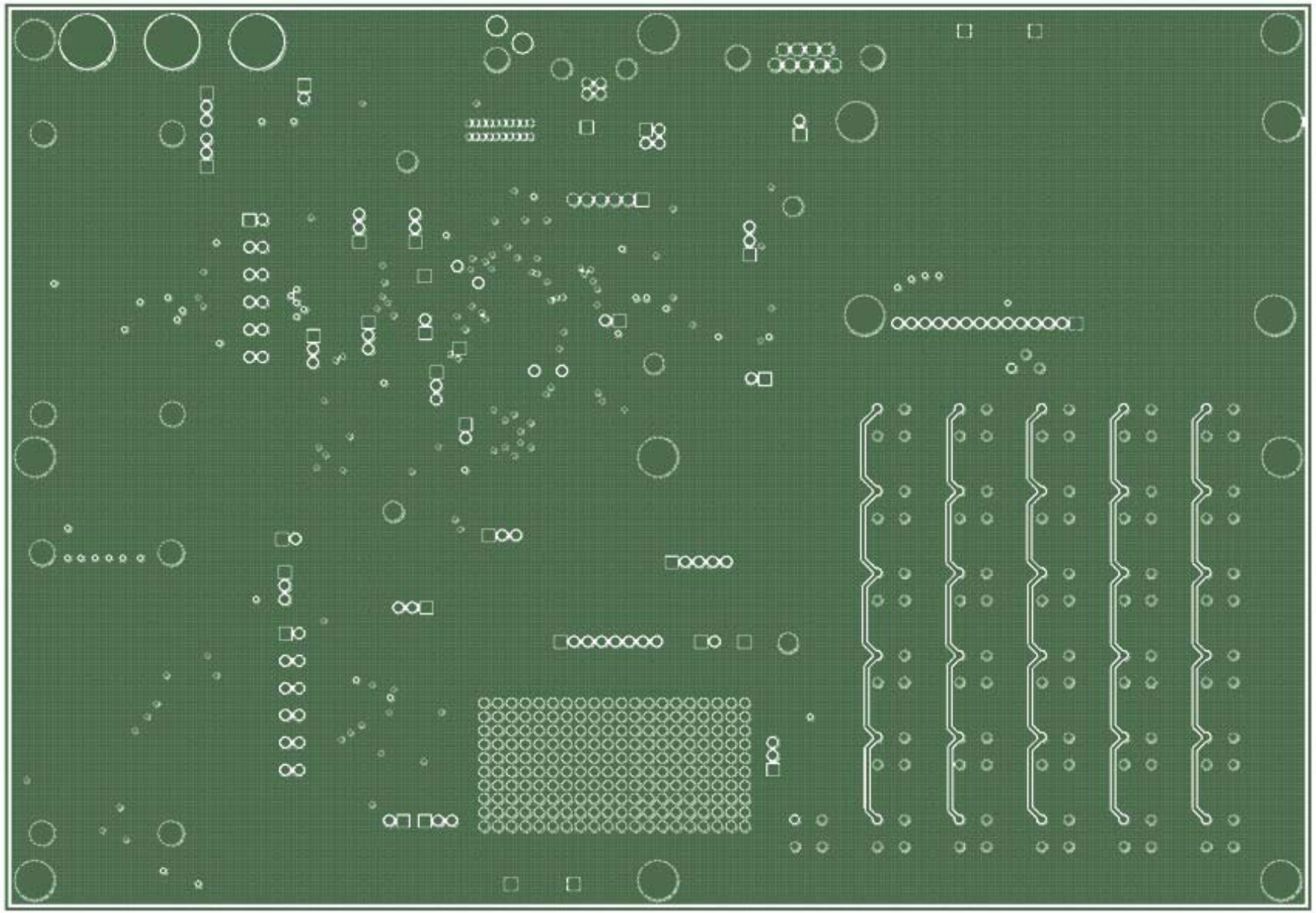


Figure 11: 73S1217F Evaluation Board Middle Layer 1 – Ground Plane

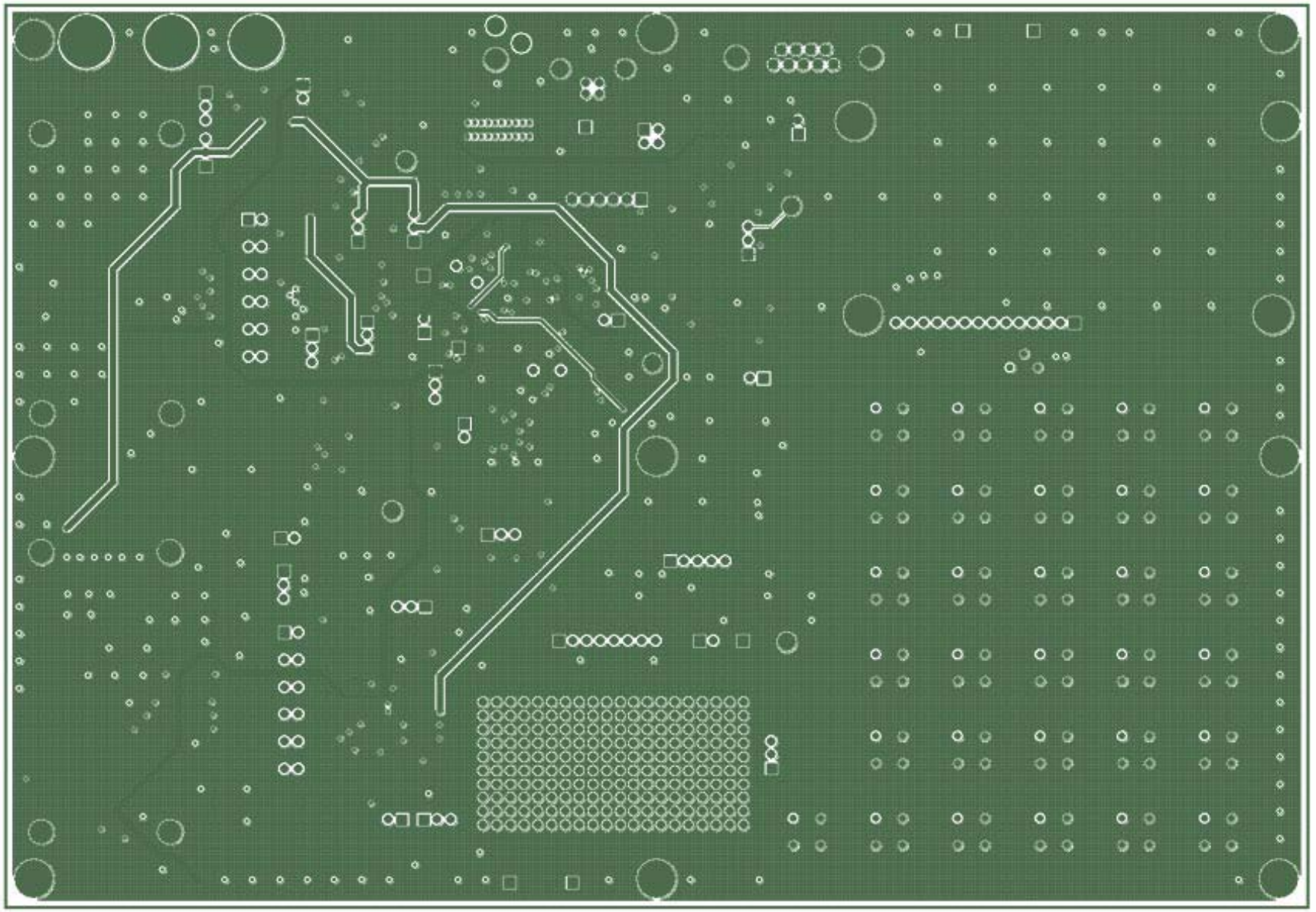


Figure 12: 73S1217F Evaluation Board Middle Layer 2 – Supply Plane

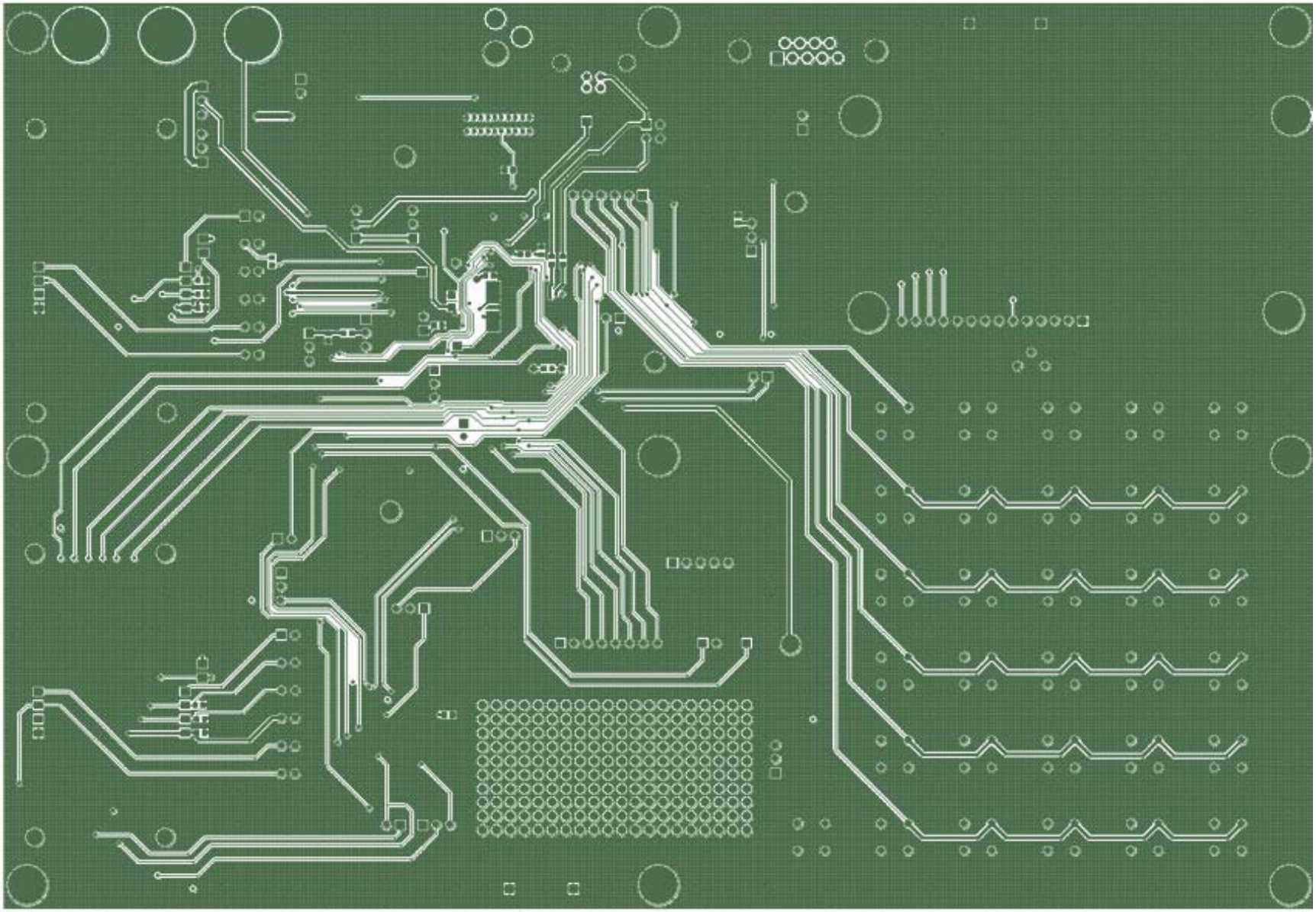


Figure 13: 73S1217F Evaluation Board Bottom Signal Layer

4.5 Bill of Materials

Table 4 provides the bill of materials for the 73S1217F Evaluation Board schematic provided in Figure 12.

Table 4: 73S1217F Evaluation Board Bill of Materials

Item	Qty.	Reference	Part	PCB Footprint	Digi-key Part Number	Part Number	Manufacturer
1	1	C27	10 µF	3528-21 (EIA)	478-1672-1-ND	TAJB106K010R	AVX Corporation
2	2	C1,C2	10 µF	0805	PCC2225CT-ND	ECJ-2FB0J106M	Panasonic
3	11	C3,C4,C5,C17,C26,C30, C31,C32,C33, C34,C35	0.1 µF	603	PCC1762CT-ND	ECJ-1VB1C104K	TDK Corporation
4	1	C28	4.7 µF	0603	PCC2396CT-ND	ECJ-1VB0J475K	Panasonic
5	1	C16	0.47 µF	0603	PCC2275CT-ND	ECJ-1VB1A474K	Panasonic
6	4	C14,C15,C20,C21	27 pF	603	PCC270ACVCT-ND	ECJ-1VC1H270J	Panasonic
7	2	C18,C29	1 µF	603	PCC2174CT-ND	C1608X5R1A105K	TDK Corporation
8	9	C22-C25, C38-42	22 pF	603	PCC220ACVCT-ND	ECJ-1VC1H220J	Panasonic
9	1	C43	1000 pF	603	PCC2151CT-ND	ECJ-1VC1H102J	Panasonic
10	1	D1	MBR0520L	SOD-123	MBR0520LCT-ND	MBR0520L	Fairchild
11	4	D2,D3,D4,D8	LED	805	160-1414-1-ND	LTST-C170FKT	LITE-ON INC
12	13	JP1,JP2,JP5,JP6,JP7, JP8,JP9,JP11,JP13, JP15, JP16, JP20, JP21	HEADER 3	1 x 3 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
13	6	JP3,JP4,JP10,JP12, JP14, JP23	HEADER 2	1 x 2 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
14	2	J1,J10	SIM/SAM Connector	ITT_CCM003_3754		CCM03-3754	C&K
15	2	J2,J3	Banana (red)	Banana		16BJ381	Mouser
16	1	J5	Banana (black)	Banana		16BJ382	Mouser
17	2	J4,J9	Smart Card Connector	ITT_CCM002-2504		CCM02-2504LFT	C&K
18	1	J6	USB_CONN_4	USB_AU_Y1007	ED90064-ND	897-43-004-90-000000	Mill-Max
19	2	J8,J7	TSM_110_01_L_SV	TSM_110_01_L_SV		TSM_110_01_L_SV	Samtec
20	1	J11	Emulator IF	10 X 2 pin	A3210-ND	104068-1	AMP/Tyco Electronics
21	1	L1	10 µH	1210	490-4059-1-ND	LQH32CN100K53L	Murata

Item	Qty.	Reference	Part	PCB Footprint	Digi-key Part Number	Part Number	Manufacturer
22	1	PJ1	+5 VDC	RAPC712	SC1152-ND	RAPC712	Switchcraft
23	1	P1	DB9_RS232	AMP_745781	A2100-ND	745781-4	AMP/Tyco Electronics
24	1	RV1	10 kΩ	3266W	3266W-103-ND	3266W-1-103	Bourns
25	2	R1,R6,R27	0 Ω	603	P0.0GCT-ND	ERJ-3GEY0R00V	Panasonic
26	2	R2,R3	24 Ω	603	P24GCT-ND	ERJ-3GEYJ240V	Panasonic
27	1	R4	100 kΩ	603	P100KGCT-ND	ERJ-3GEYJ104V	Panasonic
28	1	R5	200 kΩ	603	P200KGCT-ND	ERJ-3GEYJ204V	Panasonic
29	3	R7,R9,R35	680 Ω	603	P680GCT-ND	ERJ-3GEYJ681V	Panasonic
30	1	R8	10 Ω	603	P10GCT-ND	ERJ-3GEYJ100V	Panasonic
31	4	R10, R24, R25, R26	10 kΩ	603	P10KGCT-ND	ERJ-3GEYJ103V	Panasonic
32	8	R11,R14,R18,R19,R20, R21, R22,R23	62 Ω	603	P62GCT-ND	ERJ-3GEYJ620V	Panasonic
33	2	R12,R13	3 kΩ	603	P3.0KGCT-ND	ERJ-3GEYJ302V	Panasonic
34	1	R34	1 MΩ	603	P1.0MGCT-ND	ERJ-3GEYJ106V	Panasonic
35	31	S2,S3,S4,S5,S6,S7,S8, S9,S10,S11,S12,S13,S14, S15,S16,S17,S18,S19, S20,S21,S22,S23,S24, S25,S26,S28,S29,S30, S31,S32,S33	SW_MOM	Pushbutton SW	401-1885-ND	D6 C 10LFS	ITT Industries
36	1	S27	SW	Panasonic EVQ	P8051SCT	EVQ-PJX05M	Panasonic
37	3	TP18, TP24, TP32	TP	1 pin	S1011-36-ND	PZC36SAAN	Sullins Electronics
38	2	TP2, TP18	TP	1 Pin White	5012K-ND	5012	Keystone Electronics
39	1	TP4	TP	1 pin Red	5010K-ND	5010	Keystone Electronics
40	3	TP11,TP12,TP17	TP	1 pin Black	5011K-ND	5011	Keystone Electronics
41	3	TP6,TP30,TP31	TP2	1 x 2 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
42	2	TP10,TP25	HEADER 2 x 6	6 x 2 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
43	1	TP21	HEADER 8	1 x 8 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
44	1	TP22	HEADER 2X2	2 x 2 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics

Item	Qty.	Reference	Part	PCB Footprint	Digi-key Part Number	Part Number	Manufacturer
45	1	TP27	HEADER 6	6 x 1 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
46	1	TP29	HEADER 5	5 x 1 pin	S1011E-36-ND	PBC36SAAN	Sullins Electronics
47	1	U4	73S8010R		73S8010R		Teridian Semiconductor
48	1	U5	MDL-16265		153-1078-ND	MDL-16265-SS-LV	Varitronix
49	1	U6	73S1217F	68 QFN		73S1217F	Teridian Semiconductor
50	1	U7	MAX3237CAI		MAX3237CAI-ND	MAX3237CAI	Maxim
51	1	Y1	12.000 MHz		X1116-ND	ECS-120-20-4XDN	ECS
52	1	Y2	32.768 kHz		XC1195CT-ND	ECS-.327-12.5-17X-TR	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 software library APIs.

4.6.1 Reset Circuit

The 73S1217F 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 6. R8 should be around 10 Ω. The capacitor C27 should be 10 µF. R8 and C27 should be mounted as close as possible to the IC.

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

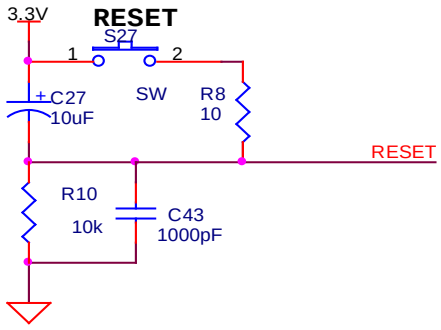


Figure 14: External Components for RESET

4.6.2 Oscillators

The 73S1217F offers two oscillators (see Figure 7); one for the primary system clock and the other for an RTC (32 kHz). The system clock should use a 12 MHz crystal to provide the proper system clock rates for the USB, serial and smart card interfaces. The system oscillator requires a 1 MΩ parallel resistor to insure proper oscillator startup.

The RTC oscillator drives a standard 32.768 kHz watch crystal. Crystals of this type are accurate and do not require a high current oscillator circuit. The oscillator in the 73S1217F has been designed specifically to handle watch crystals and is compatible with their high impedance and limited power handling capability.

The 32 kHz oscillator does not require a parallel startup resistor.

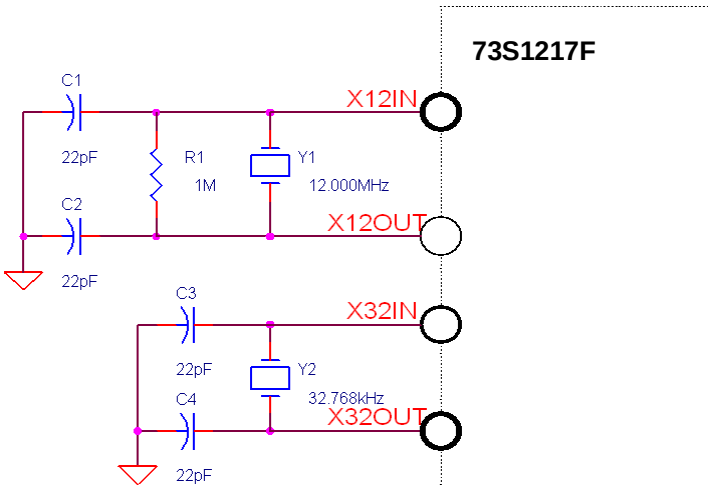


Figure 15: Oscillator Circuit

4.6.3 LCD

The 73S1217F does not contain an on-chip LCD controller. However, an LCD module (with built-in controller) can be used with the 73S1217F via use of specific USR (GPIO) pins. The LCD API libraries support up to a 2 line/16 character display. Figure 8 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.

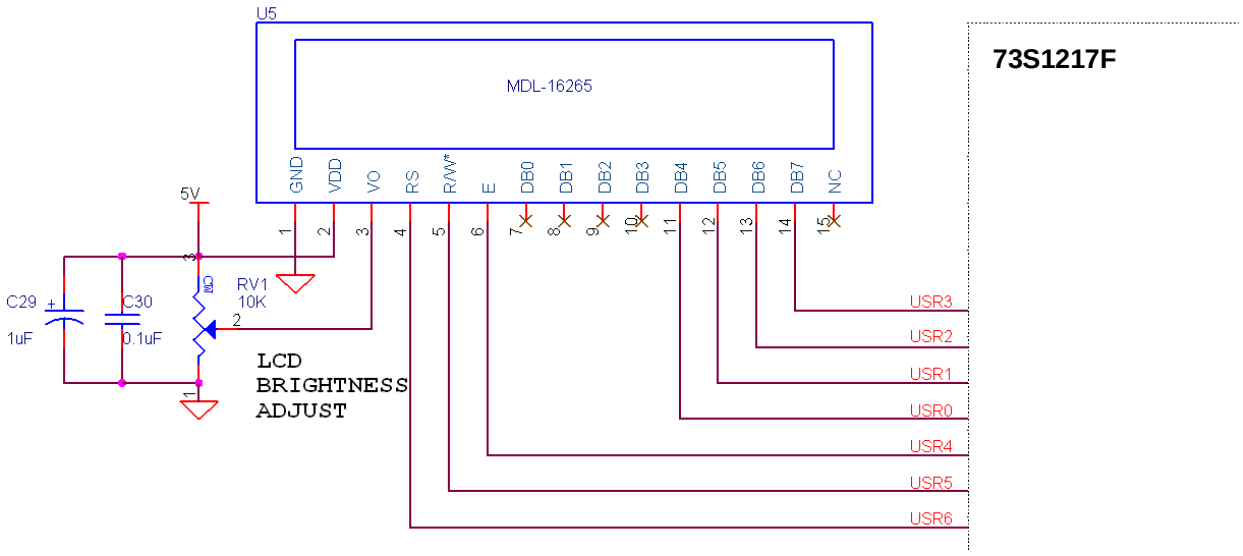


Figure 16: LCD Connections

4.6.4 USB Interface

The USB interface on the 73S1217F requires few external components for proper operation. Two serial resistors of 24 Ω ± 1% are needed to provide proper impedance matching for the USB data signals D+ and D-.

For self-powered USB applications, a connection must be made between the VBUS power input and USR7 for proper operation with the provided API libraries. A direct connection cannot be made as the VBUS voltage exceeds the digital power supply running at 3.3 V. As a result, a resistor divider is required to scale the VBUS voltage down to 3.3 V. Figure 9 shows the basic USB connections.

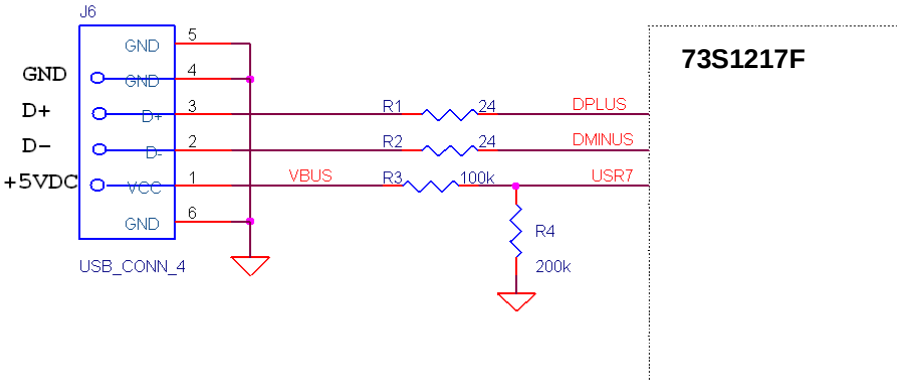


Figure 17: USB Connections

4.6.5 Smart Card Interface

The smart card interface on the 73S1217F requires few external components for proper operation. Figure 10 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 Ω 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 μF 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 10μF and a 0.1 μF capacitor are connected to provide proper decoupling for this input.
- The PRES input on the 73S1217F 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 Ω).
- 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 μF close to VDD pin of the device and directly take other end to ground
- Keep 10 μF and 0.1 μF capacitors close to VPC pin of the device and directly take other end to ground
- Keep 1.0 μF close to VCC pin of the smart card connector and directly take other end to ground

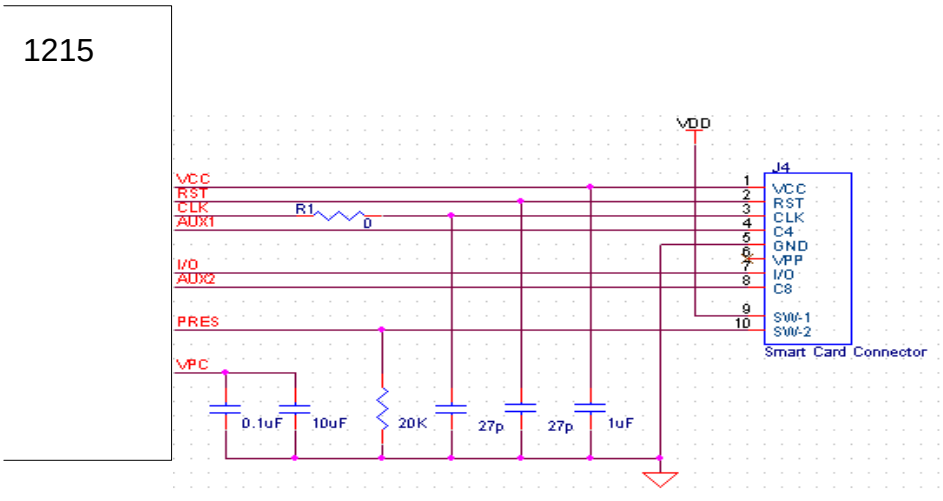


Figure 18: Smart Card Connections

5 Ordering Information

Part Description	Order Number
73S1217F 68-Pin QFN Evaluation Board	73S1217F-EB

6 Related Documentation

The following 73S1217F documents are available from Teridian Semiconductor Corporation:

73S1217F Data Sheet
73S1217F 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 73S1217F contact us at:

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Suite 100
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Telephone: (714) 508-8800
FAX: (714) 508-8878
Email: 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	September 25, 2007	First Publication.
2.0	November 29, 2007	Updated to Rev B PWB and added emulator usage and Schematic descriptions.
2.1	January 3, 2007	Removed pull up resistors and 1000 pF capacitor from ICE interface and added LED0 jumper description.
2.2	February 12, 2007	Changed 5.1 V zener diode part number and value of limiting resistor R27.
2.3	January 8, 2009	Updated BOM parts to remove bad or obsolete part numbers. Removed Zener and current limiting resistor.
2.4	August 17, 2009	Removed LAPIE references. Added information from the Quick Start Guide. Miscellaneous editorial modifications.