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## Evaluation Board for the Si2494/39/38/37/36/35/29/19/18/17 ISOModem

### Description

The Global Voice ISOModem EVB evaluation board provides the system designer with an easy way of evaluating the ISOModem<sup>®</sup>. The Voice ISOModem EVB consists of a motherboard with a complete removable daughter card

The Voice ISOModem is a complete controller based modem chipset with an integrated and programmable direct access arrangement (DAA) that meets the global telephone line requirements. It is available in a 24-pin or 38-pin system side device and a 16-pin line side device. The hardware versions at the time of publication are:

- Voice Mother Board Si24xxVMB Rev 2.0
- Modem Daughter Card Si24xx2G-DC Rev 2.0
- Modem Daughter Card Si24xx2G-QFN38-DC Rev 1.0

The voice daughter card is populated with the correct ISOModem system side chip (Si2494/39/38/37/36/35/29/19/18/17) and the correct line side DAA chip, the Si3018 to suit the voice applications.

The ISOModem eliminates the need for a separate DSP data pump, modem controller, memories, codec, isolation transformers, relays, opto-isolators and a 3-4 wire hybrid. The ISOModem is ideal for embedded modem and voice applications due to its small board area, controller based architecture, low power consumption and global compliance.

An onboard rectifier, filter, and voltage regulator allow the power input to be 7.5–13 V ac or dc (either polarity) supplied through a screw terminal (J8) or a standard 2 mm power jack (J9). Alternatively, power can be supplied through the USB interface (whether the USB or RS232 interface is used).

The Power Source Selection is automatic, while the signaling port is selected by a jumper (JP23).

The evaluation board audio power amplifier can drive an external speaker for either call progress monitoring or speakerphone function. A small onboard speaker, suitable for call progress monitoring, is installed.

Please note that fax modem versions listed in the title require a software driver in order to implement fax send/receive functionality. The driver must be compliant with the Silicon Labs ISOModem and with applicable ITU-T standards (e.g., T.30, T.31, T.4 and T.6) Contact Silicon Labs for details.

### Features

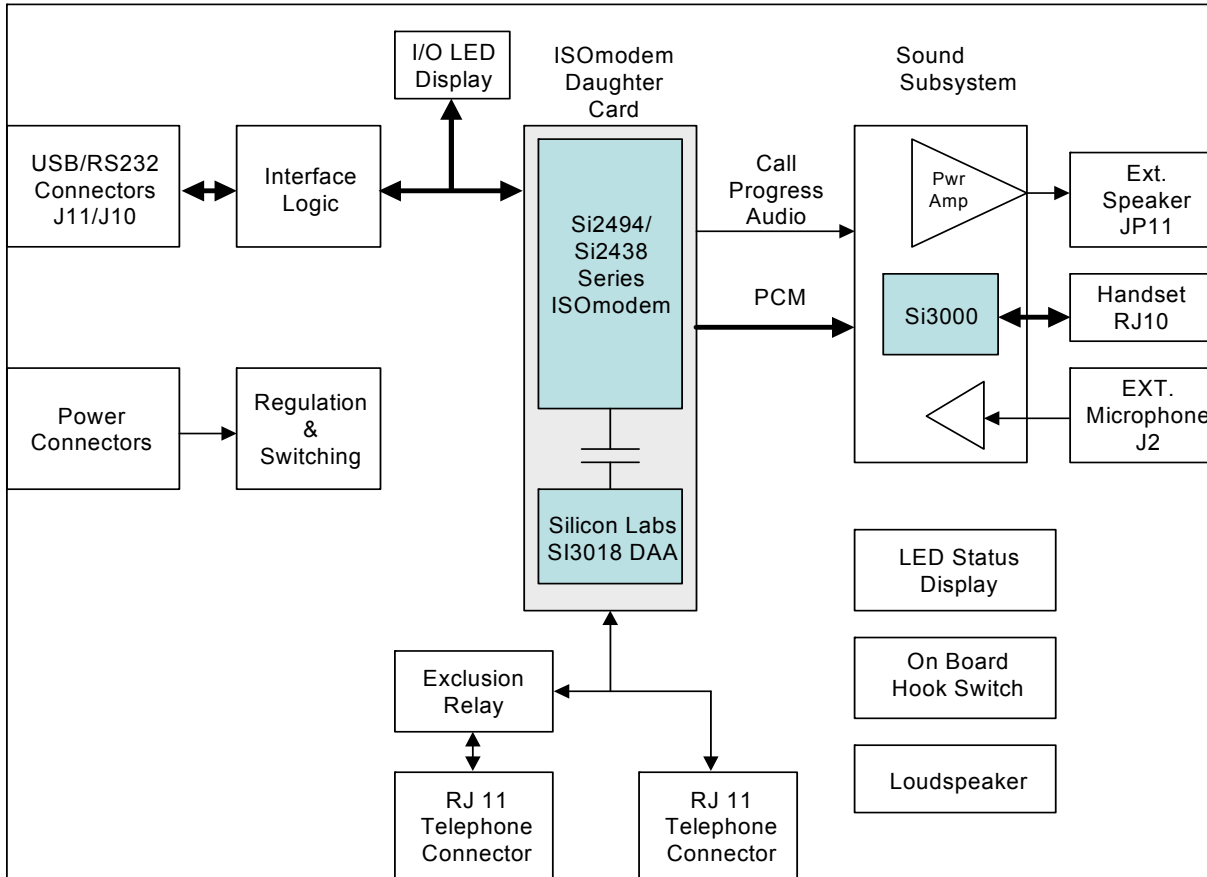
This evaluation board includes the following:

- Socketed module with the modem chipset
- USB or asynch RS232 Serial Interface
- RJ11 connection to the phone line
- Onboard relay-excludable RJ11 connection
- RS232 and USB interface to the PC
- Direct access to the ISOModem signals for embedded system evaluation
- Power from a provided 8.5–13.5 V dc power supply or from the USB port
- Handset connector (J1)
- Onboard hookswitch
- External hookswitch connector
- Jumper matrix that allows any handset wiring scheme to work with this board
- Onboard speakerphone microphone
- RCA jack connector to an optional off-board speakerphone electret microphone
- Selectable and adjustable electret power supplies for both handset and speakerphone microphones
- Onboard 300 mW audio power amplifier (into a 4  $\Omega$  load) for driving either onboard or external speaker.
- Onboard voice coil driven loudspeaker for call monitoring
- LED display of all RS232 signals

# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## Functional Block Diagram

As shown in Figure 1, the daughter card is a plug-in component with the complete modem, while the rest of the motherboard provides selectable serial RS232 or USB links, the sound subsystem, and power regulation and distribution.



**Figure 1. Functional Block Diagram**

The voice ISOmodem EVB provides a sound system consisting of the Si3000 codec along with a handset RJ10 connector as well as onboard microphone and loudspeaker with options for these devices to be placed off-board.

The bias voltages for both the onboard microphone and the handset microphone can be modified and alternate sources used.

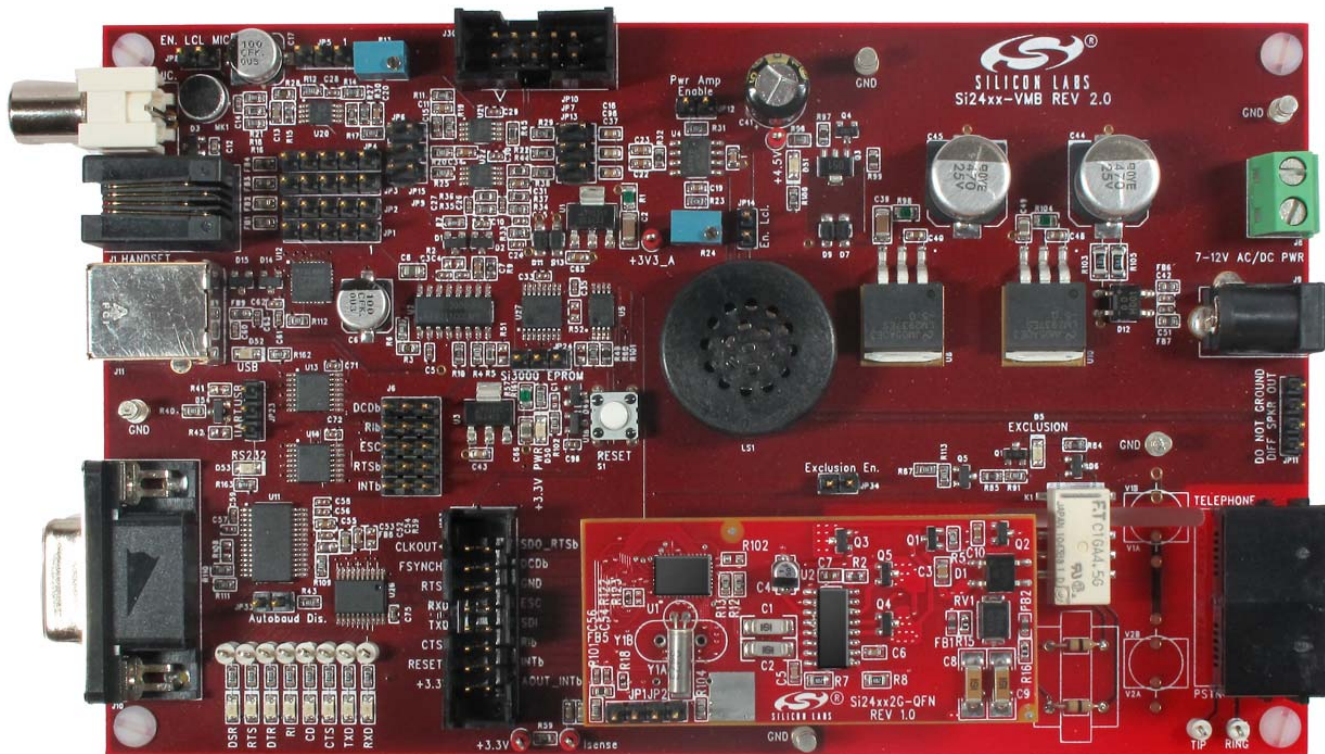
This allows the board to be used as a telephone or as a speakerphone as is, or to be integrated into the customer's system.

The evaluation board can drive an external speaker or a small onboard speaker. For speaker-phone applications it is recommended that an off board loudspeaker be used.

An onboard rectifier, filter and voltage regulator allow the power input to be 8.5 to 13.5 V peak ac or dc of either polarity supplied through screw terminals (J8) or a standard 2 mm power jack (J9). Alternatively the power can be supplied through the USB interface. Automatic switching is provided for the power, but not for the data interface. That data interface is selected by JP23.

## 1. Global Voice ISModem EVB

The evaluation board is shown in Figure 2. Note the socketed daughter card with the modem chipset on the bottom right of the board.



**Figure 2. Global Voice ISModem Evaluation Board**

The ISModem chip requires software driver in order to perform either FAX or sound functionality. Contact Silicon Labs for details. “AN244: Si2438/37/36/35/29/19/18/17 Fax Modem Designer’s Guide” and “AN93: Si2494/93/57/39/34/15/04 Data Modem Designer’s Guide” are useful for driver development.

The Global Voice ISModem EVB provides an RJ11 jack for interfacing to the phone line and the USB or serial ports can interface to a PC or a host CPU. This allows the board to operate as a class 1 fax modem for an evaluation or as a global voice and data modem (depending on the specific ISModem used).

A handset, microphone and speaker can also be attached to demonstrate the sound features, which may include TAM and speaker-phone operations, depending on the specific ISModem chip used. Table 1 lists which ISModem chips have these features. A software driver or application is required to perform these data and sound operations. The included UltraCOM application can demonstrate the sound features of the ISModem and provides a tool to aid development.

# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## 2. Daughter Cards

There are two types of daughter cards available for this EVB. One supports the TSSOP version of the system side chip, and the other supports the QFN38 version of the system side.

An example of the TSSOP version of the daughter card is shown in Figure 3. It has the ISOModem system-side chip as well as the Si3018 DAA chip. The left side of the board contains the system side while the right side contains the DAA chip along with the few interface parts needed to connect to a telephone line.

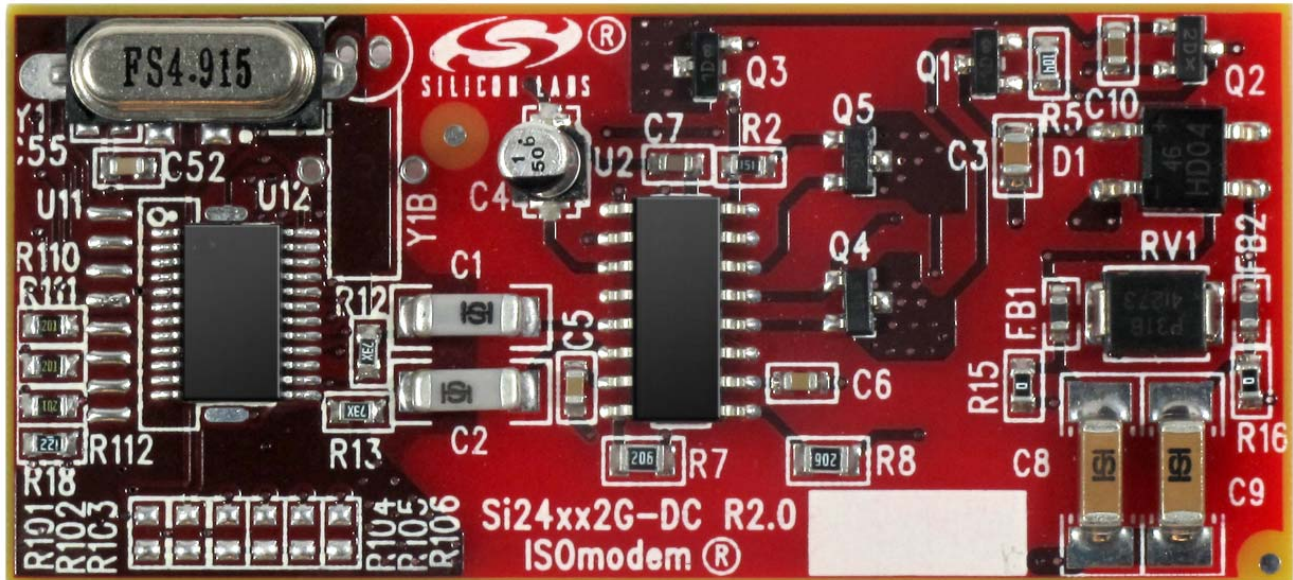


Figure 3. Daughter Card

Although this card is provided as part of the global voice EVB, it can also be directly connected to an embedded system using TTL logic.

When run by a software driver the chipset on this daughter card is capable of making fax calls, telephone calls with a handset, data calls and both. TAM and speaker-phone operations. Table 1 lists the various ISOModem chips and their features.

Table 1. ISOModem Features

Part Number	Fax	Data	Handset	TAM	Speaker Phone
Si2417	≤V.17	—	✓	—	—
Si2418	≤V.17	—	✓	✓	✓
Si2419	≤V.17	≤V.32bis	✓	—	—
Si2429	≤V.29	—	✓	✓	✓
Si2435	≤V.34	—	✓	—	—
Si2436	≤V.34	—	✓	✓	✓
Si2437	≤V.34	≤V.34	✓	—	—
Si2438	≤V.34	≤V.34	✓	✓	✓
Si2439	—	≤V.34	✓	✓	✓
Si2494	—	≤V.92	✓	✓	✓

## 3. Setup and Evaluation

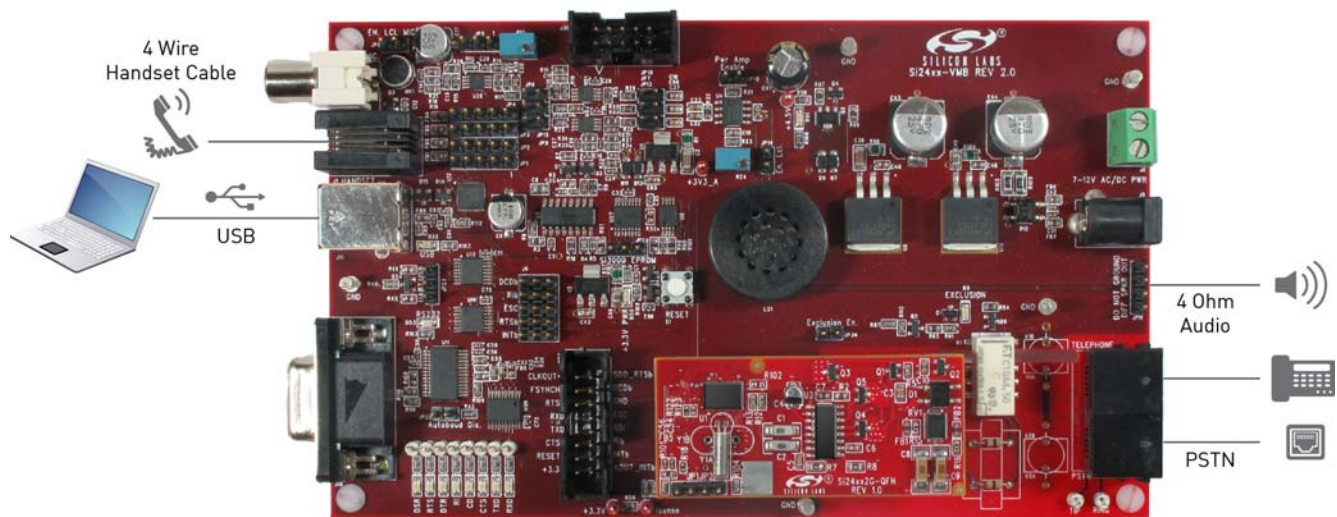
This section explains how to set up the Voice ISOmodem EVB for evaluation as an RS-232 or USB interface. Jumper settings and system interconnections are given, as well as the use of a demonstration and test application provided called UltraCOM.

See the following documents for additional technical details

- Si2494/39/38/37/36/35/29/19/18/17 data sheets
- “AN244: Fax Modem Designer’s Guide”
- “AN93: Data Modem Designer’s Guide”

Diagrams and tables are provided here that define the operation of all the jumpers, settings and connectors, as well as their default states.

A typical global voice EVB as it arrives from the factory can be connected into a system by using only four cables.



**Figure 4. Global Voice ISOmodem EVB Connection**

The UltraCOM application provided on the included CD can be used to demonstrate:

- Telephone Operation.
- Speakerphone Operation
- Telephone answering machine operation.

Fax Operation can be demonstrated but requires a fax driver application.



# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

Table 2 explains the use of the data related jumpers. It also shows the default state.

Check all jumper settings on the EVB before applying power.

These default data related jumper settings shown below configure the EVB for USB serial operation with auto baud as a default. Any terminal emulator program configured to communicate through the virtual com port created by the provided driver can be used to communicate with the EVB. There are no BAUD settings required since the modem has an auto baud feature.

The USB virtual com port drivers needed for the USB link to work are on the provided CD.

Customers that want to use an RS232 port only need to change JP23 and connect an RS232 cable to the host. As with the USB configuration, any terminal emulator program configured to communicate through a PC COM port can be used to communicate with the EVB.

Although the user can exercise many of the modem commands (including voice features) using a terminal emulator program, a fax driver is required to implement fax send/receive functionality.

This EVB also provides an application, UltraCOM distributed on the CD that can act as a terminal emulator and as a sound feature demonstration vehicle. See Appendix I for an UltraCOM quick start guide that shows how to run this demonstration.

**Table 2. Digital Data Related Jumpers**

Jumper Number	Pins Jumped	Default State	Comments
JP23	1-2	✓	USB selected
	2-3		UART selected
J6	1-2, 4-5, 7-8, 10-11, 13-14	✓	Typical Si2438/37/36/35/29/19/18/17 FT setup (24 pin pkg)
JP33	1-2		Disable Auto baud
JP24	1-2		Enable EEPROM
	2-3	✓	Enable Si3000



# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

Table 3 explains the use of the analog audio oriented jumpers and adjustments, while showing the default state. These jumpers and adjustments can be used to tailor the operation of the global fax EVB so that it interfaces well with the users host system and provides the maximum flexibility as the choice of loudspeaker microphone and alternate sources of sound.

**Table 3. Sound Related Jumpers**

Jumper Number	Pins Jumped	Default State	Comments
JP34	1-2		Enable Exclusion Relay
JP1	1-2	✓	Handset pin 4 connection (ground)*
JP2	1-2	✓	Handset pin 3 connection (ground)*
JP3	4-5	✓	Handset pin 2 connection (earpiece signal)*
JP4	2-3	✓	Handset pin 1 connection (mouthpiece signal)*
JP24	1-2		Enable EEPROM (factory use only)
	2-3	✓	Enable Si3000
JP5	1-2	✓	Variable mic gain = 6 to 34 dB
	3-3		Fixed mic gain = 21 dB
JP6	1-2	✓	Mic to input mixer
JP15	1-2		External Line In to input mixer
JP9	1-2		AOUT to input mixer
JP8	1-2	✓	Connects on board mic
JP10	1-2		AOUT to power amp mixer
JP7	1-2	✓	Si3000 line out to power amp mixer
JP13	1-2		Aux Input to power amp mixer
JP14	1-2		On Board Speaker connected
JP12	1-2	✓	Enable Pwr Amp.
*Note: For typical Cisco handset.			

## 3.2. I/O and Adjustments

Table 4 explains the use of the adjustable analog audio-oriented controls as well as their default state.

**Table 4. Audio Adjustments**

Ref	Default State	Comments
R13	4 turns CW	Mic Preamp Gain 6 dB to 34 dB
R24	CCW(21.4 dB)	Power Amp Gain 21.4 dB to 46.4 dB WRT line out

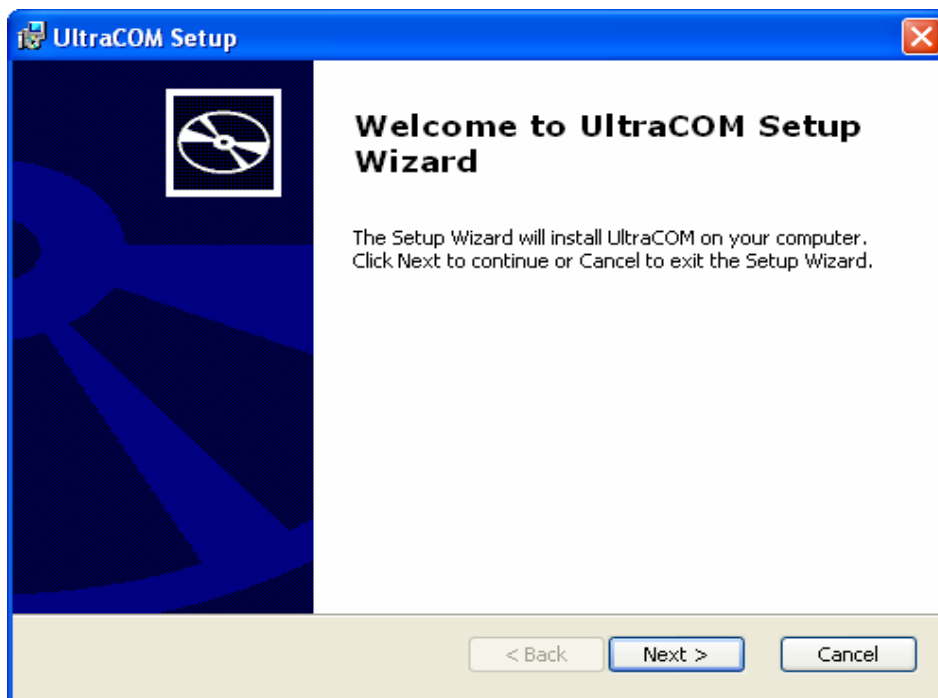
## 3.3. USB Interface Data Link Setup Quick Start

1. Set jumpers according to the default configuration shown in Table 2 on page 7.
2. Connect:
  - Install USB cable and provided driver.
  - RJ-11 to phone line or test box.
3. Open the terminal emulator program, and apply power to the EVB.
4. Select the serial COM channel used.
5. Type "AT" followed by a carriage return. (Autobaud automatically adjusts modem DTE speed and protocol.). The modem should echo "AT" and then send the "OK" response code.
6. Type ATH1 and ATH0 to seize and release the telephone line.

## 3.4. UltraCOM Installation Instructions

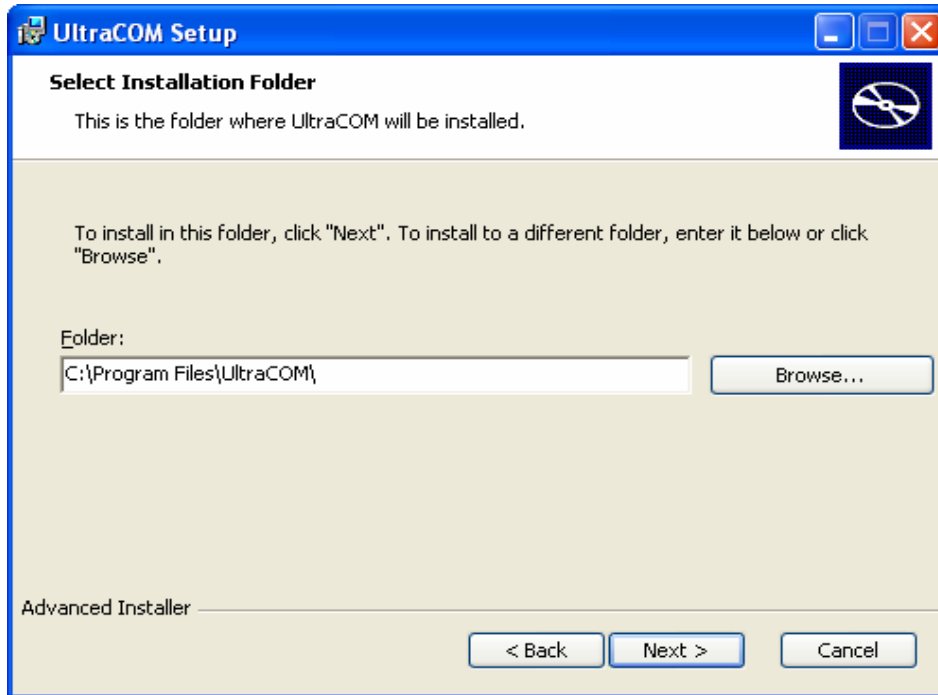
Perform the following steps:

1. Double-click the ultracom.msi file to launch the installer. Click Next.



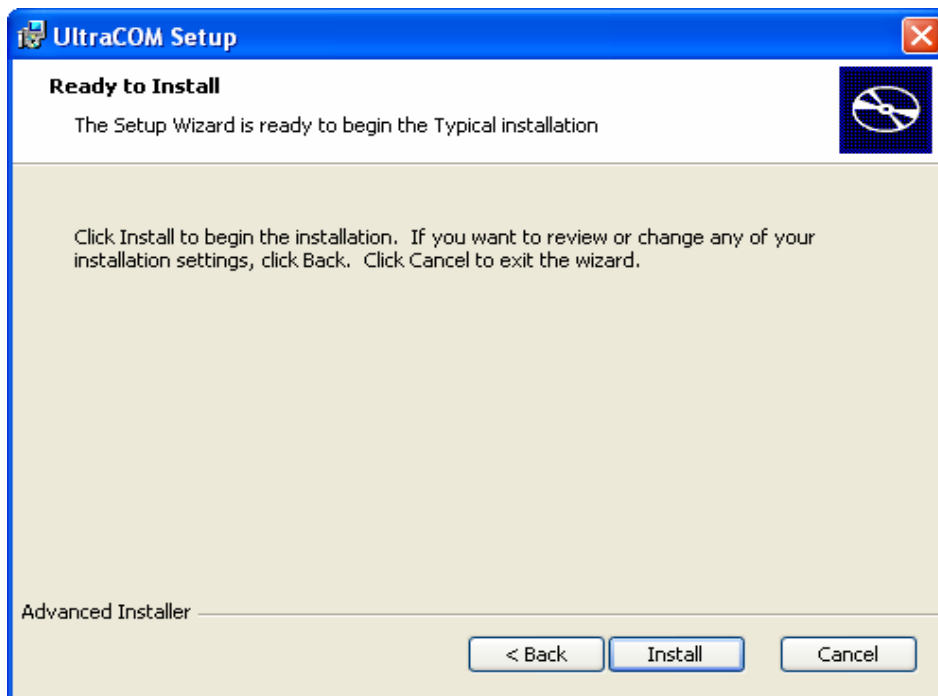
**Figure 6. UltraCOM Setup Wizard**

2. Accept the default installation path and click Next.



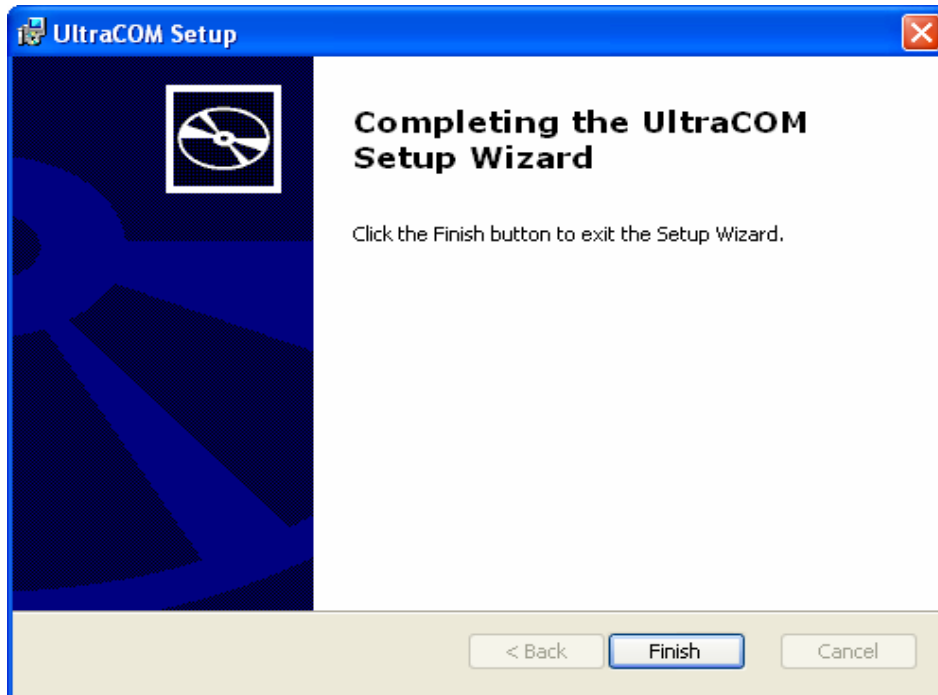
**Figure 7. Select Installation Folder Dialog Box**

3. Click Install to start the installation.



**Figure 8. Install Dialog Box**

4. After installation is complete, click Finish to close the installer.



**Figure 9. Completing UltraCOM Setup Wizard**

5. UltraCOM may be launched from the desktop link or from the Start menu:  
Start Programs→UltraCOM→UltraCOM
6. From the UltraCOM main menu, select Help Index. This will load the help file.
7. Select the Quick Start link from the main menu and review the information.

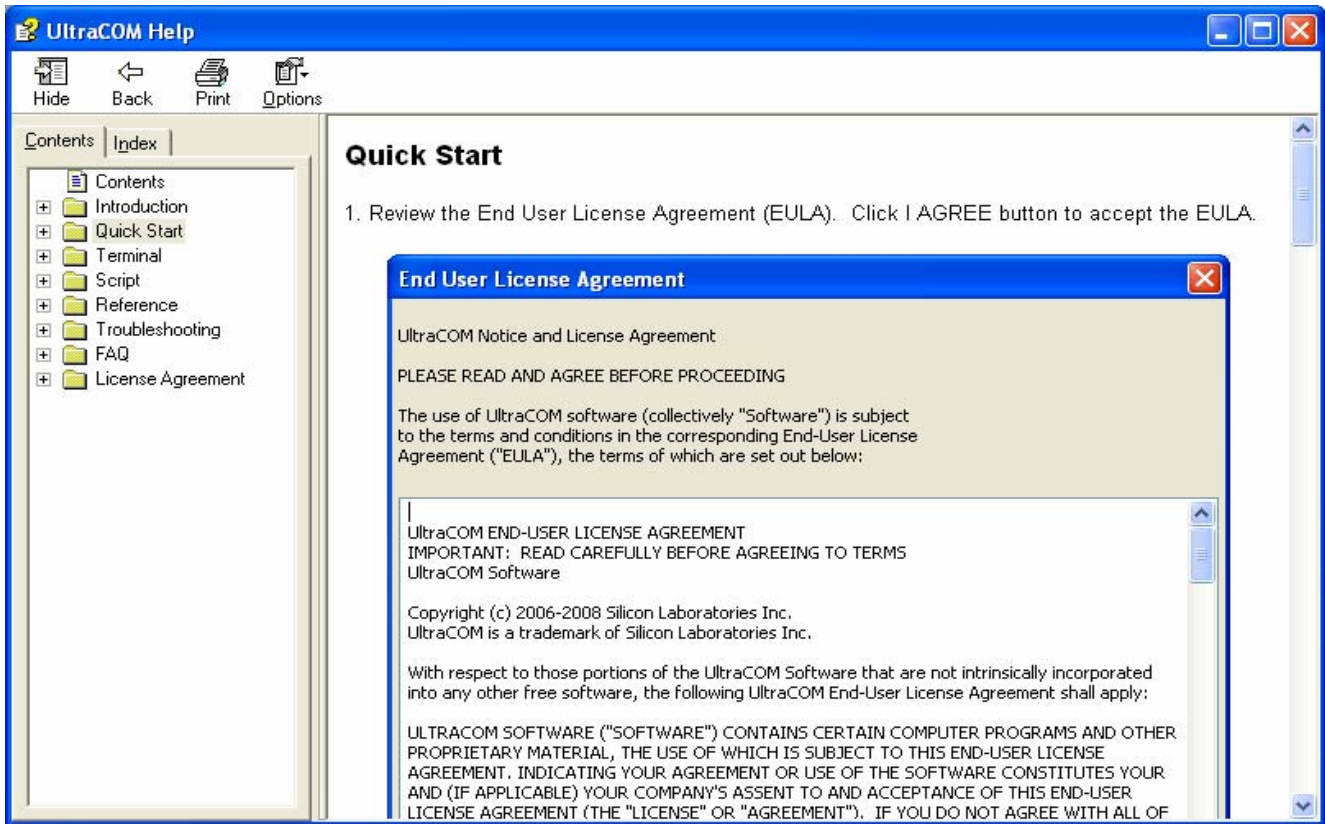


Figure 10. Quick Start

### 3.5. USB Interface Data Link Setup Quick Start

1. Set jumpers according to the default configuration shown in Figure 5.
2. Install the USB driver for your operating system from the CD supplied with the evaluation board.
3. Connect:
  - USB cable to PC
  - RJ-11 to phone line or test box
4. Open the terminal emulator program.
5. Select one of the USB Virtual Com Port numbers in the emulator program's user interface.
6. Type "AT" followed by a carriage return. (Autobaud automatically adjusts modem DTE speed and protocol.) The modem should echo "AT" and then send the "OK" response code.
7. Type ATH1 and ATH0 to seize and release the telephone line.

## 3.6. Sound Demonstration Using UltraCOM Quick Start Guide

### Step 1: Perform the Quick Start USB Interface Data Link Setup Quick Start

1. Set jumpers according to the default configuration shown in Figure 5.
2. Install the USB driver for your operating system from the CD supplied with the evaluation board.
3. Connect:
  - USB cable to PC
  - RJ-11 to phone line or test box.
4. Open the terminal emulator program.
5. Select one of the USB Virtual Com Port numbers in the emulator program's user interface.
6. Type "AT" followed by a carriage return. (Autobaud automatically adjusts modem DTE speed and protocol.). The modem should echo "AT" and then send the "OK" response code.
7. Type ATH1 and ATH0 to seize and release the telephone line.

### Step 2

Add connections to a loudspeaker and a handset as shown in the following diagram.

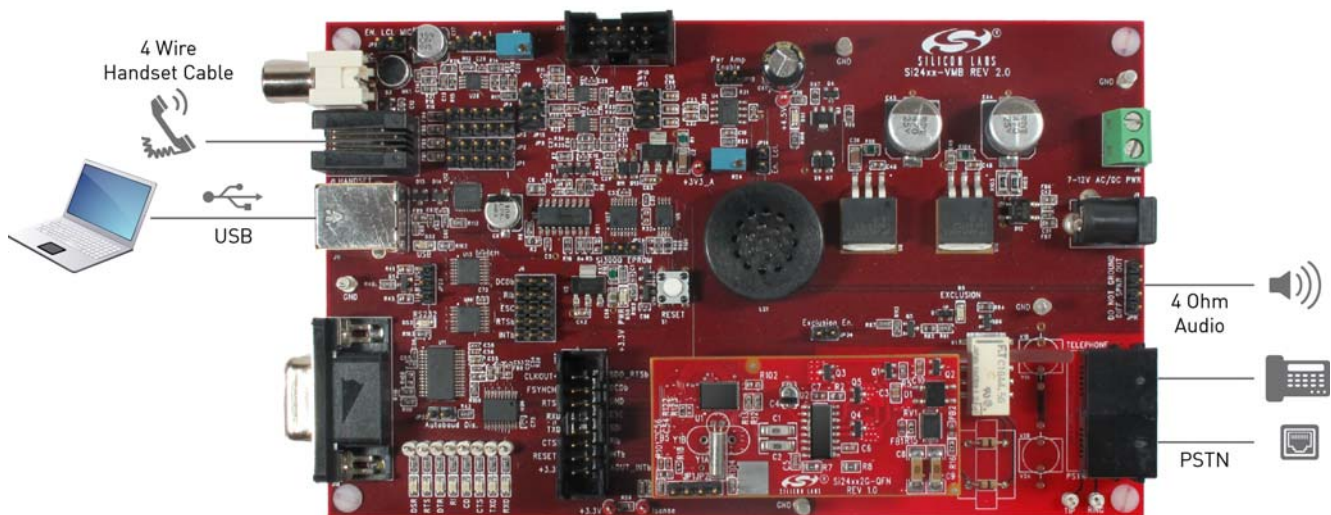


Figure 11. Sound Demonstration Hardware Interconnect Guide

### Step 3:

1. Install UltraCOM (provided in this kit) on Windows XP
2. Launch UltraCOM.

# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## Step 4:

Select "Terminal-Open" making sure the serial configuration is as shown (except for port selection), then select OK.

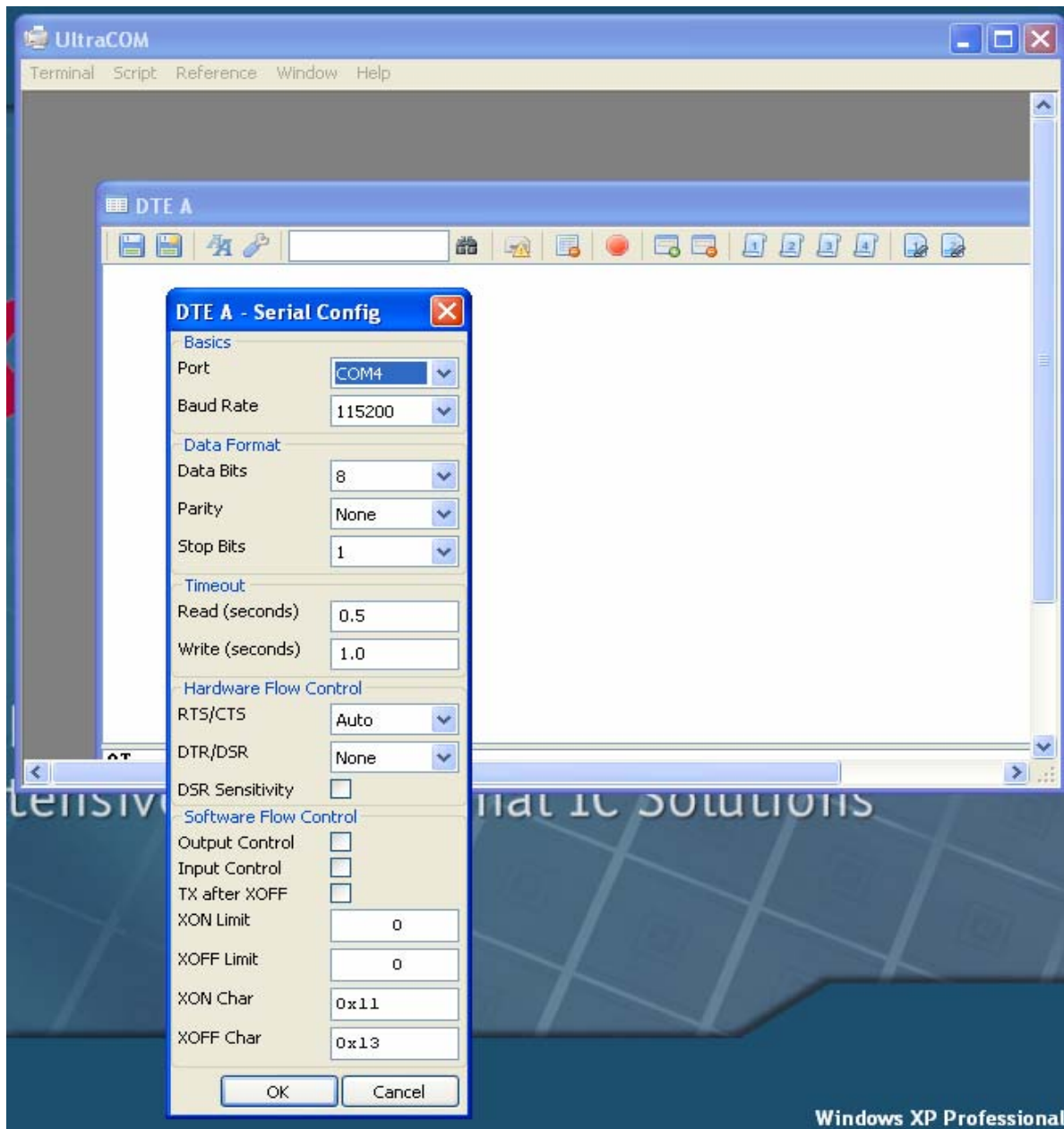
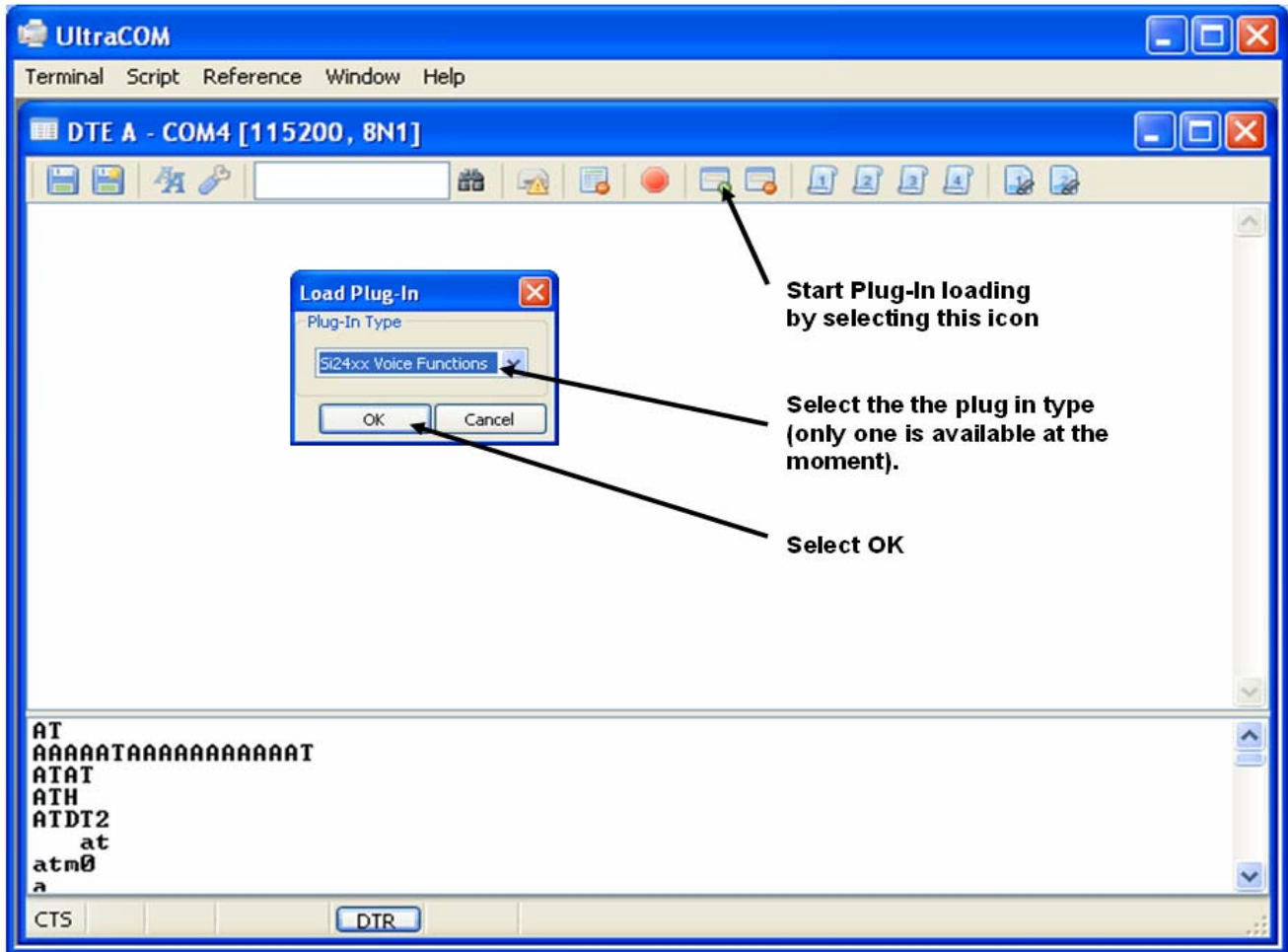


Figure 12. UltraCOM Serial Configuration Dialog Box

**Step 5:**

1. Select Open Plug-In (The Green Icon) in the screen snapshot that follows.
2. Respond OK to "Load Plug-in" "24xx Voice Functions"



**Figure 13. UltraCOM Load Plug-In Dialog Box**



# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## Step 6:

Wait for the screen below to open and the patch to load.

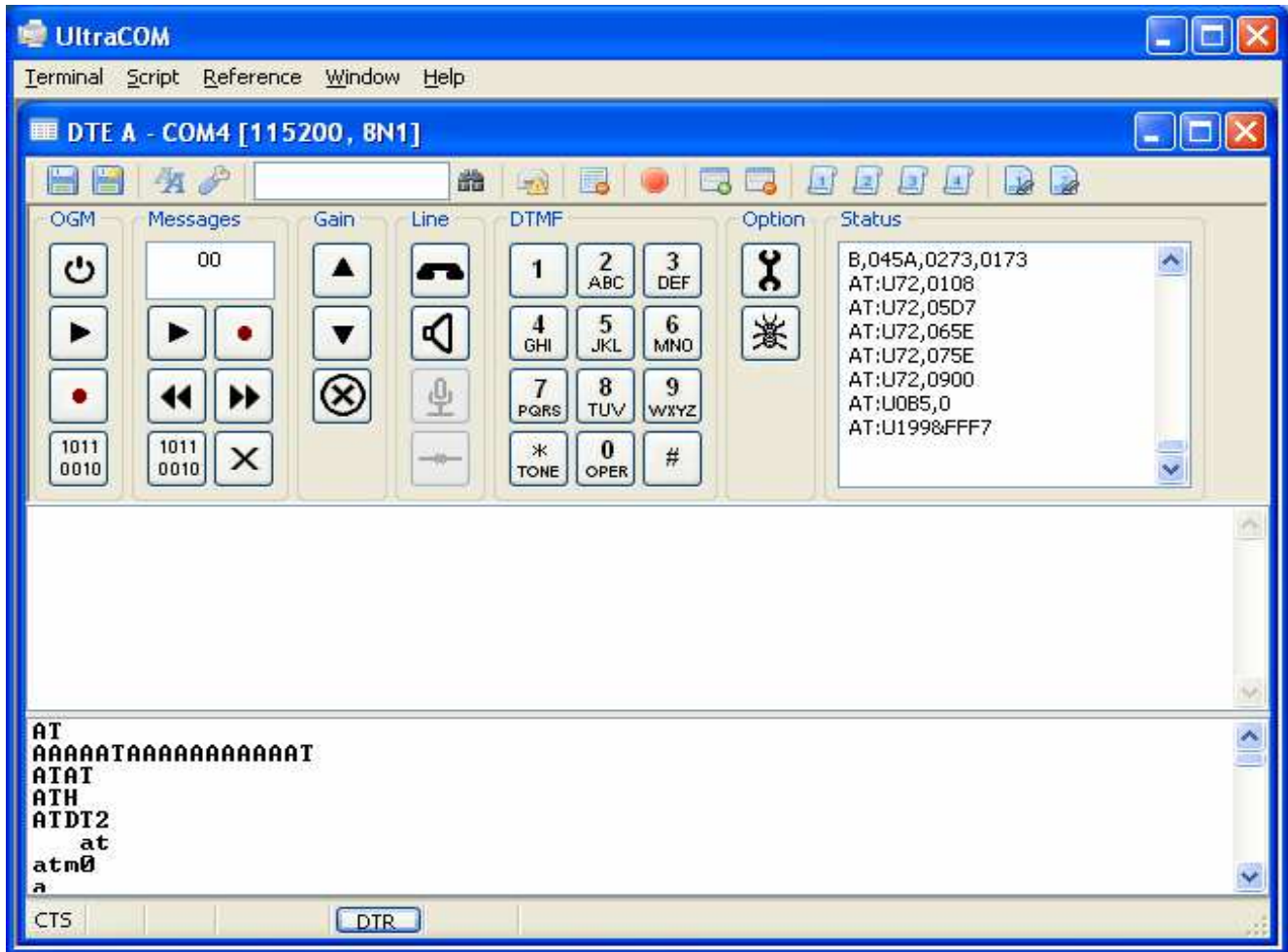


Figure 14. UltraCOM Plug-Ins Patch Load Phase

## Step 7:

Use the interface above to do the following:

- Go off hook with the handset by selecting the handset symbol
- Select the speakerphone button to start that mode.
- Dial a DTMF number.
- Note the following suggestions.
  - Use the external off-board speaker for speakerphone functionality
  - Use the on-board electret for the microphone.
  - Use the PSTN, a PBX or a Line Simulator for the phone line.

## How to Change the Patch Used in the UltraCOM Plug-In

1) Load Plug In by selecting the Plug-In's icon

2) Select Preferences Icon (the wrench)

3) Select ISModem Options Tab

4) Select Patch Tab

5) Cut and Paste a new patch Text into this editable area, replacing the old patch between the lines:

```

ATZ
ATE0+FCLASS=0
AT+IFC
AT+PF000,7b5d,4dc,7b5f,4de,7b59,4d8,7b5b,4da
AT+PF006,7b55,494,7b57,4db,7b51,4db,7b53,4d2
AT+PF010,7b4d,4cc,7b4f,4cb,7b49,4cb,7b4b,4ca
AT+PF018,7b45,4c4,7b47,4c6,7b41,4c0,7b43,4c2
AT+PF020,fc9a,fc8c,4f9,7f3c,fb78,44f9,fae4
AT+PF027,42d2,f99b,f99c,42c2,4204,f98b,f985
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AT+PF035,fae4,faa,4eb7,75c9,fa11,fa1b,75d1
AT+PF03c,757b,fa3b,fa3c,752b,49d,48e,49f,3c5
AT+PF044,7f5e,48a,49b,3c1,fcdc,c795,65ef,494
AT+PF04c,e391,fcce,65eb,496,e28d,fc49,c58e
AT+PF053,2681,6709,c8b,c58e,92,c6d7,f594,e19c
AT+PF05b,5cda,c58f,810b,6703,8482,b8bd,55cb
AT+PF069,84d2,6637,48c,c58f,8443,6633,fc81
AT+PF070,abf5,8458,b6f7,4aa,7a20,e2e9,8925
AT+PF077,c6eb,c5ab,8452,6727,4af,c5af,8451
AT+PF07e,6723,cad,c553,2687,b6ef,45e,c557,2689
AT+PF086,b6db,269b,abf5,2682,c559,46ca,7bd1
AT+PF08d,e149,c752,b65a,763c,e144,fcdb,673f
AT+PF094,451,b64b,553f,e29a,946c,c745,4036
AT+PF09b,e346,fcab,c741,4835,e242,fc97,660a
AT+PF0a2,444,b802,ac21,848c,b87b,7bf9,9578
AT+PF0b9,416,e174,24c,fc03,ac20,b89e,b6b6,41b
AT+PF0b1,b606,43f,b605,469,b600,475,b877,b67b
AT+PF0b9,4e4,b672,465,b861,67d3,267,c68b,3d67
AT+PF0c1,c6a6,268a,c517,16d7,b6f9,abf5,b6fa
AT+PF0c6,fcfc,b694,417,c6a3,19,c642,fc13,8fcc
    
```

6) Select OK

7) Close the Preferences Dialog Box and Plug-In, then open the Plug-In again

Figure 15. UltraCOM Plug-In Patch Changing

## 3.7. Power Requirements

The EVB has an onboard diode bridge, filter capacitor, and voltage regulators. Power can be supplied from the USB connection or a source capable of providing 8.5–13.5 V dc or 6–9.5 VRMS peak ac and at least 300 mA. A suitable wall mounted 9 V supply is provided with the kit.

Of the 300 mA required current 200 mA is used to drive the loudspeaker and may be removed from the requirement if the power amp is enabled by placing a jumper on JP12.

Power may be applied to the Voice ISModem EVB through the screw terminals, J8, the 2 mm power jack, J9, or the USB cable. The modem cable may be used to supply power even if the modem is configured for RS-232 operation.

The power consumed by the audio section is limited with an active limiter. This circuit will protect the power sources when the sound is overdriven or if the amplifier output is shorted. The power amplifier is also naturally protected with thermal limiting. Digital operations such as host to modem serial data transfer or the modem telephone line operations are unaffected by the limiter operation.

Note that the modem will take power from wherever it finds it and that it is possible to use the RS232 port for signaling and the USB for power or to use the USB for signaling and to provide power through the provided external 9 V supply.

## 3.8. EVB Part Numbers

The Voice ISModem evaluation boards are offered in multiple versions. The first four numbers indicate the system-side device. The options include speed and various audio capabilities as well as package and temperature. See Figure 16:

**Si2438FT18-EVB**  
**Si2437FT18-EVB**  
**Si2436FT18-EVB**  
**Si2435FT18-EVB**  
**Si2419FT18-EVB**  
**Si2418FT18-EVB**  
**Si2417FT18-EVB**  
**Si2494AFM18-EVB**  
**Si2439AFM18-EVB**

Figure 16. EVB Part Number Example

## 4. Voice ISModem EVB Functional Description

The Voice ISModem EVB is a multipurpose evaluation system. The modem daughter card illustrates the small size and few components required to implement an entire controller-based modem with global compatibility. The daughter card can be used independently of, or in conjunction with, the motherboard. The motherboard adds features that enhance the ease of evaluating the many capabilities of the Si24xx ISModem.

### 4.1. Motherboard

The motherboard provides a convenient interface to the Si24xx ISModem DC (daughter card). The versatile power supply allows for a wide range of ac and dc voltages to power the board.

A versatile digital IO system allows either a USB virtual com port to be used to interface to the board or an RS-232 transceivers with a DB9 connector allowing the EVB to be easily connected to a PC or other terminal device. A jumper option allows direct access to the LVCMOS/TTL level serial inputs to the Si24xx, bypassing the RS-232 transceivers or USB interface. This is particularly useful for directly connecting the Si24xx to embedded systems.

The motherboard provides connectivity to a telephone line or a phone extension via a pair of RJ11 connectors. The extension connector may be actively excluded by an onboard relay.

A switch and a connector is provided on the motherboard that is read by the modem firmware and can perform the hookswitch function.

The motherboard also contains a complete sound system including microphone, loudspeaker and handset connector. The sound system includes easy to adjust gain controls and extra inputs that allow system generated noises to be added to the sound.

A functional block diagram of the system as a whole can be seen below.

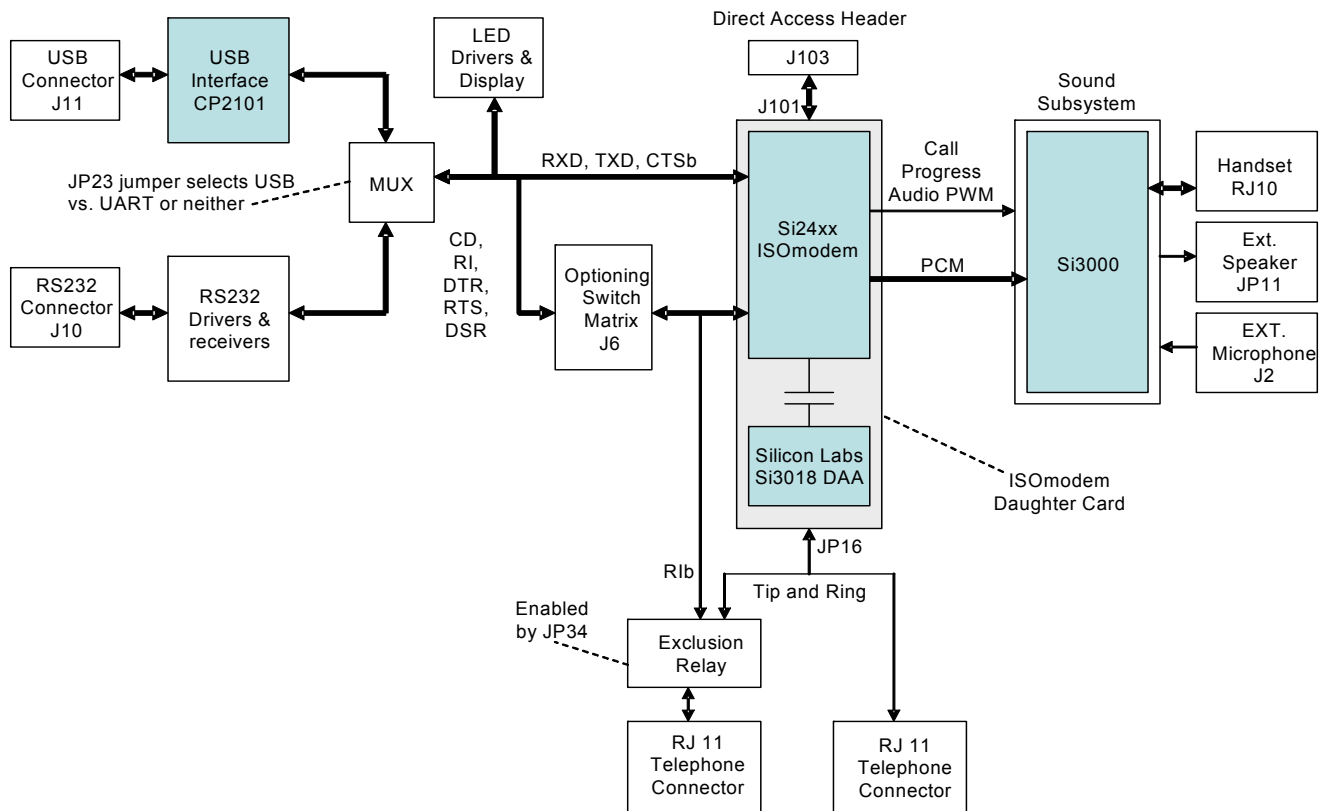


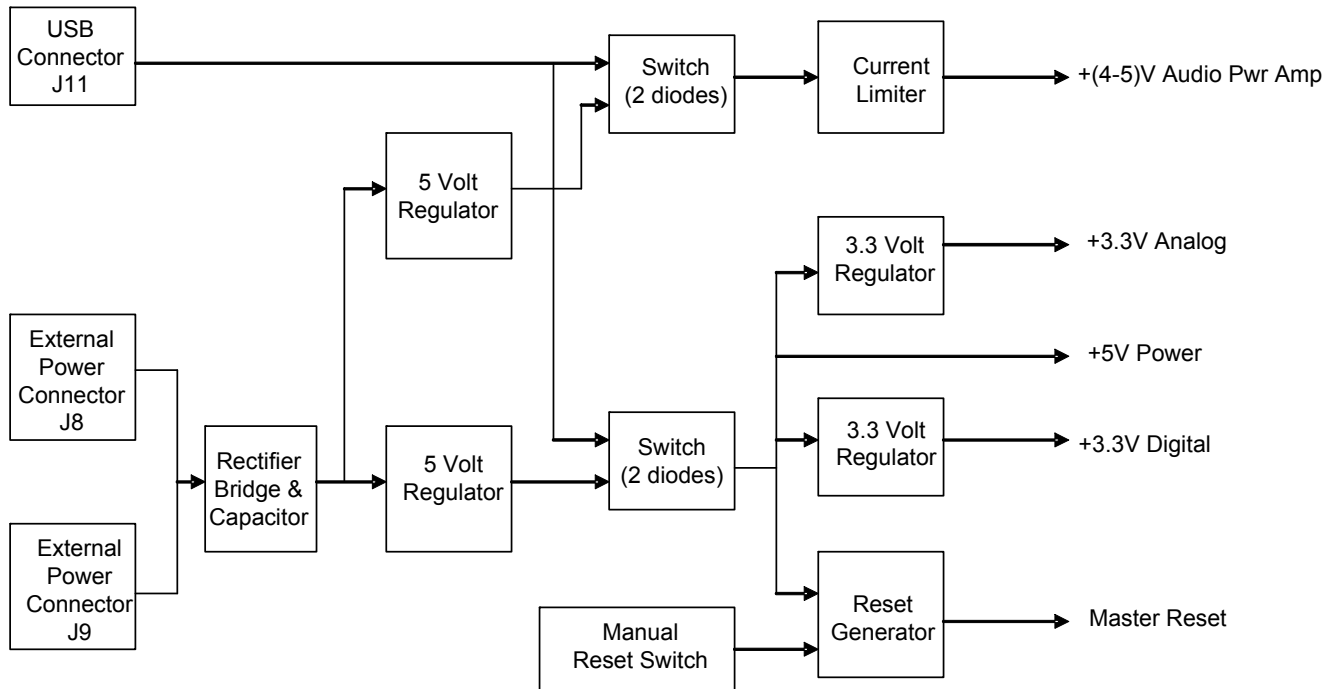
Figure 17. Sound System Block Diagram

# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## 4.1.1. Power Supply

### 4.1.1.1. Power Distribution

The power distribution diagram for the global voice EVB can be seen in Figure 18 below. Analog and Digital voltages are separately regulated while the audio power amplifier supply is current limited to prevent accidental overload and disruption of the digital supplies.



**Figure 18. Power Distribution Diagram**

The onboard full-wave rectifier and filter ensure the correct polarity is applied to the Voice ISModem EVB.

Daughter card 3.3 V power is supplied through voltage regulator U3. Daughter card current can be measured by connecting a DVM across R59, a 1  $\Omega$  current sensing resistor in the 3.3 V supply line to the daughter card.

The input voltage to either J8 or J9 must be between 8.5 and 13.5 V dc, or 6 and 9.5 VPEAK ac. The motherboard includes a diode bridge (D12) to guard against a polarity reversal of the dc voltage or to rectify an ac voltage. The power source must be capable of continuously supplying at least 100 mA. The voltage regulator, U10, can provide 5 V for the motherboard and the input for voltage regulator U3, which outputs 3.3 V for use on the motherboard and to power the daughter card. Alternately, power may be supplied to U3 through D11 from the USB port.

The power consumed by the audio section is limited with an active limiter. This circuit will protect both power sources and the audio amplifier when the sound is overdriven or if the amplifier output is shorted. Digital operations such as host to modem serial data transfer or the modem telephone line operations are unaffected by the limiter operation.

Two indicator LEDs indicate main power (+5 V) and audio amp power (~+4.5 V). See Figure 15 for locations. You will notice the one for the audio power blinking when audio is loud and clipping. This is normal.

## 4.1.2. Reset Circuitry

The Si24xx requires a reset pulse to remain low for at least 5.0 ms after the power supply has stabilized during the power up sequence or for at least 5.0 ms during a power-on reset. Most production Si24xx modem chipset applications require that RESET be controlled by the host processor. Certain Si24xx operation modes, including power down, require a hardware reset to recover.

The Voice ISOModem EVB contains two reset options, an automatic power-on reset device, U18 (DS1818) (default), and a manual reset switch (S1) to permit resetting the chip without removing power. A reset, regardless of the mechanism, causes all modem settings to revert to factory default values.

## 4.1.3. DS1818

The DS1818 is a small, low-cost device that monitors the voltage on VD and an external reset pushbutton. If VD drops below 3.0 V, the DS1818 provides a 220 ms active-low reset pulse. On power up, the DS1818 also outputs an active low reset pulse for 220 ms after VD reaches 90% of the nominal 3.3 V value. The DS1818 outputs a 220 ms reset pulse any time the power supply voltage exceeds the 3.3 V 10% window.

## 4.1.4. Manual Reset

The manual reset switch (S1) performs a power-on reset. This resets the Si24xx to factory defaults without turning off power. Pressing S1 activates the reset monitor in the DS1818 and produces a 220 ms active low reset pulse.

## 4.1.5. Interface Selection

The serial interface of the Voice ISOModem EVB can be connected to a computer, terminal, embedded system, or any other data terminal equipment (DTE) via a standard RS-232 interface, USB interface, or through a direct TTL serial interface.

At the heart of this capability is the MUX and the jumper that controls it: JP23.

**Table 5. Board Configuration**

JP23	Modem Signalling Done Via
X	Header, J103
1–2 Jumped	USB Port
2–3 Not Jumped	Serial Port

### 4.1.5.1. RS-232 Interface

The serial cable connects to J10 on the motherboard and provides a data link the PC or embedded host processor. Moving the jumper on JP23 enables the RS232 interface or the USB interface.

The Maxim MAX3237 transceiver interfaces directly with the TTL levels available at the serial interface of the Si24xx and, using internal charge pumps, makes these signals compatible with the RS-232 standard. The RS-232 transceiver on the Voice ISOModem EVB can communicate at rates between 300 bps and 1 Mbps. This simplifies the connection to PCs and other data terminal equipment (DTE).

The signals available on the Voice ISOModem EVB serial interface (DB9 connector) are listed in Table 6 along with the various signal names used and both connector pin numbers and ISOModem package pin numbers.

**Table 6. DB9 Pin Connections (J10)**

J10 Name	J10 Symbol	J10 Pin	ISOModem Pin Number	ISOModem Signal Name
Carrier Detect	CD	1*	See Note*	DCD/EESD
Received Data	RXD	2	9	RXD
Transmit Data	TXD	3	10	TXD
Data Terminal Ready	DTR	4*	See Note*	ESC/RI
Signal Ground	SG	5	6	GND
Data Set Ready	DSR	6*	See Note*	INT/AOUT
Ready to Send	RTS	7*	See Note*	RTS/RXCLK
Clear to Send	CTS	8	11	CTS
Ring Indicator	RD	9*	17	RI
<b>*Note:</b> JP6 jumper option.				

#### 4.1.5.2. USB Interface

The USB cable connects to J11 on the motherboard and provides both data and power.

This operation mode uses the standard factory jumper settings illustrated in Table 2 on page 7.

Installing a jumper on J23 enables the USB interface and disables the RS-232 interface. The USB interface is provided by U12. A USB driver for this chip is available for most PC and MAC operating systems on the CD.

#### 4.1.5.3. Direct Access Interface

The direct access interface header (J103) can be used to connect the motherboard to an embedded system.

If J103 is used in this manner, it is necessary to remove the jumper from JP23 to disable both the RS-232 and USB interface and prevent signal contention. See Table 5.

In this mode, the motherboard continue to supply a few other signals and functions such as power (derived from J8, J9, or USB) as well as a power-on reset signal and the telephone line connection via the exclusion relay contact and the RJ-11 jack connected to the modem line side.

J103 provides access to all the ISOModem system side signals available on the daughter card.

If the user wishes to go further and use his embedded system's power supply or reset line, he can remove the daughter card from the mother board and integrate it directly into his system.

## 4.1.6. Exclusion Relay

The exclusion relay (Figure 19) on the motherboard allows the modem to turn on the relay and exclude the phone line connection from an auxiliary device such as a telephone connected to the second RJ11 socket. The relay is enabled via jumper JP34.

The control signal used is the one called R1b and is managed by special command sequences (see application notes AN93 or AN244). R1b goes low to turn on the relay via a driver transistor.

See the diagram below for the location of the connectors and the relay.

Note that the R1b signal must be kept high during the reset pulse, due to the use of this pin for special manufacturing functions. This demands that this pin drive either an NMOS relay driver transistor or a 3.3 V referenced buffer like the one used here.

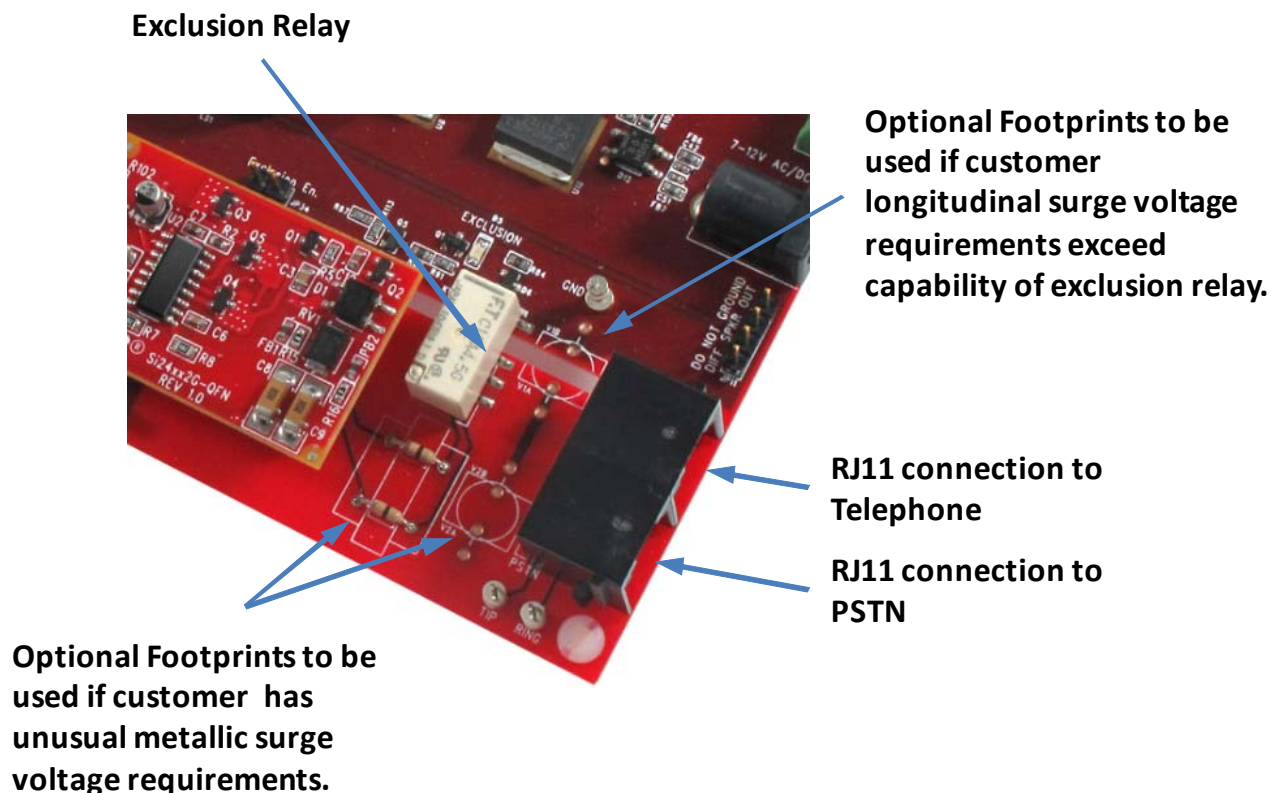


Figure 19. Exclusion Relay and Surge Protection



# Si2494/39/38/37/36/35/29/19/18/17FT18-EVB

## 4.1.7. Surge Protection Circuits

This evaluation board is designed to provide several possible levels of surge protection.

The ISModem alone does not need surge protection for a global implementation except for the components normally selected and implemented on the daughter card. These are the P3100B sidactor and the Y2 caps used for C1, C2, C8, and C9.

There are two basic reasons a customer may enhance this surge protection. The first is to protect the telephone exclusion relay, which often does not meet the same surge capability of the Y2 caps, and the second is to meet enhanced requirements put forth by customers and/or corporate guidelines.

Thus, footprints for either low-current 800 V or 1 kV high-current longitudinal GDTs are in place on the board (see Figure 20) to protect either the typical 2.5 kV exclusion relay or the 5 kV capacitors on the daughter card. But, note that the relay used on this motherboard is 5 kV rated (as are the capacitors) and does not need special protection. Regardless of which GDT is used by the customer, it is required to stay at 1 kV or less to control stress on the ISModem during the GDT arcing process.

For extra metallic protection where higher current surges are mandated, a GDT combined with a common-mode choke acting as a delay element is recommended. The choke protects the Sidactor due to its leakage inductance, allowing the metallic GDT to fire first. There are two possible GDTs shown in Figure 20, and the optimal one can be chosen by the trading of cost for current carrying capacity. When populated with capable ceramic parts, the motherboard and modem can survive 15 kV/ 2 Ω, 1.2/50 μs combination waveform, i.e. 7.5 kA surge current.

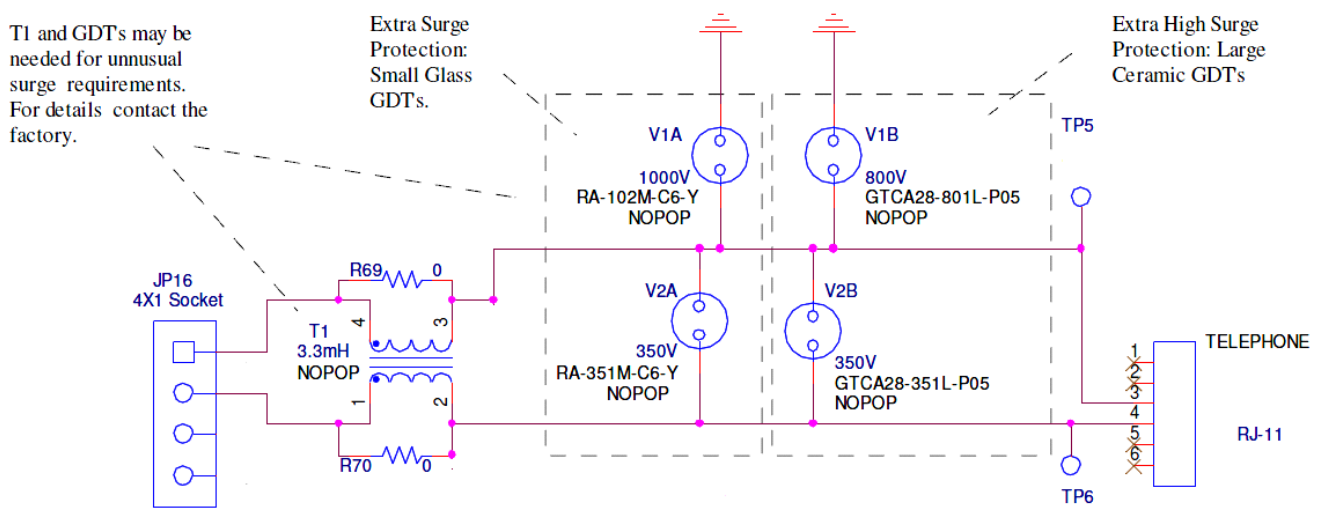
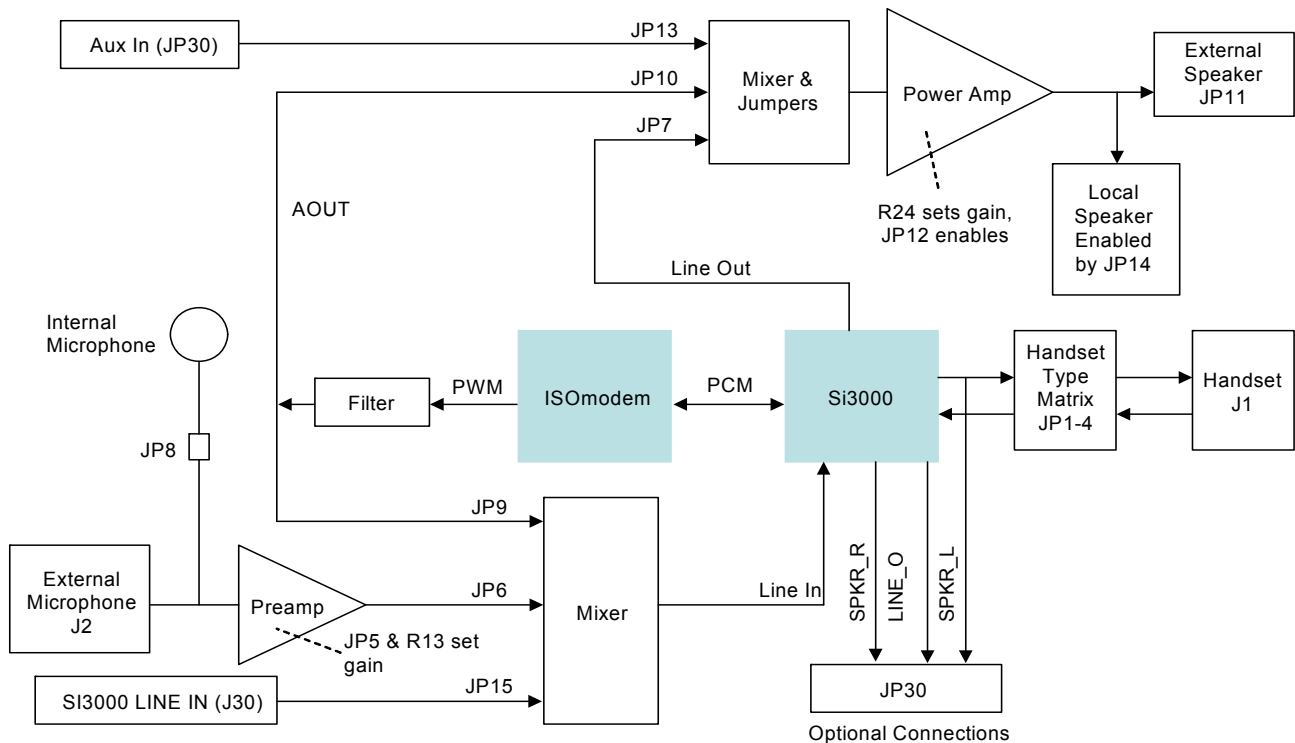


Figure 20. Optional Surge Protection Enhancement Circuits

## 4.1.8. The Sound System



**Figure 21. Sound System**

The sound system on the board is centered around the Si3000 code chip shown in the above diagram, and is designed to demonstrate handset operation as well as speakerphone and telephone answering machine operation.

The Si3000 links to the ISModem via a PCM bus that allows the transfer of audio between the modem and the various audio "peripherals" that the Si3000 links to the following:

- Loudspeaker
- Handset microphone and speaker
- Microphone
- Line In
- Line Out

### 4.1.8.1. The Power Amplifier and Loudspeaker

The Power amplifier on the global Voice ISModem EVB can drive a 4  $\Omega$  speaker with 300 mW of audio that has 3 possible sources:

- Si3000 Line out
- Aux in, J30 signal SPKR\_AUX\_IN (e.g., a customer system's generated beeps or ticks)
- Call progress analog signal from modem. (ISModem's call dialing and negotiation tones)

The power amplifier itself is a low cost, rugged 3.3 V bridge device, the LM4862M. Similar parts are available from other vendors.

The sources listed above can be independently turned off by jumpers JP7, 10, and 13 or be gain controlled with no interaction, by changing the value of the summing node current injection resistors' values.

The inverted input of this chip is used as a summing junction for an audio mixer for the inputs mentioned above and with gain control effected via the feedback resistor R24.