SocketModem® GSM
MTSMC-G1

Draft

Hardware Guide for Developers

MultiTech®
Systems

Hardware Guide for Developers
SocketModem® GSM – MTSMC-G1

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Record of Revisions

Revision	Date	Description
A	03/14/08	Initial release.
B	08/21/08	Updated the FCC statement on page 13.

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Chapter 1 – SocketModem GSM

Introduction

The SocketModem® GSM wireless modem is a complete, ready-to-integrate communications device that offers standards-based multi-band GSM/GPRS Class 10 performance. It is based on industry-standard open interfaces and utilizes Multi-Tech's universal socket design. This SocketModem includes an embedded TCP/IP protocol stack to bring embedded Internet connectivity to any device.

Product Features

- Embedded TCP/IP stack with UDP and PING support
- Short Message Services (SMS) Features:
- Text and PDU, Point-to-Point, Cell broadcast
- AT command compatible
- Advanced management features include phone book management, fixed dialing number, real time clock, and alarm management
- Large Memory SIM support to store/recall more than 127 text messages (SMS)
- Large Memory SIM support to store/recall more than 127 entries per phonebook
- Symstream multi-dimensional symbolic communication protocol
- Link Status (LS) LED and Signal Strength Indicator (SSI) LED on-board

Product Ordering Information

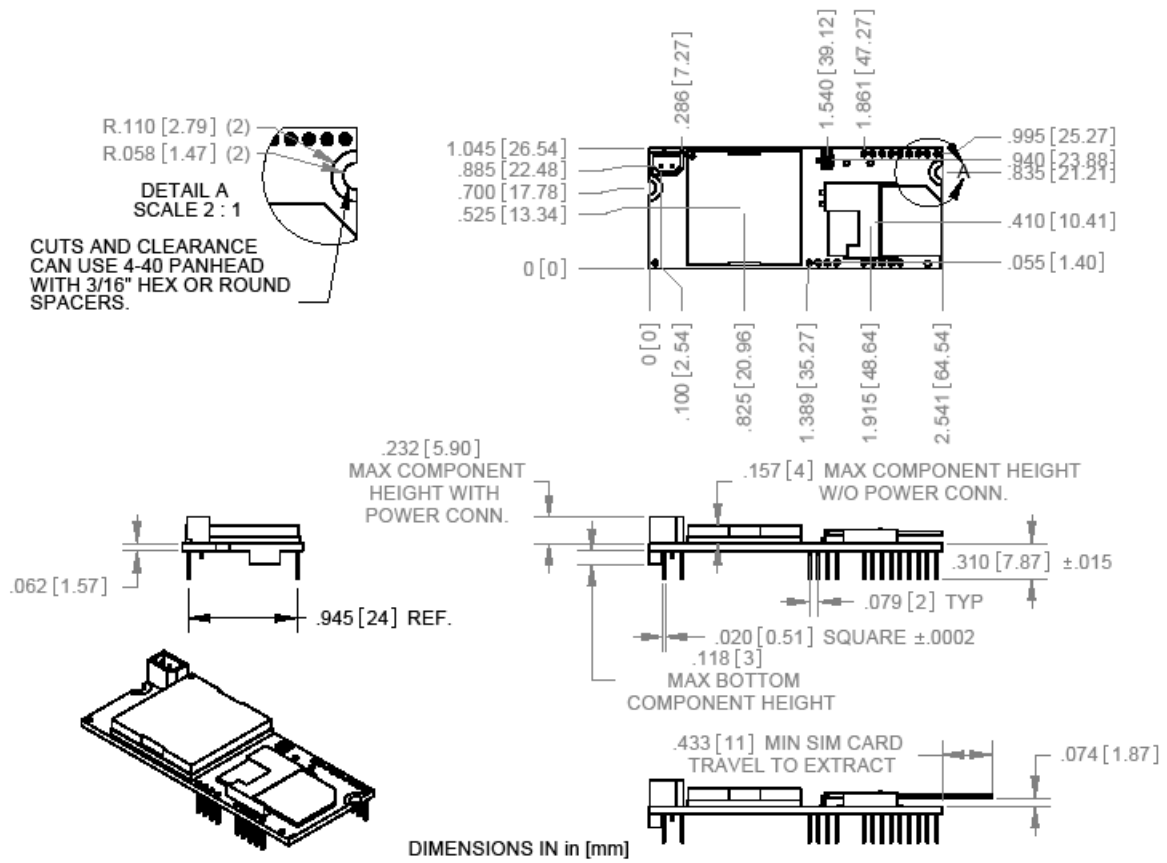| Product	Description	Region
MTSMC-G1	Quad-band GSM/GPRS SocketModem (850/1900 MHz Default)	Global
MTSMC-G1-ED	Quad-band GSM/GPRS SocketModem (900/1800 MHz Default)	Global
MTSMC-G1-SS	Quad-band GSM/GPRS SocketModem - Symstream Enabled (850/1900 MHz Default)	Global
MTSMC-G1-ED-SS	Quad-band GSM/GPRS SocketModem - Symstream Enabled (900/1800 MHz Default)	Global
MTSMC-G1-XP-SS	Quad-band GSM/GPRS SocketModem - Symstream Enabled - External Power (850/1900 MHz Default)	Global
MTSMC-G1-XP-ED-SS	Quad-band GSM/GPRS SocketModem - Symstream Enabled - External Power (900/1800 MHz Default)	Global

How to Read the Table Above

Build	Description
-G1	GSM/GPRS
-ED	Euro Default, 900/1800 MHz
-SS	Symstream Enabled
-XP	External Power Source

Technical Specifications

The SocketModem GSM meets the following specifications:

Category	Description
Standards	GPRS Class 10
Bandwidth	Quad-band 850/1900 or 900/1800 MHz GSM/GPRS
Serial/Data Speed	Serial interface supports DTE speeds to 921600 baud Packet data up to 85.6K bps Circuit-switched data (GPRS) up to 14.4K bps transparent and non-transparent
Data Format	Asynchronous, transparent and non-transparent
Data Error Correction	MNP2
Data Compression	V.42bis
Fax Compatibility	GSM
Fax Class	Class 1 and Class 2 Group 3
Dimensions	2.541" L x 1.045" W x 0.542" H (6.45cm x 2.65cm x 1.38cm) with SIM retracted 2.974" L x 1.045" W x 0.542" H (7.55cm x 2.65cm x 1.38cm) with SIM ejected
Weight	To be determined
Operating Temperature	-30° to +70° C (FCC certified operating temperature range is -30° to +50° C)
Storage Temperature	-40° to +85° C
Humidity	20% to 90% (non-condensing)
Operating Voltage	5VDC

Power Requirements	**5V:** Typical: To be determined (minimum 400mA)
	        Maximum Peak Current 2.0A
	       (Note: The VCC supply does not have to provide a constant high current but must accommodate the short current spikes of about 1154μs every 4.651ms.)

Connectors	Antenna: UFL button-type with maximum cable length of *TBD" (TBD cm)* SIM: Standard 1.8V and 3V SIM receptacle VCC/GND: Extra connector for retrofit situations in case VCC pin is not provided with enough current (must be same 5V source as VCC pin) and cable length must not cause more than *TBD* volts drop.
IP Protocols Supported	FTP client, ICMP, POP3 (receive mail), HTTP, SMTP (send mail), TCP/UDP socket: **To be determined at a later date.**

Approvals	**Safety Certifications**
	   UL 60950
	   cUL 60950
	   EN 60950
	   AS/NZS 60950:2000
	EMC Approvals
	   FCC Part 22, 24
	   ETSI EN 301 489-7
	Network
	   PTCRB

Warranty	Two years

Mechanical Dimensions

R.110 [2.79] (2)
R.058 [1.47] (2)

DETAIL A
SCALE 2 : 1

CUTS AND CLEARANCE
CAN USE 4-40 PANHEAD
WITH 3/16" HEX OR ROUND
SPACERS.

.286 [7.27]
1.540 [39.12]
1.861 [47.27]

1.045 [26.54]
.885 [22.48]
.700 [17.78]
.525 [13.34]

0 [0]

.995 [25.27]
.940 [23.88]
.835 [21.21]

.410 [10.41]

.055 [1.40]

0 [0]
.100 [2.54]
.825 [20.96]
1.389 [35.27]
1.915 [48.64]
2.541 [64.54]

.232 [5.90]
MAX COMPONENT
HEIGHT WITH
POWER CONN.

.157 [4] MAX COMPONENT HEIGHT
W/O POWER CONN.

.062 [1.57]

.945 [24] REF.

.310 [7.87] ±.015

.079 [2] TYP

.020 [0.51] SQUARE ±.0002
.118 [3]
MAX BOTTOM
COMPONENT HEIGHT

DIMENSIONS IN in [mm]

.433 [11] MIN SIM CARD
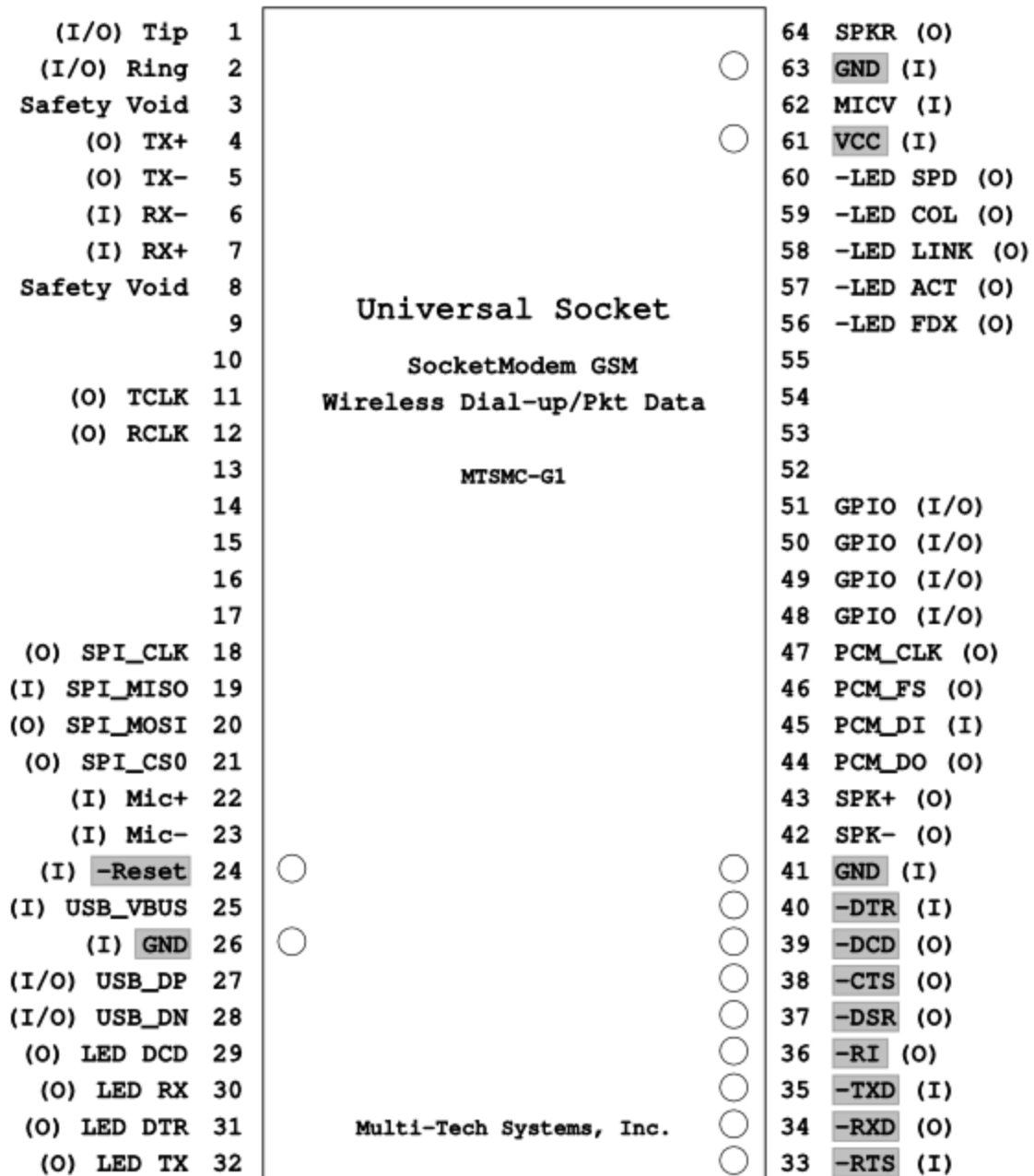TRAVEL TO EXTRACT

.074 [1.87]

SocketModem GSM Mechanical Drawing

SocketModem Configuration

Serial Configuration

Note: The **bolded, shaded pins** are the SocketModem GSM **active** pins.

```
     (I/O)  Tip    1                              64  SPKR  (O)
     (I/O)  Ring   2                 ○            63  GND  (I)
     Safety Void   3                              62  MICV  (I)
            (O) TX+   4              ○            61  VCC  (I)
            (O) TX-   5                            60  -LED SPD  (O)
            (I) RX-   6                            59  -LED COL  (O)
            (I) RX+   7                            58  -LED LINK  (O)
     Safety Void   8                              57  -LED ACT  (O)
                   9         Universal Socket     56  -LED FDX  (O)
                  10                              55
     (O)  TCLK   11       SocketModem GSM         54
     (O)  RCLK   12     Wireless Dial-up/Pkt Data 53
                  13                              52
                  14          MTSMC-G1            51  GPIO (I/O)
                  15                              50  GPIO (I/O)
                  16                              49  GPIO (I/O)
                  17                              48  GPIO (I/O)
     (O) SPI_CLK  18                              47  PCM_CLK (O)
     (I) SPI_MISO 19                              46  PCM_FS (O)
     (O) SPI_MOSI 20                              45  PCM_DI (I)
     (O) SPI_CS0  21                              44  PCM_DO (O)
         (I) Mic+ 22                              43  SPK+ (O)
         (I) Mic- 23                              42  SPK- (O)
     (I) -Reset   24    ○                    ○   41  GND (I)
     (I) USB_VBUS 25                          ○   40  -DTR (I)
         (I) GND  26    ○                    ○   39  -DCD (O)
     (I/O) USB_DP 27                          ○   38  -CTS (O)
     (I/O) USB_DN 28                          ○   37  -DSR (O)
     (O) LED DCD  29                          ○   36  -RI (O)
     (O) LED RX   30                          ○   35  -TXD (I)
     (O) LED DTR  31   Multi-Tech Systems, Inc. ○ 34  -RXD (O)
     (O) LED TX   32                          ○   33  -RTS (I)
```

Top View
SocketModem Pinout

Pinout Descriptions

Pin	Signal	In/Out	Description
24	-Reset	I	**Device Reset (with pull-up).** The active low -RESET input resets the device logic and returns the configuration of the device to the original factory default values or "stored values" in the NVRAM. -RESET is tied to VCC through a time-constant circuit for "Power-on-Reset" functionality. The module is ready to accept commands after about 6 seconds after power-on or reset. This signal is used to force a reset procedure by providing low level during reset of at least 500µs. The signal is considered an emergency reset only. A reset procedure is already driven by internal hardware during the power-up sequence. If no external reset is necessary, this input can be left open. If used (emergency reset), it has to be driven by an open collector or an open drain.
26	GND	I	**Logic Ground.**
33	-RTS	I	**Request to Sent (Active Low).** -RTS signal is used for hardware flow control. -RTS input ON (low) indicates that the DTE is ready to send data to the modem. In the command state, the modem ignores -RTS. **Note:** When the -RTS pin is not in use, it should be tied low.
34	-RXD	O	**Received Data.** The module uses the RXD line to send data to the DTE and to send module responses to the DTE. In command mode, -RXD data presents the module responses to the DTE. Module responses take priority over incoming data when the two signals are in competition for -RXD. When no data is transmitted, the signal is held in mark condition.
35	-TXD	I	**Transmitted Data.** The DTE uses the -TXD line to send data to the module for transmission or to transmit commands to the module. The DTE holds this circuit in mark state when no data is being transmitted or during intervals between characters.
36	-RI	O	**RING (Active Low).** Incoming ring signal from phone. **Ring Indicate.** -RI output ON (low) indicates the presence of an ON segment of a ring signal on the telephone line. The modem will not go off-hook when -RI is active; the modem waits for -RI to go inactive before going off-hook.
37	-DSR	O	**Data Set Ready (Active Low).** -DSR indicates module status to the DTE. -DSR OFF (high) indicates that the DTE is to disregard all signals appearing on the interchange circuits except Ring Indicator (-RI). It reflects the status of the local data set and does not indicate an actual link with any remote data equipment.
38	-CTS	O	**Clear to Send (Active Low).** -CTS is controlled by the module to indicate whether or not the module is ready to transmit data. -CTS ON indicates to the DTE that signals on TXD will be transmitted. -CTS OFF indicates to the DTE that it should not transfer data on TXD.
39	-DCD	O	**Data Carrier Detect (Active Low).** -DCD output is ON (low) when a data connection is established and the module is ready to send/receive data.
40	-DTR	I	**Data Terminal Ready (Active Low).** The -DTR input is turned ON (low) when the DTE is ready to communicate. -DTR ON prepares the modem to be connected, and, once connected, maintains the connection. -DTR OFF places the modem in the disconnect state under control of the &Dn and &Qn commands. **Note:** When the -DTR pin is not in use, it should be tied low.
41	GND	I	**Logic Ground.**
61	VCC	I	**DC Input Power.** 5V DC power.
63	GND	I	**Analog Ground.** Analog ground is tied common with DGND on the SocketModem. To minimize potential ground noise issues, connect audio circuit return to AGND.

Electrical Characteristics and Power Consumption

Note: These are preliminary measurements.

Electrical Characteristics

5V DC Characteristics (VDD = 5V ± 0.25V) $_{VDDMAX}$ = 5.25V

Digital Inputs –DTR (40), –TXD (35), –RTS (33)	Input High Min 2.0V	Input Low Max 0.8V	
–RESET	Input High Min 2.0V	Input Low Max 0.5V	
Digital Outputs –DCD (39), –CTS (38), –DSR (37), –RI (36), –RXD (34)	Output High Min 4V	Output Low Max 0.4V	Current Drive: 2mA
Digital Input Capacitance			5 pF

Power Consumption

Power Consumption in EGSM900 and GSM850 @ 25 degrees C

	Conditions	I_{NOM}	I_{MAX}
+5V	During TX bursts @ 2W	1.2 A	1.3 A
+5V	Average @ 2W	250mA	320mA
+5V	Average @ 0.5W	180mA	200mA
+5V	Average idle mode	15mA	25mA

Power Consumption in GSM1800 & 1900 MHz @ 25 degrees C

	Conditions	I_{NOM}	I_{MAX}
+5V	During TX bursts @1W	1.1 A	1.2 A
+5V	Average @1W	210mA	235mA
+5V	Average @ 0.25W	165mA	185mA
+5V	Average idle mode	15mA	25mA

Power Consumption in EGSM/GPRS 900 MHz and GSM/GRPS 850 MHz Mode Class 10

	Conditions	I_{NOM}	I_{MAX}
+5V	During TX bursts @ 2W	1.2 A	1.3 A
+5V	Average @ 2W	420mA	470mA
+5V	Average @ 0.5W	280mA	320mA
+5V	Average idle mode	15mA	25mA

Power Consumption in GSM/GRPS 1800 MHz and GSM/GRPS 1900 MHz Class 10

	Conditions	I_{NOM}	I_{MAX}
+5V	During TX bursts @ 1W	1.1 A peak	1.2 A peak
+5V	Average @ 1W	350mA	400mA
+5V	Average @ 0.25W	180mA	210mA
+5V	Average idle mode	15mA	25mA

LED Indicators

The LEDs are used to indicate the working mode of the SocketModem. The LS LED indicates Network Link Status and Network Strength

Network – defined by WMP100

Signal	What Is Indicated
Off	Processor Off
On	Processor On – Not registered on the network
Slow Flash (on 200ms, off 2s)	Registered on network
Quick flash (on 200ms, off 600ms)	Registered on the network – Communication in progress
Very quick flash (on 100ms, off 200ms)	Bad software; software is bad or not compatible

Signal Strength

Signal	What Is Indicated
Off	Processor off or modem not registered on network
On	Good GSM signal (RSSI >= 12)
Quick flash (on 200ms, off 600ms)	Weak GSM signal (7 <= RSSI < 12)
Very quick flash (on 100ms, off 200ms)	Very weak or no GSM signal (RSSI < 7)

RF Interface

Radio Characteristics

	GSM 850	EGSM 900	GSM 1800	GSM 1900
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz
RF Power Stand	2W at 12.5% duty cycle	2W at 12.5% duty cycle	1W at 12.5% duty cycle	1W at 12.5% duty cycle
Impedance	50 ohms			
VSWR	<2			
Typical Radiated Gain	0 dBi on azimuth plane			

RF Performances

RF performances are compliant with the ETSI recommendation 05.05 and 11.10.
The main parameters are:

Receiver Features
- EGSM Sensitivity : < -104 dBm
- GSM 1800/GSM 1900 Sensitivity : < -102 dBm
- Selectivity @ 200 kHz : > +9 dBc
- Selectivity @ 400 kHz : > +41 dBc
- Dynamic range : 62 dB
- Intermodulation : > -43 dBm
- Co-channel rejection : + 9 dBc

Transmitter Features
- Maximum output power (EGSM) : 33 dBm ± 2 dB
- Maximum output power (DCS/PCS) : 30 dBm ± 2 dB
- Minimum output power (EGSM): 5 dBm ± 5 dB
- Minimum output power (DCS/PCS): 0 dBm ± 5 dB
- H2 level : < -30 dBm
- H3 level : < -30 dBm
- Noise in 925 - 935 MHz : < -67 dBm
- Noise in 935 - 960 MHz : < -79 dBm
- Noise in 1805 - 1880 MHz : < -71 dBm
- Phase error at peak power : < 5 ° RMS
- Frequency error : ± 0.1 ppm max

RF Connection

The RF connector on the SocketModem GSM is a UFL standard type. An antenna can be directly connected through a mating UFL to SMA adapter.

Upgrading Firmware

Upgrading the Firmware will be addressed in a later revision of this document.

Chapter 2 – The Antenna System

Antenna System for Embedded GSM Modems

The antenna system for use with the GSM modem includes a coax cable to interface between the UFL connection on the modem and the antenna.
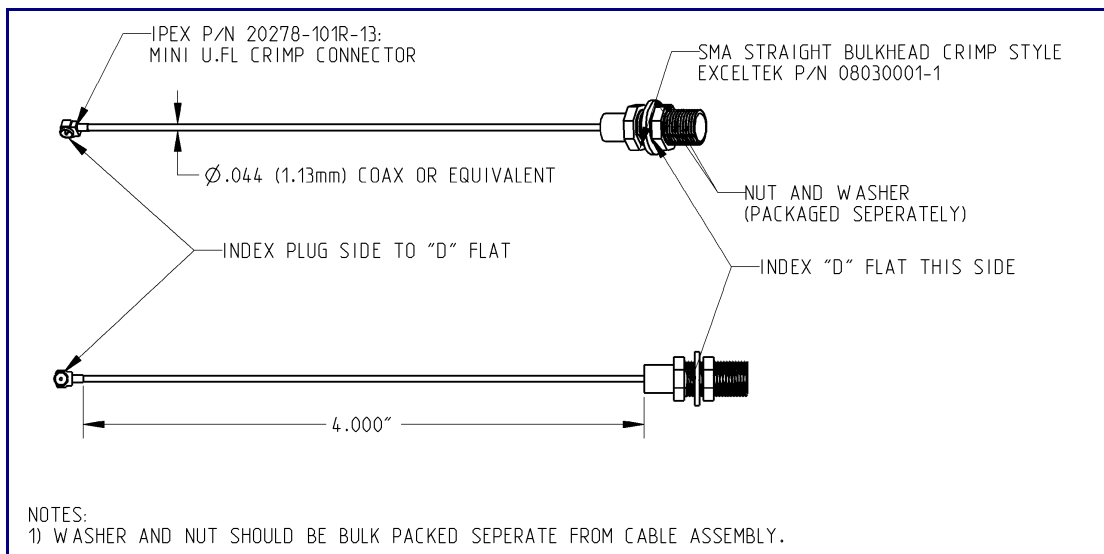
RF Specifications

GSM/EGSM RF Specifications

	GSM 850	EGSM 900	GSM 1800	GSM 1900
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz
RF Power Stand	2W at 12.5% duty cycle	2W at 12.5% duty cycle	1W at 12.5% duty cycle	1W at 12.5% duty cycle

Coax Cable

An optional 6" antenna cable (SMA Jack to UFL Plug) can be ordered from **Multi-Tech Systems, Inc.**

Part Number   **Description**
CASMA-UFL-1   SMA to UFL COAX RF 6 inch cable (Single Pack)
CASMA-UFL-10   SMA to UFL COAX RF 6 inch cable (Ten Pack)

Cable Specifications

Cable Type: Dia. 1.13mm Coaxial Cable
Attenuation: <1.0db
Connector Impedance: 50 ohm

Antenna

GSM Antenna Requirements/Specifications

Frequency Range:	824 – 960 MHz / 1710 – 1990 MHz
Impedance:	50 ohm
VSWR:	<2.0:1
Typical Radiated Gain:	0 dBi on azimuth plane
Radiation:	Omni
Polarization:	Vertical
Wave:	Half Wave Dipole

Antennas Available from Multi-Tech:

Quad Band Description	Qty	Part Number
Hinged Right Angle 800/900/1800/1900 MHz Cellular Modem Antenna	1	ANQB-1HRA
Hinged Right Angle 800/900/1800/1900 MHz Cellular Modem Antenna	10	ANQB-10HRA
Hinged Right Angle 800/900/1800/1900 MHz Cellular Modem Antenna	50	ANQB-50HRA

PTCRB Requirements Note:

There cannot be any alteration to the authorized antenna system. The antenna system must be the same type with similar in-band and out-of-band radiation patterns and maintain the same specifications.

FCC Requirements Note:

The antenna gain, including cable loss, must not exceed 3.1 dBi at 1900 MHz / 0.9 dBi at 850 MHz for mobile operating configurations and 7.1 dBi at 1900 MHz / 0.9 dBi at 850 MHz for fixed mounted operations, as defined in 2.1091 and 1.1307 of the rules for satisfying RF exposure compliance.

Chapter 3 – Design Considerations

Noise Suppression Design Considerations

Engineering noise-suppression practices must be adhered to when designing a printed circuit board (PCB) containing the SocketModem module. Suppression of noise is essential to the proper operation and performance of the modem itself and for surrounding equipment.

Two aspects of noise in an OEM board design containing the SocketModem must be considered: on-board/off-board generated noise that can affect digital signal processing. Both on-board and off-board generated noise that is coupled on-board can affect interface signal levels and quality. Of particular concern is noise in frequency ranges affecting modem performance.

On-board generated electromagnetic interference (EMI) noise that can be radiated or conducted off-board is a separate, but equally important, concern. This type of noise can affect the operation of surrounding equipment. Most local government agencies have stringent certification requirements that must be met for use in specific environments.

Proper PC board layout (component placement, signal routing, trace thickness and geometry, etc.) component selection (composition, value, and tolerance), interface connections, and shielding are required for the board design to achieve desired modem performance and to attain EMI certification.

Other aspects of proper noise-suppression engineering practices are beyond the scope of this designer guide. The designer should consult noise suppression techniques described in technical publications and journals, electronics and electrical engineering text books, and component supplier application notes.

PC Board Layout Guidelines

In a 4-layer design, provide adequate ground plane covering the entire board. In 4-layer designs, power and ground are typically on the inner layers. All power and ground traces should be 0.05 inches wide.

The recommended hole size for the SocketModem pins is 0.036 in. +/-0.003 in. in diameter. Spacers can be used to hold the SocketModem vertically in place during the wave solder process. A spacer should be placed on pin 32 and pin 64 of the SocketModem. A suggested part number for the spacer is BIVAR 938-0.130 for P1 (0.310in) option SocketModems. The spacers can be left on permanently and will not effect operation.

All creepages and clearances for the SocketModem have been designed to meet requirements of safety standards EN60950 or EN60601. The requirements are based on a working voltage of 125V or 250V. When the recommended DAA* circuit interface is implemented in a third party design, all creepage and clearance requirements must be strictly followed in order to meet safety standards. The third party safety design must be evaluated by the appropriate national agency per the required specification.

User accessible areas: Based on where the third party design is to be marketed, sold, or used, it may be necessary to provide an insulating cover over all TNV exposed areas. Consult with the recognized safety agency to determine the requirements.

Note: Even if the recommended design considerations are followed, there are no guarantees that a particular system will comply with all the necessary regulatory requirements. It is imperative that specific designs be completely evaluated by a qualified/recognized agency.

*DAA stands for Data Access Arrangement. DAA is the telephone line interface of the module.

Electromagnetic Interference (EMI) Considerations

The following guidelines are offered specifically to help minimize EMI generation. Some of these guidelines are the same as, or similar to, the general guidelines but are mentioned again to reinforce their importance. In order to minimize the contribution of the SocketModem-based design to EMI, the designer must understand the major sources of EMI and how to reduce them to acceptable levels.

1. Keep traces carrying high frequency signals as short as possible.
2. Provide a good ground plane or grid. In some cases, a multilayer board may be required with full layers for ground and power distribution.
3. Decouple power from ground with decoupling capacitors as close to the SocketModem module power pins as possible.
4. Eliminate ground loops, which are unexpected current return paths to the power source and ground.
5. Decouple the telephone line cables at the telephone line jacks. Typically, use a combination of series inductors, common mode chokes, and shunt capacitors. Methods to decouple telephone lines are similar to decoupling power lines; however, telephone line decoupling may be more difficult and deserves additional attention. A commonly used design aid is to place footprints for these components and populate as necessary during performance/EMI testing and certification.
6. Decouple the power cord at the power cord interface with decoupling capacitors. Methods to decouple power lines are similar to decoupling telephone lines.
7. Locate high frequency circuits in a separate area to minimize capacitive coupling to other circuits.
8. Locate cables and connectors so as to avoid coupling from high frequency circuits.
9. Lay out the highest frequency signal traces next to the ground grid.
10. If a multilayer board design is used, make no cuts in the ground or power planes and be sure the ground plane covers all traces.
11. Minimize the number of through-hole connections on traces carrying high frequency signals.
12. Avoid right angle turns on high frequency traces. Forty-five degree corners are good; however, radius turns are better.
13. On 2-layer boards with no ground grid, provide a shadow ground trace on the opposite side of the board to traces carrying high frequency signals. This will be effective as a high frequency ground return if it is three times the width of the signal traces.
14. Distribute high frequency signals continuously on a single trace rather than several traces radiating from one point.

Electrostatic Discharge Control

All electronic devices should be handled with certain precautions to avoid damage due to the accumulation of static charge.

See the ANSI/ESD Association Standard (ANSI/ESD S20.20-1999) – a document "for the Development of an Electrostatic Discharge Control for Protection of Electrical and Electronic Parts, Assemblies and Equipment." This document covers ESD Control Program Administrative Requirements, ESD Training, ESD Control Program Plan Technical Requirements (grounding/bonding systems, personnel grooming, protected areas, packaging, marking, equipment, and handling), and Sensitivity Testing.

Multi-Tech Systems, Inc. strives to follow all of these recommendations. Input protection circuitry has been incorporated into the Multi-Tech devices to minimize the effect of this static buildup, proper precautions should be taken to avoid exposure to electrostatic discharge during handling.

Multi-Tech uses and recommends that others use anti-static boxes that create a faraday cage (packaging designed to exclude electromagnetic fields). Multi-Tech recommends that you use our packaging when returning a product and when you ship your products to your customers.

Chapter 4 – Safety and Regulatory Compliance

Safety Notices and Warnings

Note to OEMs: The following safety statements may be used in the documentation of your final product applications.

Telecom Safety Warning

1. Never install telephone wiring during a lightning storm.
2. Never install a telephone jack in wet locations unless the jack is specifically designed for wet locations.
3. This product is to be used with UL and cUL listed computers.
4. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
5. Use caution when installing or modifying telephone lines.
6. Avoid using a telephone during an electrical storm. There may be a remote risk of electrical shock from lightning.
7. Do not use a telephone in the vicinity of a gas leak.
8. To reduce the risk of fire, use only 26 AWG or larger telecommunication line cord.
9. This product must be disconnected from its power source and telephone network interface when servicing.

Wireless Safety

General Safety

The modem is designed for and intended to be used in fixed and mobile applications. "Fixed" means that the device is physically secured at one location and is not able to be easily moved to another location. "Mobile" means that the device is designed to be used in other than fixed locations.

Caution: Maintain a separation distance of at least 20 cm (8 inches) is normally maintained between the transmitter's antenna and the body of the user or nearby persons. The Modem is not designed for or intended to be used in portable applications within 20 cm. (8 inches) of the body of the user.

RF Interference Issues

It is important to follow any special regulations regarding the use of radio equipment due in particular to the possibility of radio frequency, RF, interference. Please follow the safety advice given below carefully.

- Switch OFF your wireless modem when in an aircraft. The use of cellular telephones in an aircraft may endanger the operation of the aircraft, disrupt the cellular network and is illegal. Failure to observe this instruction may lead to suspension or denial of cellular telephone services to the offender, or legal action or both.
- Switch OFF your wireless modem when around gasoline or diesel-fuel pumps and before filling your vehicle with fuel.
- Switch OFF your wireless modem in hospitals and any other place where medical equipment may be in use.
- Respect restrictions on the use of radio equipment in fuel depots, chemical plants or where blasting operations are in progress.

- There may be a hazard associated with the operation of your wireless modem close to inadequately protected personal medical devices such as hearing aids and pacemakers. Consult the manufacturers of the medical device to determine if it is adequately protected.
- Operation of your wireless modem close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.

Vehicle Safety

- Do not use your wireless modem while driving.
- Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.
- If incorrectly installed in a vehicle, the operation of wireless modem telephone could interfere with the correct functioning of vehicle electronics. To avoid such problems, be sure that qualified personnel have performed the installation. Verification of the protection of vehicle electronics should be part of the installation.
- The use of an alert device to operate a vehicle's lights or horn on public roads is not permitted.

Maintenance of Your Modem

Your wireless modem is the product of advanced engineering, design, and craftsmanship and should be treated with care. The suggestions below will help you to enjoy this product for many years.

- Do not expose the wireless modem to any extreme environment where the temperature is above 50ºC or humidity is above 90% noncondensing.
- Do not attempt to disassemble the wireless modem. There are no user serviceable parts inside.
- Do not expose the wireless modem to water, rain, or spilled beverages. It is not waterproof.
- Do not place the wireless modem alongside computer discs, credit or travel cards, or other magnetic media. The phone may affect the information contained on discs or cards.
- The use of accessories not authorized by Multi-Tech or not compliant with Multi-Tech's accessory specifications may invalidate the warranty of the wireless modem.
- In the unlikely event of a fault in the wireless modem, contact Multi-Tech Tech Support.

Your Responsibility

This wireless modem is your responsibility. Please treat it with care respecting all local regulations. It is not a toy. Therefore, keep it in a safe place at all times and out of the reach of children.

Try to remember your Unlock and PIN codes. Become familiar with and use the security features to block unauthorized use and theft.

Certifications, Approvals, Compliance, and Requirements

Wireless Approvals

The Multi-Tech SocketModem is Industry and/or Carrier Approved as an End Product modem. When integrated and used with an antenna system that was part of the Multi-Tech modem certification, no additional approvals or certification are required (however, CDMA has a few exceptions) for the device you develop as long as the following are met:

- **PTCRB Requirements:**
  The antenna system **cannot** be altered.

- **Model Identification:**

> **IMPORTANT**
> When the wireless carrier asks you to provide the modem's model identification, give the Multi-Tech wireless model identification, not the identification of the host device.
> See the label example below.

The Multi-Tech model identification allows the carrier to verify the modem as one of its approved models.

This information is located on the modem's label.

Example:

The following is an example of Multi-Tech's wireless model identification:

MTSMC-G1 – Multi-Tech wireless GSM model identification.

The following is an example of what an end product label could look like. End product includes an integrated GSM modem:
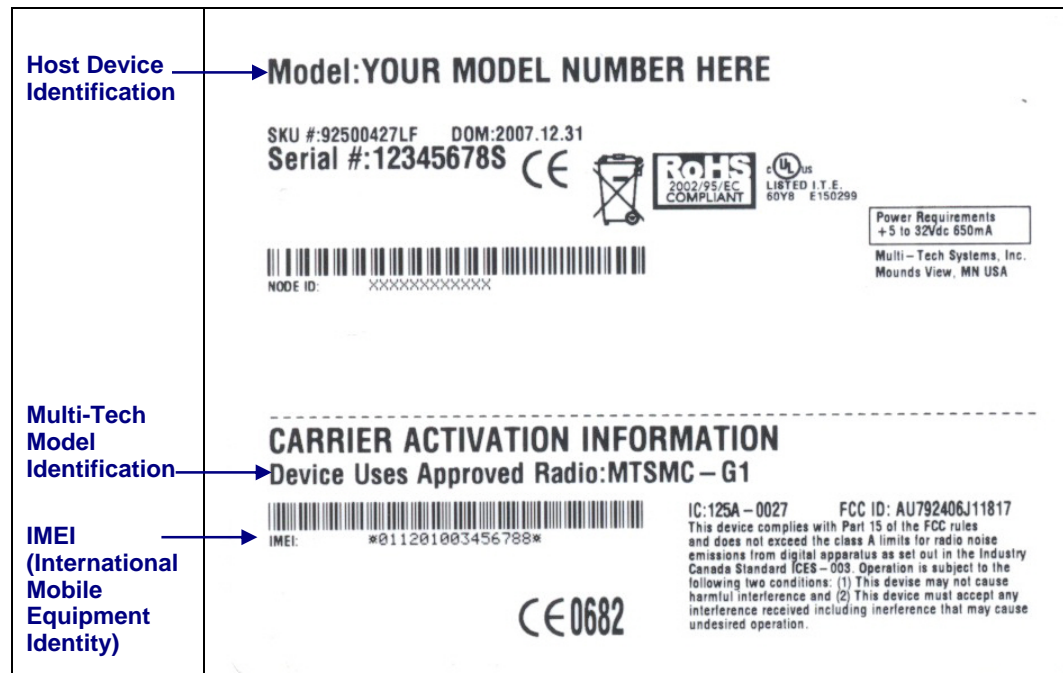
- **Other Information the Wireless Carrier Asks You to Provide:**

  The modem's 15-character IMEI (International Mobile Equipment Identity) number printed on the modem's label.

Regulatory Compliance Statements

$C\epsilon$

EMC, Safety, and R&TTE Directive Compliance

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility;
and
Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;
and
Council Directive 1999/5/EC of 9 March on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

International Modem Restrictions

Some dialing and answering defaults and restrictions may vary for international modems. Changing settings may cause a modem to become non-compliant with national telecom requirements in specific countries. Also note that some software packages may have features or lack restrictions that may cause the modem to become non-compliant.

EMC Requirements for the United States

FCC Part 15 Regulation

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Plug the equipment into an outlet on a circuit that is different from the one used by the receiver.
Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

WARNING – Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

EMC Requirements for Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Reglement Canadien sur le matériel brouilleur.

Waste Electrical and Electronic Equipment Statement

Note to OEMs: The statement is included for your information and may be used in the documentation of your final product applications.

WEEE Directive

The WEEE directive places an obligation on EU-based manufacturers, distributors, retailers, and importers to take-back electronics products at the end of their useful life. A sister Directive, ROHS (Restriction of Hazardous Substances) complements the WEEE Directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE Directive covers all Multi-Tech products imported into the EU as of August 13, 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the WEEE requirements.

Instructions for Disposal of WEEE by Users in the European Union

The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

July, 2005

Restriction of the Use of Hazardous Substances (RoHS)

Multi-Tech Systems, Inc.
Certificate of Compliance
2002/95/EC

Multi-Tech Systems Inc. confirms that its embedded products now comply with the chemical concentration limitations set forth in the directive **2002/95/EC** of the European Parliament (Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment - **RoHS**)

These Multi-Tech Systems, Inc. products do not contain the following banned chemicals:

Lead, [Pb] < 1000 PPM

Mercury, [Hg] < 1000 PPM

Hexavalent Chromium, [Cr+6] < 1000 PPM
Cadmium, [Cd] < 100 PPM

Polybrominated Biphenyl, [PBB] < 1000 PPM

Polybrominated Diphenyl Ether, [PBDE] < 1000 PPM

Moisture Sensitivity Level (MSL) =1

Tin Whisker Growth = None detected

Maximum Soldering temperature = 260C (wave only)

Notes:

1. Lead usage in some components is exempted by the following RoHS annex; therefore, higher lead concentration would be found in some modules (>1000ppm).
    a. Lead in high melting temperature type solders (i.e., tin-lead solder alloys containing more than 85% lead).
    b. Lead in electronic ceramic parts (e.g., piezoelectronic devices).
2. Moisture Sensitivity Level (MSL) – Analysis is based on the components/material used on the board.
3. Tin Whisker Study was done per NEMI guidelines (Elevated temperature cycle of 60°C and non-condensing relative humidity of 87% exposed to this environment for 1000 hours).

Information on HS/TS Substances According to Chinese Standards

In accordance with China's Administrative Measures on the Control of Pollution Caused by Electronic Information Products (EIP) # 39, also known as China RoHS, the following information is provided regarding the names and concentration levels of Toxic Substances (TS) or Hazardous Substances (HS) which may be contained in Multi-Tech Systems Inc. products relative to the EIP standards set by China's Ministry of Information Industry (MII).

Name of the Component	Hazardous/Toxic Substance/Elements					
	Lead (PB)	Mercury (Hg)	Cadmium (CD)	Hexavalent Chromium (CR6+)	Polybrominated Biphenyl (PBB)	Polybrominated Diphenyl Ether (PBDE)
Printed Circuit Boards	O	O	O	O	O	O
Resistors	X	O	O	O	O	O
Capacitors	X	O	O	O	O	O
Ferrite Beads	O	O	O	O	O	O
Relays/Opticals	O	O	O	O+	O	O
ICs	O	O	O	O	O	O
Diodes/ Transistors	O	O	O	O	O	O
Oscillators and Crystals	X	O	O	O	O	O
Regulator	O	O	O	O	O	O
Voltage Sensor	O	O	O	O	O	O
Transformer	O	O	O	O	O	O
Speaker	O	O	O	O	O	O
Connectors	O	O	O	O	O	O
LEDs	O	O	O	O	O	O
Screws, Nuts, and other Hardware	X	O	O	O	O	O
AC-DC Power Supplies	O	O	O	O	O	O
Software / Documentation CDs	O	O	O	O	O	O
Booklets and Paperwork	O	O	O	O	O	O
Chassis	O	O	O	O	O	O

X Represents that the concentration of such hazardous/toxic substance in all the units of homogeneous material of such component is higher than the SJ/Txxx-2006 Requirements for Concentration Limits.

O Represents that no such substances are used or that the concentration is within the aforementioned limits.

Information on HS/TS Substances According to Chinese Standards (in Chinese)

依照中国标准的有毒有害物质信息

根据中华人民共和国信息产业部 (MII) 制定的电子信息产品 (EIP)
标准－中华人民共和国《电子信息产品污染控制管理办法》（第 39 号），也称作中国
RoHS，下表列出了 Multi-Tech Systems, Inc. 产品中可能含有的有毒物质（TS）或有害物质
(HS) 的名称及含量水平方面的信息。

成分名称	有害/有毒物质/元素					
	铅 (PB)	汞 (Hg)	镉 (CD)	六价铬 (CR6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板	O	O	O	O	O	O
电阻器	X	O	O	O	O	O
电容器	X	O	O	O	O	O
铁氧体磁环	O	O	O	O	O	O
继电器/光学部件	O	O	O	O	O	O
IC	O	O	O	O	O	O
二极管/晶体管	O	O	O	O	O	O
振荡器和晶振	X	O	O	O	O	O
调节器	O	O	O	O	O	O
电压传感器	O	O	O	O	O	O
变压器	O	O	O	O	O	O
扬声器	O	O	O	O	O	O
连接器	O	O	O	O	O	O
LED	O	O	O	O	O	O
螺丝、螺母以及其它五金件	X	O	O	O	O	O
交流-直流电源	O	O	O	O	O	O
软件/文档 CD	O	O	O	O	O	O
手册和纸页	O	O	O	O	O	O
底盘	O	O	O	O	O	O

X 表示所有使用类似材料的设备中有害/有毒物质的含量水平高于 SJ/Txxx-2006 限量要求。

O 表示不含该物质或者该物质的含量水平在上述限量要求之内。

Chapter 5 – The SocketModem Developer Board

SocketModem Developer Board Block Diagram
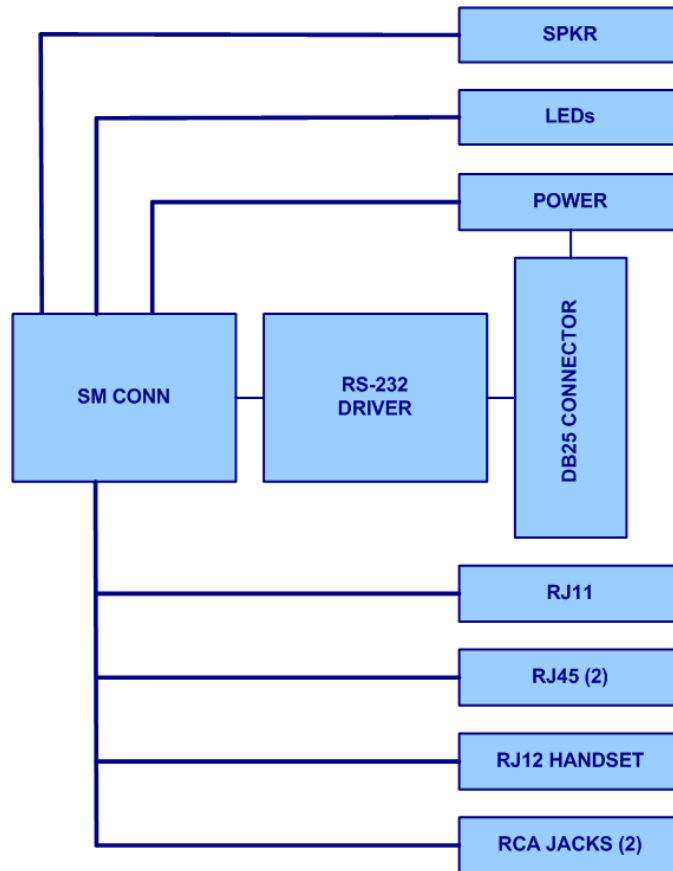
The Developer Board Components
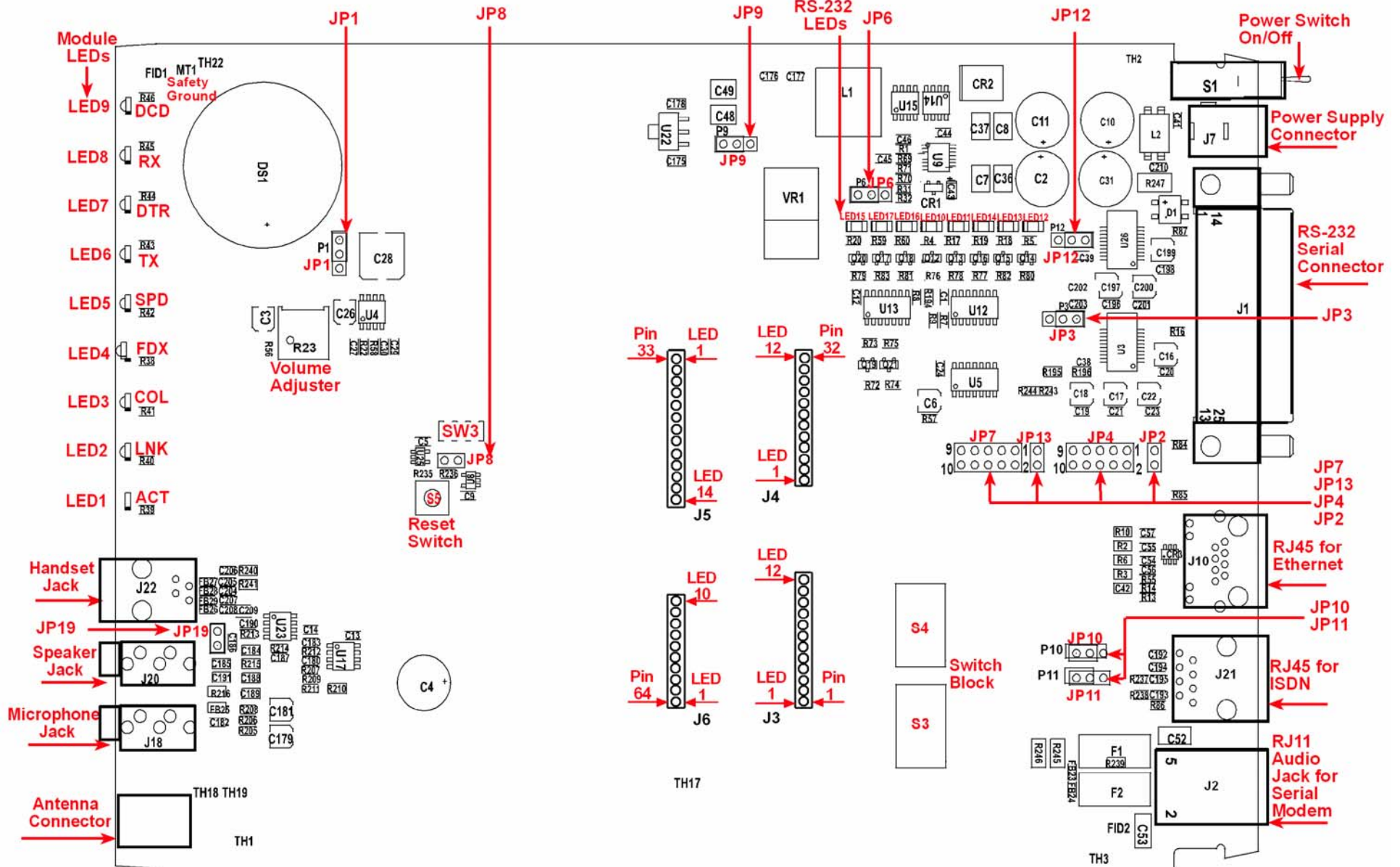
See the next page for a description of the Board Components.

Board Components

Jumper	Description
JP1	Mutes the speaker. Default positions are 1 and 2 (speaker is not muted).
JP2 & 4	Testing interface (debugging) for the RS-232 signals.
JP3	Changes the speed of the driver. For Multi-Tech use only. Default positions are 1 and 2 (transceiver operates normally).
JP6 & JP9	JP6 & JP9 are the 5V / 3.3V regulators. The operating voltage factory default setting is 3.3V. JP1 jumper must be set to 3.3V. **Warning** – Be sure to that 5V / 3.3V jumper is set to match the requirements of your SocketModem. If this jumper is set incorrectly, damage to the SocketModem and/or the Test/Demo card could result. **Caution** – Use only the provided Multi-Tech Systems, Inc. transformer with the Test/Demo board. Use of any other power source will void the warranty and will likely damage the Test/Demo board and the SocketModem. The transformer connector is keyed to prevent improper connection to the Test/Demo board.
JP7 & JP13	Testing interface (debugging) for the serial TTL signals.
JP8	Enables/disables the Watchdog interface.
JP10 & JP11	100 OHM terminator for ISDN. Default positions are 1 and 2 (off).
JP12	Ties the TX and RX clock lines together. Default positions are 1 and 2 (transmit and receiver clock act independently.
JP19	Allows a stereo jack feed. Default is ON. If ON, then left and right stereo channels are combined and form a mono channel.
Switch 3	Sets the alternate ISDN clock. Default position is OFF (the alternate ISDN clock is off).
Switch Block	Set the switch to the product being used.

Pins and Corresponding Signals

J4 and J7			
10	PWR	9	RI
8	CTS	7	RTS
6	DSR	5	GND
4	DTR	3	TXD
2	RXD	1	DCD

| J2 and J13			
2	RXC	1	TXC

Table of Switch Blocks

| Switch Blocks and Board Orientation	Module Style	Board Labels & Block Settings – S4	Board Labels & Block Settings – S3
	Non-ISDN SocketModems and SocketEthernet IP	"MODEM ETHERNET"	"MT ISDN / ETHERNET MODEM"
	Standard ISDN	"ALT ISDN MT ISDN"	"MT ISDN / ETHERNET MODEM"
	Alternate ISDN	"ALT ISDN MT ISDN"	"ALT ISDN"

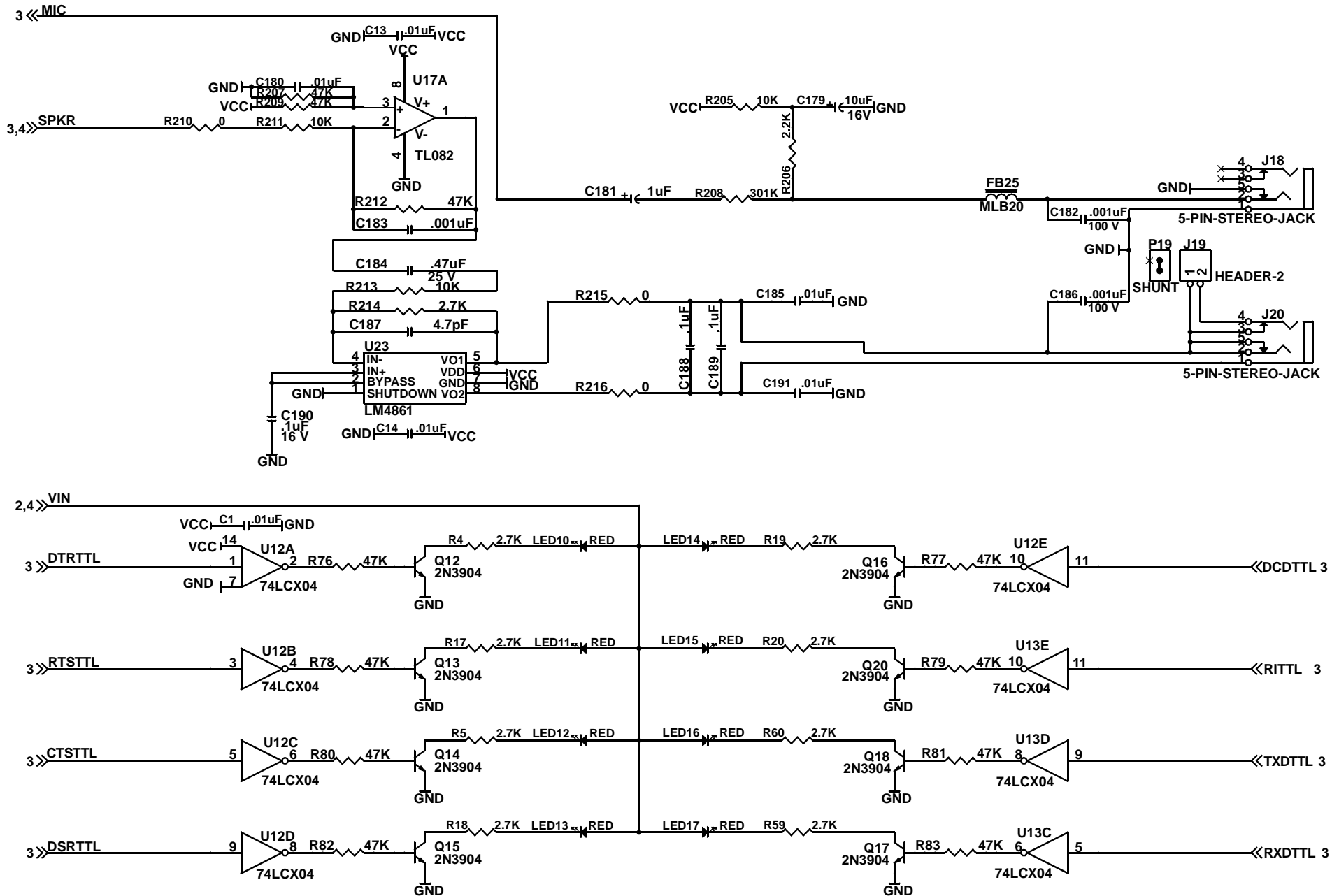Note: **ALT** stands for alternate ISDN

Developer Board Schematics
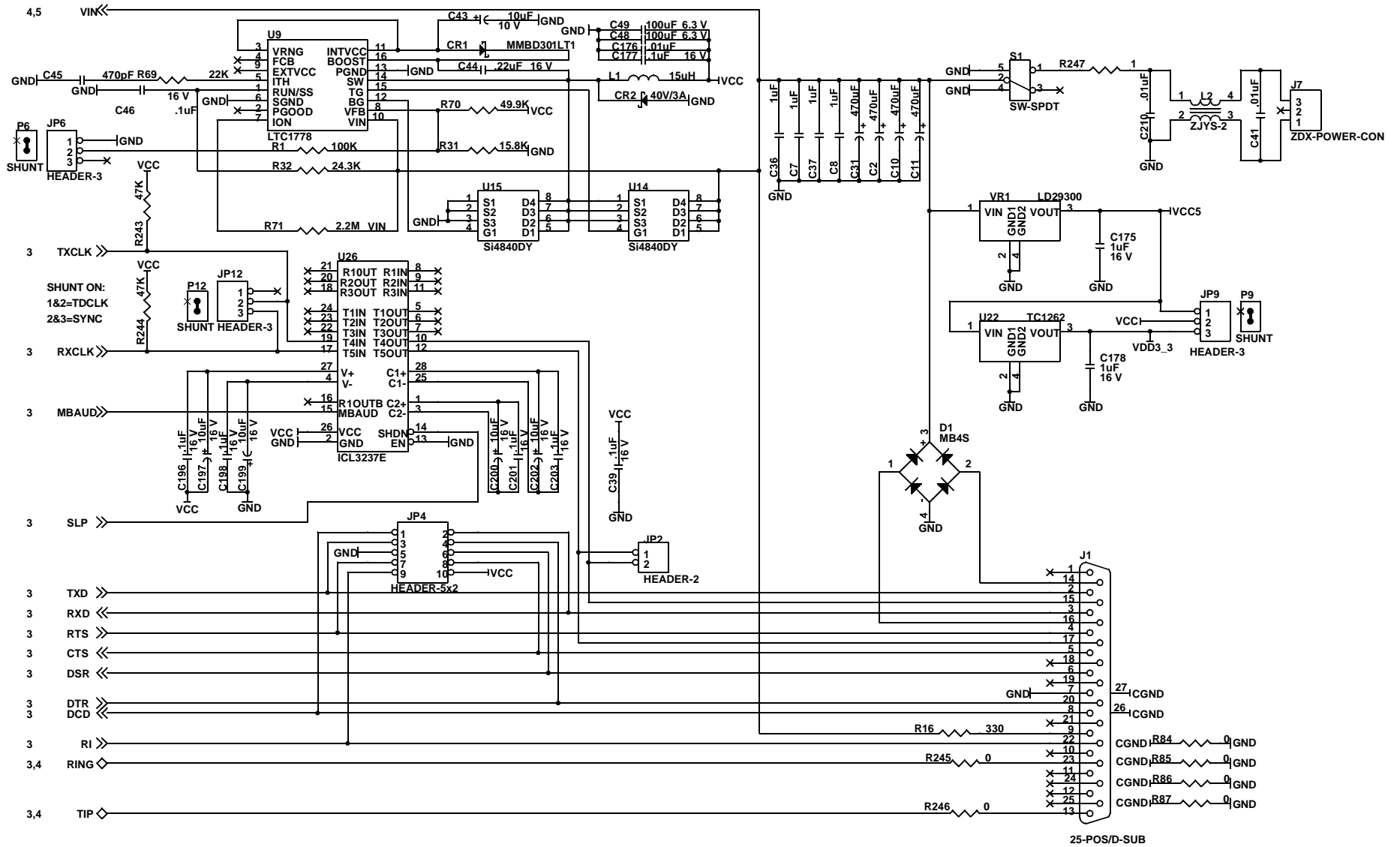
Developer Board Schematics
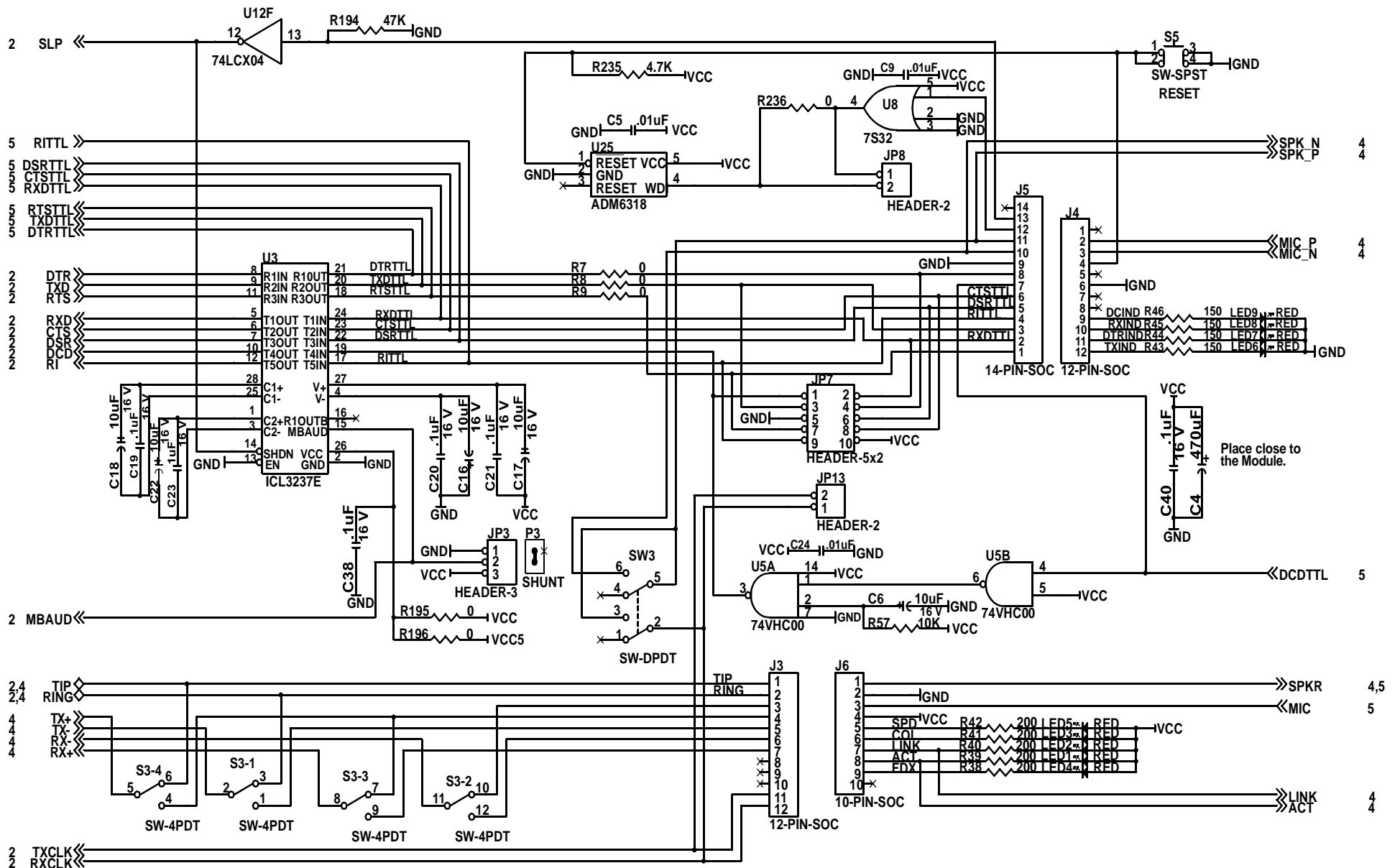
Developer Board Schematics
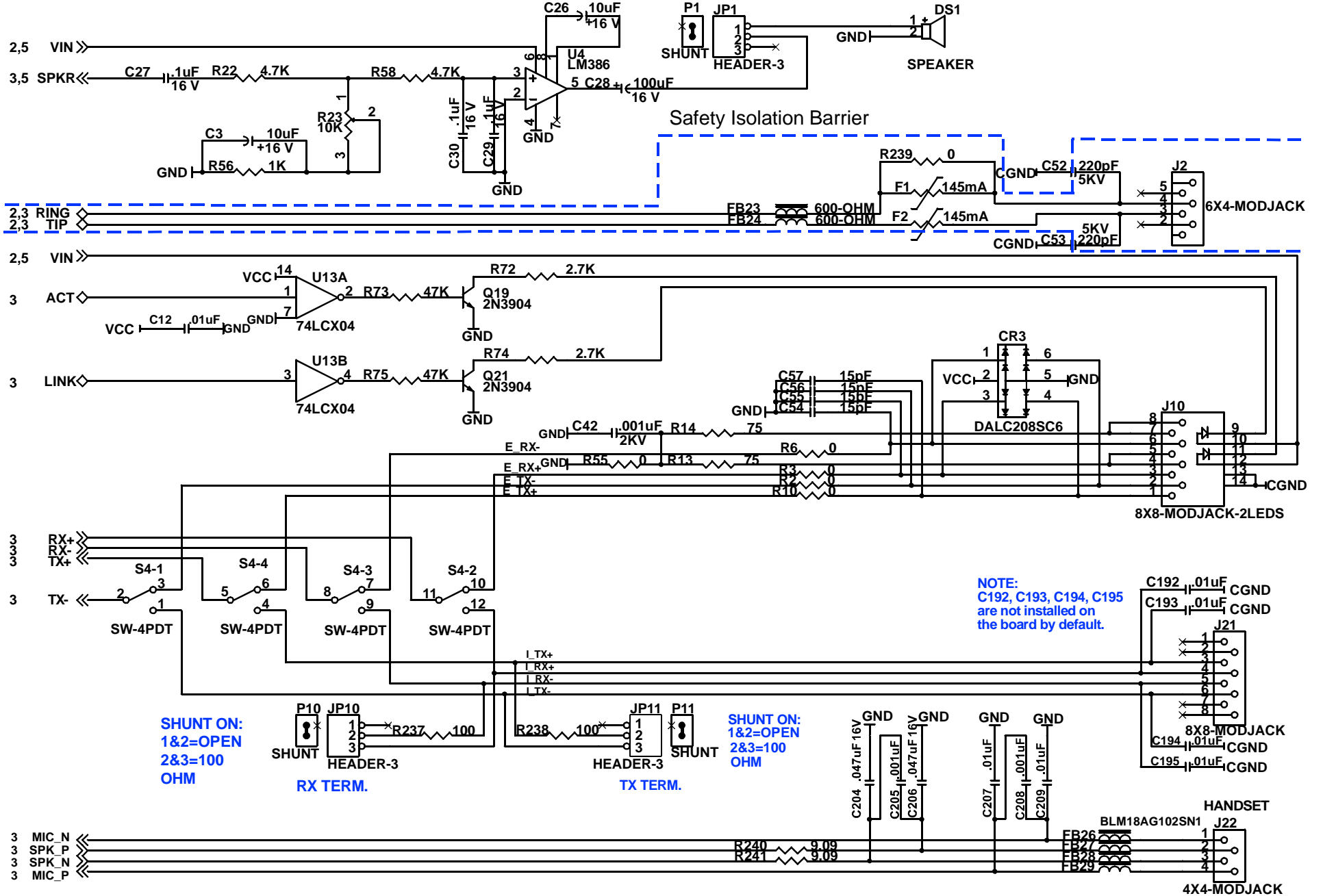
Developer Board Schematics

Chapter 6 – Multi-Tech Warranty Statement

The Multi-Tech Systems, Inc. Warranty Policy

Multi-Tech Systems, Inc., (hereafter "MTS") warrants that its products will be free from defects in material or workmanship for a period of two, five, or ten years (depending on model) from date of purchase, or if proof of purchase is not provided, two, five, or ten years (depending on model) from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by Customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory — transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PRICE FOR DEFECTIVE PRODUCTS.

Repair Procedures for U.S. and Canadian Customers

In the event that service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota factory:

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, MN 55112 U.S.A.
Attn: Repairs, Serial # _____

A Returned Materials Authorization (RMA) is not required. Return shipping charges (surface) will be paid by MTS to destinations in U.S. and Canada.

Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a payment in advance is required. Acceptable means of payment include credit card, wire transfer or a check in U.S. dollars drawn on a U.S. Bank.

For out of warranty repair charges, go to COMPANY/Policies/warranty/

Extended two-year overnight replacement service agreements are available for selected products. Please call MTS customer service at (888) 288-5470 or visit our web site at /PARTNERS/Programs/overnight_replacement/ for details on rates and coverages.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department at (800) 972-2439 or email support@multitech.com. Please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at (800) 328-9717 or (763) 717-5631, or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Customers (Outside U.S.A. and Canada)

Your original point-of-purchase Reseller may offer the quickest and most economical repair option for your Multi-Tech product. You may also contact any Multi-Tech sales office for information about the nearest distributor or other repair service for your Multi-Tech product. The Multi-Tech sales office directory is available at www.multitech.com/PARTNERS/Channels/offices/

In the event that factory service is required, products may be shipped, freight prepaid to our Mounds View, Minnesota factory. Recommended international shipment methods are via Federal Express, UPS or DHL courier services, or by airmail parcel post; shipments made by any other method will be refused. Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a payment in advance is required. Acceptable means of payment include credit card, wire transfer or a check in U.S. dollars drawn

on a U.S. Bank. Repaired units shall be shipped freight collect, unless other arrangements are made in advance.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department nearest you or email support@multitech.com. When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at +(763) 717-5631 in the U.S.A., or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Distributors

International distributors should contact their MTS International sales representative for information about the repair of Multi-Tech product(s).

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our International Technical Support department at +(763)717-5863. When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at +(763) 717-5631 in the U.S.A. or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Multi-Tech Systems, Inc., (hereafter "MTS") warrants that its products documented in the *Developer Guide* will be free from defects in material or workmanship for a period of two years from date of purchase; or, if proof of purchase is not provided, two years from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by Customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory — transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PRICE FOR DEFECTIVE PRODUCTS.

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