SocketModem® GSM

MTSME-G2

Draft

Hardware Guide for Developers

MultiTech Systems

Copyright

Trademarks

Patents

This device covered by one or more of the following patents: 6,031,867; 6,012,113; 6,009,082; 5,905,794; 5,864,560; 5,815,567; 5,815,503; 5,812,534; 5,809,068; 5,790,532; 5,764,628; 5,764,627; 5,754,589; 5,724,356; 5,673,268; 5,673,257; 5,644,594; 5,628,030; 5,619,508; 5,617,423; 5,600,649; 5,592,586; 5,577,041; 5,574,725; 5,559,793; 5,546,448; 5,546,395; 5,535,204; 5,500,859; 5,471,470; 5,463,616; 5,453,986; 5,452,289; 5,450,425; 5,355,365; 5,309,562; 5,301,274. Other Patents Pending.

Warranty and Repairs Statement

Please see the Multi-Tech Systems, Inc. Web site for the current Warranty and Repairs Statement.
http://www.multitech.com/COMPANY/Policies/warranty/

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Chapter 1 – SocketModem® Cell (MTSMC-G2) & SocketModem® iCell (MTSMC-G2-IP)

Introduction

The MTSMC-G2 is a serial to wireless quad-band GPRS SocketModem. It is a complete, ready-to-integrate SocketModem 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. The SocketModem is available with the Multi-Tech's *Universal IP*™ stack to bring embedded Internet connectivity to any device.

Notes about Activation:

- These units are shipped without network activation.
- To connect to the wireless network, you will have to establish a wireless account. See the Wireless Activation procedures on separate sheets included with the Developer Kit and available on the Developer Kit CD.

Product Build Options and Ordering Information

Product	Description	Region	Order This Product ✓
MTSMC-G2	Quad-band GPRS SocketModem Cell	US Default	
MTSMC-G2-ED	Quad-band GPRS SocketModem Cell	EU Default	
MTSMC-G2-V	Quad-band GPRS SocketModem Cell with Voice	US Default	
MTSMC-G2-V-ED	Quad-band GPRS SocketModem Cell with Voice	EU Default	
MTSMC-G2-IP	Quad-band GPRS SocketModem iCell with Universal IP	US Default	
MTSMC-G2-IP-ED	Quad-band GPRS SocketModem iCell with Universal IP	EU Default	
Developer Kit			
MTSMI-UDK	Universal Developer Kit	Global	

How to Read the Product Codes in the Table Above:

G2	GPRS
ED	European Default
V	Voice (microphone and speaker)
IP	Universal IP™ Stack
UDK	Universal Developer Kit

Other Product Codes:

The complete product code may end in **.Rx**. For example, MTSMC-G2.Rx.
"R" indicates product revision. "*x*" is the revision number.
Note: All products can be ordered in single packs or 50-packs. Single pack product codes end in **SP**.

AT Commands Reference Guides

Products	AT Commands Reference Guide Title & Document Number	Fax Commands	Voice Commands
SocketModem Cell (MTSMC-G2 and MTSMC-G2-V)	GPRS AT Commands for Multi-Tech G2 Wireless Modems **(S000463x)** AT Commands for Multi-Tech G2 Wireless Modems with IP Connectivity **(S000469x)**	NA	Included
SocketModem iCell (MTSMC-G2-IP)	GPRS AT Commands for Multi-Tech G2 Wireless Modems **(S000463x)** Universal IP Commands **(S000457x)**	NA	Included

Technical Specifications

The MTSMC-G2 and MTSMC-G2-IP SocketModems meet the following specifications:

Category	*Description*
Standards	GPRS Class 10
Frequency Bands	Quad-band GSM/EGPRS 850/900/1800/1900 MHz
Serial/Data Speed	Serial interface supports DTE speeds up to 921.6K IP interface supports DTE speeds at the fixed rate of 115.2 Packet data up to 85.6K bps Circuit-switched data (GPRS) up to 14.4K bps transparent and non-transparent Supports data rates of 921600, 460800, 230400, 115200 bps
Data Format	10 bit Serial Asynchronous
Data Error Correction	MNP2
Data Compression	V.42bis
Weight	1 oz. (28 g)
Size	3.15" x 1.375" (80.010 mm x 34.925 mm)
Operating Temperature	-40° C to +85° C
Storage Temperature	-40 °C to +85°C
Humidity	10% to 90%
Input Power	5VDC
Operating Voltage	Supply Range: VCC Maximum: 5.5
Voltage at Any Signal Pin	Minimum: GND Maximum: VCC
Antenna Connector	Surface mount UFL
SIM Holder	Standard 3V SIM holder
IP Protocols Supported	**MTSMC-G2** DNS Resolve, FTP client, LCP, PPP (dial-out),TCP socket, UDP socket, PAP & CHAP authentication **MTSMC-G2-IP** DNS Resolve, FTP client, Ping, POP3 client, PPP (dial-out), SMTP, TCP RAW client & server, UDP RAW client & server, PAP & CHAP authentication
M2M Applications	**MTSMC-G2-IP** Automatic connect/reconnect, device monitor, modem emulation, Ping & TCP keep alive, wake-up on caller ID, wake-up on ring
Compliance	**EMC Compliance** FCC Part 15 EN55022 EN55024 **Radio Compliance** FCC Part 22 FCC Part 24 RSS 132 RSS 133 EN 301 511 EN 301 489-1 EN 301 489-7 AS/ACIF S042.1 AS/ACIF S042.3 **Safety Compliance** UL 60950-1 cUL 60950-1 EN 60950-1 AS/NZS 60950-1 **Network Compliance** PTCRB GCF
Warranty	Two years

Comment [DAR1]: From Dustin 6/24/09

Comment [DAR2]: From Dustin 6/24/09

Specifications Continued:

Category	Description
Features	Modes of Operation: Data Mode, Command Mode, and Voice Mode Embedded TCP/IP stack Short Message Services (SMS) RTS/CTS hardware flow control AT command compatible Support for HR, FR, EFR, and AMR (Adaptive Multi Rate) voice codec support Flash upgradeable Non-volatile memory

Electrical Characteristics

Units: Volts

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

Parameter	Minimum	Maximum
Digital Signal Input Low Level –DTR (40), –TXD (35), –RTS (33)	GND	0.8
Digital Signal Input High Level –DTR (40), –TXD (35), –RTS (33)	2	Vcc
Digital Signal Output Low Level –DCD (39), –CTS (38), –DSR (37), –RI (36), –RXD (34)		0.4
Digital Signal Output High Level –DCD (39), –CTS (38), –DSR (37), –RI (36), –RXD (34)	3.84	
Reset (Low Active) Input Low Level –Reset (24)		0.8
Reset (Low Active) Input High Level –Reset (24)	2	
Digital Input Capacitance		14pF

Power Consumption

MTSMC-G2 Measured Power* Measures at Input Voltage 5.00

	Sleep	Typical	Maximum	Peak
Current (AMPS)	0.049	0.113	0.24	1.10
Watts	0.245	0.564	1.195	

Comment [DAR3]: Measurements for MTSMC-G2-IP 73120965 Rev 0 from Tom Fix. He suggested the current peak text also 4/22/09. He said these measurements apply to G2 without IP, too.

MTSMC-G2-IP Measured Power* Measures at Input Voltage 5.00

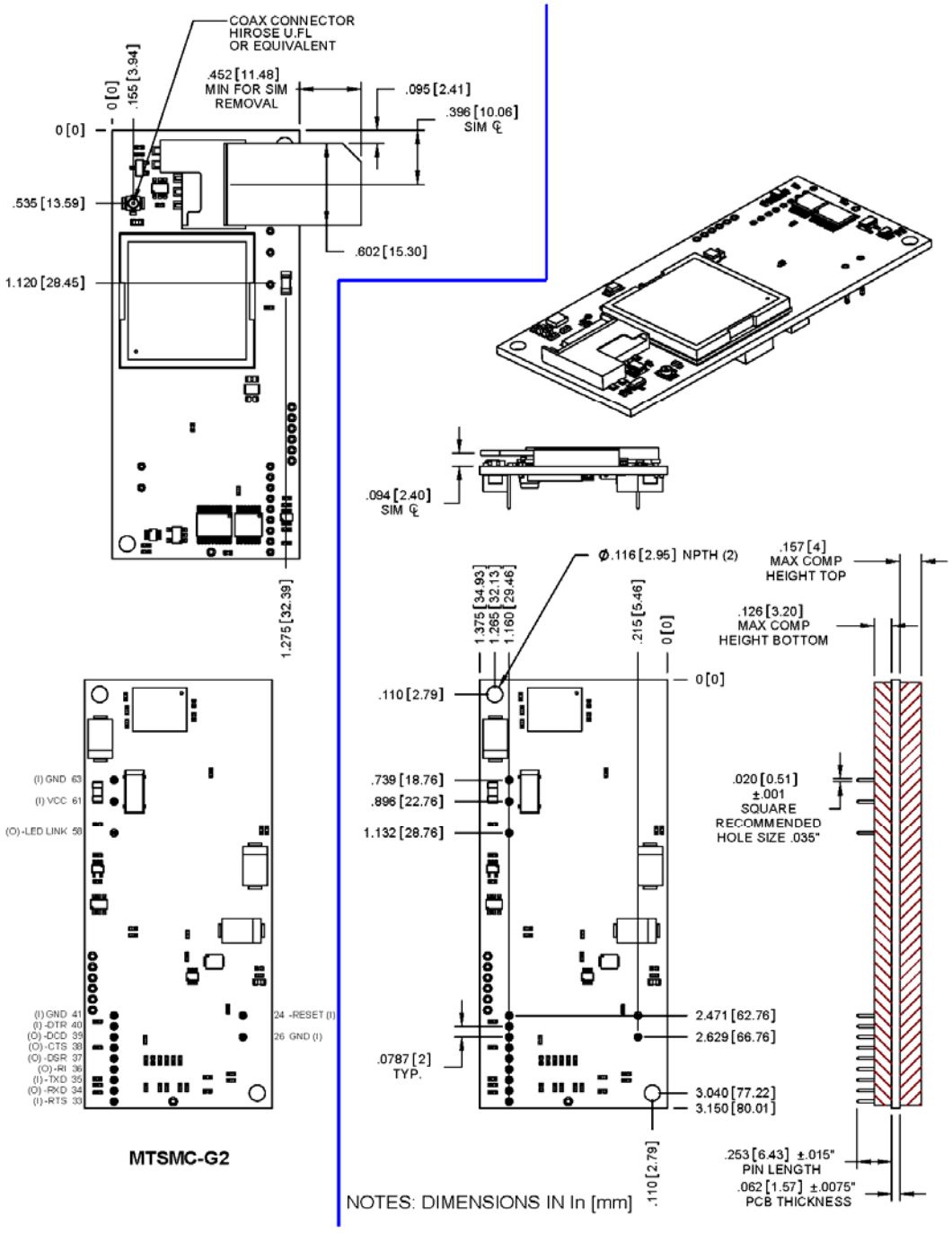
	Sleep	Typical	Maximum	Peak
Current (AMPS)	0.080	0.135	0.280	1.250
Watts	0.382	0.664	1.358	

Comment [DAR4]: Measurements for MTSMC-G2-IP 73120965 Rev 0 from Tom Fix. He suggested the current peak text also 4/22/09. He said these measurements apply to G2 without IP, too.

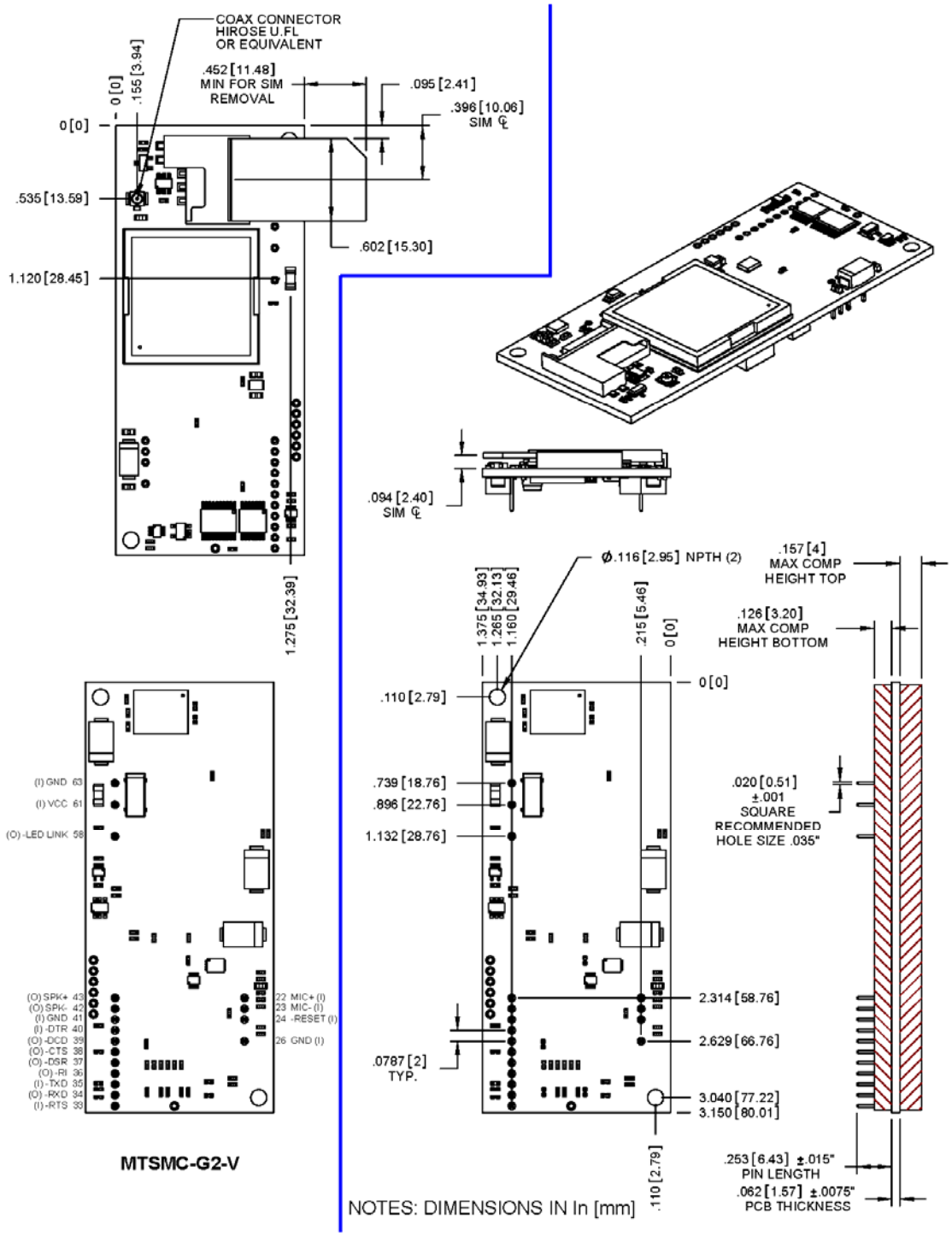
Note: *Current Peak = 1500mA maximum during Tx burst.*

* Multi-Tech Systems, Inc. recommends that the customer incorporate a 10% buffer into their power source when determining product load.

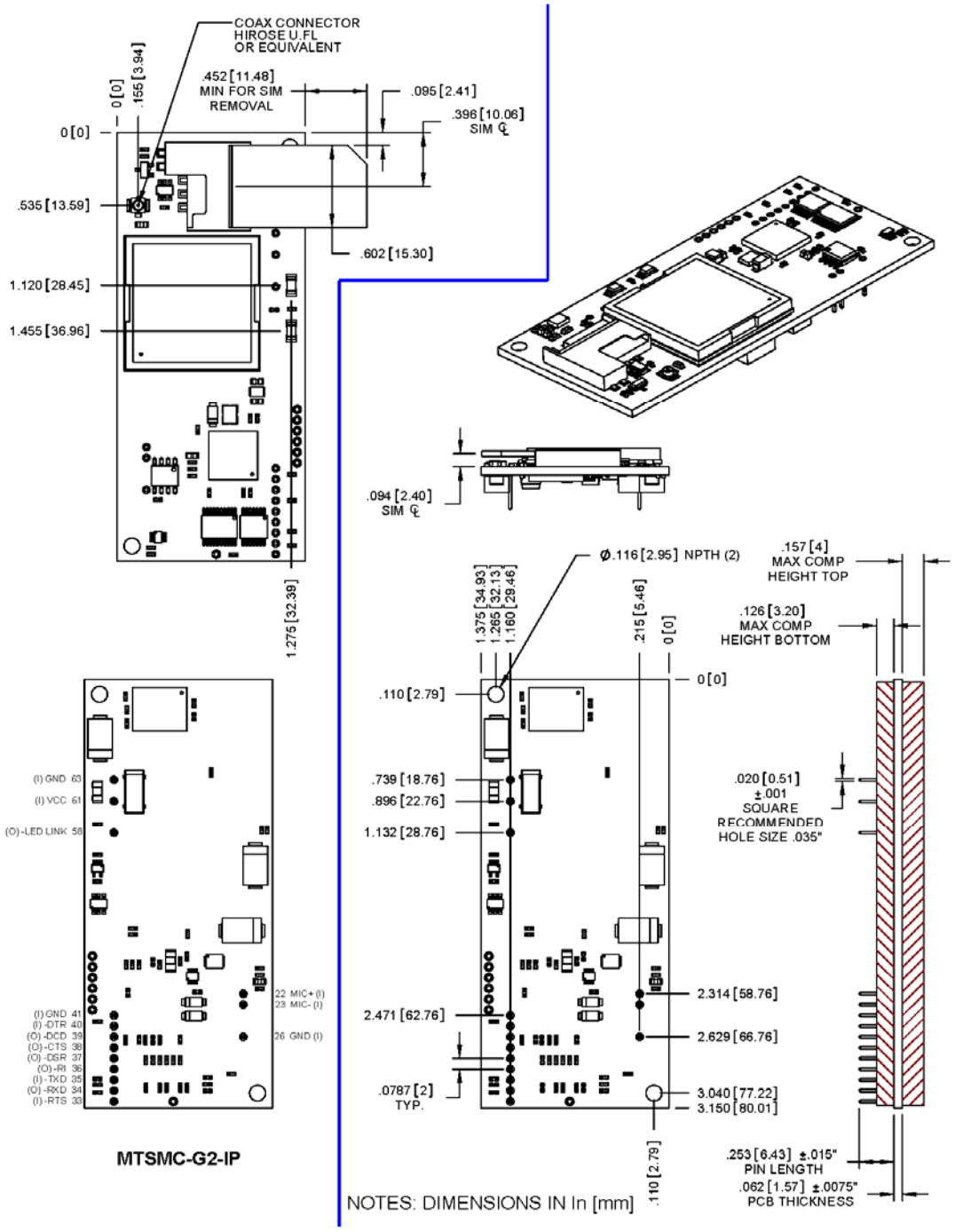
Mechanical Drawings – Basic Build



Mechanical Drawings – Voice Build



Mechanical Drawings – IP Build



Application Notes

Flashing LED Interface

The flashing LED signal is used to indicate the working mode of the SocketModem.

LEDs and SocketModem Status

Signal	SocketModem Status	
OFF	Download mode or switched OFF>	
ON	Continuously lit	Switched ON (not registered on the network)
	Flashing	Switched ON (registered on the network)

RF Performances

RF performances are compliant with the ETSI recommendation 05.05 and 11.10.

Note: The following statistics are subject to change due to pending test results.

Comment [DAR5]: Tom Hofstedt expects text results in by June 24th.

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

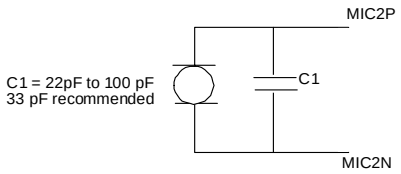
RF Connection and Antenna

The RF connector on the SocketModem GPRS is a UFL standard type. See Chapter 1 for Antenna System details.

Microphone Inputs

The MIC inputs are differential ones. They already include the convenient biasing for an electret microphone (0.5 mA and 2 Volts). This electret microphone can be directly connected on these inputs. The impedance of the microphone has to be around 2K. These inputs are the standard ones for a handset design.

The gain of the MIC inputs is internally adjusted. The gain can be tuned from 30dB to 51dB. The connection to the microphone is direct.



Changing the Quad Band

The SocketModem Cell and the SocketModem iCell both support quad band frequencies (850/1900/900/1800 MHz). In reality, these products operate like dual, dual-band devices. In other words, they can be configured for 850/1900 or 900/1800 MHz. They do not auto-seek the local area frequency.

Build Options

These wireless modems can be ordered with the default set to 850/1900 MHz **or** 900/1800 MHz.

- **850/1900 MHz –** The wireless modem defaulting to 850/1900 MHz is the default build option.
- **900/1800 MHz –** The wireless modem defaulting to 900/1800 MHz is identified with **-ED** in the product ordering number which signifies European default.

Changing the GSM Band

If for any reason, such as moving the modem from one geographical area to another, you want to change the band, you can accomplish this by using the **+WMBS** AT Command.

Steps for Changing the GSM Band

Use a terminal application such as HyperTerminal for entering the AT Command.

1. To open HyperTerminal, click **Start**. Then select **Programs** > **Accessories > Communications**. Then click **HyperTerminal**.
2. When the command window opens, type **AT+WMBS=<Band><Param>**. Press **Enter**.
   - For **<Band>**, enter the option you desire:
     4 = Dual-band mode 850/1900MHz
     5 = Dual-band mode 900/1800MHz
   - For **<Param>**, enter the option you desire:
     0 = Modem must be reset in order to use the specified band(s). This is the default.
     1 = Modem restarts immediately using the specified band(s).

   Example: AT+WMBS=4,0. Press **Enter**.

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 3.0 dBi at 1900 MHz / 1.6 dBi at 850 MHz for mobile operating configurations and 7.0 dBi at 1900 MHz / 2.3 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: onboard/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 offboard 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 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.

RF Safety

The remote modems are wireless cellular telephones devices. 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.

Caution: A separation distance of at least 20 cm must be maintained between the modem 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 of the body of the user. In particular, if using a Yagi antenna, it must be in a location that prevents public exposure to the radiation limits being exceeded. Check your local standards regarding safe distances, etc.

- Wireless modems in an ATM in, for example, a hospital environment and any other place where medical equipment may be in use, may be a hazard. This statement also applies to inadequately protected personal medical devices such as hearing aids and pacemakers.
- Operation of a wireless modem close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers’ recommendations.
- The modems must not be operated around gasoline or diesel-fuel.

RF Interference Safety

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 MultiModem 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 MultiModem when around gasoline or diesel-fuel pumps and before filling your vehicle with fuel.

- Switch OFF your wireless device 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 device 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 device 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 device 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 a wireless 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 Wireless Device

Your wireless device 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 device to any extreme environment where the temperature is above 50ºC or humidity is above 90% noncondensing.
- Do not attempt to disassemble the wireless device. There are no user serviceable parts inside.
- Do not expose the wireless device to water, rain, or spilled beverages. It is not waterproof.
- Do not place the wireless device 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 device.
- In the unlikely event of a fault in the wireless device, contact Multi-Tech Tech Support.

Your Responsibility

This wireless device 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.

Upgrading Firmware

Your modem is controlled by semi-permanent firmware, which is stored in flash memory. Multi-Tech's firmware is nonvolatile; that is, it remains stored in memory when the modem is turned off and can be upgraded as new features are added.

Multi-Tech's *Flash Wizard* can be downloaded from Multi-Tech's FTP site and is available on CD. Use this Flash Wizard for upgrading your firmware. Documentation for using the Flash Wizard is included with the wizard.

The following table shows you which products support the Flash Wizard.

Wireless SocketModems	
SocketModem GPRS MTSMC-G2	Do not use the Flash Wizard for the wireless modems. Contact Multi-Tech for wireless modem firmware upgrade directions.

Account Activation for Wireless Devices

Pre-Configured Multi-Tech Products

Some Multi-Tech wireless modems have been pre-configured to operate on a specific wireless network, such as Sprint and Verizon.

However, before you can begin to use the modem, you must set up a wireless data account with your wireless network provider. Then, follow the activation procedures covered on the Activation Notices available from Multi-Tech.

Wireless Approvals and Labeling Requirements

Wireless Approvals (GSM, CDMA)

The Multi-Tech SocketModem is Industry and/or Carrier Approved as an End Product modem. In most cases, when integrated and used with an antenna system that was part of the Multi-Tech modem certification, no additional approvals or certification is 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.

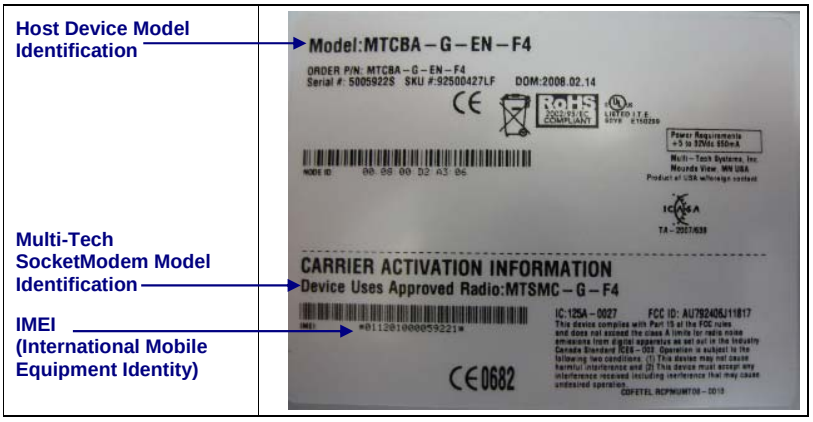
- **Model Identification:**

  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 model. See the label example below.

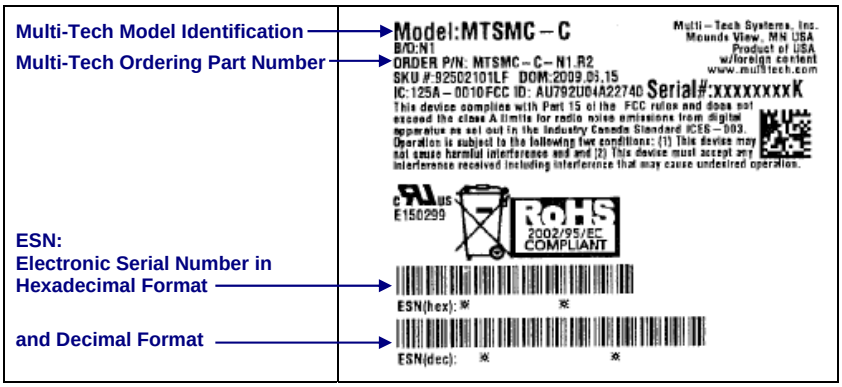
  The Multi-Tech model identification allows the carrier to verify the modem as one of its approved models. This information is located on the modem's label.

  The Following Is an Example of an End Product GPRS Label:

  Comment [DAR6]: Label_GPRS_F4.png



The Following Is an Example of a CDMA Label:



- **Other Information the Wireless Carrier Asks You to Provide:**

  For CDMA SocketModems**:** The modem's 8-character ESN (Electronic Serial Number) number printed next to the barcode on the modem. The ESN may vary in format by various CDMA carriers; some use a decimal number while others use a hexadecimal number.

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

Regulatory Compliance Statements

CE

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 2004/108/EC of 15 December 2004 on the approximation of the laws of Member States relating to electromagnetic compatibility;

and

Council Directive 2006/95/EC of 12 December 2006 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 1999 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

47 CFR – FCC Part 15 Regulation

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to 47 CFR – FCC Part 15 regulations. The stated limits in this regulation are designed to provide reasonable protection against harmful interference in a residential environment. 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 different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with 47 CFR – FCC Part 15 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.

New Zealand Telecom Warning Notice

1. The grant of a Telepermit for any item of terminal equipment indicates only that Telecom has accepted that the item complies with minimum conditions for connection to its network. It indicates no endorsement of the product by Telecom, nor does it provide any sort of warranty. Above all, it provides no assurance that any item will work correctly in all respects with another item of Telepermitted equipment of a different make or model, nor does it imply that any product is compatible with all of Telecom's network services.
   This equipment is not capable under all operating conditions of correct operating conditions of correct operation at the higher speed which it is designated. 33.6 kbps and 56 kbps connections are likely to be restricted to lower bit rates when connected to some PSTN implementations. Telecom will accept no responsibility should difficulties arise in such circumstances.
2. Immediately disconnect this equipment should it become physically damaged, and arrange for its disposal or repair.
3. This modem shall not be used in any manner which could constitute a nuisance to other Telecom customers.
4. This device is equipped with pulse dialing, while the Telecom standard is DTMF tone dialing. There is no guarantee that Telecom lines will always continue to support pulse dialing.
   Use of pulse dialing, when this equipment is connected to the same line as other equipment, may give rise to 'bell tinkle' or noise and may also cause a false answer condition. Should such problems occur, the user should NOT contact the Telecom Faults Service.
   The preferred method of dialing is to use DTMF tones, as this is faster than pulse (decadic) dialing and is readily available on almost all New Zealand telephone exchanges.
5. Warning Notice: No '111' or other calls can be made from this device during a mains power failure.
6. This equipment may not provide for the effective hand-over of a call to another device connected to the same line.
7. Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. The associated equipment shall be set to operate within the following limits for compliance with Telecom's Specifications:
   For repeat calls to the same number:
   - There shall be no more than 10 call attempts to the same number within any 30 minute period for any single manual call initiation, and
   - The equipment shall go on-hook for a period of not less than 30 seconds between the end of one attempt and the beginning of the next attempt.

   For automatic calls to different numbers:
   - The equipment shall be set to ensure that automatic calls to different numbers are spaced such that there is no less than 5 seconds between the end of one call attempt and the beginning of another.
8. For correct operation, total of the RN's of all devices connected to a single line at any time should not exceed 5.

South African Statement

This modem must be used in conjunction with an approved surge protection device.

Thailand Approval for MT9234SMI

This telecom device conforms to NTC* requirements.

**NTC is the National Telecommunications Commission, Thailand's telecommunications regulator.*

"เครื่องโทรคมนาคมและอุปกรณ์นี้ มีความสอดคล้องตามข้อกำหนดของ กทช."

Brazil Approval for the MT9234SMI and MT5656SMI

This product has been homologated by ANATEL. This product meets the applied technical requirements in accordance with the procedures regulated by ANATEL. Reference of homologation of this product can be viewed in ANATEL web page: **http://www.anatel.gov.br**

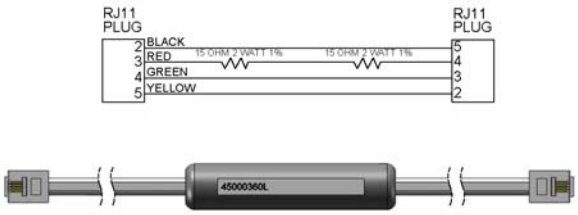
Brazil Bar Code for MT9234SMI

Brazil Bar Code for MT5656SMI

Brazil Certification (MT9234SMI Model Only)

A special phone cable is required for regulatory compliance.

Um cabo especial para telefone é requerido para a conformidade regulatória.



Other

The above country-specific examples do not cover all countries with specific regulations; they are included to show you how each country may differ. If you have trouble determining your own country's requirements, check with Multi-Tech's Technical Support for assistance.

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 SocketModems (>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 English

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

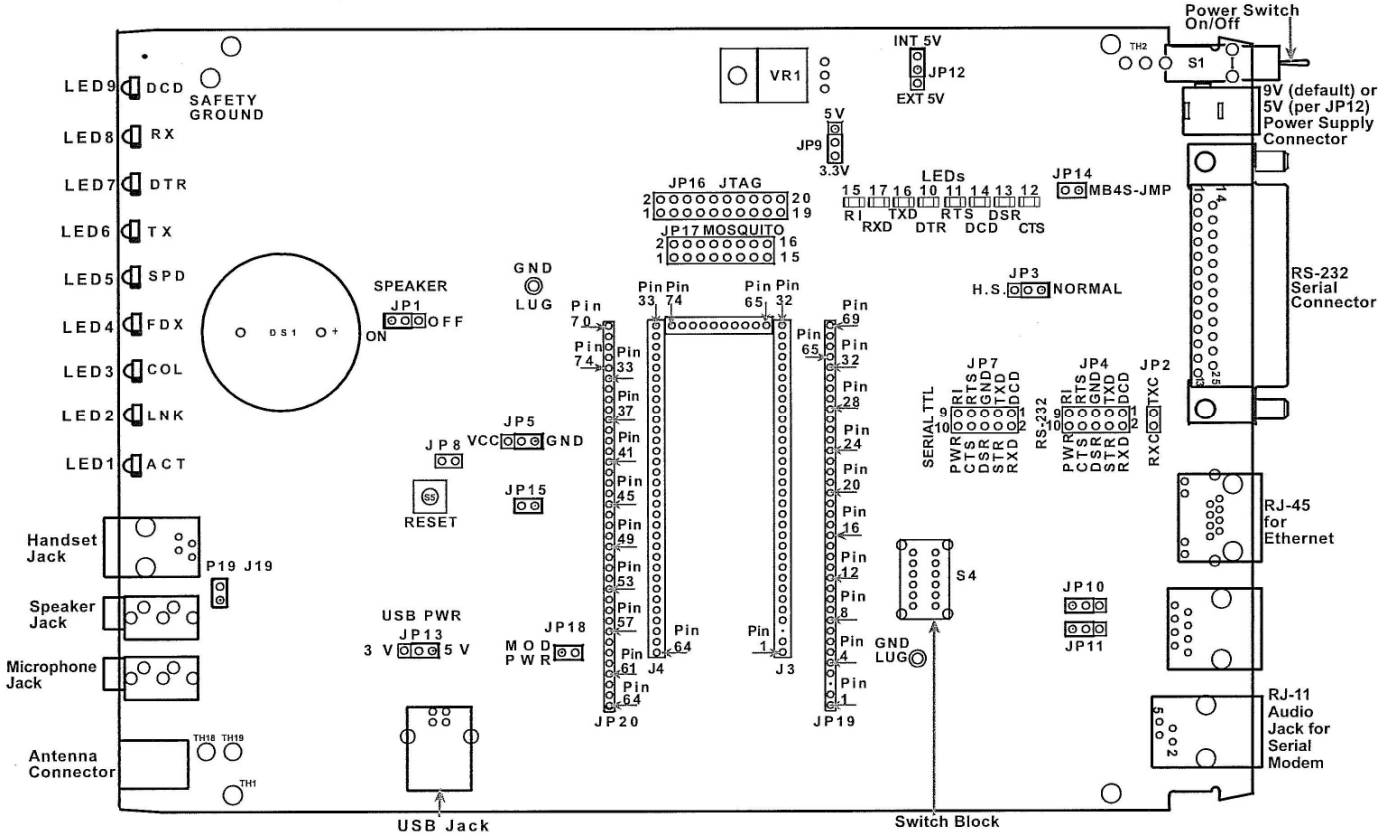
X 表示所有使用类似材料的设备中有害/有毒物质的含量水平高于 SJ/Txxx-2006 限量要求。

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 – SocketModem Developer Board

SocketModem Developer Board

This developer board drawing shows the major board components for all SocketModems.



Board Revision B

See the next page for description of Board Components

Comment [DAR7]: C:\Universal_SocketModem \ Graphics_ETC_Rev_I \ Board_B_Schematics \ SchematicsfromJohnM \ Board_B_for_Universal_260b0_forRev J jumper fixed.png

Board Components

Jumper	Description
JP1	Mutes the speaker. Default positions are 1 and 2 (speaker is not muted).
JP2	Ties the TX and RX clock lines together. Default positions are 1 and 2 (transmit and receive clock act independently).
JP3	Sets the data rate. NORMAL sets the data rate at 250kbps. H.S. (high speed serial communications) sets the data rate at 1Mbps.
JP4	Testing interface (debugging) for the RS-232 signals.
JP5	JP5 acts as a replacement for pin 45 when pin 45 is used for another function.
JP7	Testing interface (debugging) for the serial TTL signals.
JP9	JP9 is the 5V / 3.3V regulator. The factory default operating voltage is 3.3V. **Warning** – Be sure that the 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.
JP12	JP12 allows you to select either the internal 5V regulator (INT 5V) or to choose EXT 5V. For the EXT 5V, you can use your own external 5V power source and plug it into J7.
JP13	Set either 5V or 3.3V for USB_VBUS line (supplied by the VCC of the USB jack).
JP14	Internal testing.
JP15	JP15 disconnects pin 45 from SLP with JP5 (the RS-232 driver sleep mode).
JP16	JTAG header.
JP17	Mosquito header. If used to debug the SocketModem while using the USB port, then the JP14 would have to be removed to disconnect USB_VBUS.
JP18	Power feed for area where SocketModems are placed (J24).
JP19 & JP20	Debugging probes.
JP25 & JP26	Ground lug.
S4	Set the switch block to the product being used.
S5	Reset

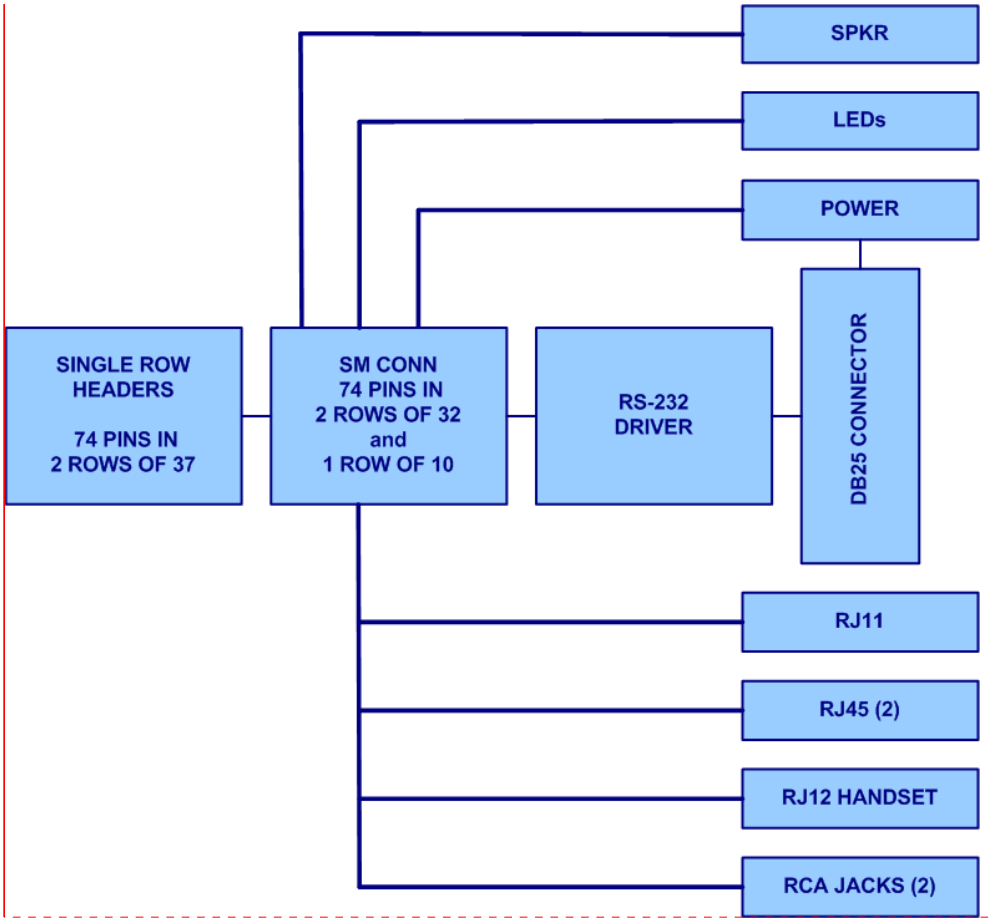
Jumpers and Corresponding Signals

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

JP10	JP11
TX Term	RX Term

SocketModem Developer Board Block Diagram



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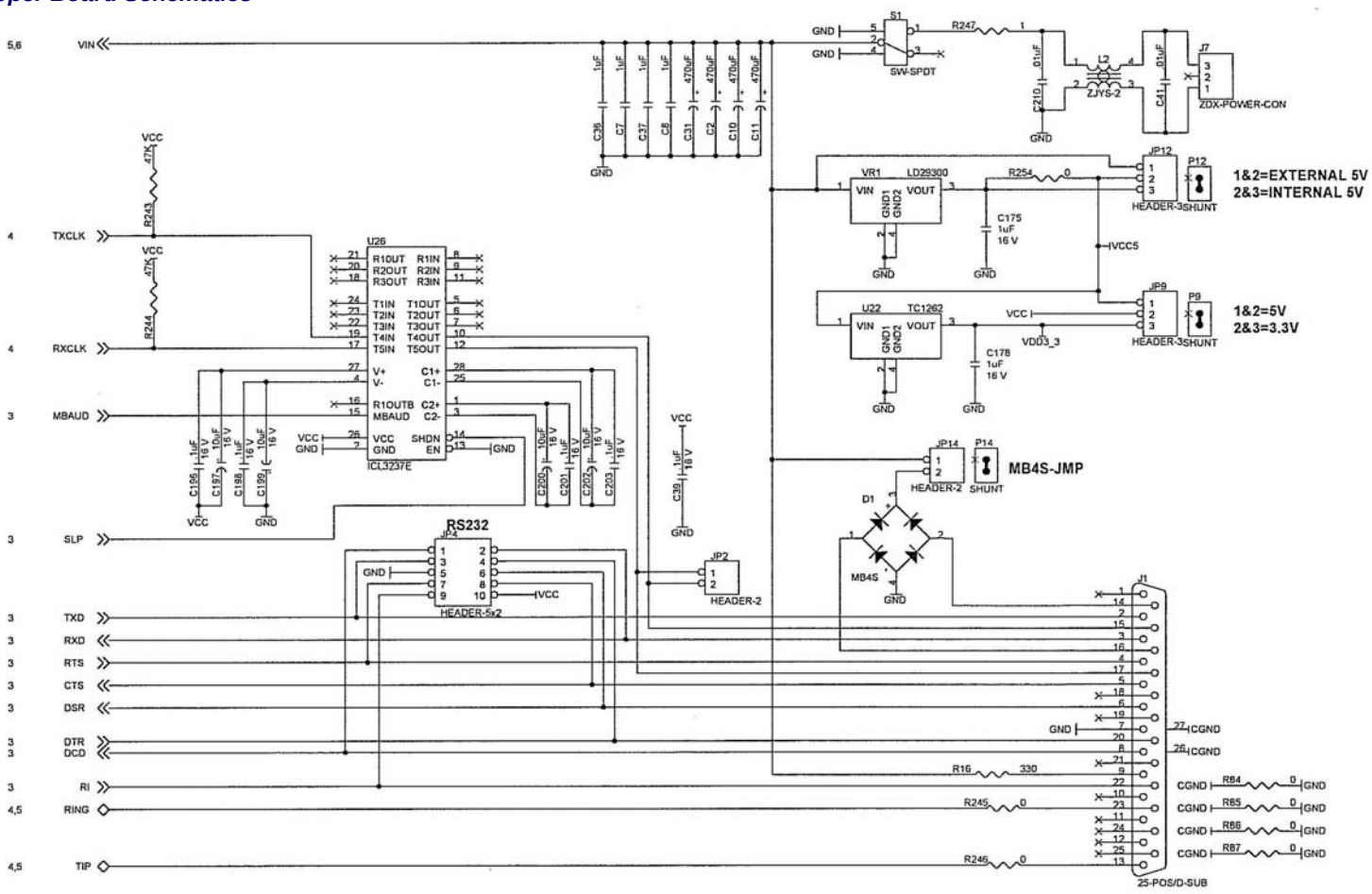
Developer Board Schematics



Board Revision B

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Developer Board Schematics

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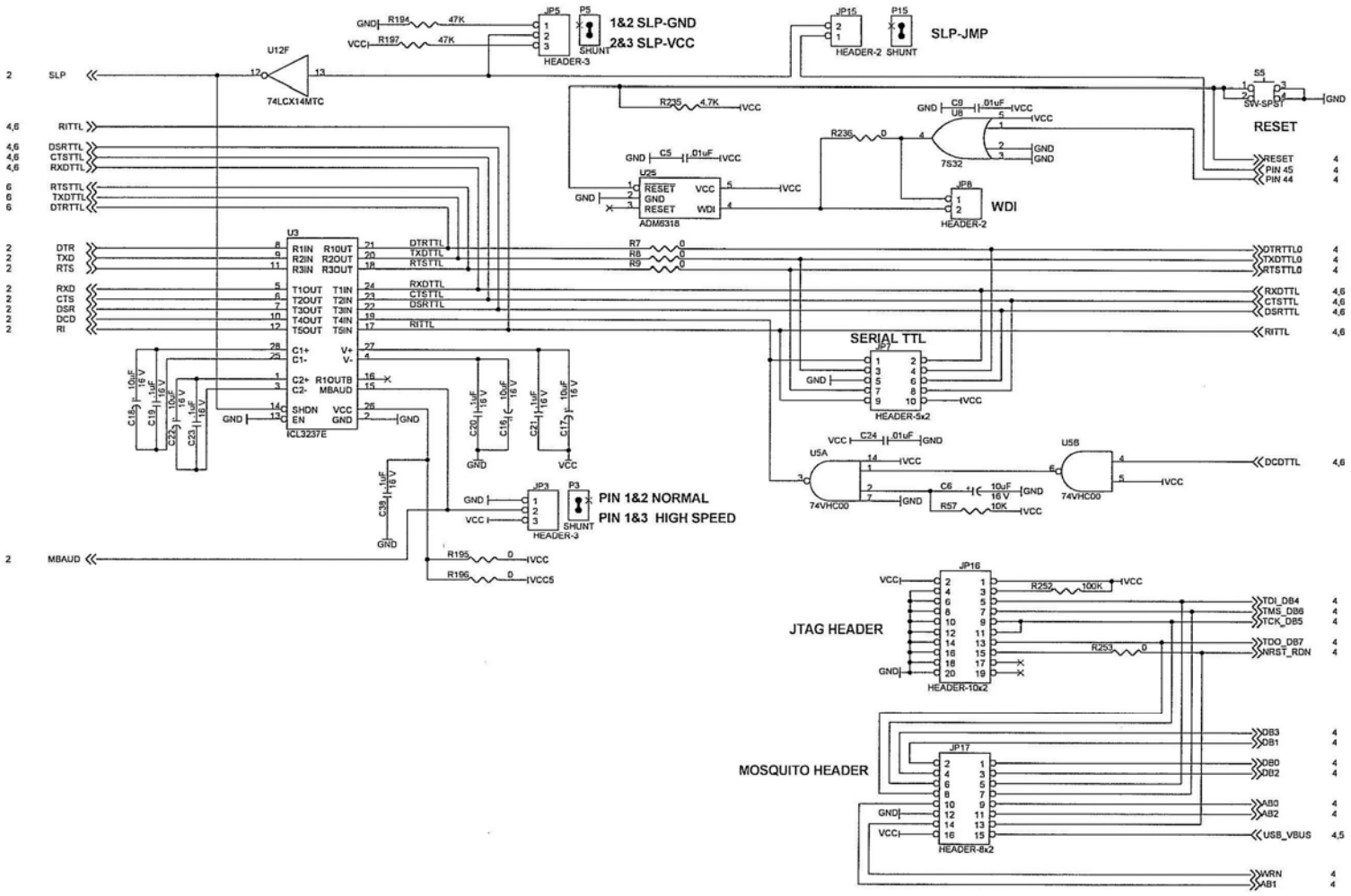

Board Revision B

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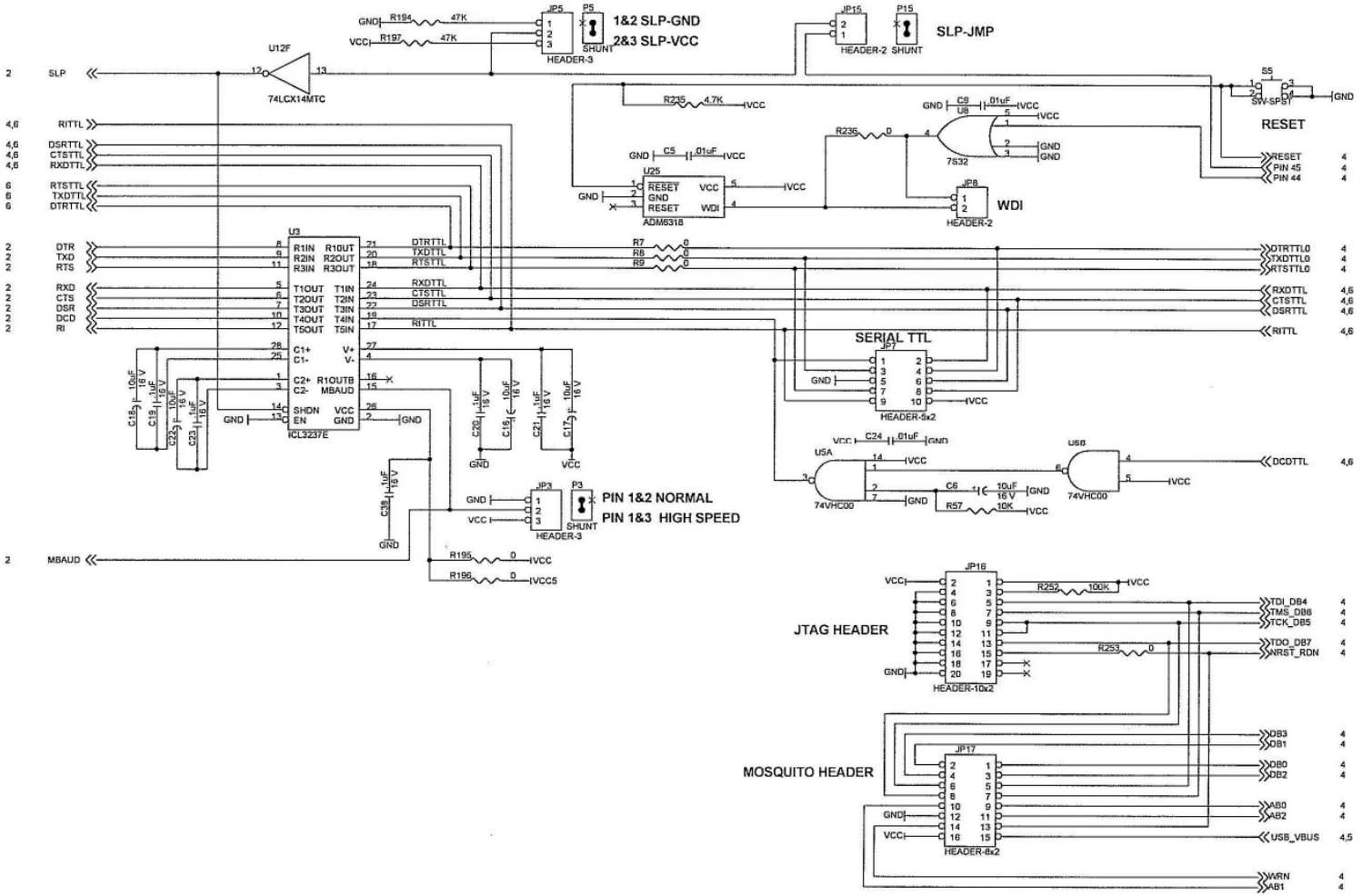

Board Revision B

Developer Board Schematics

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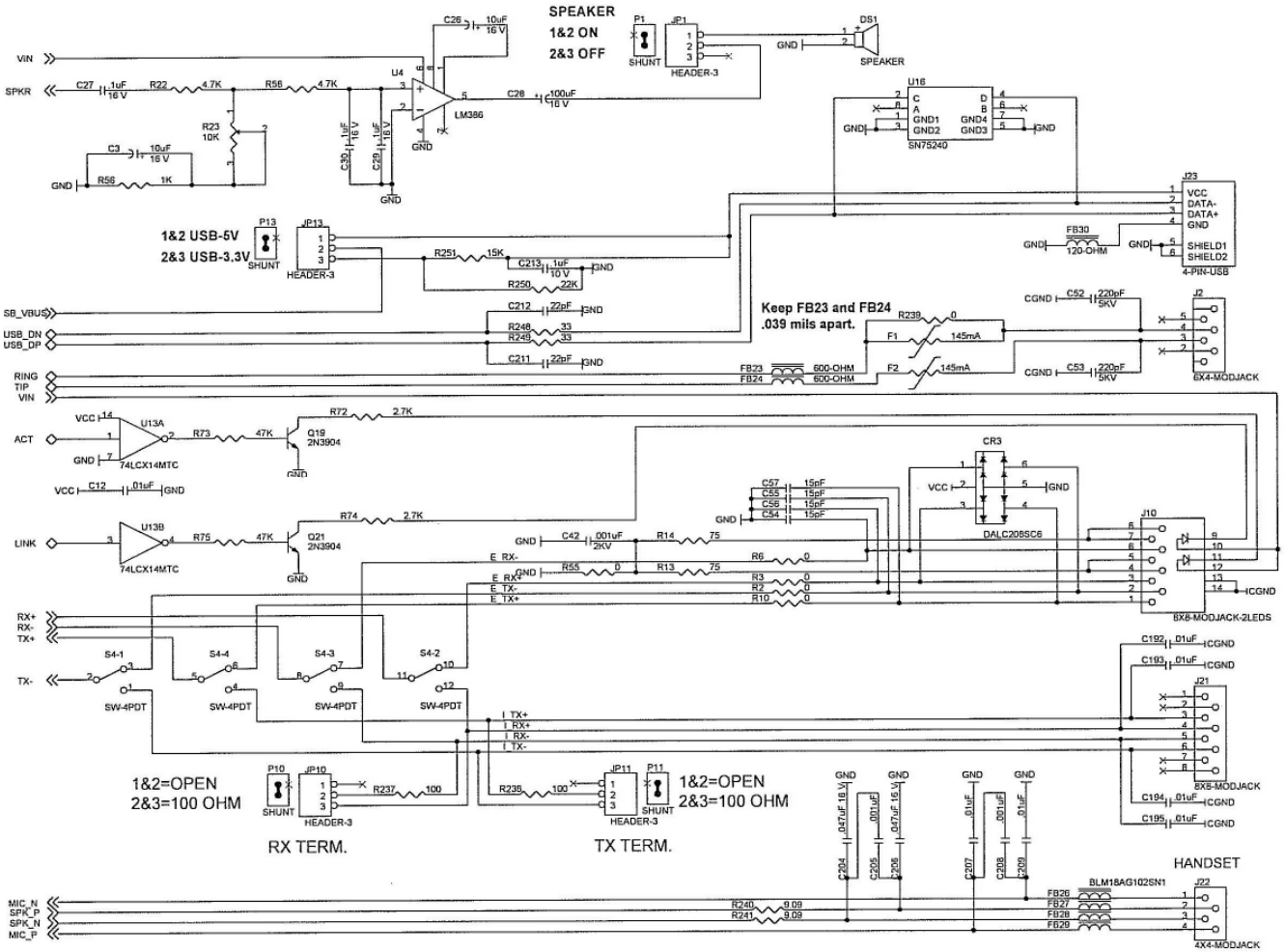
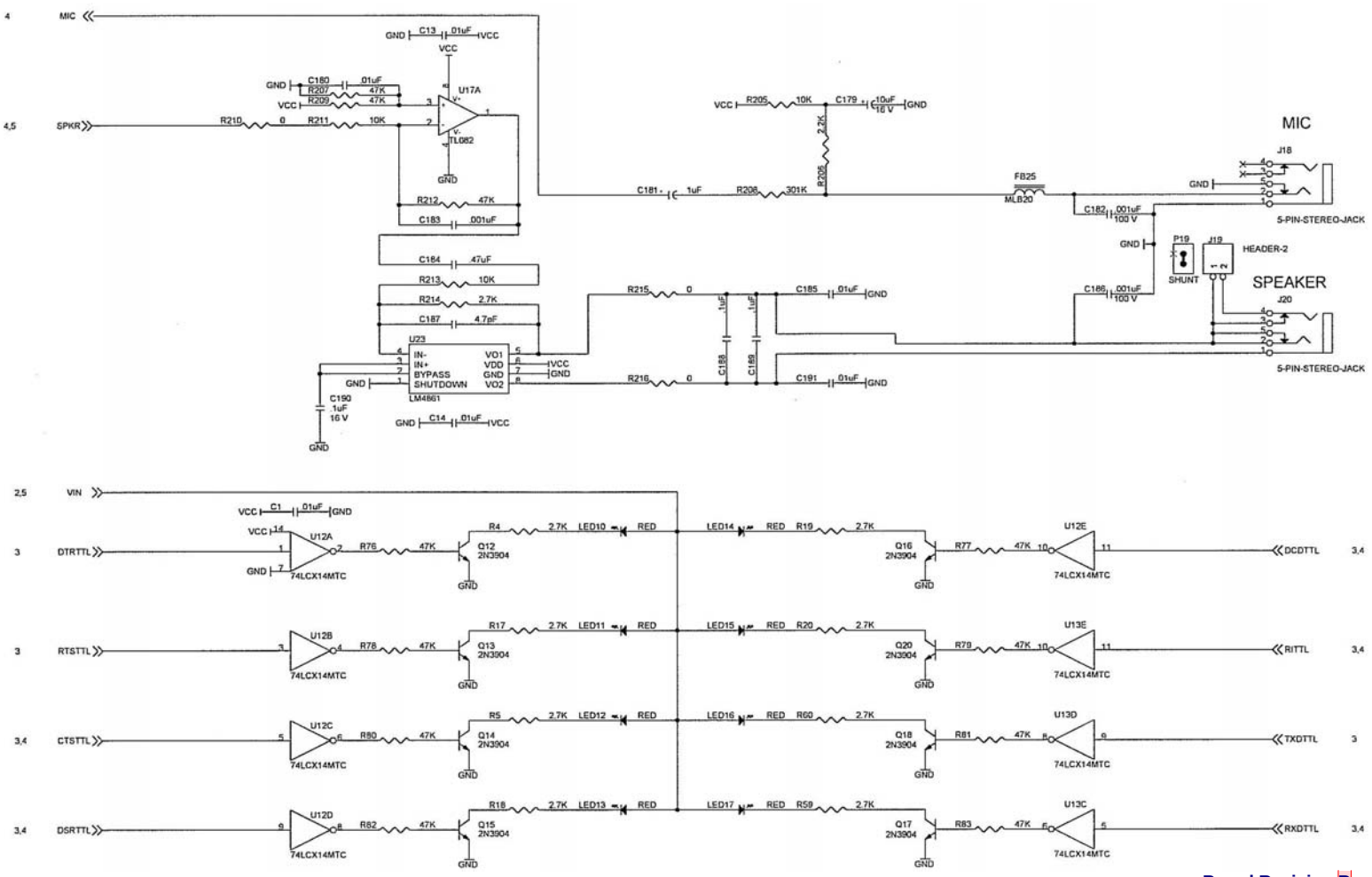


Board Revision B

Developer Board Schematics



Board Revision B

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