WISMO-CDMA

Q24X8 Product Technical Specification

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Overview

This document is intended to detail the Product Design of the Wavecom Q24x8 CDMA Module, allowing the customer to understand the function, capabilities and interface of the Module and integrate the Module into a viable consumer product.

1 Q24x8 Introduction

1.1 CDMA

Code Division Multiple Access, a cellular technology also known as **IS-95,** competes with GSM technology for dominance in the cellular world. There are now different variations, but the original CDMA is now known as **cdmaOne.** Developed originally by Qualcomm and enhanced by others, CDMA is characterized by high capacity and small cell radius, employing spread-spectrum technology and a special coding scheme. The Telecommunications Industry Association (TIA) adopted CDMA, in 1993. By December 2000, there were 80 million subscribers on cdmaOne systems worldwide.

In 1999 a new third generation (3G) standard was accepted, of which CDMA2000 is one of three operating modes (WCDMA and TD-SCDMA are the other two).

The Module provides peak data rates of up to 153 kbps, without sacrificing voice capacity for data capabilities. It allows for extended battery life and twice the system capacity over earlier products. The Module detailed in this document is based on this 1XRTT technology.

1.2 Safety and Governmental Agency Approval

The Q24x8 CDMA module shall comply with the following standards or guidelines:

- Formal Qualification Test, as mutually specified by Wavecom and manufacturer.
- IEC950, for electrical safety
- UL950, for electrical safety
- FCC Part 15B power supply, conducted requirements only
- FCC Part 22 (800 MHz), Part 24 (1900 MHz)
- SAR (host dependent)
- CSA for Canada
- Canada IC-133
- CDG 1, 2 (IS-98D, IS-898)
- CDG 3 (application specific)

2 General Description

Designed for fast and easy integration, this 2nd generation line of CDMA Modules includes the Q2438 Dual Band (800/1900 MHz) and the Q2458 Single Band (800 MHz) versions. The Modules provide handheld devices with wireless connectivity, high-speed reliable performance, and critical features such as gpsOne, AMPS and Open AT. The Q24x8 family is designed to target Wireless Local Loop, Telematics, Machine-to-Machine Interfaces, and Global Positioning Devices.

2.1 Product Features

- EVRC, 13kQCELP
- 153 kbps forward and reverse
- Circuit Switch (IS707-A.4)
- Packet Data (IS707-A.5)
- Class II G3 FAX
- gpsOne position location capabilities
- AMPS (Analog) voice
- RUIM (for China only – see *R-UIM Interface*)
- SMS (Mobile Originated and Mobile Terminated)
- OTASP, OTAPA
- IOTA
- Differential Audio: 60 pin System Connector
- TTY/TTD
- USB (population option)
- Wireless interface: CDMA2000 (IS-2000)
- Open AT Platform
- Dimension: 58 x 32.6 x 3.9 mm (Including shielding)
- Weight: ~11 grams
- Operating Temperature: -30°C ~ +60°C
- Band (CDMA2000) – (Dual Band)
  - Band class 0 (TX: 824 ~ 849 MHz/ RX: 869 ~ 894 MHz)
  - Band class 1 (TX: 1850 ~ 1910 MHz/ RX: 1930 ~ 1990 MHz)

2.2 Radio Functionality

The radio design is based on the Qualcomm RadioOne direct conversion chipset. It supports the following four frequency bands and four operation modes.

- CDMA Band Class 0 (Cellular 800MHz Band)
- CDMA Band Class 1 (PCS 1900 MHz Band)
- AMPS (Cellular 800MHz Band)
- Qualcomm gpsOne (L1 1575.42MHz Band)

CDMA Cellular, CDMA PCS, and AMPS functions are supported through the same RF connection. The gpsOne has a separate RF connection. This allows the users to have more antenna selections and a more flexible design overall.

2.3 Baseband Functionality

The Q24x8 CDMA Module is based on the Qualcomm MSM6050 Mobile Station Modem.

The features of this solution include:

- Embedded QDSP2000 digital signal processor core, providing hardware support for features such as voice recognition, voice memo, speech compression, acoustic echo cancellation, audio automatic gain control (additional Software licensing is required)
- 4Mbytes of Flash (900kbytes available for customer applications)

- 2Mbytes of Pseudo SRAM (200kbytes available for customer applications)
- Voice mode V1 (EVRC, 13k QCELP)
- ARM7TDMI embedded microprocessor subsystem
- Tri-Mode capable (CDMA cellular, CDMA PCS, AMPS cellular)
- General-Purpose Interface Bus
- Battery Management
- Charge Control
- Ringer driver
- USB support (population and Software option)
- Keypad (Software option)
- R-UIM

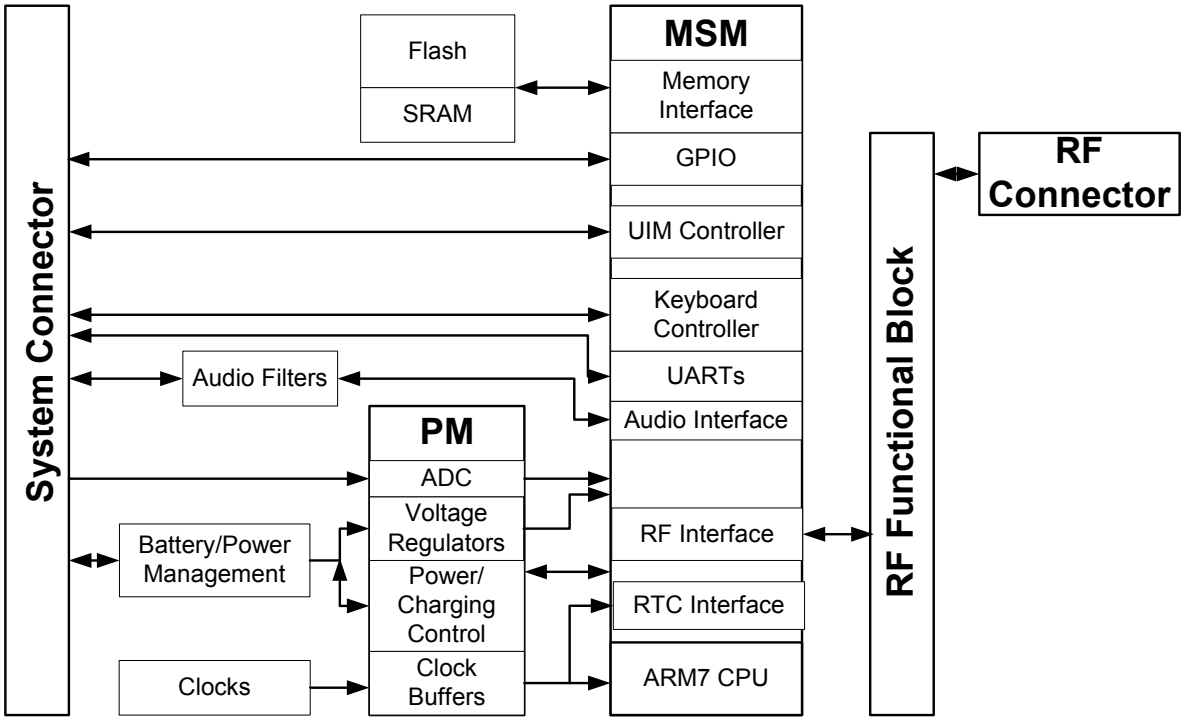
The Baseband is composed of three basic blocks; Power, Digital and System Connector.

The Power block is based primarily on the Qualcomm PM6000 Power Management IC. Within this chip are 7 controllable low dropout regulators; charging control lines and monitors; a 10-bit ADC with multiplexed inputs, and various clock buffers and current drivers. Control is via a 3 wire serial bus connected to the MSM.

The Digital block consists of the Qualcomm MSM6050 and one stacked memory part. The stacked memory includes both the SRAM and FLASH memory. The Flash within is a read-while-write part containing both the executable code and non-volatile parameters such as Calibration data. The Flash can be reprogrammed using the Wavecom Flash Download Tool running on a PC. This allows field upgrades of any embedded software.

The third block, the System Connector, is a 60-pin dual row surface mount component. The overall board-to-board stack height is 3.0 mm.

Figure 2-1 Q24x8 Block Diagram



2.4 Software Functionality

The Q24x8 CDMA Module embedded software supports the CDMA2000 Rev 0 Standard. In addition, features have been developed in the Module to support the various applications described in the following sections.

2.4.1 Feature List

Table 2-1 Software Feature List

Feature	Specification	Priority
CDG Stage 1		Required
CDG Stage 2	Lucent, Motorola, Nortel	Required
	Samsung	Optional
CDG Stage 3	Sprint, Verizon	Required
CTIA Lab Certification	Part of Verizon certification	Required
GPSOne	Qualcomm's Snaptrack AGPS	Required
	Standalone GPS	Optional
IOTA	For Sprint; embedded	Required
AMPS	Voice	Required
AMPS	Data over AMPS	Optional
RIL	Radio Interface Layer for Pocket PC	Required

USB	Universal Serial Bus Specification – Revision 2.0	Desirable
RUIM	For China	Required for the RUIM Build
BREW	Allows customer to write their own AT commands for a dual processor configured application	Optional
	Provides an API for 3rd party applications development in a single processor configured application	Optional
Open AT	Compatible with MUSE	Optional
AT commands	IS707.3	Required
	GSM relevant (from Wavecom's GSM Quik)	Required
	Qualcomm specific	Required
	Carrier specific	Required
FAX	Class 2.0 Group III	Required
SMS	EIA-637A -- 2 way MT and MO	Required
	EIA-637A -- Broadcast	Required
EMS		Optional
MMS		Optional
Over the Air	EIA-683A -- OTAPA	Required
	EIA-683A -- OTASP	Required
Mobile IP	RFC-2002 (Sprint)	Required
Multiplexing	UART 1 - Data and AT commands	Desirable
	UART 3 - AT and DM commands	Desirable
Phonebook		Required
WAP		Desirable
Charging		Desirable
Power Management		Required
Silent Retry		Required
Sprint Media Messaging Protocol		Optional
Authentication		Required
Individual call timer (AT command)		Required
Accumulated call timer (AT command)		Required
Subscriber number display (AT command)		Required
WLNP (Wireless Local Number Portability)	MDN, and MSID	Required
Dual NAM (2 numbers)		Required
Subsidy Lock		Required
Encryption		Required
Voice Privacy		Required
System Determination 1.0 and 2.0, Preferred Roaming Support		Required
Enhanced roaming – positive SIDs		Required

Negative SID list capable		Required
System selection settings		Required
NAM programming (serial port capable)		Required
TTY/TTD		Required
Master Unlock	Non-alternable ESN	Required
	Factory loaded random A-key	Required
E911 Emergency Dialing		Required
Dual Band ~~Mode~~ PRL and System Select Functionality		Required
Caller ID		Required
IMSI/TMSI		Required
Call Forwarding		Required
Call waiting		Required
3 way calling		Required
QNC (Not Supported for Sprint)		Required for Verizon
Simple IP (Not Supported for Sprint)		Required for Veorizon
Fundamental and supplemental channel support		Required
Airlink dormancy		Required
Carrier Support Package	Sprint, Verizon	Required
Production Support Package	Wavecom, S.A.	Required

2.4.2 Functional Descriptions

This section details functions of each software feature listed in section 2.4.1.

2.4.2.1 Required Features

2.4.2.1.1 CDG Stage 1

CDMA Development Group Interoperability Test Stage 1.

2.4.2.1.2 CDG Stage 2

CDMA Development Group Interoperability Test Stage 2. Performed on following network equipment: Lucent, Motorola, Nortel.

2.4.2.1.3 CDG Stage 3

CDMA Development Group Interoperability Test Stage 1. Performed according to following carrier requirements: Sprint, Verizon.

2.4.2.1.4 CTIA Lab Certification

Performed per Verizon specification.

2.4.2.1.5 GPSOne

The module supports Qualcomm's gpsOne solution for mobile position determination. The two key uses for the gpsOne features are:

Emergency mode position determination, and Mobile initiated position determination.

The emergency mode position determination is entered when the mobile enters emergency mode (E911 in the US market). The network may request the mobile to report its position during emergency mode. When the request is made the mobile responds with its position information using data burst messaging. There is no indication to the user during this position request transaction.

Another method of initiating a gpsOne session is mobile originated. The module offers a set of AT commands that are specific to gpsOne feature. These commands allow the user to set position determination parameters that are used to set up the GPS session. Different types of GPS sessions may be set up depending on the choice of parameters set by the user. The resulting data of a GPS session is returned as an unsolicited command.

NOTE: a position Determination Entity (PDE) is necessary on the network side to provide signal phases to the mobile for any network-assisted position determination session.

2.4.2.1.6 IOTA – (Sprint only)

IOTA (IP-based Over-the-Air) provides a mechanism to automatically provision or retrieve configuration data from mobile terminals through any IP-based data connection. The use of IP provides maximum flexibility for application developers and customer support providers. Some carriers including Sprint now require this feature. The configuration data include NAM related parameters, Mobile IP profile, browser proxy address and home page, OEM info, firmware info, etc. This feature is planned for a two-phase support.

1. A windows based client implemented by Future Dial. The windows tool would interface to the module by setting up a data call using the Data port. The IOAT client would be running on the PC side, and the tool would use modules DM port to provision the module with over-the-air downloaded parameters.
2. Embedded IOTA client. This would entail integration of a third party IOTA client into the modules embedded software.

IOTA (IP-based Over-the-Air) provides a mechanism to automatically provision or retrieve configuration data from mobile terminals through any IP-based data connection. The use of IP provides maximum flexibility for application developers and customer support providers. Some carriers including Sprint now require this feature. The configuration data include NAM related parameters, Mobile IP profile, browser proxy address and home page, OEM info, firmware info, etc.

2.4.2.1.7 AMPS – Voice

AMPS voice is supported in the system selection.

2.4.2.1.8 RIL – Currently not supported

Not yet supported.

2.4.2.1.9 RUIM – for China

The R-UIM (Removable User Identity Module) is required for China Market. The full

functions of R-UIM including the R-UIM Tool Kit, Phone Book and SMS storage are supported. This applies to the Q2458 version of the Module. The RUIM build has a reconfiguration of UARTs, with UART3 hardware pins being used for RUIM.

2.4.2.1.10 AT Commands - IS707.3, GSM relevant (from Wavecom GSM Quick), Qualcomm specific, Carrier specific

Rich set of AT commands: general phone commands, call control, network service, security, SMS, data, V24-V25, Phone book, GPS, provisioning, IS707.3, Wavecom specific, Qualcomm specific. For a complete description of all AT commands supported by the Q2438 module please refer to *Q24X8 CMDA 1xRTT AT Commands Interface Specification* document.

2.4.2.1.11 FAX

Class 2.0 Group III. Module is able to send and receive facsimile documents. In a typical application the module can work in conjunction with a WinFax type software application. In order to receive a fax the module needs to be set up with and AT command for a prearranged fax setting.

2.4.2.1.12 SMS - EIA-637A - 2 way MT and MO, Broadcast

Message pass through to host and local storage modes are supported. The module can store up to 30 messages on the module. The SMS functionality provides message read, write, list, send and send from memory. Message storage and sending from RUIM is supported in the RUIM build. The module supports turning off and on of receiving of Broadcast SMS messages (Emergency Broadcast SMS is always allowed). Selection of Broadcast SMS Type is not currently supported. PDU mode is not supported, but user is able to send uniquely encoded messages (7-bit ASCII, UNICODE, octet, etc), as well as binary data.

2.4.2.1.13 Over the Air - EIA-683A – OTASP, OTAPA

OTASP – User initiated over the air programming. Download all service parameters, NAM, PRL, Service Programming Lock, A-Key.

OTAPA - Network initiated over the air programming. Service programming is done without user intervention.

2.4.2.1.14 Mobile IP - RFC-2002 (Sprint)

This feature makes it possible for IP packets to find nodes whose point of attachment to the Internet changes. Mobile IP is completely transparent to the host device running a data application. AT commands are provided to enable and disable this feature.

2.4.2.1.15 Phonebook

Support adding, reading, and deleting contacts to/from phone book. Allow multiple phone books (100 phone numbers, 20 missed calls, 10 emergency numbers, 20 received calls list). Supports Storage in NV, RUIM or combined.

2.4.2.1.16 Power Management

The module has been configured for minimal power consumption. During Slot Cycle 2

sleep mode current consumption is averaged at 4 mA.

2.4.2.1.17 Silent Retry – Carrier Dependent

Redial after a failed voice call attempt that is seamless to the user. This feature is supported but the algorithm that is specified by individual carriers needs to defined and implemented.

2.4.2.1.18 Authentication

Authentication of voice and data calls is supported according to standards TIA/EIA 95-A, B, JSTD-008 and TIA/EIA 91. It is performed for Registration, Origination, Page Response and Data Burst Messages.

2.4.2.1.19 Individual call timer (AT command)

This feature is supported with AT+WTMR command. The module provides time duration of the most recent voice call.

2.4.2.1.20 Accumulated call timer (AT command) – Carrier Specific

This feature is supported with AT+WTMR command. WTMR supports Uptime, Call Time, and Call Count. Uptime is the number of seconds the module has been running since boot-up. Call Time is the total number of seconds the module has been in a call since manufacture (Voice, Data, Fax, OTASP, and CDMA Test Calls; but SMS is not included). Call count is the total number of calls made since manufacture.

2.4.2.1.21 Subscriber number display (AT command)

This feature is supported with AT+CNUM command.

2.4.2.1.22 WLNP (Wireless Local Number Portability)

Support for number portability, giving a mobile subscriber ability to keep the same phone number when changing service providers. The module allows MDIN and IMSI_S to be programmed to different values, allowing the network recognizes number and user number to be different. Supported with AT+WIMI and AT+WMDN commands.

2.4.2.1.23 Dual NAM (2 numbers)

Dual NAM is supported by the module and NAM programming is supported by the Carrier Support Package. Command AT+WNAM allows the NAMs to be switched.

2.4.2.1.24 Subsidy Lock

This feature is supported with AT+WSPC command. It allows for entry of service programming code, which allows for programming of provisioning parameters. AT commands +WSPC, +WMDN, +WIMI, +WSID, +WAOC, +WSCI, +WBGP, +WBGS, +WPDS, +WCMT can not be accessed without initially setting the correct service programming code.

2.4.2.1.25 Encryption

This feature is supported with use of Qualcomm's DMSS SSL (Secure Socket Layer)

services. Encryption is performed for data only. Secure Socket Layer allows for authenticated and encrypted communication over wireless networks.

2.4.2.1.26 Voice Privacy

This feature is supported with AT+WPRV command. The command enables a request from the module to the base station for voice privacy. Voice privacy is only enabled during a voice call if the base station supports voice privacy; otherwise this feature is unavailable.

2.4.2.1.27 System Determination 1.0 and 2.0, Preferred Roaming Support – Carrier Specific

This feature defines a set of rules that determine a best network the module should operate on. It works in conjunction with the PRL (Prefer Roaming List). Each carrier has it's own set of rules for acquiring it's system, and System Determination allows for easier modification of DMSS code to suite those special requirements.

2.4.2.1.28 Enhanced roaming – positive SIDs

This feature allows for 128 roaming states, instead of standard 4 states (no service, home, roam affiliated and roam unaffiliated).

2.4.2.1.29 Negative SID list capable

This feature allows for setting a negative preference for a particular network (SID) in the preferred roaming list file.

2.4.2.1.30 System selection settings

This feature is supported with AT+COPS command. This command along with the PRL (Preferring Roaming List) dictates modules system acquisition behaviour.

2.4.2.1.31 NAM programming (serial port capable)

NAM programming is supported by the Carrier Support Package.

2.4.2.1.32 TTY/TTD

This feature allows the module to reliably transport 45.45 bps Baudot code in the audio path. It complies with IS-733 and IS-127 standards.

2.4.2.1.33 Master Unlock

Provide module functionality in conjunction with the Wavecom tools to restrict ability to program and modify crucial and encrypted provisioning parameters.

2.4.2.1.33.1 Non-alterable ESN

2.4.2.1.33.2 Factory loaded random A-key

2.4.2.1.33.3 Production Number

2.4.2.1.34 E911 Emergency Dialing – Carrier Specific

As soon as 911 is dialled the module goes into the E911 mode. Each carrier defines E911

behaviour of the phone. This feature may effect system determination. At the time of E911 dial the module looks for any available system. AT command WSOS is provided to exit the emergency mode. The module supports configurable emergency dialling string (for non-US markets), as well as additional emergency numbers, which are configurable with Production Support Package.

2.4.2.1.35 Dual Band PRL and System Select Functionality

This feature is supported with AT+COPS command.

2.4.2.1.36 Caller ID

This feature is supported with unsolicited AT command +CLIP.

2.4.2.1.37 IMSI/TMSI

This feature is supported with AT+WIMI and AT+WMDN for writing and AT+CIMI for reading.

2.4.2.1.38 Call Forwarding

Call forwarding is supported either by dialling a carrier specific dialling string (ex. *72) or with command AT+CCFC.

2.4.2.1.39 Call waiting

This feature is supported with AT+WFSH command (FLASH).

2.4.2.1.40 3 way calling

This feature is supported with AT+WFSH command (FLASH).

2.4.2.1.41 QNC (Not Supported for Sprint) – Verizon

Enabling and disabling of this feature is supported with $QCQNC command. When QNC is disabled the Packet Originations will use the Packet Data Service Option. When QNC is enabled Packet Originations will use the Async Data Service Option number.

2.4.2.1.42 Simple IP (Not Supported for Sprint) – Verizon

Enabling and disabling of this feature is supported with $QCMIP command.

2.4.2.1.43 Fundamental and supplemental channel support

The module supports high-speed data rates as specified by IS-2000 (1xRTT) protocol. The data through put should be 153 kbps on forward and reverse channels.

2.4.2.1.44 Air-link dormancy

Support carrier rules for air-link dormancy during a MobileIP session.

2.4.2.1.45 Carrier Support Package

The Carrier Support Package includes applications and libraries that provide the functionality necessary to perform software downloads, program preferred roaming lists,

and program NAM and user settings. Wavecom's Carrier Support Package is comprised of a either a module specific UPST/UMPP DLL that is compliant with the Spirent Universal Product Support Tool Standards [Revision 1.9] and the Sprint Universal Product Support Tool [Revision 1.9] or the Wavecom Programming Service Tool (WPST).

2.4.2.1.46 Production Support Package

The Production Support Package includes applications and libraries that provide the functionality necessary to perform software download, numerical testing, calibration, test, provisioning, and labelling.

2.4.2.2 Desirable Features

2.4.2.2.1 Universal Serial Bus Specification – Revision 2.0

This feature is not currently supported by available firmware.

2.4.2.2.2 Charging

The module supports controlled charging of a Lithium Ion battery. AT command +CBC is used to query battery charge level. For further details please refer to *Q24x8 Module Hardware Specification*.

2.4.2.2.3 Multiplexing

Multiplexing feature allows multiple uses of a single serial port. The module is configured with two serial ports. Data port (UART 1) is configured for data services task (AT commands and data). DM port (UART 3) is configured as a DM port, supporting Qualcomm diagnostics mode command set.

Two types of multiplexing are proposed:

Multiplexing on the DM port (UART3), where AT commands would be multiplexed with DM commands. This solution is targeted for a two-port solution, where access to AT commands is lost on the Data port (UART 1) while on the data call.

Multiplexing on the data port (UART 1), where AT commands would be multiplexes with data while module is on a data call. This solution is targeted for a single port solution.

1. Multiplexing on the DM port (UART3), where AT commands would be multiplexed with DM commands. This solution is targeted for a two-port solution, where access to AT commands is lost on the Data port (UART 1) while on the data call.
2. Multiplexing on the data port (UART1), where AT commands would be multiplexes with data while module is on a data call. This solution is targeted for a single port solution.

2.4.2.2.4 WAP

2.4.2.3 Optional Features

2.4.2.3.1 EMS - EIA-637B

This feature extends the existing EIA-637B SMS standard. Certain transport layer fields are updated and some are added. EMS (Extended Messaging Service) standard is added on top of EIA-637B. It supports segmented SMS messages, which can transport various types of content (images, ring tones, animations, styled text, etc).

2.4.2.3.2 MMS

Multimedia Messaging Service (MMS) is a standard that allows sending and receiving of media rich messages. To the user MMS seems like an extension of SMS service, but technology wise it is a step in a different direction. The only portion of the SMS service that MMS uses is to send notification where the content to be downloaded resides. The actual content transfer is done over a data call using still not completely defined protocols. Some MMS solutions use HTTP transfer, while others use WAP. The content is presented to the user in a power-point type style, with images and sounds interchanging as a presentation. Common presentation standard used is SMIL.

2.4.2.3.3 Open AT

Open AT architecture is an open platform, which allows customers or third party developers to develop AT commands quickly. This concept provides an easy way to develop AT commands running on Wismo modules and adapted to the application specific hardware. Open AT provides a set of header files, source code samples, and a set of tools, which can be used with the Qualcomm BREW SDK to design and test AT commands. Once compiled, the modified source code can drive a Wismo in a fully customized way.

2.4.2.3.4 CDG Stage 2 – Samsung

CDMA Development Group Interoperability Test Stage 2. Performed on Samsung network equipment.

2.4.2.3.5 AMPS –Data

2.4.2.3.6 BREW

2.4.2.3.7 Sprint Media Messaging Protocol (SMM)

The module currently supports up to 10 SMM segments with length of 160 bytes per segment.

3 Hardware Interface

3.1 System Connector

A 60-pin connector is provided to interface the Module within the host application. This System Connector is a 0.5mm pitch surface mount board-to-board connector, equivalent to the Kyocera/AVX part number 14-5087-060-930-861. The mating part, required on the Host, is a Kyocera/AVX part number 24-5087-060-X00-861.

Unless otherwise noted, the typical interface voltage is referenced to the primary regulator

for the digital processor, which is 2.8Vdc CMOS level.

See *System Connector* below for the individual pin assignments of the connector.

3.1.1 Power

Multiple pins on the System Connector are used to provide the input power to the Module. These are referred to as +V_BAT. This input supplies the PM6000 chip and thus all regulators within the Module. In addition this input supplies the RF Power Amplifiers (via a FET switch that is used to isolate the battery from the Charger if required).

Although the PM chip can handle a broad range of input voltage, the RF amplifiers limit the acceptable range for the Module, as given below.

Table 3-1 Power Supply Voltage

	Vmin	Vnom	Vmax
+V_BAT	3.2Vdc	3.7Vdc	4.2Vdc

The power supply to the Module must be able to deliver 1.0 Amps minimum at the rated operating voltages.

Ground for the Module is obtained through the shielding case of the Module itself. There is no connector pin provided for this. The shielding case has four pins (feet) that should be directly soldered through a ground layer on the host PCB to provide a suitable return path for the Module.

3.1.2 On-Off Control

There are two methods of turning the Module on. The primary method is via the ON/OFF pin on the System Connector. The alternative method is via the application of an external charger to the Module. Note that in the second case, the Module will come up in an Offline Mode, on and running however the RF deck is disabled.

3.1.2.1 ON/OFF Pin

Pin 6 of the System Connector is ON/OFF. This is configured to be both a logic level input, and a pulsed input. Either signal type can be Refer to the following table for details.

Table 3-2 ON/OFF Pin Function

		ON	OFF
Pulse	Voltage (V)	2.0Vdc ≤ **V** ≤ +V_BAT+0.5Vdc (V ≤ 0.7Vdc when Low)	2.0Vdc ≤ **V** ≤ +V_BAT+0.5Vdc (V ≤ 0.7Vdc when Low)

	Time (T) *	**T** ≥ 0.1 Seconds	**T** ≥ 2.0 Seconds
Logic Level	Voltage (V)	2.0Vdc ≤ **V** ≤ +V_BAT+0.5Vdc	**V** ≤ 0.7Vdc
	Time (T) *	**T** ≥ 5.0 Seconds	**T** ≥ 2.0 Seconds

***Note**: The times **T** given in the table above are subject to change once more tests have been performed on prototype Modules. Also, the times **T** for the ON condition assume a valid supply voltage +V_BAT has already been applied.

The Logic Level method is the preferred method recommended for use. However, the Pulse method is most appropriate when an external keypad is to be controlled by the Module.

NOTE: There is a design constraint in the Q24x8 CDMA Module regarding the ON/OFF and /RESET line. If the Pulse method is used, and the Module is either issued a Reset from the Host, or the Module tries to reset itself for some reason, the Module will turn off. Another pulse on the ON/OFF line will be required to turn back on the Module, where it will operate in the normal state. If the Logic Level method is used, the presence of the High on the ON/OFF line will automatically cause the Module to turn back on and operate in the normal state.

3.1.2.2 External Charger On/Off

The application of an external charging supply to the CHG_IN (pins 1,2,4) will power on the Module in an Offline state (no RF capability). Refer to the *Charging* section for details on the charger itself and the requirements for this input.

3.1.3 Vcc_Out

The Module has a current limited regulated output voltage pin that can be used to supply some external circuitry on the host PCB. Pin 40 of the System Connector is Vcc_Out.

This line is sourced from the same regulator that is supplying the baseband processor and memory, and is thus only active when the Module in on. This regulator is enabled when the /Reset pin is initially pulled low, and has a settling time of approximately 1mS.

Table 3-3 VCC_Out Pin Specifications

Vcc_Out	Voltage (V)	2.887Vdc ±2%
	Current (I)	10mA maximum
	Temp Coeff	±100 ppm/°C

3.1.4 /Reset

Pin 14 of the System Connector is a bi-directional /Reset line. The internal reset for the Module is generated within the power management chip on the Module. This output then controls the processor and memories. It is this line that is also brought to the connector.

The host can use this signal to force a reset procedure to execute within the Module. This signal should be considered as an emergency reset only. If used, it has to be driven low by an external open collector or open drain source, as it is internally pulled up. The signal should be pulled low for a minimum of 20mS to guarantee a valid Module reset.

This signal can also be used to reset external circuitry if required. Again, it is active low and will stay low for 20 mS nominal.

> **NOTE:** There is a design constraint in the Q24x8 CDMA Module regarding the ON/OFF and /RESET line. A Reset of the Module, either via the external /RESET line, or by the internal Watchdog, will cause the Module to shut off if the Pulse Method of ON/OFF control is being used. If the Logic Level method of control is in use, the Module will turn back on as usual. Refer to the *ON/OFF Pin* section for details.

3.1.5 Charging

The Q24x8 Module provides controlled charging of a Lithium Ion battery. A regulated external supply is required, to provide the constant current constant voltage source. This should be connected to CHG_IN pins 1,2 and 4 of the System Connector. The application of the external charger will cause the Module to power up in an Offline Mode (no RF capability).

Internally the charging current will be gated to provide Trickle Charging, Constant Current charging, and finally Residual Charging.

> **Note:** The external supply must be a constant current constant voltage supply, with the current limit set to be the 1C rate of the battery (ex. A 1000mAh Li+ battery has a capacity C of 1000mAh thus the required 1C charge current is 1000mA), and the voltage limit set to be the recommended charge voltage for the particular cell being used. No regulation is provided within the Module.

3.1.5.1 Trickle Charging

Trickle charging is enabled automatically through software control when an external charger is applied and the main battery voltage is less than a set threshold. This is to prevent excessive current draw by the battery, minimizing heat and voltage fluctuations. The Module controls the appropriate trickle charging current and monitors the battery voltage to determine when to end trickle charging.

Table 3-4 Trickle Charge Specifications

Parameter	Typical	Units
Voltage Threshold	TBD	V
Current	TBD	mA

3.1.5.2 Constant Current Charging

When a Charger is applied to the Module and the main battery voltage is above the Trickle Charge Threshold, then Constant Current Charging will begin. The battery is charged at a current set by the external supply. As the battery voltage rises and approaches the desired value set by the constant voltage limiting of the external supply, the charging current begins to decrease. This marks the end of this cycle and the beginning of the Residual Charging.

3.1.5.3 Residual Charging

During charging of the main battery, the voltage of the battery will increase to a point where the voltage limiting of the external supply is reached. At this point the external supply current output will decrease exponentially, while the voltage remains constant at this set level. The Module will remain in this mode for TBD minutes to allow the Lithium Ion battery to become 100% charged. After this time, the battery will be isolated from the external supply to prevent over charging of the battery pack.

3.1.6 Digital I/O

There are 31 General Purpose Input/Outputs available on the Module. Many of these lines have an alternate function selectable via Software. There are also differences in the pin characteristics so care must be taken in choosing a GPIO for the function desired.

Refer to the *System Connector* section for details on the pin numbers, the pin type (drive strength, pull up or pull down, etc), the default function of the lines, and the alternate function available.

3.1.7 LCD Interface

The Q24x8 does not provide a dedicated LCD interface. However GPIOs can be used to control an external serial LCD. The control lines and data lines would have to be individually manipulated, limiting the capability to a small monochrome display.

> **Note**: As every display is custom, this feature requires additional design effort and is not supported in the basic offering.

3.1.8 Activity Status Indicators

There are two GPIO's whose default functionality is to give an Activity Status Indication. These signals can be used to drive external LED's through external open collector transistors, or alternatively to signal a controlling processor directly. The Starter Kit

provides two LED's, LED1 and LED2, controlled by these lines. The functionality of these lines is detailed in the following *Table 3-5*.

Note: The functionality of Pin 52 is fixed in all current Software loads and cannot be altered via any AT Command. However the default Status functionality of Pin 53 can be overwritten via an AT Command, to enable that pin as a true GPIO, controllable by the Host through the AT+WIOR and WIOW commands. The AT Command to overwrite the function of the line has not been implemented to date, but will be available in future firmware loads.

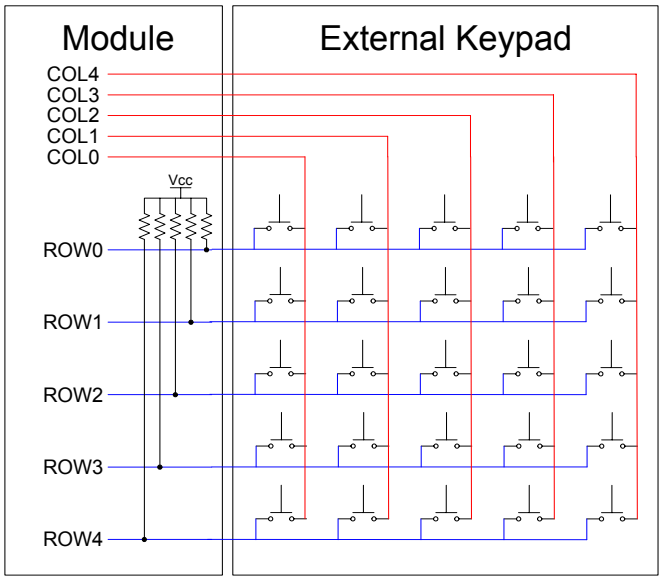
Table 3-5 Activity Status Indicators

Pin #	State	Function
Pin 52	LOW (LED1 is OFF)	Module is OFF or in Download Mode.
	HIGH (LED1 is ON permanent)	Module is ON but not registered on the Network
	Slow Pulse: HIGH for 200 mS; LOW for 2 S.	Module is ON and registered on the Network.
	Quick Pulse: HIGH for 200 mS; LOW for 600 mS.	Module is ON, registered on the Network, and call is in progress.
Pin 53 (GPIO 54)	LOW (LED2 is OFF)	Module is OFF or Software has not Initialized yet.
	HIGH (LED2 is ON)	Module is ON and Software is Initialized.

3.1.9 Keypad Interface

The Module provides support for a 5x5 keypad matrix. The ROW and COL lines of the System Connector, as given in the *System Connector* section, set up the scan matrix for the external keypad. The ROW pins have active pull-ups built in to reduce the need for external components, and are active-low level-sensitive inputs. The COL pins are provided by GPIOs configured to be outputs, toggled low by Software. When shorted to the ROW lines through the external matrix, an interrupt INT will be generated, the key press location decoded and reported. No external de-bouncing is required as this is provided for in Software.

Figure 3-1 Keypad Matrix Organization



Note: The Keypad Interface is the default function provided by the embedded firmware. The alternate function of having the ROW and COL lines as GPIO will be made available through an AT Command which will allow the host to configure the complete interface. This AT Command has not been implemented yet as of V2.00 firmware.

The key being pressed will be reported via either an unsolicited AT response or a solicited one. The mapping of the keys is as shown below. Both a key down and a key up indication is available via the +CKEV AT Command. Refer to the *Q24X8 CMDA 1xRTT AT Commands Interface Specification* document for details.

Table 3-6 Keypad Mapping

	COL0	COL1	COL2	COL3	COL4
ROW0	SEND	DOWN	UP	LEFT	(no key)
ROW1	1	1	3	RIGHT	LEFT
ROW2	4	5	6	END	UP
ROW3	7	8	9	RIGHT	DOWN
ROW4	*	0	#	CLR	SEL

3.1.10 Communication

The Q24x8 provides options on the number and type of serial communication interfaces with the host. Alternative embedded Software loads, and jumpers (resistors) populated during the production of the Module determine the availability and functionality of the

interface pins of the Connector. A USB Interface, 2 UARTs, and various GPIO are configurable. Care must be taken in designing the appropriate interfaces, as not all are available simultaneously. *Figure 3-2*, *Table 3-7* and *Table 3-8* indicate the options available. In general, 2 UARTS or 1 USB is available, with the R-UIM being available in either case. Refer to the following sections for details.

Figure 3-2 Serial Communication Interface

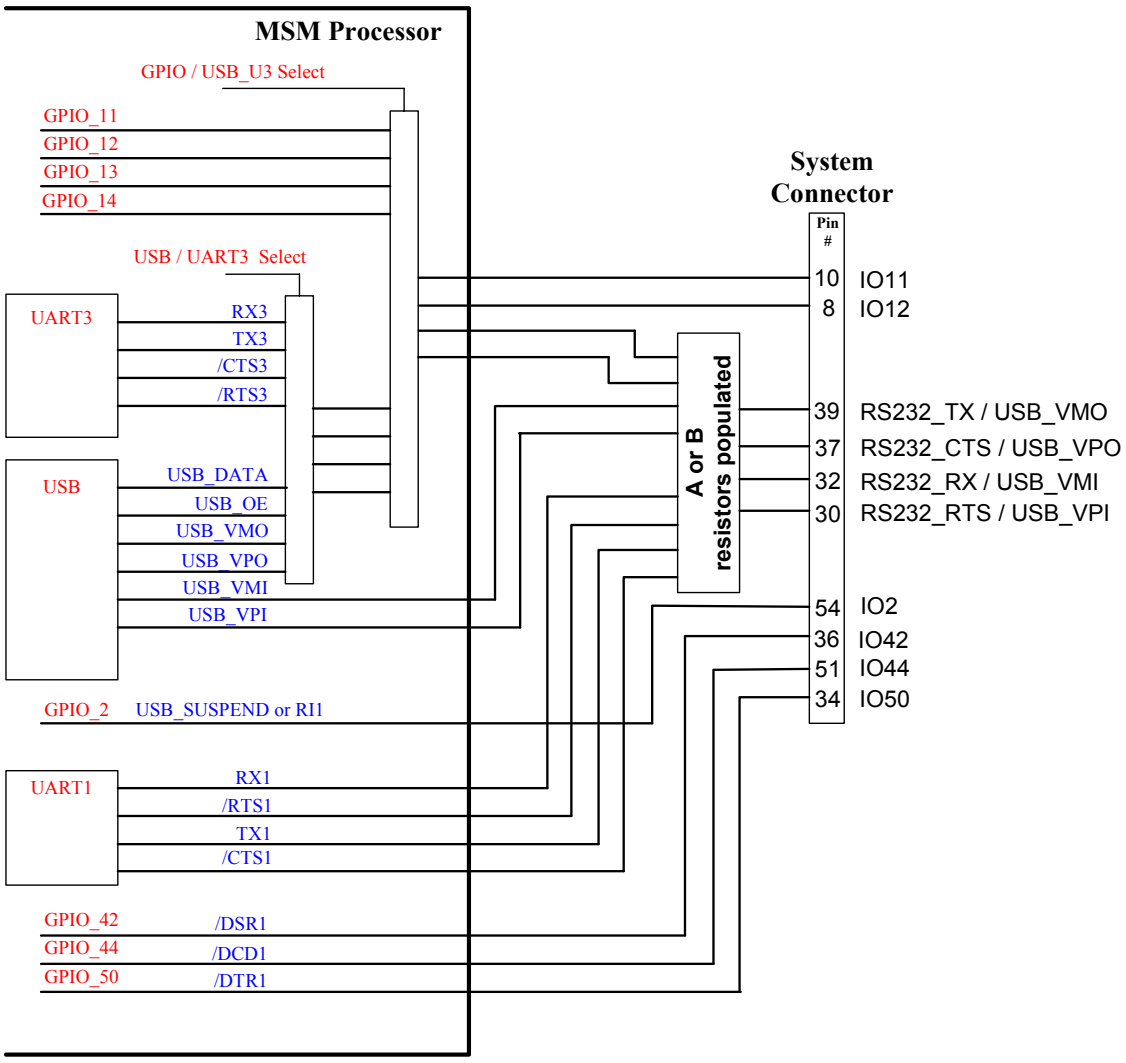


Table 3-7 Population Resistor A (Default configuration)

System Connector Pin Number	Default Function		Alternate Function 1		Alternate Function 2	
10	UART2 RX	I	GPIO 11			I/O
8	UART2 TX	O	GPIO 12			I/O
39	UART1 RX					I
37	UART1 CTS					O
32	UART1 TX					O
30	UART1 RTS					I
54	UART1 RI		O	GPIO 2		I/O
36	UART1 DSR		O	GPIO 42		I/O
51	UART1 DCD		O	GPIO 44		I/O
34	UART1 DTR		I	GPIO 50		I/O

Note: The default function of pins 8 and 10 may change to being the GPIOs, instead of the second UART, on future builds.

Table 3-8 Population Resistor Option B

System Connector Pin Number	Alternate Function 3		Alternate Function 4		Alternate Function 5	
10	USB_DATA			I	UART2 RX	I
8	USB_OE			O	UART2 TX	O
39	USB_VMO	O	USB_VMO	I/O	UART2 RTS	I
37	USB_VPO	O	USB_VPO	I/O	UART2 CTS	O
32	USB_VMI	I	GPIO 10			I/O
30	USB_VPI	I	GPIO 9			I/O
54	USB_SUSPEND			O	GPIO 2	I/O
36	GPIO 42					I/O
51	GPIO 44					I/O
34	GPIO 50					I/O

3.1.10.1 UART1

The Q24x8 contains a Universal Asynchronous Receiver Transmitter (UART) that communicates with serial data conforming to the RS-232 interface protocol. The UART1 can be used as a serial data port for data transfer, testing and debugging, and to load and/or upgrade the system software. This UART has 512 byte TX and RX FIFO buffers and a maximum operating speed of 230.4 kbps.

The UART1 uses 8 pins on the System Connector as shown in *Table 3-9*. The default population is with the UART1 Interface populated and enabled. This is Option "A", as shown in *Table 3-7* above, and in *Table 3-9* below.

Table 3-9 UART1 Pin Names and Numbers

Signal Name	I/O (wrt Module)		Description (wrt Host)	Sys. Conn. #
RS232-RX	O	Module -> Host	Receive serial data	32(A)
RS232-TX	I	Host -> Module	Transmit serial data	39(A)
RS232-RTS	I	Host -> Module	Request To Send	30(A)
RS232-CTS	O	Module -> Host	Clear To Send	37(A)
IO44 (DCD)	O	Module -> Host	Data Carrier Detect	51
IO2 (RI)	O	Module -> Host	Ring Indicator	54
IO50 (DTR)	I	Host -> Module	Data Terminal Ready	34
IO42 (DSR)	O	Module -> Host	Data Set Ready	36

*(A) indicates that resistor networks were populated to enable the "A" option of UART.

*wrt = "with respect to"

3.1.10.2 UART2

The Module supports an optional second UART, UART2 (connected internal to the Module to UART-3 of the MSM processor, as shown in the block diagram above). The UART2 is either a two-wire interface (RX2 and TX2), or a four-wire interface (with additional RTS2_N and CTS2_N). However because of some shared functionality on the connector pins, use of the four-wire interface for UART2 precludes the use of both the USB and UART1, as shown above in *Table 3-7* and *Table 3-8*. For this reason use of the 4-wire interface is not suggested. This UART has 64 byte TX and RX FIFO buffers and a maximum operating speed of 115.2 kbps.

3.1.10.3 USB

The Q24x8 is capable of supporting a Universal Serial Bus (USB). The default Q24x8 firmware however does not include support for USB. The Modules USB interface is USB Rev 1.1 compliant, and USB Rev 2.0 compliant (12Mbps only) however an external USB transceiver is required to implement the interface. There are 7 lines required to support the USB.

The USB interface supports connections to transceivers with both separate input and output data pins (Philips ISP1106) or with bi-directional data pins (Micrel MIC2550). The embedded Software is used to determine which style of USB interface is preferred, however Module Hardware must be populated to enable the USB control lines. This is Option "B", as shown in *Table 3-7* above, and in Table 3-10 below.

Note: The use of the USB interface precludes the use of both UART1 and UART2 at the System Connector. For test purposes, UART1 is still available at Test Points on the Module itself.

Table 3-10 USB/UART-2 Pins and Connections

Signal Name	Philips ISP1106	Micrel MIC2550	System Conn. #
USB-VMI	VM	Not used	32(B)
USB_VMO	VMO	VM	39(B)
USB_VPI	VP	Not used	30(B)
USB-VPO	VPO	VP	37(B)
USB_OE	OE/	OE/	8
USB_DATA	RCV	RCV	10
USB_SUSPND	SUSPEND	SUS	54

*(B) indicates that resistor networks were populated to enable the "B" option of USB.

The following figures show the connections between the System Connector and the two external transceivers, one of which the user must use if USB is desired. Refer to the appropriate data sheet for each transceiver connection requirements.

Figure 3-3 Example Connections for Philips ISP1106 Transceiver

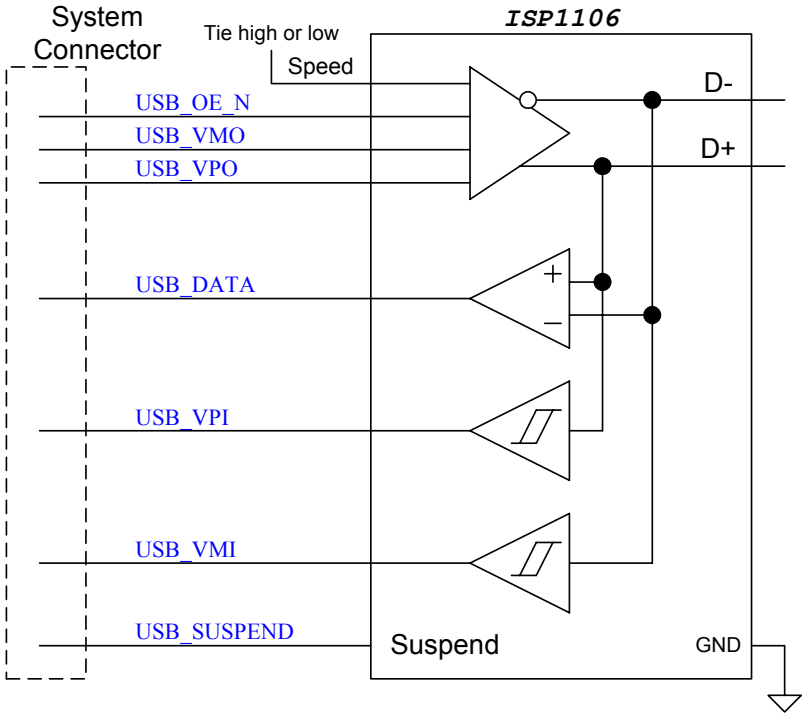
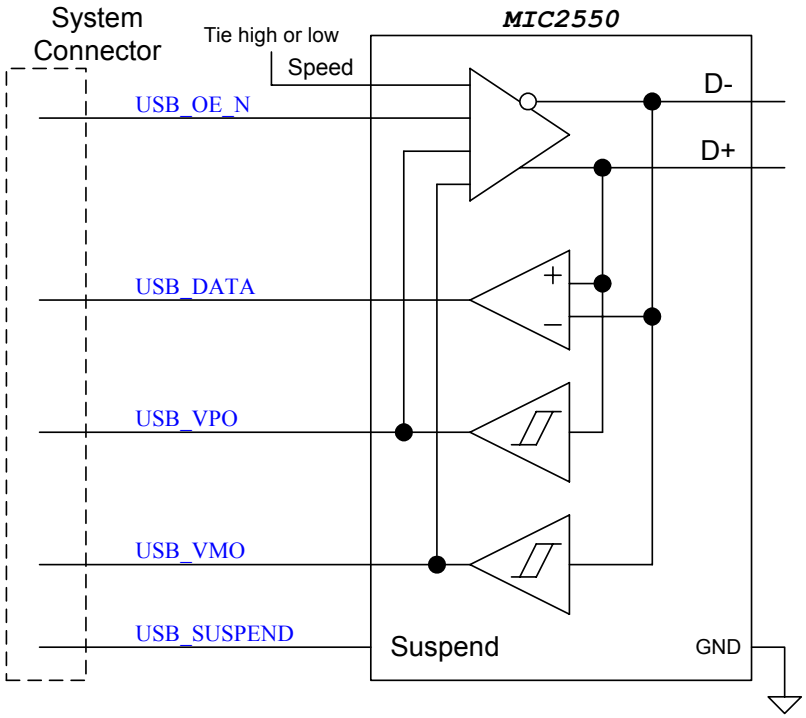


Figure 3-4 Example Connections for Micrel MIC2550 Transceiver



3.1.11 R-UIM Interface

The Removable User Identity Module (R-UIM) is a smart card for CDMA cellular applications. The Q2458 (Single Band Module) can support a 3.0 Volt R-UIM interface, as required in the China marketplace.

Two of the 4 required lines, R-UIM_CLK pin 3 of the System Connector and R-UIM_Data pin 7, are dedicated pins on the interface. The other two lines, R-UIM_RST and R-UIM_PWR_EN, are GPIO lines under Software control.

Table 3-11 R-UIM Pin Functionality

Pin Number	Signal Name	Alternate Function
3	R-UIM_CLK	
5	GPIO_INT_49	R-UIM_RST
7	R-UIM_Data	
9	GPIO_INT_56	R-UIM_PWR_EN

Note: Pins 5 and 9 are available as standard GPIO if the R-UIM is not required.

The R-UIM_PWR_EN line is used to enable an LDO regulator in order to supply power to the R-UIM. The R-UIM has a maximum constant current draw of 50 mA and can spike to 50 mA above this level. Refer to the R-UIM specification for further details.

3.1.12 Analog to Digital Converter

The Module includes a multi-input Analog to Digital Converter. Two external inputs, along with four internal inputs, are multiplexed into one converter within the Module and can be queried with the appropriate AT Command. Both the external inputs have the following specifications.

Table 3-12 ADC Analog Input Specification

Parameter	Conditions	Min.	Typ.	Max.	Units
Channel Isolation	f = 1KHz		50		dB
Resolution			10		bits
Input voltage range		0		2.5	V
Input resistance	Parallel RC	3			MOhm
Input capacitance	Parallel RC			10	pF
Input Bandwidth	0Ω source impedance		TBD		KHz
Full scale error				±3	%
Offset error				5	LSB
Sampling clock freq.	From internal RC oscillator	0.96	1.28	1.92	MHz
Conversion timing				43	µsec

The two external inputs are available at the System Connector as general-purpose Analog-to-Digital Converter inputs, ADC_0 and ADC_1 on pins 33 and 38 respectively. The user can determine the functionality of these two external channels. There are three additional internal ADC channels that may be of interest to the user. These monitor the internal temperature of the Module, the battery voltage (+Vbatt) being supplied to the Module, and the Charger Voltage (CHG_IN). The conversion transfer functions for these inputs are given below.

Table 3-13 ADC Digital Transfer Functions

ADC Channel	Digital word D=	Parameter definitioin
Vbatt	(+V_BAT*256)/(2.5*2.5)	+V_BAT is voltage (Volts) at System Connector
Vtherm	(Vtemp*256)/2.5	Vtemp = -0.012*T + 1.864 Vdc where “T” is temperature at sensor in °Celsius.
ADC_0,1	(Vadc *256)/2.5	Vadc is voltage (Volts) at System Connector
Vcharge	(CHG_IN*256)/4.2	CHG_IN is voltage (Volts) at System Connector

One additional ADC channel is used internally in the feedback loop of the RF deck and is not of concern to the user.

3.1.13 Audio Interface

The Q24x8 provides audio input and output on the System Connector. The System Connector provides for two microphones and two speakers to be connected, with either pair being selectable via AT Commands.

3.1.13.1 Microphone

The System Connector provides two microphone interfaces to the main board. Both the primary interface (MIC_1) and secondary (MIC_2) are differential interfaces. Either can of course be used in a single-ended application (such as for a headset) however the differential configuration is recommended to help reduce noise.

The full scale input range (clipping point = +3 dBm0) of the transmit A/D Converter is 3.63 Vpp. There is a fixed 18 dB gain block and a software controllable gain setting (AT+VGT) before this input, within the Module. Assuming this adjustable gain is at 6 dB, for a total of 24dB, the Transmit reference signal level (0 dBm0) will be typically 57.3 mVrms for the differential analog input signals.

This is the theoretical level assuming +6 dB gain in the variable gain block controlled via the AT+VGT Command. If a different gain is programmed, the 0 dBm0 level must be calculated to account for the gain chosen by the user.

The device has been configured to allow for 24 dB of dynamic headroom for typical speech volumes at the microphone differential inputs. The determination of these typical speech volumes is left up to the application designer, as it is a function of the host architecture,

acoustic design, and working environment of the final product.

Figure 3-5 is example of a differential microphone in a typical handset application.

Figure 3-5 MIC_1 Differential Interface

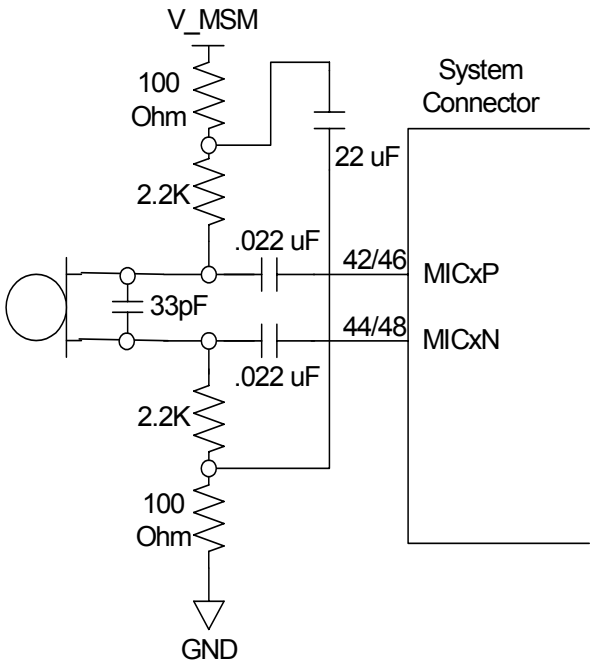
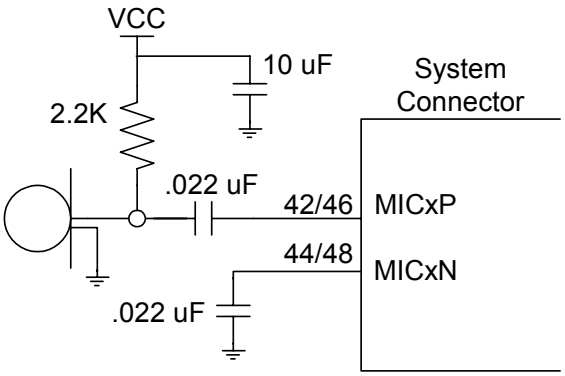


Figure 3-6 is example of a single-ended microphone in a typical handset application.

Figure 3-6 MIC_2 Single-Ended Interface



3.1.13.2 Speaker

The System Connector provides two speaker interfaces to the main board. The primary interface (SPK_1) is a differential interface. This interface is the preferred receive path, as

the differential circuitry will help to minimize noise at the speaker. The secondary interface (SPK_2) is single-ended. The single-ended application is normally used for the headset, which by nature typically requires a single ended driver.

Figure 3-7 is example of a differential speaker in a typical handset application.

Figure 3-7 SPK_1 Differential Interface

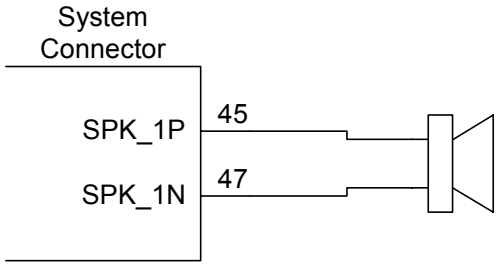


Figure 3-8 is example of a single-ended speaker in a typical handset application.

Figure 3-8 SPK_2 Single-Ended Interface

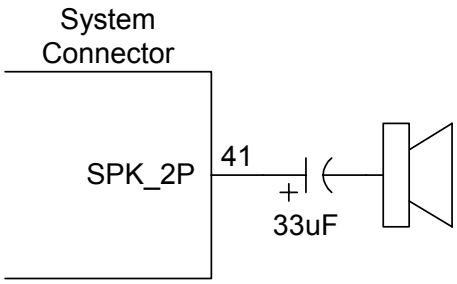


Table 3-14 Speaker Amplifier Power

	Max output power, +3 dBm0 1kHz sine wave into 32 Ohm speaker
SPK_1 (differential)	70mW
SPK_2 (single-ended)	10.8mW

3.1.13.3 Ringer

The Q24x8 Module provides a Ringer or buzzer driver (sink) via pin 49 of the System Connector. A pulsed digital waveform is generated within the MSM via AT Commands that

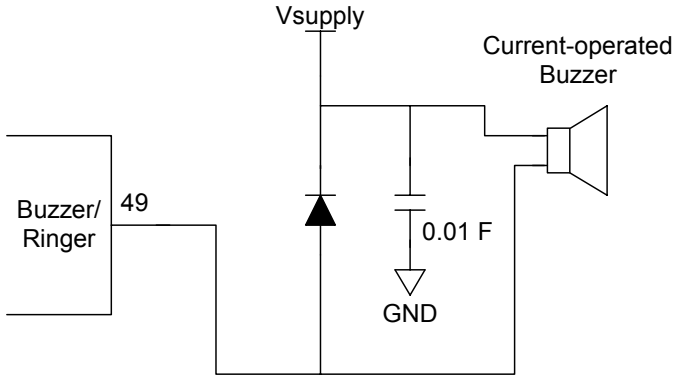
control the pitch (programmed frequency) and loudness (programmed duty cycle). The pulse stream can be a single tone or the sum of two different frequencies or DTMF tones. This waveform becomes the input signal to a driver contained within the PM chip. The driver is a current sink, so the external ringer or buzzer device must be externally connected to a current source, with the Module providing the return-to-ground path for the device. A fly-back diode and decoupling capacitor are recommended to prevent voltage spikes that might damage the Module, and to minimize switching noise of the device.

Note: This Ringer interface is not the same as the one available on the Q23x8 Module design. There, an external current sink was required as the Module was only able to source a weak PWM output for control. On the Q24x8 family, this sink has been incorporated into the design. Refer to *Figure 3-9* below for details.

Table 3-15 Ringer Driver Specifications

	Min	Typ	Max	Units
Load current	300			mA
Load resistance	7	10		Ω

Figure 3-9 Ringer: External Circuit example



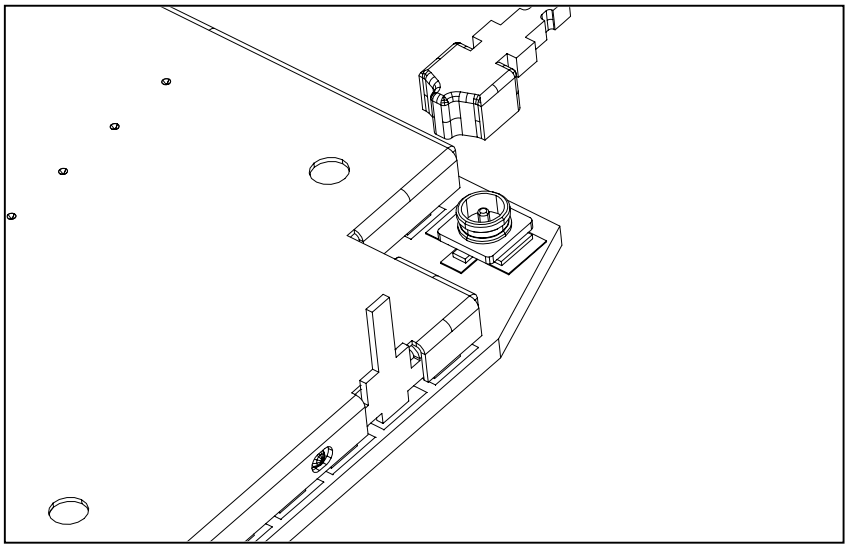
3.2 RF Connection

The V2 and later versions of the Q24x8 have only a single RF launch, incorporating both GPS and the CDMA paths. The RF connection is a 50-ohm impedance system and is a DC short to ground. Best effort should be made to provide low insertion loss and shielding between the external antenna and RF connection over the frequency band interested. Also, keep the external RF cable away from any possible interference sources; especially high-speed digital signals and switching power supply.

3.2.1 GPS, Cellular and PCS.

A Hirose U.FL connector is available on the Module as a factory default, to launch all of the RF signals. The connector is located on the component side of the Module as shown in Figure 3-10. The total mating height is 2.5mm. A right-angle plug shell with cable harness is available from Hirose. Please contact Hirose for detail specifications.

Figure 3-10 RF Connection Option



3.2.2 Antenna

The following details the recommended antenna requirements.

Table 3-16 Antenna Requirement

	Cellular	PCS	gpsOne
Freq. Range	824 – 894 MHz	1850 – 1990 MHz	1574 – 1576 Mhz
Impedance	50 ohm		
VSWR	2.0:1 max		
Gain	0 dBi in one direction at least		

Note: Depending on applications, the requirement of the gain will be different. Typically, the higher the antenna gain, the more directional the antenna is.

4 Software Interface

The external applications communicate with Q24x8 Module through AT commands as specified in the *WismoQuick AT Interface Specification*.

5 CDMA → GSM/GPRS Design Differences

Although the pin outs for both the CDMA Module with the GSM/GPRS Module designs are identical, and every attempt has been made to ensure the complete compatibility of the designs, there are some particular areas where care must be taken to allow a “plug and play” swap of the two Module families.

5.1 Power Supply

The maximum voltage of the CDMA Module is 4.2Vdc. The GSM Module maximum is 4.5Vdc.

5.2 BOOT

To allow the customer to download new firmware into the Module, the GSM design requires the use of the BOOT line, pin 12 on the System Connector. Pulling this line LOW (to Ground through a 1k Ohm resistor) will put the Module in Download mode. For normal operation of the GSM Module, this line should be left floating.

The CDMA design does not require this line to downloading. This line on the CDMA Module is treated as a GPIO.

> **Note**: The Starter Kit includes a switch labeling “BOOT”. On the Kit, this switch will pull pin 12 of the Module HIGH or LOW through a 10k Ohm resistor, depending on its position. For proper startup and shutdown of the CDMA Module, this line should remain in the “LO” position. The Module will “latch” on otherwise as the Module would get power applied to a GPIO input when no power is applied to the processor itself.

5.3 Audio

The CDMA Module provides only a single ended driver for the second speaker audio path. The GSM family has a differential driver here. Although any external circuit design making use of the differential drive will be compatible with the CDMA Module, the CDMA Module will have a relatively reduced drive level (6dB) on this audio speaker path compared to the GSM.

5.4 SIM / R-UIM

The GSM SIM card spec requires a maximum of 10mA supply to the card. However the R-UIM specification from Qualcomm specifies a higher current requirement for this supply. Care must be taken to ensure that adequate current is available to the R-UIM card. Refer to the *R-UIM Interface* section above for the requirements and recommendations.

5.5 GPIO

The mapping of the GPIO pins to the System Connector pins is different between any GSM Module and the Q24x8. This is also true when comparing any to the Q23x8 Module. Care must be taken to assure the correct GPIO is being addressed via the AT Command, for the given connector pin required.

Also, one particular GPIO has a default function on the CDMA Module. GPIO 54, pin 53 on the System Connector, is configured as one of the *Activity Status Indicators*. The GSM Modules do not offer this functionality and instead offer only the standard GPIO on this pin.

6 Q23x8 → Q24x8 Design Differences

The Q24x8 Module is the second generation of CDMA Module provided by Wavecom. In an effort to make the Module more closely resemble the GSM/GPRS designs, some of the pin functionality has been changed on this new generation. The user should take note of the follows design differences if migrating from the Q23x8 family.

6.1 On/Off

The Module now handles a higher input voltage (broader range) on the ON/OFF Control line. Refer to the *On-Off Control* section for details.

6.2 LCD interface

The option for a parallel bus to drive an external LCD is no longer available. Refer to the *LCD Interface* section for details.

6.3 GPIOs

The reference numbers of the GPIOs have changed. For example: Pin 8 on the System Connector used to be controlled via GPIO 21 on the Q23x8 Module. On the Q24x8 Module, this is now GPIO 12. Care must be taken to access the correct GPIO. Refer to the *System Connector* section and the following table for details.

Table 6-1 Q23x8 vs Q24x8 GPIO Map

System Connector Pin Number	Q23x8 GPIO Number	Q24x8 GPIO Number	System Connector Pin Number	Q23x8 GPIO Number	Q24x8 GPIO Number
5	5	49	27	45	59
8	21	12	28	36	19
9	30	56	29	23	58

10	20	11	31	22	57
12	42	6	34	2	50
16	44	3	35	7	48
18	43	4	36	3	42
20	13	15	50	40	37
22	14	16	51	4	44
23	47	61	52	9	41
24	16	17	53	8	54
25	46	60	54	11	2
26	10	18	56	Vibra	5

6.4 USB

There is the additional hardware/software option of using a USB interface instead of the two available UARTs. Refer to the *Communication* section for details.

6.5 Ringer

The Module now includes a Ringer driver (a current sink). The Q23x8 only had a control output and required an external driver. Refer to the *Ringer* section for details.

6.6 ADC

The Analog to Digital Converter now has a different transfer function, so the value reported will mean a different voltage level. Refer to the *Analog to Digital Converter* section for details.

6.7 RF Connection

The Module now only has one method for connection, which is via a Hirose U.FL connector. Refer to the *RF Connection* section for details.

6.8 Board dimensions

The Module is 0.6mm wider and the angle at the top near the RF connector has changed slightly. The footprint (System Connector and grounding pads for shield pins) will remain the same. Refer to the *Mechanical* section for details.

6.9 Starter Kit

A new Starter Kit (V4.2) is available to better suit the Q24x8 Module, however the original CDMA SK will work well in all areas except the Ringer and USB. The new SK is backwards compatible with the Q23x8 Modules.

7 Technical Specification

7.1 System Connector

Table 7-1 I/O Pin Parameters

Symbol	Description
Type	
B	Bi-directional
BS	Bi-directional with Schmitt trigger
CCS	Controlled Current Sink
CHV	Input Charging Voltage
I	CMOS input
IS	Input with Schmitt trigger
O	Output
V	Power
Special Circuitry	
A	Analog pad
PU	Contains internal pull-up device
PD	Contains internal pull-down device
KP	Contains an internal weak keeper device. Keepers cannot drive external busses
H	Digital input where input voltage level may reach up to 3.6 V
(1,2,5, etc.)	Values are the +/- maximum current drive strength in mA for output pins
n[m]	Variable drive strength pins. The number 'n' is the drive strength when the PAD_CTL register bit is clear (0). The Number [m] is the drive strength when the PAD_CTL bit is set (1).

Table 7-2 System Connector Pin Assignment

Pin #	Signal Name	Pin Type	Alt Function	Alt Function
1	CHG_IN			
2	CHG_IN			
3	R-UIM_CLK **	BS-PD3[5]	N/A *	
4	CHG_IN			
5	GPIO_INT_49 *	BS-PD3[5]	R-UIM_RST **	
6	ON_/OFF	0 - VBATT		
7	R-UIM_Data	BS-PD3[5]	N/A *	
8	GPIO_INT_12	BS-PD3[5]	TX2 *	USB-OE
9	GPIO_INT_56	BS-PD3[5]		
10	GPIO_INT_11	BS-HK2	RX2 *	USB-DATA
11	No Connect			
12	GPIO_INT_6	BS-PD3[5]		
13	GPIO_INT_62	BS-PU3[5]	ROW_0* **	
14	/RESET	0 – 2.8v		
15	GPIO_INT_63	BS-PU3[5]	ROW_1* **	
16	GPIO_INT_3	BS-PU3[5]		
17	GPIO_INT_64	BS-PU3[5]	ROW_2* **	
18	GPIO_INT_4	BS-PD3[5]		
19	GPIO_INT_65	BS-PU3[5]	ROW_3* **	
20	GPIO_INT_15	BS-PU3[5]		
21	GPIO_INT_66	BS-PU3[5]	ROW_4* **	
22	GPIO_INT_16	BS-PU3[5]		
23	GPIO_INT_61	BS-PD3[5]	COL_0* **	
24	GPIO_INT_17	BS-PU3[5]		
25	GPIO_INT_60	BS-PD3[5]	COL_1* **	
26	GPIO_INT_18	BS-PD3[5]		
27	GPIO_INT_59	BS-PD3[5]	COL_2* **	
28	GPIO_INT_19	BS-PD3[5]		
29	GPIO_INT_58	BS-PD3[5]	COL_3* **	
30-A	RS232-RTS	IS-PU		

30-B	USB_VPI	BS-HK2	GPIO 9* **	
31	GPIO_INT_57	BS-PD3[5]	COL_4* **	
32-A* **	RS232-RX	O-3[5]		
32-B	USB_VMI	BS-HK2	GPIO 10	
33	ADC_0	IA		
34	GPIO_INT_50	BS-PU3[5]	DTR* **	
35	GPIO_INT_48	BS-PU3[5]		
36	GPIO_INT_42	BS-PD3[5]	DSR* **	
37-A* **	RS232-CTS	O-3[5]		
37-B	USB_VPO	BS-PD3[5]	UART2 CTS	
38	ADC_1	IA		
39-A* **	RS232-TX	IS-PD		
39-B	USB_VMO	BS-PD3[5]	UART2 RTS	
40	VCC-Out_2.8v			
41	SPK_2P	OA		
42	MIC_2P	IA		
43	GND			
44	MIC_2N	IA		
45	SPK_1P	OA		
46	MIC_1P	IA		
47	SPK_1N	OA		
48	MIC_1N	IA		
49	BUZ	?		
50	GPIO_INT_37	BS-PU3[5]		
51	GPIO_INT_44	BS-PU3[5]	UART1 DCD* **	
52	GPIO_INT_41	BS-PD3[5]	LED1 –Activity Status* **	
53	GPIO_INT_54	BS-PD3[5]		
54	GPIO_INT_2	BS-PU3[5]	UART1 RI* **	USB-SUSPND
55	+Vbatt			
56	GPIO_INT_5	BS-PD3[5]		

57	+Vbatt			
58	+Vbatt			
59	+Vbatt			
60	+Vbatt			

NOTE:

* indicates the default function for the Q2438 Module.

** indicates the default function for the Q2458 (R-UIM) Module.

7.2 DC Electrical Specifications

7.2.1 Absolute Maximum Ratings

Operating the Q24x8 under conditions that exceed those listed in Table 7-3 may result in damage to the device. Absolute maximum ratings are limiting values, and are considered individually, while all other parameters are within their specified operating ranges. Functional operation of the WISMOCDMA under any other conditions in Table 7-3 is not implied.

Table 7-3 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Storage temperature	TS	-40	+85	C
Supply voltage (Battery)	VBATT	-0.5	4.2	Vdc
Supply voltage (Charger)	CHG_IN	-0.5	4.2	Vdc
Charger current	I_CHG		2.0	Adc
Voltage on input/output pin	Vpin	-0.5	VCC + 0.5	Vdc

7.2.2 Recommended Operating Conditions

Table 7-4 Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units
Ambient operating temperature	TS	-30	-	+60	C
Battery supply voltage	VBATT	3.2	3.7	4.2	Vdc
Charger supply voltage	CHG_IN	4.2	4.2	4.2	Vdc
Charger current	I_CHG	-	Battery 1C	-	Adc

7.2.3 DC Characteristics

Table 7-5 DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
High-level input voltage, CMOS/Schmitt	V_IH	1.88	-	3.19	Volts
Low-level input voltage, CMOS/Schmitt	V_IL	-0.3	-	1.01	Volts
Schmitt hysteresis voltage	Vshys	150	-	-	mVolts
Input high leakage current	I_IH	-	-	2	µA
Input low leakage current	I_IL	-2	-	-	µA
Input high leakage current with pull-down	I_IHPD	10	-	60	µA
Input low leakage current with pull-up	I_ILPU	-60	-	-10	µA
High-level, three-state leakage current	I_OZH	-	-	2	µA
Low-level, three-state leakage current	I_OZL	-2		-	µA
High-level, 3-state leakage current w/ pull-	I_OZHPD	10	-	60	µA
Low-level, 3-state leakage current w/ pull-up	I_OZLPU	60	-	-10	µA
High-level, 3-state leakage current w/ keeper	I_OZHKP	-25	-	-5	µA
Low-level, 3-state leakage current w/ keeper	I_OZLKP	5	-	25	µA
High-level output voltage, CMOS	V_OH	2.44	-	2.88	Volts
Low-level output voltage, CMOS	V_OL	0.0	-	0.45	Volts
Input capacitance	C_IN	-	-	15	PF
ADC Full-Scale Input Range	A_FS	-	2.5	-	Volt
ADC Input Serial Resistance	A_ISR	3	-	-	Mohm
ADC Input Capacitance	A_C_IN	-	-	10	pF
Input offset voltage at MIC1, MIC2	MV_IO	-5	-	5	mVolts
Input bias current at MIC1, MIC2	MI_IB	-200		200	NA
Input capacitance at MIC1, MIC2	M_CI	-	5	-	pF
Input DC Common Mode Voltage	-	0.85	0.9	0.95	Volts
Input impedance MIC1, MIC2	M_ZIN	62	72	82	Kohm

7.3 RF System Specification

The RF performance is compliant with IS-98D or 3GPP2 Mobile Station Minimum Performance Specification for CDMA operation in Cellular band and PCS band. The AMPS performance is compliant with IS_98B analog mode or IS-19C. Please refer to those documents for detailed specifications and test methods. The maximum transmit power and receiver sensitivity at different modes are listed below in *Table 7-6*.

Table 7-6 RF Power/Sensitivity

Band	Spec	Min	Nominal	Max	Units
Cellular	Max Output Power	23	24	30	dBm
		(200)	(250)	(1000)	mW

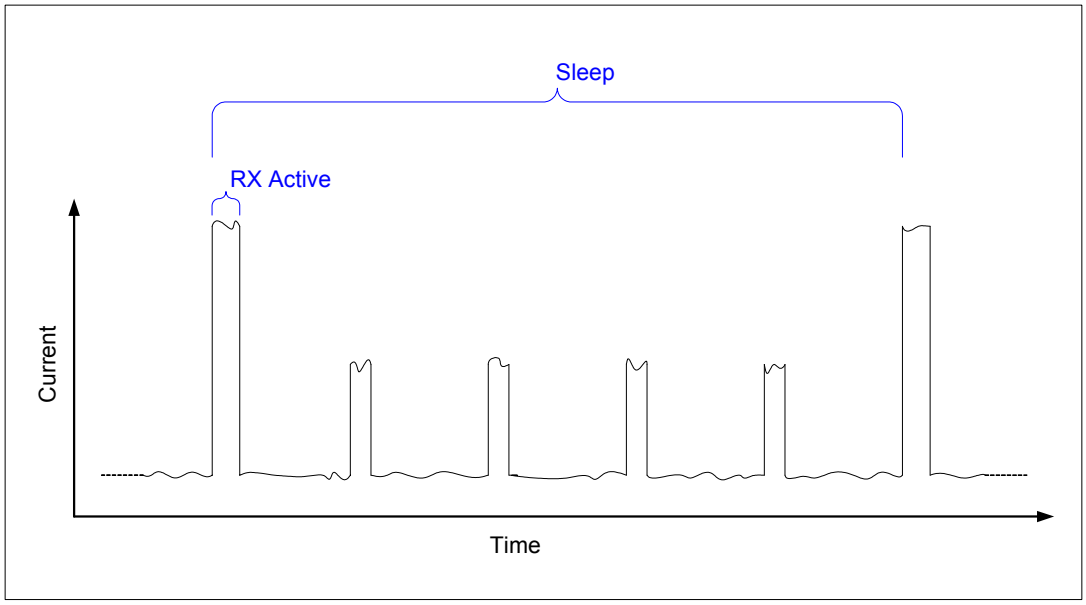
	Sensitivity	-	-107	-104	dBm
PCS	Max Output Power	23	24	30	dBm
		(200)	(250)	(1000)	mW
	Sensitivity	-	-107	-104	dBm
AMPS	Max Output Power	22	28	30	dBm
		(160)	(630)	(1000)	mW
	Sensitivity	-	-118	-116	dBm

7.4 Power Consumption

Table 7-7 Power Consumption

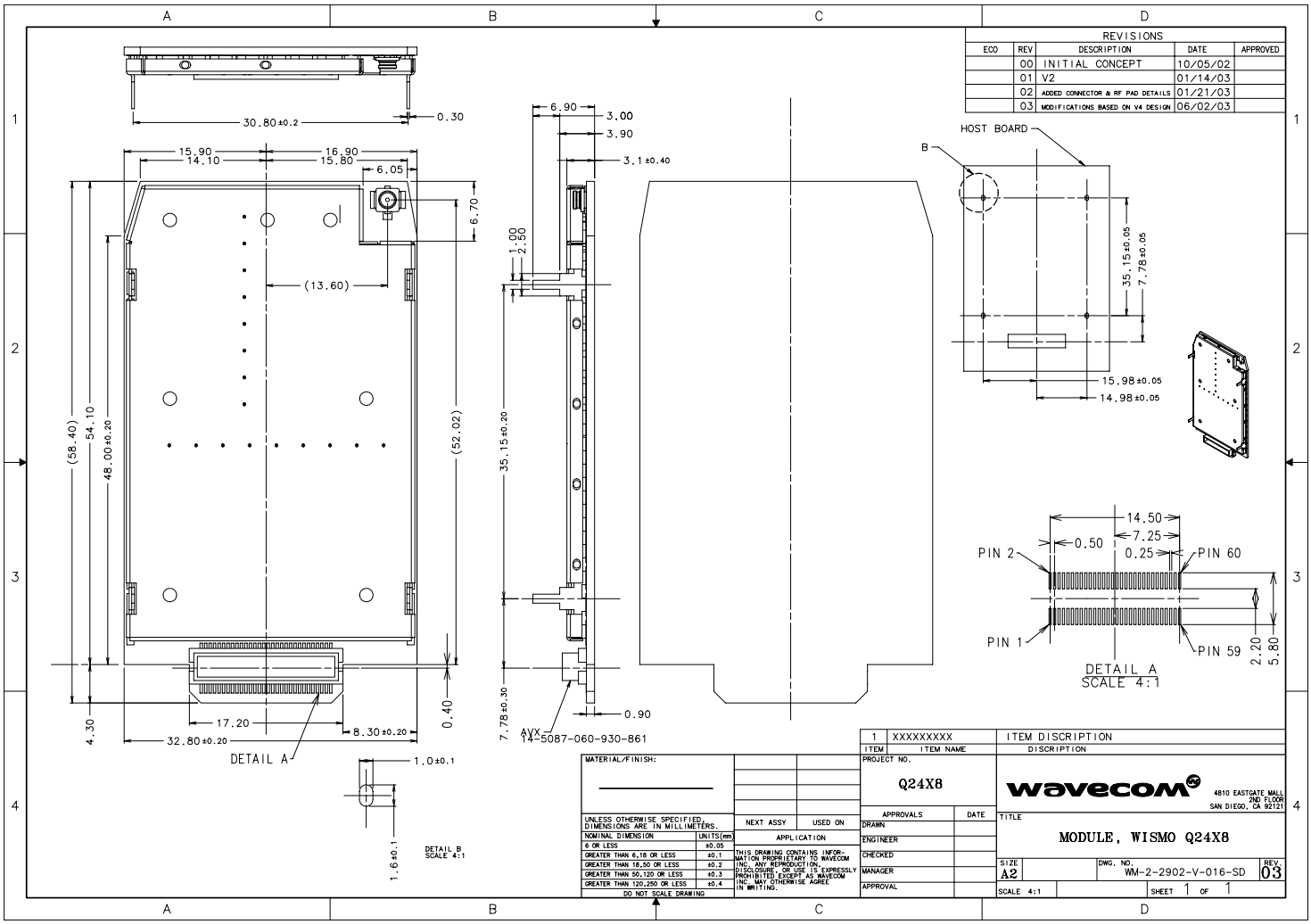
Operating Mode	Band	Average	Units	Notes
CDMA RxTx Full Power	Cellular	620	mA	@+23dBm Tx Power
	PCS	670		
CDMA RxTx Average Power	Cellular	300	mA	@+10dBm Tx Power
	PCS	340		
CDMA RxTx Average Power	Cellular	250	mA	@0dBm Tx Power
	PCS	265		
CDMA Rx Active	Cellular	108	mA	See *Figure* 7-1
	PCS	118		
CDMA Sleep	Cellular	4.0	mA	Slot Cycle 2 – average over cycle. See *Figure* 7-1
	PCS	4.0		
AMPS Idle		130	mA	
AMPS Full Power		1.0	A	@+26dBm Tx Power

Figure 7-1 Sleep Current Definition



8 Mechanical

Figure 8-1 Module Mechanical Drawing



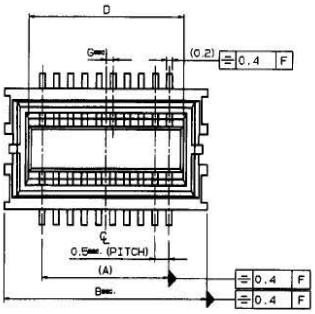
9 Appendix: Datasheets

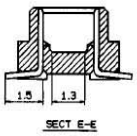
9.1 System Connector

A 60-pin connector is provided to interface the Module within the host application. This System Connector is a 0.5mm pitch surface mount board-to-board connector, equivalent to the Kyocera/AVX part number 14-5087-060-930-861. The mating part, required on the Host, is a Kyocera/AVX part number 24-5087-060-X00-861.

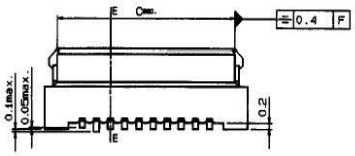
0,5 mm Spacing SERIES 5087

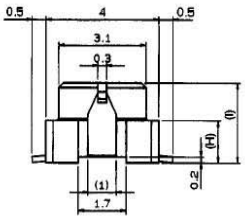
Surface Mount Vertical Plug

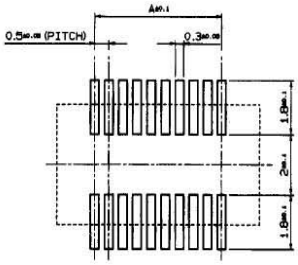




Specifications:
- 1000 per Tape and Reel
- Voltage - 50 V
- Current Rating - 0.4 A
- Dielectric Withstanding Voltage - 500 V
- Operating Temperature - (-25°C ~ +85°C)
- Contact Material - phosphor bronze
- Insulator Material - PPS (UL 94 V-0)







MOUNTING LAYOUT

No. of Pos.	P/N	A	B	C	D	G
20	10 5087 020 XX0 861	4.5/.177	7.2/.283	6.2/.244	5.5/.217	0.25/.0098
30	10 5087 030 XX0 861	7.0/.276	9.7/.382	8.7/.343	8.0/.315	0.50/.0196
36	10 5087 036 XX0 861	8.5/.335	11.2/.441	10.2/.402	9.5/.374	0.25/.0098
40	10 5087 040 XX0 861	9.5/.374	12.2/.480	11.2/.441	10.5/.414	0.25/.0098
50	10 5087 050 XX0 861	12.0/.472	14.7/.579	13.7/.539	13.0/.512	0.50/.0196
60	10 5087 060 XX0 861	14.5/.571	17.2/.677	16.2/.638	15.5/.610	0.25/.0098

Dimensions millimeters/inches

ORDERING CODE

Typical Example	14	5087	0XX	2XX	861

14: PLUG - Tape and Reel

NUMBER OF CONTACTS:

40, 60 : 3.0mm Stack
36, 40, 50 : 3.5mm Stack
20, 30, 36, 50, 60 : 4.0mm Stack

2: Without Adhesive Tape
9: Adhesive Cover Tape

VARIATION CODE:

	H	I
30	.9	2.15
35	1.4	2.7
40	1.9	3.2

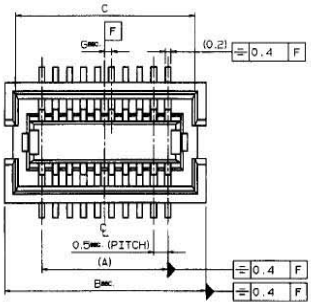
PLATING VARIATION:

861: 15 microinches of gold with gold flash tails

Consult factory for other sizes

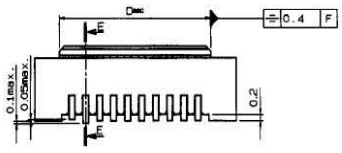
65/70

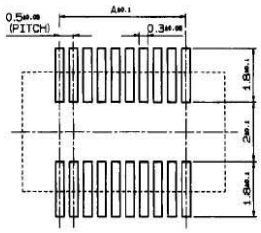
0,5 mm Spacing SERIES 5087



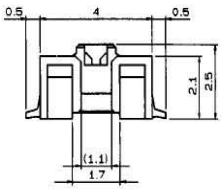
Surface Mount Vertical Receptacle

Specifications:
- 1000 per Tape and Reel
- Voltage - 50 V
- Current Rating - 0.4 A
- Dielectric Withstanding Voltage - 500 V
- Operating Temperature - (-25°C ~ +85°C)
- Contact Material - phosphor bronze
- Insulator Material - PPS (UL 94 V-0)





MOUNTING LAYOUT



No. of Pos.	P/N	A	B	C	D	G
20	20 5087 020 x00 861	4.5/.177	7.2/.283	6.4/.252	5.4/.213	0.25/.0098
30	20 5087 030 x00 861	7.0/.276	9.7/.382	8.9/.350	7.9/.311	0.50/.0196
36	20 5087 036 x00 861	8.5/.335	11.2/.441	10.4/.409	9.4/.370	0.25/.0098
40	20 5087 040 x00 861	9.5/.374	12.2/.480	11.4/.449	10.4/.409	0.25/.0098
50	20 5087 050 x00 861	12.0/.472	14.7/.579	13.9/.547	12.9/.508	0.50/.0196
60	20 5087 060 x00 861	14.5/.570	17.2/.677	16.4/.646	15.4/.606	0.25/.0098

Dimensions millimeters/inches

ORDERING CODE

Typical Example	24	5087	0XX	200	861

24: Receptacle - Tape and Reel

NUMBER OF CONTACTS:
20, 30, 36, 40, 50, 60

2: Without Adhesive Tape
9: Adhesive Cover Tape

PLATING VARIATION:
861: 15 microinches of gold with gold flash tails

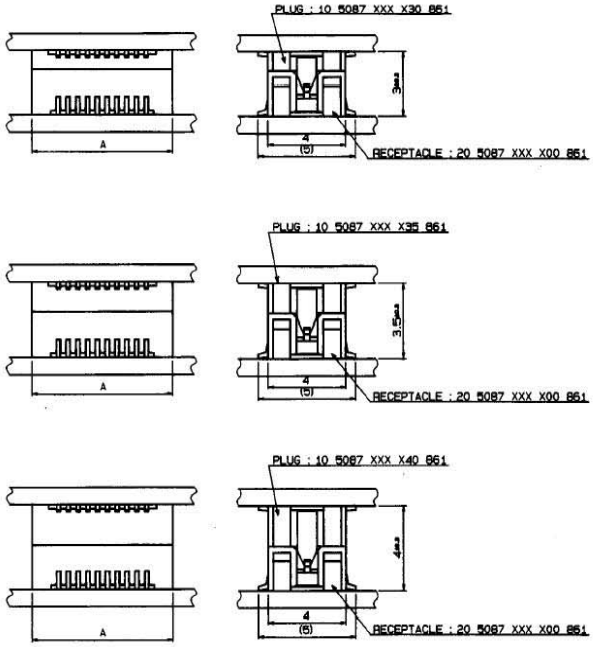
Consult factory for other sizes

66/70

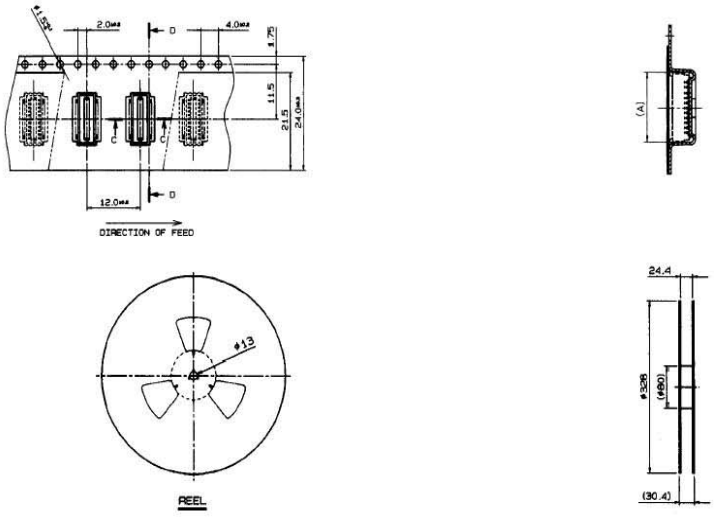
0,5 mm Spacing Applications

	P/N	Stacking Height
PLUG	10 5087 xxx x30 861	3.0
RECE.	20 5087 xxx x00 861	
PLUG	10 5087 xxx x35 861	3.5
RECE.	20 5087 xxx x00 861	
PLUG	10 5087 xxx x40 861	4.0
RECE.	20 5087 xxx x00 861	

No. of Pos.	A
20	7.2/.283
30	9.7/.382
36	11.2/.441
40	12.2/.480
50	14.7/.579
60	17.2/.677

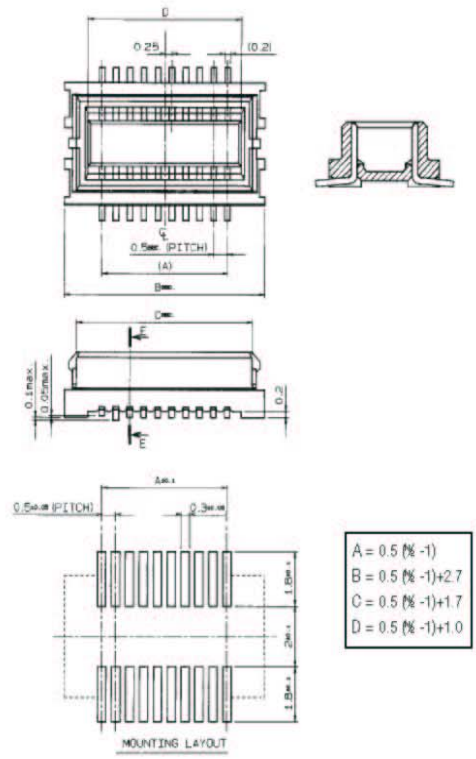


0,5 mm Spacing Tape and Reel



Super Micro Connectors 0.5mm Pitch

Series 5087 Plug



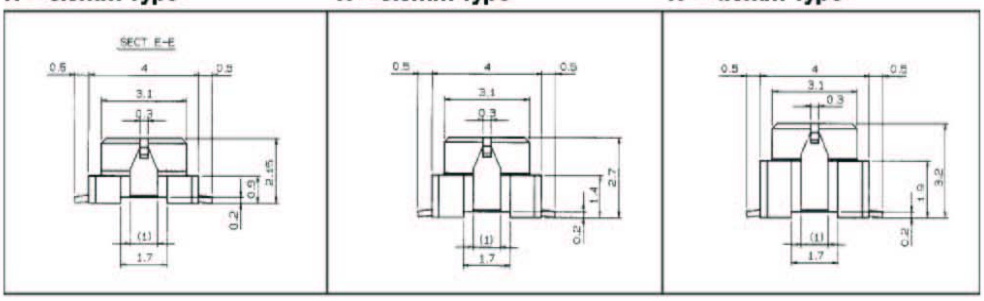
A = 0.5 (N -1)
B = 0.5 (N -1)+2.7
C = 0.5 (N -1)+1.7
D = 0.5 (N -1)+1.0

ORDERING CODE

14 5087 0XX X XX 8XX

- FINISH
  - 861 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.38µm min.
  - 829 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.1µm min.
- VARIATION
  - 30 : H = 3.0mm
  - 35 : H = 3.5mm
  - 40 : H = 4.0mm
- TYPE 0 = without Boss with Retention Clip
  - 2 = without Boss, Retention Clip
  - 9 = without Boss, Retention Clip, with Adhesive Tape
- NUMBER OF POSITIONS (20, 30, 32, 36, 40, 50, 60)
- SERIES
- TAPE AND REEL 14 = Plug

H = 3.0mm Type | **H = 3.5mm Type** | **H = 4.0mm Type**



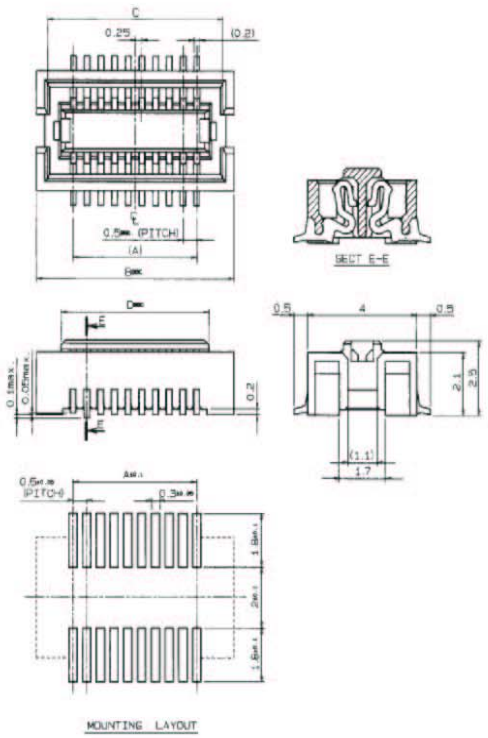
Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document **#269.** Visit our website http://www.avxcorp.com

ELCO

68/70

Super Micro Connectors 0.5mm Pitch

Series 5087 Receptacle H = 3.0 ~ 4.0mm Type



ORDERING CODE

24 5087 0XX X 00 8XX

- FINISH
  - 861 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.38µm min.
  - 829 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.1µm min.
- VARIATION H = 3.0 ~ 4.0mm
- TYPE 0 = without Boss with Retention Clip
  - 2 = without Boss, Retention Clip
  - 9 = without Boss, Retention Clip, with Adhesive Tape
- NUMBER OF POSITIONS (20, 30, 32, 36, 40, 50, 60)
- SERIES
- TAPE AND REEL 24 = Receptacle

A = 0.5 (N-1)
B = A +2.7
C = A +1.9
D = A +0.9

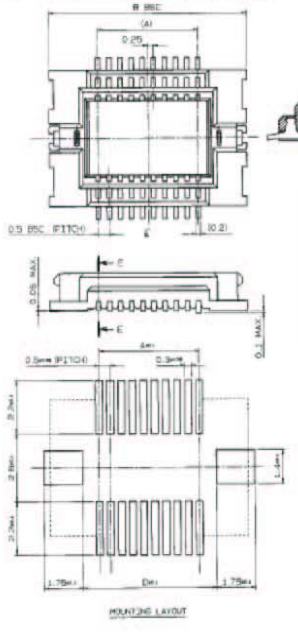
Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document **#270**. Visit our website http://www.avxcorp.com

ELCO

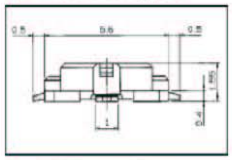
69/70

Super Micro Connectors 0.5mm Pitch

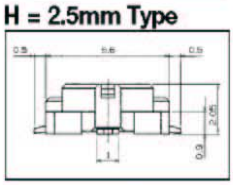
Series 5087 Plug



H = 2.0mm Type



H = 2.5mm Type



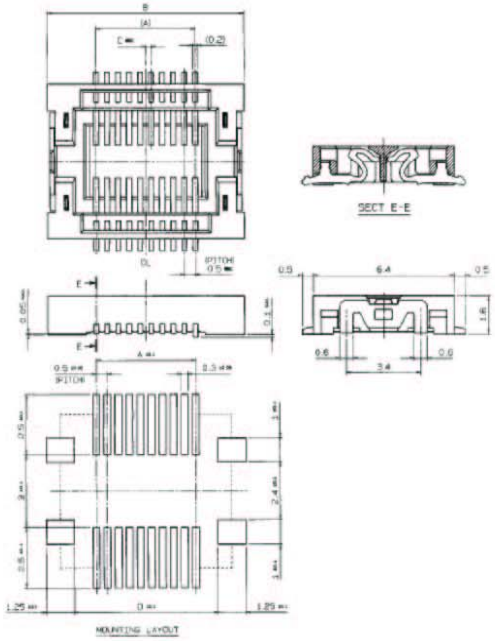
A	= 0.5 (N -1)
B	= 0.5 (N -1)+4.4
D	= 0.5 (N -1)+1.5

ORDERING CODE

14 5087 0XX X XX 8XX

- 14 = TAPE AND REEL, Plug
- 5087 = SERIES
- 0XX = NUMBER OF POSITIONS (10*, 20, 30, 40, 50, 60) *2.0mm H only
- X = TYPE: 0 = without Boss with Retention Clip; 2 = without Boss, Retention Clip; 9 = without Boss, Retention Clip, with Adhesive Tape
- XX = VARIATION: 20 : H = 2.0mm; 25 : H = 2.5mm
- 8XX = FINISH: 861 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.38µm min.; 829 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.1µm min.

Series 5087 Receptacle H = 2.0 ~ 2.5mm Type



ORDERING CODE

24 5087 0XX X 01 8XX

- 24 = TAPE AND REEL, Receptacle
- 5087 = SERIES
- 0XX = NUMBER OF POSITIONS (10, 20, 30, 40, 50, 60)
- X = TYPE: 0 = without Boss with Retention Clip; 2 = without Boss, Retention Clip; 9 = without Boss, Retention Clip, with Adhesive Tape
- 01 = VARIATION: H = 2.0 ~ 2.5mm
- 8XX = FINISH: 861 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.38µm min.; 829 = Ni Under Coated 1.25µm min. Gold-Mating Area Au 0.1µm min.

Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document **#271.** Visit our website http://www.avxcorp.com

ELCO 70/70

9.2 RF Conncector

The V2 and later versions of the Q24x8 have only a single RF launch, incorporating both GPS and the CDMA paths. The RF connection is a 50-ohm impedance system and is a DC short to ground, equivalent to the Hirose U.FL Coaxial Connector shown below. Best effort should be made to provide low insertion loss and shielding between the external antenna and RF connection over the frequency band interested. Also, keep the external RF cable away from any possible interference sources; especially high-speed digital signals and switching power supply.

SMT Ultra-Miniature Coaxial Connectors - Mating Heights Owing to the Lowest Profile and the Lightest

U.FL Series

Meets up to 6 GHz Requirement

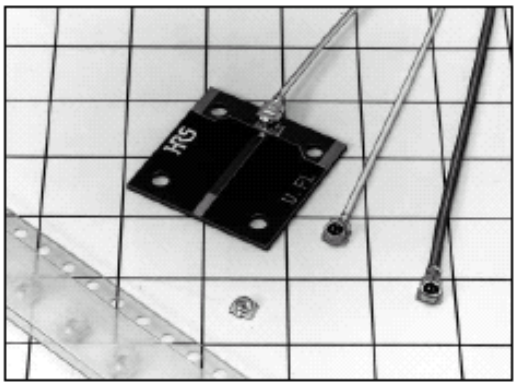
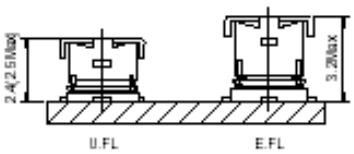


Figure 1. Mating Height Comparison
(with Hirose Electric Products)



■Features

1. Mating Heights Owing to Lowest Profile
Height from the printed circuit board when mates a receptacle with a (right-angle) plug is 2.5 mm maximum. This low Profile is at the world's shortest level.

2. Extremely Small Board Occupation Area
In comparison with our E.FL Series of SMT coaxial connectors, the receptacles offer a reduction of approximately 18% of the board occupation area resulting in an area of just 7.7 mm².

3. World's Lightest
These are the world's lightest coaxial connectors.
Receptacle: 15.7 mg
Right-angle plugs
For ϕ 0.81 mm cable: 53.7 mg
For ϕ 1.13 & 1.32 mm cable: 59.1 mg

4. Can Be Used Up to a Frequency of 6 GHz
To meet the frequency requirements of a wide variety of miniature equipment, these connectors offer high frequency performance from DC to 6 GHz.

5. Can Be Used with Automatic Mounting
The embossed tape packaging specification of the receptacles permits automatic mounting.

6. Use of Ultra-Fine Teflon Cable
From among the types of suitable cable, ϕ 0.8 mm (single shield) outside diameter ultra-fine Teflon coaxial cable has been made a standard specification in consideration of improving the construction qualities and construction area.
An external diameter ϕ1.32 mm (double shield) & ϕ1.13mm (single shield) ultra-fine Teflon coaxial cable specification is also available.

7. Simple Removal of Connectors
The extraction jig permits simple removal of connectors.

8. Mating Checks Are Easy
Subminiature size notwithstanding, the lock sensation permits a check of sure mating.

●Space Factor of Mated Connector

Figure 2. U.FL-LP-040 and U.FL-R-SMT

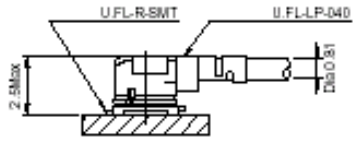
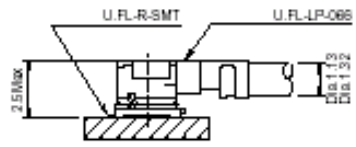


Figure 3. U.FL-LP-066and U.FL-R-SMT



■Applications

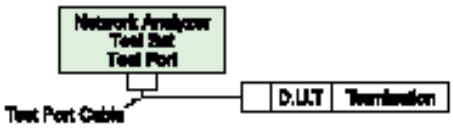
Mobile phones, wireless communications equipment, electronic measuring instruments, GPS, wireless LAN, Bluetooth etc.

Product Specifications

Ratings	Nominal characteristic impedance Rated voltage Rated frequency	50Ω 60 V AC (rms) DC to 6 GHz	Operating temperature range Operating humidity	-40°C to +90°C 90% max.

Item	Specification		Conditions
1. Contact resistance	Center: 20 mΩ max. Outside: 10 mΩ max.		Measured at 10 mA max.
2. Insulation resistance	500 MΩ min.		Measured at 100 V DC
3. Withstand voltage	No fire or insulation breakdown		200 V AC for 1 minute
4. V.S.W.R.*	1.3 max.		DC to 3 GHz
	Dia.0.81Cable	1.35	3 to 6 GHz
	Dia.1.13Cable	1.4	
	Dia.1.32Cable	1.5	
5. Female contact holding force	0.15 N min.		Measured with a ϕ 0.475 pin gauge
6. Repetitive operation	Contact resistance 25 mΩ max. (Center) 15 mΩ max. (Outside)		30 cycles of insertion and disengagement
7. Vibration	No momentary disconnections of 1 µs min. No damage, cracks, or parts looseness min.		Frequency of 10 to 100 Hz, single amplitude of 1.5 mm, acceleration of 69 m/s², for 6 cyles in the direction of each of the 3 axes
8. Shock	No momentary disconnections of 1 µs min. No damage, cracks, or parts looseness		Acceleration of 735 m/s², 11 ms duration, sine half-wave waveform, for 6 cycles in the direction of each of the 3 axes
9. Humidity resistance (Steady state)	No damage, cracks, or parts looseness Insulation resistance 100 MΩ min.(High temperature) Insulation resistance 500 MΩ min.(Dry)		Temperature of 40°C, humidity of 95%, let stand for 96 hours
10. Temperature cycle	No damage, cracks, or parts looseness Contact resistance 25 mΩ max. (Center) 15 mΩ max. (Outside)		Temperature: +40°C → 5 to 35°C → +90°C → 5 to 35°C Time: 30 min. → Within 5 min. → 30 min. → Within 5 min. Cycles: 5
11. Salt spray test	No excessive corrosion		48 hours continuous exposure to 5% salt water

*V.S.W.R. Measurement System
The above V.S.W.R. standard values were measured using the measurement system of the diagram below.



NOTE 1: Cable type connectors were measured with SMA conversion adapters attached to both ends of the harness product of a suitable 100cm cable.
NOTE 2: Board type connectors were mounted to a 50Ω glass epoxy board and measurements were conducted with SMA conversion adapters attached.

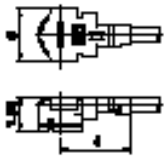
Materials

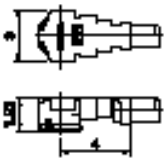
Part	Material		Finish	Remarks
Shell	Phosphor bronze		Silver plating	———
Male center contact	Brass		Gold plating	———
Female center contact	Phosphor bronze		Gold plating	———
Insulator	Plug	PBT	Black	UL94V-0
	Receptacle	LCP	Beige	UL94V-0

■Plugs


U.FL-LP-040


U.FL-LP-066


Form of Plug After Cable Wiring


Form of Plug After Cable Wiring

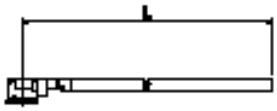
Item	HRS No.	Part No.	Applicable Cable	Weight (mg)
Right-angle plug shell (for ϕ 0.81 cable)	CL331-0451-2	U.FL-LP-040	RF-MF5010 Manufactured by Nissei Electric Co., Ltd. J12B0964 Manufactured by Junkosha Co., Ltd. CO-6F-SB-CX50 Manufactured by Hitachi Cable, Ltd.	53.7/unit
Right-angle plug shell (for ϕ 1.13 cable)	CL331-0452-5	U.FL-LP-066	RF-MF5016 Manufactured by Nissei Electric Co., Ltd. J12B1054 Manufactured by Junkosha Co., Ltd.	59.1/unit
Right-angle plug shell (for ϕ 1.32 cable)			A12B0733 Manufactured by Junkosha Co., Ltd. CO-6F-DSB-CX-50 Manufactured by Hitachi Cable, Ltd.	

Please order plugs with the cable assembly specifications.

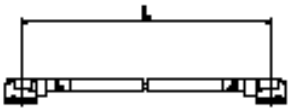
■Cable Assembly

Dimension of U.FL Series assembly products should be made as indicated below.

Single-Ended Cable Assembly



Double-Ended Cable Assembly



●Ordering Information

U.FL - [①] LP - [②] - A - (③)

① Series name	U.FL
② Assembly type	Blank: Single ended 2: Double ended
③ Cable type	04 : For use with ϕ 0.81 cable 5016 : For use with ϕ 1.13 cable 066 : For use with ϕ 1.32 cable
④ Overall length (mm)	Length L is expressed in mm units.

●Cable Assembly Overall Length Standard Tolerance

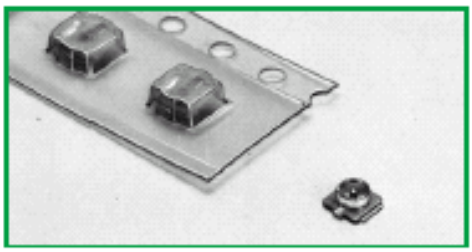
Overall Length L (mm)	Standard Tolerance (mm)
35≦L≦ 200	± 4
200<L 500	± 8
500<L 1000	±12
1000<L	±1.5%

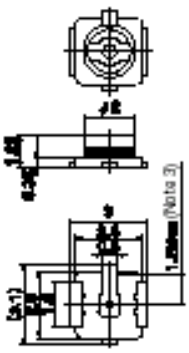
Note: Shortest length L is 35 mm.

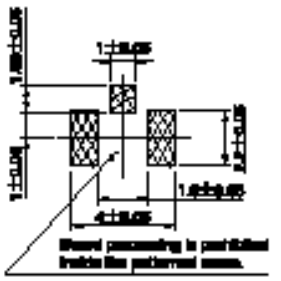
Part No. of Cable Assembly	CL No.	Description
U.FL-2LP-04-A-(L)	321-1937-2-**	Dia. 0.81mm Double Ended Cable Assembly
U.FL-LP-04-A-(L)	321-1998-7-**	Dia. 0.81mm Single Ended Cable Assembly
U.FL-2LP-5016-A-(L)	321-2493-6-**	Dia. 1.13mm Double Ended Cable Assembly
U.FL-LP-5016-A-(L)	321-2492-3-**	Dia. 1.13mm Single Ended Cable Assembly
U.FL-2LP-066-A-(L)	321-2170-7-**	Dia. 1.32mm Double Ended Cable Assembly
U.FL-LP-066-A-(L)	321-2573-3-**	Dia. 1.32mm Single Ended Cable Assembly

Please contact Hirose Sales Representative about cable length and cable end treatment.

■Receptacles







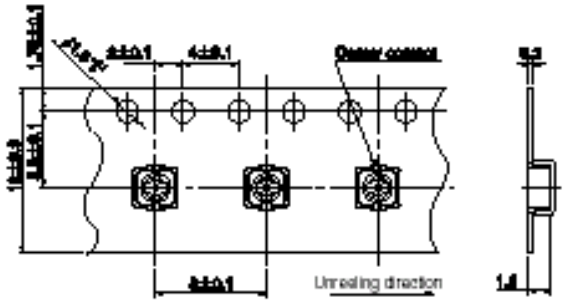
Recommended PCB Footprints

NOTE 1: Receptacles of the (01) specification are sold by the pack with 100 pieces per pack. Please order in pack units.
NOTE 2: Receptacles of the (10) specification are sold by the reel (which contains 2,500 pieces). Please order in reel units.
NOTE 3: Permissible value for mold resin which gets onto the center contact.

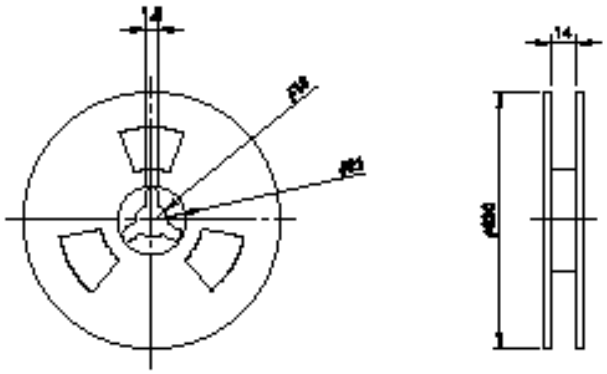
HRS No.	Part No.	Sales Quantity	Weight (mg)
CL331-0471-0-01	U.FL-R-SMT(01)	Pack sales (100 pieces per pack)	15.7/unit
CL331-0471-0-10	U.FL-R-SMT(10)	Reel sales (2,500 pieces per reel)	

●Packaging Specifications

Embossed Carrier Tape Dimensions



Reel Dimensions

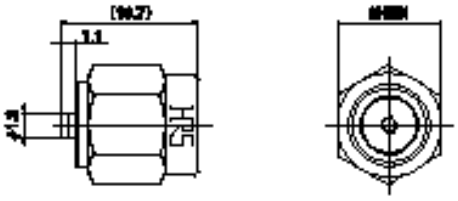


4. HRS

■Conversion Adapter

●SMA Conversion Adapter
(Coupling portion: U.FL side jack - SMA side plug)

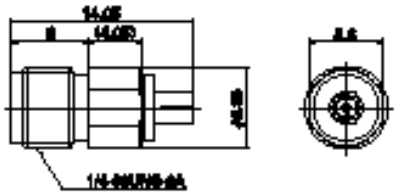
NOTE: The U.FL side coupling portion has a weaker lock than the regular product and, therefore, cannot be used for purposes other than performance measurements.



HRS No.	Product No.
CL311-0300-2	HRMP-U.FLJ

●SMA Conversion Adapter
(Coupling portion: U.FL side plug - SMA side jack)

NOTE: The U.FL side coupling portion has a weaker lock than the regular product and, therefore, cannot be used for purposes other than performance measurements.

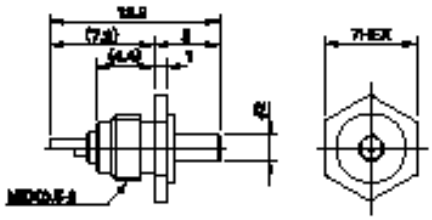


HRS No.	Product No.
CL311-0301-5	HRMJ-U.FLP

■Inspection Receptacle

This receptacle is used for inspecting the continuity, withstand voltage, and other aspects of the harness product.

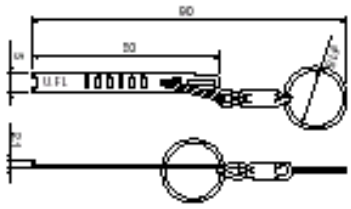
NOTE: The U.FL side coupling portion does not have a lock and, therefore, cannot be used for purposes other than continuity and withstand voltage inspections.



HRS No.	Product No.
CL331-0466-0	U.FL-R-1

■Extraction Jig

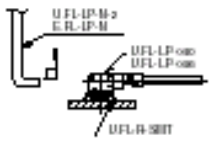
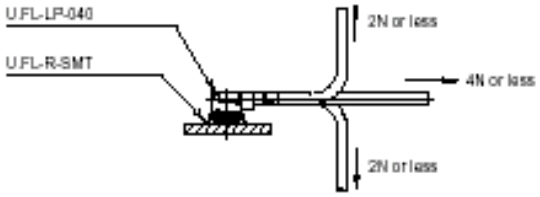
This jig is used for extraction from a coupled condition.



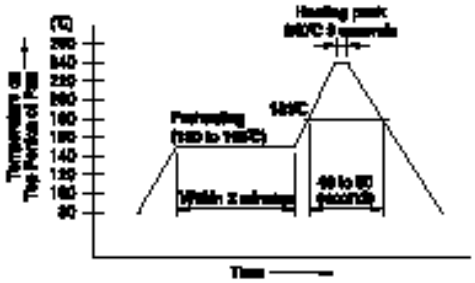
HRS No.	Product No.
CL331-0494-5	U.FL-LP-N-2
CL331-0441-9	E.FL-LP-N

Usage Precautions

1. Plugs

(1) Connection/ disconnection of connectors	1) To disconnect connectors, hook the end portion of E.FL-LP-N and U.FL-LP-N-2 onto the connector cover and pull off vertically in the direction of the connector coupling axis. To remove the connector directly, hold the connector cover and pull off vertically in the direction of the connector coupling axis. (Please exercise caution so as not to injure fingertips or nails.) 2) To couple the connectors, the coupling axes of both connectors are aligned and the connectors are inserted as perpendicularly as possible. Do not attempt to insert on an extreme angle. 
(2) Permissible load on the cable after connector coupling.	After the connectors are coupled, do not apply a load to the cable in excess of the values indicated in the diagram below. 
(3) Precautions	Please note that excessive twisting in the action of insertion or removal will cause damage.

2. Receptacles

(1) Recommended temperature profile (Reference)	Recommended Temperature Profile (Reference)  1) The temperature indicates the printed circuit board surface temperature of the connector lead portion. 2) The reflow soldering method should be performed at a peak temperature of 240°C or less at the surface of the printed circuit board. 3) The temperature profile will change depending on conditions which include such factors as the size of the board, the solder used, and the solder thickness.
(2) Recommended hand soldering conditions (Reference)	Soldering iron temperature: 350°C Soldering time: Within 5 seconds
(3) Recommended screen thickness	0.15 mm