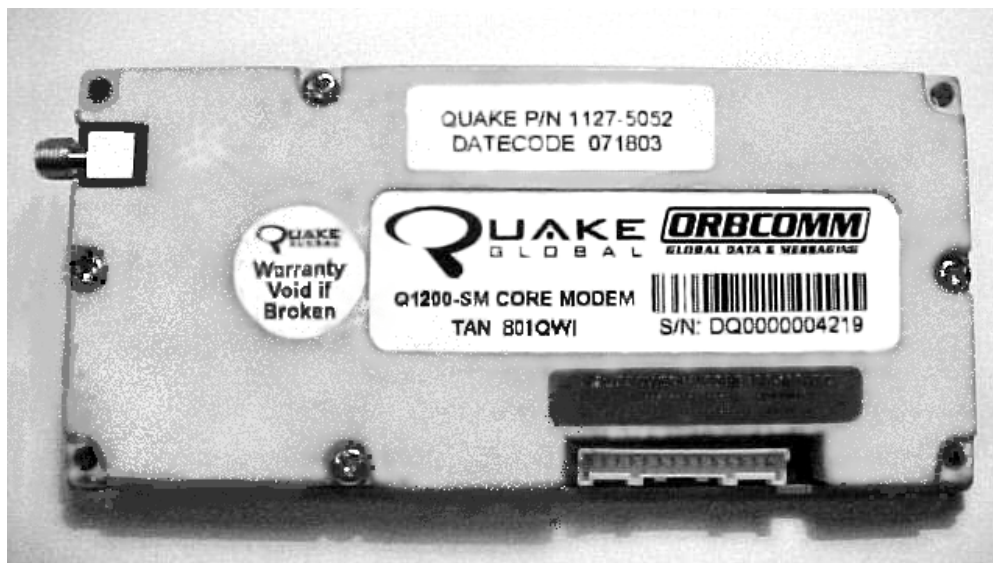




## **1200-SM Product Data Sheet**

Rev A



SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE. PLEASE REFER TO THE QUAKE GLOBAL WEBSITE FOR THE MOST RECENT RELEASE OF THIS DOCUMENT. <http://www.QUAKEglobal.com>

## Table of Contents

<b>1</b>	<b>SCOPE.....</b>	<b>1</b>
<b>2</b>	<b>WHAT IS THE ORBCOMM SYSTEM?.....</b>	<b>1</b>
<b>3</b>	<b>GENERAL INFORMATION.....</b>	<b>1</b>
3.1	POWER.....	1
3.2	MEMORY .....	1
3.3	GPS.....	1
3.4	ENVIRONMENTAL SPECIFICATIONS .....	1
3.5	CERTIFICATIONS .....	1
3.6	COMMUNICATIONS.....	1
3.7	EXTERNAL CONNECTORS .....	1
3.8	PHYSICAL SPECIFICATIONS .....	1
<b>4</b>	<b>INTERFACING TO THE Q1200-SM.....</b>	<b>3</b>
4.1	INTERFACE CONNECTOR.....	3
4.2	SIGNAL DESCRIPTIONS.....	3
4.3	SPECIFICATIONS .....	5
<b>5</b>	<b>FUNCTIONS OF THE Q1200-SM.....</b>	<b>6</b>
5.1	MODES OF OPERATION.....	6
5.2	PROGRAMMING.....	7
5.3	OPERATING SYSTEM.....	8
5.4	SETTING PARAMETERS.....	8
5.5	SAVING DATA.....	8
5.6	ADDITIONAL FEATURES.....	8

## Table of Figures & Tables

TABLE 1:	CURRENT DRAW AT 12V.....	1
TABLE 2:	EXTERNAL CONNECTORS.....	1
TABLE 3:	INTERFACE CONNECTOR PINOUT .....	3
TABLE 4:	INTERFACE CONNECTOR ELECTRICAL SPECIFICATIONS.....	5
TABLE 5:	CURRENT DRAW OF FUNCTIONAL BLOCKS (12V).....	6

**WARNING!**

The Maximum allowable RF input power to any QUAKE modem receiver is +20dBm. Typical input levels are <-60dBm. Exceeding +20dBm input level may result in damage to the receiver, and will void the warranty.

**WARNING!**

The operating voltage range for QUAKE Q1200-SM modems must be between +9 to +18 Volts DC. Steady state input voltages outside this range may result in damage to the modem, and will void the warranty.

**CAUTION!**

RF antennas connected to QUAKE modems should not be mounted closer than six feet (6') away from other ORBCOMM communication devices (Such as another QUAKE modem). There is a risk of overpowering the receiver if two modem antennas are mounted too closely to one another. See WARNING above.

**CAUTION!**

RF antennas connected to QUAKE modems should be inductively coupled to ground (DC Short). Use of antennas that are capacitively coupled to ground (DC Open) could cause damage to the modem through lightning strikes or other electrical events. Damage to the Q1200-SM due to use of antennas that are NOT inductively-coupled will void QUAKE Warranty.

For further information, contact your QUAKE representative at (858) 277-7290.



**1 Scope**

This document contains a description of the overall operation and characteristics of the **Q1200-SM modem**. It also describes the specifications of the input/output signals used to interface the **Q1200-SM** to a customer interface board. Included is a description of the signals on the 14-pin connector, which is the customer's interface to the OEM module. Also included is a list of the normal operating modes along with an explanation of each.

**2 What is the ORBCOMM System?**

The ORBCOMM System is a wireless, two-way global satellite communications network. It consists of over 30 Low Earth Orbit (LEO) satellites, national or regional Gateway Earth Stations and Network Control Centers, and the global Network Operations Center in Dulles, Virginia. The system provides data communications between mobile subscriber equipment and the operator via the Internet or dedicated leased lines for high volume operators.

**3 GENERAL INFORMATION**

The **Q1200-SM** Core Modem has a custom built ASIC for ORBCOMM message processing and customer interfacing, a high performance Radio Frequency (RF) design for communicating with the ORBCOMM satellite system, and a 16-channel high performance GPS. The unit contains two RS232 serial ports for interfacing to host applications. Additionally, many of the RS-232 lines can be individually controlled and monitored for digital input/output signals.

**3.1 Power**

**Table 1: Current Draw at 12V**

MODE	CURRENT (nominal)
Sleep	10 uA
ORBCOMM Receive	80 mA
GPS	N/A
ORBCOMM Transmit	1.7 A (nominal)

Input Power Requirements:  
 +9 to +18 V DC  
 Maximum current draw: 2.0 A

**3.2 Memory**

1 MB Flash (300 KB user application space)  
 2 MB DRAM

**3.3 GPS**

There is no GPS system on the Q1200-SM modem

**3.4 Environmental Specifications**

Operating Temperature: -40C to +85 C  
 Storage Temperature: -50C to +85 C  
 Shock: 20G, 11ms ½ Sine Wave  
 Vibration: 8G's RMS, 20-2,000Hz

**3.5 Certifications**

FCC

**3.6 Communications**

Transmit Frequency: 148.000 to 150.050 MHz  
 Receive Frequency: 137.000 to 138.000 MHz  
 Transmit Power: 5W (Min), 10W(Max)  
 Data Rates: 2400 bps Uplink  
 4800 bps Downlink

**3.7 External Connectors**

There are two external connectors that interface to the **Q1200-SM**.

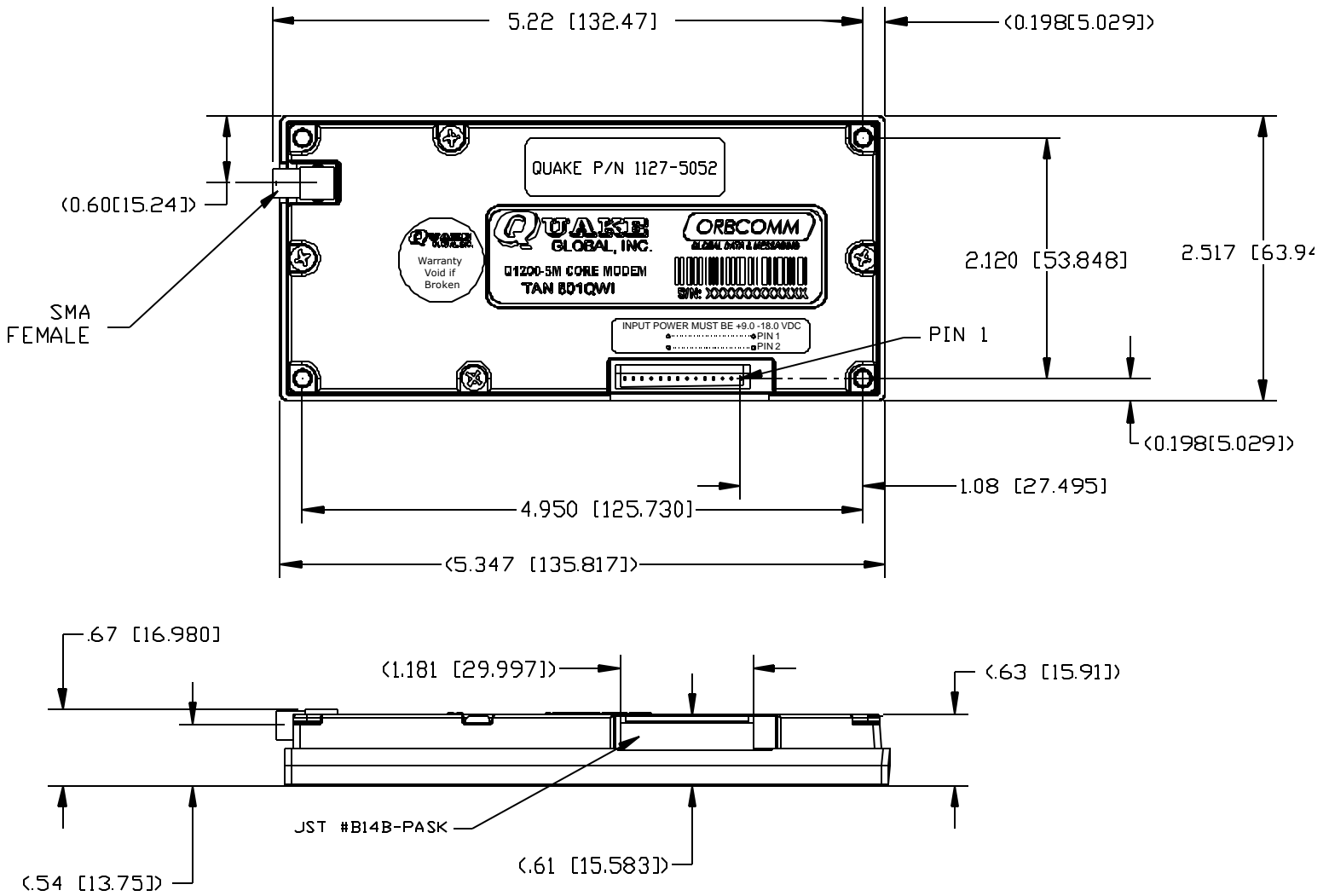
**Table 2: External Connectors**

Name	OEM Module	Customer Interface
<b>Interface Conn.</b> 14-pin Header	Male 14x1 (JST # B14B-PASK)	Female 14x1 cable style (JST # PAP-14V-S, or equivalent)
<b>RF Antenna</b> (50? impedance)	SMA Female	SMA Male

**3.8 Physical Specifications**

The **Q1200-SM** is encased in a rugged clamshell style shield assembly.  
 Size: 5.4" x 2.6" x 0.7" (137mm x 66mm x 18mm)  
 Weight: 0.4 lbs (182 grams)

Figure1: Q1200-SM Physical Dimensions



## 4 INTERFACING TO THE Q1200-SM

### 4.1 Interface Connector

The **Q1200-SM** has a 14-pin interface connector which includes power and data lines. The signals are alternated with grounds to allow for the use of a ribbon cable.

**Table 3: Interface Connector Pinout**

Q1200-SM CONNECTOR	
PS_VIN	1
PS_VIN	2
GND	3
GND	4
MTS_TX / DIG_2 *	5
MTS_RX	6
MTS_DTR	7
MTS_DSR	8
MTS_DCD	9
SERIAL_GND	10
LOGGER_TX	11
LOGGER_RX / DIG_3 *	12
DIG_0	13
DIG_1	14

\* See Digital I/O Section (This Page)

### 4.2 Signal Descriptions

#### Power

##### PS\_VIN

+9 to +18Vdc operational power is supplied through 2 pins to the **Q1200-SM**. This is the sole power source for the **Q1200-SM**. The power supply must be able to provide 2.0 Amps maximum current drive at +12 Volts. High current drive is required during transmits, with duration of no more than a few seconds, and typically only tens of milliseconds. The power supply has been designed for 12 V automotive applications.

Caution: It is highly recommended that all applications utilize a 3A Fast Blow fuse in line with the power connections (pins 1 & 2).

#### Serial Ports

##### MTS

The following RS-232 lines are available for the MTS port: RX, TX, DTR, DCD, DSR. The signal names are from the perspective of the DTE. The interface protocol for this port complies with the ORBCOMM serial specification.

The DTR line is an RS-232 input that is used in the power supply wake-up circuitry to wake up the **Q1200-SM** from sleep mode. In order to wake the **Q1200-SM** via DTR, a 1.8 Volt rise on the DTR line with a rise time of less than 100µs is required.

DCD is an RS-232 output that is asserted automatically when an ORBCOMM satellite is in view. DSR is an RS-232 output line that is asserted when the **Q1200-SM** is in an operating mode (not sleep).

##### LOGGER

This RS-232 RX/TX pair is available for a second serial port. This port is named from the perspective of the **Q1200-SM**, as it is typically used for logging and debugging activities. See the **QUAKE** Application Programming Manual for details of the Logger port operations.

#### DIGITAL I/O

##### MTS\_TX, LOGGER\_RX

The RS-232 lines MTS\_TX and LOGGER\_RX are routed to the **Q1200-SM** digital inputs Digital 2 and 3 respectively. These lines can be used for digital inputs when not being used for other purposes, such as serial port applications. The low/high thresholds on these lines are 0.8 and 2 Volts respectively. The signals are inverted; thus at 2+ Volts the digital signal will read low and at 0.8 Volts or less, the signal will read high.

**MTS\_DTR, MTS\_DCD, MTS\_DSR**

MTS\_DTR is a software readable digital input. The low and high thresholds are 0.8 volts and 2.0 volts respectively.

The MTS\_DSR RS-232 output line is under **Q1200-SM** software control. The normal functions of this line, as discussed above, can be programmed off and the line then controlled completely by the user's own software application.

The MTS\_DCD RS-232 output line is asserted and de-asserted according to the ORBCOMM serial interface specification when a satellite goes in and out of view.

**DIG\_0, DIG\_1**

DIG0 and DIG1 are TTL level digital inputs. These inputs are accessible through the QUAKE base application software, or through the QUAKE API.

### 4.3 Specifications

**Table 4: Interface Connector Electrical Specifications**

Signal	Type	Max Voltage	Max Current Output Drive	Notes
PS_VIN	Input	18V Operating (SAE J1455 12V Transients)	----	9 to 18Vdc Operating Voltage
GND	Input	----	----	
DIG0	Input	30V	---	TTL Digital Input
DIG1	Input	30V	---	TTL Digital Input
MTS_RX	Output	6V	15 mA	RS-232
MTS_TX / DIG 2 *	Input	30V	----	RS-232
MTS_DTR	input	30V	----	RS-232
MTS_DCD	Output	6V	15 mA	RS-232
MTS_DSR	Output	6V	15 mA	RS-232
LOGGER_TX	Output	6V	15 mA	RS-232
LOGGER_RX / DIG 3 *	Input	30V	----	RS-232

\* See Digital I/O Section (Page 3)



## 5 Functions of the Q1200-SM

The **Q1200-SM** custom ASIC contains two processors: an ARM7TDMI for control processing, and an OAK DSP for ORBCOMM signal processing. The ARM7 runs all the ORBCOMM protocol code, as well as the **Q1200-SM** application.

Information can be transferred to the **Q1200-SM** through serial ports, over the air, or other digital signals. Short messages may be transmitted through the ORBCOMM system on regular intervals, or based on any programmed event. The **Q1200-SM** is highly configurable, either locally through a serial port or remotely over-the-air.

### 5.1 Modes of Operation

#### Functional Modes

##### Sleep

In this mode the **Q1200-SM** is completely shutdown. The processors and memories are off. Only the real-time clock(RTC) is running, maintaining ORBCOMM time. The **Q1200-SM** can be configured to shutdown when DTR goes low, or it can be programmed to shutdown with software, as desired. A normal shutdown includes a data save to Flash consisting of unsent messages, and configuration parameters. A power cycle, external DTR pulse, or RTC alarm will wake-up the unit.

##### Standby

In this mode the **Q1200-SM** is in a constant receive mode. (Depending on the availability of the ORBCOMM satellite the unit will be receiving satellite downlink information or searching for a downlink.) The RF, digital signal processor, and control processor portion of the modem is active in this mode.

##### Data Collection

In this mode the control processor (CP) is active. The **Q1200-SM** may be sampling data inputs through the serial port or interacting with other **Q1200-SM** Subsystems. The CP is used to power on, control and collect data from the RF Subsystem. The CP is active during its interaction with these

subsystems, but does not need to stay active while the other subsystems run their tasks.

##### Transmit

In this mode the unit is sending an outgoing message. It could be from any programmed condition including an alarm, an application event, a scheduled report, or in response to an over-the-air inquiry. The **Q1200-SM** may also query the ORBCOMM system looking for incoming messages.

#### Power Consumption

The **Q1200-SM** is designed for low power battery applications. Portions of the modem may be powered on and off independently to minimize current draw. Power consumption is a function of how the **Q1200-SM** is configured to operate. The amount of time the **Q1200-SM** spends in each of its states will determine the overall current draw.

**Table 5: Current Draw of Functional Blocks (12V)**

MODE	CURRENT DRAW
SLEEP	10 uA
CP ON	60 mA *
RF RECEIVE	20 mA
TRANSMIT	1.7 A

**Note: These are typical, not maximum values**

Standard operating modes include Standby and Data Collection Modes. The lowest operating power mode would be where the RF Subsystem is powered off resulting in 60mA of current draw. The current consumption for each Subsystem is isolated, therefore it is additive. In the case where the modem is in Standby Mode and constantly sensing inputs, the current draw would be:

Power Up, CP ON	60 mA *
RF Receive	20 mA
<hr/>	
	80 mA Standby, data collection

\*This current draw is reduced by 20mA if CP is placed in low-power mode.

## 5.2 Programming

The **Q1200-SM** can be programmed with QUAKE's base application or custom C-code. Furthermore, the **Q1200-SM** firmware implements the ORBCOMM Serial Interface Protocol on the MTS port. This means that external processors can communicate with the **Q1200-SM** and the ORBCOMM Network using this protocol. With this technique, programming of the **Q1200-SM** is not required at all.

QUAKE's base application allows simple programming of the **Q1200-SM** without any software development experience. These programming methods are described in detail in QUAKE's Application Programmer's Manual (Document # 1122-4706) and in the QUAKETools Manual (Document # 1122-4707). For embedding custom C-code applications into the **Q1200-SM**, QUAKE offers an Application Programmer's Interface and Development Environment that runs on any Windows platform. For custom C applications, the **Q1200-SM** has over 1 MB of DRAM and approximately 300 KB of FLASH available for data and program code.

QUAKE's base application software for the **Q1200-SM** is extremely flexible, allowing each application to be tailored to the customer's specific needs. The application code is driven by an event table. The actions performed as the result of an event are defined by the event table. Actions may be to collect certain pieces of data, to change modes (Standby, Sleep, etc.), or to send a formatted message. QUAKE's base application is completely explained in the Application Programmer's Manual

What causes an event?

### Timers

The **Q1200-SM** has several timers for scheduling activities. Timers can be set to cause the **Q1200-SM** to change modes, scheduling when the **Q1200-SM** is on Standby and how frequently the unit transmits messages. Events can be scheduled as frequently as every second, and as seldom as once a month.

### Queries

An external device connected to a serial port could be considered an event condition. If in Sleep Mode, the **Q1200-SM** could be awakened by the DTR signal. Also, an inquiry from the ORBCOMM system could solicit a response from the **Q1200-SM**. The **Q1200-SM** would have to be in Standby Mode to receive the remote inquiry.

What happens when an event occurs?

### Send Control Signal to Customer Equipment

An event could trigger an output, or start a series of events which sends control signals to the customer's equipment. A message may be sent through the serial port to communicate with customer equipment.

### Transmit a Message

An event could instruct the **Q1200-SM** to send a message through the ORBCOMM system. Up to 100 user configurable message formats can be created with the base application. Each event could be associated with its own message type.

### Nothing (Polled Only Modem)

A **Q1200-SM** may be configured to transmit only when queried remotely through the ORBCOMM system, or through the serial port.

Note: The standard firmware in a **Q1200-SM** dynamically loads the QUAKE base application or the custom C-code application when the **Q1200-SM** boots. This process can take anywhere from 3 seconds to over 30 seconds for very large applications. Dynamic loading has benefits in that it provides a better environment during software development and more system modularity. However, the increase in boot time may be undesirable for some applications. When the custom application has been completed, QUAKE can include the application as part of the firmware build, eliminating the dynamic load time. If interested in a static load, or other measures to reduce boot time, please contact QUAKE.

### 5.3 Operating System

The **Q1200-SM** uses the VxWorks operating system. This sophisticated, robust operating system is associated with many unattended systems, such as those in space vehicles. The VxWorks kernel includes multitasking with preemptive priority scheduling, inter-task synchronization and communications facilities interrupt handling support, watchdog timers, and memory management. This system, combined with the ARM 7TDMI processor in the **Q1200-SM**, provides for powerful processing capabilities. Knowledge of this operating system may be required for those programmers who choose not to use QUAKE's scripting language or the event driven application code. Information on this operating system can be found at [www.windriver.com](http://www.windriver.com).

### 5.4 Setting Parameters

#### **QUAKETools and the Logger Port**

QUAKETools is a Windows-based application that interfaces to the **Q1200-SM** through the MTS port. QUAKETools provides the user interface for configuring QUAKE's base application program, i.e., for identifying events and applicable response actions. It provides service and support capabilities allowing the user to perform functions such as setting basic configuration parameters. Also, all configuration parameters can be set and debug functions executed through the Logger Serial Port using any PC terminal emulation program. For more details, see the Application Programmer's Manual and the QUAKETools Manual

#### **Remote**

The **Q1200-SM** can be reprogrammed over-the-air. This includes replacement of the complete application program, as well as resetting the configuration parameters. See the Application Programmer's Manual for details.

### 5.5 Saving Data

Data can be saved to the **Q1200-SM** FLASH. Approximately 300 KB of space is available for the application program and data. Custom applications should be designed to limit writes to Flash to less

than 100K over the lifetime of the **Q1200-SM**. The **Q1200-SM** firmware employs wear-leveling software that can improve the lifetime by as much as 5 times this limit, but performance over 100K writes cannot be guaranteed.

### 5.6 Additional Features

#### **Low Battery Indicator**

The **Q1200-SM** will indicate a low battery voltage condition on Digital 6 . When the battery is low, this line will be high. The state of this line can be read by software. The setpoint is set at the factory as +11.8 Volts; the setpoint may be changed for high volume orders.

#### **I2C Stuffing Option**

##### **SCL,SDA**

The Q1200-SM has a stuffing option for an I2C interface. The I2C lines SCL and SDA replace interface connector signals DIG0 and DIG1, respectively, if the I2C interface is required. The SCL and the SDA signals are the clock and data lines, respectively. I2C Slave components may be connected as peripherals to the processor. The maximum capacitive load on each line is limited to 250pF. This stuffing Option is available for high volume orders.