WISMO Quik Q25 series

Application note for Dead Reckoning

Reference: **Dead_Reckoning_WM_HW_AUT_APN_001**
Revision: **001**
Date: **23th November 2004**

Document Information

Revision	Date	History of the evolution	
001	23 Nov 04	Creation	JCO

	Name	Function	Date	Signature
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Overview

This document is intended to provide information to WAVECOM customers to design specific application based on WISMO Q25 series for Dead Reckoning .

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Cautions

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1 References

1.1 Reference Documents

1.1.1 Wavecom documents

[1]   WISMO Quik Q2501 Customer Design Guidelines
        WM_PRJ_Q2501_PTS_002.

[2]   WISMO Quik Q2501 Project Technical Specification
        WM_PRJ_Q2501_PTS_001.

[3]   AT commands Interface Guide for X50
        WM_ASW_OAT_UGD_00016

1.2 Glossary

Glossary	Definition
Dead Reconing	Is the system which estimate your position when GPS signal is dead or poor.

1.3 Abbreviations

Abbreviation	Definition
SPI	Serial Peripheral Interface

2 Introduction

2.1 Scope of application

Wavecom is proposing on the Q2501 module, the Dead Reckoning interface which is used to estimate the position by advancing a known position using speed, time, distance and direction when GPS reception is poor or when it don't exist.

This application note describes an hardware reference design, based on the sensors and the interfaces to be used.

Dead Reckoning feature need specific software, please contact Wavecom for more information.

3 Functional description
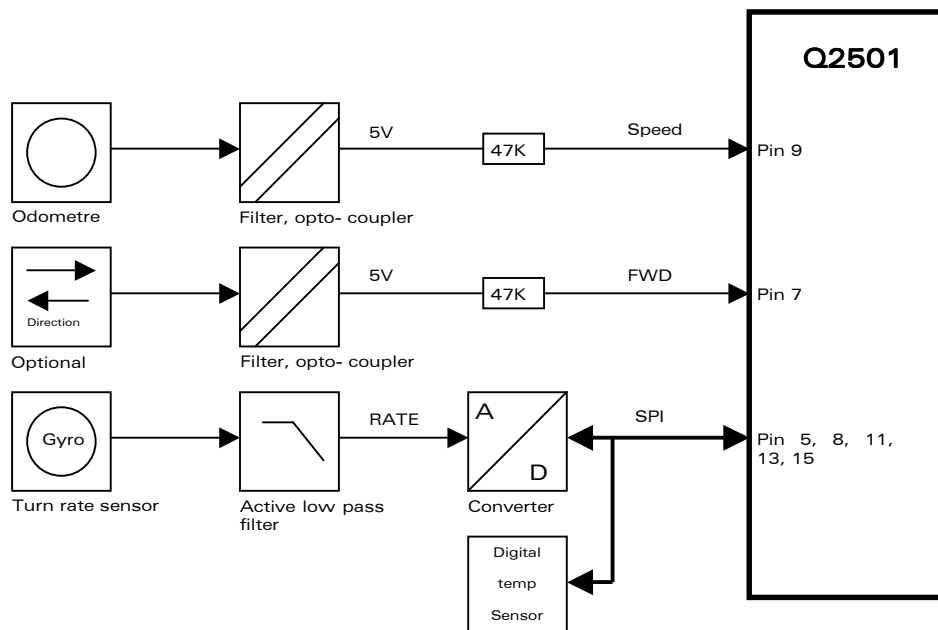
3.1 Block diagram

Figure 1 : Dead Reckoning block diagram

3.2 Functional

Wismo Q2501 module provide all necessary pin to the connection of the four sensor needed for dead reckoning.

  ➢ Input Speed line to connection the odometer sensor

  ➢ Input FWD to connect the optional direction sensor

  ➢ An SPI interface to connect the temperature and the turn rate sensor (Gyroscope)

<u>Odometre and Direction</u>

The odometer sensor is used to provide the Speed information and the Direction sensor is used to provide the reverse or forward indication.

It is strongly recommended to use otpo-coupler or other EMI protection and filtering on the both lines.

After filtering, the maximum voltage level must be 5.5V with the addition of a 47K resistor to limit the current into the FWD and the SPEED input.

<u>Note :</u>   If the optional Direction sensor is not used, it is necessary to connect the input FWD to 1.8V.(GPS_VCORE)

<u>Gyroscope and Temperature sensor</u>

The Gyroscope and the Temperature sensor are connected to WISMO Q2501 through a SPI bus.

The Gyroscope sensor is sensitive at the temperature, for that, it must be corrected according to the temperature. The temperature sensor give the reference temperature.

The Gyroscope signal is low pass filtering by an active filter and then it is converted in a numerical value by a 12Bit A/D converter.

Following signals used for Dead Reckoning:

Pin Q2501	Signal	Direction	Usage
9	GPS_EXTINT0	Input	Speed
7	GPS_REVERSE	Input	Reverse/Forward
13	GPS_PCS0_N	Output	**(SPI)** Selects A/D converter for Gyro
15	GPS_PCS1_N	Output	**(SPI)** Selects temp Sensor
5	GPS_SCK	Output	**(SPI)** SPI clock
11	GPS_MISO	Input / Output	**(SPI)** Serial data In
8	GPS_MOSI	Input / Output	**(SPI)** Serial data Out

Figure 2 : Dead Reckoning Pin

Note : All I/O type for Dead Reckoning are 1V8_CMOS

GPS_VCORE (Pin 19) : 1.8V power supply output is available on the System Connector when GPS is activated.

3.3 Functional known limitations

Analog to Digital converter and temperature sensor must have a SPI interface.

4 Design information
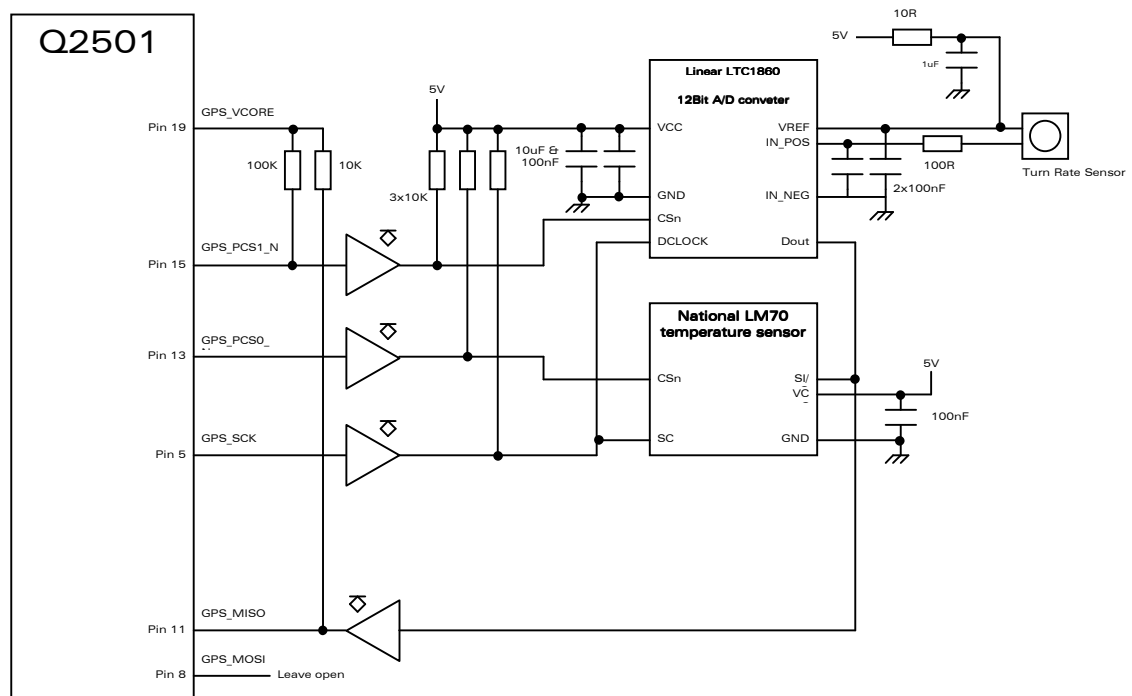
4.1 Schematics

Figure 3 : Dead Reckoning reference schematic

4.2 Partlist

The 100K resistor between GPS_PCS1_N and GPS_VCORE is required to keep GPS_PCS1_N high (inactive) during power-up when GPS_PCS1_N is temporarily in high impedance state.

All resistors shall have 5% accuracy or better.

All capacitors are X7R type and shall have 10% accuracy or better.

For best result, supply the 5V voltage for the gyroscope through a low pass filter as illustrated. Provide a dedicated reference voltage line form the gyroscope supply pin to the VREF input of the A/D converter.

Open drain level translator can be **Fairchild NC7WZ07** (2 shifters per unit)

A/D converter is the **Linear LTC1860** :
 - Power supply : 5V
 - Resolution : 12Bit
 - Sample rate : 250Ks/s

The temperature sensor is the **National LM70**:
 - Power supply : 5V
 - Resolution : 0.25°C (10bit signed)

Only following gyroscopes are approved, do not use others.
 - MURATA ENV-05F/ ENV-05G
 - PANASONIC EWTS82

4.3 Place & Route constraints

Be careful, gyroscope sensor provide an analog signal, so follow design recommendations form the gyroscope manufacturers.

The temperature sensor must be close to the Gyroscope.