Perpetuum Ltd

wSNAK User Manual

Revision	Release Date	Notes
1.0	28th January 2009	General release.
2.0	5th February 2009	Revision table and disclaimer added. 'Version' changed to 'revision' in footer.

Table of Contents

Caution

! When operating near rotating machinery keep clothing and cables away from rotating parts.

! The supplied magnetic mounts use very strong magnets. Ensure fingers are kept away from the magnet when attaching.

! Keep the magnetic mounts away from recordable magnetic media.

Disclaimer

The wSNAK is an "Assessment kit" and should only be used to evaluate the suitability of vibration-energy-harvester-powered wireless sensor nodes for condition-based machine monitoring. Perpetuum Ltd accepts no responsibility for loss or damage incurred through the use of this kit or any of its parts for a purpose other than stated above.

The wSNAK system uses the IEEE 802.15.4 protocol in 2.4GHz radio frequency band. While the system has been designed to meet various radio frequency emission regulations, no approval or certification has been applied for or granted for this equipment. Hence users of this wireless assessment kit do so at their own risk.

The wSNAK sensor node assessment kit is not suitable for use in explosive atmospheres.

The software supplied with the wSNAK has been tested on a Windows XP system and a Windows Vista system. However Perpetuum Ltd accepts no responsibility for loss of damage of data or hardware through the use of its software on third-party personal computers or servers.

Introduction

The Perpetuum wSNAK assessment kit allows the user to appraise vibration energy harvesting in industrial wireless condition monitoring applications. The kit contains everything needed to evaluate the benefits of vibration energy harvester powered wireless condition monitoring sensor nodes.

The wSNAK harvests waste energy in the form of vibration and converts it to electricity. This electrical energy is stored in a capacitor until sufficient is available to power the data acquisition, processing and transmission.

The data, comprising of raw analogue accelerometer values, temperature, power generated by the PMG17 and LQI[1], is transmitted to the USB powered receiver via a 2.4GHz 802.15.4 radio.

The Perpetuum wSNAK display software reads the received time domain accelerometer data from the USB port, performs a FFT (Fast Fourier Transform) on it and displays the resultant frequency domain data. The wSNAK display software also displays a graph of the accelerometer temperature, PMG17 generated power and LQI.

[1] Link Quality Indicator is a metric of the quality of the 802.15.4 radio link. It is best used as a relative indicator. LQI varies between 0 and 255, with 255 being a better radio link.

Kit Contents

Figure 1 - wSNAK kit contents

The wSNAK assessment kit comprises:

Component	wSNAK Kit	wSNAK-Lite Kit
Laptop containing auto-starting viewing software	1	
Energy harvester powered condition monitoring wireless sensor node	4	1
Sensor node antenna	4	1
Sensor node magnetic mount	4	1
Combined IEPE accelerometer and temperature sensor	4	1
Accelerometer magnetic mount	4	1
USB receiver	1	1
Receiver antenna	1	1
USB cable	1	1
USB flash drive, containing wSNAK display software and essential documentation	1	1

Table 1 – Kit Contents

Software Installation

Before You Start

Before plugging in the receiver or starting the Perpetuum Demonstration software it is necessary to install the USB receiver drivers. The following screenshots are from Windows XP. The installation process for Windows Vista is similar; however different dialogue boxes will be displayed.

Copy and unzip the supplied driver folder and take a note of its location.

USB Driver Installation

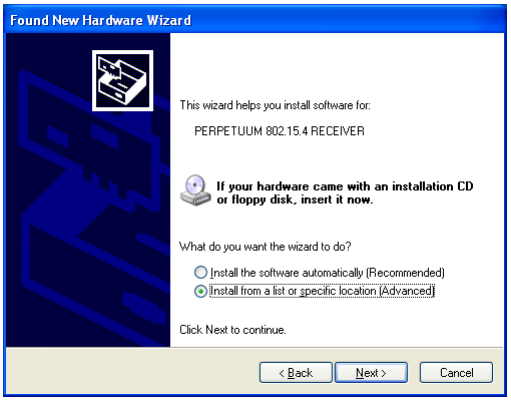
Please note the driver installation is in two parts, be sure to install both drivers.

USB Serial Converter Installation

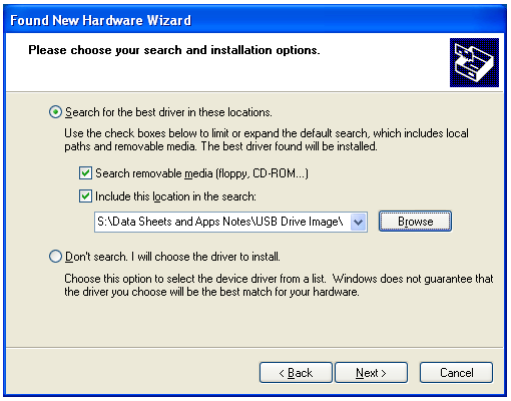
Plug the USB receiver into a spare USB port[2]. The following window will appear, check the 'No, not this time' box and click next.

Click the 'Install from a list' option and click next.

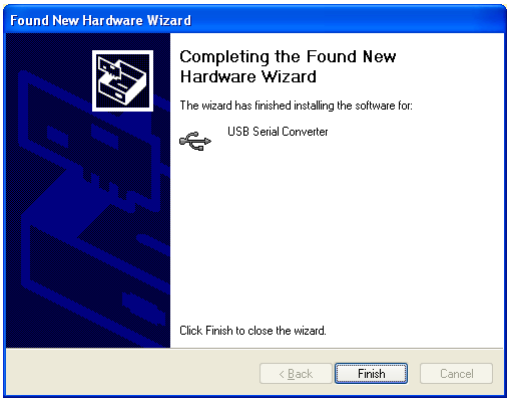
[2] Some computers are not able to support a full USB load on all USB ports. If this causes a problem change ports to one that can support a full load or use a powered USB hub.



In the subsequent window click on the browse button and navigate to the location where you saved the drivers earlier and click OK. Click Next.



The drivers will now be installed and the following window will be presented.

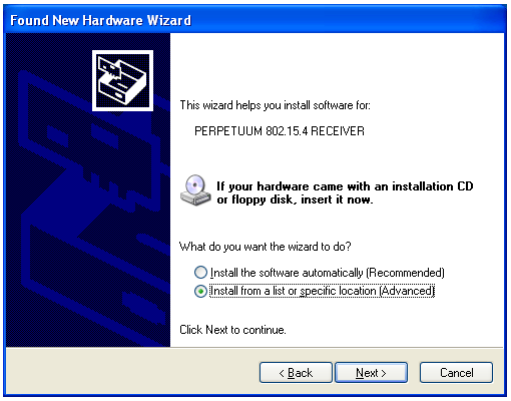


Click Finish, after a few seconds the next stage will start automatically.

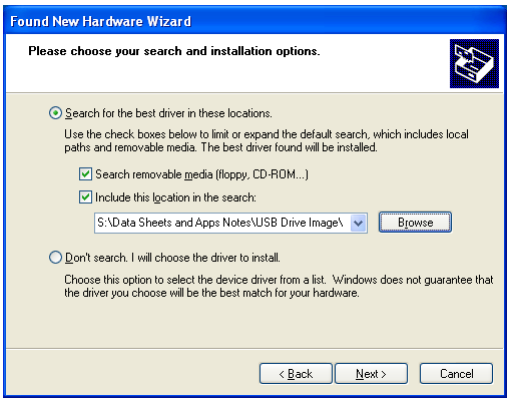
USB Serial Port Installation

The following window will appear check the 'No, not this time' box and click next.

Click the 'Install from a list' option and click next.



In the subsequent window click on the browse button and navigate to the location where you saved the drivers earlier and click OK. Click Next.



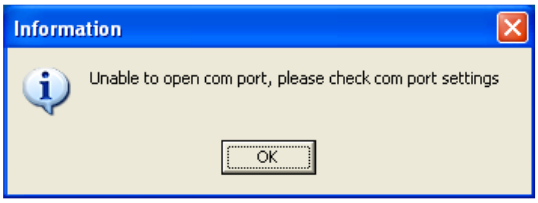
The drivers will now be installed click finish at the resulting window.

Data Viewer Software Installation

Copy the exe file from the flash drive to a local folder. Double clicking this exe file will start the software. Ensure the USB dongle is connected to the USB port before opening the Data Viewer Software.

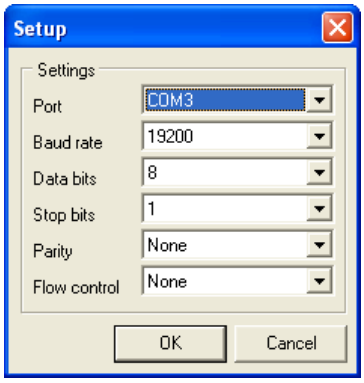
Configuring the Com Port in the Perpetuum Data Viewer Software.

The Perpetuum Demonstration Software communicates with the USB receiver via a Virtual Com Port over the Universal Serial Bus (USB). The data viewer software will try and determine the correct Com port settings; if you get the following message the following procedure will allow you to enter them manually.



Click the 'OK' button.

On the menu bar click tools and settings to get the following window. Select the correct com port[3] for your computer and ensure that the rotation of the boxes are filled in as shown in the diagram below. Click OK.



[3] If you are not sure what is the correct com port the following procedure will help you identify it. Cancel the Setup window and disconnect the receiver from the USB port. Click on Tools and Settings and take a note of the com ports available. Cancel the Setup window and connect the USB receiver. Open the Setup window again using Tools and Settings and again take a note of the available com ports, the new com port is the correct one to use.

Hardware Installation

The magnetic mounts are shipped with a keeper; please ensure this is removed before installation. Retain the keeper for future use.

The magnetic mounts are very strong; please ensure fingers are kept away from the magnet when attaching to prevent injuries.

Always ensure the antenna and accelerometer are attached when used outside as these are required to maintain the IP rating of the device.

Determining The Optimal Location For The wSNAK

The location of the wSNAK is determined by three key requirements:

- good radio performance
- optimal power generation
- within 2m of the accelerometer installation point

The wSNAK is equipped with an LCD power meter. This power meter displays the power generated by the PMG17 vibration energy harvester in mW.

Using the magnetic mount, attach the wSNAK to a suitable part of the motor and after a few seconds note the amount of power on the display. Typical values range from 0.5mW to 10mW. Try the wSNAK in several locations to determine the best 'power' location.

To determine the optimal 'radio' location visually survey the motor to determine the location that gives the best clear sight of the receiver.

Place the wSNAK in a location that satisfies good power generation (>1mW), has good radio characteristics and can reach the intended accelerometer location.

Accelerometer Installation

Attach the accelerometer to the motor in the desired position and plug the accelerometer connector into the wSNAK. Ensure the cable is secured and is clear of rotating parts.

Operating Instructions

wSNAK Display Software

The wSNAK Display Software comprises of 3 panels (Figure 2 – Perpetuum wSNAK Display Software showing the accelerometer FFT. The different graphs are accessed via the tabs provided at the top of the display panel.

The graph viewer panel displays the most recent FFT along with trends for the PMG17 power generated; accelerometer temperature and LQI. The different graphs are accessed via the tabs provided at the top of the display panel.

The data viewer panel lists the time, node address and data length of the incoming data.

The display properties panel displays the node address of the four wireless nodes and allows the user to assign colours for each.

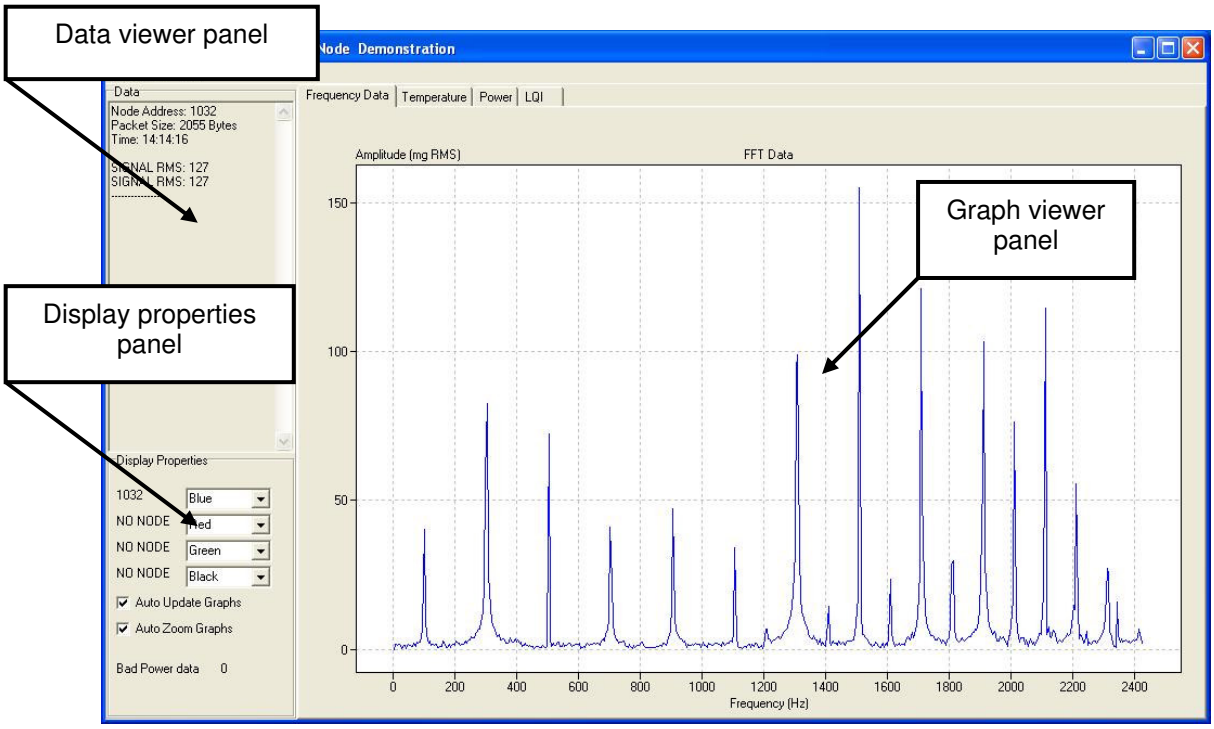


Figure 2 – Perpetuum wSNAK Display Software showing the accelerometer FFT

Reporting Interval

The wSNAK reporting interval is a function of the power generated by the vibration energy harvester. The following table gives the approximate reporting interval for various power levels.

Power	Time to first report (minutes)	Subsequent reporting interval (seconds)
0.5mW	40	240
1.0mW	20	120
5.0mW	4	20
10.0mW	2	10

Contact Information

For more information please contact

Perpetuum Ltd,
Enterprise Road,
Southampton Science Park,
Southampton.
SO16 7NS.
United Kingdom.

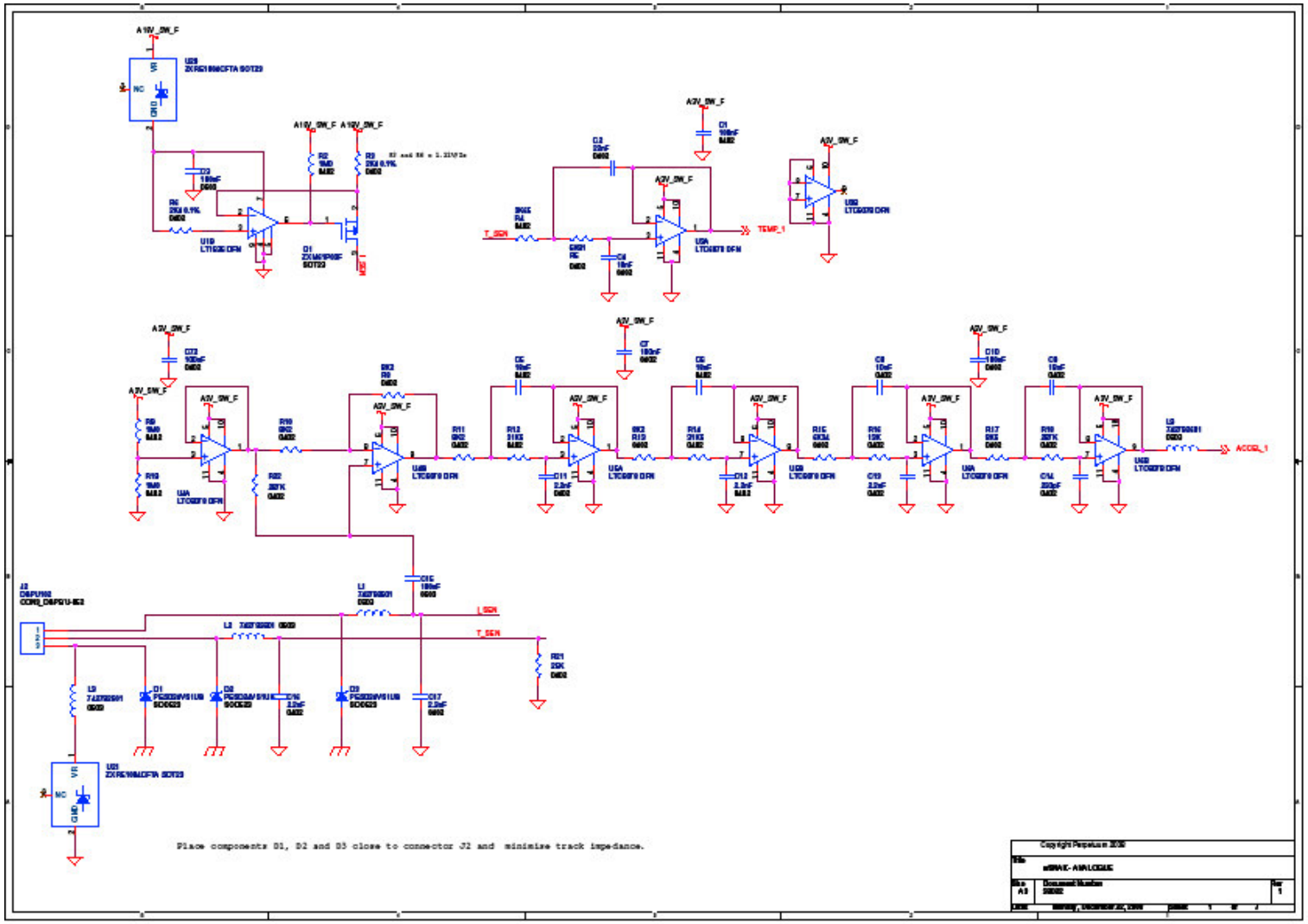
+44 (0) 2380 765 888.

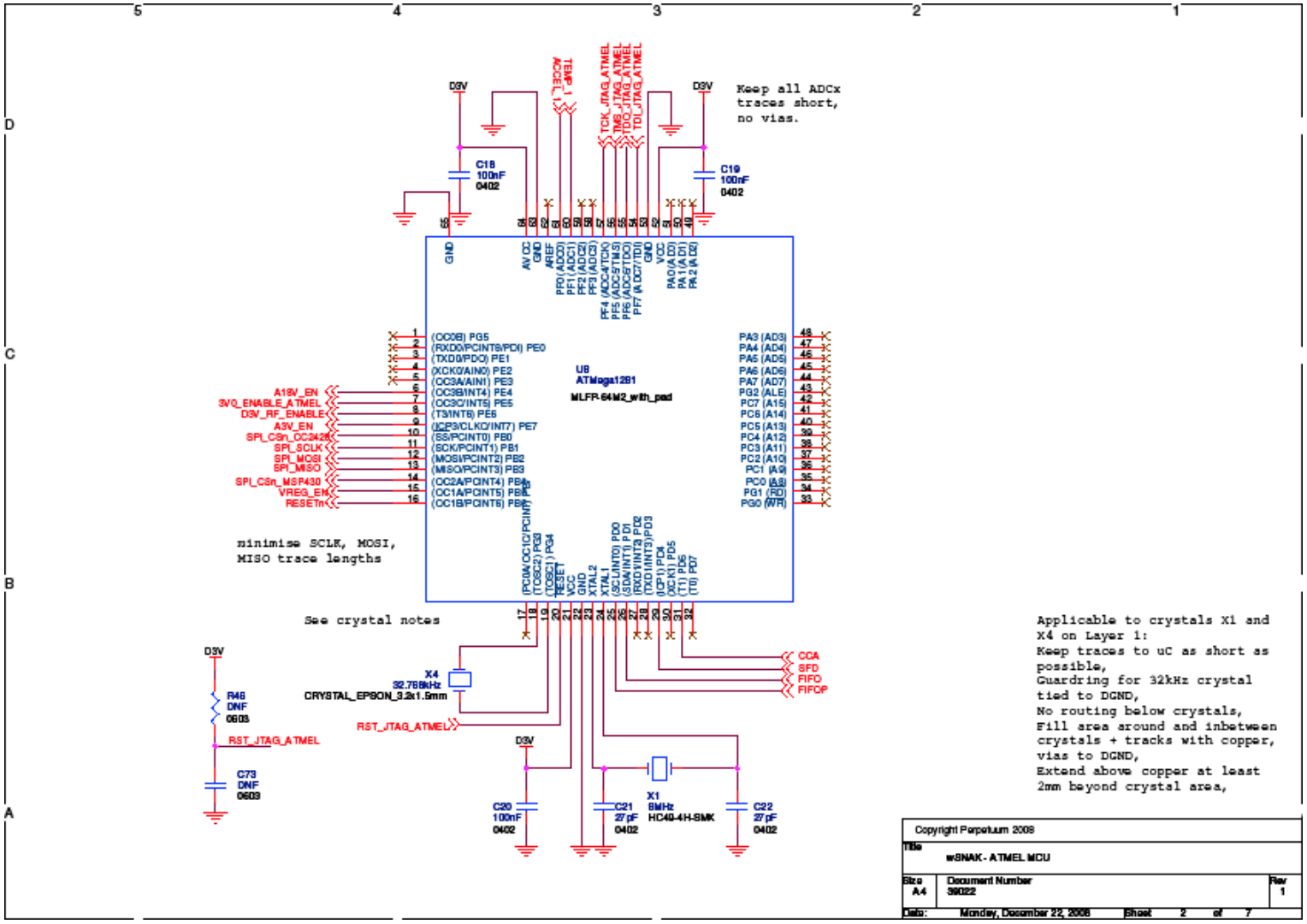
info@perpetuum.com.

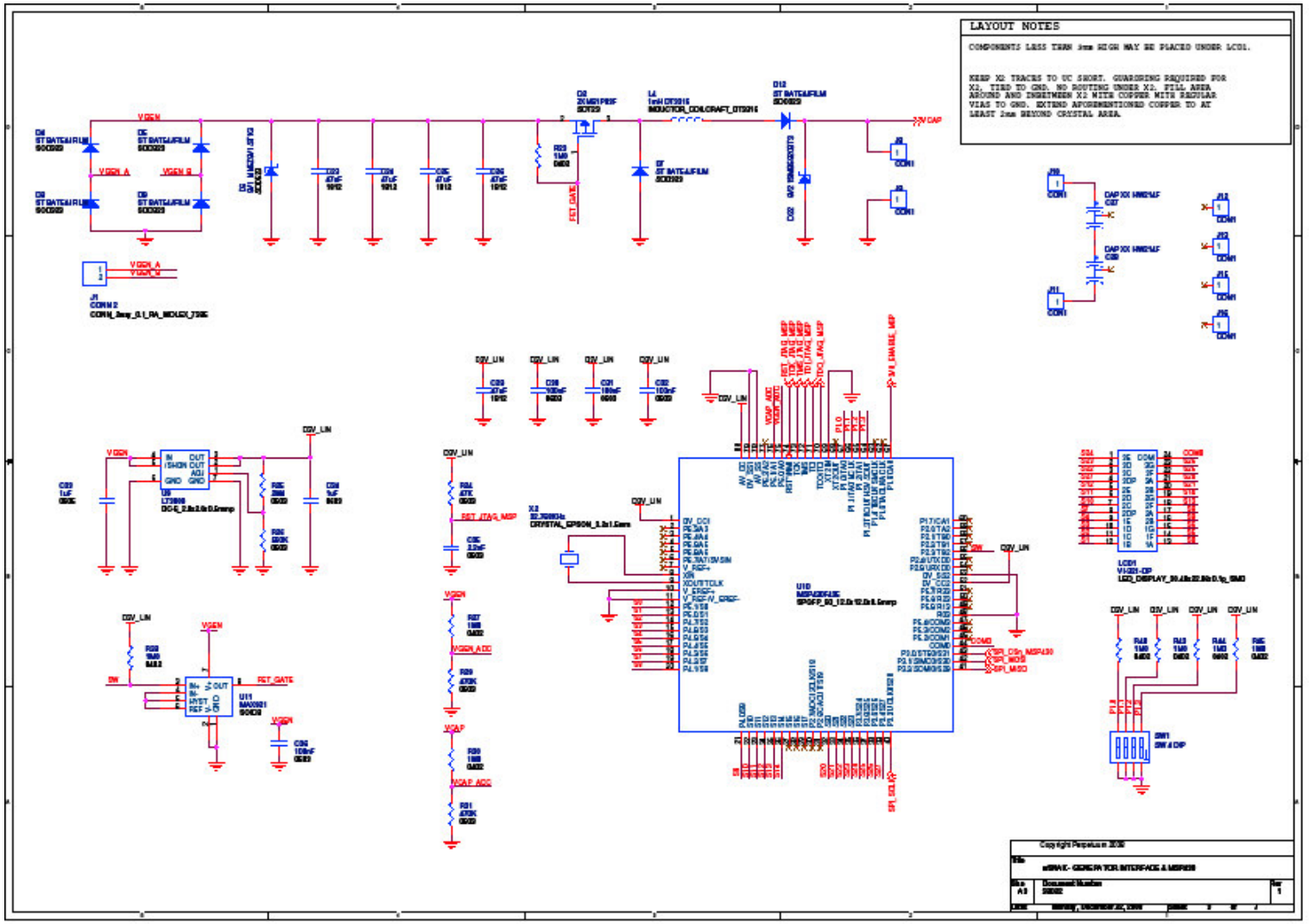
www.perpetuum.com

Appendix

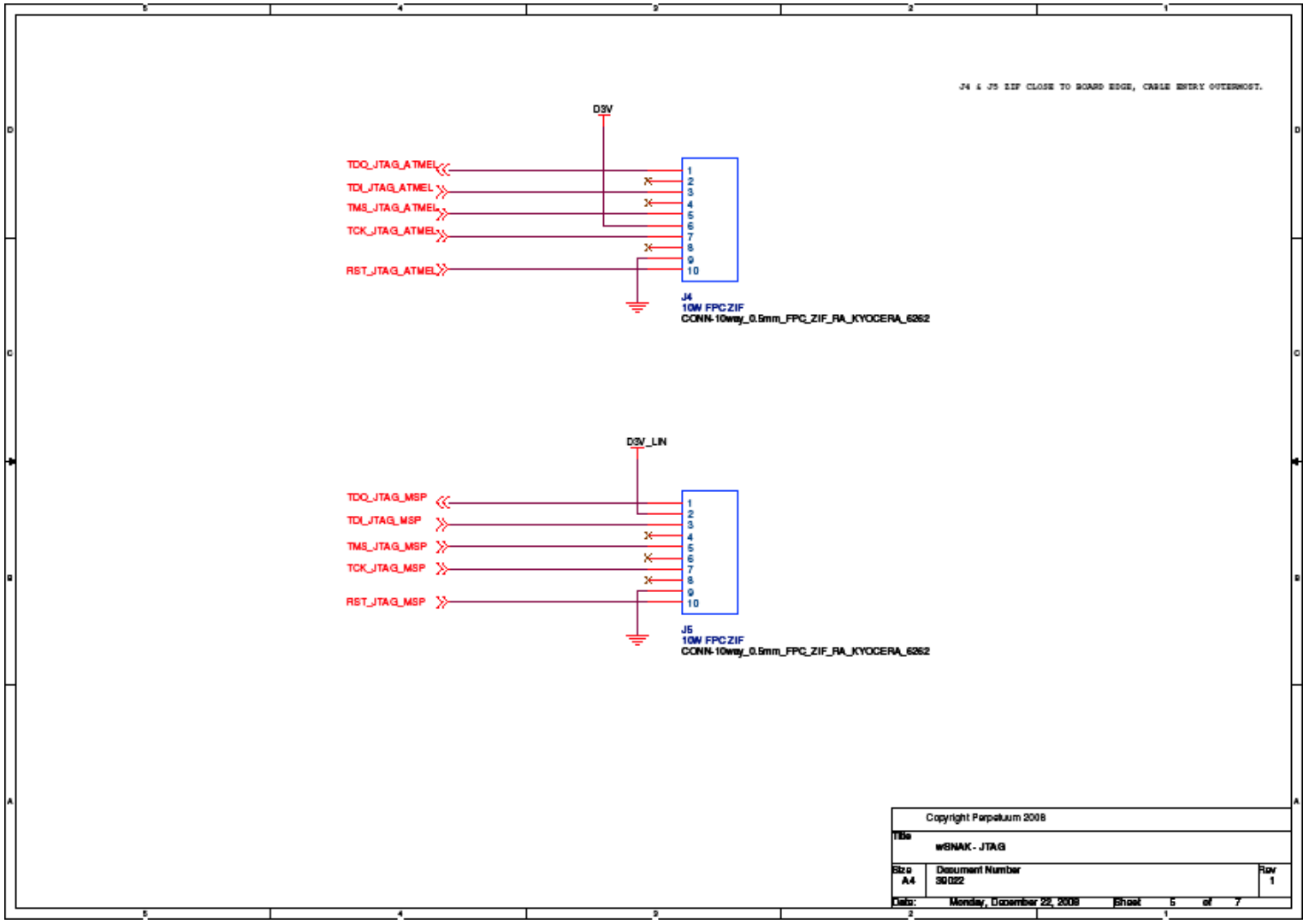
Circuit Diagrams

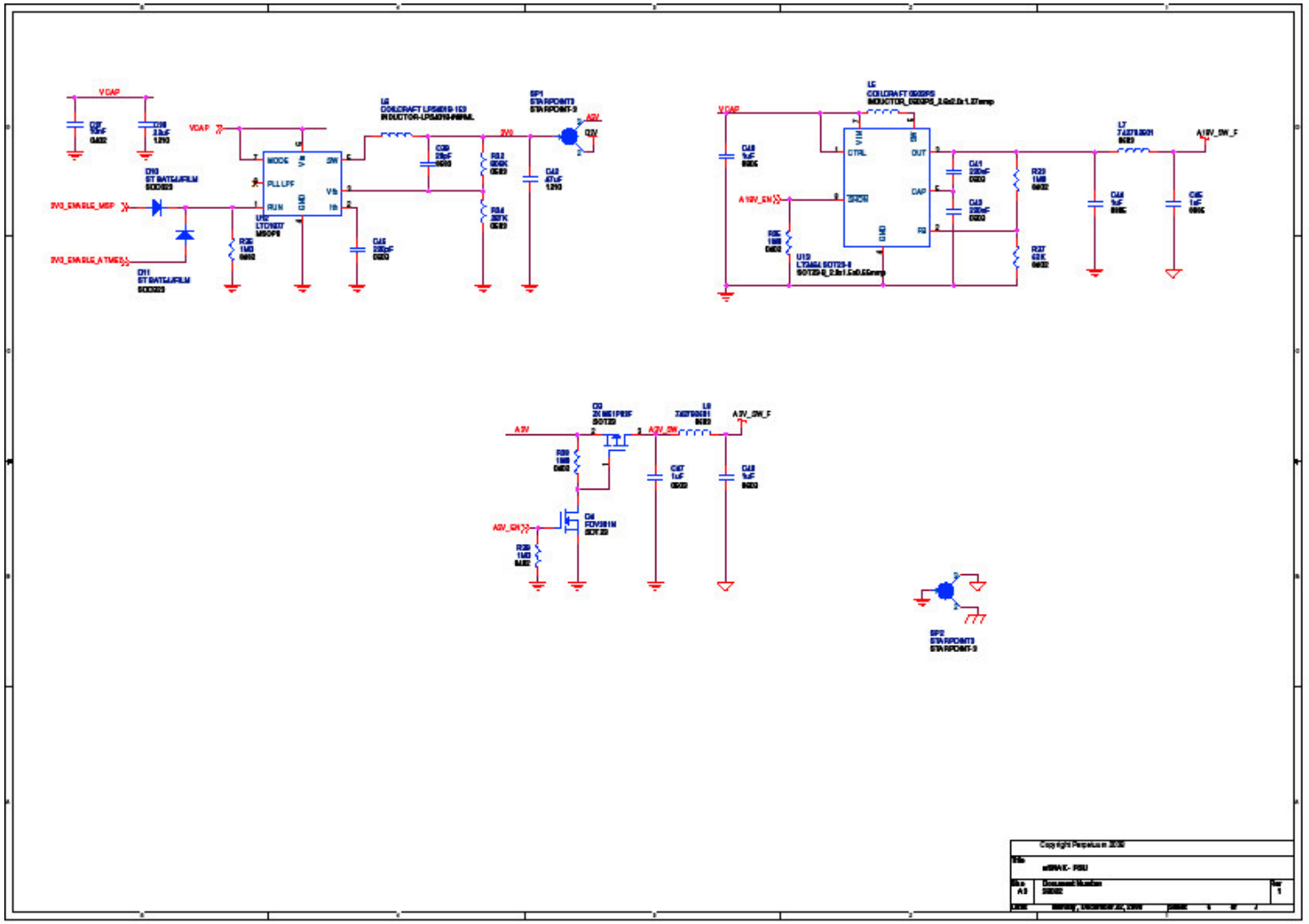

Place components D1, D2 and D3 close to connector J2 and minimise track impedance.

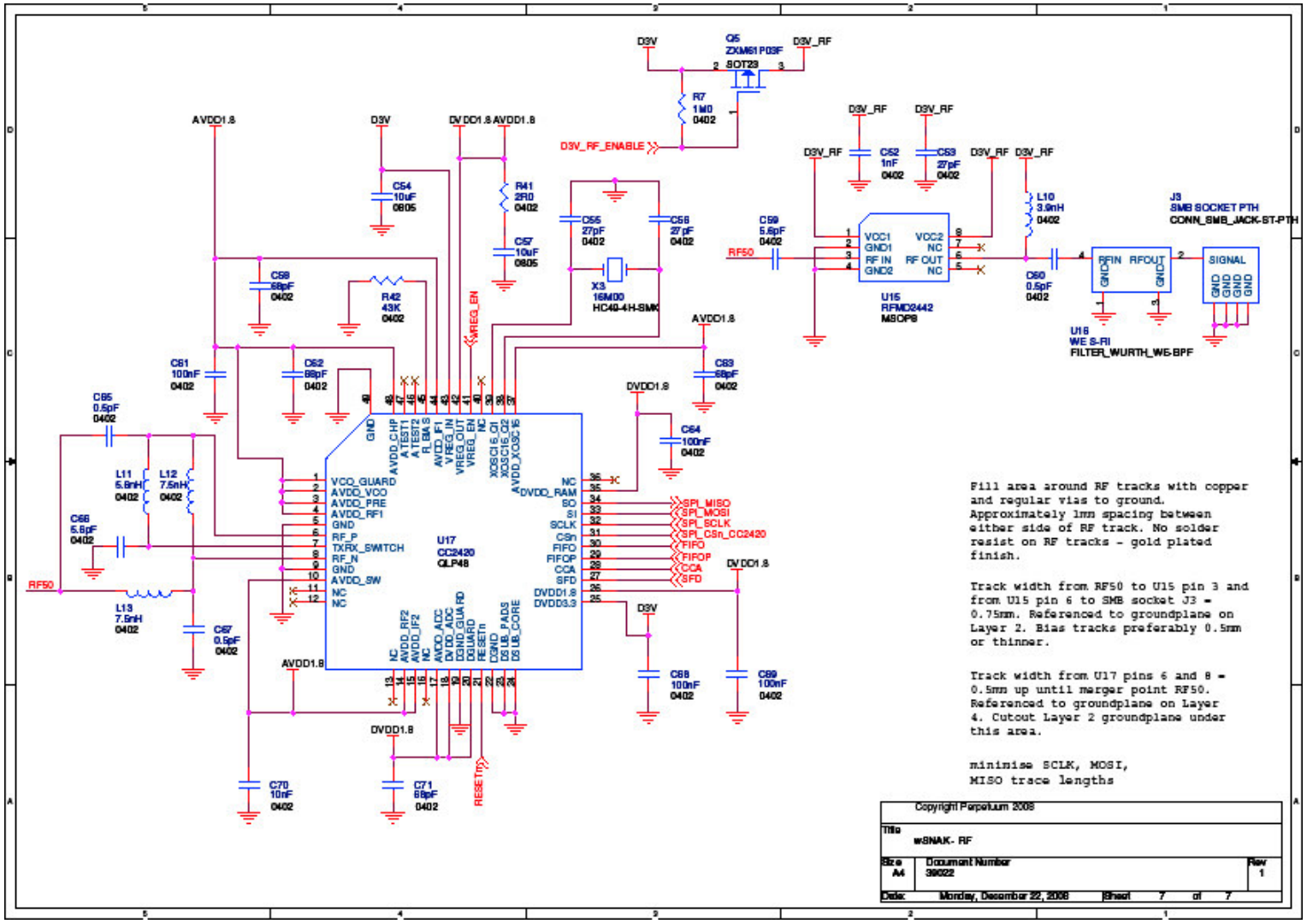

Keep all ADCx traces short, no vias.
minimise SCLK, MOSI, MISO trace lengths
See crystal notes
Applicable to crystals X1 and X4 on Layer 1:
Keep traces to uC as short as possible,
Guardring for 32kHz crystal tied to DGND,
No routing below crystals,
Fill area around and inbetween crystals + tracks with copper, vias to DGND,
Extend above copper at least 2mm beyond crystal area,
U8
ATMega128l
MLFP-64M2_with_pad
X4
32.768kHz
CRYSTAL_EPSON_3.2x1.5mm
X1
8MHz
HC49-4H-SMK
C18
100nF
0402
C19
100nF
0402
C20
100nF
0402
C21
27pF
0402
C22
27pF
0402
R46
DNF
0603
C73
DNF
0603
D3V
RST_JTAG_ATMEL
CCA
SFD
FIFO
FIFOP
Copyright Perpetuum 2008
wSNAK - ATMEL MCU
Document Number
39022
Monday, December 22, 2008


LAYOUT NOTES
COMPONENTS LESS THAN 3mm HIGH MAY BE PLACED UNDER LCD1.
KEEP X2 TRACES TO UC SHORT. GUARDRING REQUIRED FOR X2. TIED TO GND. NO ROUTING UNDER X2. FILL AREA AROUND AND UNDERNEATH X2 WITH COPPER WITH KEEPOUT VIAS TO GND. EXTEND AFOREMENTIONED COPPER TO AT LEAST 2mm BEYOND CRYSTAL AREA.


J1 - GENERATOR - 2 WAY
J2 - ACCELEROMETER - 3 WAY
J3 - SMB - COAXIAL
J4 - JTAG - 10 WAY ATMEL
J5 - JTAG - 10 WAY MSP
Please mark assembly number in silkscreen followed by a box for the issue, eg,
39022 ISS [ ]
Please mark PCB number in copper, eg,
39004 ISS 1
H1
H2
H3
H4
H5
NS
2.7 NPTH
Copyright Perpetuum 2008
Title
wSNAK - SUPPLEMENTAL INFORMATION
Size
A4
Document Number
39022
Rev
1
Date:
Monday, December 22, 2008
Sheet 4 of 7


J4 & J5 ZIF CLOSE TO BOARD EDGE, CABLE ENTRY OUTERMOST.
D3V
TDO_JTAG_ATMEL
TDI_JTAG_ATMEL
TMS_JTAG_ATMEL
TCK_JTAG_ATMEL
RST_JTAG_ATMEL
1
2
3
4
5
6
7
8
9
10
J4
10W FPC ZIF
CONN-10way_0.5mm_FPC_ZIF_RA_KYOCERA_6252
D3V_LIN
TDO_JTAG_MSP
TDI_JTAG_MSP
TMS_JTAG_MSP
TCK_JTAG_MSP
RST_JTAG_MSP
J5
10W FPC ZIF
CONN-10way_0.5mm_FPC_ZIF_RA_KYOCERA_6252
Copyright Perpetuum 2008
Title
wSNAK - JTAG
Size
A4
Document Number
39022
Rev
1
Date:
Monday, December 22, 2008
Sheet
5
of
7




Fill area around RF tracks with copper and regular vias to ground. Approximately 1mm spacing between either side of RF track. No solder resist on RF tracks - gold plated finish.
Track width from RF50 to U15 pin 3 and from U15 pin 6 to SMB socket J3 = 0.75mm. Referenced to groundplane on Layer 2. Bias tracks preferably 0.5mm or thinner.
Track width from U17 pins 6 and 8 = 0.5mm up until merger point RF50. Referenced to groundplane on Layer 4. Cutout Layer 2 groundplane under this area.
minimise SCLK, MOSI, MISO trace lengths
Copyright Perpetuum 2008
Title
wSNAK- RF
Size A4
Document Number 39022
Rev 1
Date: Monday, December 22, 2008
Sheet 7 of 7