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Date	*2024 / 04 / 09*

US-MUPI

Révision 1 le 31 août 2023

1 DESCRIPTION

US-MUPI is a complete single ultrasound channel which is multiplexed to 8 probes.

Only one power supply of 5VDC/500mA.

2 communication protocols: SPI and USB2.0.

2 HARDWARE

2.1 Receiver

- F.I.R. : 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz and broadband
- Bandwidth : 0.5 MHz to 18 MHz
- Noise : 10 µV RMS

2.2 Emitter

- Voltage : -10 à -160 Volts step 10V
- Width : 25 ns à 1.6 µs by step of 6.25ns
- Falling time (50Ω load / 150V / 10 à 90 %) : < 10 ns

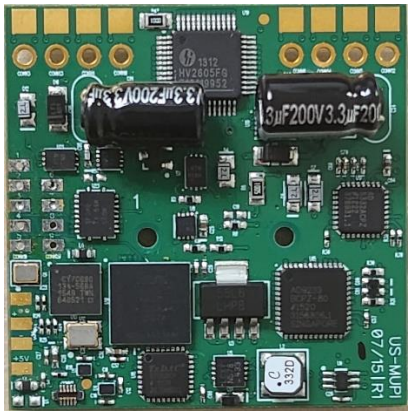
2.3 ADC

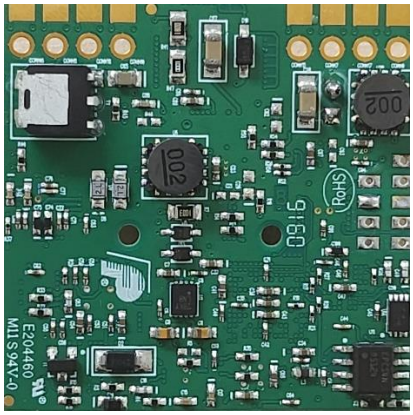
- 12 bits
- 20/40/80/160MHz
- linearity < 0.1 %

2.4 PCB Size

- *40x40x10mm*

2.5 Pictures





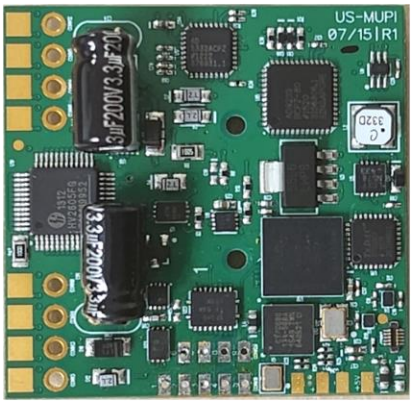
2.6 I/O

<table>
<tr>
<td rowspan="2">

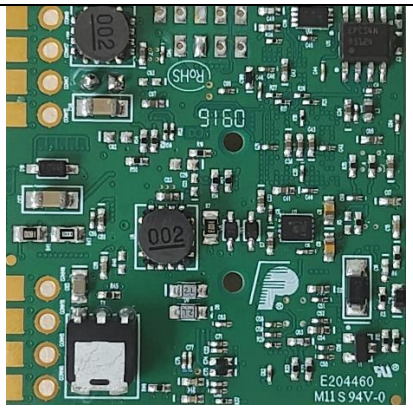
- *8 pads for 8 Tx*
- *8 pads for 8 Tx ground*
- *8 pads for 8 Rx*
- *8 pads for 8 Rx ground*

</td>
<td>Rx4
Tx4
Rx3
Tx3

FPGA Side

Rx2
Tx2
Rx1
Tx1</td>
<td> 
</td>
</tr>
<tr>
<td>Tx5
Rx5
Tx6
Rx6

TMOS Side

Tx7
Rx7
Tx8
Rx8</td>
<td> 
</td>
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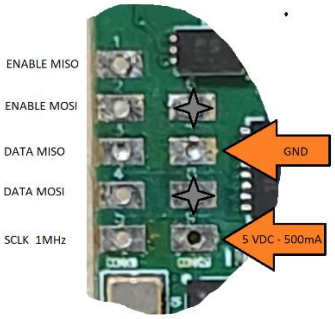
<tr>
<td colspan="3">Note: To work in Pulse echo mode, hardware strap will be done between each Tx/Rx of the same channel</td>
</tr>
<tr>
<td>

- *SPI: 9 pads*
  - *SCLK (1MHz)*
  - *Data MOSI*
  - *Data MISO*
  - */Enable MOSI*
  - */Enable MISO*
  - *+5VDC 500mA*
  - *GND*
  - *2 unusable*

</td>
<td></td>
<td> 
</td>
</tr>
<tr>
<td>

- *USB: 4 pads*
  - *+5VDC 500mA*
  - *D-*
  - *D+*
  - *GND*

</td>
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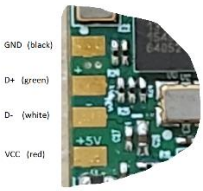
<td> 
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</table>

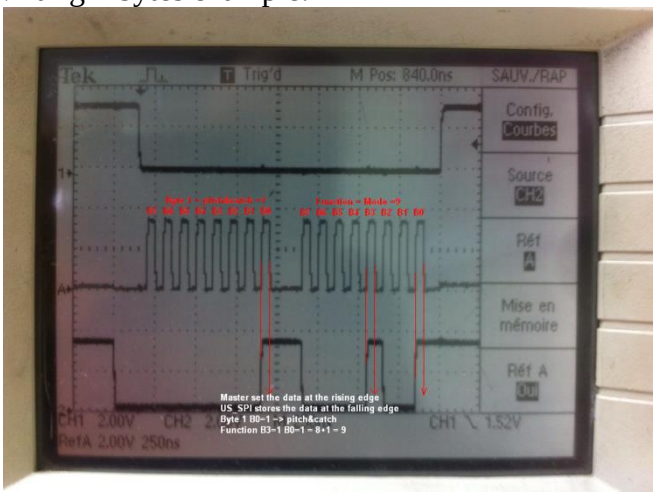
3 SPI CONFIGURATION

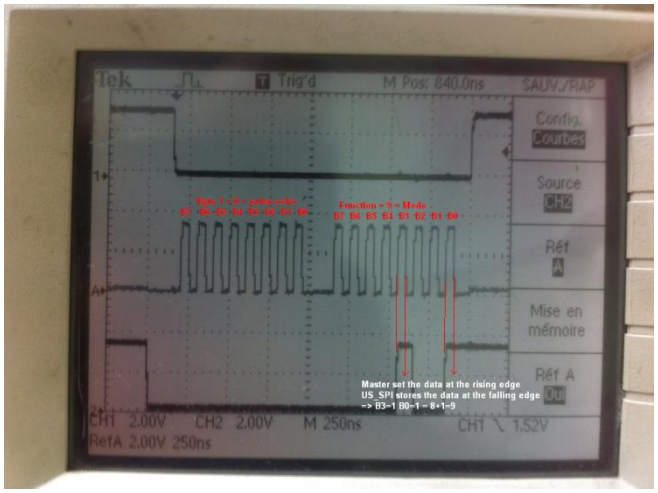
US_SPI uses 2 SPI lines: 1 for Writing and 1 for reading.
So, the number of wires necessary is 5:

- 2 for Writing (EnableMOSI/, DataMOSI)
- 2 for Reading (EnableMISO/, DataMISO)
- SCLK is common for the 2 ports at 1MHz.

Sleeping state for SCLK=0
Sleeping state for both Enable=1
DataMISO = Hi-Z when EnableMISO/=1

Writing 2 bytes example:





This example shows the function 9 because it needs only 1 byte DATA (0/1)