MCU

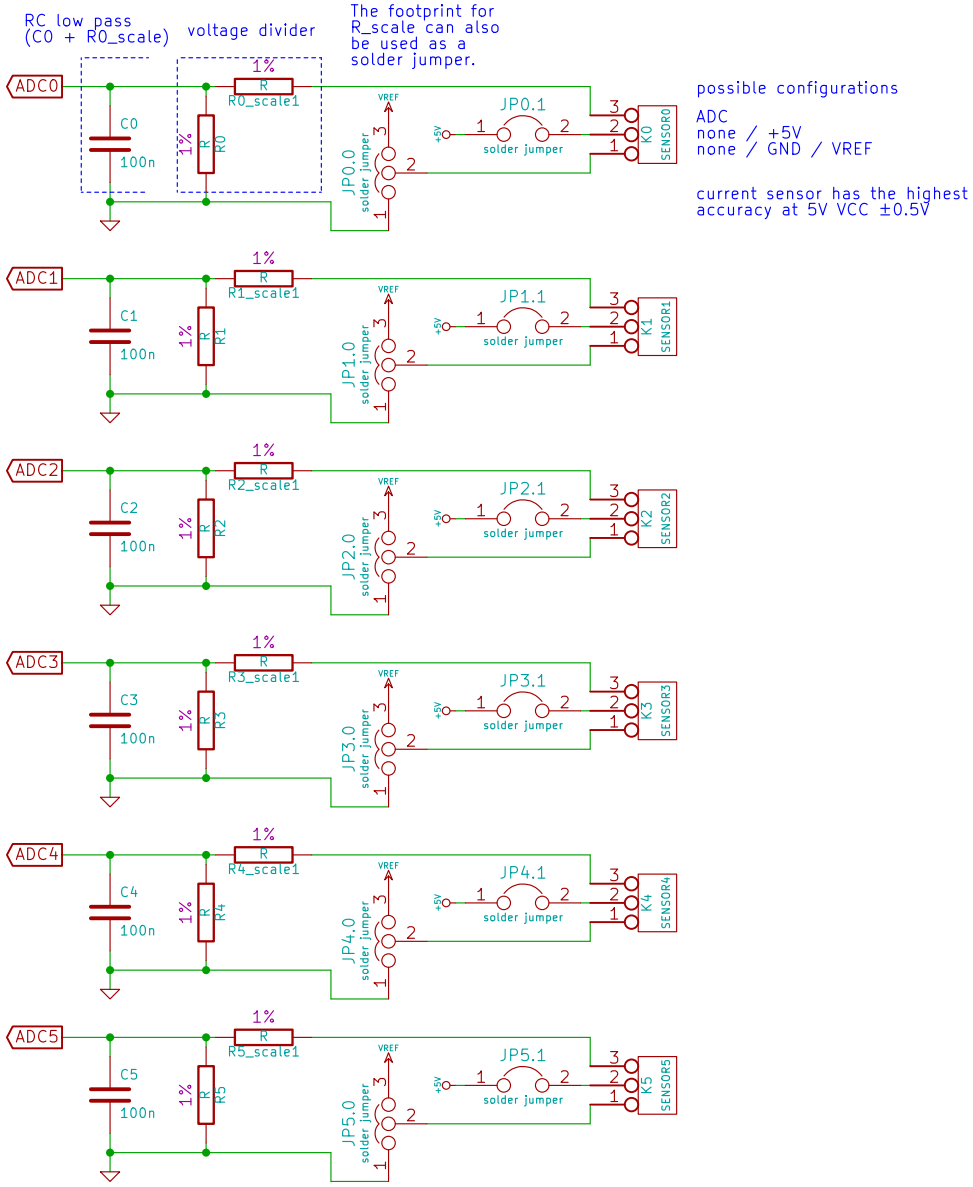
mcu.sch

ADC

adc.sch

Matthias Kolja Miehl <miehl@w3hs.net>		
File: msb_sensor.sch		
Sheet: /		
Title: MSB Sensor		
Size: A4	Date: 18 dec 2012	Rev: 4
KiCad E.D.A.		Id: 1/3

ADC Wiring for different Sensor Types



possible configurations

ADC
none / +5V
none / GND / VREF

current sensor has the highest accuracy at 5V VCC ±0.5V

Connector Configurations

VOLTAGE	CURRENT	TEMPERATURE
3: ADC	3: ADC	3: ADC
2: none	2: +5V	2: none
1: none	1: GND	1: VREF

Cut-Off Frequencies
V: 49900 Ohm → 32 Hz
I: 8060 Ohm → 197 Hz
T: 1200 Ohm @ 52°C → 1326 Hz

3 Possible Configurations for the Channels to Reduce Part Costs

VOLTAGE
|| measure 0..5x4.2V
|| i.e. 5S battery
|| 2LSB error=10.5mV

R = 8060 Ohm
R_scale = 49900 Ohm
V_in,max = 21.5 V
I_in,max = 0.372 mA

CURRENT
|| measure 0..150A
|| 2LSB error=37mA

R = 8060 Ohm
R_scale = 8060 Ohm
V_in,max = 6 V
I_in,max = 0.372 mA

TEMPERATURE
|| measure 0..120°C

R = 8060 Ohm
R_scale = 0 Ohm
V_in,max = VREF
I_in,max = 0.33 mA
P_heat = 145mW @ 120°C
self-heat = 147°C
error_max = 12.6°C
error_calib = 1.96°C

→ R = 8060
If one is going to calibrate the sensor.

→ R = 49900
If one won't calibrate and 12.6°C error is tolerable.

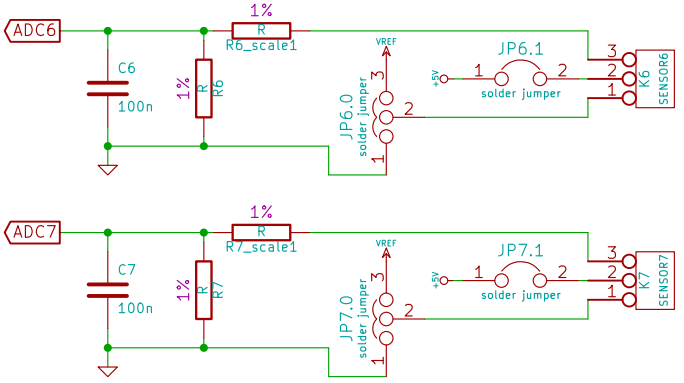
R = 49900 Ohm
R_scale = 0 Ohm
V_in,max = VREF
I_in,max = 0.06 mA
P_heat = 5mW @ 120°C
self-heat = 5°C
error_max = 12.6°C
error_calib = 7.26°C

ADVICE: Use a PT10000, e.g. HYG NTC 103

Sensors Used

CURRENT SENSOR
ACS758LCB-100U-PFF-T (max 100A, 40mV/A, -40..+50°C)
absolute max rating: I_VOUT = 3mA
VCC = +3..5V (not stabalized), ICC = 10mA

TEMPERATURE SENSOR
PCA 1.2005 10 Bauform PCA/M (PT1000, Platin-Chip-Temperatursens., bedrahtet)



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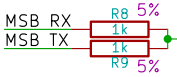
Multiplex Sensor Bus (MSB)

1k Ohm → 5mA
250 Ohm → 20mA

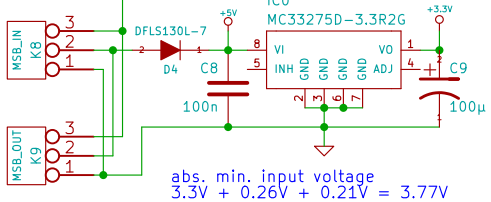


MSB input (cable)

signal
+5V
GND

MSB output (pins)

signal
+5V
GND



abs. min. input voltage
3.3V + 0.26V + 0.21V = 3.77V

The sensor is supplied with power via the MSB connector. May vary from 4..6V.

VCC=3.3V
→ MCU voltage MSB compatible

Schottky Diode
VR,max=30V
VF=0.21V@100mA
IF,avg=1A

Voltage Regulator
0.26V drop @ 300mA

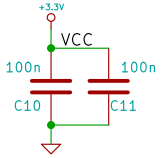
MCU: 5.5mA
MSB: 5mA
LEDs: 2x5mA
VREF: 1.15mA
NPN Tr.: 1mA
SD Card: 80mA

TOTAL: 102.65mA

+ I Sensor: 10mA (8x)
= 182.65mA

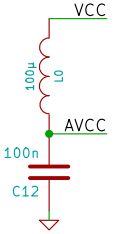
+3.3V Supply
max 300mA

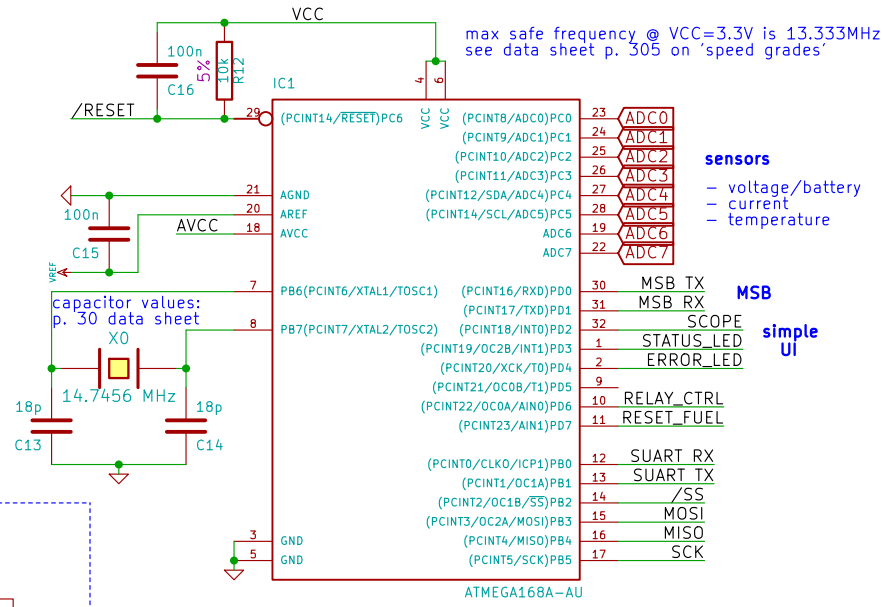
VCC Supply



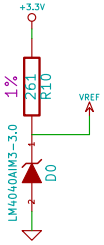
capacitors placed directly accross MCU pins 3/4 and 5/6

AVCC Supply





+3V Voltage Reference



series reference
– provides not enough current
→ needs an OP as voltage follower
– low power dissipation

shunt reference
– provides enough current, but idles at maximum current

R = (VCC−AREF)/(ICC)

Temp Sensor: 0.1mA (8x)
MCU: 0.1mA (?)

TOTAL: 0.9mA

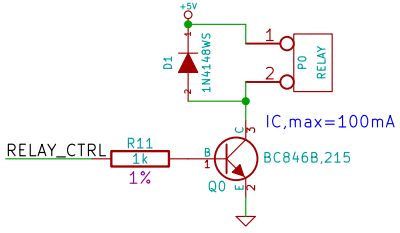
max current with 261R → 1.15mA

VR(IR=0.1mA) = 3V
IR,min=67µA

ΔVR/ΔIR(IR,min ≤ IR ≤ 1mA) = 0.6..1mV

NOTE: pin 3 of the SOT−23 package must be left floating or be connected to pin 2 because of the parasitic Schottky diode between those pins

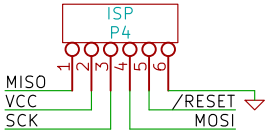
Relay Connection for Buzzer



BC846: 100mA switching current
1.3k → 3.3V control voltage
2.2k → 5V control voltage

IM03JR: 2A switching current
28mA coil current, 5VDC coil voltage,
3.75V max turn on voltage

ISP



SPI

/SS /RESET

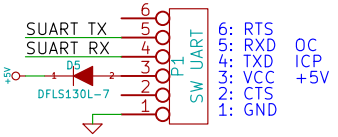
simple UI

R = (Vcc−Vd)/Id
= (3.3V−2V)/5mA = 261 Ohm

SCOPE SCOPE P2 digital output for debugging

use MSB GND pin as reference

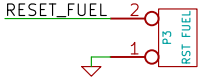
Software UART



SW UART connector can power the sensor board

pin configuration = FTDI cable (delock 83116)

Reset Fuel Indicator to 100%



connector for button to reset the fuel indicator

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