Data Acquisition System

ADC1299

VIN

$\overline{CS}$
MOSI
MISO
SCLK

START
$\overline{DRDY}$

AVSS
DGND

$\overline{RESET}$
$\overline{PWDN}$

ADC1299.sch

$\overline{CS}$

START
$\overline{DRDY}$

$\overline{RESET}$
$\overline{PWDN}$

GND

Arduino Nano

$\overline{CS}$
MOSI
MISO
SCLK

START
$\overline{DRDY}$

RESET
PWDN

VIN
+5V

AT_COMM

RX
TX

GND

Arduino_Nano.sch

VIN
+5V

AT_COMM

GND

SW2
SW_DIP_x02

1   4   HC05_TX
2   3

R20
2K

GND

R21
1K

HC05_RX

Mounting Holes & Logos

MH1
MountingHole

MH2
MountingHole

MH3
MountingHole

MH4
MountingHole

TEXT1
Text

LOGO1
UoNLogo

LOGO2
SparkerLogo

VIN Auto Selector

D1
NSR20F40NXT5GOSCT−ND

VIN   VBAT

Test Points

VIN_RAW   2   J7
GND   1   VIN_RAW_TP

$\overline{CS}$ 2   J10
GND   1 $\overline{CS}$_TP

START   2   J12
GND   1   START_TP

HC−05 Bluetooth Module

1   Enable AT Commands
+5V   2   +5V
GND   3   GND
HC05_RX   4   TX
HC05_TX   5   RX
6   LED

J5
HC−05 BT Module

Reverse Polarity and Overcurrent Protection

F1
0251004.NRT1L

VIN_RAW

4A Rating

Q1
DMP2100U

3   1

2

D3
7.5V

VIN

R19
33k

GND

Power Connections

J3
Battery Connector

2   GND
1

SW1
DIP

1   2

D2

1   2   VBAT

MURA140T3GOSCT−ND

J4
DC Barrel Jack

1   GND

2   VIN_RAW

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ADS1299-8 and Support Circuitry

+5V Regulated Supply

U2
MCP1755T-5002E_SOT223-5

5V Supply driving 3.3V LED, so
1.7V drop across resistor.
I = 20mA. R = V/I = 1.7 / 20m
= 85 Ohms. Round to higher
standard value, 100 Ohms

VIN

SHDN GND VOUT
VIN

C26 100uF C27 10uF C29 100nF C31 10nF

AVDD

R22 100

C34 1nF C35 10nF C37 100nF C39 10uF

D4 LTST-C194TBKT
PWR (Blue)

AVSS

+3.3V Regulated Supply

U3
LM3480-3.3

DVDD

AVDD

VI VO
GND

C28 100uF C30 10uF C32 100nF C33 10nF

C36 1nF C38 10nF C40 100nF C41 10uF

DGND

Mid-Supply Voltage Divider

AVDD

R1 10k

MID_SUPPLY

R2 10k

AVSS

J1
Conn_01x09_Male

SW3 R3 220k IN8P / IN8N 2 / 1
SW4 R4 220k IN7P / IN7N 4 / 3
SW5 R5 220k IN6P / IN6N 6 / 5
SW6 R6 220k IN5P / IN5N 8 / 7
SW7 R7 220k IN4P / IN4N 10 / 9
SW8 R8 220k IN3P / IN3N 12 / 11
SW9 R9 220k IN2P / IN2N 14 / 13
SW10 R10 220k IN1P / IN1N 16 / 15
SW11 R11 220k
SW_SPDT

Jump unused
analog inputs
directly to
AVDD

AVDD

MID_SUPPLY

C1 24nF C2 24nF C3 24nF C4 24nF C5 24nF C6 24nF C7 24nF C8 24nF

Referred Montage: All electrodes will be referenced to reference electrode.
Negative electrode inputs are unused, set to mid-supply.
MAKE SURE CORRECT REGISTERS ARE SET IN SOFTWARE!

RC LPF: f_c = 1 / (2*pi*R*C)
R = 220kOhms
https://pdfs.semanticscholar.org/05b6/6348fc1a11726d76eb08ddddabfc4cd36f6.pdf

Lowest Sampling Frequency = 250sps, therefore Nyquist Frequency at 125Hz,
but this is still very high for EEG. Will LPF at 30Hz

30 = 1/ (2 * pi * 220k * C)
C = 1/ (2 * pi * 220k*30)
C = 24.11nF, approx 24nF --> f_c = 30.14Hz

ADC1
ADS1299-8

AVSS C12 0.1uF C14 1uF

AVDD

C15 0.1uF C18 1uF

Right Leg Drive
Bias not used
under instruction
from Psychology
Department

AVDD C10 1uF

AVSS

C17 1uF

AVDD

Pins: 58 AVSS, 59 AVDD, 61 BIASINV, 63 BIASOUT, 62 BIASIN, 60 BIASREF, 22 AVDD, 55 VCAP3, 54 AVDD1, 53 AVSS1

RESV1 31 DGND
RESERVED 64
CLKSEL 52
AVSS 32 AVSS
DVDD 48
/DRDY 47 DRDY
GPIO4 46 MISO
DOUT 43
GPIO2 44
GPIO3 45
SCLK 40 SCLK
/CS 39 CS
CLK 37
START 38 START
DIN 34 MOSI
DGND 33 DGND

DVDD

C20 0.1uF C21 1uF

R13 33k
R15 33k
R14 33k

DGND

All GPIO Pins pulled to GND, unused

SRB2 18, SRB1 17, VCAP4 26, VREFP 24, NC 29, VREFN 25, NC 27, PWDN 35, VCAP1 28, GPIO1 42, DAISY_IN 41, VCAP2 30, /RESET 36

R12 33k

DGND

RESET

C11 0.1uF C13 1uF

C9 1uF

AVSS

C16 100uF C19 1uF

Using internal 4.5V Reference,
so short VREFN to AVSS

PWDN

Control and Data Lines

MOSI MOSI
MISO MISO
SCLK SCLK
CS CS

START START
DRDY DRDY
PWDN PWDN
RESET RESET

Power Connections

VIN VIN
AVSS AVSS
DGND DGND

MID_SUPPLY 2 J14
DGND 1 MID_SUPPLY_TP

AVDD 2 J15
AVSS 1 AVDD_TP

DVDD 2 J16
DGND 1 DVDD_TP

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ATMega328P

U1
ATmega328P-AU

5V Supply driving 2V LED, so
3V drop across resistor.
I = 20mA. R = V/I = 2 / 20m
= 100 Ohms

RESET — 29 RESET/PC6

PB5(SCK) 17 — SCLK
PB4(MISO) 16 — MISO
PB3(MOSI/OC2) 15 — MOSI
PB2(SS/OC1B) 14
PB1(OC1A) 13 — $\overline{CS}$
PB0(ICP) 12 — STATUS (Green)

Y1
16MHz
8 XTAL2/PB7
7 XTAL1/PB6
GND

100 R23
LTST-C191KGKT D5
GND

20 AREF
18 AVCC
21 AGND
C22 100nF
GND

PC5(ADC5/SCL) 28
PC4(ADC4/SDA) 27
PC3(ADC3) 26
PC2(ADC2) 25
PC1(ADC1) 24
PC0(ADC0) 23

3 GND
4 VCC
+5V

C42 100uF
C43 10uF
C23 1uF
C24 4.7uF
C25 1uF
GND

PD7(AIN1) 11 — START
PD6(AIN0) 10 — DRDY
PD5(T1) 9 — PWDN
PD4(XCK/T0) 2
PD3(INT1) 1
PD2(INT0) 32
PD1(TXD) 31 — TX
PD0(RXD) 30 — RX

19 ADC6
22 ADC7

1K R17
1K R18

USB Interface

VUSB
C52 4.7uF
C53 100nF
GND

+5V
C55 10uF
C56 100nF
C57 10nF
GND

+5V
C58 10nF
C59 100nF
C61 10uF
GND

+3V3
C54 100nF
GND

+5V
LTST-C191KRKT
USB_TX (Green)
D8
USB_RX (Red)
D9 LTST-C191KGKT

J2
USB_B_Mini

F2
MF-MSMF050-2
VUSB
500mA

VBUS 1
D+ 3 — USBD+ 15
D- 2 — USBD- 16
ID 4
Shield
GND 6 5
GND

U5
FT232RL

17 3V3OUT
VCCIO 4
VCC 20

TXD 1 — RX
RXD 5 — TX
RTS 3
CTS 11
DTR 2
DCR 9
DCD 10
RI 6

C60 100nF
GND

R25 100
R26 100

19 RESET
27 OSCI
28 OSCO

26 TEST

CBUS0 23
CBUS1 22
CBUS2 13
CBUS3 14
CBUS4 12

AGND 25
GND 7
GND 18
GND 21

GND

Programming Header
J6
ICSP Header

MISO 1 — 2 +5V
SCLK 3 — 4 MOSI
RESET 5 — 6 GND

+5V Auto Selector
D7
B130-13-F
+5V — VUSB

Reset Pushbutton
+5V
R16 1K
RESET
PB1
TE-1825910-6
GND

Power Connections
+6.3V - +15V VIN → VIN
GND GND → GND
+5V OUT +5V → +5V

Communication Pins
SPI
MOSI → MOSI
MISO → MISO
$\overline{CS}$ → CS
SCLK → SCLK

ADC Control
START → START
DRDY → DRDY
PWDN → PWDN
RESET → RESET

UART
TX → TX
RX → RX

+5V Regulated Supply
MCP1755T-5002E_SOT223-5

5V Supply driving 3.3V LED, so
1.7V drop across resistor.
I = 20mA. R = V/I = 1.7 / 20m
= 85 Ohms. Round to higher
standard value, 100 Ohms

VIN
1 SHDN
2 VIN
3 GND
VOUT 4
U4

+5V

C44 100uF
C45 10uF
C46 100nF
C47 10nF
GND

C48 1nF
C49 10nF
C50 100nF
C51 10uF

R24 100
D6
LTST-C194TBKT
PWR (Blue)
GND

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