2022/07/25

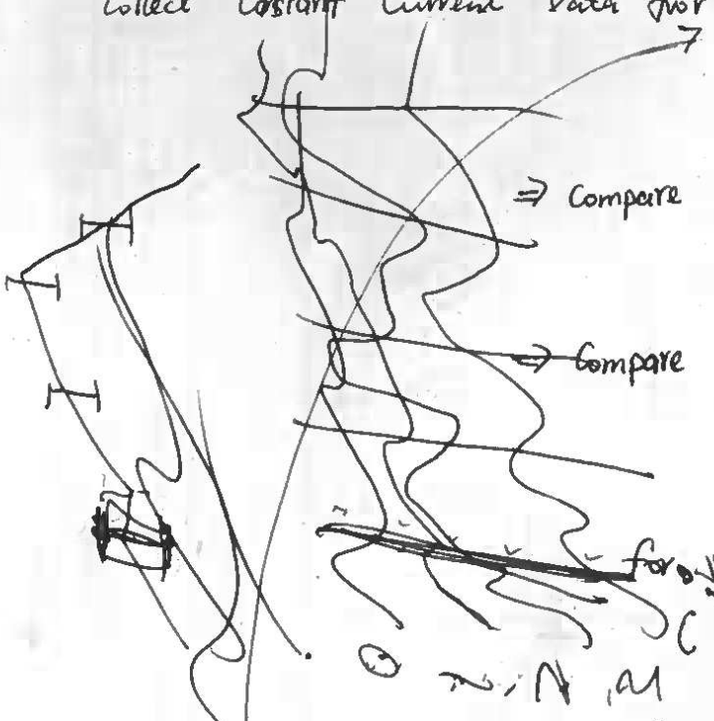
Collect Constant Current Data for 10mV to 40mV by step 1mV
(20mA to 80mA)

dataset 1V / 2V / 3V / 4V / 5V

⇒ Compare Vref - from Arduino PWM - performance
(How accurate / How to effect)

⇒ Compare Difference of performance between different source voltage.

for 485mV to 505mV by step 20mV
(70mA to 1,01A)



Improve resolution at low value

⇒ Compare Vref performance

⇒ Compare Vsource different performance

(With In-Amp)

Collect Constant Resistance Data (Offset & - 10 - 15 - 20)

R = 2Ω, ~~10Ω~~ 10Ω, 33Ω, 40Ω

2Ω / 1V ~ 2V

~~10Ω~~ 1 ~ 5V

How accurate it is

Because not good enough resolution $\frac{5V}{1023} = 4.8mV$

we need more resolution.

1023 - 10 bit

Arduino Mega 2560 - do not support > 10 bits resolution

Timer One

① 4 stages Large Current — Electronic Load.

4A → Each branch stays max 1A.

0.5Ω with 5W power resistor — ~~5W/1A = 5M~~ $5W = I^2R = I^2 \times 0.5$

$I^2 = 10$ $I = \sqrt{10}$

~~Actually only 2 stages~~ ≈ 3.16A

~~However~~ However — under 1V approach 4A.

4 parallel 0.5Ω → 0.125Ω

1/4 = 0.25Ω → (it limited by resistance of R power)

Actually only use 2 stages can barely support 4A at 1 V output

4 stages separate current, as well as power dissipated on Power MOSFET & Power resistor → better thermal control.

② 1 stage Large resistance — Electronic Load.

Load Resistance > 33Ω ⇒ 1V & 33Ω → min 30.3 mA

(if using 4 stages, each branch has too little current Pone MOSFET hard to control)

One stage - small current control (limited by MOSFET)

30.3mA at 0.5Ω Rsense ⇒ 15.15 mV

Instrumention Amplifier is implemented to provide precise control.

↳ gain 20 on 15.15mV ⇒ 303mV

1 stage works for 10Ω to 33Ω (Vout = 1V 5 V)

current from (1/33 to 5/10)

⇒ 30.3 mA to 500 mA

⇒ Rsense voltage ∈ [15.15mV to 250mV]

⇒ In-Amp Gain 20

⇒ Ref Voltage to LM324 ∈ [303mV to 5V]

① 4 stages works for ~~0.125Ω~~ 0.25Ω to 10Ω — Vsource ∈ [1 ~ 5V]

Current ∈ [~~5/0.125~~ 5/0.25Ω to 1/10]

= [5/0.25Ω to 1/10] = [~~20~~ 20A. to 0.1]A

Cannot active since 0.25Ω only for 1V situation

1V to 5V with max 4A

↓ ↘

min R_{Load} = 0.25Ω min R_{load} = 1.25Ω

current ∈ [4A ~ 0.1A] } No need for In-Amp.

R_{sense} Voltage ∈ [1V ~ 0.05V] min voltage across R_S = 50mV.

[1V ~ 50mV] achievable (checked ☆)

↙

by using one stage

1R 0.25W normal Resistor

$P = \frac{V^2}{R} = \frac{(0.5)^2}{1}$

$= 2.5 \times 10^{-3}$

$= 0.0025$ W.

③ Fan_on & Temp Monitor ⟶ PTF Family

↓

can be controlled by

Arduino Logic 1 pin (5V) with Amp to 11V

turn on the MOSFET to supply 12V to fan

NB_PTC0_1P2

PTFM_102A1A0

→ 1kΩ F. 0.15(A)

Ag (wire)

→ Calculation Temp

$T \geq 0°C \quad R_{(T)} = R_{(0)} \times (1 + a \cdot T + b \cdot T^2)$

$T < 0°C \quad R_{(T)} = R_{(0)} \times [1 + a \times T + b \cdot T^2 + c\,(T - 100°C) \cdot T^3]$

Never use

Operation Situation always at room temp

Heated up by Power MOSFET

Class F0.15(A) $\pm (0.15 + 0.002 * |T/°C|)°C$ tolerance

Temp Range = −30 ~ +300°C sufficient for our design.

over 50°C turn on the fan.

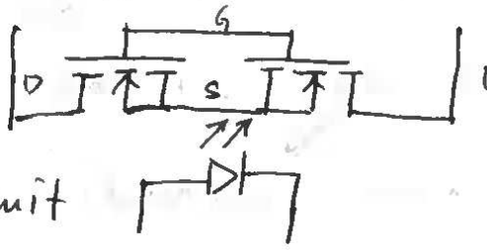
④ LCD print

a. Vref → V_{Rsense} → Id → (CC mode / CR mode) (Electronic Load).

b. Fan on/oF & Temp print.

c. Shunt Down (circuit Shorted).

⑤ Relay → MOSFET



used for Load short circuit

used for Capselect Switch

May also used for SyncBuck Switch (if it has bidirectional current go through).

Easily controlled by Arduino Pin (simply give 5V to the LED).

⑥ ADS1115 Analog to Digital Converter (test and display purpose).

4 pins to detect (Vsoure -(Vout+ Vout-))

also avaliable for differencial deteetion (2 pins involved. Voltage across Rsense (to Vout- ≠ GND)

⑦ Digital Potentiometer + SP3T (single-pole tripple-throw)

↓ 2 setpoint 1 freq 1 feedback

↘ 1 for mode selection.

~~4~~ 4.

PCB → ① 4 stage Electronic Load

② 1 stage Electronic Load.

③ Short circuit – Relay

SP3T selection.

Ron 2.06Ω ✗ one relay may need or MOSFET (one pair) ✓ 4.9mΩ Ron

involve CC/CR mode select by Arduino PWM pin → Vref