# Digital Adjustable DC Power Supply Reference Design

MPULAB
2015.12.26

# Motive of Development

- A monster on the desk
- A normal bench-top power 30V 3A weighs 9.1Kg


=

# Motive of Development

- Limited voltage and current resolution

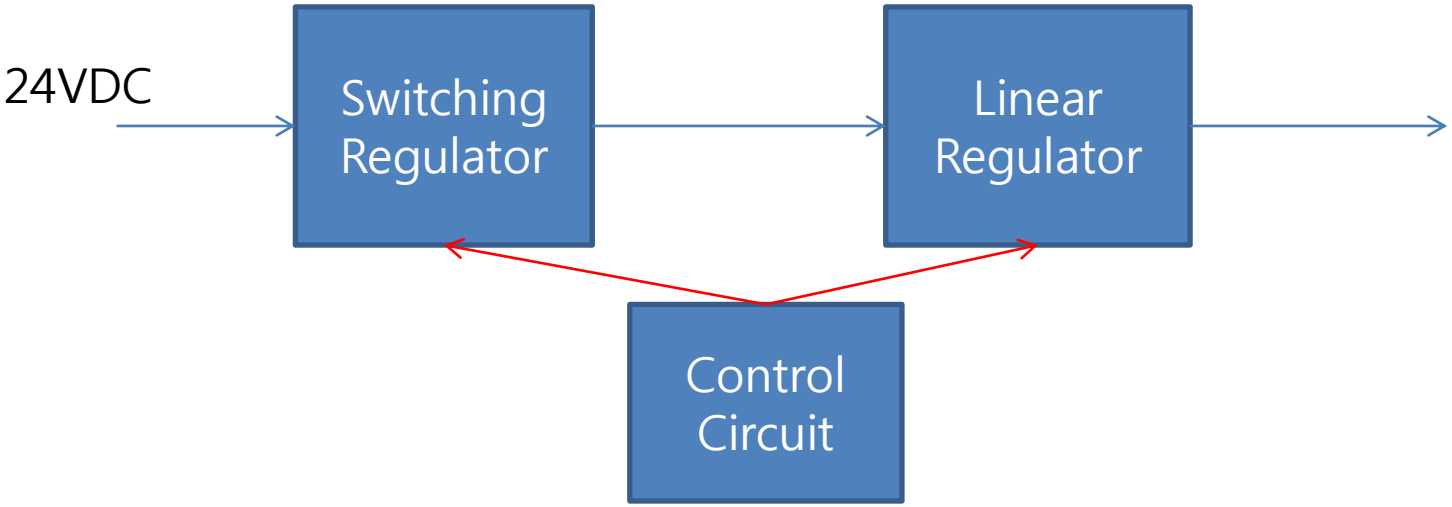

- If I could get more information…

# Design goal

- Compact and lightweight equipment
- 0 to 20V, 2A DC power supply
- 0.01 V voltage and 0.001 A current resolution
- Total MC should be less than 50 USD
- Stand-alone or USB operation (HID protocol)
- Using proven AC/DC adaptor as main power source
- Open source project (H/W, F/W, MFC Application)
- You can add additional functions. (e.g. Battery simulator)

# Design Concept

2-stage Regulation

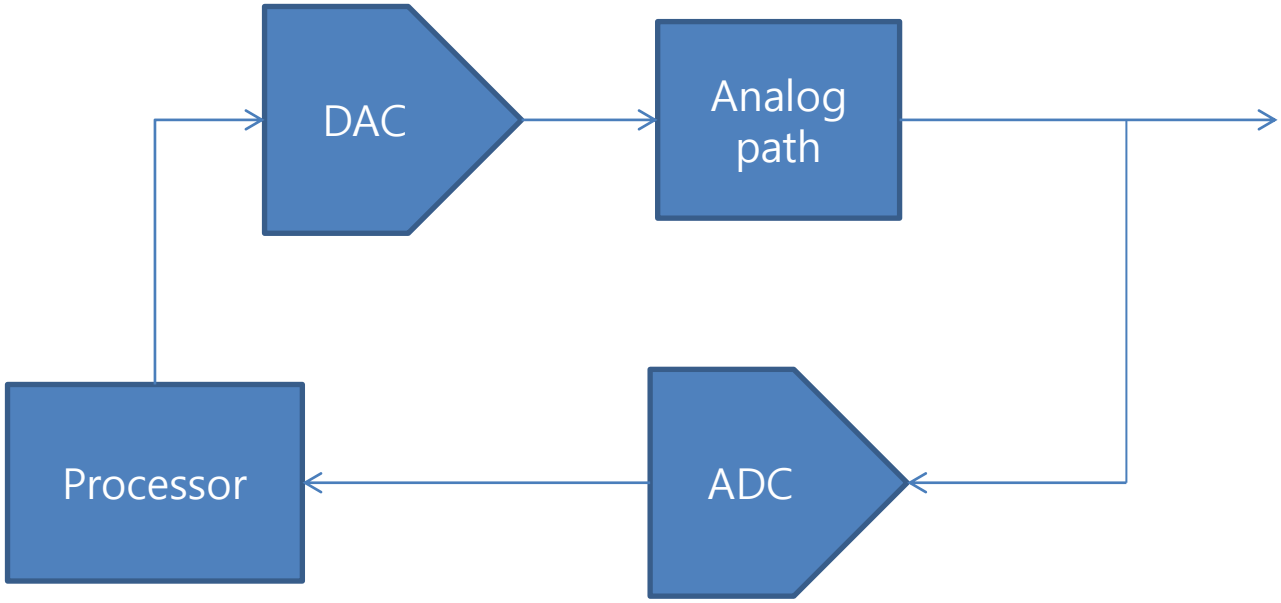



-Improvement of switching regulator's ripple voltage
-Minimizing power dissipation of linear regulator by means of reducing linear regulator's input
-Removing necessity of heat sink or cooling fan

* There is no way you build circuit which satisfy loop stability issue with ready made switching regulator IC within 0 to 20V and 0 to 2A whole ranges. (Pspice and Trial&error method requied)

# Design Concept

Minimizing DAC & Analog path errors using ADC




-Adjusting DAC input value using pre-saved compensation value

# Specification

| | |
|---|---|
| DC Voltage | 0 to 20V |
| Voltage Resolution | 0.01V |
| Voltage Accuracy | ±0.01V |
| Load Regulation | <0.02V |
| Current Range | 0 to 2A |
| Current Resolution | 1mA |
| Current Accuracy | ±1mA |
| Power Source | 24V 2.5A AC/DC Adaptor |
| Operation mode | Standalone / USB |

# Disadvantages of this cost-saving concept

- One-quadrant unipolar power supply (voltage and current source only)
- Voltage channel is not isolated to input source.
- Inaccurate voltage near 0V due to unipolar/asymmetric power source of internal circuits

# Calibration manual

1. While pressing leftmost button, turn on switch.

2. Adjust VR1 to get 20V at TP14 or R29.

3. Press leftmost button.

4. Adjust VR2 to get 4000 display.

5. Turn off and on again.

6. After calibration process, connect USB cable.

7. Execute MLP101C.exe

8. Press Open button.

9. Press Cal. RESET button.

10. Using active load with precision current meter, write real current and displayed current value.

11. Press WRITE button.

# Improvement point

- USB connection must be done after calibration process (because STM32F103 series don't have USB pull-up resistor attachment/detachment function) : You should add circuit which control pull-up resistor for proper operation.