2022/06/17

RV1 - potentionmeter — adjustable resistor

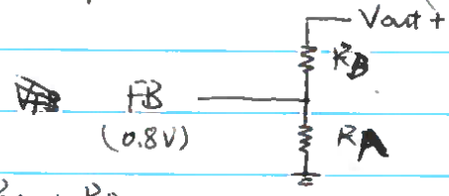
— Freq pin - resistor - GND

↓

determine frequency (switches) 320kHz ~ 2.25MHz

RV2 - ITH pin

$V_{FB} = 0.8V$



$$\left(\frac{R_B}{R_A} + 1\right) - \frac{R_A + R_B}{R_A} \times 0.8 = V_{out}$$

✯ V_{FB} : Regulated Feedback Voltage

I_{TH} voltage = 1.2V

☆ LTC78w is tested in a feedback loop that servos V_{ITH} to a specified voltage and measures the resultant V_{FB}

Pin 8 : ITH : Error Amplifier Outputs and Switching Regulator Compensation Point. , The current comparator trip point increases with this control voltage.

Main Control Loop.

→ Current mode step-down architecture

Top MOSFET on — RS latch (Clock)

off — main current comparator ICMP resets RS latch

↑

the peak inductor current and resets the latch

is controlled by ILH pin

↙

output of EA error amplifier

/ \

Compare signal at V_{FB}

and internal 0.800V reference

If load current ↑ V_{FB} ↓ (due to less current flow in this branch)

Thus V_{FB} < reference 0.800 V

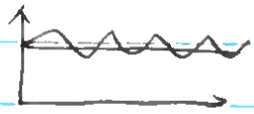
EA increases ITH voltage until the average inductor current matches the new load current

ITH → Optimization of control loop behavior.

→ DC coupled and AC filtered close-loop response test point
直流耦合和交流滤波

Coupling: 2个以及2个以上电路元件输入输出之间存在紧密配合与相互影响

DC coupled: DC & AC



→ Phase margin & damping factor & Bandwidth (2nd order system)

can be estimated by this point ↓ examining the rise time at this pin

percentage of overshoot seen at pin ITH

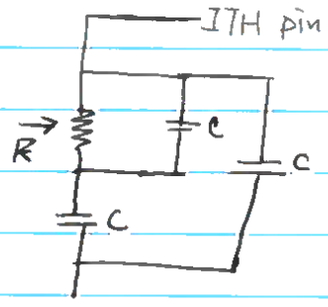
⇒ ITH pin waveforms will give a sense of the overall loop stability without breaking the feedback loop

ITH series RC-CC filter sets the dominant pole-zero loop compensation.

Loop gain increase by increasing RC

Loop bandwidth increase by decreasing CC

If RC increase as same factor as CC decrease
zero freq keeps the same, same phase shift
in the most critical freq range of feedback loop



Stability of closed-loop system.

RV3 & RV4 for SPDT: SN74LVC1G3157

B0, B1 pin

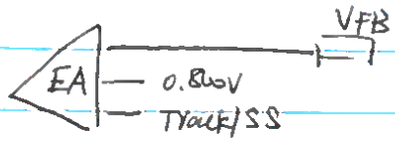
This is for setpoint circuit — providing Track/SS pin.

Track/SS → External tracking & Soft-start point

LTC78x regulates V_{FB} = smaller 0.8 or Voltage at Track/SS pin

→ Internal 10μA pull-up current source connected.

→ Capacitor to GND at this pin sets the ramp time to final Vout.



Shutdown & Start-Up

↓

RUN < 1.6V shuts down the main control loop

< 0.7V disable controller and internal circuit.

RUN ≤ 8V. (absolut max rating of)

≤ 100 μA

internal 11 V voltage clamp

↓ Start-up of controller's output voltage Vout is controlled by Track/SS pin

① Vss < 0.8 internal reference ⇒ VFB = Vss instead of 0.8 V

② Vss – Capacitor (external) SS – Cap – SGND ⇒ Soft-start 10μA internal pull-up current.

Vss from 0 V to 0.8 V gradually (or 5 V)

Vout from 0V to final value

③ Vout track another supply.

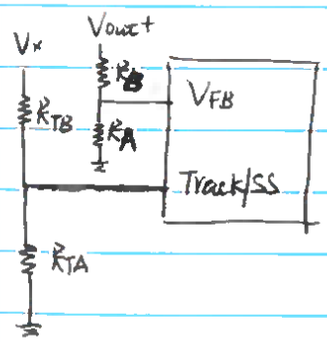
SS – ~~another~~ external resistor divider from another supply to GND

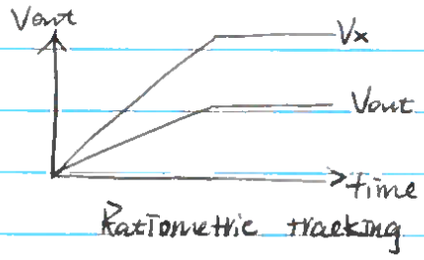
↓

Total soft start time = $t_{ss} = C_{ss} \cdot \frac{0.8V}{10\mu A}$

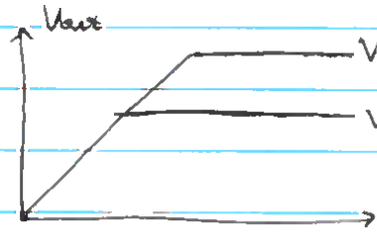
③ Vout track Vx

$$\frac{V_x}{V_{out}} = \frac{R_A}{R_{Track\,A}} \times \frac{R^2_{Track\,A} + R^2_{Track\,B}}{R_A + R_B}$$





Ratiometric tracking



Coincident tracking ⇒ $R_A = R_{Track\_A}$

$R_B = R_{Track\_B}$