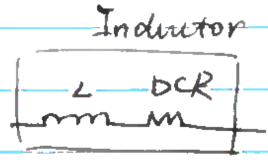
2022/06/15



Page 14 of LTC7800 tells about "SENSE"
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Two current sensing schemes
- DCR : Inductor DC resistance sensing
- Low value resistance sensing R

I_{LIM} — tri-level logic input ⇒ sets the max current limit of the controller.

① I_{LIM} grounded — threshold voltage of the current comparator — 30mV → Vsense(max)
② I_{LIM} is floated — 75mV
③ I_{LIM} is INTVcc — 50mV

$Sense^-$ & $Sense^+$ ⇒ Current comparator

Common mode voltage range 0V ~ 28V (abs max)
↓
enabling the LTC7800 regulator V_{out} = 24V nominal.

$Sense^+$ → High impedance, low current ±1μA
$sense^-$ → < INTVcc − 0.5V current < 1μA
> INTVcc + 0.5V current ~ 700μA
INTVcc − 0.5V > ● > INTVcc + 0.5V current 1μA ~ 700μA.

Rsense – for low resistance sensing — chosen based on required output current
Vsense(max) = Comparator max. threshold voltage

Project Definition
Preparatory task
Main task
Scope of for extension
Background knowledge
Resource.
Reference (主要資料)
Signed : Student.

} Mission statement

☆ Low Value Resistor Current Sensing

R_{sense} → based on required output current

$$R_{sense} = \frac{V_{sense(max)}}{I_{max} + \frac{\Delta I_L}{2}}$$ → The current comparator has a max threshold $V_{sense(max)}$ determined by I_{LIM}

$V_{sense(max)}$ sets $I_{L\,peak}$ → $I_{max} = I_{L\,peak} - \frac{1}{2}\Delta I_L$

30mV, 50mV, 75mV.

☆ Inductor DCR sensing (Heavy load)

→ for applications requiring highest efficiency at high load current

Because for high current, sense resistor will cost several points of efficiency.

if $(R_1 \parallel R_2) \cdot C1$ time constant $= \frac{L}{DCR}$ (satisfied)

thus $V_{C1} = V_{DCR\,inductor} \times \frac{R_2}{R_1 + R_2}$

Using inductor ripple current value, the target sense resistor value

$$R_{sense(equivalent)} = \frac{V_{sense(max)}}{I_{max} + \frac{\Delta I_L}{2}}$$

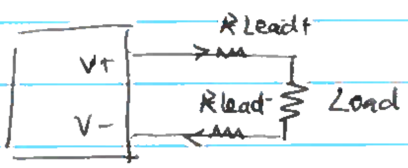
$$R_D = \frac{R_{sense(equivalent)}}{DCR_{max}\ at\ T_{L(max)}}$$

C_1 : $0.1\mu F \sim 0.47\mu F$ $R1 \parallel R2$ around 2k.

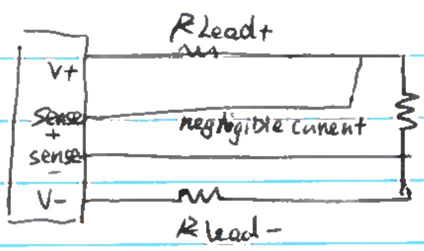
R1 → Max power loss in R1 is related to duty cycle.

☆ Sense : — a technique used in power supplies to produce the correct voltage for a load (wiki)

Vsense → Output voltage over load ?



power supply without sense



power supply with sense connection

Sense → a measurement of the voltage at the resistor

no current flow in the sense wires because of high input resistance

without having impact (no voltage drop since no current)

Control V+, V− power supply (Feedback)

$\left(\frac{449}{82}+1\right) \times 0.8 = 5.668V$ not 6.2V output / my simulation $\sim$ ~~3.8~~ 3.7V

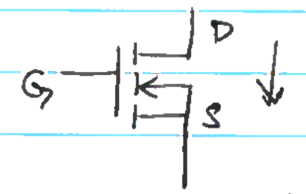
$\left(\frac{x}{82}+1\right) \times 0.8 = 3.3V$

$\frac{x}{82}+1 = \frac{3.3}{0.8}$

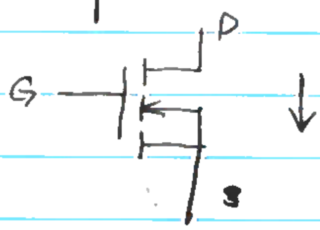
$x = \left(\frac{3.3}{0.8}-1\right) \times 82 = 256.25$

ignore LTspice simulation different.

Top MOSFET (n type)



Bottom MOSFET (n type)



$V_{GS1} = V\_TG - V_{SW}$

$V_{GS2} = V\_BG - GND = V\_BG$