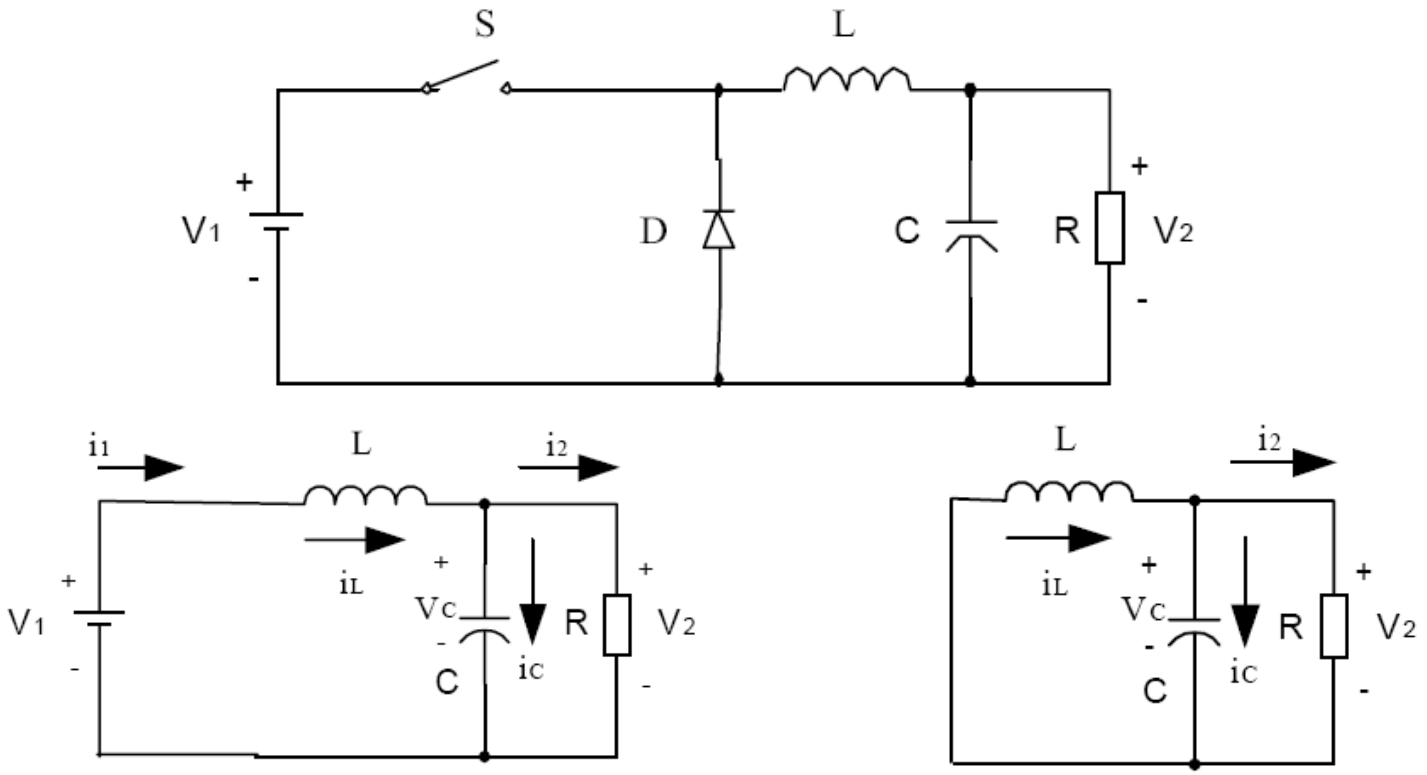
电源培训

The Future of Analog Technology ™

目录

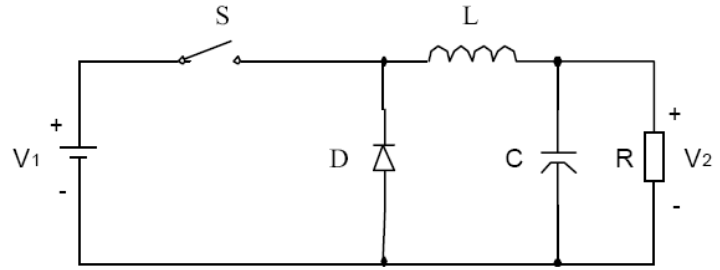
DC/DC 工作原理

非同步BUCK



开关闭合时　　开关断开时

Buck波形



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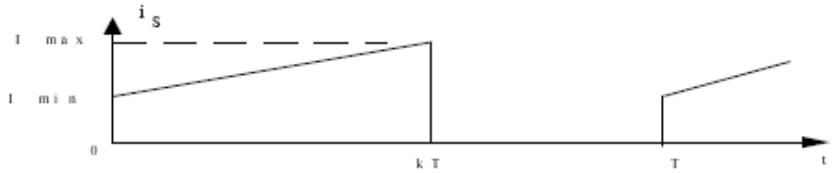
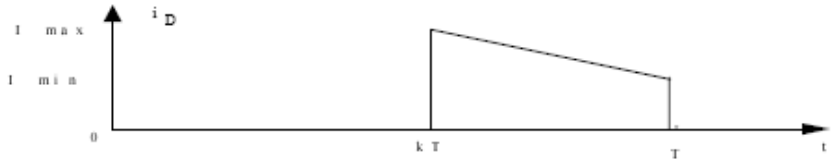
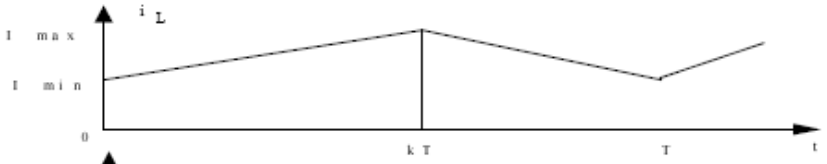


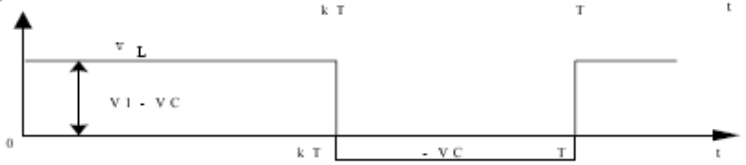
I_D



I_L



V_L



Buck公式计算

$$V_2 = V_C = kV_1$$

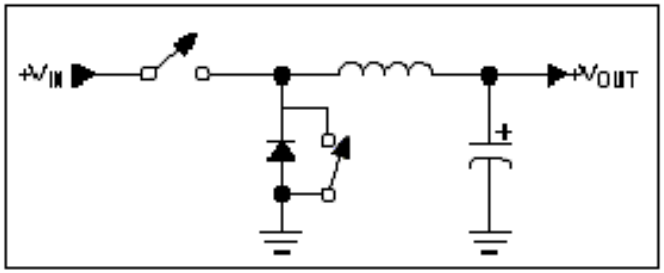
$$\Delta i_L = \frac{V_1 - V_C}{L} kT = \frac{k(1-k)}{fL} V_1$$

$$I_{max} = kV_1(\frac{1}{R} + \frac{1-k}{2L}T)$$

$$I_{min} = kV_1(\frac{1}{R} - \frac{1-k}{2L}T)$$

$$I_L = I_2 = \frac{kV_1}{R}$$

$$\Delta v_C = \Delta Q / C = \frac{I_{max} - I_{min}}{8C} T = \frac{k(1-k)V_1}{8f^2CL}$$



同步整流结构

- 开关稳压器中功率消耗最大的元件是二极管，消耗功率为二极管导通压降与电流的乘积，该功耗降低了总体效率。为最大限度地提高效率，可以用一个开关替代二极管，即所谓的“同步整流结构”

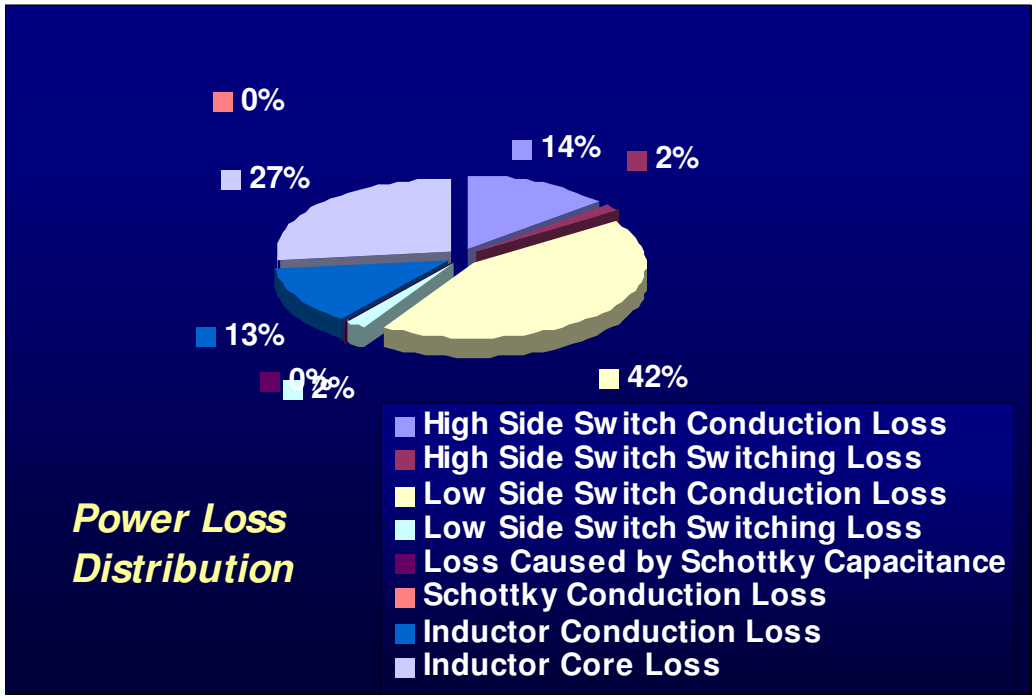
功率损耗对比

- 以5V转1.2V/1A为例

假设：同步整流IC的MOSFET内阻为130mohm，开关时间为5uS;
非同步整流IC的上MOSFET内阻为130m ohm，开关时间同为5uS,
肖特基压降0.5V.

同步芯片

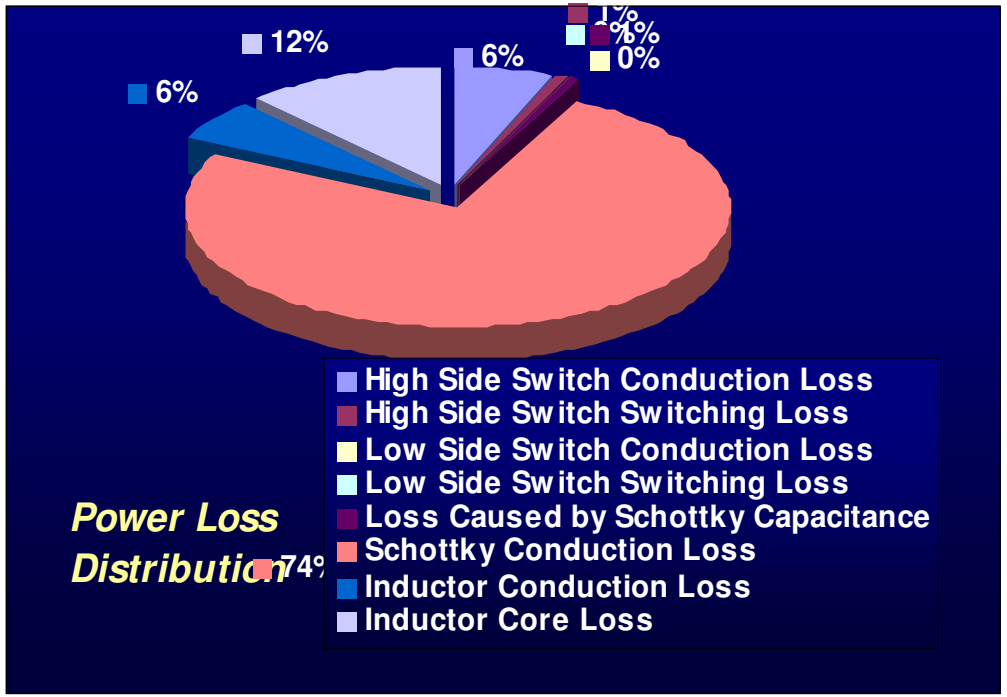
效率=84.2%



功率损耗对比

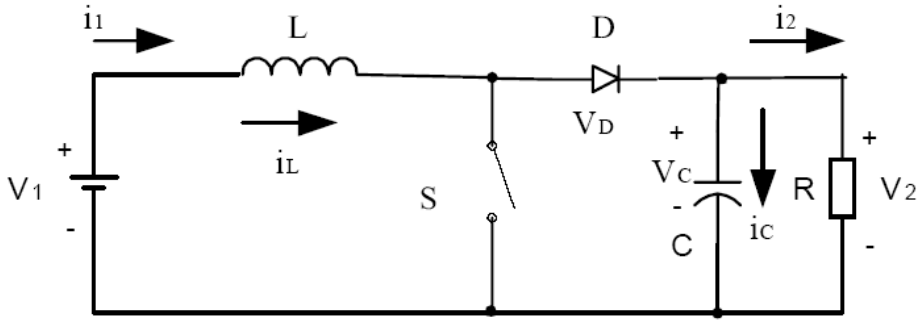
非同步芯片

效率=70.3%



从饼图中明显可以看到非同步芯片在肖特基二极管的损耗很大，效率也因此远低于同步整流芯片。通常在大压差的应用条件下，同步整流芯片从节能和发热的角度来看，要优于非同步整流芯片。

Boost变换器



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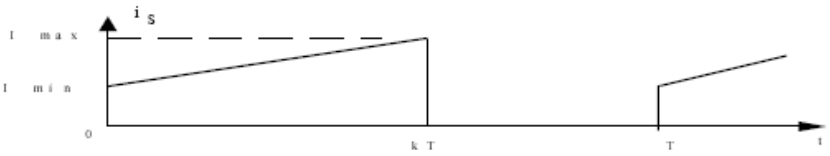
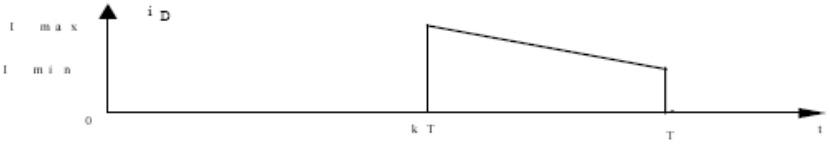
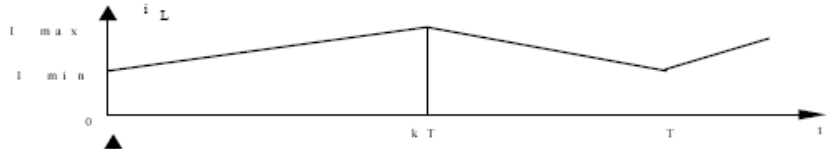


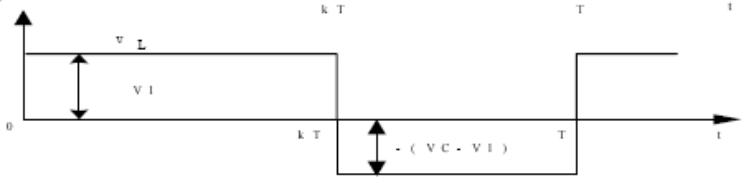
I_D



I_L



V_L



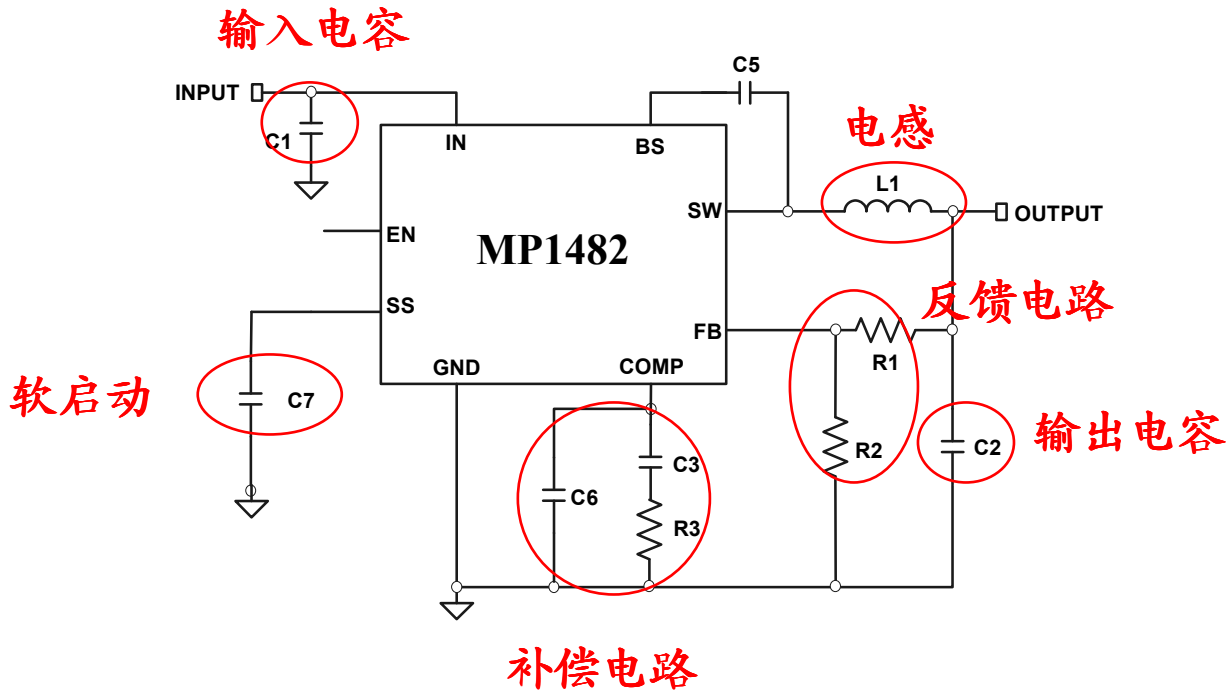
$$V_2 = V_C = \frac{V_1}{1-k} \qquad \Delta i_L = \frac{kV_1}{fL}$$

$$I_{\max} = \frac{V_1}{R(1-k)^2} + \frac{V_1}{2L}kT \qquad I_{\min} = \frac{V_1}{R(1-k)^2} - \frac{V_1}{2L}kT$$

$$I_L = \frac{I_2}{1-k} = \frac{V_1}{R(1-k)^2} \qquad \Delta v_C = \frac{\Delta Q}{C} = \frac{kTI_2}{C} = \frac{kV_2}{RfC}$$

参 数 设 计

典型同步整流芯片电路


输入电容
INPUT
C1
IN
C5
BS
电感
L1
OUTPUT
SW
EN
MP1482
SS
FB
反馈电路
R1
软启动
C7
GND
COMP
C6
C3
R3
R2
C2
输出电容
补偿电路

反馈电阻选择

- 输出电压由反馈电阻R1，R2设定，公式如下

$$V_O = V_{FB}\frac{R1+R2}{R2}.$$

- R2 的典型值为10KΩ.
- R1由下式确定

$$R1 = R2\frac{V_O - V_{FB}}{V_{FB}}.$$