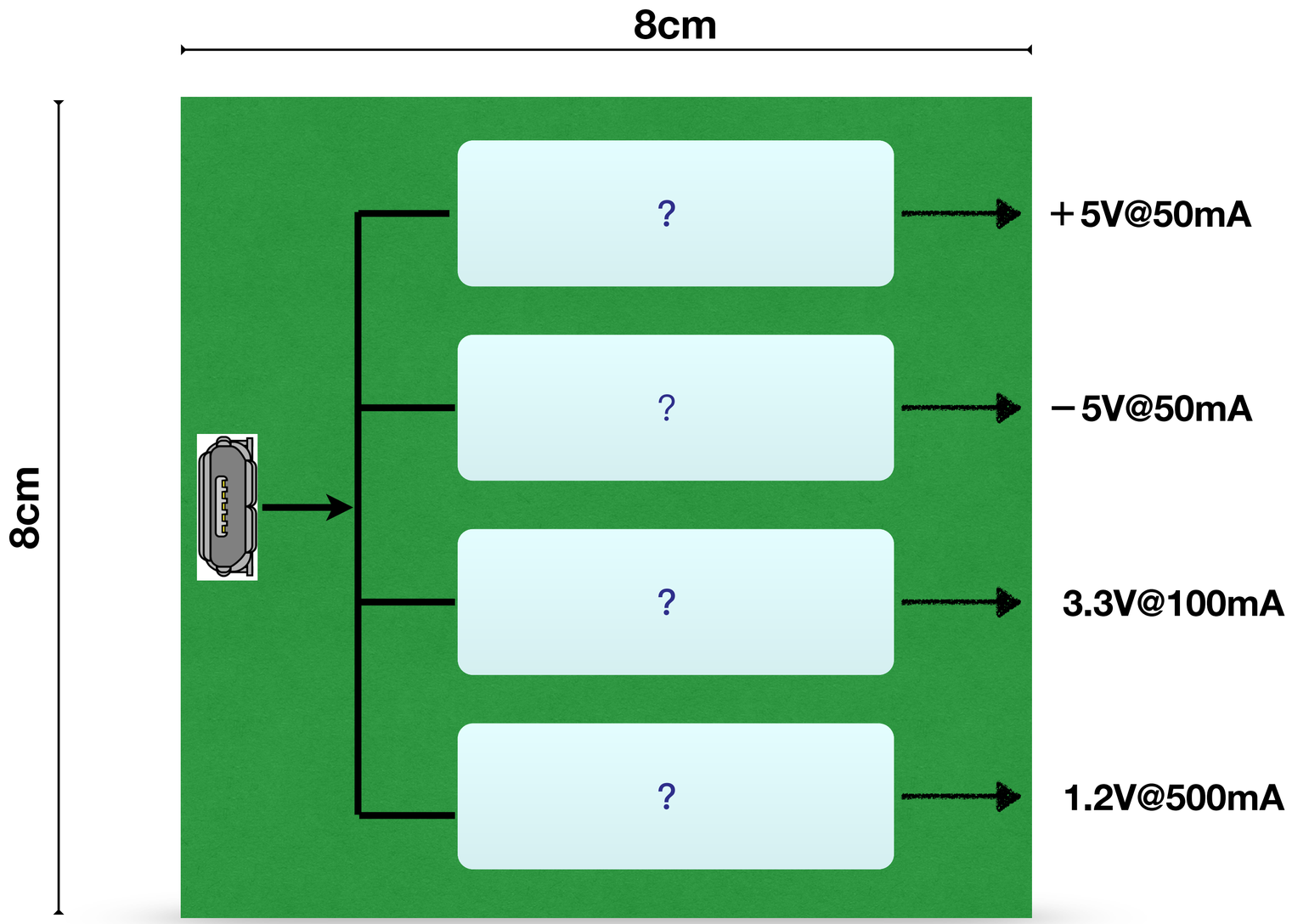
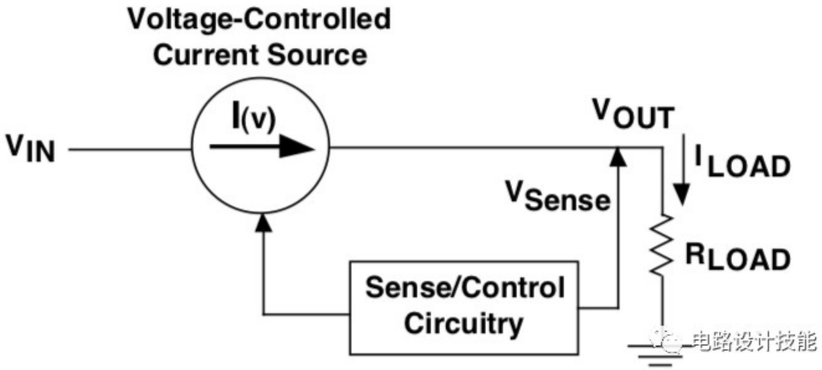
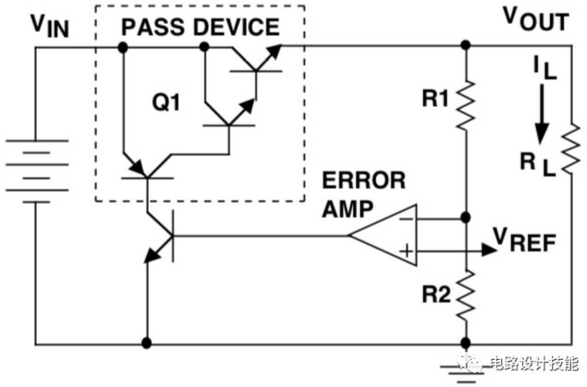
要求

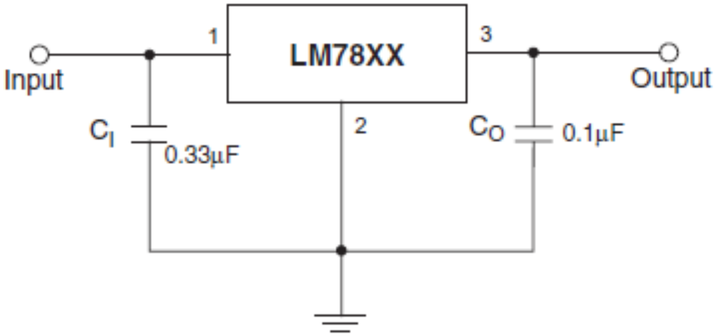


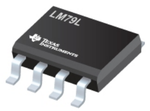
- **输入：+5V通过USB适配器提供**
- **输出：**
  - 3.3V：100mA，用于数字接口电路
  - 1.2V：500mA，数字内核供电
  - +/-5V：50mA，用于模拟电路，低噪声
- **2层板，8cm * 8cm**
- **所有器件从www.mouser.cn上查找**

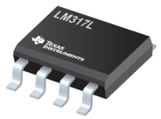
线性稳压





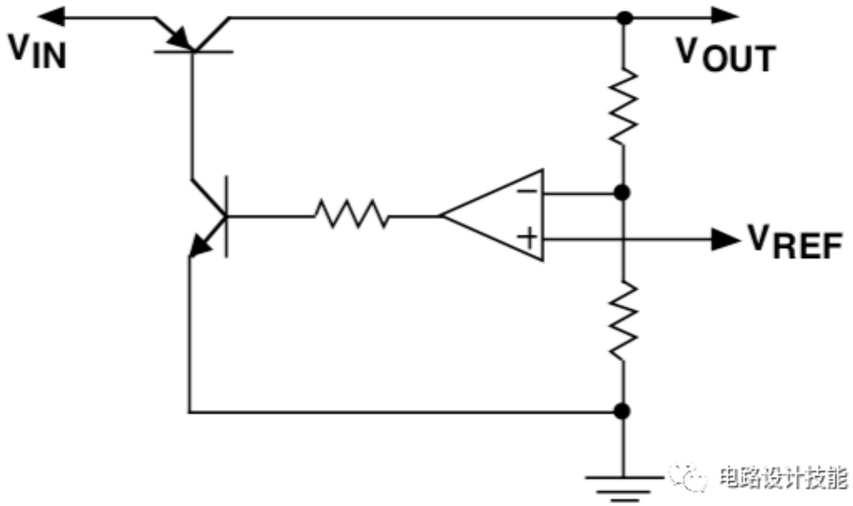


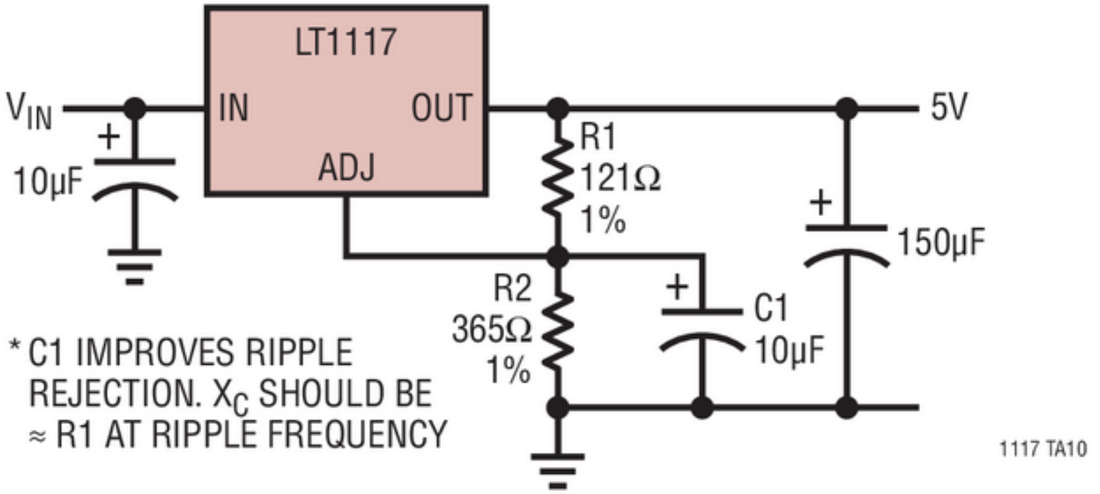




- 三极管工作于线性状态 - 可变电阻
- 输入输出要保证一定的压差才能起到稳压的效果 - 2V-2.5V，只能降压
- 外围电路非常简单
- 不同负载电流能力的封装不同
- 固定电压 - 78xx、79xx
- 可调电压 - LM317、LM117

LDO





- LDO是线性稳压器的一种
- 输入端和输出端需要的压差较小，在小电流的情况下（比如150mA）压差可以低到50mV。
- LDO非常适合电池供电的场景，因为在很小的压差下也可以正常工作

LP5907 250-mA, Ultra-Low-Noise, Low-I_Q LDO

1 Features

- Input Voltage Range: 2.2 V to 5.5 V
- Output Voltage Range: 1.2 V to 4.5 V
- Stable With 1-µF Ceramic Input and Output Capacitors
- No Noise Bypass Capacitor Required
- Remote Output Capacitor Placement
- Thermal-Overload and Short-Circuit Protection
- –40°C to 125°C Operating Junction Temperature
- Low Output Voltage Noise: < 6.5 μV_{RMS}
- PSRR: 82 dB at 1 kHz
- Output Voltage Tolerance: ±2%
- Very Low I_Q (Enabled): 12 µA
- Low Dropout: 120 mV (typical)
- Create a Custom Design Using the LP5907 With the WEBENCH® Power Designer

2 Applications

- Mobile Phones, Tablets
- Digital Cameras and Audio Devices
- Portable and Battery-Powered Equipment
- Portable Medical Equipment
- Smart Meters and Field Transmitters
- RF, PLL, VCO, and Clock Power Supplies
- IP Cameras
- Drones

3 Description

The LP5907 is a low-noise LDO that can supply up to 250 mA output current. Designed to meet the requirements of RF and analog circuits, the LP5907 device provides low noise, high PSRR, low quiescent current, and low line or load transient response figures. Using new innovative design techniques, the LP5907 offers class-leading noise performance without a noise bypass capacitor and the ability for remote output capacitor placement.

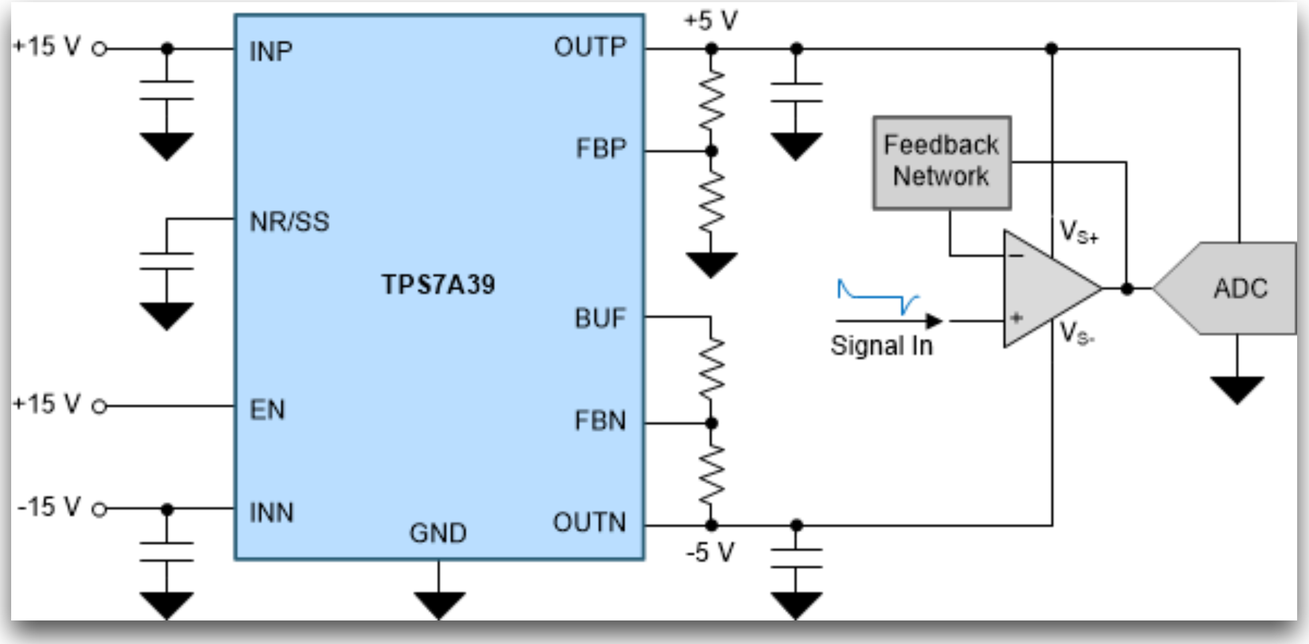
The device is designed to work with a 1-µF input and a 1-µF output ceramic capacitor (no separate noise bypass capacitor is required).

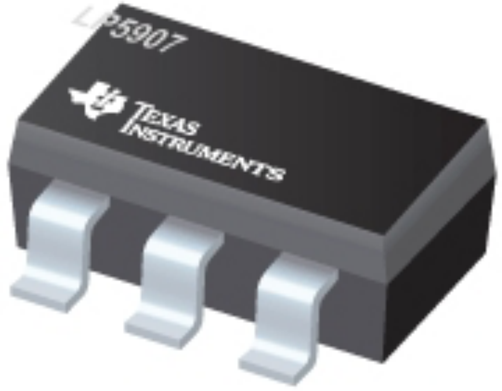
This device is available with fixed output voltages from 1.2 V to 4.5 V in 25-mV steps. Contact Texas Instruments Sales for specific voltage option needs.

Device Information(1)

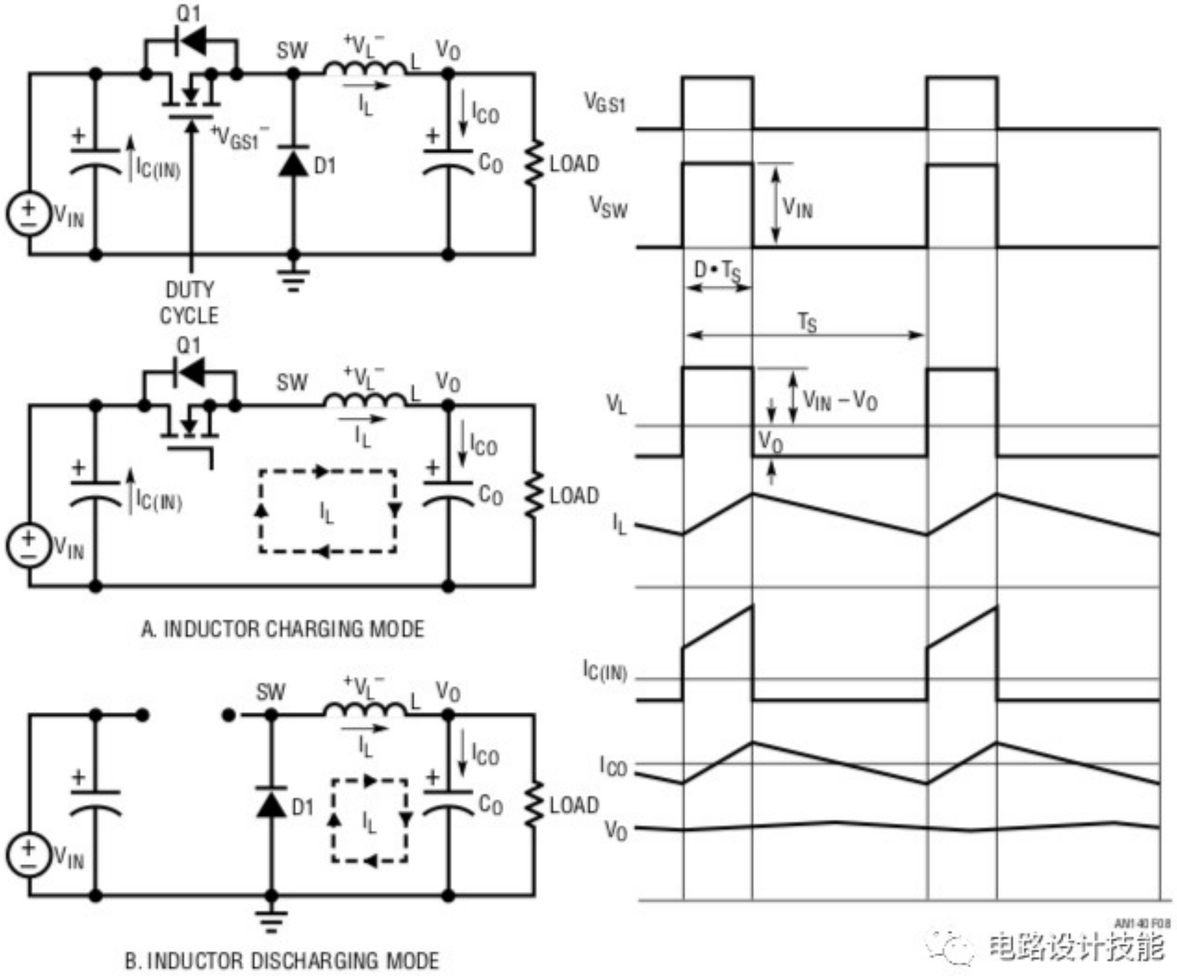
PART NUMBER	PACKAGE	BODY SIZE
LP5907	DSBGA (4)	0.675 mm × 0.675 mm (MAX)
	SOT-23 (5)	2.90 mm × 1.60 mm (NOM)
	X2SON (4)	1.00 mm × 1.00 mm (NOM)

(1) For all available packages, see the orderable addendum at the end of the data sheet.



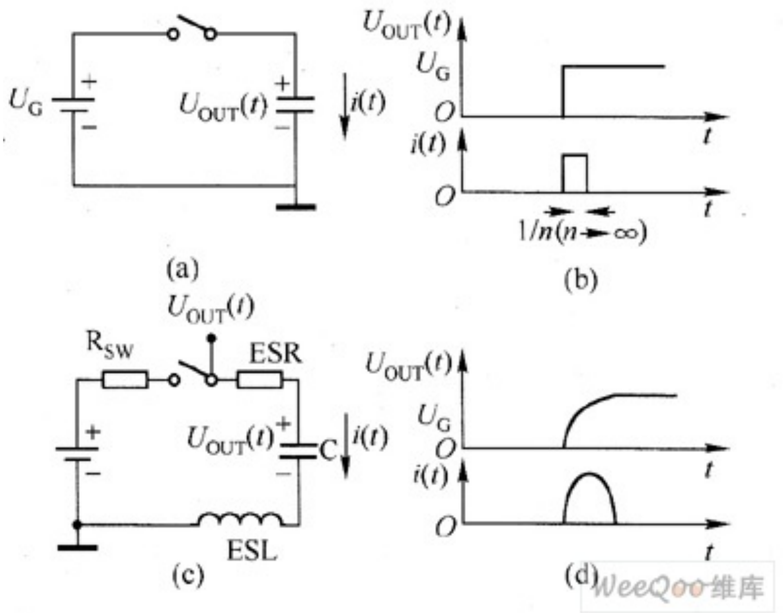


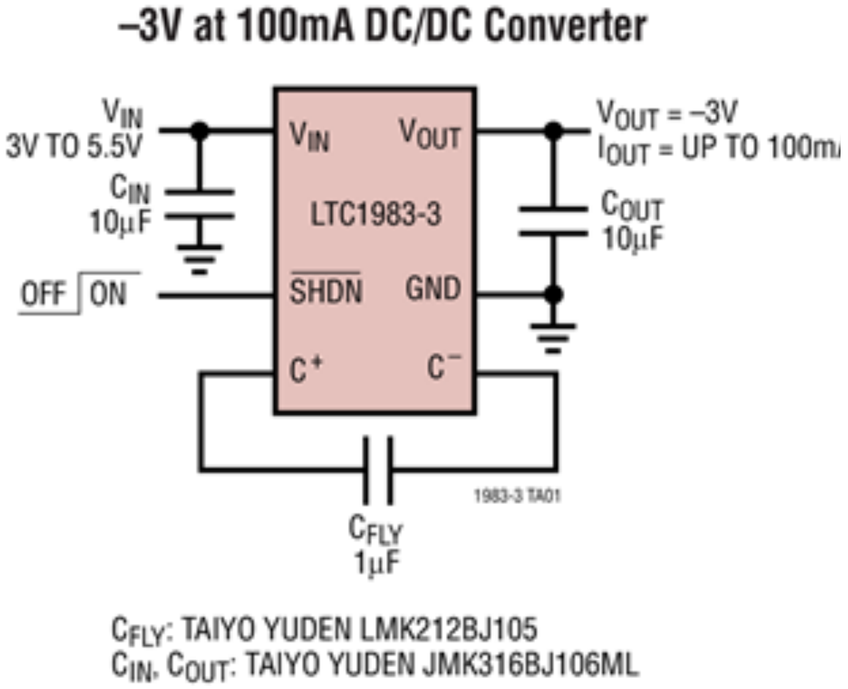
开关稳压

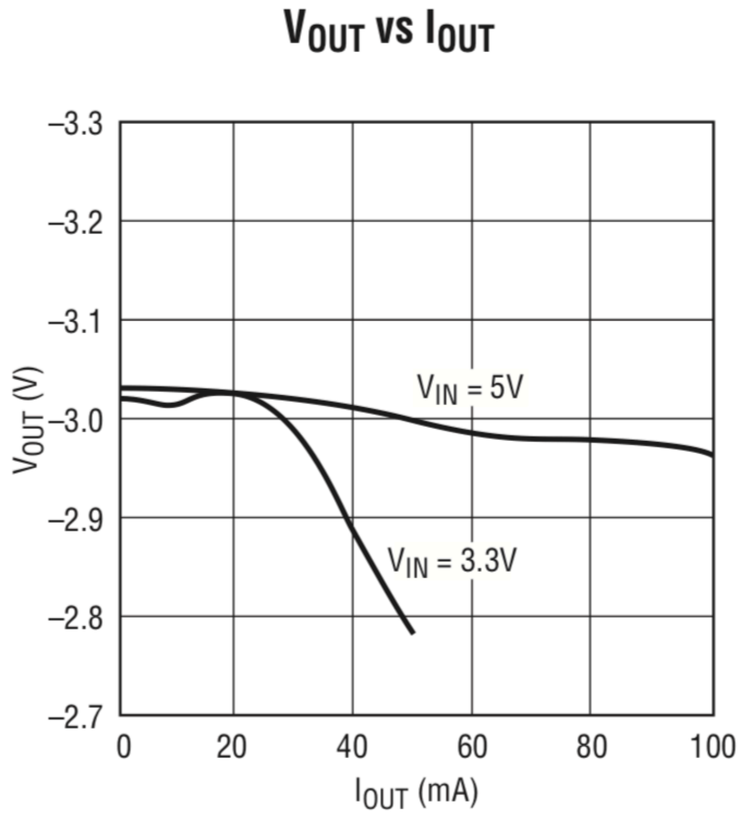


- 工作于开关状态的三极管 + 电感 + 电容
- 输入电压范围较宽
- 工作于较高的频率，有开关噪声
- 可升压、降压、逆变
- 元器件的选用也非常关键，比如MOS管、储能电感、平滑电容等

电荷泵





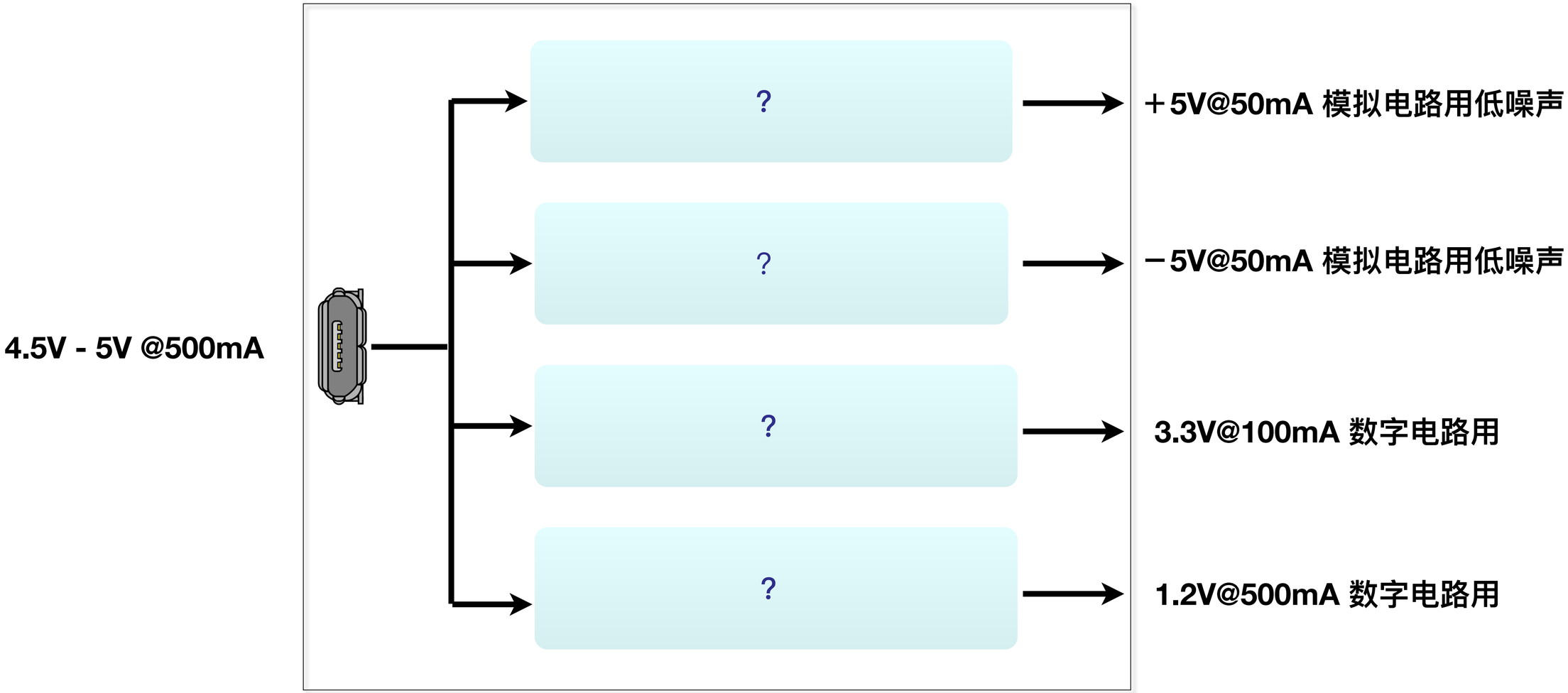


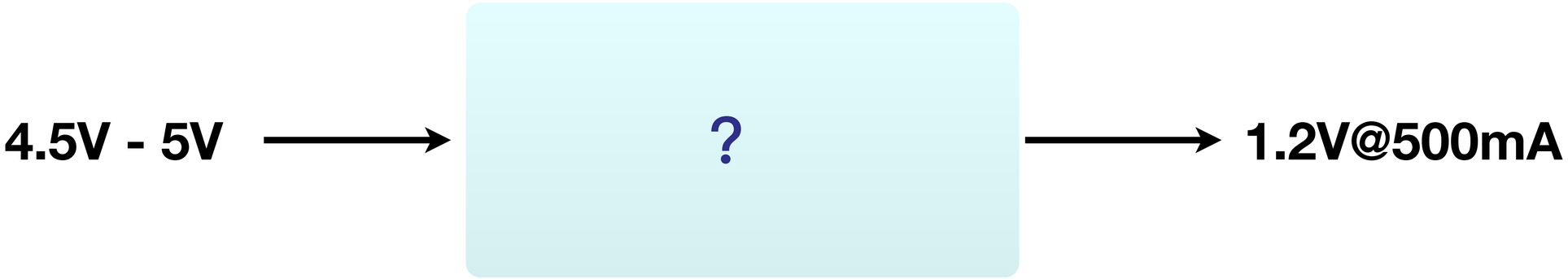
- 无需电感，只需要电容做储能元件，电路非常简单
- 外围电路简单，但负载电流比较低，用于小电流/对电压要求不严格的场合
- 可以倍压、反压

几种常用的稳压方式的对比

	结构	优点	缺点	效率	典型器件	应用
线性稳压	• 可变电阻分压 • 晶体管工作于线性状态	• 外围电路简单 • 系统成本低 • 噪声抑制度高 • 反应迅速	• 需要满足压差 • 一般效率低 • 只能降压	输出电压/输入电压	7805 7905 LM317	交流变直流
线性稳压 - LDO	采用了低压差结构	• 同上 • 要求的压差比较低	同一般线性稳压	输出电压/输入电压	LT1117	电池供电
开关稳压	工作于开关状态的三极管+电感/电容储能	• 效率高 • 输入电压范围宽 • 可升压/降压 • 体积比较小	• 外围元器件多 • 外围器件比较敏感 • 高频开关噪声	取决于结构及器件的损耗	很多	各种升压、降压、反压等对电源噪声不敏感的应用领域
电荷泵稳压	电容做为储能元件	• 电路简单 • 无电感 • 可以升压/降压/反压	• 负载能力有限 • 输出电压随电流增大而降低	中等，不如开关稳压高	ICL7660 MAX7660	单电源供电，需要负电压/小电流的场景

需求

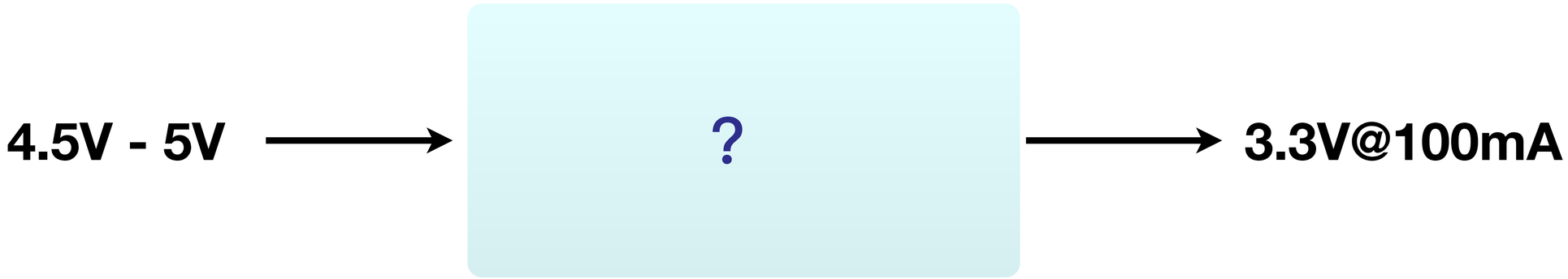

4.5V - 5V @500mA
?
?
?
?
+5V@50mA 模拟电路用低噪声
−5V@50mA 模拟电路用低噪声
3.3V@100mA 数字电路用
1.2V@500mA 数字电路用



① 线性稳压/LDO — 1.2V/5V ～ 24%效率，76%浪费，发热

② 开关稳压 - 90%效率

③ 对数字内核电压，对噪声不敏感



① 线性稳压 - （4.5V-3.3V）～ 1.2V Vdo＜2V，没有合适器件

② LDO — 3.3V/（5V～4.5V）： 66% ～ 73%效率，最大0.17W浪费，成本低

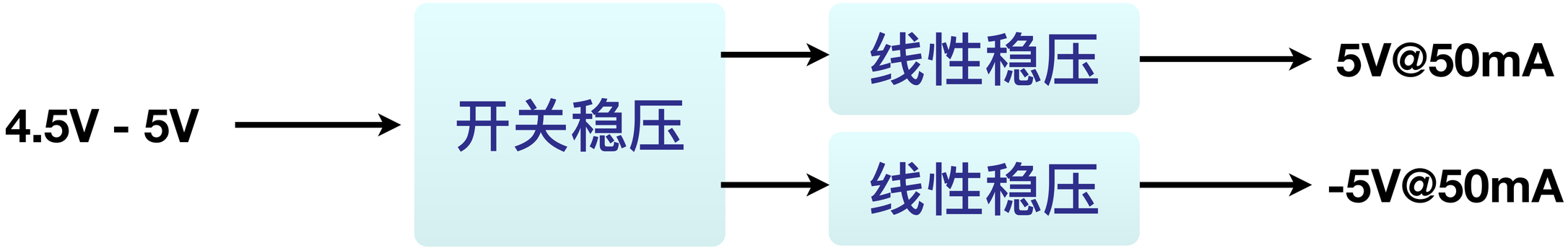
③ 开关稳压 - 90%效率，0.03W浪费，元器件多，成本高

④ 性能上LDO和开关稳压都可以选用

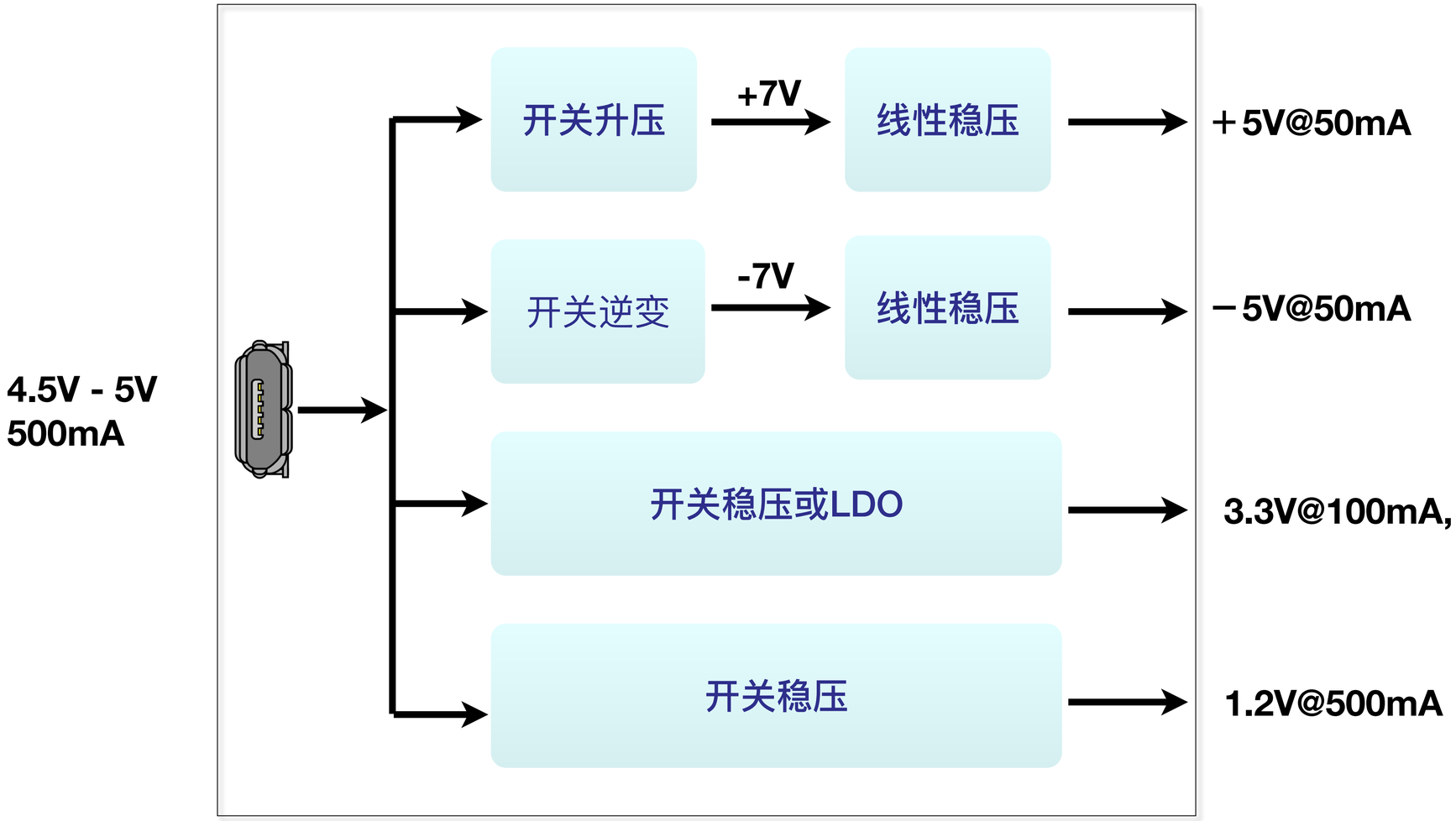
① 开关稳压 - 开关噪声太大，无法满足性能要求

② 只有线性稳压/LDO才能满足低噪声性能要求，但Vdo不满足条件

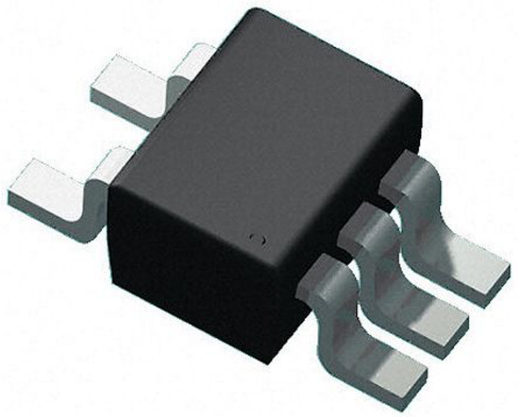
③ 前面加一级开关稳压，输出+/-7V的DC



架构选定

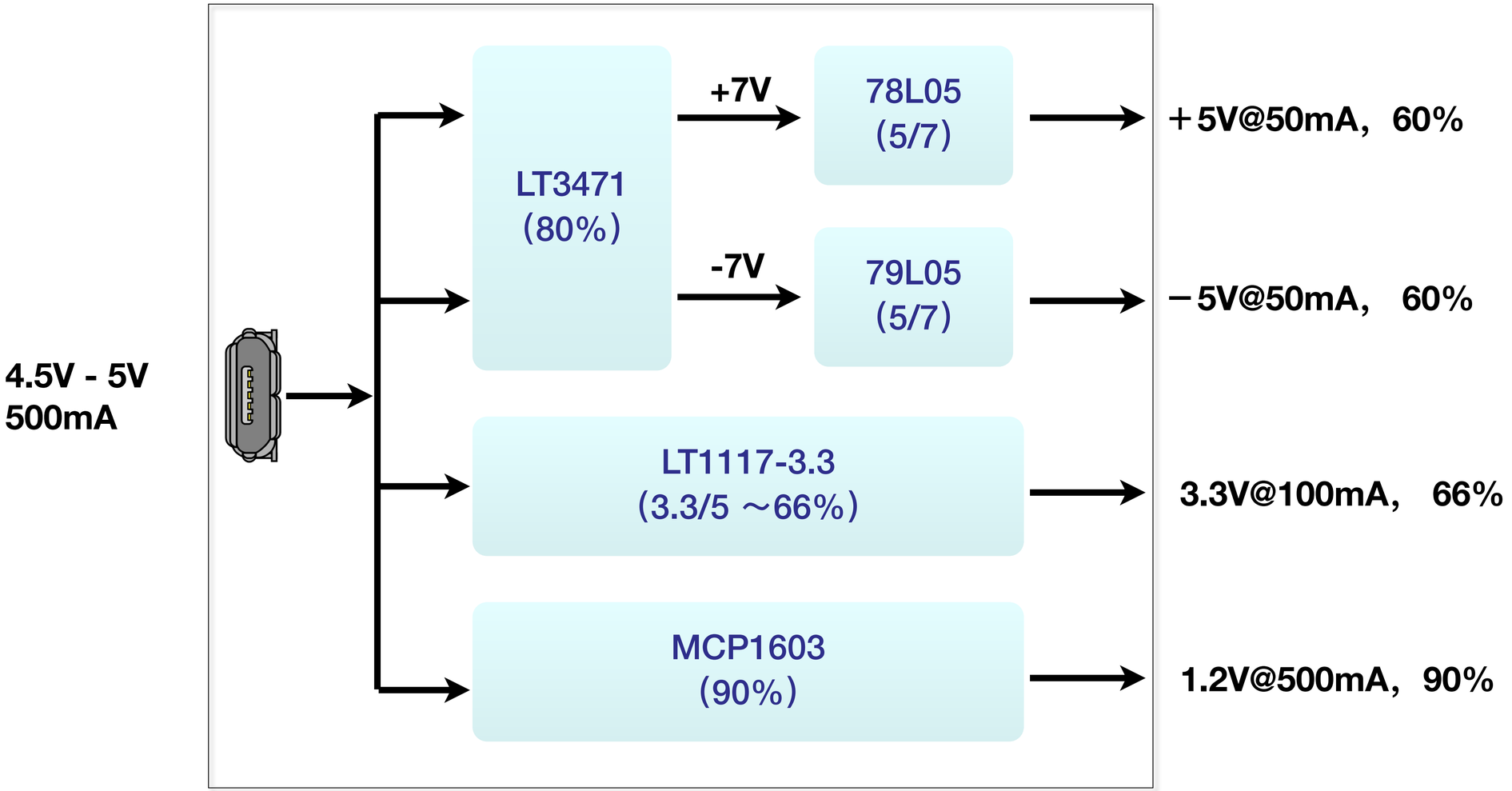

4.5V - 5V
500mA
开关升压
+7V
线性稳压
＋5V@50mA
开关逆变
-7V
线性稳压
－5V@50mA
开关稳压或LDO
3.3V@100mA,
开关稳压
1.2V@500mA

器件选择



- 性能/效率/系统成本的折衷
- 在满足负载电流的情况下，越小的电流封装越小，价格越便宜
- 用得越普遍的则价格和供货越有优势
- 选择好焊接的封装
- 输入电压范围适中，一般情况范围越宽越难做，价格也就越贵
- 成本：电源器件 + 周边配套器件
- 功率较小的部分在整体效率方面的比重越小

芯片选定


4.5V - 5V
500mA
LT3471
(80%)
+7V
78L05
(5/7)
-7V
79L05
(5/7)
LT1117-3.3
(3.3/5 ～66%)
MCP1603
(90%)
＋5V@50mA，60%
－5V@50mA， 60%
3.3V@100mA， 66%
1.2V@500mA，90%