

电源网2017中国工程师巡回培训会-西安站

解密充电五分钟通话2小时

钟任生

决定手机充电电流的因素

手机充电电流的发展

USB口默认最大电流5V0.5A

USB充电识别标准BC1.2-----5V1.5A

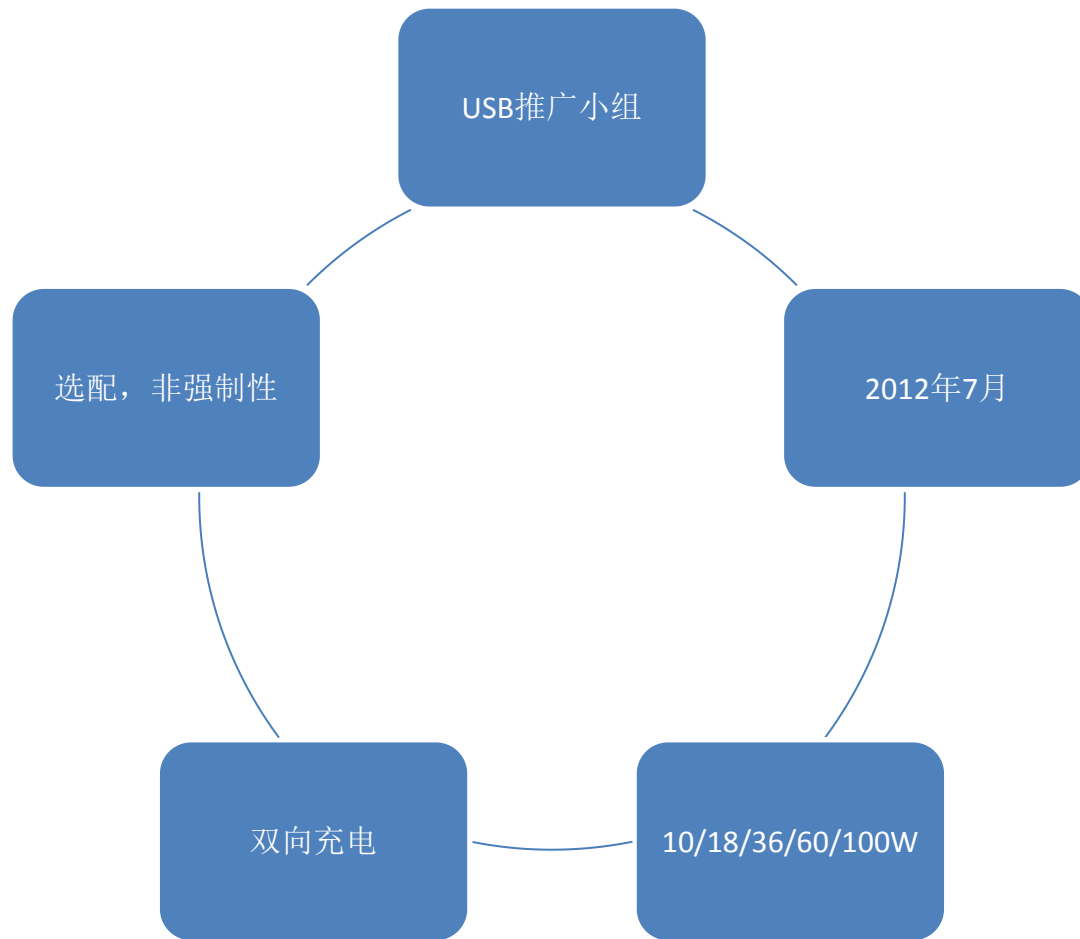
USB充电识别标准BC1.2-----5V2A

Quick Charge2.0（QC2.0）-----A(手机) :5/9/12V,B（平板或笔记本） :5/9/12/20V,top to 60W

Quick Charge3.0（QC3.0）-----3.6-20V,增量为200mV一档

Quick Charge4.0（QC4.0）-----,28W5V4.7A-5.6A；9V3A增量为20mV一档,快20%，效率高30%，15分钟充到50%，充电5分钟/通话5小时支持type C/USB-PD。加入最佳电压智能协商电源管理算法（INOV）

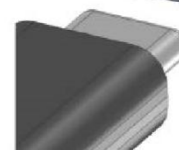
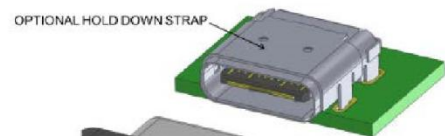
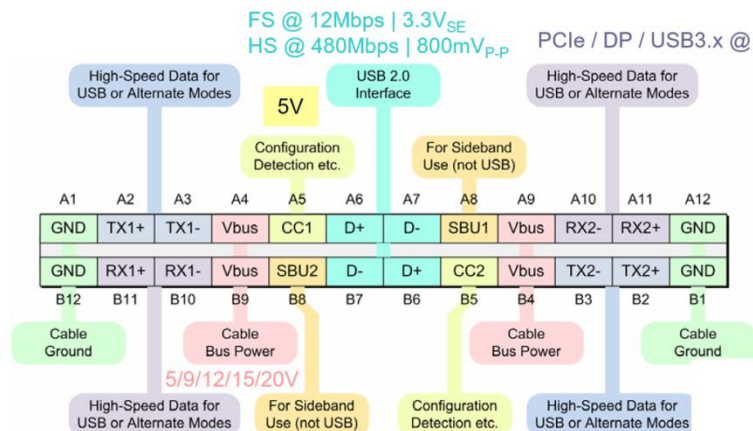
USB PD (USB Power delivery specification) 协议



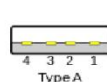
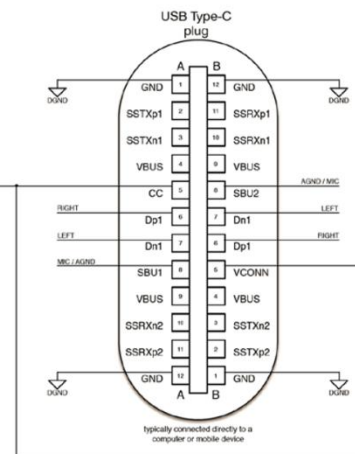
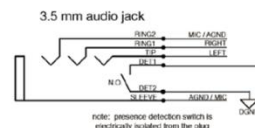
MicroSoft Type C

- USB Type-C standard • Allows USB 2.0, USB 3.1 and up to 15W (5V and 1.5A or 3A) • USB 3.1 Gen1 (5 Gbps), Gen2 (10 Gbps)

Type-C Connectors



DUAL ROW SMT TOP MOUNT CONNECTOR



OPPO的VOOC闪充技术

第一代闪充：5V4.5A(22.5W),赛尔康代工

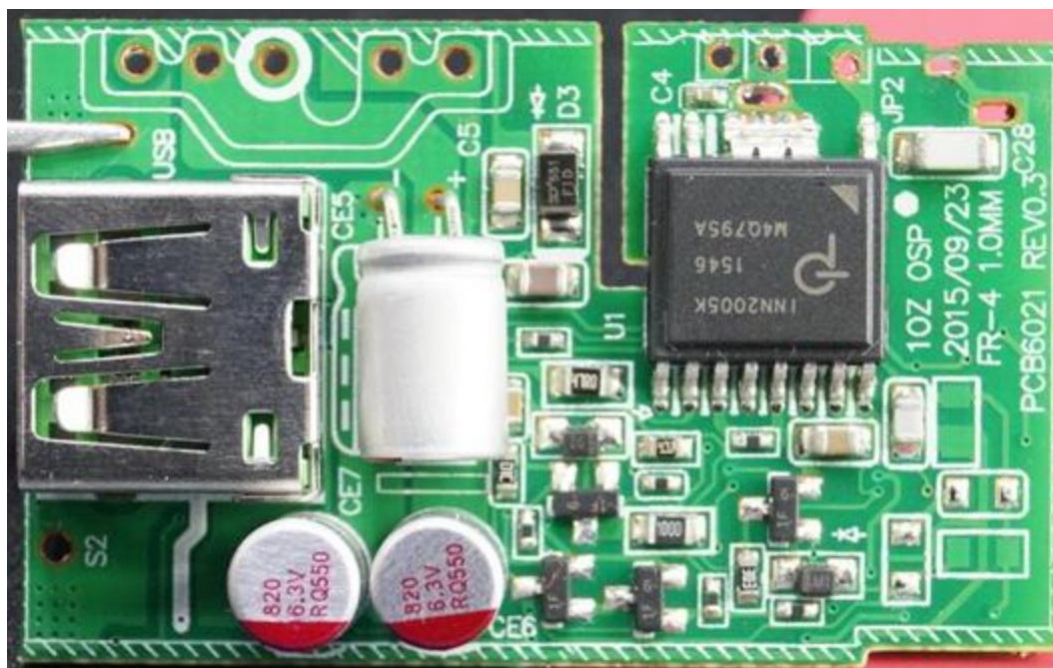


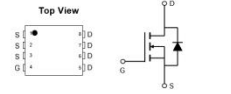
第二代闪充：5V5A(25W),光宝代工

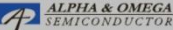


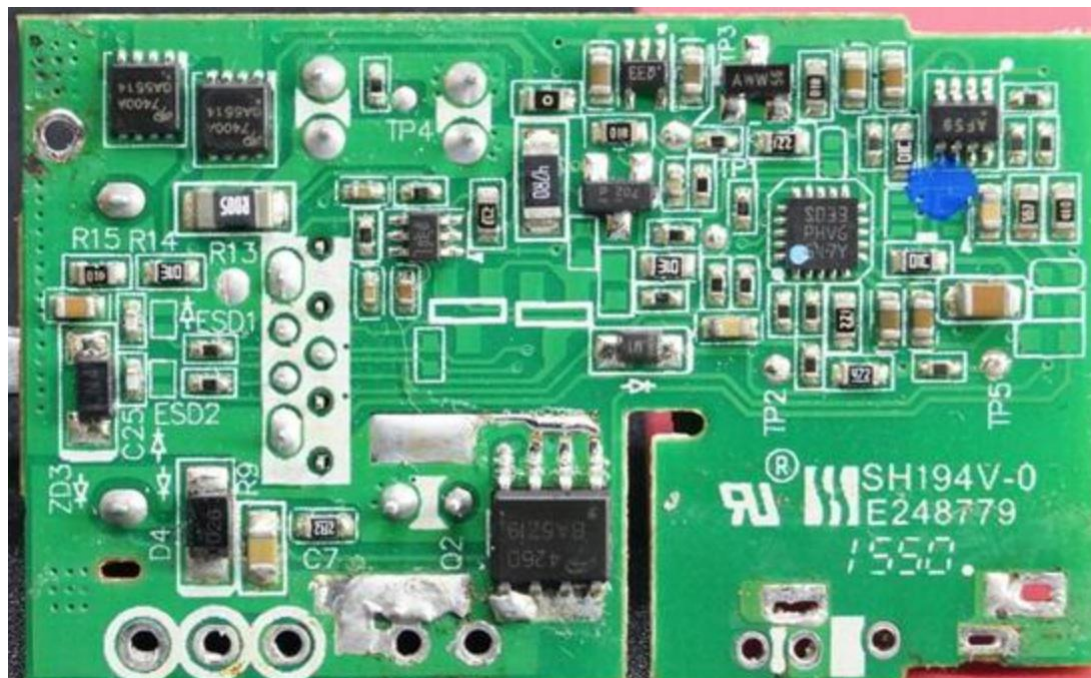
第三代闪充：5V4A(20W),光宝，天
宝，航嘉三家代工

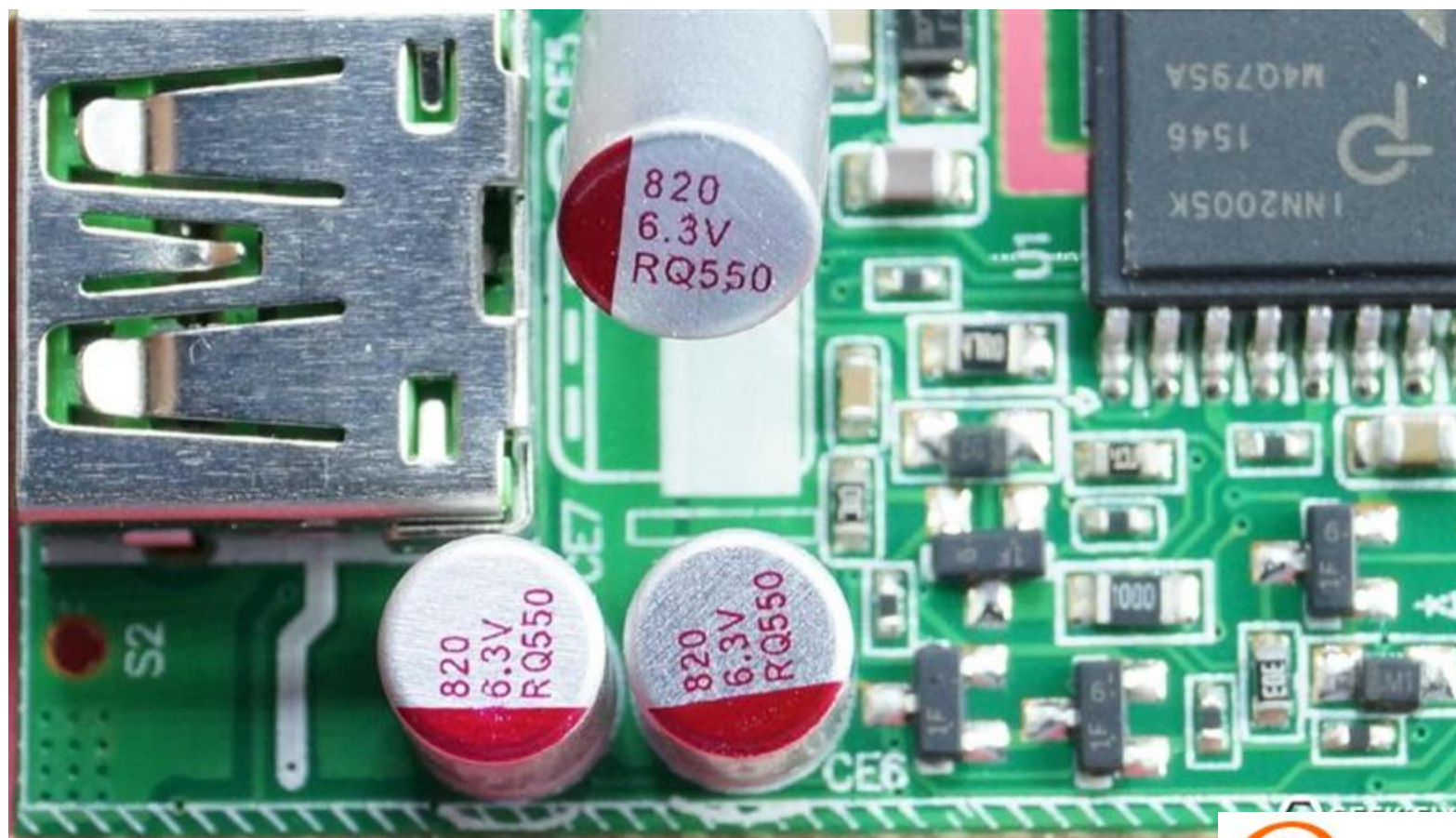
OPPO充电器拆解



 AON7400A 30V N-Channel MOSFET									
General Description The AON7400A combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(on)}$. This device is suitable for use as a high side switch in SMPS and general purpose applications.	Product Summary <table border="0"> <tr> <td>V_{DS}</td> <td>30V</td> </tr> <tr> <td>I_D (at $V_{GS}=10V$)</td> <td>40A</td> </tr> <tr> <td>$R_{DS(on)}$ (at $V_{GS}=10V$)</td> <td>< 7.5mΩ</td> </tr> <tr> <td>$R_{DS(on)}$ (at $V_{GS}=4.5V$)</td> <td>< 10.5mΩ</td> </tr> </table> 100% UIS Tested 100% R_g Tested 	V_{DS}	30V	I_D (at $V_{GS}=10V$)	40A	$R_{DS(on)}$ (at $V_{GS}=10V$)	< 7.5m Ω	$R_{DS(on)}$ (at $V_{GS}=4.5V$)	< 10.5m Ω
V_{DS}	30V								
I_D (at $V_{GS}=10V$)	40A								
$R_{DS(on)}$ (at $V_{GS}=10V$)	< 7.5m Ω								
$R_{DS(on)}$ (at $V_{GS}=4.5V$)	< 10.5m Ω								
DFN 3x3 EP   Top View 									

 AO4260 60V N-Channel MOSFET									
General Description The AO4260 uses trench MOSFET technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(on)}$, C_{iss} and C_{oss} . This device is ideal for boost converters and synchronous rectifiers for consumer, telecom, industrial power supplies and LED backlighting.	Product Summary <table border="0"> <tr> <td>V_{DS}</td> <td>60V</td> </tr> <tr> <td>I_D (at $V_{GS}=10V$)</td> <td>18A</td> </tr> <tr> <td>$R_{DS(on)}$ (at $V_{GS}=10V$)</td> <td>< 5.2mΩ</td> </tr> <tr> <td>$R_{DS(on)}$ (at $V_{GS}=4.5V$)</td> <td>< 6.3mΩ</td> </tr> </table> 100% UIS Tested 100% R_g Tested 	V_{DS}	60V	I_D (at $V_{GS}=10V$)	18A	$R_{DS(on)}$ (at $V_{GS}=10V$)	< 5.2m Ω	$R_{DS(on)}$ (at $V_{GS}=4.5V$)	< 6.3m Ω
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I_D (at $V_{GS}=10V$)	18A								
$R_{DS(on)}$ (at $V_{GS}=10V$)	< 5.2m Ω								
$R_{DS(on)}$ (at $V_{GS}=4.5V$)	< 6.3m Ω								
SOT-4   									







OPPO的VOOC闪充技术特点

1.简单粗暴地从头到尾改造硬件增加电流，一整套上游供应商定制化硬件；

2.充电器增加MCU对充电开路电压，电流分级控制；

3.相当于充电器直接模块化连接电池，相当于把手机充电热量转移到了充电器；

4.多重保护技术，增加了保险丝，接口过载保护；

5.高成本。

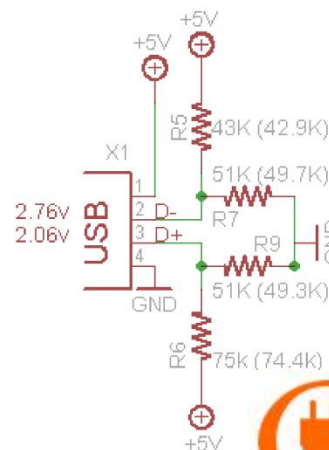
部分手机充电器D+D-电压及其充电电流设置

BC1.2协议

D+	D+偏置电阻	D-	D-偏置电阻	充电电流
2.0V	50/75K	2.0V	50/75K	0.5A
2.0V	50/75K	2.7V	50/43K	1A
2.7V	50/43K	2.0V	50/75K	2.1A
D+和D-短接	无	D+和D-短接	无	最大电流

QC3.0协议

D+	D-	输出电压	备注
0.6V	0.6V	12V	classA
3.3V	0.6V	9V	classA
0.6V	3.3V	连续模式	classA/B0.2V步进
3.3V	3.3V	20V	classB
0.6V	0V	5V	默认模式



插错充电器对充电电流的影响

手机	充电器	实际充电电流	对手机的影响	对充电器的影响
最大1A	最大2.1A	1A	无影响	无影响
最大2.1A	最大1A	1A	充电缓慢	无影响
要求充电器 D+D-短路	D+D-有偏置电压	0.5A	充电缓慢	无影响
要求充电器 D+D-有偏置电压	D+D-短路	0.5A	充电缓慢	无影响

特例：

- 1.插上输出电流4-5A的OPPO闪充充电器：电流不会超过2A;
- 2.Iphone6/PLUS实际分别最高支持1.5/2A电流充电，但只配了1A的充电器，如果接上IPAD的充电器，最大充电电流能达到接近1.5/2A.

一些应用方案-----QC2.0移动电源

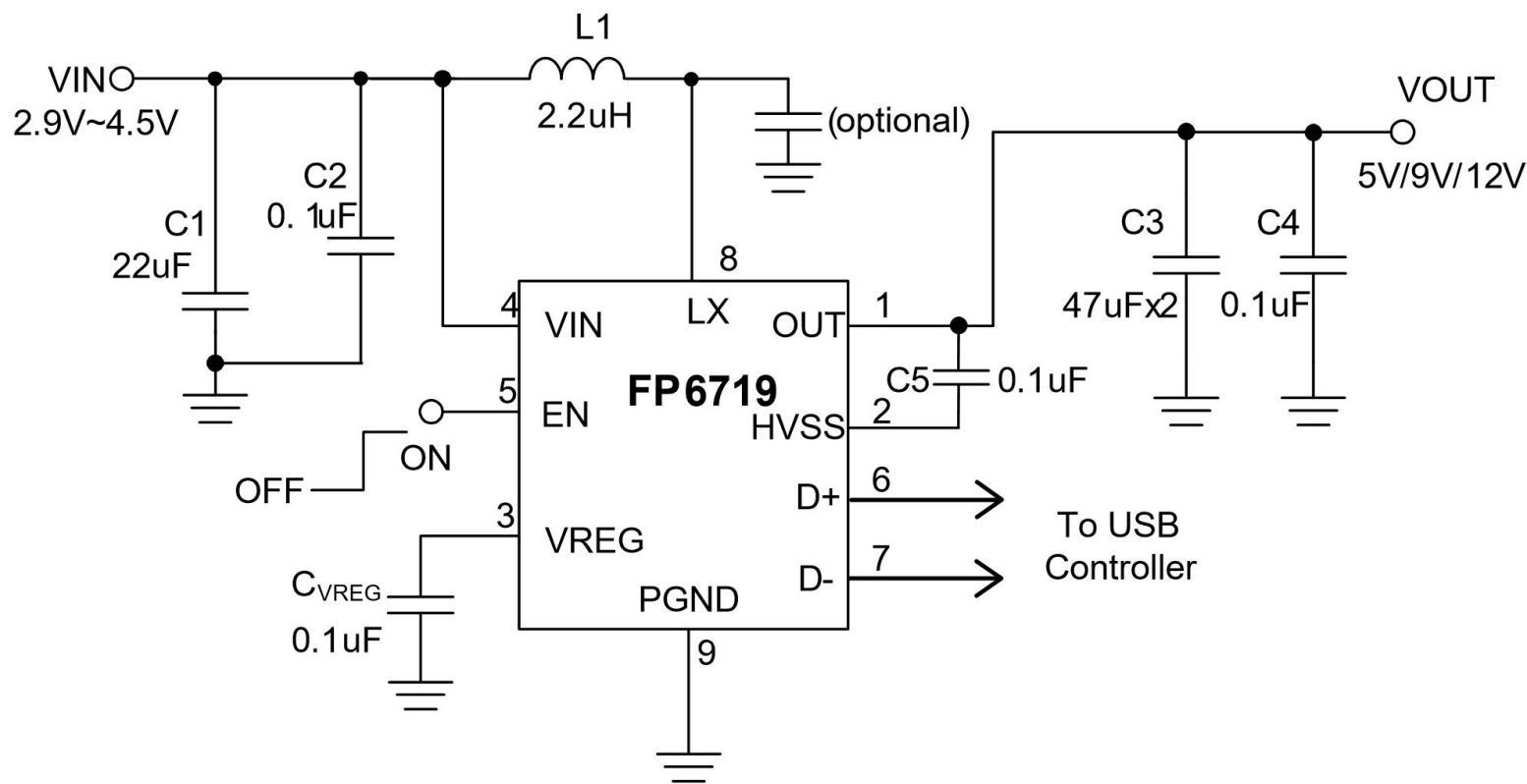


Figure 2. Typical Application Schematic

快充协议控制器

Typical Application Circuit

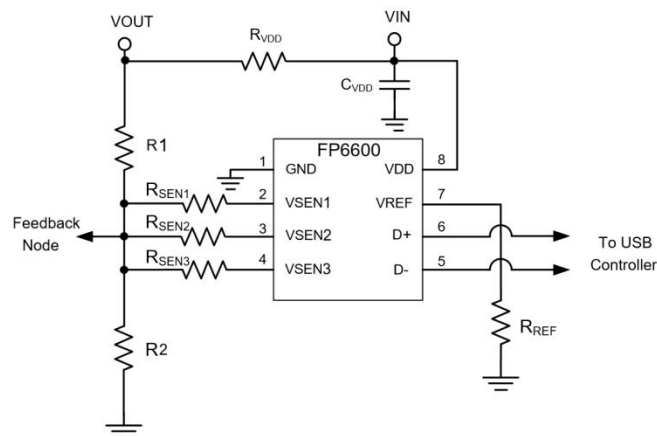


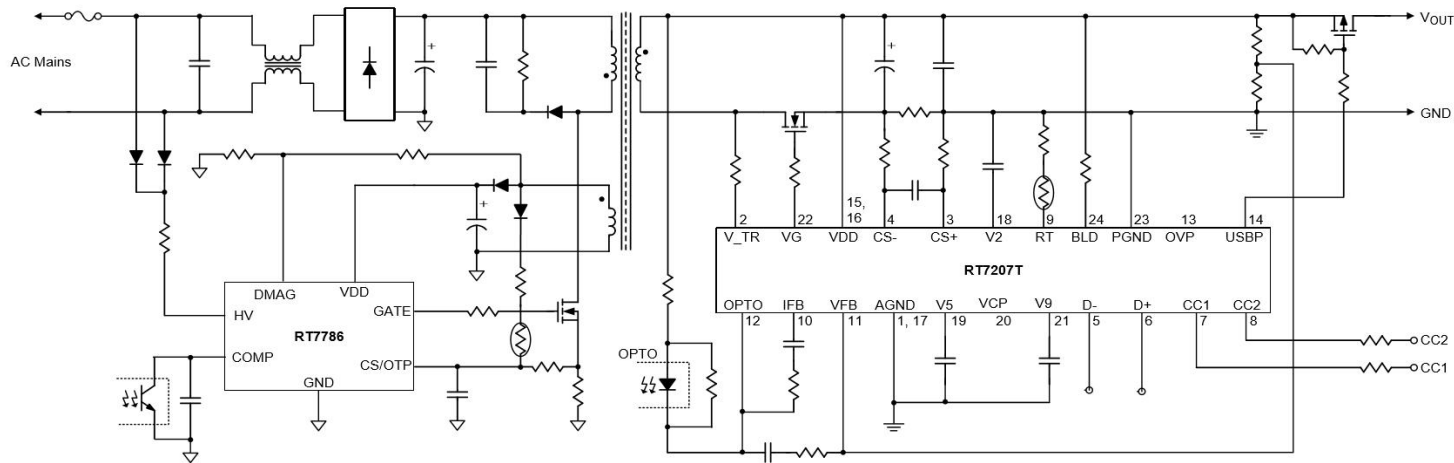
Figure 2. Typical Application Schematic

Output Voltage Lookup Table

D+	D-	Output Voltage	Internal Switch Setting		
			SW1	SW2	SW3
3.3V	3.3V	20V	0	0	0
0.6V	0.6V	12V	0	0	1
3.3V	0.6V	9V	0	1	1
0.6V	GND	5V (Default)	1	1	1

Note: 1 represent the NMOS are OFF, 0 represent the NMOS are ON.

Adaptive Adaptor:



- High Efficiency > 90%
- Power Saving < 30mW @ 5V
- High integration and Protection
- Small size
- Low cost

- QFN4x4 24 pin

