车充讲义

PART 1 : 认识规格

PART2 : 认识回路

PART 3 : 认识零件

PART 1：认识规格

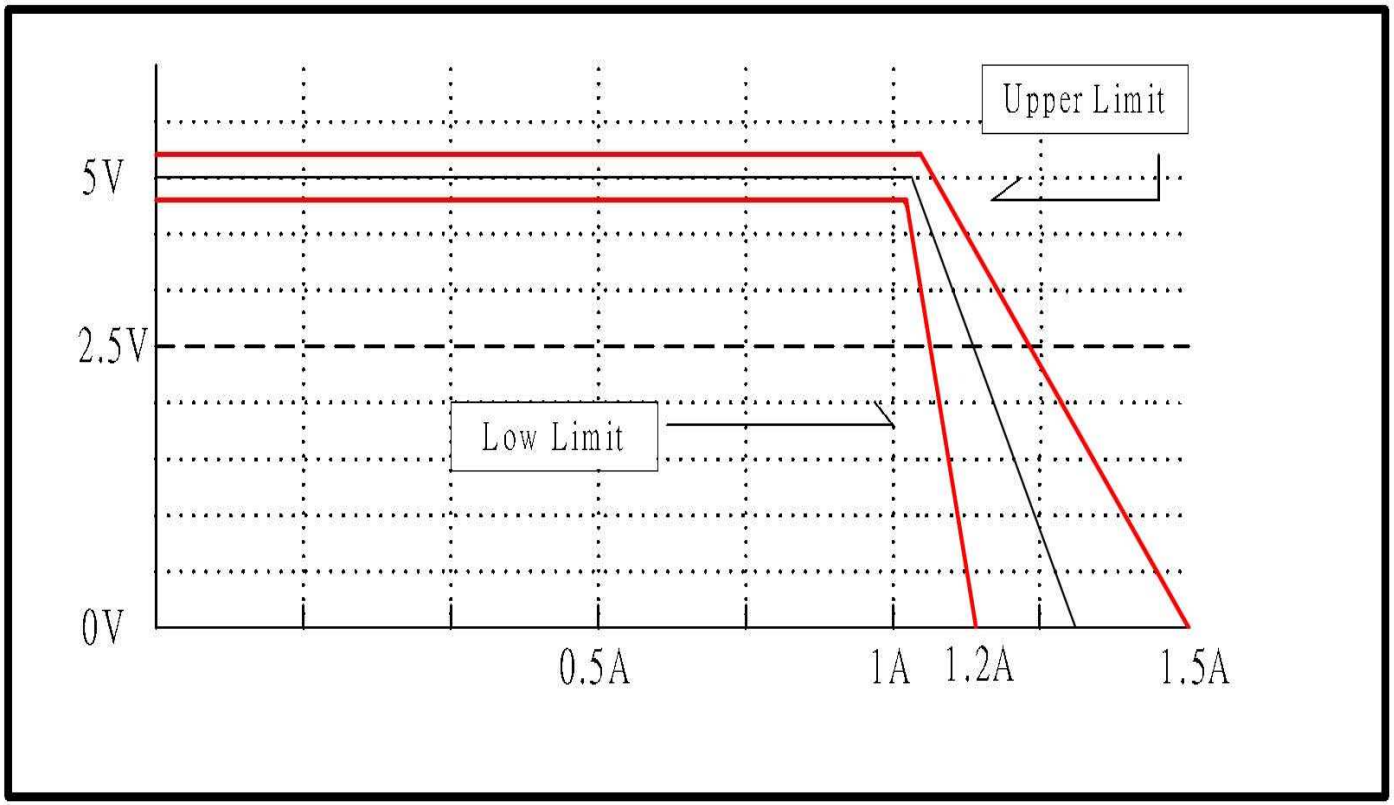
- **1.0 Features**
  - 10 V to 30V Input Voltage Operation
  - Low Quiescent Current at 10mA
  - Led Indicator
  - Efficiency Up to 75% min
- **2.0 Environment**
- **2.1** Operating
- Temperature 0 ～ 50℃ Humidity 0 ～ 98% RH
- **2.2 Storage**
- Temperature -40 ～ 85℃ Humidity 0 ～ 98% RH
- **2.3 Temperature Rise Of Case**
- The temperature rise of the case should be less than 30℃ under full load .
- **3.0 Electrical Specifications**
- (Ta = 25℃, Unless Otherwise Specified.)

- Input Voltage Full Load 10v~ 30V
- Input Current Vin = 12V Full Load Vin = 30/10 0.25(30V) 0.65(10V)A
- Off Load Quiescent Current 10mA
- Inrush Current Vin =10V~30V, No matter how high inrush current it is, it would not cause any damage
- Input Voltage Surge Full Load 40V
- Input power 10V/30v, full load 6.5W/7.5W
- Operation Frequency Vin = 12V, 150KHz
- Output Voltage Vin = 12V, FullLoad 4.75/5.25
- Output Current Vin = 12V, 1A
- Output Voltage Ripple/Noise Vin = 12V, Full Load < 100mV

- **4.0 Protection Function**
- **4.1 Input Over Current Protection**
- Fuse protection (250V/2A)
- **4.2 Input Surge Voltage**
- When 30V<Vin≦40V, the CLA can't be damaged. If the input voltage exceeds 40V, the fuse can be broken and the TVS can be damaged, but CLA must be normal after replacing fuse and TVS.
- **4.3 Reverse Voltage Protection**
- When apply a reverse voltage on CLA, the fuse can be broken to perform a protection function. But the CLA must work fine after replacing fuse.
- **4.4 Over Current Protection**
- The output voltage must be less than 1.0V when the output current is over 1.5A.
- **4.5 Over Voltage Protection**
- It can be component damaged to perform protection function, but the over voltage trip point should not be greater than7.5V,the decay time should be less than 200msec. Besides, it should be no fire under this condition.
- **4.6 Short Circuit Protection**
- It should cause no damage to the CLA when output in short circuit condition at least 72hrs.

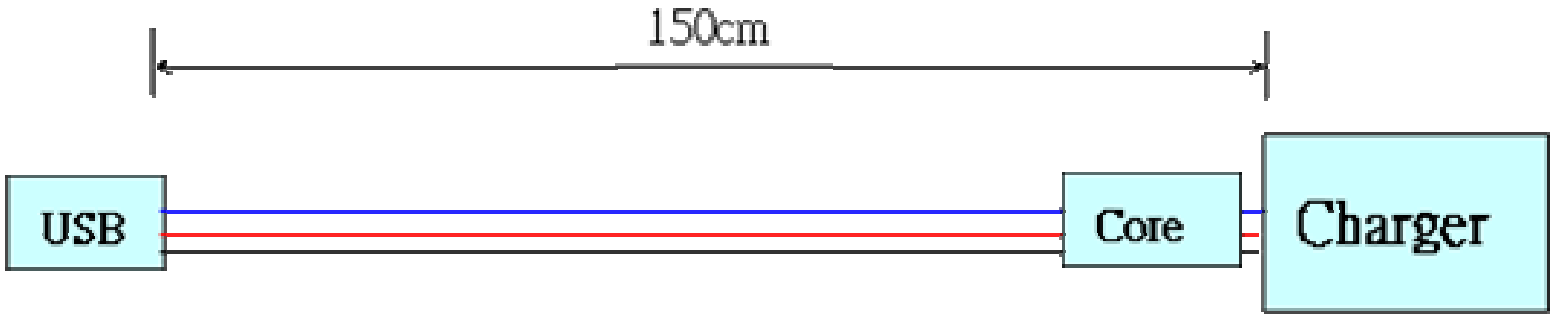
- **5.0 Certificate**
  - UL2089,UL60950-1,EN 60950-1(LVD),CE,IEC60950-1, FCC
  - CB,e-mark (e-9 or other any requirement by customer change)
  - IOS 7637 LEVEL3, (pulse 5a,5b)
- Automotive eqipment: CISPR25, ISO 11452-2,ISO11452-4

- **6.0 Output Voltage & Current Curve**



- **7.0 Mechanical**
- **7.1 Output Cable Flammability**
- The output cable shall have a flammability class of at least 94V2.
- **7.2 Plug Fitting Of The CLA Shaft**
- The CLA shall fit into the cigarette lighter sockets of any manufactured car
- **7.3 Vibration Test （Ambient temperature ：25℃)**

- **7.4 Shock**
- The product shall meet the electrical requirements after the shock test at 10G for duration of 11ms for each (±) axis 5 times each.
- **7.5 Drop Test**
- The product should have no electrical & mechanical damaged after the 75cm drop test.
- **7.6 Cable**



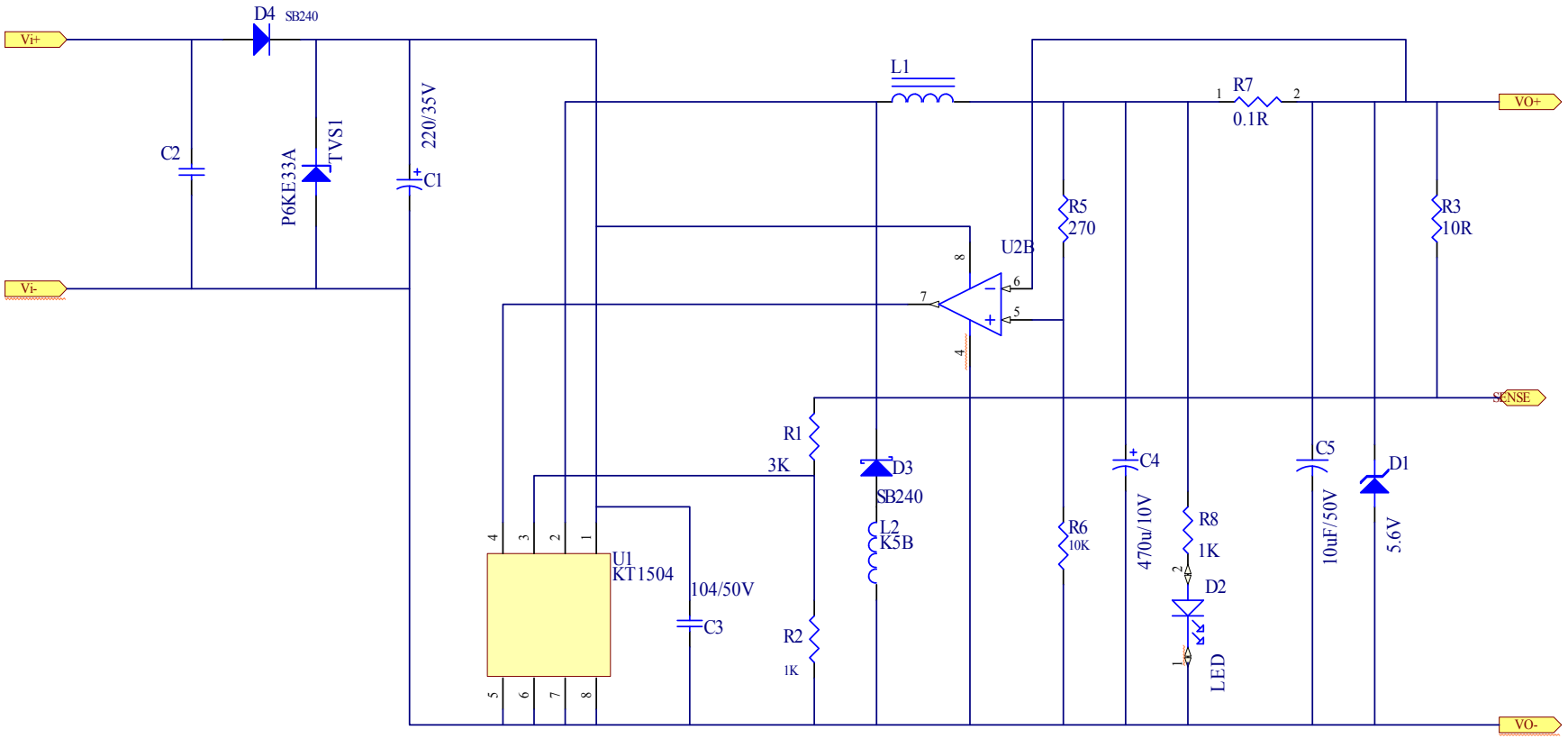
- MINIUSB pin 1:+5V,
- Pin 2,3:NC
- Pin 4,5:grounding
-
- CABLE NEED UL SAFETY

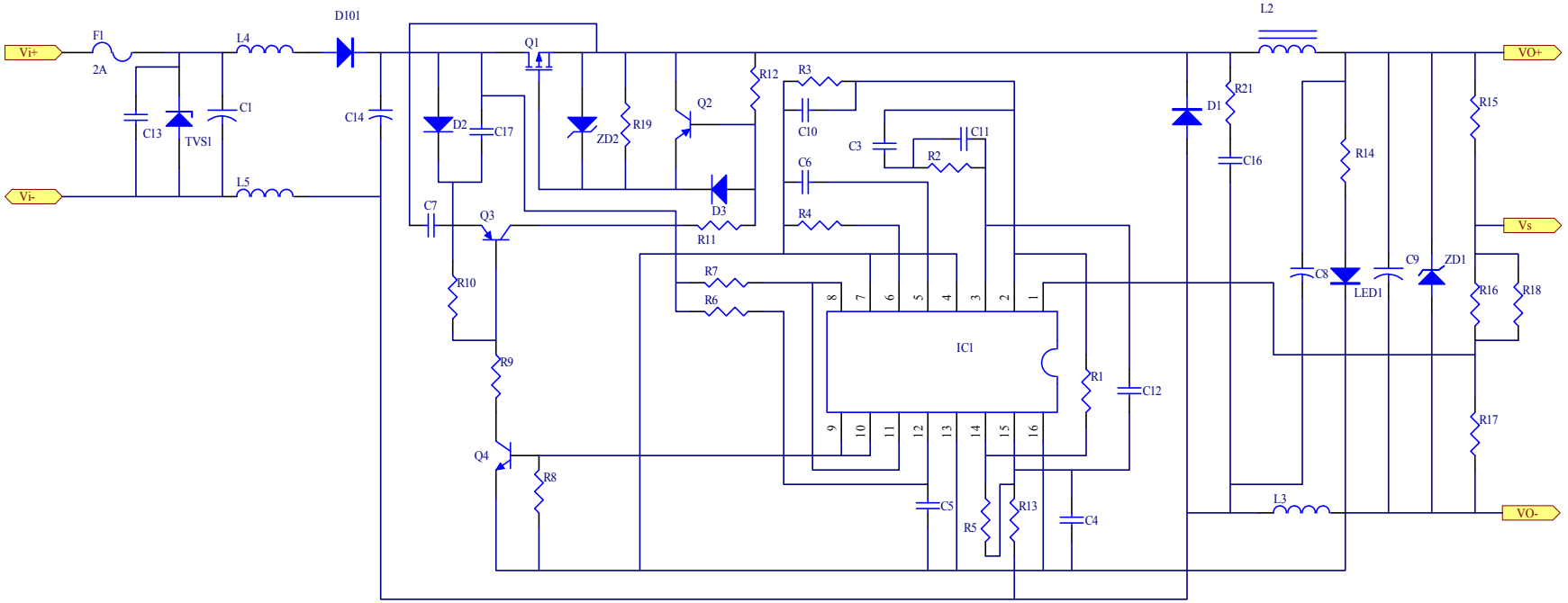
- **8.0 Immunity Requirements**
- IEC1000-4-2(ESD) Contact: +/-4KV Air: +/- 8KV
- IEC1000-4-3
- IEC1000-4-4
- IEC1000-4-6
- **9.0 Automotive EMC Requirements**
- The CLA should comply with CE, and should be certified by,e-mark(e-9 or other any requirement by customer change)
- CISPR25 CLASS 5 LIMIT(RE/CE)(with system)
- MORE THAN UNDER 6dBuV MARGIN FOR EN55022,(RE/CE)
- **10. Radio Interference**
- The CLA shall not cause any interference with AM/FM car radio while in operation.

- **11. Reliability**
- **11.1MTBF (MIL-HDBK-217F, GB)**
- 30,000 hrs minimum at typical input voltage, 25℃ ambient temperature.
- **11.2 LOW TEMPERATURE STORAGE TEST**
- Lowest Storage Temperature ;12hrs
- **11.3 HIGH TEMPERATURE STORAGE TEST**
- Highest Storage Temperature ; 12hrs
- **11.4 LOW TEMPERATURE OPERATION TEST**
- Lowest Operating Temperature ; 12hrs
- **11.5 HIGH TEMPERATURE OPERATION TEST**
- Highest Operating Temperature ; 12hrs
- **11.6 TEMPERATURE CYCLE TEST**
- Lowest Storage Temperature (1hrs)~ Highest Operating Temperature(1hrs) ~Lowest Storage Temperature ; 10 cycle
- **11.7 HUMIDITY STORAGE TEST**
- 65℃/85~90%RH; 12 hrs
- **11.8 SWITCH ON/OFF TEST**
- INPUT (min input voltage ,max input voltage ,full load)
- 200 TIMES THE PERIODS OF EACH TEST IS 1 MINS
- **11.9 Burn in**
- 100% burn-in (40℃/2hrs)
- **11.10 Mini USB life test**
- 5,000 times, 10 cycle/ min
- **11.11 Cable bending test**
- 200 bending for automotive installation cables.
  Attach 200g loading to cable for test.
  Wiggled angle: +/- 90°
- **11.12 Cigarette lighter charger characteristics (DC-Charger)**
- 2,000 mating cycles test.
  After life test, execute the damp heat test.

- 12. Mechanical
- 12.1 Outline drawing
- 12.2 Plastic material
- 13. Package and Label
- 13.1 Package
-
- 13.2 Labeling
-
- 13.3 Labeling material

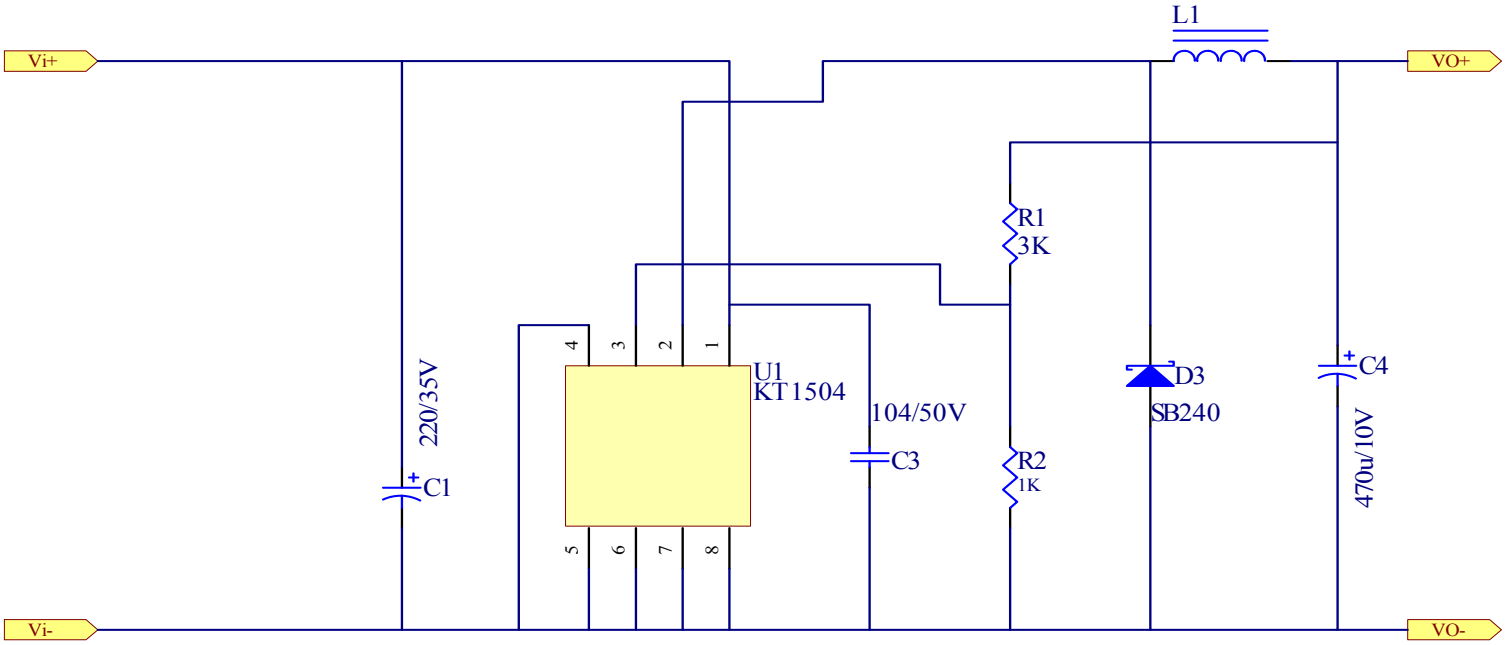
PART2：認識迴路


D4
SB240
Vi+
Vi-
C2
P6KE33A
TVS1
220/35V
C1
L1
R7
0.1R
VO+
R5
270
U2B
R3
10R
SENSE
R1
3K
D3
SB240
L2
K5B
U1
KT1504
104/50V
C3
R2
1K
R6
10K
C4
470u/10V
R8
1K
D2
LED
C5
10uF/50V
D1
5.6V
VO-


Vi+
Vi-
F1
2A
L4
L5
D101
C13
TVS1
C1
C14
Q1
D2
C17
ZD2
R19
Q2
R12
R3
C10
C3
C11
R2
C6
R4
D3
R11
C7
Q3
R10
R7
R6
IC1
R9
Q4
R8
C5
R5
R13
C4
R1
C12
L2
D1
R21
C16
R14
C8
LED1
C9
ZD1
R15
R16
R18
R17
L3
VO+
Vs
VO-

PART 3：认识零件

- 电感的选择
  此处以图1所示的基本型降压稳压器说明如何选择电感。

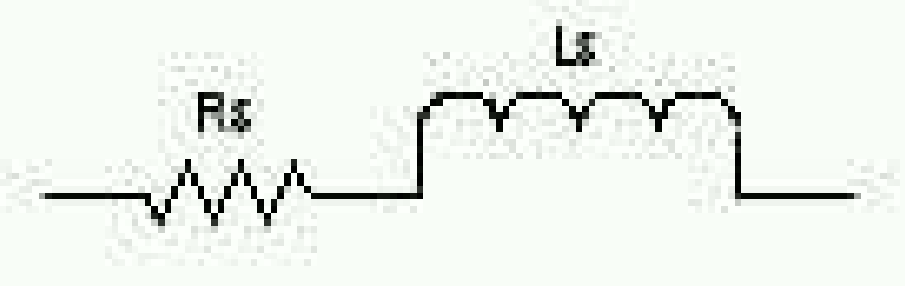


- 多数应用可选择10 μH到100 μH的电感值，实际值则须根据涟波电流要求才能决定，设计人员通常需要涟波电流小于20%的平均电感电流。如公式1所示，较高的VIN或VOUT也会增加涟波电流。由于核心饱和会导致电感产生功耗，因此电感必须在不造成核心饱和的情形下承受峰值开关电流。

$$\Delta I_L = \frac{1}{f * L} V_{OUT}\left(1 - \frac{V_{OUT}}{V_{IN}}\right)$$

- ----------(1)

- 小电感值能提高输出电流回转率，这可改善转换器的负载瞬时响应能力；其缺点则是输出电压涟波会变大。大电感值则会降低涟波电流并减少电感的磁滞功耗。电感的总功耗可由与理想电感 (Ls) 串联的功耗电阻 (Rs) 代表，图1就是所得到的简化电路。　　图1



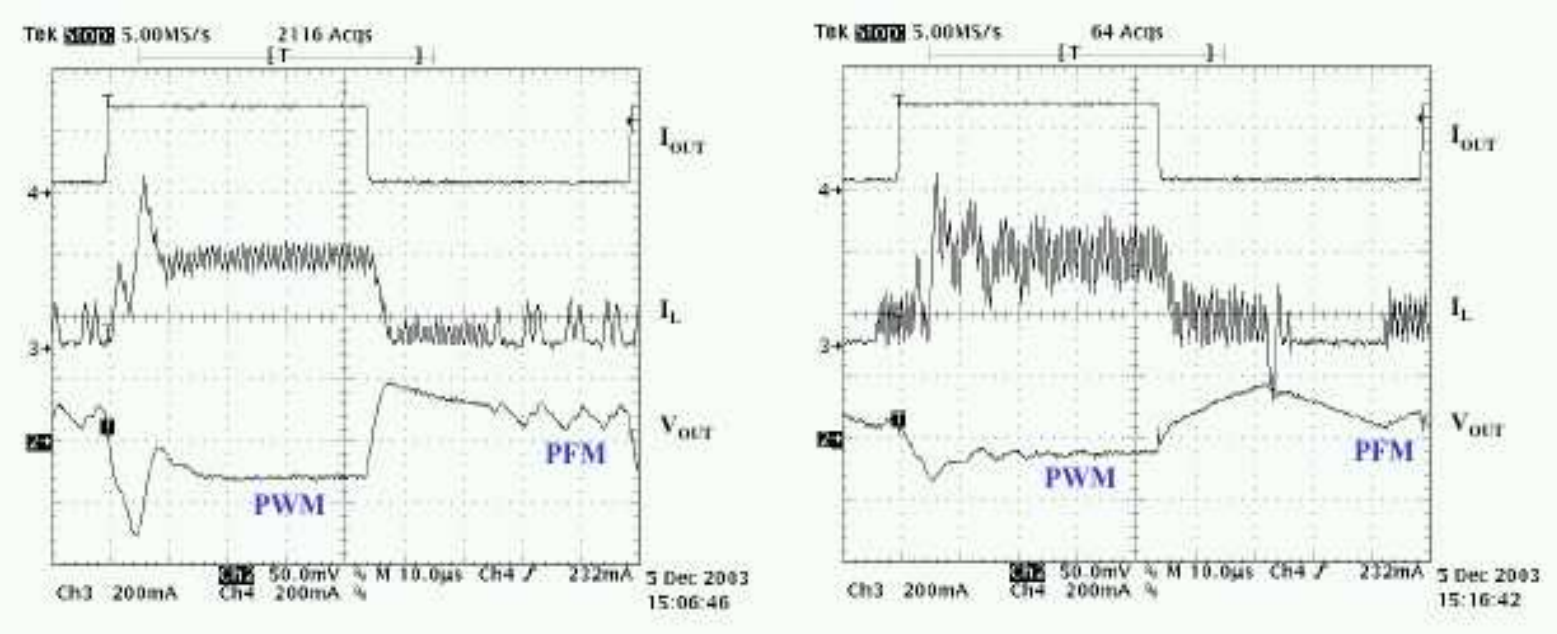
- 虽然Rs的功耗与频率有关，组件规格表却会列出它的直流阻抗 (RDC)。电感的直流阻抗与其构造或线圈材料有关，实际大小通常则是在室温下经由简单的电阻测量来决定。直流阻抗RDC的大小会直接影响线圈的温度上升速率，故在实际应用中应尽量避免超过电流额定值的时间太长。
  电感总功耗包含直流阻抗RDC以及下列频率相关组件的功耗：
  - 核心材料的功耗 (磁滞功耗和涡流功耗)
  - 电感集肤效应 (电流在高频时集中到线圈表面)造成的额外功耗
  - 相邻线圈的磁场功耗 (邻近效应)
  - 辐射功耗

输出电容

- 输出电容的基本选择考虑包括涟波电流、涟波电压和回路稳定性。输出电容的等效串联阻抗 (ESR) 和电感值会直接影响输出涟波电压。我们可以根据电感涟波电流 (ΔIL) 和输出电容的等效串联阻抗轻易估计输出涟波电压值。设计人员应选择等效串联阻抗最小的电容，例如高涟波值的470到1000Mf电解电容大约只有70mΩ等效串联阻抗。负载很小时 (或不必考虑涟波的应用) 还能使用更小电容。

- 一般的控制回路架构允许设计人员自行选择输出电容，然后透过控制回路补偿来提供最佳瞬时响应和回路稳定性。当然，内部补偿方式只能在一组操作条件下发挥最佳效果，它们也很容易受到输出电容的特性影响。内含回路补偿功能的组件，外部LC滤波器必须经过特别选择以配合这些内部补偿功能。如果组件的内部补偿功能最适合16kHz的LC角频率，这相当于10μH电感和10μF输出电容。则在选择不同的输出滤波器时，LC乘积不应出现大幅改变，这对于选择会造成角频率升高的较小电感和电容特别重要。

- 输出电容须在负载瞬时出现到组件导通为止的期间内供应负载所需全部电流。输出电容供应的电流会在等效串联阻抗两端产生电压降，这会导致输出电压降低；等效串联阻抗越小，输出电容供应负载电流时的电压损失就越小。



- L=10 μH / COUT = 10 μF　　L = 4.7 μH / Cout = 22 μF