安森美半导体
ON Semiconductor®

功率小于75 W的适配器方案

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议程

- 新的“能源之星”标准
- 满足新规范所需要的特性
- 新的控制器
- 实际案例
- 结论

EPA 2.0 (External Power Supplies)

EPA ENERGY STAR Version 2.0 EPS Voluntary Specification
(Effective November 1, 2008)

Energy-Efficiency Criteria for Ac-Ac and Ac-Dc External Power Supplies in Active Mode: Standard Models

Nameplate Output Power (P_{no})	Minimum Average Efficiency in Active Mode (expressed as a decimal)
0 to ≤ 1 watt	≥ 0.480 * P_{no} + 0.140
> 1 to ≤ 49 watts	≥ [0.0626 * Ln (P_{no})] + 0.622
> 49 watts	≥ 0.870

(此前的1.1版中的相应规范为>0.84)

Energy Consumption Criteria for No-Load

Nameplate Output Power (P_{no})	Maximum Power in No-Load	
	AC-AC EPS	AC-DC EPS
0 to < 50 watts	≤ 0.5 watts	≤ 0.3 watts
≥ 50 to ≤ 250 watts	≤ 0.5 watts	≤ 0.5 watts

(1.1版规范为<0.5 W)

(1.1版规范为<0.75 W)

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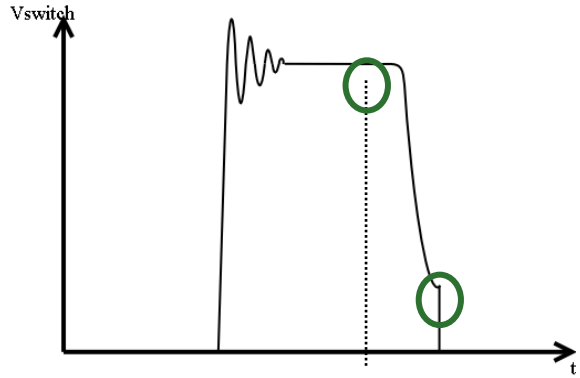
提升效率

- 损耗来源：
  - 开关损耗：

$$P_{loss(switching)} = \frac{1}{2} \cdot C_{DRAIN} \cdot V_{DRAIN(turn-off)}^{2} \cdot F_{SW}$$

  - 门极驱动损耗：

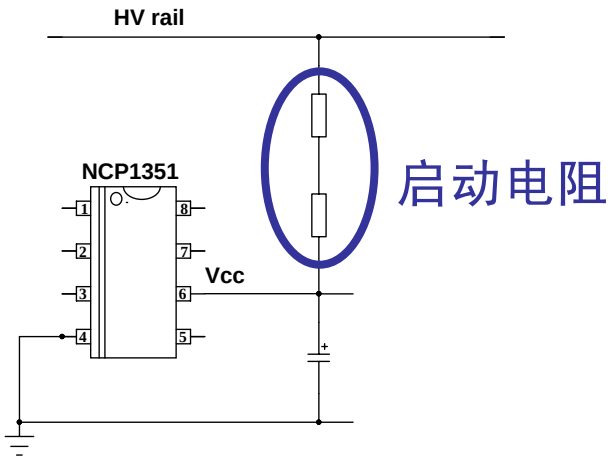
$$P_{loss(gate)} = V_{gate(high)} \cdot Q_{gate} \cdot F_{SW}$$



- 提升效率的方法：
  - 降低开关频率(F_{SW}) ➔ 轻载时频率反走
  - 降低关断时的漏极电压 ➔ 谷底开关

降低空载输入功率

- 启动电路中的静态损耗
  - 启动电阻持续地从大电容消耗电流
- 降低启动电路损耗的方法
  - 采用外部启动电阻时 ➔ 极低启动电流
  - 集成启动电流源 ➔ 关闭时极低泄漏电流
  - 连接启动电路至半波整流交流输入t



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满足要求的适当的控制器

- 安森美半导体推出两款新的系列控制器，实现提升能效和降低空载输入功率，以满足新的能源之星标准
  - NCP1237/38/87/88:

    固定频率控制器，带集成高压启动电流源、频率反走和跳周期模式

    → 提升轻载能效，改善待机能耗

  - NCP1379/80

    谷底开关控制器，极低启动电流和频率反走功能

    → 提升所有负载等级时的能效！

NCP1237/38/87/88

价值主张 Value Proposition

The NCP12X7/X8 series represents the next generation of fixed frequency PWM controllers. It targets applications where cost-effectiveness, reliability, design flexibility and low standby power are compulsory.

独特特性 Unique Features

- High-voltage current source with built-in Brown-out and mains OVP
- Freq. reduction in light load conditions and skip mode
- Adjustable Over Power Protection

优势 Benefits

- Fewer components and rugged design
- Extremely low no-load standby power
- Simple option to alter the max. peak current set point at high line

其它特性 Others Features

- Latch-off input for severe fault conditions, allowing direct connection of NTC
- Timer-based protection: auto-recovery or latched
- Dual OCP option available
- Built-in ramp compensation
- Frequency jittering for a softened EMI signature
- Vcc operation up to 30 V

市场和应用 Market & Applications

- AC-DC adapters for notebooks, LCD monitor, game console, printers
- CE applications (DVD, STB)

应用数据 Application Data



	DSS	Dual OCP	Latch	Auto Recovery
NCP1237A	Yes	Yes	Yes	
NCP1237B	Yes	Yes		Yes
NCP1238A	Yes	No	Yes	
NCP1238B	Yes	No		Yes
NCP1287A	HV only	Yes	Yes	
NCP1287B	HV only	Yes		Yes
NCP1288A	HV only	No	Yes	
NCP1288B	HV only	No		Yes

根据不同终端应用需求提供不同选择

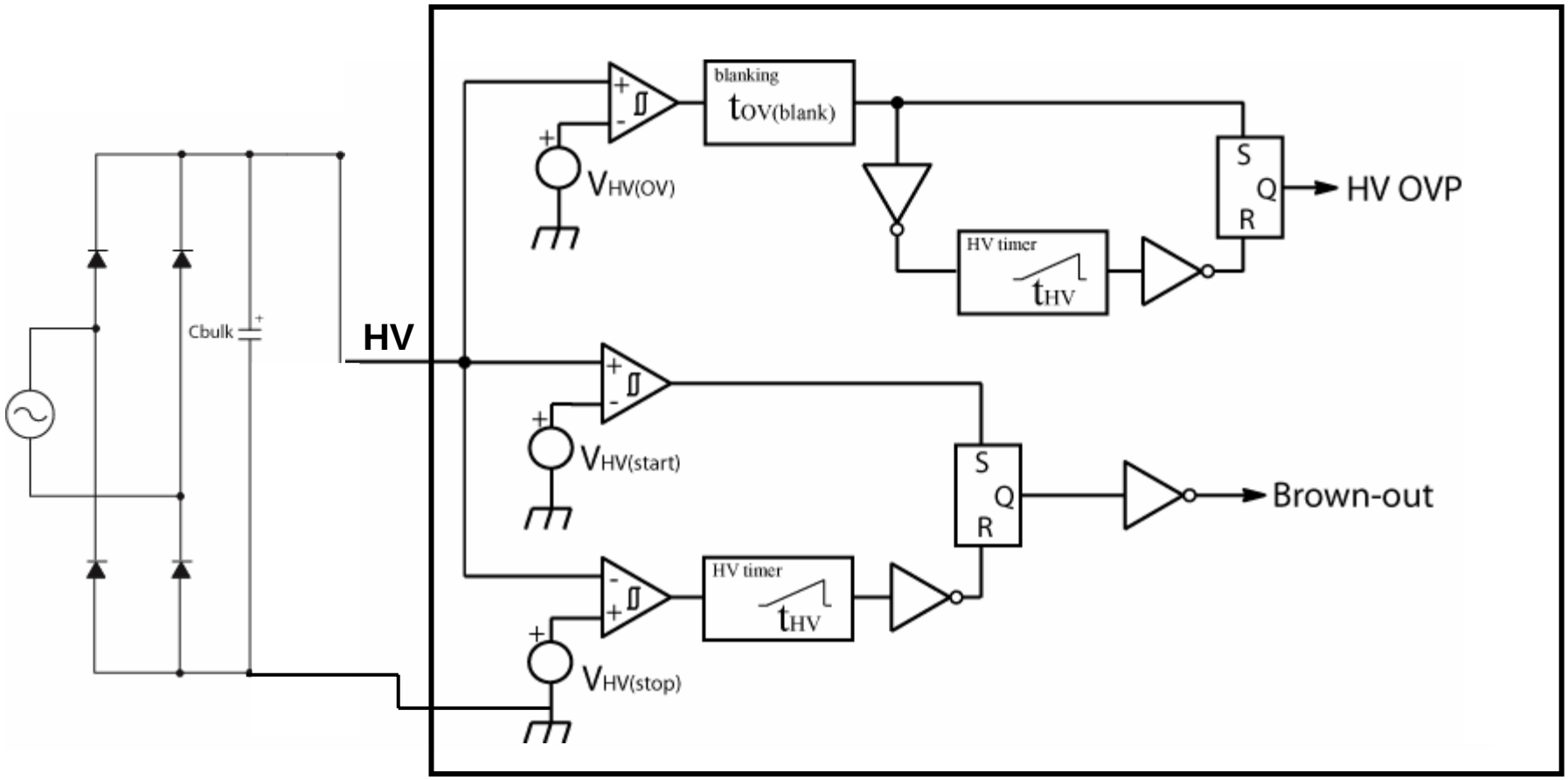
Various options available depending upon end applications needs

订购和封装信息 Ordering & Package Information

- NCP1237/38xDR2G - NCP1287/88xDR2G
- SOIC-7 2500p per reel

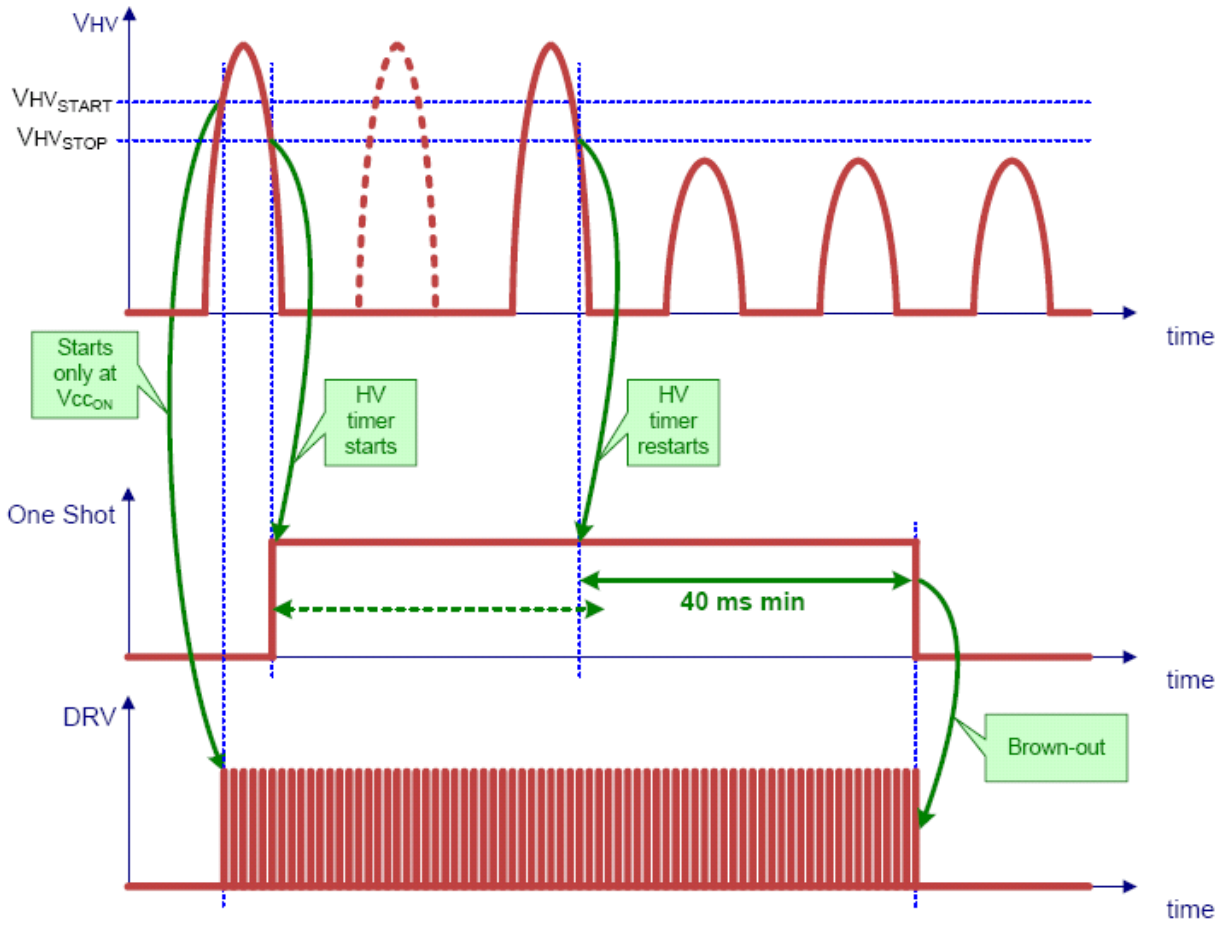
Pb O, DW

NCP1237/38/87/88 – 输入欠压和过压保护



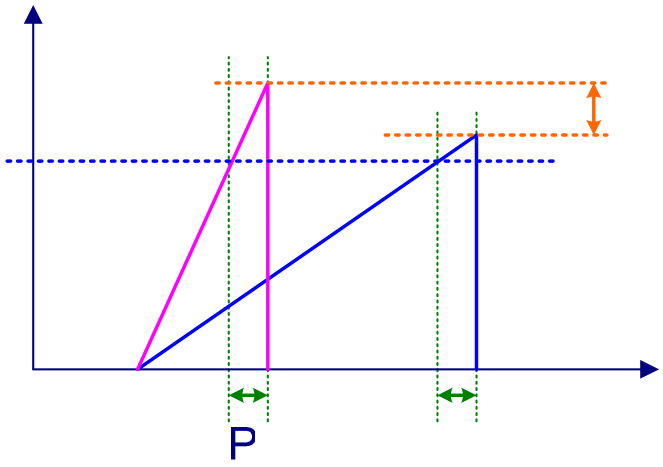
检测不受高压引脚纹波影响 ⇒ 能连接至半波整流交流线路

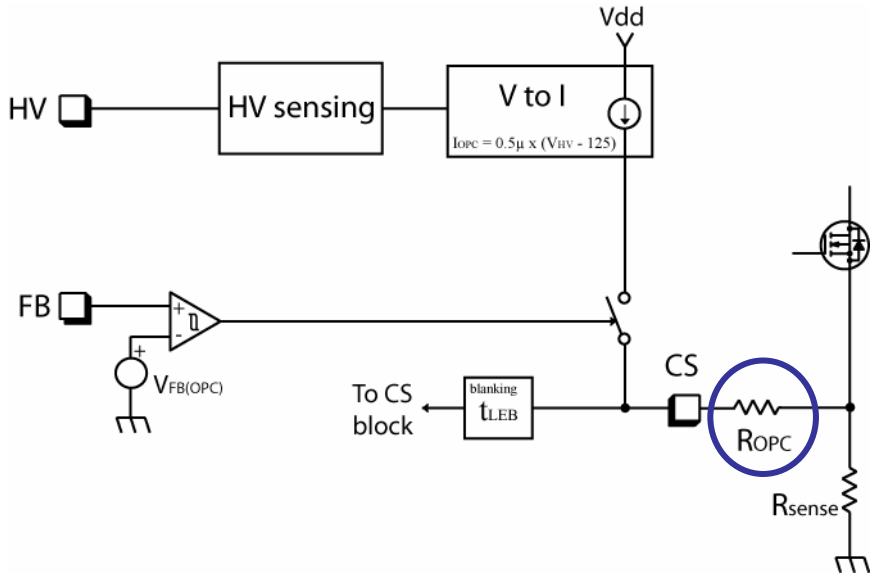
NCP1237/38/87/88 – 输入欠压和过压保护



基于定时器的检测 ⇒ 传递整个周期压降

NCP1237/38/87/88 – 过功率保护





需要对延时进行补偿

补偿电流产生电流感测信号偏移

Δ to be compensa

I_{LIMIT}

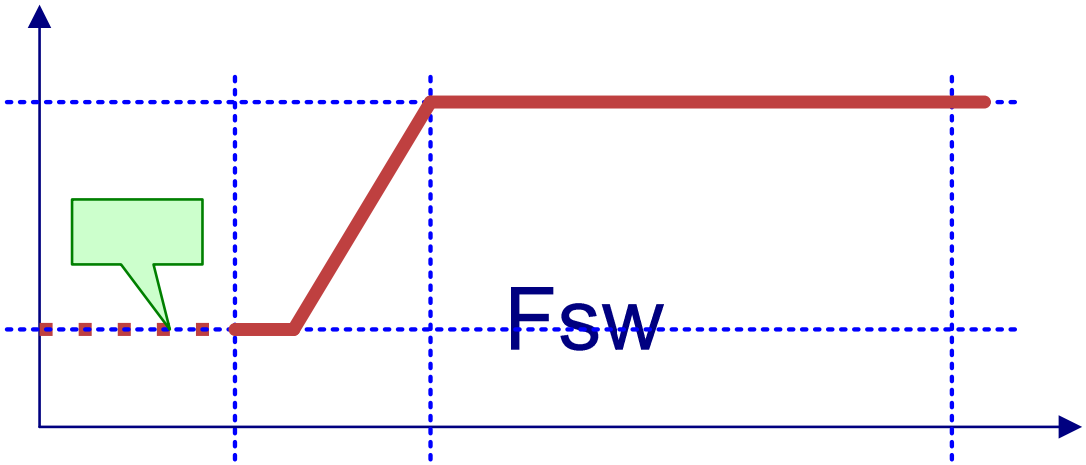
过功率保护 → 最大输出功率时钳位

High Line

Low Line

NCP1237/38/87/88 – 频率反走

NCP1237/38/87/88 – Frequency Foldback



f_{OSC}

轻载时开关频率降低 ⇒ 能效升高

Skip

开关频率在25 kHz时钳位 ⇒ 没有可听噪声

$f_{OSC(min)}$

NCP1379/80

价值主张 Value Proposition

The NCP1380 is a high-performance circuitry aimed to powering QR converters. Capitalizing on a novel valley-lockout system, the controller shifts gears and reduces the switching frequency as the power loading becomes lighter.

独特特性 Unique Features

- Valley switching operation with valley-lockout
- Freq. reduction in light load condition
- Adjustable Over Power Protection

优势 Benefits

- Excellent efficiency over a wide range and noise free operation
- Extremely low no-load standby power
- Simple option to alter the max. peak current set point at high line

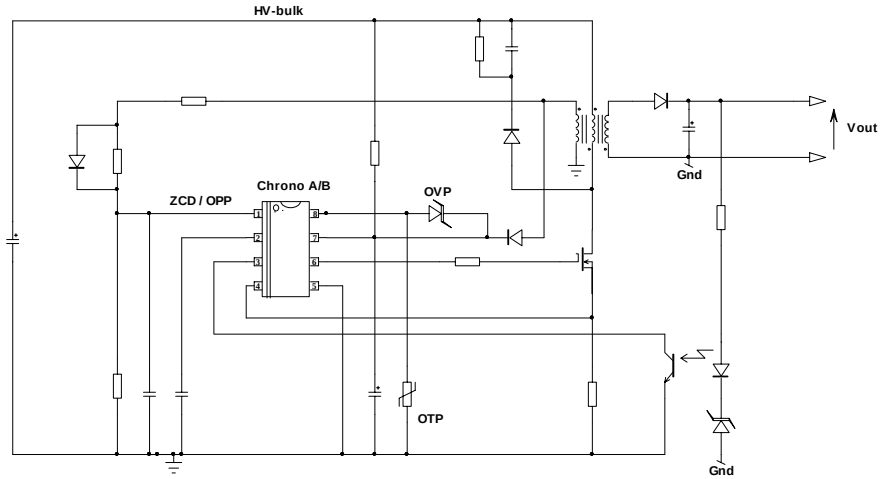
其它特性 Others Features

- Auto-recovery or latched internal output short-circuit protection
- Fixed 80 ms timer for short-circuit protection
- Combined Over-voltage and over-temperature protection (A and B versions)
- Combined OVP & brown-out (C and D versions)
- 3 µs blanking delay to ignore leakage ringing at turn-off

市场和应用 Market & Applications

- AC-DC adapters for notebooks, LCD monitor, game console
- Auxiliary power for Flat TVs
- CE applications (DVD, STB)

应用数据 Application Data



Design flexibility

订购和封装信息 Ordering & Package Information

- NCP1380xDR2G
- SOIC-8 2500p per reel

Pb

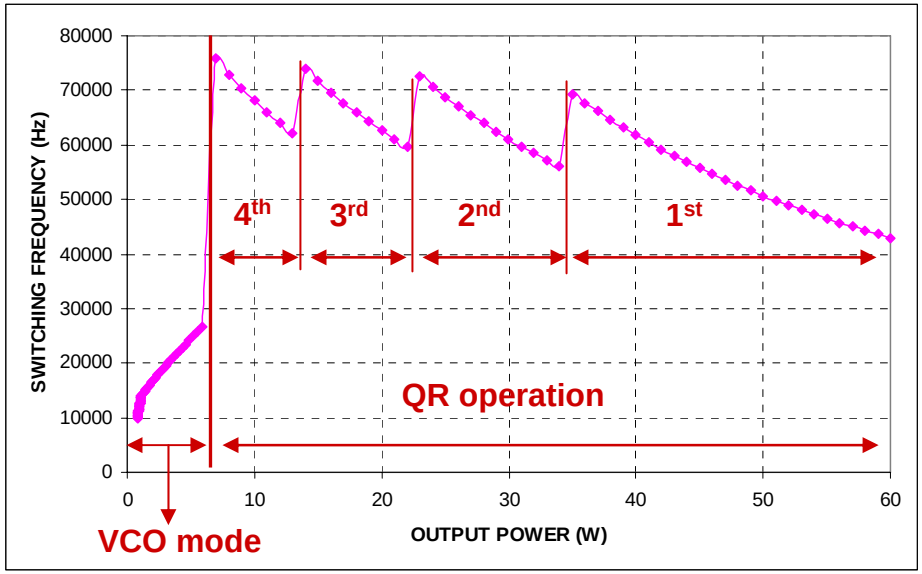
O, DW

NCP1379/80 – 准谐振模式，带谷底锁定

- 负载下降时，控制器改变谷底频率(从第1至第4个谷底)
- 在输出功率大幅变化之前，控制器将保持谷底锁定状态

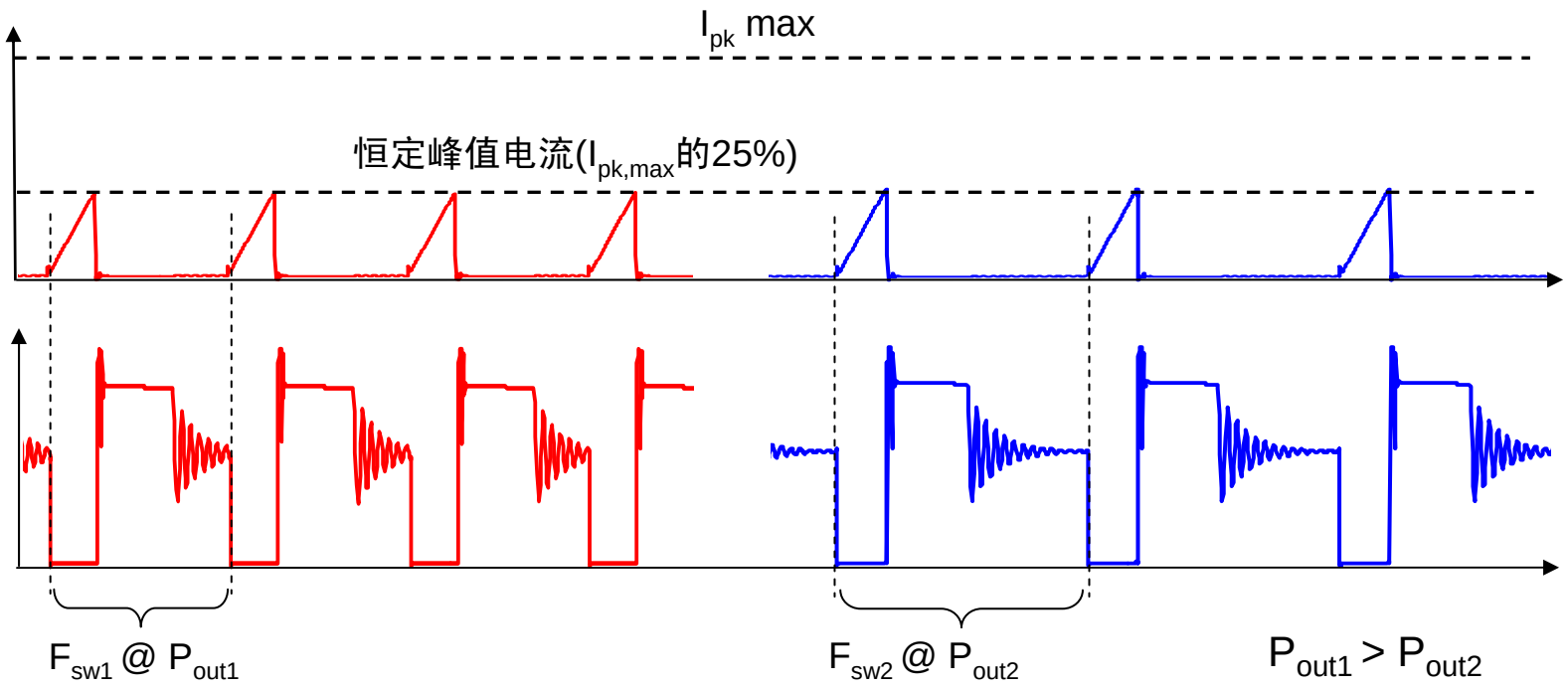
➢ 没有谷底跳频噪声

➢ 自然的开关频率限制



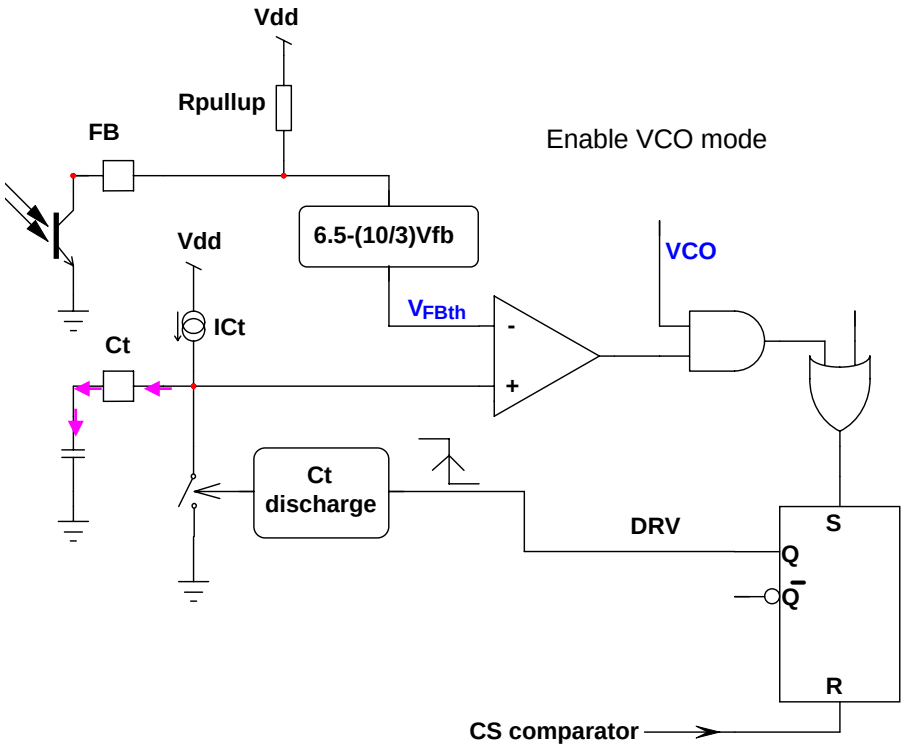
NCP1379/80 – 频率反走

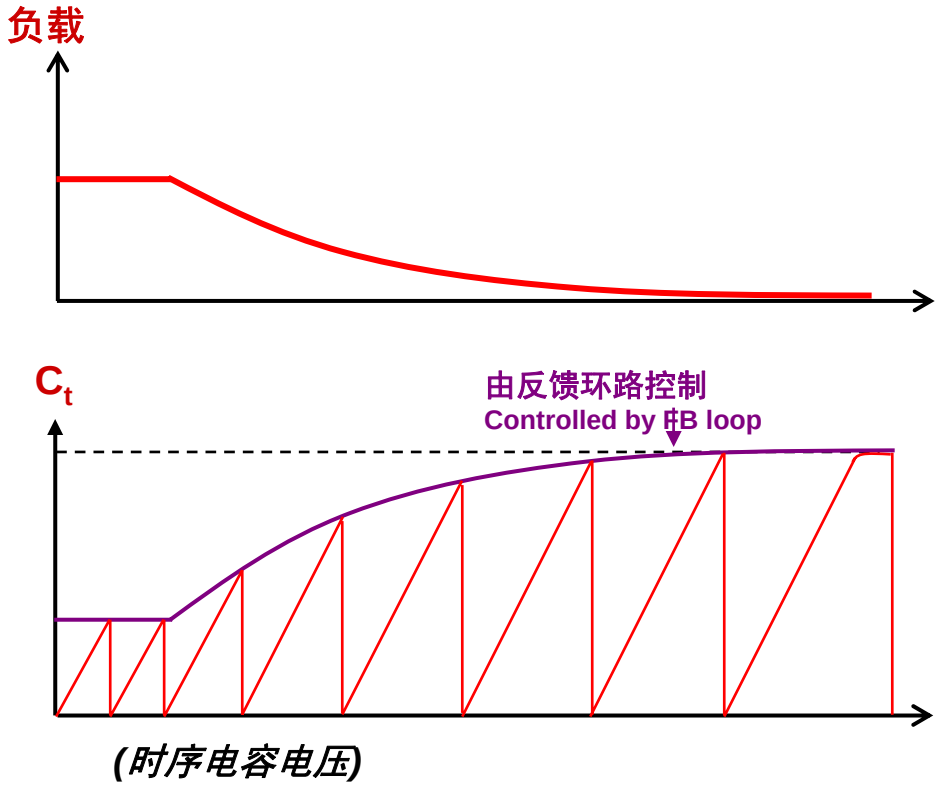
- 当反馈电压(V_{FB})低于0.8 V(输出功率P_{OUT}下降)或反馈电压低于1.6 V(输出功率上升)时发生频率反走
- 固定峰值电流(最大峰值电流$I_{pk,max}$的25%)、可变频率由反馈(FB)环路设定



NCP1379/80 – 频率反走

- 开关频率在Ct电容充电结束前设定
- Ct电容的充电结束由反馈(FB)环路来控制

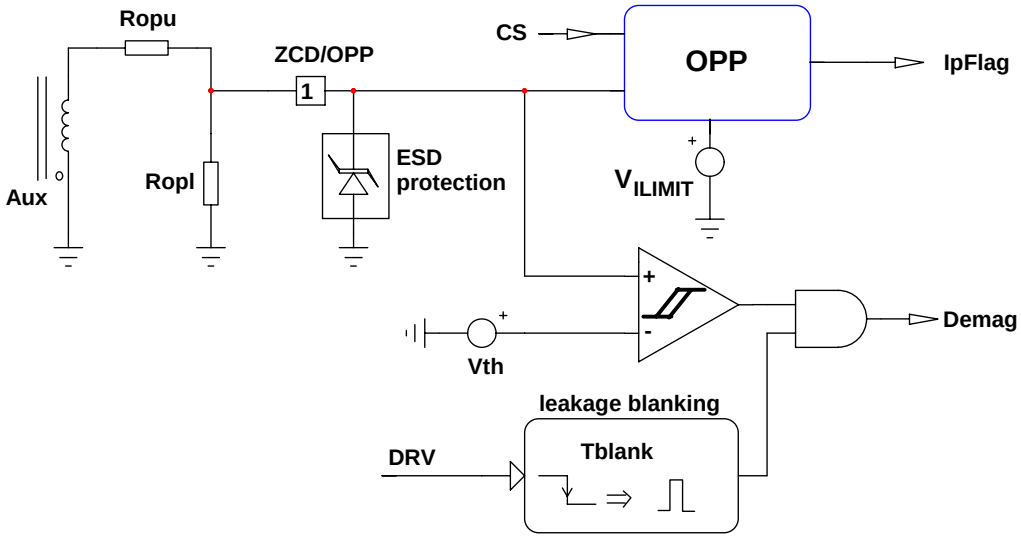


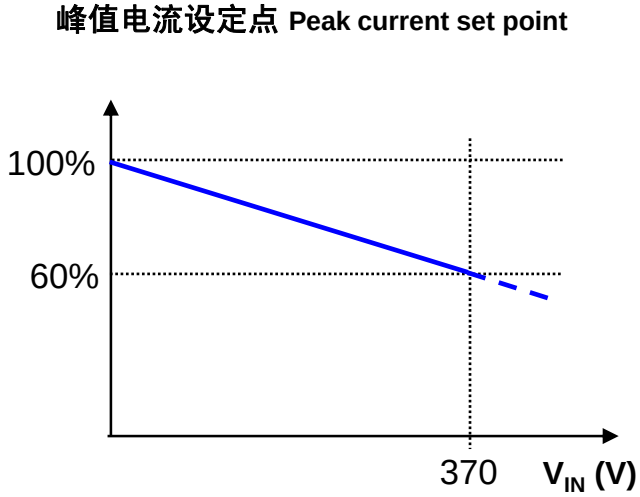


(时序电容电压)

NCP1379/80 – 过功率保护

- 导通时间期间带反激极性的谐振电感L_{aux}振荡至$-NV_{IN}$
- 采用R_{opu} // R_{opl}调节过功率保护(OPP)电压值 $V_{CS,max} = 0.8\ V + V_{OPP}$





非耗散型过功率保护！

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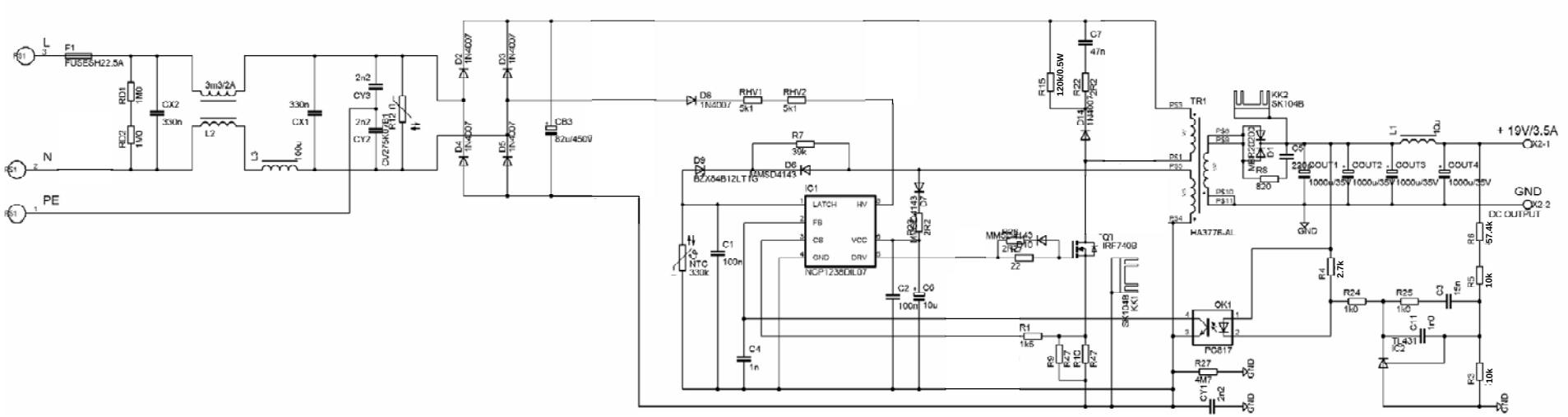
固定频率示例：原理图

典型的65 W笔记本适配器(19 V输出)



(未针对EPS 2.0版规范优化)

(not optimized for EPS 2.0)

固定频率示例：效率

V_{IN} % of P_{OUTnom}	115 Vac	230 Vac
100 % (65 W)	88.5 %	88.4 %
75 % (49 W)	89.2 %	88.2 %
50 % (32 W)	88.9 %	86.8 %
25 % (16 W)	88.2 %	87.3 %

频率反走产生的效果

230 Vac时平均能效：87.7%

固定频率示例：待机功耗

- 轻载和空载输入功率

P_{OUT} \ V_{IN}	115 Vac	230 Vac
10.7 W	12.0 W (88.7 %)	12.5 W (85.1 %)
1.3 W	1.67 W (78.0 %)	1.75 W (74.2 %)
0.5 W	0.74 W (69.0 %)	0.76 W (66.0 %)
空载	71 mW	97 mW

谷底开关示例：能效

V_{IN} % of P_{OUTnom}	115 Vac	230 Vac
100 %	88.7 %	91.1 %
75 %	88.8 %	90.9 %
50 %	89.2 %	89.1 %
25 %	88.2 %	87.9 %

115 Vac时平均能效：88.7%

谷底开关示例：待机功耗

- 轻载和空载输入功率

P_{OUT} \ V_{IN}	115 Vac	230 Vac
10.7 W	12.37 W (86.5 %)	12.44 W (86 %)
1.3 W	1.85 W (70.3 %)	1.82 W (71.4 %)
0.5 W	0.82 W (61 %)	0.78 W (64.1 %)
空载	122 mW	140 mW

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功率小于75 W的适配器方案：结论

- 采用传统反激转换器满足“能源之星”或IEC的最新要求已经可行
- 具有相同的轻载时频率反走概念的两款新控制器使这成为可能
  - 固定频率：NCP1238系列
  - 谷底开关(准谐振，QR)：NCP1380系列
- 平均能效高于**87%**具有可能性
- 可以实现低于**100 mW**的空载输入功率，但单纯凭控制器本身并不能确保这一点。整个电源的设计必须做到减少功率浪费。

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ON Semiconductor®

谢谢！如有问题，敬请提出！

Thank You! Any Questions?