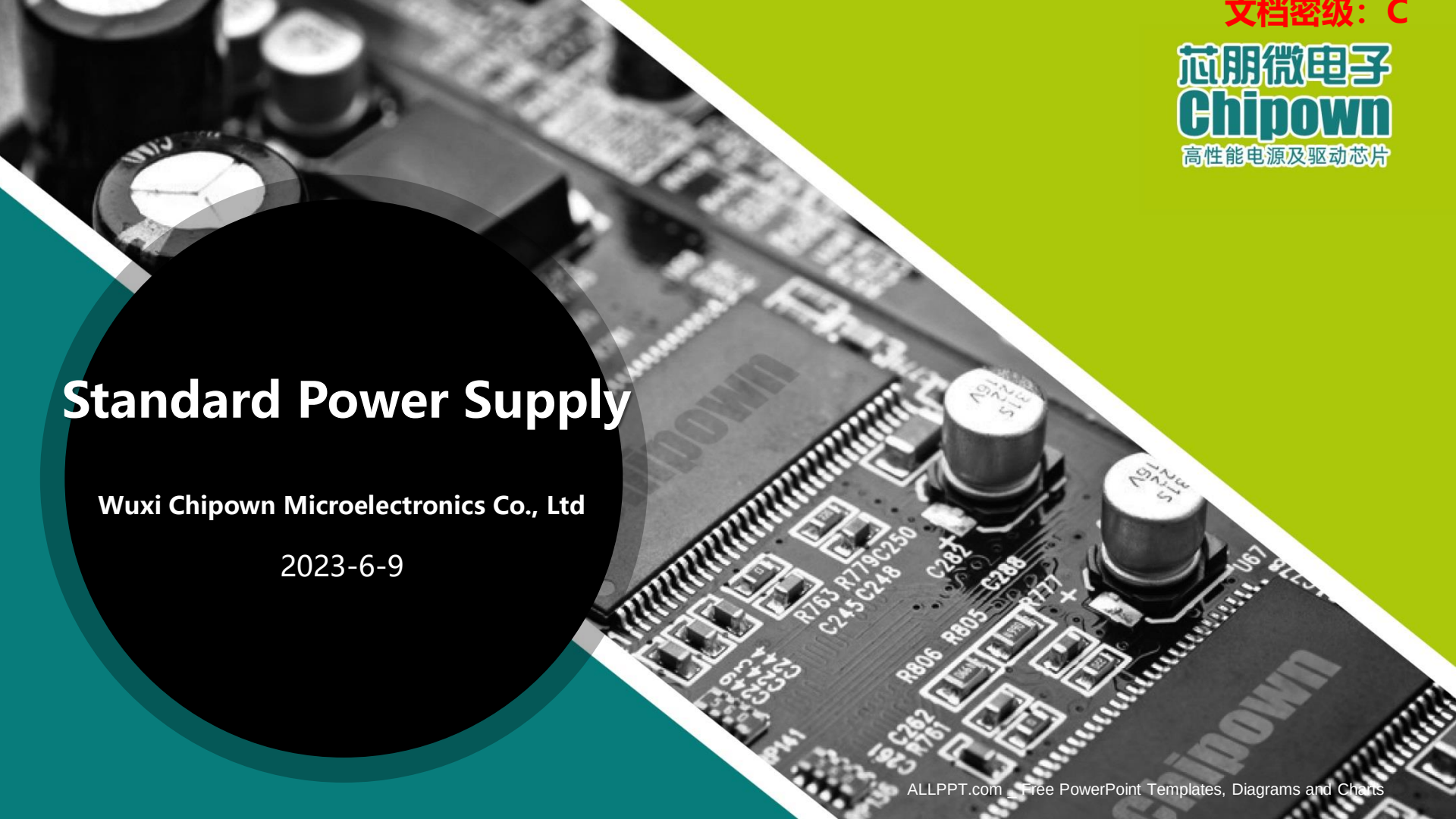
文档密级：C

芯朋微电子
Chipown
高性能电源及驱动芯片

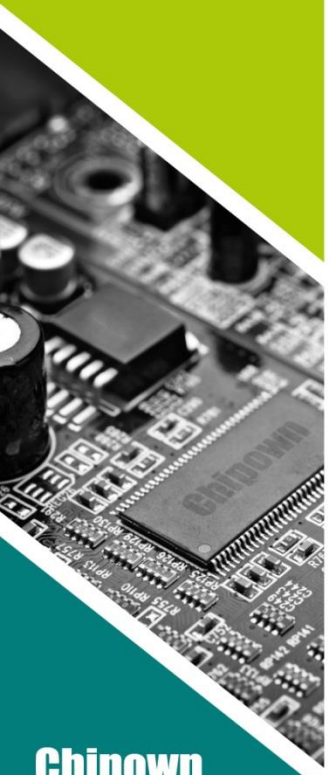
Standard Power Supply

Wuxi Chipown Microelectronics Co., Ltd

2023-6-9



Content

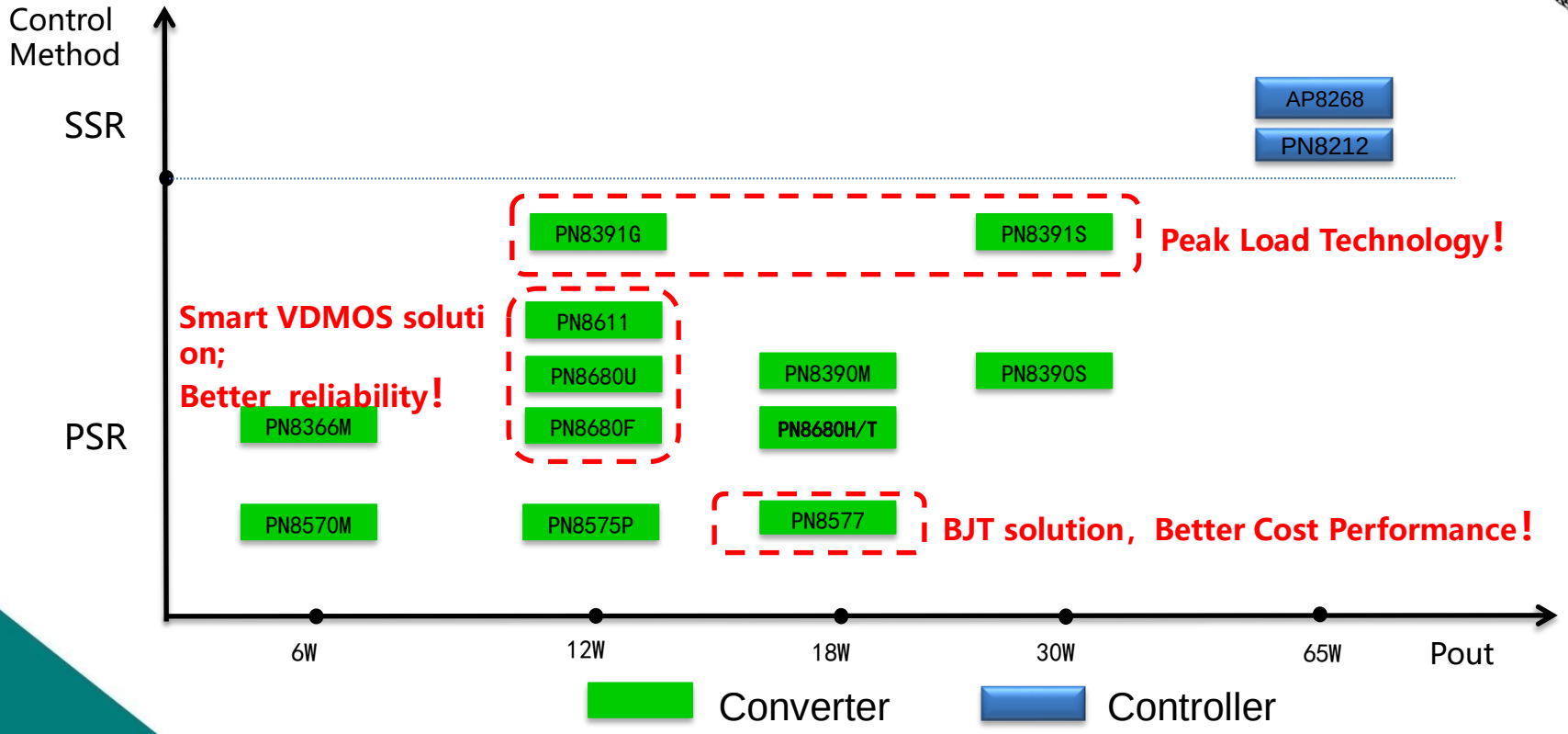


Chipown

Adapter

Charger

1. Typical Solution



2.Development Review of PSR Control Method

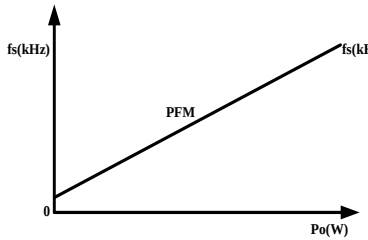
1st PSR
Adopt single **PFM** Control;
Application for LED lighting.

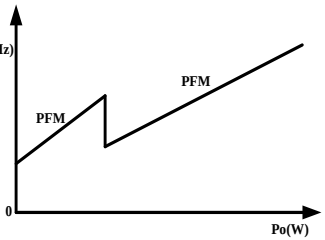
2nd PSR(PN8359)
Adopt multi-**PFM** Control;
Application for Adapter.

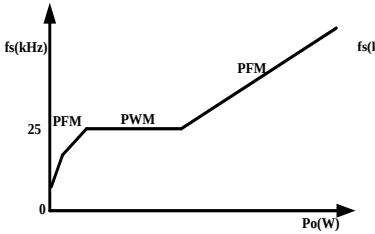
3rd PSR(PN8370)
Adopt PFM+**PWM**+PFM Control;
Application for Adapter/Built-in Power Supply.

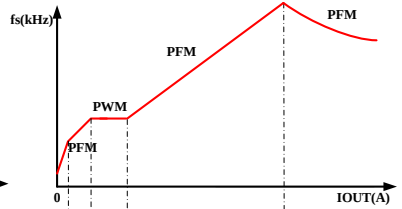
3.5th PSR(PN8680F)
Adopt **PFM**+PWM+DPFM Control;
Application for charger of Smart audio system.

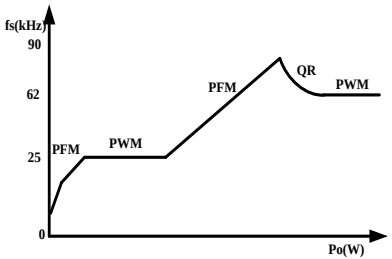
4th PSR(PN8390)
Adopt **PWM**+PFM+PWM+PFM Control; Application for above 24W Design.

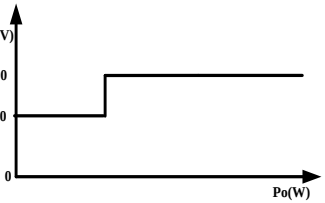


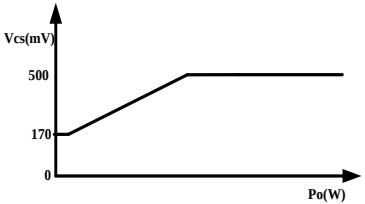


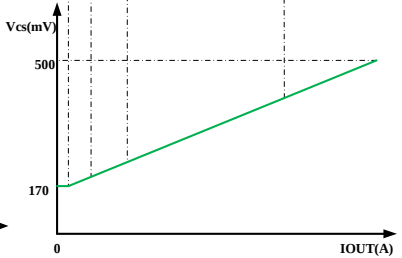












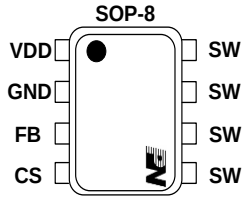
3.12W Classic Solution： PN8680F/U

Drain Pin in one side, simple layout, better heat dissipation, more safe distance;

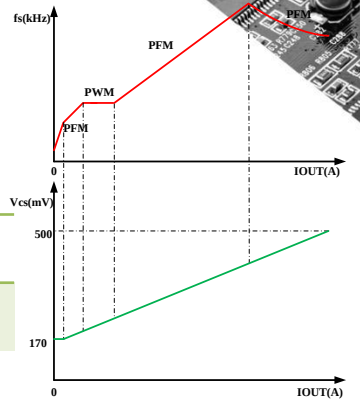
Internal integrated high-voltage start, standby power consumption<75mW, can save 2pcs startup resistors when replacing competitive Products;

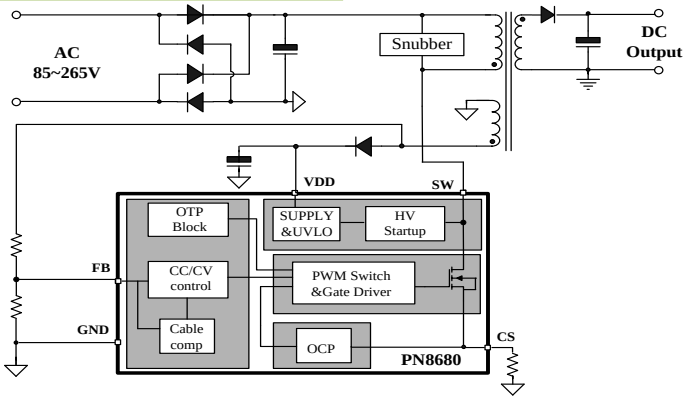
Equipped with 3.5 generation control core, suitable for small size, large over current and VI energy efficiency adapter application;

The core product has been iterated for 7 years, and many abnormal protection(such as conve rsion efficiency, dynamic response, EFT anti-interference, EMC, OVP of AC input etc.) are at the leading level;



P/N	Description
PN8680F	650V3.6ohm
PN8680U	650V4.5ohm





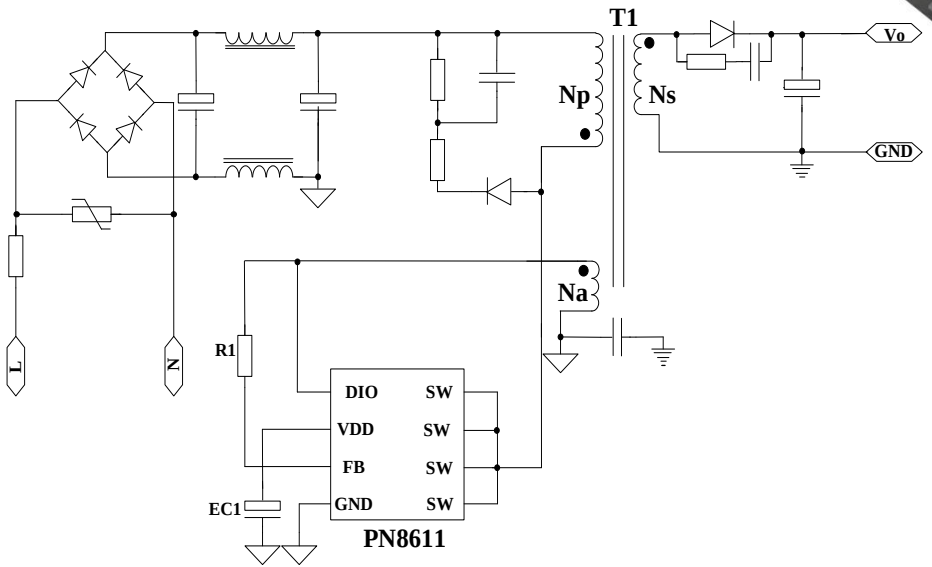
4. Higher integration: PN8611

High integration, only 2pcs peripherals, 1pcs supply capacitor and 1pcs feedback resistor to adjust the output voltage;

High constant voltage and constant current accuracy, using advanced trim technology to achieve 3% CC/CV accuracy;

High conversion efficiency, multiple operating modes, easily meet CoC V5 Tier 2 energy efficiency standards;

Complete protection functions, cycle-by-cycle overcurrent protection, output under-voltage protection, overtemperature protection, open loop protection, output short circuit protectio n, VDD under-voltage lock protection, AC brown-out protection;



5. Key technology 1: Integrated current sampling network

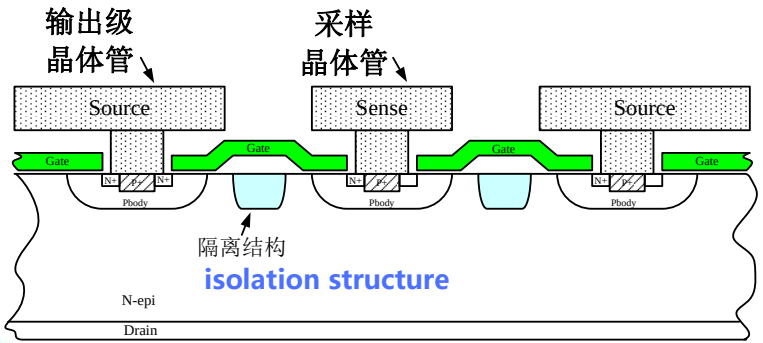
PN8611 uses the sampling tube current of intelligent MOS for peak current control, without the need for external CS detection resistor;
T TRIM technology to achieve the accuracy of Id_limit within ±2%, and the accuracy of constant current can meet 3%.

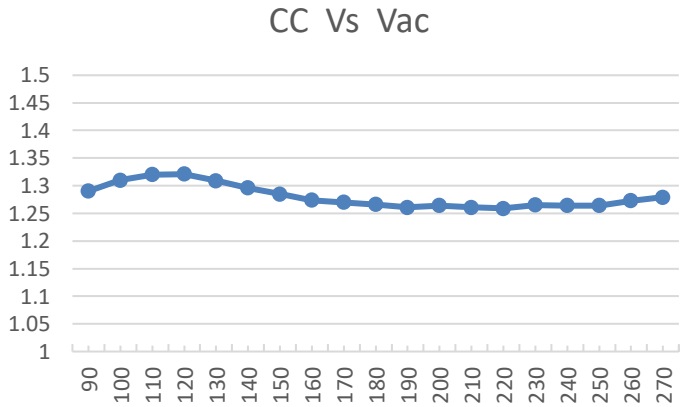
•Constant current point is adjusted by transformer primary and secondary coil number:

$$I_{cc} = \frac{N_p I_{limit}}{N_s 4} = 0.1625 \frac{N_p}{N_s}$$

•Output transistor

•Sampling transistor



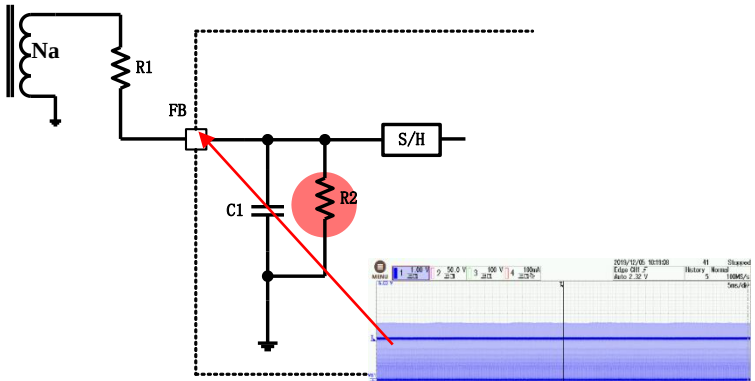


6. Key technology 2: Integrated FB lower bias sampling network

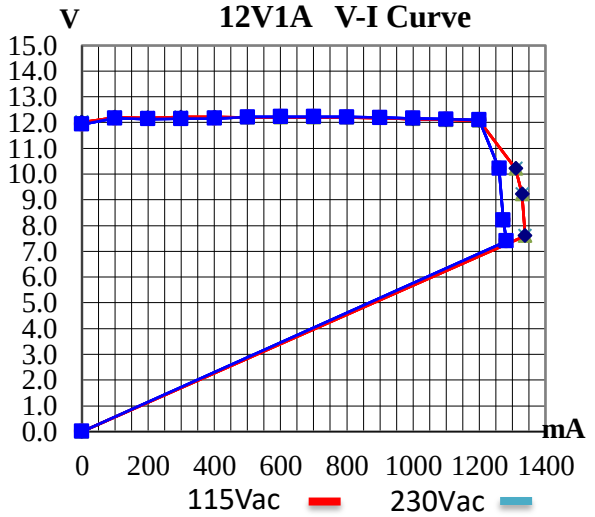
FB pin of PN8611 integrates the lower bias sampling resistor and filter capacitor, and ensures the lower resistor accuracy of ±1% through CP Trim technology, and the output voltage accuracy can meet 3%.

•The output voltage is regulated by the up-bias resistor R1 and the number of auxiliary winding turns:

$$V_o = \frac{N_p}{N_a}\frac{R_2 V_{ref,cv}}{R_1} + R_2$$



•Anti-interference performance of FB greatly improved!



7.Peak Load Function: PN8391G

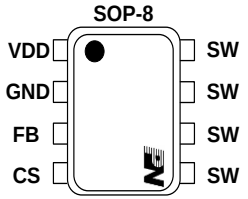
Peak load control: On the basis of the fourth generation control kernel, the two-stage peak load function is added, which significantly reduces the BOM cost and realizes 12V1A replacing 12V1.5A;

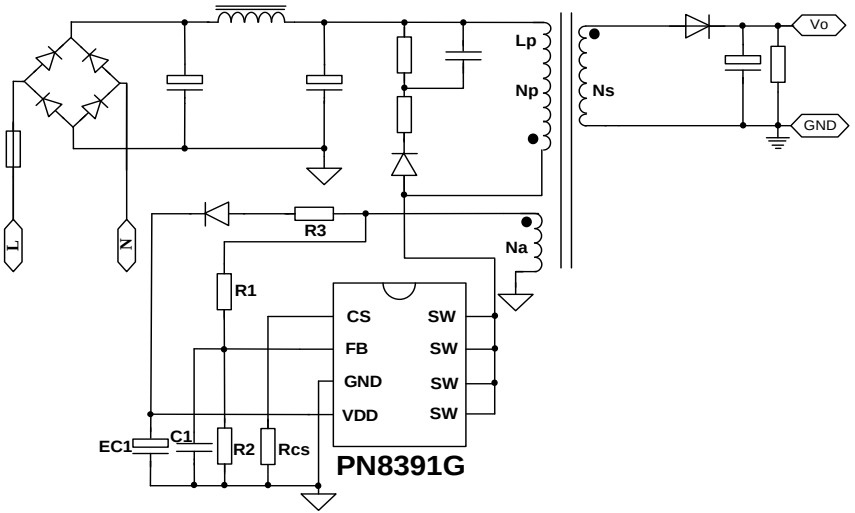
Comprehensive intelligent protection: new under-voltage and overvoltage protection, open loop of feedback protection, higher security;

High conversion efficiency: Patented high voltage start + 5 CV working modes, easily meet the VI energy efficiency;

Patent fast ring+slow ring double ring control technology: Complete solution Anti-interference and dynamic load response conflict of PSR;

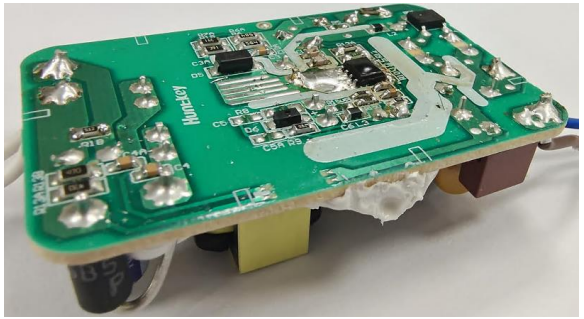
CP+CC+CV three-stage start: rise time of output voltage <30ms, and peak of Vds is significantly reduced;





8.12V1A experimental data： Peakload Capacity

12V1A Demo

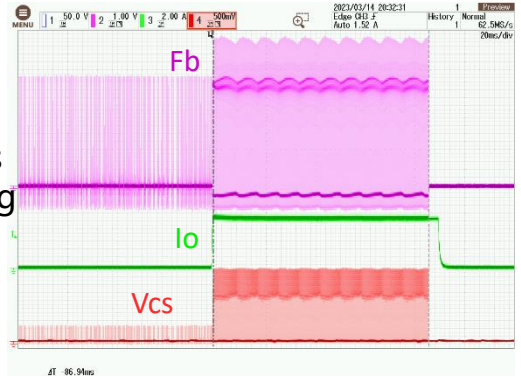


Np:Na:Ns=68:10:8
Lp=1.35mH Rcs=1.12ohm Ae=48.8mm2

	90Vac	115Vac	150Vac	180Vac	230Vac	264Vac
OLP1	1.6A	1.8A	1.9A	2A	1.7A	1.7A
OLP2	2.4A	2.7A	2.7A	2.6A	2.4A	2A

OLP1 14s timekeeping

OLP2 80ms timekeeping



9.18W Cost-effective BJT solution：PN8577

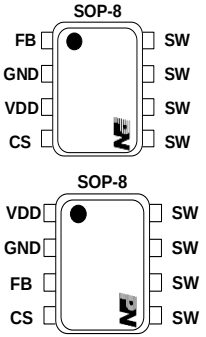
Drain Pin in one side, simple layout, better heat dissipation, more safe distance;

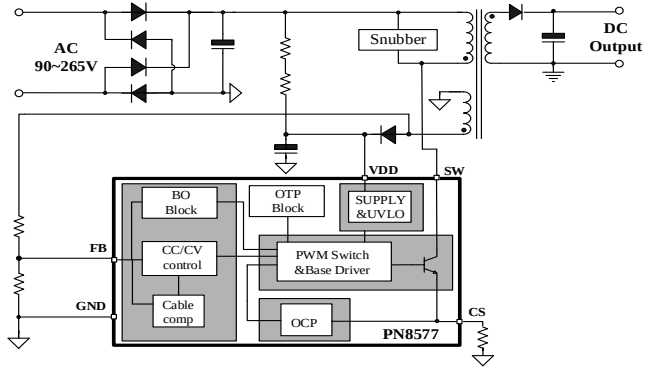
According to the characteristics of BJT devices, tailor-made power adaptive control technology can easily meet the requirements of VI energy efficiency and temperature rise;

Withstand voltage of BJT is greater than 800V, new AC undervoltage and overvoltage dual protection (4.2:1), suitable for the Indian market;

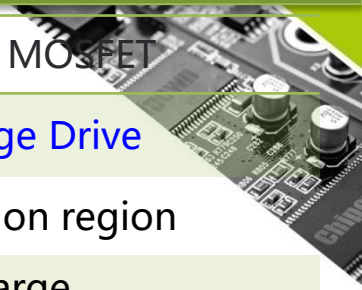
Five-segment drive ensures BJT safety switch, operating voltage is low to 4.2V in order to reduce drive loss;

PN8577 optimizes the contradiction between capacitive load, standby power consumption, and startup time to meet the requirements of th e high-end 18W adapter standard;



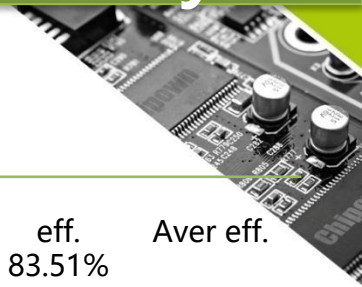


10.Technical differences between Power BJT and Power MOSFET



	Power BJT	Power MOSFET
Type	Current Drive	Voltage Drive
Driving state	Saturation region(critical)	Saturation region
Id_Max	Limited by Ib*β (PN8577 1A)	Large PN8680x 1.5A
Complexity of drive	Complexity It takes a lot of current when turn it on, Shutdown requires a pre-shutdown Slow shutdown speed	Simple
Range of VDD	PN8575P 4.5-21V	PN8680M 10-30V
Operation Frequency	Full Load: 40-45kHz	Wide Range:40K-65kHz
Hotspot of OTP	If VDD voltage is higher than 15V, hotspot of OTP may be in the controller	hotspot of OTP is at power MOS Low controller temperature

11.12V1.5A experimental data： conversion efficiency



	PN8577 NEW						Industry average level					
	Io/A	Vo/V	Po/W	Pi/W	eff.	Aver eff.	Io/A	Vo/V	Po/W	Pi/W	eff.	Aver eff.
90Vac	1.5	12.01	18.015	21.429	84.07%	84.29%	1.5	12.05	18.075	21.645	83.51%	83.64%
	1.125	12.02	13.52259	16.028	84.37%		1.125	12.01	13.5115	16.156	83.63%	
	0.75	12		10.661	84.42%		0.75	11.95	8.9625	10.696	83.79%	
	0.375	11.99	4.49625	5.35	84.04%		0.375	11.91	4.46625	5.327	83.84%	
265Vac	1.5	12.03	18.045	20.844	86.57%	85.78%	1.5	12.02	18.03	21.019	85.78%	85.29%
	1.125	11.97	13.46625	15.597	86.34%		1.125	11.96	13.455	15.693	85.74%	
	0.75	11.92	8.94	10.384	86.09%		0.75	11.91	8.9325	10.384	86.02%	
	0.375	11.9	4.4625	5.305	84.12%		0.375	11.87	4.45125	5.322	83.64%	

Average efficiency of 90Vac PN8577 is higher 0.64% than competitive product ;
Average efficiency of 265Vac PN8577 is higher 0.49% than competitive product;

12.24W Classic Solution： PN8390S+PN8309M

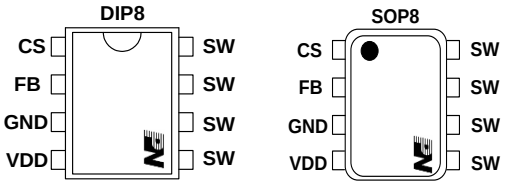
Patented closed-loop constant current technology,
to achieve CCM, DCM arbitrary working mode constant current, CC accuracy within 5%;

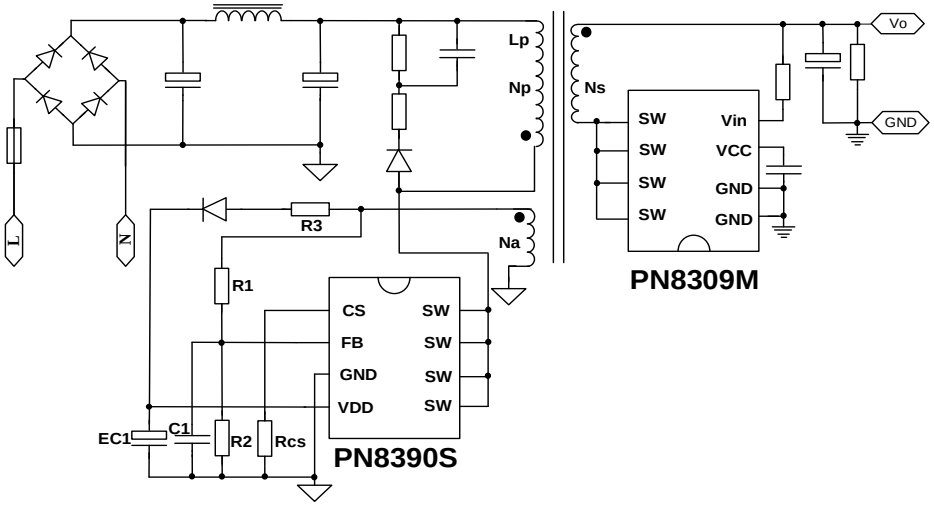
High power density, benefits to intelligent super junction MOS technology, SOP8 can achieve 24W, DIP8 can achieve 30W;

Patent fast ring + slow ring double ring control technology: Complete solution, Anti-interference and dynamic load response conflict of PSR;

CP+CC+CV three-stage start:the rise time of output voltage<30ms, and peak of Vds is significantly reduced;

Patented high voltage start+5 CV operating modes, the winding transformer can meet the CoC V5 Tier 2, the adapter is easy to remove Y capacitor;





13.Key technology 1:
CCM/DCM constant current compensation technology

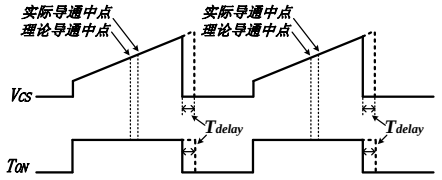
4th generation PN839X series of Chipown achieves CC accuracy of ±5% across t he full voltage input range through built-in constant current compensation mod ule;

Constant current technology is difficult and has many variables: it is necessary to calculate the degaussing duty cycle and simplify CS current from trapezoidal wave to rectangular wave through midpoint sampling technol ogy to facilitate calculation;

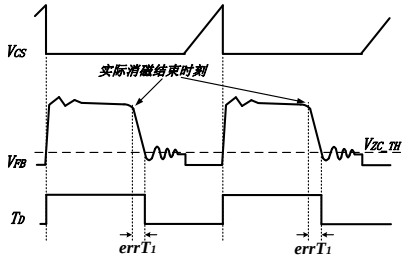
Ratio of on-duty can be greater than 0.5, but built-in slope compensation is required to avoid subharmonic oscillation;

Compensation of constant current is built inside the chip in order to improve the influence of different control objects of QR/CCM on constant current accuracy;

1.Compensation of Current sampling



2. Compensation of Operating mode



3. Compensation of Slope

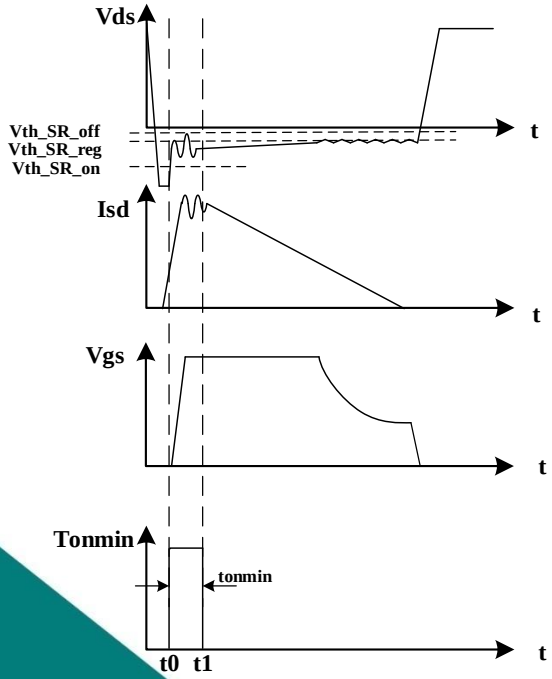
$$m > -\frac{(2-\frac{1}{D})m_2}{2} = \frac{(2-\frac{nV_o+V_g}{nV_o})nV_oR_{cs}}{2L_p}$$

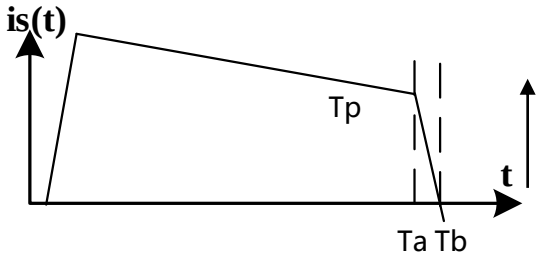
14.Key technology 2:
current tracking mode synchronous rectification technology

Safely open: body diode conduction+ 3 Toff min condition (prevents incorrect ringing);

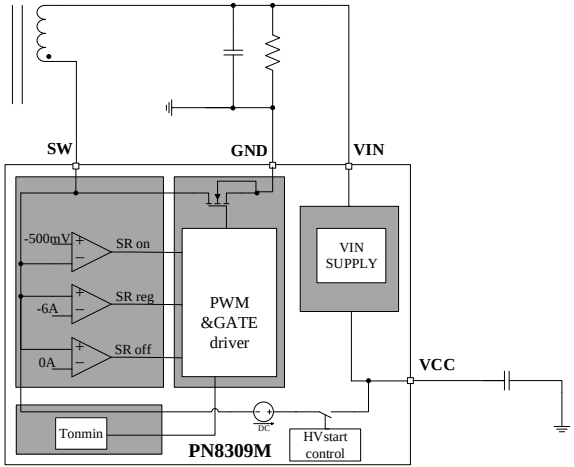
Fast shutdown: Current tracking technology can quickly shut down SR within 30ns;

Strong impact capability: Thanks to intelligent SGT and dual power supply technology;
PN8309X has more than 6KV ability to surge;

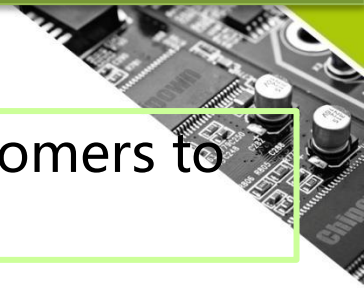




1.Set pre-shutdown breakpoint Tp in order to prepare for quickly shutdown after Ta point;
2.Intelligent SGT with built-in super junction capacitor, MOS is easy to be turned off;
3.The controller has strong sink current capability and zero delay response for accelerated shutdown;



15.Summary

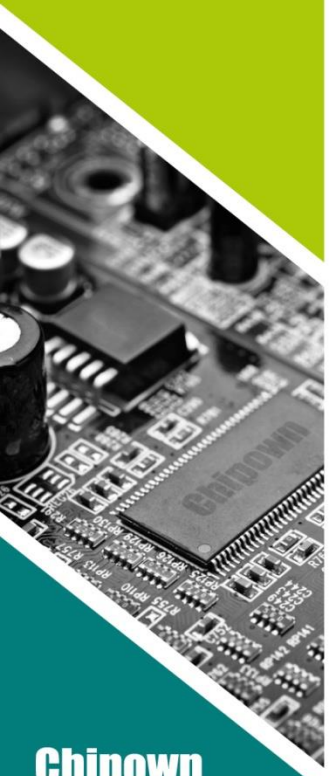


12W solution: Mainly push PN8680X, gradually guide customers to adopt PN8611 and PN8391G;

18W solution: MOS solution replacing with BJT has just arrived, PN8577 has seized the priority opportunity. Optimized PN8577 version, technology leading;

24W solution: PN8390S+PN8309M total solution is leading in efficiency, ripple, surge ability and so on.

Content

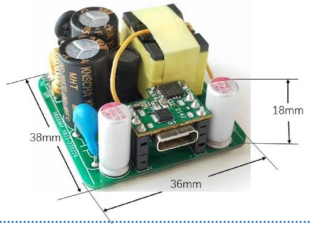


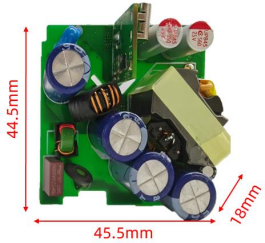
Adapter

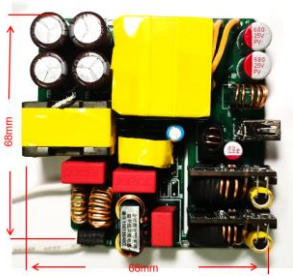
Charger

1. Fast Charger solution for 20W-140W

Framework







CRM PFC

SSR Flyback

SR

20W	35W	65W	140W
Pure QR PN8161	Pure QR 8162 8165	QR-LOCK 8783	6811
	Pure QR 8166	QR-LOCK 8212/3	8282
			8280
			QR-LOCK 8212/3
DCM PN8307H	DCM 8307H	DCM 8307P	CCM/DCM 8601

Output Power

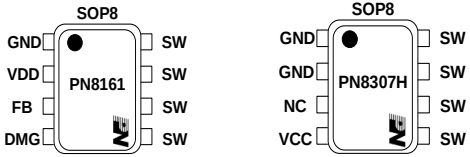
Converter Controller

2. 20W Full Integrated solution：PN8161+PN8307H

Built-in intelligent super junction MOS, don’ t need external startup/ CS resist or, easy wiring;

Pure QR control mode, performance of EMC is excellent;

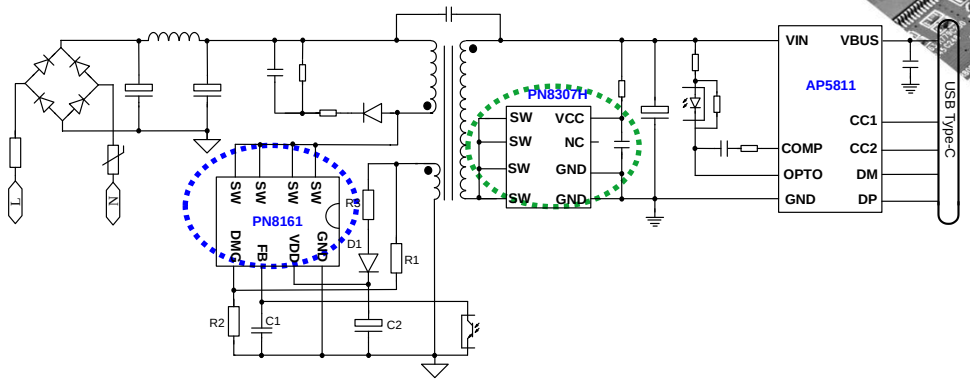
Four SW pins are used to heat dissipation, low temperature rise, more safe distance;



Built-in 60V/12mohm Trench cost-effective

Support 150K QR/DCM Operation Mode

Easy to use, simple design(1-2 periphery)

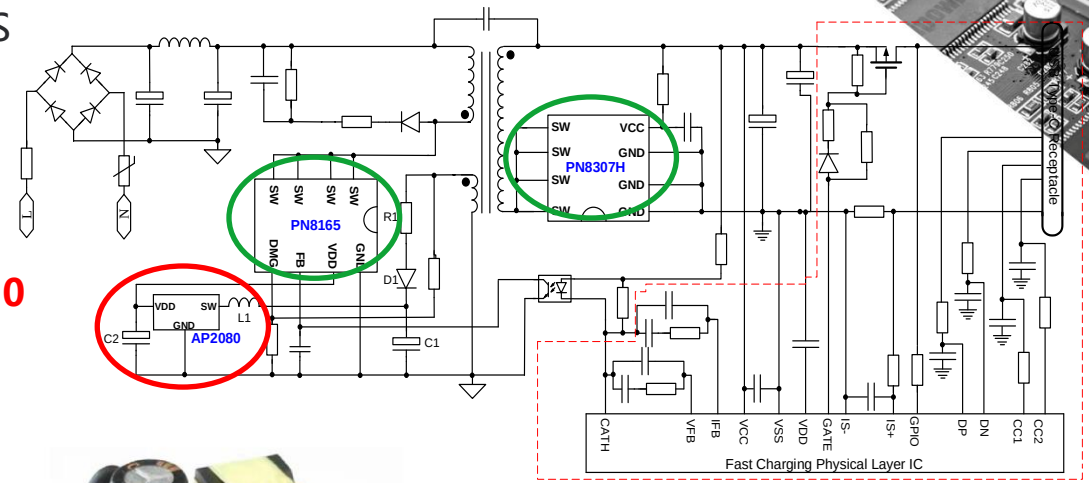


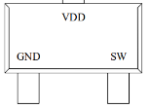
Ordering Code	Specification of Built-in MOS
PN8161SE-S1	690V 1Ω
PN8161SE-U1	690V 1.5Ω
PN8161SE-G1	690V 2Ω

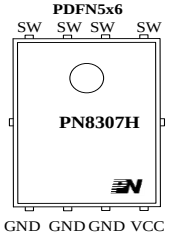
Note: Temperature difference between each gear is about 5°C, seamless compatibility (may fine-tune 1 feedback resistor);

3. 35W Full Integrated solution： PN8165+PN8307H

- Built-in 650V0.55Ω intelligent super junction MOS, no external start and CS resistor, easy wiring;
- Pure QR control mode, low voltage stress, excellent EMC performance;
- **Achieve the simplest solution 3.3V-20 V PD output(Optical);**
- SR built-in 100V/10mohm Smart SGT, the most streamlined in the industry, and significantly improves the ESD capability of the system;
- Primary and secondary sides are packaged with PDFN5*6, which significantly improves the power density of the solution;

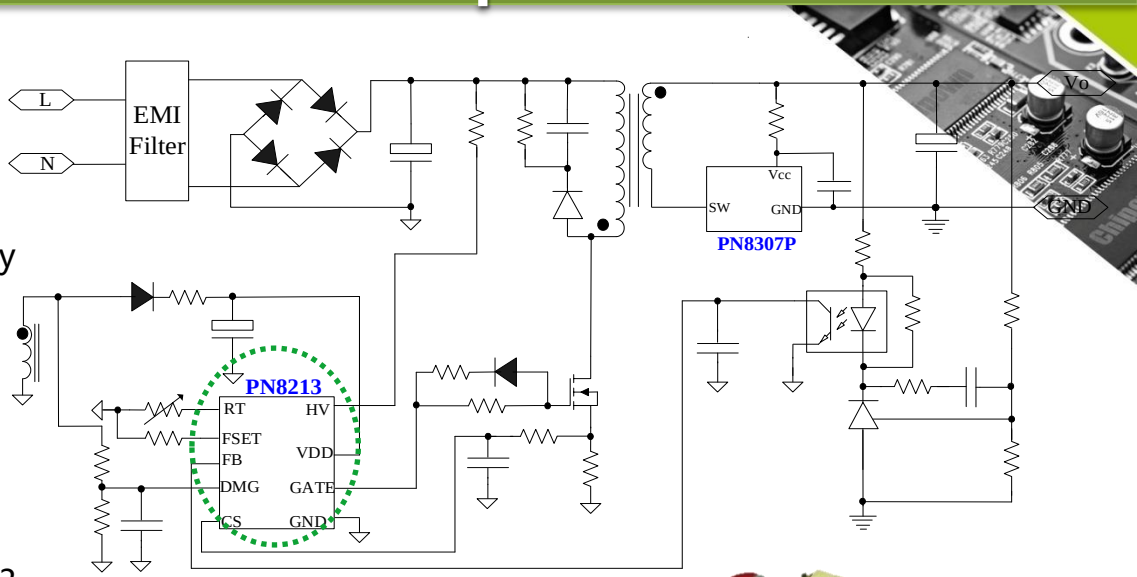




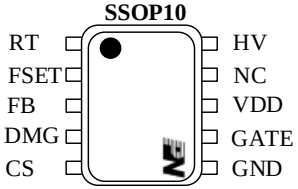


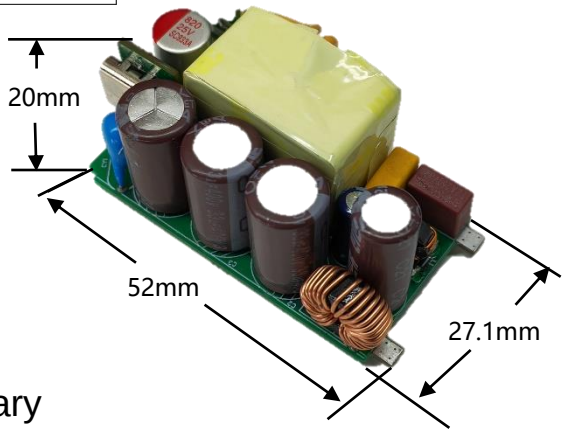
4. QR-lock controller for 1342 seamless replacement: PN8213

- QR-lock technology: maximum frequency is 500kHz, 100% compatible with overseas competitive product;
- Integrated 800V high voltage start: 75mW standby can be easily achieved, and the ability to resist power grid fluctuations is stronger;
- QR-Lock + PFM + Burst hybrid mode: conversion efficiency of 25% load is better;
- More compact on the periphery: Wide power supply range can remove external LDO; Only 3 peripherals are needed for DMG;
- Excellent comprehensive protection functions: In addition to conventional protection such as OTP, the mains BNO protection escorts the saf e operation of the power supply.



PN8213ST-A1



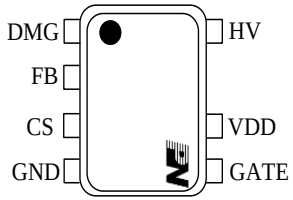


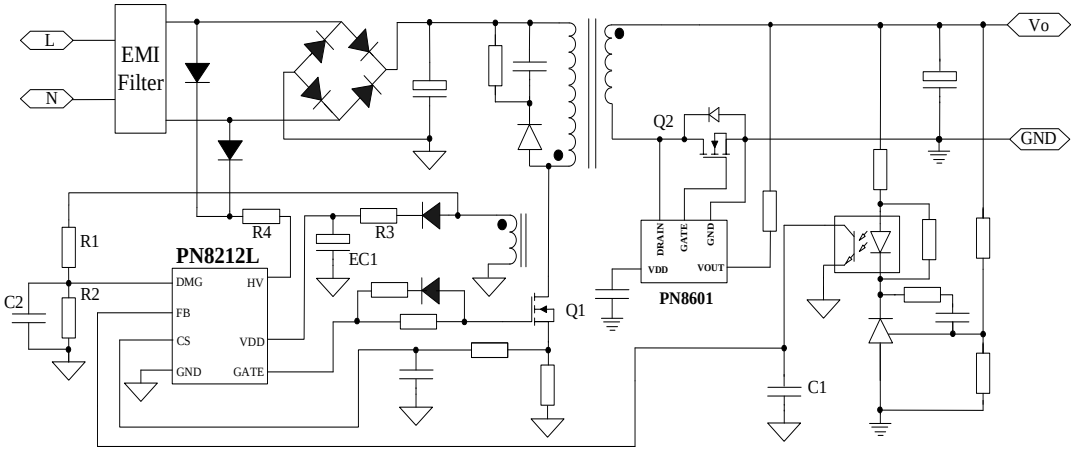
5. QR-lock controller with AC protection：PN8212L

- QR-lock technology: maximum frequency is 130kHz;
- Integrated 800V high voltage start: 75mW standby can be easily achieved, and the ability to resist power grid fluctuations is stronger;
- QR-Lock + PFM + Burst hybrid mode: conversion efficiency of 25% load is better;
- More compact on the periphery: Wide power supply range can remove external LDO; Only 3 peripherals are needed for DMG;
- Excellent comprehensive protection functions: In addition to conventional protection, AC OV P+BNO dual protection for power supply safe operation;

PN8212LST-A1

SOP7





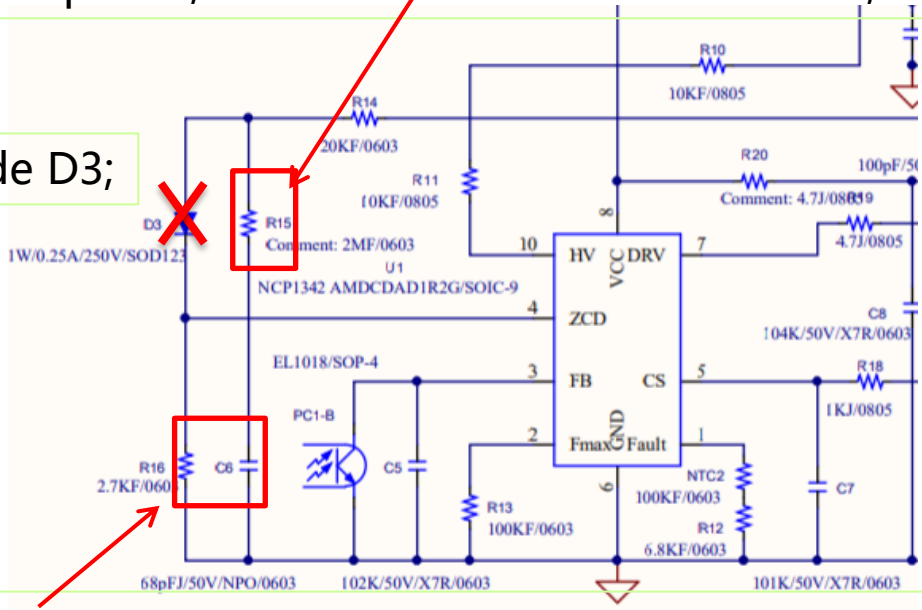
6. PN8212/3 Comparison table with overseas competitors

Item	PN8212/3	overseas competitors
Vcc_Max ☺	60V	30V
HV_Min ☺	800V	700V
Periphery of DMG ☺	3pcs	5pcs(more 1pcs diode and resistor)
conversion efficiency ☺	higher(high 1% in 1/4 load)	high
AC Protection ☺	AC BNO/OVP，Suitable for universal	ACBNO
Overload	Delay 120ms, capacity of capacitive load is strong;	Delay 160ms, capacity of capacitive load is strong;

7. PN8213 Replacement of Overseas Competitive Products
100W Fast Charge Case: One deletion and three fine-tuning

Fine-tuning (1) : In order to ensure the consistency of high and low OCP points, R15 is modified from 2M to 39K;

Delete: Remove diode D3;

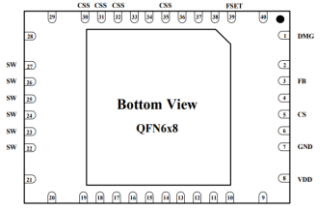


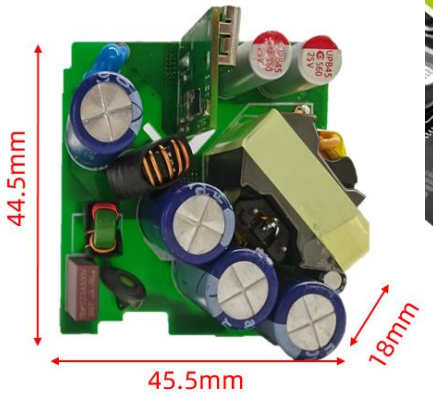
Fine-tuning (2-3) : To set the output voltage OVP point, the R16 is modified from 2.7k t o 10k and the C6 capacity is reduced to 22pF;

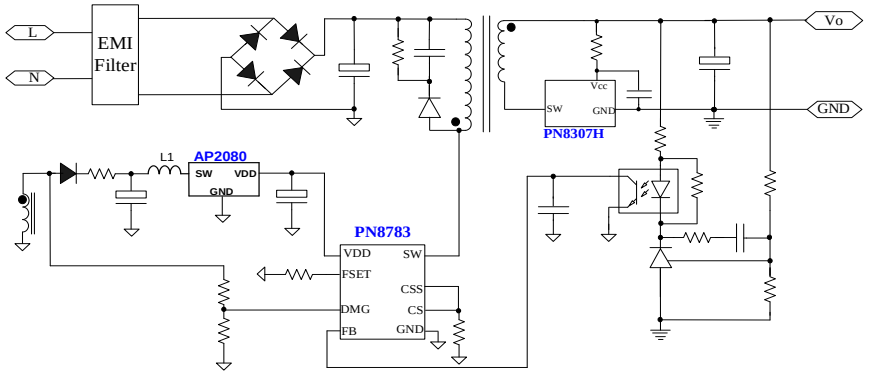
8. 65W Integrated GaN Solution: PN8783

- Highly integrated: Built-in high-performance 750V GaN HEMT, typical conversion efficiency is up to 93 %, improve the charger power density;
- High power density: QR-Lock technology, support 500kHz operating frequency (can be set by resistor), reduce the volume of transformer and output capacitance;
- Ultra-low standby power consumption: built-in high voltage start tube, standby power consumption is less than 75mW;
- Ultra-high reliability: The drive circuit is optimized for GaN characteristics to prevent GaN mis-opening and reduce peak voltage of synchronous rectifier;
- Excellent EMC performance: jitter frequency technol ogy improves conduction EMC; Multi-segment drive reduces dV/dt and improves radiation EMC.

PN8783QF-A1







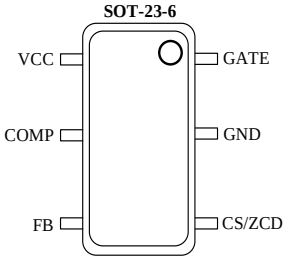
9. PFC Cost-effective Solution： PN8282

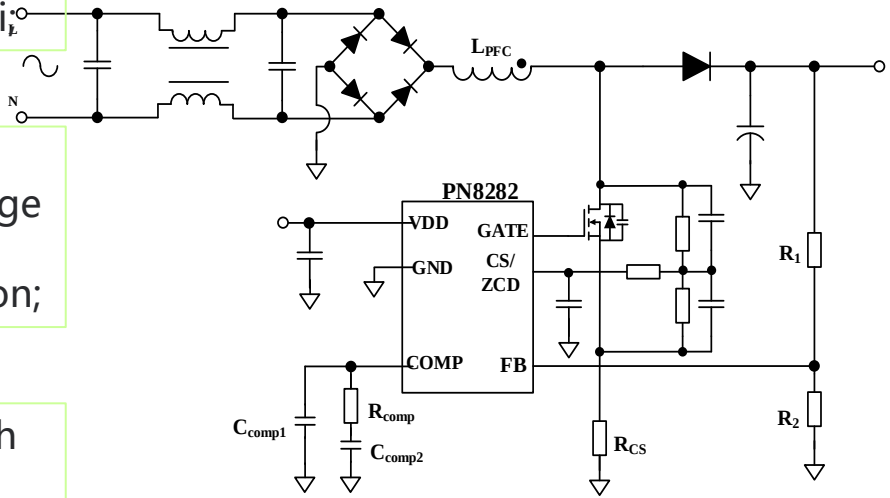
High cost performance: Save auxiliary winding of ZCD, and can externally adjust zero crossing time to achieve accurate valley opening;

Excellent THDi index: Adaptive adjustment of Ton time near AC crossing zero, optimize THDi;

Rich protection features: system overvoltage protection (SOVP) and fast dynamic overvoltage protection (DOVP), cycle by cycle overcurrent protection, on-chip overtemperature protection;

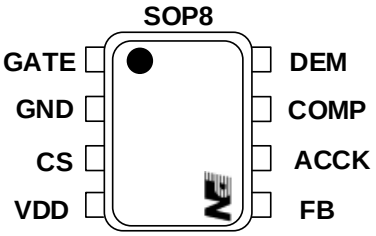
Universal Pin, easy promotion: compatible with **LD7593**;

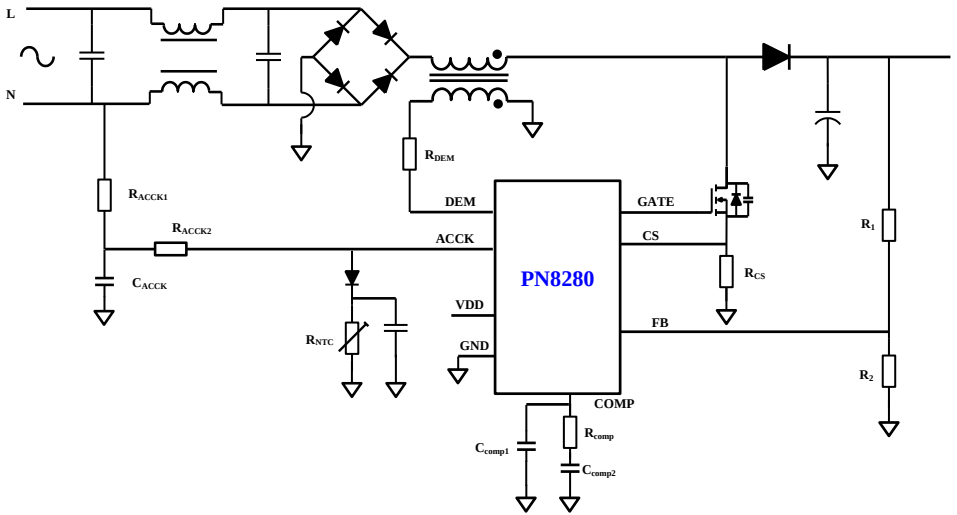




10. PFC High Reliability Solution： PN8280

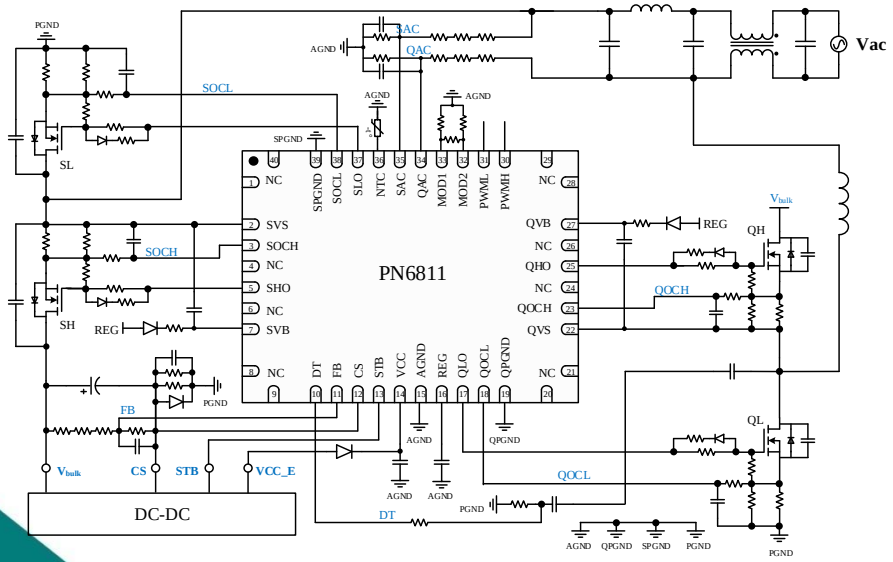
- Wide power supply range: 8V-60V for PD applications;
- Excellent EMC performance: the maximum frequency is limited to 150kHz, simplify the difficulty of EMC design;
- COT control: Built-in input feedforward in order to improve the consistency high and low voltage dynamic;
- Rich protection features: AC undervoltage protection, external OTP protection (ACCK);
- Universal Pin, easy promotion: compatible with **TEA19162;**





11. PFC High Power Density Solution：PN6811

PN6811 is a highly integrated Totem pole bridgeless PFC control chip. COT control, the system works in CRM/DCM state. Peripheral simplification, omit the rectifier bridge to improve efficiency and reduce heat, very suitable for high efficiency and high power density requirements, it is recommended that the power in the full input voltage range of 90W~400W.



Product feature

Support the maximum frequency of 135KHz, 270KHz, 500KHz, three optional
Built-in high-low MOS tube drive
Constant on-time COT control mode
Triangular current TCM control mode
Built-in loop compensation
Adaptive dead time control
Built-in soft start function
Built-in Burst Mode
Simple Peripheral circuit
Comprehensive protection features, includes the below:

- ✓ VCC undervoltage protection(UVP)
- ✓ Output overvoltage protection(OVP)
- ✓ AC undervoltage protection(BO)
- ✓ Cycle-by-cycle overcurrent protection(CBC)
- ✓ Internal/external overtemperature protection(OTP)
- ✓ Terminal short-circuit protection
- ✓ Surge current protection

12. Full Mode Synchronous Rectifier Controller：PN8601

PN8601 is a synchronous rectifier controller with a drain pin voltage of 120V and a VOUT pin voltage o f 35V. Built-in high voltage start circuit supports the system voltage down to 3V, so PN8601 is suitable for 3.3V-20V wide output applications, and integrates extremely comprehensive auxiliary functions, including power undervoltage protection, anti-false shutdown, anti-false start, and light load mode.

Supports DCM/QR/CCM full-mode work;

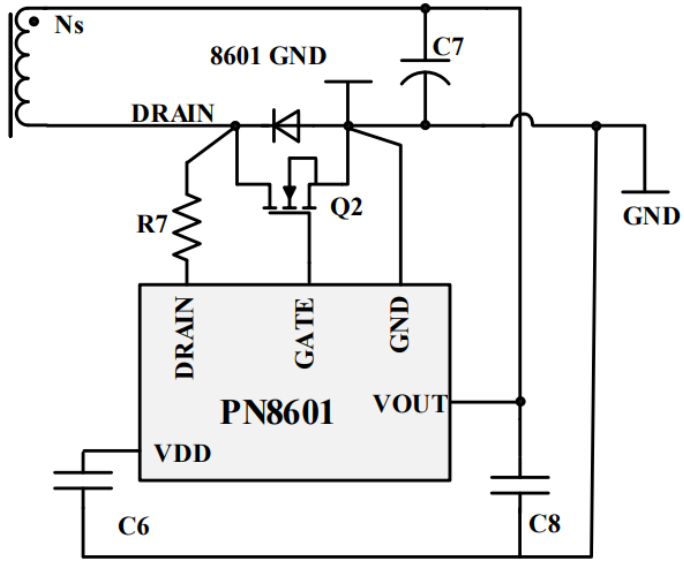
Withstand voltage of Drain 120V,
Withstand voltage of Vout 35V;

•High voltage power supply + output power supply;

Algorithm of preventing ring to trigger false;

Fast shutdown + adaptive dead-time control;

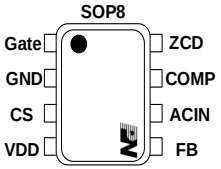
Light load mode;



13. 100W Main scheme：PN8280+PN8213+PN8601+AP2968

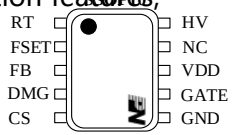
➢ main feature of PN8280

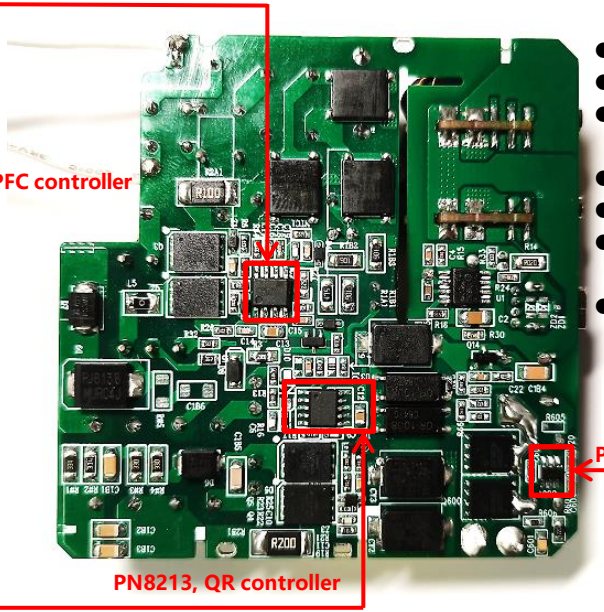
- Wide supply range (9-60V);
- Integrate soft start and soft stop;
- Accurate FB voltage adjustment
- Maximum frequency limit
- Critical mode bottom opens
- Low standby power



➢ main feature of PN8213

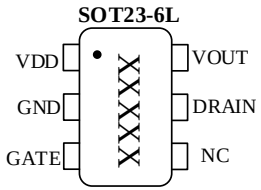
- Built-in high voltage start (800V);
- Wide Supply voltage 9~57V, suitable for wide output voltage;
- QR-lock control technology to improve system stability and noise;
- The maximum frequency can be set externally to meet different requirements;
- Excellent comprehensive protection features;





➢ main feature of PN8601

- Suitable for CCM and DCM;
- Adaptive dead-time control;
- High voltage self-power supply technology;
- Light load mode;
- Quickly shutdown;
- Suitable for wide output voltage range 3.3V~20V;
- SOT23-6 package;



14. Summary

20W solution: Recommended PN8161SE-G1+PN8307H, configure with cost-effective protocol AP5811, Q3 release;

65Wsolution: Shortage of 1342 will still continue, search for PN8213 (one deletion and three fine-tuning) replacement opportunities; The new design-in focuses on the PN8783+PN8307H total solution, and the price of total solution is attractive;

100W solution: PN8280/PN8282+PN8212/PN8213/PN8783+PN8601+AP2968 total solution, high investment and high return;

芯朋微电子
Chipown
高性能电源及驱动芯片

THANKS!

www.chipown.com

官 方 微 信