FOR ENERGY EFFICIENT INNOVATIONS

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65W GaN System Flyback 电源适配器

Reporter： Jiam Zhu

Public Information

日常生活实景

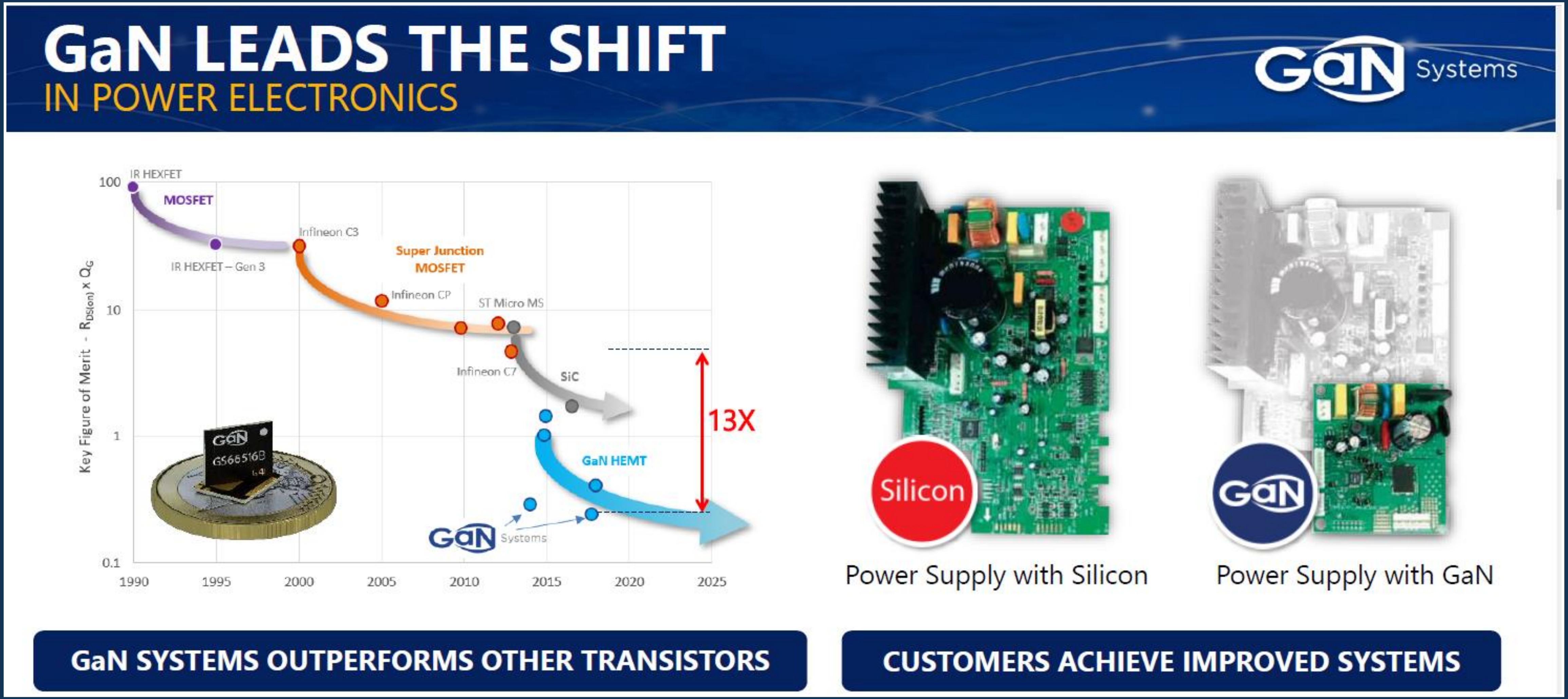
YOSUN 友尚集团

ON

多口充电,尺寸小


黑科技 更有料
【GaN】中文名【氮化镓】是一种新型半导体材料，它具有禁带宽度大、热导率高、耐高温、抗辐射、耐酸碱、高强度和高硬度等特性。采用GaN氮化镓元件，充电器不仅仅可以做到体积小和重量轻，在发热量和效率转换上相比普通充电器也更具优势。
【GaNFast】充电技术使得移动充电器在保持与传统充电器相同的外壳尺寸情况下，充电速度提高达5倍。现有的慢速、笨重的硅基充电器设计正在迅速被GaNFast设计取代，因为GaNFast技术固有的能力可以将开关速度提高100倍，减少元器件并增加功率输出以实现快充，是时候使用GaNFast了！
更优温控

WHY GaN PD?


GaN LEADS THE SHIFT
IN POWER ELECTRONICS
GaN Systems
Key Figure of Merit - $R_{DS(on)} \times Q_G$
100
10
1
0.1
IR HEXFET
MOSFET
IR HEXFET – Gen 3
Infineon C3
Super Junction MOSFET
Infineon CP
ST Micro M5
Infineon C7
SiC
GaN HEMT
13X
GaN Systems
GS66516B
1990
1995
2000
2005
2010
2015
2020
2025
Silicon
GaN
Power Supply with Silicon
Power Supply with GaN
GaN SYSTEMS OUTPERFORMS OTHER TRANSISTORS
CUSTOMERS ACHIEVE IMPROVED SYSTEMS

功率密度高

200W Adapter

- Workstation & Gaming laptop
- 3x power density with GaN

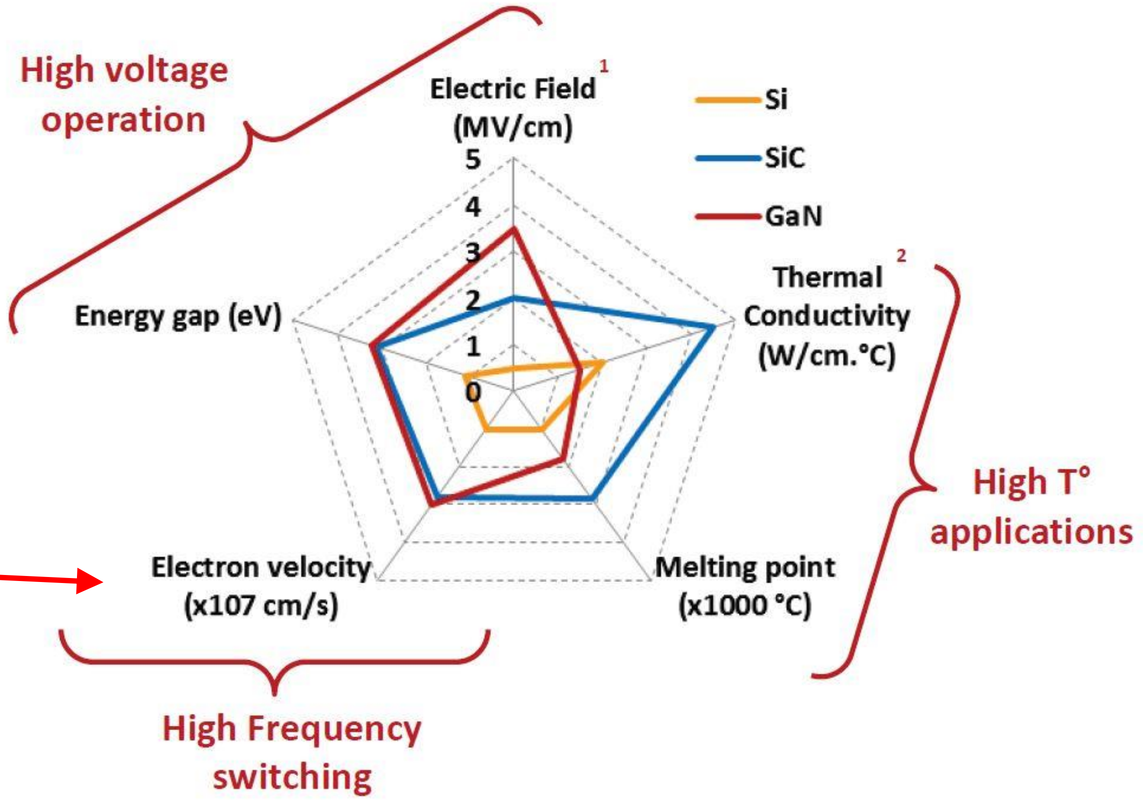
65W Adapter

- Laptop computer
- 5x power density with GaN

COST 更低

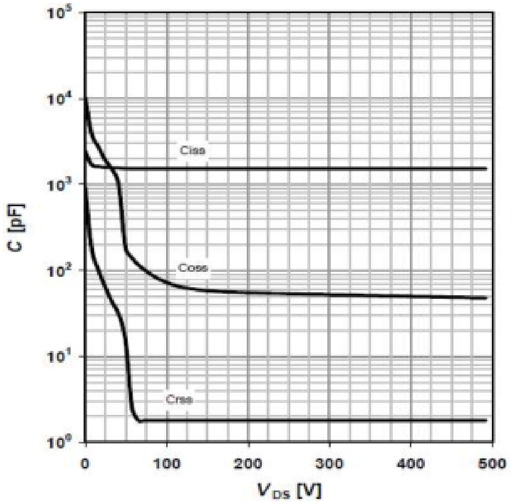
GaN特性比较

Properties	Si	4H-SiC	GaN
Bandgap Energy (eV)	1.12	3.26	3.50
Electron Mobility (cm^2/Vs)	1400	900	1250
Hole Mobility (cm^2/Vs)	600	100	200
Breakdown Field (MV/cm)	0.3	2.0	3.5
Electron Velocity ($10^7 cm/s$)	420	1800	4375
Thermal Conductivity (W/cm°C)	1.5	4.9	1.3
Maximum Junction Temperature (°C)	150	600	400

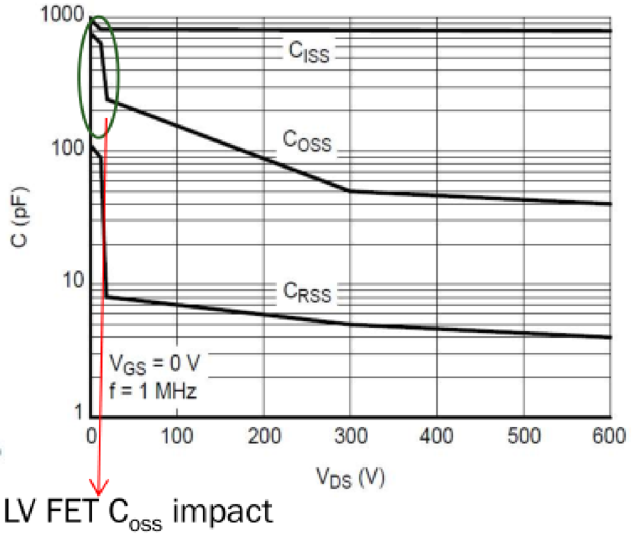


Electron velocity=Electron mobility x Breakdown field

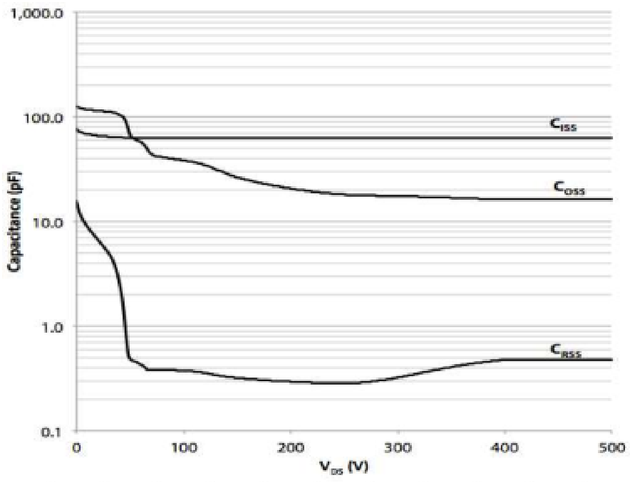
GaN 输出电容比较



200 mΩ SJ FET



NTP8G206-N
150 mΩ Cascoded GaN HEMT



GS66502B
200 mΩ eGaN HEMT

SJ FET C_{oss} > 10x Cascoded GaN C_{oss}

Cascoded GaN C_{oss} > 4x eGaN

- 越小的coss就越容易在高频率下实现谐振拓扑
- 越小的coss也可以大大减少实现ZVS的电流损耗。

安森美GAN驱动芯片 NCP1342 主要特性简介

- 高频率准谐振反激控制芯片
- 支持8pin与9pin的2种封装
- 集成了HV pin，里面同时集成了BO与X2电容放电功能
- NCP1342有波谷锁定功能，最多6个波谷锁定。
- 最小工作频率（26KHz）的钳制和安静跳模式
- 空载功耗 < 30 mW @ 265 Vac
- 频率抖动以减小EMI干扰
- 频率反走以及MPCM（最小峰值电流调制）功能来减少开关次数提高轻载效率

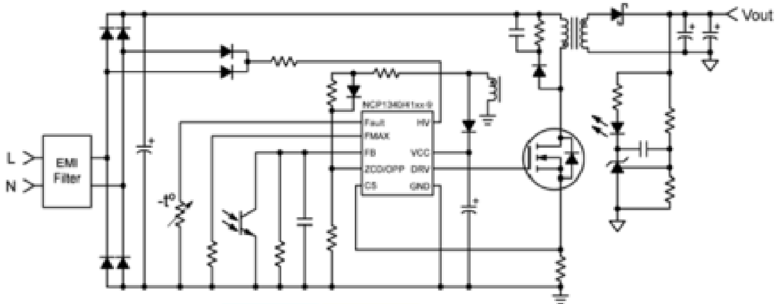
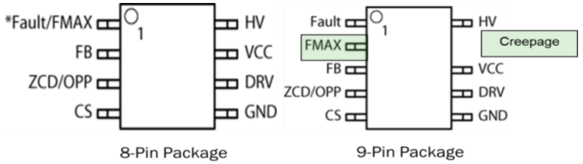
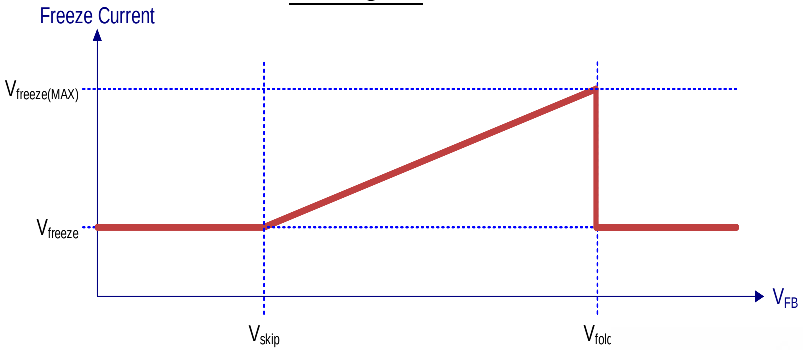


Figure 4: NCP1342xx-9/NCP1343xx-9 Typical Application Circuit

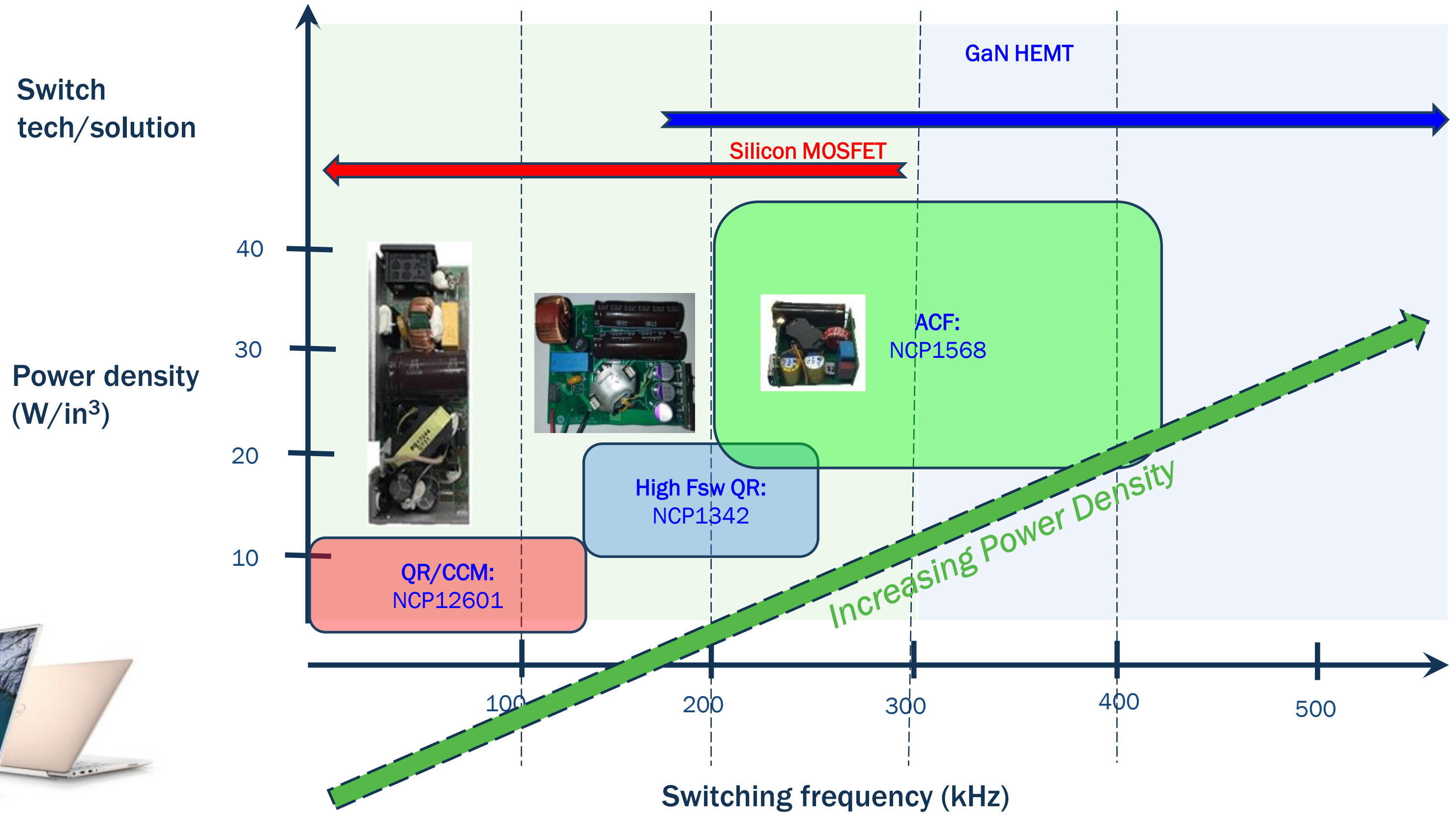


MPCM



安森美半导体150W以下高密度USB-PD电源主打方案

- 主推：高频率准谐振的NCP1342和有源钳位的NCP1568
- 集成了各种保护功能使外围设计简化，使整个方案高性价比

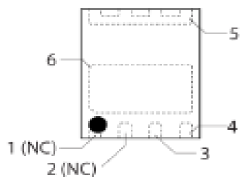


GS-065-011-1-L
Bottom-side cooled 650 V E-mode GaN transistor
Preliminary Datasheet

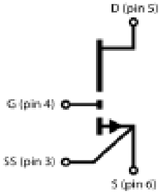
Features

- 650 V enhancement mode power switch
- Bottom-side cooled
- $R_{DS(on)}$ = 150 mΩ
- $I_{DS(max)}$ = 11 A
- Small 5x6 mm PDFN package
- Easy gate drive requirements (0 V to 6 V)
- Transient tolerant gate drive (-20 V / +10 V)
- Very high switching frequency (> 10 MHz)
- Fast and controllable fall and rise times
- Source Sense pad for optimized gate drive
- Reverse current capability
- Zero reverse recovery loss
- RoHS 6 compliant

Package Outline



Circuit Symbol



Applications

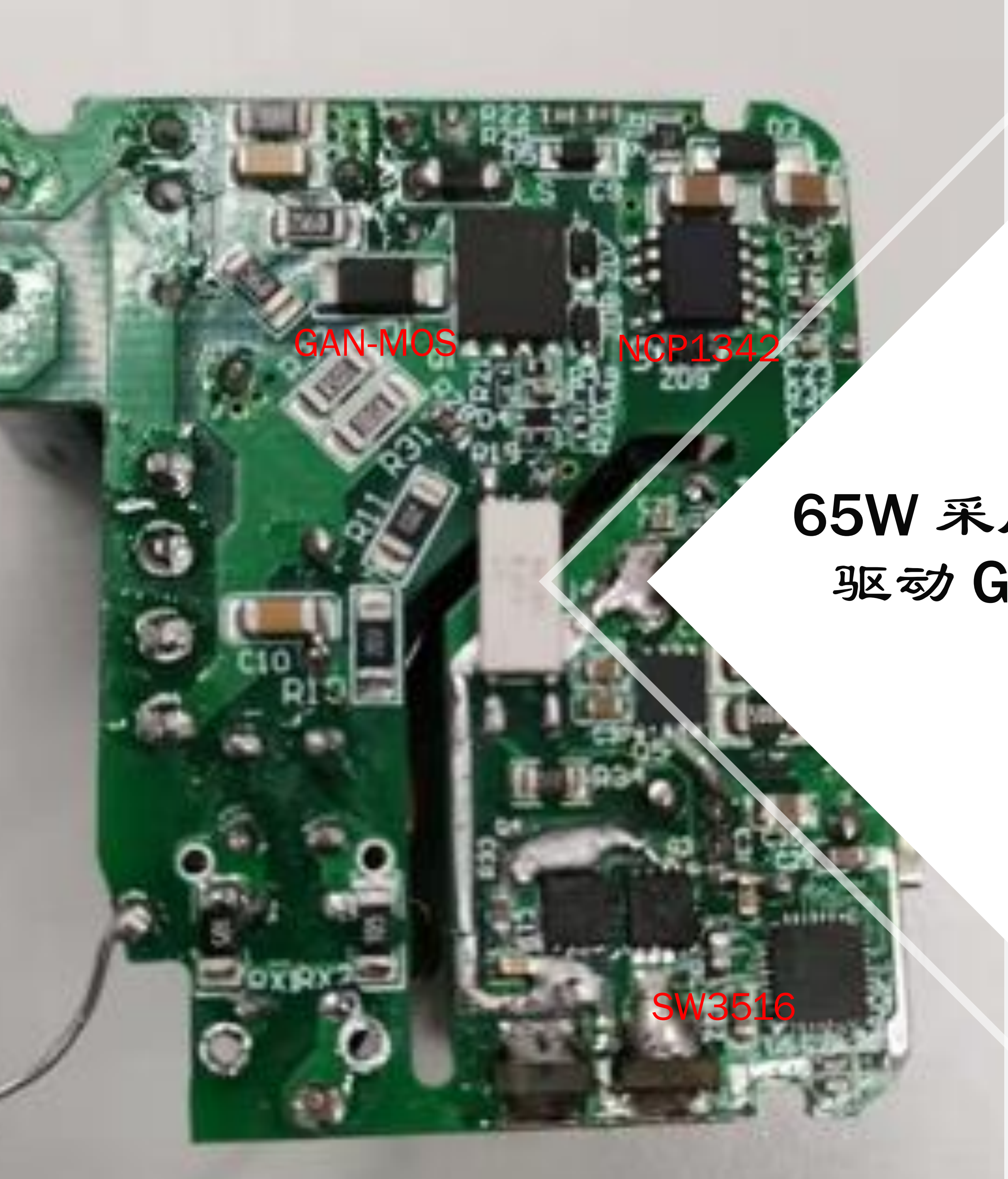
- Power Adapters
- LED lighting drivers
- Fast Battery Charging
- LLC Converters
- Power Factor Correction
- Appliance Motor Drives
- Wireless Power Transfer
- Industrial power supplies

Description

The GS-065-011-1-L is an enhancement mode GaN-o
silicon power transistor. The properties of GaN allow
high current, high voltage breakdown and high swi
frequency. The GS-065-011-1-L is a bottom-side
transistor that offers low junction-to-case
resistance. These features combine to provi
efficiency power switching.

Public Information

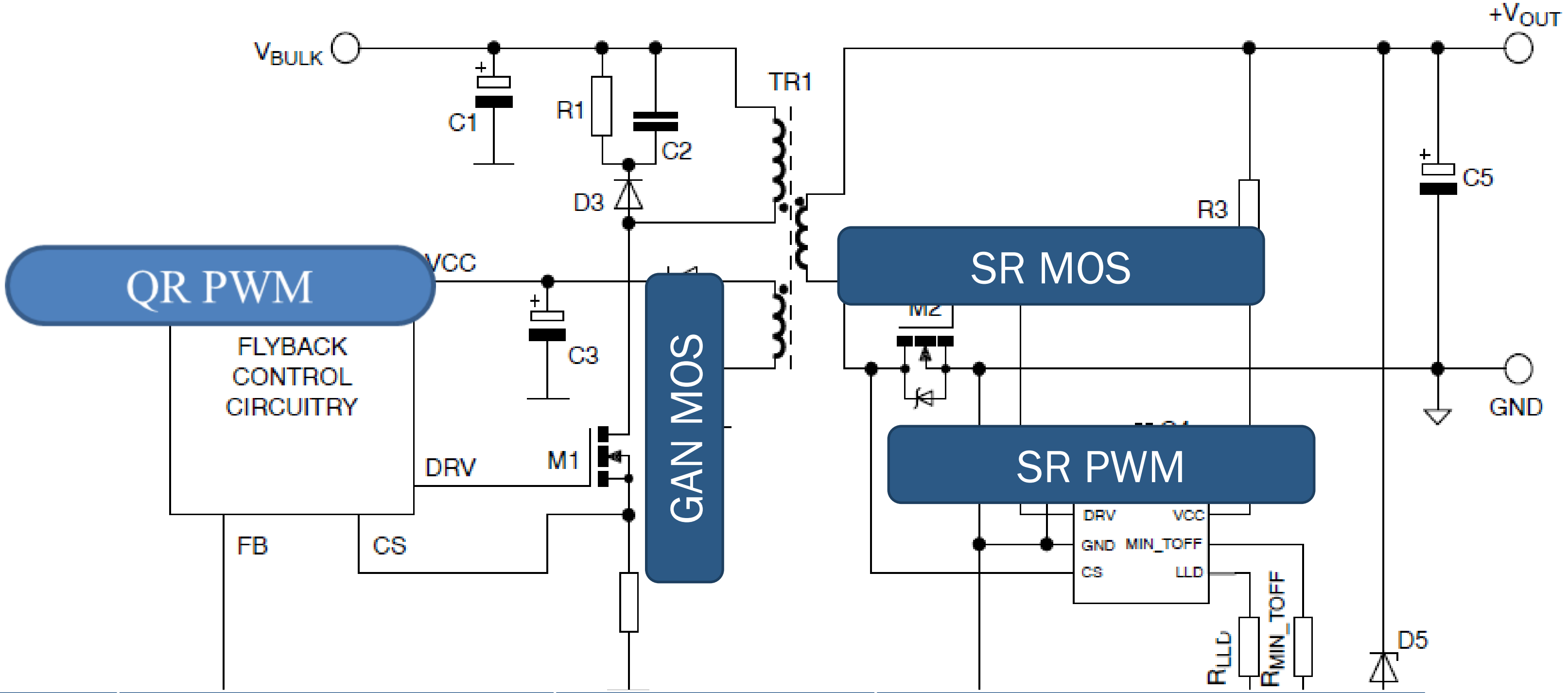
GaN Transistor



65W 采用 NCP1342 驱动 GS-065-011

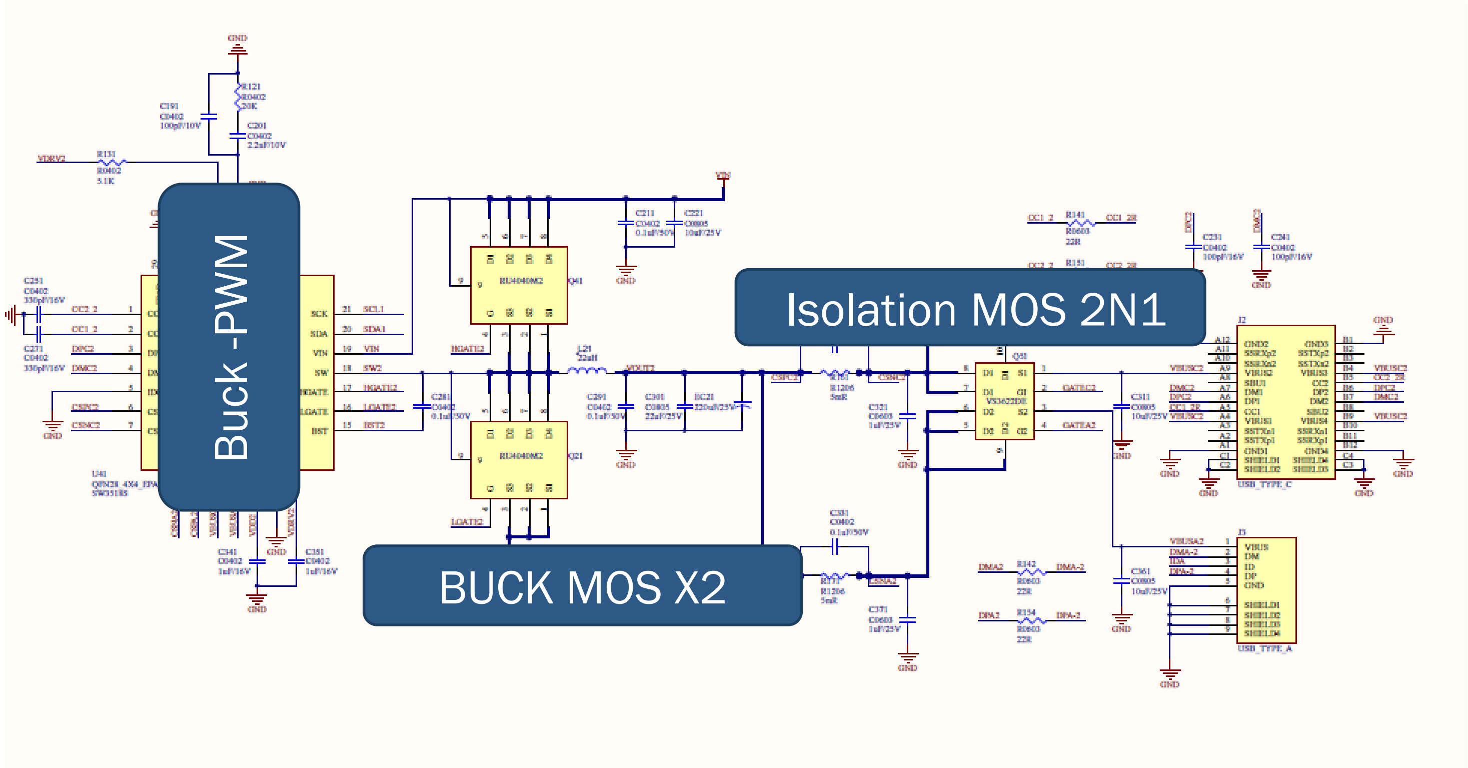
GaN-65W PD 电源优势

65WPD快充电源AC to DC 原理图



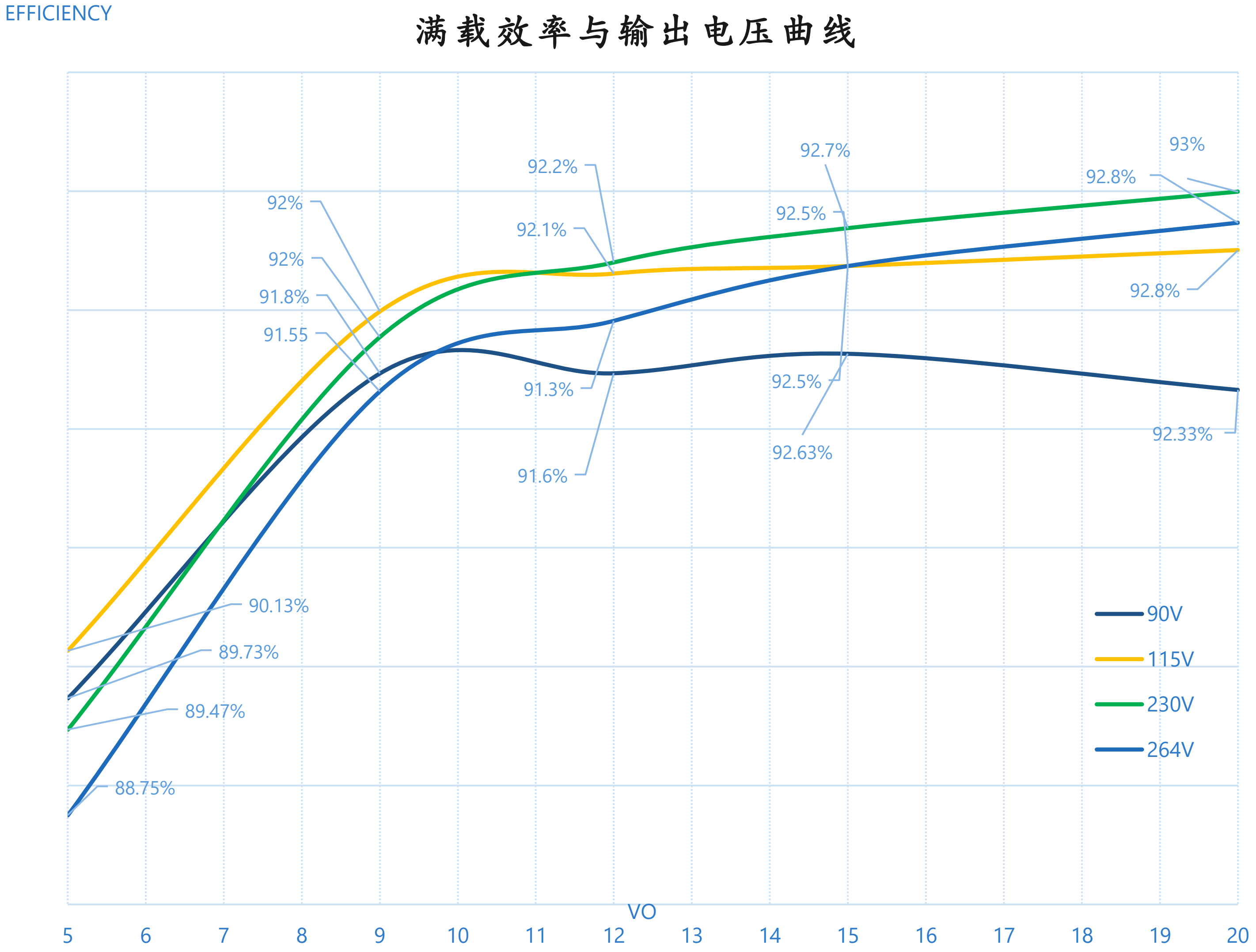
Block	Device	Block	Device
PWM	NCP1342AMDCDD1R2G	SR-MOS	FDMS86181
GaN MOS	GS-065-011	SR-PWM	NCP4306

65WPD快充电源DC to DC 原理图



Block	Device	Block	Device
PWM	SW3516H	DC/DC-MOS	NTTFS4C10NTAG*2
ISO MOS	FDMC8032L		

效率曲线


EFFICIENCY
满载效率与输出电压曲线
92.2%
92.7%
93%
92.8%
92%
92.1%
92.5%
92%
91.8%
92.8%
91.55
91.3%
92.5%
92.33%
92.63%
91.6%
90.13%
89.73%
89.47%
88.75%
90V
115V
230V
264V
VO
5
6
7
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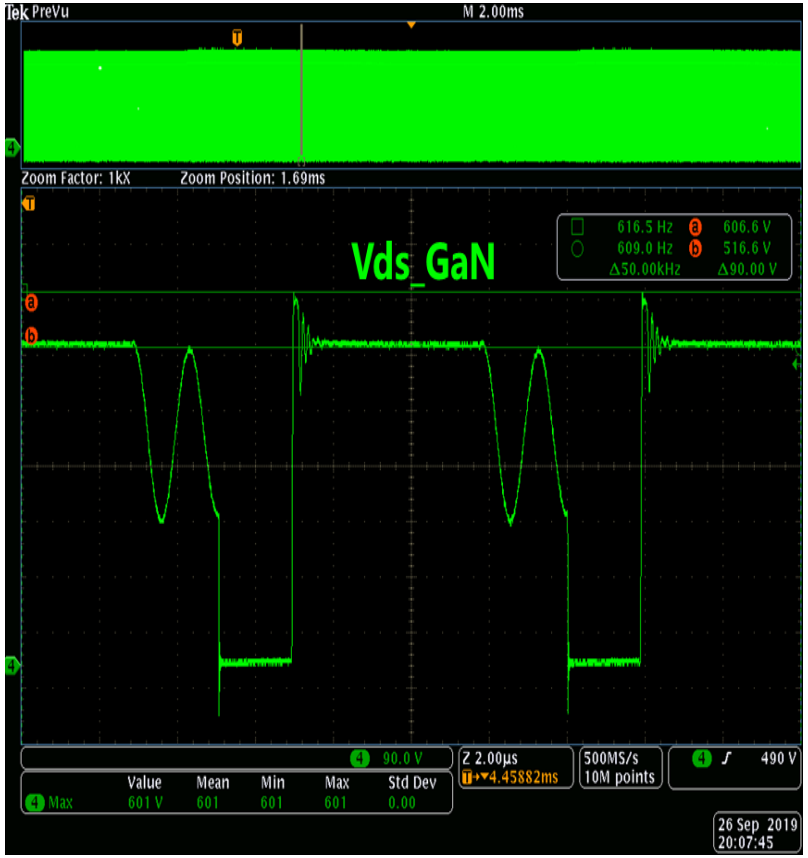
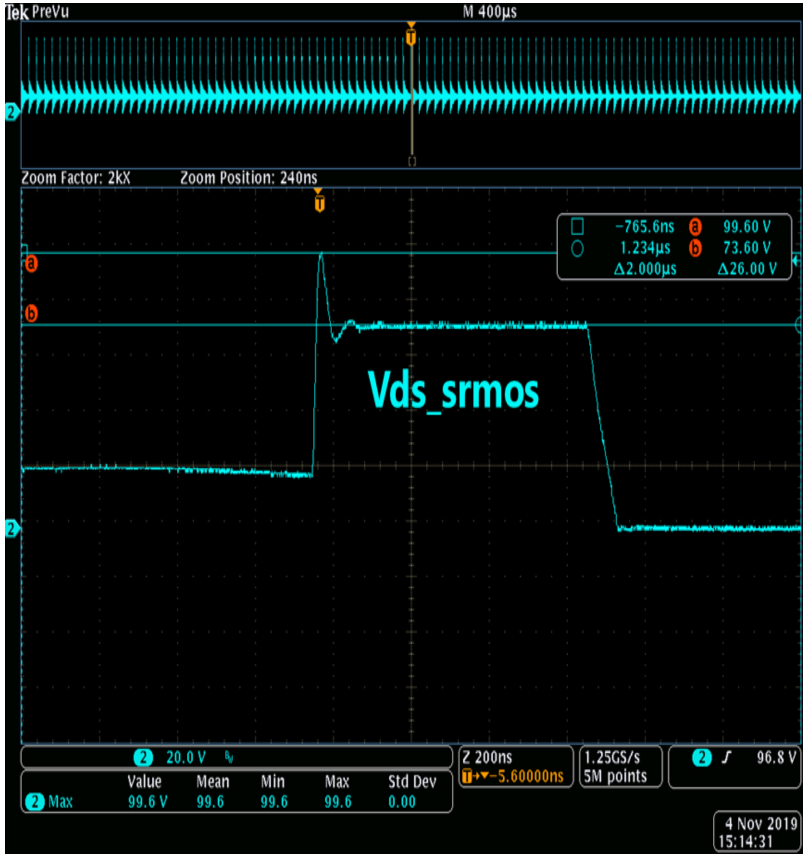
20

最大电压应力测试波形

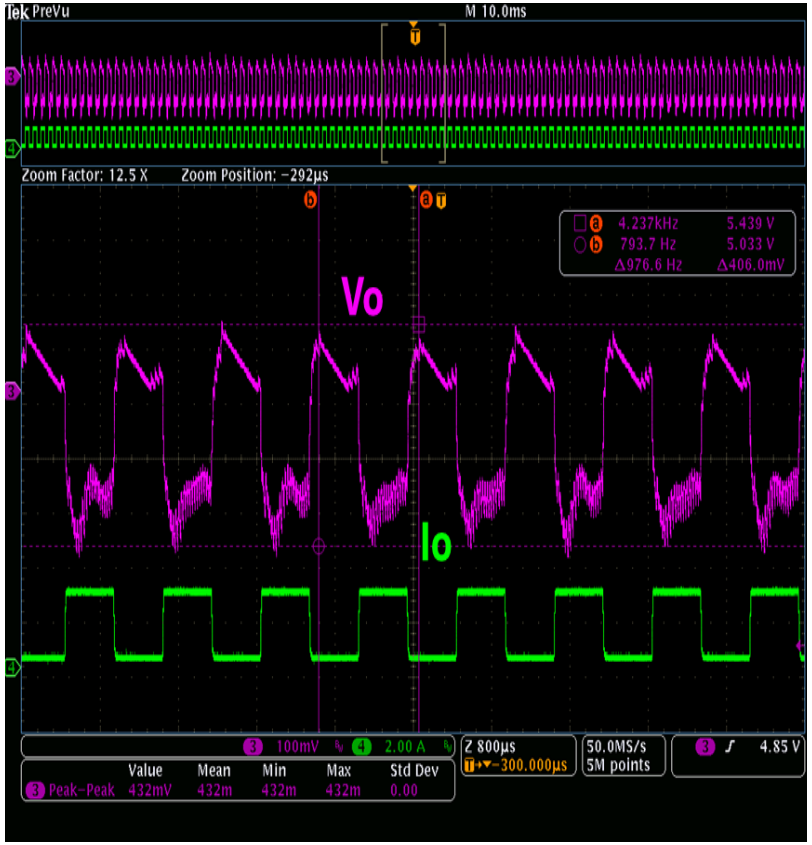


测试条件：Vin=264Vac，满载输出
测试结果：Vds_max=601V

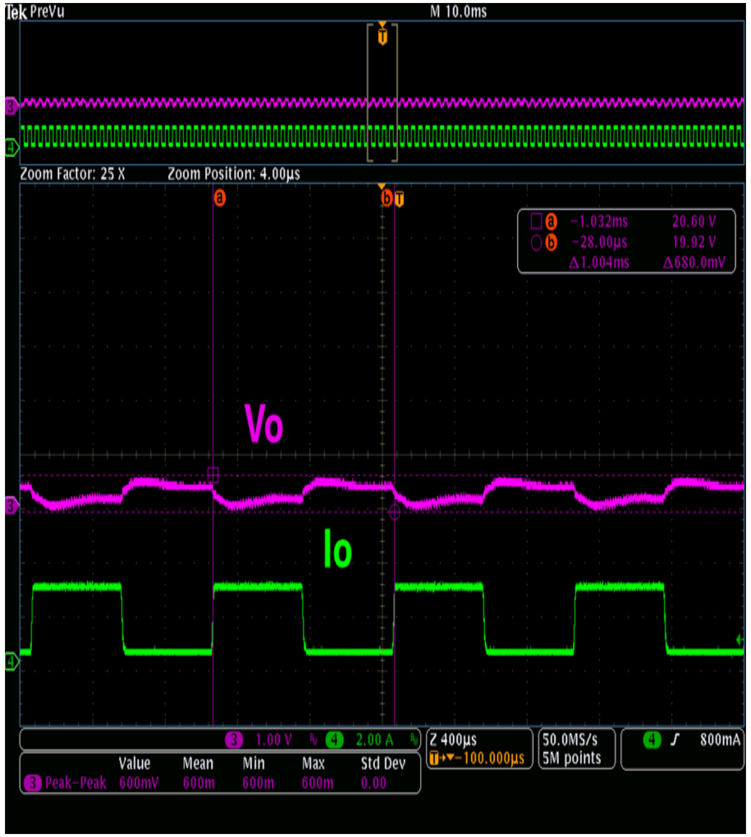


测试条件：Vin = 264Vac，轻载输出
测试结果：Vds_max=86V

动态测试波形

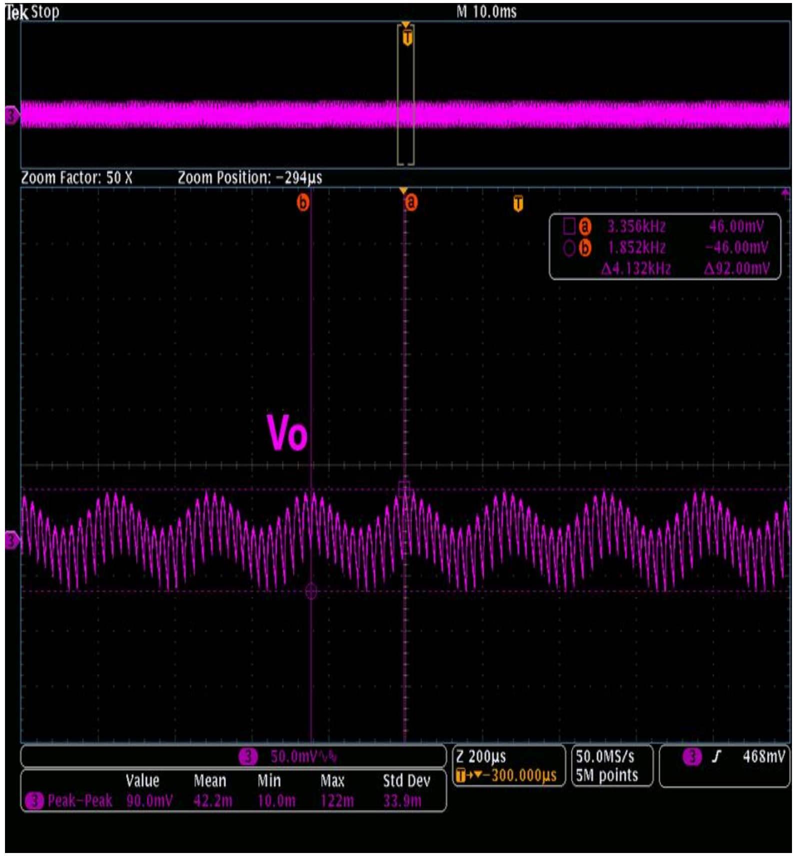


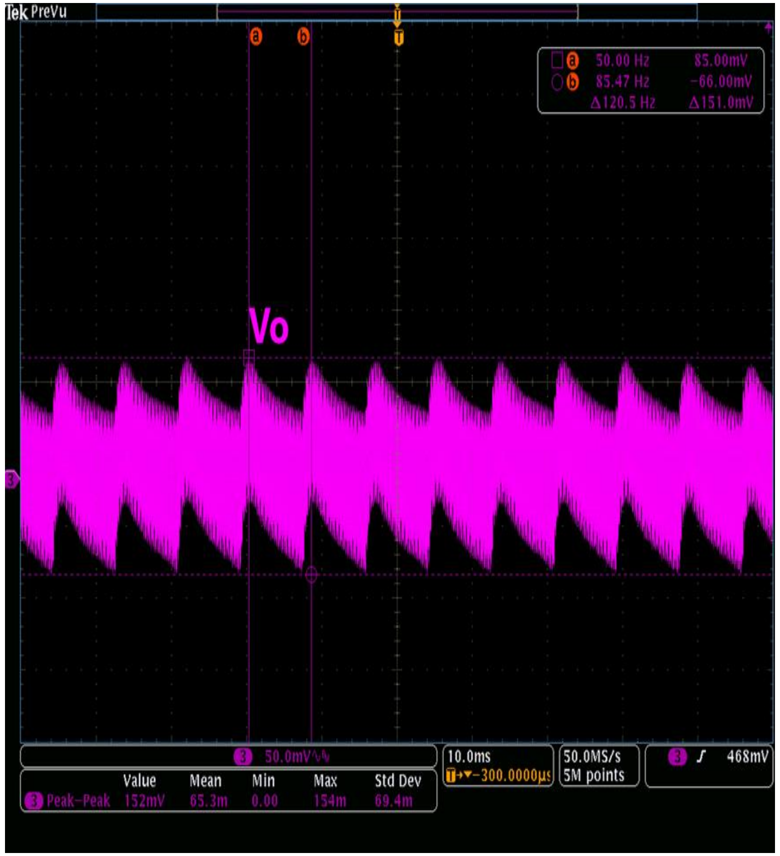
测试条件： Vin=115Vac，Vout=5V
10%~90%load，0.25A/us，T1=T2=0.5ms
测试结果： 纹波峰峰值<10%



测试条件：Vin=115Vac，Vout=20V
10%~90%load，0.255A/us，T1=T2=0.5ms
测试结果： 纹波峰峰值<10%

纹波测试波形





测试条件：Vin:90Vac Vout:5V，满载
测试结果：输出纹波峰峰值：90mV

测试条件： Vin:90Vac Vout:20V，满载
测试结果：输出纹波峰峰值：152mV

温升测试

测试条件: Input: 100Vac;

Output： 20V/3.25A;25℃

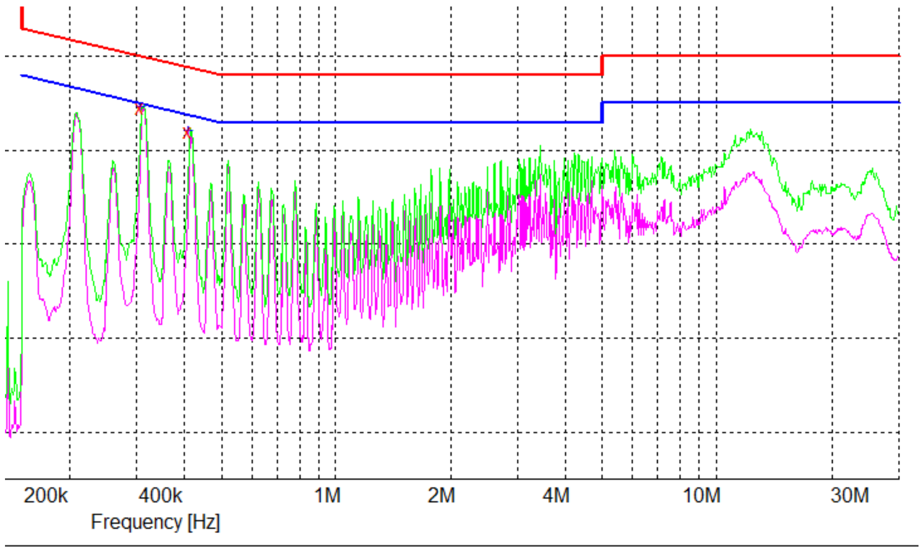
C口支持协议测试

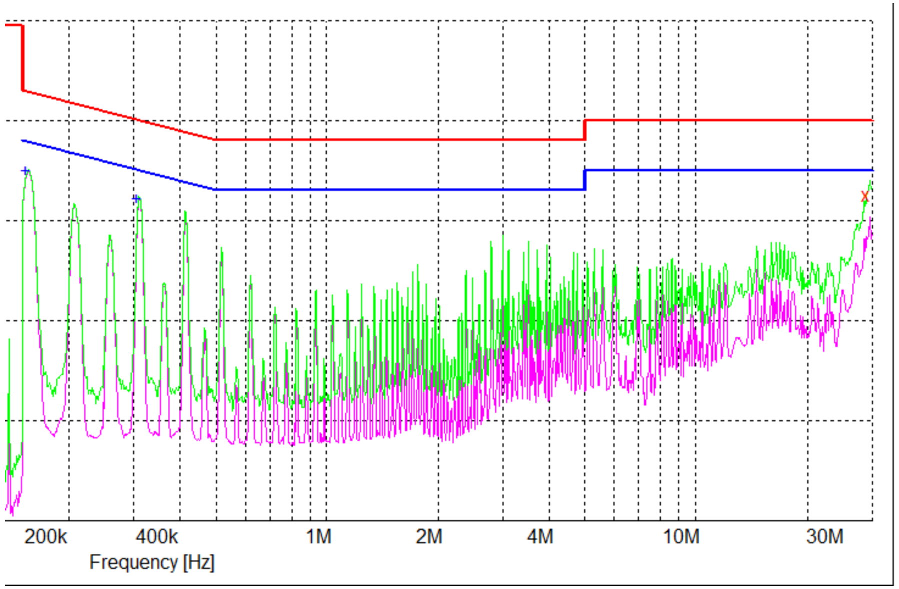
- USB-C输出：
- PPS： 3.3-20V/3A
- PD3.0： 5V/3A、9V/3A、12V/3A、15V/3A、20V/3.25A 65W Max

A口支持协议测试

USB-A口输出：
APPLE5V2.4A;BC1.2DCP 5V1.5A,MTK PE1.1 PE2.0,MTK 2.0

EMI-CE测试





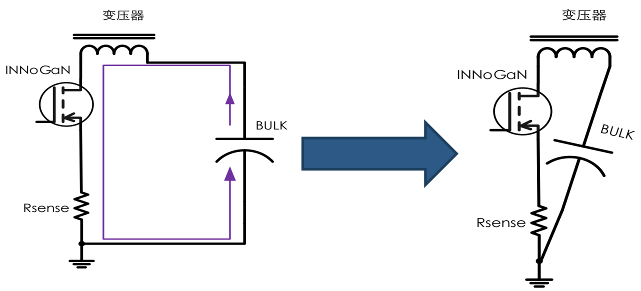
测试条件: Input: 230Vac;
Output：20V/3.25A;L line QP
余量: 5 dB

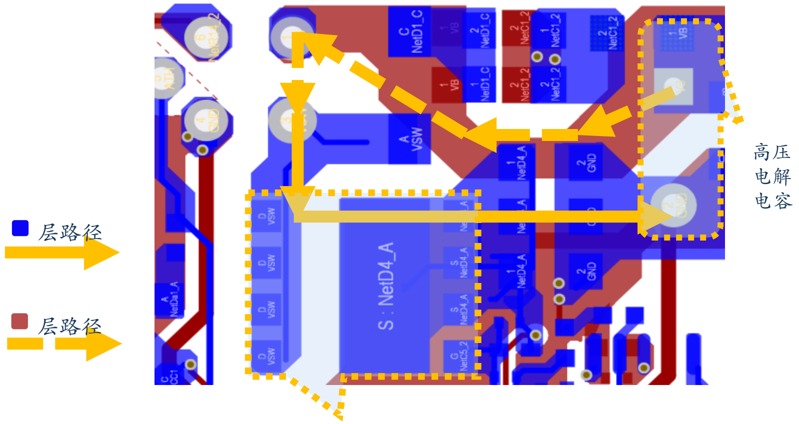
测试条件: Input: 230Vac;
Output：20V/3.25A;N line QP
余量: 6 dB

PCB Layout建议

➢ **主功率回路:**

当GaN®开通，回路电流由高压电解电容正极流进变压器，经过GaN®漏极、源极、再经过Sense 电阻，回流到高压电解电容负极。电流流通整个回路是瞬变的，如果走线太长，开关关断瞬间会产生较大电压尖峰，对应力和EMI带来不利影响，所以要求回路路径尽可能最短，回路面积尽可能最小。

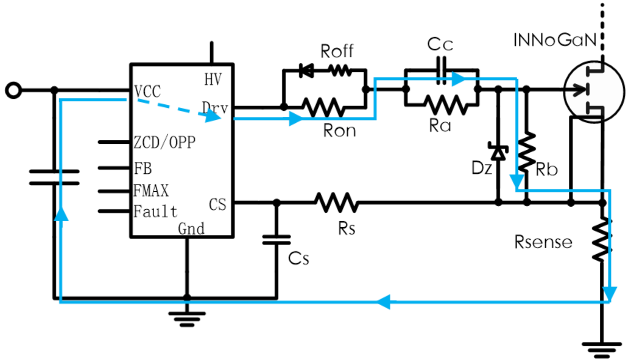


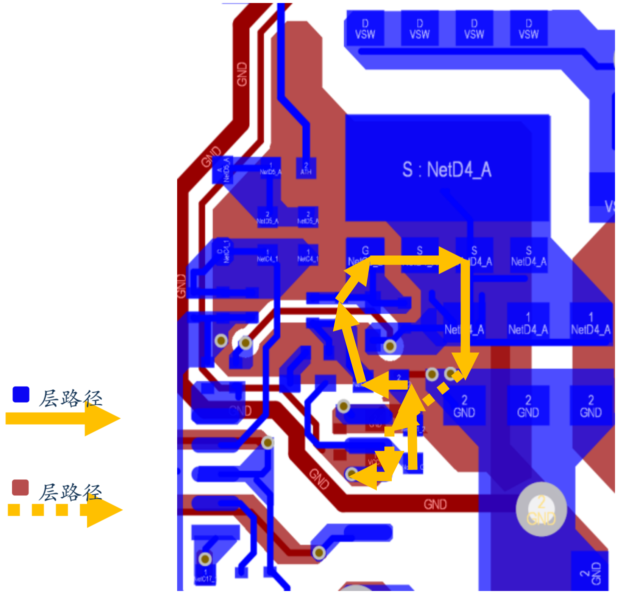


PCB Layout建议

➢ **驱动回路:**

开通回路如下图标记所示，在PCB layout 的时候，尽量让驱动元件靠近氮化镓，缩短驱动路径和减小驱动回路的面积。因为较长的路径和大的回路面积会带来较大的寄生电感， 可能会导致驱动波形存在较大的振铃。





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