

100瓦以上AC/DC USB-PD多口充电器之谐振拓扑+GAN MOS方案: TEA2016/2017 + TEA2095

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SECURE CONNECTIONS
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AGENDA

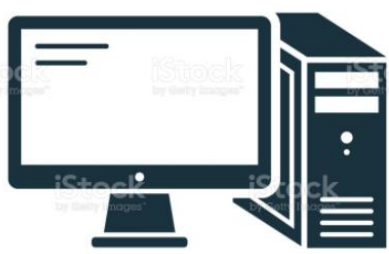
Vincent Chang

- The developing story of TEA1916, 2016 to 2017
- Key unique features of TEA2016/TEA2017 & key performance
- Energy saving regulations
- Use cases TEA2016 & TEA2017 in Multi Port Charger
- NXP LLC Product Portfolio
- Web address of related documents of TEA2017 on NXP web

Peter Deng

- The developing story of PD charger
- Detail introduction of TEA2016/7 key features
- TEA2095 feature of synchronous rectification
- TEA2016/7 user applications

Live Q&A



Regular:200~300W
Peak Power:400~600W



Indoor
Display
Power
5V/40A~80A



TEA2016/17

NEW GENERATION

DIGITAL & PROGRAMMABLE

RESONANT POWER PLATFORM

工业电源

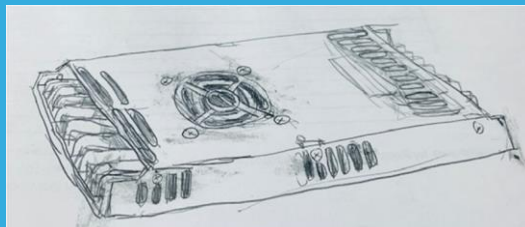
600W



80" TV or
65" OLED TV



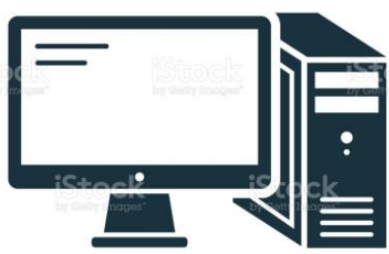
12V/10A~33A



300W

4~20 USB Ports
Charger

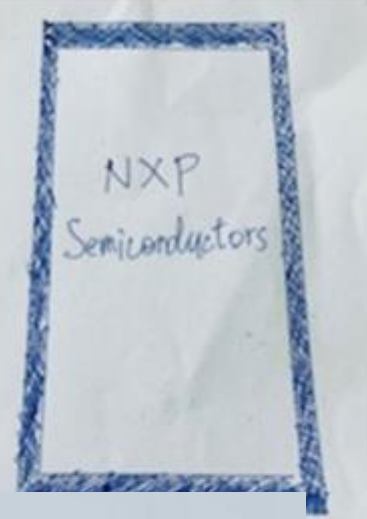
100~400W



Regular:200~300W
Peak Power:400~600W



Indoor
Display
Power
5V/40A~80A



TEA2016/17

NEW GENERATION

DIGITAL & PROGRAMMABLE

RESONANT POWER PLANT



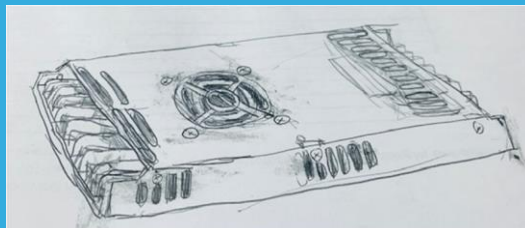
1000W



80" TV or
65" OLED TV



12V/10A~33A



300W

4~20 USB Ports
Charger

100~400W

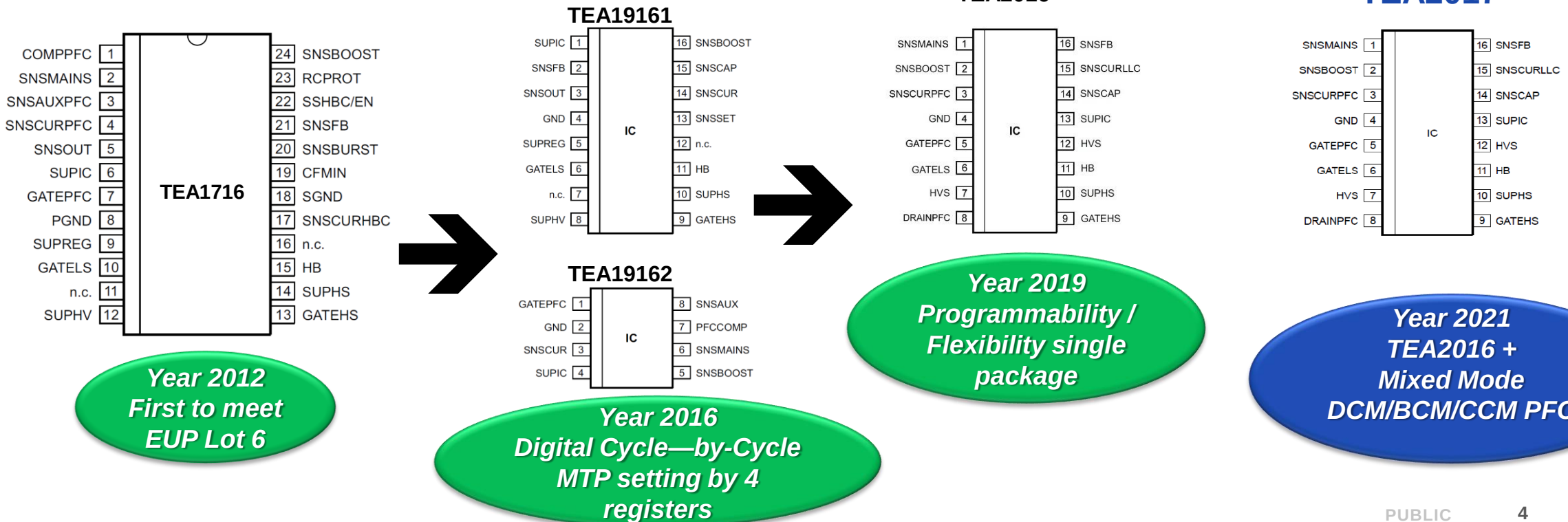


新一代可数字设定PFC + LLC ACDC 电源方案: TEA2016/17

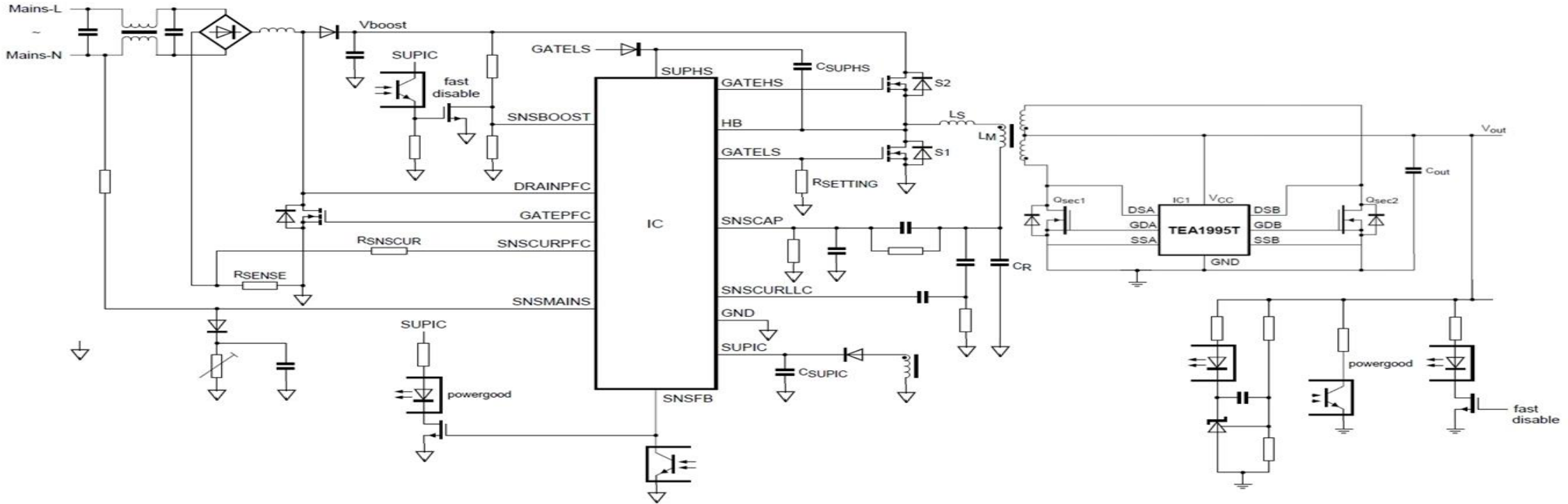
- DCM/QR/CCM Mixed Mode PFC
- Up to 1,400W
- Power Factor, THD and EMI improvement
- High amount of protections, including second independent OVP & inrush current
- High configurability via MTP
- Digital state-machine. **NO FIRMWARE !!**

LLC & PFC in single
SO16 package
MTP settings internal

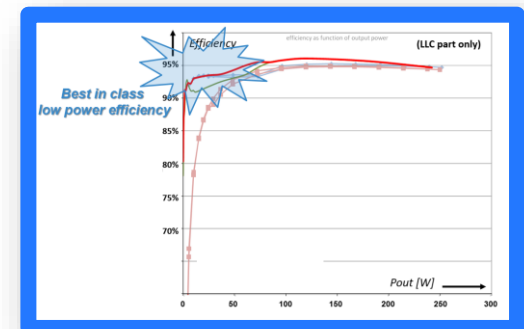
Pin compatible with
TEA2016
SO16 package



TEA2016 APPLICATION – LOW EBOM AND MANY FUNCTIONS INCLUDED



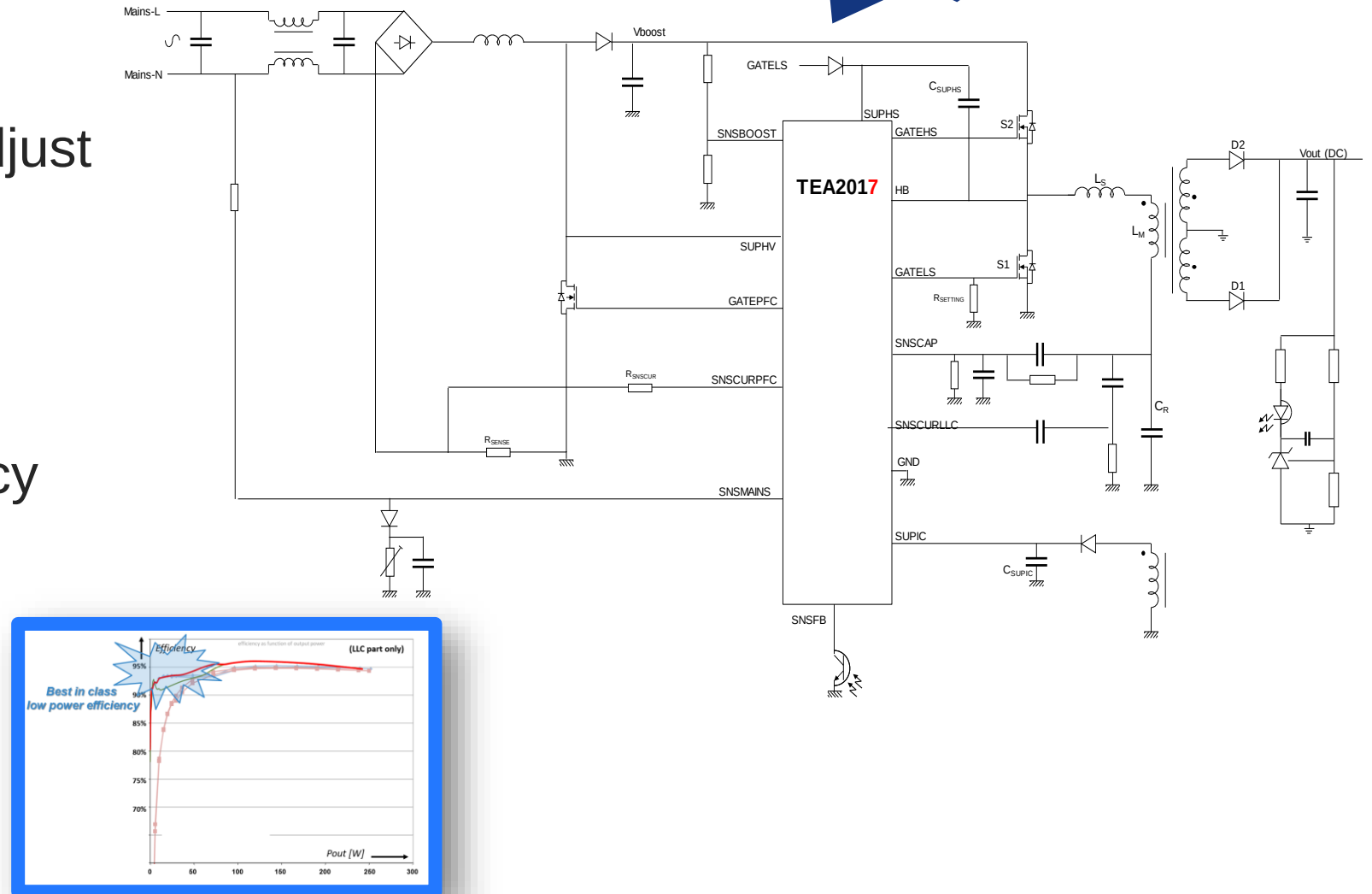
- Low eBOM count
- X-cap discharge integrated
- Power-Good signal to secondary side
- Fast Dynamic load response (<+/- 5V when the load increased from 0% to 100%)
- Very High Efficiency at Light Load
- 可数字设定(超过80个参数)
- Overtemperature PROTECTION (NTC for OTP)
- up to 350W
- <70mW@no load for 240W/12V



ADDITIONAL ADVANTAGES OF TEA2017 VS 2016

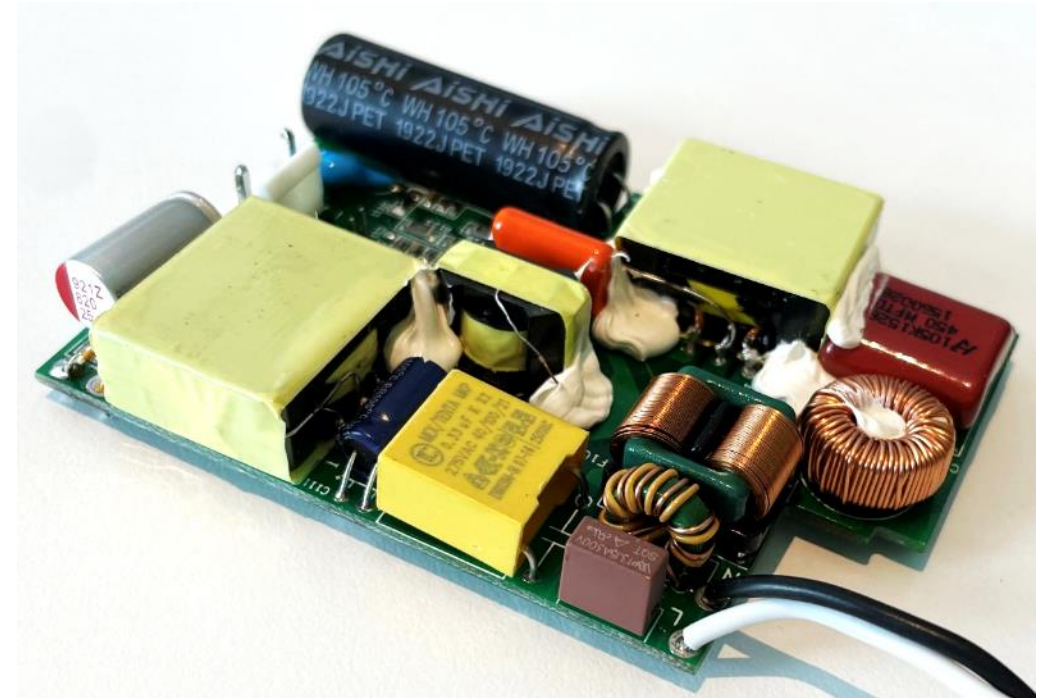
- Up to 1000~1400W
- DCM or CCM PFC auto-adjust
- Low audible noise
- Less components
- Low THD
- Higher Switching Frequency
- Mature platform (very high volume of TEA2016 & TEA1916 in Market)

Pin
compatible
with TEA2016



TEA2016 100W DEMO

- *Input spec : 90Vac ~ 264Vac*
- *Output spec : 19.5V, 100W*
- *Low height : 82.5mm x 55mm x **15mm***
- *NXP controller :*
 - *TEA2016T : DCM/QR PFC + LLC combo controller, SO16*
 - *TEA1995T : SR controller, SO8*
- *Efficiency :*
 - *Max power : 93.2% at 115Vac, 94.9% at 230Vac*
 - *Satisfy Coc-tier2*



Board available

TEST RESULTS FOR 600W DEMO (185MMX 73.5MM X 39MM; 18.5W/IN3) WITH TEA2017AAT, TEA2209T & TEA2095T

Symbol	Parameter	Value	Condition
Input			
V_{mains}	AC mains voltage	90 V to 265 V	AC
f_{mains}	mains frequency	47 Hz to 63 Hz	
$P_{\text{i(noload)}}$	no-load input power	< 150 mW	at 230 V / 50 Hz
$P_{\text{i(lightload)}}$	light load input power	Refer standby power section	
PF	power factor	> 0.99 > 0.95	At 90 VAC ~ 264 VAC, 600 W Pout At 90 VAC ~ 264 VAC, 300 W Pout
Output			
V_{out}	nominal output voltage	12 V	Constant voltage regulation, 0 A to 50 A
I_{out}	maximum nominal output current	50 A	At 90 V to 265 V
$V_{\text{out(pk-pk)}}$	output voltage peak to peak level during dynamic load	< $\pm 5\%$	50 Hz and 1000 Hz dynamic load at the PCB end
$V_{\text{out_ripple}}$	output voltage ripple	< 500 mV	Oscilloscope bandwidth 20MHz
$t_{\text{hold_up}}$	hold-up time	> 15 ms	600 W Pout
$t_{\text{start-up}}$	start-up time	< 1 s	600 W Pout
t_{rise}	output voltage rising time	< 20 ms	5% to 95 % at 600 W Pout
$\eta_{100\%}$	max load efficiency	> 94 %	600 W Pout
η	max, 50% and 20% load efficiency	80 Plus Platinum	
EMC and Safety			
CE	conduction EMI	> 3dB	at 600 W Pout
T_{comp}	components temperature	Refer temp section	at room temp

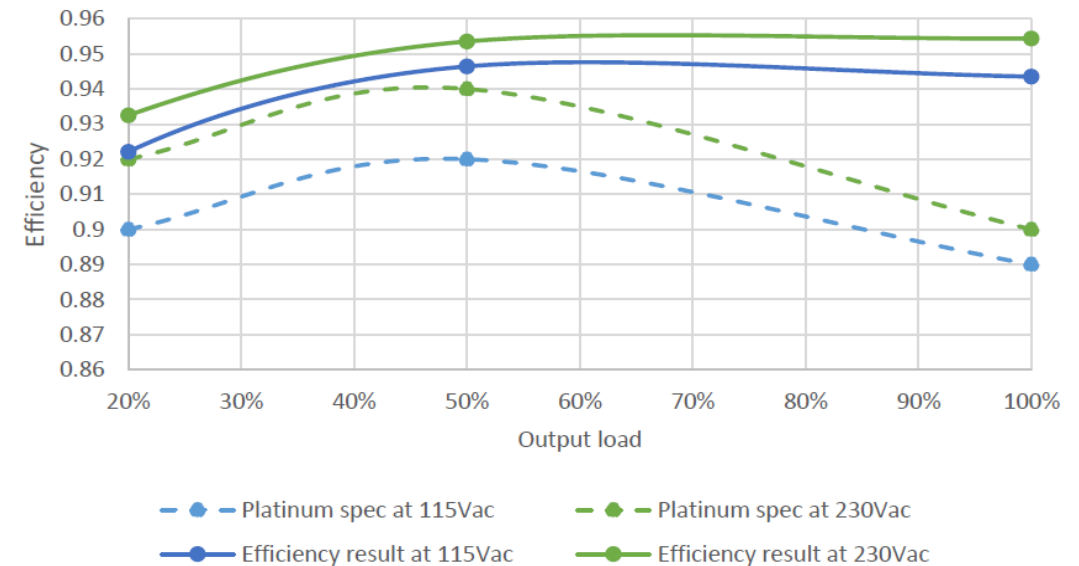
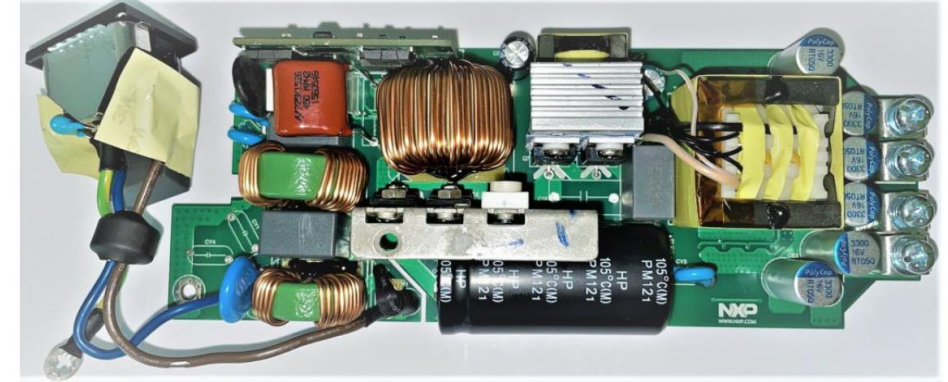


Figure 18. Efficiency test result comparison with 80 plus platinum efficiency standard

TEA2017 140W DEMO, ALL GAN FOR PD 3.1 EPR

- *Input spec : 90Vac ~ 264Vac*
- *Output spec : 28.5V, 140W*
- *High power density : 30 W/inch³*
- *Small size : 65mm x 55mm x 22mm*
- *High frequency operation : 200kHz PFC & 250kHz LLC*
- *INN650DA260A GaN FETs for PFC and LLC*
- *INN50LA070A GaN FETs for SR*
- *NXP controller :*
 - *TEA2206T : Active bridge controller, SO8*
 - *TEA2017T : Multi-mode PFC + LLC combo controller, SO16*
 - *SR controller Gan Controller, SO8*
- *Efficiency :*
 - *Max power : 94.3% at 115Vac, 95.3% at 230Vac*
 - *Satisfy Coc-tier2 with >3% margin*



Report available

能源法规



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能源法规——刚刚发布或即将发布

- 加州新能源法规: >80% 从~3W到以上 (何时?)
- 电视电源: <0.3W@待机模式(e.g. 12V/10mA) (某些品牌目前标准)
- EPA能源之星 7.0
 - ✓ 希望将最低计算 IPS 效率从 80Plus Bronze 提高到 80Plus Silver 效率等级 (自2019年11月生效)
 - ✓ **完整网络连接能力**- 已经修改完整网络连接能力的定义, 以适应业界正在开发的全新极低功率模式。这些新模式可让网络持续处于连线状态, 但功耗低于2瓦。
- USB PD3.1 EPR (扩展功率范围)
 - 2021 年 5 月 USB-IF 在 Power Delivery 加入了新的规格, 并发表**PD 3.1 规范**
 - 扩展PD 3.0 供电最大瓦数100W 的限制, 增加到 240W (48V 5A) 其设定须满足表1的规范。
 - **Fixed PDO**: 定电压输出, 在 EPR 模式中, Fixed PDO 指电压 >20V 的规格, 包含 28V、36V 以及 48V 三个选项。
 - **AVS (Adjustable Voltage Supply) APDO**: 在 EPR 模式中, 电压可以在一定范围区间内调整输出, 范围由最低 15V 到最高有 28V、36V 和 48V 三种, 视瓦数而定 (表 2)
- EUP Lot 7: <0.2W@no load or stand by mode: no schedule yet

PDP Rating (W)	Fixed (V)							AVS
	5	9	15	20	28	36	48	
100 < x ≤ 140	3A~5A			5A	$(\frac{PDP}{28}) A$	N/A	N/A	$(15 \sim \frac{PDP}{5}) V @ 5A$ $(>\frac{PDP}{5} \sim 28)V @ (\frac{PDP}{AVS \text{ Voltage}}) A$
140 < x ≤ 180	3A~5A			5A	5A	$(\frac{PDP}{36}) A$	N/A	$(15 \sim \frac{PDP}{5}) V @ 5A$ $(>\frac{PDP}{5} \sim 36)V @ (\frac{PDP}{AVS \text{ Voltage}}) A$
180 < x ≤ 240	3A~5A			5A	5A	5A	$(\frac{PDP}{48}) A$	$(15 \sim \frac{PDP}{5}) V @ 5A$ $(>\frac{PDP}{5} \sim 48)V @ (\frac{PDP}{AVS \text{ Voltage}}) A$

表 1: 支援 EPR 產品供電規格規範 (資料來源參考自 PD 3.1 Spec)

	AVS Voltage Ranges		
	28V AVS	36V AVS	48V AVS
Maximum Voltage	28V	36V	48V
Minimum Voltage	15V	15V	15V

表 2: AVS 電壓範圍 (取自 PD 3.1 Spec)

TEA2016/17 成功应用案例



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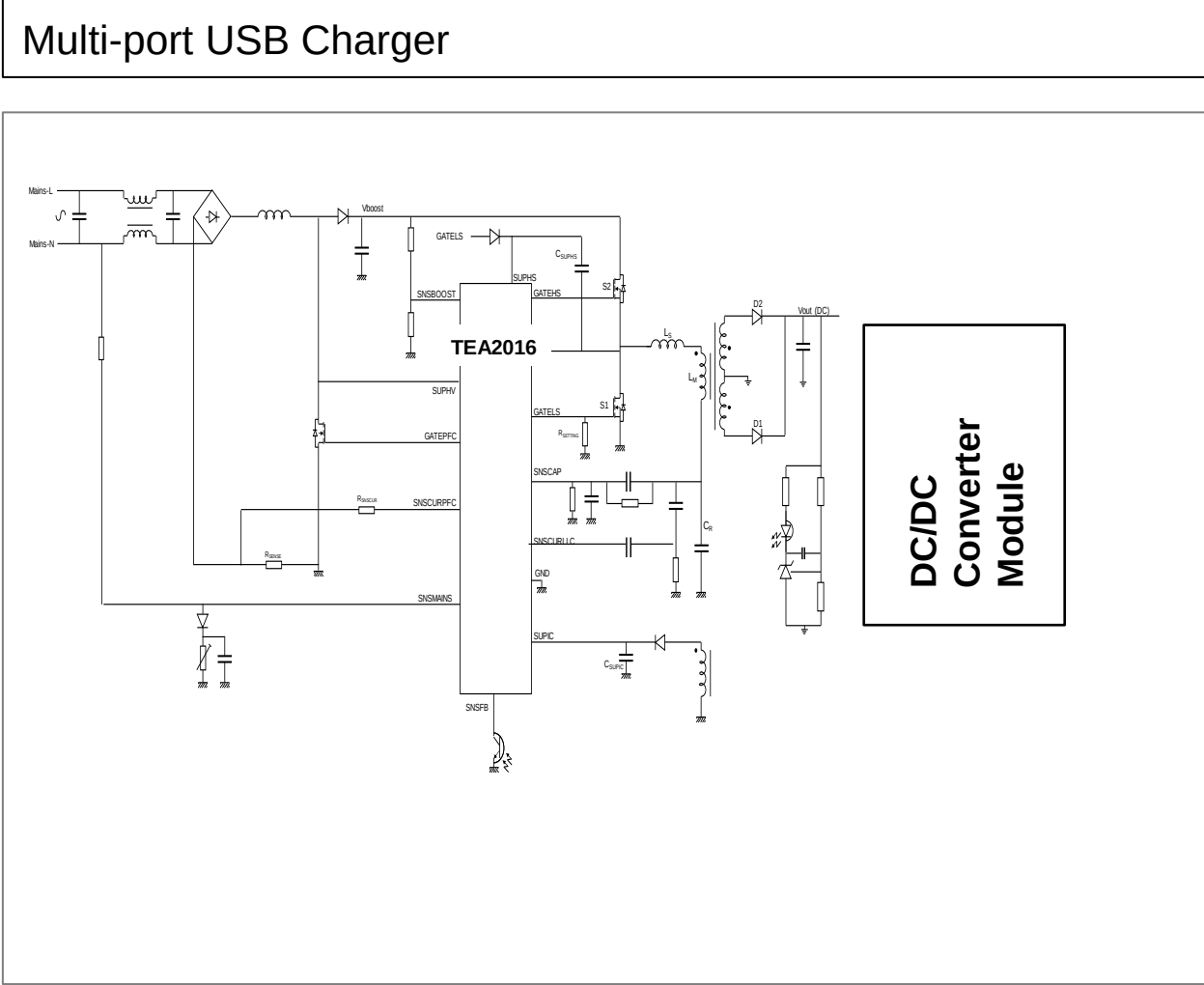
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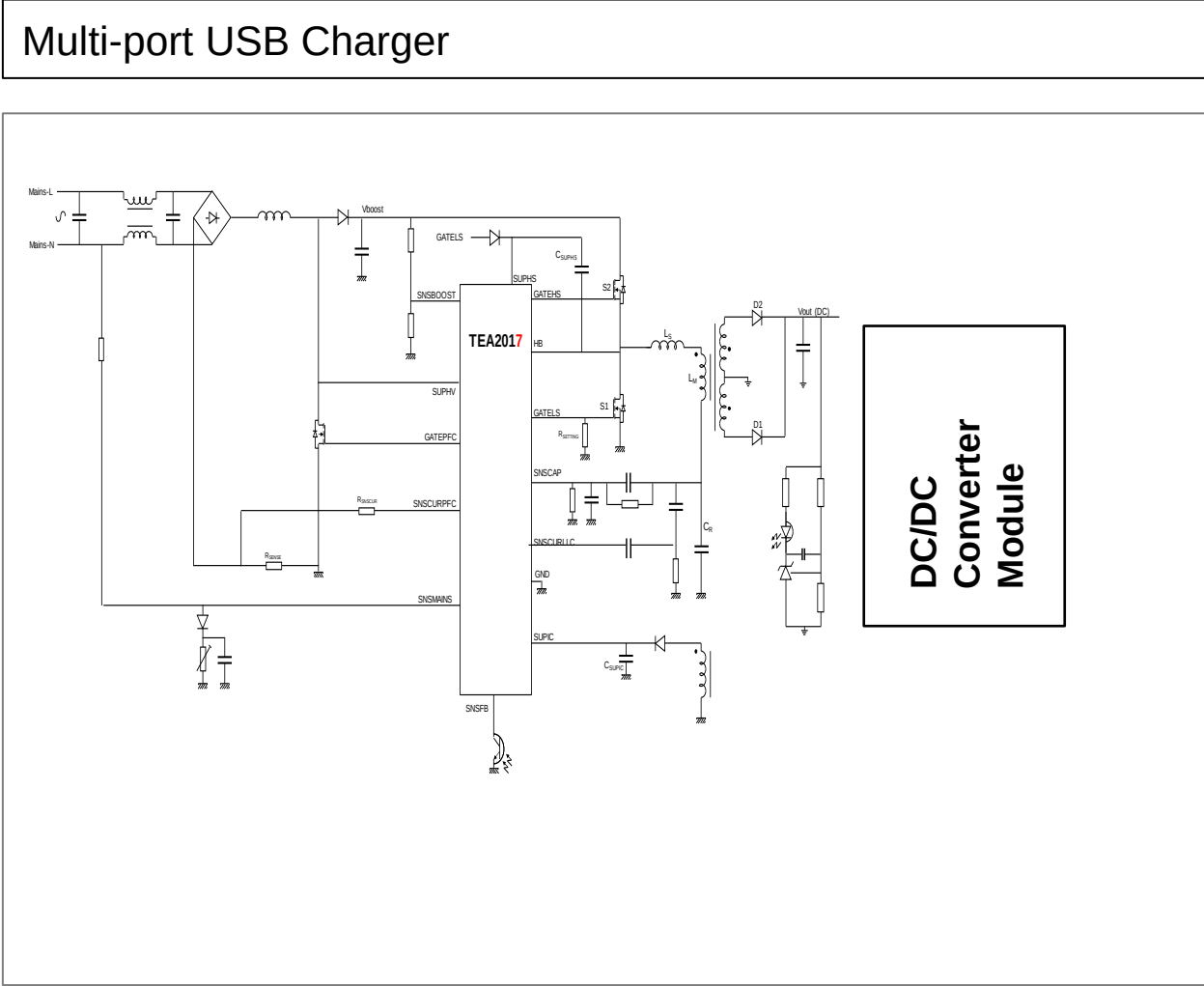
USE CASE: 100W, 120W, 150W & 180 MULTI-PORT USB PD CHARGER

Customer	USB Multi Port charger makers
BL AA Device	TEA2016AAT+ TEA2095
End Application	3~10-Ports USB Chargers
Why TEA2016AAT Chosen	• Low power consumption at no load, tiny load & standby Power • Very low component count • Easy to work with Local or Abroad GaN Switch(MOS) • Mature & high share in the market
Use Experience	• Direct support from NXP FAE at begging stage • Disti FAE support from PCB layout to debug • Short development time



USE CASE: 300W MULTI-PORT USB PD CHARGER

Customer	USB Multi Port charger makers
BL AA Device	TEA2017AAT+ TEA2095
End Application	More than-10-Ports USB Chargers
Why TEA2017AAT Chosen	• Low power consumption at no load, tiny load & standby Power • Very low component count • Easy to work with Local or Abroad GaN Switch(MOS) • Mature & high share in the market
Use Experience	• Direct support from NXP FAE at begging stage • Disti FAE support from PCB layout to debug • Short development time



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LLC拓扑的推力产品ACDC电源控制器

Application	Description	Part Number	Unique Advantages	Status & Remarks
>75W Adapters, Lighting but no THD requirement, NB PC, Desktop PC, AIO PC, TV, out/in door display. Medical Power, Multi-Port USB Charger & etc. (<=300W)	LLC digital controller+ DCM PFC Controller	TEA19161 (SO16)+ TEA19162 (SO8)	- Parameters can be set by 4 registers <70mW@no load for 240W/12V 2~15% higher than traditional LLC Power at load <10%; <+/-5% voltage regulation for 0% to 100% load - Meets Platinum standard	TEA19161+TEA19162: MP Q1'16 Design tool of TEA1916 released April'20
SR IC for LLC power supply (<1000W)	LLC Synchronous Rectifier IC	TEA1995T (SO8) or TEA2095T(SO8) /TEA2095TE(HSO8)	2~7% High efficiency at middle load via adaptive driving capability by loading - TEA2095 for higher power (over 300W) & lower Vds MOSFET	TEA1995: MP Q3'15 TEA2095: Released Nov'19 TEA2095T(E)/1 with copper wire: released Q3'20
>75W Adapters, NB PC, Desktop PC, AIO PC, TV, out/in door display. Medical Power, Multi-Port USB Charger with GAN Transistor & etc. (<=300W)	Combo Controller with LLC digital control+ DCM PFC Control	TEA2016 (SO16) + (TEA1995 or TEA2095)	- Parameters can be set for >80 parameters 30~50 components reduced vs TEA1916 generation - Meets Platinum standard - Advantage of TEA19161+ TEA19162	TEA2016 released June'19 TEA2016AAT/1/S30 with Copper wire; released Q1;22
200~ few KWs for any power which needs higher efficiency on Bridge stage	Active Bridge Rectifier Controller can work under any topology(e.g. LLC, & Forward, Fullbridge & etc.)	TEA2208 (SO14): replace 4 diodes TEA2206 (SO8) : replace 2 Diodes TEA2209 (SO16): replace 4 Diodes, much lower power @no/tiny load	- Forward conduction losses of the diode rectifier bridge are eliminated - Very low IC power consumption (2 mW) with X-capacitor discharge - Very low external part count	TEA2208: released Nov'19 TEA2206: Released Dec'20 TEA2209: Released Jan'21
Up to 1,400W: Adapters, Lighting , NB PC, Desktop PC, AIO PC, TV, out/in door display. Medical Power, Multi-Port USB Charger with GAN Transistor & etc.	Combo Controller with LLC digital control+ DCM/QR/CCM Mixed Mode PFC	TEA2017 (SO16) + (TEA2095)	Additional Advantages on top of TEA2016 - Low THD, higher PF value - easier to handle EMI - DCM/QR/CCM Mixed Mode PFC - Less Audible noise	TEA2017: released June'21 Design tool of TEA2017: Released July'21 TEA2017AAT/2/S30 with copper wire: Released Q1'22

2022X量产力推ACDC电源控制器产品

Application	Description	Part Number	Unique Advantages	Status & Remarks
50~1400W LLC+PFC power which needs high input AC (up to 440Vac), especially Industrial and LED Lighting and Power for India Market	LLC digital controller+ DCM PFC Controller	TEA6017AT (SO16)	Additional Advantages on top of TEA2017AAT - Input AC Voltage: $\leq 440\text{Vac}$ (650V on IC) - Fits the application in Industrial & India Market	MP: April '22
LLC Topology SR IC used in Any Application with High Output Voltage (up to 1400W)	LLC Synchronous Rectifier IC	TEA2096T(SO8)	- Drain sense voltage to 200 V 2~7% High efficiency from light to middle load via adaptive driving capability by loading - TEA2096 can handle higher power (over 300W) vs TEA1995 & lower Vds MOSFETs	MP: June'22
75~250W USB PD 3.1 EPR Adapters for NB PC, Desktop PC, AIO PC, TV,. Medical Power, & etc.	Synchronous Rectifier IC for Asymmetrical Half-bridge Flyback and Standard Flyback Converters	TEA2093 (TSOP6)	2~7% High efficiency from light to middle load tp middle loading via adaptive gate driving - Low Power Consumption: Typical supply current in no-load operation below 200 μA	MP: June'22

TEA2017官方网站

- <https://www.nxp.com.cn/products/power-management/ac-dc-solutions/ac-dc-controllers-with-integrated-pfc/digital-configurable-llc-and-multimode-pfc-controller:TEA2017AAT>



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主页 / 能源管理 / AC-DC Solutions / 集成PFC的AC-DC控制器 / TEA2017AAT/2 Digital Configurable LLC and Multimode PFC Controller

TEA2017AAT: Digital Configurable LLC and Multimode PFC Controller NEW

跳转至

概述与特性

开发板和设计

目标应用

相似产品

概述

PREPRODUCTION

The TEA2017AAT is a digital configurable LLC and PFC combo controller for high-efficiency resonant power supplies. It includes both the LLC controller and PFC controller functionality. The PFC can be configured to operate in DCM/QR, CCM fixed frequency, or multimode which supports all operation modes to optimize the PFC efficiency. The TEA2017AAT enables building a complete

特征

> Distinctive features

> Green features

> Protection features

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TECHNOLOGY SHOWROOM

JOURNEYS BY DESIRED ENGAGEMENT

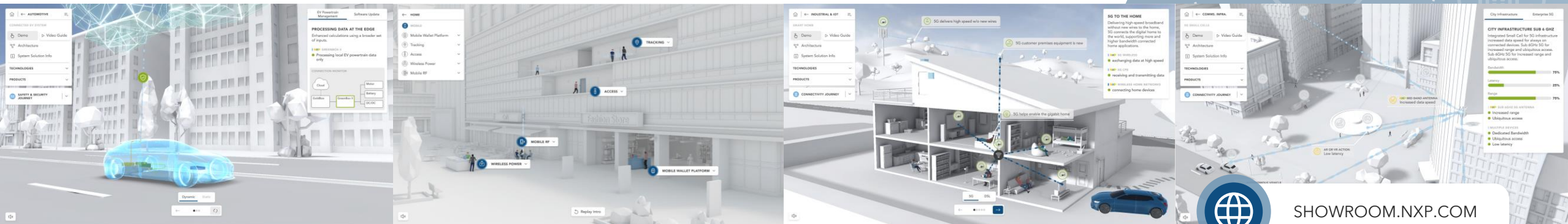
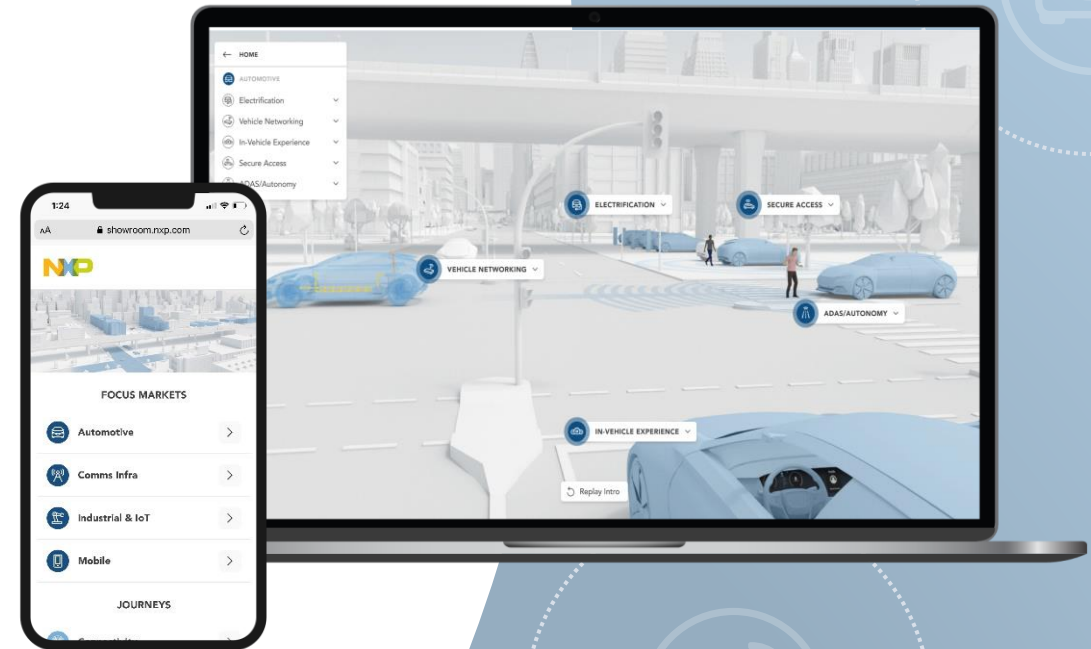
- Self-guided tour
- Live-streaming at set times
- Guided tours

40+ VIRTUAL DEMOS

- Focus on system solutions
- Set up along NXP verticals

JOURNEYS BY DESIRED FOCUS

- Edge & AI/ML
- Safety & Security
- Connectivity
- Analog





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