

100~1400瓦全数字设定PFC + LLC整合型电源控制IC: TEA2017

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AGENDA

Vincent Chang

- The developing story of TEA1916, 2016 to 2017
- Key unique features of TEA2017 & key performance; also using our 600W demo board as examples.
- Energy saving regulation
- Use cases TEA2017
- NXP LLC Product Portfolio
- Web address of related documents of TEA2017 on NXP web.

Nick Chen

- Power Factor and THD Improvement
- Mixed Mode PFC: “CCM”+ “QR”+ “DCM with valley detection”
- PFC frequency decrement
- PFC frequency jitter
- PFC improved soft-start
- MTP setting & Programming
- Introduction to TEA2017 600W demo board

LIVE Q&A



Regular:300W
Peak Power:500W



Indoor
Display
Power
5V/40A~80A



80" TV or
65" OLED TV

NEW GENERATION DIGITAL & PROGRAMMABLE RESONANT POWER PLATFORM

工業電
源

600W



12V/33A



300W

10~20 USB Ports
Charger

300~400W



NEXT GENERATION: DIGITAL PROGRAMMABLE PFC + LLC: TEA2017

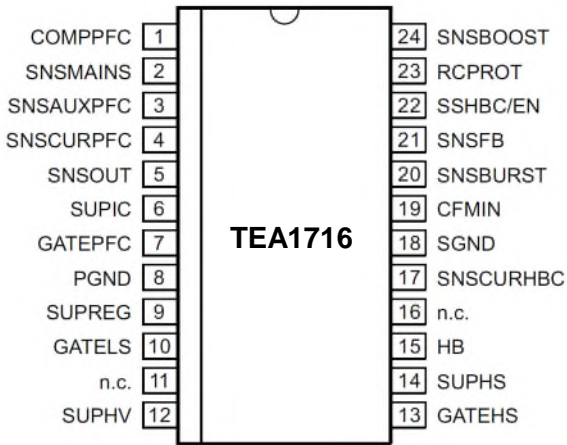
- DCM/QR/CCM Mixed Mode PFC
- Up to 1,400W
- Power Factor, THD and EMI improvement
- High amount of protections, including second independent OVP & inrush current
- High configurability via MTP
- Digital state-machine. **NO FIRMWARE !!**

Pin compatible with
TEA2016
SO16 package

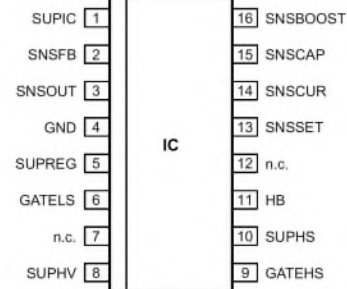
LLC & PFC in single
SO16 package
MTP settings internal

TEA2016

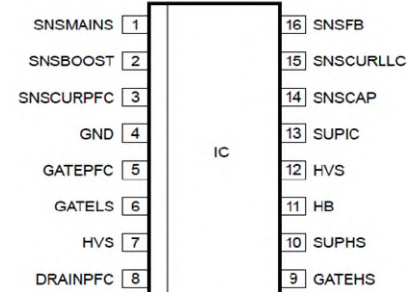
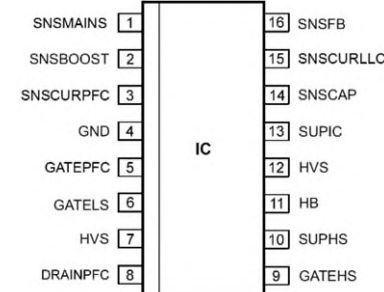
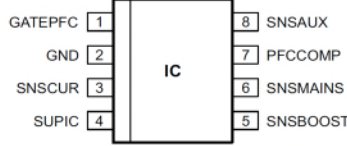
TEA2017



TEA19161



TEA19162



Year 2012
First to meet
EUP Lot 6

Year 2016
Digital Cycle—by-Cycle
MTP setting by 4
registers

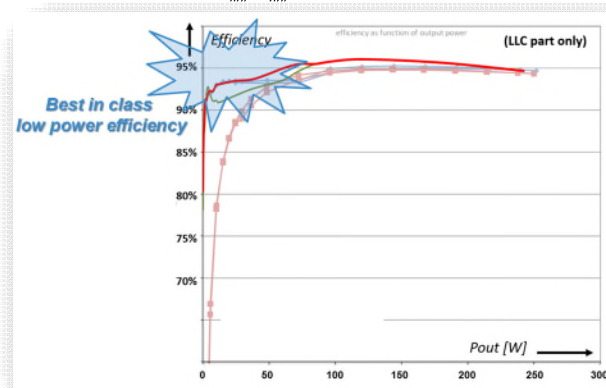
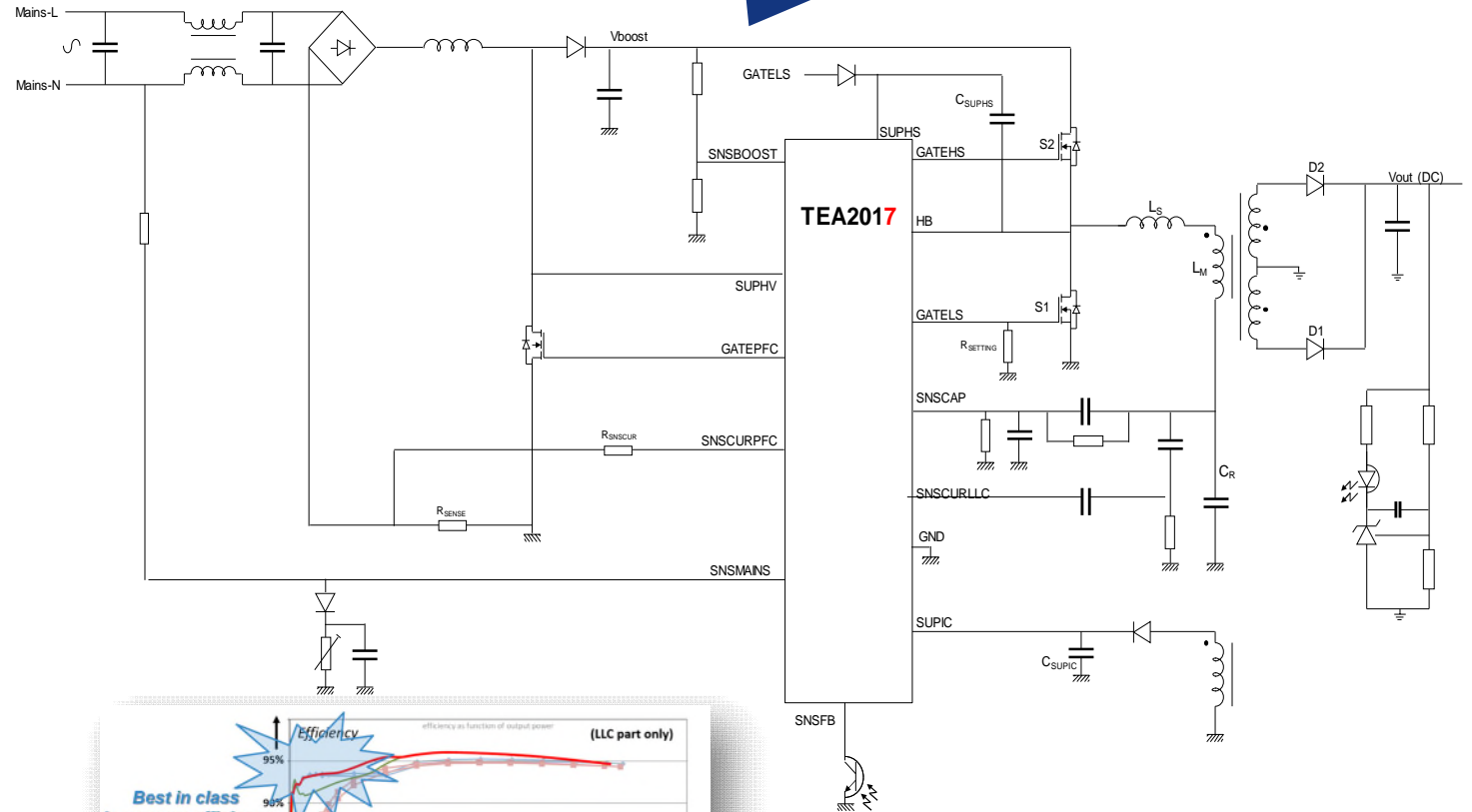
Year 2019
Programmability /
Flexibility single
package

Year 2021
TEA2016 +
Mixed Mode
DCM/BCM/CCM PFC

Additional Advantages of TEA2017

- Very high efficacy a light load
- Very low component count
- Fast Dynamic load response ($\pm 5V$ when the load increased from 0% to 100%)
- Very low power consumption @no load ($<70mW$ @ no load for 300W/20V)
- Accurate burst-mode level
- Low audible noise
- Many protections
- Short development time needed
- Mature platform (very high volume of TEA2016 & TEA1916 in Market)

Pin compatible
with TEA2016



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

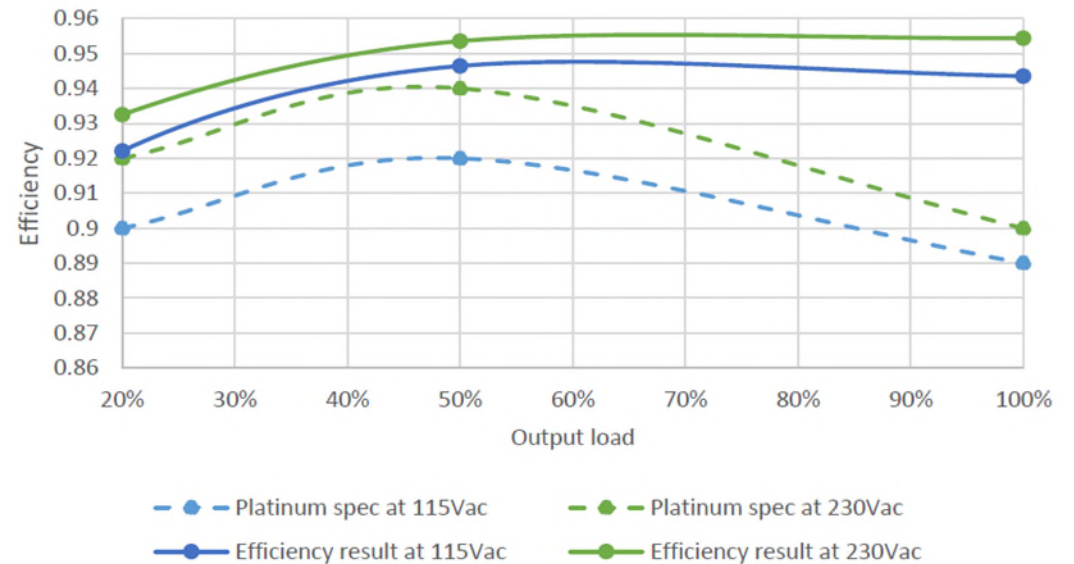
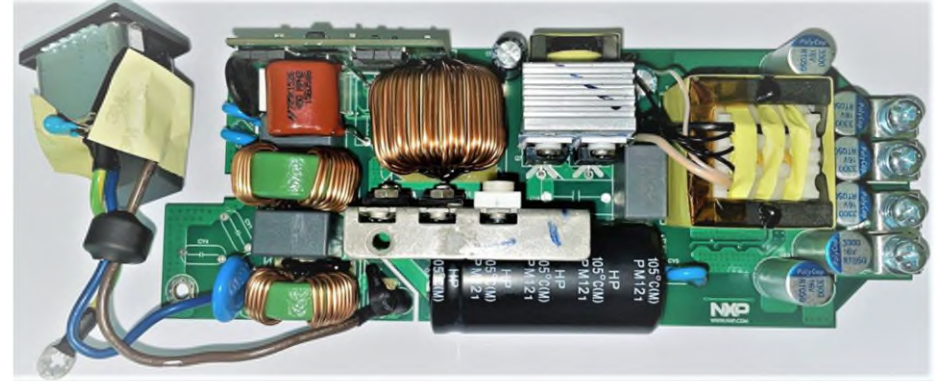


Figure 18. Efficiency test result comparison with 80 plus platinum efficiency standard

能源法规与市场趋势

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。
- EUP/ERP Lot 7: <0.2W@待机模式/无负载 (何时?)
- **UL62368 (2019上半年)**
- ...

大尺寸电视机电源的改变 (55/65 & OLED)

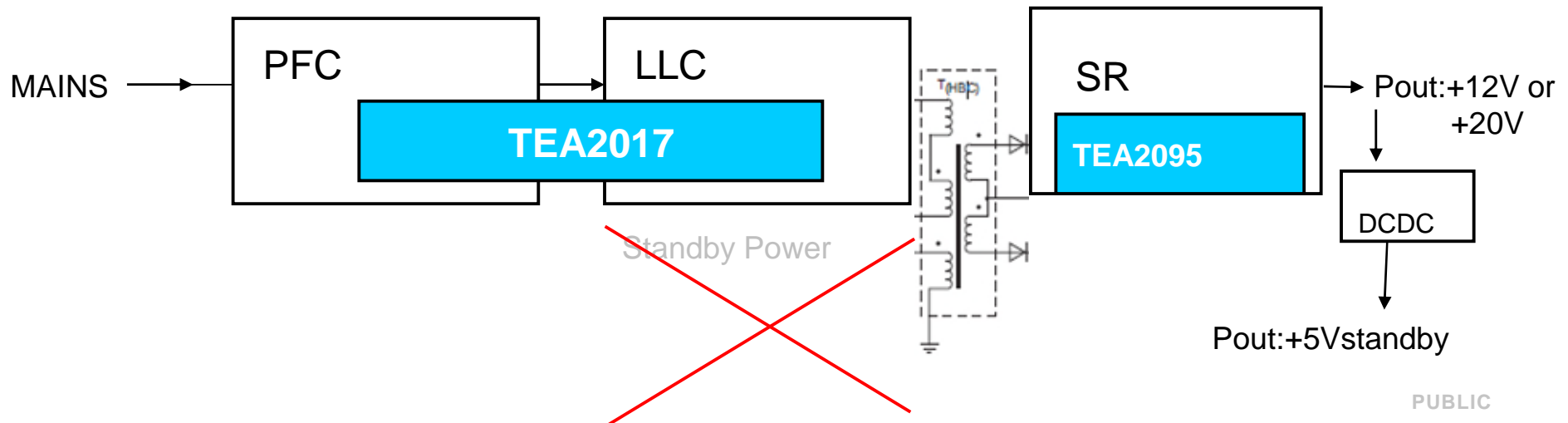
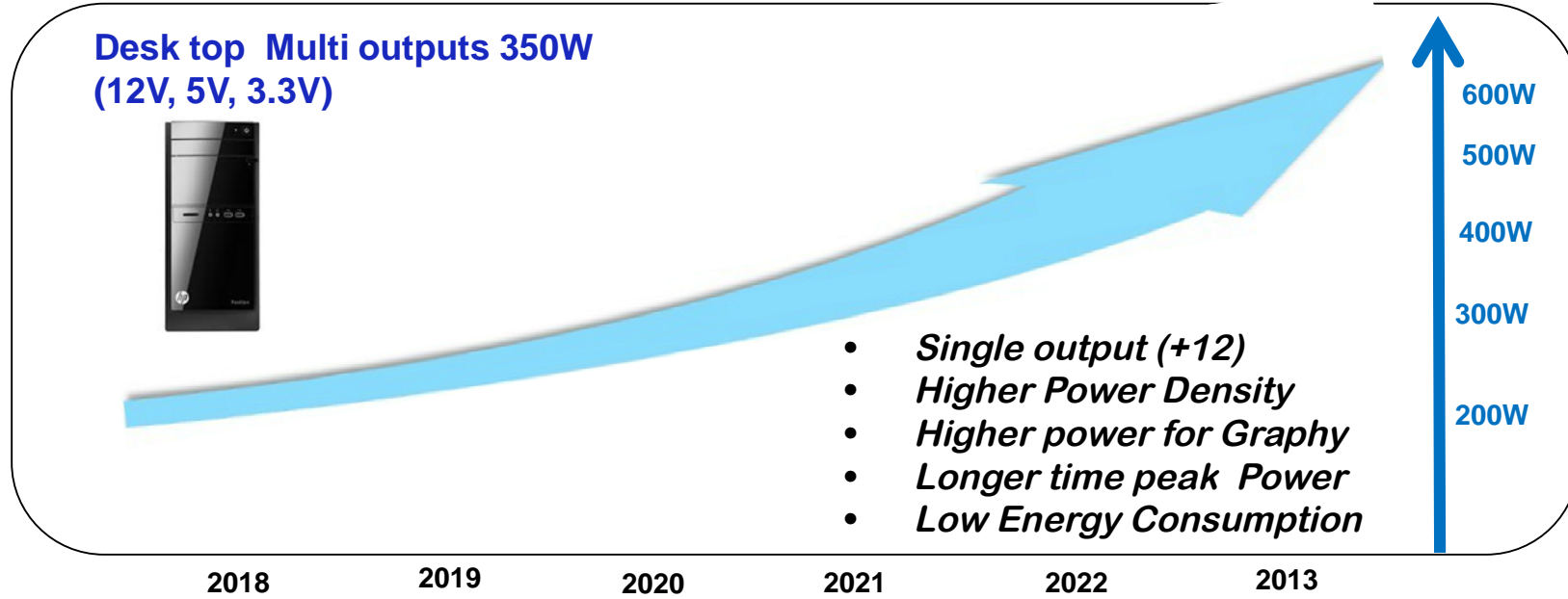
尺寸	W/O Type Port & Edge LEDs	W/O Type C port & Direct Bakclight	With 2 Type C Ports & Direct Backlight	2 Type C ports & OLED Light Source
55"	Vout <=24V: 50W Vout >50V: 80W Sub-TTL: 130W	Vout <=24V: 50W Vout > 50V: 100W Sub-TTL: 150W	Vout <24V: 150W Vout >50V: 100W Sub-TTL: 250W	Vout <24V 150W Vout 30~48V: 250W Sub-TTL: 400W
65"	Vout <=24V: 50W Vout >50V: 120W Sub-TTL: 170W	Vout <=24V: 50W Vout > 50V: 150W Sub-TTL: 250W	Vout <24V: 150W Vout >50V: 150W Sub-TTL: 300W	Vout <24V 150W Vout 30~48V: 350W Sub-TTL: 500W

不再使用 Flyback
(反激), 改用
PFC+LLC (諧振)

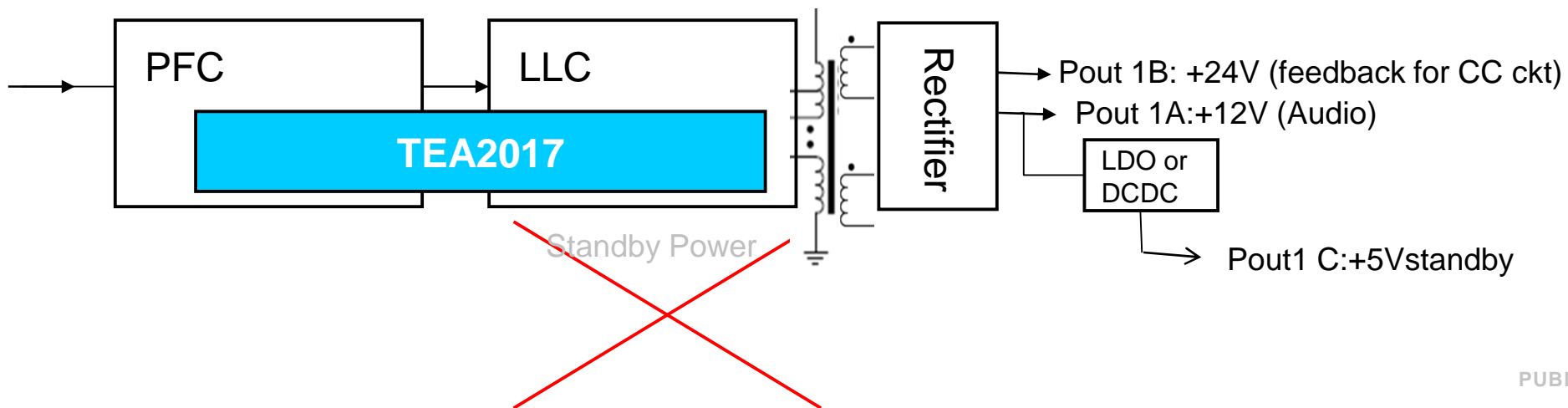
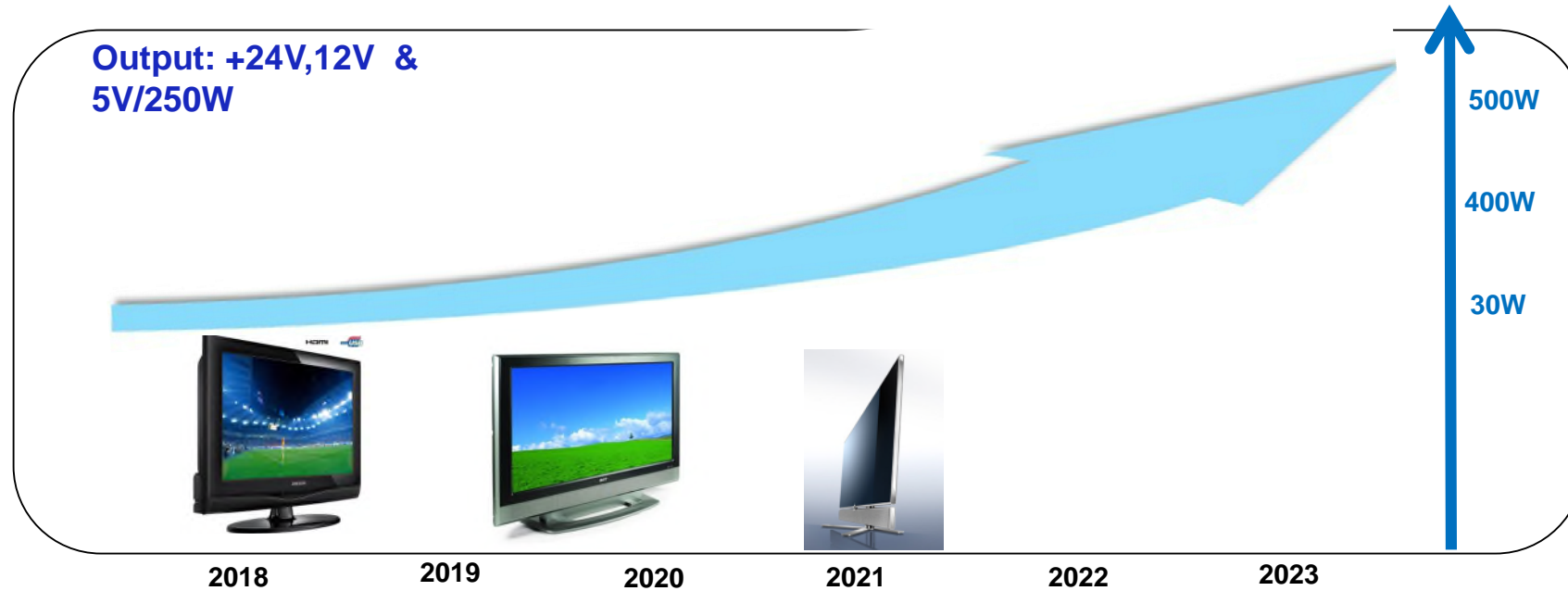
- 總功率大增
- 輸出電壓變小
- 同步整流使用機率大增 (TEA2095T)

PC电源的主要市场趋势 (桌面) 多输出→单输出

Single Peak output: 12V/500W



多输出电视趋势 → 2个输出，例如 $\geq 300\text{W}$ LED with Type Ports or OLED 电视电源



为什么AIO和台式电脑为单输出功率

- 设计更简单；
- 更容易通过法规要求；
- 减少组件数量；
- 更坚固/可靠，更长的产品寿命；
- 更容易获得EnergyStar法规认证；
- LDO或DC / DC级的效率更高，成本更低。

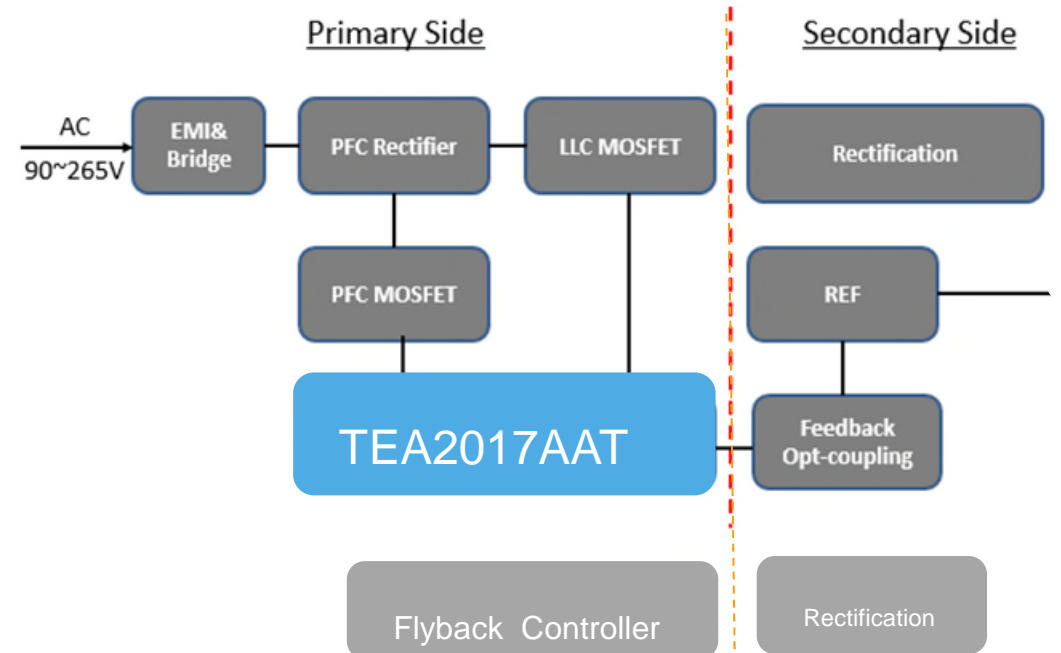
TEA2017 成功应用案例



USE CASE: 400~600W TV POWER

Customer	TV Power Maker
BL-SIP Part No. (Sockets)	TEA2017AAT
End Application	>70" TV Set platform
Why TEA2017 chosen	<ul style="list-style-type: none"> Easier to use & debug than the other combo IC PCB size smaller & less compony count than old projects Better Power saving
Use Experience	<ul style="list-style-type: none"> Direct support from NXP FAE at begging stage Disti FAE support from PCB layout to debug

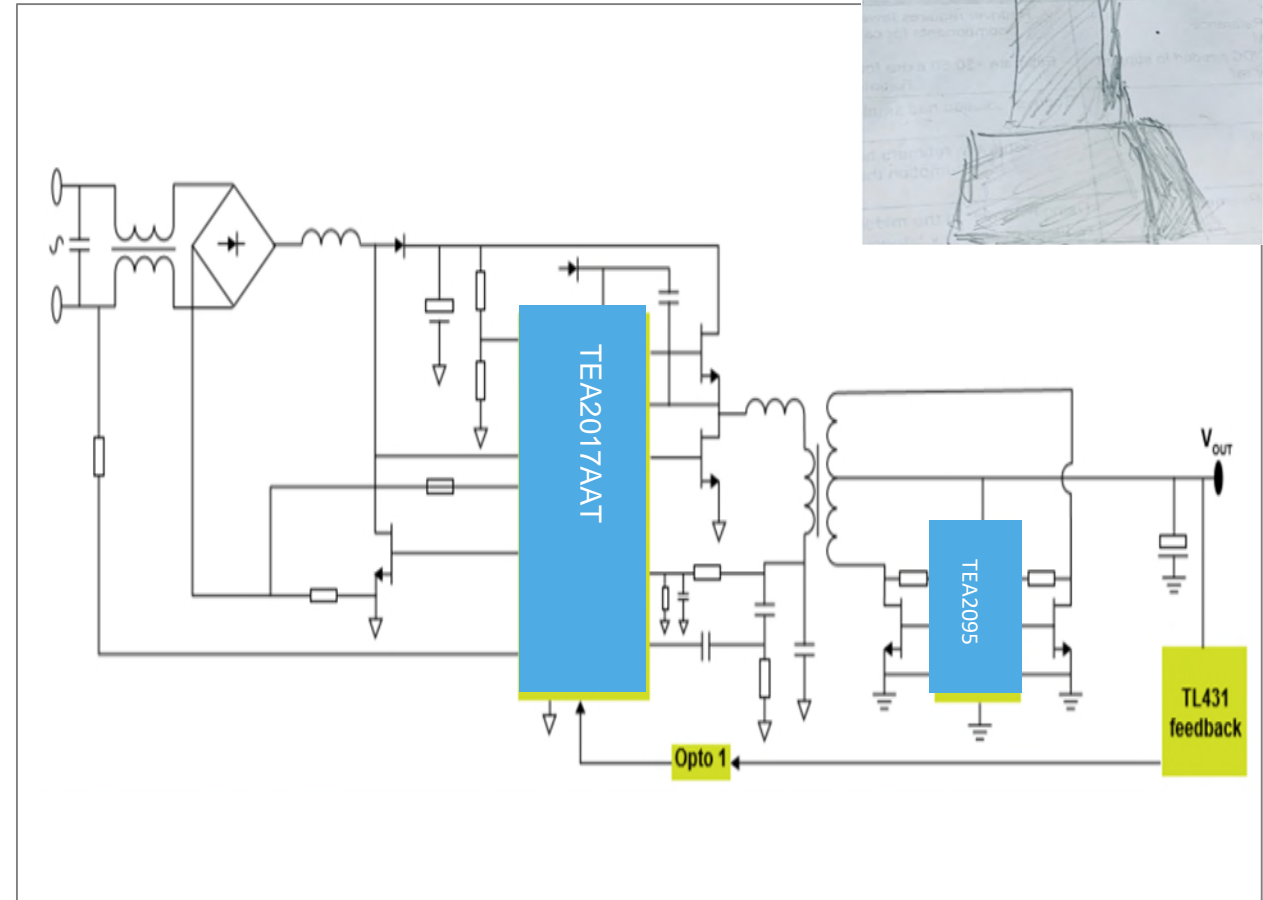
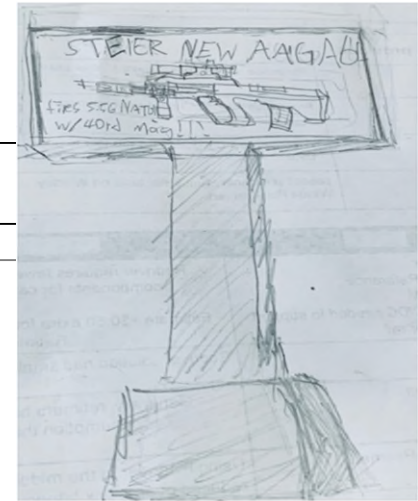
End Product: TV SET



USE CASE: 300W OUTDOOR DISPLAY POWER

Customer	Out Door Display Makers
BL AA Device	TEA2017AAT+ TEA2095
End Application	China local brands outdoor display Power with 5Vout
Why TEA2017AAT Chosen	<p>Product features highly match customer requirements</p> <p>Good relationship with customer</p> <p>High Efficiency at light and high load</p> <p>Low component count</p>
Use Experience	<ul style="list-style-type: none"> • Direct support from NXP FAE at begging stage • Disti FAE support from PCB layout to debug • Short development time

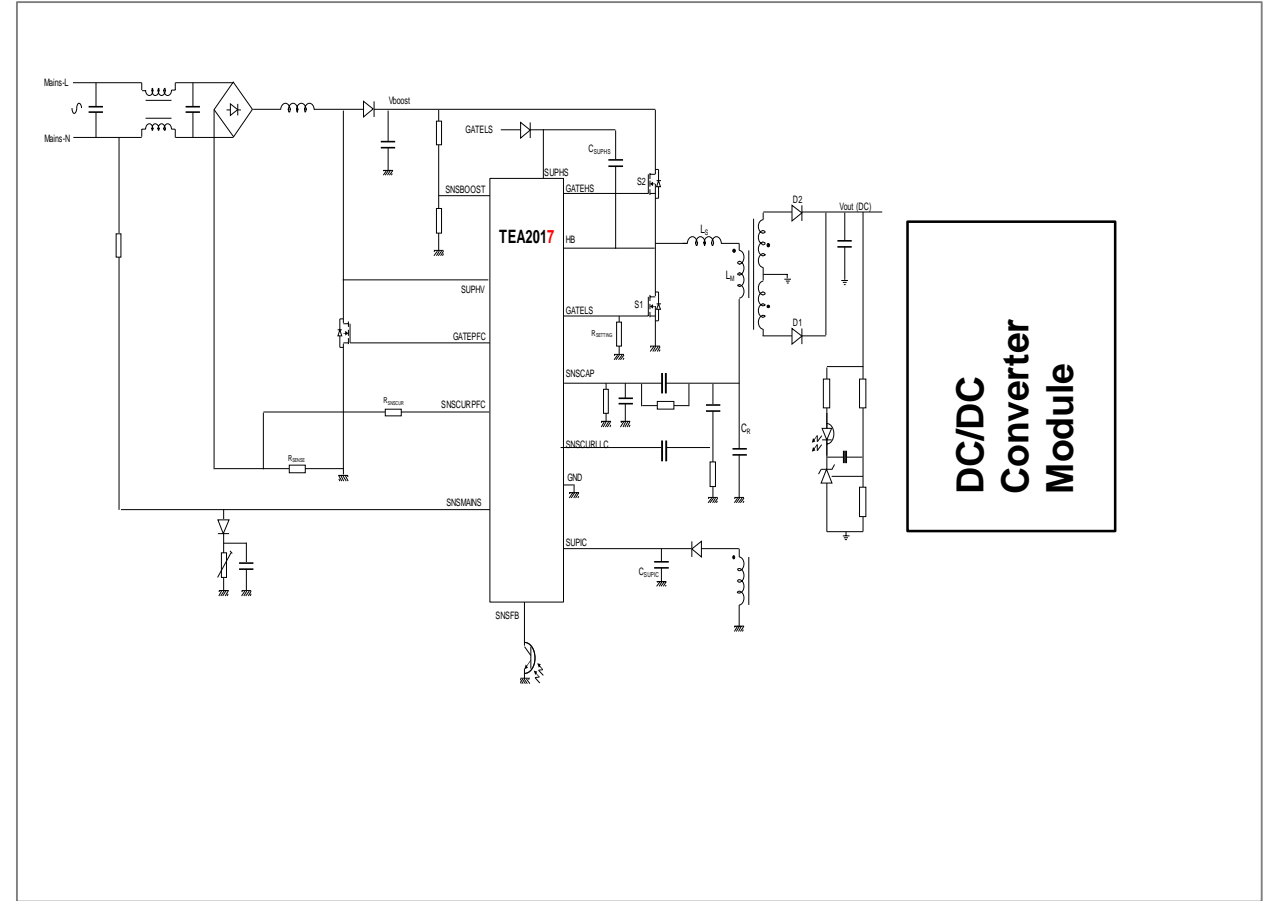
Outdoor Display Power



USE CASE: 300W MULTI-PORT USB PD CHARGER

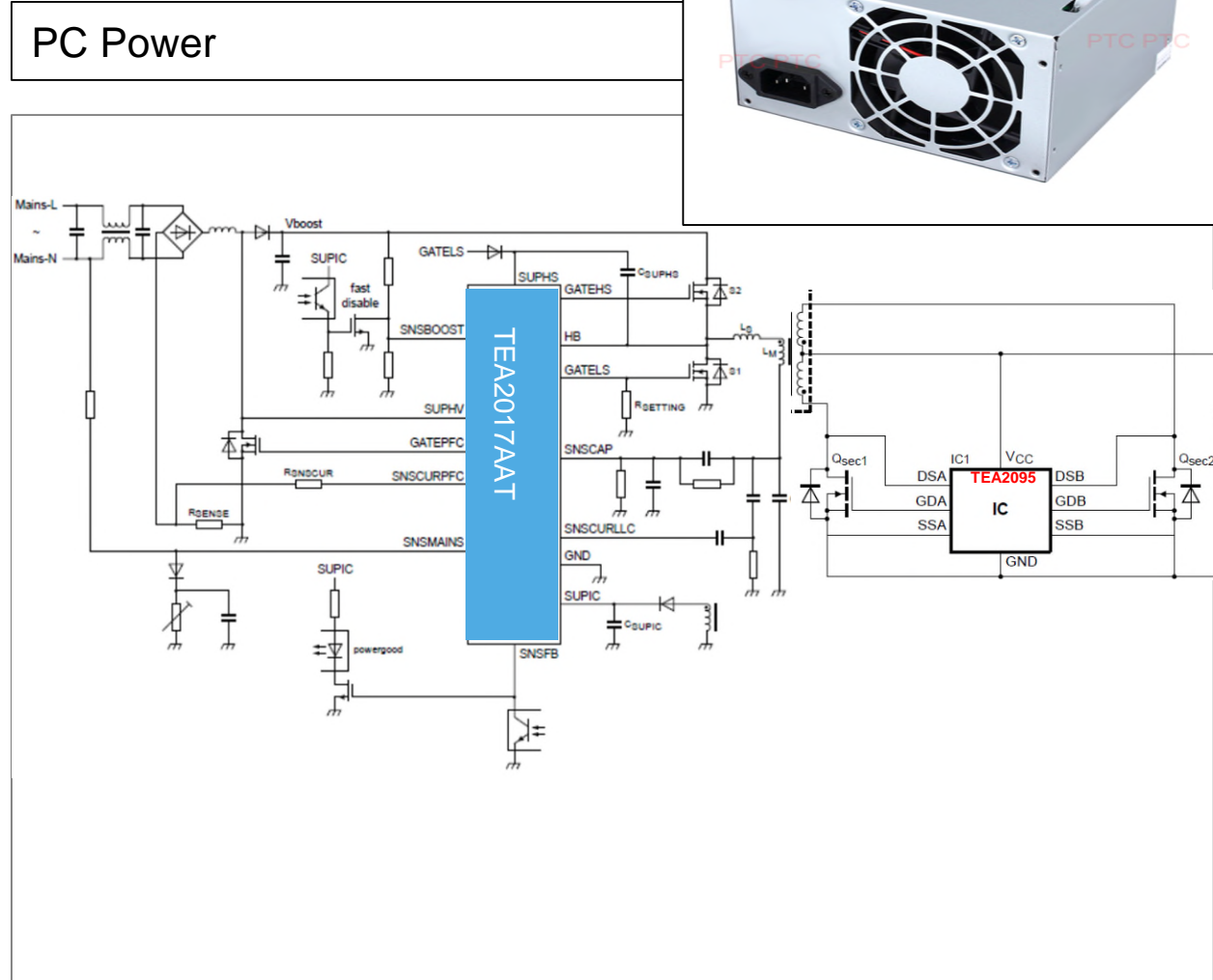
Customer	USB Multi Port charger makers
BL AA Device	TEA2017AAT+ TEA2095
End Application	More than-10-Ports USB Chargers
Why TEA2017AAT Chosen	<ul style="list-style-type: none"> • Low power consumption at no load, tiny load & standby Power • Very low component count • Mature & high share in the market
Use Experience	<ul style="list-style-type: none"> • Direct support from NXP FAE at begging stage • Disti FAE support from PCB layout to debug • Short development time

Multi-port USB Charger



USE Case: 500W Peak Power for Desktop PC

Customer	PC Power Maker
BL AA Device	TEA2017AAT+ TEA2095ET
Application	Desktop PC Power with 2- time peak power
Why TEA2017AAT Chosen	<ul style="list-style-type: none"> • Low power consumption at no load, tiny load & standby Power • Easy to pass Energy Star • Meet 2 time-peak power requirement • Very low component count • Mature & high share in the market
Use Experience	<ul style="list-style-type: none"> • Direct support from NXP FAE at begging stage • Disti FAE support from PCB layout to debug • Short development time



最新恩智浦电源IC产品组合



LLC拓扑的推力产品ACDC电源控制器

Application	Description	Part Number	USP	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)	<ul style="list-style-type: none"> Parameters can be set by 4 registers <70mW@no load for 240W/12V 2~15% higher 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)	<ul style="list-style-type: none"> 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, Lighting but no THD requirement, 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)	<ul style="list-style-type: none"> 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
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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Advantages of TEA2016 Low THD, high PF value & easier to handle EMI DCM/QR/CCM Mixed Mode PFC 	TEA2017: released June'21 Design tool of TEA2017: Released July'21

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>

NXP 产品 应用 设计 技术支持 公司

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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**

概述 文档 工具 & 软件 购买/参数 封装/质量

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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