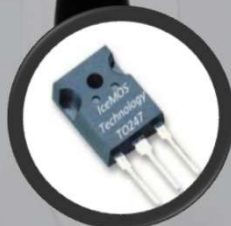


IceMOS Technology

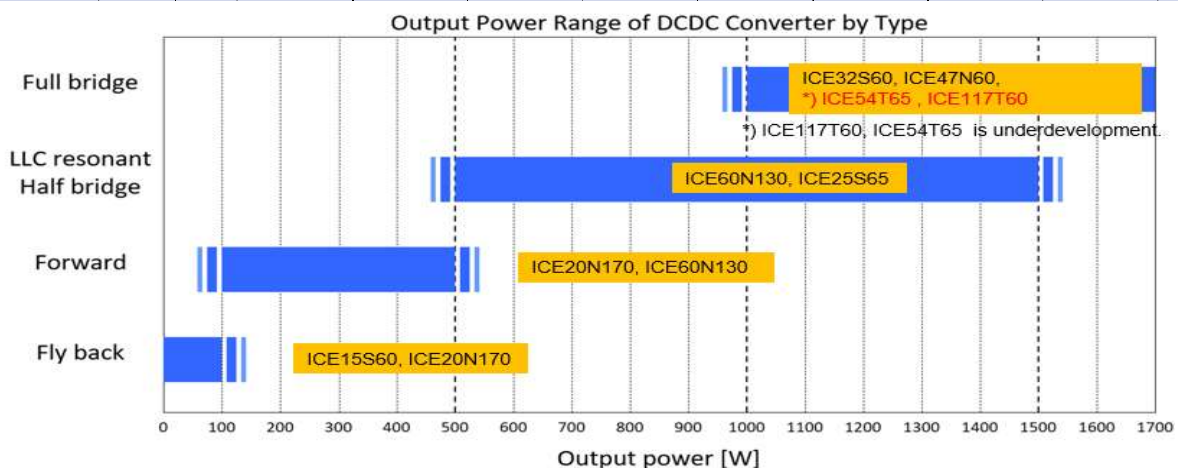
Super -Junction MOSFET 應用案例研究

<https://cn.icemostech.com/>



应用矩阵表★: 显示每个应用程序使用的电路

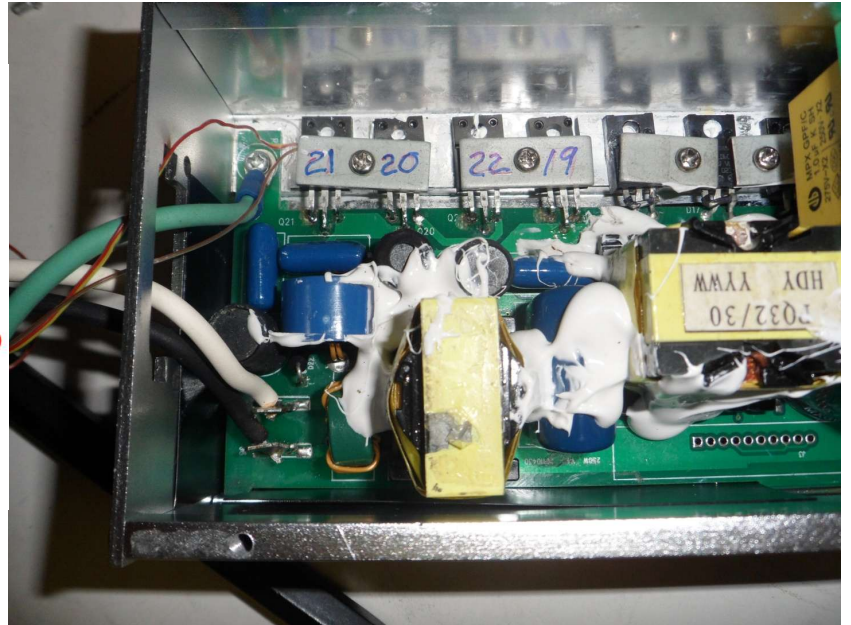
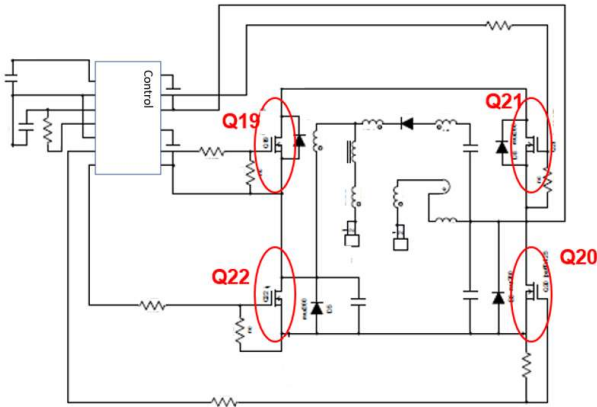
#	Application	Output Power (W)		Circuit								ICEMOS Product
				AC-DC			DC-DC				DC-AC	
		Min	Max	Half wave	Full Wave1	Full Wave2	Fly back	For ward	LLC Half Bridge	Full Bridge	Inverter	
1	SMPS Power Factor Correction	500							★	★		ICE25S65 ICE60N130
2	LLC Half Bridge	1000								★		ICE47N60 ICE32S60
3	Low power SMPS Quasi- Resonant Flyback		100				★					ICE8S65,ICE8N60, ICE10N60,ICE15S60
4	High Power SMPS LLC Half- Bridge	500	1500						★			ICE47N60 ICE32S60
5	ATX Power Supplies	200	1600	★	★	★	★	★	★			ICE47N60 ICE32S60
6	LED TV	5k- 140inch				★					★	ICE32S60 ICE47N60
7	LED Lighting	20	500	★	★	★	★	★				ICE25S65 ICE60N130
8	Data center AC/DC(Servers and Telecom)	500k-1k node				★					★	ICE32S60 ICE47N60
9	Fast Chargers	3k	400k			★					★	ICE47N60
10	Chargers PC Adapters	36	90	★	★		★					ICE8S65,ICE8N60, ICE10N60,ICE15S60
11	TV Power application	24	410		★	★	★	★				ICE25S65 ICE60N130
12	UPS	500	10k			★			★	★	★	ICE32S60 ICE47N60
13	Solar inverters	300	6k						★	★	★	ICE32S60 ICE47N60
14	HID Street lights	22	500			★			★	★		ICE25S65 ICE60N130
15	Gaming consoles	100	200		★	★			★			ICE60N130 ICE20N170
16	LED signage	10	250	★	★				★			ICE60N130 ICE20N170
17	E bikes E-Mobility	600	40k			★			★	★		ICE32S60 ICE47N60
18	Printers	10	1500	★	★	★	★	★	★	★		ICE32S60 ICE47N60
19	White good Fridge	200	300			★			★	★	★	ICE60N130 ICE20N170
20	Washing machine	800	1500			★			★	★	★	ICE32S60 ICE47N60
21	Audio Amp	200 x n	5k x n			★			★	★		ICE32S60 ICE47N60
22	Projector	300	2k			★			★	★		ICE32S60 ICE47N60
23	Car audio	10 x n	100xn				★	★				ICE47N60 ICE32S60
24	Navigation	10	20				★					ICE8S65,ICE8N60, ICE10N60,ICE15S60
25	3D printer	180	1500	★	★	★	★	★	★	★		ICE32S60 ICE47N60
26	Smart phone adaptors	20	90	★	★		★					ICE15S60 ICE20N170
27	Factorized power	320	1300			★			★	★		ICE47N60
28	Tablet computers	200	1500	★	★		★					ICE15S60 ICE20N170
29	Micro Inverters	200	1500						★	★	★	ICE47N60



2. 一般应用

1) HID light ballast application ~500W

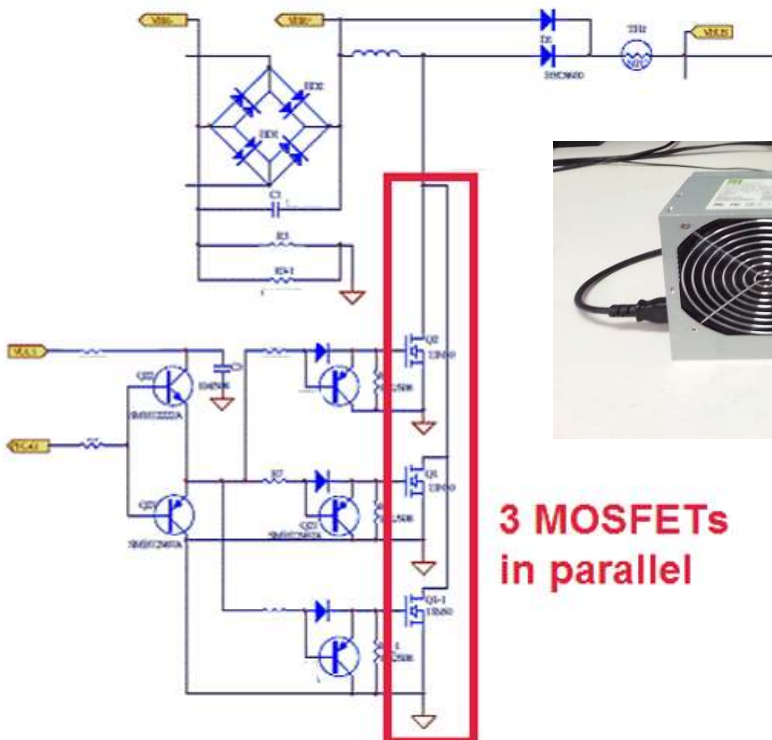
ICE15N60-15A/600V (4 MOSFETs are used for Bridge section)



2) ATX 600W Model

ICE20N170 -20A/600V /TO220

(3つの MOSFET をPFC(boost Converter))に使用。
SPEC:AC 100/240V DC 0~400W, 12V output



**3 MOSFETs
in parallel**



3) Switched-Mode Power Supply for Multifunction Peripheral/Printer/Product_FC Stage 多功能复印机电源

ICE10N60FP -10A/600V

Alternative:

ICE15N60FP -15A/600V

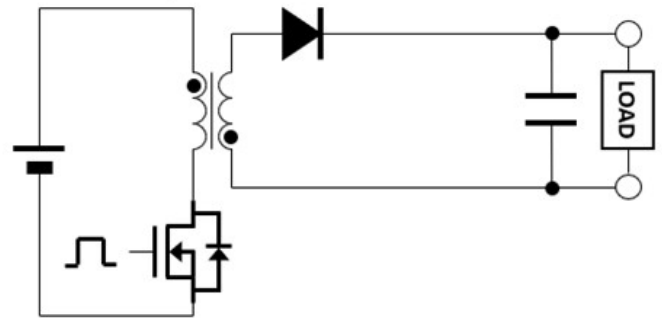
ICE20N170FP- 20A/ 600V

LED Driver

ICE20N170 20A/600V Robust UIS —

ICE15S60 15A/600V Lower FOM

Flyback converter



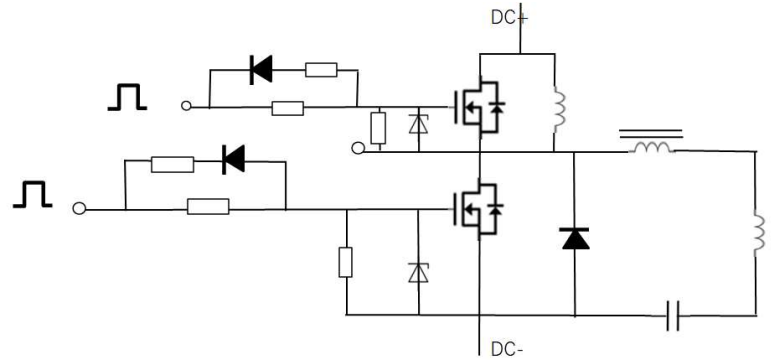
リップル電圧は他のコンバーターと比べると大きいので比較的大き目のキャパシターが必要となる。

出力電圧は一次側と二次側のTurn比で決まります。

4) ATE 420W products

ICE60N130 25A/ 600V 2pcs

ICE15N60 15A/600V 2pcs

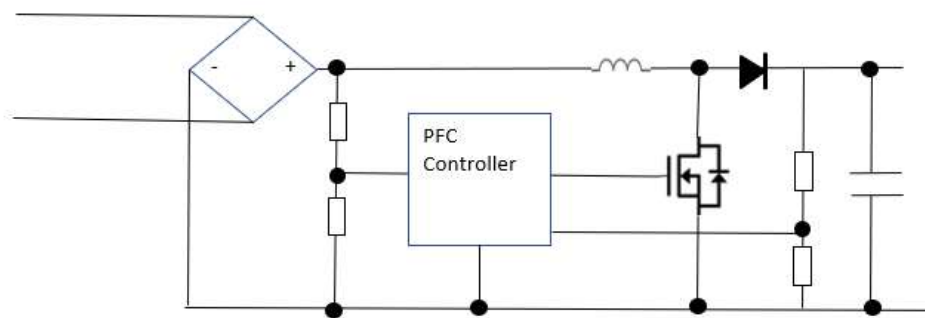


5) AC/DC 100kHz PFC Boost Converter

ICE8S65-8A/650V

ICE7N60 7A/ 600V

200V DC Input Output 385

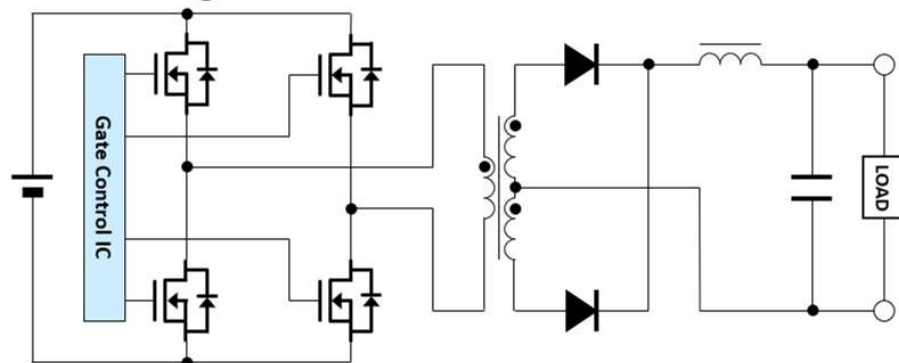


6) Full Bridge Converter

ICE47N60W -47A/600V

Audio (声学电源)

Full Bridge Converter



7) LLC Resonant Half Bridge Converter

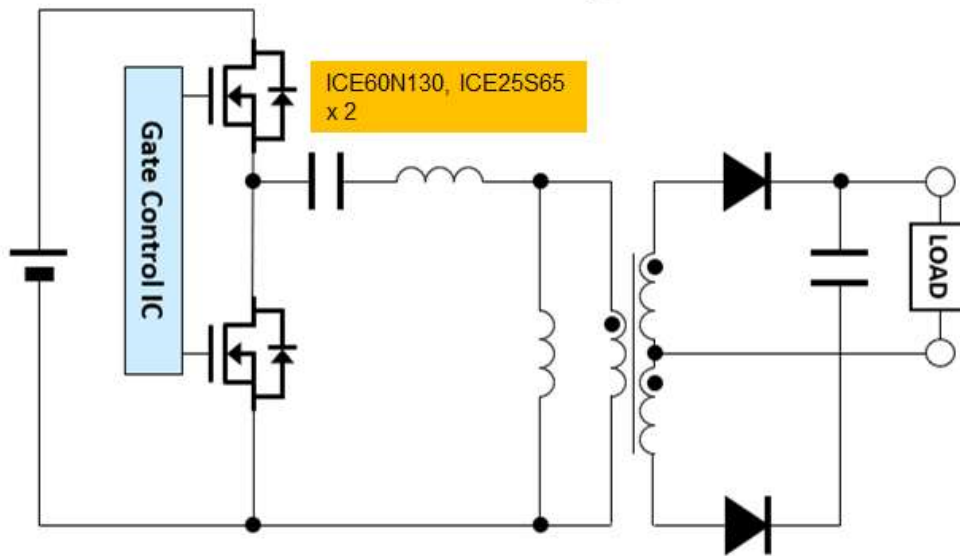
Printer Power supply (打印机电源)

ICE60N130 25A/600V -Robust UIS
ICE25S65 25A/650V - Lower FOM

Audio Power supply (声学电源)

22N60B 22A/600V/D2PAK

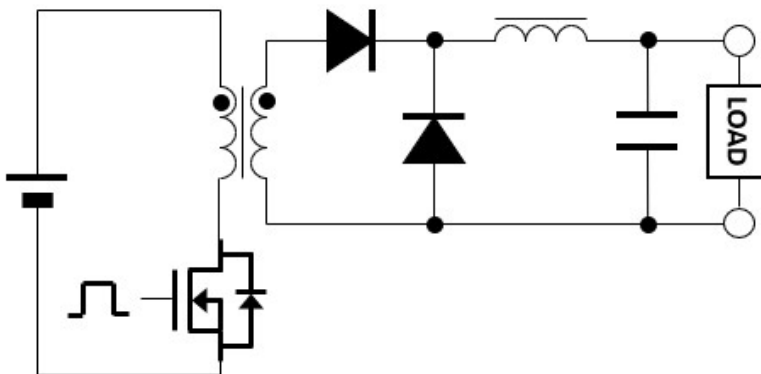
LLC Resonant Half Bridge Converter



8) Forward Converter (孤立型) Low to High:个人电脑, 工业

ICE20N170 20A/600V Robust UIS
ICE60N130 25A/600V Lower FOM

Forward converter



使用一台 ICE20N170 和一台 ICE60N130 的示例。该系统可提供多种输出。与反激式相比, 虽然必须包括二极管和扼流线圈, 但纹波电压较低。输出电压由初级和次级的匝数比决定。

9) DC-AC Inverter /DC-DC Converter

UPS 25A and 15A rated 600 and 650V

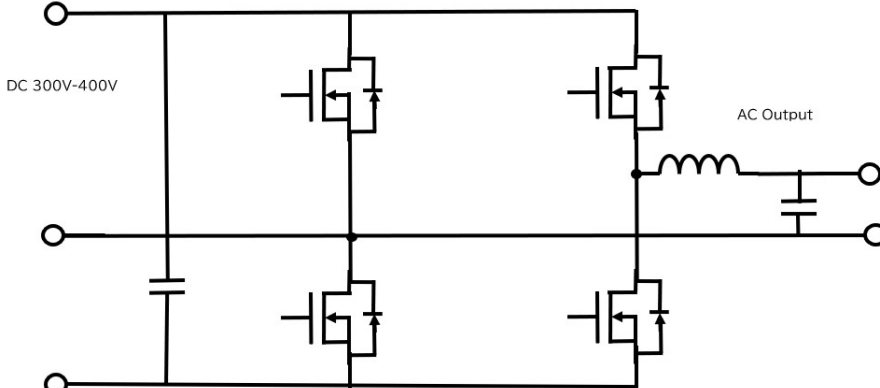
ICE60N130 25A/600V-Robust EAS

ICE25S65 25A/650V -Low FOM due to Low Qg

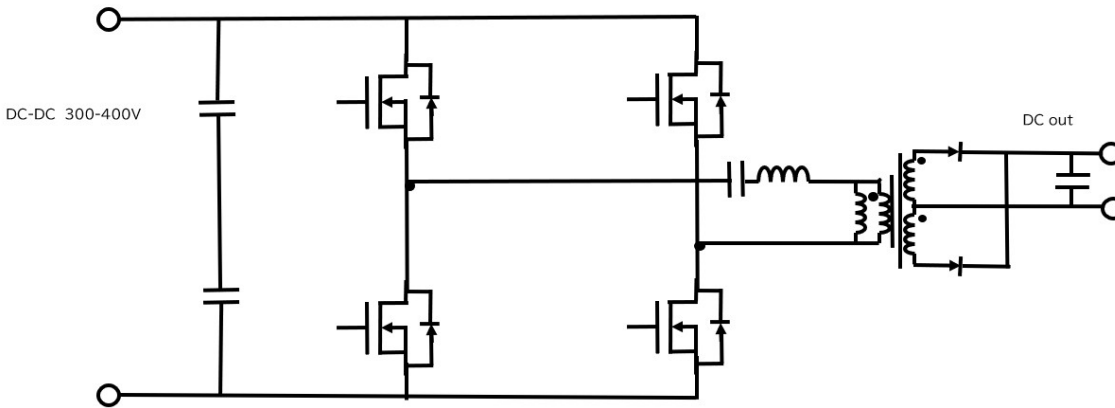
ICE15N60 15A/600V -Cost Effective

ICE15S60 15A/600V -Low FOM due to Low Qg

DC-AC Inverter



DC-DC Converter as DC in 300-400V and DC out 30-60V



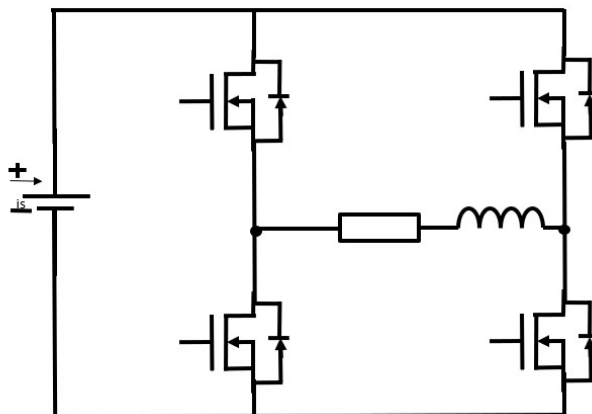
10) Inverter 逆变器

Solar Inverter/ Micro Inverter

25A and 15A rated 600 and 650V

ICE25S65 25A/650V -Low FOM due to Low Qg

ICE15S60 15A/600V -Low FOM due to Low Qg



需要大电流的情况, 如太阳能电池板。

11) PFC/PWM/AC-DC

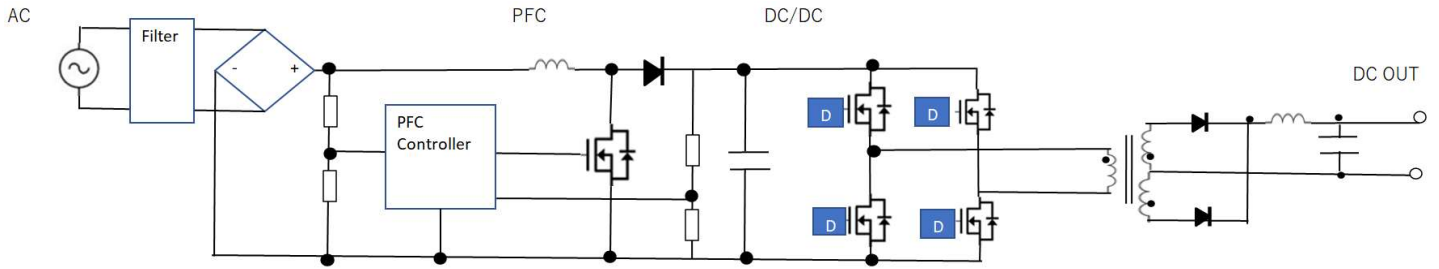
Data Center 数据中心电源

AC 90-265V

DC-DC 400V and Output 12V dc

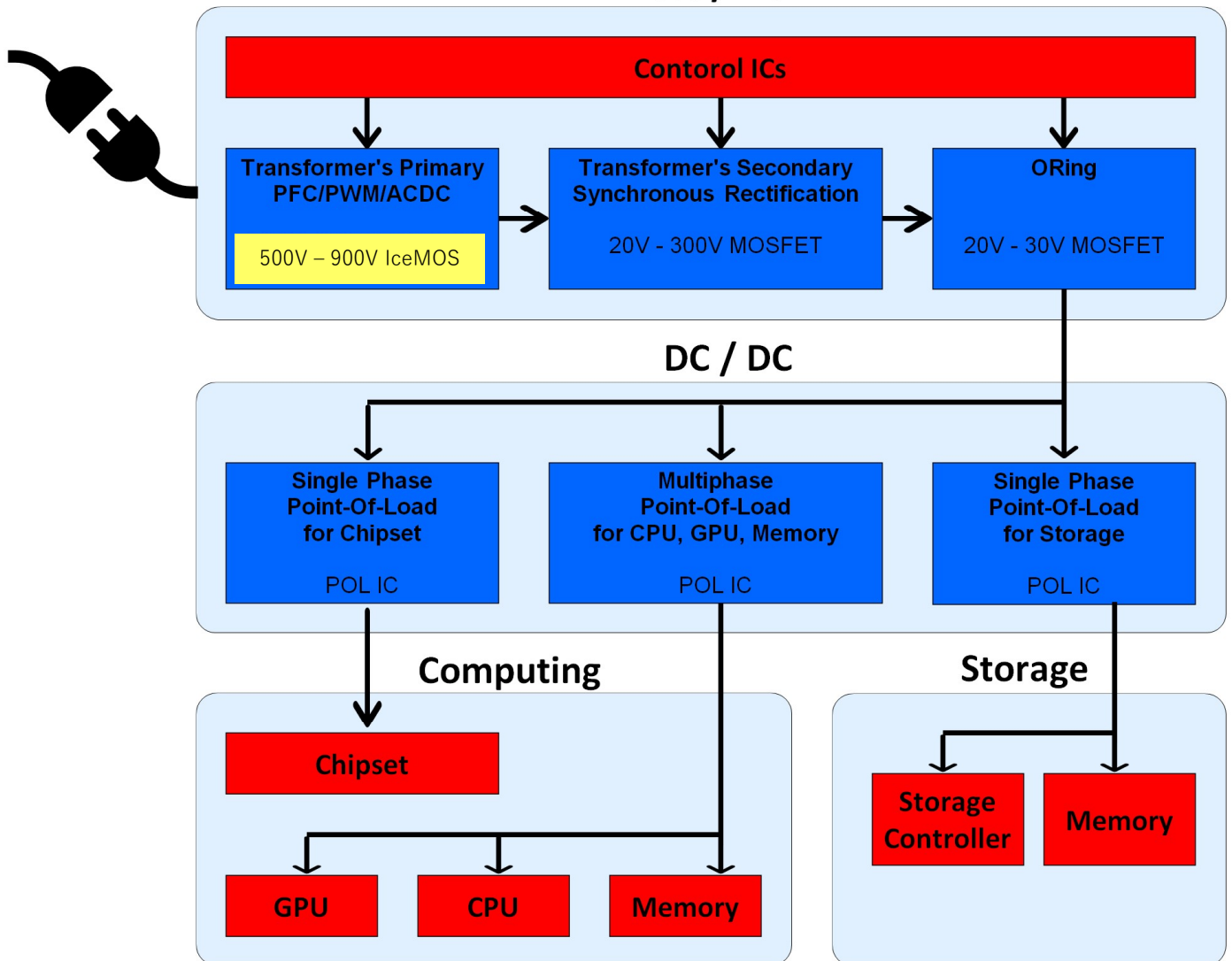
ICE25S65 25A/650V -Low FOM due to Low Qg

ICE60N130 25A/600V-Robust UIS



AC socket

AC / DC



根据设计和规格，使用不同电流和电压范围的 MOSFET。

13) PMF 电路

ICE22N60W Device 22A/600V TO247

Design WIN CASE

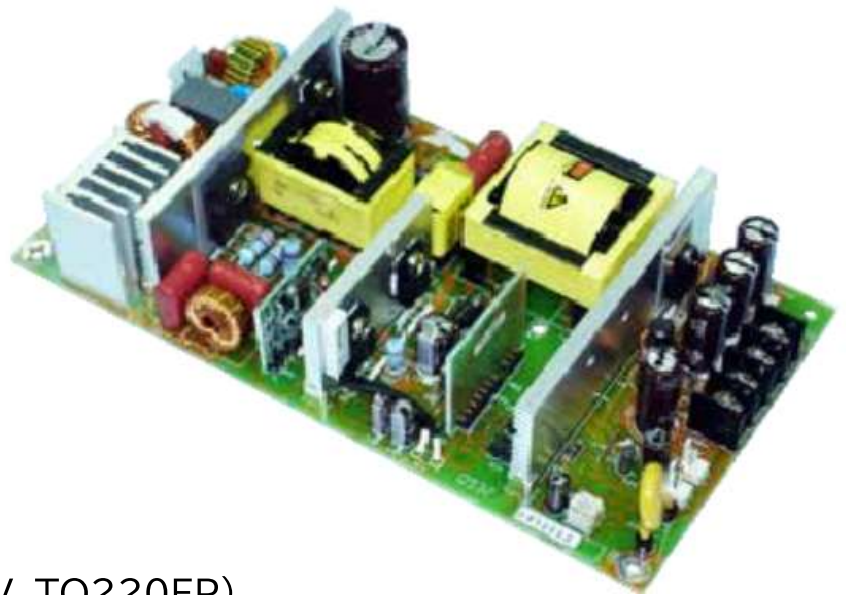
Efficiency 86-88%

380W peak load

与其他两家公司一起进行评估后, 用 ICE22N60W 代替。

采用原因: 由于 V_g 过高, 其他公司的设备无法正常工作。此外, 在规格制定过程中, 其他公司的器件经常出现故障, 而我们的器件却能正常工作。ICEMOS ICE22N60W 被采用。

ICE22N60W



14) 100 V 电源 (Power Supply)

ICE20N60EFP (20A, 600V, TO220FP)

100W Power Supply

Input 90Vac to 264Vac 47-63Hz

Input current 4A max 115Vac, 2A max /230Vac

Inrush current 40A max 115Vac, 80A max 230Vac

Output

V_o 24V, Peak load 8.4A

ICE20N60EFP

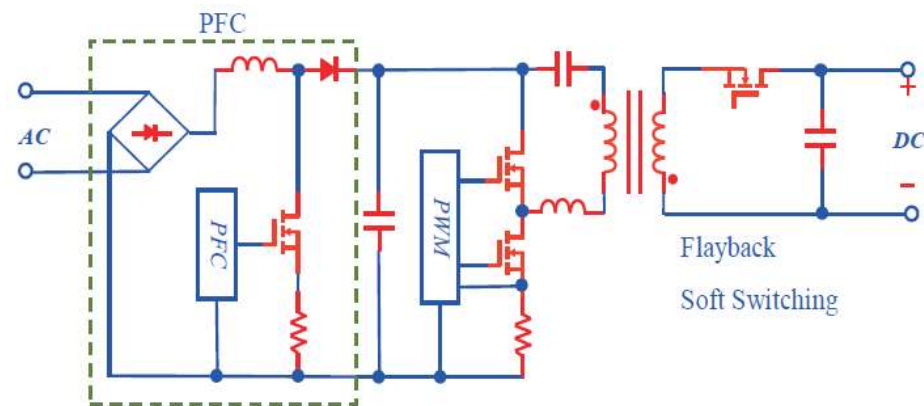


15) Asymmetrical ZVS Flyback 120W to 300W with PFC

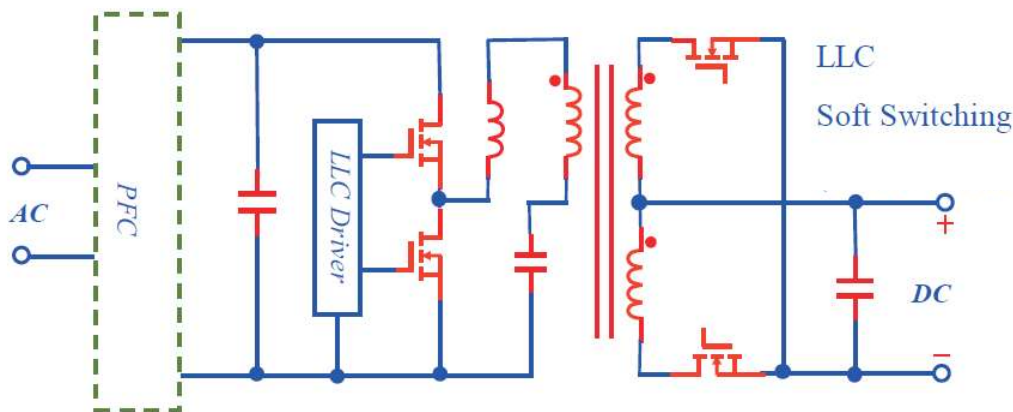
ICE47N60W ,47A/600V TO247

2 MOSFETs
为欧洲制造者设计 WIN 案例

Two MOS with PFC, Single & Multiple output



16) Half Bridge LLC Resonant Soft Switching ZVS 200W Single Output with PFC , Peak and Surge Load



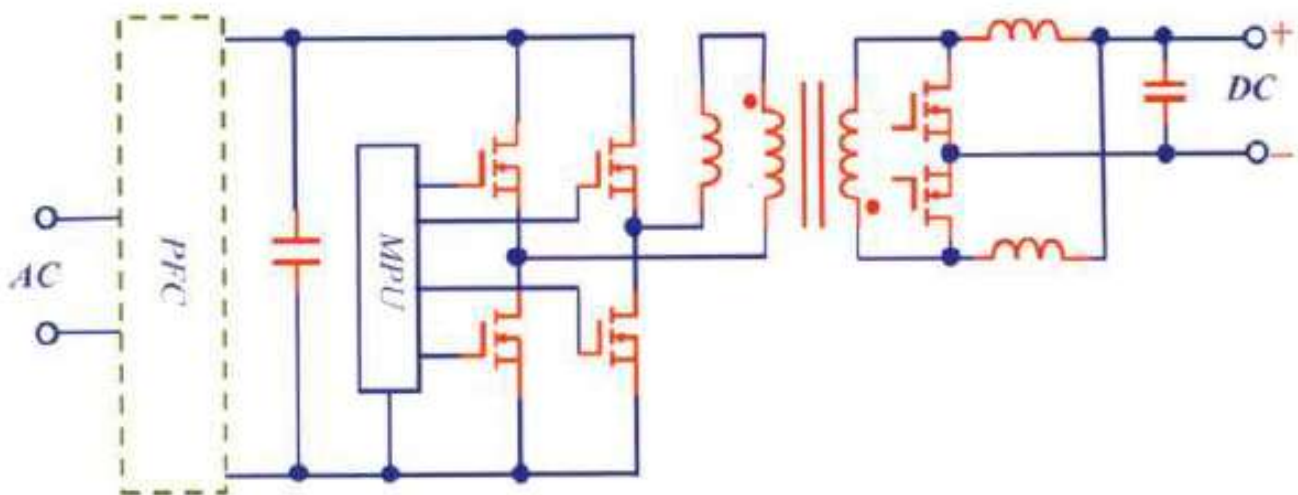
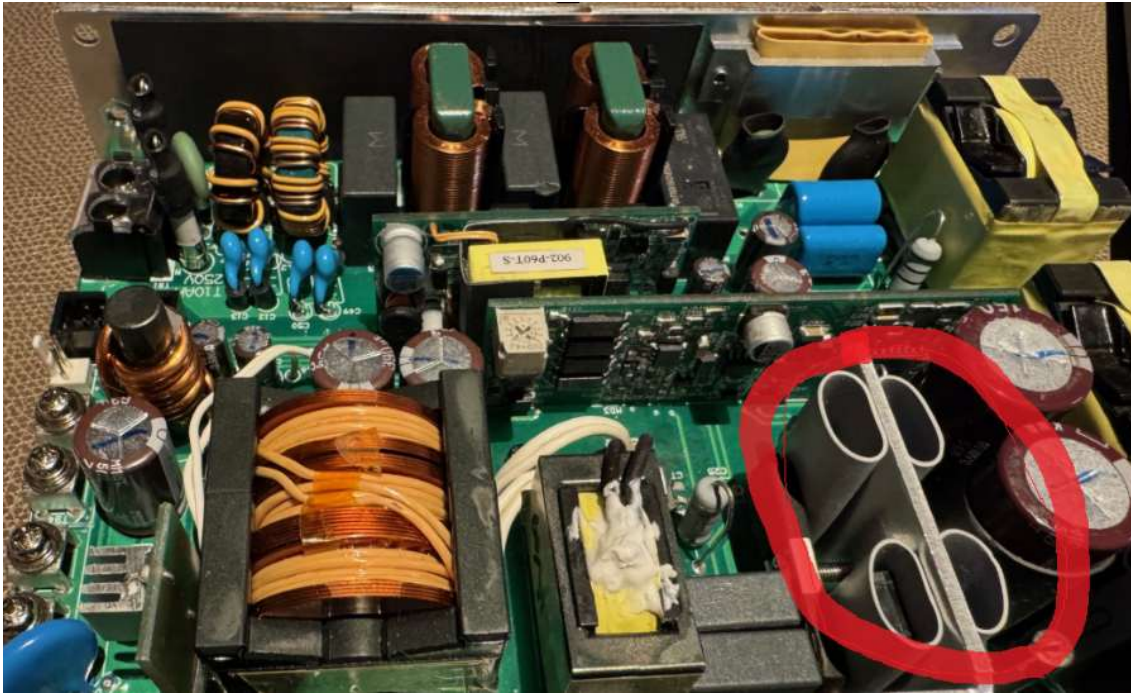
ICE22N60B 2 MOSFETs
22A,600V D2PAK

ICE20N60B 2 MOSFETs
20A,600V D2PAK



16) Phase shift full bridge ZVS topology

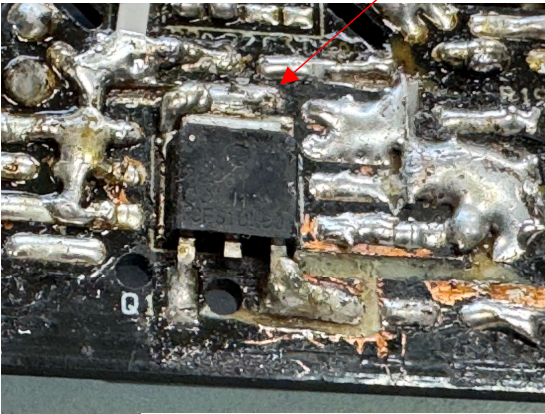
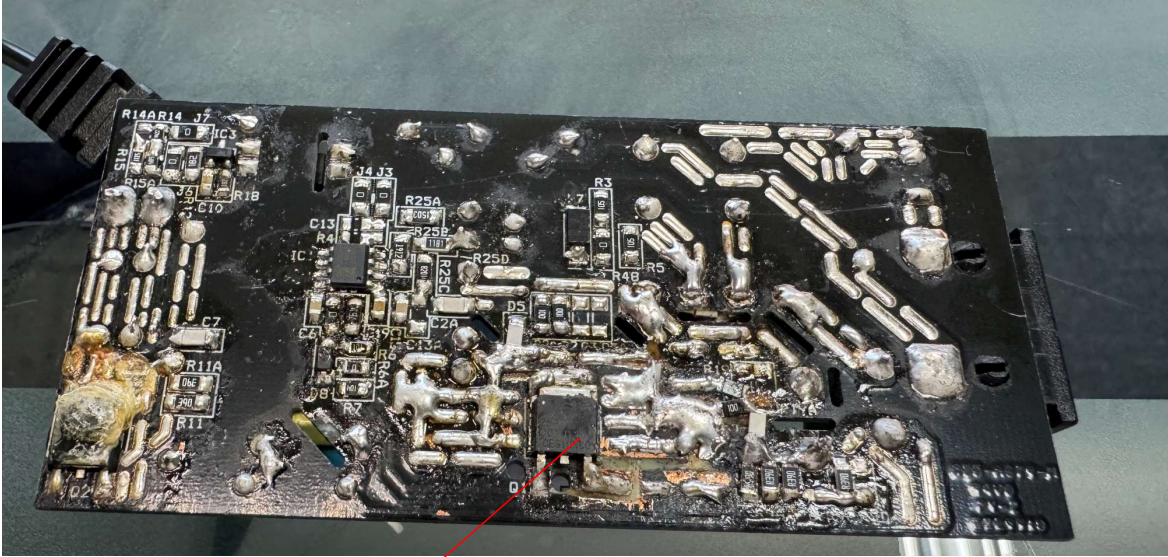
ICE20N60EFP 4 顆, 用於 600W 全橋電路所有功率 MOSFET 均以軟切換模式運作。對於高功率應用, 全橋相位偏移拓撲結構搭配電流倍增器是理想的組合。



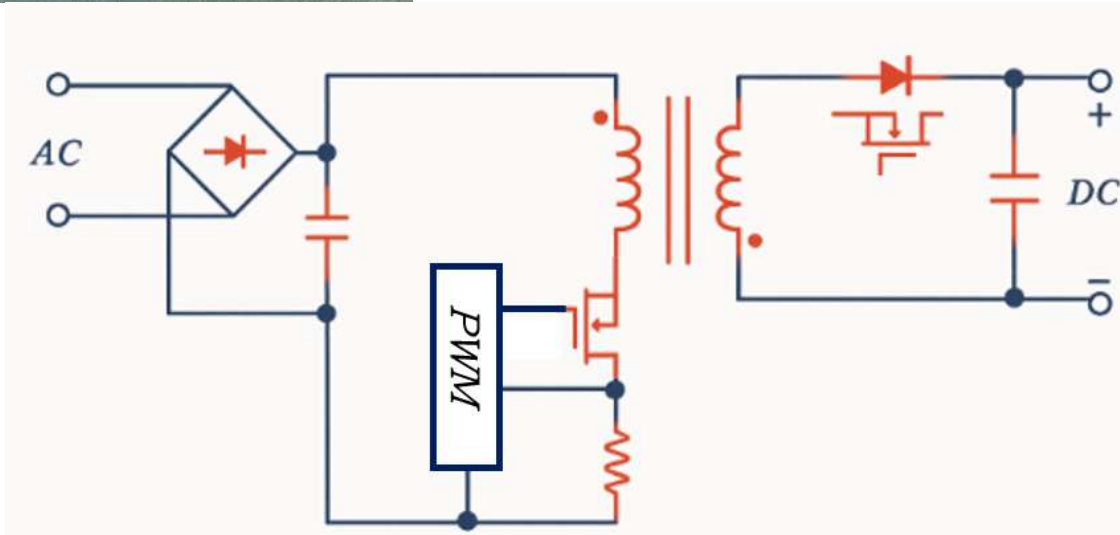
ICE20N60EFP 4pcs
600V, 20A, 190mohm

17) Flyback Topology Hard switching.

反激式拓撲結構，硬切換。此電源適配器採用 1 顆 600V 10A ICES10N60D 晶體管，適用於歐洲醫療應用。



ICES10N60D 1pcs
600V, 10A, 360mohm



高壓超級結 MOSFET 產品一覽表

Power MOSFETs								
Device Type	Product	BVDSS Min. (V)	ID Max. (A)	RDSON Max. (mΩ)	Qg Typ. (nC)	FOM (Ω·nC)	Trr/Qrr (ns)/us	Package
MEMS SJ GEN1 Robust UIS	ICE47N60	600	47	68	189	12.85	552/12	W,C
	ICE60N130	600	25	150	84	12.6	440/8	TO,FP,W,C
	ICE22N60	600	22	160	84	13.44	440/8	TO, B ,W
	ICE20N170	600	20	199	59	11.74	358/6.8	TO,FP,W,C,B
	ICE20N60	600	20	190	59	11.21	358/6.8	TO,FP,W,B,C
	ICE19N60	600	19	220	59	12.98	358/6.8	L8x8
	ICE15N73	730	15	350	75	26.25	383/7.0	TO,FP,W,T
	ICES15N60	600	15	240	52	12.48	318/5.3	TO,FP,L8X8,T
	ICE13N60	600	13	270	48	12.96	285/4.2	TO,FP,L8X8,T
	ICE11N70	700	11	250	84	21	408/7.5	TO,FP,W,B,C
	ICE10N60	600	10	330	43	14.19	303/4.21	TO,FP,W,B,L8x8
	ICES10N60	600	10	360	40	14.4	281/3.9	D
	ICE8N60	600	8	520	32	16.64	194/2.2	TO,FP,W,B,L8X8,T,D,LK
MEMS SJ GEN2 Good FOM	ICE32S60	600	32	78	47	3.67	400/6.8	TO,FP,W,C
	ICE25S65	650	25	133	34	4.52	326/5.6	TO,FP,W,C,B
	ICE24S65	650	24	141	34	4.79	326/5.6	L8x8
	ICE15S60	600	15	175	30	5.25	300/4	TO,FP,W,C,B
	ICE14S65	650	14	195	24	4.68	300/4	TO,FP,W,C,B
	ICE8S65	650	7.8	400	11.5	4.6	308/2	TO,FP,W,B,C,D,L5x6
Silicon SJ K series FAST Recovery	*ICEK55NF60	600	55.1	38	136	5.17	130/0.8	T, TO
	*ICEK49NF60	600	49.1	45	117	5.27	132/1.0	T,W,TO
	*ICEK42NF60	600	42	58	95	5.51	90/0.8	W, TO220,T
	*ICEK35NF60	600	35	68	83	5.64	111/0.6	TO , W
	*ICEK16NF60	600	16	180	32	5.76	83/1.0	D,FP
	*ICE26NF65	650	25.6	99	48	4.75	114/0.7	T,W
	*ICEK15NF65	650	15.1	190	32	6.08	66/0.6	TO,D,FP
	*ICEK11NF65	650	10.5	290	22	6.38	71.5/0.29	TO220 ,D,FP
	*ICEK9NF65	650	9.1	360	20	7.2	59/0.35	D , FP
	*ICEK6NF65	650	6	600	14	8.4	62/0.33	D

重要信息的重要说明本文件中包含的信息以本文件发布时为准;有关最新规格, 请参阅我们网站上的数据表。本文件中描述的产品或规格如有变更, 恕不另行通知。请在我们的保修范围内使用产品, 包括最大额定值、工作电源电压、热特性、安装条件和我们的规格书中指明的工作环境。

免责声明:

本文档仅作为 ISMOS Technology Limited 产品应用的提示, 并不保证产品的状态、功能或性能。因此, 对于因使用任何信息而造成的任何损失, 或侵犯第三方的知识产权或其他权利, 我们概不负责。尽管我们努力提高产品的质量和可靠性, 但半导体产品根据使用条件可能会出现一定的故障率或故障, 因此请在考虑安全设计的前提下进行验证, 风险自担。