

方案简介

本应用方案基于一款高集成度的峰值电流型反激电源控制器 VPS2103，结合隔离功率变压器 VPE24FF10A、输出整流二极管以及必要的阻容元件，实现 18V-36V 输入，24V 输出的隔离稳压电源方案。本方案可实现全输入电压范围最大功率 10W 的输出能力，原副边隔离耐压不小于 1500VDC，同时具备远程控制关断、可长期短路保护并自恢复等功能。本方案可应用在系统板需要实施电气隔离以达到安全和（或）抗干扰目的的相关场合。

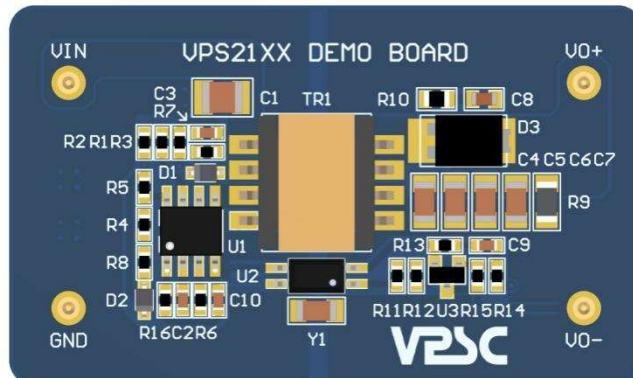
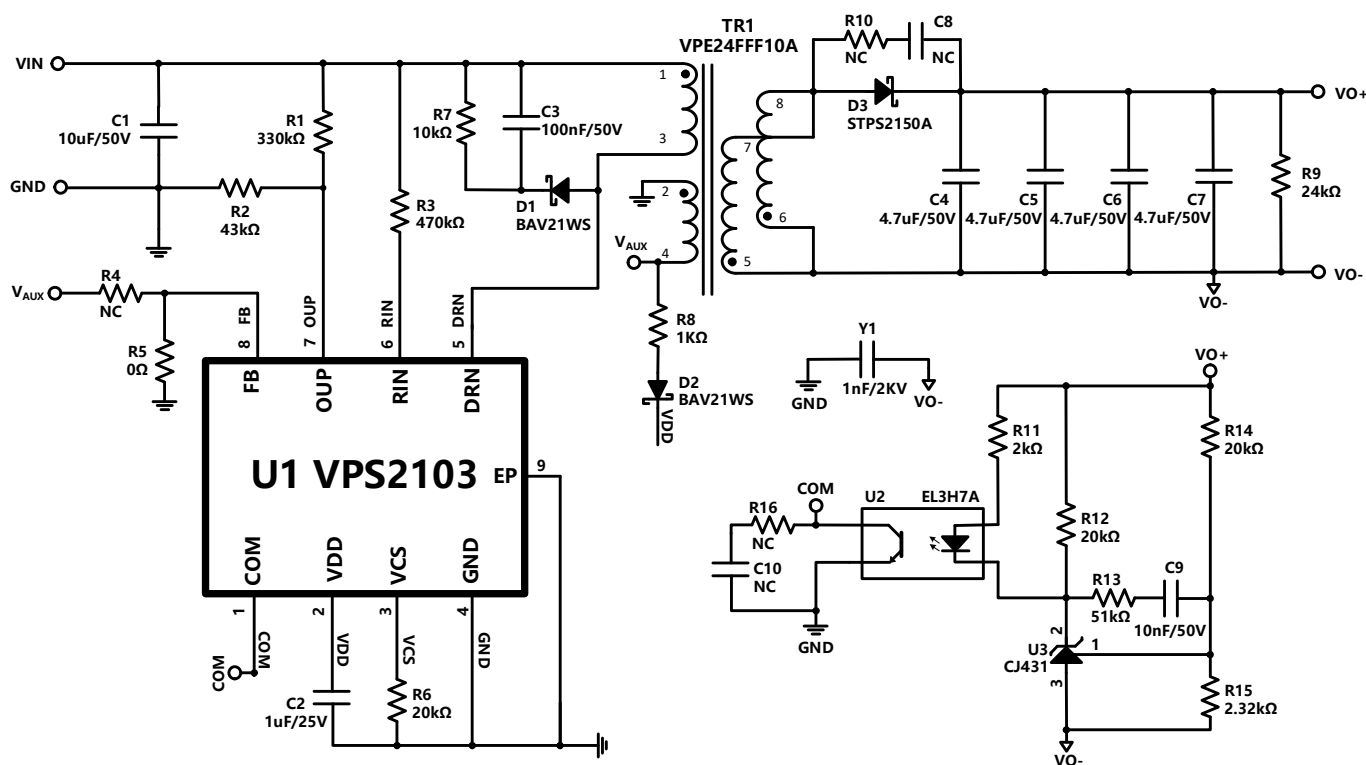


图 1: VPS2103 Demo 板(尺寸:50mm*30mm)

关键词：输入：18V-36V，输出 24V/10W，隔离电压：1500VDC，反馈方式：副边反馈-SSR

原理图



引脚功能说明

编号	功能	功能描述
1	VIN	电源输入端
2	GND	电源接地端
3	VO+	电源输出正
4	VO-	电源输出负

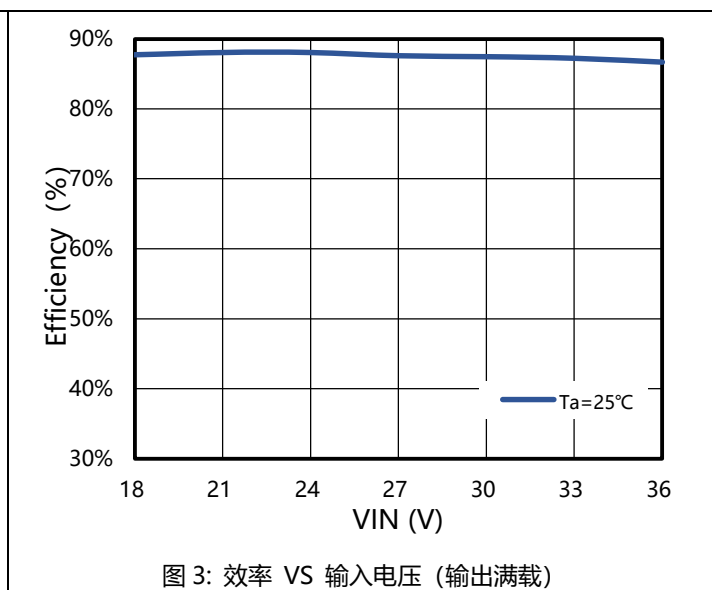
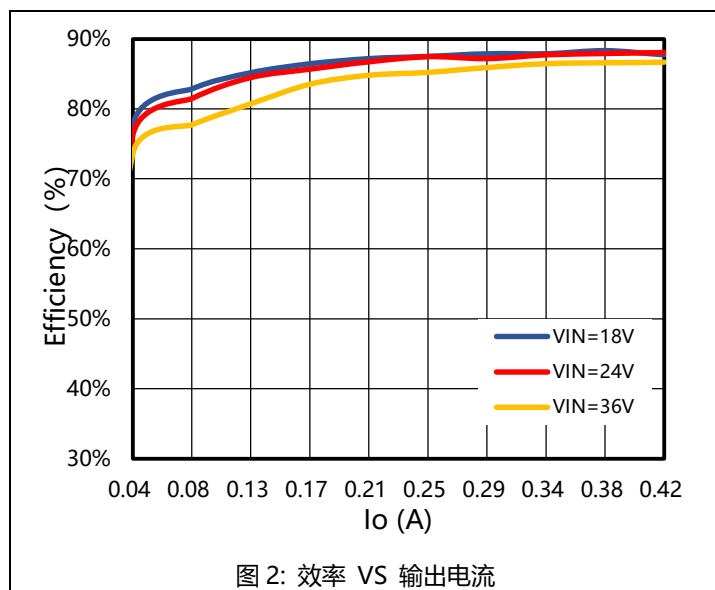
物料清单

位号	参数	封装	型号	品牌
C1	10uF/50V-X7R	1210	CC1210KKX7R9BB106	YAGEO
C2	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C3	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C4	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C5	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C6	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C7	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C8	NC	-	-	-
C9	10nF/50V-X7R	0603	CC0603KRX7R9BB103	YAGEO
C10	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	330K Ω ±1%	0603	RC0603FR-07330KL	YAGEO
R2	43K Ω ±1%	0603	RC0603FR-0743KL	YAGEO
R3	470K Ω ±1%	0603	RC0603FR-07470KL	YAGEO
R4	NC	-	-	-
R5	0 Ω ±1%	0603	RC0603FR-070RL	YAGEO
R6	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R7	10K Ω ±1%	0603	RC0603FR-0710KL	YAGEO
R8	1K Ω ±1%	0603	RC0603FR-071KL	YAGEO
R9	24K Ω ±1%	1206	RC1206FR-0724KL	YAGEO
R10	NC	-	-	-
R11	2K Ω ±1%	0603	RC0603FR-072KL	YAGEO
R12	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R13	51K Ω ±1%	0603	RC0603FR-0751KL	YAGEO
R14	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R15	2.32K Ω ±1%	0603	RC0603FR-072K32L	YAGEO
R16	NC	-	-	-
TR1	NP:NS:NA=10:14:7 Lp=11uH	ER11.5	VPE24FFF10A	VPSC
D1	200V/0.2A	SOD-323	BAV21WS	CJ
D2	200V/0.2A	SOD-323	BAV21WS	CJ
D3	150V/2A	SMA	STPS2150A	ST
U1	4-50VIN/90V/0.1 Ω 电流模式 PWM 控制器	ESOP-8	VPS2103	VPSC
U2	CTR=80~160, Viso=3750VAC	SSOP-4	EL3H7A	EVERLIGHT
U3	Vref=2.495V	SOT23-3	CJ431	CJ

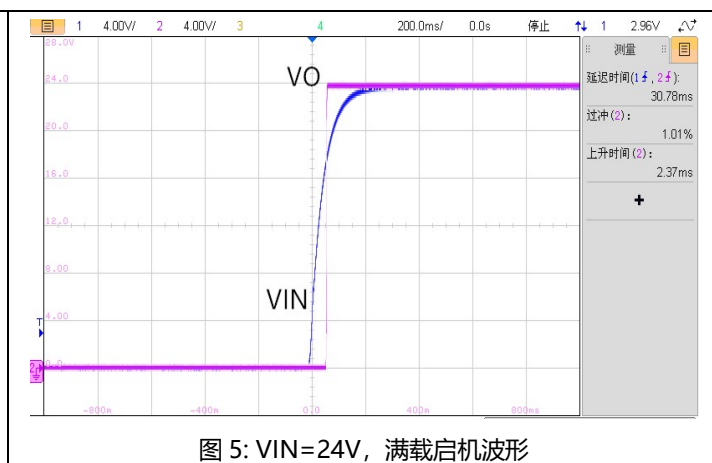
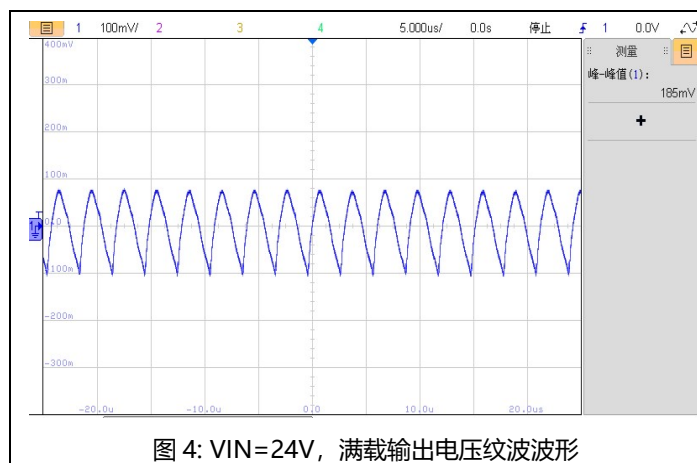
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=24V	6	---	477	mA
转换效率	VIN=24V, IO=0.42A	---	88	---	%
纹波&噪声	VIN=24V, IO=0.42A	---	190	230	mV
输出电压精度	VIN=24V, IO=0.42A	---	0	---	%
线性调节率	VIN=18V-36V, IO=0.42A	---	0	---	%
负载调整率	VIN=24V, IO=0.42A	---	-0.1	---	%
输入欠压保护	锁定电压	---	15.2	---	V
	恢复电压	---	17.4	---	V
短路保护	VIN=18V-36V	可长期保护, 自恢复			
工作温度	大于 70°C需降额使用	-40	---	85	°C
绝缘电压	原边短接 VS 副边短接	1500	---	---	VDC

关键性能指标测试结果

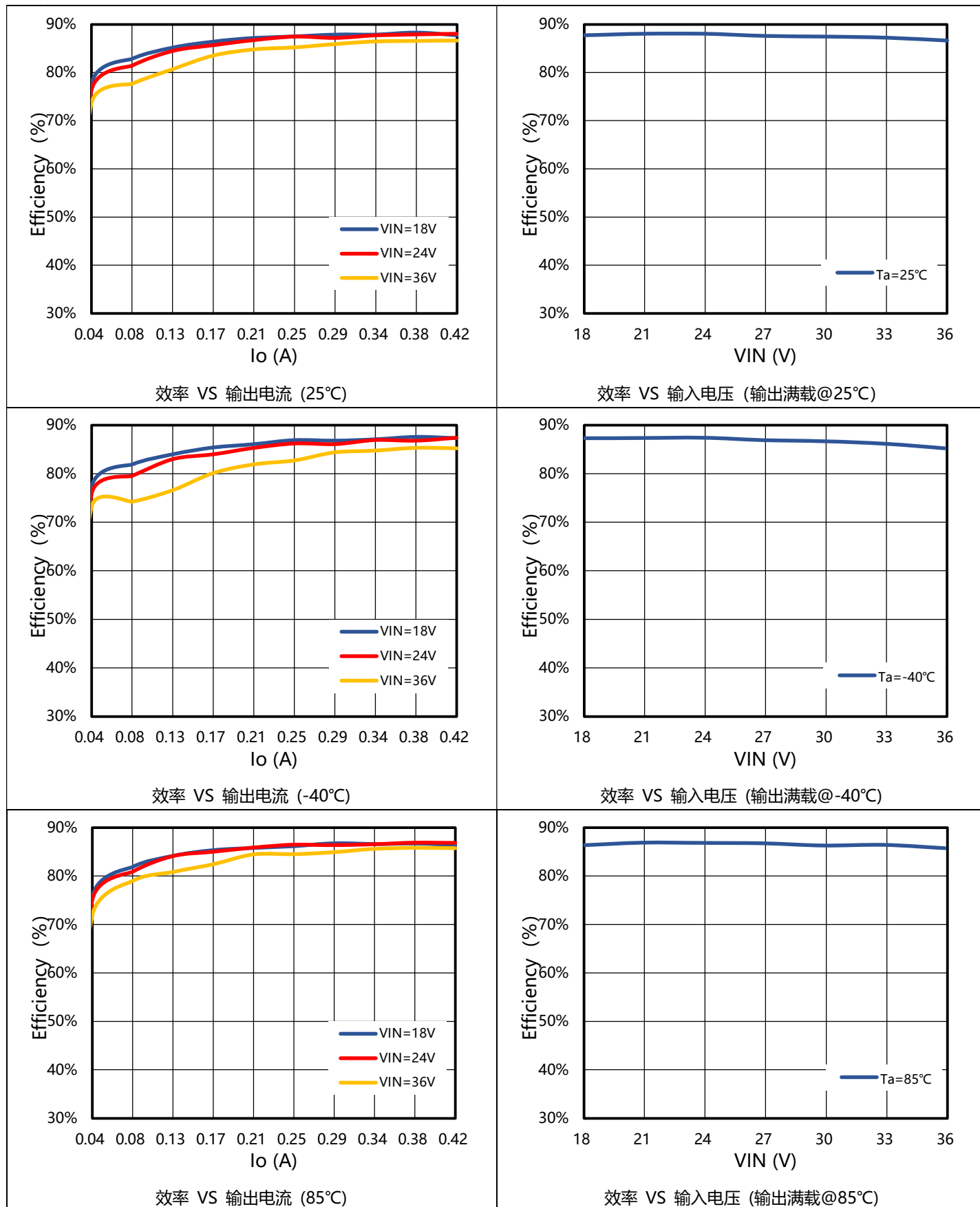


相关波形



详细测试数据

高低温测试曲线



VIN=24V, Ta=25°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
24.02	0.006	23.99	0	0%	0.00%
24.02	0.055	23.99	0.042	10%	76.27%
24.02	0.103	23.99	0.084	20%	81.45%
24.02	0.149	24.00	0.126	30%	84.49%
24.01	0.196	24.00	0.168	40%	85.68%
24.01	0.242	24.00	0.210	50%	86.74%
24.01	0.288	24.00	0.252	60%	87.46%
24.01	0.337	24.00	0.294	70%	87.20%
24.00	0.383	24.00	0.336	80%	87.73%
24.00	0.430	24.00	0.378	90%	87.91%
24.00	0.477	24.00	0.420	100%	88.05%

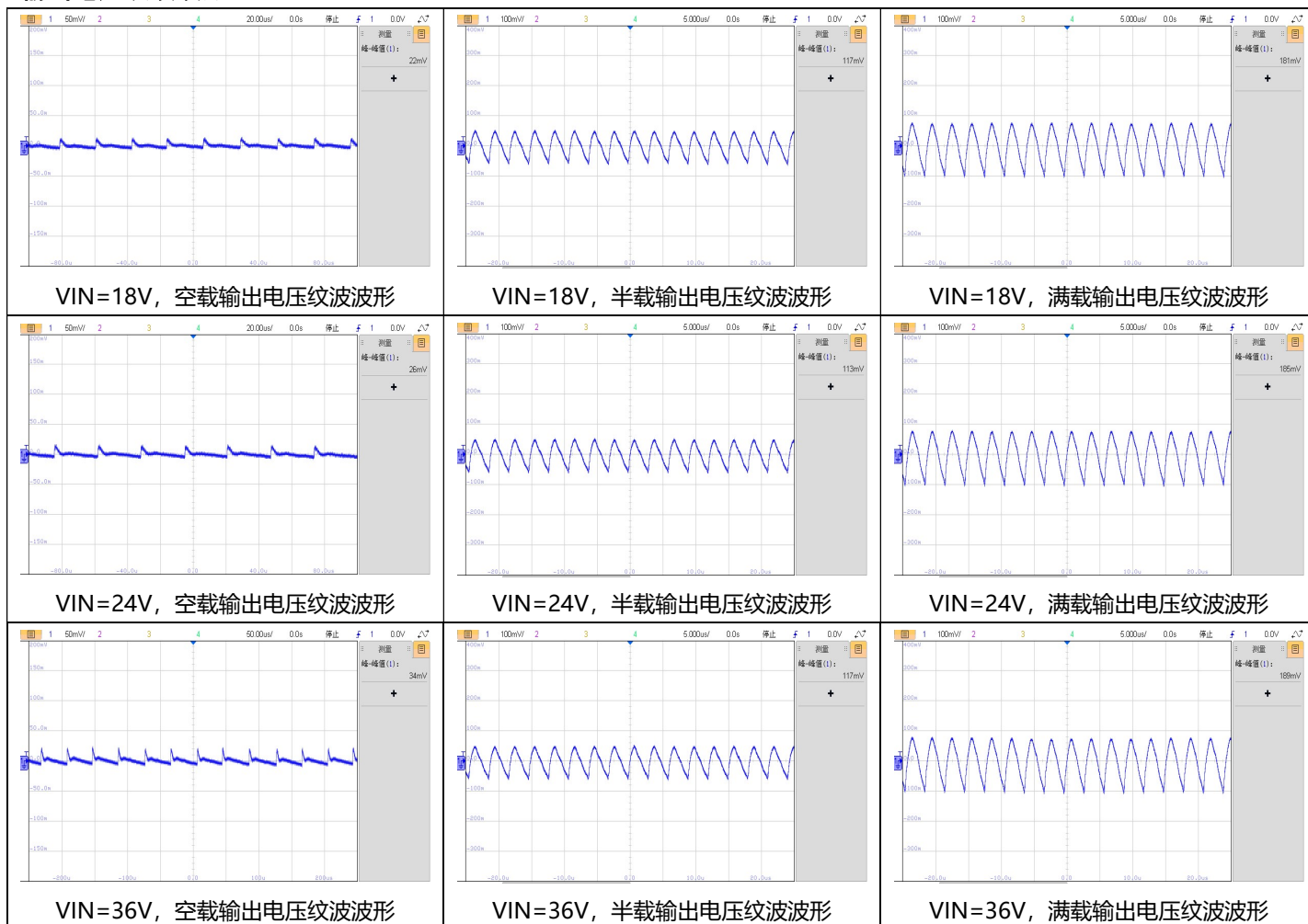
VIN=24V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.93	0.005	23.78	0	0%	0.00%
23.93	0.055	23.78	0.042	10%	75.88%
23.92	0.105	23.79	0.084	20%	79.57%
23.92	0.151	23.79	0.126	30%	82.99%
23.91	0.199	23.79	0.168	40%	84.00%
23.91	0.245	23.80	0.210	50%	85.32%
23.90	0.291	23.80	0.252	60%	86.24%
23.90	0.340	23.80	0.294	70%	86.11%
23.89	0.385	23.80	0.336	80%	86.94%
23.89	0.434	23.81	0.378	90%	86.81%
23.88	0.479	23.81	0.420	100%	87.43%

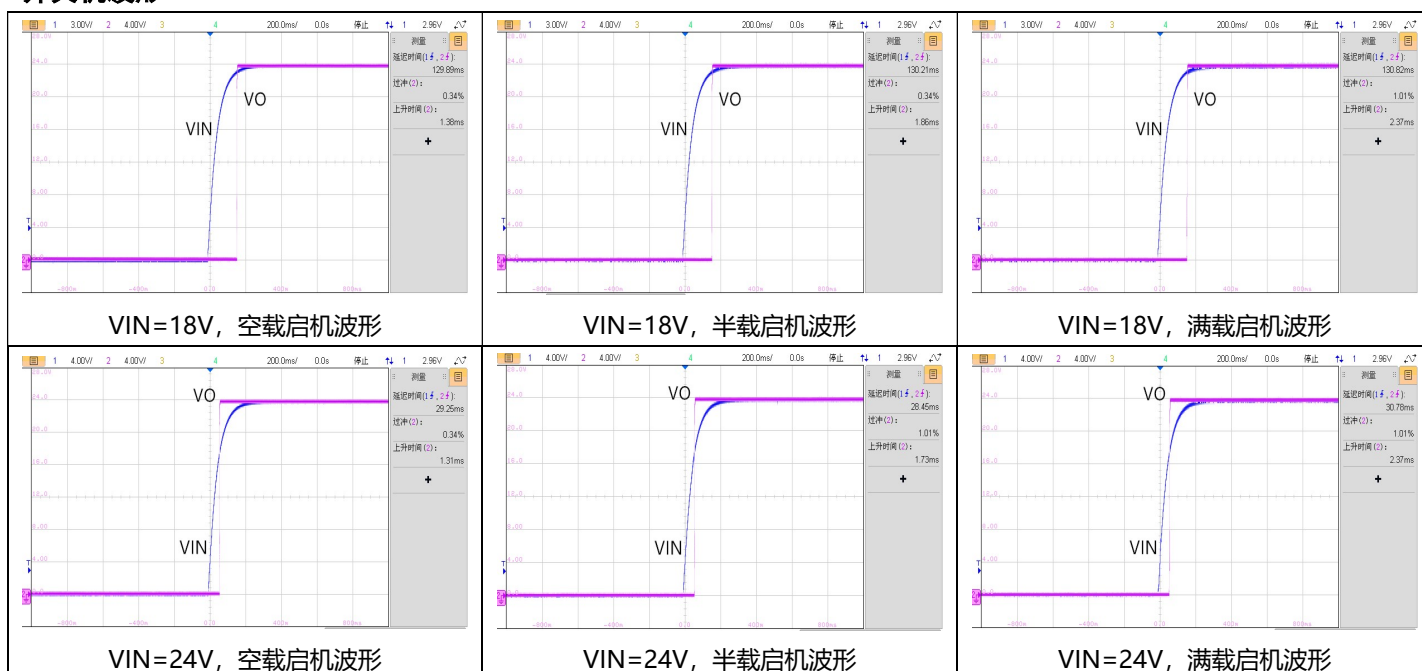
VIN=24V, Ta=85°C, 输入、输出及效率数据:

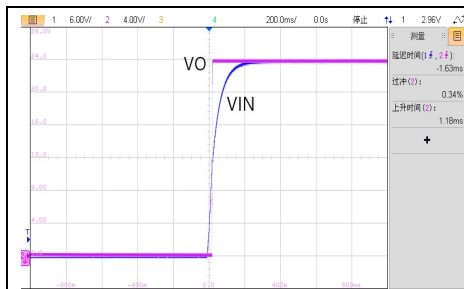
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.93	0.007	23.96	0	0%	0.00%
23.93	0.056	23.96	0.042	10%	75.09%
23.92	0.104	23.96	0.084	20%	80.90%
23.92	0.150	23.96	0.126	30%	84.14%
23.91	0.198	23.96	0.168	40%	85.03%
23.91	0.245	23.96	0.210	50%	85.89%
23.90	0.292	23.95	0.252	60%	86.48%
23.90	0.341	23.95	0.294	70%	86.40%
23.89	0.389	23.95	0.336	80%	86.59%
23.89	0.436	23.95	0.378	90%	86.91%
23.88	0.485	23.95	0.420	100%	86.85%

输出电压纹波波形

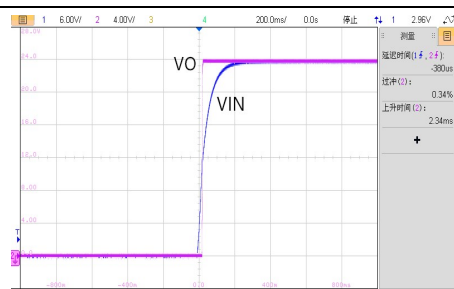


开关机波形

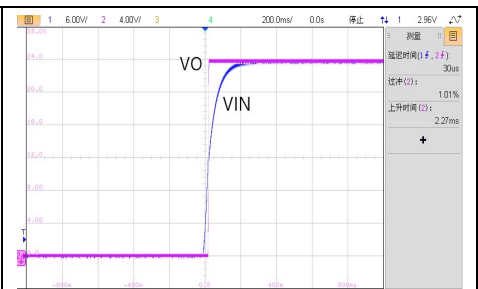




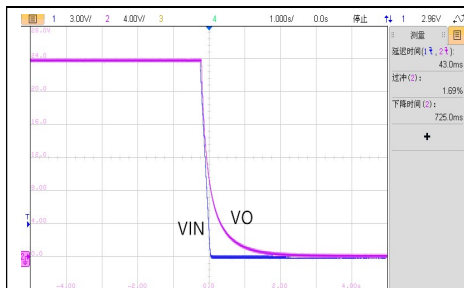
VIN=36V, 空载启机波形



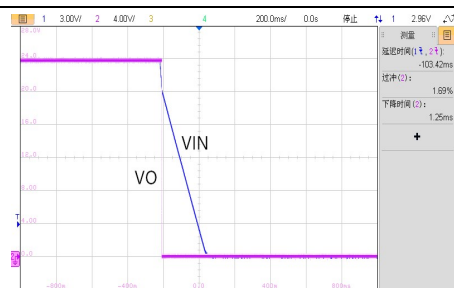
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VIN=36V, 满载启机波形



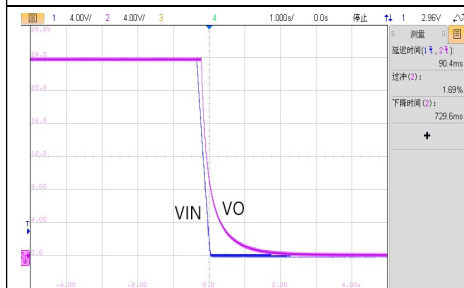
VIN=18V, 空载关机波形



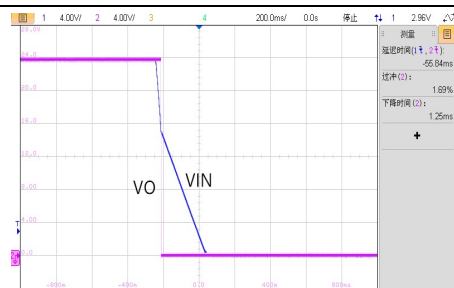
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VIN=18V, 满载关机波形



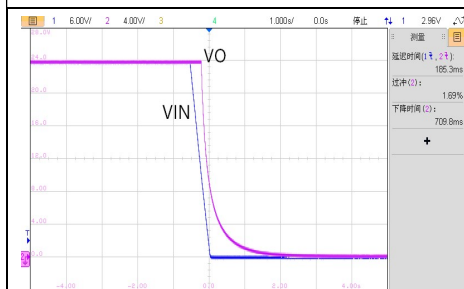
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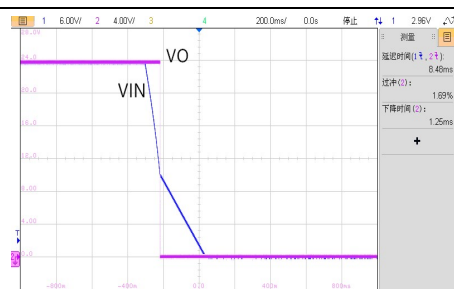
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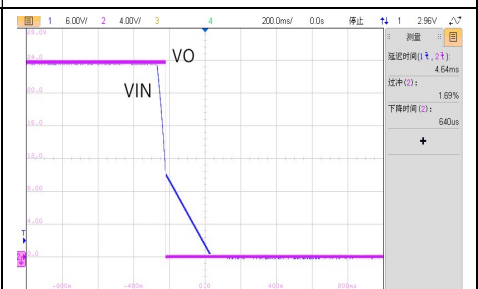
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VIN=36V, 空载关机波形

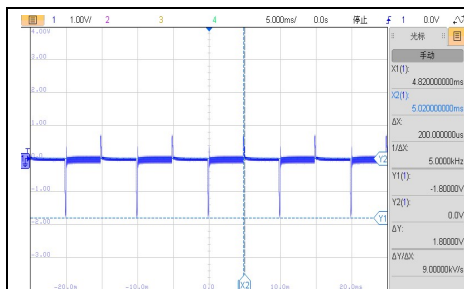


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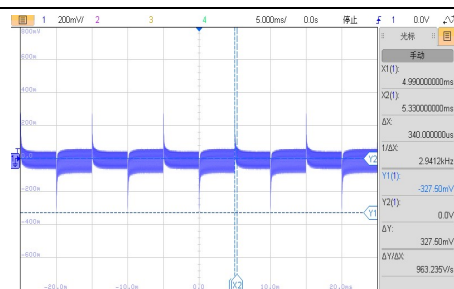


VIN=36V, 满载关机波形

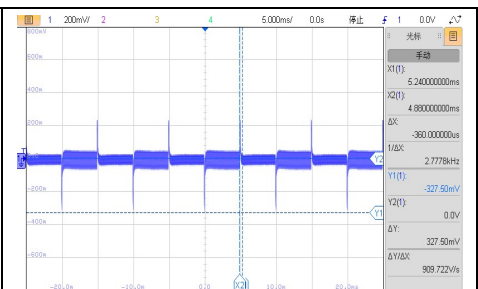
动态波形



VIN=18V, 100%-10%-100%Io 动态波形

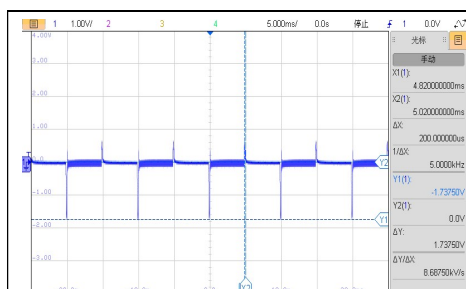


VIN=18V, 75%-50%-75%Io 动态波形

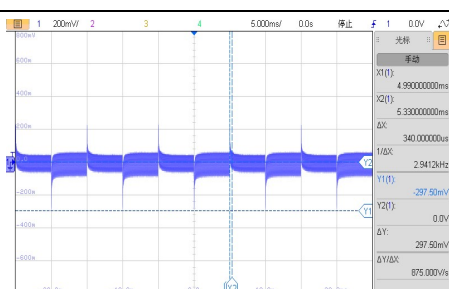


VIN=18V, 50%-25%-50%Io 动态波形

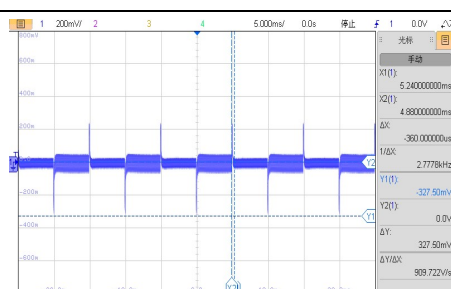
18-36V 输入, 1.5KV 隔离 24V/10W 单路输出解决方案



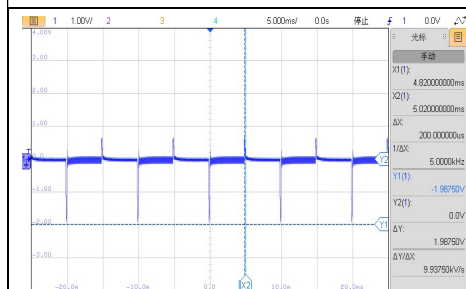
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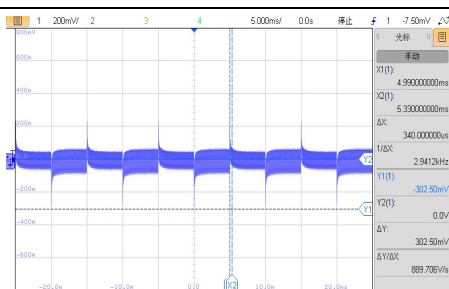
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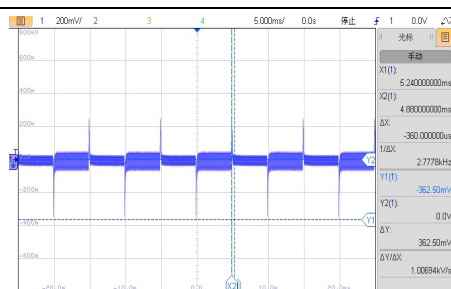
VIN=24V, 50%-25%-50%Io 动态波形



VIN=36V, 100%-10%-100%Io 动态波形

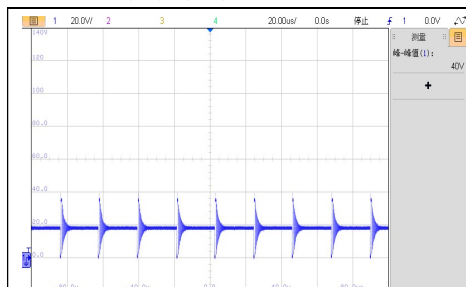


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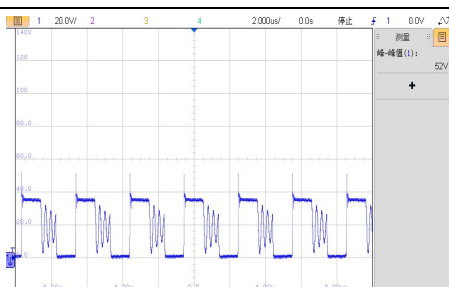


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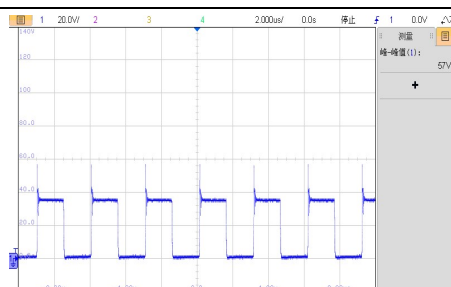
MOS 管电压应力波形



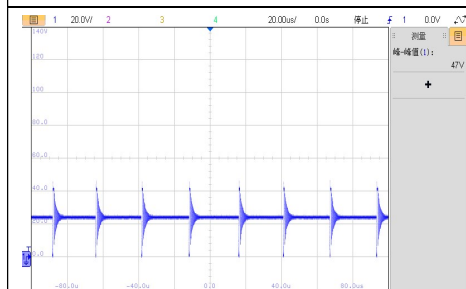
VIN=18V, 空载 VDS 波形



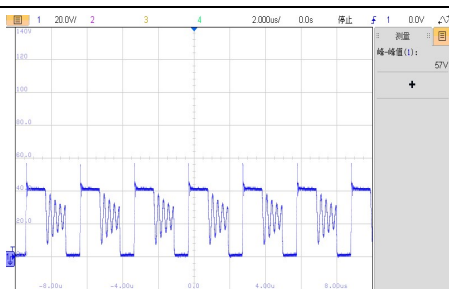
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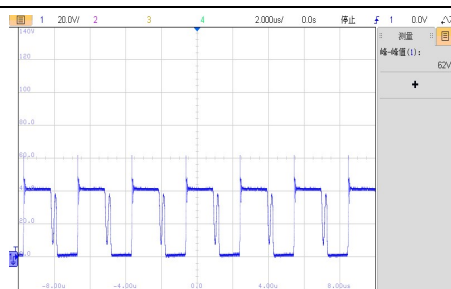
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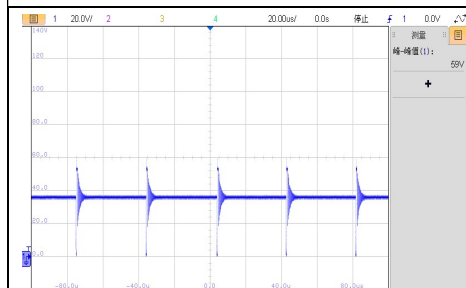
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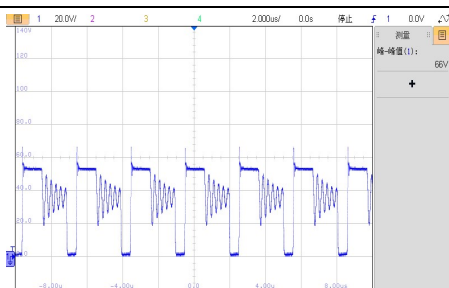
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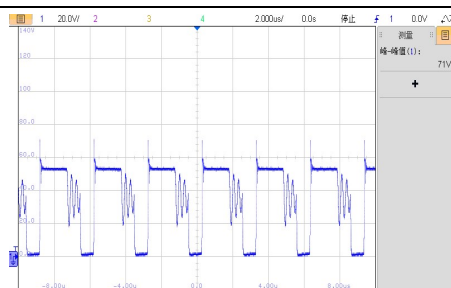
VIN=24V, 满载 VDS 波形



VIN=36V, 空载 VDS 波形

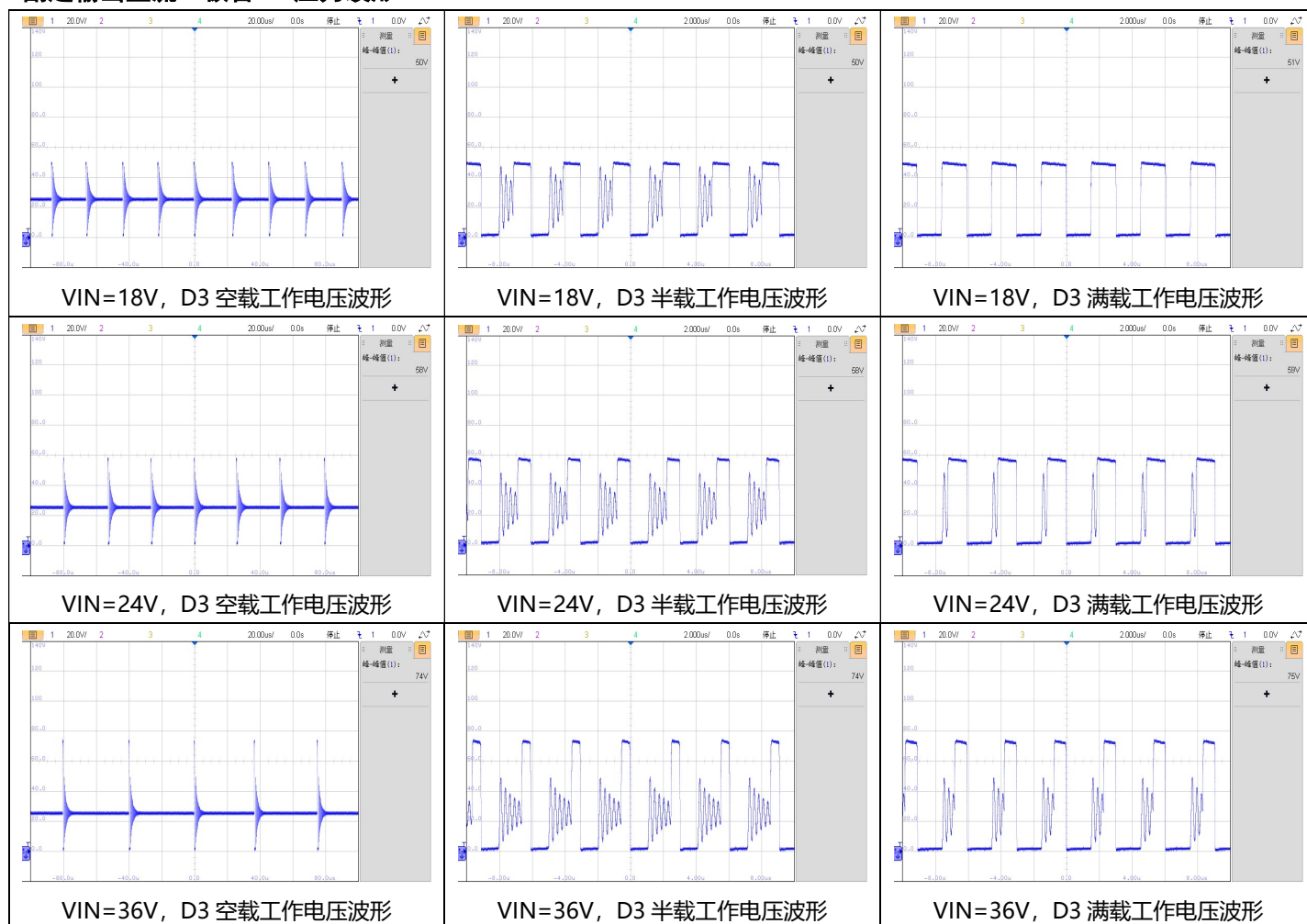


VIN=36V, 半載 VDS 波形



VIN=36V, 满载 VDS 波形

副边输出整流二极管 D3 应力波形



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