

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 VPS2105，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 18-36V 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）抗干扰目的相关场合。

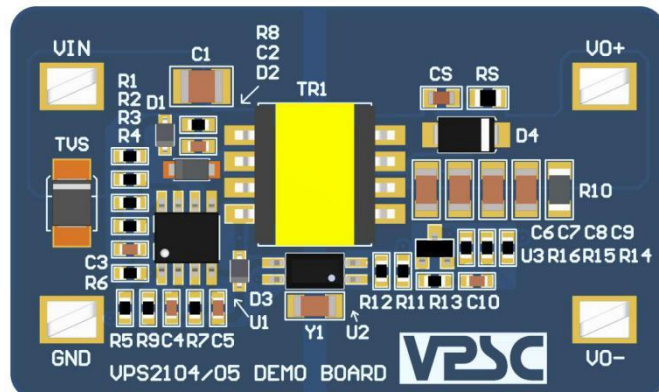
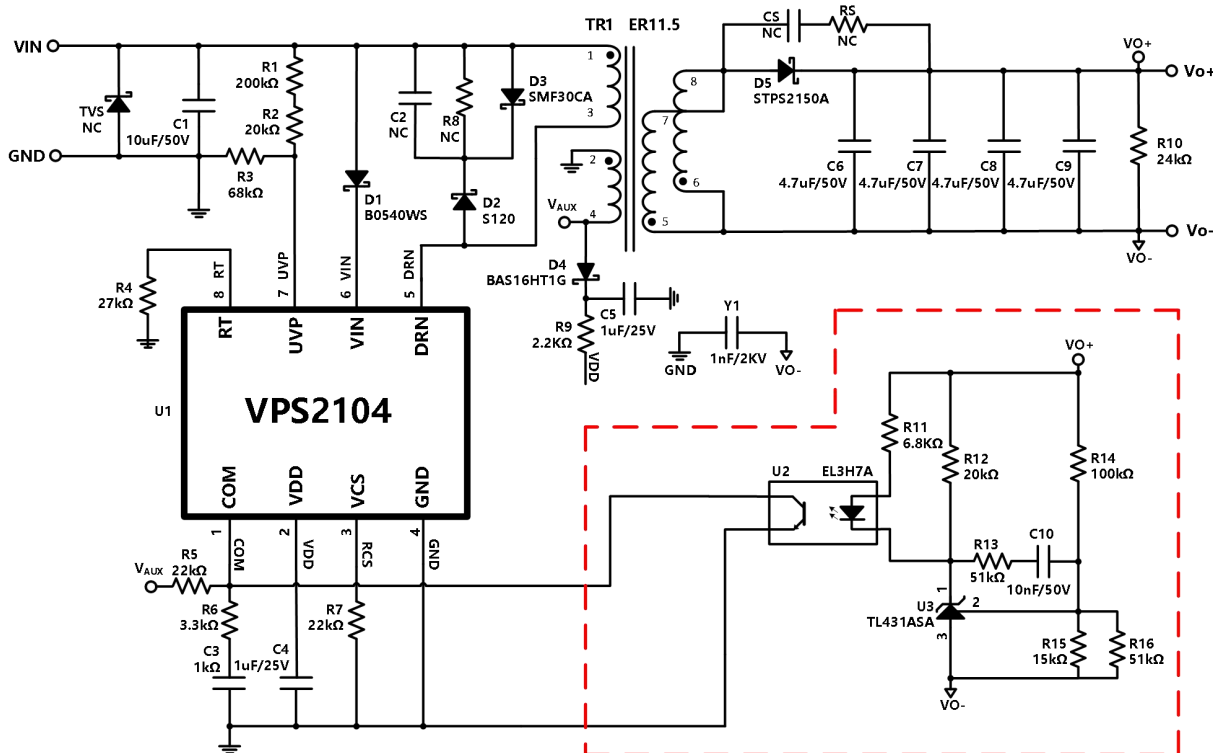


图 1: VPS2105 Demo 板(尺寸:50mm*30mm)

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

原理图



说明：PCB 板为 VPS2104/VPS2105 兼容设计，在使用 VPS2105 时虚线框内器件无需使用。

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

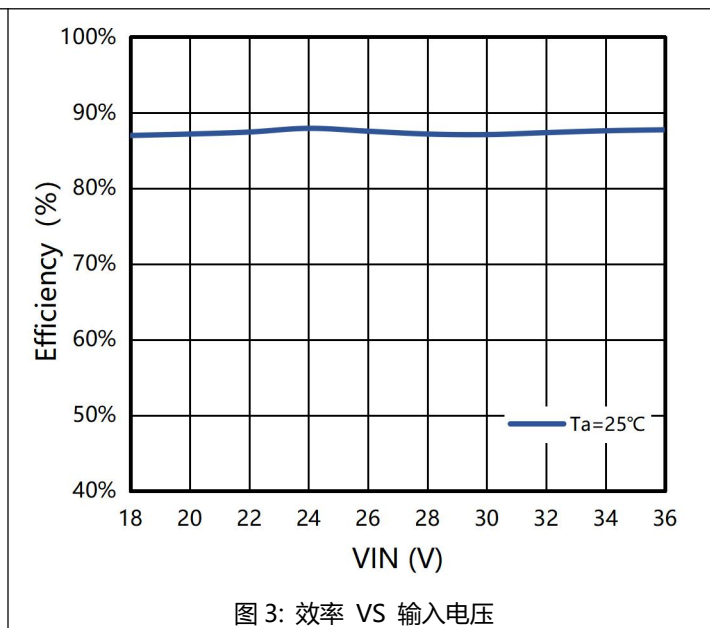
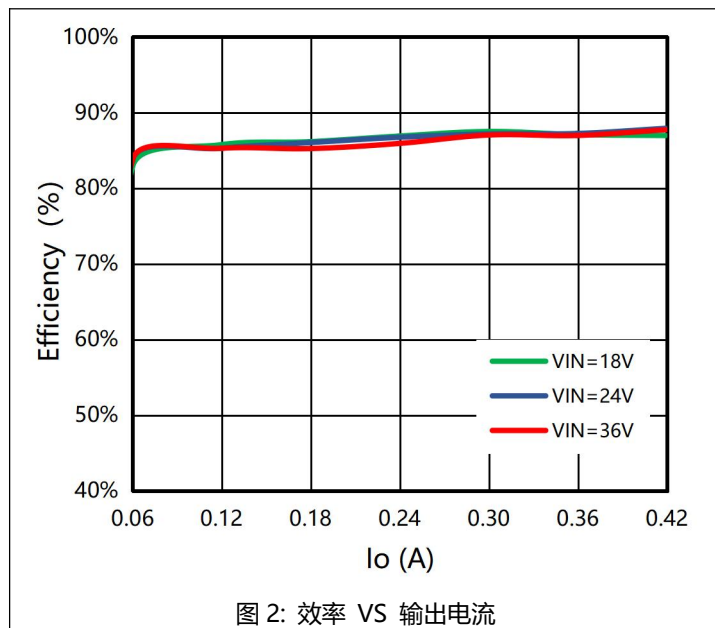
物料清单

位号	参数	封装	型号	品牌
C1	10uF/50V-X7R	1210	CL31B106KBHNNNE	SAMSUNG
C2	NC	-	-	-
C3	1K Ω ±1%	0603	RC0603FR-071KL	YAGEO
C4	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C5	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C6	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C7	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C8	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C9	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	YAGEO
C10	NC	-	-	-
CS	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	200K Ω ±1%	0603	RC0603FR-07200KL	YAGEO
R2	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R3	68K Ω ±1%	0603	RC0603FR-0768KL	YAGEO
R4	27K Ω ±1%	0603	RC0603FR-0727KL	YAGEO
R5	22K Ω ±1%	0603	RC0603FR-0722KL	YAGEO
R6	3.3K Ω ±1%	0603	RC0603FR-073K3L	YAGEO
R7	22K Ω ±1%	0603	RC0603FR-0722KL	YAGEO
R8	NC	-	-	-
R9	2.2K Ω ±1%	0603	RC0603FR-072K2L	YAGEO
R10	10K Ω ±1%	1206	RC1206FR-0710KL	YAGEO
R11	NC	-	-	-
R12	NC	-	-	-
R13	NC	-	-	-
R14	NC	-	-	-
R15	NC	-	-	-
R16	NC	-	-	-
RS	NC	-	-	-
D1	40V/0.5A	SOD-323	B0540WS	YANGJIE
D2	120V/1A	SOD-123	S120	YANGJIE
D3	30V/8.3A TVS	SOD-123	SMF30CA	MDD
D4	85V/200mA	SOD-323	BAS16HT1G	ON
D5	150V/2A	SMA	STPS2150A	ST
TVS	NC	-	-	-
U1	VPS2105	ESOP-8	VPS2105	VPSC
U2	NC	-	-	-
U3	NC	-	-	-
TR1	Np:Ns:Na=10:14:7 Lp=11uH	ER11.5	VPE24FFF10A	VPSC

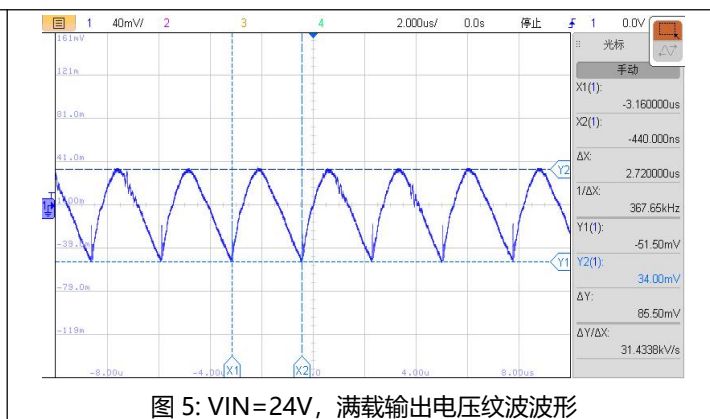
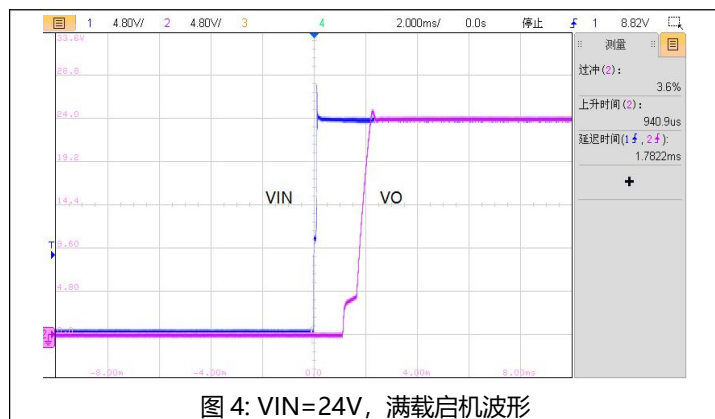
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=24V	3	---	476	mA
转换效率	VIN=24V, IO=0.42A	---	88	---	%
纹波&噪声	VIN=24V; IO=0.42A	---	50	100	mV
线性调节率	VIN=18V-36V, IO=0.42A	---	0.02	---	%
负载调整率	VIN=24V; IO=0.42A	---	0.02	---	%
输入欠压保护	锁定电压	---	15.5	---	V
	恢复电压	---	17.2	---	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

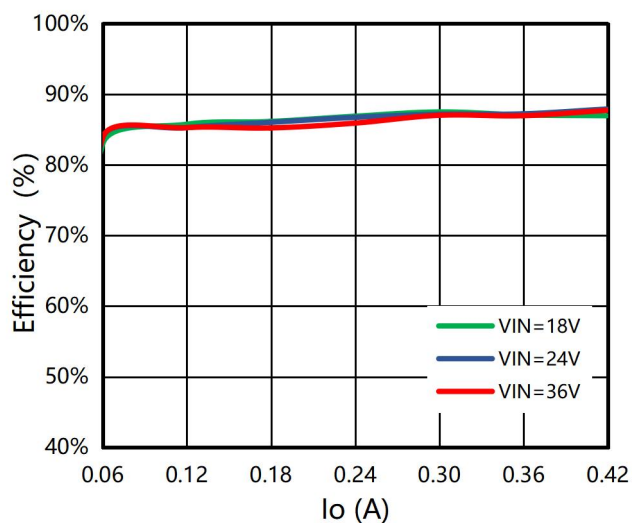


相关波形

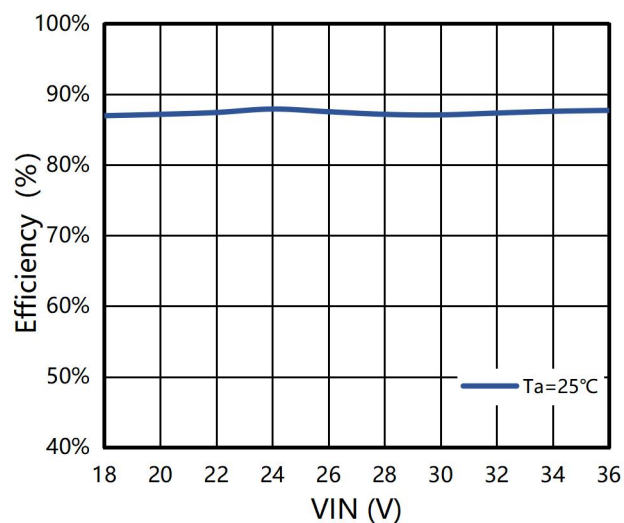


详细测试数据

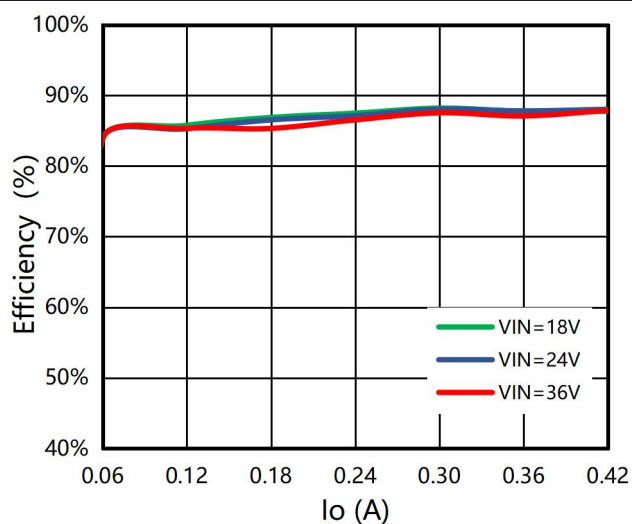
高低温测试曲线



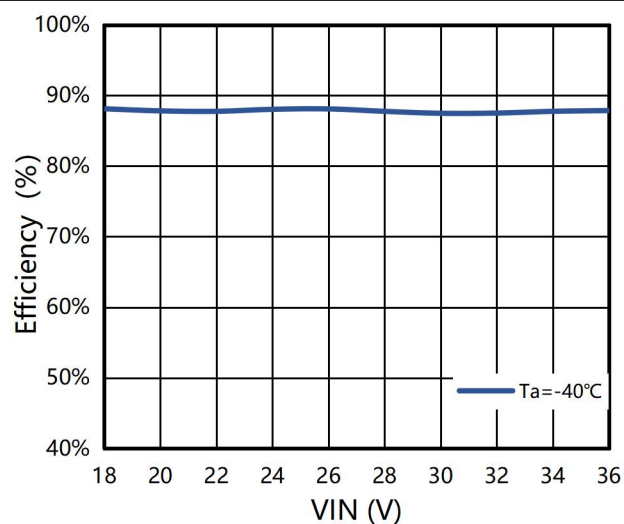
效率 VS 输出电流(25°C)



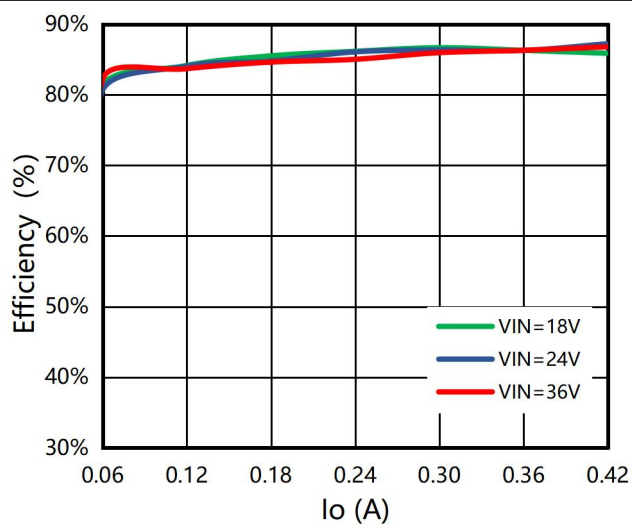
效率 VS 输入电压 (25°C)



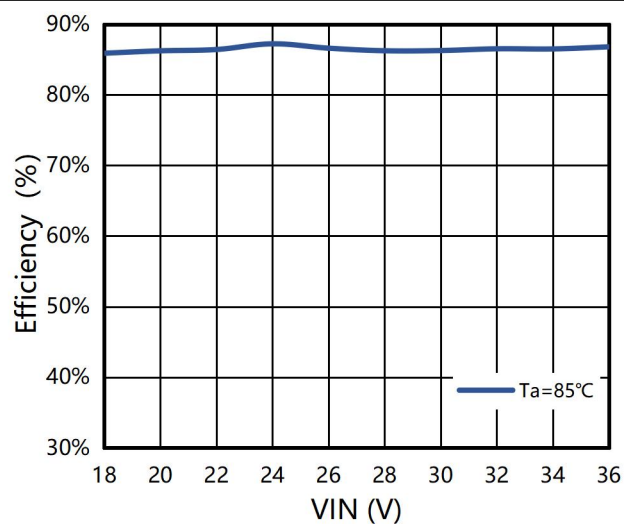
效率 VS 输出电流(-40°C)



效率 VS 输入电压(-40°C)



效率 VS 输出电流(85°C)



效率 VS 输入电压(85°C)

VIN=24V, Ta=25°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
24.03	0.003	24.38	0	0.00%
24.03	0.072	24.15	0.060	83.75%
24.02	0.141	24.07	0.120	85.28%
24.02	0.208	24.01	0.179	86.02%
24.01	0.275	23.96	0.239	86.73%
24.01	0.342	23.94	0.299	87.17%
24	0.410	23.91	0.359	87.23%
24	0.475	23.92	0.419	87.92%

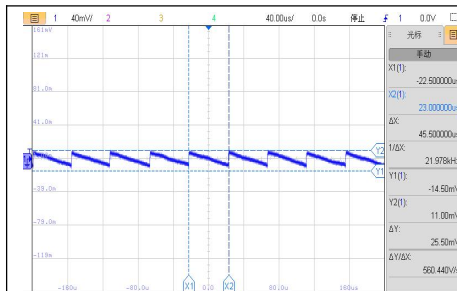
VIN=24V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
24.03	0.003	24.33	0	0.00%
24.03	0.072	24.16	0.060	83.78%
24.03	0.141	24.08	0.120	85.28%
24.02	0.207	24.03	0.179	86.51%
24.01	0.274	23.98	0.239	87.12%
24.01	0.340	23.96	0.300	88.05%
24	0.408	23.95	0.359	87.81%
24	0.475	23.95	0.419	88.03%

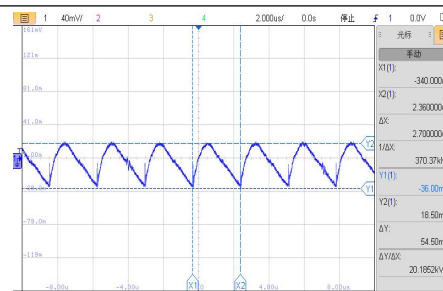
VIN=24V, Ta=85°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
24.03	0.003	24.44	0	0.00%
24.03	0.074	24.16	0.059	80.16%
24.02	0.143	24.06	0.120	84.06%
24.02	0.211	24	0.179	84.76%
24.01	0.277	23.95	0.239	86.07%
24.01	0.345	23.92	0.299	86.34%
24	0.414	23.88	0.359	86.28%
24	0.478	23.88	0.419	87.22%

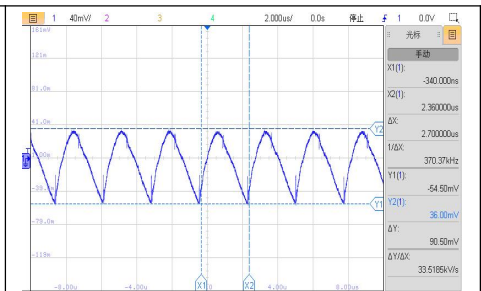
输出电压纹波波形



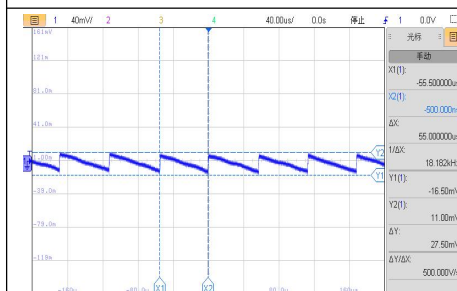
VIN=18V, 空载输出电压纹波波形



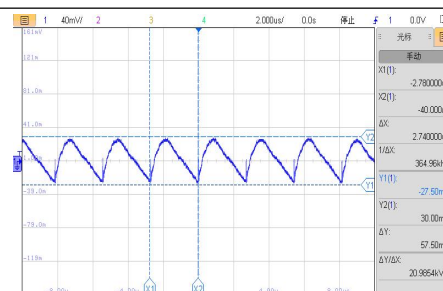
VIN=18V, 半载输出电压纹波波形



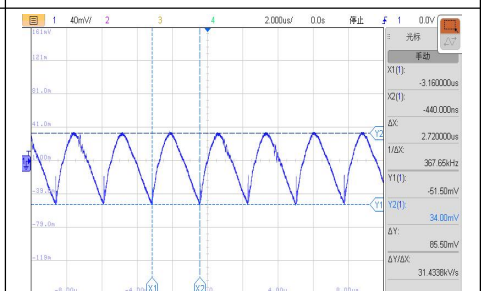
VIN=18V, 满载输出电压纹波波形



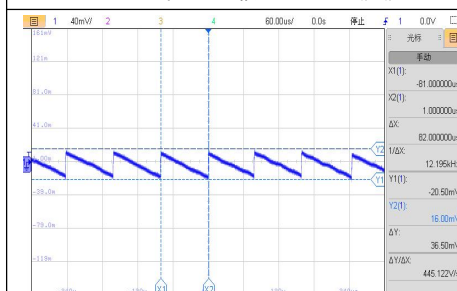
VIN=24V, 空载输出电压纹波波形



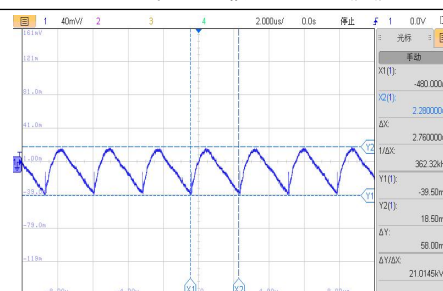
VIN=24V, 半载输出电压纹波波形



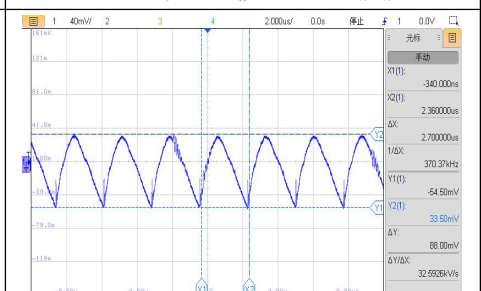
VIN=24V, 满载输出电压纹波波形



VIN=36V, 空载输出电压纹波波形

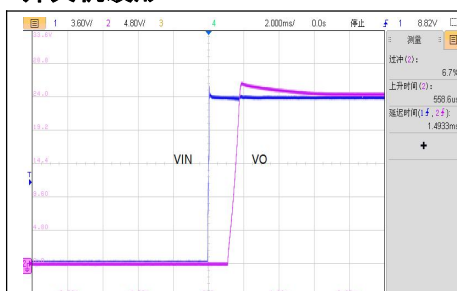


VIN=36V, 半载输出电压纹波波形



VIN=36V, 满载输出电压纹波波形

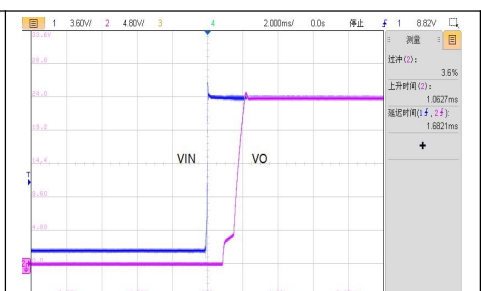
开关机波形



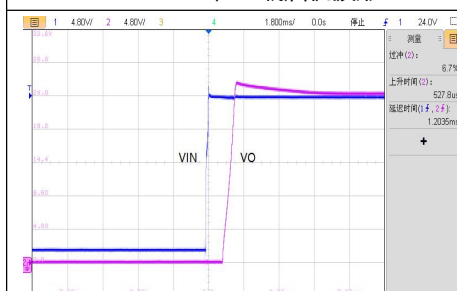
VIN=18V, 空载启机波形



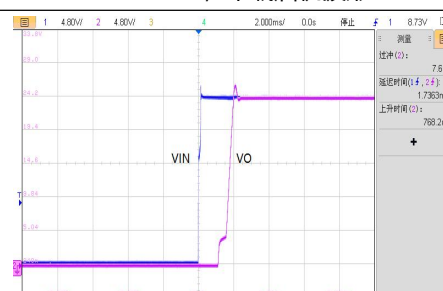
VIN=18V, 半载启机波形



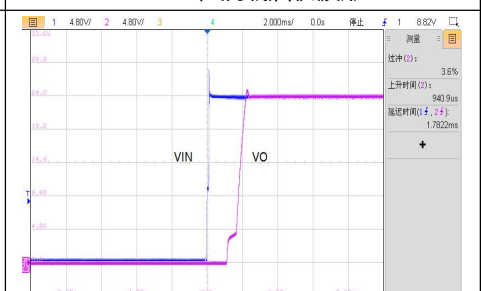
VIN=18V, 满载启机波形



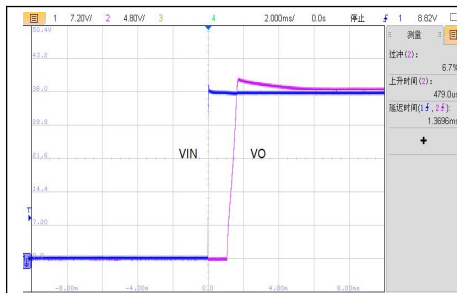
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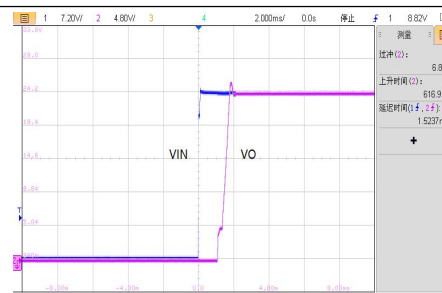
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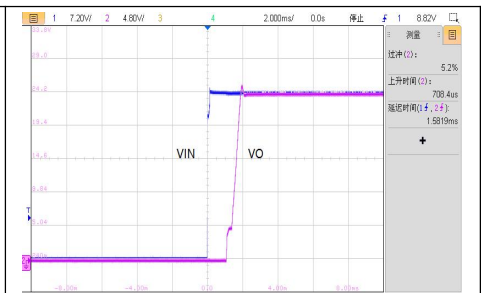
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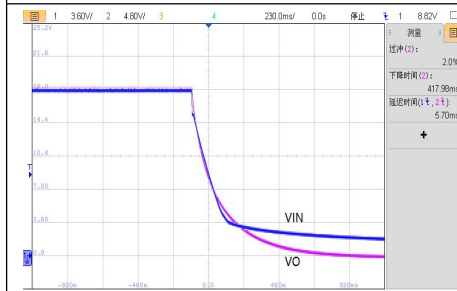
VIN=36V, 空载启机波形



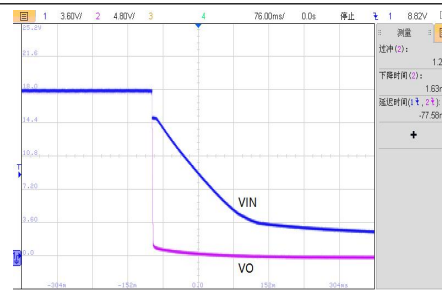
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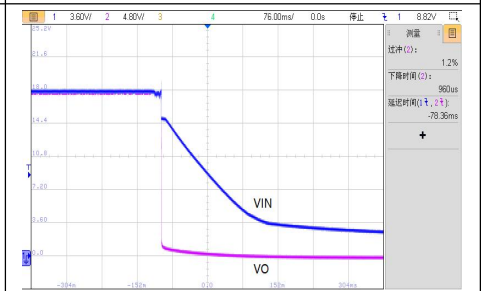
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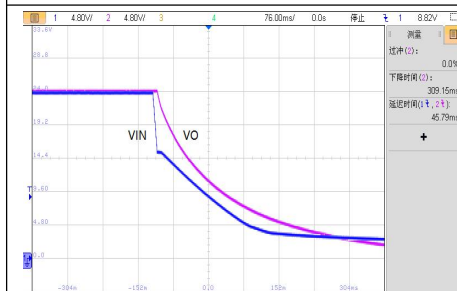
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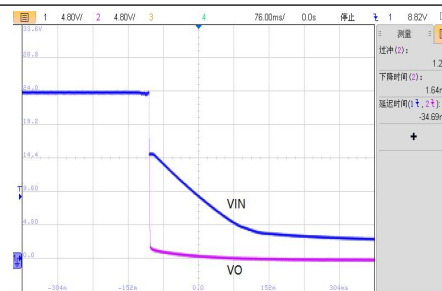
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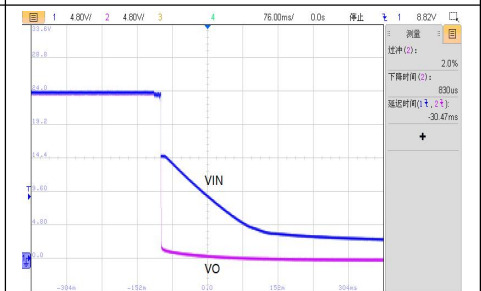
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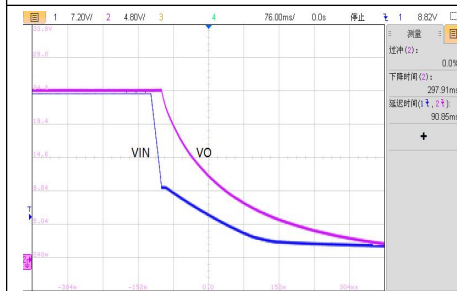
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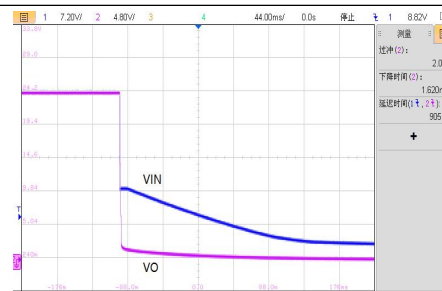
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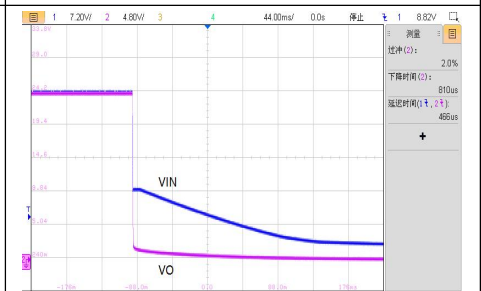
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VIN=36V, 空载关机波形

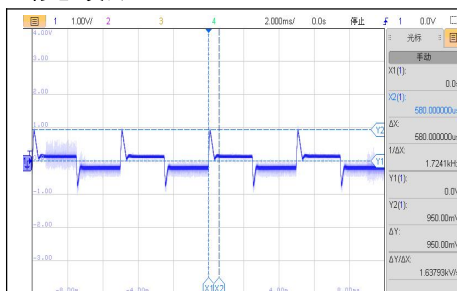


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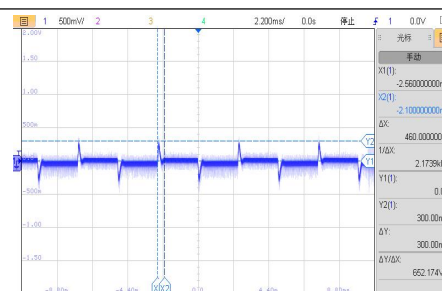


VIN=36V, 满载关机波形

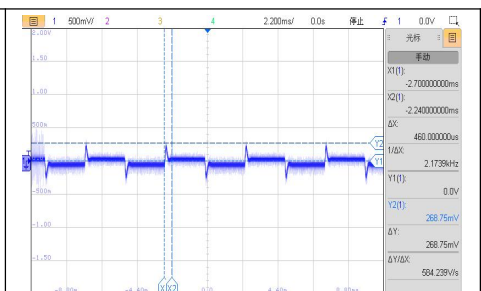
动态波形



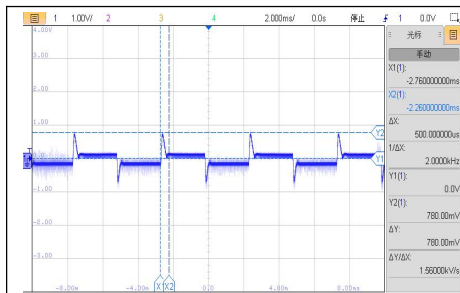
VIN=18V, 100%-10%-100%Io 动态波形



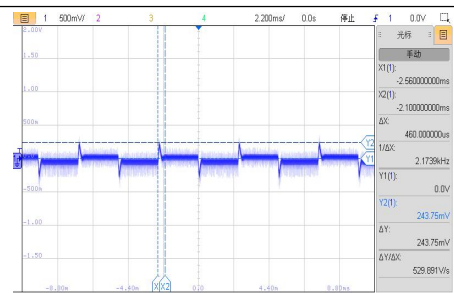
VIN=18V, 75%-50%-75%Io 动态波形



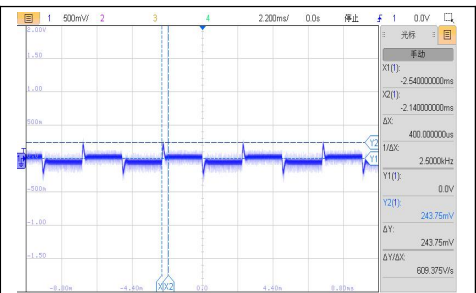
VIN=18V, 50%-25%-50%Io 动态波形



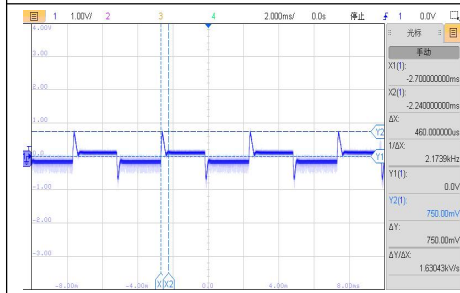
VIN=24V, 100%-10%-100%Io 动态波形



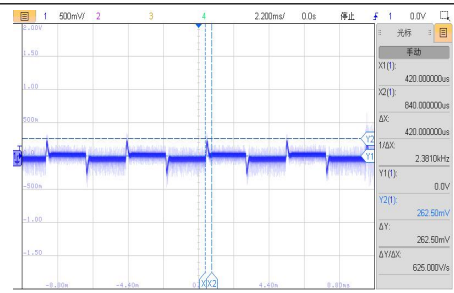
VIN=24V, 75%-50%-75%Io 动态波形



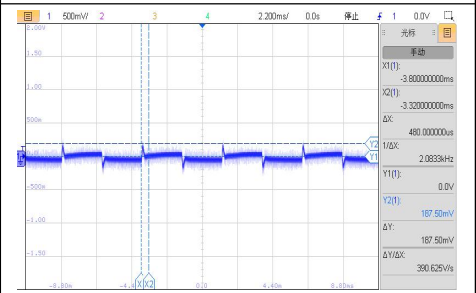
VIN=24V, 50%-25%-50%Io 动态波形



VIN=36V, 100%-10%-100%Io 动态波形

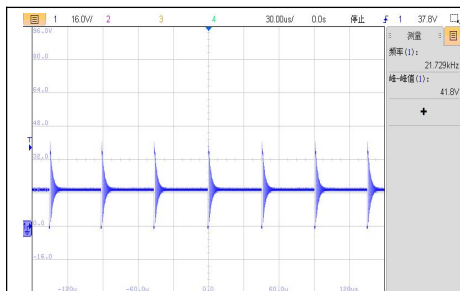


VIN=36V, 75%-50%-75%Io 动态波形

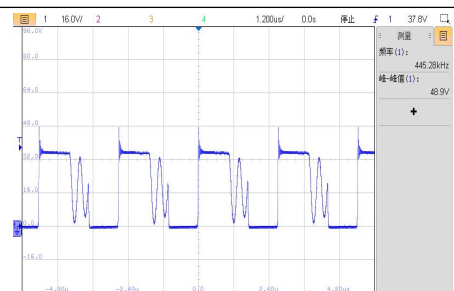


VIN=36V, 50%-25%-50%Io 动态波形

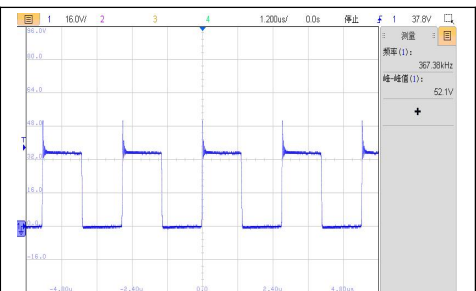
MOS 管电压应力波形



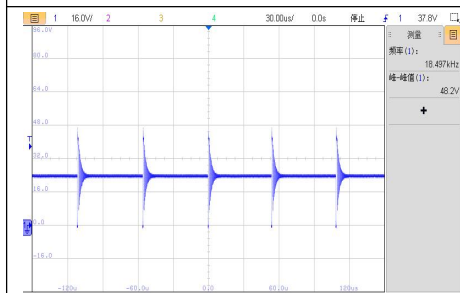
VIN=18V, 空载 VDS 波形



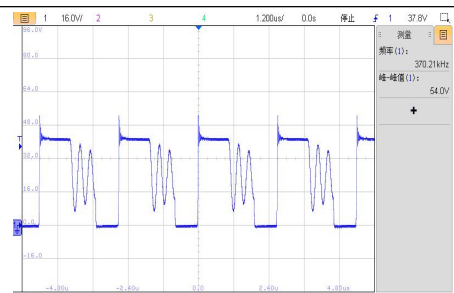
VIN=18V, 半载 VDS 波形



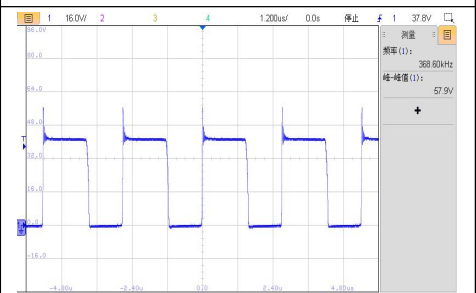
VIN=18V, 满载 VDS 波形



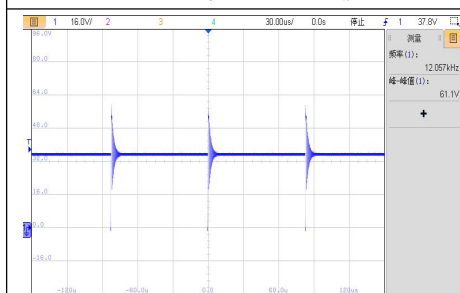
VIN=24V, 空载 VDS 波形



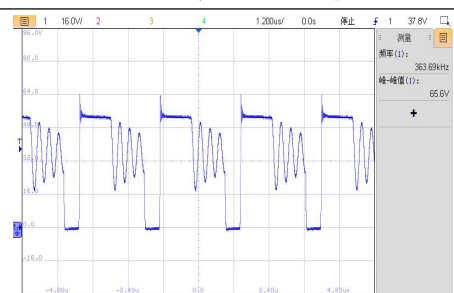
VIN=24V, 半载 VDS 波形



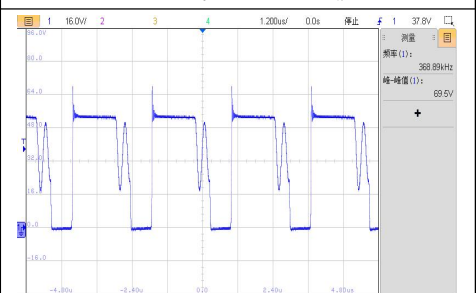
VIN=24V, 满载 VDS 波形



VIN=36V, 空载 VDS 波形

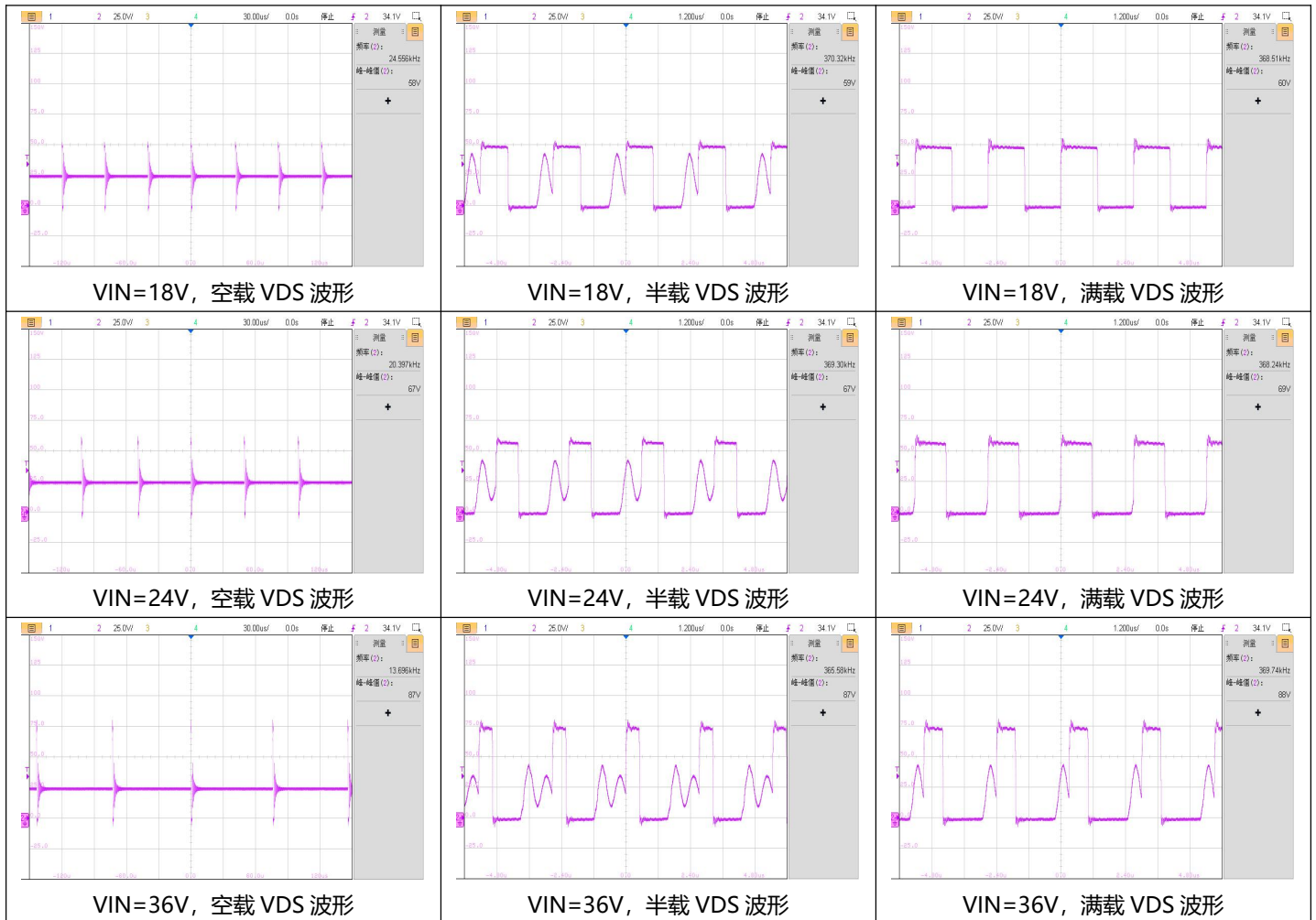


VIN=36V, 半载 VDS 波形

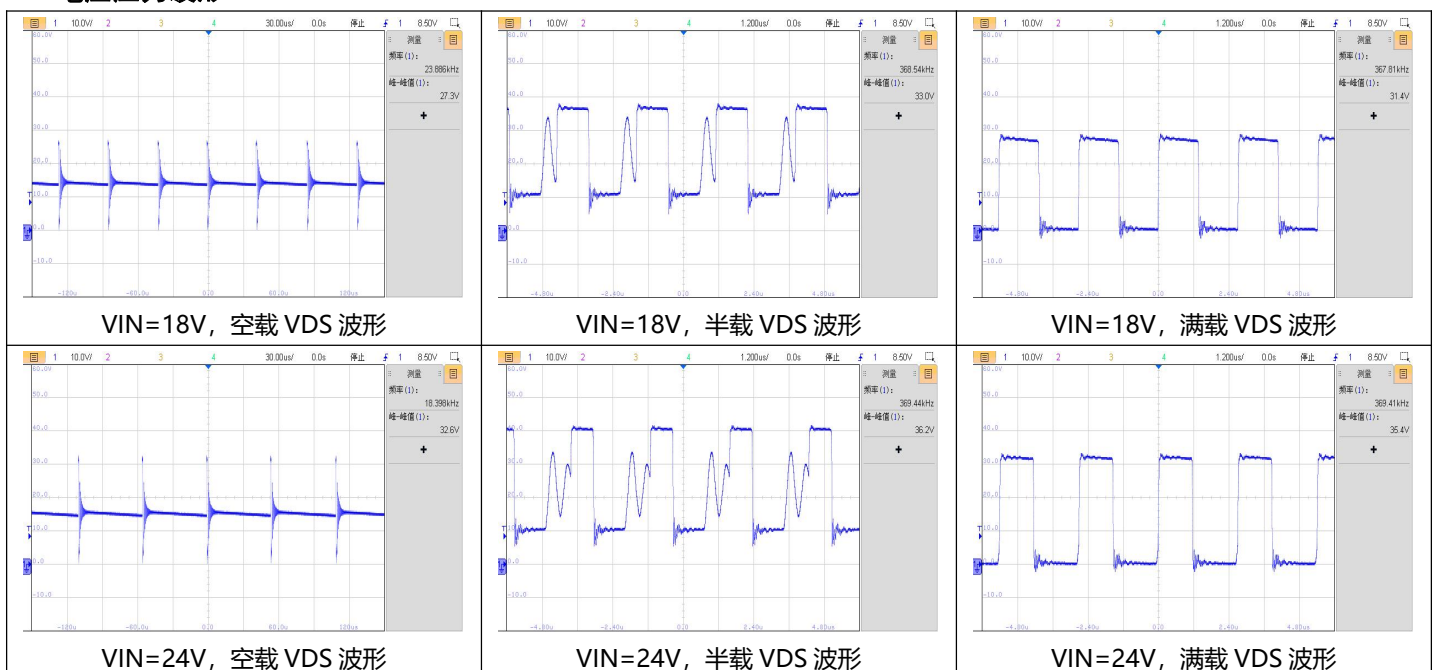


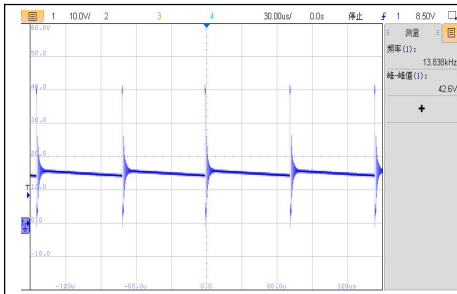
VIN=36V, 满载 VDS 波形

副边输出整流二极管 D5 应力波形

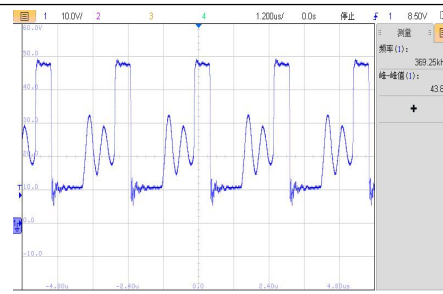


D2 电压应力波形

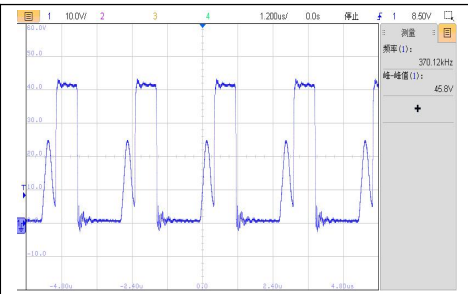




VIN=36V, 空载 VDS 波形

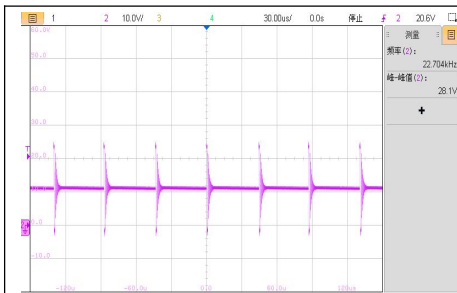


VIN=36V, 半载 VDS 波形

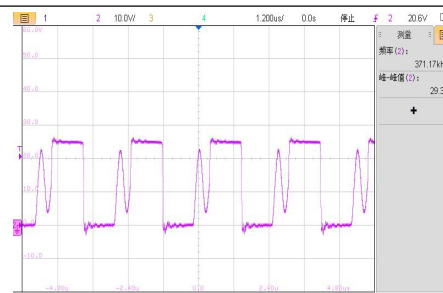


VIN=36V, 满载 VDS 波形

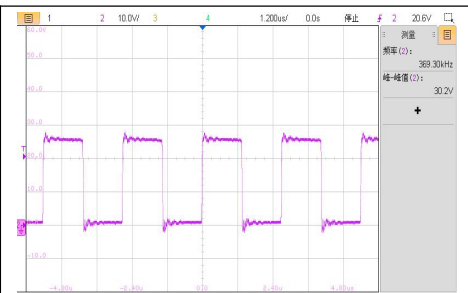
D4 电压应力波形



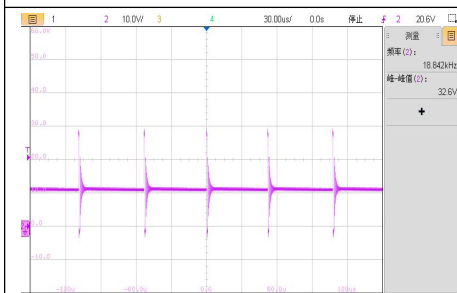
VIN=18V, 空载 VDS 波形



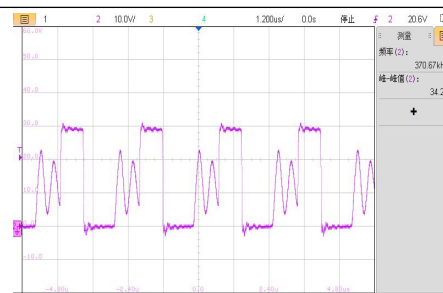
VIN=18V, 半载 VDS 波形



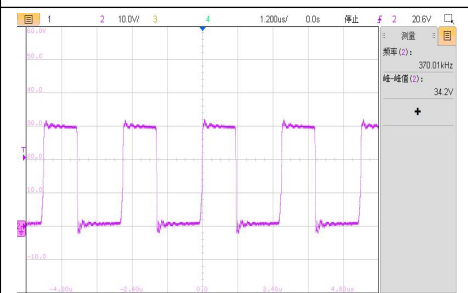
VIN=18V, 满载 VDS 波形



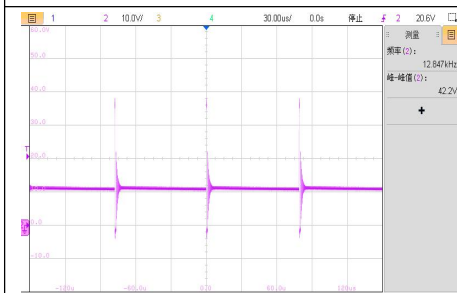
VIN=24V, 空载 VDS 波形



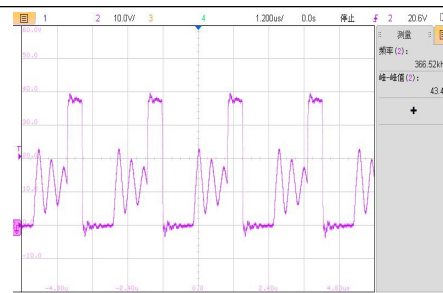
VIN=24V, 半载 VDS 波形



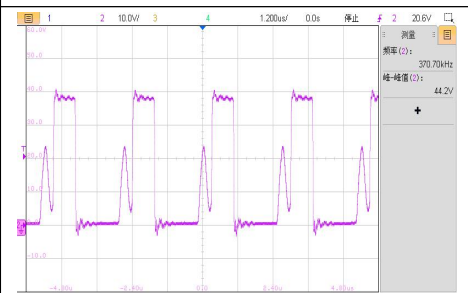
VIN=24V, 满载 VDS 波形



VIN=36V, 空载 VDS 波形



VIN=36V, 半载 VDS 波形



VIN=36V, 满载 VDS 波形

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