

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 VPE24PBB06A、输出整流二极管以及必要的阻容元件，实现 9V-36V 输入，5V 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 6W 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。

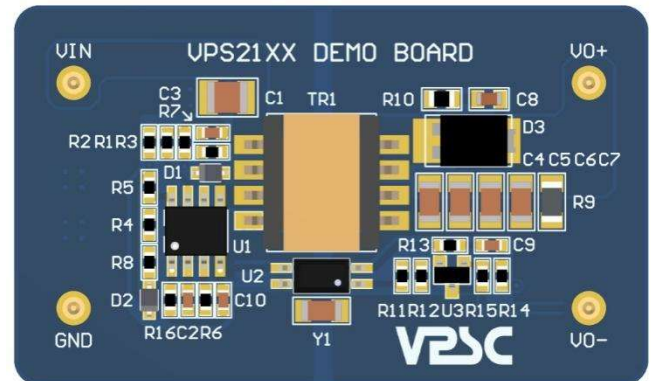
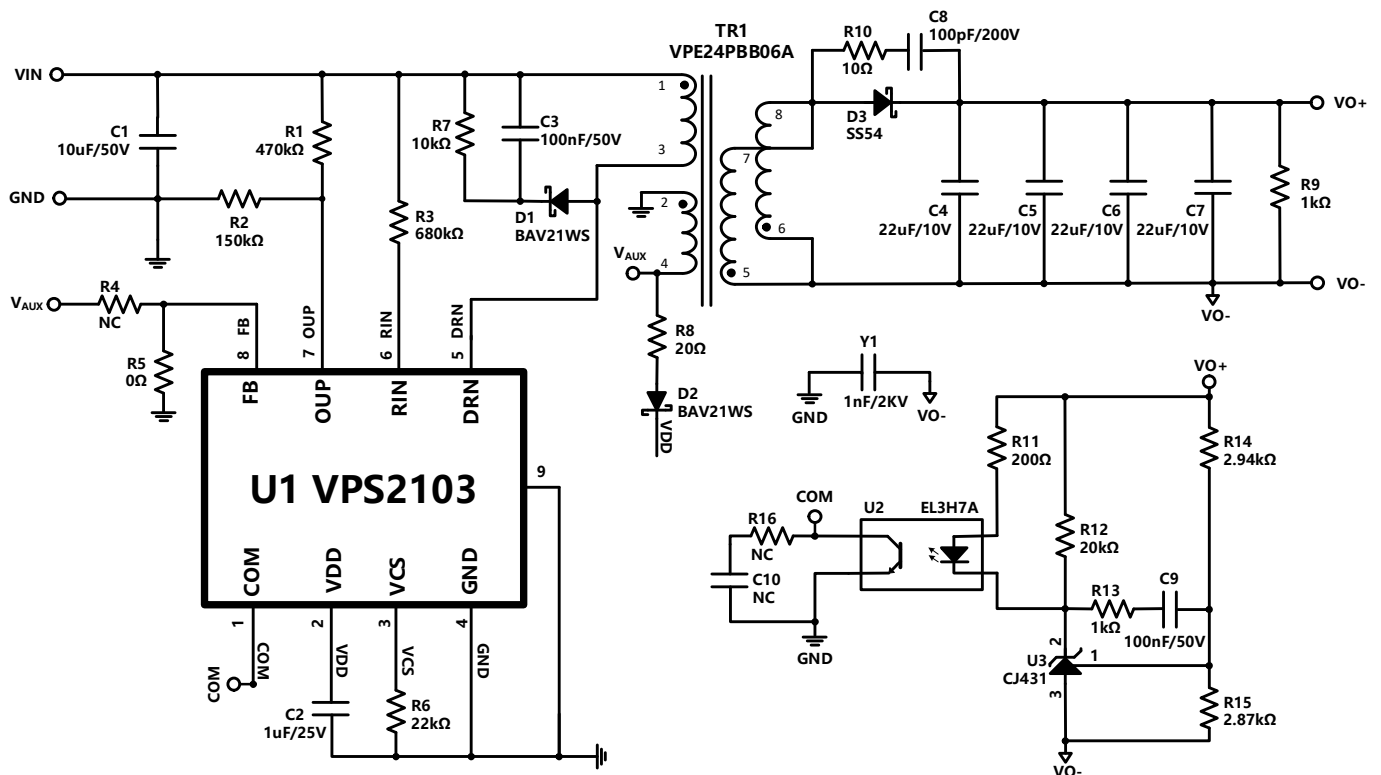


图 1: VPS2103 Demo 板(尺寸:50mm*30mm)

关键词：输入：9V-36V，输出 5V/6W，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

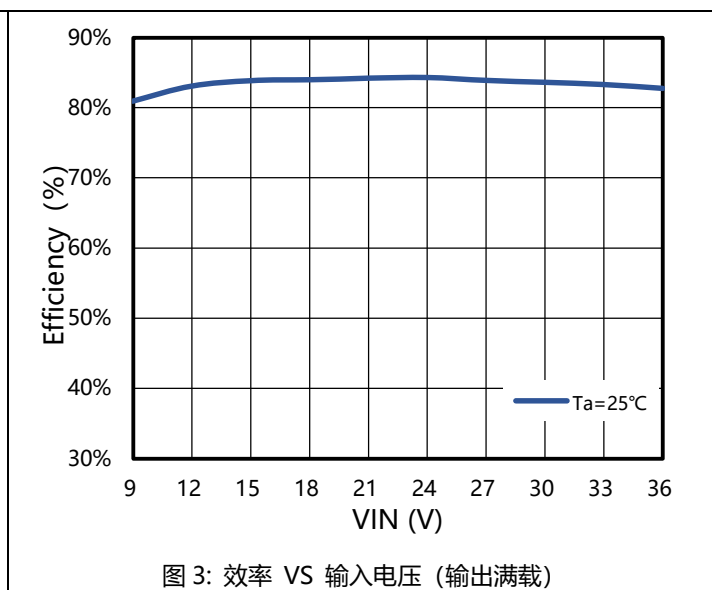
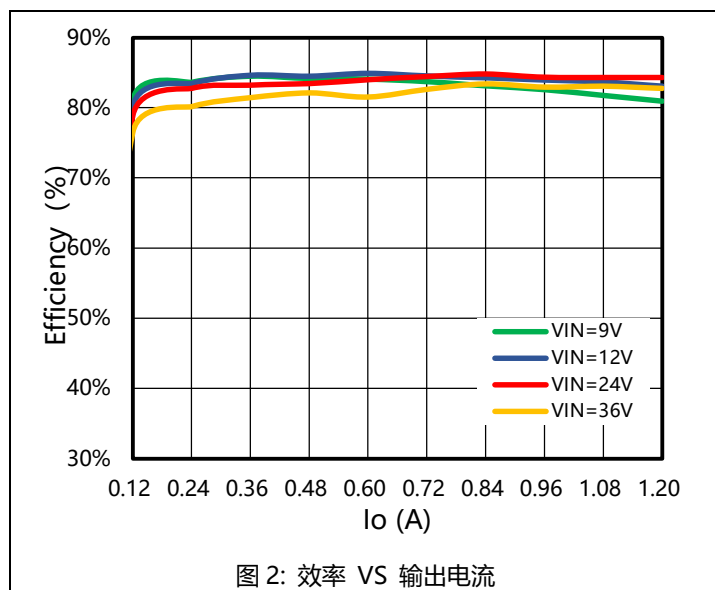
物料清单

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	22uF/10V-X7R	1206	CC1206KKX7R6BB226	YAGEO
C5	22uF/10V-X7R	1206	CC1206KKX7R6BB226	YAGEO
C6	22uF/10V-X7R	1206	CC1206KKX7R6BB226	YAGEO
C7	22uF/10V-X7R	1206	CC1206KKX7R6BB226	YAGEO
C8	100pF/200V-NP0	0805	CC0805JRNPOABN101	YAGEO
C9	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C10	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	470K Ω ±1%	0603	RC0603FR-07470KL	YAGEO
R2	150K Ω ±1%	0603	RC0603FR-07150KL	YAGEO
R3	680K Ω ±1%	0603	RC0603FR-07680KL	YAGEO
R4	NC	-	-	-
R5	0 Ω ±1%	0603	RC0603FR-070RL	YAGEO
R6	22K Ω ±1%	0603	RC0603FR-0722KL	YAGEO
R7	10K Ω ±1%	0603	RC0603FR-0710KL	YAGEO
R8	20 Ω ±1%	0603	RC0603FR-0720RL	YAGEO
R9	1K Ω ±1%	1206	RC1206FR-071KL	YAGEO
R10	10 Ω ±1%	0805	RC0805FR-0710RL	YAGEO
R11	200 Ω ±1%	0603	RC0603FR-07200RL	YAGEO
R12	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R13	1K Ω ±1%	0603	RC0603FR-071KL	YAGEO
R14	2.94K Ω ±1%	0603	RC0603FR-072K94L	YAGEO
R15	2.87K Ω ±1%	0603	RC0603FR-072K87L	YAGEO
R16	NC	-	-	-
TR1	NP:NS:NA=10:6:6 Lp=15uH	ER11.5	VPE24PBB06A	VPSC
D1	200V/0.2A	SOD-323	BAV21WS	CJ
D2	200V/0.2A	SOD-323	BAV21WS	CJ
D3	40V/5A	SMA	SS54	MDD
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

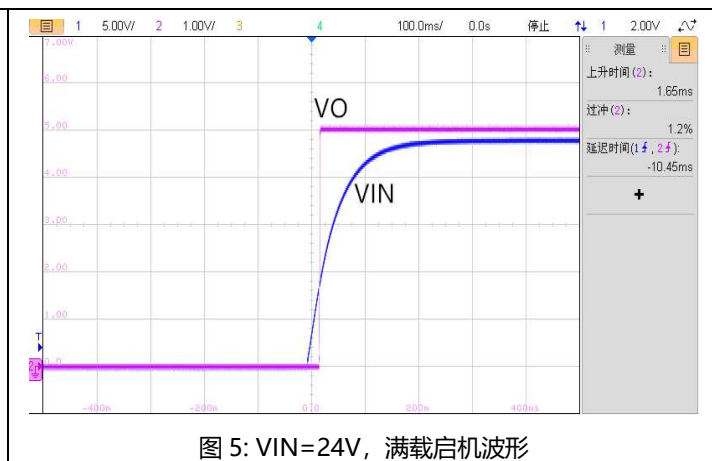
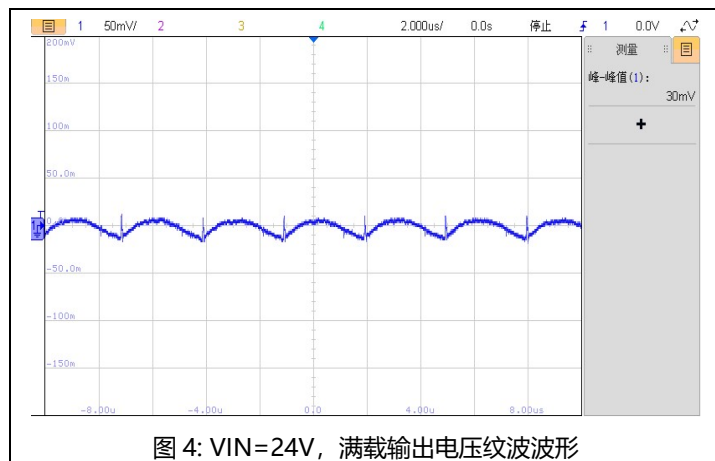
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=24V	4	---	299	mA
转换效率	VIN=24V, IO=1.2A	---	84	---	%
纹波&噪声	VIN=24V, IO=1.2A	---	50	80	mV
输出电压精度	VIN=24V, IO=1.2A	---	0.8	---	%
线性调节率	VIN=9V-36V, IO=1.2A	---	0	---	%
负载调整率	VIN=24V, IO=1.2A	---	0.2	---	%
输入欠压保护	锁定电压	---	7.2	---	V
	恢复电压	---	8.3	---	V
短路保护	VIN=9V-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

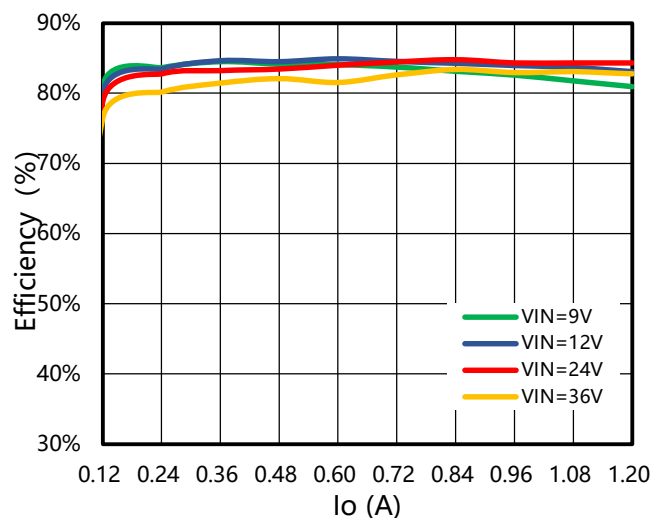


相关波形

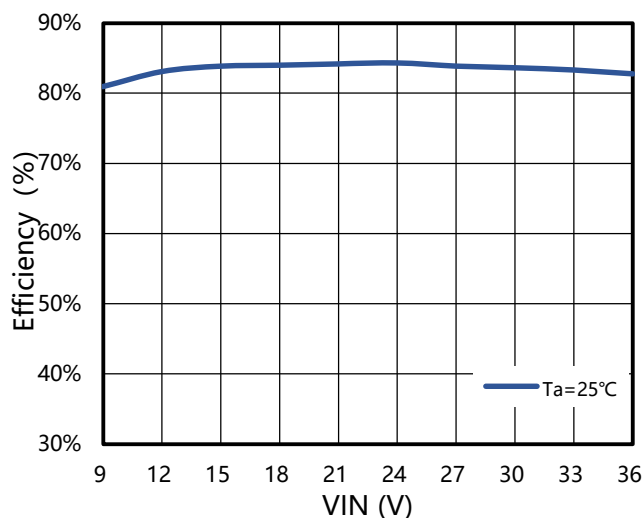


详细测试数据

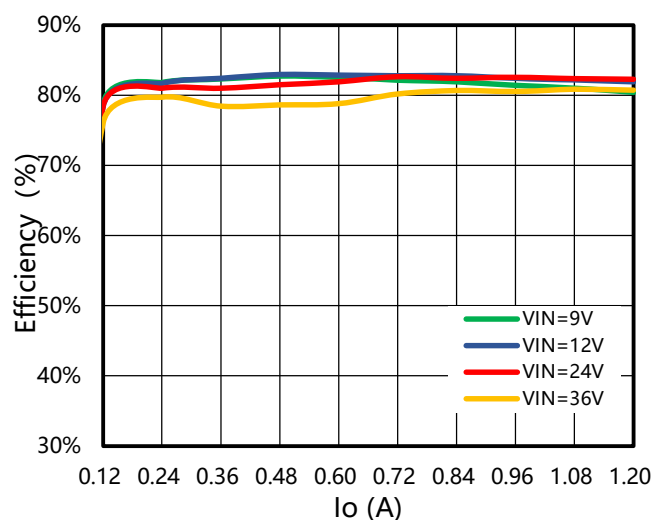
高低温测试曲线



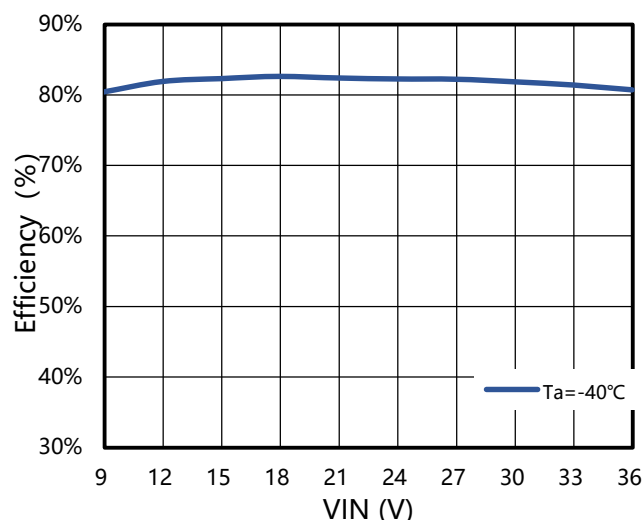
效率 VS 输出电流 (25°C)



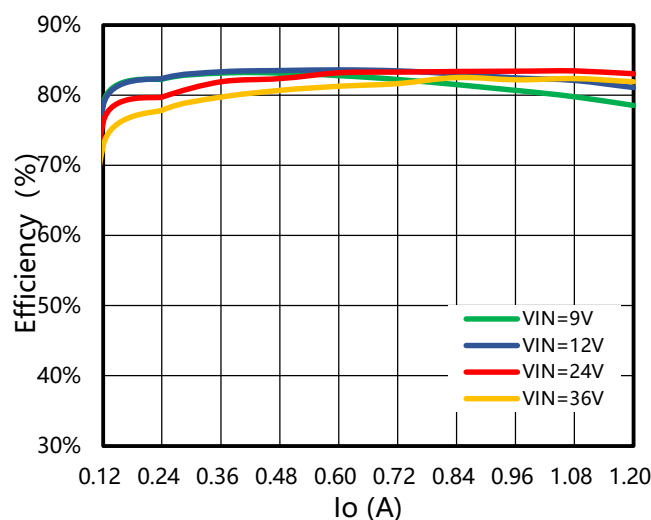
效率 VS 输入电压 (输出满载@25°C)



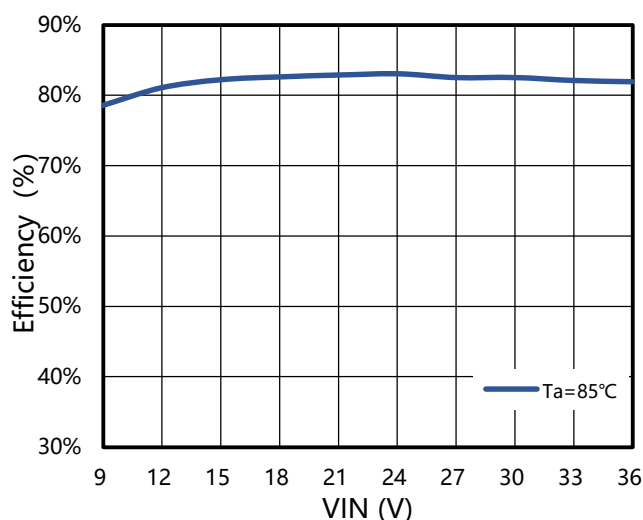
效率 VS 输出电流 (-40°C)



效率 VS 输入电压 (输出满载@-40°C)



效率 VS 输出电流 (85°C)



效率 VS 输入电压 (输出满载@85°C)

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	0.004	5.05	0	0%	0.00%
24	0.032	5.05	0.120	10%	78.91%
24	0.061	5.05	0.240	20%	82.79%
24	0.091	5.05	0.360	30%	83.24%
24	0.121	5.05	0.480	40%	83.47%
24	0.150	5.04	0.600	50%	84.00%
24	0.179	5.04	0.720	60%	84.47%
24	0.208	5.04	0.840	70%	84.81%
24	0.239	5.04	0.960	80%	84.35%
24	0.269	5.04	1.080	90%	84.31%
23.99	0.299	5.04	1.200	100%	84.32%

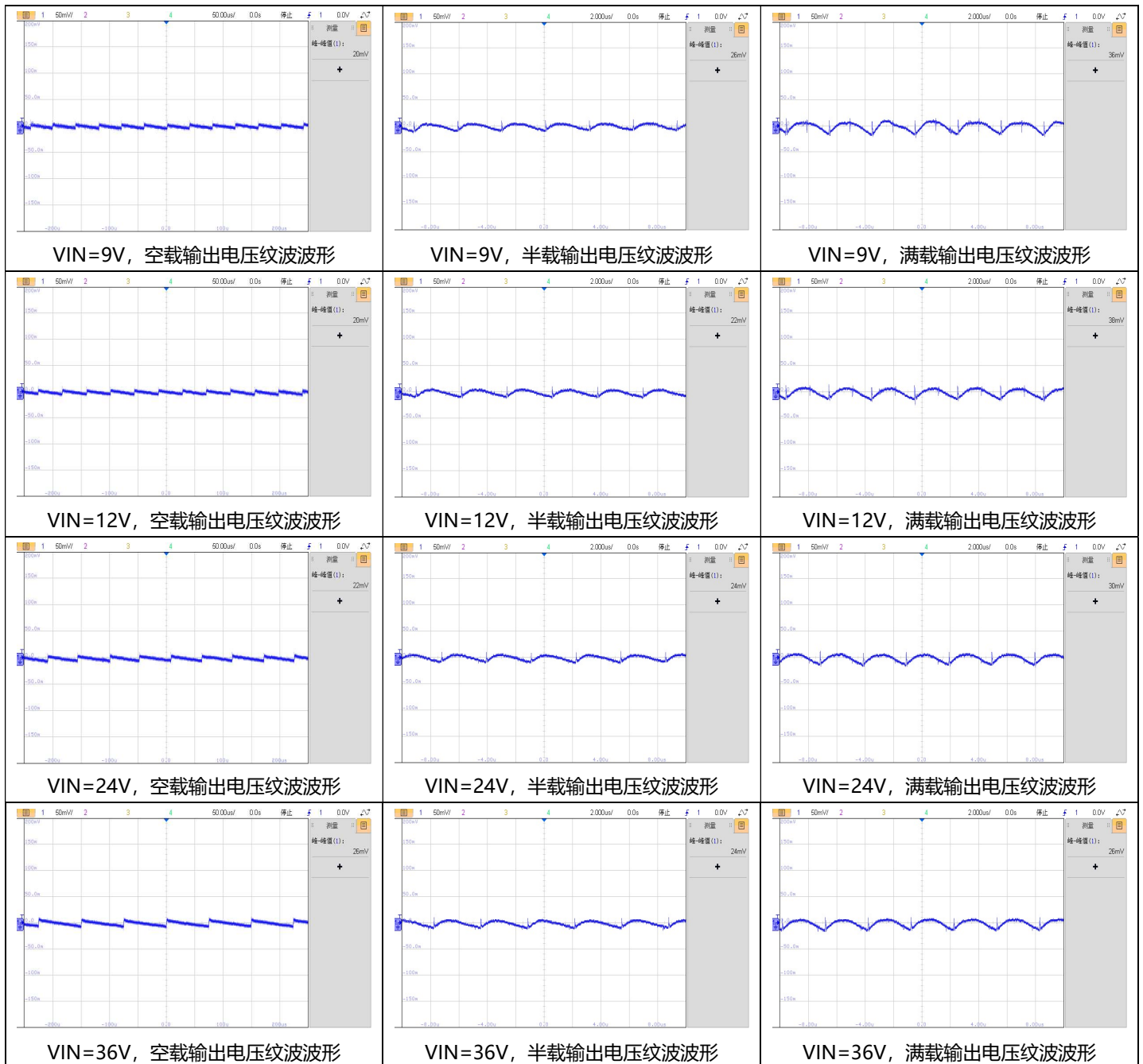
VIN=24V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.98	0.003	5.02	0	0%	0.00%
23.99	0.032	5.02	0.120	10%	78.47%
23.99	0.062	5.02	0.240	20%	81.00%
23.99	0.093	5.02	0.360	30%	81.00%
23.99	0.123	5.01	0.480	40%	81.50%
23.98	0.153	5.01	0.600	50%	81.93%
23.98	0.182	5.01	0.720	60%	82.65%
23.97	0.213	5.01	0.840	70%	82.43%
23.97	0.243	5.01	0.960	80%	82.57%
23.97	0.274	5.01	1.080	90%	82.38%
23.96	0.305	5.01	1.200	100%	82.27%

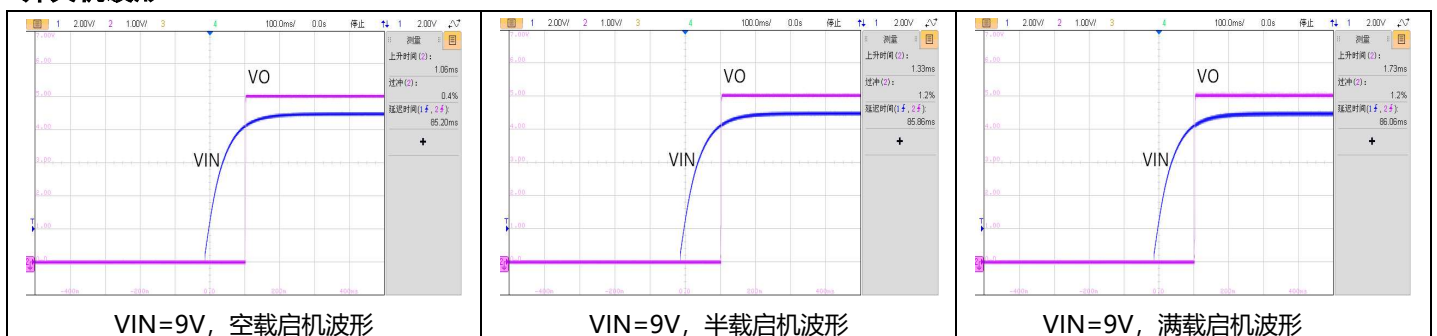
VIN=24V, Ta=85°C, 输入、输出及效率数据:

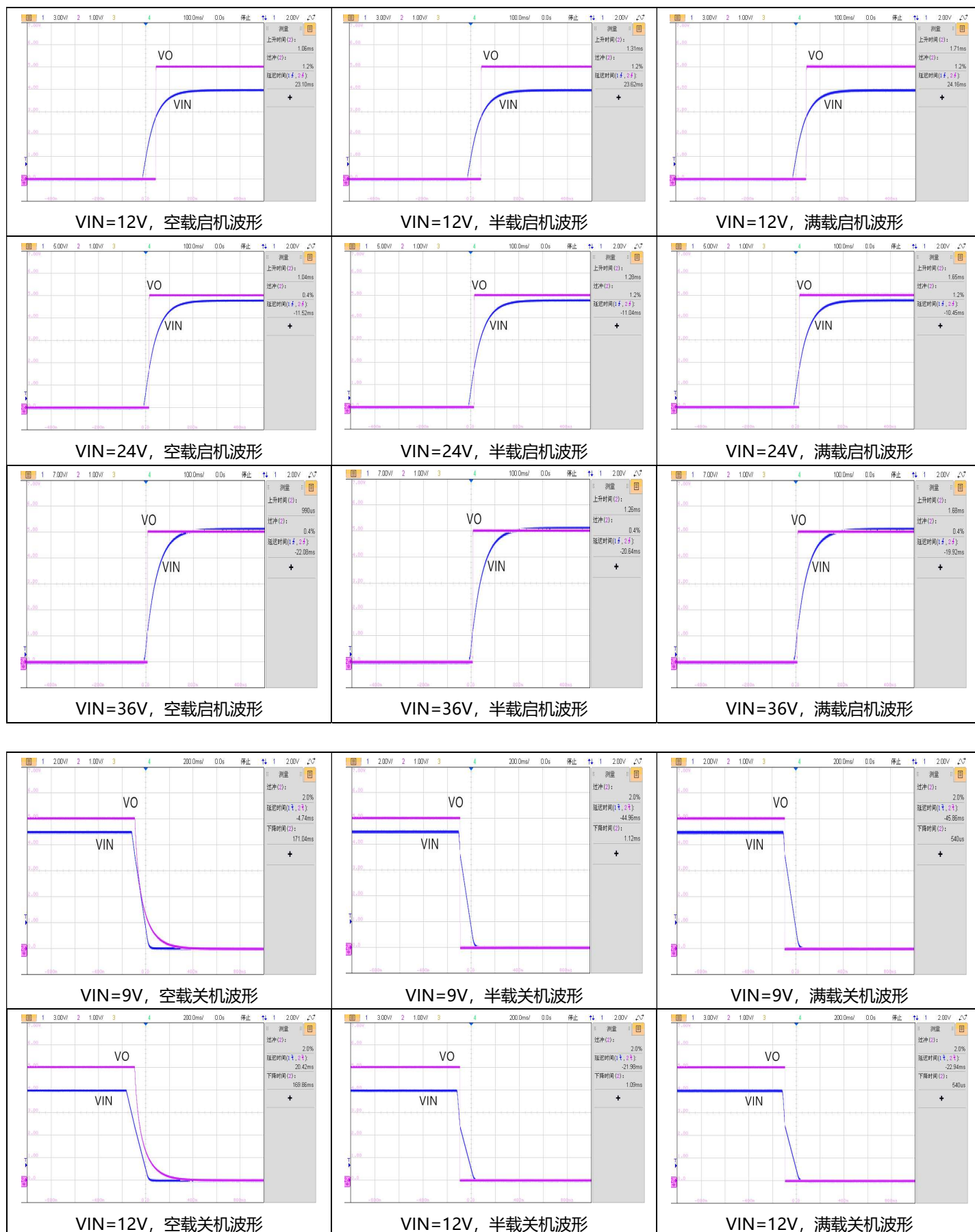
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.98	0.004	5.02	0	0%	0.00%
23.98	0.033	5.02	0.120	10%	76.12%
23.98	0.063	5.02	0.240	20%	79.75%
23.98	0.092	5.02	0.360	30%	81.92%
23.98	0.122	5.02	0.480	40%	82.36%
23.98	0.151	5.02	0.600	50%	83.18%
23.97	0.181	5.02	0.720	60%	83.31%
23.97	0.211	5.02	0.840	70%	83.37%
23.97	0.241	5.02	0.960	80%	83.42%
23.97	0.271	5.02	1.080	90%	83.46%
23.96	0.302	5.01	1.200	100%	83.09%

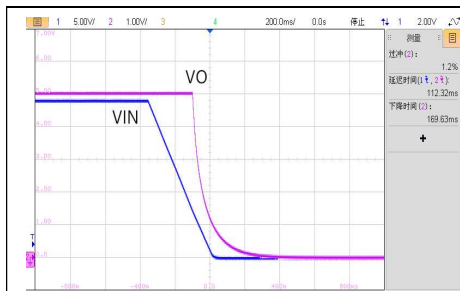
输出电压纹波波形



开关机波形



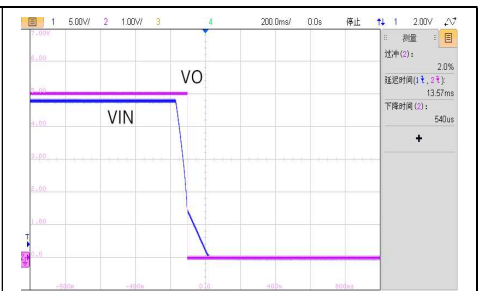




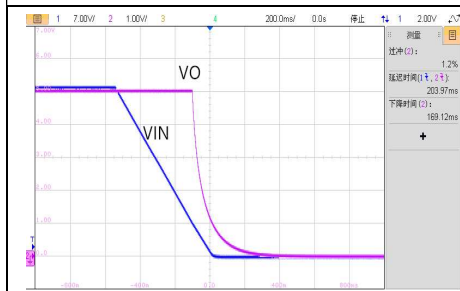
VIN=24V, 空载关机波形



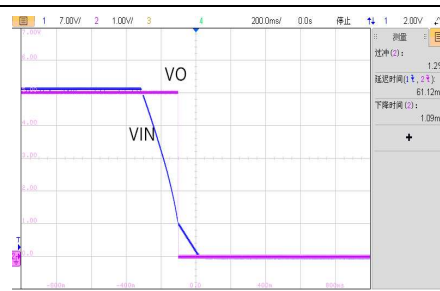
VIN=24V, 半载关机波形



VIN=24V, 满载关机波形



VIN=36V, 空载关机波形

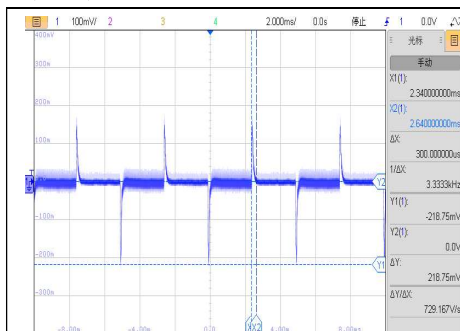


VIN=36V, 半载关机波形

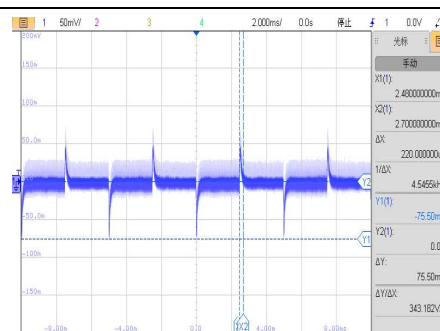


VIN=36V, 满载关机波形

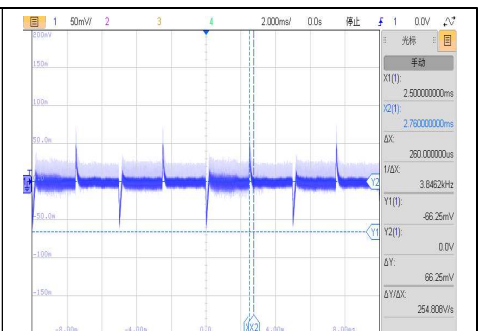
动态波形



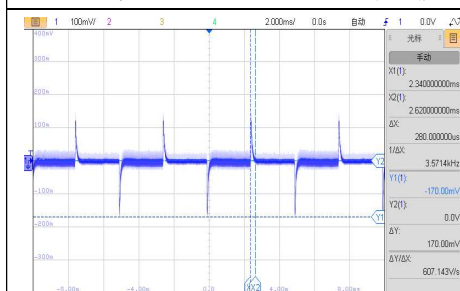
VIN=9V, 100%-10%-100%Io 动态波形



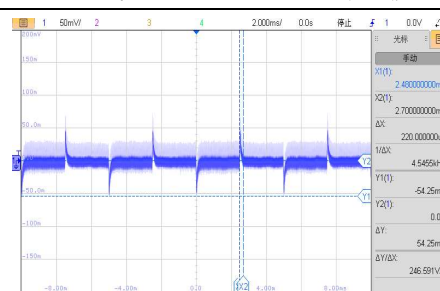
VIN=9V, 75%-50%-75%Io 动态波形



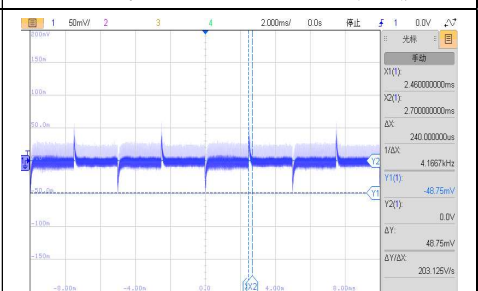
VIN=9V, 50%-25%-50%Io 动态波形



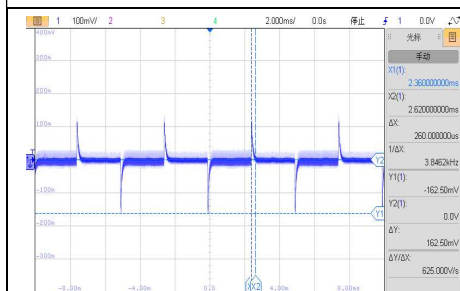
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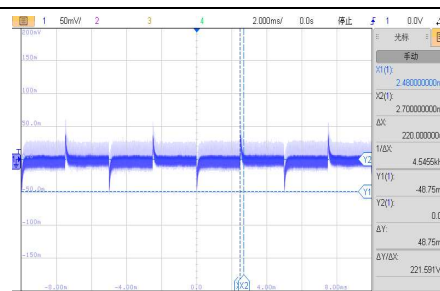
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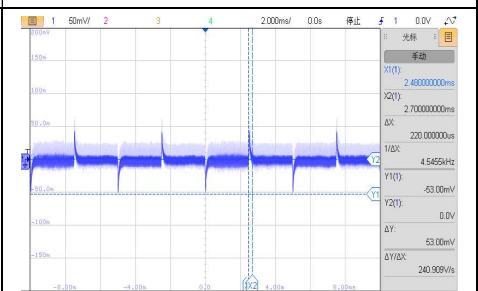
VIN=12V, 50%-25%-50%Io 动态波形



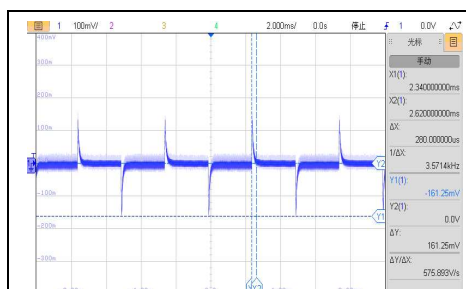
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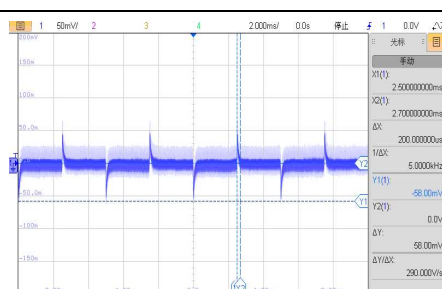
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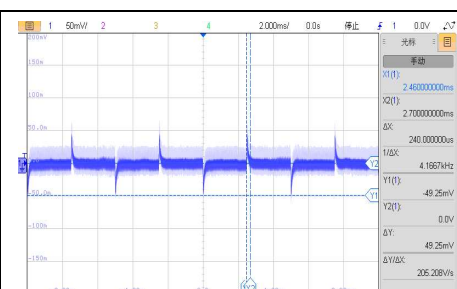
VIN=24V, 50%-25%-50%Io 动态波形



VIN=36V, 100%-10%-100%Io 动态波形

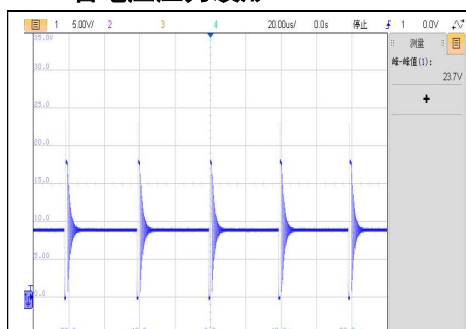


VIN=36V, 75%-50%-75%Io 动态波形

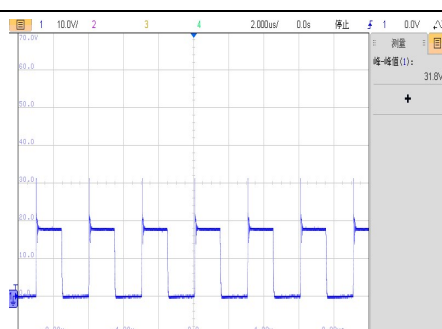


VIN=36V, 50%-25%-50%Io 动态波形

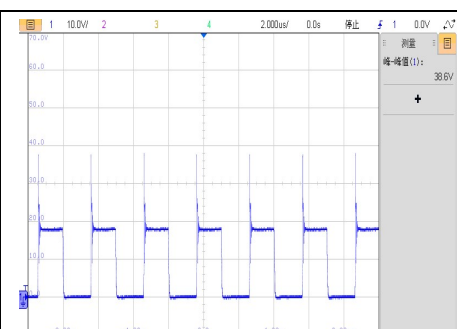
MOS 管电压应力波形



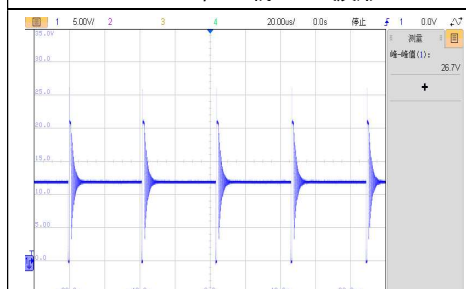
VIN=9V, 空载 VDS 波形



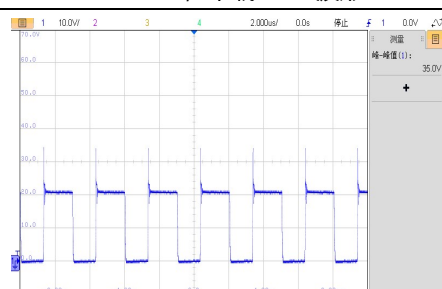
VIN=9V, 半载 VDS 波形



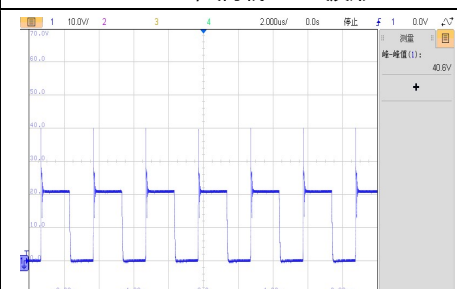
VIN=9V, 满载 VDS 波形



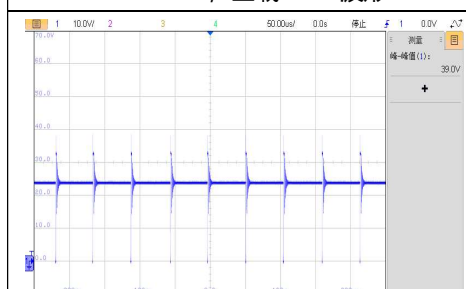
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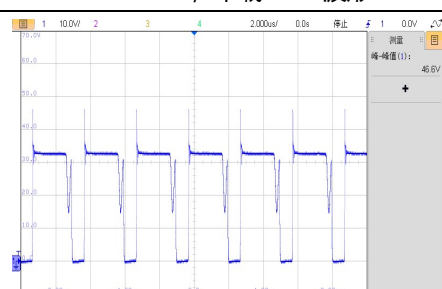
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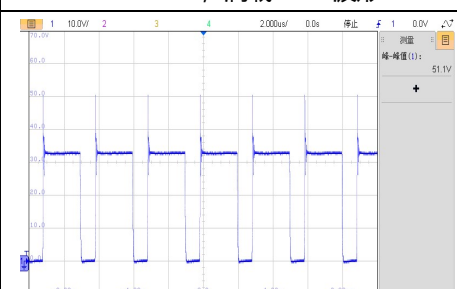
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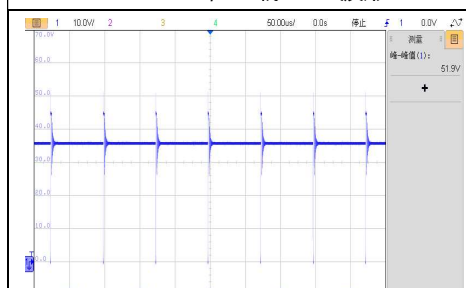
VIN=24V, 空载 VDS 波形



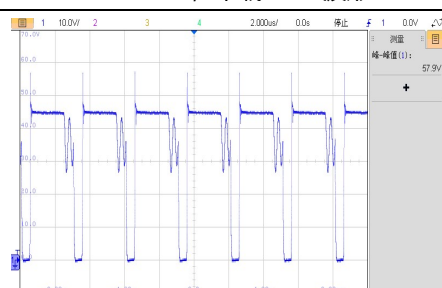
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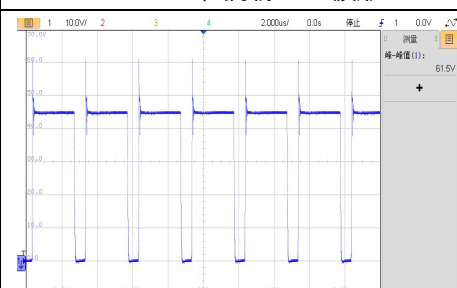
VIN=24V, 满载 VDS 波形



VIN=36V, 空载 VDS 波形

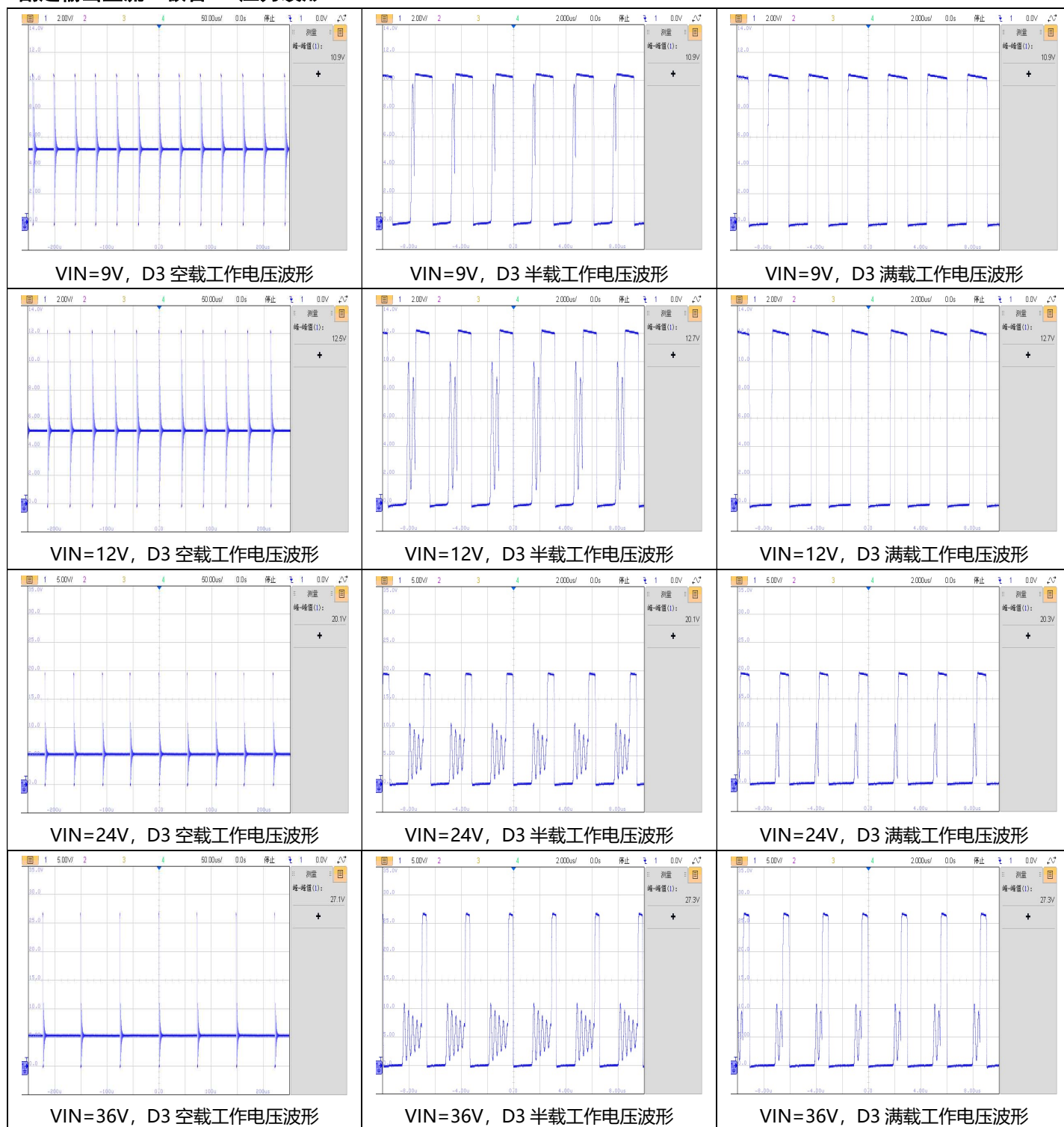


VIN=36V, 半载 VDS 波形



VIN=36V, 满载 VDS 波形

副边输出整流二极管 D3 应力波形



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