

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 VPC2187B，结合隔离功率变压器 VPE27PDD10A、输出整流二极管以及必要的阻容元件，实现 9V-36V 输入，12V 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。

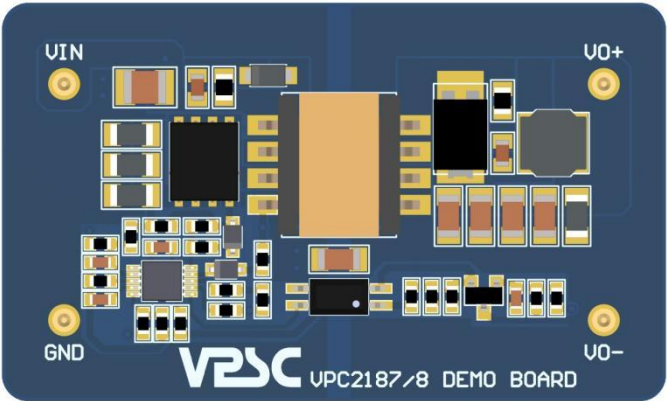
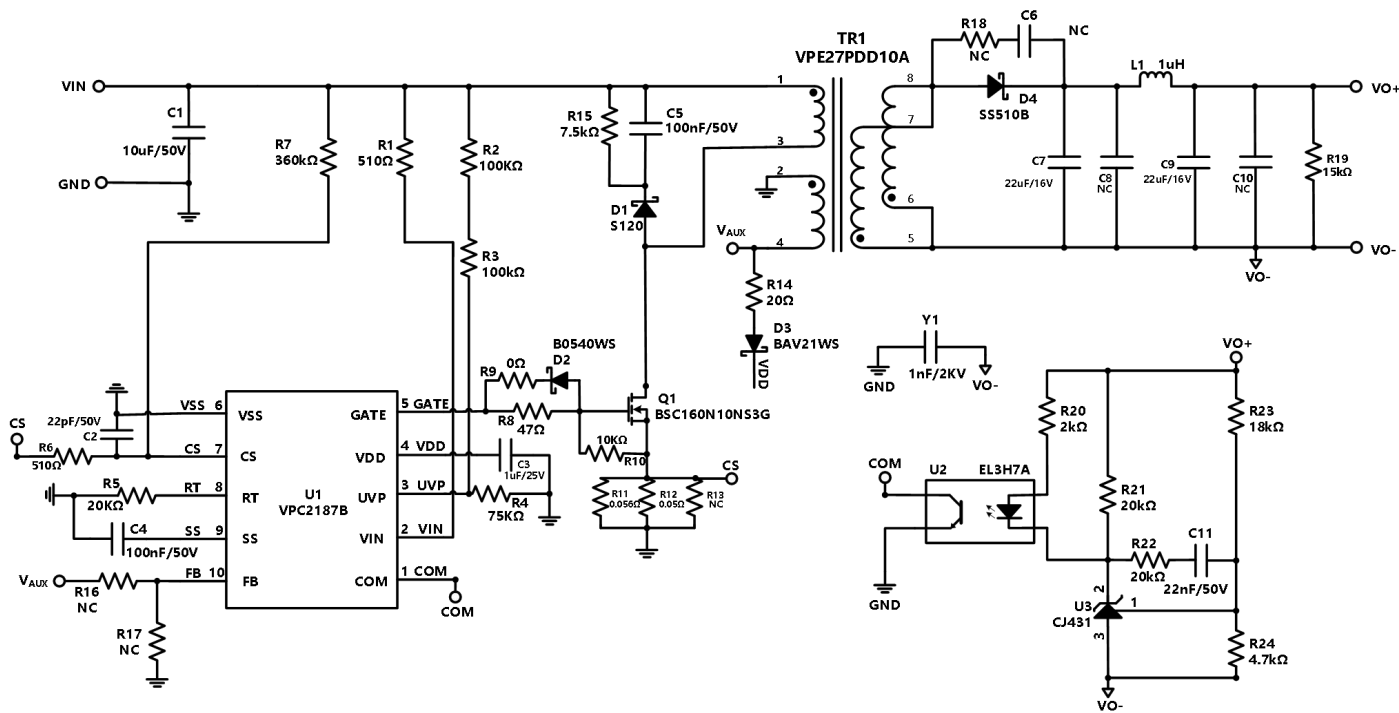


图 1: VPC2187 Demo 板(尺寸:50mm*30mm)

关键词：输入：9V-36V，输出 12V/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

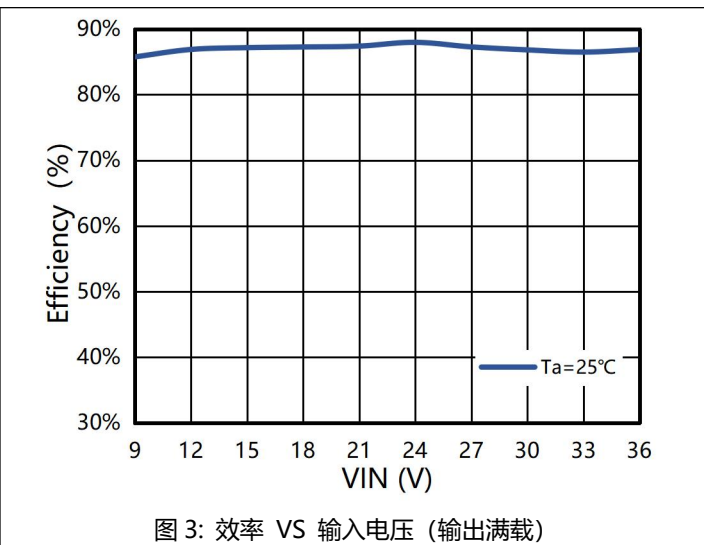
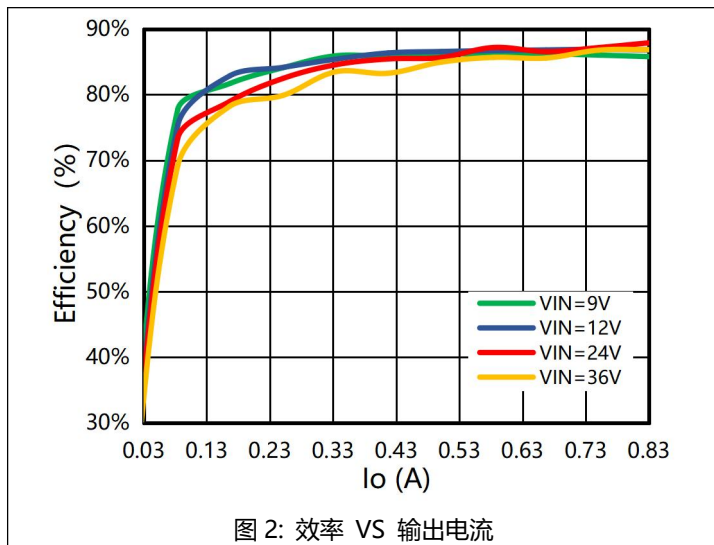
位号	参数	封装	型号	品牌
C1	10uF/50V-X7R	1210	CC1210KKX7R9BB106	YAGEO
C2	22pF/50V- NP0	0603	CC0603KRNPO9BN220	YAGEO
C3	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C4	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C5	100nF/50V-X7R	0805	CC0805KKX7R0BB104	YAGEO
C6	NC	-	-	-
C7	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C8	NC	-	-	-
C9	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C10	NC	-	-	-
C11	22nF/50V-X7R	0603	CC0603KRX7R9BB223	YAGEO
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R2	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R3	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R4	75KΩ±1%	0603	RC0603FR-0775KL	YAGEO
R5	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R6	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R7	360KΩ±1%	0603	RC0603FR-07360KL	YAGEO
R8	47Ω±1%	0603	RC0603FR-0747RL	YAGEO
R9	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R10	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R11	0.056Ω ±1%	1206	RL1206FR-070R056L	YAGEO
R12	0.05Ω ±1%	1206	RL1206FR-070R05L	YAGEO
R13	NC	-	-	-
R14	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R15	7.5KΩ±1%	0805	RC0805FR-077K5L	YAGEO
R16	NC	-	-	-
R17	NC	-	-	-
R18	NC	-	-	-
R19	15KΩ±1%	1206	RC1206FR-0715KL	YAGEO
R20	2KΩ±1%	0603	RC0603FR-072KL	YAGEO
R21	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R22	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R23	18KΩ±1%	0603	RC0603FR-0718KL	YAGEO
R24	4.7KΩ±1%	0603	RC0603FR-074K7L	YAGEO
TR1	NP:NS:NA=8:9:9 Lp=7.04uH	ER11.5	VPE27PDD10A	VPSC
Q1	N 沟道 100V 42A	TDSON-8-EP	BSC160N10NS3G	INFINEON
L1	1uH ±20%	SMD	SWPA4030S1R0MT	SUNLORD

D1	200V/1A	SOD-123	S120	YANGJIE
D2	40V/0.5A	SOD-323	B0540WS	CJ
D3	200V/0.2A	SOD-323	BAV21WS	CJ
D4	100V/5A	SMB	SS510B	YANGJIE
U1	4-100VIN 电源管理芯片	MSOP-10	VPC2187B	VPSC
U2	CTR=80~160, Viso=3750VAC	SSOP-4	EL3H7A	EVERLIGHT
U3	Vref=2.495V	SOT-23	CJ431	CJ

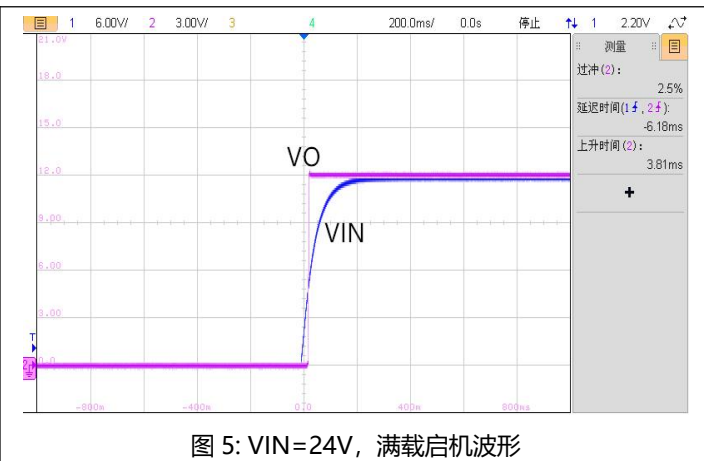
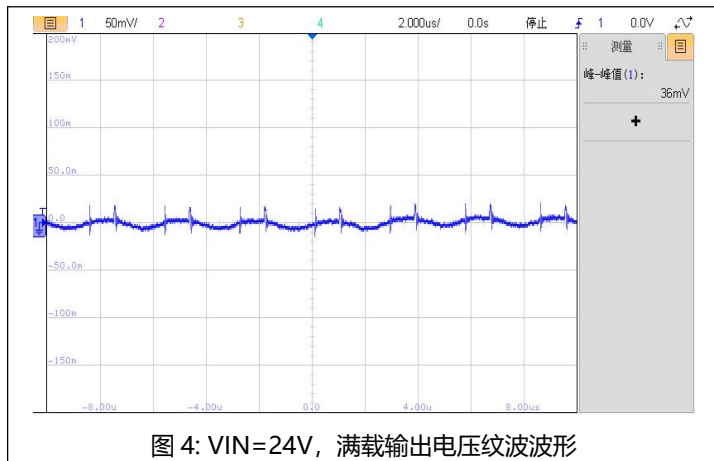
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=24V	6	---	486	mA
转换效率	VIN=24V, IO=0.84A	---	87.93	---	%
纹波&噪声	VIN=24V, IO=0.84A	---	60	90	mV
输出电压精度	VIN=24V, IO=0.84A	---	0.9	---	%
线性调节率	VIN=9V-36V, IO=0.84A	---	0.1	---	%
负载调整率	VIN=24V, IO=0.84A	---	-0.1	---	%
最大容性负载	VIN=9V, IO=0.84A	---	4920	---	uF
输出过流点系数	VIN=9V, IO=0.84A	---	1.7	---	倍
输入欠压保护	锁定电压	---	7.3	---	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

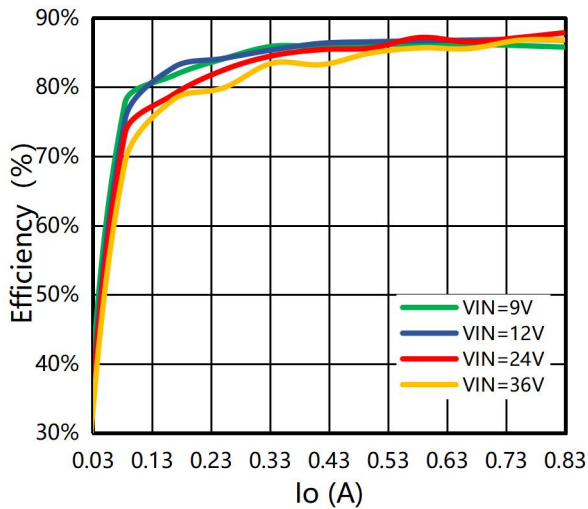


相关波形

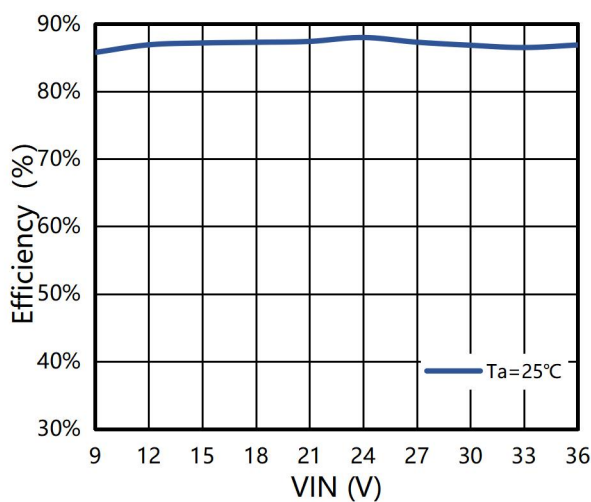


详细测试数据

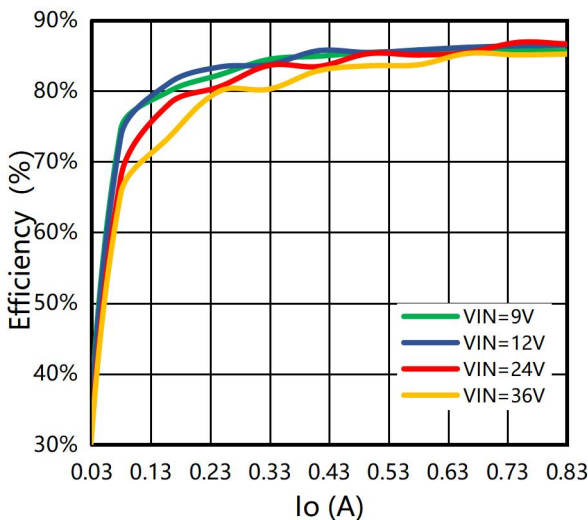
高低温测试曲线



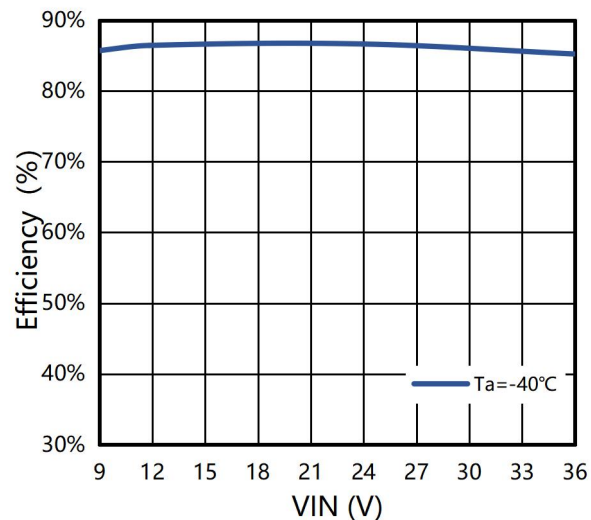
效率 VS 输出电流 (25°C)



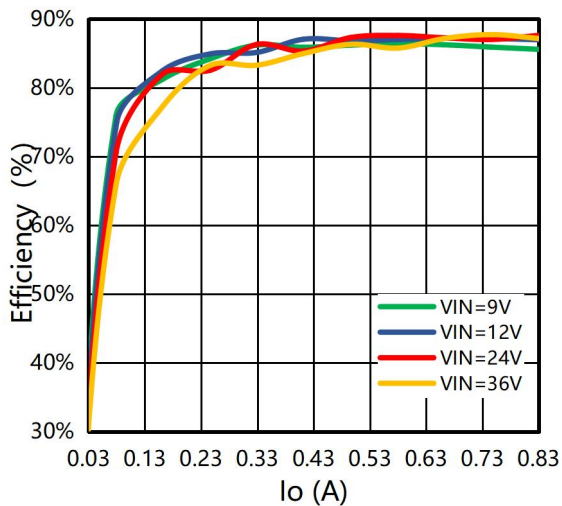
效率 VS 输入电压 (输出满载@25°C)



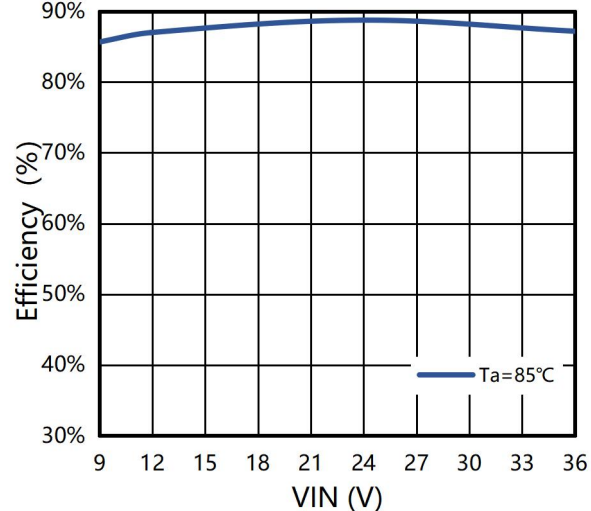
效率 VS 输出电流 (-40°C)



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(%)
23.98	0.008	12.14	0.001	0%	6.33%
23.99	0.058	12.14	0.084	10%	73.29%
23.99	0.107	12.14	0.167	20%	78.98%
23.99	0.154	12.14	0.251	30%	82.48%
23.86	0.201	12.14	0.334	40%	84.55%
23.99	0.247	12.14	0.417	50%	85.43%
23.99	0.296	12.14	0.501	60%	85.65%
23.99	0.339	12.14	0.584	70%	87.18%
23.99	0.39	12.14	0.667	80%	86.55%
23.99	0.436	12.14	0.751	90%	87.16%
23.99	0.48	12.14	0.834	100%	87.93%

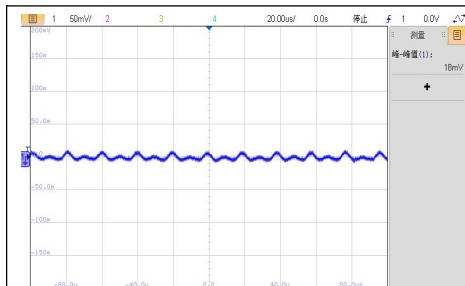
VIN=24V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
24.03	0.006	11.95	0	0%	0.00%
24.02	0.058	11.95	0.079	10%	67.76%
24.01	0.103	11.95	0.162	20%	78.28%
23.99	0.152	11.95	0.246	30%	80.62%
23.99	0.196	11.95	0.329	40%	83.61%
23.98	0.246	11.95	0.412	50%	83.46%
23.97	0.290	11.95	0.496	60%	85.27%
23.96	0.340	11.95	0.580	70%	85.08%
23.96	0.387	11.95	0.663	80%	85.44%
23.96	0.430	11.95	0.749	90%	86.87%
23.95	0.478	11.95	0.830	100%	86.64%

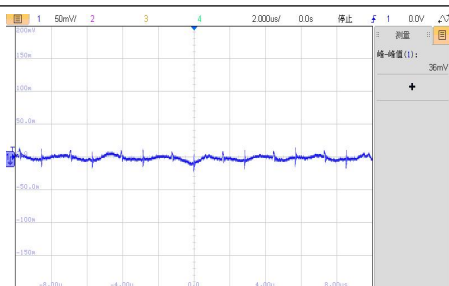
VIN=24V, Ta=85°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
24.03	0.008	12.04	0	0%	0.00%
24.03	0.056	12.03	0.079	10%	70.62%
24.02	0.099	12.04	0.162	20%	82.02%
24.01	0.150	12.04	0.247	30%	82.57%
24.01	0.191	12.03	0.329	40%	86.31%
24	0.242	12.03	0.412	50%	85.34%
24	0.285	12.04	0.496	60%	87.31%
23.99	0.332	12.03	0.580	70%	87.60%
23.99	0.381	12.03	0.663	80%	87.26%
23.98	0.430	12.03	0.746	90%	87.03%
23.99	0.475	12.03	0.830	100%	87.62%

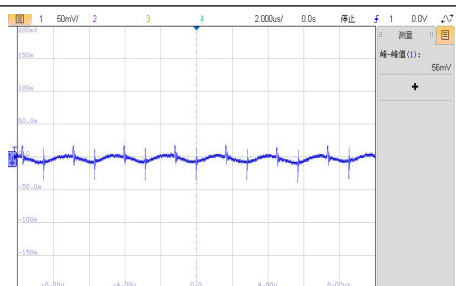
输出电压纹波波形



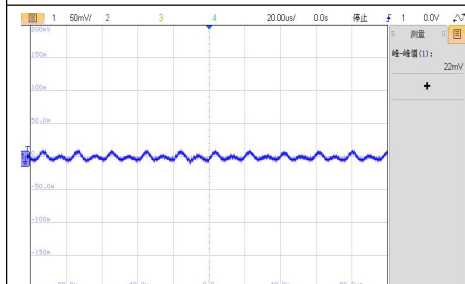
VIN=9V, 空载输出电压纹波波形



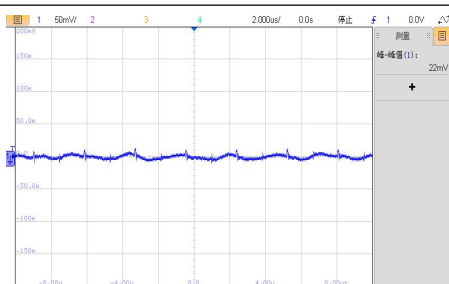
VIN=9V, 半载输出电压纹波波形



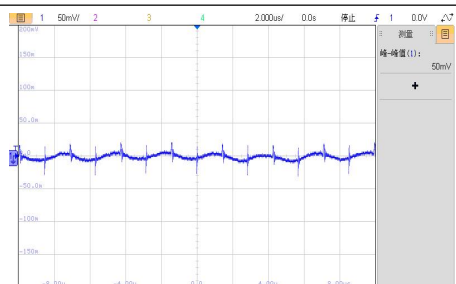
VIN=9V, 满载输出电压纹波波形



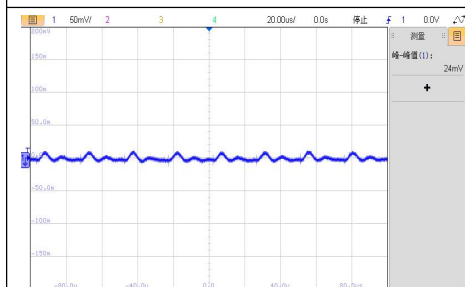
VIN=12V, 空载输出电压纹波波形



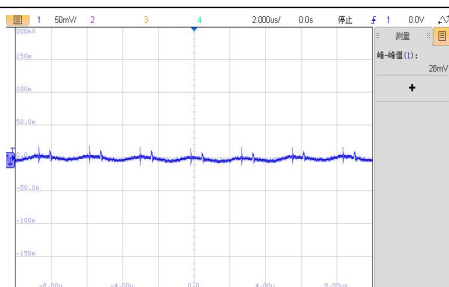
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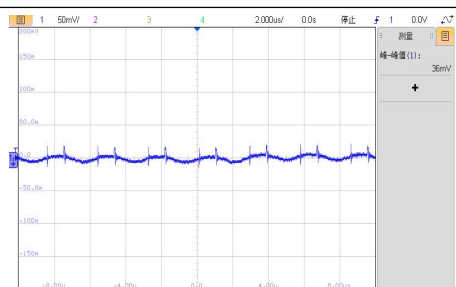
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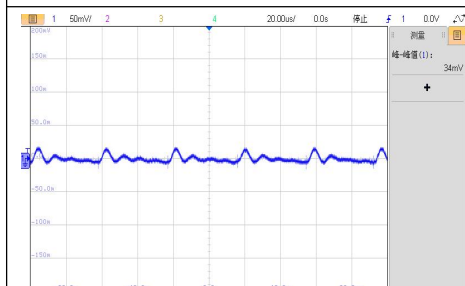
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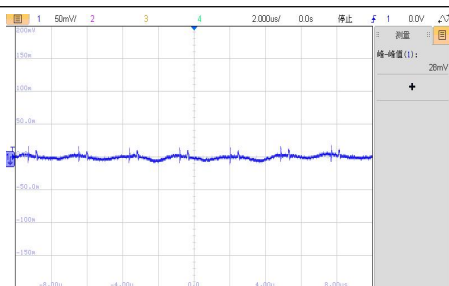
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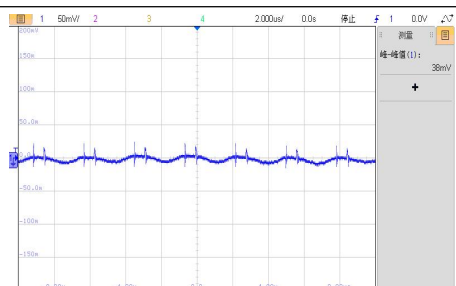
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VIN=36V, 空载输出电压纹波波形

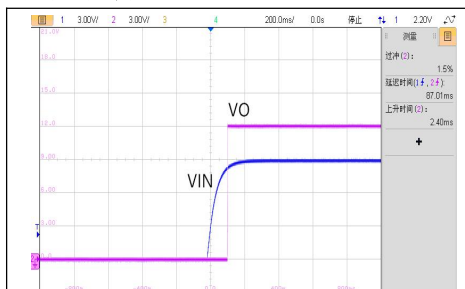


VIN=36V, 半载输出电压纹波波形

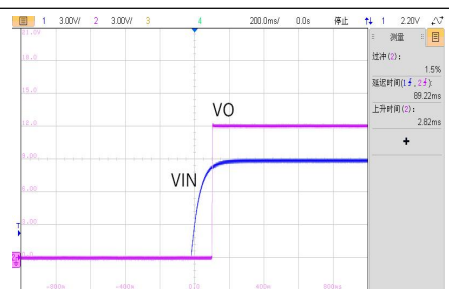


VIN=36V, 满载输出电压纹波波形

开关机波形



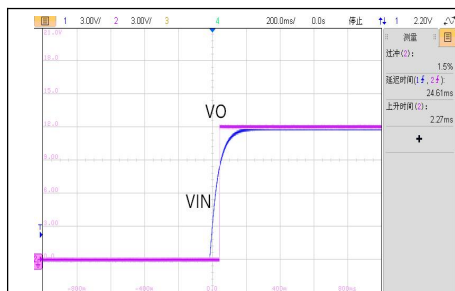
VIN=9V, 空载启机波形



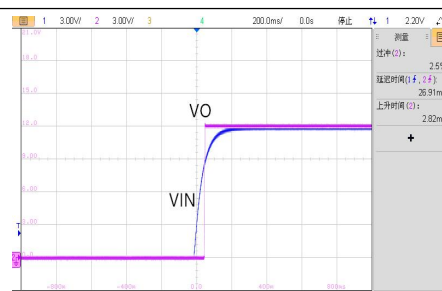
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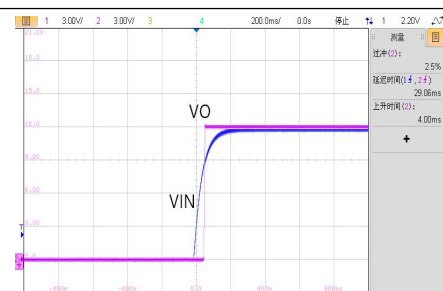
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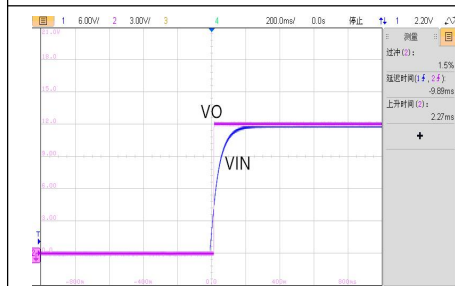
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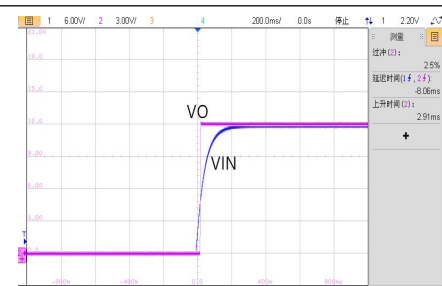
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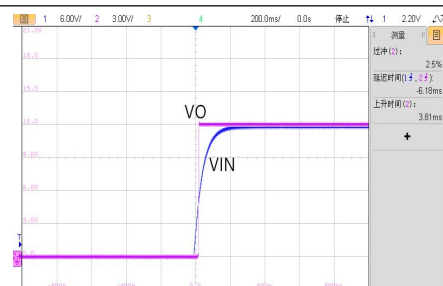
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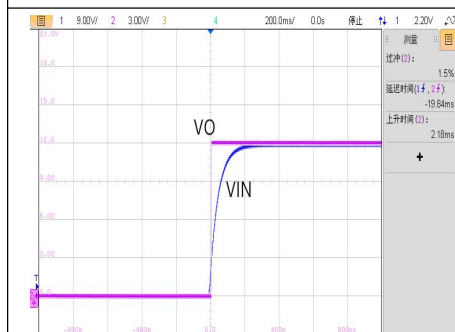
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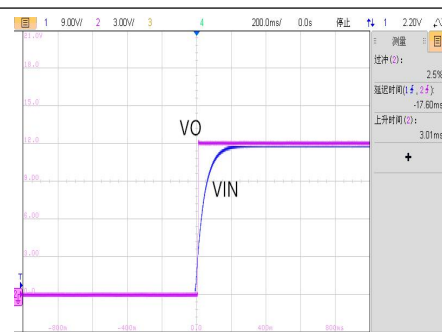
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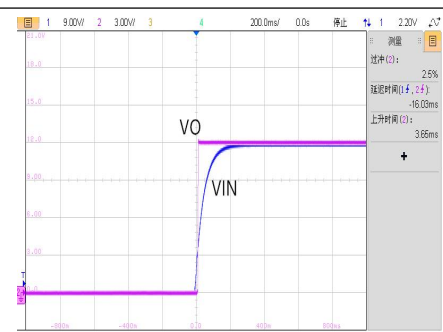
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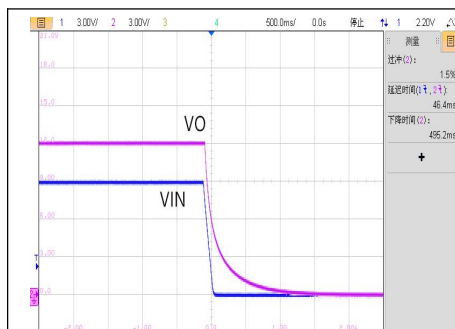
VIN=36V, 空载启机波形



VIN=36V, 半载启机波形



VIN=36V, 满载启机波形



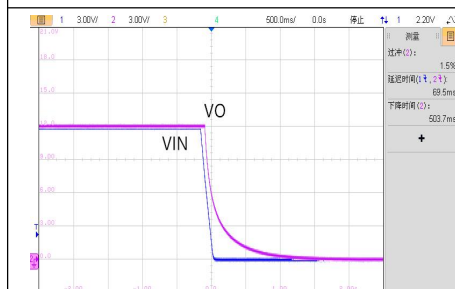
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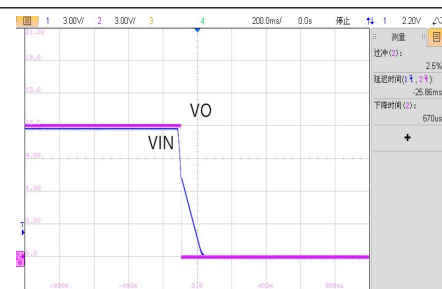
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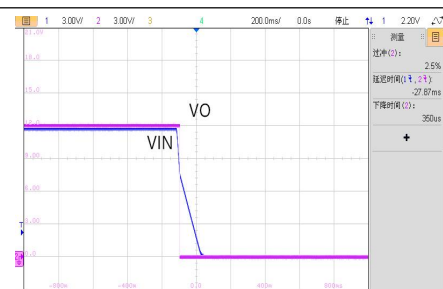
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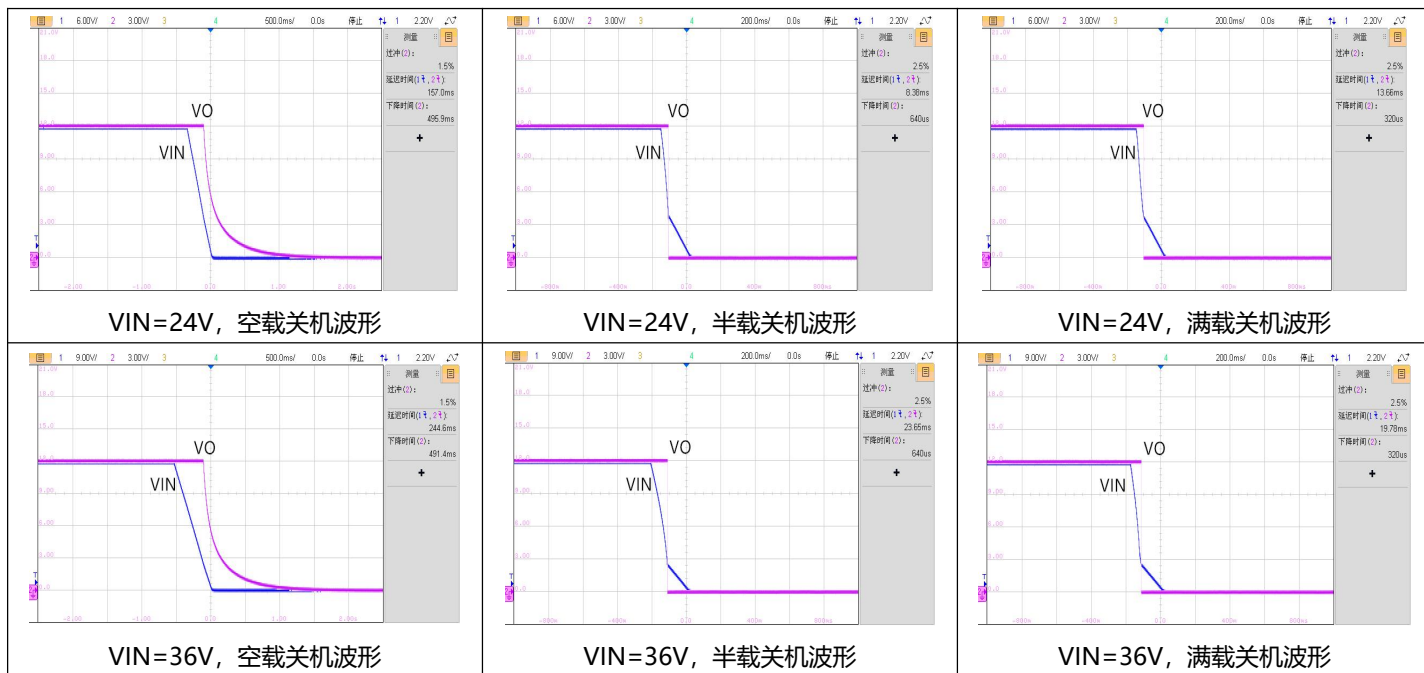
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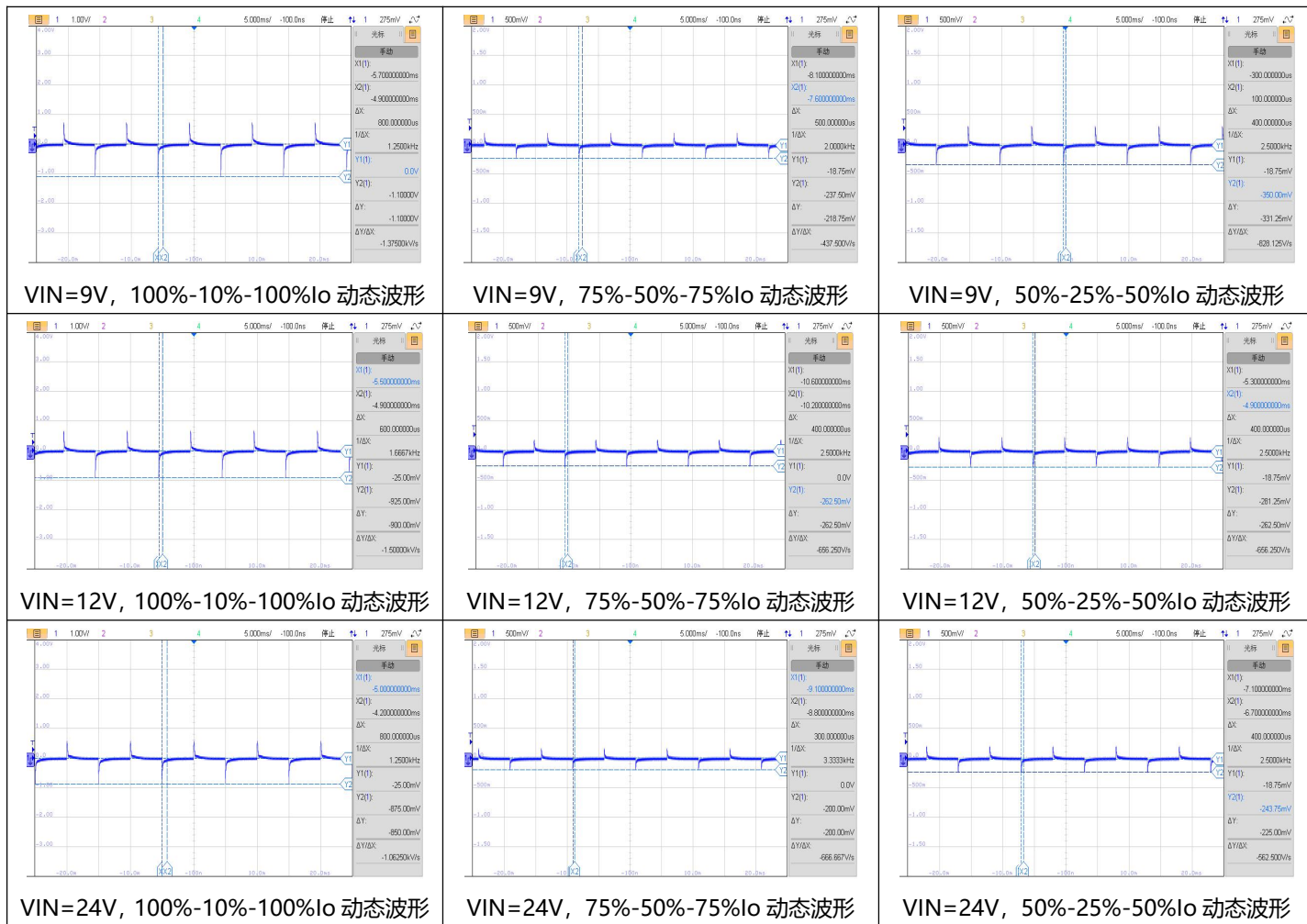
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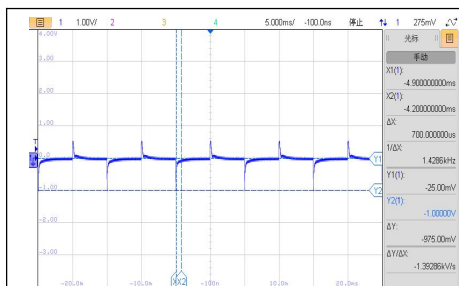


VIN=12V, 满载关机波形

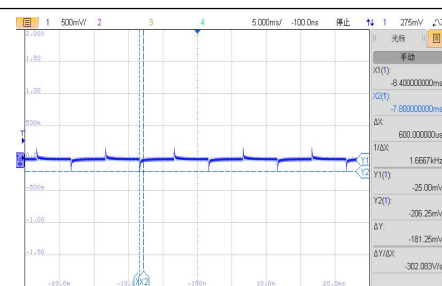


动态波形

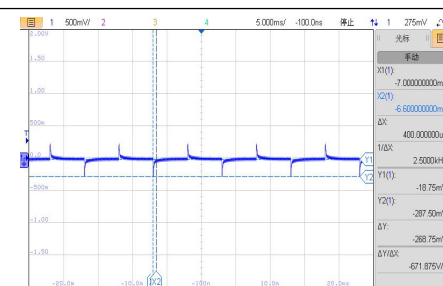




VIN=36V, 100%-10%-100%Io 动态波形

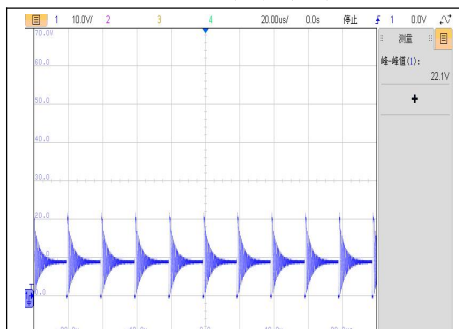


VIN=36V, 75%-50%-75%Io 动态波形

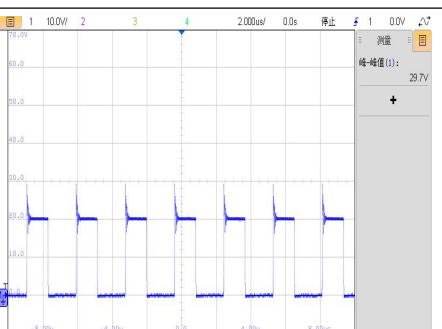


VIN=36V, 50%-25%-50%Io 动态波形

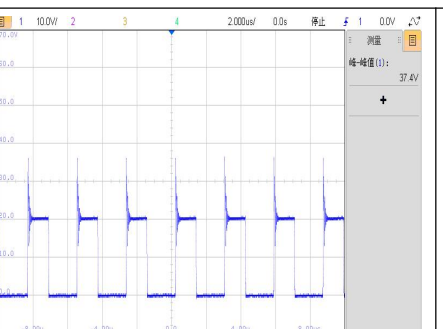
外置 MOS 管 Q1 电压应力波形



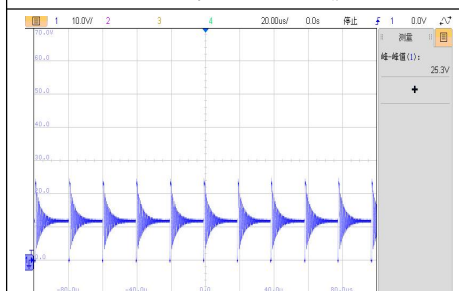
VIN=9V, 空载 VDS 波形



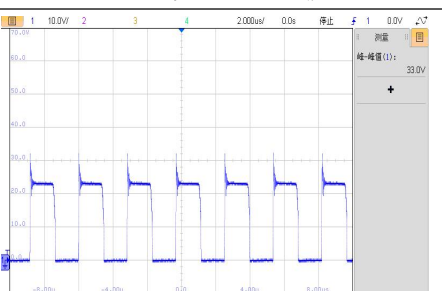
VIN=9V, 半载 VDS 波形



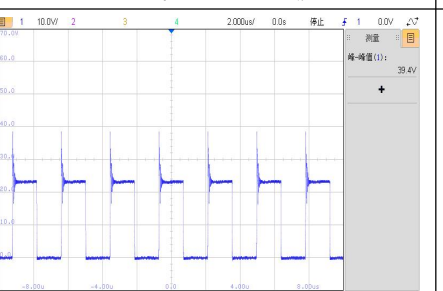
VIN=9V, 满载 VDS 波形



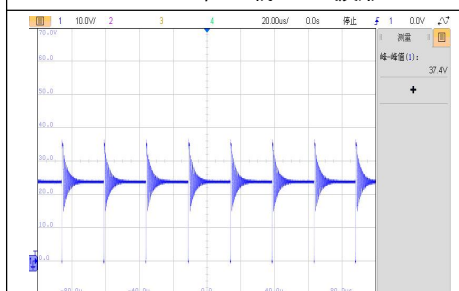
VIN=12V, 空载 VDS 波形



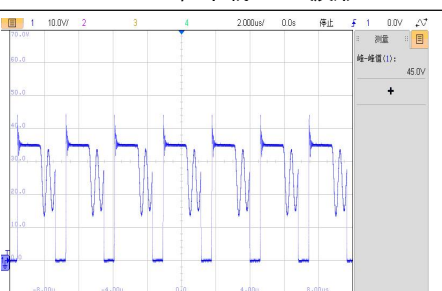
VIN=12V, 半载 VDS 波形



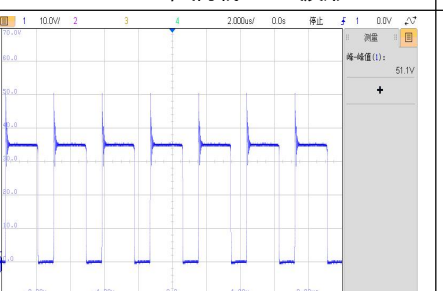
VIN=12V, 满载 VDS 波形



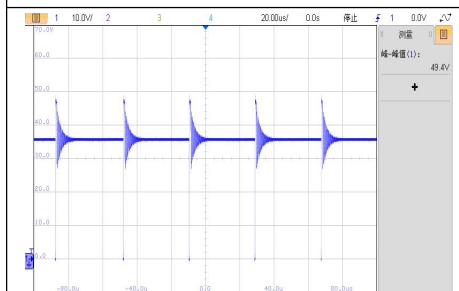
VIN=24V, 空载 VDS 波形



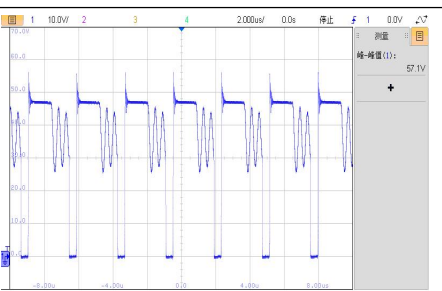
VIN=24V, 半载 VDS 波形



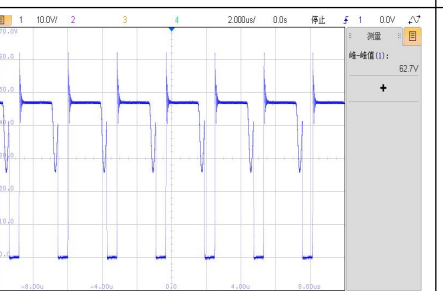
VIN=24V, 满载 VDS 波形



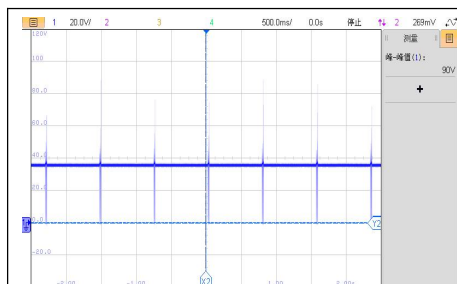
VIN=36V, 空载 VDS 波形



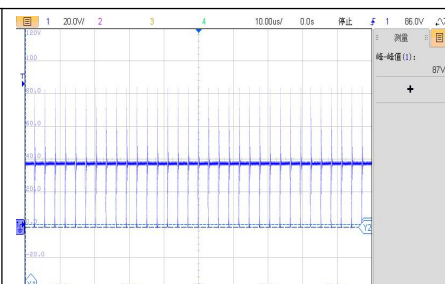
VIN=36V, 半载 VDS 波形



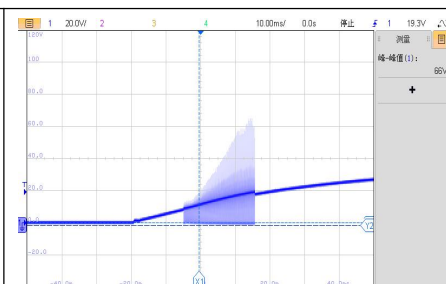
VIN=36V, 满载 VDS 波形



VIN=36V, 短路保护 VDS 波形

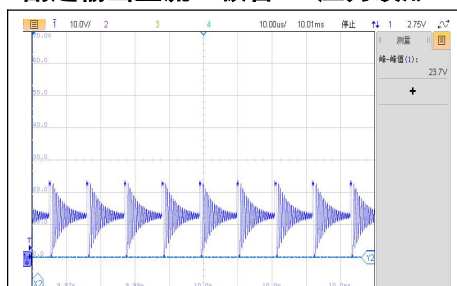


VIN=36V, 短路保护 VDS 展开波形

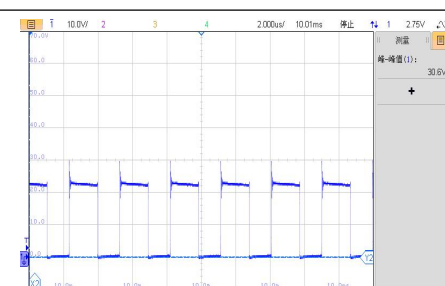


VIN=36V, 短路保护 VDS 启机波形

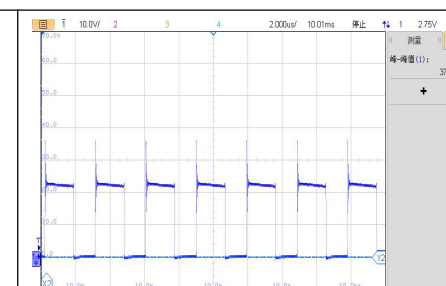
副边输出整流二极管 D4 应力波形



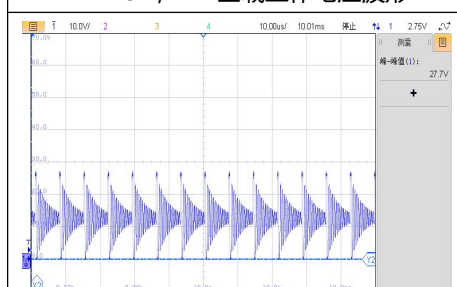
VIN=9V, D4 空载工作电压波形



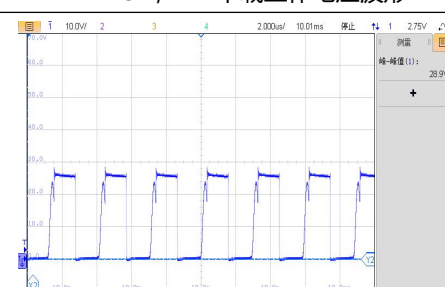
VIN=9V, D4 半载工作电压波形



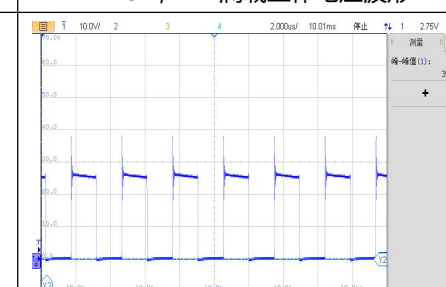
VIN=9V, D4 满载工作电压波形



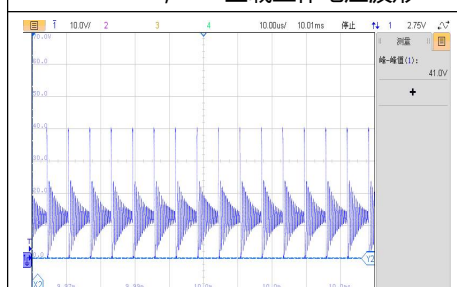
VIN=12V, D4 空载工作电压波形



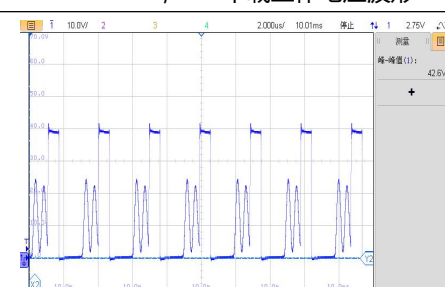
VIN=12V, D4 半载工作电压波形



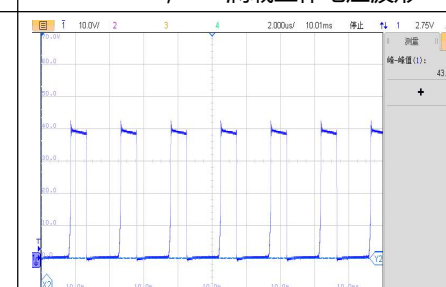
VIN=12V, D4 满载工作电压波形



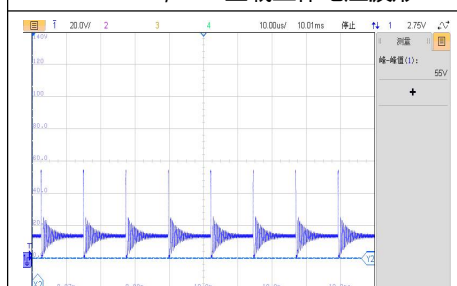
VIN=24V, D4 空载工作电压波形



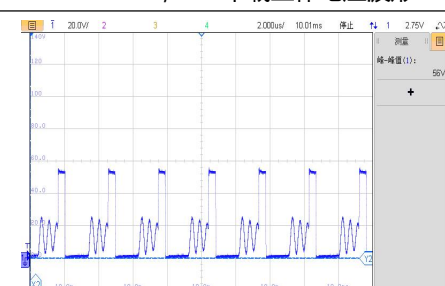
VIN=24V, D4 半载工作电压波形



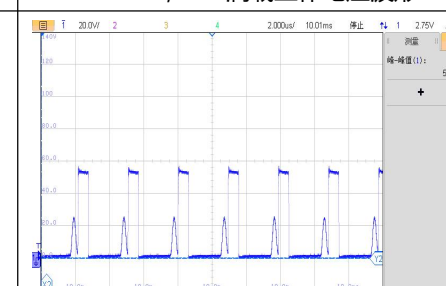
VIN=24V, D4 满载工作电压波形



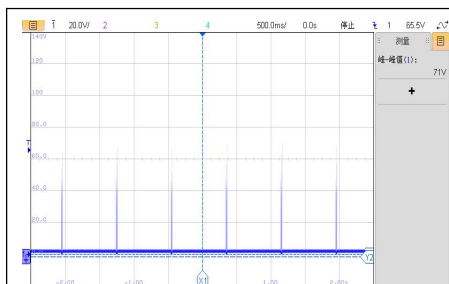
VIN=36V, D4 空载工作电压波形



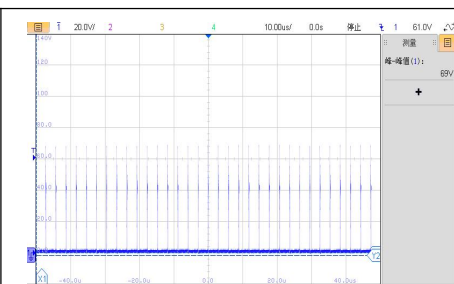
VIN=36V, D4 半载工作电压波形



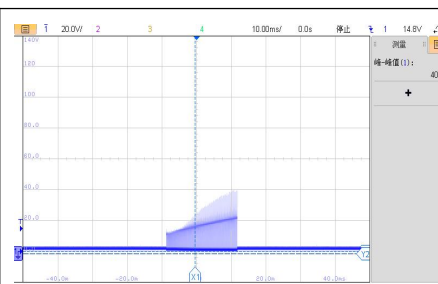
VIN=36V, D4 满载工作电压波形



VIN=36V, D4 短路保护工作电压波形



VIN=36V, D4 短路保护工作电压展开波形



VIN=36V, D4 短路保护工作启机波形

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