

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 VPE27PEE10A、输出整流二极管以及必要的阻容元件，实现 9V-36V 输入，双路±15V 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。

关键词：输入：9V-36V，输出±15V/10W，隔离电压：1500VDC，反馈方式：副边反馈-SSR

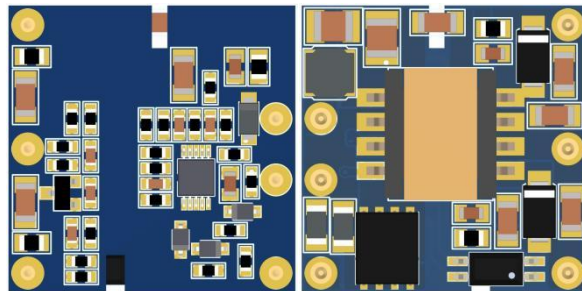
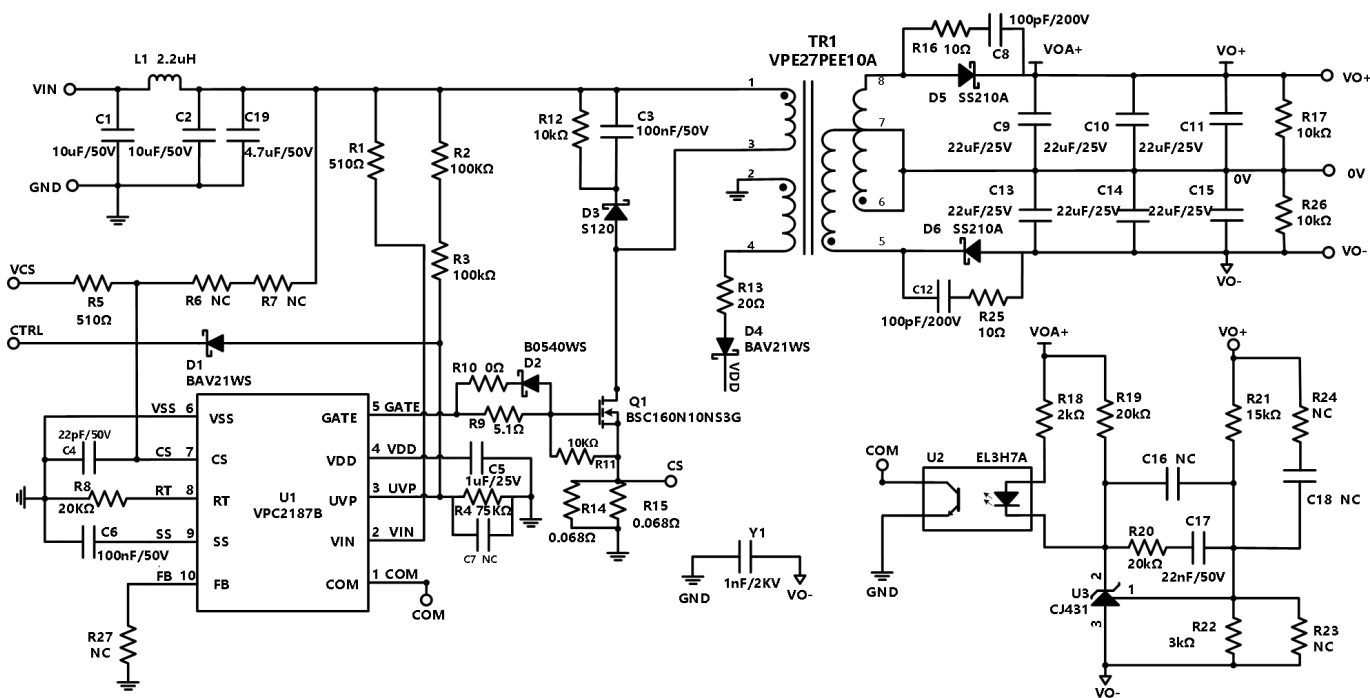


图 1: VPC2187 Demo 板(尺寸:25mm*25mm)

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	CTRL	电源控制引脚
4	VO+	电源输出正
5	VO-	电源输出负

物料清单

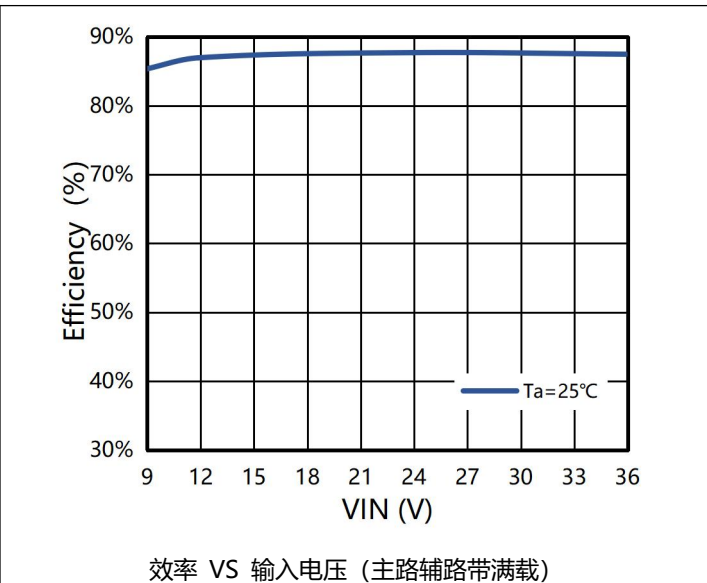
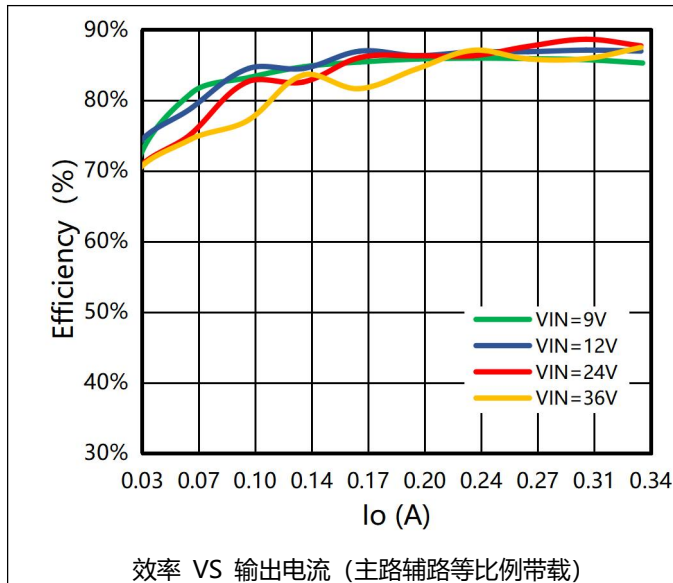
位号	参数	封装	型号	品牌
C1	10uF/50V-X7R	1210	CC1210KKX7R9BB106	YAGEO
C2	10uF/50V-X7R	1210	CC1210KKX7R9BB106	YAGEO
C3	100nF/50V-X7R	0805	CC0805KKX7R0BB104	YAGEO
C4	22pF/50V- NP0	0603	CC0603KRNPO9BN220	YAGEO
C5	1uF/25V-X7R	0805	CC0805KKX7R9BB105	YAGEO
C6	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C7	NC	-	-	-
C8	100pF/200V- NP0	0805	CC0805JRNPOABN101	YAGEO
C9	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C10	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C11	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C12	100pF/200V- NP0	0805	CC0805JRNPOABN101	YAGEO
C13	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C14	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C15	22uF/25V-X5R	1206	CL31A226KAHNNNE	SAMSUNG
C16	NC	-	-	-
C17	22nF/50V-X7R	0603	CC0603KRX7R9BB223	YAGEO
C18	NC	-	-	-
C19	4.7uF/50V-X7R	1206	CC1206KKX7R9BB475	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	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R6	NC	-	-	-
R7	NC	-	-	-
R8	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R9	5.1Ω±1%	0603	RC0603FR-075R1L	YAGEO
R10	0Ω±1%	0603	AC0603FR-070RL	YAGEO
R11	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R12	10KΩ±1%	0805	AC0805FR-0710KL	YAGEO
R13	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R14	0.068Ω ±1%	1206	RL1206FR-070R068L	YAGEO
R15	0.068Ω ±1%	1206	RL1206FR-070R068L	YAGEO
R16	10Ω±1%	0805	RC0805FR-0710RL	YAGEO
R17	10kΩ±1%	1206	RC1206FR-0710KL	YAGEO
R18	2kΩ±1%	0603	RC0603FR-072KL	YAGEO
R19	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R20	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO

R21	15kΩ±1%	0603	RC0603FR-0715KL	YAGEO
R22	3KΩ±1%	0603	RC0603FR-073KL	YAGEO
R23	NC	-	-	-
R24	NC	-	-	-
R25	10Ω±1%	0805	RC0805FR-0710RL	YAGEO
R26	10kΩ±1%	1206	RC1206FR-0710KL	YAGEO
TR1	NP:NS:NA=8:12:10 Lp=7.04uH	ER11.5	VPE27PEE10A	VPSC
Q1	N 沟道 100V 42A	PG-TDSON-8	BSC160N10NS3G	INFINEON
L1	2.2uH ±20%	SMD	SWPA4030S2R2MT	SUNLORD
D1	200V/0.2A	SOD-323	BAV21WS	CJ
D2	40V/0.5A	SOD-323	B0540WS	DIODES
D3	200V/1A	SOD-123	S120	YANGJIE
D4	200V/0.2A	SOD-323	BAV21WS	CJ
D5	100V/2A	SMA	SS210A	YANGJIE
D6	100V/2A	SMA	SS210A	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	SOT23-3	CJ431	CJ

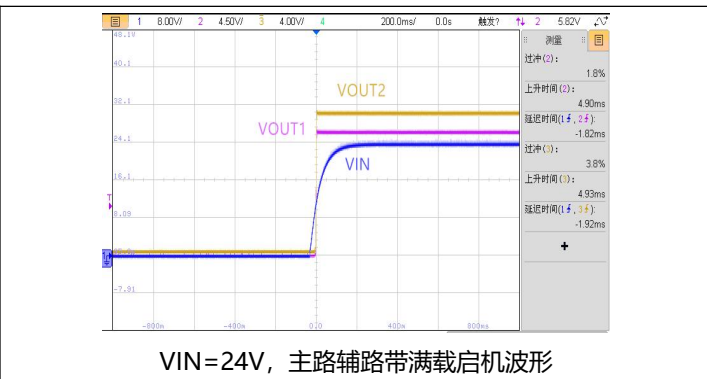
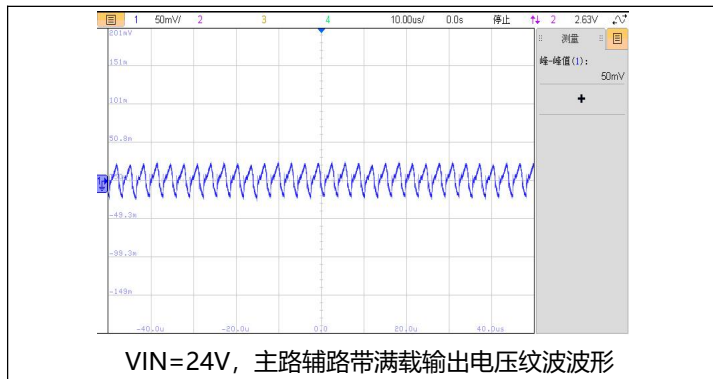
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流(满载/空载)	VIN=24V, IO1=0.34A, IO2=0.34A	2	---	491	mA
转换效率	VIN=24V, IO1=0.34A, IO2=0.34A	---	87.69	---	%
纹波&噪声	VIN=24V, IO1=0.34A, IO2=0.34A	---	50	68	mV
线性调节率	VIN=9V-36V, IO1=0.34A, IO2=0.34A 主路	---	0.7	---	%
负载调整率	VIN=24V, IO1=0.34A, IO2=0.034A 主路	---	0.6	---	%
输出电压	VIN=24V, IO1=0.34A, IO2=0.034A 主路	---	14.80	---	V
	VIN=24V, IO1=0.34A, IO2=0.034A 辅路	---	15.38	---	V
	VIN=24V, IO1=0.034A, IO2=0.34A 主路	---	14.80	---	V
	VIN=24V, IO1=0.034A, IO2=0.34A 辅路	---	14.26	---	V
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

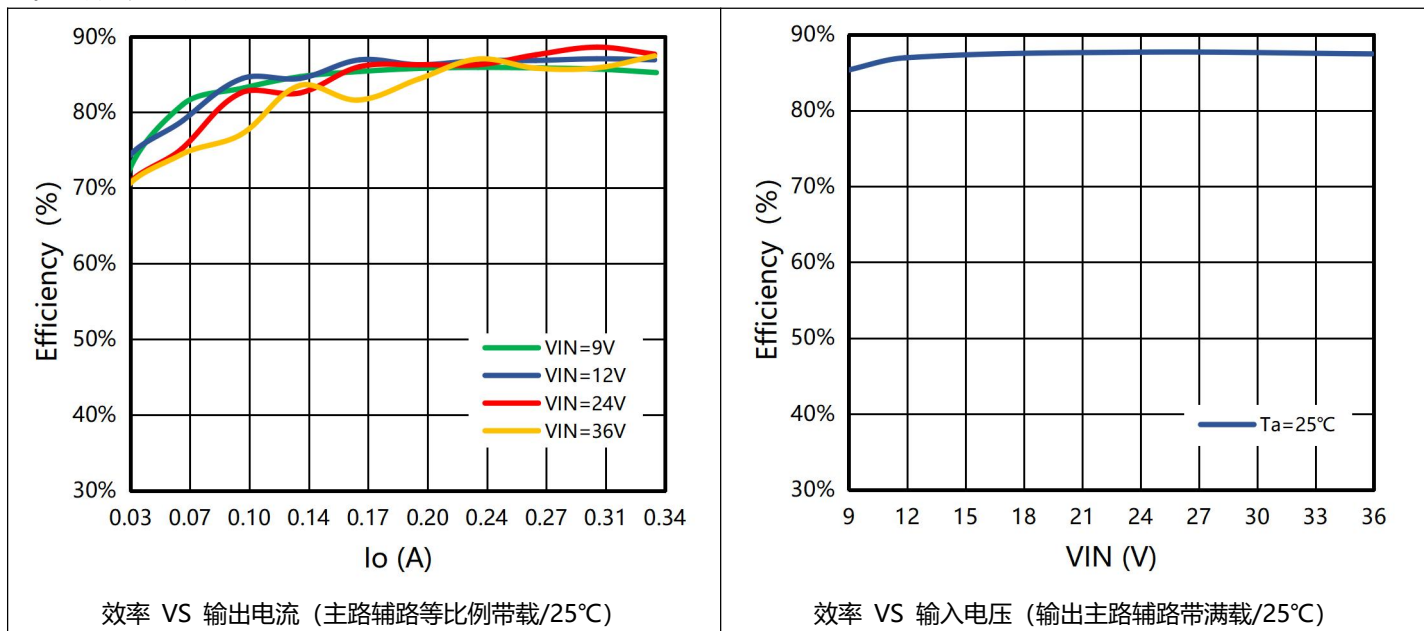


相关波形



详细测试数据

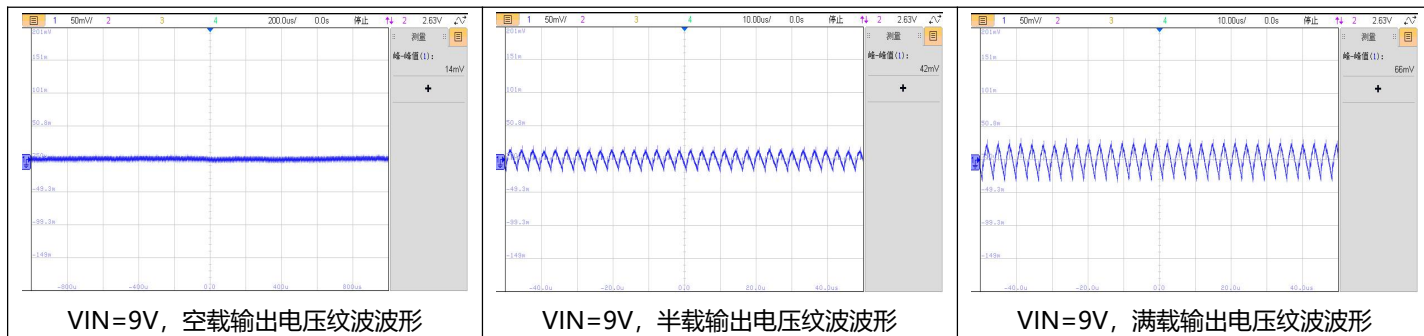
常温测试曲线

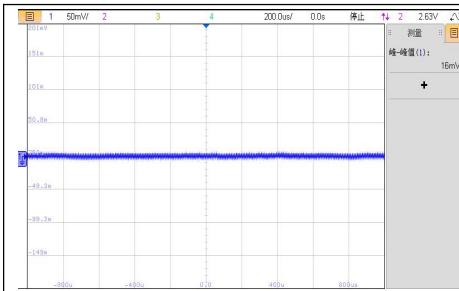


VIN=24V, Ta=25°C, 输入、输出及效率数据:

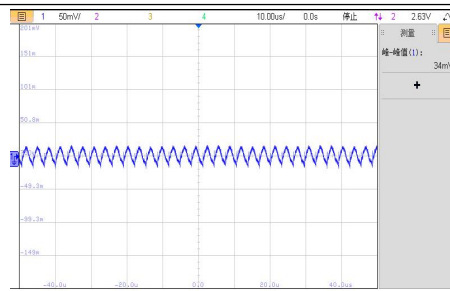
VIN(V)	IIN(A)	VO1(V)	IO1(A)	VO2(V)	IO2(A)	IO-max%	η (%)
23.96	0.006	15	0	15.12	0	0%	0
23.96	0.056	14.96	0.03	14.96	0.032	10%	69.13
23.96	0.107	14.93	0.063	14.93	0.066	20%	75.12
23.95	0.149	14.95	0.097	14.96	0.1	30%	82.56
23.95	0.2	14.92	0.131	14.93	0.134	40%	82.57
23.94	0.241	14.94	0.165	14.96	0.167	50%	86.03
23.94	0.29	14.93	0.199	14.95	0.202	60%	86.29
23.93	0.339	14.91	0.233	14.94	0.236	70%	86.29
23.93	0.382	14.93	0.266	14.95	0.270	80%	87.60
23.92	0.427	14.95	0.301	14.97	0.304	90%	88.61
23.92	0.478	14.91	0.334	14.93	0.338	100%	87.69

主路输出电压纹波波形 (副路带等比例负载)

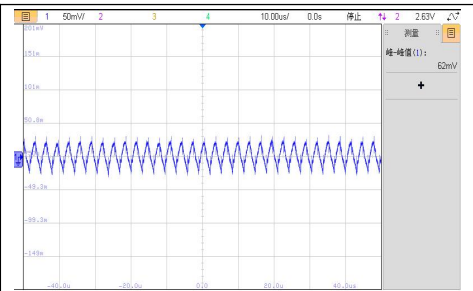




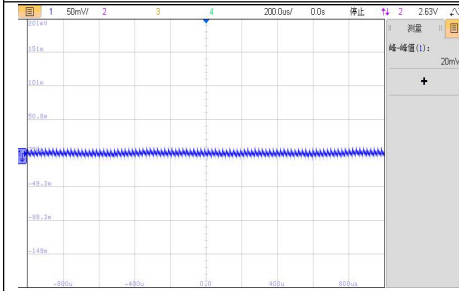
VIN=12V, 空载输出电压纹波波形



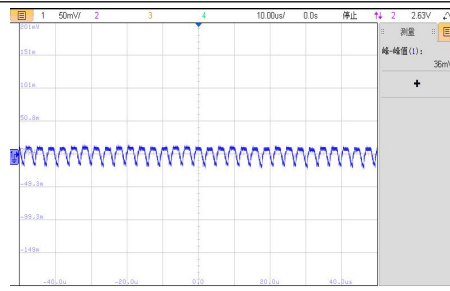
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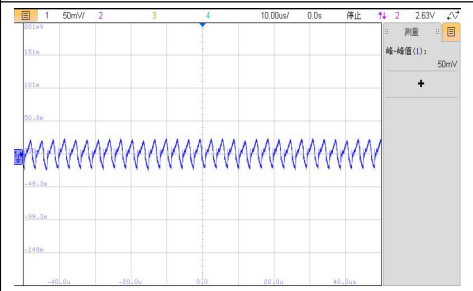
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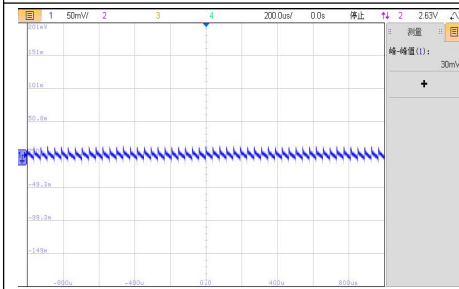
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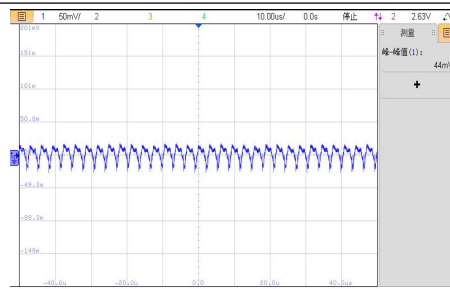
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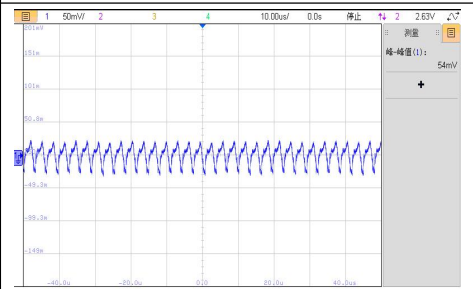
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VIN=36V, 空载输出电压纹波波形

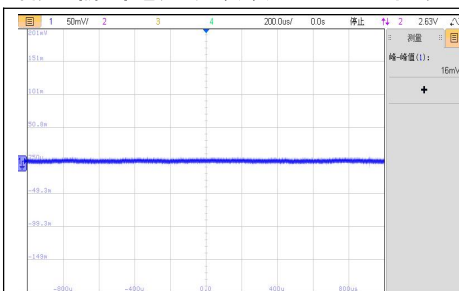


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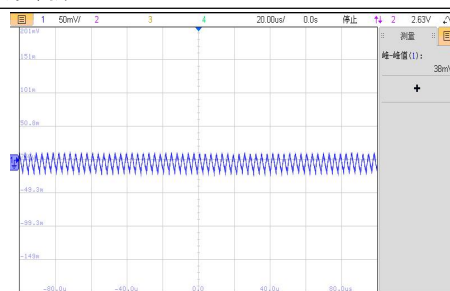


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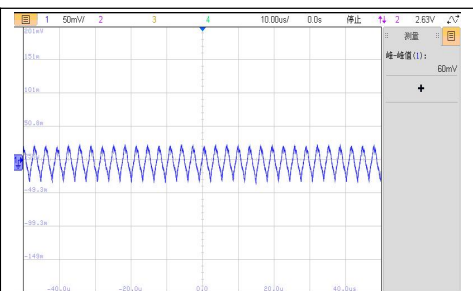
副路输出电压纹波波形（主路带等比例负载）



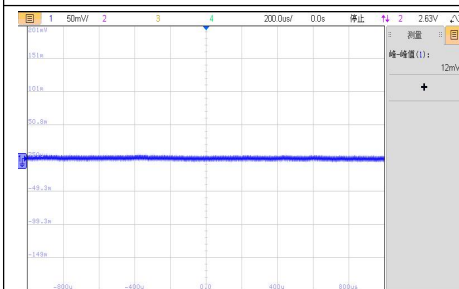
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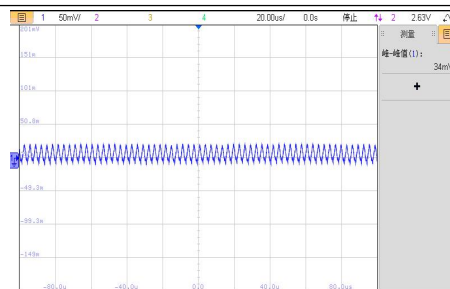
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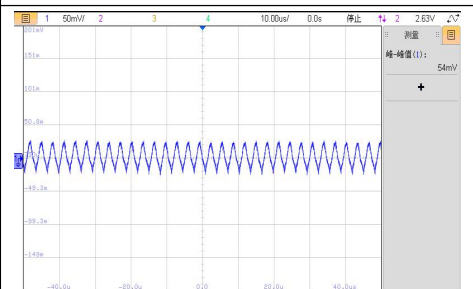
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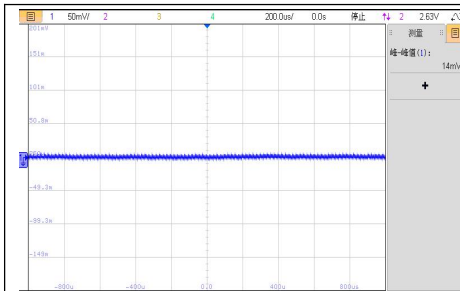
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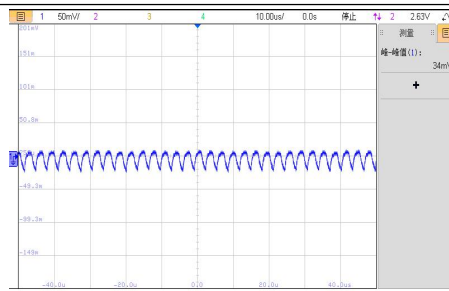
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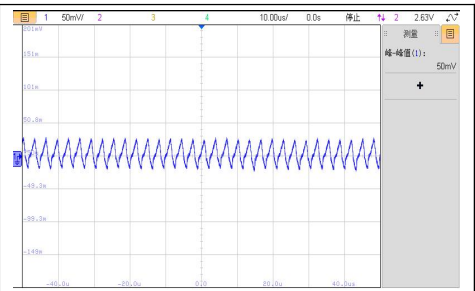
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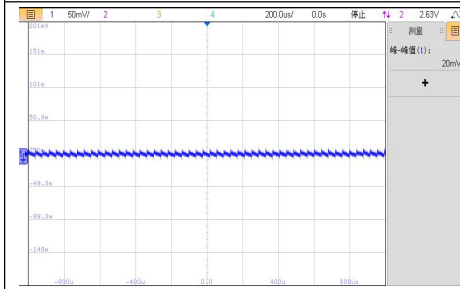
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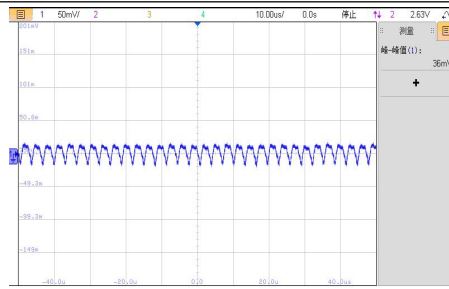
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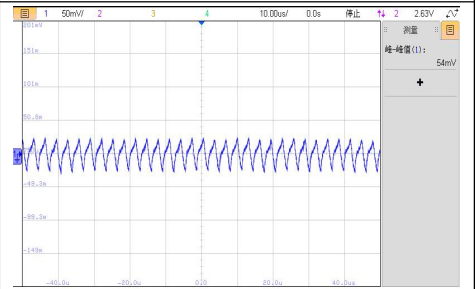
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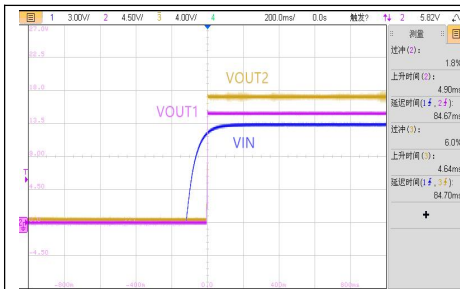


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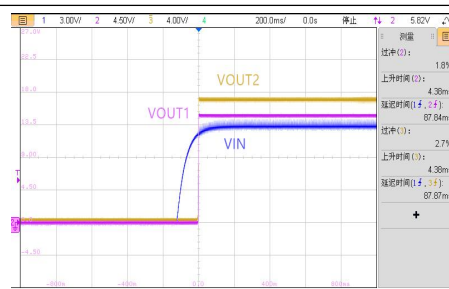


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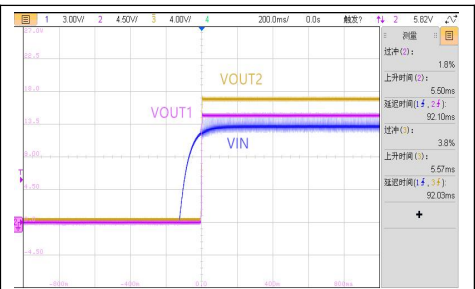
开关机波形（主路带等比例负载）



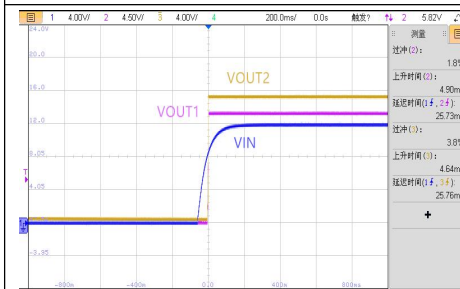
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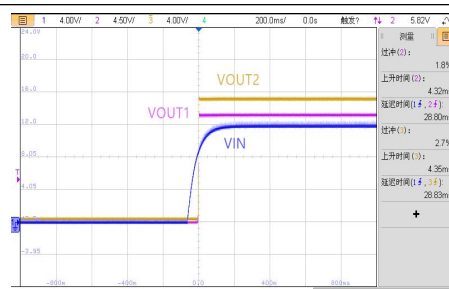
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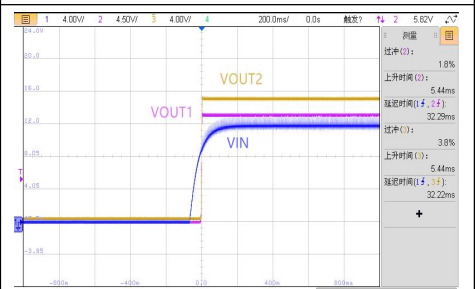
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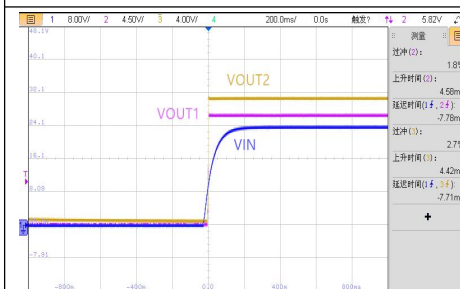
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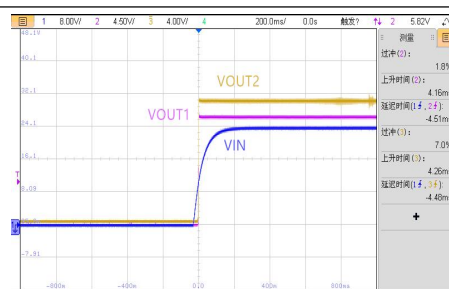
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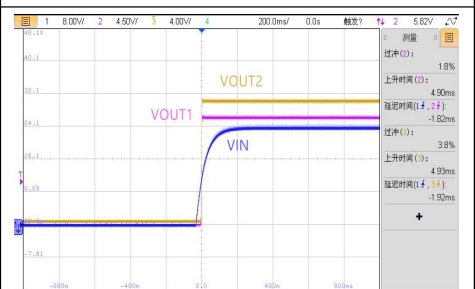
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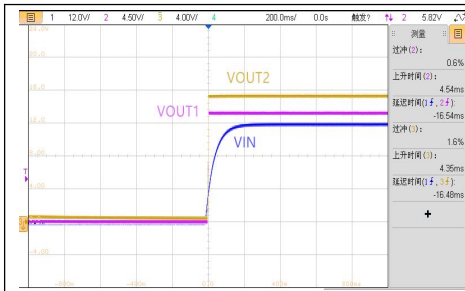
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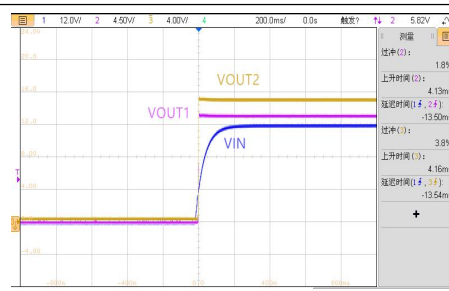
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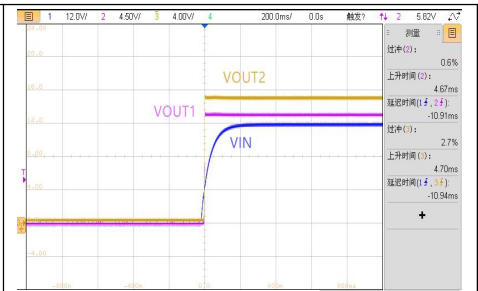
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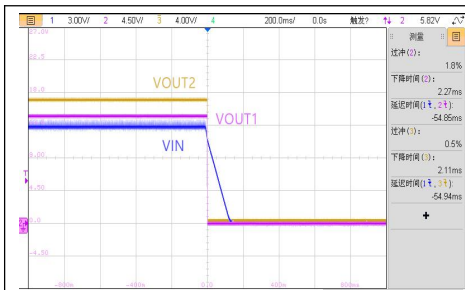
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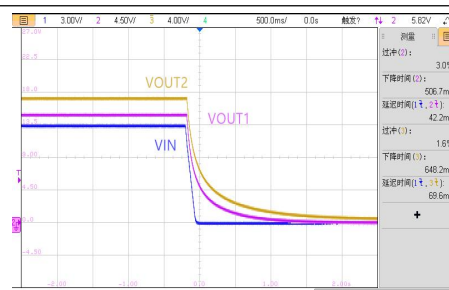
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VIN=36V, 满载启机波形



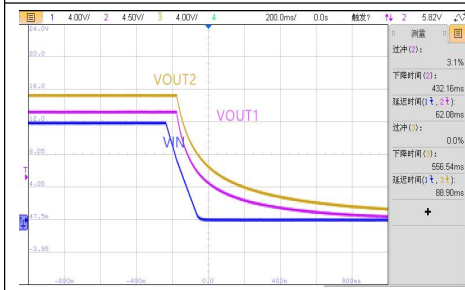
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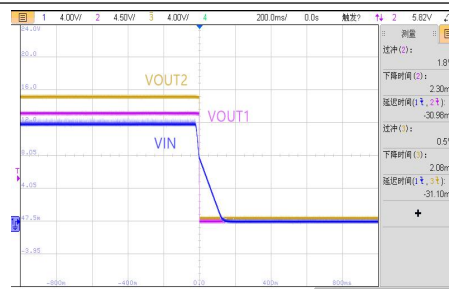
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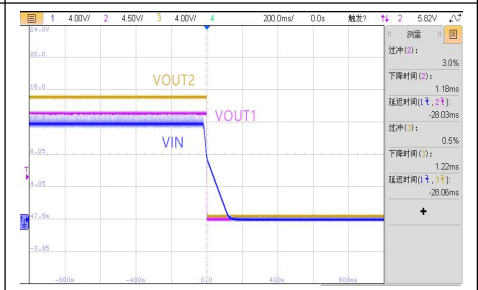
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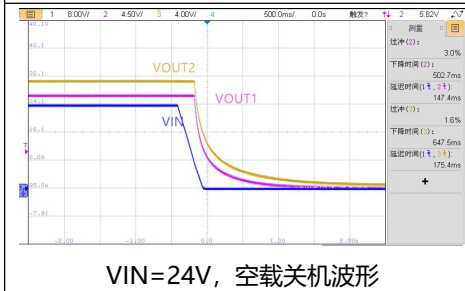
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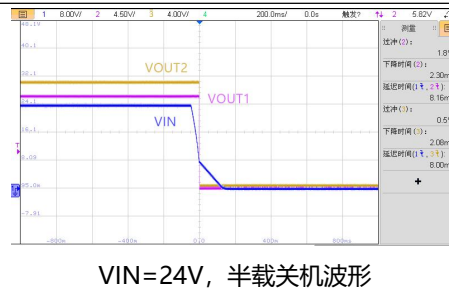
VIN=12V, 半载关机波形



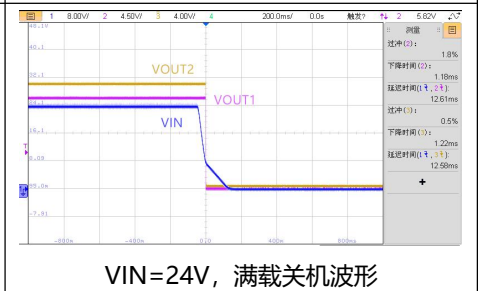
VIN=12V, 满载关机波形



VIN=24V, 空载关机波形



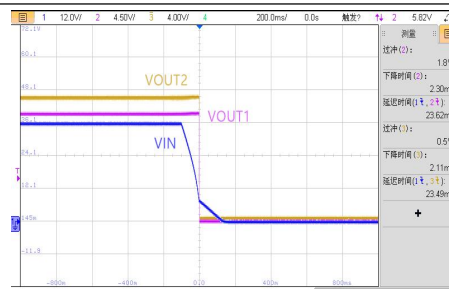
VIN=24V, 半载关机波形



VIN=24V, 满载关机波形



VIN=36V, 空载关机波形

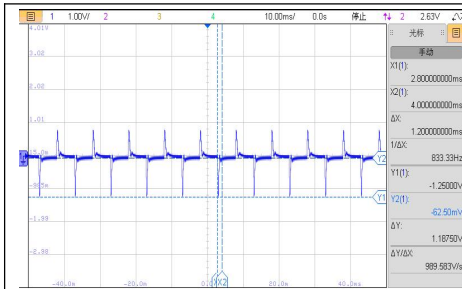


VIN=36V, 半载关机波形

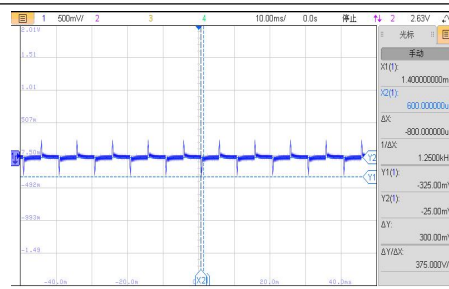


VIN=36V, 满载关机波形

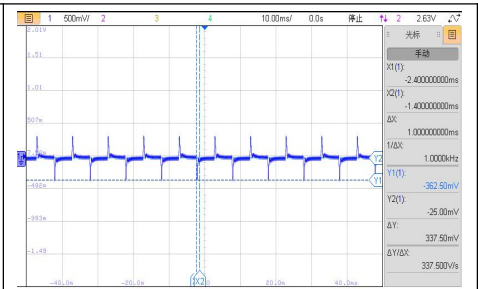
主路动态波形（主路和辅路串接成一路，输出 30V）



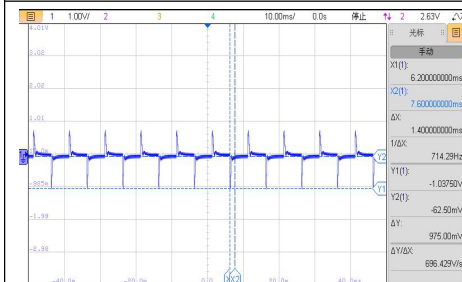
VIN=9V, 100%-10%-100%Io 动态波形



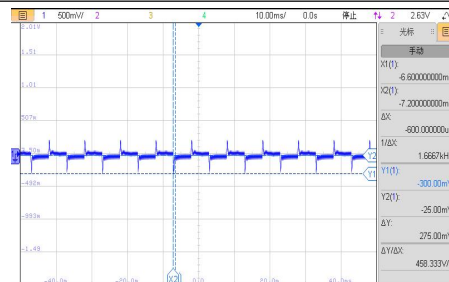
VIN=9V, 75%-50%-75%Io 动态波形



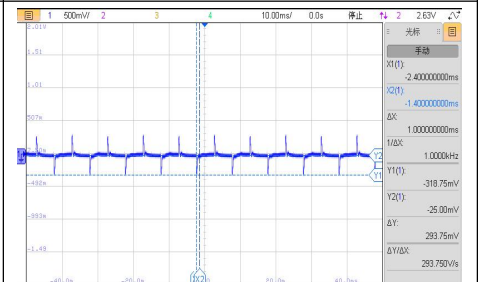
VIN=9V, 50%-25%-50%Io 动态波形



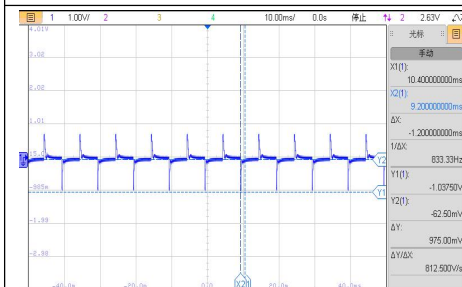
VIN=12V, 100%-10%-100%Io 动态波形



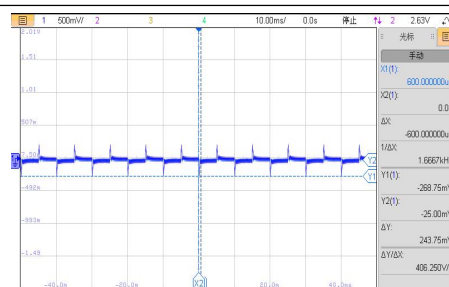
VIN=12V, 75%-50%-75%Io 动态波形



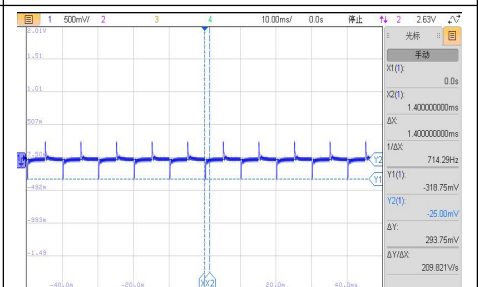
VIN=12V, 50%-25%-50%Io 动态波形



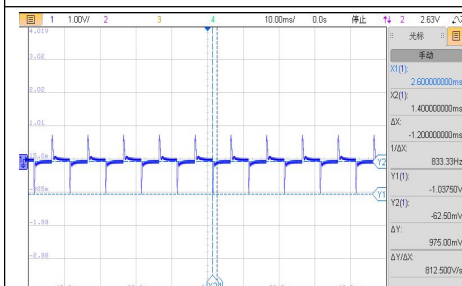
VIN=24V, 100%-10%-100%Io 动态波形



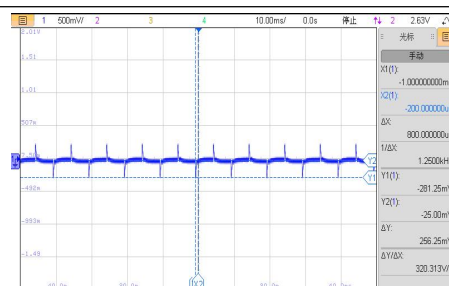
VIN=24V, 75%-50%-75%Io 动态波形



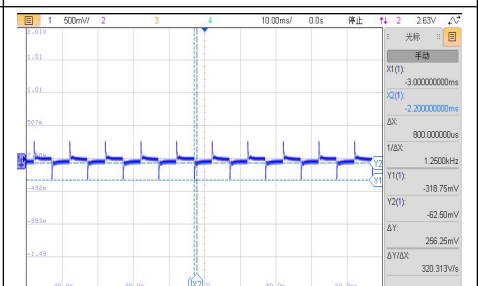
VIN=24V, 50%-25%-50%Io 动态波形



VIN=36V, 100%-10%-100%Io 动态波形

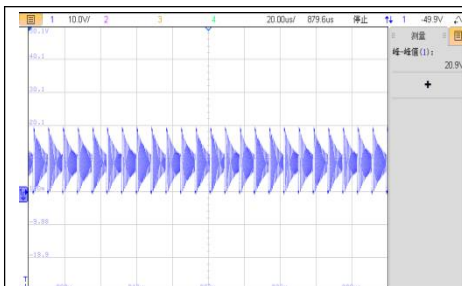


VIN=36V, 75%-50%-75%Io 动态波形

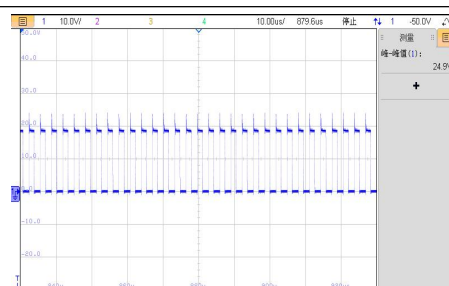


VIN=36V, 50%-25%-50%Io 动态波形

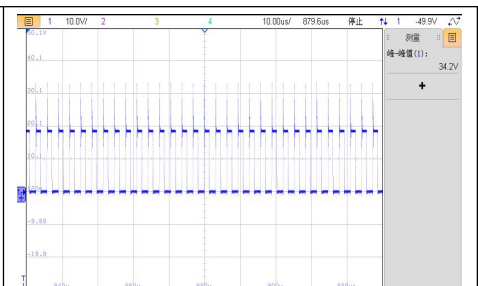
MOS 管电压应力波形（主路带等比例负载）



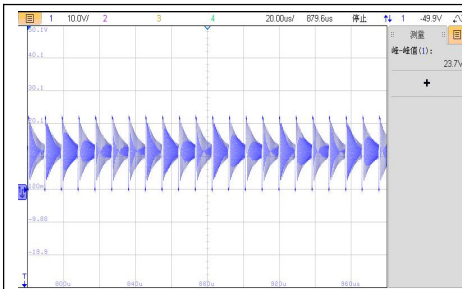
VIN=9V, 空载 VDS 波形



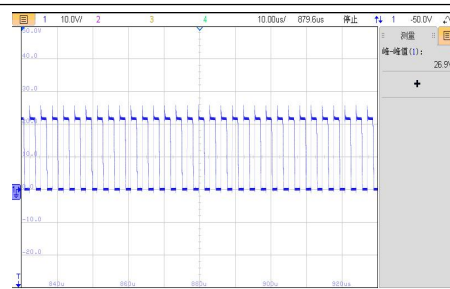
VIN=9V, 半载 VDS 波形



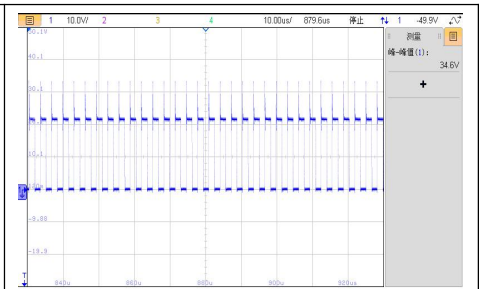
VIN=9V, 满载 VDS 波形



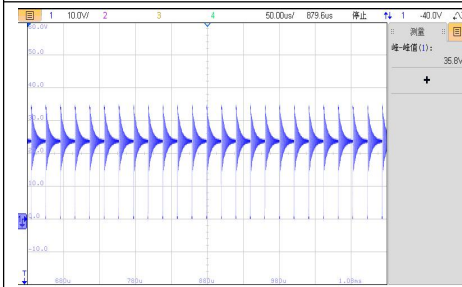
VIN=12V, 空载 VDS 波形



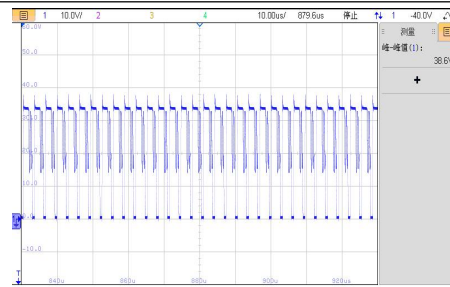
VIN=12V, 半载 VDS 波形



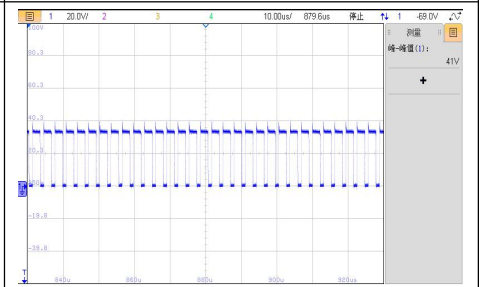
VIN=12V, 满载 VDS 波形



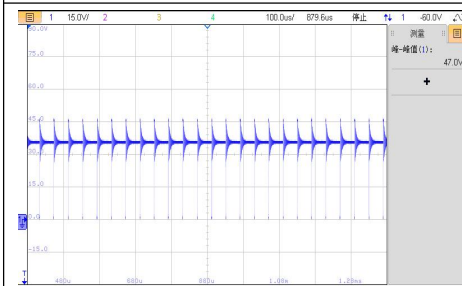
VIN=24V, 空载 VDS 波形



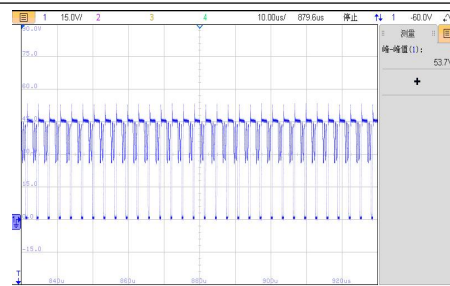
VIN=24V, 半载 VDS 波形



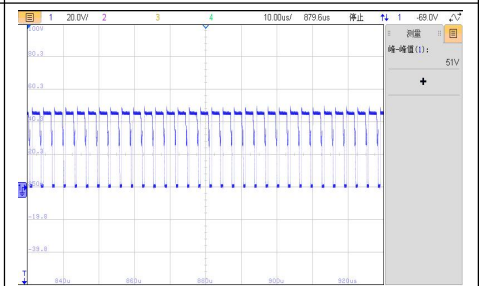
VIN=24V, 满载 VDS 波形



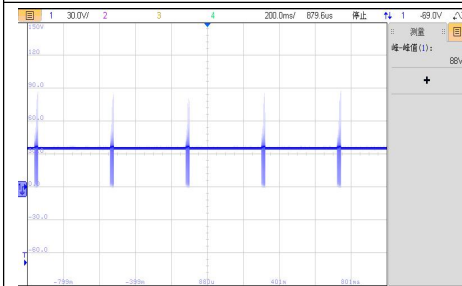
VIN=36V, 空载 VDS 波形



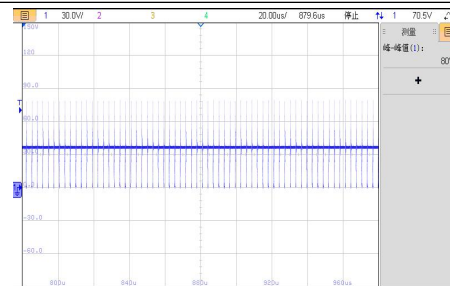
VIN=36V, 半载 VDS 波形



VIN=36V, 满载 VDS 波形

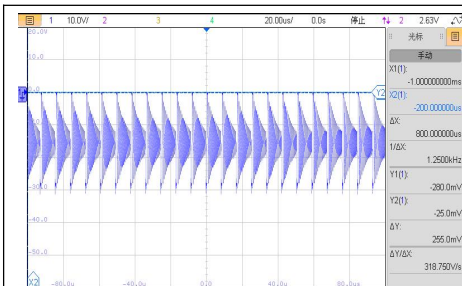


VIN=36V, 输出短路 VDS 波形

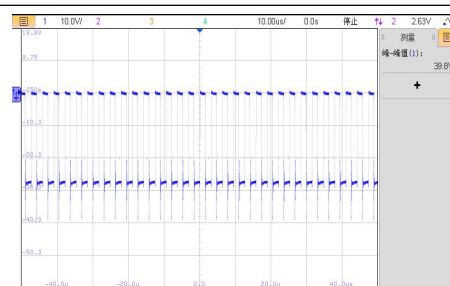


VIN=36V, 输出短路 VDS 展开波形

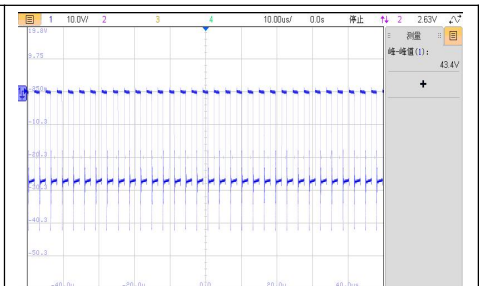
副边输出整流二极管 D5 应力波形（主路带等比例负载）



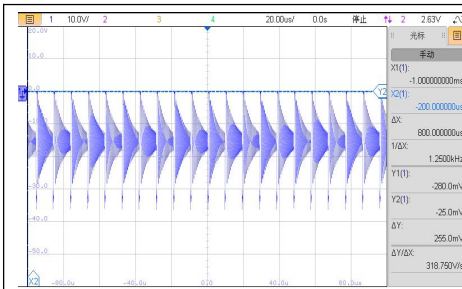
VIN=9V, 空载工作电压波形



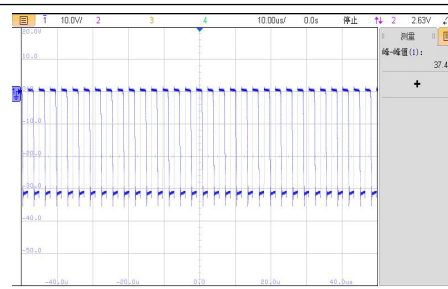
VIN=9V, 半载工作电压波形



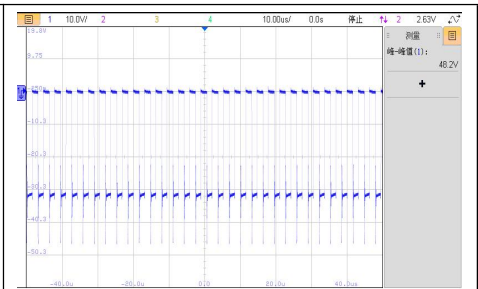
VIN=9V, 满载工作电压波形



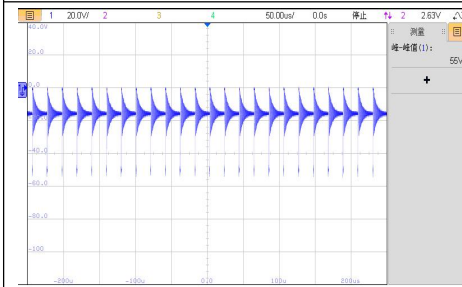
VIN=12V, 空载工作电压波形



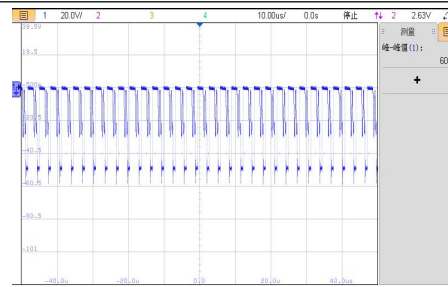
VIN=12V, 半载工作电压波形



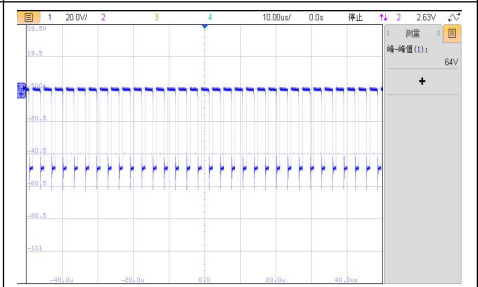
VIN=12V, 满载工作电压波形



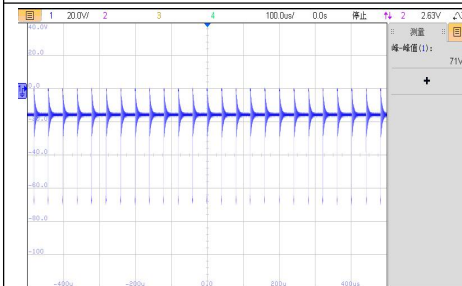
VIN=24V, 空载工作电压波形



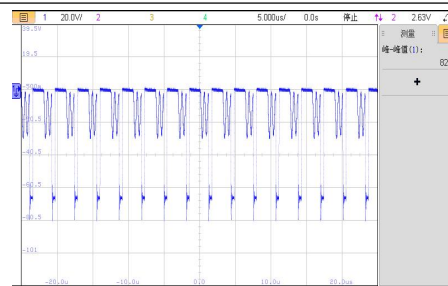
VIN=24V, 半载工作电压波形



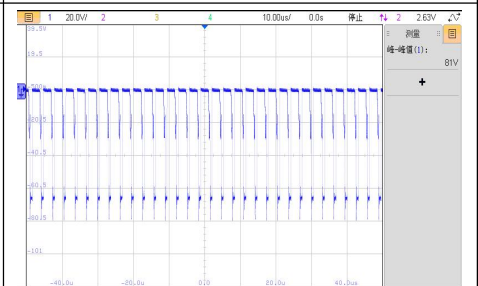
VIN=24V, 满载工作电压波形



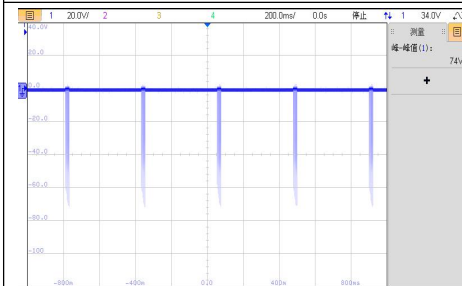
VIN=36V, 空载工作电压波形



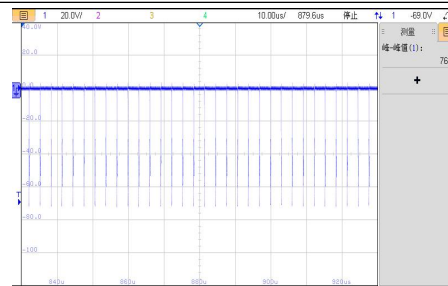
VIN=36V, 半载工作电压波形



VIN=36V, 满载工作电压波形

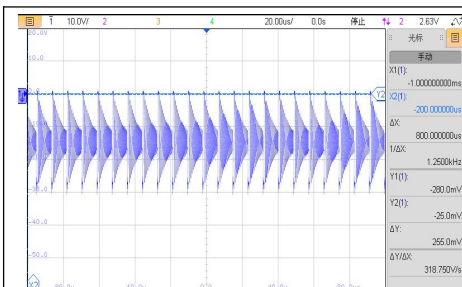


VIN=36V, 满载短路电压波形



VIN=36V, 满载短路电压展开波形

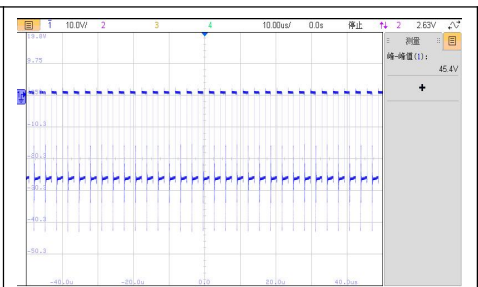
副边输出整流二极管 D5 应力波形（主路带等比例负载）



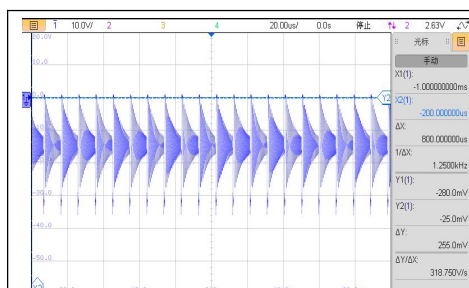
VIN=9V, 空载工作电压波形



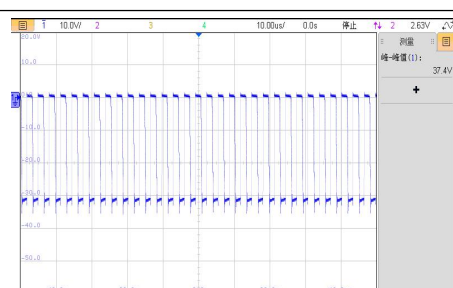
VIN=9V, 半载工作电压波形



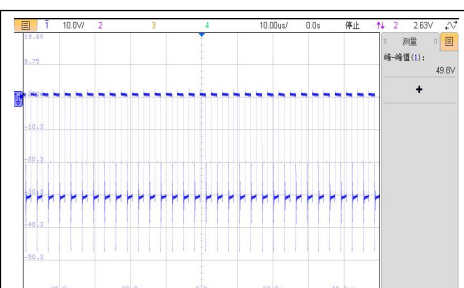
VIN=9V, 满载工作电压波形



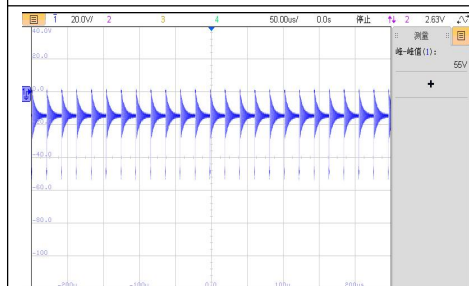
VIN=12V, 空载工作电压波形



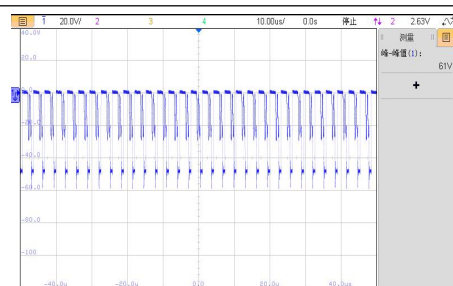
VIN=12V, 半载工作电压波形



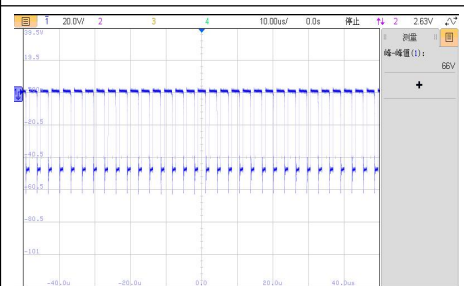
VIN=12V, 满载工作电压波形



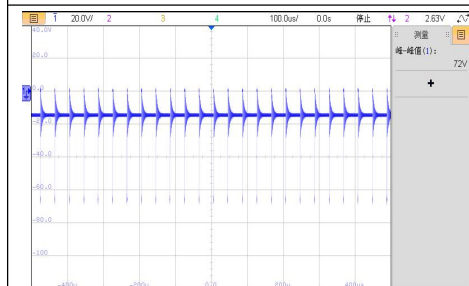
VIN=24V, 空载工作电压波形



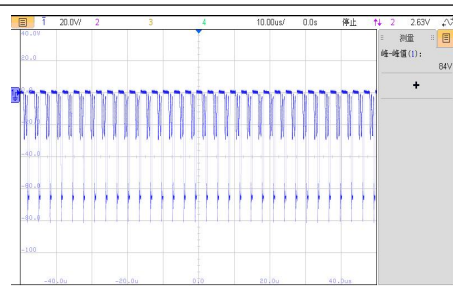
VIN=24V, D4 半载工作电压波形



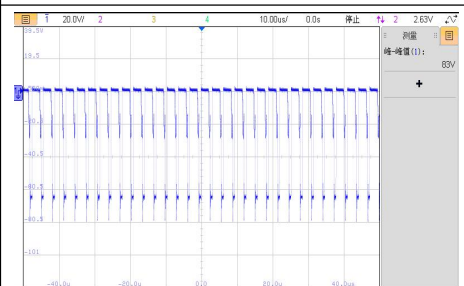
VIN=24V, 满载工作电压波形



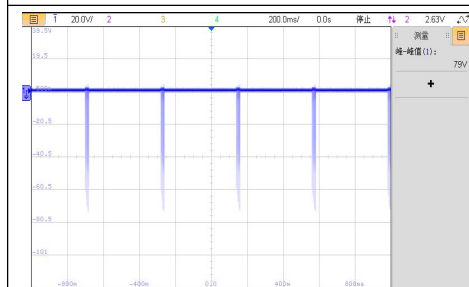
VIN=36V, 空载工作电压波形



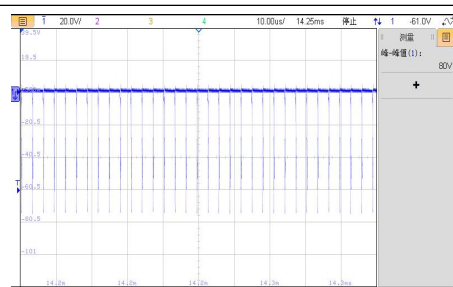
VIN=36V, 半载工作电压波形



VIN=36V, 满载工作电压波形



VIN=36V, 满载短路电压波形



VIN=36V, 满载短路电压展开波形

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