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 VPE25DDF03A、输出整流二极管以及必要的阻容元件，实现 9-18V 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 3W 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。

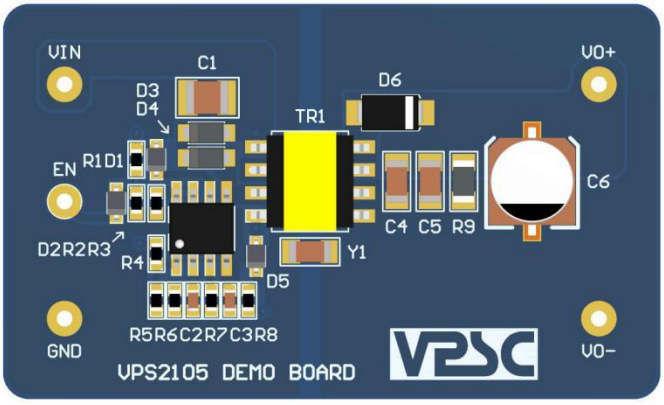
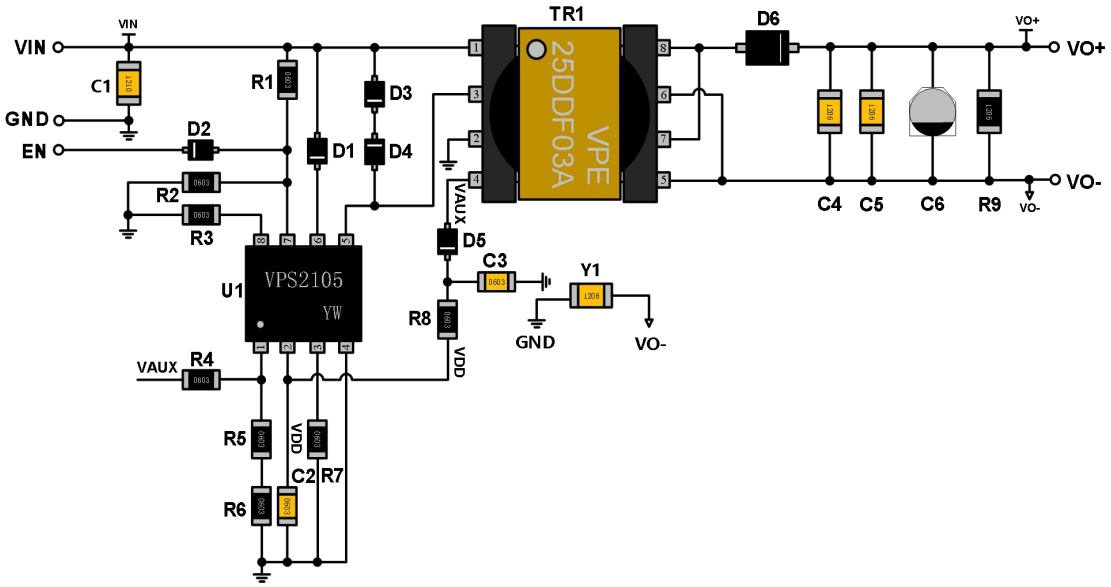


图 1: VPS2105 Demo 板(尺寸:50mm*30mm)

关键词：输入：9V-18V，输出 12V/3W，隔离电压：1500VDC，反馈方式：原边反馈-PSR

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	EN	使能引脚
3	GND	电源接地端
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	2.2uF/50V-X7R	1210	CL32B225KBJNNNE	SAMSUNG
C2	1uF/16V-X7R	0603	CC0603KRX7R7BB105	YAGEO
C3	1uF/16V-X7R	0603	CC0603KRX7R7BB105	YAGEO
C4	10uF/16V-X7R	0603	CL31B106KOHVPNE	SAMSUNG
C5	10uF/16V-X7R	0603	CL31B106KOHVPNE	SAMSUNG
C6	-	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R2	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R3	33KΩ±1%	0603	RC0603FR-0733KL	YAGEO
R4	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R5	5.1KΩ±1%	0603	RC0603FR-075K1L	YAGEO
R6	1KΩ±1%	0603	RC0603FR-071KL	YAGEO
R7	27KΩ±1%	0603	RC0603FR-0727KL	YAGEO
R8	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R9	2KΩ±1%	1206	RC1206FR-072KL	YAGEO
D1	40V/0.5A	SOD323	B0540WS	YANGJIE
D2	85V/200mA	SOD323	BAS16HT1G	ON
D3	30V/8.3A TVS	SOD123	SMF30CA	MDD
D4	120V/1A	SOD123	S120	YANGJIE
D5	85V/200mA	SOD323	BAS16HT1G	ON
D6	60V/1A	SOD123	RB160M-60TR	ROHM
U1	VPS2105	SOIC-8E	VPS2105	VPSC
TR1	Lp=6.5uH,Np1:Np2:Ns1:Ns2=9:6:14:14	ER7.5	VPE25DDF03A	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=12V	7	---	295	mA
转换效率	VIN=12V，IO=0.25A	---	84	---	%
纹波&噪声	VIN=12V；IO=0.25A	---	100	150	mV
线性调节率	VIN=9V-18V，IO=0.25A	---	0.02	---	%
负载调整率	VIN=12V；IO=0.25A	---	0.02	---	%
输入欠压保护	锁定电压	---	7.2	---	V
	恢复电压	---	8.1	---	V
短路保护	VIN=9V-18V	可长期保护，自恢复			
工作温度	大于 70℃需降额使用	-40	---	85	℃
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

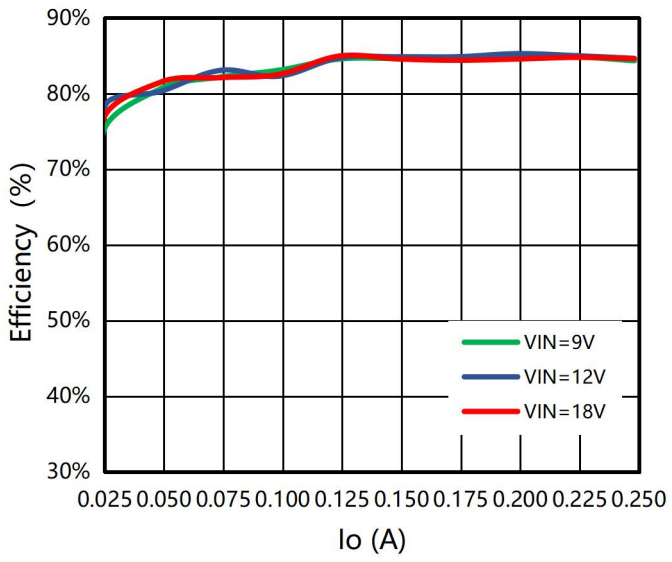


图 2: 效率 VS 输出电流

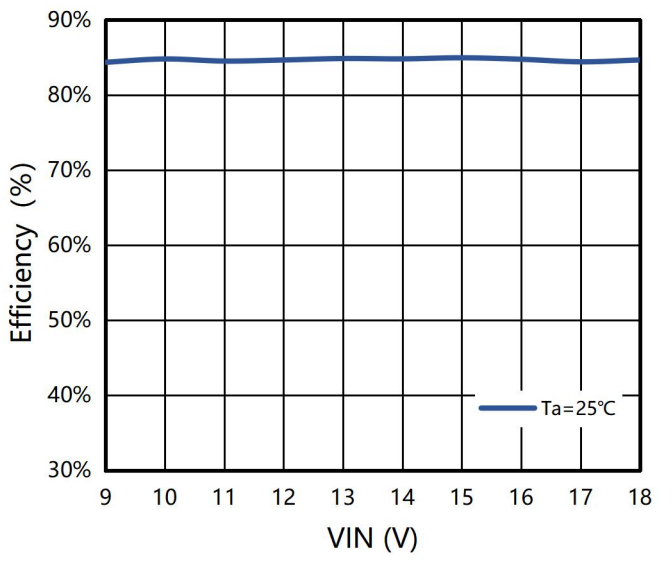


图 3: 效率 VS 输入电压

相关波形

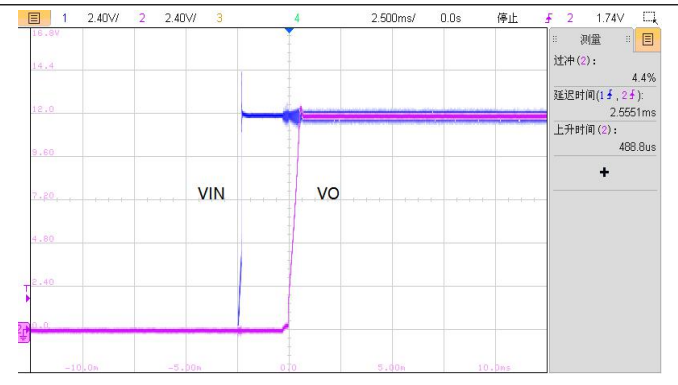


图 4: VIN=12V，满载启机波形

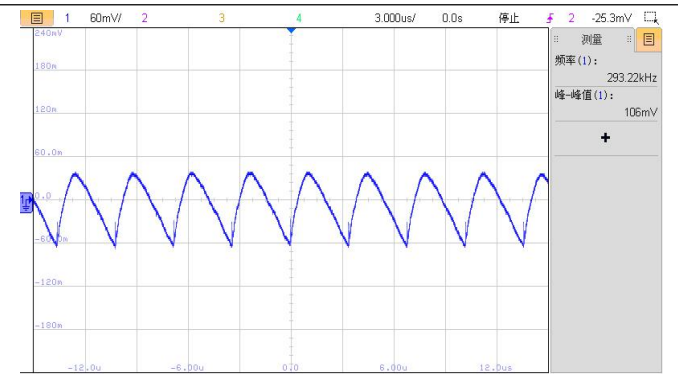
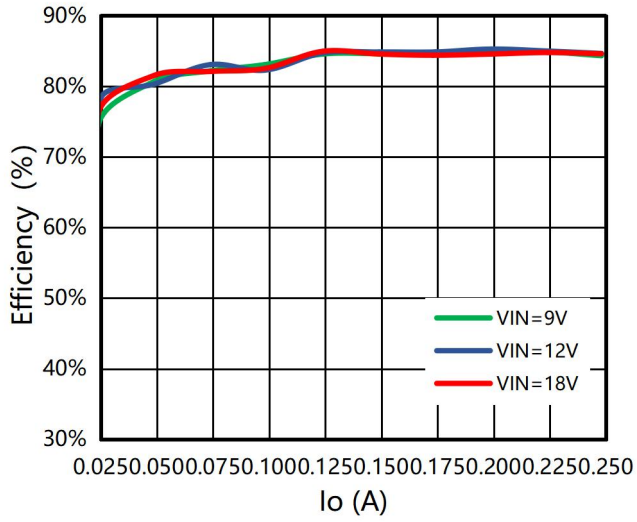


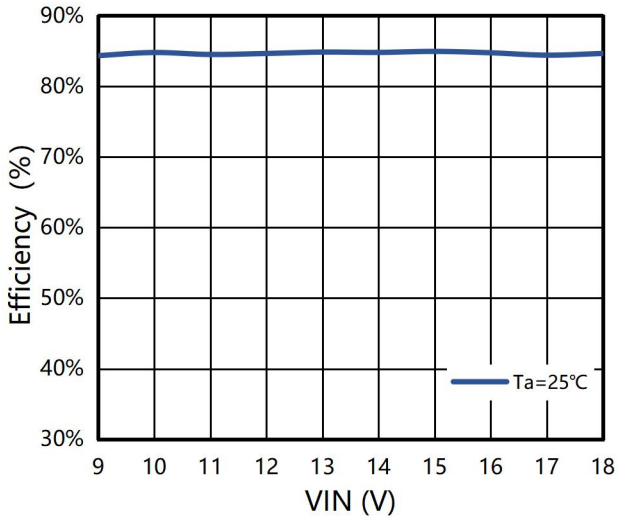
图 5: VIN=12V，满载输出电压纹波波形

详细测试数据

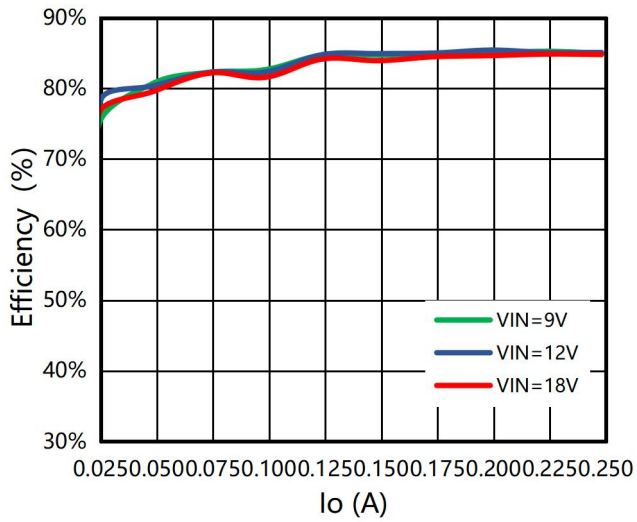
高低温测试曲线



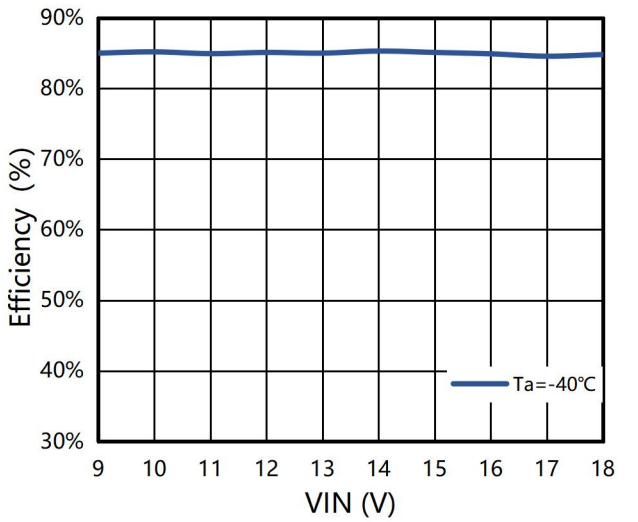
效率 VS 输出电流(25℃)



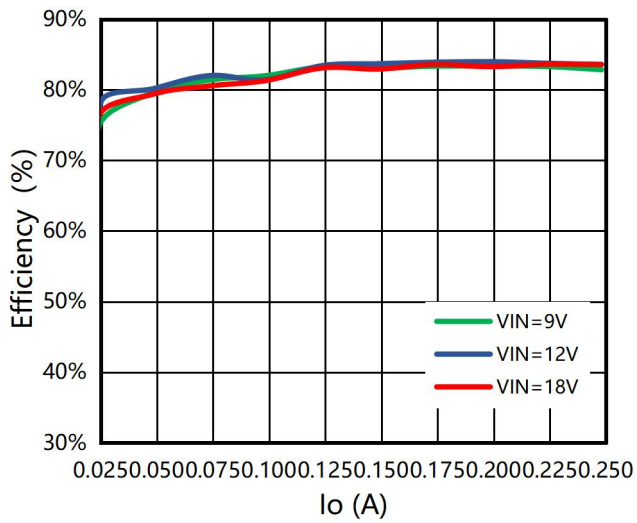
效率 VS 输入电压（25℃）



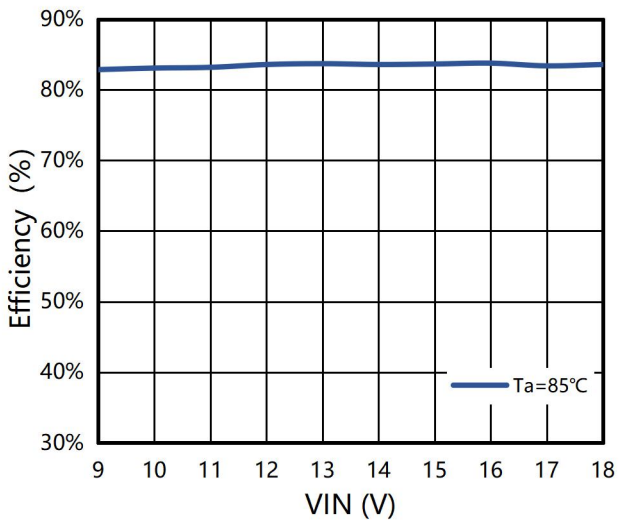
效率 VS 输出电流(-40℃)



效率 VS 输入电压(-40℃)



效率 VS 输出电流(85℃)



效率 VS 输入电压(85℃)

VIN=12V，Ta=25℃，输入、输出及效率数据：

VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
12.01	0.002	12.02	0	0.00%
12.01	0.032	12.01	0.025	78.13%
12.01	0.061	12.01	0.049	80.33%
12.01	0.089	12	0.074	83.08%
12	0.119	11.99	0.098	82.28%
12	0.146	11.97	0.124	84.72%
12	0.175	11.96	0.149	84.86%
12	0.204	11.94	0.174	84.87%
12	0.232	11.93	0.199	85.28%
12	0.262	11.93	0.224	85.00%
12	0.291	11.92	0.248	84.66%

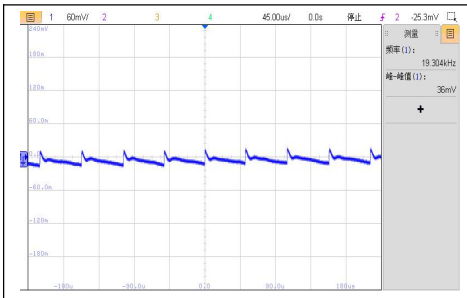
VIN=12V，Ta=-40℃，输入、输出及效率数据：

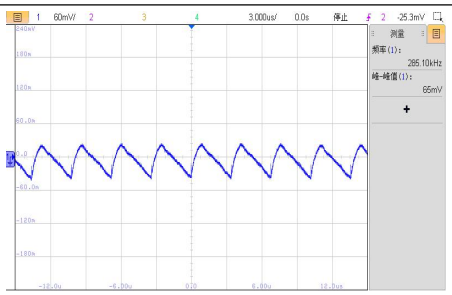
VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
12	0.002	12.01	0	0.00%
12	0.032	12.01	0.025	78.19%
12	0.061	12.01	0.049	80.39%
12	0.090	12.01	0.074	82.29%
12	0.119	11.99	0.098	82.28%
12	0.146	11.98	0.124	84.79%
12	0.175	11.97	0.149	84.93%
12	0.204	11.96	0.174	85.01%
12	0.232	11.95	0.199	85.42%
12	0.262	11.94	0.224	85.07%
12	0.29	11.94	0.248	85.09%

VIN=12V，Ta=85℃，输入、输出及效率数据：

VIN(V)	IIN(A)	VO(V)	IO(A)	η(%)
12.01	0.002	12.02	0	0.00%
12.01	0.032	12.00	0.025	78.06%
12.01	0.061	11.99	0.049	80.19%
12.01	0.090	11.98	0.074	82.02%
12	0.120	11.96	0.098	81.39%
12	0.148	11.95	0.124	83.43%
12	0.177	11.93	0.149	83.69%
12	0.206	11.92	0.174	83.90%
12	0.235	11.90	0.199	83.98%
12	0.265	11.89	0.224	83.75%
12	0.294	11.89	0.248	83.58%

输出电压纹波波形


VIN=9V，空载输出电压纹波波形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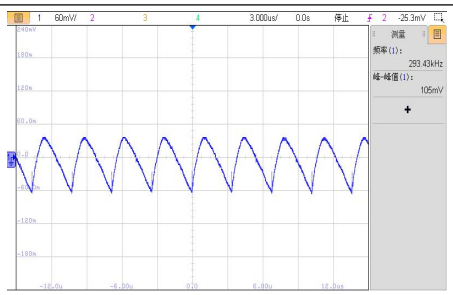
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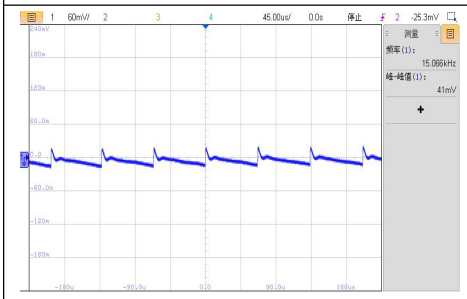
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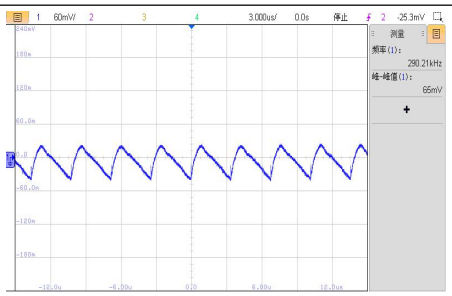
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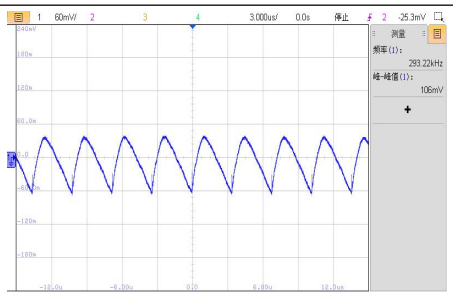
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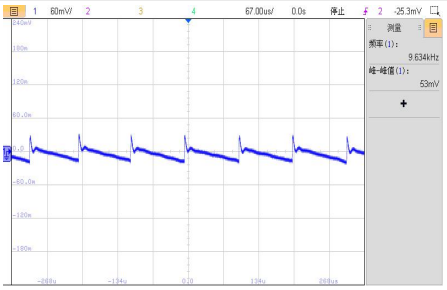
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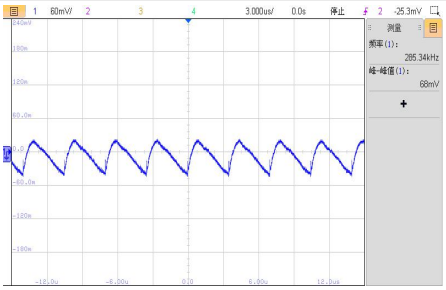
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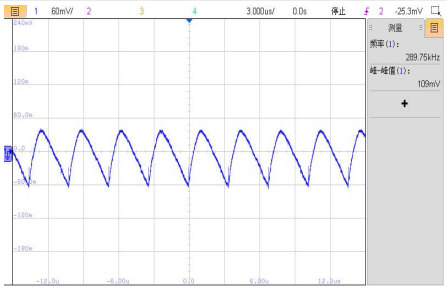
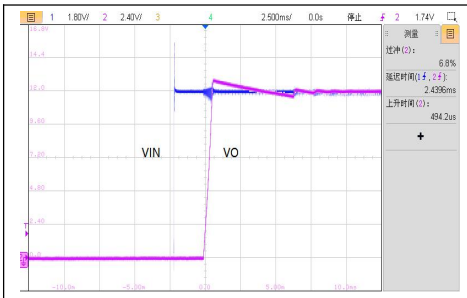
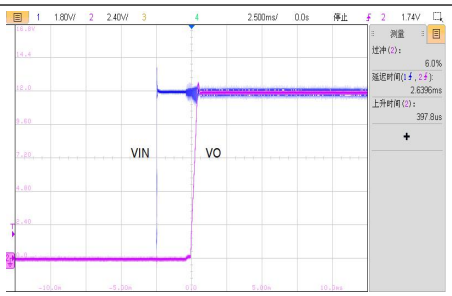

VIN=18V，满载输出电压纹波波形

开关机波形



VIN=9V，空载启机波形



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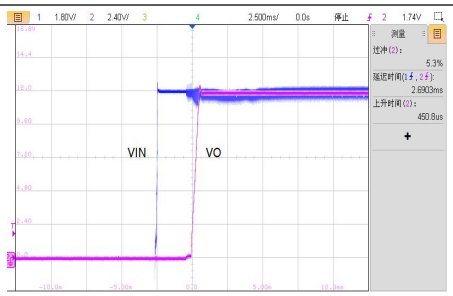

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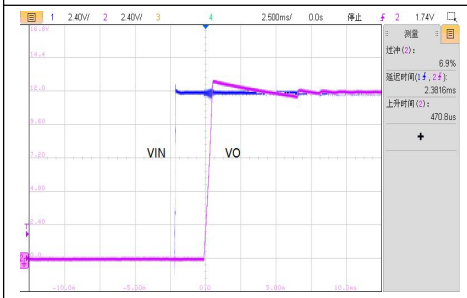

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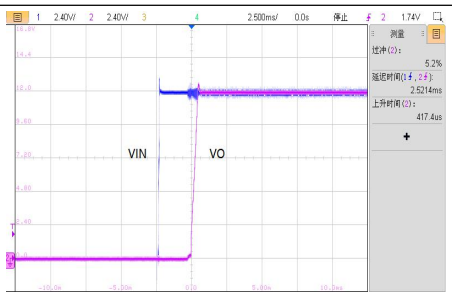

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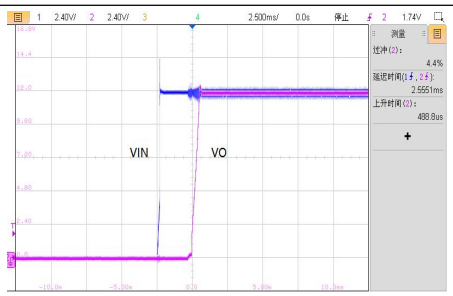

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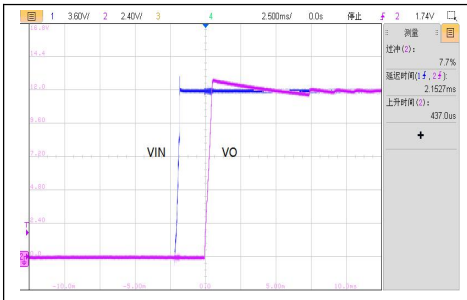

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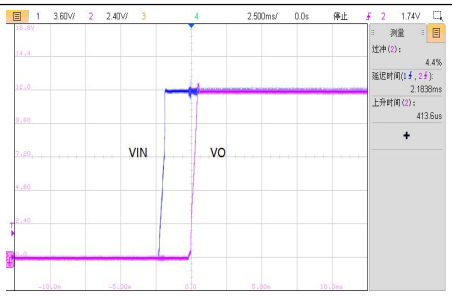

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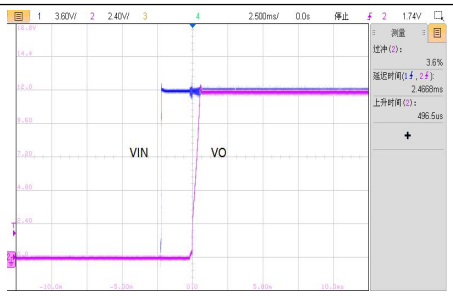

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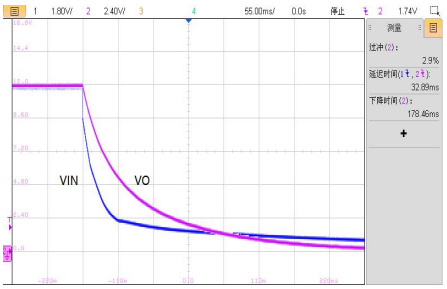

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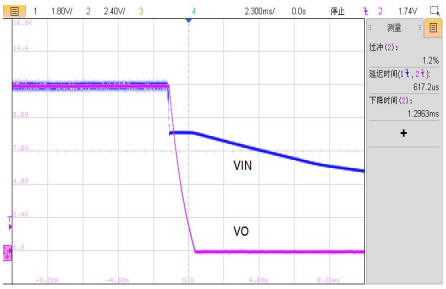

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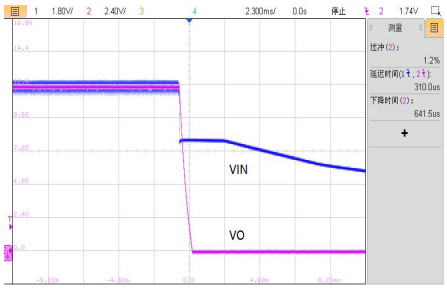

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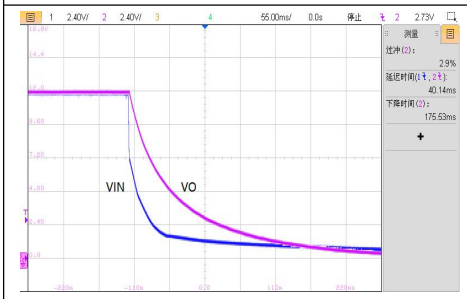

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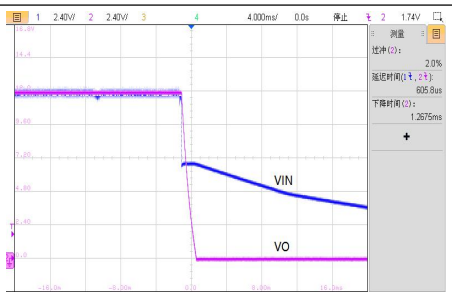

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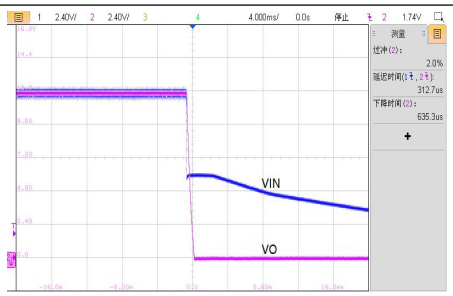

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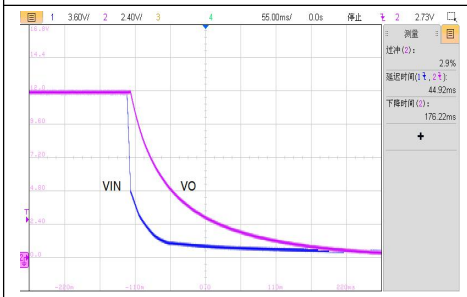

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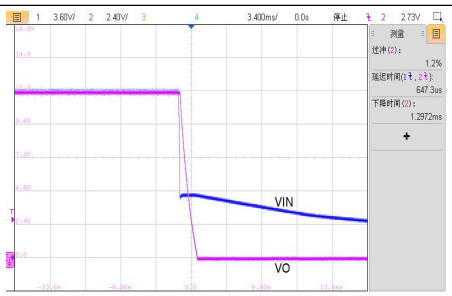
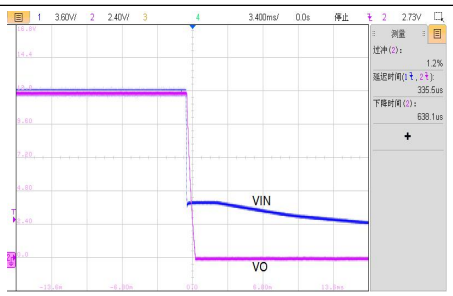
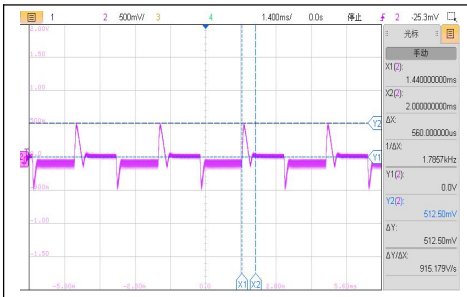


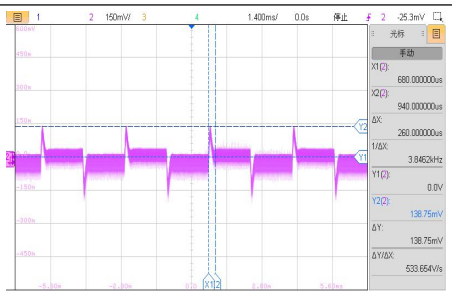
VIN=18V，半载关机波形

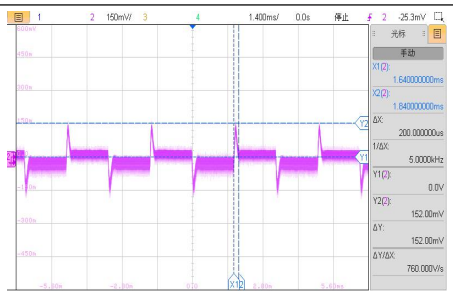


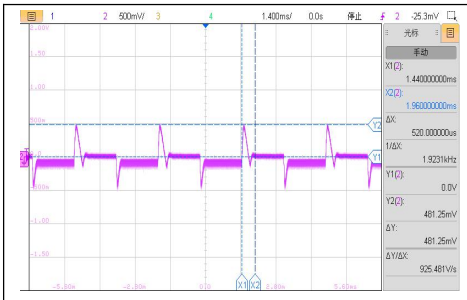
VIN=18V，满载关机波形

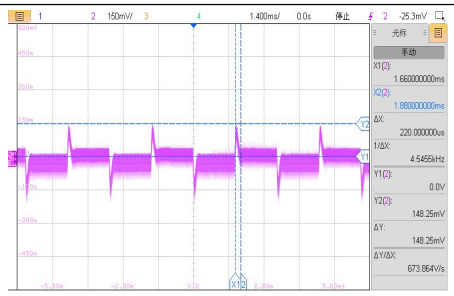
动态波形


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


VIN=12V，100%-10%-100%Io 动态波形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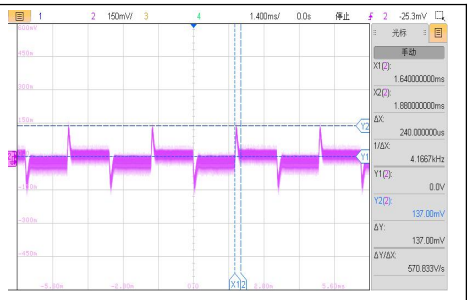
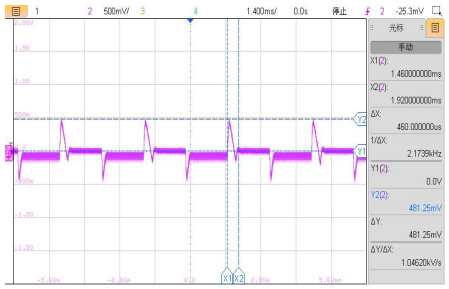
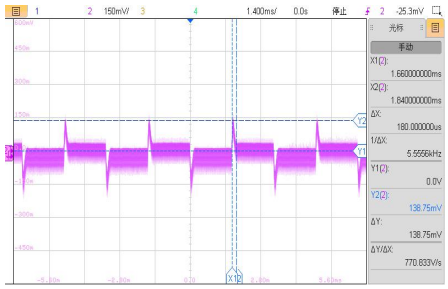

VIN=12V，50%-25%-50%Io 动态波形


VIN=18V，100%-10%-100%Io 动态波形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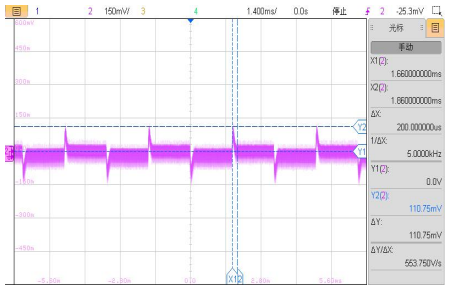
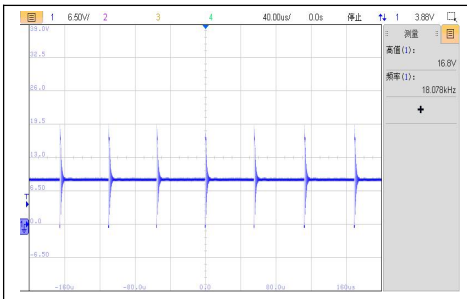
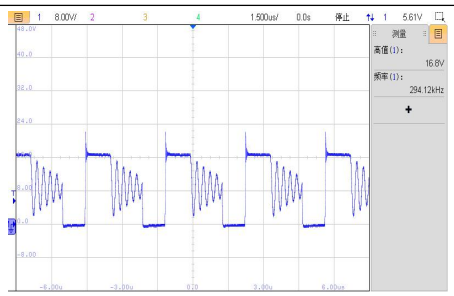

VIN=18V，50%-25%-50%Io 动态波形

MOS 管电压应力波形


VIN=9V，空载 VDS 波形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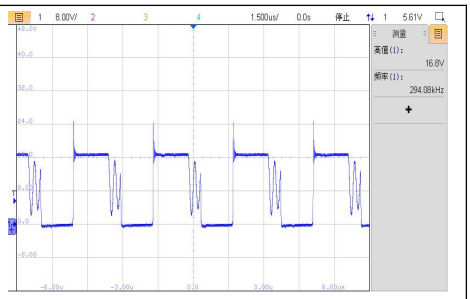
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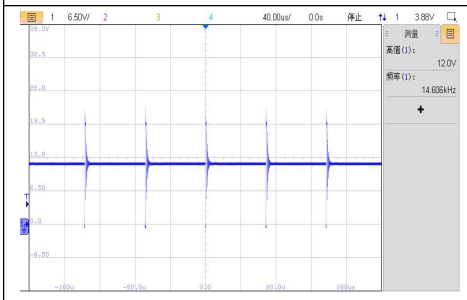
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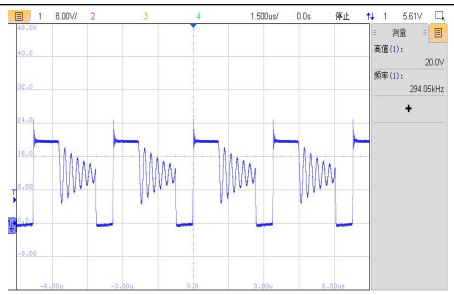
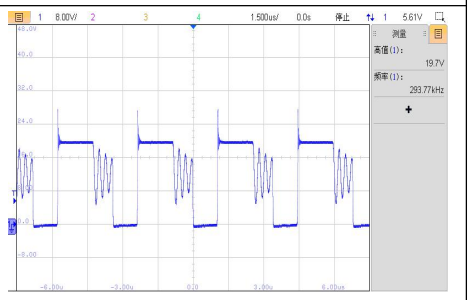

VIN=12V，半载 VDS 波形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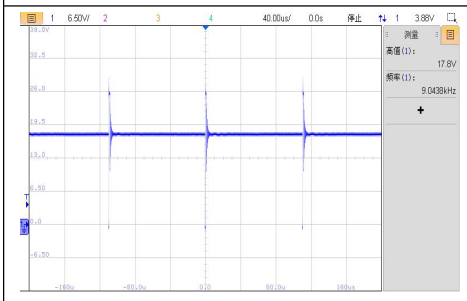
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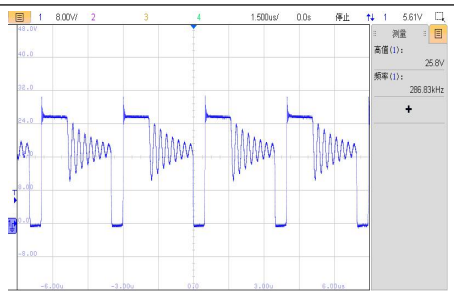
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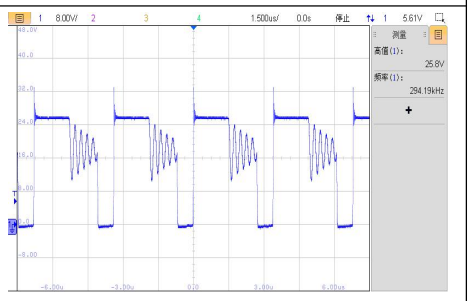
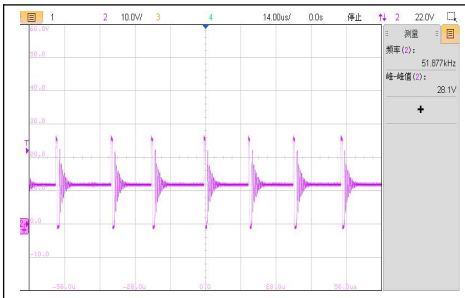
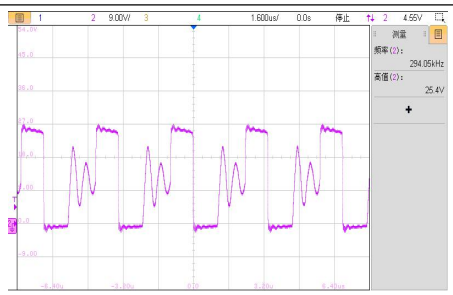

VIN=18V，满载 VDS 波形

副边输出整流二极管 D6 应力波形


VIN=9V，空载 VDS 波形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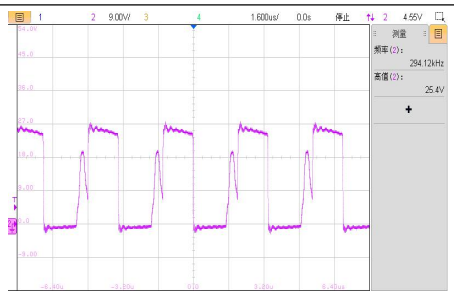
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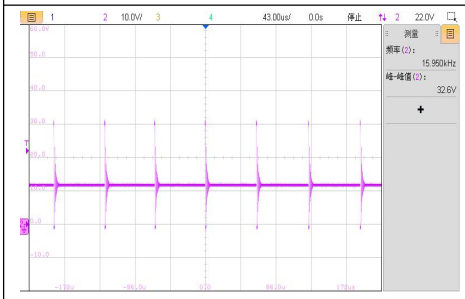
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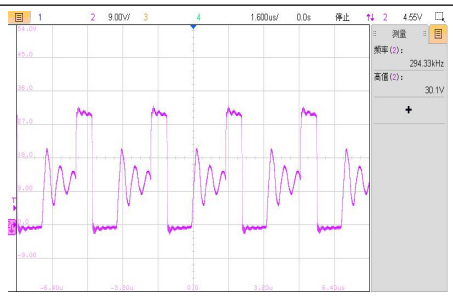
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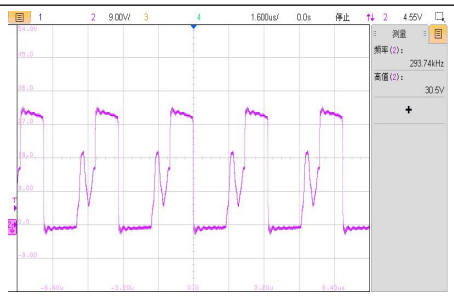
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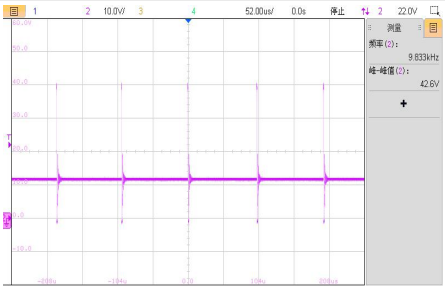
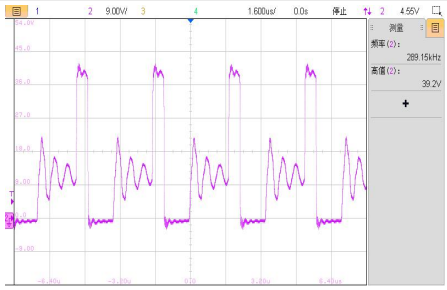

VIN=18V，空载 VDS 波形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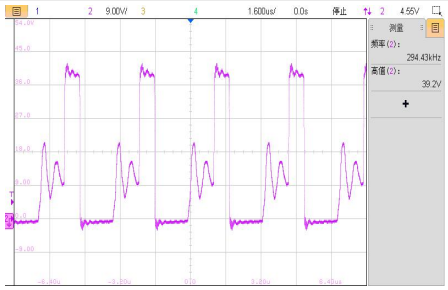
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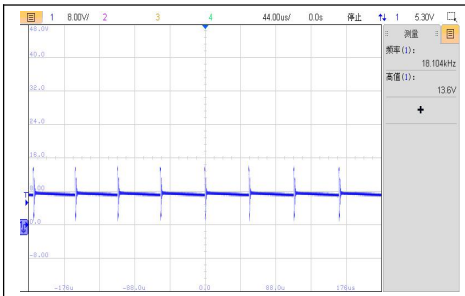
D4 电压应力波形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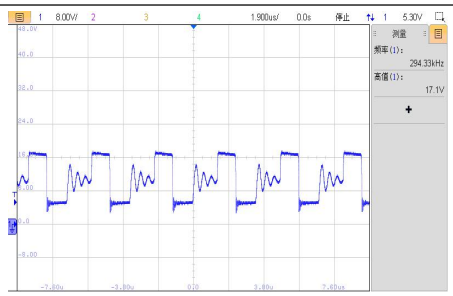
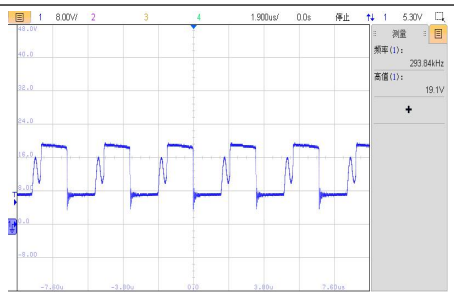

VIN=9V，半载 VDS 波形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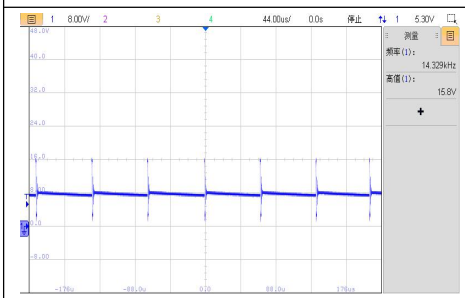
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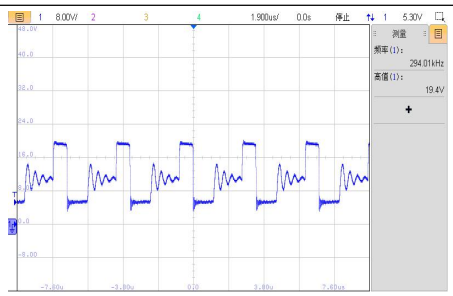
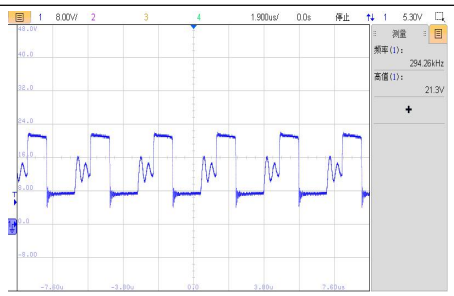
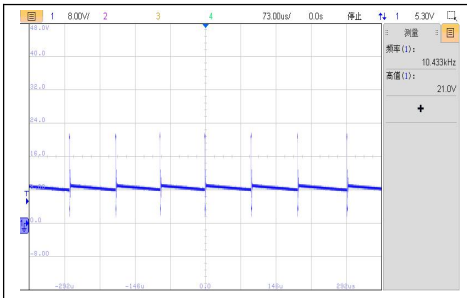
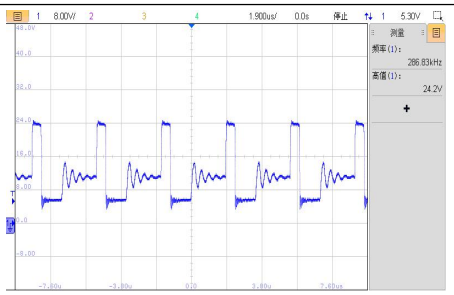
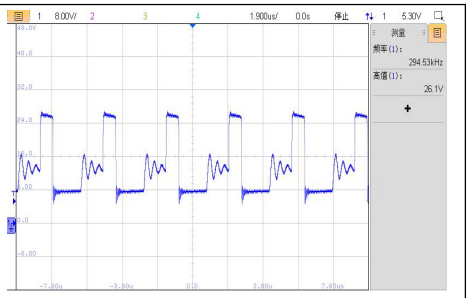
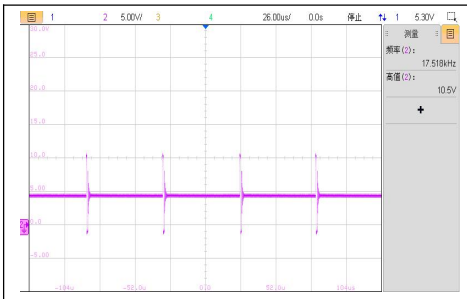
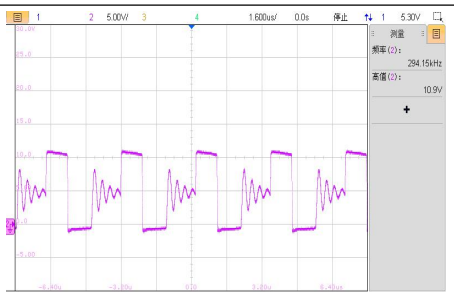
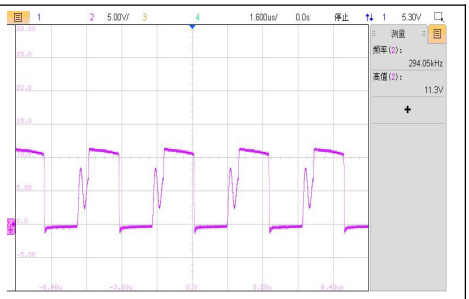
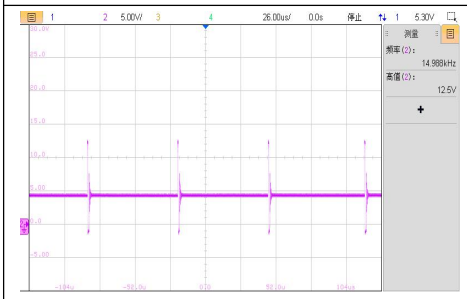
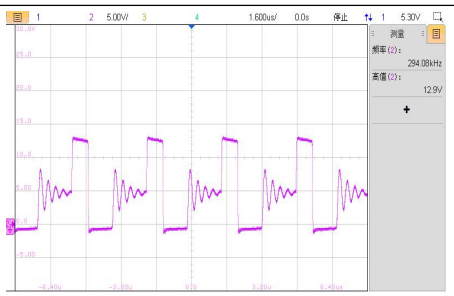
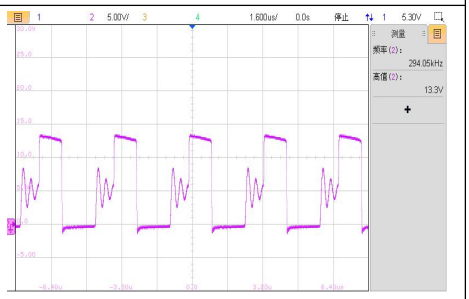
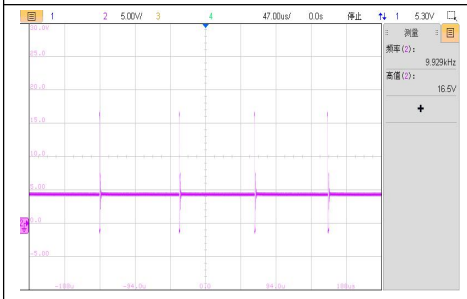
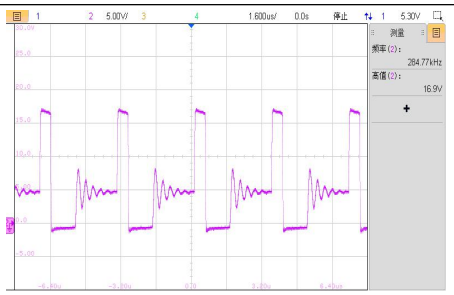
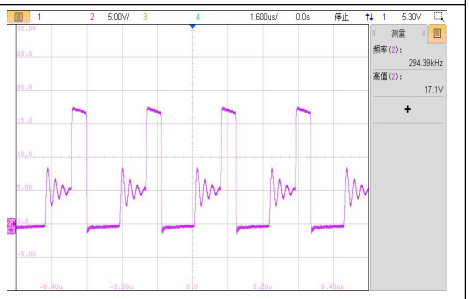

VIN=12V，半载 VDS 波形


VIN=12V，满载 VDS 波形

		
VIN=18V，空载 VDS 波形	VIN=18V，半载 VDS 波形	VIN=18V，满载 VDS 波形

D5 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=18V，空载 VDS 波形	VIN=18V，半载 VDS 波形	VIN=18V，满载 VDS 波形

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