

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 VPS2104，结合隔离功率变压器 VPE24FBB10A、输出整流二极管以及必要的阻容元件，实现 18V-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 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：18V-36V，输出 5V/10W，隔离电压：1500VDC，反馈方式：副边反馈-SSR

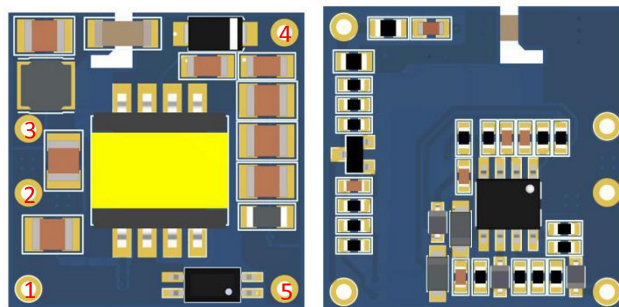
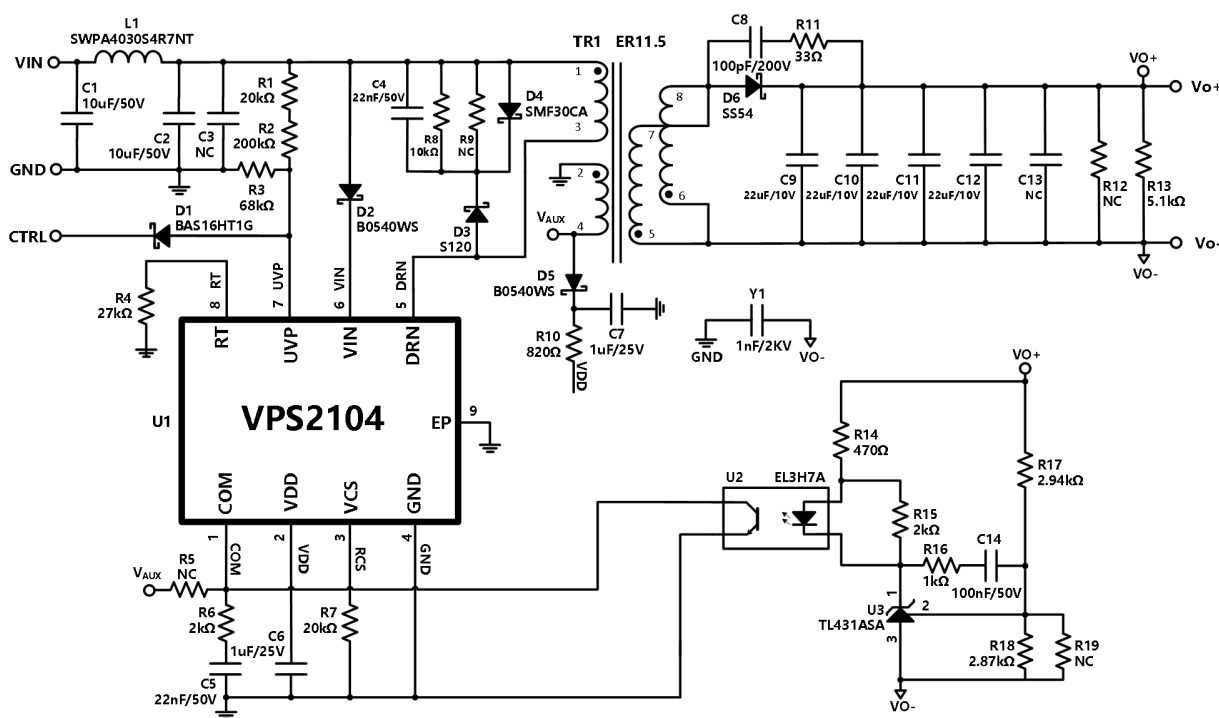


图 1: VPS2104 Demo 板

原理图



引脚功能说明

编号	功能	功能描述
1	CTRL	电源控制端
2	GND	电源接地端
3	VIN	电源输入正
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	1206	CL31B106KBHNNNE	SAMSUNG
C2	10uF/50V-X7R	1206	CL31B106KBHNNNE	SAMSUNG
C3	NC	-	-	-

C4	22nF/50V-X7R	0603	CC0603KRX7R9BB223	YAGEO
C5	22nF/50V-X7R	0603	CC0603KRX7R9BB223	YAGEO
C6	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C7	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C8	100pF/200V-NP0	0805	CC0805JRNPOABN101	YAGEO
C9	22uF/10V-X7R	1206	CL31B226KPHNNNE	SAMSUNG
C10	22uF/10V-X7R	1206	CL31B226KPHNNNE	SAMSUNG
C11	22uF/10V-X7R	1206	CL31B226KPHNNNE	SAMSUNG
C12	22uF/10V-X7R	1206	CL31B226KPHNNNE	SAMSUNG
C13	NC	-	-	-
C14	100nF/50V-X7R	0603	AC0603KRX7R9BB104	YAGEO
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R2	200K Ω ±1%	0603	RC0603FR-07200KL	YAGEO
R3	68K Ω ±1%	0603	RC0603FR-0768KL	YAGEO
R4	27K Ω ±1%	0603	RC0603FR-0727KL	YAGEO
R5	NC	-	-	-
R6	2K Ω ±1%	0603	RC0603FR-072KL	YAGEO
R7	20K Ω ±1%	0603	RC0603FR-0720KL	YAGEO
R8	10K Ω ±1%	0603	RC0603FR-0710KL	YAGEO
R9	NC	-	-	-
R10	820 Ω ±1%	0603	RC0603FR-07820RL	YAGEO
R11	33 Ω ±1%	0805	RC0805FR-0733RL	YAGEO
R12	NC	-	-	-
R13	5.1K Ω ±1%	0805	RC0603FR-075K1L	YAGEO
R14	470 Ω ±1%	0603	RC0603FR-07470RL	YAGEO
R15	2K Ω ±1%	0603	RC0603FR-072KL	YAGEO
R16	1K Ω ±1%	0603	RC0603FR-071KL	YAGEO
R17	2.94K Ω ±1%	0603	RC0603FR-072K94L	YAGEO
R18	2.87K Ω ±1%	0603	RC0603FR-072K87L	YAGEO
R19	NC	-	-	-
D1	85V/200mA	SOD-323	BAS16HT1G	ON
D2	40V/0.5A	SOD-323	B0540WS	YANGJIE
D3	200V/1A	SOD-123	S120	YANGJIE
D4	30V/8.3A	SOD-123	SMF30CA	MDD
D5	40V/0.5A	SOD-323	B0540WS	YANGJIE
D6	40V/5A	SMA	SS54	MDD
U1	4-100VIN/120V/0.1W小功率反激电源控制器	ESOP-8	VPS2104	VPSC
U2	CTR=80~160,Viso=3750VAC	SSOP-4	EL3H7A	EVERLIGHT
U3	Vref=2.495V	SOT23-3	TL431ASA	DIODES
L1	4.7uH±20%, I=2A, DCR=78m Ω max	CD43	SWPA4030S4R7MT	SUNLORD
TR1	Np:Ns:Na=10:6:6 Lp=11uH	ER11.5	VPE24FBB10A	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	2.06	---	506	mA
转换效率	VIN=24V, IO=2A	---	82	---	%
纹波&噪声	VIN=24V; IO=2A	---	90	100	mV
线性调节率	VIN=18V-36V, IO=2A	---	0	---	%
负载调整率	VIN=24V; IO=2A	---	0	---	%
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			
容性负载	VIN=18V, IO=2A	---	6600	---	uF
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

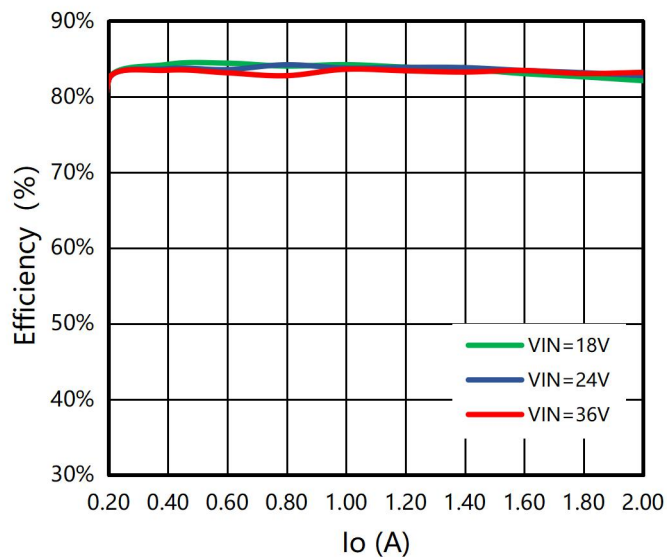


图 2: 效率 VS 输出电流

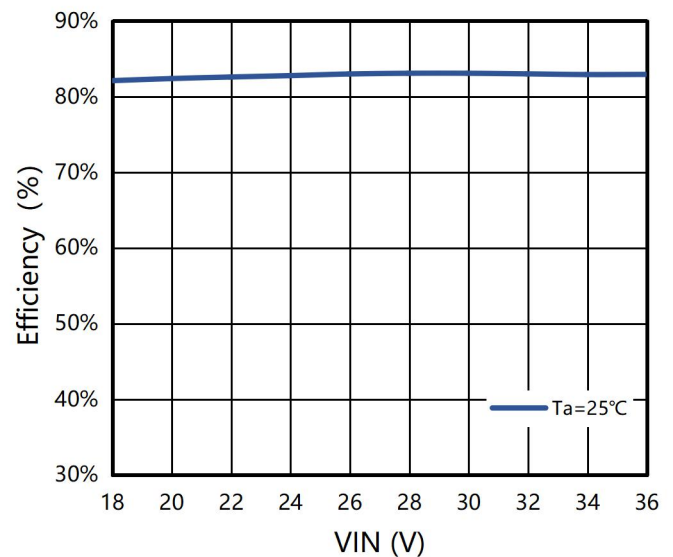


图 3: 效率 VS 输入电压(输出满载)

相关波形

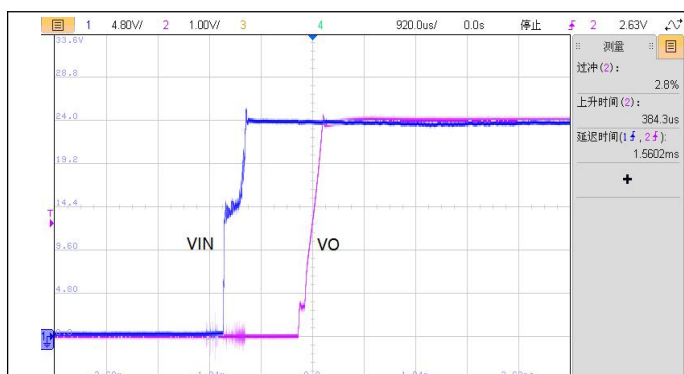


图 4: VIN=24V, 满载启机波形

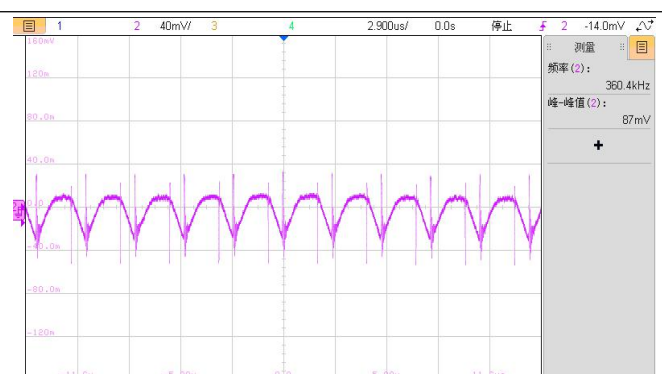
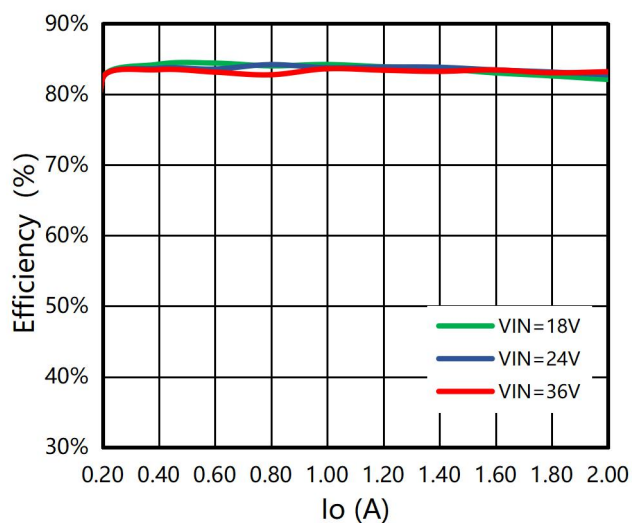


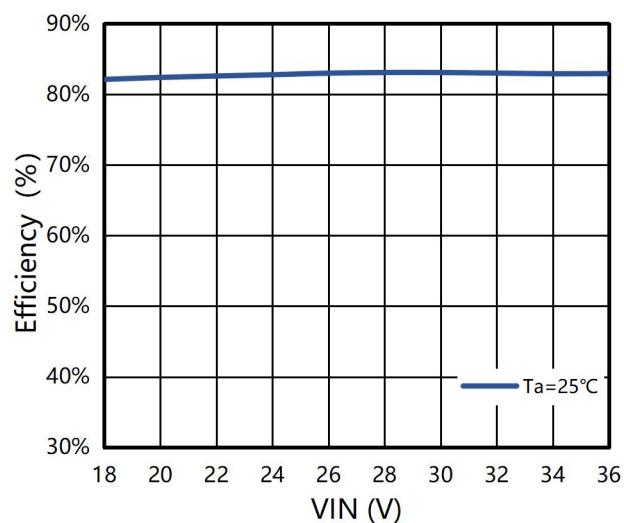
图 5: VIN=24V, 满载输出电压纹波波形

详细测试数据

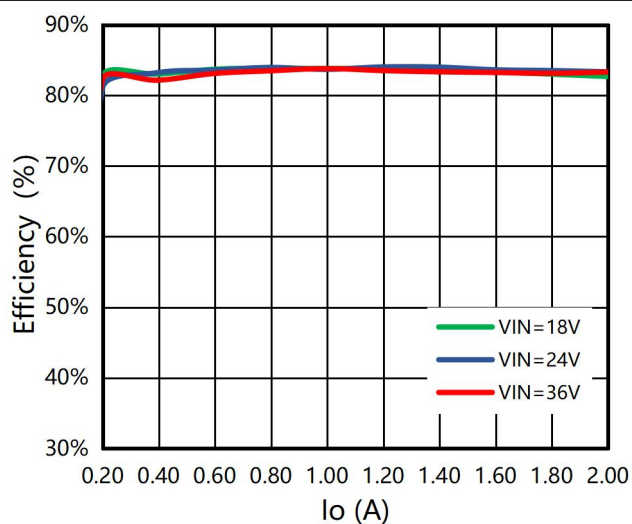
高低温测试曲线



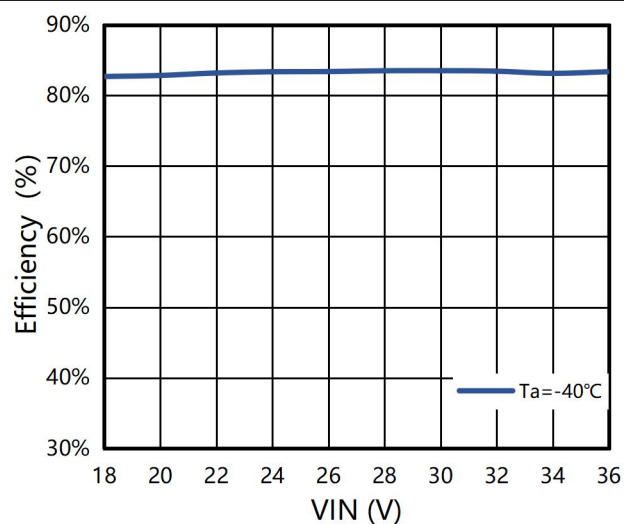
效率 VS 输出电流(25°C)



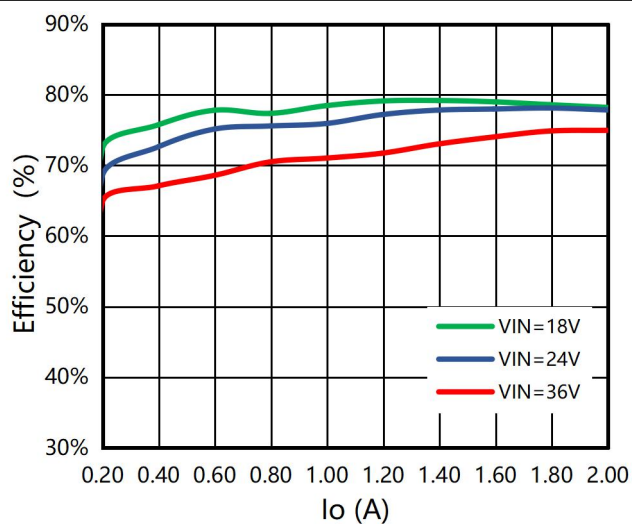
效率 VS 输入电压(输出满载@25°C)



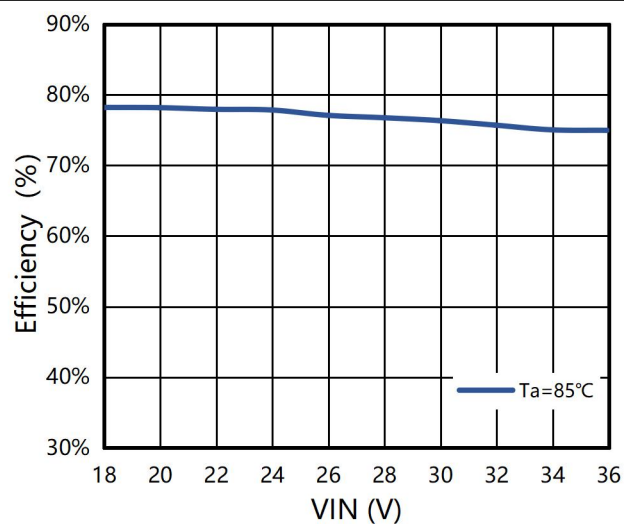
效率 VS 输出电流(-40°C)



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	0.001	5.04	0	0%	0.00%
23.98	0.051	5.04	0.199	10%	82.01%
23.97	0.100	5.04	0.398	20%	83.68%
23.97	0.151	5.05	0.599	30%	83.57%
23.97	0.199	5.04	0.797	40%	84.21%
23.97	0.250	5.04	0.996	50%	83.77%
23.96	0.300	5.04	1.196	60%	83.86%
23.96	0.350	5.04	1.395	70%	83.84%
23.96	0.402	5.04	1.595	80%	83.46%
23.96	0.454	5.04	1.795	90%	83.17%
23.96	0.508	5.04	1.999	100%	82.77%

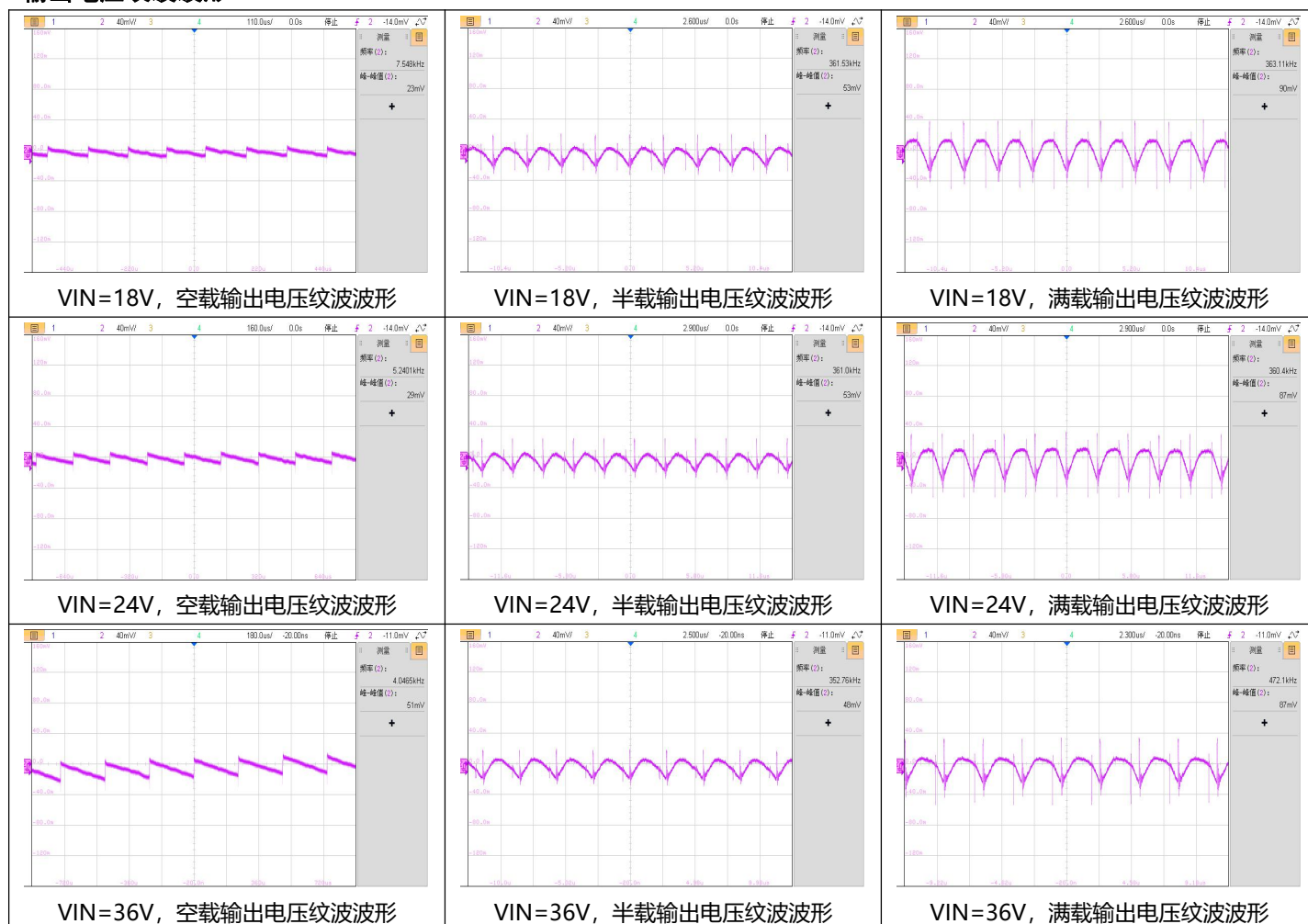
VIN=24V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.98	0.001	5.05	0	0%	0.00%
23.97	0.052	5.05	0.200	10%	81.03%
23.97	0.101	5.05	0.399	20%	83.23%
23.97	0.151	5.05	0.599	30%	83.57%
23.97	0.200	5.05	0.797	40%	83.96%
23.97	0.251	5.05	0.997	50%	83.68%
23.96	0.300	5.05	1.196	60%	84.03%
23.96	0.350	5.05	1.395	70%	84.01%
23.96	0.402	5.05	1.595	80%	83.63%
23.96	0.453	5.05	1.795	90%	83.52%
23.95	0.506	5.05	2.000	100%	83.34%

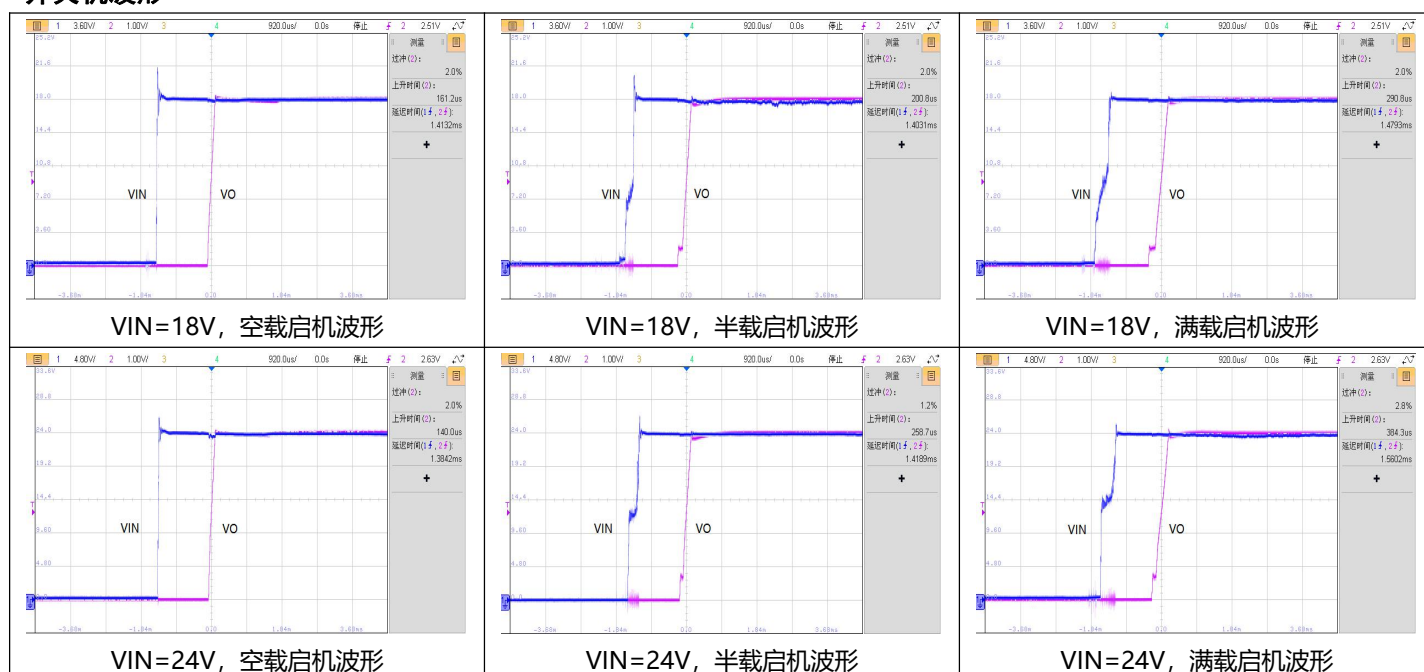
VIN=24V, Ta=85°C, 输入、输出及效率数据:

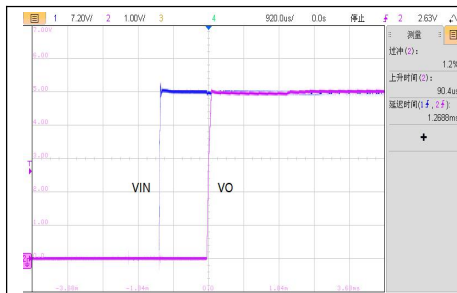
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
23.98	0.002	5.03	0	0%	0.00%
23.97	0.061	5.03	0.199	10%	68.46%
23.97	0.115	5.03	0.398	20%	72.62%
23.97	0.167	5.03	0.598	30%	75.14%
23.97	0.221	5.03	0.796	40%	75.58%
23.97	0.275	5.03	0.995	50%	75.93%
23.96	0.325	5.03	1.195	60%	77.19%
23.96	0.376	5.03	1.394	70%	77.83%
23.95	0.429	5.03	1.593	80%	77.99%
23.95	0.482	5.03	1.793	90%	78.13%
23.95	0.539	5.03	1.998	100%	77.85%

输出电压纹波波形

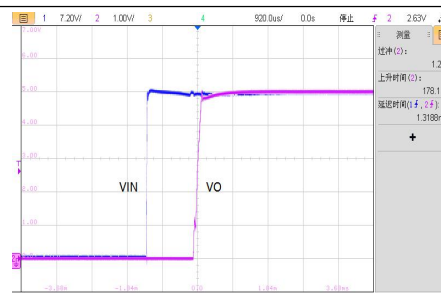


开关机波形

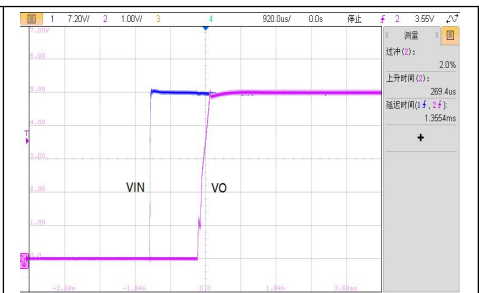




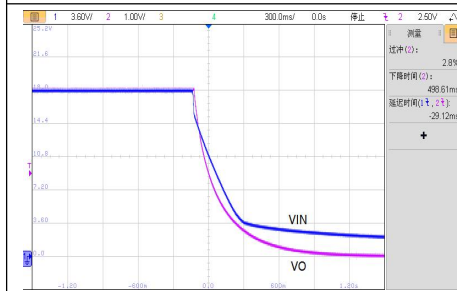
VIN=36V, 空载启机波形



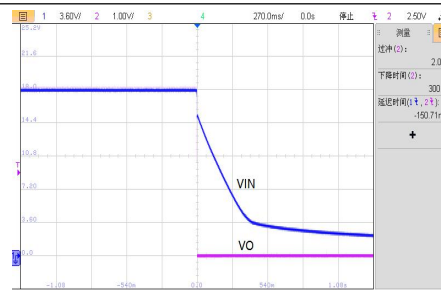
VIN=36V, 半载启机波形



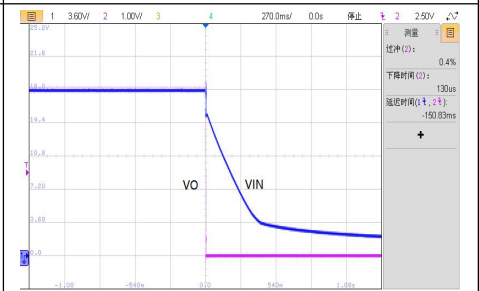
VIN=36V, 满载启机波形



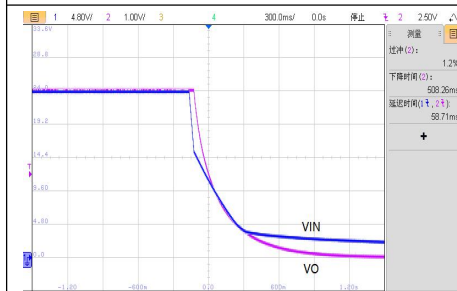
VIN=18V, 空载关机波形



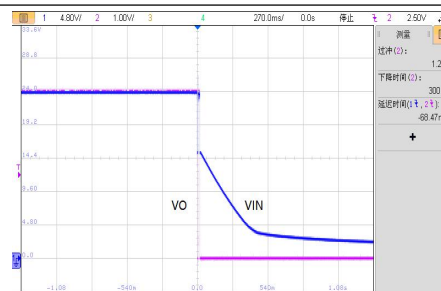
VIN=18V, 半载关机波形



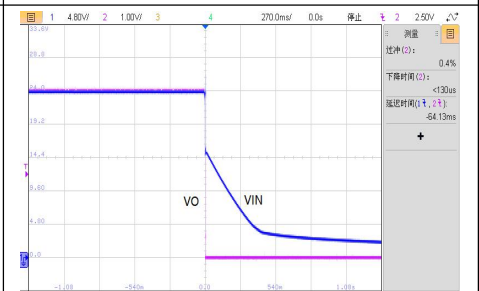
VIN=18V, 满载关机波形



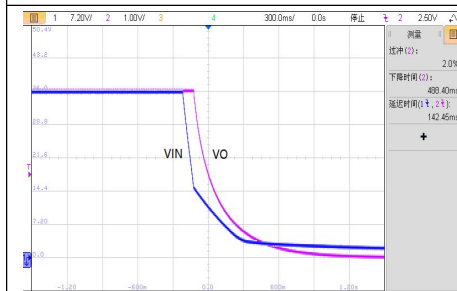
VIN=24V, 空载关机波形



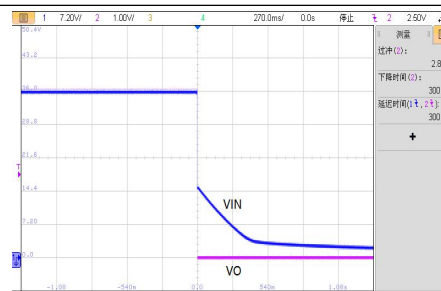
VIN=24V, 半载关机波形



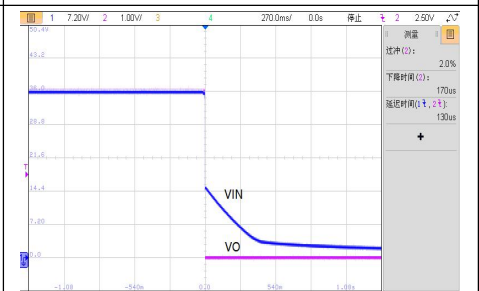
VIN=24V, 满载关机波形



VIN=36V, 空载关机波形

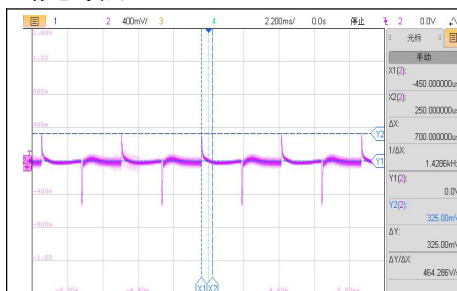


VIN=36V, 半载关机波形

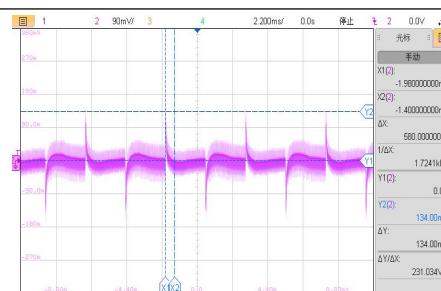


VIN=36V, 满载关机波形

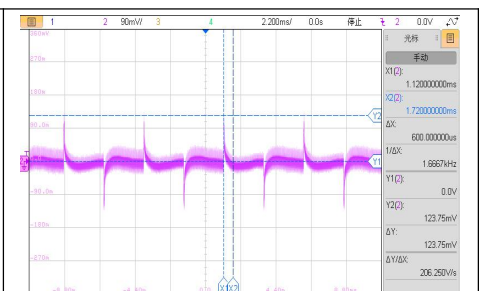
动态波形



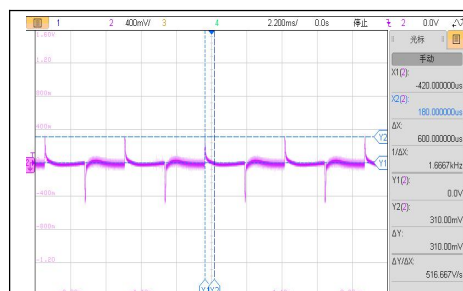
VIN=18V, 100%-10%-100%Io 动态波形



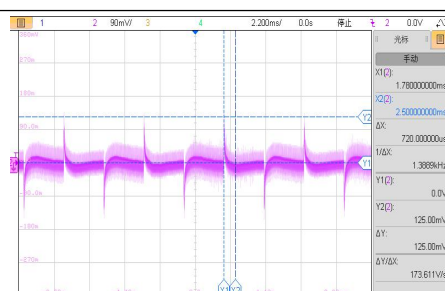
VIN=18V, 75%-50%-75%Io 动态波形



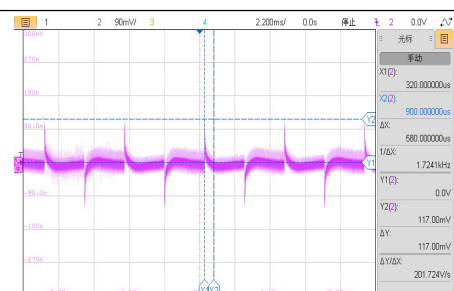
VIN=18V, 50%-25%-50%Io 动态波形



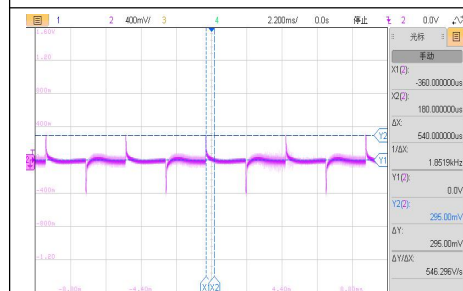
VIN=24V, 100%-10%-100%Io 动态波形



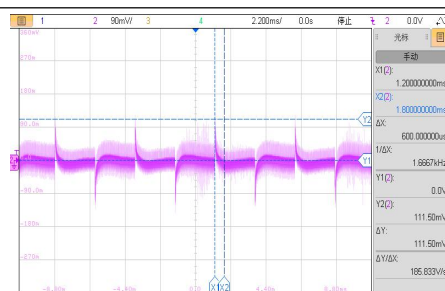
VIN=24V, 75%-50%-75%Io 动态波形



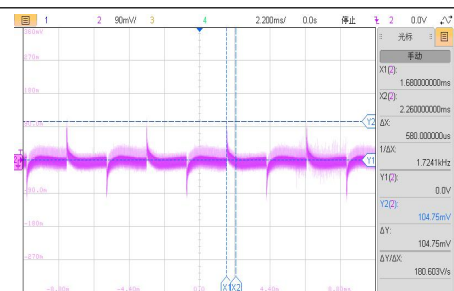
VIN=24V, 50%-25%-50%Io 动态波形



VIN=36V, 100%-10%-100%Io 动态波形

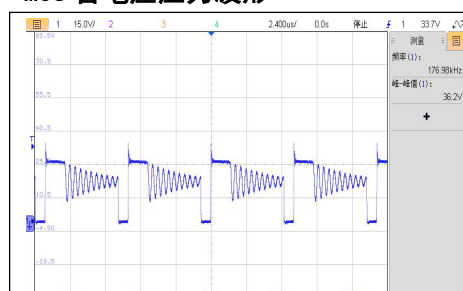


VIN=36V, 75%-50%-75%Io 动态波形

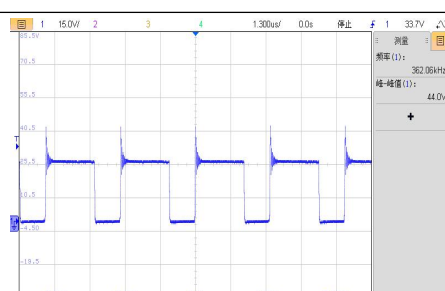


VIN=36V, 50%-25%-50%Io 动态波形

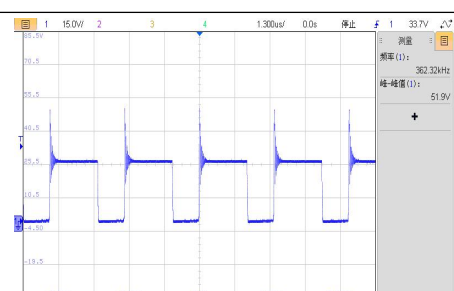
MOS 管电压应力波形



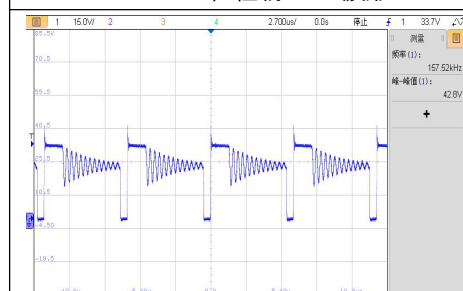
VIN=18V, 轻载 VDS 波形



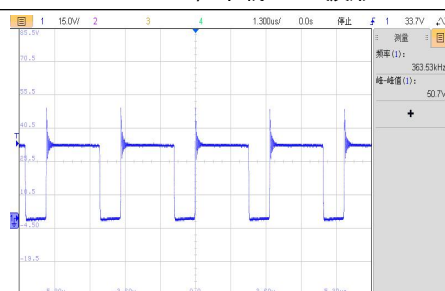
VIN=18V, 半载 VDS 波形



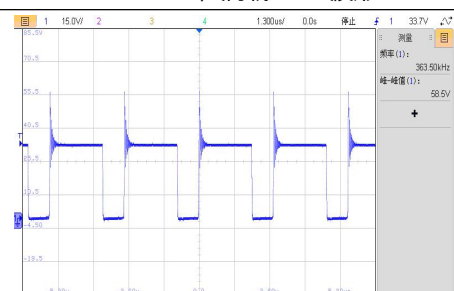
VIN=18V, 满载 VDS 波形



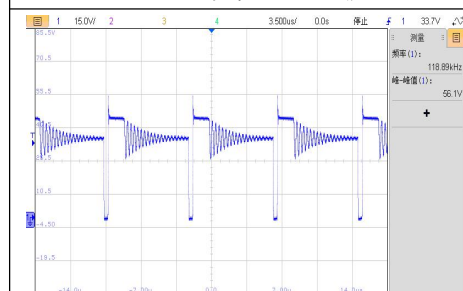
VIN=24V, 轻载 VDS 波形



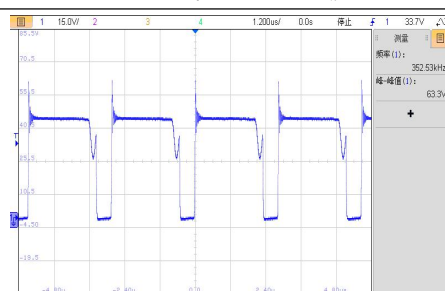
VIN=24V, 半载 VDS 波形



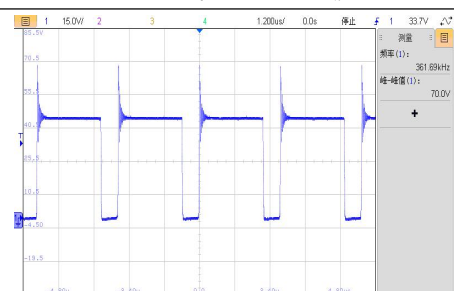
VIN=24V, 满载 VDS 波形



VIN=36V, 轻载 VDS 波形

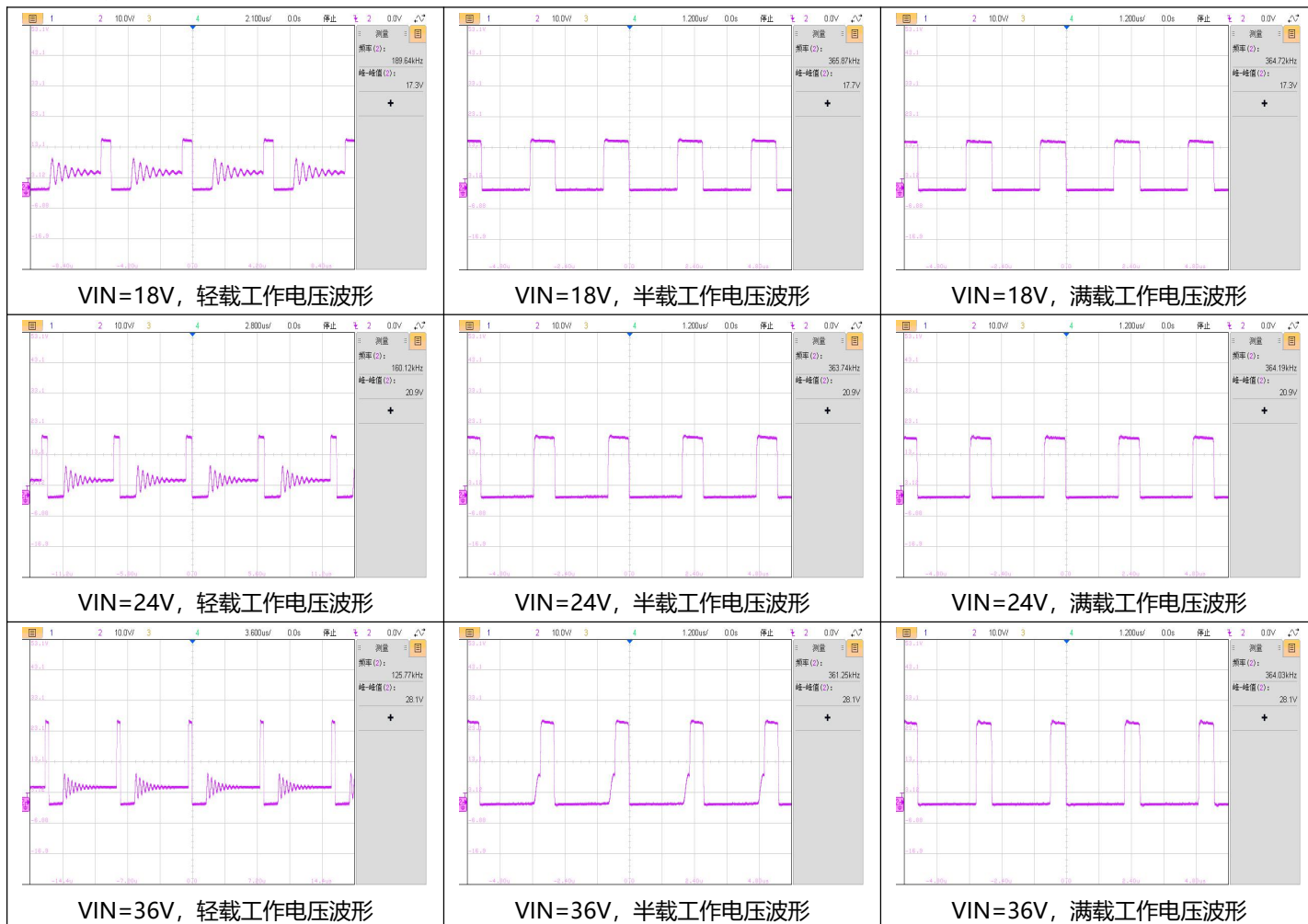


VIN=36V, 半载 VDS 波形

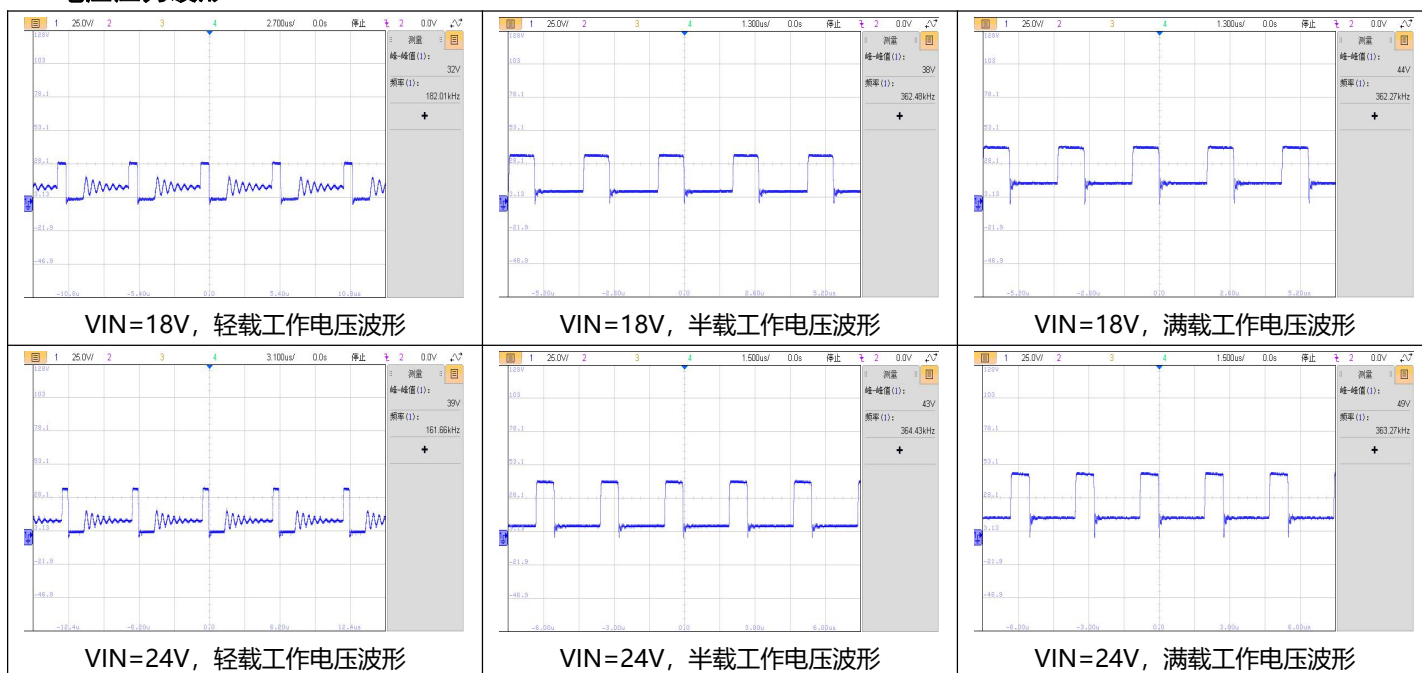


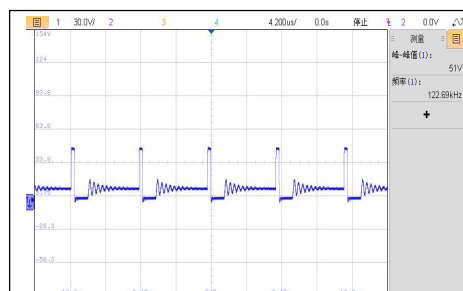
VIN=36V, 满载 VDS 波形

输出整流二极管 D6 应力波形

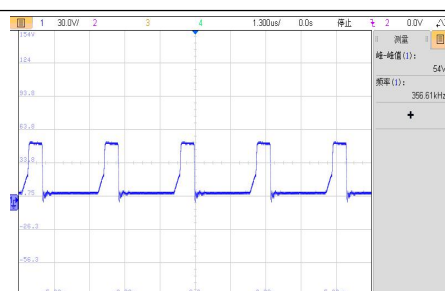


D3 电压应力波形

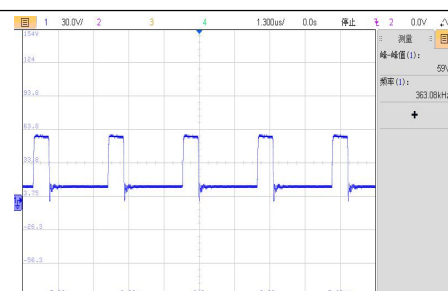




VIN=36V, 轻载工作电压波形

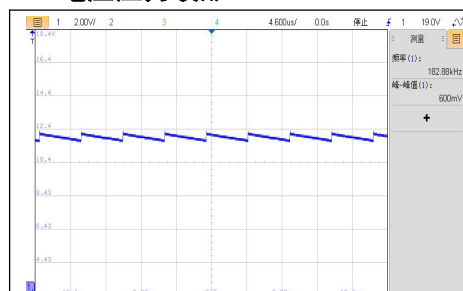


VIN=36V, 半载工作电压波形

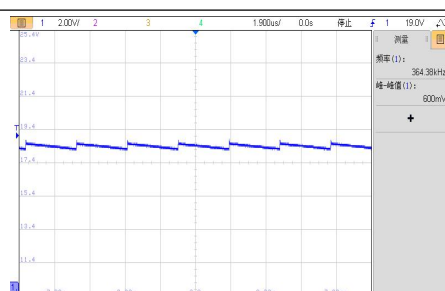


VIN=36V, 满载工作电压波形

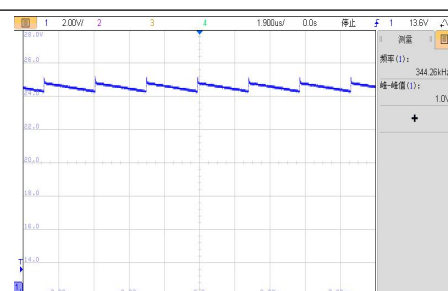
D4 电压应力波形



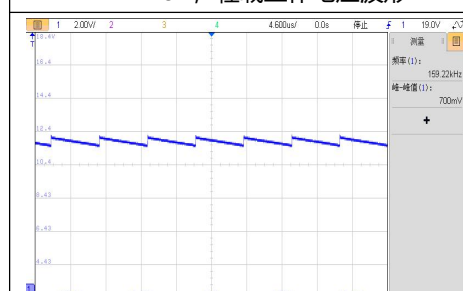
VIN=18V, 轻载工作电压波形



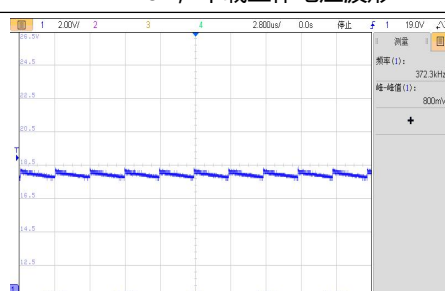
VIN=18V, 半载工作电压波形



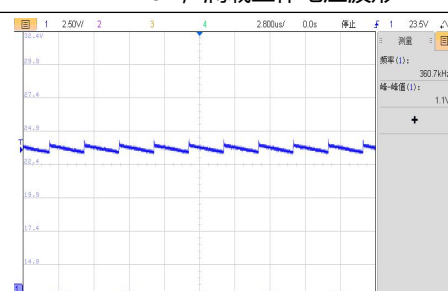
VIN=18V, 满载工作电压波形



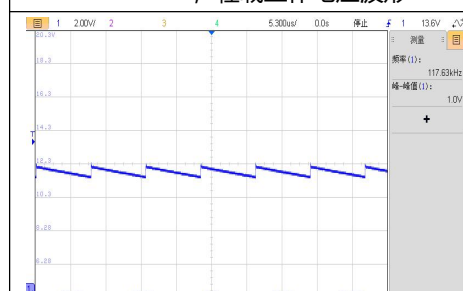
VIN=24V, 轻载工作电压波形



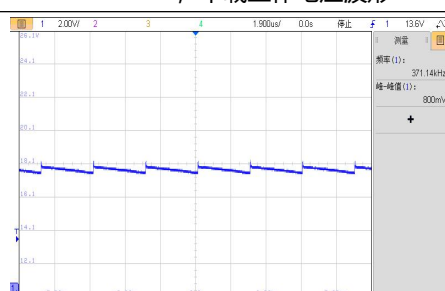
VIN=24V, 半载工作电压波形



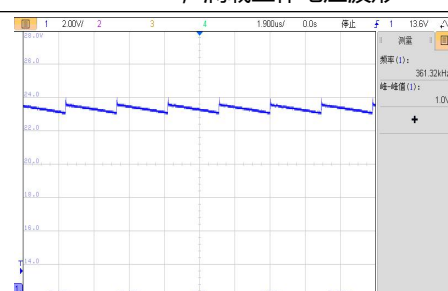
VIN=24V, 满载工作电压波形



VIN=36V, 轻载工作电压波形

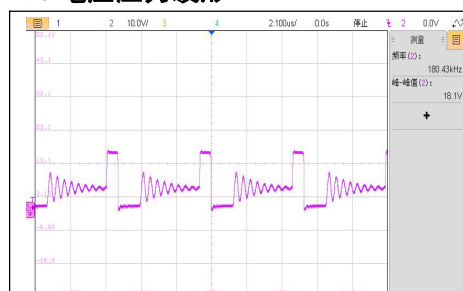


VIN=36V, 半载工作电压波形

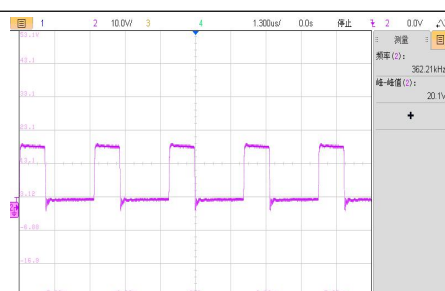


VIN=36V, 满载工作电压波形

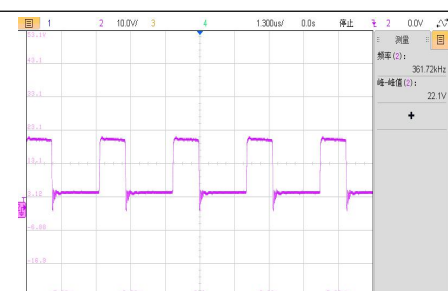
D5 电压应力波形



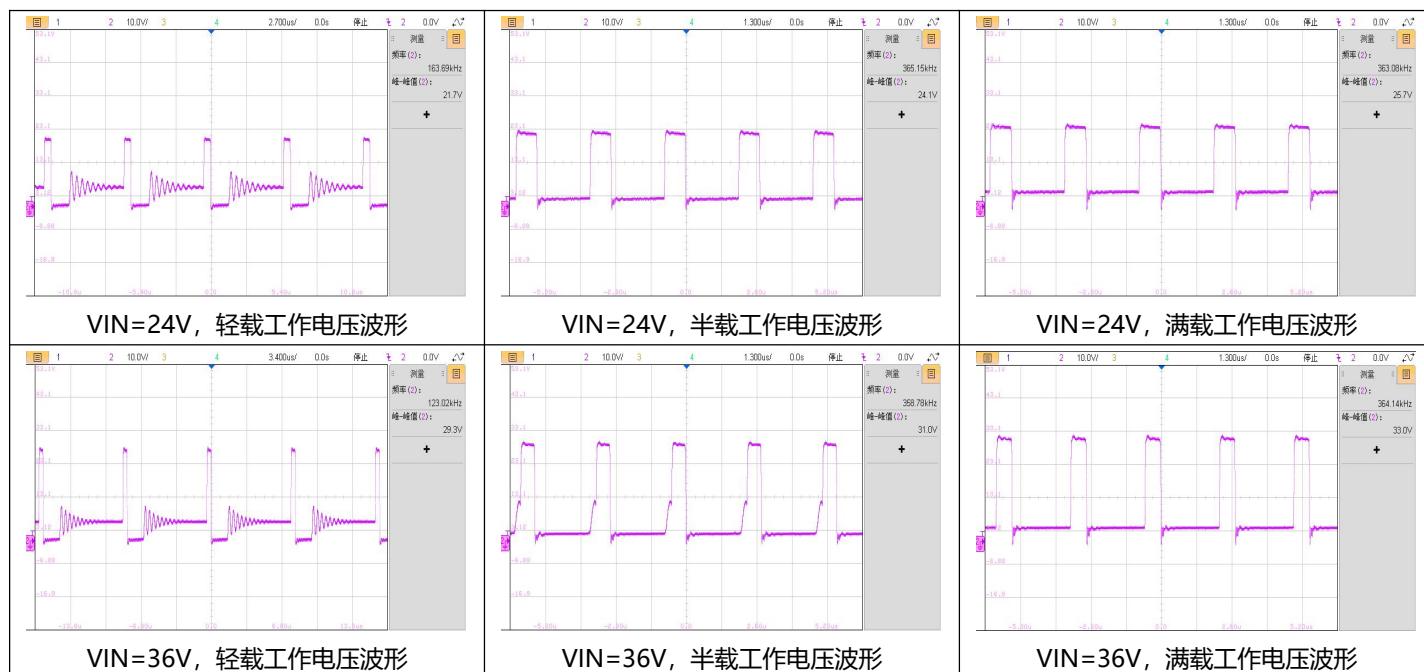
VIN=18V, 轻载工作电压波形



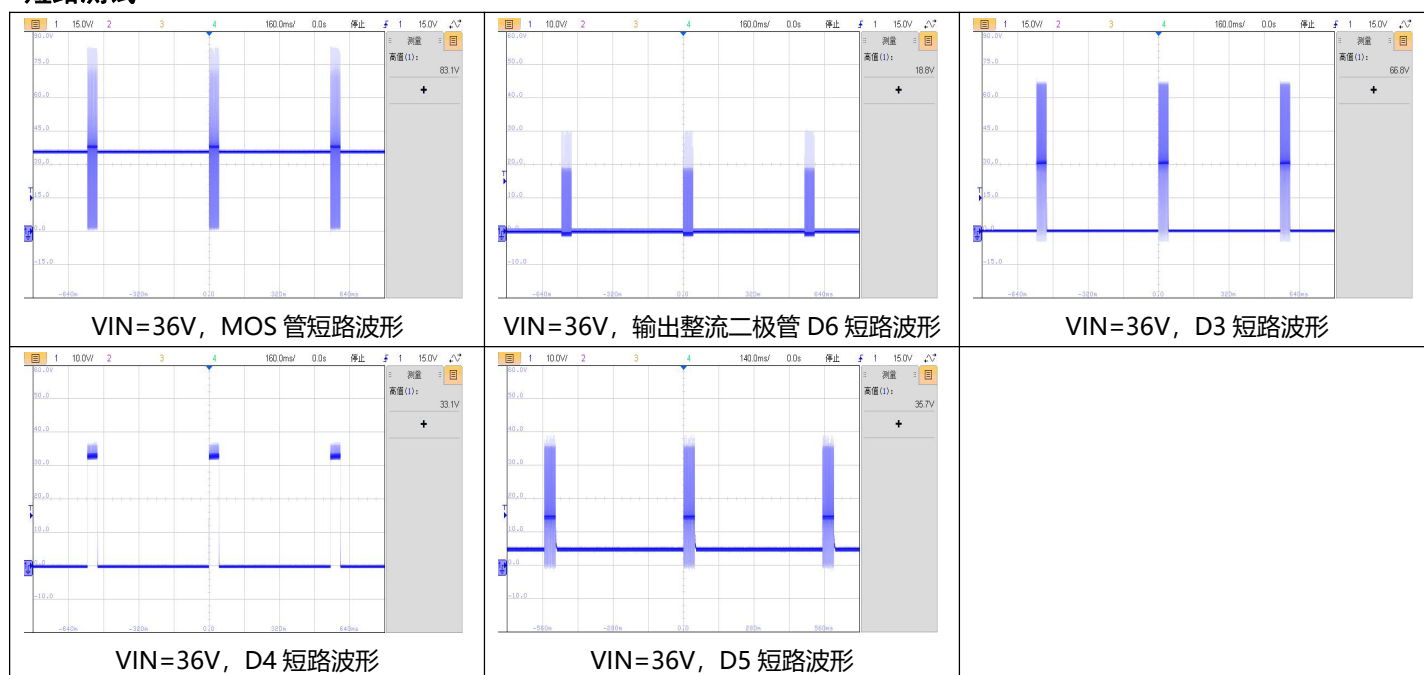
VIN=18V, 半载工作电压波形



VIN=18V, 满载工作电压波形



短路测试



免责声明

本文的主要目的是为了让客户更好地理解与应用源特相关产品。所涉及技术信息提供的所有参数、数值、数据都是基于源特对于部分标准的理解得到的，所提供的信息并不能保证所有假设情况和工作条件。客户在使用源特产品设计开发时，需进行充分的设计验证以确保设计方案能满足特定的应用场合。本文所提供的测试数据是基于有限数量样品测试的典型值，源特不能保证所有数据的准确性和完整性，也不对本文所提供的任何参数、数值、数据、建议、观点的准确性和充分性承担任何责任，不对由本文所造成的直接、间接损失承担任何责任。