

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 VPS2107, 结合隔离功率变压器 VPE27QB-06A、输出整流二极管以及必要的阻容元件, 实现 18V-75V 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。

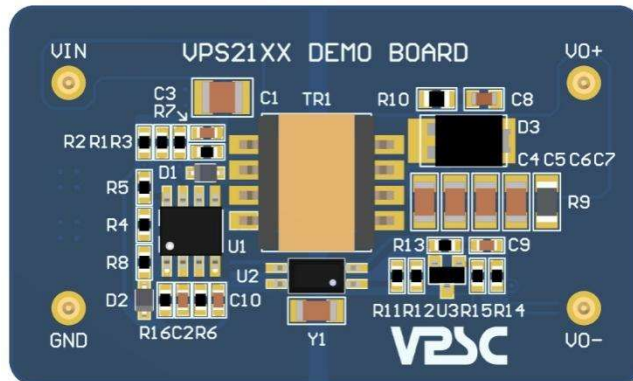
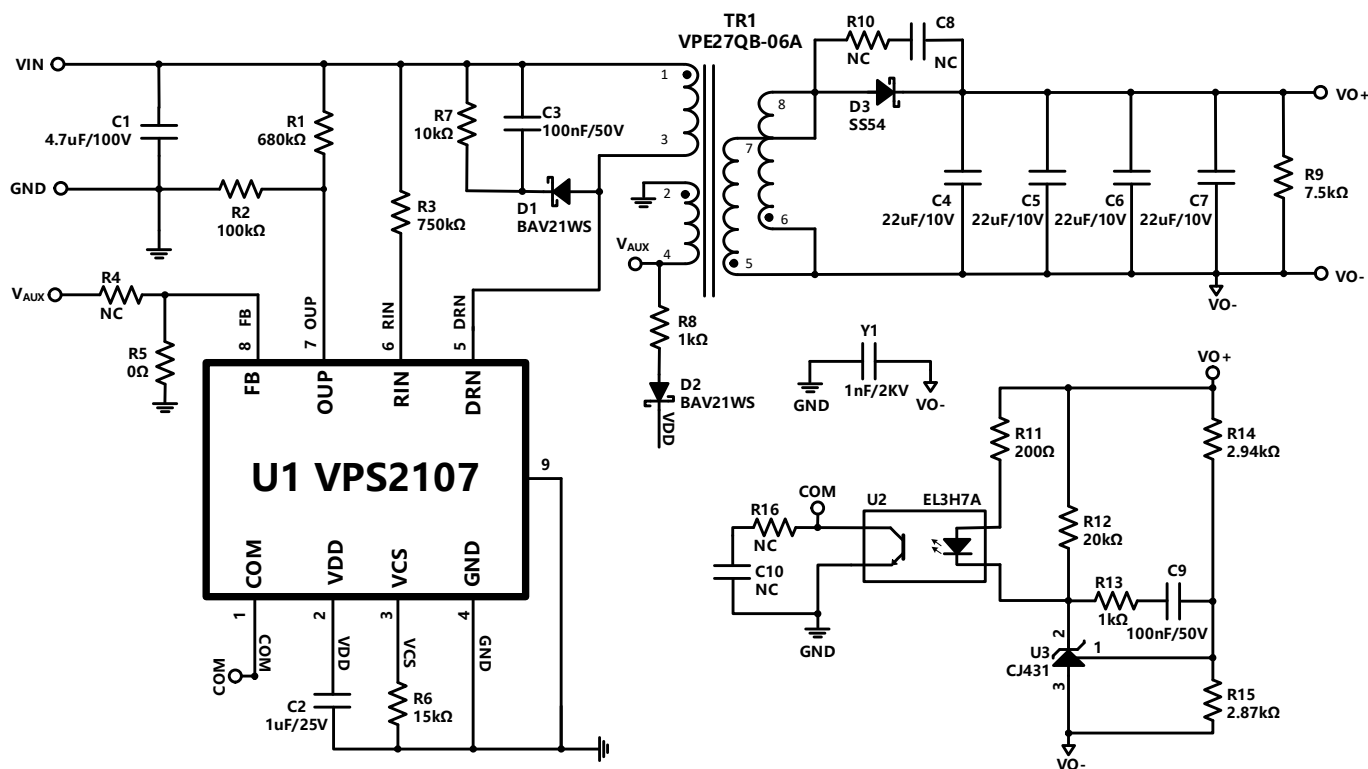


图 1: VPS2107 Demo 板(尺寸:50mm*30mm)

关键词: 输入: 18V-75V, 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

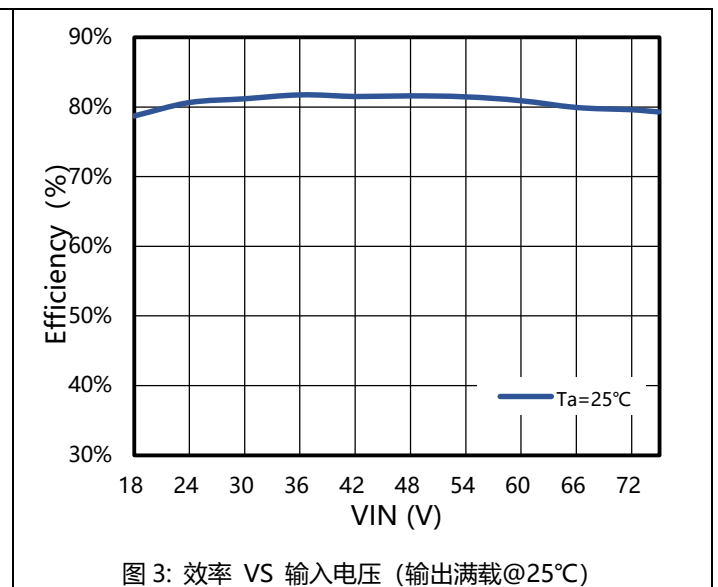
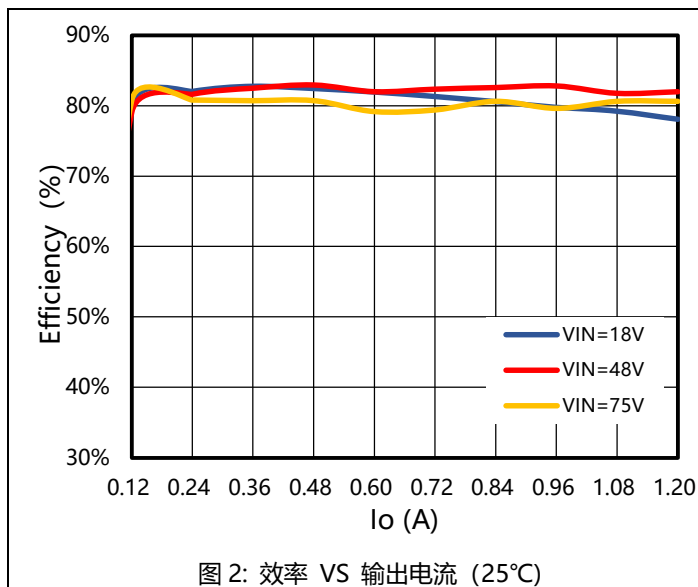
物料清单

位号	参数	封装	型号	品牌
C1	4.7uF/100V-X7R	1210	CL32Y475KCIVPNE	SAMSUNG
C2	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C3	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C4	22uF/10V-X5R	1206	CC1206KKX5R6BB226	YAGEO
C5	22uF/10V-X5R	1206	CC1206KKX5R6BB226	YAGEO
C6	22uF/10V-X5R	1206	CC1206KKX5R6BB226	YAGEO
C7	22uF/10V-X5R	1206	CC1206KKX5R6BB226	YAGEO
C8	NC	-	-	-
C9	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C10	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	680K Ω ±1%	0603	RC0603FR-07680KL	YAGEO
R2	100K Ω ±1%	0603	RC0603FR-07100KL	YAGEO
R3	750K Ω ±1%	0603	RC0603FR-07750KL	YAGEO
R4	NC	-	-	-
R5	0 Ω ±1%	0603	RC0603FR-070RL	YAGEO
R6	15K Ω ±1%	0603	RC0603FR-0715KL	YAGEO
R7	10K Ω ±1%	0603	RC0603FR-0710KL	YAGEO
R8	1k Ω ±1%	0603	RC0603FR-071KL	YAGEO
R9	7.5K Ω ±1%	1206	RC1206FR-077K5L	YAGEO
R10	NC	-	-	-
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=18:5:12 Lp=48.6uH	ER11.5	VPE27QB-06A	VPSC
D1	200V/0.2A	SOD-323	BAV21WS	CJ
D2	200V/0.2A	SOD-323	BAV21WS	CJ
D3	40V/5A	SMA	SS54	MDD
U1	4-80VIN/132V/0.6 Ω 电流模式 PWM 控制器	ESOP-8	VPS2107	VPSC
U2	CTR=80~160, Viso=3750VAC	SSOP-4	EL3H7A	EVERLIGHT
U3	Vref=2.495V	SOT23-3	CJ431	CJ

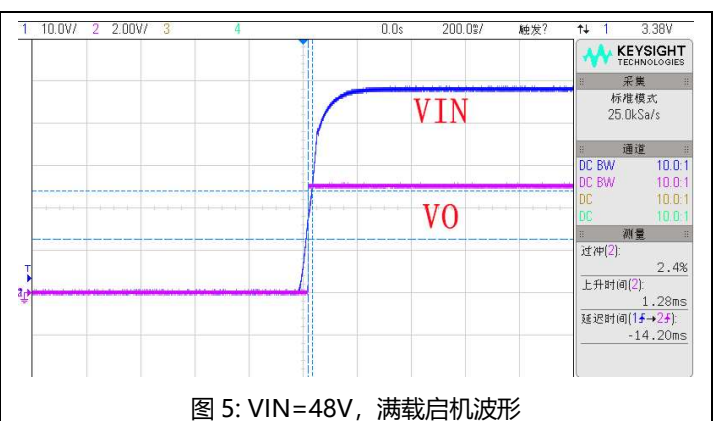
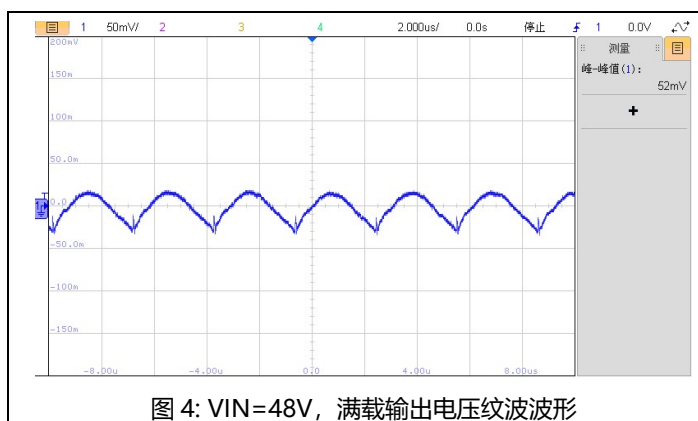
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=48V	3	---	154	mA
转换效率	VIN=48V, IO=1.2A	---	82	---	%
纹波&噪声	VIN=48V, IO=1.2A	---	50	90	mV
输出电压精度	VIN=48V, IO=1.2A	---	0.4	---	%
线性调节率	VIN=18V-75V, IO=1.2A	---	0.1	---	%
负载调整率	VIN=48V, IO=1.2A	---	0.2	---	%
输出过流点系数	VIN=48V, IO=1.2A	---	2	---	倍
输入欠压保护	锁定电压	---	13.6	---	V
	恢复电压	---	15.8	---	V
短路保护	VIN=18V-75V	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

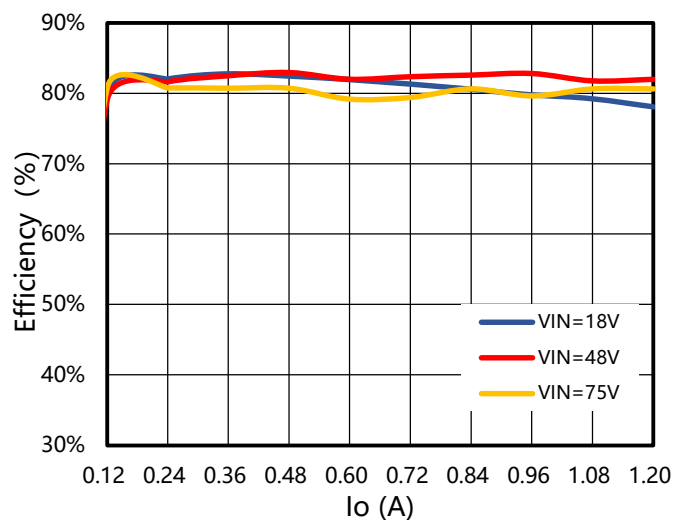


相关波形

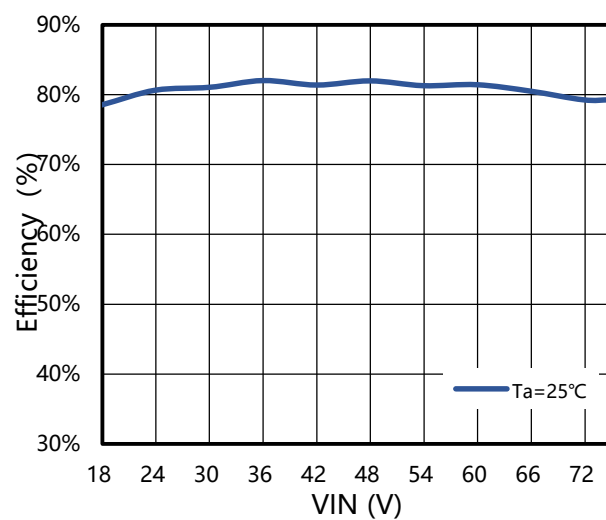


详细测试数据

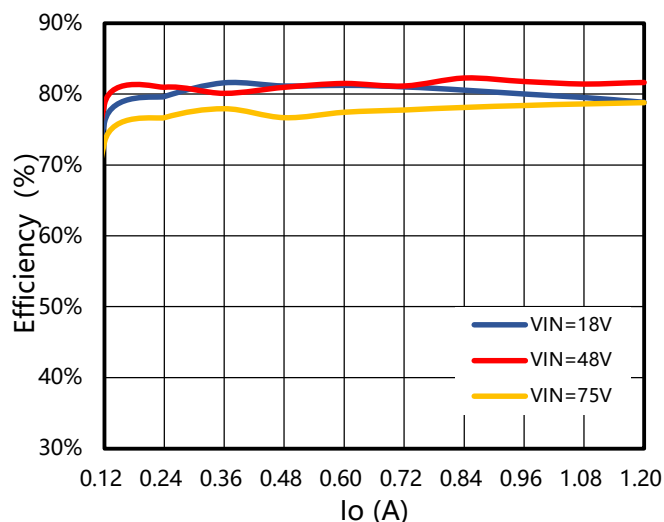
高低温测试曲线



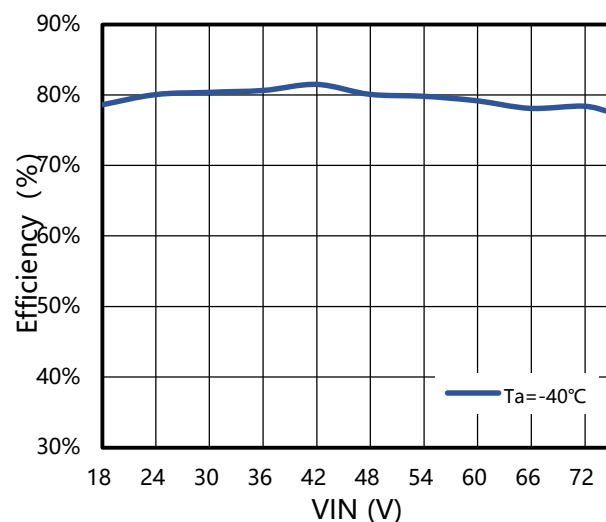
效率 VS 输出电流 (25°C)



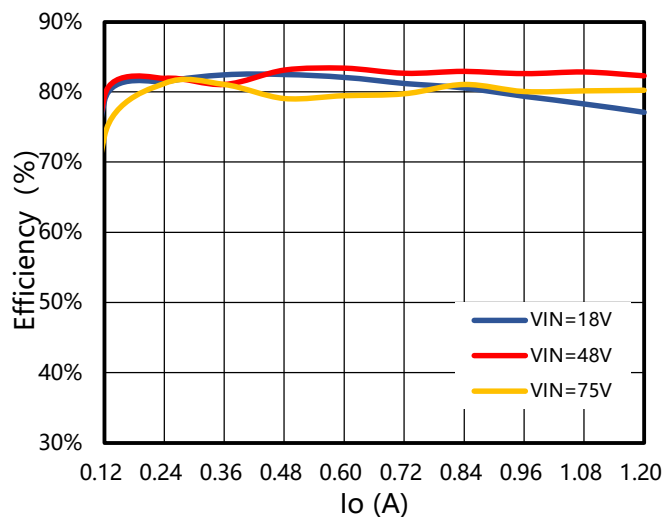
效率 VS 输入电压 (输出满载@25°C)



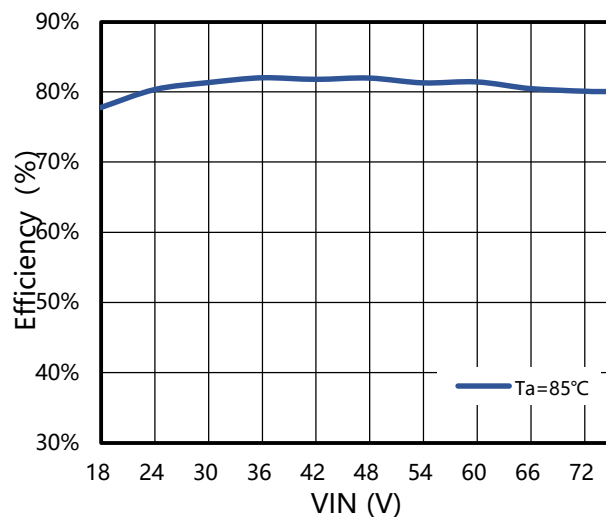
效率 VS 输出电流 (-40°C)



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=48V, Ta=25°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.70	0.003	5.03	0	0%	0.00%
47.70	0.016	5.03	0.120	10%	79.09%
47.70	0.031	5.03	0.240	20%	81.64%
47.70	0.046	5.03	0.360	30%	82.53%
47.70	0.061	5.03	0.480	40%	82.98%
47.70	0.077	5.02	0.600	50%	82.01%
47.70	0.092	5.02	0.720	60%	82.36%
47.70	0.107	5.02	0.840	70%	82.62%
47.70	0.122	5.02	0.960	80%	82.81%
47.70	0.139	5.02	1.080	90%	81.77%
47.70	0.154	5.02	1.200	100%	82.01%

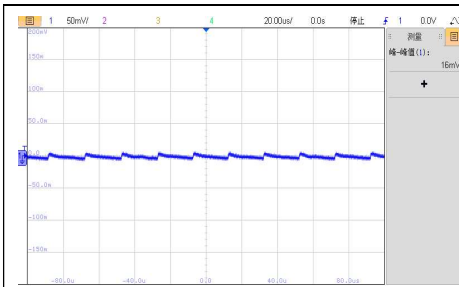
VIN=48V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.90	0.002	5.01	0	0%	0.00%
47.90	0.016	5.02	0.120	10%	78.60%
47.90	0.031	5.01	0.240	20%	80.98%
47.90	0.047	5.01	0.360	30%	80.11%
47.90	0.062	5.01	0.480	40%	80.98%
47.90	0.077	5.01	0.600	50%	81.50%
47.80	0.093	5.01	0.720	60%	81.14%
47.80	0.107	5.01	0.840	70%	82.28%
47.80	0.123	5.01	0.960	80%	81.80%
47.80	0.139	5.01	1.080	90%	81.44%
47.80	0.154	5.01	1.200	100%	81.67%

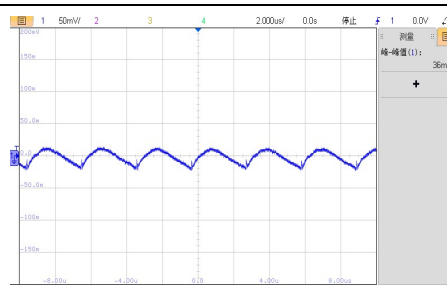
VIN=48V, Ta=85°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.80	0.003	5.06	0	0%	0.00%
47.80	0.016	5.06	0.120	10%	79.39%
47.80	0.031	5.06	0.240	20%	81.95%
47.80	0.047	5.06	0.360	30%	81.08%
47.90	0.061	5.06	0.480	40%	83.12%
47.90	0.076	5.06	0.600	50%	83.40%
47.90	0.092	5.06	0.720	60%	82.67%
47.90	0.107	5.06	0.840	70%	82.93%
47.80	0.123	5.06	0.960	80%	82.62%
47.80	0.138	5.06	1.080	90%	82.85%
47.90	0.154	5.06	1.200	100%	82.31%

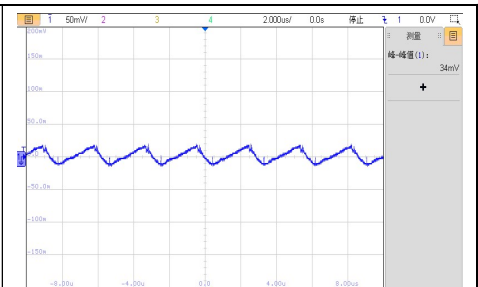
输出电压纹波波形



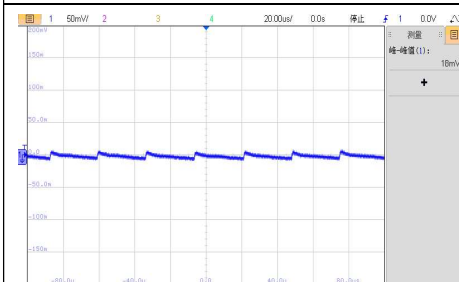
VIN=18V, 空载输出电压纹波波形



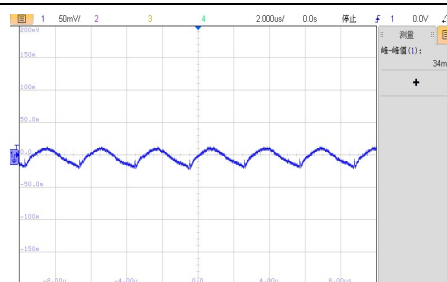
VIN=18V, 半载输出电压纹波波形



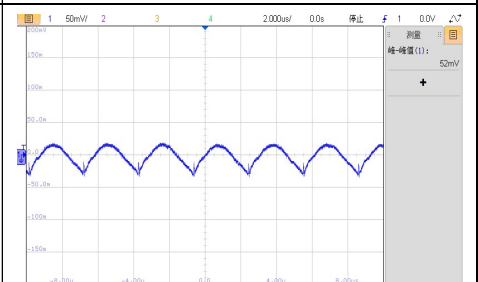
VIN=18V, 满载输出电压纹波波形



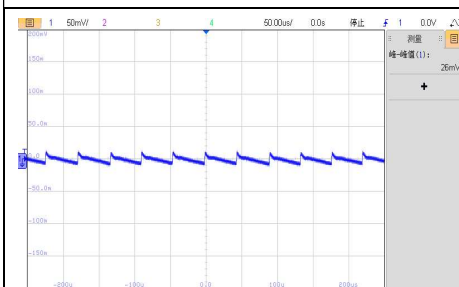
VIN=48V, 空载输出电压纹波波形



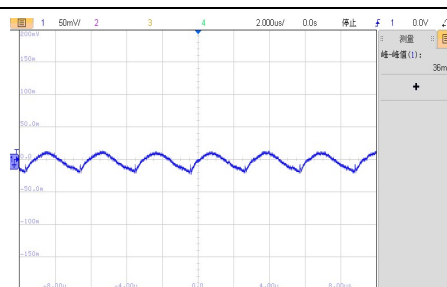
VIN=48V, 半载输出电压纹波波形



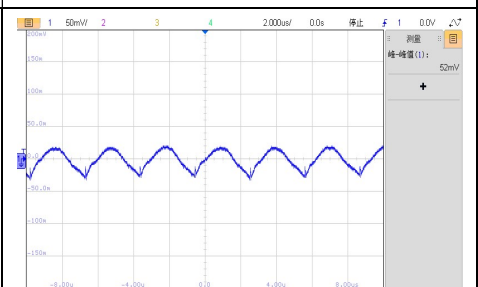
VIN=48V, 满载输出电压纹波波形



VIN=75V, 空载输出电压纹波波形

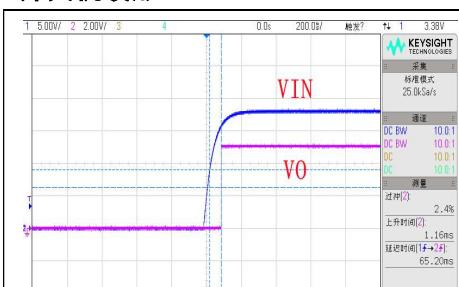


VIN=75V, 半载输出电压纹波波形

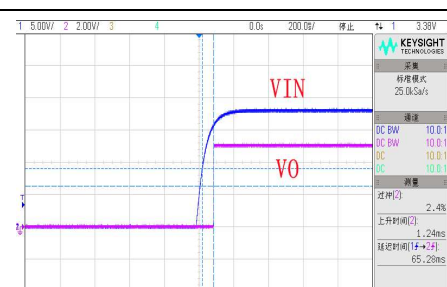


VIN=75V, 满载输出电压纹波波形

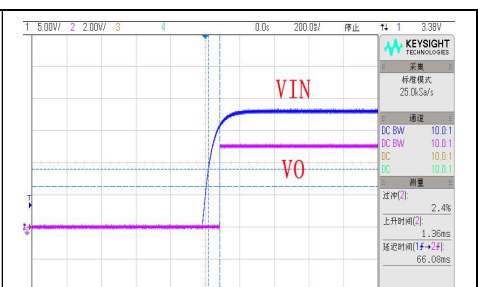
开关机波形



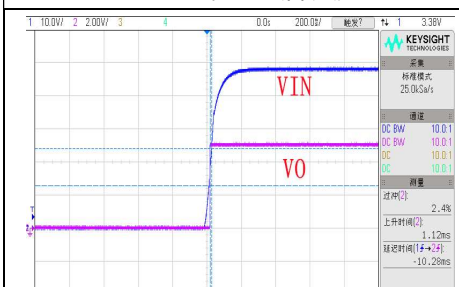
VIN=18V, 空载启机波形



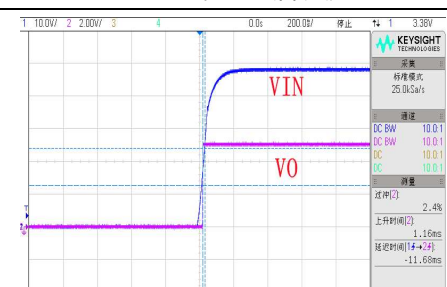
VIN=18V, 半载启机波形



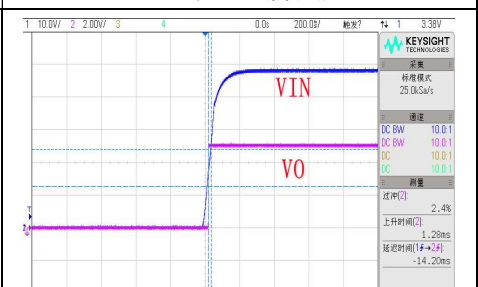
VIN=18V, 满载启机波形



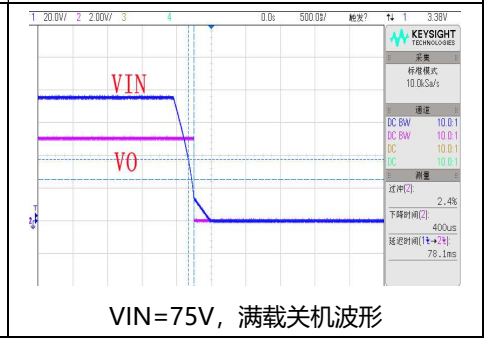
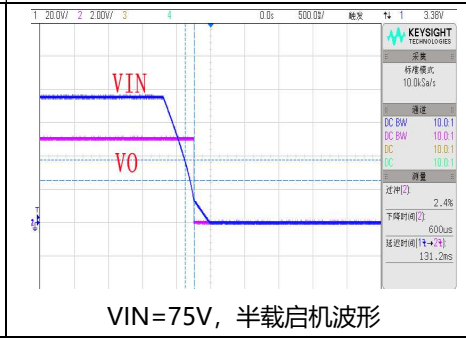
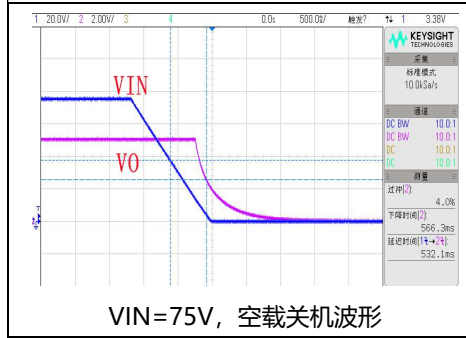
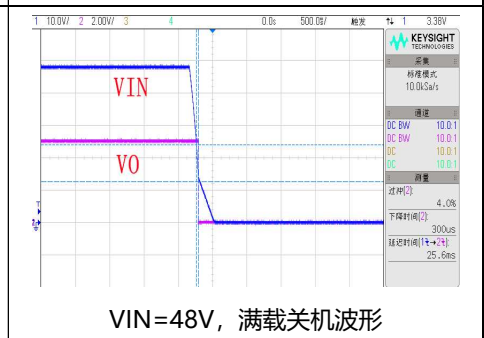
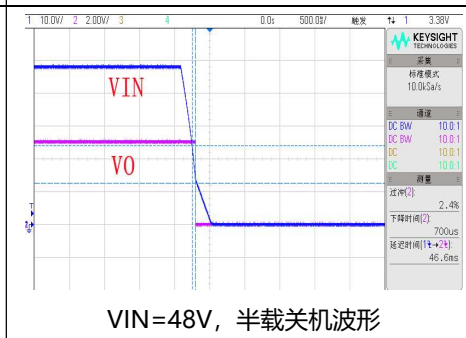
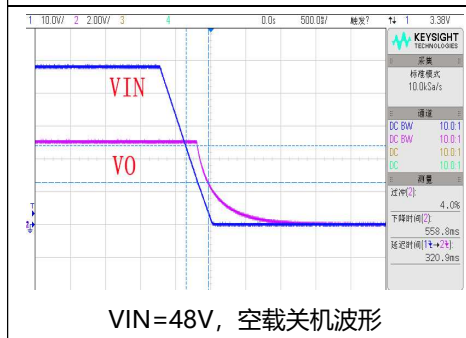
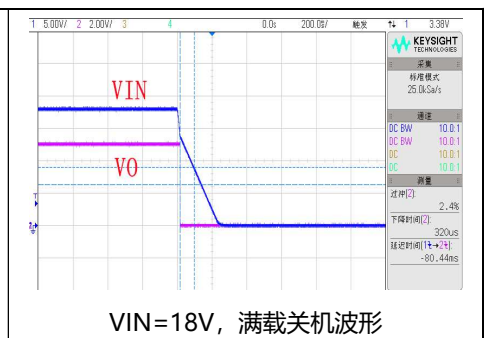
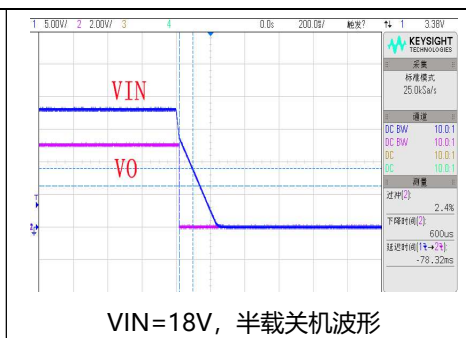
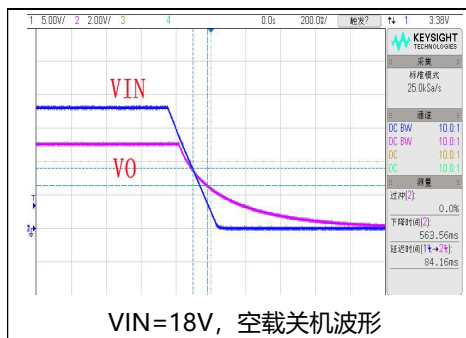
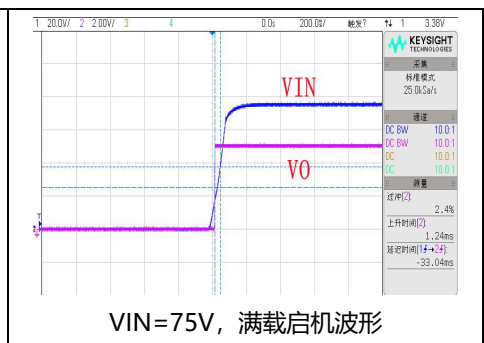
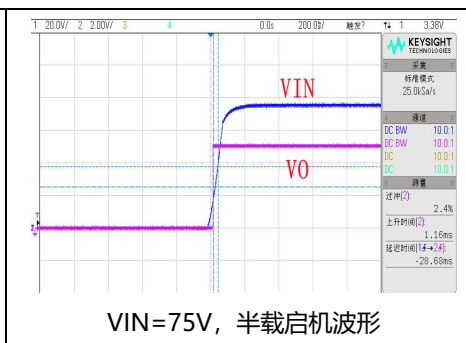
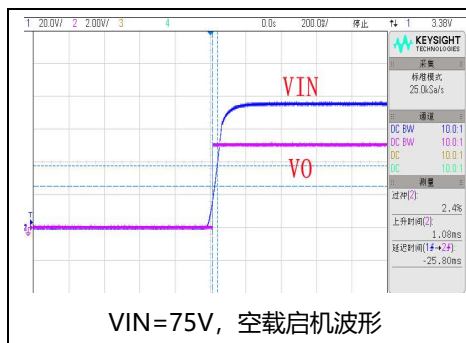
VIN=48V, 空载启机波形



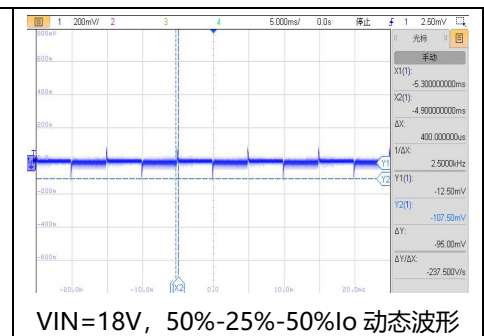
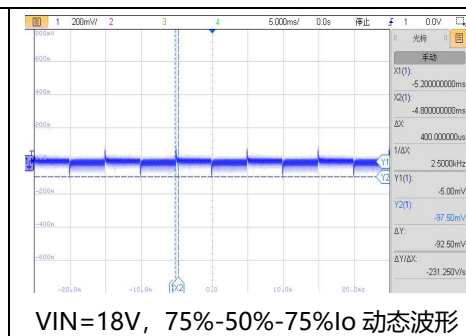
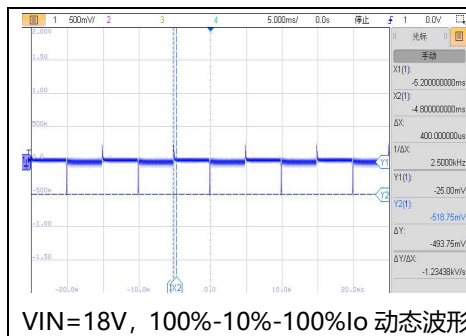
VIN=48V, 半载启机波形

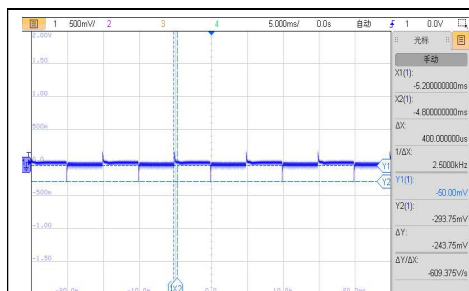


VIN=48V, 满载启机波形

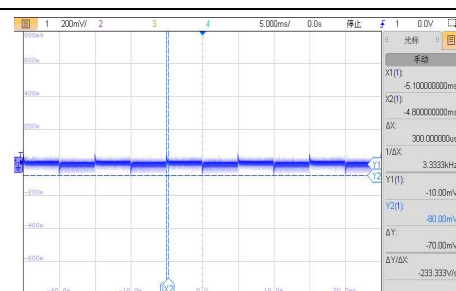


动态波形

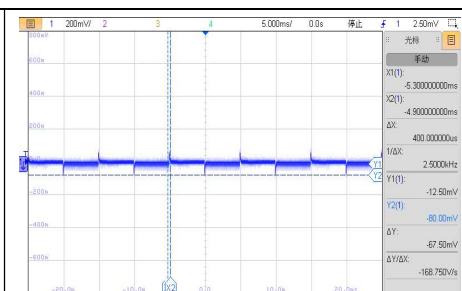




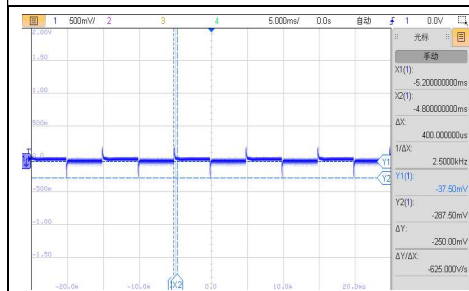
VIN=48V, 100%-10%-100%Io 动态波形



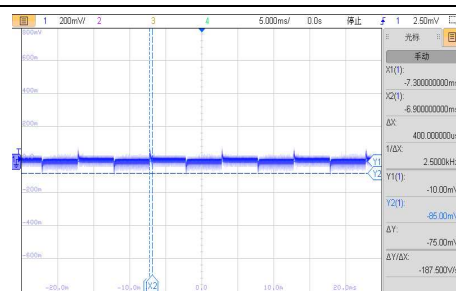
VIN=48V, 75%-50%-75%Io 动态波形



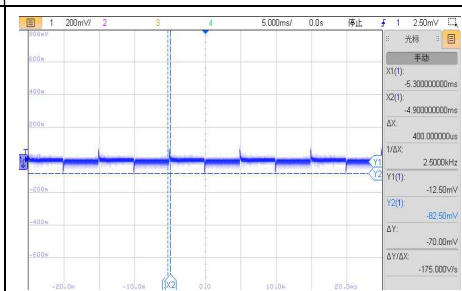
VIN=48V, 50%-25%-50%Io 动态波形



VIN=75V, 100%-10%-100%Io 动态波形

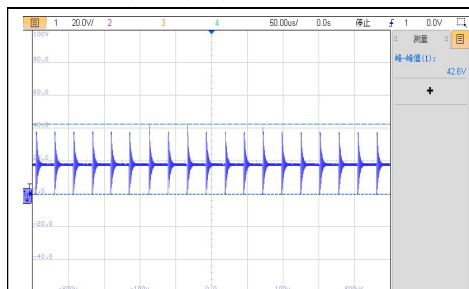


VIN=75V, 75%-50%-75%Io 动态波形

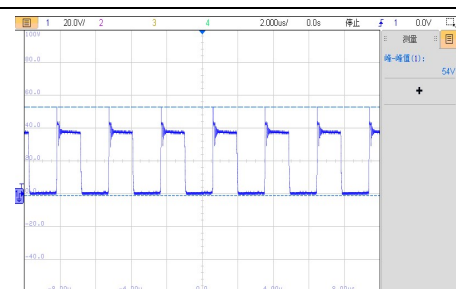


VIN=75V, 50%-25%-50%Io 动态波形

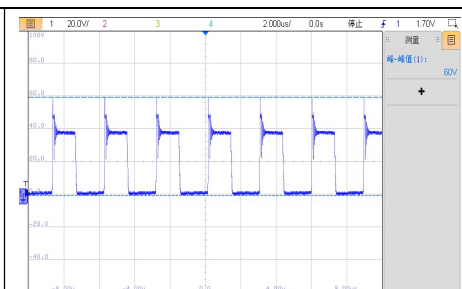
MOS 管电压应力波形



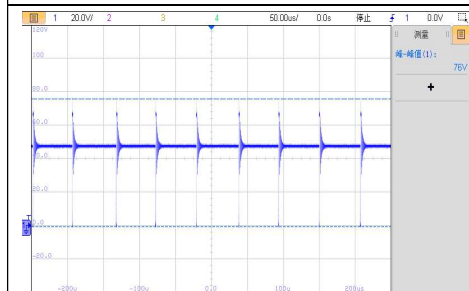
VIN=18V, 空载 VDS 波形



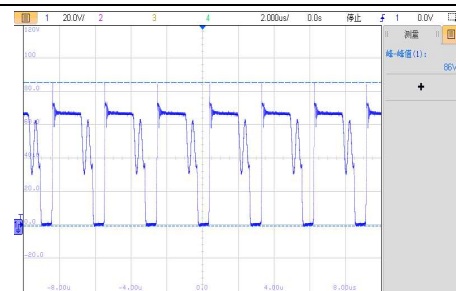
VIN=18V, 半载 VDS 波形



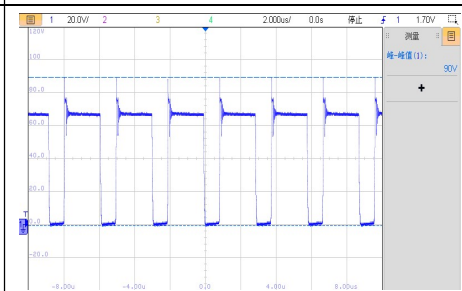
VIN=18V, 满载 VDS 波形



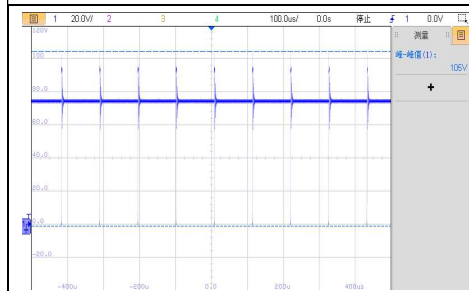
VIN=48V, 空载 VDS 波形



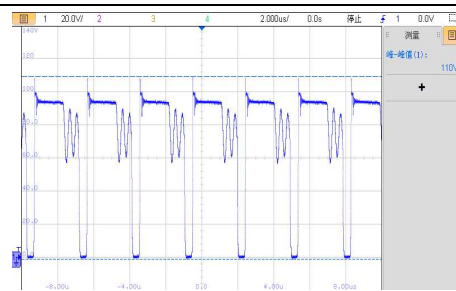
VIN=48V, 半载 VDS 波形



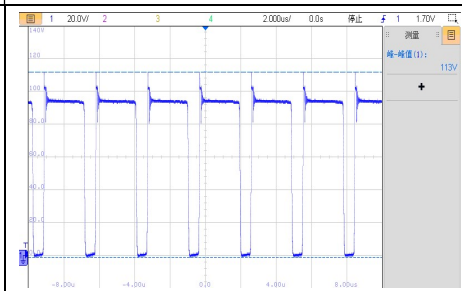
VIN=48V, 满载 VDS 波形



VIN=75V, 空载 VDS 波形

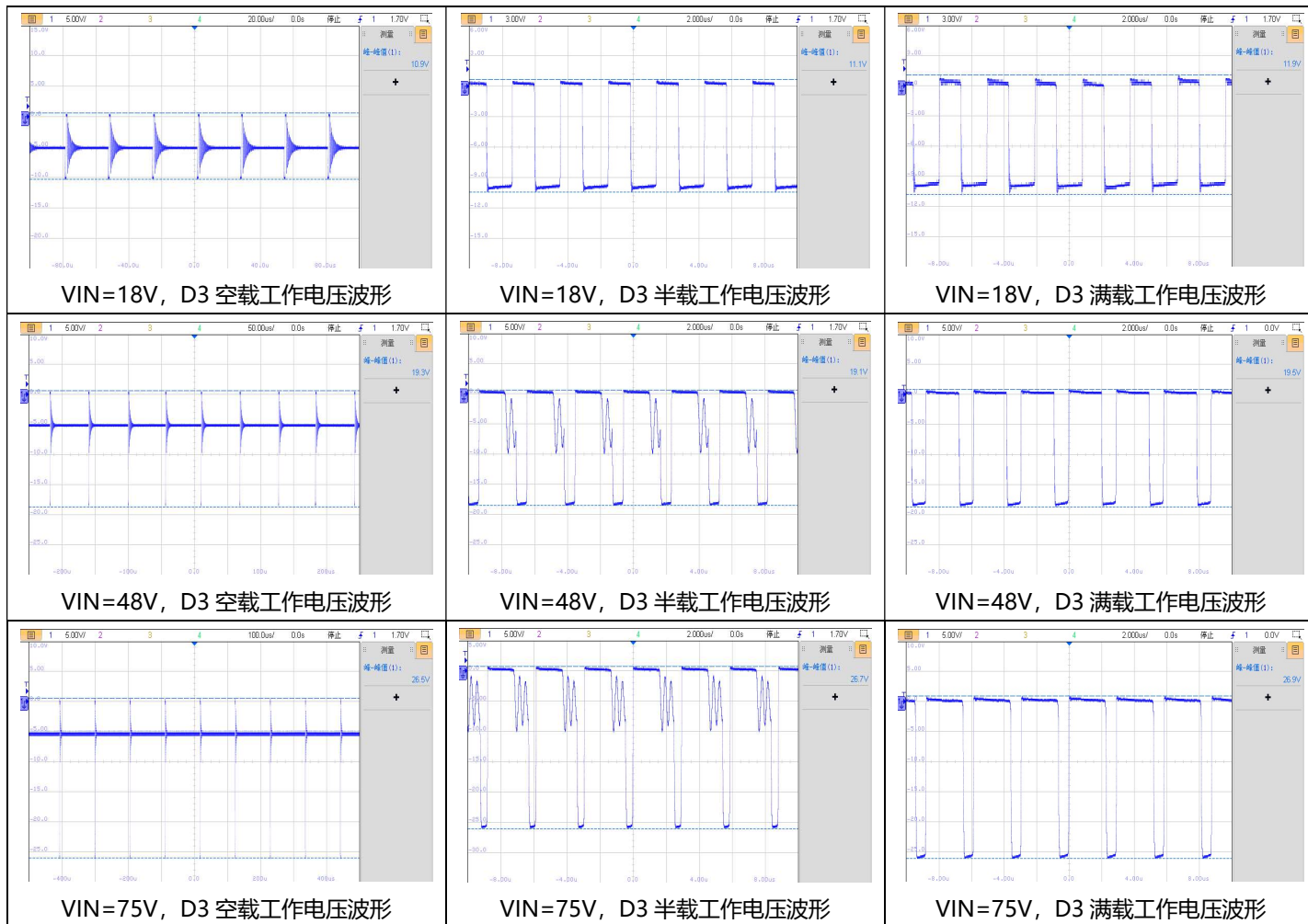


VIN=75V, 半载 VDS 波形



VIN=75V, 满载 VDS 波形

副边输出整流二极管 D3 应力波形



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。