

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 VPC2188B，结合隔离功率变压器 VPD18GF-48A、输出整流二极管以及必要的阻容元件，实现 36V-72V 输入，24V 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 48W 的输出能力，原副边隔离耐压不小于 1500VDC，同时具备欠压保护、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。

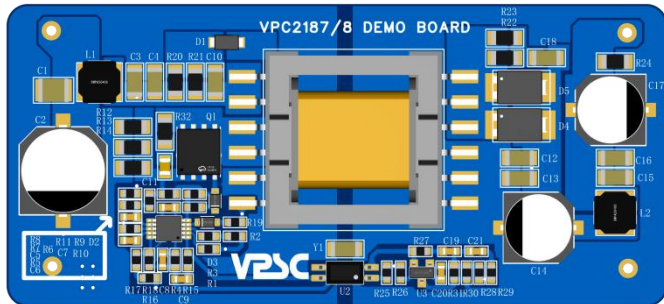
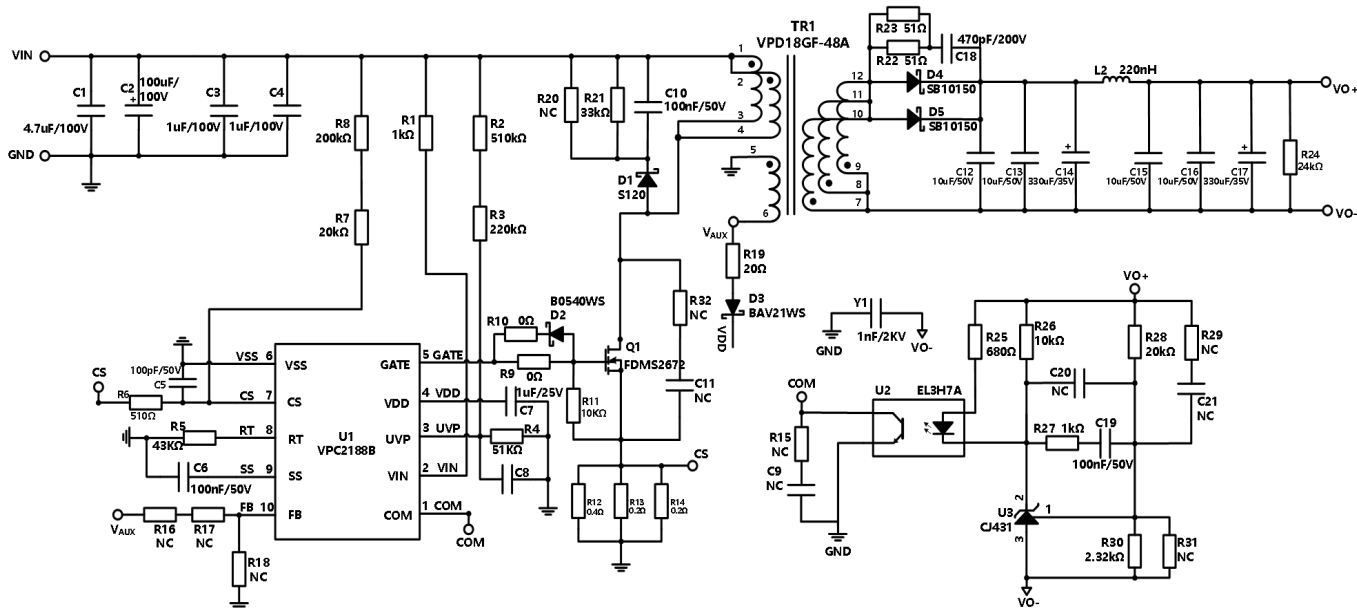


图 1: VPC2188B Demo 板(尺寸:78.6mm*36mm)

关键词：输入：36V-72V，输出 24V/48W，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

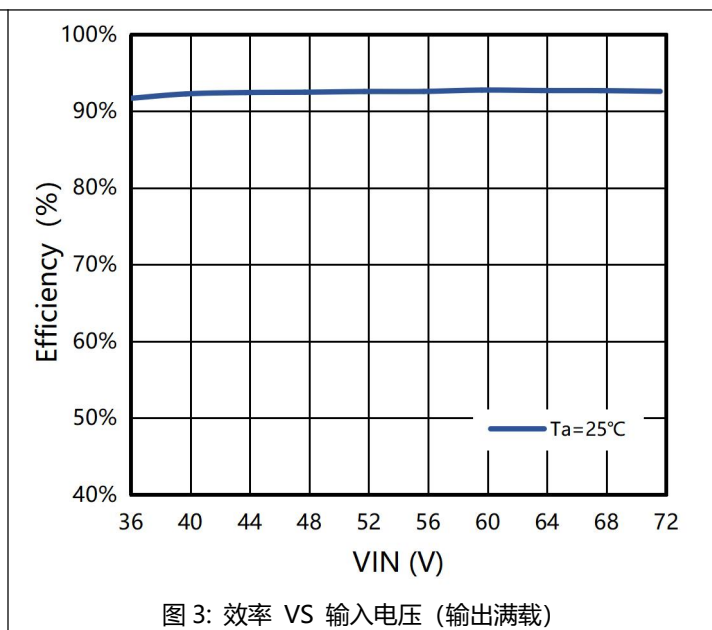
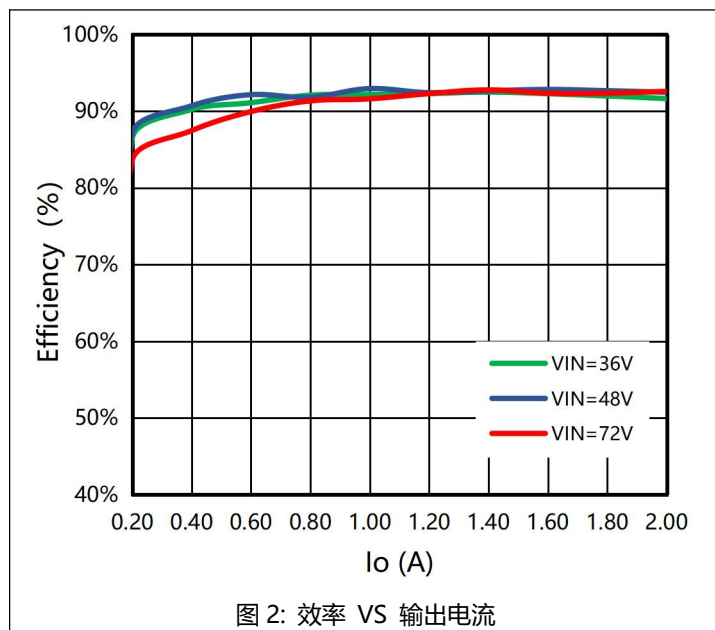
位号	参数	封装	型号	品牌
C1	4.7uF/100V-X7R	1210	FS32X475K101EGG	PSA
C2	100uF±20%/100V	D10xL16mm	01EC0961	KNSCHA
C3	1uF/100V-X7R	1206	CC1206KKX7R0BB105	YAGEO
C4	1uF/100V-X7R	1206	CC1206KKX7R0BB105	YAGEO
C5	100pF/50V-X7R	0603	CC0603KRX7R9BB101	YAGEO
C6	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C7	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C8	NC	-	-	-
C9	NC	-	-	-
C10	100nF/50V-X7R	1206	CC1206KRX7R9BB104	YAGEO
C11	NC	-	-	-
C12	10uF/50V-X5R	1206	FS31B106K500EPG	PSA
C13	10uF/50V-X5R	1206	FS31B106K500EPG	PSA
C14	330uF±20%/35V	D10xL12.5mm	35YXJ330M10X12.5	RUBYCON
C15	10uF/50V-X5R	1206	FS31B106K500EPG	PSA
C16	10uF/50V-X5R	1206	FS31B106K500EPG	PSA
C17	330uF±20%/35V	D10xL12.5mm	35YXJ330M10X12.5	RUBYCON
C18	680pF+1%/50V-NP0	1206	CC1206FRNPO9BN681	YAGEO
C19	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C20	NC	-	-	-
C21	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
L2	220nH±20%/12.5A	SMD,4.2x4.4x1.8mm	MWSA0402S-R22MT	Sunlord
R1	1KΩ±1%	0603	RC0603FR-071KL	YAGEO
R2	510KΩ±1%	0603	RC0603FR-07510KL	YAGEO
R3	220KΩ±1%	0603	RC0603FR-07220KL	YAGEO
R4	51KΩ±1%	0603	RC0603FR-0751KL	YAGEO
R5	43KΩ±1%	0603	RC0603FR-0743KL	YAGEO
R6	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R7	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R8	200KΩ±1%	0603	RC0603FR-07200KL	YAGEO
R9	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R10	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R11	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R12	0.4Ω±1%	1206	RL1206FR-070R4L	YAGEO
R13	0.2Ω±1%	1206	RL1206FR-070R2L	YAGEO
R14	0.2Ω±1%	1206	RL1206FR-070R2L	YAGEO
R15	NC	-	-	-
R16	NC	-	-	-
R17	NC	-	-	-
R18	NC	-	-	-

R19	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R20	NC	-	-	-
R21	33KΩ±1%	1206	RC1206FR-0733KL	YAGEO
R22	51Ω±1%	1206	RC1206FR-0751RL	YAGEO
R23	51Ω±1%	1206	RC1206FR-0751RL	YAGEO
R24	24KΩ±1%	1206	RC1206FR-0724KL	YAGEO
R25	680Ω±1%	0603	RC0603FR-07680RL	YAGEO
R26	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R27	1KΩ±1%	0603	RC0603FR-071KL	YAGEO
R28	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R29	NC	-	-	-
R30	2.32KΩ±1%	0603	RC0603DR-072K32L	YAGEO
R31	NC	-	-	-
R32	NC	-	-	-
TR1	NP:NS:NA=22:15:8 Lp=42uH	EFD20	VPD18GF-48A	VPSC
Q1	N 沟道 200V 20A	PDFN-8	FDMS2672	onsemi
D1	200V/1A	SOD-123FL	S120	YANGJIE
D2	40V/0.5A	SOD-323	B0540WS	CJ
D3	200V/0.2A	SOD-323	BAV21WS	CJ
D4	150V/10A	TO-277	SB10150	GOODWORK
D5	150V/10A	TO-277	SB10150	GOODWORK
U1	4-100VIN 电源管理芯片	MSOP-10	VPC2188B	VPSC
U2	CTR=80~160, Viso=3750VAC	SSOP-4	EL3H7A	EVERLIGHT
U3	Vref=2.495V	SOT23-3	CJ431	CJ

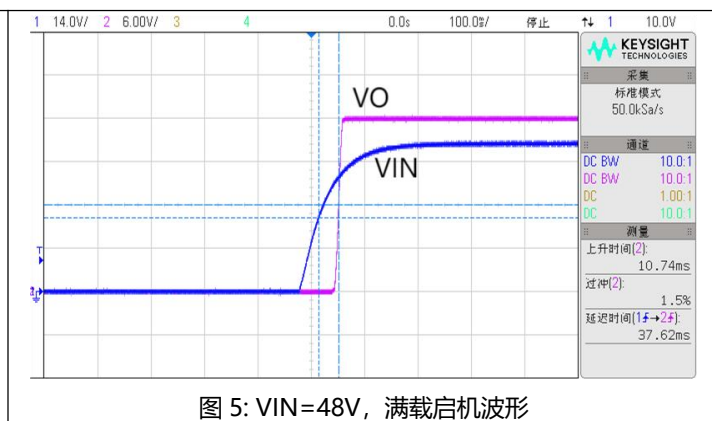
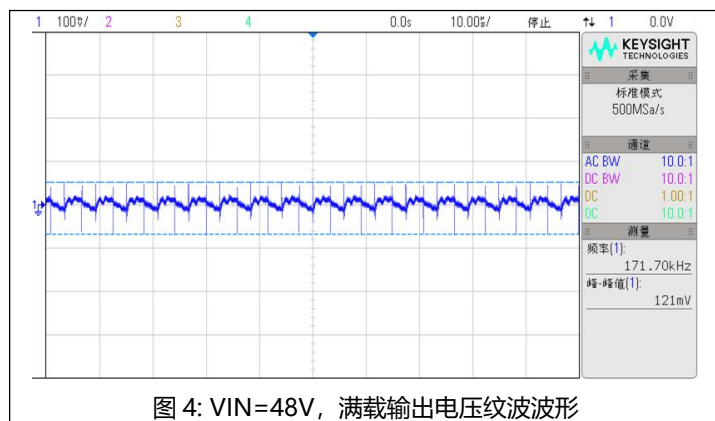
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=48V	6	---	1086	mA
转换效率	VIN=48V, IO=2A	---	92.47	---	%
纹波&噪声	VIN=48V, IO=2A	---	120	180	mV
输出电压精度	VIN=48V, IO=2A	---	0.5	---	%
线性调节率	VIN=36V-72V, IO=2A	---	0.5	---	%
负载调整率	VIN=48V, IO=2A	---	0.5	---	%
输入欠压保护	锁定电压	---	31.0	---	V
	恢复电压	---	33.9	---	V
短路保护	VIN=36V-72V	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

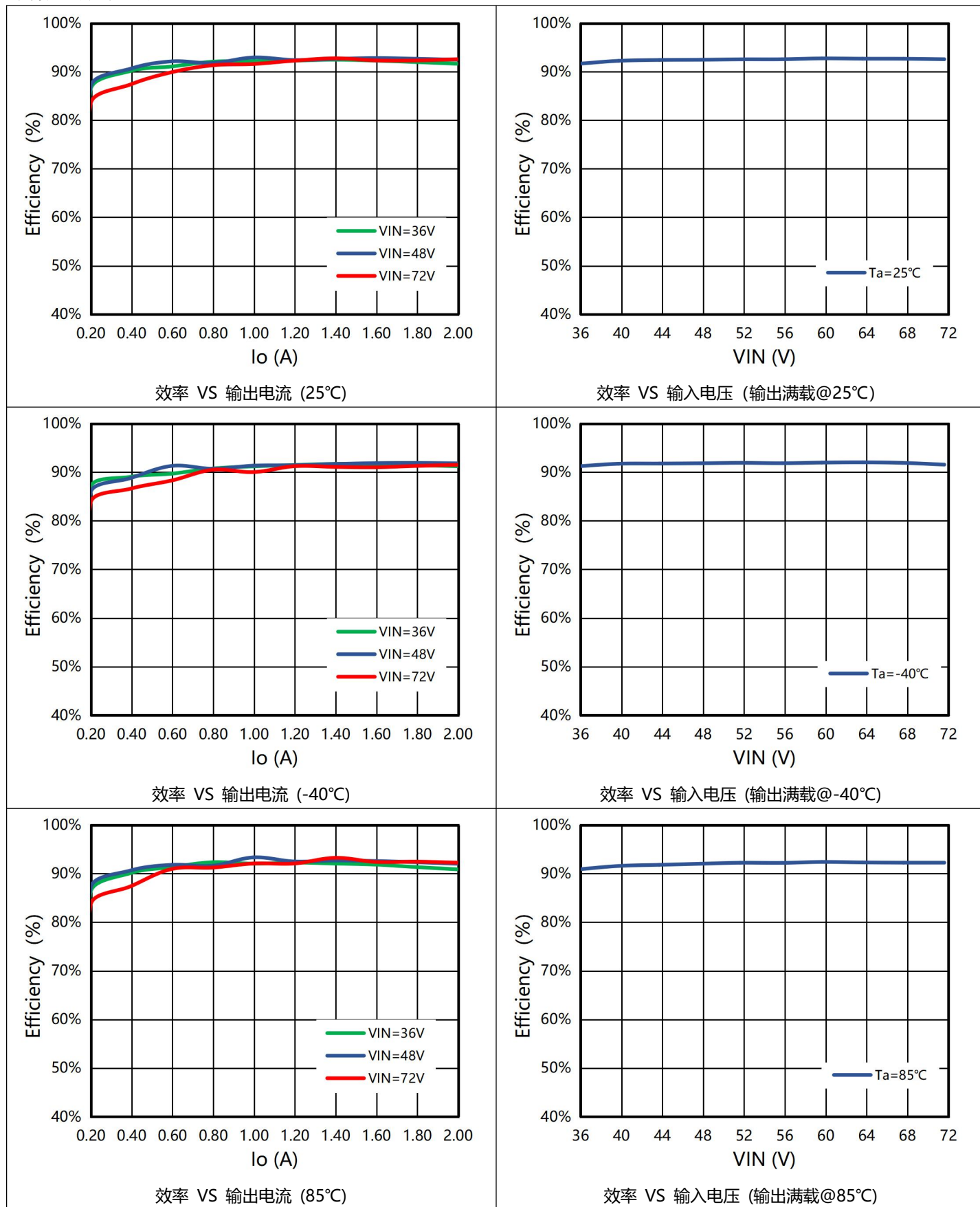


相关波形



详细测试数据

高低温测试曲线



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(%)
47.8	0.006	24.02	0	0%	0.00%
47.8	0.115	24.02	0.199	10%	86.96%
47.8	0.221	24.01	0.399	20%	90.69%
47.8	0.326	24.01	0.598	30%	92.14%
47.7	0.437	24.01	0.797	40%	91.80%
47.7	0.540	24.01	0.997	50%	92.93%
47.7	0.652	24.01	1.197	60%	92.41%
47.7	0.759	24.01	1.397	70%	92.65%
47.7	0.866	24.01	1.597	80%	92.82%
47.7	0.975	24.01	1.795	90%	92.67%
47.7	1.086	24.01	1.995	100%	92.47%

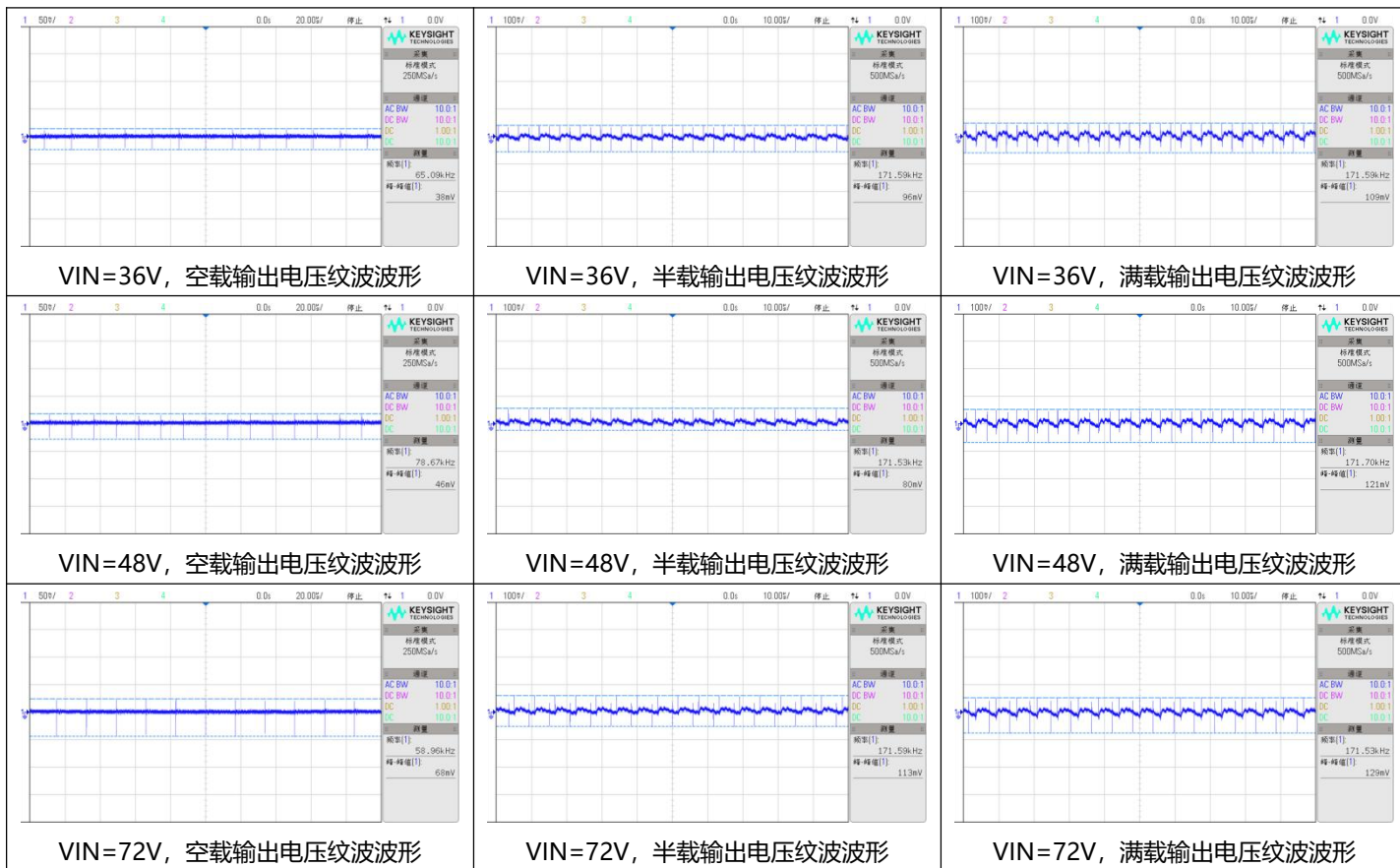
VIN=48V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.8	0.005	23.81	0	0%	0.00%
47.8	0.115	23.8	0.198	10%	85.73%
47.8	0.223	23.79	0.398	20%	88.83%
47.8	0.326	23.79	0.598	30%	91.30%
47.7	0.438	23.78	0.797	40%	90.71%
47.8	0.543	23.78	0.997	50%	91.34%
47.7	0.653	23.79	1.197	60%	91.42%
47.7	0.760	23.79	1.397	70%	91.68%
47.7	0.867	23.79	1.597	80%	91.87%
47.7	0.975	23.8	1.796	90%	91.91%
47.7	1.085	23.81	1.996	100%	91.83%

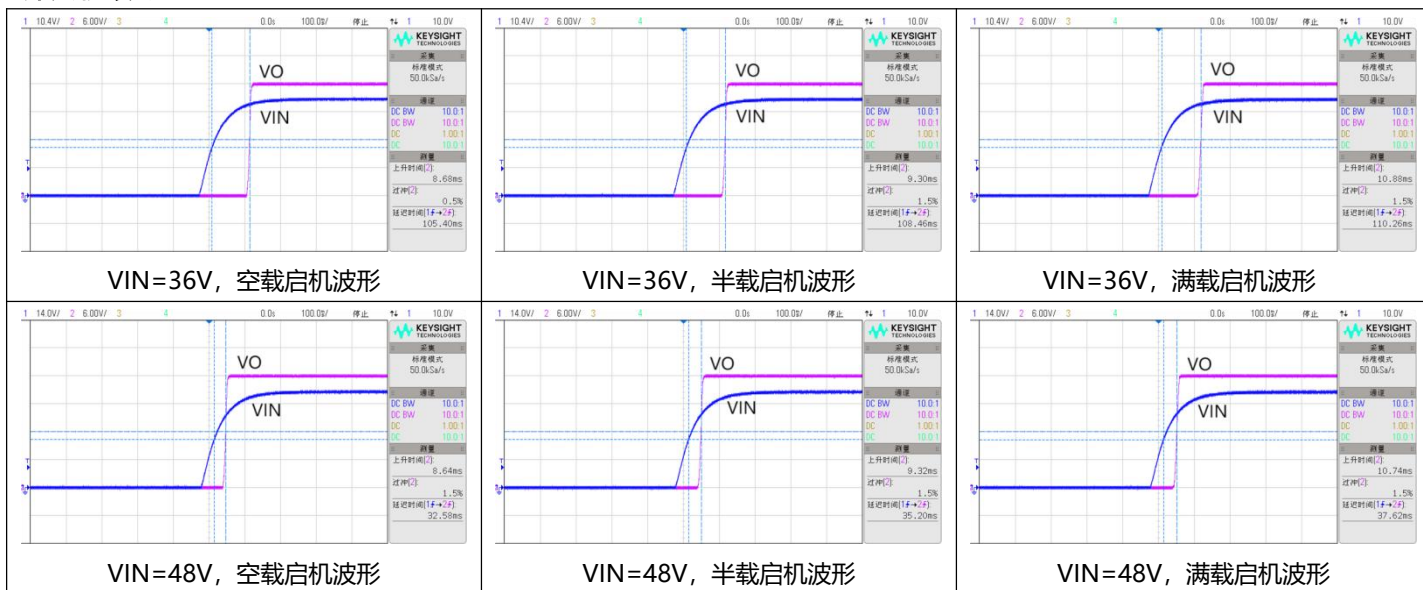
VIN=48V, Ta=85°C, 输入、输出及效率数据:

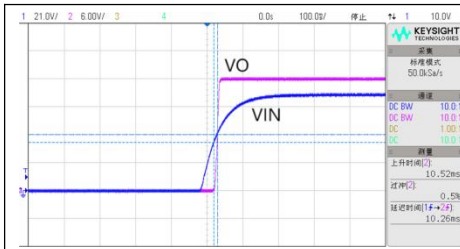
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.8	0.007	24.06	0	0%	0.00%
47.8	0.115	24.06	0.199	10%	87.10%
47.8	0.221	24.07	0.398	20%	90.69%
47.8	0.328	24.07	0.598	30%	91.81%
47.8	0.438	24.07	0.797	40%	91.63%
47.7	0.539	24.07	0.997	50%	93.34%
47.7	0.653	24.07	1.197	60%	92.50%
47.7	0.761	24.07	1.398	70%	92.70%
47.7	0.870	24.06	1.597	80%	92.59%
47.7	0.981	24.06	1.796	90%	92.35%
47.7	1.094	24.06	1.996	100%	92.03%

输出电压纹波波形

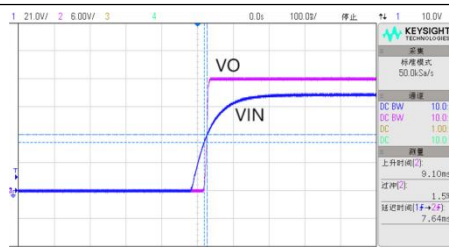


开关机波形

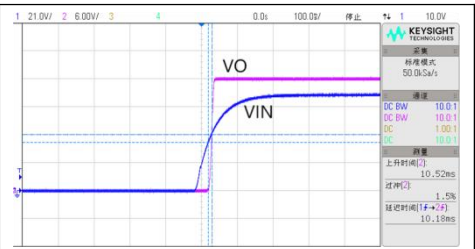




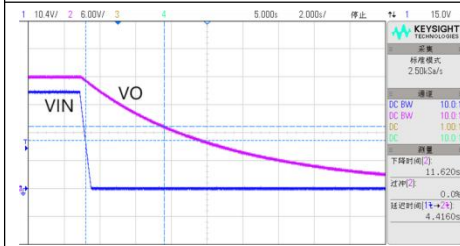
VIN=72V, 空载启机波形



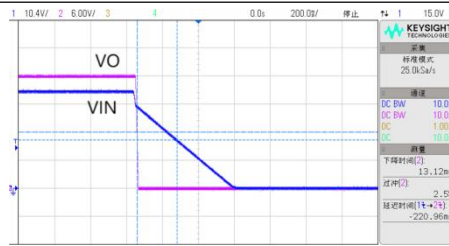
VIN=72V, 半载启机波形



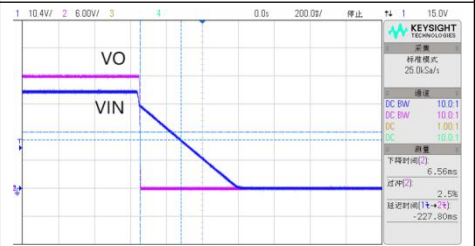
VIN=72V, 满载启机波形



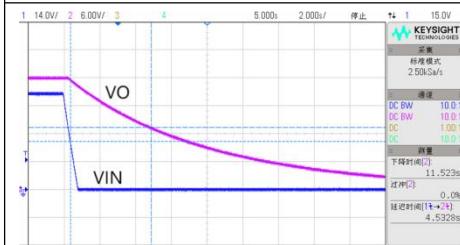
VIN=36V, 空载关机波形



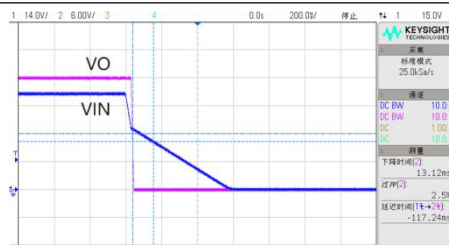
VIN=36V, 半载关机波形



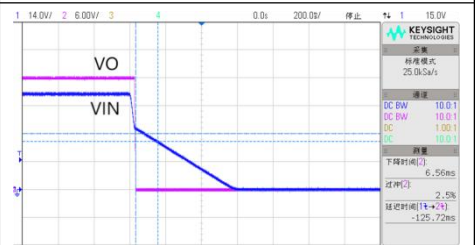
VIN=36V, 满载关机波形



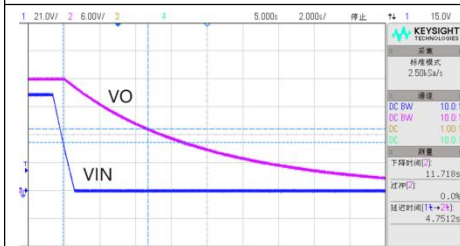
VIN=48V, 空载关机波形



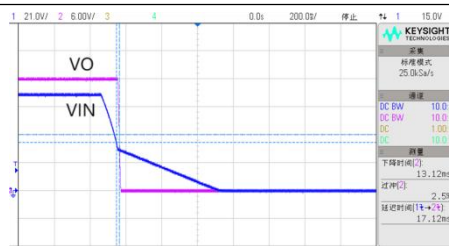
VIN=48V, 半载关机波形



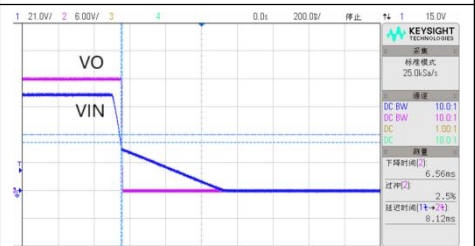
VIN=48V, 满载关机波形



VIN=72V, 空载关机波形

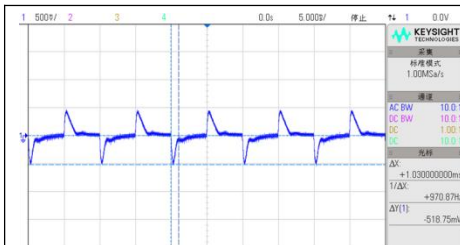


VIN=72V, 半载关机波形

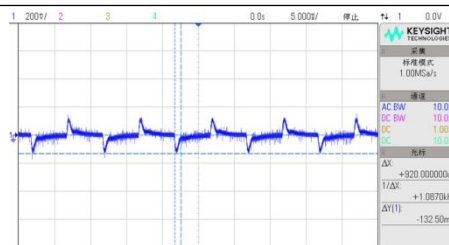


VIN=72V, 满载关机波形

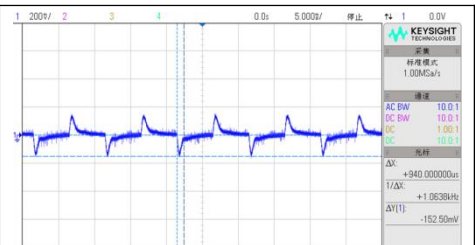
动态波形



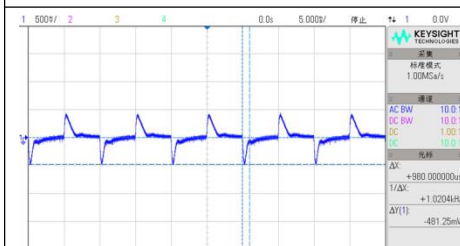
VIN=36V, 100%-10%-100%Io 动态波形



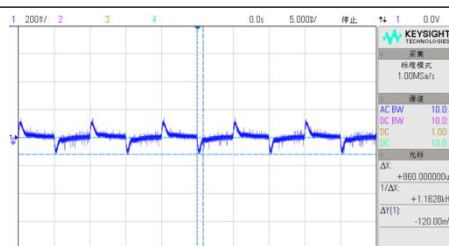
VIN=36V, 75%-50%-75%Io 动态波形



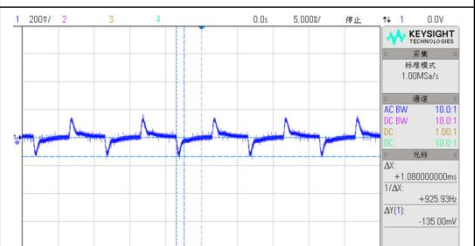
VIN=36V, 50%-25%-50%Io 动态波形



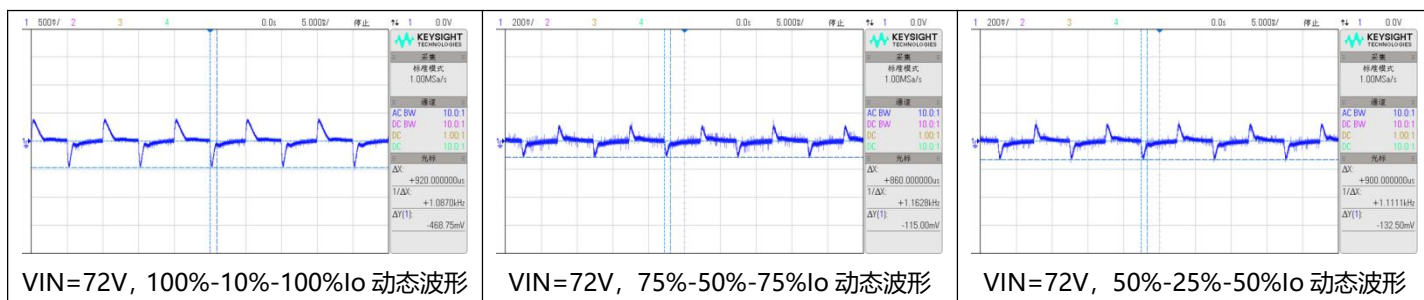
VIN=48V, 100%-10%-100%Io 动态波形



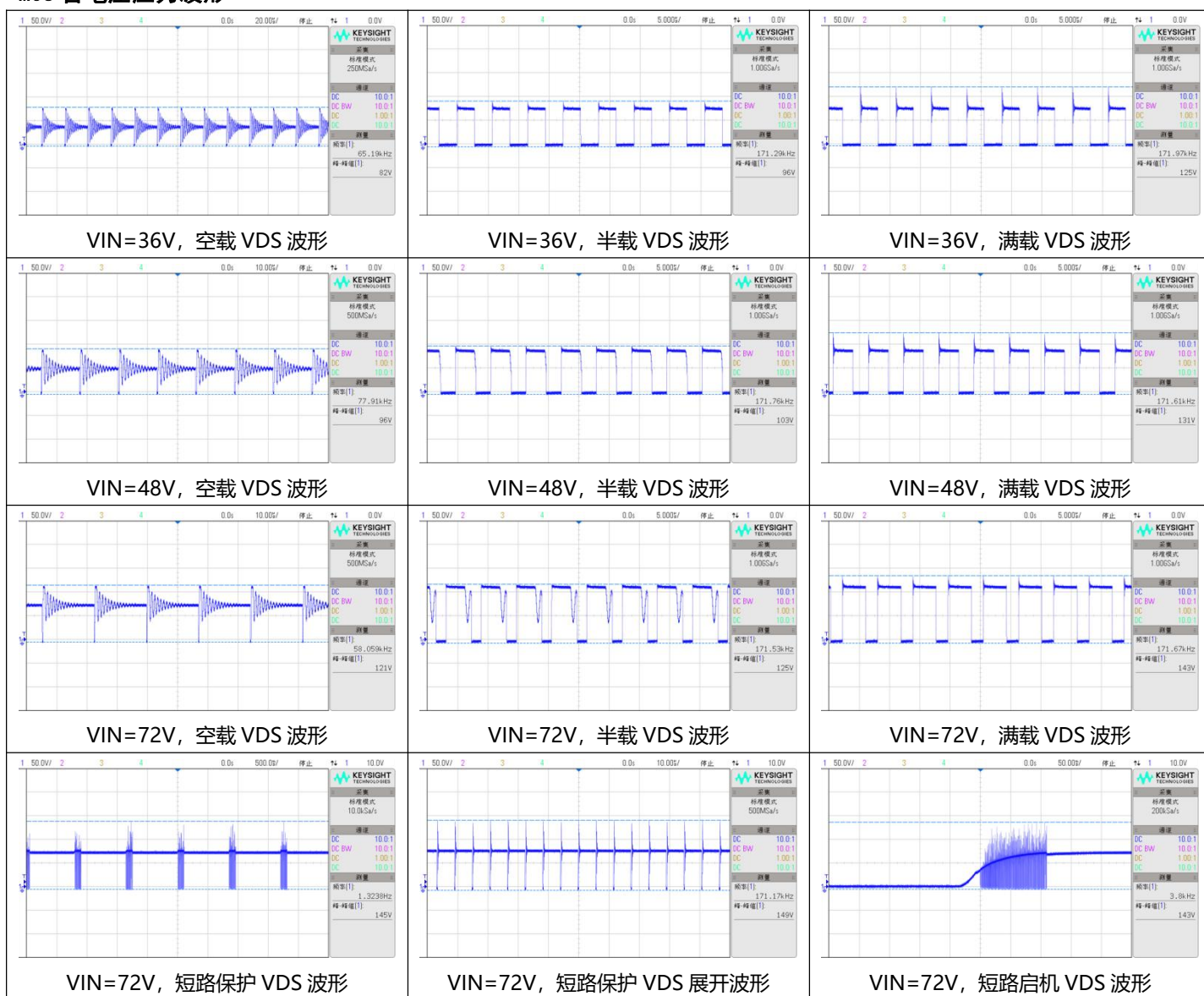
VIN=48V, 75%-50%-75%Io 动态波形



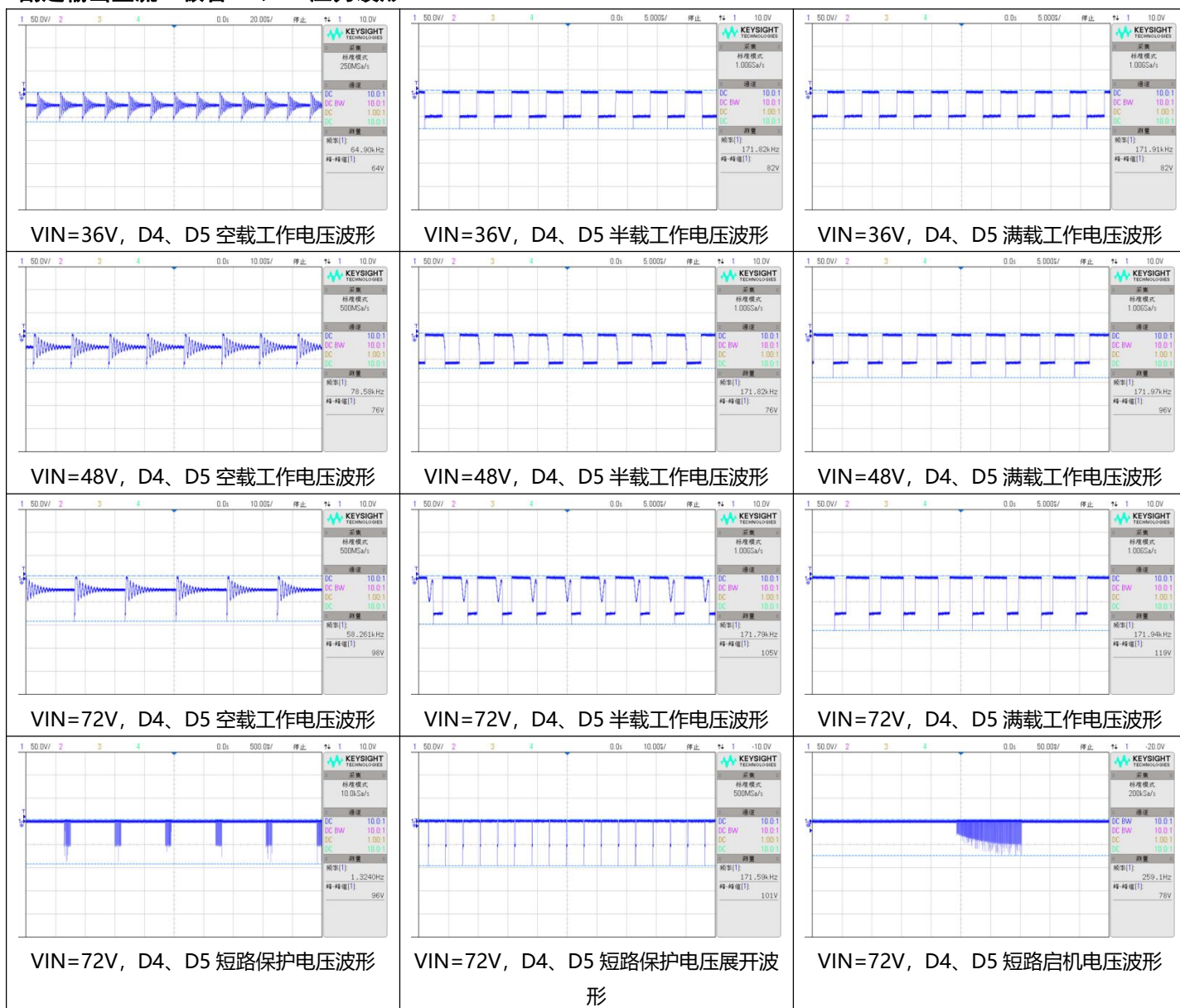
VIN=48V, 50%-25%-50%Io 动态波形



MOS 管电压应力波形



副边输出整流二极管 D4、D5 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。