

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 VPE17VD-12A、输出整流二极管以及必要的阻容元件，实现 6V-60V 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 12W 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：6V-60V，输出 12V/12W，隔离电压：1500VDC

反馈方式：副边反馈-SSR

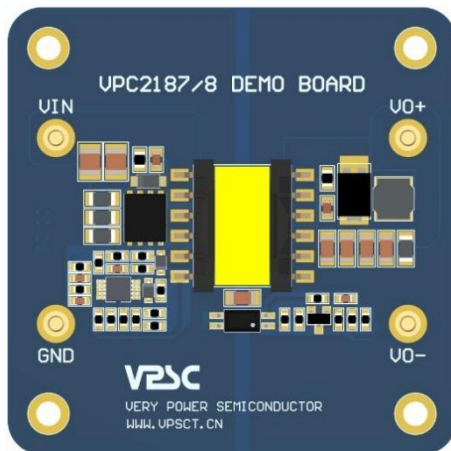
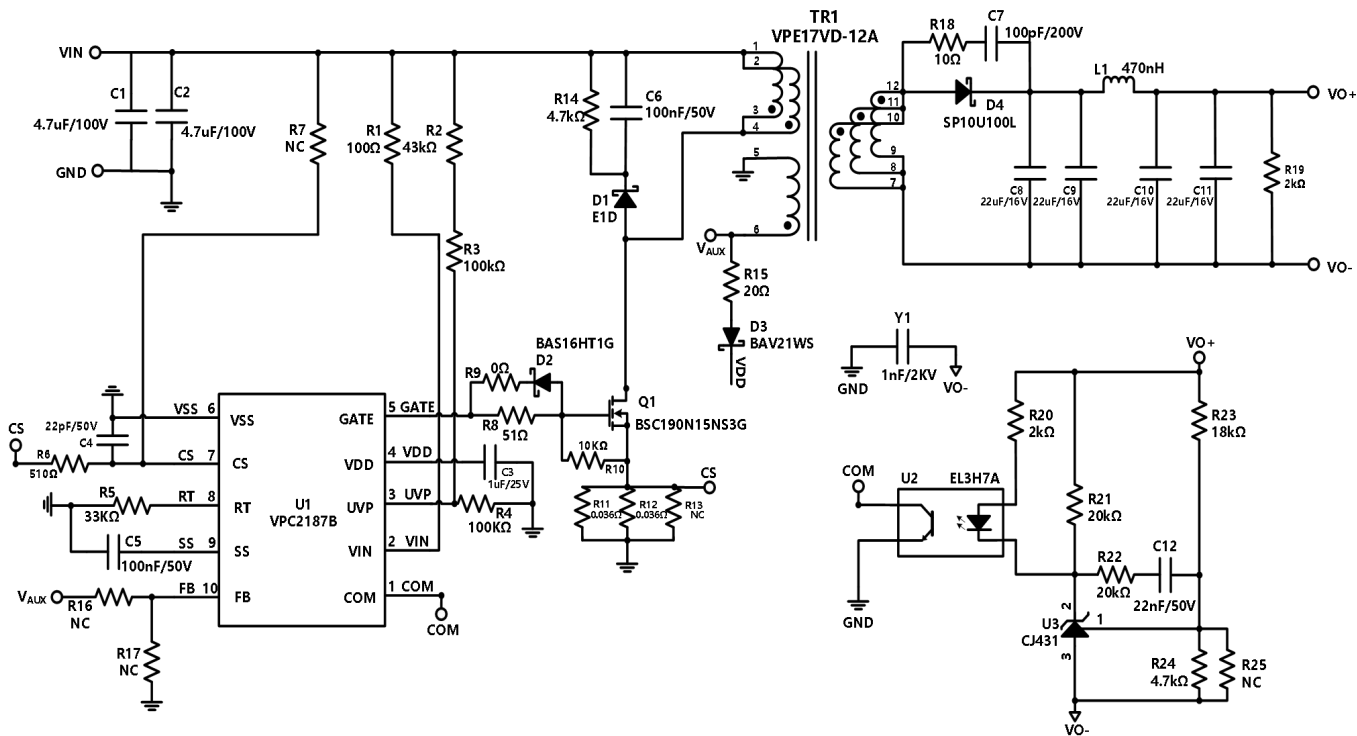


图 1: VPC218xB Demo 板(尺寸:55mm*55mm)

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

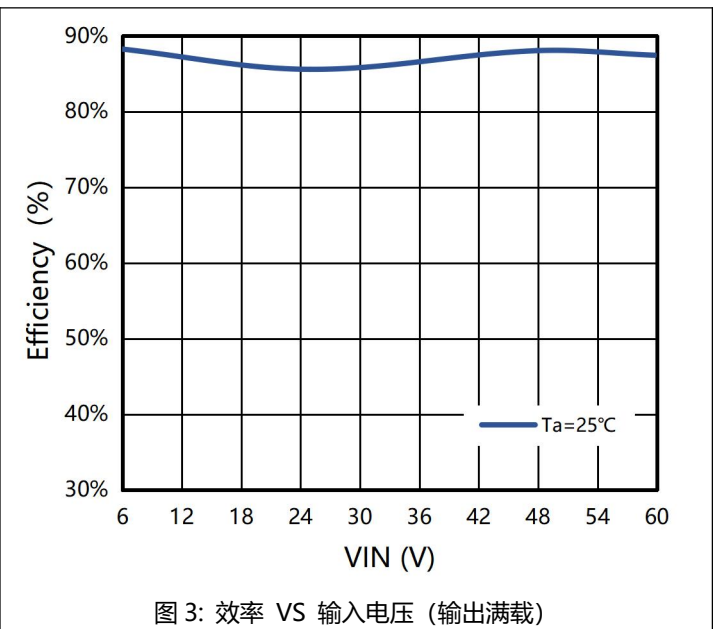
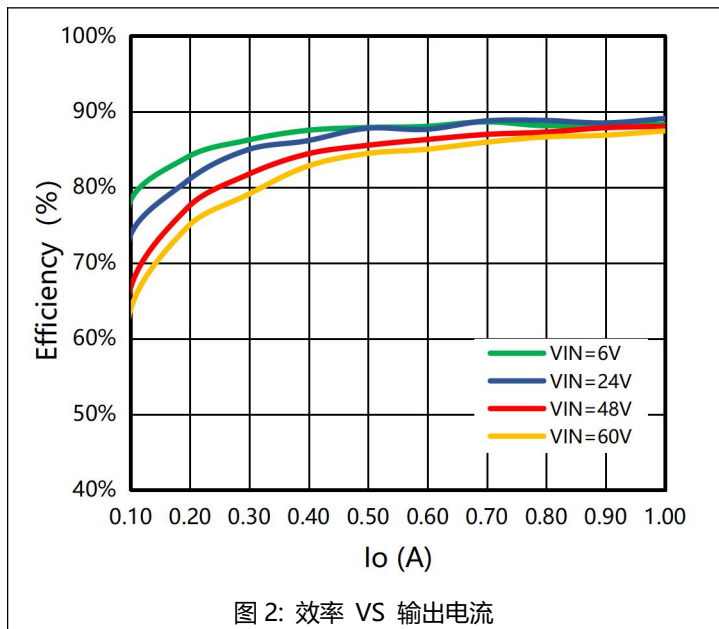
位号	参数	封装	型号	品牌
C1	4.7uF/100V	1210	1210B475K101NT	FH(风华)
C2	4.7uF/100V	1210	1210B475K101NT	FH(风华)
C3	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C4	22pF/50V-NP0	0603	CC0603KRNPO9BN220	YAGEO
C5	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C6	100nF/50V-X7R	0805	CC0805KKX7R0BB104	YAGEO
C7	100pF/200V- NP0	0805	CC0805JRNPOABN101	YAGEO
C8	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C9	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C10	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C11	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C12	22nF/50V-X7R	0603	CC0603KRX7R9BB223	YAGEO
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	100Ω±1%	0603	RC0603FR-07100RL	YAGEO
R2	43KΩ±1%	0603	RT0603FRE0743KL	YAGEO
R3	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R4	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R5	33KΩ±1%	0603	AC0603FR-0733KL	YAGEO
R6	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R7	NC	-	-	-
R8	51Ω±1%	0603	RC0603FR-0751RL	YAGEO
R9	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R10	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R11	0.036Ω ±1%	1206	RL1206FR-070R036L	YAGEO
R12	0.036Ω ±1%	1206	RL1206FR-070R036L	YAGEO
R13	NC	-	-	-
R14	4.7KΩ±1%	0805	RC0805FR-074K7L	YAGEO
R15	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R16	NC	-	-	-
R17	NC	-	-	-
R18	10Ω±1%	0805	RC0805FR-0710RL	YAGEO
R19	2KΩ±1%	1206	RC1206FR-072KL	YAGEO
R20	2KΩ±1%	0603	RC0603FR-072KL	YAGEO
R21	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R22	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R23	18KΩ±1%	0603	RC0603FR-0718KL	YAGEO
R24	4.7KΩ±1%	0603	RC0603FR-074K7L	YAGEO
R25	NC	-	-	-
TR1	NP:NS:NA=5:5:5 Lp=3.5uH	ER14.5	VPE17VD-12A	VPSC

Q1	N 沟道 150V 50A	PG-TDSON-8	BSC190N15NS3G	INFINEON
L1	470nH $\pm 30\%$	SMD-5x5x2.9mm	AMWPH5030SR47NT	Sunlord
D1	200V/1A	SOD-123	E1D	YANGJIE
D2	85V/0.2A	SOD-323	BAS16HT1G	ON
D3	200V/0.2A	SOD-323	BAV21WS	CJ
D4	100V/10A	TO-277	SP10U100L	科微杰
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

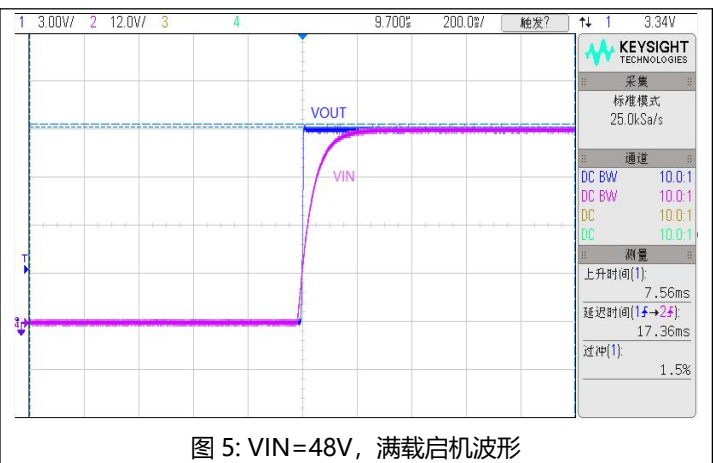
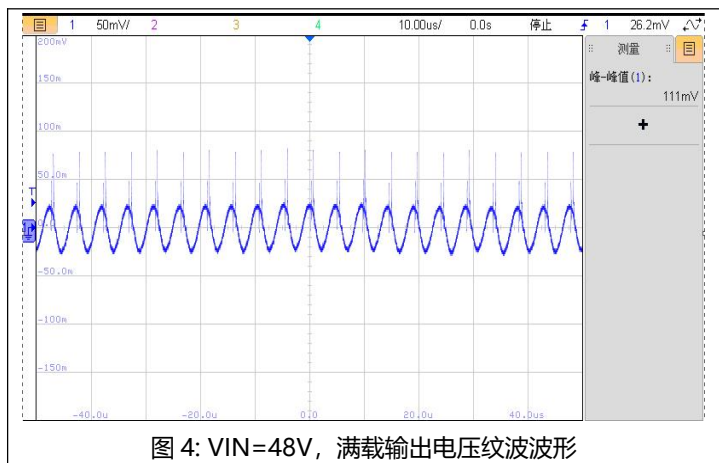
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流（满载/空载）	VIN=48V	5	---	287	mA
转换效率	VIN=48V, IO=1A	---	88.4	---	%
纹波&噪声	VIN=48V, IO=1A	---	46	111	mV
输出电压精度	VIN=48V, IO=1A	---	0.5	---	%
线性调节率	VIN=6V-60V, IO=1A	---	0	---	%
负载调整率	VIN=48V, IO=1.25A	---	0	---	%
短路保护	VIN=6V-60V	可长期保护，自恢复			
工作温度		-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

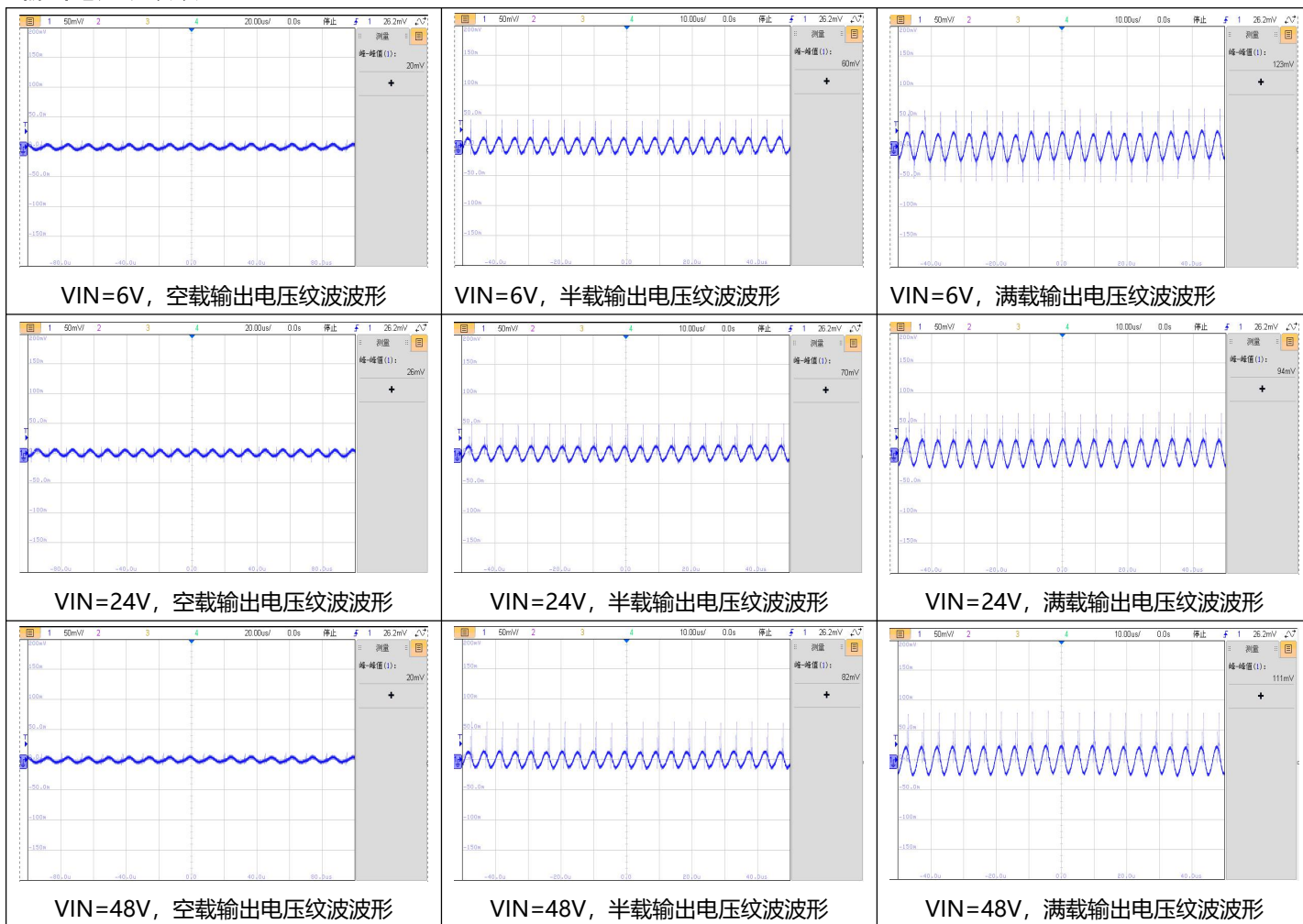


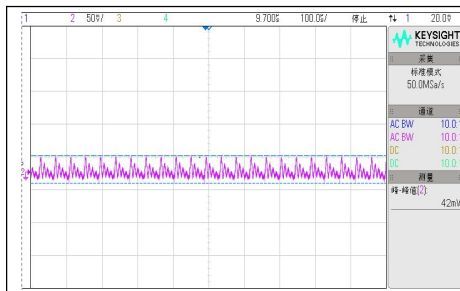
详细测试数据

VIN=48V, Ta=25°C, 输入、输出及效率数据:

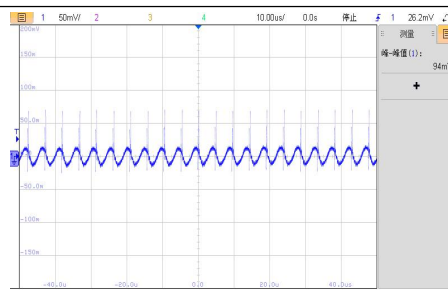
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.9	0.005	12.09	0	0%	0%
47.9	0.037	12.09	0.096	10%	65.49%
47.9	0.067	12.09	0.196	20%	77.30%
47.8	0.092	12.09	0.297	30%	81.65%
47.8	0.119	12.09	0.397	40%	84.38%
47.9	0.147	12.09	0.497	50%	85.51%
47.9	0.175	12.09	0.597	60%	86.28%
47.8	0.203	12.09	0.698	70%	86.97%
47.8	0.231	12.09	0.797	80%	87.27%
47.9	0.258	12.09	0.898	90%	87.85%
47.9	0.287	12.09	0.999	100%	88.04%

输出电压纹波波形

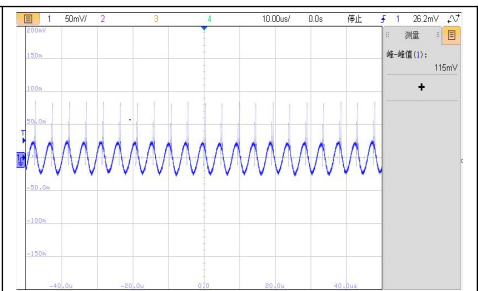




VIN=60V, 空载输出电压纹波波形

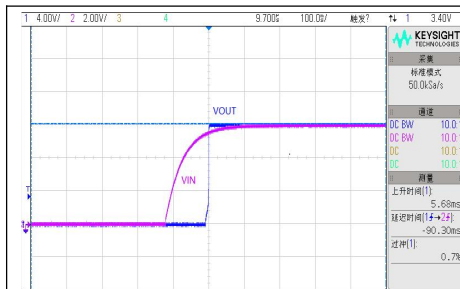


VIN=60V, 半载输出电压纹波波形

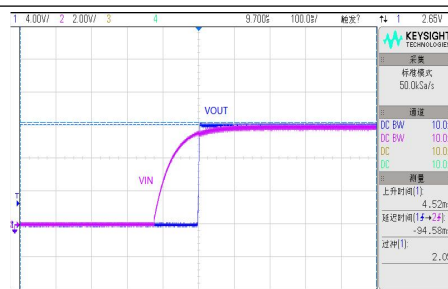


VIN=60V, 满载输出电压纹波波形

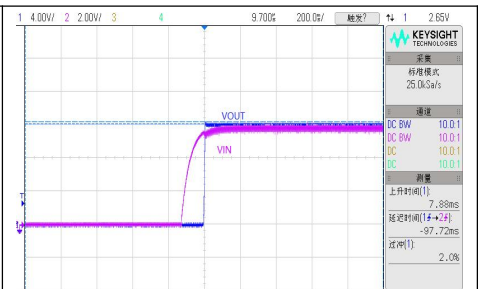
开关机波形



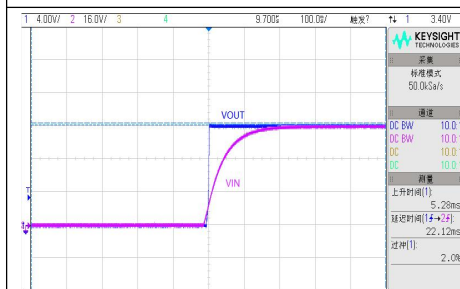
VIN=6V, 空载启机波形



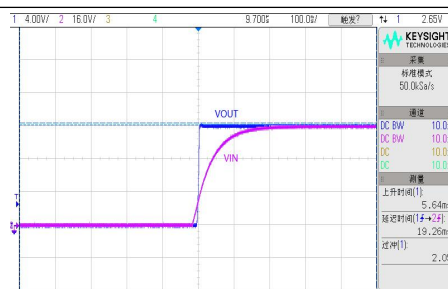
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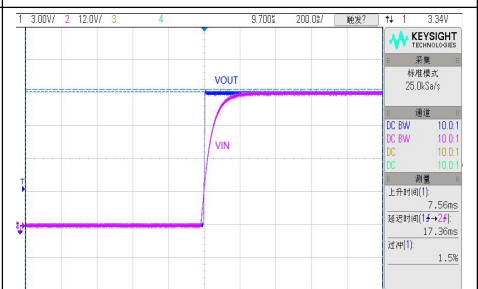
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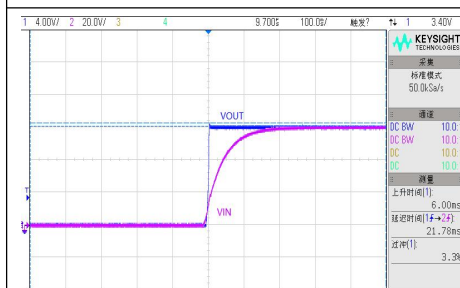
VIN=48V, 空载启机波形



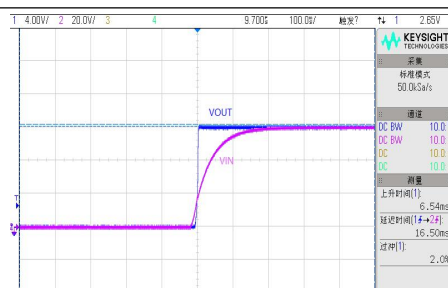
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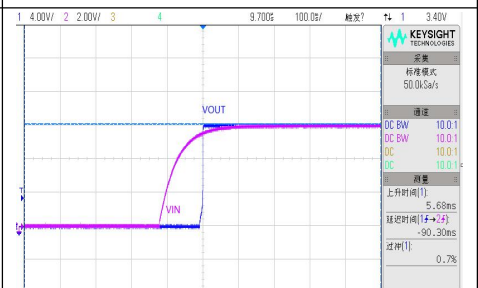
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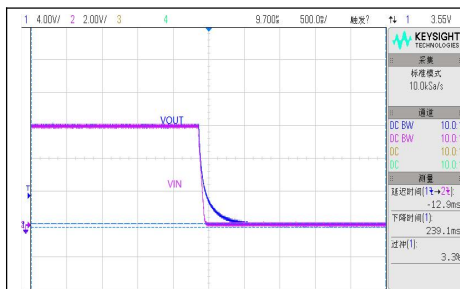
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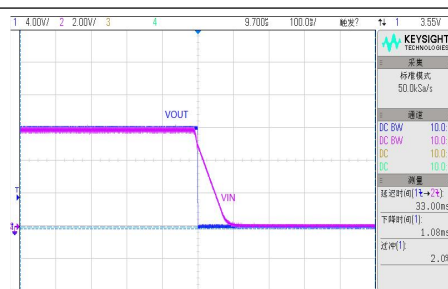
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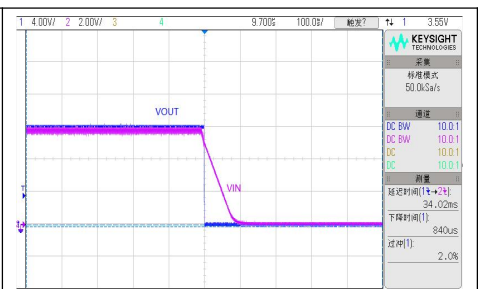
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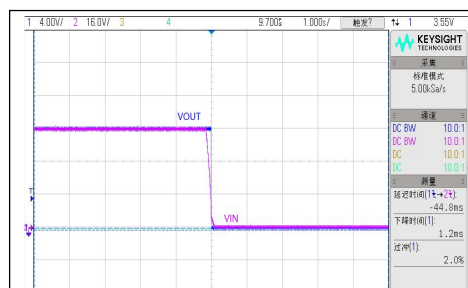
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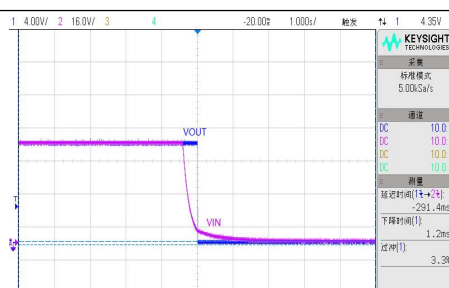
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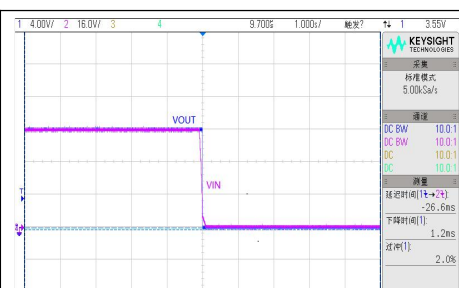
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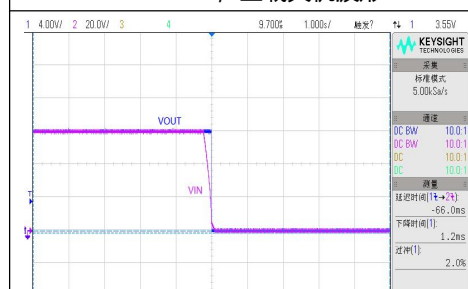
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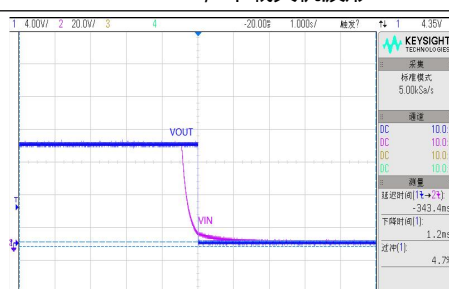
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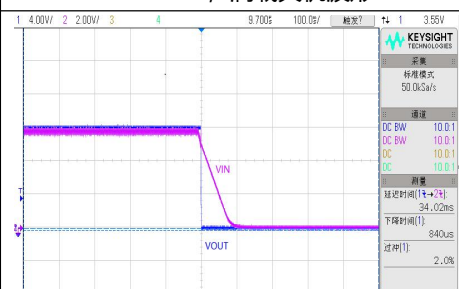
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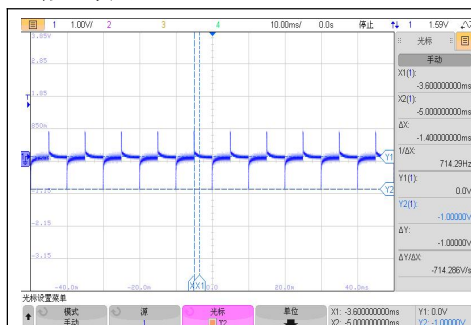


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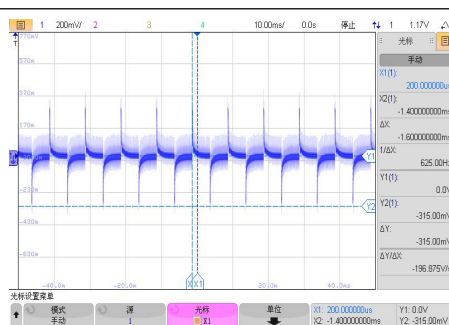


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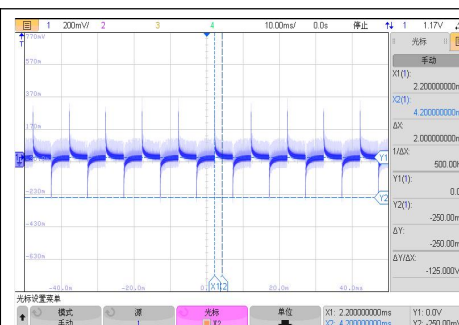
动态波形



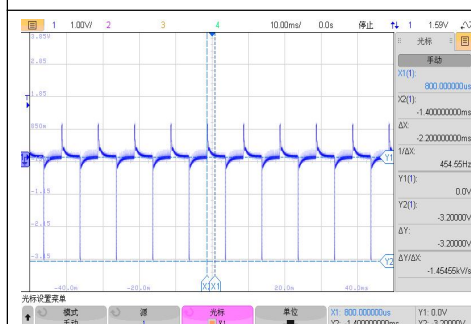
VIN=6V, 100%-10%-100%Io 动态波形



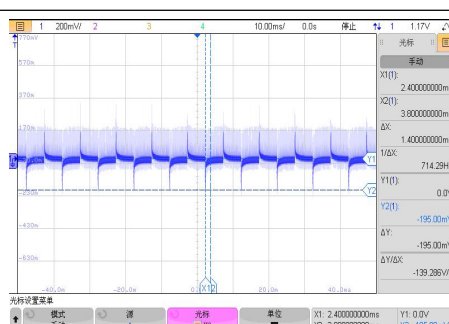
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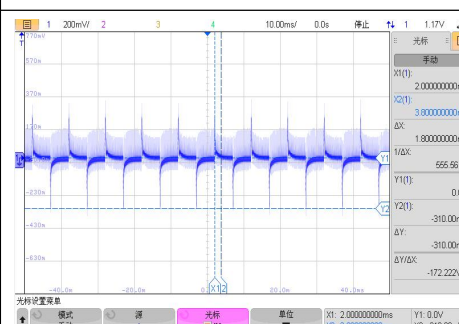
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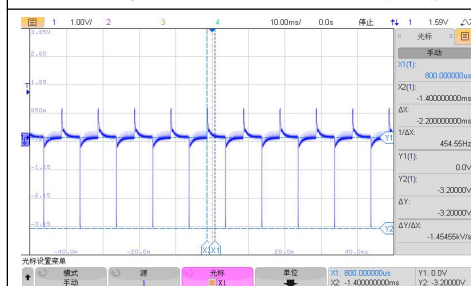
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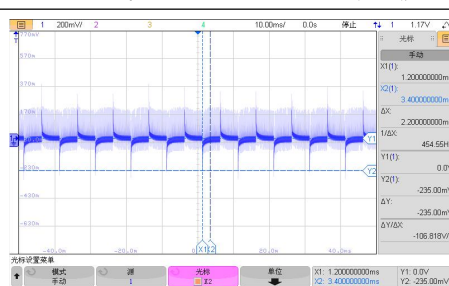
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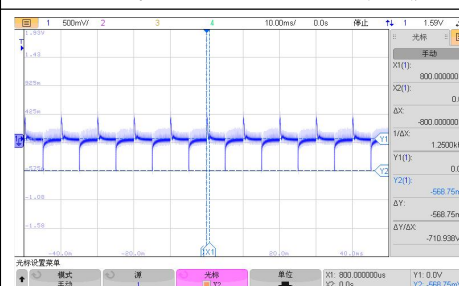
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VIN=60V, 100%-10%-100%Io 动态波形

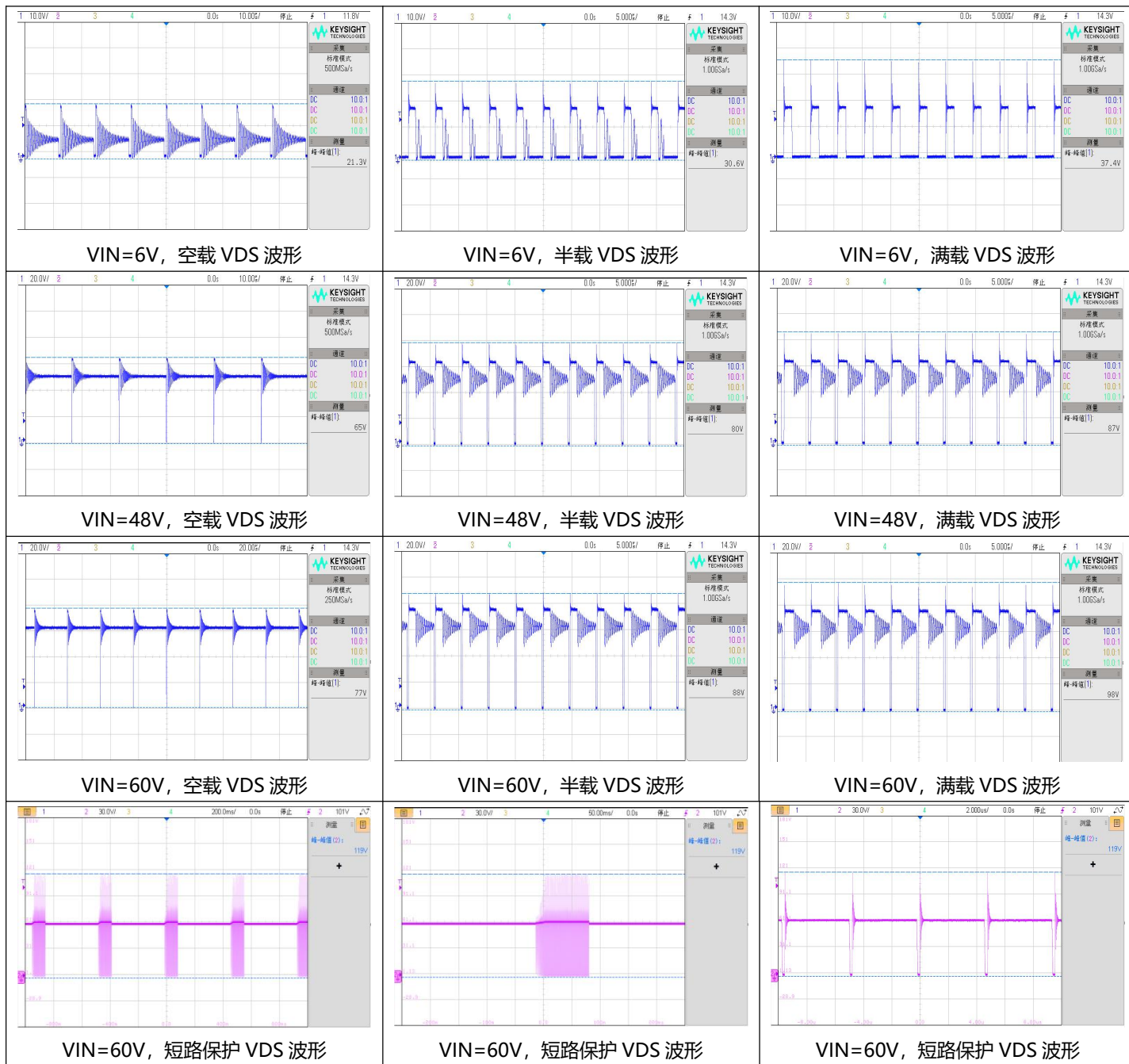


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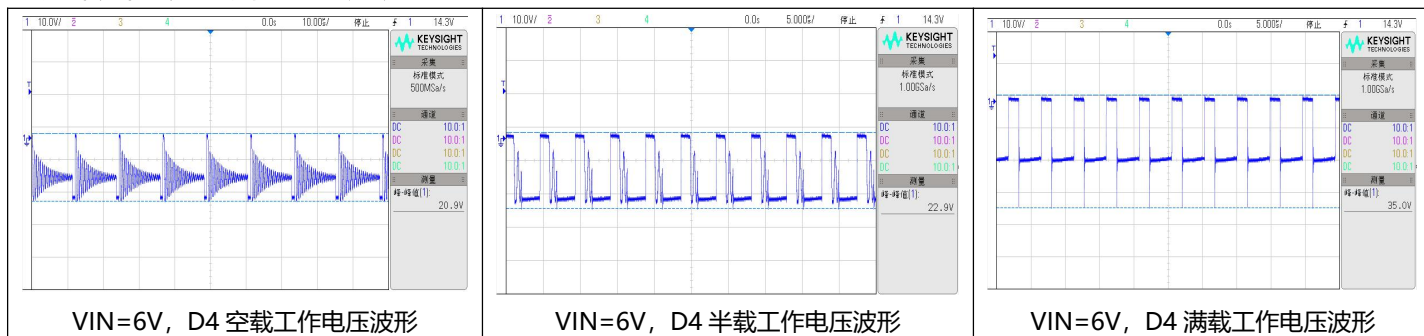


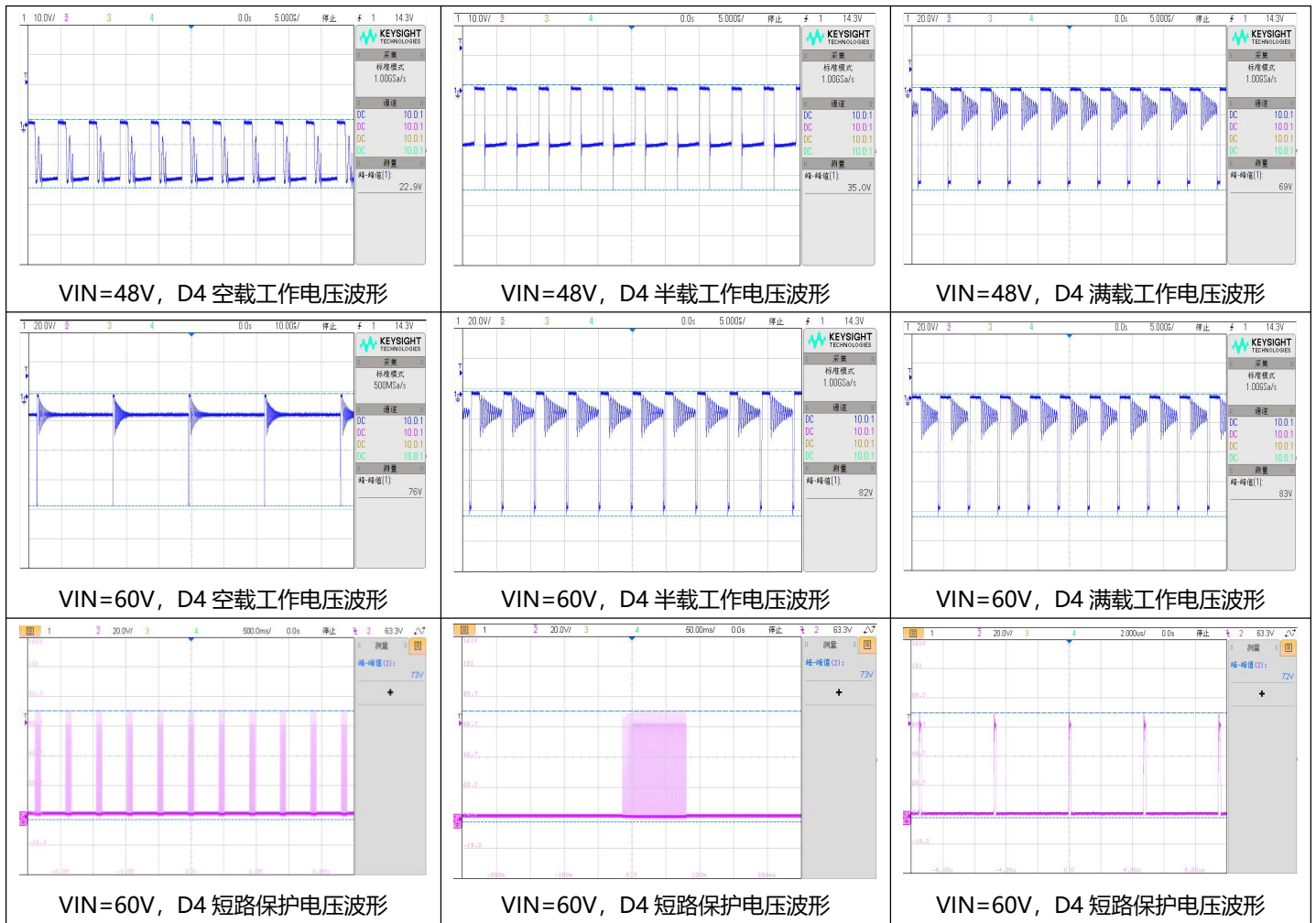
VIN=60V, 50%-25%-50%Io 动态波形

MOS 管应力波形



副边输出整流二极管 D4 应力波形





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