

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 VPE27BMS09B、输出整流二极管以及必要的阻容元件，实现 12V-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 3W 的输出能力，原副边隔离耐压不小于 3000VDC，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。

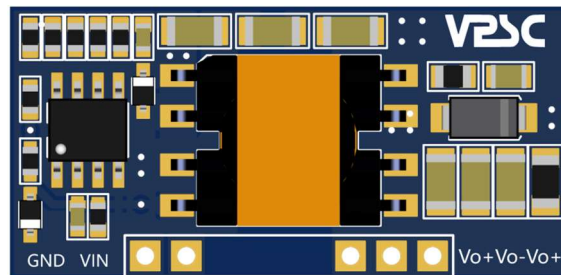
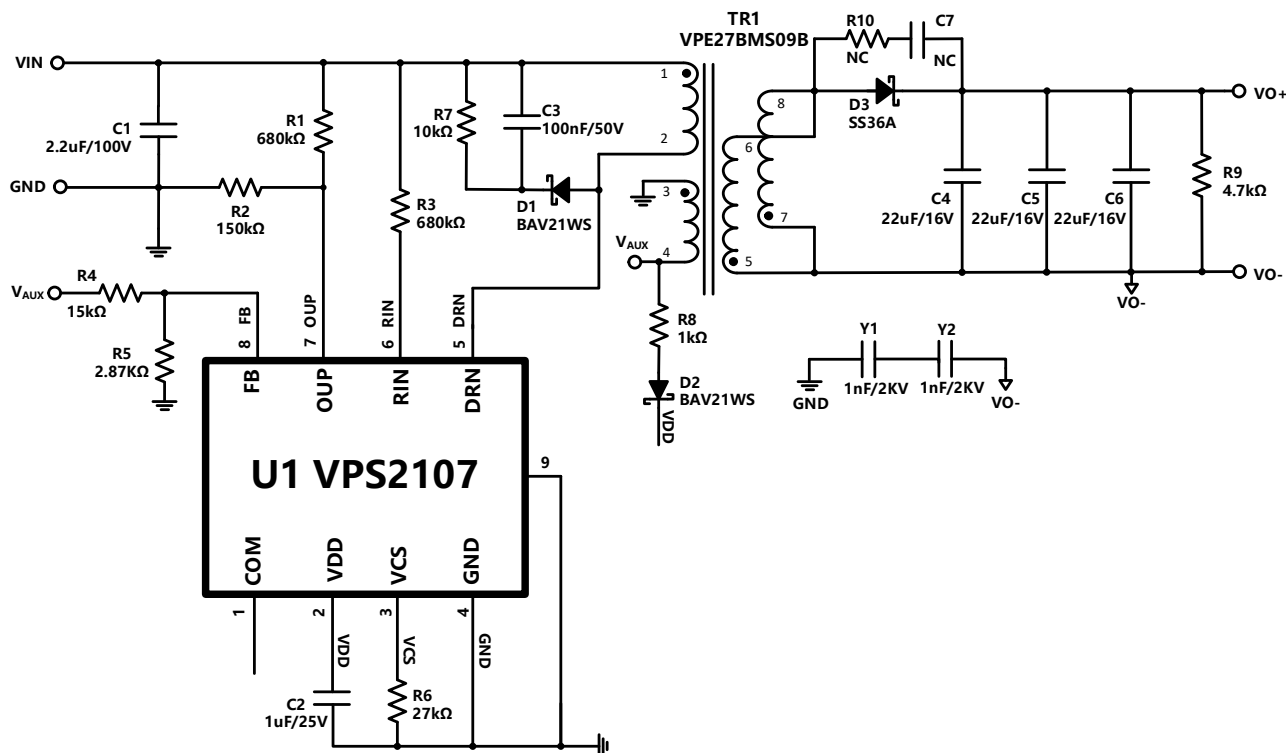


图 1: VPS2107 Demo 板(尺寸:34.5mm*16.8mm)

关键词：输入：12V-60V，输出 12V/3W，隔离电压：3000VDC，反馈方式：原边反馈-PSR

原理图



引脚功能说明

功能	功能描述
VIN	电源输入端
GND	电源接地端
VO+	电源输出正
VO-	电源输出负

物料清单

位号	参数	封装	型号	品牌
C1	2.2uF/100V-X7R	1206	CC1206KKX7R0BB225	YAGEO
C2	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C3	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C4	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C5	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C6	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C7	NC	-	-	-
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
Y2	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	680K Ω ±1%	0603	RC0603FR-07680KL	YAGEO
R2	150K Ω ±1%	0603	RC0603FR-07150KL	YAGEO
R3	680K Ω ±1%	0603	RC0603FR-07680KL	YAGEO
R4	15K Ω ±1%	0603	RC0603FR-0715KL	YAGEO
R5	2.87K Ω ±1%	0603	RC0603FR-072K87L	YAGEO
R6	27K Ω ±1%	0603	RC0603FR-0727KL	YAGEO
R7	10K Ω ±1%	0603	RC0603FR-0710KL	YAGEO
R8	1K Ω ±1%	0603	RC0603FR-071KL	YAGEO
R9	4.7K Ω ±1%	1206	RC1206FR-074K7L	YAGEO
R10	NC	-	-	-
TR1	NP:NS:NA=23:11:11 Lp=79.35uH	ER11.5L	VPE27BMS09B	VPSC
D1	200V/0.2A	SOD-323	BAV21WS	CJ
D2	200V/0.2A	SOD-323	BAV21WS	CJ
D3	60V/3A	SMA	SS36A	MDD
U1	4-80VIN/132V/0.6 Ω 电流模式 PWM 控制器	ESOP-8	VPS2107	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=48V	3	---	75	mA
转换效率	VIN=48V, IO=0.25A	---	84.7	---	%
纹波&噪声	VIN=48V, IO=0.25A	---	50	100	mV
输出电压精度	VIN=48V, IO=0.25A	---	1.3	---	%
线性调节率	VIN=12V-60V, IO=0.25A	---	-2.2	---	%
负载调整率	VIN=48V, IO=0.25A	---	0.2	---	%
输出过流点系数	VIN=48V, IO=0.25A	---	2.8	---	倍
输入欠压保护	锁定电压	---	9.8	---	V
	恢复电压	---	11.2	---	V
短路保护	VIN=12V-60V	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	3000	---	---	VDC

关键性能指标测试结果

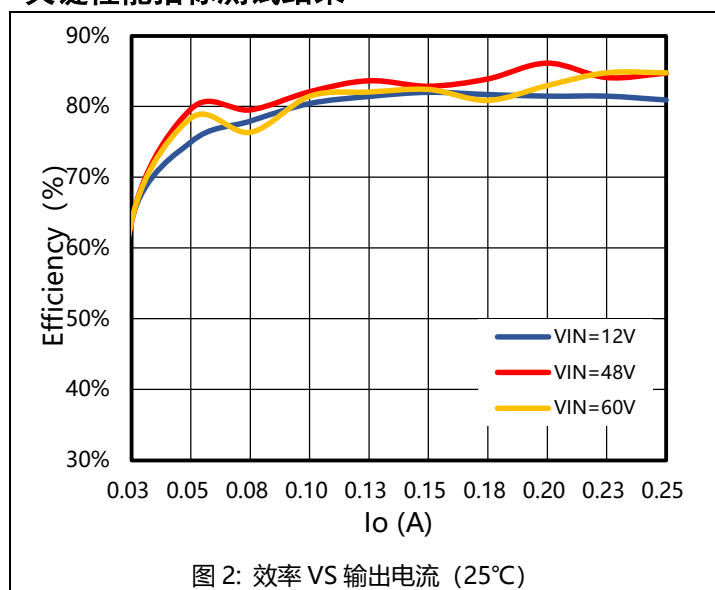


图 2: 效率 VS 输出电流 (25°C)

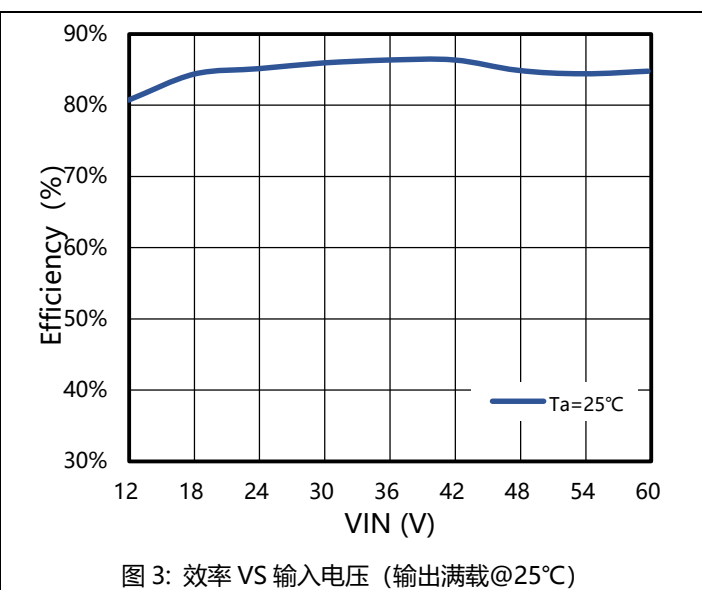


图 3: 效率 VS 输入电压 (输出满载@25°C)

相关波形

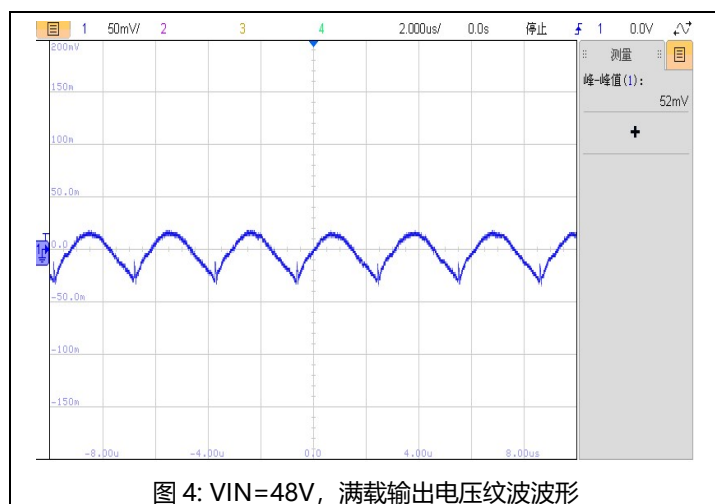


图 4: VIN=48V, 满载输出电压纹波波形

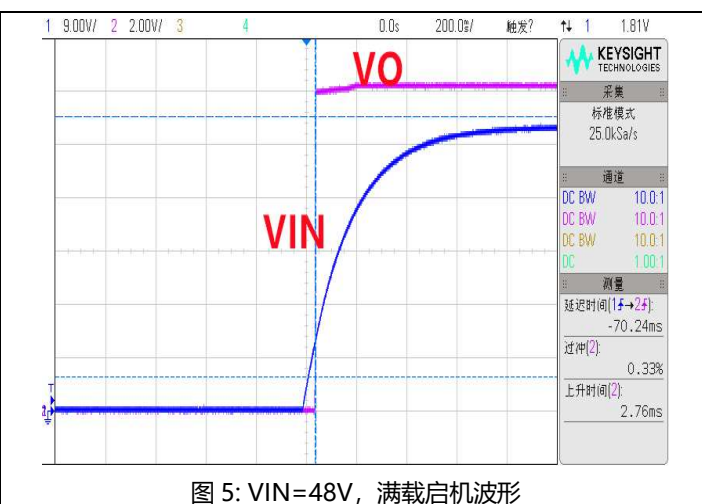
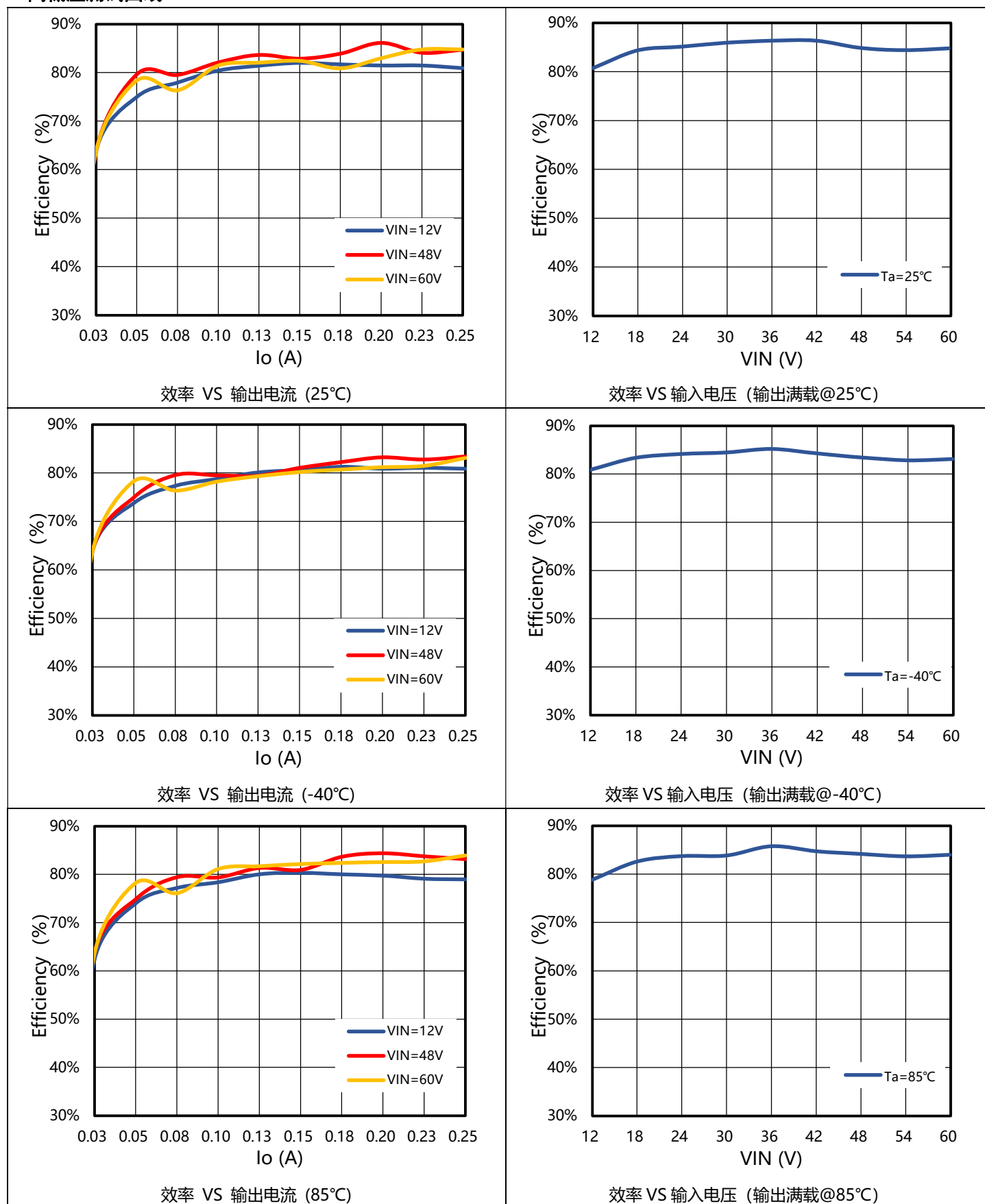


图 5: VIN=48V, 满载启机波形

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(%)
47.80	0.003	12.19	0	0%	0.00%
47.80	0.010	12.19	0.025	10%	63.76%
47.80	0.016	12.19	0.050	20%	79.69%
47.80	0.024	12.17	0.075	30%	79.56%
47.80	0.031	12.17	0.100	40%	82.13%
47.80	0.038	12.16	0.125	50%	83.68%
47.80	0.046	12.15	0.150	60%	82.89%
47.80	0.053	12.15	0.175	70%	83.93%
47.80	0.059	12.15	0.200	80%	86.16%
47.80	0.068	12.15	0.225	90%	84.11%
47.80	0.075	12.15	0.250	100%	84.73%

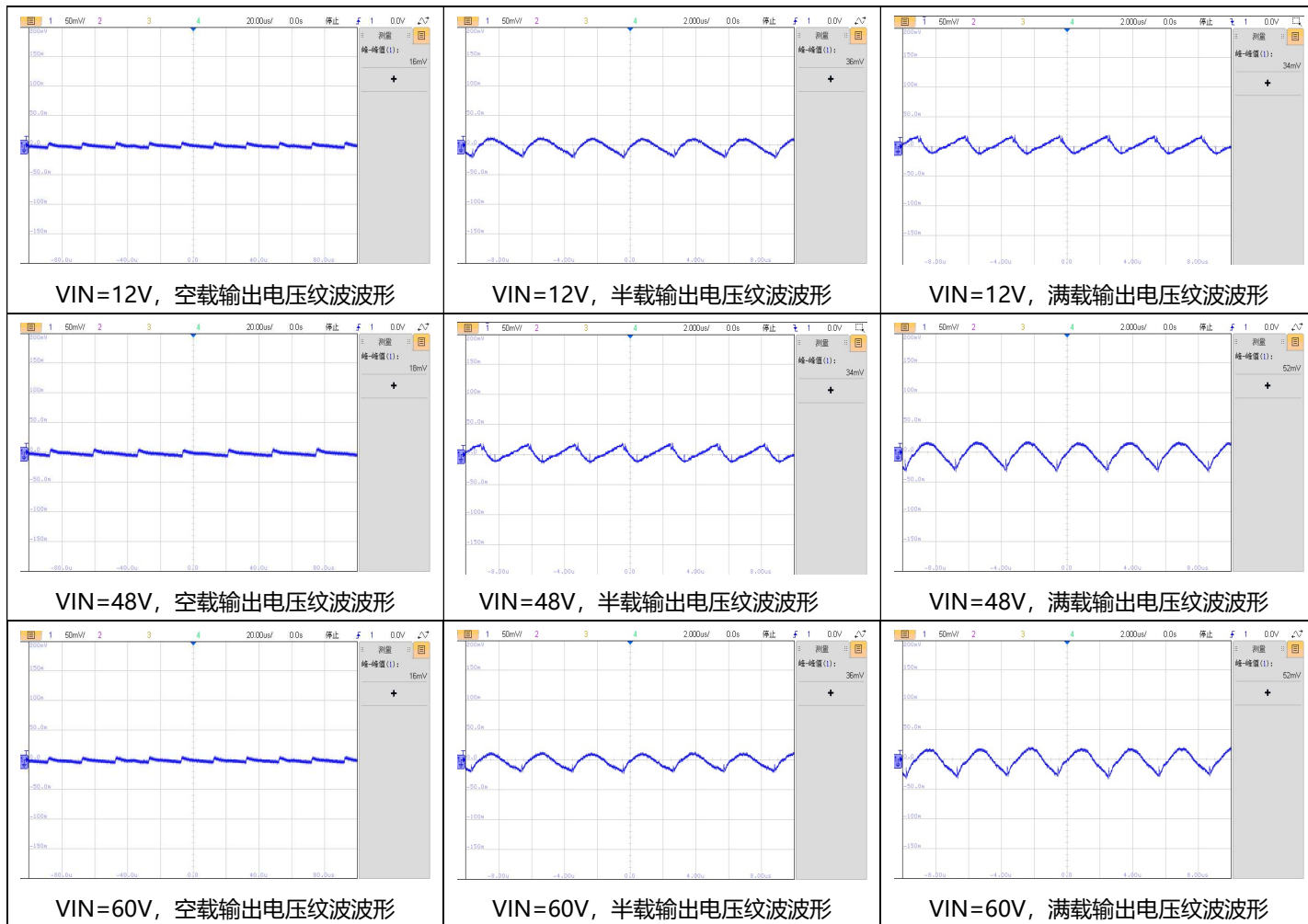
VIN=48V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.90	0.003	12.22	0	0%	0.00%
47.90	0.010	12.22	0.025	10%	63.78%
47.90	0.017	12.21	0.050	20%	74.97%
47.90	0.024	12.20	0.075	30%	79.59%
47.90	0.032	12.19	0.100	40%	79.53%
47.90	0.040	12.18	0.125	50%	79.46%
47.90	0.047	12.17	0.150	60%	81.09%
47.90	0.054	12.16	0.175	70%	82.27%
47.90	0.061	12.16	0.200	80%	83.23%
47.90	0.069	12.16	0.225	90%	82.78%
47.90	0.076	12.15	0.250	100%	83.44%

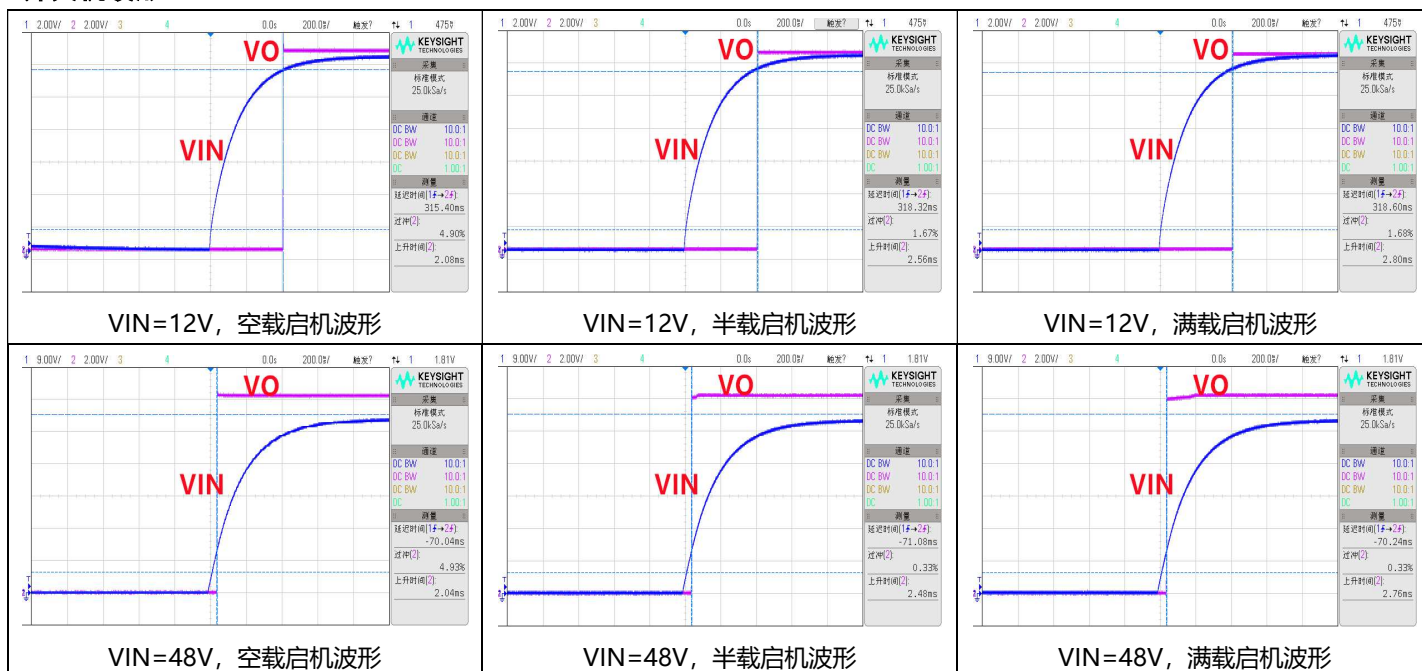
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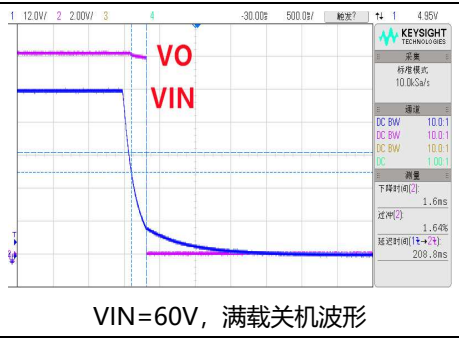
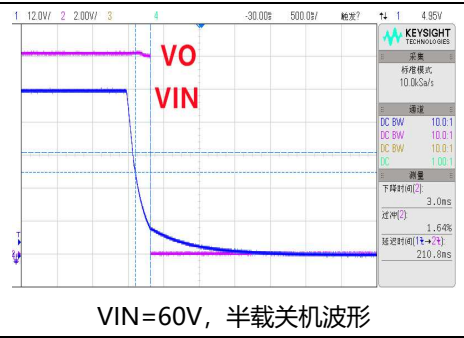
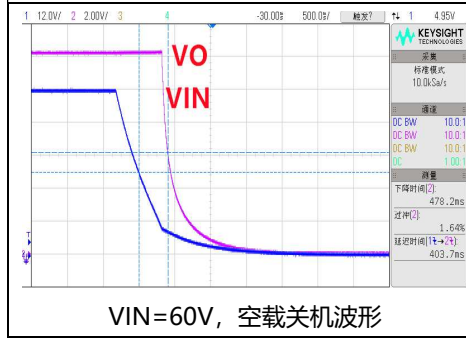
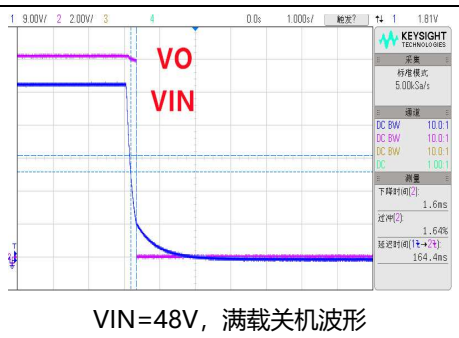
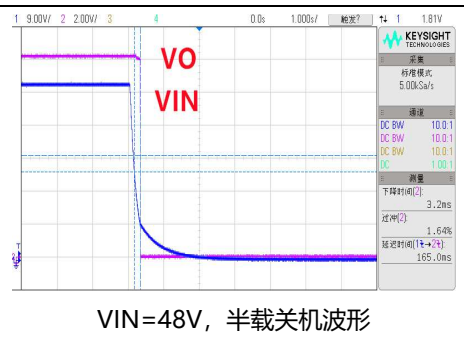
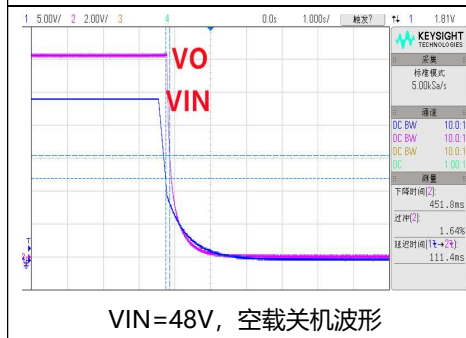
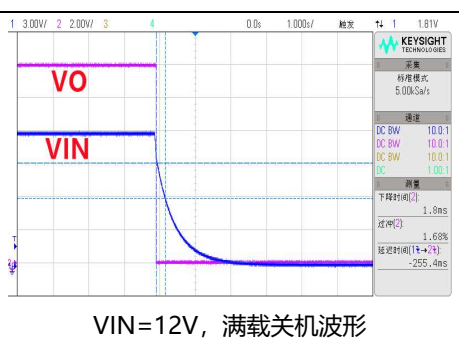
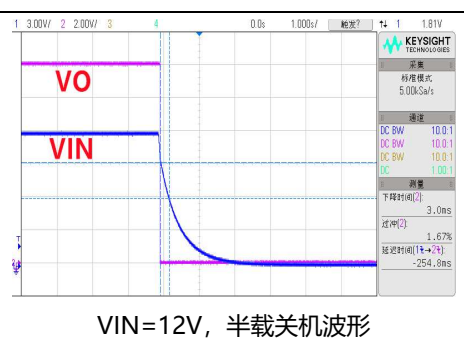
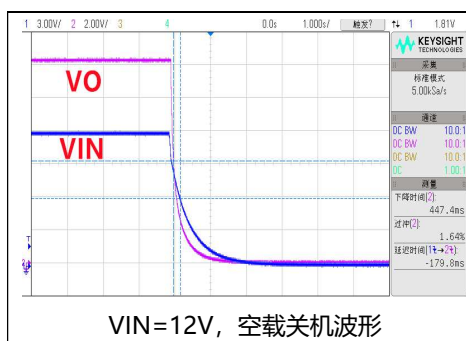
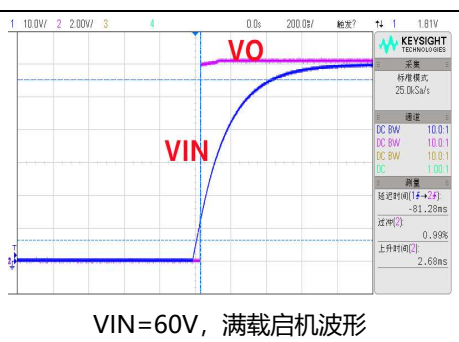
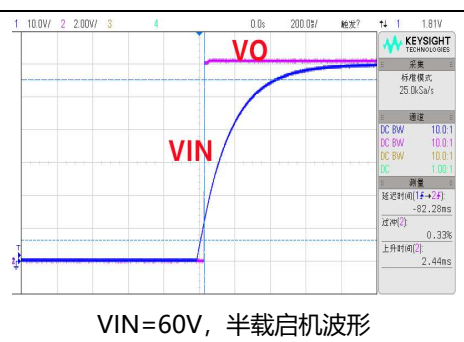
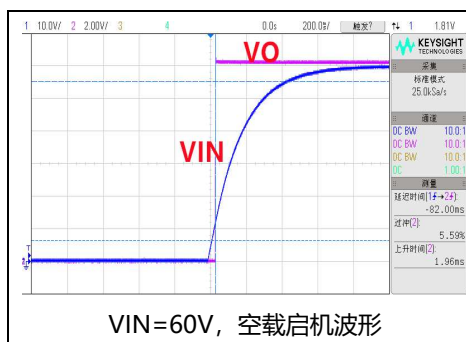
VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
47.90	0.003	12.25	0	0%	0.00%
47.90	0.010	12.23	0.025	10%	63.83%
47.90	0.017	12.20	0.050	20%	74.91%
47.90	0.024	12.18	0.075	30%	79.46%
47.90	0.032	12.17	0.100	40%	79.40%
47.90	0.039	12.16	0.125	50%	81.37%
47.90	0.047	12.15	0.150	60%	80.95%
47.90	0.053	12.14	0.175	70%	83.68%
47.90	0.060	12.13	0.200	80%	84.41%
47.90	0.068	12.13	0.225	90%	83.79%
47.90	0.076	12.11	0.250	100%	83.16%

输出电压纹波波形

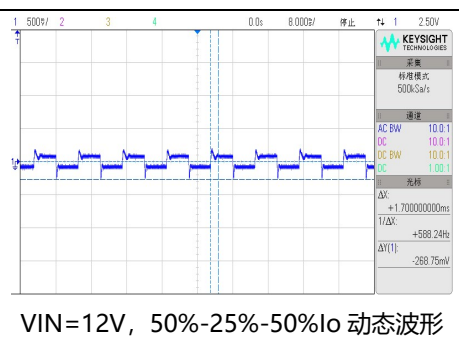
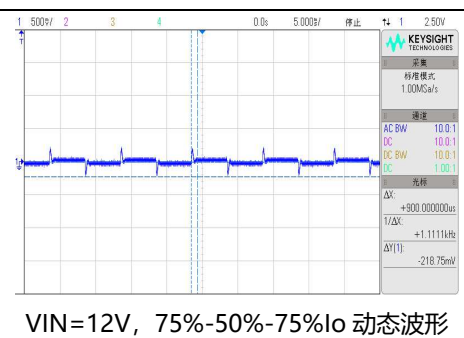
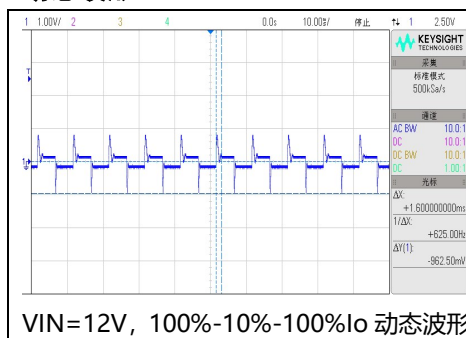


开关机波形

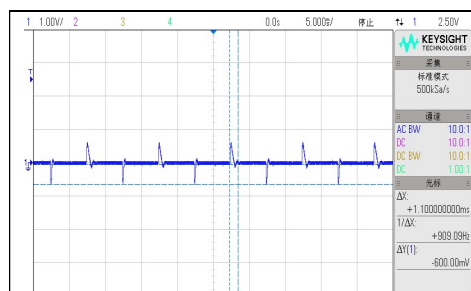




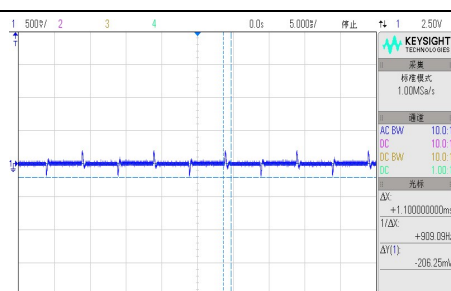
动态波形



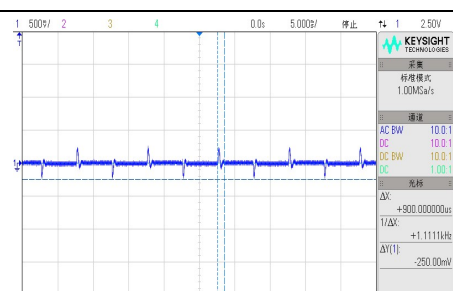
12-60V 输入, 3KV 隔离 12V/3W 单路输出解决方案



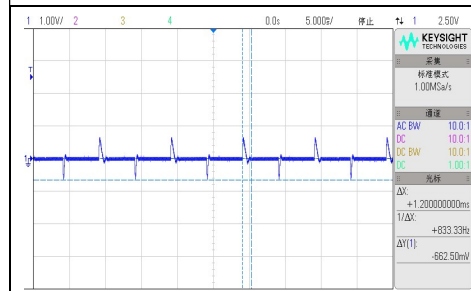
VIN=48V, 100%-10%-100%Io 动态波形



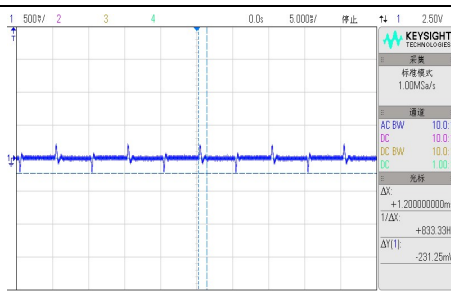
VIN=48V, 75%-50%-75%Io 动态波形



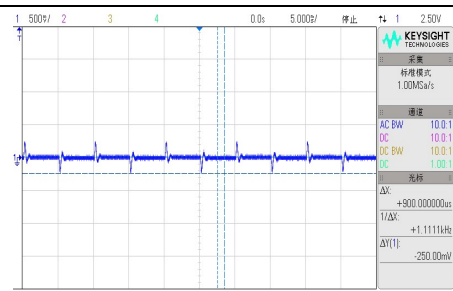
VIN=48V, 50%-25%-50%Io 动态波形



VIN=60V, 100%-10%-100%Io 动态波形

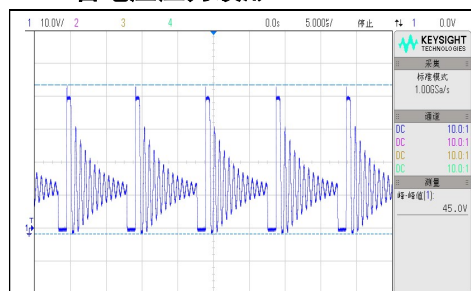


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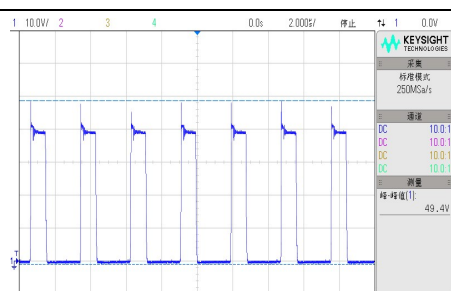


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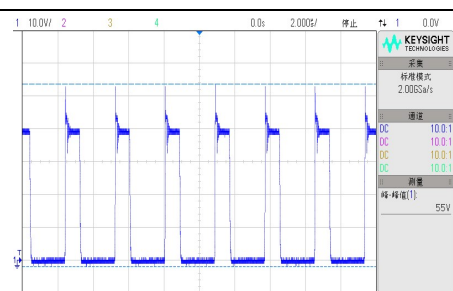
MOS 管电压应力波形



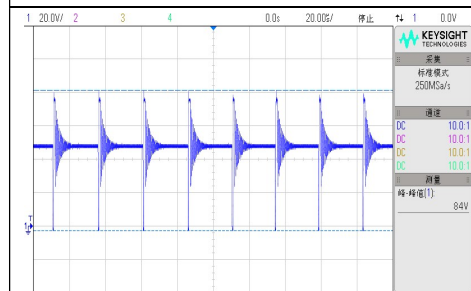
VIN=12V, 空载 VDS 波形



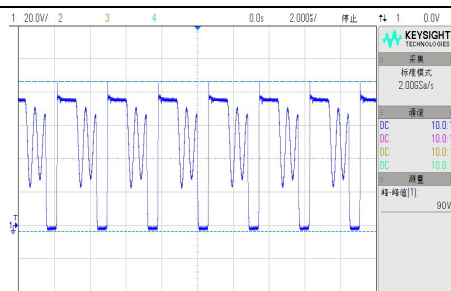
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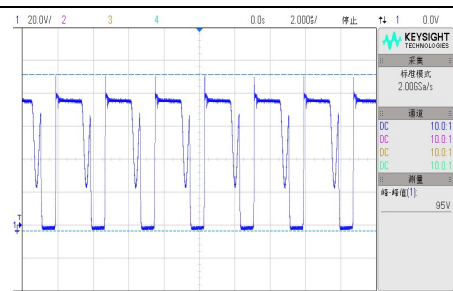
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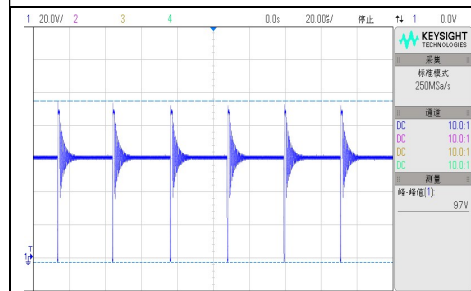
VIN=48V, 空载 VDS 波形



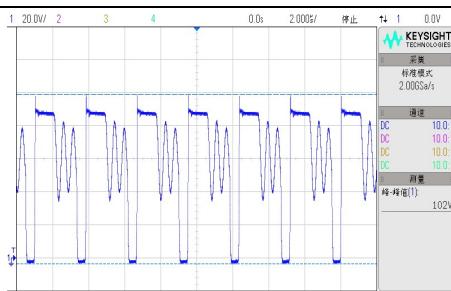
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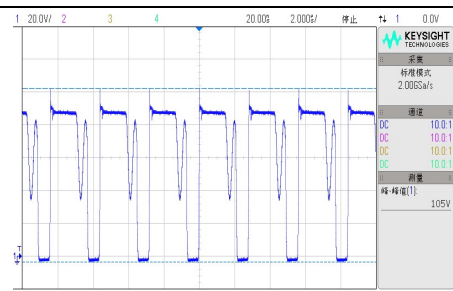
VIN=48V, 满载 VDS 波形



VIN=60V, 空载 VDS 波形

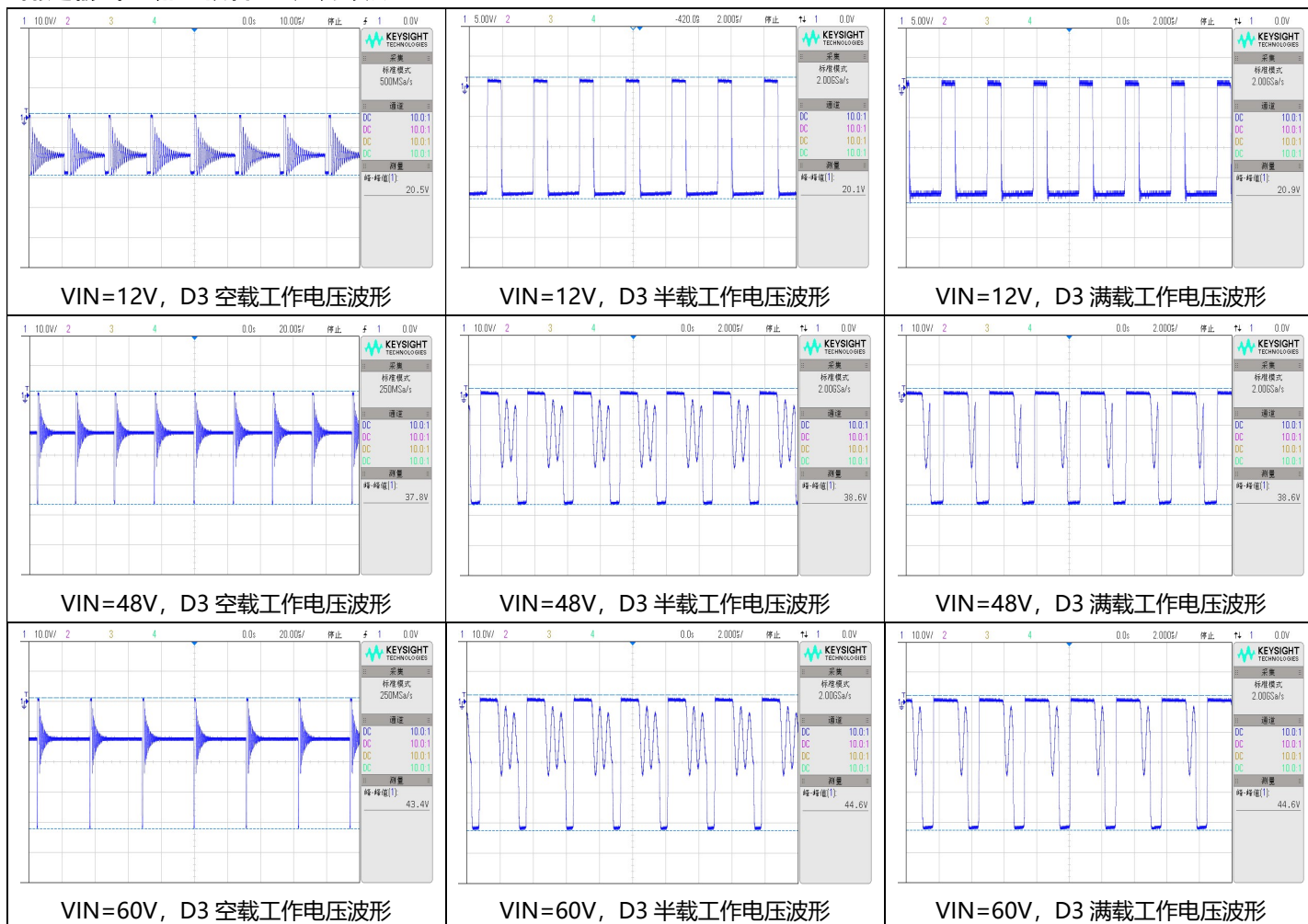


VIN=60V, 半载 VDS 波形



VIN=60V, 满载 VDS 波形

副边输出整流二极管 D3 应力波形



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