

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 VPE17POE01A、输出整流二极管以及必要的阻容元件，实现 37V-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 50W 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：37V-60V，输出 12V/50W，隔离电压：1500VDC

反馈方式：副边反馈-SSR

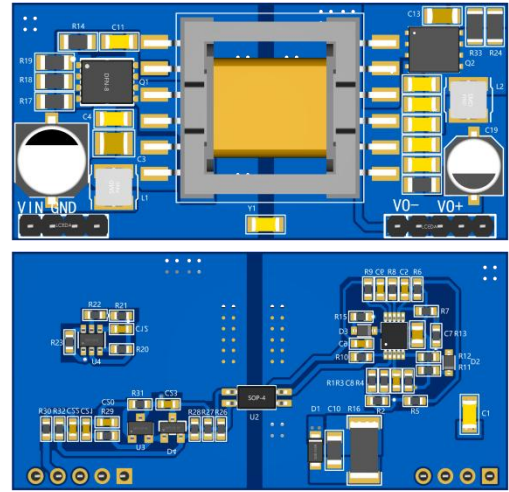
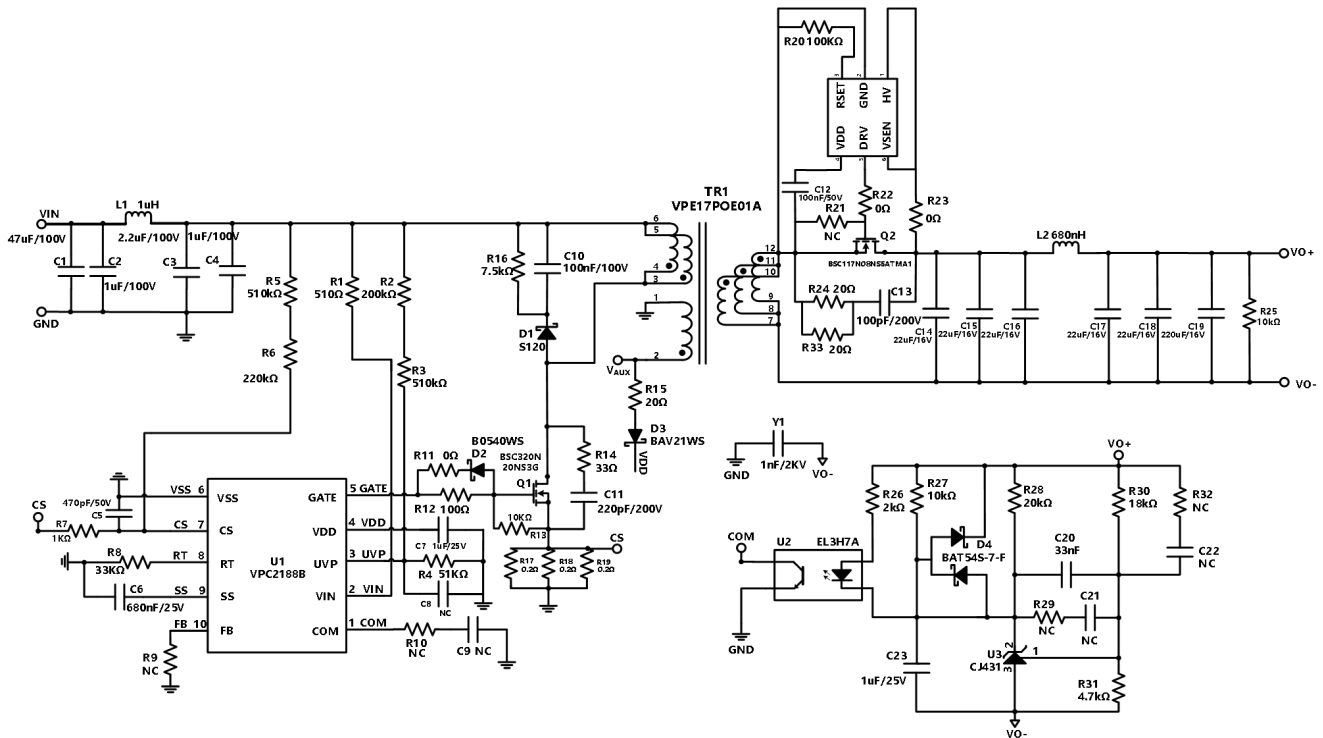


图 1: VPC2188B Demo 板(尺寸:56.9mm*27mm)

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

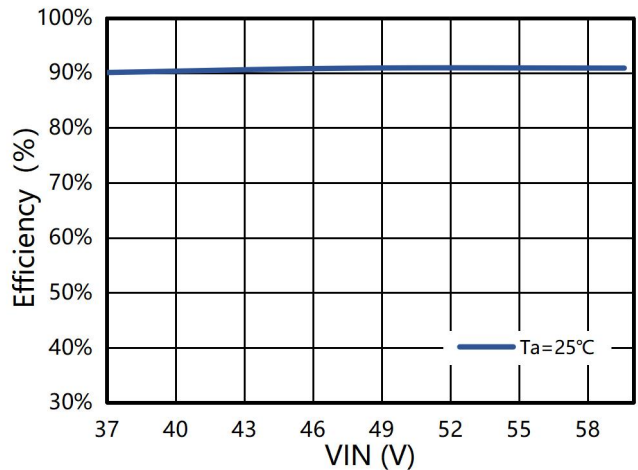
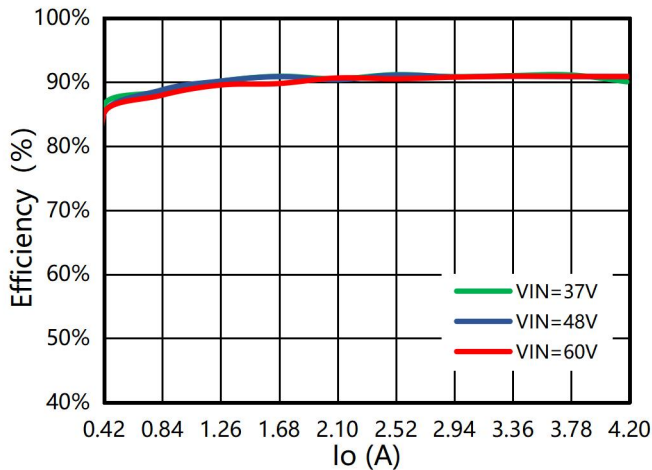
位号	参数	封装	型号	品牌
C1	47uF/100V	SMD,D8xL10.5mm	189RV0093	KNSCHA(科尼盛)
C2	1uF/100V	1206	CC1206KKX7R0BB105	YAGEO
C3	2.2uF/100V	1210	1210B225K101NT	FH(风华)
C4	1uF/100V	1206	CC1206KKX7R0BB105	YAGEO
C5	470pF/50V-X7R	0603	CC0603JRX7R9BB471	YAGEO
C6	680nF/25V-X7R	0603	CC0603KRX7R8BB684	YAGEO
C7	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
C8	NC	-	-	-
C9	NC	-	-	-
C10	100nF/100V-X7R	1206	CC1206KKX7R0BB104	YAGEO
C11	220pF/50V-X7R	1206	CC1206KRX7R9BB221	YAGEO
C12	100nF/50V-X7R	0603	CC0603KRX7R9BB104	YAGEO
C13	100pF/200V- NP0	1206	CC1206JRNPOABN101	YAGEO
C14	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C15	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C16	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C17	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C18	22uF/16V-X5R	1206	CC1206KKX5R7BB226	YAGEO
C19	220uF/16V	SMD,D6.3xL8mm	16TZV220M6.3X8	红宝石
C20	33nF/16V	0603	CC0603KRX7R9BB333	YAGEO
C21	NC	-	-	-
C22	NC	-	-	-
C23	1uF/25V-X7R	0603	CC0603KRX7R8BB105	YAGEO
Y1	1nF/2KV-X7R	1206	CC1206KKX7RDBB102	YAGEO
R1	510Ω±1%	0603	RC0603FR-07510RL	YAGEO
R2	200KΩ±1%	0603	RC0603FR-07200KL	YAGEO
R3	510KΩ±1%	0603	RC0603FR-07510KL	YAGEO
R4	51KΩ±1%	0603	RC0603FR-0751KL	YAGEO
R5	510KΩ±1%	0603	RC0603FR-07510KL	YAGEO
R6	220KΩ±1%	0603	RC0603FR-07220KL	YAGEO
R7	1KΩ±1%	0603	RC0603FR-071KL	YAGEO
R8	33KΩ±1%	0603	RC0603FR-0733KL	YAGEO
R9	NC	-	-	-
R10	NC	-	-	-
R11	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R12	100Ω±1%	0603	RC0603FR-07100RL	YAGEO
R13	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R14	33Ω±1%	1206	RC1206FR-0733RL	YAGEO
R15	20Ω±1%	0603	RC0603FR-0720RL	YAGEO
R16	7.5KΩ±1%	2512	RC2512FK-077K5L	YAGEO

R17	0.2Ω±1%	1206	RL1206FR-070R2L	YAGEO
R18	0.2Ω±1%	1206	RL1206FR-070R2L	YAGEO
R19	0.2Ω±1%	1206	RL1206FR-070R2L	YAGEO
R20	100KΩ±1%	0603	RC0603FR-07100KL	YAGEO
R21	NC	-	-	-
R22	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R23	0Ω±1%	0603	RC0603FR-070RL	YAGEO
R24	20Ω±1%	1206	RC1206FR-0720RL	YAGEO
R25	10KΩ±1%	1206	RC1206FR-0710KL	YAGEO
R26	2KΩ±1%	0603	RC0603FR-072KL	YAGEO
R27	10KΩ±1%	0603	RC0603FR-0710KL	YAGEO
R28	20KΩ±1%	0603	RC0603FR-0720KL	YAGEO
R29	NC	-	-	-
R30	18KΩ±1%	0603	RC0603FR-0718KL	YAGEO
R31	4.7KΩ±1%	0603	RC0603FR-074K7L	YAGEO
R32	NC	-	-	-
R33	NC	-	-	-
TR1	NP:NS:NA=12:4:4 Lp=14.4uH	EFD20	VPE17POE01A	VPSC
Q1	N 沟道 200V 36A	PG-TDSON-8	BSC320N20NS3G	INFINEON
Q2	N 沟道 80V 49A	PG-TDSON-8	BSC117N08NS5ATMA1	INFINEON
L1	1uH ±20%	SMD	SWPA5040S1R0MT	Sunlord
L2	680nH ±20%	SMD-5.0mm*3.0mm	MWSA0503S-R68MT	Sunlord
D1	200V/1A	SOD-123	S120	YANGJIE
D2	40V/0.5A	SOD-323	B0540WS	DIDDOES
D3	200V/0.2A	SOD-323	BAV21WS	CJ
D4	30V/0.2A	SOT-23	BAT54S-7-F	DIDDOES
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
U4	同步整流控制 IC	SOT-23-6	MP6908A	MPS

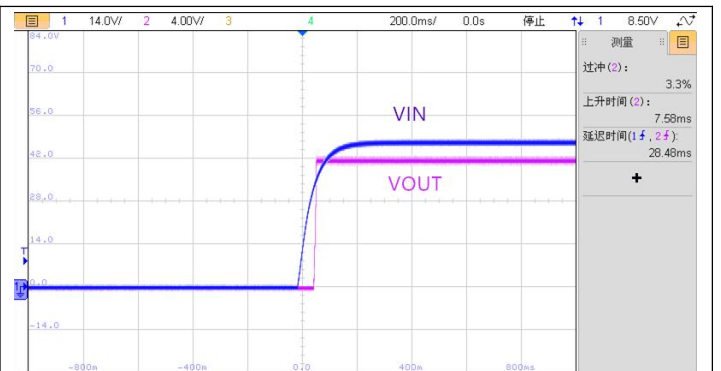
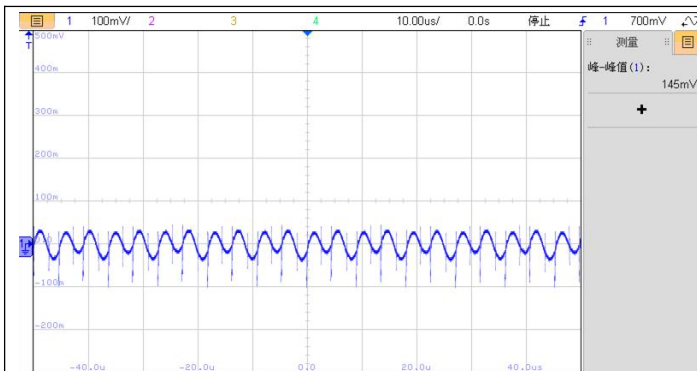
总体性能一览表

性能指标	测试条件	Min	Typ	Max	Unit
输入电流 (满载/空载)	VIN=48V	3	---	1161	mA
转换效率	VIN=48V, IO=4.2A	---	90.84	---	%
纹波&噪声	VIN=48V, IO=4.2A	---	145	160	mV
输出电压精度	VIN=48V, IO=4.2A	---	0.42	---	%
线性调节率	VIN=37V-60V, IO=4.2A	---	0.5	---	%
负载调整率	VIN=48V, IO=4.2A	---	0.3	---	%
过流点系数	VIN=37V, IO=4.2A	---	135	---	%
输入欠压保护	锁定电压	---	30.2	---	V
	恢复电压	---	32.8	---	V
短路保护	VIN=37V-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

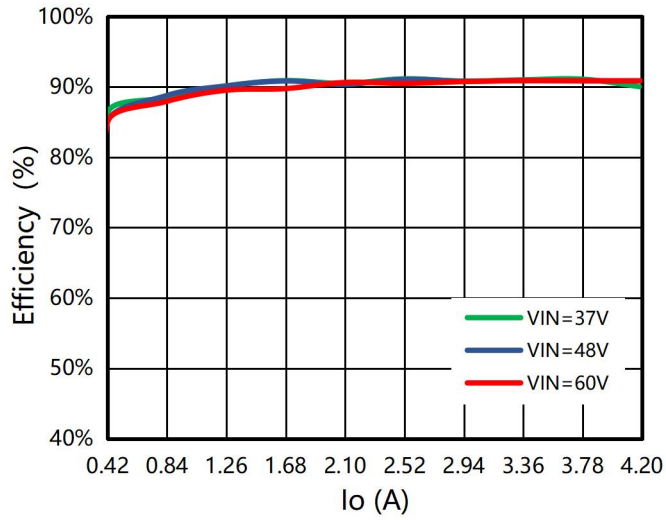


相关波形

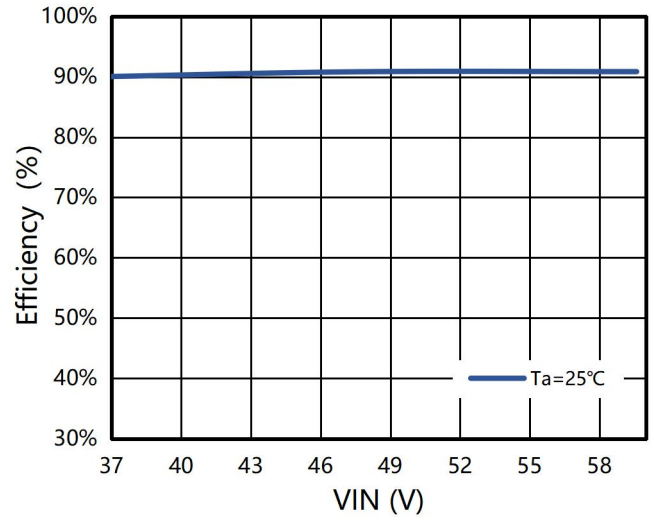


详细测试数据

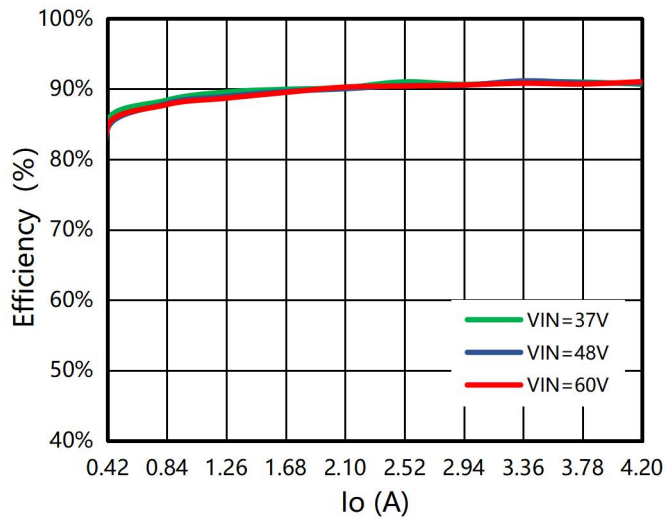
高低温测试曲线



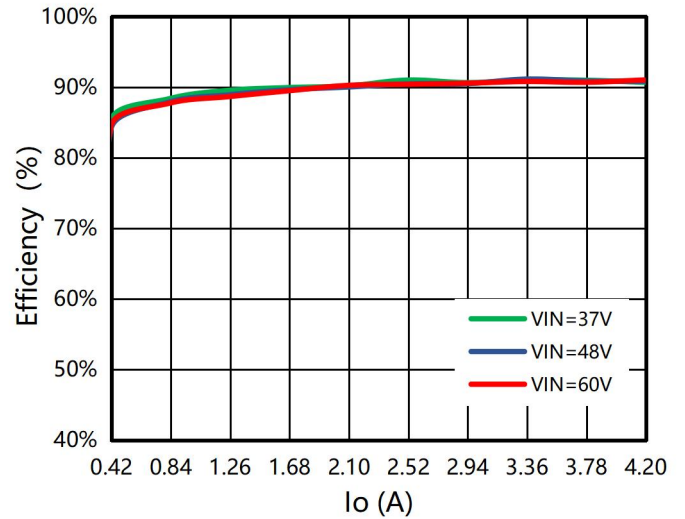
效率 VS 输出电流 (25°C)



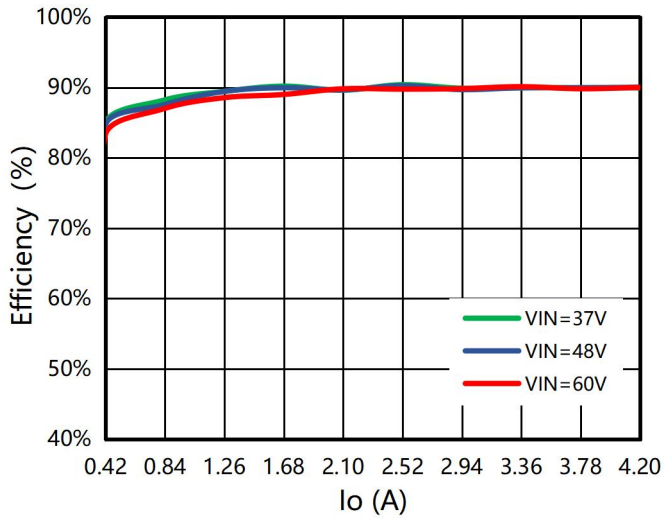
效率 VS 输入电压 (输出满载@25°C)



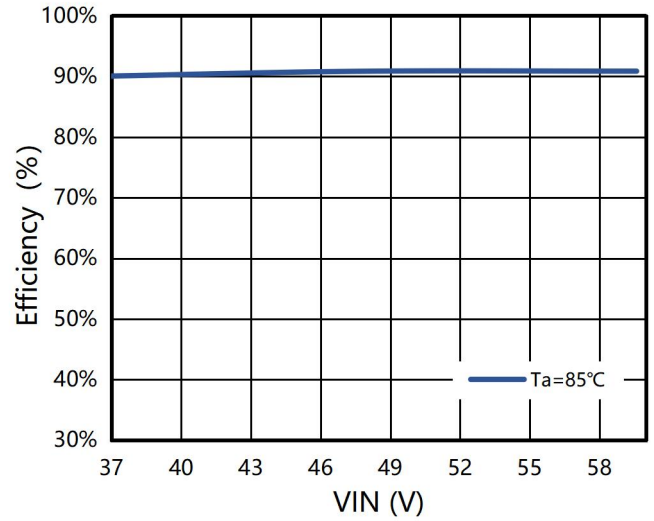
效率 VS 输出电流 (-40°C)



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(%)
47.7	0.003	12.05	0	0%	0.00%
47.7	0.124	12.05	0.416	10%	84.75%
47.7	0.238	12.04	0.837	20%	88.77%
47.7	0.352	12.04	1.257	30%	90.14%
47.7	0.466	12.04	1.677	40%	90.84%
47.7	0.585	12.03	2.096	50%	90.36%
47.7	0.697	12.03	2.517	60%	91.07%
47.7	0.816	12.03	2.938	70%	90.80%
47.7	0.931	12.02	3.358	80%	90.89%
47.7	1.048	12.02	3.778	90%	90.84%
47.6	1.161	12.01	4.180	100%	90.84%

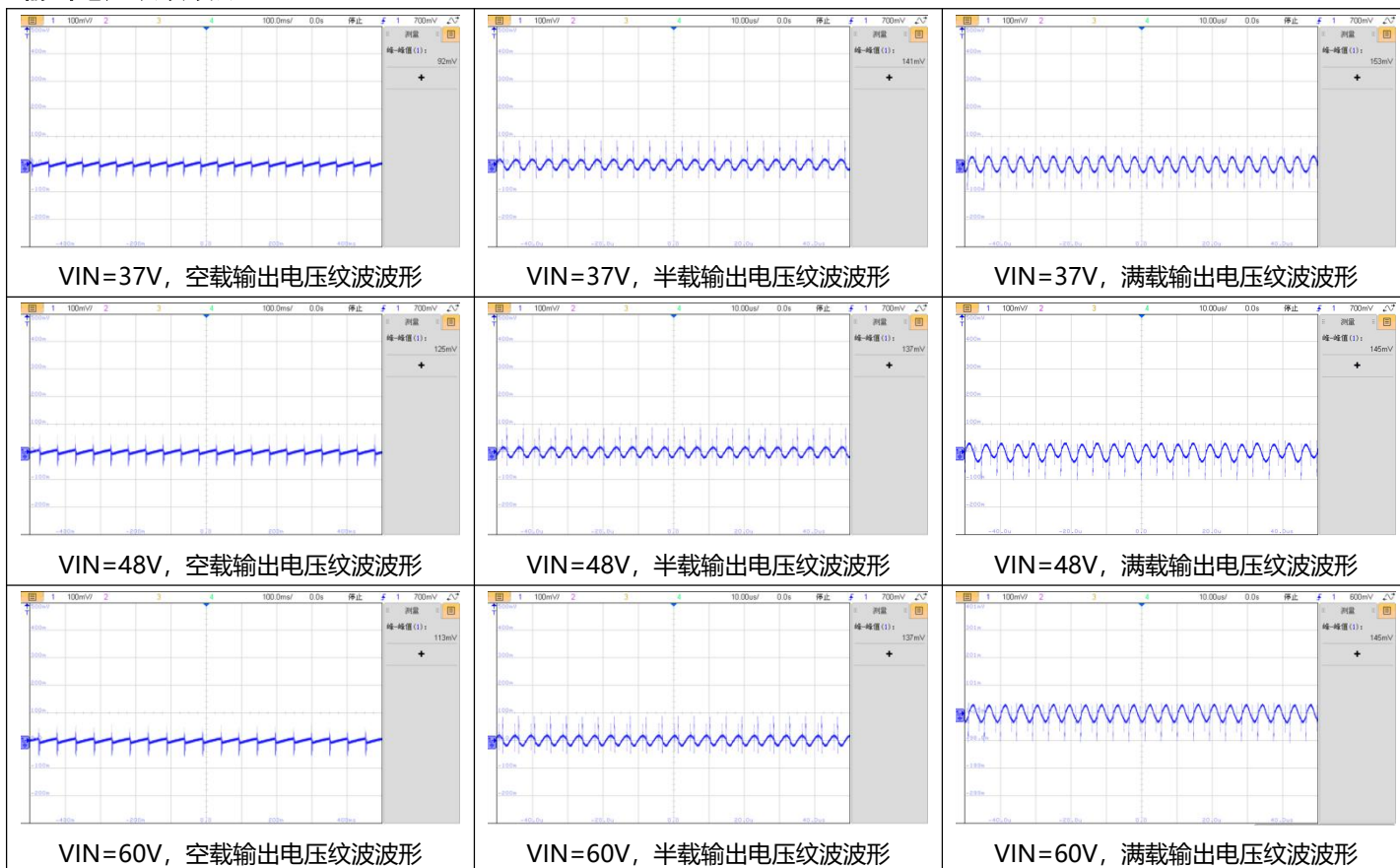
VIN=48V, Ta=-40°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η(%)
48.1	0.003	12.05	0	0%	0.00%
48.1	0.124	12.05	0.416	10%	84.05%
48.1	0.238	12.04	0.836	20%	87.92%
48	0.354	12.04	1.255	30%	88.93%
48	0.469	12.04	1.676	40%	89.64%
48	0.584	12.04	2.096	50%	90.03%
48	0.697	12.03	2.516	60%	90.47%
48	0.813	12.03	2.936	70%	90.51%
47.9	0.924	12.02	3.356	80%	91.14%
47.9	1.043	12.02	3.777	90%	90.87%
47.8	1.160	12.02	4.190	100%	90.83%

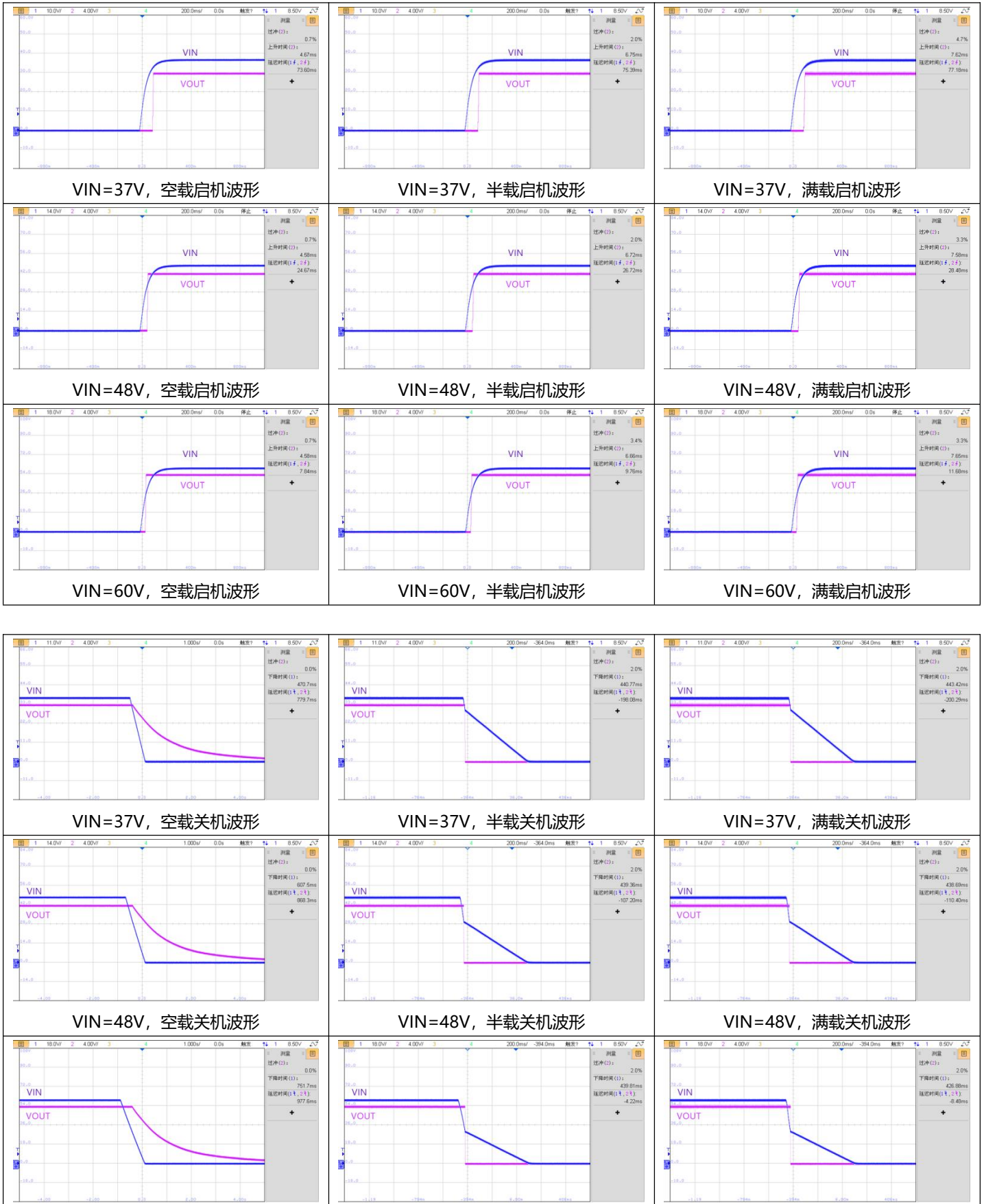
VIN=48V, Ta=85°C, 输入、输出及效率数据:

VIN(V)	IIN(A)	VO(V)	IO(A)	IO-max%	η (%)
48	0.003	11.99	0	0%	0.00%
48	0.123	11.99	0.416	10%	84.48%
48	0.238	11.98	0.835	20%	87.56%
48	0.35	11.98	1.254	30%	89.42%
48	0.465	11.98	1.676	40%	89.96%
48	0.583	11.97	2.096	50%	89.66%
48	0.695	11.97	2.515	60%	90.24%
48	0.816	11.97	2.935	70%	89.70%
47.9	0.932	11.97	3.355	80%	89.96%
47.9	1.049	11.97	3.776	90%	89.95%
47.9	1.162	11.96	4.19	100%	90.03%

输出电压纹波波形



开关机波形

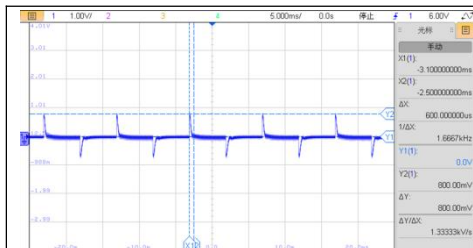


VIN=60V，空载关机波形

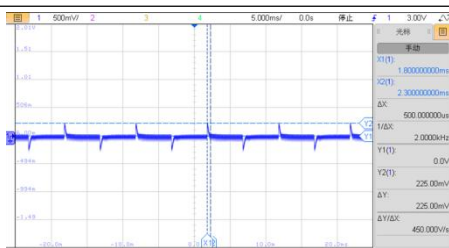
VIN=60V，半载关机波形

VIN=60V，满载关机波形

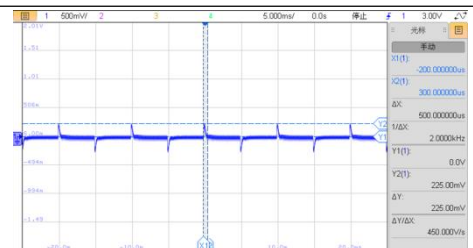
动态波形



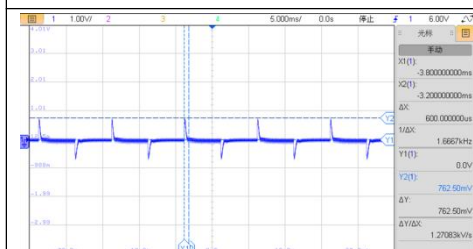
VIN=37V，100%-10%-100%Io 动态波形



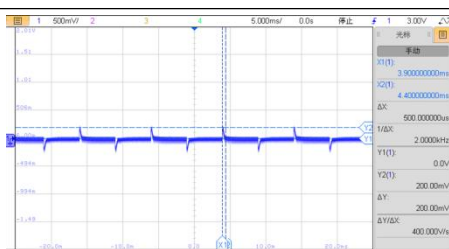
VIN=37V，75%-50%-75%Io 动态波形



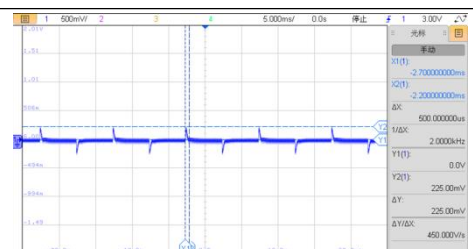
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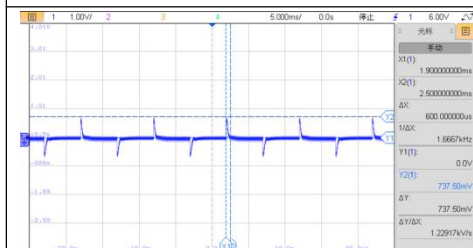
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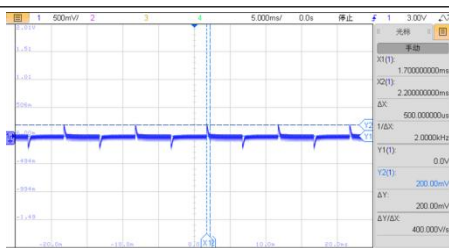
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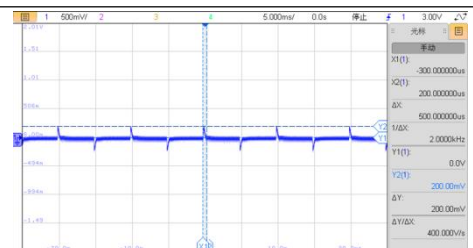
VIN=48V，50%-25%-50%Io 动态波形



VIN=60V，100%-10%-100%Io 动态波形

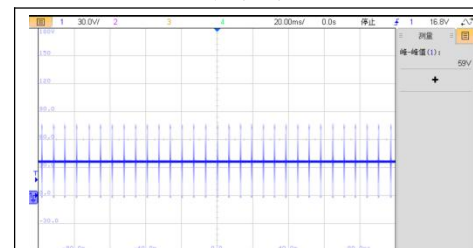


VIN=60V，75%-50%-75%Io 动态波形

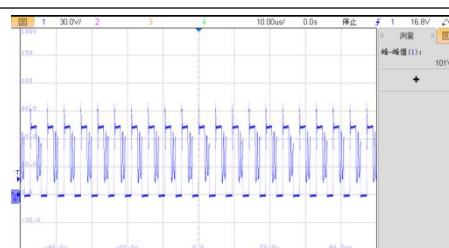


VIN=60V，50%-25%-50%Io 动态波形

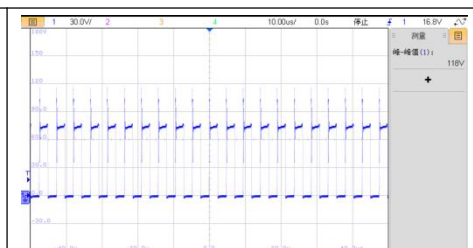
原边 MOS 管 Q1 应力波形



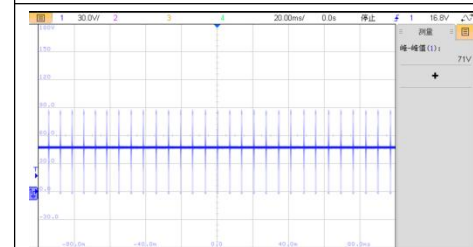
VIN=37V，空载 VDS 波形



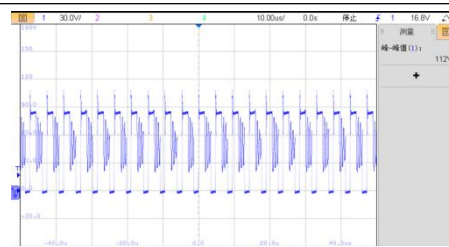
VIN=37V，半载 VDS 波形



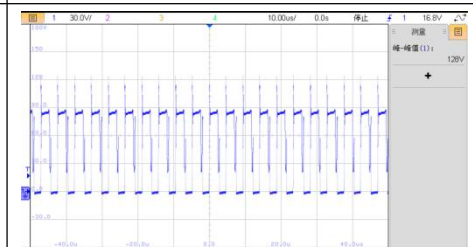
VIN=37V，满载 VDS 波形



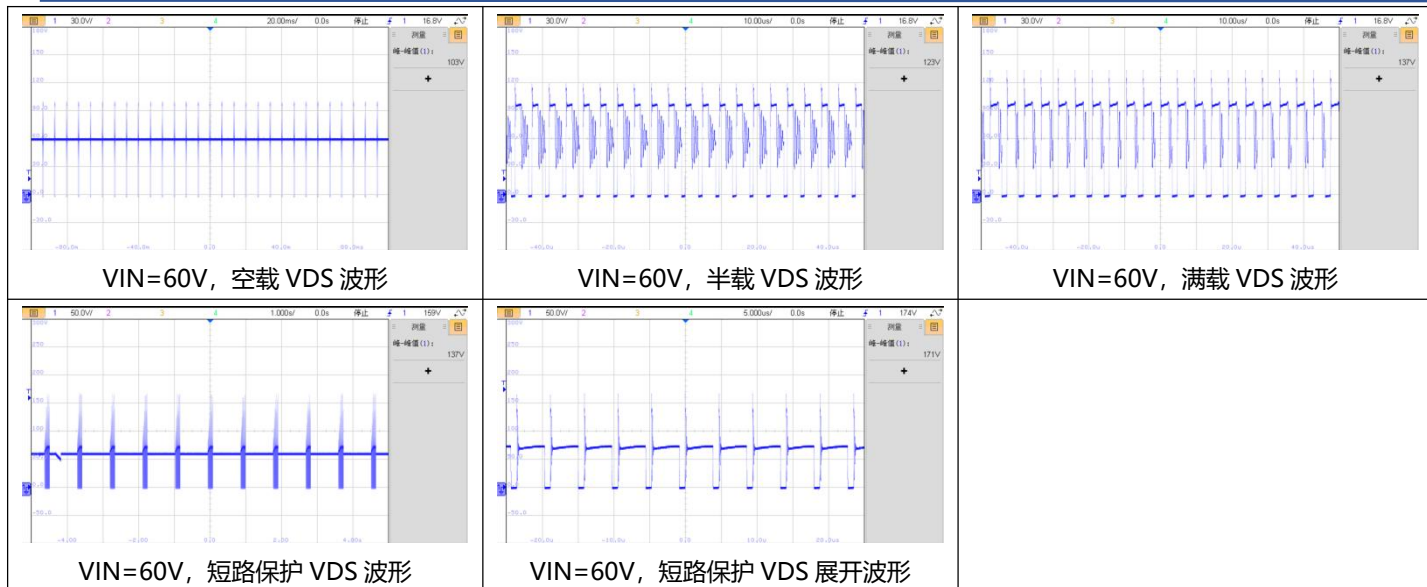
VIN=48V，空载 VDS 波形



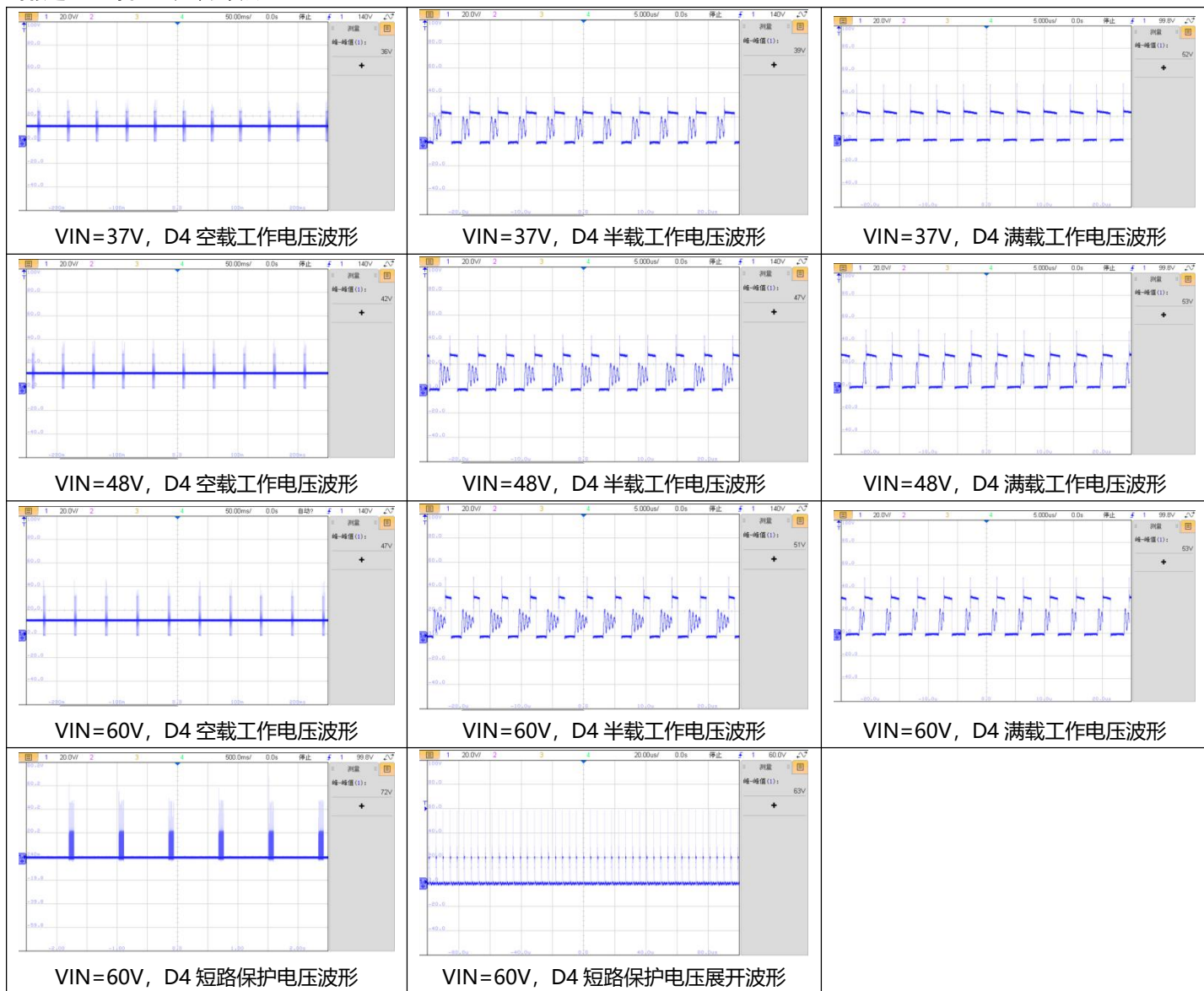
VIN=48V，半载 VDS 波形



VIN=48V，满载 VDS 波形



副边 MOS 管 Q2 应力波形



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