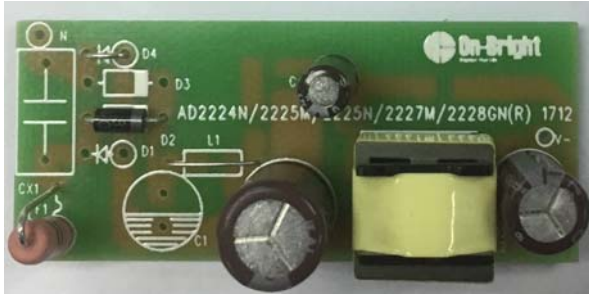


Subject
OB2228GR Demo Board Manual

Board Model: AD18V0.5A2228GR.00
Doc. No.: OB_DOC_DBM_2228GR00



Key features:

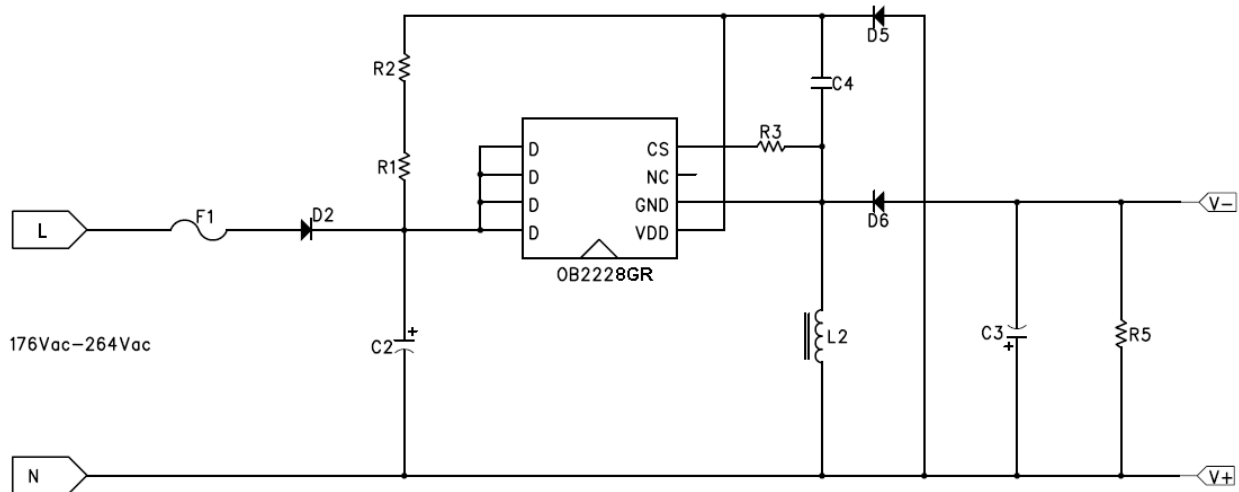
- Lowest possible component count
- Standby power <100mW @264Vac
- Efficiency measured >80% at full load
- Good dynamic response
- Comprehensive protection including output short protection, OTP, OCP etc.

Revision History

Revise Date	Version	Reason/Issue
2017-4-28	00	First issue

1. Board Information

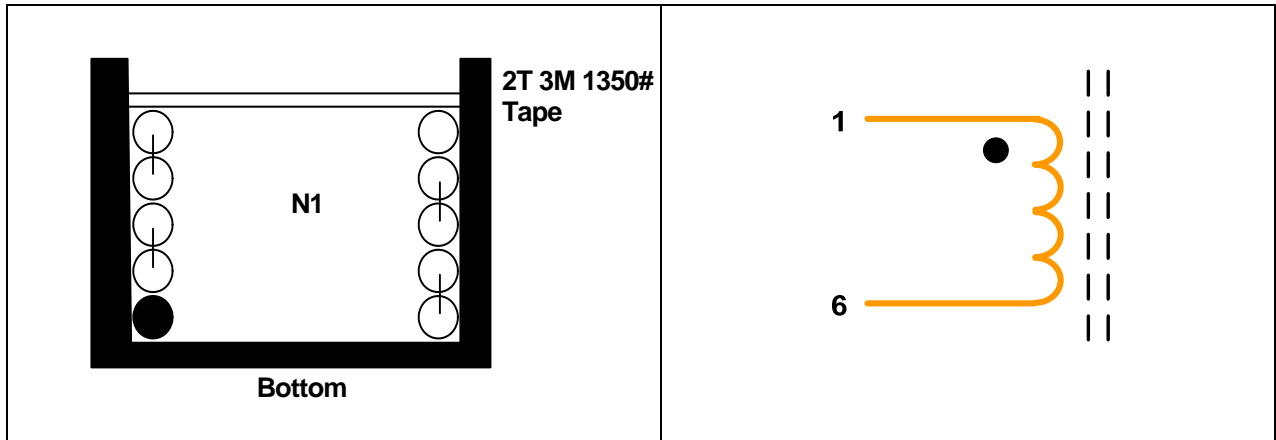
1.1. Board schematic



1.2. Component list

No.	Position	Description	Quantity
1	F1	Resistor fuse 10R/1W	1
2	D2	Diode 1N4007	1
3	D4	Jumper	1
4	D5	Diode M7	1
5	D6	Fast diode ES2J	1
6	C2	E.C. 10uF /400V	1
7	C3	E.C. 470uF /25V	1
8	C4	E.C. 3.3uF /50V	1
9	R1,R2	SMD RES 2M /5% /1206	2
10	R3	SMD RES 0R39 /5% /1206	1
11	R5	SMD RES 20K /5% /0805	1
12	U1	OB2228GR SOP8	1
13	L1	Jumper	1
14	L2	EE13 400uH	1
	Total		15

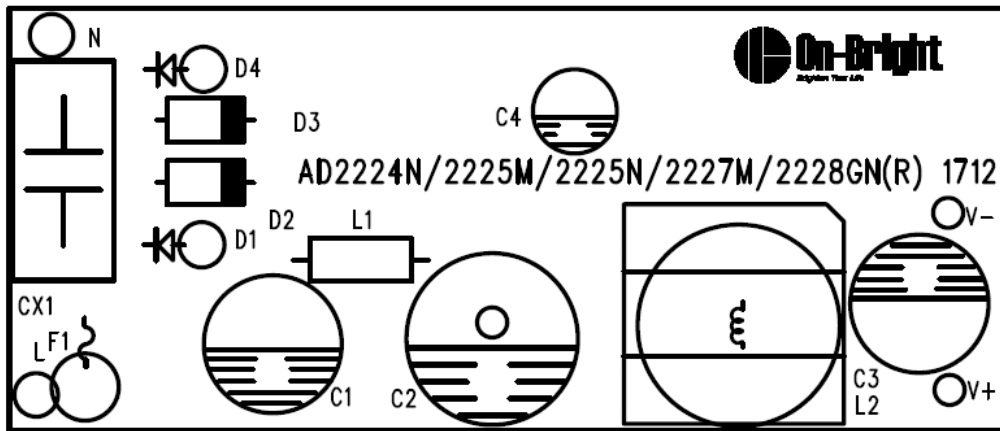
1.3. Inductor design



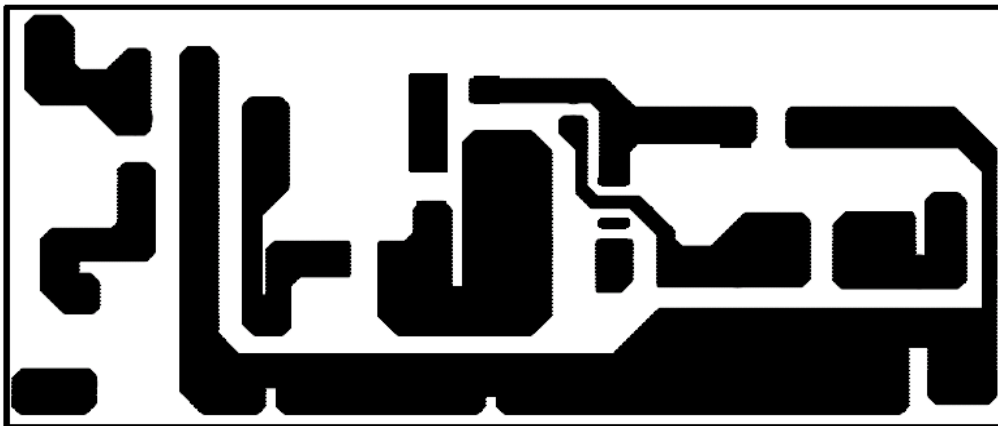
1. Bobbin: EE13
2. Core: TDK PC40.
3. L1-6= 400uH (at:10KHz, 1V)

Material	Turns	Inductance & Tolerance
Φ0.30 *1 2UEW	95	400uH ± 7%

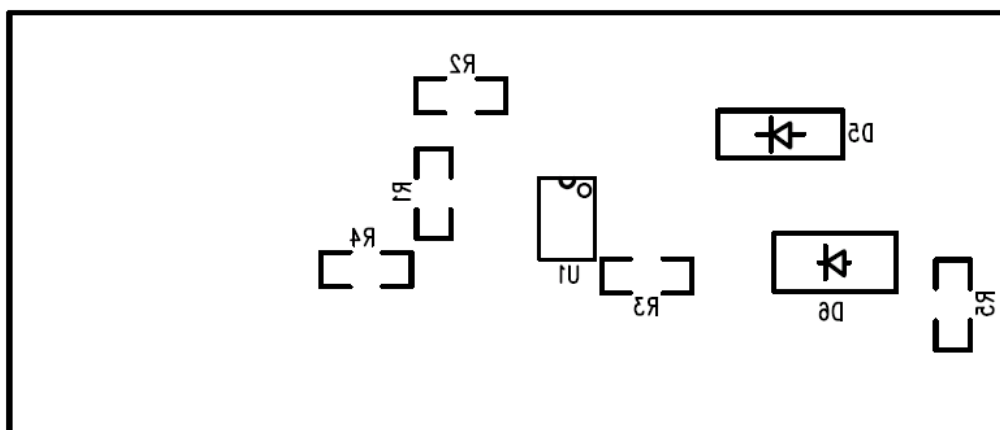
1.4. PCB Gerber File



Top

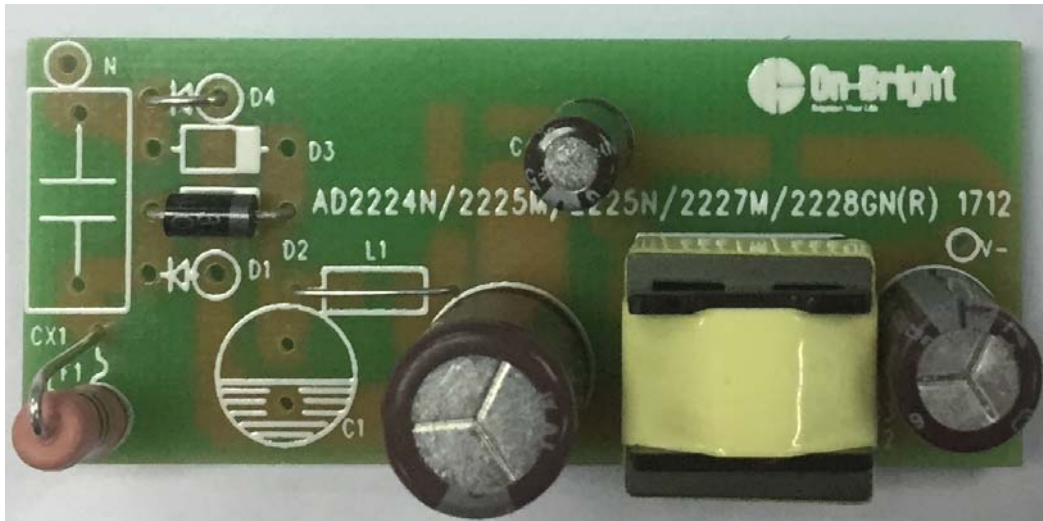


Bottom



Silkscreen Bottom

1.5. Snapshot



2. Converter Specification

2.1. Input Characteristics

- AC input voltage range 176Vac ~ 264Vac
- AC input frequency range 47Hz ~ 63Hz

2.2. Output Characteristics

- Output voltage V_{OUT} 18.0V
- Output current I_{OUT} 500mA
- Operating frequency 40KHz
- Output power 9W

2.3. Performance Function

- Standby Power < 100mW @ 264Vac/50Hz, no load, 25°C
- Efficiency >80%
- Ripple & Noise <150mV

2.4. Protection Function

- Short Circuit Protection Output shut down with auto-restart
- Over Temperature Protection Output shut down with auto-restart
- Over Current Protection Output shut down with auto-restart

3. Performance Evaluation

3.1. Standby Power

Input voltage	P_{IN} (mW)	Spec	Remark
176Vac/50Hz	56	<100mW	Pass
200Vac/50Hz	60		Pass
230Vac/50Hz	64		Pass
264Vac/50Hz	77		Pass

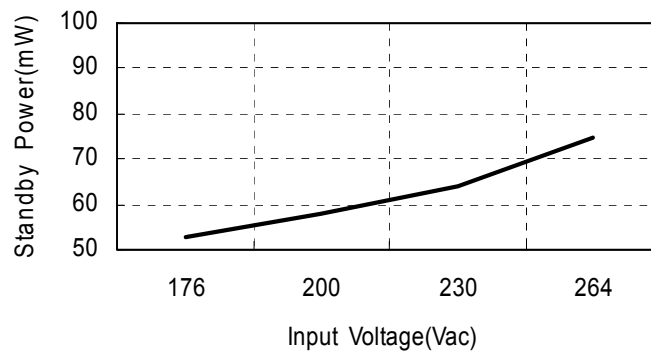


Figure 1. Standby input power

3.2. Efficiency

Input voltage	load 500mA	Spec	Remark
176Vac/50Hz	83.93	>80%	Pass
200Vac/50Hz	84.55		Pass
230Vac/50Hz	85.01		Pass
264Vac/50Hz	85.04		Pass

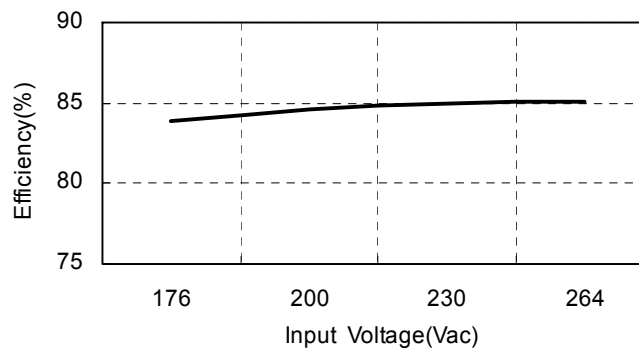


Figure 2. Efficiency @500mA load

3.3. Output Voltage

Input voltage	0mA	5mA	100mA	200mA	400mA	500mA	Spec	Remark
176Vac/50Hz	19.05	18.64	18.55	18.44	18.26	18.18	17~20V	Pass
200Vac/50Hz	19.05	18.63	18.54	18.43	18.26	18.18		Pass
230Vac/50Hz	19.06	18.63	18.54	18.43	18.25	18.18		Pass
264Vac/50Hz	19.06	18.63	18.54	18.43	18.25	18.18		Pass

3.4. Dynamic (Figure 13)

Input voltage	V _{OUT-min} (V)	V _{OUT-max} (V)	Spec	Remark
176Vac/50Hz	17.59	18.88	17~20V	Pass
200Vac/50Hz	17.58	18.88		Pass
230Vac/50Hz	17.55	18.92		Pass
264Vac/50Hz	17.52	18.90		Pass

Note: A dynamic loading with low load set at 0mA load lasting for 5ms and high set at 500mA load lasting for 5ms is added to output. The ramp is set at 0.25A/us at transient.

3.5. Over Current Protection & Recovery

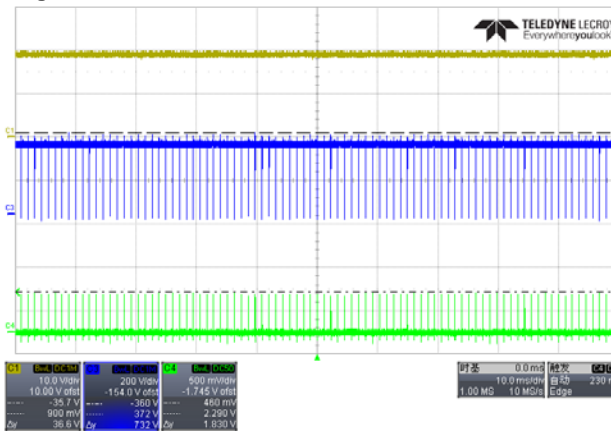
Input voltage	OCP (mA)	Recovery (mA)	Spec	Remark
176Vac/50Hz	666	662	$\geq 1.1 \cdot I_{OUT}$	Pass
200Vac/50Hz	680	676		Pass
230Vac/50Hz	698	693		Pass
264Vac/50Hz	715	710		Pass

3.6. Ripple & Noise (Figure 11&12)

Input voltage	No-load (mV)	Full load (mV)	Spec	Remark
176Vac/50Hz	25.2	98	<150mV	Pass
200Vac/50Hz	27.3	98		Pass
230Vac/50Hz	28.8	100		Pass
264Vac/50Hz	29.5	102		Pass

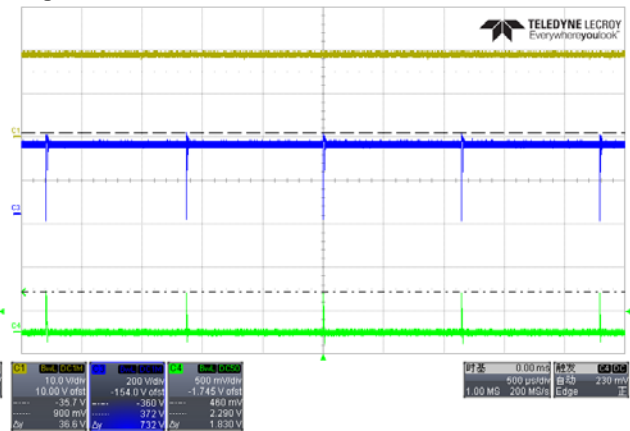
3.7. Waveforms

Figure 3: 230Vac, no-load



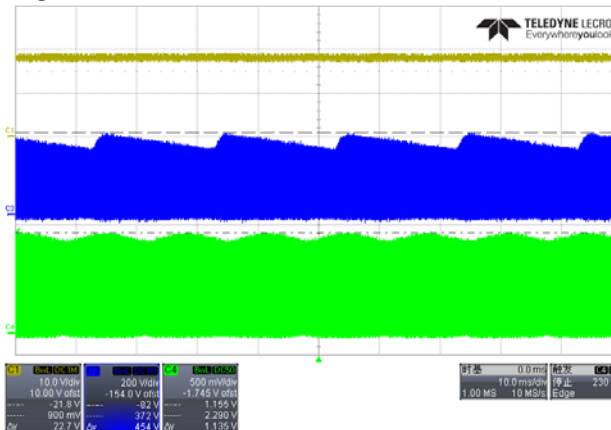
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 空载, $V_{DS}=372V$

Figure 4: 230Vac, no-load



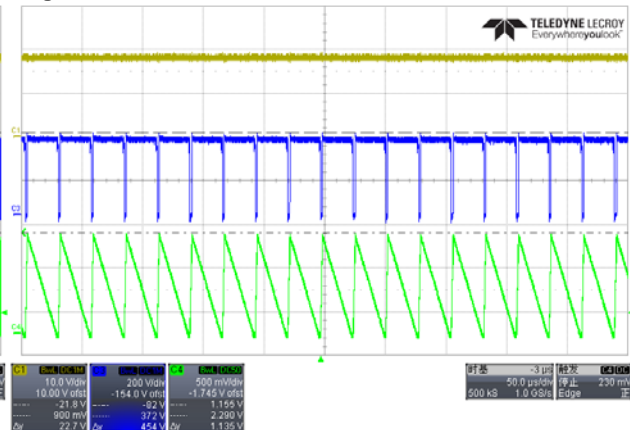
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 空载波形展开, $V_{DS}=372V$

Figure 5: 230Vac, full load



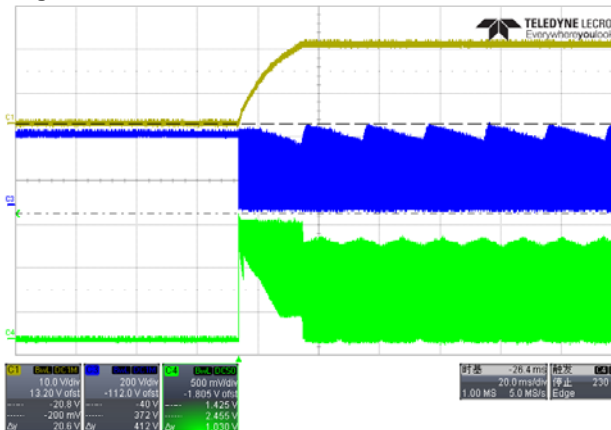
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载, $V_{DS}=372V$

Figure 6: 230Vac, full load



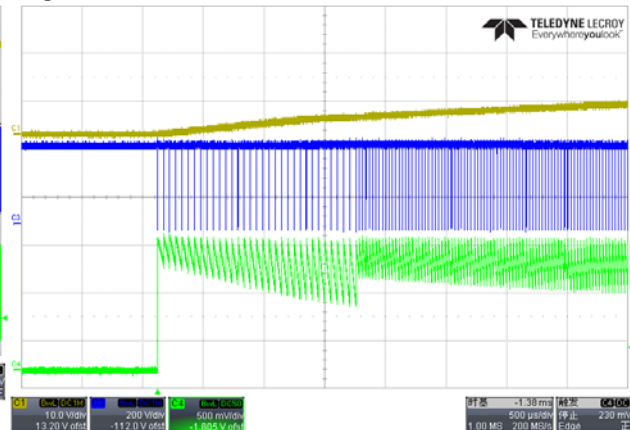
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载波形展开, $V_{DS}=372V$

Figure 7: 230Vac, start at full load



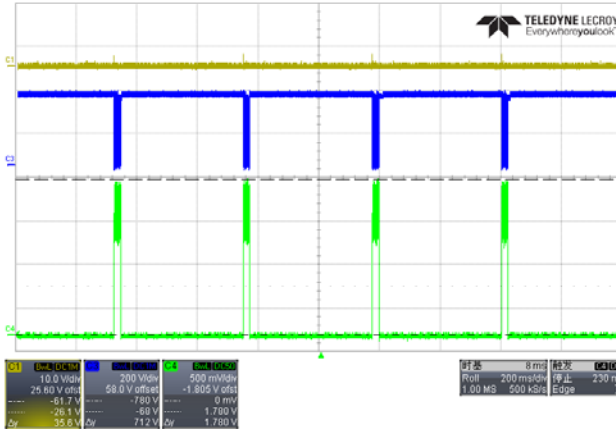
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载启动, $V_{DS}=372V$

Figure 8: 230Vac, start at full load



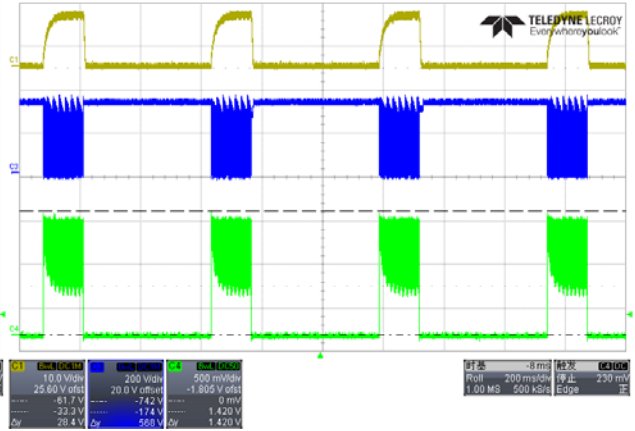
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载启动波形展开, $V_{DS}=372V$

Figure 9: 230Vac, output short



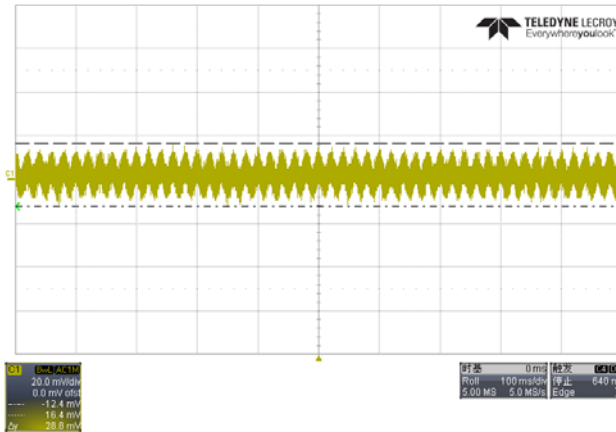
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载, $V_{DS}=335V$

Figure 10: 230Vac, output OLP



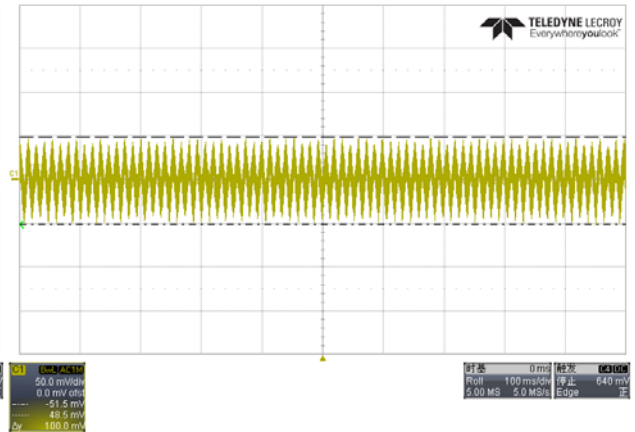
CH1: V_{out} CH3: V_{DS} CH4: $I_{inductor}$
230Vac 输入, 满载, $V_{DS}=335V$

Figure 11: 230Vac, no-load



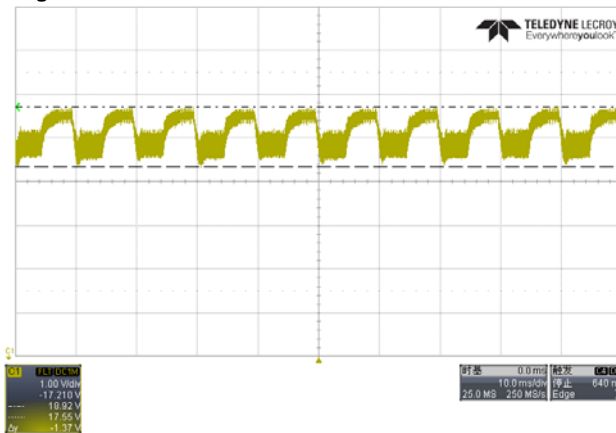
CH1: V_{ripple}
230Vac 输入, 空载, $V_{ripple}=28.8mV$

Figure 12: 230Vac, full load



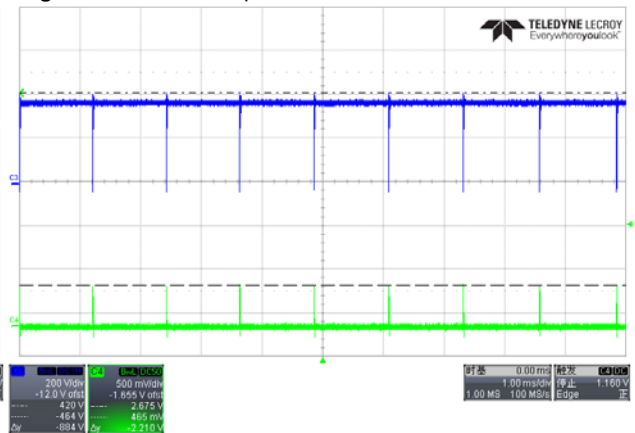
CH1: V_{ripple}
230Vac 输入, 满载, $V_{ripple}=100mV$

Figure 13: 230Vac, 0~500mA load



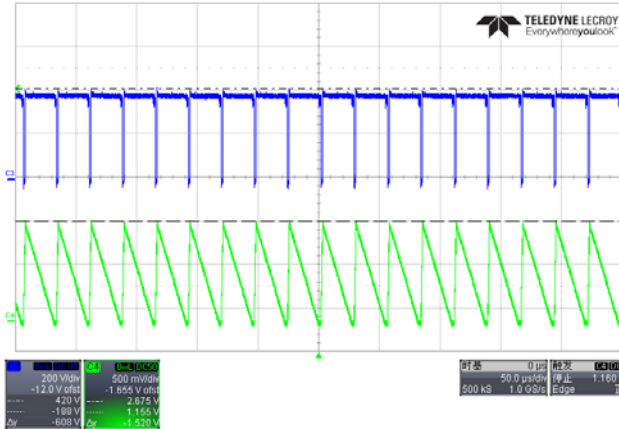
CH1: V_{OUT}
230Vac 输入, 负载变化, $V_{out}=17.55-18.92V$

Figure 14: 264Vac, Output no-load



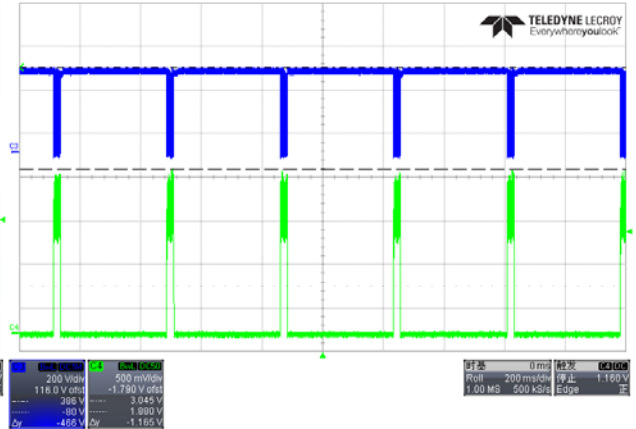
CH3: V_{DS} CH4: $I_{inductor}$
264Vac 输入, 输出空载

Figure 15: 264Vac, Output full load



CH3: V_{DS} CH4: I_{Inductor}
264Vac 输入, 输出满载

Figure 16: 264Vac, output short to GND



CH3: V_{DS} CH4: I_{Inductor}
264Vac 输入, 输出短路

Input	V _{DS_MAX} (V)	Remark
264Vac @ no-load	420	Figure 14
264Vac @ full load	420	Figure 15
264Vac @ Output short	386	Figure16

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