

Subject
OB2228GN Demo Board Manual

Board Model: AD18V0.4A2228GN.00
Doc. No.: OB_DOC_DBM_2228GN02



Key features:

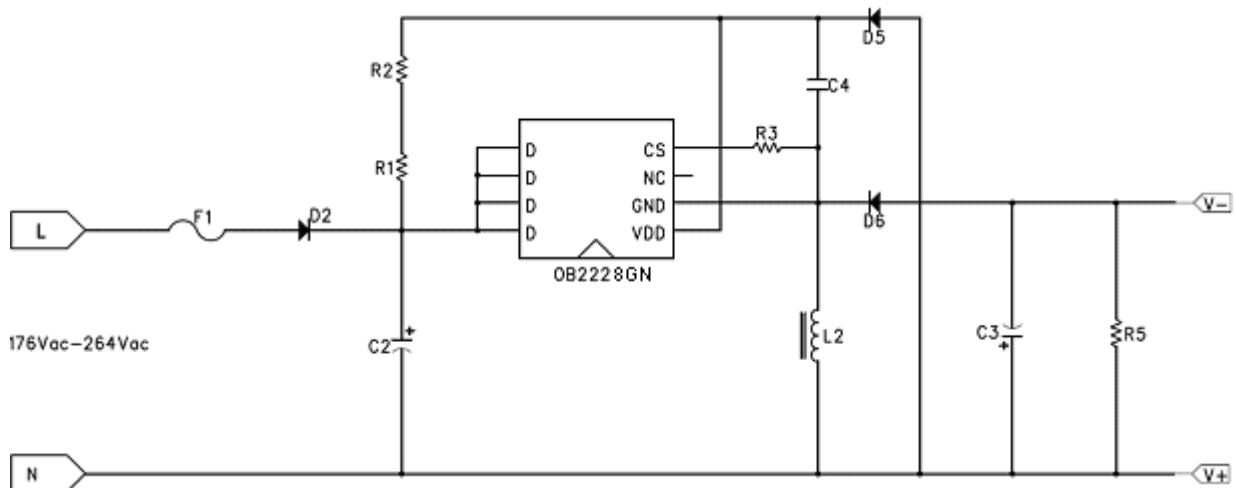
- Lowest possible component count
- Standby power <100mW @264Vac
- Efficiency measured >75% at full load
- Good dynamic response
- Comprehensive protection including output short protection, OTP, OCP etc.

Revision History

Revise Date	Version	Reason/Issue
2014-10-20	00	First issue
2016-8-26	01	System optimized
2017-4-28	02	Model version updated

1. Board Information

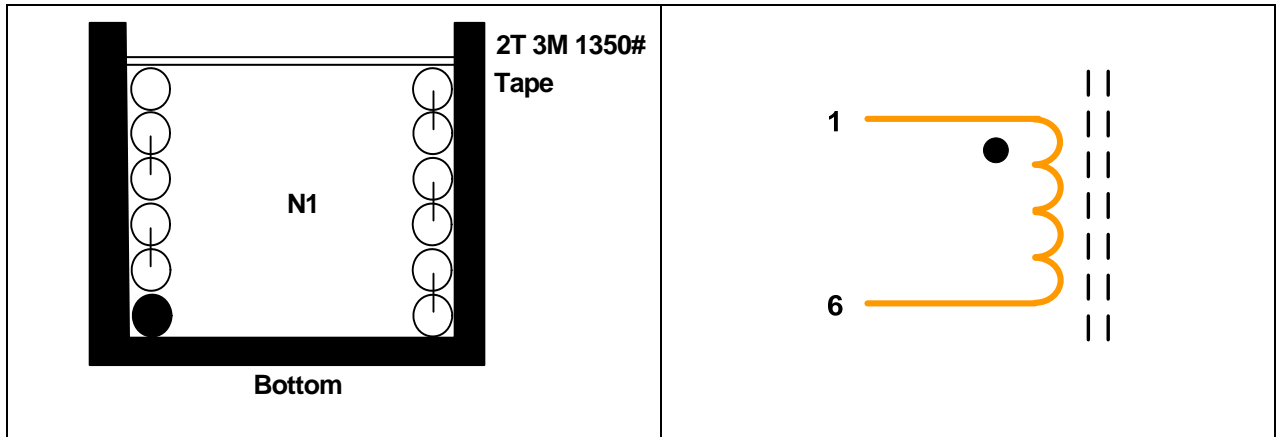
1.1. Board schematic



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. 8.2uF /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 0R47 /5% /1206	1
11	R5	SMD RES 20K /5% /0805	1
12	U1	OB2228GN SOP8	1
13	L1	Jumper	1
14	L2	EE10 0.5mH	1
	Total		15

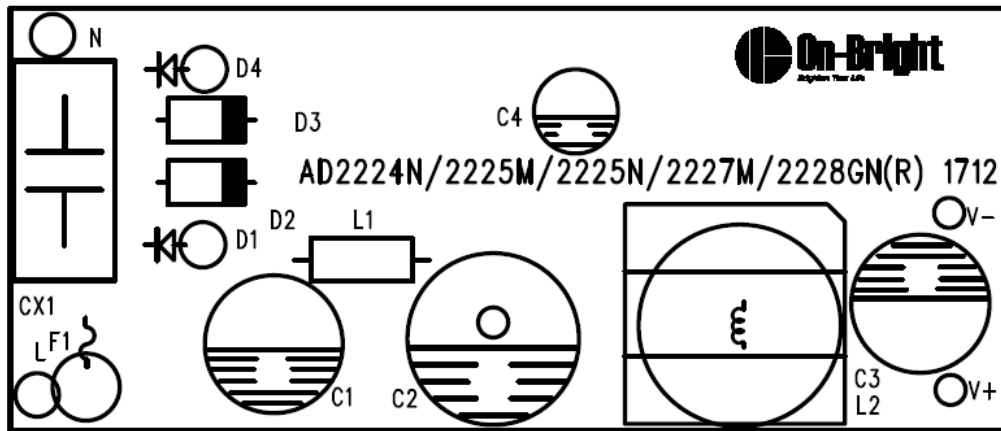
1.3. Inductor design



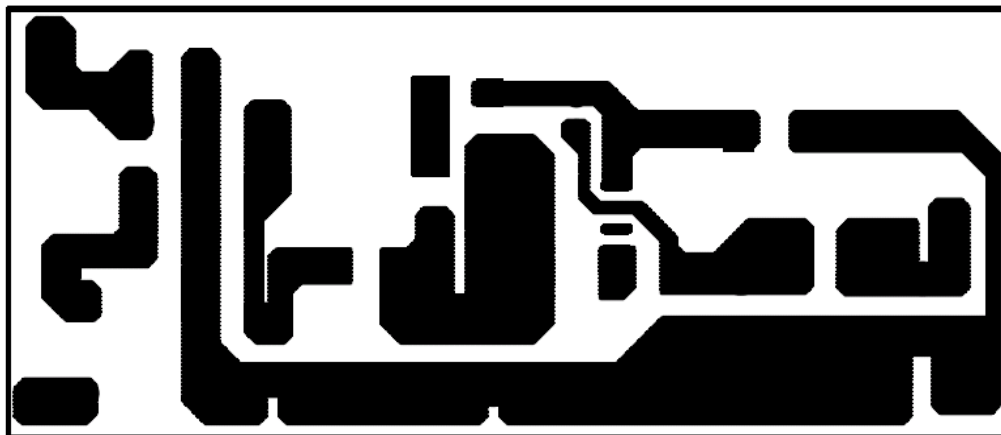
1. Bobbin: EE10
2. Core: TDK PC40.
3. L1-6= 500uH (at:10KHz, 1V)

Material	Turns	Inductance & Tolerance
Φ0.27 *1 2UEW	115	500uH ± 7%

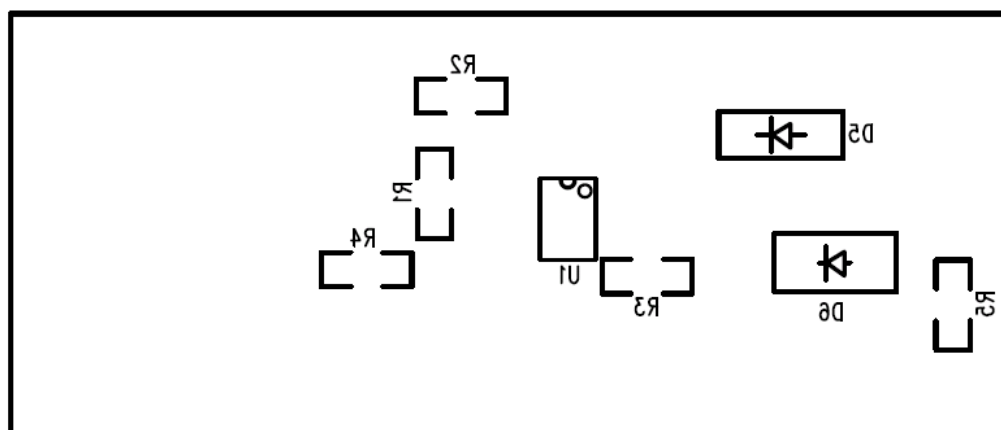
1.4. PCB Gerber File



Top

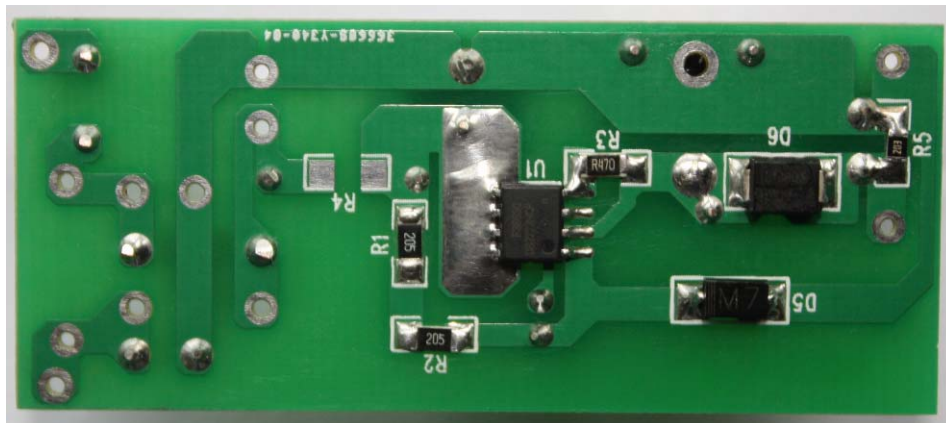
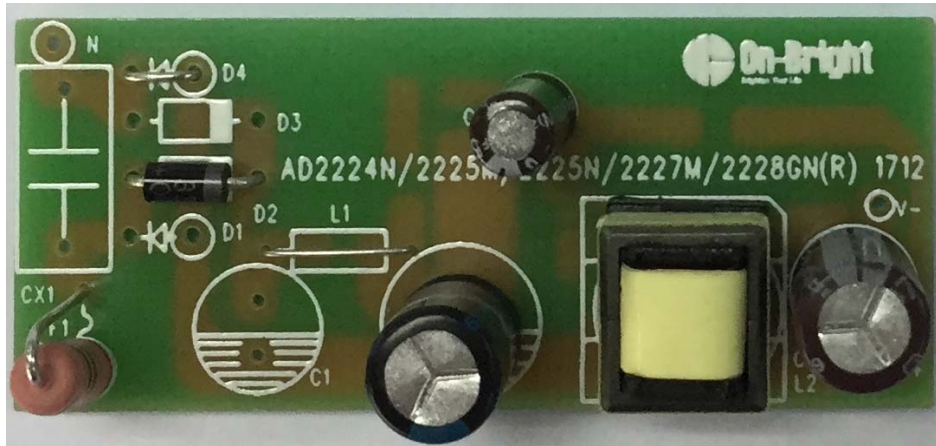


Bottom



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} 400mA
- Operating frequency 40KHz
- Output power 7.2W

2.3. Performance Function

- Standby Power < 100mW @ 264Vac/50Hz, no load, 25°C
- Efficiency >75%
- 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

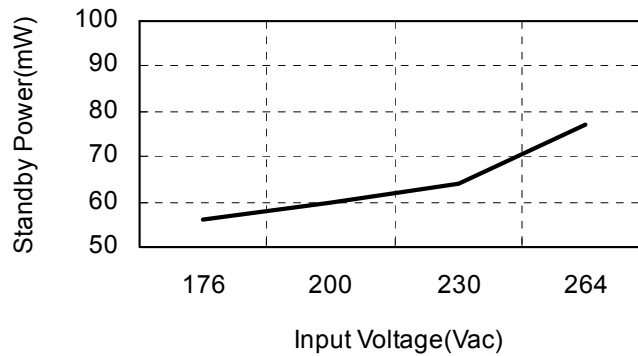


Figure 1. Standby input power

3.2. Efficiency

Input voltage	load 400mA	Spec	Remark
176Vac/50Hz	82.41	>75%	Pass
200Vac/50Hz	83.19		Pass
230Vac/50Hz	83.58		Pass
264Vac/50Hz	83.55		Pass

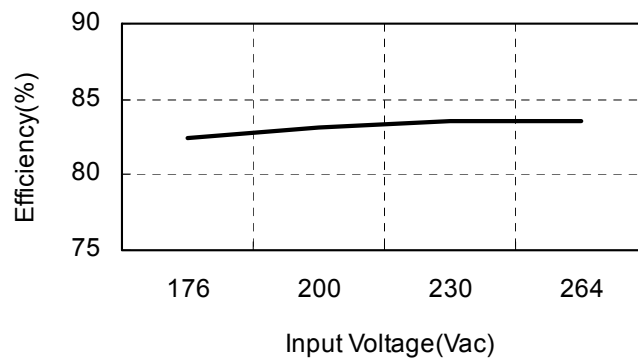


Figure 2. Efficiency @400mA load

3.3. Output Voltage

Input voltage	0mA	5mA	100mA	200mA	300mA	400mA	Spec	Remark
176Vac/50Hz	18.96	18.75	18.43	18.30	18.18	18.08	17~20V	Pass
200Vac/50Hz	18.96	18.75	18.44	18.30	18.18	18.09		Pass
230Vac/50Hz	18.96	18.74	18.44	18.30	18.19	18.09		Pass
264Vac/50Hz	18.96	18.74	18.43	18.30	18.19	18.09		Pass

3.4. Dynamic (Figure 13)

Input voltage	V _{OUT-min} (V)	V _{OUT-max} (V)	Spec	Remark
176Vac/50Hz	17.91	18.75	17~20V	Pass
200Vac/50Hz	17.93	18.76		Pass
230Vac/50Hz	17.93	18.76		Pass
264Vac/50Hz	17.90	18.75		Pass

Note: A dynamic loading with low load set at 0mA load lasting for 5ms and high set at 400mA load lasting for 5ms is added to output. The ramp is set at 0.25A/us at transient.

3.5. Over Current Protection & Recovery

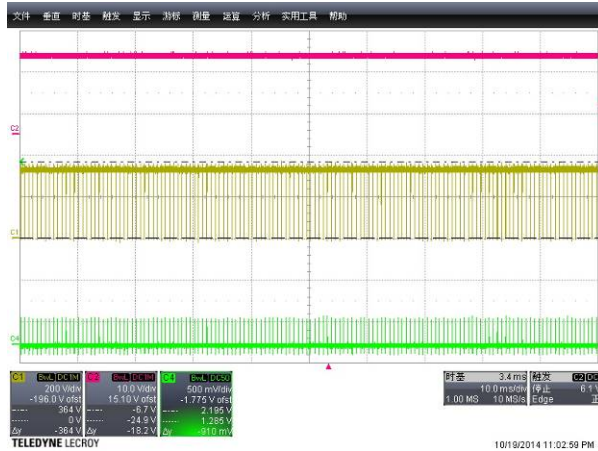
Input voltage	OCP (mA)	Recovery (mA)	Spec	Remark
176Vac/50Hz	496	493	$\geq 1.1 \cdot I_{OUT}$	Pass
200Vac/50Hz	507	502		Pass
230Vac/50Hz	511	508		Pass
264Vac/50Hz	522	519		Pass

3.6. Ripple & Noise (Figure 11&12)

Input voltage	No-load (mV)	Full load (mV)	Spec	Remark
176Vac/50Hz	15.0	83.5	<150mV	Pass
200Vac/50Hz	13.0	85.0		Pass
230Vac/50Hz	12.0	85.0		Pass
264Vac/50Hz	13.5	86.0		Pass

3.7. Waveforms

Figure 3: 230Vac, no-load



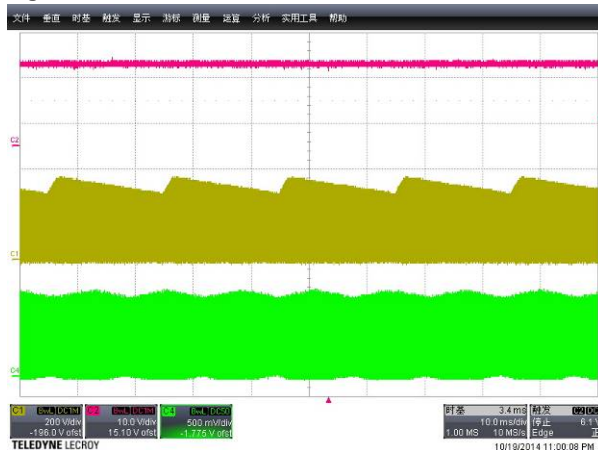
CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 空载, $V_{DS}=364V$

Figure 4: 230Vac, no-load



CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 空载波形展开, $V_{DS}=364V$

Figure 5: 230Vac, full load



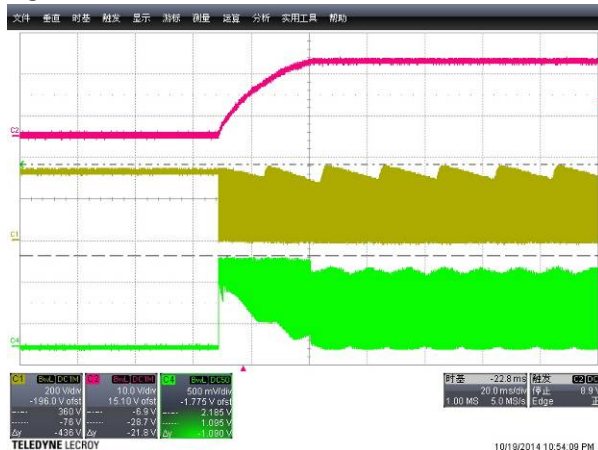
CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 满载, $V_{DS}=360V$

Figure 6: 230Vac, full load



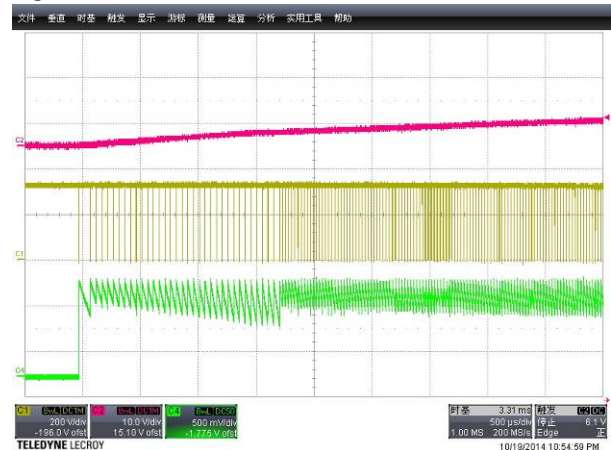
CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 满载波形展开, $V_{DS}=360V$

Figure 7: 230Vac, start at full load



CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 满载启动, $V_{DS}=360V$

Figure 8: 230Vac, start at full load



CH1: V_{DS} CH2: V_{out} CH4: $I_{Inductor}$
230Vac 输入, 满载启动波形展开, $V_{DS}=360V$

Figure 9: 230Vac, output short



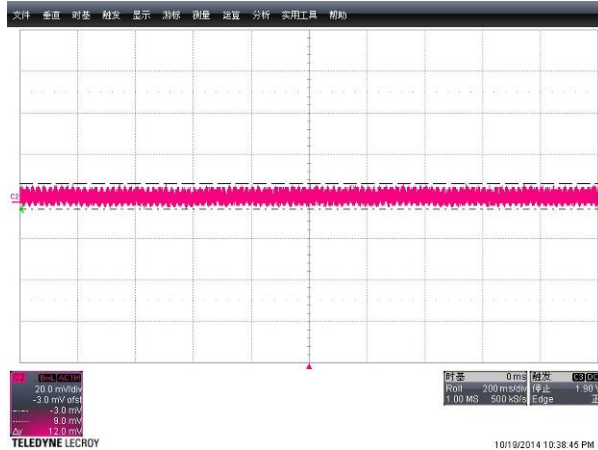
CH1: V_{DS} CH2: V_{out} CH4: $I_{inductor}$
230Vac 输入, 满载, $V_{DS}=335V$

Figure 10: 230Vac, output OLP



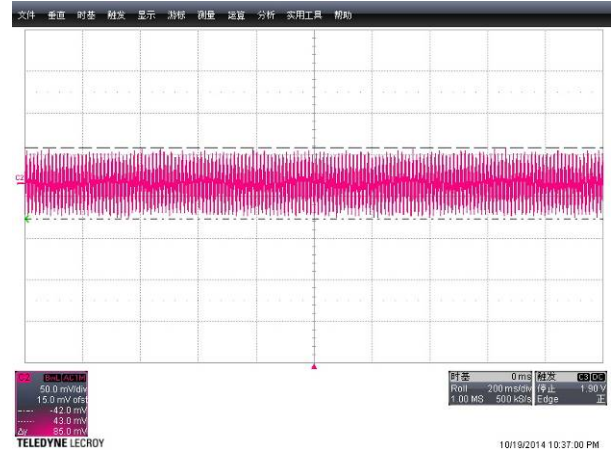
CH1: V_{DS} CH2: V_{out} CH4: $I_{inductor}$
230Vac 输入, 满载, $V_{DS}=335V$

Figure 11: 230Vac, no-load



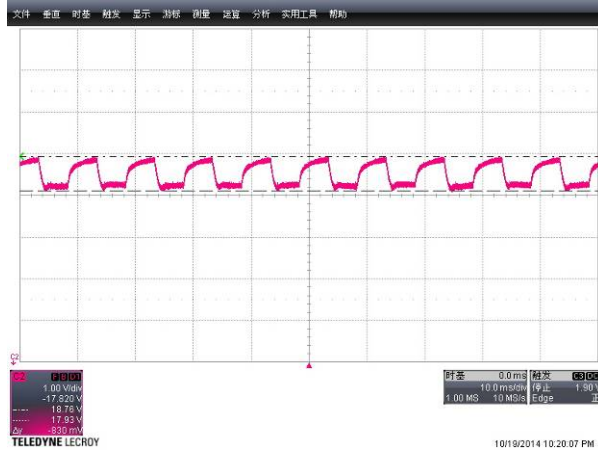
CH2: V_{ripple}
230Vac 输入, 空载, $V_{ripple}=12mV$

Figure 12: 230Vac, full load



CH2: V_{ripple}
230Vac 输入, 满载, $V_{ripple}=85mV$

Figure 13: 230Vac, 0~400mA load



CH2: V_{OUT}
230Vac 输入, 负载变化, $V_{out}=17.93-18.76V$

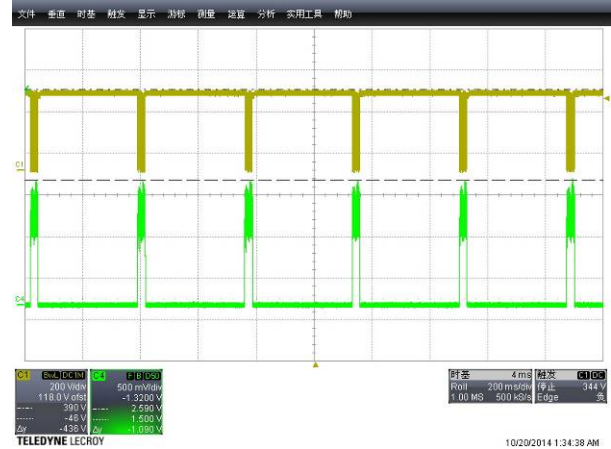
Figure 14: 264Vac, Output no-load



CH1: V_{DS} CH4: $I_{inductor}$
264Vac 输入, 输出空载

Figure 15: 264Vac, Output full load


CH2: V_{OUT}
 264Vac 输入, 输出满载

Figure 16: 264Vac, output short to GND


CH1: V_{DS} CH4: I_{Inductor}
 264Vac 输入, 输出短路

Input	V _{DS_MAX} (V)	Remark
264Vac @ no-load	410	Figure 14
264Vac @ full load	410	Figure 15
264Vac @ Output short	390	Figure16

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