



200 W PFC LD7593 & LD7932RG

By : Jess Lu

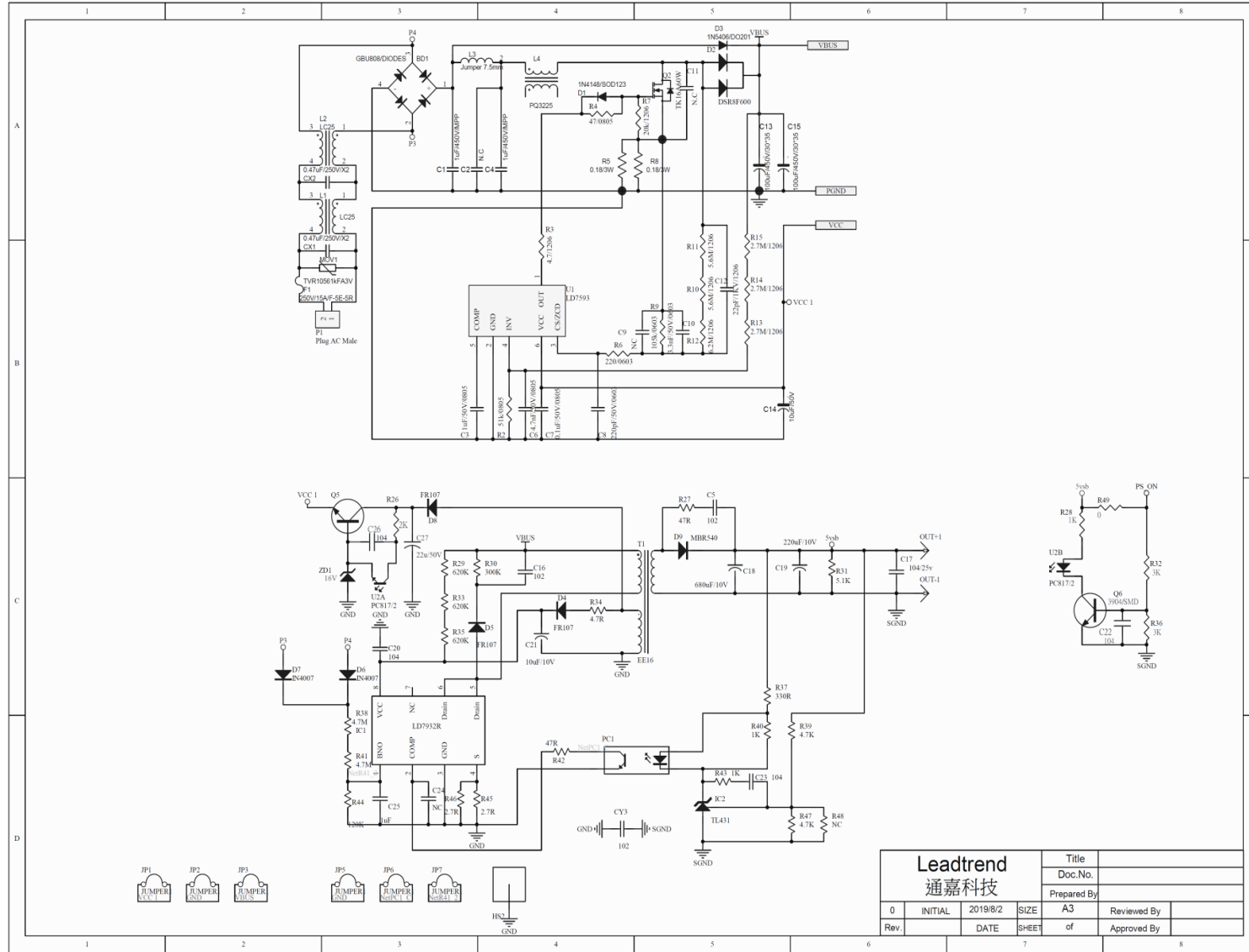
Date : 2019/08/01

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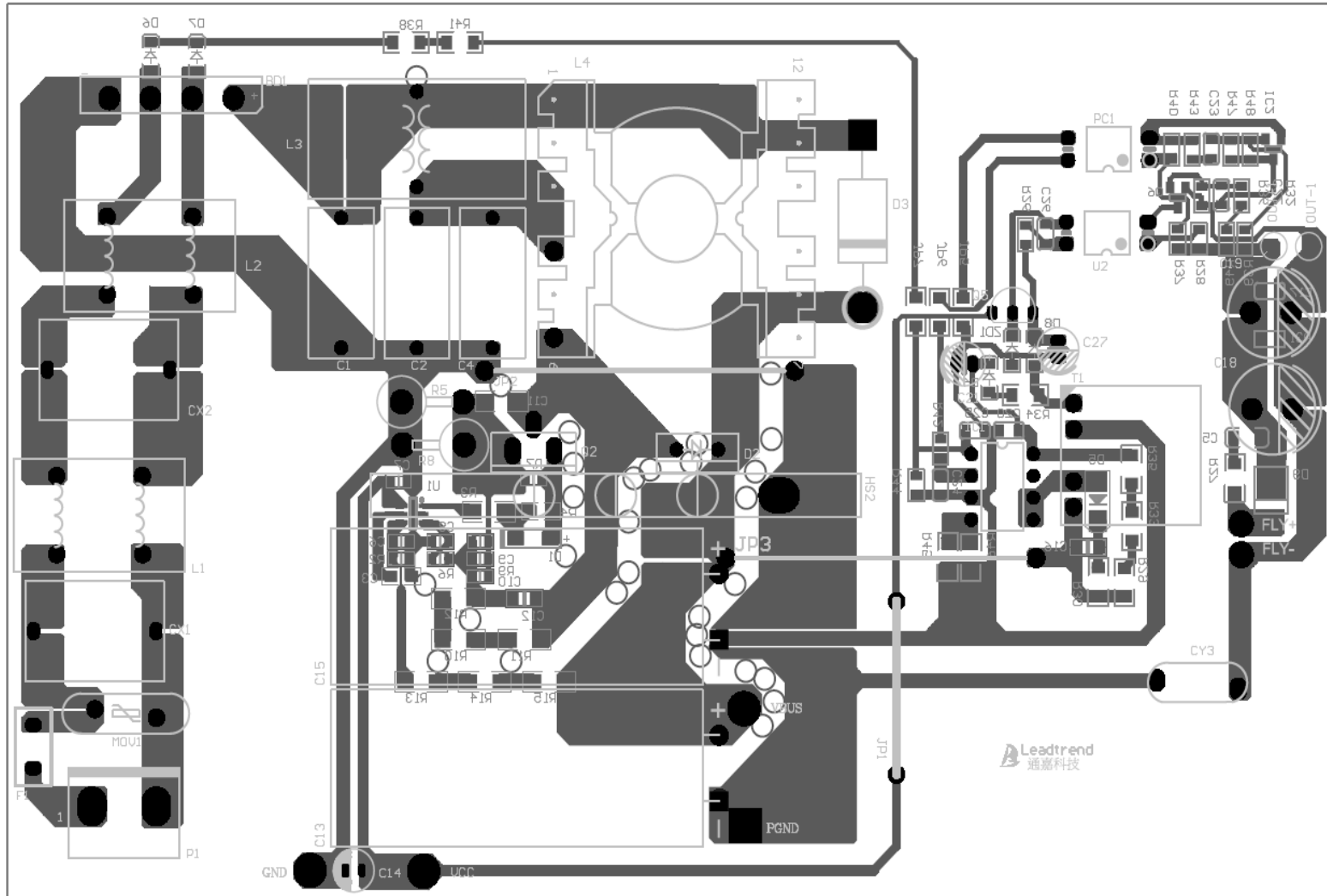
1. Specification

Item	Min.	Typ.		Max.	Test Result
Input Voltage (V_{AC})	90	115	230	264	—
Input Frequency (Hz)	47	60	50	63	—
Output Voltage & Current (V / A)	390V/0.5A		5V/2A		—
Efficiency	>90%				Pass
Power Factor	>0.9				Pass
Stress	<90%				Pass
Regulation	385V~415V				Pass

2. Schematic



3. PCB Layout



4. Bill of Materials

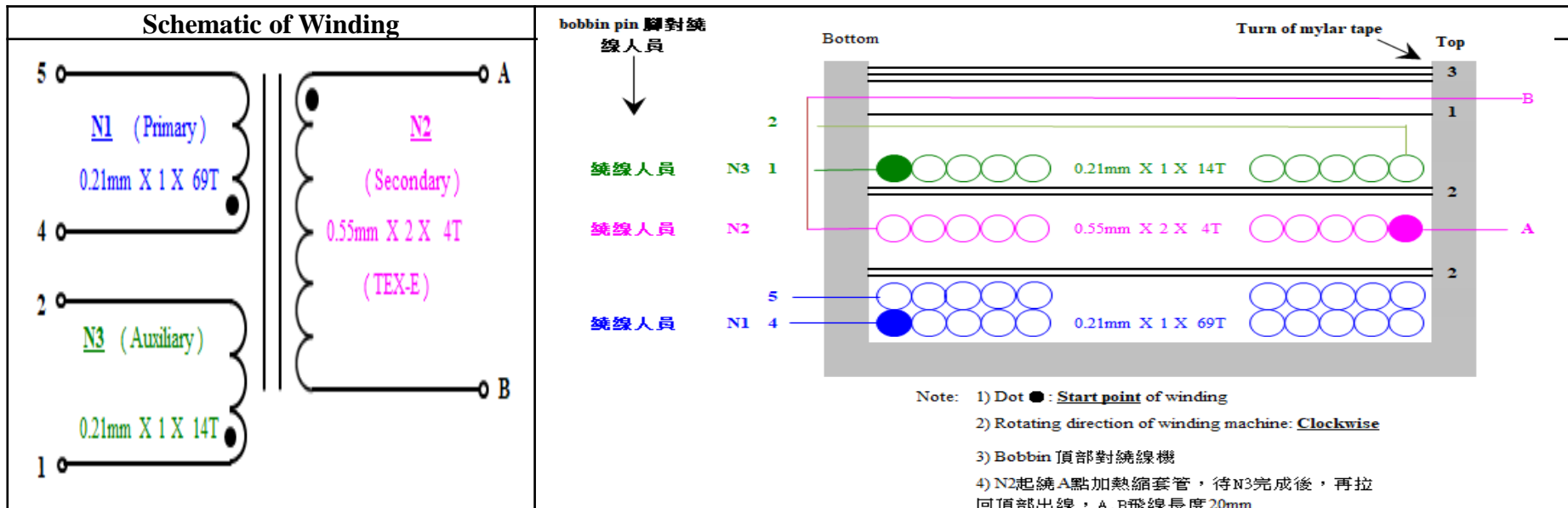
Location	Description	Q'ty
R2	SMD RES 0805 51K 1%	1
R3	SMD RES 1206 4.7R 5%	1
R4	SMD RES 0805 47R 5%	1
R5,R8	0.18Ω DIP-3W MOF 1%	2
R6	SMD RES 0603 220R 5%	1
R7	SMD RES 0805 20K 5%	1
R9	SMD RES 0603 105K 1%	1
R10,R11	SMD RES 1206 5.6M 1%	2
R12	SMD RES 1206 6.2M 1%	1
R13,R14,R15	SMD RES 1206 2.7M 1%	3
R26	SMD RES 0805 2K 5%	1
R27	SMD RES 1206 47R 5%	1
R28,R40,R43	SMD RES 0805 1K 5%	3
R29,R33,R35	SMD RES 1206 620K 5%	3
R30	SMD RES 1206 300K 5%	1
R31	SMD RES 0805 5.1K 5%	1
R32,R36	SMD RES 0805 3K 5%	2
R34	SMD RES 1206 4.7R 5%	1
R37	SMD RES 0805 330R 5%	1
R38,R41	SMD RES 1206 4.7MF 1%	2
R39,R47	SMD RES 0805 4.7K 5%	2
R42	SMD RES 0805 47R 5%	1
R44	SMD RES 0805 120KF 1%	1
R45,R46	SMD RES 1206 2.7R F 1%	2
R49	SMD RES 0805 0R 5%	1
JP5,JP6,JP7	SMD RES 1206 0R 5%	3
CY3	Y1 CAP CD 102 250V P:10mm	1
C1,C4	105/450V/MPP/18*7.5*15mm	2
C3	SMD CC 0805 105 50V X7R 10%	1
C5,C16	SMD CC 1206 102 1000V X7R 10%	2
C6	SMD CC 0805 222 50V X7R 10%	1
C7	SMD CC 0805 104 50V X7R 10%	1
C8	SMD CC 0603 221 50V X7R 10%	1

Location	Description	Q'ty
C10	SMD CC 0603 332 50V X7R 10%	1
C12	SMD CC 1206 22pF 1KV NP0 5%	1
C13,C15	FOAI FPF 100uF/450V/16*40	2
C14,C27	E CAP 22uF 50V SY 20% 5*11 P:2.0mm	2
C17,C20,C22,C23,C26	SMD CC 0805 104 50V X7R 10%	5
C18,C19	E CAP 470uF 25V SC 10*12 P:5.0mm	2
C21	E CAP 10uF 50V SY 5*10 P:2.5mm	1
C25	SMD CC 0805 105 50V X7R 10%	1
CX1,CX2	DIP X2 CAP HQX 0.47uF(474) ±10% 275V P:15mm(17*16*10.3mm)	2
BD1	HY GBJ 808	1
D1	1N4148 / SOD-123	1
D2	TI STTH10LCD06FP / TO-220	1
D3	1N5406 / DO201	1
D4,D5,D6,D7,D8	FRS1ME / SOD-123	5
D9	威倫 MBR1045ULPS	1
IC1	LD7932R / DIP-8	1
IC2	SMD IC LA431OCRPA SOT-23-3L	1
Q2	AUK SJMN190R65F / TO-220	1
Q5,Q6	MMBT2222A / SOT-23	2
ZD1	BZT52-B16 16V / SOD-123	1
U1	LD7592E1 / SOT-26	1
PC1,U2	DIP IC EL817C (CTR 200-400)	2
MOV1	14N561	1
T1	EE-16加寬 / AE 38 / 65:4:15 / 1800 uH	1
L1,L2	COMMON	2
L4	PQ3225 / 0.1*85*30T L= 170uH	1
F1	DIP FUSE 5A 250V 2010 Time Lag 8.5*8.5*4mm 方型塑膠外殼	1
PCB	162 x 103 x 2 mm / FR-4 / 2 oz	1
JP1	JUMP / 20mm / 1 Φ	1
JP2,JP3	JUMP / 38mm / 1 Φ	2

4. Bill of Materials (Cont.)

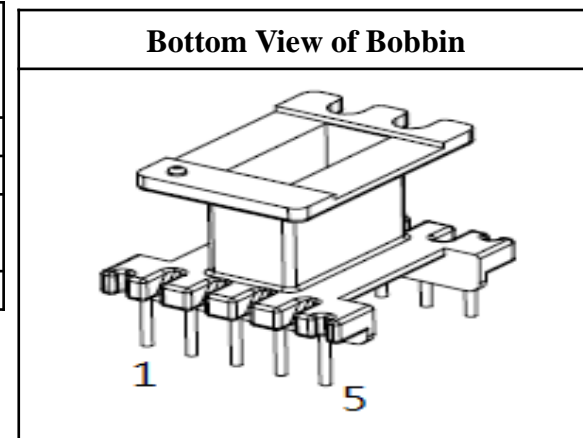
Location	Description	Q'ty
HS1	散熱片 / 80*25*5mm	1
HS2	散熱片 / 60*25*5mm	1
CON1	Pitch = 3.96 mm (3 PIN Cut pin2)	1
L3	JUMP / 7.5mm / 1 Φ	1

T1



Winding No.	Pin No.		Winding Types	Number of Turns		Remarks	
	Start	Finish		Winding	Tape		
N1	4	5	0.21 mm X 1	69	2	N_p	Pin 朝人順繞
N2	A	B	0.55 mm X 2	4	2	N_s	Pin 朝人順繞
N3	1	2	0.21 mm X 1	14	1	N_A	Pin 朝人順繞(疏繞)

二次側線由頂部凹槽出線，起繞A點加熱縮套管



Bobbin Shape	Core Material	A_e (mm ²)	L_p (μH)
EE-16W	PC44	38	1800 ± 5 % @ 65 kHz / 1 V

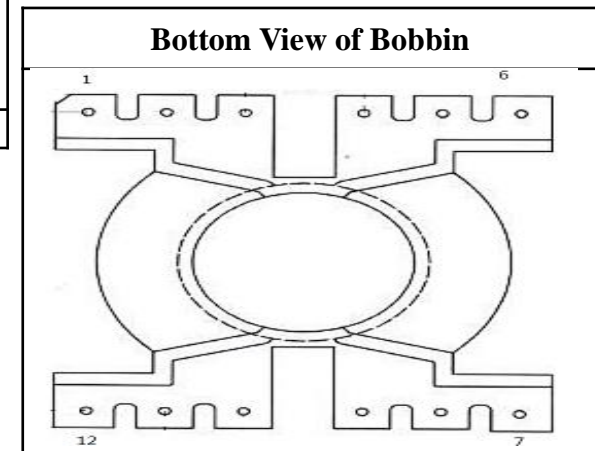
5. Transformer Design

L4

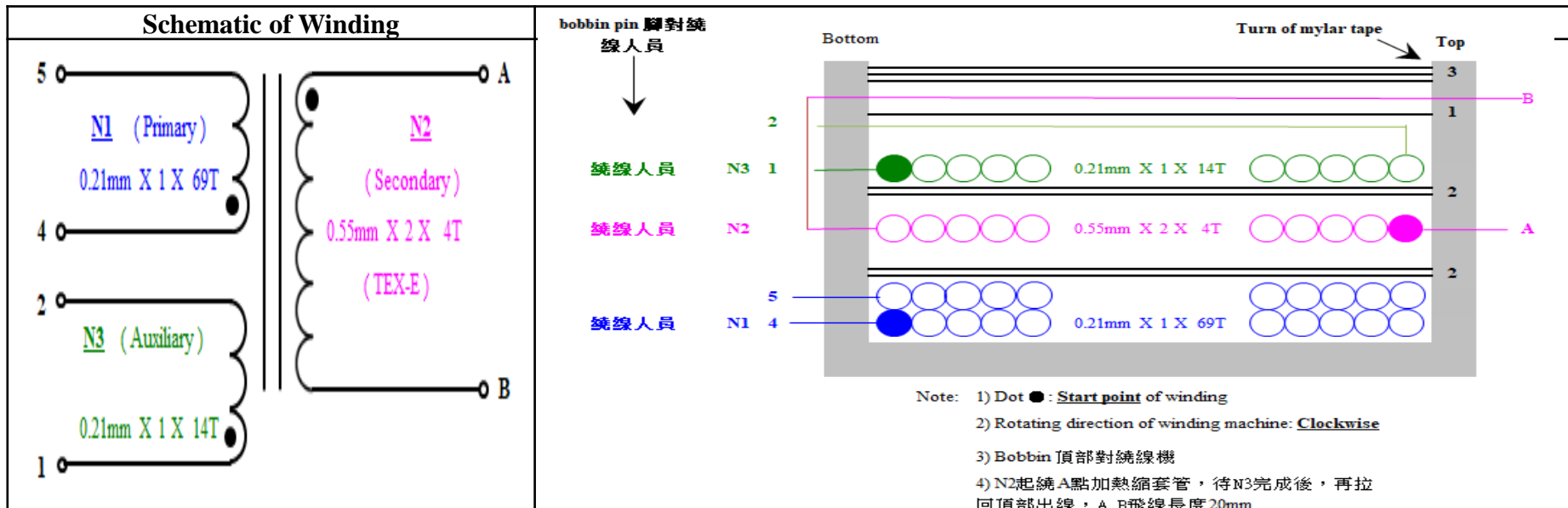
Schematic of Winding	Construction of Winding
<p style="text-align: center;">N1 0.1mm X 85 X 30T</p>	<p style="text-align: center;">bobbin pin 腳對繞線人員 ↓ 繞線人員</p> <p style="text-align: center;">Bottom Turn of mylar tape ↘ Top</p> <p style="text-align: center;">6 3</p> <p style="text-align: center;">N1 4 0.1mm X 85 X 30T</p> <p style="text-align: center;">Note: 1) Dot ●: Start point of winding 2) Rotating direction of winding machine: Clockwise 3) Bobbin 頂部對繞線機</p>

Winding No.	Pin No.		Winding Types	Number of Turns		Remarks	
	Start	Finis h		Winding	Tape		
N1	4	6	0.1 mm X 85	30	3	N1	Pin 朝人順繞

Bobbin Shape	Core Material	A_e (mm ²)	L_p (μH)
PQ3225	PC44	149	170 ± 5 % @ 65 kHz / 1 V



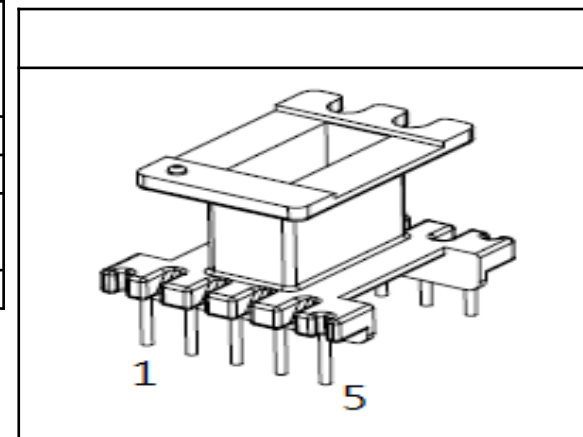
T1



Winding No.	Pin No.		Winding Types	Number of Turns		Remarks	
	Start	Finish		Winding	Tape		
N1	4	5	0.21 mm X 1	69	2	N_p	Pin 朝人順繞
N2	A	B	0.55 mm X 2	4	2	N_s	Pin 朝人順繞
N3	1	2	0.21 mm X 1	14	1	N_a	Pin 朝人順繞(疏繞)

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EE-16W	PC44	38	1800 ± 5 % @ 65 kHz / 1 V

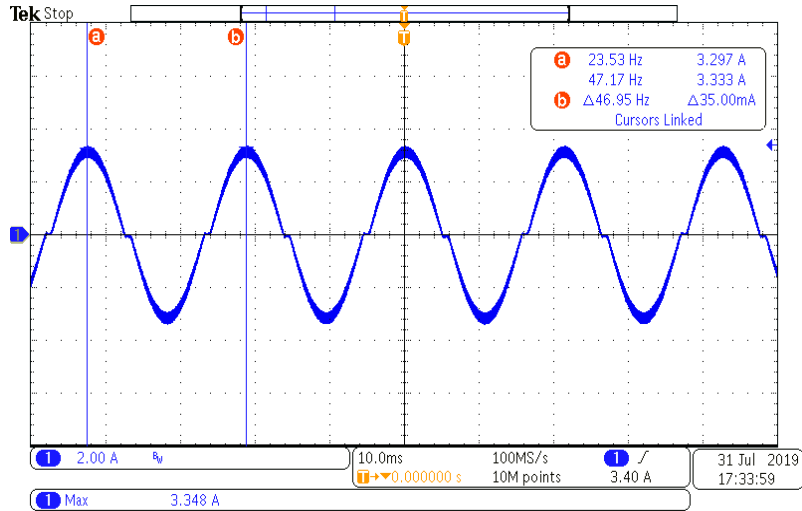


6. Efficiency & Power Factor

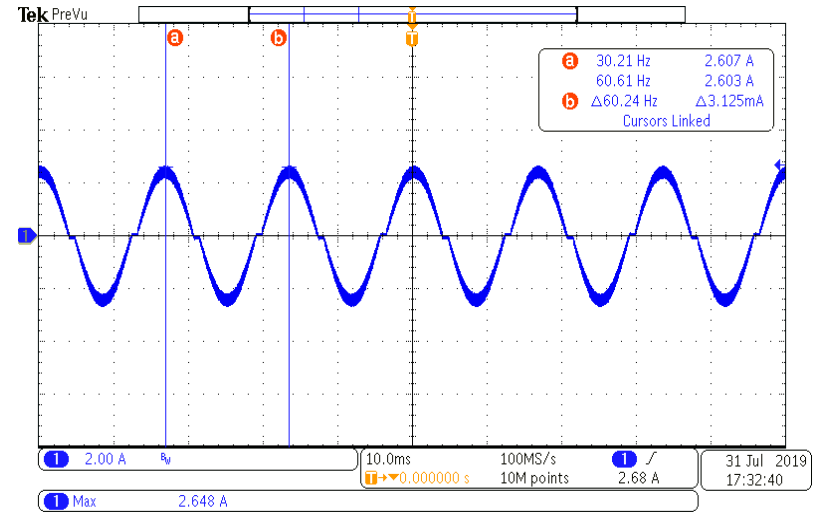
Input Voltage	90 V _{AC} / 47 Hz 115 V _{AC} / 60Hz 230 V _{AC} / 50 Hz 264 V _{AC} / 63 Hz
Output Current	Full Load
Measured Point of Output Voltage	End of PCB

Voltage (V)	Efficiency (%)	Power Factor
90	94.75%	0.996
115	96.31%	0.994
230	98.24%	0.954
264	98.54%	0.934

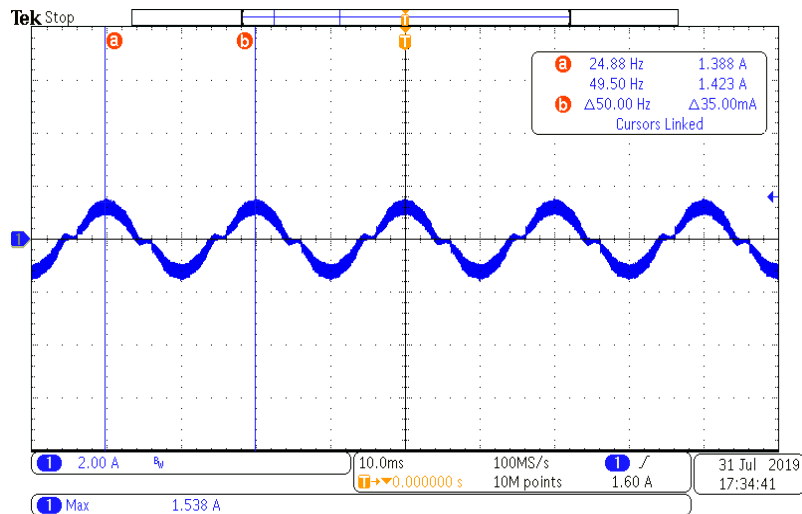
7. Key Waveform



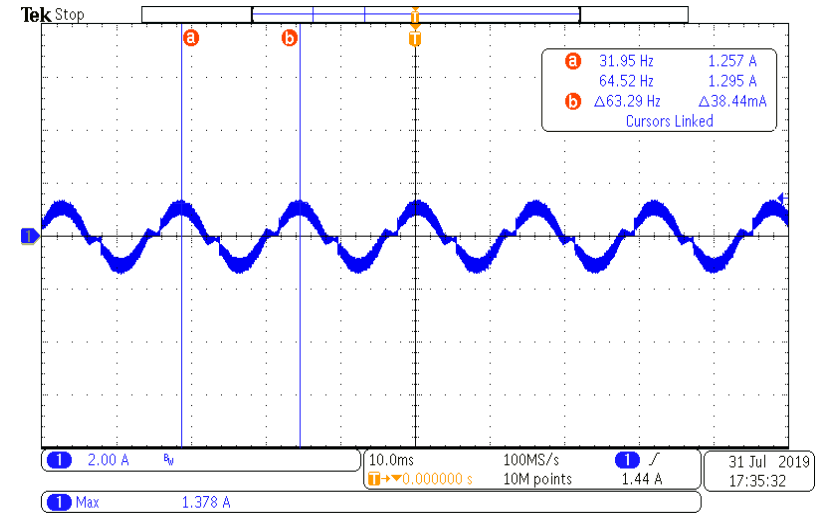
90Vac AC Current Waveform



115Vac AC Current Waveform

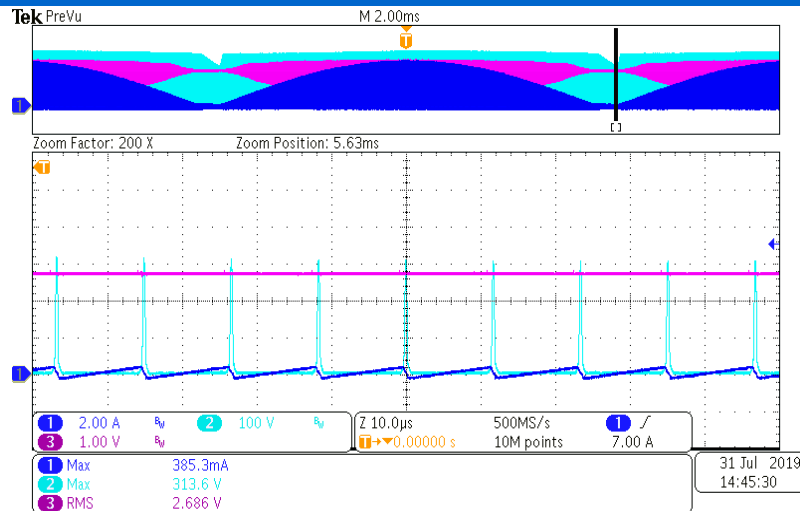
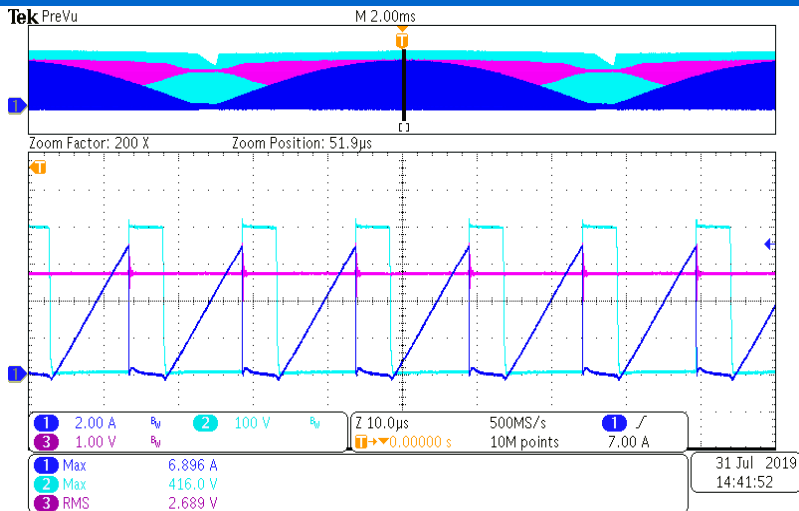


230Vac AC Current Waveform

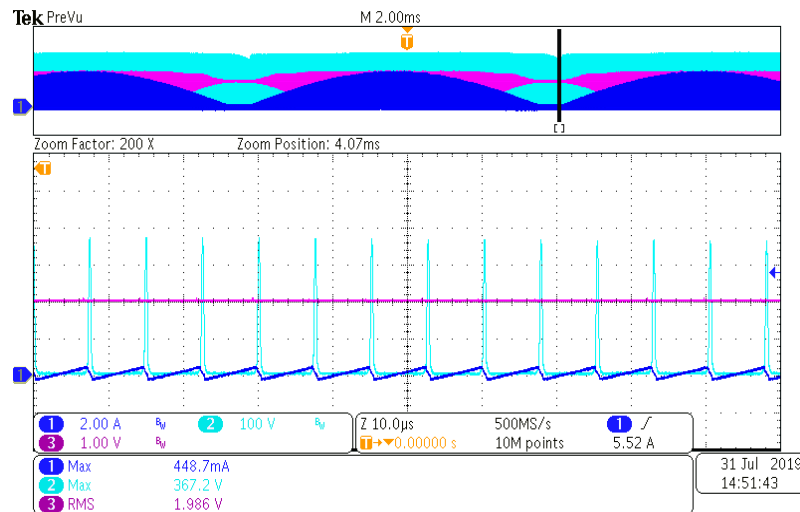
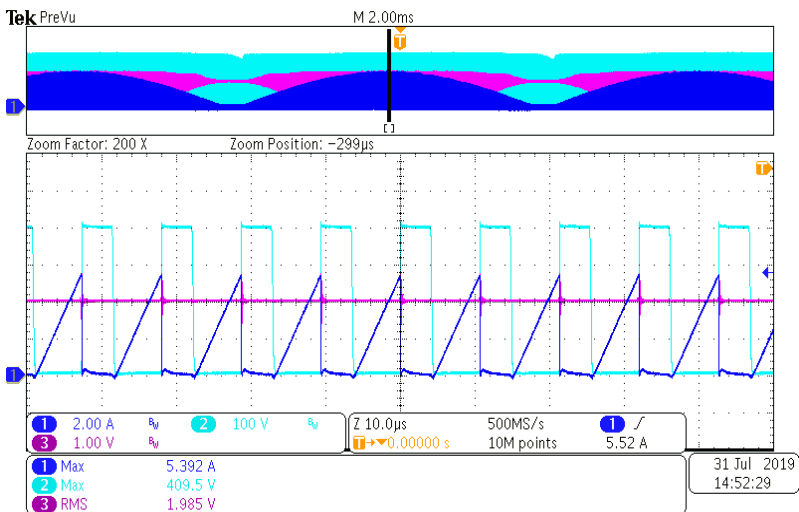


264Vac AC Current Waveform

7. Key Waveform (Cont.)

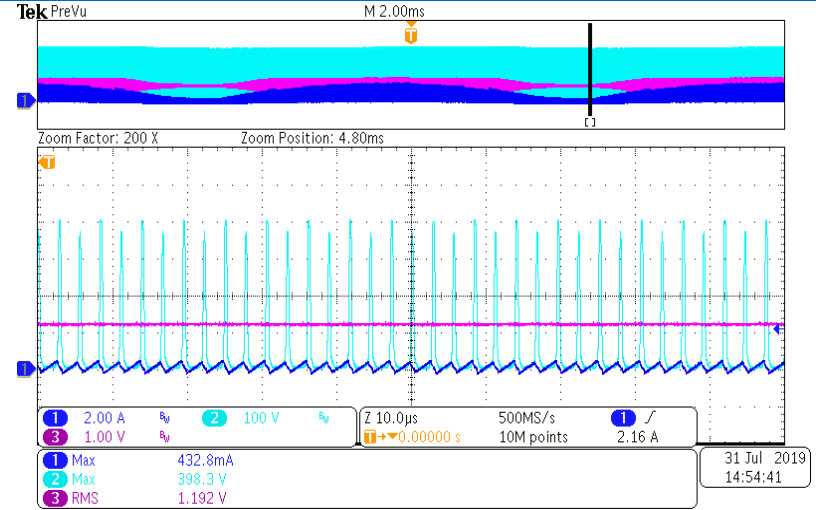
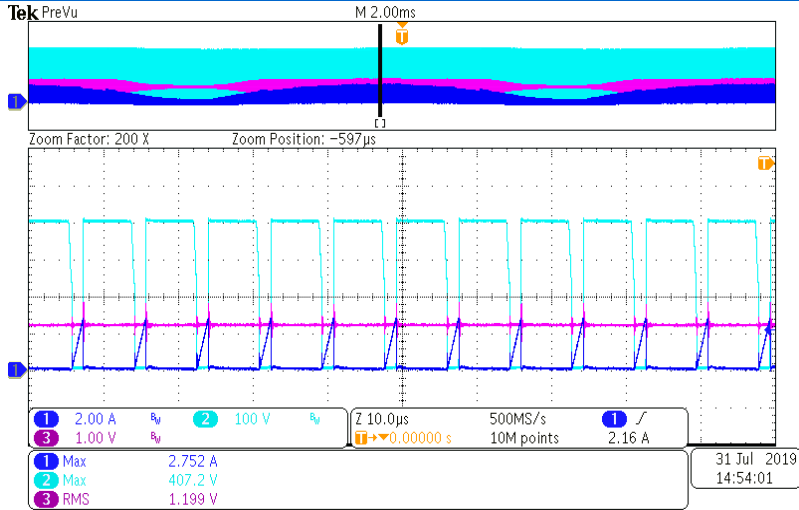


90Vac 390V/0.5A , CH1 I_{DS} . CH2 V_{DS} . CH3 Comp

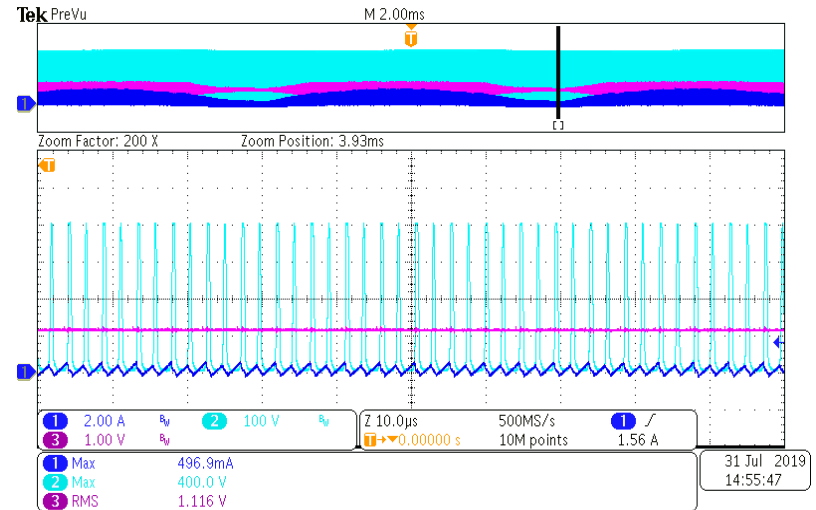
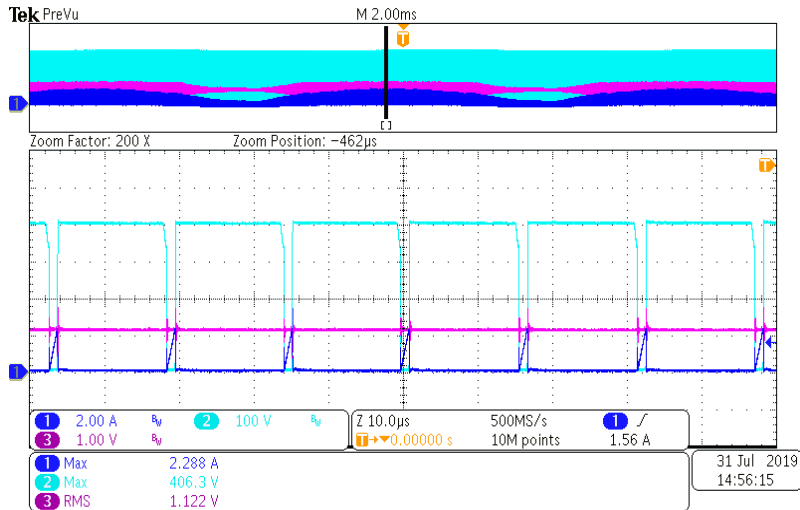


115Vac 390V/0.5A , CH1 I_{DS} . CH2 V_{DS} . CH3 Comp

7. Key Waveform (Cont.)

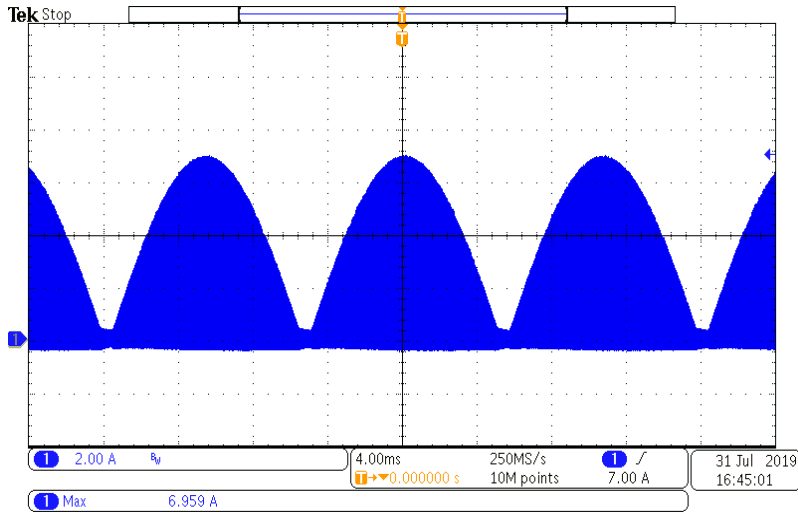


230Vac 390V/0.5A , CH1 I_{DS} . CH2 V_{DS} . CH3 Comp

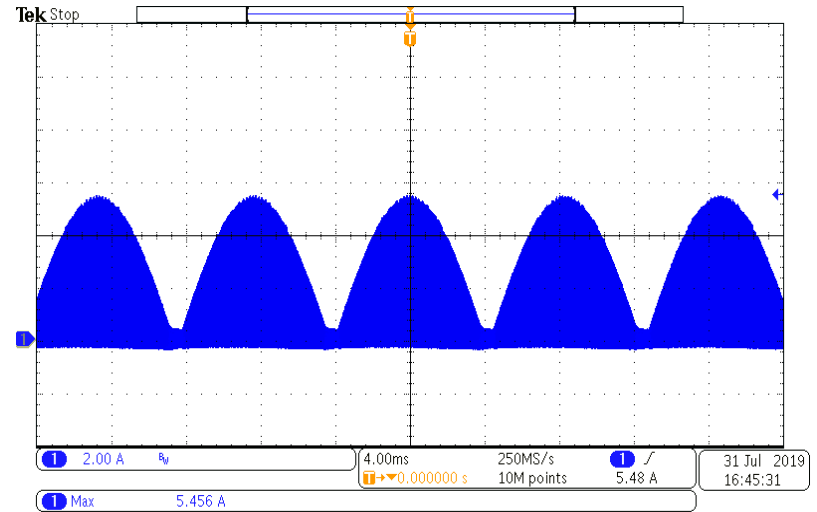


264Vac 390V/0.5A , CH1 I_{DS} . CH2 V_{DS} . CH3 Comp

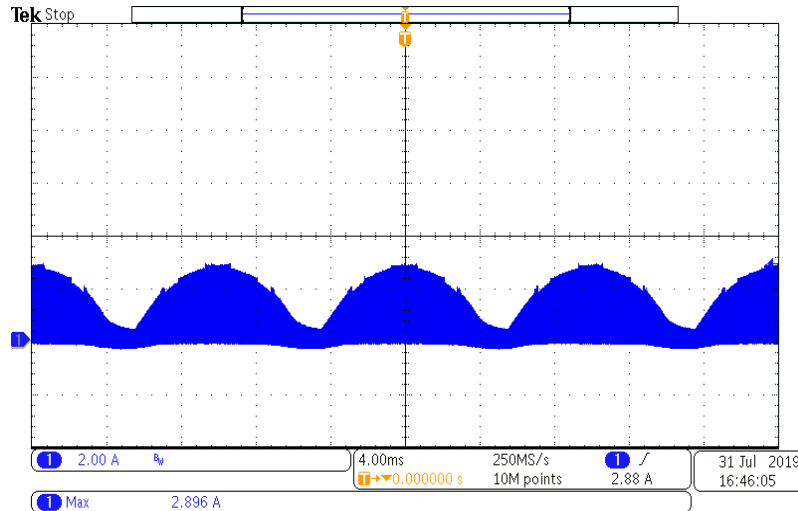
7. Key Waveform (Cont.)



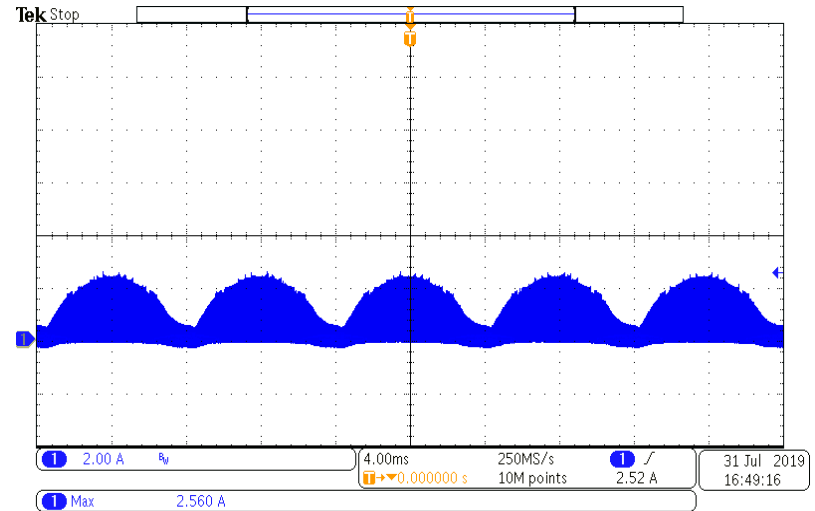
90Vac PFC Current Waveform



115Vac PFC Current Waveform



230Vac PFC Current Waveform



264Vac PFC Current Waveform

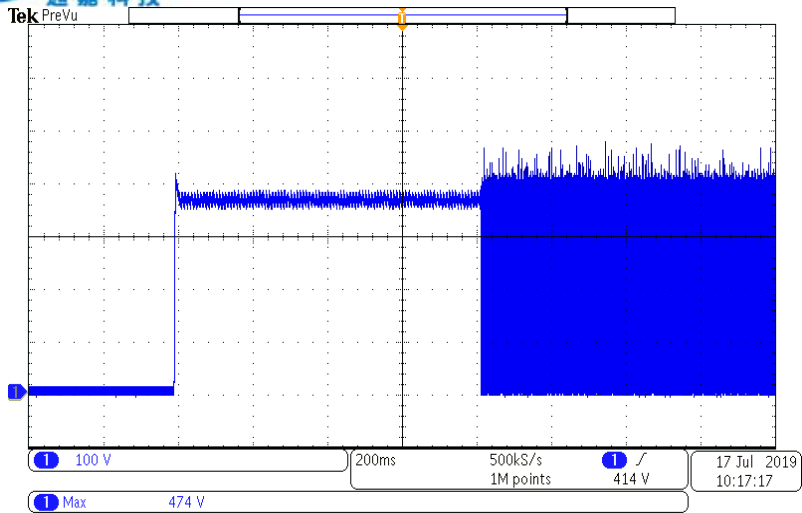
8. Stress on Switching Parts

Input Voltage	264 V _{AC} / 63 Hz
Output Current	Full Load
Requirement	<90 %

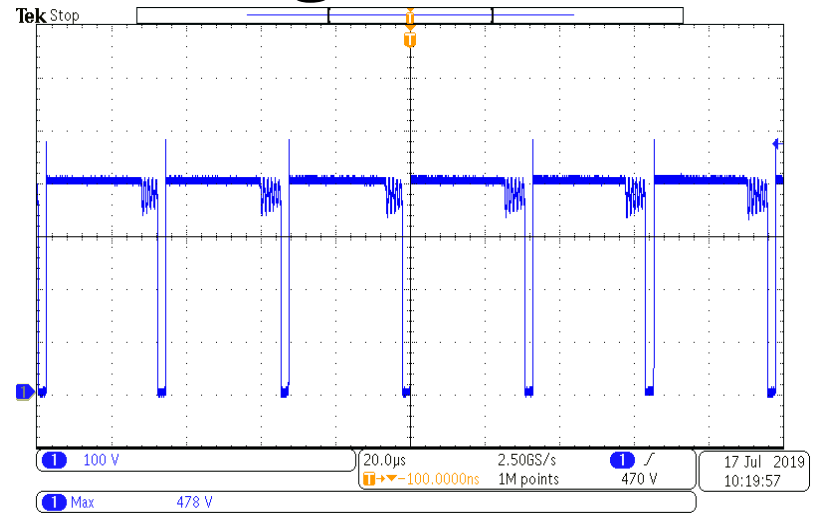
Turn on (264/63Hz)				
NO.	Location	Voltage (V)	Measurement (V)	Derating (%)
1	Q1	600	474	79
2	D1	600	418	69.6

Normal (264/63Hz)				
NO.	Location	Voltage (V)	Measurement V	Derating (%)
			V	%
1	Q1	600	478	79.6
2	D1	600	418	69.6

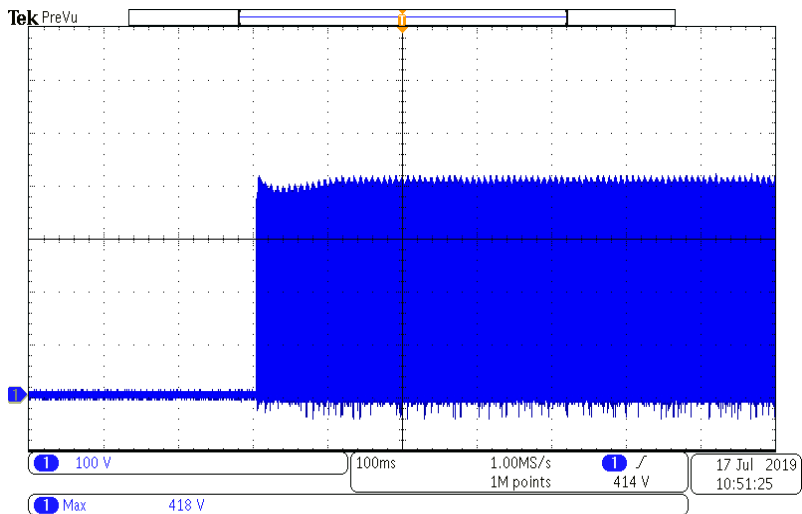
8. Stress on Switching



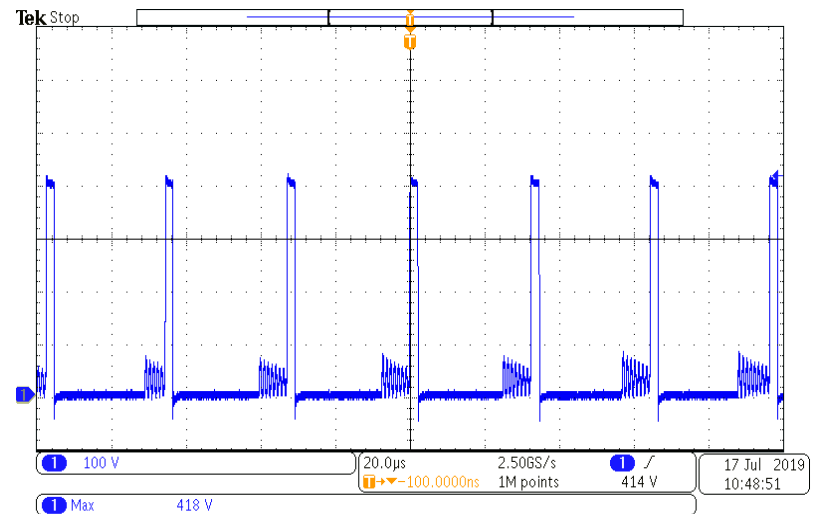
264Vac Q1 Vds turn on



264Vac Q1 Vds normal



264Vac D1 Vrrm turn on



264Vac D1 Vrrm normal

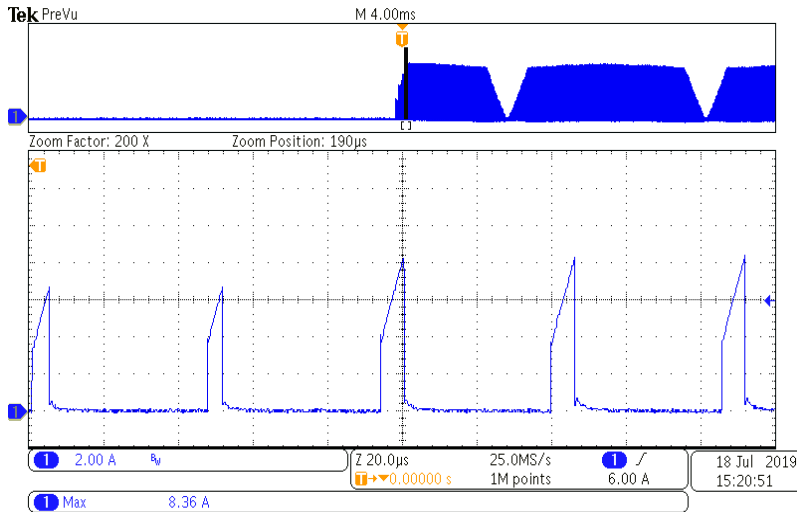
9. Mosfet Id Current

Input Voltage	90 V _{AC} / 47 Hz
Output Current	Full Load
Requirement	<90 %

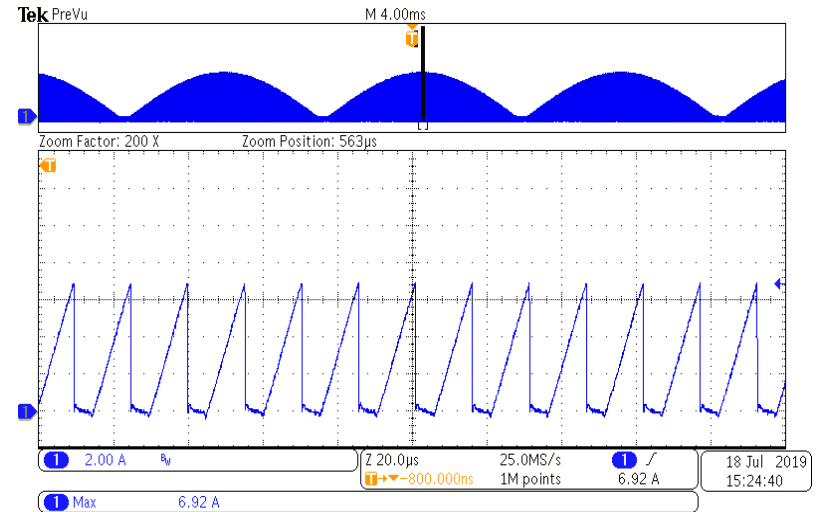
Turn on (264/63Hz)				
NO.	Location	Current (A)	Measurement (A)	Derating (%)
1	Q1	15.8	8.36	52.9

Normal (264/63Hz)				
NO.	Location	Current (A)	Measurement (A)	Derating (%)
1	Q1	15.8	6.92	43.79

9. Mosfet Id Current



90Vac Q1 Ids turn on



90Vac Q1 Ids normal

$$\Delta B_{max} = \frac{170\mu H \times 8.36 A \times 10^8}{30ts \times 1.49cm^2} = 3179gauss$$

$$\Delta B_{max} = \frac{170\mu H \times 6.92 A \times 10^8}{30ts \times 1.49cm^2} = 2631gauss$$

10. Load Regulation

Input Voltage	90 V _{AC} / 47 Hz	115 V _{AC} / 60 Hz	230 V _{AC} / 50 Hz	264 V _{AC} / 63 Hz
Output Current	No Load & Full Load			
Requirement	PASS			

(V / Hz)	(V)		Requirement (V)
	No Load	Full Load	
90 / 47	404	399	PASS
115 / 60	407	399	
230 / 50	411	399	
264 / 63	411	399	

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