

Evaluation Board Report

AC/DC 60W 20V/3A

(LD5760E1+LD8526)

Tested by	Reviewed by	Approved by
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Total Pages	Revision	Date
40	01	2021 / 07 / 20

Key Feature

- The Evaluation Board is designed to demonstrate the capabilities of LD5760E1 & LD8526.
- Application For TV/MNT/ Networking/Standy power..etc
- LD5760E1:Secondary-side feedback control
- LD8526: Suited for low side and high side flyback synchronous rectification in CCM, DCM and QR(valley lock) mode
- Universal Main Supply Operation (90V~265VAC)
- Power Saving< 0.75mW
- Efficiency Meet CoC Tier 2
- EMI meet EN55032 Class B

LD5760E1: High Voltage Green-Mode PWM Controller with BNO Function

- High-Voltage (700V) Startup Circuit
- Operating Current: 0.25mA(VCOMP=0)
- Built-in Brown-in/out Function on HV pin
- Built- in X-Cap Discharge on HV pin
- OPP (Over Power Protection)
- OSCP(Output Short Circuit Protection)
- SDSP (Secondary Diode Short Protection)
- OVP (Over Voltage Protection) on VCC/CS
- Gate Source/Sink Capability: +120mA/-750mA @ output pin with 33nF capacitor.

LD8526: Supports CCM and DCM Operation

- Self-supplying for operation with low output voltage and/or high-side rectification without an auxiliary winding.
- Suited for primary side with peak load function (max. frequency 130kHz)
- Suited for PD application, which output voltage range from 3V to 21V, and VCC range from 3V to 6V.
- Programmable turn-off level
- Fast turn-off total delay of 30ns
- Gate source/sink capability: 0.5A/-3A

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1. Specification

Item	Min.	Typ.		Max.	Test Result
Input Voltage	90Vac	115Vac	230Vac	264Vac	—
Input Frequency	47Hz	60Hz	50Hz	63Hz	—
Output Voltage & Current	20V / 3A				—
Efficiency	CoC Tier 2				Pass
Standby Power	< 75mW @ 230 V_{AC}				Pass
Output Voltage Accuracy	± 5 %				Pass
Over Current Protection	< 5.3A				Pass
Over Voltage Protection	< 25 V				Pass
Ripple & Noise Voltage	< 300 mV				Pass
Dynamic Load	< ± 5% of V_{BUS,SET}				Pass
Turn-on Delay Time	< 1 S				Pass
Hold-up Time	> 10mS @ Typical AC Input				Pass
Rise Time	< 40 mS				Pass
Overshoot	< 10 %				Pass
Component Stress	Continue <90 % ; instant <95 %				Pass
EMI	EN55032 Class B				Pass

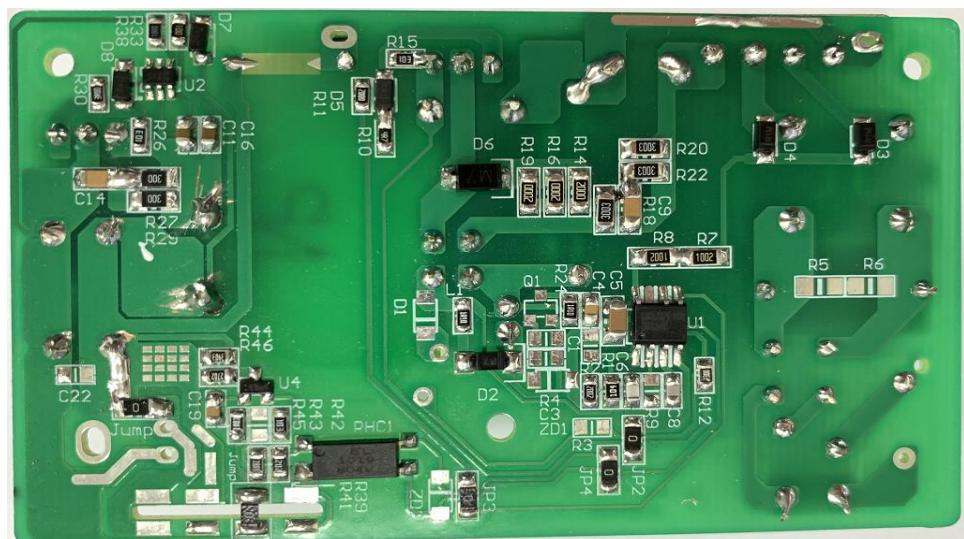
2. OUTLINE

11.0165 W / inch³

Top View

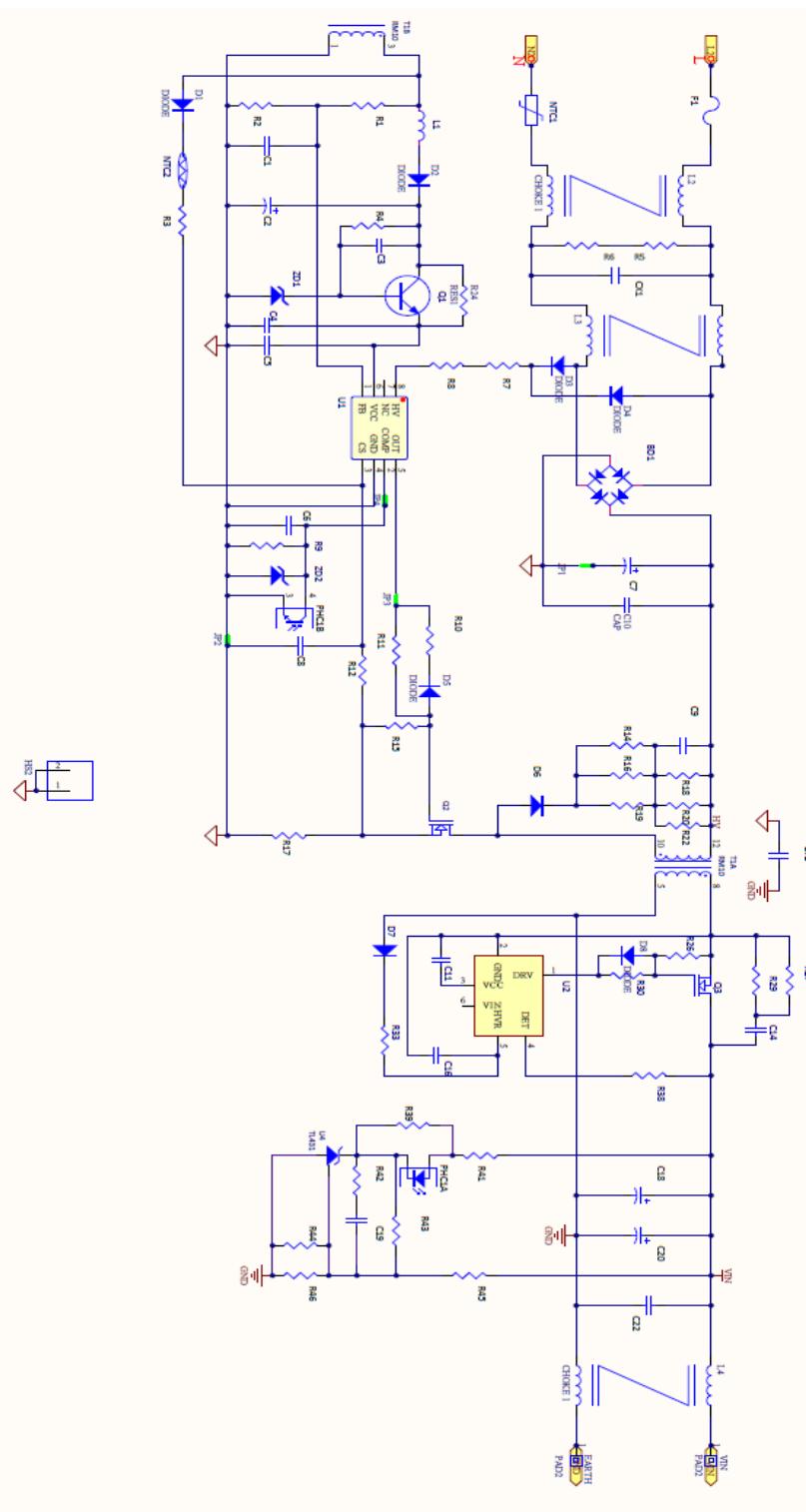


Bottom View



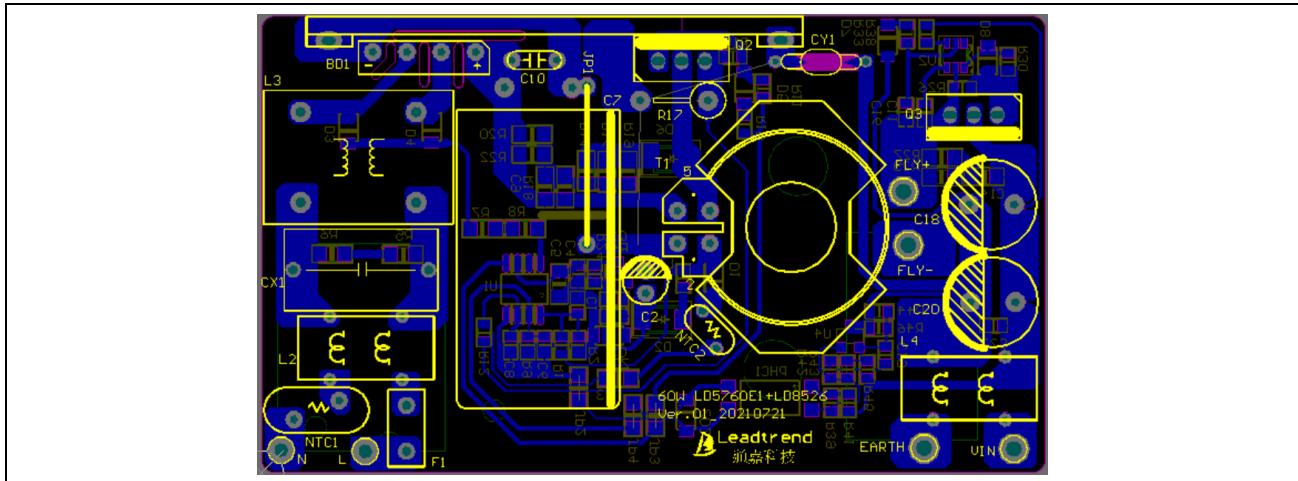
Size: 85 mm (L) x 50 mm (W) x 21mm (H)

3. SCHEMATIC

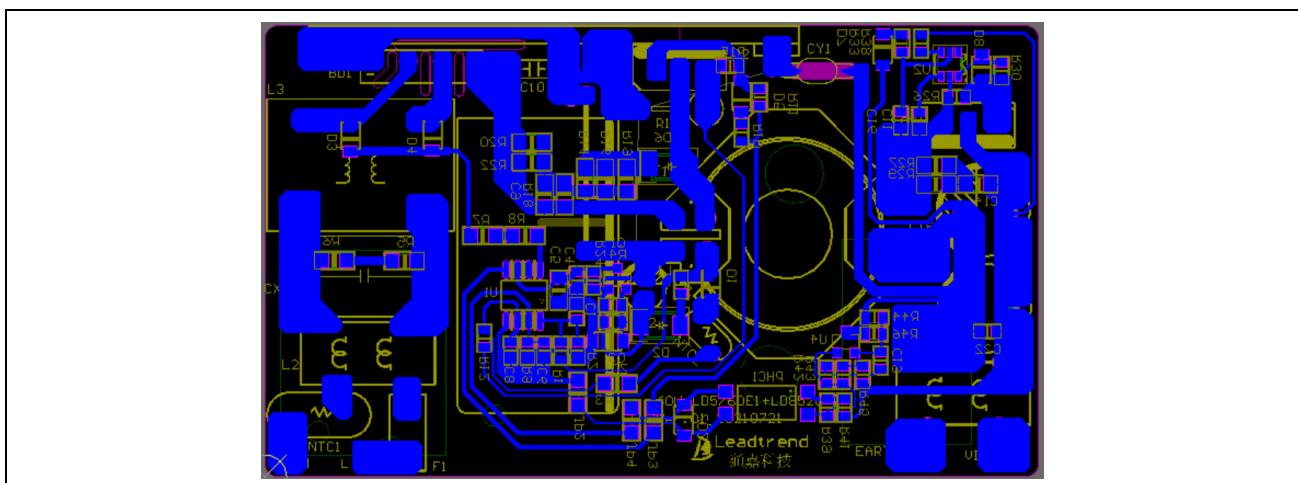


4. PCB LAYOUT

Top side



Bottom side

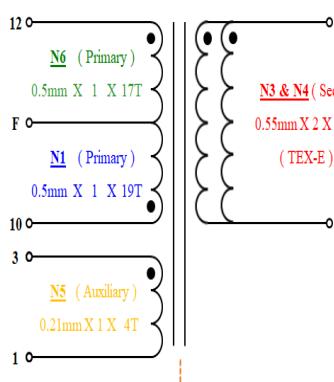
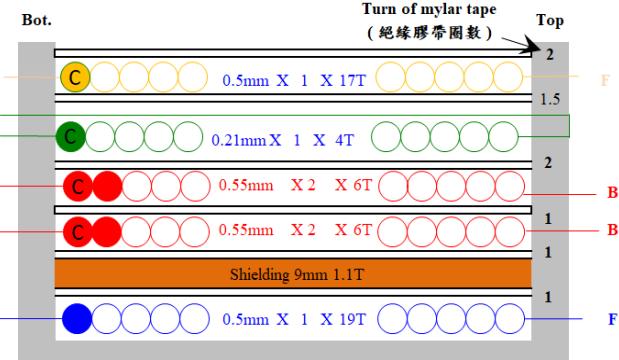


5. BOM

Location	Description	Q'ty
JP2,JP3,JP4	0 Ω / J / 1206	3
R1	100 KΩ / F / 0805	1
R2	20 KΩ / F / 0805	1
R5,R6	NC	2
R7,R8	10 KΩ / J / 1206	2
R24	1.1 Ω / F / 0805	1
R10	4.7 Ω / J / 0805	1
R11	330 Ω / J / 0805	1
R12	330 Ω / J / 1206	1
R14, R16, R19	200 Ω / J / 1206	3
R15	10 KΩ / J / 0805	1
R17	0.27 Ω / F / 2W	1
R18, R20, R22	300 KΩ / J / 1206	3
R26,R42	10 KΩ / J / 0805	2
R27,R29	30 Ω / J / 1206	2
R30	3 Ω / J / 0805	1
R33	10 Ω / J / 0805	1
R38	180 Ω / J / 0805	1
R39	2 KΩ / J / 0805	1
R41	2 KΩ / J / 0805	1
R44	390 KΩ / F / 0805	1
R45	180 KΩ / F / 0805	1
R46	27 KΩ / F / 0805	1
BD1	KBP406 / 4A / 600V	1
C2	10 uF / 50V / 5*11	1
C4,C19	0.1 uF (104) / 50 V / X7R / 0805	2
C5	0.1 uF (104) / 50V / X7R / 1206	1
C6	1000 pF (102) / 50 V / X7R / 0805	1
C7	120 uF / 400 V	1
C8	220 pF / 50 V / X7R / 0805	1
C9	1000 pF (102) / 1 KV / X7R / 1206	1
C11,C16	2.2 uF / 50V 0805	2

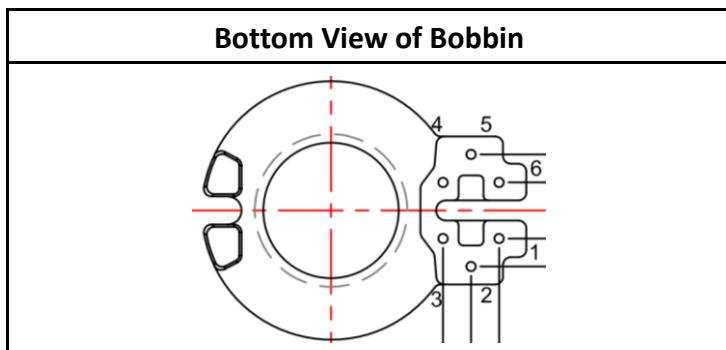
Location	Description	Q'ty
C14	1000 pF / 50V / X7R / 1206	1
C18, C20	1000 uF / 25 V / ZLH / 10*20	2
CX1	334/275V/X2	1
CY1	470 pF / Y1	1
D5, D8	1N4148 / SOD-123	2
D3, D4	FM4007-M / SOD-123	2
D2	RS1ML / SOD-123	1
D6	S1M / SMA	1
D7	BAV21W	1
F1	T4A/250VAC	1
PHC1	EL1019	1
U2	LD5762E1 SO-8	1
U3	LA431OCRPA / SOT23	1
U4	LD8526 SOT-26	1
T1	RM10 / KP44A / 36 : 6 : 4 / 500 μH	1
NTC1	SCK10015	1
JP1	17.5 mm	1
L1	1.1 Ω / J / 0805	1
Q2	WML13N65EM / 650V /0.35R	1
Q3	TK65A10N1/100V/65A/TOSHIBA	1
PCB	107 x 51 mm / CEM-1 / 1 oz	1
L2	T10X6X5, 500uH	1
L3	SO1515:20mH	1
L4	JUMP	2
HS1	55*20*1.5mm	1
C10	3.3 nF (332) / 1 kV / X7R / Pitch 5	1

6. Magnetic Component Design

Schematic of Winding	Construction of Winding
	 <p>Bot. Top</p> <p>Turn of mylar tape (絕緣膠帶圈數)</p> <p>0.5mm X 1 X 17T</p> <p>0.21mm X 1 X 4T</p> <p>0.55mm X 2 X 6T</p> <p>0.55mm X 2 X 6T</p> <p>Shielding 9mm 1.1T</p> <p>0.5mm X 1 X 19T</p> <p>Note: 1) Dot ●: Start point of winding (點 ●: 繞組起繞點) 2) Rotating direction of winding machine: Clockwise (繞線機旋轉方向: 順時針)</p>

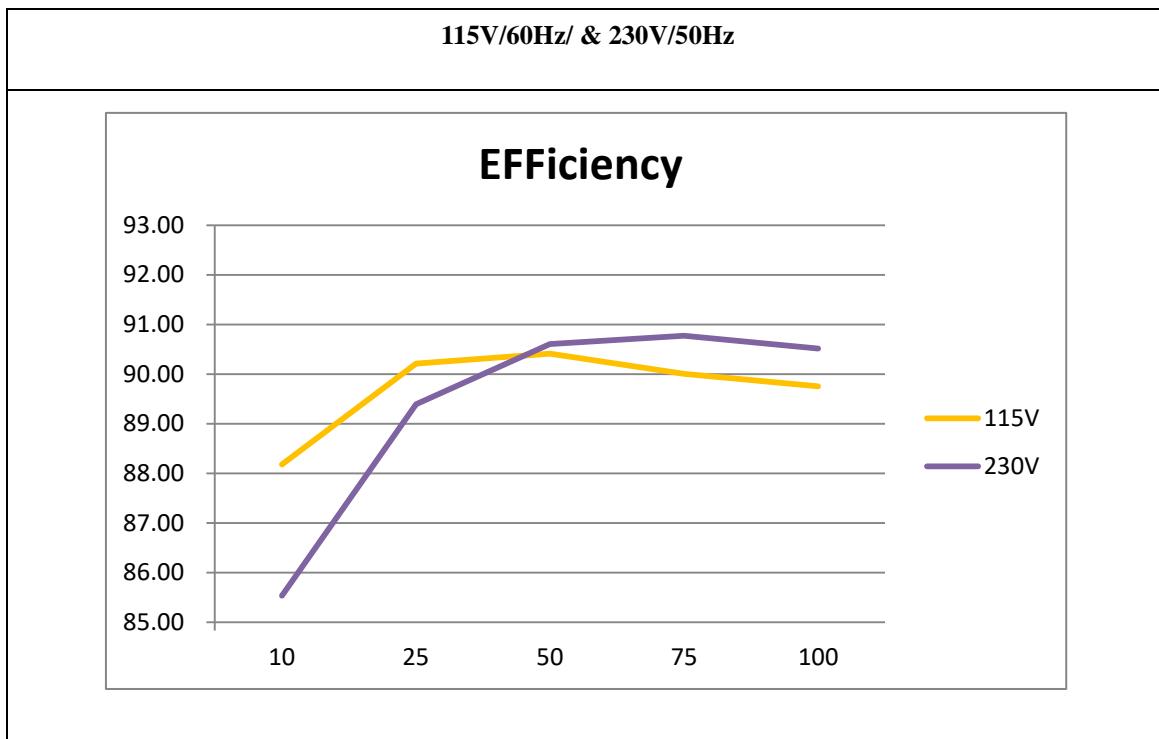
Winding No.	Pin No.		Winding Types	Number of Turns		Remarks	
	Start	Finish		Winding	Tape		
N1	10	F	0.5mm X 1	19	1	Np1	Pin 朝繞線人員
N2	1	X	9 mm X 1mil	1.1	1	Coil	Pin 朝繞線人員
N3	A	B	0.55 mm X 2	6	1	Ns1	
N4	A	B	0.55 mm X 2	6	2	Ns2	
N5	3	1	0.21 mm X 1	4	2	Na1	Pin 朝繞線人員
N6	F	12	0.5mm X 1	17	2	Np2	Pin 朝繞線人員
Foil	1		10 mm X 10 mm X 1 mil	—	—	Core 頂部貼銅下地 Pin 1	

Bobbin Shape	Core Material	A_e (mm ²)	L_p (μ H)
RM10	PC47	98	$500 \pm 5\%$ @ 100 kHz / 1 V



7. Efficiency

Input Voltage	115 V_{AC} / 60 Hz	230 V_{AC} / 50 Hz
Output Current	100 %, 75 %, 50 %, 25 %, 10 % of Full Load	
Measured Point of Output Voltage	End of Cable (18AWG/1.5M)	
Duration of Burn-in	30 Minutes	
Requirement	CoC Tier 2	



115V/60Hz

V_{IN,AC} (V / Hz)	V_{BUS,SET} (V)	V_{BUS,PCB} (V)	I_{OUT} (A)	P_{BUS,PCB} (W)	P_{IN} (W)	η (%)	η_{AV,4-Points} (%)	Requirement (%)
115 / 60	20	19.99	3.000	59.9888	66.84	89.75	90.09	> 89
		20.06	2.250	45.145	50.16	90.00		
		20.14	1.500	30.215	33.42	90.41		
		20.20	0.750	15.155	16.8	90.21		
		20.31	0.300	6.093	6.91	88.81		
							—	> 79

230V/50Hz

V_{IN,AC} (V / Hz)	V_{BUS,SET} (V)	V_{BUS,PCB} (V)	I_{OUT} (A)	P_{BUS,PCB} (W)	P_{IN} (W)	η (%)	η_{AV,4-Points} (%)	Requirement (%)
230 / 50	20	19.99	3.000	59.991	66.28	90.51	90.32	> 89
		20.06	2.251	45.141	49.73	90.77		
		20.13	1.500	30.208	33.34	90.61		
		20.20\	0.750	15.152	16.95	89.39		
		20.3	0.300	6.09	7.12	85.53		
							—	> 79

8. No Load Power Consumption

Input Voltage	115 V_{AC} / 60 Hz	230 V_{AC} / 50 Hz
Standby Current	20V / 0A	
Requirement	<75 mW	

V_{IN,AC} (V / Hz)	P_{IN} (mW)	Requirement (mW)
115 / 60	42	< 75 mW
230 / 50	70	

9. Line / Load / Cross Regulation

Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No Load & Full Load	
Measured Point of Output Voltage	End of Cable	
Requirement	< ± 5 % of V_{BUS,SET}	

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	V_{BUS,PCB} (V)		Requirement (V)
			0 A	3 A	
Typical	20	90 / 47	20.255	19.994	19 ~ 21
		264 / 63	20.255	19.995	

10. Over Current Protection

Input Voltage		90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Requirement	Protection Mode	Auto Recovery	
	OCP Trigger Point	< 5.3A	

Mode	V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	I _{OUT,OCP} (A)	Requirement	
				Protection Mode	OCP Trigger Point (A)
Typical	20	90 / 47	4.02	Auto Recovery	< 5.3A
		264 / 63	3.44	Auto Recovery	

11. Over Voltage Protection

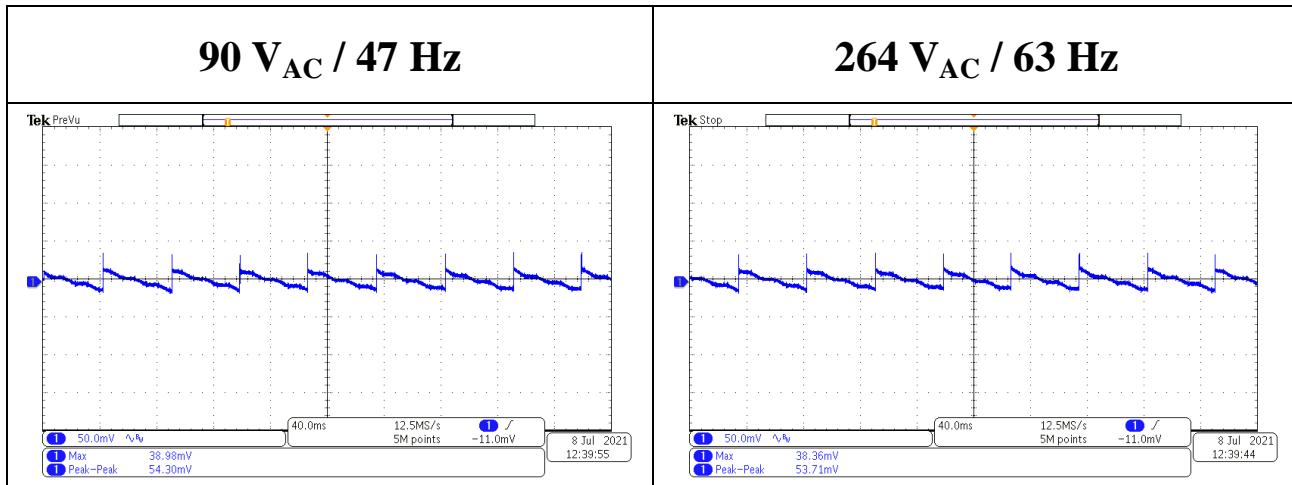
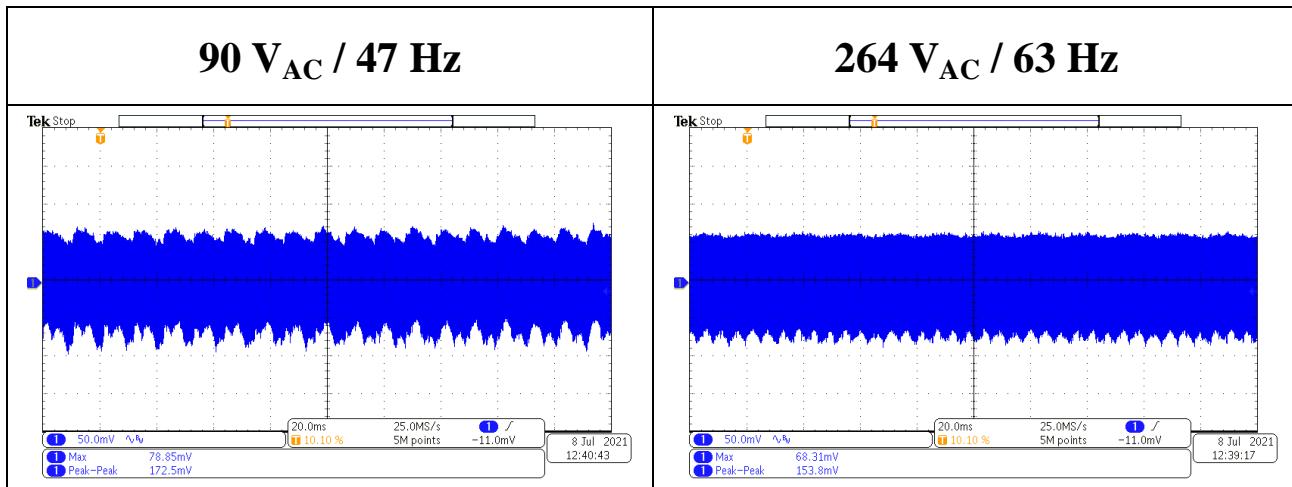
Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No Load & Full Load	
Measured Point of Output Voltage	End of Cable	
Requirement	Defined by Different Output Voltage	

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	V_{BUS,OVP} (V)		Requirement (V)
			No Load	Full Load	
Typical	20	90 / 47	22.88	22.65	< 25
		264 / 63	22.7	22.18	

12. Ripple & Noise Voltage

Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No Load & Full Load	
Measured Point of Output Voltage	End of Cable	
Bandwidth	20 MHz (with 10 μF E-cap & 0.1 μF MLCC)	
Requirement	< 300 mV	

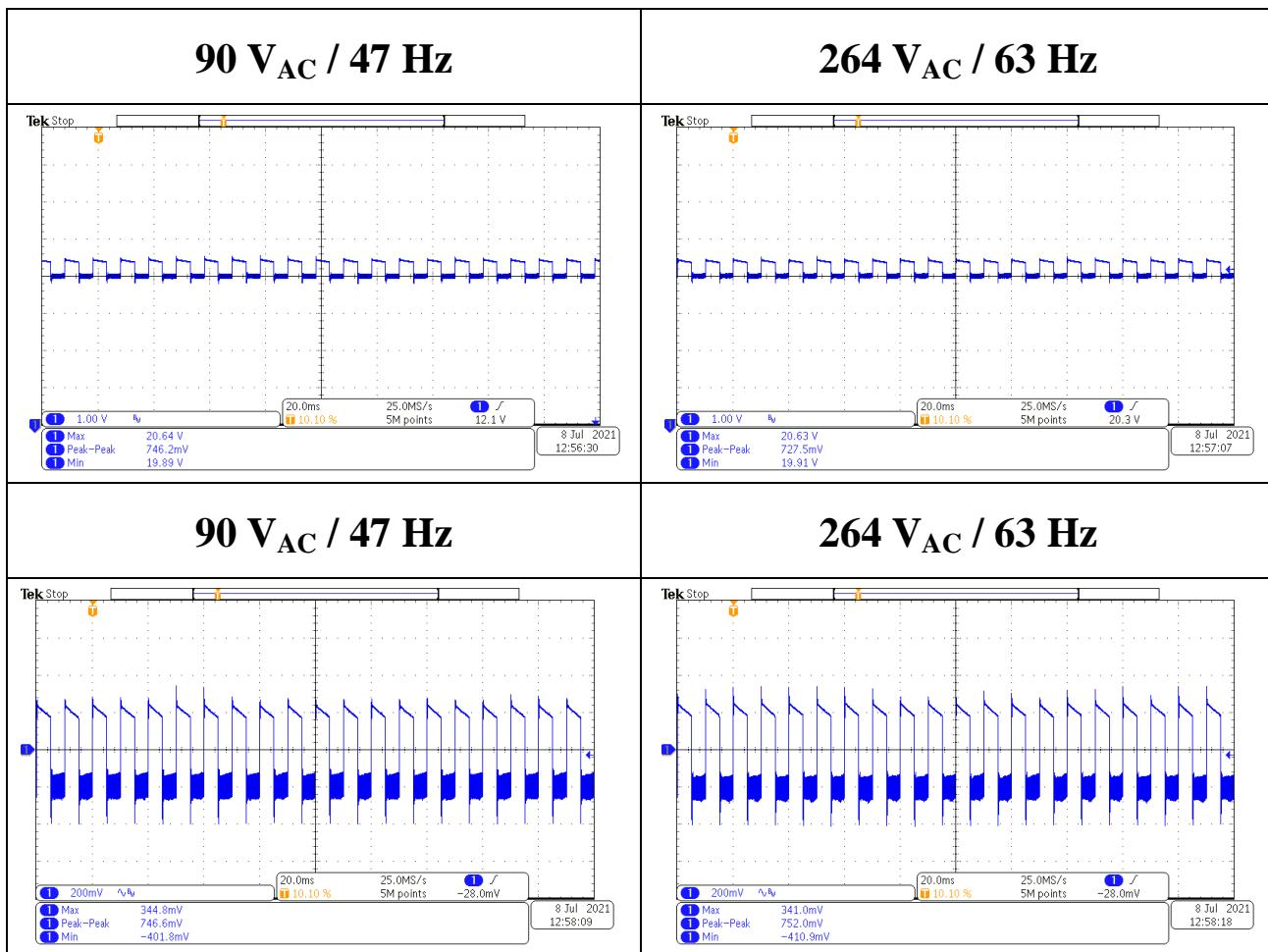
Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	V_{BUS,PK-PK} (mV)		Requirement (mV)
			0 A	3 A	
Typical	20	90 / 47	54.3	172.5	< 300
		264 / 63	53.71	153.8	

20 V / 0 A

20 V / 3 A


13. Dynamic Load

Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	0 ↔ 100 % of Full Load	
Frequency of Load	100 Hz (5 mS High / 5 mS Low)	
Slew Rate of Load	1.25 A / μS	
Measured Point of Output Voltage	End of Cable	
Requirement	< ± 5 % of V_{BUS,SET}	

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	V_{BUS,PCB} (V)		Requirement (V)
			Min.	Max.	
Typical	20	90 / 47	19.89	20.64	19~21
		264 / 63	19.91	20.63	

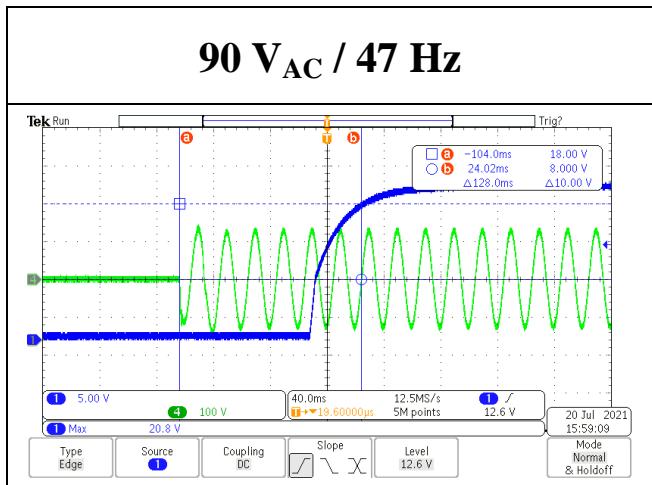


14. Turn-on Delay Time

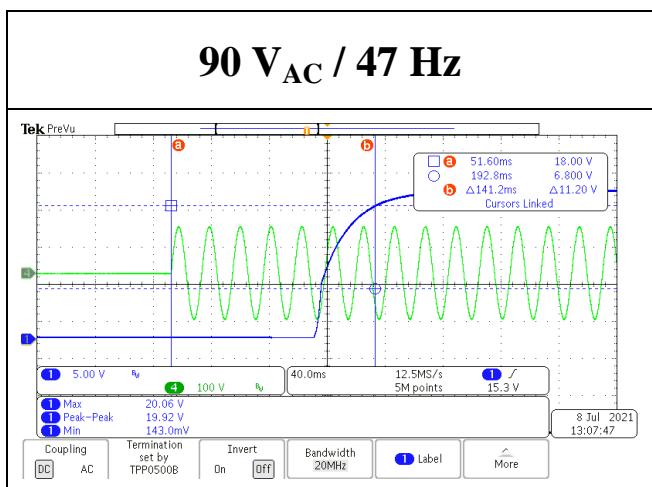
Input Voltage	90 V_{AC} / 47 Hz
Output Current	No Load & Full Load
Measured Point of Output Voltage	End of Cable
Requirement	< 1 S

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	T_{ON} (S)		Requirement (S)
			0 A	3 A	
Typical	20	90 / 47	0.128	0.142	< 1

No load



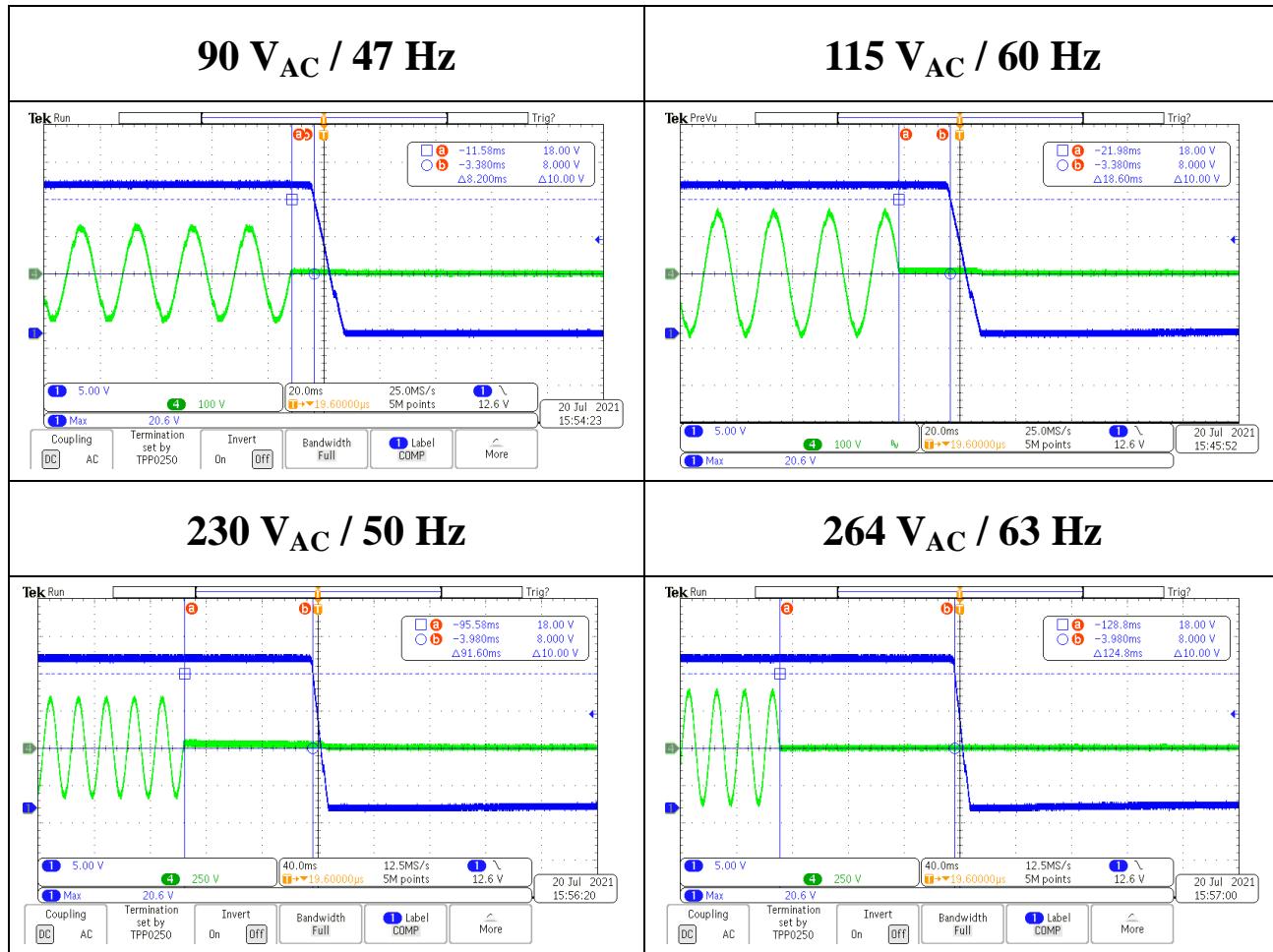
Full Load



15. Hold-up Time

Input Voltage	90 V_{AC} / 47 Hz	115 V_{AC} / 60 Hz	230 V_{AC} / 50 Hz	264 V_{AC} / 63 Hz
Output Current	Full Load			
Measured Point of Output Voltage	End of Cable			
Angle of AC Off	0°			
Requirement	> 10 mS @ Typical AC Input			

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	T_{HOLD-UP} (mS)	Requirement (mS)
PD 3.0	20	90 / 47	8.2	—
		115 / 60	18.6	> 10
		230 / 50	91.6	> 10
		264 / 63	124.8	—

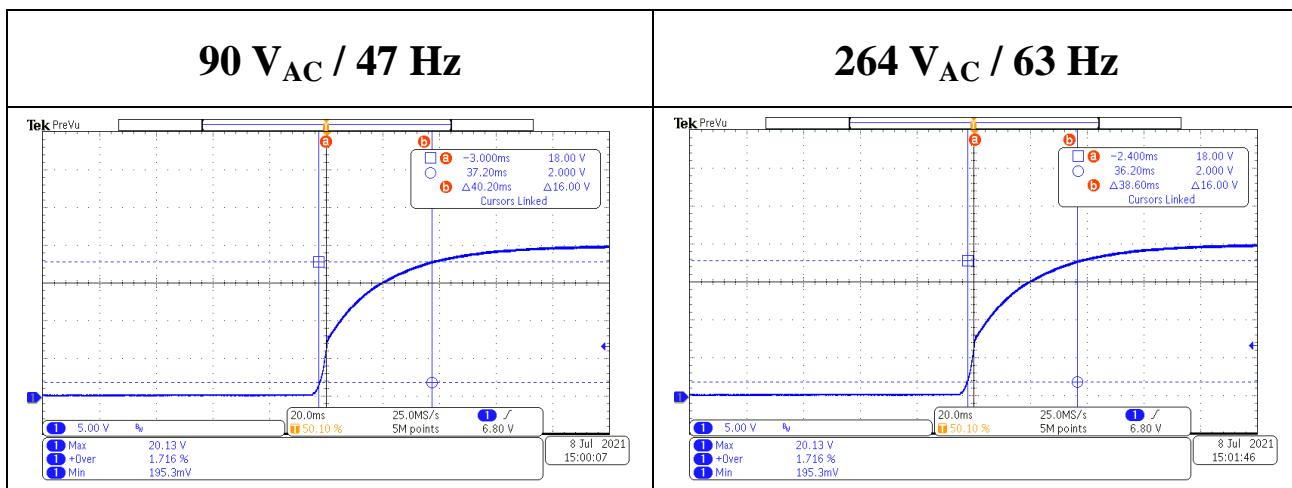
20 V / 3 A


16. Rise Time & Overshoot

Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No Load	
Measured Point of Output Voltage	End of Cable	
Requirement	Rise Time	< 40 mS
	Overshoot	< 10 %

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	T_{RISE} (uS)	Requirement (mS)
Typical	20	90 / 47	38.6	< 40
		264 / 63	38.4	

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	Overshoot (%)	Requirement (%)
Typical	20	90 / 47	1.716	< 10
		264 / 63	1.703	



17. Supply Voltage of IC

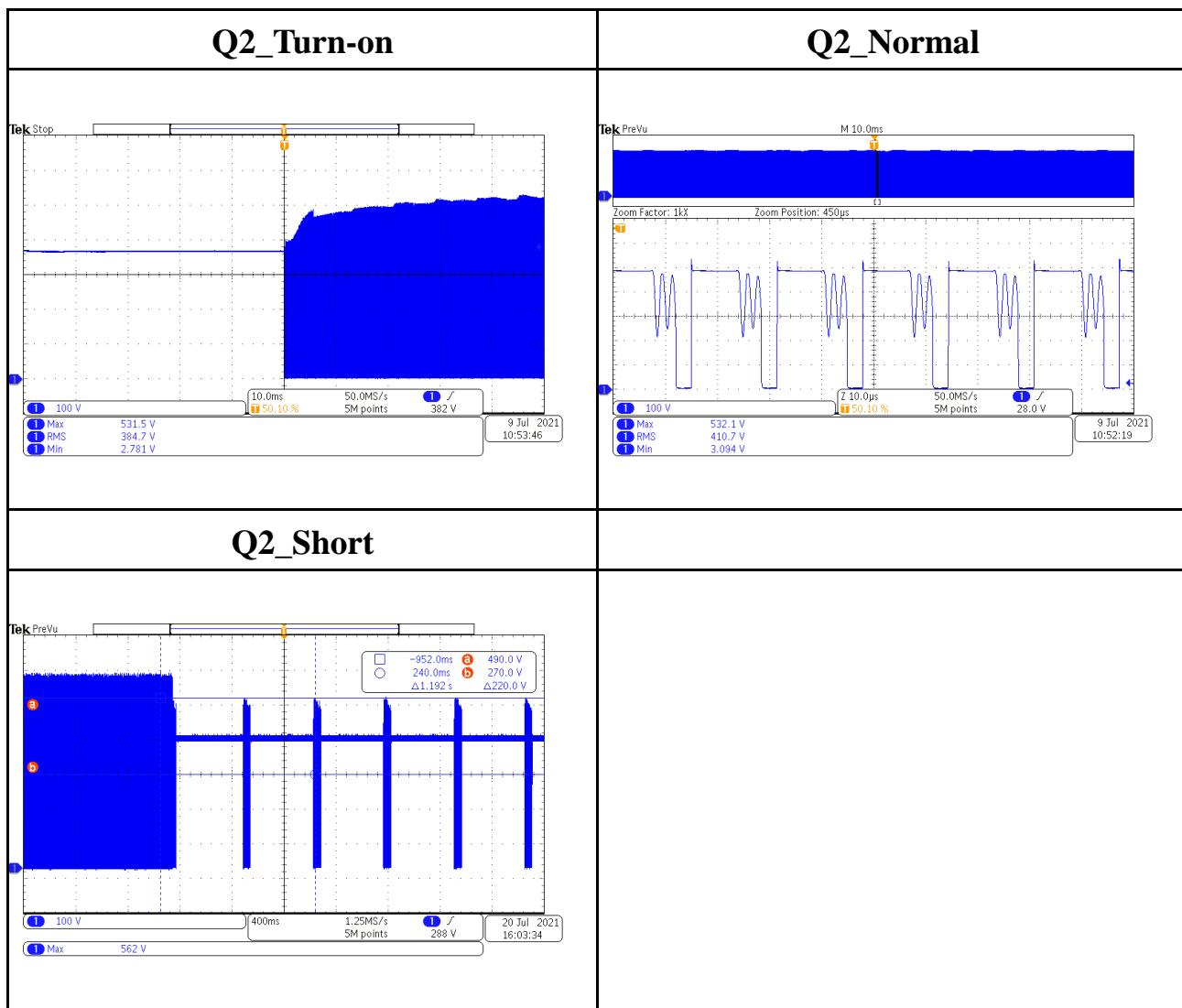
Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No Load & Full Load	
Requirement	> V_{IN_OFF} & < V_{IN_OVP}	

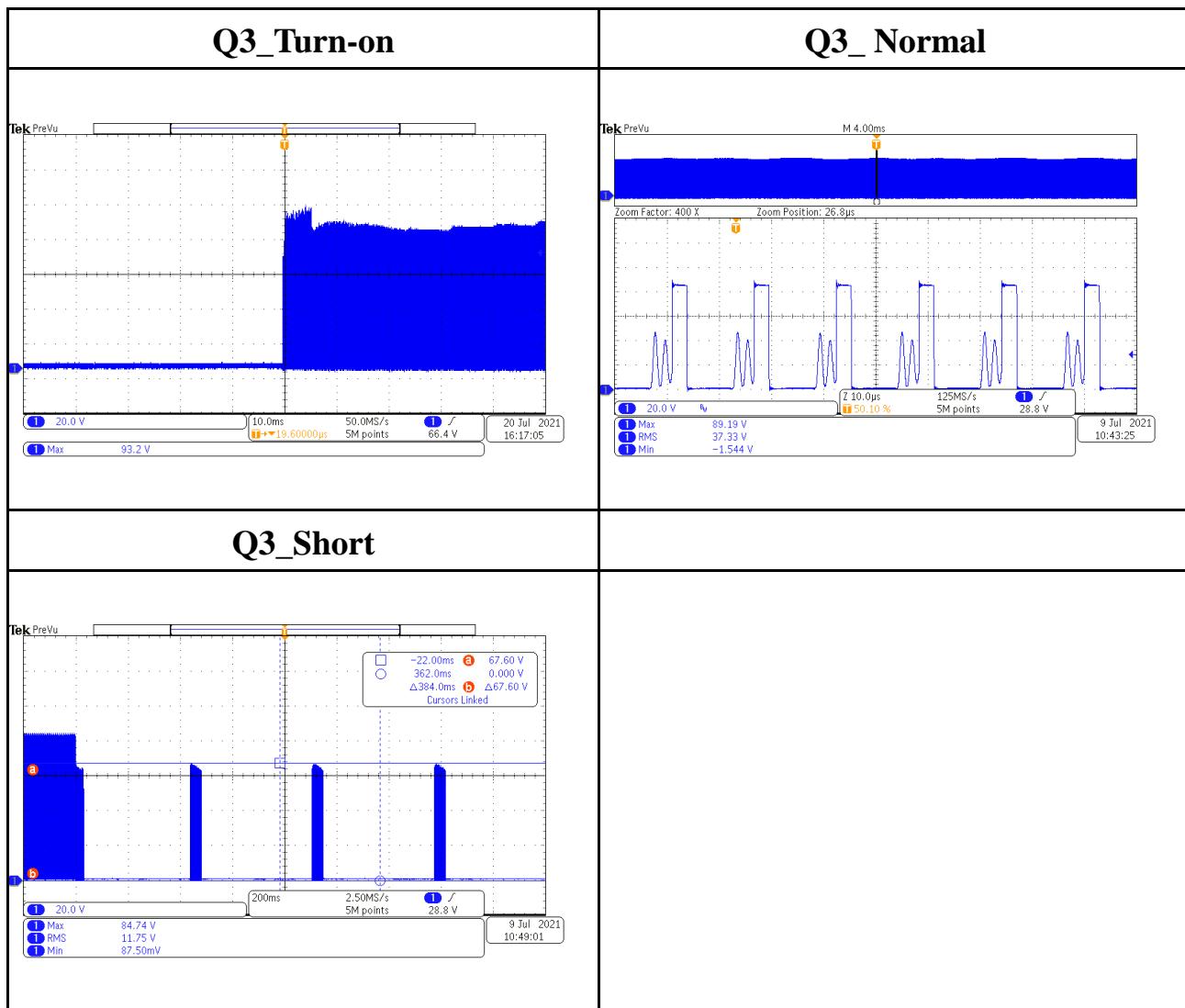
Mode	V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{IN,U101} (V)				Requirement (V)	
			No Load		Full Load			
			Min.	Max.	Min.	Max.		
Typical	20	90 / 47	11.5	12.46	13.04	13.13	> 7	
		264 / 63	11.34	12.47	13.41	13.54		

18. Stress on Switching Parts

Input Voltage	264 V_{AC} / 63 Hz
Output Current	No Load & Full Load
Requirement	Defined by Different Parts

Location	Part No.	Mode	Condition	V_{BUS,SET} (V)	I_{OUT} (A)	V_{DS} (V)	Requirement (V)
Q2	WML13N65EM	Typical	Turn-on	20	3	531.5	< 617.5 (650 * 0.95)
			Normal	20	3	532	
			Short	20	3	490	
Q3	TK65A10N1	Typical	Turn-on	20	3	93.2	< 95 (100 * 0.95)
			Normal	20	3	89.19	
			Short	20	3	84.74	

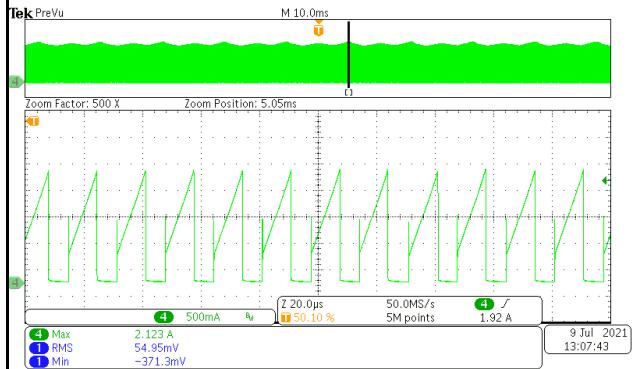
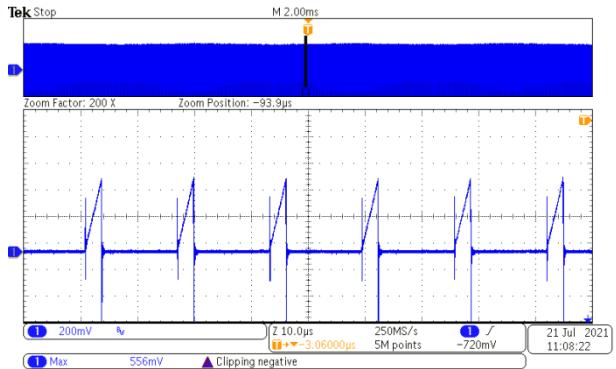
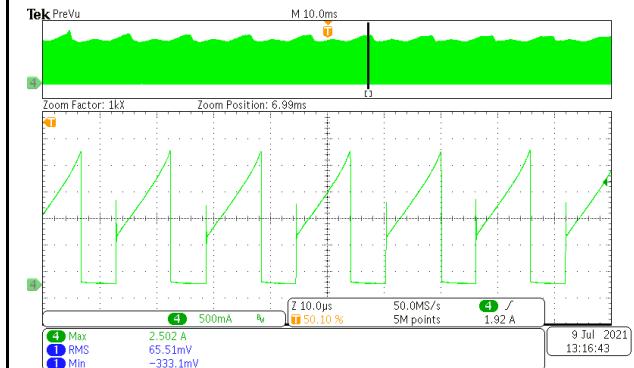
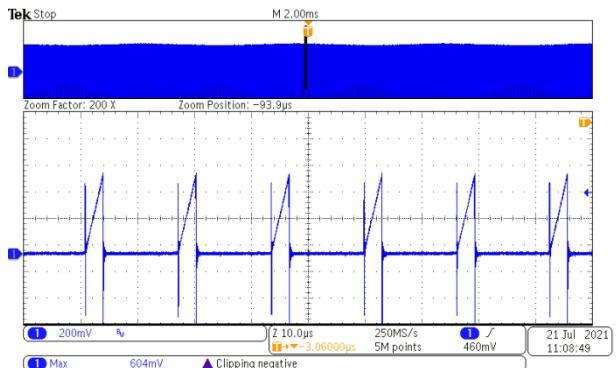




19. Flux Density on Transformer

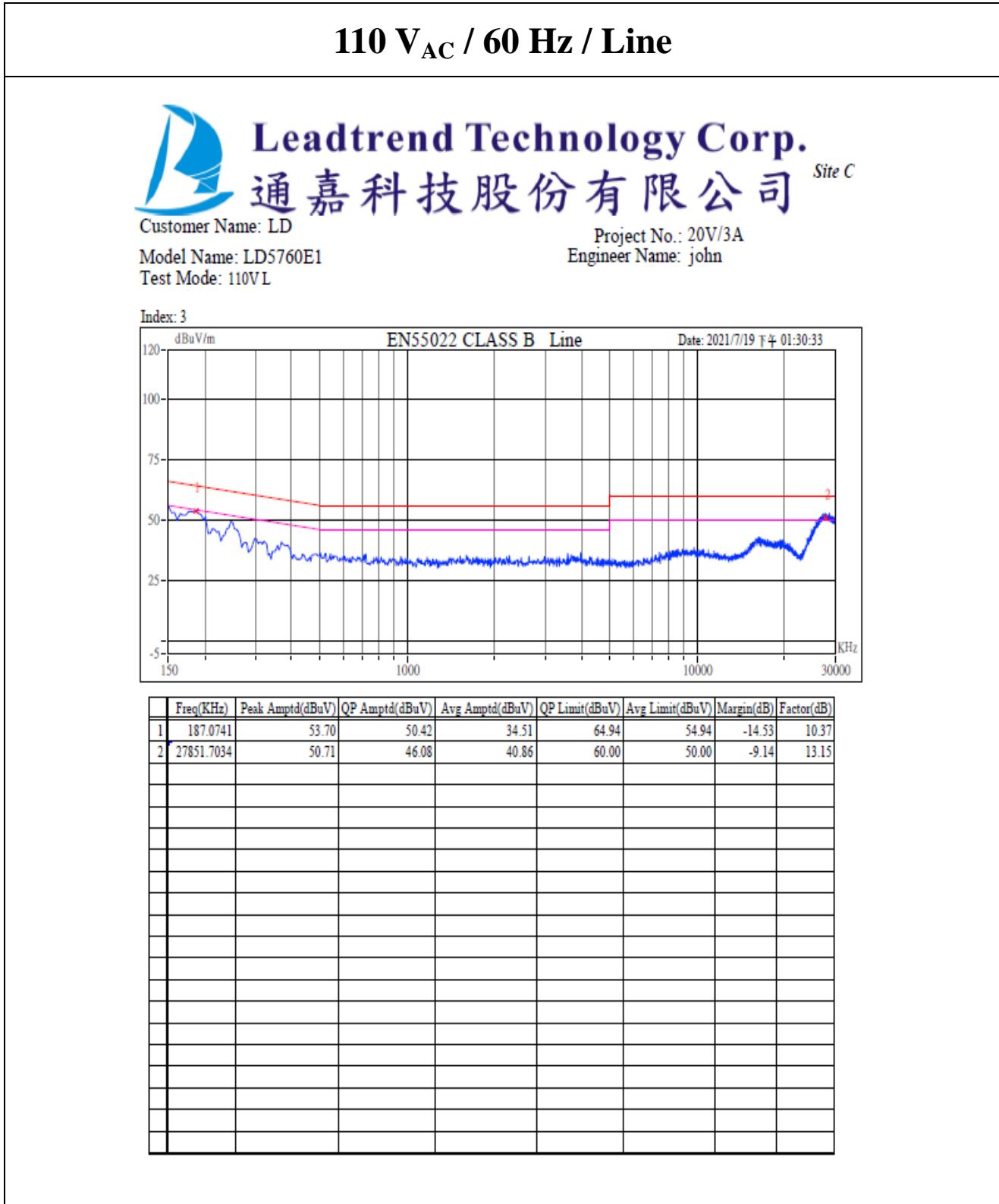
Input Voltage	90 V_{AC} / 47 Hz	264 V_{AC} / 63 Hz
Output Current	No load & Full Load & Max & Short	
Requirement	95 % of Rating	

Mode	Part No.	V_{BUS,SET} (V)	I_{OUT} (A)	V_{IN,AC} (V / Hz)	I_{P,MAX} (A)	B_{MAX} (G)	Requirement (G)
Typical	T1	20	3	90 / 47	2.123	2949	< 3,990 (4,200 * 0.95)
				264 / 63	2.059	2918	
			Max	90 / 47	2.502	3475	
				264 / 63	2.165	3170	

T1 20 V / 3 A_90 V_{AC} / 47 Hz

T1 20 V / 3 A_264 V_{AC} / 63 Hz

T1 20 V / OCP_90 V_{AC} / 47 Hz

T1 20 V / OCP_264 V_{AC} / 63 Hz


20. EMI

Conduction



Conduction

110 V_{AC} / 60 Hz / Neutral



Leadtrend Technology Corp.
通嘉科技股份有限公司

Site C

Customer Name: LD

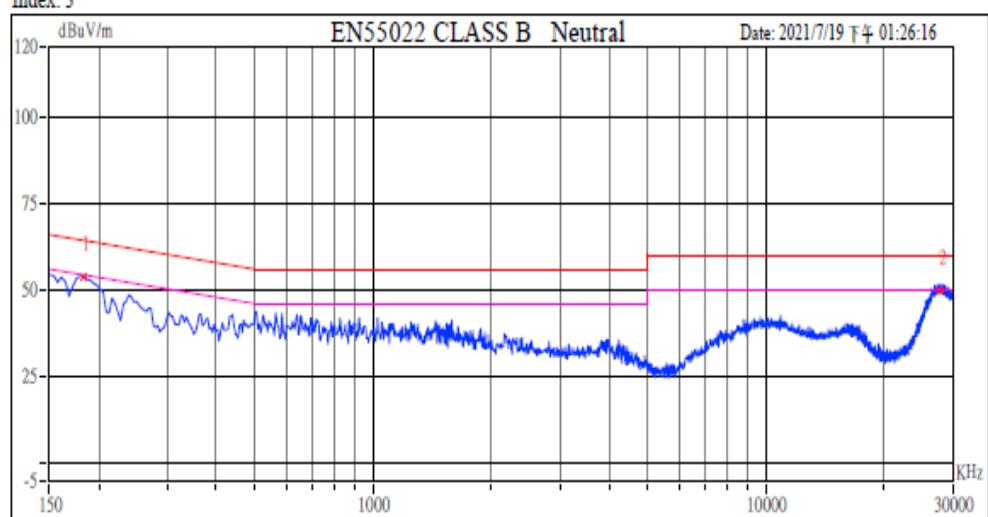
Model Name: LD5760E1

Test Mode: 110VN

Project No.: 20V/3A

Project No.: 2017

Index: 3



Conduction

220 V_{AC} / 50 Hz / Line



Customer Name: LD

Model Name: LD5760E1

Test Mode: 220V L

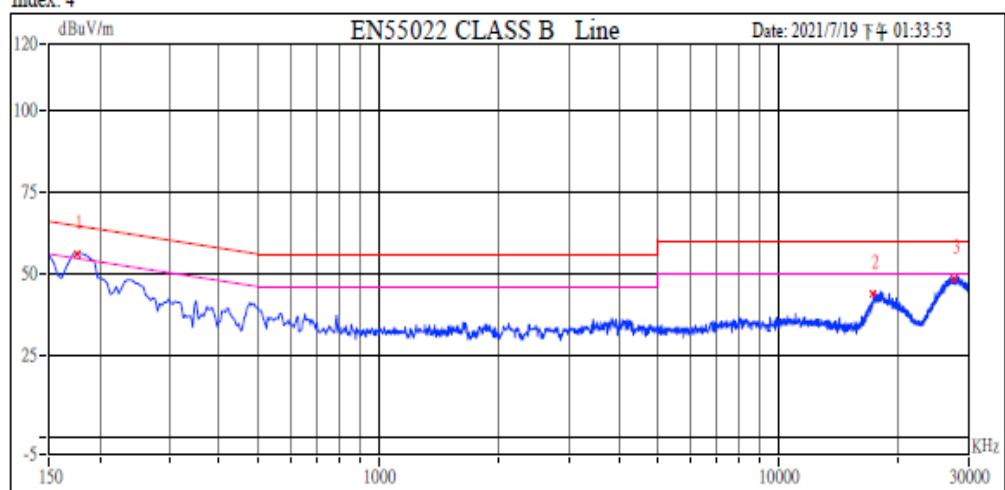
Leadtrend Technology Corp.
通嘉科技股份有限公司

Site C

Project No.: 20V/3A

Project No.: 2017

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Conduction

220 V_{AC} / 50 Hz / Neutral



**Leadtrend Technology Corp.
通嘉科技股份有限公司**

Site C

Customer Name: LD

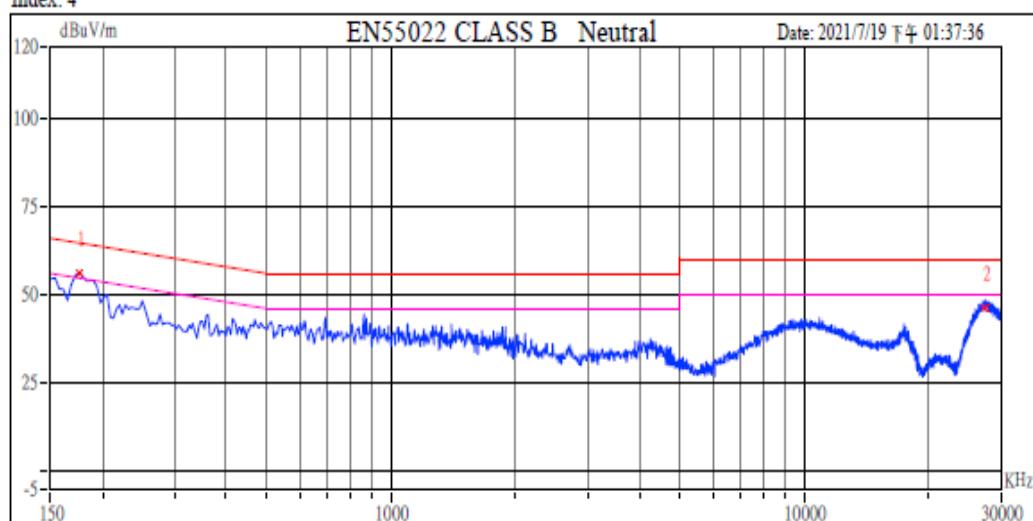
Project No.: 20V/3A

Project No.: 2017
Engineer Name: john

Model Name: LD5760E1

Test Mode: 220V N

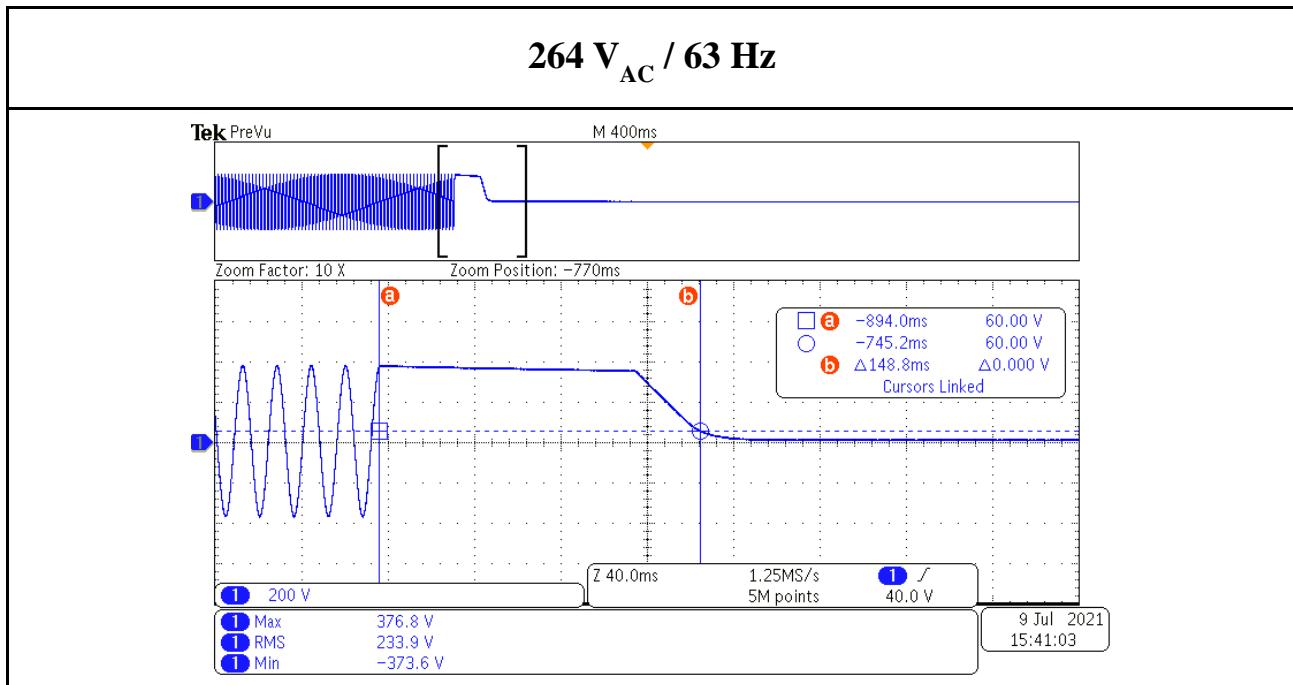
Index: 4



21. X CAP discharge

Input Voltage	264 V_{AC} / 63 Hz
Output Current	No load
Requirement	IEC62368 (@2 sec < 60V)

Mode	V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	T_{discharge} (mS)	Requirement (S)
Typical	20	264 / 63	148.8ms	2



22. Issues Data for internal

No	Item	Status
1		
2		
3		
4		
5		
6		

