



20V/3A 60 W Peak Load 6A LD5523P & LD8526P

By : Jeff Chen

Date : 2020/04/21

- 1. Specification**
- 2. Outline**
- 3. Schematic**
- 4. PCB Layout**
- 5. Bill of Materials**
- 6. Transformer Design**
- 7. Efficiency**
- 8. No Load Power Consumption**
- 9. Line / Load / Cross Regulation**
- 10. Over Current Protection**
- 11. Over Voltage Protection**
- 12. Ripple & Noise Voltage**
- 13. Dynamic Load**
- 14. Peak load**
- 15. Turn-on Delay Time**
- 16. Rise Time & Overshoot**
- 17. Supply Voltage of IC**
- 18. Stress on Switching Parts**
- 19. Flux Density of Transformer**
- 20. EMI**
- 21. X CAP discharge**

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)		20V / 3A Peak load 6A(200mS high / 2S low)				—
Efficiency		CoC Tier 2				Pass
Standby Power (mW)		< 75				Pass
Output Voltage Accuracy (%)	Typical load	< ± 5				Pass
	Peak load	> -10				Pass
Over Current Protection (A)		< 5.3				Pass
Over Voltage Protection (V)		< 25				Pass
Ripple & Noise Voltage (mV)		< 300				Pass
Dynamic Load (%)		< ± 5 of V _{BUS,SET}				Pass
Peak Load (%)		< ± 10 of V _{BUS,SET}				Pass
Turn-on Delay Time (S)		< 3				Pass
Rise Time (mS)		< 40				Pass
Overshoot (%)		< 10				Pass
EMI (Conduction)		EN55032 Class B				Pass
Component stress(%)		Continue <90 ; instant <95				Pass

2. Outline

Top View



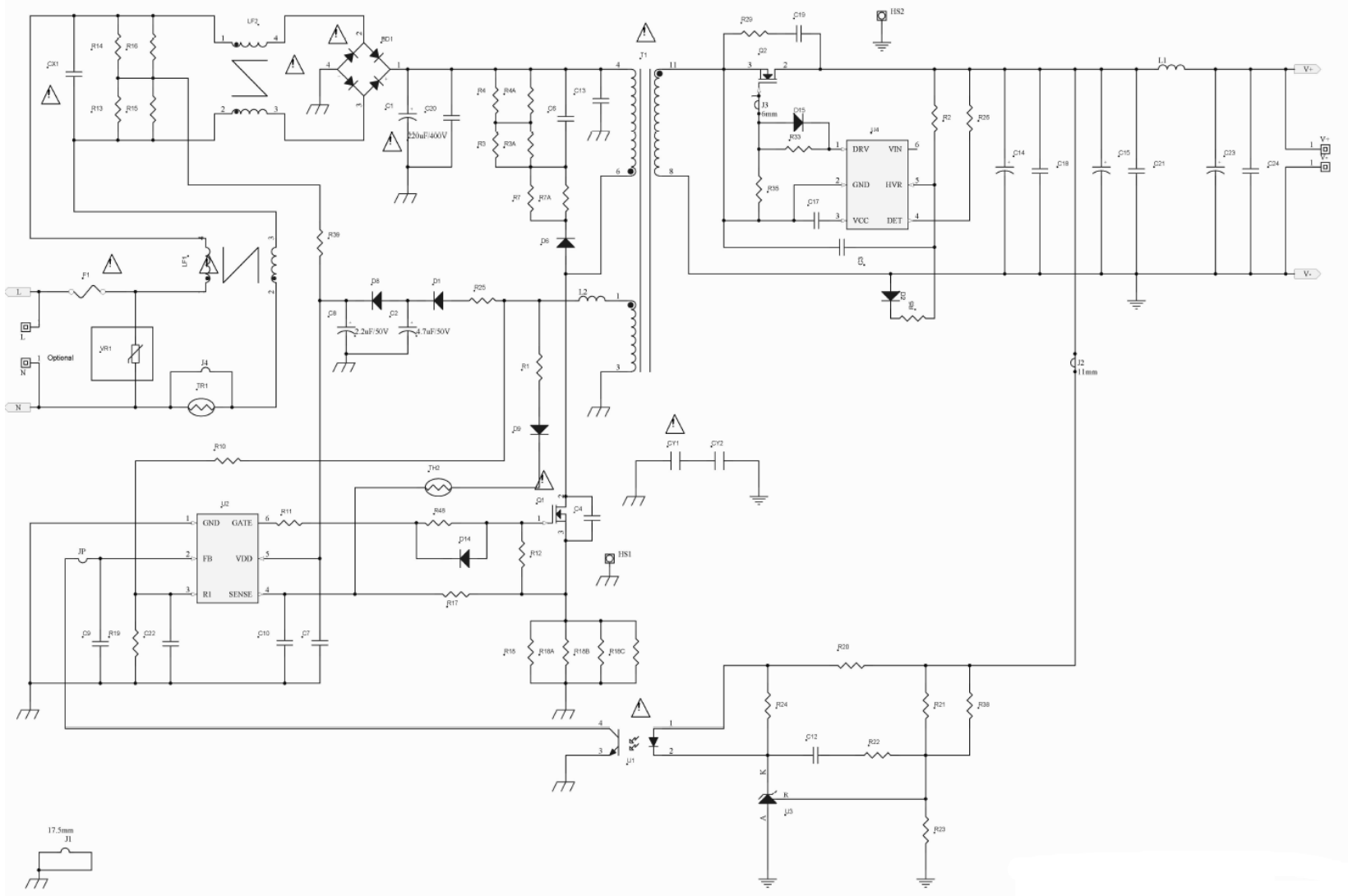
107 mm

51 mm

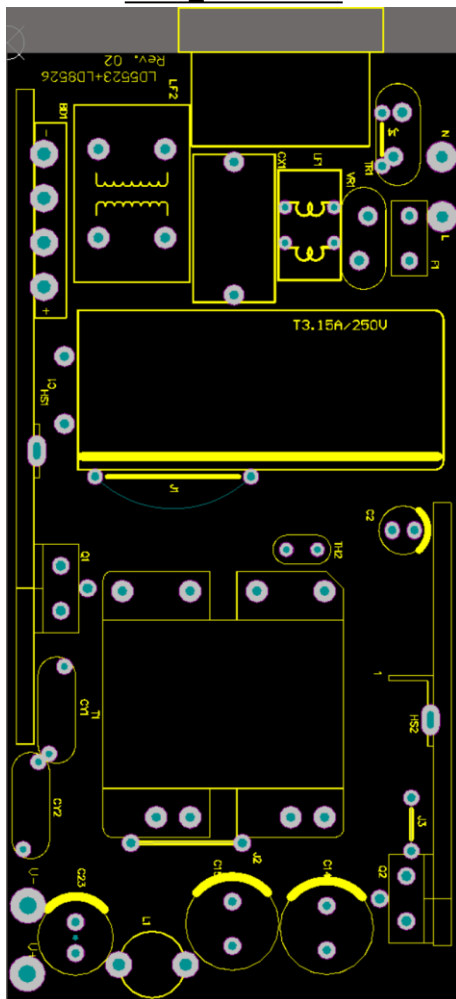
Bottom View



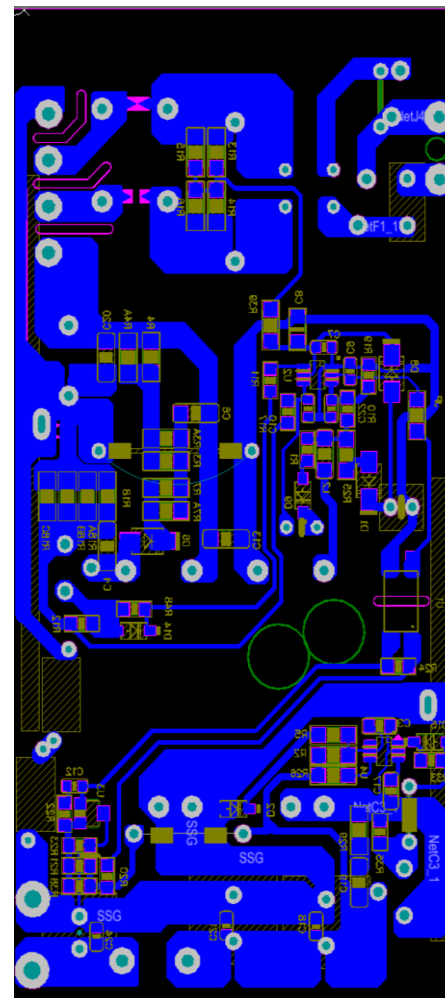
3. Schematic



Top Side



Bottom Side

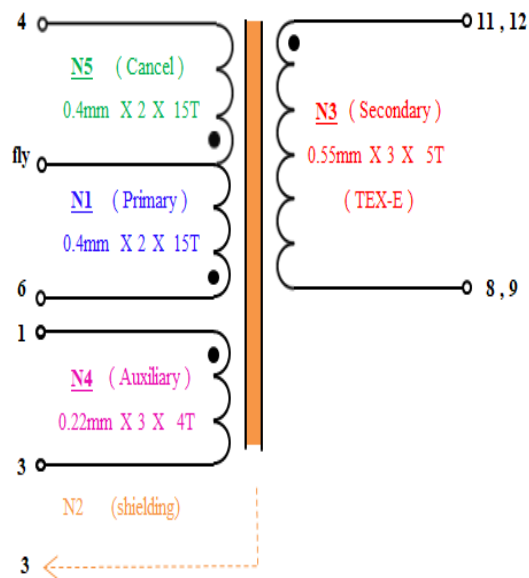
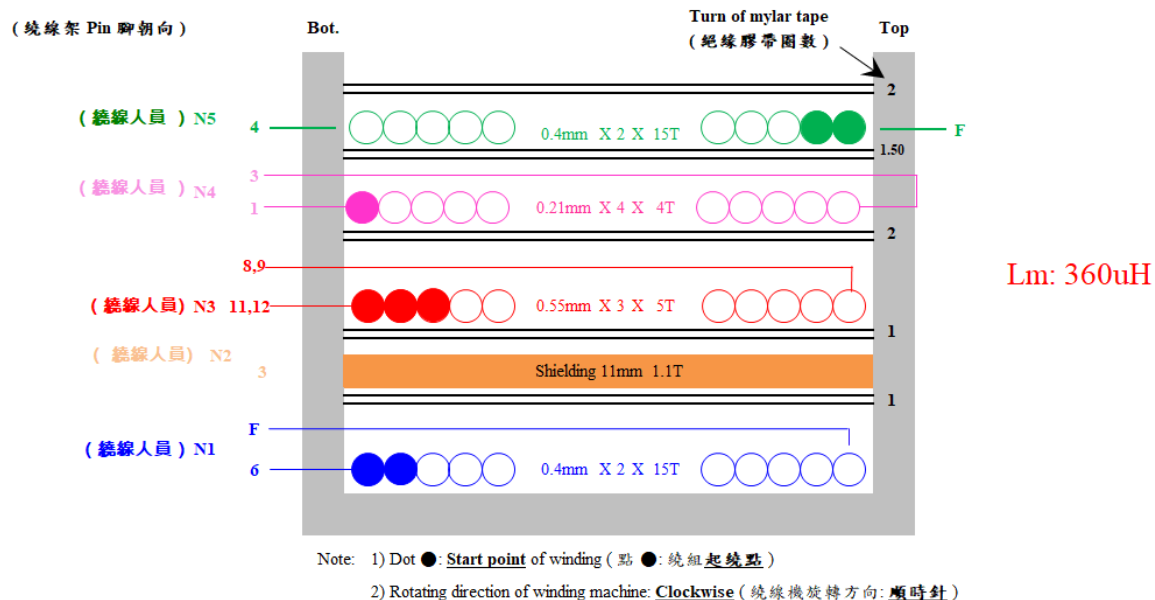


5. Bill of Materials

Location	Description	Q'ty
R2,JP,L2	0 Ω / J / 1206	3
R3,R3A,R4,R4A	75 K Ω / J / 1206	4
R7,R7A	82 Ω / J / 1206	2
R10	130 K Ω / J / 0805	1
R11	10 Ω / F / 0805	1
R12,R22,R35	10 K Ω / F / 0805	3
R15,R16	2.2 M Ω / J / 1206	42
R17	680 Ω / J / 0805	1
R18,R18A	1 Ω / J / 1206	2
R18B,R18C	1.2 Ω / J / 1206	2
R19	28.7 K Ω / J / 0805	1
R20	2 K Ω / F / 0805	1
R21,R38	430 K Ω / F / 0805	2
R23	30 K Ω / J / 0805	1
R24	9.1 K Ω / J / 0805	1
R25	2.2 Ω / J / 1206	1
R26	270 Ω / J / 1206	1
R29	10 Ω / J / 1206	1
R33	2 Ω / J / 0805	1
R39	10 K Ω / F / 1206	1
C6	2200 pF / 1000V / X7R / 1206	1
C7	0.1 μ F / 50 V / X7R / 0805	1
C8	4.7 μ F (475) / 50 V / X7R / 1206	1
C9	1000 pF (102) / 25 V / X7R / 0603	1
C10	330 pF (331) / 50 V / X7R / 0603	1
C12	0.1 μ F (104) / 50 V / X7R / 0603	1
C13,C20	10 nF (103) / 1 KV / X7R / 1206	1
C17	2.2 μ F (225) / 16 V / X7R / 0805	1
C19	1000 pF (102) / 200 V / X7R / 1206	1
D1,D6	RS1M / 1 KV / 1 A / SOD-123	2
D8,D14,D15	1N4148 / 100 V / 150 mA / SOD-123	3
BD1	KBP406 / 4A / 600V	1

Location	Description	Q'ty
C1	150 μ F / 400V / TY / 105°C	1
CX1	0.33 μ F / 350 V / X1	1
C2	3.3 μ F / 50V / 5*12	1
C14,C15	820 μ F / 25 V / TK / 10*20	2
C23	470 μ F / 25 V / LZG / 8*16	1
CY1	1000 pF / Y1	2
LF1	JUMP	2
LF2	T1628-103S 10 mH	1
F1	T 4A / 250V	1
Q1	IPA70R360P7S / 700 V / 12.5 A / 0.36 Ω / TO-220F	1
Q2	AOT296L / 100 V / 50 A / 12.5 m Ω / TO-220	1
U1	LTV-817C	1
U2	LD5523P SOT-26	1
U3	TL431	1
U4	LD8526P SOT-26	1
T1	PQ2625 / KP44A / 30 : 4 : 5 / 360 μ H	1
TR1	NTC 5 ohm	1
J1	17.5 mm	1
J2	12.5 mm	1
PCB	107 x 51 mm / CEM-1 / 1 oz	1
HS1	63*20*2mm	1
HS2	50*20*2mm	1
VR1	10471	1

6. Transformer Design

Schematic of Winding

Construction of Winding


Winding No.	Pin No.		Winding Types	Number of Turns		Remarks	
	Start	Finish		Winding	Tape		
N1	6	F	0.4 mm X 2	15	1	N _{p1}	Pin 朝外順繞
N2	3	X	11 mm X 1mil	1.1	1	Shielding	Pin 朝外順繞
N3	11,12	8,9	0.55 mm X 3	5	2	N _{S1}	Pin 朝外順繞
N4	1	3	0.21 mm X 4	4	1.5	N _{aux}	Pin 朝外順繞
N5	F	4	0.4 mm X 2	15	2	N _{p2}	Pin 朝外順繞

Bobbin Shape	Core Material	A _e (mm ²)	L _p (μH)
PQ2625	KP44A	100	360 ± 5 % @ 1 kHz / 1 V
Bottom View of Bobbin			

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	Cable end	
Duration of Burn-in	30 Minutes	
Requirement	CoC Tier 2	

7. Efficiency (Cont.)

$V_{IN,AC}$ (V / Hz)	$V_{BUS,SET}$ (V)	$V_{BUS,PCB}$ (V)	I_{OUT} (A)	$P_{BUS,PCB}$ (W)	P_{IN} (W)	η (%)	$\eta_{AV,4-Points}$ (%)	Requirement (%)
115 / 60	20	20.235	3.009	60.887	68.11	89.395	89.95	> 89
		20.312	2.242	45.539	50.62	89.963		
		20.386	1.496	30.497	33.77	90.309		
		20.459	0.7501	15.346	17.03	90.113		
		20.504	0.2998	6.147	6.97	88.194	—	> 79
230 / 50	20	20.231	3.009	60.875	67.06	90.777	90.91	> 89
		20.304	2.242	45.522	50.05	90.952		
		20.38	1.494	30.448	33.45	91.025		
		20.454	0.7501	15.343	16.88	90.892		
		20.499	0.2998	6.146	6.857	89.625	—	> 79

8. No Load Power Consumption

Input Voltage	115 V _{AC} / 60 Hz	230 V _{AC} / 50 Hz
Output Current	20V / 0 A	
Requirement	CoC Tier 2	
Duration of Burn-in	10 Minutes	

V_{IN,AC} (V / Hz)	P_{IN} (mW)	Requirement (mW)
115 / 60	33	< 75
230 / 50	64	

9. Line / Load / Cross Regulation

Input Voltage		90 V _{AC} / 47 Hz		264 V _{AC} / 63 Hz	
Output Current		20V: 0A/3.00A			
Measured Point of Output Voltage		Cable end			
Requirement		< ± 5 %			
Mode	V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{BUS,PCB} (V)		Requirement (V)
			0 A	3 A / 20V	
Typical	20	90 / 47	20.546	19.867	19 ~ 21
		264 / 63	20.542	19.876	
Mode	V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{BUS,PCB} (V)		Requirement (V)
			6 A / 20V		
Peak load	20	100 / 47	18.4		> 18
		264 / 63	19		

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	

V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	I _{OUT,OCP} (A)	Requirement	
			Protection Mode	OCP Trigger Point (A)
20	90 / 47	5.16	Auto Recovery	< 5.3
	264 / 63	4.30	Auto Recovery	

11. Over Voltage Protection

Input Voltage	90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current	20V: 0A/3.0A	
Measured Point of Output Voltage	End of Cable	
Requirement	< 25V	

Load (A)	V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{BUS,OVP} (V)	Requirement (V)
0A	20	90 / 47	23.5	< 25
		264 / 63	24.5	
3A	20	90 / 47	23.3	< 25
		264 / 63	24.1	

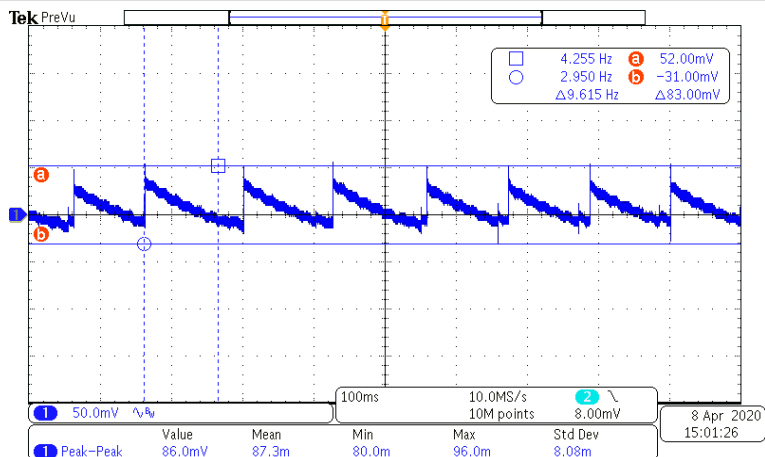
12. Ripple & Noise Voltage

Input Voltage	90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current	20V: 0A/3.0A	
Measured Point of Output Voltage	End of Cable	
Bandwidth	20 MHz (with 10 μF E-cap & 0.1 μF MLCC)	
Requirement	20V < 300 m V	

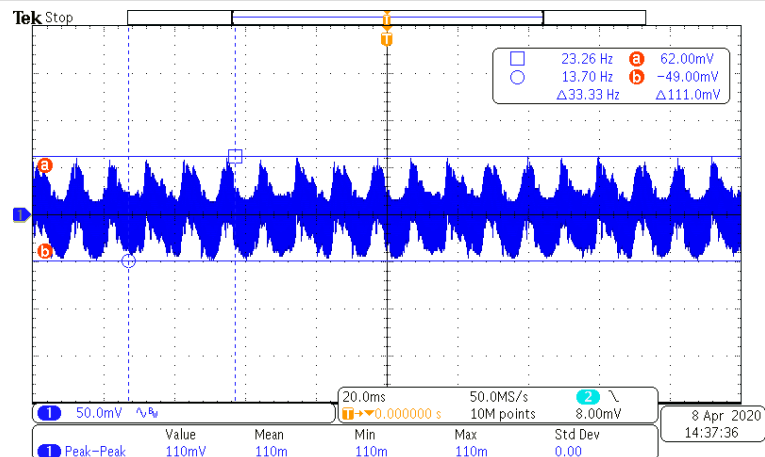
V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	V_{BUS,PK-PK} (mV)		Requirement (mV)
		0 A	3 A	
20	90 / 47	86	111	< 300
	264 / 63	80	96	

12. Ripple & Noise Voltage (Cont.)

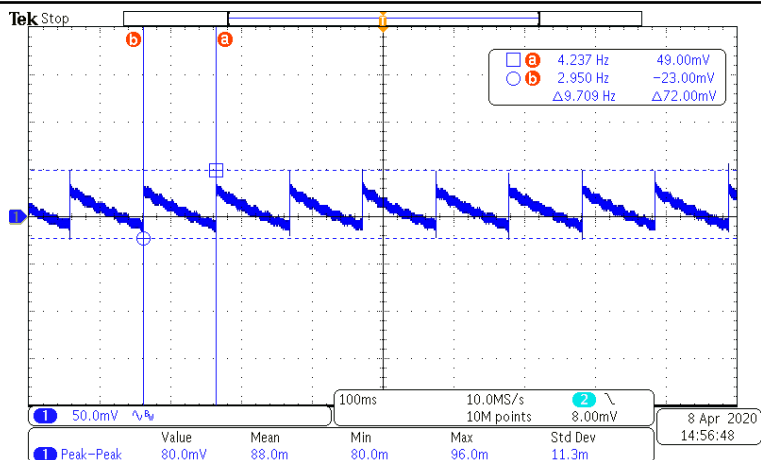
90 V_{AC} / 47 Hz / 20V / 0A



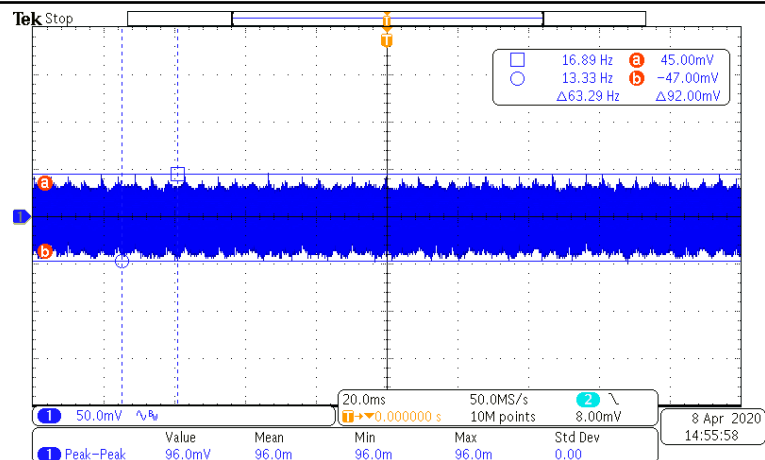
90 V_{AC} / 47 Hz / 20V / 3A



264 V_{AC} / 63Hz / 20V / 0A



264 V_{AC} / 63 Hz / 20V / 3A



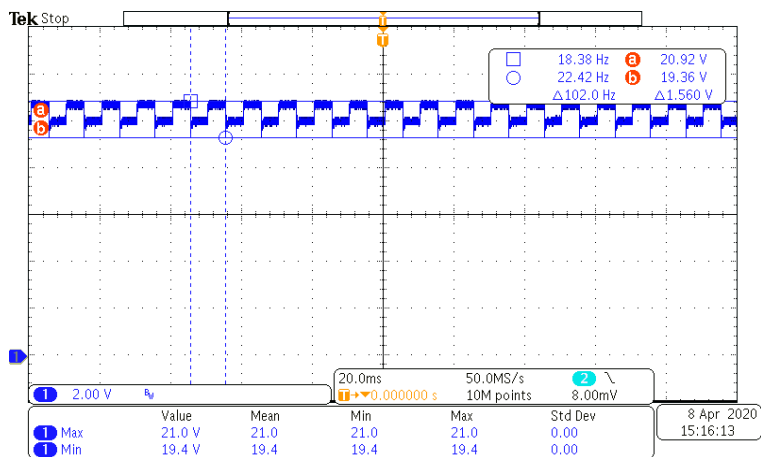
13. Dynamic Load

Input Voltage	90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current	20V: 0A/3.0A	
Frequency of Load	100 Hz (5 mS High / 5 mS Low)	
Slew Rate of Load	1.25 A / μ S	
Measured Point of Output Voltage	End of Cable	
Requirement	< ± 5 % of V _{BUS,SET}	

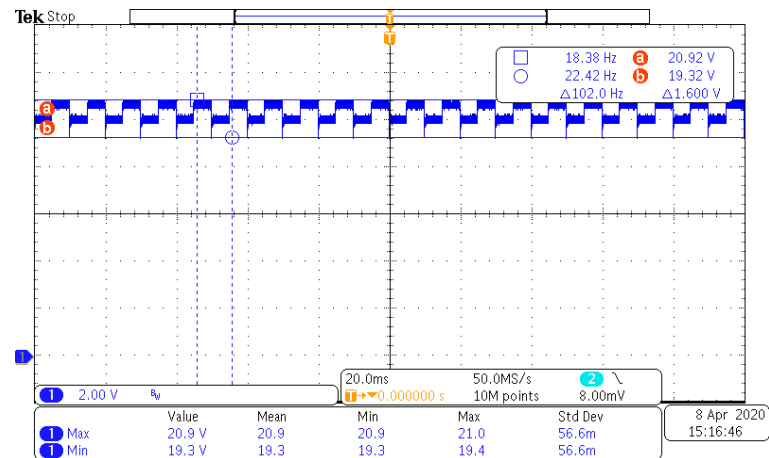
V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{BUS,PCB} (V)		Requirement (V)
		Min.	Max.	
20	90 / 47	19.7	20.4	19~21
	264 / 63	19.8	20.3	

13. Dynamic Load (Cont.)

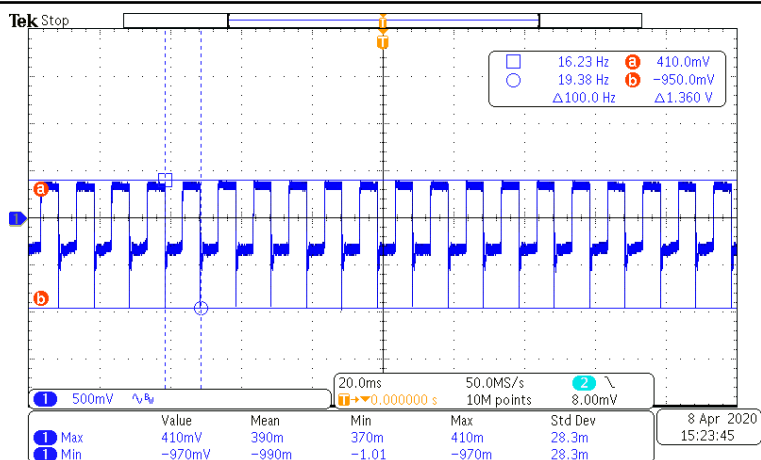
90 V_{AC} / 47 Hz / 20V



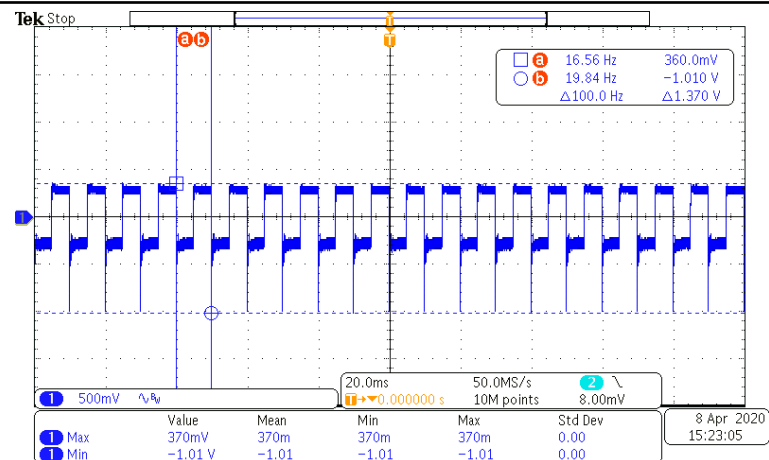
264 V_{AC} / 63 Hz / 20V



90 V_{AC} / 47 Hz / 20V



264 V_{AC} / 63 Hz / 20V



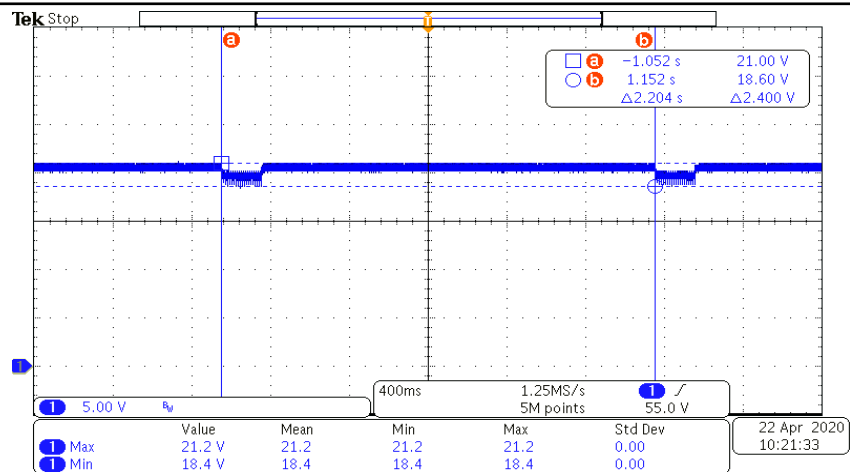
14. Peak Load

Input Voltage	100 V _{AC} / 60 Hz	264 V _{AC} / 63 Hz
Output Current	20V: 1.5A/6.0A	
Frequency of Load	(200 mS High / 2000 mS Low)	
Slew Rate of Load	1.25 A / μ S	
Measured Point of Output Voltage	End of Cable	
Requirement	< $\pm 10\%$ of V _{BUS,SET}	

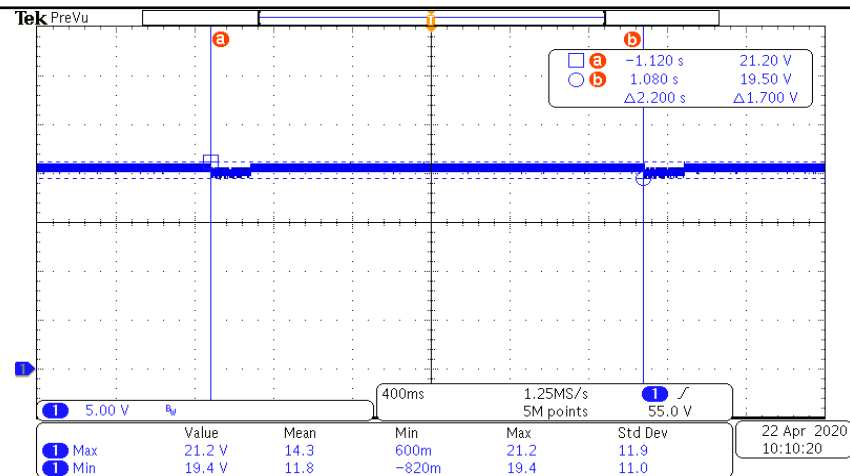
V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{BUS,PCB} (V)		Requirement (V)
		Min.	Max.	
20	100 / 47	18.4	21.2	18~22
	264 / 63	19.4	21.2	

14. Peak Load (Cont.)

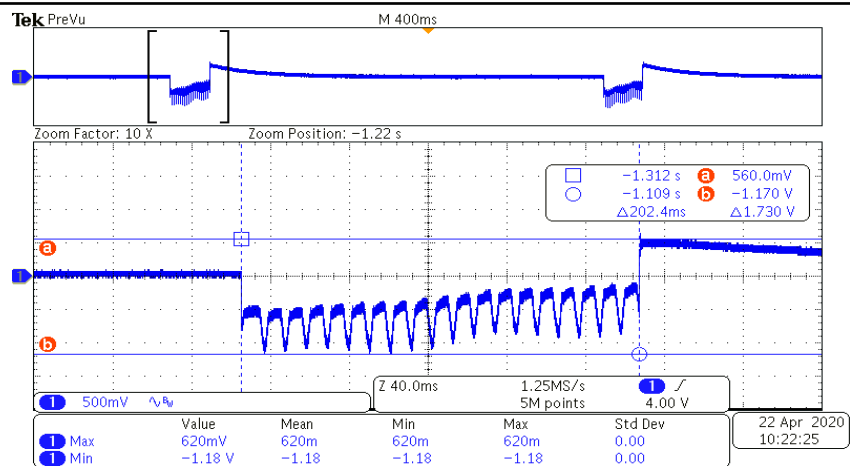
100 V_{AC} / 47 Hz / 20V



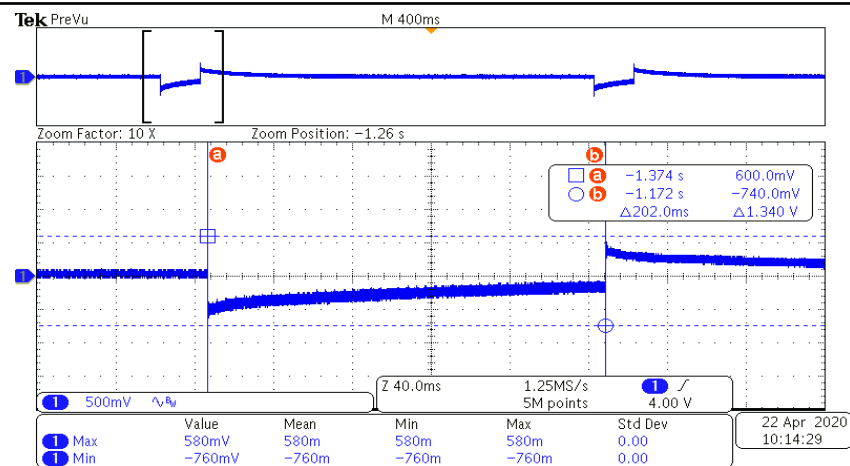
264 V_{AC} / 63 Hz / 20V



100 V_{AC} / 47 Hz / 20V



264 V_{AC} / 63 Hz / 20V



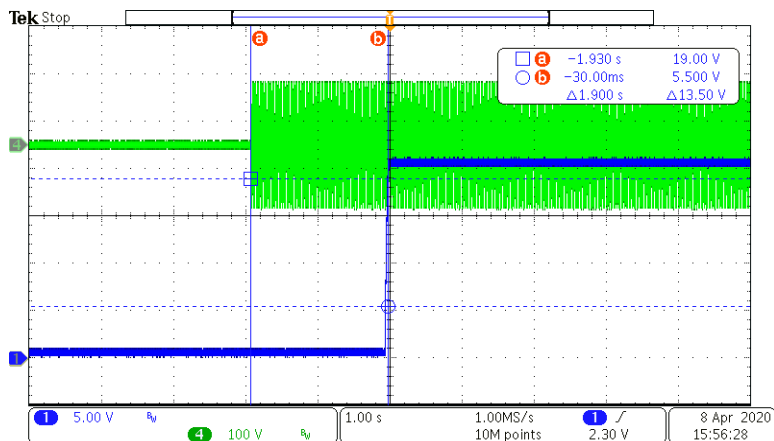
15. Turn-on Delay Time

Input Voltage	90 V _{AC} / 47 Hz
Output Current	20V : 0 A / 3A
Measured Point of Output Voltage	End of Cable
Requirement	< 3 S

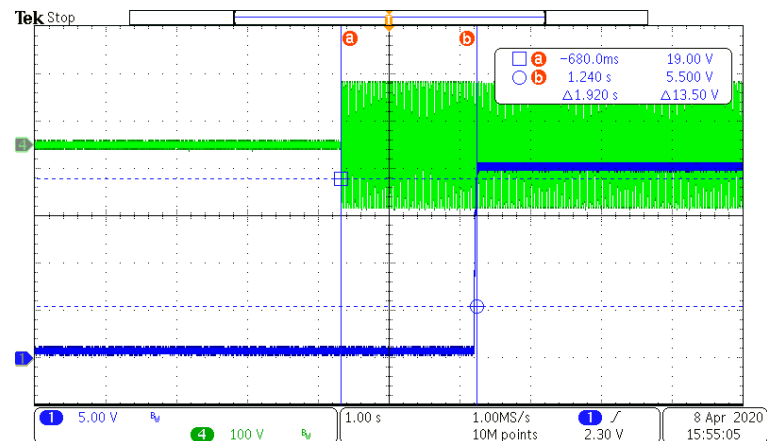
V_{BUS,SET} (V)	V_{IN,AC} (V / Hz)	T_{ON} (S)		Requirement (S)
		0 A	3 A	
20	90 / 47	1.9	1.92	< 3

15. Turn-on Delay Time (Cont.)

90 V_{AC} / 47 Hz / 0A



90 V_{AC} / 47 Hz / 3A



16. Rise Time & Overshoot

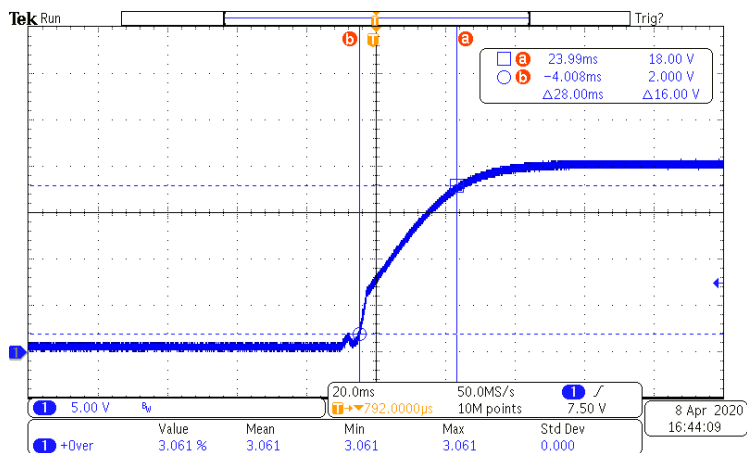
Input Voltage		90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current		20V : 0 A	
Measured Point of Output Voltage		End of PCB	
Requirement	Rise Time	< 40 mS	
	Overshoot	< 10 %	

V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	T _{RISE} (mS)	Requirement (mS)
20	90 / 47	28	< 40
	264 / 63	28.4	

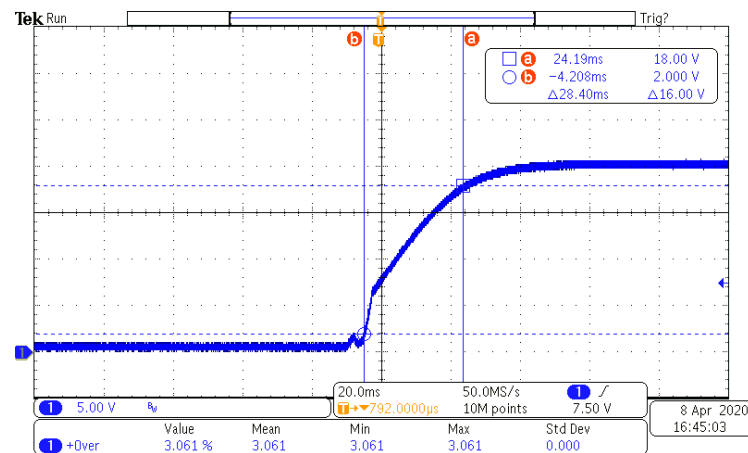
V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	Overshoot (%)	Requirement (%)
20	90 / 47	3.061	< 10
	264 / 63	3.061	

16. Rise Time & Overshoot (Cont.)

90 V_{AC} / 47 Hz / 0 A



264 V_{AC} / 63 Hz / 0 A



17. Rise Time & Overshoot (Cont.)

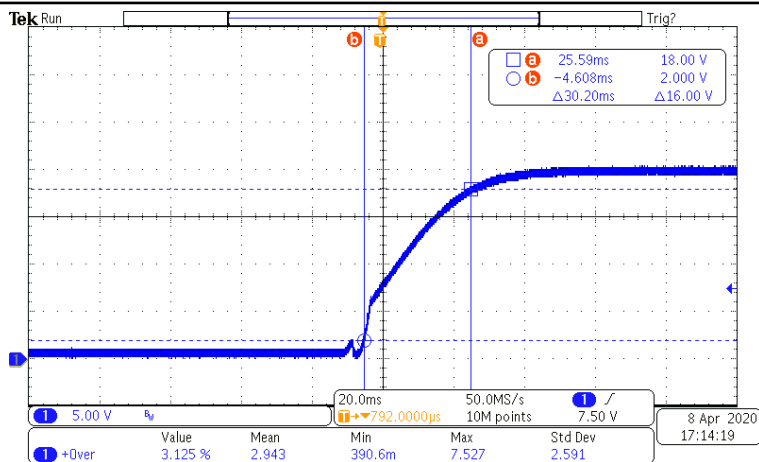
Input Voltage		90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current		20V : 3 A	
Measured Point of Output Voltage		End of Cable	
Requirement	Rise Time	< 40 mS	
	Overshoot	< 10 %	

V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	T _{RISE} (mS)	Requirement (mS)
20	90 / 47	30.2	< 40
	264 / 63	30.2	

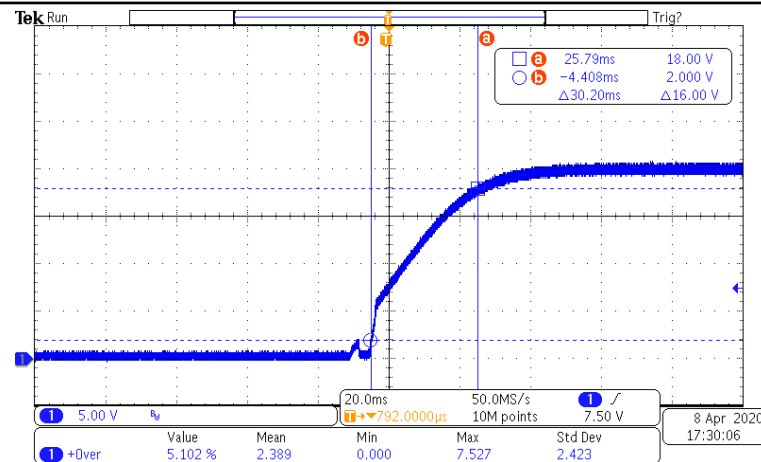
V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	Overshoot (%)	Requirement (%)
20	90 / 47	3.125	< 10
	264 / 63	5.102	

17. Rise Time & Overshoot (Cont.)

90 V_{AC} / 47 Hz / 3 A



264 V_{AC} / 63 Hz / 3 A



18. Supply Voltage of IC

Input Voltage	90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current	20V: 0A/3A	
Requirement	$> V_{CC_OFF} \ \& \ < V_{CC_OVP}$	

V _{BUS,SET} (V)	V _{IN,AC} (V / Hz)	V _{CC,U1} (V)				Requirement (V)
		No Load		Full Load		
		Min.	Max.	Min.	Max.	
20	90 / 47	10.7	14.9	16.1	15.1	7.5 < VCC < 27
	264 / 63	11.7	15	16.3	14.9	

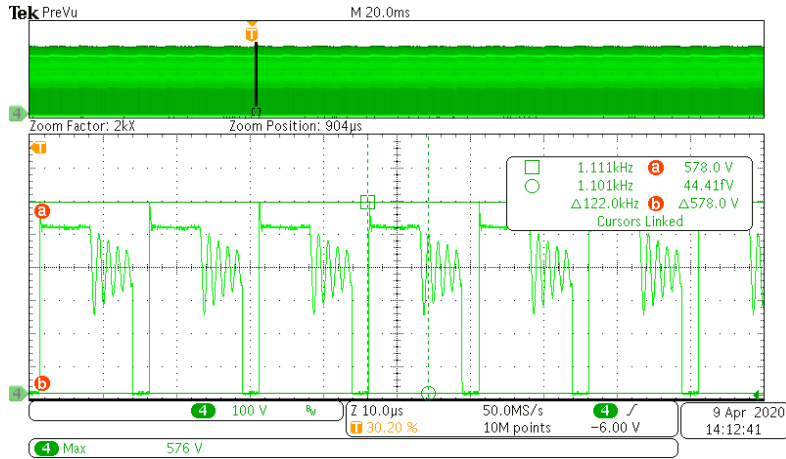
18. Stress on Switching Parts

Input Voltage	264 V _{AC} / 63 Hz
Output Current	Full Load & Peak Load (20 V: 3.00 A / 6.00 A)
Requirement	Defined by Different Parts

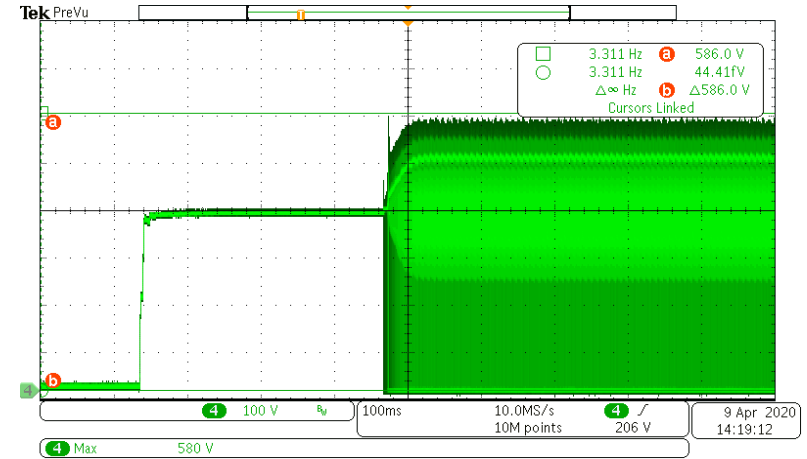
Location	Part No.	Mode	Condition	V _{BUS,SET} (V)	I _{OUT} (A)	V _{DS} (V)	Requirement (V)
Q1	70S360P7		Normal	20	3.00	576	< 630 (700 * 0.90)
			Turn-on	20	3.00	586	< 665 (700 * 0.95)
			Peak load	20	6.00	632	
			Short	20	--	608	
Q2	AOT296L		Normal	20	3.00	89.2	< 90 (100 * 0.90)
			Turn-on	20	3.00	92	< 95 (100 * 0.95)
			Peak load	20	6.00	89.6	
			Short	20	--	90	

18. Stress on Switching Parts (Cont.)

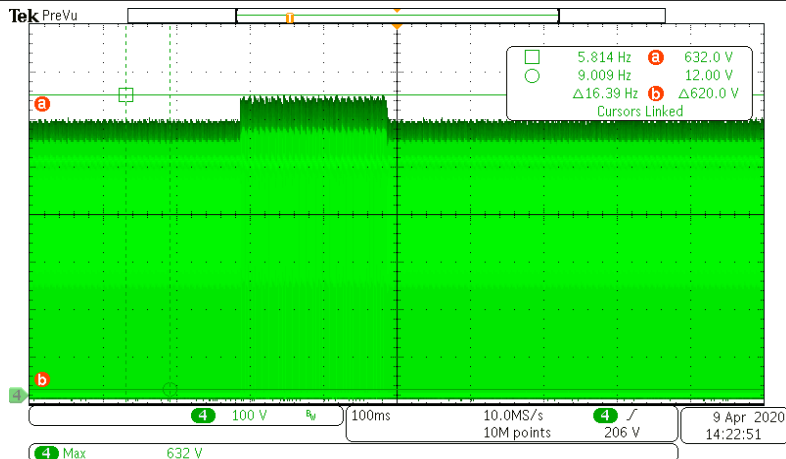
Q1_20 V / 3.00 A_Normal



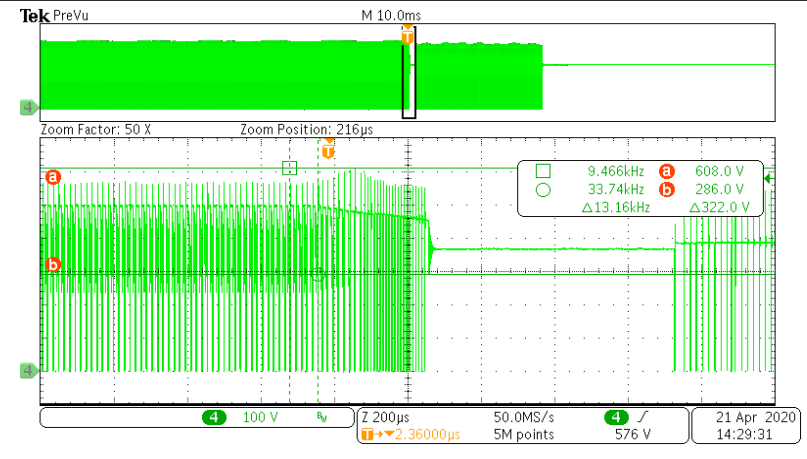
Q1_20V / 3.00A_Turn-on



Q1_20 V / 6.00 A_Peak load

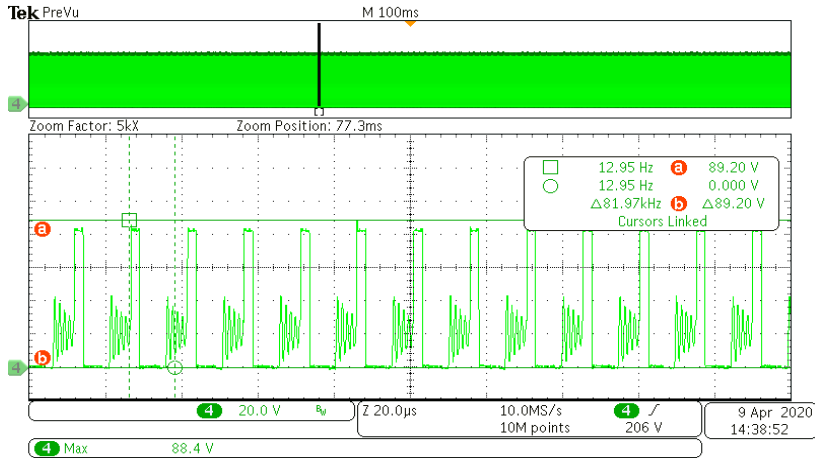


Q1_20V Short

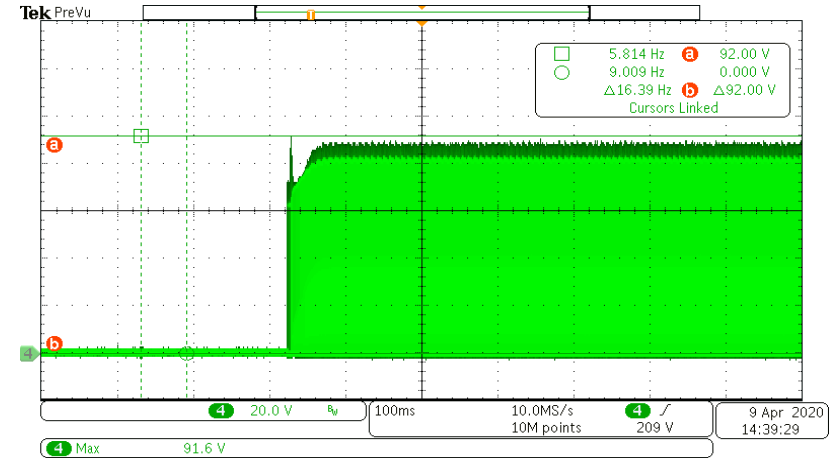


18. Stress on Switching Parts (Cont.)

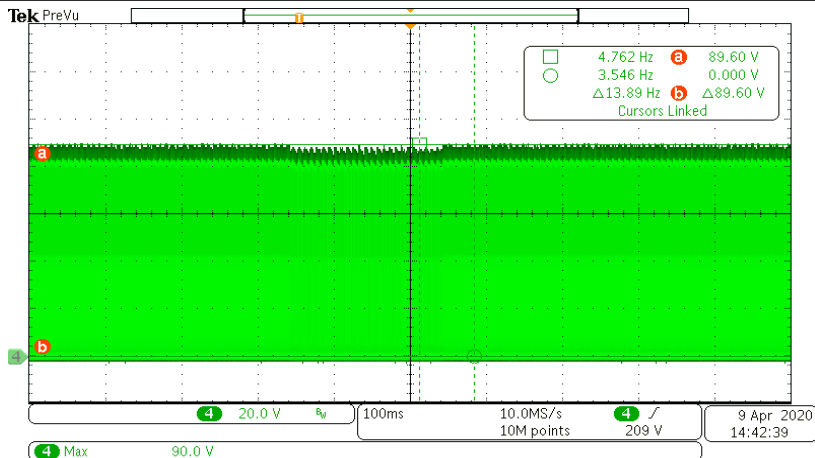
Q2_20 V / 3.00 A_Normal



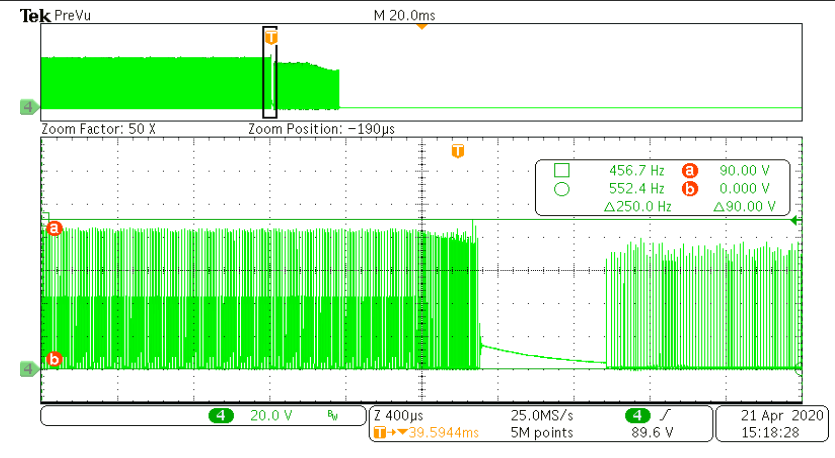
Q2_20V / 3.00A_Turn-on



Q2_20 V / 6.00 A_Peak load



Q2_20V Short



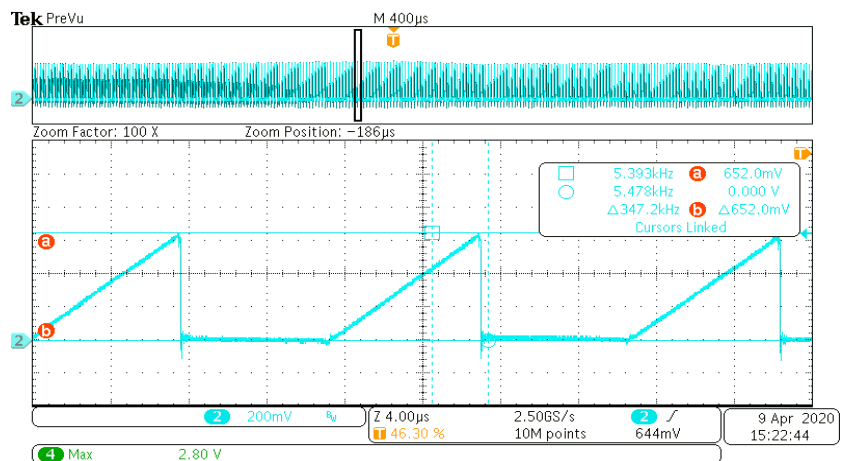
19. Flux Density of Transformer

Input Voltage	90 V _{AC} / 47 Hz	264 V _{AC} / 63 Hz
Output Current	Full Load & Maximum Power	
Requirement	90 % of Rating	

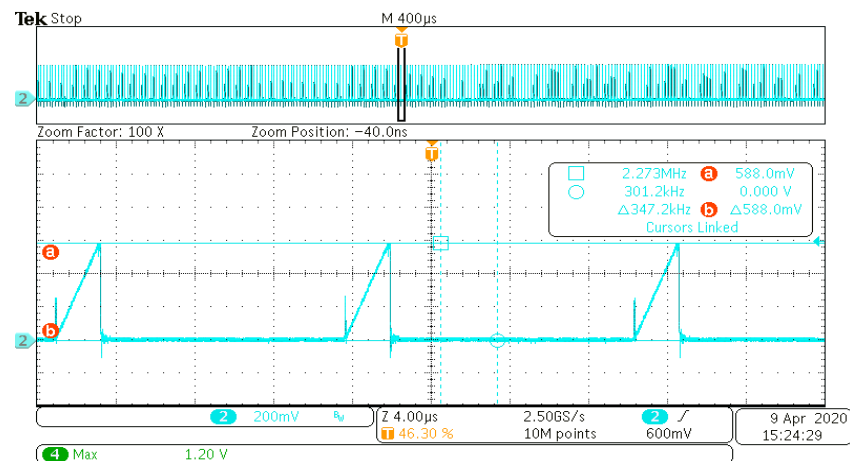
Mode	V _{BUS,SET} (V)	I _{OUT} (A)	V _{IN,AC} (V / Hz)	I _{PR1,MAX} (A)	B _{MAX} (G)	Requirement (G)
Normal	20	3.00	90 / 47	2.391	2881	< 3,780 (4,200 * 0.90)
		3.00	264 / 63	2.156	2590	
OCP		4.31	90 / 47	2.537	3032	
		5.18	264 / 63	2.948	3531	
Peak Load		6.00	100 / 60	2.948	3531	
		6.00	264 / 63	3.095	3704	

19. Flux Density of Transformer (Cont.)

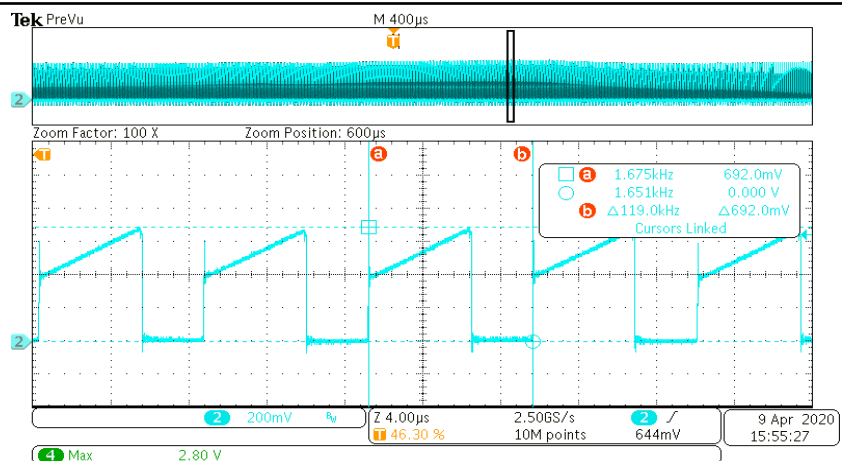
20 V / 3.00 A_90 V_{AC} / 47 Hz (R_{CS} = 0.273Ω)



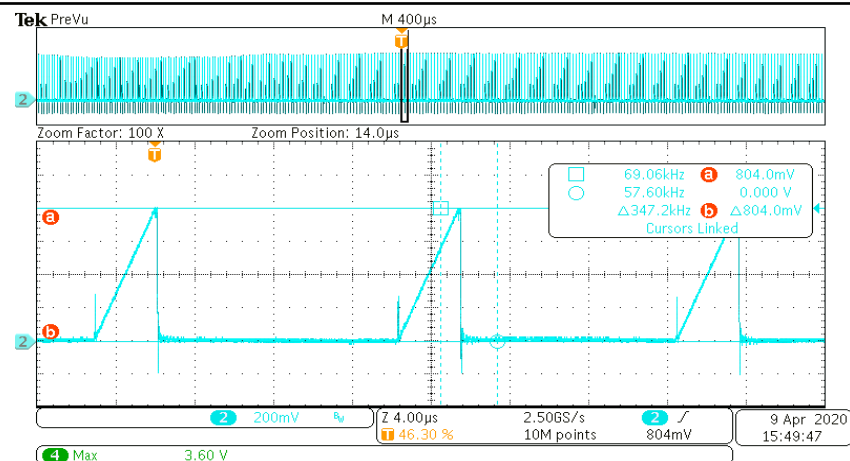
20 V / 3.00A_264 V_{AC} / 63 Hz (R_{CS} = 0.273Ω)



20 V / 4.31 A_90 V_{AC} / 47 Hz (R_{CS} = 0.273Ω)

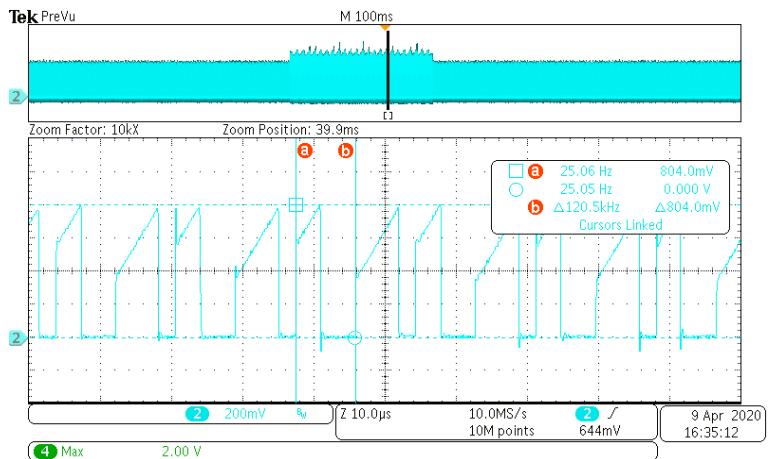


20 V / 5.18 A_264 V_{AC} / 63 Hz (R_{CS} = 0.273Ω)

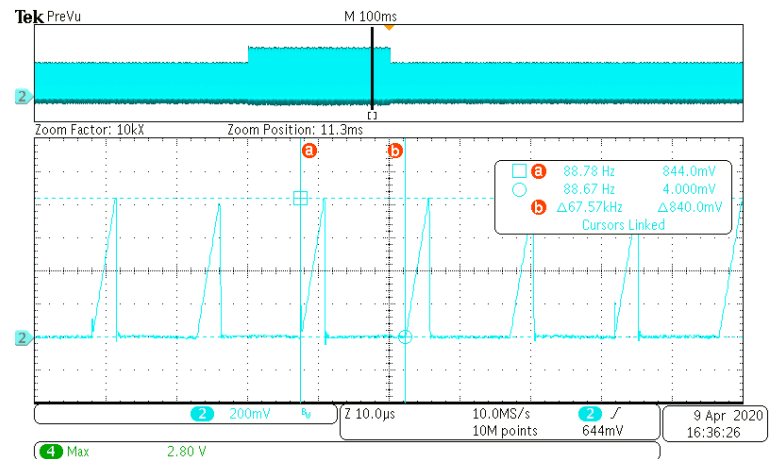


19. Flux Density of Transformer (Cont.)

20 V / 6.00 A _100 V_{AC} / 60 Hz (R_{cs} = 0.273Ω)



20 V / 6.00 A _264 V_{AC} / 63 Hz (R_{cs} = 0.273Ω)



Conduction:

20 V / 3 A

110 V_{AC} / 60 Hz / Line

110 V_{AC} / 60 Hz / Neutral



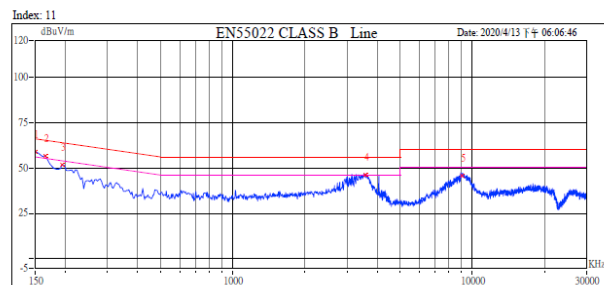
Customer Name: 20V 3A

Project No.: 60W peak 120W

Model Name: LD5523P

Engineer Name:

Test Mode: 輔助四線並接 鐵心下地



	Freq(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)	Factor(dB)
1	150.0000	58.92	37.64	33.12	66.00	56.00	-22.88	10.38
2	164.8297	56.77	44.76	27.01	65.58	55.58	-20.81	10.37
3	194.4890	51.88	44.88	27.81	64.73	54.73	-19.85	10.36
4	3579.1583	46.07	40.43	23.48	56.00	46.00	-15.57	10.61
5	9094.1884	45.96	39.30	30.42	60.00	50.00	-19.58	11.09



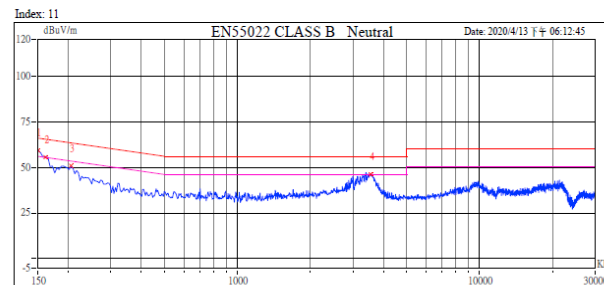
Customer Name: 20V 3A

Project No.: 60W peak 120W

Model Name: LD5523P

Engineer Name:

Test Mode: 輔助四線並接 鐵心下地



	Freq(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)	Factor(dB)
1	150.0000	59.45	36.93	32.25	66.00	56.00	-23.75	10.42
2	161.1222	55.79	50.56	30.95	65.68	55.68	-15.12	10.41
3	205.6112	50.69	43.79	31.39	64.41	54.41	-20.62	10.39
4	3555.1102	46.18	40.34	24.21	56.00	46.00	-15.66	10.61

Conduction:

20 V / 3 A

220 V_{AC} / 50 Hz / Line

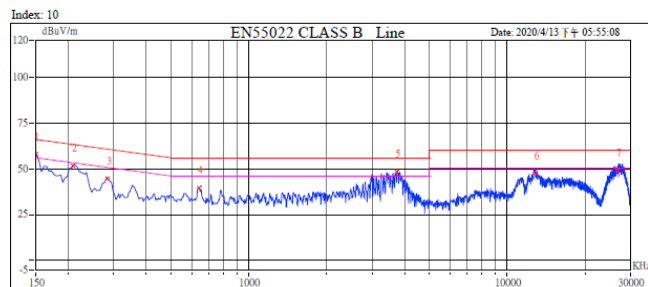


Customer Name: 20V 3A

Model Name: LD5523P

Test Mode: 輔助四線並繞 鐵心下地

Project No.: 60W peak 120W
 Engineer Name: john



	Freq(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)	Factor(dB)
1	150.0000	57.98	35.60	29.42	66.00	56.00	-26.58	10.38
2	209.3186	51.82	49.83	39.53	64.31	54.31	-14.47	10.36
3	283.4669	44.95	41.97	32.26	62.19	52.19	-19.92	10.39
4	639.3788	39.73	35.84	32.60	56.00	46.00	-13.40	10.41
5	3747.4950	48.44	45.83	30.98	56.00	46.00	-10.17	10.62
6	12797.5952	47.82	44.45	29.76	60.00	50.00	-15.55	11.51
7	26857.7154	48.95	43.35	33.29	60.00	50.00	-16.65	13.04

220 V_{AC} / 50 Hz / Neutral

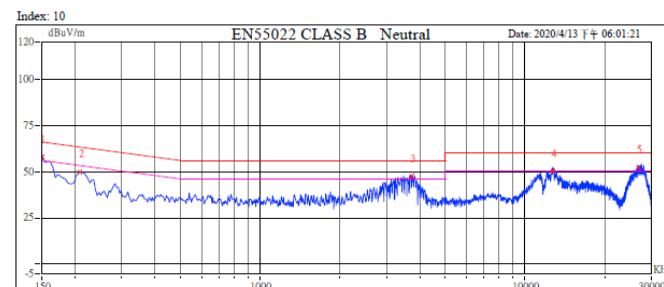


Customer Name: 20V 3A

Model Name: LD5523P

Test Mode: 輔助四線並繞 鐵心下地

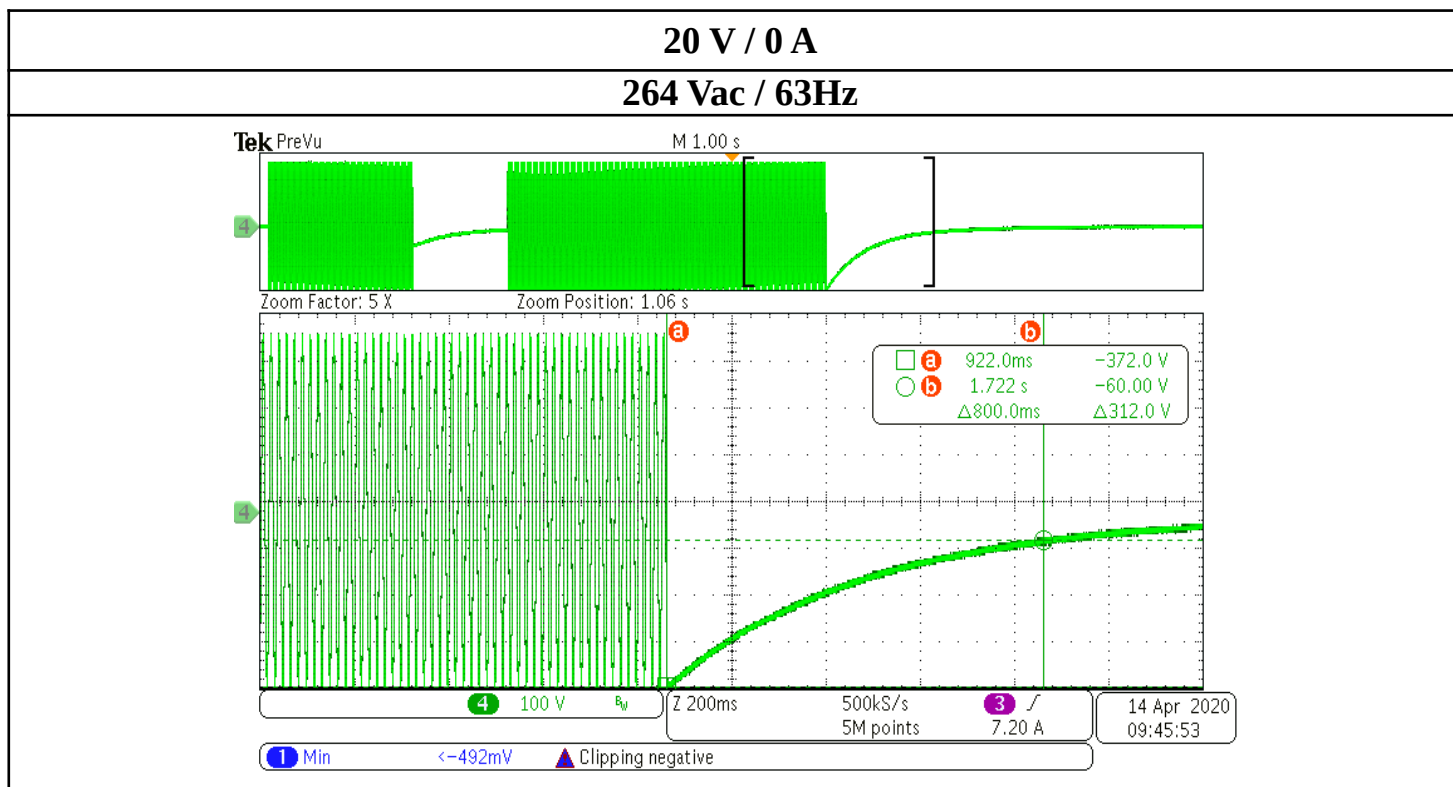
Project No.: 60W peak 120W
 Engineer Name: john



	Freq(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)	Factor(dB)
1	150.0000	57.87	35.25	30.81	66.00	56.00	-25.19	10.42
2	209.3186	49.76	48.09	37.64	64.31	54.31	-16.21	10.39
3	3747.4950	47.82	45.59	32.44	56.00	46.00	-10.41	10.63
4	12717.4349	50.46	45.80	34.78	60.00	50.00	-14.20	11.67
5	26697.3948	52.47	45.38	34.99	60.00	50.00	-14.62	13.54

21. X CAP discharge

	264 V _{AC} / 63 Hz
Output Current	No Load
Requirement	IEC62368 (@2 sec < 60V)



Result

1.722 S

The Best Company for AC-DC Mid & High Power Application Total Solution



THANK YOU

