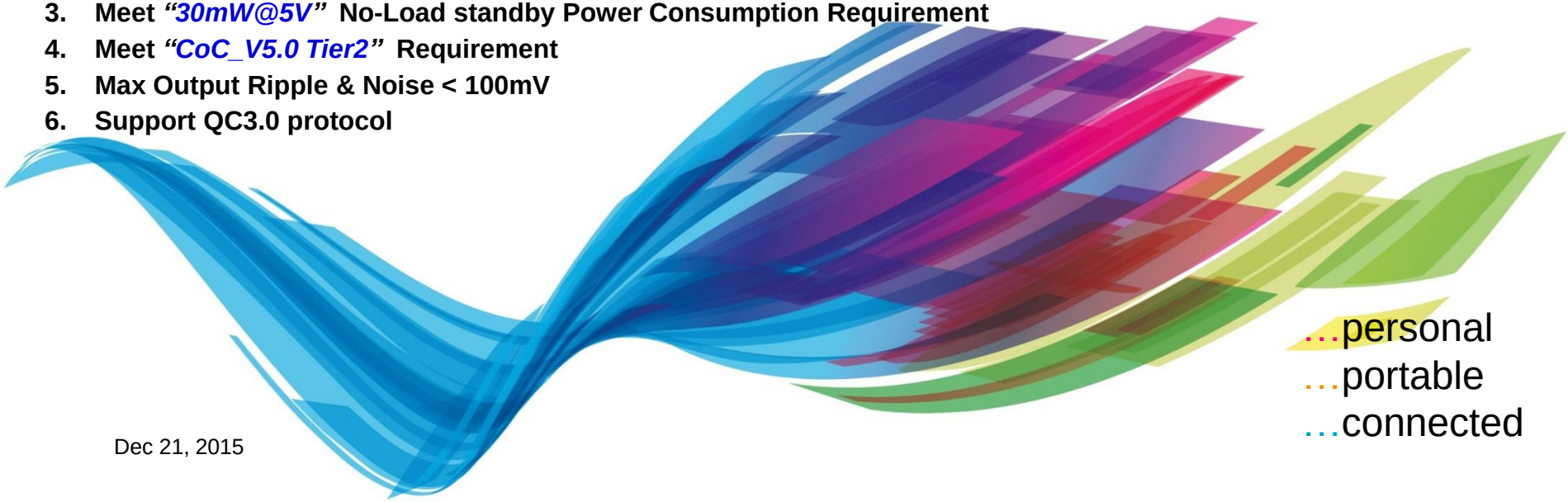
iW1782-01+iW636-00+iW673-00 for 18W(5V3A/9V2A/12V1.5A) QC3.0 Design

General Design Specification:

1. **AC Input Range 90-264V_{AC}**
2. **DC Output 5V/3A, 9V/2A, 12V/1.5A**
3. **Meet *"30mW@5V"* No-Load standby Power Consumption Requirement**
4. **Meet *"CoC_V5.0 Tier2"* Requirement**
5. **Max Output Ripple & Noise < 100mV**
6. **Support QC3.0 protocol**



…personal
…portable
…connected

Dec 21, 2015

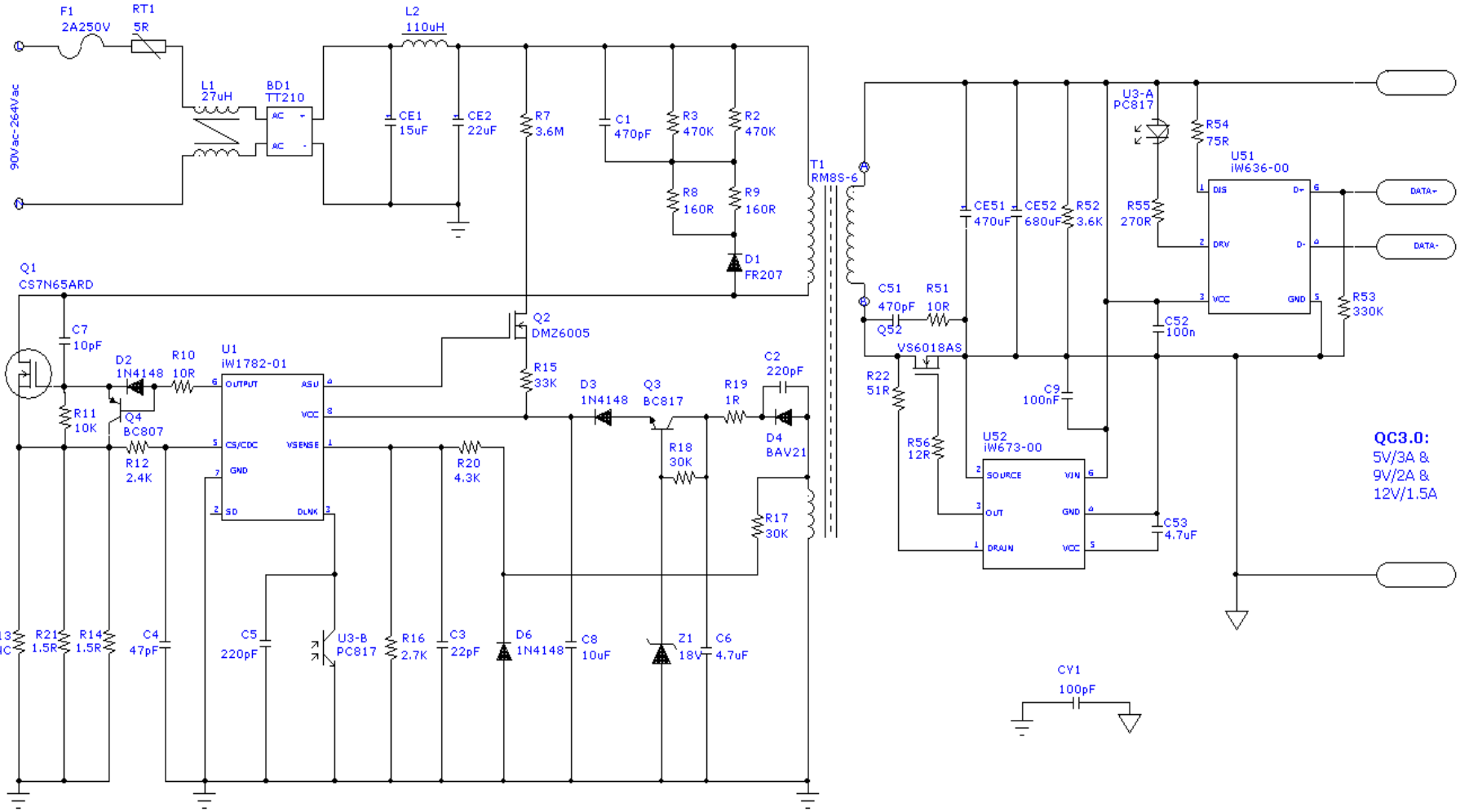
1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V_{IN}	90		264	V_{AC}	2 Wire
Frequency		f_{LINE}	47	50/60	63	Hz	
No-load Input Power (230V_{AC})					30	mW	Measured under 5V output
Output							
5V/3A	Output Voltage	V_{OUT}	4.75	5.00	5.25	V	Measured at the end of USB-A
	Output Current	I_{OUT}	0		3	A	
	Over Current Protection	I_{OCP}			3.6	A	
	Ripple & Noise	V_{RIPPLE}			100	mV_{P_P}	Note1
	Average Efficiency	η	81.84			%	Refer to CoC_V5_Tier2
9V2A	Output Voltage	V_{OUT}	8.55	9.00	9.45	V	Measured at the end of USB-A
	Output Current	I_{OUT}	0		2	A	
	Over Current Protection	I_{OCP}			2.4	A	
	Ripple & Noise	V_{RIPPLE}			100	mV_{P_P}	Note1
	Average Efficiency	η	85.45			%	Refer to CoC_V5_Tier2
12V1.5A	Output Voltage	V_{OUT}	11.40	12.00	12.60	V	Measured at the end of USB-A
	Output Current	I_{OUT}	0		1.5	A	
	Over Current Protection	I_{OCP}			1.8	A	
	Ripple & Noise	V_{RIPPLE}			100	mV_{P_P}	Note1
	Average Efficiency	η	85.45			%	Refer to CoC_V5_Tier2
Environmental							
Conducted EMI			Meets CISPR22B / EN55022B				Output (-) is floating
Safety			Designed to meet IEC60950, UL1950 Class II				
Ambient Temperature		T_{AMB}	0		40	° C	Free convection, sea level

Note1: Add 0.1uF Ceramic capacitor and 10uF E-cap at the end of connector and set oscilloscope at 20MHz bandwidth.

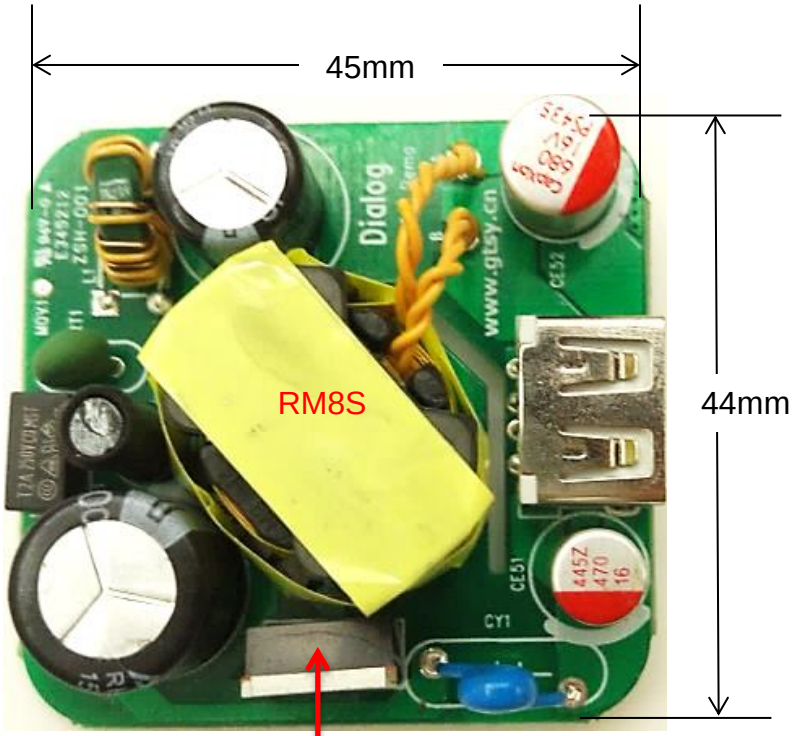
2. Schematic

威兆原厂快充MOS:刘生Q:532557197

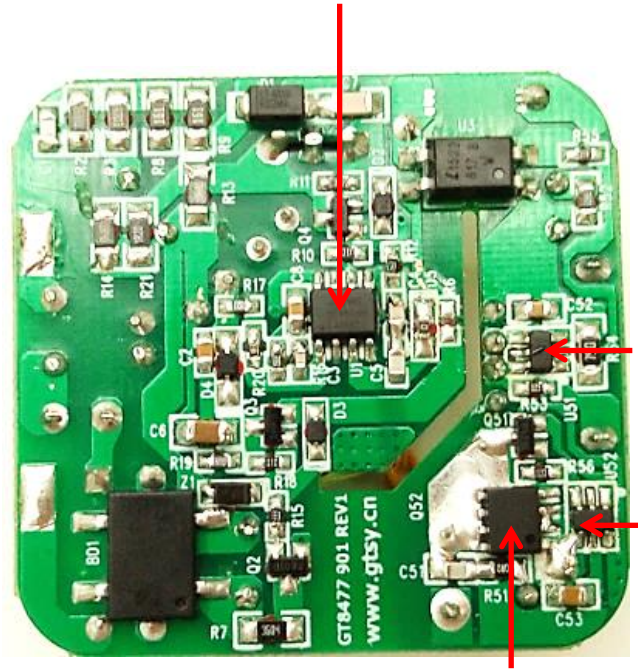


3. Circuit Board Photograph

Top View



Bottom View



4.1 Bill of Material

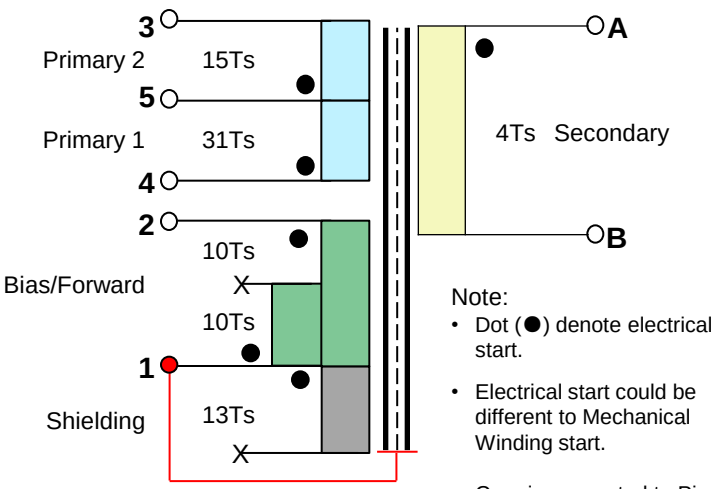
Item	Qty.	Ref.	Description
1	1	U1	iW1782-01, Off-line Digital PSR & PWM & VMS Controller, SOIC-8
2	1	U52	iW673-00, SR Controller,SOT23-6
3	1	U51	iW636-00, AC/DC Secondary-Side Controller for Qualcomm® Quick ChargeTM 3.0, SOT23-6
4	1	F1	2A250V, Fuse,size: 4*8
5	1	L1	27uH, Common-mode inductor, T9.5X5X4, Wire: 0.35mmX9T
6	1	L2	110uH,Differential-mode inductor, Φ5x11, Wire:0.3mmX80T
7	1	Q4	BC807,PNP Transistor, SOT-23
8	1	Q1	CS7N65ARD,7A650V, N-channel MOSFET, TO-262
9	1	Q3	BC817,NPN Transistor, SOT-23
10	1	Q2	DMZ6005, 600V12mA, depletion mode MOSFET, SOT23
11	1	Q52	60VDSS 8mR N-channel
12	1	U3	PC817, Photo coupler
13	1	T1	RM8, Transformer,Vertical tapy
14	1	CE1	15uF, 400V, Low-ESR E-Cap, Φ10mm X 12mm
15	1	CE2	22uF, 400V, Low-ESR E-Cap, Φ13mm X 14mm
16	1	C1	470pF, 500V, X7R, SMD-0805
17	1	C2	220pF, 250V, X7R, SMD-0805
18	1	C8	10uF, 25V, X7R, SMD-0805
19	1	C9	100nF, 25V, X7R, SMD-0803
20	1	C6	4.7uF, 50V, X7R, SMD-1206
21	1	C3	22pF, 25V, X7R, SMD-0603
22	1	C4	39pF, 25V, X7R, SMD-0603
23	1	C5	220pF, 50V, X7R, SMD-0805
24	1	CE52	680uF,16V,Solid E-cap,Φ8mm X 11mm
25	1	CE51	470uF,16V,Solid E-cap,Φ6mm X 11mm
26	1	C51	470pF, 100V, X7R, SMD-0805
27	1	C53	4.7uF, 50V, X7R, SMD-0805
28	1	C52	100nF, 50V, X7R, SMD-0805
29	1	CY1	100pF,Y-Cap
30	3	D2,D3,D6	1N4148, Fast Rectifier Diode,SMD-323
31	1	D1	FR207, 2A1000V,Fast Recovery Rectifier (Trr=500ns), SMD-1206S
32	1	D4	BAV21, 200mA250V, Fast switching diode(Trr=50nS), SOD-123

4.2 Bill of Material(Cont.)

Item	Qty.	Ref.	Description
33	1	BD1	TT210,2A1000V,Rectifier bridge
34	1	Z1	18±5%V,Zener Diode, SMD-1206
35	1	RT1	NTC,5Ω, 5D-7
36	2	R2,R3	470KΩ ±5%, SMD-1206
37	1	R7	3.6MΩ ±5%, SMD-1206
38	2	R8,R9	160Ω ±5%, SMD-1206
39	2	R51,R10	10Ω ±5%, SMD-0603
40	1	R11	10KΩ ±5%, SMD-0603
41	1	C7	10pF,1000V,SMD-1206S
42	2	R14,R21	1.5Ω ±1%, SMD-1206
43	1	R15	33KΩ ±1%, SMD-0603
44	2	R12	2.4KΩ ±1%, SMD-0603
45		R16	2.7KΩ ±1%, SMD-0603
46	2	R17,R18	30KΩ ±1%, SMD-0603
47	1	R19	1Ω ±1%, SMD-0603
48	1	R20	4.3KΩ ±1%, SMD-0603
49	1	R22	51Ω ±5%, SMD-0603
50	1	R52	3.6KΩ ±5%, SMD-0805
51	1	R53	330KΩ ±5%, SMD-0603
52	1	R54	75Ω ±5%, SMD-1206
53	1	R55	270Ω ±5%, SMD-0603
54	1	R56	12Ω ±1%, SMD-0603
55	1	USB	USB, horizontal type
55	1	PCB	Double side board, FR-4

5. Transformer Drawing

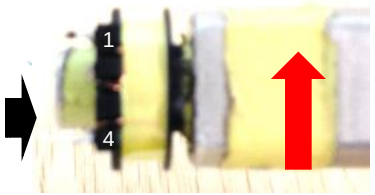
SCHEMATIC

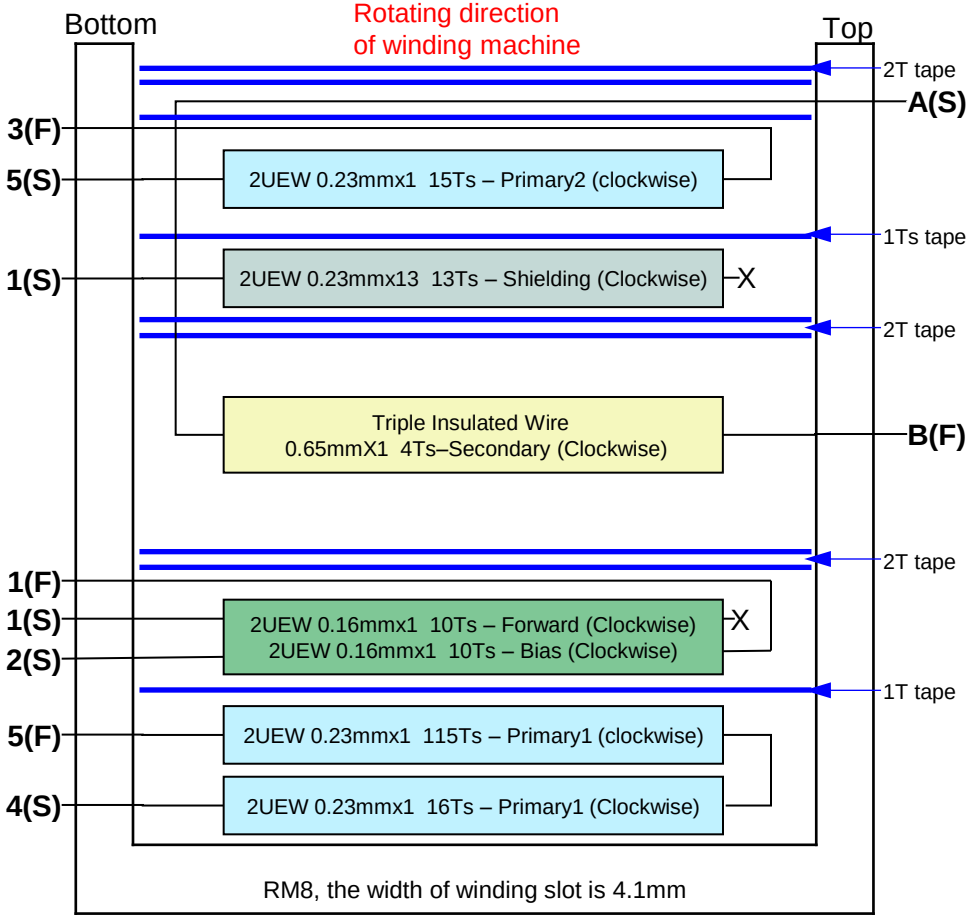


Note:

- Dot (●) denote electrical start.
- Electrical start could be different to Mechanical Winding start.
- Core is connected to Pin-1(Pri_GND) by wire

Winding Start pin-4& End pin-5 in "Clockwise" direction – looking from bottom side of the Bobbin





ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) =750±5%uH @10KHz
2. Electrical Strength = 3KV, 50/60Hz,1Min(pins1~5 to pins A~B)

MATERIALS:

1. Core : RM8(Ferrite Material JP95 or equivalent)
2. Bobbin :RM8,Vertical
3. Magnet Wires (pri): Type 2-UEW
4. Magnet wires(sec): Triple Insulated Wire
5. Layer Insulation Tape :3M1298 or equivalent.

FINISHED :

1. Varnish the complete assembly
2. Core is connected to pin1

6.1 Regulation and Efficiency Measurement (@5V)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	OCP (A)	CoC_V5_Tier2 Requirement
90	**0.018**	5.060	0	30				3.42	1. Minimum Efficiency in Active Mode at 10% load of full rated output current is 72.48%. 2. Minimum Four Point (25%, 50%, 75% and 100%) Average Efficiency in Active Mode is 81.84%.
	1.76	5.100	0.3	33	1.53	86.93	88.51		
	4.37	5.168	0.8	38	3.88	88.70			
	8.94	5.296	1.5	43	7.94	88.86			
	13.73	5.418	2.25	73	12.19	88.79			
	18.89	5.523	3.0	65	16.57	87.71			
115	**0.019**	5.060	0	28				3.42	
	1.76	5.101	0.3	34	1.53	86.95			
	4.34	5.170	0.8	43	3.88	89.34	89.37		
	8.88	5.297	1.5	51	7.95	89.48			
	13.60	5.417	2.3	65	12.19	89.62			
	18.62	5.526	3.0	61	16.58	89.03			
230	**0.021**	5.060	0	29				3.43	
	1.84	5.098	0.3	30	1.53	83.12			
	4.41	5.167	0.8	48	3.88	87.87	88.95		
	8.91	5.290	1.5	54	7.94	89.06			
	13.61	5.403	2.3	53	12.16	89.32			
	18.51	5.526	3.0	57	16.58	89.56			
264	**0.024**	5.060	0	29				3.43	
	1.89	5.103	0.3	30	1.53	81.00	88.36		
	4.45	5.167	0.8	45	3.88	87.08			
	8.97	5.289	1.5	61	7.93	88.44			
	13.68	5.403	2.3	54	12.16	88.87			
	18.62	5.528	3.0	53	16.58	89.07			

*Note: Output voltage is measured at the end of PCB.

6.2 Regulation and Efficiency Measurement (@6V)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	OCP (A)	CoC_V5_Tier2 Requirement
90	**0.022**	6.070	0	18				3.44	1. Minimum Efficiency in Active Mode at 10% load of full rated output current is 75.45%. 2. Minimum Four Point (25%, 50%, 75% and 100%) Average Efficiency in Active Mode is 85.45%.
	2.11	6.108	0.3	32	1.83	86.84	88.50		
	5.24	6.180	0.8	47	4.64	88.45			
	10.63	6.300	1.5	38	9.45	88.90			
	16.28	6.423	2.25	58	14.45	88.77			
	22.29	6.528	3.0	58	19.58	87.86			
115	**0.023**	6.075	0	20				3.44	
	2.11	6.115	0.3	29	1.83	86.94			
	5.19	6.188	0.8	49	4.64	89.42	89.65		
	10.53	6.312	1.5	40	9.47	89.91			
	16.07	6.427	2.3	46	14.46	89.99			
	21.95	6.531	3.0	55	19.59	89.26			
230	**0.024**	6.070	0	22				3.45	
	2.20	6.110	0.3	29	1.83	83.32			
	5.23	6.180	0.8	50	4.64	88.62	89.40		
	10.58	6.300	1.5	49	9.45	89.32			
	16.08	6.413	2.3	47	14.43	89.73			
	21.79	6.532	3.0	47	19.60	89.93			
264	**0.026**	6.070	0	22				3.45	
	2.26	6.116	0.3	32	1.83	81.19	88.76		
	5.29	6.185	0.8	47	4.64	87.69			
	10.65	6.300	1.5	46	9.45	88.73			
	16.18	6.410	2.3	49	14.42	89.14			
	21.90	6.532	3.0	41	19.60	89.48			

*Note: Output voltage is measured at the end of PCB.

6.3 Regulation and Efficiency Measurement (@9V)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	OCP (A)	CoC_V5_Tier2 Requirement
90	0.052	9.143	0.000	27				2.25	1. Minimum Efficiency in Active Mode at 10% load of full rated output current is 75.45%. 2. Minimum Four Point (25%, 50%, 75% and 100%) Average Efficiency in Active Mode is 85.45%.
	2.19	9.170	0.200	29	1.83	83.74	88.54		
	5.25	9.219	0.500	42	4.61	87.80			
	10.50	9.299	1.000	40	9.30	88.56			
	15.83	9.379	1.500	43	14.07	88.87			
	21.28	9.461	2.000	49	18.92	88.92			
115	0.055	9.143	0.000	29				2.24	
	2.18	9.175	0.200	31	1.84	84.17	89.53		
	5.21	9.223	0.500	45	4.61	88.52			
	10.38	9.301	1.000	41	9.30	89.61			
	15.65	9.382	1.500	54	14.07	89.92			
	21.02	9.465	2.000	47	18.93	90.06			
230	0.060	9.149	0.000	29				2.25	
	2.28	9.179	0.200	36	1.84	80.52	89.38		
	5.25	9.223	0.500	47	4.61	87.84			
	10.41	9.304	1.000	44	9.30	89.38			
	15.65	9.383	1.500	42	14.07	89.93			
	20.94	9.462	2.000	52	18.92	90.37			
264	0.067	9.133	0.000	29				2.25	
	2.32	9.166	0.200	35	1.83	79.02	88.76		
	5.29	9.210	0.500	47	4.61	87.05			
	10.46	9.288	1.000	48	9.29	88.80			
	15.72	9.366	1.500	43	14.05	89.37			
	21.04	9.448	2.000	54	18.90	89.81			

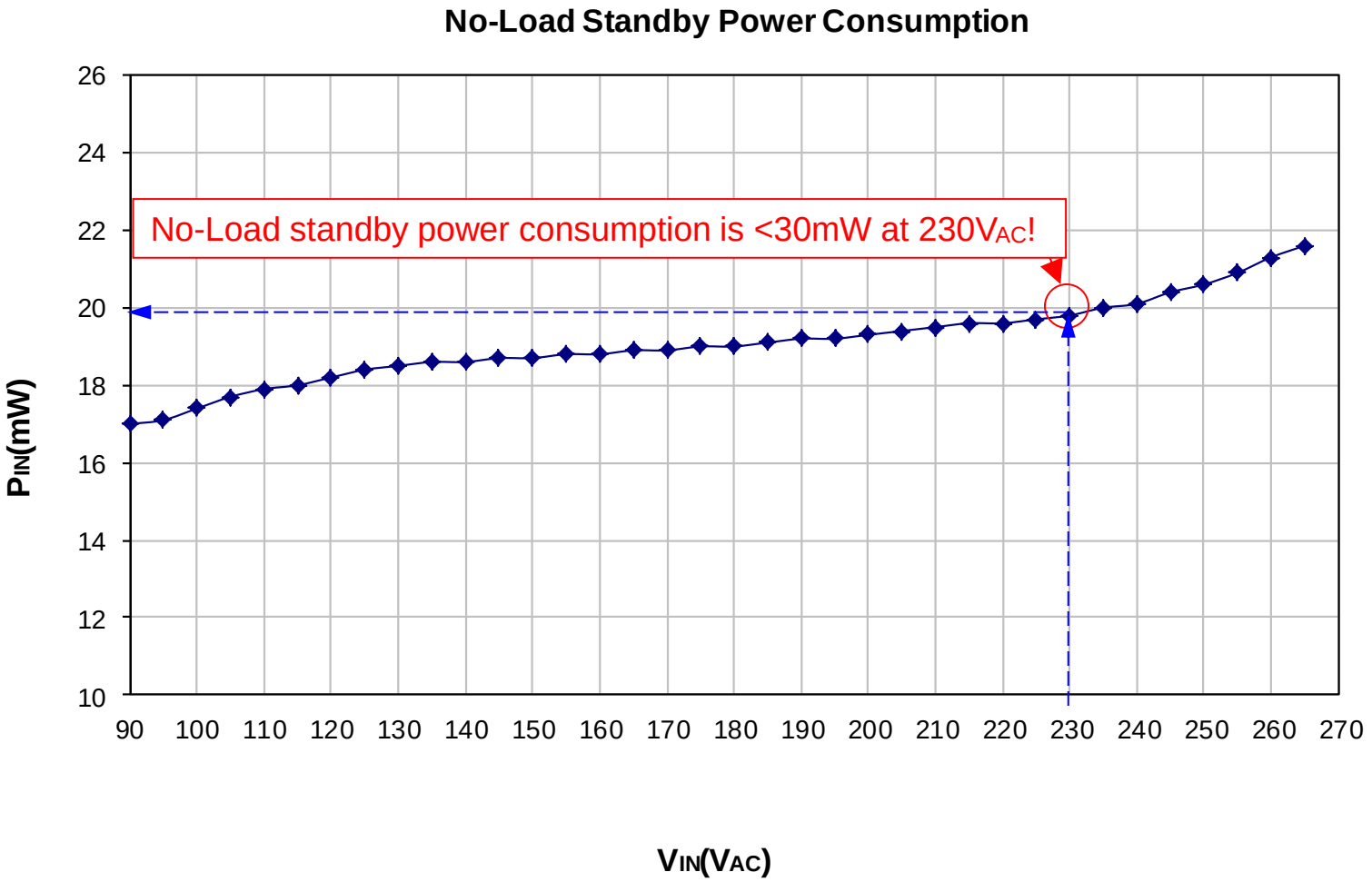
*Note: Output voltage is measured at the end of PCB.

6.4 Regulation and Efficiency Measurement (@12V)

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	Average η(%)	OCP (A)	CoC_V5_Tier2 Requirement
90	0.069	12.197	0.000	21				1.64	1. Minimum Efficiency in Active Mode at 10% load of full rated output current is 75.45%. 2. Minimum Four Point (25%, 50%, 75% and 100%) Average Efficiency in Active Mode is 85.45%.
	2.27	12.223	0.150	24	1.83	80.77	88.02		
	5.31	12.255	0.375	37	4.60	86.55			
	10.50	12.314	0.750	40	9.24	87.96			
	15.73	12.380	1.125	43	13.93	88.54			
	20.97	12.448	1.500	58	18.67	89.04			
115	0.072	12.200	0.000	22				1.64	
	2.27	12.224	0.150	36	1.83	80.78			
	5.27	12.265	0.375	40	4.60	87.27	89.01		
	10.37	12.325	0.750	40	9.24	89.14			
	15.54	12.388	1.125	40	13.94	89.68			
	20.76	12.449	1.500	55	18.67	89.95			
230	0.100	12.191	0.000	27				1.65	
	2.36	12.217	0.150	39	1.83	77.65			
	5.30	12.254	0.375	41	4.60	86.70	88.92		
	10.38	12.311	0.750	44	9.23	88.95			
	15.51	12.366	1.125	45	13.91	89.70			
	20.64	12.427	1.500	57	18.64	90.31			
264	0.106	12.207	0.000	29				1.65	
	2.42	12.240	0.150	40	1.84	75.87			
	5.35	12.266	0.375	43	4.60	85.98	88.40		
	10.45	12.324	0.750	46	9.24	88.45			
	15.60	12.383	1.125	43	13.93	89.30			
	20.77	12.443	1.500	63	18.66	89.86			

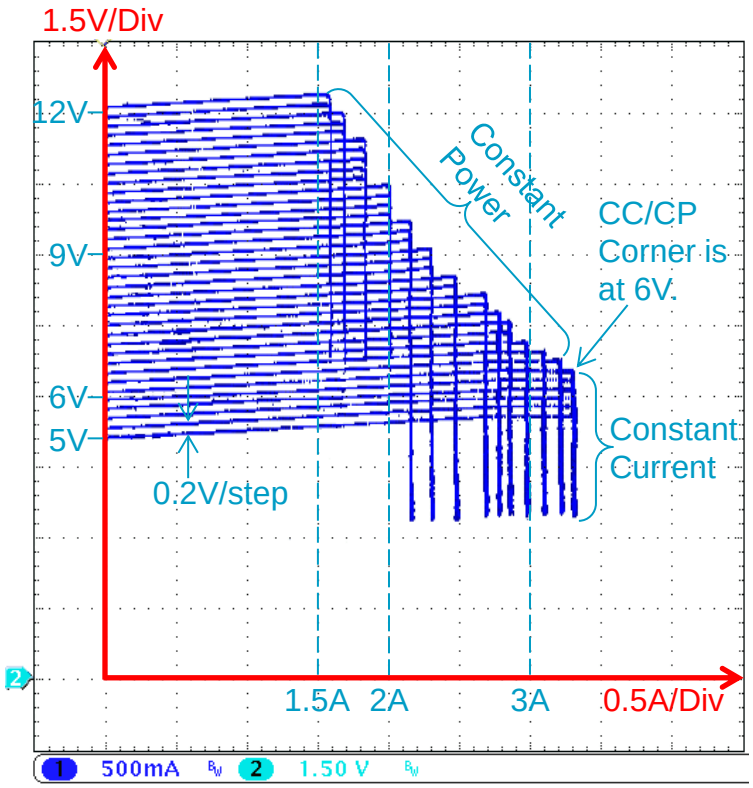
*Note: Output voltage is measured at the end of PCB.

7. No-Load Standby Power Consumption (@5V)

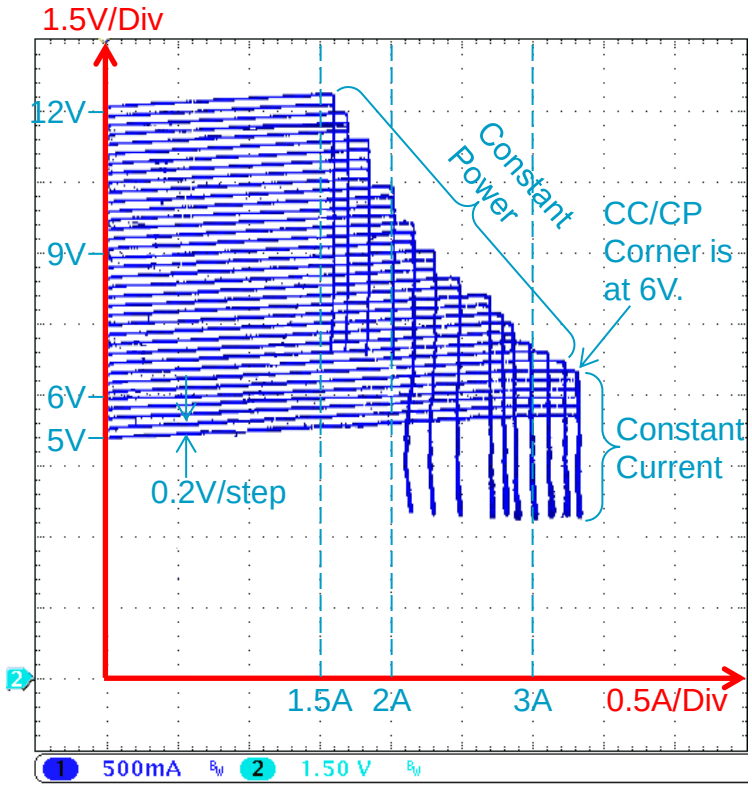


8. Output VI Characteristics

V_{IN}=90V_{AC}/60Hz



V_{IN}=264V_{AC}/50Hz



Note:

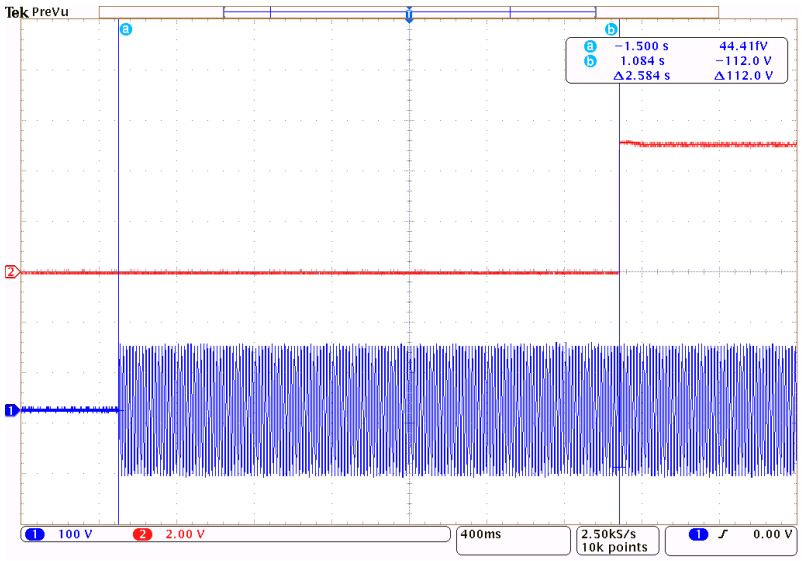
1) Output voltage is monitored at end of PCB

2) The CDC (Cable Drop Compensation) is configured to 450mV at 5V level.

9. Turn-on Delay Time

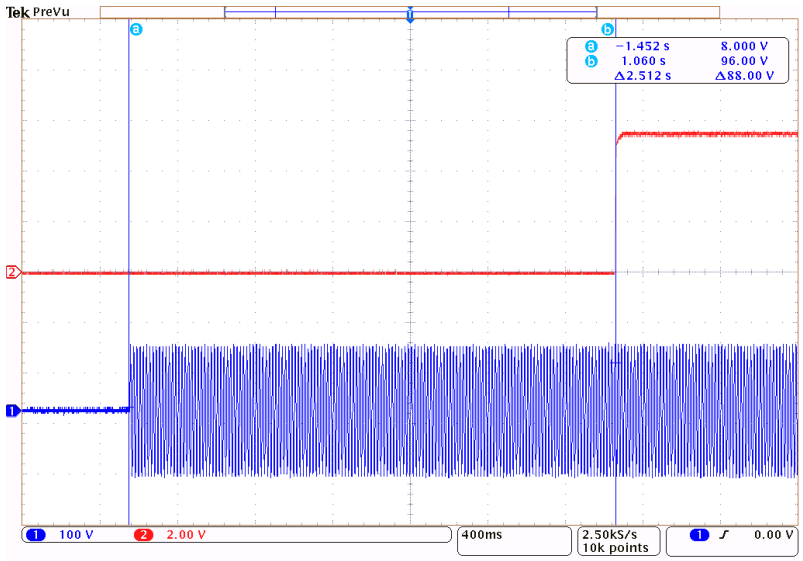
90V_{AC}, No Load

T_{ST_DELAY}=2.584S



90V_{AC}, Full Load

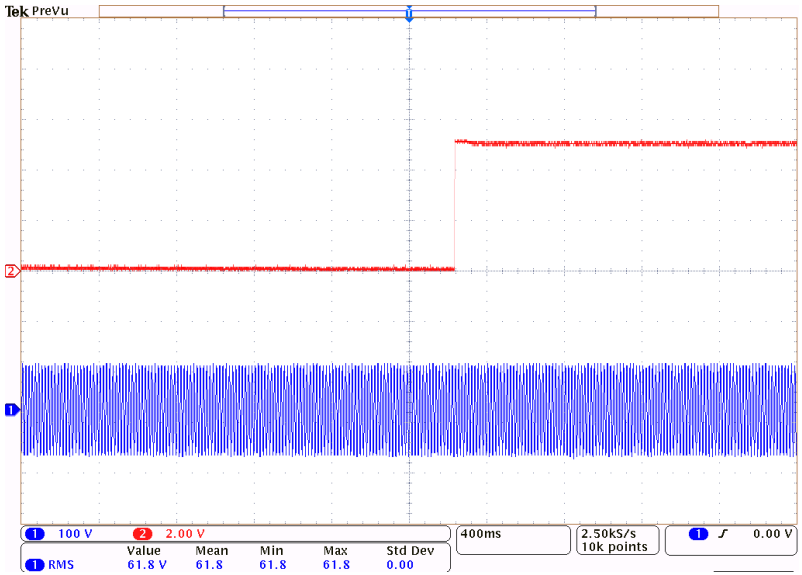
T_{ST_DELAY}=2.512S



10. AC Startup Voltage

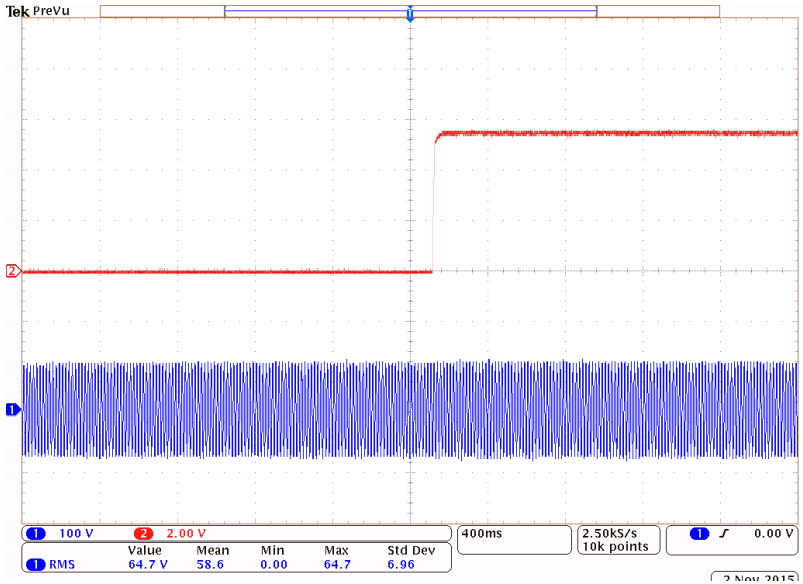
No Load

$V_{IN\_STARTUP}$ =61.8V_{AC}



Full Load

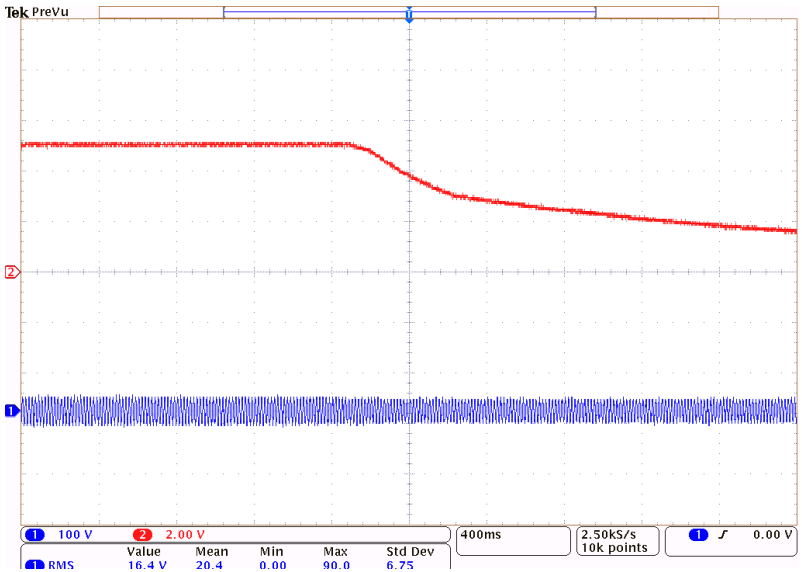
$V_{IN\_STARTUP}$=64.7V_{AC}



11. AC Brownout Voltage

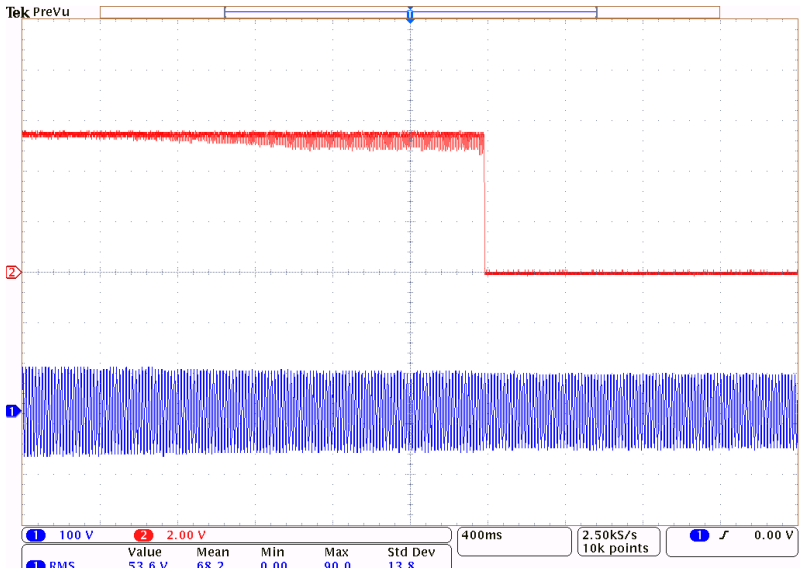
No Load

$V_{IN\_BROWNOUT}$ =16.4V_{AC}



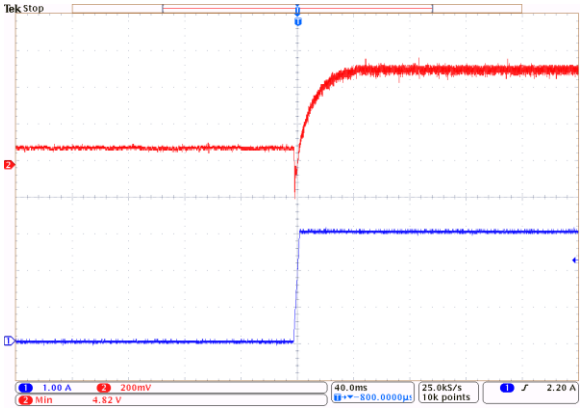
Full Load

$V_{IN\_BROWNOUT}$=53.6V_{AC}

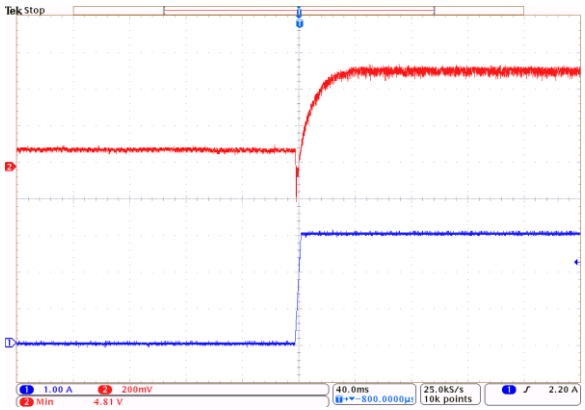


12.1 One-time DLR(@5V) 威兆原厂快充MOS:刘生Q:532557197

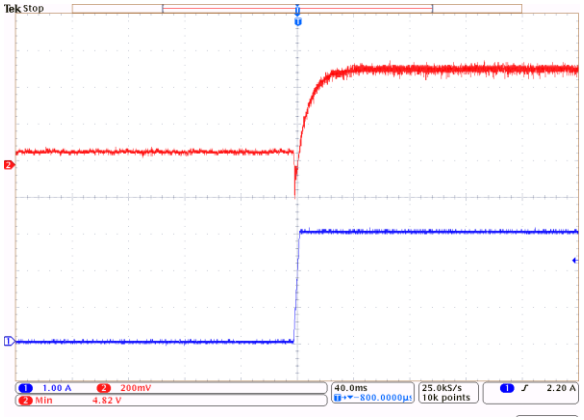
V_{IN}=90V_{AC}/60Hz, I_{OUT}=0A→3A
V_{OUT_MIN}=4.82V



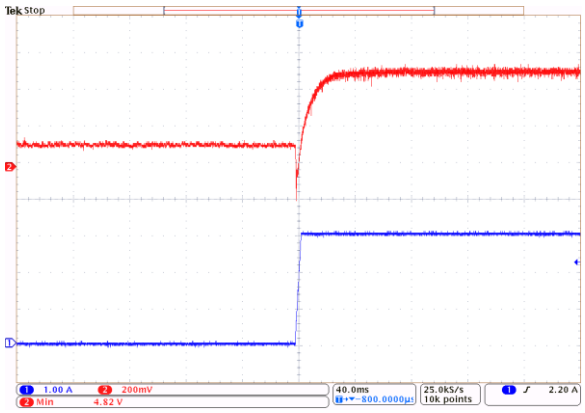
V_{IN}=115V_{AC}/60Hz, I_{OUT}=0A→3A
V_{OUT_MIN}=4.81V



V_{IN}=230V_{AC}/50Hz, I_{OUT}=0A→3A
V_{OUT_MIN}=4.82V



V_{IN}=264V_{AC}/50Hz, I_{OUT}=0A→3A
V_{OUT_MIN}=4.82V

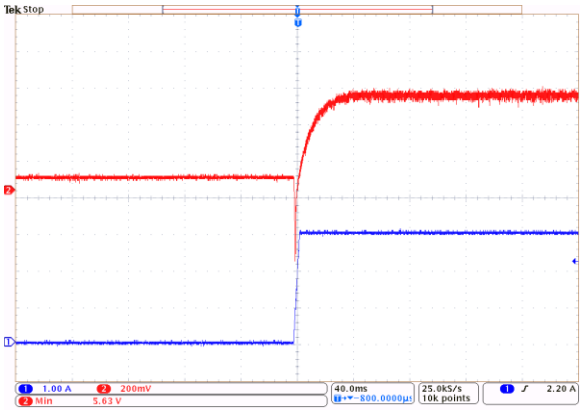


* Note: Output voltage is monitored at end of PCB.

12.2 One-time DLR(@6V)

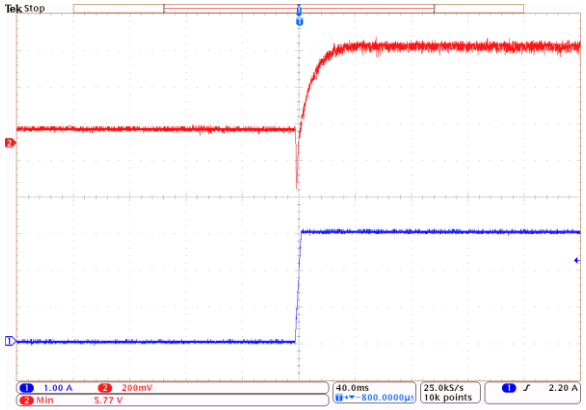
V_{IN}=90V_{AC}/60Hz, I_{OUT}=0A→3A

V_{OUT_MIN}=5.63V



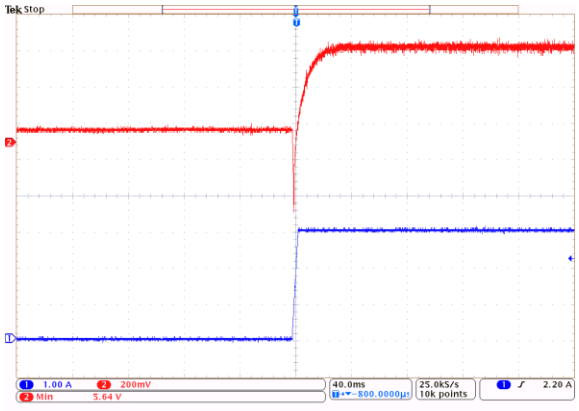
V_{IN}=115V_{AC}/60Hz, I_{OUT}=0A→3A

V_{OUT_MIN}=5.77V



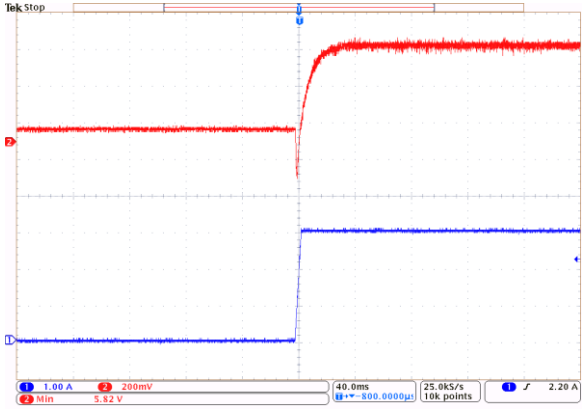
V_{IN}=230V_{AC}/50Hz, I_{OUT}=0A→3A

V_{OUT_MIN}=5.64V



V_{IN}=264V_{AC}/50Hz, I_{OUT}=0A→3A

V_{OUT_MIN}=5.82V

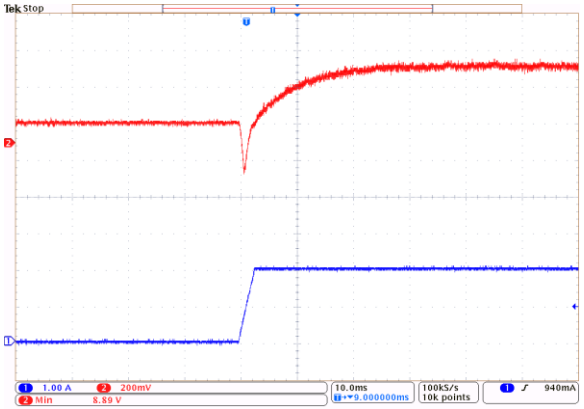


* Note: Output voltage is monitored at end of PCB.

12.3 One-time DLR(@9V) 威兆原厂快充MOS:刘生Q:532557197

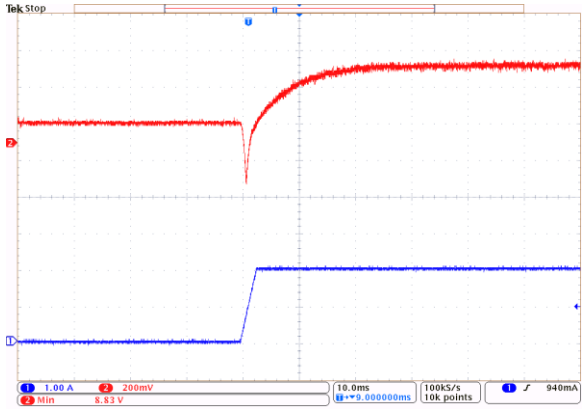
V_{IN}=90V_{AC}/60Hz, I_{OUT}=0A→2A

V_{OUT_MIN}=8.89V



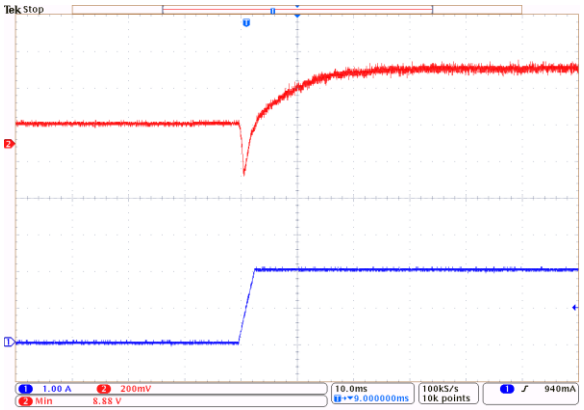
V_{IN}=115V_{AC}/60Hz, I_{OUT}=0A→2A

V_{OUT_MIN}=8.83V



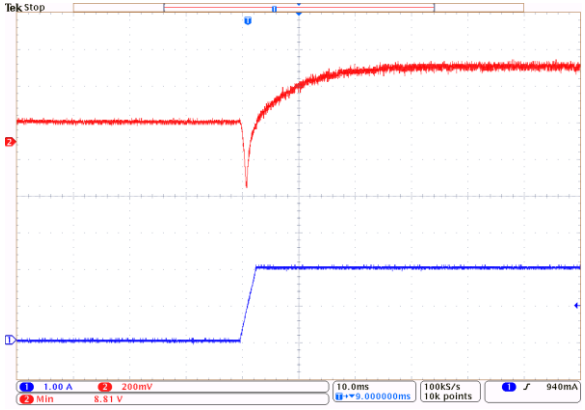
V_{IN}=230V_{AC}/50Hz, I_{OUT}=0A→2A

V_{OUT_MIN}=8.88V



V_{IN}=264V_{AC}/50Hz, I_{OUT}=0A→2A

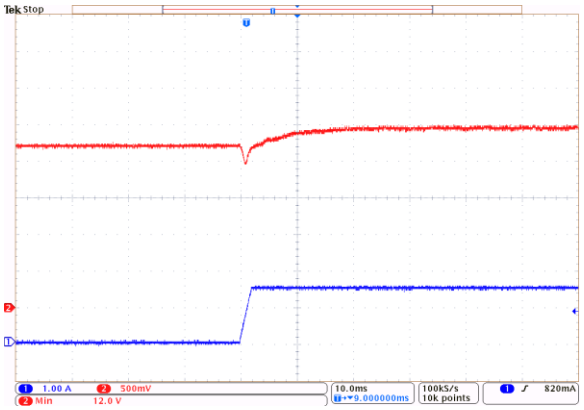
V_{OUT_MIN}=8.81V



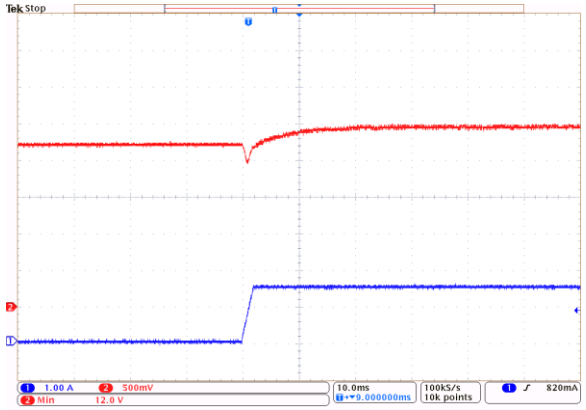
* Note: Output voltage is monitored at end of PCB.

12.4 One-time DLR(@12V)

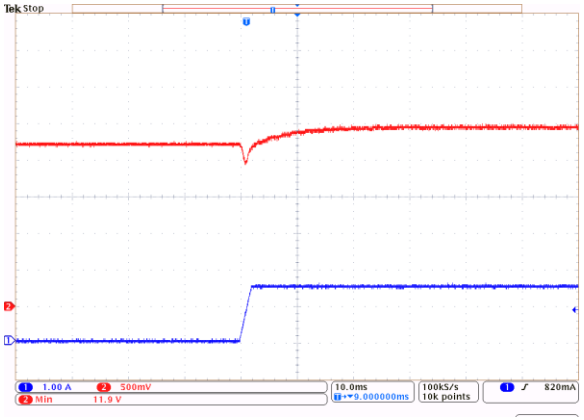
V_{IN}=90V_{AC}/60Hz, I_{OUT}=0A→1.5A
V_{OUT_MIN}=12V



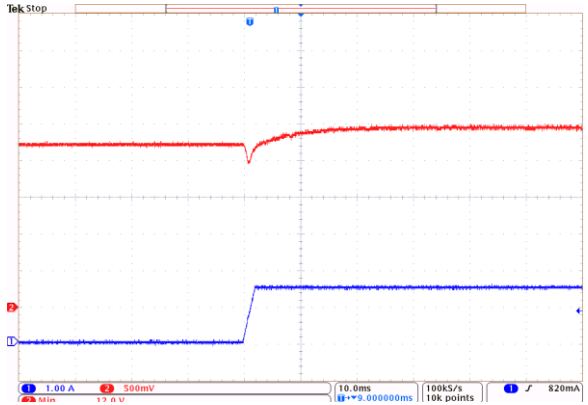
V_{IN}=115V_{AC}/60Hz, I_{OUT}=0A→1.5A
V_{OUT_MIN}=12V



V_{IN}=230V_{AC}/50Hz, I_{OUT}=0A→1.5A
V_{OUT_MIN}=11.9V



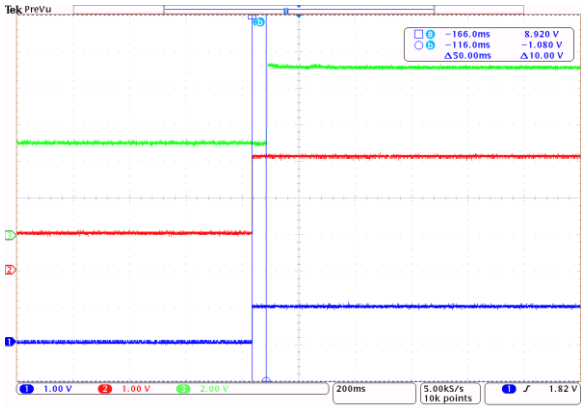
V_{IN}=264V_{AC}/50Hz, I_{OUT}=0A→1.5A
V_{OUT_MIN}=12V



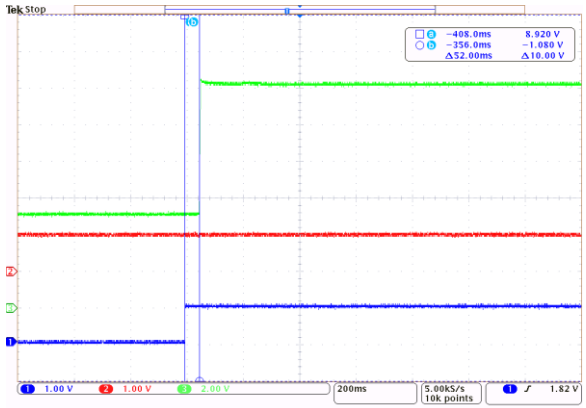
* Note: Output voltage is monitored at end of PCB.

13.1 Output Voltage Transition

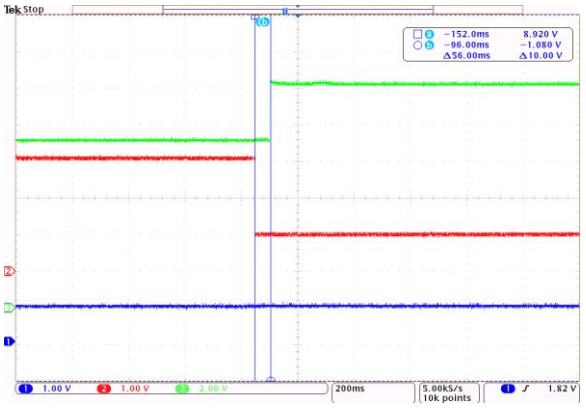
5V→9V, T_T =50.0mS



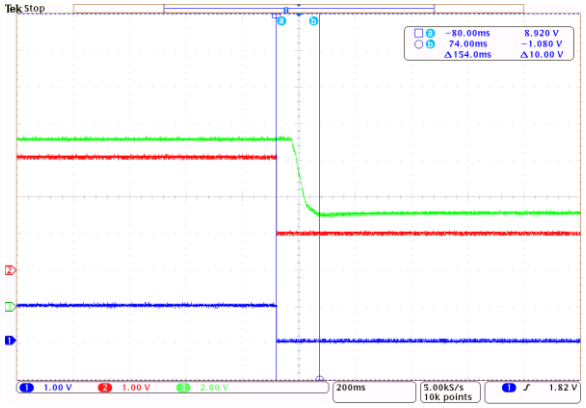
5V→12V, T_T =52.0mS



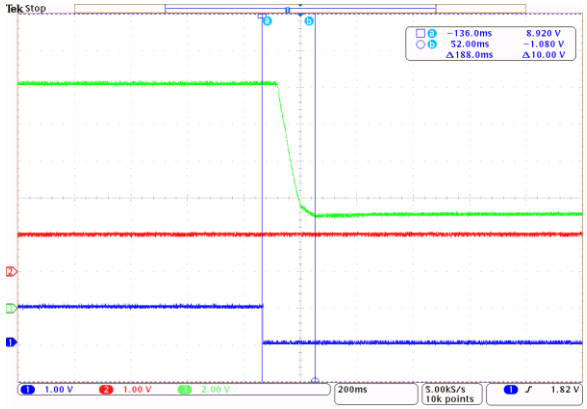
9V→12V, T_T =56.0mS



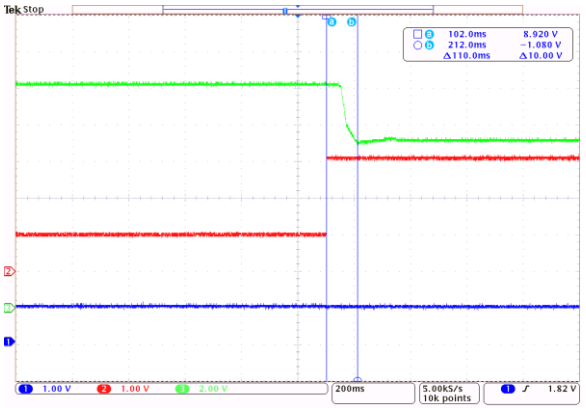
9V→5V, T_T =154.0mS



12V→5V, T_T =188.0mS



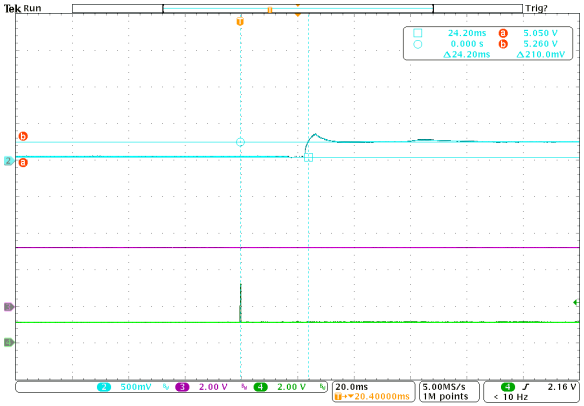
12V→9V, T_T =110.0mS



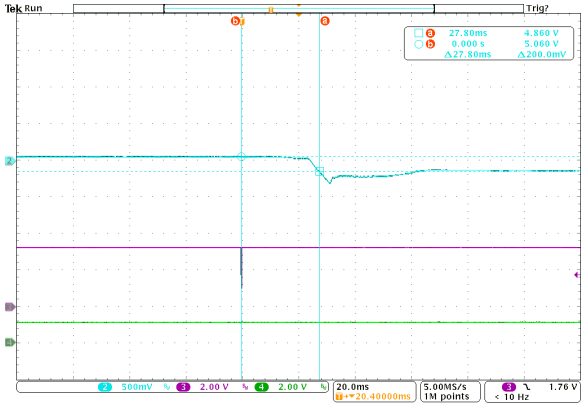
*Note: CH1: D-, 1V/Div; CH2: D+, 1V/Div; CH3: V_{OUT}, 2V/Div

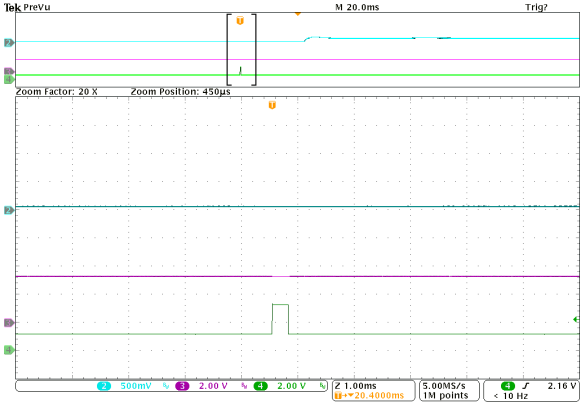
13.2 Output Voltage Transition (Single Request Mode)

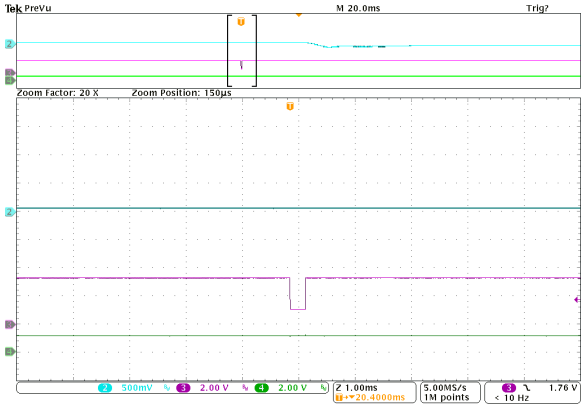
5V→5.2V, T_T =24.2mS



5V→4.8V, T_T =27.8mS





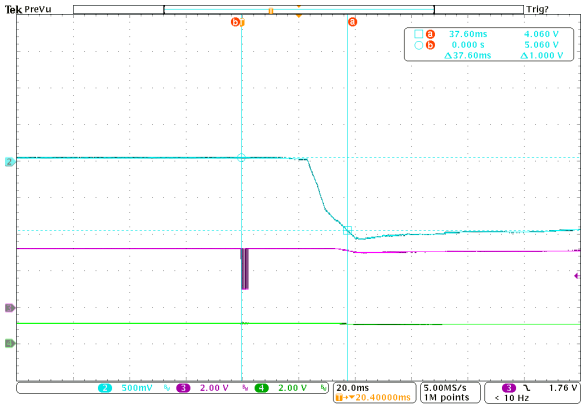


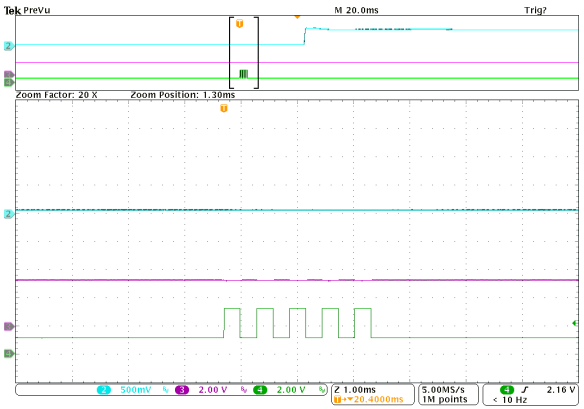
*Note: CH2:V_{OUT}, 0.5V/Div (5V Offset); CH3: D-, 2V/Div; CH4:D+, 2V/Div

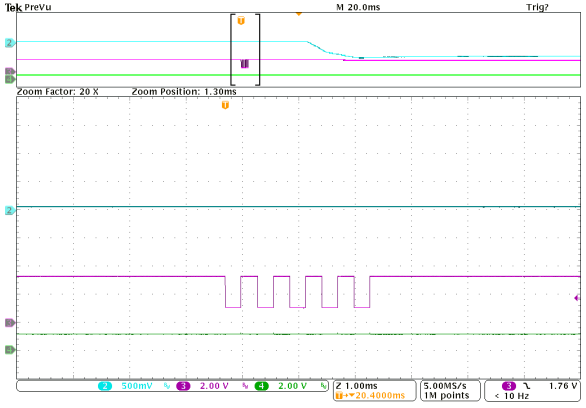
13.3 Output Voltage Transition (Group Request Mode)

5V→6V, T_T =23.4mS

5V→4V, T_T =37.6mS



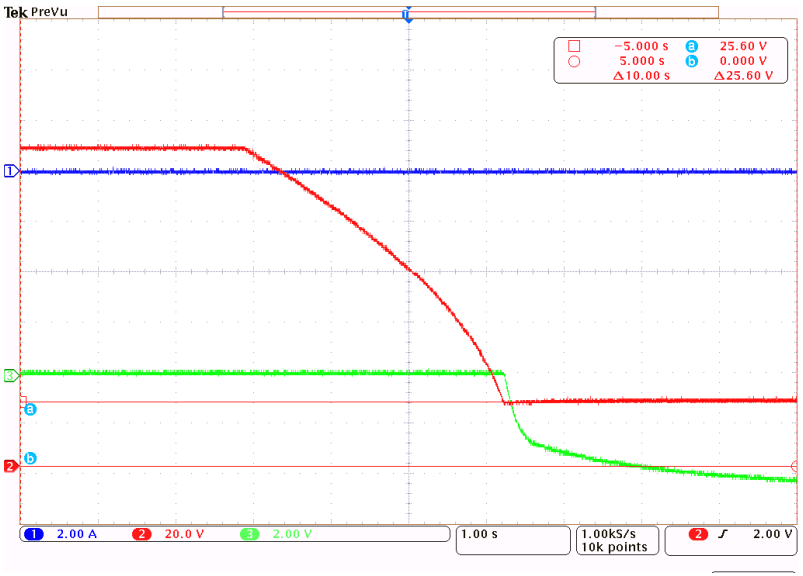




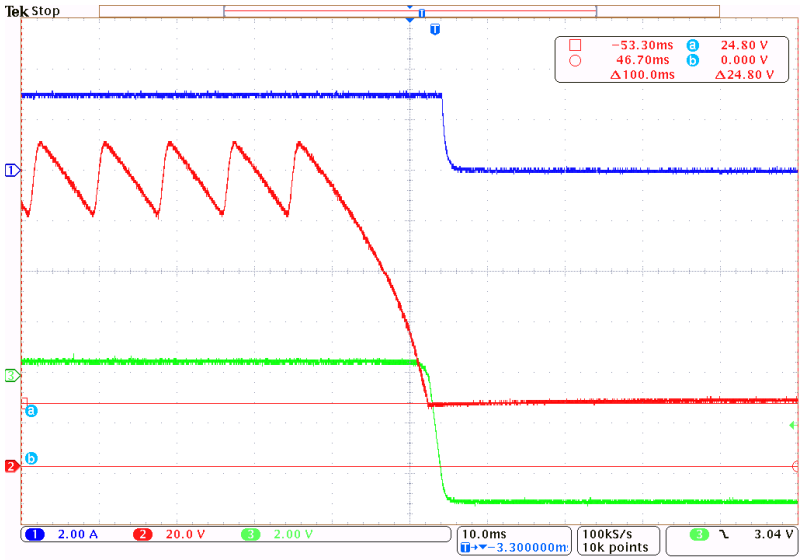
*Note: CH2:V_{OUT}, 0.5V/Div (5V Offset); CH3: D-, 2V/Div; CH4:D+, 2V/Div

14. Bulky Capacitor Discharging

No Load, V_{BULK_DIS}=25.6V



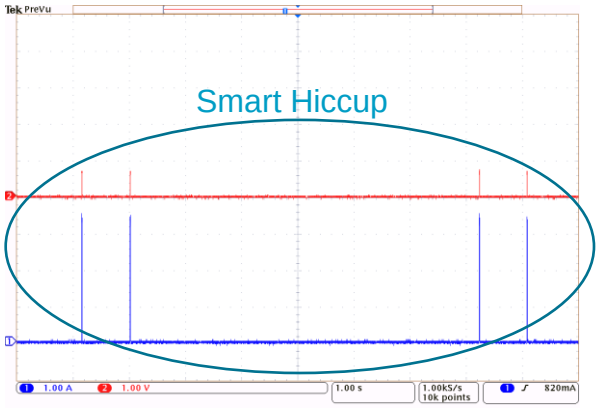
Full Load, V_{BULK_DIS}=24.85V



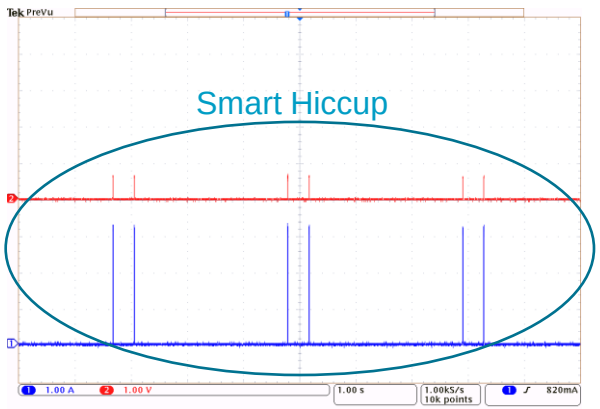
*Note: CH1: I_{OUT}, 2A/Div; CH2: V_{BULK}, 20V/Div; CH3: V_{OUT}, 2V/Div

15. Output Short Circuit

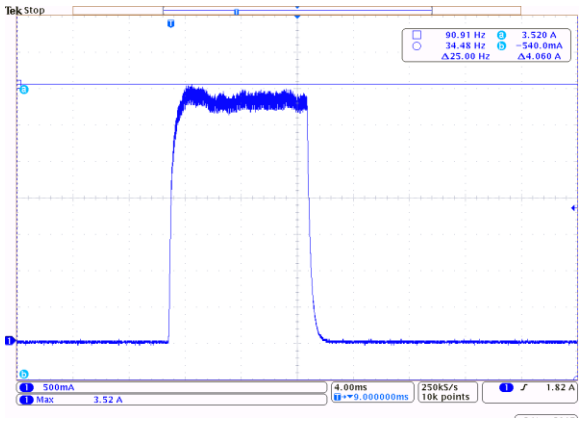
V_{IN}=85V_{AC}, $P_{IN\_S/C}$=5mW



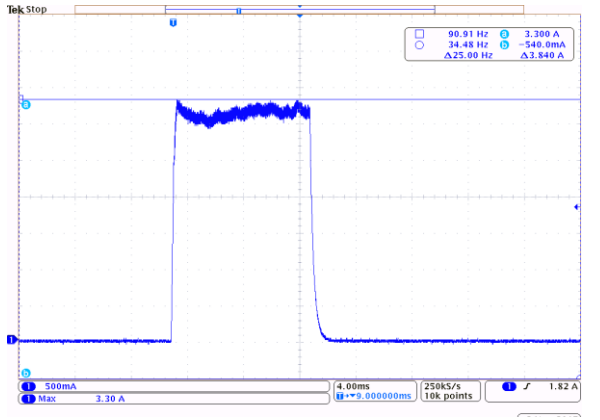
V_{IN}=264V_{AC}, $P_{IN\_S/C}$=30mW



V_{IN}=85V_{AC} , I_{S/C_PEAK}=3.52A



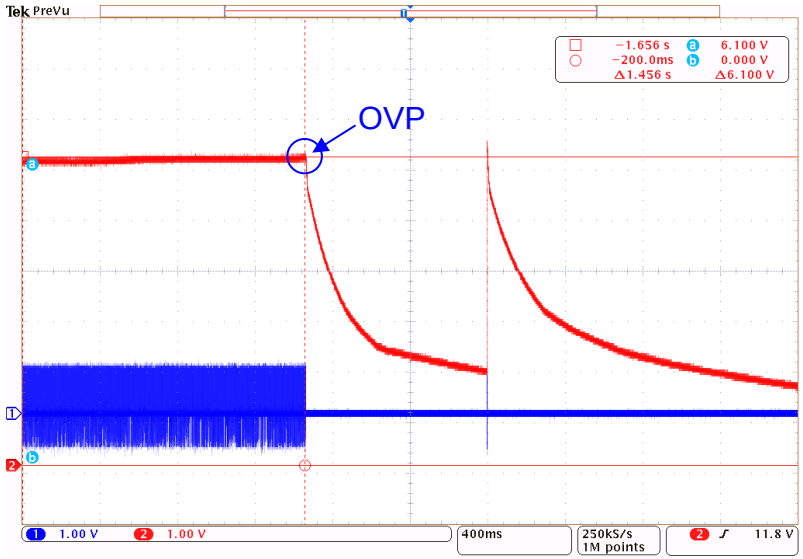
V_{IN}=264V_{AC} , I_{S/C_PEAK}=3.3A



16.1 Output Over Voltage Protection (@5V)

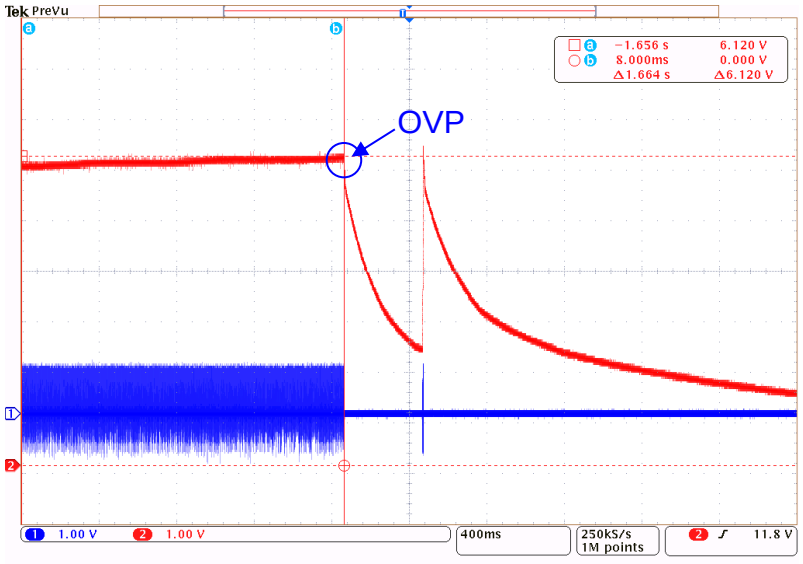
V_{IN}=90V_{AC}/60Hz

V_{OUT_OVP}=6.1V



V_{IN}=264V_{AC}/50Hz

V_{OUT_OVP}=6.12V

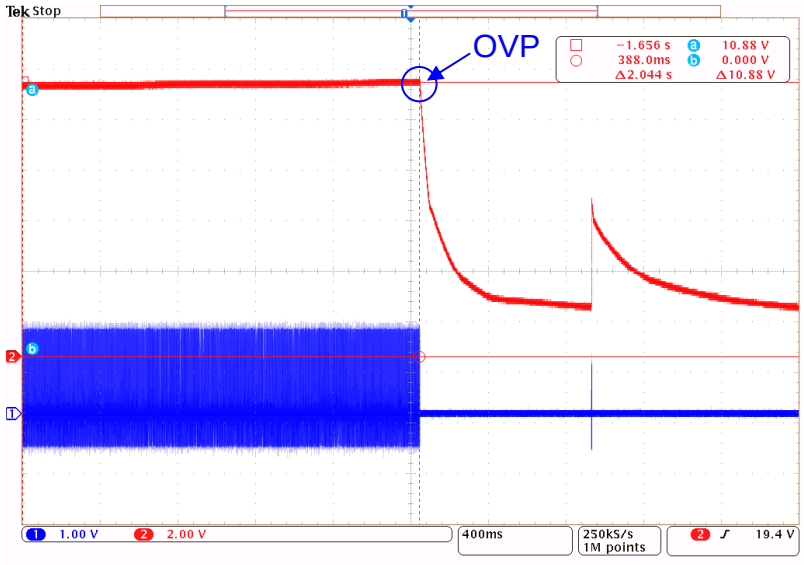


*Note: CH1: V_{SENSE}, 1V/Div; CH2: V_{OUT}, 1V/Div

16.2 Output Over Voltage Protection (@9V)

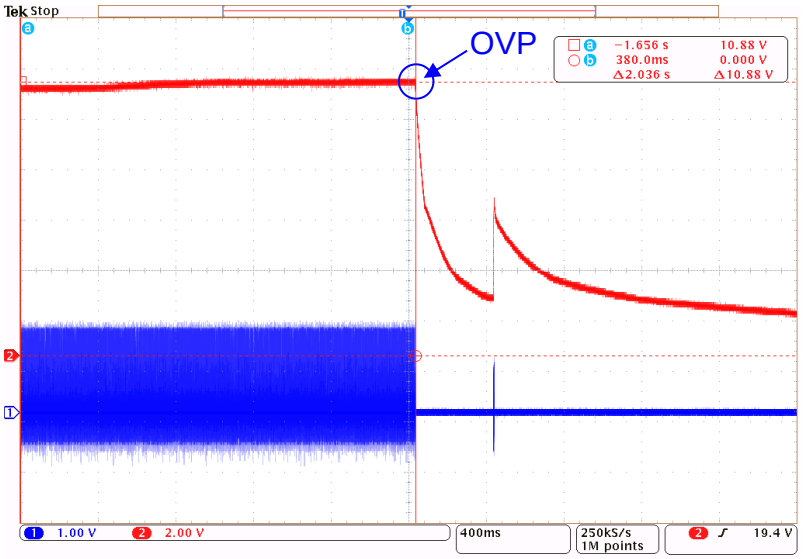
V_{IN}=90V_{AC}/60Hz

V_{OUT_OVP}=10.88V



V_{IN}=264V_{AC}/50Hz

V_{OUT_OVP}=10.88V

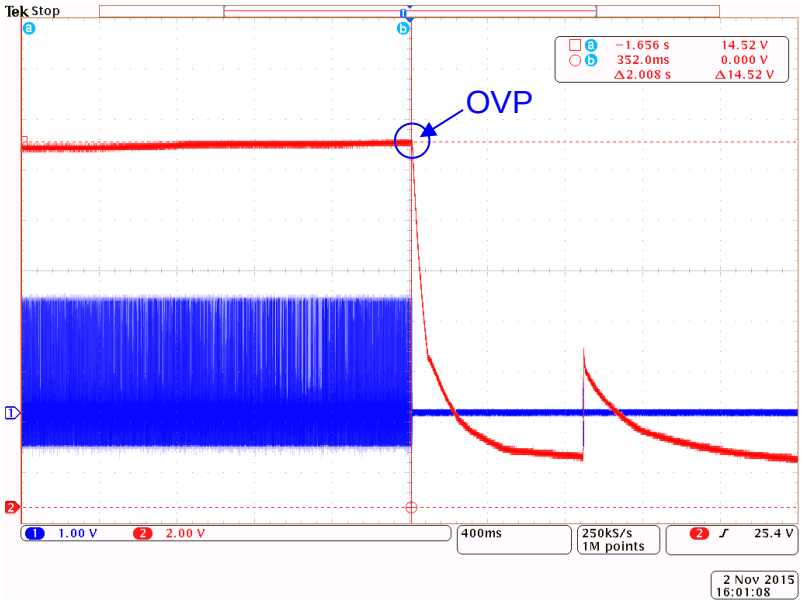


*Note: CH1: V_{SENSE}, 1V/Div; CH2: V_{OUT}, 2V/Div

16.3 Output Over Voltage Protection (@12V)

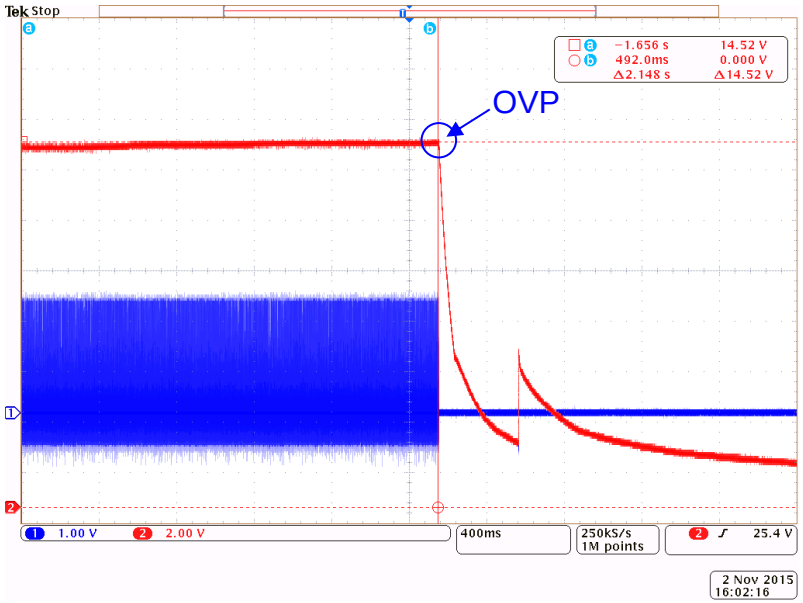
V_{IN}=90V_{AC}/60Hz

V_{OUT_OVP}=14.52V



V_{IN}=264V_{AC}/50Hz

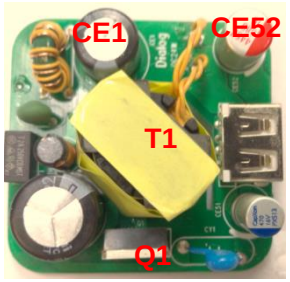
V_{OUT_OVP}=14.52V



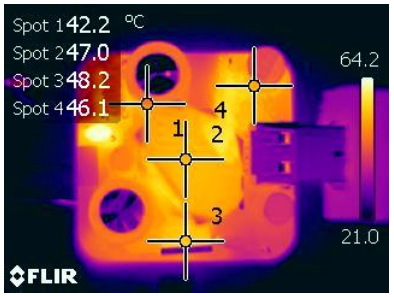
*Note: CH1: V_{SENSE}, 1V/Div; CH2: V_{OUT}, 2V/Div

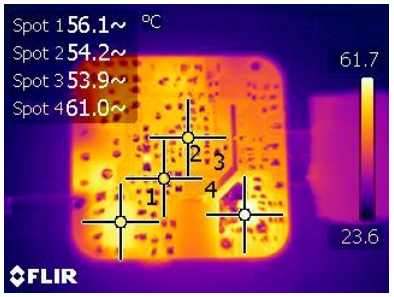
17.1 Thermal Test for Critical Component (@5V)

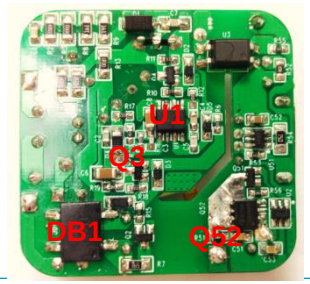
Item	V_{IN}=90V_{AC}, V_{OUT}=5V I_{OUT}=3A		V_{IN}=264V_{AC}, V_{OUT}=5V I_{OUT}=3A	
	Temp.(℃)	Rising Temp.(℃)	Temp.(℃)	Rising Temp.(℃)
Input Bulk_cap(CE1, 15uF/400V)	42.2	17.2	38.4	13.4
Transformer(T1, RM8S-6)	47.0	22.0	50.5	25.5
MosFet(Q1,CS7N65ARD)	48.2	23.2	64.9	39.9
Solid capacitior(CE52, 680uF/16V)	46.1	21.1	46.7	21.7
Bridge(DB1, DBLS207G)	56.1	31.1	36.2	11.2
NPN Transistor(Q3, BC817)	54.2	29.2	45.5	20.5
PWMIC(U1, iW1782-01)	53.9	28.9	50.1	25.1
MosFet(Q52, VS6018AS)	61.0	36.0	52.6	27.6
Ambient(Chamber) Temp.	25.0		25.0	



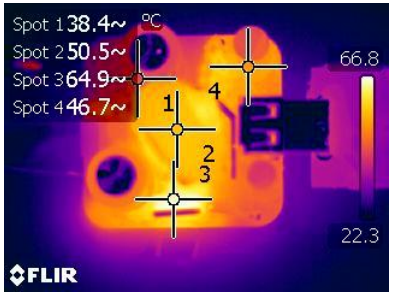
90V/60Hz

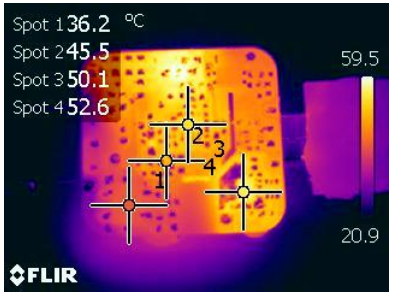






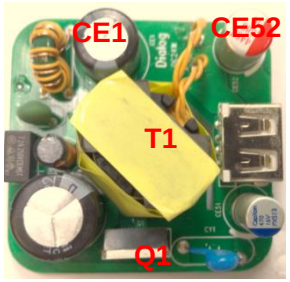
264V/60Hz



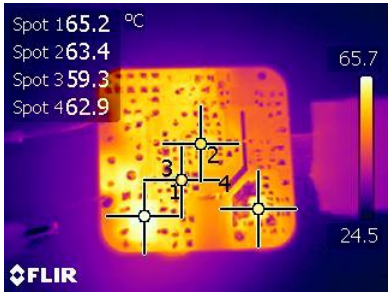


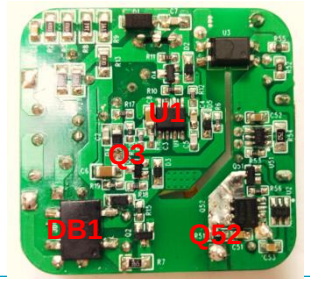
17.2 Thermal Test for Critical Component (@6V)

Item	V_{IN}=90V_{AC}, V_{OUT}=6V I_{OUT}=3A		V_{IN}=264V_{AC}, V_{OUT}=6V I_{OUT}=3A	
	Temp.(℃)	Rising Temp.(℃)	Temp.(℃)	Rising Temp.(℃)
Input Bulk_cap(CE1, 15uF/400V)	54.8	29.8	49.4	24.4
Transformer(T1, RM8S-6)	57.0	32.0	61.3	36.3
MosFet(Q1,CS7N65ARD)	58.6	33.6	77.2	52.2
Solid capacitior(CE52, 680uF/16V)	53.2	28.2	55.3	30.3
Bridge(DB1, DBLS207G)	65.2	40.2	42.6	17.6
NPN Transistor(Q3, BC817)	63.4	38.4	55.4	30.4
PWMIC(U1, iW1782-01)	59.3	34.3	55.6	30.6
MosFet(Q52, VS6018AS)	62.9	37.9	55.2	30.2
Ambient(Chamber) Temp.	25.0		25.0	

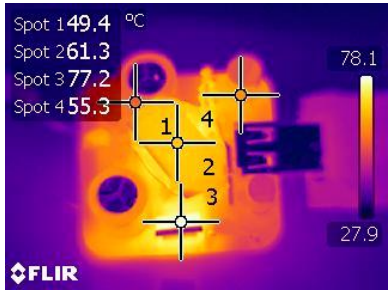


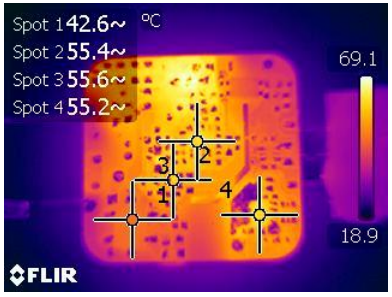
90V/60Hz





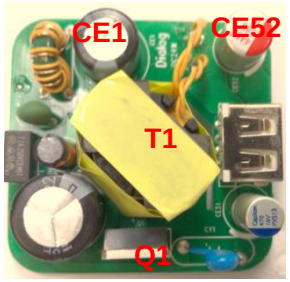
264V/60Hz



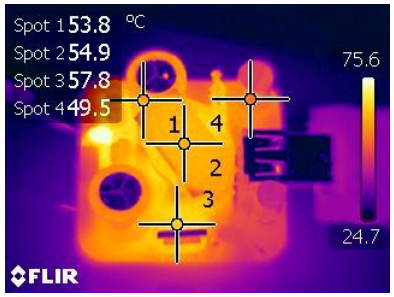


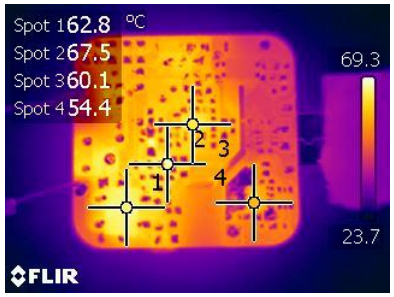
17.3 Thermal Test for Critical Component (@9V)

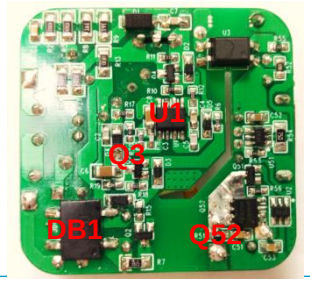
Item	V_{IN}=90V_{AC}, V_{OUT}=9V I_{OUT}=2A		V_{IN}=264V_{AC}, V_{OUT}=9V I_{OUT}=2A	
	Temp.(℃)	Rising Temp.(℃)	Temp.(℃)	Rising Temp.(℃)
Input Bulk_cap(CE1, 15uF/400V)	53.8	28.8	42.5	17.5
Transformer(T1, RM8S-6)	54.9	29.9	57.5	32.5
MosFet(Q1,CS7N65ARD)	57.8	32.8	71.9	46.9
Solid capacitior(CE52, 680uF/16V)	49.5	24.5	47.2	22.2
Bridge(DB1, DBLS207G)	62.8	37.8	48.9	23.9
NPN Transistor(Q3, BC817)	67.5	42.5	64.9	39.9
PWMIC(U1, iW1782-01)	60.1	35.1	61.0	36.0
MosFet(Q52, VS6018AS)	54.4	29.4	57.7	32.7
Ambient(Chamber) Temp.	25.0		25.0	



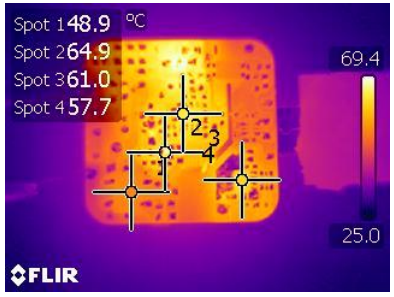
90V/60Hz





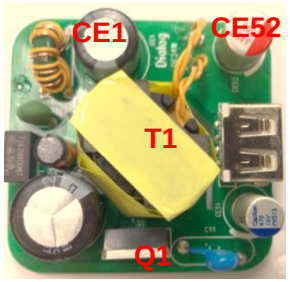


264V/60Hz

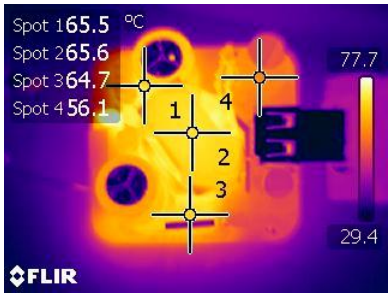


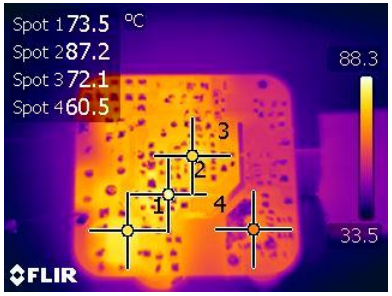
17.4 Thermal Test for Critical Component (@12V)

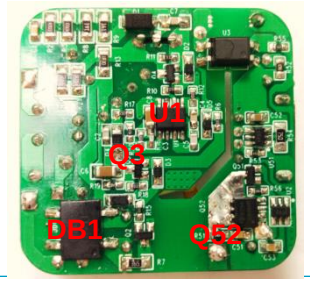
Item	V_{IN}=90V_{AC}, V_{OUT}=12V I_{OUT}=1.5A		V_{IN}=264V_{AC}, V_{OUT}=12V I_{OUT}=1.5A	
	Temp.(℃)	Rising Temp.(℃)	Temp.(℃)	Rising Temp.(℃)
Input Bulk_cap(CE1, 15uF/400V)	65.5	40.5	45.5	20.5
Transformer(T1, RM8S-6)	65.6	40.6	57.0	32.0
MosFet(Q1,CS7N65ARD)	64.7	39.7	70.4	45.4
Solid capacitior(CE52, 680uF/16V)	56.1	31.1	48.9	23.9
Bridge(DB1, DBLS207G)	73.5	48.5	50.9	25.9
NPN Transistor(Q3, BC817)	87.2	62.2	74.8	49.8
PWMIC(U1, iW1782-01)	72.1	47.1	64.3	39.3
MosFet(Q52, VS6018AS)	60.5	35.5	54.9	29.9
Ambient(Chamber) Temp.	25.0		25.0	



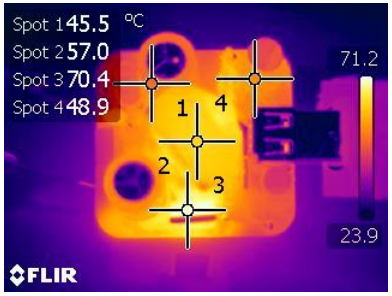
90V/60Hz

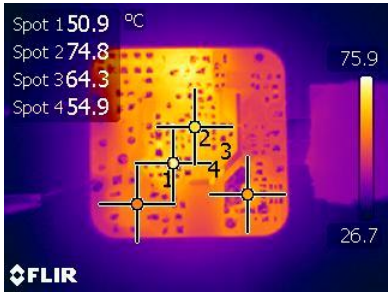






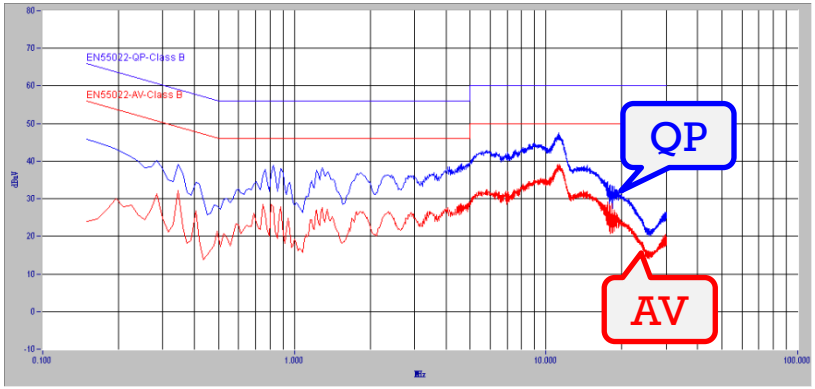
264V/60Hz



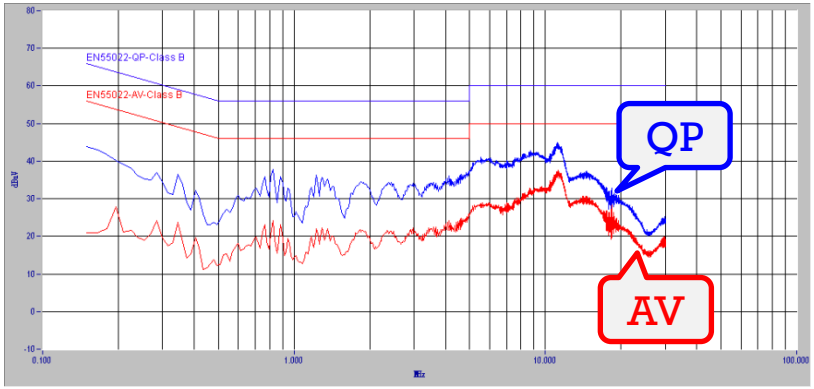


18.1 Conducted EMI (@5V)

V_{IN}=230V_{AC}/50Hz, Live



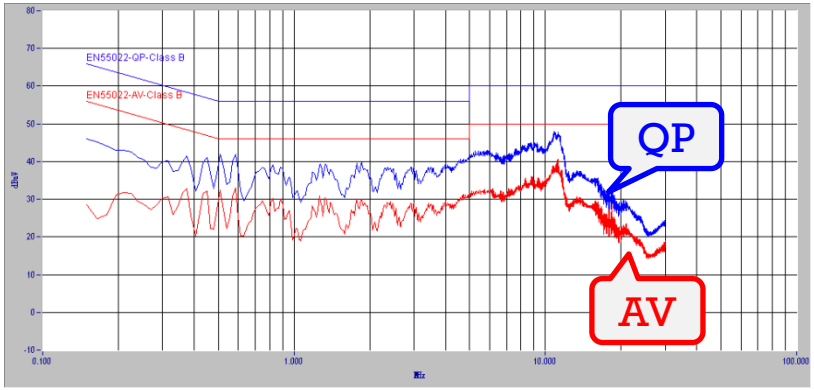
V_{IN}=230V_{AC}/50Hz, Natural



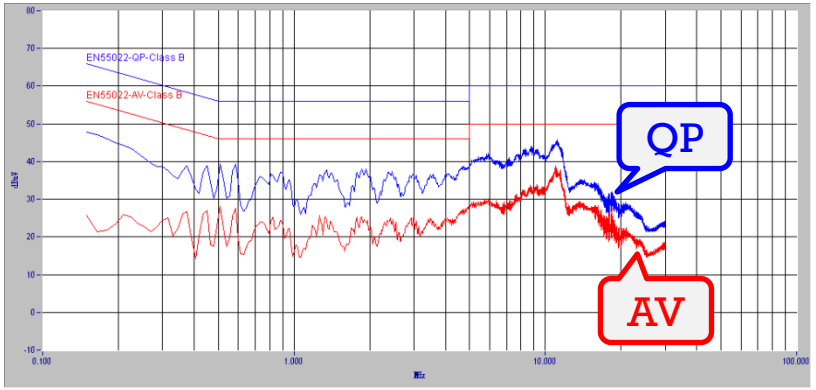
*Note: Resistive & Full load; output (-) is floating.

18.2 Conducted EMI (@9V)

V_{IN}=230V_{AC}/50Hz, Live



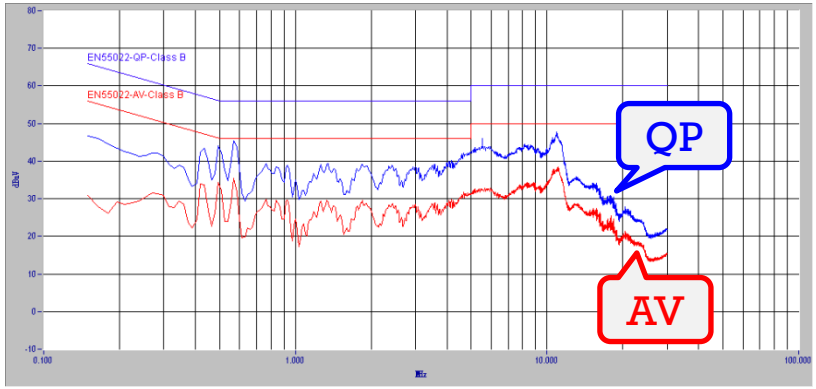
V_{IN}=230V_{AC}/50Hz, Natural



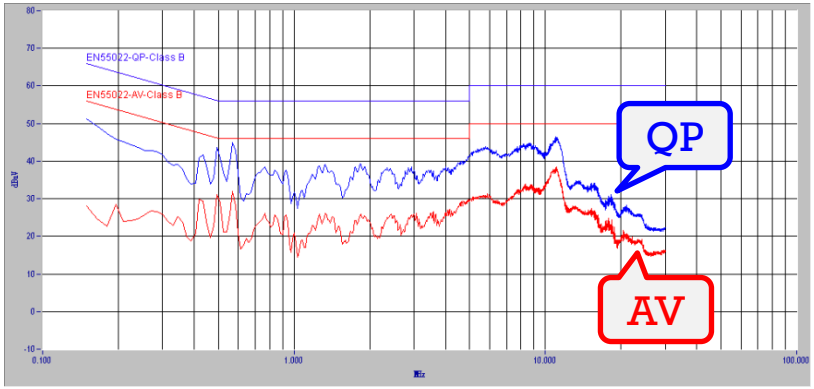
*Note: Resistive & Full load; output (-) is floating.

18.3 Conducted EMI (@12V)

V_{IN}=230V_{AC}/50Hz, Live



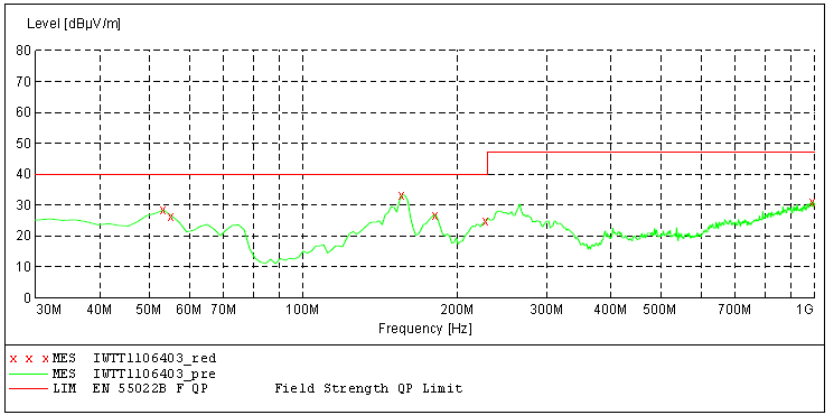
V_{IN}=230V_{AC}/50Hz, Natural



*Note: Resistive & Full load; output (-) is floating.

19.1 Radiated EMI (@5V)

V_{IN}=230V_{AC}/50Hz, Vertical

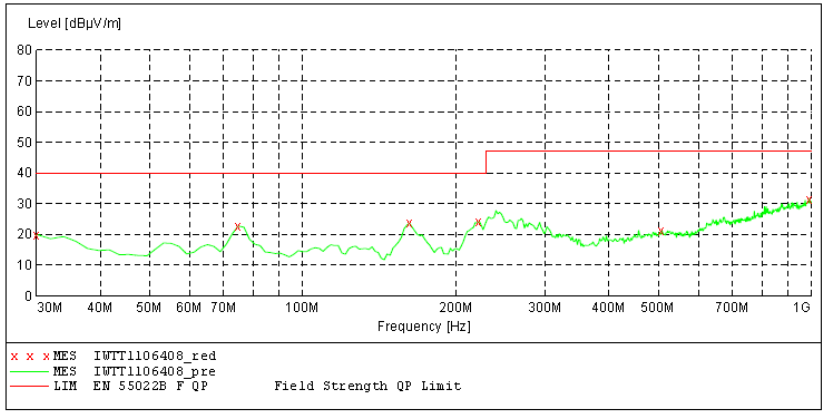


MEASUREMENT RESULT: "IWTT1106403_red"

11/6/2015 2:24PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.326653	28.40	-21.9	40.0	11.6	---	100.0	359.00	VERTICAL
55.270541	26.50	-22.4	40.0	13.5	---	100.0	359.00	VERTICAL
156.352705	33.40	-21.3	40.0	6.6	---	100.0	172.00	VERTICAL
181.623246	26.80	-20.5	40.0	13.2	---	100.0	199.00	VERTICAL
228.276553	25.00	-18.2	40.0	15.0	---	100.0	130.00	VERTICAL
992.224449	31.10	-3.1	47.0	15.9	---	100.0	84.00	VERTICAL

V_{IN}=230V_{AC}/50Hz, Horizontal



MEASUREMENT RESULT: "IWTT1106408_red"

11/6/2015 2:36PM

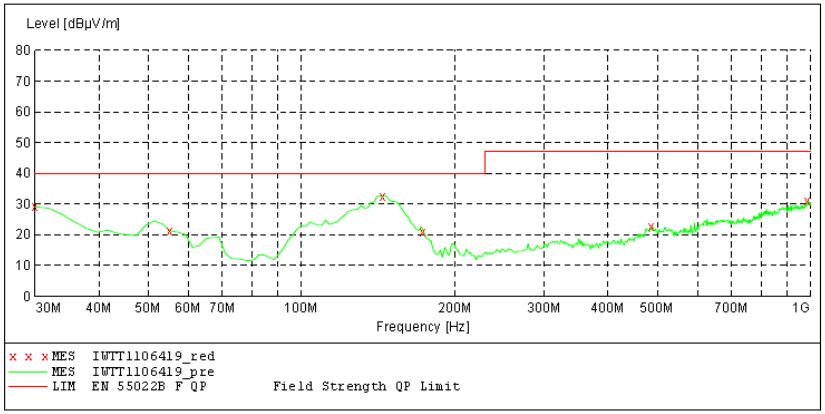
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	19.90	-10.0	40.0	20.1	---	100.0	177.00	HORIZONTAL
74.709419	22.70	-20.9	40.0	17.3	---	300.0	173.00	HORIZONTAL
162.184369	23.70	-21.6	40.0	16.3	---	300.0	105.00	HORIZONTAL
222.444890	24.30	-18.7	40.0	15.7	---	100.0	286.00	HORIZONTAL
508.196393	21.40	-11.3	47.0	25.6	---	100.0	7.00	HORIZONTAL
992.224449	31.50	-3.1	47.0	15.5	---	300.0	91.00	HORIZONTAL

*Note: 1) Resistive & Full load

2) Output (-) is floating

19.2 Radiated EMI (@9V)

V_{IN}=230V_{AC}/50Hz, Vertical

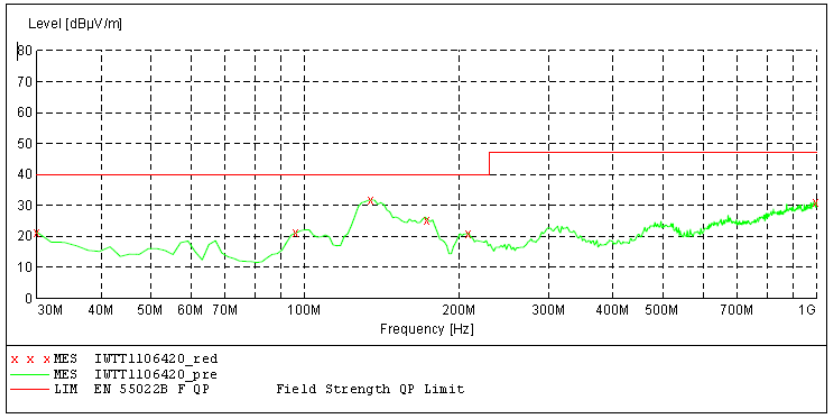


MEASUREMENT RESULT: "IWTT1106419_red"

11/6/2015 3:13PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	29.10	-10.0	40.0	10.9	---	100.0	0.00	VERTICAL
55.270541	21.20	-22.4	40.0	18.8	---	100.0	50.00	VERTICAL
144.689379	32.70	-20.8	40.0	7.3	---	100.0	10.00	VERTICAL
173.847695	21.00	-21.3	40.0	19.0	---	100.0	247.00	VERTICAL
486.813627	22.60	-11.6	47.0	24.4	---	100.0	206.00	VERTICAL
988.336673	30.90	-3.1	47.0	16.1	---	100.0	308.00	VERTICAL

V_{IN}=230V_{AC}/50Hz, Horizontal



MEASUREMENT RESULT: "IWTT1106420_red"

11/6/2015 3:15PM

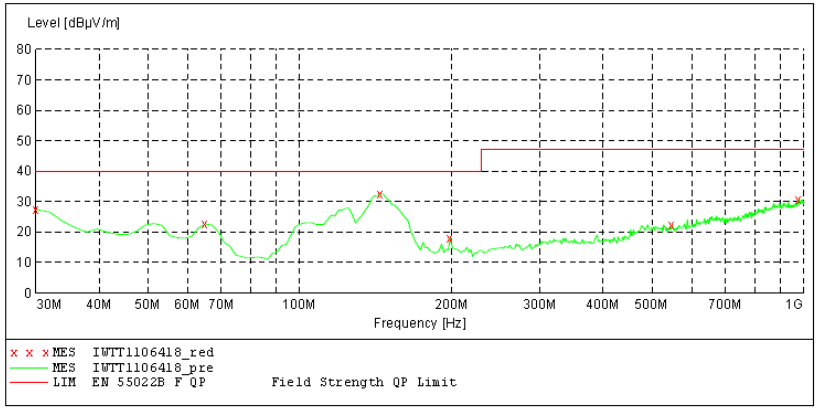
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	21.30	-10.0	40.0	18.7	---	300.0	142.00	HORIZONTAL
96.092184	21.10	-18.5	40.0	18.9	---	300.0	288.00	HORIZONTAL
134.969940	31.80	-19.5	40.0	8.2	---	300.0	220.00	HORIZONTAL
173.847695	25.40	-21.3	40.0	14.6	---	100.0	289.00	HORIZONTAL
208.837675	21.00	-19.3	40.0	19.0	---	100.0	302.00	HORIZONTAL
998.056112	31.10	-3.0	47.0	15.9	---	100.0	146.00	HORIZONTAL

*Note: 1) Resistive & Full load

2) Output (-) is floating

19.3 Radiated EMI (@12V)

V_{IN}=230V_{AC}/50Hz, Vertical

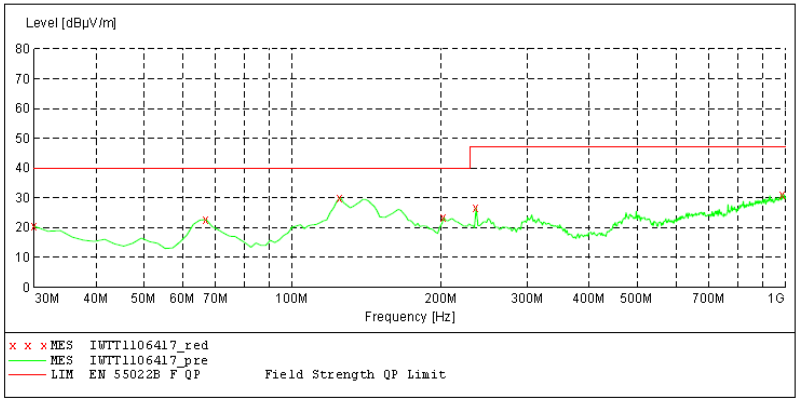


MEASUREMENT RESULT: "IWTT1106418_red"

11/6/2015 3:10PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	27.40	-10.0	40.0	12.6	---	100.0	158.00	VERTICAL
64.989980	22.60	-22.4	40.0	17.4	---	100.0	254.00	VERTICAL
144.689379	32.60	-20.8	40.0	7.4	---	100.0	294.00	VERTICAL
199.118236	18.10	-19.7	40.0	21.9	---	100.0	192.00	VERTICAL
549.018036	22.50	-11.8	47.0	24.5	---	100.0	239.00	VERTICAL
980.561122	30.80	-3.3	47.0	16.2	---	100.0	239.00	VERTICAL

V_{IN}=230V_{AC}/50Hz, Horizontal



MEASUREMENT RESULT: "IWTT1106417_red"

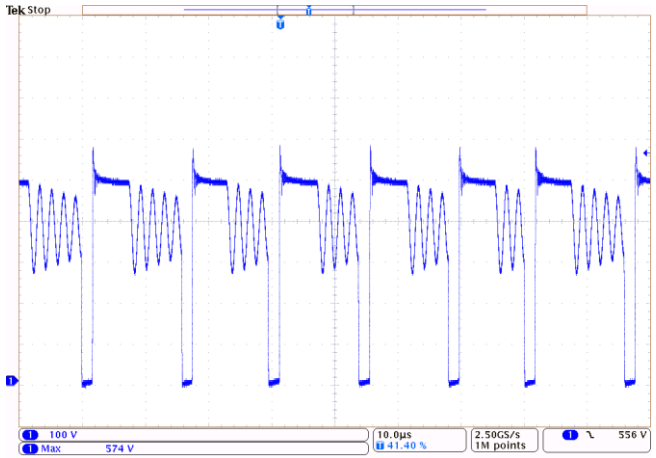
11/6/2015 3:08PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	20.40	-10.0	40.0	19.6	---	300.0	166.00	HORIZONTAL
66.933868	22.60	-22.2	40.0	17.4	---	300.0	327.00	HORIZONTAL
125.250501	30.10	-18.2	40.0	9.9	---	300.0	200.00	HORIZONTAL
203.006012	23.30	-19.5	40.0	16.7	---	100.0	281.00	HORIZONTAL
236.052104	26.70	-17.5	47.0	20.3	---	100.0	111.00	HORIZONTAL
986.392786	31.20	-3.2	47.0	15.8	---	300.0	118.00	HORIZONTAL

*Note: 1) Resistive & Full load

2) Output (-) is floating

20. Maximum Drain Voltage of HV MOSFET (@12V)



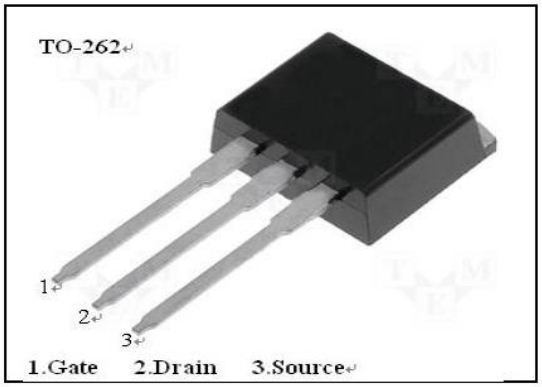
Test Condition(Full Load):

V_{IN}=264V_{AC}, I_{OUT}=1.5A

Result:

V_{DS_MAX}=**574V**

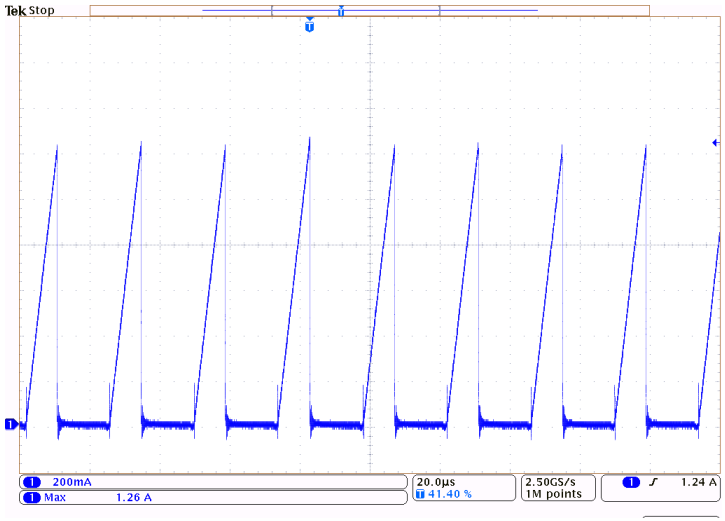
Appendix – Simple Specification for used MOSFET (CS7N65ARD, 7A/650V)



V_{DSS}	650	V
I_D	7	A
$P_D(T_C=25℃)$	100	W
$R_{DS(ON)Typ}$	1.0	Ω

22. Transformer Flux Density (@6V)

(Np=54Ts, Lm=0.66mH, Ae=64mm^2-RM8)

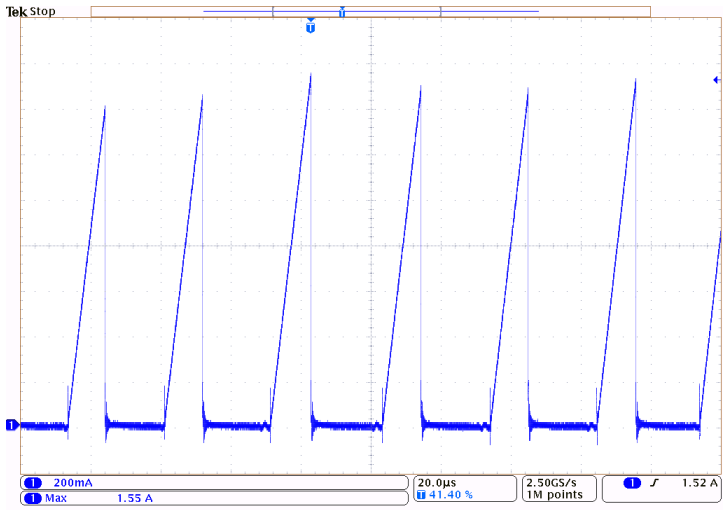


CH1: I_P ,200mA/div

I_P *is monitored at* 90*Vac and* 3*A (full load)*

$I_P = 1260mA$

$$B_{MAX} = \frac{L_{PRI} \times I_P}{N_P \times A_e} = \frac{0.66 \times 1260}{54 \times 64} = 0.241(Tesla)$$



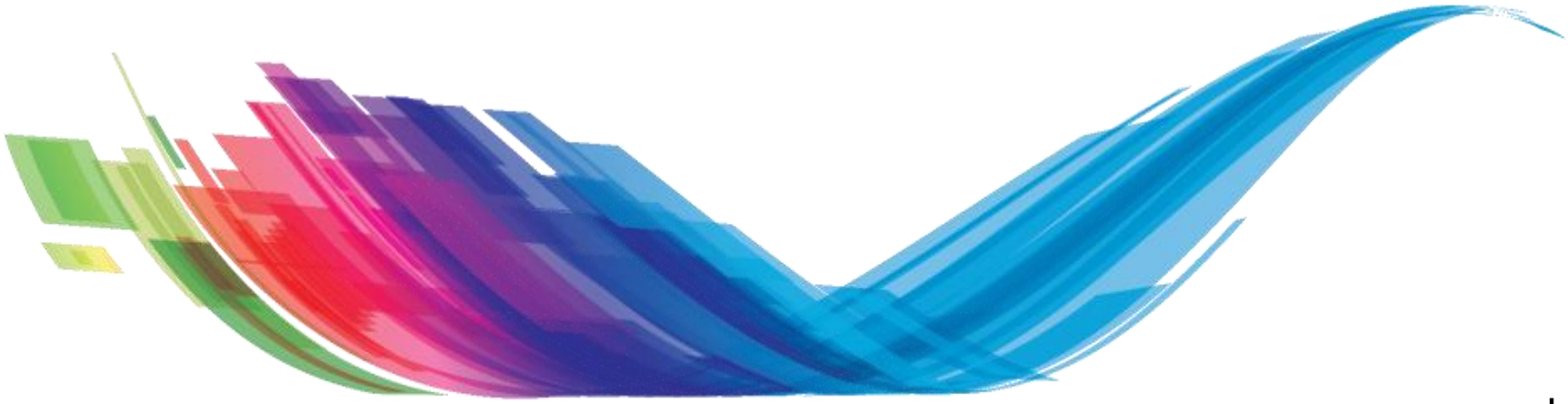
CH1: I_P ,200mA/div

I_P *is monitored at* 90*Vac and* 3.4*A (Max* P_{OUT}*)*

$I_P = 1550mA$

$$B_{MAX} = \frac{L_{PRI} \times I_P}{N_P \times A_e} = \frac{0.66 \times 1550}{54 \times 64} = 0.296(Tesla)$$

The power to be...



...personal
...portable
...connected