iW1780-04For 5V/2A, 9V/2A, 12V/1.5A QC2.0 Design

General Design Specification:

1. **AC Input Range 90-264V_{AC}**
2. **DC Output 5V/2A, 9V/2A, 12V/1.5A**
3. **Meet *"75mW@5V"* No-Load standby Power Consumption Requirement**
4. **Max Output Ripple & Noise < 120mV**

Sep 18, 2014

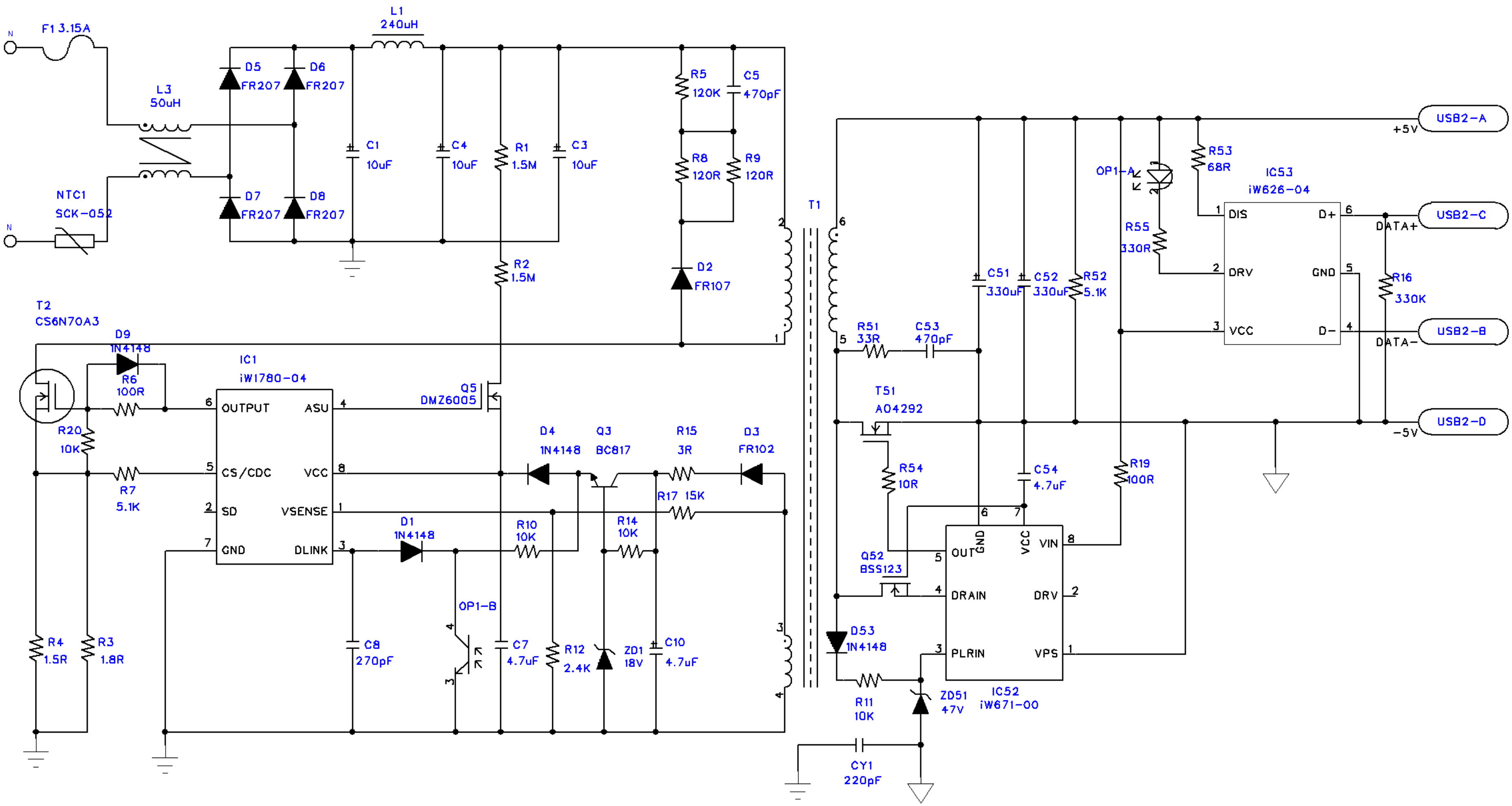
...personal
...portable
...connected

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})					75	mW	Measured under 5V output
Output							
5V/2A	Output Voltage	V_{OUT}	4.75	5.0	5.25	V	Measured at the end of DC Cable
	Output Current	I_{OUT}	0		2.0	A	
	Over Current Protection	I_{OCP}		2.3		A	
	Ripple & Noise	V_{RIPPLE}			80	mV_{P_P}	Note1
	Average Efficiency	η	78.70			%	Refer to DOE
9V2A	Output Voltage	V_{OUT}	8.55	9.0	9.45	V	Measured at the end of DC Cable
	Output Current	I_{OUT}	0		2	A	
	Over Current Protection	I_{OCP}		2.3		A	
	Ripple & Noise	V_{RIPPLE}			120	mV_{P_P}	Note1
	Average Efficiency	η	85.0			%	Refer to DoE
12V1.5A	Output Voltage	V_{OUT}	11.4	12.0	12.6	V	Measured at the end of DC Cable
	Output Current	I_{OUT}	0		1.5	A	
	Over Current Protection	I_{OCP}		1.7		A	
	Ripple & Noise	V_{RIPPLE}			120	mV_{P_P}	Note1
	Average Efficiency	η	85.0			%	Refer to DoE
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

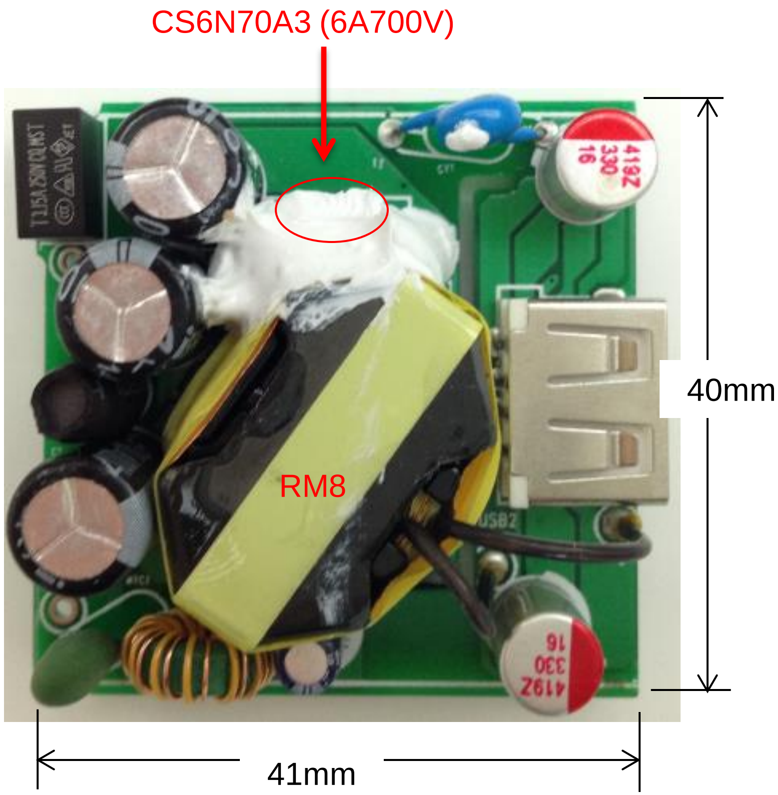
Note1: Add 0.1uF Ceramic capacitor and 10uF E-cap at the end of connector and set oscilloscope at 20MHz bandwidth.

2. Schematic

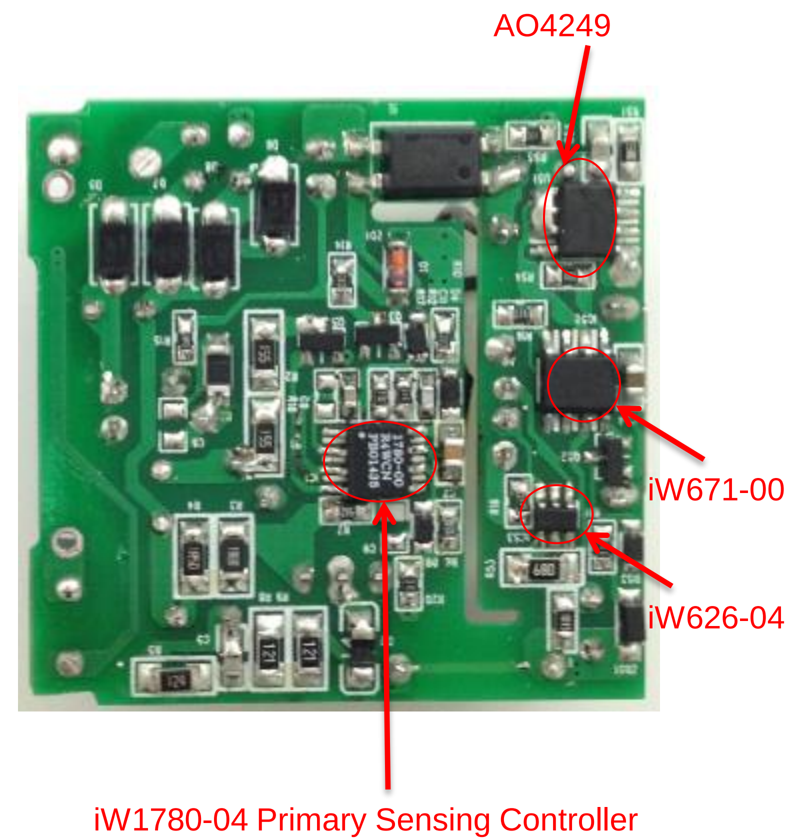

N
F1 3.15A
L1
240uH
L3
50uH
D5
FR207
D6
FR207
D7
FR207
D8
FR207
NTC1
SCK-052
N
C1
10uF
C4
10uF
R1
1.5M
C3
10uF
R5
120K
C5
470pF
R8
120R
R9
120R
R2
1.5M
D2
FR107
T1
USB2-A
+5V
R53
68R
IC53
iW626-04
OP1-A
R55
330R
DIS
D+
DRV
GND
VCC
D-
USB2-C
DATA+
R16
330K
USB2-B
DATA-
USB2-D
-5V
C51
330uF
C52
330uF
R52
5.1K
R51
33R
C53
470pF
T51
AO4292
R54
10R
C54
4.7uF
R19
100R
T2
CS6N70A3
D9
1N4148
R6
100R
IC1
iW1780-04
OUTPUT
ASU
CS/CDC
VCC
SD
VSENSE
GND
DLINK
Q5
DMZ6005
R20
10K
R7
5.1K
D4
1N4148
Q3
BC817
R15
3R
D3
FR102
R17 15K
D1
1N4148
R10
10K
R14
10K
OP1-B
R4
1.5R
R3
1.8R
C8
270pF
C7
4.7uF
R12
2.4K
ZD1
18V
C10
4.7uF
Q52
BSS123
OUT
GND
VCC
VIN
DRAIN
DRV
PLRIN
VPS
IC52
iW671-00
D53
1N4148
R11
10K
ZD51
47V
CY1
220pF

3. Circuit Board Photograph

Top View



Bottom View

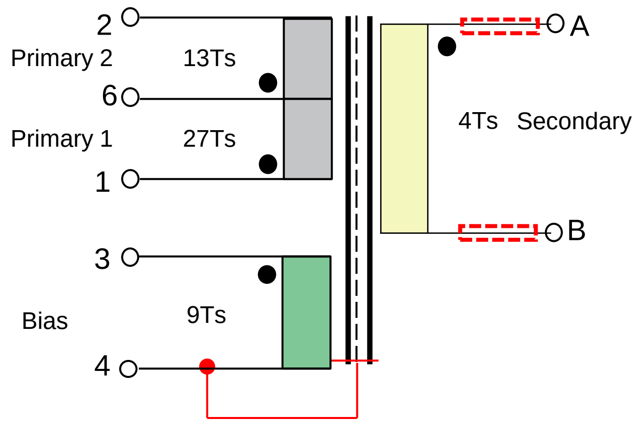


4. Bill of Material

Item	Qty.	Ref.	Description
1	1	IC1	iW1780-04, Off-line Digital PSR & PWM & VMS Controller, SOIC-8
2	1	U1	Light coupling,PC817,SMD
3	1	IC52	iW1671-00, Off-line Digital SR_Controller, SOIC-8
4	1	IC53	iW626-04,SOT23
5	1	F1	3.15A/250V, Fuse 4X8
6	1	L1	240uH,DM-inductor, Core: 4*8, Wire: 0.2mmX120Ts
7	1	L3	50uH,DM-inductor,Core: 8*4*4, Wire: 0.3mmX10Ts
8	1	T1	RM8 Transformer Vertical Type
9	1	T2	CS6N70A3,6A700V, TO-251
10	1	T51	AO4292, 100V8A, 23mΩ, SOIC-8
11	1	Q3	BC817,NPN Transistor, SOT-23
12	1	Q5	DMZ6005, 12mA600V, depletion mode MOSFET, SOT23
13	1	Q52	BSS123, 100V/0.17A, N-MOSFET, SOT23
14	3	C1,C3,C4	10uF, 400V, Low-ESR E-Cap, Φ8mm X 12mm Aishi
15	1	C5	470pF, 250V, X7R, SMD-0805
16	2	C7,C54	4.7uF, 25V, X7R, SMD-0805
17	1	C8	270pF, 25V, X7R, SMD-0603
18	1	C10	4.7uF, 50V, Low-ESR E-Cap,Φ5mm X 7mm
19	1	C51,C52	330uF,16V, Solid-Cap, ULR 6.3*11,艾华科技
20	1	C53	470pF, 100V, X7R, SMD-0805
21	1	CY1	220pF,Y-Cap
22	4	D1,D4,D9,D53	1N4148, Fast Rectifier Diode,,SMD-323
23	1	D2	FR107, 1A1000V,Fast Recovery Rectifier (Trr=500ns), SMD-1206S
24	1	D3	FR102, 1A200V, Fast switching diode(Trr=150nS), SMD-1206S
25	4	D5-D8	S2MF,2A/1000V, Rectifier Diode,SMD-1206S
26	1	ZD1	ZVS,18±5%V,SMD
27	1	ZD51	ZVS,47±5%V,SMD
28	2	R1,R2	1.5MΩ ±5%, SMD-0805
29	1	R3	1.8Ω ±1%, SMD-1206
30	1	R4	1.5Ω ±1%, SMD-1206
31	1	R5	120KΩ ±5%, SMD-1206
32	1	R6	100Ω ±5%, SMD-0603
33	1	R7	5.1KΩ ±5%, SMD-0603
34	2	R8,R9	120Ω ±5%, SMD-1206
35	4	R10,R11R14,R20	10KΩ ±5%, SMD-0603
36	1	R12	2.4KΩ ±1%, SMD-0603
37	1	R15	3.0Ω ±5%, SMD-0603
38	1	R16	330KΩ ±5%, SMD-0603
39	1	R17	15KΩ ±1%, SMD-0603
40	1	R19	100Ω ±5%, SMD-0603
41	1	R51	33Ω ±5%, SMD-0805
42	1	R52	5.1KΩ ±5%, SMD-0805
43	1	R53	68Ω ±5%, SMD-1206
44	1	R54	10Ω ±5%, SMD-0603
45	1	R55	330Ω ±5%, SMD-0603
46	1	USB	USB,Horizontal,2A current
47	1	PCB	Double Side Board, FR-4,41X40mm

5. Transformer Design

SCHEMATIC



Core is connected to Pin-4

ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) =650±7%uH @10KHz
2. Electrical Strength = 3KV, 50/60Hz,1Min(pins1~5 to pins A~B)

MATERIALS:

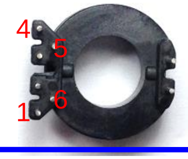
1. Core : RM8(Ferrite Material PC40 or equivalent)
2. Bobbin :RM8 Vertical
3. Magnet Wires (pri): Type 2-UEW
4. Magnet wires(sec): Triple Insulated Wire
5. Layer Insulation Tape :3M1298 or equivalent.

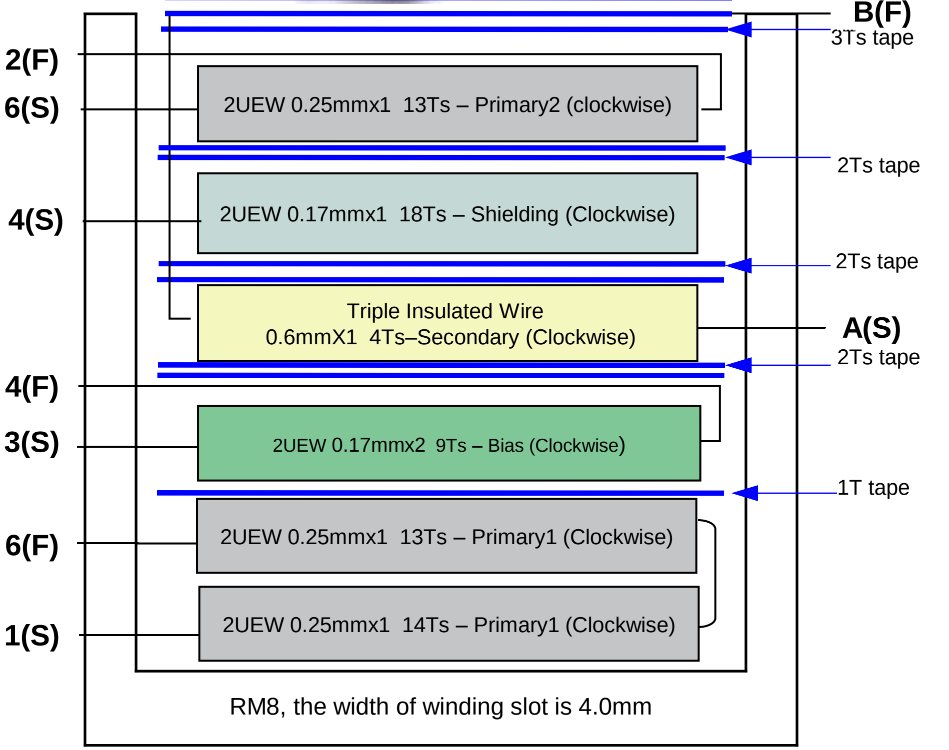
FINISHED :

1. Varnish the complete assembly
2. Core is connected to pin4

Winding Start pin-1& End pin-6 in "Clockwise" direction – looking from Top side of the Bobbin

Rotating direction of winding machine





6.1. Regulation, Ripple and Efficiency Measurement

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	OCP (A)	Average η(%)	DOE η(%)
90	0.019	5.129	0	28			2.28	86.80	78.70
	2.95	5.122	0.5	40	2.56	86.81			
	5.92	5.175	1.0	36	5.18	87.42			
	9.04	5.237	1.5	47	7.86	86.90			
	12.32	5.301	2.0	48	10.60	86.06			
115	0.020	5.126	0	31			2.26	87.28	
	2.94	5.128	0.5	44	2.56	87.21			
	5.90	5.175	1.0	37	5.18	87.71			
	9.00	5.242	1.5	43	7.86	87.37			
	12.21	5.301	2.0	50	10.60	86.83			
230	0.022	5.110	0	26			2.25	86.39	
	2.99	5.125	0.5	32	2.56	85.70			
	5.98	5.173	1.0	36	5.17	86.51			
	9.06	5.240	1.5	36	7.86	86.75			
	12.25	5.304	2.0	40	10.61	86.60			
264	0.030	5.110	0	26			2.26	85.68	
	3.02	5.126	0.5	33	2.56	84.87			
	6.04	5.173	1.0	42	5.17	85.65			
	9.13	5.240	1.5	42	7.86	86.09			
	12.32	5.305	2.0	50	10.61	86.12			

* Note: Output voltage is monitored at end of PCB

6.2. Regulation, Ripple and Efficiency Measurement

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	OCP (A)	Average η(%)	DoE η(%)
90	0.046	9.116	0	32			2.26	86.94	85.00
	5.17	8.970	0.5	39	4.49	86.75			
	10.30	9.016	1	47	9.02	87.53			
	15.62	9.078	1.5	50	13.62	87.18			
	21.15	9.127	2	88	18.25	86.31			
115	0.046	9.110	0	28			2.25	87.71	
	5.16	8.982	0.5	40	4.49	87.03			
	10.23	9.015	1	42	9.02	88.12			
	15.48	9.077	1.5	53	13.62	87.96			
	20.83	9.136	2	62	18.27	87.72			
230	0.049	9.100	0	38			2.24	87.52	
	5.22	8.986	0.5	44	4.49	86.07			
	10.32	9.016	1	43	9.02	87.36			
	15.43	9.076	1.5	44	13.61	88.23			
	20.68	9.140	2	52	18.28	88.39			
264	0.055	9.100	0	40			2.22	86.96	
	5.26	8.980	0.5	44	4.49	85.36			
	10.41	9.017	1	54	9.02	86.62			
	15.51	9.076	1.5	45	13.61	87.78			
	20.75	9.139	2	56	18.28	88.09			

* Note: Output voltage is monitored at end of PCB

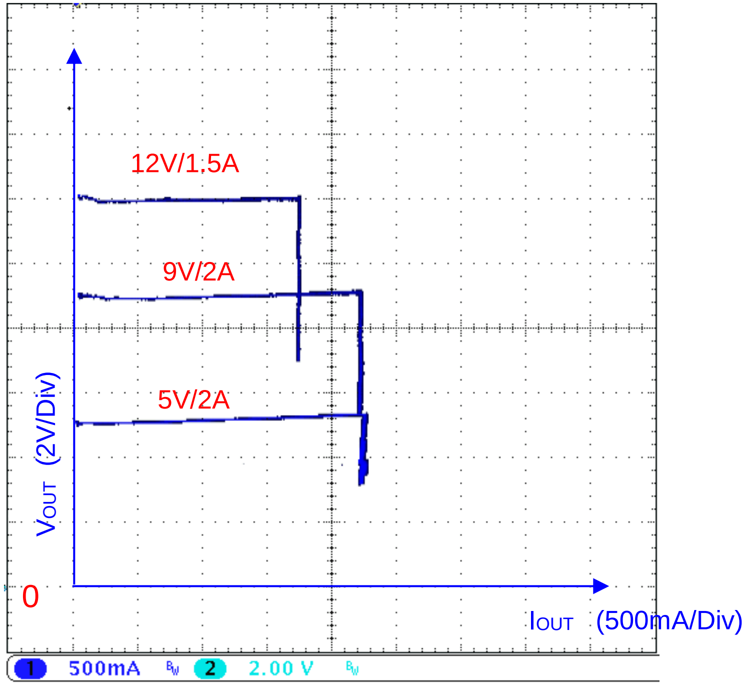
6.3. Regulation, Ripple and Efficiency Measurement

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (A)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	OCP (A)	Average η(%)	DoE η(%)
90	0.11	12.19	0	22			1.75	86.32	85.00
	5.31	11.98	0.375	36	4.49	84.60			
	10.38	12.00	0.75	70	9.00	86.71			
	15.49	11.99	1.125	78	13.49	87.11			
	20.80	12.05	1.5	73	18.07	86.87			
115	0.11	12.18	0	24			1.76	87.04	
	5.29	11.98	0.375	34	4.49	84.95			
	10.34	12.03	0.75	100	9.02	87.26			
	15.36	12.00	1.125	78	13.50	87.89			
	20.52	12.05	1.5	62	18.07	88.05			
230	0.11	12.18	0	24			1.73	86.95	
	5.35	12.00	0.375	54	4.50	84.11			
	10.41	12.04	0.75	92	9.03	86.74			
	15.34	12.03	1.125	58	13.53	88.20			
	20.36	12.04	1.5	62	18.07	88.73			
264	0.12	12.18	0	40			1.73	86.42	
	5.39	11.99	0.375	52	4.50	83.43			
	10.49	12.03	0.75	42	9.02	86.01			
	15.42	12.03	1.125	49	13.53	87.75			
	20.42	12.04	1.5	60	18.07	88.47			

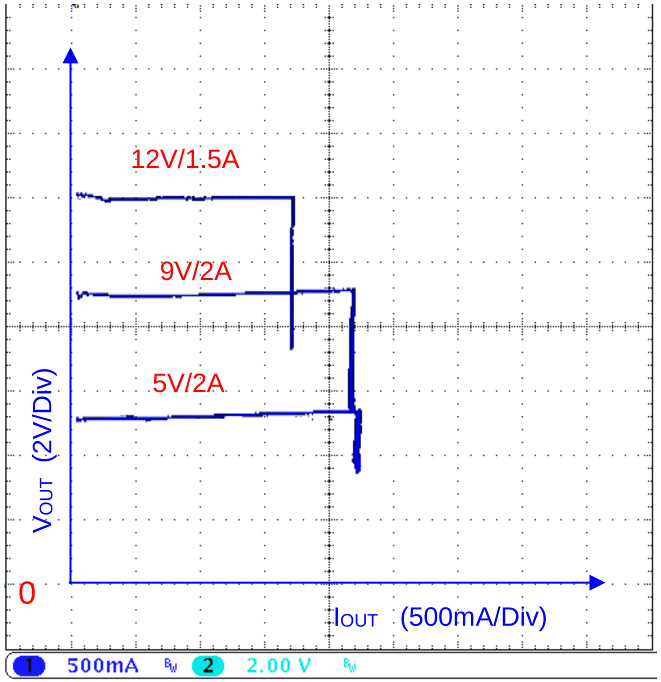
* Note: Output voltage is monitored at end of PCB

7. Output VI Characteristics

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



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

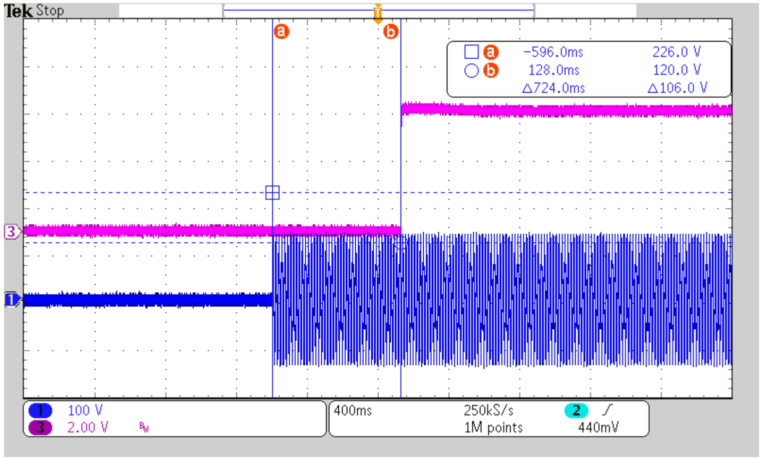


* Note: Output voltage is monitored at end of PCB

8. Turn-on Delay Time

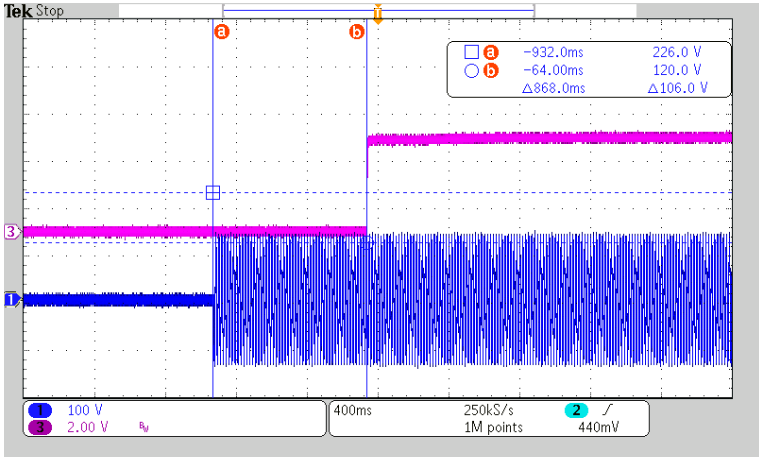
90VAC,No Load

T_{ST_DELAY}=0.724S



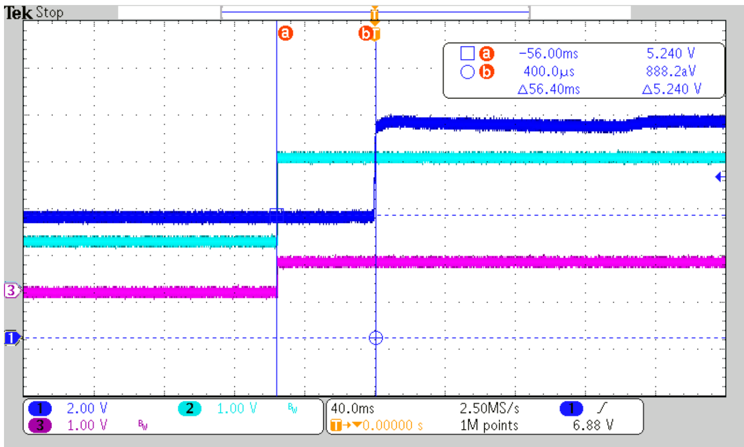
90VAC,Full Load

T_{ST_DELAY}=0.868S

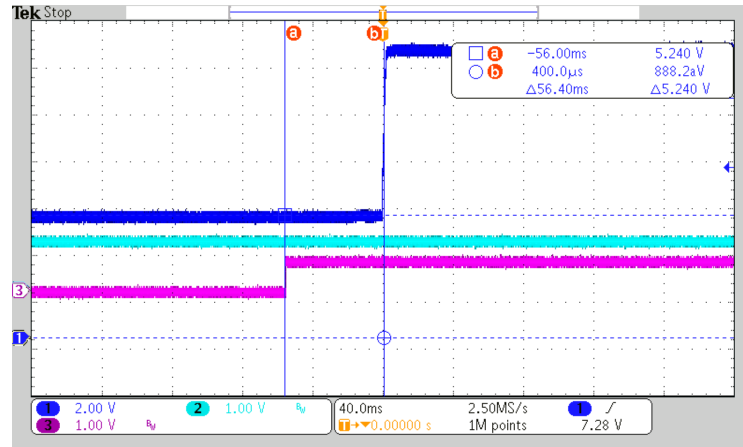


9.1 QC2.0 Output Voltage Transition Delay time

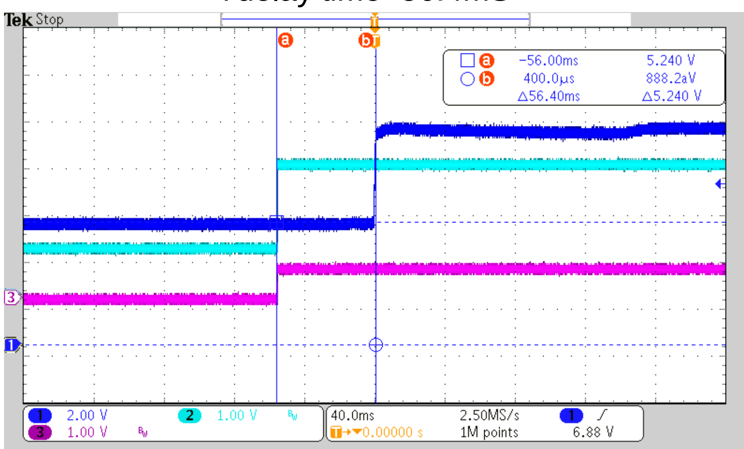
5 -> 9V, No Load
Tdelay time =56.4mS



5V ->12V, No Load
Tdelay time=56.4mS



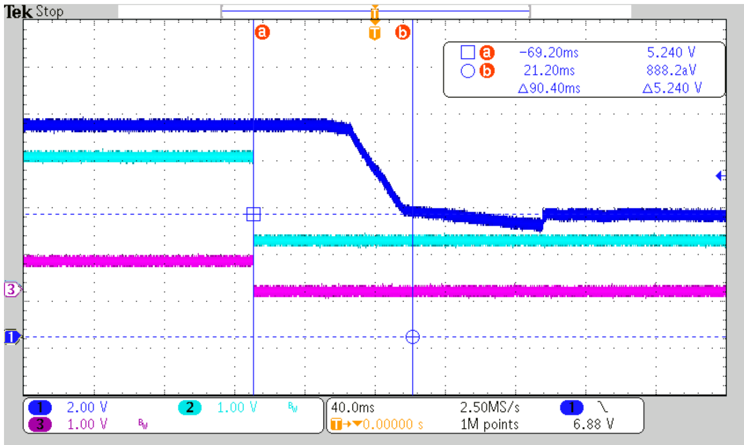
9V -> 12V, No Load
Tdelay time=56.4mS



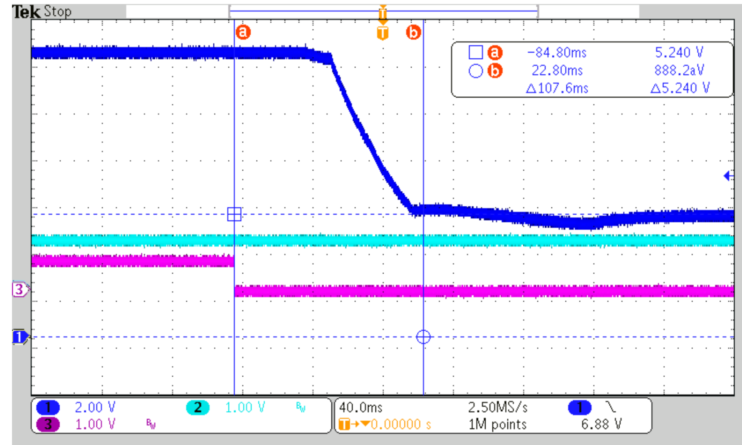
- Note: CH1, Vout; CH2,D+; CH3,D-

9.2 QC2.0 Output Voltage Transition Delay time

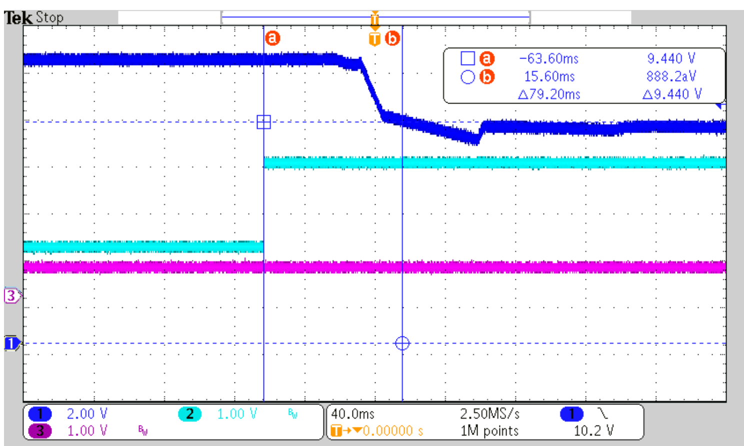
9 -> 5V, No Load
Tdelay time =90.4mS



12V ->5V, No Load
Tdelay time=107.6mS



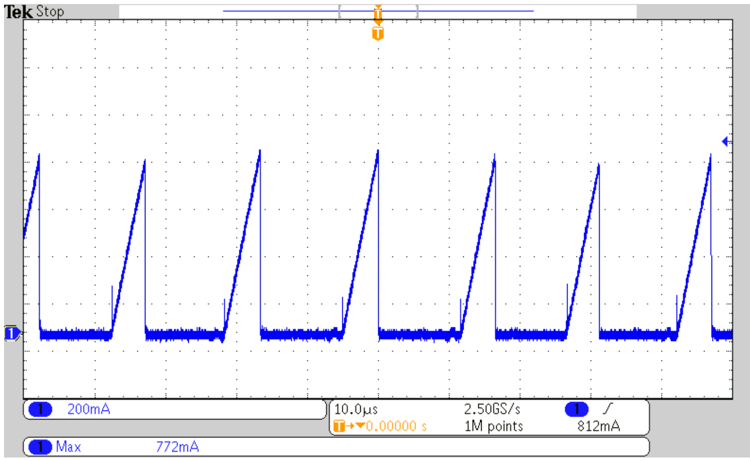
12V -> 9V, No Load
Tdelay time=79.2mS

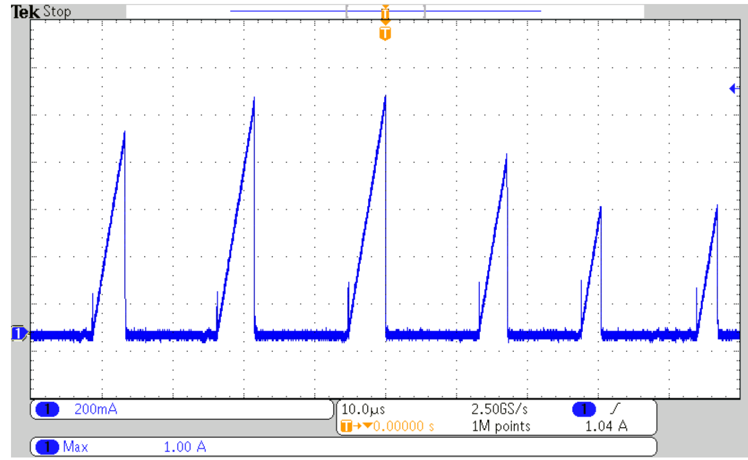


- Note: CH1, Vout; CH2,D+; CH3,D-

9.1 Transformer Flux Density (@5V)

(Np=40Ts, Lm-max=0.7mH, Ae=64mm²-RM8)





CH1: I_{PRI} ,200mA/div

I_{PRI} *is monitored at 90Vac and 2A (full load)*

$$I_{PRI} = 772mA$$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 772}{40 \times 64} = 0.211(Tesla)$$

CH1: I_{PRI} ,200mA/div

I_{PRI} *is monitored at 90Vac*

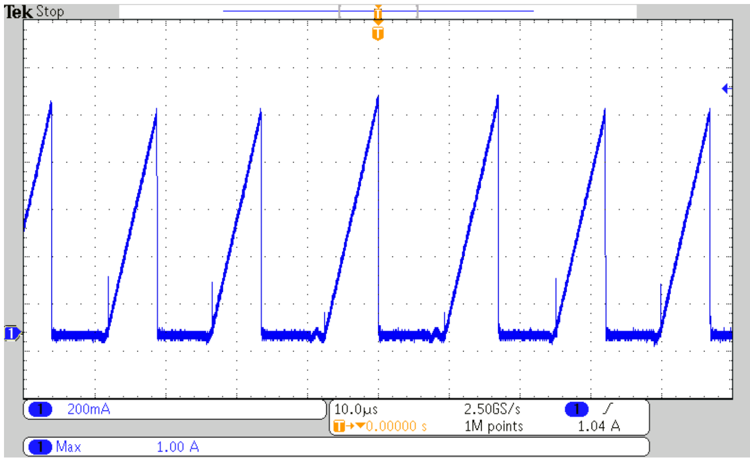
(Worst Case under DLR@0A–2A–0A)

$$I_{PRI} = 1000mA$$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 1000}{40 \times 64} = 0.273(Tesla)$$

9.2 Transformer Flux Density (@9V)

(Np=40Ts, Lm-max=0.7mH, Ae=64mm^2-RM8)

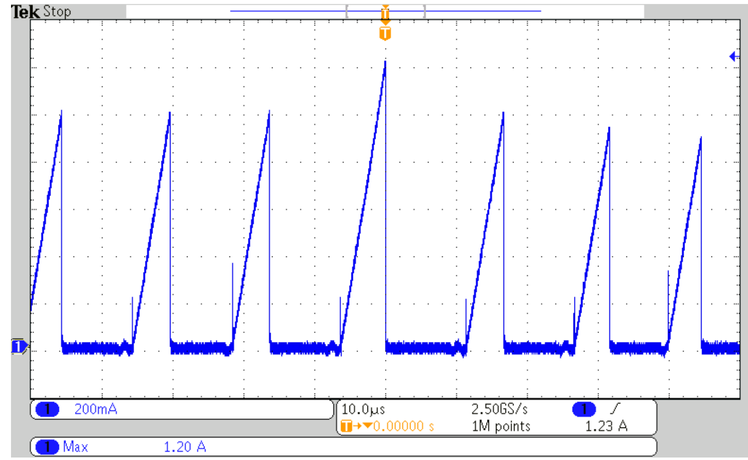


CH1: I_{PRI} ,200mA/div

I_{PRI} *is monitored at* 90*Vac and* 2*A (full load)*

$$I_{PRI} = 1000mA$$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 1000}{40 \times 64} = 0.273 Tesla)$$



CH1: I_{PRI} ,200mA/div

I_{PRI} *is monitored at* 90*Vac*

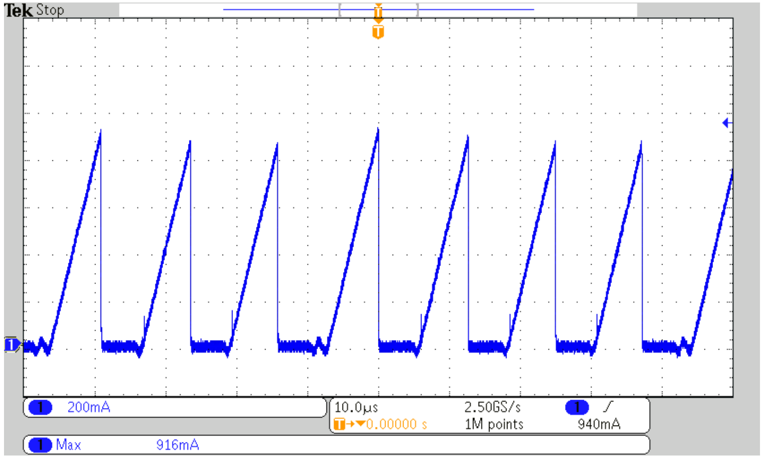
*(Worst Case under DLR@*0*A*−2*A*−0*A)*

$$I_{PRI} = 1200mA$$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 1200}{40 \times 64} = 0.328(Tesla)$$

9.3 Transformer Flux Density (@12V)

(Np=40Ts, Lm-max=0.7mH, Ae=64mm²-RM8)

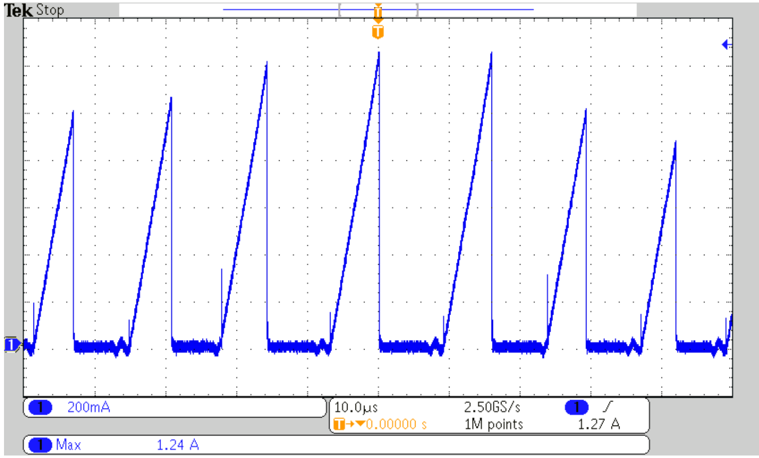


CH1: I_{PRI} ,200mA/div

I_{PRI} *is monitored at 90Vac and 1.5A (full load)*

$I_{PRI} = 916mA$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 916}{40 \times 64} = 0.250 Tesla)$$



CH1: I_{PRI} ,200mA/div

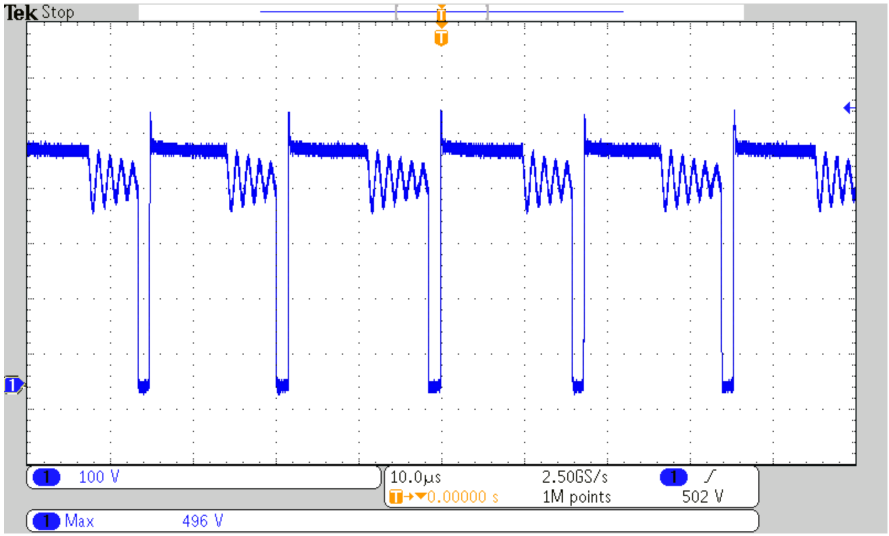
I_{PRI} *is monitored at 90Vac*

(Worst Case under DLR@0A−1.5A−0A)

$I_{PRI} = 1240mA$

$$B_{MAX} = \frac{L_{PRI} \times I_{PRI}}{N_P \times A_e} = \frac{0.7 \times 1240}{40 \times 64} = 0.339(Tesla)$$

10.1 V_{DS} Waveform (@5V)



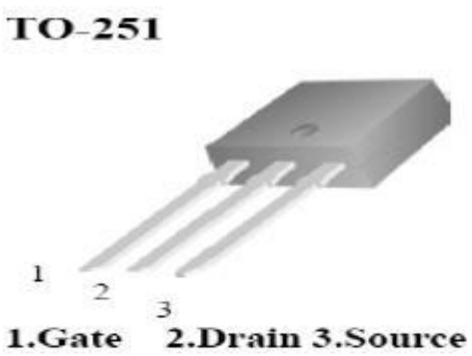
Test Condition (Worst Case):

V_{IN}=264V_{AC},I_{OUT}=2A(Startup)

Result:

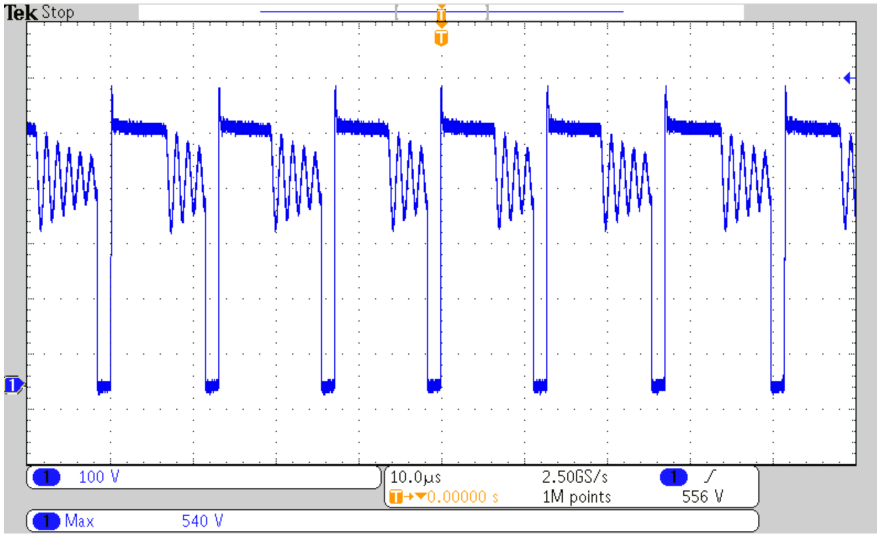
V_{DS_MAX}=**496V**

Appendix – Simple Specification for used MOSFET (CS6N70A3)



Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	700	V
I_D	Continuous Drain Current	6	A
	Continuous Drain Current T_C = 100 °C	3.6	A
I_{DM} a1	Pulsed Drain Current	24	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} a2	Single Pulse Avalanche Energy	60	mJ
E_{AR} a1	Avalanche Energy ,Repetitive	10	mJ
I_{AR} a1	Avalanche Current	1.4	A
dv/dt a3	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	100	W
	Derating Factor above 25°C	0.80	W/℃
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5kΩ)	3000	V
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, −55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

10.2 V_{DS} Waveform (@9V)



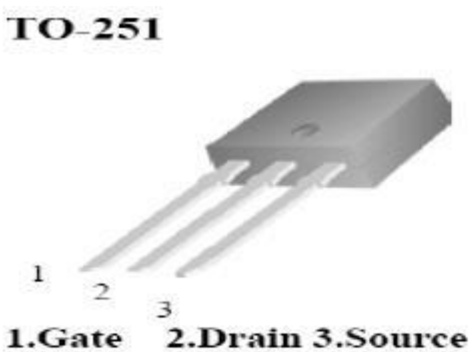
Test Condition (Worst Case):

V_{IN}=264V_{AC},I_{OUT}=2A

Result:

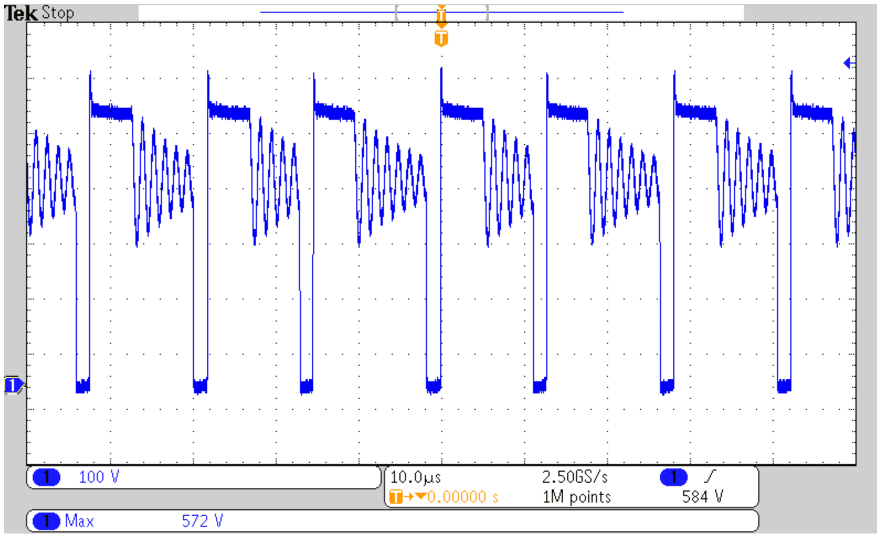
V_{DS_MAX}=**540V**

Appendix – Simple Specification for used MOSFET (CS6N70A3)



Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	700	V
I_D	Continuous Drain Current	6	A
	Continuous Drain Current T_C = 100 °C	3.6	A
I_{DM} [a1]	Pulsed Drain Current	24	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} [a2]	Single Pulse Avalanche Energy	60	mJ
E_{AR} [a1]	Avalanche Energy ,Repetitive	10	mJ
I_{AR} [a1]	Avalanche Current	1.4	A
dv/dt [a3]	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	100	W
	Derating Factor above 25°C	0.80	W/℃
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5kΩ)	3000	V
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, −55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

10.3 V_{DS} Waveform (@12V)



Test Condition (Worst Case):

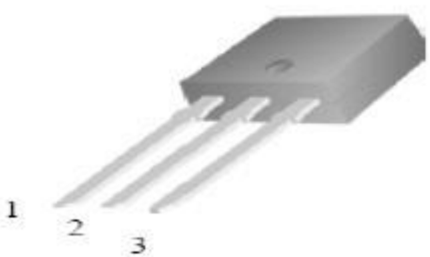
V_{IN}=264V_{AC},I_{OUT}=1.5A

Result:

V_{DS_MAX}=**572**V

Appendix – Simple Specification for used MOSFET (CS6N70A3)

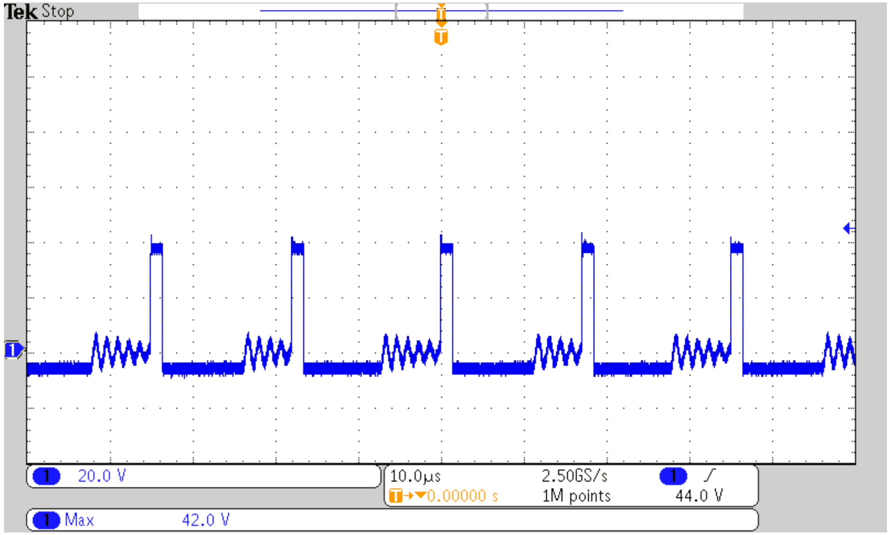
TO-251



1.Gate 2.Drain 3.Source

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	700	V
I_D	Continuous Drain Current	6	A
	Continuous Drain Current T_C = 100 °C	3.6	A
I_{DM} a1	Pulsed Drain Current	24	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} a2	Single Pulse Avalanche Energy	60	mJ
E_{AR} a1	Avalanche Energy ,Repetitive	10	mJ
I_{AR} a1	Avalanche Current	1.4	A
dv/dt a3	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	100	W
	Derating Factor above 25°C	0.80	W/℃
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5kΩ)	3000	V
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, −55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

11.1 Schottky Diode Waveform (@5V)



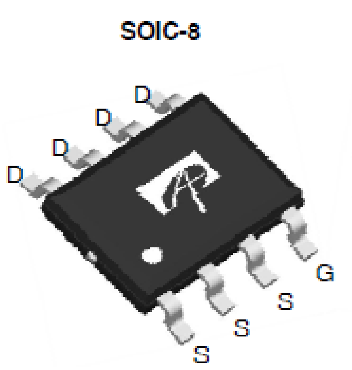
Test Condition:

V_{IN}=264V_{AC},I_{OUT}=2A

Result:

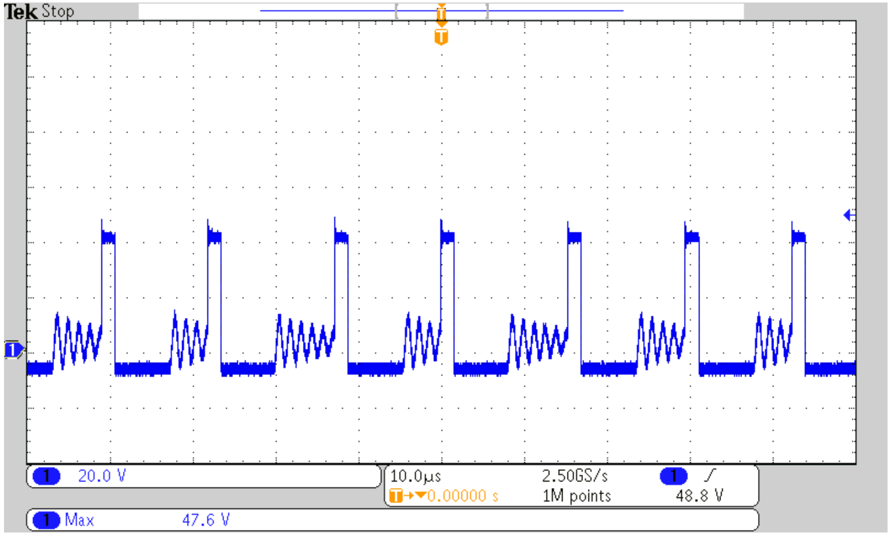
V_{R_MAX}=**42V**

Appendix – Simple Specification for used Schottky diodes (AO4292)



V_{DS}	100	V
$R_{DS(on), (at VGS=10V)}$	<23	mΩ
$I_{D(at VGS=10V)}$	8	A

11.1 Schottky Diode Waveform (@9V)



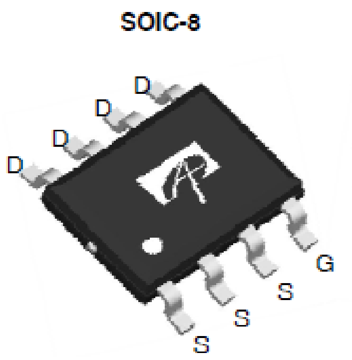
Test Condition:

V_{IN}=264V_{AC},I_{OUT}=2A

Result:

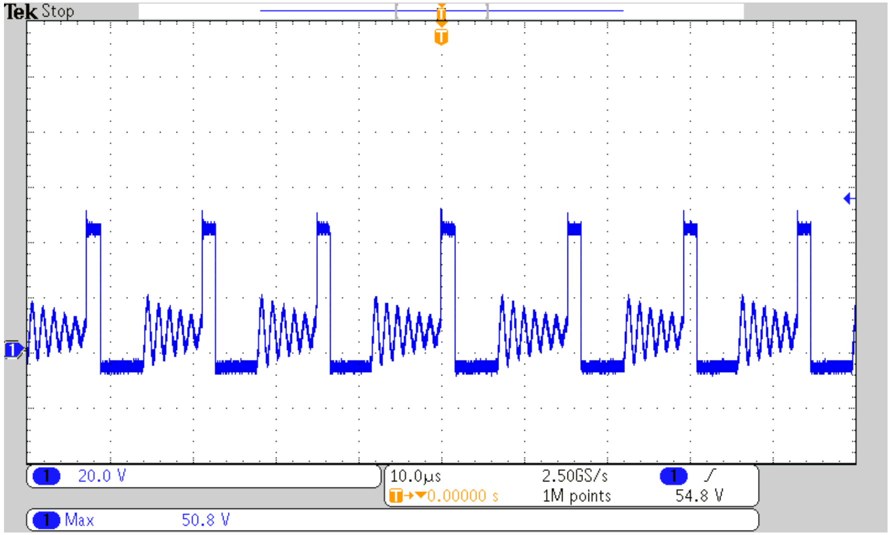
V_{R_MAX}=**47.6V**

Appendix – Simple Specification for used Schottky diodes (AO4292)



V_{DS}	100	V
$R_{DS(on)}$, (at VGS=10V)	<23	mΩ
I_{D}(at VGS=10V)	8	A

11.1 Schottky Diode Waveform (@12V)



Test Condition:

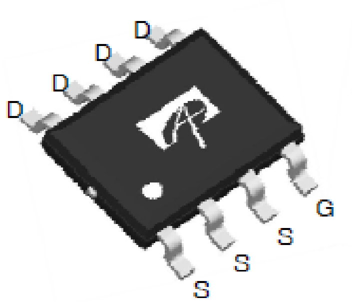
V_{IN}=264V_{AC},I_{OUT}=1.5A

Result:

V_{R_MAX}=**50.8V**

Appendix – Simple Specification for used Schottky diodes (AO4292)

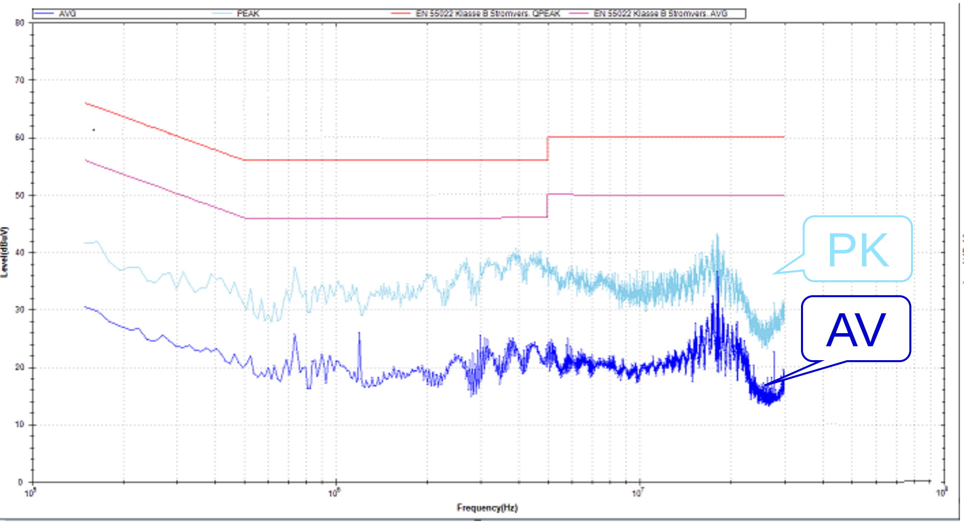
SOIC-8



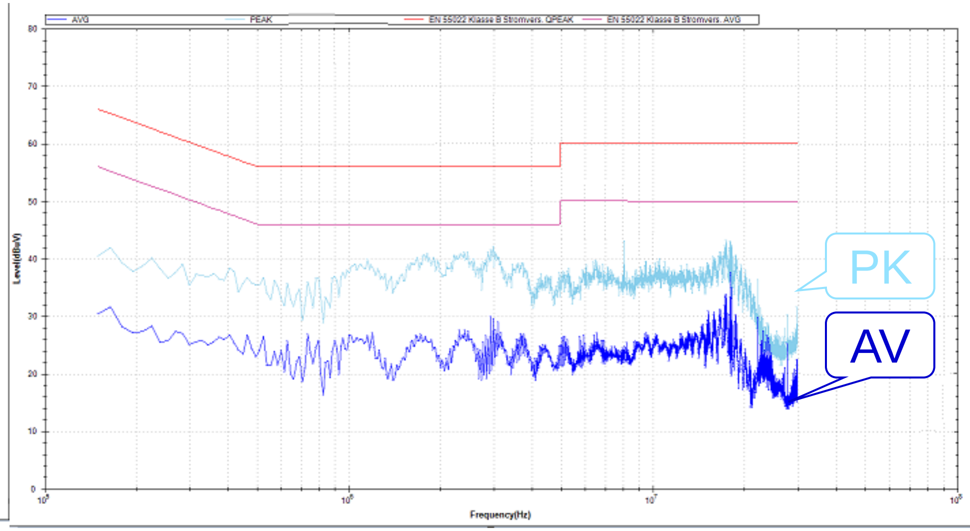
V_{DS}	100	V
$R_{DS(on)}$, (at VGS=10V)	<23	mΩ
I_{D}(at VGS=10V)	8	A

13.1 Conducted EMI (@5V)

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



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

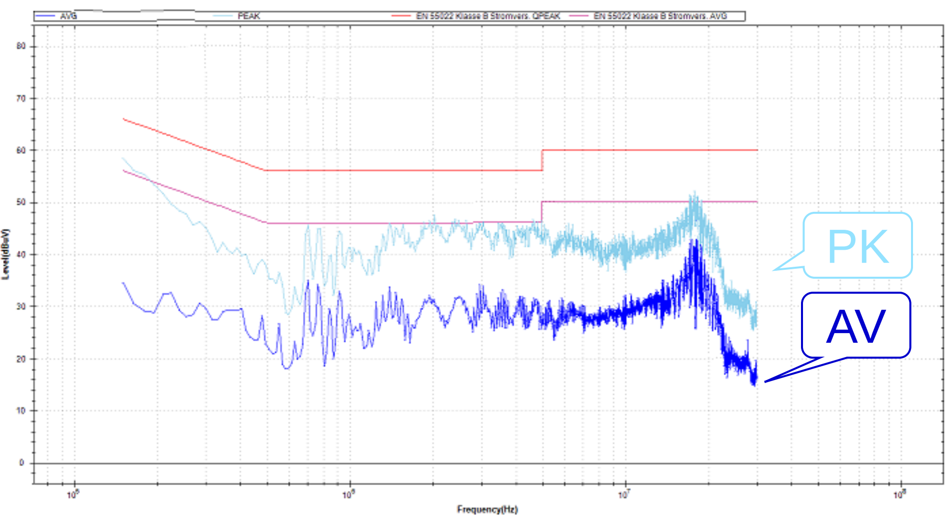


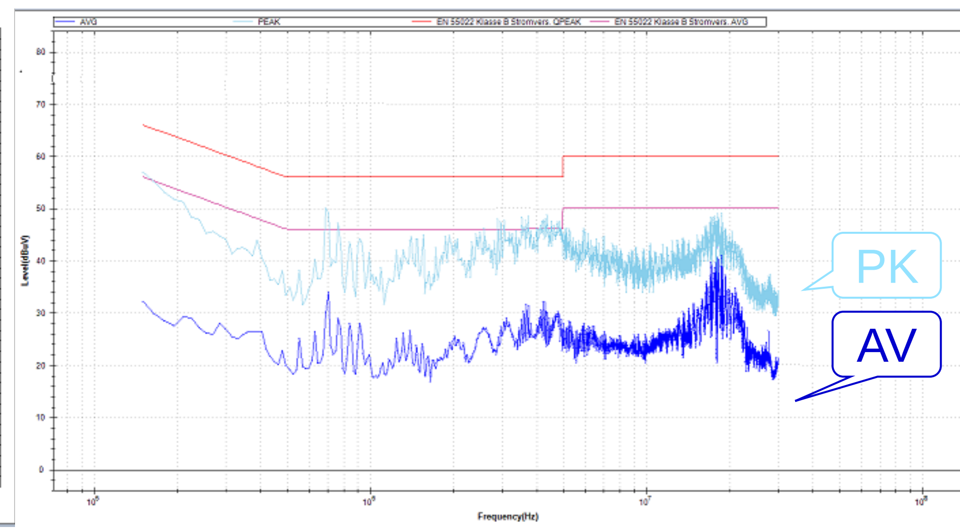
*Note: Resistive & Full load; output (-) is floating.

13.2 Conducted EMI (@9V)

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

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



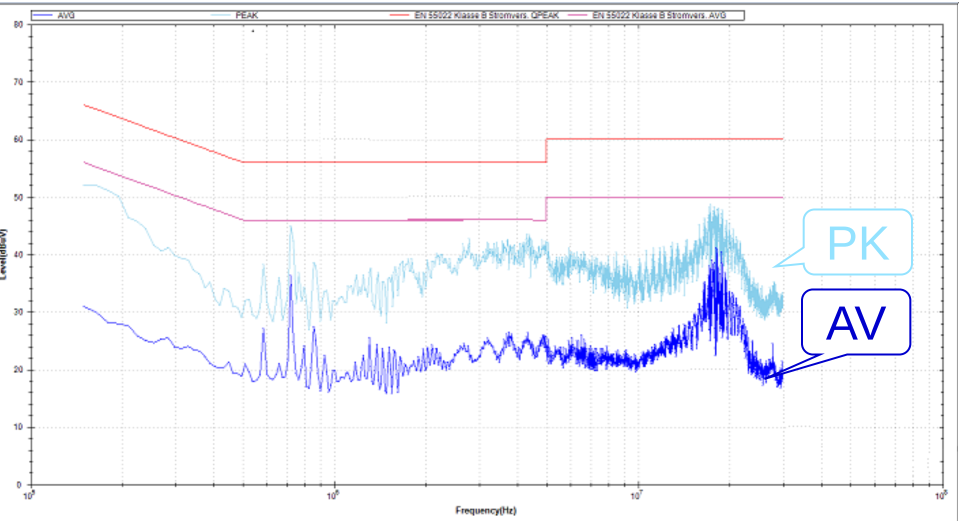


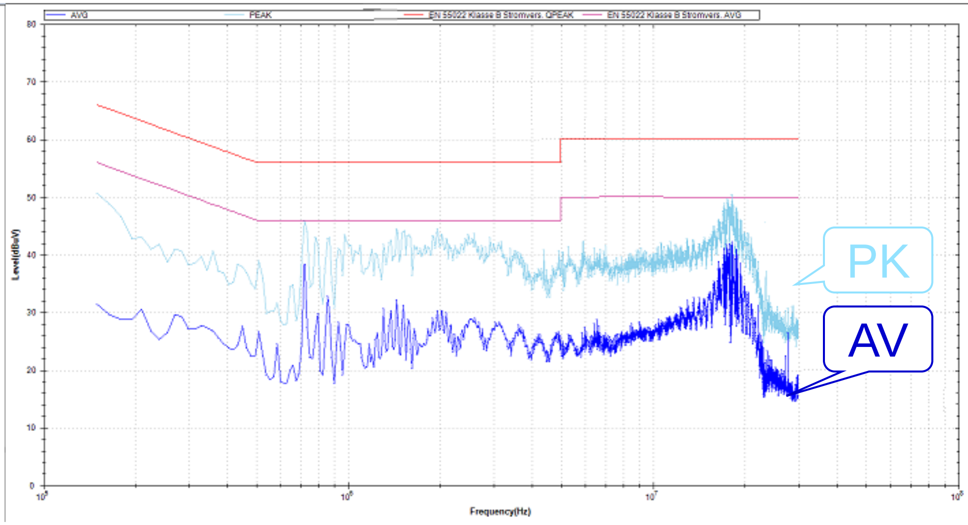
*Note: Resistive & Full load; output (-) is floating.

13.3 Conducted EMI (@12V)

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

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

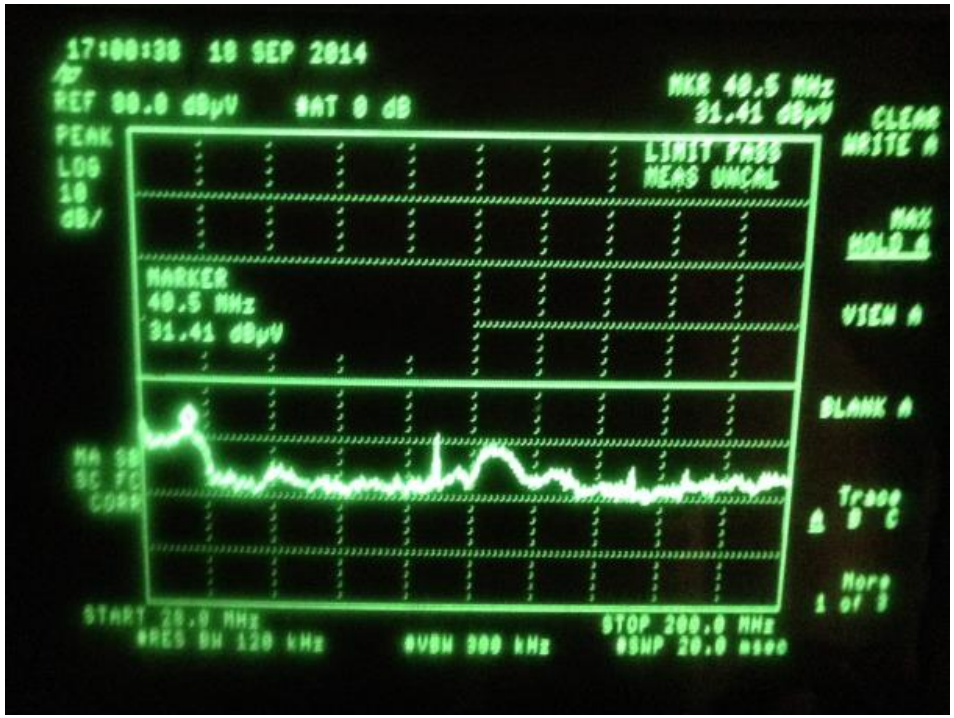




*Note: Resistive & Full load; output (-) is floating.

14.1 Radiated EMI(@5V)

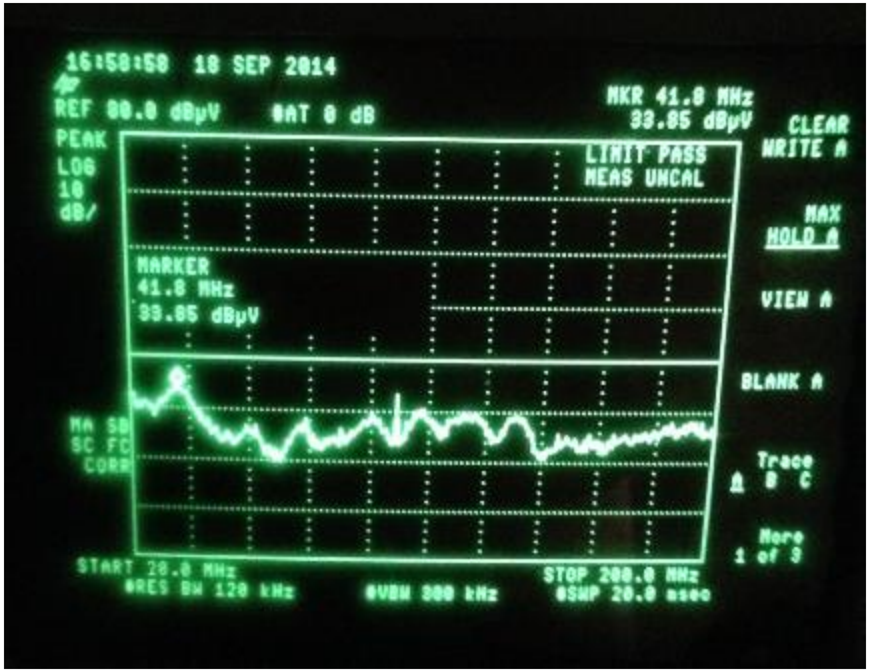
Vin=230Vac/50Hz



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

14.2 Radiated EMI(@9V)

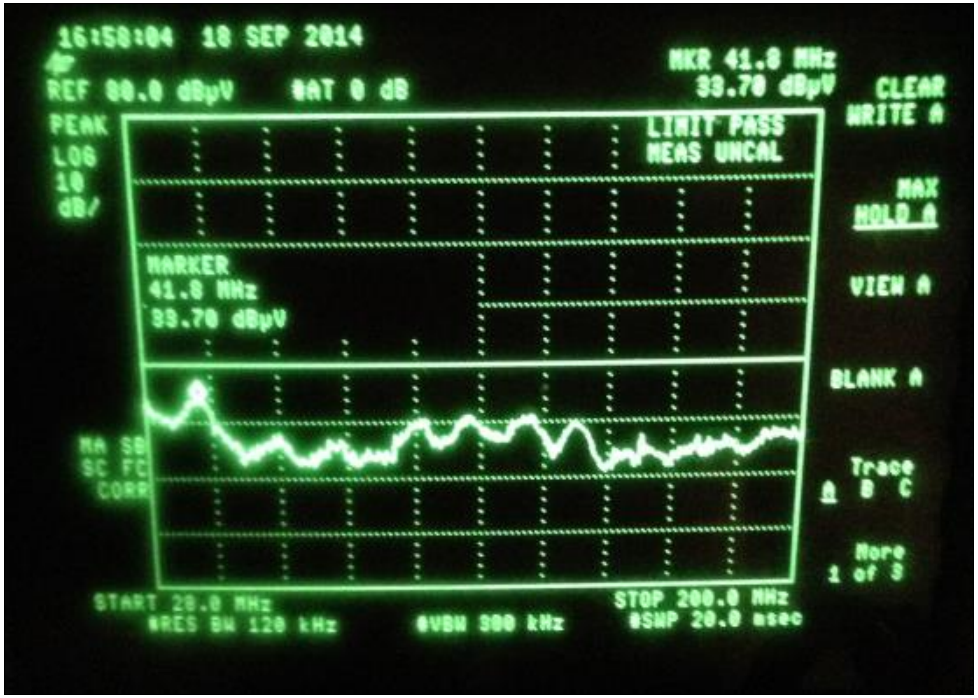
Vin=230Vac/50Hz



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

14.3 Radiated EMI(@12V)

Vin=230Vac/50Hz



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

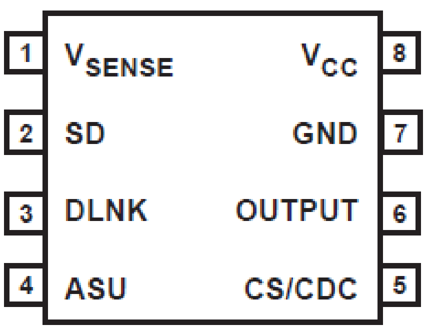
Appendix-1. V_{CC} Supply Voltage (@5V)

The purpose of this test is to verify range of V_{CC} voltage under different loading conditions.

Item	Vcc range [Max:20V, Min:6.5V]			
Input Vac	V_{IN}=90V_{AC}	V_{IN}=115V_{AC}	V_{IN}=230V_{AC}	V_{IN}=264V_{AC}
Output No-load	8.4V	8,4V	8.4V	8.5V
Output Full-load (2.0A)	12.2V	12.3V	12.2V	12.3V
Max load (CC/CV corner)	12.5V	12.4V	12.5V	12.4V

Above test result show all voltage measuring points & is within normal operating range.

iW1780



V_{CC} SECTION (Pin 8)						
Operating voltage (Note 2)	V_{CC}				20	V
Start-up threshold	$V_{CC(ST)}$	V_{CC} rising	12.7	13.7	14.7	V
Under-voltage lockout threshold	$V_{CC(UVL)}$	V_{CC} falling		6.5		V
Latch release threshold	$V_{CC(RLS)}$	V_{CC} falling		4.5		V
V_{CC} over-voltage protection level (Note 2)	$V_{CC(OVP)}$	V_{CC} rising		23		V

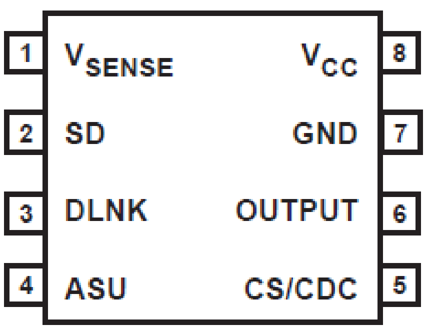
Appendix-2. V_{CC} Supply Voltage (@9V)

The purpose of this test is to verify range of V_{CC} voltage under different loading conditions.

Item	Vcc range [Max:20V, Min:6.5V]			
Input Vac	V_{IN}=90V_{AC}	V_{IN}=115V_{AC}	V_{IN}=230V_{AC}	V_{IN}=264V_{AC}
Output No-load	17.0V	16.9V	16.9V	16.8V
Output Full-load (1.2A)	16.8V	16.7V	16.7V	16.6V
Max load (CC/CV corner)	16.8V	16.7V	16.7V	16.7V

Above test result show all voltage measuring points & is within normal operating range.

iW1780



V_{CC} SECTION (Pin 8)						
Operating voltage (Note 2)	V_{CC}				20	V
Start-up threshold	$V_{CC(ST)}$	V_{CC} rising	12.7	13.7	14.7	V
Under-voltage lockout threshold	$V_{CC(UVL)}$	V_{CC} falling		6.5		V
Latch release threshold	$V_{CC(RLS)}$	V_{CC} falling		4.5		V
V_{CC} over-voltage protection level (Note 2)	$V_{CC(OVP)}$	V_{CC} rising		23		V

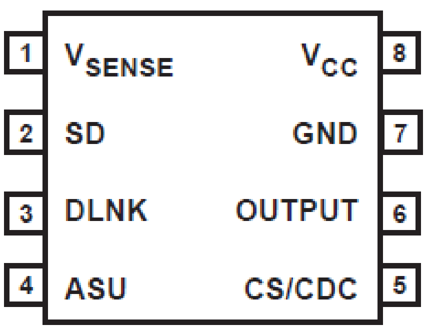
Appendix-3. V_{CC} Supply Voltage (@12V)

The purpose of this test is to verify range of V_{CC} voltage under different loading conditions.

Item	Vcc range [Max:20V, Min:6.5V]			
Input Vac	V_{IN}=90V_{AC}	V_{IN}=115V_{AC}	V_{IN}=230V_{AC}	V_{IN}=264V_{AC}
Output No-load	16.8V	17.1V	17.1V	17.2V
Output Full-load (1A)	16.9V	17.0V	16.9V	17.0V
Max load (CC/CV corner)	16.9V	17.0V	16.9V	17.0V

Above test result show all voltage measuring points & is within normal operating range.

iW1780



V_{CC} SECTION (Pin 8)						
Operating voltage (Note 2)	V_{CC}				20	V
Start-up threshold	$V_{CC(ST)}$	V_{CC} rising	12.7	13.7	14.7	V
Under-voltage lockout threshold	$V_{CC(UVL)}$	V_{CC} falling		6.5		V
Latch release threshold	$V_{CC(RLS)}$	V_{CC} falling		4.5		V
V_{CC} over-voltage protection level (Note 2)	$V_{CC(OVP)}$	V_{CC} rising		23		V

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