COSEL

TEST DATA OF WMA35F-24

Regulated DC Power Supply
November 9, 2020

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Model	WMA35F-24
Item	Input Current (by Load Current)
Object	

Temperature 25°C
Testing Circuitry Figure A

1.Graph

—△—	Input Volt.	100V
- - -□- - -	Input Volt.	115V
— —⊖— —	Input Volt.	230V
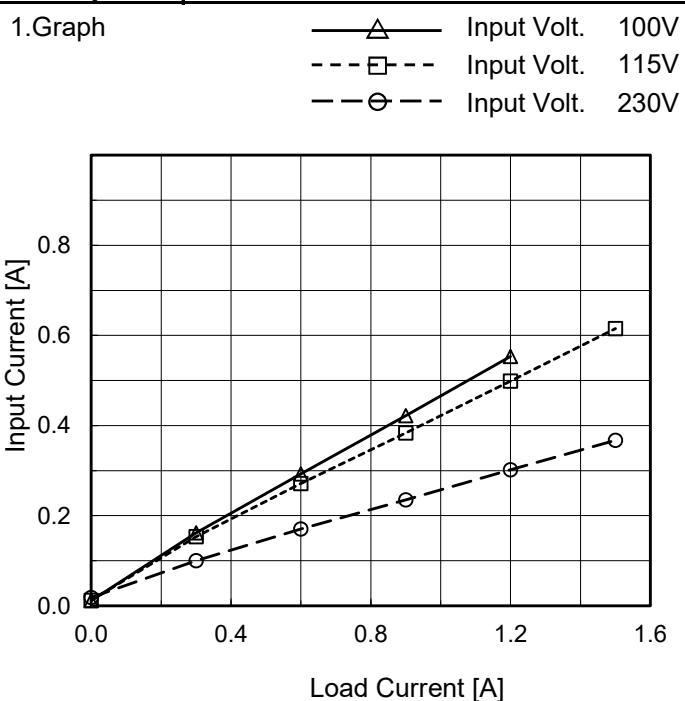
Input Current [A] vs Load Current [A]

2.Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	0.011	0.012	0.018
0.3	0.162	0.154	0.100
0.6	0.293	0.271	0.170
0.9	0.422	0.384	0.235
1.2	0.553	0.499	0.302
1.5	-	0.616	0.367
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Input Power (by Load Current)
Object	————————

Temperature 25°C
Testing Circuitry Figure A

1.Graph

——△—— Input Volt. 100V
- - -☐- - - Input Volt. 115V
— —⊖— — Input Volt. 230V
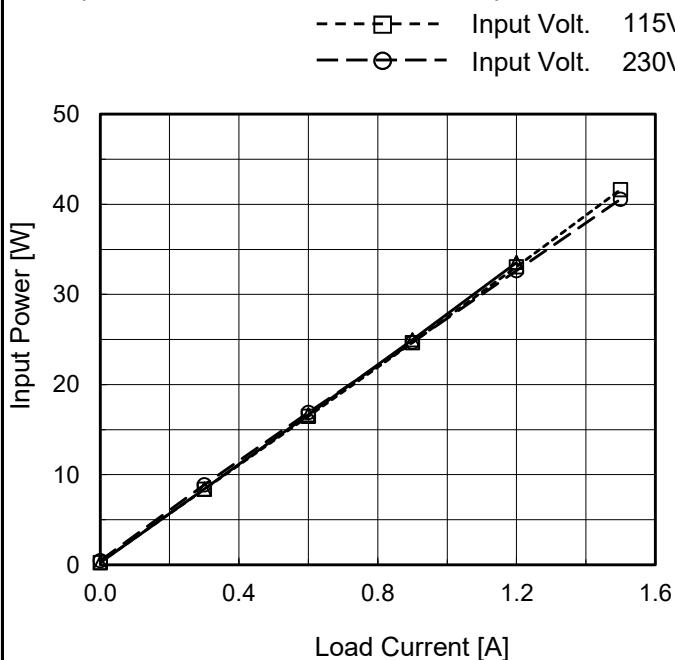
2.Values

Load Current [A]	Input Power [W]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	0.26	0.26	0.46
0.3	8.43	8.37	8.89
0.6	16.65	16.48	16.92
0.9	24.96	24.66	24.67
1.2	33.55	33.07	32.65
1.5	-	41.63	40.56
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Efficiency (by Input Voltage)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

- - -▱- - -   Load 50%

———△———   Load 100%

2.Values

Input Voltage	Efficiency [%]	
[V]	Load 50%	Load 100%
85	85.7	-
100	86.8	-
115	87.4	86.7
200	87.1	88.7
230	86.3	88.7
240	86.0	88.6
264	85.2	88.4
--	-	-
--	-	-

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Model	WMA35F-24
Item	Efficiency (by Load Current)
Object	

Temperature 25°C
Testing Circuitry Figure A

1.Graph

⎯△⎯ Input Volt. 100V
- - -□- - - Input Volt. 115V
— —⊖— — Input Volt. 230V

2.Values

Load Current [A]	Efficiency [%]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	-	-	-
0.3	84.9	85.5	80.4
0.6	86.2	87.1	84.8
0.9	86.2	87.2	87.1
1.2	85.6	86.8	87.9
1.5	-	86.3	88.5
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Power Factor (by Input Voltage)
Object	

Temperature 25°C
Testing Circuitry Figure A

1.Graph

- - - □ - - - Load 50%
————△———— Load 100%

2.Values

Input Voltage	Power Factor	
[V]	Load 50%	Load 100%
85	0.595	-
100	0.564	-
115	0.539	0.575
200	0.461	0.492
230	0.442	0.472
240	0.437	0.466
264	0.425	0.454
--	-	-
--	-	-

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Model	WMA35F-24
Item	Power Factor (by Load Current)
Object	———————

Temperature 25°C
Testing Circuitry Figure A

1.Graph
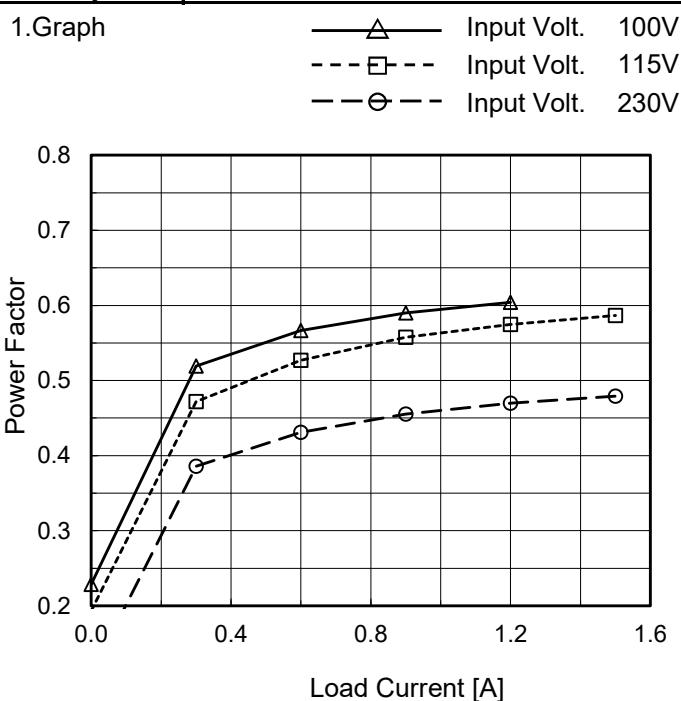
— △ — Input Volt. 100V
--- ⊟ --- Input Volt. 115V
— ⊖ — Input Volt. 230V

Load Current [A]

2.Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	0.228	0.193	0.109
0.3	0.519	0.472	0.386
0.6	0.567	0.527	0.431
0.9	0.590	0.557	0.455
1.2	0.604	0.575	0.470
1.5	-	0.586	0.479
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Inrush Current
Object	

Temperature 25°C
Testing Circuitry Figure A

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Time [50ms/div]

Input Voltage 115 V
Frequency 50 Hz
Load 100 %

Primary inrush current
16.8 A
Secondary inrush current
1.9 A

Input
Current
[20A/div]

Input
Voltage
[200V/div]

Time [50ms/div]

Input Voltage 230 V
Frequency 50 Hz
Load 100 %

Primary inrush current
38.4 A
Secondary inrush current
1.7 A

Primary inrush current   Secondary inrush current

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Model	WMA35F-24
Item	Leakage Current
Object	

Temperature　25°C
Testing Circuitry　Figure B

1.Results

[mA]

Standards	Measuring Method	Input Volt.			Note
		100 [V]	115 [V]	230 [V]	
IEC60601-1	Both phases	0.12	0.14	0.31	Operation
	One of phases	0.23	0.26	0.59	Stand by

The value for "One of phases" is the reference value only.

2.Condition
Leakage current value is concluded after measuring both phases of
AC input and by choosing the larger one.

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Model	WMA35F-24
Item	Line Regulation
Object	+24V1.5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph
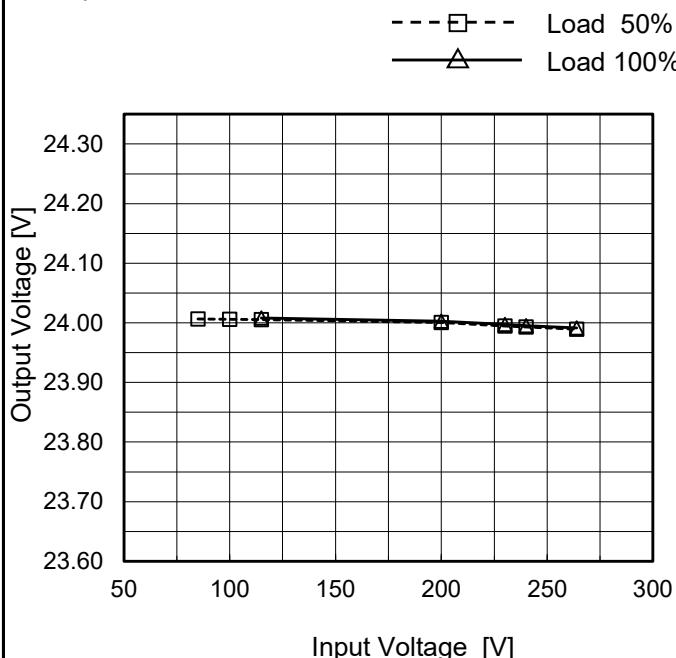
--□-- Load 50%
--△-- Load 100%

2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	24.007	-
100	24.006	-
115	24.006	24.008
200	24.001	24.003
230	23.995	23.997
240	23.993	23.995
264	23.989	23.991
--	-	-
--	-	-

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Model	WMA35F-24
Item	Load Regulation
Object	+24V1.5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

```
──△──  Input Volt.  100V
---⊟---  Input Volt.  115V
──⊖──  Input Volt.  230V
```
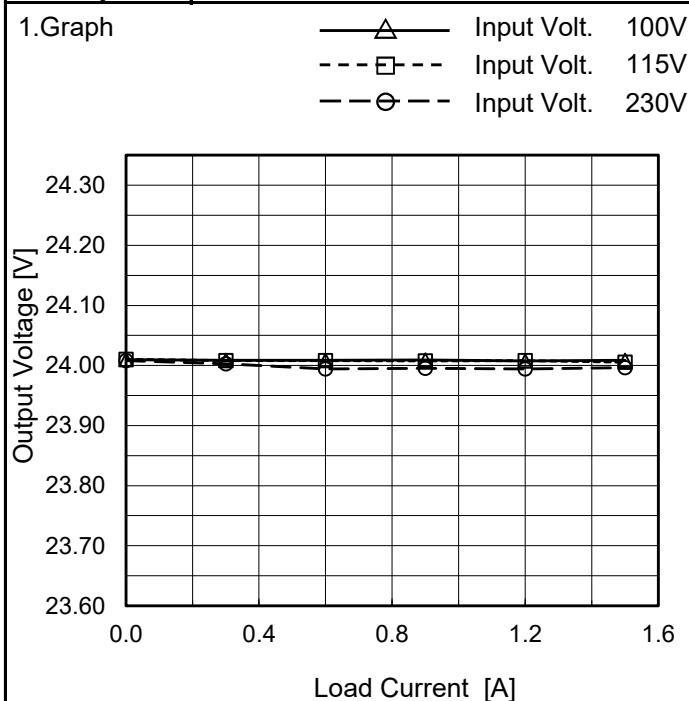

2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	24.010	24.010	24.008
0.3	24.009	24.008	24.003
0.6	24.009	24.008	23.994
0.9	24.009	24.008	23.995
1.2	24.008	24.008	23.994
1.5	24.008	24.006	23.996
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Dynamic Load Response
Object	+24V1.5A

Temperature   25°C
Testing Circuitry   Figure A

Input Volt.   230 V
Cycle   1000 ms

t1,t2 = 50 μs

Load Current

t1   t2

Min.Load (0A)←→
    Load 100% (1.5A)

100 mV/div

20 ms/div   20 ms/div

Min.Load (0A)←→
    Load 50% (0.75A)

100 mV/div

20 ms/div   20 ms/div

Load 50% (0.75A)←→
    Load 100% (1.5A)

100 mV/div

20 ms/div   20 ms/div

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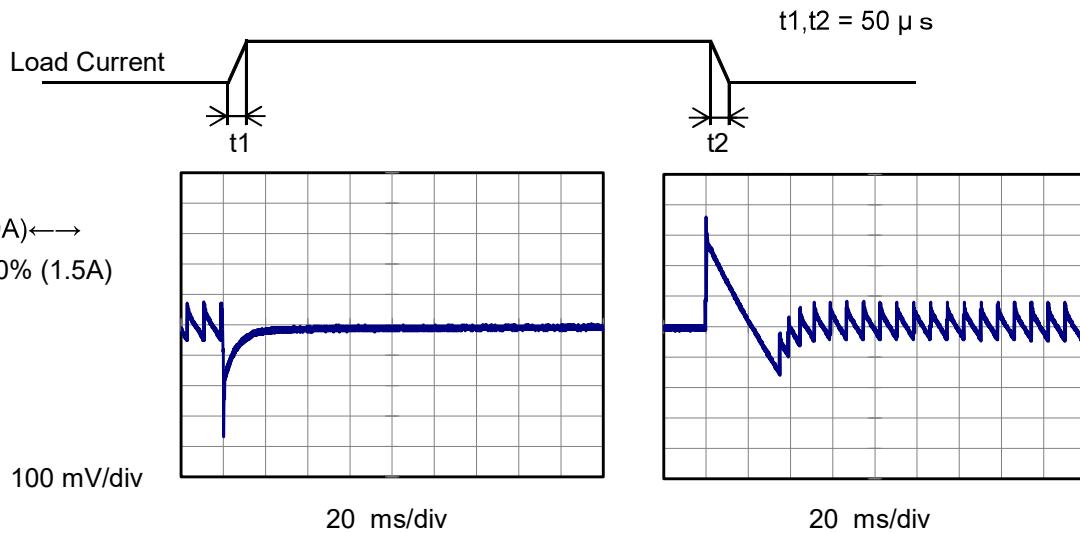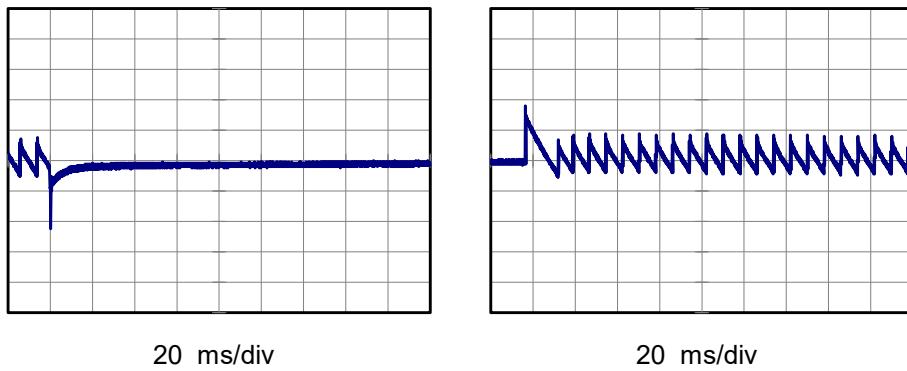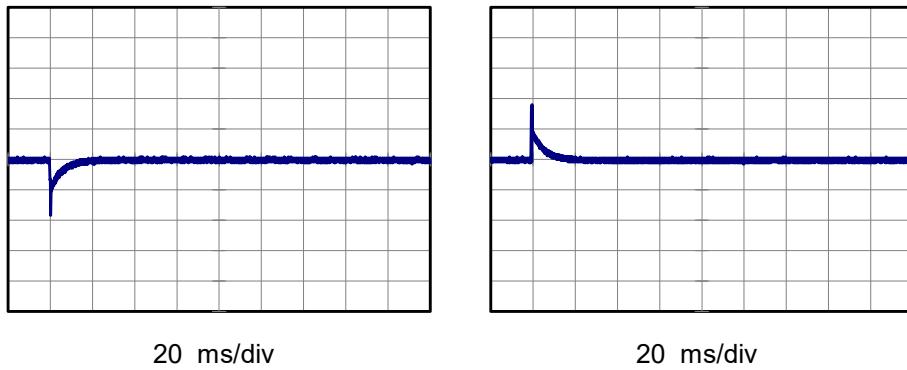
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Model	WMA35F-24
Item	Ripple-Noise (by Load Current)
Object	+24V1.5A

Temperature 25°C
Testing Circuitry Figure C

1.Graph

—△— Input Volt. 115V
— ⊖ — Input Volt. 230V
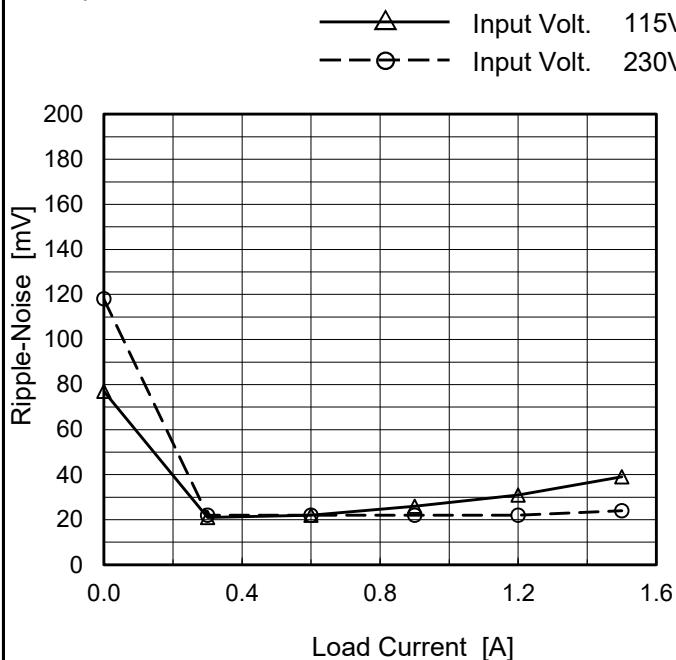
Load Current [A]

2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
0.0	77	118
0.3	21	22
0.6	22	22
0.9	26	22
1.2	31	22
1.5	39	24
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.
Ripple-Noise is shown as p-p in the figure below.

T1: Due to AC Input Line
T2: Due to Switching

Ripple-Noise [mVp-p]

T2

T1
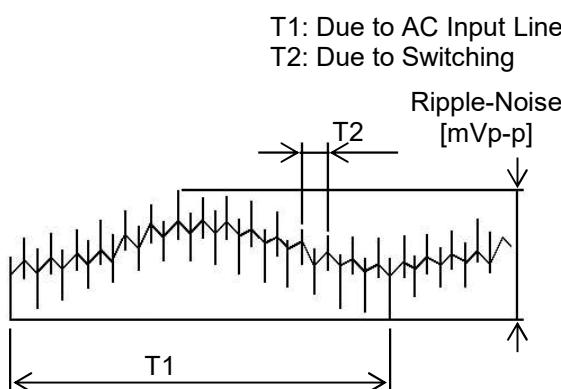
Fig. Complex Ripple Wave Form

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Model	WMA35F-24
Item	Ripple-Noise (by Ambient Temp.)
Object	+24V1.5A

Testing Circuitry   Figure C

1.Graph

--□-- Load 50%
—△— Load 100%

Ambient Temperature [°C]
Load 100 %

Measured by 20 MHz Oscilloscope.
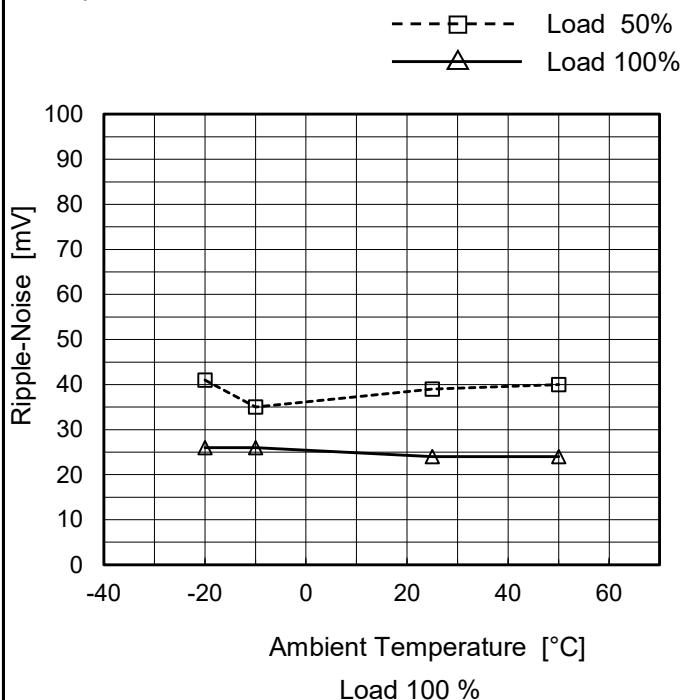
2.Values

Ambient Temperature [°C]	Ripple-Noise [mV]	
	115 [V]	230[V]
-20	41	26
-10	35	26
25	39	24
50	40	24
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA35F-24
Item	Ambient Temperature Drift
Object	+24V1.5A

Testing Circuitry   Figure A

1.Graph

	Input Volt.	100V
---□---	Input Volt.	115V
---○---	Input Volt.	230V

Ambient Temperature [°C]

Load 100%
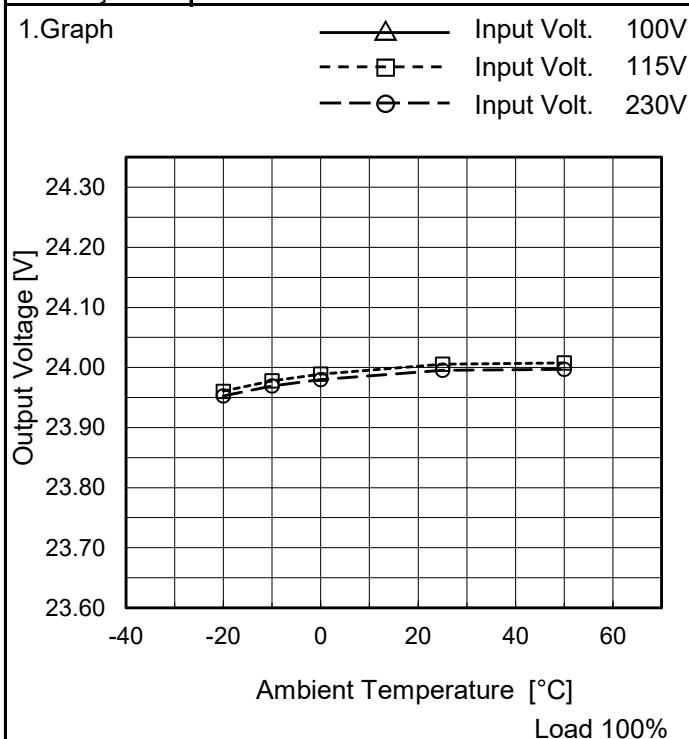
2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
-20	-	23.960	23.953
-10	-	23.978	23.969
0	-	23.989	23.980
25	-	24.005	23.996
50	-	24.008	23.997
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24		
Item	Output Voltage Accuracy	Testing Circuitry	Figure A
Object	+24V1.5A		

1.Output Voltage Accuracy

This is defined as the value of the output voltage, regulation load, ambient temperature and input voltage varied at random in the range as specified below.

Temperature : -20 - 50°C

Input Voltage : 100 - 230V

Load Current : 0 - 1.5A

* Output Voltage Accuracy = ±(Maximum of Output Voltage - Minimum of Output Voltage) / 2

* Output Voltage Accuracy (Ratio) = $\dfrac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}} \times 100$

2.Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	200	0	24.017	±29	±0.1
Minimum Voltage	-20	132	1.5	23.960		

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Model	WMA35F-24
Item	Time Lapse Drift
Object	+24V1.5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Input Volt. 115V
Load 100%

2.Values

Time since start [H]	Output Voltage [V]
0.0	23.976
0.2	23.989
0.5	23.991
1.0	23.993
2.0	23.991
3.0	23.991
4.0	23.991
8.0	23.994

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Model	WMA35F-24
Item	Rise and Fall Time
Object	+24V1.5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Load 100%

Output Volt.

[5V/div]

0

Input Volt. 115 V

Load 100%

Output Volt.

[5V/div]

0

Input Volt. 230 V

Input Volt.

0

Time [50ms/div]

Time [50ms/div]
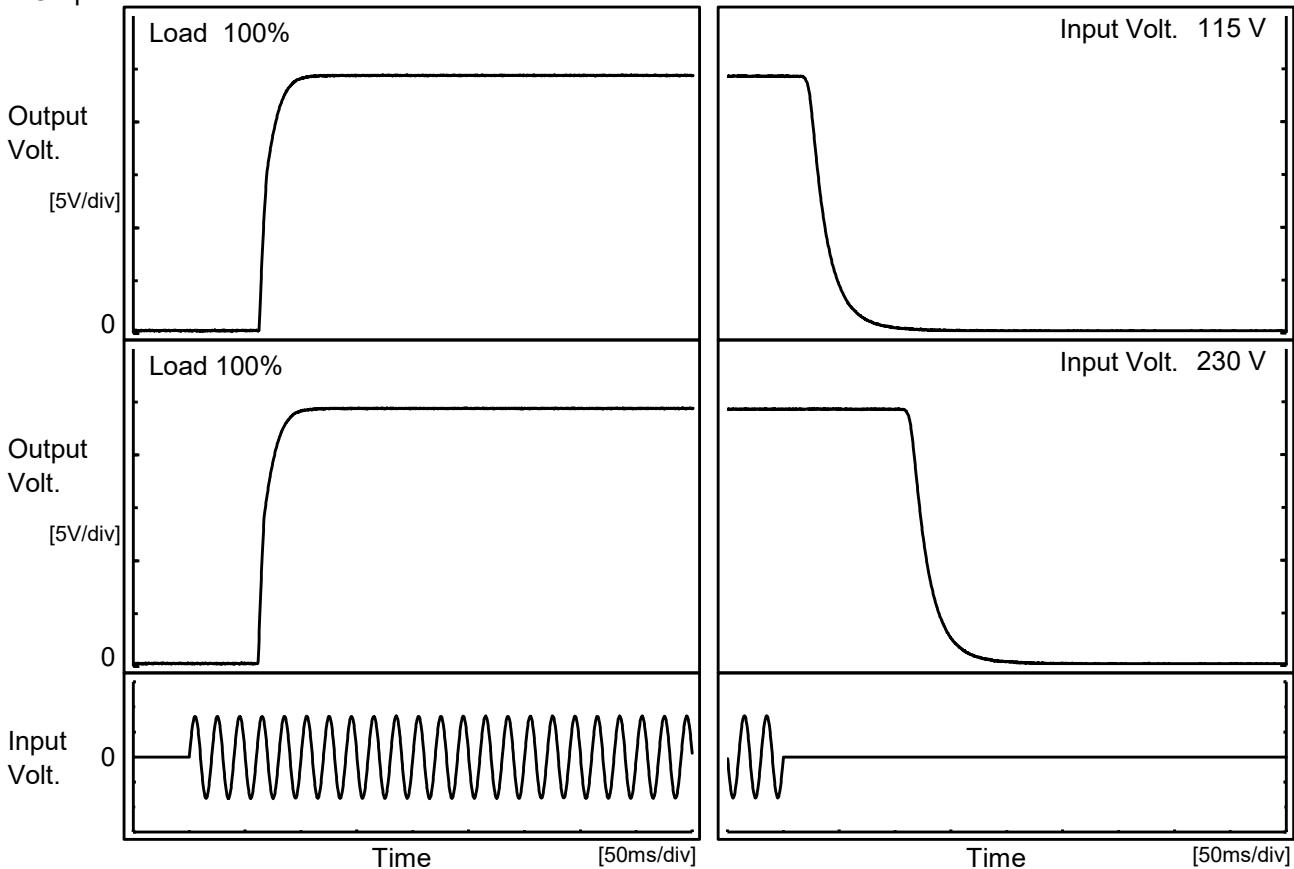
2.Values [ms]

Input Volt \ Time	Td	Tr	Ts	Th	Tf
115 V	63.5	18.8	82.3	24.3	35.3
230 V	62.5	18.8	81.3	115.0	35.0

Output Volt.
90%
10%

Input Volt.

Td Tr Th Tf
Ts

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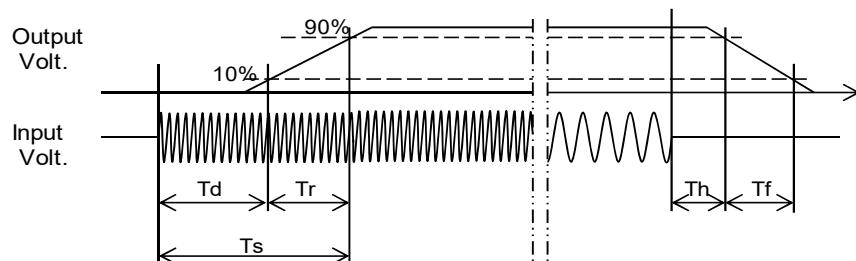
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Model	WMA35F-24
Item	Hold-Up Time
Object	+24V1.5A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

- - -◻- - -   Load 50%
— △ —   Load 100%

Hold-Up Time [ms] vs Input Voltage [V]
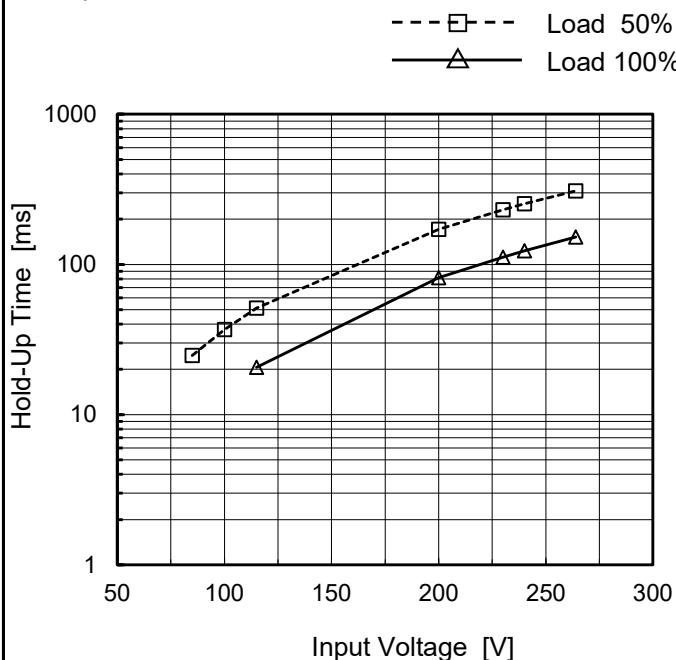
2.Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
85	25	-
100	37	-
115	51	21
200	171	82
230	231	112
240	253	123
264	309	152
--	-	-
--	-	-

This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy.

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Model	WMA35F-24
Item	Instantaneous Interruption Compensation
Object	+24V1.5A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

△ Input Volt. 100V
□ Input Volt. 115V
○ Input Volt. 230V

Instantaneous Compensation Time [ms] vs Load Current [A]
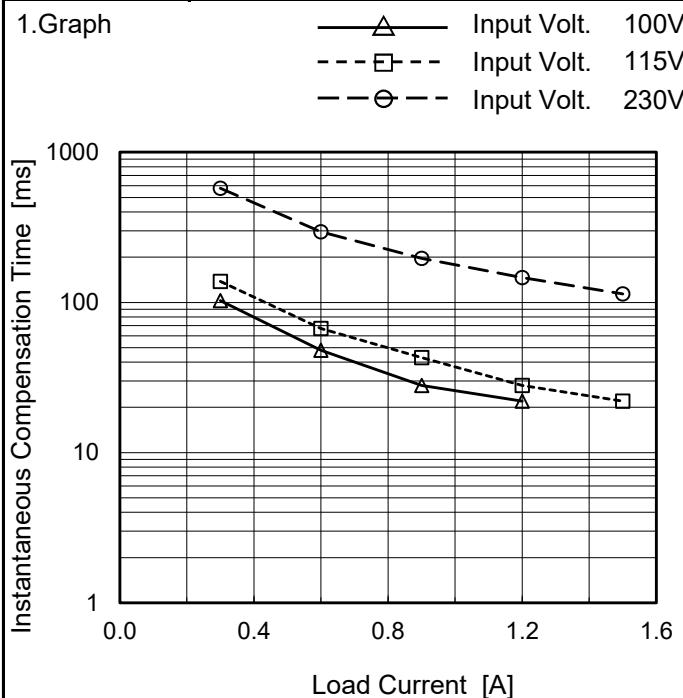
2.Values

Load Current [A]	Time [ms]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.0	-	-	-
0.3	103	138	575
0.6	48	67	295
0.9	28	43	196
1.2	22	28	146
1.5	-	22	114
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+24V1.5A

Testing Circuitry   Figure A

1.Graph
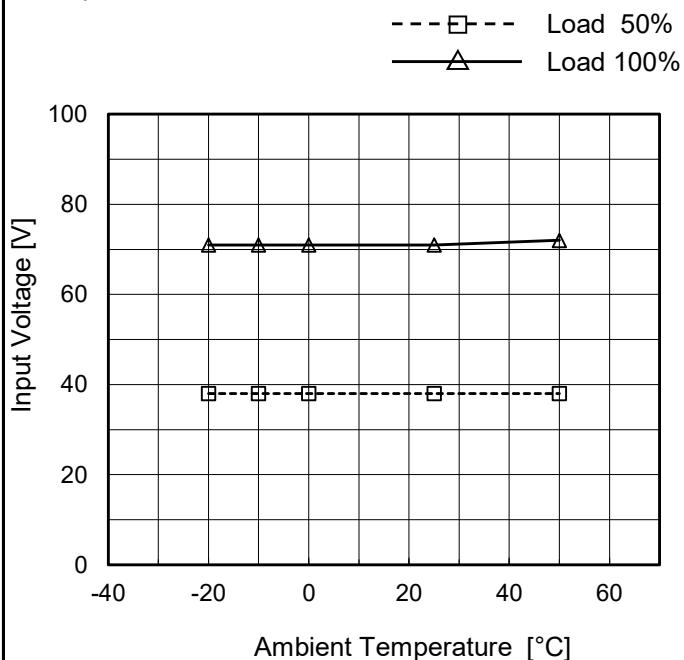
Load 50%
Load 100%

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-20	38	71
-10	38	71
0	38	71
25	38	71
50	38	72
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA35F-24
Item	Overcurrent Protection
Object	+24V1.5A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

——————— Input Volt. 100V
——————— Input Volt. 115V
——————— Input Volt. 230V

Load Current [A]

Note: Slanted line shows the range of the rated
        load current.

2.Values

Output Voltage [V]	Load Current [A]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
24	1.81	1.92	2.18
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA35F-24
Item	Overvoltage Protection
Object	+24V1.5A

Testing Circuitry   Figure A

1.Graph

—△— Input Volt.   115V
- - -□- - - Input Volt.   230V

Ambient Temperature [°C]

Load 0%
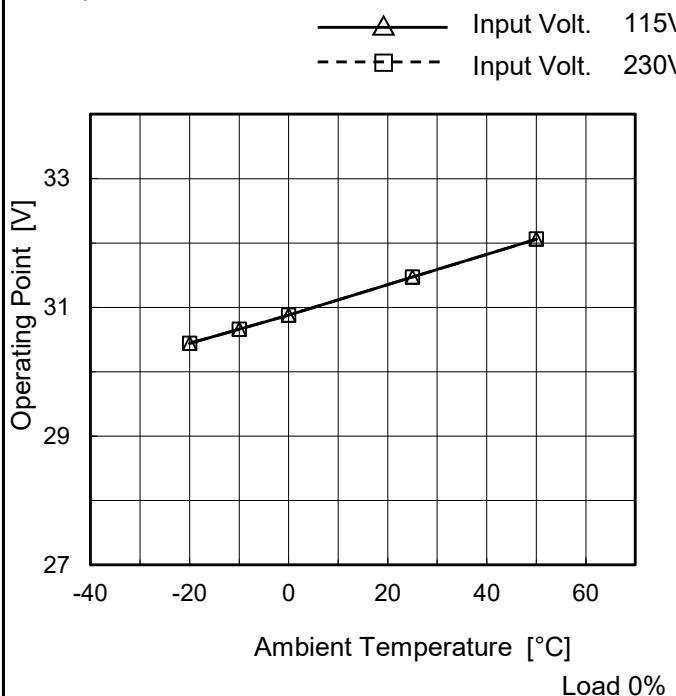
2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 115[V]	Input Volt. 230[V]
-20	30.44	30.44
-10	30.66	30.66
0	30.88	30.88
25	31.47	31.47
50	32.06	32.06
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Figure A

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{1k\ [\Omega]}$$
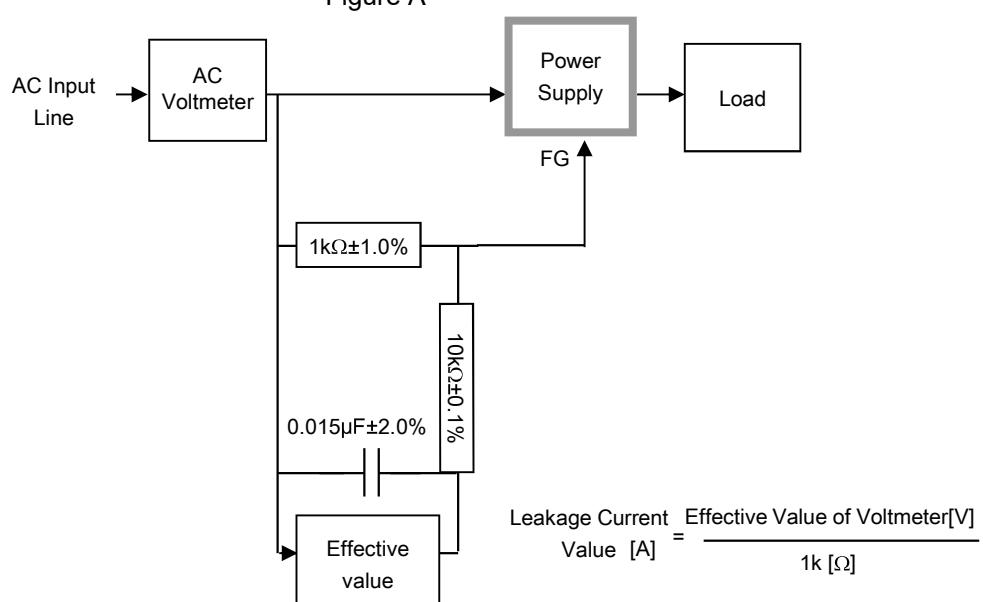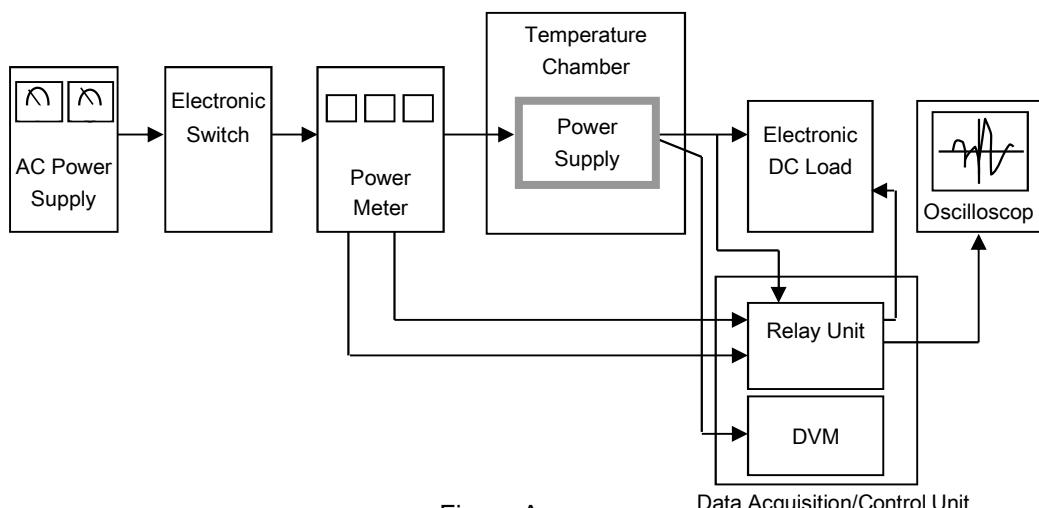
Figure B (IEC60601-1)

150mm
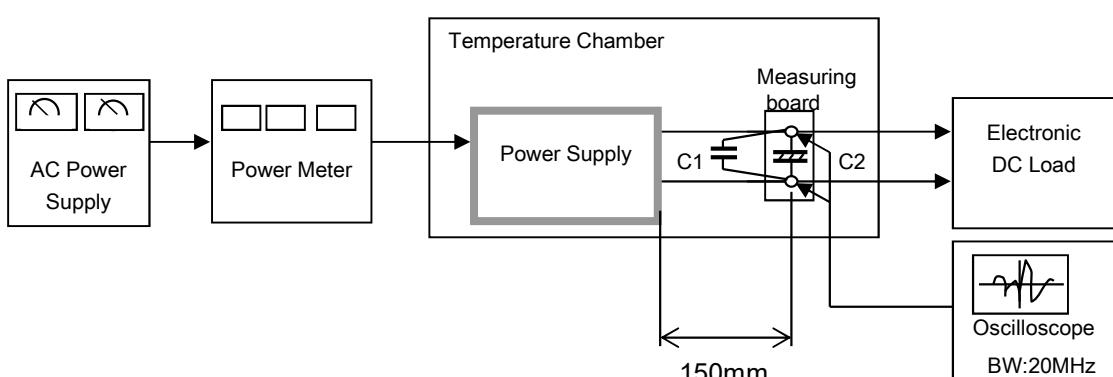
(Ceramic capacitor)
C1= 0.1 μF

(Electrolytic capacitor)
C2= 47 μF

Figure C

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