COSEL

TEST DATA OF WMA350H-48
(115V INPUT)

Regulated DC Power Supply
December 5, 2019

Approved by : _Takashi Kajii_

Takashi Kajii   Design Manager

Prepared by : _Ryo Takahashi_

Ryo Takahashi   Design Engineer

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Item	Input Current (by Load Current)
Object	——————

Temperature	25°C
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1.Graph
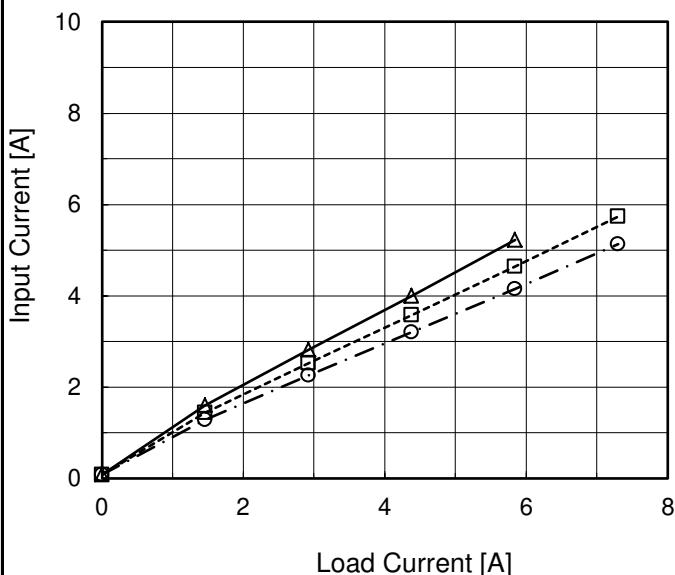
—△— Input Volt. 100V
---⊟--- Input Volt. 115V
—·—○—·· Input Volt. 132V

2.Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
0.00	0.073	0.077	0.082
1.46	1.601	1.439	1.287
2.92	2.817	2.519	2.250
4.38	4.000	3.580	3.198
5.84	5.220	4.640	4.150
7.30	-	5.740	5.130
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Input Power (by Load Current)
Object	

Temperature	25°C
Testing Circuitry	Figure A

1.Graph

```
———△——— Input Volt.   100V
- - -⊟- - - Input Volt.   115V
—·—○—·— Input Volt.   132V
```
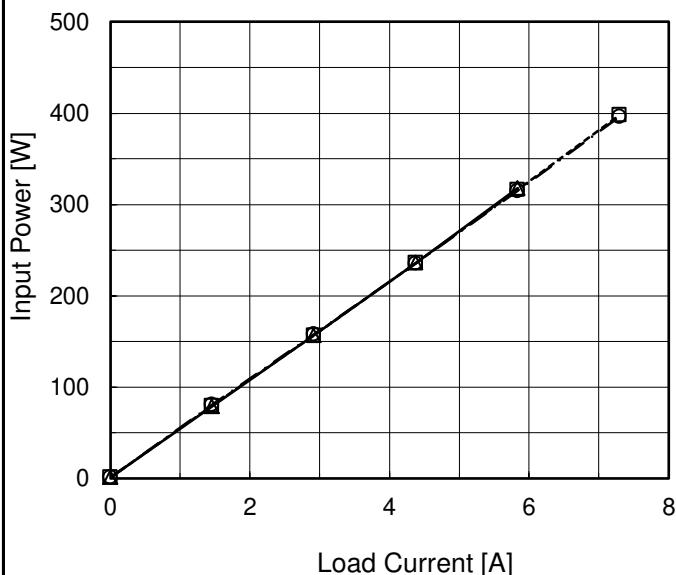

Input Power [W] vs Load Current [A]

2.Values

Load Current [A]	Input Power [W]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
0.00	1.0	1.0	1.1
1.46	78.7	79.4	80.5
2.92	156.4	156.8	157.5
4.38	236.0	236.0	235.6
5.84	318.0	316.0	315.0
7.30	-	398.0	396.0
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Efficiency (by Input Voltage)
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

- - - ⊟ - - - Load 50%
——— △ ——— Load 100%

Efficiency [%] vs Input Voltage [V]
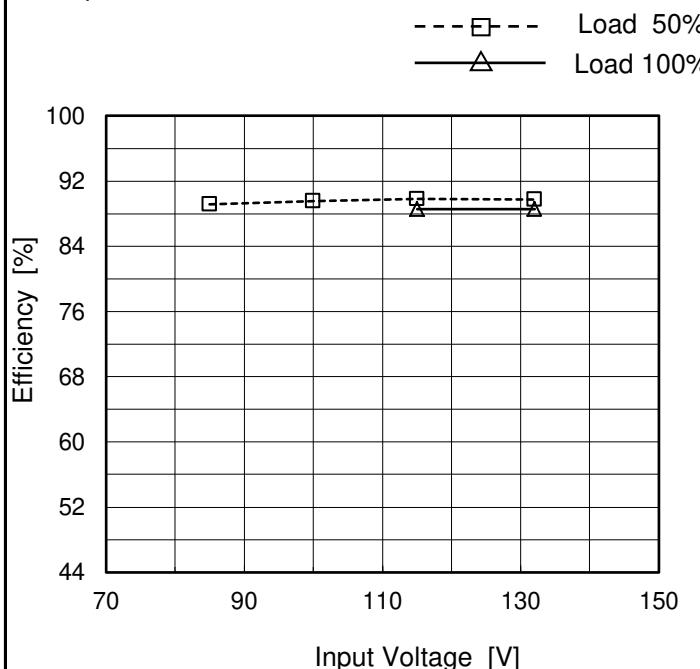
2.Values

Input Voltage [V]	Efficiency [%]	
	Load 50%	Load 100%
85	89.2	-
100	89.6	-
115	89.8	88.6
132	89.8	88.6
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA350H-48
Item	Efficiency (by Load Current)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph   ——△—— Input Volt.   100V
               --- ⊟ --- Input Volt.   115V
               —·—○—·— Input Volt.   132V

Efficiency [%] vs Load Current [A]

2.Values

Load Current	Efficiency [%]		
	Input Volt.	Input Volt.	Input Volt.
[A]	100[V]	115[V]	132[V]
0.00	-	-	-
1.46	89.0	88.2	87.0
2.92	90.0	89.8	89.4
4.38	89.3	89.3	89.5
5.84	88.3	88.9	89.1
7.30	-	88.1	88.6
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Power Factor (by Input Voltage)
Object	+48V7.3A

Temperature	25°C
Testing Circuitry	Figure A

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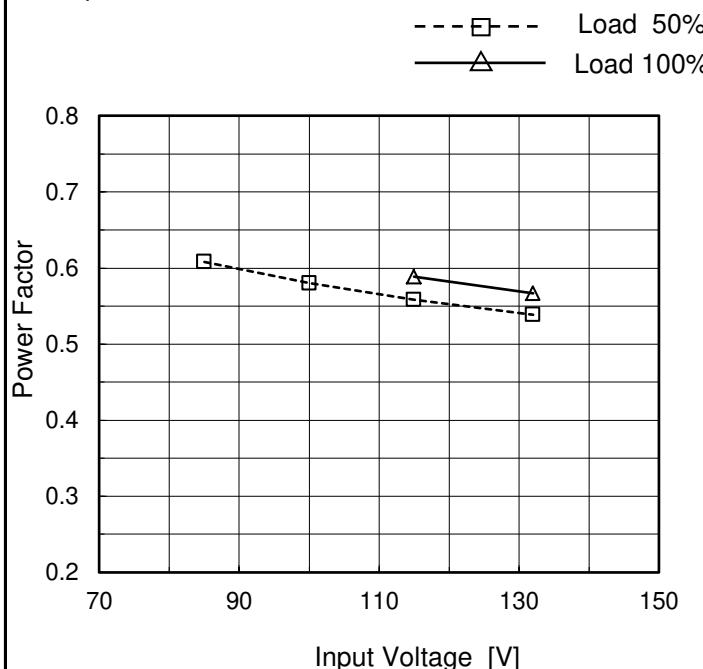
- - -□- - - Load 50%
———△——— Load 100%

2.Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
85	0.608	-
100	0.580	-
115	0.558	0.588
132	0.539	0.567
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA350H-48
Item	Power Factor (by Load Current)
Object	

Temperature	25°C
Testing Circuitry	Figure A

1.Graph

— △ — Input Volt. 100V
--- □ --- Input Volt. 115V
— · ○ — · · Input Volt. 132V

Power Factor vs Load Current [A]

2.Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
0.00	0.141	0.115	0.104
1.46	0.491	0.479	0.474
2.92	0.555	0.541	0.530
4.38	0.590	0.574	0.558
5.84	0.609	0.593	0.575
7.30	-	0.604	0.585
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48		
Item	Inrush Current	Temperature	25°C
		Testing Circuitry	Figure A
Object	——————		

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Time   [50ms/div]

Input Voltage	115 V
Frequency	60 Hz
Load	100 %
Primary inrush current	33.5 A
Secondary inrush current	2.3 A

Primary inrush current   Secondary inrush current

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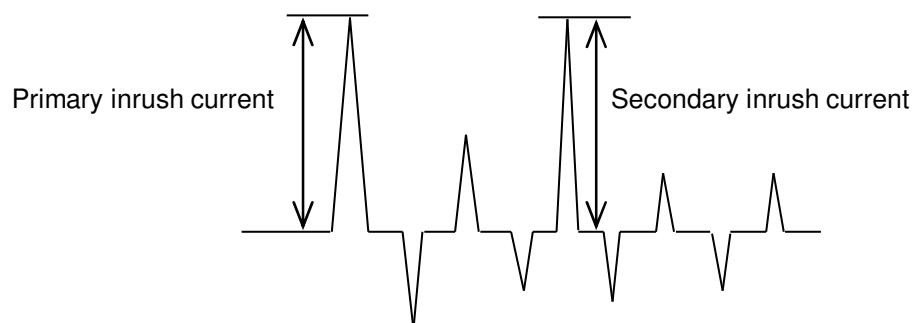
Model	WMA350H-48
Item	Leakage Current
Object	

Temperature   25°C
Testing Circuitry   Figure B

1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	115 [V]	132 [V]	
IEC60601-1	Both phases	0.15	0.18	0.20	Operation
	One of phases	0.24	0.27	0.31	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	WMA350H-48
Item	Line Regulation
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

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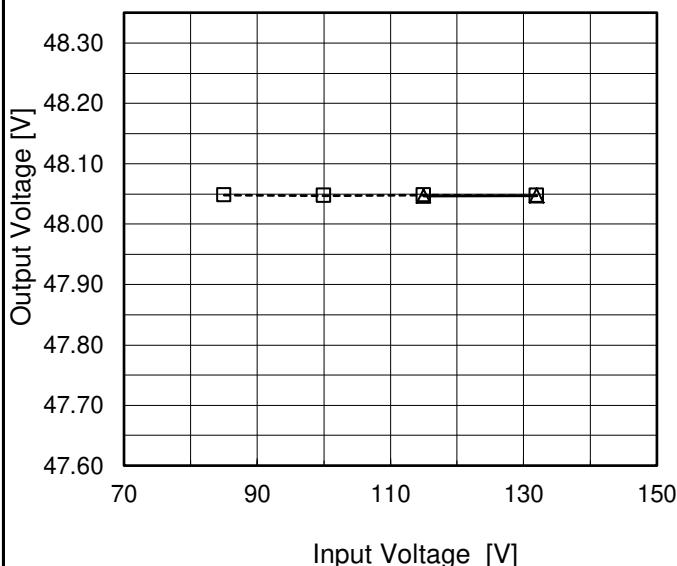
- - -□- - - Load 50%
———△——— Load 100%

2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	48.048	-
100	48.047	-
115	48.048	48.046
132	48.047	48.047
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA350H-48
Item	Load Regulation
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Symbol	Input Volt.	
—△—	Input Volt.	100V
---⊟---	Input Volt.	115V
—·—○—·—	Input Volt.	132V

2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
0.00	48.059	48.058	48.059
1.46	48.057	48.057	48.058
2.92	48.057	48.057	48.057
4.38	48.056	48.056	48.056
5.84	48.055	48.056	48.056
7.30	-	48.053	48.054
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Dynamic Load Response
Object	+48V7.3A

Temperature　　25°C
Testing Circuitry　Figure A

Input Volt.　　115 V
Cycle　　　　1000 ms

t1,t2 = 50 μs

Load Current

t1　　　　　　　　　　　t2
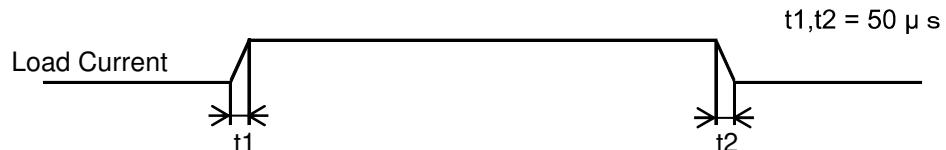
Min.Load (0A)←→
　Load 100% (7.3A)

500 mV/div

200 us/div　　　　　　4 ms/div
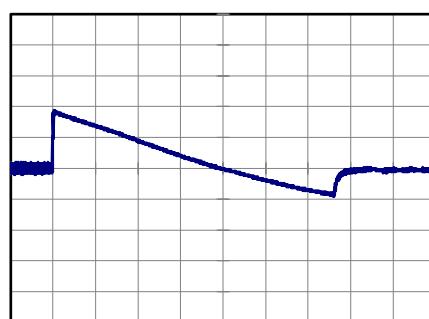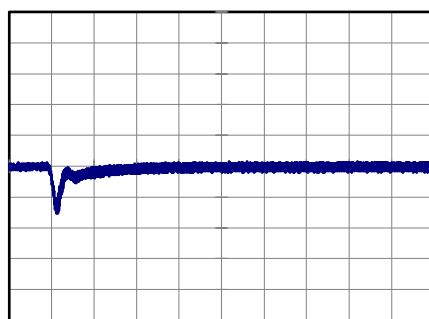
Min.Load (0A)←→
　Load 50% (3.65A)

500 mV/div

200 us/div　　　　　　4 ms/div
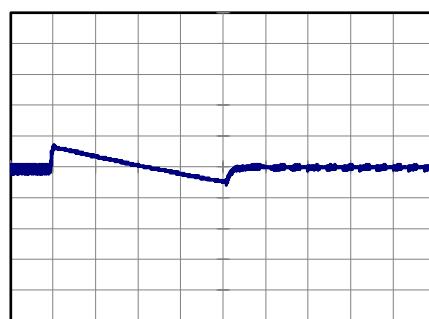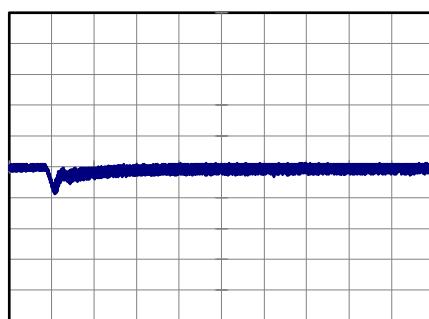
Load 50% (3.65A)←→
　Load 100% (7.3A)

500 mV/div

200 us/div　　　　　　4 ms/div

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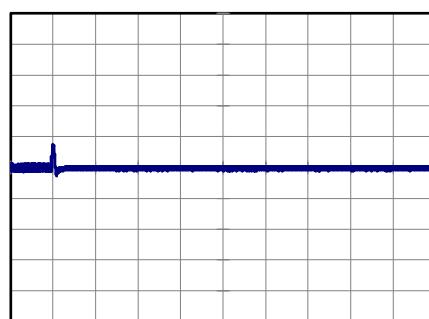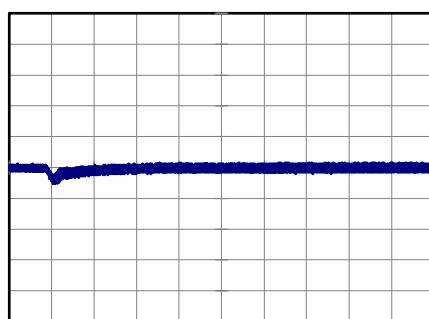
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Model	WMA350H-48
Item	Ripple Noise(by Load Current)
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure C

1.Graph

△ Input Volt. 100V
○ Input Volt. 132V
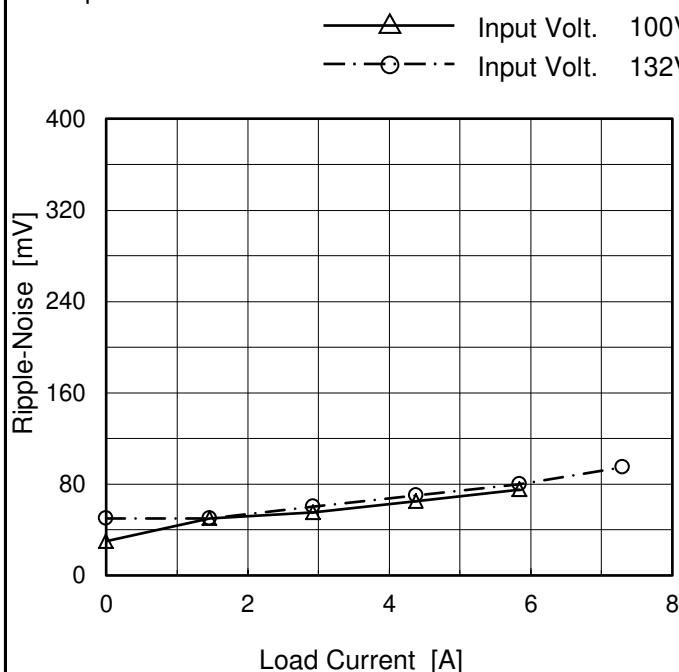
Load Current [A]

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

2.Values

Load Current [A]	Ripple Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 132 [V]
0.00	30	50
1.46	50	50
2.92	55	60
4.38	65	70
5.84	75	80
7.30	-	95
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

T1: Due to AC Input Line
T2: Due to Switching
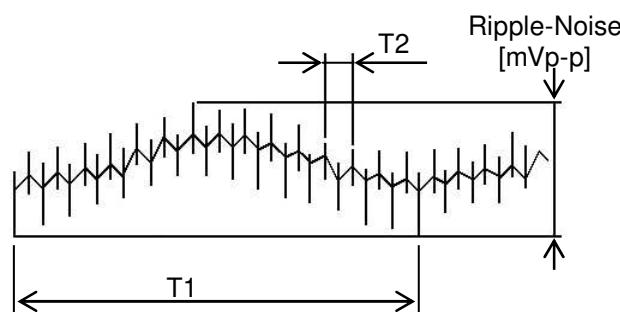
Fig. Complex Ripple Wave Form

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Model	WMA350H-48
Item	Ripple Noise (by Ambient Temp.)
Object	+48V7.3A
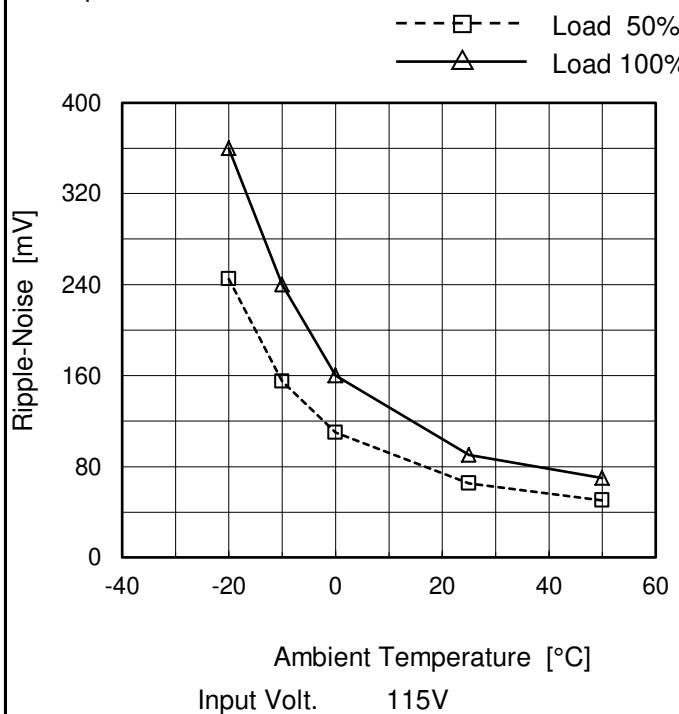
Testing Circuitry   Figure C

1.Graph

- - -□- - - Load 50%

───△─── Load 100%

Ambient Temperature [°C]

Input Volt.   115V

Measured by 20 MHz Oscilloscope.

2.Values

Ambient Temperature [°C]	Ripple Noise [mV]	
	Load 50%	Load 100%
-20	245	360
-10	155	240
0	110	160
25	65	90
50	50	70
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA350H-48

Item	Ambient Temperature Drift

Object	+48V7.3A

Testing Circuitry   Figure A

1.Graph

—△— Input Volt. 100V
---□--- Input Volt. 115V
—·—○—·— Input Volt. 132V
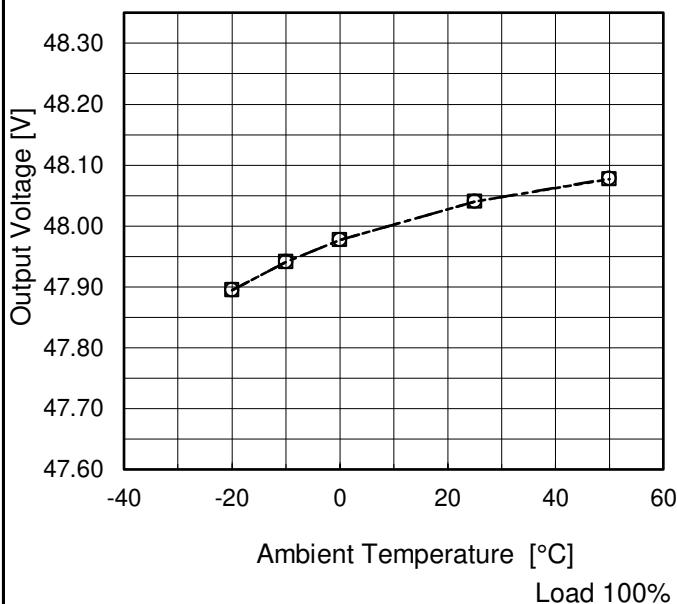
2.Values

Ambient Temperature [°C]

Load 100%

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
-20	-	47.895	47.895
-10	-	47.941	47.941
0	-	47.977	47.977
25	-	48.040	48.040
50	-	48.077	48.078
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48	
Item	Output Voltage Accuracy	Testing Circuitry Figure A
Object	+48V7.3A	

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   : -10 - 50°C
        Input Voltage : 100 - 132V
        Load Current   : 0 - 7.3A

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

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

2.Values

Item	Temperature [°C]	Input Voltage[V]	Output Current[A]	Output Voltage[V]	Output Voltage Accuracy Value [mV]	Output Voltage Accuracy Ratio [%]
Maximum Voltage	50	115	0	48.082	±71	±0.1
Minimum Voltage	-10	115	7.3	47.941		

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Model	WMA350H-48
Item	Time Lapse Drift
Object	+48V7.3A

Temperature	25°C
Testing Circuitry	Figure A

1.Graph

Output Voltage [V]

48.90
48.80
48.70
48.60
48.50
48.40
48.30
48.20

0   2   4   6   8   10

Time [H]

Input Volt.   115V
Load   100%
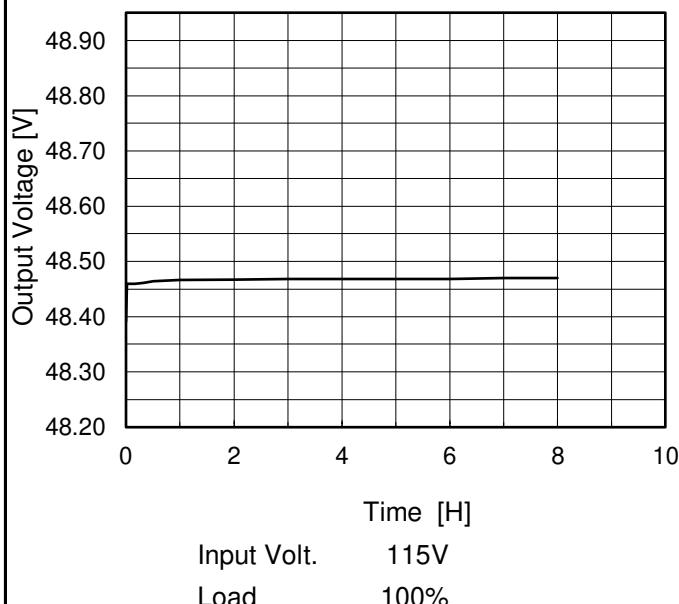
2.Values

Time since start [H]	Output Voltage [V]
0.0	48.391
0.5	48.464
1.0	48.466
2.0	48.467
3.0	48.468
4.0	48.468
5.0	48.468
6.0	48.468
7.0	48.470
8.0	48.470

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Model	WMA350H-48
Item	Rise and Fall Time
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Input Volt. 115 V

Load 50%

Output Volt.

[10V/div]

0

Load 100%

Output Volt.

[10V/div]

0

Input Volt. 0

[100V/div]

Time [200ms/div]

Time [20ms/div]
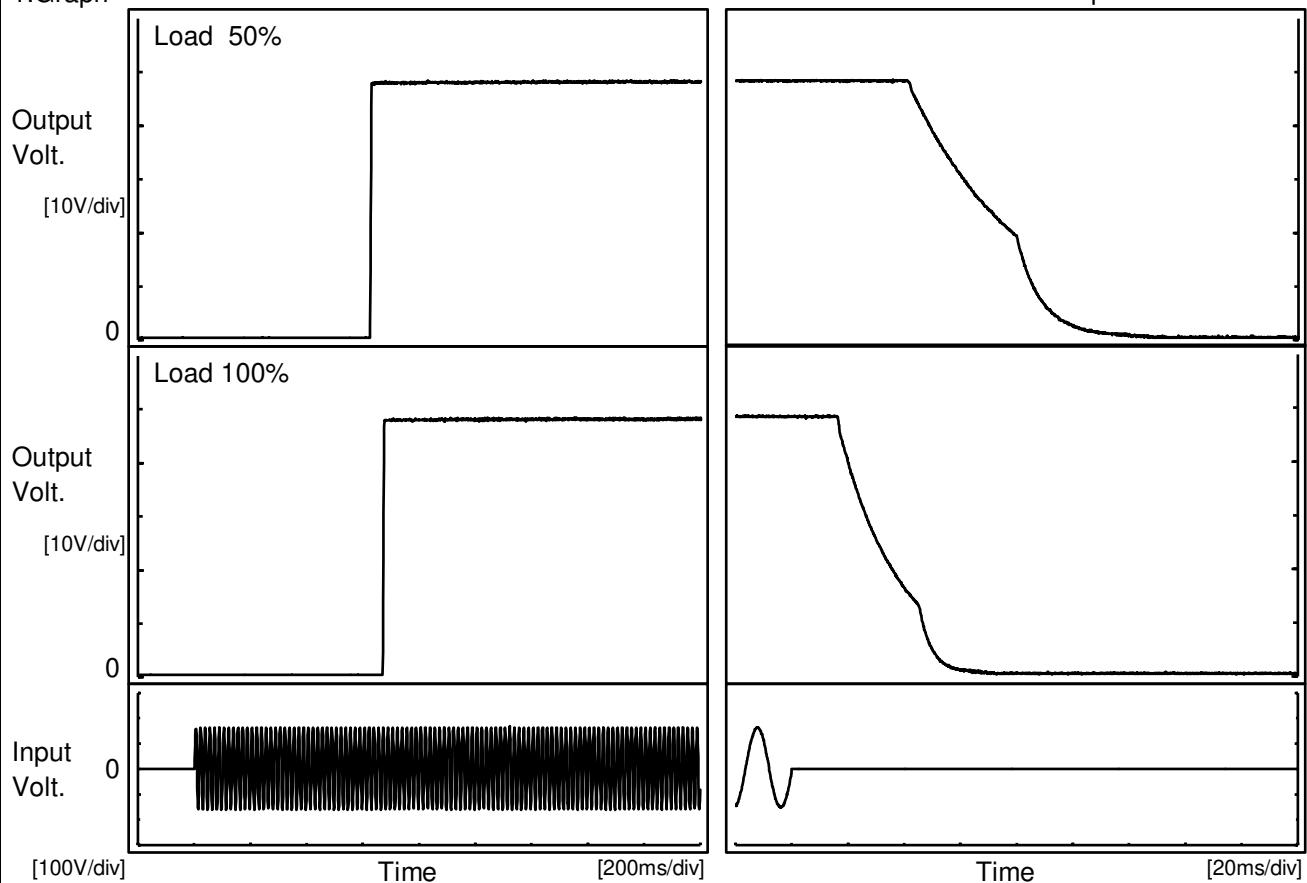
2.Values [ms]

Load	Time	Td	Tr	Ts	Th	Tf
50 %		626.0	4.0	630.0	45.1	47.1
100 %		670.0	4.0	674.0	17.9	31.7

Output Volt.

90%

10%

Input Volt.

Td | Tr

Ts

Th | Tf

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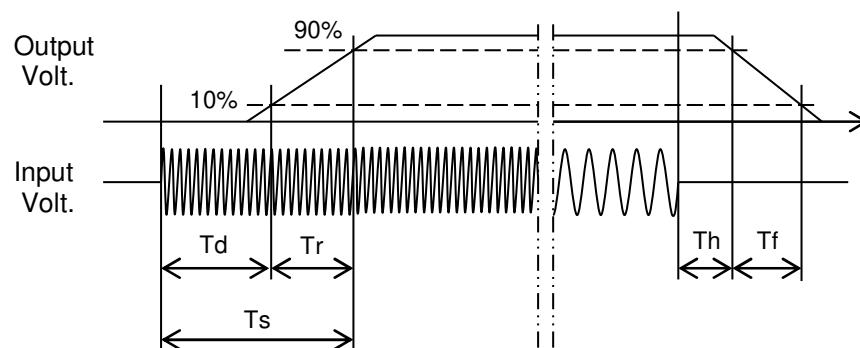
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Model	WMA350H-48
Item	Hold-Up Time
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

```
- - - ⊟ - - -   Load  50%
———— △ ————   Load 100%
```


2.Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
85	12	-
100	26	-
115	42	17
132	63	27
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
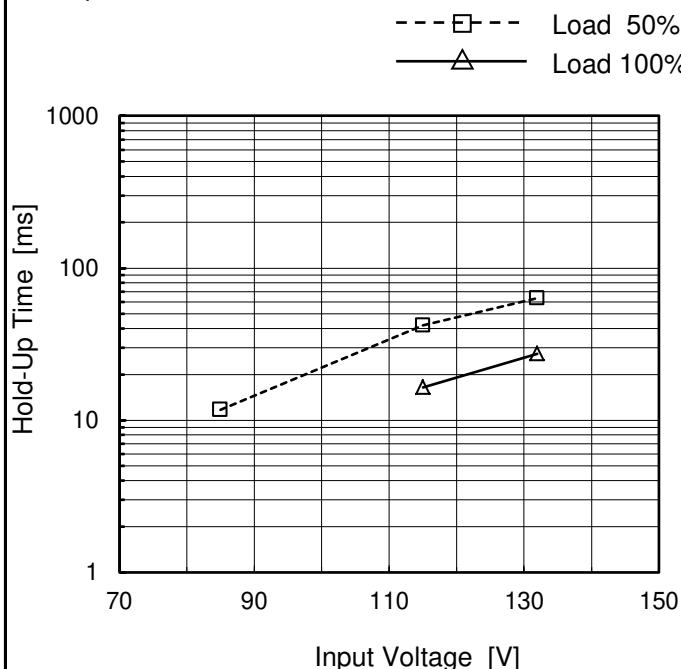
This duration covers from Shut-off of input
voltage to the moment when output voltage
descends to the rated range of voltage accuracy.

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Model	WMA350H-48
Item	Instantaneous Interruption Compensation
Object	+48V7.3A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph   —△— Input Volt.   100V
    ---⊟--- Input Volt.   115V
    —·—○—·— Input Volt.   132V

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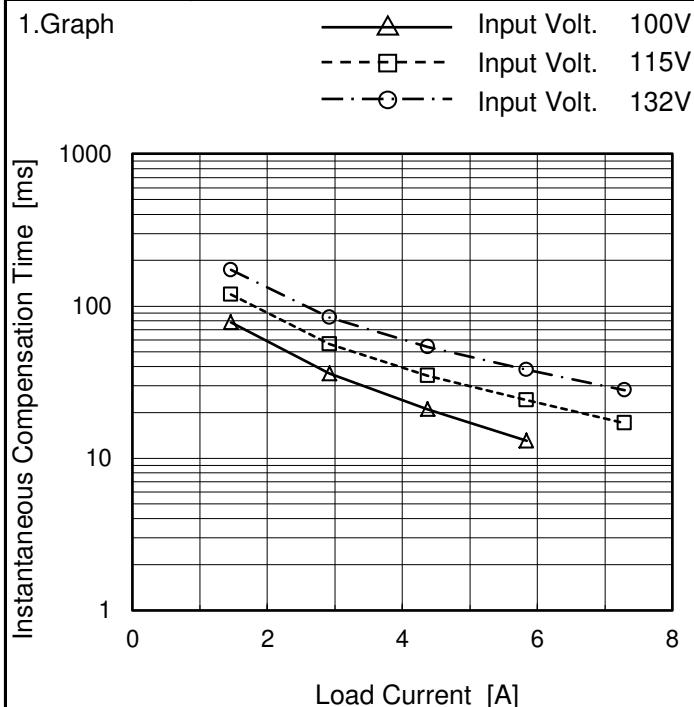
2.Values

Load Current [A]	Time [ms]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
0.00	-	-	-
1.46	78	119	173
2.92	36	56	84
4.38	21	35	54
5.84	13	24	38
7.30	-	17	28
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+48V7.3A

Testing Circuitry   Figure A

1.Graph

--□-- Load 50%
—△— Load 100%
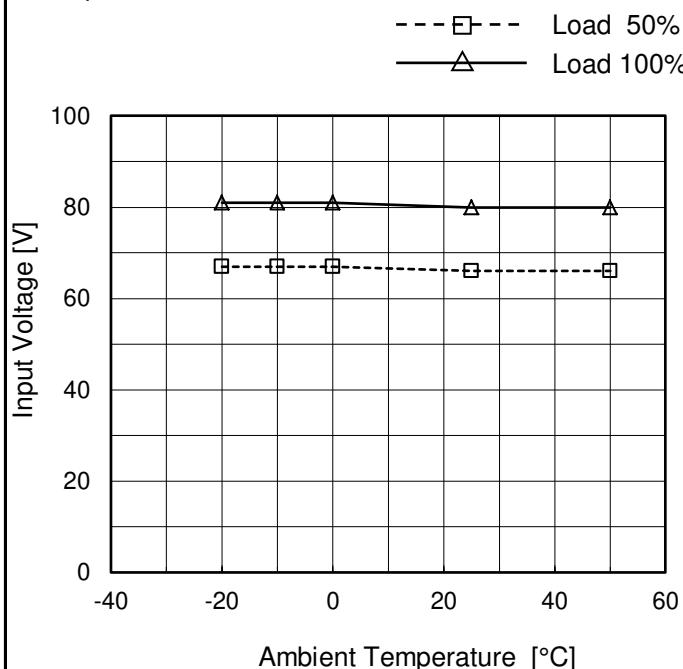
Input Voltage [V] vs Ambient Temperature [°C]

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-20	67	81
-10	67	81
0	67	81
25	66	80
50	66	80
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Model	WMA350H-48
Item	Overcurrent Protection
Object	+48V7.3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Input Volt. 100V
Input Volt. 115V
Input Volt. 132V
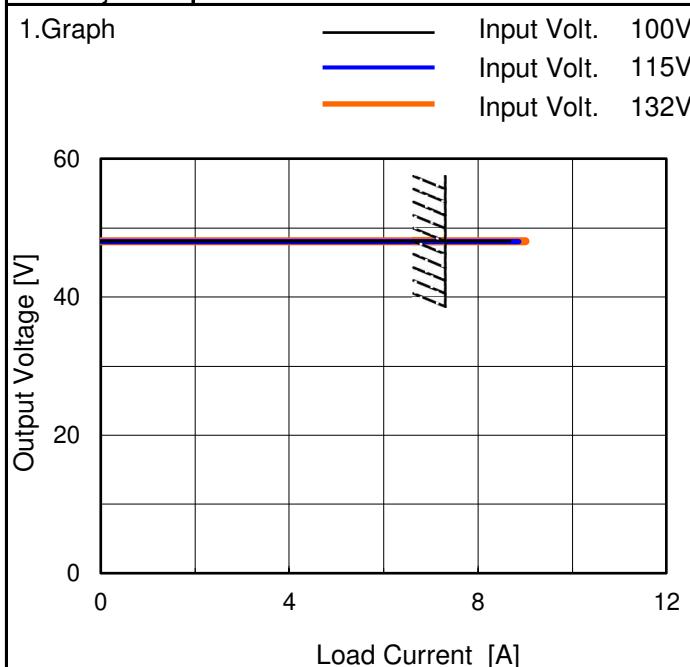
2.Values

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

Output Voltage [V]	Load Current [A]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 132[V]
48	8.68	8.87	9.01
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	WMA350H-48
Item	Overvoltage Protection
Object	+48V7.3A

Testing Circuitry   Figure A

1.Graph

2.Values

Input Volt.   85V
Input Volt.   132V

Operating Point [V]

Ambient Temperature [°C]

Load 0%

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 85[V]	Input Volt. 132[V]
-20	59.64	59.70
-10	59.04	58.98
0	59.34	59.57
25	59.63	59.74
50	60.40	60.39
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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Temperature Chamber

AC Power Supply

Electronic Switch

Power Meter

Power Supply

Electronic DC Load

Oscilloscop

Relay Unit

DVM

Data Acquisition/Control Unit

Figure A

AC Input Line

AC Voltmeter

Power Supply

Load

FG

1kΩ±1.0%

10kΩ±1.0%

0.015μF±2.0%

Effective value

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter [V]}}{1k\ [\Omega]}$$

Figure B (IEC60601-1)

Temperature Chamber

Measuring board

AC Power Supply

Power Meter

Power Supply

C1

C2

Electronic DC Load

Oscilloscope

BW:20MHz

150mm

(Ceramic capacitor)

C1= 0.1 μF

(Electrolytic capacitor)

C2= 47 μF

Figure C

BC-11512