

TEST DATA OF TUHS25F24

Regulated DC Power Supply
February 28, 2014

Approved by : Nobuyuki Shiraishi
Nobuyuki Shiraishi Design Manager

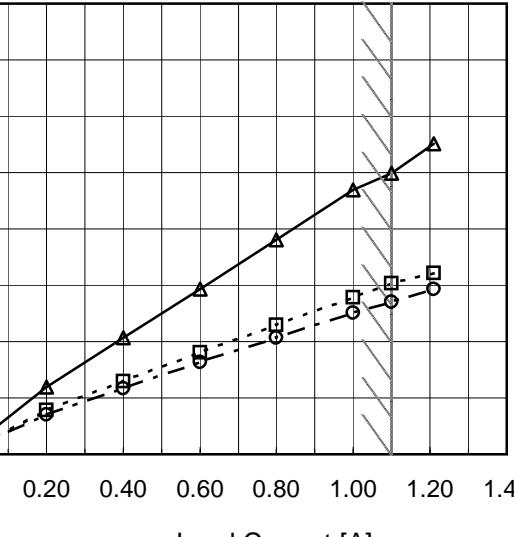
Prepared by : Sakae Minamide
Sakae Minamide Design Engineer

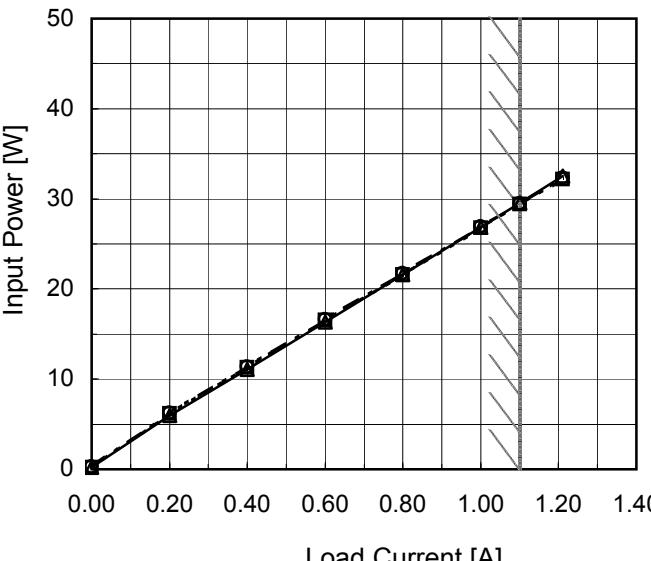
COSEL CO.,LTD.

CONTENTS

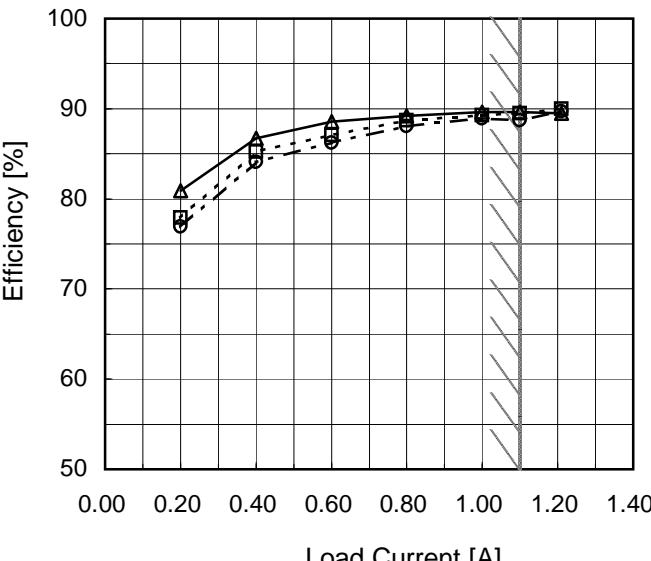
1.Input Current (by Load Current)	1
2.Input Power (by Load Current)	2
3.Efficiency (by Input Voltage)	3
4.Efficiency (by Load Current)	4
5.Power Factor (by Input Voltage)	5
6.Power Factor (by Load Current)	6
7.Inrush Current	7
8.Leakage Current	8
9.Line Regulation	9
10.Load Regulation	10
11.Dynamic Load Response	11
12.Ripple Voltage (by Load Current)	12
13.Ripple-Noise	13
14.Ripple Voltage (by Ambient Temperature)	14
15.Ambient Temperature Drift	15
16.Output Voltage Accuracy	16
17.Time Lapse Drift	17
18.Rise and Fall Time	18
19.Hold-Up Time	19
20.Instantaneous Interruption Compensation	20
21.Minimum Input Voltage for Regulated Output Voltage	21
22.Overcurrent Protection	22
23.Oversupply Protection	23
24.Figure of Testing Circuitry	24

(Final Page 25)

Model	TUHS25F24																																																					
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1. Graph <div style="text-align: center; margin-top: 10px;"> Input Volt. 100V Input Volt. 200V Input Volt. 230V </div>  <p>Note: Slanted line shows the range of the rated load current.</p>																																																						
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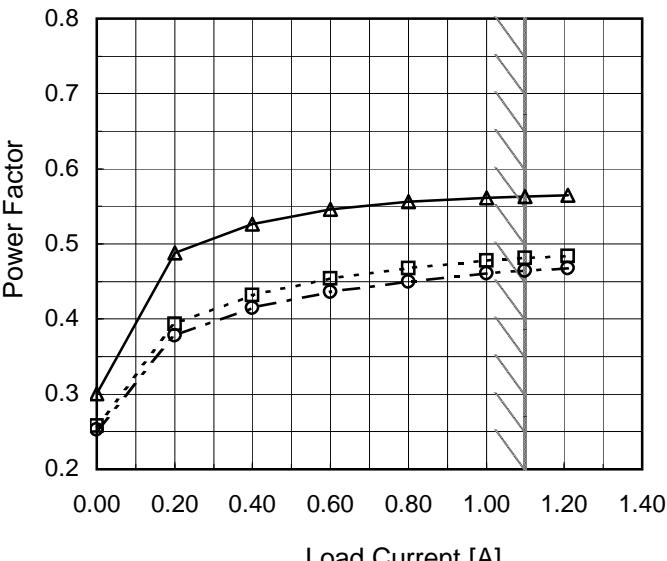
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<p>The graph plots Efficiency [%] on the y-axis (50 to 100) against Input Voltage [V] on the x-axis (50 to 300). Two data series are shown: Load 50% (dashed line with square markers) and Load 100% (solid line with triangle markers). Both series show a slight decrease in efficiency as input voltage increases. A slanted line on the graph indicates the rated input voltage range.</p> <table border="1"> <thead> <tr> <th>Input Voltage [V]</th> <th>Efficiency Load 50% [%]</th> <th>Efficiency Load 100% [%]</th> </tr> </thead> <tbody> <tr><td>75</td><td>88.1</td><td>88.2</td></tr> <tr><td>85</td><td>88.2</td><td>89.0</td></tr> <tr><td>100</td><td>88.2</td><td>89.6</td></tr> <tr><td>120</td><td>87.9</td><td>89.9</td></tr> <tr><td>200</td><td>86.2</td><td>89.5</td></tr> <tr><td>230</td><td>85.8</td><td>89.1</td></tr> <tr><td>264</td><td>84.6</td><td>88.7</td></tr> <tr><td>280</td><td>84.3</td><td>88.7</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>			Input Voltage [V]	Efficiency Load 50% [%]	Efficiency Load 100% [%]	75	88.1	88.2	85	88.2	89.0	100	88.2	89.6	120	87.9	89.9	200	86.2	89.5	230	85.8	89.1	264	84.6	88.7	280	84.3	88.7	--	-	-		
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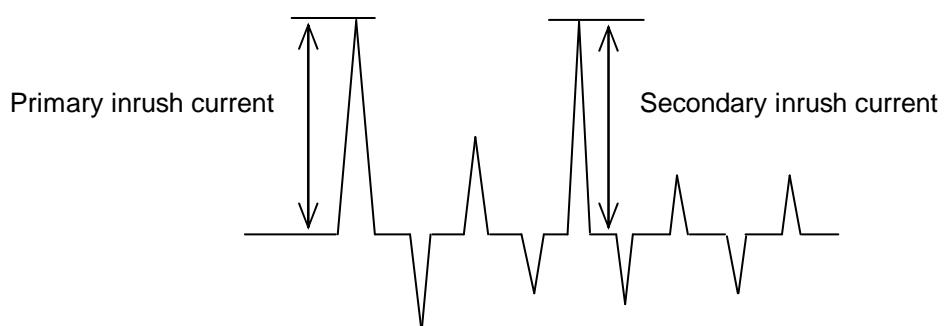
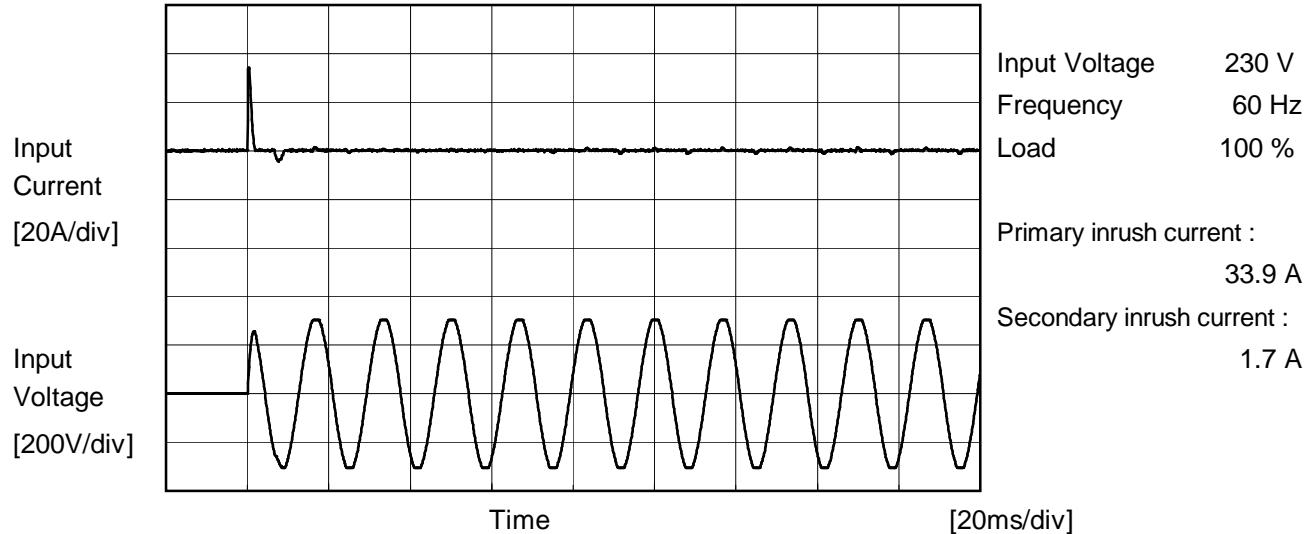
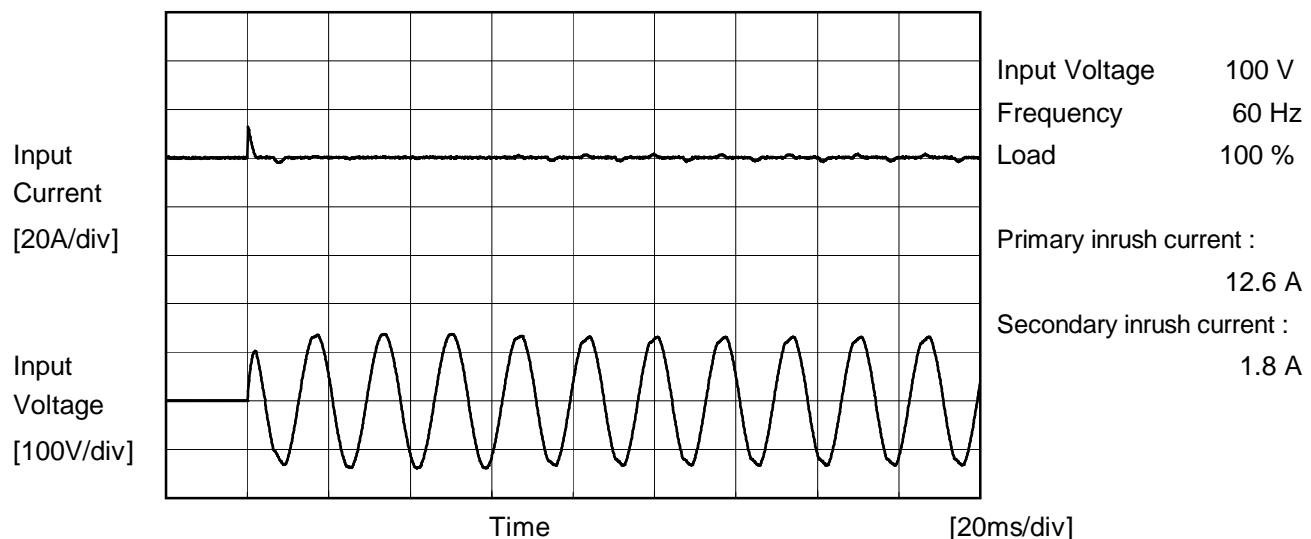
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COSEL

Model	TUHS25F24	Temperature Testing Circuitry 25°C Figure A
Item	Inrush Current	
Object	_____	





Model	TUHS25F24	Temperature Testing Circuitry	25°C Figure B
Item	Leakage Current		
Object	<hr/>		

1. Results

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.008	0.009	0.010	Operation
	One of phases	0.008	0.017	0.020	Stand by
IEC60950-1	Both phases	0.006	0.011	0.014	Operation
	One of phases	0.008	0.016	0.020	Stand by

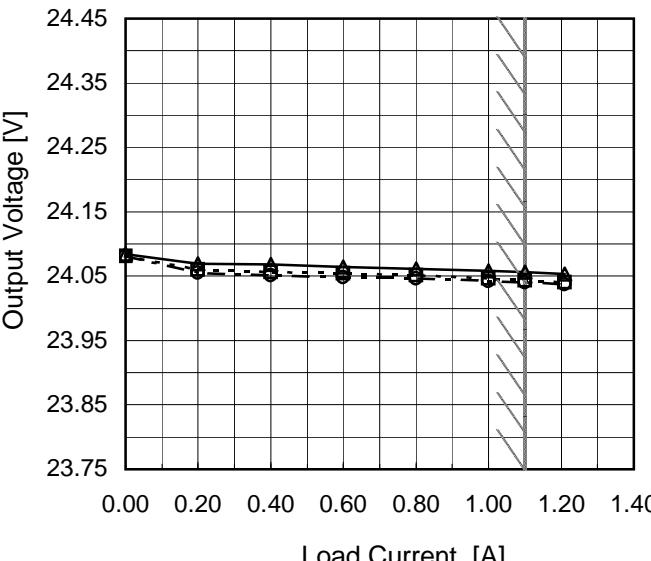
The value for "One of phases" is the reference value only.

2. Condition

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

There is no FG in TUHS series and it is a reinforced insulation power supply of the class 2.

Model	TUHS25F24																																	
Item	Line Regulation	Temperature Testing Circuitry 25°C Figure A																																
Object	+24V1.1A																																	
1.Graph																																		
<p>Output Voltage [V]</p> <p>Input Voltage [V]</p> <p>Legend: - - - □ - - - Load 50% — △ — Load 100%</p>																																		
Note: Slanted line shows the range of the rated input voltage.																																		
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Object	+24V1.1A																																																						
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COSEL

Model	TUHS25F24	Temperature	25°C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+24V 1.1A		

Input Volt. 230V
Cycle 500ms

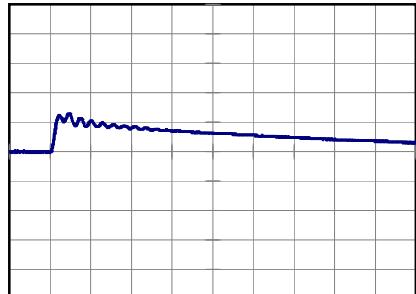
Load Current
1.1A / 100us

Min.Load (0A)↔
Load 100%(1.1A)

1 V/div



200 us/div



200 us/div

Load 20% (0.22A)↔
Load 100%(1.1A)

1 V/div



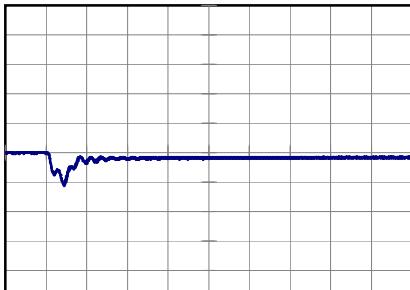
200 us/div



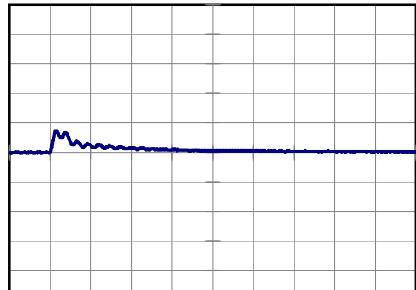
200 us/div

Load 50% (0.55A)↔
Load 100% (1.1A)

1 V/div



200 us/div



200 us/div

Model	TUHS25F24																																							
Item	Ripple Voltage (by Load Current)	Temperature 25°C Testing Circuitry Figure C																																						
Object	+24V1.1A																																							
1.Graph																																								
<p>Graph showing Ripple Voltage [mV] vs Load Current [A]. The Y-axis ranges from 0 to 400 mV, and the X-axis ranges from 0.00 to 1.40 A. Two curves are plotted: Input Volt. 100V (solid line with open circles) and Input Volt. 230V (dashed line with open circles). Both curves remain low until approximately 0.8A, then rise sharply after 1.0A, indicated by a slanted line.</p>																																								
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<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="2">Ripple Voltage [mV]</th> </tr> <tr> <th>Input Volt. 100 [V]</th> <th>Input Volt. 230 [V]</th> </tr> </thead> <tbody> <tr> <td>0.00</td><td>115</td><td>210</td></tr> <tr> <td>0.20</td><td>10</td><td>20</td></tr> <tr> <td>0.40</td><td>10</td><td>20</td></tr> <tr> <td>0.60</td><td>10</td><td>20</td></tr> <tr> <td>0.80</td><td>15</td><td>20</td></tr> <tr> <td>1.00</td><td>15</td><td>20</td></tr> <tr> <td>1.10</td><td>15</td><td>20</td></tr> <tr> <td>1.21</td><td>15</td><td>20</td></tr> <tr> <td>--</td><td>-</td><td>-</td></tr> <tr> <td>--</td><td>-</td><td>-</td></tr> <tr> <td>--</td><td>-</td><td>-</td></tr> </tbody> </table>			Load Current [A]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	115	210	0.20	10	20	0.40	10	20	0.60	10	20	0.80	15	20	1.00	15	20	1.10	15	20	1.21	15	20	--	-	-	--	-	-	--	-	-
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<p>Measured by 100 MHz Oscilloscope. Ripple Voltage is shown as p-p in the figure below. Note: Slanted line shows the range of the rated load current.</p> <p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Fig. Complex Ripple Wave Form</p>																																								

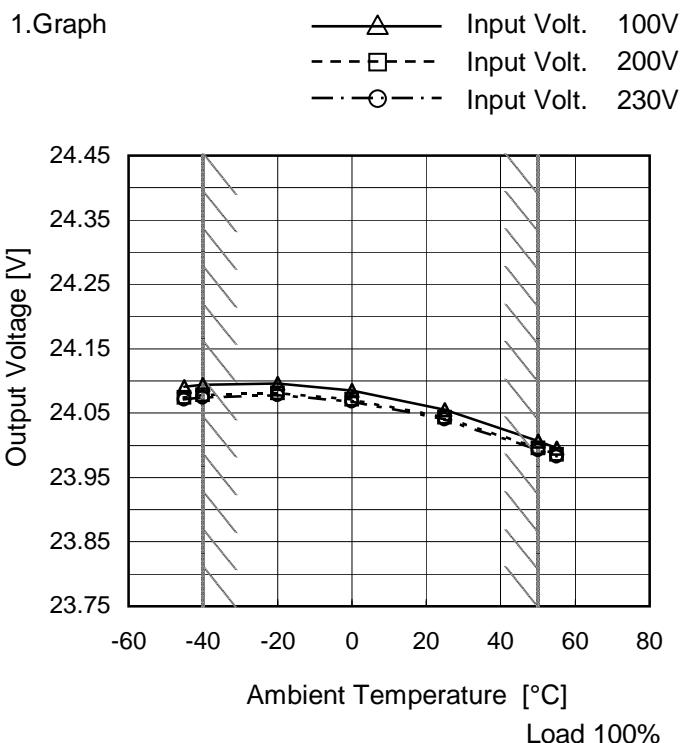
Model	TUHS25F24																																						
Item	Ripple-Noise	Temperature Testing Circuitry 25°C Figure C																																					
Object	+24V1.1A																																						
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Model	TUHS25F24	Testing Circuitry Figure C																																			
Item	Ripple Voltage (by Ambient Temp.)																																				
Object	+24V1.1A																																				
1.Graph		2.Values																																			
<p>Graph showing Ripple Voltage [mV] vs Ambient Temperature [°C] for TUHS25F24 at +24V1.1A load. The graph shows two sets of data points: Input Volt. 100V (represented by squares) and Input Volt. 200V (represented by triangles). A horizontal dashed line at approximately 20 mV indicates the ripple voltage range. A vertical slanted line marks the rated ambient temperature range from -40°C to 60°C.</p> <table border="1"> <thead> <tr> <th>Ambient Temperature [°C]</th> <th>Ripple Voltage [mV] (Input Volt. 100V)</th> <th>Ripple Voltage [mV] (Input Volt. 230V)</th> </tr> </thead> <tbody> <tr><td>-45</td><td>25</td><td>25</td></tr> <tr><td>-40</td><td>25</td><td>25</td></tr> <tr><td>-20</td><td>15</td><td>20</td></tr> <tr><td>0</td><td>15</td><td>20</td></tr> <tr><td>25</td><td>15</td><td>20</td></tr> <tr><td>50</td><td>10</td><td>20</td></tr> <tr><td>55</td><td>10</td><td>20</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 230V)	-45	25	25	-40	25	25	-20	15	20	0	15	20	25	15	20	50	10	20	55	10	20	--	-	-	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 230V)																																			
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<p>Measured by 100 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.</p>																																					

Model TUHS25F24

Item Ambient Temperature Drift

Object +24V1.1A



Testing Circuitry Figure A

2. Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-45	24.091	24.074	24.071
-40	24.094	24.078	24.074
-20	24.097	24.081	24.078
0	24.085	24.072	24.068
25	24.056	24.044	24.040
50	24.006	23.996	23.992
55	23.996	23.986	23.982
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

Note: Slanted line shows the range of the rated ambient temperature.



Model	TUHS25F24	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+24V1.1A	

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 : -40 - 50°C

Input Voltage : 85 - 264V

Load Current : 0 - 1.1A

* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

$$\text{* Output Voltage Accuracy (Ration)} = \frac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}} \times 100$$

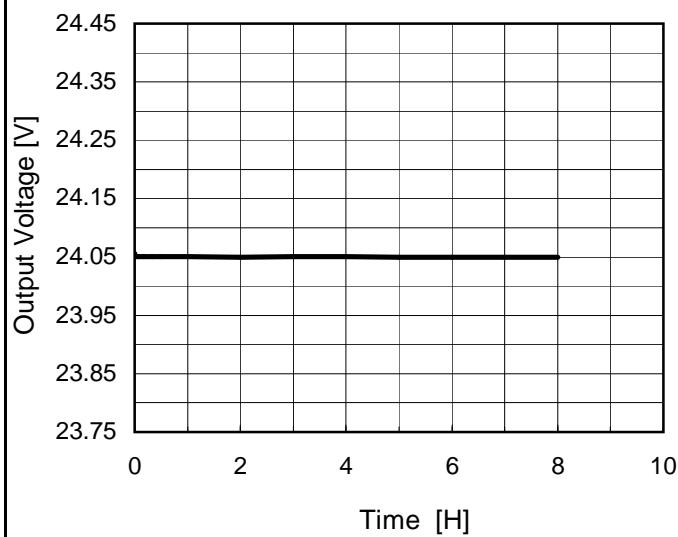
2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-20	264	0	24.116	±63	±0.3
Minimum Voltage	50	264	1.1	23.990		

COSSEL

Model	TUHS25F24
Item	Time Lapse Drift
Object	+24V1.1A

1.Graph



2.Values

Time since start [H]	Output Voltage [V]
0.0	24.056
0.5	24.050
1.0	24.050
2.0	24.050
3.0	24.050
4.0	24.050
5.0	24.050
6.0	24.050
7.0	24.050
8.0	24.050

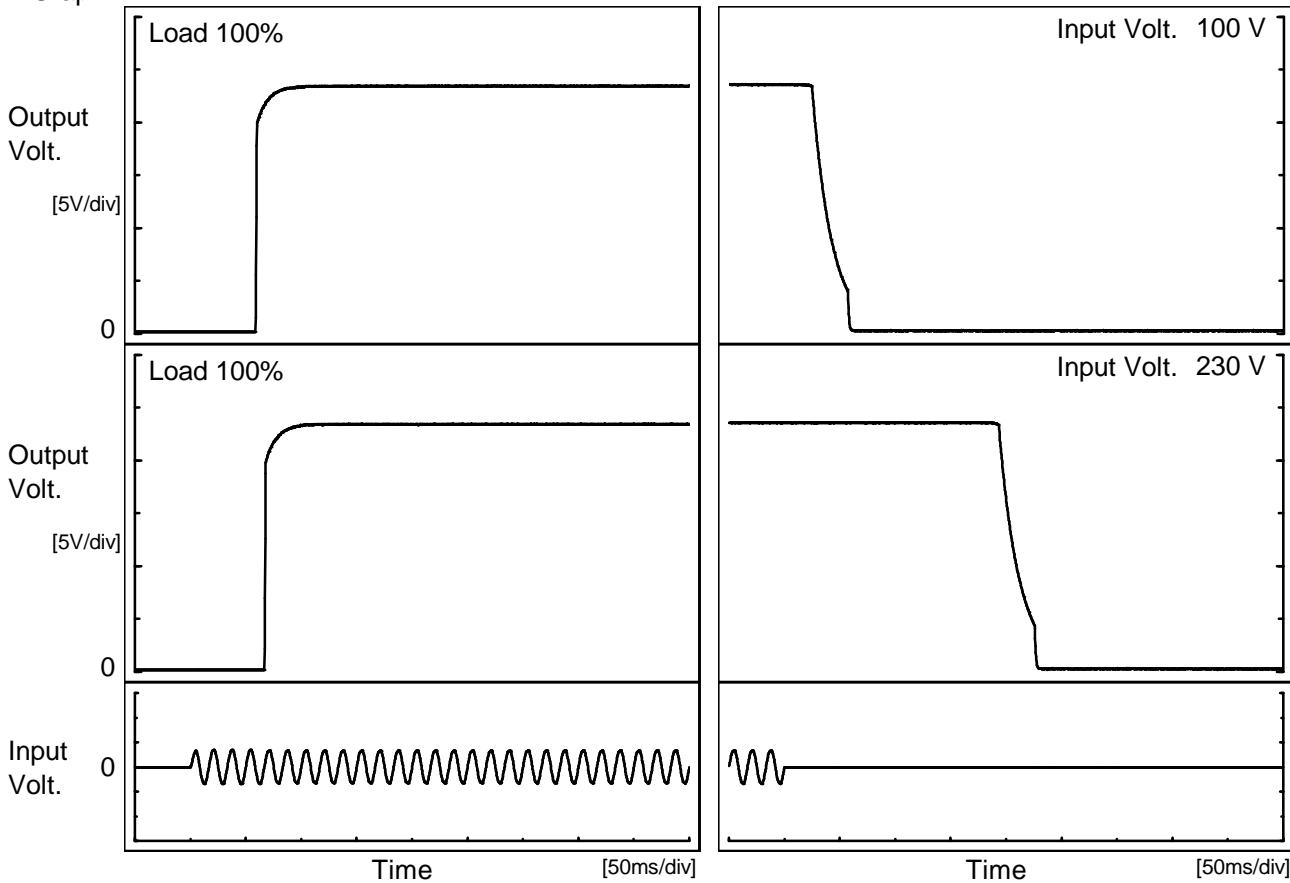
* The characteristic of AC230V is equal.

COSEL

Model	TUHS25F24
Item	Rise and Fall Time
Object	+24V1.1A

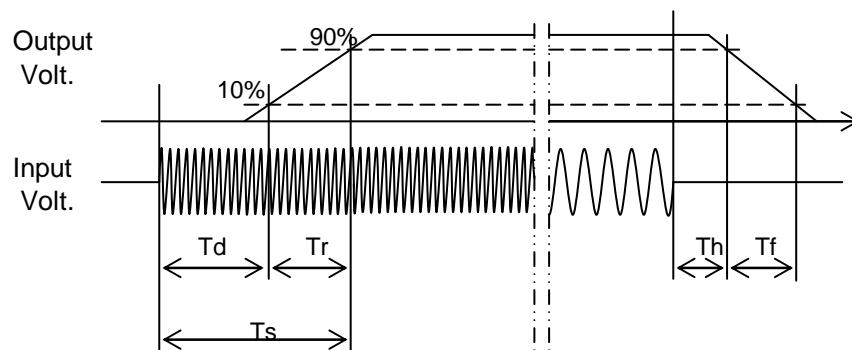
Temperature 25°C
Testing Circuitry Figure A

1. Graph



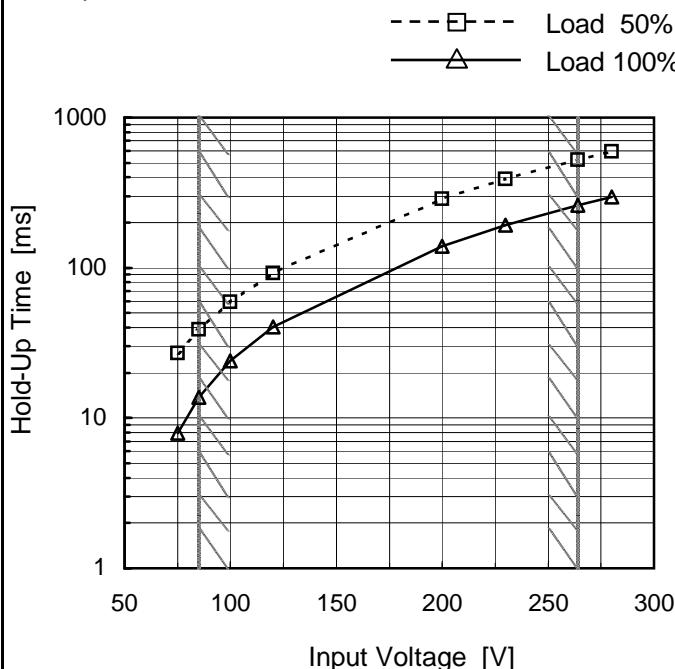
2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf	[ms]
100 V		59.3	8.3	67.6	23.5	31.5	
230 V		67.3	8.3	75.6	191.5	31.8	



Model	TUHS25F24
Item	Hold-Up Time
Object	+24V1.1A

1. Graph



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

Temperature 25°C
Testing Circuitry Figure A

2. Values

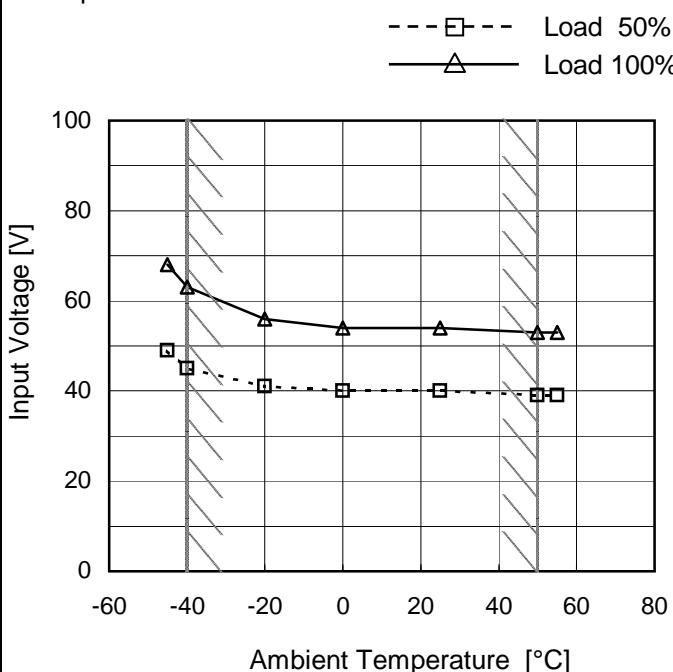
Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
75	27	8
85	39	14
100	59	24
120	92	40
200	288	140
230	389	192
264	523	260
280	593	296
--	-	-

Model	TUHS25F24	Temperature Testing Circuitry 25°C Figure A																																																		
Item	Instantaneous Interruption Compensation																																																			
Object	+24V1.1A																																																			
1.Graph	<p>Graph showing Instantaneous Compensation Time [ms] vs Load Current [A]. The Y-axis is logarithmic from 1 to 1000 ms. The X-axis ranges from 0.00 to 1.40 A. Three curves are plotted for Input Volt. 100V (triangles), Input Volt. 200V (squares), and Input Volt. 230V (circles). A slanted line indicates the rated load current range.</p> <table border="1"> <thead> <tr> <th>Load Current [A]</th> <th>Input Volt. 100V [ms]</th> <th>Input Volt. 200V [ms]</th> <th>Input Volt. 230V [ms]</th> </tr> </thead> <tbody> <tr><td>0.20</td><td>~80</td><td>~250</td><td>~450</td></tr> <tr><td>0.40</td><td>~60</td><td>~180</td><td>~320</td></tr> <tr><td>0.60</td><td>~45</td><td>~120</td><td>~220</td></tr> <tr><td>0.80</td><td>~35</td><td>~100</td><td>~180</td></tr> <tr><td>1.00</td><td>~25</td><td>~80</td><td>~150</td></tr> <tr><td>1.20</td><td>~20</td><td>~60</td><td>~120</td></tr> </tbody> </table>	Load Current [A]	Input Volt. 100V [ms]	Input Volt. 200V [ms]	Input Volt. 230V [ms]	0.20	~80	~250	~450	0.40	~60	~180	~320	0.60	~45	~120	~220	0.80	~35	~100	~180	1.00	~25	~80	~150	1.20	~20	~60	~120																							
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Note:	Slanted line shows the range of the rated load current.																																																			

Model	TUHS25F24
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+24V1.1A

Testing Circuitry Figure A

1. Graph



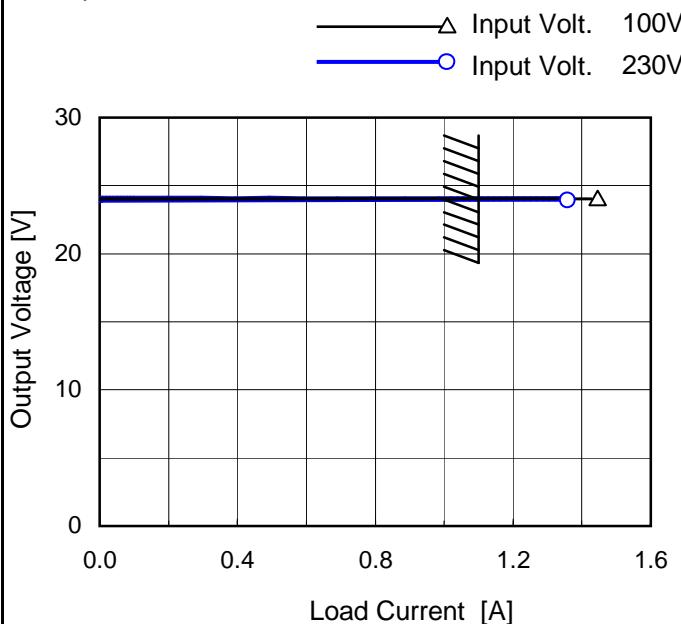
2. Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-45	49	68
-40	45	63
-20	41	56
0	40	54
25	40	54
50	39	53
55	39	53
--	-	-
--	-	-
--	-	-
--	-	-

Note: Slanted line shows the range of the rated ambient temperature.

Model	TUHS25F24
Item	Overcurrent Protection
Object	+24V1.1A

1. Graph



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

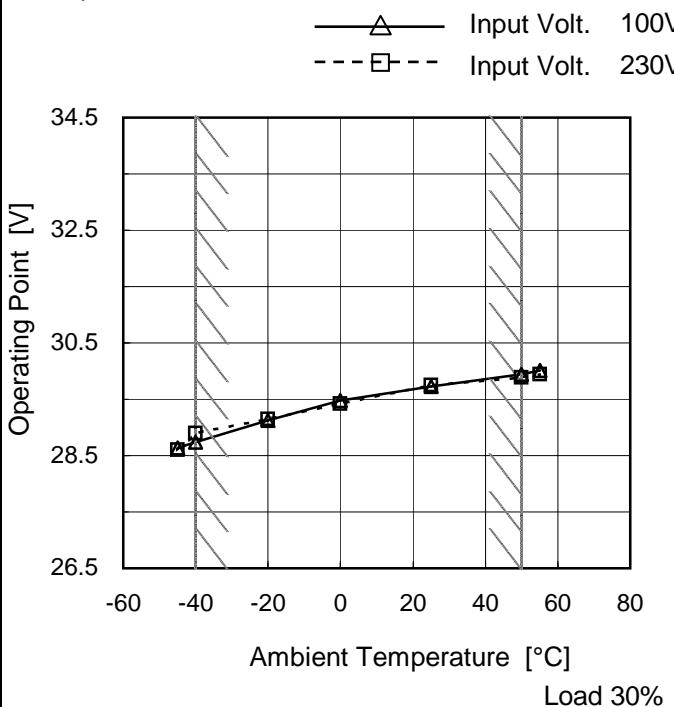
Temperature 25°C
Testing Circuitry Figure A

2. Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
24	1.43	1.34
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Model	TUHS25F24
Item	Overvoltage Protection
Object	+24V1.1A

1. Graph



Note: Slanted line shows the range of the rated ambient temperature.

Testing Circuitry Figure A

2. Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-45	28.64	28.60
-40	28.74	28.90
-20	29.12	29.15
0	29.48	29.42
25	29.73	29.75
50	29.94	29.89
55	30.01	29.94
--	-	-
--	-	-
--	-	-
--	-	-

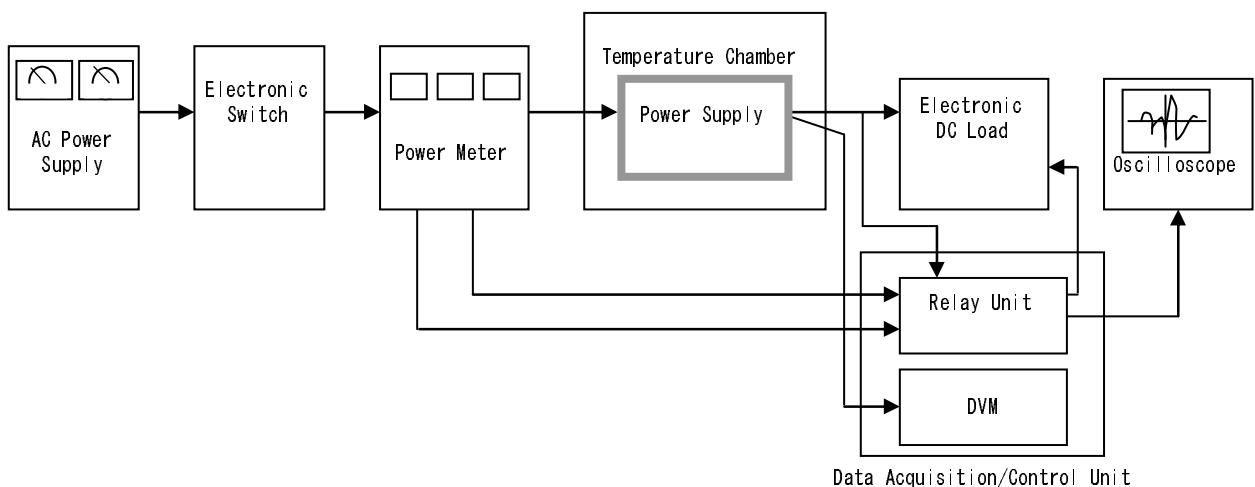


Figure A

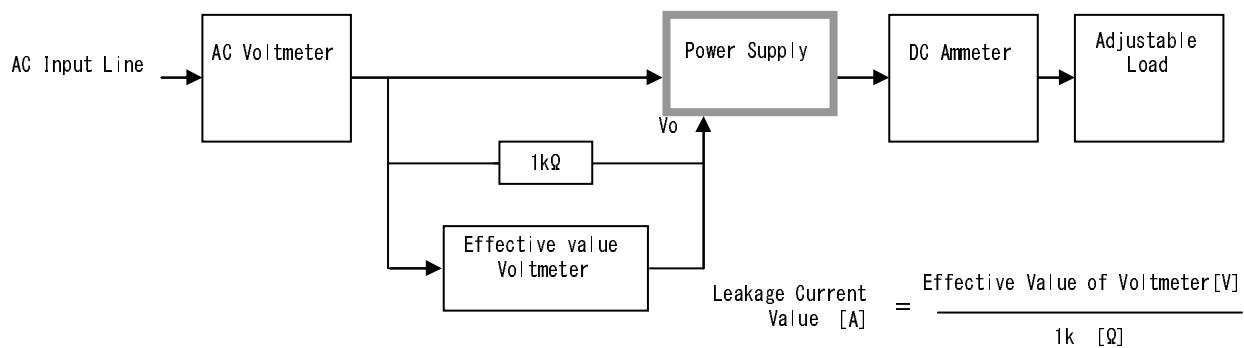


Figure B (DEN-AN)

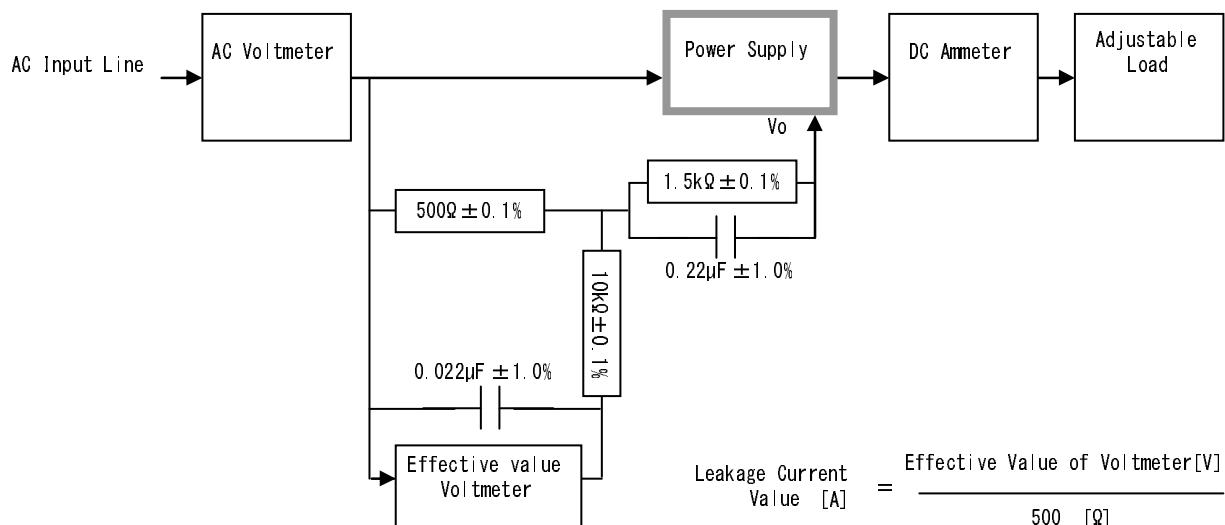


Figure B (IEC60950-1)

COSEL

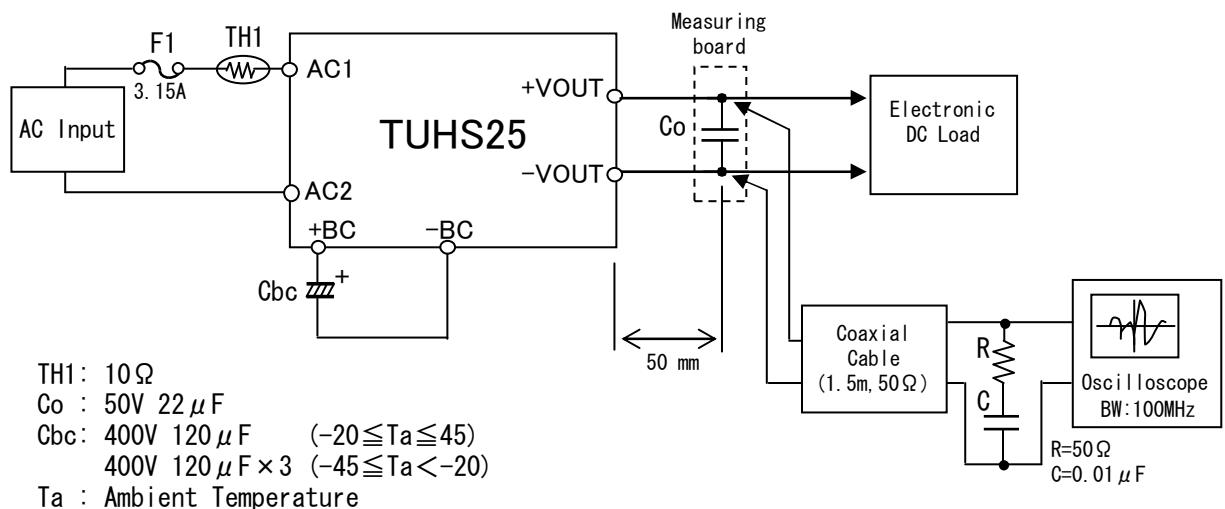


Figure C