

TEST DATA OF TUHS25F12

Regulated DC Power Supply
February 28, 2014

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Nobuyuki Shiraishi Design Manager

Prepared by : Sakae Minamide
Sakae Minamide Design Engineer

COSEL CO.,LTD.

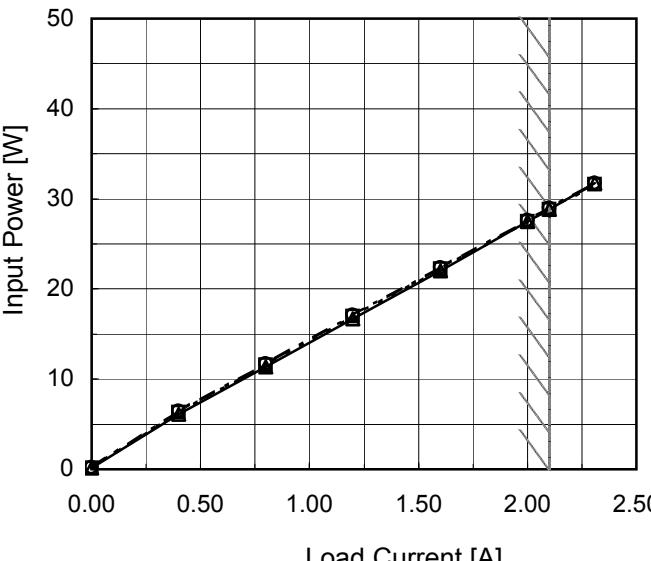
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Model	TUHS25F12	Temperature Testing Circuitry 25°C Figure A																																																					
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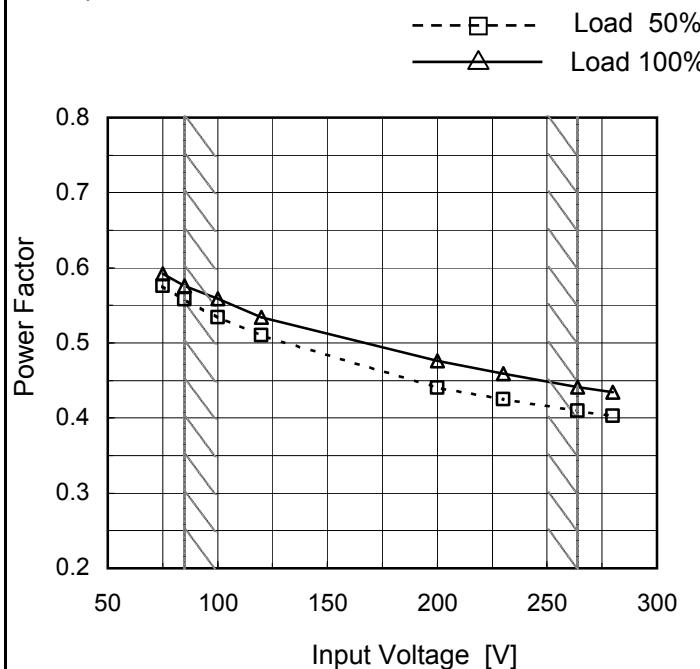
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1. Graph



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Temperature 25°C
Testing Circuitry Figure A

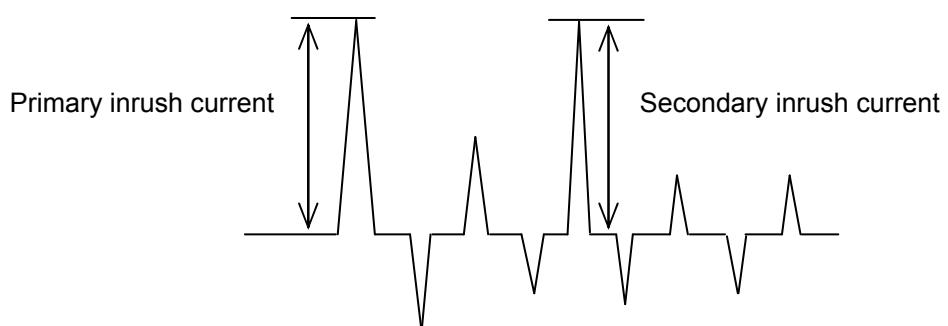
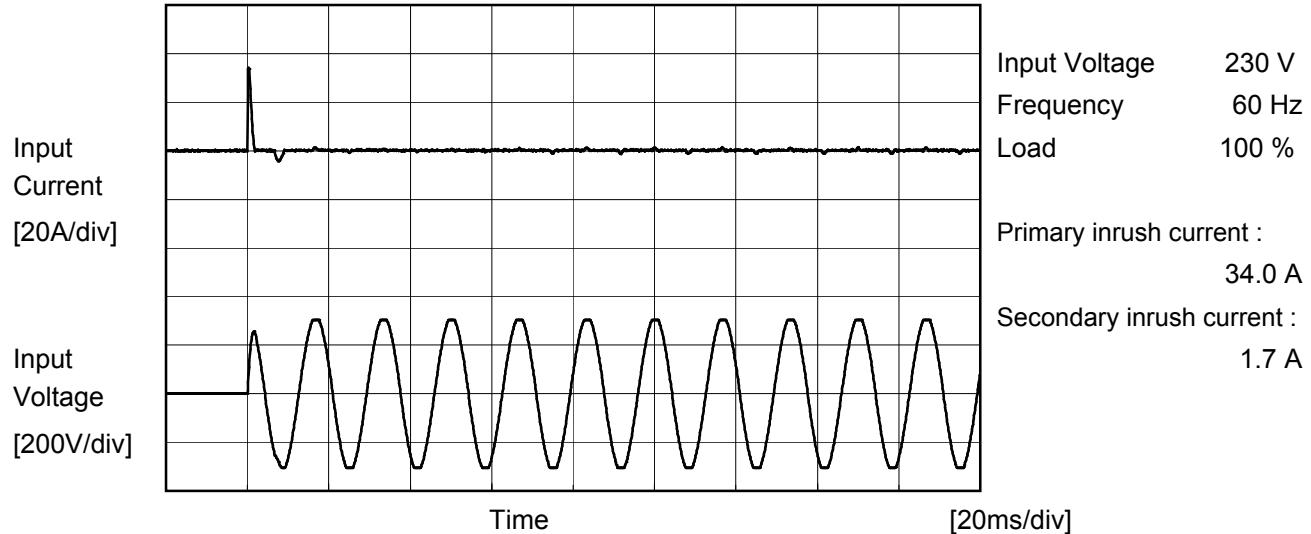
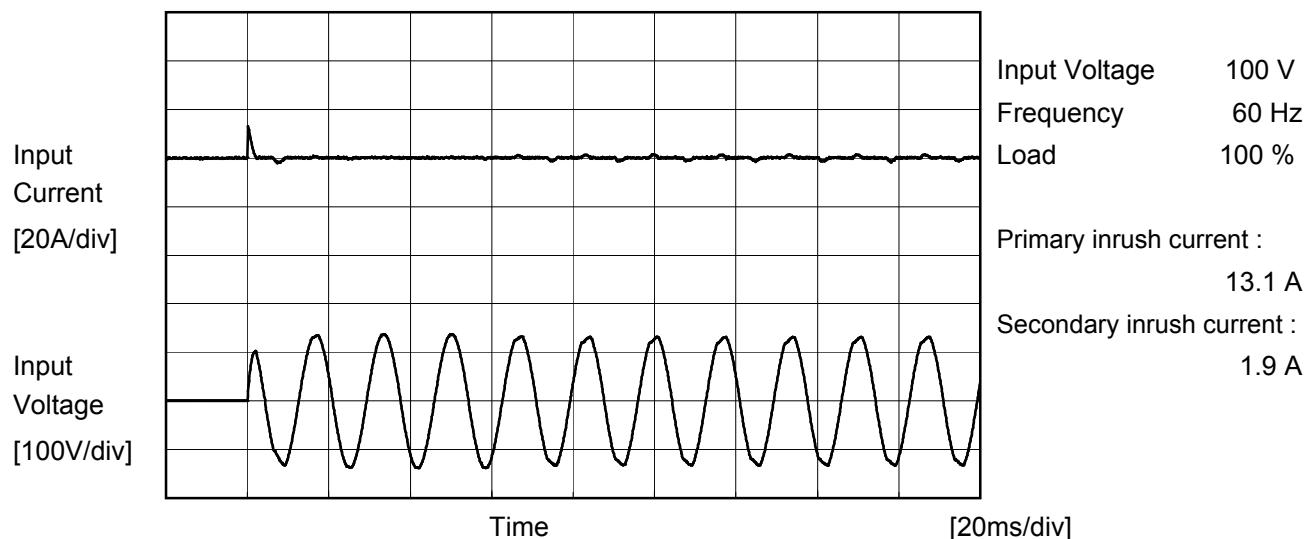
2. Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
75	0.576	0.592
85	0.558	0.576
100	0.534	0.559
120	0.510	0.534
200	0.440	0.476
230	0.425	0.459
264	0.409	0.441
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1.20	0.544	0.452	0.435																																																			
1.60	0.553	0.466	0.449																																																			
2.00	0.559	0.475	0.458																																																			
2.10	0.559	0.476	0.459																																																			
2.31	0.560	0.480	0.463																																																			
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Note:	Slanted line shows the range of the rated load current.																																																					

COSEL

Model	TUHS25F12	Temperature Testing Circuitry Figure A	25°C
Item	Inrush Current		
Object	_____		





Model	TUHS25F12	Temperature Testing Circuitry	25°C Figure B
Item	Leakage Current		
Object	_____		

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

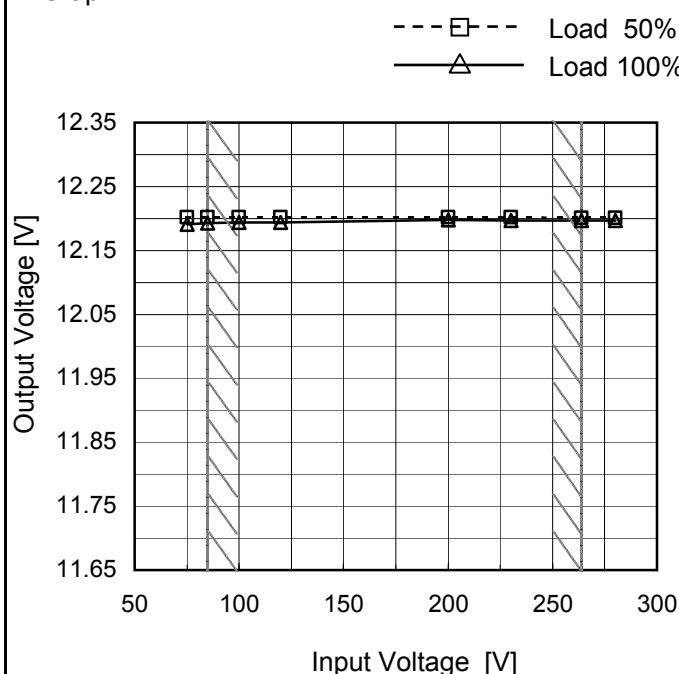
Leakage current value is concluded after measuring both phases of

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	TUHS25F12
Item	Line Regulation
Object	+12V2.1A

1.Graph



Note: Slanted line shows the range of the rated input voltage.

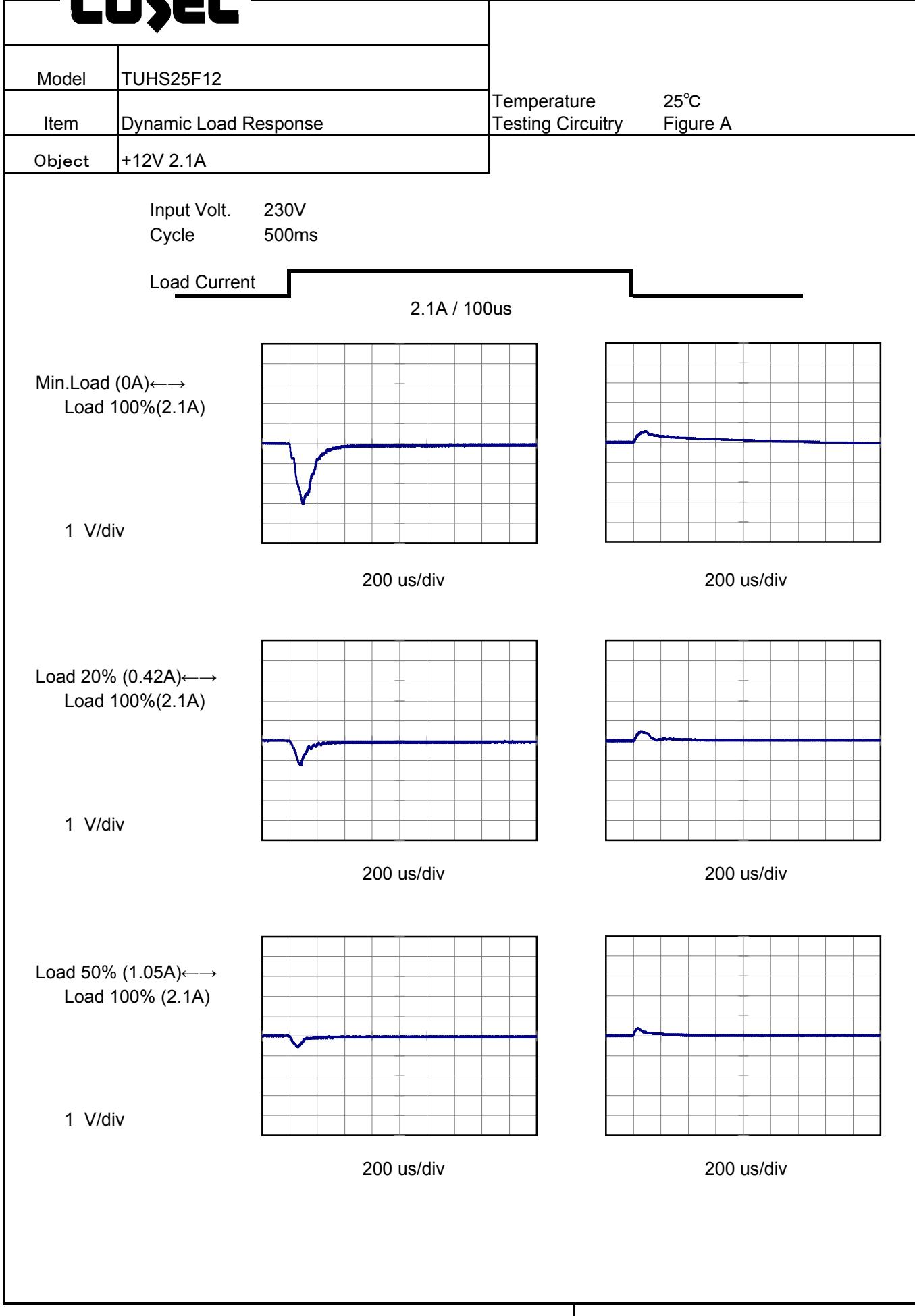
2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
75	12.202	12.190
85	12.202	12.192
100	12.202	12.194
120	12.202	12.194
200	12.202	12.197
230	12.201	12.197
264	12.201	12.197
280	12.201	12.197
--	-	-

Model	TUHS25F12	Temperature Testing Circuitry 25°C Figure A																																																					
Item	Load Regulation																																																						
Object	+12V2.1A																																																						
1.Graph	<p>—△— Input Volt. 100V - - -□--- Input Volt. 200V - - -○--- Input Volt. 230V</p> <table border="1"> <caption>Data points estimated from Graph 1</caption> <thead> <tr> <th>Load Current [A]</th> <th>100V [V]</th> <th>200V [V]</th> <th>230V [V]</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>12.208</td><td>12.206</td><td>12.205</td></tr> <tr><td>0.40</td><td>12.204</td><td>12.203</td><td>12.202</td></tr> <tr><td>0.80</td><td>12.204</td><td>12.203</td><td>12.200</td></tr> <tr><td>1.20</td><td>12.202</td><td>12.202</td><td>12.201</td></tr> <tr><td>1.60</td><td>12.200</td><td>12.201</td><td>12.199</td></tr> <tr><td>2.00</td><td>12.196</td><td>12.198</td><td>12.197</td></tr> <tr><td>2.10</td><td>12.194</td><td>12.197</td><td>12.197</td></tr> <tr><td>2.31</td><td>12.191</td><td>12.195</td><td>12.195</td></tr> </tbody> </table>	Load Current [A]	100V [V]	200V [V]	230V [V]	0.00	12.208	12.206	12.205	0.40	12.204	12.203	12.202	0.80	12.204	12.203	12.200	1.20	12.202	12.202	12.201	1.60	12.200	12.201	12.199	2.00	12.196	12.198	12.197	2.10	12.194	12.197	12.197	2.31	12.191	12.195	12.195																		
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Note: Slanted line shows the range of the rated load current.

COSEL



COSSEL

Model	TUHS25F12																																							
Item	Ripple Voltage (by Load Current)	Temperature 25°C Testing Circuitry Figure C																																						
Object	+12V2.1A																																							
1.Graph																																								
<p>Graph showing Ripple Voltage [mV] vs Load Current [A]. The graph compares two input voltages: 100V (solid line with triangles) and 230V (dashed line with circles). The x-axis represents Load Current [A] from 0.00 to 2.50. The y-axis represents Ripple Voltage [mV] from 0 to 400. Both curves show a sharp increase in ripple voltage as the load current approaches the rated value of 2.1A.</p>																																								
2.Values																																								
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Load Current [A]	Ripple Voltage [mV]																																							
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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>Diagram illustrating the complex ripple wave form. The vertical axis is labeled "Ripple [mVp-p]". The horizontal axis shows two time intervals: T1 and T2. T1 is the full width of the waveform, and T2 is a shorter interval within T1 where the switching component is dominant.</p>																																								
<p>Fig. Complex Ripple Wave Form</p>																																								

Model	TUHS25F12																																						
Item	Ripple-Noise	Temperature 25°C Testing Circuitry Figure C																																					
Object	+12V2.1A																																						
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Model	TUHS25F12	Testing Circuitry Figure C																																			
Item	Ripple Voltage (by Ambient Temp.)																																				
Object	+12V2.1A																																				
1.Graph		2.Values																																			
<p>Graph showing Ripple Voltage [mV] vs Ambient Temperature [°C] for TUHS25F12 at Load 100%.</p> <p>Legend:</p> <ul style="list-style-type: none"> - - - □ - - - Input Volt. 100V — △ — Input Volt. 200V <table border="1"> <thead> <tr> <th>Ambient Temperature [°C]</th> <th>Ripple Voltage [mV] (Input Volt. 100V)</th> <th>Ripple Voltage [mV] (Input Volt. 200V)</th> </tr> </thead> <tbody> <tr><td>-45</td><td>55</td><td>10</td></tr> <tr><td>-40</td><td>55</td><td>10</td></tr> <tr><td>-20</td><td>20</td><td>5</td></tr> <tr><td>0</td><td>20</td><td>5</td></tr> <tr><td>25</td><td>35</td><td>10</td></tr> <tr><td>50</td><td>35</td><td>10</td></tr> <tr><td>55</td><td>35</td><td>10</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. 200V)	-45	55	10	-40	55	10	-20	20	5	0	20	5	25	35	10	50	35	10	55	35	10	--	-	-	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 200V)																																			
-45	55	10																																			
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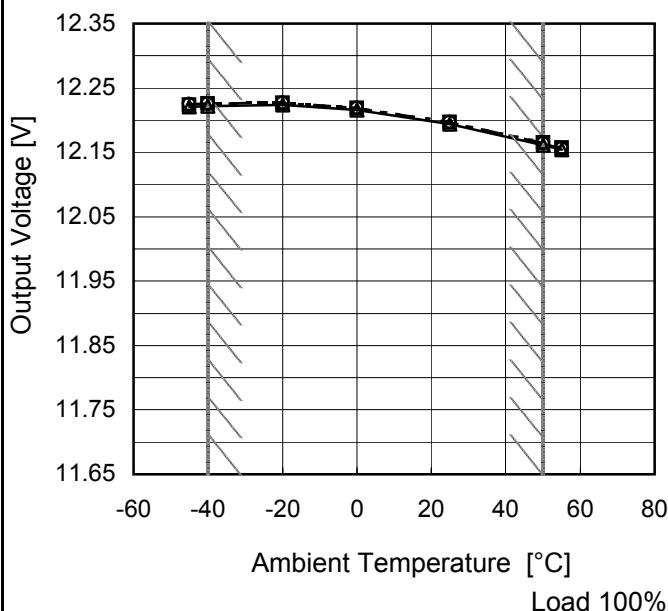
Measured by 100 MHz Oscilloscope.

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

Model	TUHS25F12
Item	Ambient Temperature Drift
Object	+12V2.1A

1. Graph

—△— Input Volt. 100V
 - - -□--- Input Volt. 200V
 - - -○--- Input Volt. 230V



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

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	12.220	12.224	12.225
-40	12.222	12.225	12.226
-20	12.224	12.227	12.227
0	12.216	12.219	12.219
25	12.194	12.197	12.197
50	12.161	12.165	12.164
55	12.154	12.157	12.157
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-



Model	TUHS25F12	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+12V2.1A	

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 - 2.1A

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

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

2. Values

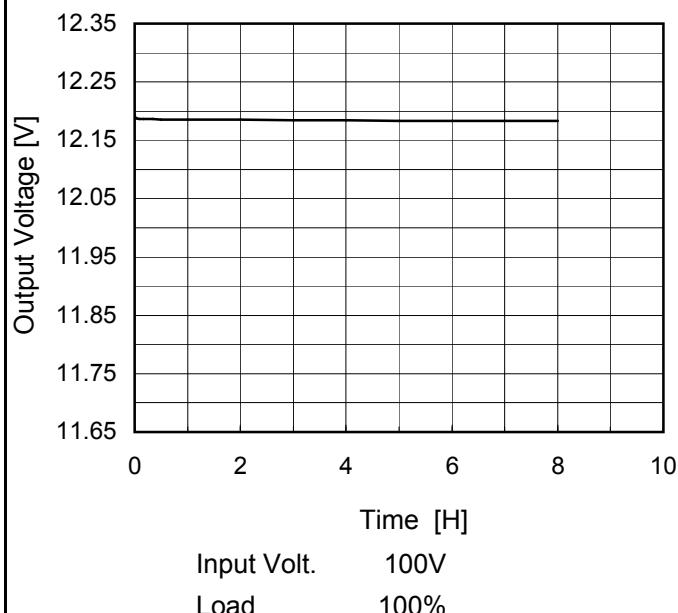
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-20	85	0	12.235	±37	±0.3
Minimum Voltage	50	85	2.1	12.161		

COSEL

Model	TUHS25F12
Item	Time Lapse Drift
Object	+12V2.1A

Temperature 25°C
 Testing Circuitry Figure A

1.Graph



2.Values

Time since start [H]	Output Voltage [V]
0.0	12.194
0.5	12.186
1.0	12.186
2.0	12.185
3.0	12.184
4.0	12.184
5.0	12.184
6.0	12.184
7.0	12.183
8.0	12.183

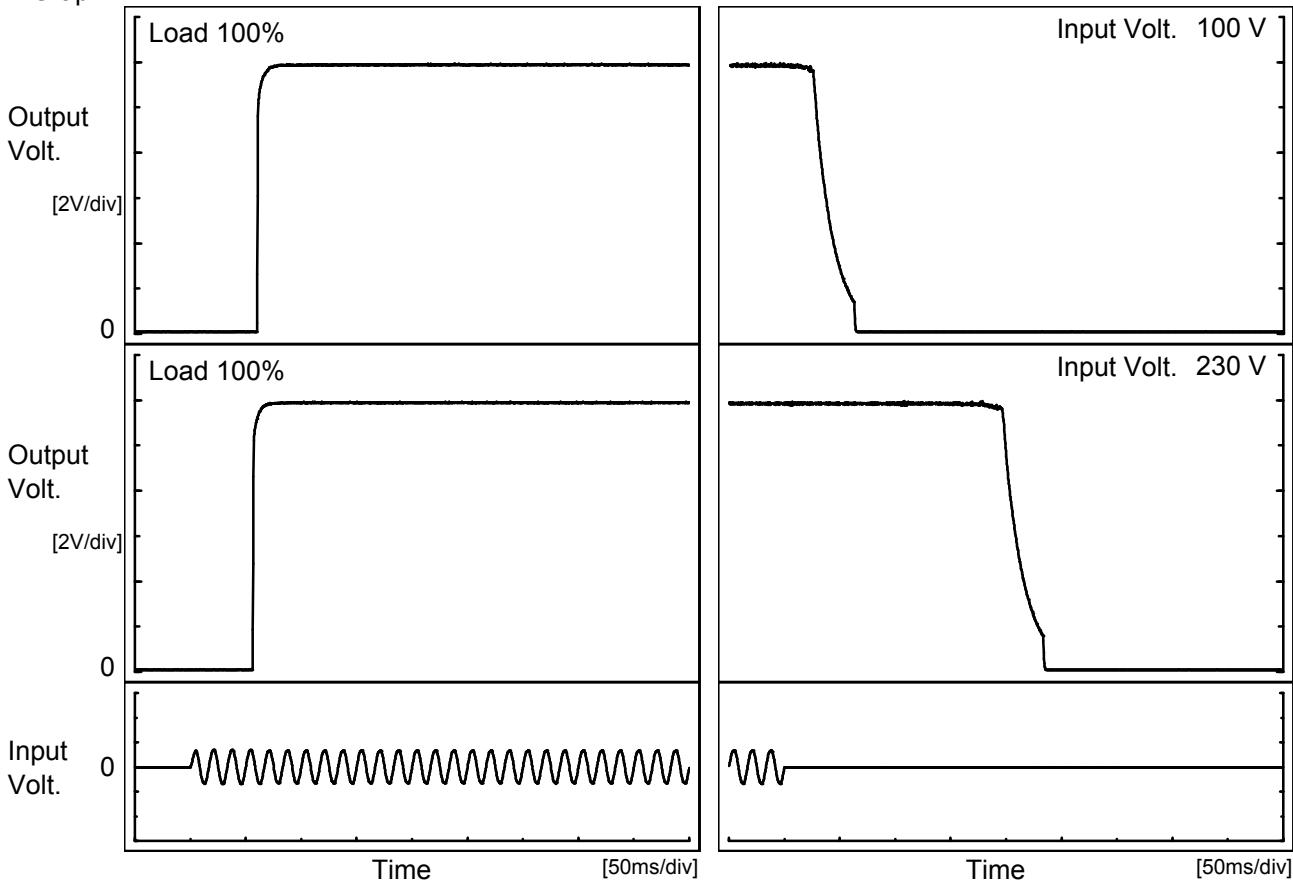
* The characteristic of AC230V is equal.

COSEL

Model	TUHS25F12
Item	Rise and Fall Time
Object	+12V2.1A

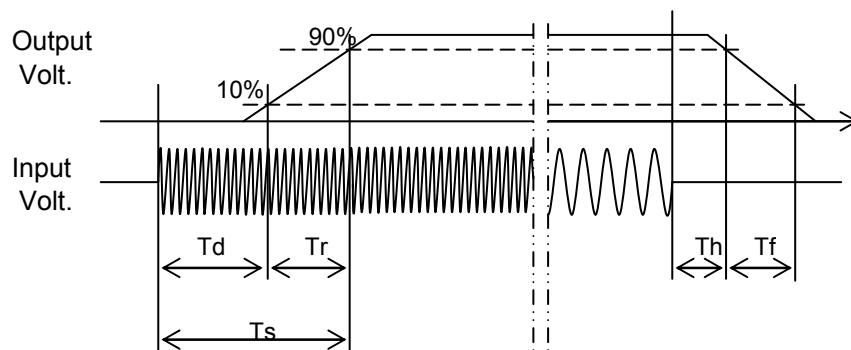
Temperature 25°C
Testing Circuitry Figure A

1. Graph



2. Values

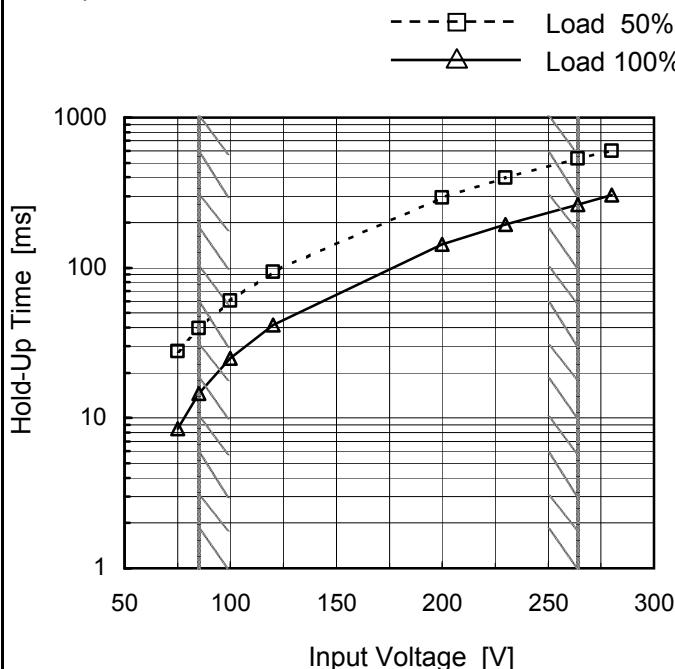
Input Volt.	Time	Td	Tr	Ts	Th	Tf	[ms]
100 V		57.3	2.8	60.1	24.8	35.8	
230 V		59.0	2.3	61.3	195.0	35.8	



Model	TUHS25F12
Item	Hold-Up Time
Object	+12V2.1A

Temperature 25°C
Testing Circuitry Figure A

1. Graph



2. Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
75	28	9
85	40	15
100	61	25
120	94	42
200	294	143
230	397	195
264	533	264
280	603	305
--	-	-

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.

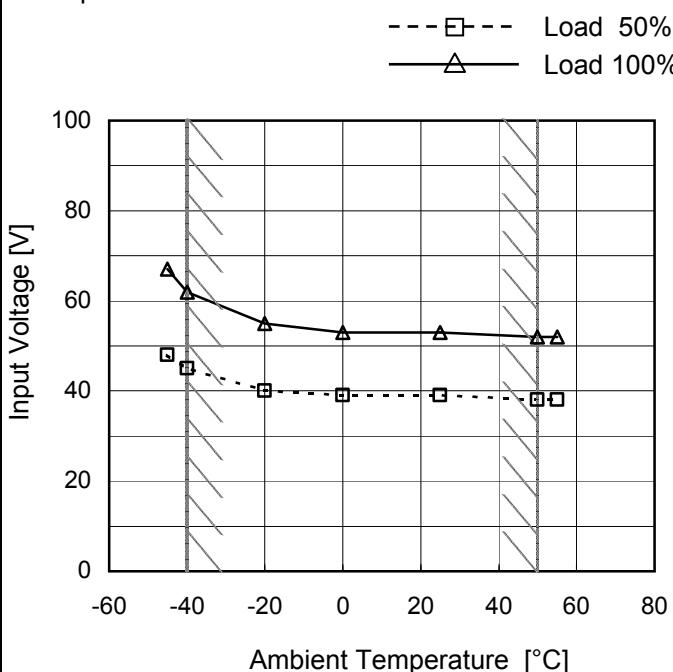
Model	TUHS25F12	Temperature Testing Circuitry 25°C Figure A																																																			
Item	Instantaneous Interruption Compensation																																																				
Object	+12V2.1A																																																				
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Note: Slanted line shows the range of the rated load current.

Model	TUHS25F12
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+12V2.1A

Testing Circuitry Figure A

1.Graph



2.Values

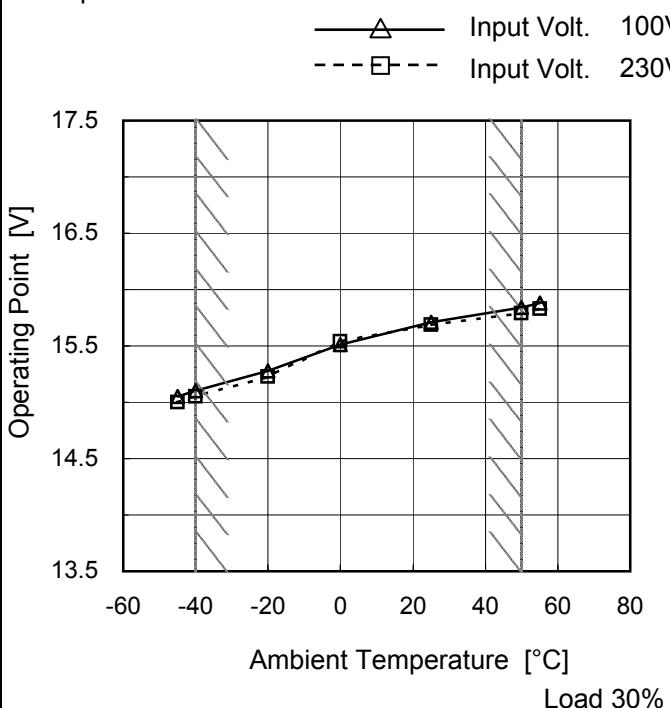
Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-45	48	67
-40	45	62
-20	40	55
0	39	53
25	39	53
50	38	52
55	38	52
--	-	-
--	-	-
--	-	-
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Note: Slanted line shows the range of the rated ambient temperature.

Model	TUHS25F12	Temperature Testing Circuitry 25°C Figure A																																															
Item	Overcurrent Protection																																																
Object	+12V2.1A																																																
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Model	TUHS25F12
Item	Oversupply Protection
Object	+12V2.1A

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	15.05	15.00
-40	15.10	15.05
-20	15.28	15.23
0	15.51	15.54
25	15.71	15.69
50	15.84	15.79
55	15.88	15.83
--	-	-
--	-	-
--	-	-
--	-	-

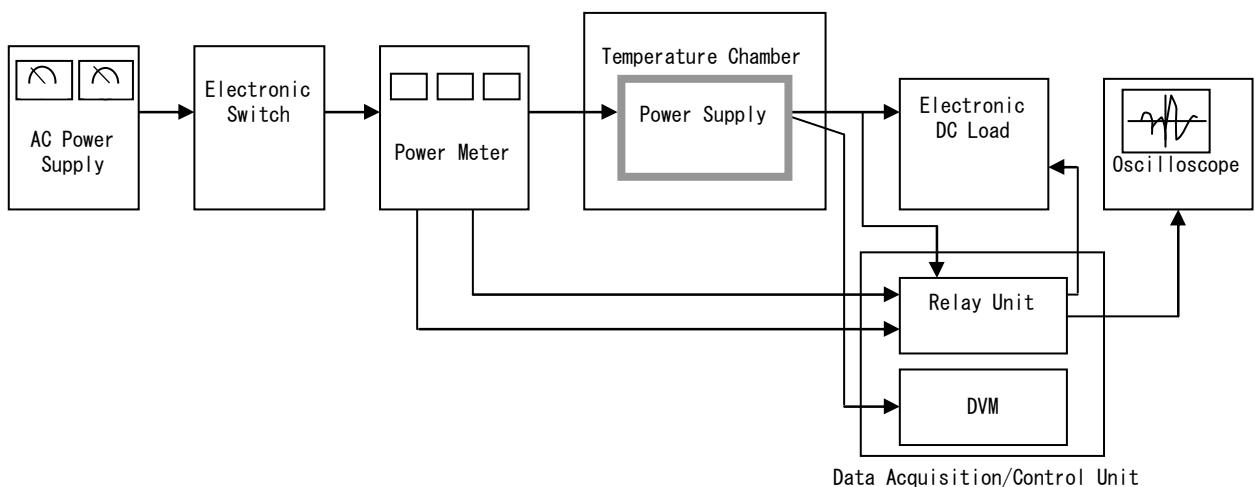


Figure A

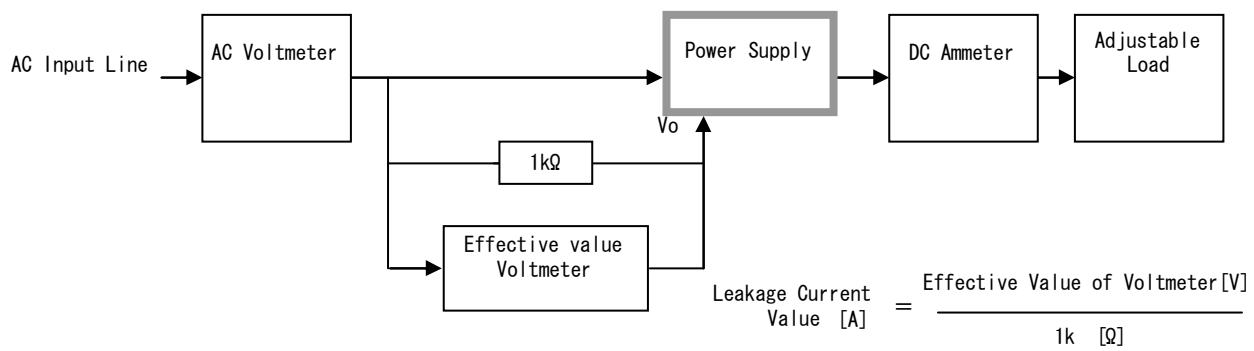


Figure B (DEN-AN)

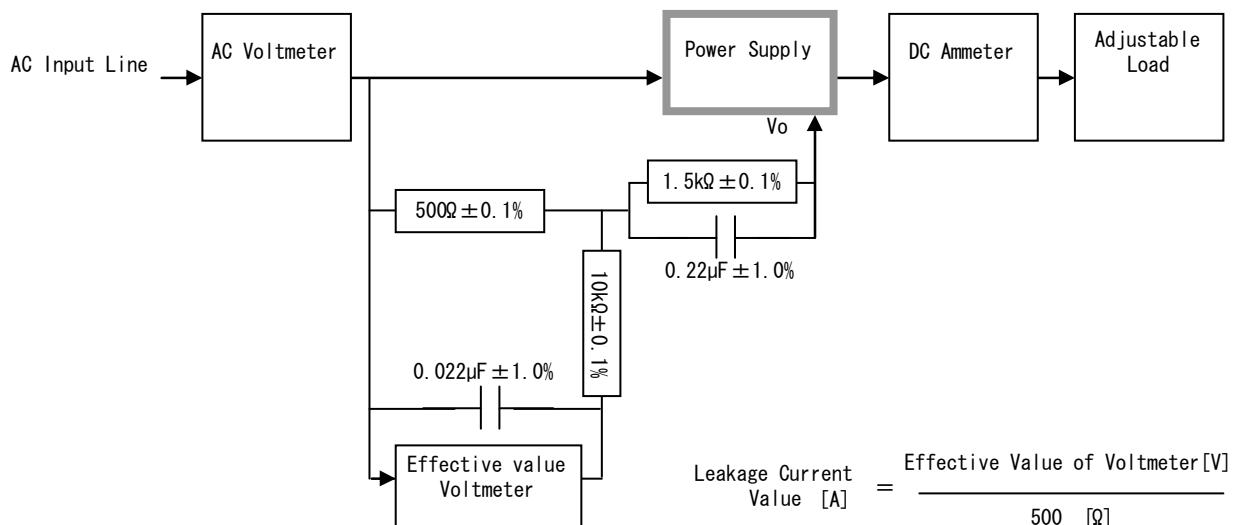


Figure B (IEC60950-1)

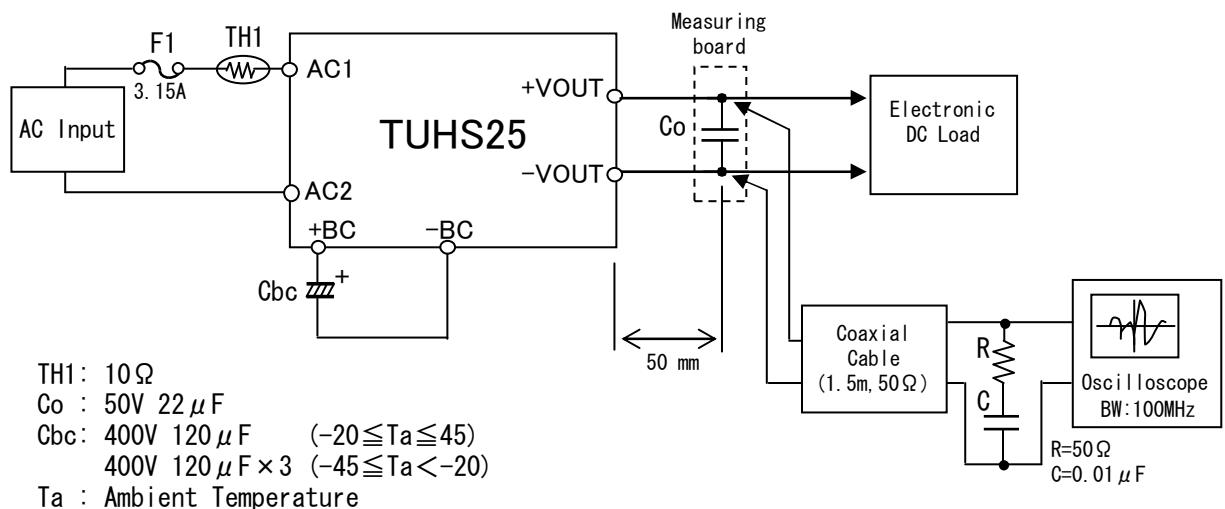
COSEL

Figure C