



# TEST DATA OF TUHS3F05

Regulated DC Power Supply  
February 28, 2014

Approved by :

Nobuyuki Shiraishi

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Prepared by :

Takayuki Yamamoto

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Design Engineer

**COSEL CO.,LTD.**



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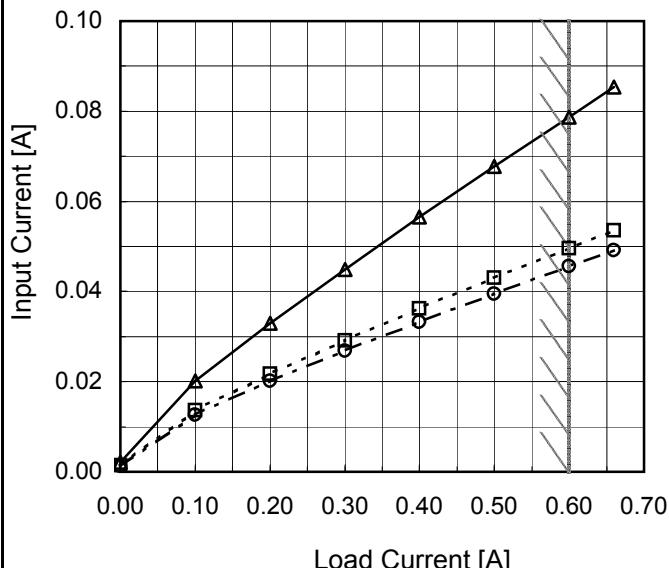
Model TUHS3F05

Item Input Current (by Load Current)

Object \_\_\_\_\_

1.Graph

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



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

 Temperature 25°C  
 Testing Circuitry Figure A

2.Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	0.002	0.001	0.001
0.10	0.020	0.014	0.013
0.20	0.033	0.022	0.020
0.30	0.045	0.029	0.027
0.40	0.057	0.036	0.033
0.50	0.068	0.043	0.040
0.60	0.079	0.050	0.046
0.66	0.085	0.054	0.049
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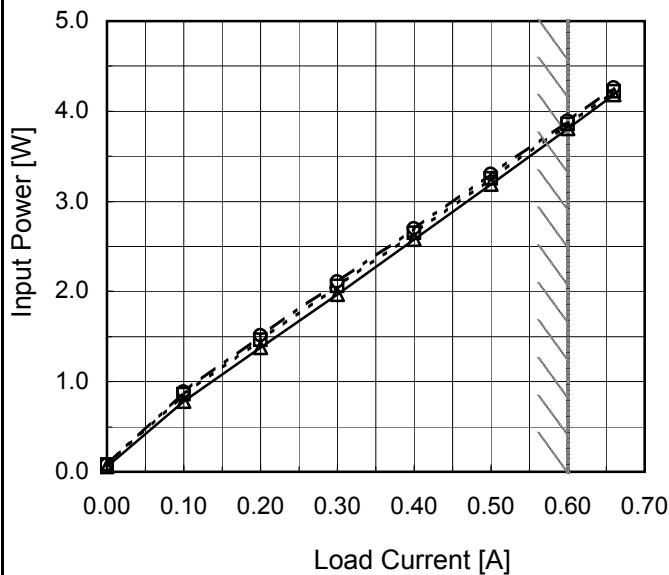
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 Temperature 25°C  
 Testing Circuitry Figure A

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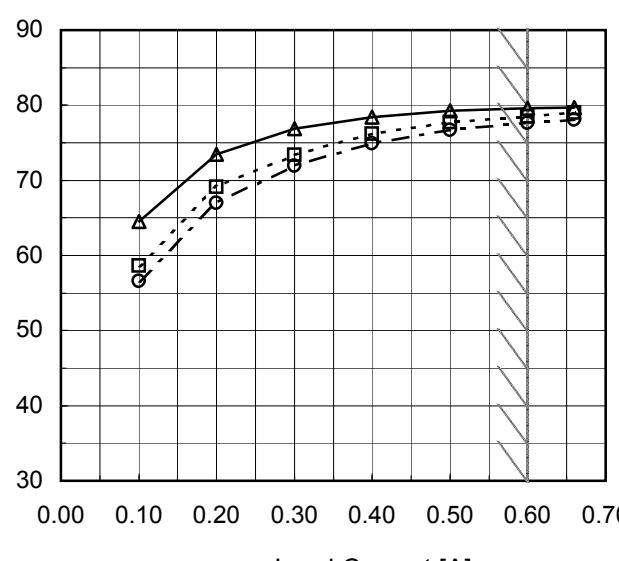
Load Current [A]	Input Power [W]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	0.06	0.08	0.08
0.10	0.78	0.86	0.89
0.20	1.38	1.46	1.51
0.30	1.97	2.06	2.11
0.40	2.58	2.65	2.70
0.50	3.19	3.25	3.30
0.60	3.81	3.86	3.89
0.66	4.18	4.22	4.26
--	-	-	-
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Model	TUHS3F05	Temperature Testing Circuitry	25°C Figure A																																
Item	Efficiency (by Input Voltage)																																		
Object	<hr/>																																		
1.Graph	<p>The graph plots Efficiency [%] on the y-axis (30 to 90) 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 general downward trend as input voltage increases. A vertical slanted line is drawn through the graph, indicating 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>77.1</td><td>78.9</td></tr> <tr><td>85</td><td>77.1</td><td>79.3</td></tr> <tr><td>100</td><td>76.9</td><td>79.6</td></tr> <tr><td>120</td><td>76.4</td><td>79.7</td></tr> <tr><td>200</td><td>73.4</td><td>78.5</td></tr> <tr><td>230</td><td>71.9</td><td>77.6</td></tr> <tr><td>264</td><td>68.7</td><td>76.0</td></tr> <tr><td>280</td><td>67.3</td><td>75.1</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>			Input Voltage [V]	Efficiency Load 50% [%]	Efficiency Load 100% [%]	75	77.1	78.9	85	77.1	79.3	100	76.9	79.6	120	76.4	79.7	200	73.4	78.5	230	71.9	77.6	264	68.7	76.0	280	67.3	75.1	--	-	-		
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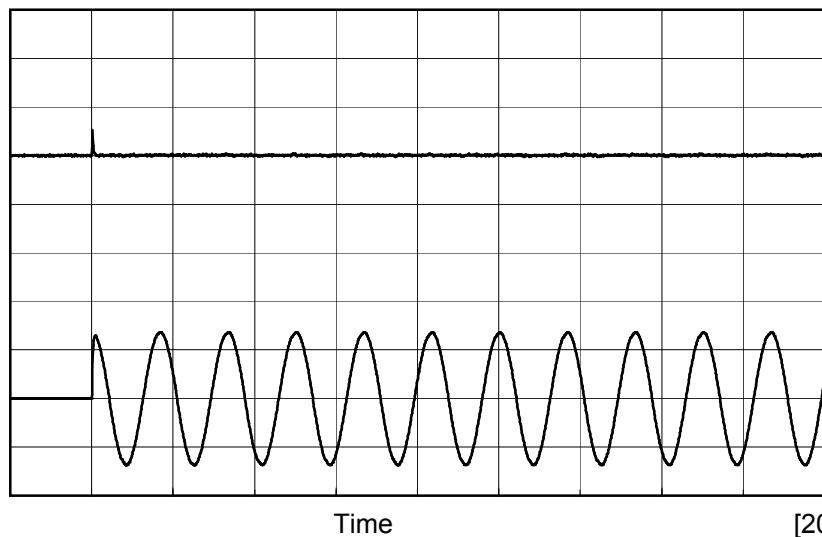
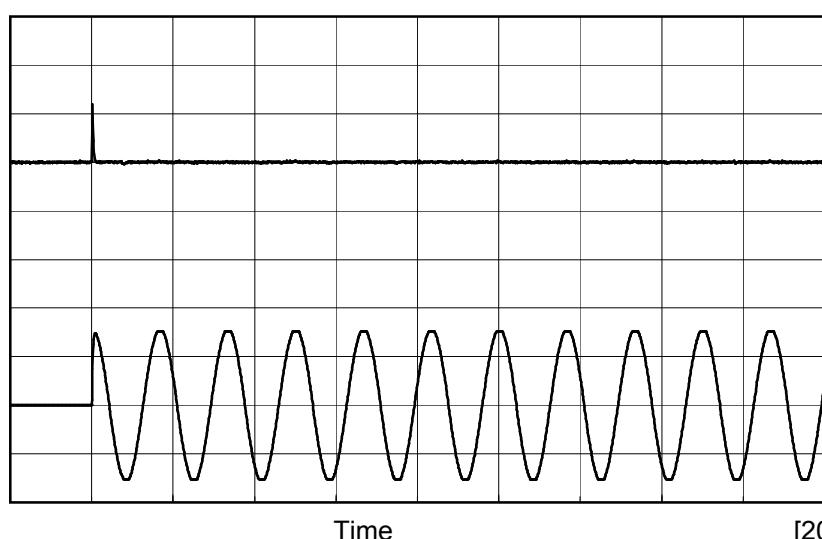
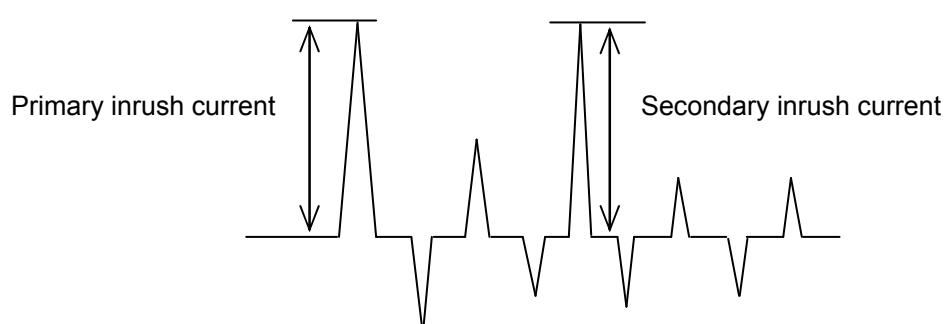
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Model TUHS3F05

Item Inrush Current

Object \_\_\_\_\_

Temperature 25°C  
Testing Circuitry Figure AInput  
Current  
[20A/div]Input  
Voltage  
[100V/div]Input  
Current  
[20A/div]Input  
Voltage  
[200V/div]



Model	TUHS3F05	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	0.003	0.004	0.004	Operation
	One of phases	0.003	0.005	0.006	Stand by
IEC60950-1	Both phases	0.002	0.005	0.005	Operation
	One of phases	0.003	0.005	0.005	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.

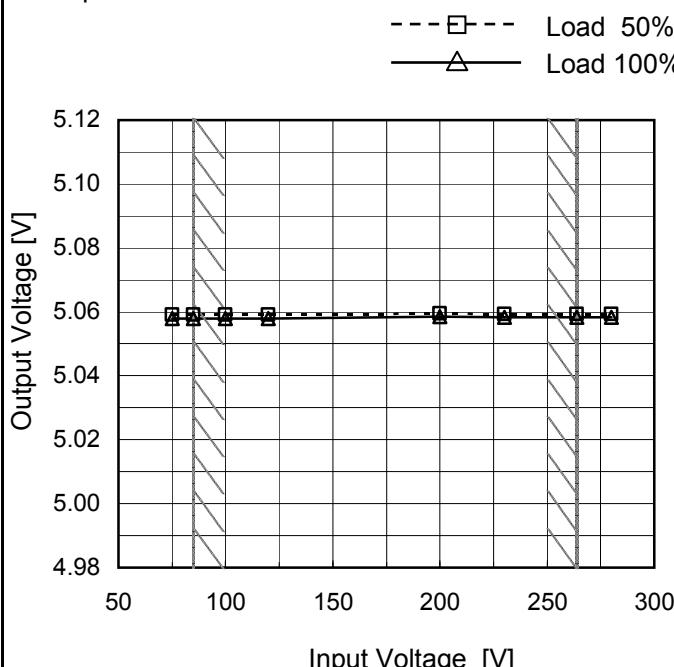
There is no FG in TUHS series and it is a reinforced insulation power supply of the class 2.



Model	TUHS3F05
Item	Line Regulation
Object	+5V0.6A

Temperature 25°C  
Testing Circuitry Figure A

## 1.Graph



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

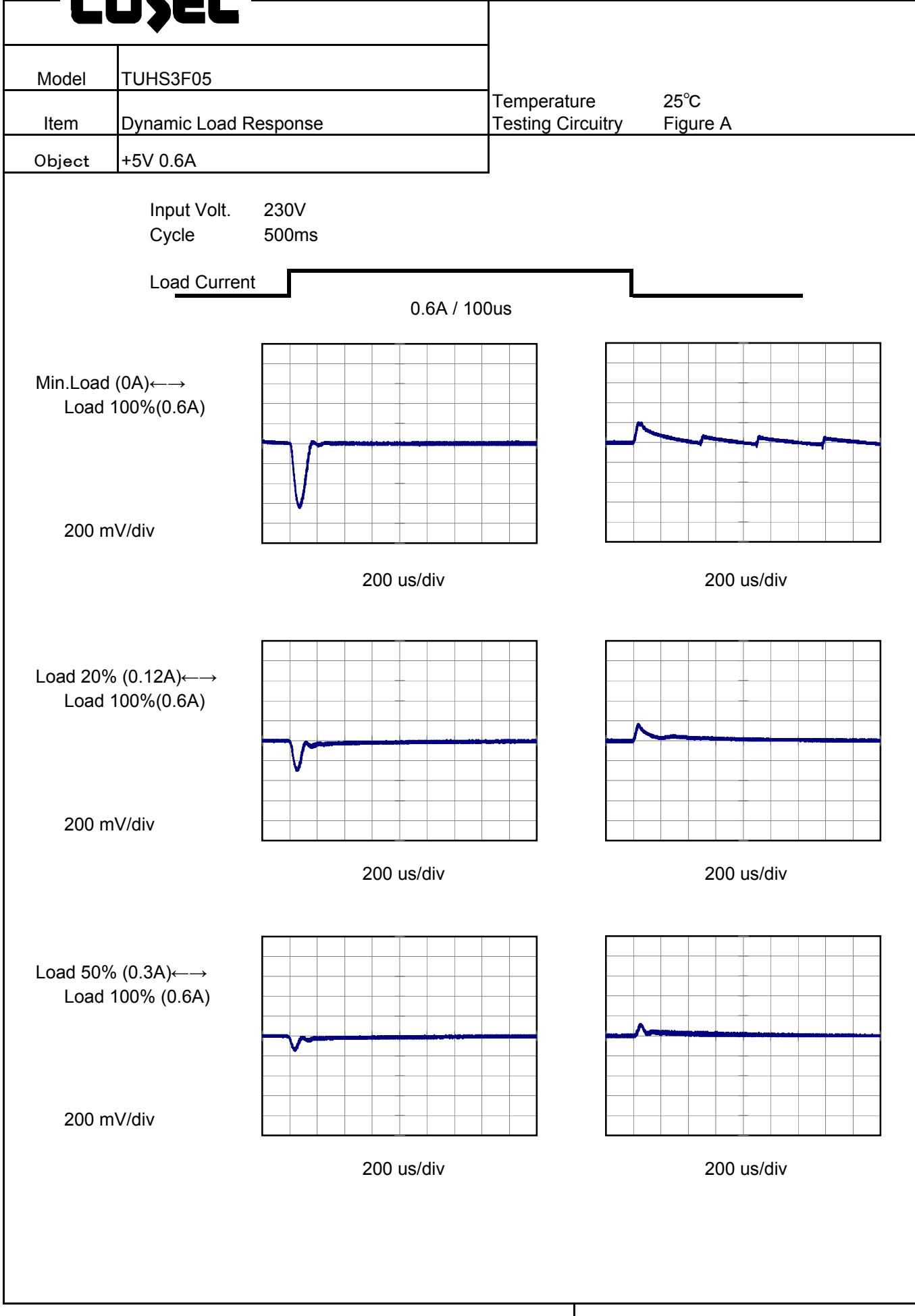
## 2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
75	5.059	5.058
85	5.059	5.058
100	5.059	5.058
120	5.059	5.058
200	5.060	5.059
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**COSEL**

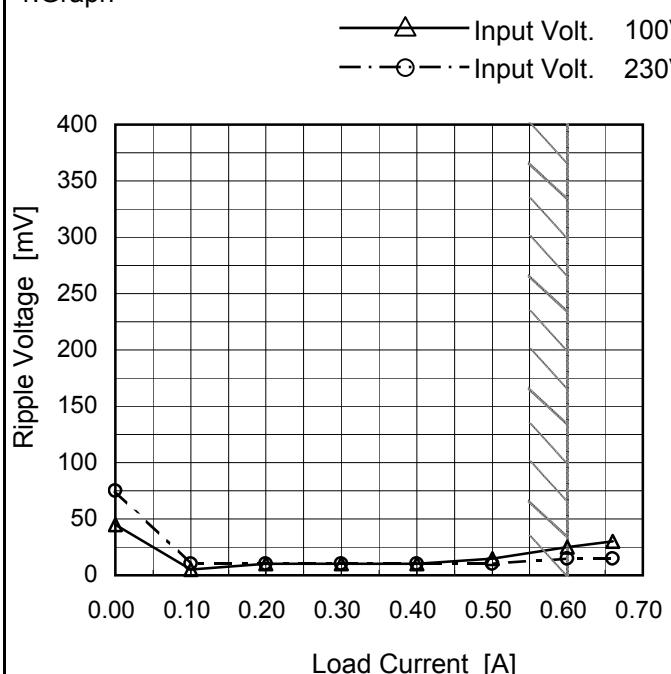


Model	TUHS3F05	Temperature	25°C																																						
Item	Ripple Voltage (by Load Current)	Testing Circuitry	Figure C																																						
Object	+5V0.6A																																								
1.Graph		2.Values																																							
<p>Graph showing 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 0.70 A. Two curves are plotted: Input Volt. 100V (solid line with triangle markers) and Input Volt. 230V (dashed line with circle markers). A vertical shaded band highlights the rated load current range between approximately 0.55A and 0.66A.</p>		<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>40</td><td>65</td></tr> <tr><td>0.10</td><td>5</td><td>5</td></tr> <tr><td>0.20</td><td>5</td><td>5</td></tr> <tr><td>0.30</td><td>10</td><td>10</td></tr> <tr><td>0.40</td><td>10</td><td>10</td></tr> <tr><td>0.50</td><td>15</td><td>10</td></tr> <tr><td>0.60</td><td>20</td><td>10</td></tr> <tr><td>0.66</td><td>25</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> </tbody> </table>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	40	65	0.10	5	5	0.20	5	5	0.30	10	10	0.40	10	10	0.50	15	10	0.60	20	10	0.66	25	10	--	-	-	--	-	-	--	-	-
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>Diagram illustrating a Complex Ripple Wave Form. The vertical axis is labeled "Ripple [mVp-p]". The horizontal axis represents time. The diagram shows a low-frequency AC input line ripple (T1) superimposed on a high-frequency switching ripple (T2). The total width of the waveform is indicated by T1, and the amplitude of the switching ripple is indicated by T2.</p>																																							
<p>Fig. Complex Ripple Wave Form</p>		<p>- 12 -</p>																																							

Model	TUHS3F05
Item	Ripple-Noise
Object	+5V0.6A

Temperature 25°C  
Testing Circuitry Figure C

## 1. Graph



Measured by 100 MHz Oscilloscope.  
Ripple-Noise is shown as p-p in the figure below.  
Note: Slanted line shows the range of the rated load current.

## 2. Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.00	45	75
0.10	5	10
0.20	10	10
0.30	10	10
0.40	10	10
0.50	15	10
0.60	25	15
0.66	30	15
--	-	-
--	-	-
--	-	-

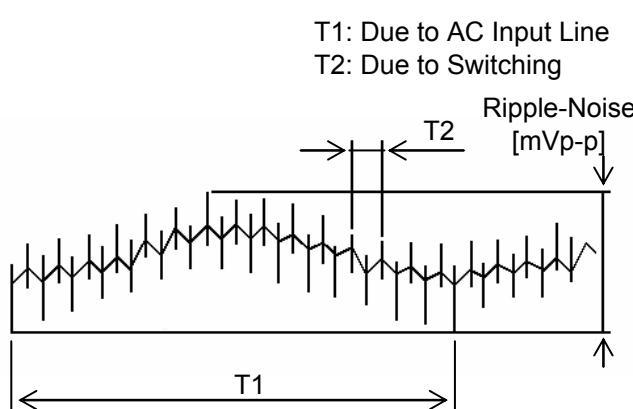


Fig. Complex Ripple Wave Form



Model	TUHS3F05	Testing Circuitry Figure C																																			
Item	Ripple Voltage (by Ambient Temp.)																																				
Object	+5V0.6A																																				
1.Graph		2.Values																																			
<p>The graph plots Ripple Voltage [mV] on the Y-axis (0 to 400) against Ambient Temperature [°C] on the X-axis (-60 to 100). Two sets of data points are shown: Input Volt. 100V (represented by squares) and Input Volt. 200V (represented by triangles). Dashed lines connect the data points for each input voltage. A slanted line indicates the range of the rated ambient temperature.</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. 200V)</th> </tr> </thead> <tbody> <tr><td>-45</td><td>30</td><td>15</td></tr> <tr><td>-40</td><td>30</td><td>15</td></tr> <tr><td>-20</td><td>25</td><td>10</td></tr> <tr><td>0</td><td>25</td><td>10</td></tr> <tr><td>25</td><td>20</td><td>10</td></tr> <tr><td>50</td><td>25</td><td>10</td></tr> <tr><td>70</td><td>25</td><td>15</td></tr> <tr><td>85</td><td>25</td><td>15</td></tr> <tr><td>90</td><td>25</td><td>15</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	30	15	-40	30	15	-20	25	10	0	25	10	25	20	10	50	25	10	70	25	15	85	25	15	90	25	15	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 200V)																																			
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<p>Measured by 100 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.</p>																																					



Model	TUHS3F05	Testing Circuitry Figure A																																																					
Item	Ambient Temperature Drift																																																						
Object	+5V0.6A																																																						
1.Graph	<p style="text-align: center;"> <span style="color: black;">—△—</span> Input Volt. 100V  <span style="color: gray;">---□---</span> Input Volt. 200V  <span style="color: gray;">---○---</span> Input Volt. 230V         </p> <p style="text-align: center;">Output Voltage [V]</p> <p style="text-align: center;">Ambient Temperature [°C]</p> <p style="text-align: center;">Load 100%</p>	2.Values																																																					
		<table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr> <td>-45</td> <td>5.055</td> <td>5.055</td> <td>5.055</td> </tr> <tr> <td>-40</td> <td>5.056</td> <td>5.056</td> <td>5.056</td> </tr> <tr> <td>-20</td> <td>5.058</td> <td>5.059</td> <td>5.059</td> </tr> <tr> <td>0</td> <td>5.059</td> <td>5.060</td> <td>5.060</td> </tr> <tr> <td>25</td> <td>5.058</td> <td>5.059</td> <td>5.058</td> </tr> <tr> <td>50</td> <td>5.050</td> <td>5.051</td> <td>5.051</td> </tr> <tr> <td>70</td> <td>5.043</td> <td>5.044</td> <td>5.044</td> </tr> <tr> <td>85</td> <td>5.039</td> <td>5.039</td> <td>5.039</td> </tr> <tr> <td>90</td> <td>5.035</td> <td>5.035</td> <td>5.035</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>			Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-45	5.055	5.055	5.055	-40	5.056	5.056	5.056	-20	5.058	5.059	5.059	0	5.059	5.060	5.060	25	5.058	5.059	5.058	50	5.050	5.051	5.051	70	5.043	5.044	5.044	85	5.039	5.039	5.039	90	5.035	5.035	5.035	--	-	-	-	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																						
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Note: Slanted line shows the range of the rated ambient temperature.



Model	TUHS3F05	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+5V0.6A	

### 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 - 85°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.6A

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

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

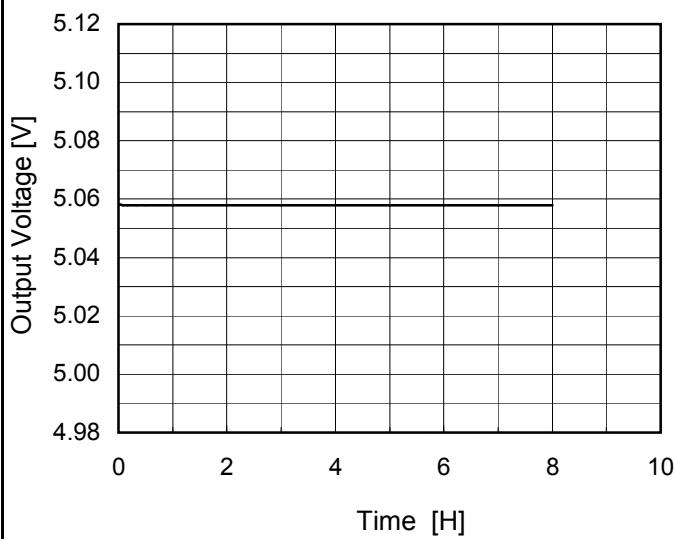
### 2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	0	200	0	5.060	±11	±0.2
Minimum Voltage	85	264	0.6	5.039		



Model	TUHS3F05
Item	Time Lapse Drift
Object	+5V0.6A

## 1.Graph



Input Volt.      100V  
Load            100%

\* The characteristic of AC230V is equal.

Temperature      25°C  
Testing Circuitry      Figure A

## 2.Values

Time since start [H]	Output Voltage [V]
0.0	5.058
0.5	5.058
1.0	5.058
2.0	5.058
3.0	5.058
4.0	5.058
5.0	5.058
6.0	5.058
7.0	5.058
8.0	5.058

coSEL

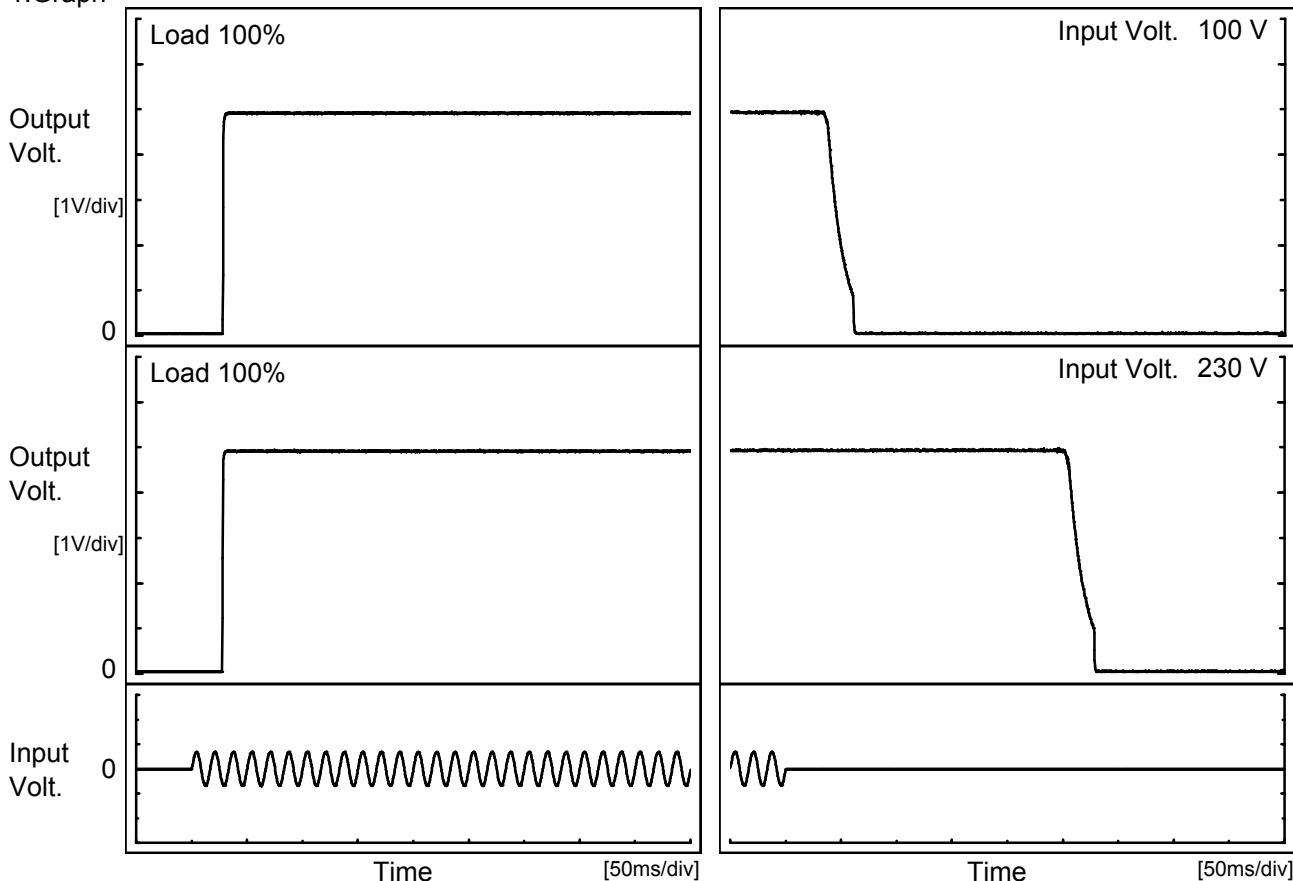
Model TUHS3F05

Item Rise and Fall Time

Object +5V0.6A

Temperature 25°C  
Testing Circuitry Figure A

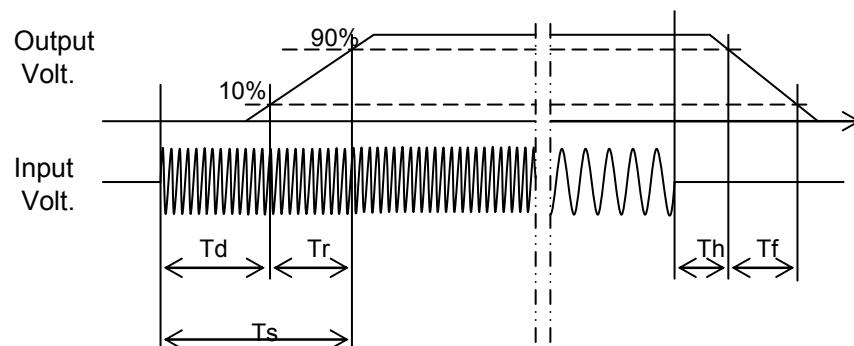
## 1. Graph



## 2. Values

[ms]

Input Volt. \ Time	Td	Tr	Ts	Th	Tf
100 V	28.3	0.8	29.1	35.8	22.8
230 V	27.8	0.8	28.6	254.4	22.8





Model	TUHS3F05	Temperature Testing Circuitry	25°C Figure A																																
Item	Hold-Up Time																																		
Object	+5V0.6A	2.Values																																	
1.Graph																																			
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	<p>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.</p>																																		

**coSEL**

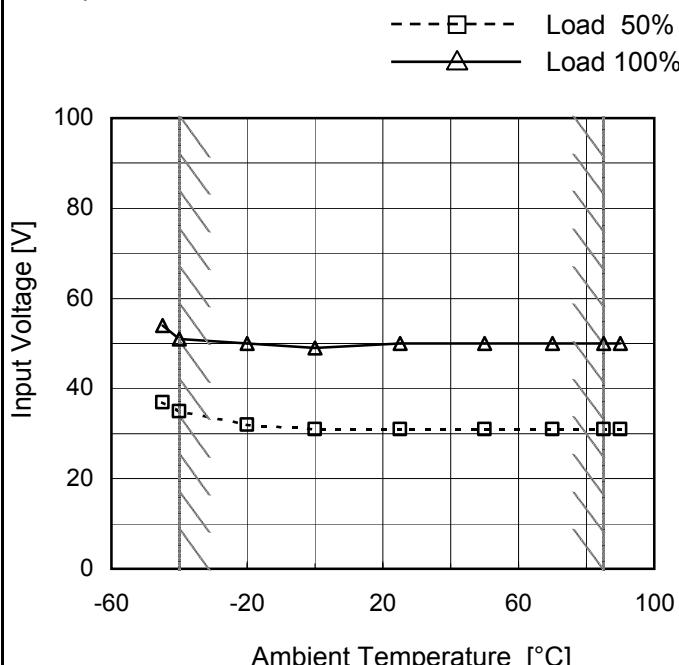
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Item	Instantaneous Interruption Compensation																																																				
Object	+5V0.6A																																																				
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Note: Slanted line shows the range of the rated load current.



Model	TUHS3F05
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+5V0.6A

## 1.Graph



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

Testing Circuitry Figure A

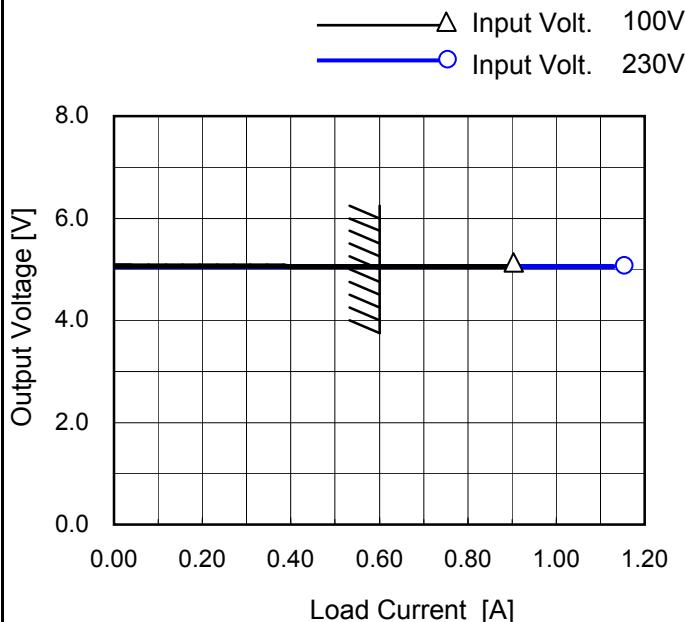
## 2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-45	37	54
-40	35	51
-20	32	50
0	31	50
25	31	50
50	31	50
70	31	50
85	31	50
90	31	50
--	-	-
--	-	-



Model	TUHS3F05
Item	Overcurrent Protection
Object	+5V0.6A

## 1. Graph



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

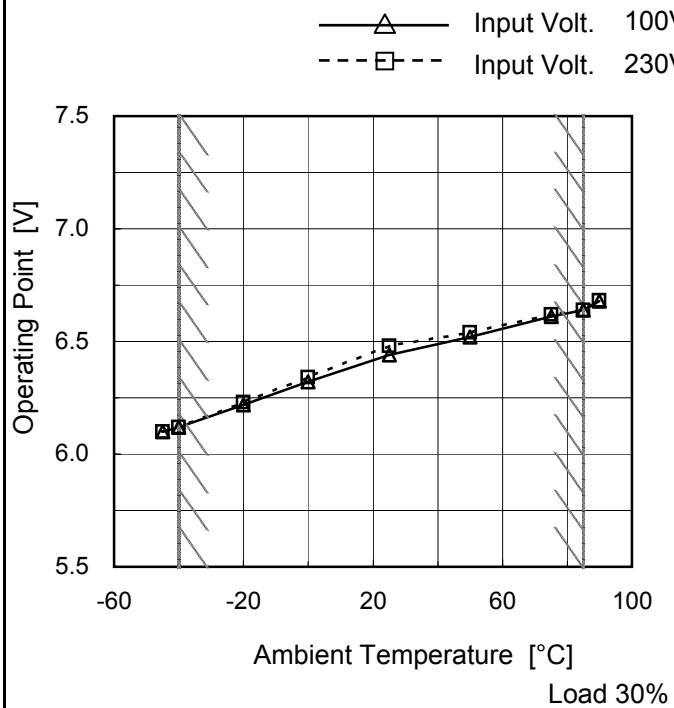
Temperature 25°C  
Testing Circuitry Figure A

## 2. Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
5.0	0.90	1.13
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-



Model	TUHS3F05
Item	Overvoltage Protection
Object	+5V0.6A

**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	6.10	6.10
-40	6.12	6.12
-20	6.22	6.23
0	6.32	6.34
25	6.44	6.48
50	6.52	6.54
75	6.61	6.62
85	6.64	6.64
90	6.68	6.68
--	-	-
--	-	-

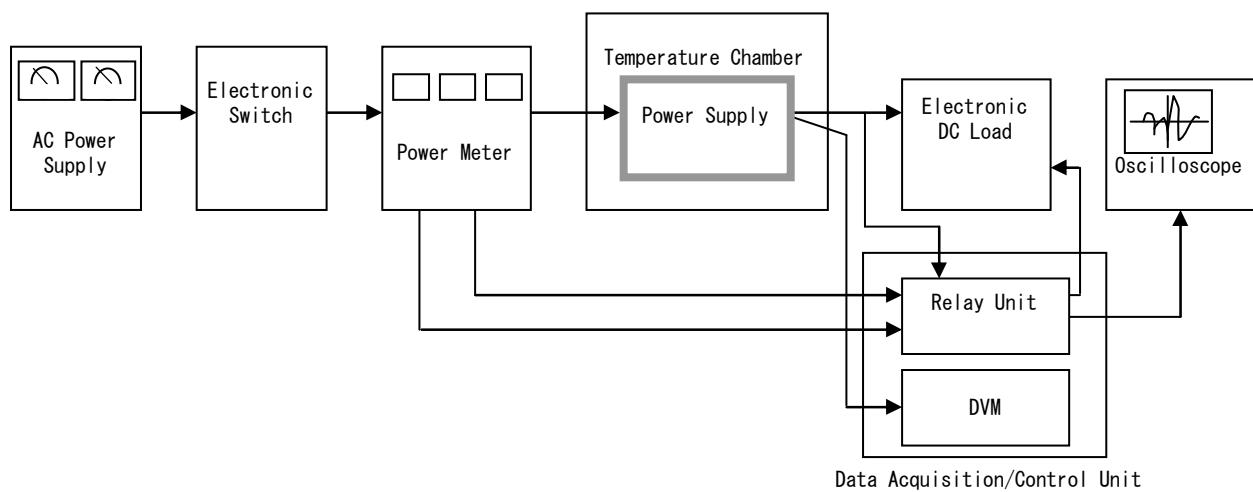


Figure A

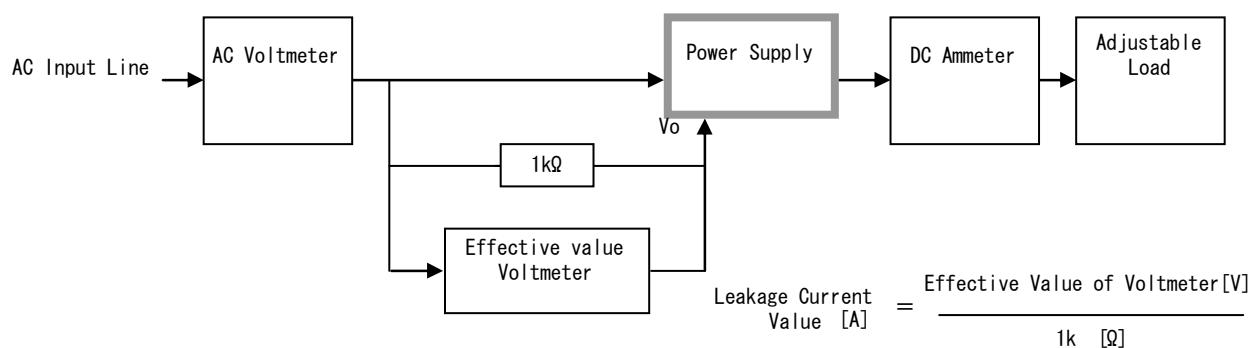


Figure B ( DEN-AN )

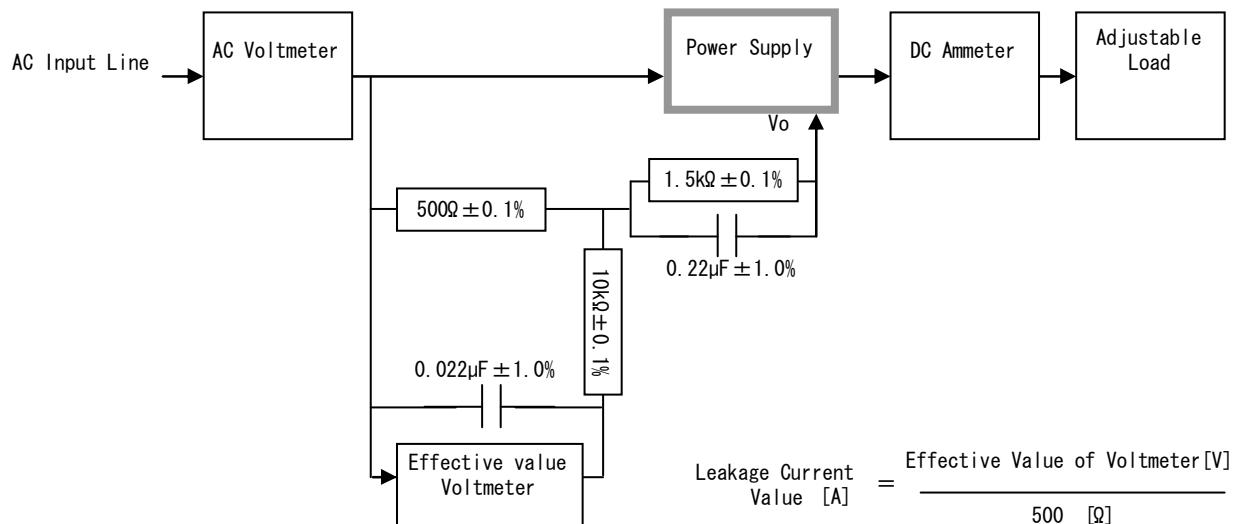


Figure B ( IEC60950-1 )

coSEL

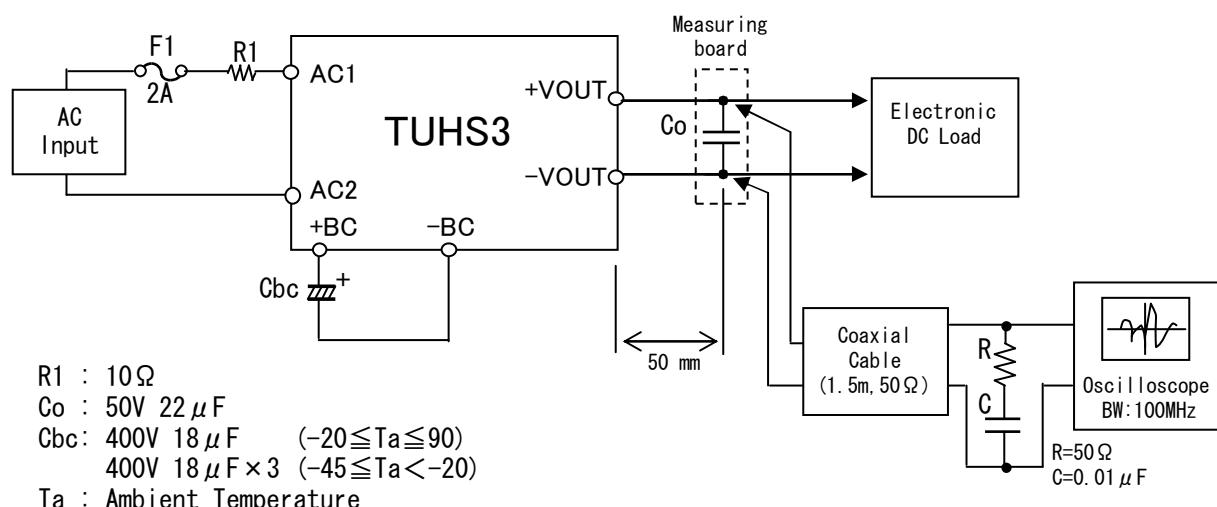


Figure C