

TEST DATA OF TUHS5F24

Regulated DC Power Supply
February 28, 2014

Approved by : Nobuyuki Shiraishi
Nobuyuki Shiraishi Design Manager

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Takayuki Yamamoto Design Engineer

COSEL CO.,LTD.

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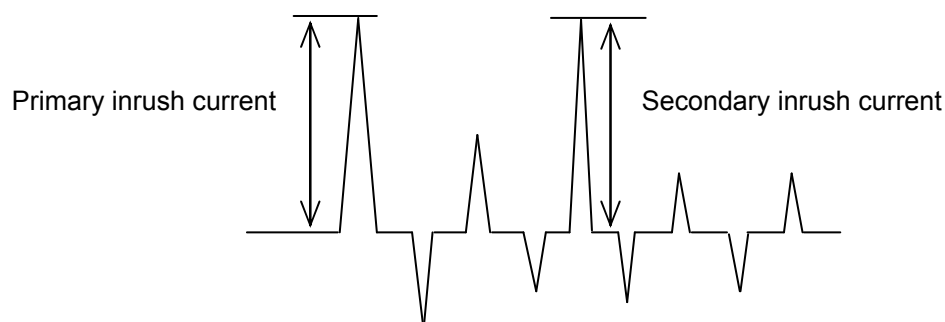
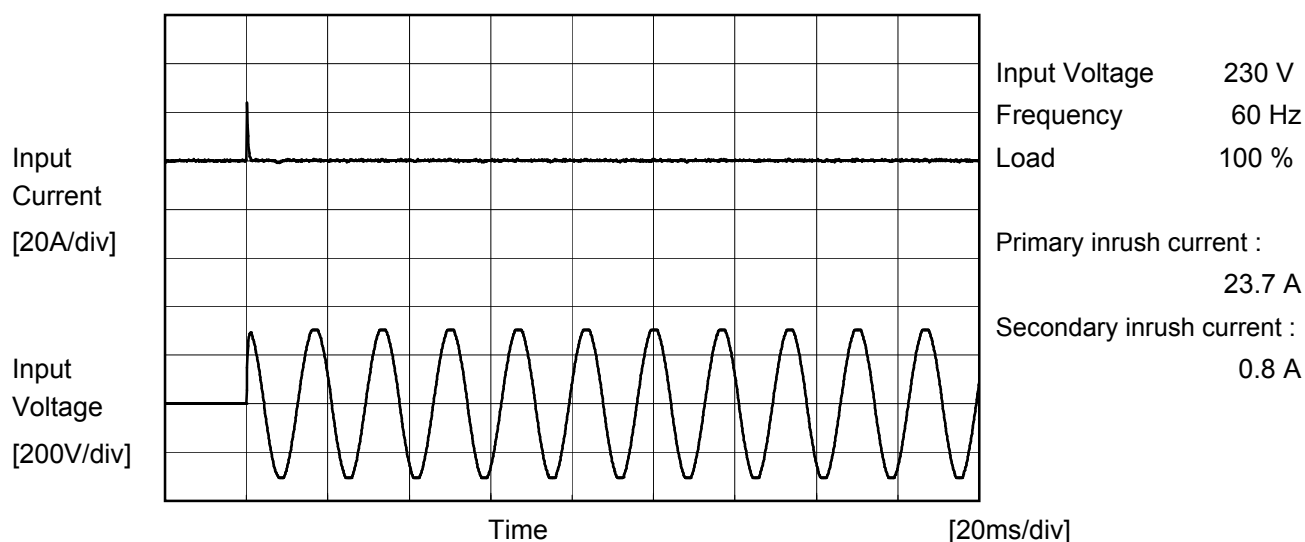
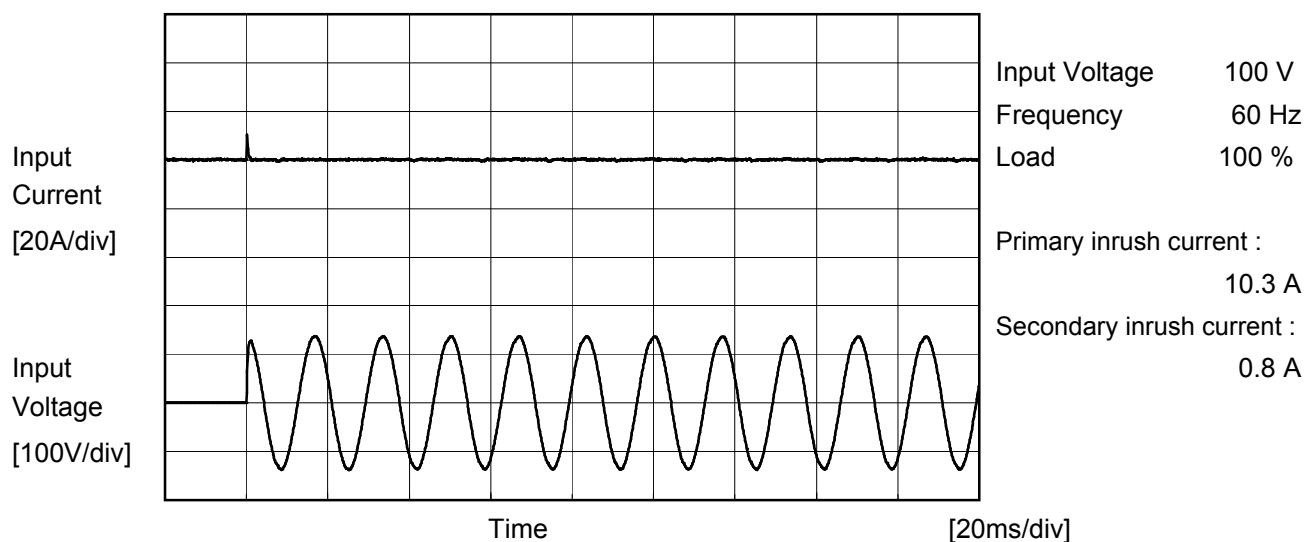
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Model	TUHS5F24																																																					
Item	Efficiency (by Load Current)	Temperature	25°C																																																			
		Testing Circuitry	Figure A																																																			
Object	_____																																																					
1.Graph		2.Values																																																				
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Model	TUHS5F24	Temperature 25°C Testing Circuitry Figure A	
Item	Inrush Current		
Object	_____		



		Temperature 25°C Testing Circuitry Figure B
Model	TUHS5F24	
Item	Leakage Current	
Object	_____	

1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.004	0.005	0.005	Operation
	One of phases	0.003	0.007	0.008	Stand by
IEC60950-1	Both phases	0.002	0.004	0.004	Operation
	One of phases	0.003	0.006	0.007	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	TUHS5F24																																		
Item	Line Regulation	Temperature	25°C																																
		Testing Circuitry	Figure A																																
Object	+24V0.22A																																		
1.Graph		2.Values																																	
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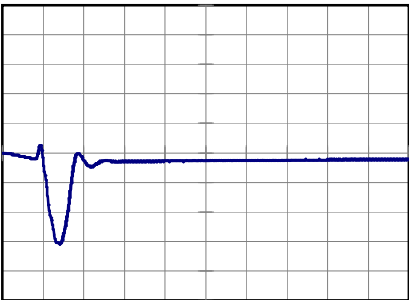
Model		TUHS5F24	
Item		Dynamic Load Response	Temperature 25°C Testing Circuitry Figure A
Object		+24V 0.22A	

Input Volt. 230V
Cycle 500ms

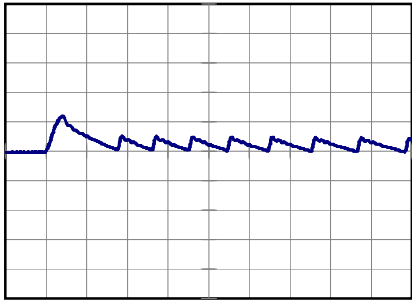
Load Current  0.22A / 100us

Min.Load (0A)←→
Load 100%(0.22A)

500 mV/div



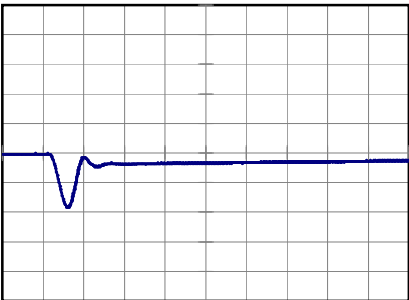
200 us/div



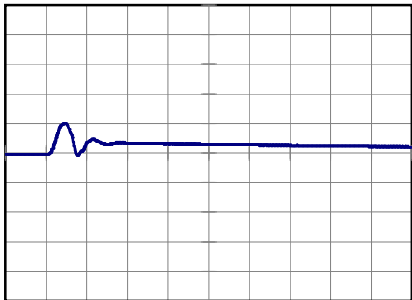
200 us/div

Load 20% (0.044A)←→
Load 100%(0.22A)

500 mV/div



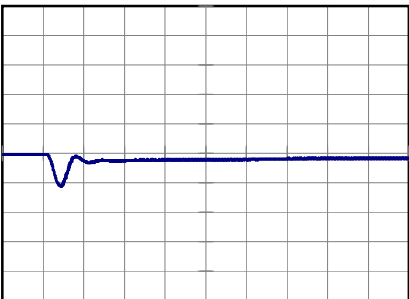
200 us/div



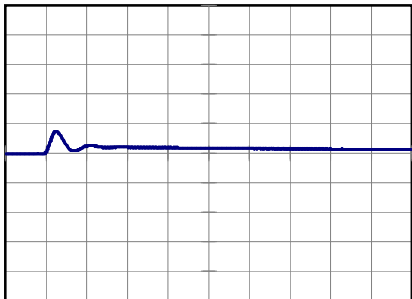
200 us/div

Load 50% (0.11A)←→
Load 100% (0.22A)

500 mV/div



200 us/div



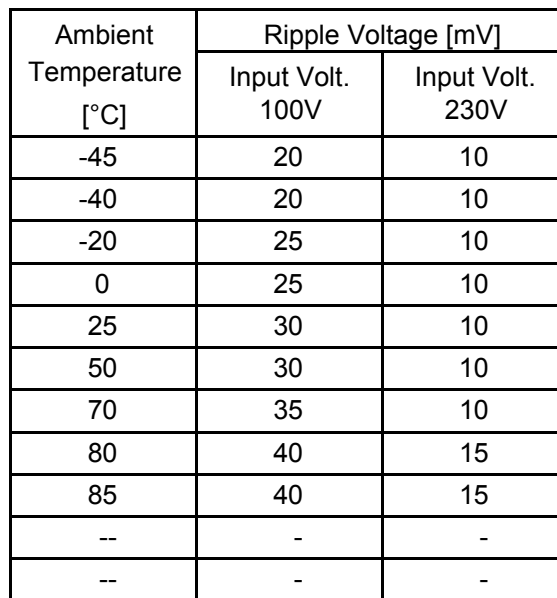
200 us/div

Model	TUHS5F24		
Item	Ripple Voltage (by Load Current)	Temperature	25°C
		Testing Circuitry	Figure C
Object	+24V0.22A		
1.Graph		2.Values	
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Model	TUHS5F24																																								
Item	Ripple-Noise	Temperature	25°C																																						
Object	+24V0.22A	Testing Circuitry	Figure C																																						
1.Graph		2.Values																																							
<div><div><div>△</div><div>Input Volt. 100V</div></div><div><div>○</div><div>Input Volt. 230V</div></div></div> <p>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.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple-Noise [mV]</th></tr><tr><th>Input Volt. 100 [V]</th><th>Input Volt. 230 [V]</th></tr><tr><td>0.00</td><td>130</td><td>200</td></tr><tr><td>0.04</td><td>5</td><td>10</td></tr><tr><td>0.08</td><td>10</td><td>10</td></tr><tr><td>0.12</td><td>15</td><td>10</td></tr><tr><td>0.16</td><td>15</td><td>10</td></tr><tr><td>0.20</td><td>25</td><td>10</td></tr><tr><td>0.22</td><td>30</td><td>10</td></tr><tr><td>0.24</td><td>30</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></table>		Load Current [A]	Ripple-Noise [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	130	200	0.04	5	10	0.08	10	10	0.12	15	10	0.16	15	10	0.20	25	10	0.22	30	10	0.24	30	10	--	-	-	--	-	-	--	-	-
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<div><div>T1: Due to AC Input Line</div><div>T2: Due to Switching</div></div> <p>Fig. Complex Ripple Wave Form</p>																																									

Testing Circuitry Figure C

2.Values



- 14 -

Model	TUHS5F24																																																						
Item	Ambient Temperature Drift	Testing Circuitry Figure A																																																					
Object	+24V0.22A																																																						
1.Graph		2.Values																																																					
<div><div>—△— Input Volt. 100V</div><div>---□--- Input Volt. 200V</div><div>-·-○-·- Input Volt. 230V</div></div> <p>Output Voltage [V]</p> <p>Ambient Temperature [°C]</p> <p>Load 100%</p>		<table><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><tr><td>-45</td><td>24.162</td><td>24.164</td><td>24.165</td></tr><tr><td>-40</td><td>24.166</td><td>24.169</td><td>24.169</td></tr><tr><td>-20</td><td>24.173</td><td>24.176</td><td>24.176</td></tr><tr><td>0</td><td>24.162</td><td>24.166</td><td>24.166</td></tr><tr><td>25</td><td>24.121</td><td>24.124</td><td>24.123</td></tr><tr><td>50</td><td>24.069</td><td>24.074</td><td>24.074</td></tr><tr><td>70</td><td>24.014</td><td>24.021</td><td>24.021</td></tr><tr><td>80</td><td>24.002</td><td>24.009</td><td>24.009</td></tr><tr><td>85</td><td>23.992</td><td>24.000</td><td>23.999</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>			Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-45	24.162	24.164	24.165	-40	24.166	24.169	24.169	-20	24.173	24.176	24.176	0	24.162	24.166	24.166	25	24.121	24.124	24.123	50	24.069	24.074	24.074	70	24.014	24.021	24.021	80	24.002	24.009	24.009	85	23.992	24.000	23.999	--	-	-	-	--	-	-	-
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Note: Slanted line shows the range of the rated ambient temperature.																																																							



Model		TUHS5F24	Testing Circuitry Figure A
Item		Output Voltage Accuracy	
Object		+24V0.22A	

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 - 80°C

Input Voltage : 85 - 264V

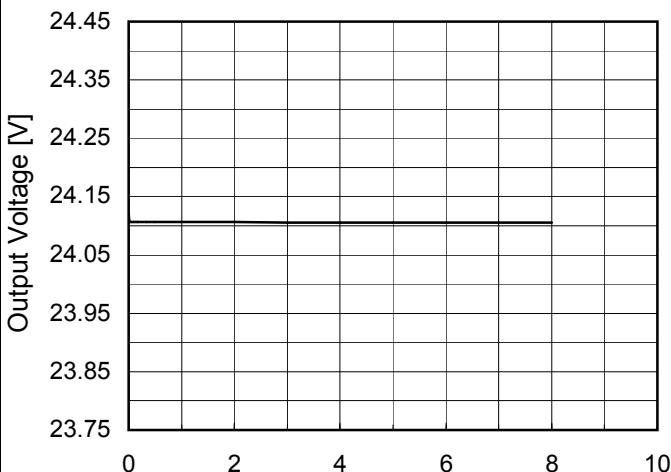
Load Current : 0 - 0.22A

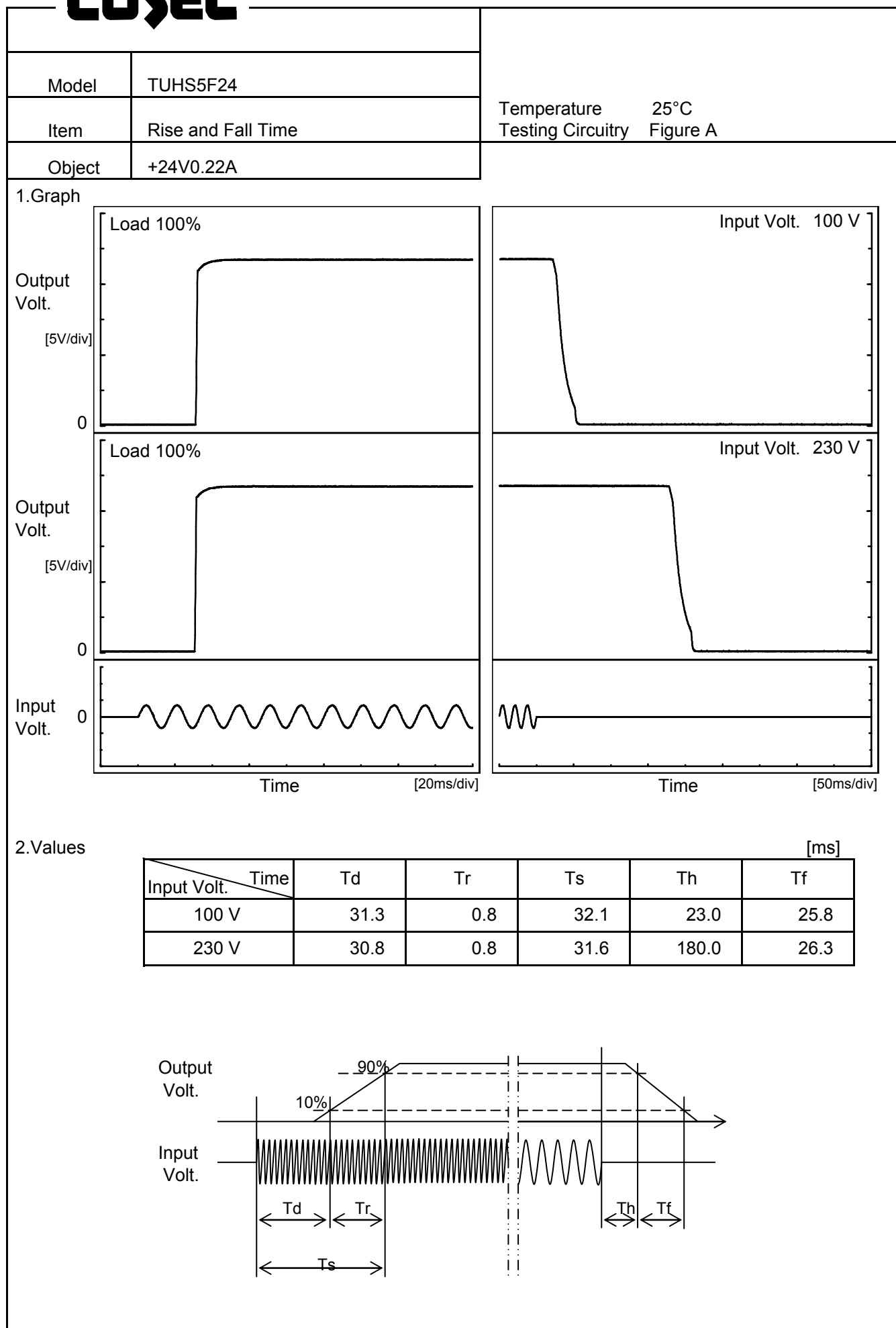
* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

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

2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	-20	85	0	24.182	±95	±0.4
Minimum Voltage	80	85	0.22	23.993		

Model	TUHS5F24																								
Item	Time Lapse Drift	Temperature	25°C																						
		Testing Circuitry	Figure A																						
Object	+24V0.22A																								
1.Graph		2.Values																							
<div><p>Output Voltage [V]</p><p>Time [H]</p><p>Input Volt. 100V</p><p>Load 100%</p></div>		<table><tr><th>Time since start [H]</th><th>Output Voltage [V]</th></tr><tr><td>0.0</td><td>24.121</td></tr><tr><td>0.5</td><td>24.107</td></tr><tr><td>1.0</td><td>24.107</td></tr><tr><td>2.0</td><td>24.106</td></tr><tr><td>3.0</td><td>24.106</td></tr><tr><td>4.0</td><td>24.106</td></tr><tr><td>5.0</td><td>24.106</td></tr><tr><td>6.0</td><td>24.106</td></tr><tr><td>7.0</td><td>24.106</td></tr><tr><td>8.0</td><td>24.106</td></tr></table>		Time since start [H]	Output Voltage [V]	0.0	24.121	0.5	24.107	1.0	24.107	2.0	24.106	3.0	24.106	4.0	24.106	5.0	24.106	6.0	24.106	7.0	24.106	8.0	24.106
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7.0	24.106																								
8.0	24.106																								
* The characteristic of AC230V is equal.																									



Model	TUHS5F24																																																																
Item	Hold-Up Time	Temperature	25°C																																																														
		Testing Circuitry	Figure A																																																														
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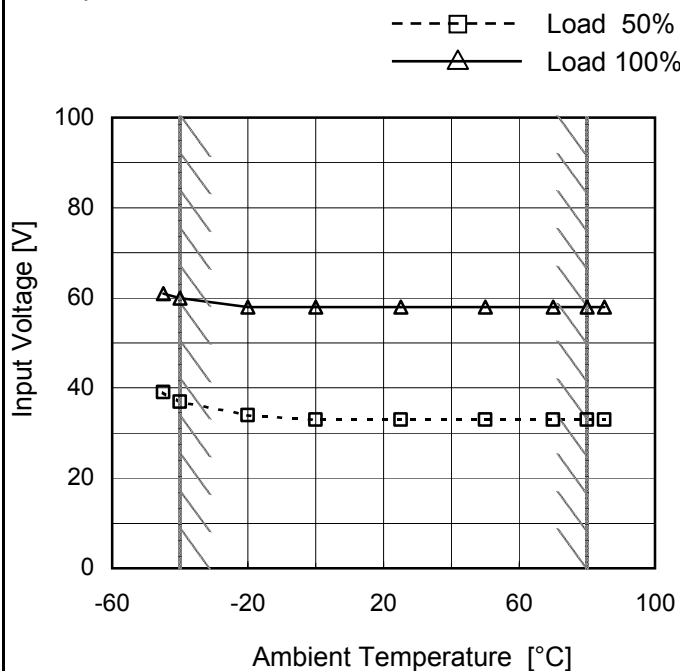
Model TUHS5F24

Item Minimum Input Voltage
for Regulated Output Voltage

Object +24V0.22A

Testing Circuitry Figure A

1. Graph



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

2. Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-45	39	61
-40	37	60
-20	34	58
0	33	58
25	33	58
50	33	58
70	33	58
80	33	58
85	33	58
--	-	-
--	-	-

Model	TUHS5F24																																																	
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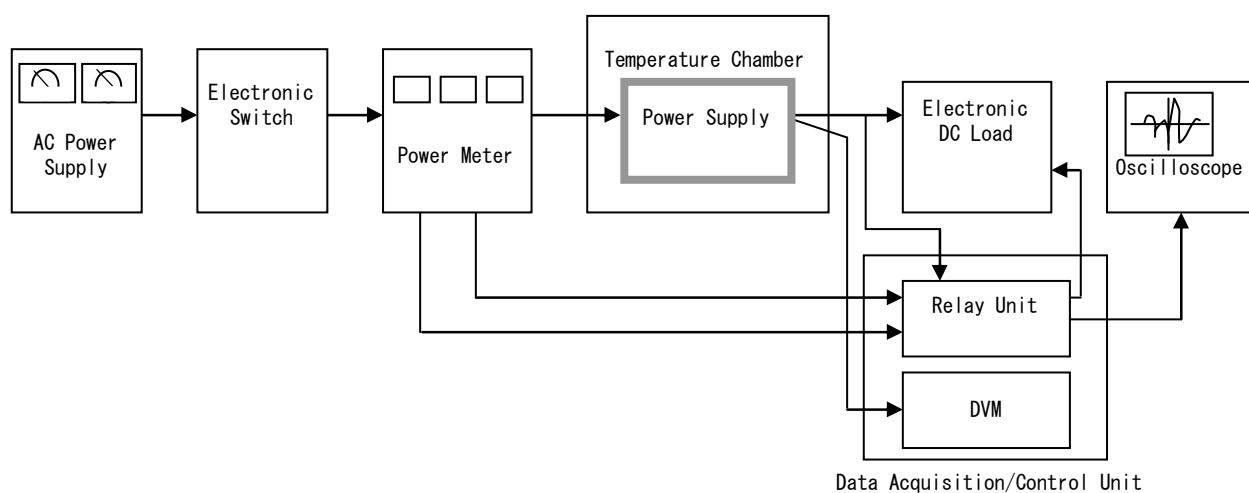


Figure A

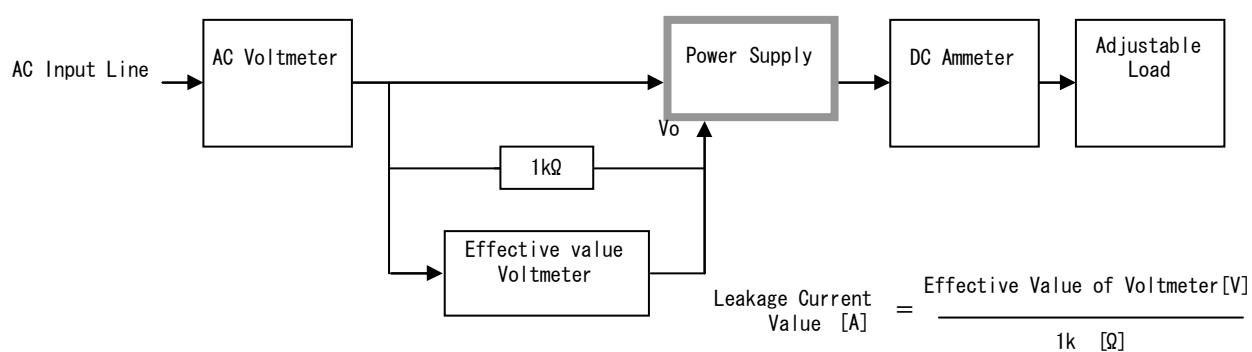


Figure B (DEN-AN)

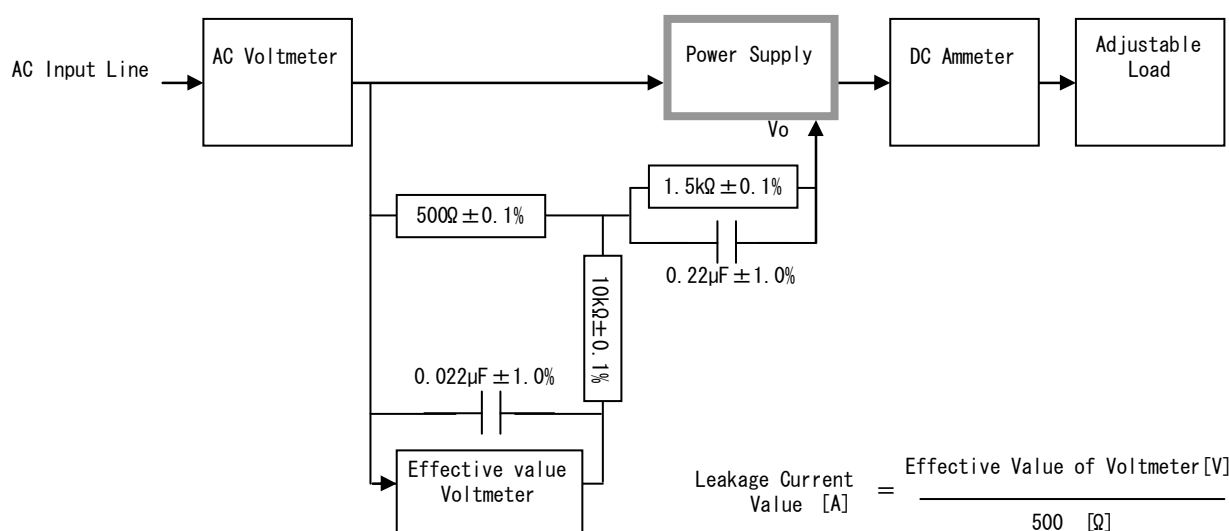


Figure B (IEC60950-1)

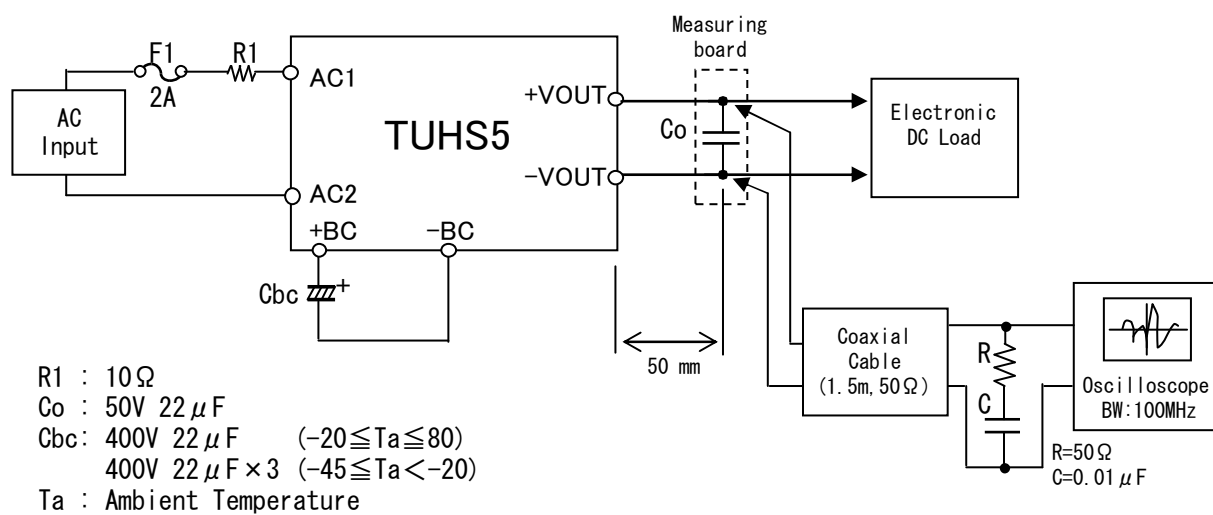


Figure C