

TEST DATA OF TUHS10F15

Regulated DC Power Supply
August 29, 2017

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COSEL CO.,LTD.

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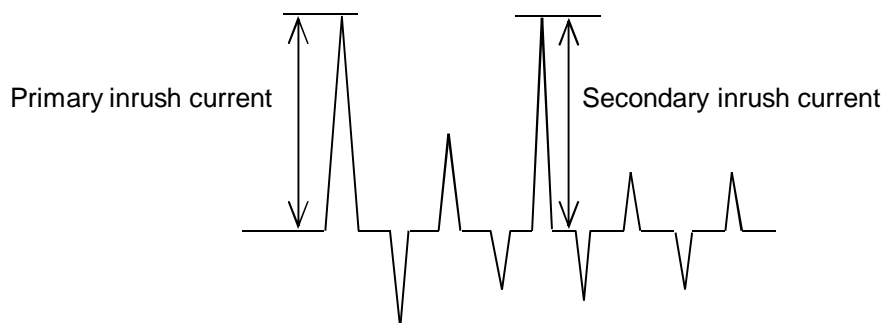
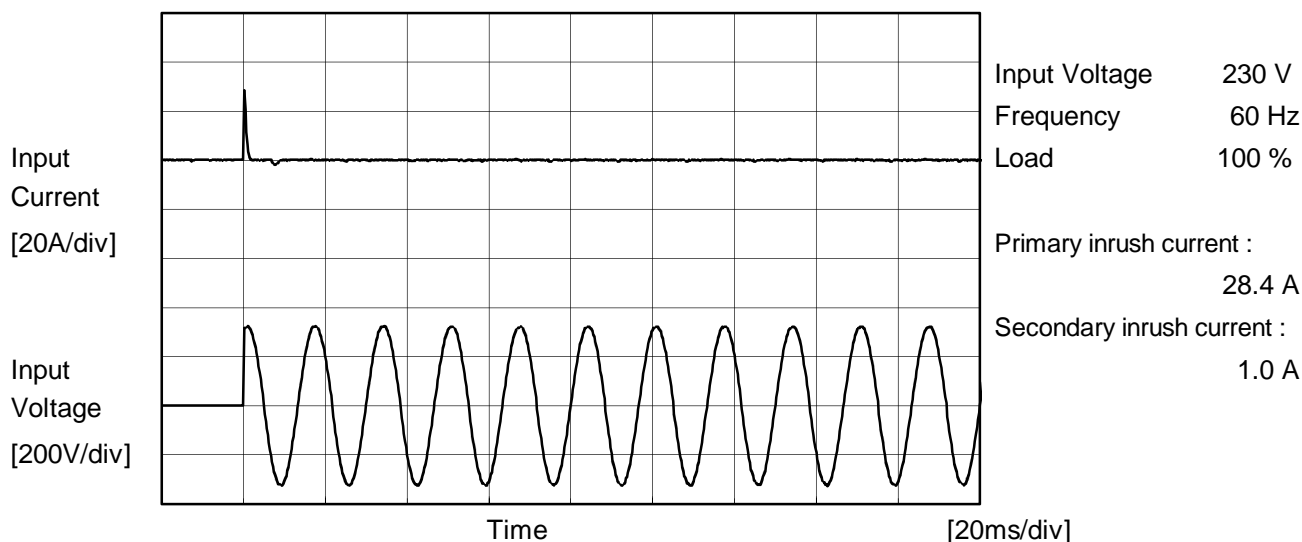
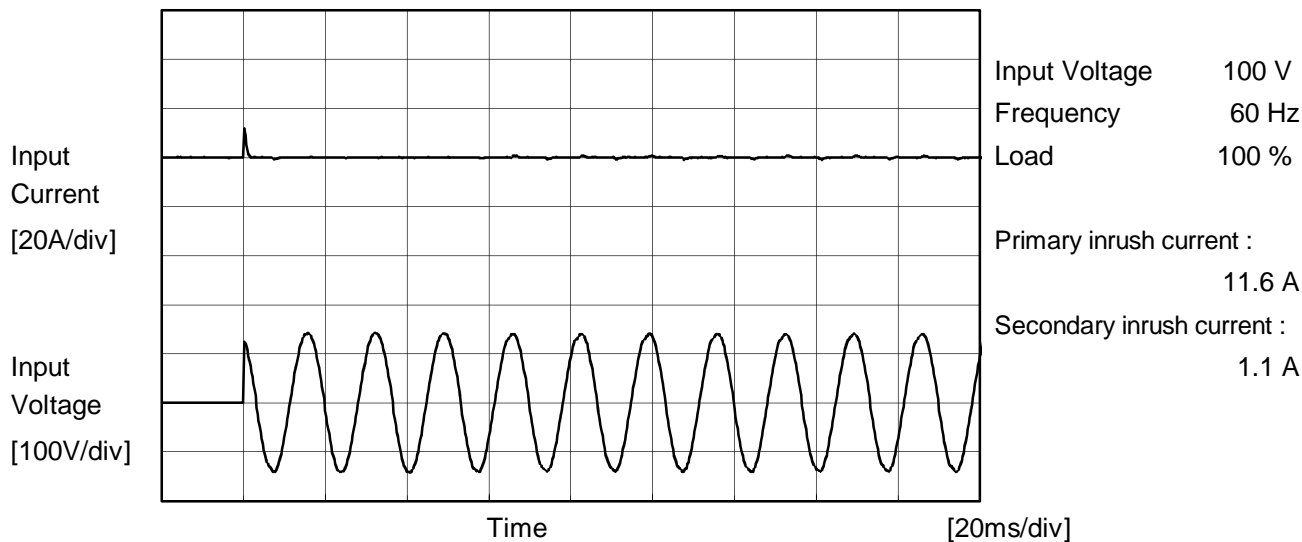
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COSEL			
Model	TUHS10F15	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		





COSEL		
Model	TUHS10F15	Temperature 25°C Testing Circuitry Figure B
Item	Leakage Current	
Object	_____	

1.Results

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.005	0.007	0.008	Operation
	One of phases	0.004	0.010	0.011	Stand by
IEC60950-1	Both phases	0.003	0.006	0.007	Operation
	One of phases	0.004	0.010	0.010	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.



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<p>1.Graph</p> <p> —△— Input Volt. 100V - - □ - - Input Volt. 200V - · ○ · - - Input Volt. 230V </p> <p>Output Voltage [V]</p> <p>Load Current [A]</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</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>0.00</td><td>15.014</td><td>15.015</td><td>15.015</td></tr> <tr><td>0.11</td><td>15.014</td><td>15.016</td><td>15.016</td></tr> <tr><td>0.22</td><td>15.015</td><td>15.017</td><td>15.016</td></tr> <tr><td>0.34</td><td>15.014</td><td>15.016</td><td>15.016</td></tr> <tr><td>0.45</td><td>15.013</td><td>15.015</td><td>15.015</td></tr> <tr><td>0.56</td><td>15.012</td><td>15.013</td><td>15.014</td></tr> <tr><td>0.67</td><td>15.011</td><td>15.012</td><td>15.012</td></tr> <tr><td>0.74</td><td>15.010</td><td>15.010</td><td>15.010</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>	Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	15.014	15.015	15.015	0.11	15.014	15.016	15.016	0.22	15.015	15.017	15.016	0.34	15.014	15.016	15.016	0.45	15.013	15.015	15.015	0.56	15.012	15.013	15.014	0.67	15.011	15.012	15.012	0.74	15.010	15.010	15.010	--	-	-	-	--	-	-	-	--	-	-	-
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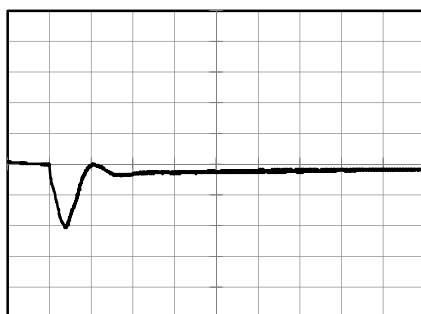
Model		TUHS10F15	
Item		Dynamic Load Response	Temperature 25°C Testing Circuitry Figure A
Object		+15V 0.67A	

Input Volt. 230V
Cycle 500ms

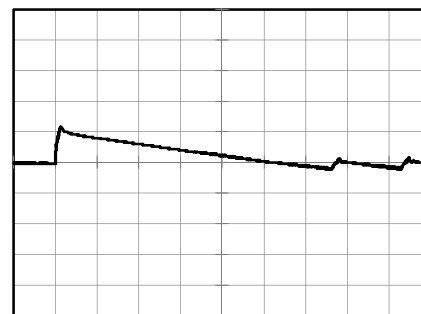
Load Current  0.67A / 100us

Min.Load (0A) ←→
Load 100%(0.67A)

500 mV/div



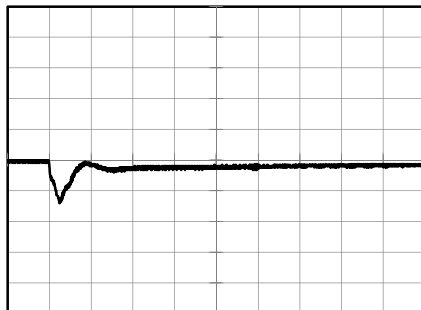
200 us/div



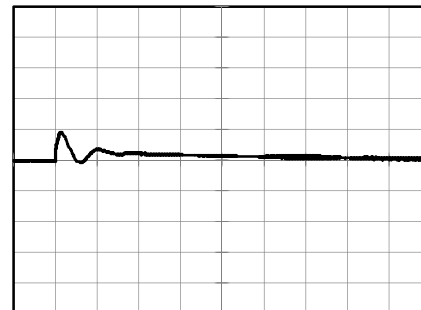
400 us/div

Load 20% (0.134A) ←→
Load 100%(0.67A)

500 mV/div



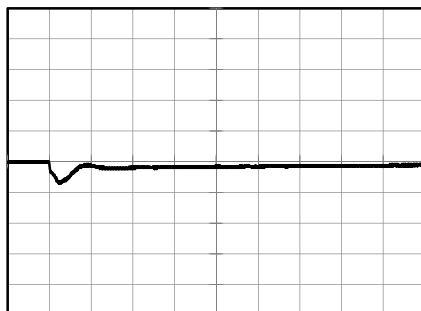
200 us/div



400 us/div

Load 50% (0.335A) ←→
Load 100% (0.67A)

500 mV/div



200 us/div



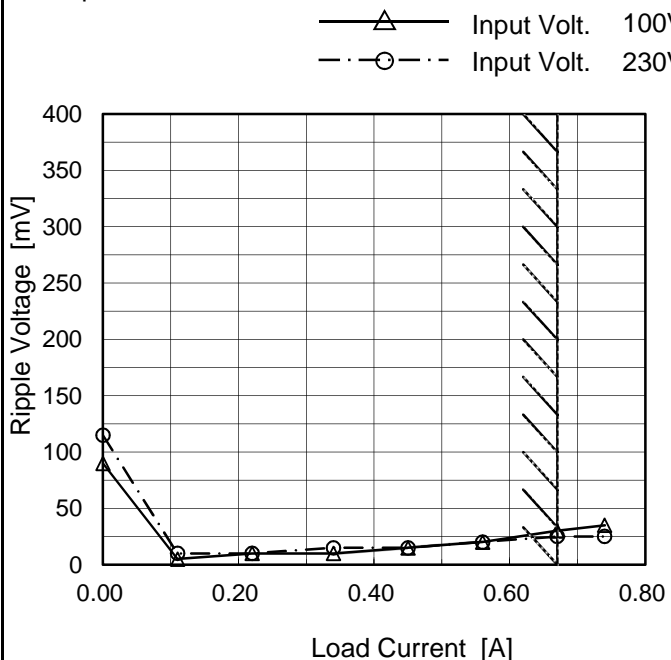
400 us/div



Model	TUHS10F15
Item	Ripple Voltage (by Load Current)
Object	+15V0.67A

Temperature 25°C
Testing Circuitry Figure C

1. Graph



2. Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.00	90	115
0.11	5	10
0.22	10	10
0.34	10	15
0.45	15	15
0.56	20	20
0.67	30	25
0.74	35	25
--	-	-
--	-	-
--	-	-

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.

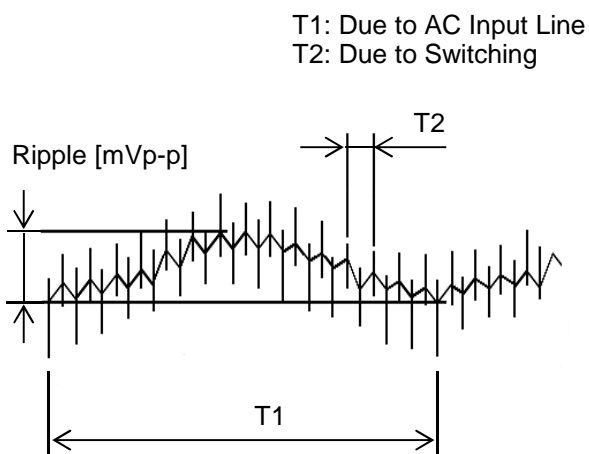


Fig. Complex Ripple Wave Form



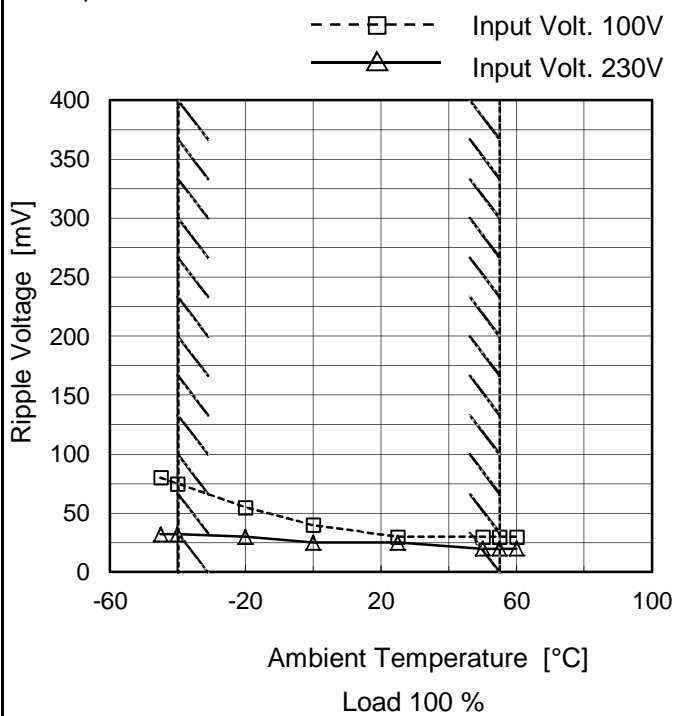
<p>Model TUHS10F15</p> <p>Item Ripple-Noise</p> <p>Object +15V0.67A</p>		<p>Temperature 25°C</p> <p>Testing Circuitry Figure C</p>																																					
<p>1.Graph</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>—△— Input Volt. 100V</p> <p>-·-○-·- Input Volt. 230V</p> </div> </div> <p>2.Values</p> <table border="1"> <thead> <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> </thead> <tbody> <tr><td>0.00</td><td>115</td><td>200</td></tr> <tr><td>0.11</td><td>10</td><td>20</td></tr> <tr><td>0.22</td><td>15</td><td>20</td></tr> <tr><td>0.34</td><td>20</td><td>20</td></tr> <tr><td>0.45</td><td>25</td><td>25</td></tr> <tr><td>0.56</td><td>35</td><td>25</td></tr> <tr><td>0.67</td><td>50</td><td>35</td></tr> <tr><td>0.74</td><td>60</td><td>35</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-Noise [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	115	200	0.11	10	20	0.22	15	20	0.34	20	20	0.45	25	25	0.56	35	25	0.67	50	35	0.74	60	35	--	-	-	--	-	-	--	-	-
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<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>																																							
<p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Fig. Complex Ripple Wave Form</p>																																							



Model	TUHS10F15
Item	Ripple Voltage (by Ambient Temp.)
Object	+15V0.67A

Testing Circuitry Figure C

1. Graph



Measured by 100 MHz Oscilloscope.
 Note: Slanted line shows the range of the rated ambient temperature.

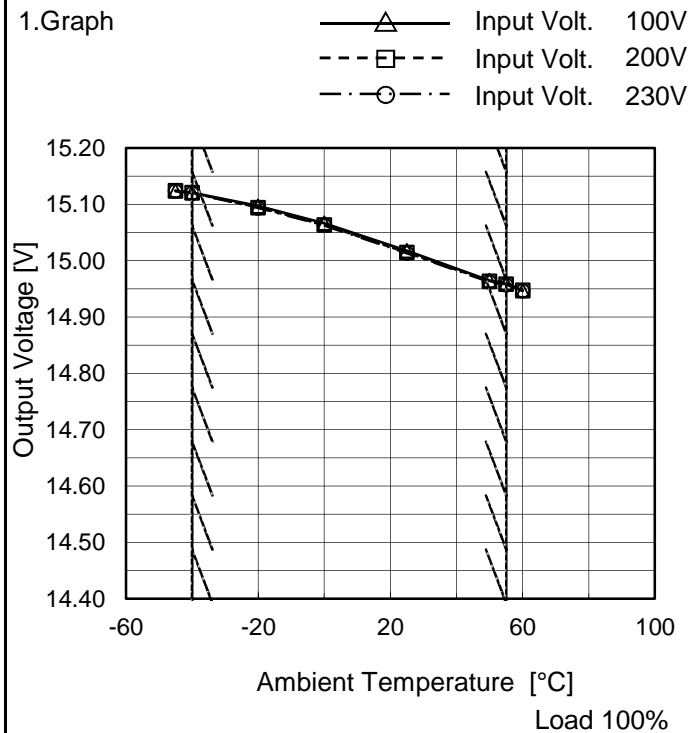
2. Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100V	Input Volt. 230V
-45	80	32
-40	75	32
-20	55	30
0	40	25
25	30	25
50	30	20
55	30	20
60	30	20
--	-	-
--	-	-
--	-	-



Model	TUHS10F15
Item	Ambient Temperature Drift
Object	+15V0.67A

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	15.124	15.124	15.124
-40	15.121	15.121	15.120
-20	15.097	15.095	15.094
0	15.067	15.064	15.063
25	15.018	15.014	15.013
50	14.965	14.964	14.962
55	14.961	14.958	14.957
60	14.947	14.948	14.947
--	-	-	-
--	-	-	-
--	-	-	-

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



COSEL		Testing Circuitry Figure A
Model	TUHS10F15	
Item	Output Voltage Accuracy	
Object	+15V0.67A	

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 - 55°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.67A

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

* 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	-40	200	0	15.121	±82	±0.5
Minimum Voltage	55	230	0.67	15.957		

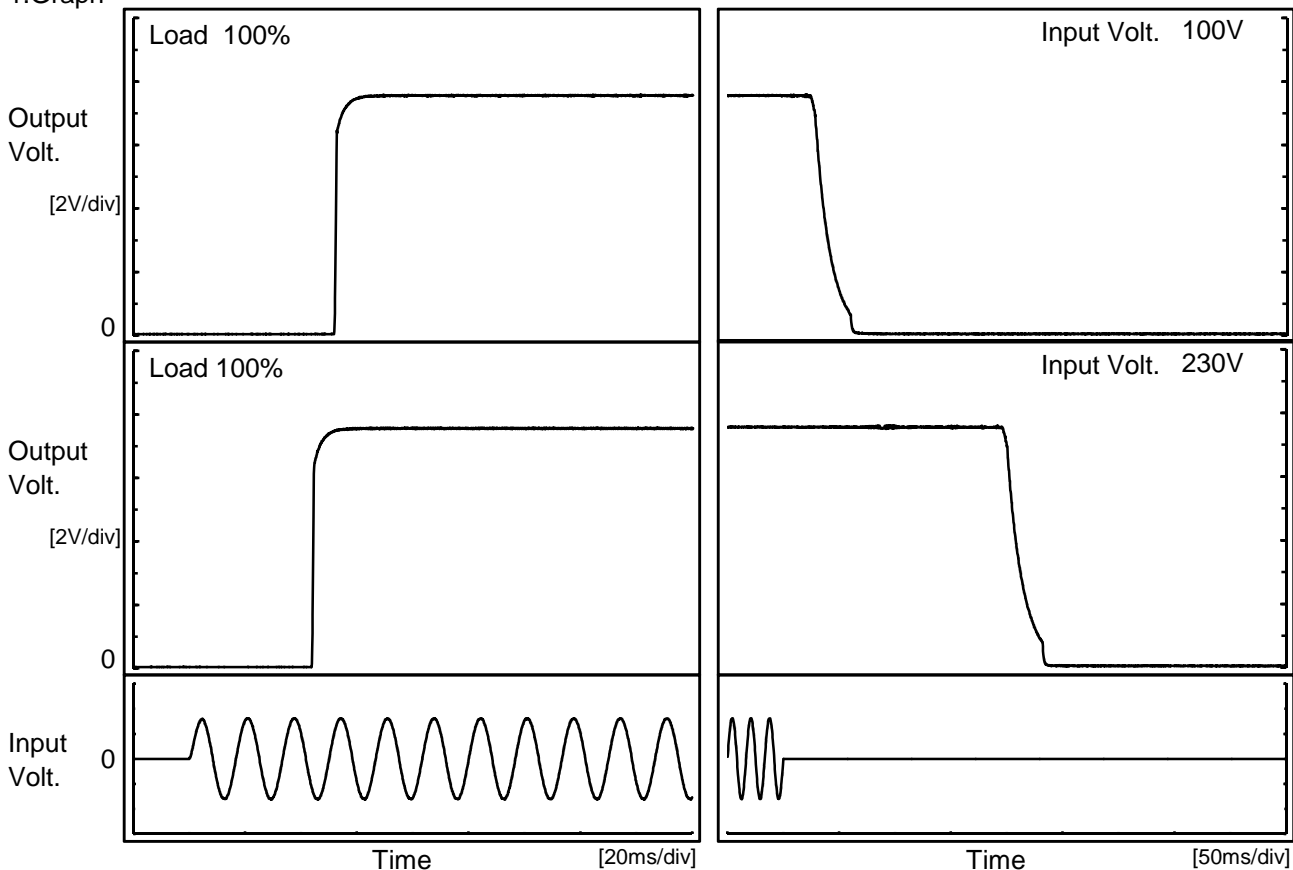


COSEL																								
Model	TUHS10F15																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	+15V0.67A																							
<p>1.Graph</p> <p style="text-align: center;">Time [H]</p> <p style="text-align: center;">Input Volt. 100V Load 100%</p> <p>* The characteristic of AC230V is equal.</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>15.043</td></tr> <tr><td>0.5</td><td>14.994</td></tr> <tr><td>1.0</td><td>14.993</td></tr> <tr><td>2.0</td><td>14.992</td></tr> <tr><td>3.0</td><td>14.992</td></tr> <tr><td>4.0</td><td>14.991</td></tr> <tr><td>5.0</td><td>14.991</td></tr> <tr><td>6.0</td><td>14.991</td></tr> <tr><td>7.0</td><td>14.991</td></tr> <tr><td>8.0</td><td>14.991</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	15.043	0.5	14.994	1.0	14.993	2.0	14.992	3.0	14.992	4.0	14.991	5.0	14.991	6.0	14.991	7.0	14.991	8.0	14.991
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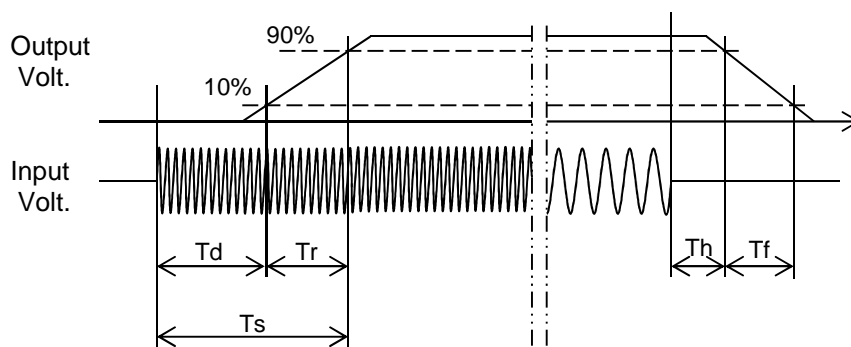
Model		TUHS10F15	Temperature		25°C
Item		Rise and Fall Time	Testing Circuitry		Figure A
Object		+15V0.67A			

1. Graph



2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf
100V		52.1	1.8	53.9	28.8	29.0
230V		44.0	1.8	45.8	200.5	31.5





Model		TUHS10F15	Temperature 25°C Testing Circuitry Figure A																																
Item		Hold-Up Time																																	
Object		+15V0.67A																																	
1.Graph		<p>---□--- Load 50% —△— Load 100%</p>	2.Values																																
		<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>	<table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Hold-Up Time [ms]</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr> <td>75</td> <td>31</td> <td>8</td> </tr> <tr> <td>85</td> <td>43</td> <td>14</td> </tr> <tr> <td>100</td> <td>64</td> <td>25</td> </tr> <tr> <td>120</td> <td>98</td> <td>42</td> </tr> <tr> <td>200</td> <td>300</td> <td>145</td> </tr> <tr> <td>230</td> <td>403</td> <td>198</td> </tr> <tr> <td>264</td> <td>540</td> <td>268</td> </tr> <tr> <td>280</td> <td>612</td> <td>306</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	75	31	8	85	43	14	100	64	25	120	98	42	200	300	145	230	403	198	264	540	268	280	612	306	--	-	-
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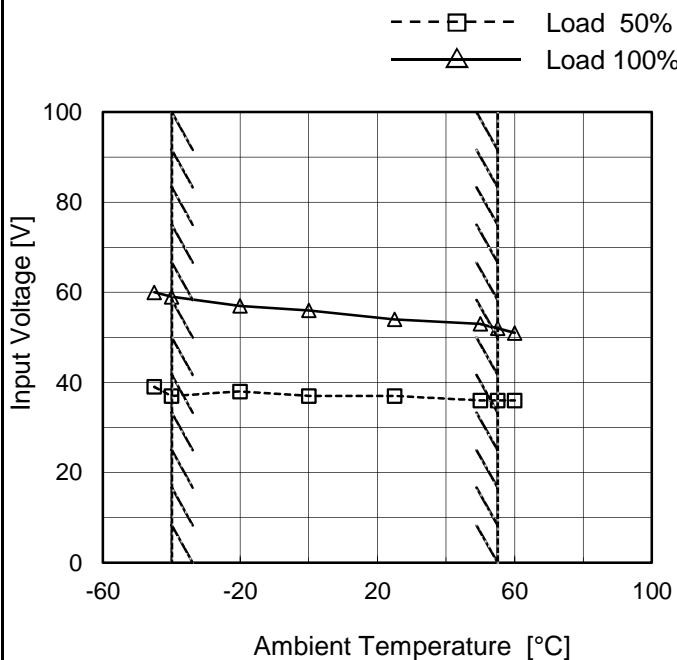
<p>Model TUHS10F15</p>		<p>Temperature 25°C Testing Circuitry Figure A</p>																																																			
Item	Instantaneous Interruption Compensation																																																				
Object	+15V0.67A																																																				
<p>1.Graph</p> <p> —△— Input Volt. 100V - - - □ - - Input Volt. 200V ···○··· Input Volt. 230V </p> <p>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Time [ms]</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>0.00</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>0.11</td><td>205</td><td>843</td><td>1116</td></tr> <tr><td>0.22</td><td>103</td><td>452</td><td>602</td></tr> <tr><td>0.34</td><td>65</td><td>297</td><td>398</td></tr> <tr><td>0.45</td><td>47</td><td>222</td><td>300</td></tr> <tr><td>0.56</td><td>36</td><td>177</td><td>240</td></tr> <tr><td>0.67</td><td>26</td><td>145</td><td>199</td></tr> <tr><td>0.74</td><td>21</td><td>129</td><td>176</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>	Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	-	-	-	0.11	205	843	1116	0.22	103	452	602	0.34	65	297	398	0.45	47	222	300	0.56	36	177	240	0.67	26	145	199	0.74	21	129	176	--	-	-	-	--	-	-	-	--	-	-	-
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Model	TUHS10F15
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+15V0.67A

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	60
-40	37	59
-20	38	57
0	37	56
25	37	54
50	36	53
55	36	52
60	36	51
--	-	-
--	-	-
--	-	-



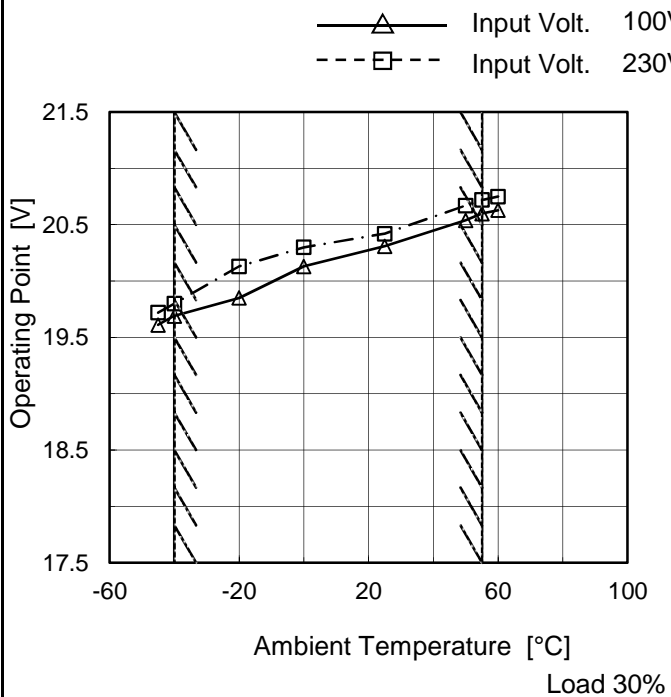
COSEL																																															
Model	TUHS10F15	Temperature	25°C																																												
Item	Overcurrent Protection	Testing Circuitry	Figure A																																												
Object	+15V0.67A																																														
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Model	TUHS10F15
Item	Oversvoltage Protection
Object	+15V0.67A

Testing Circuitry Figure A

1.Graph



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

2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-45	19.61	19.72
-40	19.69	19.80
-20	19.85	20.13
0	20.13	20.30
25	20.31	20.42
50	20.54	20.67
55	20.60	20.72
60	20.63	20.75
--	-	-
--	-	-
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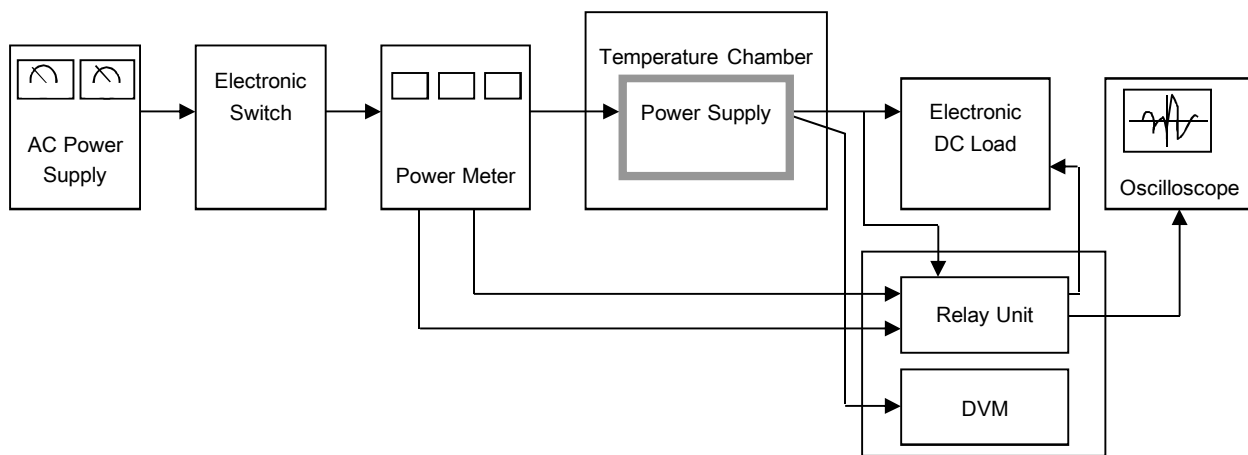


Figure A

Data Acquisition/Control Unit

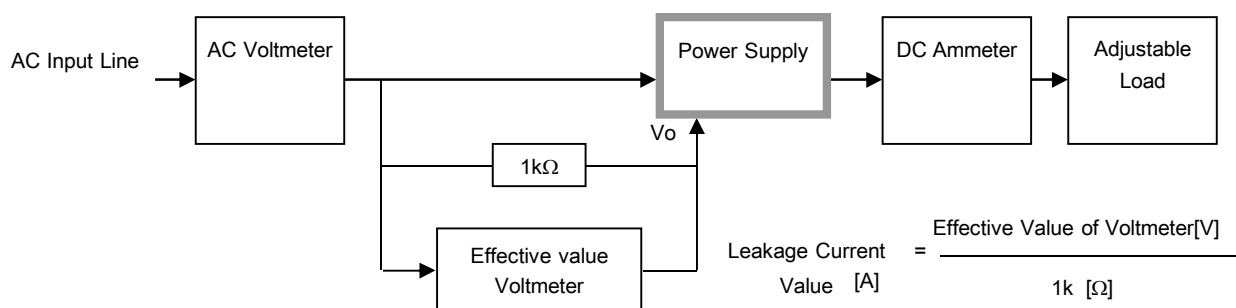


Figure B (DEN-AN)

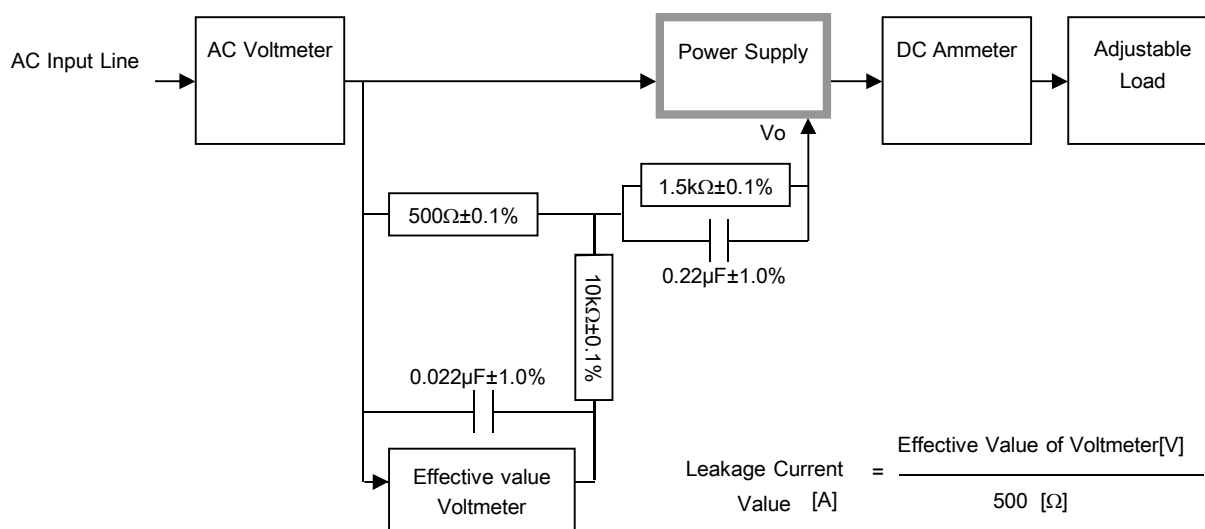


Figure B (IEC60950-1)

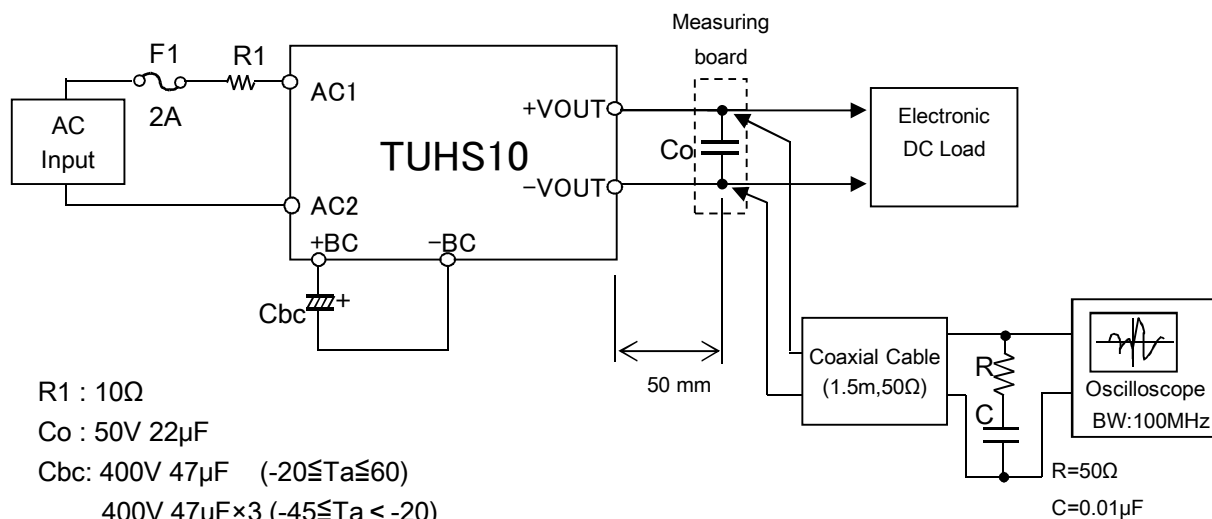


Figure C