

# TEST DATA OF TUHS3F15

Regulated DC Power Supply  
August 29, 2017

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Kenji Shihō Design Manager

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Tomoyuki Sakuma Design Engineer

**COSEL CO.,LTD.**

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Model	TUHS3F15																																																					
Item	Input Current (by Load Current)	Temperature	25°C																																																			
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<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Input Current [A]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>0.008</td><td>0.003</td><td>0.003</td></tr><tr><td>0.03</td><td>0.020</td><td>0.013</td><td>0.013</td></tr><tr><td>0.06</td><td>0.030</td><td>0.020</td><td>0.019</td></tr><tr><td>0.09</td><td>0.040</td><td>0.026</td><td>0.024</td></tr><tr><td>0.12</td><td>0.049</td><td>0.032</td><td>0.030</td></tr><tr><td>0.15</td><td>0.058</td><td>0.038</td><td>0.035</td></tr><tr><td>0.18</td><td>0.067</td><td>0.043</td><td>0.040</td></tr><tr><td>0.20</td><td>0.073</td><td>0.047</td><td>0.043</td></tr><tr><td>0.22</td><td>0.078</td><td>0.050</td><td>0.046</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Input Current [A]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	0.008	0.003	0.003	0.03	0.020	0.013	0.013	0.06	0.030	0.020	0.019	0.09	0.040	0.026	0.024	0.12	0.049	0.032	0.030	0.15	0.058	0.038	0.035	0.18	0.067	0.043	0.040	0.20	0.073	0.047	0.043	0.22	0.078	0.050	0.046	--	-	-	-	--	-	-	-
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<div> <div>Item</div> <div>Input Power (by Load Current)</div> </div>		
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1.Graph

—△—

Input Volt.

100V

---□---

Input Volt.

200V

---○---

Input Volt.

230V

Input Power [W]

5.0

4.0

3.0

2.0

1.0

0.0

0.00

0.05

0.10

0.15

0.20

0.25

Load Current [A]

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

2.Values

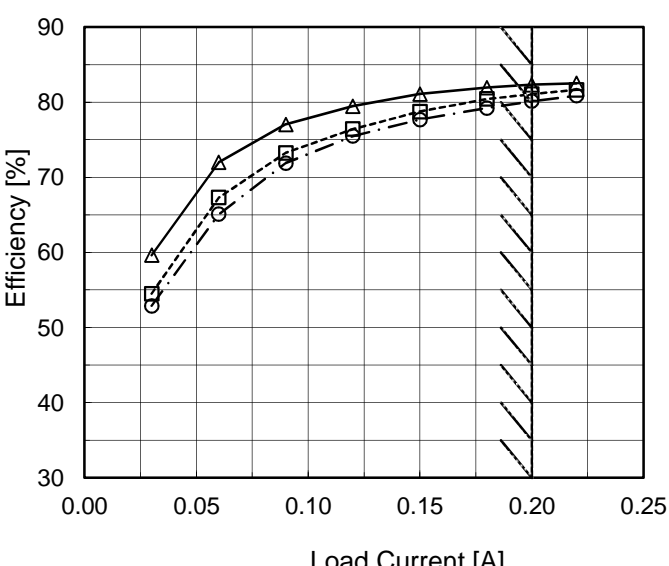
Load Current [A]	Input Power [W]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	0.26	0.15	0.15
0.03	0.75	0.83	0.85
0.06	1.25	1.34	1.37
0.09	1.75	1.84	1.88
0.12	2.26	2.34	2.38
0.15	2.77	2.84	2.88
0.18	3.28	3.35	3.38
0.20	3.63	3.69	3.72
0.22	3.98	4.02	4.06
--	-	-	-
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- 2 -

BC-11210

Model		TUHS3F15		Temperature 25°C	
Item		Efficiency (by Input Voltage)		Testing Circuitry Figure A	
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1.Graph				2.Values	
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# COSEL

Model	TUHS3F15																																																					
Item	Power Factor (by Load Current)	Temperature	25°C																																																			
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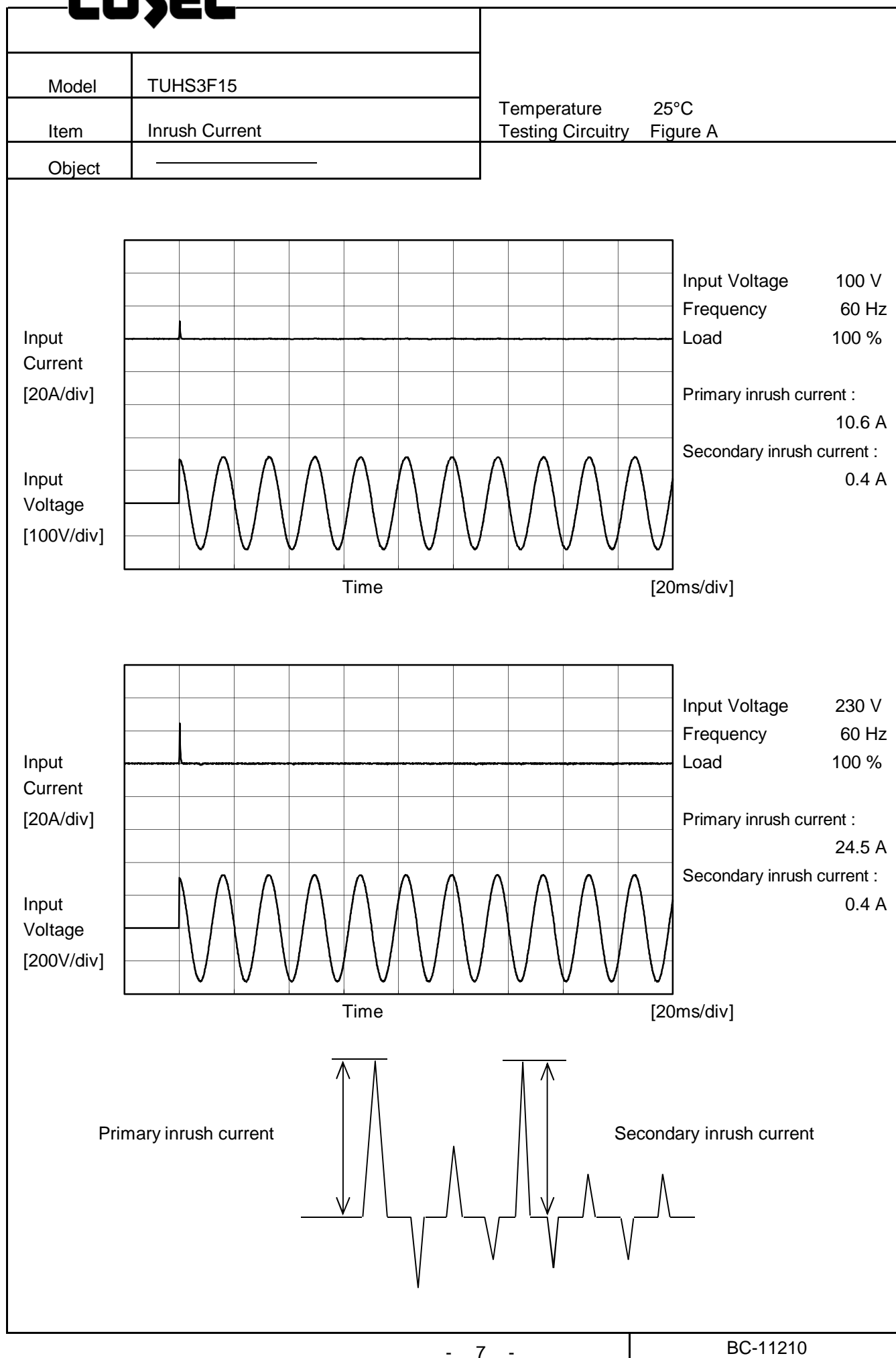
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BC-11210



**COSEL**



		Temperature 25°C Testing Circuitry Figure B
Model	TUHS3F15	
Item	Leakage Current	
Object	_____	

## 1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.003	0.004	0.005	Operation
	One of phases	0.003	0.005	0.006	Stand by
IEC60950-1	Both phases	0.002	0.004	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.

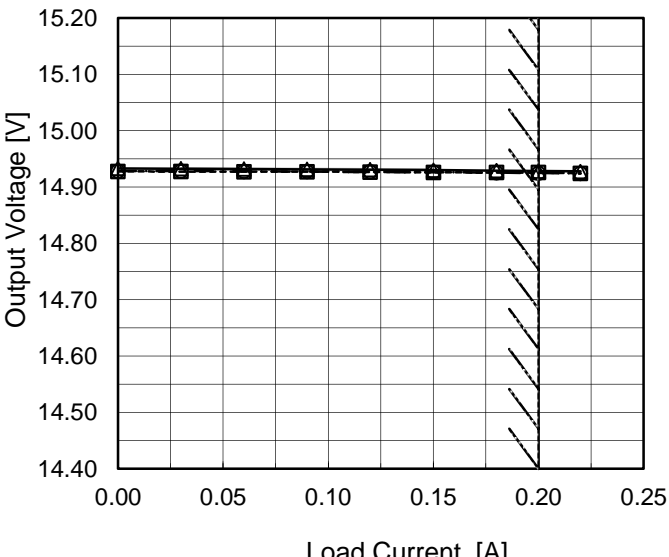
## 2.Condition

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	TUHS3F15																																
Item	Line Regulation	Temperature	25°C																														
		Testing Circuitry	Figure A																														
Object	+15V0.2A																																
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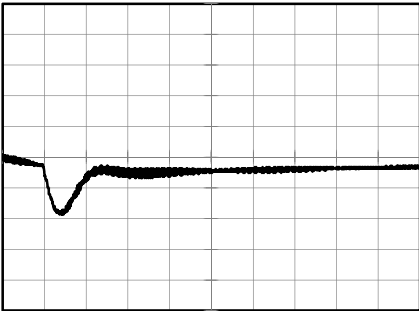
			
Model	TUHS3F15		
Item	Dynamic Load Response	Temperature	25°C
		Testing Circuitry	Figure A
Object	+15V 0.2A		

Input Volt. 230V  
Cycle 500ms

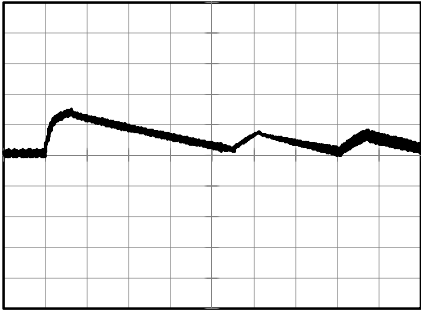
Load Current  0.2A / 100us

Min.Load (0A)←→  
Load 100%(0.2A)

200 mV/div



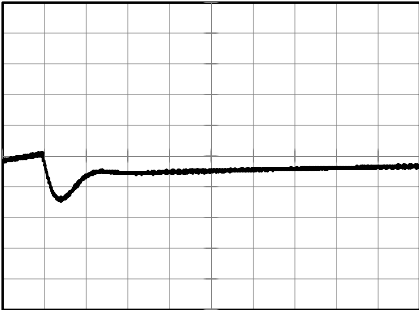
200 us/div



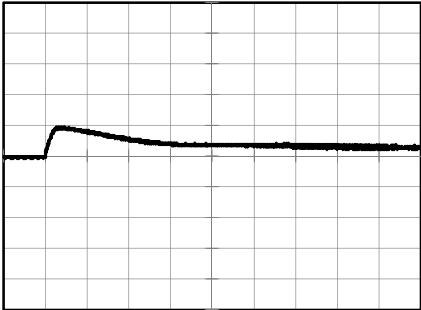
200 us/div

Load 20% (0.04A)←→  
Load 100%(0.2A)

200 mV/div



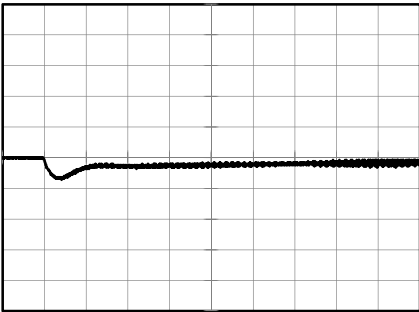
200 us/div



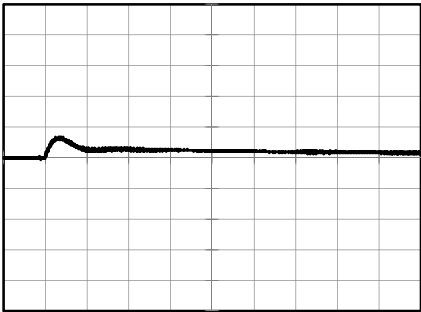
200 us/div

Load 50% (0.1A)←→  
Load 100% (0.2A)

200 mV/div



200 us/div



200 us/div

Model	TUHS3F15																																										
Item	Ripple Voltage (by Load Current)	Temperature	25°C																																								
Object	+15V0.2A	Testing Circuitry	Figure C																																								
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Model	TUHS3F15																																						
Item	Ripple Voltage (by Ambient Temp.)	Testing Circuitry    Figure C																																					
Object	+15V0.2A																																						
1.Graph		2.Values																																					
<div><div><div>---□---</div><div>Input Volt. 100V</div></div><div><div>—△—</div><div>Input Volt. 230V</div></div></div> <table><thead><tr><th>Ambient Temperature [°C]</th><th>Input Volt. 100V [mV]</th><th>Input Volt. 230V [mV]</th></tr></thead><tbody><tr><td>-45</td><td>85</td><td>30</td></tr><tr><td>-40</td><td>80</td><td>30</td></tr><tr><td>-20</td><td>55</td><td>25</td></tr><tr><td>0</td><td>45</td><td>20</td></tr><tr><td>25</td><td>30</td><td>15</td></tr><tr><td>50</td><td>30</td><td>15</td></tr><tr><td>75</td><td>30</td><td>10</td></tr><tr><td>85</td><td>25</td><td>10</td></tr><tr><td>90</td><td>20</td><td>10</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></tbody></table> <p>Measured by 100 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.</p>		Ambient Temperature [°C]	Input Volt. 100V [mV]	Input Volt. 230V [mV]	-45	85	30	-40	80	30	-20	55	25	0	45	20	25	30	15	50	30	15	75	30	10	85	25	10	90	20	10	--	-	-	--	-	-		
Ambient Temperature [°C]	Input Volt. 100V [mV]	Input Volt. 230V [mV]																																					
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0	45	20																																					
25	30	15																																					
50	30	15																																					
75	30	10																																					
85	25	10																																					
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Model	TUHS3F15																																																						
Item	Ambient Temperature Drift	Testing Circuitry    Figure A																																																					
Object	+15V0.2A																																																						
1.Graph		2.Values																																																					
<div><div><div>—△—</div><div>Input Volt. 100V</div></div><div><div>---□---</div><div>Input Volt. 200V</div></div><div><div>---○---</div><div>Input Volt. 230V</div></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>14.953</td><td>14.956</td><td>14.956</td></tr><tr><td>-40</td><td>14.956</td><td>14.957</td><td>14.958</td></tr><tr><td>-20</td><td>14.957</td><td>14.958</td><td>14.958</td></tr><tr><td>0</td><td>14.951</td><td>14.950</td><td>14.950</td></tr><tr><td>25</td><td>14.929</td><td>14.930</td><td>14.929</td></tr><tr><td>50</td><td>14.895</td><td>14.894</td><td>14.893</td></tr><tr><td>70</td><td>14.858</td><td>14.857</td><td>14.856</td></tr><tr><td>85</td><td>14.835</td><td>14.831</td><td>14.829</td></tr><tr><td>90</td><td>14.826</td><td>14.816</td><td>14.815</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	14.953	14.956	14.956	-40	14.956	14.957	14.958	-20	14.957	14.958	14.958	0	14.951	14.950	14.950	25	14.929	14.930	14.929	50	14.895	14.894	14.893	70	14.858	14.857	14.856	85	14.835	14.831	14.829	90	14.826	14.816	14.815	--	-	-	-	--	-	-	-
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Note: Slanted line shows the range of the rated ambient temperature.																																																							



		Testing Circuitry Figure A
Model	TUHS3F15	
Item	Output Voltage Accuracy	
Object	+15V0.2A	

### 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 - 0.2A

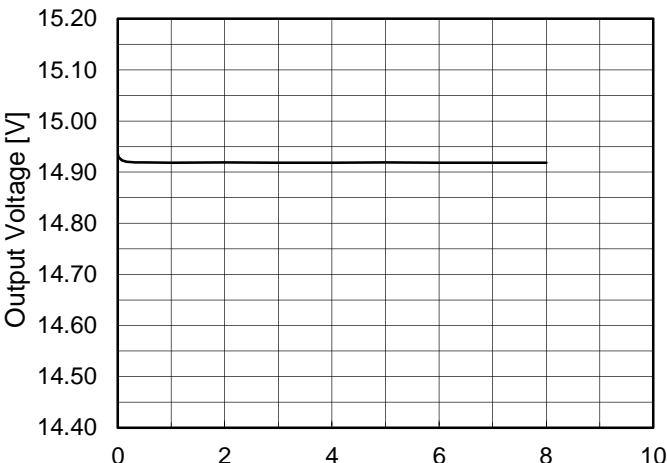
\* Output Voltage Accuracy =  $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

\* 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	14.972	±73	±0.5
Minimum Voltage	85	264	0.2	14.827		

# COSEL

Model	TUHS3F15																								
Item	Time Lapse Drift	Temperature	25°C																						
Object	+15V0.2A	Testing Circuitry	Figure A																						
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>14.936</td></tr><tr><td>0.5</td><td>14.919</td></tr><tr><td>1.0</td><td>14.918</td></tr><tr><td>2.0</td><td>14.919</td></tr><tr><td>3.0</td><td>14.918</td></tr><tr><td>4.0</td><td>14.919</td></tr><tr><td>5.0</td><td>14.919</td></tr><tr><td>6.0</td><td>14.919</td></tr><tr><td>7.0</td><td>14.919</td></tr><tr><td>8.0</td><td>14.918</td></tr></table>		Time since start [H]	Output Voltage [V]	0.0	14.936	0.5	14.919	1.0	14.918	2.0	14.919	3.0	14.918	4.0	14.919	5.0	14.919	6.0	14.919	7.0	14.919	8.0	14.918
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7.0	14.919																								
8.0	14.918																								
* The characteristic of AC230V is equal.																									

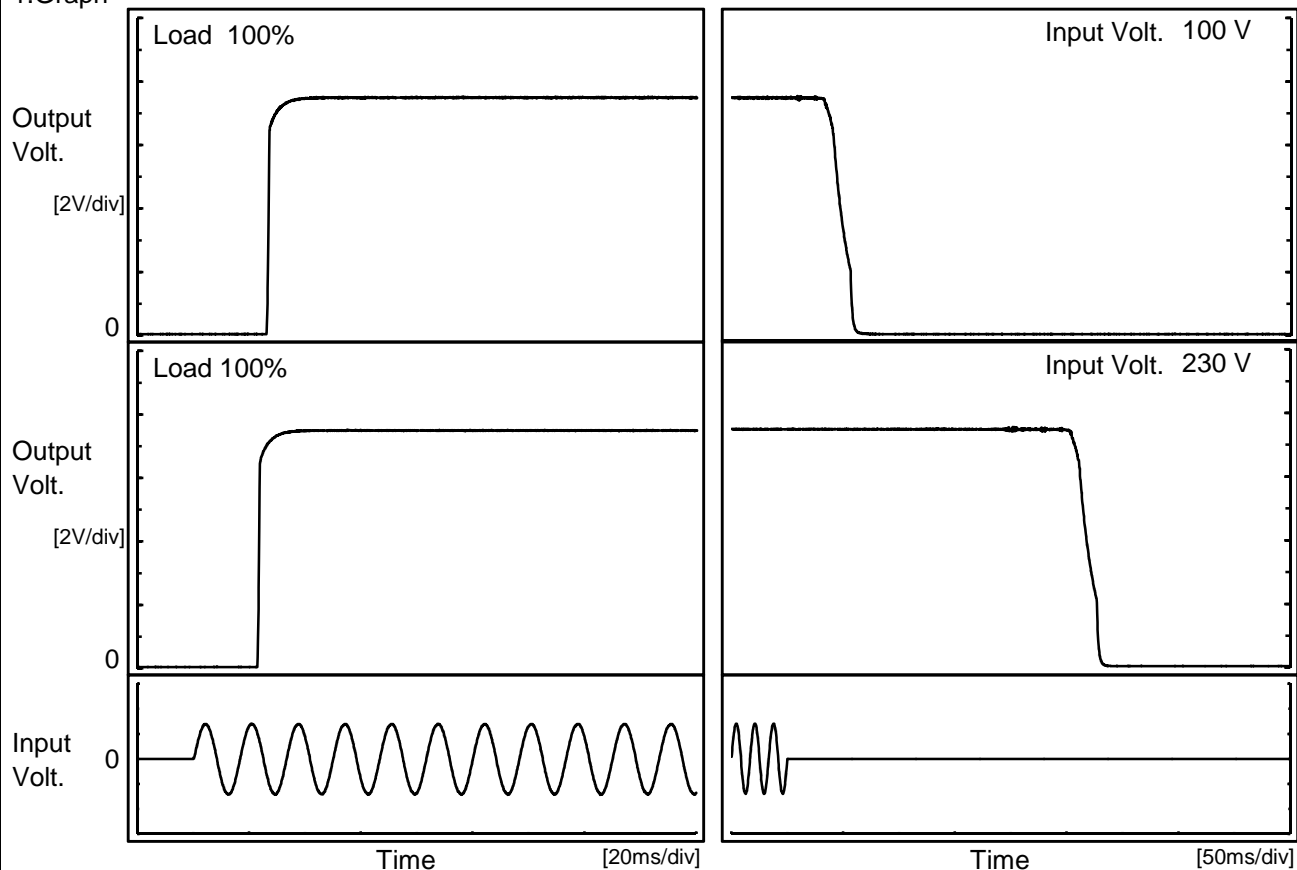
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# COSEL

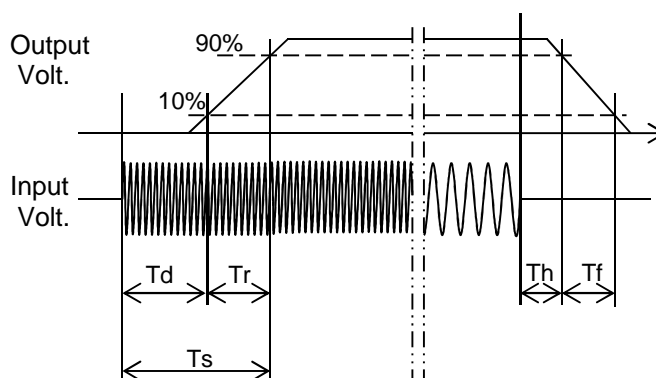
Model	TUHS3F15	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+15V0.2A		

## 1. Graph



## 2. Values

Input Volt. \ Time	Td	Tr	Ts	Th	Tf
100V	26.5	1.7	28.2	38.5	19.3
230V	23.1	1.8	24.9	258.8	19.5



Model	TUHS3F15																																		
Item	Hold-Up Time	Temperature	25°C																																
		Testing Circuitry	Figure A																																
Object	+15V0.2A																																		
1.Graph		2.Values																																	
<div><div>---□--- Load 50%</div><div>—△— Load 100%</div><div><p>Hold-Up Time [ms]</p><p>Input Voltage [V]</p></div></div>		<table><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><tr><td>75</td><td>42</td><td>12</td></tr><tr><td>85</td><td>57</td><td>20</td></tr><tr><td>100</td><td>83</td><td>34</td></tr><tr><td>120</td><td>126</td><td>56</td></tr><tr><td>200</td><td>371</td><td>188</td></tr><tr><td>230</td><td>496</td><td>256</td></tr><tr><td>264</td><td>659</td><td>346</td></tr><tr><td>280</td><td>744</td><td>392</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></table>		Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	75	42	12	85	57	20	100	83	34	120	126	56	200	371	188	230	496	256	264	659	346	280	744	392	--	-	-
Input Voltage [V]	Hold-Up Time [ms]																																		
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280	744	392																																	
--	-	-																																	
<p>This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy.</p> <p>Note: Slanted line shows the range of the rated input voltage.</p>																																			

Model	TUHS3F15																																																					
Item	Instantaneous Interruption Compensation	Temperature	25°C																																																			
Object	+15V0.2A	Testing Circuitry	Figure A																																																			
1.Graph		2.Values																																																				
<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div> <p>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><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><tr><td>0.00</td><td>-</td><td>-</td><td>-</td></tr><tr><td>0.03</td><td>238</td><td>954</td><td>1256</td></tr><tr><td>0.06</td><td>136</td><td>573</td><td>761</td></tr><tr><td>0.09</td><td>92</td><td>407</td><td>542</td></tr><tr><td>0.12</td><td>68</td><td>311</td><td>418</td></tr><tr><td>0.15</td><td>54</td><td>216</td><td>303</td></tr><tr><td>0.18</td><td>43</td><td>170</td><td>243</td></tr><tr><td>0.20</td><td>36</td><td>143</td><td>210</td></tr><tr><td>0.22</td><td>29</td><td>121</td><td>182</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	-	-	-	0.03	238	954	1256	0.06	136	573	761	0.09	92	407	542	0.12	68	311	418	0.15	54	216	303	0.18	43	170	243	0.20	36	143	210	0.22	29	121	182	--	-	-	-	--	-	-	-
Load Current [A]	Time [ms]																																																					
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		Testing Circuitry    Figure A																																						
Model	TUHS3F15																																							
Item	Minimum Input Voltage for Regulated Output Voltage																																							
Object	+15V0.2A																																							
1.Graph		2.Values																																						
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Ambient Temperature [°C]	Input Voltage [V]																																							
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BC-11210

# COSEL

Model	TUHS3F15																																																	
Item	Overcurrent Protection	Temperature	25°C																																															
Object	+15V0.2A	Testing Circuitry	Figure A																																															
1.Graph		2.Values																																																
<div><div><div></div><div>△</div><div>Input Volt. 100V</div></div><div><div></div><div>□</div><div>Input Volt. 230V</div></div></div> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><tr><th rowspan="2">Output Voltage [V]</th><th colspan="2">Load Current [A]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>15.0</td><td>0.29</td><td>0.38</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><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><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><tr><td>--</td><td>-</td><td>-</td></tr></table>		Output Voltage [V]	Load Current [A]		Input Volt. 100[V]	Input Volt. 230[V]	15.0	0.29	0.38	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
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Model

TUHS3F15

Item

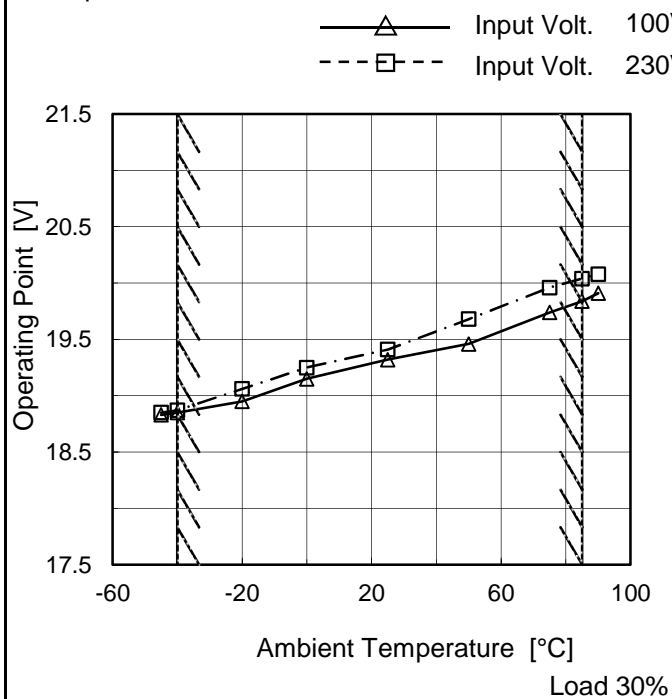
Overvoltage Protection

Object

+15V0.2A

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	18.83	18.85
-40	18.85	18.87
-20	18.95	19.06
0	19.15	19.25
25	19.32	19.41
50	19.46	19.68
75	19.74	19.96
85	19.84	20.04
90	19.91	20.08
--	-	-
--	-	-

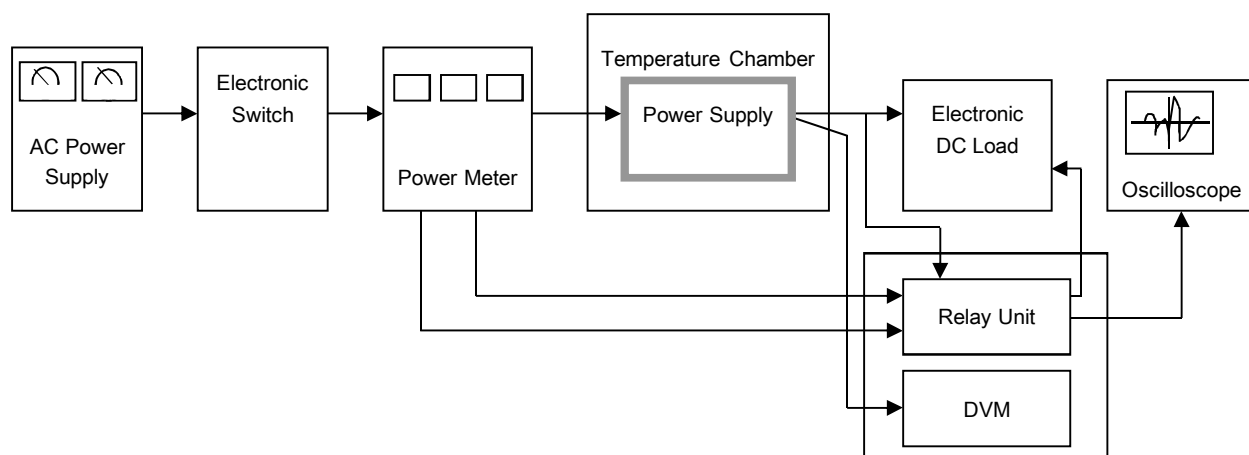


Figure A

Data Acquisition/Control Unit

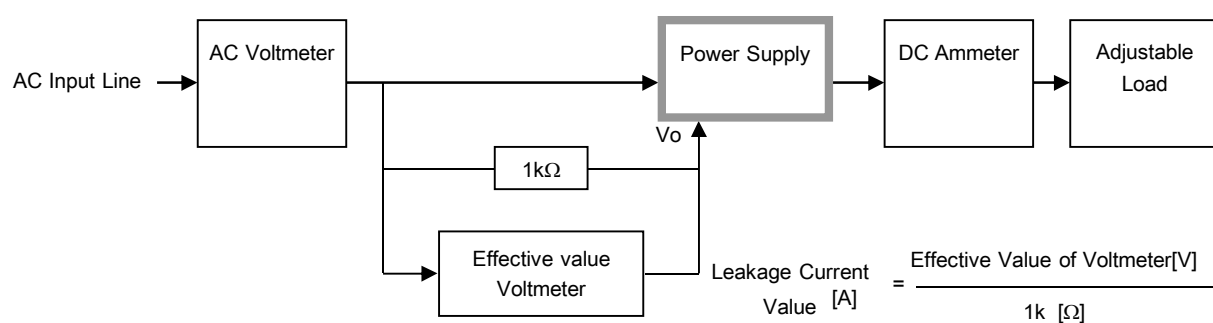


Figure B ( DEN-AN )

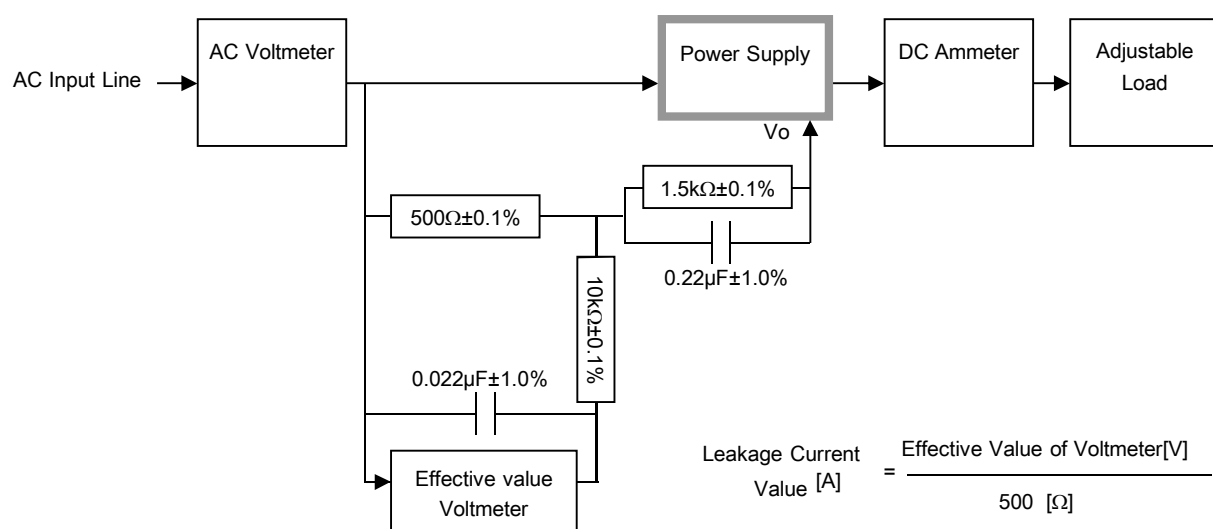


Figure B ( IEC60950-1 )

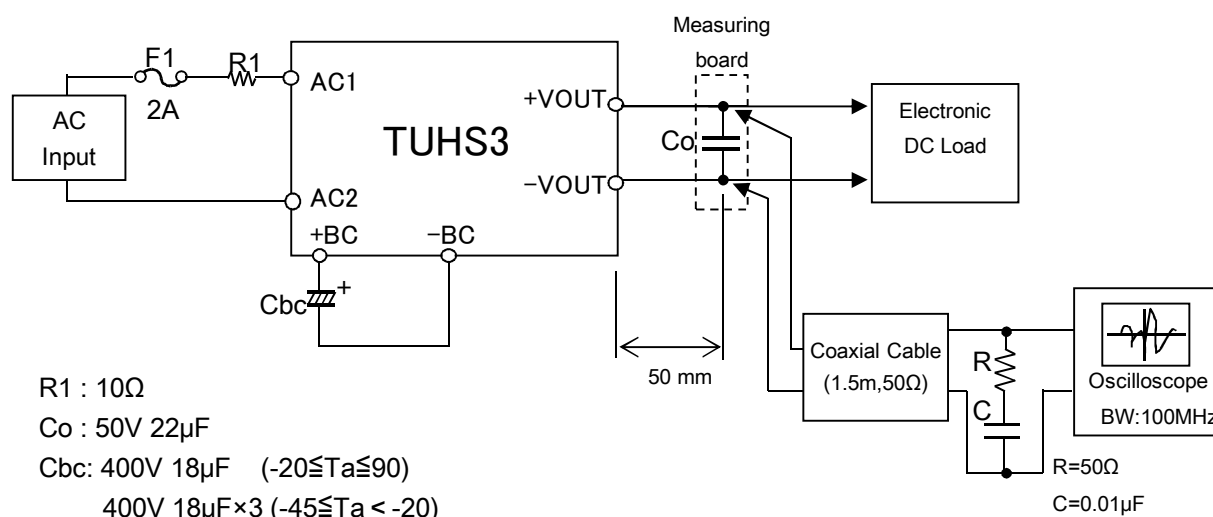


Figure C