

# TEST DATA OF TUHS5F15

Regulated DC Power Supply  
August 29, 2017

Approved by : Kenji Shiho  
Kenji Shiho Design Manager

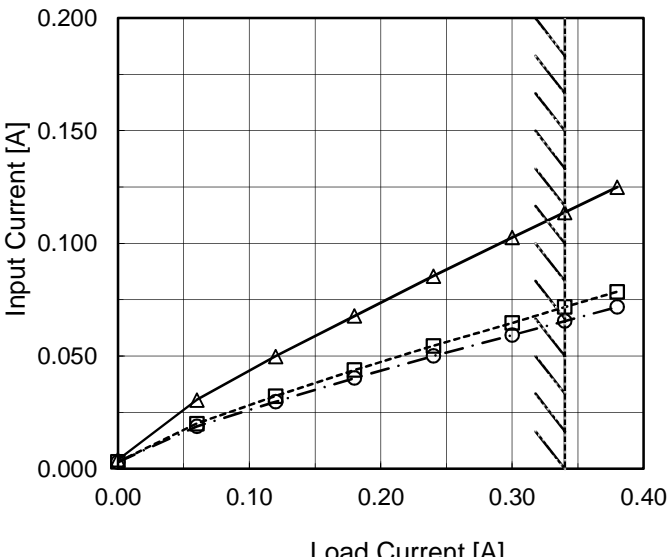
Prepared by : Tomoyuki Sakuma  
Tomoyuki Sakuma Design Engineer

**COSEL CO.,LTD.**

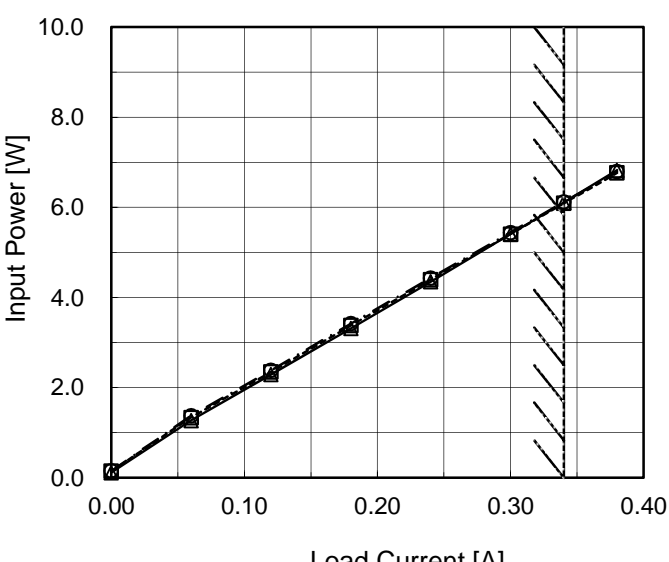
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Model		TUHS5F15		Temperature 25°C																																																				
Item		Input Current (by Load Current)		Testing Circuitry Figure A																																																				
Object		_____																																																						
1.Graph		<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>		2.Values																																																				
		<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>0.004</td><td>0.003</td><td>0.003</td></tr><tr><td>0.06</td><td>0.031</td><td>0.020</td><td>0.019</td></tr><tr><td>0.12</td><td>0.050</td><td>0.032</td><td>0.030</td></tr><tr><td>0.18</td><td>0.068</td><td>0.044</td><td>0.040</td></tr><tr><td>0.24</td><td>0.086</td><td>0.055</td><td>0.050</td></tr><tr><td>0.30</td><td>0.103</td><td>0.065</td><td>0.059</td></tr><tr><td>0.34</td><td>0.114</td><td>0.072</td><td>0.066</td></tr><tr><td>0.38</td><td>0.125</td><td>0.079</td><td>0.072</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></table>				Load Current [A]	Input Current [A]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	0.004	0.003	0.003	0.06	0.031	0.020	0.019	0.12	0.050	0.032	0.030	0.18	0.068	0.044	0.040	0.24	0.086	0.055	0.050	0.30	0.103	0.065	0.059	0.34	0.114	0.072	0.066	0.38	0.125	0.079	0.072	--	-	-	-	--	-	-	-	--	-	-	-
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Model	TUHS5F15																																																					
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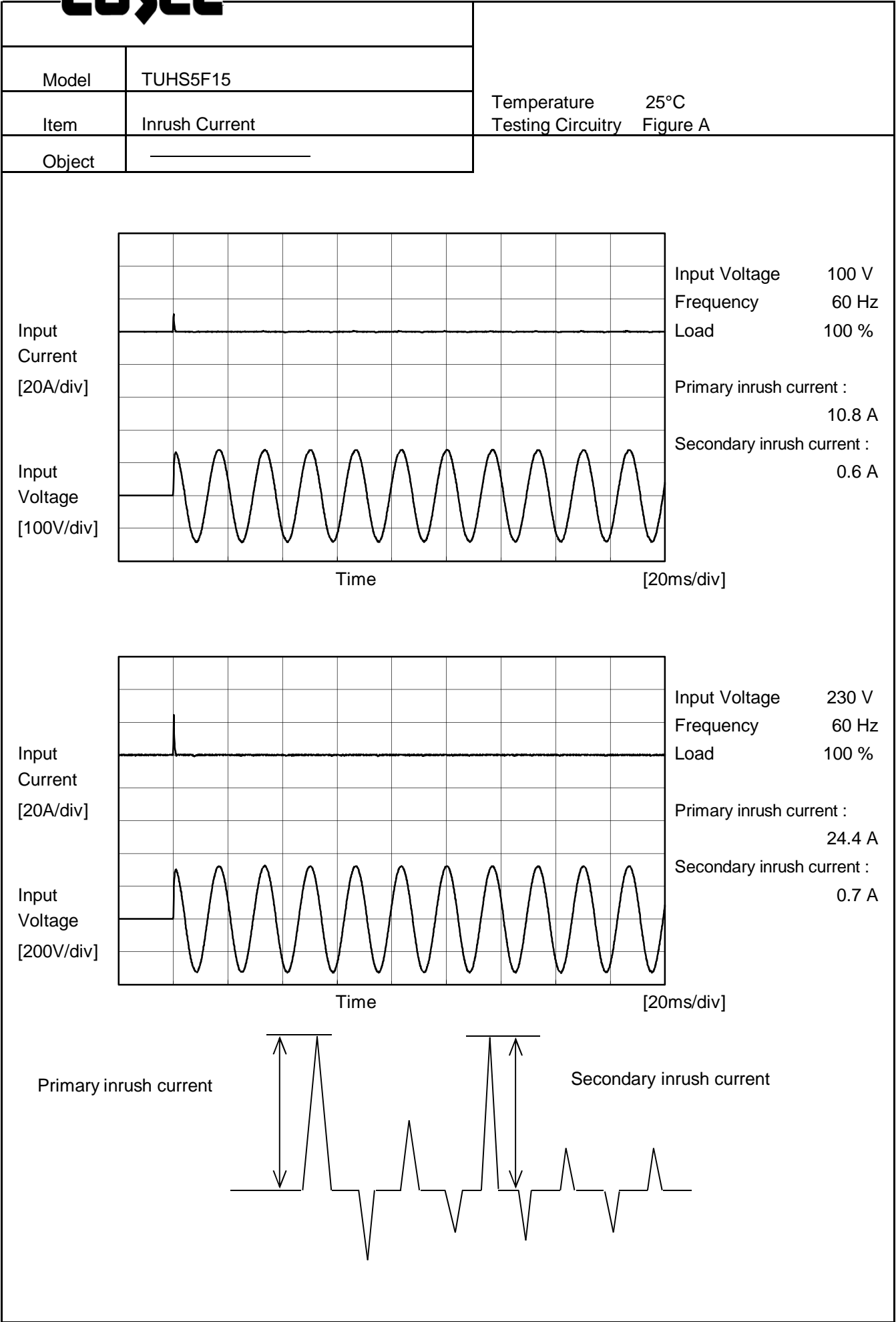
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BC-11211







		Temperature 25°C Testing Circuitry Figure B
Model	TUHS5F15	
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	0.005	Operation
	One of phases	0.003	0.005	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	TUHS5F15																																		
Item	Line Regulation	Temperature	25°C																																
		Testing Circuitry	Figure A																																
Object	+15V0.34A																																		
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<div><div><div>---□---</div><div>Load 50%</div></div><div><div>—△—</div><div>Load 100%</div></div></div> <table><thead><tr><th rowspan="2">Input Voltage [V]</th><th colspan="2">Output Voltage [V]</th></tr><tr><th>Load 50%</th><th>Load 100%</th></tr></thead><tbody><tr><td>75</td><td>14.956</td><td>14.948</td></tr><tr><td>85</td><td>14.957</td><td>14.948</td></tr><tr><td>100</td><td>14.956</td><td>14.948</td></tr><tr><td>120</td><td>14.956</td><td>14.948</td></tr><tr><td>200</td><td>14.955</td><td>14.948</td></tr><tr><td>230</td><td>14.955</td><td>14.947</td></tr><tr><td>264</td><td>14.953</td><td>14.946</td></tr><tr><td>280</td><td>14.952</td><td>14.945</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></tbody></table> <p>Note: Slanted line shows the range of the rated input voltage.</p>		Input Voltage [V]	Output Voltage [V]		Load 50%	Load 100%	75	14.956	14.948	85	14.957	14.948	100	14.956	14.948	120	14.956	14.948	200	14.955	14.948	230	14.955	14.947	264	14.953	14.946	280	14.952	14.945	--	-	-		
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BC-11211



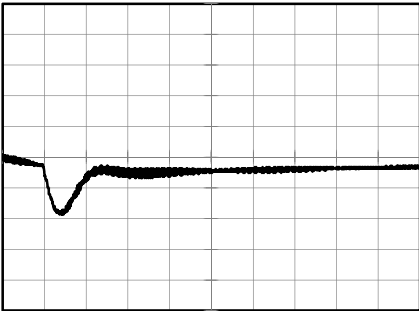
Model	TUHS5F15		
Item	Dynamic Load Response	Temperature	25°C
		Testing Circuitry	Figure A
Object	+15V 0.34A		

Input Volt. 230V  
Cycle 500ms

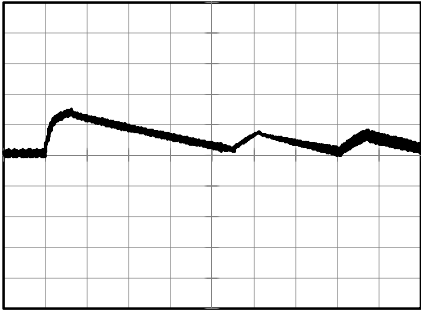
Load Current  0.34A / 100us

Min.Load (0A)←→  
Load 100%(0.34A)

200 mV/div



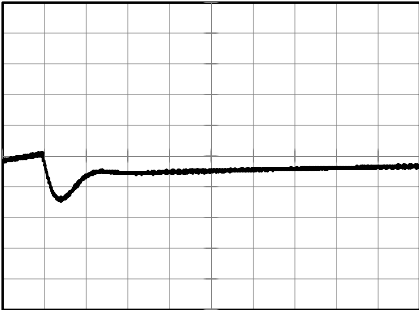
200 us/div



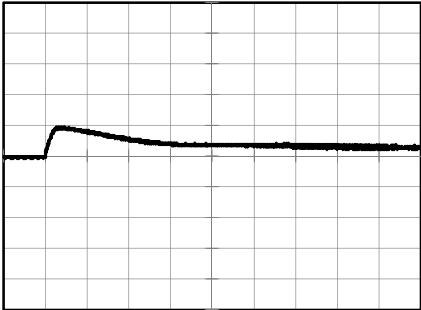
200 us/div

Load 20% (0.068A)←→  
Load 100%(0.34A)

200 mV/div



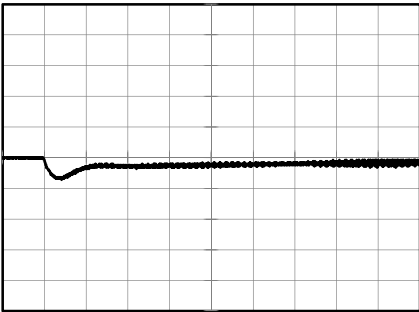
200 us/div



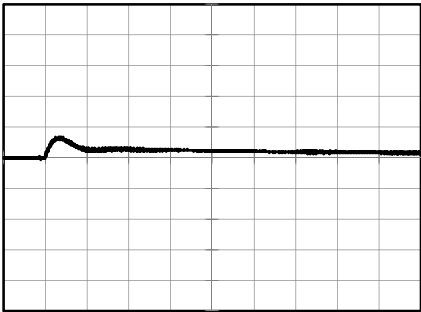
200 us/div

Load 50% (0.17A)←→  
Load 100% (0.34A)

200 mV/div



200 us/div



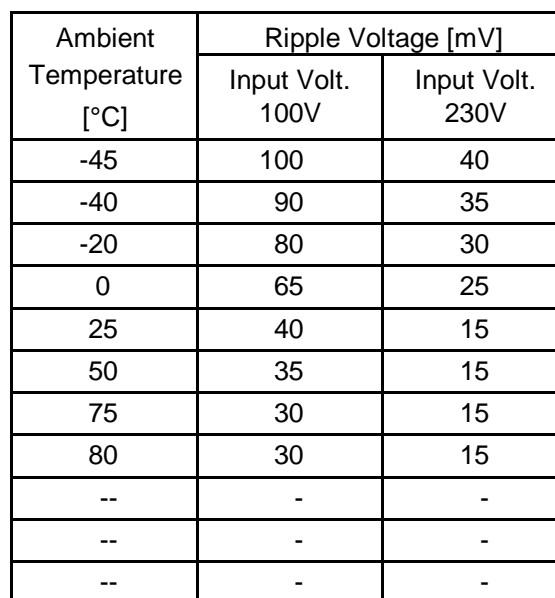
200 us/div

Model	TUHS5F15																																								
Item	Ripple Voltage (by Load Current)	Temperature	25°C																																						
		Testing Circuitry	Figure C																																						
Object	+15V0.34A																																								
1.Graph		2.Values																																							
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<p>Measured by 100 MHz Oscilloscope.</p> <p>Ripple Voltage is shown as p-p in the figure below.</p> <p>Note: Slanted line shows the range of the rated load current.</p>																																									
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Fig. Complex Ripple Wave Form																																									

Model	TUHS5F15																																																																												
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Testing Circuitry Figure C

## 2.Values



- 14 -



# COSEL

Model	TUHS5F15																																																					
Item	Ambient Temperature Drift	Testing Circuitry    Figure A																																																				
Object	+15V0.34A																																																					
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>Output Voltage [V]</p> <p>Ambient Temperature [°C]</p> <p>Load 100%</p> <p>Note: Slanted line shows the range of the rated ambient temperature.</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>14.973</td><td>14.974</td><td>14.974</td></tr><tr><td>-40</td><td>14.976</td><td>14.977</td><td>14.977</td></tr><tr><td>-20</td><td>14.988</td><td>14.988</td><td>14.988</td></tr><tr><td>0</td><td>14.986</td><td>14.984</td><td>14.984</td></tr><tr><td>25</td><td>14.969</td><td>14.966</td><td>14.965</td></tr><tr><td>50</td><td>14.938</td><td>14.934</td><td>14.932</td></tr><tr><td>75</td><td>14.887</td><td>14.881</td><td>14.878</td></tr><tr><td>80</td><td>14.878</td><td>14.869</td><td>14.866</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></table>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-45	14.973	14.974	14.974	-40	14.976	14.977	14.977	-20	14.988	14.988	14.988	0	14.986	14.984	14.984	25	14.969	14.966	14.965	50	14.938	14.934	14.932	75	14.887	14.881	14.878	80	14.878	14.869	14.866	--	-	-	-	--	-	-	-	--	-	-	-
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		Testing Circuitry Figure A
Model	TUHS5F15	
Item	Output Voltage Accuracy	
Object	+15V0.34A	

### 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 - 75°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.34A

\* 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	-20	85	0	14.991	±57	±0.4
Minimum Voltage	75	264	0.34	14.878		

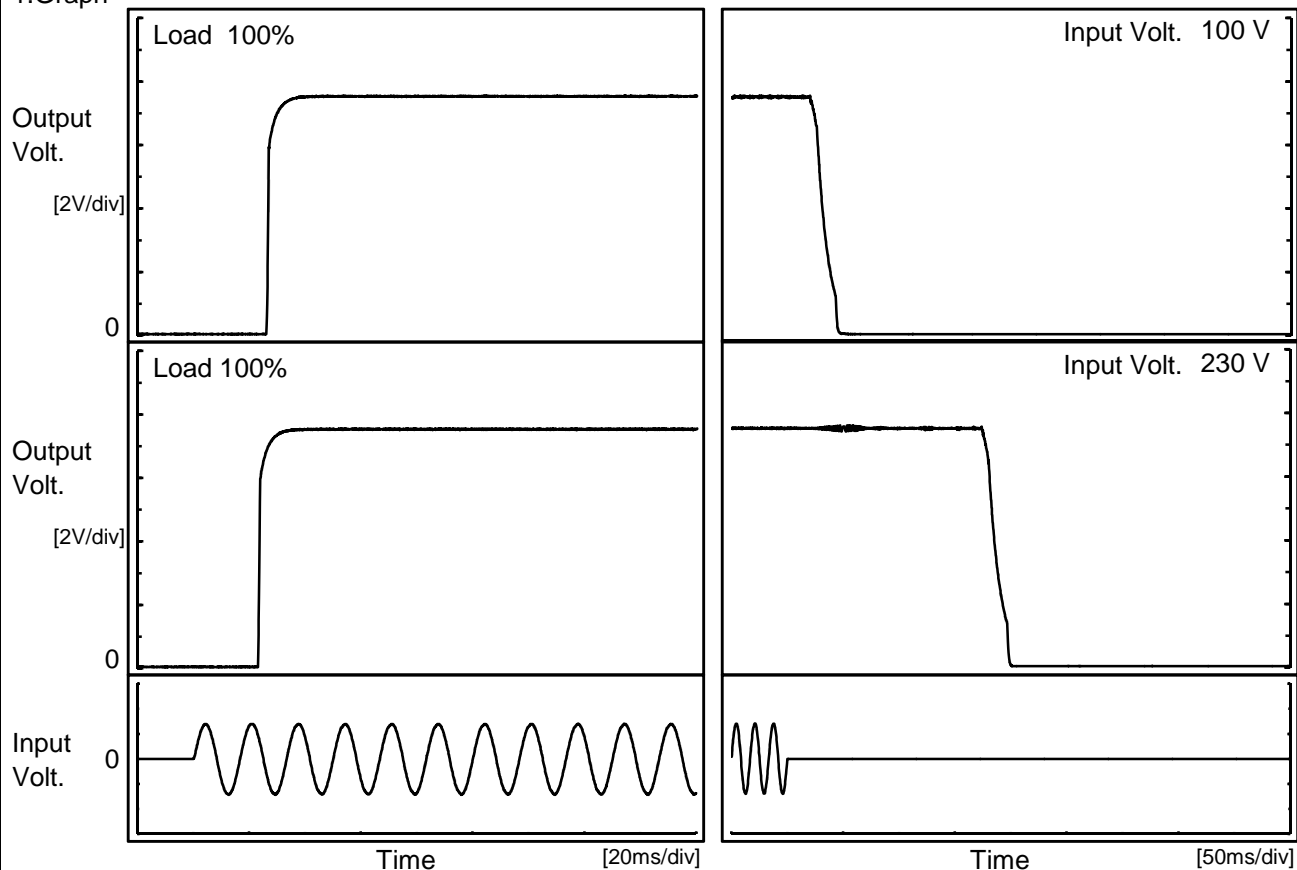
# COSEL

Model	TUHS5F15		
Item	Time Lapse Drift	Temperature	25°C
Object	+15V0.34A	Testing Circuitry	Figure A
1.Graph		2.Values	
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[V]</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></di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# COSEL

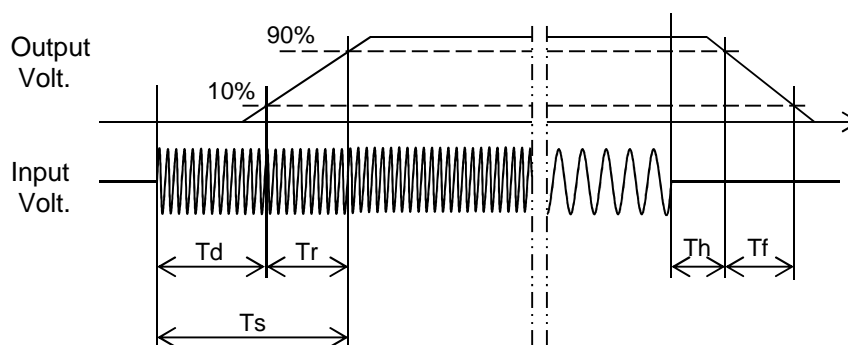
Model	TUHS5F15	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+15V0.34A		

## 1. Graph



## 2. Values

Input Volt. \ Time	Td	Tr	Ts	Th	Tf
100V	26.4	2.7	29.1	24.8	18.8
230V	23.3	2.7	26.0	178.5	19.0



# COSEL

Model	TUHS5F15		
Item	Hold-Up Time	Temperature	25°C
Object	+15V0.34A	Testing Circuitry	Figure A
1.Graph		2.Values	
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Item	Instantaneous Interruption Compensation	Temperature	25°C																																																			
Object	+15V0.34A	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> <div>Instantaneous Compensation Time [ms]</div> <div>Load Current [A]</div> <div>Note: Slanted line shows the range of the rated load current.</div>		<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>0.06</td><td>159</td><td>655</td><td>872</td></tr><tr><td>0.12</td><td>84</td><td>365</td><td>486</td></tr><tr><td>0.18</td><td>55</td><td>250</td><td>336</td></tr><tr><td>0.24</td><td>39</td><td>187</td><td>253</td></tr><tr><td>0.30</td><td>27</td><td>149</td><td>202</td></tr><tr><td>0.34</td><td>23</td><td>130</td><td>177</td></tr><tr><td>0.38</td><td>14</td><td>113</td><td>156</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></table>		Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	-	-	-	0.06	159	655	872	0.12	84	365	486	0.18	55	250	336	0.24	39	187	253	0.30	27	149	202	0.34	23	130	177	0.38	14	113	156	--	-	-	-	--	-	-	-	--	-	-	-
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- 20 -

BC-11211

Model

TUHS5F15

Item

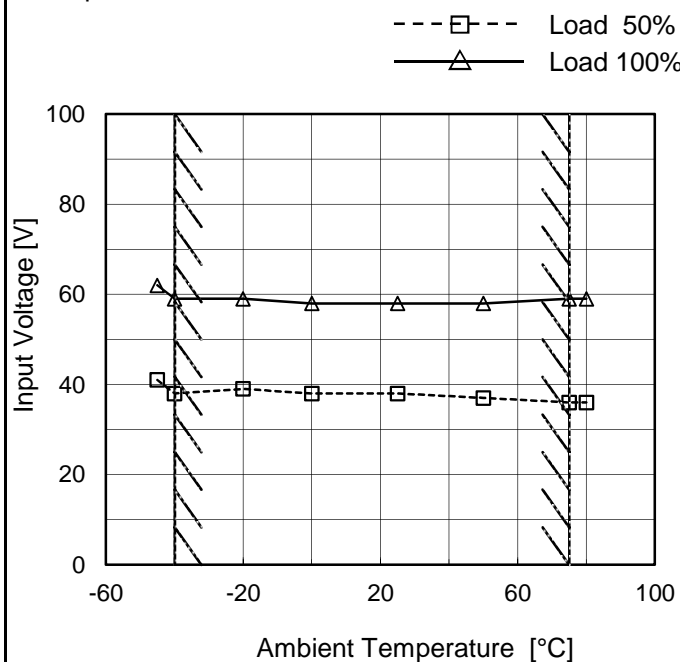
Minimum Input Voltage  
for Regulated Output Voltage

Object

+15V0.34A

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	41	62
-40	38	59
-20	39	59
0	38	58
25	38	58
50	37	58
75	36	59
80	36	59
--	-	-
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# COSEL

Model	TUHS5F15																																																	
Item	Overcurrent Protection	Temperature	25°C																																															
Object	+15V0.34A	Testing Circuitry	Figure A																																															
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Model		TUHS5F15
Item		Overvoltage Protection
Object		+15V0.34A

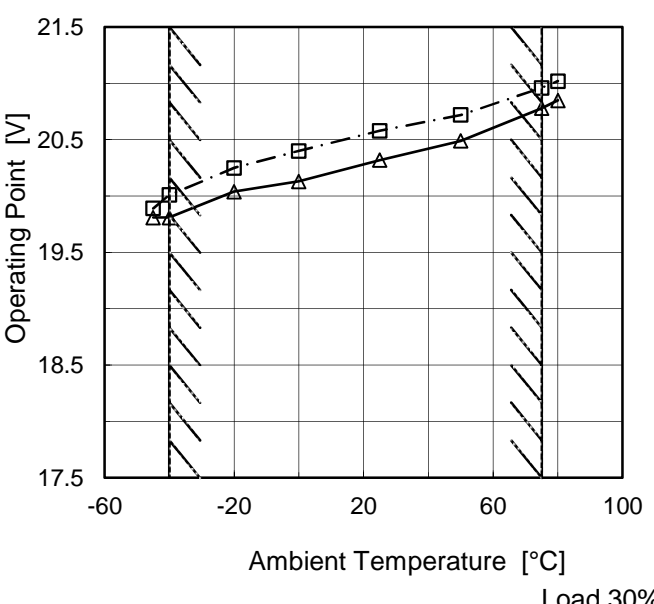
1.Graph

△

Input Volt. 100V

□

Input Volt. 230V



Operating Point [V]

Ambient Temperature [°C]

Load 30%

2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-45	19.81	19.89
-40	19.81	20.01
-20	20.04	20.25
0	20.13	20.40
25	20.32	20.58
50	20.49	20.72
75	20.78	20.96
80	20.85	21.02
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Note: Slanted line shows the range of the rated ambient temperature.

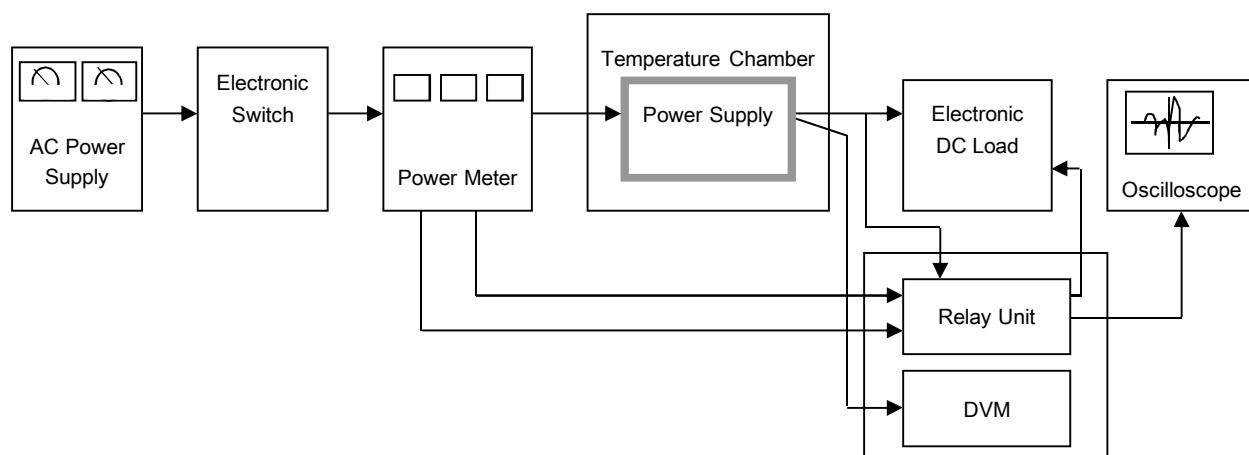


Figure A

Data Acquisition/Control Unit

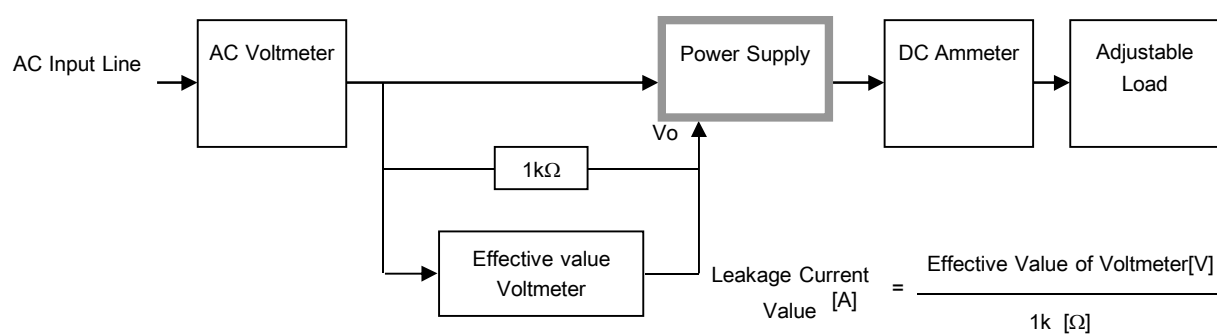


Figure B ( DEN-AN )

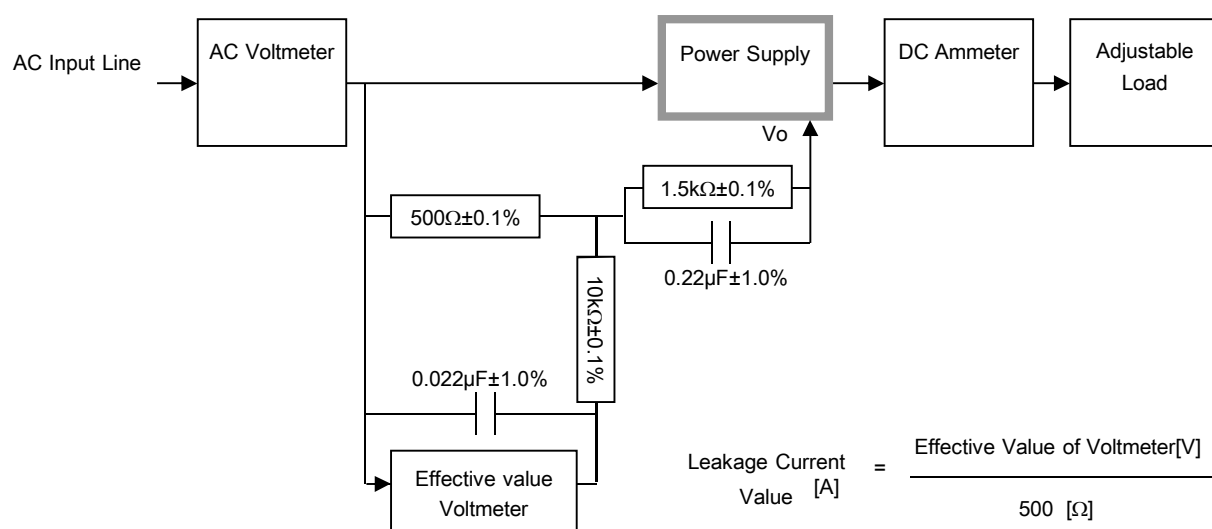


Figure B ( IEC60950-1 )

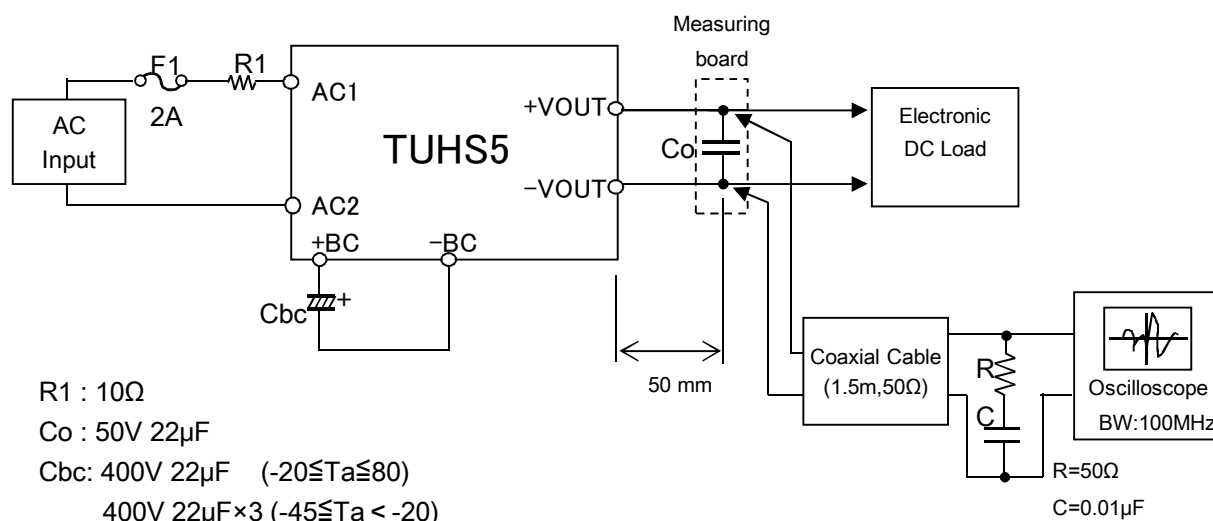


Figure C