

TEST DATA OF LHA50F-15

Regulated DC Power Supply
September 9, 2019

Approved by : Junya Kaneda
Junya Kaneda Design Manager

Prepared by : Yasushi Fukumura
Yasushi Fukumura Design Engineer

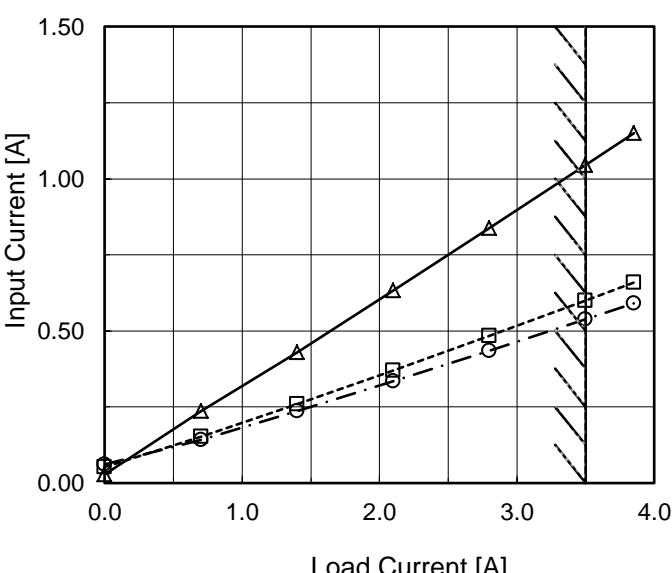
COSEL CO.,LTD.

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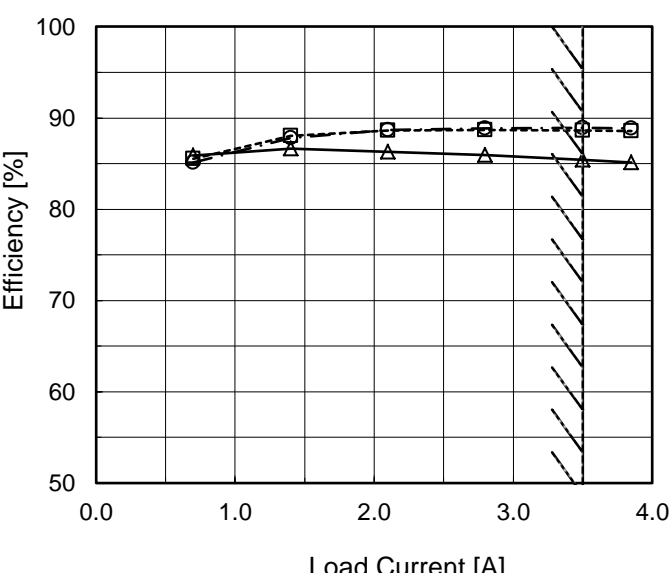
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Model		LHA50F-15		Temperature 25°C																																																				
Item		Input Current (by Load Current)		Testing Circuitry Figure A																																																				
Object		_____																																																						
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>Input Current [A]</p> <p>Load Current [A]</p> <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>0.027</td><td>0.053</td><td>0.060</td></tr><tr><td>0.70</td><td>0.236</td><td>0.152</td><td>0.142</td></tr><tr><td>1.40</td><td>0.429</td><td>0.258</td><td>0.237</td></tr><tr><td>2.10</td><td>0.633</td><td>0.369</td><td>0.334</td></tr><tr><td>2.80</td><td>0.838</td><td>0.483</td><td>0.435</td></tr><tr><td>3.50</td><td>1.045</td><td>0.599</td><td>0.538</td></tr><tr><td>3.85</td><td>1.150</td><td>0.659</td><td>0.591</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><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	0.027	0.053	0.060	0.70	0.236	0.152	0.142	1.40	0.429	0.258	0.237	2.10	0.633	0.369	0.334	2.80	0.838	0.483	0.435	3.50	1.045	0.599	0.538	3.85	1.150	0.659	0.591	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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Model		LHA50F-15	Temperature		25°C
Item		Efficiency (by Load Current)	Testing Circuitry		Figure A
Object					
1.Graph					
		—△—	Input Volt.	100V	
		---□---	Input Volt.	200V	
		-·-○-·-	Input Volt.	230V	
					
2.Values					
Load Current [A]		Efficiency [%]			
		Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	
0.00		-	-	-	
0.70		85.9	85.5	85.1	
1.40		86.6	88.0	87.8	
2.10		86.3	88.6	88.7	
2.80		86.0	88.7	88.9	
3.50		85.4	88.6	88.9	
3.85		85.1	88.6	88.9	
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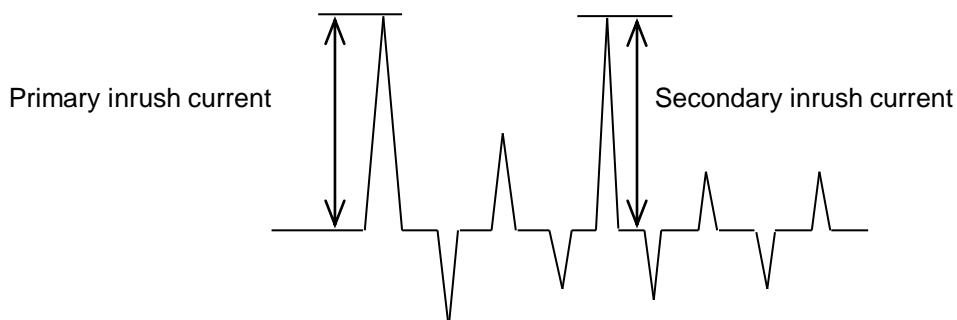
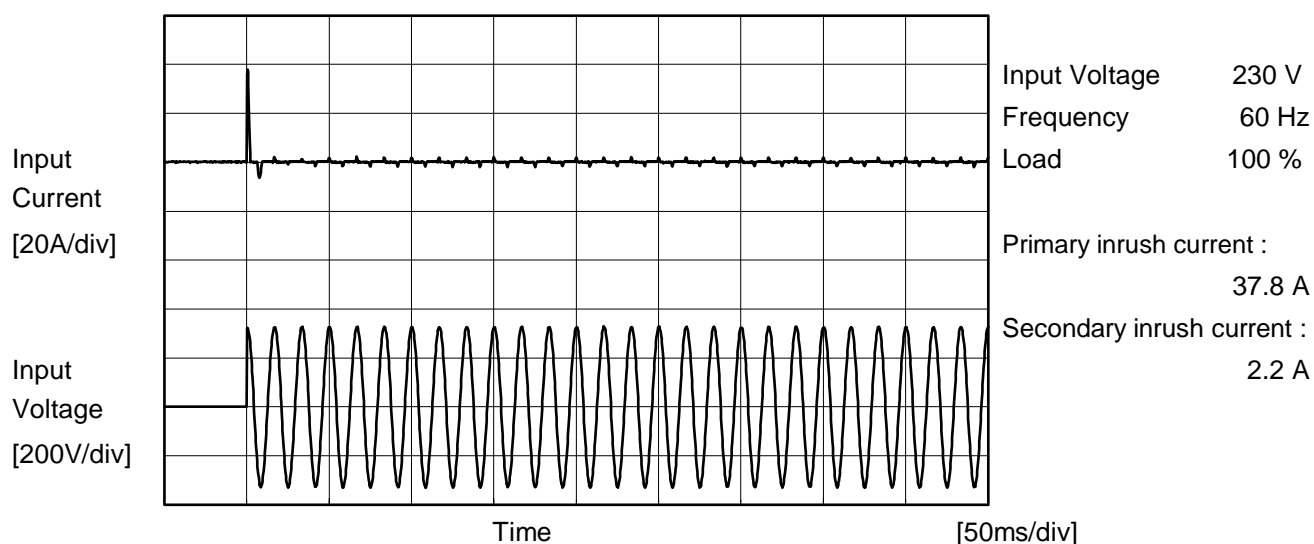
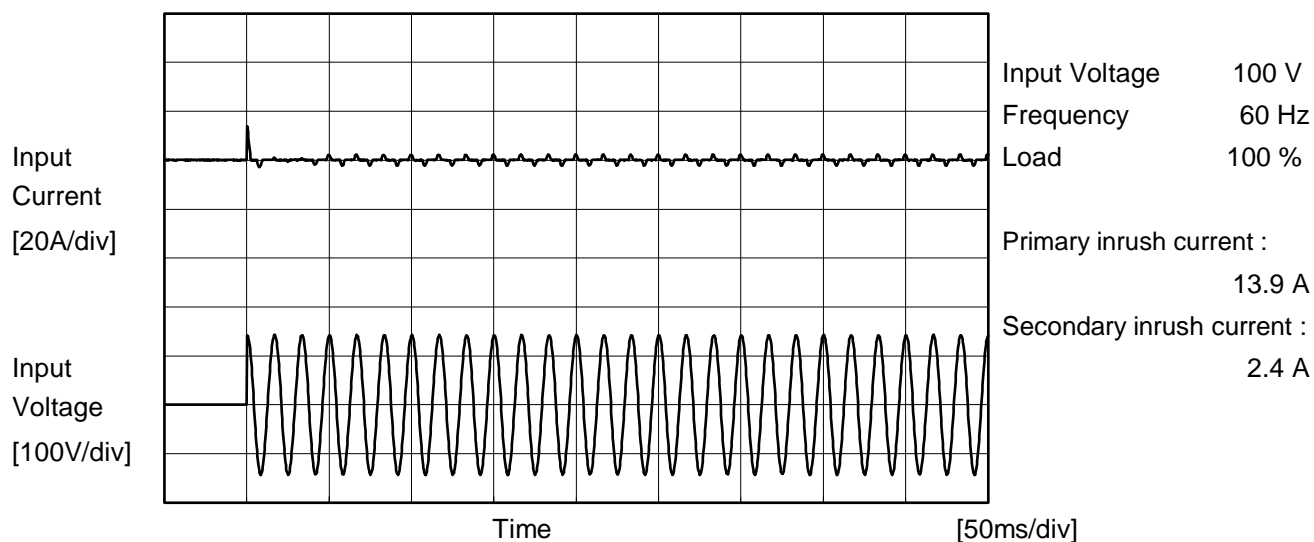
Note: Slanted line shows the range of the rated load current.



Model		LHA50F-15		Temperature 25°C																																																				
Item		Power Factor (by Load Current)		Testing Circuitry Figure A																																																				
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<div><div><div>—△— Input Volt. 100V</div><div>---□--- Input Volt. 200V</div><div>-·-○-·- Input Volt. 230V</div></div><div>Power Factor</div><div>Load Current [A]</div></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">Power Factor</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>0.104</td><td>0.101</td><td>0.090</td></tr><tr><td>0.70</td><td>0.519</td><td>0.405</td><td>0.377</td></tr><tr><td>1.40</td><td>0.564</td><td>0.462</td><td>0.439</td></tr><tr><td>2.10</td><td>0.577</td><td>0.482</td><td>0.462</td></tr><tr><td>2.80</td><td>0.583</td><td>0.490</td><td>0.473</td></tr><tr><td>3.50</td><td>0.589</td><td>0.495</td><td>0.478</td></tr><tr><td>3.85</td><td>0.591</td><td>0.496</td><td>0.478</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><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Power Factor			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	0.104	0.101	0.090	0.70	0.519	0.405	0.377	1.40	0.564	0.462	0.439	2.10	0.577	0.482	0.462	2.80	0.583	0.490	0.473	3.50	0.589	0.495	0.478	3.85	0.591	0.496	0.478	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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Model	LHA50F-15	Temperature 25°C Testing Circuitry Figure A	
Item	Inrush Current		
Object			





		Temperature 25°C Testing Circuitry Figure B
Model	LHA50F-15	
Item	Leakage Current	
Object	_____	

1.Results

[mA]

Standards	Testing Circuitry	Measuring Method	Input Volt.			Note
			100 [V]	230 [V]	240 [V]	
DEN-AN	Figure B-1	Both phases	0.08	0.21	0.22	Operation
		One of phases	0.16	0.42	0.45	Stand by
IEC62368-1	Figure B-2	Both phases	0.11	0.26	0.27	Operation
		One of phases	0.16	0.38	0.40	Stand by
	Figure B-3	Both phases	0.11	0.29	0.30	Operation
		One of phases	0.17	0.43	0.46	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.



Model		LHA50F-15	Temperature		25°C
Item		Line Regulation	Testing Circuitry		Figure A
Object		+15V3.5A			
1.Graph			2.Values		
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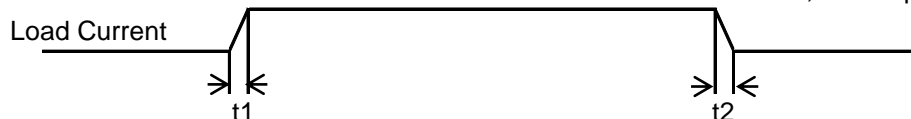
Model		LHA50F-15		Temperature		25°C																																																				
Item		Load Regulation		Testing Circuitry		Figure A																																																				
Object		+15V3.5A																																																								
1.Graph				2.Values																																																						
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Note: Slanted line shows the range of the rated load current.																																																										



Model	LHA50F-15	Temperature 25°C Testing Circuitry Figure A
Item	Dynamic Load Response	
Object	+15V3.5A	

Input Volt. 230 V
Cycle 1000 ms

$t1, t2 = 50 \mu s$



Min.Load (0A) \longleftrightarrow
Load 100% (3.5A)

200 mV/div

800 μs /div

4 ms/div

Min.Load (0A) \longleftrightarrow
Load 50% (1.75A)

200 mV/div

800 μs /div

4 ms/div

Load 50% (1.75A) \longleftrightarrow
Load 100% (3.5A)

200 mV/div

800 μs /div

4 ms/div

Model		LHA50F-15	Temperature		25°C																																																														
Item		Ripple-Noise(by Load Current)	Testing Circuitry		Figure C																																																														
Object		+15V3.5A																																																																	
1.Graph			2.Values																																																																
<div><div><div><div><div></div><div>—△—</div><div>Input Volt. 100V</div></div><div><div>-·-○-·-</div><div>Input Volt. 230V</div></div></div><div><table border="1"><caption>Ripple-Noise Data (from graph)</caption><thead><tr><th>Load Current [A]</th><th>100V Input [mV]</th><th>230V Input [mV]</th></tr></thead><tbody><tr><td>0.00</td><td>45</td><td>15</td></tr><tr><td>0.70</td><td>20</td><td>20</td></tr><tr><td>1.40</td><td>25</td><td>20</td></tr><tr><td>2.10</td><td>40</td><td>25</td></tr><tr><td>2.80</td><td>50</td><td>35</td></tr><tr><td>3.50</td><td>55</td><td>50</td></tr><tr><td>3.85</td><td>60</td><td>60</td></tr></tbody></table></div></div></div>			Load Current [A]	100V Input [mV]	230V Input [mV]	0.00	45	15	0.70	20	20	1.40	25	20	2.10	40	25	2.80	50	35	3.50	55	50	3.85	60	60	<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>45</td><td>15</td></tr><tr><td>0.70</td><td>20</td><td>20</td></tr><tr><td>1.40</td><td>25</td><td>20</td></tr><tr><td>2.10</td><td>40</td><td>25</td></tr><tr><td>2.80</td><td>50</td><td>35</td></tr><tr><td>3.50</td><td>55</td><td>50</td></tr><tr><td>3.85</td><td>60</td><td>60</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>			Load Current [A]	Ripple-Noise [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	45	15	0.70	20	20	1.40	25	20	2.10	40	25	2.80	50	35	3.50	55	50	3.85	60	60	--	-	-	--	-	-	--	-	-	--	-	-
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<p>Measured by 20 MHz Oscilloscope.</p> <p>Ripple-Noise is shown as p-p in the figure below.</p> <p>Note: Slanted line shows the range of the rated load current.</p>																																																																			
<div><div><div>T1: Due to AC Input Line</div><div>T2: Due to Switching</div></div><div><p>Ripple-Noise [mVp-p]</p><p>T1</p><p>T2</p></div></div>																																																																			
Fig. Complex Ripple Wave Form																																																																			

Model		LHA50F-15	
Item		Ambient Temperature Drift	
Object		+15V3.5A	
1.Graph		2.Values	

—△—

Input Volt. 100V

---□---

Input Volt. 200V

---○---

Input Volt. 230V

Output Voltage [V]

Ambient Temperature [°C]

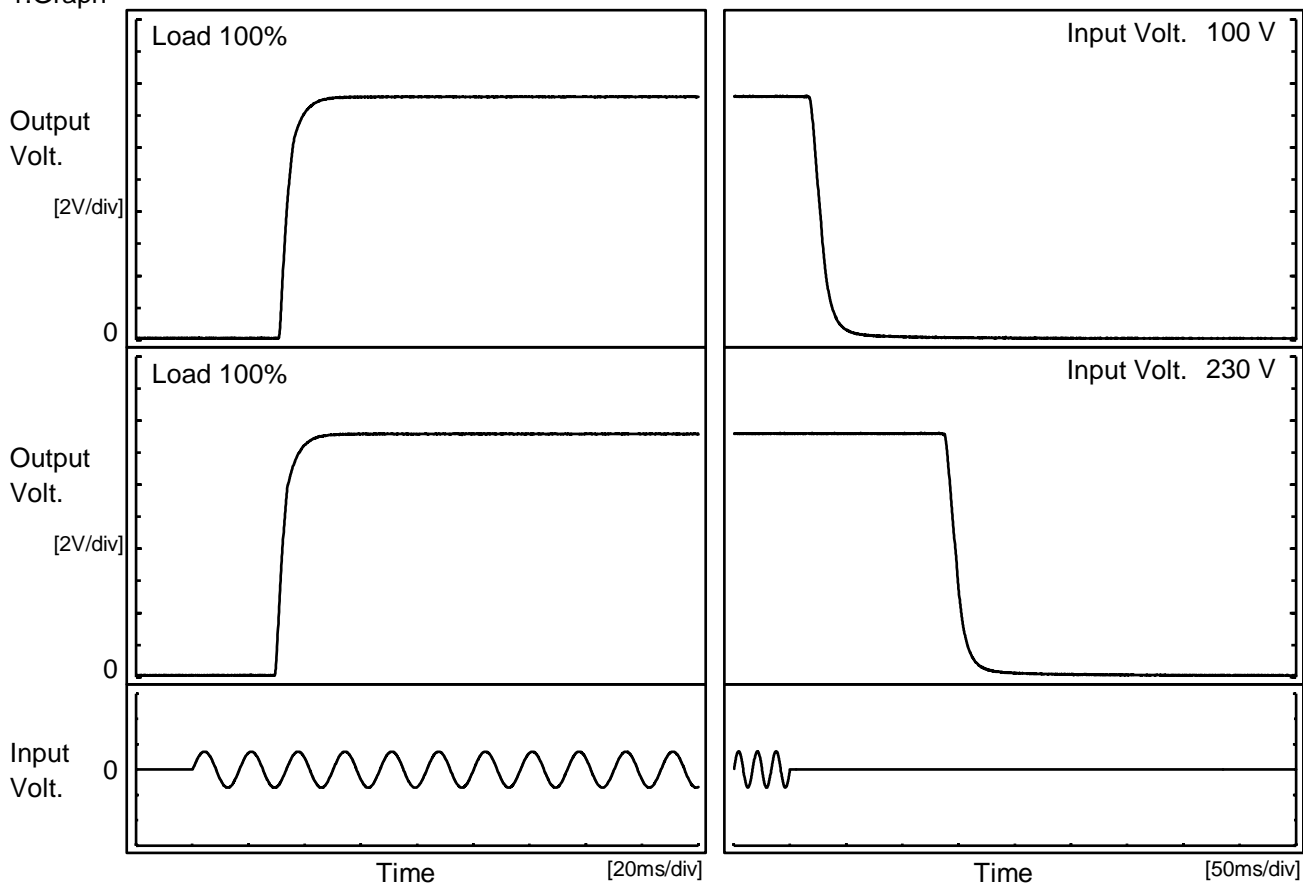
Load 100%

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

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-20	15.094	15.094	15.095
-15	15.099	15.100	15.100
-10	15.104	15.104	15.105
0	15.112	15.112	15.112
25	15.123	15.123	15.124
40	15.126	15.127	15.126
50	15.126	15.126	15.125
60	15.124	15.124	15.124
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--	-	-	-

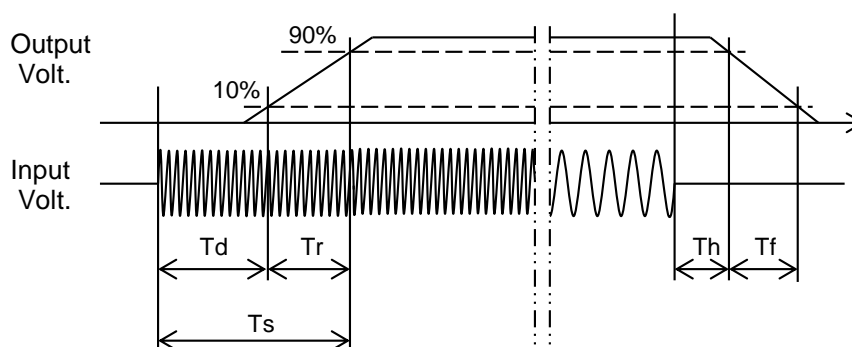
Model	LHA50F-15		
Item	Rise and Fall Time	Temperature	25°C
Object	+15V3.5A	Testing Circuitry	Figure A

1.Graph



2.Values

		[ms]				
Input Volt.	Time	Td	Tr	Ts	Th	Tf
100 V		31.5	6.7	38.2	20.3	19.5
230 V		30.1	6.8	36.9	140.3	19.8



BC-11427



Model		LHA50F-15	Temperature		25°C																																																			
Item		Instantaneous Interruption Compensation	Testing Circuitry		Figure A																																																			
Object		+15V3.5A																																																						
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><div><div>Instantaneous Compensation Time [ms]</div><div>1000</div><div>100</div><div>10</div><div>1</div></div><div><div>0.0</div><div>1.0</div><div>2.0</div><div>3.0</div><div>4.0</div></div><div><div>Load Current [A]</div><div></div></div></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>0.70</td><td>126</td><td>549</td><td>736</td></tr><tr><td>1.40</td><td>61</td><td>275</td><td>371</td></tr><tr><td>2.10</td><td>38</td><td>181</td><td>246</td></tr><tr><td>2.80</td><td>27</td><td>134</td><td>182</td></tr><tr><td>3.50</td><td>18</td><td>102</td><td>140</td></tr><tr><td>3.85</td><td>14</td><td>90</td><td>125</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><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	-	-	-	0.70	126	549	736	1.40	61	275	371	2.10	38	181	246	2.80	27	134	182	3.50	18	102	140	3.85	14	90	125	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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<div>Note: Slanted line shows the range of the rated load current.</div>																																																								

1. Graph

The graph plots Input Voltage [V] on the Y-axis (0 to 100) against Ambient Temperature [°C] on the X-axis (-40 to 80). Two data series are shown: Load 50% (dashed line with square markers) and Load 100% (solid line with triangle markers). Both series show a constant input voltage across the temperature range. A slanted line indicates the range of the rated ambient temperature, which is approximately from -10°C to 50°C.

Ambient Temperature [°C]	Input Voltage [V] (Load 50%)	Input Voltage [V] (Load 100%)
-20	37	55
-10	37	55
0	36	55
10	36	55
20	36	55
30	36	55
40	36	55
50	36	55
60	36	55

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

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-20	37	56
-15	37	55
-10	37	55
0	36	55
25	36	55
40	36	55
50	36	55
60	36	55
--	-	-
--	-	-
--	-	-

Model		LHA50F-15	Temperature Testing Circuitry	25°C Figure A																																												
Item		Overcurrent Protection																																														
Object		+15V3.5A																																														
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>Note: Slanted line shows the range of the rated load current.</p> <p>Overcurrent protection is Hiccup mode.</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>15.00</td><td>4.42</td><td>4.42</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]	15.00	4.42	4.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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Model		LHA50F-15	Testing Circuitry Figure A																																						
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<table><tr><th rowspan="2">Ambient Temperature [°C]</th><th colspan="2">Operating Point [V]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>-20</td><td>18.45</td><td>18.52</td></tr><tr><td>-15</td><td>18.59</td><td>18.59</td></tr><tr><td>-10</td><td>18.66</td><td>18.66</td></tr><tr><td>0</td><td>18.79</td><td>18.79</td></tr><tr><td>25</td><td>19.13</td><td>19.13</td></tr><tr><td>40</td><td>19.26</td><td>19.26</td></tr><tr><td>50</td><td>19.40</td><td>19.40</td></tr><tr><td>60</td><td>19.53</td><td>19.53</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>				Ambient Temperature [°C]	Operating Point [V]		Input Volt. 100[V]	Input Volt. 230[V]	-20	18.45	18.52	-15	18.59	18.59	-10	18.66	18.66	0	18.79	18.79	25	19.13	19.13	40	19.26	19.26	50	19.40	19.40	60	19.53	19.53	--	-	-	--	-	-	--	-	-
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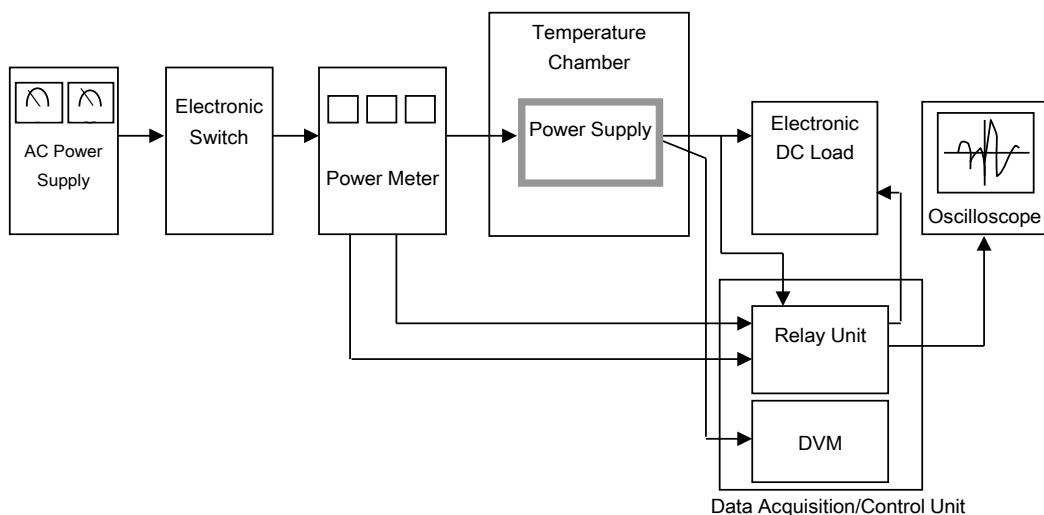


Figure A

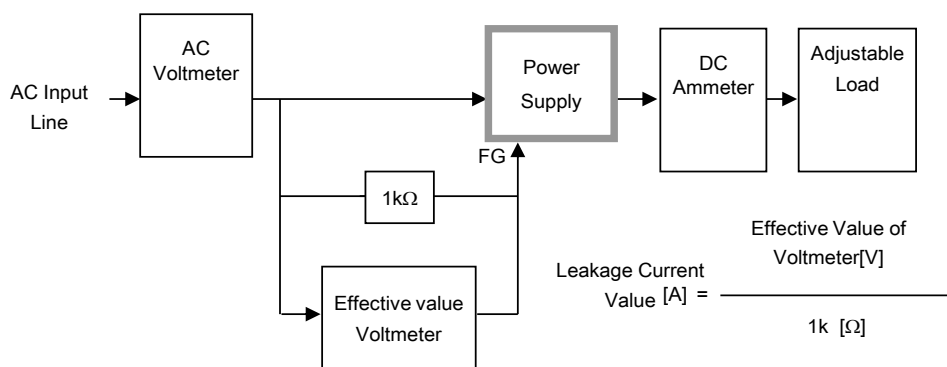


Figure B-1 (DEN-AN)

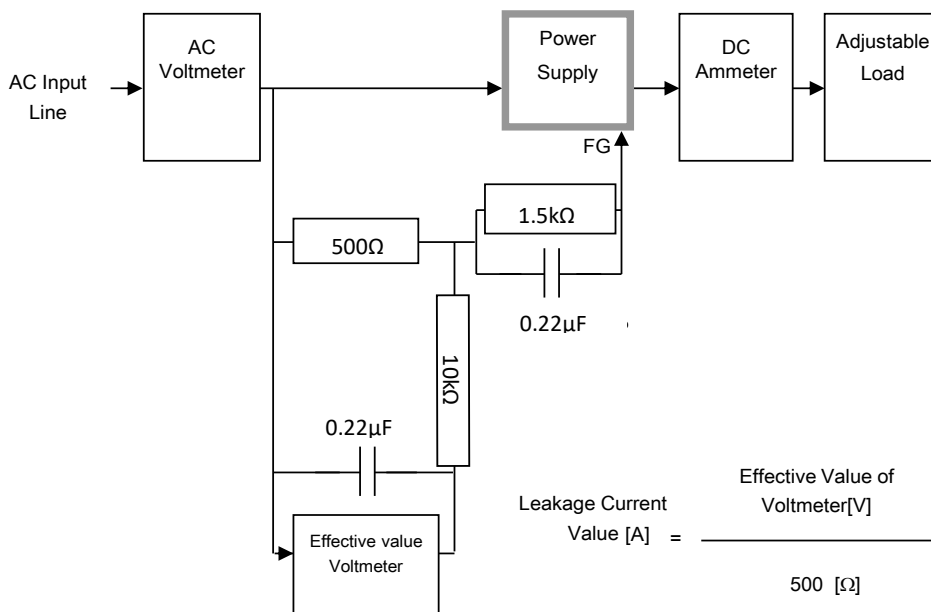


Figure B-2 (IEC62368-1 refer to IEC60990 Fig.4)

