



# TEST DATA OF PMA60F-12

Regulated DC Power Supply  
June 4, 2010

Approved by : Katsumi Ishikawa  
Katsumi Ishikawa Design Manager

Prepared by : Shintaro Oki  
Shintaro Oki Design Engineer

**COSEL CO.,LTD.**

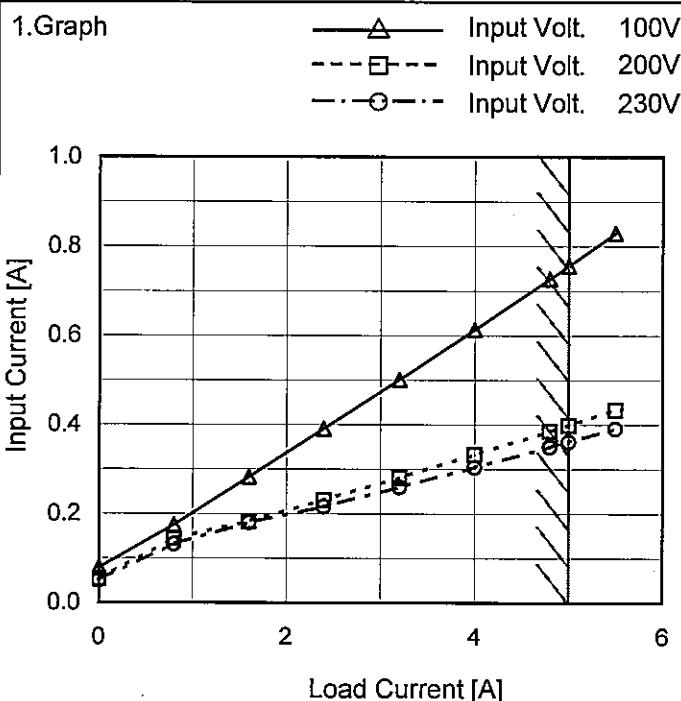
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Model	PMA60F-12
Item	Input Current (by Load Current)
Object	—



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

Temperature 25°C  
Testing Circuitry Figure A

## 2. Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.078	0.052	0.050
0.8	0.175	0.144	0.132
1.6	0.282	0.182	0.180
2.4	0.391	0.230	0.216
3.2	0.501	0.281	0.259
4.0	0.613	0.333	0.304
4.8	0.727	0.386	0.350
5.0	0.756	0.399	0.361
5.5	0.829	0.433	0.391
—	-	-	-
—	-	-	-

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Model	PMA60F-12	Temperature	25°C																																																			
Item	Input Power (by Load Current)	Testing Circuitry	Figure A																																																			
Object	_____																																																					
1.Graph	<p>Input Power [W]</p> <p>Load Current [A]</p> <p>Legend:</p> <ul style="list-style-type: none"> <li>Input Volt. 100V</li> <li>Input Volt. 200V</li> <li>Input Volt. 230V</li> </ul>																																																					
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<p>The graph plots Efficiency [%] on the y-axis (30 to 86) against Input Voltage [V] on the x-axis (50 to 300). Two data series are shown: Load 50% (dashed line with square markers) and Load 100% (solid line with triangle markers). Both series show efficiency increasing slightly as input voltage increases. A slanted line indicates the rated input voltage range.</p> <table border="1"> <thead> <tr> <th>Input Voltage [V]</th> <th>Load 50% [%]</th> <th>Load 100% [%]</th> </tr> </thead> <tbody> <tr><td>75</td><td>74.6</td><td>77.6</td></tr> <tr><td>85</td><td>75.1</td><td>78.8</td></tr> <tr><td>100</td><td>75.7</td><td>80.1</td></tr> <tr><td>120</td><td>76.4</td><td>80.9</td></tr> <tr><td>200</td><td>76.2</td><td>82.1</td></tr> <tr><td>230</td><td>75.8</td><td>82.3</td></tr> <tr><td>264</td><td>75.5</td><td>82.3</td></tr> <tr><td>280</td><td>75.8</td><td>82.3</td></tr> </tbody> </table>				Input Voltage [V]	Load 50% [%]	Load 100% [%]	75	74.6	77.6	85	75.1	78.8	100	75.7	80.1	120	76.4	80.9	200	76.2	82.1	230	75.8	82.3	264	75.5	82.3	280	75.8	82.3					
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<p>The graph plots Power Factor against Input Voltage. The Y-axis ranges from 0.4 to 1.0 in increments of 0.1. The X-axis ranges from 50 to 300 in increments of 50. Two data series are shown: 'Load 50%' represented by a dashed line with square markers, and 'Load 100%' represented by a solid line with triangle markers. Both series show a general downward trend as input voltage increases. A diagonal line is drawn across the graph, starting from approximately (75V, 0.98) and ending at (280V, 0.61), representing the rated input voltage range.</p>			<table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Power Factor</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr> <td>75</td> <td>0.998</td> <td>0.999</td> </tr> <tr> <td>85</td> <td>0.995</td> <td>0.999</td> </tr> <tr> <td>100</td> <td>0.985</td> <td>0.999</td> </tr> <tr> <td>120</td> <td>0.965</td> <td>0.989</td> </tr> <tr> <td>200</td> <td>0.835</td> <td>0.919</td> </tr> <tr> <td>230</td> <td>0.781</td> <td>0.880</td> </tr> <tr> <td>264</td> <td>0.693</td> <td>0.838</td> </tr> <tr> <td>280</td> <td>0.610</td> <td>0.774</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Input Voltage [V]	Power Factor		Load 50%	Load 100%	75	0.998	0.999	85	0.995	0.999	100	0.985	0.999	120	0.965	0.989	200	0.835	0.919	230	0.781	0.880	264	0.693	0.838	280	0.610	0.774	--	-	-
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<p>The graph plots Power Factor (Y-axis, 0.3 to 1.0) against Load Current [A] (X-axis, 0 to 6). Three data series are shown for different input voltages: 100V (solid line with triangles), 200V (dashed line with squares), and 230V (dash-dot line with circles). All curves show an initial increase in power factor with load current, followed by a slight decrease as the load approaches the rated current. A slanted line on the graph indicates the range of the rated load current.</p> <table border="1"> <caption>Data points estimated from Figure A</caption> <thead> <tr> <th>Load Current [A]</th> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0.602</td><td>0.433</td><td>0.404</td></tr> <tr><td>0.8</td><td>0.925</td><td>0.576</td><td>0.545</td></tr> <tr><td>1.6</td><td>0.967</td><td>0.756</td><td>0.676</td></tr> <tr><td>2.4</td><td>0.982</td><td>0.826</td><td>0.774</td></tr> <tr><td>3.2</td><td>0.990</td><td>0.868</td><td>0.820</td></tr> <tr><td>4.0</td><td>0.993</td><td>0.896</td><td>0.853</td></tr> <tr><td>4.8</td><td>0.997</td><td>0.916</td><td>0.876</td></tr> <tr><td>5.0</td><td>0.997</td><td>0.919</td><td>0.881</td></tr> <tr><td>5.5</td><td>0.999</td><td>0.927</td><td>0.892</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]	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	0.602	0.433	0.404	0.8	0.925	0.576	0.545	1.6	0.967	0.756	0.676	2.4	0.982	0.826	0.774	3.2	0.990	0.868	0.820	4.0	0.993	0.896	0.853	4.8	0.997	0.916	0.876	5.0	0.997	0.919	0.881	5.5	0.999	0.927	0.892	--	-	-	-	--	-	-	-	2.Values						
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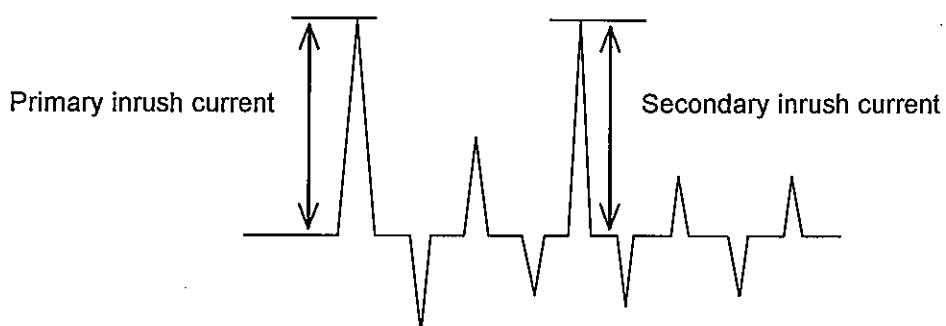
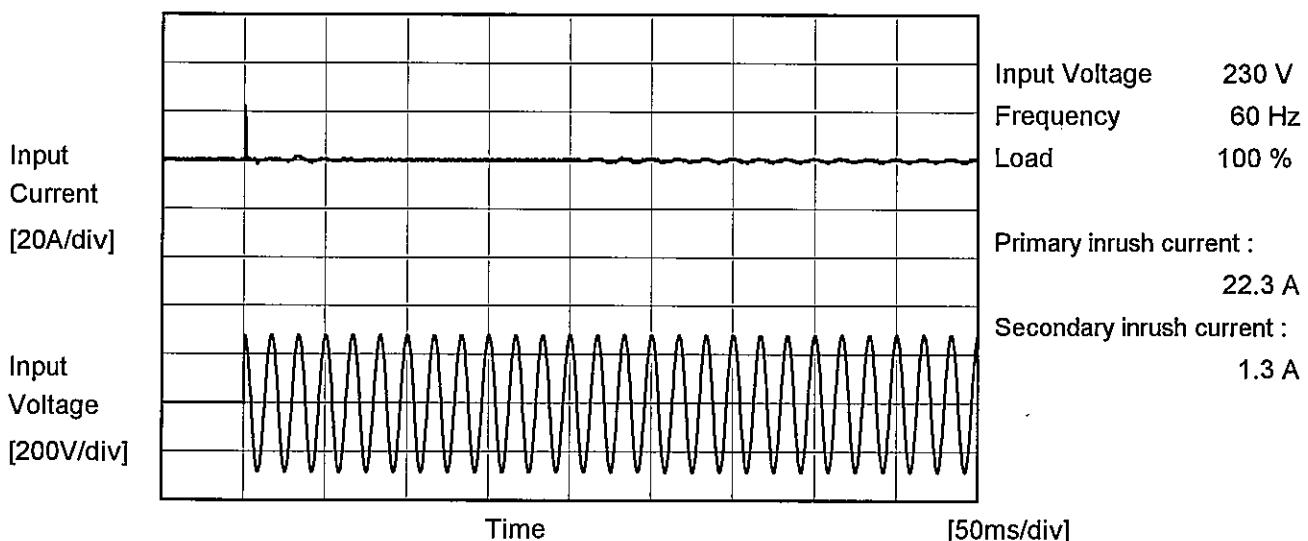
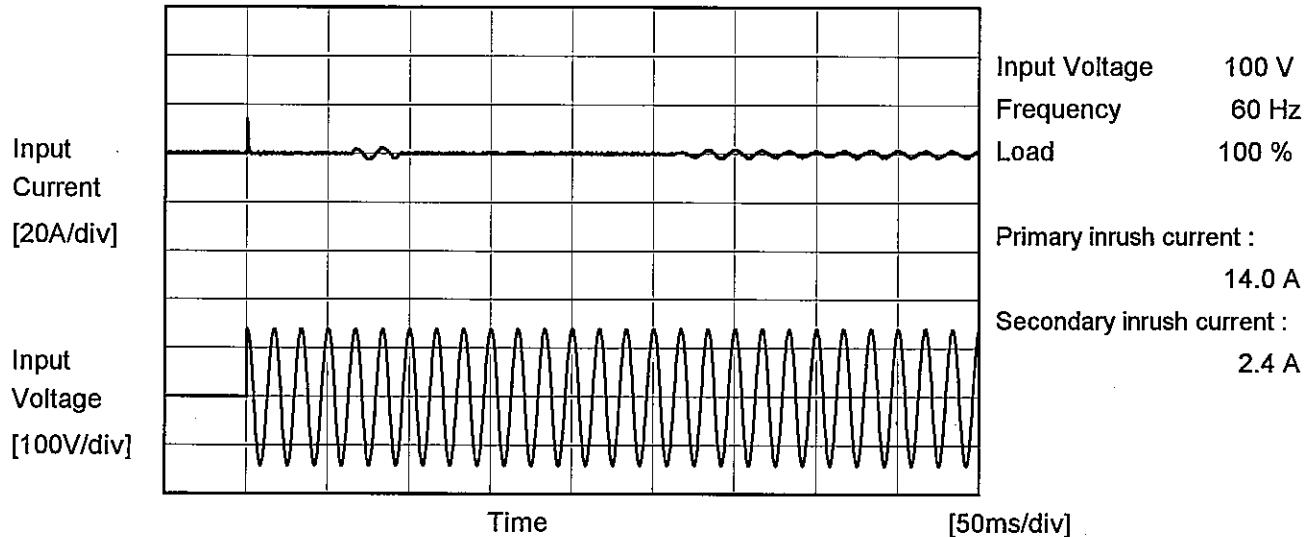
Note: Slanted line shows the range of the rated load current.

**COSEL**

Model PMA60F-12

Item Inrush Current

Object \_\_\_\_\_

Temperature 25°C  
Testing Circuitry Figure A



Model	PMA60F-12	Temperature	25°C
Item	Leakage Current	Testing Circuitry	Figure B
Object	_____		

### 1. Results

Standards		Input Volt.			Note
		100 [V]	200 [V]	240 [V]	
IEC60601	Both phases	0.05	0.12	0.14	Operation
	One of phases	0.08	0.19	0.21	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.

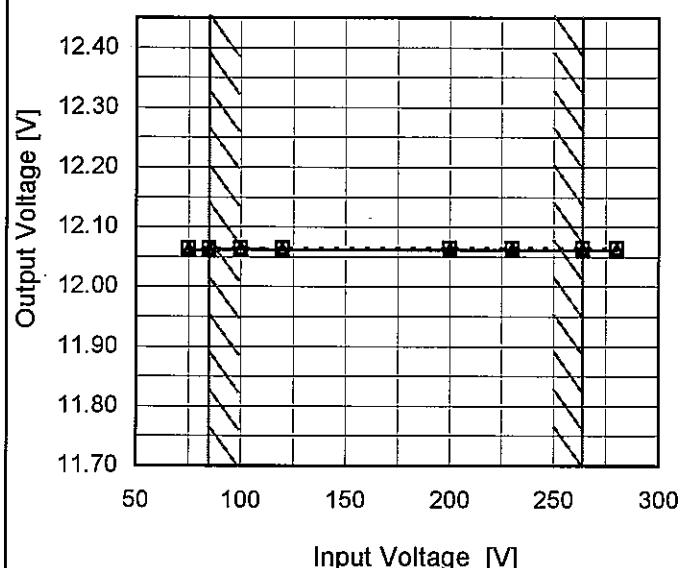
**COSEL**

Model	PMA60F-12
Item	Line Regulation
Object	+12V5A

Temperature 25°C  
 Testing Circuitry Figure A

## 1. Graph

--- □ --- Load 50%  
 —△— Load 100%



Note: Slanted line shows the range of the rated input voltage.

## 2. Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
75	12.065	12.062
85	12.065	12.062
100	12.065	12.062
120	12.065	12.062
200	12.065	12.062
230	12.065	12.062
264	12.065	12.062
280	12.065	12.062
--	-	-

**COSSEL**

Model	PMA60F-12
Item	Load Regulation
Object	+12V5A

1.Graph

Output Voltage [V]

Load Current [A]

Legend:

- Input Volt. 100V
- Input Volt. 200V
- Input Volt. 230V

Temperature 25°C  
Testing Circuitry Figure A

## 2.Values

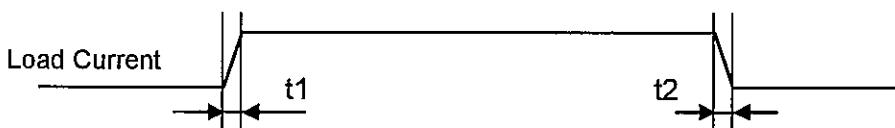
Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	12.069	12.069	12.069
0.8	12.067	12.067	12.067
1.6	12.066	12.066	12.066
2.4	12.065	12.065	12.065
3.2	12.064	12.064	12.064
4.0	12.063	12.063	12.063
4.8	12.062	12.062	12.062
5.0	12.062	12.062	12.062
5.5	12.061	12.061	12.061
--	-	-	-
--	-	-	-

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

**COSEL**

Model	PMA60F-12	Temperature Testing Circuitry 25°C Figure A
Item	Dynamic Load Response	
Object	+12V4A	

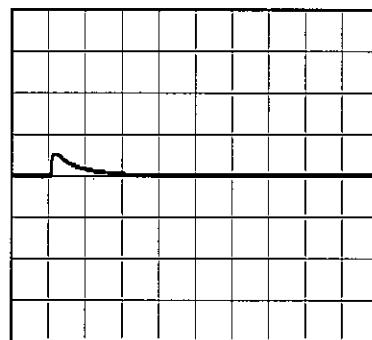
Input Volt. 100 V  
Cycle 1000 ms

Response.  $t_1=t_2=50\mu s$ . Typ

Min. Load (0A) ↔  
Load 100% (4A)

100 mV/div

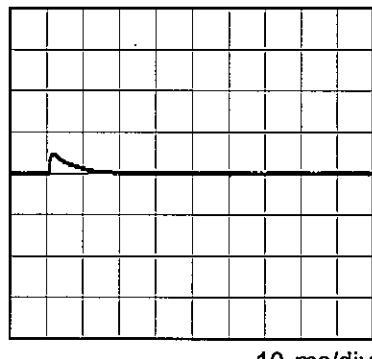
10 ms/div



Min. Load (0A) ↔  
Load 50% (2A)

100 mV/div

10 ms/div



**COSEL**

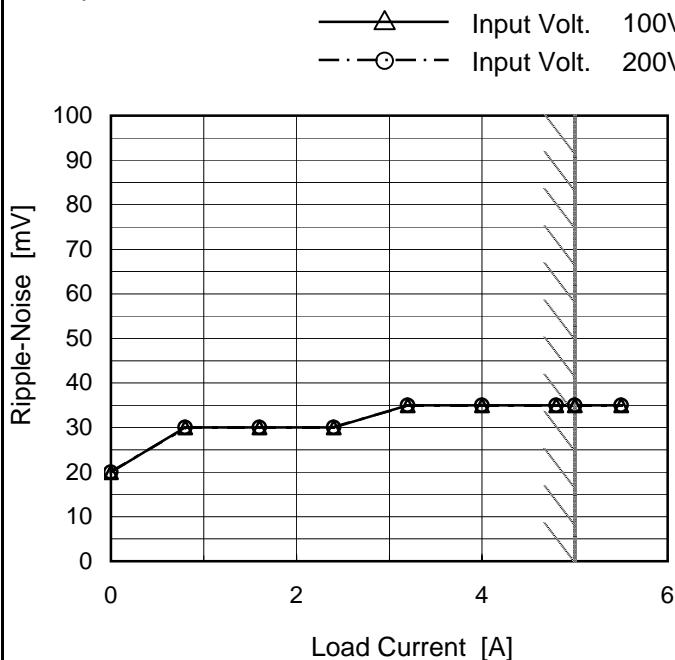
Model	PMA60F-12																																							
Item	Ripple Voltage (by Load Current)	Temperature 25°C Testing Circuitry Figure A																																						
Object	+12V5A																																							
1. Graph																																								
<p>Graph showing Ripple Voltage [mV] vs Load Current [A].</p> <p>Legend:</p> <ul style="list-style-type: none"> <li>Input Volt. 100V (Solid line with open circles)</li> <li>Input Volt. 200V (Dashed line with open circles)</li> </ul> <table border="1"> <thead> <tr> <th>Load Current [A]</th> <th>Ripple Voltage [mV] (100V)</th> <th>Ripple Voltage [mV] (200V)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>10</td><td>10</td></tr> <tr><td>0.8</td><td>20</td><td>20</td></tr> <tr><td>1.6</td><td>25</td><td>25</td></tr> <tr><td>2.4</td><td>25</td><td>25</td></tr> <tr><td>3.2</td><td>25</td><td>25</td></tr> <tr><td>4.0</td><td>25</td><td>25</td></tr> <tr><td>4.8</td><td>30</td><td>30</td></tr> <tr><td>5.0</td><td>30</td><td>30</td></tr> <tr><td>5.5</td><td>30</td><td>30</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Load Current [A]	Ripple Voltage [mV] (100V)	Ripple Voltage [mV] (200V)	0.0	10	10	0.8	20	20	1.6	25	25	2.4	25	25	3.2	25	25	4.0	25	25	4.8	30	30	5.0	30	30	5.5	30	30	--	-	-	--	-	-			
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<p>Measured by 20 MHz Oscilloscope.      Ripple Voltage 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>																																								

**COSEL**

Model	PMA60F-12
Item	Ripple-Noise
Object	+12V5A

 Temperature 25°C  
 Testing Circuitry Figure A

## 1. Graph



Measured by 20 MHz Oscilloscope.

Ripple-Noise is shown as p-p in the figure below.

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

## 2. Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
0.0	20	20
0.8	30	30
1.6	30	30
2.4	30	30
3.2	35	35
4.0	35	35
4.8	35	35
5.0	35	35
5.5	35	35
--	-	-
--	-	-

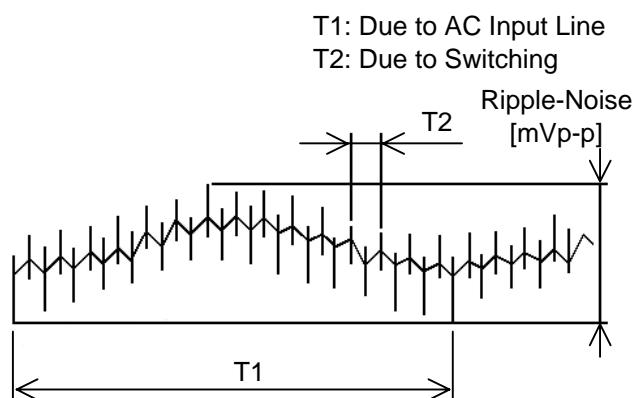
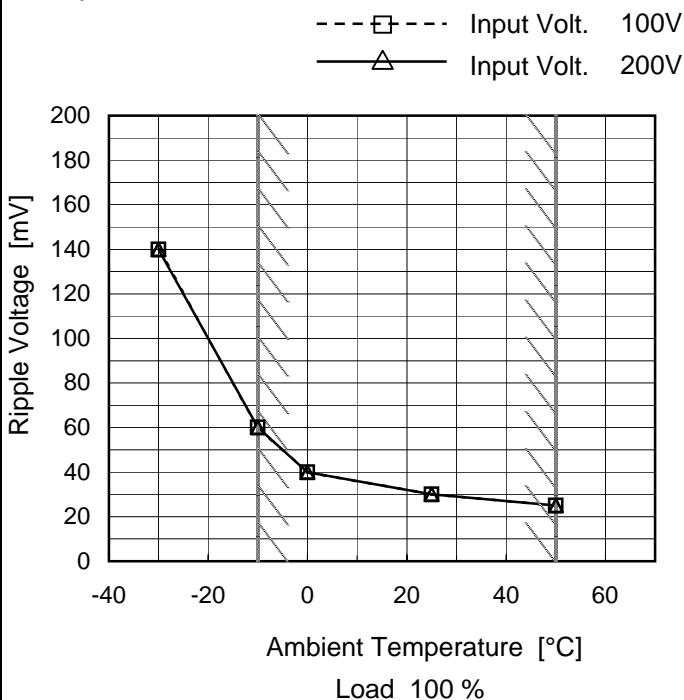


Fig. Complex Ripple Wave Form

**COSEL**

Model	PMA60F-12
Item	Ripple Voltage (by Ambient Temp.)
Object	+12V5A

## 1.Graph



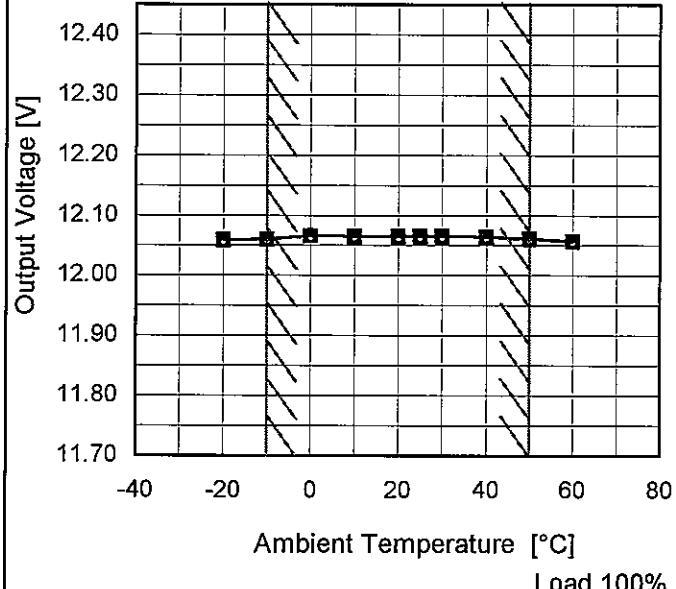
Testing Circuitry Figure A

## 2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-30	140	140
-10	60	60
0	40	40
25	30	30
50	25	25
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.

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

Model	PMA60F-12	Testing Circuitry Figure A																																																					
Item	Ambient Temperature Drift																																																						
Object	+12V5A																																																						
1.Graph	<p>—▲— Input Volt. 100V        ---□--- Input Volt. 200V        -·○--- Input Volt. 230V</p> 																																																						
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Note:	Slanted line shows the range of the rated ambient temperature.																																																						



Model	PMA60F-12	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+12V5A	

### 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 : -10 - 50°C

Input Voltage : 85 - 264V

Load Current : 0 - 5A

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

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

### 2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-5	200	0	12.073	±7	±0.1
Minimum Voltage	50	264	5	12.060		

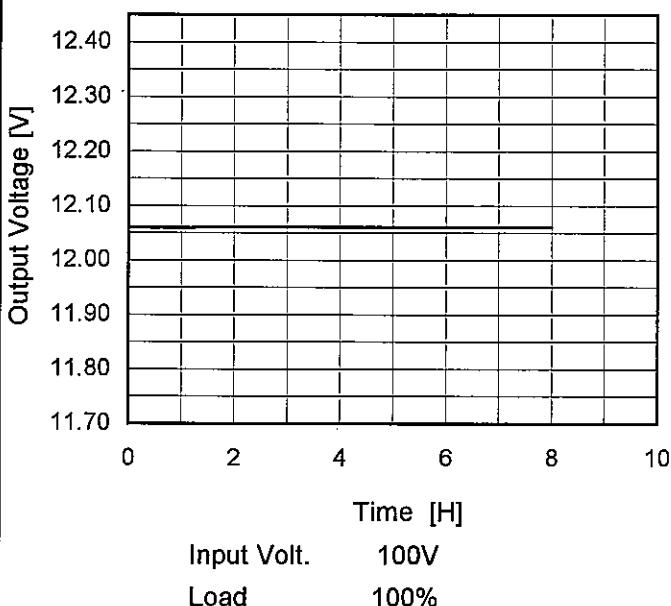
**COSEL**

Model PMA60F-12

Item Time Lapse Drift

Object +12V5A

## 1.Graph



\* The characteristic of AC200V is equal.

Temperature 25°C  
Testing Circuitry Figure A

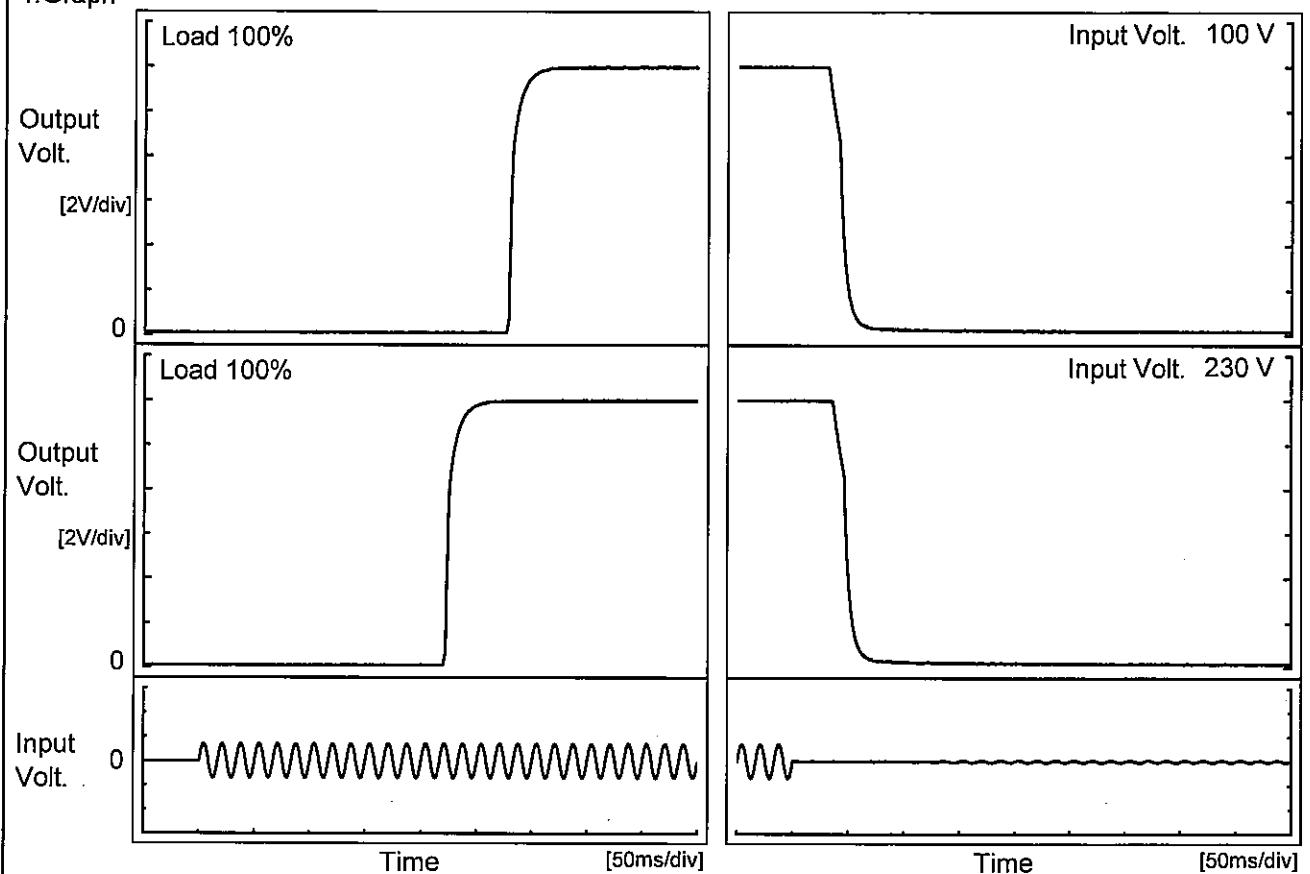
## 2.Values

Time since start [H]	Output Voltage [V]
0.0	12.062
0.5	12.060
1.0	12.060
2.0	12.061
3.0	12.061
4.0	12.061
5.0	12.061
6.0	12.061
7.0	12.061
8.0	12.061

**COSEL**

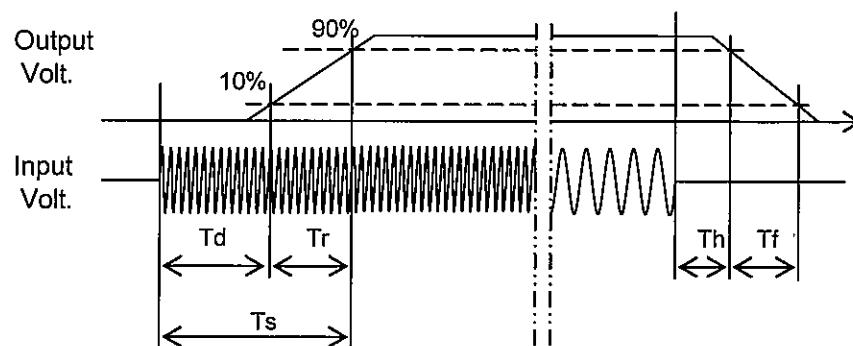
Model	PMA60F-12	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+12V5A		

## 1. Graph



## 2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf	[ms]
100 V		279.0	13.3	292.3	34.5	17.8	
230 V		222.3	13.3	235.6	38.8	18.0	



**COSEL**

Model	PMA60F-12	Temperature	25°C																																
Item	Hold-Up Time	Testing Circuitry	Figure A																																
Object	+12V5A																																		
1. Graph																																			
2. Values																																			
<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>61</td><td>27</td></tr> <tr> <td>85</td><td>63</td><td>29</td></tr> <tr> <td>100</td><td>65</td><td>31</td></tr> <tr> <td>120</td><td>67</td><td>33</td></tr> <tr> <td>200</td><td>71</td><td>35</td></tr> <tr> <td>230</td><td>72</td><td>36</td></tr> <tr> <td>264</td><td>73</td><td>36</td></tr> <tr> <td>280</td><td>73</td><td>37</td></tr> <tr> <td>--</td><td>-</td><td>-</td></tr> </tbody> </table>				Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	75	61	27	85	63	29	100	65	31	120	67	33	200	71	35	230	72	36	264	73	36	280	73	37	--	-	-
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280	73	37																																	
--	-	-																																	
<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>																																			

Model	PMA60F-12	Temperature	25°C																																																			
Item	Instantaneous Interruption Compensation	Testing Circuitry	Figure A																																																			
Object	+12V5A																																																					
1.Graph	<p>—△— Input Volt. 100V        - - - □ - - Input Volt. 200V        - - - ○ - - Input Volt. 230V</p>																																																					
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<p>Model      PMA60F-12</p> <p>Item      Minimum Input Voltage for Regulated Output Voltage</p> <p>Object    +12V5A</p>	Testing Circuitry   Figure A																																						
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	Load 50%	Load 100%																																					
-20	43	57																																					
-10	42	57																																					
0	42	56																																					
10	42	56																																					
20	42	56																																					
25	42	56																																					
30	42	56																																					
40	42	56																																					
50	42	56																																					
60	42	57																																					
--	-	-																																					
<p>1.Graph</p> <p>--- □ --- Load 50%</p> <p>— △ — Load 100%</p> <p>Input Voltage [V]</p> <p>Ambient Temperature [°C]</p>																																							

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

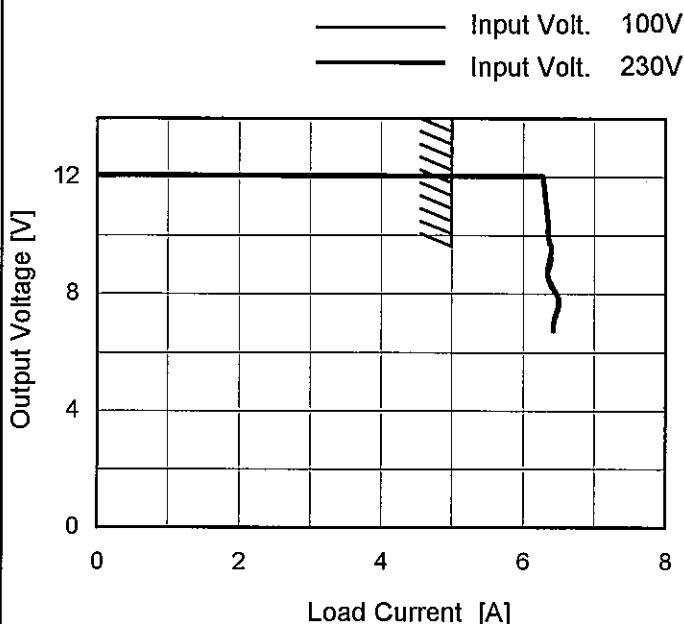
**COSEL**

Model PMA60F-12

Item Overcurrent Protection

Object +12V5A

## 1. Graph



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

 Temperature 25°C  
 Testing Circuitry Figure A

## 2. Values

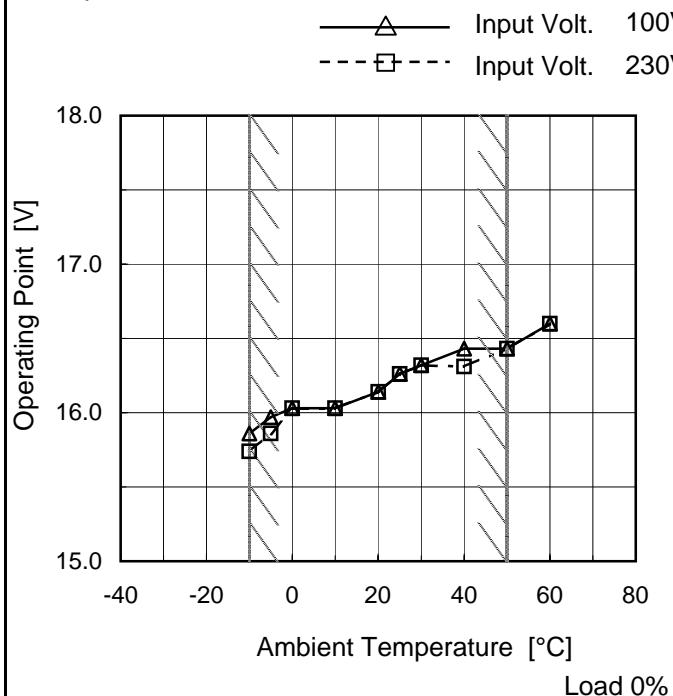
Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
12.0	6.28	6.27
11.4	6.31	6.31
10.8	6.28	6.27
9.6	6.38	6.39
8.4	6.36	6.37
7.2	6.48	6.45
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

**COSEL**

Model	PMA60F-12
Item	Overvoltage Protection
Object	+12V5A

Testing Circuitry Figure A

## 1.Graph



## 2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-10	15.86	15.74
-5	15.97	15.86
0	16.03	16.03
10	16.03	16.03
20	16.14	16.14
25	16.26	16.26
30	16.32	16.32
40	16.43	16.31
50	16.43	16.43
60	16.60	16.60
--	-	-

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

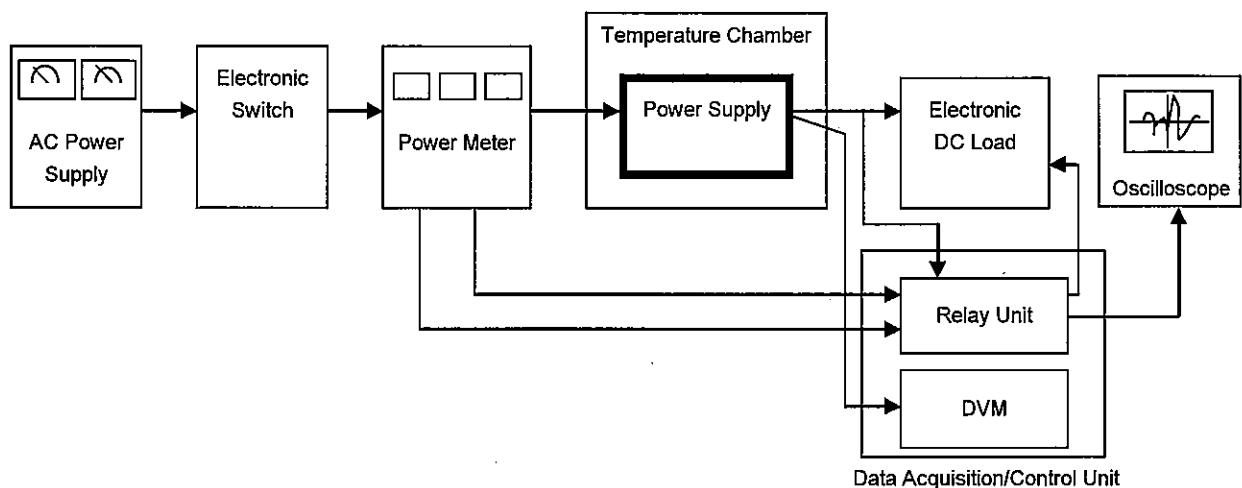


Figure A

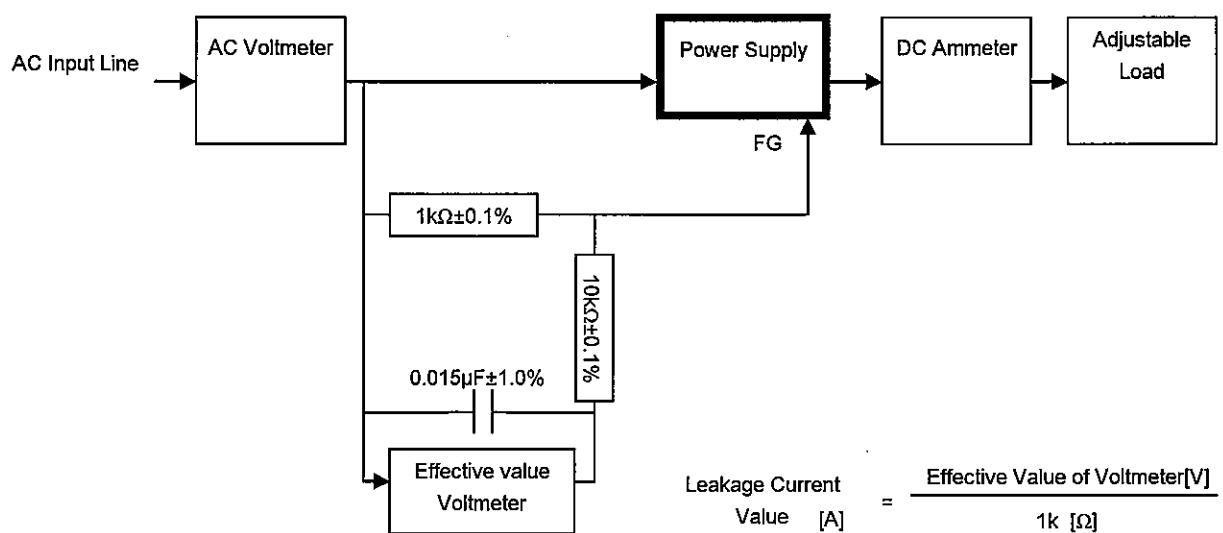


Figure B ( IEC60601-1 )