

# TEST DATA OF LFA100F-48

Regulated DC Power Supply  
November 18, 2010

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**COSEL CO.,LTD.**

## CONTENTS

|   |    |
|---|----|
| 1.Input Current (by Load Current) . . . . .                     | 1  |
| 2.Input Power (by Load Current) . . . . .                       | 2  |
| 3.Efficiency (by Input Voltage) . . . . .                       | 3  |
| 4.Efficiency (by Load Current) . . . . .                        | 4  |
| 5.Power Factor (by Input Voltage) . . . . .                     | 5  |
| 6.Power Factor (by Load Current) . . . . .                      | 6  |
| 7.Inrush Current . . . . .                                      | 7  |
| 8.Leakage Current . . . . .                                     | 8  |
| 9.Line Regulation . . . . .                                     | 9  |
| 10.Load Regulation . . . . .                                    | 10 |
| 11.Dynamic Load Response . . . . .                              | 11 |
| 12.Ripple Voltage (by Load Current) . . . . .                   | 12 |
| 13.Ripple-Noise . . . . .                                       | 13 |
| 14.Ripple Voltage (by Ambient Temperature) . . . . .            | 14 |
| 15.Ambient Temperature Drift . . . . .                          | 15 |
| 16.Output Voltage Accuracy . . . . .                            | 16 |
| 17.Time Lapse Drift . . . . .                                   | 17 |
| 18.Rise and Fall Time . . . . .                                 | 18 |
| 19.Hold-Up Time . . . . .                                       | 19 |
| 20.Instantaneous Interruption Compensation . . . . .            | 20 |
| 21.Minimum Input Voltage for Regulated Output Voltage . . . . . | 21 |
| 22.Overcurrent Protection . . . . .                             | 22 |
| 23.Overvoltage Protection . . . . .                             | 23 |
| 24.Figure of Testing Circuitry . . . . .                        | 24 |

(Final Page 25)

# COSEL

Model

LFA100F-48

Item

Input Current (by Load Current)

Object

Temperature

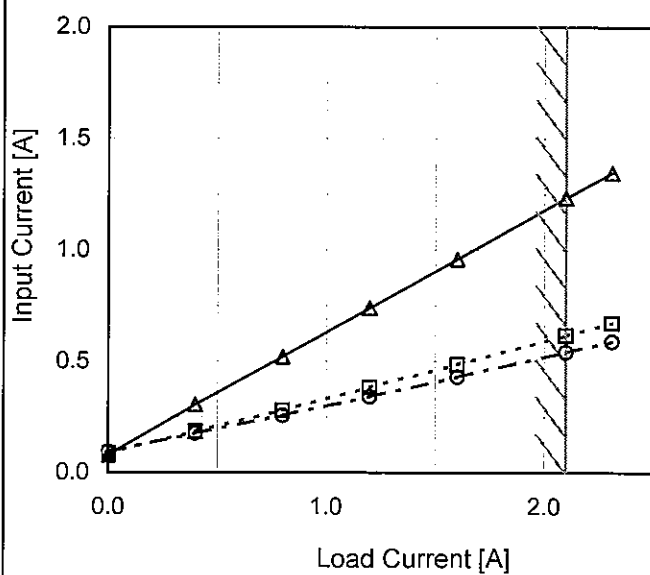
25°C

Testing Circuitry

Figure A

## 1. Graph

—△— Input Volt. 100V  
 ---□--- Input Volt. 200V  
 -·-○-·- Input Volt. 230V



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

## 2. Values

| Load Current [A] | Input Current [A]  |                    |                    |
|------------------|--------------------|--------------------|--------------------|
|                  | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00             | 0.077              | 0.086              | 0.091              |
| 0.40             | 0.304              | 0.184              | 0.175              |
| 0.80             | 0.520              | 0.279              | 0.256              |
| 1.20             | 0.739              | 0.383              | 0.341              |
| 1.60             | 0.959              | 0.486              | 0.429              |
| 2.10             | 1.234              | 0.617              | 0.541              |
| 2.31             | 1.346              | 0.673              | 0.589              |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |

# COSEL

Model LFA100F-48

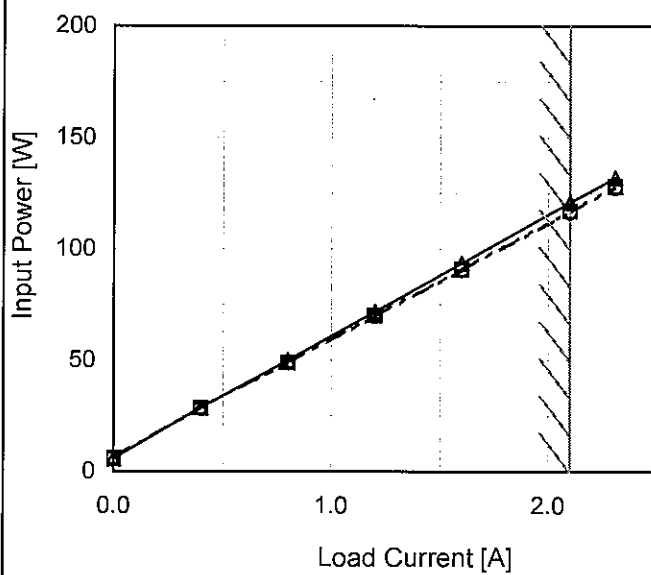
Item Input Power (by Load Current)

Object

Temperature 25°C  
Testing Circuitry Figure A

## 1. Graph

—△— Input Volt. 100V  
 ---□--- Input Volt. 200V  
 ---○--- Input Volt. 230V



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             | 5.7                | 5.9                | 6.1                |
| 0.40             | 28.6               | 28.5               | 28.6               |
| 0.80             | 50.0               | 48.9               | 48.9               |
| 1.20             | 71.7               | 70.1               | 69.7               |
| 1.60             | 93.5               | 90.8               | 90.5               |
| 2.10             | 121.0              | 117.1              | 116.5              |
| 2.31             | 132.1              | 128.2              | 127.6              |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |

LOREL

|        |                               |
|--------|-------------------------------|
| Model  | LFA100F-48                    |
| Item   | Efficiency (by Input Voltage) |
| Object |                               |

1.Graph

---□--- Load 50%

—△— Load 100%

Efficiency [%]

Input Voltage [V]

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

| Input Voltage [V] | Load 50% Efficiency [%] | Load 100% Efficiency [%] |
|-------------------|-------------------------|--------------------------|
| 75                | 79.6                    | 82.5                     |
| 85                | 80.7                    | 84.4                     |
| 100               | 81.5                    | 85.3                     |
| 120               | 82.2                    | 86.1                     |
| 200               | 83.8                    | 88.1                     |
| 230               | 83.9                    | 88.5                     |
| 264               | 83.9                    | 88.7                     |
| 280               | 84.1                    | 89.2                     |

Temperature 25°C  
Testing Circuitry Figure A

2.Values

| Input Voltage [V] | Efficiency [%] |           |
|-------------------|----------------|-----------|
|                   | Load 50%       | Load 100% |
| 75                | 79.6           | 82.5      |
| 85                | 80.7           | 84.4      |
| 100               | 81.5           | 85.3      |
| 120               | 82.2           | 86.1      |
| 200               | 83.8           | 88.1      |
| 230               | 83.9           | 88.5      |
| 264               | 83.9           | 88.7      |
| 280               | 84.1           | 89.2      |
| --                | -              | -         |

- 3 -

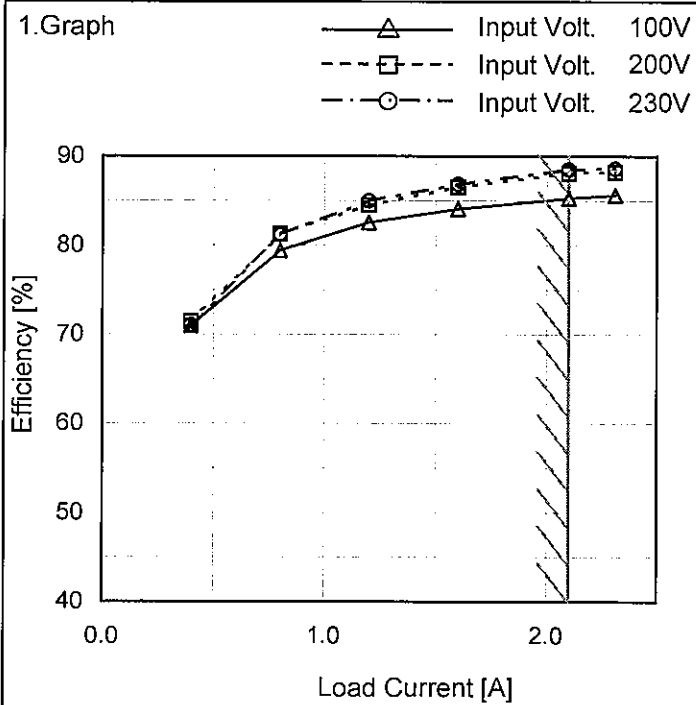
BC-10480

# COSEL

Model LFA100F-48

Item Efficiency (by Load Current)

Object

Temperature 25°C  
Testing Circuitry Figure A

2.Values

| Load Current [A] | Efficiency [%]     |                    |                    |
|------------------|--------------------|--------------------|--------------------|
|                  | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00             | -                  | -                  | -                  |
| 0.40             | 71.0               | 71.4               | 71.0               |
| 0.80             | 79.4               | 81.3               | 81.2               |
| 1.20             | 82.5               | 84.5               | 85.0               |
| 1.60             | 84.1               | 86.5               | 86.8               |
| 2.10             | 85.3               | 88.1               | 88.5               |
| 2.31             | 85.6               | 88.2               | 88.6               |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |

Model

LFA100F-48

Item

Power Factor (by Input Voltage)

Object

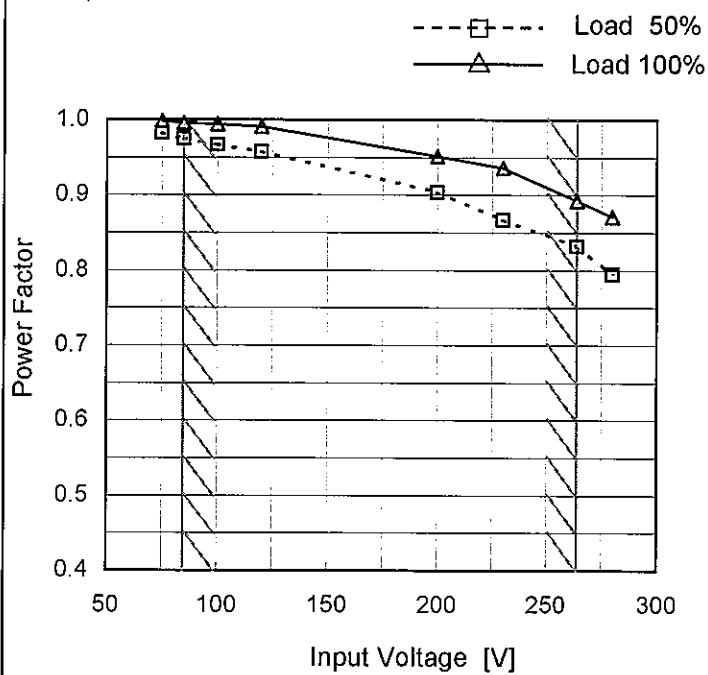
Temperature

25°C

Testing Circuitry

Figure A

## 1. Graph



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

## 2. Values

| Input Voltage [V] | Power Factor |           |
|-------------------|--------------|-----------|
|                   | Load 50%     | Load 100% |
| 75                | 0.982        | 0.998     |
| 85                | 0.974        | 0.996     |
| 100               | 0.967        | 0.994     |
| 120               | 0.958        | 0.991     |
| 200               | 0.904        | 0.951     |
| 230               | 0.867        | 0.936     |
| 264               | 0.832        | 0.893     |
| 280               | 0.794        | 0.872     |
| --                | -            | -         |

# COSEL

| Model  |                    | LFA100F-48   |                    |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
|--|--------------------|--|--------------------|------------------|--------------|--|--|--------------------|--------------------|--------------------|------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|-------|----|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|
| Item   |                    | Power Factor (by Load Current)   |                    |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| Object   |                    |  |                    |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 1.Graph  |                    | 2.Values   |                    |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| <div><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>Power Factor</p><p>Load Current [A]</p><p>Note: Slanted line shows the range of the rated load current.</p></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>0.735</td><td>0.345</td><td>0.290</td></tr><tr><td>0.40</td><td>0.941</td><td>0.772</td><td>0.710</td></tr><tr><td>0.80</td><td>0.962</td><td>0.875</td><td>0.832</td></tr><tr><td>1.20</td><td>0.972</td><td>0.915</td><td>0.888</td></tr><tr><td>1.60</td><td>0.976</td><td>0.935</td><td>0.918</td></tr><tr><td>2.10</td><td>0.994</td><td>0.951</td><td>0.936</td></tr><tr><td>2.31</td><td>0.996</td><td>0.953</td><td>0.942</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 | 0.735 | 0.345 | 0.290 | 0.40 | 0.941 | 0.772 | 0.710 | 0.80 | 0.962 | 0.875 | 0.832 | 1.20 | 0.972 | 0.915 | 0.888 | 1.60 | 0.976 | 0.935 | 0.918 | 2.10 | 0.994 | 0.951 | 0.936 | 2.31 | 0.996 | 0.953 | 0.942 | -- | - | - | - | -- | - | - | - | -- | - | - | - | -- | - | - | - |
| Load Current [A]   | Power Factor       |  |                    |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
|  | Input Volt. 100[V] | Input Volt. 200[V]   | Input Volt. 230[V] |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.00   | 0.735              | 0.345  | 0.290              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.40   | 0.941              | 0.772  | 0.710              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.80   | 0.962              | 0.875  | 0.832              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 1.20   | 0.972              | 0.915  | 0.888              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 1.60   | 0.976              | 0.935  | 0.918              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 2.10   | 0.994              | 0.951  | 0.936              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 2.31   | 0.996              | 0.953  | 0.942              |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --   | -                  | -  | -                  |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --   | -                  | -  | -                  |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --   | -                  | -  | -                  |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --   | -                  | -  | -                  |                  |              |  |  |                    |                    |                    |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |      |       |       |       |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |

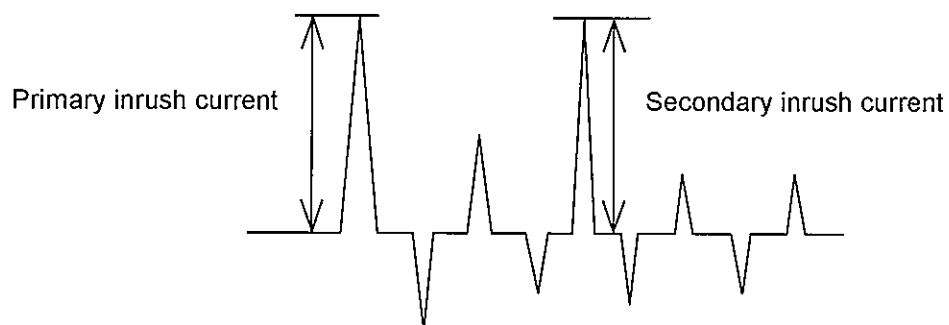
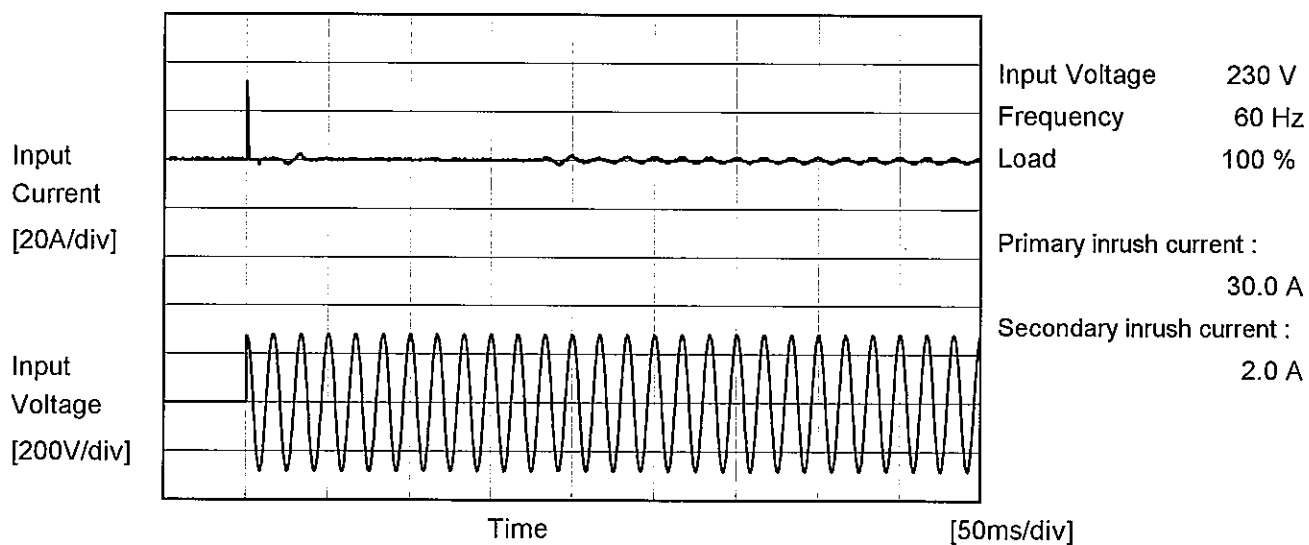
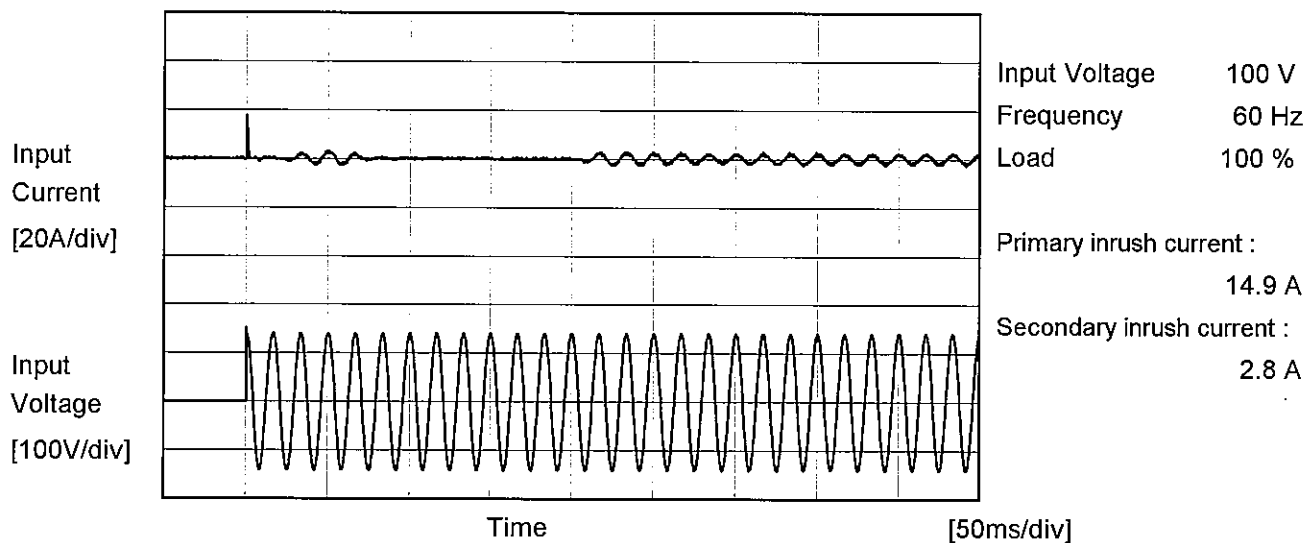
- 6 -

BC-10480



**COSEL**

|        |                |                   |          |
|--------|----------------|-------------------|----------|
|        |                |                   |          |
| Model  | LFA100F-48     |                   |          |
| Item   | Inrush Current | Temperature       | 25°C     |
| Object |                | Testing Circuitry | Figure A |





|        |                 |  |
|--------|-----------------|--|
|        |                 | Temperature 25°C<br>Testing Circuitry Figure B |
| Model  | LFA100F-48      |  |
| Item   | Leakage Current |  |
| Object | _____           |  |

## 1.Results

[mA]

| Standards  |              | Input Volt. |         |         | Note      |
|------------|--------------|-------------|---------|---------|-----------|
|            |              | 100 [V]     | 200 [V] | 240 [V] |           |
| DEN-AN     | Both phases  | 0.27        | 0.34    | 0.37    | Operation |
|            | One of phase | 0.25        | 0.55    | 0.67    | stand by  |
| IEC60950-1 | Both phases  | 0.13        | 0.28    | 0.33    | Operation |
|            | One of phase | 0.25        | 0.52    | 0.64    | stand by  |

The value for "One phase" 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  | LFA100F-48                  |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|--|-----------------------------|------------------------------|-----------------------------|------------------------------|----|--------|--------|----|--------|--------|-----|--------|--------|-----|--------|--------|-----|--------|--------|-----|--------|--------|-----|--------|--------|-----|--------|--------|----|---|---|--|--|
| Item   | Line Regulation             | Temperature                  | 25°C                        |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| Object   | +48V2.1A                    | Testing Circuitry            | Figure A                    |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 1.Graph  |                             | 2.Values                     |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| <div><div><div>---□---</div><div>Load 50%</div></div><div><div>—△—</div><div>Load 100%</div></div></div> <table><thead><tr><th>Input Voltage [V]</th><th>Output Voltage [V] Load 50%</th><th>Output Voltage [V] Load 100%</th></tr></thead><tbody><tr><td>75</td><td>48.610</td><td>48.605</td></tr><tr><td>85</td><td>48.610</td><td>48.605</td></tr><tr><td>100</td><td>48.610</td><td>48.605</td></tr><tr><td>120</td><td>48.610</td><td>48.605</td></tr><tr><td>200</td><td>48.610</td><td>48.605</td></tr><tr><td>230</td><td>48.610</td><td>48.605</td></tr><tr><td>264</td><td>48.610</td><td>48.605</td></tr><tr><td>280</td><td>48.610</td><td>48.605</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% | Output Voltage [V] Load 100% | 75 | 48.610 | 48.605 | 85 | 48.610 | 48.605 | 100 | 48.610 | 48.605 | 120 | 48.610 | 48.605 | 200 | 48.610 | 48.605 | 230 | 48.610 | 48.605 | 264 | 48.610 | 48.605 | 280 | 48.610 | 48.605 | -- | - | - |  |  |
| Input Voltage [V]  | Output Voltage [V] Load 50% | Output Voltage [V] Load 100% |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 75   | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 85   | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 100  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 120  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 200  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 230  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 264  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| 280  | 48.610                      | 48.605                       |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
| --   | -                           | -                            |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             |                              |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |
|  |                             | </                           |                             |                              |    |        |        |    |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |     |        |        |    |   |   |  |  |

# COSEL

Model LFA100F-48

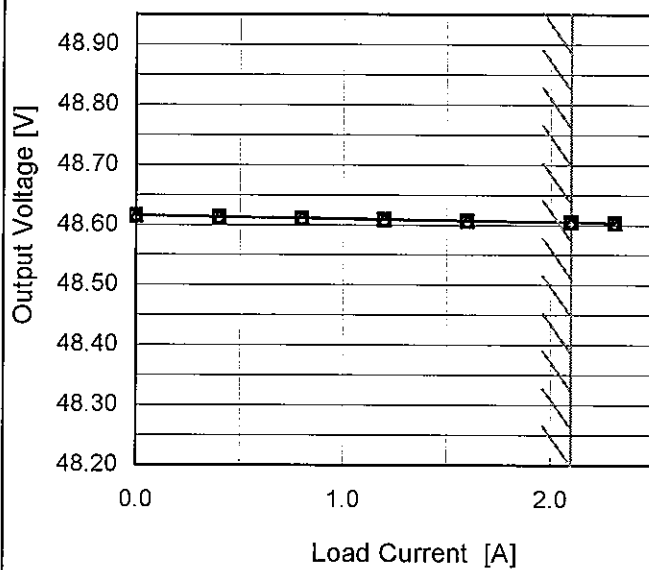
Item Load Regulation

Object +48V2.1A

 Temperature 25°C  
 Testing Circuitry Figure A

## 1. Graph

—△— Input Volt. 100V  
 ---□--- Input Volt. 200V  
 ---○--- Input Volt. 230V



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

## 2. Values

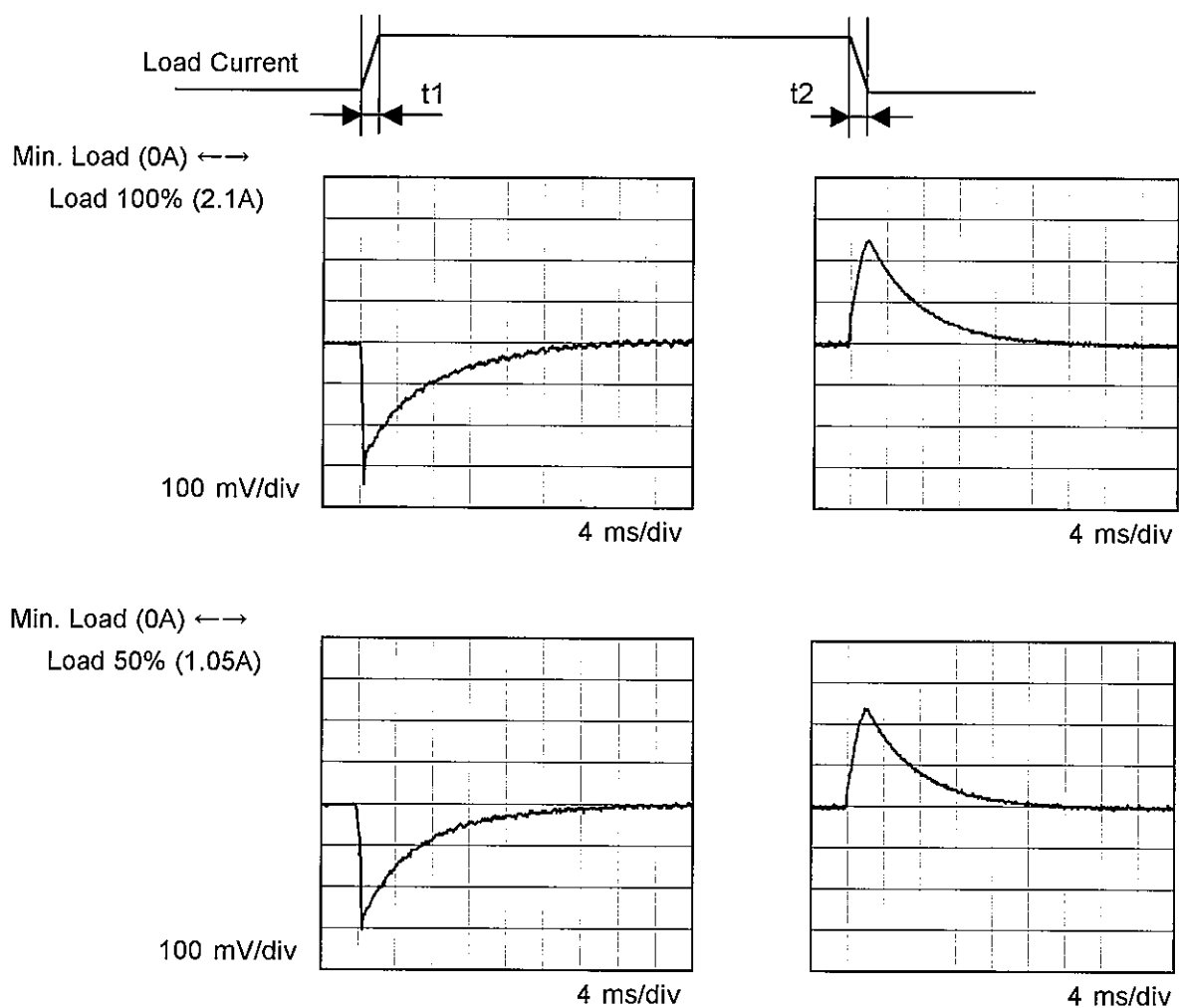
| Load Current [A] | Output Voltage [V] |                    |                    |
|------------------|--------------------|--------------------|--------------------|
|                  | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00             | 48.615             | 48.615             | 48.615             |
| 0.40             | 48.613             | 48.613             | 48.613             |
| 0.80             | 48.611             | 48.611             | 48.611             |
| 1.20             | 48.609             | 48.609             | 48.609             |
| 1.60             | 48.607             | 48.607             | 48.607             |
| 2.10             | 48.605             | 48.605             | 48.605             |
| 2.31             | 48.604             | 48.604             | 48.604             |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |
| --               | -                  | -                  | -                  |

# COSEL

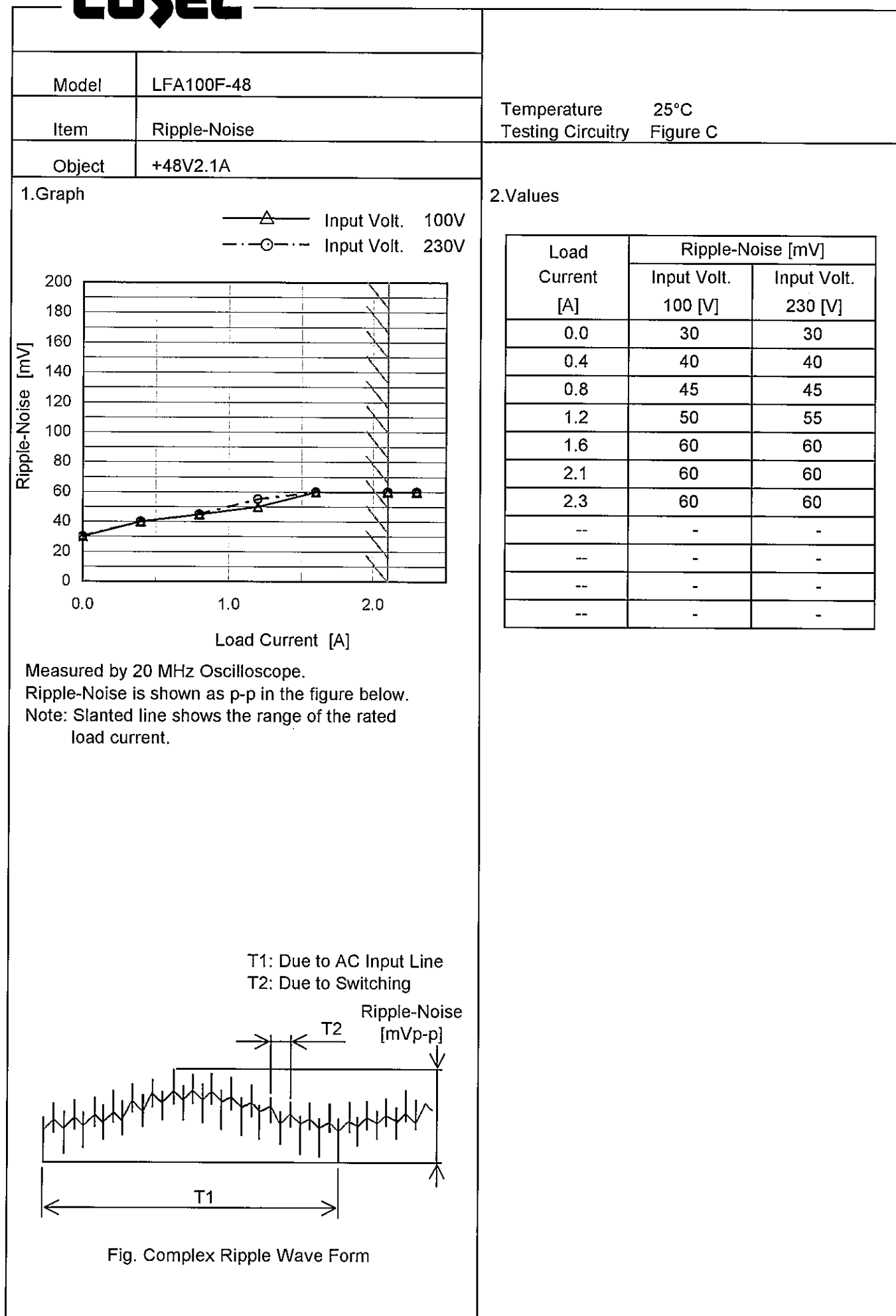
|        |                       |                   |          |
|--------|-----------------------|-------------------|----------|
| Model  | LFA100F-48            | Temperature       | 25°C     |
| Item   | Dynamic Load Response | Testing Circuitry | Figure A |
| Object | +48V2.1A              |                   |          |

Input Volt. 100 V  
Cycle 1000 ms

Response.  $t_1=t_2=50\mu\text{s}$ . Typ



| Model  | LFA100F-48                       |                     |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
|--|----------------------------------|---------------------|---------------------|--|---------------------|---------------------|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|----|---|---|----|---|---|----|---|---|----|---|---|--|--|
| Item   | Ripple Voltage (by Load Current) | Temperature         | 25°C                |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| Object   | +48V2.1A                         | Testing Circuitry   | Figure C            |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 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><div><div>Ripple Voltage [mV]</div><div>Load Current [A]</div></div></div></div><table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple Voltage [mV]</th></tr><tr><th>Input Volt. 100 [V]</th><th>Input Volt. 230 [V]</th></tr><tr><td>0.0</td><td>20</td><td>20</td></tr><tr><td>0.4</td><td>25</td><td>25</td></tr><tr><td>0.8</td><td>30</td><td>30</td></tr><tr><td>1.2</td><td>35</td><td>35</td></tr><tr><td>1.6</td><td>40</td><td>40</td></tr><tr><td>2.1</td><td>45</td><td>45</td></tr><tr><td>2.3</td><td>50</td><td>50</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></div> |                                  | Load Current [A]    | Ripple Voltage [mV] |  | Input Volt. 100 [V] | Input Volt. 230 [V] | 0.0 | 20 | 20 | 0.4 | 25 | 25 | 0.8 | 30 | 30 | 1.2 | 35 | 35 | 1.6 | 40 | 40 | 2.1 | 45 | 45 | 2.3 | 50 | 50 | -- | - | - | -- | - | - | -- | - | - | -- | - | - |  |  |
| Load Current [A]   | Ripple Voltage [mV]              |                     |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
|  | Input Volt. 100 [V]              | Input Volt. 230 [V] |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 0.0  | 20                               | 20                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 0.4  | 25                               | 25                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 0.8  | 30                               | 30                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 1.2  | 35                               | 35                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 1.6  | 40                               | 40                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 2.1  | 45                               | 45                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| 2.3  | 50                               | 50                  |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| --   | -                                | -                   |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| --   | -                                | -                   |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| --   | -                                | -                   |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| --   | -                                | -                   |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| <div>Measured by 20 MHz Oscilloscope.</div> <div>Ripple Voltage is shown as p-p in the figure below.</div> <div>Note: Slanted line shows the range of the rated load current.</div> <div><div><div><div><div></div><div>T1: Due to AC Input Line</div><div>T2: Due to Switching</div></div><div><div><div>Ripple [mVp-p]</div><div>T1</div><div>T2</div></div></div></div></div></div>   |                                  |                     |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |
| Fig. Complex Ripple Wave Form  |                                  |                     |                     |  |                     |                     |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |   |   |    |   |   |    |   |   |    |   |   |  |  |



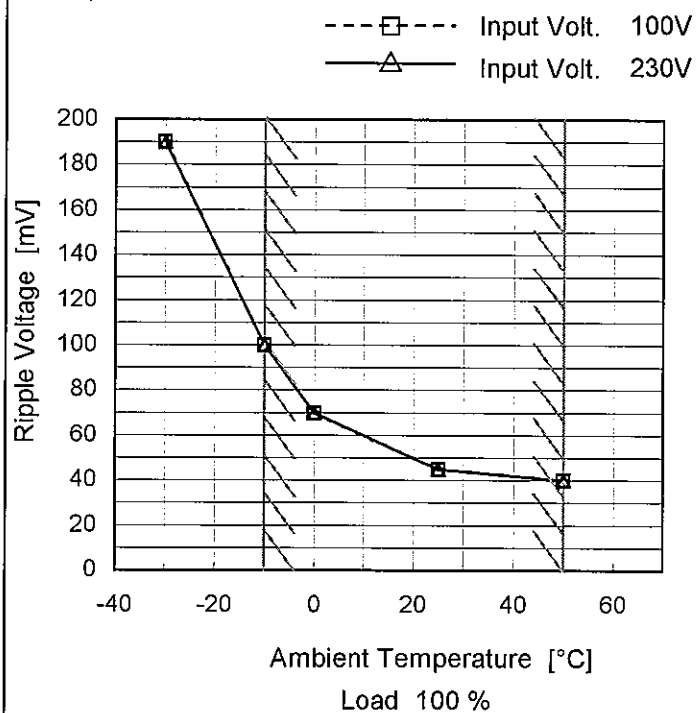
Model LFA100F-48

Item Ripple Voltage (by Ambient Temp.)

Object +48V2.1A

Testing Circuitry Figure C

## 1. Graph



Measured by 20 MHz Oscilloscope.

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

## 2. Values

| Ambient Temperature [°C] | Ripple Voltage [mV] |                     |
|--------------------------|---------------------|---------------------|
|                          | Input Volt. 100 [V] | Input Volt. 230 [V] |
| -30                      | 190                 | 190                 |
| -10                      | 100                 | 100                 |
| 0                        | 70                  | 70                  |
| 25                       | 45                  | 45                  |
| 50                       | 40                  | 40                  |
| --                       | -                   | -                   |
| --                       | -                   | -                   |
| --                       | -                   | -                   |
| --                       | -                   | -                   |
| --                       | -                   | -                   |
| --                       | -                   | -                   |
| --                       | -                   | -                   |



Model

LFA100F-48

Item

Ambient Temperature Drift

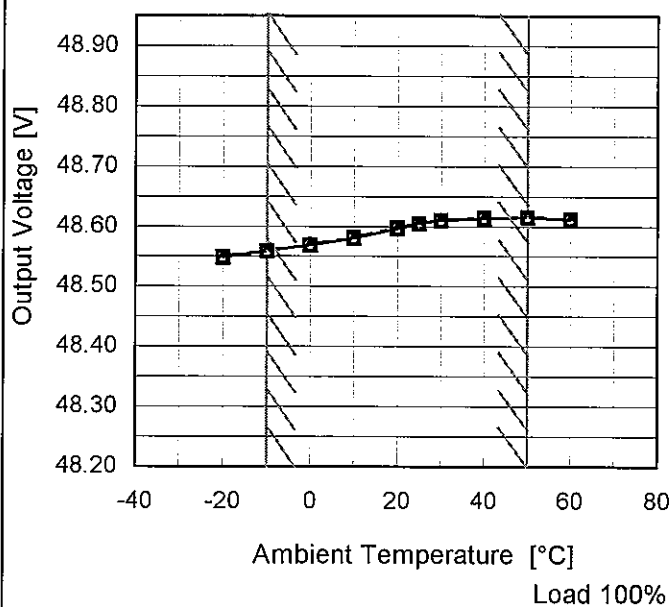
Object

+48V2.1A

Testing Circuitry Figure A

1. Graph

—△— Input Volt. 100V  
 ---□--- Input Volt. 200V  
 ---○--- Input Volt. 230V



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

2. Values

| Ambient Temperature [°C] | Output Voltage [V] |                    |                    |
|--------------------------|--------------------|--------------------|--------------------|
|                          | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| -20                      | 48.549             | 48.549             | 48.549             |
| -10                      | 48.559             | 48.560             | 48.560             |
| 0                        | 48.569             | 48.569             | 48.569             |
| 10                       | 48.581             | 48.581             | 48.582             |
| 20                       | 48.596             | 48.597             | 48.597             |
| 25                       | 48.605             | 48.605             | 48.605             |
| 30                       | 48.610             | 48.610             | 48.611             |
| 40                       | 48.614             | 48.614             | 48.615             |
| 50                       | 48.615             | 48.616             | 48.616             |
| 60                       | 48.612             | 48.612             | 48.613             |
| --                       | -                  | -                  | -                  |



|        |  |                         |                            |
|--------|--|-------------------------|----------------------------|
| Model  |  | LFA100F-48              | Testing Circuitry Figure A |
| Item   |  | Output Voltage Accuracy |                            |
| Object |  | +48V2.1A                |                            |

### 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 - 2.1A

\* 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<br>[°C] | Input<br>Voltage[V] | Output     |            | Output Voltage Accuracy |            |
|-----------------|---------------------|---------------------|------------|------------|-------------------------|------------|
|                 |                     |                     | Current[A] | Voltage[V] | Value [mV]              | Ration [%] |
| Maximum Voltage | 50                  | 264                 | 0          | 48.623     | ±32                     | ±0.1       |
| Minimum Voltage | -10                 | 85                  | 2.1        | 48.559     |                         |            |

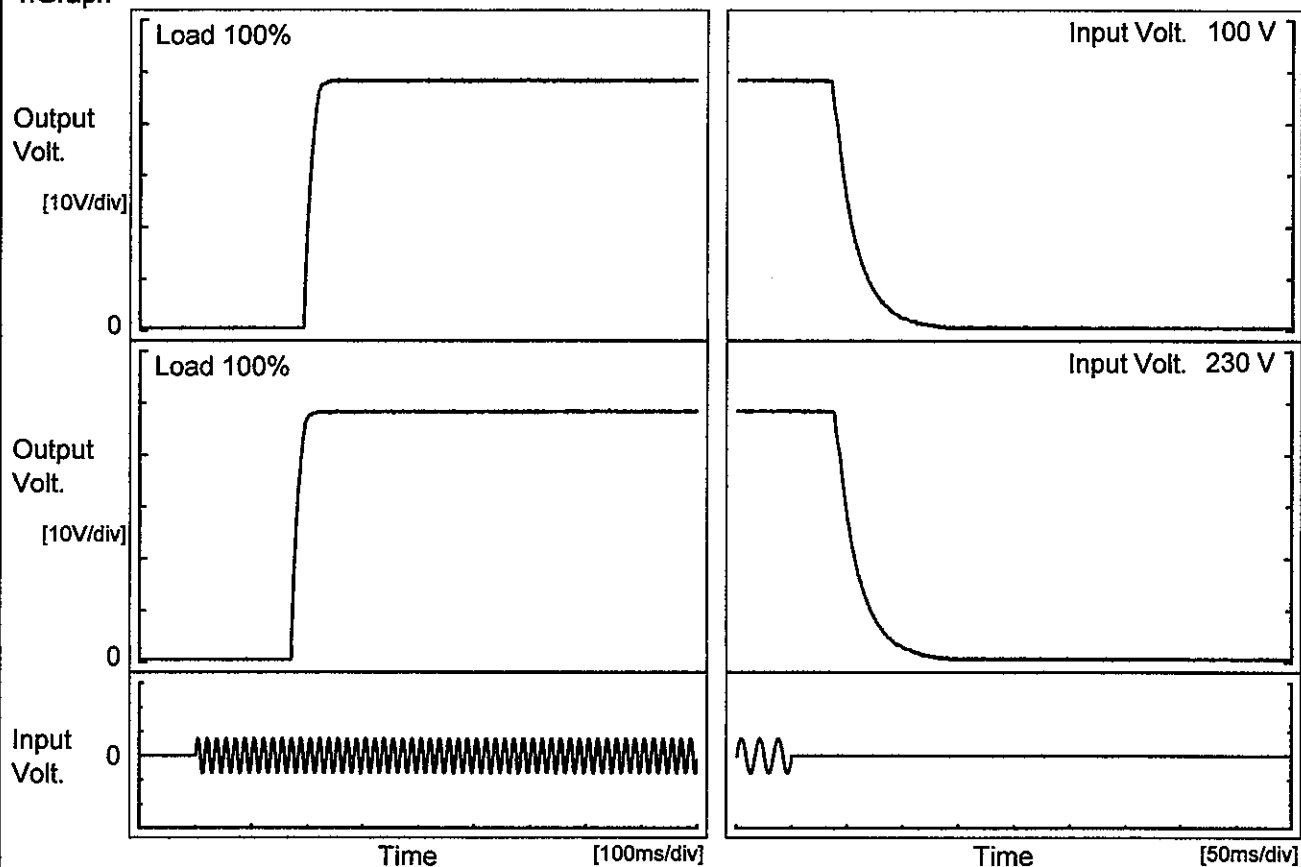
# COSEL

|  |                  |                   |          |
|--|------------------|-------------------|----------|
|  |                  |                   |          |
| Model  | LFA100F-48       |                   |          |
| Item   | Time Lapse Drift | Temperature       | 25°C     |
|  |                  | Testing Circuitry | Figure A |
| Object   | +48V2.1A         |                   |          |
| 1.Graph  |                  | 2.Values          |          |
| <div><div>Output Voltage [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

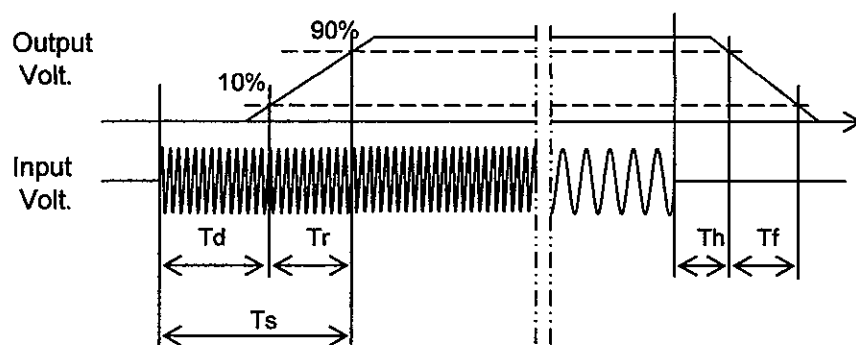
|        |                    |                   |          |
|--------|--------------------|-------------------|----------|
| Model  | LFA100F-48         | Temperature       | 25°C     |
| Item   | Rise and Fall Time | Testing Circuitry | Figure A |
| Object | +48V2.1A           |                   |          |

## 1. Graph



## 2. Values

| Input Volt. | Time | Td    | Tr   | Ts    | Th   | Tf   |
|-------------|------|-------|------|-------|------|------|
| 100 V       |      | 194.0 | 20.0 | 214.0 | 37.0 | 45.8 |
| 230 V       |      | 172.5 | 19.5 | 192.0 | 40.5 | 45.8 |



# COSEL

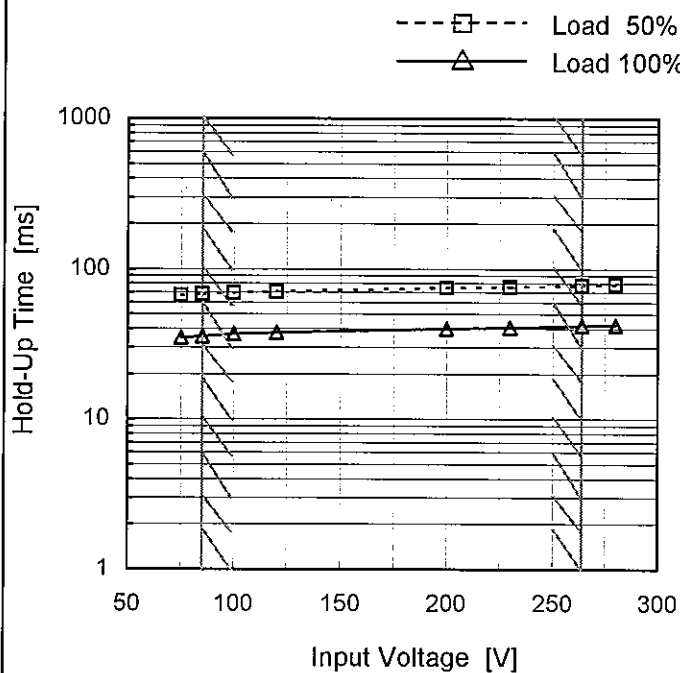
Model LFA100F-48

Item Hold-Up Time

Object +48V2.1A

 Temperature 25°C  
 Testing Circuitry Figure A

## 1. Graph



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.

## 2. Values

| Input Voltage [V] | Hold-Up Time [ms] |           |
|-------------------|-------------------|-----------|
|                   | Load 50%          | Load 100% |
| 75                | 67                | 35        |
| 85                | 68                | 36        |
| 100               | 69                | 37        |
| 120               | 71                | 38        |
| 200               | 75                | 40        |
| 230               | 76                | 41        |
| 264               | 78                | 42        |
| 280               | 79                | 43        |
| --                | -                 | -         |

| Model   | LFA100F-48                              |  |                    |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
|---|---|--|--------------------|------------------|-----------|--|--|--------------------|--------------------|--------------------|------|---|---|---|------|-----|-----|-----|------|----|-----|-----|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|----|---|---|---|----|---|---|---|----|---|---|---|----|---|---|---|
| Item  | Instantaneous Interruption Compensation | Temperature  | 25°C               |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| Object  | +48V2.1A                                | Testing Circuitry  | Figure A           |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 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>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</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>0.40</td><td>160</td><td>186</td><td>186</td></tr><tr><td>0.80</td><td>91</td><td>102</td><td>107</td></tr><tr><td>1.20</td><td>61</td><td>73</td><td>71</td></tr><tr><td>1.60</td><td>45</td><td>56</td><td>57</td></tr><tr><td>2.10</td><td>36</td><td>40</td><td>40</td></tr><tr><td>2.31</td><td>34</td><td>36</td><td>37</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 | - | - | - | 0.40 | 160 | 186 | 186 | 0.80 | 91 | 102 | 107 | 1.20 | 61 | 73 | 71 | 1.60 | 45 | 56 | 57 | 2.10 | 36 | 40 | 40 | 2.31 | 34 | 36 | 37 | -- | - | - | - | -- | - | - | - | -- | - | - | - | -- | - | - | - |
| Load Current [A]  | Time [ms]                               |  |                    |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
|   | Input Volt. 100[V]                      | Input Volt. 200[V]   | Input Volt. 230[V] |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.00  | -                                       | -  | -                  |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.40  | 160                                     | 186  | 186                |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 0.80  | 91                                      | 102  | 107                |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 1.20  | 61                                      | 73   | 71                 |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 1.60  | 45                                      | 56   | 57                 |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 2.10  | 36                                      | 40   | 40                 |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| 2.31  | 34                                      | 36   | 37                 |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --  | -                                       | -  | -                  |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --  | -                                       | -  | -                  |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --  | -                                       | -  | -                  |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| --  | -                                       | -  | -                  |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |
| Note: Slanted line shows the range of the rated load current.   |   |  |                    |                  |           |  |  |                    |                    |                    |      |   |   |   |      |     |     |     |      |    |     |     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |    |   |   |   |    |   |   |   |    |   |   |   |    |   |   |   |

- 20 -

BC-10480

Model

LFA100F-48

Item

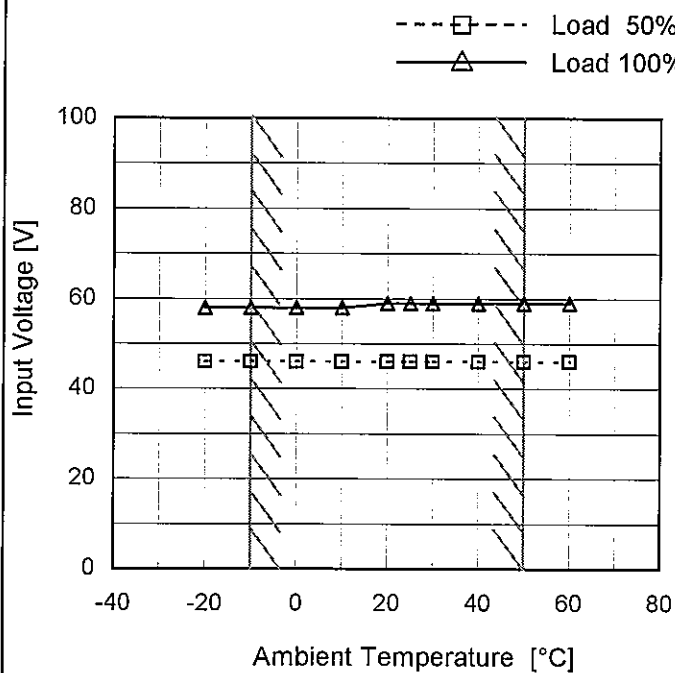
Minimum Input Voltage  
for Regulated Output Voltage

Object

+48V2.1A

Testing Circuitry Figure A

## 1. Graph



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

## 2. Values

| Ambient Temperature<br>[°C] | Input Voltage<br>[V] |           |
|-----------------------------|----------------------|-----------|
|                             | Load 50%             | Load 100% |
| -20                         | 46                   | 58        |
| -10                         | 46                   | 58        |
| 0                           | 46                   | 58        |
| 10                          | 46                   | 58        |
| 20                          | 46                   | 59        |
| 25                          | 46                   | 59        |
| 30                          | 46                   | 59        |
| 40                          | 46                   | 59        |
| 50                          | 46                   | 59        |
| 60                          | 46                   | 59        |
| --                          | -                    | -         |

# COSEL

| Model  | LFA100F-48             |  |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
|--|------------------------|--|----------|--------------------|------------------|--|--------------------|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|------|------|-----|------|------|-----|------|------|
| Item   | Overcurrent Protection | Temperature  | 25℃      |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| Object   | +48V2.1A               | Testing Circuitry  | Figure A |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 1.Graph  |                        | 2.Values   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| <div><div><div></div>Input Volt. 100V</div><div><div></div>Input Volt. 230V</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>48.0</td><td>2.68</td><td>2.70</td></tr><tr><td>45.6</td><td>2.71</td><td>2.71</td></tr><tr><td>43.2</td><td>2.72</td><td>2.74</td></tr><tr><td>38.4</td><td>2.76</td><td>2.77</td></tr><tr><td>33.6</td><td>2.82</td><td>2.83</td></tr><tr><td>28.8</td><td>2.88</td><td>2.90</td></tr><tr><td>24.0</td><td>2.88</td><td>2.92</td></tr><tr><td>19.2</td><td>2.96</td><td>3.00</td></tr><tr><td>14.4</td><td>2.97</td><td>2.99</td></tr><tr><td>9.6</td><td>2.93</td><td>2.96</td></tr><tr><td>4.8</td><td>2.90</td><td>2.94</td></tr><tr><td>0.0</td><td>5.27</td><td>5.60</td></tr></table> |          | Output Voltage [V] | Load Current [A] |  | Input Volt. 100[V] | Input Volt. 230[V] | 48.0 | 2.68 | 2.70 | 45.6 | 2.71 | 2.71 | 43.2 | 2.72 | 2.74 | 38.4 | 2.76 | 2.77 | 33.6 | 2.82 | 2.83 | 28.8 | 2.88 | 2.90 | 24.0 | 2.88 | 2.92 | 19.2 | 2.96 | 3.00 | 14.4 | 2.97 | 2.99 | 9.6 | 2.93 | 2.96 | 4.8 | 2.90 | 2.94 | 0.0 | 5.27 | 5.60 |
| Output Voltage [V]   | Load Current [A]       |  |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
|  | Input Volt. 100[V]     | Input Volt. 230[V]   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 48.0   | 2.68                   | 2.70   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 45.6   | 2.71                   | 2.71   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 43.2   | 2.72                   | 2.74   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 38.4   | 2.76                   | 2.77   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 33.6   | 2.82                   | 2.83   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 28.8   | 2.88                   | 2.90   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 24.0   | 2.88                   | 2.92   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 19.2   | 2.96                   | 3.00   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 14.4   | 2.97                   | 2.99   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 9.6  | 2.93                   | 2.96   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 4.8  | 2.90                   | 2.94   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |
| 0.0  | 5.27                   | 5.60   |          |                    |                  |  |                    |                    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |      |     |      |      |     |      |      |



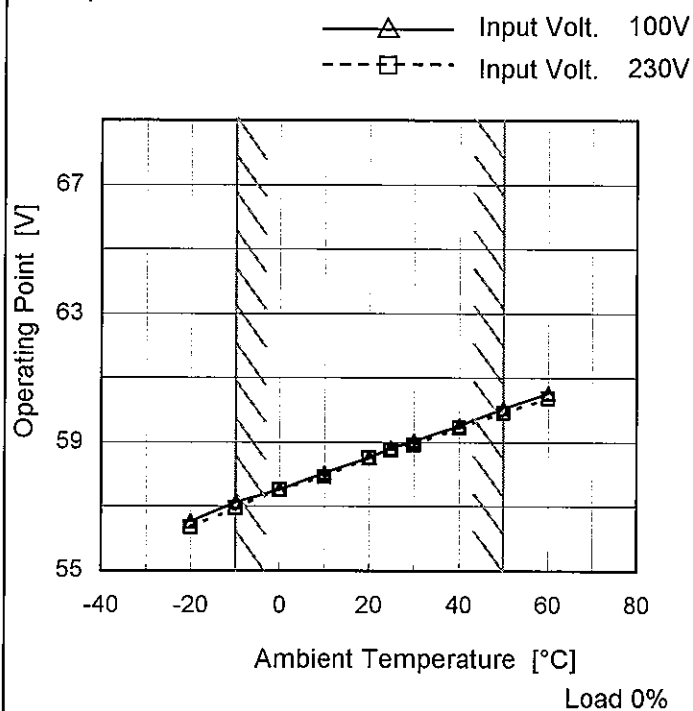
Model LFA100F-48

Item Overvoltage Protection

Object +48V2.1A

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] |
| -20                      | 56.54               | 56.36              |
| -10                      | 57.12               | 56.94              |
| 0                        | 57.53               | 57.53              |
| 10                       | 58.05               | 57.93              |
| 20                       | 58.51               | 58.52              |
| 25                       | 58.81               | 58.75              |
| 30                       | 59.04               | 58.92              |
| 40                       | 59.51               | 59.45              |
| 50                       | 60.06               | 59.92              |
| 60                       | 60.53               | 60.36              |
| --                       | -                   | -                  |

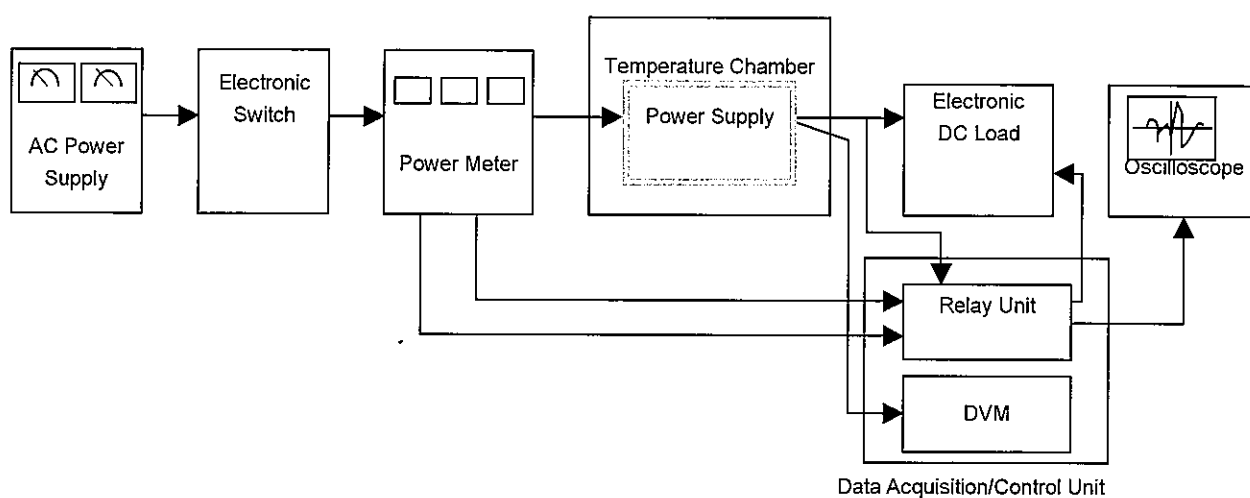


Figure A

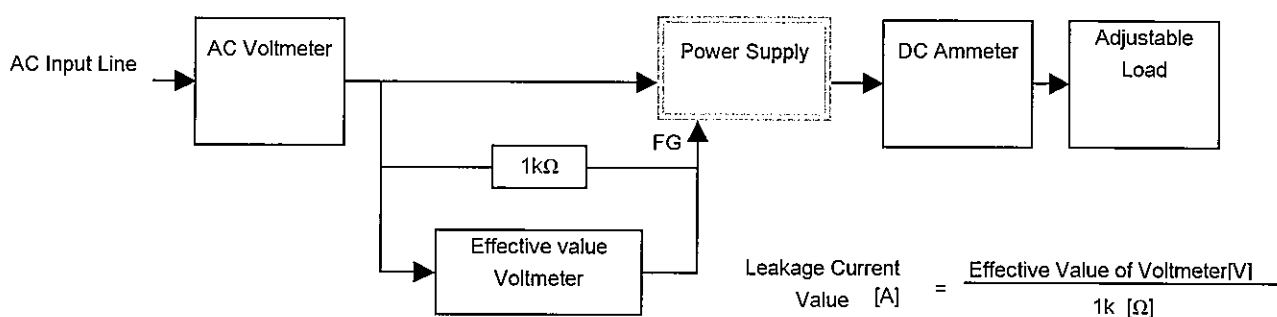


Figure B ( DEN-AN )

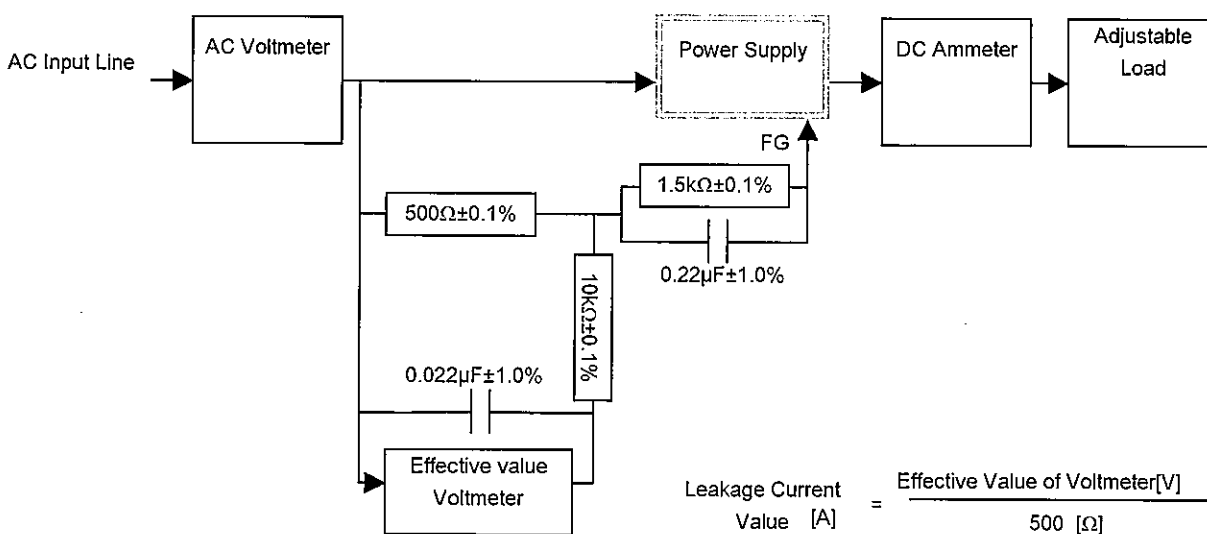


Figure B ( IEC60950-1 )

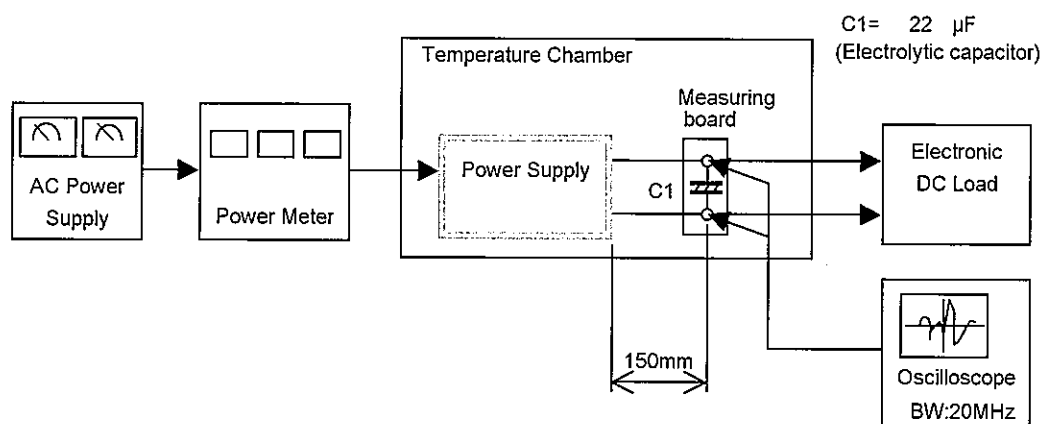


Figure C