# COSEL

# TEST DATA OF PJA600F-5

Regulated DC Power Supply
December 2, 2016

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# COSEL CO.,LTD.

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Input Current (by Load Current) |
| Object | ———————— |

Temperature     25°C
Testing Circuitry     Figure A

1.Graph

——△—— Input Volt.  100V
– – –□– – – Input Volt.  115V
—·—○—·— Input Volt.  230V



Load Current [A]

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. 115[V] | Input Volt. 230[V] |
| 0 | 0.136 | 0.150 | 0.277 |
| 15 | 1.183 | 1.047 | 0.616 |
| 30 | 2.100 | 1.841 | 1.003 |
| 45 | 3.016 | 2.631 | 1.396 |
| 60 | 3.966 | 3.446 | 1.798 |
| 75 | 4.949 | 4.291 | 2.208 |
| 90 | 5.971 | 5.170 | 2.629 |
| 100 | 6.668 | 5.776 | 2.918 |
| 110 | 7.380 | 6.386 | 3.215 |
| -- | - | - | - |
| -- | - | - | - |

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Input Power (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph

| | | |
|---|---|---|
| —△— | Input Volt. | 100V |
| - - -⊟- - - | Input Volt. | 115V |
| —·—○—·— | Input Volt. | 230V |



Input Power [W] vs Load Current [A]

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

2.Values

| Load Current [A] | Input Power [W] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 230[V] |
| 0 | 4.9 | 4.9 | 5.4 |
| 15 | 105.8 | 105.4 | 104.5 |
| 30 | 196.4 | 195.4 | 192.6 |
| 45 | 289.2 | 287.8 | 282.5 |
| 60 | 385.7 | 383.1 | 375.0 |
| 75 | 485.2 | 481.3 | 470.0 |
| 90 | 588.2 | 583.3 | 568.0 |
| 100 | 659.7 | 653.6 | 635.0 |
| 110 | 733.0 | 725.9 | 703.0 |
| -- | - | - | - |
| -- | - | - | - |

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Efficiency (by Input Voltage) |
| Object | ———————— |

Temperature        25°C
Testing Circuitry    Figure A

## 1.Graph

- - -☐- - -        Load  50%
———△———        Load 100%



Efficiency [%] vs Input Voltage [V]

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

## 2.Values

| Input Voltage [V] | Efficiency [%] | |
|---|---|---|
| | Load  50% | Load 100% |
| 85 | 78.3 | 75.7 |
| 100 | 79.0 | 76.7 |
| 115 | 79.6 | 77.4 |
| 200 | 80.9 | 79.4 |
| 230 | 81.1 | 79.8 |
| 264 | 81.5 | 80.0 |
| 280 | 81.5 | 80.0 |
| -- | - | - |
| -- | - | - |

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# COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Efficiency (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph

⎯⎯△⎯⎯ Input Volt. 100V
---□--- Input Volt. 115V
—·—○—·— Input Volt. 230V



Efficiency [%]
Load Current [A]

2.Values

| Load Current [A] | Efficiency [%] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 230[V] |
| 0 | - | - | - |
| 15 | 72.2 | 72.5 | 73.1 |
| 30 | 77.8 | 78.2 | 79.3 |
| 45 | 79.1 | 79.5 | 81.0 |
| 60 | 79.0 | 79.6 | 81.3 |
| 75 | 78.4 | 79.1 | 81.0 |
| 90 | 77.5 | 78.2 | 80.3 |
| 100 | 76.7 | 77.4 | 79.8 |
| 110 | 75.9 | 76.7 | 79.2 |
| -- | - | - | - |
| -- | - | - | - |

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

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# COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Power Factor (by Input Voltage) |
| Object | ———————— |

Temperature     25°C
Testing Circuitry     Figure A

## 1.Graph

- - -□- - -   Load  50%
————△————   Load 100%



Power Factor vs Input Voltage [V]

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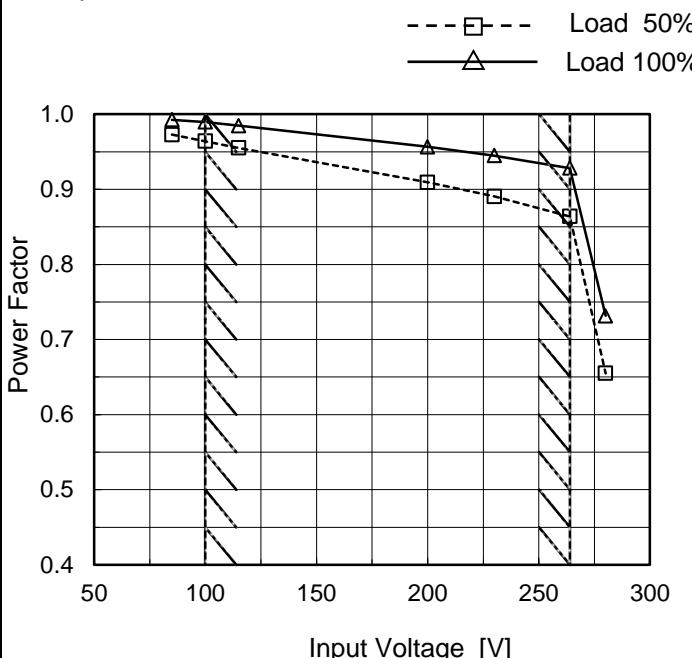
## 2.Values

| Input Voltage | Power Factor | |
|---|---|---|
| [V] | Load  50% | Load 100% |
| 85 | 0.973 | 0.993 |
| 100 | 0.964 | 0.990 |
| 115 | 0.955 | 0.985 |
| 200 | 0.909 | 0.957 |
| 230 | 0.891 | 0.945 |
| 264 | 0.864 | 0.928 |
| 280 | 0.655 | 0.731 |
| -- | - | - |
| -- | - | - |

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# COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Power Factor (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph

— △ — Input Volt. 100V
- - - ⊟ - - - Input Volt. 115V
— · — ○ — · — Input Volt. 264V



Power Factor vs Load Current [A]

2.Values

| Load Current [A] | Power Factor | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 264[V] |
| 0 | 0.363 | 0.284 | 0.085 |
| 15 | 0.893 | 0.874 | 0.736 |
| 30 | 0.934 | 0.922 | 0.834 |
| 45 | 0.959 | 0.950 | 0.879 |
| 60 | 0.973 | 0.966 | 0.906 |
| 75 | 0.981 | 0.975 | 0.925 |
| 90 | 0.986 | 0.981 | 0.939 |
| 100 | 0.990 | 0.985 | 0.945 |
| 110 | 0.993 | 0.988 | 0.950 |
| -- | - | - | - |
| -- | - | - | - |

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

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| Model | PJA600F-5 |
|---|---|
| Item | Inrush Current |
| Object | ———————— |

Temperature　　　25°C
Testing Circuitry　Figure A

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Input Voltage　　100 V
Frequency　　　60 Hz
Load　　　　　100 %

Primary inrush current :
　　　　　　　13.8 A
Secondary inrush current :
　　　　　　　14.4 A

Time　　　　　　　　　　　　　[50ms/div]

Input
Current
[20A/div]

Input
Voltage
[200V/div]

Input Voltage　　230 V
Frequency　　　60 Hz
Load　　　　　100 %

Primary inrush current :
　　　　　　　27.2 A
Secondary inrush current :
　　　　　　　36.8 A

Time　　　　　　　　　　　　　[50ms/div]

Primary inrush current　　　　　　　Secondary inrush current

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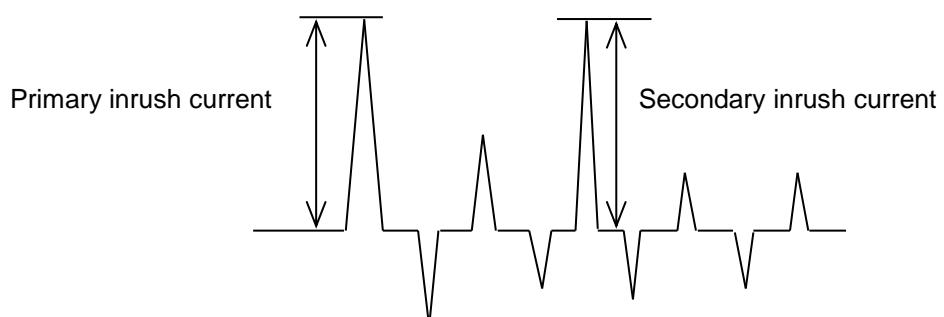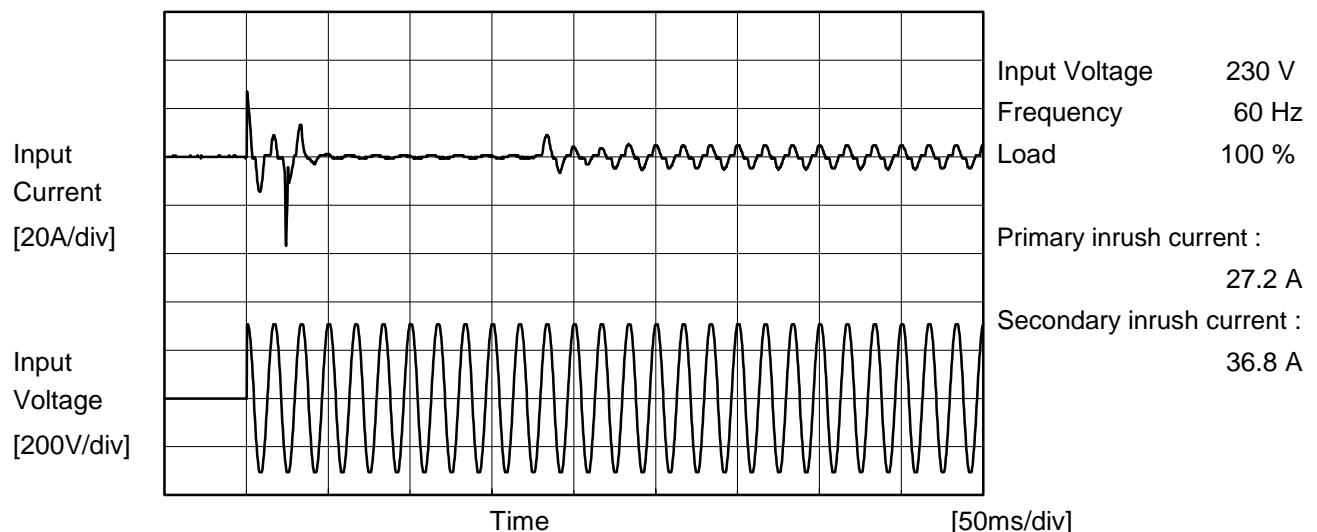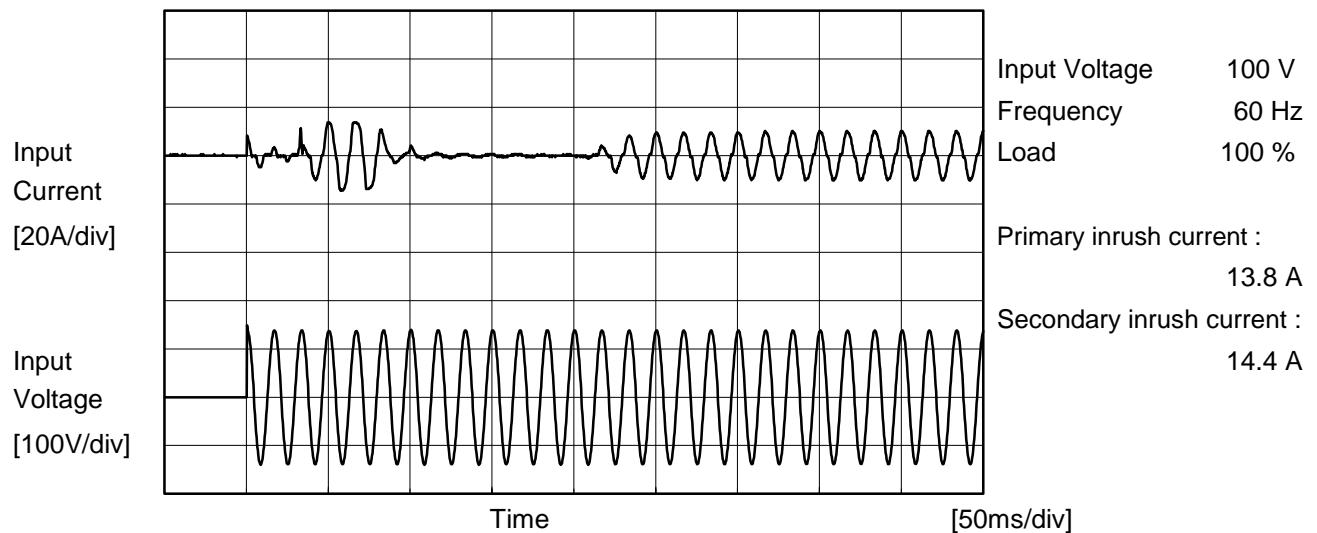
| | |
|---|---|
| Model | PJA600F-5 |
| Item | Leakage Current |
| Object | ———————— |

Temperature    25°C
Testing Circuitry    Figure C

1.Results

[mA]

| Standards | Testing Circuitry | Measuring Method | Input Volt. | | | Note |
|---|---|---|---|---|---|---|
| | | | 100 [V] | 115 [V] | 240 [V] | |
| DEN-AN | Figure C-1 | Both phases | 0.17 | 0.19 | 0.42 | Operation |
| | | One of phases | 0.28 | 0.33 | 0.73 | Stand by |
| IEC62368-1 | Figure C-2 | Both phases | 0.16 | 0.18 | 0.39 | Operation |
| | | One of phases | 0.28 | 0.32 | 0.71 | Stand by |
| | Figure C-3 | Both phases | 0.16 | 0.18 | 0.39 | Operation |
| | | One of phases | 0.28 | 0.32 | 0.68 | Stand by |

The value for "One of phases" is the reference value only.

2.Condition
Leakage current value is concluded after measuring both phases of
AC input and by choosing the larger one.

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Line Regulation |
| Object | +5V100A |

Temperature 25°C
Testing Circuitry Figure A

## 1.Graph

- - - ⊟ - - - Load 50%
——△—— Load 100%



Output Voltage [V] vs Input Voltage [V]

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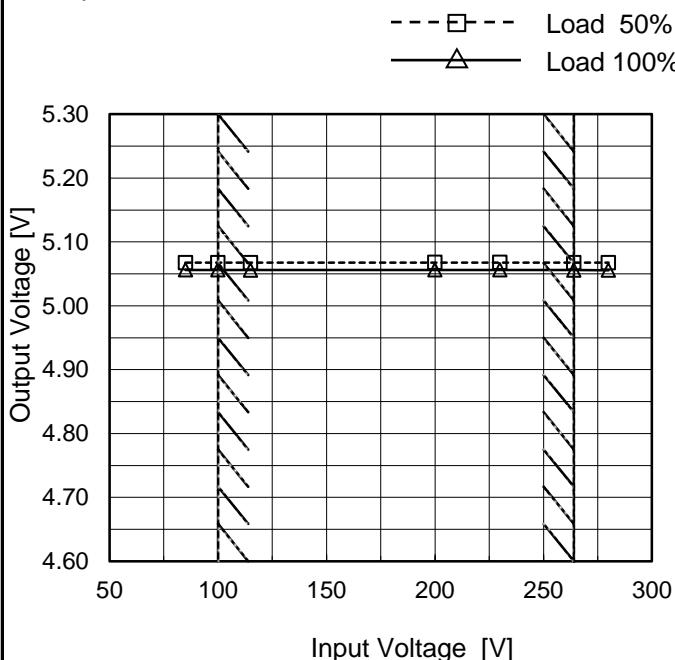
## 2.Values

| Input Voltage [V] | Output Voltage [V] | |
|---|---|---|
| | Load 50% | Load 100% |
| 85 | 5.068 | 5.056 |
| 100 | 5.068 | 5.056 |
| 115 | 5.068 | 5.056 |
| 200 | 5.068 | 5.056 |
| 230 | 5.068 | 5.056 |
| 264 | 5.068 | 5.056 |
| 280 | 5.068 | 5.056 |
| -- | - | - |
| -- | - | - |

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| Model | PJA600F-5 |
|---|---|
| Item | Load Regulation |
| Object | +5V100A |

Temperature 25°C
Testing Circuitry Figure A

1.Graph

| | | |
|---|---|---|
| ——△—— | Input Volt. | 100V |
| – – –⊟– – – | Input Volt. | 115V |
| —·—◯—·— | Input Volt. | 230V |
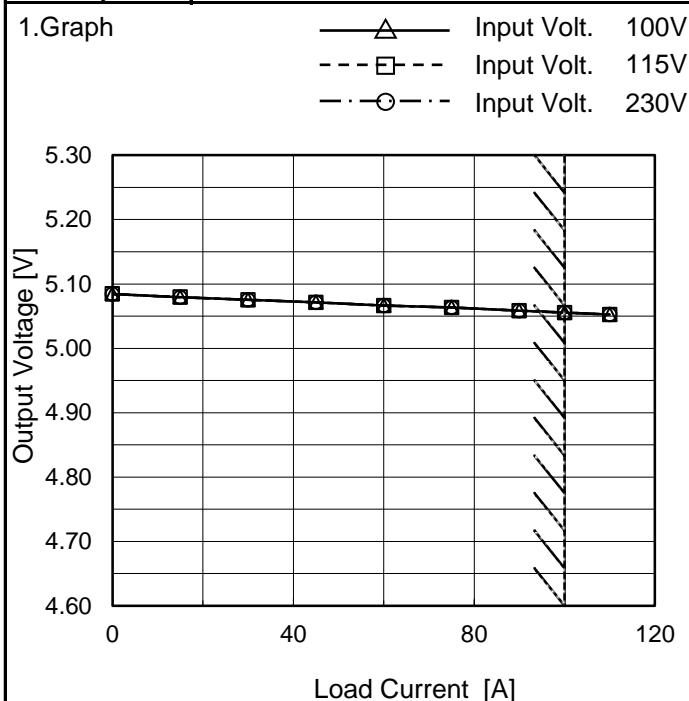
2.Values



Output Voltage [V] vs Load Current [A]

| Load Current [A] | Output Voltage [V] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 230[V] |
| 0 | 5.085 | 5.084 | 5.084 |
| 15 | 5.080 | 5.079 | 5.079 |
| 30 | 5.076 | 5.075 | 5.075 |
| 45 | 5.072 | 5.071 | 5.071 |
| 60 | 5.067 | 5.066 | 5.066 |
| 75 | 5.064 | 5.063 | 5.063 |
| 90 | 5.059 | 5.058 | 5.058 |
| 100 | 5.056 | 5.056 | 5.056 |
| 110 | 5.053 | 5.052 | 5.052 |
| -- | - | - | - |
| -- | - | - | - |

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

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Dynamic Load Response |
| Object | +5V100A |

Temperature 25°C
Testing Circuitry Figure A

Input Volt. 100 V
Cycle 1000 ms

t1,t2 = 50 μ s Typ

Load Current

t1          t2

Min.Load (0A)←→
  Load 100% (100A)

200 mV/div

40 ms/div          40 ms/div

Min.Load (0A)←→
  Load 50% (50A)

200 mV/div

40 ms/div          40 ms/div

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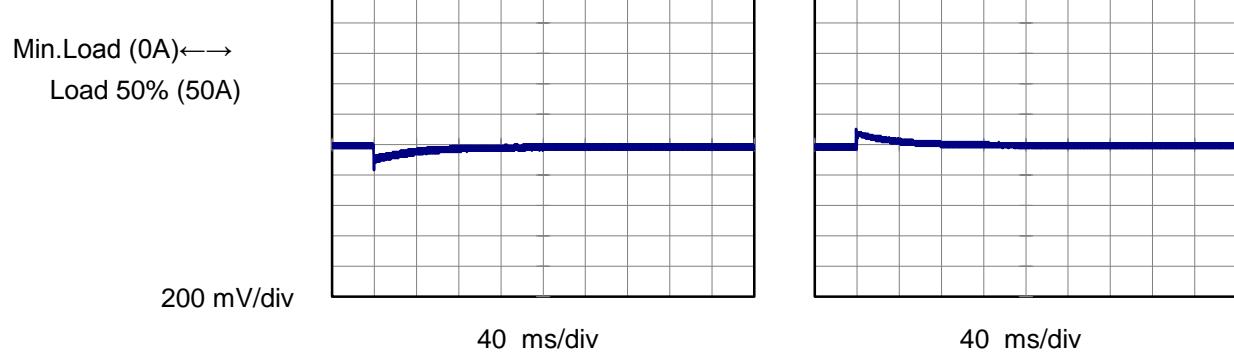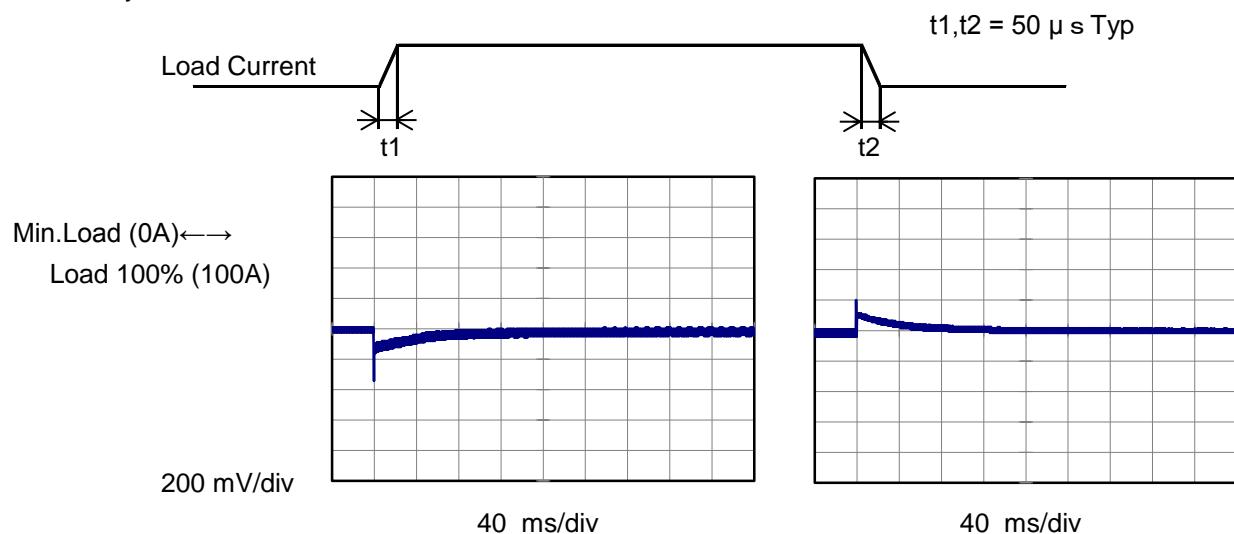
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| Model | PJA600F-5 |
|---|---|
| Item | Ripple Voltage (by Load Current) |
| Object | +5V100A |

Temperature     25°C
Testing Circuitry    Figure B

1.Graph

2.Values

———△——— Input Volt.   100V
—·—○—·— Input Volt.   230V



Ripple Voltage [mV] (y-axis)
Load Current [A] (x-axis)
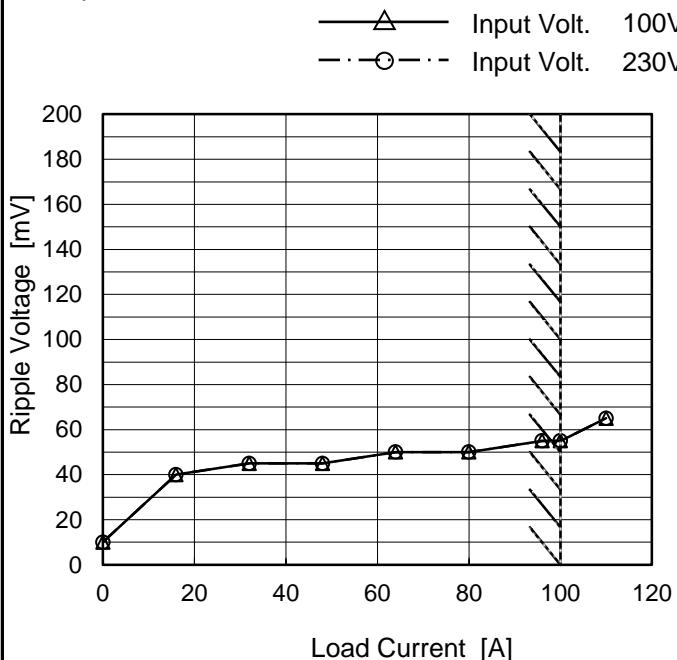
| Load Current [A] | Ripple Voltage [mV] | |
|---|---|---|
| | Input Volt. 100 [V] | Input Volt. 230 [V] |
| 0 | 10 | 10 |
| 16 | 40 | 40 |
| 32 | 45 | 45 |
| 48 | 45 | 45 |
| 64 | 50 | 50 |
| 80 | 50 | 50 |
| 96 | 55 | 55 |
| 100 | 55 | 55 |
| 110 | 65 | 65 |
| -- | - | - |
| -- | - | - |

Measured by 20 MHz Oscilloscope.
Ripple Voltage is shown as p-p in the figure below.
Note: Slanted line shows the range of the rated
     load current.

T1: Due to AC Input Line
T2: Due to Switching



Ripple [mVp-p]

T2

T1

Fig. Complex Ripple Wave Form

BC-11150
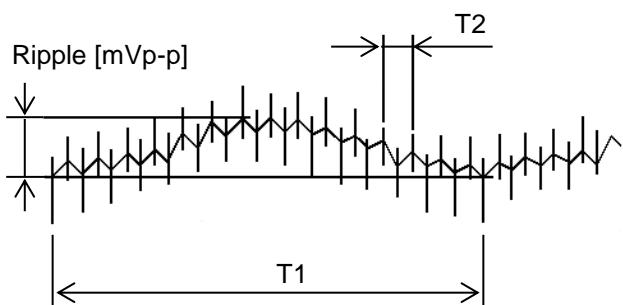
# COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Ripple-Noise |
| Object | +5V100A |

Temperature      25°C
Testing Circuitry     Figure B

1.Graph

—△— Input Volt.    100V
—·—○—·— Input Volt.    230V
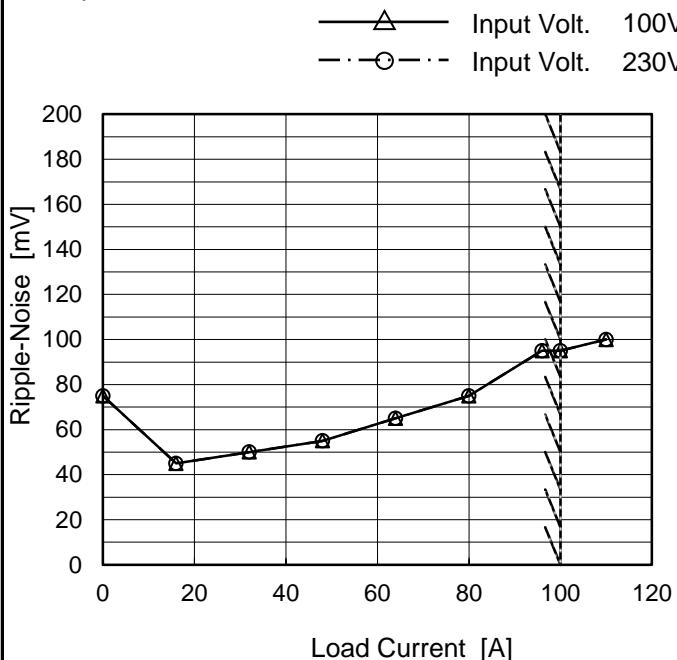


Load Current [A]

Measured by 20 MHz Oscilloscope.
Ripple-Noise is shown as p-p in the figure below.
Note: Slanted line shows the range of the rated
load current.

2.Values

| Load Current [A] | Ripple-Noise [mV] | |
|---|---|---|
| | Input Volt. 100 [V] | Input Volt. 230 [V] |
| 0 | 75 | 75 |
| 16 | 45 | 45 |
| 32 | 50 | 50 |
| 48 | 55 | 55 |
| 64 | 65 | 65 |
| 80 | 75 | 75 |
| 96 | 95 | 95 |
| 100 | 95 | 95 |
| 110 | 100 | 100 |
| -- | - | - |
| -- | - | - |

T1: Due to AC Input Line
T2: Due to Switching

Ripple-Noise
[mVp-p]

T2



T1

Fig. Complex Ripple Wave Form

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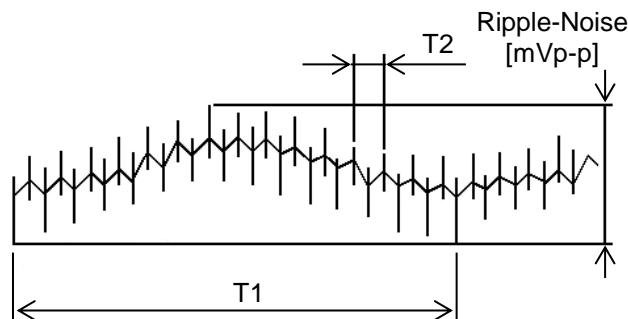
# COSEL

| | |
|---|---|
| Model | PJA600F-5 |
| Item | Ripple Voltage (by Ambient Temp.) |
| Object | +5V100A |

Testing Circuitry    Figure B

1.Graph

2.Values

--- ⊟ --- Input Volt.    100V

──△── Input Volt.    230V



Ambient Temperature  [°C]

Load  100 %
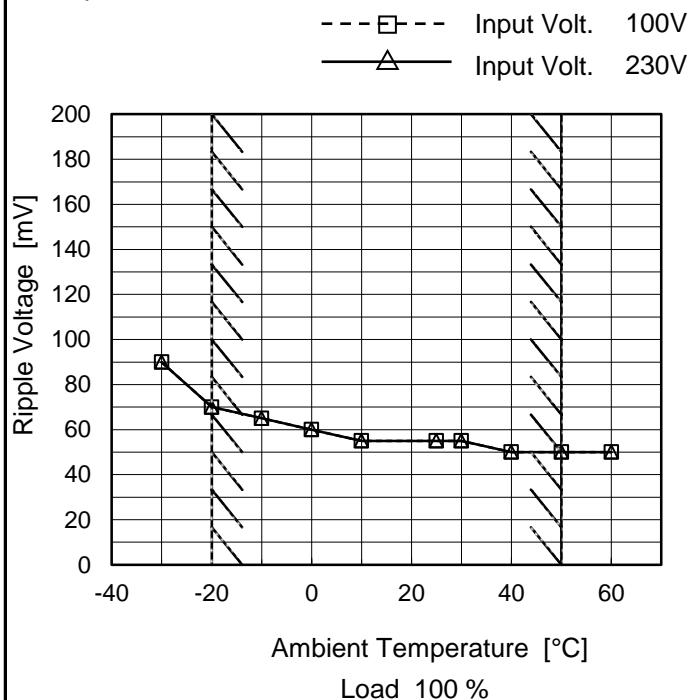
| Ambient Temperature [°C] | Ripple Voltage [mV] | |
|---|---|---|
| | Input Volt. 100 [V] | Input Volt. 230 [V] |
| -30 | 90 | 90 |
| -20 | 70 | 70 |
| -10 | 65 | 65 |
| 0 | 60 | 60 |
| 10 | 55 | 55 |
| 25 | 55 | 55 |
| 30 | 55 | 55 |
| 40 | 50 | 50 |
| 50 | 50 | 50 |
| 60 | 50 | 50 |
| -- | - | - |

Measured by 20 MHz Oscilloscope.
Note: Slanted line shows the range of the rated
         ambient temperature.

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Ambient Temperature Drift |
| Object | +5V100A |

Testing Circuitry    Figure A

1.Graph

——△—— Input Volt.  100V
- - -⊟- - - Input Volt.  115V
—·—○—·— Input Volt.  230V



Ambient Temperature  [°C]

Load 100%

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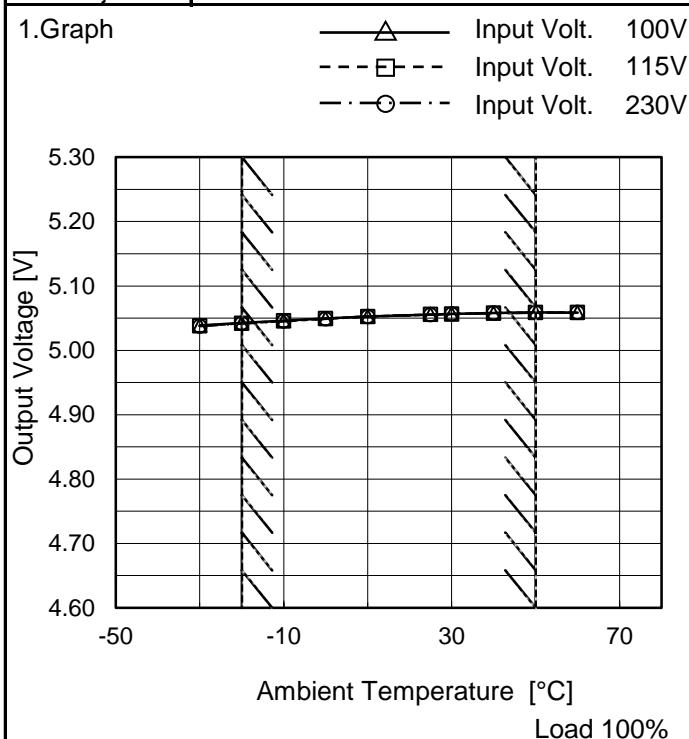
2.Values

| Ambient Temperature [°C] | Output Voltage  [V] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 230[V] |
| -30 | 5.039 | 5.038 | 5.038 |
| -20 | 5.043 | 5.042 | 5.042 |
| -10 | 5.046 | 5.046 | 5.045 |
| 0 | 5.050 | 5.049 | 5.049 |
| 10 | 5.053 | 5.053 | 5.052 |
| 25 | 5.056 | 5.056 | 5.056 |
| 30 | 5.057 | 5.057 | 5.056 |
| 40 | 5.058 | 5.058 | 5.058 |
| 50 | 5.059 | 5.059 | 5.059 |
| 60 | 5.059 | 5.059 | 5.059 |
| -- | - | - | - |

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| Model | PJA600F-5 |
|---|---|
| Item | Output Voltage Accuracy |
| Object | +5V100A |

Testing Circuitry    Figure A

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    :  -20  -  50°C
Input Voltage  :  100  -  230V
Load Current   :  0  -  100A

* Output Voltage Accuracy = ±(Maximum of Output Voltage  - Minimum of Output Voltage) / 2

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

2.Values

| Item | Temperature [°C] | Input Voltage[V] | Output | | Output Voltage Accuracy | |
|---|---|---|---|---|---|---|
| | | | Current[A] | Voltage[V] | Value [mV] | Ration [%] |
| Maximum Voltage | 50 | 230 | 0 | 5.088 | ±23 | ±0.5 |
| Minimum Voltage | -20 | 230 | 100 | 5.042 | | |

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Time Lapse Drift |
| Object | +5V100A |

Temperature      25°C
Testing Circuitry      Figure A

1.Graph



Time  [H]

Input Volt.      230V
Load          100%

*The characteristic of AC100V is equal.

2.Values

| Time since start [H] | Output Voltage [V] |
|---|---|
| 0.0 | 5.054 |
| 0.5 | 5.055 |
| 1.0 | 5.055 |
| 2.0 | 5.055 |
| 3.0 | 5.055 |
| 4.0 | 5.055 |
| 5.0 | 5.055 |
| 6.0 | 5.055 |
| 7.0 | 5.055 |
| 8.0 | 5.055 |

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Rise and Fall Time |
| Object | +5V100A |

Temperature 25°C
Testing Circuitry Figure A

## 1.Graph



Load 100% — Output Volt. [1V/div] — Input Volt. 100 V

Load 100% — Output Volt. [1V/div] — Input Volt. 230 V

Input Volt.

Time [100ms/div]     Time [20ms/div]
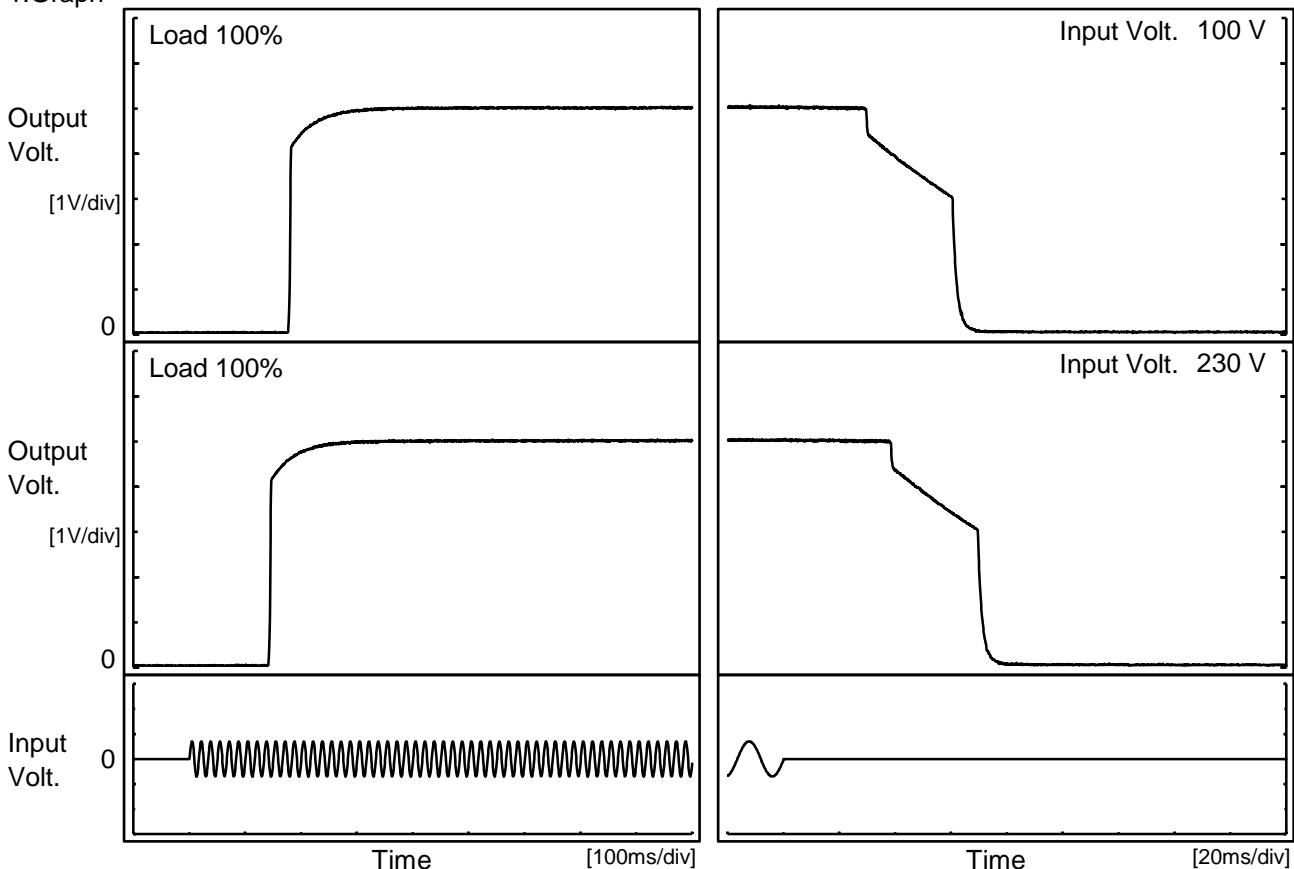
## 2.Values

[ms]

| Input Volt. \ Time | Td | Tr | Ts | Th | Tf |
|---|---|---|---|---|---|
| 100 V | 179.0 | 29.0 | 208.0 | 30.0 | 33.4 |
| 230 V | 143.5 | 29.0 | 172.5 | 38.9 | 33.4 |



Output Volt. — 90% — 10%

Input Volt.

Td  Tr     Th  Tf

Ts

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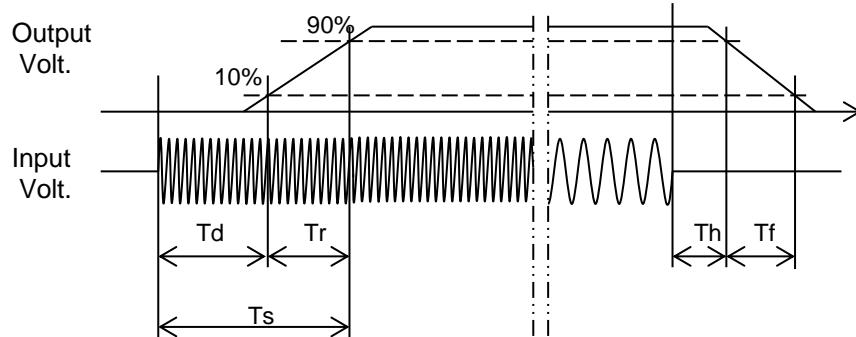
# COSEL

| | |
|---|---|
| Model | PJA600F-5 |
| Item | Hold-Up Time |
| Object | +5V100A |

Temperature 25°C
Testing Circuitry Figure A

## 1.Graph



Legend: ---☐--- Load 50%, ——△—— Load 100%

Y-axis: Hold-Up Time [ms]
X-axis: Input Voltage [V]
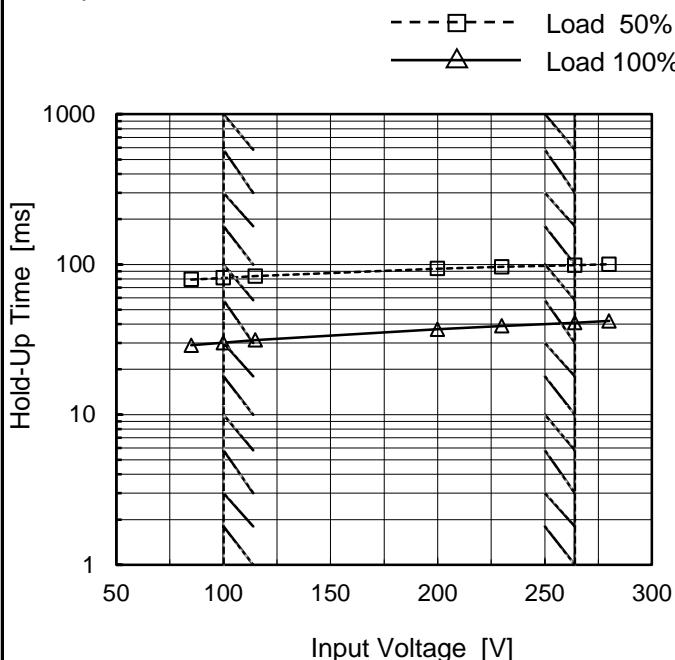
## 2.Values

| Input Voltage [V] | Hold-Up Time [ms] | |
|---|---|---|
| | Load 50% | Load 100% |
| 85 | 79 | 29 |
| 100 | 81 | 30 |
| 115 | 84 | 31 |
| 200 | 94 | 37 |
| 230 | 96 | 39 |
| 264 | 99 | 41 |
| 280 | 100 | 42 |
| -- | - | - |
| -- | - | - |

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.

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## COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Instantaneous Interruption Compensation |
| Object | +5V100A |

Temperature        25°C
Testing Circuitry    Figure A

1.Graph

△ Input Volt. 100V
⊟ Input Volt. 115V
○ Input Volt. 230V



Instantaneous Compensation Time [ms] vs Load Current [A]

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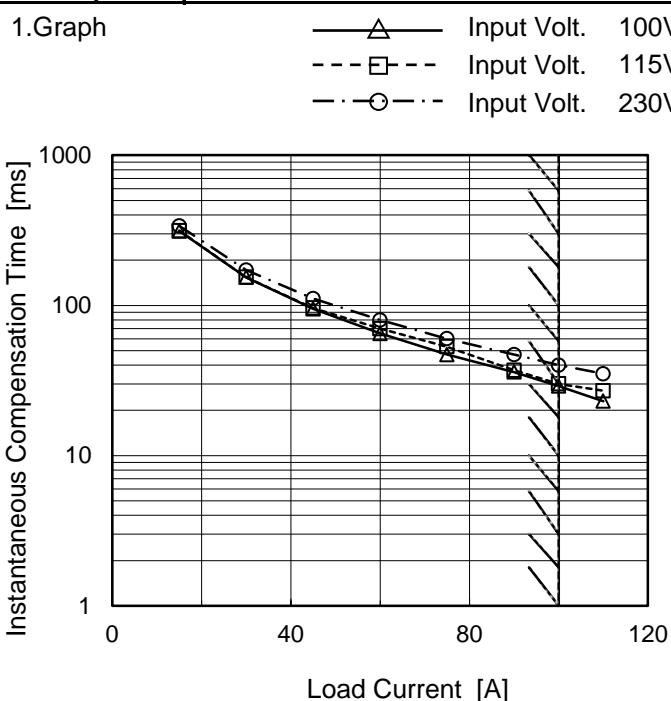
2.Values

| Load Current [A] | Time [ms] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 115[V] | Input Volt. 230[V] |
| 0 | - | - | - |
| 15 | 313 | 314 | 338 |
| 30 | 154 | 154 | 172 |
| 45 | 95 | 96 | 111 |
| 60 | 65 | 70 | 80 |
| 75 | 47 | 53 | 60 |
| 90 | 36 | 37 | 47 |
| 100 | 29 | 30 | 40 |
| 110 | 23 | 27 | 35 |
| -- | - | - | - |
| -- | - | - | - |

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| | |
|---|---|
| Model | PJA600F-5 |
| Item | Minimum Input Voltage<br> for Regulated Output Voltage |
| Object | +5V100A |

Testing Circuitry    Figure A

1.Graph

--- ⊟ --- Load  50%
—△— Load 100%



Input Voltage [V] vs Ambient Temperature [°C]

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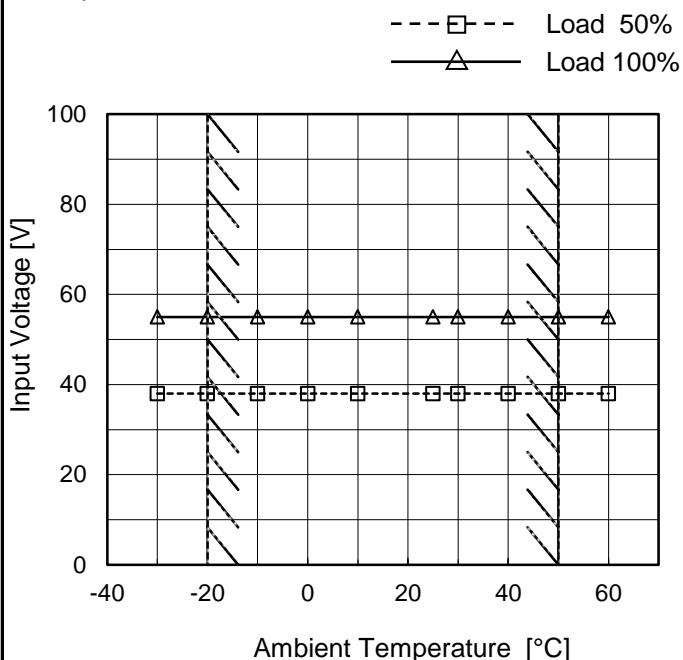
2.Values

| Ambient<br>Temperature<br>[°C] | Input Voltage<br>[V] | |
|---|---|---|
| | Load  50% | Load  100% |
| -30 | 38 | 55 |
| -20 | 38 | 55 |
| -10 | 38 | 55 |
| 0 | 38 | 55 |
| 10 | 38 | 55 |
| 25 | 38 | 55 |
| 30 | 38 | 55 |
| 40 | 38 | 55 |
| 50 | 38 | 55 |
| 60 | 38 | 55 |
| -- | - | - |

BC-11150

# COSEL

| Model | PJA600F-5 |
|---|---|
| Item | Overcurrent Protection |
| Object | +5V100A |

Temperature　　25°C
Testing Circuitry　Figure A

## 1.Graph

——— Input Volt.　100V

——— Input Volt.　230V



Output Voltage [V]
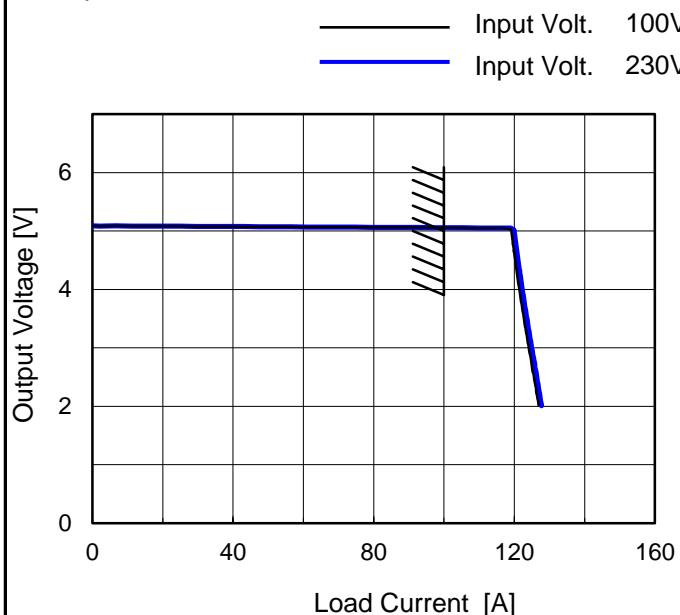
Load Current  [A]

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

Intermittent operation occurs when the output
voltage is from 2.0V to 0V.

## 2.Values

| Output Voltage [V] | Load Current  [A] | |
|---|---|---|
| | Input Volt. 100[V] | Input Volt. 230[V] |
| 4.75 | 119.71 | 120.47 |
| 4.50 | 120.13 | 121.03 |
| 4.00 | 121.33 | 122.19 |
| 3.50 | 122.71 | 123.47 |
| 3.00 | 124.09 | 124.84 |
| 2.50 | 125.53 | 126.36 |
| 2.00 | 126.91 | 127.77 |
| -- | - | - |
| -- | - | - |
| -- | - | - |
| -- | - | - |
| -- | - | - |

BC-11150

# COSEL

| | |
|---|---|
| Model | PJA600F-5 |
| Item | Overvoltage Protection |
| Object | +5V100A |

Testing Circuitry    Figure A

## 1.Graph

——△—— Input Volt.    100V

---□--- Input Volt.    230V



Ambient Temperature  [°C]

Load 0%

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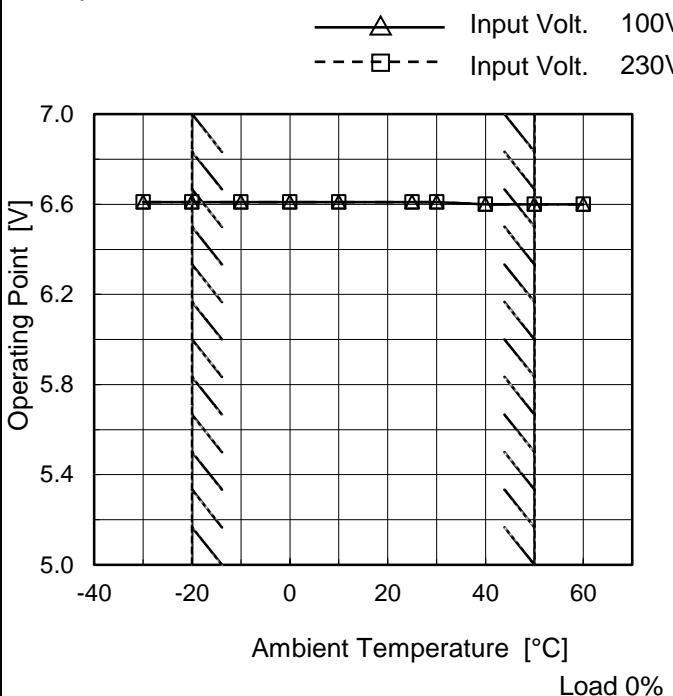
## 2.Values

| Ambient Temperature [°C] | Operating Point [V] | |
|---|---|---|
| | Input Volt. 100[V] | Input Volt. 230[V] |
| -30 | 6.61 | 6.61 |
| -20 | 6.61 | 6.61 |
| -10 | 6.61 | 6.61 |
| 0 | 6.61 | 6.61 |
| 10 | 6.61 | 6.61 |
| 25 | 6.61 | 6.61 |
| 30 | 6.61 | 6.61 |
| 40 | 6.60 | 6.60 |
| 50 | 6.60 | 6.60 |
| 60 | 6.60 | 6.60 |
| -- | - | - |

BC-11150

Temperature
Chamber

Power
Supply

Electronic
DC Load

Oscilloscop

AC
Power

Electronic
Switch

Power
Meter

Relay Unit

DVM

Data Acquisition/Control Unit

Figure A

Temperature Chamber

Measuring
board

AC Power
Supply

Power Meter

Power Supply

C1          C2

Electronic
DC Load

Oscilloscope

BW:20MHz

150mm

C1=   0.1   µF
 (Ceramic capacitor)

C2=   22   µF
 (Electrolytic capacitor)

Figure B

BC-11150

**CO$EL**

AC Input Line → AC Voltmeter → Power Supply → DC Ammeter → Adjustable Load

FG

1kΩ

Effective value Voltmeter

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{1k\ [\Omega]}$$

Figure C-1 ( DEN-AN )

AC Input Line → AC Voltmeter → Power Supply → DC Ammeter → Adjustable Load

FG

500Ω±0.1    1.5kΩ±0.1%

10kΩ±0.1%    0.22μF±1.0%

0.022μF±1.0%

Effective value

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{500\ [\Omega]}$$

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

AC Input Line → AC Voltmeter → Power Supply → DC Ammeter → Adjustable Load

FG

500Ω±0.1%    1.5kΩ±0.1%

10kΩ±0.1%    0.22μF±1.0%

9100pF±1.0%

20kΩ±0.1%    6200pF±1.0%

Effective value

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{500\ [\Omega]}$$
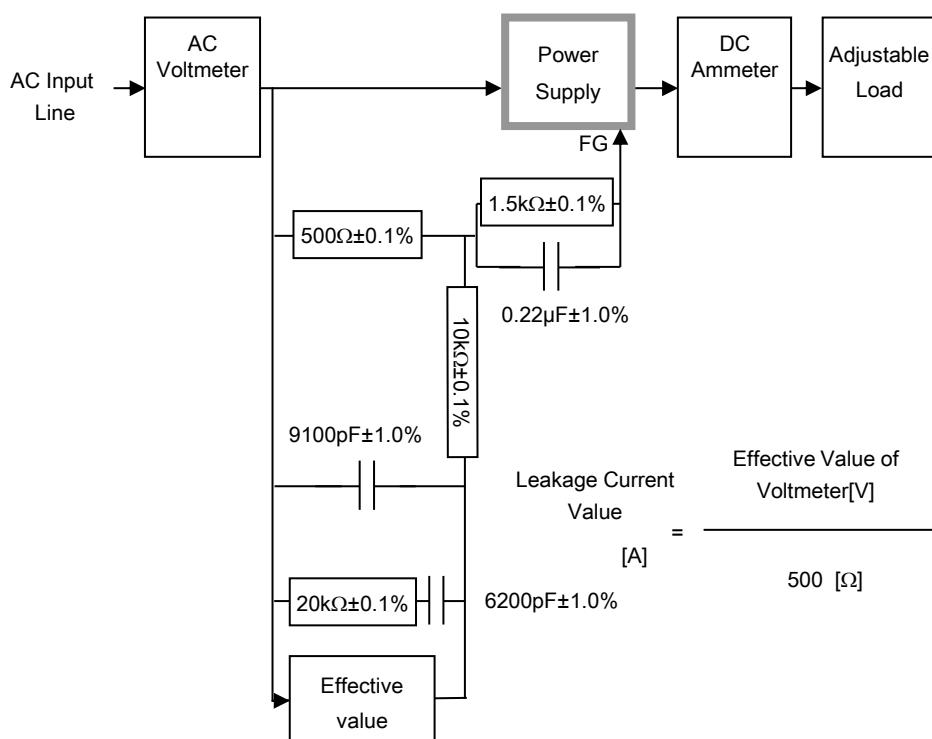
Figure C-3 ( IEC62368-1  refer to IEC60990 Fig.5 )

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