



TEST DATA OF MODULE P

(RB series)

Regulated DC Power Supply
November 5, 2018

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Jun Uchida Design Manager

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Hideaki Douguchi Design Engineer

COSEL CO.,LTD.



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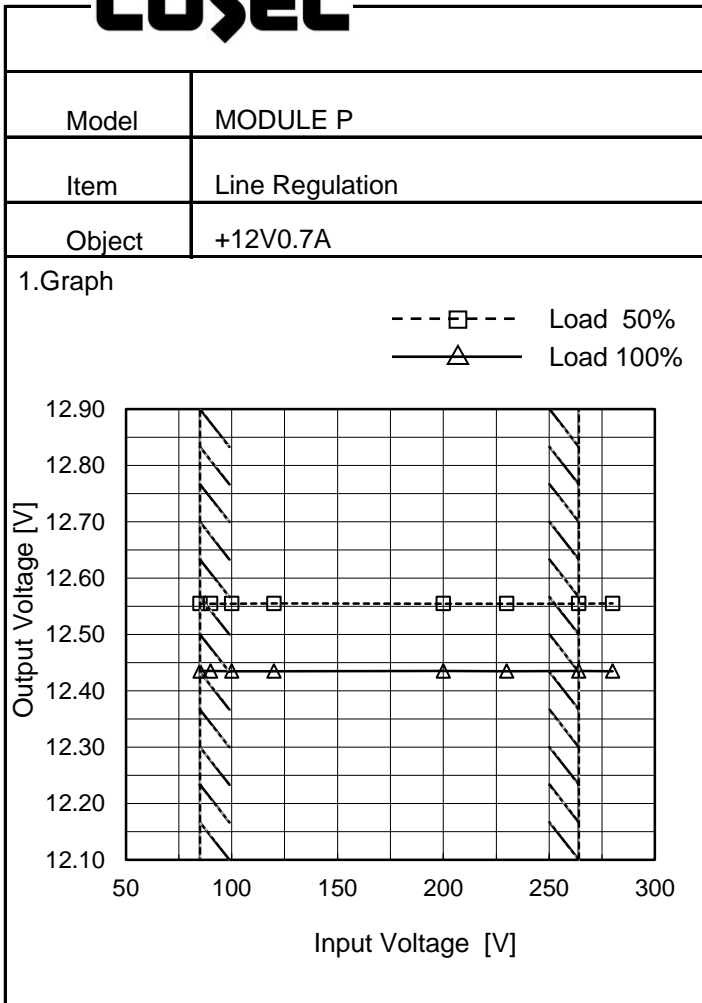
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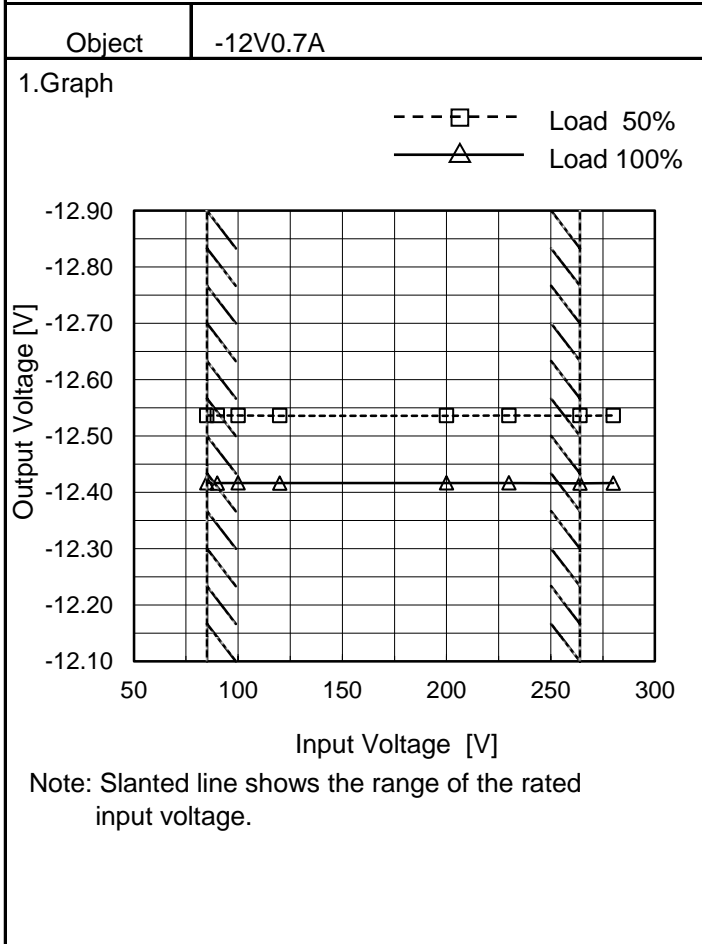


Temperature 25°C
Testing Circuitry Figure A

2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	12.555	12.435
90	12.555	12.435
100	12.555	12.435
120	12.555	12.435
200	12.555	12.435
230	12.555	12.435
264	12.555	12.435
280	12.555	12.435
--	-	-

-12V: Rated Load Current



2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	-12.536	-12.417
90	-12.536	-12.417
100	-12.536	-12.417
120	-12.536	-12.417
200	-12.536	-12.417
230	-12.536	-12.417
264	-12.536	-12.416
280	-12.536	-12.416
--	-	-

+12V: Rated Load Current



COSEL																																																						
Model	MODULE P	Temperature	25°C																																																			
Item	Load Regulation	Testing Circuitry	Figure A																																																			
Object	+12V0.7A																																																					
<p>1.Graph</p> <p> </p> <p> △ Input Volt. 100V □ Input Volt. 200V ○ Input Volt. 230V </p> <p style="text-align: center;">Load Current [A]</p>		<p>2.Values</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>12.768</td><td>12.768</td><td>12.769</td></tr> <tr><td>0.10</td><td>12.663</td><td>12.663</td><td>12.664</td></tr> <tr><td>0.20</td><td>12.617</td><td>12.617</td><td>12.617</td></tr> <tr><td>0.30</td><td>12.577</td><td>12.577</td><td>12.577</td></tr> <tr><td>0.40</td><td>12.538</td><td>12.538</td><td>12.538</td></tr> <tr><td>0.50</td><td>12.503</td><td>12.503</td><td>12.503</td></tr> <tr><td>0.60</td><td>12.453</td><td>12.453</td><td>12.453</td></tr> <tr><td>0.70</td><td>12.435</td><td>12.435</td><td>12.435</td></tr> <tr><td>0.77</td><td>12.422</td><td>12.422</td><td>12.422</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table> <p style="text-align: center;">-12V: Rated Load Current</p>		Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	12.768	12.768	12.769	0.10	12.663	12.663	12.664	0.20	12.617	12.617	12.617	0.30	12.577	12.577	12.577	0.40	12.538	12.538	12.538	0.50	12.503	12.503	12.503	0.60	12.453	12.453	12.453	0.70	12.435	12.435	12.435	0.77	12.422	12.422	12.422	--	-	-	-	--	-	-	-
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<p>Note: Slanted line shows the range of the rated load current.</p>																																																						



Model		MODULE P	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		+12V0.7A	

Input Volt. 100 V
Other output current rated
Cycle 1000 ms

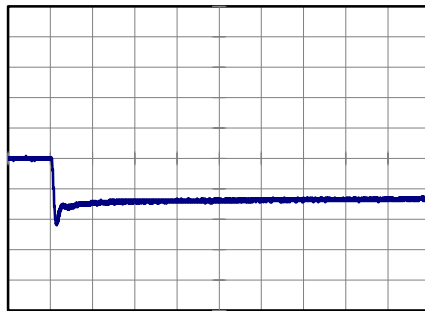
t1,t2 = 50 μsTyp



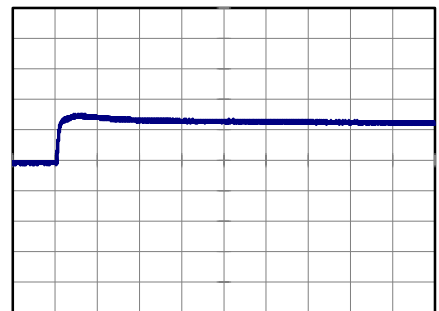
Min.Load (0A) ←→
Load 100% (0.7A)

200 mV/div

2 ms/div



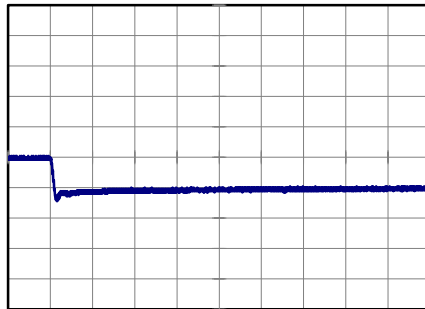
2 ms/div



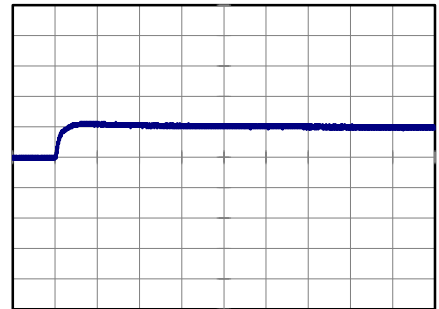
Min.Load (0A) ←→
Load 50% (0.35A)

200 mV/div

2 ms/div



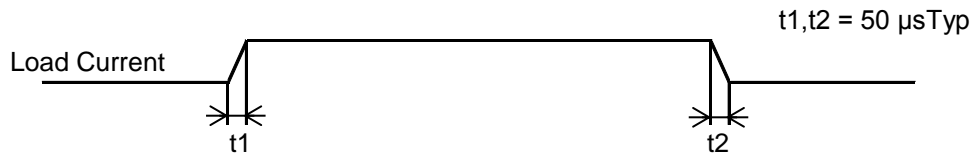
2 ms/div





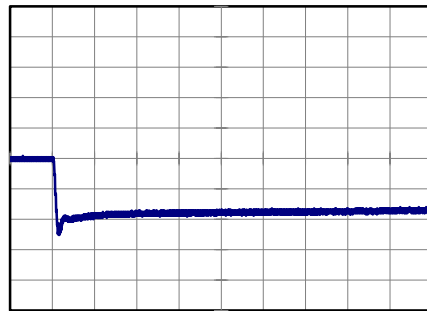
Model		MODULE P	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		-12V0.7A	

Input Volt. 100 V
 Other output current rated
 Cycle 1000 ms

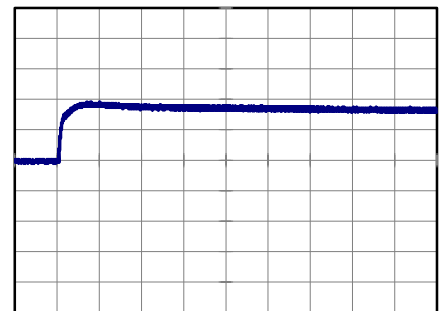


Min. Load (0A) ←→
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200 mV/div



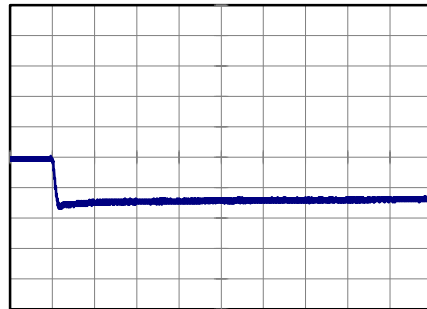
2 ms/div



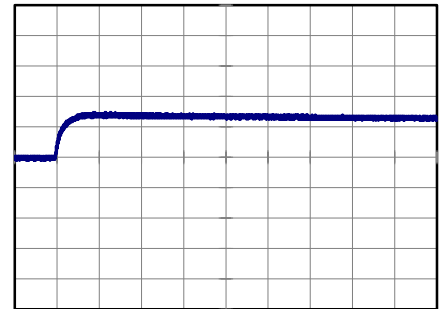
2 ms/div

Min. Load (0A) ←→
 Load 50% (0.35A)

200 mV/div



2 ms/div



2 ms/div



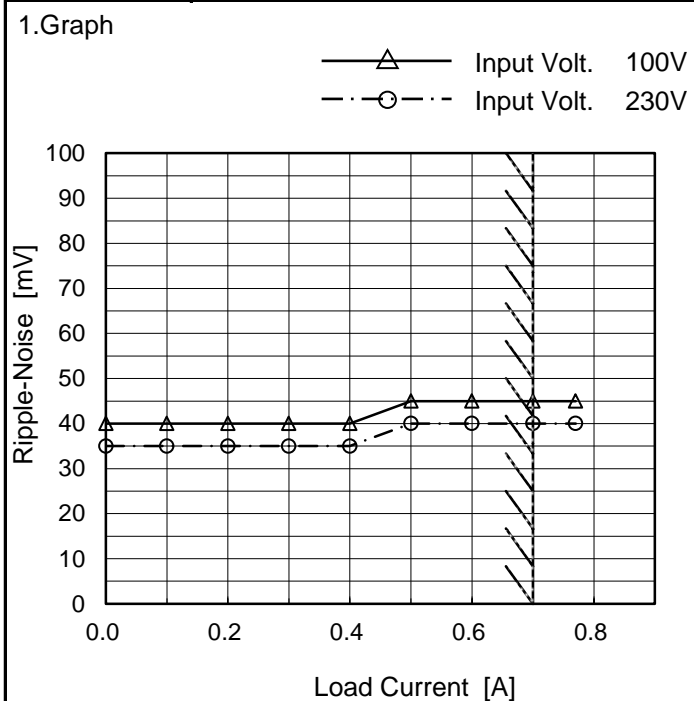
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<p>1.Graph</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>—△— Input Volt. 100V</p> <p>-·-○-·- Input Volt. 230V</p> </div> <div style="text-align: center;"> </div> </div>		<p>2.Values</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <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> </thead> <tbody> <tr><td>0.00</td><td>10</td><td>10</td></tr> <tr><td>0.10</td><td>10</td><td>10</td></tr> <tr><td>0.20</td><td>10</td><td>10</td></tr> <tr><td>0.30</td><td>10</td><td>10</td></tr> <tr><td>0.40</td><td>10</td><td>10</td></tr> <tr><td>0.50</td><td>15</td><td>15</td></tr> <tr><td>0.60</td><td>15</td><td>15</td></tr> <tr><td>0.70</td><td>15</td><td>15</td></tr> <tr><td>0.77</td><td>15</td><td>15</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table> <p style="text-align: center;">-12V: Rated Load Current</p>	Load Current [A]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	10	10	0.10	10	10	0.20	10	10	0.30	10	10	0.40	10	10	0.50	15	15	0.60	15	15	0.70	15	15	0.77	15	15	--	-	-	--	-	-
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<div style="text-align: center;"> <p>T1: Due to AC Input Line T2: Due to Switching</p> </div> <p style="text-align: center;">Fig. Complex Ripple Wave Form</p>																																								



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Load Current [A]	Ripple Voltage [mV]																																							
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<p>Fig. Complex Ripple Wave Form</p>																																								



Model	MODULE P	Temperature	25°C
Item	Ripple-Noise	Testing Circuitry	Figure B
Object	+12V0.7A		



2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.00	40	35
0.10	40	35
0.20	40	35
0.30	40	35
0.40	40	35
0.50	45	40
0.60	45	40
0.70	45	40
0.77	45	40
--	-	-
--	-	-

-12V: Rated Load Current

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.

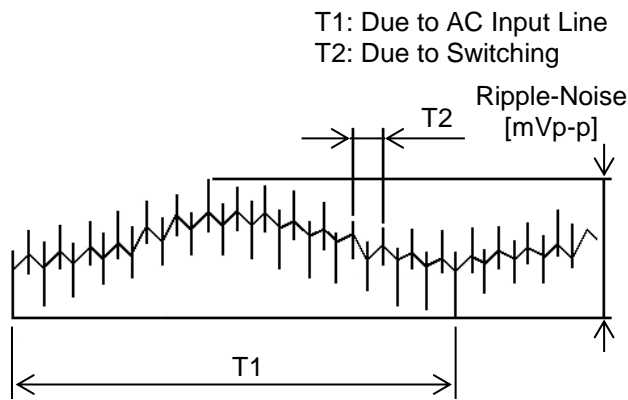
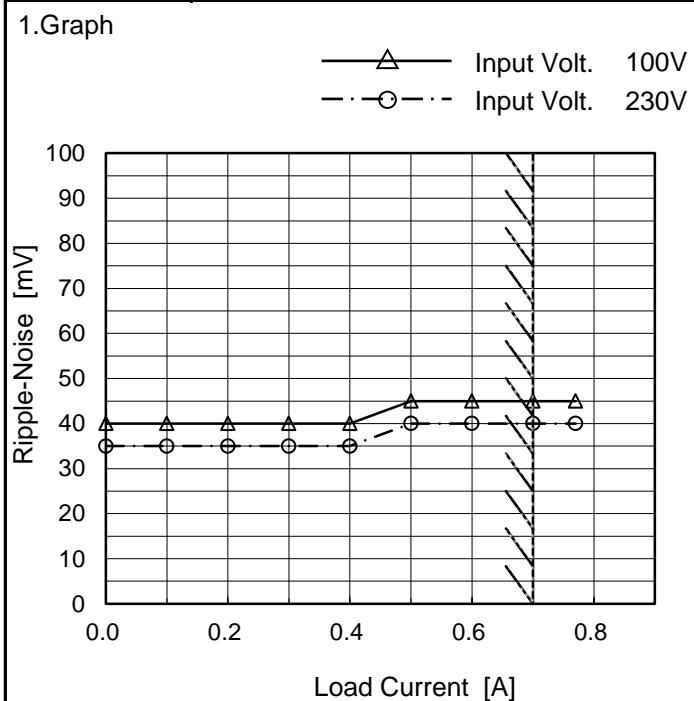


Fig. Complex Ripple Wave Form



Model	MODULE P	Temperature	25°C
Item	Ripple-Noise	Testing Circuitry	Figure B
Object	-12V0.7A		



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]
0.00	40	35
0.10	40	35
0.20	40	35
0.30	40	35
0.40	40	35
0.50	45	40
0.60	45	40
0.70	45	40
0.77	45	40
--	-	-
--	-	-

+12V: Rated Load Current

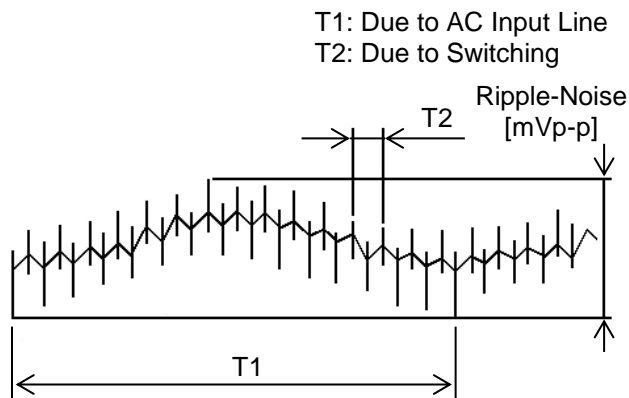
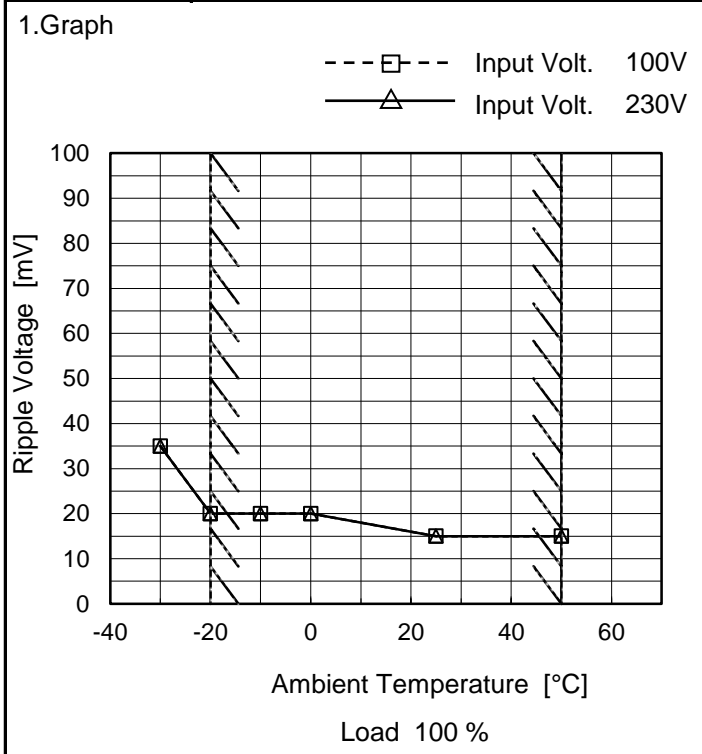


Fig. Complex Ripple Wave Form



Model	MODULE P
Item	Ripple Voltage (by Ambient Temp.)
Object	+12V0.7A

Testing Circuitry Figure B

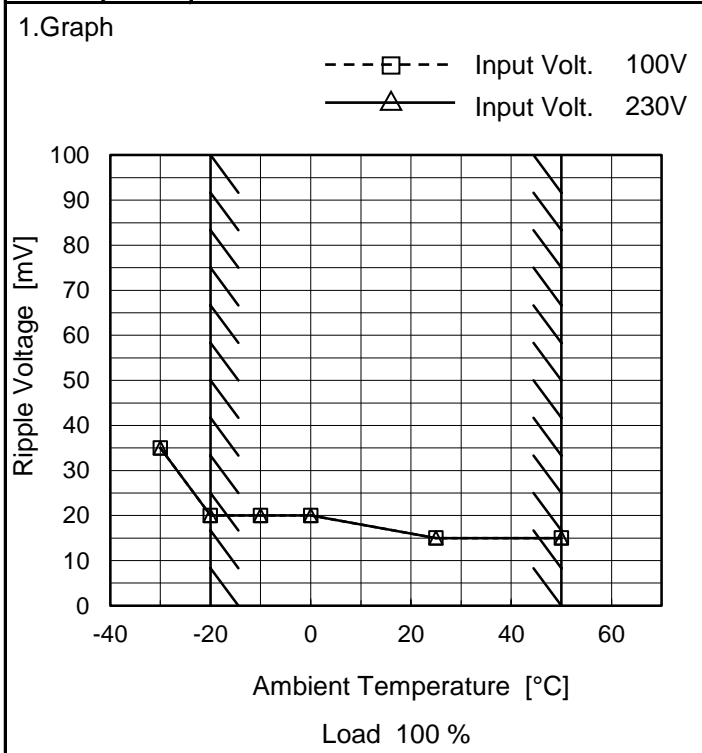


2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	35	35
-20	20	20
-10	20	20
0	20	20
25	15	15
50	15	15
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

-12V: Rated Load Current

Object	-12V0.7A
--------	----------



2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	35	35
-20	20	20
-10	20	20
0	20	20
25	15	15
50	15	15
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

+12V: Rated Load Current

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



COSEL																																																						
Model	MODULE P																																																					
Item	Ambient Temperature Drift	Testing Circuitry Figure A																																																				
Object	+12V0.7A																																																					
<p>1.Graph</p> <p>—△— Input Volt. 100V ---□--- Input Volt. 200V -·-○-·- Input Volt. 230V</p> <p style="text-align: center;">Ambient Temperature [°C] Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>-30</td><td>12.424</td><td>12.424</td><td>12.424</td></tr> <tr><td>-20</td><td>12.428</td><td>12.428</td><td>12.428</td></tr> <tr><td>-10</td><td>12.432</td><td>12.432</td><td>12.432</td></tr> <tr><td>0</td><td>12.435</td><td>12.434</td><td>12.434</td></tr> <tr><td>10</td><td>12.436</td><td>12.436</td><td>12.436</td></tr> <tr><td>25</td><td>12.435</td><td>12.435</td><td>12.435</td></tr> <tr><td>30</td><td>12.435</td><td>12.435</td><td>12.435</td></tr> <tr><td>40</td><td>12.431</td><td>12.431</td><td>12.431</td></tr> <tr><td>50</td><td>12.427</td><td>12.427</td><td>12.427</td></tr> <tr><td>60</td><td>12.422</td><td>12.422</td><td>12.422</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table> <p style="text-align: center;">-12V: Rated Load Current</p>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-30	12.424	12.424	12.424	-20	12.428	12.428	12.428	-10	12.432	12.432	12.432	0	12.435	12.434	12.434	10	12.436	12.436	12.436	25	12.435	12.435	12.435	30	12.435	12.435	12.435	40	12.431	12.431	12.431	50	12.427	12.427	12.427	60	12.422	12.422	12.422	--	-	-	-
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0	-12.417	-12.417	-12.417																																																			
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<p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																																						



COSEL		Testing Circuitry Figure A
Model	MODULE P	
Item	Output Voltage Accuracy	

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 : 85 - 264V

Load Current (AVR 1) : 0 - 0.7A (AVR 2) : 0 - 0.7A

* 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

Object		+12V0.7A				
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	264	0.00	12.765	±374	±3.1
Minimum Voltage	50	85	0.70	12.017		

Object		-12V0.7A				
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	85	0.00	-12.817	±374	±3.1
Minimum Voltage	50	264	0.70	-12.070		



COSEL																								
Model	MODULE P																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	+12V0.7A																							
<p>1.Graph</p> <p style="text-align: center;">Time [H]</p> <p>Input Volt. 100V Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>12.434</td></tr> <tr><td>0.5</td><td>12.430</td></tr> <tr><td>1.0</td><td>12.430</td></tr> <tr><td>2.0</td><td>12.429</td></tr> <tr><td>3.0</td><td>12.430</td></tr> <tr><td>4.0</td><td>12.429</td></tr> <tr><td>5.0</td><td>12.429</td></tr> <tr><td>6.0</td><td>12.429</td></tr> <tr><td>7.0</td><td>12.429</td></tr> <tr><td>8.0</td><td>12.429</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	12.434	0.5	12.430	1.0	12.430	2.0	12.429	3.0	12.430	4.0	12.429	5.0	12.429	6.0	12.429	7.0	12.429	8.0	12.429
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<p>* The characteristic of AC230V is equal.</p>																								

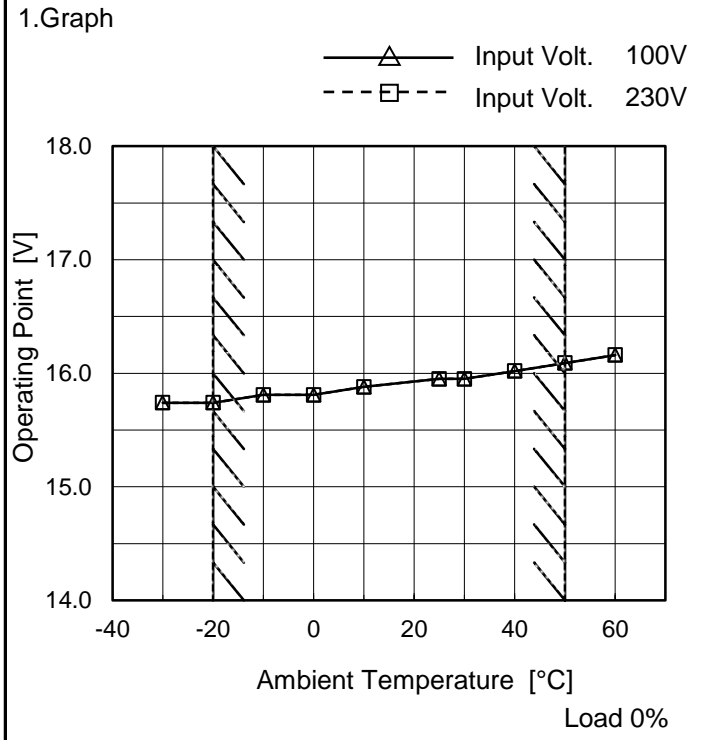


COSEL																																																									
Model	MODULE P																																																								
Item	Overcurrent Protection	Temperature 25°C Testing Circuitry Figure A																																																							
Object	+12V0.7A																																																								
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Output Voltage [V]	Load Current [A]																																																								
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Object	-12V0.7A																																																								
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Output Voltage [V]	Load Current [A]																																																								
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<p>Note: Slanted line shows the range of the rated load current.</p> <p>Intermittent operation occurs when overcurrent protection is activated.</p>																																																									



Model	MODULE P
Item	Overvoltage Protection
Object	+12V0.7A

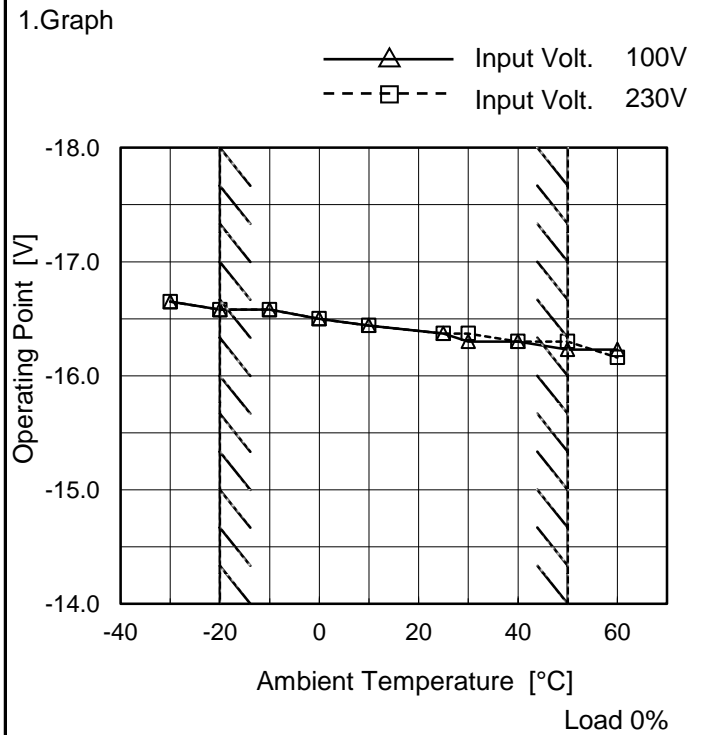
Testing Circuitry Figure A



2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	15.74	15.74
-20	15.74	15.74
-10	15.81	15.81
0	15.81	15.81
10	15.88	15.88
25	15.95	15.95
30	15.95	15.95
40	16.02	16.02
50	16.09	16.09
60	16.16	16.16
--	-	-

Object	-12V0.7A
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2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	-16.65	-16.65
-20	-16.58	-16.58
-10	-16.58	-16.58
0	-16.50	-16.50
10	-16.44	-16.44
25	-16.37	-16.37
30	-16.30	-16.37
40	-16.30	-16.30
50	-16.23	-16.30
60	-16.23	-16.16
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Note: Slanted line shows the range of the rated ambient temperature.

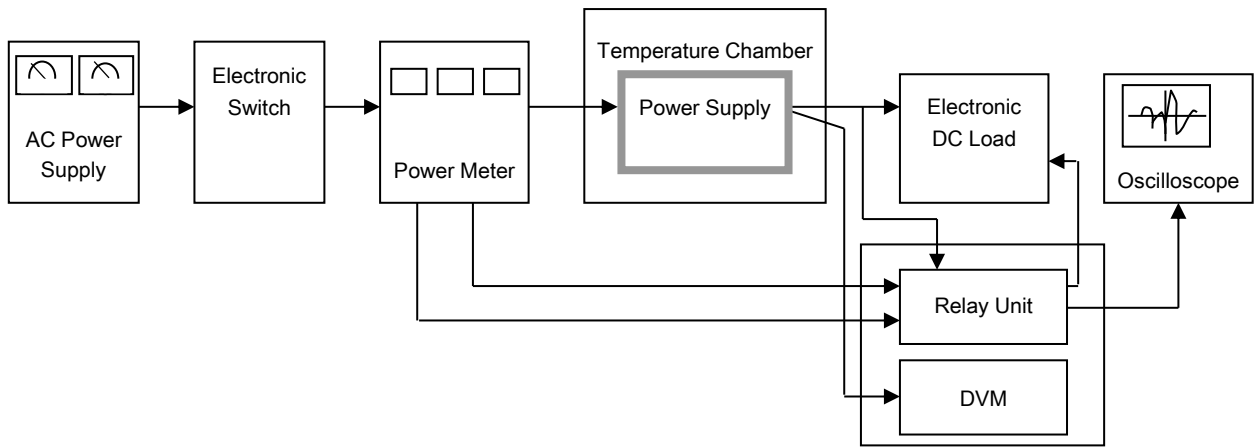
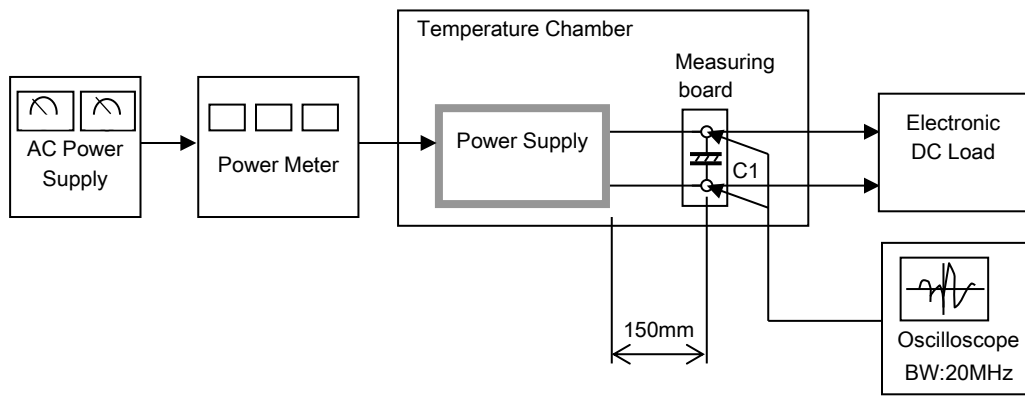


Figure A

Data Acquisition/Control Unit



C1= 22 μ F
(Electrolytic capacitor)

Figure B