

# TEST DATA OF MODULE C

(AME series)

Regulated DC Power Supply  
August 30, 2019

Approved by : *Yoshimichi Hirokawa*  
Yoshimichi Hirokawa Design Manager

Prepared by : *Enkyo Kaku*  
Enkyo Kaku Design Engineer

**COSEL CO.,LTD.**

## CONTENTS

1. Line Regulation . . . . .	1
2. Load Regulation . . . . .	2
3. Dynamic Load Response . . . . .	3
4. Ripple Voltage (by Load Current) . . . . .	4
5. Ripple Noise . . . . .	5
6. Ripple Voltage (by Ambient Temperature) . . . . .	6
7. Ambient Temperature Drift . . . . .	7
8. Output Voltage Accuracy . . . . .	8
9. Time Lapse Drift . . . . .	9
10. Overcurrent Protection . . . . .	10
11. Overvoltage Protection . . . . .	11
12. Figure of Testing Circuitry . . . . .	12

(Final Page 12)



<b>COSEL</b>																																		
Model	MODULE C																																	
Item	Line Regulation	Temperature 25°C Testing Circuitry Figure A																																
Object	+24V5A																																	
<p>1. Graph</p> <p style="text-align: right;">             ---□--- Load 50%              —△— Load 100%         </p>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Output Voltage [V]</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr><td>85</td><td>24.137</td><td>24.137</td></tr> <tr><td>90</td><td>24.138</td><td>24.138</td></tr> <tr><td>100</td><td>24.138</td><td>24.140</td></tr> <tr><td>115</td><td>24.138</td><td>24.140</td></tr> <tr><td>150</td><td>24.137</td><td>24.140</td></tr> <tr><td>200</td><td>24.137</td><td>24.140</td></tr> <tr><td>230</td><td>24.137</td><td>24.139</td></tr> <tr><td>264</td><td>24.137</td><td>24.139</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>	Input Voltage [V]	Output Voltage [V]		Load 50%	Load 100%	85	24.137	24.137	90	24.138	24.138	100	24.138	24.140	115	24.138	24.140	150	24.137	24.140	200	24.137	24.140	230	24.137	24.139	264	24.137	24.139	--	-	-
Input Voltage [V]	Output Voltage [V]																																	
	Load 50%	Load 100%																																
85	24.137	24.137																																
90	24.138	24.138																																
100	24.138	24.140																																
115	24.138	24.140																																
150	24.137	24.140																																
200	24.137	24.140																																
230	24.137	24.139																																
264	24.137	24.139																																
--	-	-																																
<p>Note: Hatched line shows the input voltage range.</p>																																		

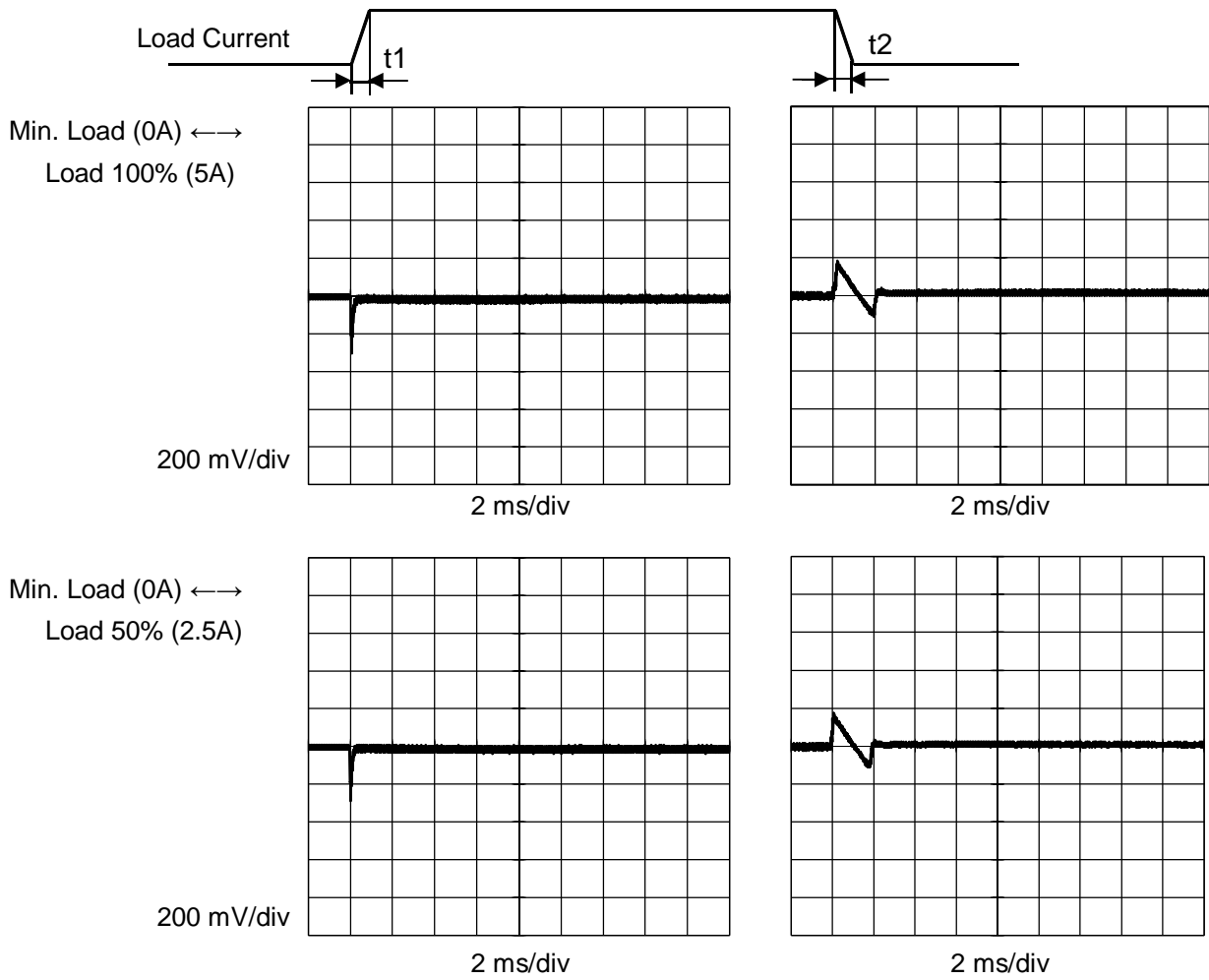


<p>Model MODULE C</p>		<p>Temperature 25°C Testing Circuitry Figure A</p>																																																			
<p>Item Load Regulation</p>																																																					
<p>Object +24V5A</p>																																																					
<p>1. Graph</p> <p>                     —△— Input Volt. 100V                      - - - □ - - - Input Volt. 200V                      - · - ○ - · - - Input Volt. 230V                 </p> <p>Output Voltage [V]</p> <p>Load Current [A]</p>		<p>2. Value</p> <table border="1"> <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>0.0</td><td>24.142</td><td>24.141</td><td>24.141</td></tr> <tr><td>1.0</td><td>24.137</td><td>24.136</td><td>24.137</td></tr> <tr><td>2.0</td><td>24.138</td><td>24.137</td><td>24.138</td></tr> <tr><td>3.0</td><td>24.139</td><td>24.138</td><td>24.138</td></tr> <tr><td>4.0</td><td>24.139</td><td>24.138</td><td>24.138</td></tr> <tr><td>5.0</td><td>24.140</td><td>24.140</td><td>24.139</td></tr> <tr><td>5.5</td><td>24.140</td><td>24.140</td><td>24.140</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> </tbody> </table>	Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	24.142	24.141	24.141	1.0	24.137	24.136	24.137	2.0	24.138	24.137	24.138	3.0	24.139	24.138	24.138	4.0	24.139	24.138	24.138	5.0	24.140	24.140	24.139	5.5	24.140	24.140	24.140	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
Load Current [A]	Output Voltage [V]																																																				
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																		
0.0	24.142	24.141	24.141																																																		
1.0	24.137	24.136	24.137																																																		
2.0	24.138	24.137	24.138																																																		
3.0	24.139	24.138	24.138																																																		
4.0	24.139	24.138	24.138																																																		
5.0	24.140	24.140	24.139																																																		
5.5	24.140	24.140	24.140																																																		
--	-	-	-																																																		
--	-	-	-																																																		
--	-	-	-																																																		
--	-	-	-																																																		
<p>Note: Hatched line shows the range of the rated load current.</p>																																																					



Model		MODULE C	
Item		Temperature	25° C
Object		Testing Circuitry	Figure A
		+24V5A	

Input Volt. 100 V      Response t1=t2=50us. Typ  
 Cycle 1000 ms





<p>Model MODULE C</p>		<p>Temperature 25°C</p>																																							
<p>Item Ripple Voltage (by Load Current)</p>		<p>Testing Circuitry Figure B</p>																																							
<p>Object +24V5A</p>																																									
<p>1. Graph</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>—△— Input Volt. 100 V</p> <p>- - -○- - - Input Volt. 230 V</p> </div> </div>		<p>2. Value</p> <table border="1"> <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>0.0</td><td>20</td><td>20</td></tr> <tr><td>1.0</td><td>35</td><td>35</td></tr> <tr><td>2.0</td><td>40</td><td>40</td></tr> <tr><td>3.0</td><td>45</td><td>45</td></tr> <tr><td>4.0</td><td>45</td><td>45</td></tr> <tr><td>5.0</td><td>45</td><td>45</td></tr> <tr><td>5.5</td><td>45</td><td>45</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> </tbody> </table>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 100[V]	Input Volt. 230[V]	0.0	20	20	1.0	35	35	2.0	40	40	3.0	45	45	4.0	45	45	5.0	45	45	5.5	45	45	--	--	--	--	--	--	--	--	--	--	--	--
Load Current [A]	Ripple Voltage [mV]																																								
	Input Volt. 100[V]	Input Volt. 230[V]																																							
0.0	20	20																																							
1.0	35	35																																							
2.0	40	40																																							
3.0	45	45																																							
4.0	45	45																																							
5.0	45	45																																							
5.5	45	45																																							
--	--	--																																							
--	--	--																																							
--	--	--																																							
--	--	--																																							
<p>Note:</p> <p>Measured by 20MHz Oscilloscope.</p> <p>Ripple Voltage is shown as p-p in the figure below.</p> <p>Hatched line shows the range of the rated load current.</p>																																									
<p>T1: Due to AC Input Line T2: Due to Switching</p>																																									
<p>Fig. Complex Ripple Wave Form</p>																																									



<b>COSEL</b>																																						
Model	MODULE C	Temperature	25°C																																			
Item	Ripple Noise	Testing Circuitry	Figure B																																			
Object	+24V5A																																					
<p>1. Graph</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>—△— Input Volt. 100 V</p> <p>-·-○-·- Input Volt. 230 V</p> </div> </div>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="2">Ripple Noise [mV]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>35</td><td>35</td></tr> <tr><td>1.0</td><td>55</td><td>55</td></tr> <tr><td>2.0</td><td>55</td><td>55</td></tr> <tr><td>3.0</td><td>60</td><td>60</td></tr> <tr><td>4.0</td><td>60</td><td>60</td></tr> <tr><td>5.0</td><td>60</td><td>60</td></tr> <tr><td>5.5</td><td>65</td><td>65</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> </tbody> </table>		Load Current [A]	Ripple Noise [mV]		Input Volt. 100[V]	Input Volt. 230[V]	0.0	35	35	1.0	55	55	2.0	55	55	3.0	60	60	4.0	60	60	5.0	60	60	5.5	65	65	--	--	--	--	--	--	--	--	--
Load Current [A]	Ripple Noise [mV]																																					
	Input Volt. 100[V]	Input Volt. 230[V]																																				
0.0	35	35																																				
1.0	55	55																																				
2.0	55	55																																				
3.0	60	60																																				
4.0	60	60																																				
5.0	60	60																																				
5.5	65	65																																				
--	--	--																																				
--	--	--																																				
--	--	--																																				
<p>Note:</p> <p>Measured by 20MHz Oscilloscope.</p> <p>Ripple Noise is shown as p-p in the figure below.</p> <p>Hatched line shows the range of the rated load current.</p> <div style="text-align: center;"> <p>T1: Due to AC Input Line</p> <p>T2: Due to Switching</p> </div> <p>Fig. Complex Ripple Wave Form</p>																																						



<b>COSEL</b>																																								
Model	MODULE C																																							
Item	Ripple Voltage (by Ambient Temp.)	Testing Circuitry Figure B																																						
Object	+24V5A																																							
<p>1. Graph</p> <div style="text-align: right;"> <p>---□--- Input Volt. 100V</p> <p>—△— Input Volt. 230V</p> </div> <p style="text-align: center;">Ambient Temperature [°C] Load 100 %</p>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</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>-30</td><td>55</td><td>55</td></tr> <tr><td>-20</td><td>45</td><td>50</td></tr> <tr><td>0</td><td>45</td><td>50</td></tr> <tr><td>25</td><td>45</td><td>50</td></tr> <tr><td>50</td><td>45</td><td>50</td></tr> <tr><td>70</td><td>70</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> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>	Ambient Temperature [°C]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	-30	55	55	-20	45	50	0	45	50	25	45	50	50	45	50	70	70	50	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV]																																							
	Input Volt. 100 [V]	Input Volt. 230 [V]																																						
-30	55	55																																						
-20	45	50																																						
0	45	50																																						
25	45	50																																						
50	45	50																																						
70	70	50																																						
--	-	-																																						
--	-	-																																						
--	-	-																																						
--	-	-																																						
--	-	-																																						
<p>Note:</p> <p>Hatched line shows the range of the rated operating temperature.</p>																																								





<b>COSEL</b>																																																						
Model	MODULE C																																																					
Item	Ambient Temperature Drift	Testing Circuitry Figure A																																																				
Object	+24V5A																																																					
<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. Value</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>24.096</td><td>24.096</td><td>24.095</td></tr> <tr><td>-20</td><td>24.110</td><td>24.110</td><td>24.111</td></tr> <tr><td>0</td><td>24.133</td><td>24.133</td><td>24.133</td></tr> <tr><td>25</td><td>24.151</td><td>24.151</td><td>24.152</td></tr> <tr><td>40</td><td>24.163</td><td>24.163</td><td>24.163</td></tr> <tr><td>50</td><td>24.170</td><td>24.170</td><td>24.170</td></tr> <tr><td>60</td><td>24.178</td><td>24.178</td><td>24.178</td></tr> <tr><td>70</td><td>24.182</td><td>24.182</td><td>24.183</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> </tbody> </table>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-30	24.096	24.096	24.095	-20	24.110	24.110	24.111	0	24.133	24.133	24.133	25	24.151	24.151	24.152	40	24.163	24.163	24.163	50	24.170	24.170	24.170	60	24.178	24.178	24.178	70	24.182	24.182	24.183	--	-	-	-	--	-	-	-	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																					
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																			
-30	24.096	24.096	24.095																																																			
-20	24.110	24.110	24.111																																																			
0	24.133	24.133	24.133																																																			
25	24.151	24.151	24.152																																																			
40	24.163	24.163	24.163																																																			
50	24.170	24.170	24.170																																																			
60	24.178	24.178	24.178																																																			
70	24.182	24.182	24.183																																																			
--	-	-	-																																																			
--	-	-	-																																																			
--	-	-	-																																																			
<p>Note:</p> <p>Hatched line shows the range of the rated operating temperature.</p>																																																						



<b>COSEL</b>		
Model	MODULE C	
Item	Output Voltage Accuracy	Testing Circuitry Figure A
Object	+24V5A	

1. Output Voltage Accuracy

This means the output voltage fluctuation of the time the ambient temperature, the input voltage and/or the load current are varied arbitrarily in the range below.

Temperature : -20 - 50°C

Input Voltage : 85 - 264V

Load Current : 0 - 5A

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

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

2. Value

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	230	0	24.199	±45	±0.2
Minimum Voltage	-20	100	5	24.110		



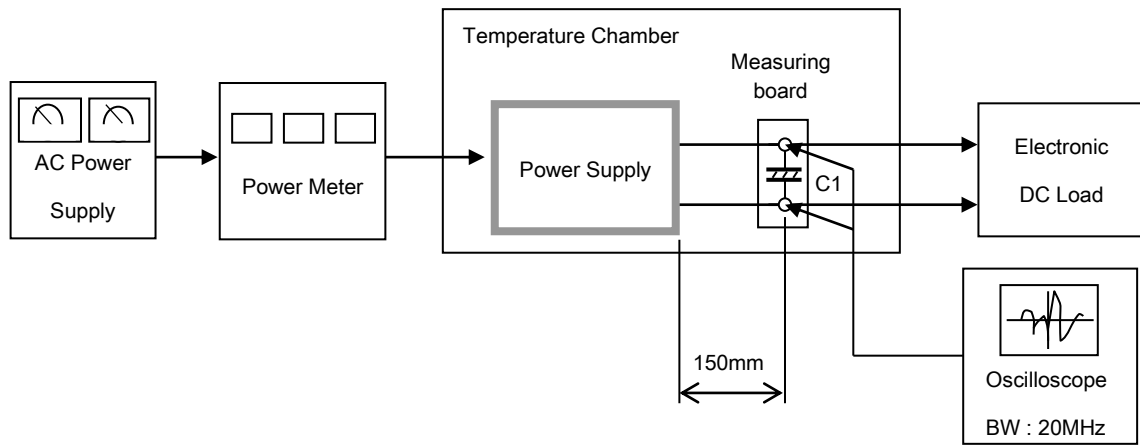
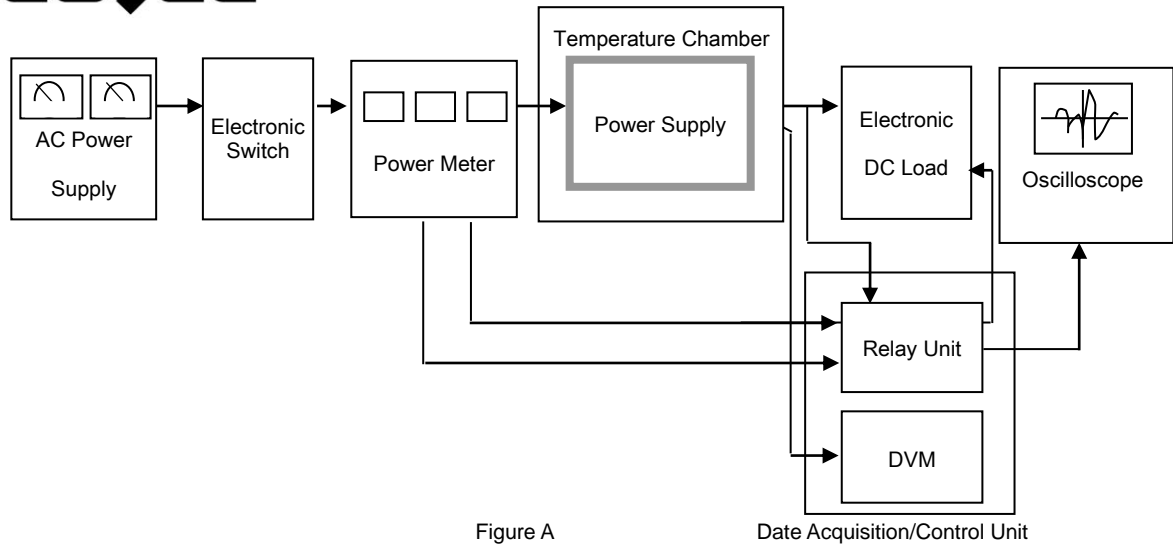
<b>COSEL</b>																								
Model	MODULE C																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	+24V5A																							
<p>1. Graph</p> <p style="text-align: center;">Time [H]</p> <p>Input Voltage 100V Load 100%</p>		<p>2. Value</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>24.151</td></tr> <tr><td>0.5</td><td>24.181</td></tr> <tr><td>1.0</td><td>24.178</td></tr> <tr><td>2.0</td><td>24.178</td></tr> <tr><td>3.0</td><td>24.177</td></tr> <tr><td>4.0</td><td>24.177</td></tr> <tr><td>5.0</td><td>24.177</td></tr> <tr><td>6.0</td><td>24.177</td></tr> <tr><td>7.0</td><td>24.177</td></tr> <tr><td>8.0</td><td>24.178</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	24.151	0.5	24.181	1.0	24.178	2.0	24.178	3.0	24.177	4.0	24.177	5.0	24.177	6.0	24.177	7.0	24.177	8.0	24.178
Time since start [H]	Output Voltage [V]																							
0.0	24.151																							
0.5	24.181																							
1.0	24.178																							
2.0	24.178																							
3.0	24.177																							
4.0	24.177																							
5.0	24.177																							
6.0	24.177																							
7.0	24.177																							
8.0	24.178																							



<p>Model MODULE C</p>		<p>Temperature 25°C Testing Circuitry Figure A</p>																																																							
<p>Item Overcurrent Protection</p>																																																									
<p>Object +24V5A</p>																																																									
<p>1. Graph</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>— Input Volt. 100V</p> <p>— Input Volt. 200V</p> <p>— Input Volt. 230V</p> </div> </div> <p>Output Voltage [V]</p> <p>Load Current [A]</p> <p>Note: Hatched line shows the range of the rated load current.  Hiccup mode activates when the output voltage is below 12.0V.</p>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Output Voltage [V]</th> <th colspan="3">Load Current [A]</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>22.8</td><td>5.95</td><td>5.93</td><td>5.96</td></tr> <tr><td>21.6</td><td>5.90</td><td>5.90</td><td>5.94</td></tr> <tr><td>19.2</td><td>5.87</td><td>5.88</td><td>5.90</td></tr> <tr><td>16.8</td><td>5.86</td><td>5.85</td><td>5.86</td></tr> <tr><td>14.4</td><td>5.85</td><td>5.84</td><td>5.84</td></tr> <tr><td>12.0</td><td>5.85</td><td>5.84</td><td>5.85</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> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>	Output Voltage [V]	Load Current [A]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	22.8	5.95	5.93	5.96	21.6	5.90	5.90	5.94	19.2	5.87	5.88	5.90	16.8	5.86	5.85	5.86	14.4	5.85	5.84	5.84	12.0	5.85	5.84	5.85	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
Output Voltage [V]	Load Current [A]																																																								
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																						
22.8	5.95	5.93	5.96																																																						
21.6	5.90	5.90	5.94																																																						
19.2	5.87	5.88	5.90																																																						
16.8	5.86	5.85	5.86																																																						
14.4	5.85	5.84	5.84																																																						
12.0	5.85	5.84	5.85																																																						
--	-	-	-																																																						
--	-	-	-																																																						
--	-	-	-																																																						
--	-	-	-																																																						
--	-	-	-																																																						
--	-	-	-																																																						



<b>COSEL</b>																																								
Model	MODULE C																																							
Item	Overvoltage Protection	Testing Circuitry Figure A																																						
Object	+24V5A																																							
<p>1. Graph</p> <p style="text-align: center;">Load 0%</p>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="2">Operating Point [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>-30</td><td>33.05</td><td>32.99</td></tr> <tr><td>-20</td><td>33.28</td><td>33.16</td></tr> <tr><td>0</td><td>33.69</td><td>33.69</td></tr> <tr><td>25</td><td>34.33</td><td>34.33</td></tr> <tr><td>40</td><td>34.74</td><td>34.68</td></tr> <tr><td>50</td><td>34.97</td><td>34.97</td></tr> <tr><td>60</td><td>35.26</td><td>35.15</td></tr> <tr><td>70</td><td>35.56</td><td>35.56</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> </tbody> </table>	Ambient Temperature [°C]	Operating Point [V]		Input Volt. 100[V]	Input Volt. 230[V]	-30	33.05	32.99	-20	33.28	33.16	0	33.69	33.69	25	34.33	34.33	40	34.74	34.68	50	34.97	34.97	60	35.26	35.15	70	35.56	35.56	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Operating Point [V]																																							
	Input Volt. 100[V]	Input Volt. 230[V]																																						
-30	33.05	32.99																																						
-20	33.28	33.16																																						
0	33.69	33.69																																						
25	34.33	34.33																																						
40	34.74	34.68																																						
50	34.97	34.97																																						
60	35.26	35.15																																						
70	35.56	35.56																																						
--	-	-																																						
--	-	-																																						
--	-	-																																						
<p>Note:</p> <p>Hatched line shows the range of the rated operating temperature.</p>																																								



C1 = 22  $\mu$ F  
(Electrolytic capacitor)