



TEST DATA OF CHS4004824

Regulated DC Power Supply
January 25, 2019

Approved by : Takayuki Fukuda Design Manager

Prepared by : Tatsuya Nakagawa Design Engineer

COSEL CO.,LTD.

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Model		CHS4004824		Temperature 25°C																																																																																
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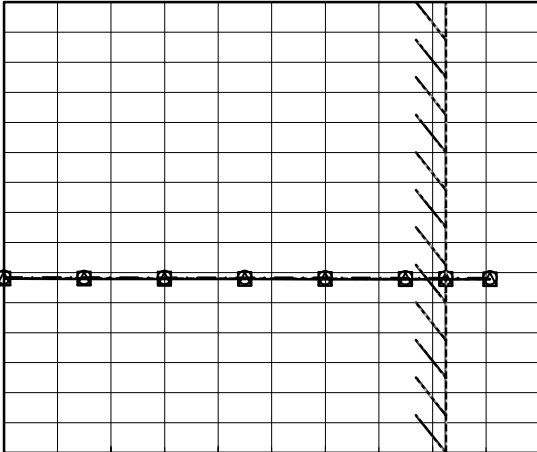


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Item	Line Regulation	Temperature	25°C
Object	+24V16.5A	Testing Circuitry	Figure A
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<div><div><div><div>---</div><div>□</div><div>---</div></div><div>Load 50%</div></div><div><div>—</div><div>△</div><div>—</div></div><div>Load 100%</div></div> <div><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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Model		CHS4004824		Temperature Testing Circuitry	25°C Figure A																																																			
Item		Load Regulation																																																						
Object		+24V16.5A																																																						
1.Graph		<div><div><div>—△—</div><div>---□---</div><div>---○---</div></div><div><div>Input Volt.</div><div>Input Volt.</div><div>Input Volt.</div></div><div><div>36V</div><div>48V</div><div>76V</div></div></div> <div><div><div>Output Voltage [V]</div><div><div>24.40</div><div>24.30</div><div>24.20</div><div>24.10</div><div>24.00</div><div>23.90</div><div>23.80</div><div>23.70</div></div><div><div>0</div><div>4</div><div>8</div><div>12</div><div>16</div><div>20</div></div><div>Load Current [A]</div></div></div> <td colspan="2">2.Values</td>		2.Values																																																				
		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 36[V]</th><th>Input Volt. 48[V]</th><th>Input Volt. 76[V]</th></tr><tr><td>0.00</td><td>23.990</td><td>23.990</td><td>23.992</td></tr><tr><td>3.00</td><td>23.989</td><td>23.990</td><td>23.992</td></tr><tr><td>6.00</td><td>23.989</td><td>23.990</td><td>23.992</td></tr><tr><td>9.00</td><td>23.989</td><td>23.990</td><td>23.991</td></tr><tr><td>12.00</td><td>23.989</td><td>23.990</td><td>23.991</td></tr><tr><td>15.00</td><td>23.989</td><td>23.989</td><td>23.991</td></tr><tr><td>16.50</td><td>23.989</td><td>23.989</td><td>23.991</td></tr><tr><td>18.15</td><td>23.988</td><td>23.989</td><td>23.991</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]	Output Voltage [V]			Input Volt. 36[V]	Input Volt. 48[V]	Input Volt. 76[V]	0.00	23.990	23.990	23.992	3.00	23.989	23.990	23.992	6.00	23.989	23.990	23.992	9.00	23.989	23.990	23.991	12.00	23.989	23.990	23.991	15.00	23.989	23.989	23.991	16.50	23.989	23.989	23.991	18.15	23.988	23.989	23.991	--	-	-	-	--	-	-	-	--	-	-	-
Load Current [A]	Output Voltage [V]																																																							
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Note: Slanted line shows the range of the rated load current.																																																								

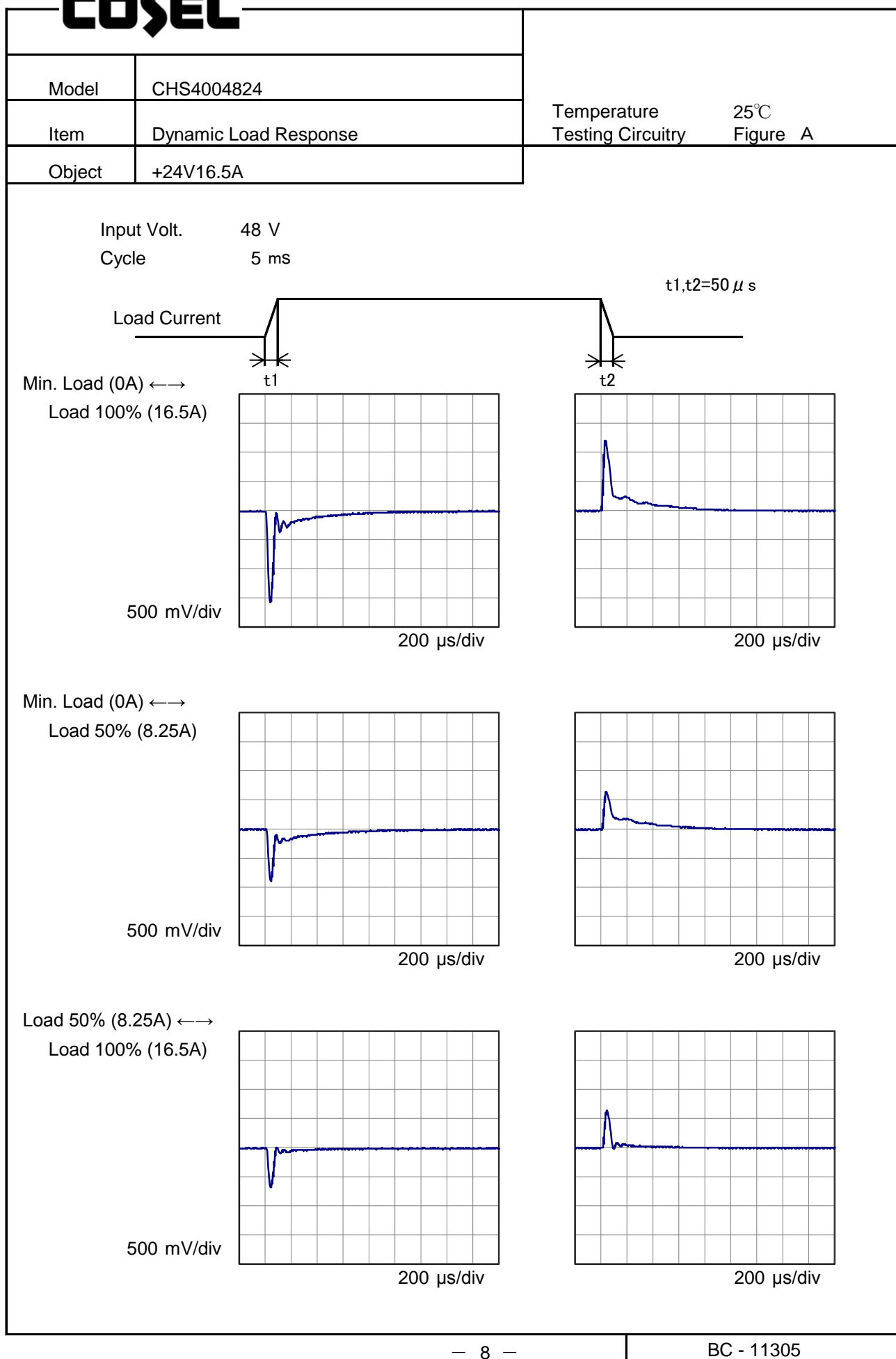
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Model		CHS4004824	Temperature Testing Circuitry	25°C Figure B																																						
Item		Ripple Voltage (by Load Current)																																								
Object		+24V16.5A																																								
1.Graph			2.Values																																							
<div><div><div><div><div></div><div></div></div><div>—△—</div><div>Input Volt.</div><div>36V</div></div><div><div><div></div><div></div></div><div>-·-○-·-</div><div>Input Volt.</div><div>76V</div></div></div><div><p>Ripple Voltage [mV]</p><p>Load Current [A]</p></div></div>			<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple Voltage [mV]</th></tr><tr><th>Input Volt. 36 [V]</th><th>Input Volt. 76 [V]</th></tr><tr><td>0.00</td><td>40</td><td>130</td></tr><tr><td>3.00</td><td>40</td><td>130</td></tr><tr><td>6.00</td><td>40</td><td>130</td></tr><tr><td>9.00</td><td>40</td><td>135</td></tr><tr><td>12.00</td><td>40</td><td>140</td></tr><tr><td>15.00</td><td>50</td><td>145</td></tr><tr><td>16.50</td><td>55</td><td>155</td></tr><tr><td>18.15</td><td>55</td><td>160</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>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 36 [V]	Input Volt. 76 [V]	0.00	40	130	3.00	40	130	6.00	40	130	9.00	40	135	12.00	40	140	15.00	50	145	16.50	55	155	18.15	55	160	--	-	-	--	-	-	--	-	-
Load Current [A]	Ripple Voltage [mV]																																									
	Input Volt. 36 [V]	Input Volt. 76 [V]																																								
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3.00	40	130																																								
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18.15	55	160																																								
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--	-	-																																								
<p>Measured by 100 MHz Oscilloscope.</p> <p>Ripple Voltage is shown as p-p in the figure below.</p> <p>Note: Slanted line shows the range of the rated load current.</p>																																										
<div><div><div><div></div><div></div></div><div>Ripple [mVp-p]</div></div><div><p>Fig.Complex Ripple Wave Form</p></div></div>																																										

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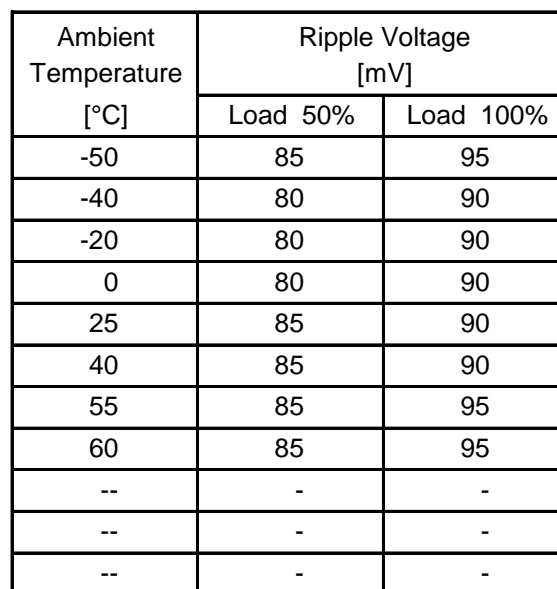
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Model		CHS4004824																																							
Item		Ripple-Noise																																							
Object		+24V16.5A																																							
1.Graph		2.Values																																							
<div><div><div><div><div></div><div></div></div><div>Input Volt.</div><div>36V</div></div><div><div><div></div><div></div></div><div>Input Volt.</div><div>76V</div></div></div><div><p>Measured by 100 MHz Oscilloscope. Ripple-Noise is shown as p-p in the figure below. Note: Slanted line shows the range of the rated load current.</p><div><div><div></div><div></div></div><div>Ripple Noise[mVp-p]</div><div></div></div><p>Fig.Complex Ripple Noise Wave Form</p></div></div>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple-Noise [mV]</th></tr><tr><th>Input Volt. 36 [V]</th><th>Input Volt. 76 [V]</th></tr><tr><td>0.00</td><td>80</td><td>160</td></tr><tr><td>3.00</td><td>80</td><td>170</td></tr><tr><td>6.00</td><td>85</td><td>170</td></tr><tr><td>9.00</td><td>105</td><td>175</td></tr><tr><td>12.00</td><td>120</td><td>190</td></tr><tr><td>15.00</td><td>120</td><td>195</td></tr><tr><td>16.50</td><td>120</td><td>195</td></tr><tr><td>18.15</td><td>130</td><td>195</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>		Load Current [A]	Ripple-Noise [mV]		Input Volt. 36 [V]	Input Volt. 76 [V]	0.00	80	160	3.00	80	170	6.00	85	170	9.00	105	175	12.00	120	190	15.00	120	195	16.50	120	195	18.15	130	195	--	-	-	--	-	-	--	-	-
Load Current [A]	Ripple-Noise [mV]																																								
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9.00	105	175																																							
12.00	120	190																																							
15.00	120	195																																							
16.50	120	195																																							
18.15	130	195																																							
--	-	-																																							
--	-	-																																							
--	-	-																																							

Testing Circuitry Figure B

2.Values



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

The diagram shows a trapezoidal dam cross-section. The water level is indicated by a horizontal line with a downward arrow, positioned above the top crest of the dam. The dam's crest is a horizontal line. The dam's body is a trapezoid with a sloped upstream face (left) and a sloped downstream face (right). The base of the dam is a horizontal line. The water level is above the crest, and the dam is shown in cross-section.

Fig.Complex Ripple Wave Form

Model		CHS4004824																																																				
Item		Ambient Temperature Drift																																																				
Object		+24V16.5A																																																				
1.Graph		2.Values																																																				
<div><div><div><div>—△—</div><div>Input Volt.</div><div>36V</div></div><div><div>---□---</div><div>Input Volt.</div><div>48V</div></div><div><div>---○---</div><div>Input Volt.</div><div>76V</div></div></div><p>Output Voltage [V]</p><p>Ambient Temperature [°C]</p><p>Load 100%</p><p>Note: Slanted line shows the range of the rated ambient temperature.</p></div>		<table><tr><th rowspan="2">Ambient Temperature [°C]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 36[V]</th><th>Input Volt. 48[V]</th><th>Input Volt. 76[V]</th></tr><tr><td>-40</td><td>23.876</td><td>23.876</td><td>23.876</td></tr><tr><td>-20</td><td>23.917</td><td>23.917</td><td>23.917</td></tr><tr><td>0</td><td>23.953</td><td>23.953</td><td>23.953</td></tr><tr><td>25</td><td>23.989</td><td>23.989</td><td>23.991</td></tr><tr><td>40</td><td>24.010</td><td>24.010</td><td>24.009</td></tr><tr><td>55</td><td>24.026</td><td>24.026</td><td>24.025</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></table>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 36[V]	Input Volt. 48[V]	Input Volt. 76[V]	-40	23.876	23.876	23.876	-20	23.917	23.917	23.917	0	23.953	23.953	23.953	25	23.989	23.989	23.991	40	24.010	24.010	24.009	55	24.026	24.026	24.025	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																					
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COSEL

		Testing Circuitry Figure A
Model	CHS4004824	
Item	Output Voltage Accuracy	
Object	+24V16.5A	

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 : -40 - 55°C

Input Voltage : 36 - 76V

Load Current : 0 - 16.5A

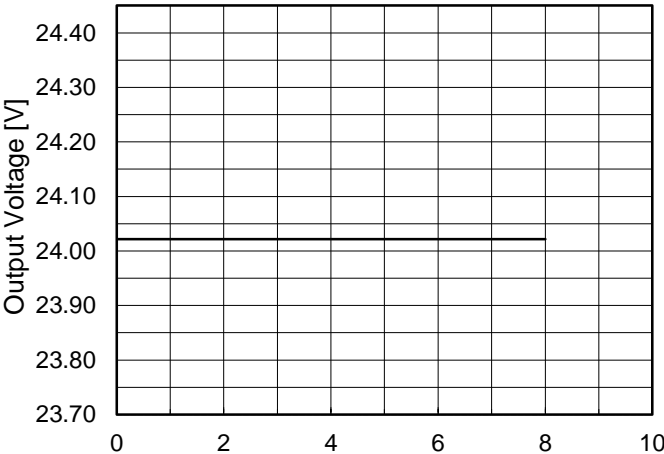
* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

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

2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	55	36	0	20.027	±75	±0.3
Minimum Voltage	-40	76	16.5	23.876		

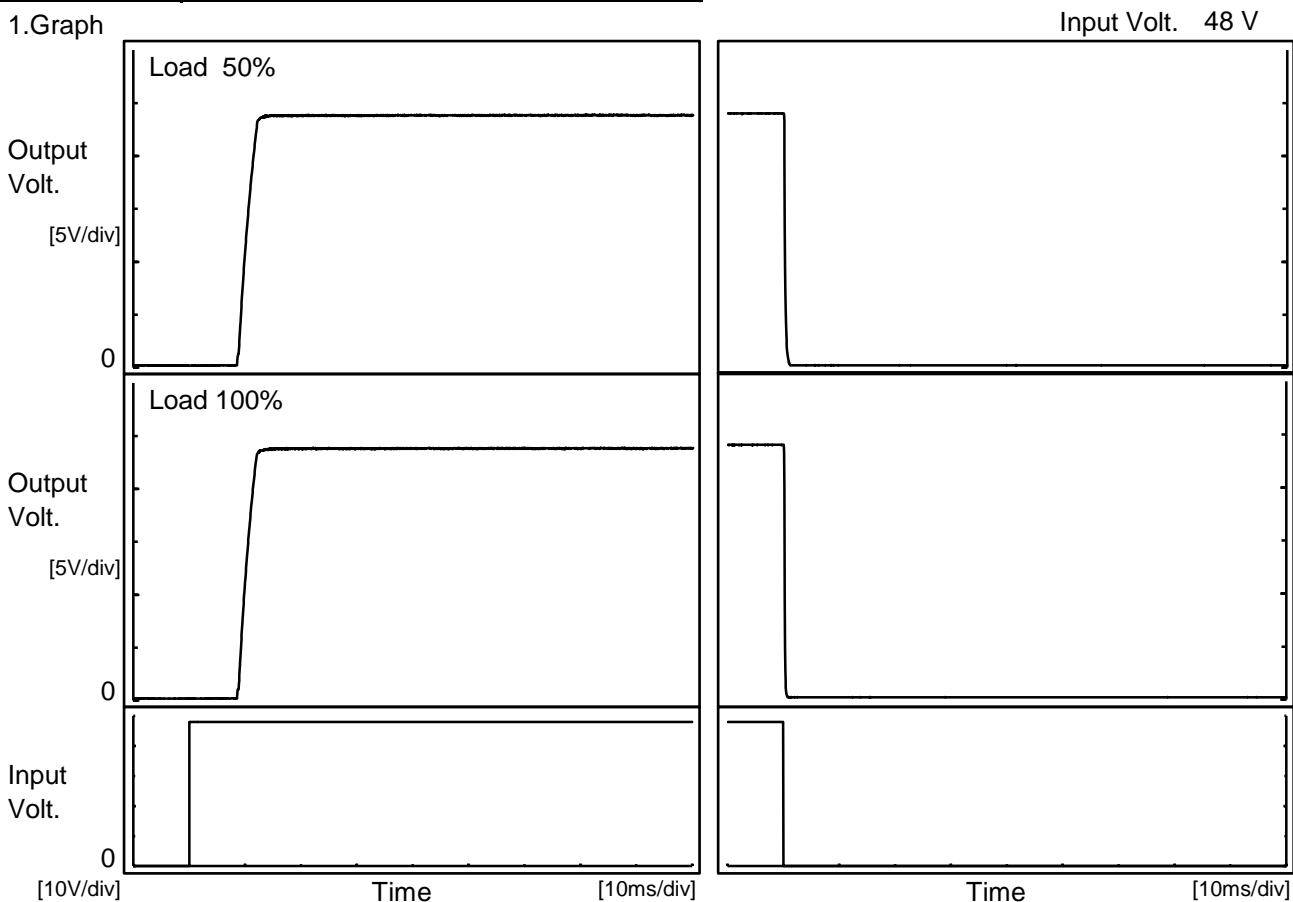


COSEL																									
Model	CHS4004824																								
Item	Time Lapse Drift	Temperature	25°C																						
Object	+24V16.5A	Testing Circuitry	Figure A																						
1.Graph		2.Values																							
<div><p>Output Voltage [V]</p><p>Time [H]</p><p>Input Volt. 48V</p><p>Load 100%</p></div>		<table><tr><th>Time since start [H]</th><th>Output Voltage [V]</th></tr><tr><td>0.0</td><td>24.022</td></tr><tr><td>0.5</td><td>24.022</td></tr><tr><td>1.0</td><td>24.022</td></tr><tr><td>2.0</td><td>24.022</td></tr><tr><td>3.0</td><td>24.022</td></tr><tr><td>4.0</td><td>24.022</td></tr><tr><td>5.0</td><td>24.022</td></tr><tr><td>6.0</td><td>24.022</td></tr><tr><td>7.0</td><td>24.022</td></tr><tr><td>8.0</td><td>24.022</td></tr></table>		Time since start [H]	Output Voltage [V]	0.0	24.022	0.5	24.022	1.0	24.022	2.0	24.022	3.0	24.022	4.0	24.022	5.0	24.022	6.0	24.022	7.0	24.022	8.0	24.022
Time since start [H]	Output Voltage [V]																								
0.0	24.022																								
0.5	24.022																								
1.0	24.022																								
2.0	24.022																								
3.0	24.022																								
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5.0	24.022																								
6.0	24.022																								
7.0	24.022																								
8.0	24.022																								



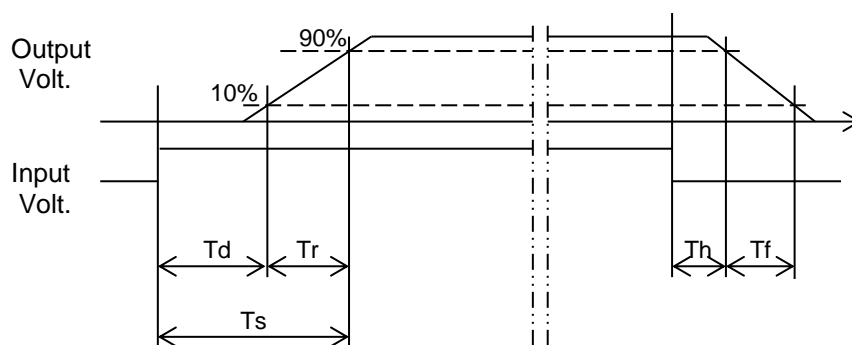
Model	CHS4004824	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+24V16.5A		


1.Graph



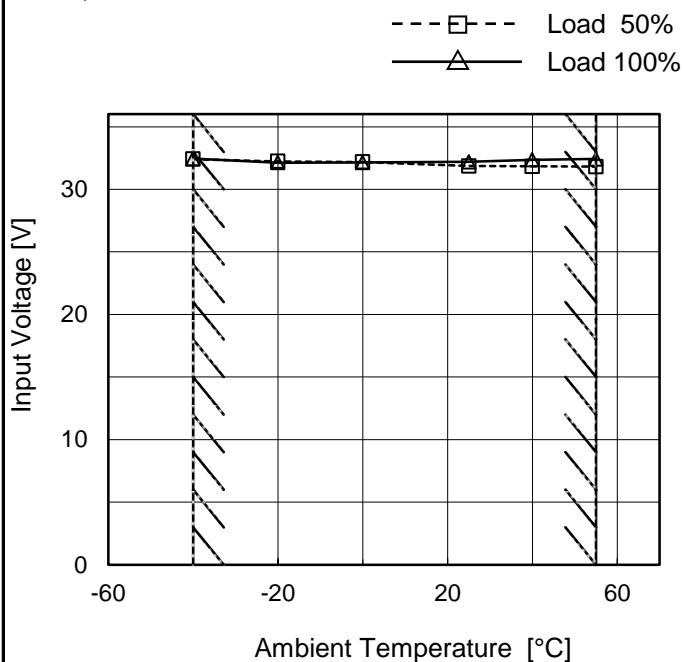
2.Values

Load \ Time	Td	Tr	Ts	Th	Tf
50 %	9.0	2.9	11.9	0.2	0.4
100 %	9.0	2.8	11.8	0.2	0.2



	
Model	CHS4004824
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+24V16.5A

1.Graph



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

Testing Circuitry Figure A

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-40	32.5	32.5
-20	32.3	32.2
0	32.2	32.2
25	31.9	32.2
40	31.9	32.4
55	31.9	32.5
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Model		CHS4004824	
Item		Overcurrent Protection	
Object		+24V16.5A	

1.Graph

Input Volt.

36V

Input Volt.

48V

Input Volt.

76V

Output Voltage [V]



Model		CHS4004824
Item		Overvoltage Protection
Object		+24V16.5A

1.Graph

---□---

Input Volt. 48V

---○---

Input Volt. 76V

Operating Point [V]

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. 48[V]	Input Volt. 76[V]
-40	28.94	28.94
-20	29.02	28.99
0	29.04	29.03
25	29.08	29.06
40	29.12	29.12
55	29.13	29.13
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

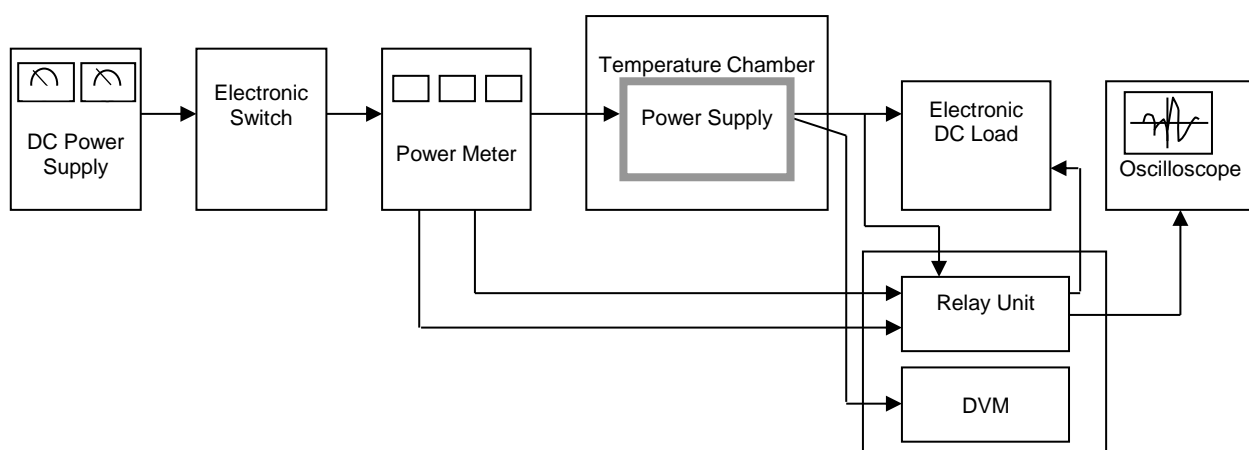


Figure A

Data Acquisition/Control Unit

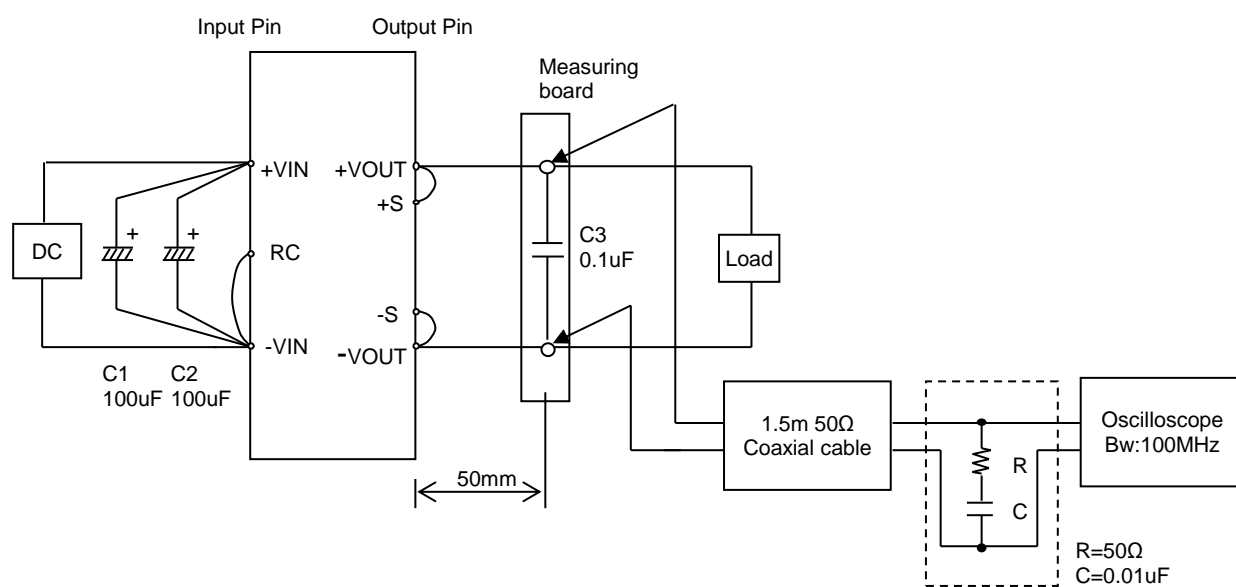


Figure B