



# TEST DATA OF CES24150-4

Regulated DC Power Supply  
May 16, 2008

Approved by : Tatsuya Mano  
Tatsuya Mano Design Manager

Prepared by : Yoshimichi Hirokawa  
Yoshimichi Hirokawa Design Engineer

**COSEL CO.,LTD.**

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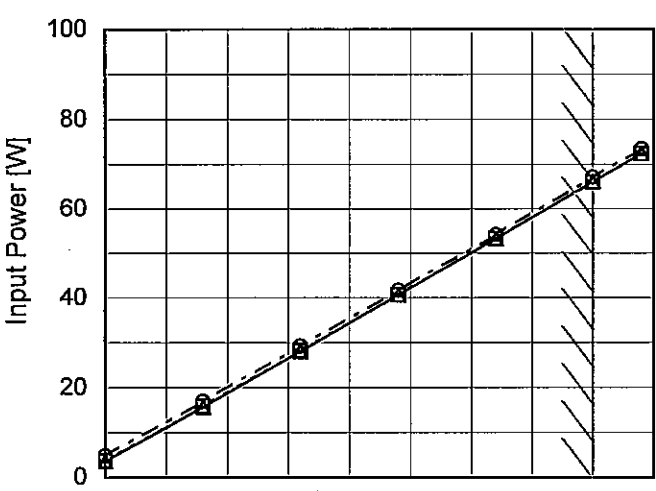
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Model		CES24150-4		Temperature		25°C																																																																																
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<div><div>Efficiency [%]</div><div><div><div>100</div><div>92</div><div>84</div><div>76</div><div>68</div><div>60</div><div>52</div><div>44</div></div><div><div>0.0</div><div>1.0</div><div>2.0</div><div>3.0</div><div>4.0</div></div><div><div>Load Current [A]</div></div></div></div> <div><div>Note: Slanted line shows the range of the rated load current.</div></div>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Efficiency [%]</th></tr><tr><th>Input Volt. 20[V]</th><th>Input Volt. 24[V]</th><th>Input Volt. 33[V]</th></tr><tr><td>0.0</td><td>-</td><td>-</td><td>-</td></tr><tr><td>0.8</td><td>77.5</td><td>76.9</td><td>72.1</td></tr><tr><td>1.6</td><td>86.2</td><td>85.8</td><td>82.8</td></tr><tr><td>2.4</td><td>89.1</td><td>89.2</td><td>86.9</td></tr><tr><td>3.2</td><td>90.4</td><td>90.4</td><td>88.9</td></tr><tr><td>4.0</td><td>91.1</td><td>91.2</td><td>89.7</td></tr><tr><td>4.4</td><td>91.3</td><td>91.4</td><td>90.1</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]	Efficiency [%]			Input Volt. 20[V]	Input Volt. 24[V]	Input Volt. 33[V]	0.0	-	-	-	0.8	77.5	76.9	72.1	1.6	86.2	85.8	82.8	2.4	89.1	89.2	86.9	3.2	90.4	90.4	88.9	4.0	91.1	91.2	89.7	4.4	91.3	91.4	90.1	—	-	-	-	—	-	-	-	—	-	-	-	—	-	-	-
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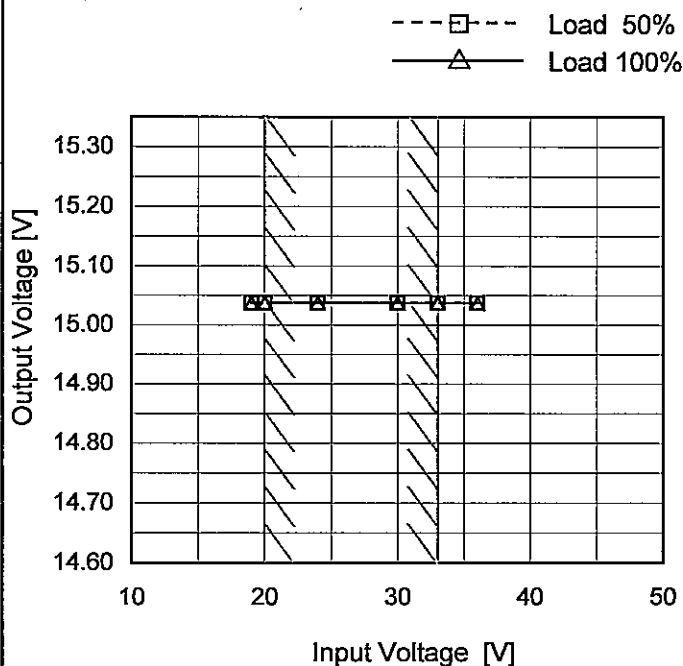
**Model** CES24150-4

**Item** Line Regulation

**Object** +15V4A

**Temperature** 25°C  
**Testing Circuitry** Figure A

## 1. Graph



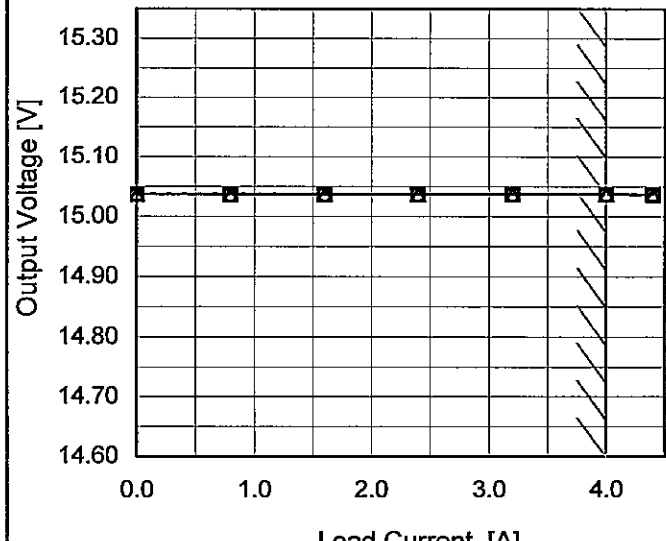
Note: Slanted line shows the range of the rated input voltage.

## 2. Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
18	-	-
19	15.038	15.038
20	15.038	15.038
24	15.038	15.038
30	15.038	15.038
33	15.038	15.038
36	15.038	15.038
—	-	-
—	-	-



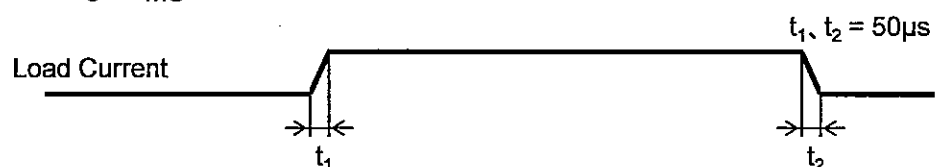
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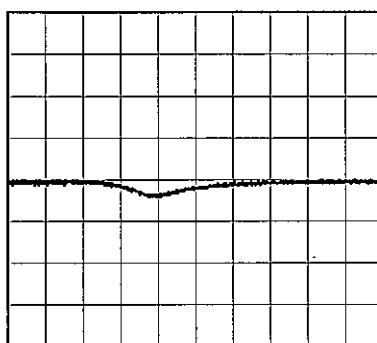
Model	CES24150-4	Temperature 25°C Testing Circuitry Figure A
Item	Dynamic Load Response	
Object	+15V4A	

Input Volt. 24 V  
Cycle 5 mS

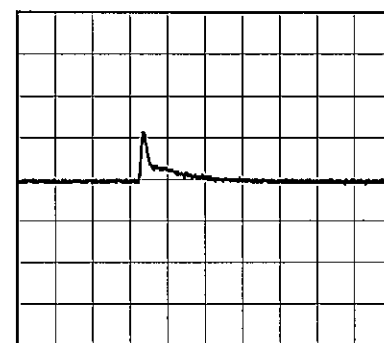


Min. Load (0A)  $\longleftrightarrow$   
Load 100% (4A)

100mV/div



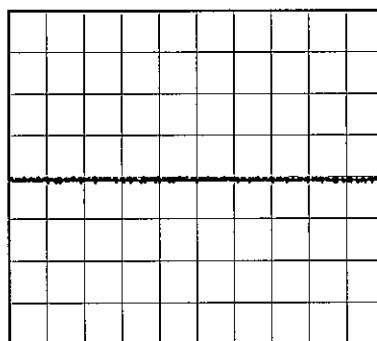
100µs/div



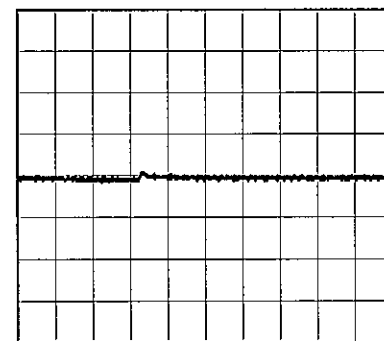
100µs/div

Min. Load (0A)  $\longleftrightarrow$   
Load 50% (2A)

100mV/div



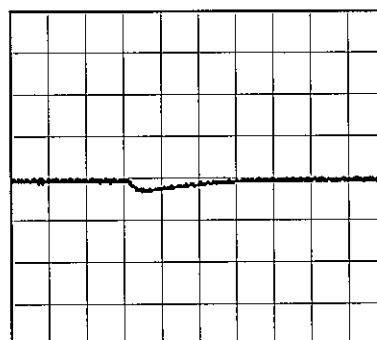
100µs/div



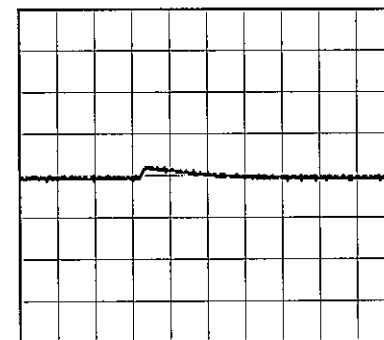
100µs/div

Load 50% (2A)  $\longleftrightarrow$   
Load 100% (4A)

100mV/div



100µs/div



100µs/div

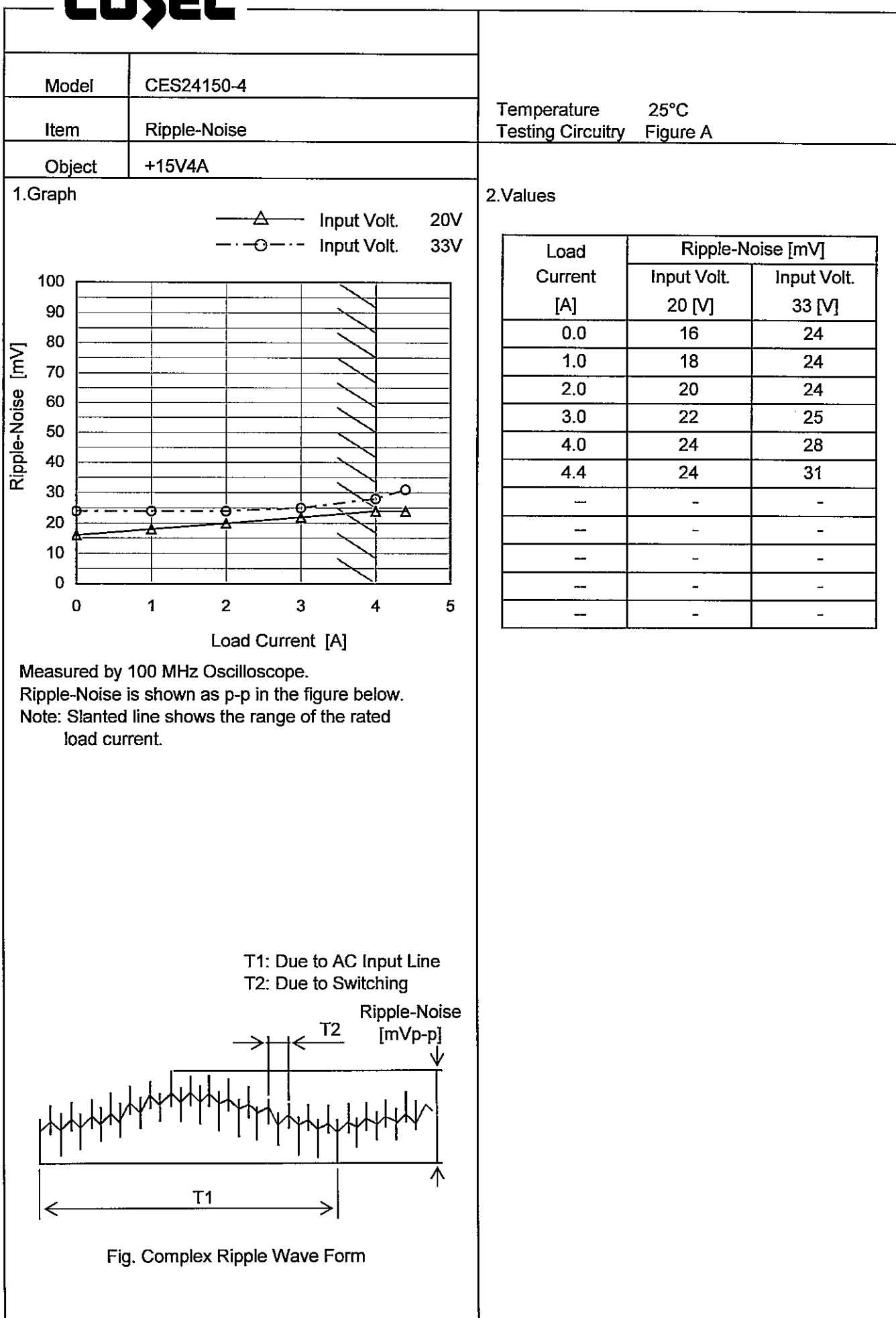
# COSEL

Model		CES24150-4		Temperature 25°C																																							
Item		Ripple Voltage (by Load Current)		Testing Circuitry Figure A																																							
Object		+15V4A																																									
1.Graph				2.Values																																							
<div><div><div>—△— Input Volt. 20V</div><div>- -○- - Input Volt. 33V</div></div><div>Ripple Voltage [mV]</div><div>Load Current [A]</div></div>				<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple Voltage [mV]</th></tr><tr><th>Input Volt. 20 [V]</th><th>Input Volt. 33 [V]</th></tr><tr><td>0.0</td><td>12</td><td>18</td></tr><tr><td>1.0</td><td>13</td><td>18</td></tr><tr><td>2.0</td><td>14</td><td>19</td></tr><tr><td>3.0</td><td>14</td><td>19</td></tr><tr><td>4.0</td><td>14</td><td>19</td></tr><tr><td>4.4</td><td>14</td><td>19</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></table>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 20 [V]	Input Volt. 33 [V]	0.0	12	18	1.0	13	18	2.0	14	19	3.0	14	19	4.0	14	19	4.4	14	19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Load Current [A]	Ripple Voltage [mV]																																										
	Input Volt. 20 [V]	Input Volt. 33 [V]																																									
0.0	12	18																																									
1.0	13	18																																									
2.0	14	19																																									
3.0	14	19																																									
4.0	14	19																																									
4.4	14	19																																									
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—	—	—																																									
<div>Measured by 100 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>Ripple [mVp-p]</div><div>Fig.Complex Ripple Wave Form</div></div>																																											

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BC-10167

# COSEL



# COSEL

Model		CES24150-4
Item		Ripple Voltage (by Ambient Temp.)
Object		+15V4A
1.Graph		
<div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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		CES24150-4																																																				
Item		Ambient Temperature Drift																																																				
Object		+15V4A																																																				
1.Graph		2.Values																																																				
<div><div><div>—△—</div><div>Input Volt.</div><div>20V</div></div><div><div>---□---</div><div>Input Volt.</div><div>24V</div></div><div><div>---○---</div><div>Input Volt.</div><div>33V</div></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. 20[V]</th><th>Input Volt. 24[V]</th><th>Input Volt. 33[V]</th></tr><tr><td>-40</td><td>15.078</td><td>15.077</td><td>15.078</td></tr><tr><td>-20</td><td>15.068</td><td>15.067</td><td>15.068</td></tr><tr><td>0</td><td>15.058</td><td>15.057</td><td>15.057</td></tr><tr><td>10</td><td>15.052</td><td>15.052</td><td>15.052</td></tr><tr><td>20</td><td>15.046</td><td>15.046</td><td>15.045</td></tr><tr><td>25</td><td>15.042</td><td>15.042</td><td>15.042</td></tr><tr><td>30</td><td>15.039</td><td>15.038</td><td>15.038</td></tr><tr><td>40</td><td>15.031</td><td>15.031</td><td>15.030</td></tr><tr><td>60</td><td>15.014</td><td>15.013</td><td>15.012</td></tr><tr><td>85</td><td>14.986</td><td>14.985</td><td>14.985</td></tr><tr><td>—</td><td>-</td><td>-</td><td>-</td></tr></table>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 20[V]	Input Volt. 24[V]	Input Volt. 33[V]	-40	15.078	15.077	15.078	-20	15.068	15.067	15.068	0	15.058	15.057	15.057	10	15.052	15.052	15.052	20	15.046	15.046	15.045	25	15.042	15.042	15.042	30	15.039	15.038	15.038	40	15.031	15.031	15.030	60	15.014	15.013	15.012	85	14.986	14.985	14.985	—	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																					
	Input Volt. 20[V]	Input Volt. 24[V]	Input Volt. 33[V]																																																			
-40	15.078	15.077	15.078																																																			
-20	15.068	15.067	15.068																																																			
0	15.058	15.057	15.057																																																			
10	15.052	15.052	15.052																																																			
20	15.046	15.046	15.045																																																			
25	15.042	15.042	15.042																																																			
30	15.039	15.038	15.038																																																			
40	15.031	15.031	15.030																																																			
60	15.014	15.013	15.012																																																			
85	14.986	14.985	14.985																																																			
—	-	-	-																																																			

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BC-10167



		Testing Circuitry Figure A
Model	CES24150-4	
Item	Output Voltage Accuracy	
Object	+15V4A	

### 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 - 85°C

Input Voltage : 20 - 33V

Load Current : 0 - 4A

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

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

### 2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-40	33	4	15.078	±47	±0.3
Minimum Voltage	85	33	4	14.985		

# COSEL

Model	CES24150-4																								
Item	Time Lapse Drift	Temperature	25°C																						
		Testing Circuitry	Figure A																						
Object	+15V4A																								
1.Graph		2.Values																							
<div><div><div>15.30</div><div>15.20</div><div>15.10</div><div>15.00</div><div>14.90</div><div>14.80</div><div>14.70</div><div>14.60</div></div><div><div>0</div><div>2</div><div>4</div><div>6</div><div>8</div><div>10</div></div><div><div>Output Voltage [V]</div><div>Time [H]</div></div><div><div>Input Volt.</div><div>24V</div></div><div><div>Load</div><div>100%</div></div></div>		<table><tr><th>Time since start [H]</th><th>Output Voltage [V]</th></tr><tr><td>0.0</td><td>15.042</td></tr><tr><td>0.5</td><td>15.037</td></tr><tr><td>1.0</td><td>15.037</td></tr><tr><td>2.0</td><td>15.037</td></tr><tr><td>3.0</td><td>15.037</td></tr><tr><td>4.0</td><td>15.037</td></tr><tr><td>5.0</td><td>15.037</td></tr><tr><td>6.0</td><td>15.037</td></tr><tr><td>7.0</td><td>15.037</td></tr><tr><td>8.0</td><td>15.037</td></tr></table>		Time since start [H]	Output Voltage [V]	0.0	15.042	0.5	15.037	1.0	15.037	2.0	15.037	3.0	15.037	4.0	15.037	5.0	15.037	6.0	15.037	7.0	15.037	8.0	15.037
Time since start [H]	Output Voltage [V]																								
0.0	15.042																								
0.5	15.037																								
1.0	15.037																								
2.0	15.037																								
3.0	15.037																								
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5.0	15.037																								
6.0	15.037																								
7.0	15.037																								
8.0	15.037																								

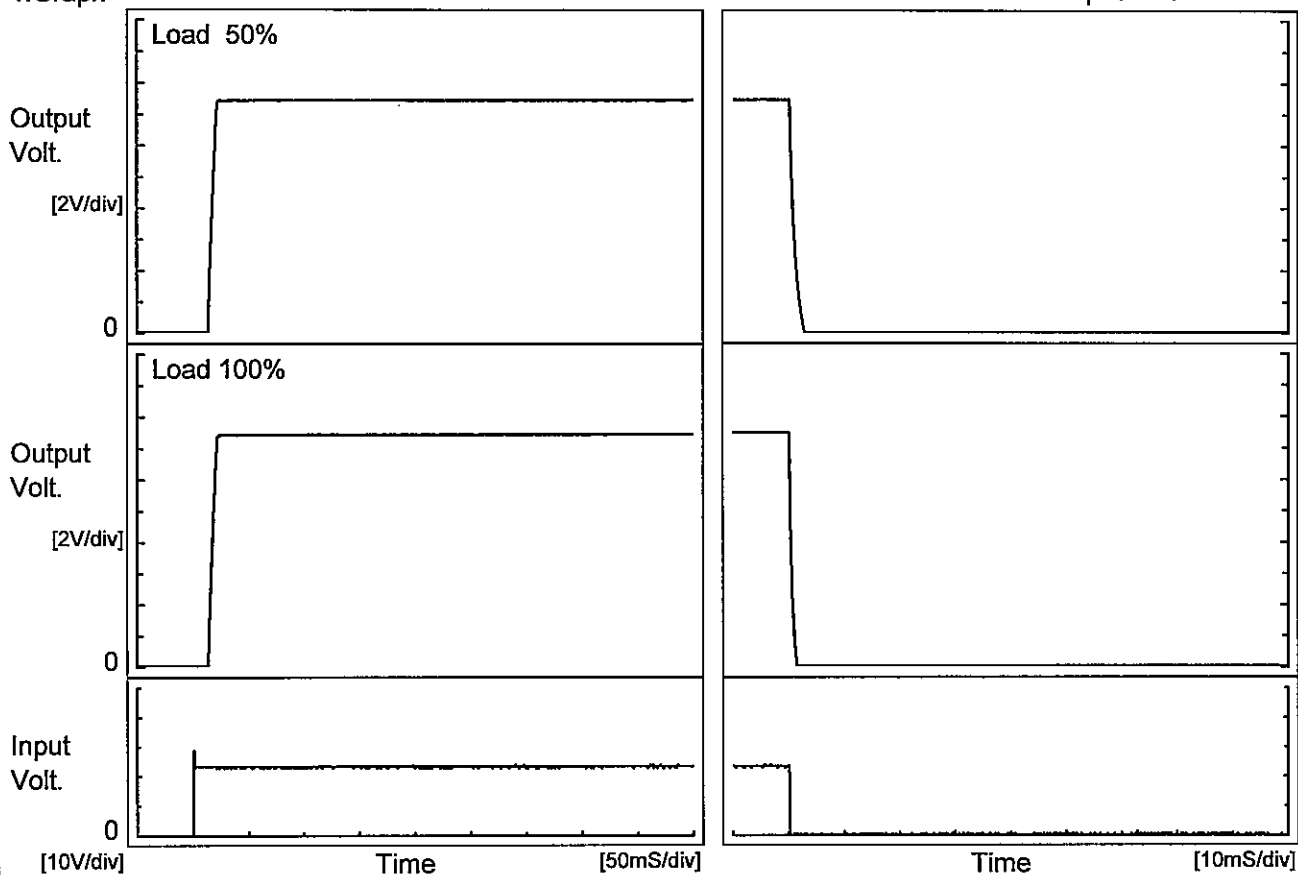


# COSEL

Model	CES24150-4	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+15V4A		

## 1. Graph

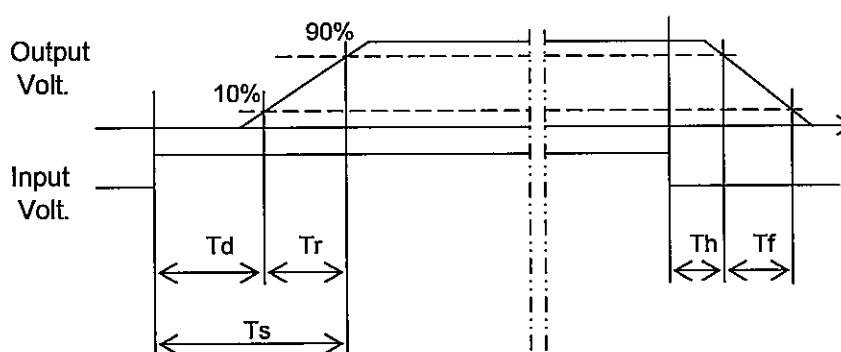
Input Volt. 24 V



## 2. Values

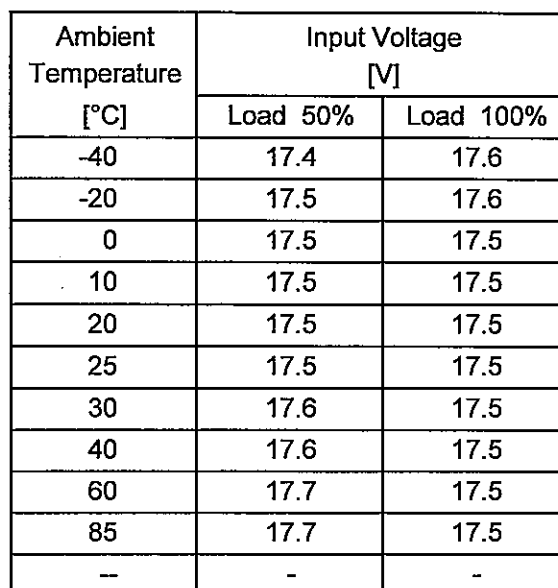
[mS]

Load \ Time	Td	Tr	Ts	Th	Tf
50 %	14.0	7.0	21.0	0.2	1.9
100 %	14.3	6.8	21.1	0.2	1.0



### Testing Circuitry Figure A

## 2.Values



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

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Item	Overcurrent Protection	Temperature	25°C																																																							
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<div><div><div></div><div>Input Volt.</div><div>20V</div></div><div><div></div><div>Input Volt.</div><div>24V</div></div><div><div></div><div>Input Volt.</div><div>33V</div></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="3">Load Current [A]</th></tr><tr><th>Input Volt. 20[V]</th><th>Input Volt. 24[V]</th><th>Input Volt. 33[V]</th></tr><tr><td>15.0</td><td>5.01</td><td>4.88</td><td>4.83</td></tr><tr><td>14.3</td><td>4.92</td><td>4.84</td><td>4.83</td></tr><tr><td>13.5</td><td>4.86</td><td>4.81</td><td>4.84</td></tr><tr><td>12.0</td><td>4.78</td><td>4.78</td><td>4.84</td></tr><tr><td>10.5</td><td>4.75</td><td>4.79</td><td>4.90</td></tr><tr><td>9.0</td><td>4.76</td><td>4.82</td><td>5.02</td></tr><tr><td>7.5</td><td>4.77</td><td>4.83</td><td>5.05</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>		Output Voltage [V]	Load Current [A]			Input Volt. 20[V]	Input Volt. 24[V]	Input Volt. 33[V]	15.0	5.01	4.88	4.83	14.3	4.92	4.84	4.83	13.5	4.86	4.81	4.84	12.0	4.78	4.78	4.84	10.5	4.75	4.79	4.90	9.0	4.76	4.82	5.02	7.5	4.77	4.83	5.05	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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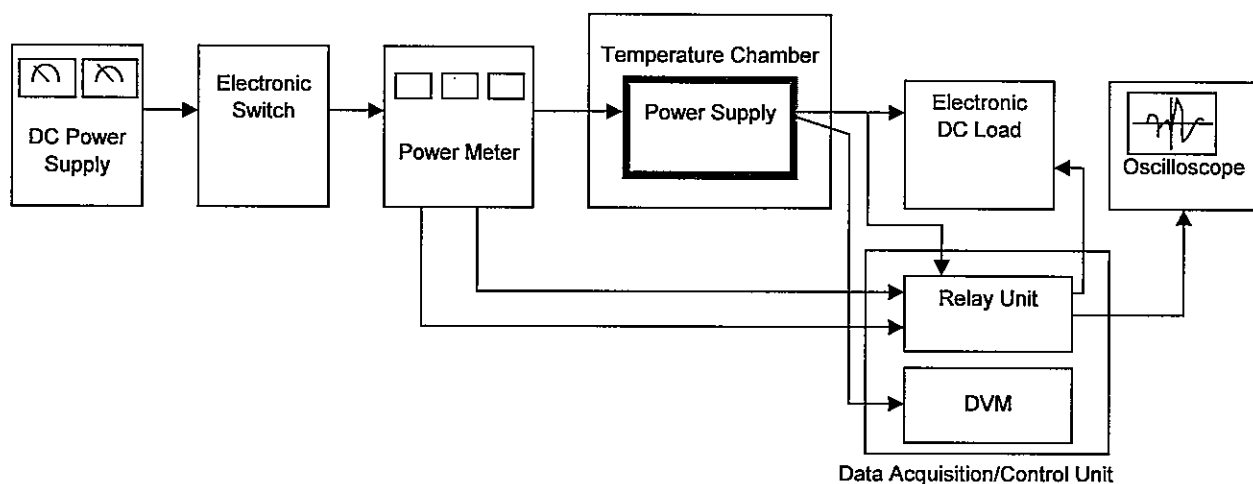


Figure A

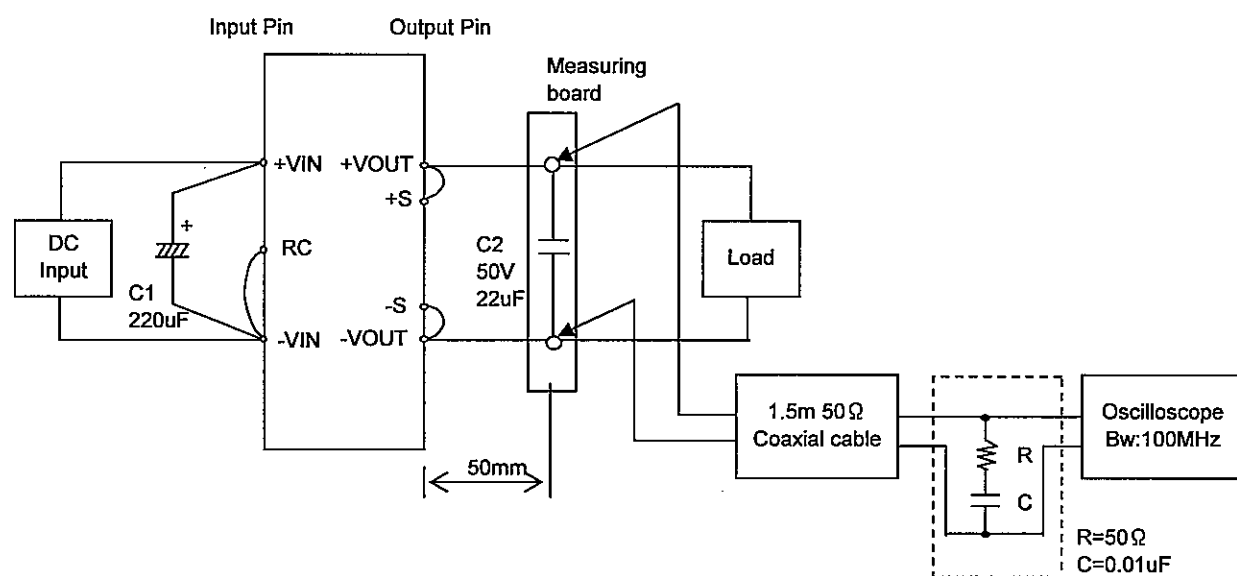


Figure B