

TEST DATA OF BRFS60

Regulated DC Power Supply
September 9, 2014

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Yoshimichi Hirokawa Design Manager

Prepared by : Yohei Urayama
Yohei Urayama Design Engineer

COSEL CO.,LTD.

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(Final Page 18)

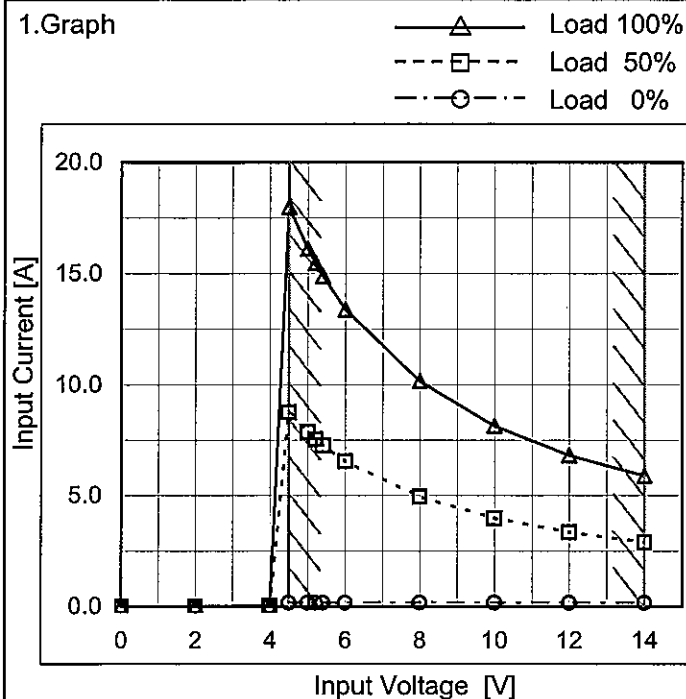
Model BRFS60

Item Input Current (by Input Voltage)

Object +1.2V

Temperature 25°C
Testing Circuitry Figure A

1. Graph

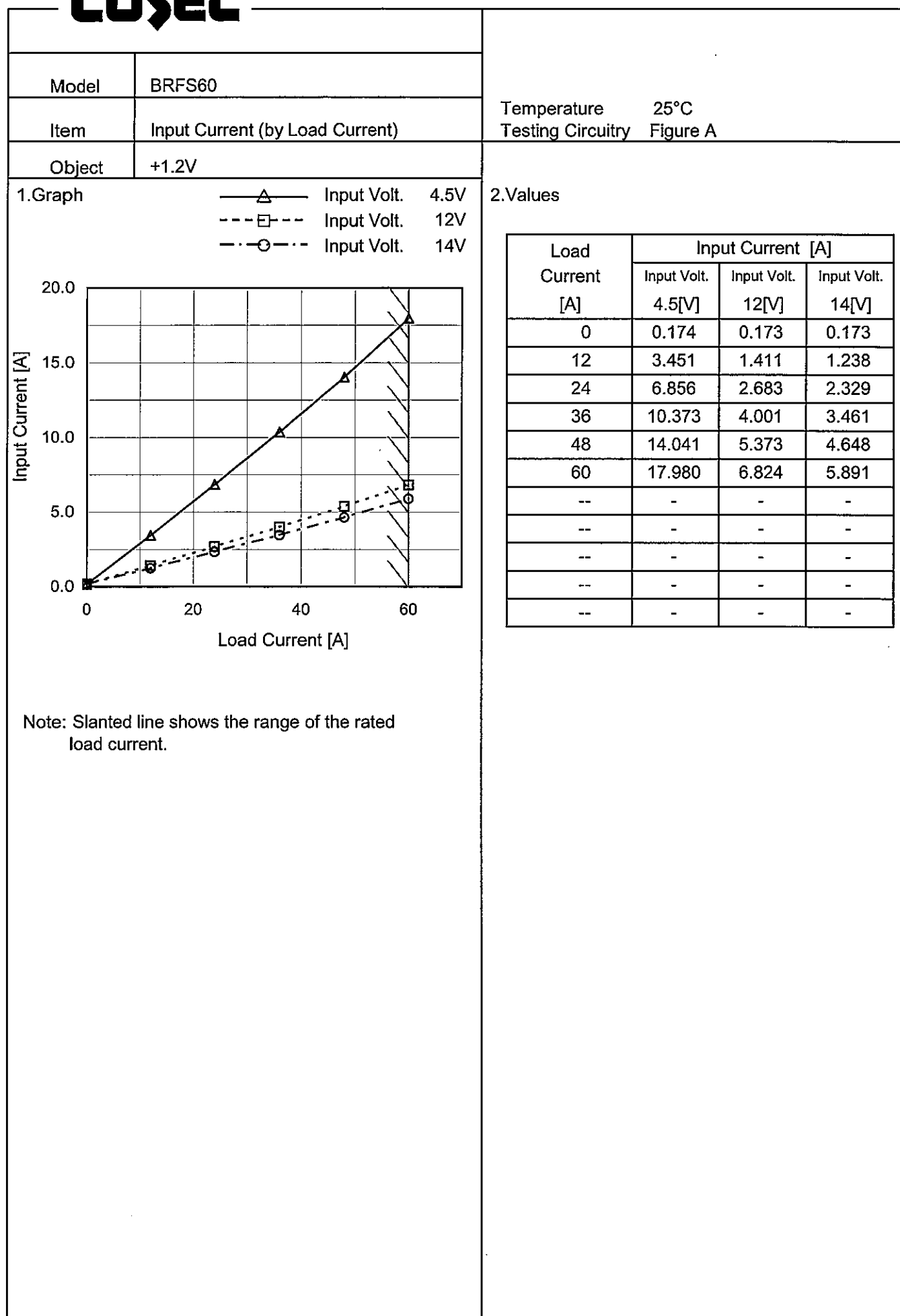


Note: Slanted line shows the range of the rated input voltage.

2. Values

Input Voltage [V]	Input Current [A]		
	Load 0%	Load 50%	Load 100%
0.0	0.000	0.000	0.000
2.0	0.001	0.001	0.000
4.0	0.034	0.035	0.035
4.5	0.174	8.750	17.980
5.0	0.177	7.853	16.115
5.2	0.178	7.546	15.466
5.4	0.178	7.266	14.884
6.0	0.176	6.547	13.379
8.0	0.173	4.942	10.163
10.0	0.172	3.977	8.147
12.0	0.173	3.344	6.824
14.0	0.173	2.893	5.891
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Model		BRFS60																																																				
Item		Input Power (by Load Current)																																																				
Object		+1.2V																																																				
1.Graph		2.Values																																																				
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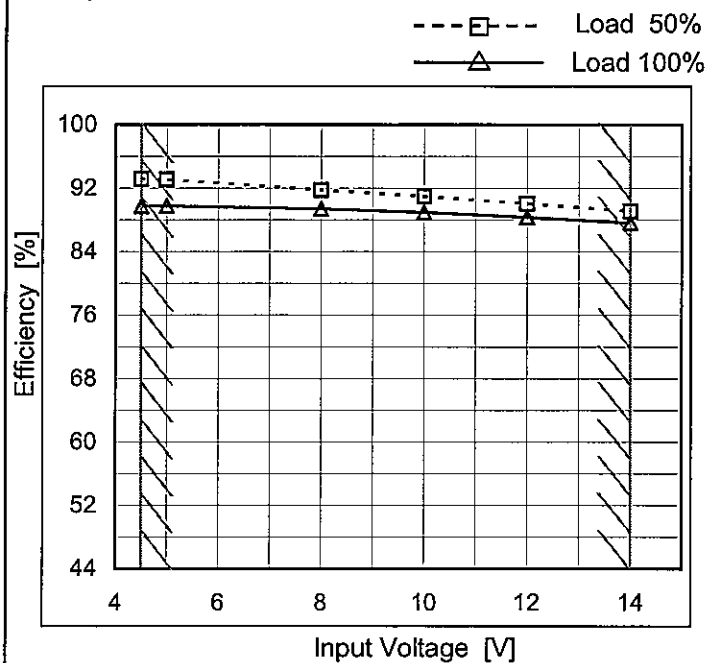
Model BRFS60

Item Efficiency (by Input Voltage)

Object +1.2V

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]	Efficiency [%]	
	Load 50%	Load 100%
4.5	93.1	89.8
5.0	93.1	89.8
8.0	91.8	89.4
10.0	90.9	89.0
12.0	90.0	88.4
14.0	89.1	87.6
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--	-	-
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<div><div><div>—△—</div><div>Input Volt.</div><div>4.5V</div></div><div><div>---□---</div><div>Input Volt.</div><div>12V</div></div><div><div>---○---</div><div>Input Volt.</div><div>14V</div></div></div> <div><div>Efficiency [%]</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</div><div>20</div><div>40</div><div>60</div></div> <div><div>Load Current [A]</div></div>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Efficiency [%]</th></tr><tr><th>Input Volt. 4.5[V]</th><th>Input Volt. 12[V]</th><th>Input Volt. 14[V]</th></tr><tr><td>0</td><td>-</td><td>-</td><td>-</td></tr><tr><td>12</td><td>92.7</td><td>85.0</td><td>83.0</td></tr><tr><td>24</td><td>93.6</td><td>89.5</td><td>88.4</td></tr><tr><td>36</td><td>92.7</td><td>90.0</td><td>89.2</td></tr><tr><td>48</td><td>91.4</td><td>89.4</td><td>88.5</td></tr><tr><td>60</td><td>89.8</td><td>88.4</td><td>87.6</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>		Load Current [A]	Efficiency [%]			Input Volt. 4.5[V]	Input Volt. 12[V]	Input Volt. 14[V]	0	-	-	-	12	92.7	85.0	83.0	24	93.6	89.5	88.4	36	92.7	90.0	89.2	48	91.4	89.4	88.5	60	89.8	88.4	87.6	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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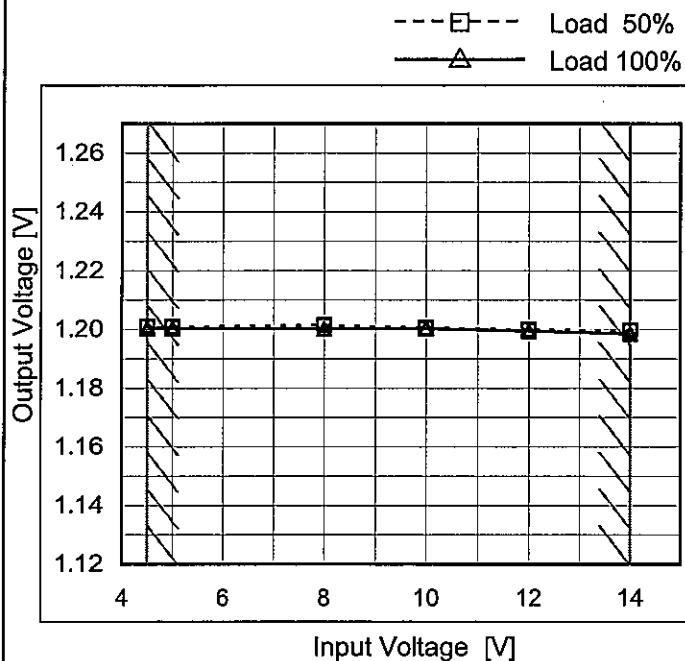
Model BRFS60

Item Line Regulation

Object +1.2V60A

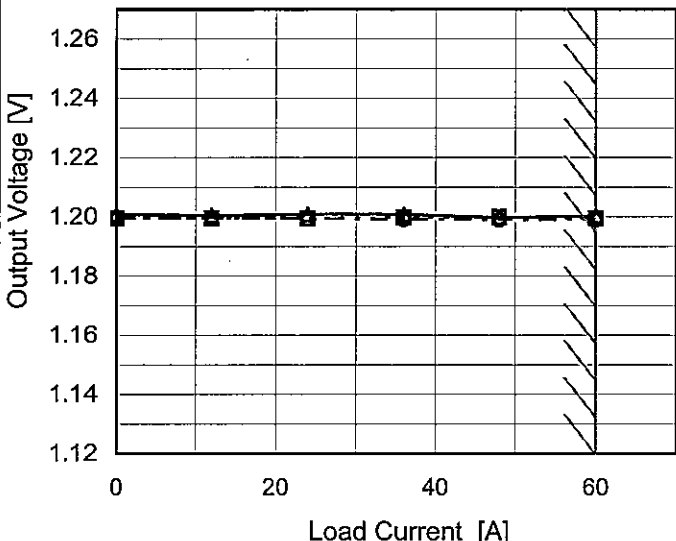
Temperature 25°C
Testing Circuitry Figure A

1. Graph



2. Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
4.5	1.201	1.200
5.0	1.201	1.200
8.0	1.201	1.200
10.0	1.201	1.200
12.0	1.200	1.200
14.0	1.200	1.199
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--	-	-
--	-	-

Model		BRFS60																																																				
Item		Load Regulation																																																				
Object		+1.2V60A																																																				
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<div><div><div><div>—△—</div><div>Input Volt.</div><div>4.5V</div></div><div><div>---□---</div><div>Input Volt.</div><div>12V</div></div><div><div>---○---</div><div>Input Volt.</div><div>14V</div></div></div><p>Note: Slanted line shows the range of the rated load current.</p></div>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 4.5[V]</th><th>Input Volt. 12[V]</th><th>Input Volt. 14[V]</th></tr><tr><td>0</td><td>1.201</td><td>1.200</td><td>1.200</td></tr><tr><td>12</td><td>1.201</td><td>1.200</td><td>1.200</td></tr><tr><td>24</td><td>1.201</td><td>1.200</td><td>1.199</td></tr><tr><td>36</td><td>1.201</td><td>1.200</td><td>1.199</td></tr><tr><td>48</td><td>1.200</td><td>1.200</td><td>1.199</td></tr><tr><td>60</td><td>1.200</td><td>1.200</td><td>1.199</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>		Load Current [A]	Output Voltage [V]			Input Volt. 4.5[V]	Input Volt. 12[V]	Input Volt. 14[V]	0	1.201	1.200	1.200	12	1.201	1.200	1.200	24	1.201	1.200	1.199	36	1.201	1.200	1.199	48	1.200	1.200	1.199	60	1.200	1.200	1.199	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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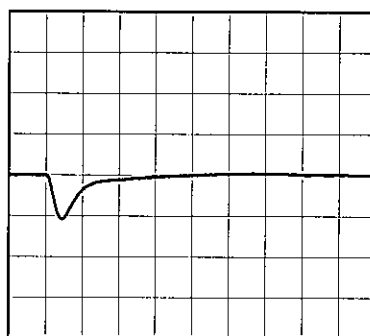
Model	BRFS60	Temperature	25°C
Item	Dynamic Load Response	Testing Circuitry	Figure B
Object	+1.2V60A		

Input Volt. 12 V
Cycle 5 ms

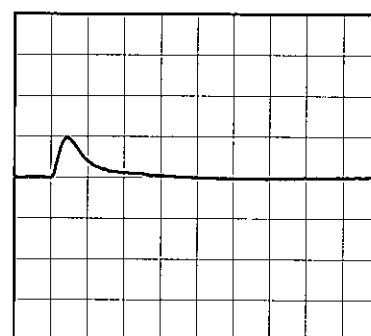


Min. Load (0A) \longleftrightarrow
Load 100% (60A)

100mV/div



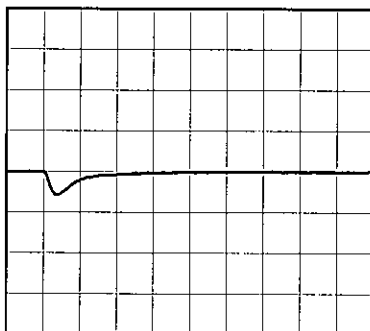
100 μs /div



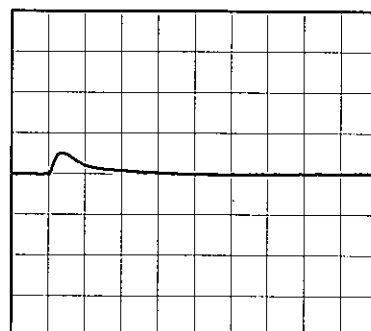
100 μs /div

Min. Load (0A) \longleftrightarrow
Load 50% (30A)

100mV/div



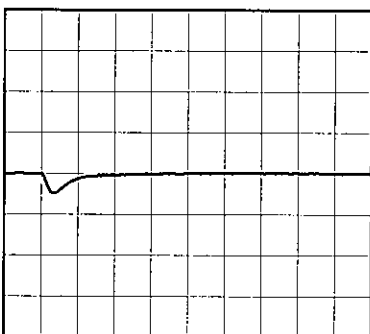
100 μs /div



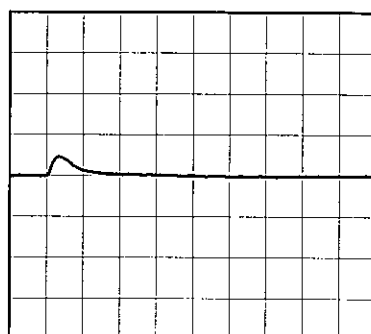
100 μs /div

Load 50% (30A) \longleftrightarrow
Load 100% (60A)

100mV/div



100 μs /div



100 μs /div

Model		BRFS60	
Item		Ripple Voltage (by Load Current)	
Object		+1.2V60A	
1.Graph		2.Values	

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Model	BRFS60	Temperature25°C Testing CircuitryFigure C																																							
Item	Ripple-Noise																																								
Object	+1.2V60A																																								
1.Graph		2.Values																																							
<div><div><div>—△—</div><div>Input Volt.5V</div></div><div><div>- - ○ - -</div><div>Input Volt.12V</div></div></div> <p>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.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple-Noise [mV]</th></tr><tr><th>Input Volt. 5 [V]</th><th>Input Volt. 12 [V]</th></tr><tr><td>0</td><td>9</td><td>13</td></tr><tr><td>12</td><td>10</td><td>15</td></tr><tr><td>24</td><td>10</td><td>17</td></tr><tr><td>36</td><td>12</td><td>17</td></tr><tr><td>48</td><td>12</td><td>17</td></tr><tr><td>60</td><td>18</td><td>20</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-Noise [mV]		Input Volt. 5 [V]	Input Volt. 12 [V]	0	9	13	12	10	15	24	10	17	36	12	17	48	12	17	60	18	20	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
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<p>Fig.Complex Ripple Noise Wave Form</p>																																									

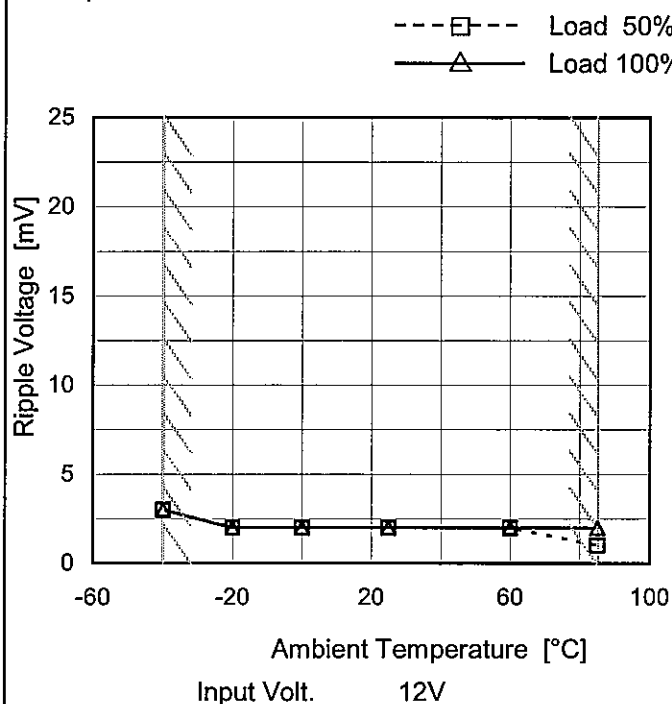
Model BRFS60

Item Ripple Voltage (by Ambient Temp.)

Object +1.2V60A

Testing Circuitry Figure C

1.Graph



Measured by 20 MHz Oscilloscope.

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

Ripple [mVp-p]

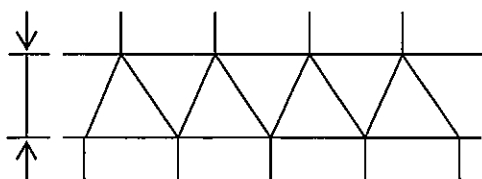


Fig.Complex Ripple Wave Form

2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Load 50%	Load 100%
-40	3.0	3.0
-20	2.0	2.0
0	2.0	2.0
25	2.0	2.0
60	2.0	2.0
85	1.0	2.0
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Model		BRFS60																																																				
Item		Ambient Temperature Drift																																																				
Object		+1.2V60A																																																				
1.Graph		2.Values																																																				
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		Testing Circuitry Figure A
Model	BRFS60	
Item	Output Voltage Accuracy	
Object	+1.2V60A	

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 : 4.5 - 14V

Load Current : 0 - 60A

* 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	-40	4.5	60	1.203	±3	±0.3
Minimum Voltage	85	14	60	1.197		

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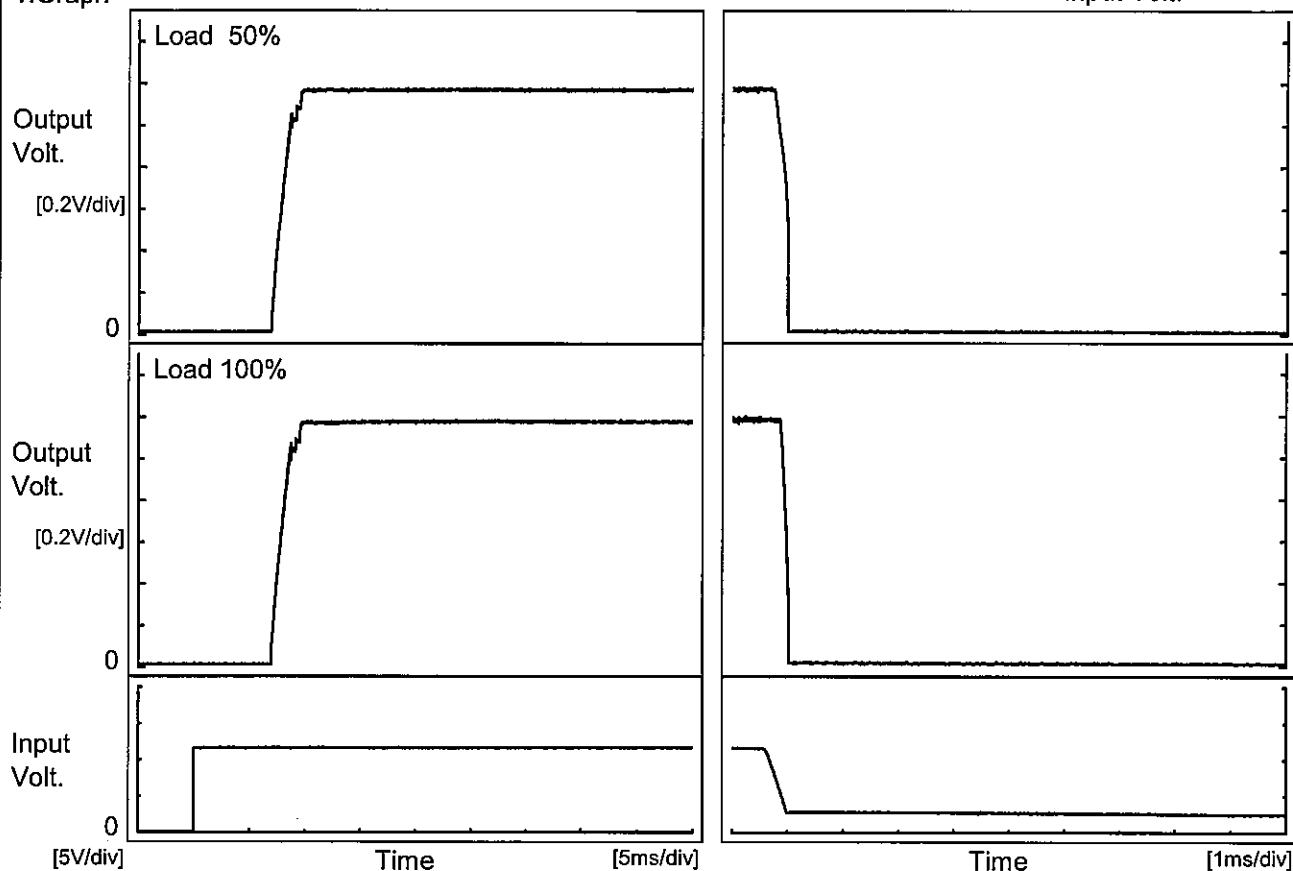
Model	BRFS60		
Item	Time Lapse Drift	Temperature	25°C
Object	+1.2V60A	Testing Circuitry	Figure A
1.Graph		2.Values	
<div><div><div>Output Voltage [V]</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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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COSEL

Model	BRFS60	Temperature 25°C Testing Circuitry Figure A
Item	Rise and Fall Time	
Object	+1.2V60A	

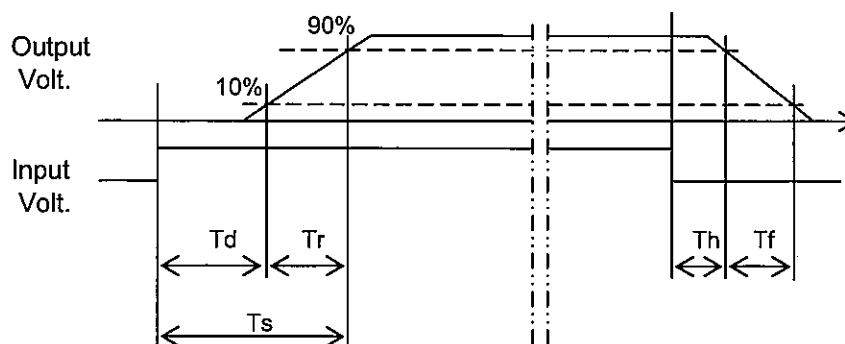
1.Graph

Input Volt. 12 V



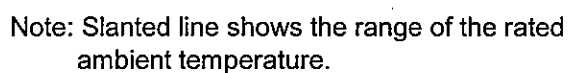
2.Values

		[ms]				
Load	Time	Td	Tr	Ts	Th	Tf
50 %		7.1	2.1	9.2	0.1	0.3
100 %		7.1	2.1	9.2	0.1	0.3



Testing Circuitry Figure A

2.Values



Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-40	4.03	4.05
-20	4.04	4.05
0	4.04	4.05
25	4.04	4.05
60	4.05	4.05
85	4.05	4.05
--	-	-
--	-	-
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COSEL

Model	BRFS60																																																																	
Item	Overcurrent Protection	Temperature	25°C																																																															
Object	+1.2V60A	Testing Circuitry	Figure A																																																															
1.Graph		2.Values																																																																
<div><div><div></div><div>△</div><div>Input Volt. 4.5V</div></div><div><div></div><div>□</div><div>Input Volt. 12V</div></div><div><div></div><div>○</div><div>Input Volt. 14V</div></div></div> <p>Note: Slanted line shows the range of the rated load current.</p> <p>Intermittent operation occurs when overcurrent protection is activated.</p>		<table><tr><th rowspan="2">Output Voltage [V]</th><th colspan="3">Load Current [A]</th></tr><tr><th>Input Volt. 4.5[V]</th><th>Input Volt. 12[V]</th><th>Input Volt. 14[V]</th></tr><tr><td>1.2</td><td>69.65</td><td>70.24</td><td>70.23</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><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><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Output Voltage [V]	Load Current [A]			Input Volt. 4.5[V]	Input Volt. 12[V]	Input Volt. 14[V]	1.2	69.65	70.24	70.23	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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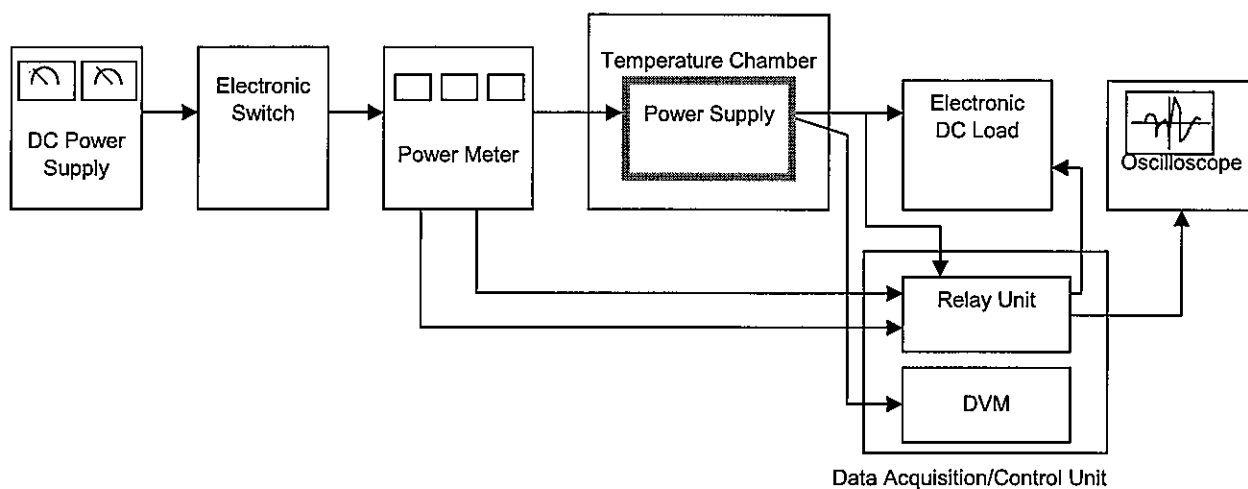


Figure A

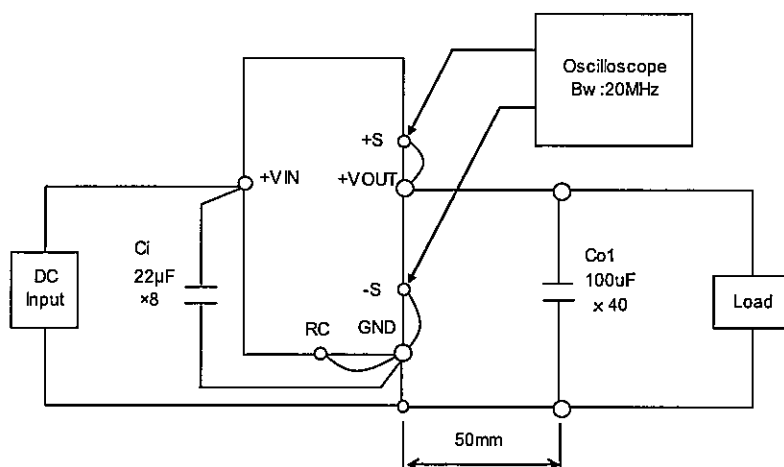


Figure B

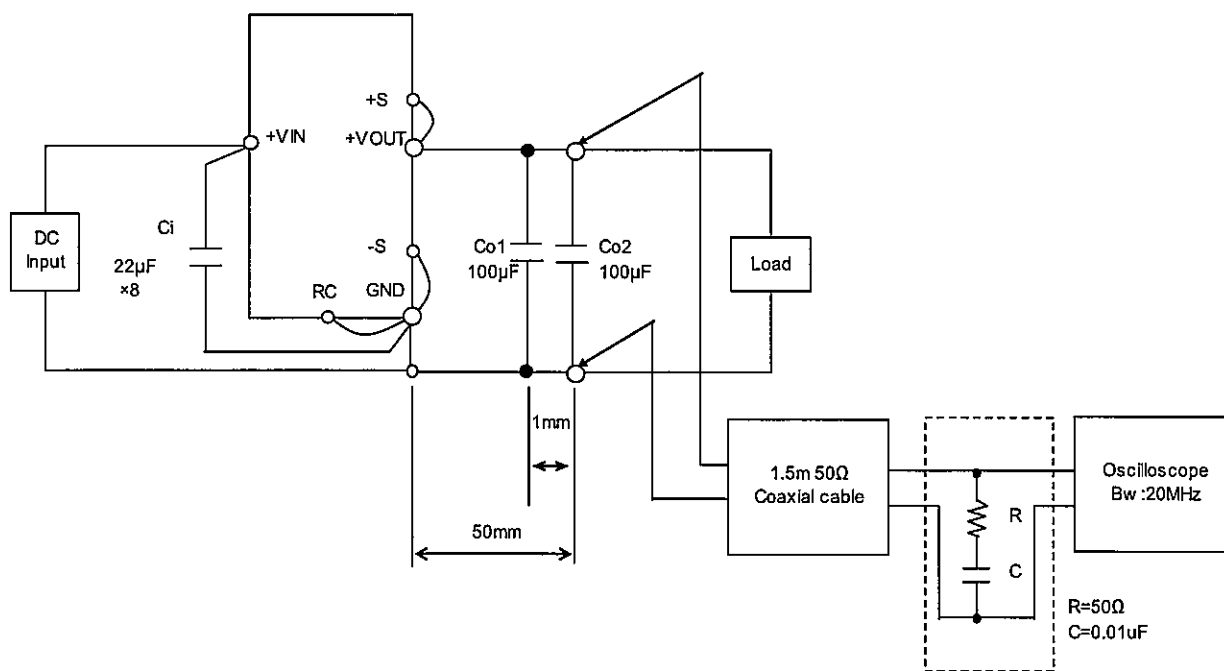


Figure C