参考資料

TEST DATA OF MGFW402415

Regulated DC Power Supply
November 29, 2018

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Design Engineer

COSEL CO.,LTD.

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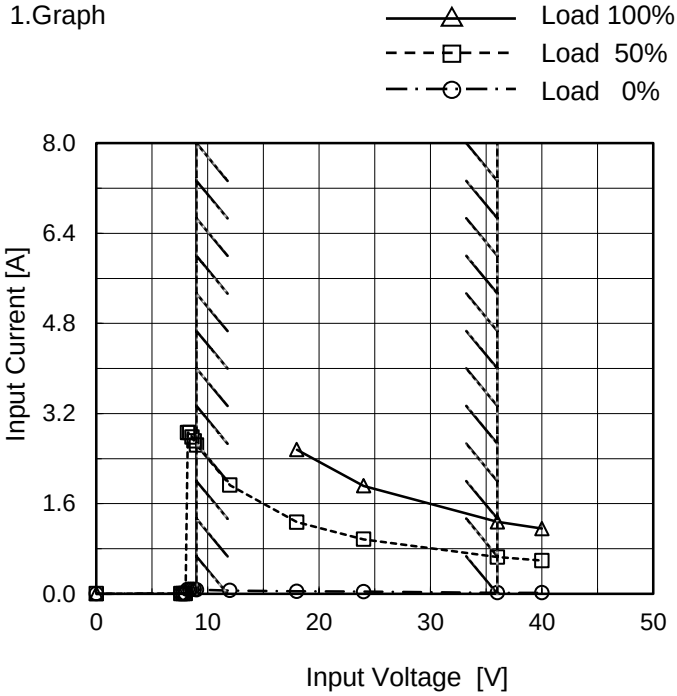
Model	MGFW402415
Item	Input Current (by Input Voltage)
Object	————————

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
7.6	0.004	0.004	- ※
7.8	0.004	0.004	- ※
8.0	0.004	0.004	- ※
8.2	0.078	2.862	- ※
8.4	0.075	2.861	- ※
8.6	0.075	2.783	- ※
8.8	0.073	2.711	- ※
9.0	0.072	2.641	- ※
12.0	0.057	1.929	- ※
18.0	0.043	1.272	2.557
24.0	0.036	0.968	1.915
36.0	0.019	0.651	1.277
40.0	0.018	0.589	1.156
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

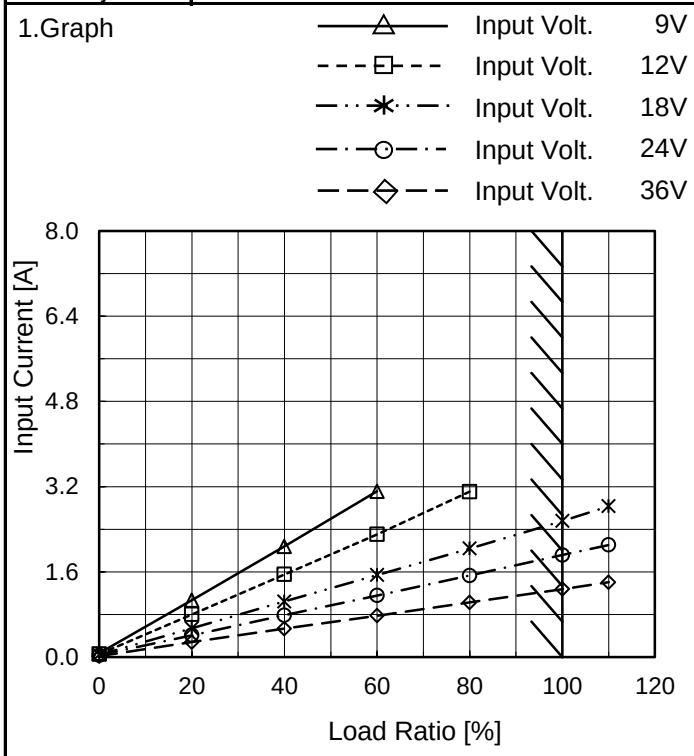
※During this area, overcurrent protection activates and power supply operates in hiccup mode.

COSEL

Model	MGFW402415
Item	Input Current (by Load Current)
Object	――――――

Temperature 25°C
Testing Circuitry Figure A

1.Graph



2.Values

Load Ratio [%]	Input Current [A]				
	Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
0	0.072	0.057	0.043	0.036	0.019
20	1.070	0.802	0.540	0.410	0.281
40	2.080	1.552	1.044	0.788	0.533
60	3.111	2.304	1.540	1.156	0.777
80	- ※1	3.106	2.038	1.532	1.026
100	- ※1	- ※2	2.557	1.915	1.277
110	- ※1	- ※2	2.832	2.104	1.406
--			-	-	-
--			-	-	-
--	-	-	-	-	-
--	-	-	-	-	-

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

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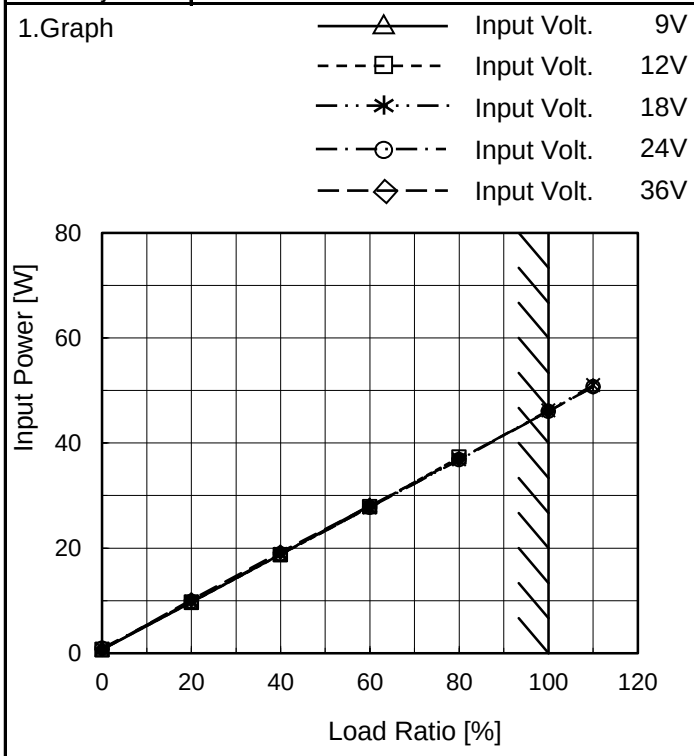
Model	MGFW402415
Item	Input Power (by Load Current)
Object	――――――

Temperature 25°C
Testing Circuitry Figure A

1.Graph



2.Values

Load Ratio [%]	Input Power [W]				
	Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
0	0.66	0.70	0.78	0.93	0.68
20	9.67	9.70	9.77	9.85	10.16
40	18.79	18.74	18.82	18.91	19.23
60	28.15	27.86	27.72	27.77	28.03
80	- ※1	37.28	36.86	36.79	36.97
100	- ※1	- ※2	46.21	46.02	46.06
110	- ※1	- ※2	51.00	50.69	50.67
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

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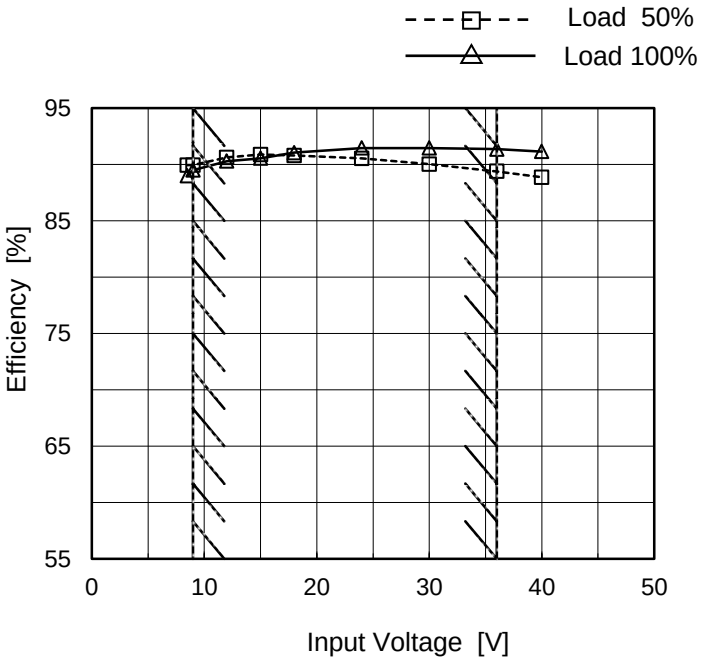
Model	MGFW402415
Item	Efficiency (by Input Voltage)
Object	――――――――――

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%
8.5	89.9	89.0 ※1
9.0	90.0	89.5 ※1
12.0	90.6	90.3 ※2
15.0	90.9	90.6
18.0	90.8	91.1
24.0	90.5	91.5
30.0	90.0	91.5
36.0	89.4	91.4
40.0	88.9	91.1

※1:Load 70%
※2:Load 80%

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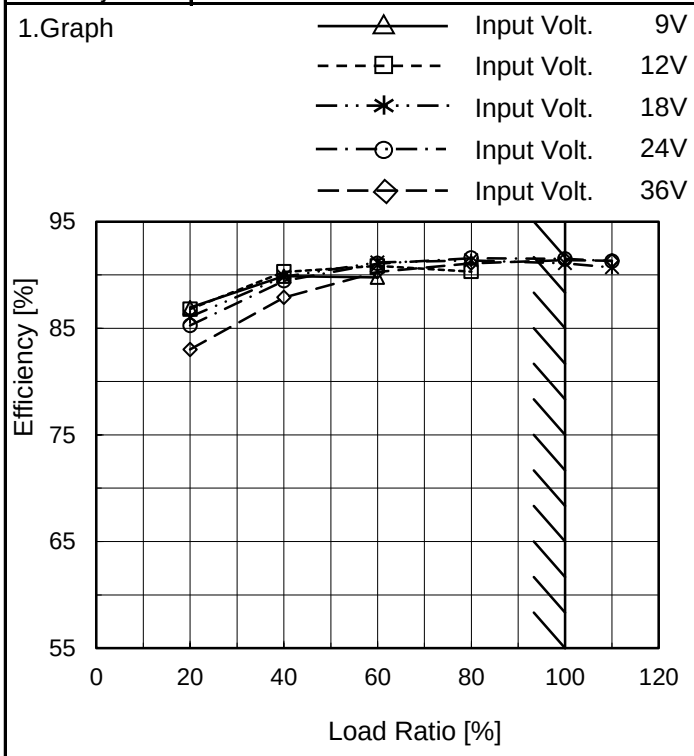
Model	MGFW402415
Item	Efficiency (by Load Current)
Object	――――――

Temperature 25°C
Testing Circuitry Figure A

1.Graph



2.Values

Load Ratio [%]	Efficiency [%]				
	Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
0	-	-	-	-	-
20	86.9	86.8	86.1	85.3	83.0
40	89.9	90.3	89.8	89.4	87.9
60	89.8	90.8	91.2	91.1	90.3
80	- ※1	90.3	91.4	91.6	91.1
100	- ※1	- ※2	91.1	91.5	91.4
110	- ※1	- ※2	90.7	91.3	91.3
--			-	-	-
--			-	-	-
--	-	-	-	-	-
--	-	-	-	-	-

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

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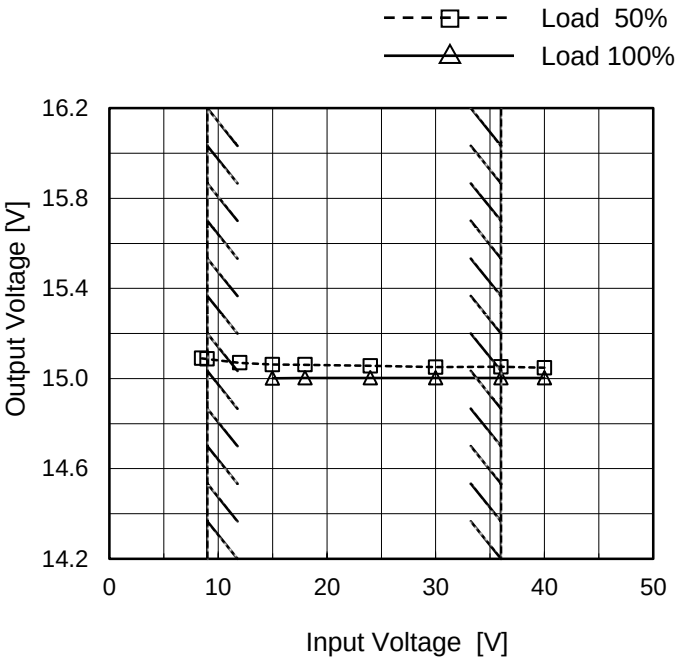
Model	MGFW402415
Item	Line Regulation
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure A

1.Graph



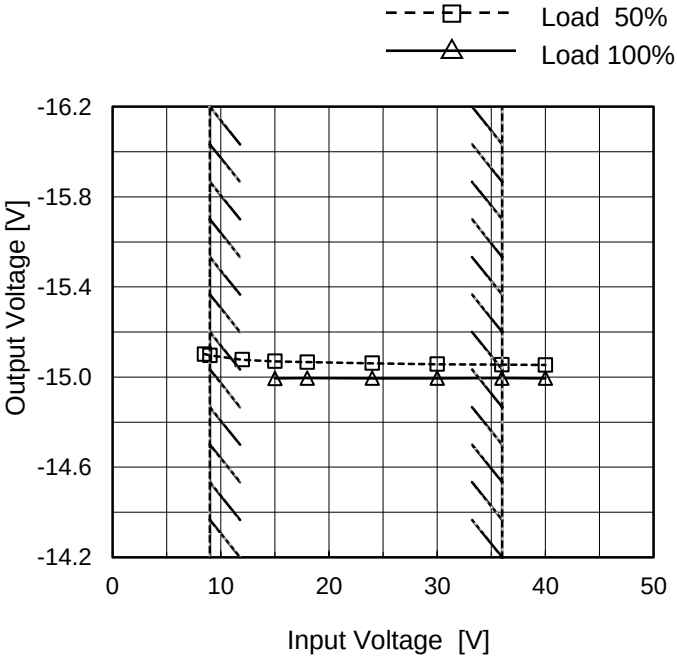
2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
8.5	15.090	- ※1
9.0	15.087	- ※1
12.0	15.070	- ※2
15.0	15.062	15.002
18.0	15.061	15.003
24.0	15.056	15.003
30.0	15.051	15.003
36.0	15.052	15.003
40.0	15.048	15.003

-15V: Rated Load Current

Object	-15V1.4A

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%
8.5	-15.102	- ※1
9.0	-15.096	- ※1
12.0	-15.077	- ※2
15.0	-15.070	-14.994
18.0	-15.066	-14.995
24.0	-15.061	-14.995
30.0	-15.057	-14.995
36.0	-15.055	-14.995
40.0	-15.054	-14.995

+15V: Rated Load Current

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

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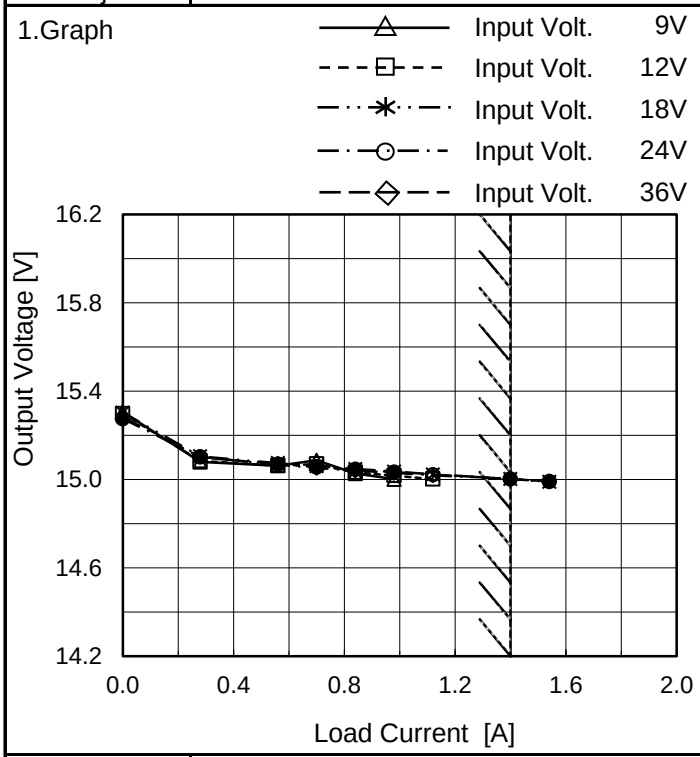
Model	MGFW402415
Item	Load Regulation
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure A

1.Graph



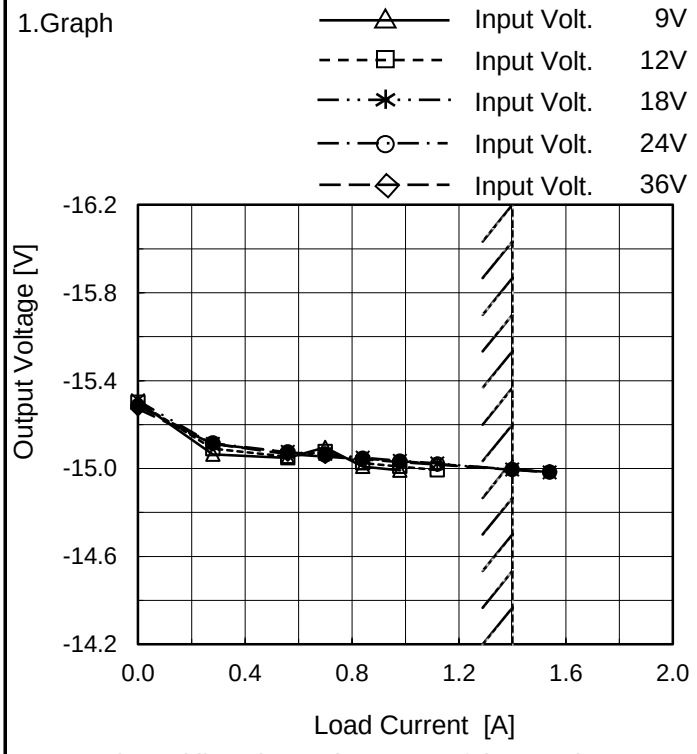
2.Values

Load Current [A]	Output Voltage [V] Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
0.00	15.306	15.298	15.303	15.275	15.281
0.28	15.079	15.085	15.105	15.102	15.102
0.56	15.063	15.063	15.075	15.068	15.067
0.70	15.087	15.070	15.061	15.056	15.052
0.84	15.027	15.032	15.048	15.045	15.040
0.98	15.001	15.018	15.036	15.033	15.030
1.12	- ※1	15.002	15.023	15.022	15.019
1.40	- ※1	- ※2	15.003	15.003	15.003
1.54	- ※1	- ※2	14.989	14.990	14.991
--	-	-	-	-	-
--	-	-	-	-	-

-15V: Rated Load Current

Object	-15V1.4A

1.Graph



Note: Slanted line shows the range of the rated load current.

2.Values

Load Current [A]	Output Voltage [V] Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
0.00	-15.303	-15.301	-15.310	-15.284	-15.272
0.28	-15.065	-15.090	-15.111	-15.116	-15.112
0.56	-15.049	-15.054	-15.075	-15.075	-15.065
0.70	-15.096	-15.077	-15.066	-15.061	-15.055
0.84	-15.010	-15.025	-15.049	-15.046	-15.042
0.98	-14.992	-15.009	-15.035	-15.033	-15.030
1.12	- ※1	-14.993	-15.023	-15.021	-15.018
1.40	- ※1	- ※2	-14.995	-14.995	-14.995
1.54	- ※1	- ※2	-14.982	-14.984	-14.984
--	-	-	-	-	-
--	-	-	-	-	-

+15V: Rated Load Current

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

COSEL

Model	MGFW402415
Item	Dynamic Load Response
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure A

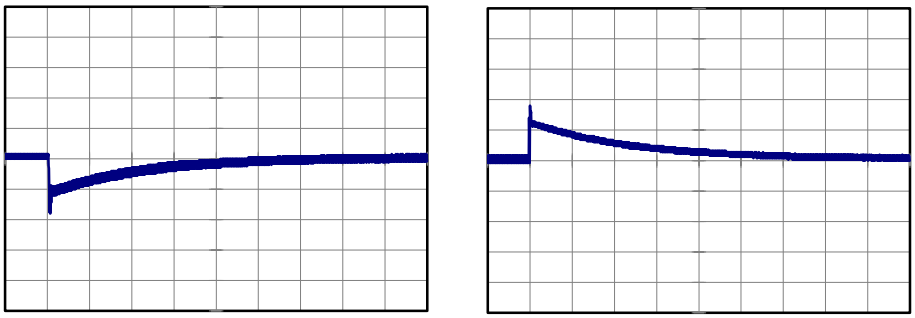
Input Volt. 24 V
-15V:rated load current.
Cycle 100 ms

t1,t2 = 100 μs

Load Current

t1 t2

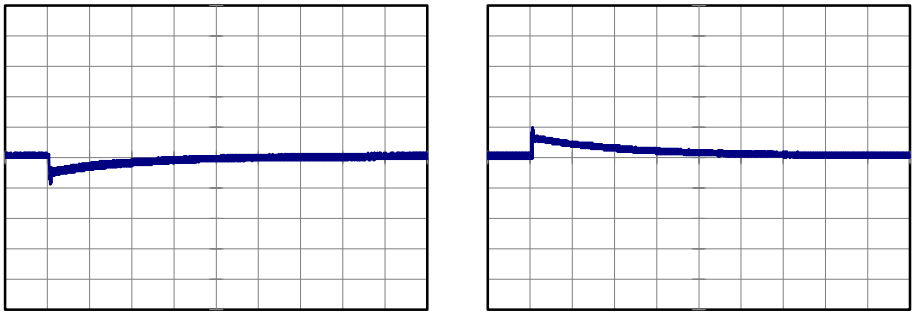
Min.Load (0A)←→
Load 100% (1.4A)



200 mV/div

2 ms/div 2 ms/div

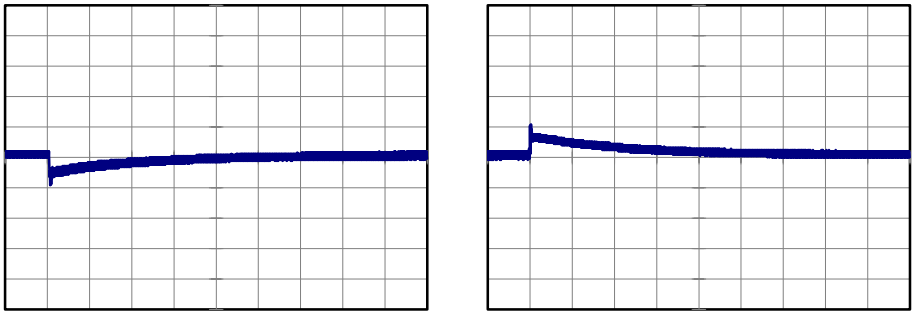
Min.Load (0A)←→
Load 50% (0.7A)



200 mV/div

2 ms/div 2 ms/div

Load 50% (0.7A)←→
Load 100% (1.4A)



200 mV/div

2 ms/div 2 ms/div

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Model	MGFW402415	
Item	Dynamic Load Response	Temperature 25°C Testing Circuitry Figure A
Object	-15V1.4A	

Input Volt. 24 V

+15V:rated load current.

Cycle 100 ms

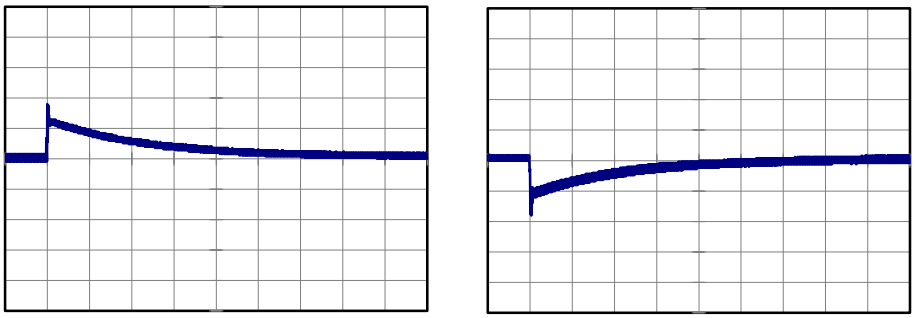
t1,t2 = 100 μs

Load Current

t1

t2

Min.Load (0A)←→
Load 100% (1.4A)

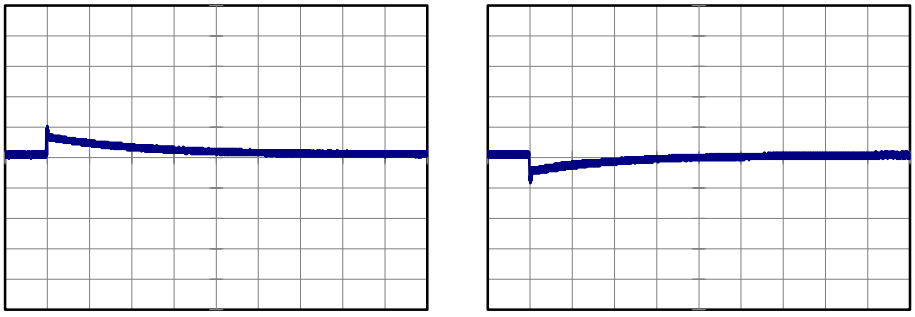


200 mV/div

2 ms/div

2 ms/div

Min.Load (0A)←→
Load 50% (0.7A)

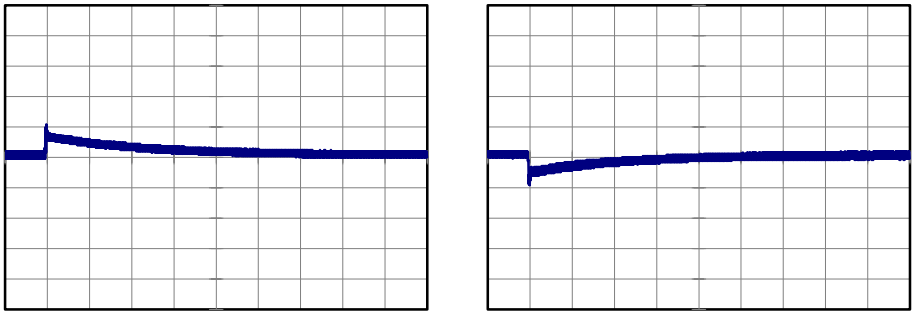


200 mV/div

2 ms/div

2 ms/div

Load 50% (0.7A)←→
Load 100% (1.4A)



200 mV/div

2 ms/div

2 ms/div

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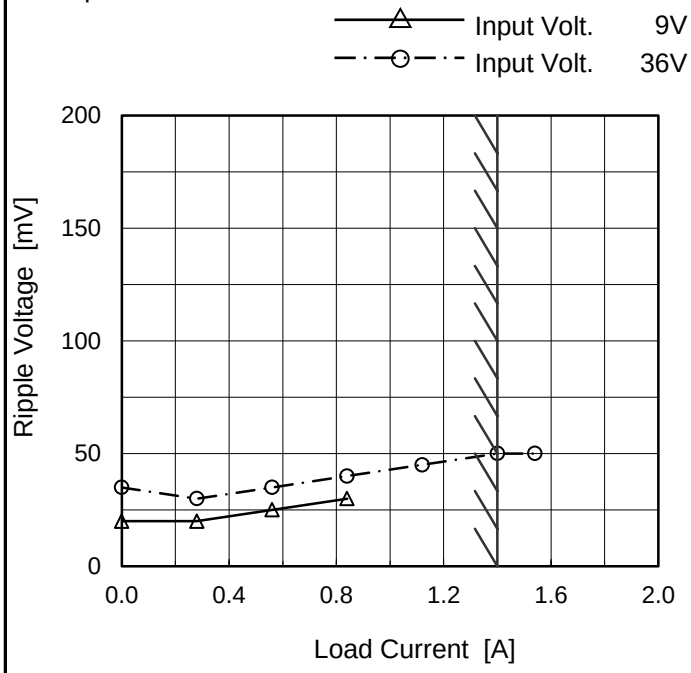
Model	MGFW402415
Item	Ripple Voltage (by Load Current)
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure B

1.Graph



Measured by 100 MHz Oscilloscope.
Ripple Voltage is shown as p-p in the figure below.
Note: Slanted line shows the range of the rated load current.

Ripple [mVp-p]

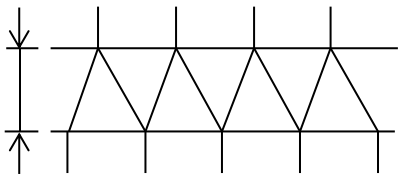


Fig.Complex Ripple Wave Form

2.Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 9 [V]	Input Volt. 36 [V]
0.00	20	35
0.28	20	30
0.56	25	35
0.84	30	40
1.12	- ※	45
1.40	- ※	50
1.54	- ※	50
--	-	-
--	-	-
--	-	-
--	-	-

-15V: Rated Load Current

※ Maximum output current at minimum input Voltage is 70% of rated load current. Refer to instruction manuals for details of input derating.

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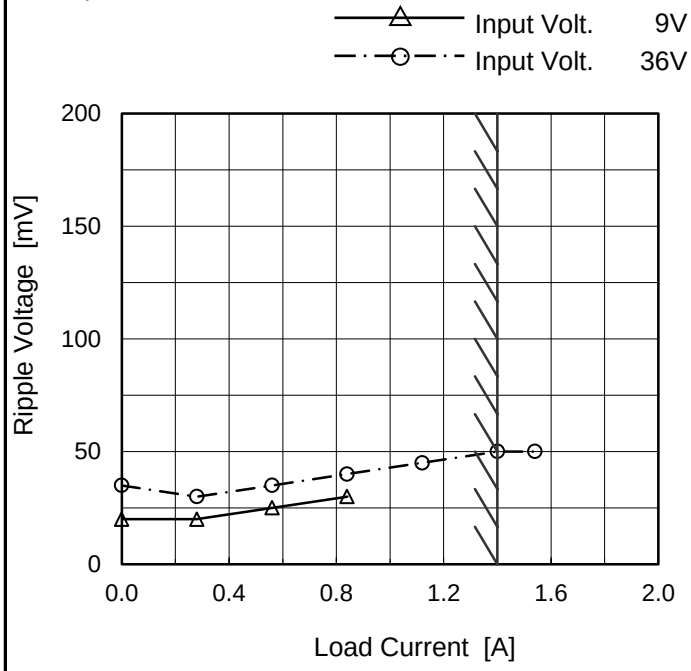
Model	MGFW402415
Item	Ripple Voltage (by Load Current)
Object	-15V1.4A

Temperature 25°C
Testing Circuitry Figure B

1.Graph



Measured by 100 MHz Oscilloscope.
Ripple Voltage is shown as p-p in the figure below.
Note: Slanted line shows the range of the rated load current.

Ripple [mVp-p]

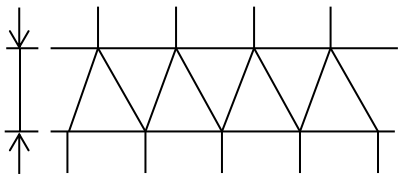


Fig.Complex Ripple Wave Form

2.Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 9 [V]	Input Volt. 36 [V]
0.00	20	35
0.28	20	30
0.56	25	35
0.84	30	40
1.12	- ※	45
1.40	- ※	50
1.54	- ※	50
--	-	-
--	-	-
--	-	-
--	-	-

+15V: Rated Load Current

※ Maximum output current at minimum input Voltage is 70% of rated load current. Refer to instruction manuals for details of input derating.

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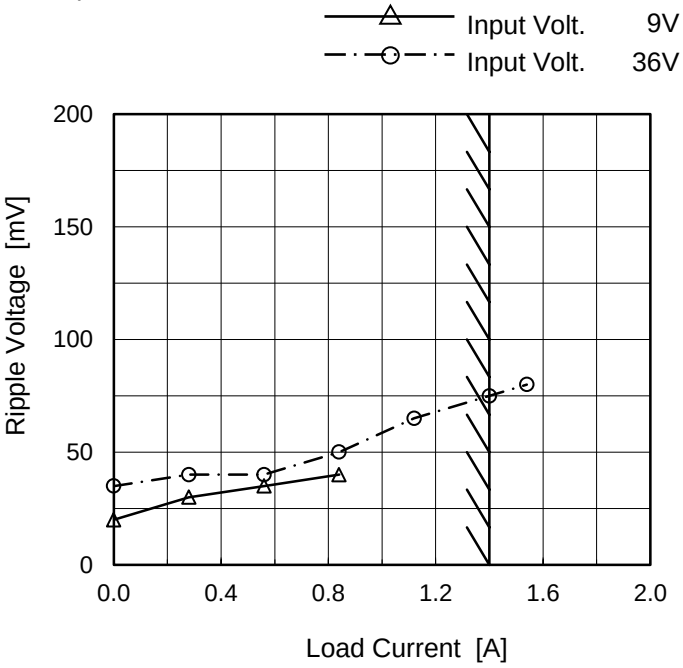
Model	MGFW402415
Item	Ripple-Noise
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure B

1.Graph



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.

Ripple Noise[mVp-p]

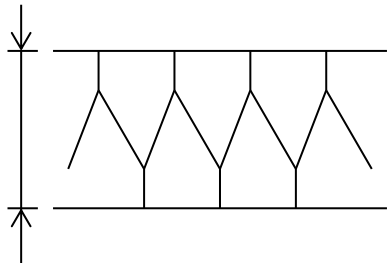


Fig.Complex Ripple Noise Wave Form

2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 9 [V]	Input Volt. 36 [V]
0.00	20	35
0.28	30	40
0.56	35	40
0.84	40	50
1.12	- ※	65
1.40	- ※	75
1.54	- ※	80
--	-	-
--	-	-
--	-	-
--	-	-

-15V: Rated Load Current

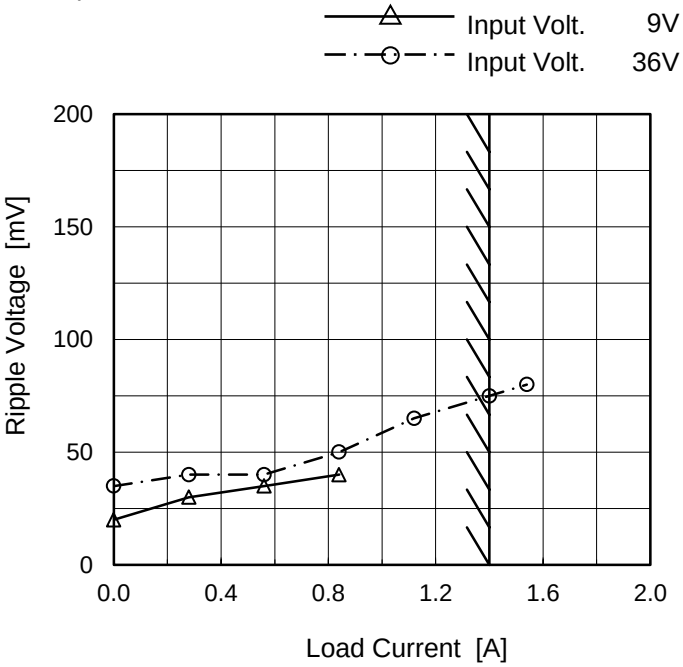
※ Maximum output current at minimum input Voltage is 70% of rated load current. Refer to instruction manuals for details of input derating.

COSEL

Model	MGFW402415
Item	Ripple-Noise
Object	-15V1.4A

Temperature 25°C
Testing Circuitry Figure B

1.Graph



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.

Ripple Noise[mVp-p]

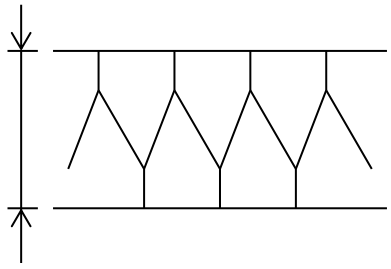


Fig.Complex Ripple Noise Wave Form

2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 9 [V]	Input Volt. 36 [V]
0.00	20	35
0.28	30	40
0.56	35	40
0.84	40	50
1.12	- ※	65
1.40	- ※	75
1.54	- ※	80
--	-	-
--	-	-
--	-	-
--	-	-

+15V: Rated Load Current

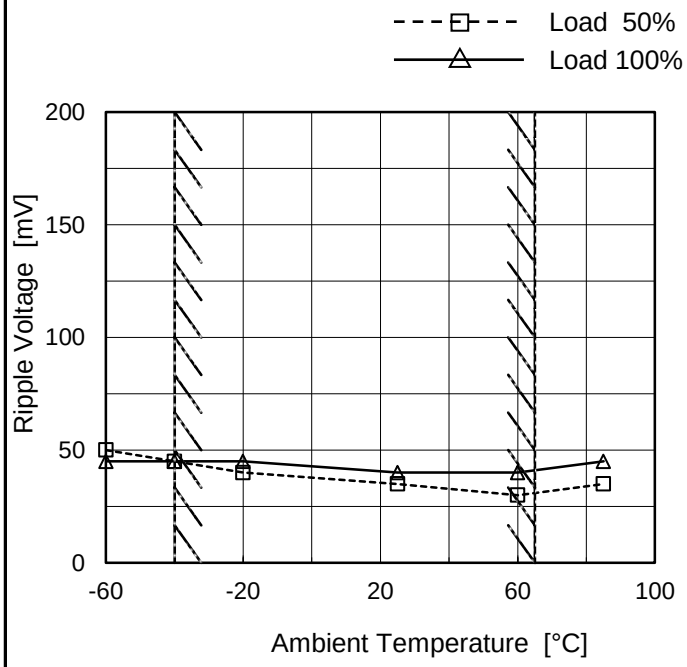
※ Maximum output current at minimum input Voltage is 70% of rated load current. Refer to instruction manuals for details of input derating.

COSEL

Model	MGFW402415
Item	Ripple Voltage (by Ambient Temp.)
Object	+15V1.4A

Testing Circuitry Figure B

1.Graph



Input Volt. 24V

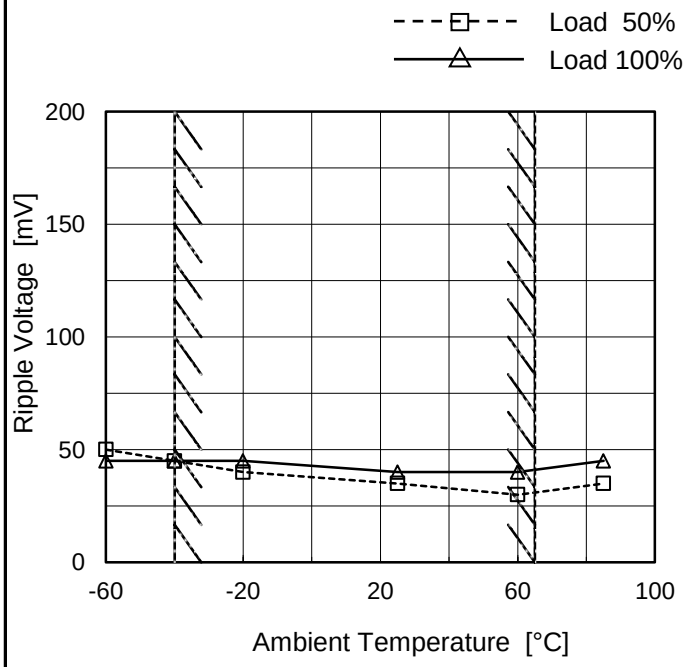
2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Load 50%	Load 100%
-60	50	45
-40	45	45
-20	40	45
25	35	40
60	30	40
85	35	45
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

-15V: Rated Load Current

Object	-15V1.4A

1.Graph



Input Volt. 24V

Measured by 100 MHz Oscilloscope.

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

2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Load 50%	Load 100%
-60	50	45
-40	45	45
-20	40	45
25	35	40
60	30	40
85	35	45
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

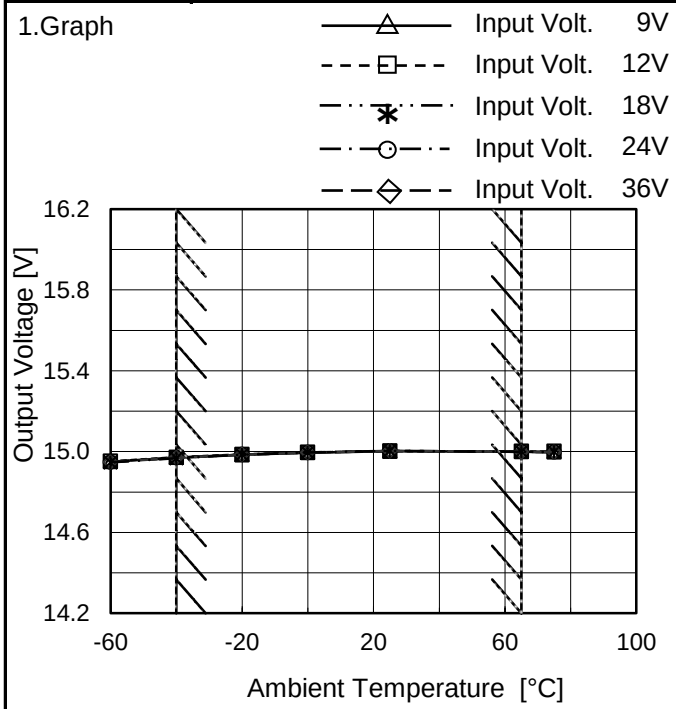
+15V: Rated Load Current

COSEL

Model	MGFW402415
Item	Ambient Temperature Drift
Object	+15V1.4A

Testing Circuitry Figure A

1.Graph



Load 100%

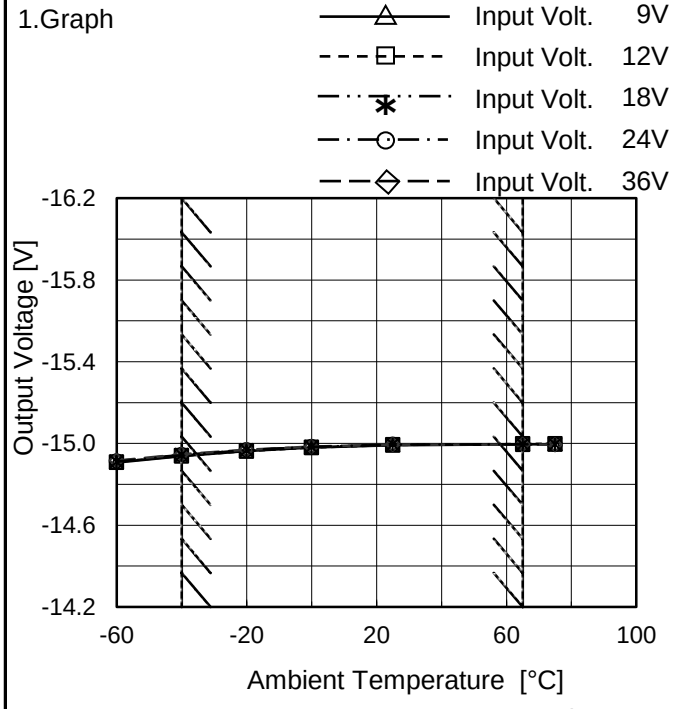
2.Values

Ambient Temperature [°C]	Output Voltage [V] Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
-60	14.950	14.952	14.946	14.948	14.948
-40	14.970	14.971	14.967	14.969	14.970
-20	14.984	14.986	14.984	14.985	14.985
0	14.995	14.996	14.995	14.995	14.995
25	15.001	15.002	15.003	15.003	15.003
65	14.999	15.001	14.999	14.999	14.999
75	14.998	15.001	14.997	14.997	14.997
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-

-15V: Rated Load Current

Object	-15V1.4A

1.Graph



Load 100%

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

2.Values

Ambient Temperature [°C]	Output Voltage [V] Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
-60	-14.907	-14.909	-14.911	-14.914	-14.917
-40	-14.938	-14.940	-14.943	-14.945	-14.947
-20	-14.963	-14.964	-14.967	-14.968	-14.970
0	-14.980	-14.981	-14.983	-14.984	-14.984
25	-14.992	-14.993	-14.995	-14.995	-14.995
65	-14.996	-14.998	-14.996	-14.996	-14.995
75	-14.997	-14.998	-14.995	-14.995	-14.994
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-
--	-	-	-	-	-

+15V: Rated Load Current

Note: In case of input Volt.9V, Load 70%.
12V, Load 80%.
Other case Load 100%.

BC-11320

Model	MGFW402415	
Item	Output Voltage Accuracy	Testing Circuitry Figure A

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 - 65°C

Input Voltage : 9 - 36V

Load Current (AVR 1) : 0 - 1.4A (AVR 2) : 0 - 1.4A

* Output Voltage Accuracy = ±(Maximum of Output Voltage - Minimum of Output Voltage) / 2

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

2.Values

Object	+15V1.4A					
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	65	9	0	15.367	±357	±2.4
Minimum Voltage	-40	18	1.4	14.653		

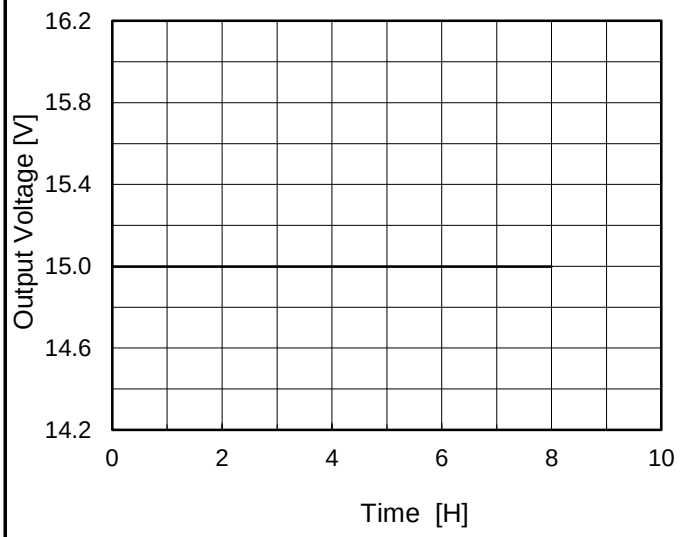
Object	-15V1.4A					
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	65	18	0	-15.325	±370	±2.5
Minimum Voltage	-40	9	1.4	-14.585		

COSEL

Model	MGFW402415
Item	Time Lapse Drift
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure A

1.Graph



Input Volt. 24V
Load 100%

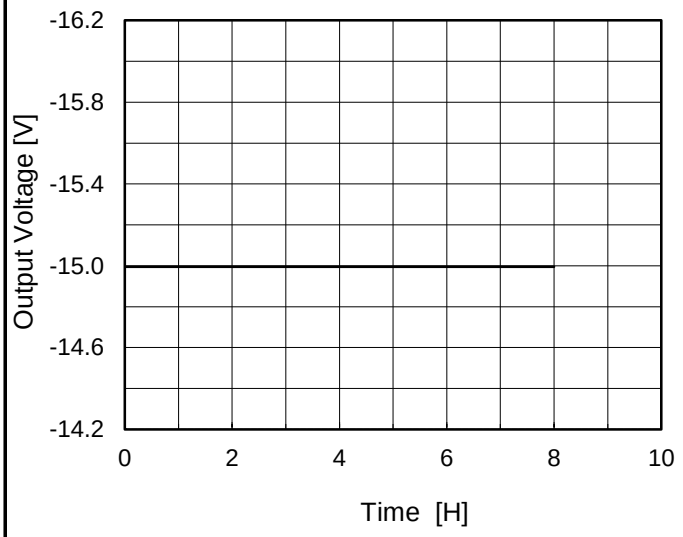
2.Values

Time since start [H]	Output Voltage [V]
0.0	15.002
0.5	14.999
1.0	14.999
2.0	14.999
3.0	14.999
4.0	14.999
5.0	14.999
6.0	14.999
7.0	14.999
8.0	14.999

-15V: Rated Load Current

Object	-15V1.4A

1.Graph



Input Volt. 24V
Load 100%

2.Values

Time since start [H]	Output Voltage [V]
0.0	-14.995
0.5	-14.996
1.0	-14.996
2.0	-14.996
3.0	-14.996
4.0	-14.996
5.0	-14.996
6.0	-14.996
7.0	-14.996
8.0	-14.996

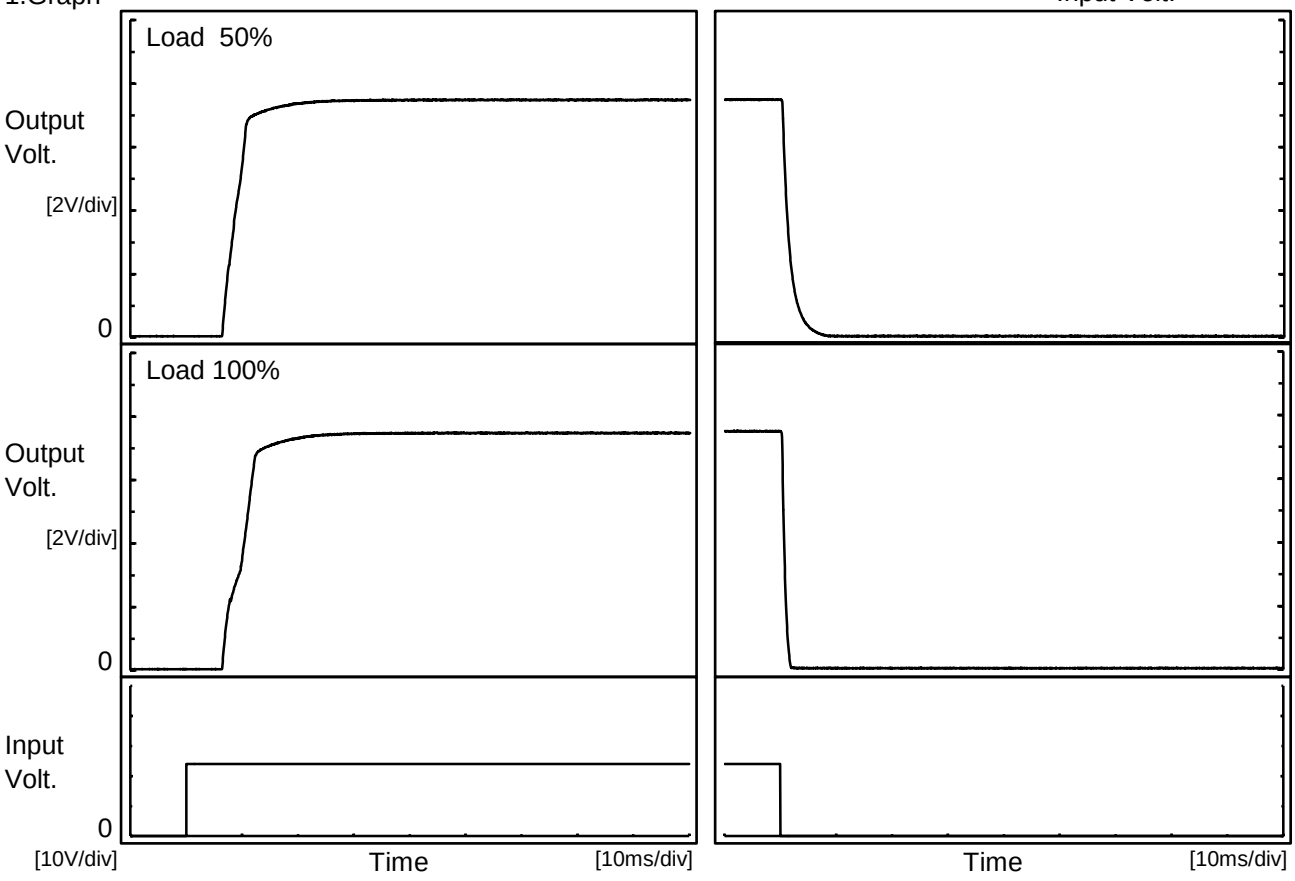
+15V: Rated Load Current

COSEL

Model	MGFW402415	
Item	Rise and Fall Time	Temperature 25°C Testing Circuitry Figure A
Object	+15V1.4A	

1.Graph

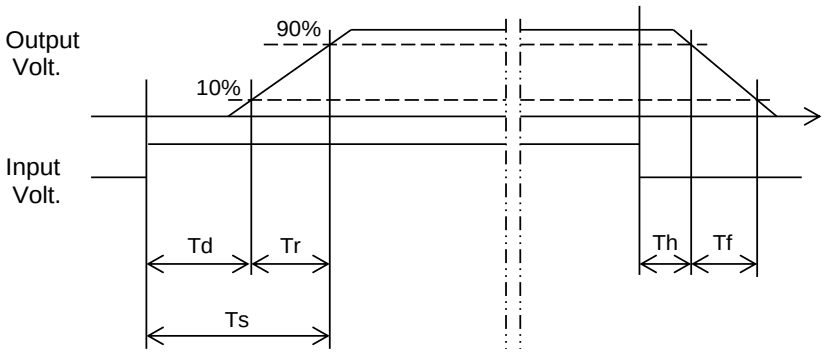
Input Volt. 24 V



2.Values

[ms]

Load \ Time	Td	Tr	Ts	Th	Tf
50 %	6.8	4.1	10.9	0.5	3.1
100 %	6.8	5.7	12.5	0.4	1.0

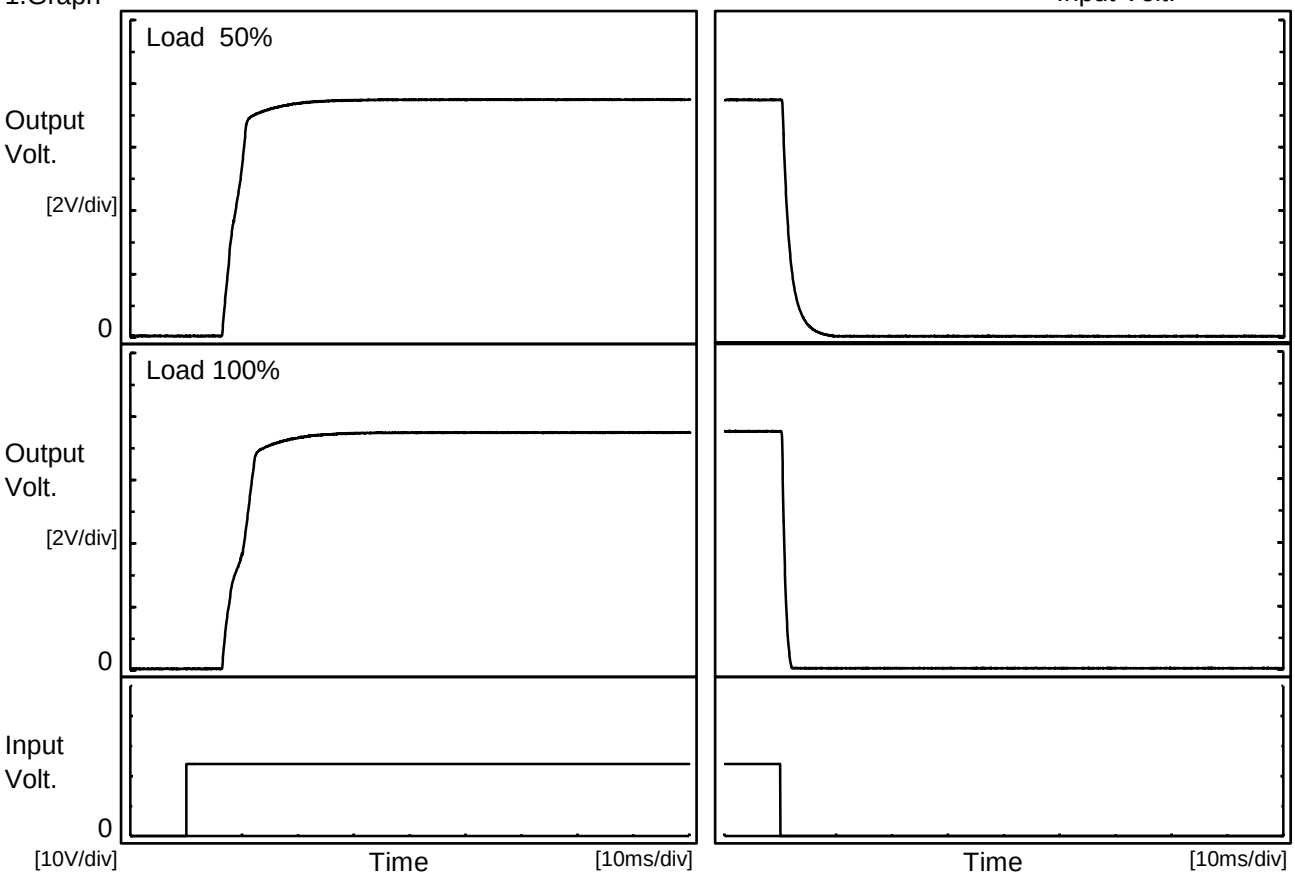


COSEL

Model	MGFW402415	
Item	Rise and Fall Time	Temperature 25°C Testing Circuitry Figure A
Object	-15V1.4A	

1.Graph

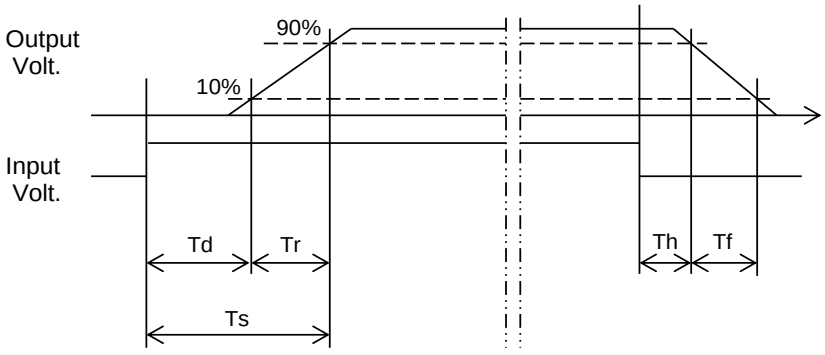
Input Volt. 24 V



2.Values

[ms]

Load \ Time	Td	Tr	Ts	Th	Tf
50 %	6.8	4.1	10.9	0.5	3.1
100 %	6.8	5.7	12.5	0.4	1.0

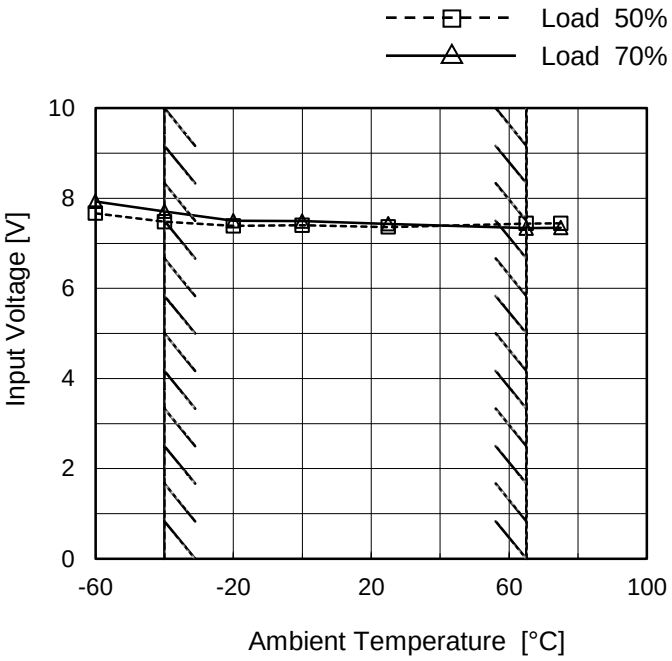


COSEL

Model	MGFW402415
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+15V1.4A

Testing Circuitry Figure A

1.Graph



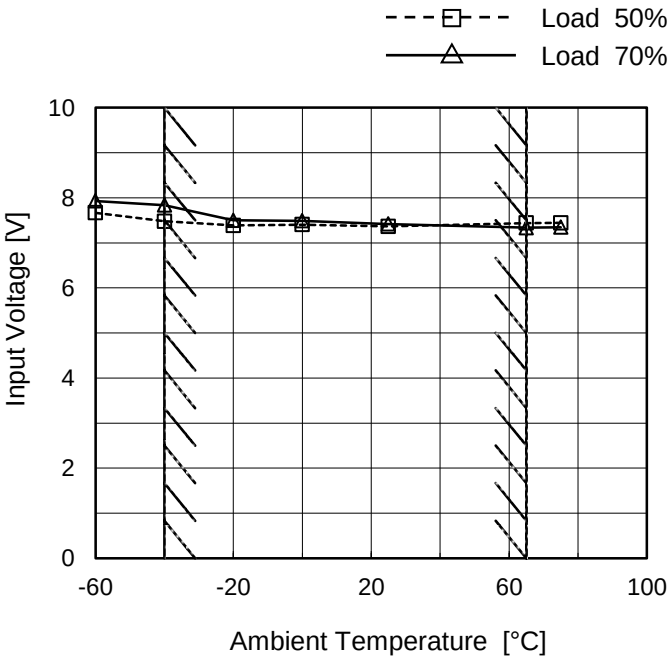
2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 70%
-60	7.7	8.0
-40	7.5	7.8
-20	7.4	7.5
0	7.4	7.5
25	7.4	7.5
65	7.5	7.4
75	7.5	7.4
--	-	-
--	-	-
--	-	-
--	-	-

-15V: Load Current is same as well as +15V

Object	-15V1.4A

1.Graph



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

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 70%
-60	7.7	8.0
-40	7.5	7.9
-20	7.4	7.5
0	7.4	7.5
25	7.4	7.5
65	7.5	7.4
75	7.5	7.4
--	-	-
--	-	-
--	-	-
--	-	-

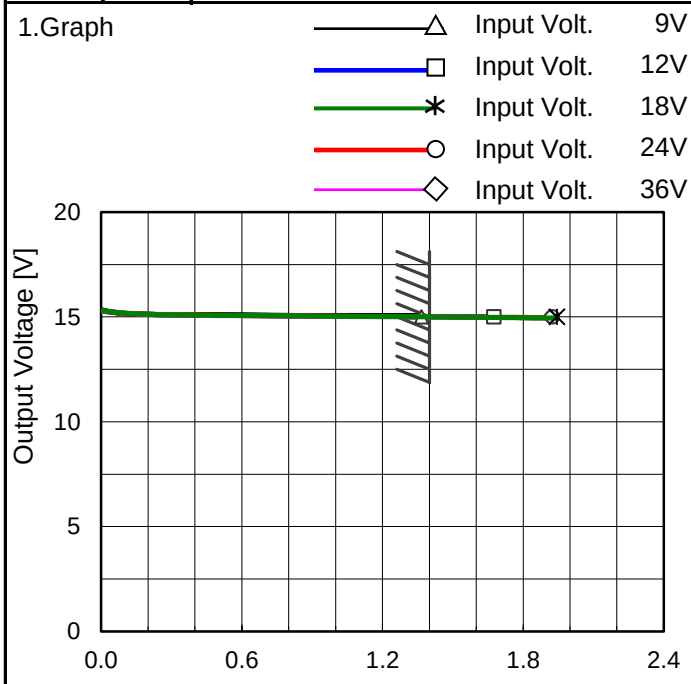
+15V: Load Current is same as well as -15V

COSEL

Model	MGFW402415
Item	Overcurrent Protection
Object	+15V1.4A

Temperature 25°C
Testing Circuitry Figure A

1.Graph



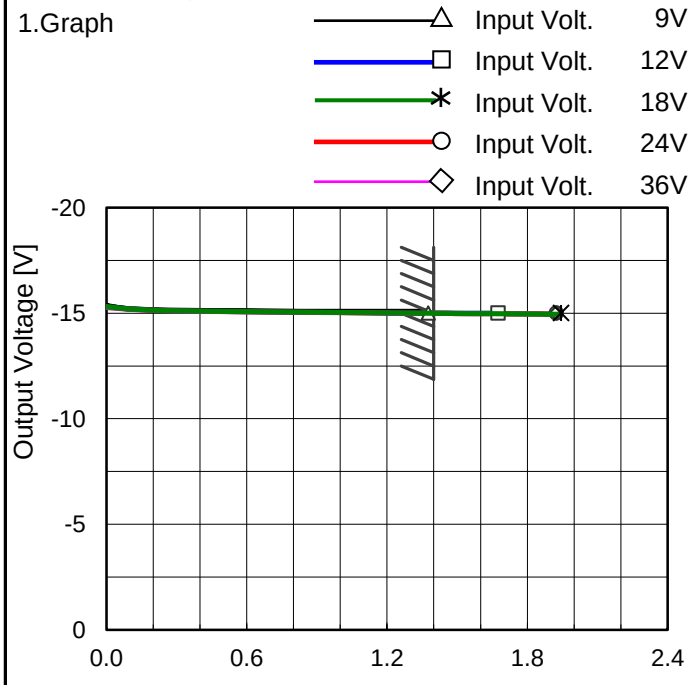
2.Values

Output Voltage [V]	Load Current [A]				
	Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
15.0	1.366	1.676	1.945	1.925	1.915
14.3	- ※1	- ※2	-	-	-
13.5	-	-	-	-	-
12.0	-	-	-	-	-
10.5	-	-	-	-	-
9.0	-	-	-	-	-
7.5	-	-	-	-	-
6.0	-	-	-	-	-
4.5	-	-	-	-	-
0.0	-	-	-	-	-

-15V: Rated Load Current

Object	-15V1.4A

1.Graph



Note: Slanted line shows the range of the rated load current.
Intermittent operation activates when overcurrent protection is activated.

2.Values

Output Voltage [V]	Load Current [A]				
	Input Volt. 9[V]	Input Volt. 12[V]	Input Volt. 18[V]	Input Volt. 24[V]	Input Volt. 36[V]
-15.0	1.377	1.676	1.945	1.925	1.925
-14.3	- ※1	- ※2	-	-	-
-13.5	-	-	-	-	-
-12.0	-	-	-	-	-
-10.5	-	-	-	-	-
-9.0	-	-	-	-	-
-7.5	-	-	-	-	-
-6.0	-	-	-	-	-
-4.5	-	-	-	-	-
0.0	-	-	-	-	-

+15V: Rated Load Current

※1 Maximum output current at minimum input Voltage is 70% of rated load current.
※2 Maximum output current at 12V input Voltage is 80% of rated load current.
Refer to instruction manuals for details of input derating.

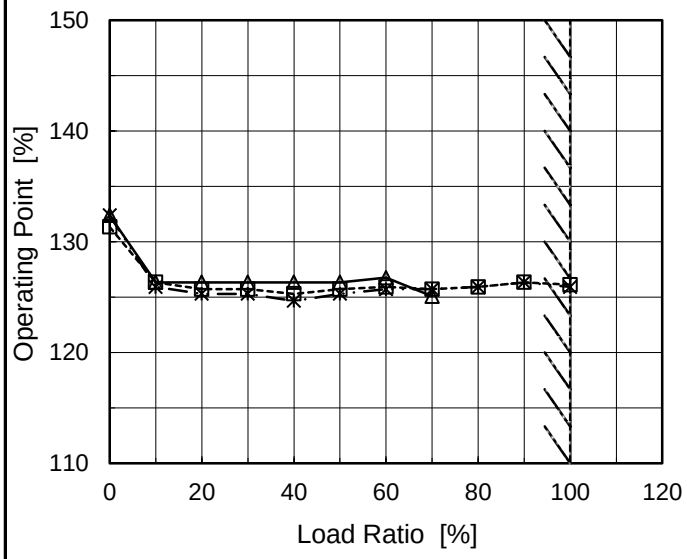
COSEL

Model	MGFW402415
Item	Overvoltage Protection
Object	+30V1.4A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Input Volt. 9V
Input Volt. 24V
Input Volt. 36V



Measured as a single output(+30V).

2.Values

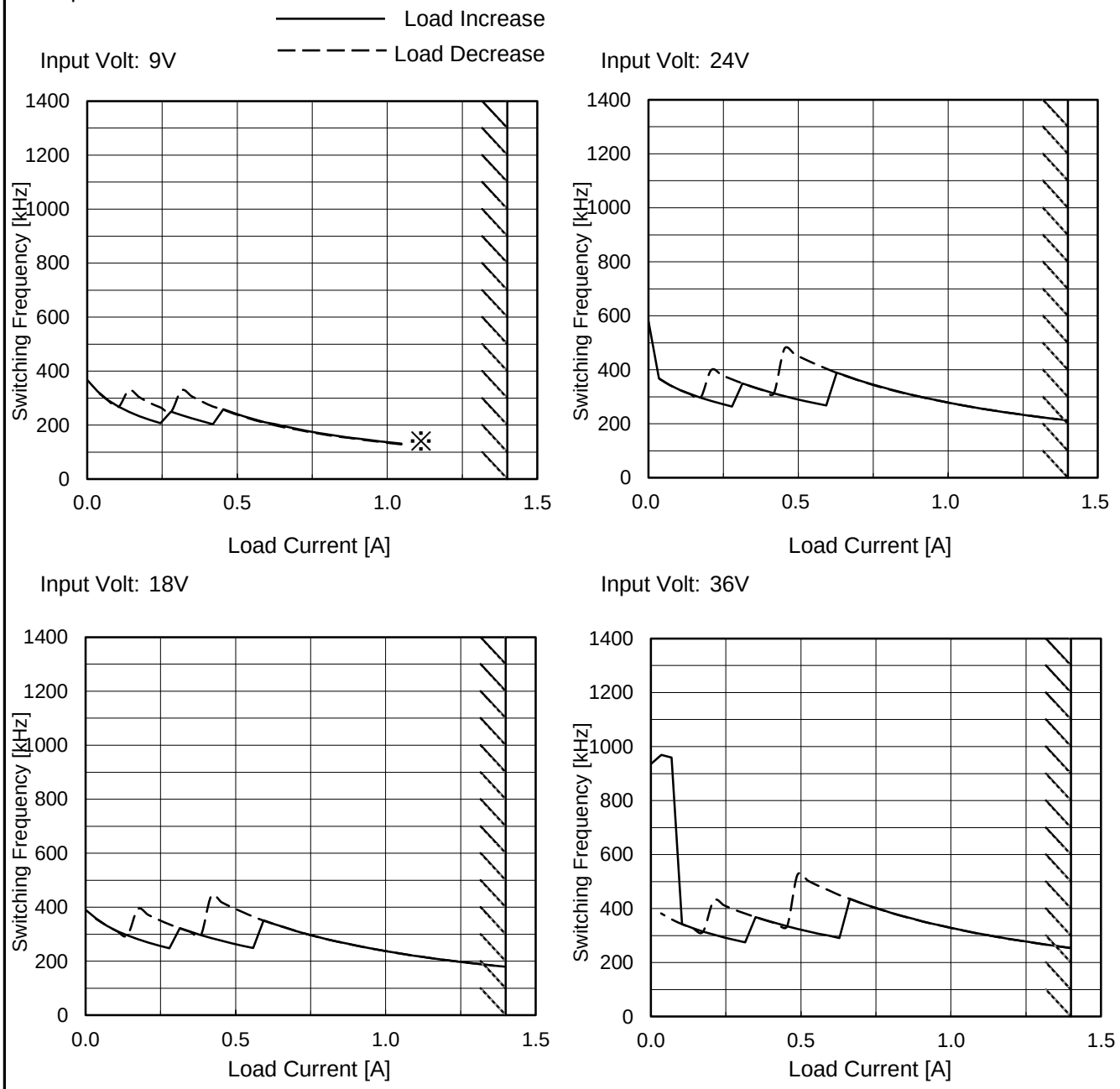
Load Ratio [%]	Operating Point [%] Input Volt. 9[V]	Input Volt. 24[V]	Input Volt. 36[V]
0	132	131	132
10	126	126	126
20	126	126	125
30	126	126	125
40	126	125	125
50	126	126	125
60	127	126	126
70	125	126	126
80	- ※	126	126
90	- ※	126	126
100	- ※	126	126

※During this area, overcurrent protection activates.

COSEL

Model	MGFW402415	
Item	Switching frequency (by Load Current)	Temperature 25°C Testing Circuitry Figure A
Object	+/-15V1.4A	

1.Graph



Note: Slanted line shows the range of the rated load current.

-switching frequency of MG40 changes depending on load current and input voltage.
When load current is low, switching frequency becomes high and step down to low frequency at certain point.
There is hysteresis, so characteristic is different between load increase (sweep from 0% to 100%) and load decrease (sweep from 100% to 0%).

-When load current is low, MG40 operates intermittently, so switching frequency can not be stable.
※ Maximum output current at minimum input Voltage is 70% of rated load current.
Refer to instruction manuals for details of input derating.

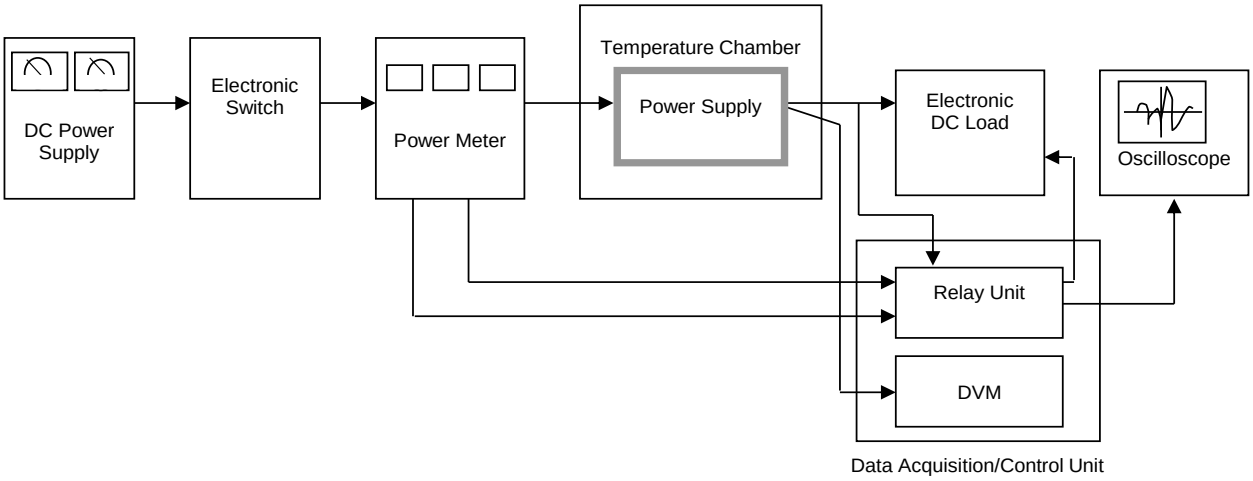


Figure A

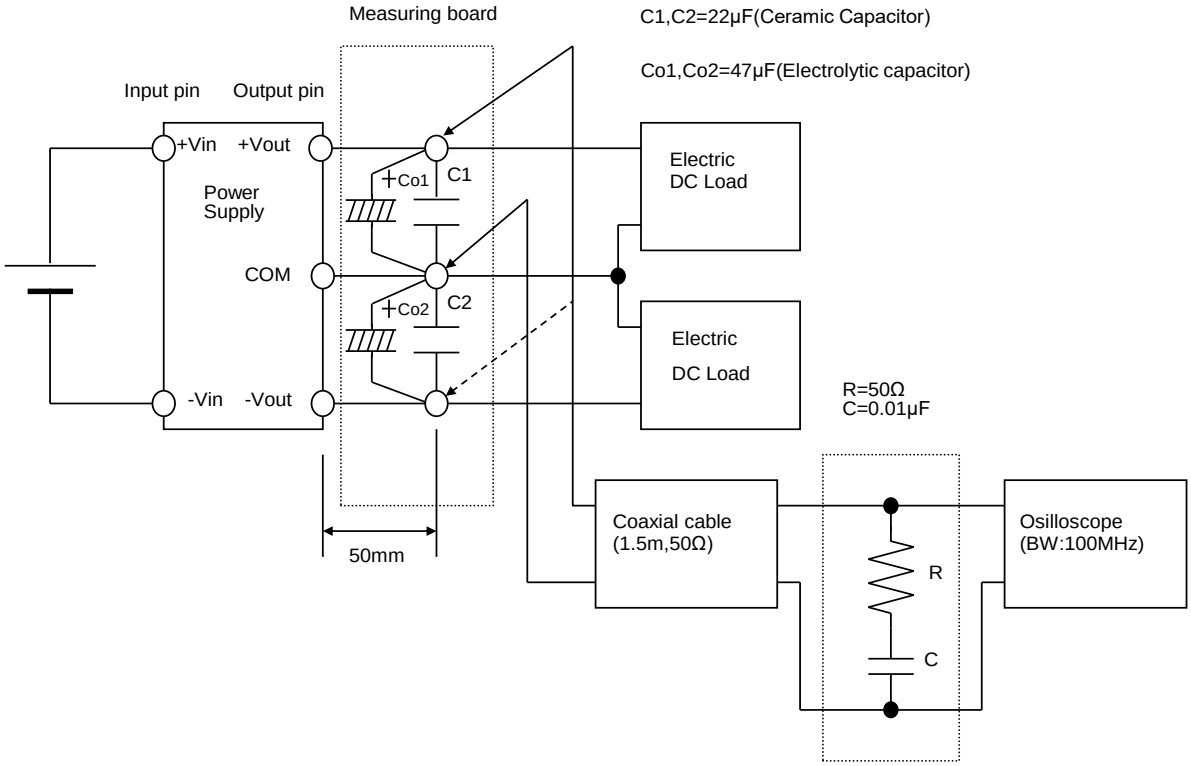


Figure B（Ripple and Ripple noise Characteristic）