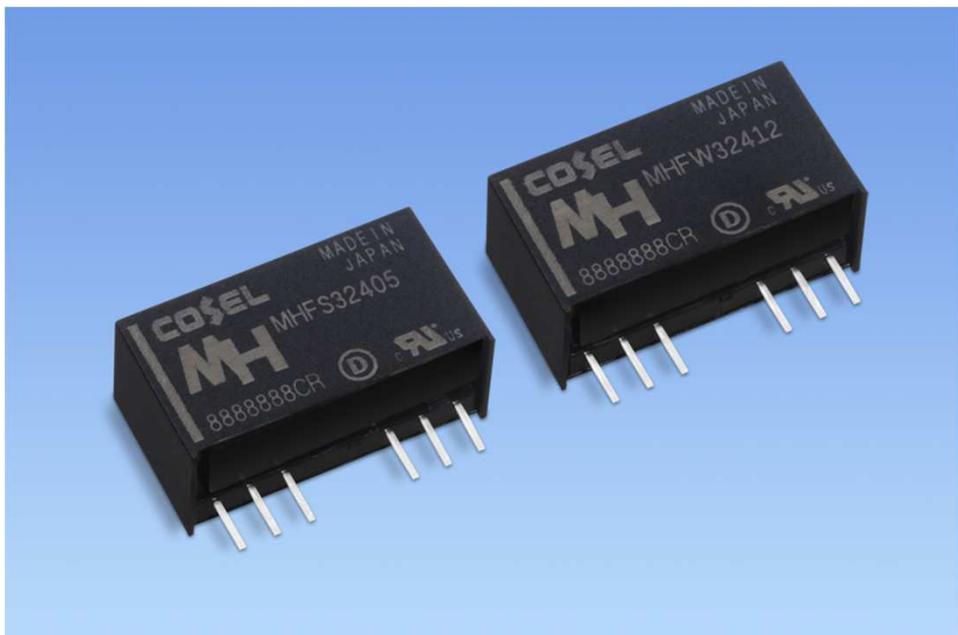


COSEL

Applications Manual for MH series



MH series

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For MH series

1. Part name description

MHF S 3 24 05
① ② ③ ④ ⑤

① Series name

MHF : MHF Series

② Output specification

S : Single output

W : Dual output

③ Output wattage

3 : 3W type

④ Input voltage

12 : DC 4.5 ~ 18 V

24 : DC 9 ~ 36 V

48 : DC 18 ~ 76 V

⑤ Output voltage

MHFS

3R3 : +3.3V

05 : +5V

09 : +9V

12 : +12V

15 : +15V

MHFW

12 : ±12V(+24V)

15 : ±15V(+30V)

For MH series

2. Connection method for standard use

2.1 Connection for standard use

Fig.2.1.1
Recommended
circuit of connect
for MHFS3

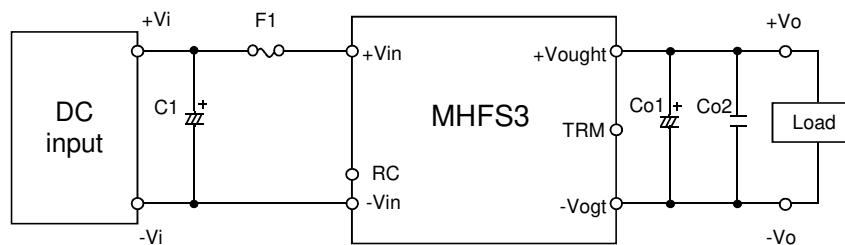


Table 2.1.1
Parts name
for MHFS3

No.	Symbol	MHFS3		
		Division	Rating	Part name
1	F1	12Vinput	3.15A	KMS32
		24Vinput	2.0A	KMS20
		48Vinput	1.6A	KMS16
2	C1	12Vinput	50V 100μF	ELXZ500E□□101MH12D
		24Vinput	50V 47μF	ELXZ500E□□470MFB5D
		48Vinput	100V 33μF	UPW2A330MPD□
3	Co1	3.3Voutput	25V 220μF	ELXZ250E□□221MH12D
		5Voutput	25V 220μF	ELXZ250E□□221MH12D
		9Voutput	50V 100μF	ELXZ500E□□101MH12D
		12Voutput	50V 100μF	ELXZ500E□□101MH12D
		15Voutput	50V 100μF	ELXZ500E□□101MH12D
4	Co2	ALL	25V 22μF	GRM32ER71E226K

※ or equivalent

For MH series

Fig.2.1.2
Recommended
circuit of connect
for MHFW3

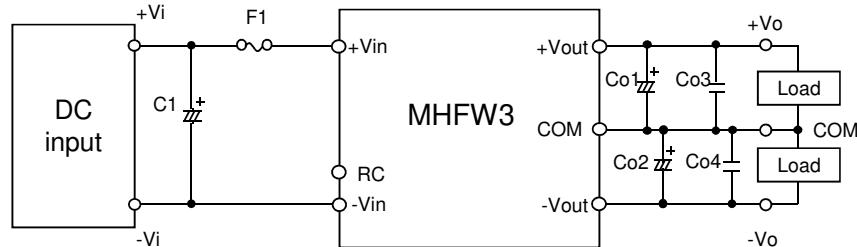


Table 2.1.2
Parts name
for MHFW3

No.	Symbol	MHFW3		
		Division	Rating	Part name
1	F1	12Vinput	3.15A	KMS32
		24Vinput	2.0A	KMS20
		48Vinput	1.6A	KMS16
2	C1	12Vinput	50V 100μF	ELXZ500E□□101MH12D
		24Vinput	50V 47μF	ELXZ500E□□470MFB5D
		48Vinput	100V 33μF	UPW2A330MPD□
3	Co1 , Co2	ALL	50V 100μF	ELXZ500E□□101MH12D
4	Co3 , Co4	ALL	25V 22μF	GRM32ER71E226K

※or equivalent

For MH series

2.2 Wiring input pin

(1) External fuse :F1

- Fuse is not built-in on input side. In order to protect the unit, install the normal-brow type fuse on +Vin of the input side.
- When the input voltage from a front end unit is supplied to multiple unit, install the normal-brow type fuse on input side of the each unit.

Table 2.2.1
Recommend
fuse

Model	MH3
Input Voltage	
5-12 (MHF□12)	3.15A
12-24 (MHF□24)	2.0A
24-48 (MHF□48)	1.6A

(2) External capacitor on the input side : Ci (MHFS3---C1, MHFW3---C1)

- Table 2.2.2 shows the recommended capacitance of external capacitor on the input side.
- Adding a capacitor Ci near the input pin terminal and reduce reflected input noise from a converter.
- When you use a capacitor Ci, please use the one with high frequency and good temperature characteristics.
- If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.
- If an external filter containing L (inductance) is added to the input line, or a wire from the input source to the DC-DC converter is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting Ci to the input pin terminal is recommended.
- If you use an aluminum electrolytic capacitor, please pay attention to its ripple current rating.
- Please adjust the capacitance in light of the effect you want to achieve.

Table 2.2.2
Recommend external
capacitor on the
input side : Ci

Model	MH3
Input Voltage	
5-12 (MHF□12)	10 - 220 [μ F]
12-24 (MHF□24)	10 - 100 [μ F]
24-48 (MHF□48)	10 - 47 [μ F]

2.3 Wiring output pin

(1) External capacitor on the output side : Co (MHFS3---Co1, MHFW3---Co1, Co2)

- Table 2.3.1 shows the recommended capacitance of external capacitor on the output side.
- In order to reduce the output ripple noise, connect the capacitor to the output side.
- If you use a ceramic capacitor, keep the capacitance within the range between about 0.1uF to 22uF.
- Please adjust the capacitance in light of the effect you want to achieve.

Table 2.3.1
Recommend external
capacitor on the
output side : Co

Model	MH3
Output Voltage	
3.3V	0 - 220 [μ F]
5V	0 - 220 [μ F]
9V	0 - 100 [μ F]
12V	0 - 100 [μ F]
15V	0 - 100 [μ F]
\pm 12V	0 - 100 [μ F]
\pm 15V	0 - 100 [μ F]

For MH series

2.4 Output voltage adjustment range (Only MHFS3)

- The output voltage is adjustable by an external potentiometer.
- To increase the output voltage, turn the potentiometer so that the resistance value between 2 and 3 becomes small.
- Please use a wire as short as possible to connect to the potentiometer and connect it from the pin on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used.
Please use the following types.
Resistor : Metal Film Type, Temperature Coefficient of $\pm 100\text{ppm}/^\circ\text{C}$ or below
Potentiometer : Cermet Type, Temperature Coefficient of $\pm 300\text{ppm}/^\circ\text{C}$ or below
- When the output voltage adjustment is used, note that the output may be stopped when output voltage is set too high.

Fig.2.4.1
Connecting of
External Devices
for MHFS3

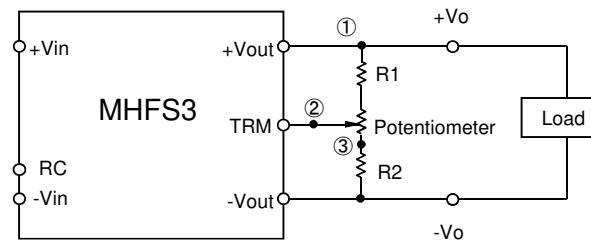
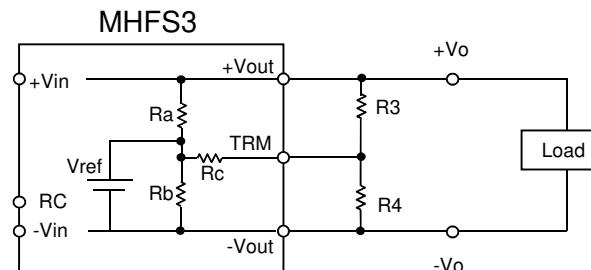


Table 2.4.1
Constant of
External Devices
for MHFS3

Output Voltage	Constant of External Devices [Ω]		
	Potentiometer	R1	R2
3.3V (-5%, +10%)	1k	680	150
5V (-5%, +20%)	1k	330	33
9V (-5%, +20%)	5k	6.8k	680
12V (-5%, +20%)	5k	12k	1.2k
15V (-5%, +20%)	5k	12k	220

- The output voltage can be fixed by R3 and R4.
- When setting the output voltage by R3 and R4, consider the output voltage setting accuracy due to individual product differences. (ex. MHFS31205:4.90-5.21[V])

Fig.2.4.2
Connecting of
External Devices
for MHFS3



$$V_o = \frac{(1/R_a + 1/R_b + 1/R_c) - (1/R_c)^2 \times (1/R_c + 1/R_3 + 1/R_4)^{-1}}{(1/R_a) + (1/R_c) \times (1/R_3) \times (1/R_c + 1/R_3 + 1/R_4)^{-1}} \times V_{ref}$$

Table 2.4.1
Value of
internal resistor
of MHFS3

Output Voltage	Value of internal resistor [Reference]			
	Ra [Ω]	Rb [Ω]	Rc [Ω]	Vref [V]
3.3V (MHFS3□3R3)	3.69k	2.2k	8.2k	1.240
5V (MHFS3□05)	2.247k	2.2k	4.7k	2.495
9V (MHFS3□09)	5.78k	2.2k	4.7k	2.495
12V (MHFS3□12)	8.42k	2.2k	3.3k	2.495
15V (MHFS3□15)	11.1k	2.2k	6.8k	2.495

For MH series

- The output voltage can be set by applying a voltage to the TRM pin.
- When changing the output voltage, apply the voltage shown in Fig. 2.4.3.
- Avoid settings outside the output voltage adjustment range. The output voltage may become unstable or malfunction.
- Make sure that the wiring to the TRM terminal is not affected by noise.

Fig.2.4.3

Example

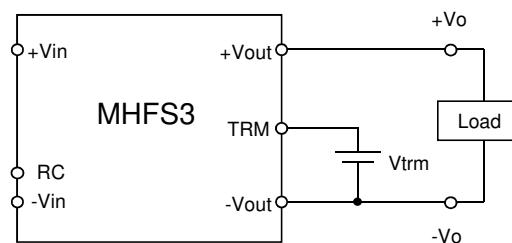
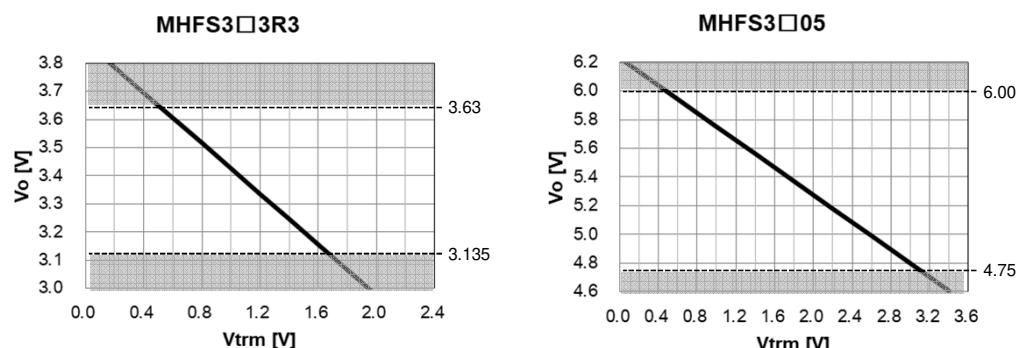
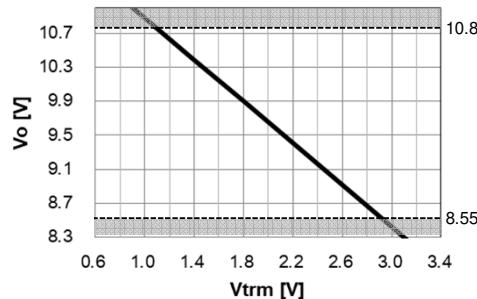
Circuit of connect
for MHFS3

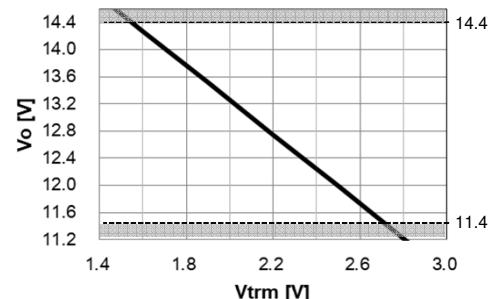
Fig.2.4.4

TRM pin applied voltage
for MHFS3
(Reference)

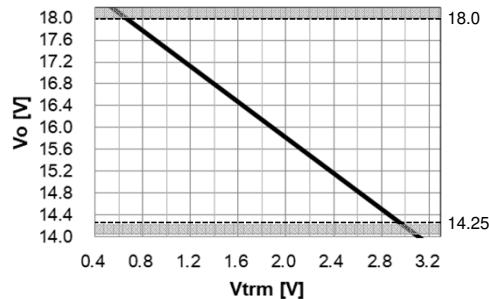
MHFS3□09



MHFS3□12



MHFS3□15



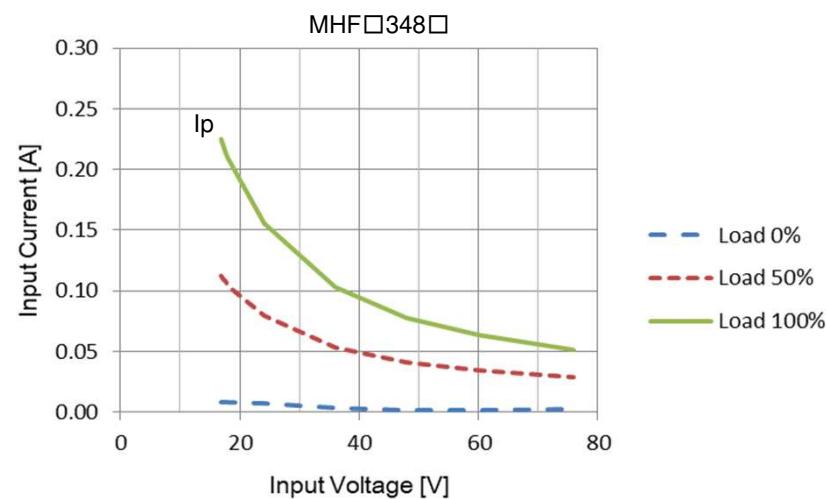
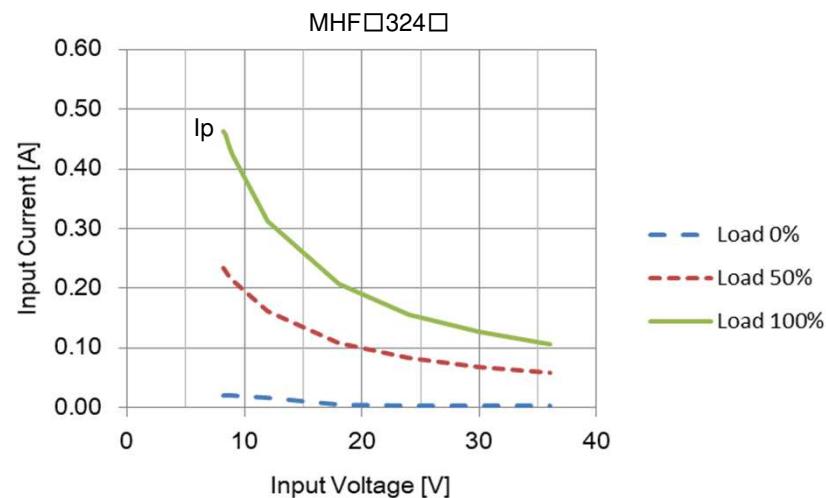
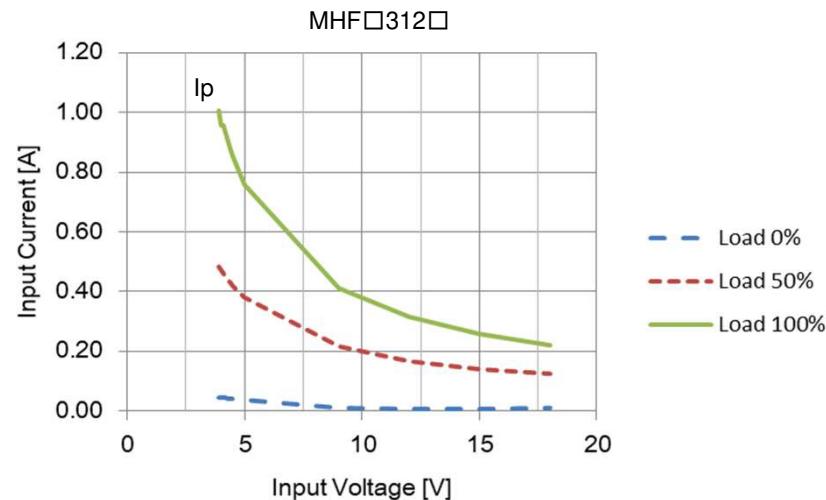
: Out of specification

For MH series

2.5 Input voltage / Current range

- If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.
- Please select an input power source with enough capacity, taking into consideration of the start-up current (I_p), which flows when a DC-DC converter starts up.

Fig.2.5.1
Input current
characteristics
for MHFS3
/ MHFW3
(Reference)



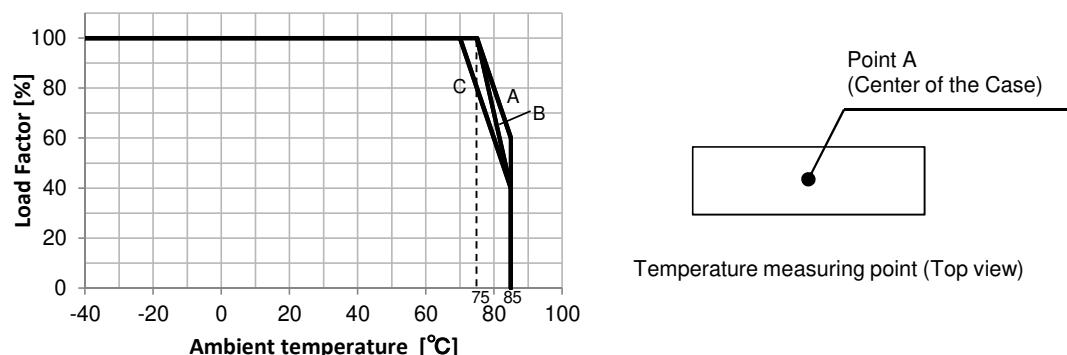
For MH series

3. Derating

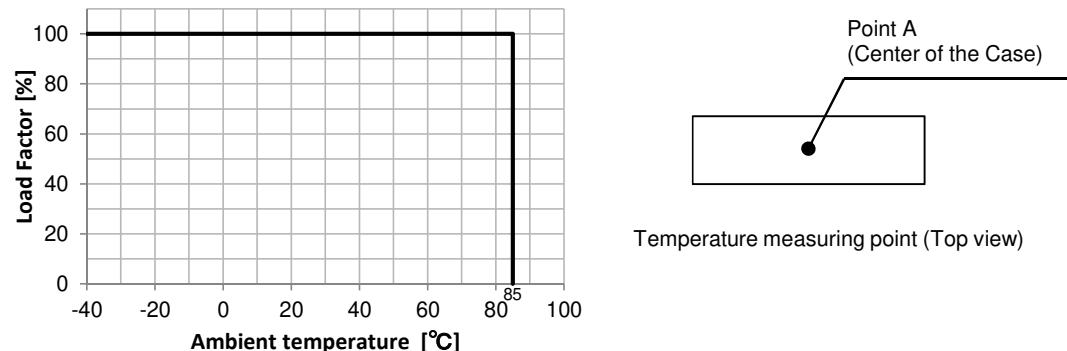
- Please use it when the ambient temperature of the power supply is less than the derating value shown in Fig. 3.1.1.
- Make sure that the temperature at point A does not exceed 105 °C.
- In case of forced air, ventilation must keep the temperature at point A does not exceed 105 °C.

3.1 Ambient temperature Derating

Fig.3.1.1
Ambient temperature
Derating for MHFS3
/ MHFW3
(Reference)



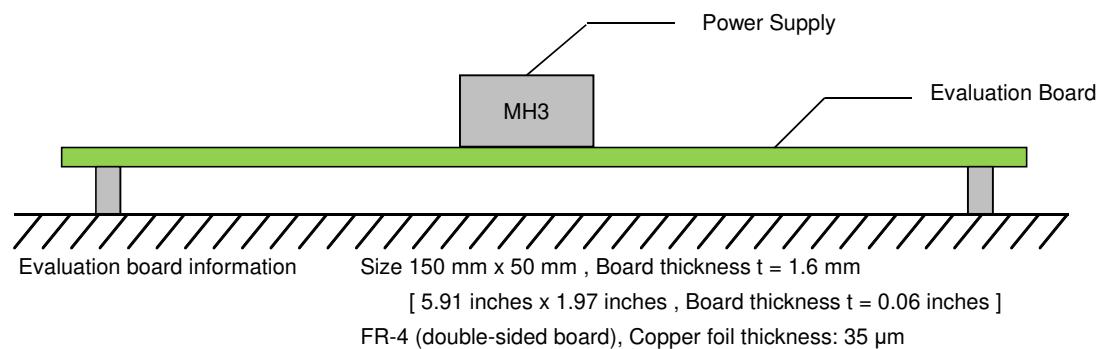
Output Voltage Input Voltage	3.3	5	9	12	15	± 12	± 15
5-12 (MHF□12)	B	B	A	A	A	C	C
12-24 (MHF□24)	A	B	B	B	B	C	C
24-48 (MHF□48)	A	B	A	A	B	C	C



3.2 Ambient temperature - Evaluation Board【Reference】

- Indicates evaluation board under our temperature measurement environment.
- It depends on the installation environment, so please refer to it.
- Please confirm the case top surface point A temperature with a real machine.

Fig.3.2.1
Evaluation
board



For MH series

Fig.3.2.2
Derating of
MHFS312□
(Reference)

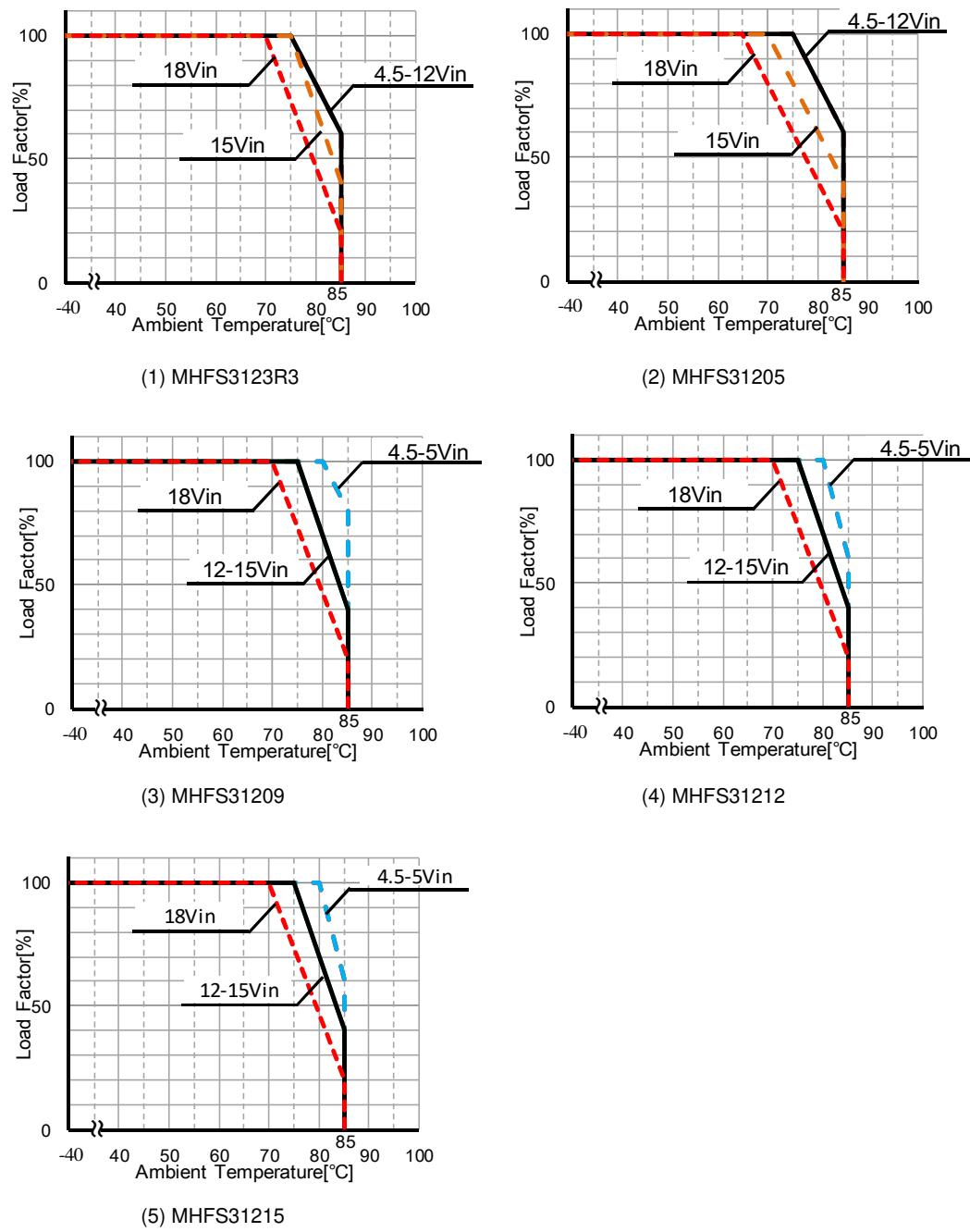
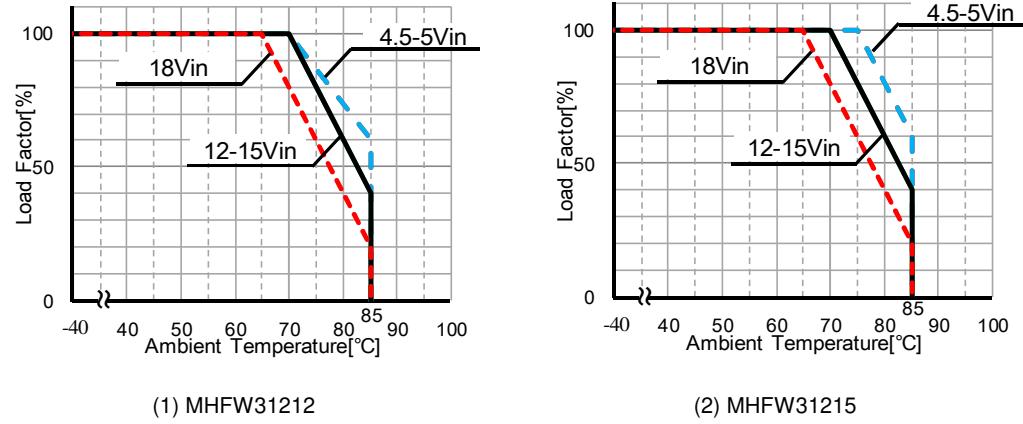
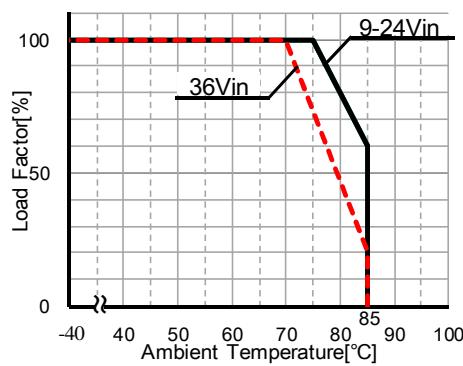


Fig.3.2.3
Derating of
MHFW312□
(Reference)

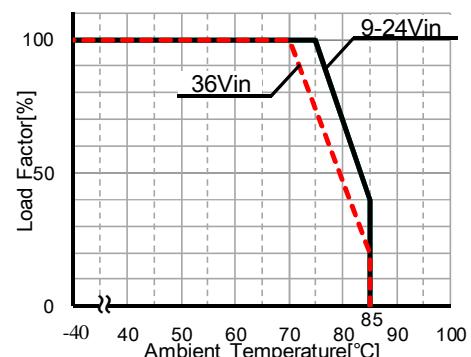


For MH series

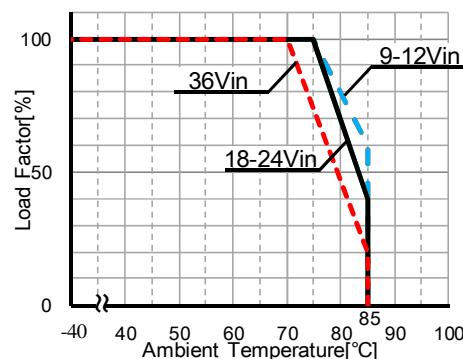
Fig.3.2.4
Derating of
MHFS324□
(Reference)



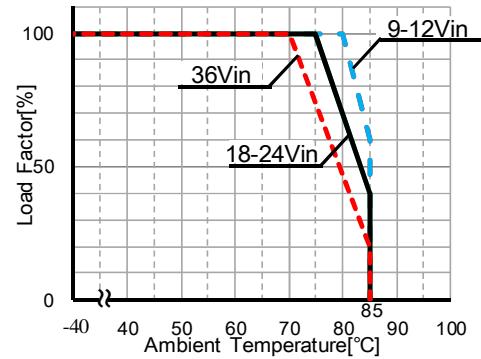
(1) MHFS324R3



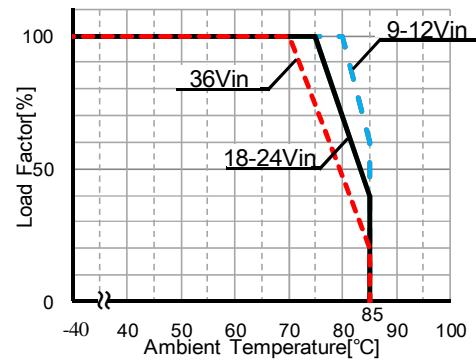
(2) MHFS32405



(3) MHFS32409

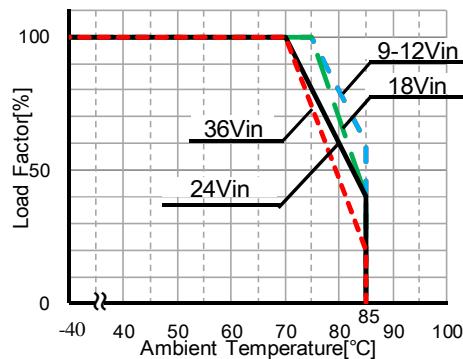


(4) MHFS32412

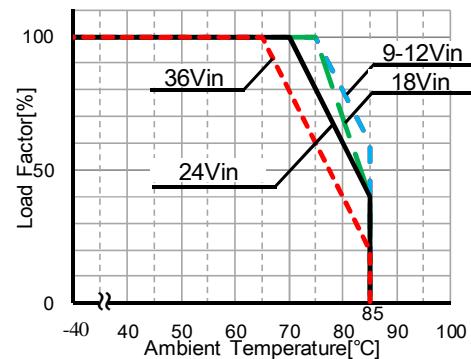


(5) MHFS32415

Fig.3.2.5
Derating of
MHFW324□
(Reference)



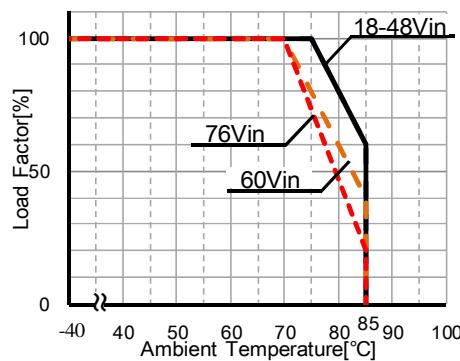
(1) MHFW32412



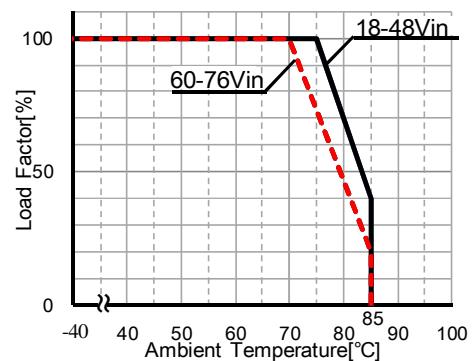
(2) MHFW32415

For MH series

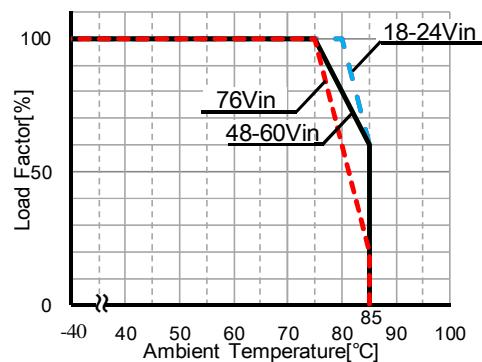
Fig.3.2.6
Derating of
MHFS348□
(Reference)



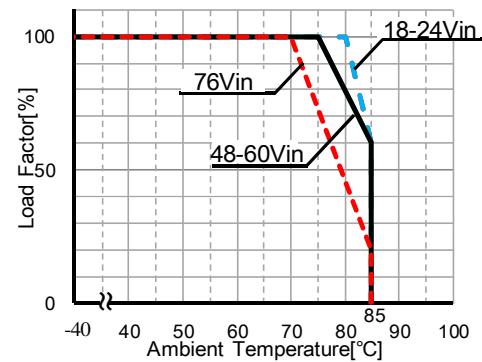
(1) MHFS348R3



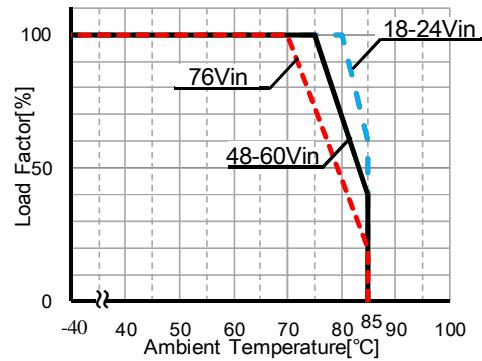
(2) MHFS34805



(3) MHFS34809

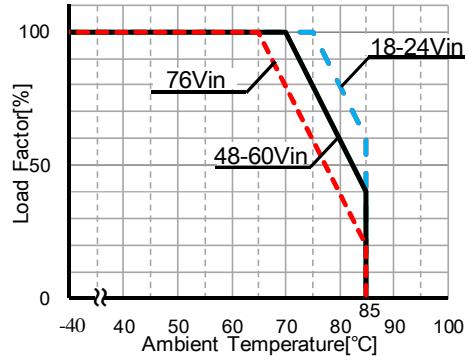


(4) MHFS34812

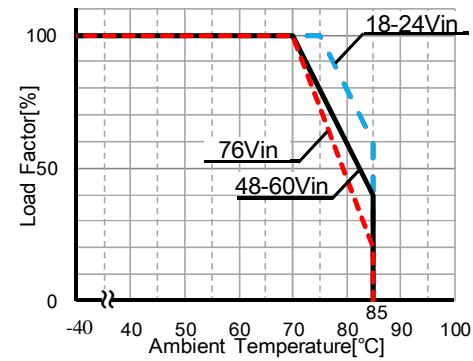


(5) MHFS34815

Fig.3.2.7
Derating of
MHFW348□
(Reference)



(1) MHFW34812



(2) MHFW34815

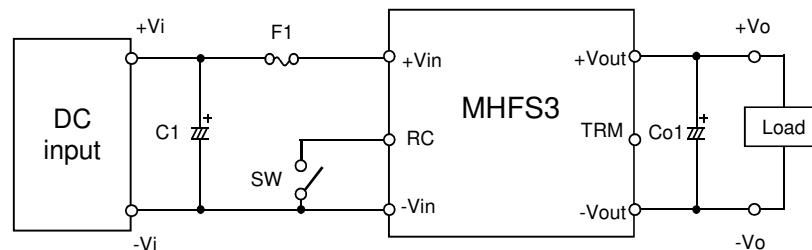
For MH series

4. Remote ON/OFF

■ You can turn the power supply ON or OFF without turning input power ON or OFF through the pin terminal RC.

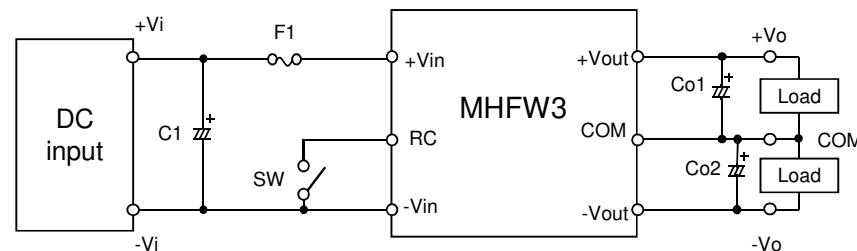
4.1 RC response time

Fig.4.1.1
Measurement circuit



Input Voltage : Rated Input

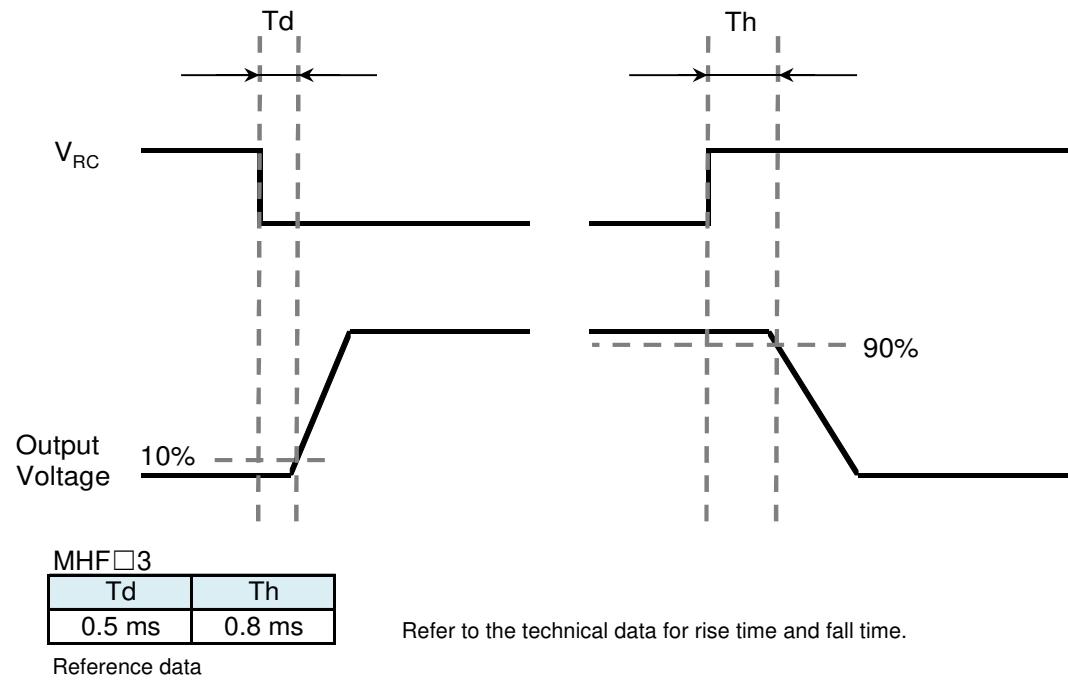
Load Current : Rated Load



Input Voltage : Rated Input

Load Current : Rated Load

Fig.4.1.2
RC response time
for MHFS3
/ MHFW3
(Reference)

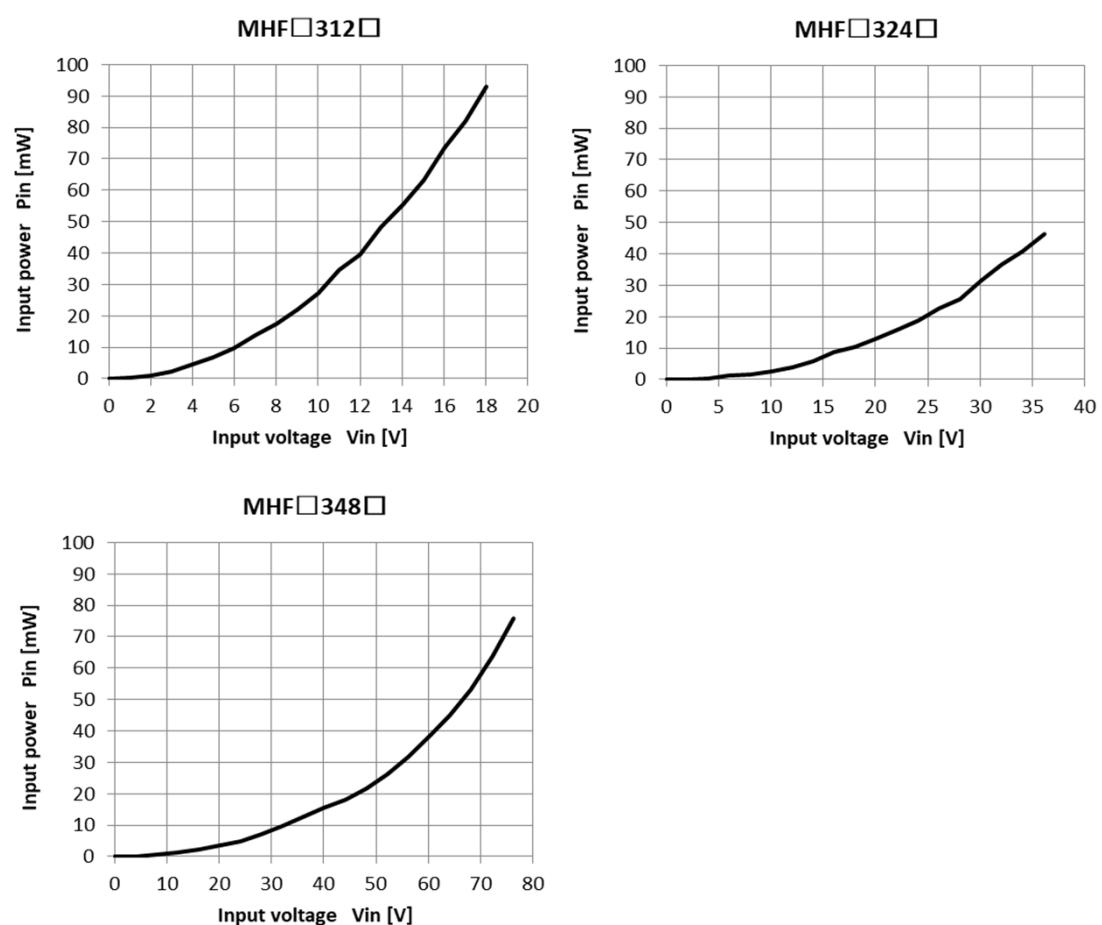


■ Indicates the standby power when the output is stopped by remote control.

4.2 RC-OFF standby power

Fig.4.2.1

RC-OFF standby power
for MHFS3
/ MHFW3
(Reference)



For MH series

5. Board layout

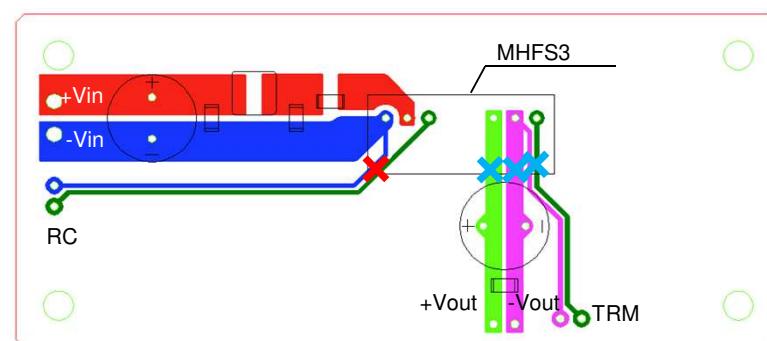
5.1 Measurement board layout

- When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation.
Ambient temperature around each power supply should not exceed the temperature range shown in Derating.
- Avoid placing the DC input line pattern layout underneath the unit. It will increase the line conducted noise.
Make sure to leave an ample distance between the line pattern layout and the unit.
Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise.
Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable.
Lay out the pattern away from the unit.
- Please check the actual product when using it.

Fig.5.1.1

Example:

Not recommended
circuit of connect
for MHFS3
/ MHFW3



✗ Avoid placing the signal line pattern layout underneath the unit.

✗ Avoid placing the DC output line pattern underneath the unit.

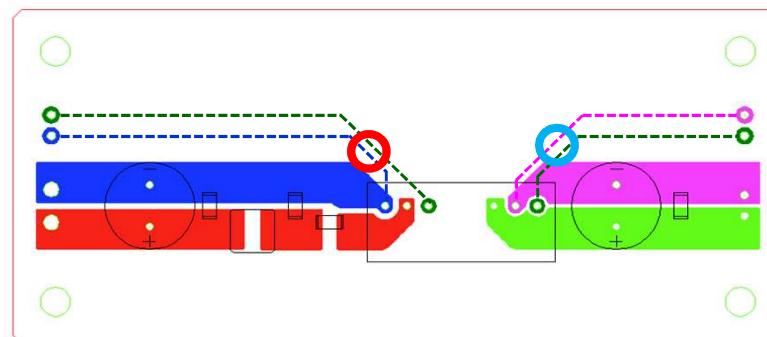
ex. Not recommended circuit of connect for MHFS3

Fig.5.1.2

Example:

Recommended
circuit of connect
for MHFS3
/ MHFW3

----- back side pattern



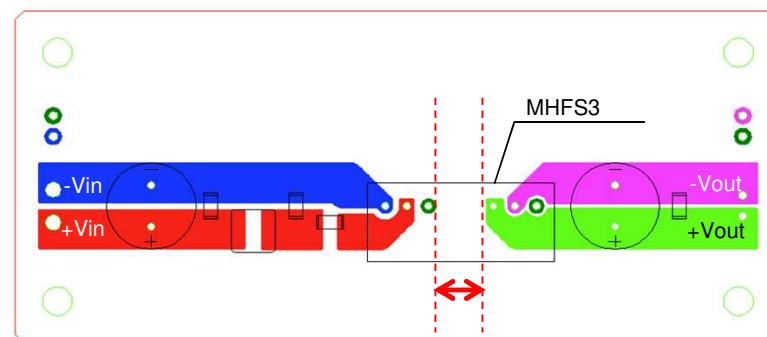
ex. Recommended circuit connect for MHFS3

- If isolation is required, design the wiring board considering the distance required for insulation between input and output.
- Please check the actual product when using it.

Fig.5.1.3

Notice

Isolation distance
for MHFS3
/ MHFW3

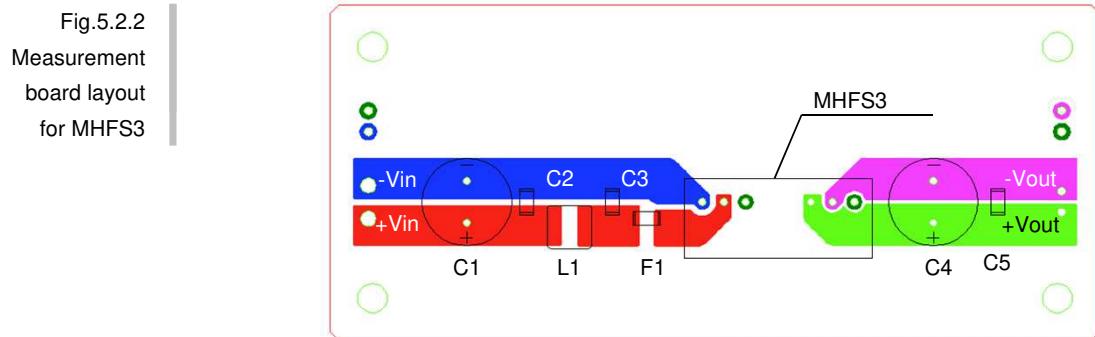
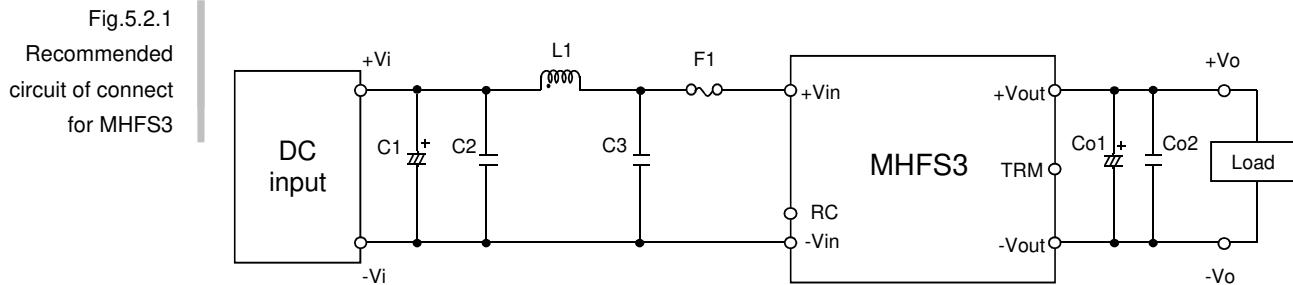


↔ If isolation is required, ensure a pattern distance between the primary (+Vin,-Vin,RC) and secondary(+Vout,-Vout,TRM,COM) sides.

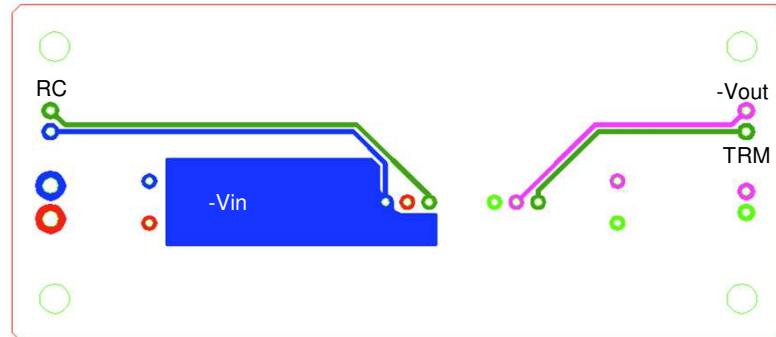
ex. MHFS3

For MH series

5.2 Measurement board layout (Example)



Front side



Back side

Table 5.2.1
Parts name
for MHFS3

No.	Symbol	MHFS3		
		Division	Rating	Part name
1	F1	12Vinput	3.15A	KMS32
		24Vinput	2.0A	KMS20
		48Vinput	1.6A	KMS16
2	C1	12Vinput	50V 100μF	ELXZ500E□□101MH12D
		24Vinput	63V 68μF	ELXZ630E□□680MH12D
		48Vinput	100V 33μF	UPW2A330MPD□
3	C2,C3	12Vinput	25V 10μF	GRM31CR71E106K
		24Vinput	50V 4.7μF	GRM31CR71H475K
		48Vinput	100V 2.2μF	HMK316AC7225KL
4	L1	12Vinput	1200mA 4.7μH	LQH32PN4R7NN0
		24Vinput	900mA 10μH	LQH32PN100MN0
		48Vinput	550mA 22μH	LQH32PN220MN0
8	Co1	3.3Voutput	25V 220μF	ELXZ250E□□221MH12D
		5Voutput	25V 220μF	ELXZ250E□□221MH12D
		9Voutput	50V 100μF	ELXZ500E□□101MH12D
		12Voutput	50V 100μF	ELXZ500E□□101MH12D
		15Voutput	50V 100μF	ELXZ500E□□101MH12D
7	Co2	ALL	25V 22μF	GRM32ER71E226K

For MH series

Fig.5.2.3

Recommended circuit of connect for MHWF3

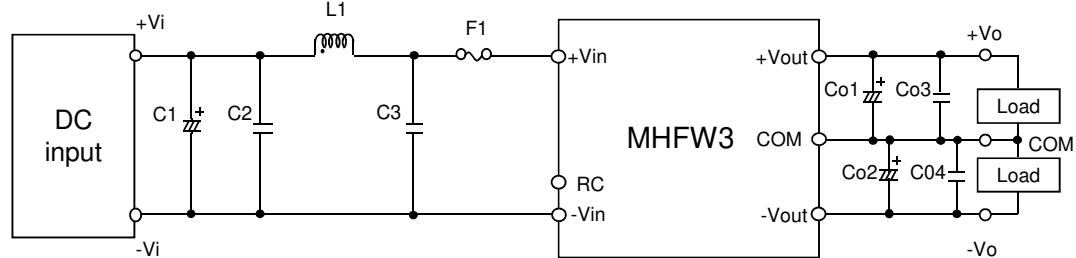
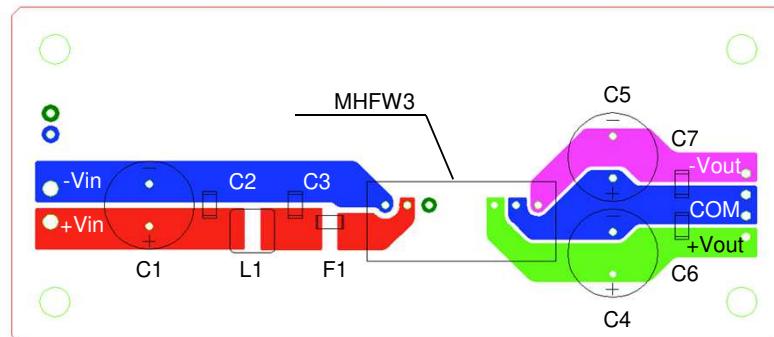
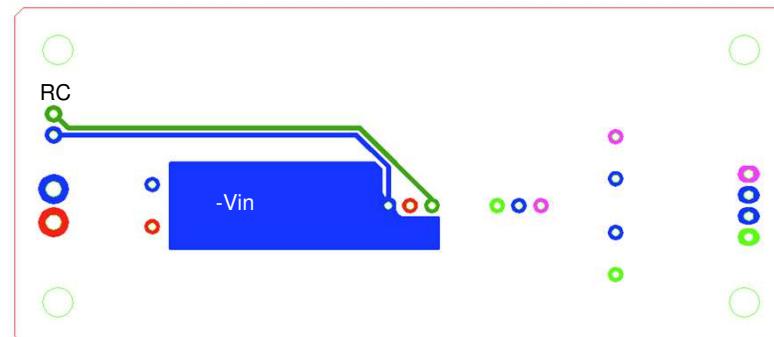


Fig.5.2.4
Measurement board layout
for MHWF3



Front side



Back side

Table 5.2.2
Parts name
for MHWF3

No.	Symbol	MHWF3		
		Division	Rating	Part name
1	F1	12Vinput	3.15A	KMS32
		24Vinput	2.0A	KMS20
		48Vinput	1.6A	KMS16
2	C1	12Vinput	50V 100μF	ELXZ500E□□101MH12D
		24Vinput	63V 68μF	ELXZ630E□□680MH12D
		48Vinput	100V 33μF	UPW2A330MPD□
3	C2,C3	12Vinput	25V 10μF	GRM31CR71E106K
		24Vinput	50V 4.7μF	GRM31CR71H475K
		48Vinput	100V 2.2μF	HMK316AC7225KL
4	L1	12Vinput	1200mA 4.7μH	LQH32PN4R7NN0
		24Vinput	900mA 10μH	LQH32PN100MN0
		48Vinput	550mA 22μH	LQH32PN220MN0
8	Co1 , Co2	ALL	50V 100μF	ELXZ500E□□101MH12D
7	Co3 , Co4	ALL	25V 22μF	GRM32ER71E226K

For MH series

6. Constant voltage application between primary and secondary

- The safety has been improved by increasing the withstand voltage between input and output.
- It can also be used for applications that require high dielectric strength such as measuring instruments.
- It is also applicable to devices such as drivers where the voltage between phases changes.

6.1 Life expectancy (Constant voltage application)

- Fig.6.1.1 is based on temperature and humidity, and Fig.6.1.2 is based on life expectancy and temperature.
- (It is a different view and the content is the same.)

Fig.6.1.1
Life expectancy
for MHFS3
/ MHFW3
(Reference)

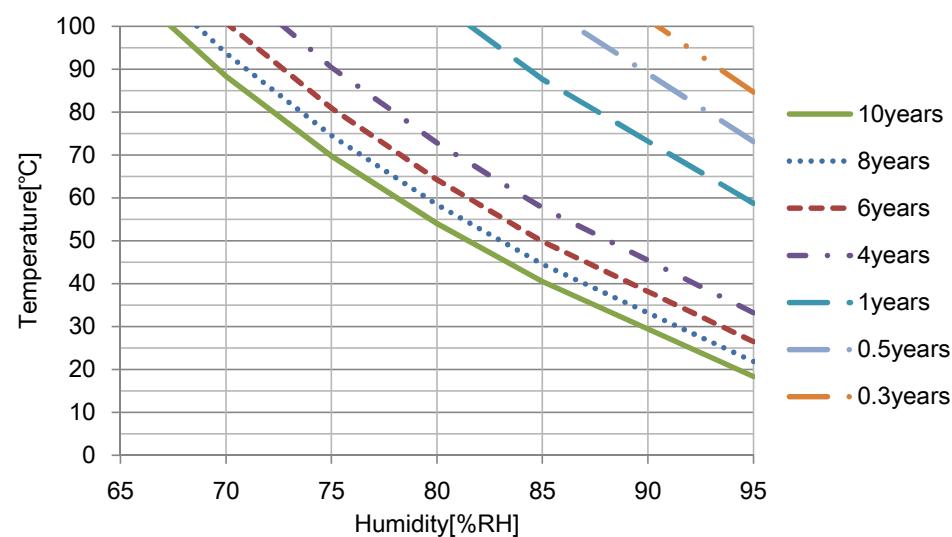
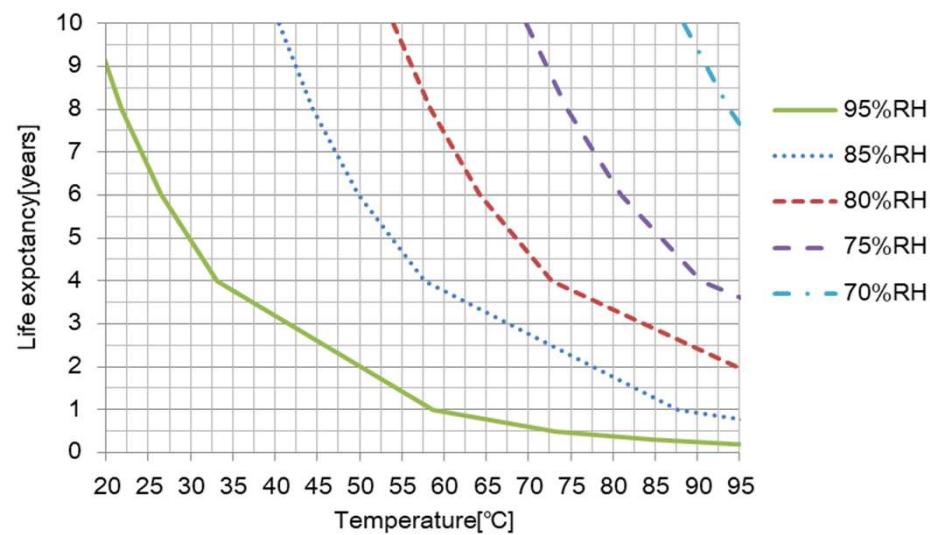


Fig.6.1.2
Life expectancy
for MHFS3
/ MHFW3
(Reference)



Input - Output : DC600V

Use the temperature and humidity within the specified range.

* It will be reference data.