P R
B X

POWERBOX Medline
PMM03(W) & PMP03(W) Series
3.3W 2:1 & 4:1 Single and Dual Output
Medical DC/DC Converter
Manual

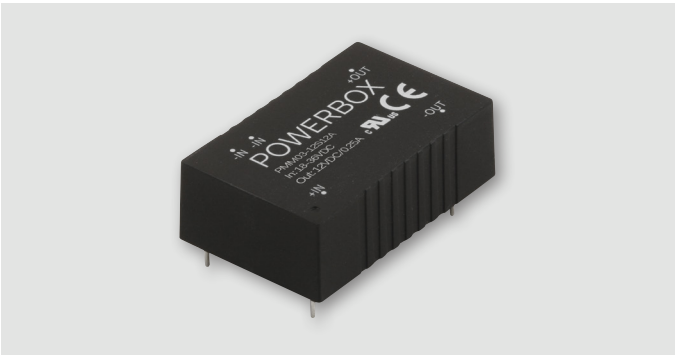


Table of Contents

1. Typical Application

- Below shows some blocks connected between power source and DC/DC module. Install the circuit of the block which is required.
- Each block has individual function and should be placed on the corresponding location.
- If CEMI is an Aluminum electrolytic capacitor and connected in parallel with CEMS. The capacitance we recommended for meeting EMS requirements could be CEMS pluses CEMI.

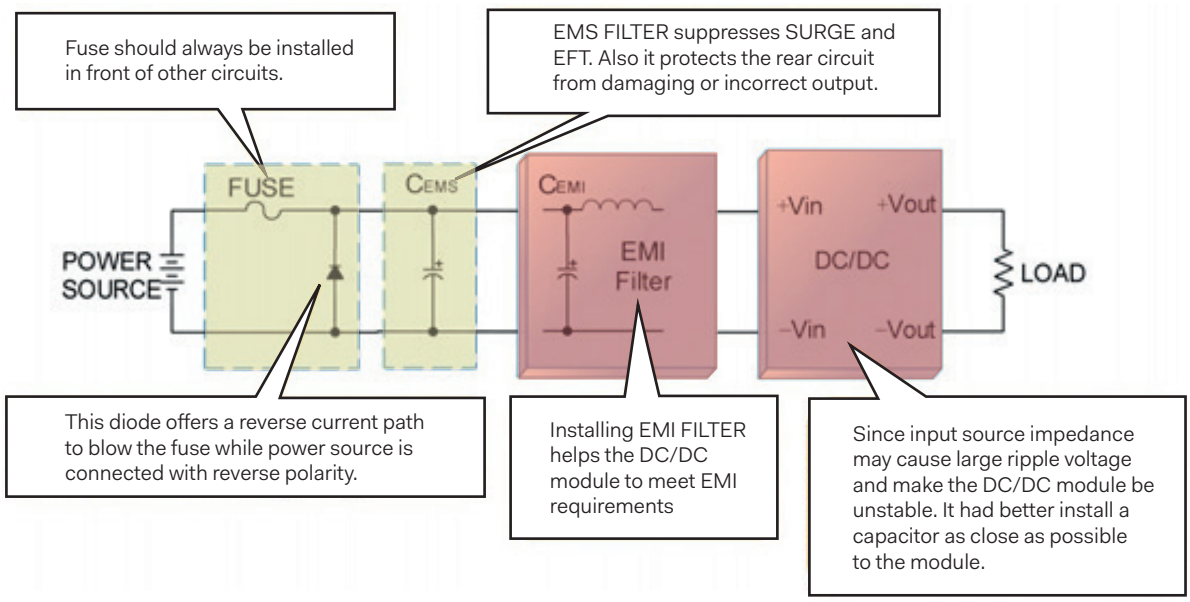


Fig. 1-1 Typical application

2. Line Protections

Fuse

- The DC/DC converter is not internally fused. An input line fuse must always be used.
- Fuses should be installed in front of each module when multiple DC/DC converters connect to the same power source.

Model	Fuse Rating (A)	Fuse Type
PM□03-05□□□	1.6	Slow-Blow
PM□03-12□□□	0.8	Slow-Blow
PM□03-24□□□	0.5	Slow-Blow
PM□03-48□□□	0.315	Slow-Blow

Model	Fuse Rating (A)	Fuse Type
PM□03-24□□□W	0.8	Slow-Blow
PM□03-48□□□W	0.5	Slow-Blow

Table 2-1 FUSE selection

- According to actual current value, calculating fuse ratings base on the following equations:

$I_{FUSE} \geq I_{in}$ /(rerating x safety margin)

Melting $I^2t = I^2_{PULSE,act} \cdot t / 0.22$

Where

I_{FUSE} is current rating of fuse.

I_{in} is actual value of input current.

Rerating is percentage of fuse rating base on ambient temperature. Fuse rating is variety under different ambient temperature.

Safety margin is percentage of fuse rating set by user.

Melting I^2t is pulse energy rating of fuse.

$I_{PULSE,act}$ is actual input pulse current.

t is the width of the input pulse current.

Reverse Input Voltage Protection

- Avoid the reverse polarity input voltage; otherwise, it will damage the DC/DC converter.
- It is likely to protect the module from the reverse input voltage by installing an external diode.
- The diode can block reverse voltage or blow the line fuse to protect DC/DC converter.
- Recommend using Schottky diode for reverse input voltage protection

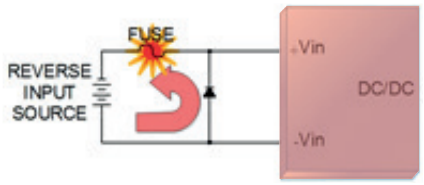


Fig. 2-1 Reverse input voltage protection

Model		Voltage Rating of the Diode	Current Rating of the Diode
PM□03-05□□□		20V	1~1.5 x Fuse Rating
PM□03-12□□□		40V	1~1.5 x Fuse Rating
PM□03-24□□□	PM□03-24□□□W	60V	1~1.5 x Fuse Rating
PM□03-48□□□	PM□03-48□□□W	100V	1~1.5 x Fuse Rating

Fig. 2-2 Reverse protection diode selection

3. EMS Considerations

- The module can meet EMS requirements as below.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5

Parameter	Conditions		Level
ESD	EN61000-4-2	Air ±15kV and Contact ±8kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2kV	Perf. Criteria A
Surge	EN61000-4-5	±2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Table 3-1 EMS requirements

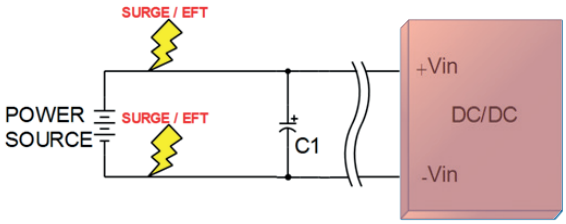


Fig. 3-1 Surge & EFT protections

- It should be noticed that the current path of the PCB trace. Wrong PCB layout reduces ability of suppressing SURGE or EFT.

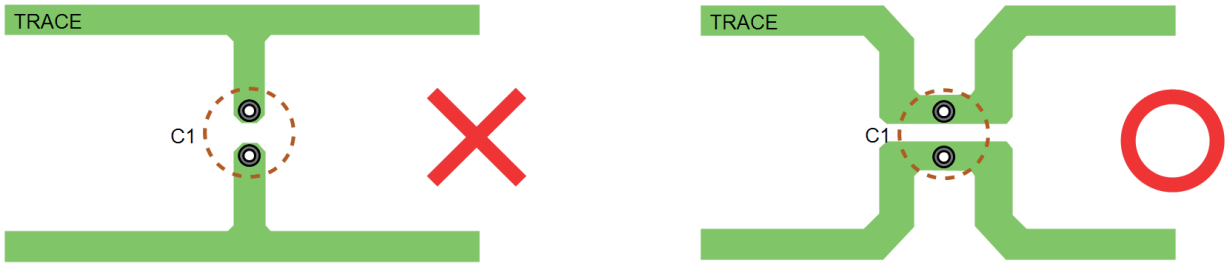


Fig. 3-2 PCB trace

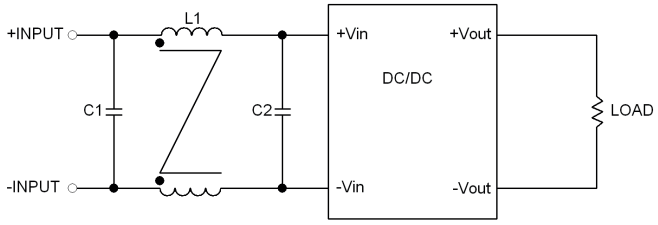
Model	Component	Specification	Reference
PM□03-05□□□	C1	1000μF/25V	Nippon Chemi-con KY series
PM□03-12□□□	C1	470μF/50V	Nippon Chemi-con KY series
PM□03-24□□□	C1	470μF/50V	Nippon Chemi-con KY series
PM□03-48□□□	C1	330μF/100V	Nippon Chemi-con KY series

Table 3-2 Surge & EFT filter

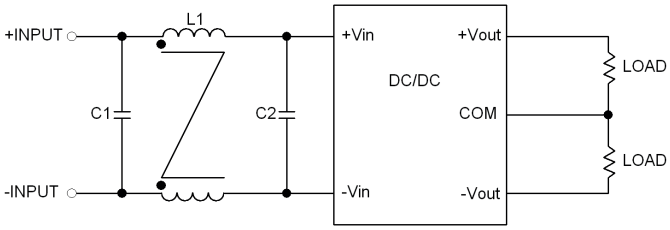
4. EMI Considerations PMP03/PMP03W - Type A

The series modules can meet EN55032 Class A without external filter

Recommended External EMI Filter for EN55032 Class A



Single Output

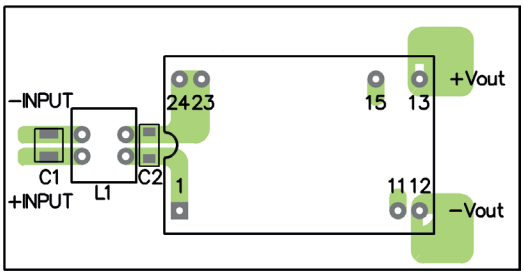


Dual Output

Fig. 4-1 Recommended EMI filter for EN55032 Class A

Model	C1	C2	L1
PMP03-05□□□A	22μF/16V 1206 MLCC	22μF/16V 1206 MLCC	137μH, PMT-127
PMP03-12□□□A PMP03-24□□□A PMP03-24□□□AW	4.7μF/50V 1206 MLCC	4.7μF/50V 1206 MLCC	277μH, PMT-128
PMP03-48□□□A PMP03-48□□□AW	2.2μF/100V 1210 MLCC	1μF/100V 1206 MLCC	175μH, PMT-118

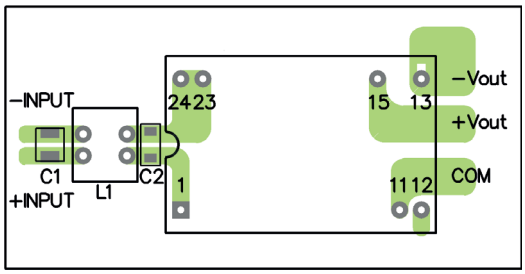
Table 4-1 B.O.M. of external EMI filter



TOP VIEW

BOTTOM VIEW

Fig. 4-2 Recommended layout pattern for Single Output



TOP VIEW

BOTTOM VIEW

Fig. 4-3 Recommended layout pattern for Dual Output

4. EMI Considerations PMP03/PMP03W - Type B

The series modules can meet EN55032 Class A without external filter

Recommended External EMI Filter for EN55032 Class B

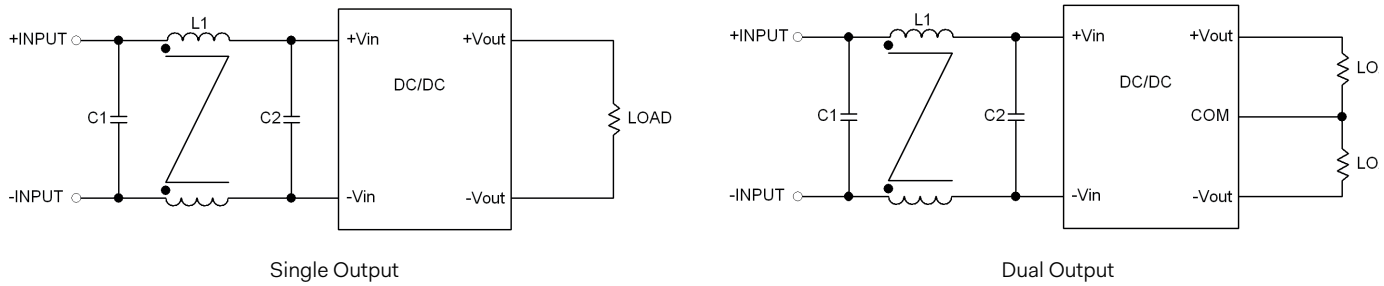


Fig. 4-4 Recommended EMI filter for EN55032 Class B

Model	C1	C2	L1
PMP03-05□□□B	22μF/16V 1206 MLCC	22μF/16V 1206 MLCC	137μH, PMT-127
PMP03-012□□□B PMP03-24□□□B PMP03-24□□□BW	4.7μF/50V 1206 MLCC	4.7μF/50V 1206 MLCC	277μH, PMT-128
PMP03-48□□□B PMP03-48□□□BW	2.2μF/100V 1210 MLCC	1μF/100V 1206 MLCC	175μH, PMT-118

Table 4-2 B.O.M. of external EMI filter

Fig. 4-5 Recommended layout pattern for Single Output

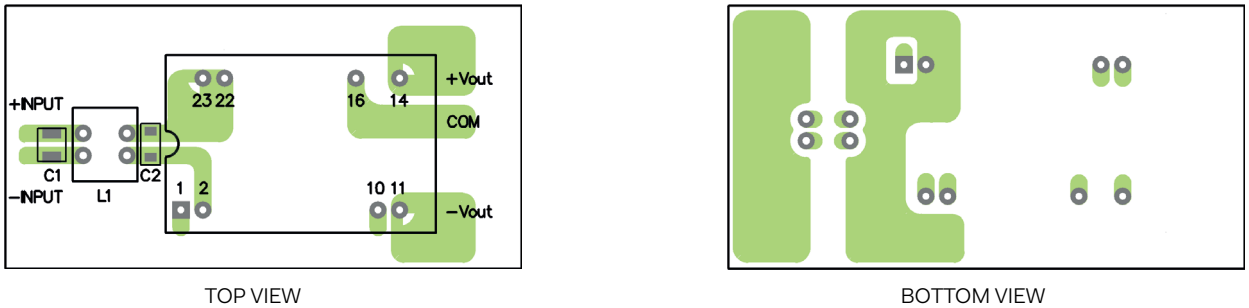


Fig. 4-6 Recommended layout pattern for Dual Output

4. EMI Considerations PMM03/PMM03W - Type A

The series modules can meet EN55032 Class A without external filter

Recommended External EMI Filter for EN55032 Class B

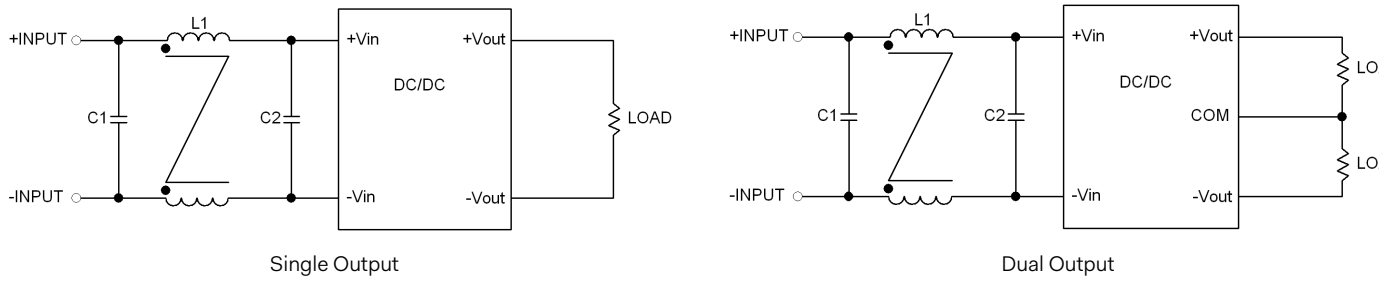


Fig. 4-7 Recommended EMI filter for EN55032 Class B

Model	C1	C2	L1
PMM03-05□□□A	22μF/16V 1206 MLCC	22μF/16V 1206 MLCC	137μH, PMT-127
PMM03-012□□□A PMM03-24□□□A PMM03-24□□□A	4.7μF/50V 1206 MLCC	4.7μF/50V 1206 MLCC	277μH, PMT-128
PMM03-48□□□A PMM03-48□□□AW	2.2μF/100V 1210 MLCC	1μF/100V 1206 MLCC	175μH, PMT-118

Table 4-3 B.O.M. of external EMI filter

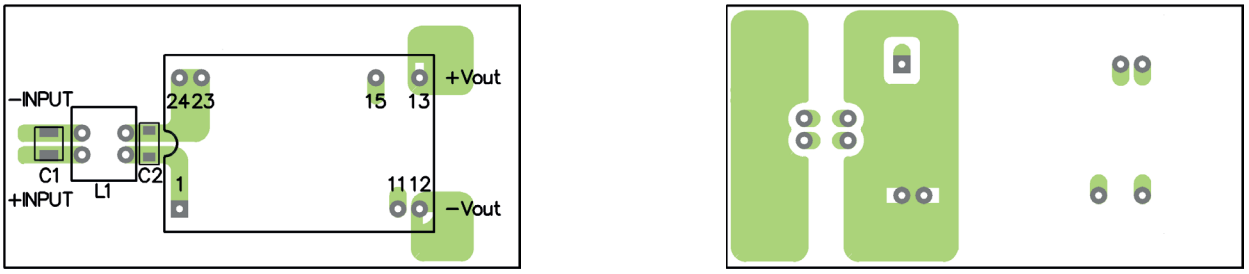


Fig. 4-8 Recommended layout pattern for Single Output

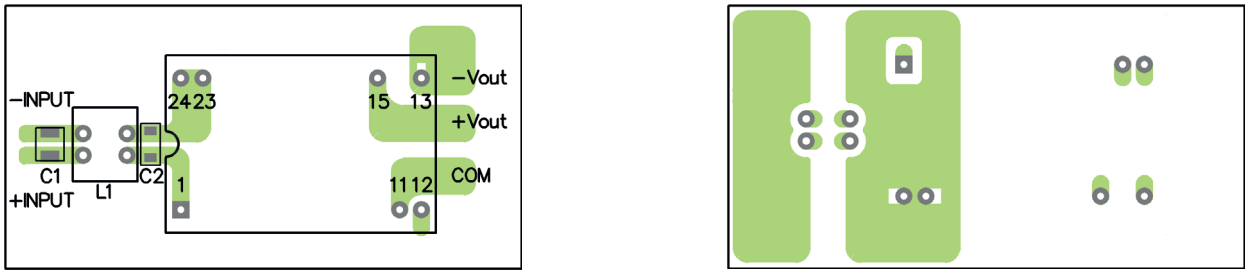


Fig. 4-9 Recommended layout pattern for Dual Output

4. EMI Considerations PMM03/PMM03W - Type B

The series modules can meet EN55032 Class A without external filter

Recommended External EMI Filter for EN55032 Class B

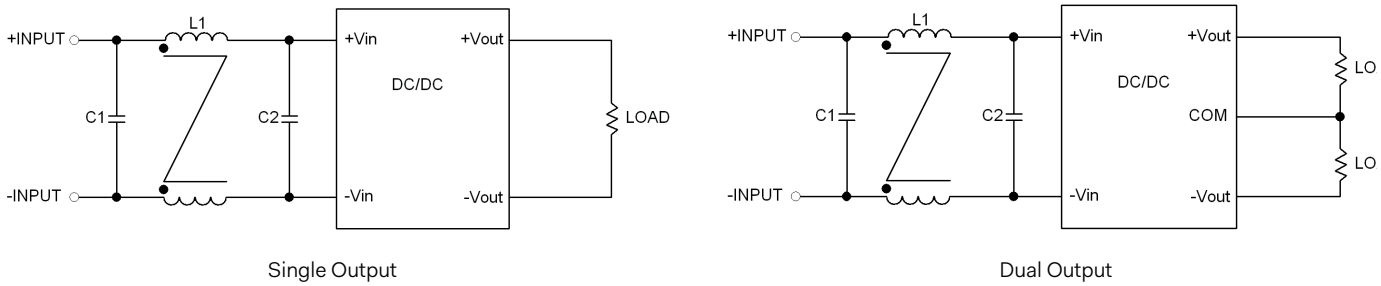


Fig. 4-10 Recommended EMI filter for EN55032 Class B

Model	C1	C2	L1
PMM03-05□□□B	22μF/16V 1206 MLCC	22μF/16V 1206 MLCC	137μH, PMT-127
PMM03-12□□□B PMM03-24□□□B PMM03-24□□□BW	4.7μF/50V 1206 MLCC	4.7μF/50V 1206 MLCC	277μH, PMT-128
PMM03-48□□□B PMM03-48□□□BW	2.2μF/100V 1210 MLCC	1μF/100V 1206 MLCC	175μH, PMT-118

Table 4-4 B.O.M. of external EMI filter

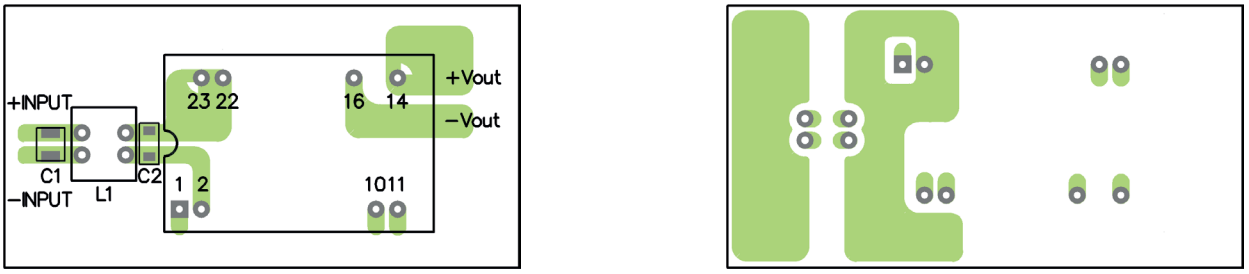


Fig. 4-11 Recommended layout pattern for Single Output

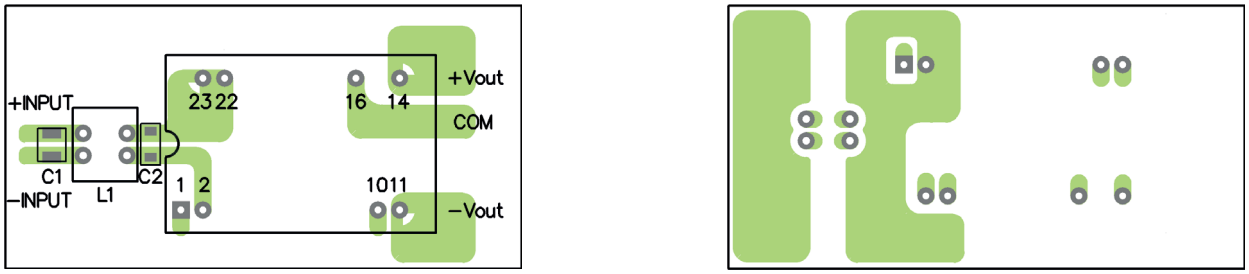


Fig. 4-12 Recommended layout pattern for Dual Output