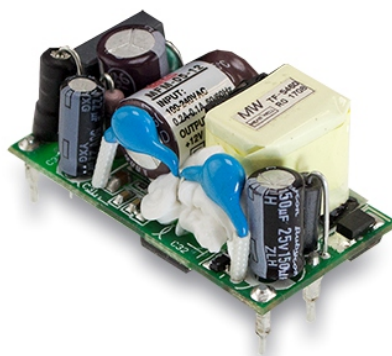




ANSI/AAMI ES60601-1



EN60601-1



IEC60601-1



## ■ Features

- 1.65"x0.88" compact size
- Medical safety approved (2 x MOPP) according to ANSI/AAMI ES60601-1 and IEC/EN60601-1
- Suitable for BF application with appropriate system consideration
- No load power consumption < 0.075W
- Extremely low leakage current
- Wide operating temp. range -40 ~ +85°C
- EMI class B for class II configuration
- Protections:  
Short circuit / Overload / Over voltage / Over temperature
- No minimum load required
- Typical lifetime > 52K hours
- 3 years warranty

## ■ Applications

- Portable medical device
- Mobile clinical workstation
- Medical computer monitor
- Medical examination instrument

## ■ Description

MFM-05 is a 5W high density and small size (42\*22.3\*20.5mm) AC/DC open frame type medical grade power supply series. It features the operation for 80~264VAC, a low no load power consumption less than 0.075W, a high efficiency up to 82%, Class II (no FG) double insulation, outstanding dissipation, 5G anti-vibration, high EMC performance, 4KVAC isolation, etc. The design observes IEC/EN60601-1 and ANSI/AAMI ES60601-1 version three with 2xMOPP level and ultra-low leakage current (<80  $\mu$  A). It is very suitable for BF (patient contact) type medical device or relevant equipment.

## ■ Model Encoding

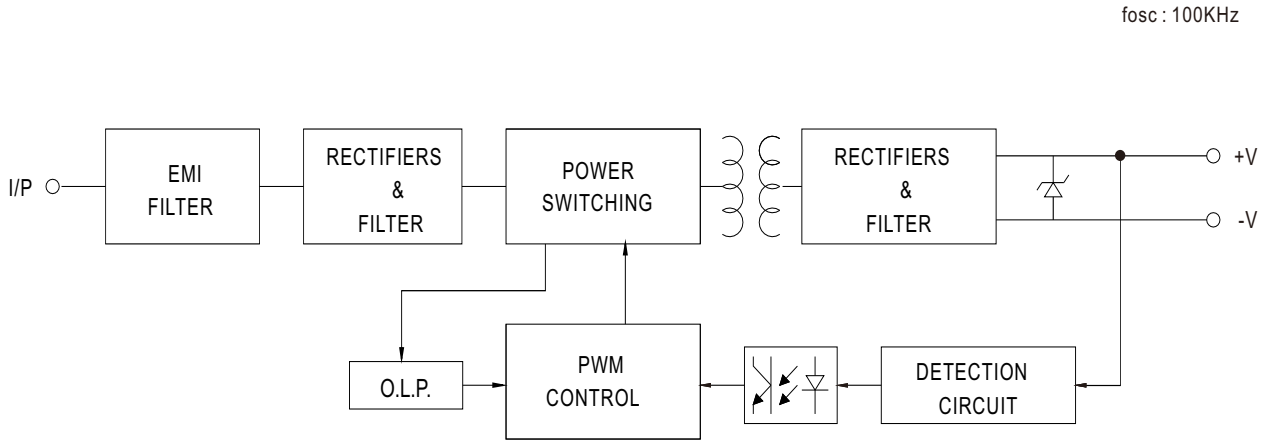
**MFM - 05 - 5**

Output voltage  
Rated wattage  
Series name

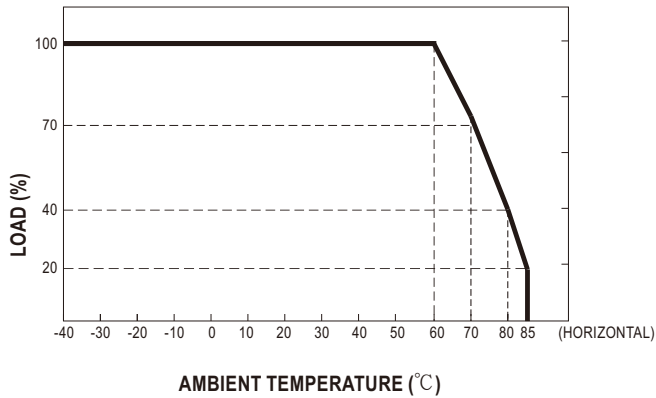
**SPECIFICATION**

| MODEL                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | MFM-05-3.3                                                                                                                           | MFM-05-5          | MFM-05-12                                                              | MFM-05-15                                | MFM-05-24    |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------------------------------|------------------------------------------|--------------|
| OUTPUT                         | DC VOLTAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3.3V                                                                                                                                 | 5V                | 12V                                                                    | 15V                                      | 24V          |
|                                | RATED CURRENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1.25A                                                                                                                                | 1A                | 0.42A                                                                  | 0.33A                                    | 0.23A        |
|                                | CURRENT RANGE <span>Note.2</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 ~ 1.25A                                                                                                                            | 0 ~ 1A            | 0 ~ 0.42A                                                              | 0 ~ 0.33A                                | 0 ~ 0.23A    |
|                                | PEAK CURRENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1.38A                                                                                                                                | 1.1A              | 0.46A                                                                  | 0.36A                                    | 0.25A        |
|                                | RATED POWER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4.1W                                                                                                                                 | 5W                | 5W                                                                     | 5W                                       | 5.5W         |
|                                | PEAK LOAD(10sec.) <span>Note.3</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4.6W                                                                                                                                 | 5.5W              | 5.5W                                                                   | 5.4W                                     | 6W           |
|                                | RIPPLE & NOISE (max.) <span>Note.4</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100mVp-p                                                                                                                             | 100mVp-p          | 150mVp-p                                                               | 150mVp-p                                 | 180mVp-p     |
|                                | VOLTAGE TOLERANCE <span>Note.5</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ±2.5%                                                                                                                                | ±2.5%             | ±2.5%                                                                  | ±2.5%                                    | ±2.5%        |
|                                | LINE REGULATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ±0.3%                                                                                                                                | ±0.3%             | ±0.3%                                                                  | ±0.3%                                    | ±0.3%        |
|                                | LOAD REGULATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ±0.5%                                                                                                                                | ±0.5%             | ±0.5%                                                                  | ±0.5%                                    | ±0.5%        |
|                                | SETUP, RISE TIME                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1000ms, 30ms/230VAC      1000ms, 30ms/115VAC at full load                                                                            |                   |                                                                        |                                          |              |
|                                | HOLD UP TIME (Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 40ms/230VAC      12ms/115VAC at full load                                                                                            |                   |                                                                        |                                          |              |
| INPUT                          | VOLTAGE RANGE <span>Note.6</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 80 ~ 264VAC                                                                                                                          |                   |                                                                        |                                          |              |
|                                | FREQUENCY RANGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 47 ~ 440Hz                                                                                                                           |                   |                                                                        |                                          |              |
|                                | EFFICIENCY (Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 74%                                                                                                                                  | 80%               | 80%                                                                    | 81%                                      | 82%          |
|                                | AC CURRENT (Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.2A/115VAC      0.1A/230VAC                                                                                                         |                   |                                                                        |                                          |              |
|                                | INRUSH CURRENT (Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | COLD START    25A/115VAC    45A/230VAC                                                                                               |                   |                                                                        |                                          |              |
|                                | LEAKAGE CURRENT (max.) <span>Note.7</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Touch current <80 $\mu$ A/264VAC                                                                                                     |                   |                                                                        |                                          |              |
| PROTECTION                     | OVERLOAD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 110% ~ 180% rated output power<br>Protection type : Hiccup mode, recovers automatically after fault condition is removed             |                   |                                                                        |                                          |              |
|                                | OVER VOLTAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3.8 ~ 5V                                                                                                                             | 5.75 ~ 6.8V       | 13.8 ~ 16.2V                                                           | 17.3 ~ 20.3V                             | 27.6 ~ 32.4V |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Protection type : Shut off o/p voltage, clamping by zener diode                                                                      |                   |                                                                        |                                          |              |
|                                | OVER TEMPERATURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Protection type : Shut down o/p voltage, recovers automatically after temperature goes down                                          |                   |                                                                        |                                          |              |
| ENVIRONMENT                    | WORKING TEMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -40 ~ +85 $^{\circ}$ C (Refer to "Derating Curve")                                                                                   |                   |                                                                        |                                          |              |
|                                | WORKING HUMIDITY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 20 ~ 90% RH non-condensing                                                                                                           |                   |                                                                        |                                          |              |
|                                | STORAGE TEMP., HUMIDITY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -40 ~ +100 $^{\circ}$ C, 10 ~ 95% RH non-condensing                                                                                  |                   |                                                                        |                                          |              |
|                                | TEMP. COEFFICIENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ±0.03%/ $^{\circ}$ C (0 ~ 60 $^{\circ}$ C)                                                                                           |                   |                                                                        |                                          |              |
|                                | SOLDERING TEMPERATURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 260 $^{\circ}$ C ±5 $^{\circ}$ C/10sec.max.                                                                                          |                   |                                                                        |                                          |              |
|                                | VIBRATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10 ~ 500Hz, 5G 10min./1cycle, period for 60min. each along X, Y, Z axes                                                              |                   |                                                                        |                                          |              |
|                                | OPERATING ALTITUDE <span>Note.8</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5000 meters                                                                                                                          |                   |                                                                        |                                          |              |
| SAFETY & EMC<br>(Note 9)       | SAFETY STANDARDS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IEC60601-1, EN60601-1, UL ANSI/AAMI ES60601-1(3.1 version), CAN/CSA-C22 3 <sup>rd</sup> Edition approved ; Design refer to EN60335-1 |                   |                                                                        |                                          |              |
|                                | ISOLATION LEVEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Primary-Secondary: 2xMOPP                                                                                                            |                   |                                                                        |                                          |              |
|                                | WITHSTAND VOLTAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | I/P-O/P:4KVAC                                                                                                                        |                   |                                                                        |                                          |              |
|                                | ISOLATION RESISTANCE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I/P-O/P:100M Ohms / 500VDC / 25 $^{\circ}$ C / 70% RH                                                                                |                   |                                                                        |                                          |              |
|                                | EMC EMISSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Parameter                                                                                                                            | Standard          |                                                                        | Test Level / Note                        |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Conducted                                                                                                                            | EN55011 (CISPR11) |                                                                        | Class B                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Radiated                                                                                                                             | EN55011 (CISPR11) |                                                                        | Class B                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Harmonic Current                                                                                                                     | EN61000-3-2       |                                                                        | Class A                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Voltage Flicker                                                                                                                      | EN61000-3-3       |                                                                        | -----                                    |              |
|                                | EMC IMMUNITY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EN55024 , EN60601-1-2, EN61204-3                                                                                                     |                   |                                                                        |                                          |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Parameter                                                                                                                            | Standard          |                                                                        | Test Level / Note                        |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ESD                                                                                                                                  | EN61000-4-2       |                                                                        | Level 4, 15KV air ; Level 4, 8KV contact |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Radiated                                                                                                                             | EN61000-4-3       |                                                                        | Level 3                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EFT / Burst                                                                                                                          | EN61000-4-4       |                                                                        | Level 3                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Surge                                                                                                                                | EN61000-4-5       |                                                                        | Level 3, 1KV/Line-Line                   |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Conducted                                                                                                                            | EN61000-4-6       |                                                                        | Level 3                                  |              |
|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Magnetic Field                                                                                                                       | EN61000-4-8       |                                                                        | Level 4                                  |              |
| Voltage Dips and Interruptions |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EN61000-4-11                                                                                                                         |                   | 100% dip 1 periods, 30% dip 25 periods, 100% interruptions 250 periods |                                          |              |
| OTHERS                         | MTBF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1799.5Khrs min.    MIL-HDBK-217F (25 $^{\circ}$ C)                                                                                   |                   |                                                                        |                                          |              |
|                                | DIMENSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 42*22.3*20.5mm (L*W*H) or 1.65*0.88*0.80" inch                                                                                       |                   |                                                                        |                                          |              |
|                                | PACKING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.018Kg; 270pcs/5.8Kg/0.97CUFT                                                                                                       |                   |                                                                        |                                          |              |
| NOTE                           | 1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25 $^{\circ}$ C of ambient temperature.<br>2. No minimum load required.<br>3. 33% Duty cycle maximum within every 30 seconds. Average output power should not exceed the rated power<br>4. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1 $\mu$ f & 47 $\mu$ f parallel capacitor.<br>5. Tolerance : includes set up tolerance, line regulation and load regulation.<br>6. Derating may be needed under low input voltages. Please check the derating curve for more details.<br>7. Touch current was measured from primary input to DC output.<br>8. The ambient temperature derating of 2.5 $^{\circ}$ C/ 1000m is needed for operating altitude greater than 2000m(6500ft).<br>9. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies."<br>(as available on <a href="http://www.meanwell.com">http://www.meanwell.com</a> ) |                                                                                                                                      |                   |                                                                        |                                          |              |

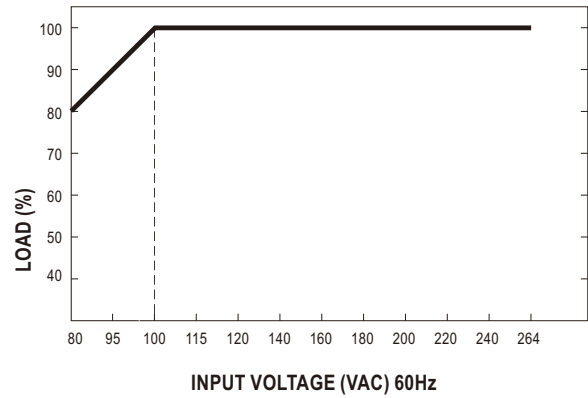
## ■ Block Diagram



## ■ Derating Curve

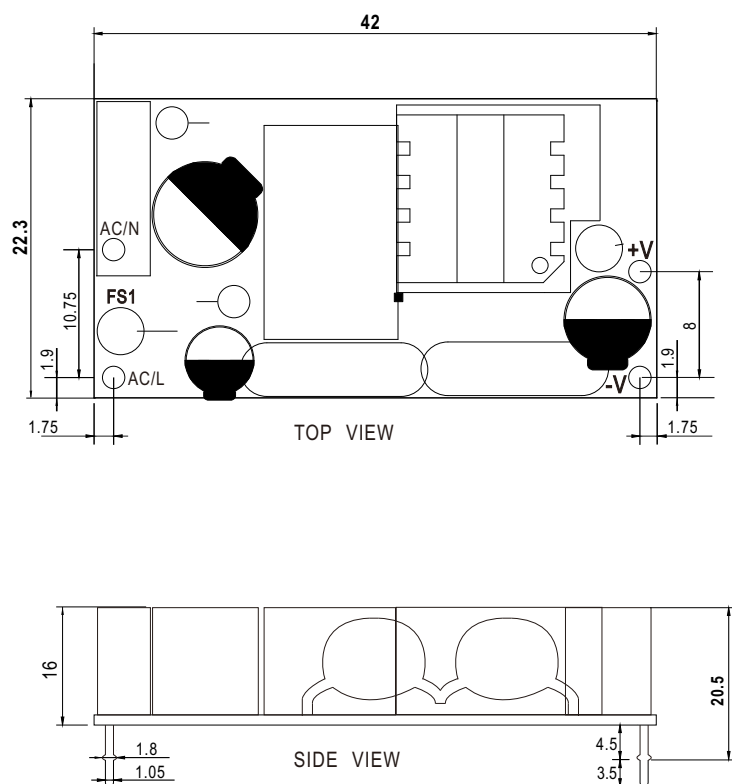


## ■ Output Derating VS Input Voltage



## ■ Mechanical Specification

Unit: mm

**■ Installation Manual**

Please refer to : <http://www.meanwell.com/manual.html>