MINMAX®

# MOA20C SERIES

DC-DC Power Module 20W

## FEATURES

- Fully Encapsulated Plastic Case for Chassis and DIN-Rail Mounting Version
- 80-160VDC Wide Input Voltage Range
- Fully Regulated Output Voltage
- High Efficiency up to 88%
- I/O Isolation 3000VAC with Reinforced Insulation, rated for 1000Vrms Working Voltage
- Operating Ambient Temp. Range -40℃ to +94.5℃
- No Min. Load Requirement
- Very Low No Load Power Consumption
- Under-voltage, Overload/Voltage and Short Circuit Protection
- Remote On/Off Control
- EMI Emission EN 55032 Class A Approved
- EMC Immunity EN 61000-4-2,3,4,5,6,8 Approved
- UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking

NEW


UL 62368-1 CB Scheme

## PRODUCT OVERVIEW

The MINMAX MOA20C series is the latest 20Watt isolated DC-DC power module generation with 9 fixed output voltage models: 5 / 5.1 / 12 / 15 / 24 / 48 / ±12 / ±15 / ±24VDC. The wide input range from 80VDC to 160VDC is specifically for electricity and renewable energy field applications within the usage of terminal strip connectors in chassis and DIN-Rail package.

The key performances are : 3000VAC I/O Isolation, reinforced insulation, high efficiency, wide operating ambient temp. range -40℃ to +94.5℃, no min. load, low no-load power consumption, remote on/off, built-in EMI emission EN 55032 Class A, UVLO, OVP, and SCP. The MOA20C series certificates in safety UL/cUL/IEC/EN 62368-1 with CB report and CE marking and offers a solution for eliminating components of a power board.

### Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current Max. | Input Current | | Over Voltage Protection | Max. capacitive Load | Efficiency (typ.) |
|---|---|---|---|---|---|---|---|---|
| | | | | @ Max. Load | @ No Load | | | @Max. Load |
| | VDC | VDC | mA | mA(typ.) | mA(typ.) | VDC | μF | % |
| **MOA20-110S05C** | 110 (80 ~ 160) | 5 | 4000 | 209 | 10 | 6.2 | 6800 | 87 |
| **MOA20-110S051C** | | 5.1 | 4000 | 213 | | 6.2 | 6800 | 87 |
| **MOA20-110S12C** | | 12 | 1670 | 207 | | 15 | 1200 | 88 |
| **MOA20-110S15C** | | 15 | 1340 | 208 | | 18 | 750 | 88 |
| **MOA20-110S24C** | | 24 | 830 | 206 | | 30 | 300 | 88 |
| **MOA20-110S48C** | | 48 | 420 | 208 | | 60 | 75 | 86 |
| **MOA20-110D12C** | | ±12 | ±830 | 208 | | ±15 | 380# | 87 |
| **MOA20-110D15C** | | ±15 | ±670 | 210 | | ±18 | 380# | 87 |
| **MOA20-110D24C** | | ±24 | ±420 | 211 | | ±30 | 150# | 87 |

# For each output

### Input Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (100 ms max.) | | -0.7 | --- | 170 | VDC |
| Start-Up Threshold Voltage | | --- | --- | 80 | |
| Under Voltage Shutdown | | 65 | 70 | --- | |
| Start Up Time (Power On) | Nominal Vin and Constant Resistive Load | --- | 30 | 60 | ms |
| Input Filter | All Models | Internal Pi Type | | | |

## Remote On/Off Control

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Converter On | 3.5V ~ 12V or Open Circuit | | | | |
| Converter Off | 0V ~ 1.2V or Short Circuit | | | | |
| Control Input Current (On) | Vctrl = 5.0V | --- | --- | 0.5 | mA |
| Control Input Current (Off) | Vctrl = 0V | --- | --- | -0.5 | mA |
| Control Common | Referenced to Negative Input | | | | |
| Standby Input Current | Nominal Vin | --- | 3 | --- | mA |

## Output Specifications

| Parameter | Conditions / Model | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Setting Accuracy | | | --- | ±1.0 | ±2.0 | %Vnom. |
| Output Voltage Balance | Dual Output, Balanced Loads | | --- | --- | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. @Full Load | | --- | ±0.5 | ±1.0 | % |
| Load Regulation | Io=0% to 100% | | --- | ±0.5 | ±1.0 | % |
| Load Cross Regulation (Dual Output Models) | Asymmetrical Load 25/100% Full Load | | --- | --- | ±5.0 | % |
| Minimum Load | No minimum Load Requirement | | | | | |
| Ripple & Noise | 0-20MHz Bandwith | 5V & 5.1V Output Models | --- | --- | 100 | mV P-P |
| | | ±24V & 48V Output Models | --- | --- | 200 | mV P-P |
| | | Other Output Models | --- | --- | 150 | mV P-P |
| Transient Recovery Time | 25% Load Step Change(2) | | --- | 250 | --- | µsec |
| Transient Response Deviation | | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | | --- | --- | ±0.02 | %/℃ |
| Over Load Protection | Hiccup | | --- | 150 | 180 | % |
| Short Circuit Protection | Continuous, Automatic Recovery (Hiccup Mode 0.5Hz typ.) | | | | | |

## General Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| I/O Isolation Voltage | 60 Seconds<br>Reinforced insulation, rated for 1000Vrms working voltage | 3000 | --- | --- | VAC |
| I/O Isolation Resistance | 500 VDC | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | --- | 2200 | pF |
| Switching Frequency | 5V & 5.1V Output Models | 187 | 220 | 253 | kHz |
| | Other Output Models | 238 | 280 | 322 | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25°C, Ground Benign | 696,909 | --- | --- | Hours |
| Safety Approvals | UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB report) | | | | |

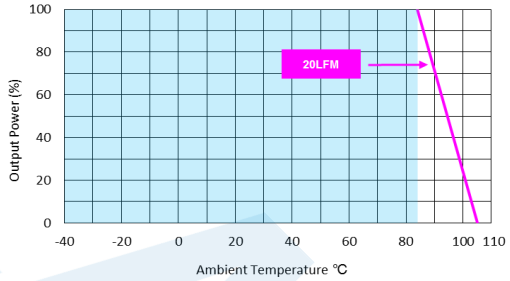
## EMC Specifications

| Parameter | Standards & Level | | | Performance |
|---|---|---|---|---|
| EMI | Conduction | EN 55032 | Without external components | Class A |
| | Radiation | | | |
| EMS | EN 55035 | | | |
| | ESD | Direct discharge | Indirect discharge HCP &VCP | A |
| | | EN 61000-4-2 Air ± 8kV | Contact ±6kV | |
| | Radiated immunity | EN 61000-4-3 10V/m | | A |
| | Fast transient | EN 61000-4-4 ±2kV | | A |
| | Surge | EN 61000-4-5 ±2kV | | A |
| | Conducted immunity | EN 61000-4-6 10Vrms | | A |
| | PFMF | EN 61000-4-8 100A/m | | A |

## Environmental Specifications

| Parameter | Min. | Max. | Unit |
|---|---|---|---|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +94.5 | ℃ |
| Case Temperature | --- | +105 | ℃ |
| Storage Temperature Range | -50 | +125 | ℃ |
| Humidity (non condensing) | --- | 95 | % rel. H |

## Power Derating Curve

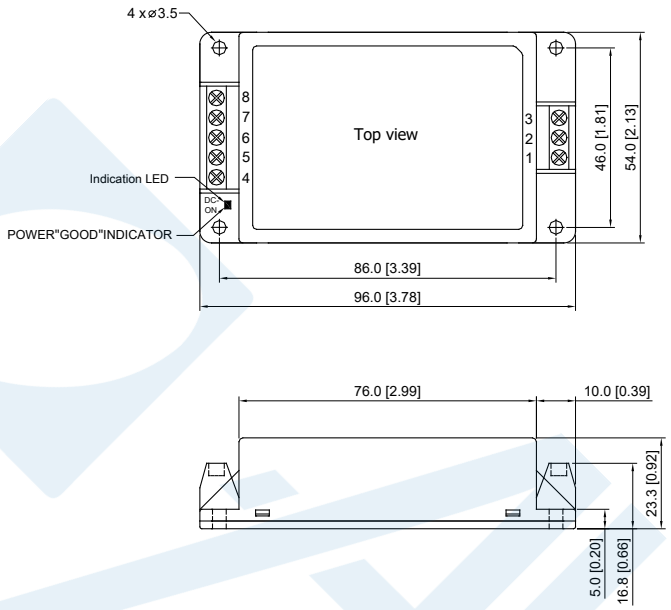



## Notes

1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3 We recommend to protect the converter by a slow blow fuse in the input supply line.
4 Other input and output voltage may be available, please contact MINMAX.
5 Specifications are subject to change without notice.

## Package Specifications Chassis Mounting

Mechanical Dimensions




Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | Remote On/Off | Remote On/Off |
| 2 | -Vin | -Vin |
| 3 | +Vin | +Vin |
| 4 | NC | NC |
| 5 | -Vout | -Vout |
| 6 | NC | Common |
| 7 | +Vout | +Vout |
| 8 | NC | NC |

NC: No Connection

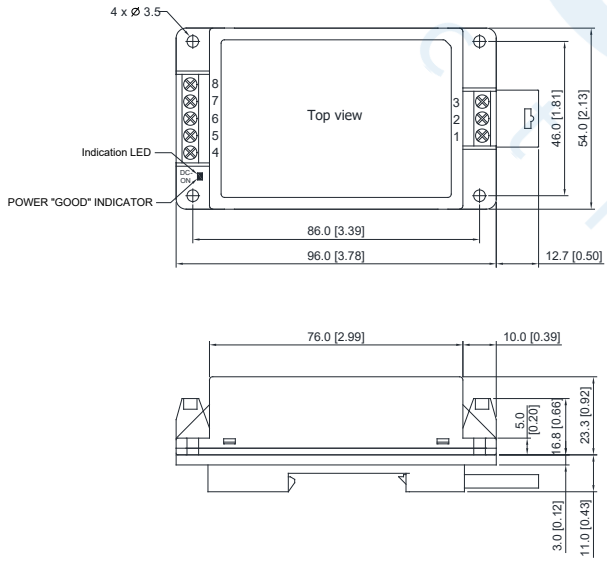
- All dimensions in mm (inches)
- Tolerance: ±0.5 (±0.02)

## Physical Characteristics

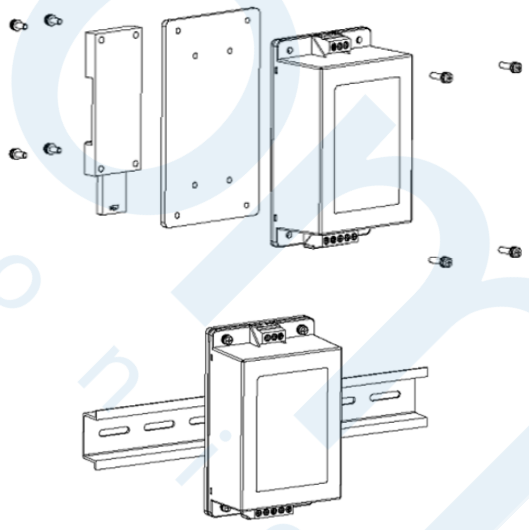
| | | |
|---|---|---|
| Case Size | : | 96.0x54.0x23.3mm (3.78x2.13x0.92 inches) |
| Case Material | : | Plastic resin (flammability to UL 94V-0 rated) |
| Weight | : | 107g |

## Package Specifications with DIN Rail Mounting Bracket (order code AC-DIN-01)

Mechanical Dimensions




DIN-Rail Mounting Kit



## Physical Characteristics

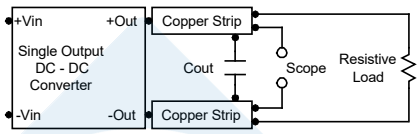
| | | |
|---|---|---|
| Case Size | : | 96.0x54.0x23.3mm (3.78x2.13x0.92 inches) |
| Case Material | : | Plastic resin (flammability to UL 94V-0 rated) |
| Weight | : | 166g |

| Order Code Table | | |
|---|---|---|
| Standard | DIN Rail | Converter with DIN Rail Mounting |
| MOA20-110S05C | AC-DIN-01 | MOA20-110S05C-DIN01 |
| MOA20-110S051C | AC-DIN-01 | MOA20-110S051C-DIN01 |
| MOA20-110S12C | AC-DIN-01 | MOA20-110S12C-DIN01 |
| MOA20-110S15C | AC-DIN-01 | MOA20-110S15C-DIN01 |
| MOA20-110S24C | AC-DIN-01 | MOA20-110S24C-DIN01 |
| MOA20-110S48C | AC-DIN-01 | MOA20-110S48C-DIN01 |
| MOA20-110D12C | AC-DIN-01 | MOA20-110D12C-DIN01 |
| MOA20-110D15C | AC-DIN-01 | MOA20-110D15C-DIN01 |
| MOA20-110D24C | AC-DIN-01 | MOA20-110D24C-DIN01 |

## Test Setup

### Peak-to-Peak Output Noise Measurement Test

Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.




## Technical Notes

### Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 1) during a logic low is -100μA.

### Overload Protection

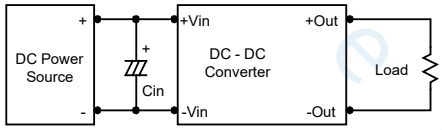
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

### Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

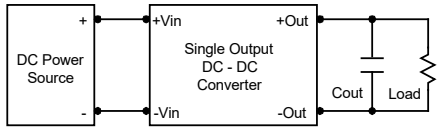
### Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 10μF for the 110V devices.




### Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7μF capacitors at the output.




### Maximum Capacitive Load

The MOA20C series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

### Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.