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M9-20W Series

20W 4:1 Regulated Single & Dual output

Features

- Ultra Wide 4:1 Input Range
- 3000 VDC Isolation
- No Minimum Load Required
- Efficiency up to 91%
- Extended Operating Temperature Range -40 ~ 100°C max.
- Adjustable Output Voltage
- Remote On/Off Control (CTRL)
- Continuous Short Circuit Protection
- Over Load Protection
- Over Voltage Protection
- Soft Start
- Built-in EMI filter meets EN55032 classA without external components

The M9 series is a family of cost effective 20W single & dual output DC-DC converters. These converters combine copper package in a 1.6"x1" case with high performance features , continuous short circuit protection with automatic restart and tight line / load regulation. Devices are encapsulated using flame retardant resin. Input voltages of 24 and 48 with output voltage of 3.3, 5, 12, 15, ±5, ±12, ±15Vdc. High performance features include high efficiency operation up to 91% and output voltage accuracy of ±1% maximum.

ALL SPECIFICATIONS ARE TYPICAL AT 25°C, NOMINAL INPUT AND FULL LOAD UNLESS OTHERWISE NOTED.

OUTPUT SPECIFICATIONS

Output Voltage Accuracy	±1%
Output Voltage Adjustability(Trim)	Single output: ±10%, max.
Maximum Output Current	See table
Line Regulation	±0.5%, max.
Load Regulation(Io=0% to 100%)	Single: ±0.5%, max. Dual:±1%, max.(balanced load)
Cross Regulation (Dual Output) (1)	±5%
Ripple&Noise Measured by 20MHz bandwidth With a 10μF/25V X7R MLCC With a 10μF/25V X7R MLCC for each output	 Single output:75mVpk-pk,max. Dual output:60mVpk-pk,max.
Over Voltage Protection	140% of Vout, typ.
Over Load Protection	170% of FL, typ.
Short Circuit Protection	Indefinite(hiccup) (Automatic Recovery)
Temperature Coefficient	±0.02%/°C
Capacitive Load (2)	See table
Transient Recovery Time (3)	250μs, typ.
Transient Response Deviation(3)	±3%, max. Single Output 3.3V:±5%, max.

INPUT SPECIFICATIONS

Input Voltage Range		See table
Under Voltage Lockout		
24V Modes	Module ON / OFF	8.8Vdc / 7.6Vdc, typ.
48V Modes	Module ON / OFF	17.5Vdc / 16.5Vdc, typ.
Start up Time (Nominal Vin and constant resistive load)		30mS, typ.
Input Filter		Pi Type
Input Current(No-Load)		See table, max.
Input Current(Full-Load)		See table, typ.
Input Reflected Ripple Current(4)		20mAp-p, typ.
Remote On/Off (Positive logic)(5)		
ON:		3.0 ... 12Vdc or open circuit
OFF:		0 ... 1.2Vdc or Short circuit pin2 and pin6
OFF idle current:		2 mA, typ.

ENVIRONMENTAL SPECIFICATIONS

Operating Ambient Temperature		-40°C ~ +100°C(See Derating Curve) -40°C ~ +66°C(For 100% load)
Maximum Case Temperature		105°C
Thermal Impedance	Without Heat-sink With Heat-sink	12°C/W, min. 11°C/W, min.
Storage Temperature		-55°C ~ +125°C
Cooling(7)		Nature Convection

GENERAL SPECIFICATIONS

Efficiency		See table, typ.
I/O Isolation Voltage(60sec)		
Input/Output		3000Vdc
Case/Input & Output		1600Vdc
Isolation Resistance		1000 MΩ, min.
Isolation Capacitance		2000 pF, typ.
Switching Frequency	3.3 & 05 Vout Models other Models	270kHz, typ. 330kHz, typ.
Humidity		95% rel H
Reliability Calculated MTBF(MIL-HDBK-217 F)		>400 Khrs
Safety Standard		UL/cUL 60950-1 , 62368-1 IEC/EN 60950-1 , 62368-1
Safety Approvals		UL/cUL 60950-1 , 62368-1 IEC/EN 60950-1 , 62368-1

EMC CHARACTERISTICS

Radiated Emissions	EN55032	CLASS A
Conducted Emissions	EN55032	CLASS A
ESD	IEC61000-4-2	Perf. Criteria B
RS	IEC61000-4-3	Perf. Criteria A
EFT(8)	IEC61000-4-4	Perf. Criteria A
Surge (8)	IEC61000-4-5	Perf. Criteria A
CS	IEC61000-4-6	Perf. Criteria A
PFMF	IEC61000-4-8	Perf. Criteria A

PHYSICAL SPECIFICATIONS

Case Material	Copper
Base Material	Non-conductive Black Plastic(UL94V-0 rated)
Pin Material	Φ1.0mm Brass Solder-coated
Potting Material	Epoxy (UL94V-0 rated)
Weight	29.0g(Without Heat-sink) / 35.5g(With Heat-sink)
Dimensions	1.60"x1.00"x0.41"

ABSOLUTE SPECIFICATIONS (6)

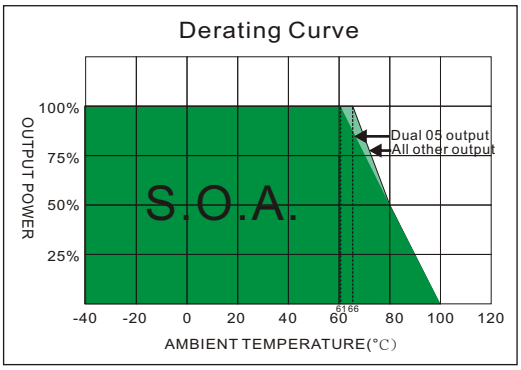
These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.

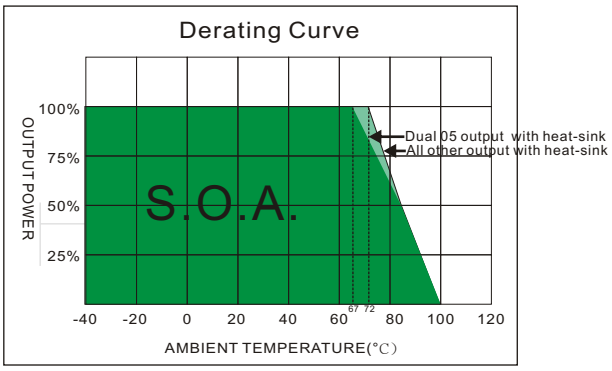
Input Voltage(100mS)	
24 Models	50 Vdc, max.
48 Models	100 Vdc, max.
Soldering Temperature(1.5mm from case 10sec Max.)	260°C, max.

PART NUMBER STRUCTURE

M9 - 24 12 S 20 SK

- M9 - Series Name
- 24 - Input Voltage Range: **24** - 9 ~ 36V; **48** - 18 ~ 75V
- 12 - Nominal Output Voltage: **3R3** - 3.3V; **05** - 5V; **12** - 12V; **15** - 15V
- S - Output Type: **S** - Single output; **D** - Dual Output
- 20 - Watt
- SK - Heat-sink(optional): **blank** - Without Heat-sink; **SK** - With Heat-sink





MODEL SELECTION GUIDE

MODEL NUMBER	INPUT Voltage Range (Vdc)	INPUT Current No-Load (mA, max.)	INPUT Current Full Load (mA, typ.)	OUTPUT Voltage (Vdc)	OUTPUT Current Min. load (mA)	OUTPUT Current Full load (mA)	EFFICIENCY @FL (%, typ.)	Capacitor Load @FL (μF, max.)
M9-243R3S20	9-36	10	849.72	3.3	0	5500	89	10000
M9-2405S20	9-36	10	936.33	5	0	4000	89	6800
M9-2412S20	9-36	10	943.50	12	0	1670	88.5	1000
M9-2415S20	9-36	15	944.60	15	0	1330	88	680
M9-483R3S20	18-75	8	422.49	3.3	0	5500	89.5	10000
M9-4805S20	18-75	8	462.96	5	0	4000	90	6800
M9-4812S20	18-75	8	463.89	12	0	1670	90	1000
M9-4815S20	18-75	8	456.73	15	0	1330	91	680
M9-2405D20	9-36	10	968.99	±5	0	±2000	86	±2200
M9-2412D20	9-36	15	943.50	±12	0	±835	88.5	±470
M9-2415D20	9-36	15	939.27	±15	0	±665	88.5	±330
M9-4805D20	18-75	8	478.93	±5	0	±2000	87	±2200
M9-4812D20	18-75	8	463.89	±12	0	±835	90	±470
M9-4815D20	18-75	10	459.25	±15	0	±665	90.5	±330

NOTE

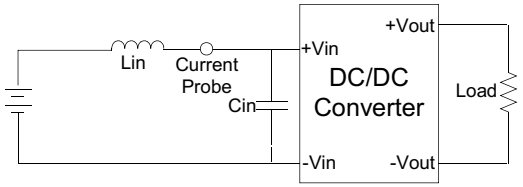
1. One load is 25% to 100% load, the other load is 100% load, the output voltage variable rate is within ±5%.
2. Tested by minimal Vin and constant resistive load.
3. Tested by normal Vin and 25% load step change (75%-50%-25% of Io).
4. Measured Input reflected ripple current with a simulated source inductance of 12μH and a source capacitor Cin(47μF, ESR<1.0Ω at 100KHz).
5. The remote on/off control pin is referenced to -Vin(pin2).
6. Exceeding the absolute ratings of the unit could cause damage.
   It is not allowed for continuous operating.
7. "Nature Convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).
8. An external filter is required if the module has to meet IEC61000-4-4,EN61000-4-5.
   The M9-24XXXX20 recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330μF/100V) and a TVS (SMDJ58A,58V,3000Watt peak pulse power) to connect in parallel.
   The M9-48XXXX20 recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330μF/100V) and a TVS (SMDJ120A,120V,3000Watt peak pulse power) to connect in parallel.
   Which application refer to the EFT/Surge Filter of design & feature configuration.

The models listed above is just for standard type. If you need the special specification product, please contact our service member by telephone presented in shortform cover or e-mail to : sales@motien.com.tw

TEST CONFIGURATIONS

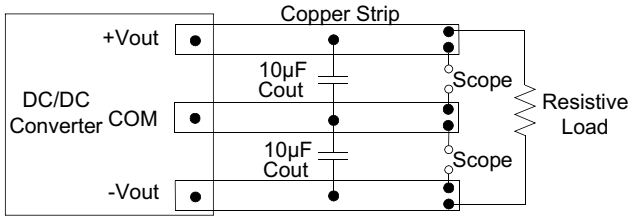
Input Reflected Ripple Current Test Step

Input reflected ripple current is measured through a source inductor Lin(12μH) and a source capacitor Cin(47μF, ESR<1.0Ω at 100KHz) at nominal input and full load.



Output Ripple & Noise Measurement Test

To reduce ripple and noise, it is recommended to use a 10μF ceramic disk capacitor to at the output.



DESIGN & FEATURE CONFIGURATIONS

Over Voltage Protection

The module includes an internal output over voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over voltage set point, the module will activate the control loop of internal circuit to clamp the output voltage.

Over Current Protection

The module includes an internal over current protection circuit, which will endure current limiting for an unlimited duration during output over load condition. If the output current exceeds the OCP set point, the module will shut down automatically (hiccup).

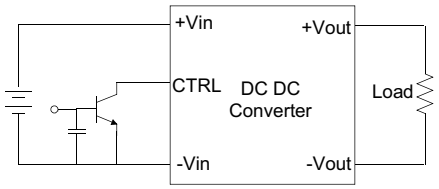
The module will try to restart after shut down.
If the over load condition still exists, the module will shut down again.

CTRL Module ON / OFF

Positive logic turns on the module during high logic and off during low logic.

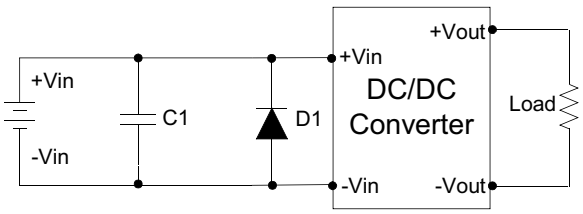
Ctrl module on/off can be controlled by an external switch between the ctrl terminal and -Vin terminal. The switch can be an open collector or open drain

For positive logic if the ctrl feature is not used, please leave the ctrl pin floating.



EFT/Surge Filter

Input filter components (C1,D1) are used to help meet EN61000-4-4 and EN61000-4-5 .



	C1	D1
M9-24XXXXX	330μF,100V	TVS,58V,3kW
M9-48XXXXX	330μF,100V	TVS,120V,3kW

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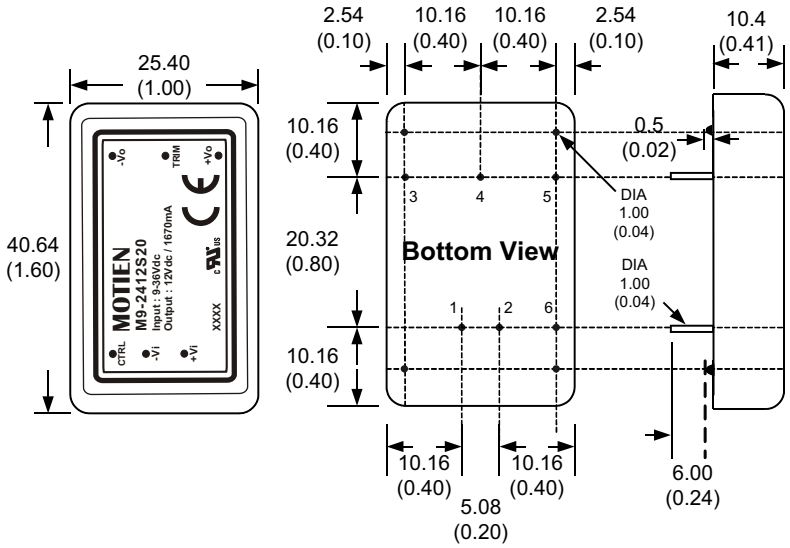
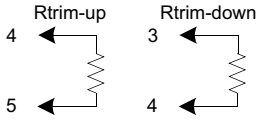
MECHANICAL SPECIFICATIONS



PIN CONNECTIONS		
PIN NUMBER	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Com
5	-Vout	-Vout
6	CTRL	CTRL

EXTERNAL OUTPUT TRIMMING

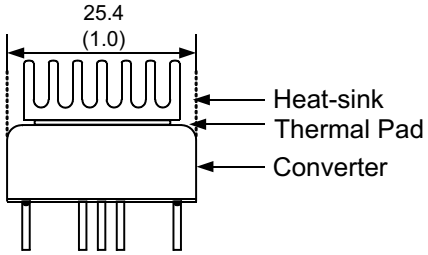
Output can be externally trimmed by using the method as below. (single output models only)

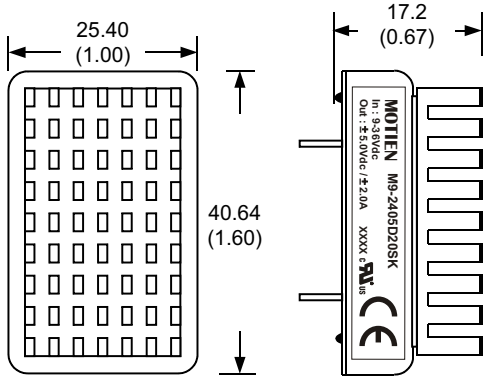


All dimensions are typical in millimeters (inches).
1. Pin diameter: 1.0 ±0.05 (0.04 ±0.002)
2. Pin pitch tolerance: ±0.35 (±0.014)
3. Case Tolerance: ±0.5 (±0.02)
4. Stand-off tolerance: ±0.1 (±0.004)

MECHANICAL SPECIFICATIONS

With Heat-sink





Order code: M9-XXXXS20SK(contain: heat-sink, thermal pad)
Material: Aluminum
Finish: Anodic treatment (black)
Weight: 6.5 g (0.23oz) (without converter)

Note:
1. Converters will be supplied with heat-sinks already mounted. Please contact factory for quotation.

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