

M60 - 60W Series

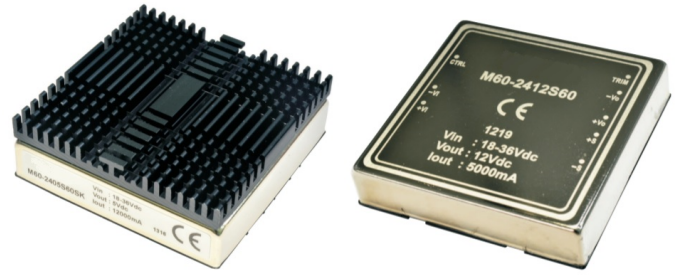
60W 2:1 Regulated Single output



electronicsolutions

Features

- Wide 2:1 Input Range
- 1600VDC Isolation
- No Minimum Load Required
- Efficiency up to 91%
- -40 ~ 85°C Operation Temperature Range
- Adjustable Output Voltage
- Remote On/Off Control (CTRL)
- Continuous Short Circuit Protection
- Over Current Protection
- Over Voltage Protection
- Over Temperature Protection
- Soft Start
- Built-in EMC filter meets EN55032 ClassA without external components
- Optional Heat-sink



The M60 series is a family of high performance 60W single output DC-DC converters. These converters combine nickle-coated copper package in a 2"x2" case with high performance features such as Active Clamp Technology, 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, 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%, max.
Output Voltage Adjustability (Trim) (1)	±10%, max.
Output Current	See table, max.
Line Regulation	±0.5%, max.
Load Regulation (0% to 100% FL)	±0.5%, max.
Ripple & Noise (2)	3.3V&5.0V output 75mVpk-pk, max. 12V&15V output 100mVpk-pk, max.
Over Voltage Protection	3.3V output 3.9V 5V output 6.2V (Zener diode clamp) 12V output 15V 15V output 18V
Over Current Protection	135% of FL, typ.
Short Circuit Protection	Indefinite(hiccup) (Automatic Recovery)
Temperature Coefficient	±0.02%/°C
Capacitive Load (3)	See table, max.
Transient Recovery Time (4)	250µs, typ.
Transient Response Deviation (4)	±3%, max.

INPUT SPECIFICATIONS	
Input Voltage Range	See table
Under Voltage Lockout	
24 Models	Module ON / OFF 17.8Vdc / 16Vdc, typ.
48 Models	Module ON / OFF 33.5Vdc / 30.5Vdc, typ.
Start up Time (Nominal Vin and constant resistive load)	20mS, typ.
Input Filter	Pi Type
Input Current (No-Load)	See table, max.
Input Current (Full-Load)	See table, typ.
Input Reflected Ripple Current (5)	20mApk-pk, typ.
Remote On/Off (CTRL) (6)	
ON:	3.0 ... 12Vdc or open circuit
OFF:	0 ... 1.2Vdc or Short circuit pin 2 and pin 3
	OFF idle current: 5.0mA, typ.

ABSOLUTE SPECIFICATIONS (7)	
These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.	
Input Surge Voltage (100mS)	
24 Models	50Vdc, max.
48 Models	100Vdc, max.
Soldering Temperature (1.5mm from case 10sec max.)	260°C, max.

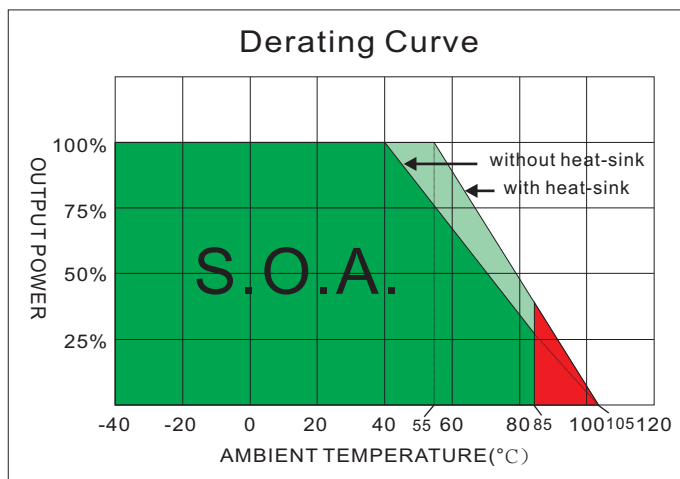
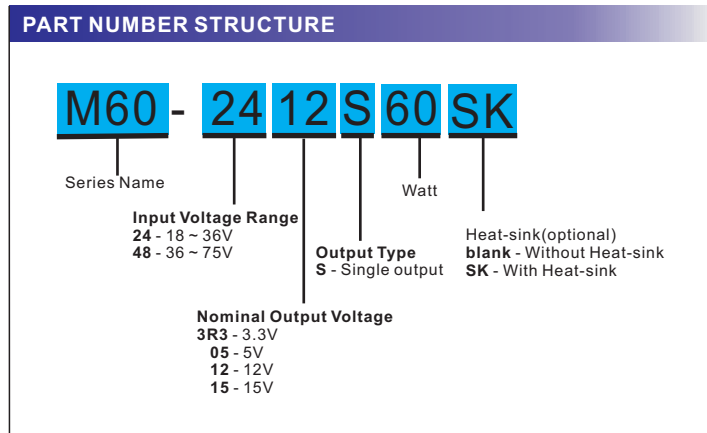
GENERAL SPECIFICATIONS	
Efficiency	See table, typ.
I/O Isolation Voltage (60sec)	
Input / Output	1600Vdc
Case / Input & Output	1600Vdc
Isolation Resistance	1000MΩ, min.
Isolation Capacitance	2000pF, typ.
Switching Frequency	270kHz, typ.
Humidity	95% rel H
Reliability Calculated MTBF (MIL-HDBK-217 F)	>110Khrs
Safety Standard	IEC/EN 60950-1 , 62368-1 UL/cUL 60950-1 , 62368-1
Safety Approvals	EN 60950-1 , 62368-1

EMC CHARACTERISTICS		
Radiated Emissions	EN55032	CLASS A
Conducted Emissions	EN55032	CLASS A
ESD	IEC61000-4-2	Perf. Criteria A
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	Nickel-coated Copper
Base Material	Non-conductive Black Plastic (UL94V-0 rated)
Pin Material	Φ1.0mm Brass Solder-coated
Potting Material	Epoxy (UL94V-0 rated)
Weight	70.0g(Without Heat-sink) / 92.0g(With Heat-sink)
Dimensions	2.00"x2.00"x0.40"

ENVIRONMENTAL SPECIFICATIONS		
Operating Ambient Temperature	-40°C ~ +85°C(See Derating Curve) -40°C ~ +40°C(For 100% load)	
Maximum Case Temperature	110°C	
Thermal Impedance (Nature Convection)	Without Heat-sink	10.5°C/W
	With Heat-sink	8.4°C/W
Storage Temperature	-55°C ~ +125°C	
Over Temperature Protection (Case)	120°C, typ.	
Cooling (9)	Nature Convection	

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MODEL SELECTION GUIDE

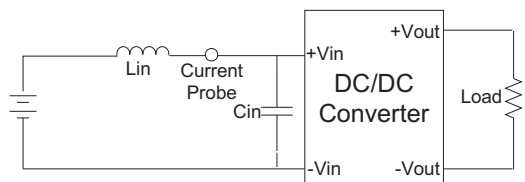
MODEL NUMBER	INPUT Voltage Range (Vdc)	INPUT Current		OUTPUT Voltage (Vdc)	OUTPUT Current		EFFICIENCY @ FL (% , typ.)	Capacitor Load @FL (μF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)		Min. load (mA)	Full load (mA)		
M60-243R3S60	18-36	80	2151	3.3	0	14000	91	36000
M60-2405S60	18-36	100	2762	5	0	12000	91	20400
M60-2412S60	18-36	40	2793	12	0	5000	90	3550
M60-2415S60	18-36	40	2793	15	0	4000	90	2300
M60-483R3S60	36-75	50	1075	3.3	0	14000	91	36000
M60-4805S60	36-75	60	1389	5	0	12000	91	20400
M60-4812S60	36-75	40	1397	12	0	5000	91	3550
M60-4815S60	36-75	40	1397	15	0	4000	91	2300

NOTE

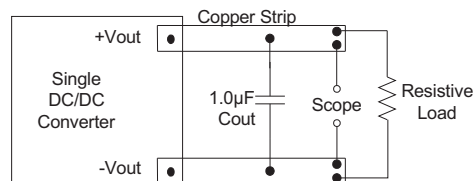
- Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being used, the +sense should be connected to its corresponding +OUTPUT and likewise the -sense should be connected to its corresponding -OUTPUT.
- Measured with 20MHz bandwidth and 1.0μF ceramic capacitor.
- Tested by minimal Vin and constant resistive load.
- Tested by normal Vin and 25% load step change (75%-50%-25% of Io).
- Measured with a simulated source inductance of 12μH and a source capacitor Cin(47μF, ESR<1.0Ω at 100KHz).
- The remote on/off control pin is referenced to -Vin(pin2).
- Exceeding the absolute ratings of the unit could cause damage. It is not allowed for continuous operating.
- An external filter capacitor is required if the module has to meet IEC61000-4-4 and IEC61000-4-5. The filter capacitor Motien suggest: Nippon chemi-con KY series, 220μF/100V.
- "Nature Convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).

TEST CONFIGURATIONS
Input Reflected Ripple Current Test Step

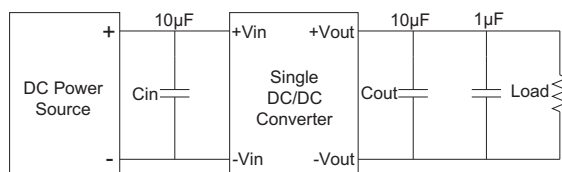
Input reflected ripple current is measured through a source inductor L_{in} ($12\mu H$) and a source capacitor C_{in} ($47\mu F$, $ESR < 1.0\Omega$ at $100KHz$) at nominal input and full load.


Output Ripple & Noise Measurement Test

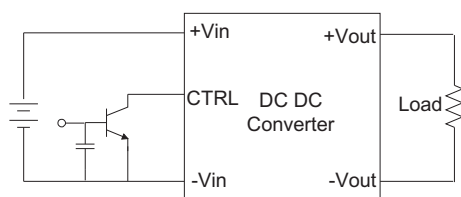
Use a capacitor C_{out} ($1.0\mu F$) measurement. The Scope measurement bandwidth is $0-20MHz$.


DESIGN & FEATURE CONFIGURATIONS
Output Ripple & Noise Reduction

To reduce ripple and noise, it is recommended to use a $1\mu F$ ceramic disk capacitor and a $10\mu F$ electrolytic capacitor to at the output.


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.

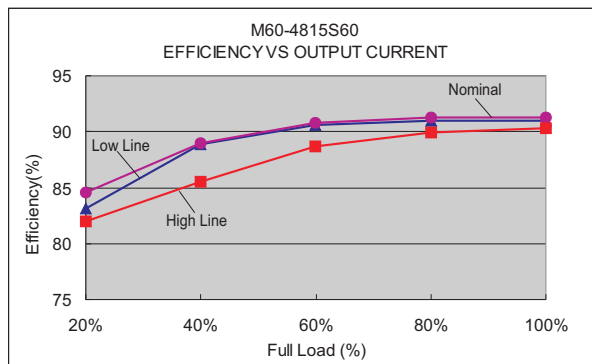
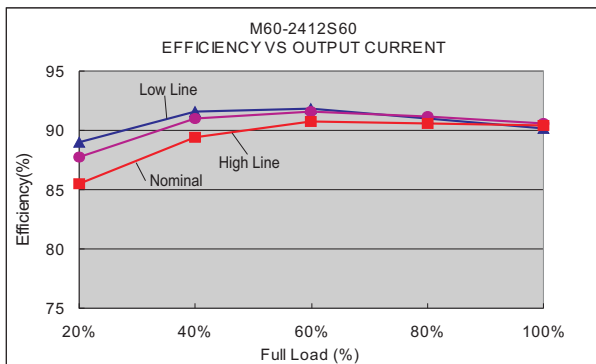
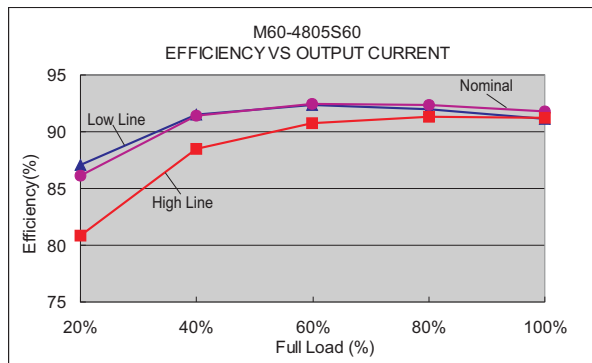
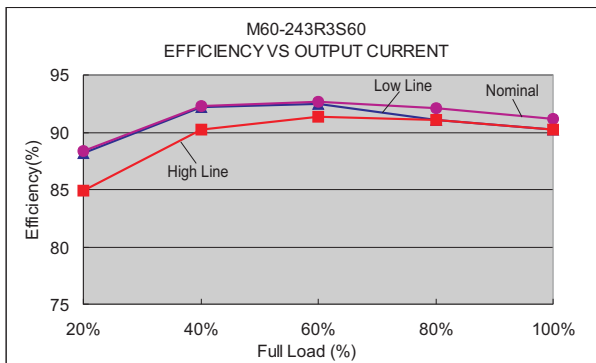
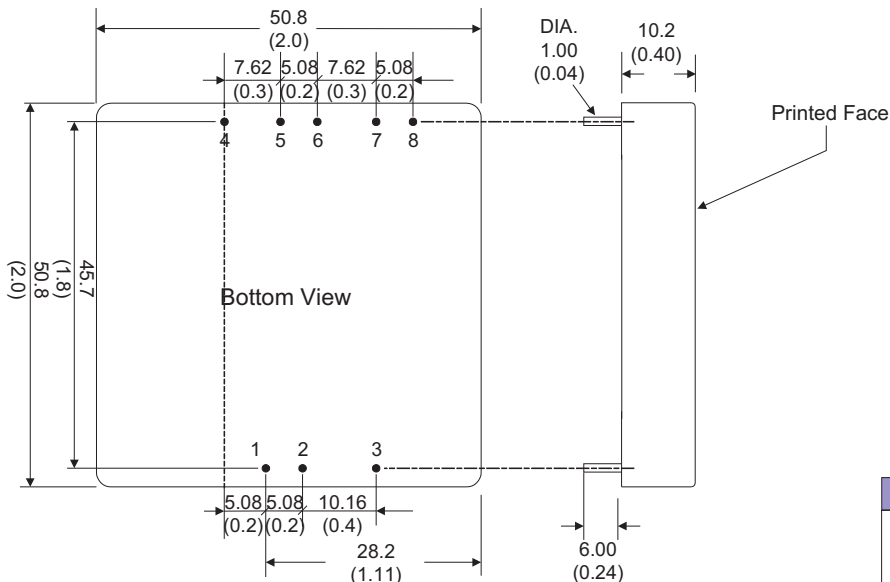

Over Voltage Protection

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.

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ELECTRICAL CHARACTERISTIC CURVES

MECHANICAL SPECIFICATIONS


PIN CONNECTIONS	
PIN NUMBER	SINGLE
1	+Vin
2	-Vin
3	CTRL
4	-Sense
5	+Sense
6	+Vout
7	-Vout
8	Trim

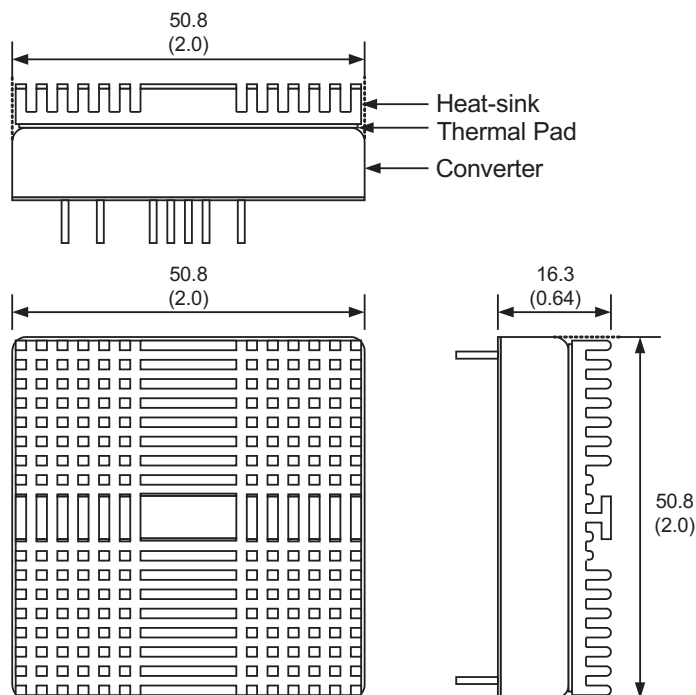
EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method as below.

- All dimensions are typical in millimeters (inches).
- Pin diameter: 1.0 ± 0.05 (0.04 ± 0.002)
 - Pin pitch and length tolerance: ± 0.35 (± 0.014)
 - Case Tolerance: ± 0.5 (± 0.02)

MECHANICAL SPECIFICATIONS

With Heat-sink



Order code: M60-XXXXS60SK(contain: heat-sink, thermal pad)
 Material: Aluminum
 Finish: Anodic treatment (black)
 Weight: 22g (0.78oz) (without converter)

Note:

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