SM60 Series

60W 2:1 Regulated Single output

Features

- Wide 2:1 Input Range
- 1600 VDC 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 EN55022 ClassA without external components

The SM60 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%
Output Voltage Adjustability **(Trim) (1)**		±10%, max.
Maximum Output Current		See table
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 (Zener diode clamp)	3.3V output	3.9V
	5V output	6.2V
	12V output	15V
	15V output	18V
Over Load Protection		135% of FL,typ.
Short Circuit Protection		Indefinite(hiccup) (Automatic Recovery)
Temperature Coefficient		±0.02%/°C
Capacitive Load **(3)**		See table
Transient Recovery Time **(4)**		250us, typ.
Transient Response Deviation **(4)**		±3%, max.

INPUT SPECIFICATIONS

Input Voltage Range		See table
Under Voltage Lockout		
24V Models	Module ON / OFF	17.8Vdc / 16Vdc, typ.
48V 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 pin2 and pin 3

OFF idle current: 5.0 mA, 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	50 Vdc, max.
48 Models	100 Vdc, max.
Soldering Temperature (1.5mm from case 10sec. max.)	260°C, max.

GENERAL SPECIFICATIONS

Efficiency	See table, typ.
I/O Isolation Voltage (3 sec)	
Input/Output	1600Vdc
Case/Input & Output	1600Vdc
Isolation Resistance	1000 MΩ, min.
Isolation Capacitance	2000 pF, typ.
Switching frequency	270kHz, typ.
Humidity	95% rel H
Reliability Calculated MTBF (MIL-HDBK-217 F)	>110Khrs
Safety Standard (design to meet)	IEC/EN 60950-1

ENVIRONMENTAL SPECIFICATIONS

Operating Ambient Temperature	-40°C ~ +85°C(See Derating Curve) -40°C ~ +40°C(For 100% load)
Maximum Case Temperature	110°C
Storage Temperature	-55°C ~ +125°C
Over Temperature Protection (Case)	120°C, typ.
Cooling	Nature Convection

EMC CHARACTERISTICS

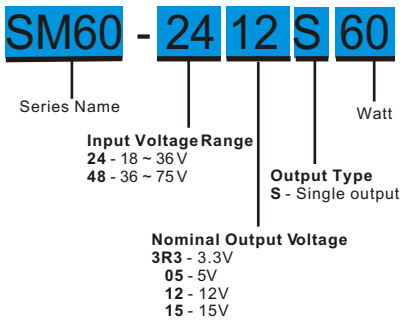
Radiated Emissions	EN55022	CLASSA
Conducted Emissions	EN55022	CLASSA
ESD	IEC61000-4-2	Perf. Criteria A
RS	IEC61000-4-3	Perf. Criteria A
EFT(8)	IEC61000-4-4	Perf. Criteria A
Surge (8)	IEC61000-4-5	Perf. Criteria A
CS	IEC61000-4-6	Perf. Criteria A
PFMF	IEC61000-4-8	Perf. Criteria A

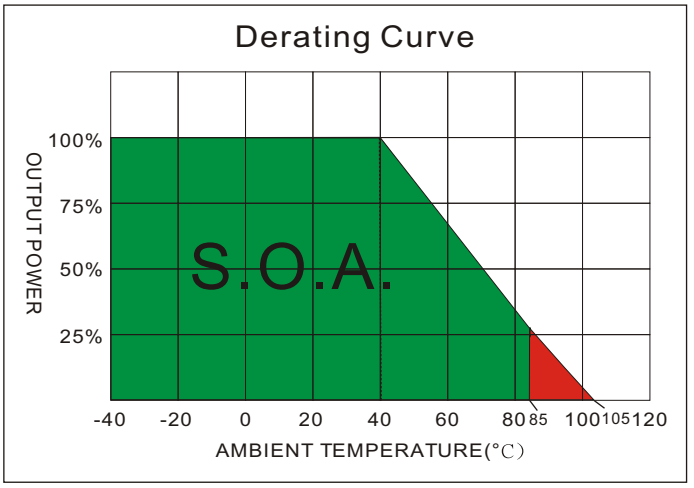
PHYSICAL SPECIFICATIONS

Case Material	Nickel-coated Copper
Base Material	Non-conductive Black Plastic (UL94V-0 rated)
Pin Material	Ø1.0mm Brass Solder-coated
Potting Material	Epoxy (UL94V-0 rated)
Weight	70.0g
Dimensions	2.00"x2.00"x0.40"

SM60 - 60W 2:1 Regulated Single output

PART NUMBER STRUCTURE





MODEL SELECTION GUIDE

MODEL NUMBER	INPUT Voltage Range (Vdc)	INPUT Current		OUTPUT Voltage (Vdc)	OUTPUT Current		EFFICIENCY @FL(%)	Capacitor Load(uF)
		No-Load (mA)	Full Load (mA)		Min. load (mA)	Full load (mA)		
SM60-243R3S60	18-36	80	2151	3.3	0	14000	91	36000
SM60-2405S60	18-36	100	2762	5	0	12000	91	20400
SM60-2412S60	18-36	40	2793	12	0	5000	90	3550
SM60-2415S60	18-36	40	2793	15	0	4000	90	2300
SM60-483R3S60	36-75	50	1075	3.3	0	14000	91	36000
SM60-4805S60	36-75	60	1389	5	0	12000	91	20400
SM60-4812S60	36-75	40	1397	12	0	5000	91	3550
SM60-4815S60	36-75	40	1397	15	0	4000	91	2300

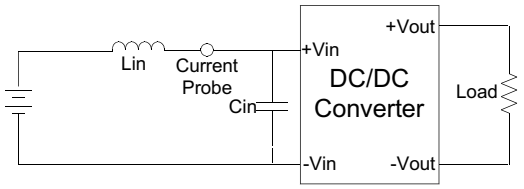
NOTE

1. 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.
2. Measured with 20MHz bandwidth and 1.0uF ceramic capacitor.
3. Tested by minimal Vin and constant resistive load.
4. Tested by normal Vin and 25% load step change (75%-50%-25% of Io).
5. Measured Input reflected ripple current with a simulated source inductance of 12uH.
6. The remote on/off control pin is referenced to -Vin(pin2).
7. Exceeding the absolute ratings of the unit could cause damage. It is not allowed for continuous operating.
8. An external filter capacitor is required if the module has to meet IEC61000-4-4 and IEC61000-4-5. The filter capacitor Schmid-M suggest: Nippon chemi-con KY series, 220uF/100V

TEST CONFIGURATIONS

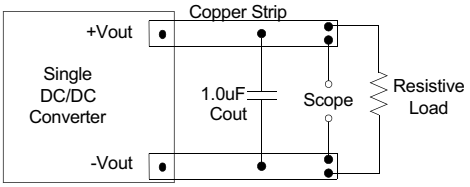
Input Reflected Ripple Current Test Step

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



Output Ripple & Noise Measurement Test

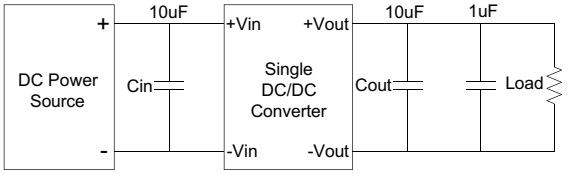
Use a capacitor Cout(1.0uF) measurement.
The Scope measurement bandwidth is 0-20MHz.



DESIGN & FEATURE CONFIGURATIONS

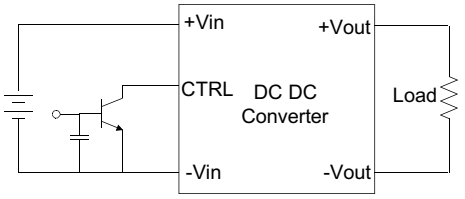
Output Ripple & Noise Reduction

To reduce ripple and noise, it is recommended to use a 1uF ceramic disk capacitor and a 10uF 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.



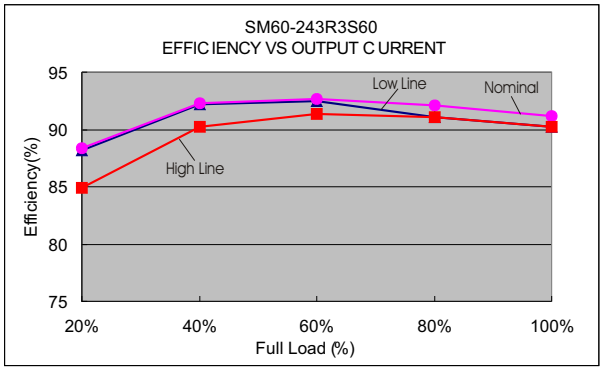
Over Voltage Protection

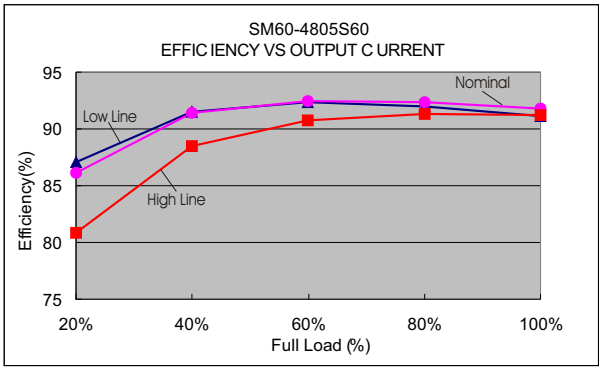
The module includes an internal output over voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over voltage set point, the module will activate the control loop of internal circuit to clamp the output voltage.

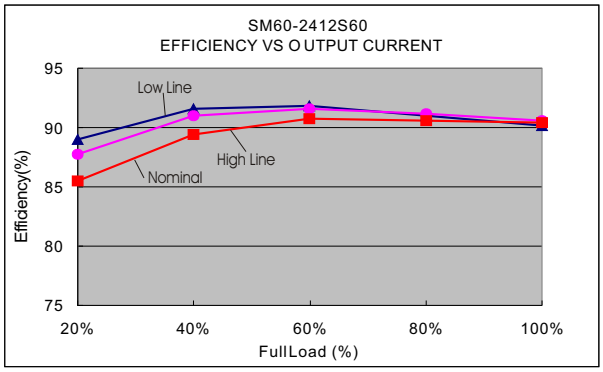
Over Current Protection

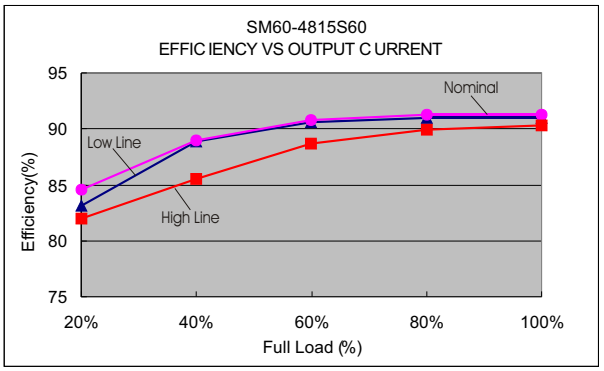
The module includes an internal over current protection circuit, which will endure current limiting for an unlimited duration during output over load condition. If the output current exceeds the OCP set point, the module will shut down automatically (hiccup).
The module will try to restart after shut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

ELECTRICAL CHARACTERISTIC CURVES

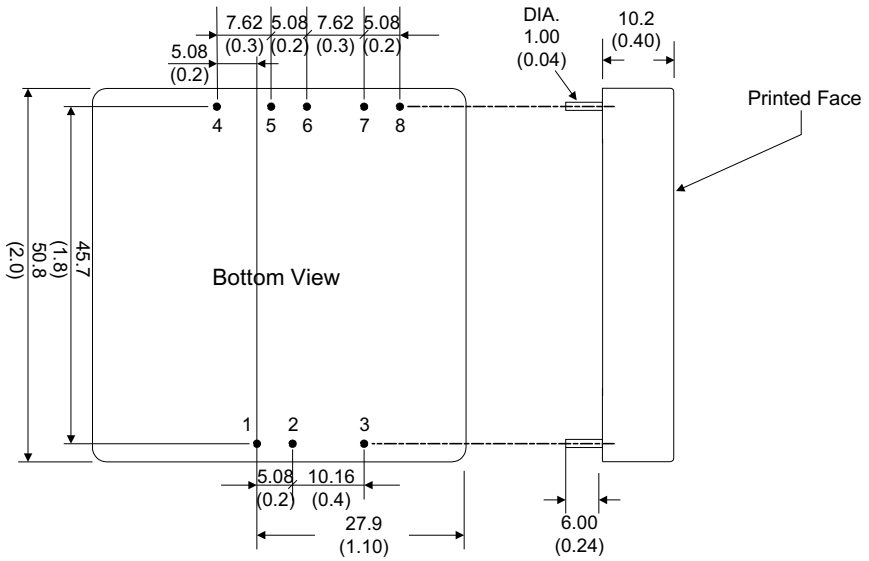








MECHANICAL SPECIFICATIONS



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

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

EXTERNAL OUTPUT TRIMMING

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