

60 Watt

2x1 Inch Package B1 4:1 Input Range - Metal Case



- o Pi Input Filter
- o 1600 VDC Isolation
- o Efficiency up to 93%
- o Remote On/Off Control
- o Continuous Short Circuit Protection
- o Over Current Protection
- o Over Voltage Protection
- o Over Temperature Protection
- o Soft Start



MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT		INPUT CURRENT		% EFF.	CAPACITOR LOAD MAX. (µF)		
			MIN. LOAD	FULL LOAD	NO LOAD MAX.	FULL LOAD				
60B1RS24X5M	9-36 VDC	5 VDC	0 mA	12000 mA	25 mA	2703 mA	92.5	30000		
60B1RS24X12M		12 VDC		5000 mA				5850		
60B1RS24X15M		15 VDC		4000 mA				2688 mA	93	3900
60B1RD24X12M		±12 VDC		±2500 mA	40 mA	2747 mA	91	±3900		
60B1RD24X15M		±15 VDC			50 mA			±2400		
60B1RS48X5M	18-75 VDC	5 VDC		12000 mA	25 mA	1344 mA	93	30000		
60B1RS48X12M		12 VDC		5000 mA				1351 mA	92.5	5850
60B1RS48X15M		15 VDC		4000 mA				1344 mA	93	3900
60B1RD48X12M		±12 VDC		±2500 mA	40 mA	1373 mA	91	±3900		
60B1RD48X15M		±15 VDC		±2000 mA	50 mA			±2400		

SPECIFICATIONS

All Specifications Typical At Nominal Line, Full Load, and 25°C Unless Otherwise Noted

INPUT SPECIFICATIONS

Input Voltage Range		4:1
Under Voltage Lockout	Module ON/OFF 24 V Module ON/OFF 48 V	8.6 VDC/7.9 VDC 17.8 VDC/16 VDC
Start up Time (Nominal Vin and constant resistive load)		60 mS
Input Filter		Pi
Input Current (No-Load)		see table
Input Current (Full-Load)		see table
Input Reflected Ripple Current ¹⁾		20 mA p-p
Remote ON/OFF (CTRL) ²⁾	ON: OFF: OFF idle Current:	3.0 ... 12 VDC or Open Circuit 0 ... 1.2 VDC or Short Circuit Pin2 and Pin3 5 mA

OUTPUT SPECIFICATIONS

Voltage Accuracy		±1% max.
Voltage Adjustability (Trim)		±10% max.
Maximum Output Current		see table
Cross Regulation ³⁾	Dual	±5%
Ripple and Noise ⁴⁾		100 mV p-p max.
Over Voltage Protection (Zener Diode Clamp)	5 VDC 12 VDC 15 VDC	6.2 V 15 V 20 V
Over Load Protection		120% to 140% of Output Current
Short Circuit Protection		Indefinite (hiccup) (Automatic Recovery)
Temperature Coefficient		±0.02%/°C
Capacitive Load ⁵⁾		see table
Transient Recovery Time ⁶⁾		250 µs
Transient Response Deviation ⁶⁾		±3% max.
Line Regulation		±0.5% max.
Load Regulation (Io=0% to 100%)	Single Dual	±0.5% max. ±1% max.

NOTE:

1. Measured Input reflected ripple current with a simulated source inductance of 1 µH and a source capacitor Cin (22 µF, ESR<1.0 Ohm at 100 kHz).
2. The Remote ON/OFF Control Pin is referenced to -Vin (Pin2).
3. Dual: One load is 25% to 100% load, the other load is 100% load, the output voltage variable rate is within ±5%.
4. Measured with 20 Mhz bandwidth and 1.0 µF ceramic capacitor.
5. Tested by minimal Vin and constant resistive load.
6. Tested by normal Vin and 25% Load step change (75%-50%-25% of Io).

ABSOLUTE SPECIFICATIONS

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

Input Surge Voltage (100 mS)	24 V 48 V	50 VDC max. 100 VDC max.
Soldering Temperature (1.5 mm from case 10 sec. max.)		+260°C max.

NOTE:

Exceeding the absolute ratings of the unit could cause damage. It is not allowed for continuous operating.

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GENERAL SPECIFICATION		
Efficiency		see table
Isolation Voltage (60 sec)	Input / Output Case/Input & Output	1600 VDC 1600 VDC
Isolation Resistance		1 GOhm min.
Isolation Capacitance		2200 pF
Switching Frequency		225 kHz
Operating Ambient Temperature		-40°C to +100°C (see Derating Curve) -40°C to +50°C (for 100% Load)
Case Temperature		+110°C max.
Thermal Impedance (Mounting at FR4 (5.9 x 2.75 Inch) PCB)	Without Heat-sink With Heat-sink	9.5°C/W min. 8.5°C/W min.
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection (Case)		+115°C
Cooling ⁷⁾		Nature Convection
Humidity		95% rel H
Reliability Calculated MTBF (MIL-HDBK-217F)		>210 khrs
Safety Standard (designed to meet)		IEC/EN 60950-1
EMC Characteristics (CE pending)	Radiated Emissions ⁸⁾	EN55032 Class A
	Conducted Emissions ⁸⁾	EN55032 Class A
	ESD	IEC61000-4-2 Perf. Criteria A
	RS	IEC61000-4-3 Perf. Criteria A
	EFT ⁹⁾	IEC61000-4-4 Perf. Criteria A
	Surge ⁹⁾	IEC61000-4-5 Perf. Criteria A
	CS	IEC61000-4-6 Perf. Criteria A
	PFMF	IEC61000-4-8 Perf. Criteria A
Reliability Calculated MTBF (MIL-HDBK-217F)		>210 khrs
Dimensions		2.00 x 1.00 x 0.45 Inches (50.80 x 25.40 x 11.5 mm)
Case Material		Copper
Base Material		Non-conductive Black Plastic (UL94V-o rated)
Pin Material		Ø1.0 mm Brass Solder-coated
Potting Material		Epoxy (UL94V-o rated)
Weight		45.0 g

NOTE:

7. "Nature Convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).

8. The 60B1RS/D-X-M series can meet EN55022 Class A with an external filter in parallel with the input pins.

9. An external filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5.

The 60B1RS/D24X-M recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330 µF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) to connect in parallel.

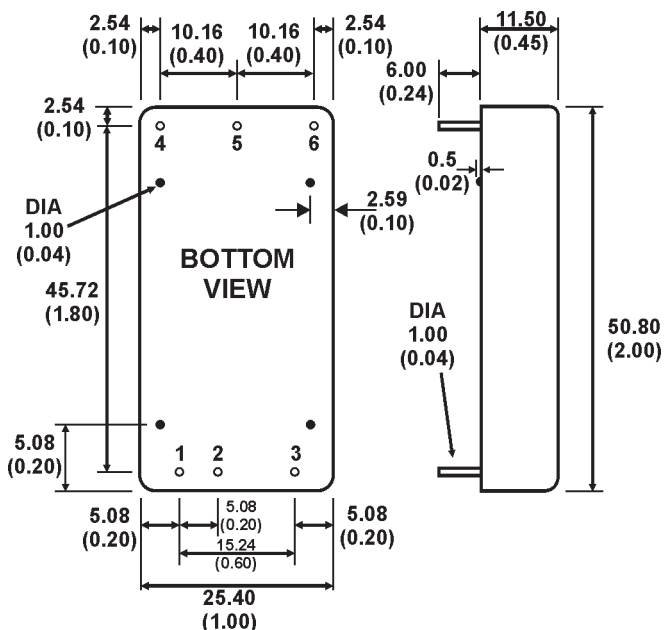
The 60B1RS/D48X-M recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330 µF/100V) and a TVS (SMDJ120A, 120V, 3000 Watt peak pulse power) to connect in parallel.

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MECHANICAL SPECIFICATIONS

Case "B1"



PIN CONNECTIONS		
PIN	SINGLE	Dual
1	+INPUT	+INPUT
2	-INPUT	-INPUT
3	REMOTE CTRL.	REMOTE CTRL.
4	+OUTPUT	+OUTPUT
5	-OUTPUT	COMMON
6	TRIM	-OUTPUT

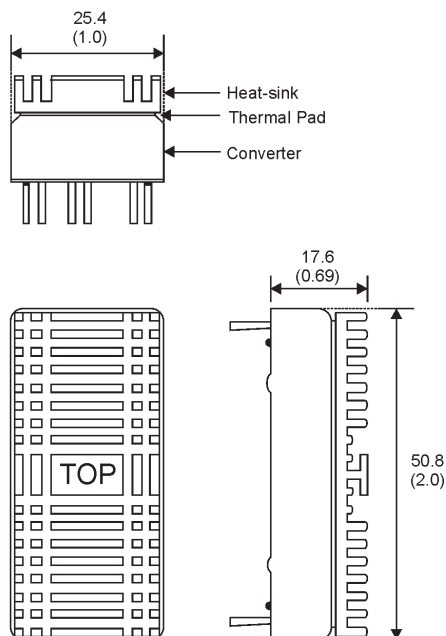
External Output Trimming

Output can be externally trimmed by using the method as below. (Single Output only!)

The diagram shows two circuit configurations for external output trimming. RTRIM-UP shows a resistor connected between pins 6 and 5. RTRIM-DOWN shows a resistor connected between pins 6 and 4.

- All Dimensions in mm (Inches)
 Tolerance:
 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)

With Heat-sink Suffix "HS"



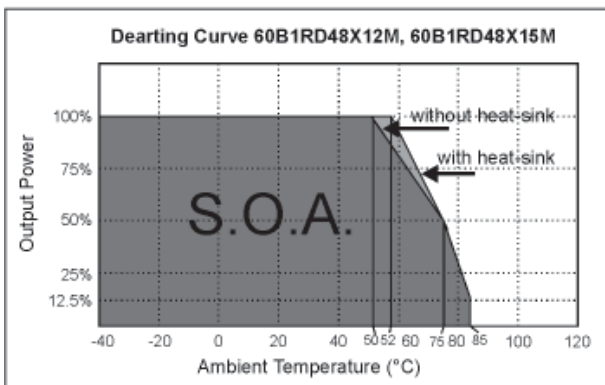
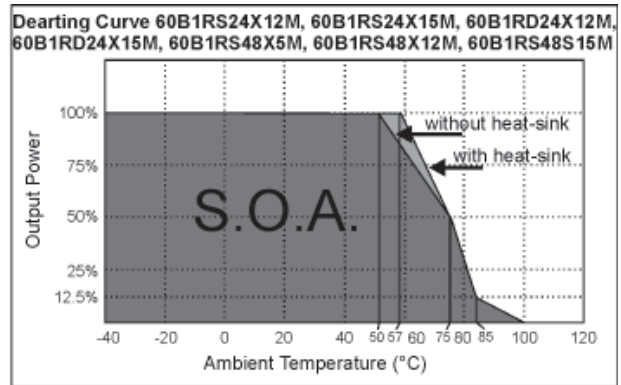
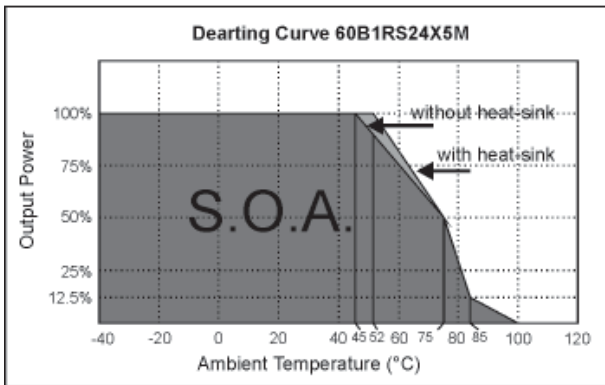
Order code: add Suffix „HS“ (contain: heat-sink, thermal pad)
 Material: Aluminum
 Finish: Anodic treatment (black)
 Weight: 11 g (0.39 oz) (without converter)

NOTE:
 1. Converters will be supplied with heat-sinks already mounted.

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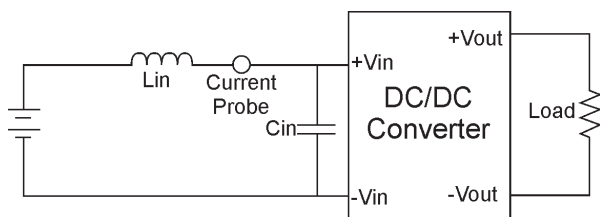
DERATING DIAGRAMS



TEST CONFIGURATIONS

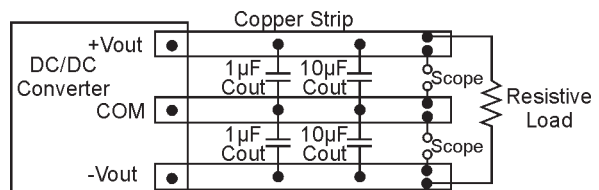
Input Reflected Ripple Current Test Step

Input reflected ripple current is measured through a source inductor L_{in} (1 μ H) and a source capacitor C_{in} (22 μ F, ESR<1.0 Ohm at 100 kHz) at nominal input and full load.



Output Ripple & Noise Measurement Test

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

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DESIGN & FEATURE CONFIGURATIONS

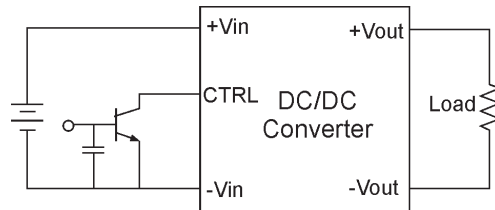
Over Temperature Protection

The over temperature protection consists of circuitry that provides protection from thermal damage. If the temperature exceeds the over temperature threshold the module will shut down.

The module will try to restart after shut down, if the over temperature condition still exists during restart, the module will shut down again. This restart trial will continue until the temperature is within specification.

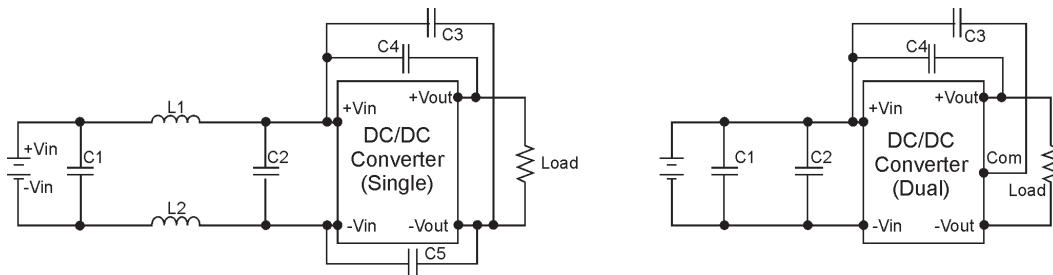
CTRL Module ON/OFF

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.



EMI Filter

Input filter components (C1 to C5, L1/L2) are used to help meet conducted emissions. These components should be mounted as close as possible to the module and all leads should be minimized to decrease radiated noise.



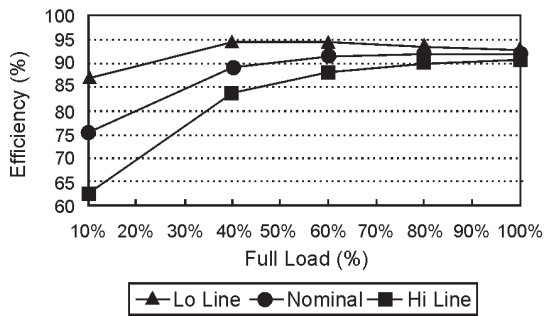
EMI FILTER						
Single	C1	L1/L2	C2	C3	C4	C5
60B1RS24X...	1812, 4.7 μF, 50 V	12 μH	1812, 4.7 μF, 50 V	1206, 470 pF, 2 kV	1206, 1000 pF, 2 kV	1206, 1000 pF, 2 kV
60B1RS48X...	1812, 1.5 μF, 100 V	12 μH	1812, 1.5 μF, 100 V	1206, 470 pF, 2 kV	1206, 1000 pF, 2 kV	1206, 1000 pF, 2 kV
Dual	C1	C2	C3	C4		
60B1RD24X...	1812, 4.7 μF, 50 V	1812, 4.7 μF, 50 V	1206, 220 pF, 2 kV	1206, 1500 pF, 2 kV		
60B1RD48X...	1812, 1.5 μF, 100 V	1812, 1.5 μF, 100 V	1206, 220 pF, 2 kV	1206, 1500 pF, 2 kV		

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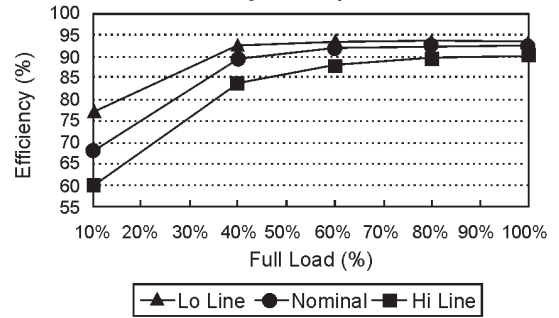
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ELECTRICAL CHARACTERISTIC CURVER

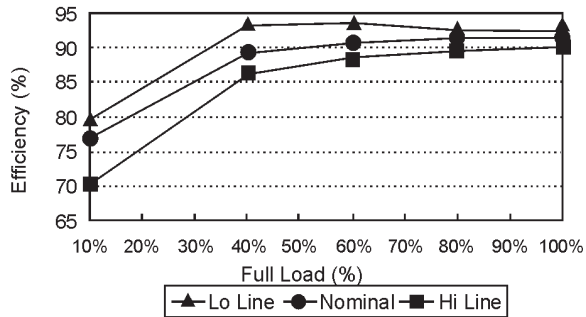
60B1RS24X5M
Efficiency vs. Output Current



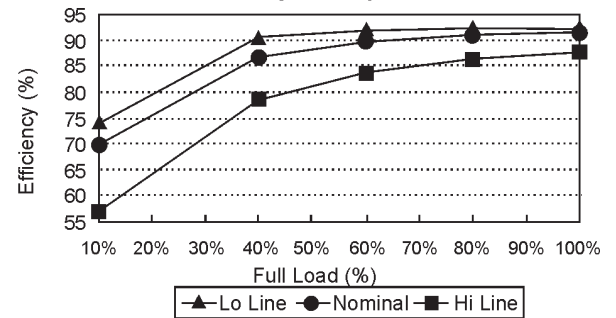
60B1RS48X12M
Efficiency vs. Output Current



60B1RD24X12M
Efficiency vs. Output Current



60B1RD48X15M
Efficiency vs. Output Current



NOTICE:
The information in this document has been carefully checked. However, no responsibility is assumed for inaccuracies!
Specifications can be changed without notice. The latest and most complete information can be found on our website.