

### Features

- Wide 2 : 1 Input Voltage Range(18~36V,36~75V)
- Remote On/Off
- Input / Output Isolation Voltage: 1.5K Vdc
- High Efficiency: up to 91%
- Output Short Circuit Protection:  
Hiccup & Auto Recovery
- Over Voltage Protection: Clamp Mode
- Over Temperature Protection
- Shielded Metal Case with Insulated Baseplate
- Lead Free Design, RoHS Compliant
- Adjustable Output Voltage
- Customer Design Available
- Option Heat Sink
- Safety Standard / Approval : IEC / EN 60950-1



### Description

The BWC60 Series are isolated 60W DC/DC converters. Designed with highly efficiency, allow the operating temperature range of these units to be -40°C to +85°C in a 50.8×50.8×10.2mm shielded metal case. Further features include wide 2 : 1 input voltage range, remote on/off control, short-circuit protection, over voltage protection and over temperature protection.

### Applications

These converters are well suitable for battery operated equipment, measurement equipment, telecom, wireless network, Industry control system, everywhere where isolated, tightly regulated voltages and compact size are required.

### Technical Specification

All specifications are typical at nominal input, full load and 25°C unless otherwise stated.

Model Number	Input Voltage Range	Output Voltage (V)	Output Current (mA)		Input Current (mA)		Eff. <sup>(1)</sup> (%)	Capacitive Load, max. <sup>(2)</sup> (uF)
			Min. Load	Full. Load	No Load	Full Load		
BWC60-24S0	18~36V Nominal:24V	3.3	0	14000	120	2292	88	47000
BWC60-24S1		5	0	12000	160	2907	90	36000
BWC60-24S2		12	0	5000	45	2941	89	6800
BWC60-24S3		15	0	4000	45	2907	90	4700
BWC60-48S0	36~75V Nominal:48V	3.3	0	14000	65	1132	89	47000
BWC60-48S1		5	0	12000	90	1453	90	36000
BWC60-48S2		12	0	5000	30	1453	90	6800
BWC60-48S3		15	0	4000	30	1437	91	4700

Input Specifications		
Input voltage	24V nominal input	18-36V
	48V nominal input	36-75V
Input filter		Pi type
Input surge voltage (100ms max.)	24V input	50V
	48V input	100V
Input reflected ripple current	Nominal Vin and full load	66mA <sub>p-p</sub> typ.
Start up time	Nominal Vin and constant resistive load	160ms typ.
Remote ON/OFF	Converter: ON	Open or $3.5V < V_r < 12V$
	Converter: OFF	Short <sup>(3)</sup> or $0V < V_r < 0.7V$
Sourcing current of remote control pin	Nominal Vin	< 0.2 mA
Idle input current (at Remote OFF state)	Nominal Vin	< 20 mA
Environmental Specifications		
Operating ambient temperature		-40°C to +85°C (with derating)
Maximum case temperature		+100°C
Storage temperature range		-55°C to +105°C
Relative humidity		95% RH max.
Temperature coefficient		±0.02% / °C max.
Output Specifications		
Output power		60 Watts max.
Voltage accuracy	Full load and nominal Vin	±1%
Minimum load		0mA
Line regulation	LL to HL at full load	±0.2%
Load Regulation	25% load to full load	±0.5%
		(±0.8% for 3.3V <sub>out</sub> )
Ripple and Noise (20MHz Bandwidth)		85mV <sub>p-p</sub> max.
Over voltage protection (Zener Diode Clamp)	3.3V <sub>out</sub> models	3.9V
	5V <sub>out</sub> models	6.2V
	12V <sub>out</sub> models	15V
	15V <sub>out</sub> models	18V
Capacitive load		See table
Over load protection	% of full load at nominal input	110% min.
Thermal shutdown		110°C typ.
Short circuit protection		Hiccup, automatic recovery
Transient response settling time	50% load step change	160µs typ.
Transient response over shoot	di/dt=0.8A/µs	≤ ±5% of V <sub>o</sub>

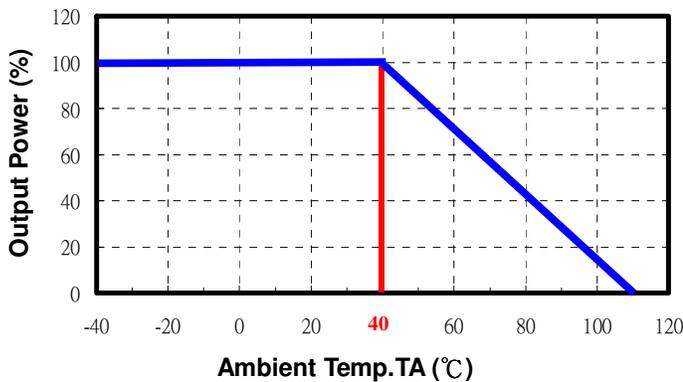
### General Specifications

Efficiency	Nominal input	See table
Isolation voltage	Input to output	1500VDC
Isolation resistance	500VDC	10 <sup>9</sup> Ohms min.
Isolation capacitance		1200pF typ.
Switching frequency		300kHz typ.
Reliability, calculated MTBF		7.48 × 10 <sup>5</sup> Hrs

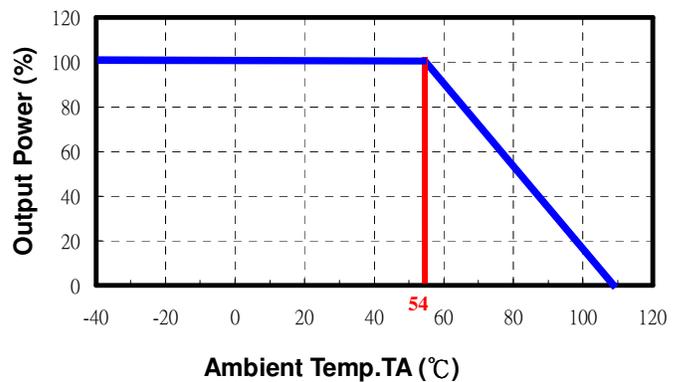
### Physical Specifications

Case material	Nickel-coated copper
Base material	FR4 PCB
Potting material	Silicon rubber (UL94 V-0)
Dimensions	2.00 × 2.00 × 0.40 Inch (50.8 × 50.8 × 10.2 mm)
Weight	60g (2.11oz) typ.

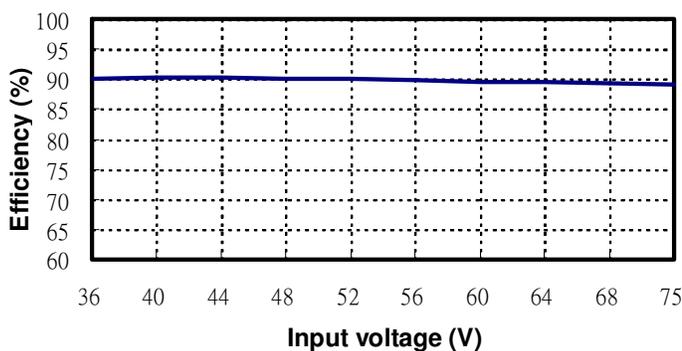
**BWC60 Series**  
Power Derating Curve without Heatsink<sup>(4)</sup>



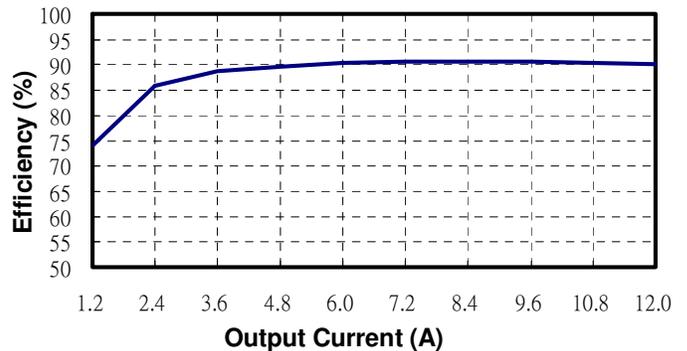
**BWC60 Series**  
Power Derating Curve with Heatsink<sup>(4)</sup>



**BWC60-48S1**  
Input voltage vs. Efficiency

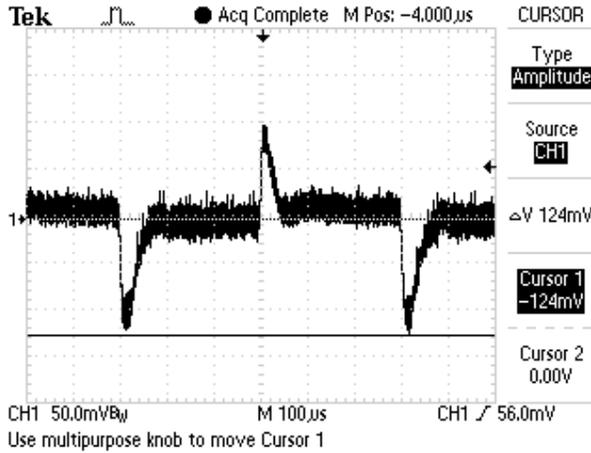


**BWC60-48S1**  
Output Current vs. Efficiency



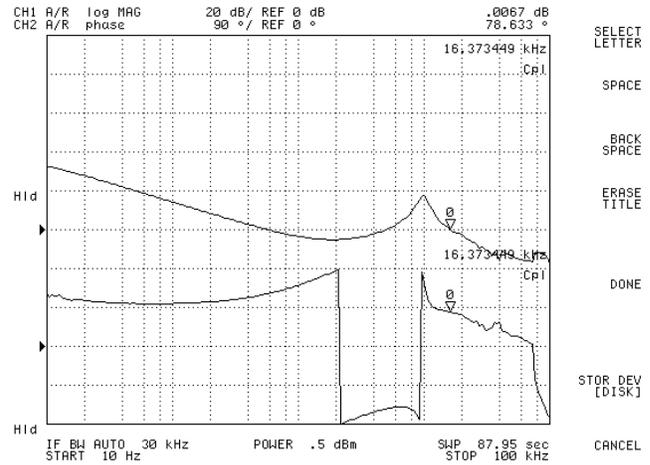
**BWC60-48S1**

**Transient Response at 50%~100% Max Load**



**BWC60-48S1**

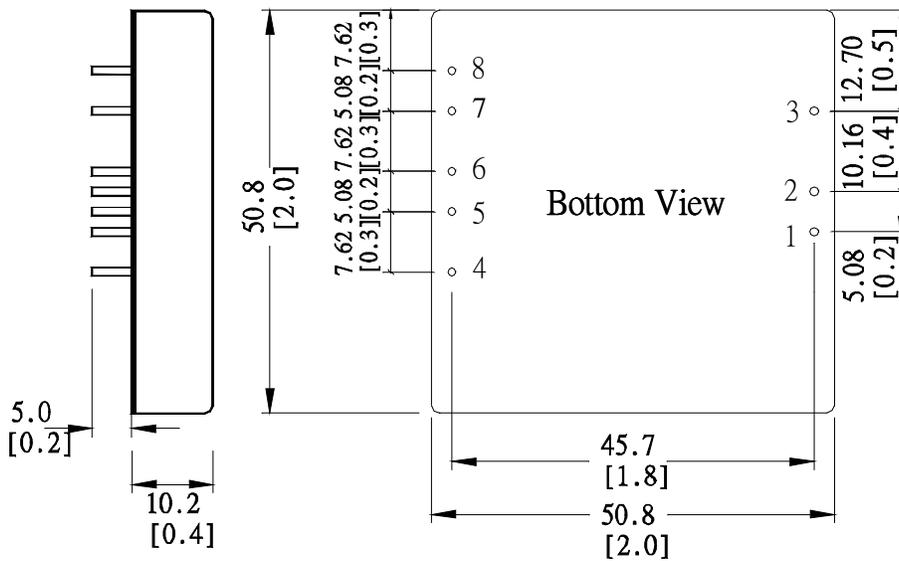
**Loop Gain & Phase at Vi=48V, Full Load**



### Note

1. Typical value, tested at nominal input and full load.
2. For each output.
3. Short to -Vin (Pin 2).
4. Based on BWC60-48S1.

### Mechanical Dimensions



Pin Assignment	
Pin	Single
1	+Vin
2	-Vin
3	Remote On/Off
4	-Sense
5	+Sense
6	+Vout
7	-Vout
8	Trim

Unit: mm [inch]  
Tolerance: ±0.5 [±0.02]

Specifications subject to change without notice.

### Heat-sink (Option)

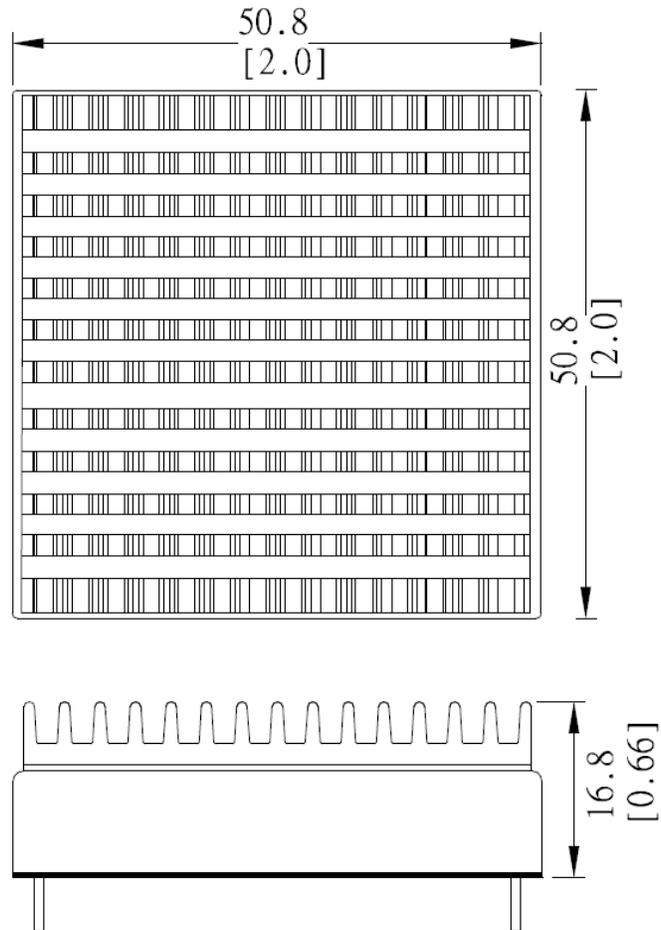
Material: Aluminum

Weight: 19g (0.67oz) (without converter)

**Note:**

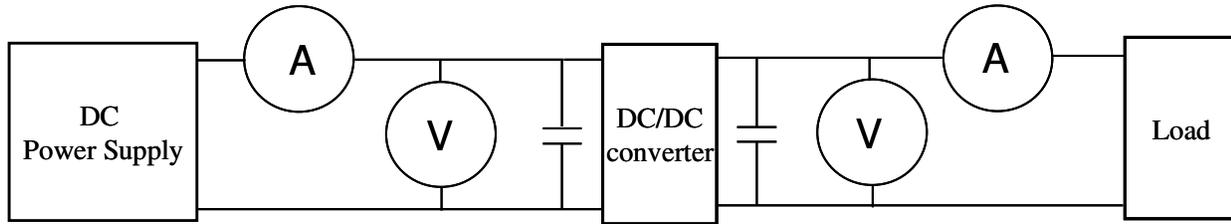
The product label on converter has to be removed before mounting the heat-sink.

For volume orders, converters will be supplied with heat-sink already mounted. Please contact factory for quotation.



## Test Configurations

All specifications are typical at nominal input, full load and 25°C unless otherwise stated.



- ⊙DC Power Supply: It offers a wide voltage and current range precisely.
- ⊙Current meter (A): Accuracy → 200μA ~ 200mA 4 ranges ±(0.2% rdg + 2 digits)  
2000mA ~ 20A 2 ranges ±(0.3% rdg + 2 digits).
- ⊙Voltage meter (V): Accuracy → ±(0.03% rdg + 4 digits).
- ⊙Load: At full load.
- ⊙Wires: The resistance of the wires must be small.

### 1. Input voltage range: Narrow input voltage range (±10%)、wide input voltage range (2:1 and 4:1)。

EX: Narrow input voltage range (±10%)

5V nominal input	→	4.5~5.5V
12V nominal input	→	10.8~13.2V
24V nominal input	→	21.6~26.4V

Wide input voltage range 2:1

5V nominal input	→	4.5~9V
12V nominal input	→	9~18V
24V nominal input	→	18~36V
48V nominal input	→	36~75V

Wide input voltage range 4:1 (W)

24V nominal input	→	9~36V
48V nominal input	→	18~75V

### 2. Input power :

$$P_{in} = V_{in} \times I_{in}$$

$V_{in}$  : Input voltage  
 $I_{in}$  : Input current

### 3. Output power :

$$P_{out} = V_{out} \times I_{out}$$

$V_{out}$  : Output voltage  
 $I_{out}$  : Output current

### 4. Efficiency :

$$\text{Efficiency} = \frac{P_{out}}{P_{in}} \times 100\%$$

$P_{out}$ : Output power  
 $P_{in}$ : Input power

### 5. Voltage accuracy:

$$\frac{|V_{out} - V_{out(nominal)}|}{V_{out}} \times 100\%$$

$V_{out}$  : Output voltage  
 $V_{out(nominal)}$  : Nominal output voltage

6. **Line regulation:** (1) Wide input voltage range and regulated output voltage series.

$$\frac{|V_{out(LL)} - V_{out(HL)}|}{V_{out(LL)}} \times 100\%$$

LL: Low Line input voltage  
HL: High Line input voltage

(2) Narrow input voltage range ( $\pm 10\%$ ) and unregulated output voltage series.

$$\text{Line regulation} = \left| \frac{\Delta V_{out}}{\Delta V_{in}} \right|$$

$$\Delta V_{out} = \frac{V_{out(+10\%)} - V_{out(-10\%)}}{V_{out}} \times 100\%$$

$V_{out(+10\%)}$  : Output voltage at  $V_{in} = 1.1 \times V_{in}(\text{nominal})$  & full load

$V_{out(-10\%)}$  : Output voltage at  $V_{in} = 0.9 \times V_{in}(\text{nominal})$  & full load

$V_{out}$  : Output voltage at  $V_{in} = V_{in}(\text{nominal})$  & full load

$$\Delta V_{in} = \frac{V_{in(+10\%)} - V_{in(-10\%)}}{V_{in}(\text{nominal})} \times 100\%$$

$V_{in(+10\%)}$  : Input voltage =  $1.1 \times V_{in}(\text{nominal})$

$V_{in(-10\%)}$  : Input voltage =  $0.9 \times V_{in}(\text{nominal})$

$V_{in}(\text{nominal})$  : Nominal Input voltage

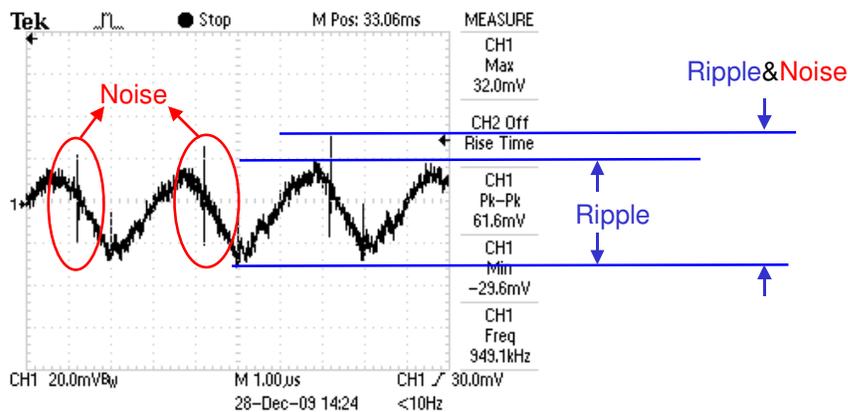
7. **Load regulation :**

$$\frac{|V_{out(FL)} - V_{out(NL)}|}{V_{out(FL)}} \times 100\%$$

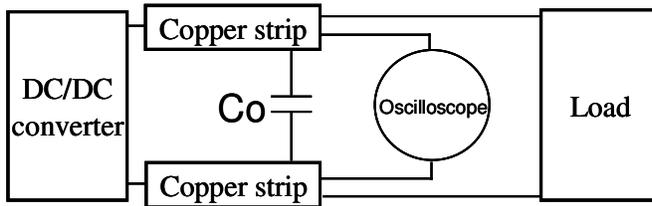
$V_{out(FL)}$ : Output voltage at full load

$V_{out(NL)}$ : Output voltage at 25% full load or 10% full load

8. **Ripple and Noise:** as shown below. The bandwidth is 0-20MHz.

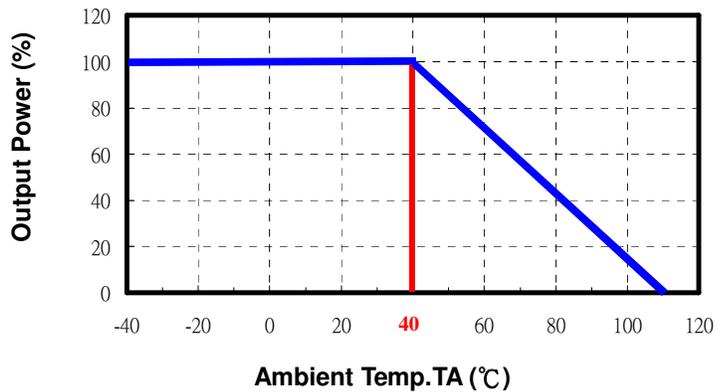


Output Ripple&Noise measurement test circuit: as shown below.



$C_o$ : usually 0.47 $\mu$ F.

9. [Temperature derating curve](#): The DC-DC converter will operate over a wider temperature range if less power is drawn from the output and the device is already running. The temperature derating curve shows the operating power-temperature range. As shown below.



10. [Switching frequency](#): The nominal operating frequency of the DC-DC converters.
11. [Input to output isolation](#): The dielectric breakdown strength test between input and output circuits. This is the isolation voltage the device is capable of withstanding for a specified time, usually 1 second or 1 minute.