

### Features

- Wide 2 : 1 Input Voltage Range(9~18V,18~36V,36~75V)
- Remote On/Off
- Input / Output Isolation Voltage: 1.5K VDC
- Extended Operating Temperature Range: -40°C to+85°C
- Output Short Circuit Protection:  
Hiccup mode & Auto Recovery
- Over Voltage Protection: Clamp Mode
- Shielded Metal Case with Insulated Baseplate
- Lead Free Design, RoHS Compliant
- 6 pin DIP Package with Industry-Standard Footprint
- Customer Design Available
- Safety Standard / Approval :IEC/ EN 60950-1



### Description

The BUB20 Series are isolated 20W DC/DC converters. Designed with highly efficiency, allow the operating temperature range of these units to be -40°C to +85°C in a 6 pin DIP package with industry-standard footprint. Further features include wide 2 : 1 input voltage range, remote on/off control, short-circuit protection and over voltage 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

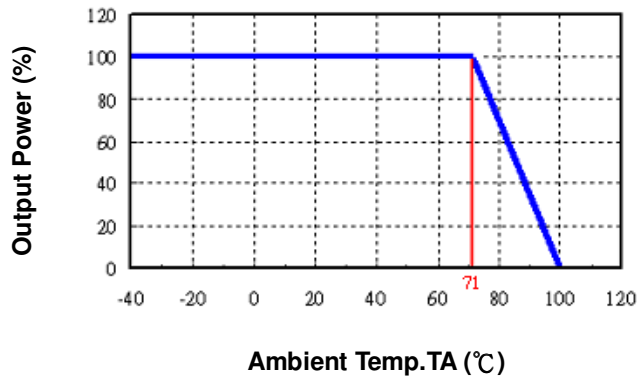
All specifications are typical at nominal input, full load and 25°C unless otherwise stated.

Model Number	Input Voltage Range	Output Voltage (V)	Output Current (mA)		Input Current (mA)		Eff. <sup>(2)</sup> (%)	Capacitive Load, max. <sup>(3)</sup> (uF)
			Min. Load <sup>(1)</sup>	Full. Load	No Load	Full Load		
BUB20-12S0	9~18V Nominal:12V	3.3	0	4000	61	1418	82	28000
BUB20-12S1		5	0	4000	92	2083	84	26000
BUB20-12S2		12	28	1670	94	1998	88	4900
BUB20-12S3		15	24	1340	90	1982	89	2960
BUB20-12D1		±5	0	±2000	85	2064	85	12000
BUB20-12D2		±12	0	±835	92	1988	88	2020
BUB20-12D3		±15	±8	±670	90	1984	88	880
BUB20-24S0	18~36V Nominal:24V	3.3	0	4000	26	693	83	36560
BUB20-24S1		5	0	4000	33	1019	86	19760
BUB20-24S2		12	0	1670	33	971	90	4600
BUB20-24S3		15	33	1340	31	968	91	2900
BUB20-24D1		±5	0	±2000	31	1004	87	13000
BUB20-24D2		±12	0	±835	34	968	90	2300
BUB20-24D3		±15	0	±670	31	964	91	1400
BUB20-48S0	36~75V Nominal:48VDC	3.3	0	4000	12	351	82	58000
BUB20-48S1		5	0	4000	15	513	85	23280
BUB20-48S2		12	0	1670	16	487	90	4584
BUB20-48S3		15	33	1340	15	484	90	2824
BUB20-48D1		±5	0	±2000	14	501	87	11760
BUB20-48D2		±12	0	±835	15	485	90	1600
BUB20-48D3		±15	0	±670	15	484	90	960

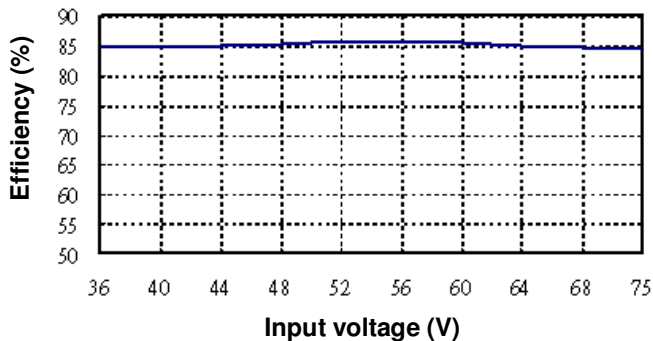
Input Specifications		
Input Voltage	12V nominal input	9-18V
	24V nominal input	18-36V
	48V nominal input	36-75V
Input filter		Pi Type
Input surge voltage (100ms max.)	12V nominal input	25V
	24V nominal input	50V
	48V nominal input	100V
Input reflected ripple current	Nominal Vin and full load	60mA <sub>p-p</sub> max.
Start up time	Nominal Vin and constant resistive load	76ms typ.
Remote ON/OFF	Converter: ON	Open or $3.5V < V_r < 12V$
	Converter: OFF	Short <sup>(4)</sup> or $0V < V_r < 1.2V$
Sourcing current of remote control pin	Nominal Vin	< 0.2 mA
Idle input current (at Remote OFF state)	Nominal Vin	< 10mA
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	5% to 95% RH	
Temperature coefficient	±0.02% / °C max.	
Output Specifications		
Output power	20 Watts max.	
Voltage accuracy	Full load and nominal Vin	±1%
Minimum load	See table	
Line regulation	LL to HL at full load	±1%
Load Regulation	25% load to full load	Single ±0.5%
	Balanced load	Dual ±0.5%
	Unbalanced load 25% to 100% full load	±5%
Ripple and Noise	20MHz bandwidth	80mV <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	150% typ.
Short circuit protection	Hiccup, automatic recovery	
Transient response settling time	50% load step change	1200µs max.
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	$10^9$ Ohms min.
Isolation capacitance		1100pF typ.
Switching frequency		330kHz typ.
Reliability, calculated MTBF		$1.58 \times 10^6$ Hrs
Physical Specifications		
Case material		Nickel-coated copper
Base material		Non-conductive black plastic
Potting material		Silicon rubber (UL94V-0)
Dimensions		2.0 × 1.0 × 0.4 Inch (50.8 × 25.4 × 10.2 mm)
Weight		32.0g (1.13oz) typ.

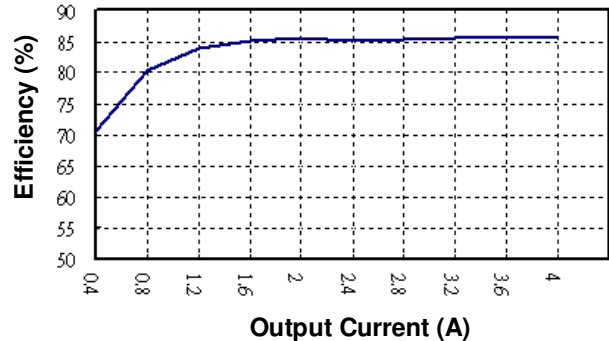
**BUB20 Series**  
Power Derating Curve(5)



**BUB20-48S1**  
Input voltage vs. Efficiency

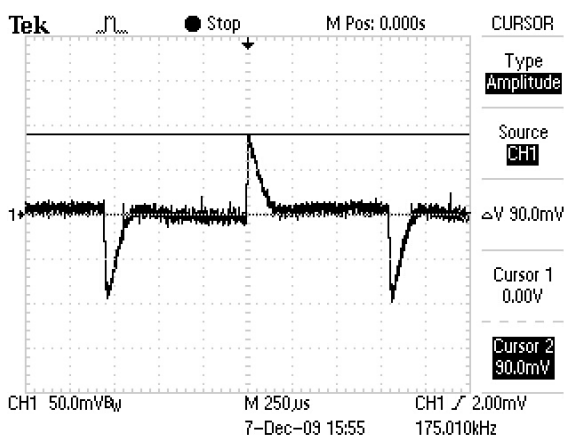


**BUB20-48S1**  
Output Current vs. Efficiency



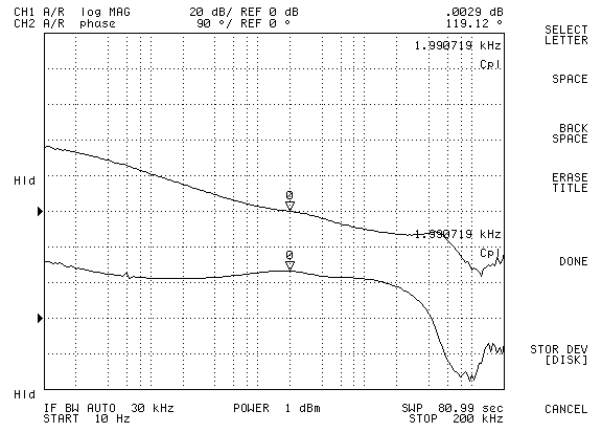
### BUB20-48S1

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



### BUB20-48S1

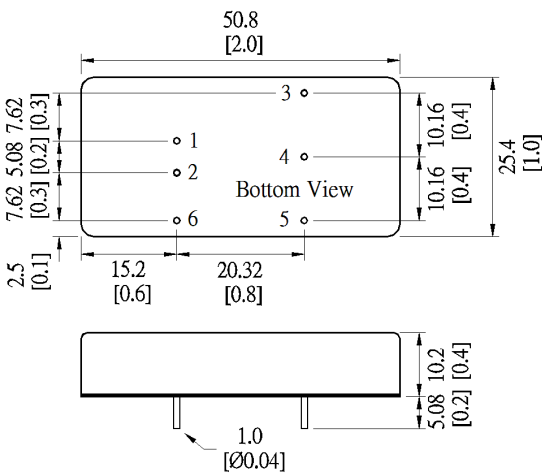
#### Loop Gain & Phase at Vi=48V, Full Load



#### Note

1. Io below this value will not damage these converters, however, they may not meet all listed specifications.
2. Typical value, tested at nominal input and full load.
3. For each output.
4. Short to -Vin (Pin 2).
5. Based on BUB20-48S1.

#### Mechanical Dimensions



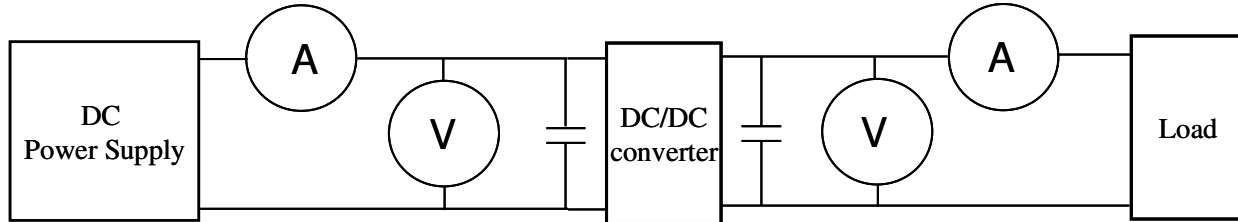
Unit: mm [inch]  
Tolerance: ±0.5 [0.02]

Pin Assignment		
Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Remote On/Off (optional)	Remote On/Off (optional)

Specifications subject to change without noticed.

### 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

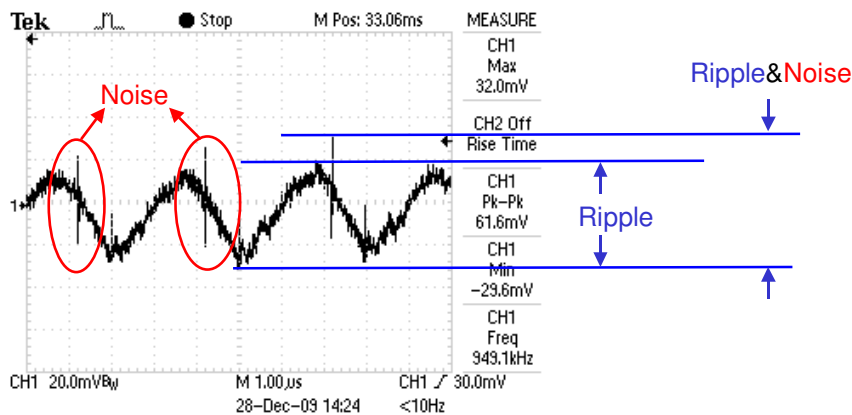
7. **Load regulation :**

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

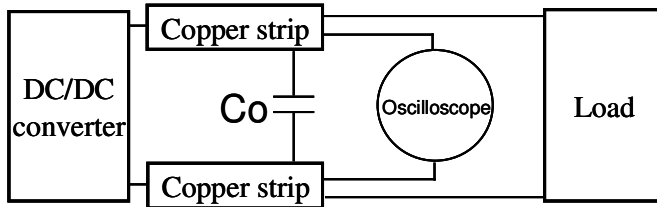
$V_{out(FL)}$ : Output voltage at full load

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

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

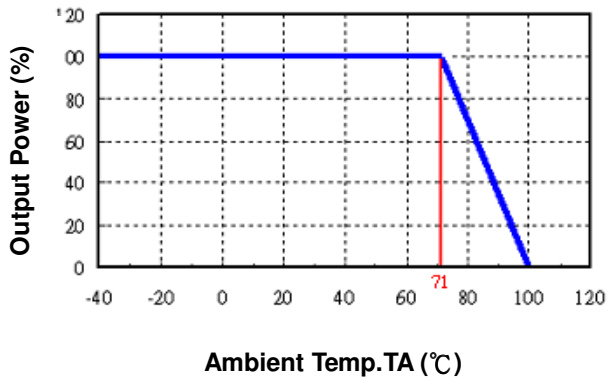


Output Ripple&Noise measurement test circuit: as shown below.



Co: usually 0.47uF.

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.