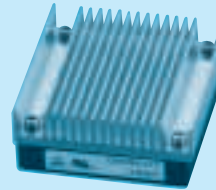


CBS50

CB S 50 48 12 - □

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
24 :DC18 - 36V
48 :DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
T :with Mounting hole
φ 3.4 thru
□ :with Addition of a
Heat sink

| MODEL | CBS50241R8 | CBS50242R5 | CBS502403 | CBS502405 | CBS502412 | CBS502415 | CBS502424 | CBS502428 |
|-----------------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|
| MAX OUTPUT WATTAGE[W] | 21.06 | 29.25 | 38.6 | 50.0 | 50.4 | 51.0 | 50.4 | 50.4 |
| DC OUTPUT | 1.8V 11.7A | 2.5V 11.7A | 3.3V 11.7A | 5V 10A | 12V 4.2A | 15V 3.4A | 24V 2.1A | 28V 1.8A |

SPECIFICATIONS

| | MODEL | CBS50241R8 | CBS50242R5 | CBS502403 | CBS502405 | CBS502412 | CBS502415 | CBS502424 | CBS502428 | |
|------------------------------------|---|---------------|-------------|-------------|---------------|---------------|---------------|---------------|-----------|--------|
| INPUT | VOLTAGE[V] | DC18 - 36 | | | | | | | | |
| | CURRENT[A] | 1.24typ | 1.58typ | 2.04typ | 2.48typ | 2.39typ | 2.44typ | 2.41typ | 2.41typ | |
| | EFFICIENCY[%] | 71typ | 77typ | 79typ | 84typ | 88typ | 87typ | 87typ | 87typ | |
| OUTPUT | VOLTAGE[V] | 1.8 | 2.5 | 3.3 | 5 | 12 | 15 | 24 | 28 | |
| | CURRENT[A] | 11.7 | 11.7 | 11.7 | 10 | 4.2 | 3.4 | 2.1 | 1.8 | |
| | LINE REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | LOAD REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | RIPPLE[mVp-p] | -20 to +100°C | 80max | 80max | 80max | 80max | 120max | 120max | 120max | 120max |
| | | -40 to -20°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | RIPPLE NOISE[mVp-p] | -20 to +100°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | | -40 to -20°C | 200max | 200max | 200max | 200max | 200max | 200max | 250max | 250max |
| | TEMPERATURE REGULATION[mV] | 0 to +65°C | 35max | 35max | 35max | 50max | 120max | 150max | 240max | 280max |
| | | -40 to +100°C | 66max | 66max | 66max | 100max | 240max | 300max | 480max | 560max |
| DRIFT[mV] | 16max | 16max | 16max | 20max | 40max | 60max | 90max | 90max | | |
| START-UP TIME[ms] | 200max (DCIN 24V, Io=100%) | | | | | | | | | |
| OUTPUT VOLTAGE ADJUSTMENT RANGE[V] | Fixed (TRM pin open), adjustable by external resistor | | | | | | | | | |
| OUTPUT VOLTAGE SETTING[V] | 1.70 - 1.98 | 1.98 - 2.75 | 1.98 - 3.63 | 3.0 - 5.5 | 7.2 - 13.2 | 9.0 - 16.5 | 14.4 - 26.4 | 16.8 - 30.8 | | |
| OVERCURRENT PROTECTION | Works over 105% of rating and recovers automatically | | | | | | | | | |
| OVERVOLTAGE PROTECTION[V] | 2.16 - 2.88 | 3.00 - 4.00 | 4.00 - 5.50 | 5.75 - 7.00 | 13.80 - 16.80 | 17.25 - 21.00 | 27.60 - 33.60 | 32.20 - 39.20 | | |
| REMOTE SENSING | Provided | | | | | | | | | |
| REMOTE ON/OFF | Provided (Negative logic L : ON, H : OFF) | | | | | | | | | |

| MODEL | CBS50481R8 | CBS50482R5 | CBS504803 | CBS504805 | CBS504812 | CBS504815 | CBS504824 | CBS504828 |
|-----------------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|
| MAX OUTPUT WATTAGE[W] | 21.06 | 29.25 | 38.6 | 50.0 | 50.4 | 51.0 | 50.4 | 50.4 |
| DC OUTPUT | 1.8V 11.7A | 2.5V 11.7A | 3.3V 11.7A | 5V 10A | 12V 4.2A | 15V 3.4A | 24V 2.1A | 28V 1.8A |

SPECIFICATIONS

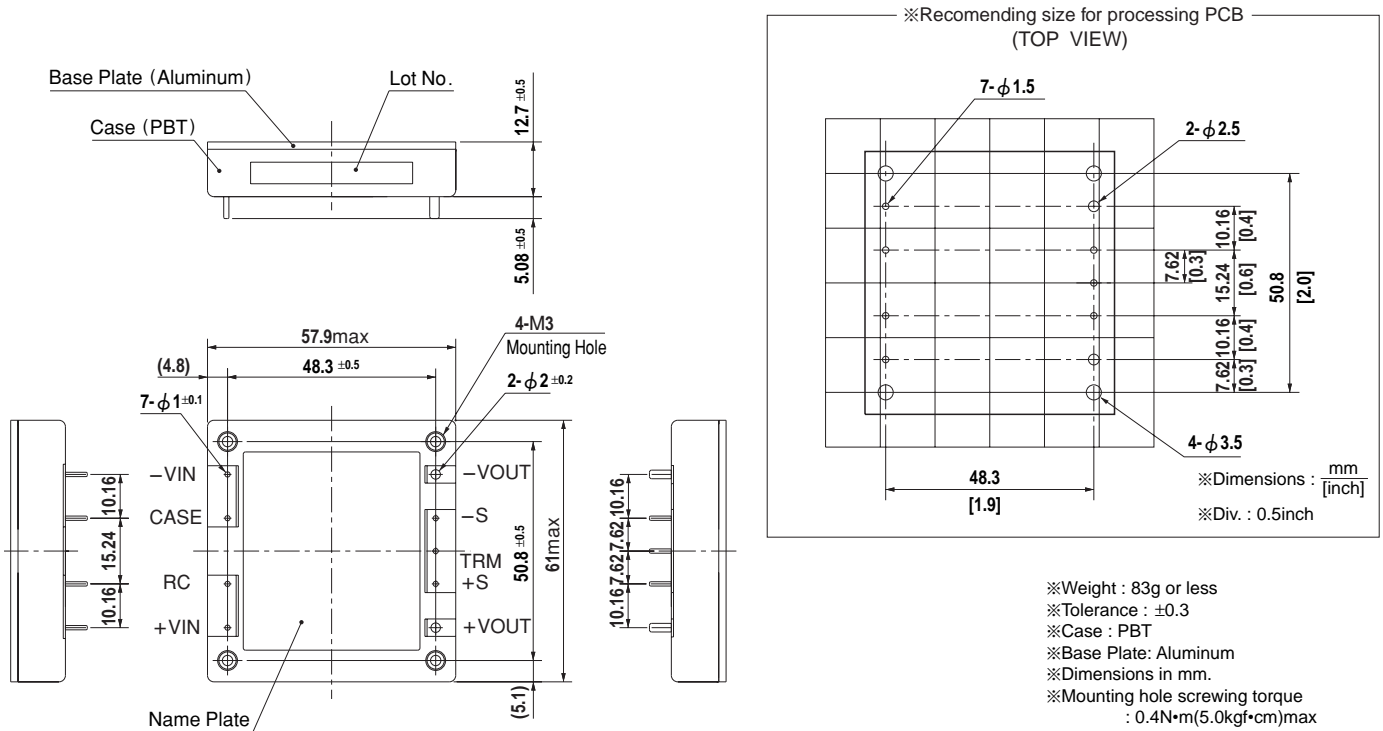
| | MODEL | CBS50481R8 | CBS50482R5 | CBS504803 | CBS504805 | CBS504812 | CBS504815 | CBS504824 | CBS504828 | |
|------------------------------------|---|---------------|-------------|-------------|---------------|---------------|---------------|---------------|-----------|--------|
| INPUT | VOLTAGE[V] | DC36 - 76 | | | | | | | | |
| | CURRENT[A] | 0.62typ | 0.79typ | 1.01typ | 1.23typ | 1.18typ | 1.21typ | 1.19typ | 1.19typ | |
| | EFFICIENCY[%] | 71typ | 77typ | 80typ | 85typ | 89typ | 88typ | 88typ | 88typ | |
| OUTPUT | VOLTAGE[V] | 1.8 | 2.5 | 3.3 | 5 | 12 | 15 | 24 | 28 | |
| | CURRENT[A] | 11.7 | 11.7 | 11.7 | 10 | 4.2 | 3.4 | 2.1 | 1.8 | |
| | LINE REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | LOAD REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | RIPPLE[mVp-p] | -20 to +100°C | 80max | 80max | 80max | 80max | 120max | 120max | 120max | 120max |
| | | -40 to -20°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | RIPPLE NOISE[mVp-p] | -20 to +100°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | | -40 to -20°C | 200max | 200max | 200max | 200max | 200max | 200max | 250max | 250max |
| | TEMPERATURE REGULATION[mV] | 0 to +65°C | 35max | 35max | 35max | 50max | 120max | 150max | 240max | 280max |
| | | -40 to +100°C | 66max | 66max | 66max | 100max | 240max | 300max | 480max | 560max |
| DRIFT[mV] | 16max | 16max | 16max | 20max | 40max | 60max | 90max | 90max | | |
| START-UP TIME[ms] | 200max (DCIN 48V, Io=100%) | | | | | | | | | |
| OUTPUT VOLTAGE ADJUSTMENT RANGE[V] | Fixed (TRM pin open), adjustable by external resistor | | | | | | | | | |
| OUTPUT VOLTAGE SETTING[V] | 1.70 - 1.98 | 1.98 - 2.75 | 1.98 - 3.63 | 3.0 - 5.5 | 7.2 - 13.2 | 9.0 - 16.5 | 14.4 - 26.4 | 16.8 - 30.8 | | |
| OVERCURRENT PROTECTION | Works over 105% of rating and recovers automatically | | | | | | | | | |
| OVERVOLTAGE PROTECTION[V] | 2.16 - 2.88 | 3.00 - 4.00 | 4.00 - 5.50 | 5.75 - 7.00 | 13.80 - 16.80 | 17.25 - 21.00 | 27.60 - 33.60 | 32.20 - 39.20 | | |
| REMOTE SENSING | Provided | | | | | | | | | |
| REMOTE ON/OFF | Provided (Negative logic L : ON, H : OFF) | | | | | | | | | |

GENERAL SPECIFICATIONS

| | | |
|-------------|--------------------------------------|--|
| ISOLATION | INPUT-OUTPUT | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | INPUT-CASE PIN, BASE PLATE | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | OUTPUT-CASE PIN, BASE PLATE | AC500V 1minute. Cutoff current = 100mA, DC500V 50MΩ min (20±15°C) |
| ENVIRONMENT | OPERATING TEMP., HUMID. AND ALTITUDE | -40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max |
| | STORAGE TEMP., HUMID. AND ALTITUDE | -40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max |
| | VIBRATION | 10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis |
| | IMPACT | 196.1m/s ² (20G), 11ms, once each along X, Y and Z axis |
| SAFETY | AGENCY APPROVALS | UL60950, C-UL, EN60950 |
| OTHERS | CASE SIZE/WEIGHT | 57.9×12.7×61.0mm (W×H×D) / 83g max |
| | COOLING METHOD | Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink) |

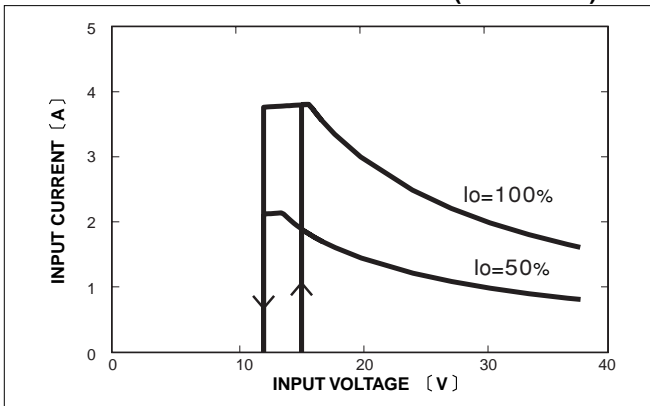
- *1 At rated input(DC24V,DC48V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V, output voltage adjustment range is 60 - 105% (except for 1R8/2R5).

External view

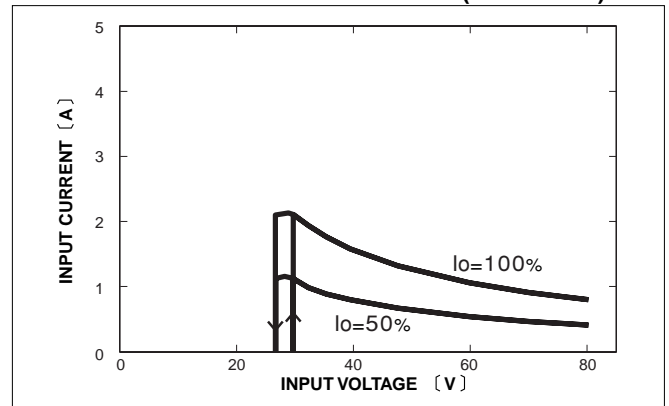


Performance data

INPUT CURRENT CHARACTERISTICS (CBS502428)



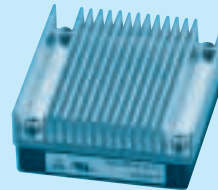
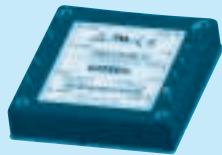
INPUT CURRENT CHARACTERISTICS (CBS504828)



CBS100

CB S 100 48 12 - □

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
24:DC18 - 36V
48:DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
T :with Mounting hole
φ 3.4 thru
□ :with Addition of a
Heat sink

| MODEL | CBS100241R8 | CBS100242R5 | CBS1002403 | CBS1002405 | CBS1002412 | CBS1002415 | CBS1002424 | CBS1002428 |
|-----------------------|-------------|-------------|------------|------------|------------|------------|------------|------------|
| MAX OUTPUT WATTAGE[W] | 42.12 | 58.50 | 77.2 | 100.0 | 100.8 | 100.5 | 100.8 | 100.8 |
| DC OUTPUT | 1.8V 23.4A | 2.5V 23.4A | 3.3V 23.4A | 5V 20A | 12V 8.4A | 15V 6.7A | 24V 4.2A | 28V 3.6A |

SPECIFICATIONS

| | MODEL | CBS100241R8 | CBS100242R5 | CBS1002403 | CBS1002405 | CBS1002412 | CBS1002415 | CBS1002424 | CBS1002428 | |
|------------------------------------|---|---------------|-------------|-------------|---------------|---------------|---------------|---------------|------------|--------|
| INPUT | VOLTAGE[V] | DC18 - 36 | | | | | | | | |
| | CURRENT[A] | 2.47typ | 3.17typ | 4.07typ | 5.02typ | 4.77typ | 4.81typ | 4.83typ | 4.83typ | |
| | EFFICIENCY[%] | 71typ | 77typ | 79typ | 83typ | 88typ | 87typ | 87typ | 87typ | |
| OUTPUT | VOLTAGE[V] | 1.8 | 2.5 | 3.3 | 5 | 12 | 15 | 24 | 28 | |
| | CURRENT[A] | 23.4 | 23.4 | 23.4 | 20 | 8.4 | 6.7 | 4.2 | 3.6 | |
| | LINE REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | LOAD REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | RIPPLE[mVp-p] | -20 to +100°C | 80max | 80max | 80max | 80max | 120max | 120max | 120max | 120max |
| | | -40 to -20°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | RIPPLE NOISE[mVp-p] | -20 to +100°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | | -40 to -20°C | 200max | 200max | 200max | 200max | 200max | 200max | 250max | 250max |
| | TEMPERATURE REGULATION[mV] | 0 to +65°C | 35max | 35max | 35max | 50max | 120max | 150max | 240max | 280max |
| | | -40 to +100°C | 66max | 66max | 66max | 100max | 240max | 300max | 480max | 560max |
| DRIFT[mV] | 16max | 16max | 16max | 20max | 40max | 60max | 90max | 90max | | |
| START-UP TIME[ms] | 200max (DCIN 24V, I _o =100%) | | | | | | | | | |
| OUTPUT VOLTAGE ADJUSTMENT RANGE[V] | Fixed (TRM pin open), adjustable by external resistor | | | | | | | | | |
| OUTPUT VOLTAGE SETTING[V] | 1.70 - 1.98 | 1.98 - 2.75 | 1.98 - 3.63 | 3.0 - 5.5 | 7.2 - 13.2 | 9.0 - 16.5 | 14.4 - 26.4 | 16.8 - 30.8 | | |
| OVERCURRENT PROTECTION | Works over 105% of rating and recovers automatically | | | | | | | | | |
| OVERVOLTAGE PROTECTION[V] | 2.16 - 2.88 | 3.00 - 4.00 | 4.00 - 5.50 | 5.75 - 7.00 | 13.80 - 16.80 | 17.25 - 21.00 | 27.60 - 33.60 | 32.20 - 39.20 | | |
| REMOTE SENSING | Provided | | | | | | | | | |
| REMOTE ON/OFF | Provided (Negative logic L : ON, H : OFF) | | | | | | | | | |

| MODEL | CBS100481R8 | CBS100482R5 | CBS1004803 | CBS1004805 | CBS1004812 | CBS1004815 | CBS1004824 | CBS1004828 |
|-----------------------|-------------|-------------|------------|------------|------------|------------|------------|------------|
| MAX OUTPUT WATTAGE[W] | 42.12 | 58.50 | 77.2 | 100.0 | 100.8 | 100.5 | 100.8 | 100.8 |
| DC OUTPUT | 1.8V 23.4A | 2.5V 23.4A | 3.3V 23.4A | 5V 20A | 12V 8.4A | 15V 6.7A | 24V 4.2A | 28V 3.6A |

SPECIFICATIONS

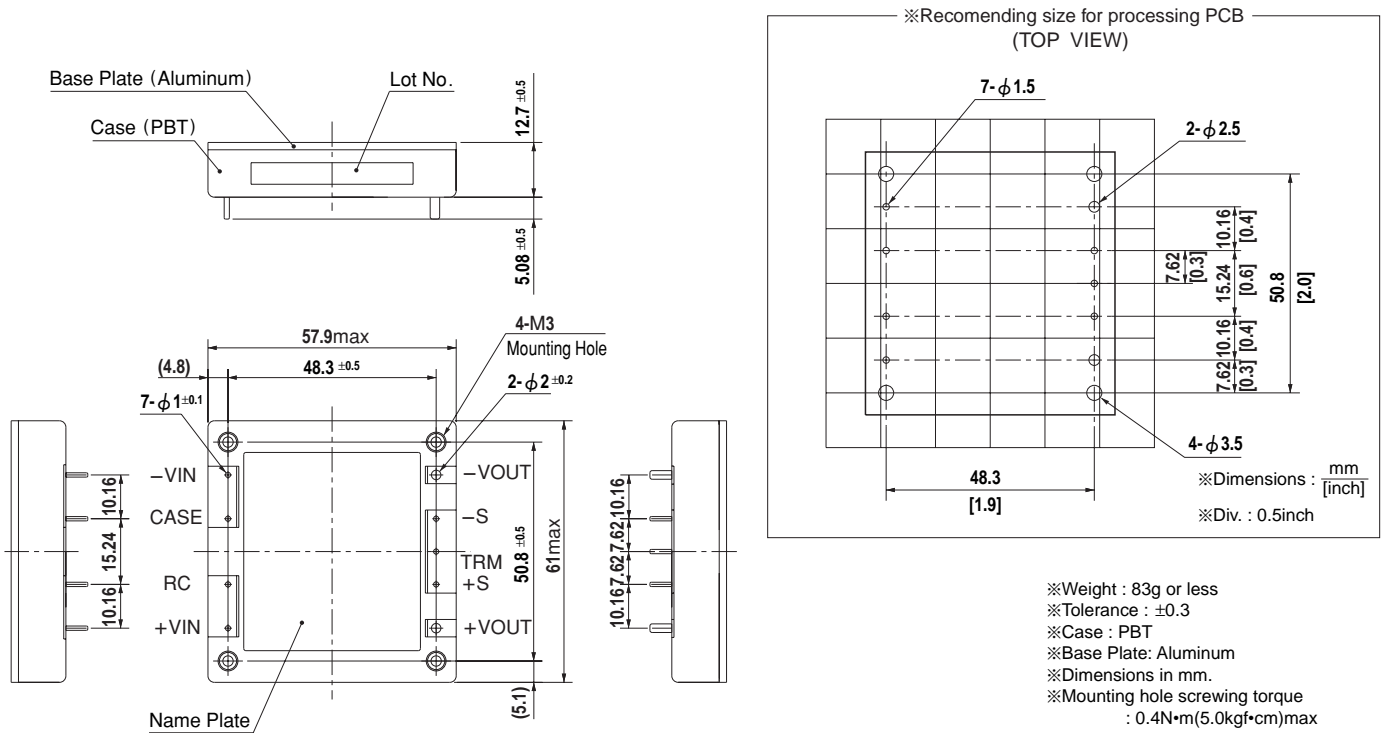
| | MODEL | CBS100481R8 | CBS100482R5 | CBS1004803 | CBS1004805 | CBS1004812 | CBS1004815 | CBS1004824 | CBS1004828 | |
|------------------------------------|---|---------------|-------------|-------------|---------------|---------------|---------------|---------------|------------|--------|
| INPUT | VOLTAGE[V] | DC36 - 76 | | | | | | | | |
| | CURRENT[A] | 1.24typ | 1.58typ | 2.01typ | 2.48typ | 2.36typ | 2.38typ | 2.39typ | 2.39typ | |
| | EFFICIENCY[%] | 71typ | 77typ | 80typ | 84typ | 89typ | 88typ | 88typ | 88typ | |
| OUTPUT | VOLTAGE[V] | 1.8 | 2.5 | 3.3 | 5 | 12 | 15 | 24 | 28 | |
| | CURRENT[A] | 23.4 | 23.4 | 23.4 | 20 | 8.4 | 6.7 | 4.2 | 3.6 | |
| | LINE REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | LOAD REGULATION[mV] | 10max | 10max | 10max | 10max | 24max | 30max | 48max | 56max | |
| | RIPPLE[mVp-p] | -20 to +100°C | 80max | 80max | 80max | 80max | 120max | 120max | 120max | 120max |
| | | -40 to -20°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | RIPPLE NOISE[mVp-p] | -20 to +100°C | 120max | 120max | 120max | 120max | 150max | 150max | 150max | 150max |
| | | -40 to -20°C | 200max | 200max | 200max | 200max | 200max | 200max | 250max | 250max |
| | TEMPERATURE REGULATION[mV] | 0 to +65°C | 35max | 35max | 35max | 50max | 120max | 150max | 240max | 280max |
| | | -40 to +100°C | 66max | 66max | 66max | 100max | 240max | 300max | 480max | 560max |
| DRIFT[mV] | 16max | 16max | 16max | 20max | 40max | 60max | 90max | 90max | | |
| START-UP TIME[ms] | 200max (DCIN 48V, I _o =100%) | | | | | | | | | |
| OUTPUT VOLTAGE ADJUSTMENT RANGE[V] | Fixed (TRM pin open), adjustable by external resistor | | | | | | | | | |
| OUTPUT VOLTAGE SETTING[V] | 1.70 - 1.98 | 1.98 - 2.75 | 1.98 - 3.63 | 3.0 - 5.5 | 7.2 - 13.2 | 9.0 - 16.5 | 14.4 - 26.4 | 16.8 - 30.8 | | |
| OVERCURRENT PROTECTION | Works over 105% of rating and recovers automatically | | | | | | | | | |
| OVERVOLTAGE PROTECTION[V] | 2.16 - 2.88 | 3.00 - 4.00 | 4.00 - 5.50 | 5.75 - 7.00 | 13.80 - 16.80 | 17.25 - 21.00 | 27.60 - 33.60 | 32.20 - 39.20 | | |
| REMOTE SENSING | Provided | | | | | | | | | |
| REMOTE ON/OFF | Provided (Negative logic L : ON, H : OFF) | | | | | | | | | |

GENERAL SPECIFICATIONS

| | | |
|-------------|--------------------------------------|--|
| ISOLATION | INPUT-OUTPUT | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | INPUT-CASE PIN, BASE PLATE | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | OUTPUT-CASE PIN, BASE PLATE | AC500V 1minute. Cutoff current = 100mA, DC500V 50MΩ min (20±15°C) |
| ENVIRONMENT | OPERATING TEMP., HUMID. AND ALTITUDE | -40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max |
| | STORAGE TEMP., HUMID. AND ALTITUDE | -40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max |
| | VIBRATION | 10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis |
| | IMPACT | 196.1m/s ² (20G), 11ms, once each along X, Y and Z axis |
| SAFETY | AGENCY APPROVALS | UL60950, C-UL, EN60950 |
| OTHERS | CASE SIZE/WEIGHT | 57.9×12.7×61.0mm (W×H×D) / 83g max |
| | COOLING METHOD | Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink) |

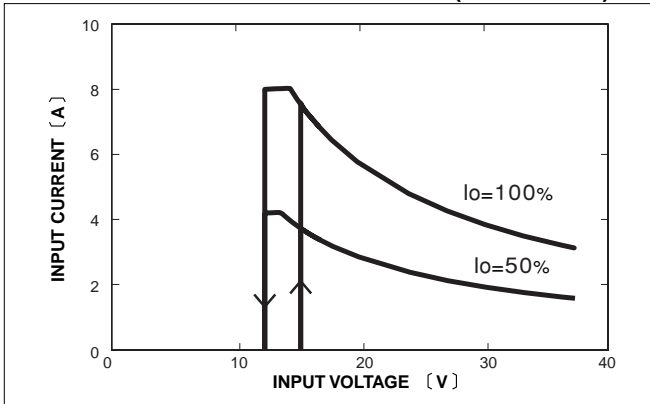
- *1 At rated input(DC24V,DC48V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V output voltage adjustment range is 60 - 105% (except for 1R8/2R5).

External view

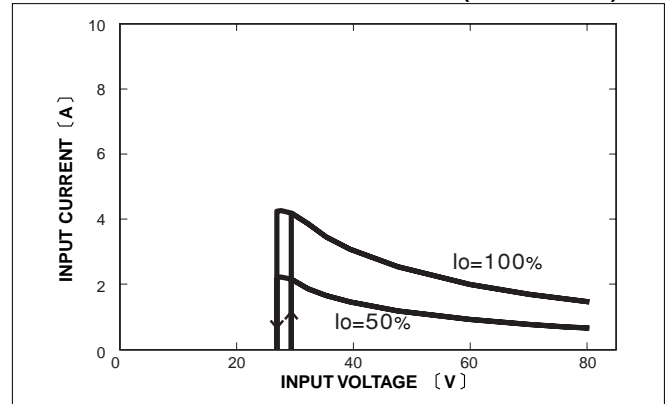


Performance data

■ INPUT CURRENT CHARACTERISTICS (CBS1002428)



■ INPUT CURRENT CHARACTERISTICS (CBS1004828)

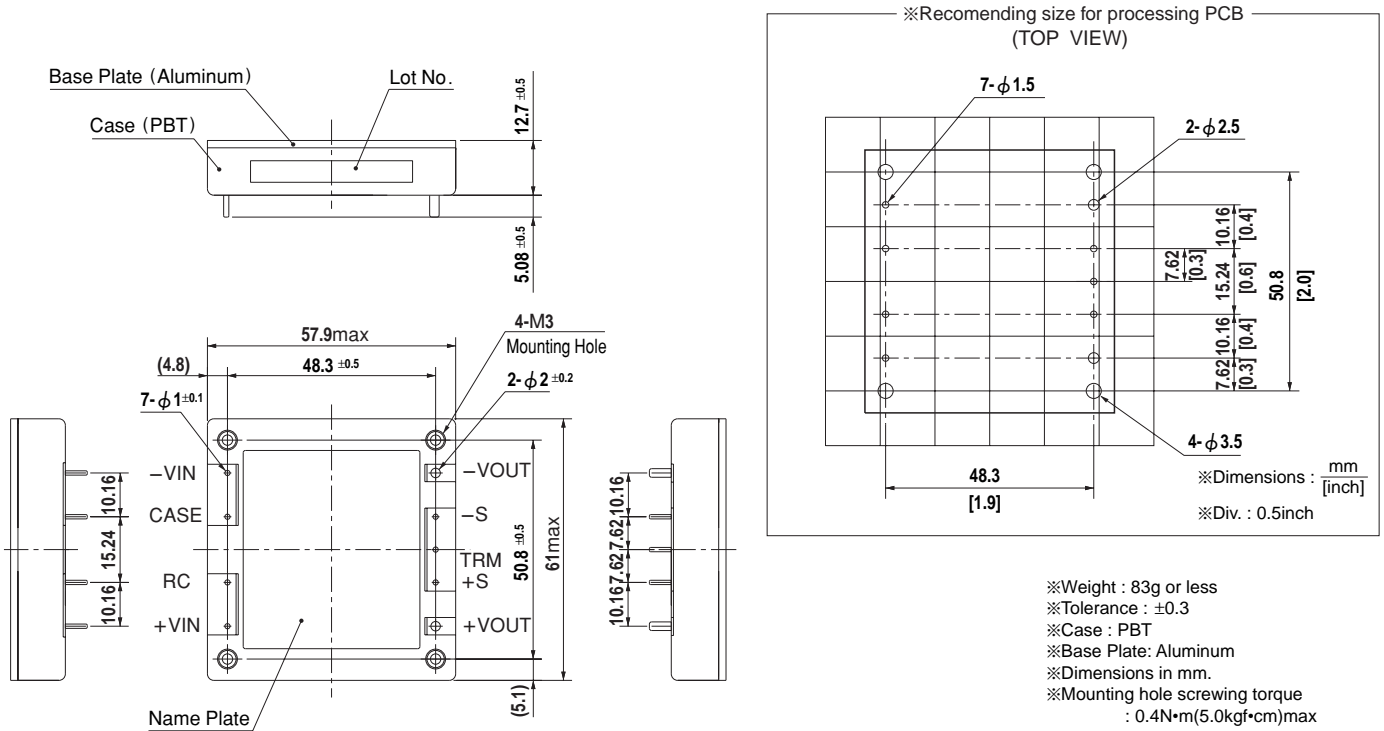


GENERAL SPECIFICATIONS

| | | |
|-------------|--------------------------------------|--|
| ISOLATION | INPUT-OUTPUT | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | INPUT-CASE PIN, BASE PLATE | DC1,500V or AC1,000V 1minute. Cutoff current = 10mA, DC500V 50MΩ min(20±15°C) |
| | OUTPUT-CASE PIN, BASE PLATE | AC500V 1minute. Cutoff current = 100mA, DC500V 50MΩ min (20±15°C) |
| ENVIRONMENT | OPERATING TEMP., HUMID. AND ALTITUDE | -40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max |
| | STORAGE TEMP., HUMID. AND ALTITUDE | -40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max |
| | VIBRATION | 10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis |
| | IMPACT | 196.1m/s ² (20G), 11ms, once each along X, Y and Z axis |
| SAFETY | AGENCY APPROVALS | UL60950, C-UL, EN60950 |
| OTHERS | CASE SIZE/WEIGHT | 57.9×12.7×61.0mm (W×H×D) / 83g max |
| | COOLING METHOD | Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink) |

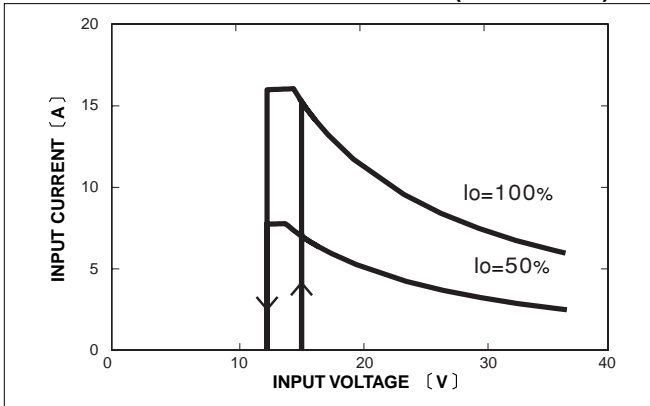
- *1 At rated input(DC24V,DC48V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V, output voltage adjustment range is 60 - 105% (except for 1R8/2R5/48).

External view

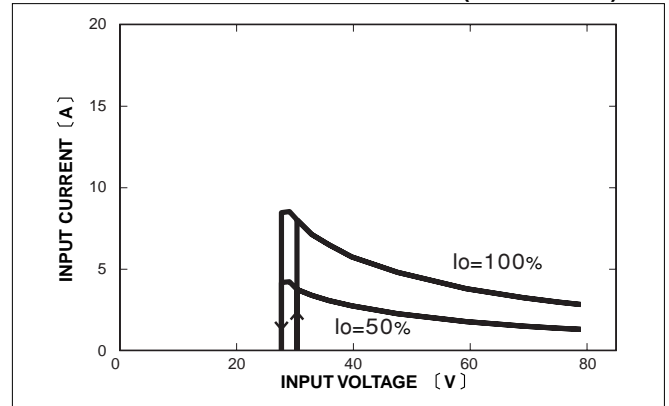


Performance data

■ INPUT CURRENT CHARACTERISTICS (CBS2002428)



■ INPUT CURRENT CHARACTERISTICS (CBS2004828)



| | | |
|----------|---|------|
| 1 | Pin Configuration | H-20 |
| 2 | Connection for Standard Use | H-20 |
| 3 | Wiring Input/Output Pin | H-20 |
| 3.1 | Wiring input pin | H-20 |
| 3.2 | Wiring output pin | H-21 |
| 4 | Function | H-21 |
| 4.1 | Overcurrent protection | H-21 |
| 4.2 | Overvoltage protection | H-22 |
| 4.3 | Thermal protection | H-22 |
| 4.4 | Remote ON/OFF | H-22 |
| 4.5 | Remote sensing | H-22 |
| 4.6 | Adjustable voltage range | H-22 |
| 4.7 | Isolation | H-23 |
| 5 | Series and Parallel Operation | H-23 |
| 5.1 | Series operation | H-23 |
| 5.2 | Parallel redundancy operation | H-23 |
| 6 | Implementation · Mounting Method | H-23 |
| 6.1 | Mounting method | H-23 |
| 6.2 | Stress onto the pins | H-24 |
| 6.3 | Cleaning | H-24 |
| 6.4 | Soldering temperature | H-24 |
| 6.5 | Derating | H-24 |
| 6.6 | Heat sink(Optional parts) | H-24 |
| 6.7 | Addition of a Heat sink(Optional:F□)..... | H-25 |
| 7 | Safety Considerations | H-26 |

1 Pin Configuration

Table 1.1 Pin configuration and function

| No. | Pin Name | Function |
|-----|---------------|------------------------------|
| ① | +VIN | +DC input |
| ② | RC | Remote ON/OFF |
| ③ | CASE | Wiring base plate |
| ④ | -VIN | -DC input |
| ⑤ | +VOUT | +DC output |
| ⑥ | +S | +Remote sensing |
| ⑦ | TRM | Adjustment of output voltage |
| ⑧ | -S | -Remote sensing |
| ⑨ | -VOUT | -DC output |
| — | Mounting hole | Mounting hole |

| No. | Pin Name | Reference |
|-----|---------------|--------------------------------|
| ① | +VIN | 3.1 "Wiring input pin" |
| ② | RC | 4.4 "Remote ON/OFF" |
| ③ | CASE | 3.1 "Wiring input pin" |
| ④ | -VIN | |
| ⑤ | +VOUT | 3.2 "Wiring output pin" |
| ⑥ | +S | 4.5 "Remote sensing" |
| ⑦ | TRM | 4.6 "Adjustable voltage range" |
| ⑧ | -S | 4.5 "Remote sensing" |
| ⑨ | -VOUT | 3.2 "Wiring output pin" |
| — | Mounting hole | 6.1 "Mounting method" |

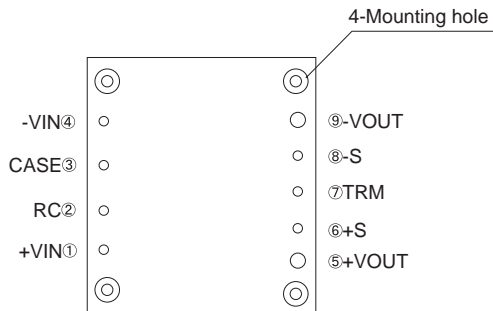


Fig.1.1 Pin configuration(bottom view)

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

{ Reference: 3 "Wiring Input/Output Pin"
6.5 "Derating" }

■ Short the following pins to turn on the power supply.

-VIN↔RC, +VOUT↔+S, and -VOUT↔-S

{ Reference: 4.4 "Remote ON/OFF"
4.5 "Remote sensing" }

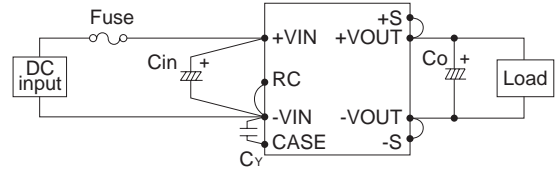
■ The CBS Series handles only the DC input.

Avoid applying AC input directly.

!! It will damage the power supply. !!

■ Operate with the conduction cooling(e.g. heat radiation from the aluminum base plate to the attached heat sink).

{ Reference: 6.5 "Derating" }



Cin : External capacitor on the input side
Co : External capacitor on the output side
CY : Primary decoupling capacitor

Fig.2.1 Connection for standard use

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.

■ When the input voltage from a front end unit is supplied to multiple units, install a normal-blow type fuse in each unit.

Table 3.1 Recommended fuse(Normal-blow type)

| Model | CBS5024 | CBS10024 | CBS20024 | |
|---------------|---------|----------|---------------|----------------|
| | | | 1R8/2R5/03/05 | 12/15/24/28 |
| Rated current | 6A | 12A | 20A | 25A |
| Model | CBS5048 | CBS10048 | CBS20048 | |
| | | | 1R8/2R5/03/05 | 12/15/24/28/48 |
| Rated current | 3A | 6A | 10A | 12A |

(2) Noise filter/Decoupling capacitor

■ Install a decoupling capacitor CY for low line-noise and for stable operation of the power supply.

■ Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.

■ Install a primary decoupling capacitor CY, with more than 4700pF, near the input pins(within 50mm from the pins).

■ When the total capacitance of the primary decoupling capacitor is more than 15000pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output.

In this case, it is that capacitor should be installed between output and CASE pin.

The total capacitance has no maximum limit when the unit is used less than AC500V(1 minute)with the Hi-Pot test between input and output.

(3) External capacitor on the input side

■ Install an external capacitor C_{in} between +VIN and -VIN input pin for low line-noise and for stable operation of the power supply.

| | |
|-------------|--|
| Capacitance | CBS50/100/20024: more than $68\mu F$ CBS50/100/20048: more than $33\mu F$ |
| T_c | -20 to $+100^\circ C$ Electrolytic or Ceramic capacitor -40 to $+100^\circ C$ Ceramic capacitor |

(4) Input voltage range/Input current range

■ The specification of input ripple voltage is shown as below.

| | |
|----------------|--|
| Ripple voltage | CBS50/100/20024: less than $2V_{p-p}$ CBS50/100/20048: less than $4V_{p-p}$ |
|----------------|--|

■ Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.

■ Use a front end unit with enough power, considering the start-up current I_p of this unit.

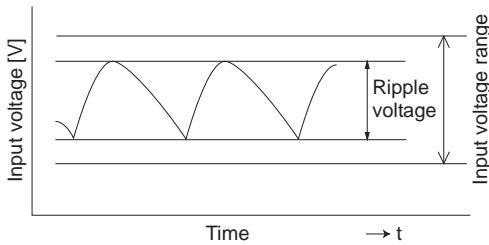


Fig.3.1 Input voltage ripple

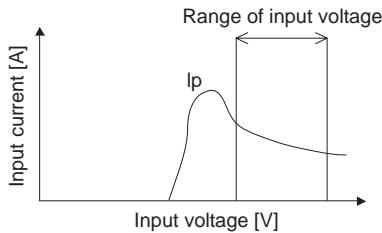


Fig.3.2 Input current characteristics

(5) Operation with AC input

■ The CBS series handles only for the DC input.

A front end unit(AC/DC unit) is required when the input voltage is from AC source.

(6) Reverse input voltage protection

■ Avoid the reverse polarity input voltage. It will damage the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.3.3.

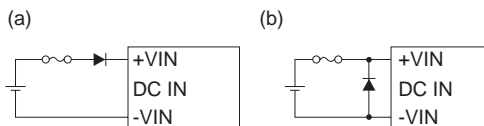


Fig.3.3 Reverse input voltage protection

3.2 Wiring output pin

■ Install an external capacitor C_o between +VOUT and -VOUT pins for stable operation of the power supply.

Recommended capacitance of C_o is shown in Table 3.2.

Table 3.2 Recommended capacitance C_o [μF]

| Base plate temperature : $T_c = -20$ to $+100^\circ C$ | | | | | | |
|--|-------------------|-----------------|-----|----------------|-----|----------------|
| VOUT | 1.8V/2.5V/3.3V/5V | 12V | 15V | 24V | 28V | 48V |
| CBS50 | 2200 | 470 | | 220 | | - |
| CBS100 | 2200 | 470 | | 220 | | - |
| CBS200 | 2200 | 1000 | | 470 | | 330 |
| Base plate temperature : $T_c = -40$ to $+100^\circ C$ | | | | | | |
| VOUT | 1.8V/2.5V/3.3V/5V | 12V | 15V | 24V | 28V | 48V |
| CBS50 | 2200×2 | 470×2 | | 220×2 | | - |
| CBS100 | 2200×2 | 470×2 | | 220×2 | | - |
| CBS200 | 2200×2 | 1000×2 | | 470×2 | | 330×2 |

■ Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR · ESL of the capacitor and the wiring impedance.

■ Install a capacitor C_o near the output pins(within 50mm from the pins).

■ Ripple and Ripple Noise are measured by using measuring board with recommended capacitor C_o & the film capacitor $0.1\mu F$ as shown in Fig.3.4.

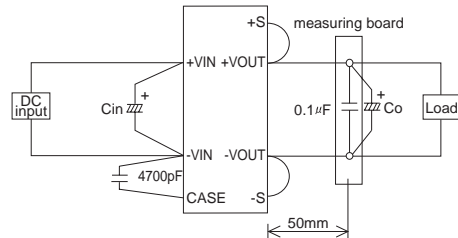


Fig.3.4 Measuring method of Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

■ When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation. In this case, recovery from overvoltage protection is accomplished by cycling the DC input power off for at least 1 second(★), or toggling Remote ON/OFF signal for at least 1 second.
- ★ The recovery time varies depending on input voltage and input capacity.

Remarks:

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

- When the base plate temperature is kept above 100°C, the thermal protection will be activated and simultaneously shut off the output. In this case, the unit should be cooled down, and then recovery from thermal protection is accomplished by cycling the DC input power off for at least 1 second, or toggling Remote ON/OFF signal for at least 1 second.

4.4 Remote ON/OFF

- Remote ON/OFF circuit is built-in on input side. The ground pin of input side remote ON/OFF circuit is "-VIN" pin.

Table 4.1 Specification of Remote ON/OFF

| | ON/OFF logic | Between RC and -VIN | Output voltage |
|-------------|--------------|-----------------------------|----------------|
| Standard | Negative | L level(0 - 1.2V) or short | ON |
| | | H level(3.5 - 7.0V) or open | OFF |
| Optional -R | Positive | L level(0 - 1.2V) or short | OFF |
| | | H level(3.5 - 7.0V) or open | ON |

When RC is "Low" level, fan out current is 0.5mA typ. When Vcc is applied, use $3.5 \leq V_{cc} \leq 7V$.

When remote ON/OFF function is not used, please short between RC and -VIN(-R: open between RC and -VIN).

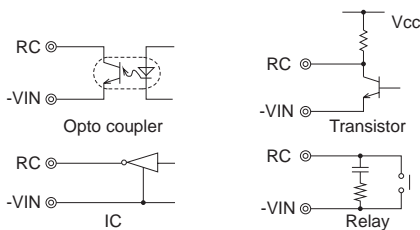


Fig.4.1 RC connection example

4.5 Remote sensing

- When the remote sensing function is not in use
 - When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.
 - Wire between +S & +VOUT and between -S & -VOUT as short as possible. Loop wiring should be avoided. This power supply might become unstable by the noise coming from poor wiring.
- When the remote sensing function is in use
 - Twisted-pair wire or shield wire should be used for sensing wire.
 - Thick wire should be used for wiring between the power supply and a load. Line drop should be less than 0.3V. Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.
 - If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged. The pattern disconnection can be prevented by installing the protection parts as close as a load.

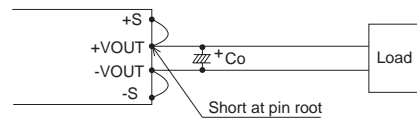


Fig.4.2 Connection when the remote sensing is not in use

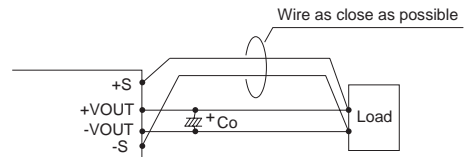


Fig.4.3 Connection when the remote sensing is in use

4.6 Adjustable voltage range

- Output voltage is adjustable by the external potentiometer or by applied voltage externally. When the input voltage is in the range of DC18 - 20V(CBS50/100/20024), DC36 - 40V(CBS50/100/20048), output voltage adjustment range is 60 - 105%(except for 1R8/2R5/48).
- When the output voltage adjustment is used, note that the overvoltage protection circuit operates when the output voltage sets too high.
- By connecting the external potentiometer(VR1) and resistors(R1, R2), output voltage becomes adjustable, as shown in Fig.4.4, recommended external parts are shown in Table 4.2.

- The wiring to the potentiometer should be as short as possible. The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.
Resistor ----- Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$
Potentiometer --- Cermet type, coefficient of less than $\pm 300\text{ppm}/^\circ\text{C}$

- When the output voltage adjustment is not used, open the TRM pin respectively.

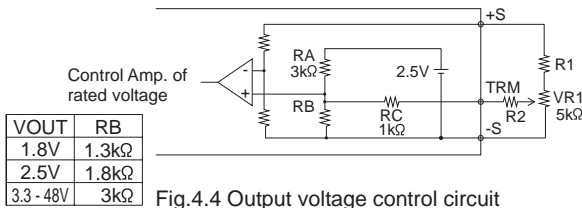


Fig.4.4 Output voltage control circuit

Table 4.2 Recommended value of external resistors

| No. | VOUT | Adjustable range | | | |
|-----|------|------------------|-------|-----------------|-------|
| | | VOUT $\pm 5\%$ | | VOUT $\pm 10\%$ | |
| | | R1 | R2 | R1 | R2 |
| 1 | 1.8V | 1.8kΩ | 6.2kΩ | 1.6kΩ | 3.6kΩ |
| 2 | 2.5V | 2.7kΩ | 7.5kΩ | 2.4kΩ | 4.7kΩ |
| 3 | 3.3V | 2.4kΩ | 11kΩ | 2.4kΩ | 6.8kΩ |
| 4 | 5V | 5.6kΩ | | 5.6kΩ | |
| 5 | 12V | 18kΩ | | 18kΩ | |
| 6 | 15V | 24kΩ | | 24kΩ | |
| 7 | 24V | 43kΩ | | 39kΩ | |
| 8 | 28V | 51kΩ | | 47kΩ | |
| 9 | 48V | 82kΩ | | 82kΩ | |

4.7 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

- Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

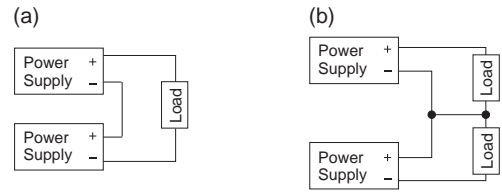


Fig.5.1 Examples of series operation

5.2 Parallel redundancy operation

- Parallel redundancy operation is available by connecting the units as shown Fig.5.2.
- Values of I1 and I2 become unbalanced by a slight different of the output voltage. Make sure that the output voltage of units is of equal value and the output current from each power supply does not exceed the rated current.

$$I_1, I_2 \leq \text{the rated current value}$$

- Use external potentiometer is recommended which can adjust the output voltage.

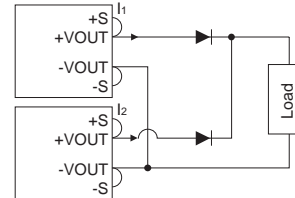


Fig.5.2 Parallel redundancy operation

6 Implementation - Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to CASE pin. The shield pattern prevents noise radiation.
- Option "-T" is available, as shown in Table 6.1.

Table 6.1 Mounting hole

| | |
|---------------|---------------|
| | Mounting hole |
| Standard | M3 tapped |
| Optional : -T | φ3.4 thru |

6.2 Stress onto the pins

- When excess stress or bending force is applied to the pins of the power supply, the internal connection may be weakened. As shown in Fig.6.1 avoid applying stress of more than 39.2N(4kgf) on +VOUT/-VOUT pins and more than 19.6N(2kgf) to the other pins.
- The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- Mounting hole diameter of PCB should be 3.5mm to reduce the stress onto the pins.
- Fix the unit on PCB(fixing fittings) by screws to reduce the stress onto the pins. Be sure to mount the unit first, then solder the unit.

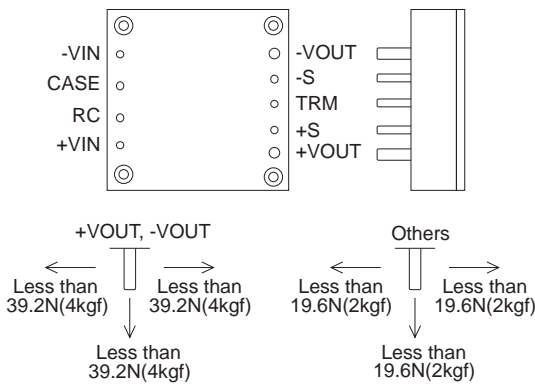


Fig.6.1 Stress onto the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product. Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case. (If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering temperature

- Flow soldering :260°C less than 15 seconds.
- Soldering iron :450°C less than 5 seconds(less than 26w).

6.5 Derating

- Use with the conduction cooling(e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).

Fig.6.2 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.

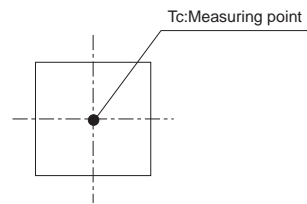
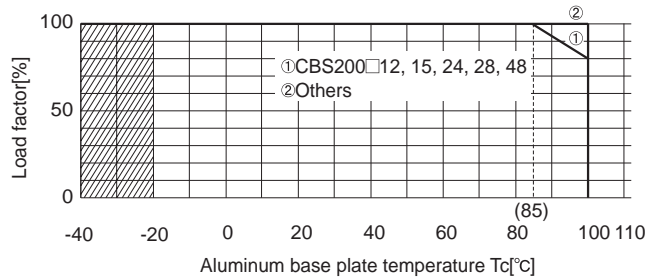


Fig.6.2 Derating curve

6.6 Heat sink(Optional parts)

- Use with the conduction cooling(e.g. heat radiation by conduction from the aluminum base to the attached heat sink). Optional heat sinks are available. Refer to Table 6.2 for thermal resistance of heat sink.

Table 6.2 Available types of heat sink

| No. | Model | Size[mm] | | | Thermal resistance[°C/W] | | Style |
|-----|----------|----------|------|------|--------------------------|---------------|------------|
| | | H | W | D | Convection (0.1m/s) | Forced Air | |
| 1 | F-CBS-F1 | 12.7 | 57.9 | 61.5 | 7.5 | Refer Fig.6.4 | Vertical |
| 2 | F-CBS-F2 | 12.7 | 58.4 | 61.0 | | | Horizontal |
| 3 | F-CBS-F3 | 25.4 | 57.9 | 61.5 | 4.6 | | Vertical |
| 4 | F-CBS-F4 | 25.4 | 58.4 | 61.0 | | | Horizontal |
| 5 | F-CBS-F5 | 38.1 | 57.9 | 61.5 | 3.0 | | Vertical |
| 6 | F-CBS-F6 | 38.1 | 58.4 | 61.0 | | | Horizontal |

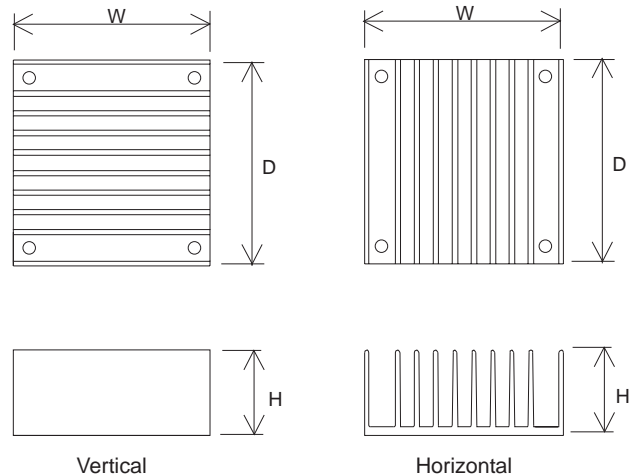


Fig.6.3 Heat sink types

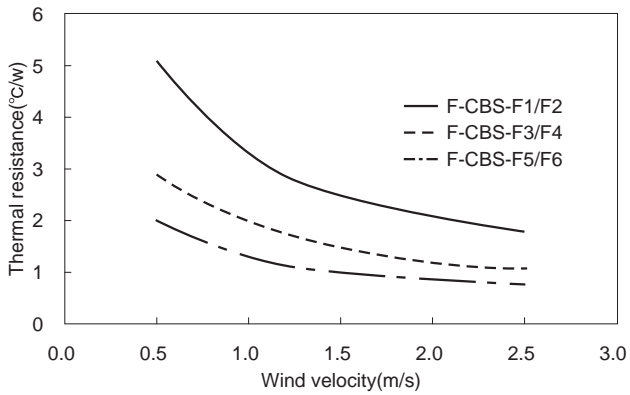


Fig.6.4 Thermal resistance of heat sink(Forced air)

6.7 Addition of a Heat sink(Optional:F□)

■The power supplies with the addition of a heat sink are available.

Table 6.3 Available types with the addition of a heat sink

| Option | Size[mm] | | | Weight [g] | Style | Heat sink type name |
|--------|----------|------|------|-------------|------------|---------------------|
| | H | W | D | | | |
| F1 | 26.5 | 58.7 | 62.5 | 150 or less | Vertical | F-CBS-F1 |
| F2 | 26.5 | 59.5 | 62.0 | | Horizontal | F-CBS-F2 |
| F3 | 39.2 | 58.7 | 62.5 | 170 or less | Vertical | F-CBS-F3 |
| F4 | 39.2 | 59.5 | 62.0 | | Horizontal | F-CBS-F4 |
| F5 | 52.0 | 58.7 | 62.5 | 185 or less | Vertical | F-CBS-F5 |
| F6 | 52.0 | 59.5 | 62.0 | | Horizontal | F-CBS-F6 |

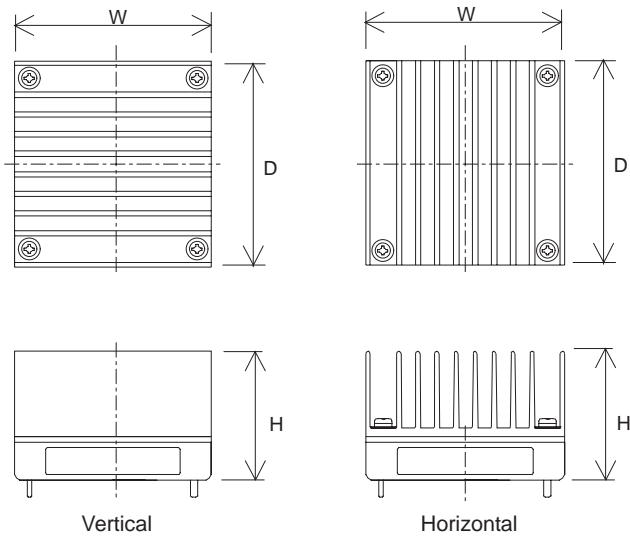


Fig.6.5 Optional types

■The temperature is measured by aluminum base plate (part A) under the air flow as shown in Fig.6.7.

Fig.6.6 shows the derating curve based on the temperature of part A.

In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.

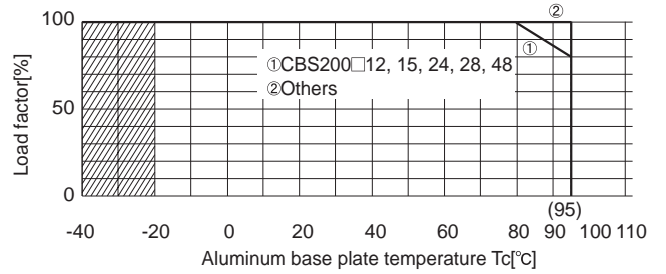


Fig.6.6 Derating curve

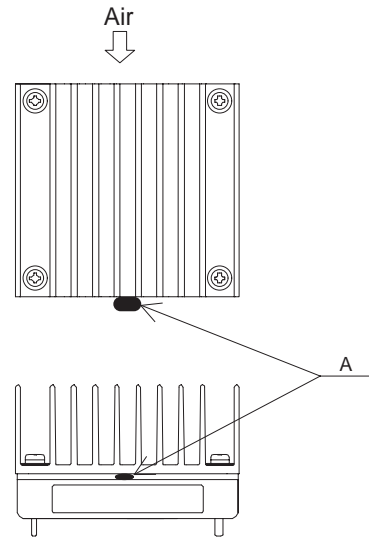


Fig.6.7 Measuring point

■Keep distance of each mounting screw, as below chart.

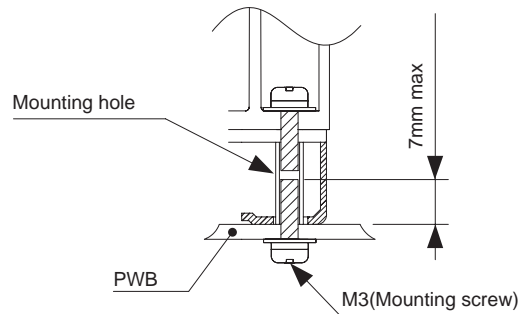


Fig.6.8 Mounting screw

7 Safety Considerations

■ To apply for safety standard approval using this power supply, the following conditions must be met.

- This unit must be used as a component of the end-use equipment.
- The equipment does neither contain any basic nor double/reinforced insulation between input and output, and base plate.

If the input voltage is greater than 60VDC, this has to be provided by the end-use equipment according to the final build in condition.

- Safety approved fuse must be externally installed on input side.

Basic Characteristics Data

| Model | Circuit method | Switching frequency [kHz] | Input current [A] | Rated input fuse | Inrush current protection | PCB/Pattern | | | Series/Parallel operation availability | |
|--------|-------------------|---------------------------|---------------------|------------------|---------------------------|-------------|--------------|--------------|--|--------------------|
| | | | | | | Material | Single sided | Double sided | Series operation | Parallel operation |
| CBS50 | Forward converter | 310 | Refer to table No.1 | - | - | Aluminum | Yes | | Yes | *1 |
| CBS100 | Forward converter | 370 | | - | - | Aluminum | Yes | | Yes | *1 |
| CBS200 | Forward converter | 370 | | - | - | Aluminum | Yes | | Yes | *1 |

*1 Refer to Instruction Manual.

Table1. The value of input current (at rated input voltage and rated load)

[A]

| Model | Output Voltage | | | | | | | | |
|----------|----------------|------|------|-----|-----|-----|-----|-----|-----|
| | 1.8V | 2.5V | 3.3V | 5V | 12V | 15V | 24V | 28V | 48V |
| CBS5024 | 1.2 | 1.6 | 2.0 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | - |
| CBS5048 | 0.6 | 0.8 | 1.0 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | - |
| CBS10024 | 2.5 | 3.2 | 4.1 | 5.0 | 4.8 | 4.8 | 4.8 | 4.8 | - |
| CBS10048 | 1.2 | 1.6 | 2.0 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | - |
| CBS20024 | 3.8 | 4.8 | 6.1 | 7.6 | 9.6 | 9.6 | 9.7 | 9.7 | - |
| CBS20048 | 1.9 | 2.4 | 3.0 | 3.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |