

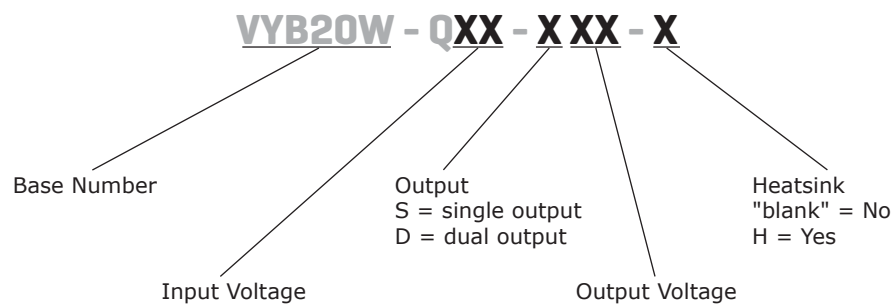
**SERIES: VYB20W | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 20W output
- industry standard pinout
- 4:1 input range (9 ~ 36 V, 18 ~ 75 V)
- single and dual outputs
- 1,500 V isolation
- short circuit, over current, and over voltage protection
- wide temperature operation (-40 ~ 85°C)
- efficiency up to 88%



| MODEL          | input<br>voltage<br>range<br>(Vdc) | output<br>voltage<br>(Vdc) | output<br>current |             | output<br>power<br>max<br>(W) | ripple <sup>1</sup><br>max<br>(mVp-p) | noise <sup>1</sup><br>max<br>(mVp-p) | efficiency<br>typ<br>(%) |
|----------------|------------------------------------|----------------------------|-------------------|-------------|-------------------------------|---------------------------------------|--------------------------------------|--------------------------|
|                |                                    |                            | min<br>(mA)       | max<br>(mA) |                               |                                       |                                      |                          |
| VYB20W-Q24-S3  | 9 ~ 36                             | 3.3                        | 500               | 5,000       | 16.5                          | 150                                   | 150                                  | 83                       |
| VYB20W-Q24-S5  | 9 ~ 36                             | 5                          | 400               | 4,000       | 20                            | 150                                   | 150                                  | 86                       |
| VYB20W-Q24-S12 | 9 ~ 36                             | 12                         | 167               | 1,667       | 20                            | 150                                   | 150                                  | 87                       |
| VYB20W-Q24-S15 | 9 ~ 36                             | 15                         | 133               | 1,333       | 20                            | 150                                   | 150                                  | 88                       |
| VYB20W-Q24-S24 | 9 ~ 36                             | 24                         | 83                | 834         | 20                            | 150                                   | 150                                  | 88                       |
| VYB20W-Q24-D5  | 9 ~ 36                             | ±5                         | ±200              | ±2,000      | 20                            | 50                                    | 100                                  | 84                       |
| VYB20W-Q24-D12 | 9 ~ 36                             | ±12                        | ±83               | ±833        | 20                            | 50                                    | 100                                  | 87                       |
| VYB20W-Q24-D15 | 9 ~ 36                             | ±15                        | ±67               | ±667        | 20                            | 50                                    | 100                                  | 87                       |
| VYB20W-Q48-S3  | 18 ~ 75                            | 3.3                        | 500               | 5,000       | 16.5                          | 150                                   | 150                                  | 83                       |
| VYB20W-Q48-S5  | 18 ~ 75                            | 5                          | 400               | 4,000       | 20                            | 150                                   | 150                                  | 87                       |
| VYB20W-Q48-S12 | 18 ~ 75                            | 12                         | 167               | 1,667       | 20                            | 150                                   | 150                                  | 88                       |
| VYB20W-Q48-S15 | 18 ~ 75                            | 15                         | 133               | 1,333       | 20                            | 150                                   | 150                                  | 88                       |
| VYB20W-Q48-S24 | 18 ~ 75                            | 24                         | 83                | 834         | 20                            | 150                                   | 150                                  | 88                       |
| VYB20W-Q48-D5  | 18 ~ 75                            | ±5                         | ±200              | ±2000       | 20                            | 50                                    | 100                                  | 85                       |
| VYB20W-Q48-D12 | 18 ~ 75                            | ±12                        | ±83               | ±833        | 20                            | 50                                    | 100                                  | 87                       |
| VYB20W-Q48-D15 | 18 ~ 75                            | ±15                        | ±67               | ±667        | 20                            | 50                                    | 100                                  | 88                       |

Notes: 1. Ripple and noise are measured at 20 MHz BW with 10µF tantalum capacitor and 1µF ceramic capacitor across output

**PART NUMBER KEY**


## INPUT

| parameter                  | conditions/description                                  |                             | min  | typ | max  | units |
|----------------------------|---------------------------------------------------------|-----------------------------|------|-----|------|-------|
| operating input voltage    |                                                         |                             | 9    | 24  | 36   | Vdc   |
|                            |                                                         |                             | 18   | 48  | 75   | Vdc   |
| start-up time              |                                                         |                             |      | 10  |      | ms    |
| under voltage lockout      | all models                                              | power up 24 V input         |      |     | 9.0  | Vdc   |
|                            | all models                                              | power up 48 V input         |      |     | 17.8 | Vdc   |
|                            | single output models                                    | power down 24 V input       | 8.0  |     |      | Vdc   |
|                            | dual output models                                      | power down 24 V input       | 7.8  |     |      | Vdc   |
|                            | all models                                              | power down 48 V input       | 16.0 |     |      | Vdc   |
| Remote on/off <sup>1</sup> | all models                                              | module off                  | 0    |     | 1.2  | Vdc   |
|                            | single output models                                    | module on (or open circuit) | 3.5  |     | 12   | Vdc   |
|                            | dual output models                                      | module on (or open circuit) | 3.5  |     | 12   | Vdc   |
| filter                     | single output models, LC<br>dual output models, PI type |                             |      |     |      |       |

Notes: 1. The on/off pin voltage is referenced to GND

## OUTPUT

| parameter                | conditions/description              |                                                              | min | typ   | max  | units |
|--------------------------|-------------------------------------|--------------------------------------------------------------|-----|-------|------|-------|
| line regulation          | measured from low line to high line |                                                              |     | ±0.2  | ±0.5 | %     |
| load regulation          | measured from 10% to full load      |                                                              |     | ±0.5  | ±1   | %     |
| voltage accuracy         | refer to recommended circuit        |                                                              |     | ±1    | ±3   | %     |
| transient recovery time  | 25% step load charge                |                                                              |     | 200   | 500  | µs    |
| transient peak deviation | 25% rated load                      |                                                              |     | ±3    | ±5   | %     |
| cross regulation         | dual output models                  | main output 55%,<br>supplemental output from<br>10~100% load |     |       | ±5   | %     |
|                          |                                     |                                                              |     |       |      |       |
| adjustability            | single output models                |                                                              |     | ±10%  |      | Vdc   |
| switching frequency      | 100% load, input voltage range      |                                                              |     | 400   |      | kHz   |
| temperature coefficient  |                                     |                                                              |     | ±0.02 |      | %/°C  |

## PROTECTIONS

| parameter                | conditions/description                 |                     | min | typ  | max | units |
|--------------------------|----------------------------------------|---------------------|-----|------|-----|-------|
| short circuit protection | hiccup, continuous, automatic recovery |                     |     |      |     |       |
| over current protection  | single output models                   | input voltage range | 120 | 130  | 150 | %     |
|                          | dual output models                     | input voltage range | 120 | 140  | 150 | %     |
| over voltage protection  | single output models                   | 3.3 V               |     | 3.9  |     | Vdc   |
|                          |                                        | 5 V                 |     | 6.2  |     | Vdc   |
|                          |                                        | 12 V                |     | 15   |     | Vdc   |
|                          |                                        | 15 V                |     | 18   |     | Vdc   |
|                          | dual output models                     | 24 V                |     | 28   |     | Vdc   |
|                          |                                        | ±5 V                |     | ±6.1 |     | Vdc   |
|                          |                                        | ±12 V               |     | ±15  |     | Vdc   |
|                          |                                        | ±15 V               |     | ±18  |     | Vdc   |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                                         | min       | typ            | max | units    |
|-----------------------|--------------------------------------------------------------------------------|-----------|----------------|-----|----------|
| isolation voltage     | tested for 1 minute at 1 mA max.                                               | 1,500     |                |     | Vdc      |
| isolation resistance  | at 500 Vdc                                                                     | 1,000     |                |     | MΩ       |
| isolation capacitance | input to output, 100 kHz / 0.1 V<br>single output models<br>dual output models |           | 1,000<br>2,000 |     | pF<br>pF |
| RoHS compliant        | yes                                                                            |           |                |     |          |
| MTBF                  | M1L-HDBK-217F                                                                  | 1,000,000 |                |     | hours    |

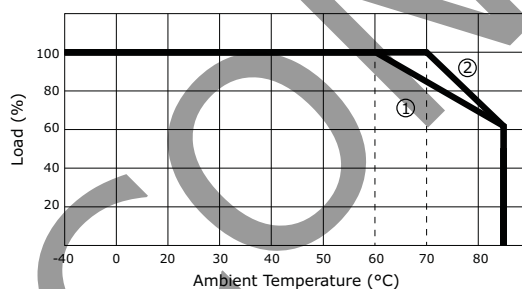
## ENVIRONMENTAL

| parameter                  | conditions/description              | min | typ | max | units |
|----------------------------|-------------------------------------|-----|-----|-----|-------|
| case operating temperature |                                     | -40 |     | 85  | °C    |
| maximum case temperature   | during operation                    |     |     | 105 | °C    |
| storage temperature        |                                     | -55 |     | 125 | °C    |
| storage humidity           | non-condensing                      | 5   |     | 95  | %     |
| temperature rise           | 100% load                           |     | 40  |     | °C    |
| lead temperature           | 1.5 mm from the case for 10 seconds |     |     | 300 | °C    |

## DERATING CURVES

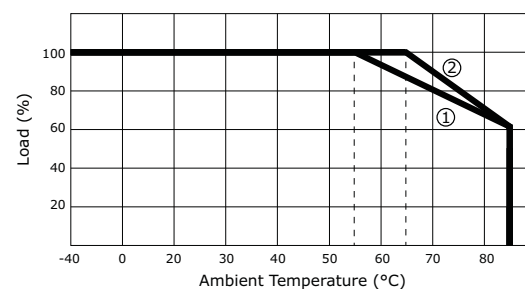
output power vs. ambient temperature

single output models

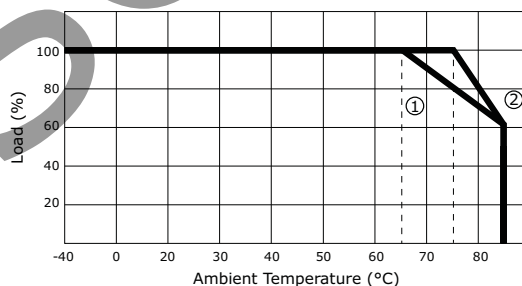


a. ≤5V models

dual output models



b. >5V models



① without heat sink

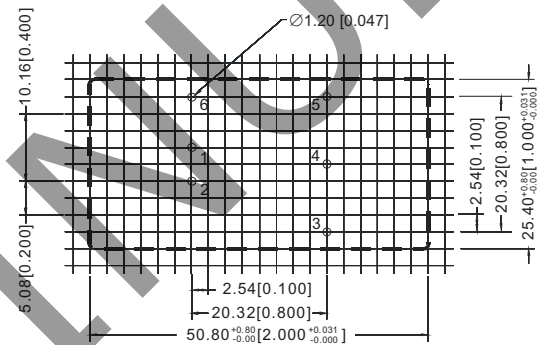
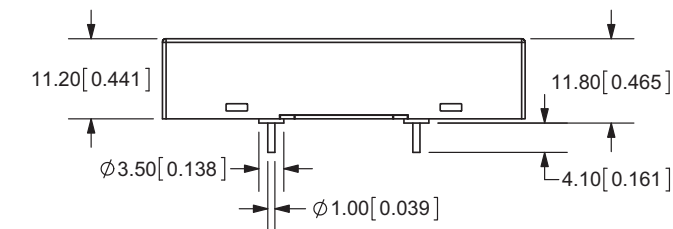
② with heatsink

## MECHANICAL

| parameter     | conditions/description                         | min | typ | max | units |
|---------------|------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 2.00 x 1.00 x 0.44 inch (50.8 x 25.4 x 11.2mm) |     |     |     |       |
| case material | nickel-coated copper (six-sided)               |     |     |     |       |
| weight        |                                                |     | 40  |     | g     |
|               | with heat sink                                 |     | 55  |     | g     |

## MECHANICAL DRAWING

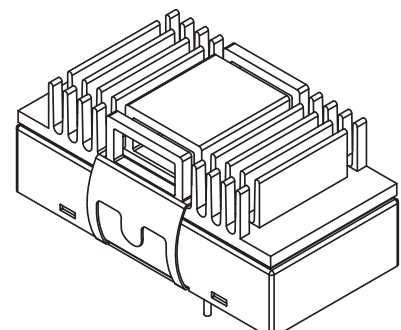
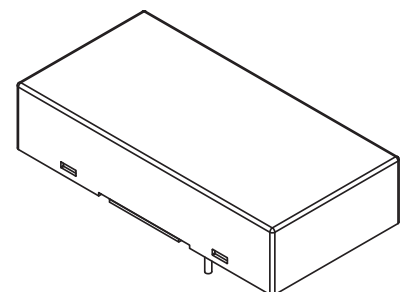
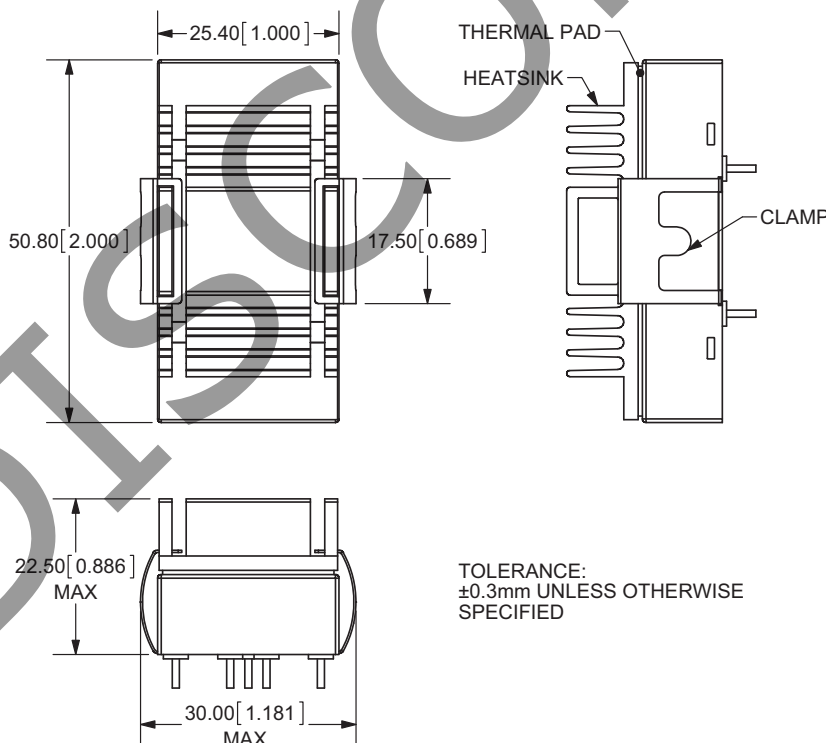
### RECOMMENDED FOOTPRINT (TOP VIEW)



Pin section tolerances:  $\pm 0.10\text{mm}$  [ $\pm 0.004\text{inch}$ ]  
General tolerances:  $\pm 0.25\text{mm}$  [ $\pm 0.010\text{inch}$ ]

| PIN CONNECTIONS |        |        |
|-----------------|--------|--------|
| Pin             | Single | Dual   |
| 1               | GND    | GND    |
| 2               | Vin    | Vin    |
| 3               | +Vo    | +Vo    |
| 4               | Trim   | 0V     |
| 5               | 0V     | -Vo    |
| 6               | On/Off | On/Off |

\*Pin 6 added for optional Remote on/off



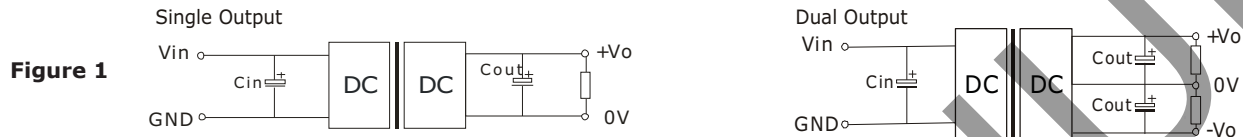
## APPLICATION NOTES

### 1. Requirement on Output Load

In order to ensure the product operates efficiently and reliably, make sure the specified range of input voltage is not exceeded and the minimum output load is not less than 10% load. If the actual load is less than the specified minimum load, the output ripple may increase sharply while its efficiency and reliability will reduce greatly. If the actual output power is very small, please add an appropriate resistor as extra loading.

### 2. Recommended Circuit

The VYB20W series has been tested according to the following recommended testing circuit. This series should be tested under load. (see Figure 1)



If you want to further decrease the input/output ripple, you can increase capacitance properly or choose capacitors with low ESR. If the capacitance is too big, a startup problem might arise. The maximum allowable capacitance to ensure safe and reliable operation is listed in Table 1.

**Table 1**

| Single Vout (Vdc) | Cout (μF) | Cin (μF) | Dual Vout (Vdc) | Cout (μF) | Cin (μF) |
|-------------------|-----------|----------|-----------------|-----------|----------|
| 3.3               | 470       | 100      | --              | --        | --       |
| 5                 | 470       | 100      | ±5              | ±220      | 100      |
| 12                | 220       | 100      | ±12             | ±100      | 100      |
| 15                | 220       | 100      | ±15             | ±100      | 100      |
| 24                | 100       | 100      | --              | --        | --       |

### 3. Trim Application and Trim Resistance (Single Output Models)

Formula for trim resistance

$$\text{up: } R = \frac{aR_2}{R_2 - a} - R_3 \quad a = \frac{V_{\text{ref}}}{V_o' - V_{\text{ref}}} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \quad a = \frac{V_o' - V_{\text{ref}}}{V_{\text{ref}}} \cdot R_2$$

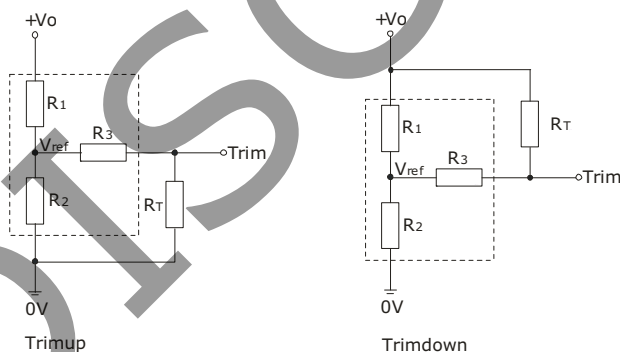
Note: Value for R1, R2, R3, and Vref refer to the following table.

R<sub>T</sub>: Trim resistance

a: User-defined parameter, no actual meaning.

V<sub>o'</sub>: Trim up/down voltage.

Application circuit for TRIM (Part in broken line is the interior of models)



| Vo Resistance | 3.3 (Vdc) | 5 (Vdc) | 12 (Vdc) | 15 (Vdc) | 24 (Vdc) |
|---------------|-----------|---------|----------|----------|----------|
| R1 (KΩ)       | 4.801     | 2.883   | 10.971   | 14.497   | 24.872   |
| R2 (KΩ)       | 2.863     | 2.864   | 2.864    | 2.864    | 2.864    |
| R3 (KΩ)       | 15        | 10      | 17.8     | 17.8     | 20       |
| Vref (V)      | 1.24      | 2.5     | 2.5      | 2.5      | 2.5      |

## REVISION HISTORY

| rev. | description                 | date       |
|------|-----------------------------|------------|
| 1.0  | initial release             | 08/09/2011 |
| 1.01 | V-Infinity branding removed | 08/29/2012 |

The revision history provided is for informational purposes only and is believed to be accurate.

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