

SERIES: VFB600 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

- up to 700 W isolated output
- industry standard full brick package
- 2:1 input range (18~36 Vdc, 36~75 Vdc)
- single output from 12~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 92%

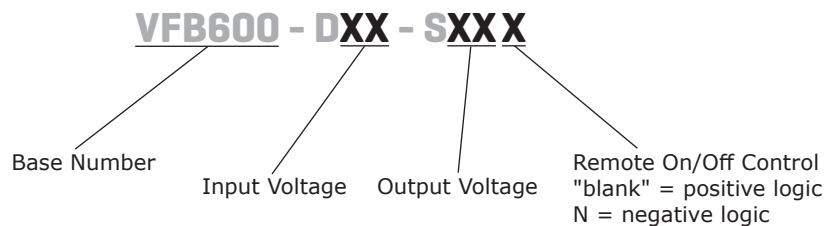


MODEL

| MODEL | input voltage | | output voltage | output current | output power | ripple and noise ¹ | efficiency |
|----------------|---------------|-------------|----------------|----------------|--------------|-------------------------------|------------|
| | typ (Vdc) | range (Vdc) | (Vdc) | max (A) | max (W) | max (mVp-p) | typ (%) |
| VFB600-D24-S12 | 24 | 18~36 | 12 | 50 | 600 | 120 | 88 |
| VFB600-D24-S24 | 24 | 18~36 | 24 | 25 | 600 | 240 | 90 |
| VFB600-D24-S28 | 24 | 18~36 | 28 | 21.5 | 600 | 280 | 90 |
| VFB600-D24-S32 | 24 | 18~36 | 32 | 19 | 600 | 320 | 91 |
| VFB600-D24-S48 | 24 | 18~36 | 48 | 12.5 | 600 | 480 | 91 |
| VFB600-D48-S12 | 48 | 36~75 | 12 | 50 | 600 | 120 | 90 |
| VFB600-D48-S24 | 48 | 36~75 | 24 | 25 | 600 | 240 | 92 |
| VFB600-D48-S28 | 48 | 36~75 | 28 | 25 | 700 | 280 | 91 |
| VFB600-D48-S32 | 48 | 36~75 | 32 | 19 | 600 | 320 | 92 |
| VFB600-D48-S48 | 48 | 36~75 | 48 | 12.5 | 600 | 480 | 92 |

Notes: 1. Ripple and noise measured at full load, 20 MHz BW with 10 µF tantalum and 1 µF ceramic capacitor across the output.
 2. An external input capacitor of 220 µF is recommended to reduce input ripple voltage.
 3. All specifications measured at nominal line, full load, and 25°C unless otherwise specified.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|-------------------------|---|------------------------|-----|-----|-------|
| operating input voltage | 24 Vdc input models | 18 | 24 | 36 | Vdc |
| | 48 Vdc input models | 36 | 48 | 75 | Vdc |
| under voltage shutdown | 24 Vdc input | power up | 17 | | Vdc |
| | | power down | 16 | | Vdc |
| | 48 Vdc input | power up | 35 | | Vdc |
| | | power down | 33 | | Vdc |
| over voltage shutdown | 24 Vdc input | power up | 38 | | Vdc |
| | | power down | 40 | | Vdc |
| | 48 Vdc input | power up | 77 | | Vdc |
| | | power down | 80 | | Vdc |
| start-up time | | | | 250 | ms |
| on/off ¹ | positive logic | models ON (0~0.01 mA) | | | |
| | | models OFF (1.0~10 mA) | | | |
| | negative logic | models ON (1.0~10 mA) | | | |
| | | models OFF (0~0.01 mA) | | | |
| filter | pi filter | | | | |
| input fuse | 60 A time delay fuse for 24 Vin models, 30 A time delay fuse for 48 Vin models | | | | |

Note: 1. See application notes.

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|----------------------------------|--|-----|-----|--------|-------|
| output capacitance ² | 12 Vdc output models | 470 | | 10,000 | μF |
| | all other models | 470 | | 5,000 | μF |
| line regulation ² | from low line to high line | | | ±0.2 | % |
| load regulation ² | from full load to no load | | | ±0.5 | % |
| voltage accuracy ² | | | | ±1.5 | % |
| load share accuracy | from 50~100% load | | ±10 | | % |
| adjustability | | 60 | | 110 | % |
| switching frequency | 48 Vdc input: 12 Vdc, 28 Vdc, 32 Vdc models | | 300 | | kHz |
| | all other models | | 250 | | kHz |
| transient response | 25% load step change | | | 500 | μs |
| temperature coefficient | | | | ±0.03 | %/°C |
| power good (IOC) | Vout ready: low level, sink current | | | 20 | mA |
| | Vout not ready: open drain output, applied voltage | | | 50 | V |
| auxiliary output voltage/current | 10 ±3 Vdc, 20 mA max. | | | | |

Note: 2. Minimum capacitor values are required on the output to maintain the specified regulation.

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|-----------------------------|------------------------|-----|-----|-----|-------|
| short circuit protection | continuous | | | | |
| over current protection | | 110 | | 150 | % |
| over voltage protection | | 115 | | 140 | % |
| over temperature protection | shutdown | | 110 | | °C |

SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|-----------------------|---|-------|---------|-----|-------|
| isolation voltage | for 1 minute, input to output, input to case, or output to case | 1,500 | | | Vdc |
| isolation resistance | | 10 | | | MΩ |
| isolation capacitance | | | 4,000 | | pF |
| safety approvals | UL 60950-1 | | | | |
| MTBF | as per MIL-HDBK-217F at full load, GB, 25 °C | | 450,000 | | hours |
| RoHS | 2011/65/EU (CE) | | | | |

ENVIRONMENTAL

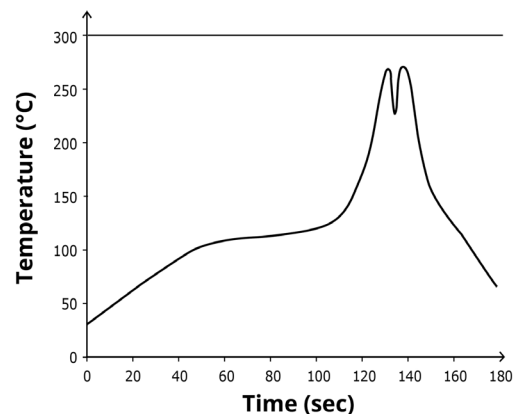
| parameter | conditions/description | min | typ | max | units |
|----------------------------|------------------------|-----|-----|-----|-------|
| operating case temperature | see derating curve | -40 | | 100 | °C |
| storage temperature | | -55 | | 105 | °C |
| humidity | non-condensing | | | 95 | % |

SOLDERABILITY

| parameter | conditions/description | min | typ | max | units |
|----------------|----------------------------|-----|-----|-----|-------|
| wave soldering | see wave soldering profile | | | 260 | °C |

- Notes:
1. Soldering materials: Sn/Cu/Ni
 2. Ramp up rate during preheat: 1.4°C/s (from 50°C to 100°C)
 3. Soaking temperature: 0.5°C/s (from 100°C to 130°C), 60±20 seconds
 4. Peak temperature: 260°C, above 250°C for 3~6 seconds
 5. Ramp down rate during cooling: -10°C/s (from 260°C to 150°C)

WAVE SOLDERING PROFILE



MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|---------------|--|-----|-----|-----|-------|
| dimensions | 116.8 x 61.0 x 12.7(4.60 x 2.40 x 0.50 inch) | | | | mm |
| case material | aluminum baseplate with plastic case | | | | |
| weight | | | 220 | | g |

MECHANICAL DRAWING

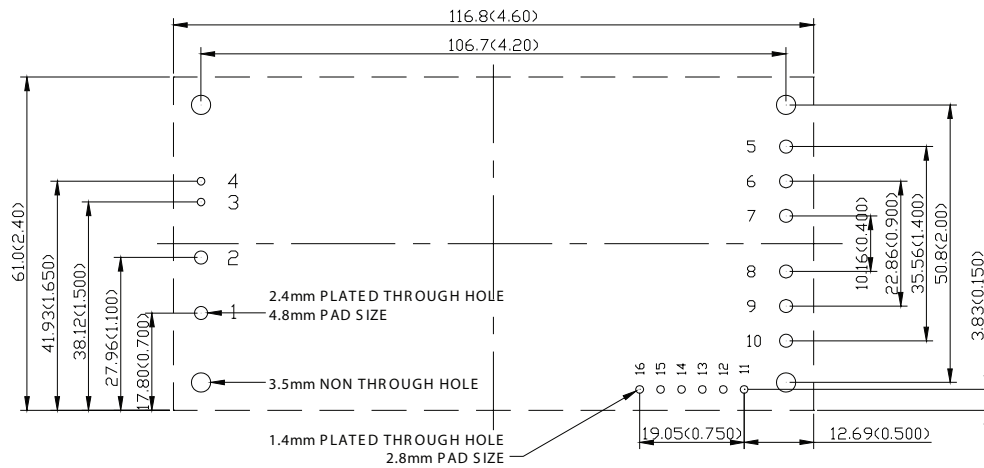
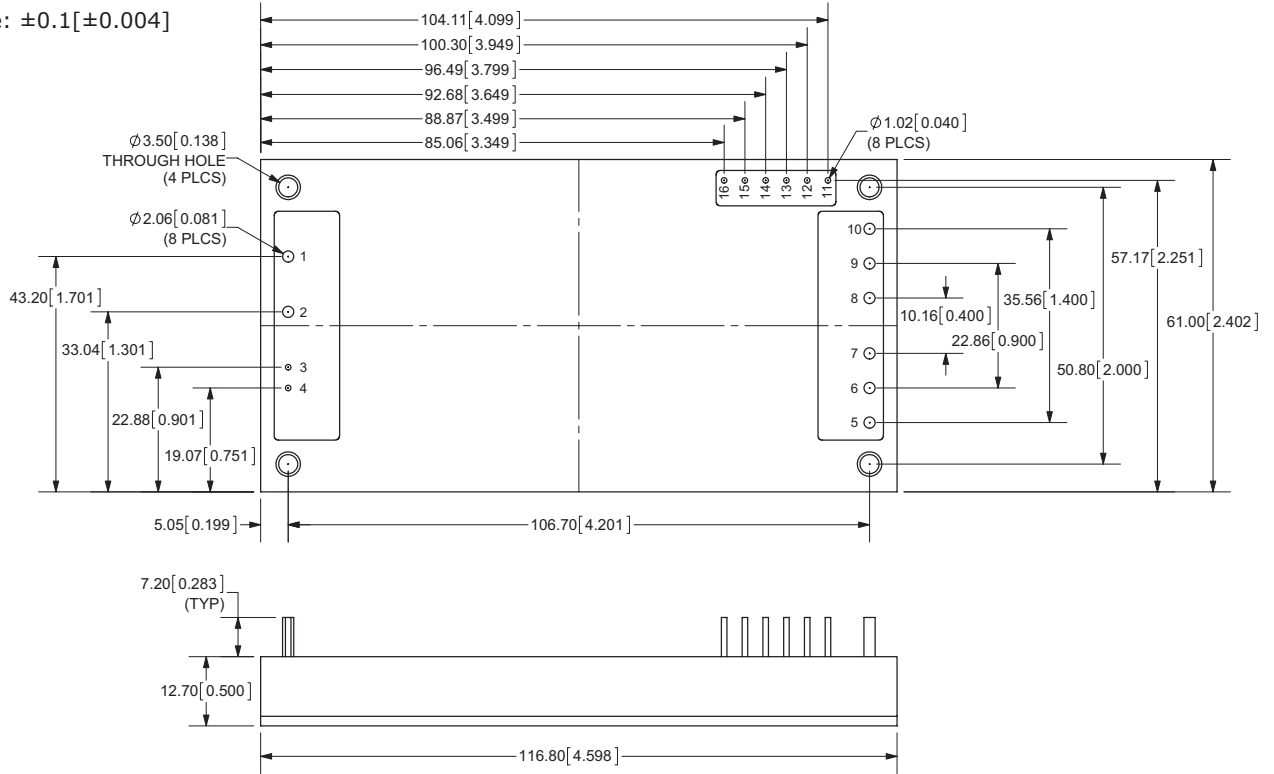
units: mm[inch]

tolerance: X.X = ±0.5[±0.02]

X.XX = ±0.25[±0.010]

pin diameter tolerance: ±0.1[±0.004]

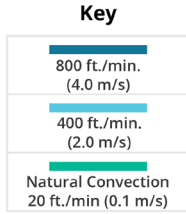
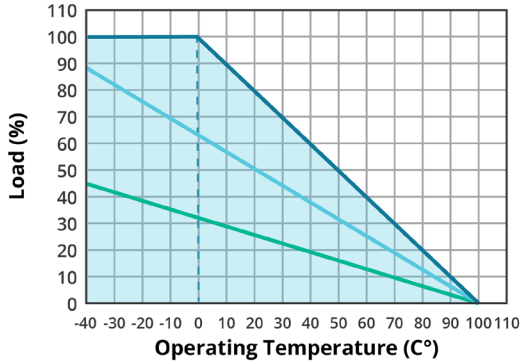
| PIN CONNECTIONS | |
|-----------------|----------|
| Pin | Function |
| 1 | -Vin |
| 2 | +Vin |
| 3 | -ON/OFF |
| 4 | +ON/OFF |
| 5 | +Vo |
| 6 | +Vo |
| 7 | +Vo |
| 8 | -Vo |
| 9 | -Vo |
| 10 | -Vo |
| 11 | -S |
| 12 | +S |
| 13 | TRIM |
| 14 | PC/NC |
| 15 | IOC |
| 16 | AUX |



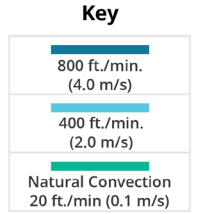
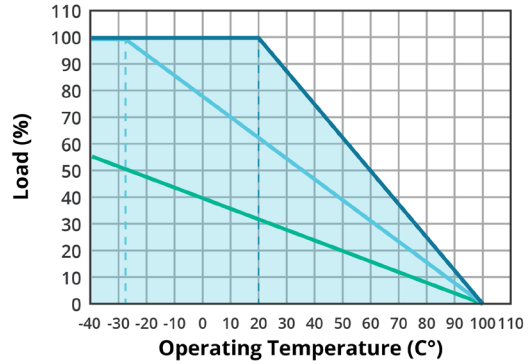
PCB Layout
Top View

DERATING CURVES

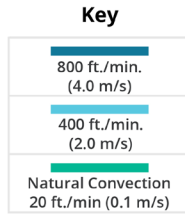
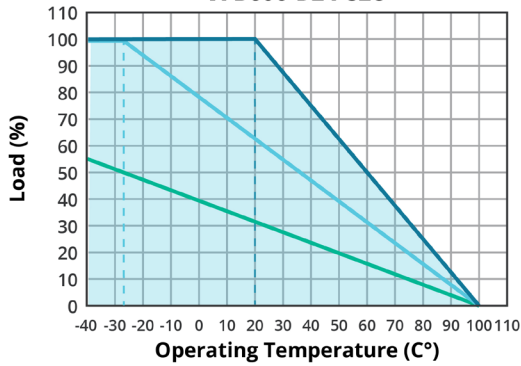
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VFB600-D24-S12**



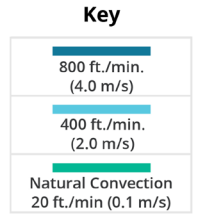
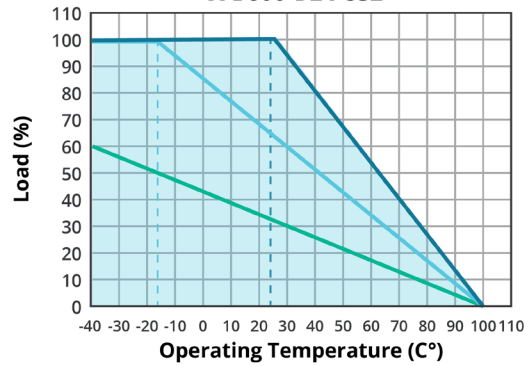
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VFB600-D24-S24**



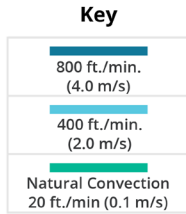
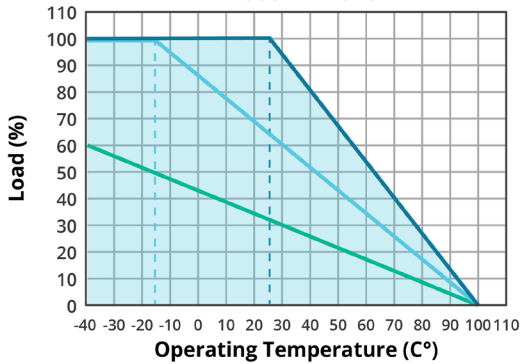
**TEMPERATURE DERATING CURVE
VFB600-D24-S28**



**TEMPERATURE DERATING CURVE
VFB600-D24-S32**

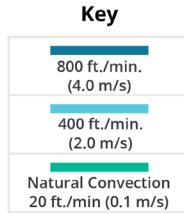
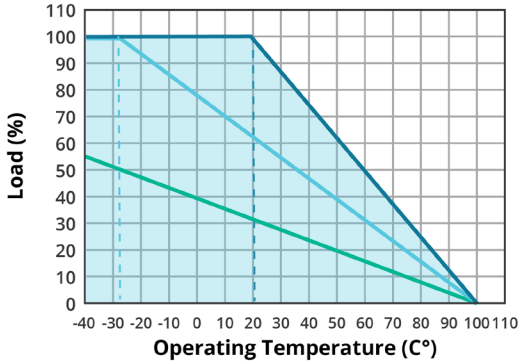


**TEMPERATURE DERATING CURVE
VFB600-D24-S48**

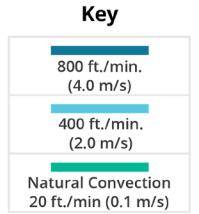
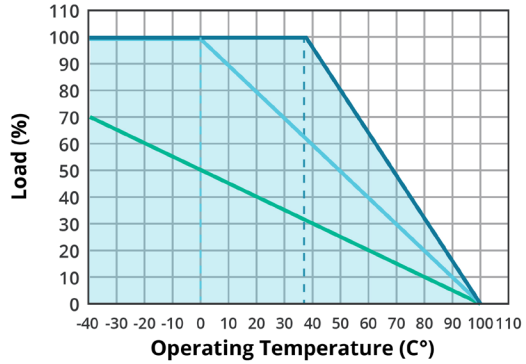


DERATING CURVES (CONTINUED)

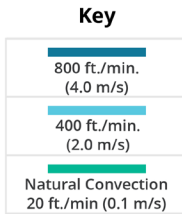
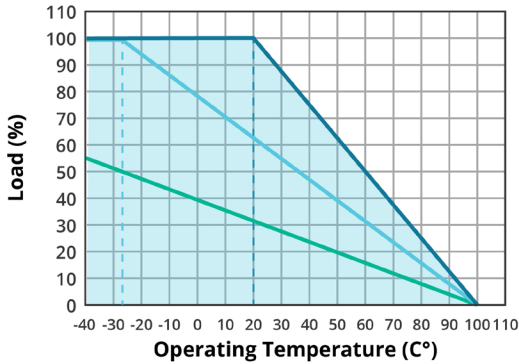
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VFB600-D48-S12**



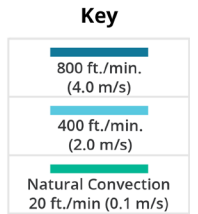
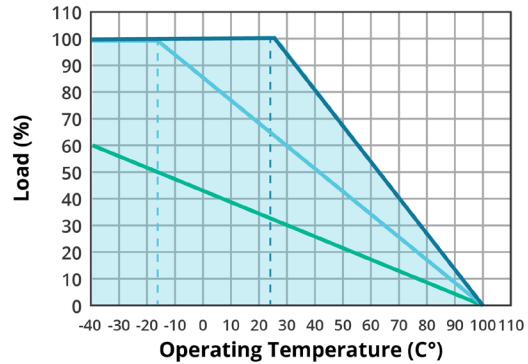
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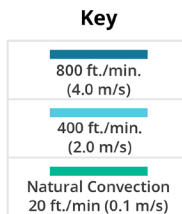
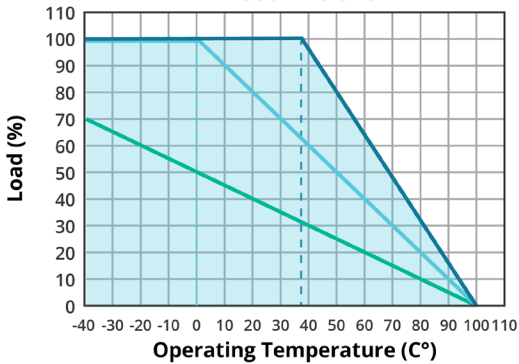
**TEMPERATURE DERATING CURVE
VFB600-D48-S28**



**TEMPERATURE DERATING CURVE
VFB600-D48-S32**

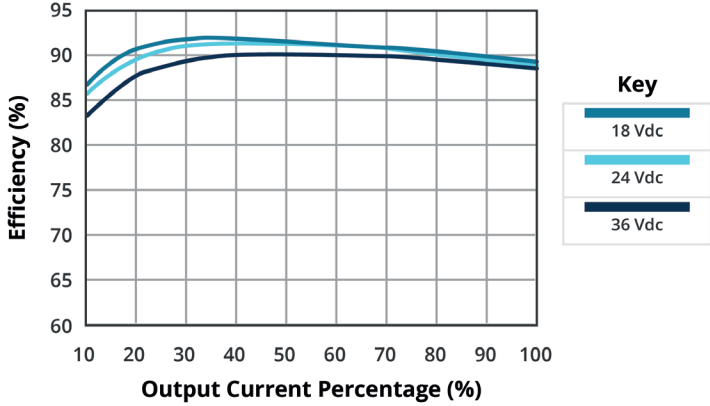


**TEMPERATURE DERATING CURVE
VFB600-D48-S48**

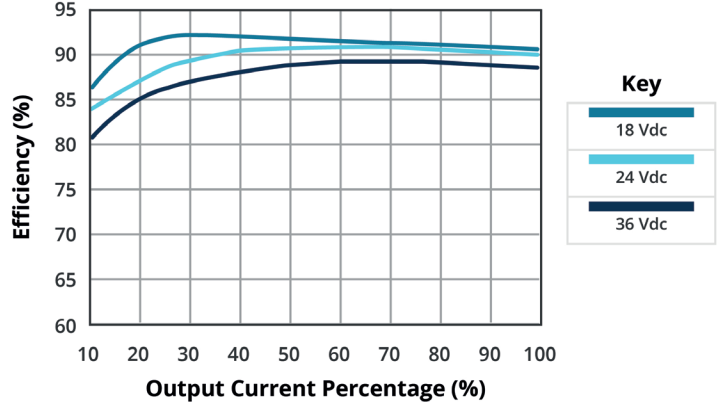


EFFICIENCY CURVES

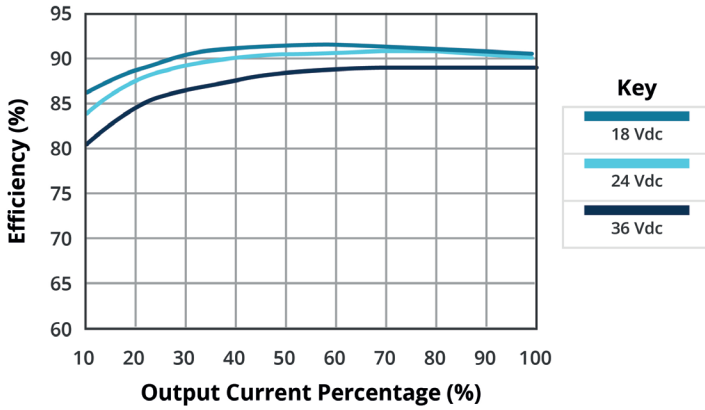
**EFFICIENCY VS OUTPUT LOAD
VFB600-D24-S12**



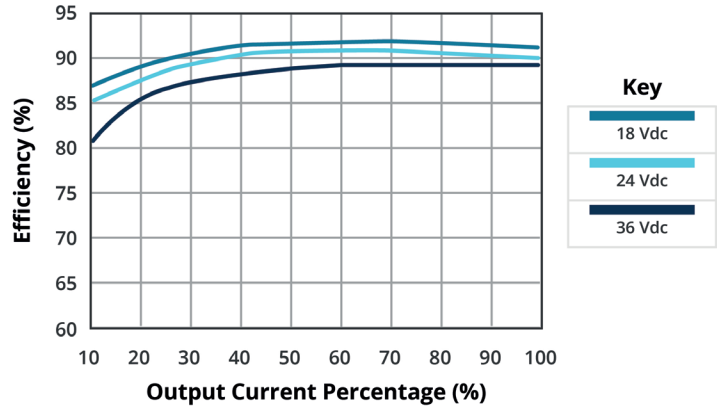
**EFFICIENCY VS OUTPUT LOAD
VFB600-D24-S24**



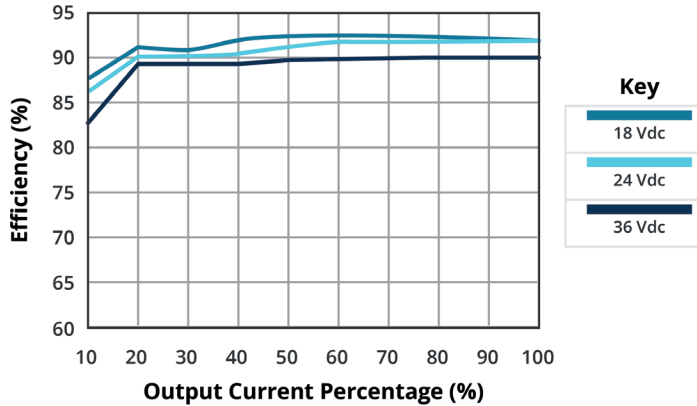
**EFFICIENCY VS OUTPUT LOAD
VFB600-D24-S28**



**EFFICIENCY VS OUTPUT LOAD
VFB600-D24-S32**

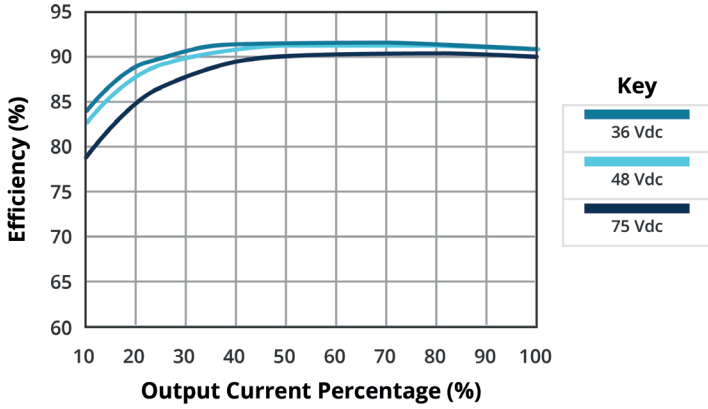


**EFFICIENCY VS OUTPUT LOAD
VFB600-D24-S48**

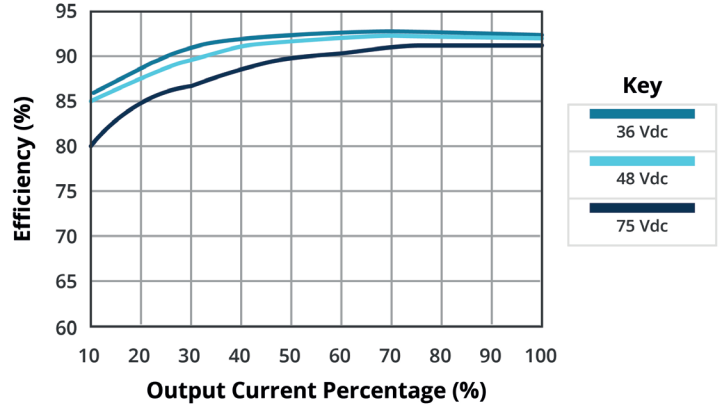


EFFICIENCY CURVES (CONTINUED)

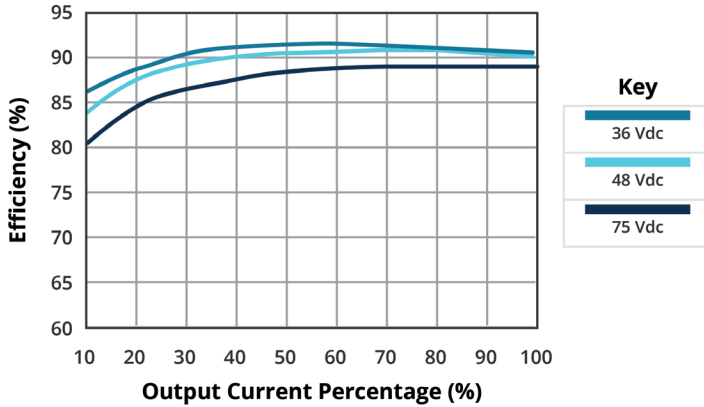
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VFB600-D48-S12



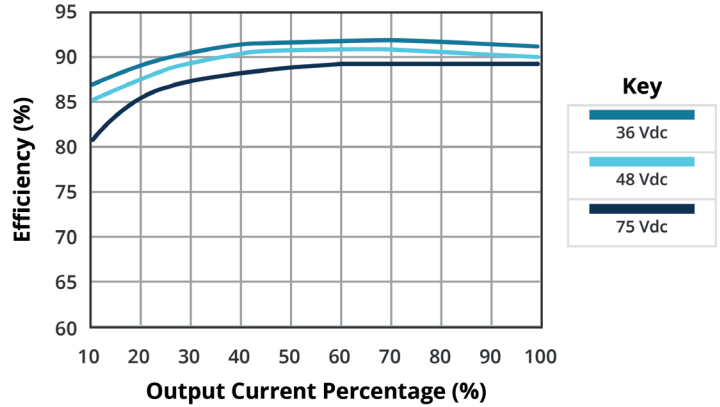
EFFICIENCY VS OUTPUT LOAD
VFB600-D48-S24



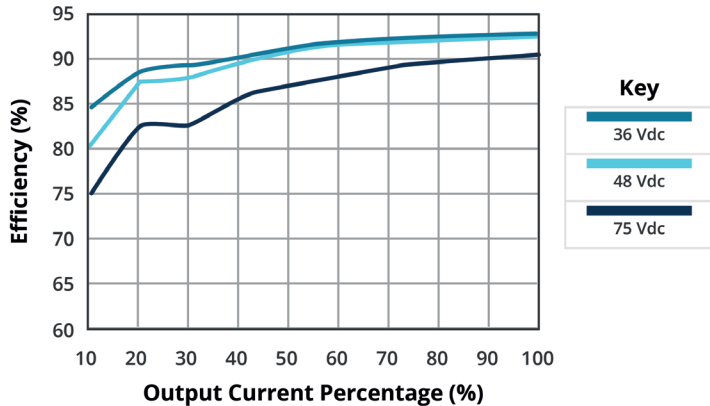
EFFICIENCY VS OUTPUT LOAD
VFB600-D48-S28



EFFICIENCY VS OUTPUT LOAD
VFB600-D48-S32



EFFICIENCY VS OUTPUT LOAD
VFB600-D48-S48



APPLICATION NOTES

1. Parallel Operation

The VFB600 series is designed for parallel operation. When in parallel the load current can be shared equally between the two modules by connecting their PC pins. The VFB600 can be setup in two different modes to achieve parallel operation. The standard parallel operation is suitable when load cannot be handled by a single unit, whereas the N+1 redundant operation is suitable for loads when backup power is required.

Figure 1
Standard Parallel Connection

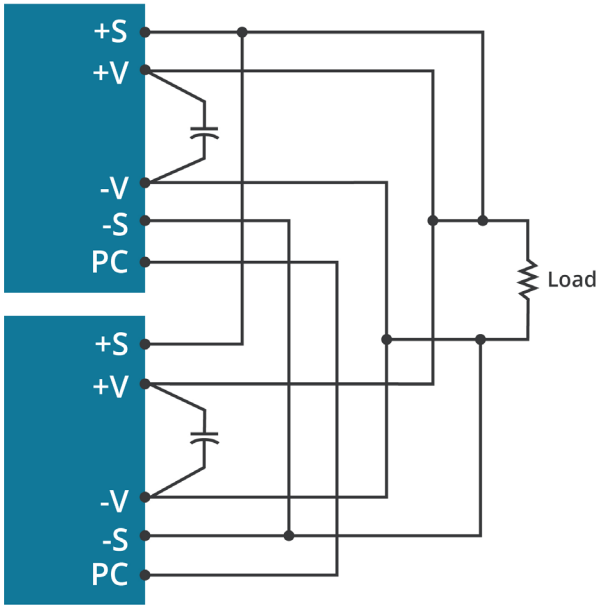


Figure 2
Parallel Connection With Programmed And Adjustable Output

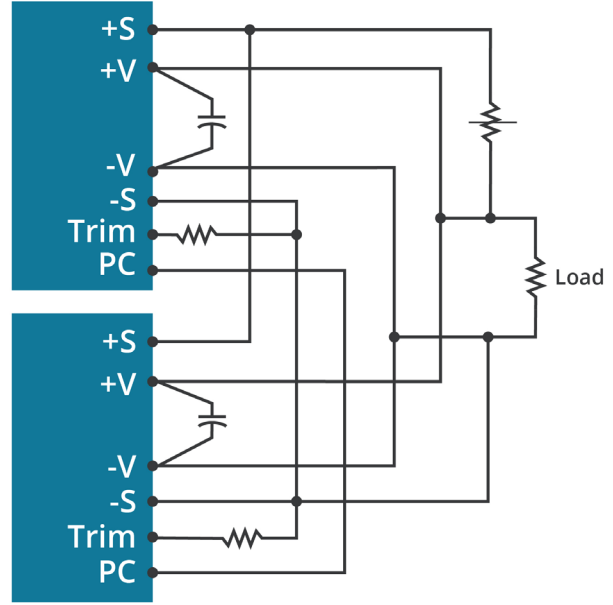


Figure 3
N+1 Redundant Connection

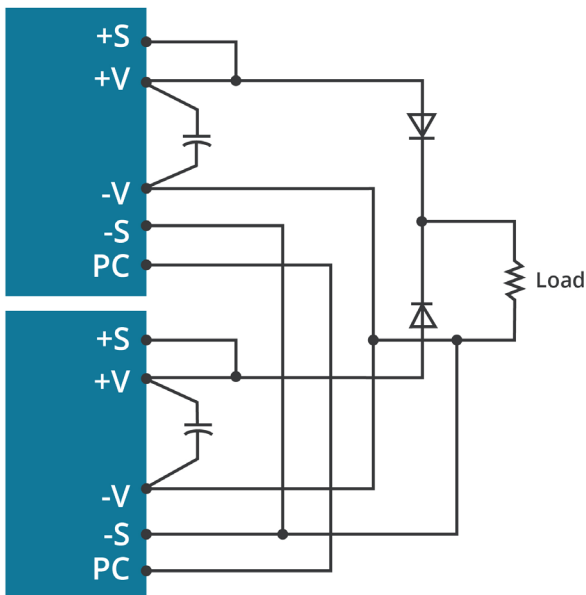
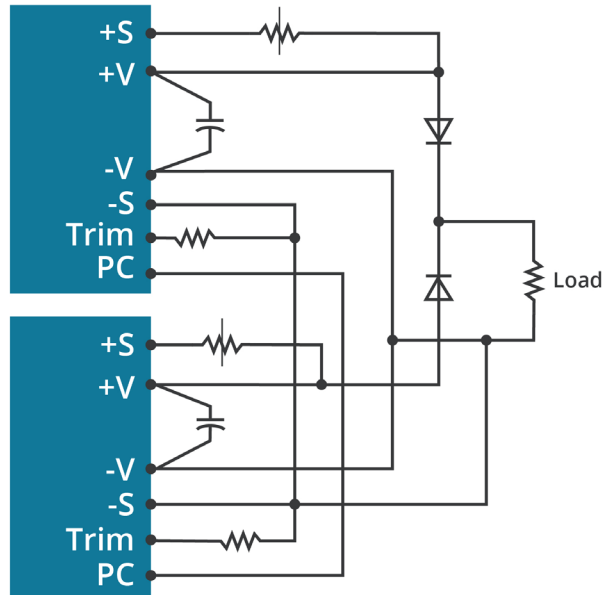


Figure 4
N+1 Redundant Connection With Programmed Output And Adjustable Output Voltage

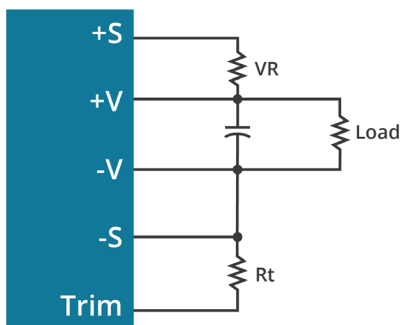


APPLICATION NOTES (CONTINUED)

2. Output Voltage Trimming

Leave open if not used.

Figure 5
External Resistors



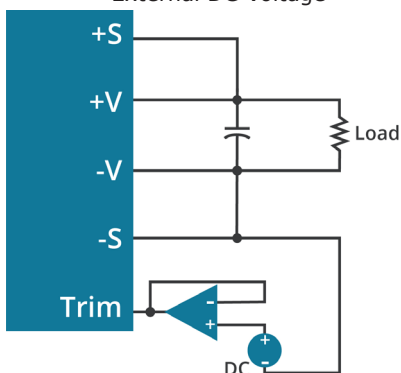
Trim-Up/Trim-Down Formulas

$$V_f = \frac{1.24 \times \left(\frac{R_t \times 33}{R_t + 33} \right)}{7.68 + \left(\frac{R_t \times 33}{R_t + 33} \right)}$$

$$V_{out} = (V_o + V_R) \times V_f$$

Note: $R_t = 6.8 \text{ k}\Omega$
 V_o is the nominal output voltage
 V_{OUT} is the desired output voltage (up or down)
 V_R is the trim resistor in $\text{k}\Omega$

Figure 6
External DC Voltage



Trim-Up/Trim-Down Formula

$$V_{out} = V_T \times V_o$$

Note: V_T is the trim terminal voltage
 V_o is the nominal output voltage
 V_{OUT} is the desired output voltage (up or down)

3. ON/OFF Control

The converter's ON/OFF function can be controlled from the input side or from the output side. The maximum current through the ON/OFF pin is 10 mA. The resistor value has to be set appropriately to avoid the maximum current through the ON/OFF pins. The remote on/off control has to be connected for the converter to operate.

(A) Controlling the ON/OFF terminal from the input side. Recommended R_1 value is $30 \text{ k}\Omega$ (0.5 W) for $48V_{IN}$ and $15 \text{ k}\Omega$ (0.25 W) for $24V_{IN}$

(B) Controlling the ON/OFF terminal from the output side. Recommended R_2 value is $5.1 \text{ k}\Omega$ (0.1 W)

Figure 7

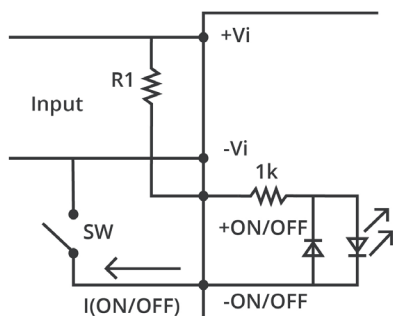
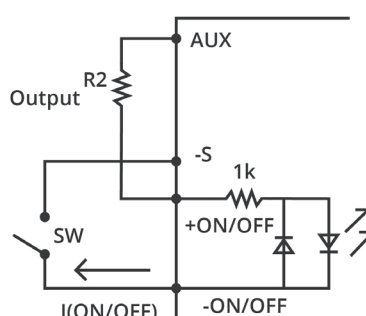


Figure 8



APPLICATION NOTES (CONTINUED)

4. IOC Signal

Normal and abnormal operation of the converter can be monitored by using the I.O.C signal. Output of this signal monitor is located at the secondary side and is open collector output, you can use the signal by the internal aux power supply or the the external DC supply as the following figures. the ground reference is the -Sense. This signal is LOW when the converter is normally operating and HIGH when the converter is disabled or when the converter is abnormally operating.

Figure 9
Internal AUX Power

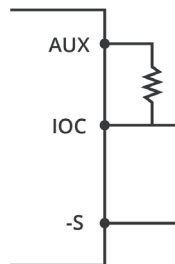
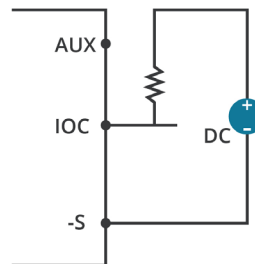


Figure 10
External DC Power



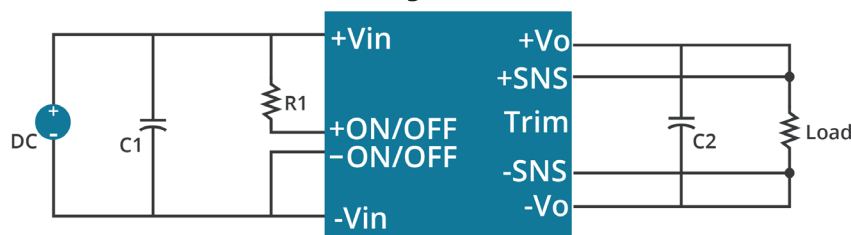
5. Output Remote Sensing

This series has the capability to remotely sense both lines of its output. This feature moves the effective output voltage regulation point from the output of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load. The voltage range of this is:

$$[(+V_{out}) - (-V_{out})] - [(+Sense) - (-Sense)] \leq 10\% \text{ of the } V_{out} \text{ nominal.}$$

If the sense feature is not used, the sense pins should be connected locally to the respective Vout pins. Please note that although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both.

Figure 11



6. Test Configuration

Figure 12

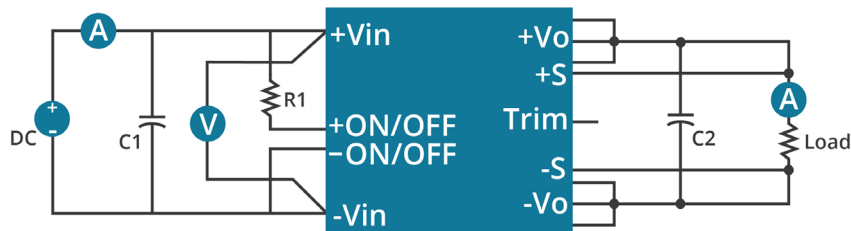


Table 1

| Recommended External components | |
|---------------------------------|-------------------|
| C1 | 220 μ F/100 V |
| C2 | 470 μ F/100 V |

REVISION HISTORY

| rev. | description | date |
|------|--|------------|
| 1.0 | initial release | 06/27/2011 |
| 1.02 | adjustability note added, V-Infinity branding removed | 08/07/2012 |
| 1.03 | updated spec | 04/01/2013 |
| 1.04 | added UL approvals to 24 Vdc and 48 Vdc output models | 03/05/2014 |
| 1.05 | added application note information | 04/10/2017 |
| 1.06 | product image and company logo updated | 02/15/2021 |
| 1.07 | derating curves, efficiency curves and circuit figures updated | 09/14/2021 |

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



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