

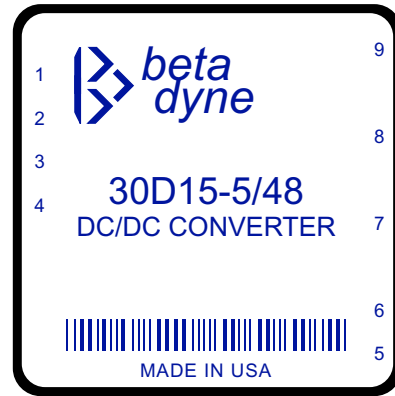


30W DUAL DC/DC CONVERTER

3:1 Input Range, Dual Output
 Parallel or Redundant Operation
 ~ Patent Pending ~

Key Features

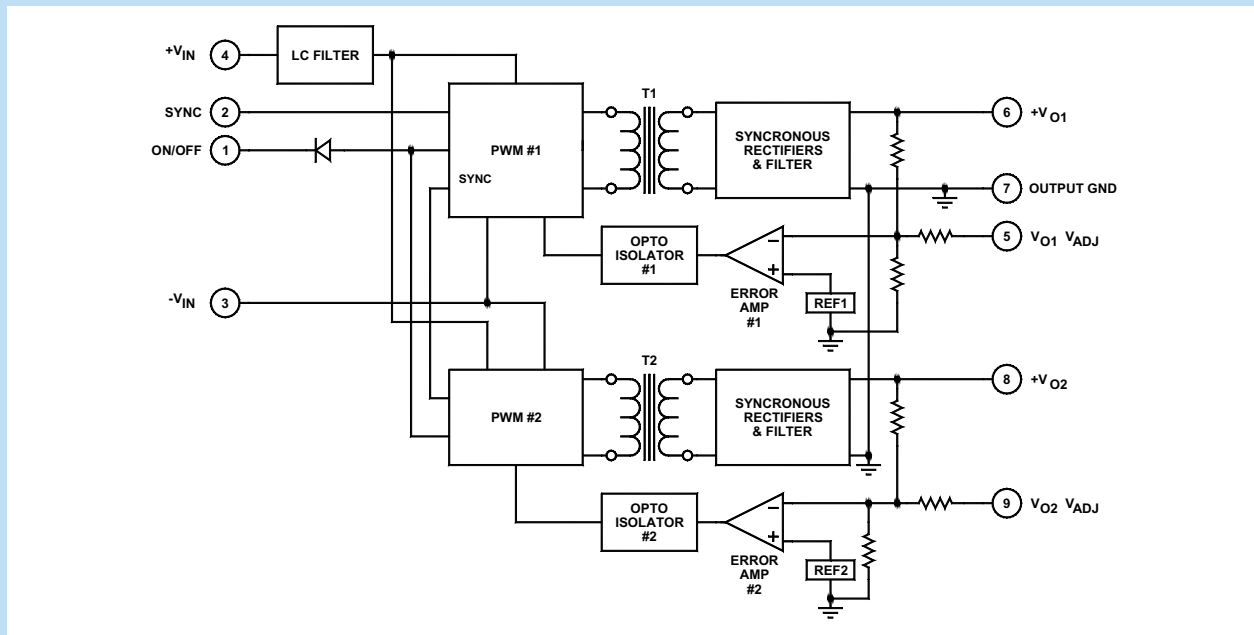
- Wide input voltage range (3:1)
- Efficiency up to 85%
- Input-to-output isolation
- Input LC filter
- Soft start
- Short circuit protection
- 150µA off state current
- Multiple converter synchronization
- Independently adjustable outputs
- Six-sided EMI shielding



Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

Functional Description

The 30W series is a family of dual 15W DC/DC converters that offer a wide 3:1 input voltage range, 400kHz switching frequency, forward topology and come packaged in a 2x2x0.395-inch case with an industry standard pinout arrangement. Synchronous rectification improves efficiency, while the dual independent control loop and independent output voltage adjustability, internal frequency synchronization, and load sharing/redundancy offer design flexibility. The six-sided shielding, SMD and improved thermal techniques enhance reliability.



Typical Block Diagram (Dual Output)

Electrical Specifications

INPUT SPECIFICATIONS

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|----------------------------------|---|-----|-----|-----|-------------------|
| Input Voltage Range | See Model Selection Guide, Table 1 | | | | |
| Input Filter | LC | | | | |
| Reverse Polarity | External series-blocking diode | | | | |
| No Load Input Current | See Model Selection Guide | | | | |
| Input Reflected Ripple | See Ordering Guide, Note 1 | | | | |
| Input Surge Current (20µS Spike) | | | | 10 | A |
| Short Circuit Current Limit | | | | 150 | % I _{IN} |
| Undervoltage Shutdown | | | 8 | | V _{dc} |
| Turn On Delay | Including Soft Start | | 4 | | mS |
| Off State Current | | | | 150 | µA |
| Remote ON/OFF Control | | | | | |
| Supply ON | Pin 1 Open (Open circuit voltage: 12V Max.) | | | | |
| Supply OFF | | 0 | | 0.8 | V _{dc} |
| Logic Input Reference | -Input | | | | |
| Logic Compatibility | TTL Open Collector or CMOS Open Drain | | | | |
| Converter Standby Input Current | See Model Selection Guide (No Load) | | | | |

OUTPUT SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|------------------------------|--|-----|------|-----|------------------|
| Voltage and Current Ratings | See Model Selection Guide, Notes 2 & 3 | | | | |
| Output Voltage Accuracy | | | ±1 | ±2 | % |
| Output Voltage Adjustment | Per output | ±3 | ±5 | | % |
| Ripple & Noise | (See App. Note DC-003) | | 75 | 100 | mV _{PP} |
| Line Regulation | | | ±0.5 | ±1 | % |
| Load Regulation | | | ±1 | | % |
| Temperature Coefficient @ FL | | | 0.02 | | %/°C |
| Transient Response Time | 50% FL to FL to 50% FL | | 100 | 150 | µS |
| Short Circuit Protection | All outputs, by input current limiting | | | | |

GENERAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|-----------------------------|---------------------------|-----|-----------------|-----|-----------------|
| Efficiency (at full power) | See Model Selection Guide | | | | |
| Isolation Voltage (1 min) | | | 1500 | | V _{dc} |
| Isolation Resistance | | | 10 ⁹ | | Ω |
| Isolation Capacitance | | | 1000 | | pF |
| Switching Frequency | | | 400 | | kHz |

ENVIRONMENTAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|-----|---------|------|----------------------|
| Operating Temperature, Industrial (Ambient) | | -40 | | +71 | °C |
| Operating Temperature, Extended | Insert an x after model number (see Ordering Guide) | -55 | | +85 | °C |
| Storage Temperature Range | | -55 | | +125 | °C |
| Thermal Resistance | | | 5 | 6 | °C/W _{DISS} |
| Derating | See Figure 1 | | | | |
| Humidity | Up to 95% non-condensing | | | | |
| Cooling | Free-air convection | | | | |
| EMI/RFI | Six-sided continuous shielded metal case | | | | |
| MTBF | per MIL-HNBK-217F (Ground benign, +25°C) | | 700,000 | | hours |

PHYSICAL CHARACTERISTICS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|-----|-----|-----|------|
| Dimensions (L×W×H) | 2.00×2.00×0.395 in. (50.80×50.80×10.03mm) | | | | |
| Weight | 2 oz. (58g) | | | | |
| Case Material | Coated metal | | | | |
| Shielding Connection, 24V _{IN} | -V _{IN} (Pin 3) | | | | |
| Shielding Connection, 48V _{IN} | +V _{IN} (Pin 4) | | | | |

Model Selection Guide

| MODEL NUMBER | INPUT | | | | | OUTPUT | | | |
|---|---------------|-------|--------------|-----------|--------------------------------------|------------------------|-------------------------|--------------|--------------------------|
| | Voltage (Vdc) | | Current (mA) | | Reflected Ripple (mA _{PP}) | MAX (I _{IN}) | Voltage (Vdc) (Vo1-Vo2) | Current (mA) | Efficiency Full Load (%) |
| | Nominal | Range | No Load | Full Load | | | | | |
| 30D2.5-1.8/24 | 24 | 10–30 | 60 | 1220 | 10 | 3.80 | 2.5–1.8 | 5000/6000 | 79 |
| 30D3.3-1.8/24 | 24 | 10–30 | 60 | 1310 | 10 | 3.80 | 3.3–1.8 | 4500/6000 | 81 |
| 30D3.3-2.5/24 | 24 | 10–30 | 70 | 1370 | 10 | 3.80 | 3.3–2.5 | 4500/5000 | 81 |
| 30D5-1.8/24 | 24 | 10–30 | 70 | 1360 | 10 | 3.80 | 5.0–1.8 | 3000/6000 | 80 |
| 30D5-3.3/24 | 24 | 10–30 | 90 | 1480 | 10 | 3.80 | 5.0–3.3 | 3000/4500 | 83 |
| 30D12-5/24 | 24 | 10–30 | 60 | 1540 | 10 | 3.80 | 12–5 | 1250/3000 | 81 |
| 30D15-3.3/24 | 24 | 10–30 | 40 | 1520 | 10 | 3.80 | 15–3.3 | 1000/4500 | 81 |
| | | | | | | | | | |
| 30D2.5-1.8/48 | 48 | 20–60 | 40 | 600 | 5 | 1.90 | 2.5–1.8 | 5000/6000 | 81 |
| 30D3.3-1.8/48 | 48 | 20–60 | 40 | 650 | 5 | 1.90 | 3.3–1.8 | 4500/6000 | 83 |
| 30D3.3-2.5/48 | 48 | 20–60 | 40 | 690 | 5 | 1.90 | 3.3–2.5 | 4500/5000 | 83 |
| 30D3.3-3.3/48 * | 48 | 20–60 | 40 | 740 | 5 | 1.90 | 3.3–3.3 | 9000 | 83 |
| 30D5-1.8/48 | 48 | 20–60 | 40 | 650 | 5 | 1.90 | 5.0–1.8 | 3000/6000 | 83 |
| 30D5-3.3/48 | 48 | 20–60 | 40 | 730 | 5 | 1.90 | 5.0–3.3 | 3000/4500 | 85 |
| 30D12-5/48 | 48 | 20–60 | 30 | 770 | 5 | 1.90 | 12–5 | 1250/3000 | 81 |
| 30D15-5/48 | 48 | 20–60 | 20 | 740 | 5 | 1.90 | 15–5 | 1000/3000 | 84 |
| | | | | | | | | | |
| <i>Contact factory for custom input and output voltage combinations</i> | | | | | | | | | |

* Parallel connect V_{O1} and V_{O2} for 9A I_{OUT}

¹ Input reflected ripple is measured with a 100µF capacitor placed across the input power pins.

² PARALLEL OPERATION (Refer to Figure 3)

For applications where more power is needed than that supplied by one of the outputs of the 30W series, both outputs of the 30W can be parallel connected. A parallel connection is possible provided that both outputs have the same nominal output voltage or through the V_{OUT} Adjust pins, in which both outputs can be adjusted for the same nominal V_{OUT}. For example, looking at the 30D2.5-1.8/48, where V_{O1} = 1.8V and V_{O2} = 2.5V, V_{O1} can be adjusted for higher output and V_{O2} can be adjusted for lower output. Assuming the required output is 2.2V and the total output current is 10A, the two individually adjusted outputs V_{O1} = V_{O2} = 2.2V can be parallel connected to share the output load. Both converters in the 30W family are internally synchronized and will NOT go to a hiccup protection mode, when their equal voltage outputs are connected in parallel. Careful layout, such as thick copper PCB runs from the pins to the load, star ground connection (to avoid ground loops) and filtering of input and control signals (as is shown below) will allow for equal current share and reliable system operation.

³ REDUNDANT OPERATION (Refer to Figure 4)

The 30W dual, equal-voltage output converter can be designed for redundant operation. In Figure 4, one of the outputs which is adjusted for V_{OUT} Nominal + 0.4V is ON and supplies all the power to the load while the other is OFF (standby). If for whatever reason the output voltage of the continuously ON converter drops below its V_{OUT} Nominal - 0.4V, the other converter—through its oring diodes—will take over and power the load.

ORDERING GUIDE

30 D - / X

Power _____

Number of Outputs _____

V_{O1} = Output Voltage between Pins 6 and 7 _____

Insert an **X** for -55°C to +85°C, otherwise leave blank

Input Voltage _____

V_{O2} = Output Voltage between Pins 7 and 8 _____

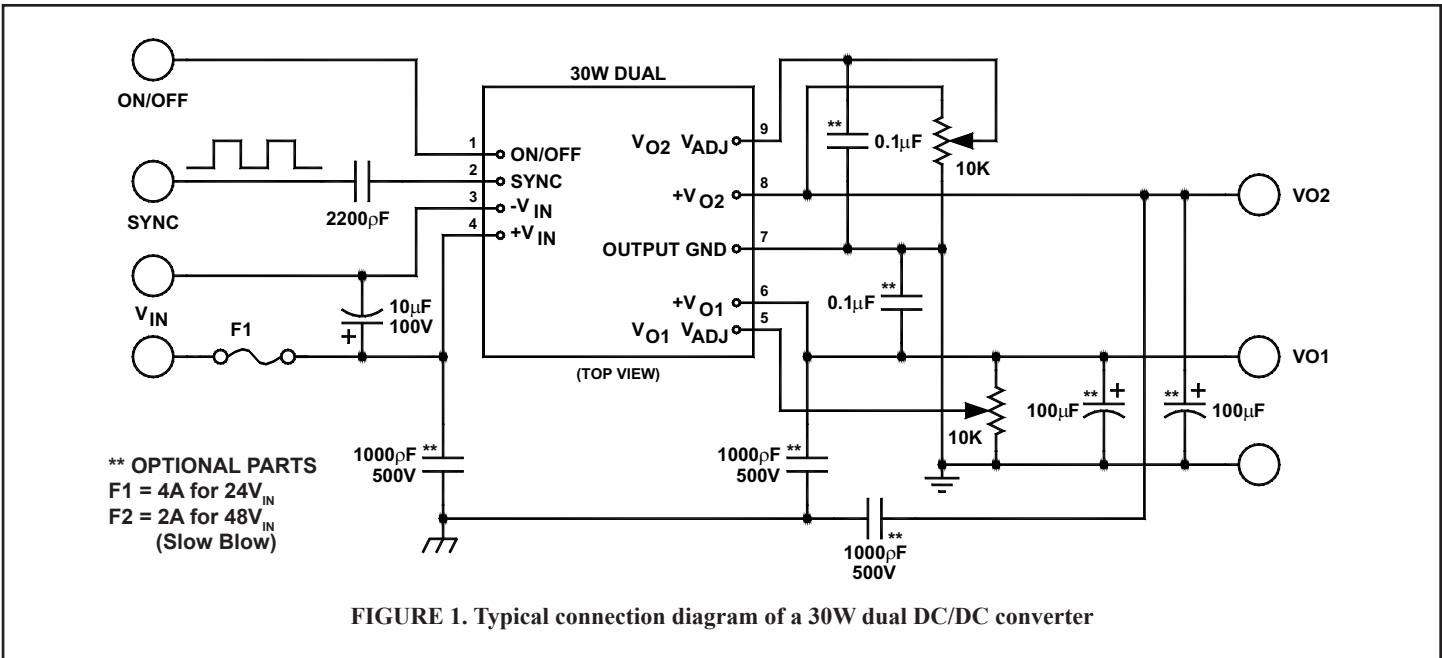
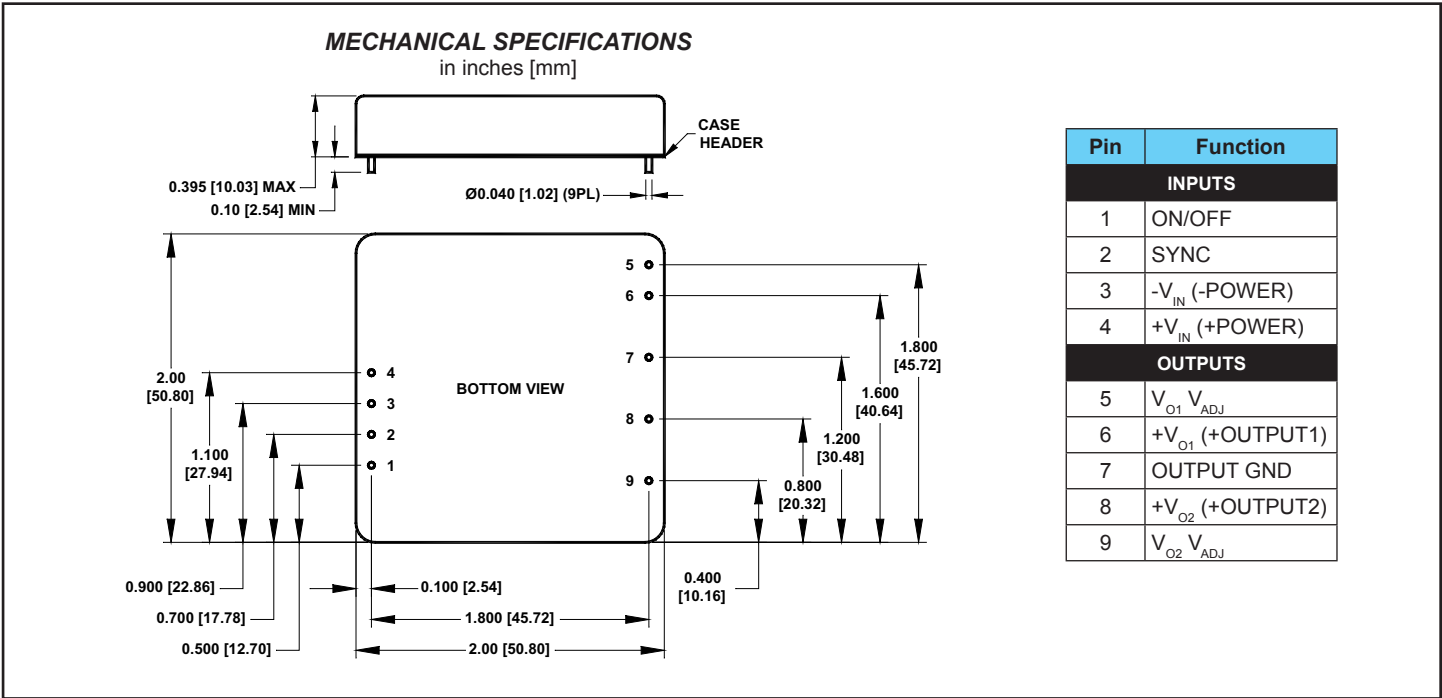


FIGURE 1. Typical connection diagram of a 30W dual DC/DC converter



EXTERNAL SYNCHRONIZATION

The converter can be synchronized to an external TTL or CMOS clock signal. Insert a 470pF to 1000pF ceramic capacitor between the driving clock signal and the Sync pin (Pin 2) of the

converter. The frequency of the signal must be between 370kHz to 450kHz and the duty cycle 20% high and 80% low. See application note DC-005: Synchronization.

EXTERNAL TRIMMING OF OUTPUT VOLTAGES

To trim the output voltage DOWN, connect a 5%, 1/4W resistor between the + (plus) output and trim pins of the converter. To trim the output voltage UP, connect a 5%, 1/4W resistor between the - (minus) output and trim pin of the converter. For UP/DOWN trimming capability, connect a 10kΩ potentiometer between the + and - pins, with the wiper arm connected to the trim pin. The trim resistors/potentiometer can be connected at the converter output pins or the load. However, if connected at the load, the resistance of the runs becomes part of the feedback network, improving load

regulation. If the load is some distance from the converter, the use of #20 gauge wire is recommended to avoid excessive voltage drop due to the resistance of the circuit paths.

- See our application notes:
 DC-001: Testing Transient Response in DC/DC Converters
 DC-004: Thermal Consideration for DC/DC Converters
 DC-006: Synchronous Rectification

TABLE 1. Minimum input operating voltage range for 24V_{IN} and 48V_{IN} models

| 30W SINGLE | | |
|------------|---------------------------------|-------------------|
| % FL | Minimum Input Operating Voltage | |
| | 24V _{IN} | 48V _{IN} |
| 10 | 7.0 | 14.0 |
| 25 | 8.5 | 17.0 |
| 50 | 8.8 | 18.0 |
| 75 | 9.0 | 18.5 |
| 100 | 9.5 | 19.5 |

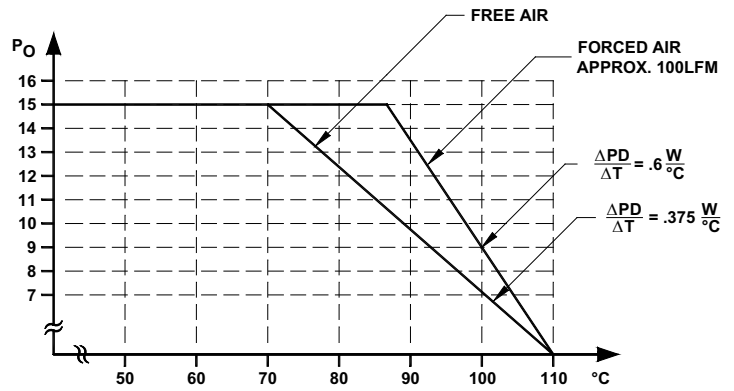


FIGURE 2. Worst case derating of 30W series

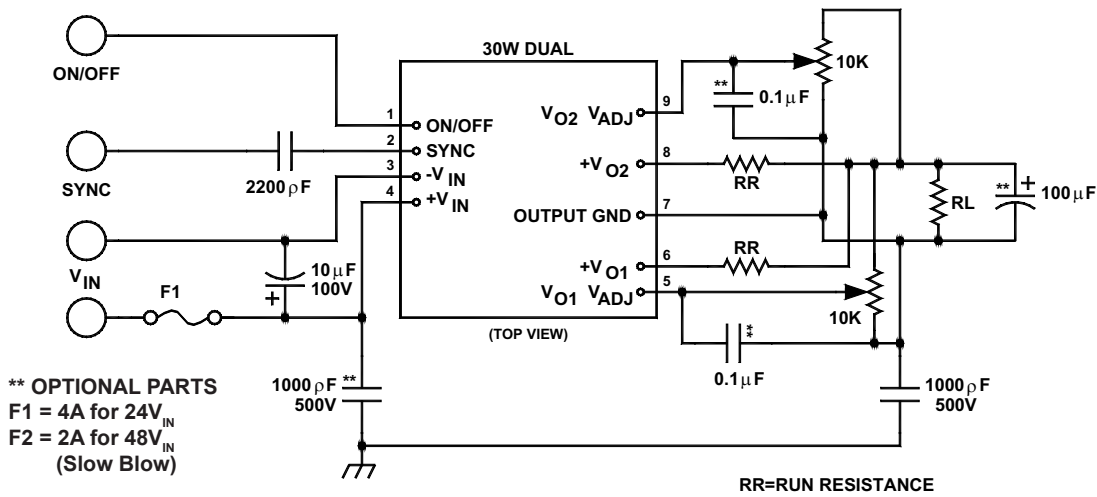


FIGURE 3. Parallel operation

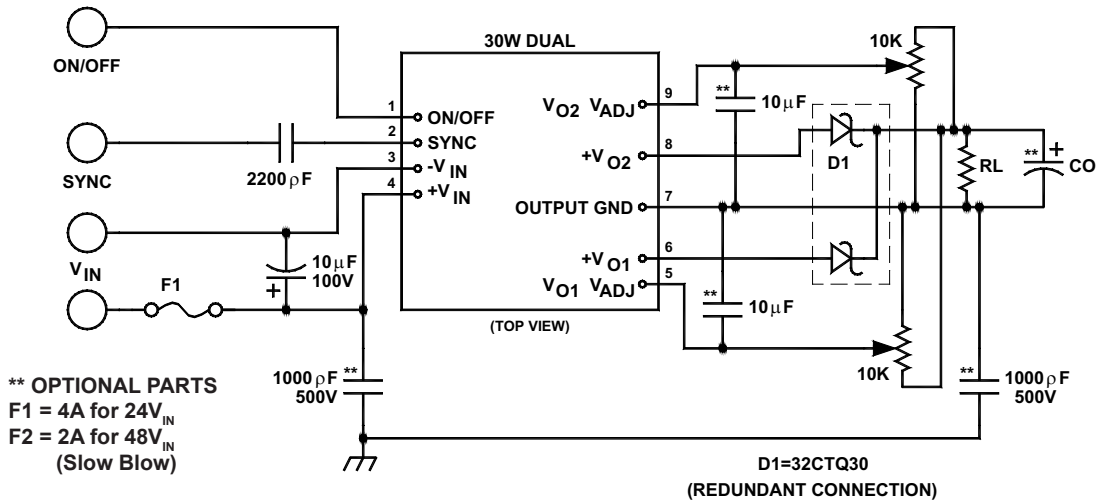


FIGURE 4. Redundant operation