DATEL®
INNOVATION and EXCELLENCE

Dual Output
Mixed Voltage, BWR Models

5V and 3.3V, Independent Dual Output
30 Watt, DC/DC Converters

Features

- **Independently regulated 5V/3.3V outputs**
- **5V @ 3A/3.3V @ 4.25A simultaneously delivered**
- **Independent V_{OUT} Trim pins for margining**
- **Independent On/Off Control pins**
- **88% efficiency; 75mV ripple/noise**
- **Input ranges: 10-18V, 18-36V or 36-75V**
- **UL 1950 and EN60950 safety approvals**
- **Fully isolated, 1500Vdc guaranteed**
- **Input under and overvoltage shutdown**
- **Independent OVP; short circuit protection**
- **Thermal shutdown**

DATEL's BWR series of DC/DC converters now includes two independent converters in one 2" x 2" package. The BWR-5/3-3.3/4.25 family provides both 5V at 3 Amps and 3.3V at 4.25 Amps for a combined output power of 30 Watts from input ranges of 10V to 18V (-D12A), 18 to 36V (-D24A), or 36 to 75V (-D48A).

Each output is regulated by its own control loop to provide ±1% load and ±0.5% line regulation. Individual trim pins and a negative or positive on/off control pin allow independent adjustment of output voltages and any combination of power-on sequencing between the 5V and 3.3V outputs. A high efficiency of 88% allows full load operation up to +65°C ambient temperature in a still air environment. Although functionally independent, both outputs are driven from synchronized PWMs to prevent asynchronously generated beat frequencies.

Housed in a plastic case, all models include input Pi filtering, input overvoltage protection, independent output short circuit and current limiting protection and independent output overvoltage protection as well as thermal shutdown. A Sync option is available in place of 3.3V on/off control. These devices meet IEC950, UL1950 and EN6950 safety standards. CB reports are available upon request. "D48A" models are CE marked (meet LVD requirements).

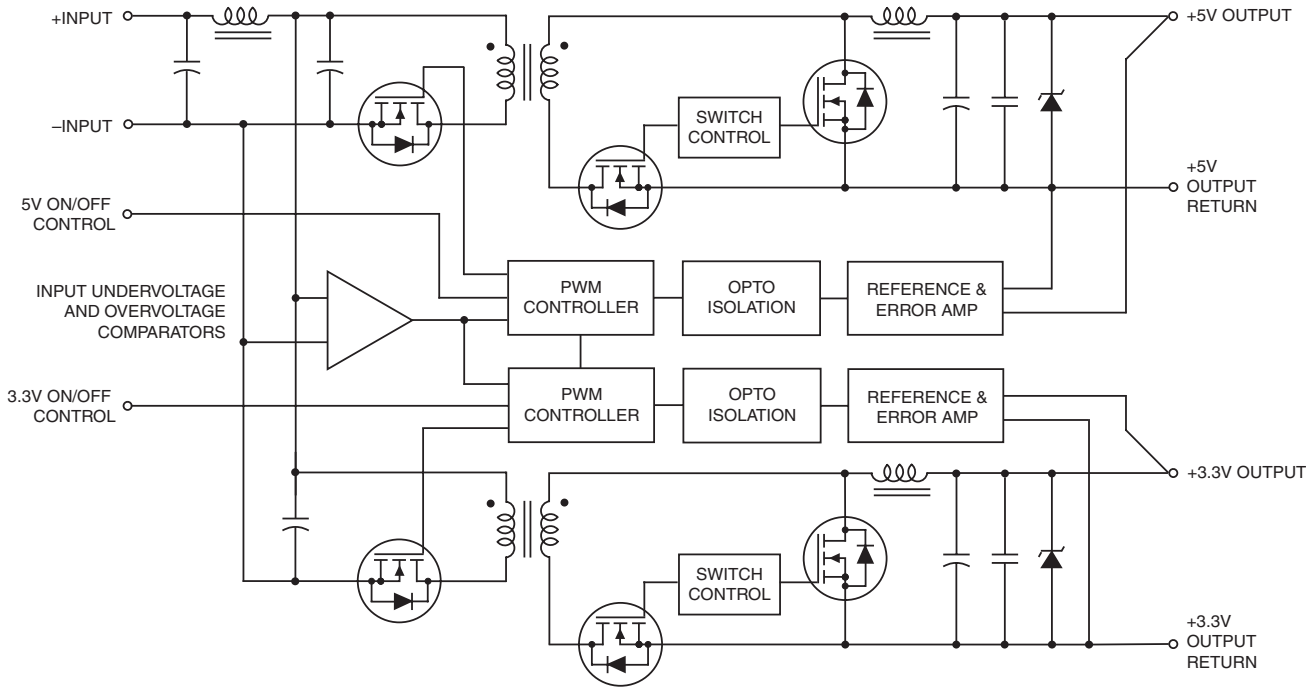


Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide ①

Model	Output						Input			Efficiency		Package (Case, Pinout)
	V_{OUT} (Volts)	I_{OUT} ② (Amps)	R/N (mVp-p) ③		Regulation (Max.)		V_{IN} Nom. (Volts)	Range (Volts)	I_{IN} ⑤ (mA)	Min.	Typ.	
			Typ.	Max.	Line	Load ④						
BWR-5/3-3.3/4.25-D12A	5	3	75	100	±0.5%	±1%	12	10-18	210/2846	83%	85%	C20, P42
	3.3	4.25	75	100	±0.5%	±1%						
BWR-5/3-3.3/4.25-D24A	5	3	75	100	±0.5%	±1%	24	18-36	115/1374	85.5%	88%	C20, P42
	3.3	4.25	75	100	±0.5%	±1%						
BWR-5/3-3.3/4.25-D48A	5	3	75	100	±0.5%	±1%	48	36-75	70/687	85.5%	88%	C20, P42
	3.3	4.25	75	100	±0.5%	±1%						

① Typical at T_A = +25°C under nominal line voltage and "full-load" conditions.
② Any combination of 5V/3.3V current, not to exceed the published I_{OUT} specification (30 Watts).
③ Ripple/Noise (R/N) measured over a 20MHz bandwidth with 0.47µF ceramic output capacitors.
④ Tested from 10% load to 100% load.
⑤ Nominal line voltage, no load/full load condition.

PART NUMBER STRUCTURE

BWR - 5 / 3 - 3.3 / 4.25 - D48A N

Dual Output/ Mixed-Voltage Series

V_1 Nominal Output Voltage: 5 Volts

I_1 Maximum Output Current: 3 Amps

V_2 Nominal Output Voltage: 3.3 Volts

I_2 Maximum Output Current: 4.25 Amps

Input Voltage Range:
D12A = 10-18 Volts (12V nominal)
D24A = 18-36 Volts (24V nominal)
D48A = 36-75 Volts (48V nominal)

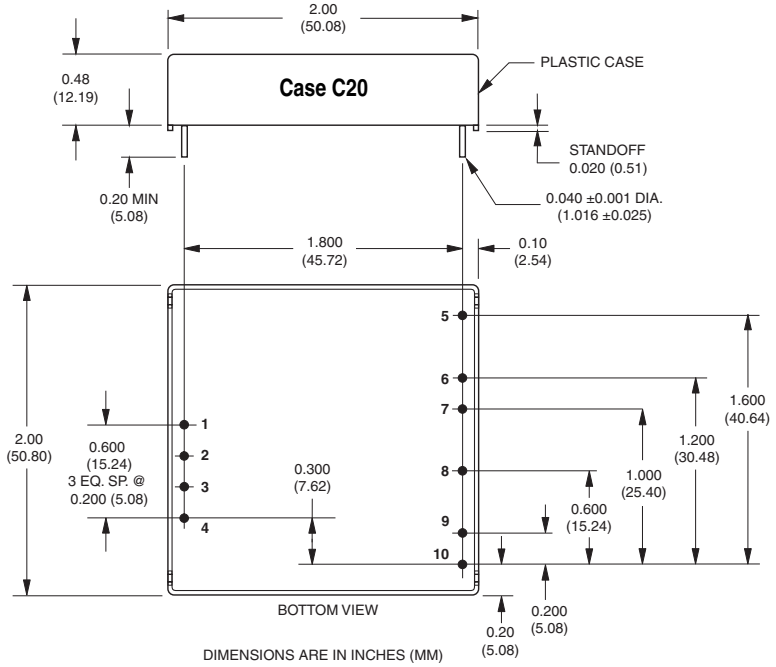
Add "N" or "S" suffix as desired

Part Number Suffixes

BWR 30 Watt DC/DC's are designed so a negative logic on/off control ("N" suffix) can be added in the pins 3 and 4 position, or a Sync function ("S" suffix) can be added in the pin 3 position.

No Suffix	On/Off Control function (positive polarity)
N	Negative polarity on/off control
S	Sync function

MEC A NICAL SPECIFICATIONS



I/O Connections	
Pin	**Function P42**
1	+Input
2	–Input
3	+5V On/Off
4	+3.3V On/Off
5	+5V Output
6	+5V Return
7	+5V Trim
8	+3.3V Return
9	+3.3V Output
10	+3.3V Trim

Performance/Functional Specifications

Typical @ T_A = +25°C under nominal line voltage, balanced "full-load" conditions, unless noted. ①

Input	
Input Voltage Range:	
D12A Models	10-18 Volts (12V nominal)
D24A Models	18-36 Volts (24V nominal)
D48A Models	36-75 Volts (48V nominal)
Overvoltage Shutdown:	
D12A Models	18.5-21 Volts (20V nominal)
D24A Models	37-40 Volts (38V typical)
D48A Models	77-81 Volts (79V typical)
Start-Up Threshold:	
D12A Models	9.4-10 Volts (9.6V typical)
D24A Models	16.5-18 Volts (17V typical)
D48A Models	34-36 Volts (35V typical)
Undervoltage Shutdown:	
D12A Models	7-8.5 Volts (8V typical)
D24A Models	16-17.5 Volts (16.5V typical)
D48A Models	32.5-34.5 Volts (33.5V typical)
Input Current:	
Normal Operating Conditions	See Ordering Guide
Standby Mode:	
Off, OV, UV, Thermal Shutdown	10mA typical
Input Reflected Ripple Current:	
Source Impedance	<0.1Ω, no external input filtering
D12A Models	TBD
D24A/D48A Models	TBD
Internal Input Filter Type	Pi (0.022µF - 4.7µH - 2.46µF)
Reverse-Polarity Protection:	
D12A Models	1 minute duration, 6A maximum
D24A Models	1 minute duration, 4A maximum
D48A Models	1 minute duration, 2A maximum
On/Off Control (Pins 3 & 4): ③ ④ ⑥	
D12A, D24A & D48A Models	On = open or 13V to +V_{IN}, I_{IN} = 1.6mA @ 13V Off = 0-0.8V, I_{IN} = 2mA @ 0V
"N" Suffix Models ⑨	On = 0-1.2V, I_{IN} = 2mA @ 0V Off = open
Sync (Option, Pin 4): ③ ④ ⑥	
Input Threshold (Rising Edge Active)	1-2.7 Volts
Input Voltage Low	0-0.9 Volts
Input Voltage High	2.8-5 Volts
Input Resistance	35kΩ minimum
Output High Voltage (100µA load)	3.5-4.8 Volts
Output Drive Current	35mA
Input/Output Pulse Width	160-360nsec

Output	
V_{OUT} Accuracy	
5V Output	±1.5% maximum
3.3V Output	±1.5% maximum
Minimum Loading Per Specification	10% of I_{OUT} maximum
Minimum Loading For Stability ⑧	No load
Ripple/Noise (20MHz BW) ⑤	See Ordering Guide
Line/Load Regulation	See Ordering Guide
Efficiency	See Ordering Guide
Trim Range ②	±5%
Isolation Voltage:	
Input-to-Output	1500Vdc minimum

Output (continued)	
Isolation Resistance	100MΩ
Isolation Capacitance	470pF
Current Limit Inception:	
5V @ 98.5% V_{OUT}	3.8-5.1 Amps
3.3V @ 98.5% V_{OUT}	5.4-6.8 Amps
Short Circuit Current:	
5V Output	3.0 Amps average current
3.3V Output	3.0 Amps average current
Overvoltage Protection:	Magnetic feedback, transorb
5V Output	6.0 Volts
3.3V Output	4.1 Volts
Maximum Capacitive Loading	
D12A Models 3.3V	1000µF
5V	680µF
D24A, D48A Models 3.3V	1000µF
5V	680µF
Temperature Coefficient	±0.02% per °C

Dynamic Characteristics	
Dynamic Load Response:	
5V (50-100% load step to 1% V_{OUT})	200µsec maximum
3.3V (50-100% load step to 1% V_{OUT})	200µsec maximum
Start-Up Time: ②	
V_{IN} to V_{OUT}	10ms
On/Off to V_{OUT}	TBD
Switching Frequency	355kHz (±35kHz)

Environmental	
MTBF ⑦	Bellcore, ground fixed, full power 25°C ambient
D12A Models	873.9 thousand hours
D24A Models	1.32 million hours
D48A Models	1.23 million hours
Operating Temperature (Ambient): ②	
Without Derating:	
D12A Models	–40 to +60°C
D24A & D48A Models	–40 to +65°C
With Derating	To +100°C (See Derating Curves)
Case Temperature:	
Maximum Operational	+100°C
For Thermal Shutdown	+100°C minimum, +110°C maximum
Storage Temperature	–40 to +120°C

Physical	
Dimensions	2" x 2" x 0.5" (50.8 x 50.8 x 12.7mm)
Case Material	Diallyl phthalate, UL94V-0 rated
Pin Material	Brass, solder coated
Weight:	2.7 ounces (76.5 grams)
Primary to Secondary Insulation Level	Operational

① All models are specified with external 0.47µF ceramic output capacitors.
② See Technical Notes/Graphs for details.
③ The On/Off Control function can be replaced with a Sync function. See Part Number Suffixes and Technical Notes for details.
④ Applying a voltage to On/Off Control (pins 3 & 4) when no input power is applied to the converter can cause permanent damage.
⑤ Output noise may be further reduced with the installation of additional external output capacitors. See Technical Notes.
⑥ On/Off control is designed to be driven with open collector or by appropriate voltage levels. Voltages must be referenced to the –Input (pin 2).
⑦ Demonstrated MTBF available on request.
⑧ For conditions with less than minimum loading, outputs remain stable. However, regulation performance will degrade.
⑨ Maximum applied voltage to On/Off pin (N suffix) less than 19.0V.

Absolute Maximum Ratings		
Input Voltage:		
Continuous:	D12A Models	23 Volts
	D24A Models	42 Volts
	D48A Models	81 Volts
Transient (100msec):	D12A Models	25 Volts
	D24A Models	50 Volts
	D48A Models	100 Volts
Input Reverse-Polarity Protection		Input Current must be limited. 1 minute duration. Fusing recommended.
D12A Models		6 Amps
D24A Models		4 Amps
D48A Models		2 Amps
Output Current ②		Current limited. Devices can withstand an indefinite output short circuit.
On/Off Control (Pins 3 & 4) Max. Voltages		
Referenced to –Input (pin 2)		
D12A, D24A & D48A Models		$+V_{IN}$
"N" Models		±19V
Storage Temperature		–40 to +120°C
Lead Temperature (Soldering, 10 sec.)		+300°C

These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied, nor recommended.

TECHNICAL NOTES

Trimming Output Voltages

These BWR converters have a trim capability (pins 3 & 4) that allow users to independently adjust the output voltages ±5%. Adjustments to the output voltages can be accomplished via a trim pot, Figure 2, or a single fixed resistor as shown in Figures 3 and 4. A single fixed resistor can increase or decrease the output voltage depending on its connection. Fixed resistors should have absolute TCR's less than 100ppm/°C to minimize sensitivity to changes in temperature.

A single resistor connected from the 5V Trim pin (pin 7) to the +5V Output (pin 5), see Figure 3, will decrease the +5V output voltage. A resistor connected from the +5V Trim (pin 7) to the +5V Return (pin 6) will increase the +5V output voltage. See Figure 4.

Similarly, the 3.3V output can be adjusted using a single resistor connected from the +3.3V Trim (pin 10) to the +3.3V Output (pin 9) or to the +3.3V Return (pin 8). See Figures 3 and 4.

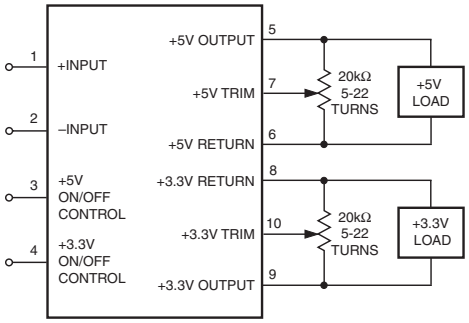
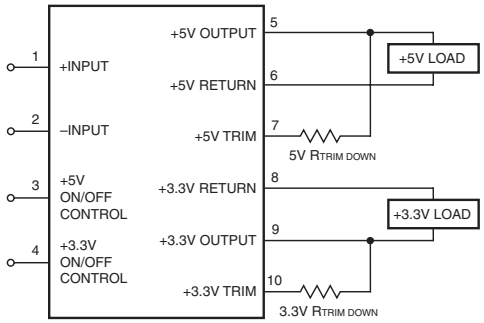
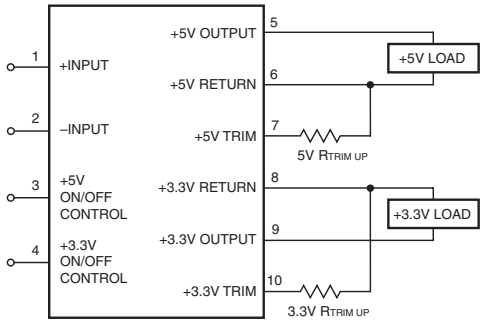


Figure 2. Trim Connections Using A Trim Pot



$$5V\ R_{T_{DOWN}}(k\Omega) = \frac{2.49(V_O - 2.52)}{5 - V_O} - 15 \qquad 3.3V\ R_{T_{DOWN}}(k\Omega) = \frac{2.49(V_O - 1.27)}{3.3 - V_O} - 14.3$$

Figure 3. Trim Connections To Decrease Output Voltages Using Fixed Resistors



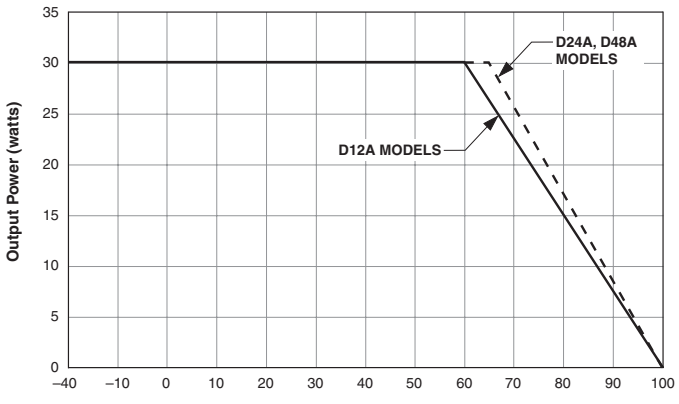
$$5V\ R_{T_{UP}}(k\Omega) = \frac{6.27}{V_O - 5} - 15 \qquad 3.3V\ R_{T_{UP}}(k\Omega) = \frac{3.16}{V_O - 3.3} - 14.3$$

Figure 4. Trim Connections To Increase Output Voltages Using Fixed Resistors

Note: Resistor values are in kΩ. Accuracy of adjustment is subject to tolerances of resistors and factory-adjusted output accuracy.
V_O = desired output voltage.

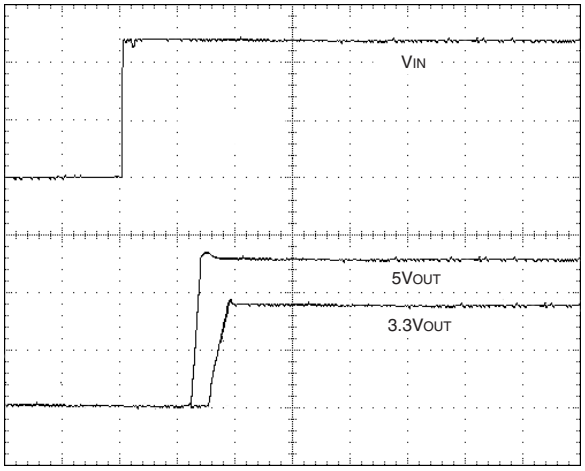
Typical Performance Curves

Output Power vs. Ambient Temperature
(V_{IN} nominal, natural convection air flow.)



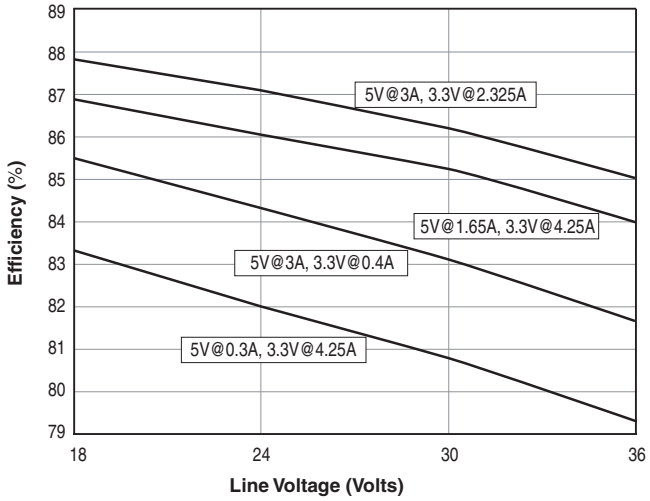
Typical Performance Curves

Typical Start-Up from V_{IN}
(V_{IN} = nominal, 5V @ 3A/3.3V @ 4.25A, 0.47µF output capacitors.)

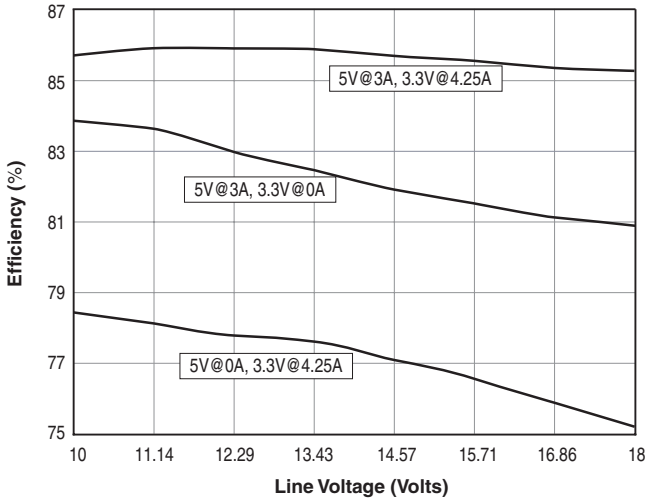


2.5msec/div

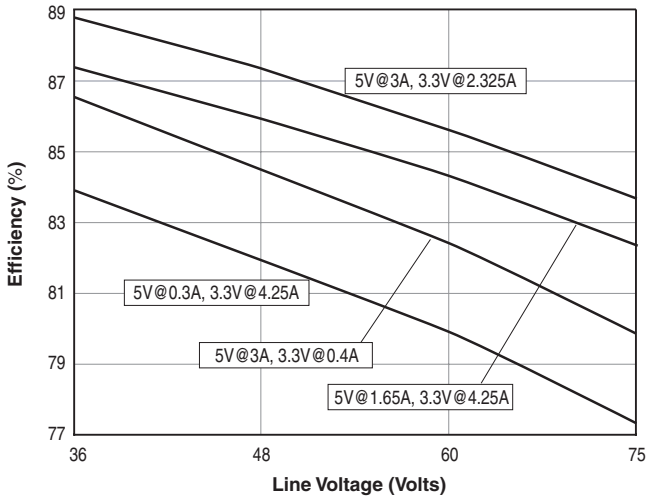
D24A Models: Efficiency vs. Line and Load



D12A Models: Efficiency vs. Line and Load



D48A Models: Efficiency vs. Line and Load



DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1151
Tel: (508) 339-3000 (800) 233-2765 Fax: (508) 339-6356
Internet: www.datel.com Email: sales@datel.com

DATEL (UK) LTD. Tadley, England Tel: (01256)-880444
DATEL S.A.R.L. Montigny Le Bretonneux, France Tel: 01-34-60-01-01
DATEL GmbH München, Germany Tel: 89-544334-0
DATEL KK Tokyo, Japan Tel: 3-3779-1031, Osaka Tel: 6-6354-2025