PRELIMINARY

DATEL®
INNOVATION and EXCELLENCE

A-SERIES

Dual Output
A-Series, BWR Models

High-Reliability, 1" x 2"
15-17 Watt, DC/DC Converters

Features

- **Output voltages: ±5, ±12 or ±15 Volts**
- **Input voltage ranges: 10-18V, 18-36V or 36-75V**
- **Small packages, 1" x 2" x 0.48"**
- **Industry-standard pinouts**
- **Low cost; Highly reliable**
- **Proven SMT-on-pcb construction**
- **Qual tested; HALT tested; EMC tested**
- **Designed to meet UL60950 and EN60950**
- **CE mark available (75V-input models)**
- **Fully isolated, 1500Vdc guaranteed**
- **Guaranteed efficiencies to 84%**
- **–40 to +100°C operating temperature**
- **Modifications and customs for OEM's**

For your mid-range power requirements, it's hard to beat the combination of small packaging, low cost, proven reliability and outstanding electrical performance offered by the 15-17W, dual-output models of DATEL's new A-Series DC/DC converters. These highly efficient, rugged converters combine straightforward circuit topologies, the newest components, proven SMT-on-pcb construction methods, and highly repeatable automatic-assembly techniques. Their superior durability is substantiated by a rigorous in-house qualification program that includes HALT (Highly Accelerated Life Testing).

The input voltage ranges of the BWR 15-17 Bipolar Series (10-18V for "D12A" models, 18-36V for "D24A" models and 36-75V for "D48A" models) make them excellent candidates for telecommunication system line drivers, or distributed power architectures. Their ±5, ±12 or ±15 Volt outputs cover virtually all standard applications.

These popular power converters are fully isolated (1500Vdc guaranteed) and display excellent line and load regulation (±0.5% max. for line and load). They are completely I/O protected (input overvoltage shutdown and reverse-polarity protection, output current limiting and overvoltage protection) and contain input (pi type) and output filtering to reduce noise.

These extremely reliable, cost-effective power converters are housed in standard 1" x 2" x 0.48" UL94V-0 rated plastic packages. They offer industry-standard pinouts and are ideally suited for high-volume computer, telecom/datacom, instrumentation and ATE applications.

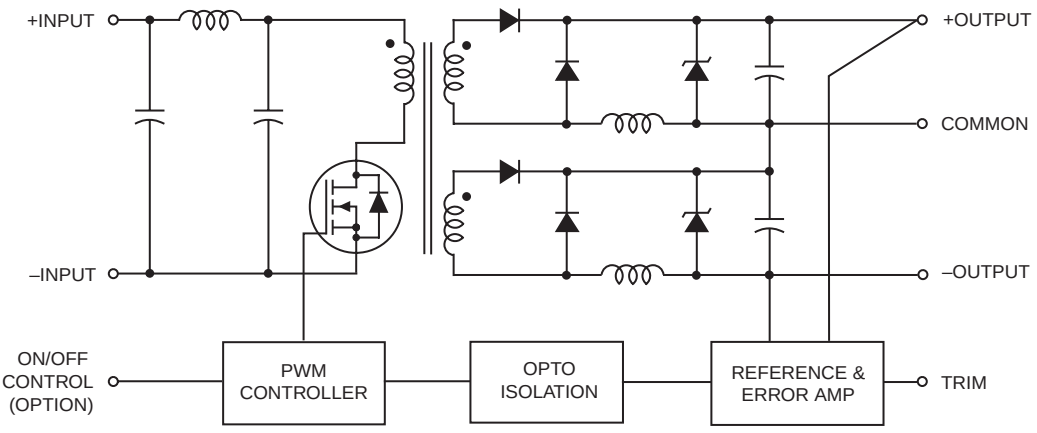


Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide ①

Model	Output						Input			Efficiency		Package (Case, Pinout)
	V_{OUT} (Volts)	I_{OUT} (mA)	R/N (mVp-p) ②		Regulation (Max.)		V_{IN} Nom. (Volts)	Range (Volts)	I_{IN} ④ (mA)	Min.	Typ.	
			Typ.	Max.	Line	Load ③						
BWR-5/1500-D12A	±5	±1500	75	100	±0.5%	±0.5%	12	10-18	35/1524	TBD	83%	C14A, P43
BWR-5/1500-D24A	±5	±1500	75	100	±0.5%	±0.5%	24	18-36	35/740	82%	84%	C14A, P43
BWR-5/1500-D48A	±5	±1500	75	100	±0.5%	±0.5%	48	36-75	35/370	83%	85%	C14A, P43
BWR-12/725-D12A	±12	±725	75	100	±0.5%	±0.5%	12	10-18	35/1710	TBD	85%	C14A, P43
BWR-12/725-D24A	±12	±725	75	100	±0.5%	±0.5%	24	18-36	35/850	83%	85%	C14A, P43
BWR-12/725-D48A	±12	±725	75	100	±0.5%	±0.5%	48	36-75	35/420	84%	86%	C14A, P43
BWR-15/575-D12A	±15	±575	75	100	±0.5%	±0.5%	12	10-18	35/1690	TBD	85%	C14A, P43
BWR-15/575-D24A	±15	±575	75	100	±0.5%	±0.5%	24	18-36	35/840	84%	86%	C14A, P43
BWR-15/575-D48A	±15	±575	75	100	±0.5%	±0.5%	48	36-75	35/420	84%	86%	C14A, P43

① Typical at T_A = +25°C under nominal line voltage and full-load conditions unless otherwise noted.
② Ripple/Noise (R/N) measured over a 20MHz bandwidth.
③ Balanced loads, 10% to 100% load.
④ Nominal line voltage, no-load/full-load conditions.

PART NUMBER STRUCTURE

B WR - 12 / 725 - D48 A C

Output Configuration:
B = Bipolar

Wide Range Input

Nominal Output Voltages:
±5, ±12 or ±15 Volts

Maximum Output Current
in mA from each output

Input Voltage Range:
D12 = 10-18 Volts (12V nominal)
D12 = 18-36 Volts (24V nominal)
D48 = 36-75 Volts (48V nominal)

A-Series
High Reliability

Add C or N suffix as desired. See below.

Part Number Suffixes

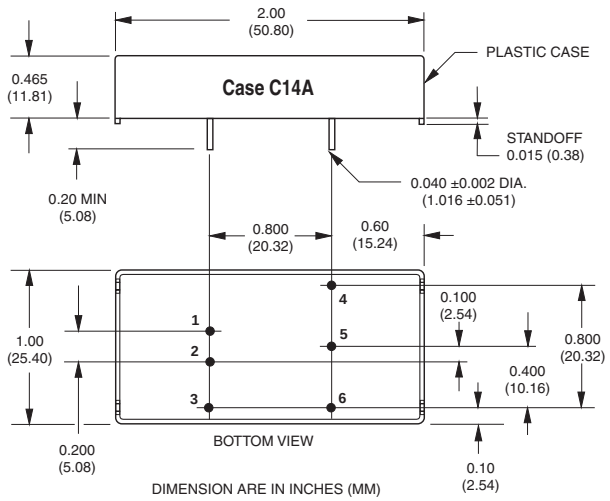
BWR 15-17 Watt DC/DC's are designed so an On/Off Control function with either positive polarity ("C" suffix) or negative polarity ("N" suffix) can be added to the pin 3 position. Models ordered without On/Off control (without C or N suffix) will not have pin 3 installed.

No Suffix Pin 3 not installed

C Positive On/Off control function (pin 3)

N Negative On/Off control function (pin 3)

MECHANICAL SPECIFICATIONS



I/O Connections	
Pin	Function P43
1	+Input
2	–Input
3	On/Off Control*
4	+Output
5	Output Return
6	–Output

* Pin is optional

Performance/Functional Specifications

Typical @ T_A = +25°C under nominal line voltage and 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 typical)
D24A Models	37-40 Volts (38V typical)
D48A Models	77-81 Volts (79V typical)
Start-Up Threshold: ③	
D12A Models	9.4-9.8 Volts (9.6V typical)
D24A Models	16.5-18 Volts (17V typical)
D48A Models	34-36 Volts (35V typical)
Undervoltage Shutdown: ③	
D12A Models	7-8.5 Volts (8V typical)
D24A Models	15.5-17.5 Volts (17.2V typical)
D48A Models	32.5-35.5 Volts (34.5V typical)
Input Current	
Normal Operating Conditions	See Ordering Guide
Standby Mode (Off, OV, UV)	TBD mA
Input Reflected Ripple Current	12µH source impedance 20MHz bandwidth, TBD mAp-p
Input Filter Type	Pi
Reverse-Polarity Protection	Brief duration, 5A maximum.
On/Off Control: ④ ⑤	
C Models	On = open or 13V- +V_{IN}, I_{IN} = TBD max. Off = 0-0.8V, I_{IN} = TBD max.
N Models	On = 0-0.5V, I_{IN} = TBD max. Off = open or TBD- +V_{IN}, I_{IN} = TBD max.

Output	
V_{OUT} **Accuracy** (full load)	±1.0%, maximum
Minimum Loading for Specification ②	10%
Minimum Loading for Stability ⑦	No load
Ripple/Noise (20MHz BW) ① ⑥	See Ordering Guide
Line/Load Regulation	See Ordering Guide
Efficiency	See Ordering Guide
Isolation Voltage	1500Vdc, minimum
Isolation Capacitance	470pF
Isolation Resistance	100MΩ
Current Limit Inception (@ 98% V_{OUT})	
±5V Models	1.75-2.25A (2A typical)
±12V Models	0.9-1.1A (1A typical)
±15V Models	0.73-0.93A (0.83A typical)
Average Short-Circuit Current	
±5V Models	TBD
±12V Models	700mA maximum
±15V Models	700mA maximum
Overvoltage protection	Output voltage comparator
±5V Models	TBD
±12V Models	13-15.8 Volts
±15V Models	16.2-19.8 Volts
Maximum Capacitive Loading	
±5V Models	TBD
±12V Models	TBD
±15V Models	TBD
Temperature Coefficient	±0.02% per °C

Dynamic Characteristics	
Transient Response:	
(50-100% load step to 2% V_{OUT})	200µsec maximum
Start-Up Time:	
V_{IN} to V_{OUT}	TBD
On/Off to V_{OUT}	TBD
Switching Frequency	300kHz (±30kHz)

Environmental	
MTBF ⑥	Bellcore, ground fixed, fullpower 25°C ambient, TBD million hours
Operating Temperature (ambient)**:**	
±5V Models	TBD
±12V Models	TBD
±15V Models	TBD
Thermal Shutdown	TBD
Storage Temperature	–40 to +120°C

Physical	
Dimensions	1" x 2" x 0.48" (25.4 x 50.8 x 12.19mm)
Case Material	Diallyl Phthalate
Pin Material	Brass, solder coated
Weight	TBD ounces (TBD grams)
Primary to Secondary Insulation Level	Operational

① All models are specified with no external I/O capacitors.
② See Technical Notes/Graphs for details.
③ Applying a voltage to the On/Off Control (pin 3) when no input power is applied to the converter can cause permanent damage to the converter.
④ Output noise may be further reduced with the addition of additional external output capacitors. See Technical Notes.
⑤ The On/Off Control is designed to be driven with open-coolector logic or the application of appropriate voltage levels. Voltages may be referenced to the –Input (pin 2).
⑥ Demonstrated MTBF available on request.
⑦ For conditions with less than minimum loading, outputs remain stable. However, regulation performance may degrade.

Absolute Maximum Ratings	
Input Voltage:	
Continuous:	
D12A Models	23 Volts
D24A Models	42 Volts
D48A Models	81 Volts
Transient (100msec):	
D12A Models	50 Volts
D24A Models	50 Volts
D48A Models	100 Volts
On/Off Control (pin 3) Max. Voltages	
Referenced to –Input (pin 2)	
"C" Suffix	+V_{IN}
"N" Suffix	+7 Volts
Input Reverse-Polarity Protection	Current must be <5 Amps. Brief duration only. Fusing recommended.
Output Current	Current limited. Devices can withstand sustained output short circuits without damage.
Case Temperature	120°C
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.

TECHNICAL NOTES

Floating Outputs

Since these are isolated DC/DC converters, their outputs are "floating," with respect to the input. As such, it is possible to use +Output, –Output or Output Return as the system ground thereby allowing the flexibility to generate a variety of output voltage combinations.

Regulation for BWR 15-17W bipolar converters is monitored between –Output and +Output (as opposed to Output to Return).

Minimum Loading Requirements

BWR 15-17W converters employ a classical diode-rectification design topology and require a minimum 10% loading to achieve their listed regulation specifications. Operation between no-load and 10% load will result in stable operation but regulation may degrade.

Filtering and Noise Reduction

All BWR 15-17W DC/DC Converters achieve their rated ripple and noise specifications without the use of external input/output capacitors. In critical applications, input/output ripple and noise may be further reduced by installing additional external I/O caps. Input capacitors should be selected for bulk capacitance, low ESR and high rms-ripple current ratings. Input capacitors serve as energy-storage devices to minimize line voltage caused by transient IR drops in PCB conductors from backplane to the DC/DC. Ouput capacitors should be selected for low ESR and appropriate frequency response. All caps should have appropriate voltage ratings and be mounted as close to the converters as possible.

The most effective combination of external I/O capacitors will be function of your particular load and layout conditions. Our Applications Engineers can recommend potential solutions. Contact our Applications Engineering Group for additional details.

Input Fusing

Certain applications and/or safety agencies may require the installation of fuses at the inputs of power conversion components. Fuses should also be used if the possibility of sustained, non-current-limited, input-voltage polartiy reversal exists. For DATEL BWR 15-17 Watt DC/DC Converters, you should use slow-blow type fuses with values no greater than the following:

Model	Fuse Value
BWR-5/1500-D12A	4 Amp
BWR-5/1500-D24A	2 Amp
BWR-5/1500-D48A	1 Amp
BWR-12/725-D12A	4 Amp
BWR-12/725-D24A	2.5 Amp
BWR-12/725-D48A	2.5 Amp
BWR-15/575-D12A	4 Amp
BWR-15/575-D24A	2.5 Amp
BWR-15/575-D48A	1 Amp

On/Off Control

The input-side, remote On/Off Control function (pin 3) can be ordered to operate with either polarity. Positive-polarity devices ("C" suffix) are enabled when pin 3 is left open or is pulled high (+13V to V_{IN} applied with respect to –Input, pin 2, (see Figure 2). Positive-polarity devices are disabled when pin 3 is pulled low (0-0.8V with respect to –Input). Negative-polarity devices are off when pin 3 open or pulled high (TBD to V_{IN}), and on when pin 2 is pulled low (0-0.5V). See Figure 3.

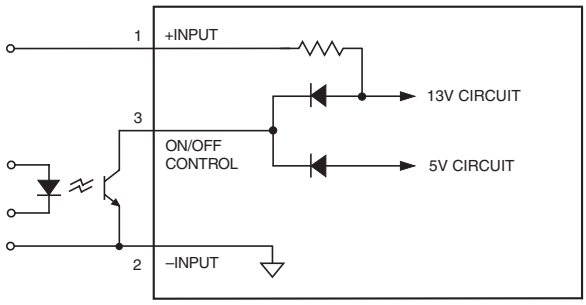


Figure 2. Driving the Positive Polarity On/Off Control Pin

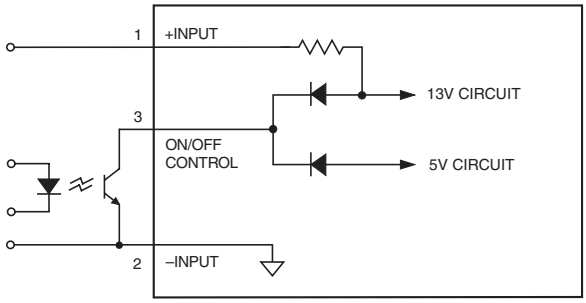


Figure 3. Driving the Negative Polarity On/Off Control Pin

Dynamic control of the remote on/off function is best accomplished with a mechanical relay or an open-collector/open-drain drive circuit (optically isolated if appropriate). The drive circuit should be able to sink appropriate current (see Performance Specs) when activated and withstand appropriate voltage when deactivated.

Applying an external voltage to pin 3 when no input power is applied to the converter can cause permanent damage to the converter.

Sync Function (Optional)

Contact DATEL for further information.

Start-Up Time

The VIN to VOUT start-up time is the interval of time where the input voltage crosses the turn-on threshold point, and the fully loaded output voltage enters and remains within its specified accuracy band. Actual measured times will vary with external output capacitance and load. The BWR 15-17W Series implements a soft start circuit that limits the duty cycle of the PWM controller at power up, thereby limiting the Input Inrush current.

The On/Off Control to VOUT start-up time assumes the converter has its nominal input voltage applied but is turned off via the On/Off Control pin. The specification defines the interval between the time at which the converter is turned on and the fully loaded output voltage enters and remains within its specified accuracy band. Similar to the VIN to VOUT start-up, the On/Off Control to VOUT start-up time is also governed by the internal soft start circuitry and external load capacitance.

Input Overvoltage/Undervoltage Shutdown and Start-Up Threshold

Under normal start-up conditions, devices will not begin to regulate until the ramping-up input voltage exceeds the Start-Up Threshold Voltage (35V for "D48" models). Once operating, devices will not turn off until the input voltage drops below the Undervoltage Shutdown limit (34V for "D48" models). Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.

Input voltages exceeding the input overvoltage shutdown specification listed in the Performance/Functional Specifications will cause the device to shutdown. A built-in hysteresis of 0.6 to 1.6 Volts for all models will not allow the converter to restart until the input voltage is sufficiently reduced.

Current Limiting

When output power increases to 16% to 52% of the rated output current, the DC/DC converter will go into a current limiting mode. In this condition the output voltage will decrease proportionately with increases in output current, thereby maintaining a somewhat constant power dissipation. This is commonly referred to as power limiting. Current limit inception is defined as the point where the full-power output voltage falls below the specified tolerance. See Performance/Functional Specifications. If the load current being drawn from the converter is significant enough, the unit will go into a short circuit condition. See "Short Circuit Condition."

Short Circuit Condition

When a converter is in current limit mode the output voltages will drop as the output current demand increases. If the output voltage drops too low, the magnetically coupled voltage used to develop primary side voltages will also drop, thereby shutting down the PWM controller.

Following a time-out period, the PWM will restart, causing the output voltages to begin ramping to their appropriate values. If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The BWR 15-17W Series is capable of enduring an indefinite short circuit output condition.

Thermal Shutdown

These BWR converters are equipped with Thermal Shutdown Circuitry. If environmental conditions cause the internal temperature of the DC/DC converter rises above the designed operating temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor the unit will self start. See Performance/Functional Specifications.

Output Overvoltage Protection

The output voltage is monitored for an overvoltage condition via magnetic coupling to the primary side. If the output voltage rises to a fault condition, which could be damaging to the load circuitry (see Performance Specifications), the sensing circuitry will power down the PWM controller causing the output voltage to decrease. Following a time-out period the PWM will restart, causing the output voltage to ramp to its appropriate value. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle. This on/off cycling is referred to as "hiccup" mode.

Trimming Output Voltages

Load Regulation

Regulation for the BWR 15-17W bipolar converters is monitored between –Output and +Output (as opposed to Output to Return). As such regulation will assure that voltage between –Output and +Output pins remains within the VOUT accuracy listed in the Performance/Functional Specifications table. If loading from +/– Outputs to Output Return is symmetrical, the voltage at Output pins with respect to Output Return will also be symmetrical. An unbalance in loading will consequently result in a degraded VOUT regulation accuracy from +/– Outputs to Output Return (–Output to +Output regulation will still be within specification). Figure 4 shows output accuracy effects of unbalanced loading.

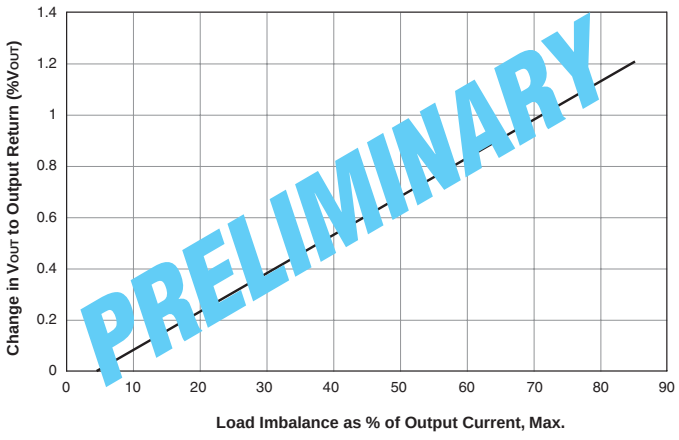


Figure 4. Output Voltaage Accuracy vs. Imbalanced Loading

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