

1600 Series

Distributed By:
B. J. Wolfe Enterprises
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KEY FEATURES

- Wide 2:1 Input Voltage Range
- Efficiency to 82%
- 10.6W/In³ Power Density
- >700,000 Hours MTBF
- UL 1950 Approved
- CSA 22.2-950 Approved
- VDE / EN 60950 Approved

General Description

The **1600 series** is a family of 16 watt single, dual and triple output DC/DC converters. These converters are specifically designed to provide the economy, compact packaging and high reliability demanded by applications involving telecommunications equipment, micro-processor based subsystems, robotic equipment and portable test gear. Most models meet the requirements of IEC 950, and are fully approved to the latest revisions of UL 1950 (File No. E140645), CSA 22.2-950 (File No. LR 89494) and VDE / EN 60950.

Operating from wide (2:1 or 3:1) input voltage ranges of 9 to 18, 18 to 36 or 36 to 72 VDC; twenty four models provide output combinations of 3.3, 5, 12, 15, ± 5 , ± 12 , ± 15 , 5 ± 12 and 5 ± 15 VDC. Standard features include 1400 VDC input/output isolation, low output ripple & noise, continuous short circuit protection and output over voltage protection (all outputs). Efficiency is as high as 82%. A remote ON/OFF control input and internal input π (Pi) filter are standard on all units.

Long field life is insured by extensive reliability screening at **CDI**. As part of the normal production processing, each unit is subjected to burn-in during which the input power is cycled on/off and the output load is switched from 0% to 100%. Per MIL-HDBK-217F, the MTBF is greater than 700,000 hours at +25 °C (ground benign).

Each module is packaged in a compact 2.0 x 2.0 x 0.375 inch metal case, yielding a power density as high as 10.6W/In³. Six sided continuous shielding virtually eliminates radiated emissions. Full operation is specified over the wide temperature range of -25°C to +71°C with no derating or heatsinking required. Cooling is by free-air convection.

Electrical Specifications

Input Specifications:

Input Voltage Range ⁽¹⁾	See Model Selection Guide
Input Filter	π (Pi) Network
Reverse Polarity Input Current	12A, Max.
Input Surge Current	20A at 10 μ Sec.
Short Circuit Current Limit	150% of I _{in}
Under Voltage Shutdown	8 VDC (4.5 VDC on 5 VDC Input Models)

Remote On/Off Control;

Supply On	5.5 VDC or Open Circuit
Supply Off	0 VDC to 0.8 VDC
Logic Input Reference	Negative (-) Input
Logic Compatibility	TTL Open Collector or CMOS Open Drain

Converter Standby Current

32 mA

Output Specifications:

Voltage and Current Ratings ⁽²⁾

Output Voltage Accuracy;

Single Output Models	$\pm 1\%$, Max.
Dual Output Models	$\pm 1\%$, Max.
Triple Output Models; Primary	$\pm 1\%$, Adj to Zero
Auxiliaries	$\pm 5\%$, Max.

Voltage Adjustment ⁽³⁾

$\pm 5\%$, Max.

Voltage Balance ⁽⁴⁾;

Dual Outputs

$\pm 1\%$, Max.

Triple Outputs (Auxiliaries)

$\pm 1\%$, Max.

Ripple & Noise ⁽⁵⁾

1% Pk-Pk of V_{out}

Minimum Load

10% of Full Load

Line Regulation ⁽⁶⁾;

3.3 VDC Output Models

$\pm 0.3\%$, Max.

Single/Dual Output Models

$\pm 0.5\%$, Max.

Triple Output Models; Primary

$\pm 0.2\%$, Max.

Auxiliaries

$\pm 5.0\%$, Max.

Load Regulation ⁽⁷⁾;

Single Output Models

$\pm 0.2\%$, Max.

Dual Output Models

$\pm 1.0\%$, Max.

Triple Output Units; Primary

$\pm 0.5\%$, Max.

Auxiliaries

$\pm 5.0\%$, Max.

Temperature Coefficient @ FL

$\pm 0.01\%/^{\circ}$ C

Transient Recovery Time ⁽⁸⁾

200 μ Sec

Short Circuit Protection ⁽⁹⁾

All outputs by

Input Current Limiting

Over Voltage Protection

See Model Selection Guide

General Specifications:

Efficiency ⁽¹⁰⁾

See Model Selection Guide

Isolation Voltage (1 min.)

1400 VDC, Min.

Isolation Resistance

>10⁹ Ω

Isolation Capacitance

100 pF

Switching Frequency

100 kHz, Min.

Environmental Specifications:

Operating Temperature (Ambient)

-25°C to +71°C

Storage Temperature Range

-55°C to +125°C

Derating

See Derating Curves

Humidity

Up to 95%, Non-Condensing

Cooling ⁽¹¹⁾

Free-air Convection

EMI/RFI

Six-sided Metal Case

Physical Characteristics:

Case Size

2.0 x 2.0 x 0.375 inches

(51 x 51 x 9.52 mm)

Case Material

Coated Copper

Weight

2.8 Oz (79g)

Shielding

Six-sided, Continuous

Shielding Connection

12V, 24V Input Models

Pin 3 (- Input)

48V Input Models

Pin 4 (+ Input)

Reliability Specifications:

MTBF; Ground Benign, @ +25°C ⁽¹²⁾

>705,000 Hours

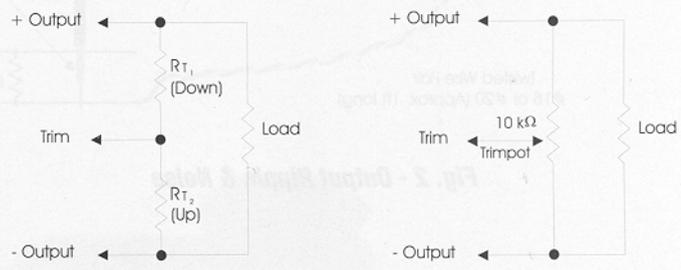
Specifications typical @ +25°C with nominal input voltage and under full output load conditions, unless otherwise noted. Specifications subject to change without notice.

Model Selection Guide

Model Number	Input				Output			Efficiency @FL (%)	Case
	Voltage (VDC)		Current (mA, Max.)		Voltage (VDC)	Current (mA)	Over Voltage (VDC)		
	Nominal	Range	No-Load	Full-Load					
1603S12-A2	12	9 - 18	45	1827	3.3	4850	4.7	78	A2
1605S12	12	9 - 18	45	1667	5.0	3200	6.8	80	A, A2
1612S12	12	9 - 18	45	1640	12.0	1300	15.0	81	A, A2
1615S12	12	9 - 18	45	1650	15.0	1060	18.0	81	A, A2
1605D12	12	9 - 18	40	1667	±5.0	±1600	±6.8	80	A, A2
1612D12	12	9 - 18	45	1640	±12.0	±665	±15.0	81	A, A2
1615D12	12	9 - 18	45	1650	±15.0	±535	±18.0	81	A, A2
1603S24-A2	24	18 - 36	45	890	3.3	4850	4.7	78	A2
1605S24	24	18 - 36	34	833	5.0	3200	6.8	80	A, A2
1612S24	24	18 - 36	34	810	12.0	1300	15.0	82	A, A2
1615S24	24	18 - 36	34	815	15.0	1060	18.0	82	A, A2
1605D24	24	18 - 36	34	833	±5.0	±1600	±6.8	80	A, A2
1612D24	24	18 - 36	34	810	±12.0	±665	±15.0	82	A, A2
1615D24	24	18 - 36	34	815	±15.0	±535	±18.0	82	A, A2
1603S48-A2	48	36 - 72	45	438	3.3	4850	4.7	78	A2
1605S48	48	36 - 72	32	411	5.0	3200	6.8	81	A, A2
1612S48	48	36 - 72	32	405	12.0	1300	15.0	82	A, A2
1615S48	48	36 - 72	32	408	15.0	1060	18.0	82	A, A2
1605D48	48	36 - 72	32	411	±5.0	±1600	±6.8	81	A, A2
1612D48	48	36 - 72	32	405	±12.0	±665	±15.0	82	A, A2
1615D48	48	36 - 72	32	408	±15.0	±535	±18.0	82	A, A2
1605/12T12	12	9 - 18	50	1667	5±12	2000±250	6.8±15	75	A, A2
1605/15T12	12	9 - 18	50	1667	5±12	2000±200	6.8±15	79	A, A2
1605/12T24	24	18 - 36	45	832	5±12	2000±250	6.8±15	81	A, A2
1605/15T24	24	18 - 36	45	832	5±15	2000±200	6.8±18	75	A, A2
1605/12T48	48	36 - 72	35	406	5±15	2000±250	6.8±18	79	A, A2
1605/15T48	48	36 - 72	35	401	5±15	2000±200	6.8±18	81	A, A2

Specification Notes:

1. Contact the factory for information on other input/output combinations.
2. Total output power should not exceed the specified output ratings for any particular model.
3. **Fig. 1** illustrates the simple external circuit required to adjust the converter output. To trim the output voltage DOWN, connect a 5%, 1/4W resistor (R_{T1}) between the plus (+) output and trim pins of the converter. To trim the output voltage UP, connect a 5%, 1/4W resistor (R_{T2}) between the minus (-) output and trim pins. For UP/DOWN trimming capability, connect a 10k potentiometer between the plus (+) and minus (-) outputs, with the wiper arm connected to the trim pin. The trim resistors or potentiometers can be connected at the converter pins or at the load. If connected at the load, the resistance of the circuit paths becomes part of the feedback loop, 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.



External Trimming

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Triple Output Load Regulation

Specification Notes Cont'd:

4. Voltage balance is measured with balanced loads applied.
5. True converter output ripple and noise can be measured by attaching a twisted wire pair (about 1 foot in length) with three twists per/inch between the converter outputs and an appropriate load as shown in Fig. 2. Connect a 33 μ F electrolytic capacitor (C1) across the load. Using a scope with a minimum bandwidth of 20 MHz and a probe with the ground clip disconnected, measure the ripple at the connection of the load and twisted pair wires. This eliminates the "common mode noise" that interferes with measurements made directly at the converter output pins.
6. Line regulation is measured by monitoring the output voltage while the input line is varied from low line to high line. Dual outputs and auxiliary outputs on triple output models are loaded equally.
7. Load regulation is measured at nominal input voltage while the output load is varied. For single output units the load variation is 1/4 load to full load. For dual output models, the load variation is no load to full load (with outputs loaded equally). For triple output units the load variation is no load to full load on the primary output and 1/4 load to full load on auxiliary outputs. Auxiliary outputs are loaded equally.
8. Transient response is measured on the primary output for a 50% load change (50% load to full load).
9. For further protection, it is recommended that an external, slow-blow line fuse be connected to the converter input lines.
10. Efficiency is specified at nominal input line and full load.
11. Free air convection cooling requires that the application be properly ventilated using a converter in a sealed application, or one in which air movement is severely limited could cause thermal runaway.
12. MTBF calculations are made per MIL-HDBK-217F.

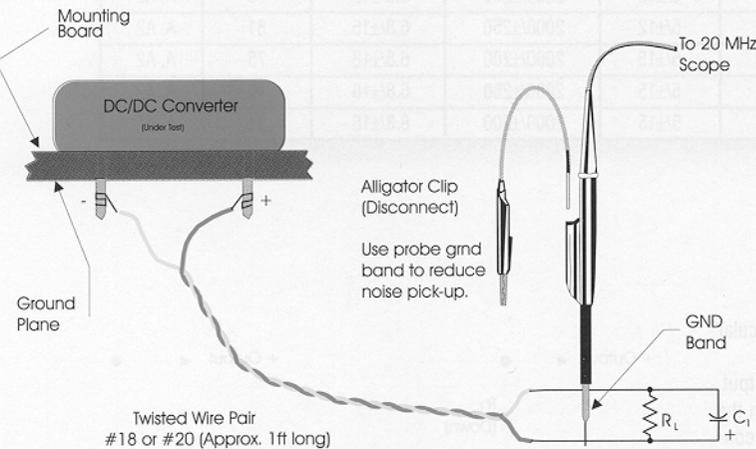
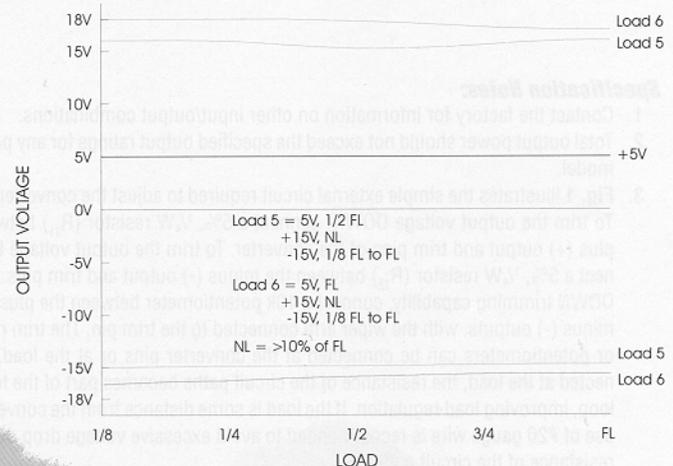
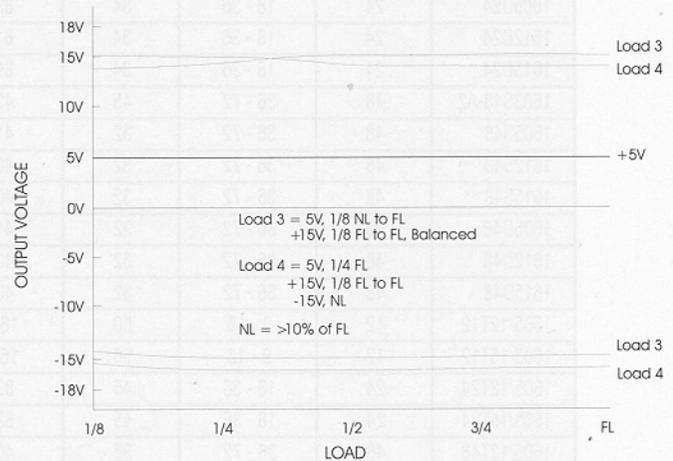
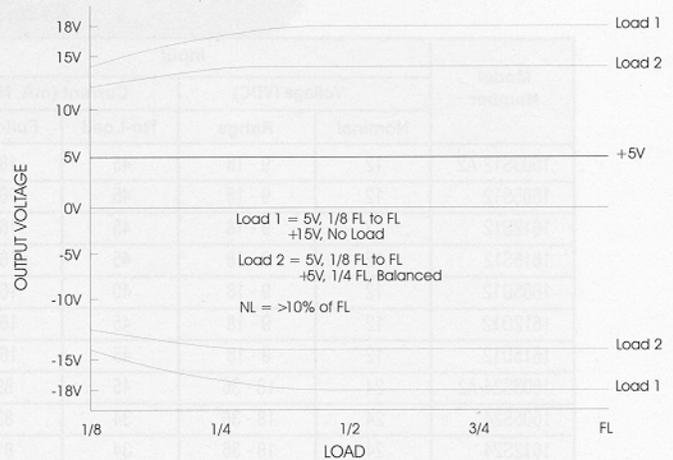
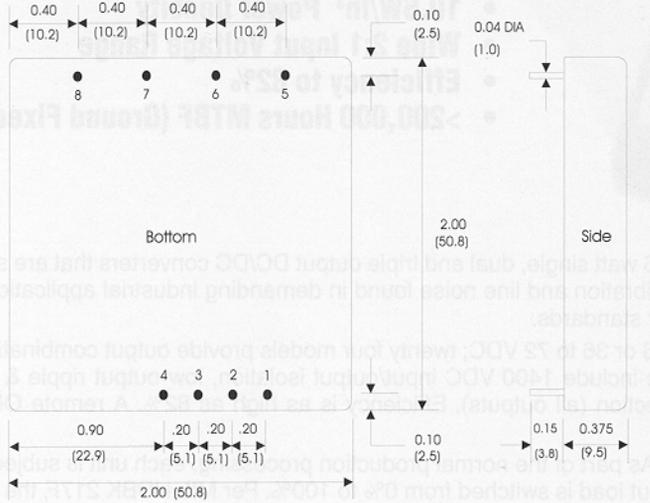


Fig. 2 - Output Ripple & Noise

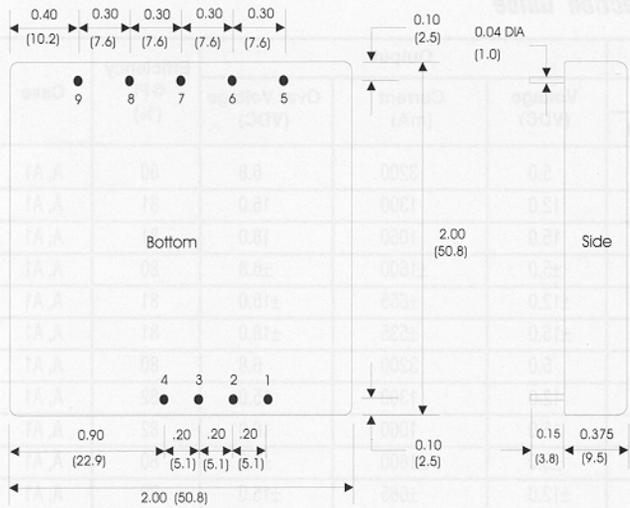
Mechanical Configuration - Case A



Pin Out - Case A

Pin	Single Output	Dual Output	Triple Output
1	Remote On/Off	Remote On/Off	Remote On/Off
2	Sync	Sync	Sync
3	- Input	- Input	- Input
4	+ Input	+ Input	+ Input
5	Trim	Trim	- Output (AUX)
6	- Output	- Output	Common
7	+ Output	Common	-5V Output
8	No Pin	+ Output	+ Output (AUX)

Mechanical Configuration - Case A2



Pin Out - Case A2

Pin	3.3V Output	Triple Output
1	Remote On/Off	Remote On/Off
2	Sync	Sync
3	- Input	- Input
4	+ Input	+ Input
5	Trim	- Output (AUX)
6	- Output	Common (AUX)
7	- Output	- 5V Output
8	+ Output	+ 5V Output
9	+ Output	+ Output (AUX)

Note: All dimensions are typical in inches (mm).
 Tolerance: X.XX = ± 0.02, (± 0.05)
 X.XXX = ± 0.010, (± 0.25)
 N/C = No Connection

Ordering Information:

- Models with case "A" packaging do not require a suffix on the part number.
- For models that are available in both the "A2" or "A3" package, the "A2" and "A3" cases are considered an alternate. Models with case "A2" or "A3" packaging must be designated with an "A2" or "A3" suffix (i.e. **1615D48-A2**).