1500 and 2100 Series

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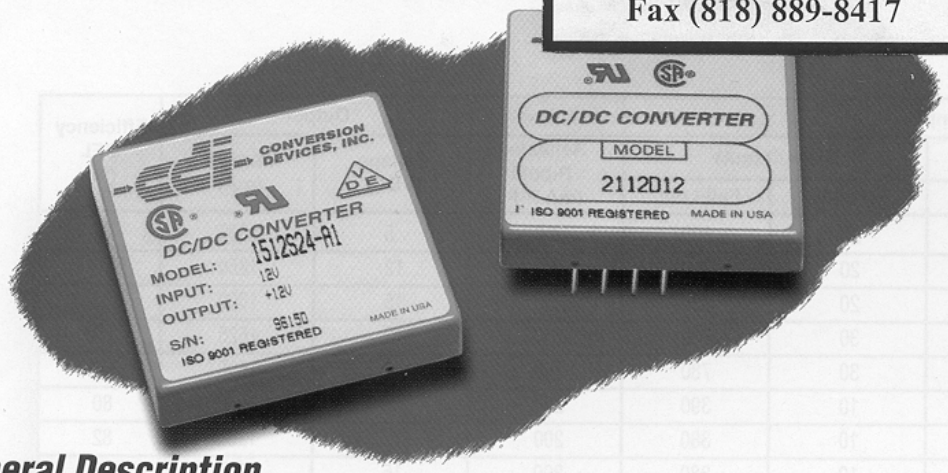
IEC950



Key Features:

- 13.3W/In³ Power Density
- Wide 2:1 Input Voltage Range
- Efficiency to 87%
- UL 1950 Approved
- CSA 22.2-950 Approved
- VDE / EN 60950 Approved
- MTBF >700,000 Hours

General Description

The **1500 and 2100** series are a family of miniature, high performance DC/DC converters. These converters provide a cost effective solution to the high reliability and performance requirements of power distribution systems in applications ranging from high speed data communications equipment to industrial robotic systems. Each model meets the requirements of IEC 950, and is fully approved to the latest revisions of UL 1950 (File No. E140645), CSA 22.2-950 (File No. LR89494) and VDE / EN 60950.

Forty eight models operate over 2:1 input voltage ranges of 9 to 18, 18 to 36 or 36 to 72 VDC; providing single, dual and triple output combinations of 5, 12, 15, ±5, ±12, ±15, 5/±12 and 5/±15VDC. Standard features include 1400 VDC input/output isolation, efficiency as high as 87%, tight line/load regulation and low output ripple and noise. A remote ON/OFF control input, continuous short circuit protection with automatic recovery and output overvoltage protection on all outputs are also standard features. The Mean Time Between Failure (MTBF) per MIL-HDBK-217F is over 700,000 hours @ +25°C, (ground benign).

All **1500 and 2100** models are packaged in compact, low profile 2 x 2 x 0.375 inch metal cases. Continuous six-sided shielding virtually eliminates radiated emissions. This miniature size yields a power density as high as 13.3W/In³. Operation is specified over the full operating temperature range of -25°C to +71°C with no derating required. Cooling is by free-air convection.

Electrical Specifications

Input Specifications:

Input Voltage Range	See Model Selection Guide
Input Filter (1)	Internal Capacitor
Reverse Polarity Input Current.	12A, Max.
Input Surge Current.	20A at 10 μ Sec.
Short Circuit Current Limit	150% of I_{in}
Undervoltage Shutdown	8 VDC
Remote ON/OFF Control;	
Supply ON	5.5V 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.	30 mA, Max.

Output Specifications:

Voltage and Current Ratings (2)	See Model Selection Guide
Output Voltage Accuracy;	
Single/Dual Output Models	±1%, Max.
Triple Output Models; Primary	±1%, Max. (Adj to Zero)
Auxiliaries	±5%, Max.
Output Voltage Adjustment	±5%, Max.
Voltage Balance;	
Dual Outputs.	±1%, Max.
Triple Outputs (Auxiliaries)	±1%, Max.
Minimum Load	10% of Full Load
Ripple & Noise	1% of V_{out}
Line Regulation;	
Single/Dual Output Models	±0.5%, Max.
Triple Output Models; Primary	±0.2%, Max.
Auxiliaries	±5.0%, Max.
Load Regulation;	
Single Output Models	±0.2%, Max.
Dual Output Models	±1.0%, Max.
Triple Output Models; Primary	±0.5%, Max.
Auxiliaries	±5.0%, Max.
Temperature Coefficient @ FL.	±0.01%/°C
Transient Recovery Time (3).	200 μ Sec.
Short Circuit Protection (4)	All Outputs, by Input Current Limiting
Output Short Circuit Duration	Continuous
Over Voltage Protection	See Model Selection Guide

General Specifications:

Efficiency	See Model Selection Guide
Isolation Voltage (1 min.)	1400 VDC, Min.
Isolation Resistance	$10^9\Omega$
Isolation Capacitance	60 pF
Switching Frequency	100 kHz, Min.

Environmental Specifications:

Operating Temperature Range(Ambient)	-25°C to +71°C (Industrial) -55°C to +85°C (Extended)(7)
Storage Temperature Range	-55°C to +125°C
Derating	See Derating Curves
Cooling (5)	Free-air Convection
EMI/RFI	Six-sided Continuous Shielded 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 Metal
Weight.	2.8 Oz (79g)
Shielding Connection	
12V, 24V Input Models	Pin3 (- Input)
48V Input Models	Pin4 (+ Input)

Reliability Specifications: (6)

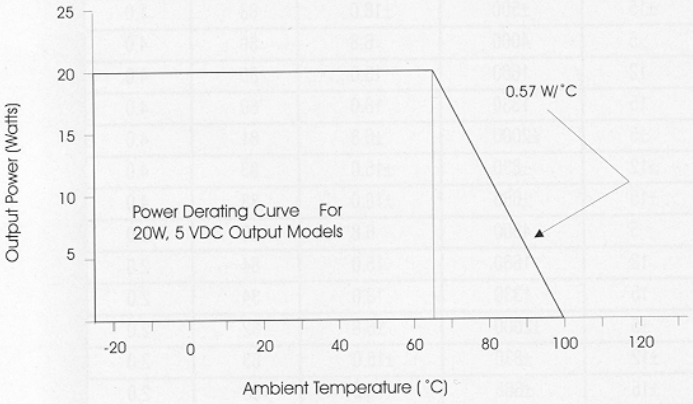
MTBF; Ground Benign, @ +25°C Ambient	707,965 Hours

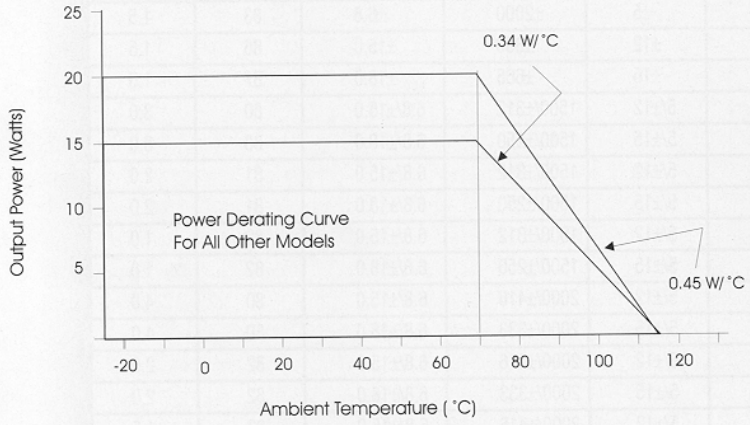
Specification Notes

1. An external, low ESR, capacitor of 10 - 20 µF, 50 - 100 VDC is required across the input pins. Recommended is a 672D for -25˚C to +71˚C models and 40D for -55˚C to +85˚C models.
2. Total output power should not exceed the specified output currents for any particular model.
3. Transient response of the primary output is measured to within a 1% error band for a step change in output load of 50% load to full load.
4. The short circuit mechanism on the input of the converter will be triggered if the specified maximum output power of the unit is exceeded. This feature will limit the module input power to a preset percentage over the maximum specified output limit. This percentage is fixed as follows:
   A. P_{out} +30% for industrial temperature products (-25°C to +71°C)
   B. P_{out} +50% for extended temperature products (-55°C to +85°C)
5. 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 restricted, could cause thermal runaway.
6. MTBF calculations are made per MIL-HDBK-217F.
7. Extended operating temperature range models (-55˚C to +85˚C), marked with suffix "x", are 100% tested to meet temperature specifications. Maximum operating case temperature is +100˚C.
8. The outputs of dual output models and the auxiliary outputs of triple output models may be operated with unbalanced loads. Care must be taken not to exceed the maximum limits of the individual outputs or the overall power rating of the module. Operating outputs in an unbalanced state may affect some specifications such as output accuracy. For more information on applying a specific model, contact the factory.

Thermal Performance of the 1500/2100 Series

Derating Curves:





Application Notes

1. The derating curves shown for the **1500/2100** series represents ambient operating conditions. They assume that good thermal design practices are being used, including sufficient space in the vicinity of the converter for good air circulation. There are certain alternate techniques that can be utilized when the ambient temperature reaches the upper limit of a particular model:

   a. Using a heat sink.

   b. Mounting the converter on a metal plate which acts as a heat sink.

   c. Cooling by forced air.

   Any of the above methods (or a combination of heat sinking and forced air) will increase the operating range of the converter up to 85°C maximum ambient temperature. However the baseplate (case) temperature must not exceed 115°C for more than one minute under any conditions.

2. External Synchronizing - All models in the **1500** and **2100** series (packaged in the standard "A" case) can be synchronized to an external clock by driving the SYNC pin (pin 2) directly with an open collector-open drain (1 TTL load). The driving signal frequency must be 220 kHz, ± 5% (20% low, 80% high duty cycle).

3. Although all models feature internal short circuit protection, it is recommended that their inputs be protected externally with a fuse. The fuse used must be a Slow-Blow type. Recommended rates are shown in the far right column of the model selection guide.

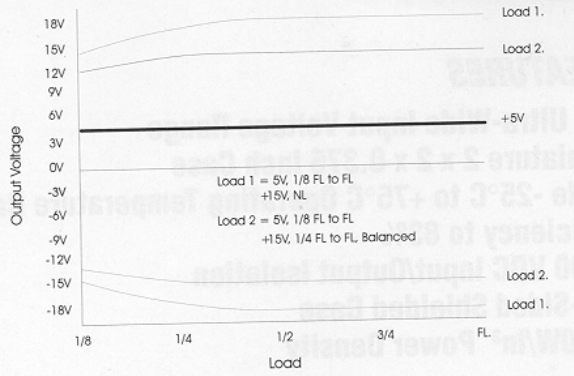
* For information on the standard conditions and methods used or approved by **CDI** to test DC/DC converter parameters, see the application note "DC/DC Converter Test Methods" on page 104.

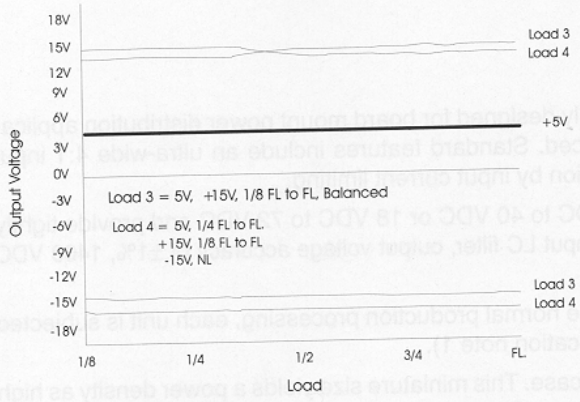
1500 and 2100 Series

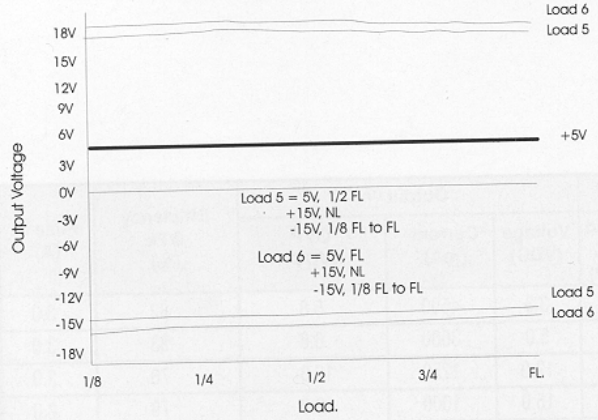
Model Selection Guide

Model Number	Input[7]				Output[8]			Efficiency @FL (%)	Fuse (Amps)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA)	Over Voltage (VDC)		
	Nominal	Range	No-Load	Full-Load					
1505S12	12	9 - 18	45	1520	5	3000	6.8	82	3.0
1512S12	12	9 - 18	45	1520	12	1250	15.0	82	3.0
1515S12	12	9 - 18	45	1520	15	1000	18.0	82	3.0
1505D12	12	9 - 18	40	1562	±5	±1500	±6.8	80	3.0
1512D12	12	9 - 18	45	1500	±12	±625	±15.0	83	3.0
1515D12	12	9 - 18	45	1500	±15	±500	±18.0	83	3.0
1505S24	24	18 - 36	34	750	5	3000	6.8	83	2.0
1512S24	24	18 - 36	31	750	12	1250	15.0	83	2.0
1515S24	24	18 - 36	31	750	15	1000	18.0	83	2.0
1505D24	24	18 - 36	35	772	±5	±1500	±6.8	81	2.0
1512D24	24	18 - 36	32	750	±12	±625	±15.0	83	2.0
1515D24	24	18 - 36	32	750	±15	±500	±18.0	83	2.0
1505S48	48	36 - 72	32	370	5	3000	6.8	84	1.0
1512S48	48	36 - 72	32	375	12	1250	15.0	83	1.0
1515S48	48	36 - 72	32	375	15	1000	18.0	83	1.0
1505D48	48	36 - 72	32	381	±5	±1500	±6.8	82	1.0
1512D48	48	36 - 72	32	376	±12	±625	±15.0	83	1.0
1515D48	48	36 - 72	32	376	±15	±500	±18.0	83	1.0
2105S12	12	10 - 18	45	2100	5	4000	6.8	80	4.0
2112S12	12	10 - 18	45	2100	12	1660	15.0	80	4.0
2115S12	12	10 - 18	45	2100	15	1330	18.0	80	4.0
2105D12	12	10 - 18	40	2057	±5	±2000	±6.8	81	4.0
2112D12	12	10 - 18	45	2000	±12	±830	±15.0	83	4.0
2115D12	12	10 - 18	45	2000	±15	±665	±18.0	83	4.0
2105S24	24	18 - 36	34	1000	5	4000	6.8	83	2.0
2112S24	24	18 - 36	31	990	12	1660	15.0	84	2.0
2115S24	24	18 - 36	32	990	15	1330	18.0	84	2.0
2105D24	24	18 - 36	35	1016	±5	±2000	±6.8	82	2.0
2112D24	24	18 - 36	32	1000	±12	±830	±15.0	83	2.0
2115D24	24	18 - 36	32	1000	±15	±665	±18.0	83	2.0
2105S48	48	36 - 72	32	490	5	4000	6.8	85	1.5
2112S48	48	36 - 72	32	500	12	1660	15.0	83	1.5
2115S48	48	36 - 72	32	500	15	1330	18.0	83	1.5
2105D48	48	36 - 72	32	502	±5	±2000	±6.8	83	1.5
2112D48	48	36 - 72	32	482	±12	±830	±15.0	86	1.5
2115D48	48	36 - 72	32	478	±15	±665	±18.0	87	1.5
1505/12T12	12	9 - 18	60	1561	5/±12	1500/±312	6.8/±15.0	80	3.0
1505/15T12	12	9 - 18	60	1562	5/±15	1500/±250	6.8/±18.0	80	3.0
1505/12T24	24	18 - 36	60	771	5/±12	1500/±312	6.8/±15.0	81	2.0
1505/15T24	24	18 - 36	60	772	5/±15	1500/±250	6.8/±18.0	81	2.0
1505/12T48	48	36 - 72	30	381	5/±12	1500/±312	6.8/±15.0	82	1.0
1505/15T48	48	36 - 72	30	381	5/±15	1500/±250	6.8/±18.0	82	1.0
2105/12T12	12	9 - 18	60	2081	5/±12	2000/±416	6.8/±15.0	80	4.0
2105/15T12	12	9 - 18	60	2082	5/±15	2000/±333	6.8/±18.0	80	4.0
2105/12T24	24	18 - 36	60	1015	5/±12	2000/±416	6.8/±15.0	82	2.0
2105/15T24	24	18 - 36	60	1016	5/±15	2000/±333	6.8/±18.0	82	2.0
2105/12T48	48	36 - 72	30	502	5/±12	2000/±416	6.8/±15.0	83	1.5
2105/15T48	48	36 - 72	30	502	5/±15	2000/±333	6.8/±18.0	83	1.5

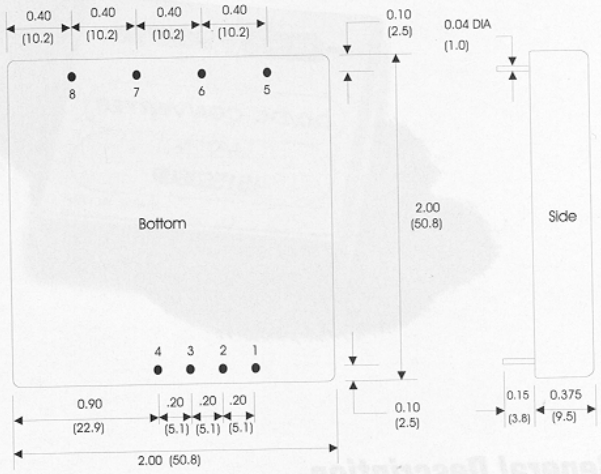
Triple Output Load Regulation







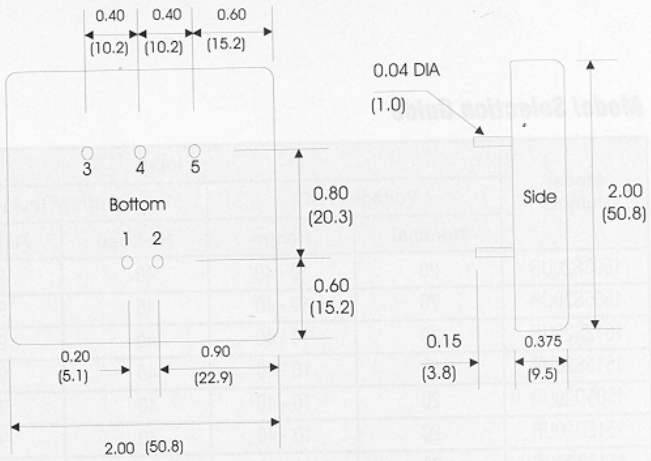
Mechanical Configuration; Case A



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 A1



Pin-Out; Case A1

Pin	Single Output	Dual Output
1	+ Input	+ Input
2	- Input	- Input
3	+ Output	+ Output
4	Trim	Common
5	- Output	- Output

Ordering Information

1. Case "A" pinning is standard. Models with case "A" packaging do not require a suffix on the part number.
2. Case "A1" is an alternate. Models with case "A1" packaging must be designated with an "A1" suffix., i.e. **2115D48-A1**

Note: All dimensions are typical in inches (mm).
Tolerance X.XX = ± 0.020, (± 0.5)
X.XXX = ± 0.010, (± 0.25)

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