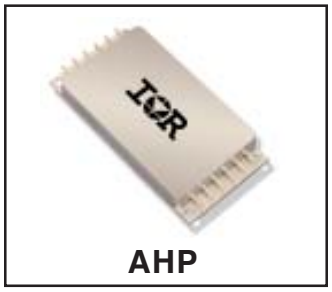
PD-97389

International
IOR Rectifier

HIGH RELIABILITY HYBRID DC/DC CONVERTERS

AHP28XXD SERIES

28V Input, Dual Output



AHP

Description

The AHP Series of DC/DC converters feature high power density with no derating over the full military temperature range. This series is offered as part of a complete family of converters providing single and dual output voltages and operating from nominal +28 or +270 volt inputs with output power ranging from 80 to 120 watts. For applications requiring higher output power, individual converters can be operated in parallel. The internal current sharing circuits assure equal current distribution among the paralleled converters. This series incorporates International Rectifier's proprietary magnetic pulse feedback technology providing optimum dynamic line and load regulation response. This feedback system samples the output voltage at the pulse width modulator fixed clock frequency, nominally 550 KHz. Multiple converters can be synchronized to a system clock in the 500 KHz to 700 KHz range or to the synchronization output of one converter. Undervoltage lockout, primary and secondary referenced inhibit, soft-start and load fault protection are provided on all models. Also included is input over-voltage protection, a new protection feature unique to the AHP.

These converters are hermetically packaged in two enclosure variations, utilizing copper core pins to minimize resistive DC losses. Three lead styles are available, each fabricated with International Rectifier's rugged ceramic lead-to-package seal assuring long term hermeticity in the most harsh environments.

Manufactured in a facility fully qualified to MIL-PRF-38534, these converters are available in four screening grades to satisfy a wide range of requirements. The CH grade is fully compliant to the requirements of MIL-PRF-38534 for class H. The HB grade is processed and screened to the class H requirement, but may not necessarily meet all of the other MIL-PRF-38534 requirements, e.g., element evaluation and Periodic Inspection (P.I.) not required. Both grades are tested to meet the complete group "A" test specification over the full military temperature range without output power deration. Two grades with more limited screening are also avail-able for use in less demanding applications. Variations in electrical, mechanical and screening can be accommodated. Contact IR Santa Clara for special requirements.

Features

- 16 To 40 Volt Input Range
- ±5, ±12, and ±15 Volts Outputs Available
- High Power Density - up to 70 W / in^3
- Up To 100 Watt Output Power
- Parallel Operation with Stress and Current Sharing
- Input Over-Voltage Protection
- High Efficiency - to 85%
- Continuous Short Circuit and Overload Protection
- External Synchronization Port
- Remote Sensing Terminals
- Primary and Secondary Referenced Inhibit Functions
- Line Rejection > 40 dB - DC to 50KHz
- Fault Tolerant Design
- Full Military Temperature Range
- Ceramic Feedthru Copper Core Pins
- Low Profile (0.380") Seam Welded Package
- Single Output Versions Available

Specifications

ABSOLUTE MAXIMUM RATINGS	
Input Voltage	-0.5V to 50V
Soldering Temperature	300°C for 10 seconds
Case Temperature - Operating	-55°C to +125°C
Case Temperature - Storage	-65°C to +135°C

Static Characteristics -55°C ≤ T_{CASE} ≤ +125°C, 16V≤ V_{IN} ≤ 40V unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
INPUT VOLTAGE		Note 6	16	28	40	V
OUTPUT VOLTAGE		V_{IN} = 28V, 100% Load				
AHP2805D	1	Positive Output	4.95	5.00	5.05	
	1	Negative Output	-5.05	-5.00	-4.95	
AHP2812D	1	Positive Output	11.88	12.00	12.12	
	1	Negative Output	-12.12	-12.00	-11.88	
AHP2815D	1	Positive Output	14.85	15.00	15.15	
	1	Negative Output	-15.15	-15.00	-14.85	V
AHP2805D	2, 3	Positive Output	4.90		5.10	
	2, 3	Negative Output	-5.10		-4.90	
AHP2812D	2, 3	Positive Output	11.76		12.24	
	2, 3	Negative Output	-12.24		-11.76	
AHP2815D	2, 3	Positive Output	14.70		15.30	
	2, 3	Negative Output	-15.30		-14.70	
OUTPUT CURRENT		V_{IN} = 16, 28, 40V - Notes 6, 11				
AHP2805D		Either Output			12.8	
AHP2812D		Either Output			6.4	A
AHP2815D		Either Output			5.3	
OUTPUT POWER		Total of Both Outputs - Notes 6,11				
AHP2805D			80			
AHP2812D			96			W
AHP2815D			100			
MAXIMUM CAPACITIVE LOAD		Each Output - Note 1	10,000			µF
OUTPUT VOLTAGE TEMPERATURE COEFFICIENT		V_{IN} = 28V, 100% Load - Notes 1, 6	-0.015		+0.015	%/°C
OUTPUT VOLTAGE REGULATION		Note 10				
Line	1, 2, 3	No Load, 50% Load, 100% Load	-0.5		+0.5	
Load	1, 2, 3	V_{IN} = 16, 28, 40V	-1.0		+1.0	
Cross		V_{IN} = 16, 28, 40V - Note 12				
AHP2805D	1, 2, 3	Positive Output	-1.0		+1.0	%
		Negative Output	-9.0		+9.0	
AHP2812D	1, 2, 3	Positive Output	-1.0		+1.0	
		Negative Output	-5.0		+5.0	
AHP2815D	1, 2, 3	Positive Output	-1.0		+1.0	
		Negative Output	-5.0		+5.0	

For Notes to Specifications, refer to page 4

Static Characteristics (Continued)

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
OUTPUT RIPPLE VOLTAGE		V_{IN} = 16, 28, 40V, 100% Load, BW = 10MHz				
AHP2805D	1, 2, 3				60	
AHP2812D	1, 2, 3				80	mV_{pp}
AHP2815D	1, 2, 3				80	
INPUT CURRENT		V_{IN} = 28V				
No Load	1	I_{OUT} = 0			80	
	2, 3				100	
Inhibit 1	1, 2, 3	Pin 4 Shorted to Pin 2			5.0	
Inhibit 2		Pin 12 Shorted to Pin 8				mA
AHP2805D	1, 2, 3				50	
AHP2812D	1, 2, 3				30	
AHP2815D	1, 2, 3				30	
INPUT RIPPLE CURRENT		V_{IN} = 28V, 100% Load				
AHP2805D	1, 2, 3				60	
AHP2812D	1, 2, 3				60	mA_{pp}
AHP2815D	1, 2, 3				60	
CURRENT LIMIT POINT		V_{OUT} = 90% V_{NOM}, Equal current on				
Expressed as a percentage of Full Rated Load	1	positive and negative outputs - Note 5	115		125	
	2		105		125	%
	3		105		125	
LOAD FAULT POWER DISSIPATION		V_{IN} = 28V				
Overload or Short Circuit	1, 2, 3				33	W
EFFICIENCY		V_{IN} = 28V, 100% Load				
AHP2805D	1, 2, 3		78	81		
AHP2812D	1, 2, 3		82	84		%
AHP2815D	1, 2, 3		81	85		
ENABLE INPUTS (Inhibit Function)						
Converter Off	1, 2, 3	Logical Low on Pin 4 or Pin 12	-0.5		0.8	V
Sink Current		Note 1			100	µA
Converter On	1, 2, 3	Logical High on Pin 4 and Pin 12 - Note 9	2.0		50	V
Sink Current		Note 1			100	µA
SWITCHING FREQUENCY	1, 2, 3		500	550	600	KHz
SYNCHRONIZATION INPUT						
Frequency Range	1, 2, 3		500		700	KHz
Pulse Amplitude, Hi	1, 2, 3		2.0		10	V
Pulse Amplitude, Lo	1, 2, 3		-0.5		0.8	V
Pulse Rise Time		Note 1			100	ns
Pulse Duty Cycle		Note 1	20		80	%
ISOLATION	1	Input to Output or Any Pin to Case (except Pin 3). Test @ 500VDC	100			MΩ
DEVICE WEIGHT		Slight Variations with Case Style		85		g
MTBF		MIL-HDBK-217F, AIF @ T_C = 40°C	300			KHrs

For Notes to Specifications, refer to page 4

Dynamic Characteristics -55°C ≤ T_{CASE} ≤ +125°C, V_{IN}=28V unless otherwise specified.

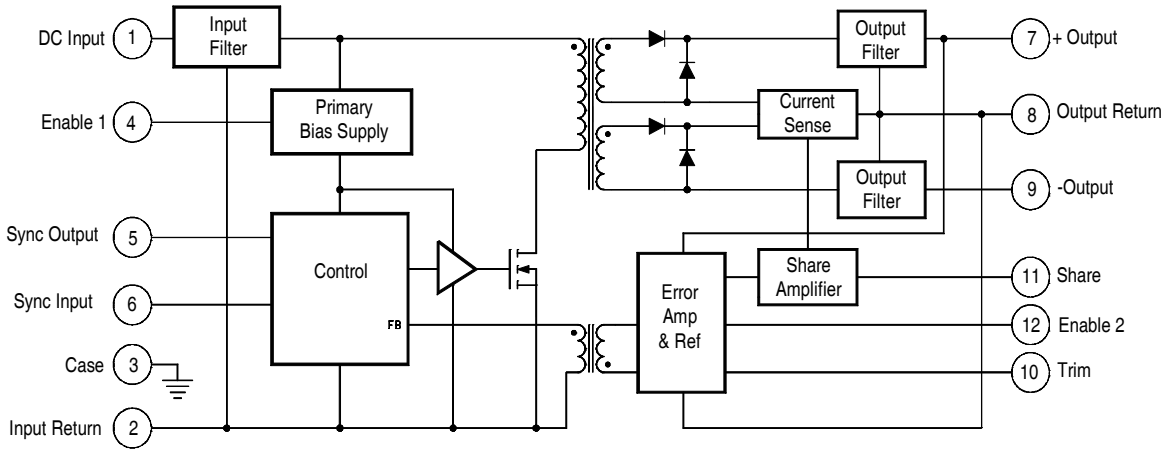
Parameter		Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
LOAD TRANSIENT RESPONSE			Notes 2, 8				
AHP2805D	Amplitude	4, 5, 6	Load Step 50% ⇔ 100%	-450		450	mV
Either Output	Recovery	4, 5, 6				200	µs
	Amplitude	4, 5, 6	Load Step 10% ⇔ 50%	-450		450	mV
	Recovery	4, 5, 6	10% ⇒ 50%			200	µs
			50% ⇒ 10%			400	µs
AHP2812D	Amplitude	4, 5, 6	Load Step 50% ⇔ 100%	-750		750	mV
Either Output	Recovery	4, 5, 6				200	µs
	Amplitude	4, 5, 6	Load Step 10% ⇔ 50%	-750		750	mV
	Recovery	4, 5, 6	10% ⇒ 50%			200	µs
			50% ⇒ 10%			400	µs
AHP2815D	Amplitude	4, 5, 6	Load Step 50% ⇔ 100%	-750		750	mV
Either Output	Recovery	4, 5, 6				200	µs
	Amplitude	4, 5, 6	Load Step 10% ⇔ 50%	-750		750	mV
	Recovery	4, 5, 6	10% ⇒ 50%			200	µs
			50% ⇒ 10%			400	µs
LINE TRANSIENT RESPONSE			Notes 1, 2, 3				
	Amplitude		V_{IN} Step = 16 ⇔ 40V	-500		500	mV
	Recovery					500	µs
TURN-ON CHARACTERISTICS			V_{IN} = 16, 28, 40V - Note 4				
	Overshoot	4, 5, 6	Enable 1, 2 on. (Pins 4, 12 high or			12	%
	Delay	4, 5, 6	open)	0	4.0	10	ms
LOAD FAULT RECOVERY			Same as Turn On Characteristics.				
LINE REJECTION			MIL-STD-461D, CS101, 30Hz to 50KHz Note 1	40	50		dB

Notes to Specifications:

1. Parameters not 100% tested but are guaranteed to the limits specified in the table.
2. Recovery time is measured from the initiation of the transient to where VOUT has returned to within ±1% of V_{out} at 50% load.
3. Line transient transition time ≥ 100 µs.
4. Turn-on delay is measured with an input voltage rise time of between 100 and 500 volts per millisecond.
5. Current limit point is that condition of excess load causing output voltage to drop to 90% of nominal.
6. Parameter verified as part of another test.
7. All electrical tests are performed with the remote sense leads connected to the output leads at the load.
8. Load transient transition time ≥ 10 µs.
9. Enable inputs internally pulled high. Nominal open circuit voltage ≈ 4.0VDC.
10. Load current split equally between +VOUT and -VOUT.
11. Output load must be distributed so that a minimum of 20% of the total output power is being provided by one of the outputs.
12. Cross regulation measured with load on tested output at 30% of maximum load while changing the load on other output from 30% to 70%.

AHP28XXD Circuit Description

Figure I. AFL Dual Output Block Diagram



Circuit Operation and Application Information

The AHP series of converters employ a forward switched mode converter topology. (refer to the block diagram in Figure I.) Operation of the device is initiated when a DC voltage whose magnitude is within the specified input voltage limits is applied between pins 1 and 2. If pin 4 is enabled (at a logical 1 or open) the primary bias supply will begin generating a regulated housekeeping voltage bringing the circuitry on the primary side of the converter to life. A power MOSFET is used to chop the DC input voltage into a high frequency square wave, applying this chopped voltage to the power transformer at the nominal converter switching frequency. By maintaining a DC voltage within specified operating range at the input, continuous generation of the bias voltage is assured.

The switched voltage impressed on the secondary output transformer windings is rectified and filtered to provide the positive and negative converter output voltages. An error amplifier on the secondary side compares the positive output voltage to a precision reference and generates an error signal proportional to the difference. This error signal is magnetically coupled through the feedback transformer into the control section of the converter varying the pulse width of the square wave signal driving the MOSFETs, narrowing the pulse width if the output voltage is too high and widening it if it is too low. These pulse width variations provide the necessary corrections to regulate the magnitude of output voltage within its' specified limits.

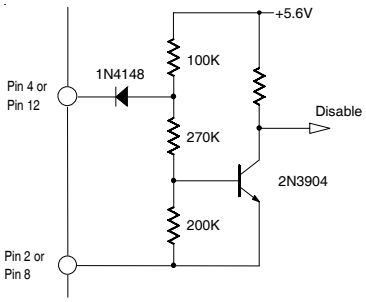
Because the primary portion of the circuit is coupled to the secondary side with magnetic elements, full isolation from input to output is maintained.

Although incorporating several sophisticated and useful ancilliary features, basic operation of the AHP28XXD series can be initiated by simply applying an input voltage to pins 1 and 2 and connecting the appropriate loads between pins 7, 8, and 9. As is the case with any high power density converter, operation should not be initiated before secure attachment to an appropriate heat dissipator. (See **Thermal Considerations,** page 7) Additional application information is provided in the paragraphs following.

Inhibiting Converter Output

As an alternative to application and removal of the DC voltage to the input, the user can control the converter output by providing TTL compatible, positive logic signals to either of two enable pins (pin 4 or 12). The distinction between these two signal ports is that enable 1 (pin 4) is referenced to the input return (pin 2) while enable 2 (pin 12) is referenced to the output return (pin 8). Thus, the user has access to an inhibit function on either side of the isolation barrier. Each port is internally pulled "high" so that when not used, an open connection on both enable pins permits normal converter operation. When their use is desired, a logical "low" on either port will shut the converter down.

Figure II. Enable Input Equivalent Circuit



Internally, these ports differ slightly in their function. In use, a low on Enable 1 completely shuts down all circuits in the converter, while a low on Enable 2 shuts down the secondary side while altering the controller duty cycle to near zero. Externally, the use of either port is transparent to the user save for minor differences in idle current. (See specification table).

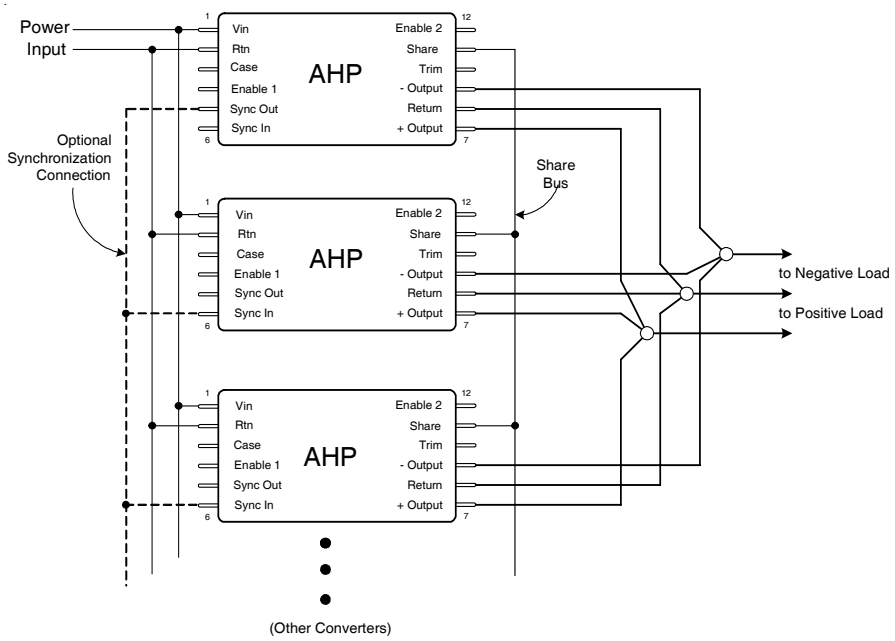
Synchronization of Multiple Converters

When operating multiple converters, system requirements often dictate operation of the converters at a common frequency. To accommodate this requirement, the AHP series converters provide both a synchronization input and output.

The sync input port permits synchronization of an AHP converter to any compatible external frequency source operating between 500 and 700 KHz. This input signal should be referenced to the input return and have a 10% to 90% duty cycle. Compatibility requires transition times less than 100 ns, maximum low level of +0.8 volts and a minimum high level of +2.0 volts. The sync output of another converter which has been designated as the master oscillator provides a convenient frequency source for this mode of operation. When external synchronization is not indicated, the sync in pin should be left open (unconnected)thereby permitting the converter to operate at its' own internally set frequency.

The sync output signal is a continuous pulse train set at 550 ±50 KHz, with a duty cycle of 15 ±5%. This signal is referenced to the input return and has been tailored to be compatible with the AFL sync input port. Transition times are less than 100 ns and the low level output impedance is less than 50 ohms. This signal is active when the DC input voltage is within the specified operating range and the converter is not inhibited. This synch output has adequate drive reserve to synchronize at least five additional converters. A typical synchronization connection option is illustrated in Figure III.

Figure III. Preferred Connection for Parallel Operation



Parallel Operation-Current and Stress Sharing

Figure III. illustrates the preferred connection scheme for operation of a set of AHP converters with outputs operating in parallel. Use of this connection permits equal current sharing among the members of a set whose load current exceeds the capacity of an individual AHP. An important feature of the AHP series operating in the parallel mode is that in addition to sharing the current, the stress induced by temperature will also be shared. Thus if one member of a paralleled set is operating at a higher case temperature, the current it provides to the load will be reduced as compensation for the temperature induced stress on that

device. When operating in the shared mode, it is important that symmetry of connection be maintained as an assurance of optimum load sharing performance. Thus, converter outputs should be connected to the load with equal lengths of wire of the same gauge and should be connected to a common physical point, preferably at the load along with the converter output and return leads. All converters in a paralleled set must have their share pins connected together. This arrangement is diagrammatically illustrated in Figure III. showing the output and return pins connected at a star point which is located as close as possible to the load.

As a consequence of the topology utilized in the current sharing circuit, the share pin may be used for other functions. In applications requiring only a single converter, the voltage appearing on the share pin may be used as a "total current monitor". The share pin open circuit voltage is nominally +1.00v at no load and increases linearly with increasing total output current to +2.20v at full load. Note that the current we refer to here is the total output current, that is, the sum of the positive and negative outout currents.

Thermal Considerations

Because of the incorporation of many innovative technological concepts, the AHP series of converters is capable of providing very high output power from a package of very small volume. These magnitudes of power density can only be obtained by combining high circuit efficiency with effective methods of heat removal from the die junctions. This requirement has been effectively addressed inside the device; but when operating at maximum loads, a significant amount of heat will be generated and this heat must be conducted away from the case. To maintain the case temperature at or below the specified maximum of 125°C, this heat must be transferred by conduction to an appropriate heat dissipater held in intimate contact with the converter base-plate.

Since the effectiveness of this heat transfer is dependent on the intimacy of the baseplate/heatsink interface, it is strongly recommended that a high thermal conductivity heat transferring medium is inserted between the baseplate and heatsink. The material most frequently utilized at the factory during all testing and burn-in processes is sold under the trade name of Sil-Pad® 400[1]. This particular product is an insulator but electrically conductive versions are also available. Use of these materials assures maximum surface contact with the heat dissipater thereby compensating for any minor surface variations. While other available types of heat conductive materials and thermal compounds provide similar effectiveness, these alternatives are often less convenient and can be somewhat messy to use.

[1]Sil-Pad is a registered Trade Mark of Bergquist, Minneapolis, MN

A conservative aid to estimating the total heat sink surface area ($A_{HEAT\ SINK}$) required to set the maximum case temperature rise (ΔT) above ambient temperature is given by the following expression:

$$A_{\text{HEAT SINK}} \approx \left\{\frac{\Delta T}{80P^{0.85}}\right\}^{-1.43} - 3.0$$

where

ΔT = Case temperature rise above ambient

P = Device dissipation in Watts = $P_{OUT}\left\{\frac{1}{Eff} - 1\right\}$

As an example, assume that it is desired to operate an AHP2815D in a still air environment where the ambient temperature is held to a constant +25°C while holding the case temperature at $T_C \leq +85°C$; then case temperature rise is

$$\Delta T = 85 - 25 = 60°C$$

From the Specification Table, the worst case full load efficiency for AHP2815D is 83% at 100 watts: thus, power dissipation at full load is given by

$$P = 100 \bullet \left\{\frac{1}{.83} - 1\right\} = 100 \bullet (0.205) = 20.5\text{W}$$

and the required heat sink area is

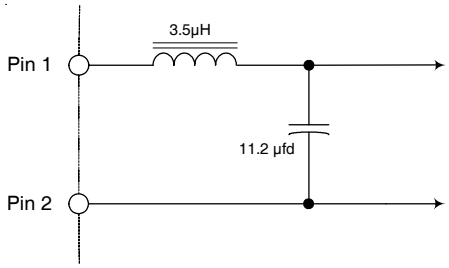
$$A_{\text{HEAT SINK}} = \left\{\frac{60}{80 \bullet 20.5^{0.85}}\right\}^{-1.43} - 3.0 = 56.3\ \text{in}^2$$

Thus, a total heat sink surface area (including fins, if any) of 56 in^2 in this example, would limit case rise to 60°C above ambient. A flat aluminum plate, 0.25" thick and of approximate dimension 4" by 7" (28 in^2 per side) would suffice for this application in a still air environment. Note that to meet the criteria in this example, both sides of the plate require unrestricted exposure to the +25°C ambient air.

Input Filter

The AHP28XXD series converters incorporate a single stage LC input filter whose elements dominate the input load impedance characteristic during the turn-on sequence. The input circuit is as shown in Figure IV.

Figure IV. Input Filter Circuit



Input Over-Voltage Protection

One additional protection feature is incorporated into the AHP input circuit. It is an input over-voltage protection. The output will shutdown and restart at approximately 110% of the maximum rated input voltage. This protection feature is unique to the AHP.

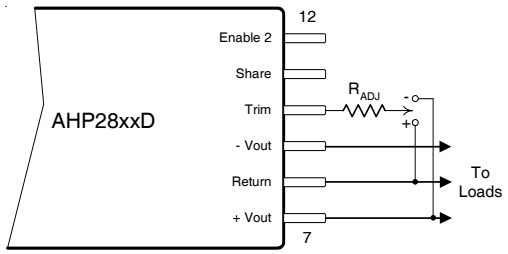
Undervoltage Lockout

A minimum voltage is required at the input of the converter to initiate operation. This voltage is set to 14.0 ± 0.5 volts. To preclude the possibility of noise or other variations at the input falsely initiating and halting converter operation, a hysteresis of approximately 1.0 volts is incorporated in this circuit. Thus if the input voltage droops to 13.0 ± 0.5 volts, the converter will shut down and remain inoperative until the input voltage returns to ≈14.0 volts.

Output Voltage Adjust

By use of the trim pin (10), the magnitude of output voltages can be adjusted over a limited range in either a positive or negative direction. Connecting a resistor between the trim pin and either the output return or the positive output will raise or lower the magnitude of output voltages. The span of output voltage adjustment is restricted to the limits shown in Table I.

Figure V. Connection for V_{OUT} Adjustment



Connect R_{adj} to + to increase, - to decrease

Table 1. Output Voltage Trim Values and Limits

AHP2805D		AHP2812D		AHP2815D	
V_{out}	R_{adj}	V_{out}	R_{adj}	V_{out}	R_{adj}
5.5	0	12.5	0	15.5	0
5.4	12.5K	12.4	47.5K	15.4	62.5K
5.3	33.3K	12.3	127K	15.3	167K
5.2	75K	12.2	285K	15.2	375K
5.1	200K	12.1	760K	15.1	1.0M
5.0	∞	12.0	∞	15.0	∞
4.9	190K	11.7	975K	14.6	1.2M
4.8	65K	11.3	288K	14.0	325K
4.7	23K	10.8	72.9K	13.5	117K
4.6	2.5K	10.6	29.9K	13.0	12.5K
4.583	0	10.417	0	12.917	0

Note that the nominal magnitude of output voltage resides in the middle of the table and the corresponding resistor value is set to ∞. To set the magnitude greater than nominal, the adjust resistor is connected to output return. To set the magnitude less than nominal, the adjust resistor is connected to the positive output. (Refer to Figure V.)

For output voltage settings that are within the limits, but between those listed in Table I, it is suggested that the resistor values be determined empirically by selection or by use of a variable resistor. The value thus determined can then be replaced with a good quality fixed resistor for permanent installation.

When use of this adjust feature is elected, the user should be aware that the temperature performance of the converter output voltage will be affected by the temperature performance of the resistor selected as the adjustment element and therefore, is advised to employ resistors with a tight temperature coefficient of resistance.

General Application Information

The AHP28XXD series of converters are capable of providing large transient currents to user loads on demand. Because the nominal input voltage range in this series is relatively low, the resulting input current demands will be correspondingly large. It is important therefore, that the line impedance be kept very low to prevent steady state and transient input currents from degrading the supply voltage between the voltage source and the converter input. In applications requiring high static currents and large transients, it is recommended that the input leads be made of adequate size to minimize resistive losses, and that a good quality capacitor of approximately100µfd be connected directly across the input terminals to assure an adequately low impedance at the input terminals. Table 2 relates nominal resistance values and selected wire sizes.

Table 2. Nominal Resistance of Cu Wire

Wire Size, AWG	Resistance per ft
24 Ga	25.7 mΩ
22 Ga	16.2 mΩ
20 Ga	10.1 mΩ
18 Ga	6.4 mΩ
16 Ga	4.0 mΩ
14 Ga	2.5 mΩ
12 Ga	1.6 mΩ

As an example of the effects of parasitic resistance, consider an AHP2815D operating at full power of 100 W. From the specification sheet, this device has a minimum efficiency of 83% which represents an input power of more than 120 W. If we consider the case where line voltage is at its' minimum of 16 volts, the steady state input current necessary for this example will be slightly greater than 7.5 Amps.

If this device were connected to a voltage source with 10 feet of 20 gauge wire, the round trip (input and return) would result in 0.2 Ω of resistance and 1.5 volts of drop from the source to the converter. To assure 16 volts at the input, a source closer to 18 volts would be required. In applications using the paralleling option, this drop will be multiplied by the number of paralleled devices. By choosing 14 or 16 gauge wire in this example, the parasitic resistance and resulting voltage drop will be reduced to 25% or 31% of that with 20 gauge wire.

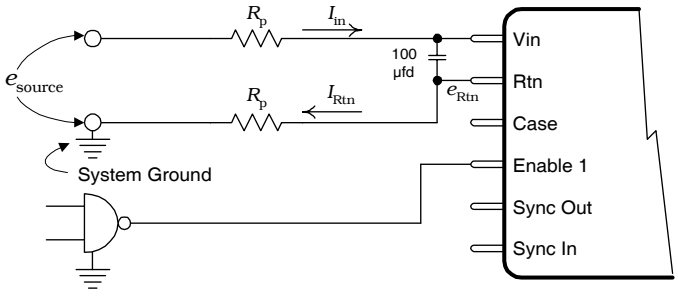
Another potential problem resulting from parasitically induced voltage drop on the input lines is with regard to the operation of the enable 1 port. The minimum and maximum operating levels required to operate this port are specified with respect to the input common return line at the converter. If a logic signal is generated with respect to a 'common' that is distant from the converter, the effects of the voltage drop over the return line must be considered when establishing the worst case TTL switching levels. These drops will effectively impart a shift to the logic levels. In Figure VI, it can be seen that referred to system ground, the voltage on the input return pin is given by

$$e_{Rtn} = I_{Rtn} \bullet R_P$$

Therefore, the logic signal level generated in the system must be capable of a TTL logic high plus sufficient additional amplitude to overcome e_{Rtn}. When the converter is inhibited, I_{Rtn} diminishes to near zero and e_{Rtn} will then be at system ground.

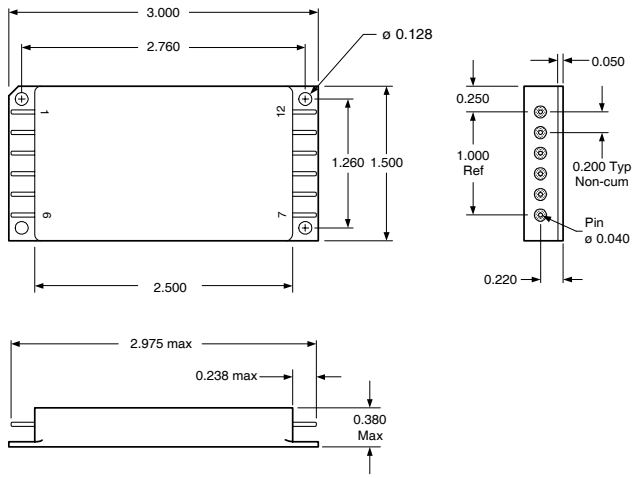
Incorporation of a 100 µfd capacitor at the input terminals is recommended as compensation for the dynamic effects of the parasitic resistance of the input cable reacting with the complex impedance of the converter input, and to provide an energy reservoir for transient input current requirements.

Figure VI. Problems of Parasitic Resistance in input Leads



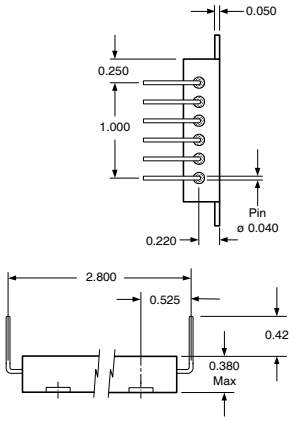
AHP28XXD Case Outlines

Case X

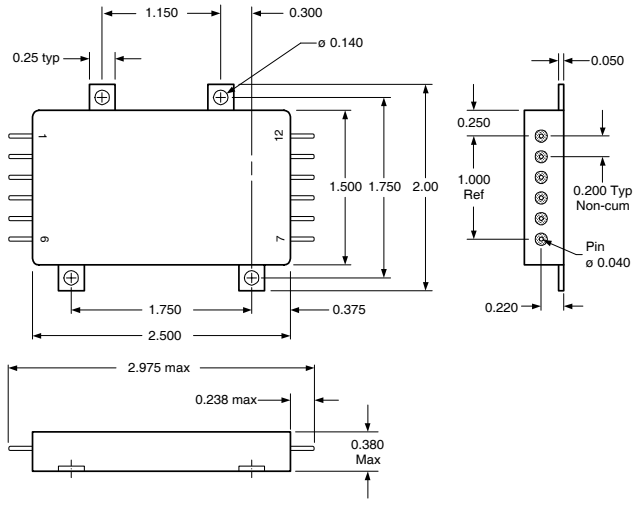


Case W

Pin Variation of Case Y

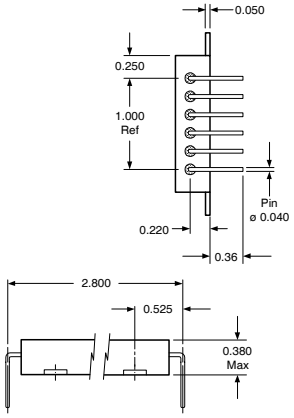


Case Y



Case Z

Pin Variation of Case Y



Tolerances, unless otherwise specified: .XX = ±0.010
.XXX = ±0.005

BERYLLIA WARNING: These converters are hermetically sealed; however they contain BeO substrates and should not be ground or subjected to any other operations including exposure to acids, which may produce Beryllium dust or fumes containing Beryllium

Available Screening Levels and Process Variations for AHP28XXD Series.

Requirement	MIL-STD-883 Method	No Suffix	ES Suffix	HB Suffix	CH Suffix
Temperature Range		-20°C to +85°C	-55°C to +125°C	-55°C to +125°C	-55°C to +125°C
Element Evaluation					MIL-H-38534
Internal Visual	2017	*	✓	✓	✓
Temperature Cycle	1010		Cond B	Cond C	Cond C
Constant Acceleration	2001, Y1 Axis		500g	3000g	3000g
Burn-in	1015	48hrs @ 85°C	48hrs @ 125°C	160hrs @ 125°C	160hrs @ 125°C
Final Electrical (Group A)	MIL-PRF-38534 Specification	25°C	25°C	-55, +25, +125°C	-55, +25, +125°C
Seal, Fine & Gross	1014	Cond C	Cond A, C	Cond A, C	Cond A, C
External Visual	2009	*	✓	✓	✓

* per Commercial Standards

AHP28XXD Pin Designation

Pin No.	Designation
1	Positive Input
2	Input Return
3	Case
4	Enable 1
5	Sync Output
6	Sync Input
7	Positive Output
8	Output Return
9	Negative Output
10	Output Voltage Trim
11	Share
12	Enable 2

Part Numbering

AHP 28 05 D X / CH

- Model
- Input Voltage
  - 28 = 28V
  - 270 = 270V
- Output Voltage
  - 05 = 5V, 12 = 12V
  - 15 = 15V
- Outputs
  - S = Single
  - D = Dual
- Case Style
  - W, X, Y, Z
- Screening Level
  - ES, HB, CH
  - Blank = min screening

International
IOR Rectifier

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Data and specifications subject to change without notice. 04/2009