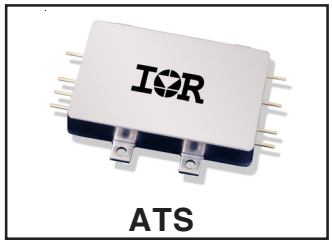
International
IOR Rectifier

PD-97221B

ATS SERIES

28V Input, Single/Dual Output

HIGH RELIABILITY DC-DC CONVERTER



ATS

Description

The ATS Series DC-DC converters are a family of 25W, single and dual output, high reliability devices designed for rugged environments and extended temperature operations such as those encountered in military, aerospace and industrial applications. The converters are in full compliant with CE03 and CS01 of MIL-STD-461C. Features include small size, low weight and conservative component stress de-rating. For operations in radiation environments, the M3L series with the identical form factor and electrical rating is recommended.

All models include an external inhibit port and have an adjustable output voltage. They are enclosed in a hermetic 1.5" x 2.3" x .425" steel package and weight less than 85grams. The package utilizes rugged ceramic feed-thru copper core pins and is sealed using parallel seam welding.

Manufactured in a facility fully qualified to MIL-PRF-38534, these converters are fabricated utilizing DLA Land and Maritime qualified processes. For available screening options, refer to device screening table in the data sheet.

Features

- 16V to 50V DC Input Range
- Input Transient per MIL-STD-704D
- Up to 25W Output Power
- Single and Dual Output Models Include 3.3V, 5V, 12V, 15V, ±5V, ±12V and ±15V
- Internal EMI Filter; Converter Capable of Meeting MIL-STD-461C CE03 and CS01
- Magnetically Coupled Feedback
- High Efficiency - to 82%
- -55°C to +125°C Operating Temperature Range
- 100MΩ @ 500VDC Isolation
- Under-Voltage Lockout
- Short Circuit and Overload Protection
- Output Over Voltage Limiter
- Adjustable Output Voltage
- External Inhibit
- 1,000,000 Hour MTBF
- Low Weight, < 85 grams

Applications

- Military Aircraft
- Commercial Aircraft
- Missiles
- Ground Equipment

Circuit Description

The ATS Series converters utilize a single-ended forward topology with resonant reset. The nominal switching frequency is 500KHz. Electrical isolation and tight output regulation are achieved through the use of a magnetically coupled feedback. Voltage feed-forward with duty factor limiting provides high line rejection and protection against output over voltage in the event of an internal control loop failure. This mechanism limits the maximum output voltage to approximately 20% over the nominal regardless of the line voltage.

An internal EMI filter allows the converter to meet the conducted emissions requirements of MIL-STD-461C on the input power leads. A single-stage output filter reduces the typical output ripple to less than 50mV peak-to-peak. Output current is limited under any load fault condition to approximately 125% of rated.

An overload condition causes the converter output to behave like a constant current source with the output voltage dropping below nominal. The converter will resume normal operation when the load current is reduced below the current limit point. This protects the converter from both overload and short circuit conditions. The current limit point exhibits a slightly negative temperature coefficient to reduce the possibility of thermal runaway.

An external inhibit port is provided to control converter operation. The converter's operation is inhibited when this pin is pulled low. It is designed to be driven by an open collector logic device. The pin may be left open for normal operation and has a nominal open circuit voltage of 10.5V with respect to the input return (pin 2). The output voltage of all models can be adjusted using a single external resistor.

Absolute Maximum Ratings		Recommended Operating Conditions	
Input voltage range	-0.5Vdc to +75Vdc	Input voltage range	+16Vdc to +50Vdc
Output power	Internally limited	Input voltage range[1]	+16Vdc to +38Vdc
Lead temperature	+300°C for 10 seconds	Output power	0 to Max. Rated
Operating case temperature	-55°C to +125°C	Operating temperature[2]	-55°C to +125°C
Storage temperature	-55°C to +135°C	Operating temperature[1]	-55°C to +70°C

[1] Meets derating per MIL-STD-975
[2] For operation at +125°C see table note 13

Electrical Performance Characteristics

Parameter	Group A Subgroup	Conditions -55°C ≤ T_C ≤ +85°C V_{IN} = 28V DC ± 5%, C_L = 0 unless otherwise specified	Limits			Unit
			Min	Nom	Max	
Input Voltage			16	28	50	V
Output Voltage (Vout)						
ATS2803R3S	1	I_{OUT} = 100% rated load	3.27	3.30	3.33	
ATS2805S	1	Note 4	4.95	5.00	5.05	
ATS2812S	1		11.88	12.00	12.12	
ATS2815S	1		14.85	15.00	15.15	V
ATS2805D	1		±4.95	±5.00	±5.05	
ATS2812D	1		±11.88	±12.00	±12.12	
ATS2815D	1		±14.85	±15.00	±15.15	
ATS2803R3S	2,3	I_{OUT} = 100% rated load	3.23		3.37	
ATS2805S	2,3	Note 4	4.90		5.10	
ATS2812S	2,3		11.76		12.24	
ATS2815S	2,3		14.70		15.30	V
ATS2805D	2,3		±4.90		±5.10	
ATS2812D	2,3		±11.76		±12.24	
ATS2815D	2,3		±14.70		±15.30	
Output power (P_{OUT})						
ATS2803R3S	1,2,3	V_{IN} = 16, 28, 50 Volts, Note 2	0		20	W
All Others			0		25	
Output current (I_{OUT})						
ATS2803R3S	1,2,3	V_{IN} = 16, 28, 50 Volts, Note 2	0		6.06	
ATS2805S			0		5.00	
ATS2812S			0		2.08	
ATS2815S			0		1.67	A
ATS2805D		Either Output, Note 3	0		4.00	
ATS2812D		Either Output, Note 3	0		1.67	
ATS2815D		Either Output, Note 3	0		1.33	
Line regulation (VR_{LINE})	1,2,3	V_{IN} = 16, 28, 50 Volts I_{OUT} = 0, 50%, 100% rated, Note 4	-0.5		0.5	%
Load regulation (VR_{LOAD})	1,2,3	I_{OUT} = 0, 50%, 100% rated, Note 4 V_{IN} = 16, 28, 50 Volts	-1.0		1.0	%
Cross regulation (VR_{CROSS})						
ATS2805D	1,2,3	V_{IN} = 16, 28, 50 Volts	-5.0		5.0	
ATS2812D		Duals only, Note 5	-3.0		3.0	%
ATS2815D			-3.0		3.0	

For Notes to Electrical Performance Characteristics Table, refer to page 5

Electrical Performance Characteristics (continued)

Parameter	Group A Subgroup	Conditions -55°C ≤ T_C ≤ +85°C V_{IN} = 28V DC ± 5%, C_L = 0 unless otherwise specified	Limits			Unit
			Min	Nom	Max	
Input current, no load (I_{IN})						
ATS2803R3S	1,2,3	I_{OUT} = 0, Pin 4 open			60	
ATS2805S					70	
ATS2812S					70	
ATS2815S					70	mA
ATS2805D					70	
ATS2812D					100	
ATS2815D					100	
Input current inhibited	1,2,3	Pin 4 shorted to pin 2			8.0	mA
Output ripple (V_{RIP})						
ATS2803R3S	1,2,3	V_{IN} = 16, 28, 50 Volts			35	
ATS2805S		I_{OUT} = 100% rated load			50	
ATS2812S		Notes 4, 6			70	
ATS2815S					80	mV p-p
ATS2805D					80	
ATS2812D					80	
ATS2815D					80	
Switching frequency (F_S)	1,2,3	Sync. Input (Pin 4) open	425	500	575	KHz
Efficiency (E_{FF})						
ATS2803R3S	1,2,3	I_{OUT} = 100% rated load	68	75		
ATS2805S		Note 4	75	79		
ATS2812S			75	80		
ATS2815S			75	81		%
ATS2805D			75	79		
ATS2812D			75	79		
ATS2815D			75	80		
Enable Input (Inhibit Function)						
open circuit voltage	1,2,3	Note 1	9.5		11.5	V
drive current (sink)					500	µA
voltage range			-0.5		50	V
Current Limit Point Expressed as a percentage of full rated load current	1,2,3	V_{out} = 90% of Nominal, Note 4	105		130	%
Power dissipation, load fault (P_D)	1,2,3	Short Circuit, Overload, Note 8			14	W
Output response to step load changes (V_{TLD})	4,5,6	Half Load to/from Full Load, Notes 4,9	-300		300	mV pk
Recovery time, step load changes (T_{TLD})	4,5,6	Half Load to/from Full Load, Note 4,9,10			200	µs
Output response to step line changes (V_{TLN})	4,5,6	16V to/from 50V I_{OUT} = 100% rated load, Notes 1,4,11	-300		300	mV pk
Recovery Time, step line changes (T_{TLN})	4,5,6	16V to/from 50V I_{OUT} = 100% rated load, Notes 1,4,10,11			200	µs
Turn-on Response						
Overshoot (V_{OS})	4,5,6	No Load, Full Load			500	mV
Turn-on Delay (T_{DLY})		Notes 4,12	2.0		10	ms

For Notes to Electrical Performance Characteristics Table, refer to page 5

Electrical Performance Characteristics (continued)

Parameter	Group A Subgroup	Conditions -55°C ≤ T_C ≤ +85°C V_{IN} = 28V DC ± 5%, C_L = 0 unless otherwise specified	Limits			Unit
			Min	Nom	Max	
Capacitive Load (CL) ATS2803R3S ATS2805S ATS2812S ATS2815S ATS2805D ATS2812D ATS2815D	1	I_{OUT} = 100% rated load No effect on DC performance Notes 1, 4, 7 Each output on duals			 2200 1000 180 120 500 90 60	 µF
Line Rejection	1	I_{OUT} = 100% rated load DC to 50KHz, Notes 1, 4	40	50		dB
Isolation	1	Input to Output or Any Pin to Case except pin 3, test @ 500VDC	100			MΩ
Device Weight					85	g
MTBF		MIL-HDBK-217F2, GM, 35°C	1.0 X10^6			Hr

Notes for Electrical Performance Characteristics Table

1. Parameter is tested as part of design characterization or after design changes. Thereafter, parameter shall be guaranteed to the limits specified.
2. Parameter verified during line and load regulation tests.
3. Output load current must be distributed such that at least 20% of the total load current is being provided by one of the outputs.
4. Load current split equally between outputs on dual output models.
5. Cross regulation is measured with 20% rated load on output under test while changing the load on the other output from 20% to 80% of rated.
6. Guaranteed for a D.C. to 20MHz bandwidth. Tested using a 20KHz to 10MHz bandwidth using the circuit on page 6.
7. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive load in excess of the maximum limit may interfere with the proper operation of the converter's overload protection, causing erratic behavior during turn-on.
8. Overload power dissipation is defined as the device power dissipation with the load set such that V_{OUT} = 90% of nominal.
9. Load step transition time ≥ 10µs.
10. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1.0% of its steady state value.
11. Line step transition time ≥ 100µs.
12. Turn-on delay time from either a step application of input power or a logic low to a logic high transition on the inhibit pin (pin 4) to the point where V_{OUT} = 90% of nominal.
13. For operation at temperatures between +85°C and +125°C, derate the maximum input voltage linearly from 100% to 75%.

Circuit for Measuring Output Ripple Voltage

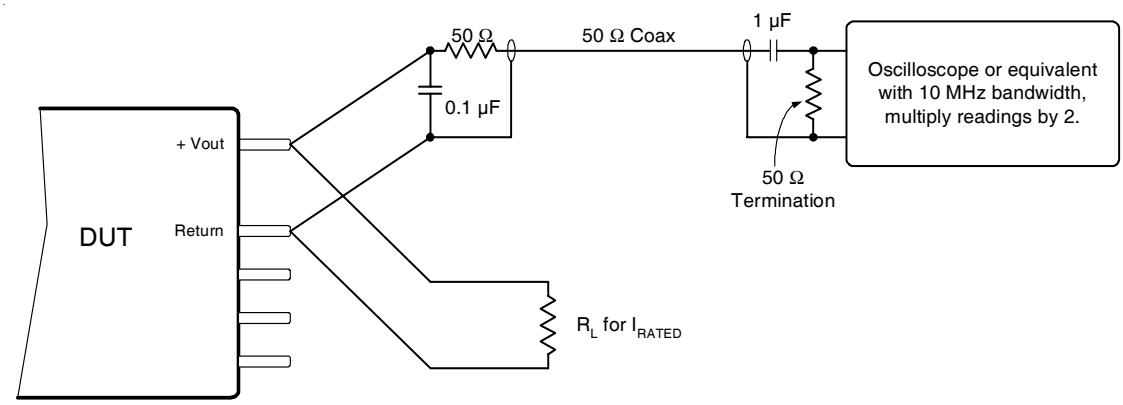


Figure 1. Conducted Emissions, Normal Mode

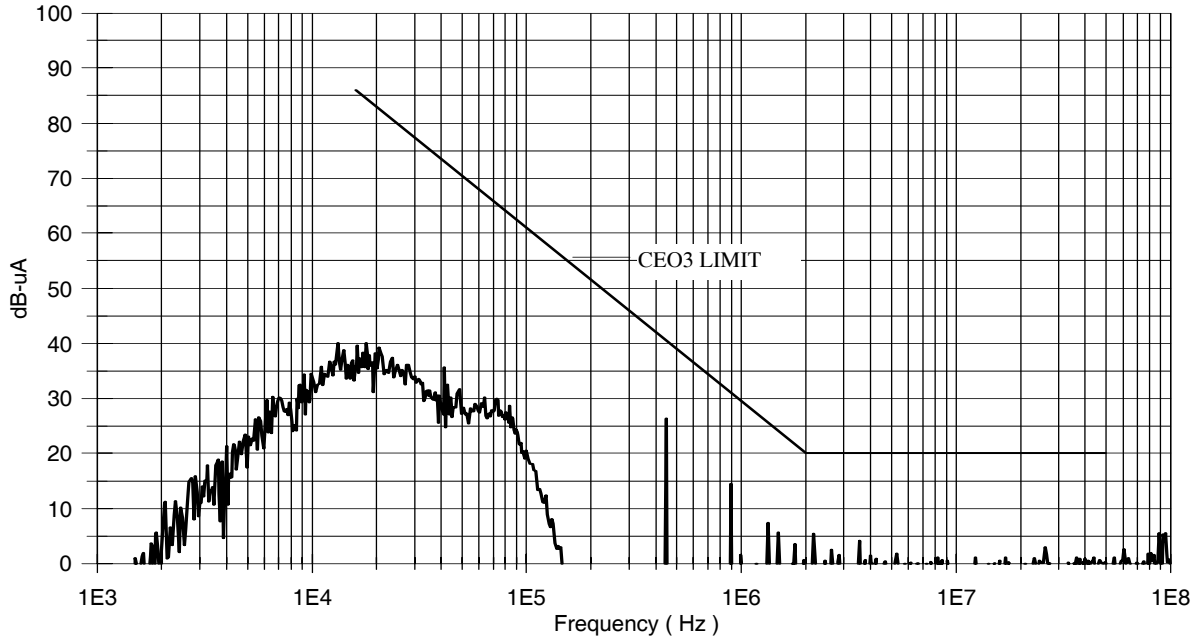


Figure 2. Conducted Emissions, Common Mode

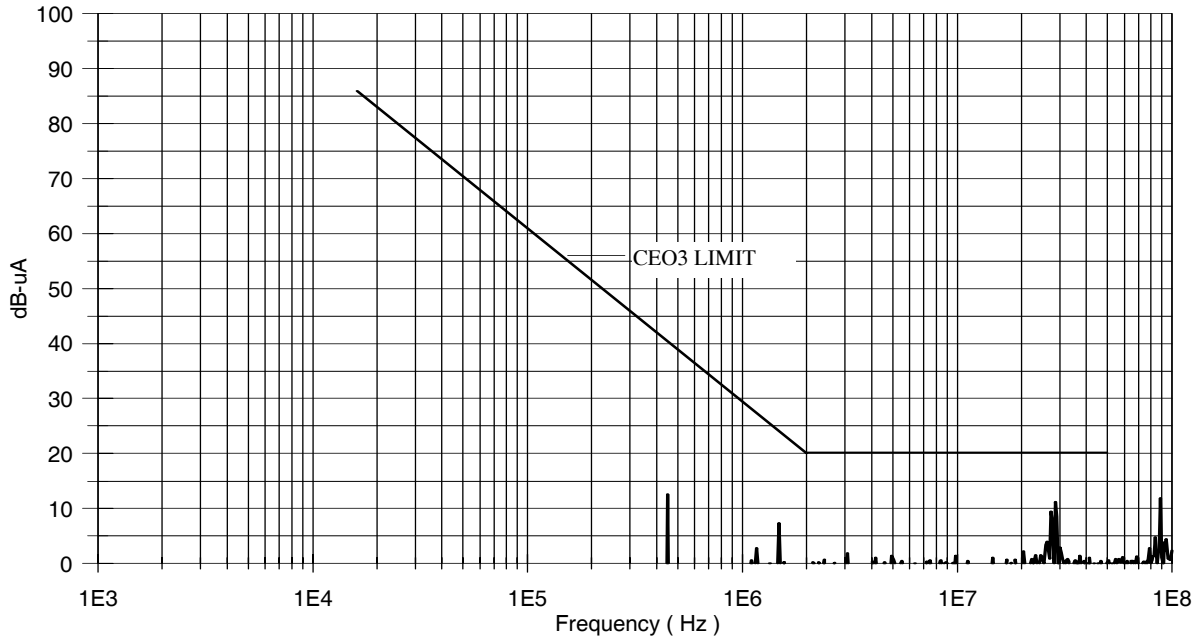


Figure 3. Block Diagram - Single Output

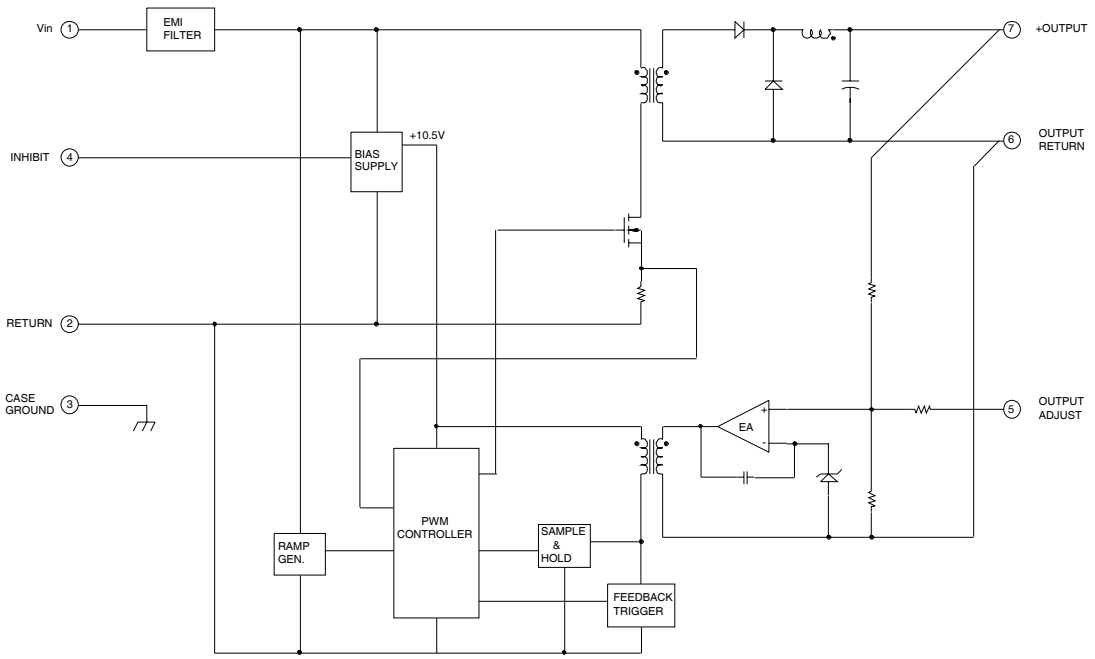
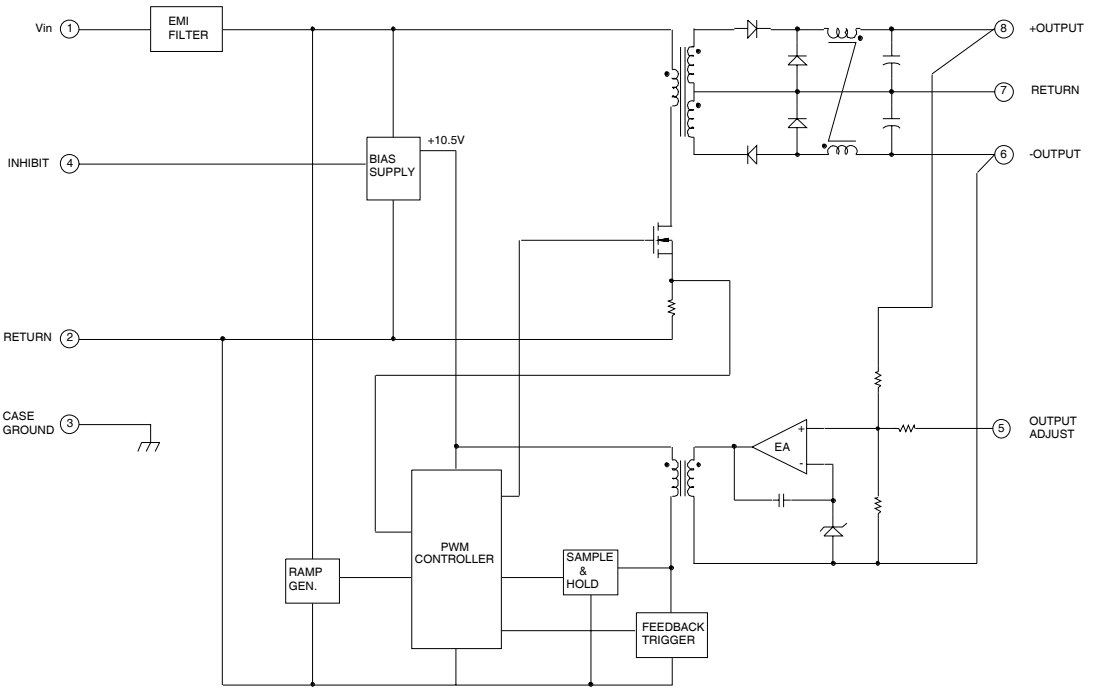
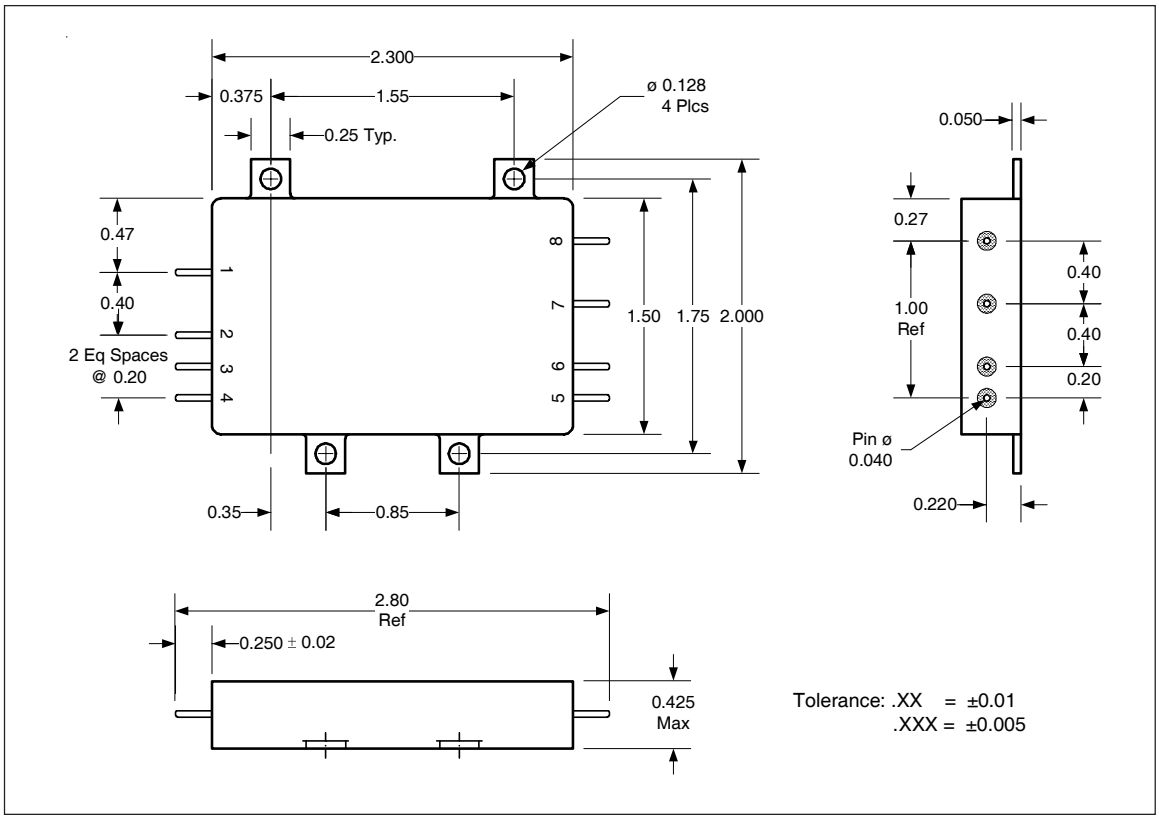


Figure 4. Block Diagram - Dual Output



Mechanical Outline



Pin Designation (Single/Dual)

Pin #	Single	Dual
1	+ Input	+ Input
2	Input Return	Input Return
3	Case	Case
4	Inhibit	Inhibit
5	Output Adjust	Output Adjust
6	Output Return	- Vout
7	+ Vout	Output Return
8	NC	+ Vout

Device Screening

Requirement	MIL-STD-883 Method	No Suffix	ES ②	HB	CH
Temperature Range	—	-20°C to +85°C	-55°C to +85°C	-55°C to +85°C	-55°C to +85°C
Element Evaluation	MIL-PRF-38534	N/A	N/A	N/A	Class H
Non-Destructive Bond Pull	2023	N/A	N/A	N/A	N/A
Internal Visual	2017	①	Yes	Yes	Yes
Temperature Cycle	1010	N/A	Cond B	Cond C	Cond C
Constant Acceleration	2001, Y1 Axis	N/A	500 Gs	3000 Gs	3000 Gs
PIND	2020	N/A	N/A	N/A	N/A
Burn-In	1015	N/A	48 hrs@hi temp	160 hrs@125°C	160 hrs@125°C
Final Electrical (Group A)	MIL-PRF-38534 & Specification	25°C	25°C ②	-55°C, +25°C, +85°C	-55°C, +25°C, +85°C
PDA	MIL-PRF-38534	N/A	N/A	N/A	10%
Seal, Fine and Gross	1014	Cond A	Cond A, C	Cond A, C	Cond A, C
Radiographic	2012	N/A	N/A	N/A	N/A
External Visual	2009	①	Yes	Yes	Yes

Notes:
① Best commercial practice
② Sample tests at low and high temperatures

Part Numbering

ATS 28 05 S /CH

Model

Input Voltage
28 = 28V

Output Voltage
Single: 03R3 = 3.3V, 05 = 5V
12 = 12V, 15 = 15V
Dual: 05 = ±5V, 12 = ±12V
15 = ±15V

Output
S = Single
D = Dual

Screening Level
(Please refer to Screening Table)
No Suffix, ES, HB, CH

International
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