

**ADVANCED ANALOG  
RADIATION TOLERANT  
DC/DC CONVERTERS**

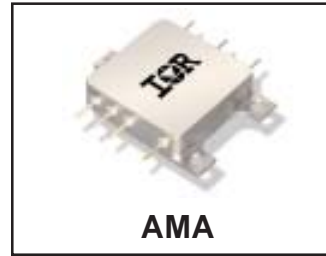
**AMA28XXD SERIES  
28V Input, Dual Output**

**Description**

The AMA28XXD series of DC/DC converter modules has been specifically designed for operation in moderate radiation environments supplementing the higher radiation performance available in the Advanced Analog ART2815T converter series. Environments presented to space vehicles operating in low earth orbits, launch boosters, orbiting space stations and similar applications requiring a low power, high performance converter with moderate radiation hardness performance will be optimally served by the AMA28XXD Series.

The physical configuration of the AMA28XXD series permits mounting directly to a heat conduction surface without the necessity of signal leads penetrating the heat sink surface. This package configuration permits greater independence in mounting and more mechanical security than traditional packages. Advanced Analog's rugged ceramic seal pins are used exclusively in the package thereby assuring long term hermeticity.

The AMA28XXD has been designed for high density using chip and wire hybrid technology that complies with the class H requirements of MIL-PRF-38534. Finished product will be fabricated in a facility fully qualified to MIL-PRF-38534. The standard processing adopted for the AMA28XXD is an enhancement of the requirements of MIL-PRF-38534 for class H and includes element evaluation. Applicable generic lot qualification test data including radiation performance can be made available on request. Variations to the standard screening can be accommodated. Consult Advanced Analog for special requirements.



**Features**

- 5 Watts Output Power
- Available in  $\pm 5$ ,  $\pm 12$  and  $\pm 15$  Volt Outputs
- 16 - 40 VDC Input Range (28 VDC Nominal)
- Total Ionizing Dose > 25KRads (Si)
- No SEE to LET > 60 MeV-cm<sup>2</sup>/mg
- -55°C to +125°C Operating Range
- Indefinite Short Circuit Protection
- Flexible Mounting
- Fully Isolated - Input to Output and to Case
- Complimentary EMI Filter Available
- Electrical Performance Similar to ASA28XXD Series

## AMA28XXD Series

### Specifications

International  
IRF Rectifier

<b>Absolute Maximum Ratings</b>	
Input Voltage Range	-0.5V to +50VDC (Continuous), 80V (100ms)
Soldering Temperature	300°C for 10 seconds
Storage Case Temperature	65°C to +135°C
<b>Recommended Operating Conditions</b>	
Input Voltage Range	+16V to +40VDC
Output Power	Less than or equal to 5W
Operating Case Temperature	-55°C to +125°C

**Static Characteristics**  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$ ,  $V_{\text{IN}}=28 \text{ VDC} \pm 5\%$ ,  $C_L=0$ , unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
<b>Input Voltage</b>			16	28	40	V
<b>Output Voltage</b>		$V_{\text{in}} = 28 \text{ Volts}$ , 20% load on both outputs				
AMA2805D	1		$\pm 4.95$	$\pm 5.00$	$\pm 5.05$	V
AMA2812D	1		$\pm 11.88$	$\pm 12.00$	$\pm 12.12$	V
AMA2815D	1		$\pm 14.85$	$\pm 15.00$	$\pm 15.15$	V
AMA2805D	2, 3		$\pm 4.90$		$\pm 5.10$	V
AMA2812D	2, 3		$\pm 11.76$		$\pm 12.24$	V
AMA2815D	2, 3		$\pm 14.70$		$\pm 15.30$	V
<b>Output Current</b> <sup>1,2</sup>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ each output				
AMA2805D	1, 2, 3	each output	200		800	mA
AMA2812D	1, 2, 3	each output	83		333	mA
AMA2815D	1, 2, 3	each output	67		267	mA
<b>Output Power</b> <sup>1,2</sup>	1, 2, 3	$V_{\text{in}} = 28 \text{ Volts}$ , 100% load			5	W
<b>Output Ripple Voltage</b> <sup>1,3</sup>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ 100% load BW = 20 Hz to 2 MHz				
AMA2805D	1, 2, 3				200	mV <sub>PP</sub>
AMA2812D	1, 2, 3				200	mV <sub>PP</sub>
AMA2815D	1, 2, 3				290	mV <sub>PP</sub>
<b>Output Voltage Regulation</b> <sup>3</sup>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ load = 10, 50%, 100% load				
Line		1, 2, 3		$\pm 10$	$\pm 25$	mV
	AMA2805D	1, 2, 3		$\pm 10$	$\pm 50$	mV
	AMA2812D AMA2815D	1, 2, 3		$\pm 10$	$\pm 50$	mV
Load		1, 2, 3		$\pm 10$	$\pm 50$	mV
	AMA2805D	1, 2, 3		$\pm 10$	$\pm 50$	mV
	AMA2812D AMA2815D	1, 2, 3		$\pm 10$	$\pm 50$	mV

For Notes to Specifications, refer to page 4

**Static Characteristics** (Continued)  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$ ,  $V_{\text{IN}}=28 V_{\text{DC}} \pm 5\%$ ,  $C_L=0$ , unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
<b>Cross Regulation</b> <sup>5</sup>		Minimum 1.0 watt on both outputs 20%-80% load				
AMA2805D	1, 2, 3				15	%
AMA2812D	1, 2, 3				8	%
AMA2815D	1, 2, 3				8	%
<b>Input Current</b>		$V_{\text{in}}=28\text{V}$ , $I_{\text{out}}=0$ , Inhibit (pin 5)=open		35	60	mA
No Load	1, 2, 3					
Inhibit	1, 2, 3	Inhibit (pin 5) shorted to input return (pin 7)			12	mA
<b>Input Ripple Current</b> <sup>3</sup>		$V_{\text{in}} = 16, 28, 40$ Volts, 100% load, BW = 20 Hz to 2 MHz				
AMA2805D	1, 2, 3				100	mA <sub>PP</sub>
AMA2812D	1, 2, 3				100	mA <sub>PP</sub>
AMA2815D	1, 2, 3				100	mA <sub>PP</sub>
<b>Efficiency</b> <sup>3</sup>		100% load				
AMA2805D	1, 3		66			%
AMA2812D	1, 3		71			%
AMA2815D	1, 3		71			%
AMA2805D	2		60			%
AMA2812D	2		68			%
AMA2815D	2		68			%
<b>Isolation</b>	1	Input to output or any pin to case (except pin 8) at 500Vdc	100			MΩ
<b>Capacitive Load</b> <sup>5,6</sup>		No effect on dc performance, total for both outputs				
AMA2805D	4				500	uF
AMA2812D	4				200	uF
AMA2815D	4				200	uF
<b>Short Circuit Power Dissipation</b>	1, 2, 3				4	watts
<b>MTBF</b>		MIL-HDBK-217F, SF @ 35°C	750			Khrs
<b>Weight</b>					32	g

For Notes to Specifications, refer to page 4

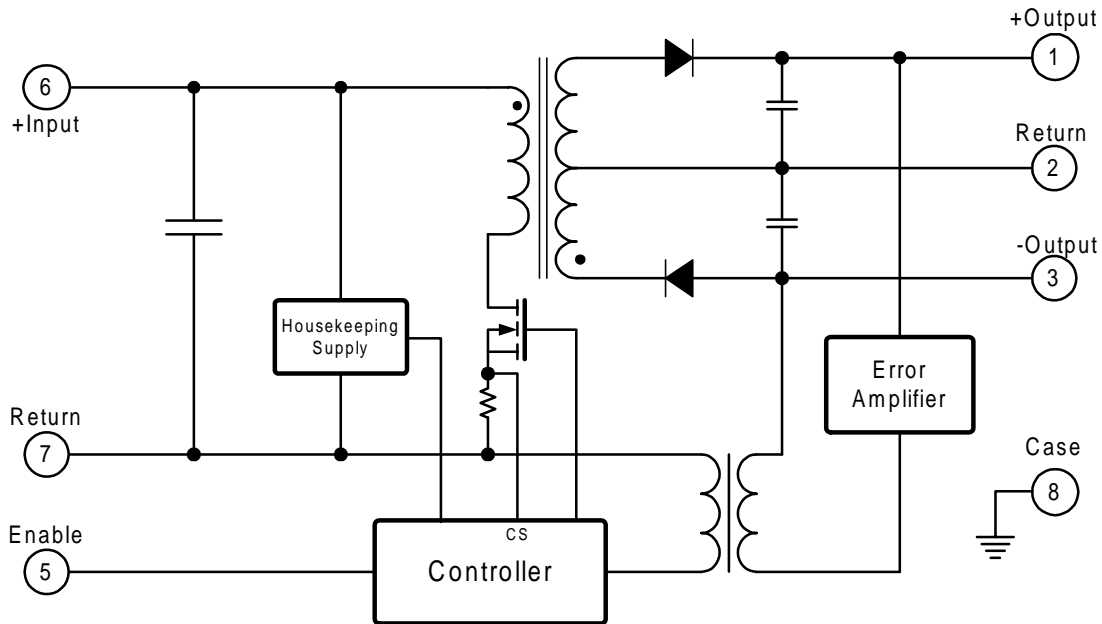
**Dynamic Characteristics**  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$ ,  $V_{\text{IN}}=28 \text{ V}_{\text{DC}} \pm 5\%$ ,  $C_{\text{L}}=0$ , unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit	
Short Circuit Recovery <sup>6</sup>	4, 5, 6	0% load to 100% load			25	ms	
Switching Frequency <sup>3</sup>	4, 5, 6	100% load	500	550	600	KHz	
Output Response To Step Transient Load Changes <sup>3,7</sup>	4, 5, 6	Load step 50% ⇔ 100%	-400		+400	mV pk	
	4, 5, 6	Load step 0% ⇔ 50%	-800		+800	mv pk	
Recovery Time, Step Transient Load Changes <sup>3,7,8</sup>	4, 5, 6	Load step 50% ⇔ 100%			100	μs	
	4, 5, 6	Load step 0% ⇔ 50%			2000	μs	
Output Response Transient Step Line Changes <sup>3,6,9</sup>		Input step 16 ⇔ 40Vdc, 100% load					
	AMA2805D		4, 5, 6	-550		+550	mV pk
	AMA2812D		4, 5, 6	-750		+750	mV pk
	AMA2815D		4, 5, 6	-750		+750	mv pk
Recovery Time Transient Step Line Changes <sup>3,6,9</sup>	4, 5, 6	Input step 16 ⇔ 40Vdc, 100% load			1200	μs	
Turn On Overshoot <sup>3,10</sup>	4, 5, 6	0% load			600	mV pk	
	4, 5, 6	100% load			400	mV pk	
Turn On Delay <sup>3,10</sup>	4, 5, 6	0% load to 100% load			25	ms	

Notes to Specifications

1. Applicable to positive and negative outputs.
2. Maximum combined output is 5 watts. 4 watts (max.) is available from either output (80%).
3. Load current split equally between  $+V_{\text{OUT}}$  and  $-V_{\text{OUT}}$ .
4. 1.0 watt load on output under test, 1.0 watt to 4.0 watt load change on other output.
5. Capacitive value may be any value from 0 to the maximum limit without compromising DC performance. A capacitive load in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
6. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limit specified.
7. Load step transition time between 2 and 10 microseconds.
8. Recovery time is measured from initiation of the transient to where  $V_{\text{out}}$  has returned to within  $\pm 1\%$  of  $V_{\text{out}}$  at 50% load.
9. Input step transient time between 1 and 10 microseconds.
10. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin while power is applied to the input.

**AMA28XXD Block Diagram**



**Application Information**

**Inhibit Function**

Connecting the enable input (Pin 5) to input common (Pin 7) will cause the converter to shut down. It is recommended that the enable pin be driven by an open collector device capable of sinking at least 400  $\mu$ A of current. The open circuit voltage of the inhibit input is  $10.0 + 1 V_{DC}$ .

**EMI Filter**

An optional EMI filter is available (ASF461 or AFH461) will reduce the input ripple current to levels below the limits imposed by MIL-STD-461 CE03.

**Thermal Considerations**

Irrespective of the fact that the AMA28XXD series of converters are relatively low power devices and are designed to provide efficient voltage conversion, there will be some heat generated during normal operation. To avoid a continuous thermal rise that may eventually exceed the maximum case temperature rating and to maintain a safe operating environment for the internal components, these converters should be attached to a heat conducting surface allowing a continuous flow of the heat away from the base plate. This becomes more important when operating in the near vacuum environment of space which provides no alternate heat radiating path.

**Standard Process Screening for AMA28XXD Series**

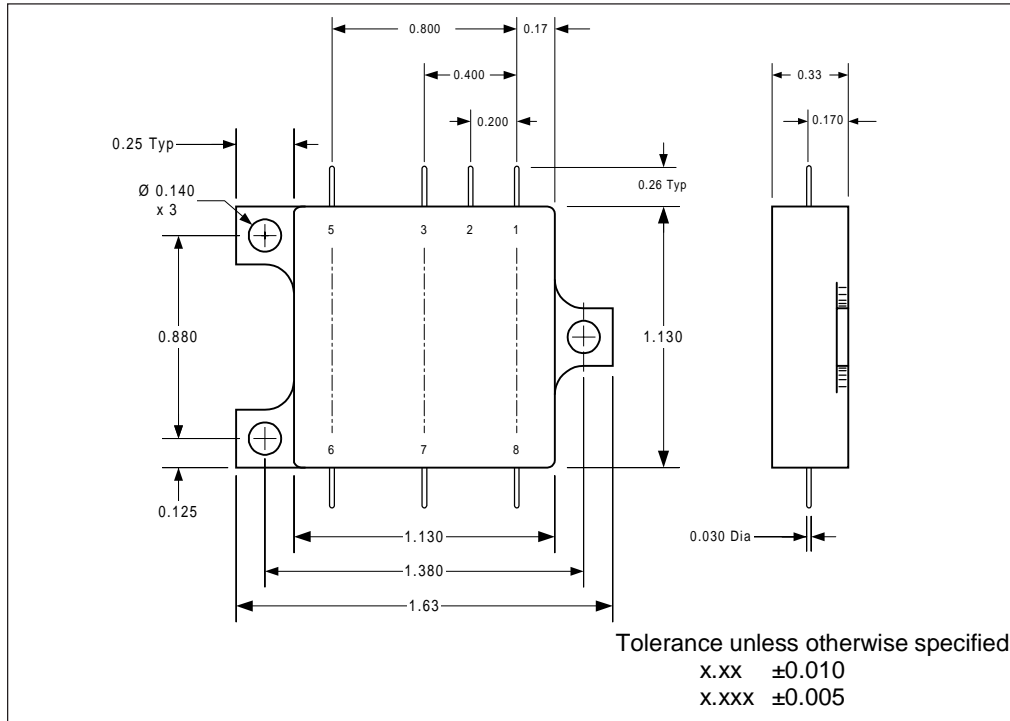
Requirement	MIL-STD-883 Method	/EM Screening	Flight Screening CH+ Limits
Baseplate Temperature Range		-55°C to +125°C	-55°C to +125°C
Element Evaluation		—	MIL-PRF-38534 Class H
Internal Visual	2017	*	Yes
Temperature Cycle	1010	—	Condition C
Constant Acceleration	2001	—	Condition A, (3000g)
PIND	2020	—	Condition A
1 <sup>st</sup> Burn-in	1015	—	160 hrs @ +125°C
Interim Electrical		+25°C	+25°C
2 <sup>nd</sup> Burn-in	1015	48 hrs @ +125°C	160 hrs @ +125°C
Final Electrical (Group A) Read & Record Data	MIL-PRF-38534 & Specification	-55°C, +25°C, +125°C	-55°C, +25°C, +125°C
PDA (25°C, interim to final)		—	2%
Radiographic Inspection	2012	—	Yes
Leak Test	1014	—	Condition A, C
External Visual	2009	*	Yes

\* Per IR Internal Standards

**Radiation Specification**

Parameter	Condition	Min	Typ	Max	Unit
Total Ionizing Dose	MIL-STD-883, Method 1019.4 Operating bias applied during exposure	25	—	—	KRads (Si)
Heavy Ion (Single event effects)	BNL Dual Van de Graf Generator	60	—	—	MeV•cm <sup>2</sup> /mg

**AMA28XXD Case Outline**



**Pin Designation**

Pin No.	Designation
1	Positive Output
2	Output Return
3	Negative Output
4	Blank
5	Enable
6	Positive Input
7	Input Return
8	Case Ground

**Part Numbering**

**AMA 28 05 D / EM**

