

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

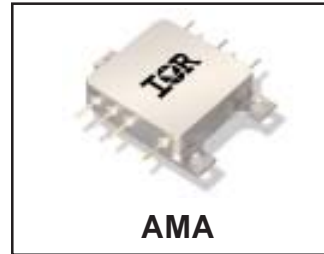
Description

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.

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



Features

- 5 Watts Output Power
- Available in ± 5 , ± 12 and ± 15 Volt Outputs
- 16 - 40 VDC Input Range (28 VDC Nominal)
- Total Ionizing Dose > 25KRads (Si)
- No SEE to LET > 60 MeV-cm²/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
IR Rectifier

Absolute Maximum Ratings	
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
Recommended Operating Conditions	
Input Voltage Range	+16V to +40VDC
Output Power	Less than or equal to 5W
Operating Case Temperature	-55°C to +125°C

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

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Input Voltage			16	28	40	V
Output Voltage		$V_{\text{in}} = 28 \text{ Volts}$, 20% load on both outputs				
AMA2805D	1		± 4.95	± 5.00	± 5.05	V
AMA2812D	1		± 11.88	± 12.00	± 12.12	V
AMA2815D	1		± 14.85	± 15.00	± 15.15	V
AMA2805D	2, 3		± 4.90		± 5.10	V
AMA2812D	2, 3		± 11.76		± 12.24	V
AMA2815D	2, 3		± 14.70		± 15.30	V
Output Current ^{1,2}		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$				
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
Output Power ^{1,2}	1, 2, 3	$V_{\text{in}} = 28 \text{ Volts}$, 100% load			5	W
Output Ripple Voltage ^{1,3}		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ 100% load BW = 20 Hz to 2 MHz				
AMA2805D	1, 2, 3				200	mV _{PP}
AMA2812D	1, 2, 3				200	mV _{PP}
AMA2815D	1, 2, 3				290	mV _{PP}
Output Voltage Regulation ³		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ I _{out} = 10, 50%, 100% load				
Line	1, 2, 3			± 10	± 25	mV
	AMA2805D			± 10	± 50	mV
	AMA2812D			± 10	± 50	mV
	AMA2815D			± 10	± 50	mV
Load	1, 2, 3			± 10	± 50	mV
	AMA2805D			± 10	± 50	mV
	AMA2812D			± 10	± 50	mV
	AMA2815D			± 10	± 50	mV

For Notes to Specifications, refer to page 4

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

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

For Notes to Specifications, refer to page 4

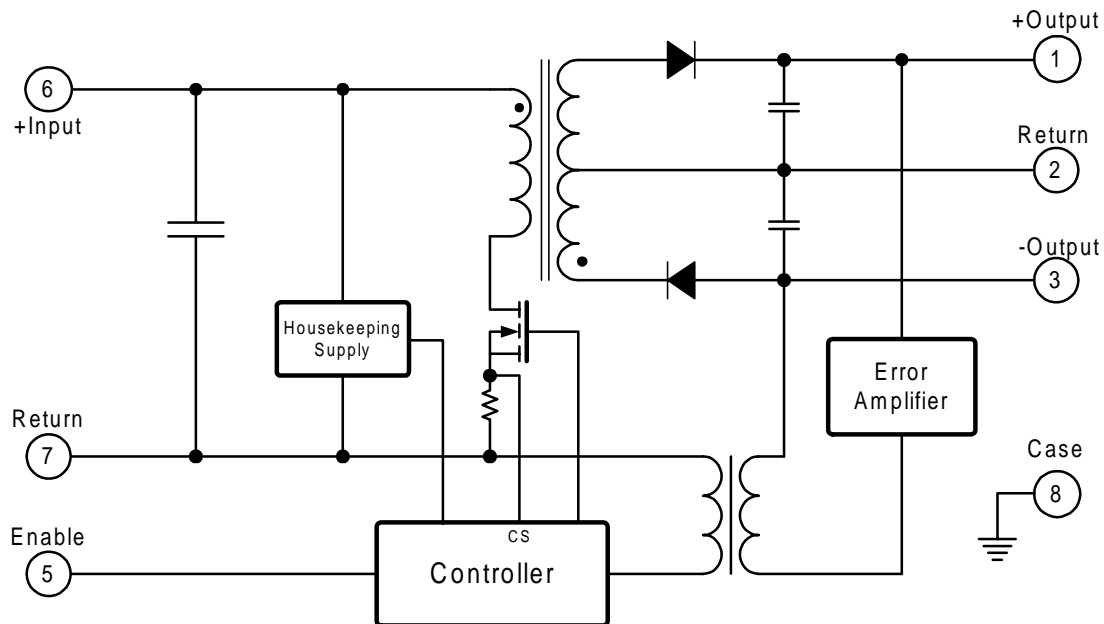
Dynamic Characteristics $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$, $V_{\text{IN}}=28\text{ V}_{\text{DC}} \pm 5\%$, $C_{\text{L}}=0$, unless otherwise specified.

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

Notes to Specifications

- Applicable to positive and negative outputs.
- Maximum combined output is 5 watts. 4 watts (max.) is available from either output (80%).
- Load current split equally between $+V_{\text{OUT}}$ and $-V_{\text{OUT}}$.
- 1.0 watt load on output under test, 1.0 watt to 4.0 watt load change on other output.
- 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.
- Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limit specified.
- Load step transition time between 2 and 10 microseconds.
- Recovery time is measured from initiation of the transient to where V_{out} has returned to within $\pm 1\%$ of V_{out} at 50% load.
- Input step transient time between 1 and 10 microseconds.
- 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 μA of current. The open circuit voltage of the inhibit input is $10.0 + 1 V_{\text{DC}}$.

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

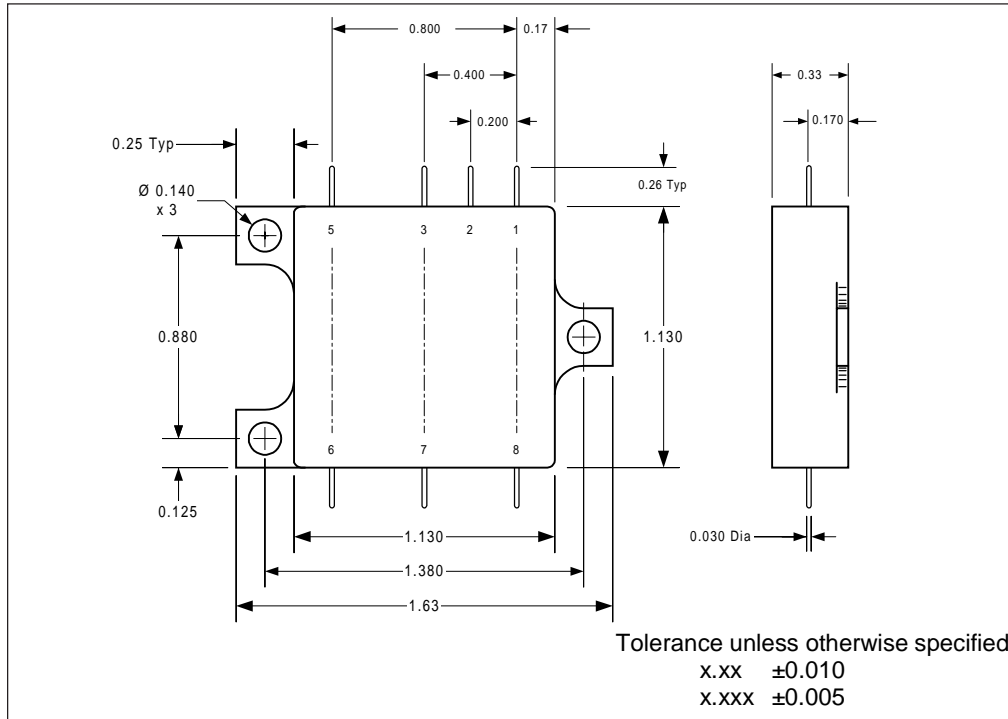
Requirement	MIL-STD-883 Method	/EM Screening	Flight Screening CH+ Limits
Baseplate Temperature Range		-55°C to +125°C	-55°C to +125°C
Element Evaluation		—	MIL-PRF-38534 Class H
Internal Visual	2017	*	Yes
Temperature Cycle	1010	—	Condition C
Constant Acceleration	2001	—	Condition A, (3000g)
PIND	2020	—	Condition A
1 st Burn-in	1015	—	160 hrs @ +125°C
Interim Electrical		+25°C	+25°C
2 nd 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 ² /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

Model
 Input Voltage
 28 = 28V
 Output Voltage
 05 = ±5V,
 12 = ±12V
 15 = ±15V
 Screening
 Blank = Flight Model (CH+)
 /EM = Engineering Model
 Outputs
 S = Single
 D = Dual

International
IOR Rectifier

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