

RADIATION TOLERANT DC/DC CONVERTERS

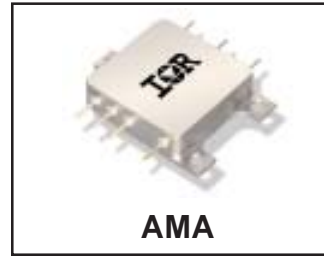
AMA28XXS SERIES 28V Input, Single Output

Description

The AMA28XXS series of DC/DC converter modules has been specifically designed for operation in moderate radiation environments supplementing the higher radiation performance available in the International Rectifier 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 AMA28XXS Series.

The AMA28XXS has been designed for high density using chip and wire hybrid technology that complies with the class H requirements of MIL-PRF-38534. The physical configuration of the AMA28XXS 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 AMA28XXS 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 AMA28XXS meets the requirements of MIL-PRF-38534 for class H but with enhanced screening steps 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 IR Santa Clara for special requirements.



Features

- 5 Watts Output Power
- Available in 3.3, 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 ASA28XXS Series

AMA28XXS Series

International
IRF Rectifier

Specifications

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

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Input Voltage			16	28	40	V
Output Voltage		$I_{\text{out}}=0$				
AMA2803R3S	1		3.25	3.30	3.35	V
AMA2805S	1		4.95	5.00	5.05	V
AMA2812S	1		11.88	12.00	12.12	V
AMA2815S	1		14.85	15.00	15.15	V
AMA2803R3S	2, 3		3.20		3.40	V
AMA2805S	2, 3		4.90		5.10	V
AMA2812S	2, 3		11.76		12.24	V
AMA2815S	2, 3		14.70		15.30	V
Output Current ¹		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$				
AMA2803R3S	1, 2, 3				1200	mA
AMA2805S	1, 2, 3				1000	mA
AMA2812S	1, 2, 3				417	mA
AMA2815S	1, 2, 3				333	mA
Output Power ¹		$V_{\text{in}} = 28 \text{ Volts, 100\% load}$				
AMA2803R3S	1, 2, 3				3.96	W
All Others	1, 2, 3				5.00	W
Output Ripple Voltage ²		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ 100% Load BW = 20 Hz to 2 MHz				
AMA2803R3S	1, 2, 3				200	mV _{PP}
AMA2805S	1, 2, 3				200	mV _{PP}
AMA2812S	1, 2, 3				200	mV _{PP}
AMA2815S	1, 2, 3				200	mV _{PP}
Output voltage Regulation						
Line	1, 2, 3	$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ $I_{\text{out}} = 0, 50\%, \text{ and } 100\% \text{ load}$		±10	±50	mV
Load	1, 2, 3			±10	±50	mV

For Notes to Specifications, refer to page 4

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

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit	
Input Current	No Load	$V_{\text{in}}=28\text{V}$, $I_{\text{out}}=0$, Inhibit (pin 5)=open		20	50	mA	
	Inhibit	Inhibit (pin 5) shorted to input return (pin 7)		8	12	mA	
Input Ripple Current ²	1, 2, 3	$V_{\text{in}} = 16, 28, 40 \text{ Volts}$, 100% load, BW = 20 Hz to 2 MHz			100	mA _{PP}	
Efficiency	AMA2803R3S	100% load	63			%	
	AMA2805S		66			%	
	AMA2812S		71			%	
	AMA2815S		71			%	
	AMA2803R3S		2	60			%
	AMA2805S		2	66			%
	AMA2812S		2	68			%
	AMA2815S		2	68			%
Isolation	1	Input to output or any pin to case (except pin 8) at 500Vdc	100			MΩ	
Capacitive Load ^{3,4}	AMA2803R3S	No effect on dc performance			500	μF	
	AMA2805S				500	μF	
	AMA2812S				100	μF	
	AMA2815S				100	μF	
Short Circuit Power Dissipation	1, 2, 3				4	watts	
MTBF		MIL-HDBK-217F, SF @ $T_{\text{c}}=35^{\circ}\text{C}$	700			Khrs	
Weight					32	g	

For Notes to Specifications, refer to page 4

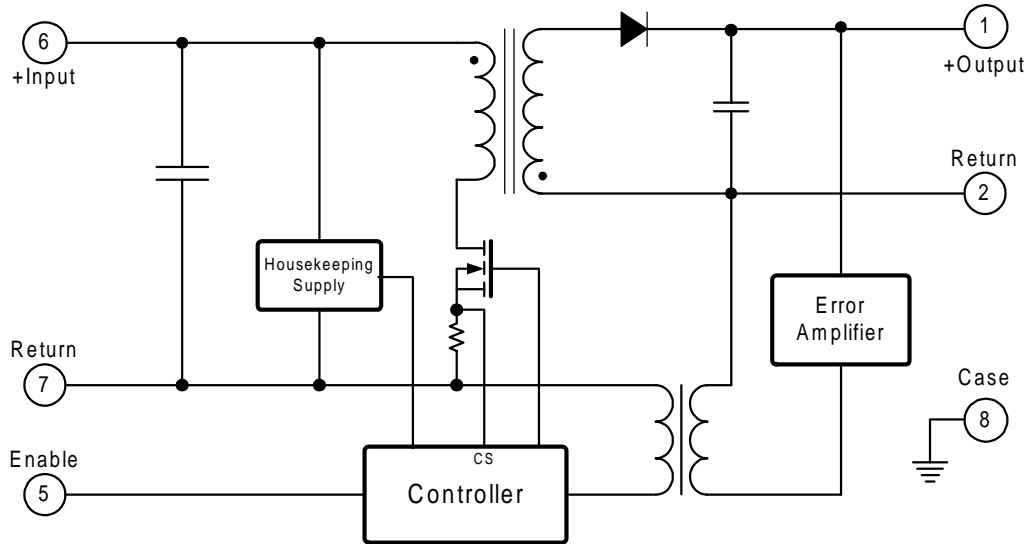
Dynamic Characteristics $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$, $V_{\text{IN}}=28 \text{ VDC} \pm 5\%$, $C_L=0$, unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Short Circuit Recovery ⁴	4, 5, 6	0% load to 100% load			25	ms
Switching Frequency	4, 5, 6	100% load	500	550	600	KHz
Output Response To Step Transient Load Changes ⁸	4, 5, 6	Load step 50% ↔ 100%	-450		+450	mVpk
	4, 5, 6	Load step 0% ↔ 50%	-750		+750	mVpk
Recovery Time, Step Transient Load Changes ^{5, 6}	AMA2803R3S	Load step 50% ↔ 100%			300	μs
	AMA2805S				300	μs
	AMA2812S				100	μs
	AMA2815S				100	μs
	AMA2803R3S	Load step 0% ↔ 50%			2000	μs
	AMA2805S				2000	μs
	AMA2812S				2000	μs
	AMA2815S				2000	μs
Output Response Transient Step Line Changes ^{4, 7}	AMA2803R3S	Input step 16 ↔ 40Vdc, 100% load	-450		+450	mV pk
	AMA2805S		-550		+550	mV pk
	AMA2812S		-750		+750	mV pk
	AMA2815S		-750		+750	mV pk
Recovery Time Transient Step Line Changes ^{4, 6, 7}	4, 5, 6	Input step 16 ↔ 40Vdc, 100% load			1200	μs
Turn On Overshoot ⁸	4, 5, 6	0% load			600	mV pk
	4, 5, 6	100% load			400	mV pk
Turn On Delay ⁸	4, 5, 6	0% load to 100% load			25	ms

Notes to Specifications

- Parameter guaranteed by line and load regulation tests.
- Bandwidth guaranteed by design. Tested for 20 KHz to 2 MHz.
- 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 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. Parameters shall be guaranteed to the limit specified in Electrical Specifications.
- Load step transition time between 2 and 10 microseconds.
- Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within $\pm 1\%$ of V_{OUT} at 50 percent load.
- Input step transition time between 2 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.

AMA28XXS 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 (AFH461) that will reduce the input ripple current to levels below the limits imposed by MIL-STD-461 CE03.

Standard Process Screening for AMA28XXS Series

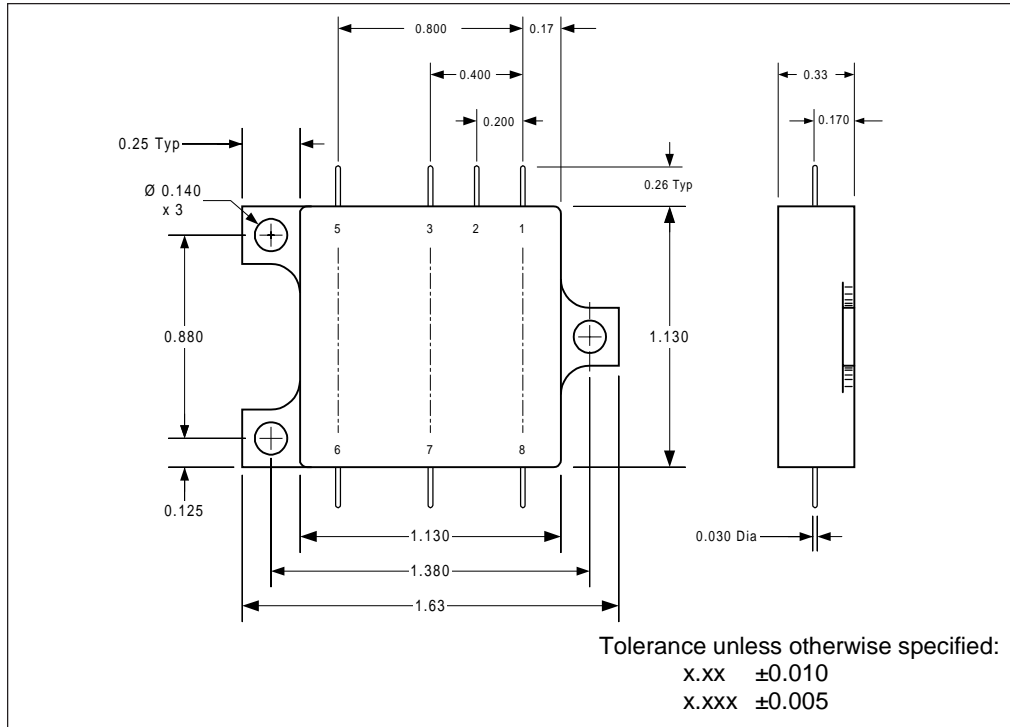
Requirement	MIL-STD-883 Method	/EM Limits	Flight (CH+) Limits
Temperature Range		-55°C to +125°C	-55°C to +125°C
Element Evaluation		—	MIL-PRF-38534
Internal Visual	2017	*	Yes
Temperature Cycle	1010	—	Condition C
Constant Acceleration	2001	—	Condition A, (3000g)
PIND	2020	—	Condition A
Burn-in Interim Electrical; @ 160 hrs	1015	48hrs	320 hrs @ +125°C (2 x 160 hrs)
Final Electrical (Group A) Read & Record Data	MIL-PRF-38534 & Specification	-55°C, +25°C, +125°C	-55°C, +25°C, +125°C
PDA (25C, interim to final)		—	2%
Radiographic Inspection	2012	—	Yes
Fine & Gross	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

AMA28XXS Case Outline



Pin Designation

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

Part Numbering

