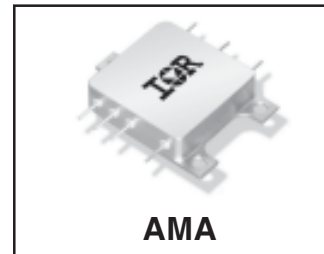


**HYBRID - HIGH RELIABILITY  
RADIATION TOLERANT  
DC/DC CONVERTER**

**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 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. International Rectifiers' 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. Manufactured in a facility fully qualified to MIL-PRF-38534, these converters are fabricated utilizing DSCC qualified processes. For available screening options, refer to device screening table in the data sheet. 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**

- 5.0 Watts Output Power
- Available in 5, 12 and 15 Volt Outputs
- 16 - 40 VDC Input Range (28 VDC Nominal)
- Total Ionizing Dose > 25KRads (Si)
- SEE Hardened to LET up to 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 ASA28XXS Series
- Standard Microcircuit Drawings Available

Specifications

Absolute Maximum Ratings		Recommended Operating Conditions	
Input Voltage range	-0.5V to +50VDC (Continuous), 80V (100ms)	Input Voltage range	+16V to +40VDC
Soldering temperature	300°C for 10 seconds	Output Power	Less than or equal to 5W
Storage case temperature	-65°C to +135°C	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>		$I_{\text{out}} = 0$				
AMA2805S	1		4.95	5.00	5.05	V
AMA2812S	1		11.88	12.00	12.12	
AMA2815S	1		14.85	15.00	15.15	
AMA2805S	2, 3		4.90		5.10	
AMA2812S	2, 3		11.76		12.24	
AMA2815S	2, 3		14.70		15.30	
<b>Output Current</b> <sup>1</sup>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$				
AMA2805S	1, 2, 3				1000	mA
AMA2812S	1, 2, 3				417	
AMA2815S	1, 2, 3				333	
<b>Output Power</b> <sup>1</sup>	All Models	$V_{\text{in}} = 28 \text{ Volts}, 100\% \text{ load}$			5.0	W
<b>Output Ripple Voltage</b> <sup>2</sup>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ 100% Load BW = 20 Hz to 2.0 MHz				
AMA2805S	1, 2, 3				200	mV <sub>PP</sub>
AMA2812S	1, 2, 3				200	
AMA2815S	1, 2, 3				200	
<b>Output voltage Regulation</b>		$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ $I_{\text{out}} = 0, 50\%, \text{ and } 100\% \text{ load}$				
Line	1, 2, 3			±10	±50	mV
Load	1, 2, 3			±10	±50	

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
<b>Input Current</b>	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)		8.0	12	
<b>Input Ripple Current</b> <sup>2</sup>	1, 2, 3	$V_{\text{in}} = 16, 28, 40 \text{ Volts}$ , 100% load, BW = 20 Hz to 2 MHz			100	mAPP
<b>Efficiency</b>	AMA2805S	100% load	66			%
	AMA2812S		71			
	AMA2815S		71			
	AMA2805S		66			
	AMA2812S		68			
	AMA2815S		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>3, 4</sup>	AMA2805S	No effect on dc performance			500	μF
	AMA2812S				100	
	AMA2815S				100	
<b>Short Circuit Power Dissipation</b>	1, 2, 3				4.0	W
<b>MTBF</b>		MIL-HDBK-217F, SF @ $T_c=35^{\circ}\text{C}$	700			Khrs
<b>Weight</b>					32	g

For Notes to Specifications, refer to page 4

## AMA28XXS Series

International  
IRF Rectifier

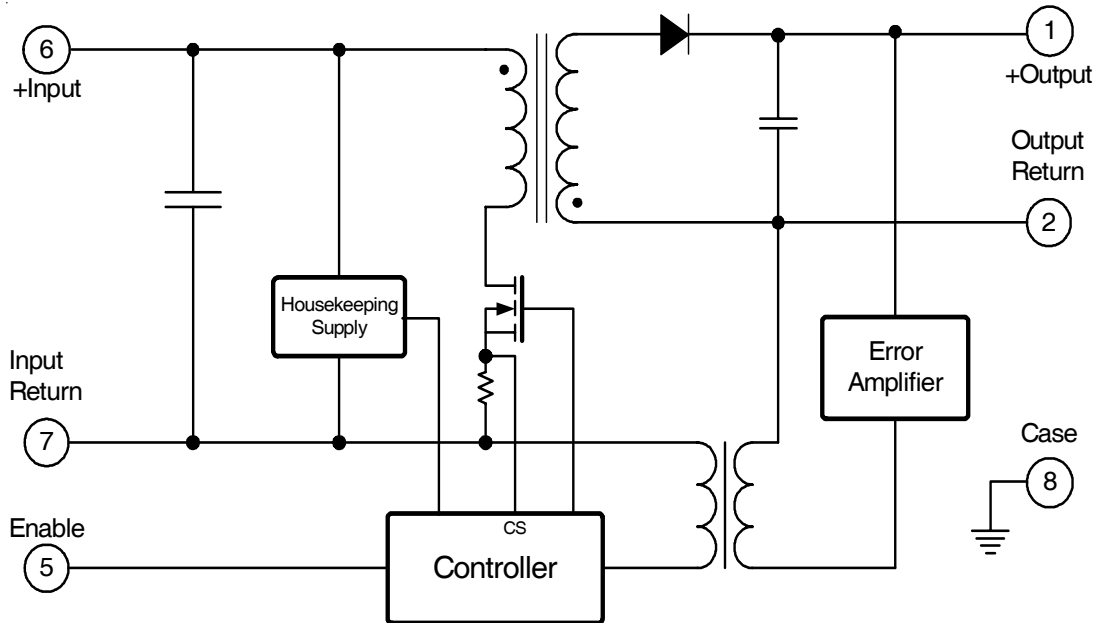
**Dynamic Characteristics**  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$ ,  $V_{\text{IN}}=28 \text{ V}_{\text{DC}} \pm 5\%$ ,  $C_{\text{L}}=0$ , unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit	
Short Circuit Recovery <sup>4</sup>	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 <sup>8</sup>	4, 5, 6	Load step 50% ⇔ 100%	-450		+450	mVpk	
	4, 5, 6	Load step 0% ⇔ 50%	-750		+750		
Recovery Time, Step Transient Load Changes <sup>5, 6</sup>		Load step 50% ⇔ 100%			300	μs	
	AMA2805S		4, 5, 6				100
	AMA2812S		4, 5, 6				100
		Load step 0% ⇔ 50%			2000		
	AMA2805S		4, 5, 6				2000
	AMA2812S		4, 5, 6				2000
Output Response Transient Step Line Changes <sup>4, 7</sup>		Input step 16 ⇔ 40Vdc, 100% load	-550		+550	mVpk	
	AMA2812S		4, 5, 6	-750			+750
	AMA2815S		4, 5, 6	-750			+750
Recovery Time Transient Step Line Changes <sup>4, 6, 7</sup>	4, 5, 6	Input step 16 ⇔ 40Vdc, 100% load			1200	μs	
Turn On Overshoot <sup>8</sup>	AMA2805S	100% load			600	mVpk	
			6				750
Turn On Overshoot <sup>8</sup>	AMA2812S AMA2815S	0 to 100% load			600	mVpk	
			4, 5, 6				
Turn On Delay <sup>8</sup>	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 20KHz to 2.0MHz.
- 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  $V_{\text{OUT}}$  has returned to within  $\pm 1\%$  of  $V_{\text{OUT}}$  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.

**Block Diagram**



**Application Information**

**Inhibit Function (Enable)**

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  $\mu\text{A}$  of current. The open circuit voltage of the inhibit input is  $10 + 1.0 V_{\text{DC}}$ .

**EMI Filter**

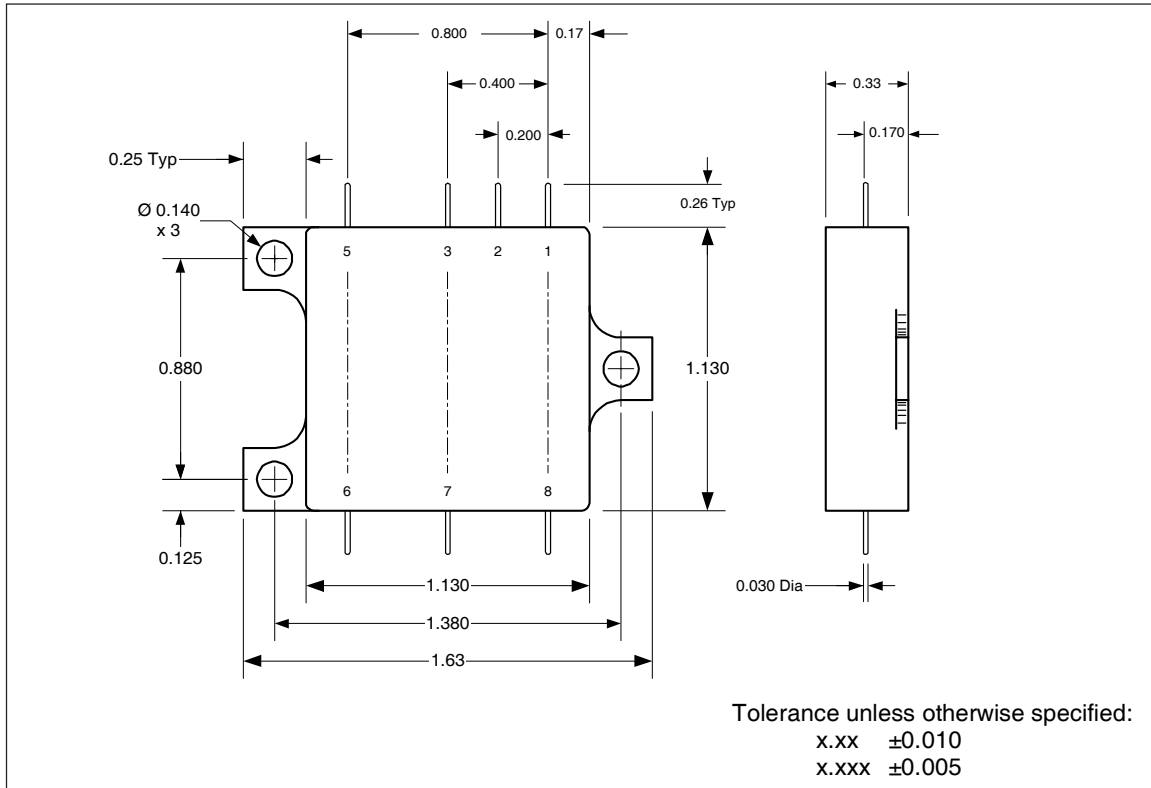
An optional EMI filter is available (AFH461) that will reduce the input ripple current to levels below the limits imposed by MIL-STD-461 CE03.

**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	—	—	$\text{MeV}\cdot\text{cm}^2/\text{mg}$

International Rectifier currently does not have a DSCC certified Radiation Hardness Assurance Program.

Mechanical Outline



Pin Designation

Pin #	Designation
1	+ Output
2	Output Return
3	NC
4	Blank
5	Enable
6	+ Input
7	Input Return
8	Case Ground

**Device Screening**

Requirement	MIL-STD-883 Method	No Suffix ②	CH ②	EM
Temperature Range	—	-55°C to +125°C	-55°C to +125°C	-55°C to +85°C
Element Evaluation	MIL-PRF-38534	Class H	Class H	N/A
Non-Destructive Bond Pull	2023	N/A	N/A	N/A
Internal Visual	2017	Yes	Yes	①
Temperature Cycle	1010	Cond C	Cond C	Cond C
Constant Acceleration	2001, Y1 Axis	3000 Gs	3000 Gs	3000 Gs
PIND	2020	Cond A	Cond A	N/A
Burn-In	1015	320 hrs @ 125°C ( 2 x 160hrs )	320 hrs @ 125°C ( 2 x 160hrs )	48 hrs @ 125°C
Final Electrical ( Group A )	MIL-PRF-38534 & Specification	-55°C, +25°C, +125°C	-55°C, +25°C, +125°C	-55°C, +25°C, +85°C
PDA	MIL-PRF-38534	2%	2%	N/A
Seal, Fine and Gross	1014	Cond A, C	Cond A, C	Cond A
Radiographic	2012	Yes	Yes	N/A
External Visual	2009	Yes	Yes	①

Notes:

- ① Best commercial practice.
  - ② Device with 'CH' suffix is a DSCC class H compliant without radiation performance. No suffix is a radiation rated device but not available as a DSCC qualified SMD per MIL-PRF-38534.
- International Rectifier currently does not have a DSCC certified Radiation Hardness Assurance Program.

**Standard Microcircuit Drawing Equivalence Table**

Standard Microcircuit Drawing Number	IR Standard Part Number
5962-04247	AMA2805S
5962-04248	AMA2812S
5962-04249	AMA2815S

**Part Numbering**

