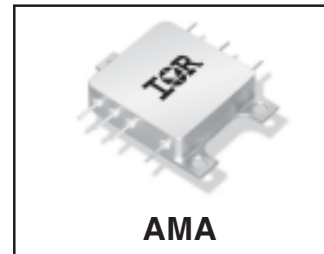


**HYBRID - HIGH RELIABILITY  
RADIATION TOLERANT  
DC/DC CONVERTER**

**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),<br>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> |                   | $V_{\text{in}} = 16, 28, 40 \text{ Volts}$<br>100% Load<br>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>          |                   | $V_{\text{in}} = 16, 28, 40 \text{ Volts}$<br>$I_{\text{out}} = 0, 50\%, \text{ and } 100\% \text{ load}$ |       |       |       |                  |
| 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           | $V_{\text{in}} = 28\text{V}$ ,<br>$I_{\text{out}} = 0$ , 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

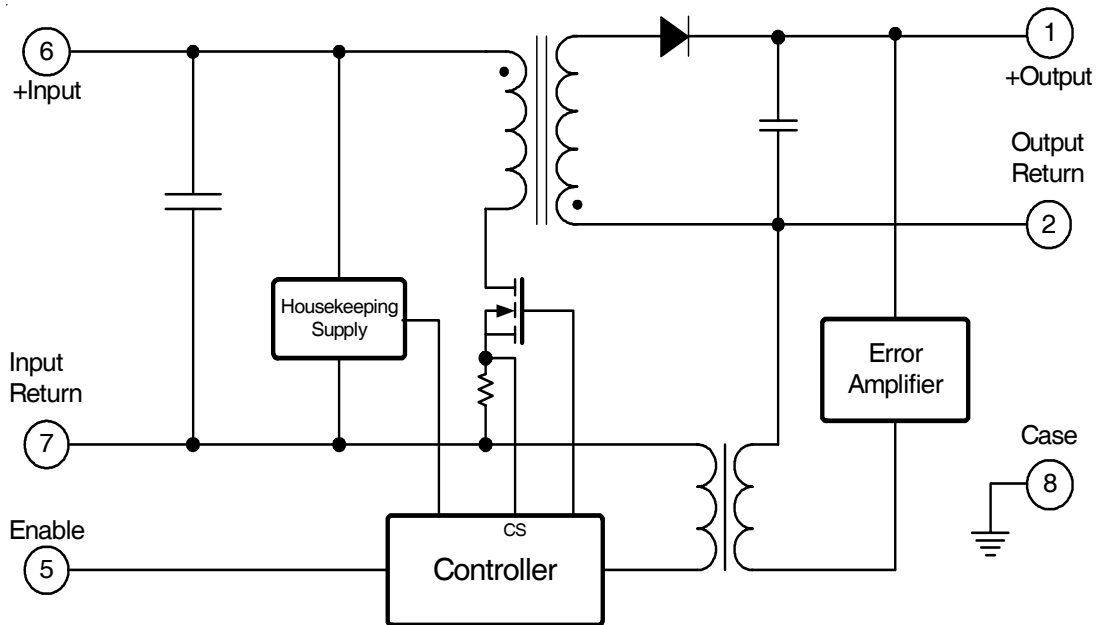
**Dynamic Characteristics**  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$ ,  $V_{\text{IN}}=28 \text{ V}_{\text{DC}} \pm 5\%$ ,  $C_{\text{L}}=0$ , unless otherwise specified.

| 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 |      |
|  |                      |                                  |         |      | 750  |      |      |
| Turn On Overshoot <sup>8</sup>                               | AMA2812S<br>AMA2815S | 0 to 100% load                   |         |      | 600  | mVpk |      |
|  |                      |                                  |         |      |      |      |      |
| 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**

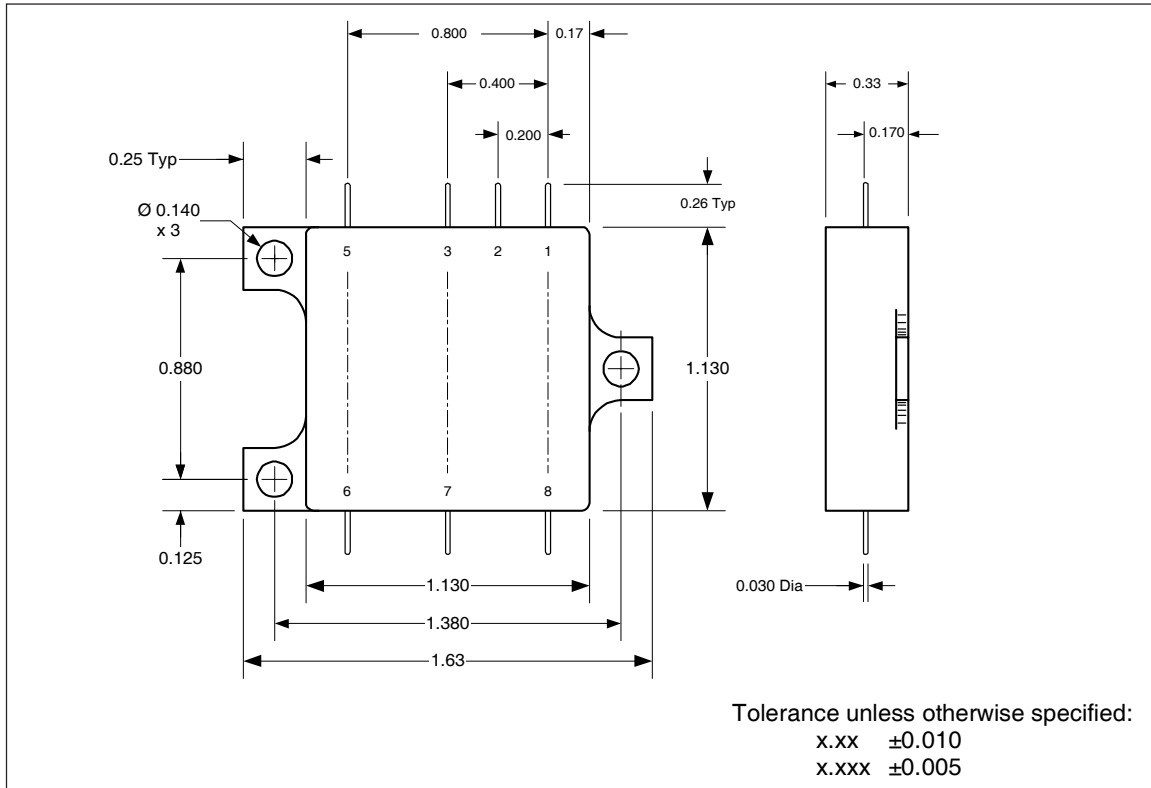
An optional EMI filter is available (AFH461) that will reduce the input ripple current to levels below the limits imposed by MIL-STD-461 CE03.

**Radiation Specification**

| Parameter                        | Condition  | Min | Typ | Max | Unit                                   |
|----------------------------------|--|-----|-----|-----|--|
| Total Ionizing Dose              | MIL-STD-883, Method 1019.4<br>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 ①                       | 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<br>( 2 x 160hrs ) | 320 hrs @ 125°C<br>( 2 x 160hrs ) | 48 hrs @ 125°C         |
| Final Electrical<br>( Group A ) | MIL-PRF-38534<br>& Specification | -55°C, +25°C,<br>+125°C           | -55°C, +25°C,<br>+125°C           | -55°C, +25°C,<br>+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**

