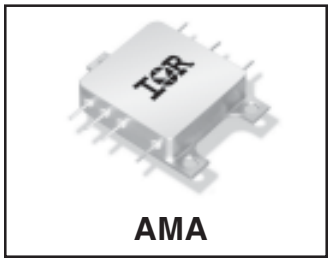
International
IOR Rectifier

PD-94692E

# AMA28XXD SERIES
## 28V Input, Dual Output

# HYBRID - HIGH RELIABILITY RADIATION TOLERANT DC-DC CONVERTER



**AMA**

## 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 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 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. International Rectifier'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. 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 accomodated. Consult IR San Jose 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$^2$/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
- 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 |
| | | Output Power | Less than or equal to 5W |
| Soldering temperature | 300°C for 10 seconds | Operating case temperature | -55°C to +125°C |
| Storage case temperature | -65°C to +135°C | | |

## Static Characteristics

-55°C ≤ $T_{CASE}$ ≤ +125°C, $V_{IN}$ = 28$V_{DC}$ ±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** | | Vin = 28 Volts, 20% load on both outputs | | | | V |
| AMA2805D | 1 | | ±4.95 | ±5.00 | ±5.05 | |
| AMA2812D | 1 | | ±11.88 | ±12.00 | ±12.12 | |
| AMA2815D | 1 | | ±14.85 | ±15.00 | ±15.15 | |
| AMA2805D | 2, 3 | | ±4.90 | | ±5.10 | |
| AMA2812D | 2, 3 | | ±11.76 | | ±12.24 | |
| AMA2815D | 2, 3 | | ±14.70 | | ±15.30 | |
| **Output Current** [1, 2] | | Vin = 16, 28, 40 Volts | | | | mA |
| AMA2805D | 1, 2, 3 | each output | 200 | | 800 | |
| AMA2812D | 1, 2, 3 | each output | 83 | | 333 | |
| AMA2815D | 1, 2, 3 | each output | 67 | | 267 | |
| **Output Power** [1, 2] | 1, 2, 3 | Vin = 28 Volts, 100% load | | | 5.0 | W |
| **Output Ripple Voltage** [1, 3] | | Vin = 16, 28, 40 Volts | | | | $mV_{PP}$ |
| AMA2805D | 1, 2, 3 | 100% load | | | 200 | |
| AMA2812D | 1, 2, 3 | BW = 20 Hz to 2 MHz | | | 200 | |
| AMA2815D | 1, 2, 3 | | | | 290 | |
| **Output Voltage Regulation** [3] | | $V_{in}$ = 16, 28, 40 Volts | | | | mV |
| | | Iout = 10, 50%, 100% load | | | | |
| Line AMA2805D | 1, 2, 3 | | | ±10 | ±25 | |
| AMA2812D | 1, 2, 3 | | | ±10 | ±50 | |
| AMA2815D | 1, 2, 3 | | | ±10 | ±50 | |
| Load AMA2805D | 1, 2, 3 | | | ±10 | ±50 | |
| AMA2812D | 1, 2, 3 | | | ±10 | ±50 | |
| AMA2815D | 1, 2, 3 | | | ±10 | ±50 | |

For Notes to Specifications, refer to page 4

**Static Characteristics** (Continued) -55°C ≤ $T_{CASE}$ ≤ +125°C, $V_{IN}$= 28$V_{DC}$ ±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 | | | | 8.0 | |
| AMA2815D | 1, 2, 3 | | | | 8.0 | |
| **Input Current** | | Vin=28V, | | | | |
| No Load | 1, 2, 3 | Iout=0, Inhibit (pin 5)=open | | 35 | 60 | mA |
| Inhibit | 1, 2, 3 | Inhibit (pin 5) shorted to input return (pin 7) | | | 12 | |
| **Input Ripple Current** [3] | | Vin = 16, 28, 40 Volts, 100% load, BW = 20 Hz to 2 MHz | | | | |
| AMA2805D | 1, 2, 3 | | | | 100 | $mA_{PP}$ |
| AMA2812D | 1, 2, 3 | | | | 100 | |
| AMA2815D | 1, 2, 3 | | | | 100 | |
| **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 | µF |
| AMA2812D | 4 | | | | 200 | |
| AMA2815D | 4 | | | | 200 | |
| **Short Circuit Power Dissipation** | 1, 2, 3 | | | | 4.0 | W |
| **MTBF** | | MIL-HDBK-217F, SF @ 70ºC | 750 | | | Khrs |
| **Weight** | | | | | 32 | g |

For Notes to Specifications, refer to page 4

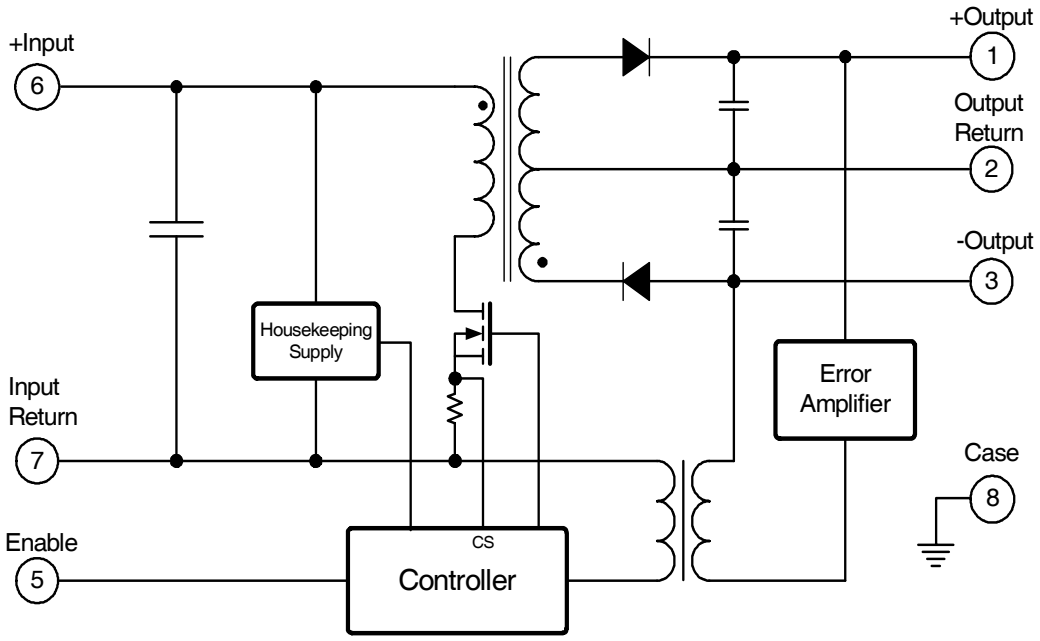
## Dynamic Characteristics -55°C ≤ $T_{CASE}$ ≤ +125°C, $V_{IN}$ = 28$V_{DC}$ ±5%, $C_L$ = 0, unless otherwise specified.

| 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<br>4, 5, 6 | Load step 50%⇔ 100%<br>Load step 0% ⇔ 50% | -400<br>-800 | | +400<br>+800 | mV pk |
| **Recovery Time, Step Transient Load Changes** [3, 7, 8] | 4, 5, 6<br>4, 5, 6 | Load step 50%⇔ 100%<br>Load step 0% ⇔ 50% | | | 100<br>2000 | µs |
| **Output Response Transient Step Line Changes** [3, 6, 9]<br>AMA2805D<br>AMA2812D<br>AMA2815D | <br>4, 5, 6<br>4, 5, 6<br>4, 5, 6 | Input step 16 ⇔ 40Vdc, 100% load | <br>-550<br>-750<br>-750 | | <br>+550<br>+750<br>+750 | mV pk |
| **Recovery Time Transient Step Line Changes** [3, 6, 9] | 4, 5, 6 | Input step 16 ⇔ 40Vdc, 100% load | | | 1200 | µs |
| **Turn On Overshoot** [3, 10] | 4, 5, 6<br>4, 5, 6 | 0% load<br>100% load | | | 600<br>400 | mV pk |
| **Turn On Delay** [3, 10] | 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 5.0 watts. 4.0 watts (max.) is available from either output (80%).
3. Load current split equally between +VOUT and –VOUT.
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 VOUT has returned to within ±1% of VOUT 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.

## 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 μA of current. The open circuit voltage of the inhibit input is 10 +1.0 $V_{DC}$.

### 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

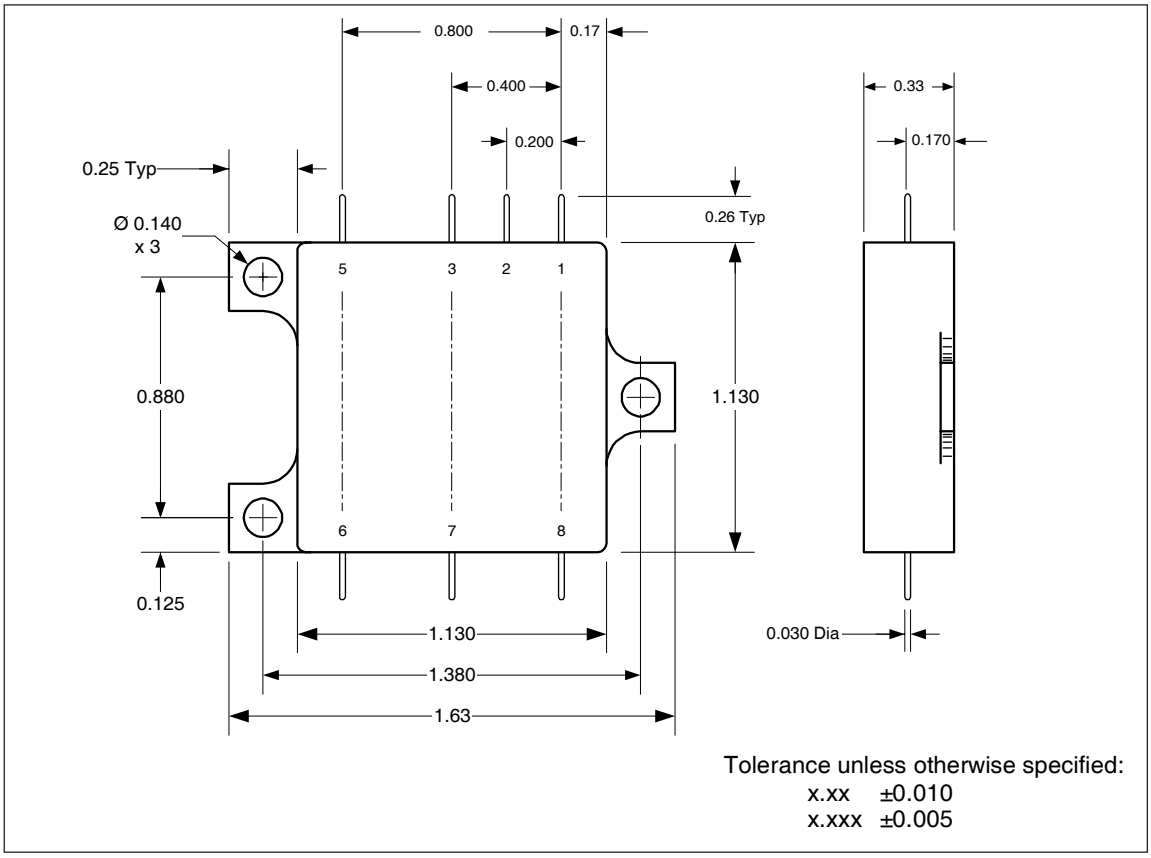
Irrespective of the fact that the AMA28XXD series of converters are relatively low power devices and are designed to provide efficient voltage conversion, there will be some heat generated during normal operation. To avoid a continuous thermal rise that may eventually exceed the maximum case temperature 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.

## 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<br>(Single event effects) | BNL Dual Van de Graf Generator | 60 | — | — | MeV•cm2 /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 | - Output |
| 4 | Blank |
| 5 | Enable |
| 6 | + Input |
| 7 | Input Return |
| 8 | Case Ground |

## Device Screening

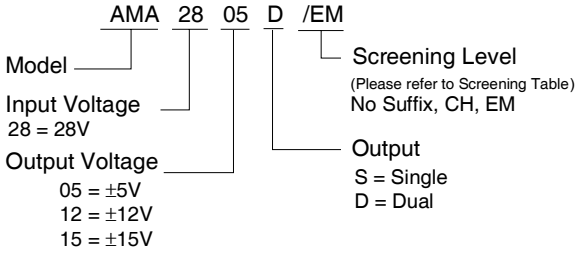
| Requirement | MIL-STD-883 Method | No Suffix ② | CH ② | EM |
|---|---|---|---|---|
| Temperature Range | — | -55°C to +125°C | -55°C to +125°C | -55°C to +85°C |
| Element Evaluation | MIL-PRF-38534 | Class H | Class H | N/A |
| Non-Destructive Bond Pull | 2023 | N/A | N/A | N/A |
| Internal Visual | 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 |
|---|---|
| 5962-04250 | AMA2812D |
| 5962-04251 | AMA2815D |

### Part Numbering




International
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*Data and specifications subject to change without notice. 08/2010*