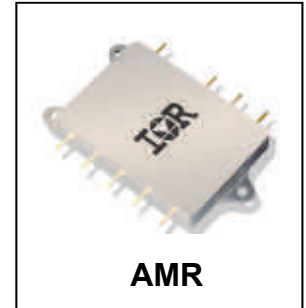


**HYBRID-HIGH RELIABILITY
RADIATION TOLERANT
DC-DC CONVERTER****28V Input, Dual Output****Description**

The AMR28XXD 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 AMR28XXD series.

The physical configuration of the AMR28XXD 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 hermetically

The AMR28XXD has been designed for high density using chip and wire hybrid technology that complies with class H requirement of MIL-PRF-38534. Manufactured in a facility fully qualified to MIL-PRF-38534, these converters are fabricated utilizing DLA Land and Maritime 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 HiRel San Jose for special requirements.

Features

- 30 Watts Output Power
- Available in ± 5 , ± 12 and ± 15 Volt Outputs
- 16- 40 V_{DC} Input Range (28 V_{DC} Nominal)
- Total Ionizing Dose > 25 kRads(Si)
- SEE Hardened to LET up to 60 MeV.cm²/mg
- -55°C to +125°C Operating Range
- Indefinite Short Circuit Protection
- External Synchronization
- Shutdown from External Signal
- Flexible Mounting
- Fully Isolated - Input to Output and to Case
- Complimentary EMI Filter Available
- Electrical Performance Similar to ATR28XXD Series

Specifications

Absolute Maximum Ratings		Recommended Operating Conditions	
Input Voltage range	-0.5V _{DC} to +50V _{DC} (Continuous), 80V (100ms)	Input Voltage range	+16V _{DC} to +40V _{DC}
		Output power	Less than or equal to 30W
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 $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq +125^{\circ}\text{C}$, $V_{\text{IN}} = 28\text{V}_{\text{DC}} \pm 5\%$, $C_{\text{L}} = 0$, unless otherwise specified.

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Input Voltage			16	28	40	V
Output Voltage	AMR2805D AMR2812D AMR2815D	$I_{\text{OUT}} = 0$	± 4.95 ± 11.88 ± 14.85	± 5.00 ± 12.00 ± 15.00	± 5.05 ± 12.12 ± 15.15	V
	AMR2805D AMR2812D AMR2815D		± 4.90 ± 11.70 ± 14.70		± 5.10 ± 12.30 ± 15.30	
Output Current ^{1,2}	AMR2805D AMR2812D AMR2815D	$V_{\text{IN}} = 16, 28, 40$ Volts	600 250 200		5400 2250 1800	mA
Output Power	AMR2805D AMR2812D AMR2815D	100% load			30 30 30	W
Output Ripple Voltage ³	AMR2805D AMR2812D AMR2815D	$V_{\text{IN}} = 16, 28, 40$ Volts BW = 20 Hz to 2 MHz			60 85 85	mV _{PP}
Output Voltage Regulation ⁴						
Line	AMR2805D AMR2812D AMR2815D	$V_{\text{IN}} = 16, 28, 40$ Volts $I_{\text{OUT}} = 0, 50\%$, and 100% load		± 10 ± 30 ± 40	± 30 ± 75 ± 75	mV
Load	AMR2805D AMR2812D AMR2815D			± 10 ± 50 ± 50	± 50 ± 120 ± 150	

For Notes to Specifications, refer to page 5

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
Cross Regulation ⁵	AMR2805D AMR2812D AMR2815D	1, 2, 3 1, 2, 3 1, 2, 3			10 5.0 5.0	%
Input Current						
No Load	AMR2805D AMR2812D AMR2815D	1, 2, 3 1, 2, 3 1, 2, 3		20 20 20	70 75 100	mA
Inhibit	AMR2805D AMR2812D AMR2815D	1, 2, 3 1, 2, 3 1, 2, 3		8.0 8.0 8.0	15 18 18	
Input Ripple Current ^{3,4}		1, 2, 3			50	mApp
Efficiency ⁴	AMR2805D AMR2812D AMR2815D AMR2805D AMR2812D AMR2815D	1 1 1 2, 3 2, 3 2, 3		76 80 79 72 75 74		%
Isolation		1	100			MΩ
Capacitive Load ^{6,7}		4			200	μF
Short Circuit Power Dissipation		1, 2, 3			9.0	W
Switching Frequency ⁴		4, 5, 6	500	550	600	kHz
Sync frequency range		4, 5, 6	500		700	kHz
MTBF			800			kHrs
Weight					68	g

For Notes to Specifications, refer to page 5

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.

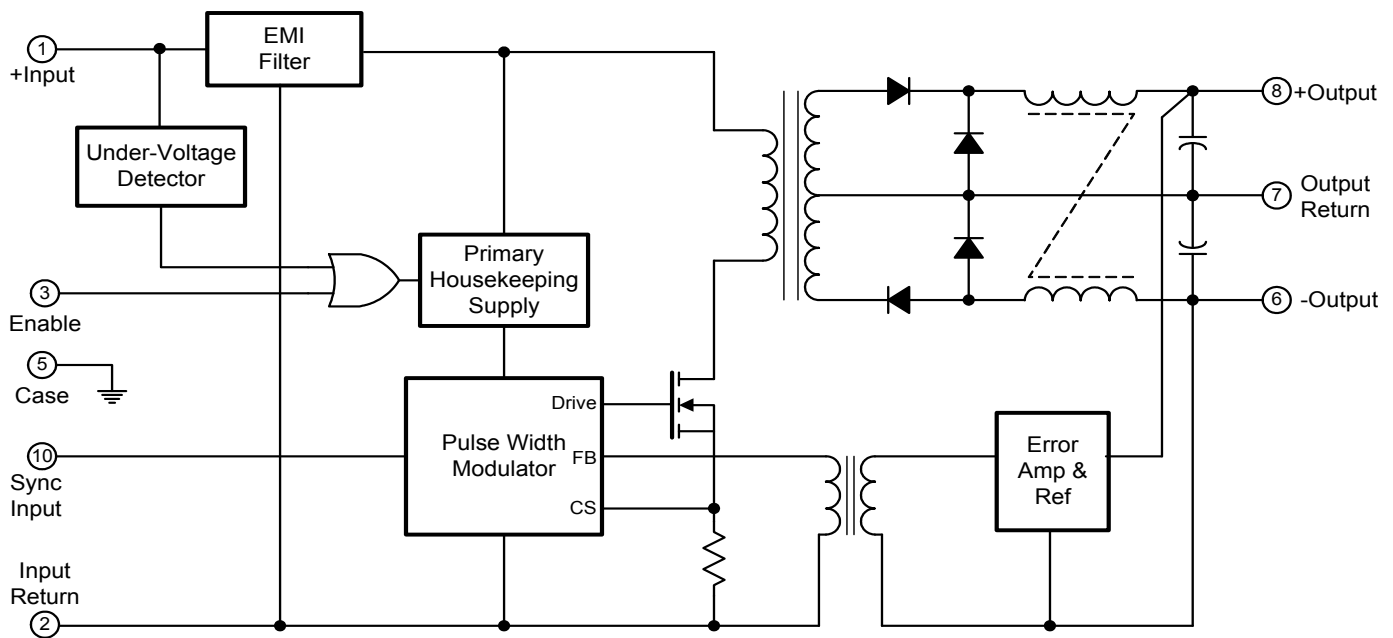
Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Output Response To Step Transient Load Changes ^{4,9}						
AMR2805D	4, 5, 6	Load step 50% \leftrightarrow 100%	-400		+400	mV pk
AMR2812D	4, 5, 6		-400		+400	
AMR2815D	4, 5, 6		-400		+400	
AMR2805D	4, 5, 6	Load step 0% \leftrightarrow 50%	-400		+400	
AMR2812D	4, 5, 6		-800		+800	
AMR2815D	4, 5, 6		-800		+800	
Recovery Time, Step Transient Load Changes ^{4,9,10}						
AMR2805D	4, 5, 6	Load step 50% \leftrightarrow 100%			70	μs
AMR2812D	4, 5, 6				70	
AMR2815D	4, 5, 6				70	
AMR2805D	4, 5, 6	Load step 0% \Rightarrow 50%			500	μs
AMR2812D	4, 5, 6				500	
AMR2815D	4, 5, 6				500	
AMR2805D	4, 5, 6	Load step 50% \Rightarrow 0%			5	μs
AMR2812D	4, 5, 6				5	
AMR2815D	4, 5, 6				5	
Output Response Transient Step Line Changes ^{4,7,11}						
AMR2805D	4, 5, 6	Input step from/to 16 to 40V _{DC} , 100% load	-500		+500	mV pk
AMR2812D	4, 5, 6		-1200		+1200	
AMR2815D	4, 5, 6		-1500		+1500	
Recovery Time Transient Step Line Changes ^{4,7,10,11}						
AMR2805D	4, 5, 6	Input step from/to 16 to 40V _{DC} , 100% load			10	ms
AMR2812D	4, 5, 6				10	
AMR2815D	4, 5, 6				10	
Turn On Overshoot ⁴						
AMR2805D	4, 5, 6	0% load to 100% load			450	mV pk
AMR2812D	4, 5, 6				600	
AMR2815D	4, 5, 6				750	
Turn On Delay ^{4,12}						
AMR2805D	4, 5, 6	0% load to 100% load			25	ms
AMR2812D	4, 5, 6				25	
AMR2815D	4, 5, 6				25	
Short Circuit Recovery ⁷						
AMR2805D	4, 5, 6				25	ms
AMR2812D	4, 5, 6				25	
AMR2815D	4, 5, 6				25	

For Notes to Specifications, refer to page 5

Notes to Specifications

1. Parameter guaranteed by line and load regulation tests.
2. Up to 90 percent of full power is available from either output provided the total output does not exceed 30 watts.
3. Bandwidth guaranteed by design, Tested for 20 Hz to 2 MHz.
4. Load current split equally between +V_{OUT} and -V_{OUT}.
5. 3 watt load on output under test. 3 watt to 27 watt load change on other output.
6. 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.
7. 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
8. Load step transition time between 2 and 10 microseconds.
9. Recovery time is measured from initiation of the transient to where V_{out} has returned to within ±1% of V_{out} at 50% load.
10. Input step transient time between 2 and 10 microseconds.
11. 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 inhibit input to input common will cause the converter to shut down. It is recommended that the inhibit 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}.

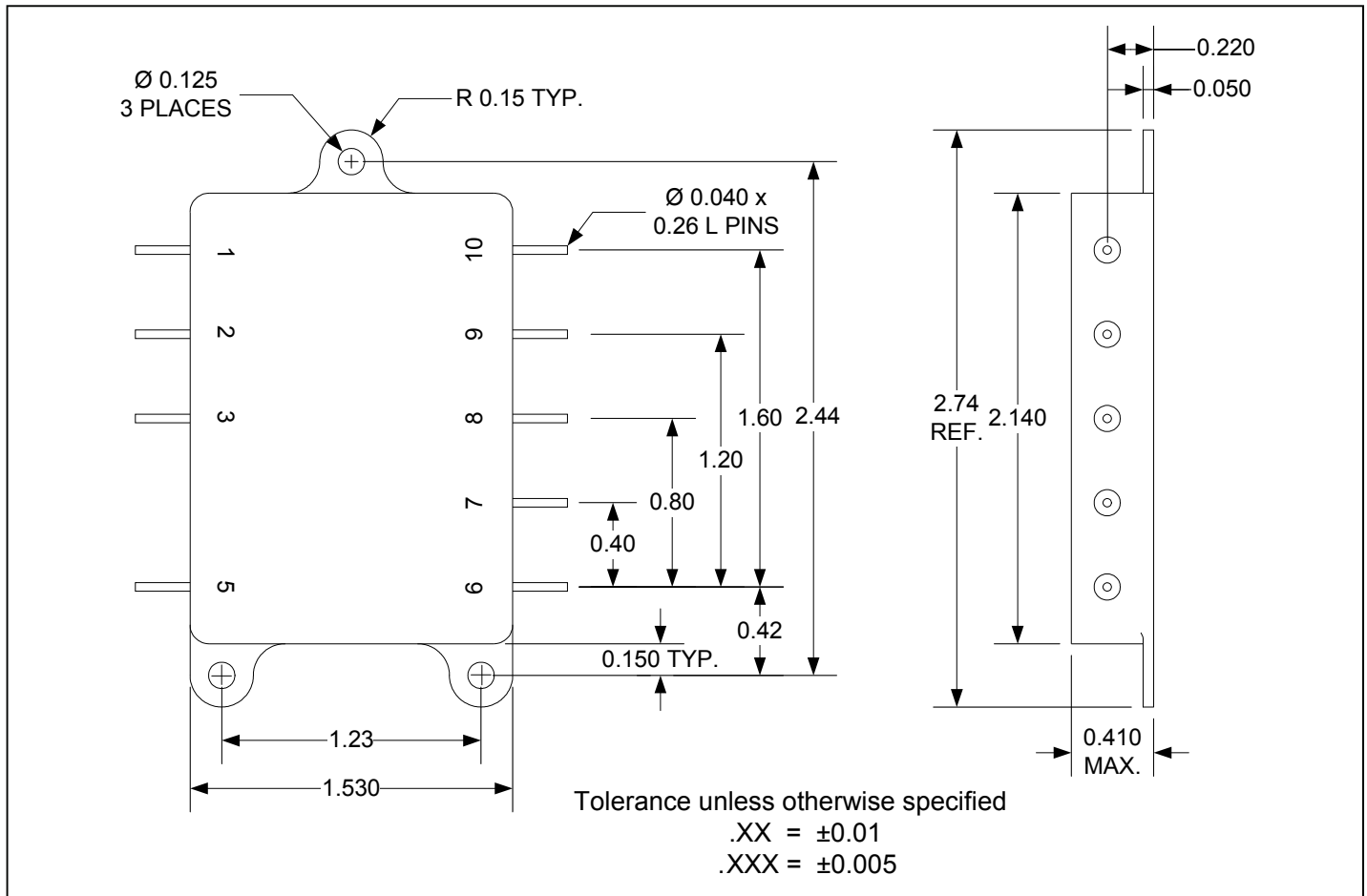
EMI Filter

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

Device Synchronization

When multiple DC-DC converters are utilized in a single system, significant low frequency noise may be generated due to a small difference in the switching frequency of the converters (beat frequency noise). Because of the low frequency nature of this noise (typically less than 10 kHz), it is difficult to filter out and may interfere with proper operation of sensitive systems (communication, radar or telemetry). IR HiRel provides synchronization of multiple AMR type converters to match switching frequency of the converter to the frequency of the system clock, thus eliminating this type of noise.

Mechanical Outline



Pin Designation

Pin #	Designation	Pin #	Designation
1	+ Input	6	- Output
2	Input Return	7	Output Return
3	Enable	8	+ Output
4	Blank	9	NC
5	Case Ground	10	Sync Input

Radiation Performance Characteristics

Parameter	Condition	Min	Typ	Max	Unit
Total Ionizing Dose	MIL-STD-883, Method 1019.4 Operating bias applied during exposure	25			kRads (Si)
Single Event effects	Heavy ions (LET) Test lab: Brookhaven National Laboratory, Tandem Van de Graaff Generator	60			MeV·cm ² /mg

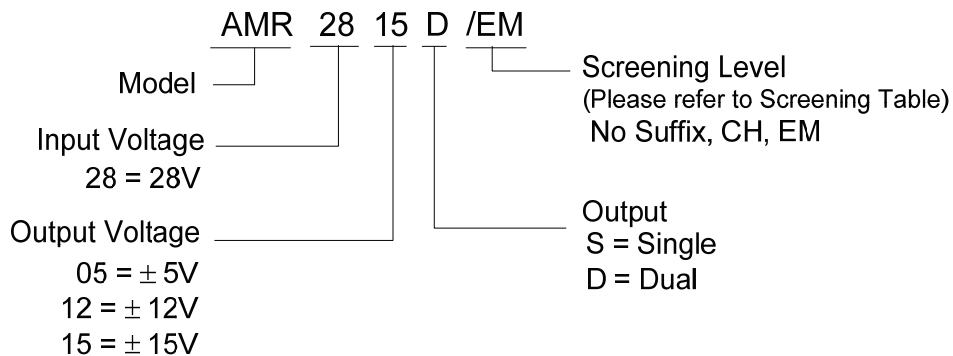
Device Screening

Requirement	MIL-STD-883 Method	No Suffix ②	CH ②	EM ③
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 160 hrs)	320 hrs @ 125°C (2 x 160 hrs)	48 hrs @ 125°C
Final Electrical (Group A)	MIL-PRF-38534 & Specification	-55°C, +25°C, +125°C	-55°C, +25°C, +85°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 Devices with "/CH" suffix is a DLA class H compliant without radiation performance. No suffix is a radiation rated device but not available as a DLA qualified SMD per MIL-PRF-38534.
- ③ Any Engineering Model (EM) build with the "EM" Suffix shall only be form, fit and functional equivalent to its Flight Model (FM) counterpart, and it may not meet the radiation performance. The EM Model shall not be expected comply with MIL-PRF-38534 flight quality/workmanship standards, and configuration control. An EM build may use electrical equivalent commercial grade components. IR HiRel will provide a list of non-compliance items upon request.

Part Numbering



IMPORTANT NOTICE

The information given in this document shall be in no event regarded as guarantee of conditions or characteristic. The data contained herein is a characterization of the component based on internal standards and is intended to demonstrate and provide guidance for typical part performance. It will require further evaluation, qualification and analysis to determine suitability in the application environment to confirm compliance to your system requirements.

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