

ADVANCED ANALOG RADIATION TOLERANT DC/DC CONVERTERS

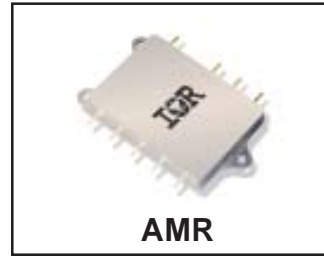
AMR28XXD SERIES 28V Input, Dual Output

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 Advanced Analog 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. Advanced Analog's rugged ceramic seal pins are used exclusively in the package thereby assuring long term hermeticity.

The AMR28XXD has been designed for high density using chip and wire hybrid technology that complies with MIL-PRF-38534. Finished products are fabricated in a facility fully qualified to MIL-PRF-38534. The standard processing adopted for the AMR28XXD is an enhanced version of the requirements of MIL-PRF-38534 for class H including 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 Advanced Analog for special requirements.



Features

- 30 Watts Output Power
- Available in ± 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
- 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

AMR28XXD Series

Specifications

International
IRF Rectifier

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 30W
Operating Case Temperature	-55°C to +125°C

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

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

For Notes to Specifications, refer to page 5

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

Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit	
Cross Regulation ⁵		10% TO 90% Load change					
	AMR2805D	1, 2, 3			10.0	%	
	AMR2812D	1, 2, 3			5.0	%	
	AMR2815D	1, 2, 3			5.0	%	
Input Current	No Load	I _{out} =0, Inhibit =open		20	70	mA	
			AMR2805D	1, 2, 3	20	75	mA
			AMR2812D	1, 2, 3	20	100	mA
	Inhibit	Inhibit shorted to input return		8	15	mA	
			AMR2805D	1, 2, 3	8	18	mA
			AMR2812D	1, 2, 3	8	18	mA
AMR2815D	1, 2, 3						
Input Ripple Current ^{3,4}	1, 2, 3	V _{in} = 16, 28, 40 Volts, 100% load, BW = 20 Hz to 2 MHz			50	mA _{PP}	
Efficiency ⁴	AMR2805D	100% load	1	76		%	
			1	80		%	
			1	79		%	
	AMR2812D	100% load	2, 3	72		%	
			2, 3	75		%	
			2, 3	74		%	
AMR2815D	100% load	2, 3					
Isolation	1	Input to output or any pin to case (except case ground pin) at 500Vdc	100			MΩ	
Capacitive Load ^{6,7}	4	No effect on dc performance			200	μF	
Short Circuit Power Dissipation	1, 2, 3				9	Watts	
Switching Frequency ⁴	4, 5, 6	100% load	500	550	600	KHz	
Sync frequency range	4, 5, 6	100% load	500		700	KHz	
MTBF		MIL-HDBK-217F, SF@T _c =35°C	800			Khrs	
Weight					68	g	

For Notes to Specifications, refer to page 5

AMR28XXD Series

International
IRF Rectifier

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

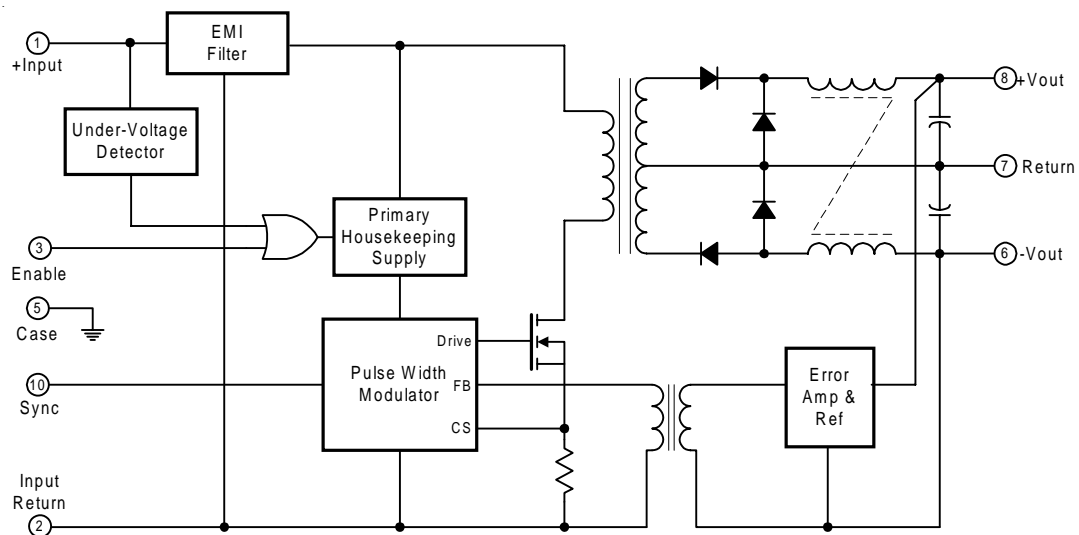
Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit	
Output Response To Step Transient Load Changes ^{4,9}		Load step 50% ⇔ 100%					
	AMR2805D	4, 5, 6	-400		+400	mV pk	
	AMR2812D	4, 5, 6	-400		+400	mV pk	
	AMR2815D	4, 5, 6	-400		+400	mV pk	
			Load step 0% ⇔ 50%				
	AMR2805D	4, 5, 6	-400	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

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.

AMR28XXD Block Diagram



Application Information

Inhibit Function

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 10.0 ±1 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). Advanced Analog 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.

AMR28XXD Series

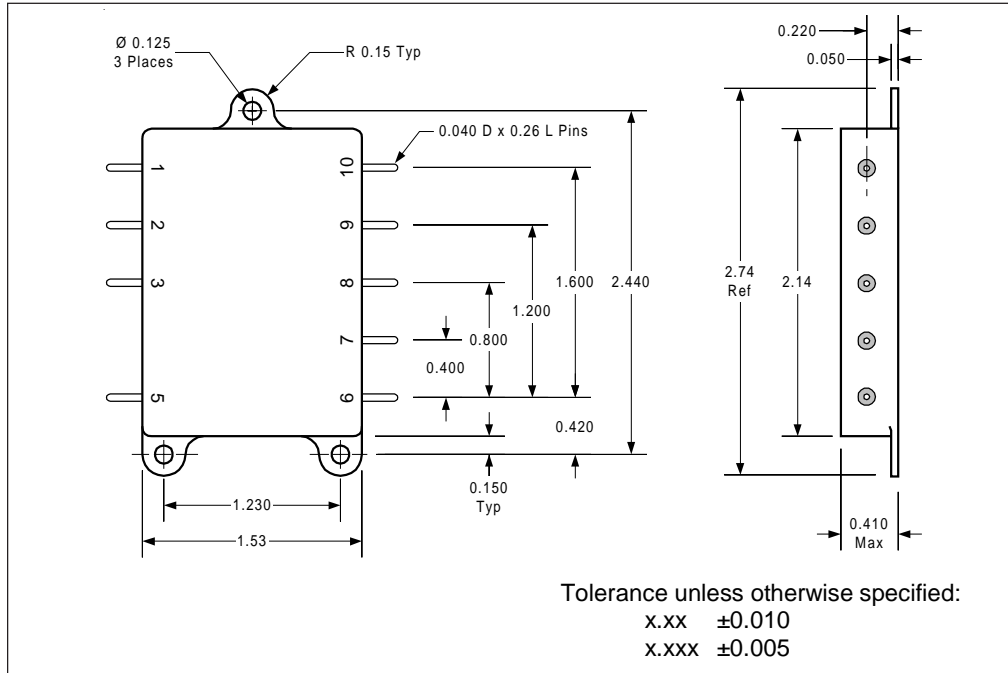
Standard Process Screening for AMR28XXD Series

Requirement	MIL-STD-883 Method	EM Limits	CH+ Limits Flight
Temperature Range		-55°C to +125°C	-55°C to +125°C
Element Evaluation		None	MIL-PRF-38534, for Class H
Internal Visual	2017	AA Standards	Yes
Temperature Cycle	1010	-	Condition C
Constant Acceleration	2001	-	Condition A, (3000g)
PIND	2020	-	Condition A
Burn-in @ +125°C	1015	48 Hrs	160 hrs
Interim Electrical		N/A	Group A, Subgroup 1
Burn-in	1015	N/A	160 hrs @ +125°C
Final Electrical (Group A) Read & Record Data	MIL-PRF-38534	-55°C, +25°C, +125°C	-55°C, +25°C, +125°C
PDA (25°C, interim to final)		N/A	2%
Radiographic Inspection	2012	N/A	Yes
Fine & Gross Leak	1014	Cond C	Condition A, C
External Visual	2009	AA Standards	Yes

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

AMR28XXD Case Outline



Pin Designation

Pin No.	Designation
1	Positive Input
2	Input Return
3	Enable
4	—
5	Case
6	Negative Output
7	Output Return
8	Positive Output
9	N/C
10	Sync Input

Part Numbering

