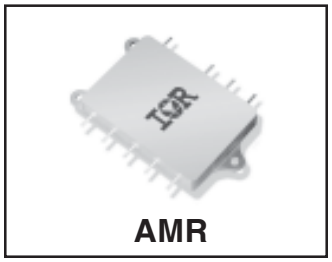
International
IOR Rectifier

AMR28XXD SERIES
28V Input, Dual Output

HYBRID - HIGH RELIABILITY RADIATION TOLERANT DC/DC CONVERTER



AMR

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 hermeticity.

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 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

- 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)
- SEE Hardened to LET up to 60 MeV.cm^2/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 to +50VDC (Continuous), 80V (100ms)	Input Voltage range	+16V to +40VDC
		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°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			Iout=0				
	AMR2805D	1		±4.95	±5.00	±5.05	
	AMR2812D	1		±11.88	±12.00	±12.12	
	AMR2815D	1		±14.85	±15.00	±15.15	
	AMR2805D	2, 3		±4.90		±5.10	V
	AMR2812D	2, 3		±11.70		±12.30	
	AMR2815D	2, 3		±14.70		±15.30	
Output Current [1, 2]			Vin = 16, 28, 40 Volts				
	AMR2805D	1, 2, 3		600		5400	
	AMR2812D	1, 2, 3		250		2250	mA
	AMR2815D	1, 2, 3		200		1800	
Output Power			100% load				
	AMR2805D	1, 2, 3				30	
	AMR2812D	1, 2, 3				30	W
	AMR2815D	1, 2, 3				30	
Output Ripple Voltage [3]			Vin = 16, 28, 40 Volts BW = 20 Hz to 2 MHz				
	AMR2805D	1, 2, 3				60	
	AMR2812D	1, 2, 3				85	mV_{PP}
	AMR2815D	1, 2, 3				85	
Output Voltage Regulation [4]							
			V_{in} = 16, 28, 40 Volts				
Line	AMR2805D	1, 2, 3	Iout = 0, 50%, and 100% load		±10	±30	
	AMR2812D	1, 2, 3			±30	±75	
	AMR2815D	1, 2, 3			±40	±75	
Load	AMR2805D	1, 2, 3			±10	±50	mV
	AMR2812D	1, 2, 3			±50	±120	
	AMR2815D	1, 2, 3			±50	±150	

For Notes to Specifications, refer to page 5

Static Characteristics (Continued) -55°C ≤ T_{CASE} ≤ +125°C, V_{IN}=28 V_{DC} ±5%, C_L=0,unless otherwise pecified.

Parameter		Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Cross Regulation [5]			10% TO 90% Load change				
	AMR2805D	1, 2, 3				10	
	AMR2812D	1, 2, 3				5.0	%
	AMR2815D	1, 2, 3				5.0	
Input Current							
No Load	AMR2805D	1, 2, 3	Iout=0, Inhibit =open		20	70	
	AMR2812D	1, 2, 3			20	75	
	AMR2815D	1, 2, 3			20	100	
			Inhibit shorted to input return				mA
Inhibit	AMR2805D	1, 2, 3			8.0	15	
	AMR2812D	1, 2, 3			8.0	18	
	AMR2815D	1, 2, 3			8.0	18	
Input Ripple Current [3, 4]		1, 2, 3	Vin = 16, 28, 40 Volts, 100% load, BW = 20 Hz to 2 MHz			50	mA_{PP}
Efficiency [4]			100% load				
	AMR2805D	1		76			
	AMR2812D	1		80			
	AMR2815D	1		79			%
	AMR2805D	2, 3		72			
	AMR2812D	2, 3		75			
	AMR2815D	2, 3		74			
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				9.0	W
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@ Tc=35°C	800			Khrs
Weight						68	g

For Notes to Specifications, refer to page 5

Dynamic Characteristics

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

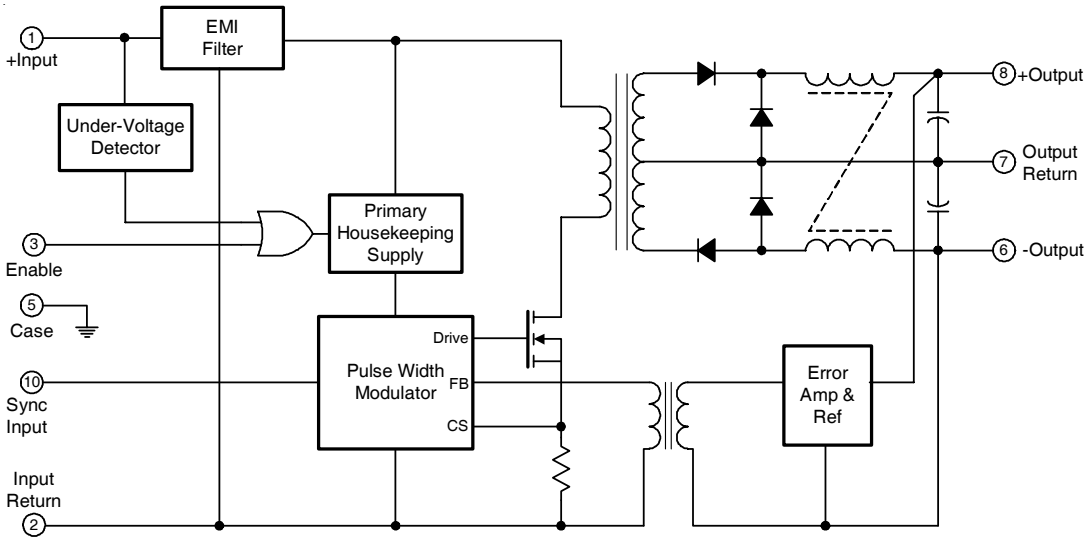
Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Output Response To Step Transient Load Changes [4, 9]						
		Load step 50% ⇔ 100%				
AMR2805D	4, 5, 6		-400		+400	
AMR2812D	4, 5, 6		-400		+400	
AMR2815D	4, 5, 6		-400		+400	mV pk
		Load step 0% ⇔ 50%				
AMR2805D	4, 5, 6		-400		+400	
AMR2812D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

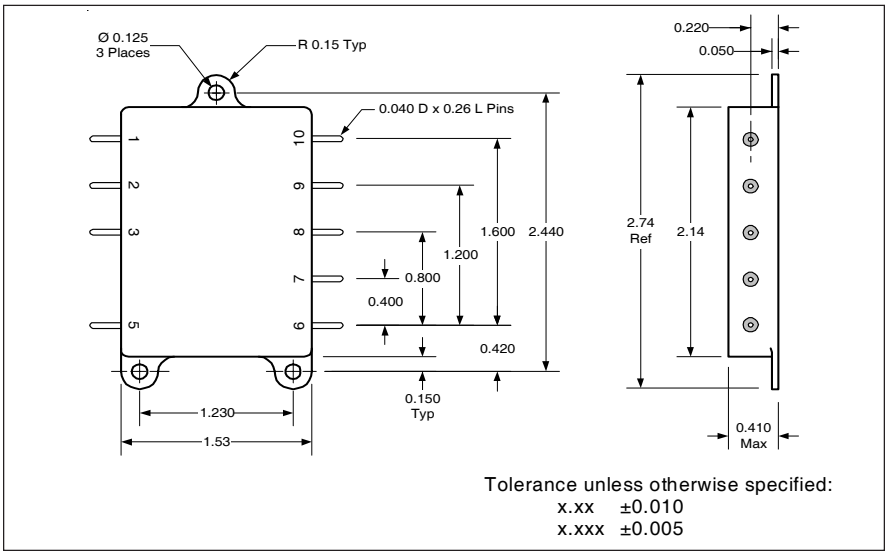
EMI Filter

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). International Rectifier 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
1	+ Input
2	Input Return
3	Enable
4	Blank
5	Case Ground
6	- Output
7	Output Return
8	+ Output
9	NC
10	Sync Input

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

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

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.

Part Numbering

AMR 28 15 D /EM

Model

Input Voltage
28 = 28V

Output Voltage
03R3 = 3.3V, 05 = 5V,
12 = 12V, 15 = 15V

Output
S = Single
D = Dual
T = Triple

Screening Level
(Please refer to Screening Table)
No Suffix, CH, EM

International
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