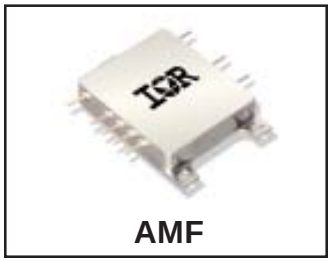
International
IOR Rectifier

PD - 94688

ADVANCED ANALOG RADIATION TOLERANT DC/DC CONVERTERS

AMF28XXD SERIES
28V Input, Dual Output



AMF

Description

The AMF28XXD 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 AMF28XXD series.

The physical configuration of the AMF28XXD 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 AMF28XXD has been designed for high density using chip and wire hybrid technology that complies with the class H requirements of MIL-PRF-38534. Finished product are fabricated in a facility fully qualified to MIL-PRF-38534. The standard processing adopted for the AMF28XXD meets the requirements of MIL-PRF-38534 for class H but with enhanced screening steps and includes element evaluation. Applicable generic lot qualification test data including radiation performance can be made available on request. Consult Advanced Analog for special requirements.

Features

- 12 Watts Output Power
- Available in ±5, ±12 and ±15 Volt Outputs
- 16 - 40 VDC Input Range (28 VDC Nominal)
- Low Input/Output Noise
- Total Ionizing Dose > 30KRads (Si)
- No SEE to LET > 60 MeV-cm^2/mg
- -55°C to +125°C Operating Range
- Indefinite Short Circuit Protection
- Flexible Mounting
- High Power Density
- Fully Isolated - Input to Output and to Case
- Complimentary EMI Filter Available
- Externally Synchronizable
- Electrical Performance Similar to AHF28XXD Series

Specifications

Absolute Maximum Ratings	
Input Voltage Range	-0.5V to +50VDC
Soldering Temperature	300°C for 10 seconds
Storage Case Temperature	65°C to +135°C
Recommmended Operating Conditions	
Input Voltage Range	+16V to +40VDC
Output Power	Less than or equal to 12W
Operating Case Temperature	-55°C to +125°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, 10% load on both outputs				
AMF2805D	1		±4.95	±5.00	±5.05	V
AMF2812D	1		±11.88	±12.00	±12.12	V
AMF2815D	1		±14.85	±15.00	±15.15	V
AMF2805D	2, 3		±4.90		±5.10	V
AMF2812D	2, 3		±11.76		±12.24	V
AMF2815D	2, 3		±14.70		±15.30	V
Output Current [1, 2]		Vin = 16, 28, 40 Volts				
AMF2805D	1, 2, 3	each output	240		2160	mA
AMF2812D	1, 2, 3	each output	100		900	mA
AMF2815D	1, 2, 3	each output	80		720	mA
Output Power [1, 2]		Vin = 28 Volts, 100% load				
AMF2805D	1, 2, 3				12	W
AMF2812D	1, 2, 3				12	W
AMF2815D	1, 2, 3				12	W
Output Ripple Voltage [1, 3]		Vin = 16, 28, 40 Volts,				
AMF2805D	1, 2, 3	100% load,		25	60	mV_{PP}
AMF2812D	1, 2, 3	BW = 20 Hz to 2 MHz		25	60	mV_{PP}
AMF2815D	1, 2, 3			25	60	mV_{PP}
Output voltage Regulation [3]						
		V_{in} = 16, 28, 40 Volts				
Line AMF2805D	1, 2, 3	Iout = 10, 50%, and 100% load		±10	±25	mV
AMF2812D	1, 2, 3			±10	±50	mV
AMF2815D	1, 2, 3			±10	±50	mV
Load AMF2805D	1, 2, 3			±10	±50	mV
AMF2805D	1, 2, 3			±10	±50	mV
AMF2805D	1, 2, 3			±10	±50	mV

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 specified.

Parameter		Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Cross Regulation [5]			Minimum 1.0 watt on both				
	AMF2805D	1, 2, 3	outputs 10%-90% load			10	%
	AMF2812D	1, 2, 3				3	%
	AMF2815D	1, 2, 3				3	%
Input Current			Vin=28V,				
No Load	AMF2805D	1, 2, 3	Iout=0, Inhibit (pin 1)=open		35	60	mA
	AMF2812D	1, 2, 3			35	60	mA
	AMF2815D	1, 2, 3			35	60	mA
Inhibit	AMF2805D	1, 2, 3	Inhibit (pin 1) shorted to input		8	12	mA
	AMF2812D	1, 2, 3	return (pin 7)		8	12	mA
	AMF2815D	1, 2, 3			8	12	mA
Input Ripple Current [3]			Vin = 16, 28, 40 Volts, 100%				
	AMF2805D	1, 2, 3	load, BW = 20 Hz to 2 MHz		20	50	mA_{PP}
	AMF2812D	1, 2, 3			20	50	mA_{PP}
	AMF2815D	1, 2, 3			20	50	mA_{PP}
Efficiency[3]			100% load				
	AMF2805D	1, 3		76			%
	AMF2812D	1, 3		77			%
	AMF2815D	1, 3		78			%
	AMF2805D	2		72			%
	AMF2812D	2		74			%
	AMF2815D	2		74			%
Isolation		1	Input to output or any pin to case (except pin 6) at 500Vdc	100			MΩ
Capacitive Load [5, 6]		4	No effect on dc performance, total for both outputs				
	AMF2805D					500	µF
	AMF2812D					200	µF
	AMF2815D					200	µF
Short Circuit Power Dissipation		1, 2, 3				6	watts
MTBF			MIL-HDBK-217F, SF @ Tc=35°C	750			Khrs
Weight						36	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.

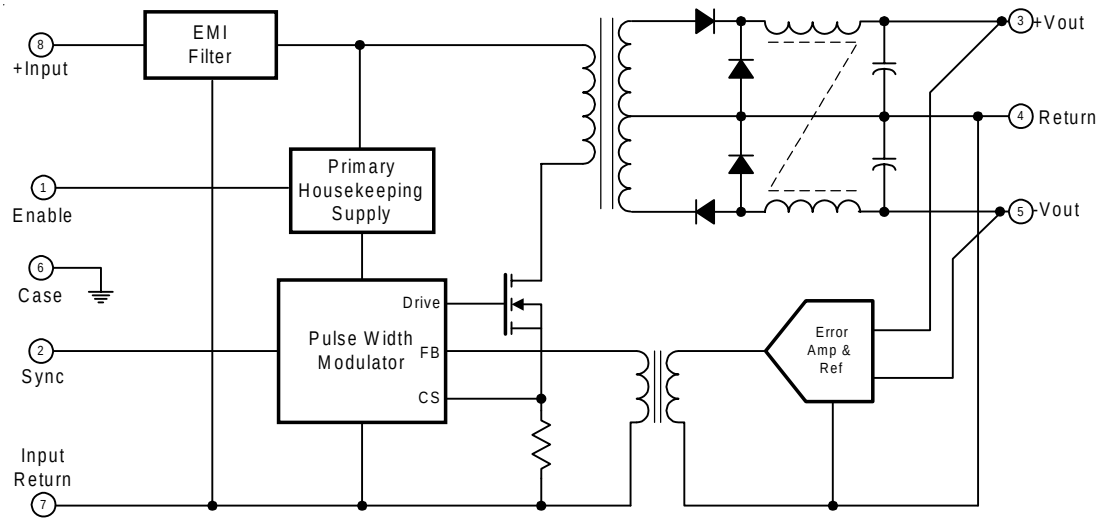
Parameter	Group A Subgroups	Test Conditions	Min	Nom	Max	Unit
Short Circuit Recovery [6]		0% load to 100% Load				
AMF2805D	4, 5, 6				25	ms
AMF2812D	4, 5, 6				25	ms
AMF2815D	4, 5, 6				25	ms
Switching Frequency [3]	4, 5, 6	100% load	500	550	600	KHz
Synchronization Input [3]						
Frequency Range	4, 5, 6		500		700	KHz
Pulse Amplitude, Hi [6]			2.5		10	V
Pulse Amplitude, Lo [6]			-0.5		0.8	V
Pulse Rise time [6]					100	ns
Pulse Duty Cycle [6]			20		80	%
Output Response To Step Transient Load Changes [3, 7]						
	4, 5, 6	Load step 50%⇔100%	-200		+200	mV_{pk}
	4, 5, 6	Load step 10% ⇔ 50%	--800		+800	mV_{pk}
Recovery Time, Step Transient Load Changes [3, 7, 8]						
	4, 5, 6	Load step 50%⇔100%			70	µs
	4, 5, 6	Load step 10% ⇔50%			2000	µs
Output Response Transient Step Line Changes [3, 6, 9]		Input step 16⇔ 40Vdc, 100% Load				
AMF2805D	4, 5, 6		-450		+450	mV_{pk}
AMF2812D	4, 5, 6		-750		+750	mV_{pk}
AMF2815D	4, 5, 6		-750		+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]						
All	4, 5, 6	0% load			600	mV_{pk}
AMF2805D	4, 5, 6	100% load			400	mV_{pk}
AMF2812D	4, 5, 6				300	mV_{pk}
AMF2815D	4, 5, 6				300	mV_{pk}
Turn On Delay [3, 10]	4, 5, 6	0% load to 100% load			25	ms

For Notes to Specifications, refer to page 5

Notes to Specifications

1. Applicable to positive and negative outputs.
2. Maximum combined output is 12 watts. 10.8 watts (max.) is available from either output (90%).
3. Load current split equally between $+V_{OUT}$ and $-V_{OUT}$.
4. 1.2 watt load on output under test, 1.2 watt to 10.8 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 V_{out} has returned to within ±1% of V_{out} 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.

AMF28XXD Block Diagram



Application Information

Inhibit Function

Connecting the enable input (Pin 1) 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. If the user chooses not to use the inhibit function, it may be left open and the converter will function normally. Because it is internally pulled up, the open circuit voltage of the inhibit input is 10.0 $+1V_{DC.}$

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 AMF type converters to match switching frequency of the converter to the frequency of the system clock, thus eliminating this type of noise.

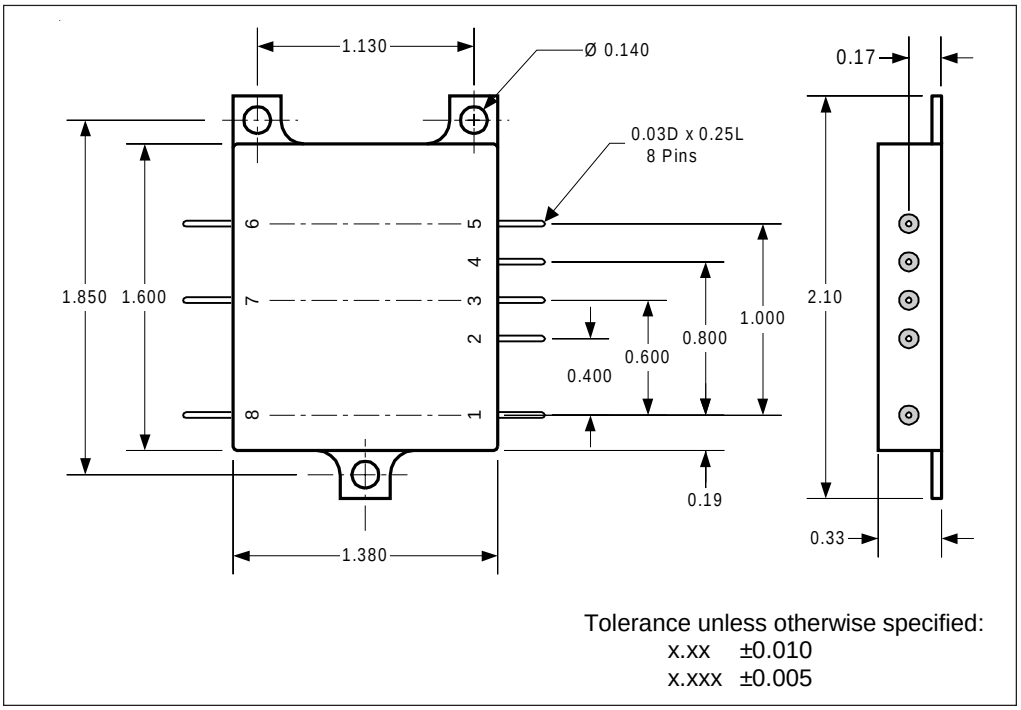
Standard Process Screening for AMF28XXD Series

Requirement	MIL-STD-883 Method	CH+ Limits
Temperature Range	—	-55°C to +125°C
Element Evaluation	—	MIL-PRF-38534
Internal Visual	2017	Yes
Temperature Cycle	1010	Condition C
Constant Acceleration	2001	Condition A, (3000g)
PIND	2020	Condition A
Burn-in Interim Electrical; @160 hrs	1015	320 hrs @ +125°C (2 x 160 hrs)
Final Electrical (Group A) Read & Record Data	MIL-PRF-38534 & Specification	-55°C, +25°C, +125°C
PDA (25C, interim to final)	—	2%
Radiographic Inspection	2012	Yes
Fine & Gross	1014	Condition A, C
External Visual	2009	Yes

Radiation Specification

Parameter	Condition	Min	Typ	Max	Unit
Total Ionizing Dose	MIL-STD-883, Method 1019.4 Operating bias applied during exposure	30	—	—	KRads (Si)
Heavy Ion (Single event effects)	BNL Dual Van de Graf Generator	60	—	—	MeV •cm^2 /mg

AMF28XXD Case Outline



Tolerance unless otherwise specified:
x.xx ±0.010
x.xxx ±0.005

Pin Designation

Pin No.	Designation
1	Enable
2	Sync Input
3	Positive Output
4	Output Return
5	Negative Output
6	Case Ground
7	Input Return
8	Positive Input

Part Numbering

AMF 28 05 D / EM

- Model
- Input Voltage
  - 28 = 28V
- Output Voltage
  - 05 = ±5V,
  - 12 = ±12V,
  - 15 = ±15V
- Outputs
  - S = Single
  - D = Dual
- Screening
  - Blank = Flight Model (CH+)
  - /EM = Engineering Model

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