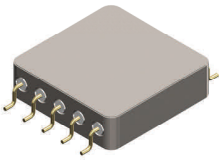
AF100461 SERIES

EMI FILTER
HYBRID-HIGH RELIABILITY



AF

Description

The AF100461 Series EMI filter is designed to provide full compliance with the input line reflected ripple current requirement specified by MIL-STD-461C and MIL-STD-461F over the extended temperature range while operating in conjunction with the corresponding ARA and ARE Series of DC-DC converters. The filter is offered as part of a family of high reliability conversion products that operate up to 110V input line. Other converters operating with a similar switching frequency could also benefit by use of this device.

The AF100461 filter is hermetically sealed in a seam welded enclosure utilizing axially oriented surface-mountable copper-core pins which minimize resistive losses. The package is fabricated with IR HiRel's rugged ceramic lead-to-package seal assuring long term hermetic seal integrity in harsh environments.

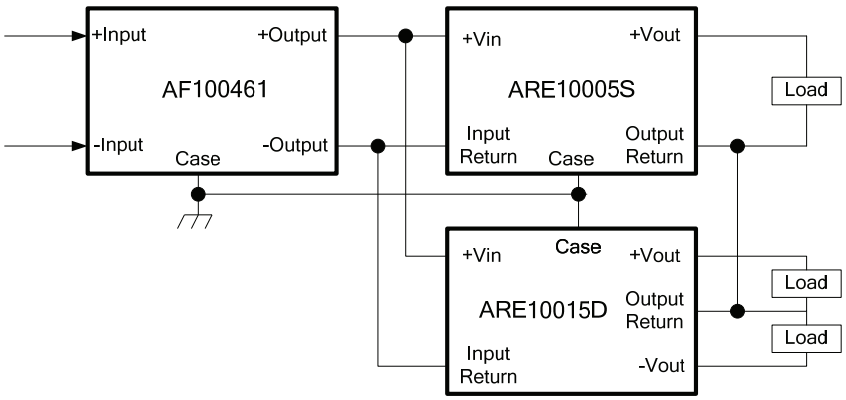
The filter is manufactured in a facility fully qualified to MIL-PRF-38534, and is available in two screening grades. The flight grade is designed with the requirements of MIL-PRF-38534 for class K.

Features

- Up to 300mA Output Current
- Attenuation > 70dB @ 400 kHz
- Low Profile Seam Welded Package
- Ceramic Insulated Copper Core Pins
- Operation Over the Temperature Range -55°C to 105°C without Power Derating - Note 3
- Class K Screened per MIL-STD-38534
- MIL-PRF-38534 Element Evaluated Components
- Enabling ARA and ARE Series DC-DC Converters to meet CE102 Requirements of MIL-STD-461F
- Derated per MIL-STD-1547 and IEEE-INST-002 up to 105°C - Note 3

The EM grade are processed and screened to a lower grade requirement. Flight grade are tested to meet the complete group "A" test specifications over the wide temperature range with no derating. The filter is designed to meet the derating guidelines of MIL-STD-1547 and IEEE-INST-002.

Typical Connection Diagram



Notes

1. One AF100461 filter is designed to accommodate up to two converters over rated voltage with rated load while not exceeding maximum power limit.
2. To obtain specified EMI performance, it is recommended that conductor length between filter and converter to be kept under 3 inches.
3. Meets derating under the following conditions: Nominal V_{IN} = 100V, Worst case V_{IN} = 110V and Worst case temperature of 105°C.

Specifications

Absolute Maximum Ratings, Note 1	
Input Voltage	-150V to +150V, Note 2
Input Current	300mA
Lead Soldering Temperature	+300°C for 10 seconds
Case Temperature-Operating	-55°C to +85°C
Case Temperature-Storage	-55°C to +135°C

Electrical Characteristics -55°C ≤ T_{CASE} ≤ +85°C, -150 ≤ V_{IN} ≤ +150V unless otherwise specified

Parameter	Group A Subgroup	Conditions	Min.	Nom.	Max.	Unit
Input Voltage		Steady State	-100	—	+110	V_{DC}
		Transient, Notes 2, 4	-150	—	+150	
Output Voltage	1, 2, 3	Continuous	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V_{DC}
Output Current			—	—	300	mA_{DC}
DC Resistance	1	T_C = 25°C, Note 3	—	—	700	mΩ
Power Dissipation	4, 5, 6	Worst case, Notes 6, 7	—	—	870	mW
		Normal operation, Notes 6, 7	—	—	63	
Noise Reduction $20 \cdot \log10 \cdot (V_{OUT} / V_{IN})$	4, 5, 6	1.0 kHz, Note 5	+1.0	0	-1.0	dB
		10 kHz, Note 5	+4.0	+1.0	-1.0	
		50 kHz, Note 5	-8.0	-13	—	
		80 kHz, Note 5	-26	-30	—	
		100 kHz, Note 5	-36	-40	—	
		200 kHz, Note 5	-60	-70	—	
		300 kHz to 3 MHz, Notes 5, 6	-70	—	—	
		3.1 MHz to 10 MHz, Notes 5, 6	-60	—	—	
Isolation	1	Any Pin to Case, Tested @ $500V_{DC}$	100	—	—	MΩ
Capacitance	1, 2, 3	Measured between any Pin and Case	16	—	24	nF
Device Weight			—	—	25	g

Notes to Specifications

1. Operation above maximum ratings may cause permanent damage to the device. Operation at maximum ratings may degrade performance and affect reliability.
2. Device can tolerate ± 150 Volt transient whose duration is ≤ 100ms when $R_S \geq 0.5\Omega$.
3. DC resistance is the total resistance of the device and includes the sum of the input to output resistance and the *return in* to *return out* resistance paths.
4. Derating guidelines do not apply for any input voltage transient conditions.
5. $V_{IN} = 0V_{DC} + 1.0V_{AC\ RMS}$. Used two 330nF capacitors (the equivalent internal capacitance of one ARX100XXX Converter) to complete the third stage of the filter.
6. This parameter is not 100% tested, guaranteed by design.
7. The listed power dissipation is the peak value during conducted susceptibility testing when using $2V_{RMS}$ signal injection and it occurs at approximately 30 kHz. For the nominal operating conditions, the nominal power dissipation is based on the maximum rated DC current and DC resistance.

Typical Attenuation Characteristics

(Temperature = 25°C, V_{IN} = 0dBm + 0V_{DC} unless otherwise specified)

Fig 1. Typical Attenuation with effects of L1-R1 ignored due to the absence of converter(s) Internal Capacitance

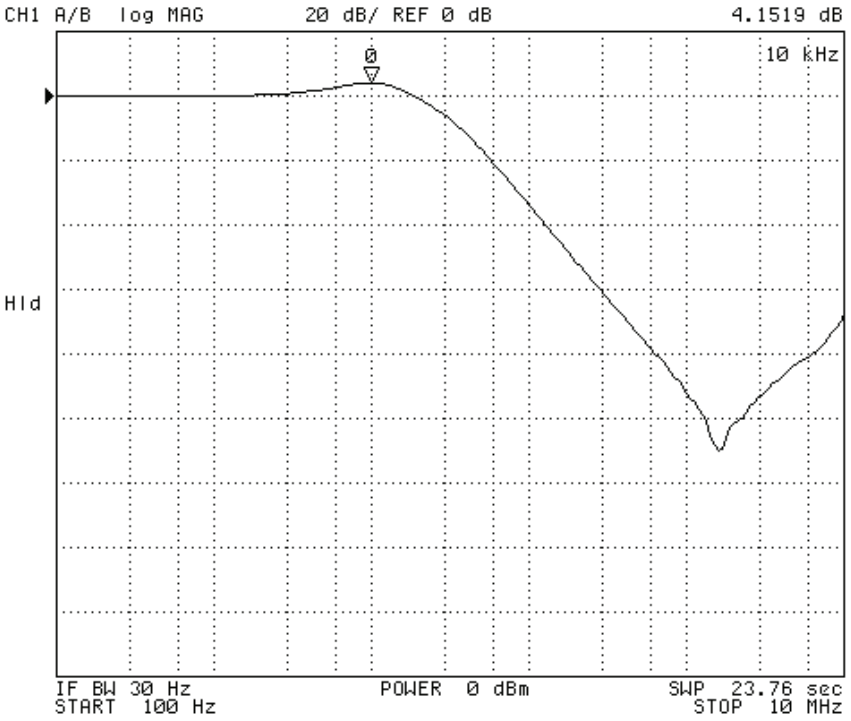
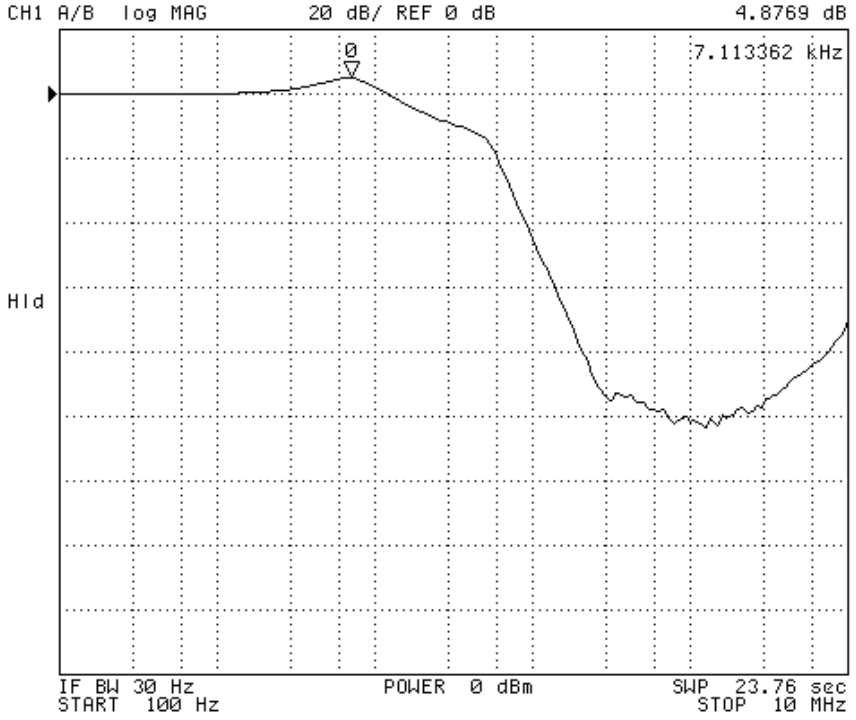


Fig 2. Typical Attenuation with the third filtering stage completed by connecting one ARX100XXX Converter.



Typical EMI Filter Performance Curves

(Temperature = 25°C, V_{IN} = 100V, with two ARE10015D operating at rated load, unless otherwise specified)

Fig 3. MIL-STD-461C CE03 without a filter, using only a series Input Impedance equivalent to R1-L1 (20Ω || 22µH) to stablish Z_{IN} before the two converters. (1dBµV = 1dBµA)

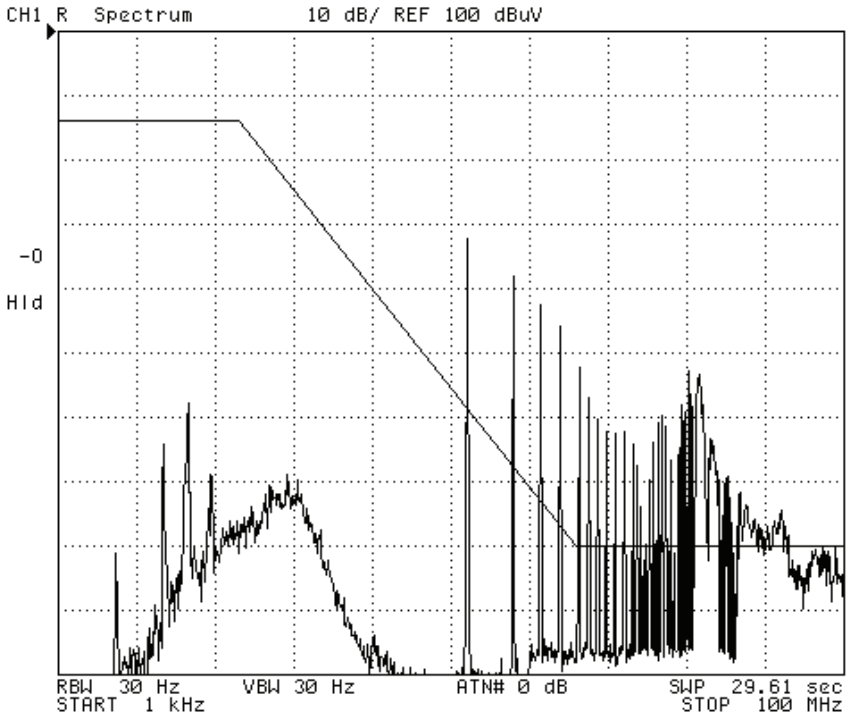


Fig 4. MIL-STD-461C CE03 with an AF100461 filter before the two converters. (1dBµV= 1dBµA)

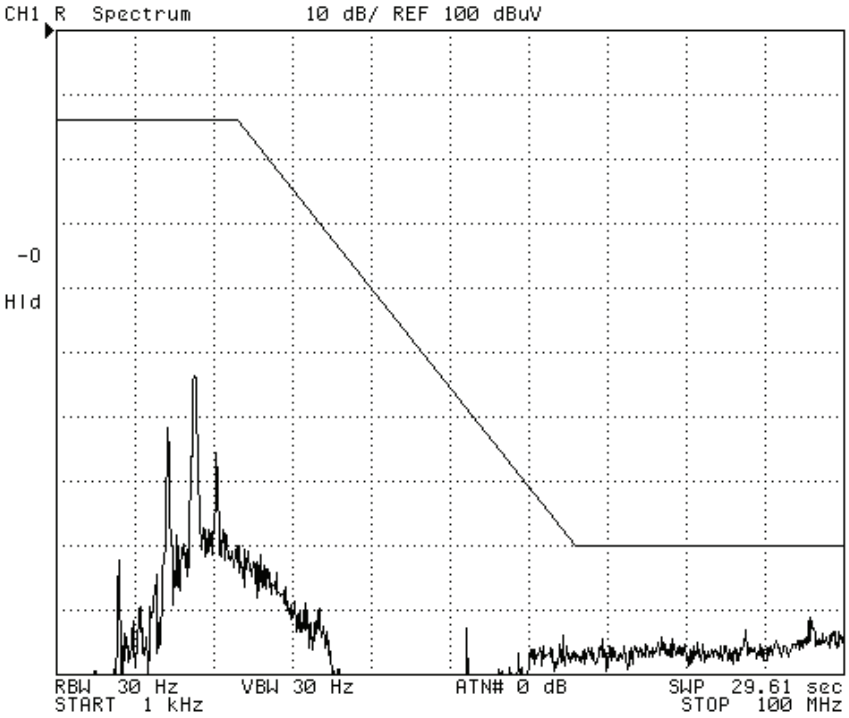


Fig 5. MIL-STD-461F CE102 without a filter, using only a series Input Impedance equivalent to R1-L1 (20Ω || 22µH) to stablish Z_{IN} before the two converters.

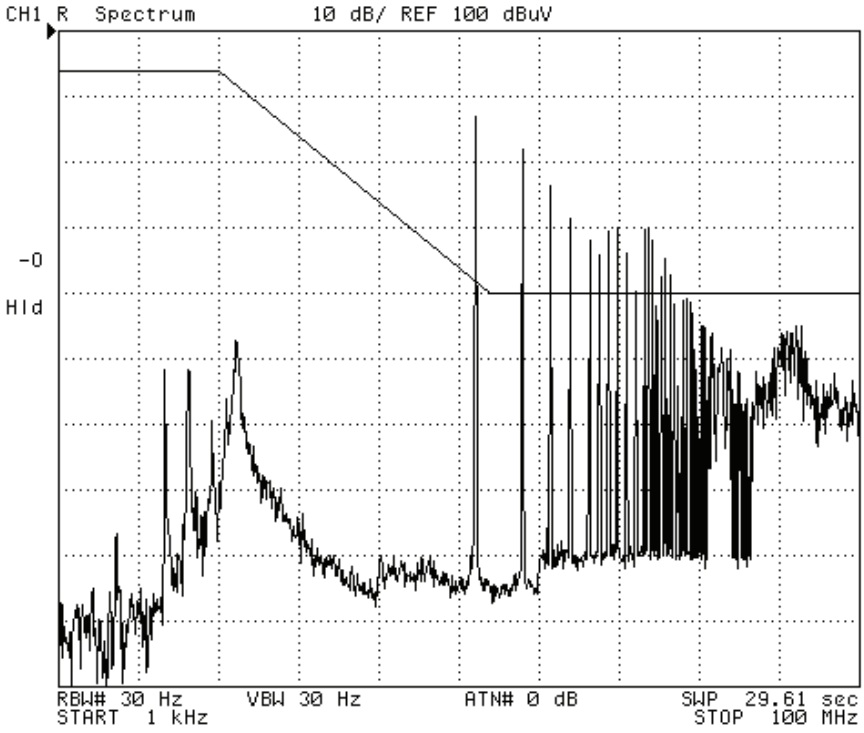
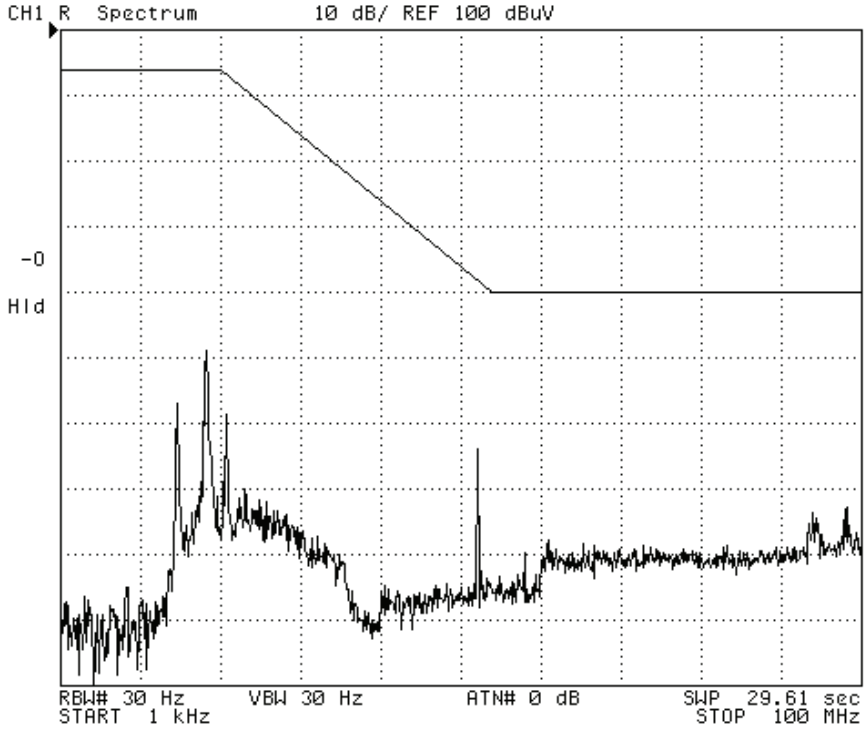
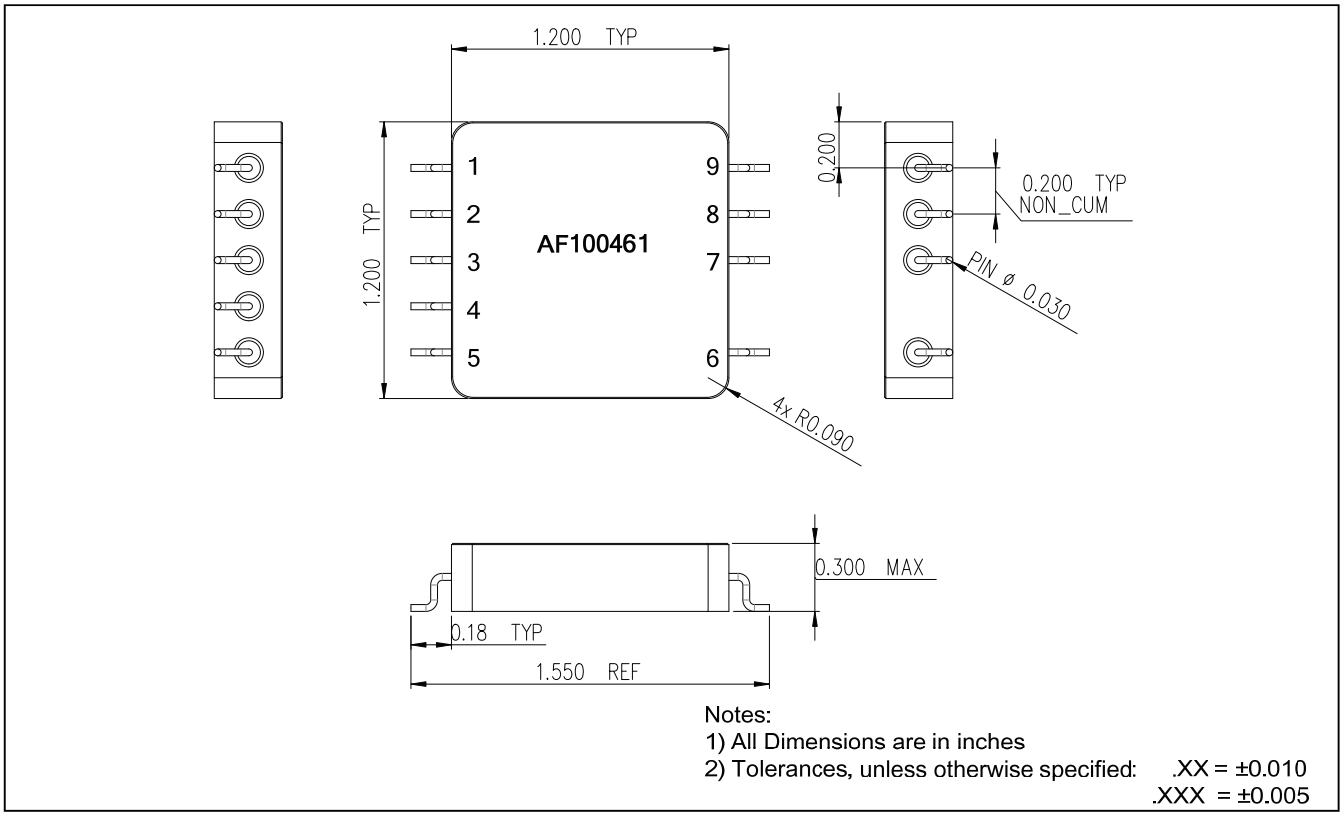


Fig 6. MIL-STD-461F CE102 with an AF100461 filter before the two converters.

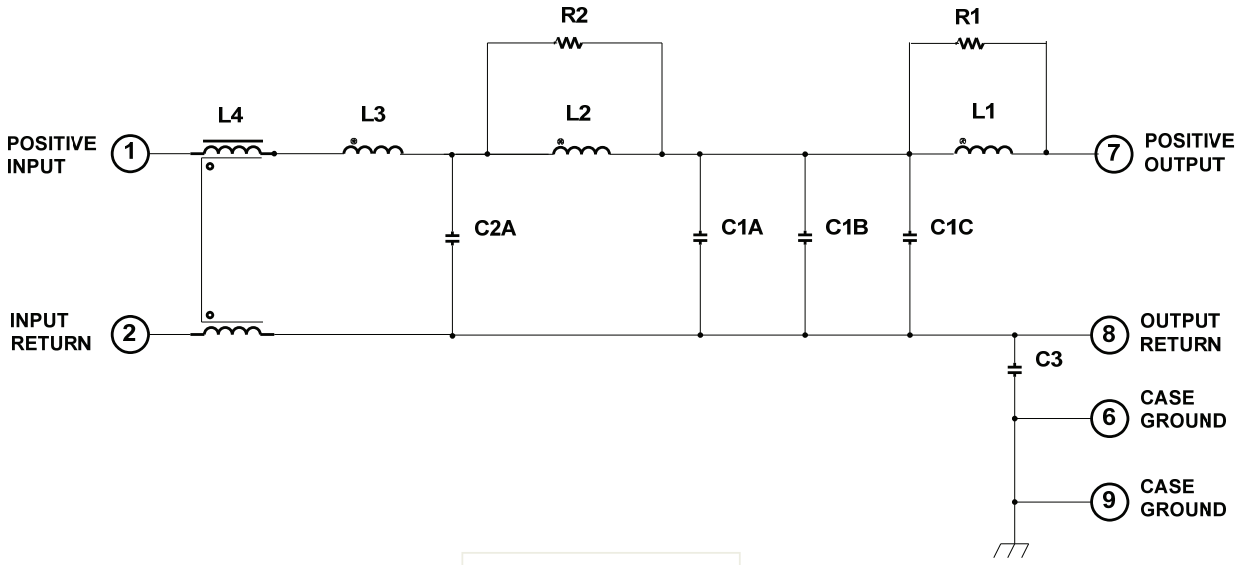


Mechanical Outline



Notes:
1) All Dimensions are in inches
2) Tolerances, unless otherwise specified: .XX = ±0.010
.XXX = ±0.005

Fig 7. Block Diagram



Pin Designation

Pin #	Designation	Pin #	Designation
1	+ INPUT	6	CASE GROUND
2	INPUT RETURN	7	+ OUTPUT
3	NC	8	OUTPUT RETURN
4	NC	9	CASE GROUND
5	NC		

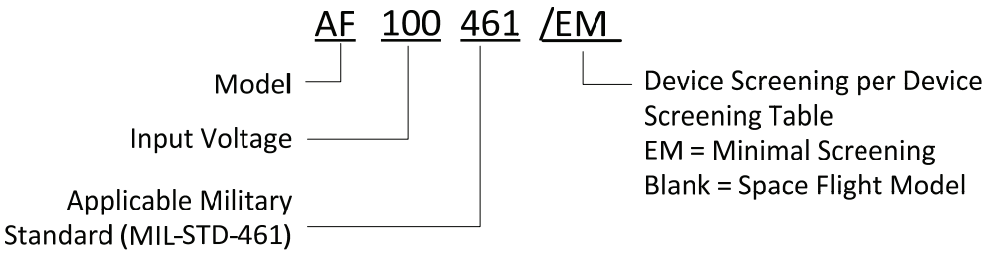
Device Screening

Requirement	MIL-STD-883 Method	Flight No Suffix	/EM Suffix ①
Temperature Range	—	-55°C to +85°C	-55°C to +85°C
Element Evaluation	—	MIL-PRF-38534,Class K	—
Internal Visual	2017	Yes	Yes
Temperature Cycle	1010	Cond C	—
Constant Acceleration	2001	Cond A	—
PIND	2020	Cond A	—
Burn-in Interim Electrical @ 160 hrs	1015	320 hrs @ 125°C	48 hrs @ 125°C
Final Electrical (Group A) Read & Record Data	MIL-PRF-38534 & Specification	-55°C, +25°C, +85°C	+25°C
PDA (25°C, interim to final)	—	2%	—
Seal, Fine & Gross	1014	Cond A, C	Cond A, C
Radiographic	2012	Yes	—
External Visual	2009	Yes	Yes

Note:

① 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



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