

AD Series™ Laminates Supplemental White Paper

The purpose of this document is to provide assistance in understanding the background and role of the various versions available in the AD Series™ portfolio of products.

With the advent of the wireless industry boom in the 1990's, Arlon LLC began development of the AD Series materials in order to address the cost-sensitive commercial antenna and satellite markets. The technology approach involved the strategic use of PTFE and woven fiberglass combined in specific ways to create a variety of lower dielectric constant options between 2.50 and 3.50. Examples of these were AD250L™, AD260L™, and AD320L™. Various thickness options were created as the market needs presented themselves. Construction options were plentiful, but limited to some degree by the physical limitations of commercially available glass styles. These products performed well in the antenna market for several years.

As time passed there was an increasing demand for lower priced versions of the "L" series products. In response, Arlon formulated ceramic filled layers that were judiciously used to replace some of the more expensive unfilled resin layers. These new partially filled composites were known as the second generation or the "A" version of the AD Series materials. Examples of these materials are AD255A™, AD300A™, and AD320A™. Aside from being lower in cost, the "A" series products displayed lower z-axis expansion rates. Also, partially due to a reduction in glass content, the dissipation factor values for the "A" series products were also lower. Due to the newer construction limitations, fewer thickness options were possible and subsequently made available, but those feasible were lower priced and better performing – clearly a benefit for the customers.

In a further act of cost reduction, Arlon created the "C" series versions of some of the AD Series products. This final "C" series again lowered the cost of manufacturing through the addition of more ceramic filled layers and less resin. In doing so the z-axis expansion and dissipation factor was again slightly reduced. Examples of these materials are AD250C™, AD255C™, and AD300C™. These final "C" versions were and continue to be the best overall value for our customers since they are the best performing products at the lowest price.

Figure 1 below shows the dissipation factor values for the various AD Series laminate materials referenced in this paper.

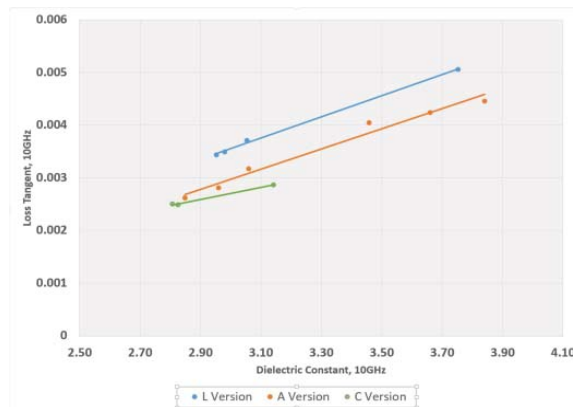


Figure 1. Loss tangent vs dielectric constant for the "L", "A", and "C" versions of the AD series materials tested using split post dielectric resonator method at 10GHz.

Under the ownership of Rogers Corporation the legacy products are still offered to customers. However, we always recommend that the latest versions of each product are considered for use. These latest versions are lowest in price, lowest in dissipation factor, and lowest in z-axis expansion.

Please note that the datasheets for the versions other than the latest of each grade are not available. Exhaustive testing has recently been completed on all latest versions of the AD series products and is now available on our website for reference (<http://www.rogerscorp.com/acs/products/85/AD250C-AD255C-AD260A-AD300C-AD300D-AD320A-AD350A-Laminates.aspx>). Tables 1 and 2 list the currently available construction options for the AD250 through AD350 products.

| Product | Series | Dk | Dk Tolerance | Thickness (inches) | Thickness Tolerance (inches) |
|---------|--------|------|--------------|--------------------|------------------------------|
| AD250 | C | 2.50 | ±0.04 | 0.020 | ±0.002 |
| AD250 | C | 2.50 | ±0.04 | 0.030 | ±0.002 |
| AD250 | C | 2.50 | ±0.04 | 0.045 | ±0.002 |
| AD250 | C | 2.50 | ±0.04 | 0.060 | ±0.003 |
| AD250 | C | 2.50 | ±0.04 | 0.090 | ±0.007 |
| AD250 | C | 2.50 | ±0.04 | 0.125 | ±0.009 |
| AD250 | C | 2.50 | ±0.04 | 0.250 | ±0.012 |
| AD250 | A | 2.50 | ±0.04 | 0.030 | ±0.002 |
| AD250 | A | 2.50 | ±0.04 | 0.040 | ±0.003 |
| AD250 | A | 2.50 | ±0.04 | 0.060 | ±0.003 |
| AD250 | A | 2.50 | ±0.04 | 0.080 | ±0.004 |
| AD250 | A | 2.50 | ±0.04 | 0.125 | ±0.009 |
| AD250 | L | 2.50 | ±0.05 | 0.010 | ±0.001 |
| AD250 | L | 2.50 | ±0.05 | 0.015 | ±0.0015 |
| AD250 | L | 2.50 | ±0.05 | 0.020 | ±0.002 |
| AD250 | L | 2.50 | ±0.05 | 0.025 | ±0.002 |
| AD250 | L | 2.50 | ±0.05 | 0.031 | ±0.003 |
| AD250 | L | 2.50 | ±0.05 | 0.062 | ±0.003 |
| AD250 | L | 2.50 | ±0.05 | 0.090 | ±0.007 |
| AD250 | L | 2.50 | ±0.05 | 0.125 | ±0.009 |
| AD255 | C | 2.55 | ±0.04 | 0.020 | ±0.002 |
| AD255 | C | 2.55 | ±0.04 | 0.025 | ±0.002 |
| AD255 | C | 2.55 | ±0.04 | 0.030 | ±0.002 |
| AD255 | C | 2.55 | ±0.04 | 0.040 | ±0.002 |
| AD255 | C | 2.55 | ±0.04 | 0.060 | ±0.002 |
| AD255 | C | 2.55 | ±0.04 | 0.080 | ±0.003 |
| AD255 | C | 2.55 | ±0.04 | 0.093 | ±0.005 |
| AD255 | C | 2.55 | ±0.04 | 0.125 | ±0.006 |
| AD255 | A | 2.55 | ±0.04 | 0.030 | ±0.002 |
| AD255 | A | 2.55 | ±0.04 | 0.031 | ±0.002 |
| AD255 | A | 2.55 | ±0.04 | 0.040 | ±0.002 |
| AD255 | A | 2.55 | ±0.04 | 0.060 | ±0.002 |
| AD255 | A | 2.55 | ±0.04 | 0.062 | ±0.003 |
| AD255 | A | 2.55 | ±0.04 | 0.080 | ±0.003 |
| AD255 | A | 2.55 | ±0.04 | 0.090 | ±0.003 |
| AD255 | A | 2.55 | ±0.04 | 0.125 | ±0.006 |
| AD255 | L | 2.55 | ±0.05 | 0.010 | ±0.001 |
| AD255 | L | 2.55 | ±0.05 | 0.020 | ±0.002 |
| AD255 | L | 2.55 | ±0.05 | 0.030 | ±0.003 |
| AD255 | L | 2.55 | ±0.05 | 0.031 | ±0.003 |
| AD255 | L | 2.55 | ±0.05 | 0.040 | ±0.003 |
| AD255 | L | 2.55 | ±0.05 | 0.060 | ±0.003 |
| AD255 | L | 2.55 | ±0.05 | 0.062 | ±0.003 |
| AD255 | L | 2.55 | ±0.05 | 0.120 | ±0.009 |
| AD255 | L | 2.55 | ±0.05 | 0.125 | ±0.009 |

Table 1. Listing of available AD250 and AD255 series product construction options for "L", "A", and "C" versions.

| Product | Series | Dk | Dk Tolerance | Thickness (inches) | Thickness Tolerance (inches) |
|---------|--------|------|--------------|--------------------|------------------------------|
| AD260 | C | 2.60 | ±0.04 | 0.090 | ±0.003 |
| AD260 | A | 2.60 | ±0.04 | 0.030 | ±0.002 |
| AD260 | A | 2.60 | ±0.04 | 0.040 | ±0.002 |
| AD260 | A | 2.60 | ±0.04 | 0.060 | ±0.003 |
| AD260 | A | 2.60 | ±0.05 | 0.090 | ±0.005 |
| AD260 | A | 2.60 | ±0.04 | 0.125 | ±0.006 |
| AD260 | L | 2.60 | ±0.05 | 0.015 | ±0.002 |
| AD260 | L | 2.60 | ±0.05 | 0.020 | ±0.002 |
| AD300 | D | 2.94 | ±0.05 | 0.030 | ±0.002 |
| AD300 | D | 2.94 | ±0.05 | 0.060 | ±0.002 |
| AD300 | C | 2.97 | ±0.05 | 0.021 | ±0.001 |
| AD300 | C | 2.97 | ±0.05 | 0.030 | ±0.002 |
| AD300 | C | 2.97 | ±0.05 | 0.040 | ±0.002 |
| AD300 | C | 2.97 | ±0.05 | 0.060 | ±0.002 |
| AD300 | C | 2.97 | ±0.05 | 0.090 | ±0.005 |
| AD300 | C | 2.97 | ±0.05 | 0.120 | ±0.005 |
| AD300 | C | 2.97 | ±0.05 | 0.125 | ±0.006 |
| AD300 | C | 2.97 | ±0.05 | 0.180 | ±0.009 |
| AD300 | C | 2.97 | ±0.05 | 0.250 | ±0.012 |
| AD300 | C | 2.97 | ±0.05 | 0.260 | ±0.013 |
| AD300 | C | 2.97 | ±0.05 | 0.270 | ±0.013 |
| AD300 | A | 3.00 | ±0.04 | 0.020 | ±0.001 |
| AD300 | A | 3.00 | ±0.04 | 0.030 | ±0.002 |
| AD300 | A | 3.00 | ±0.04 | 0.040 | ±0.002 |
| AD300 | A | 3.00 | ±0.04 | 0.060 | ±0.002 |
| AD300 | A | 3.00 | ±0.04 | 0.090 | ±0.005 |
| AD300 | A | 3.00 | ±0.04 | 0.120 | ±0.006 |
| AD300 | A | 3.00 | ±0.04 | 0.125 | ±0.006 |
| AD320 | A | 3.20 | ±0.04 | 0.031 | ±0.002 |
| AD320 | A | 3.20 | ±0.04 | 0.030 | ±0.002 |
| AD320 | C | 3.20 | ±0.05 | 0.031 | ±0.002 |
| AD320 | A | 3.20 | ±0.04 | 0.041 | ±0.002 |
| AD320 | A | 3.20 | ±0.04 | 0.062 | ±0.003 |
| AD320 | A | 3.20 | ±0.04 | 0.120 | ±0.008 |
| AD320 | A | 3.20 | ±0.04 | 0.250 | ±0.012 |
| AD320 | L | 3.20 | ±0.10 | 0.020 | ±0.002 |
| AD320 | L | 3.20 | ±0.10 | 0.030 | ±0.002 |
| AD320 | L | 3.20 | ±0.10 | 0.031 | ±0.002 |
| AD320 | L | 3.20 | ±0.10 | 0.062 | ±0.003 |
| AD320 | L | 3.20 | ±0.10 | 0.125 | ±0.009 |
| AD350 | A | 3.50 | ±0.05 | 0.020 | ±0.0015 |
| AD350 | A | 3.50 | ±0.05 | 0.030 | ±0.002 |
| AD350 | A | 3.50 | ±0.05 | 0.040 | ±0.003 |
| AD350 | A | 3.50 | ±0.05 | 0.050 | ±0.003 |
| AD350 | A | 3.50 | ±0.05 | 0.060 | ±0.003 |
| AD350 | A | 3.50 | ±0.05 | 0.090 | ±0.004 |
| AD350 | A | 3.50 | ±0.05 | 0.120 | ±0.008 |
| AD350 | A | 3.50 | ±0.05 | 0.125 | ±0.008 |
| AD350 | A | 3.50 | ±0.05 | 0.200 | ±0.012 |

Table 2. Listing of available AD260 through AD350 series product construction options for "L", "A", and "C" versions.

The information in this data sheet is intended to assist you in designing with Rogers' laminates. It is not intended to and does not create any warranties express or implied, including any warranty of merchantability or fitness for a particular application. The user should determine the suitability of Rogers' laminates for each application.

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Advanced Connectivity Solutions
100 S. Roosevelt Avenue, Chandler, AZ 85226
Tel: 480-961-1382, Fax: 480-961-4533 www.rogerscorp.com