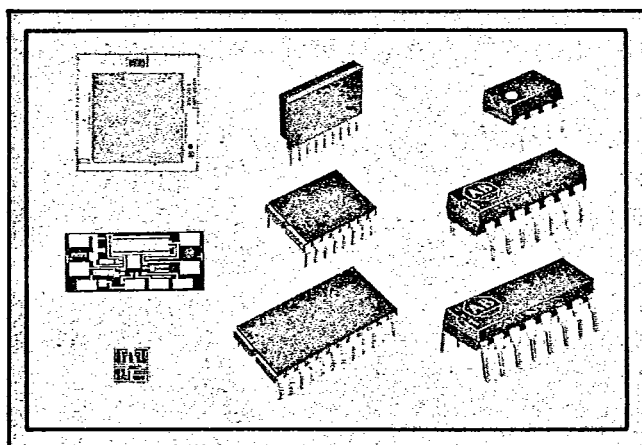




Series FC, FG Custom Thin Film Precision Resistor Networks



FEATURES

- 1K Ohms to 10 Megohms
- $\pm 0.015\%$ Tolerance
- $\pm 0.015\%$ Ratio
- ± 25 ppm/ $^{\circ}\text{C}$ TCR, ± 10 ppm available
- ± 5 ppm/ $^{\circ}\text{C}$ TCR Tracking
- SIP Package (ceramic)
- DIP Packages (molded and ceramic)
- Surface Mount Packages (ceramic)
- Chip Resistor Networks (alumina or glass)
- Hybrid Network Substrates (alumina or glass)

SPECIFICATIONS

Introduction

Allen-Bradley thin film resistor networks consist of integrated films of chromium cobalt vacuum deposited on specially selected glass substrates resulting in networks having precision tolerance and stability. They can be calibrated to tolerance at Allen-Bradley or they can be designed for functional (active) trimming by the customer.

For additional information on chromium/cobalt technology refer to Allen-Bradley Publication EC90.

General Capabilities

Film stability — Unique chromium cobalt thin film provides consistent long term stability.

Interconnection reliability — Metal film interconnections and bonding pads are reliable; no soldered or welded interconnections.

Electrical uniformity — Resistance change due to temperature (TCR) is low and uniform across substrate (TCRT).

Performance repeatability — Network-to-network, circuit performance is reliable and repeatable.

Consistent quality — From prototype to high volume production, quality is a major factor.

Applications

These precision networks are ideally suited for use on any electronic equipment requiring close tolerances and/or low temperature coefficient resistors. Some of these applications are listed below.

- Ladder networks
- Digital multimeters
- Current summing applications
- Precision attenuators
- A/D and D/A converters
- Communication equipment
- Precision voltage dividers
- Telemetry equipment
- Coding and decoding circuitry
- Measurement bridges
- Paging systems

For application information refer to the following Allen-Bradley Application Notes:

- R/2R Ladder Networks: EC5510-4.2
- Voltage Divider Networks: EC5515-4.2

For handling and soldering procedures refer to Allen-Bradley Product Data EC5570-5.1.

Electrical Capabilities

Resistance range — 1K ohms to 10 megohms standard. Single substrate range; 10,000 to 1.

Tolerance (absolute) — As low as ± 0.015 percent at $+25^{\circ}\text{C}$.

Resistance matching or ratio — As low as ± 0.015 percent at $+25^{\circ}\text{C}$.

Temperature coefficient of resistance (TCR) — ± 25 ppm/ $^{\circ}\text{C}$ standard. ± 10 ppm available.

TCR tracking — Between resistors in the same network is ± 5 ppm/ $^{\circ}\text{C}$ standard. ± 3 ppm available.

Temperature ranges of operation — -55°C to $+125^{\circ}\text{C}$ military; 0°C to $+70^{\circ}\text{C}$ industrial. Other ranges available.

Temperature range of storage — -65°C to $+150^{\circ}\text{C}$.

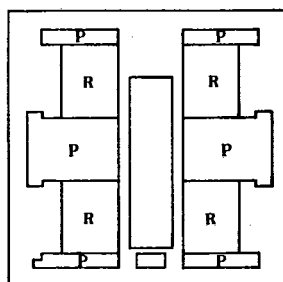
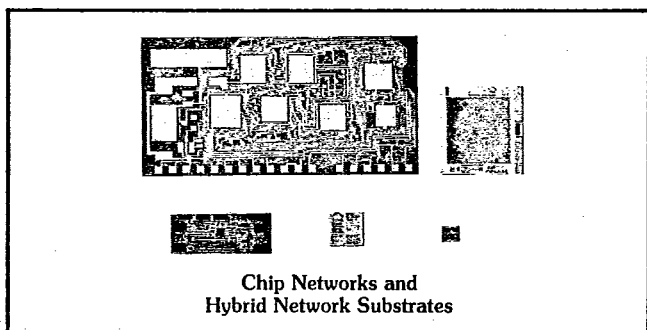
Power rating — 50 milliwatts per resistor standard. Up to 250 milliwatts per resistor special. Power ratings specified at $+125^{\circ}\text{C}$ derated linearly to 0 milliwatts per resistor at $+175^{\circ}\text{C}$.

Frequency response — Excellent non-inductive high frequency characteristics. Fast rise time. Less than 100 nsec. for packaged precision thin film resistors.

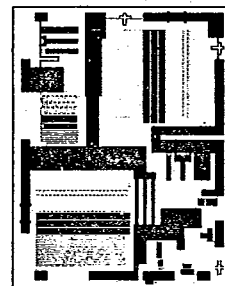
Noise index — Measured on Quantech Model 315 MIL-STD-202D, Method 308, -60db to -25db.

Shelf life stability (no load) — $\Delta R < 0.005\%$ per year.

CHIP AND HYBRID NETWORK SUBSTRATE SPECIFICATIONS



Chip Network



Hybrid Network Substrate

Hybrid network substrates — Allen-Bradley hybrid network substrates contain resistors, bonding pads and interconnections used in producing hybrid networks. Allen-Bradley does not manufacture complete hybrid circuits, but does manufacture the basic hybrid network substrates.

Termination and bonding pad material — Gold, with a minimum thickness of 5000A, is used for all termination pads, bonding pads and interconnections. This material is compatible with ultrasonic and thermocompression bonding methods for attaching gold or aluminum wire, integrated circuit dice, LID's or beam leaded IC's. Chip capacitors can be attached by reflow solder methods.

Substrate material — Glass: Corning 7059 glass (Barium Alumino Silicate - electrically inert [Alkali-free]) .032 \pm .005 inch (0,81 \pm 0,13mm) thick. Ceramic: 99.5% Alumina, .010 \pm .001 inch (2,54 \pm 0,3mm) thick.

User trimmable option — Chip and hybrid network resistors can be trimmed to tolerance by Allen-Bradley or, if needed, resistors can be

designed for active trimming by the user during final hybrid assembly operations to meet predetermined functional requirements. The amount of adjustment available is dependent on the initial resistance value, resolution, final value and available substrate area. The active trimming results in a positive resistance change only and can be done by mechanical methods or a laser. These networks are referred to as user trimmable resistor networks.

Standard substrate sizes (in inches) —

.150 x .150	.350 x .150	.200 x .200	.600 x .200
.250 x .150	.450 x .150	.400 x .200	.250 x .250

Bonding pad sizes — 5 mils x 5 mils minimum.

Resistance range — 1K ohms to 10 megohms.

Tolerances — Absolute: as low as $\pm 0.015\%$ at $+25^{\circ}\text{C}$. Ratio: as low as $\pm 0.015\%$ at $+25^{\circ}\text{C}$.

TCR — ± 25 ppm/ $^{\circ}\text{C}$. 10 ppm available.

TCRT — ± 5 ppm/ $^{\circ}\text{C}$. 3 ppm available.

Temperature ranges of operation — -55°C to $+125^{\circ}\text{C}$ or 0°C to $+70^{\circ}\text{C}$. Other ranges available.

Power rating — Up to 50mw per resistor.

**Chip Networks, Ceramic or Glass Substrate
Resistor Networks, Ceramic or Glass Substrate,
in a Ceramic DIP or SIP Package**

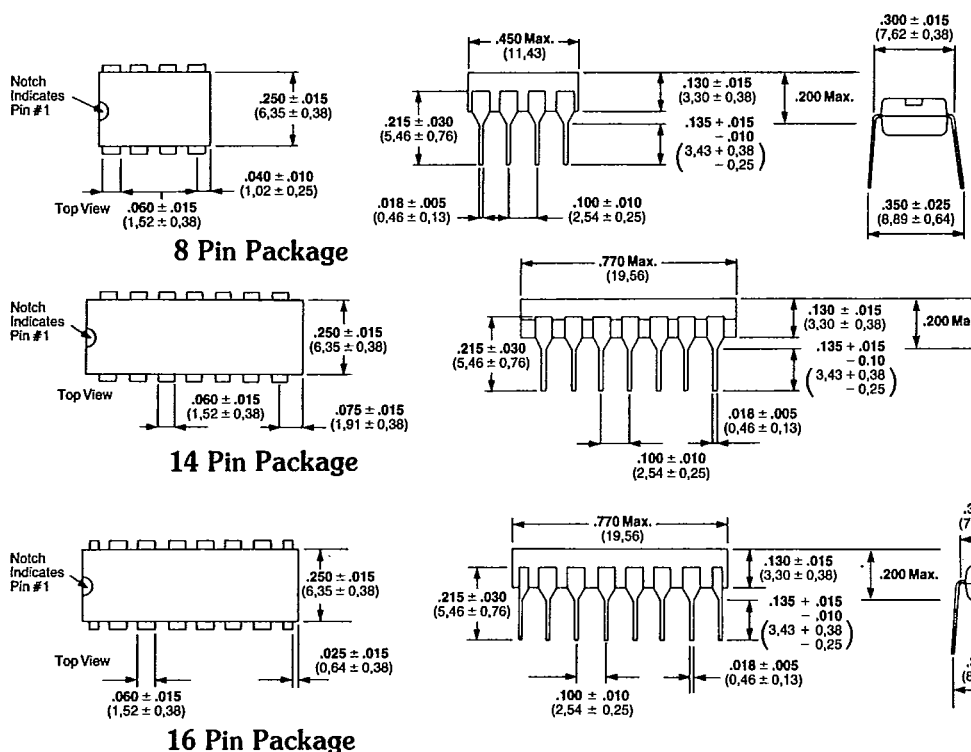
Typical Performance Test Capabilities

Test Group	Order Of Test	Examination or Test	Test Method	Post Test Requirements
I	1	Visual and Mechanical Examination	MIL-STD-883, Method 2008, Test Condition A.	In accordance with applicable requirements.
	2	DC Resistance	MIL-STD-202, Method 303.	
II	1	Temperature Cycling	MIL-STD-883, Method 1010, Test Condition B.	Resistance change ± 0.05 percent maximum
	2	Low Temperature Operation	MIL-R-10509F, Paragraph 4.6.5.	Resistance change ± 0.1 percent maximum
	3	Short Time Overload	MIL-R-10509F, Paragraph 4.6.6.	Resistance change ± 0.2 percent maximum
	4	Terminal Strength	MIL-STD-883, Method 2004, Test Condition A, 3 lb.	Resistance change ± 0.1 percent maximum.
	5	Resistance to Solvents	MIL-STD-202, Method 215.	Resistance change ± 0.05 percent maximum. Markings shall remain legible.
III	1	Dielectric Withstanding Voltage	MIL-STD-202, Method 301, 500V RMS. Method 105C, Test Condition B with 300V RMS applied for 60 ± 5 sec.	No mechanical damage, arcing or breakdown. Resistance change ± 0.1 percent maximum.
	2	Insulation Resistance	MIL-STD-883, Method 1003, Test Condition D.	10^{12} Ohms minimum.
	3	Temperature Cycling	MIL-STD-883, Method 1010, Test Condition B.	Resistance change ± 0.05 percent maximum.
	4	Resistance to Soldering Heat	MIL-STD-202, Method 210, Test Condition B.	Resistance change ± 0.05 percent maximum.
	5	Moisture Resistance	MIL-STD-883, Method 1004, Figure 1004-1. Omit Paragraphs 3.1 and 3.6.1.	Resistance change ± 0.1 percent maximum.
IV	1	Resistance Temperature Characteristic	MIL-STD-202, Method 304, (Over Specified Operating Temperature Range)	Within specified limits.
	2	Life	MIL-STD-883, Method 1006, 125°C, 1000 hrs. 1 1/2 hours on, 1/2 hour off.	Resistance change ± 0.1 percent maximum.
V	1	Solderability	MIL-STD-883, Method 2003.	Resistance change ± 0.1 percent maximum.
	2	Vibration, Fatigue	MIL-STD-883, Method 2005, Condition A.	Resistance change ± 0.05 percent maximum.
	3	Shock	MIL-STD-202, Method 213A, Test Condition I.	Resistance change ± 0.05 percent maximum.

INSPECTION CONDITIONS: Unless otherwise specified, all measurements are understood to be made at the following initial inspection conditions:

Normal atmospheric pressure.
Relative humidity of 40 ± 10 percent.
Ambient temperature of $24^\circ \pm 2^\circ\text{C}$.

NOTE: During an inspection or qualification, all the networks shall be subjected to the inspections of Test Group I. The total samples are then divided into Groups II to V inclusive, and subjected to the tests and inspections of the particular group.

PACKAGE DIMENSIONS**Plastic Molded DIP**

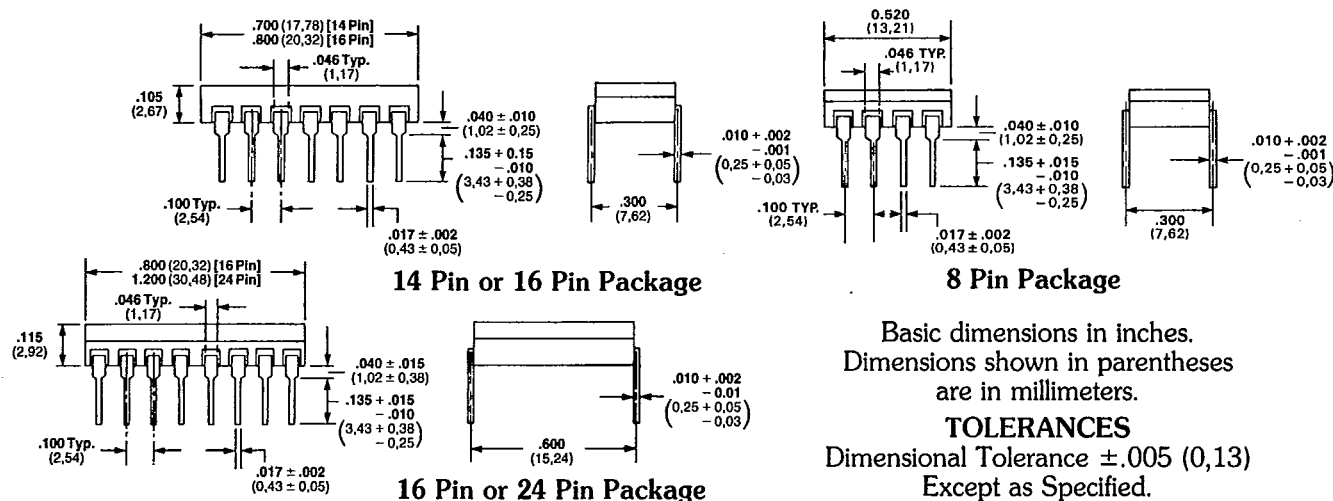
Basic dimensions in inches.
Dimensions shown in parentheses
are in millimeters.

TOLERANCES

Dimensional Tolerance
±.005 (0,13)

Angular Tolerance ±5°
Except as Specified.

NOT TO SCALE

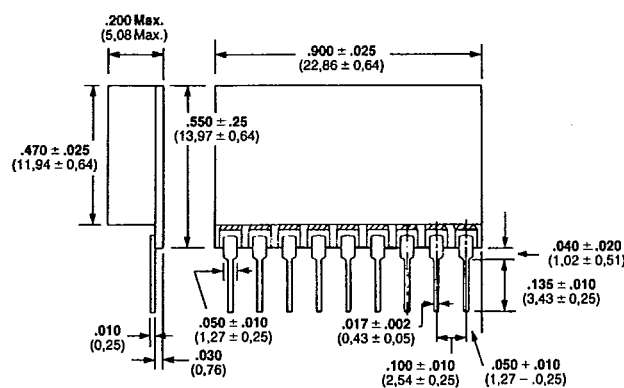
Ceramic DIP

Basic dimensions in inches.
Dimensions shown in parentheses
are in millimeters.

TOLERANCES

Dimensional Tolerance ±.005 (0,13)
Except as Specified.

NOT TO SCALE

Ceramic SIP

Basic dimensions in inches.
Dimensions shown in parentheses
are in millimeters.

TOLERANCE

Dimensional Tolerance ±.015 (0,38)
Except as Specified.

NOT TO SCALE

Resistor Networks

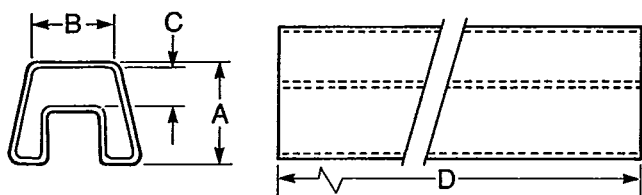
Thick Film and Thin Film Packaging Methods

Package Type	SERIES									
	100	200	400	700	314/316	M83401	800	BC/AC	F08,F14,F16	FGFC
Poly Bag (bulk)				S			S	S		
Tube Back-to-Back	S	S	S							
Tape and Reel							*	S		
Dip Tube End-to-End				*	S	S				S
Thin Film Tube End-to-End									S	
Blister Pack							S			S

S - Denotes Standard Packaging

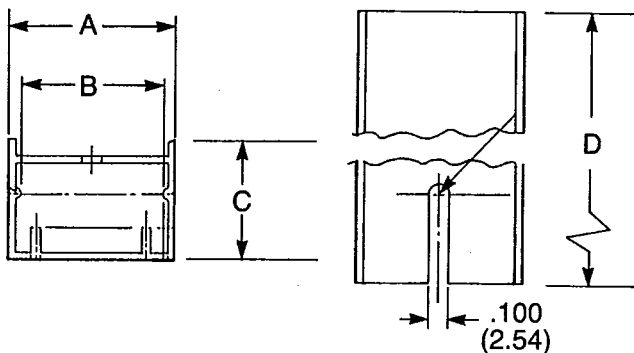
* - Consult Factory

Dip End-to-End Tube

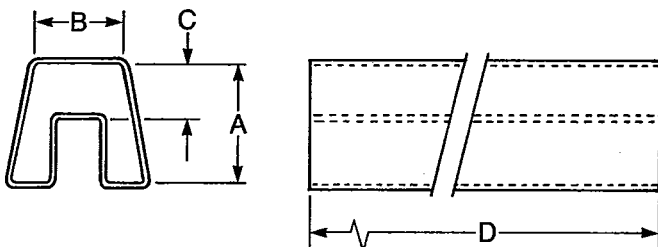


A	B	C	D
.415" 10.54mm	.320" 8.13mm	.150" 3.81mm	23" Max. 584mm

SIP Back-to-Back Tube



Thin Film End-to-End Tube



A	B	C	D
.500" 12.70mm	.375" 9.52mm	.238" 6.05mm	23" Max. 584mm

Standard Package Quantity

Series	Quantity
100, 200, 400	50 pcs. or 250 pcs.
700	100 pcs.
314, 316	25 pcs.
M83401	25 pcs.
BC, AC	5000 pcs. or 4000 pcs. reel 2500 pcs. bulk
F08	52 pcs.
F14, F16	25 pcs.

Low Profile Series 100	A	B	C	D
6 Pin	.700"	.594"	.500"	5.5" or 23"
8 Pin	.900"	.794"	.500"	5.5" or 23"
10 Pin	1.100"	.994"	.500"	5.5" or 23"
Medium Profile Series 200	A	B	C	D
6 Pin	.700"	.594"	.550"	23"
8 Pin	.900"	.794"	.500"	23"
10 Pin	1.100"	.994"	.500"	23"
High Profile Series 400	A	B	C	D
4 Pin	.500"	.394"	.650"	5.5" or 23"
6 Pin	.700"	.594"	.650"	5.5" or 23"
8 Pin	.900"	.794"	.650"	5.5" or 23"
10 Pin	1.100"	.994"	.650"	5.5" or 23"