Type USF Ultra-Stable Low TC Film Resistors
200 Series and 300 Series

Zero Nominal TC — Maximum Absolute TC to 2 ppm/°C, -40°C to +85°C, ref. to +25°C
Absolute Tol. to ±0.01%, Resistance Range 50 Ohm to 25 Megohm, Voltage Ratings up to 2500 Volts

The USF Ultra-Stable Low TC Ultra-Precision Film Resistors were developed to meet the requirements for increasing performance for resistors in high performance analog electronics. **Utilizing Caddock proprietary resistance film systems, the Type USF resistors provide the Lowest TC with the Widest Resistance Range and the Highest Voltage Ratings available in the industry.**

- Resistance Range 50 ohm to 25 Megohm.
- Temperature Coefficient -40°C to +85°C, referenced to +25°C
  200 Series — **ZERO Nominal TC** — Maximum Absolute TC 2 ppm/°C
  300 Series — **ZERO Nominal TC** — Maximum Absolute TC 5 ppm/°C or 10 ppm/°C
- Tolerance: ±0.01% or ±0.1%.
- Specific standard resistance values are available that are most commonly required in high accuracy analog design. These values were selected and optimized for produceability and performance.
- Matched Pairs of USF 300 Series are available with ratio TC as tight as 0.5 ppm/°C. Contact Applications Engineering.
- Ceramic package provides cool operation.

Type USF Ultra-Stable Resistors are offered in standard resistance values that are most commonly used in precision analog design. These standard resistance values can be used in precise amplifier gain setting, precise resistor bridge circuits, precise transducer sense circuits, and precise voltage dividers with up to 2500 volt input voltage.

Extremely Low Power Coefficient (Wattage Coefficient): Type USF resistors are constructed with an aluminum oxide ceramic sandwich that provides great thermal conductivity. The ceramic sandwich package very effectively minimizes the power coefficient drift. Power coefficient is the resistance drift due to temperature rise in the element caused by the power (wattage) dissipation in the resistor where the self-heating temperature rise of the resistor element results in TC drift (temp. rise in °C, times the temperature coefficient of the resistor). In the USF package, heat is pulled away from the resistance material efficiently by this ceramic sandwich package construction. Plastic molded Low TC foil resistors cannot provide this outstanding benefit since the plastic impedes the flow of heat, causing greater temperature rise at the resistor element and greater self-heating related resistance drift due to power dissipation. The USF 200 Series resistors provide a new level of performance with near ZERO TC, very low power coefficient, wide resistance range, and higher voltage ratings than is offered by other resistor technologies.



Type USF 200 Series Ultra-Stable Resistors

- Constructed with two selected USF 300 Series Resistors bonded back to back to achieve outstanding low Absolute Temperature Coefficient performance. The resistors are to be connected in parallel on the circuit board.
- **ZERO Nominal TC** — Max. Absolute TC: 2 ppm/°C, -40°C to +85°C, referenced to +25°C



Type USF 300 Series Ultra-Stable Resistors

- **ZERO Nominal TC** — Max. Absolute TC: 5 ppm/°C or 10 ppm/°C, -40°C to +85°C, referenced to +25°C

Model Number	Wattage @ +85°C	Maximum Continuous Oper. Voltage	Resistance		Tolerance	Temperature Coefficient	Fig.	Dimensions inches (mm)			
			Min.	Max.				A	B	C	D
USF240	0.33	300	50 Ω	10 Meg	0.01% or 0.1%	2 ppm/°C	1	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)	.425 Max. (10.8 Max.)	.600 ±.020 (15.24 ±.51)
USF270	0.75	1,400	990 K	5 Meg	0.01% or 0.1%	2 ppm/°C	1	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)	.550 Max. (13.97 Max.)	1.350 ±.020 (34.29 ±.51)
USF271	0.75	2,500	9.9 Meg	10 Meg	0.01% or 0.1%	2 ppm/°C	1	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)	.550 Max. (13.97 Max.)	1.350 ±.020 (34.29 ±.51)
USF340	0.33	300	50 Ω	20 Meg	0.01% or 0.1%	5 ppm/°C or 10 ppm°C	2	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)	.395 Max. (10.03 Max.)	.600 ±.020 (15.24 ±.51)
USF370	0.75	1,400	990 K	10 Meg	0.01% or 0.1%	5 ppm/°C or 10 ppm°C	2	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)	.520 Max. (13.21 Max.)	1.350 ±.020 (34.29 ±.51)
USF371	0.75	2,500	19.8 Meg	25 Meg	0.01% or 0.1%	5 ppm/°C or 10 ppm°C	2	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)	.520 Max. (13.21 Max.)	1.350 ±.020 (34.29 ±.51)

CADDOCK ELECTRONICS, INC.
e-mail: caddock@caddock.com • web: www.caddock.com
For Caddock Distributors listed by country see caddock.com/contact/dist.html

Sales and Applications Engineering
17271 North Umpqua Hwy.
Roseburg, Oregon 97470-9422
Phone: (541) 496-0700
Fax: (541) 496-0408

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Type USF Ultra-Stable Low TC Film Resistors
200 Series and 300 Series

Standard Resistance Values:

USF240 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 2 ppm/°C

50.0 Ω	350 Ω	2.00 K	10.0 K	90.0 K	250 K	2.50 Meg	10.0 Meg
100 Ω	500 Ω	2.50 K	20.0 K	99.0 K	500 K	5.00 Meg	
200 Ω	900 Ω	5.00 K	25.0 K	100 K	1.00 Meg	9.90 Meg	
250 Ω	1.00 K	9.00 K	50.0 K	200 K	2.00 Meg	9.99 Meg	

USF270 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 2 ppm/°C

990 K 1.00 Meg 2.00 Meg 5.00 Meg

USF271 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 2 ppm/°C

9.90 Meg 9.99 Meg 10.0 Meg

USF340 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 5 ppm/°C or 10 ppm/°C

50.0 Ω	400 Ω	1.80 K	10.0 K	50.0 K	180 K	500 K	2.00 Meg	9.99 Meg
100 Ω	500 Ω	2.00 K	18.0 K	90.0 K	198 K	990 K	4.00 Meg	10.0 Meg
200 Ω	700 Ω	4.00 K	20.0 K	99.0 K	200 K	999 K	5.00 Meg	19.8 Meg
350 Ω	1.00 K	5.00 K	40.0 K	100 K	400 K	1.00 Meg	9.90 Meg	19.98 Meg
								20.0 Meg

USF370 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 5 ppm/°C or 10 ppm/°C

990 K 1.98 Meg 4.00 Meg 9.90 Meg 10.0 Meg
1.00 Meg 2.00 Meg 5.00 Meg 9.99 Meg

USF371 Standard Resistance Values:

Absolute Tolerance: ±0.01% or ±0.1%, Absolute TC: 5 ppm/°C or 10 ppm/°C

19.8 Meg 19.98 Meg 20.0 Meg 25.0 Meg

Specifications:

Resistance Tolerance: ±0.01% or ±0.1% measured at +23°C ±2°C.

Absolute Temperature Coefficient: TC referenced to +25°C, ΔR taken at -40°C and +85°C.

Load Life Stability: 2,000 hours at +85°C at rated voltage, not to exceed rated power, ΔR (+0.015 ±0.015)% max.
10,000 hours at +85°C at rated voltage, not to exceed rated power, ΔR (+0.030 ±0.030)% max.

Thermal Shock: Mil-Std-202 Method 107 condition A, except min. temp. is -40°C, ΔR ±0.01% maximum.

Voltage Coefficient: USF270 at 5 Meg, and USF271, USF370, USF371 at resistances of 9 Meg or greater, 0.02 ppm/volt maximum.

Shelf Life Stability: Typical +(20 ppm ±20 ppm)/yr. after 1 year. Extended shelf life (ten years) 10 ppm/year maximum.

Operating Temperature: -40°C to +85°C.

Lead Finish: Matte Tin (Sn)

Ordering Information:

USF200 Series Part Numbers:

USF240 - 10.0M - 0.01% - 2ppm

- Model Number
- Resistor Value
- Tolerance (0.01% or 0.1%)

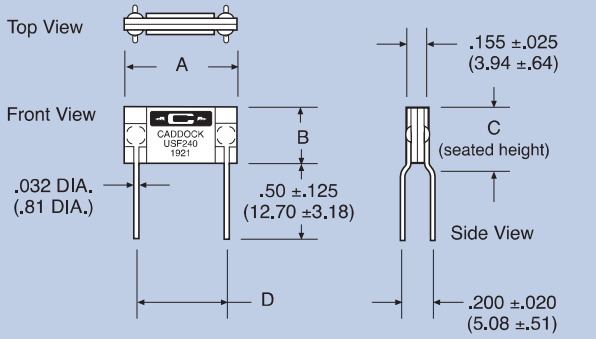
USF300 Series Part Numbers:

USF370 - 990K - 0.1% - 5ppm

- Model Number
- Resistor Value
- Tolerance (0.01% or 0.1%)
- TC (5ppm or 10ppm)

Fig. 1
USF 200 Series

Dimensions in inches and (millimeters)



USF 200 Series Circuit Board Connection Note: The Type USF 200 Series Resistor must have the two "bonded" resistors in the package connected in parallel on the circuit board as shown. This parallel connection of the two resistors achieves the specified resistance with the specified performance.

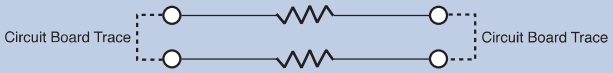
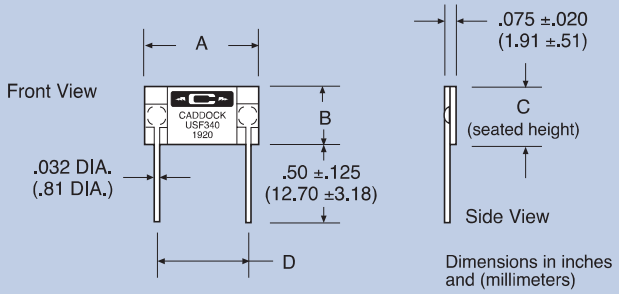


Fig. 2
USF 300 Series



Custom USF 200 Series and 300 Series Resistors:

USF 200 Series and 300 Series Resistors are available, for high quantity applications, with custom performance:

- In the 200 Series, Absolute TC to as tight as 1 ppm/°C is available for certain resistances.
- Matched Ratio TC to as tight as 0.5 ppm/°C for equal resistances.
- Matched Ratio TC can be provided in the 200 Series style "bonded" Resistor pairs.

Other Low TC Resistor Products from Caddock:

- Type TF Low TC Ultra-Precision Film Resistors (1K to 125Meg)
- Type TK Low TC Precision Radial-Lead Film Resistors
- Type TG Low TC Precision High Voltage Resistors (up to 30KV)
- Type USG Low TC Ultra-Precision High Voltage Resistors
- T912 and T914 Low TC Ultra-Precision Resistor Networks
- Type USVD Ultra-Precision Voltage Dividers (up to 2000 Volts)
- Type THV Precision High Voltage Dividers (up to 15KV)

CADDOCK ELECTRONICS, INC.
e-mail: caddock@caddock.com • web: www.caddock.com
For Caddock Distributors listed by country see caddock.com/contact/dist.html

Sales and Applications Engineering
17271 North Umpqua Hwy.
Roseburg, Oregon 97470-9422
Phone: (541) 496-0700
Fax: (541) 496-0408

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