

## Precision Thin Film Nichrome Chip Resistors

### PCF Series

- Precision thin film technology
- Extended ohmic range 1R - 3M
- Precision to  $\pm 0.01\%$  and 2ppm/ $^{\circ}\text{C}$
- Passivated range for superior humidity performance
- Load life stability and humidity to 0.05%
- Pb-free standard with SnPb option
- AEC-Q200 grade available



All Pb-free parts comply with EU Directive 2011/65/EU (RoHS2)

## Electrical Data - Standard Range

Type	TCR (ppm/ $^{\circ}\text{C}$ )	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range <sup>1</sup>				
				1% & 0.5%	0.25%	0.1%	0.05%	0.01%
PCF0201	50	0.031	15	49R9-33K	-	-	-	-
	25			49R9-5K	-	-	-	-
PCF0402	50	0.063	25	10R-205K		-	-	-
	25			-	49R9-33K	49R9-12K	-	
	15			-	49R9-12K	49R9-3K	-	
	10			-	10R-5K	49R9-3K	-	
	5			-	-	49R9-4K99	-	
	3			-	-	-	-	
PCF0603	50	0.063	50	2R-1M	4R7-1M	4R7-332K	-	
	25			-	4R7-332K	24R9-100K	-	
	15			-	24R9-15K	24R9-15K	-	
	10			-	-	24R9-15K	-	
	5			-	-	-	-	
	3			-	-	-	-	
PCF0805	50	0.1	100	1R-2M	4R7-2M	24R9-200K	-	
	25			-	4R7-511K	24R9-200K	24R9-200K	
	15			-	-	24R9-30K	-	
	10			-	-	-	-	
	5			-	-	-	-	
	3			-	-	-	-	
PCF1206	50	0.125	150	1R-2M5	4R7-2M5	4R7-1M	-	
	25			-	4R7-1M	24R9-500K		
	15			-	-	24R9-49K9	-	
	10			-	-	-	-	
	5			-	-	-	-	
	3			-	-	-	-	
PCF1210	50	0.2	150	1R-2M5	4R7-2M5	-	-	
	25			-	4R7-1M	-		
	15			-	24R9-50K	-		
	10			-	-	-		
	5			-	-	-		
	3			-	-	-		
PCF2010	50	0.25	150	1R-3M	4R7-3M	4R7-1M	-	
	25			-	4R7-1M	24R9-500K		
	15			-	-	24R9-100K	-	
	10			-	-	-	-	
	5			-	-	-	-	
	3			-	-	-	-	
PCF2512	50	0.5	150	1R-3M	4R7-3M	4R7-1M	-	
	25			-	4R7-1M	24R9-500K		
	15			-	-	24R9-100K	-	
	10			-	-	-	-	
	5			-	-	-	-	
	3			-	-	-	-	

Note 1: Standard values E24 or E96. Other values may be available by request.

### General Note

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PCF Series

## Electrical Data - AEQ-Q200 Grade - Standard Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range *				
				1%	0.5%	0.25%	0.1%	0.05%
PCF0402...A	50	0.063	25	49R9 – 100K				49R9 – 10K
	25							
PCF0603...A	50	0.063	50	10R – 332K				10R – 49K9
	25							
PCF0805...A	50	0.1	100	10R – 1M0				10R – 100K
	25							
PCF1206...A	50	0.125	150	10R – 1M0				10R – 200K
	25							
PCF1210...A	50	0.25	150	10R – 1M0				10R – 499K
	25							
PCF2010...A	50	0.25	150	10R – 1M0				10R – 499K
	25							
PCF2512...A	50	0.5	150	10R – 1M0				10R – 499K
	25							

\* Standard values E24 or E96.

## Electrical Data – High Power Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range *					
				0.5%	0.25%	0.1%	0.05%	0.01%	
PCF0603H	50	0.1	75	4R7-1M			4R7-332K	24R9-100K	
	25			4R7-332K					
	15			24R9-15K					
	10			-					
	5			24R9-15K					
	3			-					
	2			24R9-15K					
PCF0805H	50	0.125	150	1R-1M		4R7-1M		4R7-511K	24R9-200K
	25			4R7-332K		4R7-511K			
	15			24R9-30K					
	10			-					
	5			24R9-30K					
	3			-					
	2			24R9-30K					
PCF1206H	50	0.25	200	4R7-1M				24R9-500K	
	25			24R9-50K					
	15			-					
	10			24R9-49K9					
	5			-					
	3			-					
	2			-					
PCF1210H	50	0.33	200	4R7-1M				24R9-500K	
	25			24R9-50K					
	15			-					
	10			24R9-49K9					
	5			-					
	3			-					
	2			-					
PCF2010H	50	0.33	200	4R7-1M				24R9-500K	
	25			24R9-50K					
	15			-					
	10			24R9-49K9					
	5			-					
	3			-					
	2			-					
PCF2512H	50	0.75	200	1R-2K		4R7-2K		24R9-2K	
	25			-		-			
	15			-		-			
	10			-		-			
	10			-		-			

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PCF Series

### Electrical Data - AEQ-Q200 Grade – High Power Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range *				
				1%	0.5%	0.25%	0.1%	0.05%
PCF0603H...A	50	0.1	75	10R – 332K				10R – 49K9
	25							
PCF0805H...A	50	0.125	150	10R – 1M0				10R – 100K
	25							
PCF1206H...A	50	0.25	200	10R – 1M0				10R – 200K
	25							
PCF1210H...A	50	0.33	200	10R – 1M0				10R – 499K
	25							
PCF2010H...A	50	0.33	200	10R – 1M0				10R – 499K
	25							

### Electrical Data - Extended High Power Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range *				
				0.5%	0.25%	0.1%	0.05%	0.01%
PCF0603X	50	0.166	100	10R-332K				
	25							
PCF0805X	50	0.25	150	10R-500K				
	25							
PCF1206X	50	0.333	200	10R-1M				
	25							
PCF2512X	50	1	200	1R-100R		4R7-100R		
	25							

### Electrical Data - Passivated Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range *		
				0.5%	0.25%	0.1%
PCF0402P	50	0.063	25	25R-25K		
	25					
PCF0603P	15	0.063	50	49R9-12K		
	50					
PCF0805P	25	0.1	100	25R-332K		
	15					
PCF1206P	50	0.125	150	10R - 1M		
	25					
PCF2010P	15	0.25	150	10R - 1M		
	50					
PCF2512P	25	0.5	150	10R - 1M5		
	15					
PCF2512P	50	0.5	150	25R - 1M		
	25					
PCF2512P	15	0.5	150	10R - 1M5		
	50					

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## Physical Data

	Dimensions (mm) and Weight (mg)					
	L	W	T max	A	C	Wt
0201	0.58 ± 0.05	0.29 ± 0.05	0.26	0.15 ± 0.05	0.12 ± 0.05	0.14
0402	1.0 ± 0.05	0.5 ± 0.05	0.55	0.2 ± 0.1	0.2 ± 0.1	0.54
0603	1.6 ± 0.2	0.8 ± 0.2	0.65	0.3 ± 0.2	0.3 ± 0.2	1.8
0805	2.0 ± 0.2	1.25 ± 0.2	0.65	0.4 ± 0.25	0.3 ± 0.2	4.7
1206	3.05 ± 0.15	1.55 ± 0.15	0.65	0.35 ± 0.25	0.42 ± 0.2	9.0
1210	3.10 ± 0.15	2.4 ± 0.15	0.65	0.55 ± 0.25	0.4 ± 0.2	10
2010	4.9 ± 0.2	2.4 ± 0.2	0.65	0.5 ± 0.25	0.6 ± 0.3	24
2512	6.3 ± 0.2	3.1 ± 0.2	0.65	0.5 ± 0.25	0.6 ± 0.3	38

Wrap-around terminations (3 faces)

### Construction

A thin-film material is selectively deposited on a 96% alumina substrate together with metallic contacts at each end of the resistor. The unadjusted resistors are heat treated to give the required TCR and stability, then a precisely controlled laser trim process adjusts the resistance value. Epoxy protection is applied and wrap-around terminations are added and plated with Nickel then Tin. Each resistor is measured immediately before packing into tape.

### Terminations

The standard termination is 100% Sn matte plated wrap-around suitable for soldering. SnPb plated option is available for standard range PCF over the restricted range below.

## SnPb Termination Option Range

Type	TCR (ppm/°C)	Power (W)	Limiting Element Voltage (V)	Ohmic Value Range			
				1%	0.5%	0.25%	0.1%
PCF0805	50	0.1	100	10R – 250K			
	25			10R – 100K			
	15			10R – 100K			
PCF1206	50	0.125	150	10R – 500K			
	25			10R – 200K			
	15			10R – 200K			

## Performance Data - Standard Range

Test Parameters	Conditions	Maximum change (+0.05R)		
		>0.05% tolerance 0603 to 2512	Chip size 0201, 0402	≤0.05% tolerance 0603 to 2512
Load life	1000 hours rated load @ 70°C	0.25%	0.5%	0.05%
Humidity	1000 hours @ 40°C, 90 - 95%RH	0.3%	0.3%	0.05%
Short term overload	6.25 x rated Power, or 2 x LEV, for 5 sec	0.5%	0.5%	0.05%
High temperature operation	1000 hours at 125°C	0.25%	0.25%	0.25%
Temperature cycle	5 cycles -55 C, 125°C	0.1%	0.1%	0.05%
Resistance to solder heat	270°C, 10 sec	0.2%	0.2%	0.05%
Solderability	235°C, 2 sec	95% minimum coverage		

## Performance Data - High Power Range/Extended High Power Range

Test Parameters	Conditions	Maximum change (+0.05R)	
		0.5%	0.25%
Load life	1000 hours rated load @ 70°C	0.5%	
Humidity	1000hrs @ 40°C, 90 - 95%RH	0.5%	
Short term overload	6.25 x rated Power, or 2 x LEV, for 5 sec	0.5%	
High temperature operation	1000 hours at 155°C	0.5%	
Temperature cycle	5 cycles -55°C, 150°C	0.25%	
Resistance to solder heat	270°C, 10 sec	0.2%	
Solderability	235°C, 2 sec	95% minimum coverage	

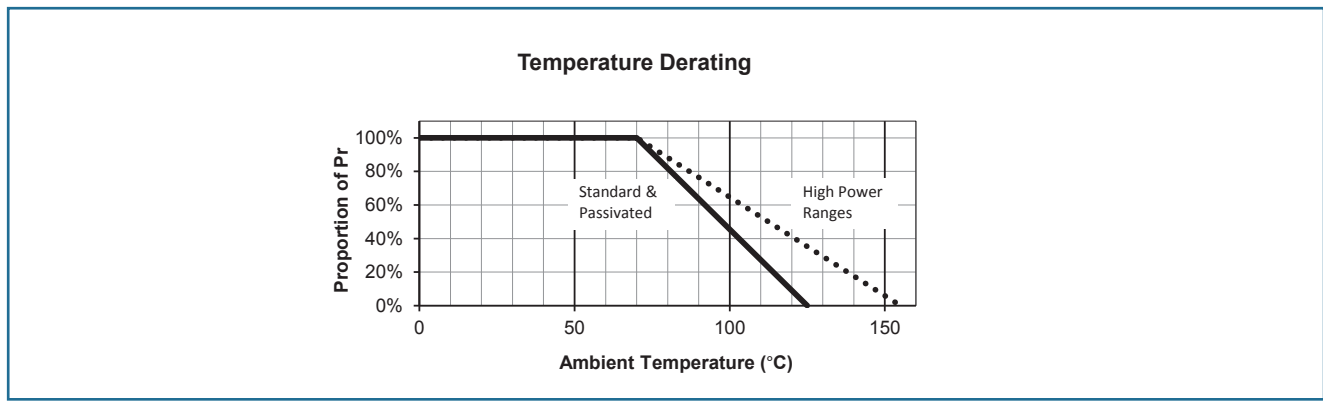
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## Performance Data - Passivated Range

Test Parameters	Conditions	Maximum change (+0.05R)	
		0603 to 2512	0402
Load life	1000 hours rated load @ 70°C	0.05%	0.25%
Humidity	1000hrs @ 40°C, 90 - 95%RH	0.05%	0.5%
Short term overload	6.25 x rated Power, or 2 x LEV, for 5 sec	0.02%	0.1%
High temperature operation	1000 hours at 125°C	0.05%	0.5%
Temperature cycle	5 cycles -55 C, 125°C	0.02%	0.1%
Resistance to solder heat	270°C, 10 sec	0.02%	0.1%
Solderability	235°C, 2 sec	95% minimum coverage	

### Derating Curve



### Solderability

The terminations have an electroplated nickel barrier and tin coating. This ensures excellent 'leach' resistance properties and solderability.

### Packaging

PCF Resistors are supplied taped and reeled as per IEC 286-3. Sizes 2010 and 2512 are in embossed plastic tape. Smaller sizes are in paper tape.

### Application Notes

PCF resistors are ideally suited for handling by automatic methods due to their rectangular shape and the small dimensional tolerances. Electrical connection to a ceramic substrate or to a printed circuit board can be made by reflow or wave soldering of wrap-around terminations.

Wrap-around terminations provide good leach properties and ensure reliable contact. Due to the robust construction, the PCF can be immersed in the solder bath for 30 seconds at 260°C. This enables the resistor to be mounted on one side of a printed circuit board and wire-leaded components applied on the other side.

PCF resistors themselves can operate at a maximum temperature of 125°C (see performance above) (155°C for High Power grades). For soldered resistors, the joint temperature should not exceed 110°C. This condition is met when the stated power levels at 70°C are used.

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PCF Series

## Ordering Procedure

This product has two valid part numbers:

**European (Welwyn) Part Number\*\*:** PCF0603-11-1K54BI (0603, standard, 15ppm/°C, 1.54 kilohm ±0.1%, Pb-free)

P	C	F	0	6	0	3	-	1	1	-	1	K	5	4	B	I
1	2		3	4		5			6	7						

1	2	3	4	5	6	7	
Type	Size	Range	TCR	Value	Tolerance	Termination & Packing	
PCF	0201	Omit for Standard	-20 = ±2ppm/°C	E24 = 3/4 characters E96 = 3/4 characters R = ohms K = kilohms M = megohms	L = ±0.01%	A = AEC-Q200 grade, Pb-free	
	0402		-19 = ±3ppm/°C		W = ±0.05%	I = Standard grade, Pb-free	
	0603	H = High Power	-13 = ±5ppm/°C	R = ohms K = kilohms M = megohms	B = ±0.1%	Standard Packing	
	0805	X = Extended	-12 = ±10ppm/°C		C = ±0.25%	0201, 0402	10,000/reel
	1206	P = Passivated	-11 = ±15ppm/°C		D = ±0.5%	0603 to 1210	5000/reel
	1210		R = ±25ppm/°C		F = ±1%	2010, 2512	4000/reel
	2010		-02 = ±50ppm/°C			T1* = Pb-free, 1K reel	
	2512					0201 to 1206, 2010, 2512	1000/reel
				PB = SnPb, 1K reel			
				0805, 1206	1000/reel		

\* Non-standard; enquire to confirm availability

\*\* Applies to all Ranges, Termination and Packing options.

**USA (IRC) Part Number\*:** PCF-W0603LF-11-1541-B-P-LT (0603, standard, 15ppm/°C, 1.54 kilohm ±0.1%, Pb-free)

P	C	F	-	W	0	6	0	3	L	F	-	1	1	-	1	5	4	1	-	B	-	P	-	L	T
1	2				3	4		5			6	7	8												

1	2	3	4	5	6	7	8	
Type	Model	Termination	TCR	Value	Tolerance	Tape	Packing	
PCF	W0201	LF = Pb-free (100%Sn)	13 = ±5ppm/°C	3 digits + multiplier R = ohms for values <100 ohms	T = ±0.01%	P = Paper (0201 to 1210)	LT = Tape & Reel	
	W0402		12 = ±10ppm/°C		A = ±0.05%		0201, 0402	10,000/reel
	W0603		11 = ±15ppm/°C	R = ohms for values <100 ohms	B = ±0.1%	E = Embossed (2010, 2512)	0603 to 1210	5000/reel
	W0805		03 = ±25ppm/°C		C = ±0.25%		2010, 2512	4000/reel
	W1206		02 = ±50ppm/°C		D = ±0.5%			
	W1210				F = ±1%			
	W2010							
	W2512							

\* Applies only to Standard Range, Pb-Free parts

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