

## 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			-	-	-	-	
	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			-	-	-		
	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			-	-	-		
	10			-	-	-		
	5			-	-	-		
	3			-	-	-		
PCF2512	50	0.5	150	1R-3M	4R7-3M	4R7-1M	-	
	25			-	4R7-1M	24R9-500K		
	15			-	-	-		
	10			-	-	-		
	5			-	-	-		
	3			-	-	-		

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

### General Note

TT Electronics reserves the right to make changes in product specification without notice or liability. All information is subject to TT Electronics' own data and is considered accurate at time of going to print.

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			-			24R9-15K	
	5			-			24R9-15K	
	3			-			24R9-15K	
	2			-			24R9-15K	
PCF0805H	50	0.125	150	1R-1M	4R7-1M	4R7-511K	24R9-200K	
	25			4R7-332K				
	15			4R7-511K		24R9-30K		
	10			24R9-30K				
	5			-			24R9-30K	
	3			-			24R9-30K	
	2			-			24R9-30K	
PCF1206H	50	0.25	200	4R7-1M			24R9-500K	
	25			24R9-50K				
	15			-			24R9-49K9	
	10			-			24R9-49K9	
	5			-			24R9-49K9	
	3			-			24R9-49K9	
	2			-			24R9-49K9	
PCF1210H	50	0.33	200	4R7-1M			24R9-500K	
	25			24R9-50K				
	15			-			24R9-49K9	
	10			-			24R9-49K9	
	5			-			24R9-49K9	
	3			-			24R9-49K9	
	2			-			24R9-49K9	
PCF2010H	50	0.33	200	4R7-1M			24R9-500K	
	25			24R9-50K				
	15			-			24R9-49K9	
	10			-			24R9-49K9	
	5			-			24R9-49K9	
	3			-			24R9-49K9	
	2			-			24R9-49K9	
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 – 100K				
	25							
PCF1206H...A	50	0.25	200	10R – 200K				
	25							
PCF1210H...A	50	0.33	200	10R – 1M0				
	25							
PCF2010H...A	50	0.33	200	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					
PCF2512P	25	0.5	150	25R - 1M		
	15					

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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	

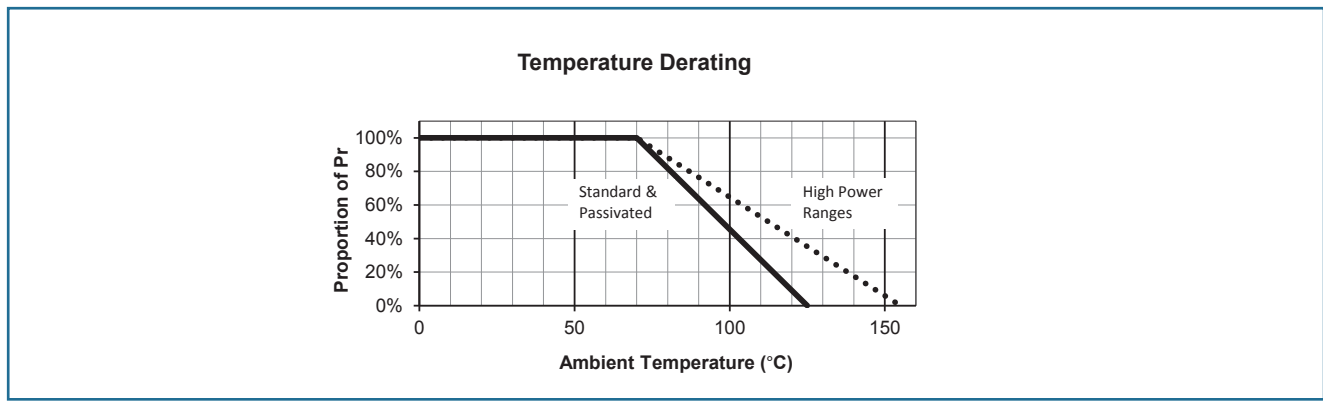
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## Performance Data - Passivated Range

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	Standard Packing	B = ±0.1%		
	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	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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