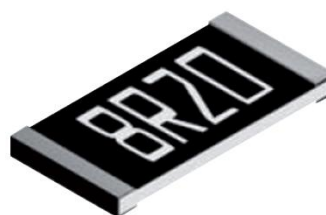


PCF Series

Features:

- Precision thin film technology
- Extended ohmic range 1R0 to 3M0
- Precision to $\pm 0.01\%$ and 1ppm/ $^{\circ}\text{C}$
- Passivated range for superior humidity performance
- Load life stability and humidity to 0.05%
- AEC-Q200 grade available



All parts are Pb-free and comply with EU Directive 2011/65/EU amended by (EU) 2015/863

Electrical Data

Range & Grade		Size								
		0201	0402	0603	0805	1206	1210	2010	2512	
Standard Range		PCF0201	PCF0402	PCF0603	PCF0805	PCF1206	PCF1210	PCF2010	PCF2512	
Power rating @70°C	W	0.031	0.063		0.1	0.125	0.2	0.25	0.5	
Limiting element voltage	V	15	25	50	100	150				
Resistance range	ohms	49R9 – 33K	10R – 205K	2R0 – 1M0	1R0 – 2M5			1R0 – 3M0		
Resistance tolerance ¹	%	0.5, 1	0.01, 0.05, 0.1, 0.25, 0.5, 1							
TCR ¹	ppm/°C	25, 50	1, 2, 3, 5, 10, 15, 25, 50							
Ambient temperature range	°C	-55 to 125								
Standard values		E24 & E96 preferred								
Standard Range AEC-Q200			PCF0402...A	PCF0603...A	PCF0805...A	PCF1206...A	PCF1210...A	PCF2010...A	PCF2512...A	
Power rating @70°C	W		0.063		0.1	0.125	0.25		0.5	
Limiting element voltage	V		25	50	100	150				
Resistance range	ohms		49R9 – 221K	10R – 680K	10R – 1M0	10R – 1M5	10R – 1M0			
Resistance tolerance ¹	%		0.05, 0.1, 0.25, 0.5, 1							
TCR ¹	ppm/°C		10, 15, 25, 50							
Ambient temperature range	°C		-55 to 125							
Standard values			E24 & E96 preferred							
High Power Range			PCF0603H	PCF0805H	PCF1206H	PCF1210H	PCF2010H	PCF2512H		
Power rating @70°C	W		0.1	0.125	0.25	0.33		0.75		
Limiting element voltage	V		75	150	200					
Resistance range	ohms		4R7 – 1M0	1R0 – 1M0	4R7 – 1M0			1R0 – 2K0		
Resistance tolerance ¹	%		0.01, 0.05, 0.1, 0.25, 0.5							
TCR ¹	ppm/°C		1, 2, 3, 5, 10, 15, 25, 50							10, 15, 25, 50
Ambient temperature range	°C		-55 to 155							
Standard values			E24 & E96 preferred							
High Power Range AEC-Q200			PCF0603H...A	PCF0805 H...A	PCF1206 H...A	PCF1210 H...A	PCF2010 H...A			
Power rating @70°C	W		0.1	0.125	0.25	0.33				
Limiting element voltage	V		75	150	200					
Resistance range	ohms		10R – 332K	10R – 1M0						
Resistance tolerance ¹	%		0.05, 0.1, 0.25, 0.5, 1							
TCR ¹	ppm/°C		10, 15, 25, 50							
Ambient temperature range	°C		-55 to 155							
Standard values			E24 & E96 preferred							
Passivated Range			PCF0402P	PCF0603P	PCF0805P	PCF1206P		PCF2010P	PCF2512P	
Power rating @70°C	W		0.063		0.1	0.125		0.25	0.5	
Limiting element voltage	V		25	50	100	150		150		
Resistance range	ohms		25R – 25K	25R – 332K	10R – 1M0			10R – 1M5		
Resistance tolerance ¹	%		0.1, 0.25, 0.5					0.1, 0.25, 0.5		
TCR ¹	ppm/°C		15, 25, 50					15, 25, 50		
Ambient temperature range	°C		-55 to 125					-55 to 125		
Standard values			E24 & E96 preferred					E24 & E96 preferred		

Note 1: See Manufacturing Capability tables.

General Note

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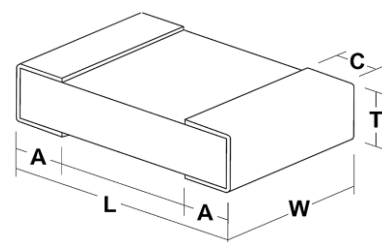
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Physical Data

Dimensions in mm and weight in mg						
	L	W	T _{max}	A	C	Wt. nom
0201	0.58 ±0.05	0.29 ±0.05	0.26	0.15 ±0.05	0.12 ±0.05	0.14
0402	1 ±0.1	0.5 ±0.05	0.55	0.25 ±0.15	0.2 ±0.15	0.54
0603	1.6 ±0.2	0.8 ±0.2	0.65	0.35 ±0.25	0.3 ±0.25	1.8
0805	2 ±0.2	1.25 ±0.2		0.4 ±0.25		4.7
1206	3.05 ±0.15	1.55 ±0.15		0.35 ±0.25		9
1210	3.1 ±0.15	2.5 ±0.25		0.55 ±0.25	0.4 ±0.3	10
2010	4.9 ±0.2	2.4 ±0.25		0.55 ±0.3		24
2512	6.3 ±0.2	3.1 ±0.25		0.7 ±0.45		38
					0.6 ±0.4	



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.

Marking

Sizes 0603 and larger are marked with three or four characters. For details see:

<https://www.ttelectronics.com/TTElectronics/media/ProductFiles/Application-Note/TN004-Methods-for-Marking-Values-on-Resistors.pdf>.

Terminations

The chips are supplied with Pb-free wrap-around terminations suitable for soldering.

Solderability

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

Manufacturing Capability

Standard Range		Tolerance (%)						
Type	TCR (ppm/°C)	1	0.5	0.25	0.1	0.05	0.01	
PCF0201	50	49R9 – 33K						
	25	49R9 – 5K0						
PCF0402	25, 50	10R – 205K						
	15				49R9 – 70K			49R9 – 12K
	10				49R9 – 5K0			49R9 – 3K0
	5				49R9 – 4K99			
	1, 2, 3				49R9 – 4K99			
PCF0603	25, 50	2R0 – 1M0		4R7 – 1M0	4R7 – 332K			
	10, 15				24R9 – 100K			
	5				24R9 – 15K			
	1, 2, 3				24R9 – 15K			
PCF0805	25, 50	1R0 – 2M0		4R7 – 2M5	4R7 – 1M0	24R9 – 500K		
	10, 15				24R9 – 49K9			
	2, 3, 5				24R9 – 30K			
	1							
PCF1206	25, 50	1R0 – 2M5		4R7 – 2M5	4R7 – 1M0	24R9 – 500K		
	10, 15				24R9 – 49K9			
	1, 2, 3, 5							
PCF1210	25, 50	1R0 – 2M5		4R7 – 2M5				
	10, 15							4R7 – 1M0
	2, 3, 5							24R9 – 50K
	1							24R9 – 49K9
PCF2010	25, 50	1R0 – 3M0		4R7 – 3M0	4R7 – 1M0	24R9 – 500K		
	10, 15				24R9 – 100K			
	1, 2, 3, 5							
PCF2512	25, 50	1R0 – 3M0		4R7 – 3M0	4R7 – 1M0	24R9 – 500K		
	10, 15				24R9 – 100K			
	1, 2, 3, 5							

General Note

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Manufacturing Capability Continued

Standard Range AEC-Q200		Tolerance (%)					
Type	TCR (ppm/°C)	1	0.5	0.25	0.1	0.05	0.01
PCF0402...A	25, 50	49R9 – 221K				49R9 – 12K	
	10, 15	49R9 – 69K8					
PCF0603...A	25, 50	10R – 680K				10R – 49K9	
	10, 15	10R – 332K					
PCF0805...A	10, 15, 25, 50	10R – 1M0				10R – 100K	
PCF1206...A	25, 50	10R – 1M5				10R – 200K	
	10, 15	10R – 1M0					
PCF1210...A	10, 15, 25, 50						
PCF2010...A	10, 15, 25, 50						
PCF2512...A	10, 15, 25, 50						

High Power Range		Tolerance (%)						
Type	TCR (ppm/°C)	1	0.5	0.25	0.1	0.05	0.01	
PCF0603H	25, 50		4R7 – 1M0				24R9 – 100K	
	10, 15		4R7 – 332K					
	5		24R9 – 15K					
	1, 2, 3							
PCF0805H	25, 50		1R0 – 1M0		4R7 – 1M0			24R9 – 200K
	15		4R7 – 332K					
	10		4R7 – 511K					
	5		24R9 – 30K					
	1, 2, 3							
PCF1206H	10, 15, 25, 50		4R7 – 1M0					24R9 – 500K
PCF1210H	5		24R9 – 50K					
PCF2010H	1, 2, 3		24R9 – 49K9					
PCF2512H	10, 15, 25, 50		1R0 – 2K0		4R7 – 2K0		24R9 – 2K0	
	1, 2, 3, 5							

High Power Range AEC-Q200		Tolerance (%)					
Type	TCR (ppm/°C)	1	0.5	0.25	0.1	0.05	0.01
PCF0603H...A	10, 15, 25, 50	10R – 332K				10R – 49K9	
PCF0805H...A	15, 25, 50	10R – 1M0				10R – 100K	
	10	10R – 511K					
PCF1206H...A	10, 15, 25, 50	10R – 1M0				10R – 200K	
PCF1210H...A	10, 15, 25, 50					10R – 499K	
PCF2010H...A	10, 15, 25, 50						

Passivated Range		Tolerance (%)					
Type	TCR (ppm/°C)	1	0.5	0.25	0.1	0.05	0.01
PCF0402P	25, 50		25R – 25K				
	15		49R9 – 12K				
PCF0603P	15, 25, 50		25R – 332K				
PCF0805P	15, 25, 50		10R – 1M0				
PCF1206P	15, 25, 50						
PCF2010P	25, 50		10R – 1M5				
	15		25R – 1M0				
PCF2512P	25, 50		10R – 1M5				
	15		25R – 1M0				

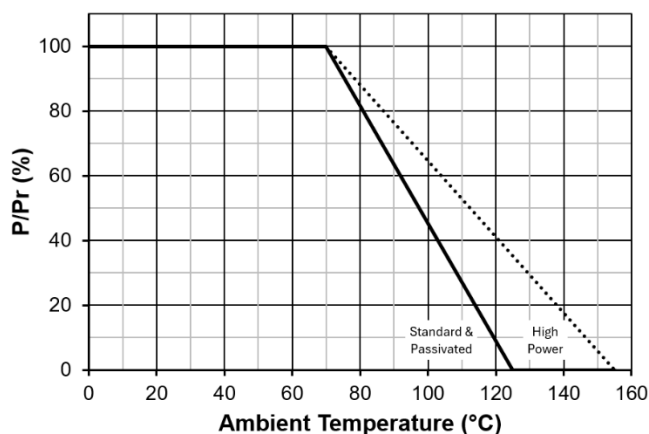
Performance Data

Standard Range		Maximum (+0.05Ω)		
Test		0201 & 0402	0603 to 2512	
			Tolerance >0.05%	Tolerance ≤0.05%
Load at rated power: 1000 hours rated power at 70°C	±ΔR%	0.5	0.25	0.05
Humidity: 1000 hours at 40°C, 90 to 95%RH	±ΔR%	0.3		
Short term overload: 6.25 x rated power or 2 x LEV for 5s	±ΔR%	0.5		
High temperature operation: 1000 hours at 125°C	±ΔR%	0.25		
Temperature cycle: 5 cycles, -55 to +125°C	±ΔR%	0.1		0.05
Resistance to solder heat: 270°C, 10s	±ΔR%	0.2		
Solderability: 235°C, 2s		95% minimum coverage		

High Power Range		Maximum (+0.05Ω)
Test		
Load at rated power: 1000 hours rated power at 70°C	±ΔR%	0.5
Humidity: 1000 hours at 40°C, 90 to 95%RH	±ΔR%	
Short term overload: 6.25 x rated power or 2 x LEV for 5s	±ΔR%	
High temperature operation: 1000 hours at 155°C	±ΔR%	
Temperature cycle: 5 cycles, -55 to +150°C	±ΔR%	0.25
Resistance to solder heat: 270°C, 10s	±ΔR%	0.2
Solderability: 235°C, 2s		95% minimum coverage

Passivated Range		Maximum (+0.05Ω)	
Test		0402	0603 to 2512
Load at rated power: 1000 hours rated power at 70°C	±ΔR%	0.25	0.05
Humidity: 1000 hours at 40°C, 90 to 95%RH	±ΔR%	0.5	
Short term overload: 6.25 x rated power or 2 x LEV for 5s	±ΔR%	0.1	0.02
High temperature operation: 1000 hours at 125°C	±ΔR%	0.5	0.05
Temperature cycle: 5 cycles, -55 to +125°C	±ΔR%	0.1	0.02
Resistance to solder heat: 270°C, 10s	±ΔR%		
Solderability: 235°C, 2s		95% minimum coverage	

Temperature Derating



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. For full dimensional details see:

<https://www.ttelectronics.com/TTElectronics/media/ProductFiles/Application-Note/PS001-Packing-of-General-Purpose-Chip-Resistors.pdf>.

General Note

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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 through-hole components applied on the other side. PCF resistors themselves can operate at a maximum temperature of 125°C for Standard and Passivated ranges and 155°C for High Power range. 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.

Ordering Procedure

Global Part Number Example:

PCF0603-11-1K54BI (0603, Standard Range, 15ppm/°C, 1.54 kilohms $\pm 0.1\%$, non-AEC-Q200, 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 Series	2 Size	3 Range	4 TCR ¹	5 Value	6 Tolerance	7 Grade & Packing
PCF	0201	Omit for Standard	-21 = $\pm 1\text{ppm}/^\circ\text{C}$	E24 / E96 = 3/4 characters R = ohms K = kilohms M = megohms	L = $\pm 0.01\%$	I = non-AEC-Q200, Standard packing
	0402	H = High Power	-20 = $\pm 2\text{ppm}/^\circ\text{C}$		W = $\pm 0.05\%$	A = AEC-Q200 grade, Standard packing
	0603	P = Passivated	-19 = $\pm 3\text{ppm}/^\circ\text{C}$		B = $\pm 0.1\%$	0201 & 0402 10,000/reel
	0805		-13 = $\pm 5\text{ppm}/^\circ\text{C}$		C = $\pm 0.25\%$	0603 to 1210 5000/reel
	1206		-12 = $\pm 10\text{ppm}/^\circ\text{C}$		D = $\pm 0.5\%$	2010 & 2512 4000/reel
	1210		-11 = $\pm 15\text{ppm}/^\circ\text{C}$		F = $\pm 1\%$	T1 = non-AEC-Q200, 1K reel packing ²
	2010		R = $\pm 25\text{ppm}/^\circ\text{C}$			A1 = AEC-Q200 grade, 1K reel packing ²
	2512		-02 = $\pm 50\text{ppm}/^\circ\text{C}$			All sizes except 1210 1000/reel

Note 1: The hyphen within TCR codes is omitted if necessary to prevent the total character count from exceeding 18.

Note 2: Non-standard packing – enquire to confirm availability.

Legacy Part Numbers

This product has a legacy part number format applying only to Standard Range non-AEC-Q200 and with TCR $\geq 5\text{ppm}/^\circ\text{C}$ in standard packing. This is still available for ordering, but for new designs use of the Global Part Number is recommended.

Legacy Part Number Example:

PCF-W0603LF-11-1K541-B-P-LT (0603, Standard Range, 15ppm/°C, 1.54 kilohms $\pm 0.1\%$, non-AEC-Q200, 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 Series	2 Model	3 Termination	4 TCR	5 Value	6 Tolerance	7 Tape	8 Packing
PCF	W0201	LF = Pb-free (100% Sn)	13 = $\pm 5\text{ppm}/^\circ\text{C}$	3 digits + multiplier R = ohms for values <100 Ω	T = $\pm 0.01\%$	P = Paper	LT = Tape & reel
	W0402		12 = $\pm 10\text{ppm}/^\circ\text{C}$		A = $\pm 0.05\%$		0201 & 0402 10,000/reel
	W0603		11 = $\pm 15\text{ppm}/^\circ\text{C}$		B = $\pm 0.1\%$	E = Embossed	0603 to 1210 5000/reel
	W0805		03 = $\pm 25\text{ppm}/^\circ\text{C}$		C = $\pm 0.25\%$		2010 & 2512 4000/reel
	W1206		02 = $\pm 50\text{ppm}/^\circ\text{C}$		D = $\pm 0.5\%$		
	W1210				F = $\pm 1\%$		
	W2010						
	W2512						

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