

# PFE 225

- High capacitance density
- High stability
- High reliability
- High test voltage
- MUAHAG approval
- French standard CPS 82
- CECC 30901-001

## Applications

This capacitor is made in 7.5 mm module that, together with RM t ferrite cores, can be designed into very dense constructions, i.e. LC-filters in telephone systems or measurement equipment.

## Specification

Capacitance range pF	>13700-25000	>1500-13700	47-1500
Rated voltage VDC	63	100	200
Capacitance tolerance	±0.5-5% (min 1.0pF)		
Climatic category	40/85/56*		
Complies with IEC 384-7	Stability class 1 and 2.		
*) Damp heat steady state ΔC/C <0.75%, 56 days.			

## Technical data

### Stability after one temperature cycle

Test is carried out in accordance with IEC 384-7. Stability class 1 for  $C \leq 18 \text{ nF}$   $\Delta C/C \leq 0.3\% + 0.3 \text{ pF}$ . Stability class 2 for  $C > 18 \text{ nF}$   $\Delta C/C \leq 0.5\% + 0.5 \text{ pF}$ .

### Rated capacitance

The E48 series is standard, other values on request.

### Test voltage

Between terminals and case 400 VDC

The test voltage between terminals is stated in the table. The capacitors will withstand the test voltage without any flashover for 60 seconds.

Rated voltage (VDC)	Test voltage (VDC)	Capacitance (nF)	Temp. coefficient (ppm/°C)
063	190	0.047-3	-100 ± 25
100	425	3-13.7	-125 ± 30
200	425	13.7-25	-160 ± 40

### Insulation resistance

It is measured at +23°C and after 60 seconds.

Test voltage is 100 VDC except for 63 VDC components tested at 10 VDC.

The requirement is an insulation of at least 500 GΩ,

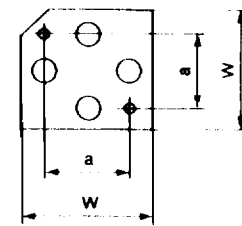
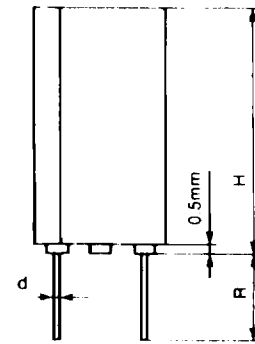
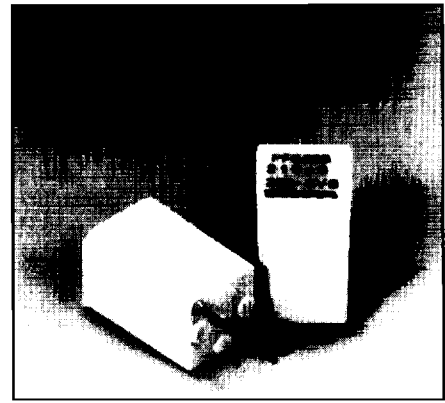
### Pulse rise time, dU/dt

The capacitors can withstand an unlimited number of pulses with a pulse steepness of 2500 V/μs.

## Basic design

PFE 225 is a polystyrene capacitor using extended foil to achieve low inductance. The winding is an extended foil construction to guarantee low ESR. The encapsulation is made of self-extinguishing material (UL 94/V-0).

The capacitor will withstand all commonly used solvents and rinsing liquids without damage. The mechanical design will assure narrow dimensional tolerances and highest possible packing density on PC-board.



W 7.4 ±<sup>0</sup><sub>0</sub> mm

H ≤ 13.1 mm

a 5.08 mm

R Standard 3.1 ± 0.3 mm

Optional 6-10 mm with tolerance ±<sup>0</sup><sub>0</sub>

d 0.6 mm

Weight 1.2 g

The outer foil is always connected to the terminal that is closest to the cut-off corner.

### Inductance

Measured at 1.5 mm from the capacitor body.

Typical value is 9nH and will not depend on the C-value. Maximum value 11nH.

### Terminals

Heavily tinned, low resistance wire with low thermal conductivity.

### Needle flame test

According to IEC Publ. 695-2-2 with underlying layer of tissue paper. The flame can be applied for 20 seconds, without any glowing particles falling.

### Temperature coefficient

The linear relation between temperature and capacitance value is valid for the total temperature range (-40°C to +85°C).

### Long term stability

After three years at rated voltage, and maximum 70% relative humidity, the capacitance drift will not exceed 0.2% + 0.2pF.

### Dielectric absorption

According to MIL-C-19978 B paragraph 4.6.15, the absorption is less than 0.01%.

### Dissipation factor

Capacitance (nF)	Frequency (kHz)	tanδ (×10 <sup>-4</sup> )
0.047-25	1	<2
0.047-25	10	<2
1-25	100	<5
0.047-1	1000	<5

Measured at +23°C.

## Environmental and testing data

### Soldering heat

According to IEC 68-2-20 Test Tb, Method 1A (Solder bath 260°C during 10 seconds). The following requirements are to be met:

1.  $\Delta C/C \leq 0.5\% + 1 \text{ pF}$
2. tanδ according to initial requirements
3. No visible damage

### Endurance test DC

2000 h at  $1.5 \times U_R$  and +85°C. The following requirements are met:

1.  $\Delta C/C \leq 0.3\% + 0.3 \text{ pF}$ ,  $C \leq 18 \text{ nF}$   
 $\Delta C/C \leq 0.5\% + 0.5 \text{ pF}$ ,  $C > 18 \text{ nF}$

### Damp heat steady state

According to IEC 58-2-3 Test Ca. The following requirements shall be met after 56 days at +40°C and 93% relative humidity.

1.  $\Delta C/C < 0.75\% + 1 \text{ pF}$  after 56 days  
 $\Delta C/C < 0.5\% + 1 \text{ pF}$  after 21 days
2. tanδ shall be less than twice the initial required value
3. Insulation more than 50% of initial value
4. No visible damage

### Bump

According to IEC 68-2-29 Test Eb mounted on a PCB. 4000 bumps with a peak acceleration of 390 m/s<sup>2</sup>. The initial requirements shall be met after test. Pulse duration 6 ms.

### Vibration

According to IEC 68-2-6 Test Fc, proc. B4 6 h with 10–2000 Hz and 0.75 mm (or 98m/s<sup>2</sup>) displacement amplitude.

### Low air pressure

In accordance with IEC 68-2-13 Test M. The capacitor is to be stored at 20 mbar (2 kPa) for one hour. For the last five minutes the rated voltage is to be applied between the terminals. The requirements are that there shall be no breakdowns or flashovers in the voltage test. No visible damage.

### Reliability

The failure rate of PFE 225 is so low that reliability data referring to normal operation cannot be achieved in laboratory tests. However, operational statistics for a total of  $4.5 \times 10^5$  unit-hours have revealed a mean failure rate of  $< 10^{-9}/\text{h}$ .

## CECC approval

PFE 225 is the only polystyrene capacitor with its own detail specification. Compared to the sectional specification the AQL levels are lower for PFE 225. Sectional = ().

Visual inspection, marking dimensions 1.0% (2.5%).

Voltage proof C, tanδ and insulation 0.25% (1.0%). Observe that in spite of the high voltage proof level (190,425VDC), the AQL level is only 25% of the standard AQL tested by 128 VDC.

The endurance test is made during 2000 h at  $1.5 \times$  rated voltage (95,150,-300 VDC), which is more rigorous than the standard procedure of 1000 h at 95 VDC. The complete detail specification will be sent on request.

## Article table

Article code	Capacitance nF	Rated voltage VDC	Quantity/ std.package pcs
PFE 225 GB	0.047-1.5	200	250
PFE 225 DB*	> 1.5-13.7	100	250
PFE 225 CB*	> 13.7-25	63	250

\*) Approved acc. to French standard CPS 82

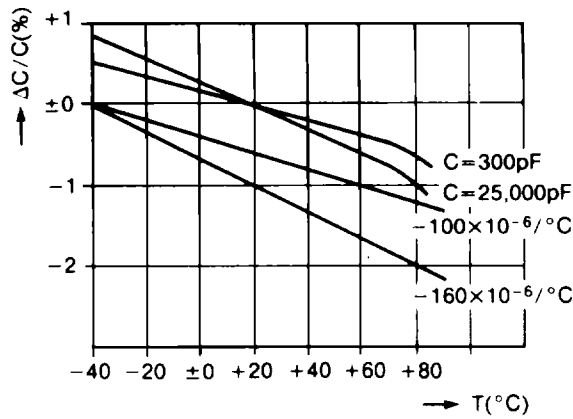
## Capacitance tolerance

Available tolerances. Preferred tolerance 1%.

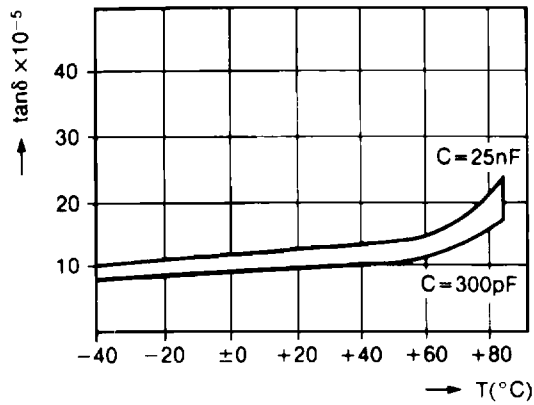
Tolerance code	Y	A	D	P	F	R	G	J
	1.0pF	1.5pF	0.5%	0.625%	1%	1.25%	2%	5%
Capacitance nF								
0.047-0.080	X	X					X	X
0.080-0.1	X	X				X	X	X
0.1-0.16	X	X			X	X	X	X
0.16-0.2	X	X		X	X	X	X	X
0.2-0.3		X	X	X	X	X	X	X
0.3-			X	X	X	X	X	X

## Typical data, graphs

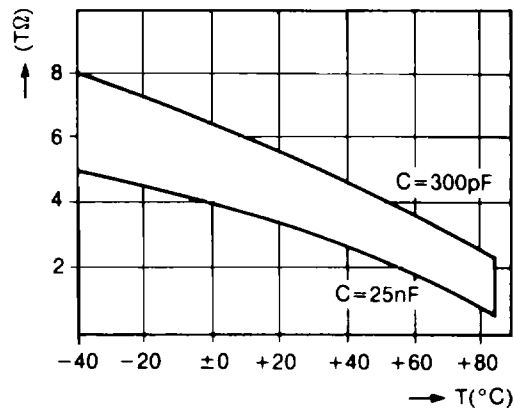
Capacitance vs. temperature



Tan $\delta$  vs. temperature (1 kHz)

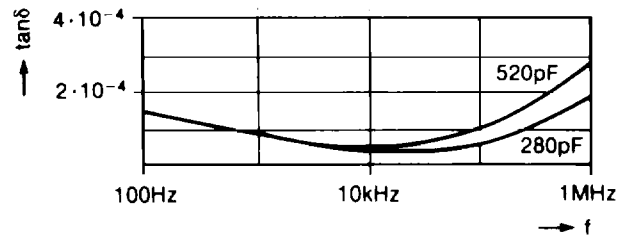


Insulation resistance vs. temperature

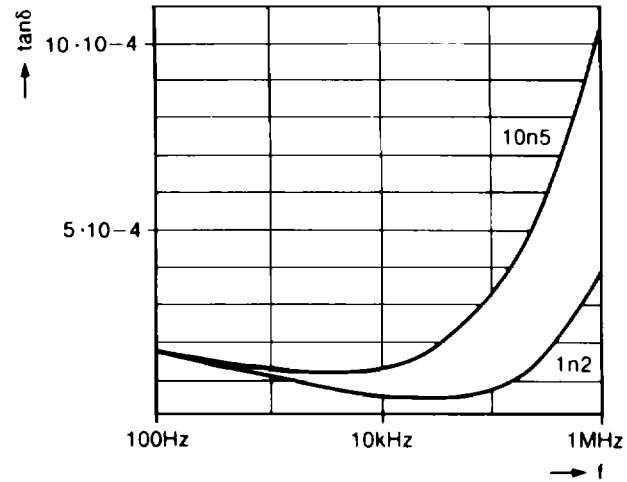


Tan $\delta$  of the loss angle vs. frequency, typical  $20^{\circ}C$

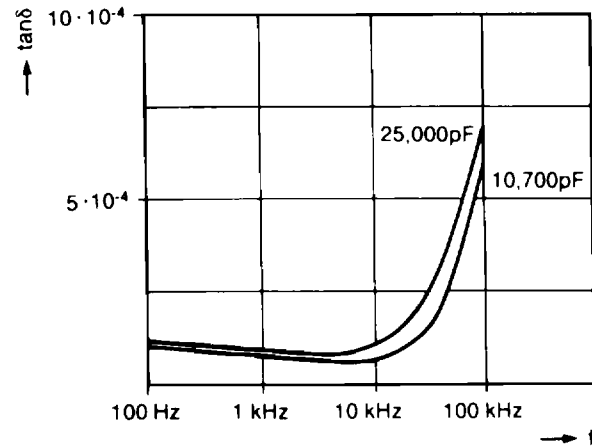
$C < 1000 \text{ pF}$



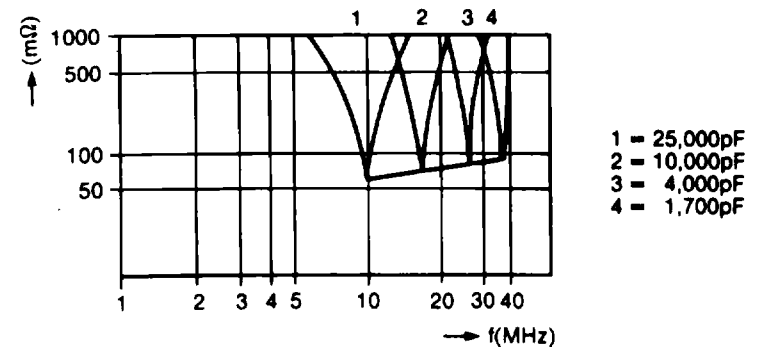
$1000 \text{ pF} < C \leq 10500 \text{ pF}$



$10500 \text{ pF} < C \leq 25000 \text{ pF}$



Resonance diagram



## Ordering information

### Article code

#### 1st block

See "Article table" and below

#### 2nd block

The capacitor is also available with 6 or 10 mm lead length (add R06 or R10 in pos. 14–16).  
Tolerance  $\pm$  mm.

**P F E 2 2 5 D B 4 2 1 5 F**

**R 0 6 C**

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20

- Pos. 9 No. of digits in cap. value (pF)
- Pos. 10–12 Sign. digits.
- Pos. 13 Code for tolerance.
- Pos. 14–16 Lead length (when not standard 3.1 mm).
- Pos. 17 If CECC approved cap. is requested.

## Marking

The capacitors are marked with:

- RIFA
- RIFA article code
- Rated capacitance
- Tolerance on rated capacitance, (see RIFA article code system on page 3)
- Rated voltage
- Code for manufacturing date (month and year)
- type designation unless otherwise specified under each detail specification.

## Packing

The capacitors are packed bulk in a box with dimensions 230×155×72 mm for capacitor types PFE 210, 216 and with the dimensions 146×55×62 mm for capacitor types PFE 225, PHE 425.