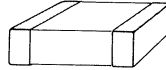


## SURFACE MOUNTED CERAMIC MULTILAYER CAPACITORS

- Six standard sizes
- High capacitance per unit volume
- Supplied in boxes or in tape on reel



### QUICK REFERENCE DATA

Capacitance range	
class 1, NP0 dielectric	0,47 to 10 000 pF (E12-series)*
N220 dielectric	4,7 to 820 pF (E12-series)*
N750 dielectric	6,8 to 1200 pF (E12-series)*
class 2, X7R dielectric	180 pF to 1 $\mu$ F (E12-series)
Y5V dielectric	2200 to 100 000 pF (E6-series)**
Rated voltage $U_R$ (d.c.)	63 V (IEC)
Tolerance on capacitance	
NP0, N220, N750 dielectrics	$\pm 10\%$ , $\pm 5\%$ ; below 10 pF: $\pm 0,5$ or $\pm 0,25$ pF
X7R dielectric	$\pm 20\%$ , $\pm 10\%$
Y5V dielectric	-20 to + 80%, $\pm 20\%$
Sectional specification	IEC 384-10, 40 (secretariat) 544
Climatic category (IEC 68)	
NP0, N220, N750 dielectrics	55/125/56
X7R dielectric	55/125/56
Y5V dielectric	25/085/56
Resistance to soldering heat	260 $^{\circ}$ C, 10 s

### APPLICATION

These capacitors with high capacitance per unit volume are for surface mounted assembly. Their dimensions, performance, and reliability make them very attractive for a wide range of applications, specially where high package density is required.

Typical application areas are e.g. radio, television, cameras, pocket calculators, telecommunication and military equipment.

The taped versions are especially suitable for automatic placement.

\* Below 10 pF other values on request.

\*\* Values up to 1  $\mu$ F under development.

# CERAMIC MULTILAYER CAPACITORS

## DESCRIPTION

The capacitors consist of a rectangular block of ceramic dielectric in which a number of interleaved precious-metal electrodes yield a high capacitance per unit volume. They are AgPd (35/65) metallized or NiSn metallized at the terminations (see Fig. 1).

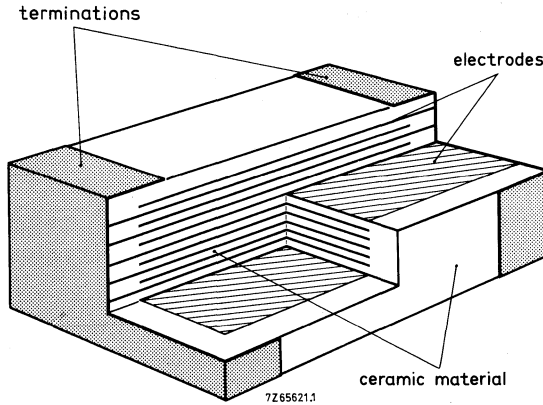


Fig. 1.

## MECHANICAL DATA

Dimensions in mm

### Outlines

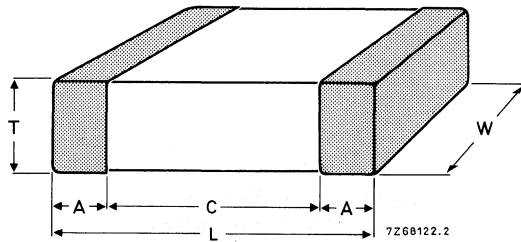


Fig. 2.

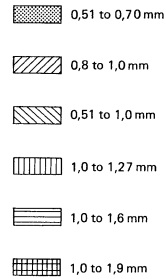
Table 1

size	L	W	T		A		C min.
			min.	max.	min.	max.	
0805	$2,0 \pm 0,15$	$1,25 \pm 0,15$	0,51*	1,27*	0,25	0,75	0,4
1206	$3,2 \pm 0,15$	$1,6 \pm 0,15$	0,51*	1,60*	0,25	0,75	
1210	$3,2 \pm 0,2$	$2,5 \pm 0,2$	0,51	1,90	0,3	1,0	
1808	$4,5 \pm 0,2$	$2,0 \pm 0,2$	0,51	1,90	0,3	1,0	
1812	$4,5 \pm 0,2$	$3,2 \pm 0,2$	0,51	1,90	0,3	1,0	
2220	$5,7 \pm 0,2$	$5,0 \pm 0,2$	0,51	1,90	0,3	1,0	

\* See also Table 2.

Table 2 Capacitor thickness for sizes 0805, 1206 and 1210

C pF	SIZE 0805					SIZE 1206					SIZE 1210	
	NP0	N220	N750	X7R	Y5V	NP0	N220	N750	X7R	Y5V	NP0	X7R
0,47												
0,56												
0,68												
0,82												
1,0												
1,2												
1,5												
1,8												
2,2												
2,7												
3,3												
3,9												
4,7												
5,6												
6,8												
8,2												
10												
12												
15												
18												
22												
27												
33												
39												
47												
56												
68												
82												
100												
120												
150												
180												
220												
270												
330												
390												
470												
560												
680												
820												
1000												
1200												
1500												
1800												
2200												
2700												
3300												
3900												
4700												
5600												
6800												
8200												
10000												
12000												
15000												
18000												
22000												
27000												
33000												
39000												
47000												
56000												
68000												
82000												
100000												
120000												
150000												
180000												
220000												



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# CERAMIC MULTILAYER CAPACITORS

## ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of  $20 \pm 1$  °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of 63 to 67%.

### Class 1

	NPO	N220	N750
Capacitance range (E12-series)*	0,47 to 10 000 pF	4,7 to 820 pF	6,8 to 1200 pF
Tolerance on capacitance			
→ $C \geq 10$ pF	$\pm 10\%$ , $\pm 5\%^{**}$		
$5$ pF $\leq C < 10$ pF	$\pm 0,5$ pF		
$C < 5$ pF	$\pm 0,25$ pF		
→ Rated voltage $U_R$ (d.c.)	63 V (IEC)		
Test voltage (d.c.) for 1 min	$2,5 \times U_R$		
Tan $\delta$ , measured at 1,0 V, 1 MHz, $C \leq 30$ pF	$10 \left( \frac{10}{C} + 0,7 \right) \times 10^{-4}$ , max. $27 \times 10^{-4}$		
1 MHz, $30$ pF $< C \leq 1000$ pF	$\leq 10 \times 10^{-4}$		
1 kHz, $C > 1000$ pF	$\leq 10 \times 10^{-4}$		
Insulation resistance	$> 100\ 000$ M $\Omega$		
Climatic category (IEC 68)	55/125/56		
Temperature coefficient			
$0,47$ pF $\leq C < 5$ pF	$(0 \pm 150) \times 10^{-6}/K$	$(-220 \pm 60) \times 10^{-6}/K$	$(-750 \pm 250) \times 10^{-6}/K$
$5$ pF $\leq C < 10$ pF	$(0 \pm 150) \times 10^{-6}/K$	$(-220 \pm 60) \times 10^{-6}/K$	$(-750 \pm 250) \times 10^{-6}/K$
$C \geq 10$ pF	$(0 \pm 30) \times 10^{-6}/K$	$(-220 \pm 60) \times 10^{-6}/K$	$(-750 \pm 250) \times 10^{-6}/K$
→ Terminations	AgPd or NiSn metallized <sup>▲</sup>		

\* Measured at 1,0 V, 1 MHz for  $C \leq 1000$  pF, and at 1,0 V, 1 kHz for  $C > 1000$  pF, by a four-gauge method.

\*\*  $\pm 2\%$  to special order.

▲ For NPO and N220 NiSn metallized terminations are available in the course of 1987.

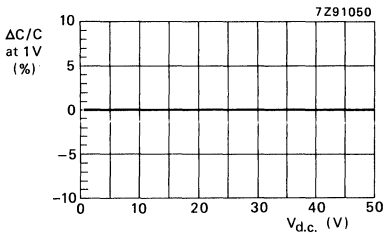


Fig. 3 Typical capacitance change with respect to the capacitance at 1 V as a function of d.c. voltage, for NPO dielectric.

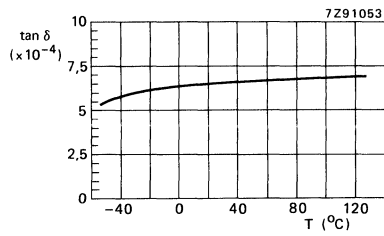


Fig. 4 Typical  $\tan \delta$  as a function of temperature for NPO dielectric.

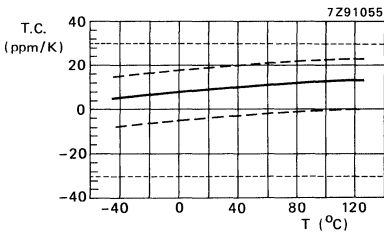


Fig. 5 Typical temperature coefficient as a function of temperature, for NPO dielectric. The dashed curves indicate sample limits, dotted lines indicate requirement levels.

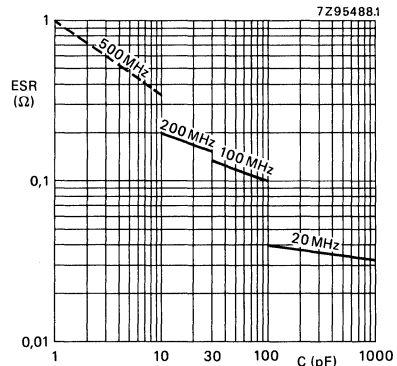


Fig. 6 Typical ESR at high frequencies as a function of capacitance, for NPO dielectric, size 0805 (measuring equipment HP4191A).

# CERAMIC MULTILAYER CAPACITORS

**Table 3** Selection chart for class 1 capacitors with AgPd and NiSn metallized terminations.  
Note: For NP0 and N220 NiSn metallized terminations are available in the course of 1987.

C pF	DIELECTRIC									
	NP0					N220		N750		
	0805	1206	1210	1808	1812	2220	0805	1206	0805	1206
0,47	■	■								
0,56	■	■								
0,68	■	■								
0,82	■	■								
1,0	■	■								
1,2	■	■								
1,5	■	■								
1,8	■	■								
2,2	■	■								
2,7	■	■								
3,3	■	■								
3,9	■	■								
4,7	■	■					■			
5,6	■	■					■			
6,8	■	■					■	■	■	■
8,2	■	■					■	■	■	■
10	■	■					■	■	■	■
12	■	■					■	■	■	■
15	■	■					■	■	■	■
18	■	■					■	■	■	■
22	■	■					■	■	■	■
27	■	■					■	■	■	■
33	■	■					■	■	■	■
39	■	■					■	■	■	■
47	■	■					■	■	■	■
56	■	■					■	■	■	■
68	■	■					■	■	■	■
82	■	■					■	■	■	■
100	■	■					■	■	■	■
120	■	■					■	■	■	■
150	■	■					■	■	■	■
180	■	■					■	■	■	■
220	■	■					■	■	■	■
270	■	■					■	■	■	■
330	■	■					■	■	■	■
390	■	■					■	■	■	■
470	■	■					■	■	■	■
560	■	■					■	■	■	■
680	■	■					■	■	■	■
820	■	■					■	■	■	■
1000	■	■					■	■	■	■
1200	■	■					■	■	■	■
1500	■	■					■	■	■	■
1800	■	■					■	■	■	■
2200	■	■					■	■	■	■
2700	■	■					■	■	■	■
3300	■	■					■	■	■	■
3900	■	■					■	■	■	■
4700	■	■					■	■	■	■
5600	■	■					■	■	■	■
6800	■	■					■	■	■	■
8200	■	■					■	■	■	■
10000	■	■					■	■	■	■

 available in bulk and in 8 mm tape on reel  
 available in bulk

7290923.2

**Class 2, X7R dielectric**

Capacitance range (E12-series)\*

180 pF to 1 μF ←

Tolerance on capacitance, at age of 1000 h

± 20%, ± 10%\*\* ←

Rated voltage  $U_R$  (d.c.)

63 V (IEC) ←

Test voltage (d.c.) for 1 min

$2,5 \times U_R$

Tan  $\delta$ , measured at 1 kHz, 1,0 V

≤ 2,5%

Insulation resistance

> 100 000 MΩ

$C \leq 10\,000$  pF

$R_{ins} \times C > 1000$  s

$C > 10\,000$  pF

Climatic category (IEC 68)

55/125/56

Maximum capacitance variation as a function of temperature

± 15%, see Fig. 9

Ageing

typ. 1% per time decade

Terminations

AgPd or NiSn metallized ←

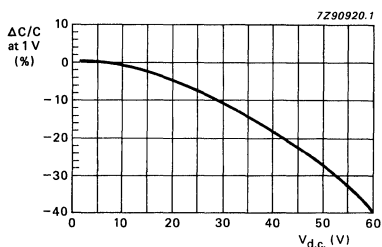


Fig. 7 Typical capacitance change with respect to the capacitance at 1 V as a function of d.c. voltage, for X7R dielectric.

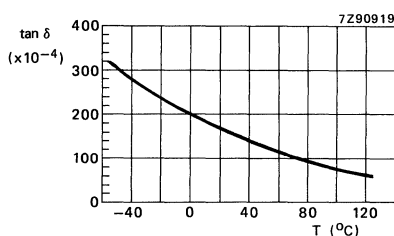


Fig. 8 Typical  $\tan \delta$  as a function of temperature, for X7R dielectric.

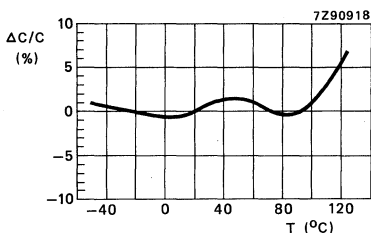


Fig. 9 Typical capacitance change as a function of temperature, for X7R dielectric.

\* Measured at 1,0 V, 1 kHz, by a four-gauge method.

\*\* ± 2% to special order.

# CERAMIC MULTILAYER CAPACITORS

→ **Table 4** Selection chart for class 2 capacitors, X7R dielectric, with AgPd and NiSn metallized terminations.

C pF	DIELECTRIC X7R					
	0805	1206	1210	1808	1812	2220
180	■					
220	■					
270	■					
330	■					
390	■					
470	■					
560	■					
680	■	■				
820	■	■				
1000	■	■				
1200	■	■				
1500	■	■				
1800	■	■				
2200	■	■	■			
2700	■	■	■	■		
3300	■	■	■	■		
3900	■	■	■	■	■	
4700	■	■	■	■	■	
5600	■	■	■	■	■	
6800	■	■	■	■	■	
8200	■	■	■	■	■	
10000	■	■	■	■	■	
12000	■	■	■	■	■	■
15000	■	■	■	■	■	■
18000	■	■	■	■	■	■
22000	■	■	■	■	■	■
27000	■	■	■	■	■	■
33000	■	■	■	■	■	■
39000	■	■	■	■	■	■
47000	■	■	■	■	■	■
56000	■	■	■	■	■	■
68000	■	■	■	■	■	■
82000	■	■	■	■	■	■
100000	■	■	■	■	■	■
120000	■	■	■	■	■	■
150000	■	■	■	■	■	■
180000	■	■	■	■	■	■
220000	■	■	■	■	■	■
270000	■	■	■	■	■	■
330000	■	■	■	■	■	■
390000	■	■	■	■	■	■
470000	■	■	■	■	■	■
560000	■	■	■	■	■	■
680000	■	■	■	■	■	■
820000	■	■	■	■	■	■
1000000	■	■	■	■	■	■

■ available in bulk and in 8 mm tape on reel

▨ available in bulk

7Z90922.3



**Class 2, Y5V dielectric**

Capacitance range (E6-series)\*

2200 to 100 000 pF  
(values up to 1 μF under development)

Tolerance on capacitance at age of 1000 h

-20 to +80% and ±20%

Rated voltage  $U_R$  (d.c.)

63 V (IEC)

Test voltage (d.c.) for 1 min

2,5 x  $U_R$

Tan  $\delta$ , measured at 1 kHz, 1,0 V

≤ 2,5%

Insulation resistance

$C \leq 25\ 000\ \text{pF}$

> 4000 MΩ

$C > 25\ 000\ \text{pF}$

$R_{\text{ins}} \times C > 100\ \text{s}$

Climatic category (IEC 68)

25/085/56

Maximum capacitance variation with respect

to C at 20 °C (IEC)

+30 to -80%, see Fig. 12

to C at 25 °C (EIA)

+22 to -82%

Ageing

typ. 5% per time decade

Terminations

AgPd or NiSn metallized

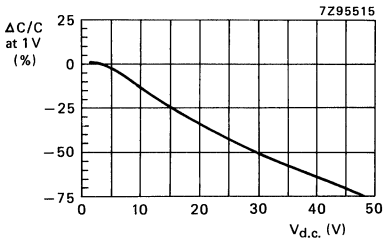


Fig. 10 Typical capacitance change with respect to the capacitance at 1 V as a function of d.c. voltage, for Y5V dielectric.

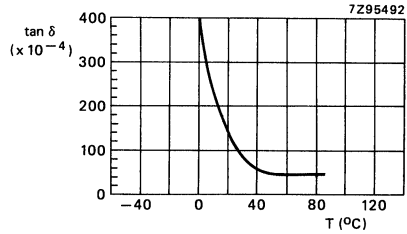


Fig. 11 Typical tan  $\delta$  as a function of temperature, for Y5V dielectric.

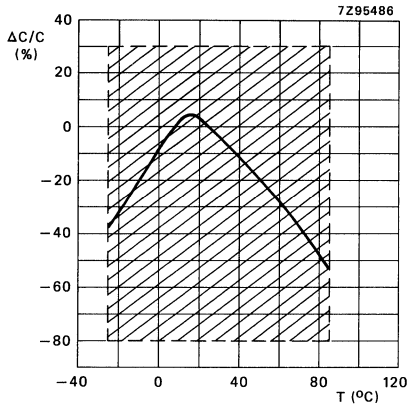


Fig. 12 Typical capacitance change as a function of temperature, for Y5V dielectric (hatched area according to IEC 384-10).

\* Measured at 1,0 V, 1 kHz, by a four-gauge method.

# CERAMIC MULTILAYER CAPACITORS

→ Table 5 Selection chart for class 2 capacitors, Y5V dielectric, with AgPd and NiSn metallized terminations.

C PF	DIELECTRIC Y5V					
	0805	1206	1210	1808	1812	2220
47						
68						
100						
150						
220						
330						
470						
680						
1000						
1500						
2200	■					
3300	■					
4700	■					
6800	■					
10000	■	■				
15000	■	■				
22000	■	■				
33000	■	■				
47000						
68000		■	■	■	■	■
100000		■	■	■	■	■
150000			■	■	■	■
220000			■	■	■	■
330000				■	■	■
470000					■	■
680000						■
1000000						■

■ available in bulk and in 8 mm tape on reel

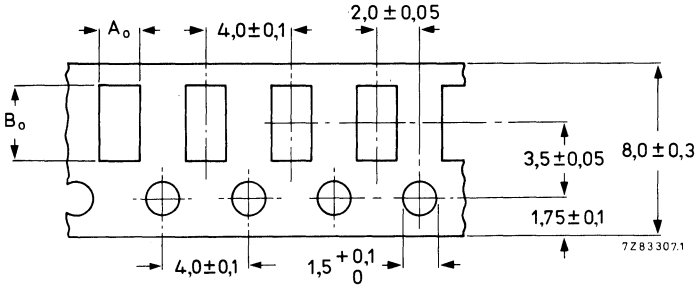
▨ under development

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**PACKING**

The capacitors are supplied in bulk in cardboard boxes of 1000; the sizes 0805, 1206 and 1210 are also supplied in tape (cardboard or blister) on reels of 4000. Capacitors with sizes 0805 and 1206 (with the smaller tolerance) are also available in bulkpacking of 100; see Appendix II.

**Cardboard tape**



dimensions	size	
	0805	1206
$A_o$	$1,5 + \begin{smallmatrix} +0,2 \\ 0 \end{smallmatrix}$	$1,85 + \begin{smallmatrix} +0,2 \\ 0 \end{smallmatrix}$
$B_o$	$2,25 + \begin{smallmatrix} +0,2 \\ 0 \end{smallmatrix}$	$3,45 + \begin{smallmatrix} +0,2 \\ 0 \end{smallmatrix}$

Fig. 13 Dimensions of carrier tape (mm).  
Cumulative pitch error 0,2 mm over 10 pitches.

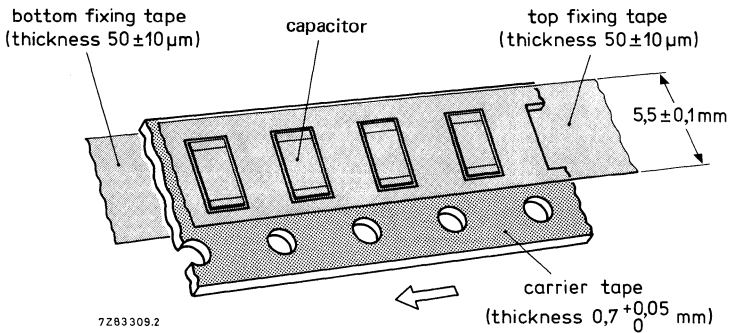
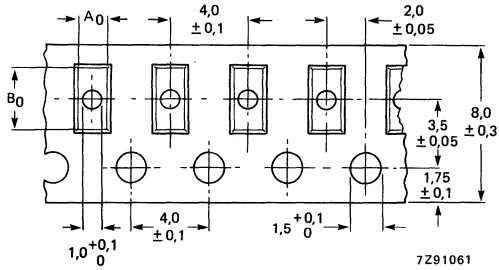


Fig. 14 Cardboard tape.

Blister tape



dimension	size	
	0805	1206
$A_0$	$1,55 \pm 0,1$	$1,85 \pm 0,1$
$B_0$	$2,3 \pm 0,1$	$3,55 \pm 0,1$

Fig. 15 Dimensions of carrier tape.  
Cumulative pitch error 0,2 mm over 10 pitches.

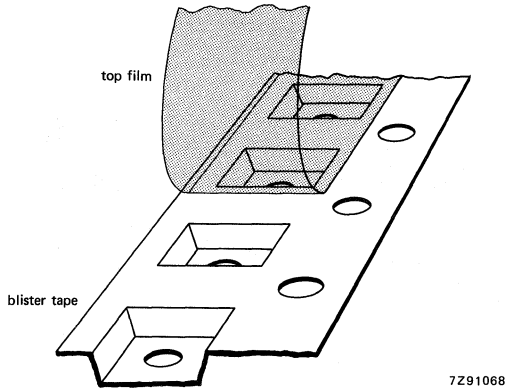


Fig. 16 Blister tape.

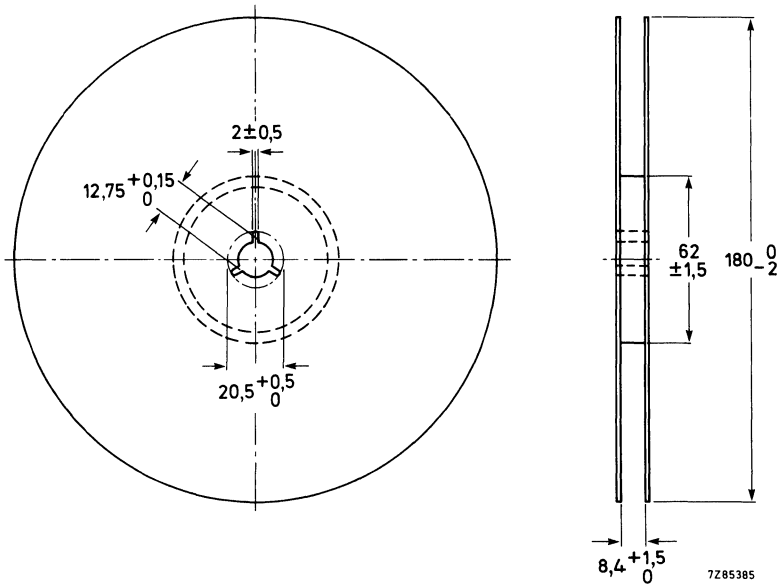


Fig. 17 Reel.

At least 40 positions at the beginning and 75 at the end of the tape are not used. The tape has a 230 mm leader.

**SOLDER CONDITIONS**

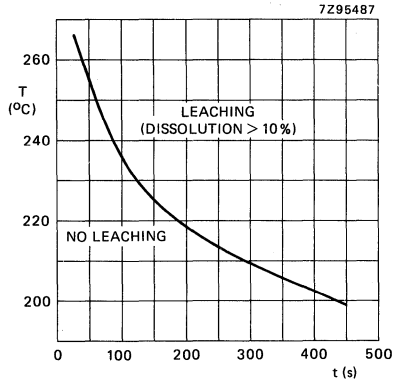
Limiting conditions

235 °C, min. 2 s, max. 100 s } see Fig. 18  
260 °C, max. 30 s

Typical solder conditions

see Figs 19, 20 and 21

(The use of weakly Cl-activated flux is advised). ←



→ Fig. 18 Resistance to leaching of AgPd metallized terminations (in static solder bath) at various temperatures. For NiSn metallized terminations the leaching resistance is 10 x better than shown in the graph.

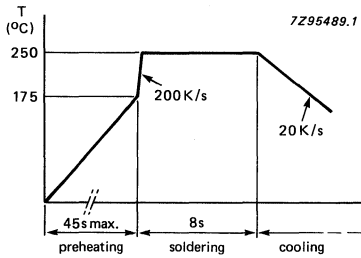


Fig. 19 Reflow soldering.

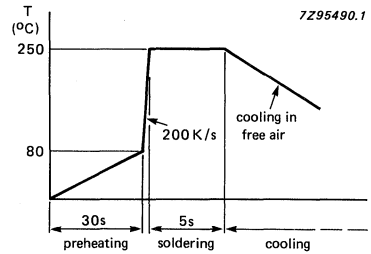


Fig. 20 Wave soldering.  
The capacitors may be soldered twice according to this method if necessary.

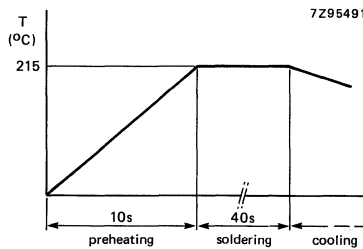
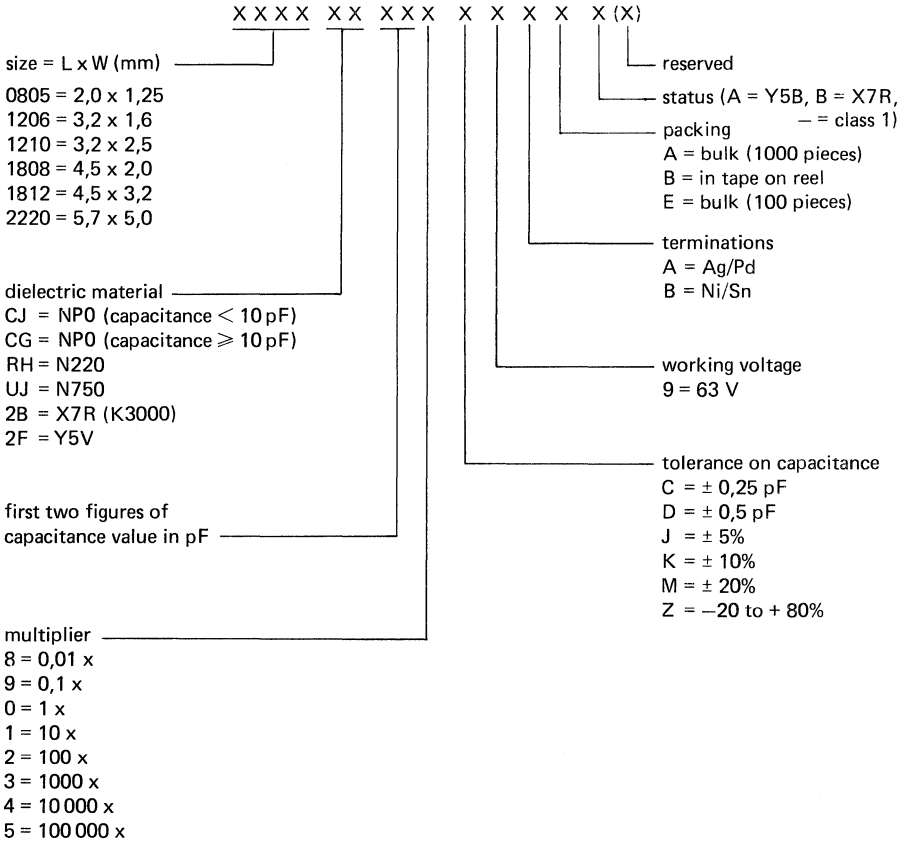


Fig. 21 Vapour phase soldering.

**HOW TO ORDER**

One can order the capacitors by quoting the 15-digit ordering code, which can be constructed as shown below\*.

Check for availability with Tables 3, 4 and 5, and with section PACKING.



**Example**

8000 capacitors, 150 pF, ± 5%, NPO dielectric, size 1206, in tape, should be ordered as:

8000 x 1206CG151J9AP - .

\* If required the 12 NC-catalogue number can be found in Appendices I and II.

CONVERSION LIST  
type number to 12NC-catalogue number  
for 1000-piece bulk  
and 4000-piece tape packing

**Examples:** A 63 V ceramic multilayer capacitor of  $12 \text{ pF} \pm 10\%$ , NP0, size 0805, with Ag/Pd terminations, supplied in tape, has the type number 0805CG120K9AB- and the 12NC-catalogue number 2222 861 13129, see next page.

A 63 V ceramic multilayer capacitor of  $820 \text{ pF} \pm 20\%$ , X7R, size 1206, with Ni/Sn terminations, supplied in bulk, has the type number 12062B821M9BAB, and the 12NC-catalogue number 2222 581 06713.



Conversion list

N750  
size 1206

cap. (pF)	1206	N750	C(pF)	type number	63 V	tolerance ± 5%		12NC-catalogue number			
						A = Ag/Pd B = Ni/Sn	A = bulk B = in tape on reel	[A] [B]	[A] [B]		
6,8	1206	UJ	689	D	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4099
8,2	1206	UJ	829	D	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4102
tolerance ± 5%											
10	1206	UJ	100	J	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4104
12			120								4106
15			150								4108
18			180								4111
22			220								4113
27			270								4115
33			330								4117
39			390								4119
47			470								4122
56			560								4124
68			680								4126
82			820								4128
100			101								4131
120			121								4133
150			151								4135
180			181								4137
220			221								4139
270			271								4142
330			331								4144
390			391								4146
470			471								4148
560			561								4151
680			681								4153
820			821								4155
1000			102								4157
1200	1206	UJ	122	J	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4159
tolerance ± 10%											
10	1206	UJ	100	K	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4238
12			120								4241
15			150								4243
18			180								4245
22			220								4247
27			270								4249
33			330								4252
39			390								4254
47			470								4256
56			560								4258
68			680								4261
82			820								4263
100			101								4265
120			121								4267
150			151								4269
180			181								4272
220			221								4274
270			271								4276
330			331								4278
390			391								4281
470			471								4283
560			561								4285
680			681								4287
820			820								4289
1000			102								4292
1200	1206	UJ	122	K	9	[A] [B]	[A] [B]	2222	[591] [581]	[0] [1]	4294