Ceramic Capacitors

SMD C Series

SCOPE

This specification describes High-Voltage NP0/X7R series chip capacitors with lead-free terminations.

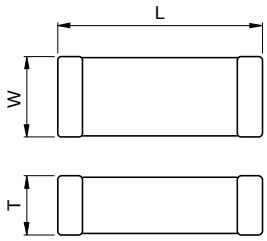
FEATURES

- Supplied in tape on reel
- Nickel-barrier end termination
- RoHS compliant
- Halogen Free compliant

APPLICATIONS

- PCs, Hard disk, Game PCs
- Power supplies
- LCD panel
- ADSL, Modem

SHAPES AND DIMENSIONS



Dimensions in mm

Type	L	W	T
C1608(0603)	1.6±0.1	0.8±0.1	Refer to table 1 to 5
C2012(0805)	2.0±0.2	1.25±0.2	Refer to table 1 to 5
C3216(1206)	3.2±0.2	1.6±0.2	Refer to table 1 to 5
C3225(1210)	3.2±0.4	2.5±0.3	Refer to table 1 to 5
C4520(1808)	4.5±0.4	2.0±0.4	Refer to table 1 to 5
C4532(1812)	4.5±0.4	3.2±0.4	Refer to table 1 to 5
C4564(1825)	4.5±0.4	6.4±0.4	Refer to table 1 to 5
C5750(2220)	5.7±0.4	5.0±0.4	Refer to table 1 to 5
C5764(2225)	5.7±0.4	6.4±0.4	Refer to table 1 to 5

PRODUCT IDENTIFICATION

C 5750 B 224 K 102 N T
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Series name

(2) Dimensions

1608(0603)	1.6×0.8mm
2012(0805)	2.0×1.25mm
3216(1206)	3.2×1.6mm
3225(1210)	3.2×2.5mm
4520(1808)	4.5×2.0mm
4532(1812)	4.5×3.2mm
4564(1825)	4.5×6.4mm
5750(2220)	5.7×5.0mm
5764(2225)	5.7×6.4mm

(3) TC Material

N=NPO

B=X7R

(4) Nominal capacitance

The capacitance is expressed in three digit codes and in units of pico farads (pF).

The first and second digits identify the first and second significant figures of the capacitance.

The third digit identifies the multiplier.

R designates a decimal point.

102	1000pF
333	33000pF
474	470000pF

(5) Capacitance tolerance

C	±0.25pF
D	±0.5 pF
G	±2%
J	±5%
K	±10%
M	±20%

(6) Rated voltage Edc

501	500V
631	630V
102	1KV
152	1.5KV
202	2KV
252	2.5KV
302	3KV

(7) Terminal type

N	Ag(or Cu)/Ni/Sn3-layers

(8) Packaging style

T	Taping (reel)
B	Bulk

CONSTRUCTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two end terminations and finally covered with a layer of plated tin (NiSn). The terminations are lead-free. A cross section of the structure is shown in Fig.1.

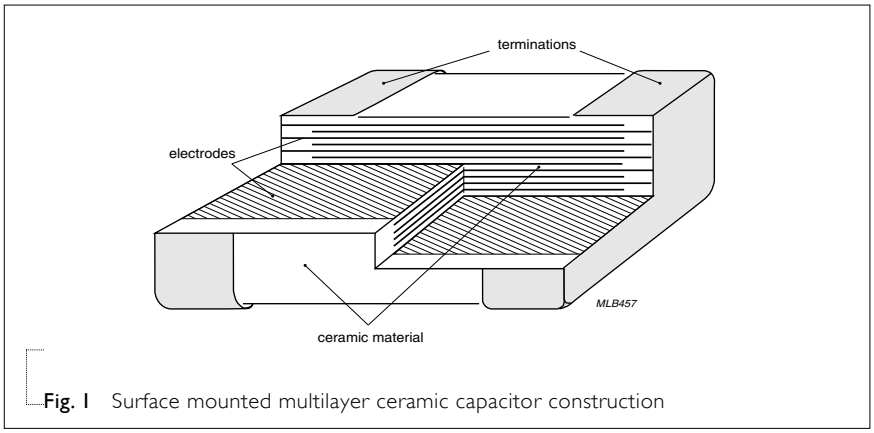


Fig. 1 Surface mounted multilayer ceramic capacitor construction

Ceramic Capacitors

SMD C Series

Table 1 – Capacitance Range/Selection Waterfall (1608 – 4532 Case Sizes)

Cap	Cap Code	Case Size	C1608			C2012			C3216					C3225					C4520							C4532						
		Voltage Code	501	631	102	501	631	102	501	631	102	152	202	501	631	102	152	202	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Rated Voltage (VDC)	500	630	1000	500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																													
10 pF	100	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
11 pF	110	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
12 pF	120	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
13 pF	130	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
15 pF	150	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
16 pF	160	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
18 pF	180	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
20 pF	200	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
22 pF	220	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
24 pF	240	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
27 pF	270	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
30 pF	300	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
33 pF	330	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
36 pF	360	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
39 pF	390	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
43 pF	430	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
47 pF	470	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
51 pF	510	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
56 pF	560	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
62 pF	620	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
68 pF	680	J K M				DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
75 pF	750	J K M				DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
82 pF	820	J K M				DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
91 pF	910	J K M				DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
100 pF	101	J K M				DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
110 pF	111	J K M				DG	DG	DG	ED	ED	ED	ED	EG	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
120 pF	121	J K M				DG	DG	DG	ED	ED	ED	ED	EG	FM	FM	FM	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
130 pF	131	J K M				DG	DG	DG	ED	ED	ED	ED	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
150 pF	151	J K M				DG	DG	DG	ED	ED	ED	EF	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
180 pF	181	J K M				DG	DG	DG	ED	ED	ED	EF	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LC	LC	LB	GK	GK	GK	GK	GK	GK	GK
220 pF	221	J K M				DG	DG	DG	ED	ED	ED	EF	EF	FG	FG	FG	FM	FM	LA	LA	LA	LA	LC	LC	LB	GH	GH	GH	GH	GH	GK	GK
270 pF	271	J K M				DG	DG	DG	ED	ED	ED	EF	EF	FG	FG	FG	FK	FK	LA	LA	LA	LB	LC	LC	LC	GH	GH	GH	GH	GH	GK	GK
330 pF	331	J K M				DG	DG	DG	ED	ED	EF	EF	EF	FG	FG	FG	FK	FK	LA	LA	LA	LB	LC	LC	LC	GH	GH	GH	GH	GH	GK	GK
390 pF	391	J K M				DG	DG	DG	ED	ED	EF	EF	EF	FG	FG	FG	FK	FS	LA	LA	LA	LB	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK
470 pF	471	J K M				DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FS	LA	LB	LB	LC	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK
560 pF	561	J K M				DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FL	LA	LB	LB	LC	LB	LB	LC	GH	GH	GH	GK	GH	GK	GK
680 pF	681	J K M				DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GK	GH	GK	GK
820 pF	821	J K M				DG	DG	DG	ED	ED	ED	EF	EF	FG	FM	FM	FL	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GK	GH	GK	GK
1,000 pF	102	J K M	CG	CG	CG	DG	DG	DG	ED	ED	ED	EF	EF	FM	FM	FM	FL	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GH	GH	GK	GK
1,200 pF	122	J K M	CG	CG		DG	DG	DG	ED	ED	ED	EG	EG	FM	FK	FK	FL	FM	LC	LC	LC	LB	LC	LC	LA		GH	GK	GK	GH	GH	GK	GK
1,500 pF	152	J K M	CG	CG		DG	DG	DG	ED	ED	ED	EG	EG	FK	FS	FS	FL	FM	LC	LC	LC	LB	LC	LC	LB		GK	GK	GK	GH	GH	GK	
1,800 pF	182	J K M	CG			DG	DG	DG	ED	ED	ED	EG	EG	FK	FS	FS	FL	FM	LC	LC	LC	LB	LC	LC	LC		GK	GK	GK	GH	GH	GK	
2,200 pF	222	J K M	CG			DG	DG	DG	ED	ED	ED	EG	EG	FK	FL	FL	FL	FM	LC	LA	LA	LB	LC	LC	LC		GK	GK	GK	GH	GH	GK	
2,700 pF	272	J K M	CG			DG	DG	DG	ED	ED	ED	EG		FS	FL	FL	FL	FM	LC	LA	LA	LB	LC				GK	GH	GH	GH	GK	GM	
3,300 pF	332	J K M	CG			DG	DG	DG	ED	ED	ED	EG		FS	FL	FL	FL	FM	LA	LA	LA	LB	LA				GK	GH	GH	GH	GK	GM	
3,900 pF	392	J K M	CG			DG	DG	DG	ED	ED	ED	EG		FL	FL	FL	FL	FK	LA	LA	LA	LB	LB				GK	GH	GH	GH	GM	GO	
4,700 pF	472	J K M				DG	DG	DG	ED	ED	ED	EG		FL	FL	FL	FL	FK	LA	LA	LA	LB	LC				GH	GH	GH	GH	GH	GO	
5,600 pF	562	J K M				DG	DG	DG	ED	EF	EF	EF		FL	FL	FL	FM	FK	LA	LB	LB	LC					GH	GH	GH	GK	GK		
6,800 pF	682	J K M				DG	DG		EF	EF	EF	EF		FL	FL	FL	FM	FS	LA	LB	LB	LC					GH	GH	GH	GK	GM		
8,200 pF	822	J K M				DG	DG		EF	EG	EG	EF		FL	FL	FL	FK		LA	LB	LB	LC					GH	GH	GH	GK	GM		
10,000 pF	103	J K M				DG	DG		EF	EG	EG	EG		FL	FL	FL	FK		LA	LB	LB	LC					GH	GH	GH	GK	GO		
12,000 pF	123	J K M				DG	DG		EG	EJ	EJ			FL	FL	FL	FK		LA	LC	LC	LB					GH	GK	GK	GK			
Cap	Cap Code	Rated Voltage (VDC)	500	630	1000	500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Voltage Code	501	631	102	501	631	102	501	631	102	152	202	501	631	102	152	202	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Case Size	C1608			C2012			C3216					C3225					C4520							C4532						

All specifications are subject to change without notice.

Ceramic Capacitors

SMD C Series

Table 2 – Capacitance Range/Selection Waterfall (1608 – 4532 Case Sizes) cont'd

Cap	Cap Code	Case Size	C1608			C2012			C3216					C3225					C4520							C4532						
		Voltage Code	501	631	102	501	631	102	501	631	102	152	202	501	631	102	152	202	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Rated Voltage (VDC)	500	630	1000	500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																													
15,000 pF	153	J K M				DG			EG	EJ	EJ			FL	FL	FL	FL		LA	LC	LC	LC				GH	GK	GK	GH			
18,000 pF	183	J K M				DG			EJ	EJ	EJ			FL	FL	FL	FM		LA	LE	LE					GH	GK	GK	GM			
22,000 pF	223	J K M				DG			EJ	EJ	EJ			FL	FM	FM	FM		LA	LE	LE					GH	GK	GK	GM			
27,000 pF	273	J K M							EJ	EJ				FM	FK	FK	FK		LA	LA	LA					GH	GB	GB	GO			
33,000 pF	333	J K M							EJ	EJ				FM	FG	FH	FS		LC	LA	LA					GH	GB	GB	GO			
39,000 pF	393	J K M							EJ					FK	FG	FH	FS		LC	LA	LA					GH	GB	GB				
47,000 pF	473	J K M							EJ					FK	FH	FK			LC	LA	LB					GH	GB	GC				
56,000 pF	563	J K M							EJ					FG	FH	FK			LC	LA	LB					GH	GB	GE				
68,000 pF	683	J K M							EJ					FG	FK	FS			LA	LA	LC					GE	GE	GE				
82,000 pF	823	J K M												FH	FK				LA	LC						GB	GE	GK				
0.10 µF	104	J K M												FK	FS				LA	LC						GB	GH	GJ				
0.12 µF	124	J K M												FK					LA							GE	GK					
0.15 µF	154	J K M												FK					LB							GE	GN					
0.18 µF	184	J K M																								GF						
0.22 µF	224	J K M																								GJ						
0.27 µF	274	J K M																								GL						
0.33 µF	334	J K M																								GS						
Cap	Cap Code	Rated Voltage (VDC)	500	630	1000	500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Voltage Code	501	631	102	501	631	102	501	631	102	152	202	501	631	102	152	202	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Case Size	C1608			C2012			C3216					C3225					C4520							C4532						

Table 3 – Capacitance Range/Selection Waterfall (4564–5664 Case Sizes)

Capacitance	Cap Code	Case Size	C4564							C5750							C5764						
		Voltage Code	501	631	102	152	202	252	302	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Rated Voltage (VDC)	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance Tolerance	Product Availability and Chip Thickness Codes – See Table 2 for Chip Thickness Dimensions																				
100 pF	101	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
110 pF	111	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
120 pF	121	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
130 pF	131	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
150 pF	151	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
180 pF	181	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
220 pF	221	J K M	HE	HE	HE	HE	HE	HE	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
270 pF	271	J K M	HE	HE	HE	HE	HE	HE	HG	JK	JK	JK	JK	JK	JK	JK	KE	KE	KE	KE	KE	KE	KF
330 pF	331	J K M								JE	JE	JE	JE	JE	JK	JK	KE	KE	KE	KE	KE	KE	KF
390 pF	391	J K M								JE	JE	JE	JE	JE	JK	JK	KE	KE	KE	KE	KE	KE	KF
470 pF	471	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JE	JE	JK	JK	KF	KF	KF	KF	KE	KE	KF
560 pF	561	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KE	KE	KF
680 pF	681	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JK	JK	JK	JK	KF	KF	KF	KF	KE	KF	KF
820 pF	821	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JK	JK	JK	JK	KE	KE	KE	KF	KE	KF	KF
Capacitance	Cap Code	Rated Voltage (VDC)	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Voltage Code	501	631	102	152	202	252	302	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Case Size/ Series	C4564							C5750							C5764						

Ceramic Capacitors

SMD C Series

Table 4 – Capacitance Range/Selection Waterfall (4564 – 5664 Case Sizes) cont'd

Capacitance	Cap Code	Case Size			C4564							C5750							C5764						
		Voltage Code			501	631	102	152	202	252	302	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Rated Voltage (VDC)			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance Tolerance			Product Availability and Chip Thickness Codes – See Table 2 for Chip Thickness Dimensions																				
1,000 pF	102	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KE	KF	KF
1,200 pF	122	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
1,500 pF	152	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
1,800 pF	182	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
2,200 pF	222	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JK	JK	JE	JE	JK	JK	KF	KE	KE	KF	KF	KF	KF
2,700 pF	272	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JK	KE	KE	KE	KE	KE	KF	KE
3,300 pF	332	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JE	KE	KE	KE	KE	KE	KF	KE
3,900 pF	392	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JE	KE	KF	KF	KE	KE	KF	KE
4,700 pF	472	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JK	JE	JE	KE	KF	KF	KE	KE	KF	KE
5,600 pF	562	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JK	JE	JE	KE	KF	KF	KE	KE	KF	KE
6,800 pF	682	J	K	M	HE	HE	HE	HE	HE	HJ		JK	JE	JE	JE	JK	JE	JE	KE	KF	KF	KE	KF	KE	KE
8,200 pF	822	J	K	M	HE	HE	HE	HE	HE	HJ		JK	JE	JE	JE	JK	JK	JK	KF	KE	KE	KE	KF	KF	KF
10,000 pF	103	J	K	M	HE	HE	HE	HE	HJ	HK		JE	JE	JE	JE	JL	JL	JL	KF	KE	KE	KE	KF	KH	KH
12,000 pF	123	J	K	M	HE	HE	HE	HG	HJ			JE	JK	JK	JK	JL	JL	JL	KE	KE	KE	KE	KF	KH	KH
15,000 pF	153	J	K	M	HE	HE	HE	HG	HK			JE	JK	JK	JK	JL	JN	JN	KE	KE	KE	KE	KF	KJ	KJ
18,000 pF	183	J	K	M	HE	HE	HE	HG				JE	JK	JK	JK	JN			KE	KE	KE	KE	KH		
22,000 pF	223	J	K	M	HE	HG	HG	HG				JE	JK	JK	JK	JN			KE	KF	KF	KF	KJ		
27,000 pF	273	J	K	M	HE	HG	HG	HG				JE	JK	JK	JK				KE	KF	KF	KF	KJ		
33,000 pF	333	J	K	M	HE	HG	HG	HE				JE	JK	JK	JK				KE	KF	KF	KF			
39,000 pF	393	J	K	M	HE	HG	HG	HG				JE	JK	JK	JE				KE	KF	KF	KF			
47,000 pF	473	J	K	M	HE	HG	HG	HJ				JE	JK	JK	JK				KE	KF	KF	KF			
56,000 pF	563	J	K	M	HE	HG	HG	HJ				JE	JE	JE	JL				KE	KF	KF	KF			
68,000 pF	683	J	K	M	HG	HJ	HJ	HK				JE	JK	JK	JL				KE	KF	KF	KJ			
82,000 pF	823	J	K	M	HG	HJ	HJ					JE	JL	JL	JN				KE	KF	KF	KJ			
0.10 µF	104	J	K	M	HG	HK	HK					JE	JN	JN					KE	KH	KH	KJ			
0.12 µF	124	J	K	M	HG	HE						JE	JN	JN					KE	KH	KH				
0.15 µF	154	J	K	M	HG	HE						JK	JE						KF	KJ	KJ				
0.18 µF	184	J	K	M	HG	HG						JK	JE						KF	KE					
0.22 µF	224	J	K	M	HG	HJ						JK	JK						KF	KF					
0.27 µF	274	J	K	M	HJ	HJ						JK	JL						KF	KH					
0.33 µF	334	J	K	M	HJ							JL	JN						KF	KH					
0.39 µF	394	J	K	M	HK							JN							KH	KJ					
0.47 µF	474	J	K	M								JN							KH	KJ					
0.56 µF	564	J	K	M															KJ						
Capacitance	Cap Code	Rated Voltage (VDC)			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Voltage Code			501	631	102	152	202	252	302	501	631	102	152	202	252	302	501	631	102	152	202	252	302
		Case Size/ Series			C4564							C5750							C5764						

Ceramic Capacitors

SMD C Series

Table 5 – Chip Thickness/Tape & Reel Packaging Quantities

Thickness Code	Case Size	Thickness ± Range (mm)	Paper Quantity		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
CG	1608(0603)	0.80 ± 0.10	4,000	15,000	0	0
DG	2012(0805)	1.25 ± 0.15	0	0	2,500	10,000
ED	3216(1206)	1.00 ± 0.10	0	0	2,500	10,000
EF	3216(1206)	1.20 ± 0.15	0	0	2,500	10,000
EG	3216(1206)	1.60 ± 0.15	0	0	2,000	8,000
EJ	3216(1206)	1.70 ± 0.20	0	0	2,000	8,000
FG	3225(1210)	1.25 ± 0.15	0	0	2,500	10,000
FL	3225(1210)	1.40 ± 0.15	0	0	2,000	8,000
FH	3225(1210)	1.55 ± 0.15	0	0	2,000	8,000
FM	3225(1210)	1.70 ± 0.20	0	0	2,000	8,000
FK	3225(1210)	2.10 ± 0.20	0	0	2,000	8,000
FS	3225(1210)	2.50 ± 0.30	0	0	1,000	4,000
LE	4520(1808)	1.00 ± 0.10	0	0	2,500	10,000
LA	4520(1808)	1.40 ± 0.15	0	0	1,000	4,000
LB	4520(1808)	1.60 ± 0.15	0	0	1,000	4,000
LC	4520(1808)	2.00 ± 0.15	0	0	1,000	4,000
GB	4532(1812)	1.00 ± 0.10	0	0	1,000	4,000
GC	4532(1812)	1.10 ± 0.10	0	0	1,000	4,000
GE	4532(1812)	1.30 ± 0.10	0	0	1,000	4,000
GH	4532(1812)	1.40 ± 0.15	0	0	1,000	4,000
GF	4532(1812)	1.50 ± 0.10	0	0	1,000	4,000
GK	4532(1812)	1.60 ± 0.20	0	0	1,000	4,000
GJ	4532(1812)	1.70 ± 0.15	0	0	1,000	4,000
GN	4532(1812)	1.70 ± 0.20	0	0	1,000	4,000
GL	4532(1812)	1.90 ± 0.20	0	0	500	2,000
GM	4532(1812)	2.00 ± 0.20	0	0	500	2,000
GS	4532(1812)	2.10 ± 0.20	0	0	500	2,000
GO	4532(1812)	2.50 ± 0.20	0	0	500	2,000
HE	4564(1825)	1.40 ± 0.15	0	0	1,000	4,000
HG	4564(1825)	1.60 ± 0.20	0	0	1,000	4,000
HJ	4564(1825)	2.00 ± 0.20	0	0	500	2,000
HK	4564(1825)	2.50 ± 0.20	0	0	500	2,000
JE	5750(2220)	1.40 ± 0.15	0	0	1,000	4,000
JK	5750(2220)	1.60 ± 0.20	0	0	1,000	4,000
JL	5750(2220)	2.00 ± 0.20	0	0	500	2,000
JN	5750(2220)	2.50 ± 0.20	0	0	500	2,000
KE	5764(2225)	1.40 ± 0.15	0	0	1,000	4,000
KF	5764(2225)	1.60 ± 0.20	0	0	1,000	4,000
KH	5764(2225)	2.00 ± 0.20	0	0	500	2,000
KJ	5764(2225)	2.50 ± 0.20	0	0	500	2,000
Thickness Code	Case Size	Thickness ± Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel
			Paper Quantity		Plastic Quantity	

Ceramic Capacitors

SMD C Series

ELECTRICAL CHARACTERISTICS

NP0/X7R DIELECTRIC CAPACITORS; NISN TERMINATIONS

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

Table 6

DESCRIPTION		VALUE
Capacitance range		0.47 pF to 33 nF
Capacitance tolerance		
NP0	C < 10 pF	±0.25 pF, ±0.5 pF
	C ≥ 10 pF	±2%, ±5%
X7R		±5% (1), ±10%
Dissipation factor (D.F.)		
NP0	C < 30 pF	≤ 1 / (400 + 20C)
	C ≥ 30 pF	≤ 0.1 %
X7R		≤ 2.5 %
Insulation resistance after 1 minute at U_r (DC)		R_{ins} ≥ 10 GΩ or R_{ins} × C ≥ 500 seconds whichever is less
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):		
NP0		±30 ppm/°C
X7R		±20%
Operating temperature range:		
NP0/X7R		–55 °C to +125 °C

NOTE

1. ±5% tolerance of capacitance value isn't available for X7R full product range, please contact local sales force before ordering

Ceramic Capacitors

SMD C Series

HIGH-VOLTAGE NP0

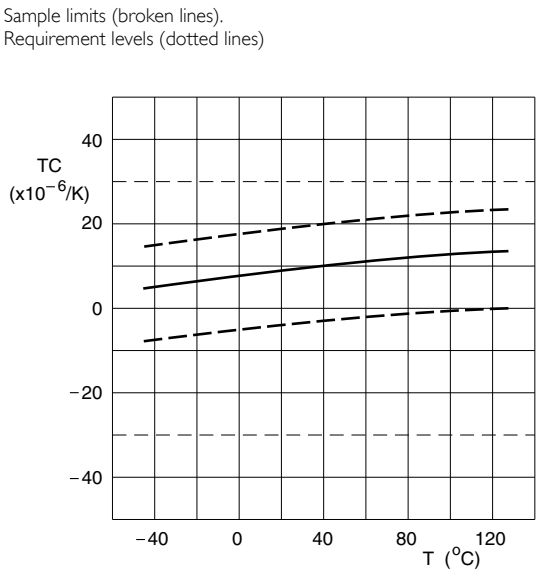


Fig. 2 Typical temperature coefficient as a function of temperature

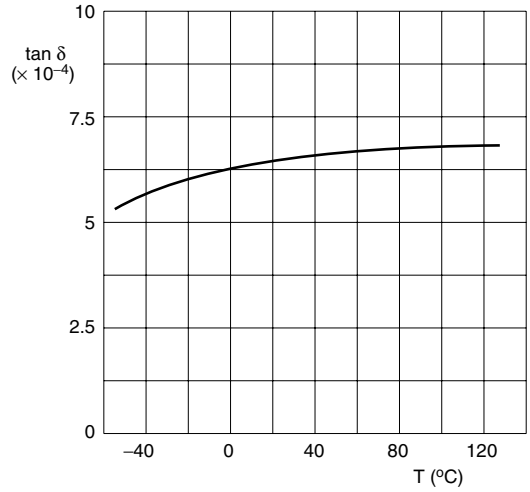


Fig. 3 Typical tan δ as a function of temperature

HIGH-VOLTAGE X7R

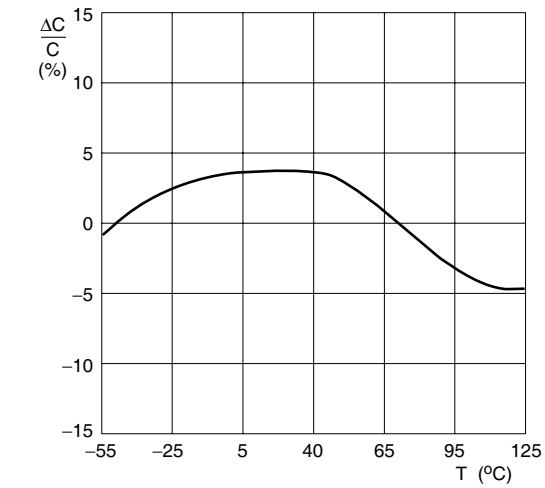


Fig. 4 Typical capacitance change as a function of temperature

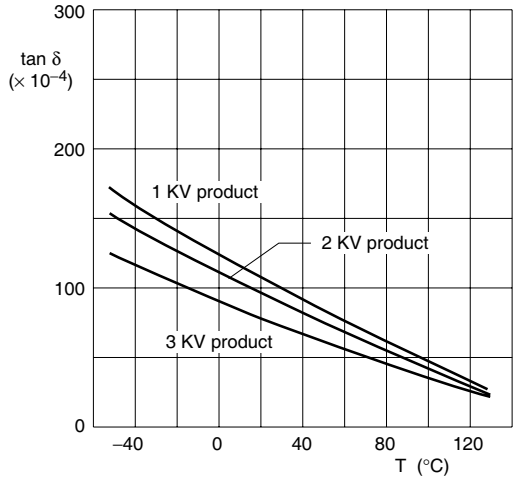


Fig. 5 Typical tan δ as a function of temperature

Ceramic Capacitors

SMD C Series

SOLDERING RECOMMENDATION

Table 7

SOLDERING METHOD	SIZE 0402	0603	0805	1206	≥ 1210
Reflow	≥ 0.1 μF	≥ 1.0 μF	≥ 2.2 μF	≥ 4.7 μF	Reflow only
Reflow/Wave	< 0.1 μF	< 1.0 μF	< 2.2 μF	< 4.7 μF	---

TESTS AND REQUIREMENTS

Table 8 Test procedures and requirements

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Mounting	IEC 60384-21/22	4.3	The capacitors may be mounted on printed-circuit boards or ceramic substrates	No visible damage
Visual Inspection and Dimension Check		4.4	Any applicable method using × 10 magnification	In accordance with specification
Capacitance		4.5.1	Class 1: f = 1 MHz for C ≤ 1 nF, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V_{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V_{rms} at 20 °C	Within specified tolerance
Dissipation Factor (D.F.)		4.5.2	Class 1: f = 1 MHz for C ≤ 1 nF , measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V_{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V_{rms} at 20 °C	In accordance with specification
Insulation Resistance		4.5.3	U_r ≤ 500 V: At Ur for 1 minute U_r > 500 V: At 500 V for 1 minute	In accordance with specification
Temperature Coefficient		4.6	Class 1: Between minimum and maximum temperature NP0: -55 °C to +125 °C Normal Temperature: 20 °C	ΔC/C: Class 1: NP0: ±30 ppm/°C
Temperature Characteristic			Class 2: Between minimum and maximum temperature X7R: -55 °C to +125 °C Normal Temperature: 20 °C	Class 2 X7R: ±15%

Ceramic Capacitors

SMD C Series

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Adhesion	IEC 60384-21/22 4.7	A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate	Force size ≥ 0603: 5N
Bond Strength of Plating on End Face	4.8	Mounting in accordance with IEC 60384-22 paragraph 4.3 Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm	No visible damage ΔC/C Class 1: NP0: within ±1% or 0.5 pF, whichever is greater Class2: X7R: ±10%
Resistance to Soldering Heat	4.9	Precondition: 150 +0/–10 °C for 1 hour, then keep for 24 ±1 hours at room temperature Preheating: for size ≤ 1206: 120 °C to 150 °C for 1 minute Preheating: for size >1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute Solder bath temperature: 260 ±5 °C Dipping time: 10 ±0.5 seconds Recovery time: 24 ±2 hours	Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned ΔC/C Class 1: NP0: within ±0.5% or 0.5 pF, whichever is greater Class2: X7R: ±10% D.F. within initial specified value R_{ins} within initial specified value
Solderability	4.10	Preheated to a temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds. Test conditions for lead containing solder alloy Temperature: 235 ±5 °C Dipping time: 2 ±0.2 seconds Depth of immersion: 10 mm Alloy Composition: 60/40 Sn/Pb Number of immersions: 1 Test conditions for lead-free containing solder alloy Temperature: 245 ±5 °C Dipping time: 3 ±0.3 seconds Depth of immersion: 10 mm Alloy Composition: SAC305 Number of immersions: 1	The solder should cover over 95% of the critical area of each termination

Ceramic Capacitors

SMD C Series

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Rapid Change of Temperature	IEC 60384-21/22 4.11	Preconditioning; 150 +0/–10 °C for 1 hour, then keep for 24 ±1 hours at room temperature 5 cycles with following detail: 30 minutes at lower category temperature 30 minutes at upper category temperature Recovery time 24 ±2 hours	No visual damage ΔC/C Class 1: NP0: within ±1% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. meet initial specified value R_{ins} meet initial specified value
Damp Heat	4.13	1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR 3. Damp heat test: 500 ±12 hours at 40 ±2 °C; 90 to 95% R.H. 4. Recovery: Class 1: 6 to 24 hours Class 2: 24 ±2 hours 5. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage after recovery ΔC/C Class 1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class 1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class 1: NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less Class2: X7R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less

Ceramic Capacitors

SMD C Series

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22 4.14	1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR 3. Endurance test: Temperature: NP0/X7R: 125 °C Specified stress voltage applied for 1,000 hours. High-Voltage series follows the stress conditions below: Applied 2.0 x U_r for < 500 V series Applied 1.3 x U_r for 500 V, 630 V series Applied 1.2 x U_r for 1 KV, 2 KV, 3 KV series 4. Recovery time: 24 ±2 hours 5. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage ΔC/C Class1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class1: NP0: ≥ 4,000 MΩ or R_{ins} x C_r ≥ 40s whichever is less Class2: X7R: ≥ 1,000 MΩ or R_{ins} x C_r ≥ 50s whichever is less
Voltage Proof	IEC 60384-1 4.6	Specified stress voltage applied for 1 minute U_r ≤ 100 V: series applied 2.5 U_r 100 V < U_r ≤ 200 V series applied (1.5 U_r + 100) 200 V < U_r ≤ 500 V series applied (1.3 U_r + 100) U_r > 500 V: 1.3 U_r I: 7.5 mA	No breakdown or flashover