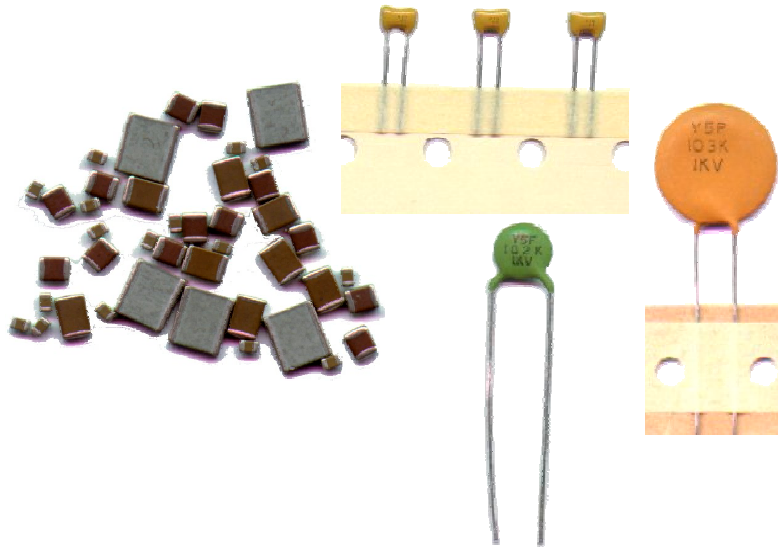


Ceramic Capacitors



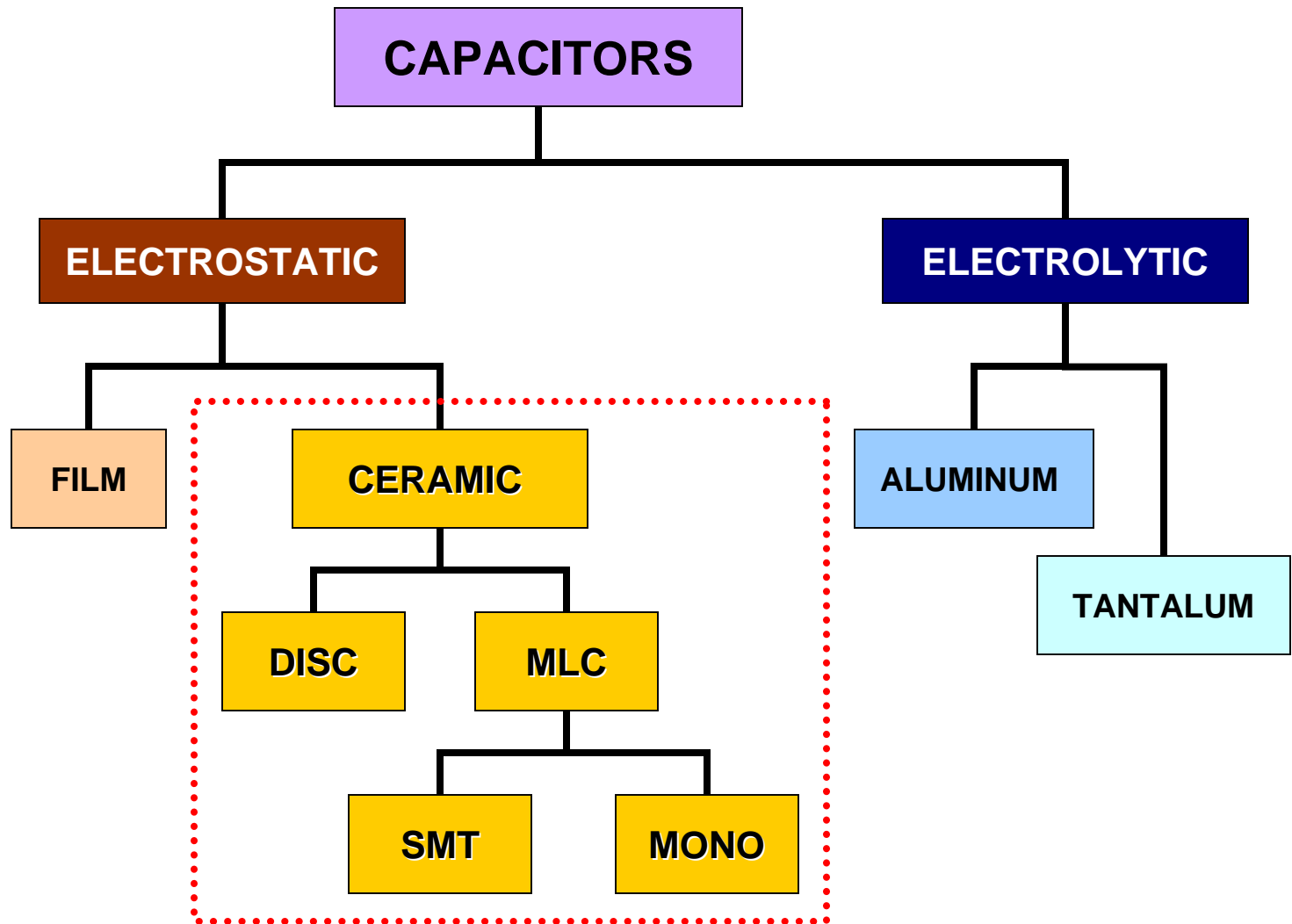
NIC PRODUCT TRAINING

Topics: Leaded and Surface Mount (SMT)

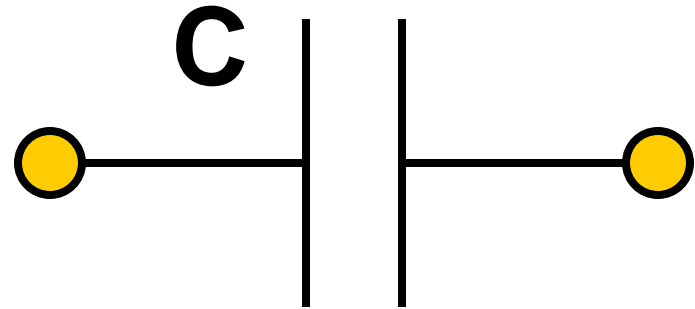
- ✓ **Characteristics**
- ✓ **Ceramic Dielectrics**
- ✓ **Substitution Guides**
- ✓ **Styles - Appearance - Dimensions**
- ✓ **NIC Part Numbers**
- ✓ **Competition Cross Reference**
- ✓ **Use in Circuit Board Assembly**
- ✓ **Buzzwords & Technical Info**



Capacitor Family Tree



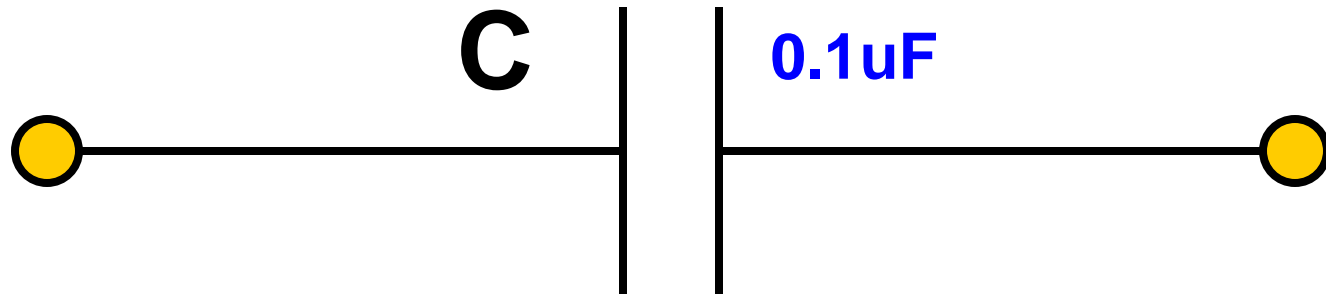
Ceramic Characteristics



Ceramic capacitors belong to the family of **ELECTROSTATIC** capacitors. They have the following characteristics:

- They are **Non-Polar**
- They dominate the **lower range of capacitance values**
- They are the **most widely used style** of capacitor (*Largest Volume & Lowest Pricing*)
- They are available in **both leaded** and **surface mount** styles
- The vast majority are **fixed capacitance value** (their value is not user variable)

Capacitance (Cap) Value Characteristic



Capacitance Value in...

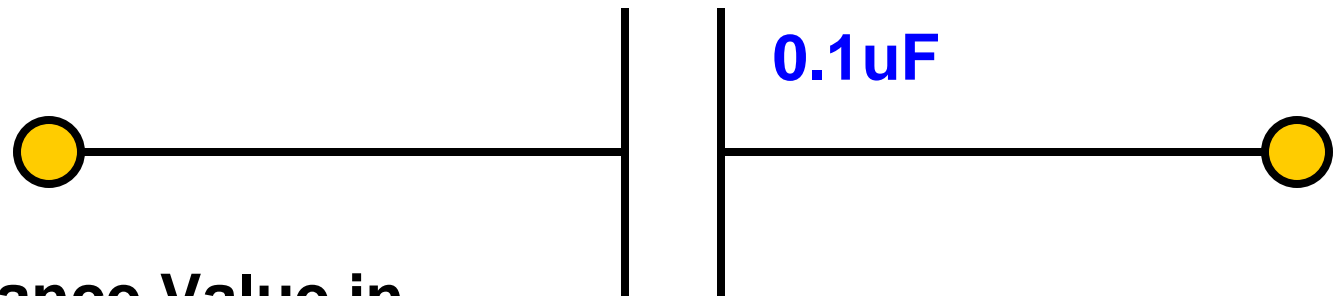
pF = pico-Farad = 1×10^{-12} F = 0.0000000000001F

NIC offers ceramic capacitors with values ranging from...

0.5pF ~ 22,000,000pF (= 22uF)

Most call outs are from 10pF ~ 0.1uF

Cap Value Characteristic



Capacitance Value in...

pF = pico-Farad = 1×10^{-12} F = 0.0000000000001F

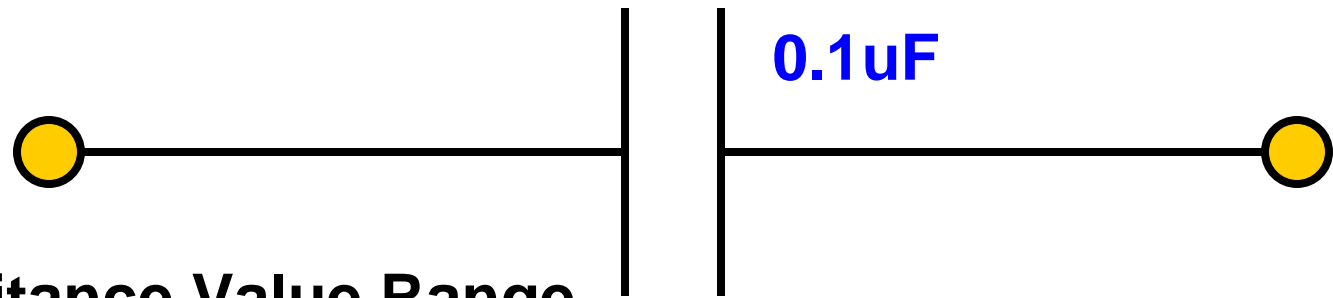
nF = nano-Farad = 1×10^{-9} F = 0.000000001F

uF = micro-Farad = 1×10^{-6} F = 0.000001F

1000**pF** = 1**nF**

1,000,000**pF** = 1000**nF** = 1**uF**

Cap Value Characteristic



Capacitance Value Range

Low End: **pF**

Typical Values: 1pF, 4.7pF, 22pF, 100pF, 330pF, 1000pF, etc.

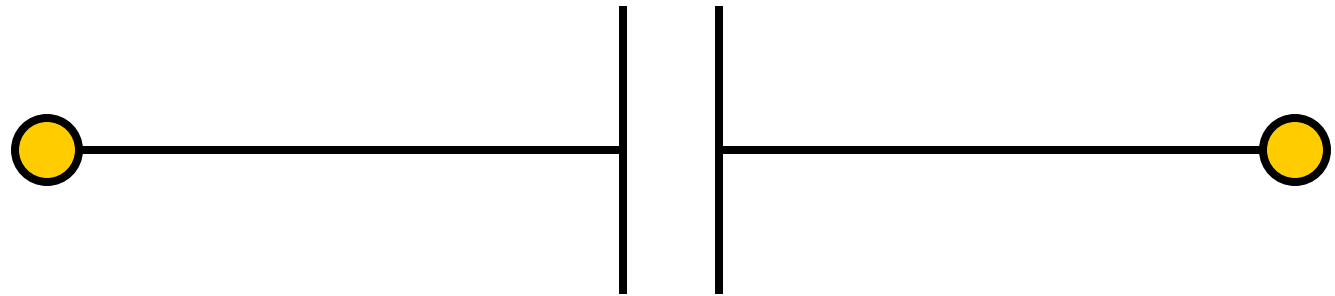
Medium Range: **nF**

Typical Values: 1nF, 10nF(0.01uF), 100nF (0.1uF), 220nF (0.22uF), etc.

High End: **uF**

Typical Values: 1uF, 2.2uF, 10uF and 22uF

Cap Value Characteristic



Standard Capacitance Values: (PER EIA-575 & RS 460)

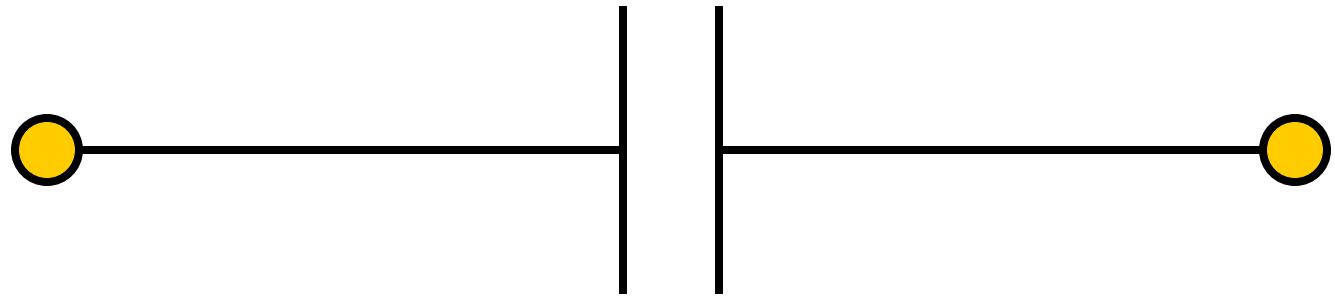
E12

10 12 15 18 22 27 33 39 47 56 68 82

Examples:

**1.0, 1.2, 1.5,..... 10, 15, 22,... 100, 180, 270,... 1K, 3.3K, 4.7K,....
10K, 33K, 56K,... 100K, 220K, 680K,... 1uF, 2.2uF, 4.7uF,....**

Cap Value Characteristic



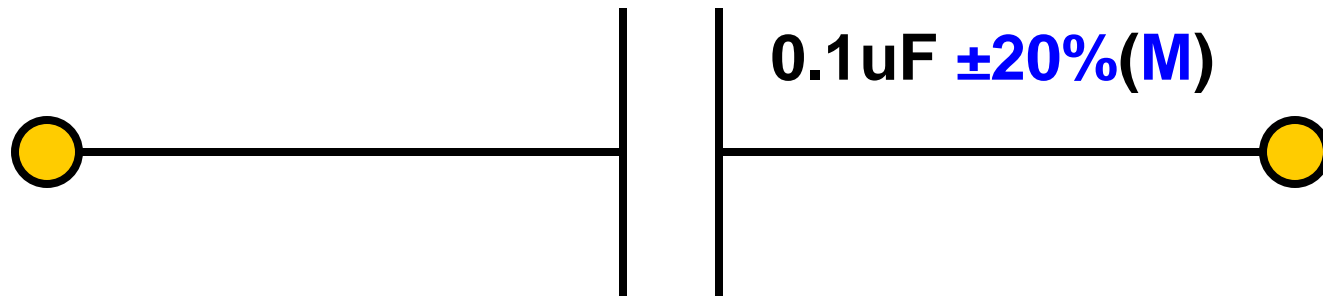
Standard Capacitance Values: (PER EIA-575 & RS 460)

E24

10 11 12 13 15 16 18 20 22 24 27 30 33 36
39 43 47 51 56 62 68 75 82 91

In-between Values Shown In **Red** Are Considered “Odd” Non-Preferred Values
And As Such Are Not Stocked
And Should Be Discouraged From Being Selected...

Tolerance Characteristic



Capacitance Tolerance

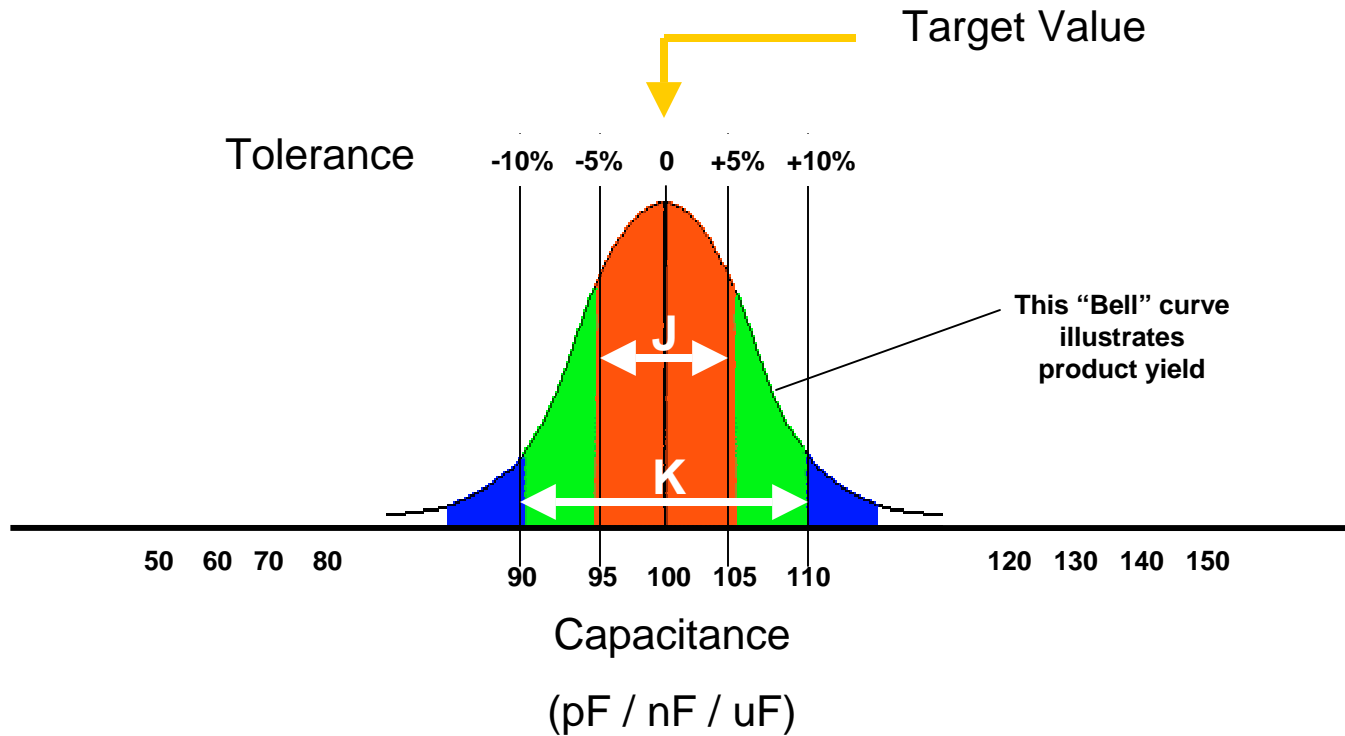
Capacitance value will have tolerance value (+25°C):

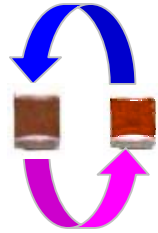
±1% (F), ±2% (G), ±5% (J), ±10% (K), ±20% (M) and +80%/-20% (Z)
±0.1 pF (B), ±0.25 pF (C) and ±0.5 pF (D)

These are the most commonly called out tolerances

Tolerance Characteristic

Capacitance Tolerance





Component Substitution Guideline

Capacitance Tolerance Substitution

“A component with a tighter (better) tolerance can replace a looser (worst) tolerance component.”

i.e... $\pm 1\%$ (F) tolerance part can replace $\pm 2\%$ (G), $\pm 5\%$ (J) or $\pm 10\%$ (K) tolerance part

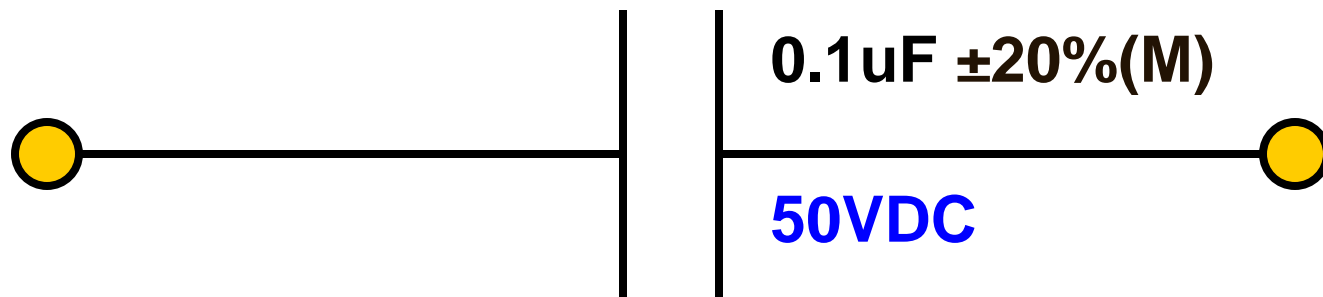
i.e... $\pm 2\%$ (G) tolerance part can replace $\pm 5\%$ (J), $\pm 10\%$ (K) or $\pm 20\%$ (M) tolerance part

i.e... $\pm 5\%$ (J) tolerance part can replace $\pm 10\%$ (K) or $\pm 20\%$ (M) tolerance part

i.e... $\pm 10\%$ (K) tolerance part can replace $\pm 20\%$ (M) or $+80\%/-20\%$ (Z) tolerance part

i.e... $\pm 20\%$ (M) tolerance part can replace $+80\%/-20\%$ (Z) tolerance part

Voltage Characteristic

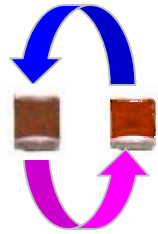


Voltage Rating

NIC offers ceramic capacitors with voltage ratings from...

16VDC ~ 15,000VDC

Most call outs are from 25V ~ 100VDC



Component Substitution Guideline

Voltage Rating Substitution

“A component with a higher voltage rating may be used in place of, or as a substitute for, a lower voltage rated component.”

- i.e... 1000V rated part can replace 500V, 250V or 100V rated part.
- i.e... 500V rated part can replace 250V , 100V or 50V rated part.
- i.e... 250V rated part can replace 100V, 50V or 25V rated part.
- i.e... 100V rated part can replace 50V or 25V rated part.
- i.e... 50V rated part can replace 25V or 16V rated part.
- i.e... 25V rated part can replace 16V or 10V rated part.

TC Characteristic

Unfortunately not all capacitance values can be produced from one ceramic dielectric formulation...

A wide range of ceramic dielectrics are needed, and have been developed, to cover a broad range of capacitance values. The EIA (*Electronics Industries Alliance*) established industry classifications for ceramic dielectrics that are agreed to and met by all ceramic capacitor producers.

These ceramic dielectric classifications are identified by their **temperature coefficient (TC)** code.

Y5P

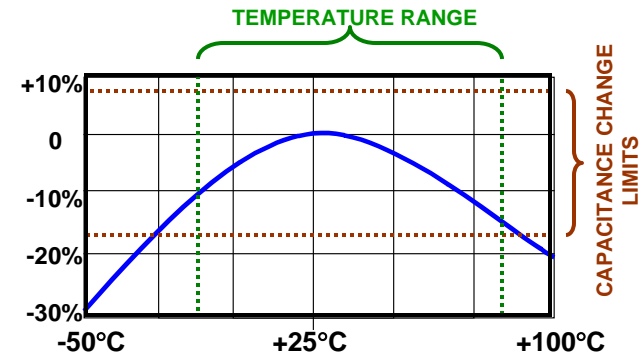
NPO

X7R

Z5U

Y5F

TC Characteristic



Room Temperature is +25°C (77°F)

All capacitors are specified (and guaranteed) with regards to their capacitance value and tolerance at +25°C

All capacitors will change in capacitance value if their temperature departs from room temperature (*through heating or cooling within an electronic circuit*). **Blue line** shown on above graph illustrates capacitance change over -50°C to +100°C temperature range.

The maximum allowable change in capacitance over a specified operating temperature range is the **Temperature Coefficient (TC)** of the capacitor.

TC Characteristic

Standard **Temperature Coefficients (TC)** of ceramic capacitors:

Low Temperature Limit	High Temperature Limit	Maximum Allowable Capacitance Change From +25°C (0 VDC)
X = -55°C	5 = +85°C	F = ±7.5%
Y = -30°C	6 = +105°C	P = ±10%
Z = +10°C	7 = +125°C	R = ±15%
	8 = +150°C (<i>SPECIAL</i>)	S = ±22%
		T = +22% / -33%
		U = +22% / -56%
		V = +22% / -82%

X7R = ±15% ΔC over -55°C ~ + 125°C

* MLC = Multi-Layer Ceramic

TC Characteristic

Industry standard **Temperature Coefficients (TC)** of ceramic capacitors:

GENERAL PURPOSE: FAIR PERFORMANCE OVER TEMPERATURE, VOLTAGE, FREQUENCY AND TIME

X5R = $\pm 15\%$ ΔC over $-55^{\circ}\text{C} \sim +85^{\circ}\text{C}$

X7R = $\pm 15\%$ ΔC over $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$ *Standard Tolerance: K = $\pm 10\%$*

Y5F = $\pm 7.5\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5P = $\pm 10\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5R = $\pm 15\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5S = $\pm 22\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5T = $+22\% / -33\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5U = $+22\% / -56\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Y5V = $+22\% / -82\%$ ΔC over $-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$ *Standard Tolerance: Z = $-20\%/+80\%$*

Z5U = $+22\% / -56\%$ ΔC over $-10^{\circ}\text{C} \sim +85^{\circ}\text{C}$ *Standard Tolerance: M = $\pm 20\%$*

Z5V = $+22\% / -82\%$ ΔC over $-10^{\circ}\text{C} \sim +85^{\circ}\text{C}$

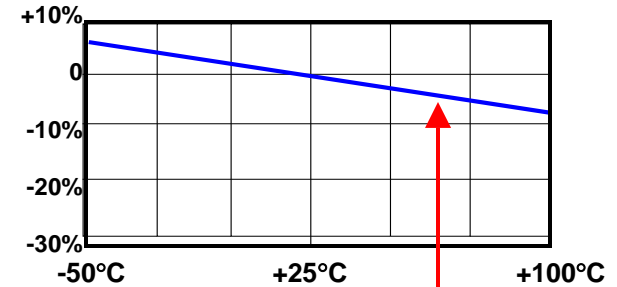
ULTRA -STABLE OVER TEMPERATURE, VOLTAGE, FREQUENCY AND TIME

COG = NPO = $0 \pm 30\text{PPM}/^{\circ}\text{C}$ over $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$

NPO = $0 \pm 30\text{PPM}/^{\circ}\text{C}$ over $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$ *Standard Tolerance: J = $\pm 5\%$*

Most Common MLC* Call-Outs

TC Characteristics



SPECIAL TEMPERATURE COMPENSATING TC'S (linear capacitance value change over temperature)

N150 = -150PPM \pm 60PPM/ °C over -30°C ~ + 85°C

N470 = -470PPM \pm 60PPM/ °C over -30°C ~ + 85°C

N750 = -750PPM \pm 120PPM/ °C over -30°C ~ + 85°C

N1500 = -1500PPM \pm 250PPM/ °C over -30°C ~ + 85°C

N3300 = -3300PPM \pm 500PPM/ °C over -30°C ~ + 85°C

SL = -330PPM \pm 500PPM/ °C over -30°C ~ + 85°C

These temperature compensating TC's are available
in CERAMIC DISC CAPACITOR styles...





Component Substitution Guideline

- **Temperature Coefficient**

“A component with a more stable (better) temperature characteristic (TC) can replace a less temperature stable (worse) component.

i.e...an X7R ceramic can replace Z5U or Y5V ceramic parts.

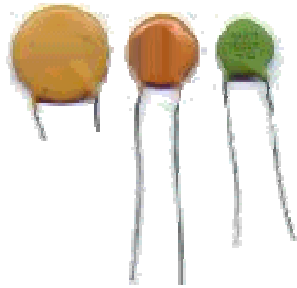
i.e...an NPO ceramic can replace a X7R or Z5U or Y5V ceramic.

NPO... X7R... X5F... X5P... X5R... XRS... X5T... Y5U... Y5V... Z5U... Z5V...

MOST STABLE

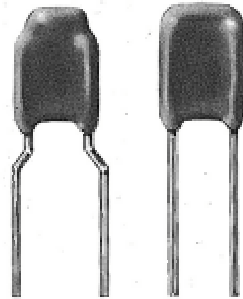
LEAST STABLE

Styles - Appearance (Leaded)



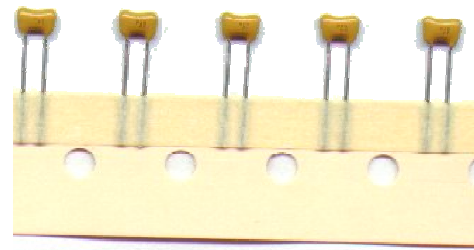
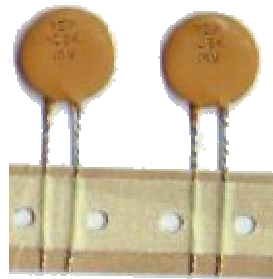
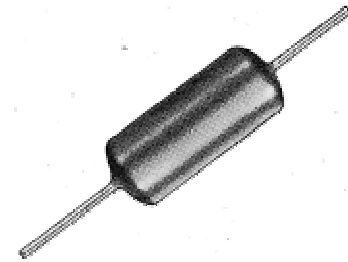
Radial Leaded Ceramic Disc

Radial Leaded "Mono"



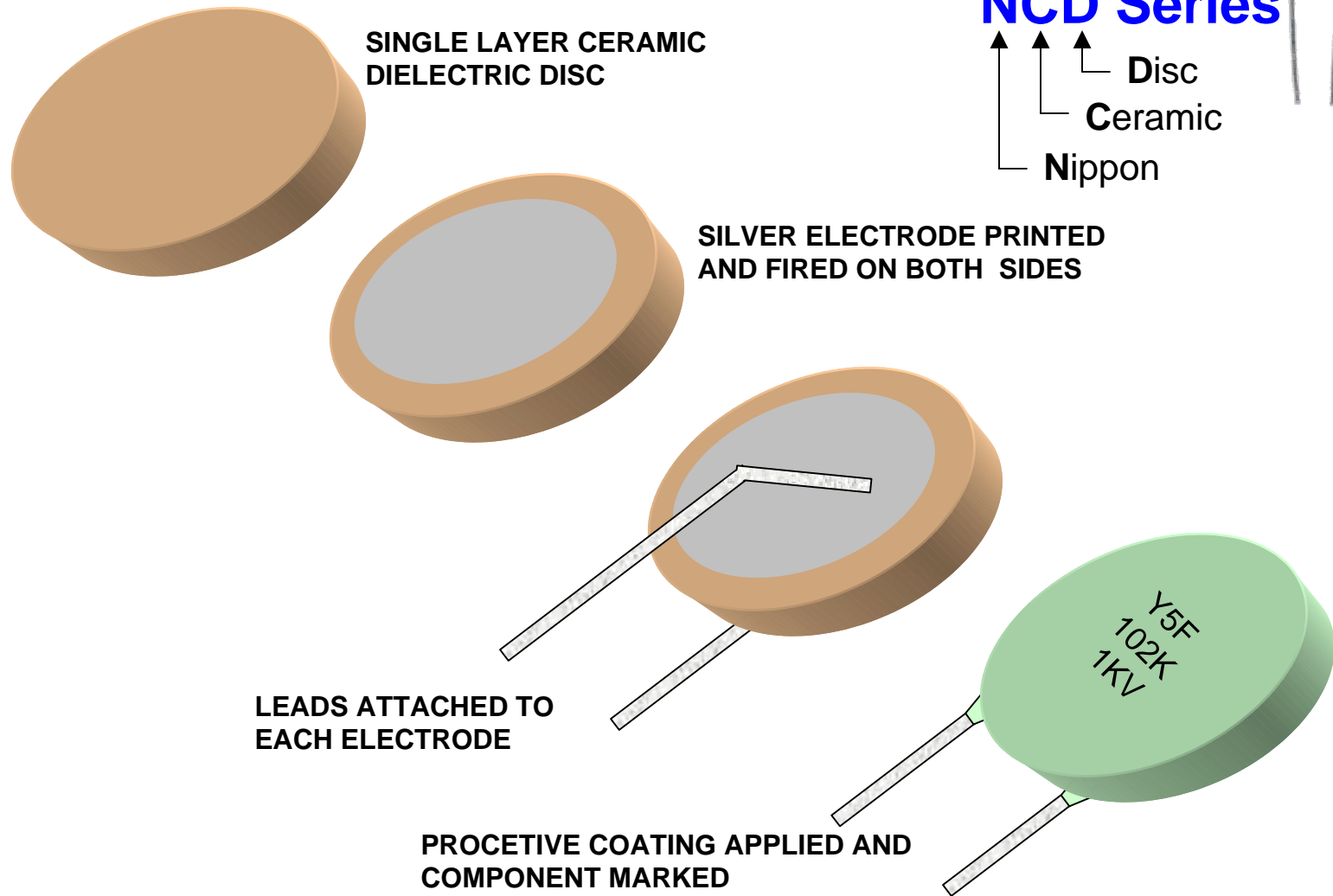
Monolithic Multi-layer Ceramic (MLC)

Axial Leaded "Mono"



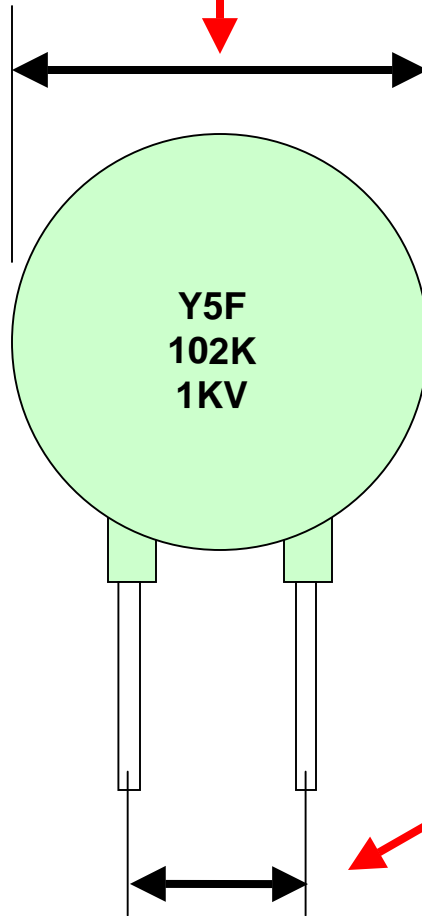
Packaged on tape for auto insertion

Single Layer Disc Capacitor (Radial)



Ceramic Disc Capacitor (Radial)

Body Diameter
From 4mm to 25mm
(0.15"~1.0")



NCD Series

↑ Disc
↑ Ceramic
↑ Nippon



Lead Spacing

6.35mm (0.25") is standard (bulk packaged)

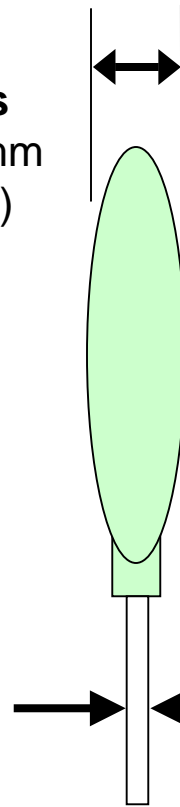
5.0mm (0.2") is standard (Tape and Reeled "T/R")

7.5mm (0.30") and 10mm(0.39") are options

Ceramic Disc Capacitor (Radial)



Body Thickness
From 2mm to 7mm
(0.079" ~ 0.276")



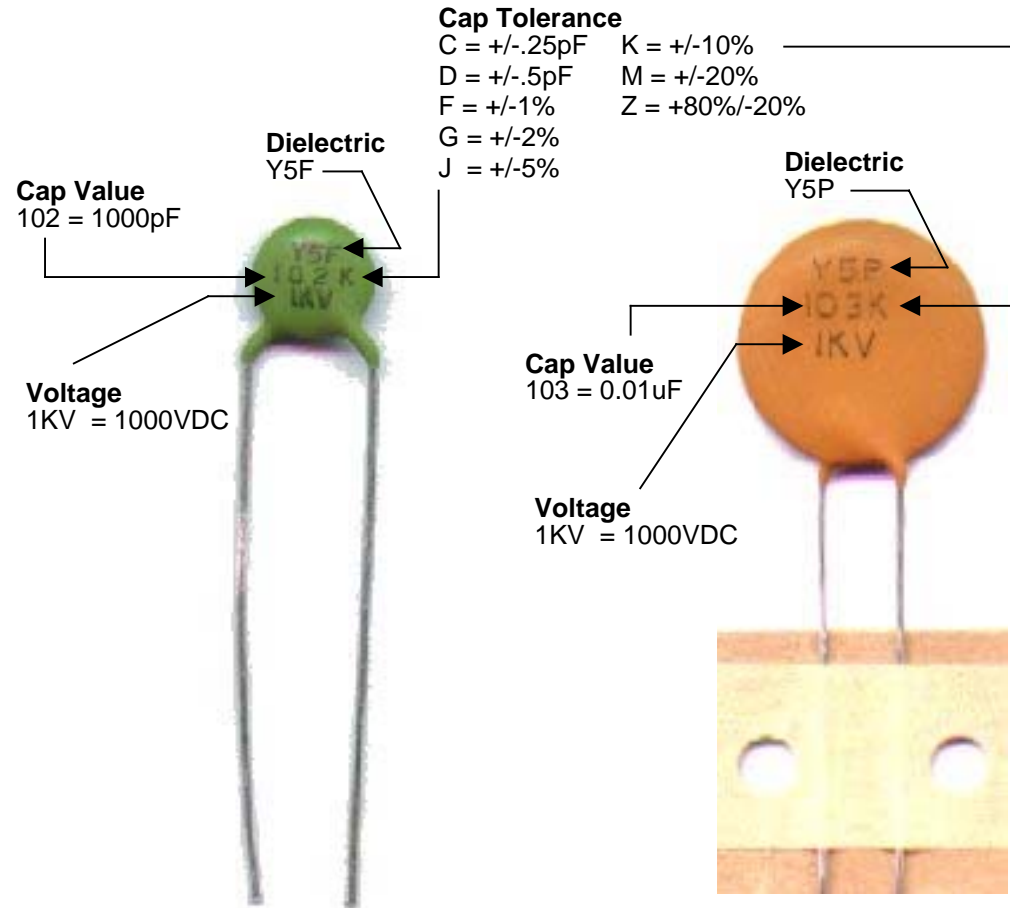
NCD Series

↑ Disc
↑ Ceramic
↑ Nippon

Lead Diameter 0.6mm (0.024")
is standard...

On larger body diameters 0.8mm
(0.031") lead diameter is available
as option. It is also standard on
5KVDC and higher voltage ratings.

Ceramic Disc Capacitor (Radial)

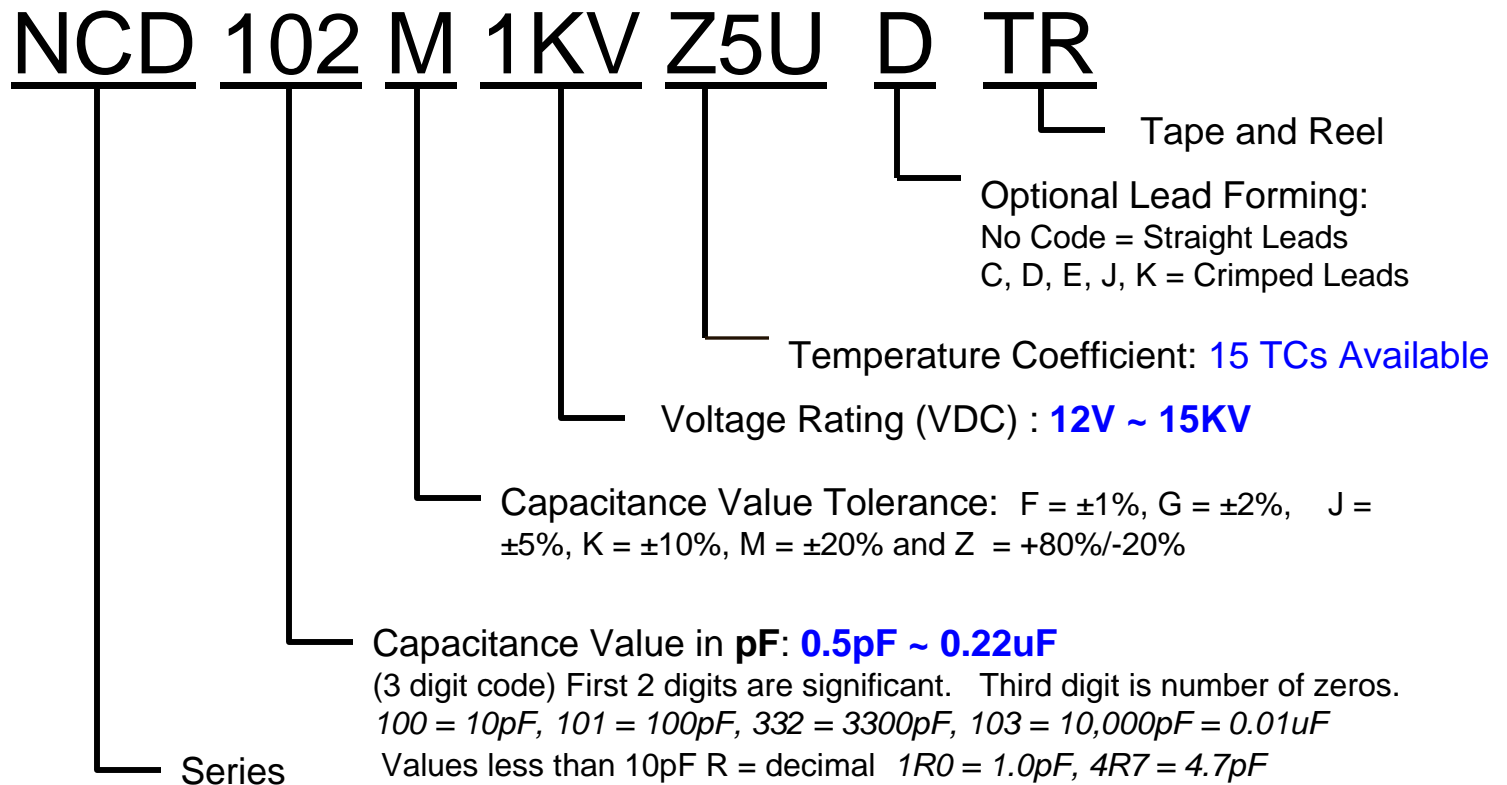
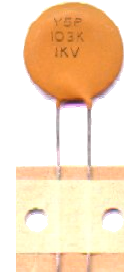


Example shown
P/N: NCD102K1KVY5F

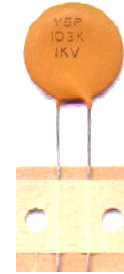
Example shown
P/N: NCD103K1KVY5PTR

Part Numbering System

NIC **NCD** Series - Ceramic Disc Capacitor



Capacitance Range per TC

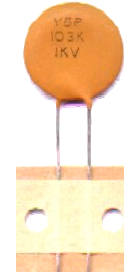


NIC **NCD** Series - Ceramic Disc Capacitor

Temperature Coefficients:

TC	Capacitance Range	Capacitance Value Code	Voltage Range
NPO	0.5pF ~ 470pF	0R5 ~ 471	50VDC ~ 15KVDC
SL	3pF ~ 1000pF	3R0 ~ 102	50VDC ~ 15KVDC
N150 & N470	3pF ~ 150pF	3R0 ~ 151	50VDC ~ 1KVDC
N750	22pF ~ 470pF	220 ~ 471	
N1500	22pF ~ 1000pF	220 ~ 102	
N3300	47pF ~ 1000pF	470 ~ 102	
Y5F	100pF ~ 4700pF	101 ~ 472	50VDC ~ 15KVDC
Y5P	100pF ~ 0.015uF	101 ~ 153	

Capacitance Range per TC



NIC **NCD** Series - Ceramic Disc Capacitor

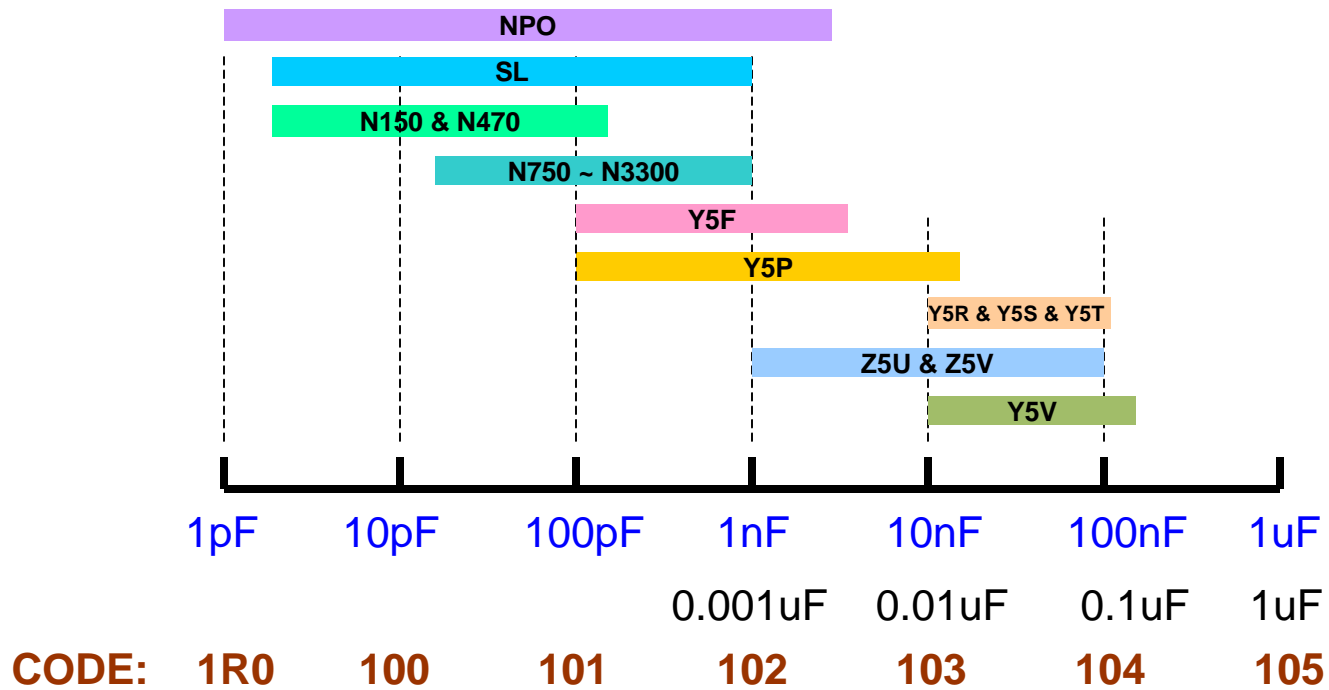
Temperature Coefficients:

TC	Capacitance Range	Capacitance Value Code	Voltage Range
Y5R / Y5S / Y5T	0.01uF ~ 0.1uF	103 ~ 104	12VDC ~ 50VDC
Y5V	0.01uF ~ 0.22uF	103 ~ 224	12VDC ~ 50VDC
Z5U	1000pF ~ 0.1uF	102 ~ 104	50VDC ~ 15KVDC
Z5V	1000pF ~ 0.1uF	102 ~ 104	50VDC ~ 5KVDC

Capacitance Range per TC










NIC **NCD** Series - Ceramic Disc Capacitor



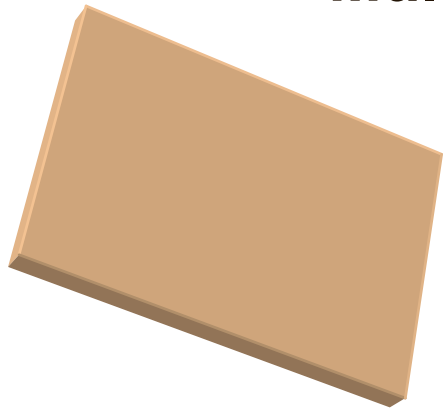
Cross Reference



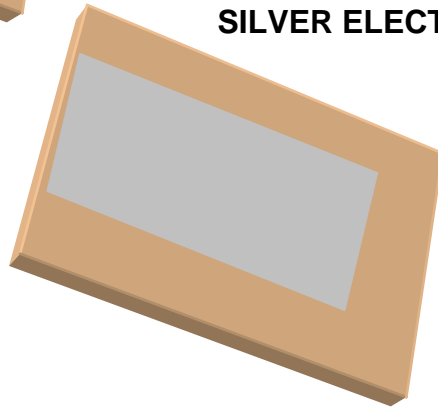
Ceramic Disc Capacitor Cross Reference -

	 <small>ILLINOIS CAPACITOR, INC.</small>						
	<i>Illinois Capacitor</i>	<i>Mallory</i>	<i>Murata</i>	<i>Panasonic</i>	<i>Phillips</i>	<i>Tecate</i>	<i>Xicon</i>
NIC	BCR	CEC	DD	ECC	D	CD	CD
NCD Series	GCR	CMC	(OBSOLETE)	ECK	DTZ		CDR
	GHR	CPC	DE	ECF	DD		
	GMR	GE	DHR	ECU-S			
	GQR	GH					
		GM					
		GP					
		GS					
		LC					
		LE					

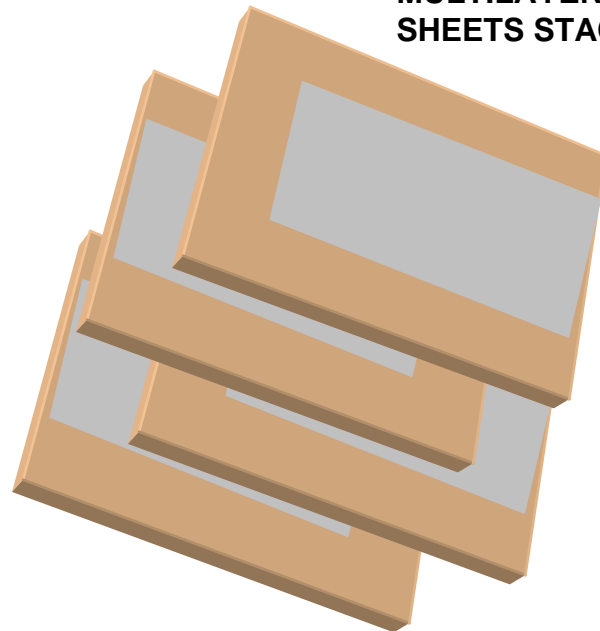
Multilayer Ceramic Capacitors (MLC)



**SINGLE LAYER CERAMIC
DIELECTRIC SHEET**



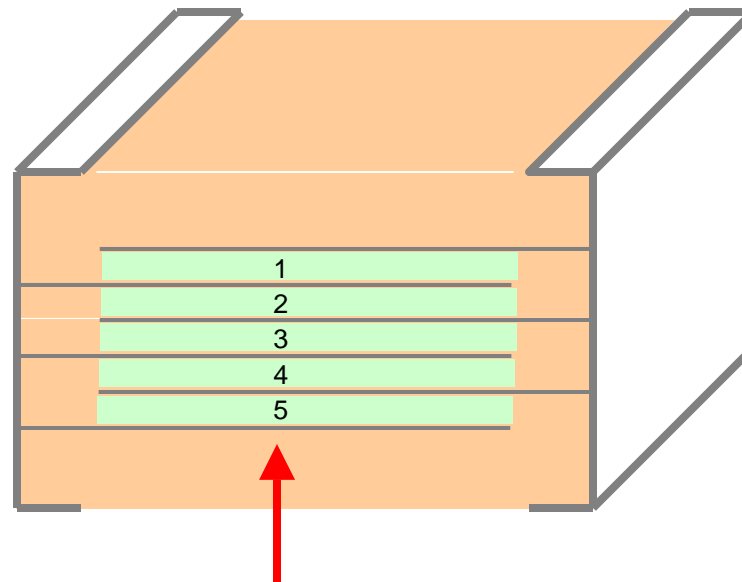
SILVER ELECTRODE PRINTED



**MULTILAYER CERAMIC
SHEETS STACKED**

Multilayer Ceramic Capacitors (MLC)

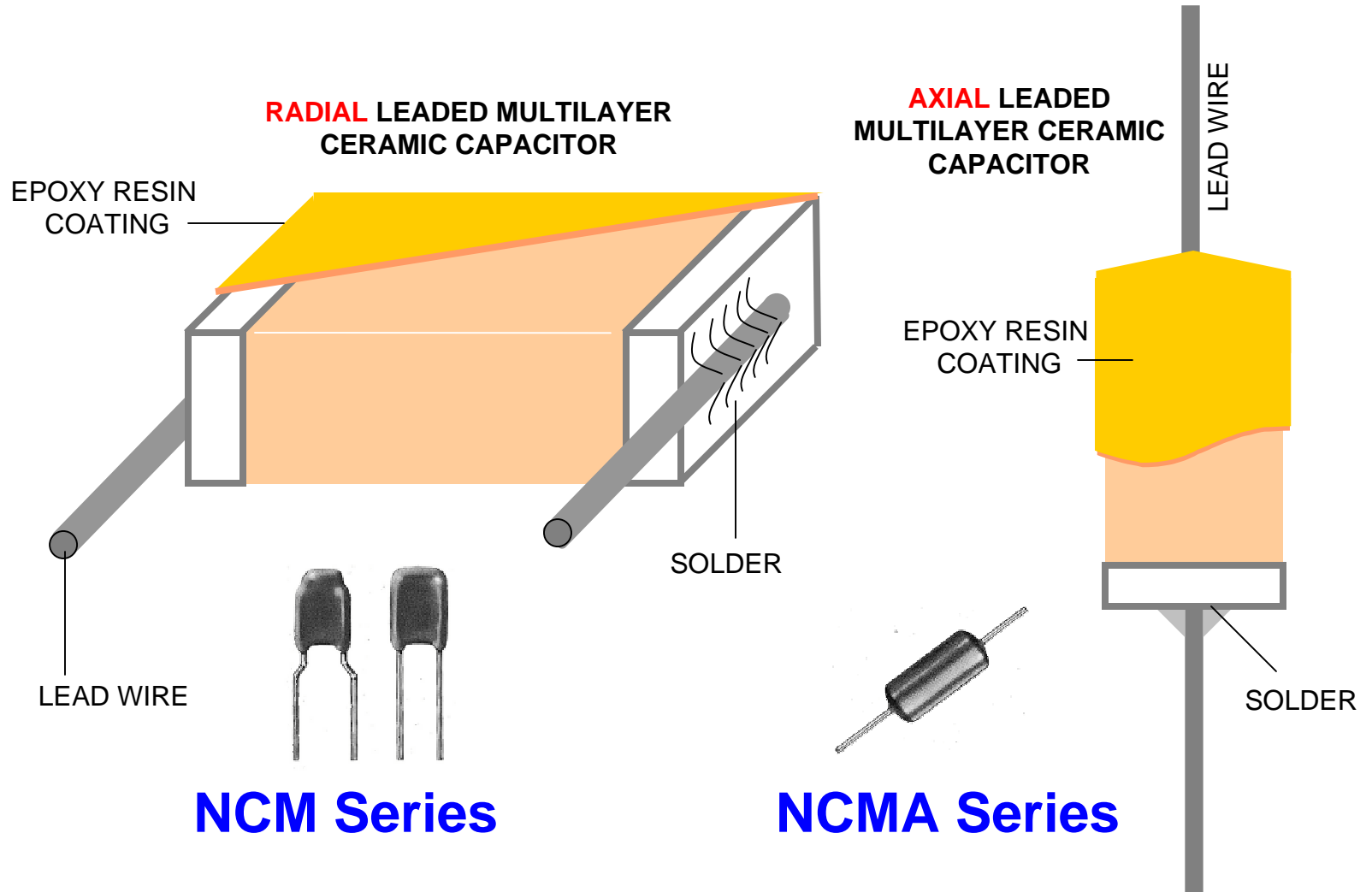
MULTILAYER CERAMIC SHEETS PRESSED,
FIRED AND CHIP ELEMENT TERMINATED



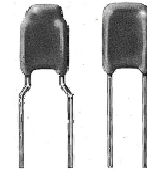
MULTIPLE LAYERS CONSTRUCTION RESULTS IN MULTIPLE
INCREASE IN CAPACITANCE SURFACE AREA = INCREASED
CAPACTANCE VALUE

Example above shows five times increase in capacitance as
compared to single layer

Multilayer Ceramic Capacitors (Leaded)



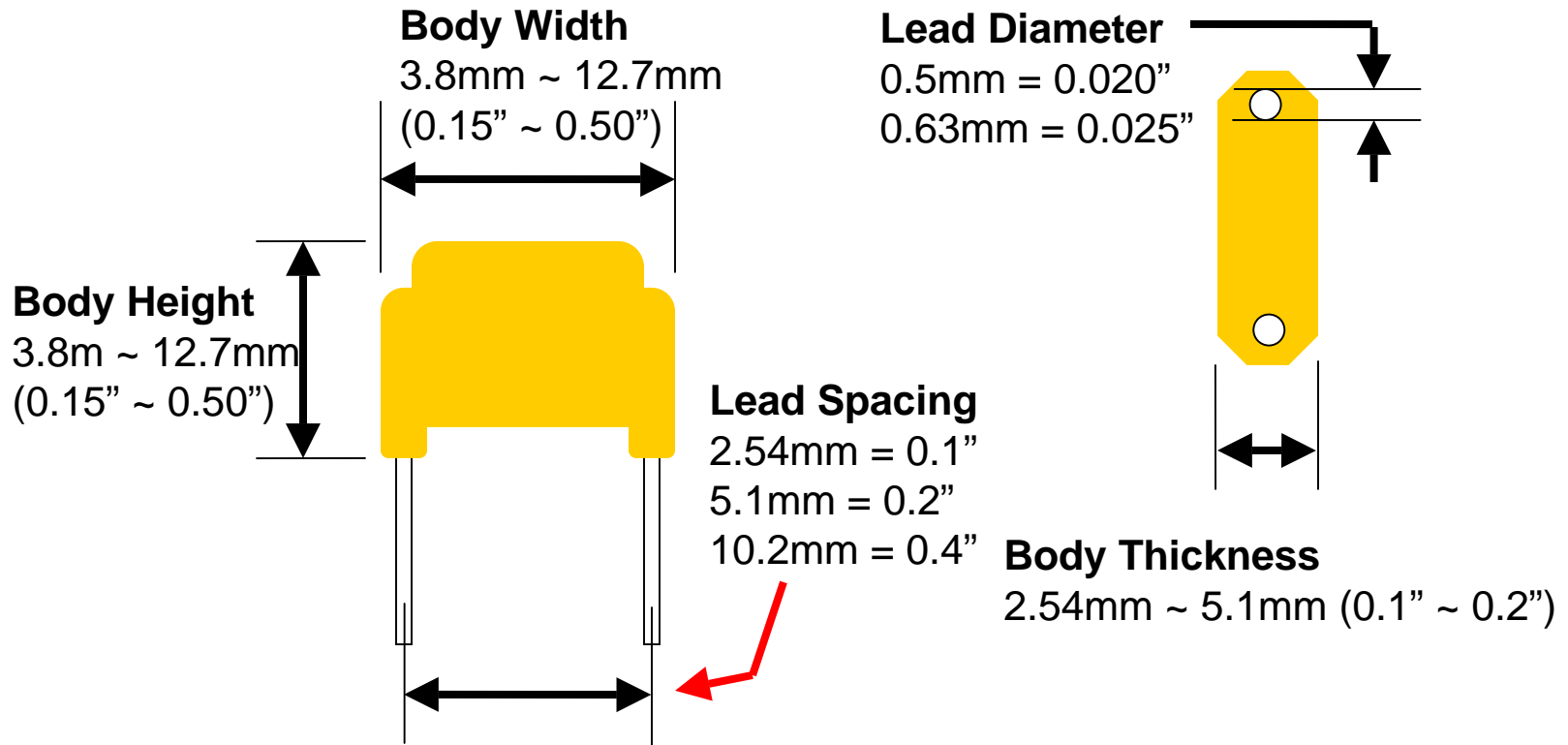
MLC Ceramic Capacitor (Radial)



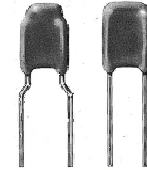
SIZE CODE	WIDTH	HEIGHT	THICKNESS	LEAD SPACING	LEAD DIAMETER
15	3.81	3.81	2.54	2.54	0.5
20	5.08	5.08	3.18		
21	5.08	5.08		5.08	
30	7.62	7.62			
40	10.15	10.15	3.81	10.16	0.63
50	12.70	12.70	5.08		

NCM Series

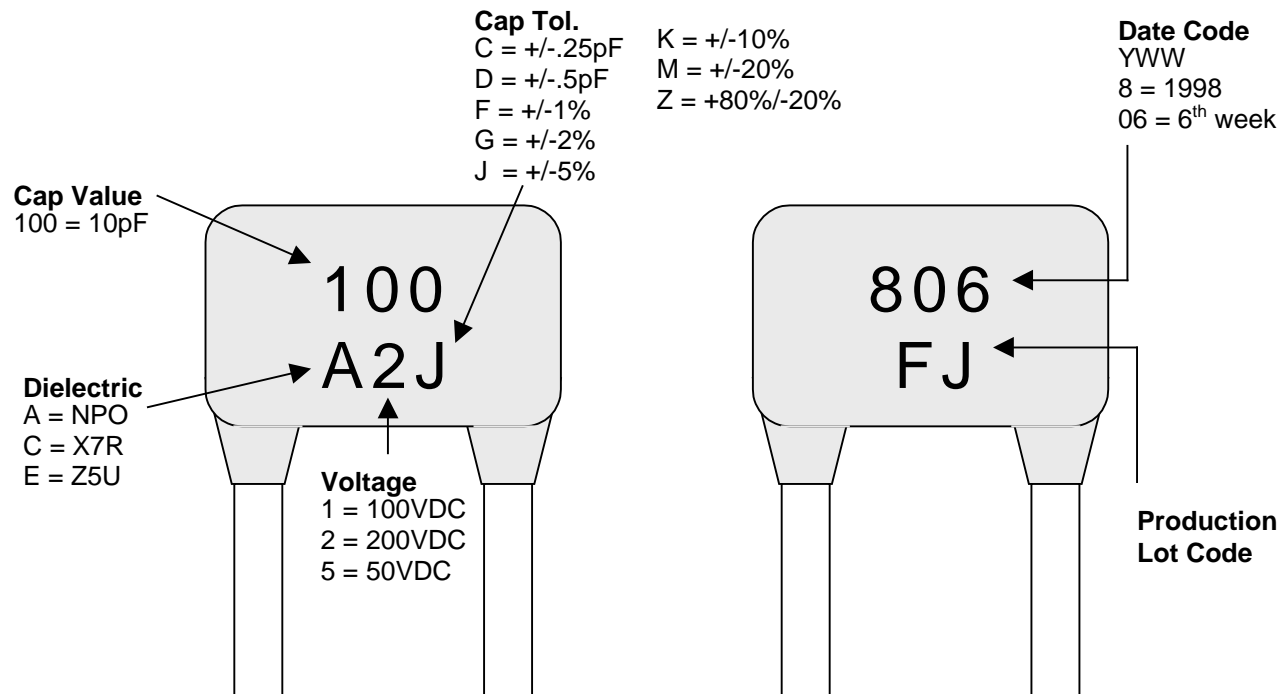
Multilayer
 Ceramic
 Nippon



MLC Ceramic Capacitor (Radial)

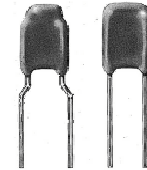


NIC NCM Series - Radial Leaded Multilayer Ceramic Capacitor Part Marking



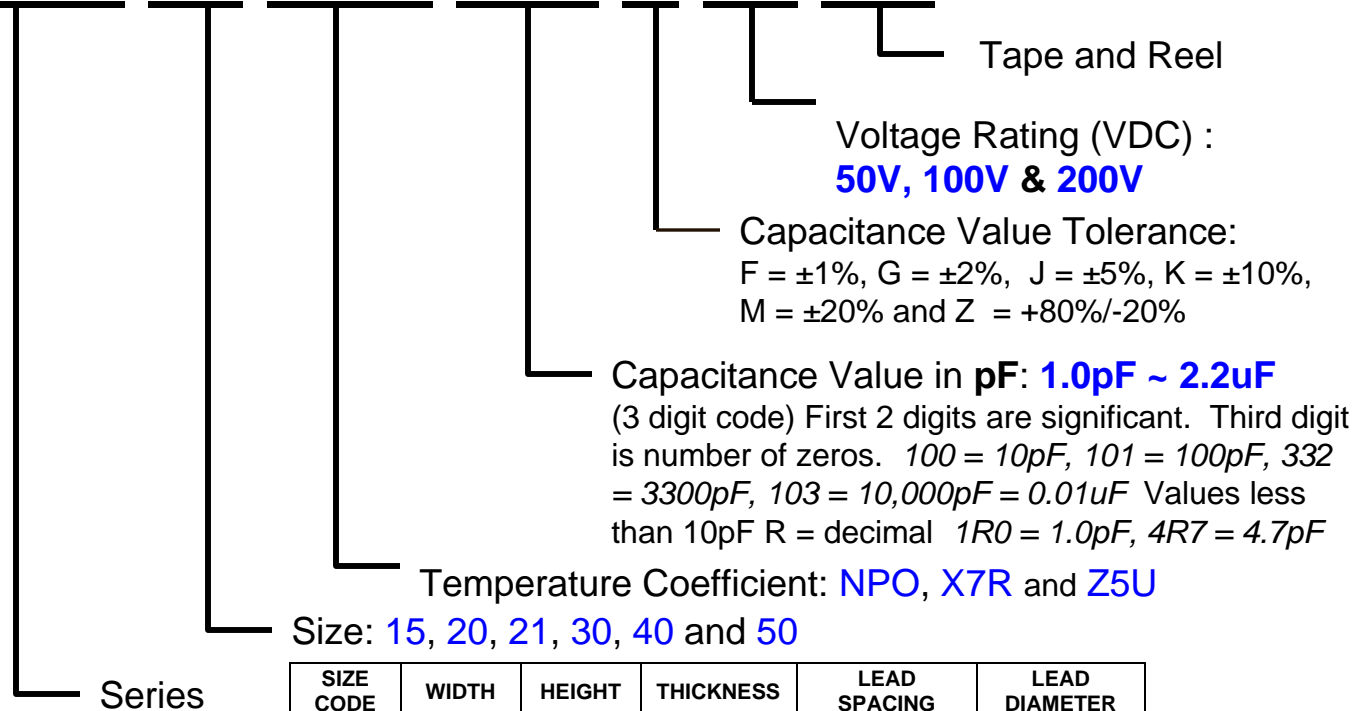
Example shown P/N: NCM15NPO100J200

Part Numbering System



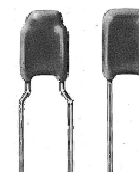
NIC **NCM** Series - Radial Leaded Multilayer Ceramic Capacitor

NCM 21 X7R 104 K 50 TR



SIZE CODE	WIDTH	HEIGHT	THICKNESS	LEAD SPACING	LEAD DIAMETER
15	3.81	3.81	2.54	2.54	0.5
20	5.08	5.08	3.18		
21	5.08	5.08		5.08	
30	7.62	7.62			
40	10.15	10.15	3.81	10.16	
50	12.70	12.70	5.08		0.63

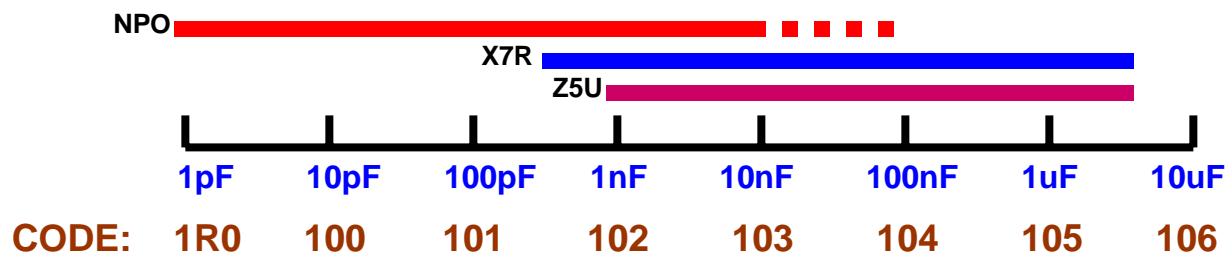
Capacitance Range per TC



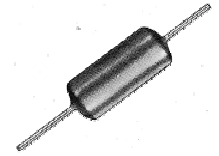
NIC **NCM** Series - Radial Leaded Multilayer Ceramic Capacitor

Temperature Coefficients:

TC	Capacitance Range	Capacitance Value Code	Voltage Range	Standard Tolerance
NPO	1.0pF ~ 0.1uF	1R0 ~ 104	50VDC ~ 200VDC	(J) +/-5%
X7R	470pF ~ 4.7uF	470 ~ 475	50VDC ~ 200VDC	(K) +/-10%
Z5U	1000pF ~ 4.7uF	102 ~ 475	50VDC ~ 200VDC	(M) +/-20%



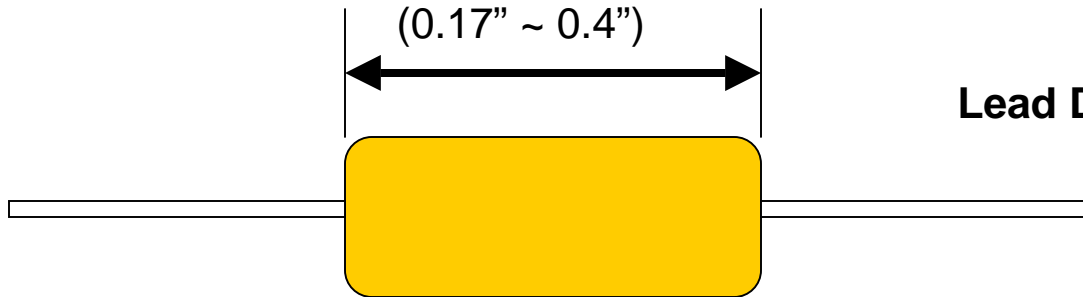
MLC Ceramic Capacitor (Axial)



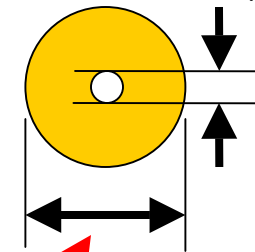
NCMA Series

↑ Axial
 ↑ Multilayer
 ↑ Ceramic
 ↑ Nippon

Body Length
 4.32mm ~ 10.2mm
 (0.17" ~ 0.4")



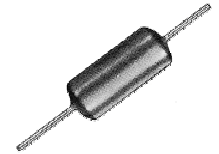
Lead Diameter 0.5mm (0.020")



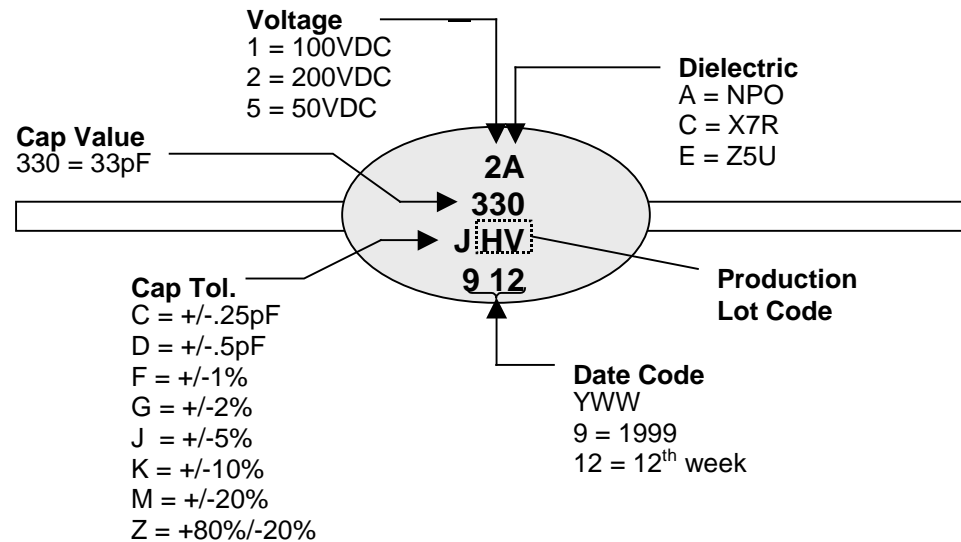
Body Diameter
 2.54mm ~ 3.81mm (0.1" ~ 0.15")

SIZE CODE	DIAMETER	LENGTH	LEAD DIAMETER
NCMA 10	2.54	4.32	0.5
NCMA 11	3.5		
NCMA 20	2.54	6.6	
NCMA 30	3.81	7.37	
NCMA 40		10.16	

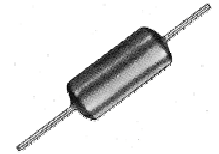
MLC Ceramic Capacitor (Axial)



NIC **NCMA** Series - Axial Leaded Multilayer Ceramic Capacitor
Part Marking

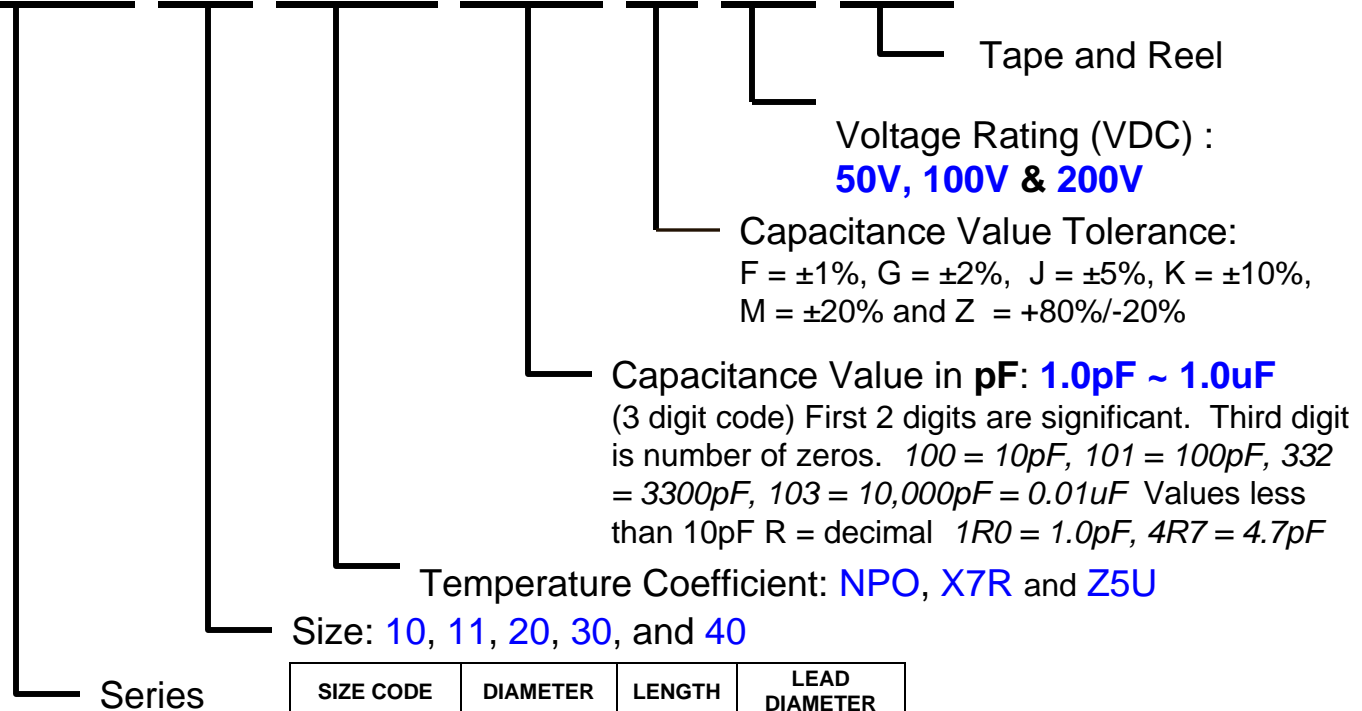


Part Numbering System



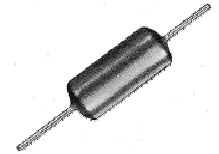
NIC **NCMA** Series - Axial Leded Multilayer Ceramic Capacitor

NCMA 10 Z5U 104 M 50 TR



SIZE CODE	DIAMETER	LENGTH	LEAD DIAMETER
NCMA 10	2.54	4.32	0.5
NCMA 11	3.5		
NCMA 20	2.54	6.6	
NCMA 30	3.81	7.37	
NCMA 40		10.16	

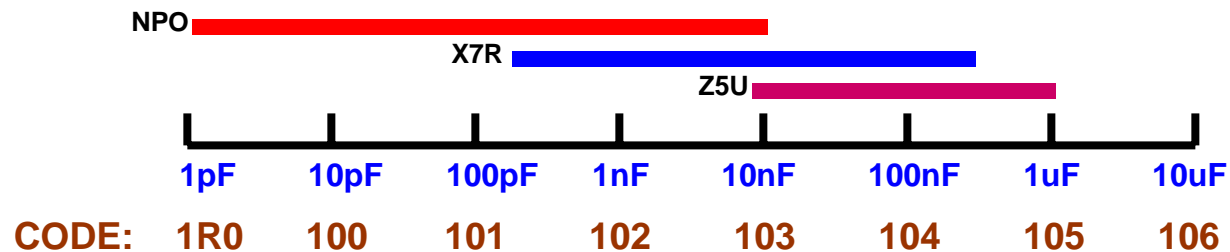
Capacitance Range per TC



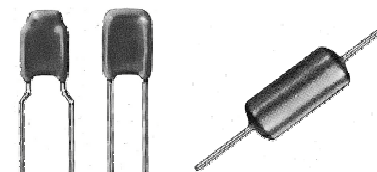
NIC **NCMA** Series - Axial Leaded Multilayer Ceramic Capacitor

Temperature Coefficients:








TC	Capacitance Range	Capacitance Value Code	Voltage Range	Standard Tolerance
NPO	1.0pF ~ 0.01uF	1R0 ~ 103	50VDC ~ 200VDC	(J) +/-5%
X7R	220pF ~ 0.47uF	221 ~ 474	50VDC ~ 200VDC	(K) +/-10%
Z5U	0.01uF ~ 1.0uF	103 ~ 105	50VDC ~ 200VDC	(M) +/-20%



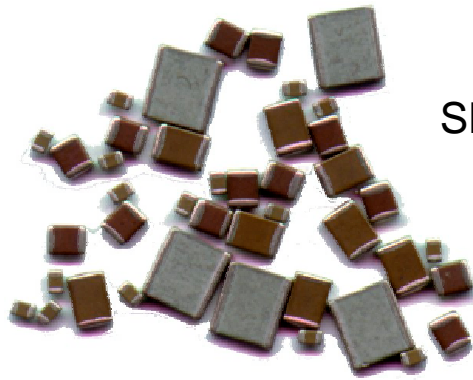
Cross Reference



Leaded Multilayer Ceramic Capacitor Cross Reference:

						
<i>NIC</i>	<i>AVX</i>	<i>KEMET</i>	<i>Mallory</i>	<i>Panasonic</i>	<i>Phillips</i>	<i>XICON</i>
NCM Series	SR	C315 ~ C350	M	ECU-S	K CN CW CZ	EDM
NCMA Series	SA	C410 ~ C440	P	<i>n/a</i>	A A40 A41 A43	CA

Styles - Appearance (Surface Mount)



SMT Ceramic Chip



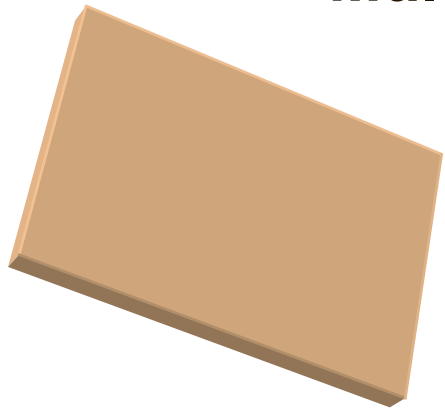
Monolithic Multi-layer Ceramic Chip (MLC)



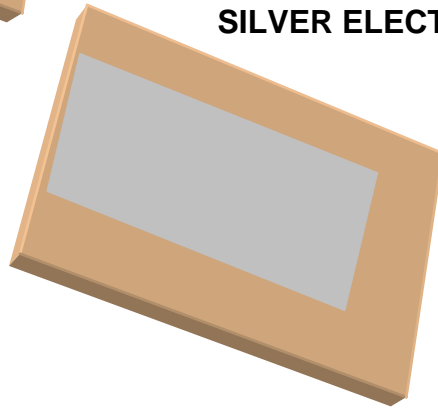
7" AND 10" REELS

Packaged on tape for auto insertion

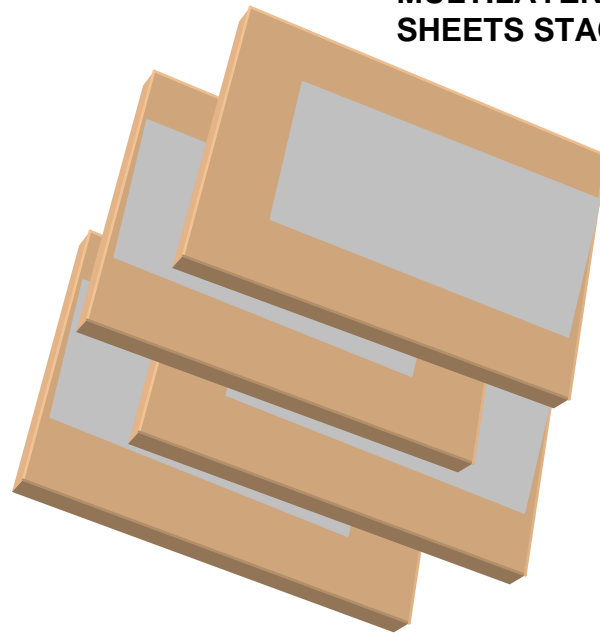
Multilayer Ceramic Capacitors



**SINGLE LAYER CERAMIC
DIELECTRIC SHEET**



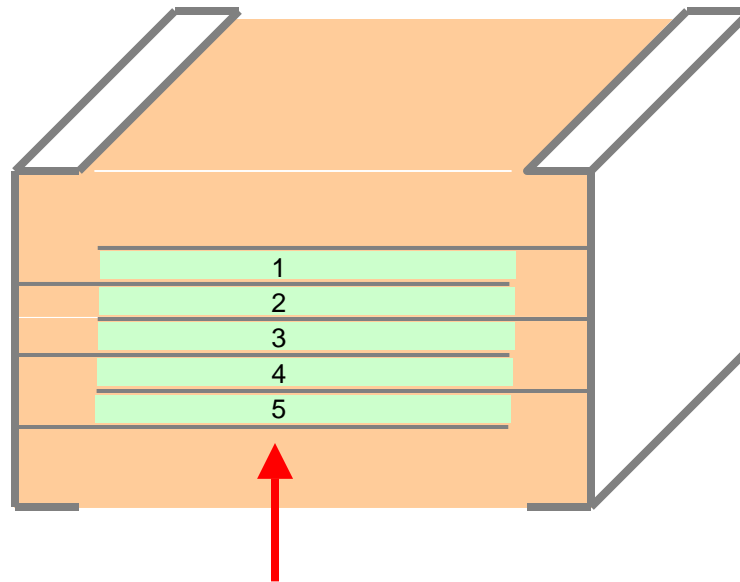
SILVER ELECTRODE PRINTED



**MULTILAYER CERAMIC
SHEETS STACKED**

Multilayer Ceramic Capacitors (MLC)

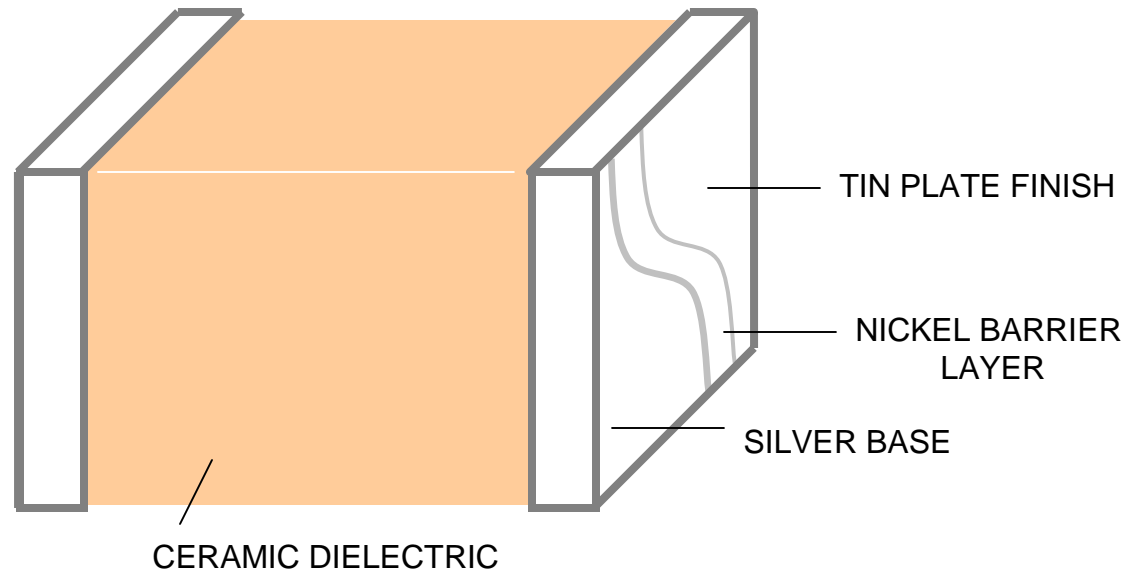
MULTILAYER CERAMIC SHEETS PRESSED,
FIRED AND CHIP ELEMENT TERMINATED



MULTIPLE LAYERS CONSTRUCTION RESULTS IN MULTIPLE
INCREASE IN CAPACITANCE SURFACE AREA = INCREASED
CAPACTANCE VALUE

Example above shows five times increase in capacitance as
compared to single layer

Multilayer Ceramic Capacitors

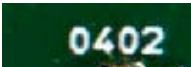

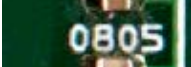






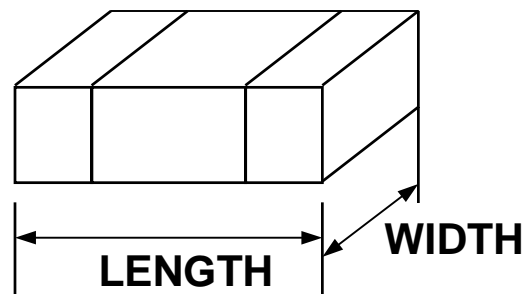
NMC Series

↑
↑
↑
Chip
Multilayer ceramic
Nippon

Dimensions (Surface Mount)



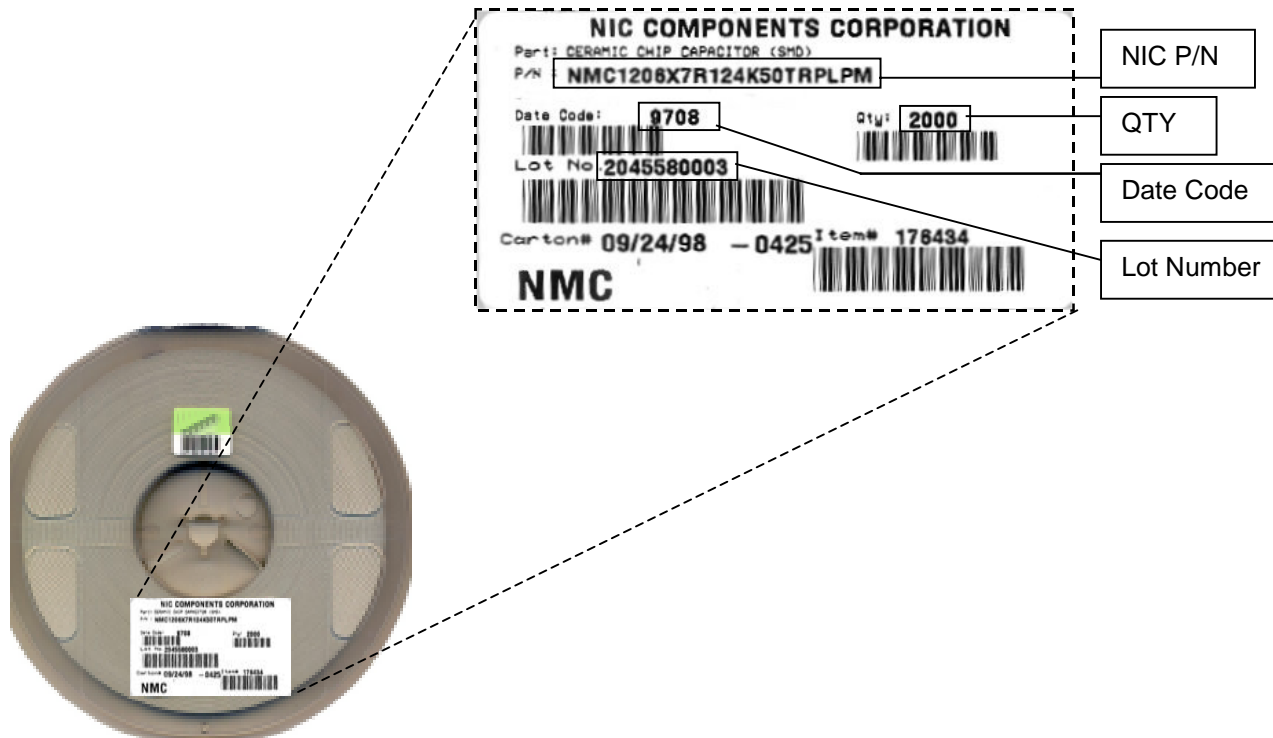
	English	Metric	Length	Width
	0402	1005	1.0mm (0.04")	0.5mm (0.02")
	0603	1608	1.6mm (0.06")	0.8mm (0.03")
	0805	2012	2.0mm (0.08")	1.2mm (0.05")
	1206	3216	3.2mm (0.12")	1.6mm (0.06")
	1210	3225	3.2mm (0.12")	2.5mm (0.10")
	1812	4532	4.5mm (0.18")	3.2mm (0.12")
	2225	5764	5.7mm (0.22")	6.4mm (0.25")



Reel Labeling System



The NIC part number, lot number, date code, reel quantity, customer part number, purchase order number, etc. is printed (and bar coded if requested) on the reel label(s) for each reel of product.

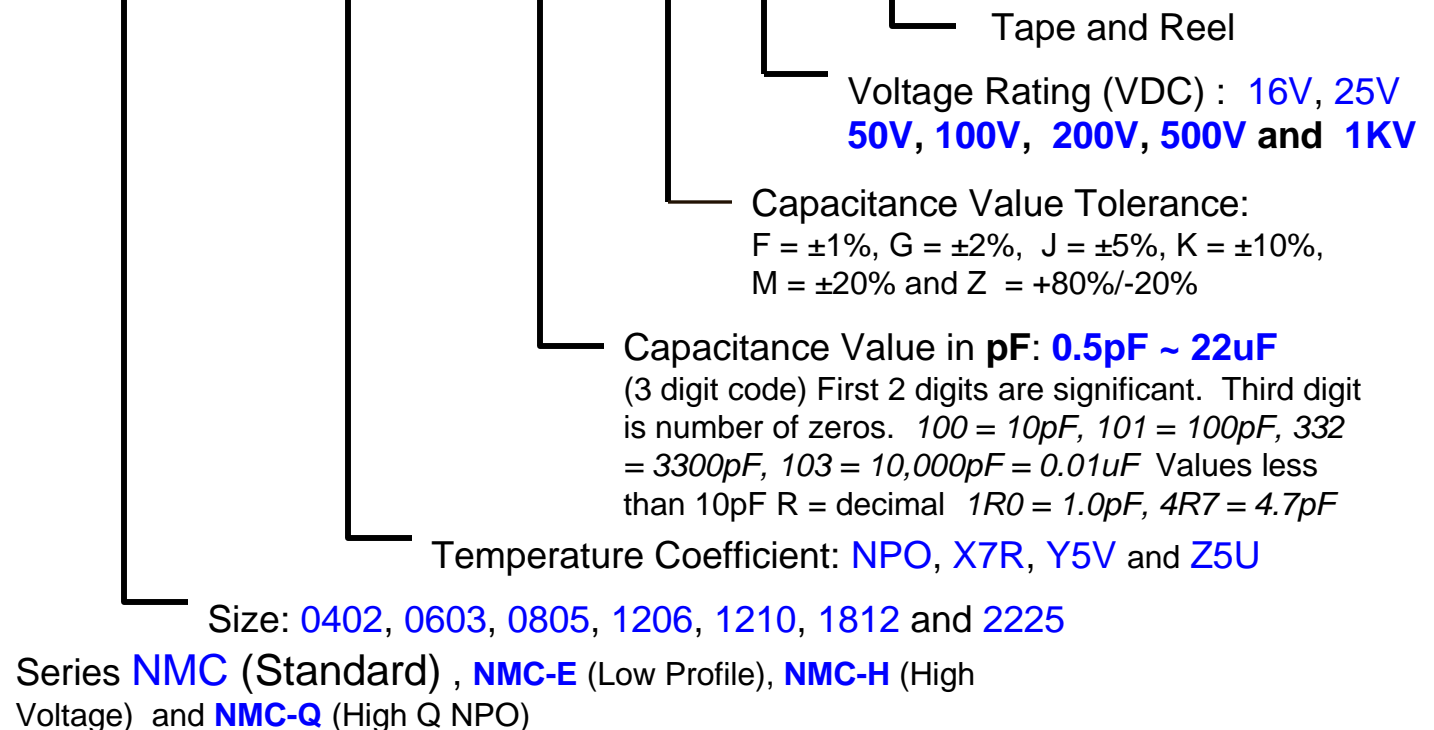


Part Numbering System



NIC **NMC** Series - Multilayer Ceramic Chip Capacitor

NMC 0603 X7R 104 K 16 TRP



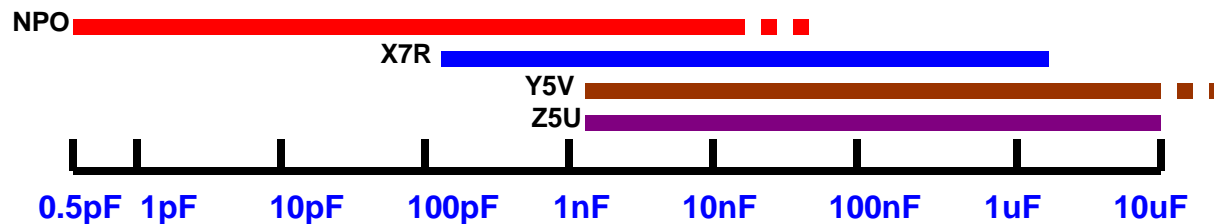
Capacitance Range per TC



NIC **NMC** Series - Multilayer Ceramic Chip Capacitor

Temperature Coefficients:











TC	Capacitance Range	Capacitance Value Code	Voltage Range	Standard Tolerance
NPO	0.5pF ~ 0.056uF	0R5 ~ 563	25VDC ~ 1KVDC	(J) +/-5%
X7R	100pF ~ 2.2uF	101 ~ 225	16VDC ~ 1000VDC	(K) +/-10%
Y5V	1000pF ~ 10uF	102 ~ 106	16VDC ~ 50VDC	(Z) -20%/+80%
Z5U	1000pF ~ 10uF	102 ~ 106	16VDC ~ 50VDC	(M) +/-20%



Cross Reference



Multilayer Ceramic Chip Capacitor Cross Reference:

 NIC	 AVX	 KEMET	 JDI	 Murata	 Panasonic
NMC0402	0402	C0402	R07	GRM36	ECU(Q)
NMC0603	0603	C0603	R11	GRM39	ECU(V)
NMC0805	0805	C0805	R15	GRM40	ECV(N)
NMC1206	1206	C1206	R18	GRM42-6	ECU(M)
NMC1210	1210	C1210	S41	GRM42-2	ECU(P)
 NIC	 Phillips	 TDK	 Vitramon		
NMC0402	Cxxxx0402	CC0402	VJ0402		
NMC0603	Cxxxx0603	CC0603	VJ0603		
NMC0805	Cxxxx0805	CC0805	VJ0805		
NMC1206	Cxxxx1206	CC1206	VJ1206		
NMC1210	Cxxxx1210	CC1210	VJ1210		

Multilayer Ceramic Capacitors

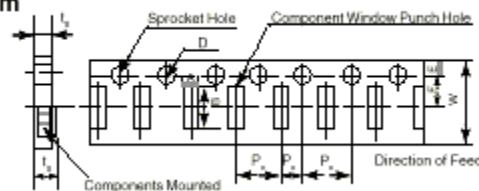


Packaged on tape for auto insertion

TR

PAPER TAPE

CARDBOARD CARRIER TAPE DIMENSIONS IN mm



7 INCH REEL QUANTITIES*

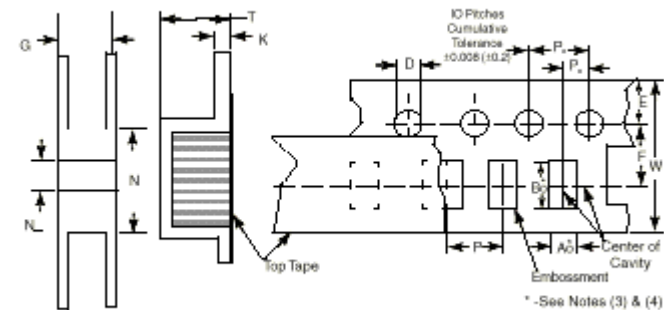
Size	0402	0603	0805	1206
Tape Size	8 mm	8 mm	8 mm	8 mm
Min Qty Per Reel	10,000	4000	4000	4000
Max Qty Per Reel	10,000	4000	5000	5000

*Qty Dependent on Chip Thickness

TRPL

PLASTIC TAPE

EMBOSSED PLASTIC CARRIER TAPE



* - See Notes (3) & (4)

7 INCH REEL QUANTITIES*

Size	0805	1206	1210	1812	2225
Tape Size	8 mm	8 mm	8 mm	12 mm	12 mm
Min Qty Per Reel	2000	2000	2000	1000	1000
Max Qty Per Reel	5000	5000	5000	2000	1000

*Qty Dependent on Chip Thickness

Notes:(1)Specifications are in compliance with [EIA RS481-1-A](#)
 "Taping of Surface Mount Components for Automatic Placement"

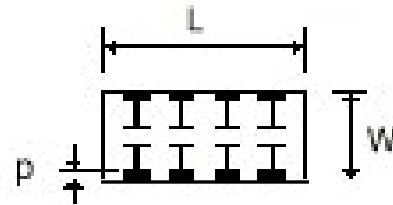
Dimensions (Surface Mount)



NIC **NCA** Series - Multilayer Ceramic Chip Capacitor Array

English	Metric	Length	Width
1206	3216	3.2mm (0.12")	1.6mm (0.06")

PART DIMENSIONS (mm)



← **4 CERAMIC CAPACITOR ELEMENTS:**
SAME VALUE, TOLERANCE, VOLTAGE RATING
AND TC



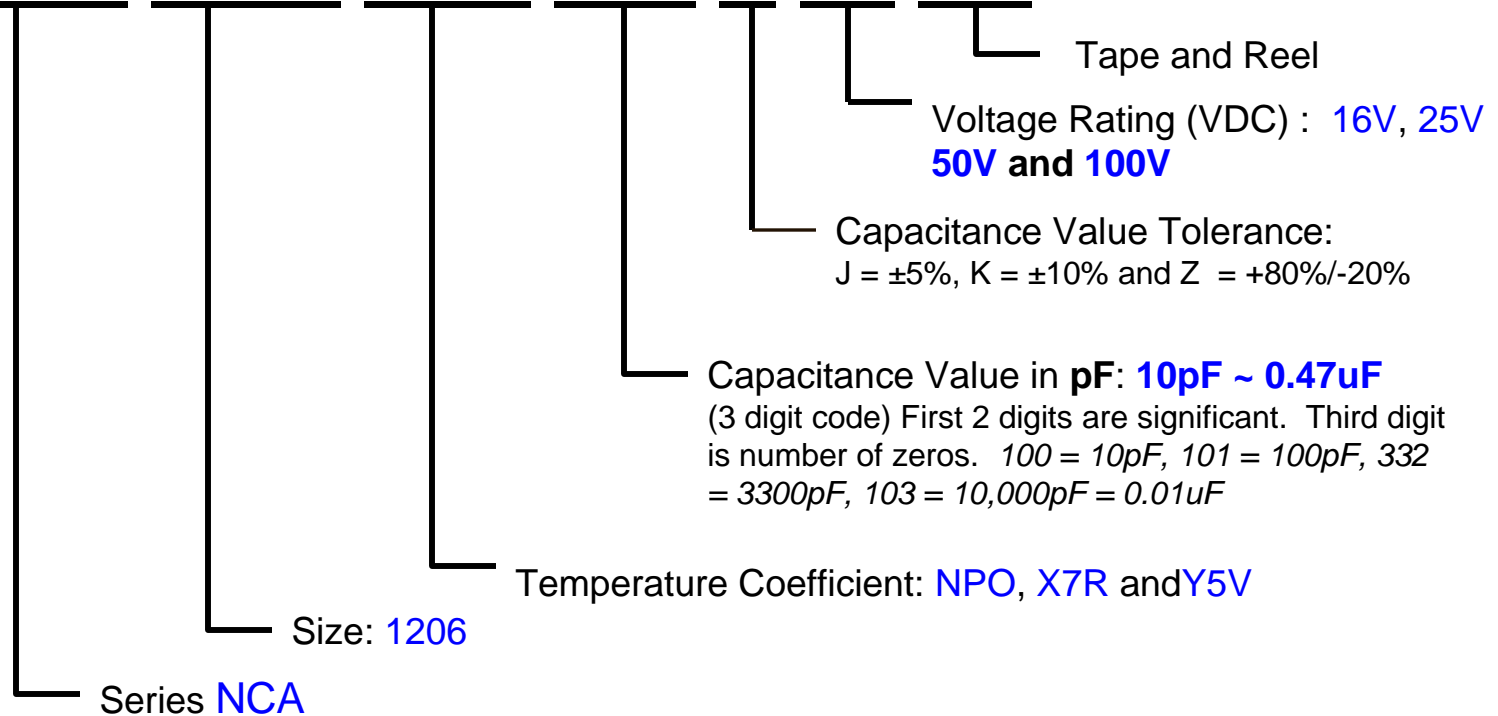
L	W	H	p	s	l
3.2 ±0.2	1.6 ±0.2	1.0 ±0.3	0.3 ±0.2	0.8 ±0.2	0.4 ±0.1

Part Numbering System



NIC **NCA** Series - Multilayer Ceramic Chip Capacitor Array

NCA 1206 X7R 104 K 16 TR



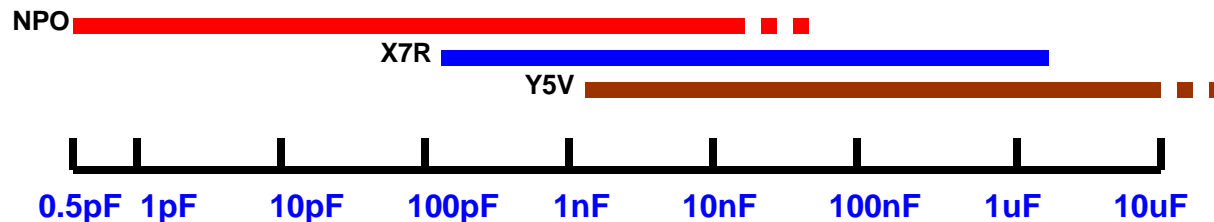
Capacitance Range per TC



NIC **NCA** Series - Multilayer Ceramic Chip Capacitor Array

Temperature Coefficients:

TC	Capacitance Range	Capacitance Value Code	Voltage Range	Standard Tolerance
NPO	10pF ~ 1000pF	100 ~ 102	16VDC ~ 100VDC	(J) +/-5%
X7R	470pF ~ 0.15uF	471 ~ 154	16VDC ~ 100VDC	(K) +/-10%
Y5V	0.01uF ~ 0.47uF	103 ~ 474	16VDC ~ 50VDC	(Z) -20%/+80%/-



Cross Reference



Multilayer Ceramic Chip Capacitor Array Cross Reference:



NIC

NCA1206



AVX

W3A4



KEMET

C1632



Murata

GNM30-
401

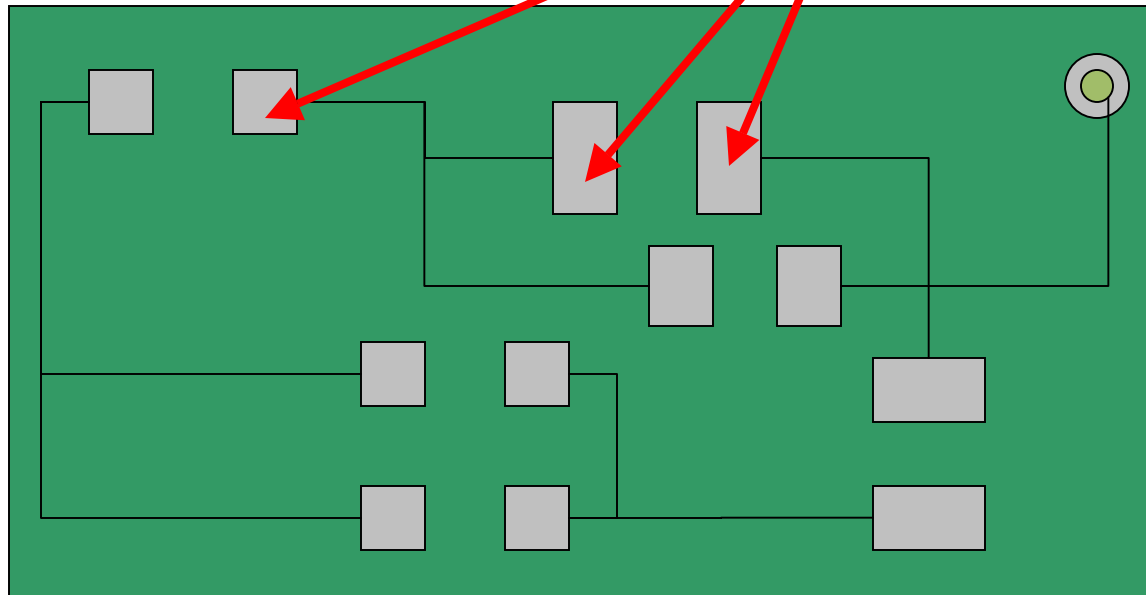


Phillips

0612

Assembly (Surface Mount)

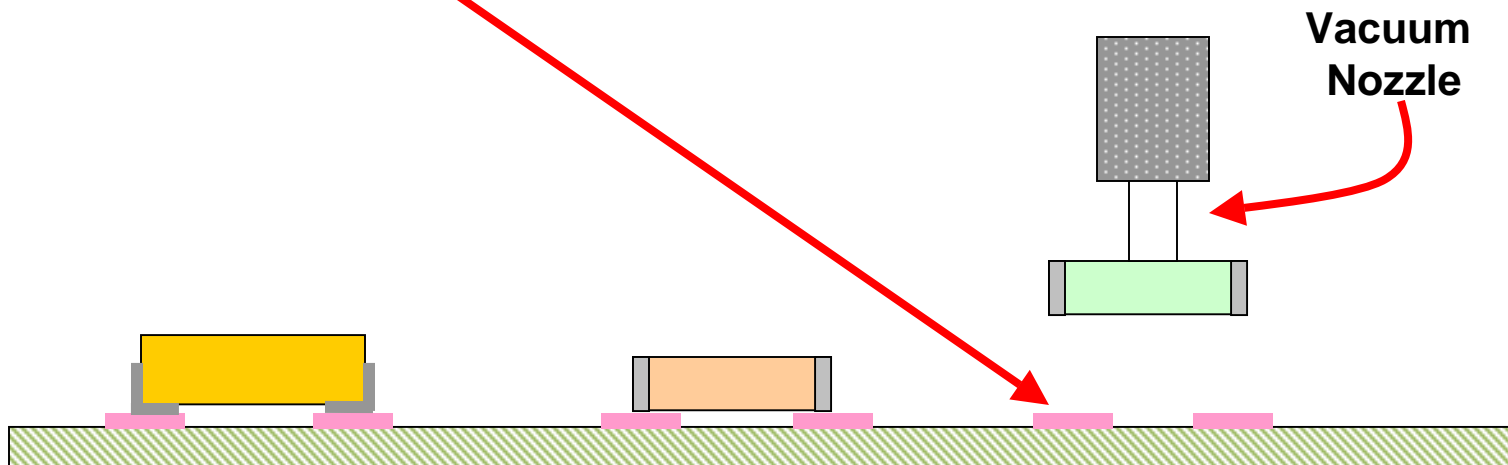
1. Solder paste is printed onto land patterns.





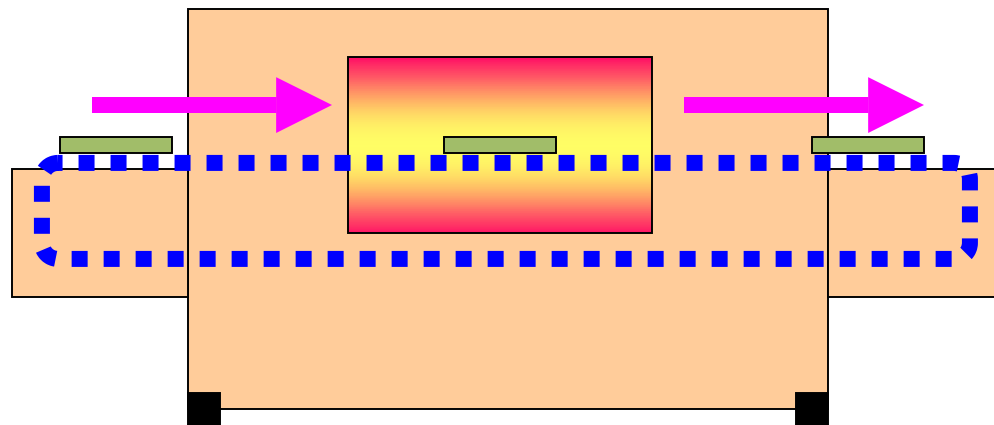
Assembly (Surface Mount)

2. **SMT parts are placed** (by automatic pick and place equipment) onto solder paste covered land patterns.




Assembly (Surface Mount)

3. Circuit board is run through a reflow soldering oven. Where the solder paste liquefies, and electrically connects the SMT component terminations to the circuit board land patterns. As the circuit board moves out of heating zone the liquid solder solidifies mechanically fixing the SMT components to the circuit board.

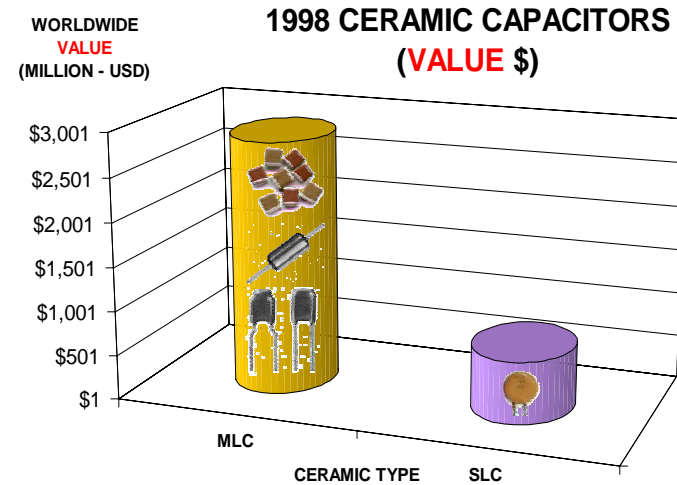
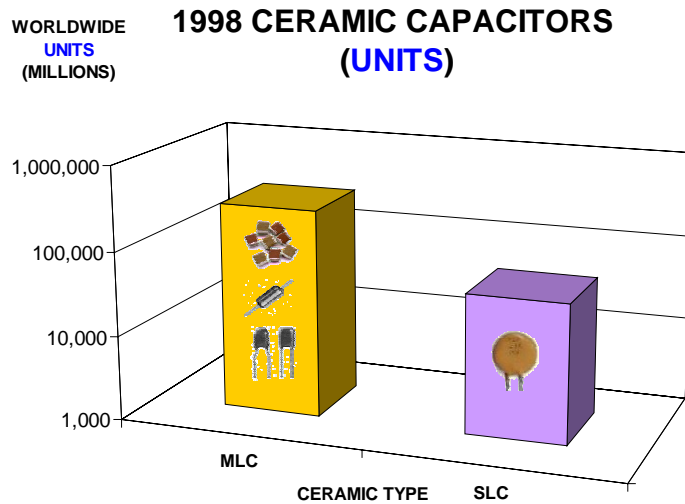


Ceramic Capacitor Market 1998

Source: Paumanok Publications Inc. presented @ CARTS 1999



Type	Units (MILLIONS)	Value (USD)	ASP (USD)	Percent Units : Value
MLC	284,000	\$2,855,000,000	\$0.010	86% : 80%
SLC	44,000	\$702,000,000	\$0.016	14% : 20%





Buzz Words

- **“MLC”** = **Multi-Layer Ceramic** (*NMC / NCM / NCMA Series are MLC*) **“MLCC”** = **Multi-layer Ceramic Chip** = *NMC Series*
- **“Mono”** = **“Monolithic”**: mono·lith·ic
Formed from a single structure < relating to a monolithic multi-layer ceramic capacitor > (*NMC / NCM / NCMA Series are Monolithic Type*)
- **“SLC”** = **Single Layer Ceramic** (*NCD Series - Ceramic Disc Capacitor is radial leaded SLC*)
- **“SMT”** = **Surface Mount** referring to *NMC Series - MLCC*
- **“TC”** (**Temperature Coefficient**): refers to the capacitor's change in capacitance value over it's operating temperature range. EIA TC codes (*NPO... X7R... Z5U... etc...*)



Buzz Words

- **“PPM”**(**P**arts **P**er **M**illion): when relating to TC (temperature coefficient) the amount of capacitance change in parts per million.
30PPM = 0.003% change in capacitance per degree Celsius.
(At +125°C capacitance change will be +/-0.3% of +25 °C value)
- **“NPO”** (also called **COG**) : **very stable**, high Q, EIA class I ceramic dielectric. TC = 0 +/- 30PPM (-55C to +125C).
- **“X7R”**: Good performance, **semi-stable**, EIA class II ceramic dielectric. Capacitance change from +/-15% max. (-55C to +125C).
- **“Z5U”**: **Fair performance**, EIA class III ceramic dielectric. Capacitance change from +22% to -56% max. (+10C to +85C).
- **“Y5V”**: **Fair performance**, EIA class III ceramic dielectric. Capacitance changes from +22% to -82% max. (-30C to +85C).



Buzz Words

- **“DF”**: (*Dissipation Factor*) also referred to as “Loss Tangent” and “Power Factor”, the ratio of the ESR to the reactance (X_c) of the capacitor. Expressed in %. The lower the DF the better the part...
- **“ESR”**: (*Equivalent Series Resistance*) in ohms, all internal resistance of a capacitor. The lower the ESR the better the part...
- **“Q”** (*Quality Factor*): figure of merit relating to material losses within the capacitor. ($Q = X_c/ESR$). The higher the Q the better the part...
- **“IR”** (*Insulation Resistance*): the insulating property of the dielectric material. Also called the standoff resistance. The higher the IR the better the part...

Technical Info

Customers may inquiry into the following:

SMT Component Taping Specifications:

- All surface mount ceramic chip capacitors are supplied on tape and reel packaging
- Taping is in accordance with EIA-481-1-A guidelines
- Tape will be punched paper tape (“TR” part number suffix) or embossed plastic tape (“TRPLP” part number suffix). Industry trend is to move to paper tape.
- You can find the NMC series taping specifications at the end of the NMC series data sheets in our catalog or at web site page:
<http://www.niccomp.com/catalog/taping5.pdf>



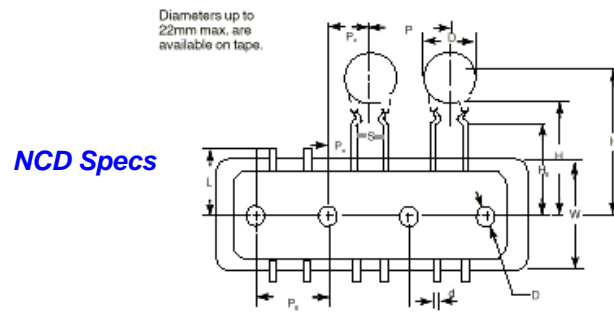
Technical Info

Customers may inquiry into the following:

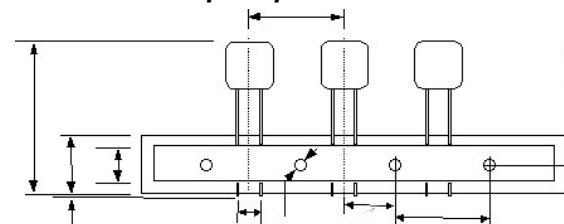
Leaded Component Taping Specifications:

Leaded components are supplied either bulk (bags) or tape and reel/tape and box (ammo pack).

- Taping is in accordance with EIA-468-B (Radial) or EIA-296-E (Axial) guidelines.
- You can find the NCD and NCMA series taping specifications in our catalog or at web site page: <http://www.niccomp.com/catalog/taping3.pdf> and <http://www.niccomp.com/catalog/ncma.pdf>



For NCM Series specs please contact NIC's TPMG



Technical Info

Customers may inquiry into the following:

Soldering Land Patterns or Pads (SMT styles, NMC series):

If the customer is looking for these, they are seeking the recommended land pattern dimensions.

These can be found on the application note section in the rear of our catalog or from web site location: <http://www.niccomp.com/pi/nmclnd.pdf>

