

# MLCCs (MULTI-LAYER CHIP CAPACITORS)

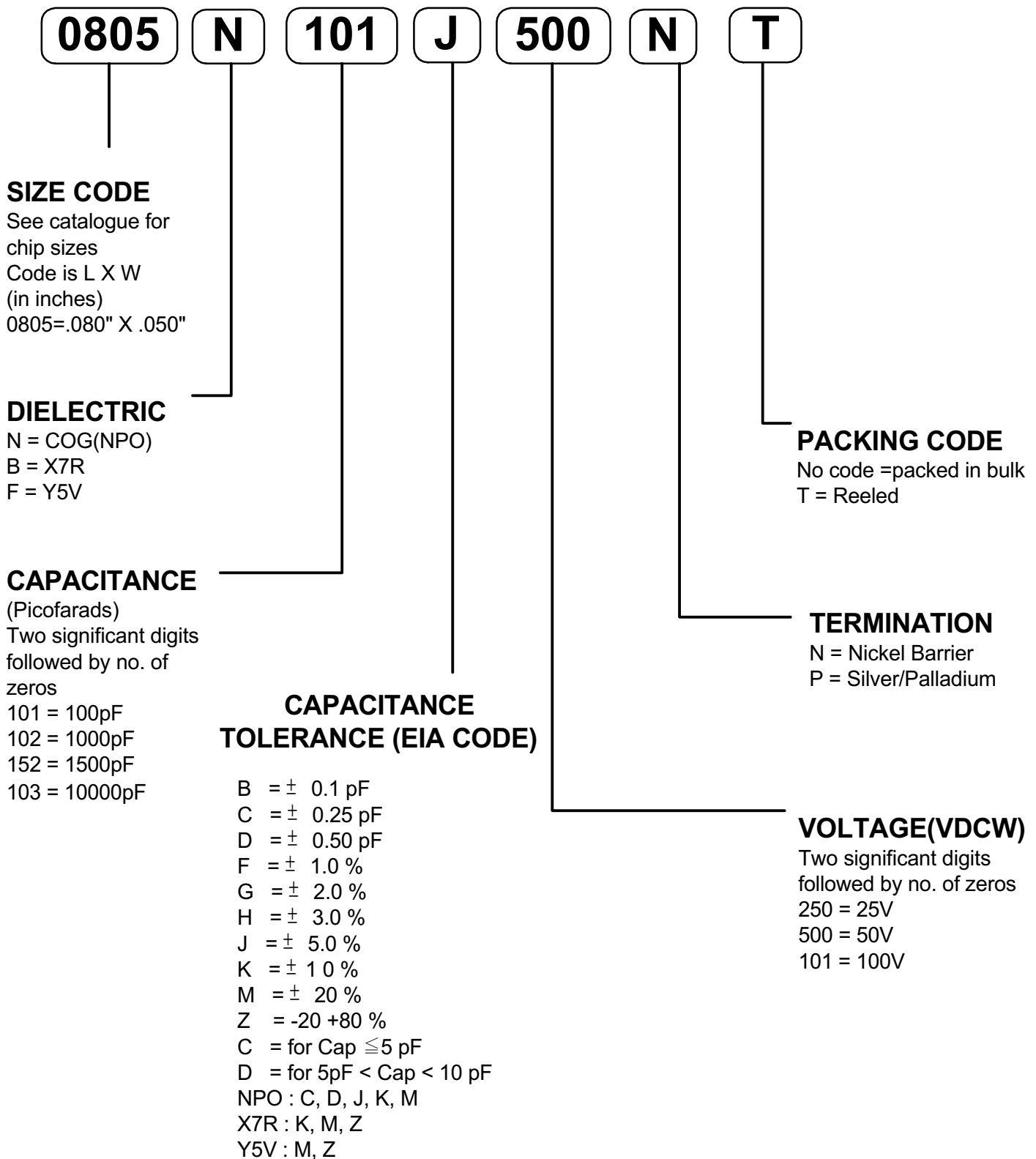
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## CLASSIFICATION OF DIELECTRIC

- NPO (COG)**
- Ultra stable class I dielectric
  - Negligible dependence of electrical properties on temperature, voltage, frequency and time
  - Often used in circuits requiring stable performance
- X7R**
- Stable class II dielectric
  - Higher capacitance than class I
  - Often used in blocking, by-passing and frequency discriminating elements
- Y5V**
- General purpose class dielectric
  - Very high capacitance units
  - Greater variation of properties with temperature and test conditions

## HOW TO ORDER



- For values below 10 pF, use "R" in place of decimal point, e.g., 4.7pF=4R7

## CAPACITANCE, THICKNESS AND PACKAGING

Size		NPO	X7R	Y5V	TAPING*	THICKNESS (mm)
0603	Capacitance	1R0-102	181-104	103-105	Paper, 4Kp/Reel	A=0.65
	Thickness	S	S	S		+0.05/-0.15
0805	Capacitance	1R0-331	102-683	103-154	A:Paper,4Kp/Reel B:Paper,4Kp/Reel C: Plastic 3Kp/Reel D: Plastic 3Kp/Reel	B=0.85
	Thickness	A	B	A		+0.05/-0.15
	Capacitance	391-152	823-104	224-105		C=1.00
	Thickness	B	C	B		+0.05/-0.15
	Capacitance		224-334			D=1.20
	Thickness		D			+0.15/-0.15
	Capacitance			105-475		S=0.80
Thickness			D	+0.10/-0.10		
1206	Capacitance	1R5-272	102-104	103-684	A:Paper,4Kp/Reel B:Paper,4Kp/Reel C: Plastic 3Kp/Reel D: Plastic 3Kp/Reel	
	Thickness	B	B	B		
	Capacitance	332	154~224	105		
	Thickness	C	C	C		
	Capacitance		105	335-106		
	Thickness		D	D		
1210	Capacitance	220-562	103-184	104-155	Plastic, 3Kp/Reel	
	Thickness	C	C	C		
	Capacitance		224	106		
	Thickness		D	D		
1812	Capacitance	102-103	103-474	104-225	Plastic, 1Kp/Reel	
	Thickness	D	D	D		

\* Reel Size : 7 inches standard, 13 inches available

## VOLTAGE

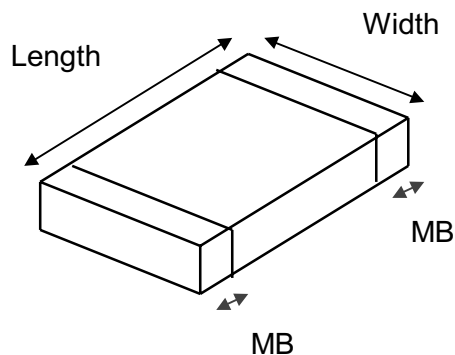
Size/Voltage		NPO	X7R	Y5V
0603	10V	1R0 - 102	181 -104	103 -105
	16V	1R0 - 102	181 -104	103 -474
	25V	1R0 - 102	181 - 823	103 - 104
	50V	1R0 - 102	181 - 393	103 - 473
0805	10V	1R0 - 152	102 - 334	103 - 475
	16V	1R0 -152	102 - 334	103 -335
	25V	1R0 - 152	102 - 104	103 - 474
	50V	1R0 - 152	102 - 104	103 - 224
	100V	1R0 - 152	102 - 472	103 - 104
	200V	1R0 - 152	102 - 222	
	500V	1R0 - 152		
	1000V	1R0 - 101		
1206	10V	1R5 - 332	102 - 105	103 - 106
	16V	1R5 - 332	102 - 105	103 - 475
	25V	1R5 - 332	102 - 224	103 - 225
	50V	1R5 - 332	102 - 224	103 - 474
	100V	1R5 - 332	102 - 154	103 - 224
	200V	1R5 - 332	102 - 103	103 - 104
	500V	1R5 - 332	102 - 472	
	1000V	1R5 - 102		
	2000V	1R5 - 221		
	1210	16V	220 - 562	103 - 224
25V		220 - 562	103 - 224	104 - 105
50V		220 - 562	103 - 224	104 - 474
100V		220 - 562	103.- 154	
200V		220 - 562	103 - 473	
500V		220 - 472	103 - 223	
1000V		220 - 152		
2000V		220 - 221		
1812	16V	102 - 103	103 - 474	104 - 225
	25V	102 - 103	103 - 474	104 - 105
	50V	102 - 103	103 - 474	104 - 155
	100V	680 - 103	103 - 274	104 - 474
	200V	680 - 103	103 - 154	104 - 474
	500V	680 - 103	103 - 223	
	1000V	680 - 332		
	2000V	680 - 331		

## CAPACITANCE AND TOLERANCE

CAPACITANCE & TOLERANCE	NPO	X7R	Y5V
1R0 = 1.0 pF 100 = 10 pF 101 = 100 pF 102 = 1000 pF = 1nF 103 = 10 nF 104 = 100 nF 105 = 1000 nF = 1μF 106 = 10000 nF = 10μF	1R0 - 103	181 - 105	103- 106
C: ±0.25pF (Cap<5pF) D: ±0.5pF (5pF<Cap<10pF) J: ±5% K: ±10% M: ±20% Z: -20% ~ +80%	C, D, J, K	K, M	M, Z

**LENGTH, WIDTH, & MB**

L,W,MB	inch (mm)				
	0603	0805	1206	1210	1812
Length	.063±.004 (1.60±0.10)	.080±.006 (2.00±0.15)	.125±.006 (3.20±0.15)	.125±.012 (3.20±0.30)	.180±.015 (4.50±0.40)
Width	.030±.004 (0.80±0.10)	.050±.006 (1.25±0.15)	.063±.006 (1.60±0.15)	.100±.008 (2.50±0.20)	.125±.012 (3.20±0.30)
MB	.015±.006 (0.40±0.15)	.020±.008 (0.50±0.20)	.025±.008 (0.60±0.20)	.030±.010 (0.75±0.25)	.030±.010 (0.75±0.25)



# SPECIFICATIONS

TEST ITEMS	TEST METHODS	REQUIREMENTS
Operating Temperature Range		COG : -55°C to + 125°C X7R : -55°C to + 125°C Y5V : -30°C to + 85°C
Temperature Coefficient		COG : +/- 30 PPM /°C X7R : +/- 15% Y5V : +30, -80 %
Capacitance	COG ≤1,000PF, 1MHz+/-10%, 1.0+/-0.2 Vrms >1,000PF, 1KHz+/-10%, 1.0+/-0.2 Vrms X7R 1KHz+/-10%, 1.0+/-0.2 Vrms Y5V 1KHz+/-10%, 1.0+/-0.2 Vrms	Does not exceed the limits given in detailed spec.
Q/Dissipation factor	Same as capacitance test method	COG : ≥50PF DF ≤0.15% <50PF DF ≤1.5[ $\frac{150}{C} + 7$ ]*10 <sup>-2</sup> % X7R : 50V, DF ≤ 2.5%max. 16V,25V, DF ≤ 3.5% 10V, DF≤5.0% Y5V : 50V, DF ≤5.0% 16V,25V, DF≤7.0% 10V, DF≤10.0%
Dielectric strength	Apply Voltage : 250%of rated Voltage for 1 to 5 sec. charge & discharge current less than 50mA	No evidence of damage or flash-over during test
Insulation resistance	Apply rated voltage for max.120 sec.	10GΩ min. or 500Ω-F min . (whichever is smaller)
Solderability	Solder temperature : 230+/-5°C Dipping time : 4 +/- 1 sec Solder : SN63A	90% min .Coverage of entire metalized area .
Resistance to soldering heat	Solder temperature : 260+/- 5°C Dipping time : 10 +/- 1 sec Solder : SN63A Measurement taken after keeping at room temp . for 24+/- 2 hours	<ul style="list-style-type: none"> <li>• Appearance: No damage</li> <li>• CAP Change : COG : ± 0.25pF max. or ± 2.5% max. X7R : ± 7.5% max. Y5V : ± 20% max.</li> <li>• DF, IR and Dielectric strength : to meet initial requirements</li> <li>• 25% max. leaching on each edge</li> </ul>
Adhesive strength of termination	<ul style="list-style-type: none"> <li>• Pressurizing force : 1kg(10N)</li> <li>• test time:10± 1sec</li> </ul>	No remarkable damage or removal of the terminations.
Vibration Resistance	<ul style="list-style-type: none"> <li>• The range of Vibration frequency : 10~55~10 Hz/min.</li> <li>• Total amplitude : 1.5mm</li> <li>• Test time : 6 hrs.(Two hours each in three mutually perpendicular directions.)</li> </ul>	<ul style="list-style-type: none"> <li>• No remarkable damage.</li> <li>• Cap change &amp; DF : To meet initial requirements.</li> </ul>
Bending test	<ul style="list-style-type: none"> <li>• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 sec.</li> <li>• Measurement to be made after keeping at room temp. for 24± 2hours</li> </ul>	<ul style="list-style-type: none"> <li>• No remarkable damage.</li> <li>• Cap change : COG : ± 5.0%MAX.or± 0.5pFMAX.,           whichever is larger. X7R : ≤± 12.5%. Y5V : ≤± 30%. This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.</li> </ul>

# SPECIFICATIONS

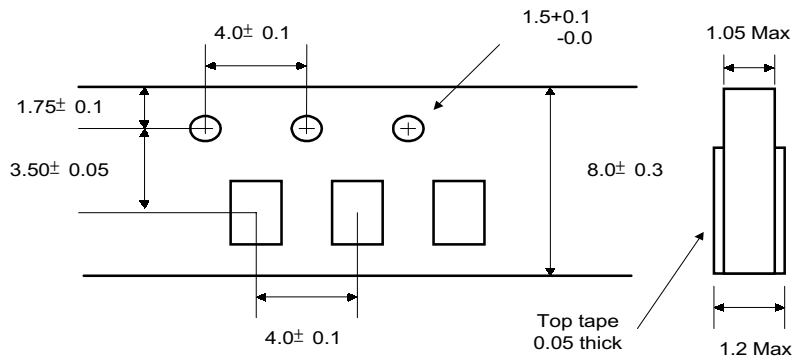
TEST ITEMS	TEST METHODS	REQUIREMENTS
Temperature cycle (Thermal Shock)	<ul style="list-style-type: none"> <li>• Test step :</li> <li style="margin-left: 20px;">COG/X7R : 1)-55± 3°C      30± 3min.</li> <li style="margin-left: 40px;">2)room temp.      2~5min.</li> <li style="margin-left: 20px;">3)125± 3°C      30± 2min.</li> <li style="margin-left: 40px;">4)room temp.      2~5min.</li> <li style="margin-left: 20px;">Y5V : 1)-30± 3°C      30± 3min.</li> <li style="margin-left: 40px;">2)room temp.      2~5min.</li> <li style="margin-left: 20px;">3)85± 3°C      30± 2min.</li> <li style="margin-left: 40px;">4)room temp.      2~5min.</li> <li>• Conduct the five cycles according to the temperatures and time .</li> <li>• Measurement to be made after keeping at room temp. for 24± 2hours.</li> </ul>	<ul style="list-style-type: none"> <li>• No remarkable damage.</li> <li>• Cap change : COG : ± 2.5%MAX.or± 0.25pFMAX., whichever is larger.</li> <li style="margin-left: 20px;">X7R : &lt;± 7.5%</li> <li style="margin-left: 20px;">Y5V : &lt; ± 20%</li> <li>• Q &amp; I.R &amp; Dielectric strength :</li> <li style="margin-left: 20px;">COG : To meet initial requirements.</li> <li>• D.F. value &amp; I.R. :</li> <li style="margin-left: 20px;">X7R/Y5V : To meet initial standard value.</li> </ul>
Humidity test (steady state)	Test temp. : 40+/- 2°C Humidity : 90-95%RH Test time : 500 + 24/-0 hours Measurement taken after keeping at room temp. for 24+/- 2 hours	<ul style="list-style-type: none"> <li>• No remarkable damage</li> <li>• CAP Change : COG :+/- 5.0%max. or +/-0.5pF max. (whichever is larger)</li> <li style="margin-left: 20px;">X7R : &lt;± 12.5%</li> <li style="margin-left: 20px;">Y5V : &lt;± 7.5%</li> <li>• Q :</li> <li style="margin-left: 20px;">COG : More than 30pF    Q ≥ 350</li> <li style="margin-left: 40px;">10pF ≤ C &lt; 30pF, Q ≥ 275+2.5C</li> <li style="margin-left: 40px;">Less than 10pF, Q ≥ 200+10C</li> <li>• DF : X7R &lt;7.5%</li> <li style="margin-left: 20px;">Y5V &lt;15%</li> <li>• IR : COG / X7R / Y5V : 1GΩ min. or 50 Ω-F min. (whichever is less)</li> </ul>
Humidity Load	<ul style="list-style-type: none"> <li>• Test temp. : 40± 2°C</li> <li>• Humidity : 90~95%RH</li> <li>• Test time : 500+24/-0 hrs.</li> <li>• To apply voltage : rated voltage</li> <li>• Measurement to be made after keeping at room temp. for 24± 2hours.</li> </ul>	<ul style="list-style-type: none"> <li>• No remarkable damage.</li> <li>• Cap change : COG : ± 7.5% MAX. or± 0.75pF MAX., whichever is larger.</li> <li style="margin-left: 20px;">X7R : &lt;± 12.5%</li> <li style="margin-left: 20px;">Y5V : &lt;± 7.5%</li> <li>• Q :</li> <li style="margin-left: 20px;">COG : More than 30pF    Q ≥ 350</li> <li style="margin-left: 40px;">10pF ≤ C &lt; 30pF, Q ≥ 275+2.5C</li> <li style="margin-left: 40px;">Less than 10pF, Q ≥ 200+10C</li> <li>• DF value :</li> <li style="margin-left: 20px;">X7R : &lt;7.5%</li> <li style="margin-left: 20px;">Y5V : &lt;15%</li> <li>• I.R. : 500M Ω- MIN. or 25 Ω-F MIN., whichever is smaller .</li> </ul>
Life test	Test temp. : at max. rated temp. Apply Voltage : 200% of rated Voltage Test time : 1000 + 24/-0 hours Measurement taken after keeping at room temp. for 24+/- 2 hours	Same as humidity test (steady state) requirements

# PACKAGING ON TYPE AND REEL

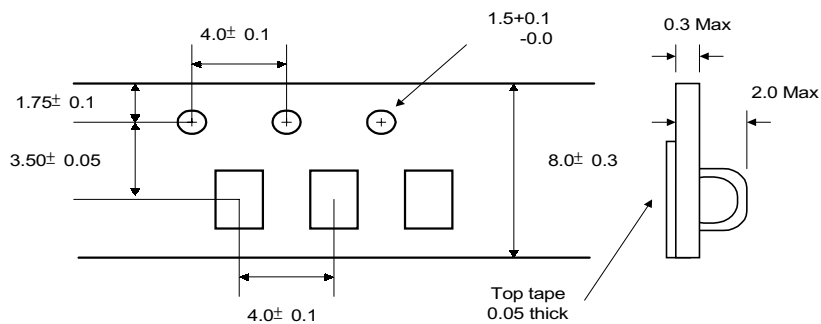
SIZE	T(mm)	TAPE TYPE	QUANTITY
0603	(0.90 ~ 0.70)	Paper tape	4Kps/reel
0805	(0.70 ~ 0.50)	Paper tape	4Kps/reel
	(0.90 ~ 0.70)	Plastic tape	3Kps/reel
	(1.05 ~ 0.85)		
	(1.35 ~ 1.05)		
1206	(0.90 ~ 0.70)	Paper tape	4Kps/reel
	(1.05 ~ 0.85)	Plastic tape	3Kps/reel
	(1.35 ~ 1.05)		
1210	(1.05 ~ 0.85)	Plastic tape	3Kps/reel
	(1.35 ~ 1.05)		
1812	(1.35 ~ 1.05)	Plastic tape	1Kps/reel

\*Reel Size: 7" diameter stand (13" reel available)

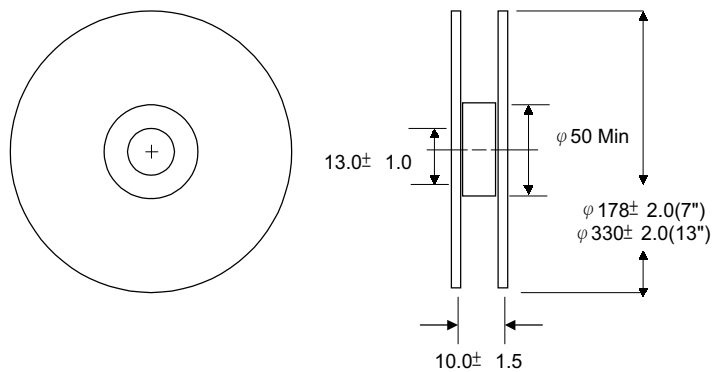
## PAPER TAPE



## PLASTIC TAPE



## REEL



NOTE: Dimension unit = mm