



THE DATASHEET OF
04023A100JAT2A



COG (NP0) Dielectric, KGM Series

General Specifications



COG (NP0) is the most popular formulation of the “temperature-compensating,” EIA Class I ceramic materials. Modern COG (NP0) formulations contain neodymium, samarium and other rare earth oxides.

COG (NP0) ceramics offer one of the most stable capacitor dielectrics available. Capacitance change with temperature is $0 \pm 30\text{ppm}/^\circ\text{C}$ which is less than $\pm 0.3\%$ C from -55°C to $+125^\circ\text{C}$. Capacitance drift or hysteresis for COG (NP0) ceramics is negligible at less than $\pm 0.05\%$ versus up to $\pm 2\%$ for films. Typical capacitance change with life is less than $\pm 0.1\%$ for COG (NP0), one-fifth that shown by most other dielectrics.

HOW TO ORDER

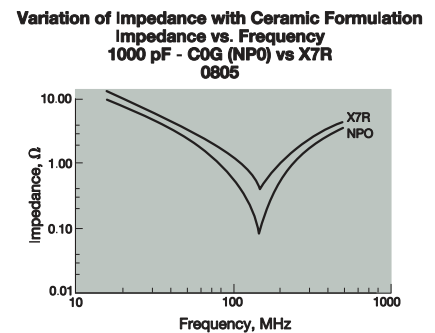
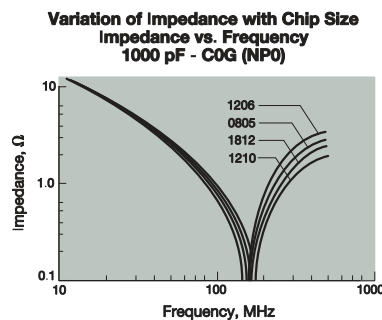
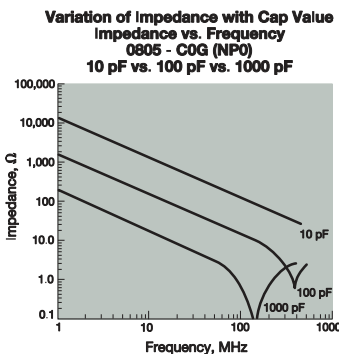
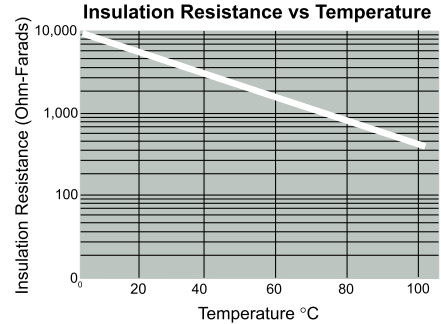
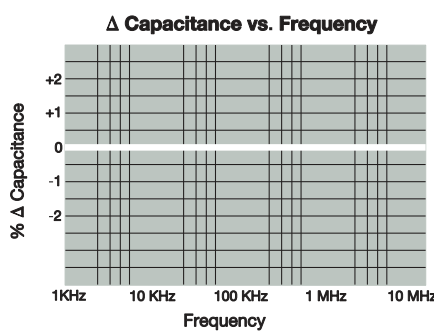
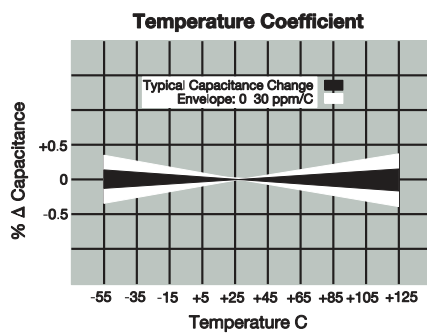
| | | | | | | | |
|--------------------------------------|--|------------------|-------------------|---|---|--|------------------|
| KGM | 21 | A | CG | 2J | 102 | F | L |
| Series | Size | Thickness | Dielectric | Voltage | Capacitance Code Code (in pF) | Capacitance Tolerance | Packaging |
| General Purpose Tin/Nickel Finish | 02 = 0101 32 = 1210 03 = 0201 43 = 1812 05 = 0402 44 = 1825 15 = 0603 55 = 2220 21 = 0805 56 = 2225 31 = 1206 | See Cap Chart | CG = COG | 0G = 4.0V 1H = 50V 0J = 6.3V 2A = 100V 1A = 10V 2D = 200V 1C = 16V 2E = 250V 1E = 25V 2H = 500V | 2 Significant Digits +Number of zeros eg. $10\mu\text{F} = 106$ $10\text{nF} = 103$ $47\text{pF} = 470$ | B = $\pm 10\text{pF}$ ($<10\text{pF}$)* C = $\pm 25\text{pF}$ ($<10\text{pF}$)* D = $\pm 50\text{pF}$ ($<10\text{pF}$)* F = $\pm 1\%$ ($\geq 10\text{pF}$)* G = $\pm 2\%$ ($\geq 10\text{pF}$)* J = $\pm 5\%$ ($\geq 10\text{pF}$) K = $\pm 10\%$ ($\geq 10\text{pF}$) M = $\pm 20\%$ | See Table Below |



PACKAGING CODES

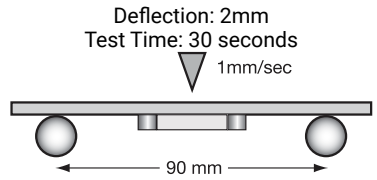
| Code | EIA (inch) | IEC(mm) | 7" Paper | 7" Embossed | 13" Paper | 13" Embossed |
|------|------------|---------|----------|-------------|-----------|--------------|
| 02 | 0101 | 0402 | H | | n/a | |
| 03 | 0201 | 0603 | H | | N | |
| 05 | 0402 | 1005 | H | | N | |
| 15 | 0603 | 1608 | T | | M | |
| 21 | 0805 | 2012 | T | U | M | L |
| 31 | 1206 | 3216 | T | U | M | L |
| 32 | 1210 | 3225 | | U | | L |
| 43 | 1812 | 4532 | | V | | S |
| 44 | 1825 | 4564 | | V | | S |
| 55 | 2220 | 5750 | | V | | S |
| 56 | 2225 | 5763 | | V | | S |

*thickness determines paper or plastic embossed packaging



COG (NP0) Dielectric, KGM Series

Specifications and Test Methods

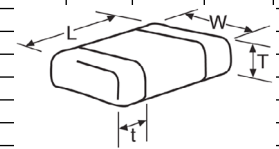
| Parameter/Test | | NP0 Specification Limits | Measuring Conditions | |
|--------------------------------|-----------------------|--|--|----------------|
| Operating Temperature Range | | -55°C to +125°C | Temperature Cycle Chamber | |
| Capacitance | | Within specified tolerance | Freq.: 1.0 MHz ± 10% for cap ≤ 1000 pF 1.0 kHz ± 10% for cap > 1000 pF Voltage: 1.0Vrms ± .2V | |
| Q | | <30 pF: Q ≥ 400+20 x Cap Value ≥30 pF: Q ≥ 1000 | | |
| Insulation Resistance | | 10,000MΩ or 500MΩ - μF, whichever is less | Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity | |
| Dielectric Strength | | No breakdown or visual defects | Charge device with 250% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices. | |
| Resistance to Flexure Stresses | Appearance | No defects |  <p>Deflection: 2mm Test Time: 30 seconds 1mm/sec 90 mm</p> | |
| | Capacitance Variation | ±5% or ±.5 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 | | |
| Solderability | | ≥ 95% of each terminal should be covered with fresh solder | Dip device in eutectic solder at 230 ± 5°C for 5.0 ± 0.5 seconds | |
| Resistance to Solder Heat | Appearance | No defects, <25% leaching of either end terminal | Dip device in eutectic solder at 260°C for 60sec- onds. Store at room temperature for 24 ± 2 hours before measuring electrical properties. | |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | Meets Initial Values (As Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| Thermal Shock | Appearance | No visual defects | Step 1: -55°C ± 2° | 30 ± 3 minutes |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | Step 2: Room Temp | ≤ 3 minutes |
| | Q | Meets Initial Values (As Above) | Step 3: +125°C ± 2° | 30 ± 3 minutes |
| | Insulation Resistance | Meets Initial Values (As Above) | Step 4: Room Temp | ≤ 3 minutes |
| | Dielectric Strength | Meets Initial Values (As Above) | Repeat for 5 cycles and measure after 24 hours at room temperature | |
| Load Life | Appearance | No visual defects | Charge device with twice rated voltage in test chamber set at 125°C ± 2°C for 1000 hours (+48, -0). Remove from test chamber and stabilize at room temperature for 24 hours before measuring. | |
| | Capacitance Variation | ≤ ±3.0% or ± .3 pF, whichever is greater | | |
| | Q (C=Nominal Cap) | ≥ 30 pF: Q ≥ 350 ≥ 10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| Load Humidity | Appearance | No visual defects | Store in a test chamber set at 85°C ± 2°C/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring. | |
| | Capacitance Variation | ≤ ±5.0% or ± .5 pF, whichever is greater | | |
| | Q | ≥ 30 pF: Q ≥ 350 ≥ 10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |

COG (NP0) Dielectric, KGM Series

Capacitance Range



| SIZE | | 1210 | | | | | 1812 | | | | | 1825 | | | 2220 | | | 2225 | | | |
|-----------------|-------|-----------------|----|-----|-----|-----|-----------------|----|-----|-----|-----|-----------------|-----|-----|-----------------|-----|-----|-----------------|-----|-----|-----|
| Soldering | | Reflow Only | | | | | Reflow Only | | | | | Reflow Only | | | Reflow Only | | | Reflow Only | | | |
| Packaging | | All Embossed | | | | | All Embossed | | | | | All Embossed | | | All Embossed | | | All Embossed | | | |
| (L) Length | mm | 3.20 ± 0.20 | | | | | 4.50 ± 0.30 | | | | | 4.50 ± 0.30 | | | 5.70 ± 0.40 | | | 5.72 ± 0.25 | | | |
| | (in.) | (0.126 ± 0.008) | | | | | (0.177 ± 0.012) | | | | | (0.177 ± 0.012) | | | (0.225 ± 0.016) | | | (0.225 ± 0.010) | | | |
| (W) Width | mm | 2.50 ± 0.20 | | | | | 3.20 ± 0.20 | | | | | 6.40 ± 0.40 | | | 5.00 ± 0.40 | | | 6.35 ± 0.25 | | | |
| | (in.) | (0.098 ± 0.008) | | | | | (0.126 ± 0.008) | | | | | (0.252 ± 0.016) | | | (0.197 ± 0.016) | | | (0.250 ± 0.010) | | | |
| (t) Terminal | mm | 0.50 ± 0.25 | | | | | 0.61 ± 0.36 | | | | | 0.61 ± 0.36 | | | 0.64 ± 0.39 | | | 0.64 ± 0.39 | | | |
| | (in.) | (0.020 ± 0.010) | | | | | (0.024 ± 0.014) | | | | | (0.024 ± 0.014) | | | (0.025 ± 0.015) | | | (0.025 ± 0.015) | | | |
| WVDC | WVDC | 25 | 50 | 100 | 200 | 500 | 25 | 50 | 100 | 200 | 500 | 50 | 100 | 200 | 50 | 100 | 200 | 50 | 100 | 200 | |
| Cap 3.9 (pF) | 4.7 | | | | | | | | | | | | | | | | | | | | |
| 5.6 | | | | | | | | | | | | | | | | | | | | | |
| 6.8 | | | | | | | | | | | | | | | | | | | | | |
| 8.2 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 12 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 15 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 18 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 22 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 27 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 33 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 39 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 47 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 56 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 68 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 82 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 100 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 120 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 150 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 180 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 220 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 270 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 330 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 390 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 470 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 560 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 680 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 820 | | E | E | E | E | E | B | B | B | B | B | | | | | | | | | | |
| 1,000 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 1200 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 1500 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 1800 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 2200 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 2700 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 3300 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 3900 | | E | E | E | E | E | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 4700 | | E | E | E | H | H | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 5600 | | E | E | E | H | H | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 6800 | | E | E | E | H | H | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 8200 | | E | E | E | H | H | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| Cap 0.010 (µF) | 0.012 | H | H | H | J | J | B | B | B | B | B | C | C | C | Z | Z | Z | D | D | D | D |
| 0.015 | | H | H | J | L | L | B | B | B | E | E | C | C | C | Z | Z | Z | D | D | D | D |
| 0.018 | | J | J | L | L | | B | B | E | F | F | C | C | C | Z | Z | Z | D | D | D | D |
| 0.022 | | J | J | L | L | | B | B | E | F | F | C | C | C | Z | Z | Z | D | D | D | D |
| 0.027 | | L | L | L | L | | E | E | F | J | | C | C | C | Z | Z | Z | D | D | D | D |
| 0.033 | | L | L | L | L | | E | E | F | | | C | C | C | Z | Z | Z | D | D | D | D |
| 0.039 | | L | L | L | | | J | J | J | | | C | C | C | Z | Z | Z | D | D | D | D |
| 0.047 | | L | L | L | | | J | J | J | | | C | C | C | Z | Z | C | D | D | D | D |
| 0.068 | | | | | | | J | J | J | | | C | C | F | Z | Z | C | D | D | D | G |
| 0.082 | | | | | | | J | J | J | | | C | F | | Z | C | | D | D | D | G |
| 0.100 | | | | | | | J | J | J | | | F | F | | C | C | | D | D | D | G |
| WVDC | WVDC | 25 | 50 | 100 | 200 | 500 | 25 | 50 | 100 | 200 | 500 | 50 | 100 | 200 | 50 | 100 | 200 | 50 | 100 | 200 | 200 |
| SIZE | SIZE | 1210 | | | | | 1812 | | | | | 1825 | | | 2220 | | | 2225 | | | |



| Case Size | 1210 (KGM 32) | | | | | 1812 (KGM 43) | | | | | 1825 (KGM 44) | | 2220 (KGM 55) | | | 2225 (KGM56) | |
|-------------------------|---------------|-----|------|------|--|---------------|-----|------|------|------|---------------|------|---------------|------|------|--------------|------|
| Thickness Letter | E | H | J | L | | B | E | F | J | C | F | Z | C | D | G | E | G |
| Max Thickness (mm) | 1.45 | 1.8 | 2.21 | 2.80 | | 1.45 | 1.8 | 2.21 | 2.80 | 2.21 | 2.80 | 2.21 | 2.80 | 2.21 | 2.80 | 2.29 | 2.80 |
| Carrier Tape | EMB | EMB | EMB | EMB | | EMB | EMB | EMB | EMB | EMB | EMB | EMB | EMB | EMB | EMB | EMB | EMB |
| Packaging Code 7" reel | U | U | U | U | | V | V | V | V | V | V | V | V | V | V | V | V |
| Packaging Code 13" reel | L | L | L | L | | S | S | S | S | S | S | S | S | S | S | S | S |

EMBOSS (EMB)

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