

DATA SHEET

Mono-axial™ series
**Leaded ceramic multilayer
capacitors**

Product specification
Supersedes data of 24th August 2000
File under BCcomponents, BC06

2002 Oct 24

Leaded ceramic multilayer capacitors

Mono-axial™ series

FEATURES

- High capacitance per unit volume
- Low cost.

APPLICATIONS

These conformally coated axial leaded capacitors are designed for commercial and industrial applications in four dielectrics, NPO (ultra-stable), X7R (stable) and Z5U, Y5V (general purpose). Applications include timing, coupling/decoupling, signal comparison and biasing. Mono-axial™ capacitors are suitable for automatic insertion equipment.

DESCRIPTION

The basic capacitor construction consists of ceramic dielectric materials processed into a tape with a typical thickness range from 0.025 to 0.076 mm. Metal electrode patterns are applied using a thick film screening process. Multiple layers are stacked and laminated in such a manner that electrodes are alternately exposed when the pattern is cut into individual chip capacitors. The capacitors are fired through a high temperature profile to mature the ceramic and metal into a homogeneous unit.

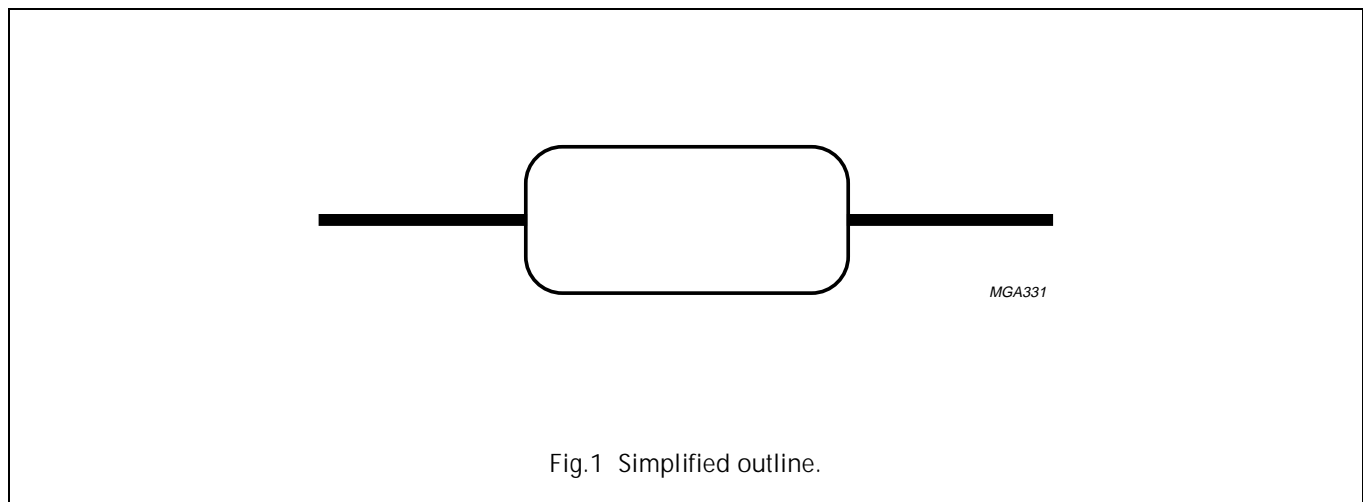
Metal end terminations are applied and fired to provide electrical connection between the individual layers. Tinned leads are attached using a solder. Encapsulation consists of a moisture resistant gold colour conformal epoxy coating that meets the flame requirements of "UL94V-0".

QUICK REFERENCE DATA

| DESCRIPTION | VALUE | | | | | | | |
|--------------------------|-------------------|-------------------|---------------------|----------------------|---------------------|----------------------|-------------------|-------------------|
| | 2252 205 | 2252 206 | 2252 225 | 2252 226 | 2252 245 | 2252 246 | 2252 262 | 2252 265 |
| Capacitance range | 10 to 5600 pF | | 220 pF to 0.22 µF | | 1000 pF to 1.0 µF | | 0.01 to 1.0 µF | |
| Rated DC voltage | 50 V | 100 V | 50 V ⁽¹⁾ | 100 V ⁽¹⁾ | 50 V ⁽¹⁾ | 100 V ⁽¹⁾ | 25 V | 50 V |
| Tolerance on capacitance | ±5% | | ±10% | | ±20% | | +80%/-20% | |
| Temperature coefficient | NPO | | X7R | | Z5U | | Y5V | |

Note

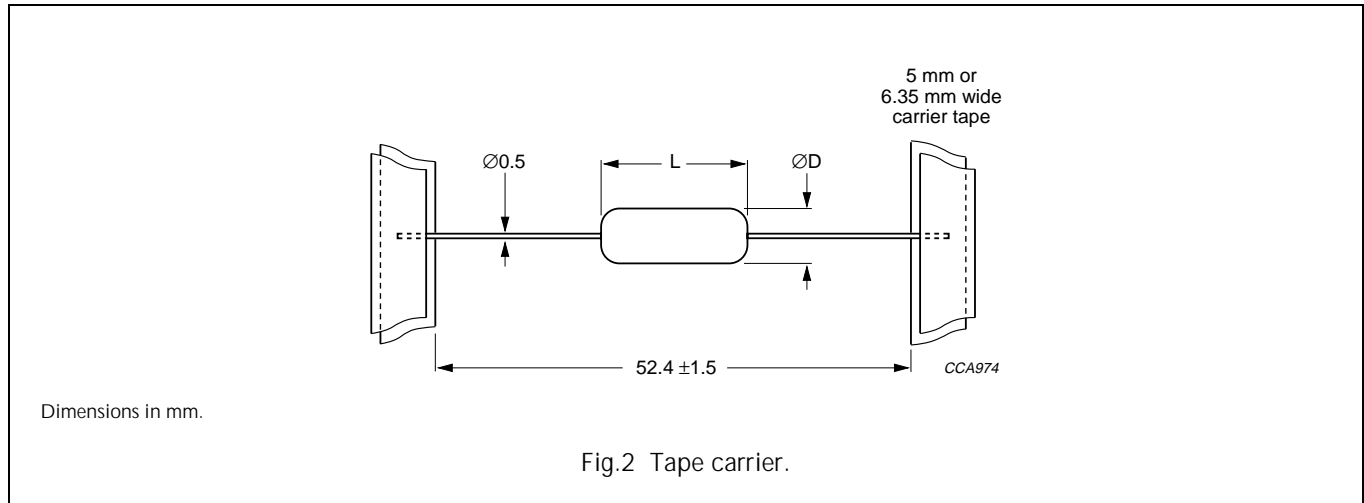
1. 7th digit of the catalogue number for U_{R(DC)} 25 V is: 2.



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MECHANICAL DATA



Marking (see Fig.3)

Date code (DDD):

Three-digit code; first digit denotes year, last two denote week of manufacture.

941 = 1999, wk 41

Capacitance value (CCC):

10 pF to 99 pF; actual value in pF (2 digits only)

100 pF and above; coded capacitance value (same as used in P/N).

Capacitance tolerance (T):

Standard EIA tolerance (same as used in P/N).

Material code (M):

- A = C0G
- C = X7R
- E = Z5U
- Y = Y5V.

Voltage code (V):

- 1 = 100 V
- 3 = 25 V
- 5 = 50 V.

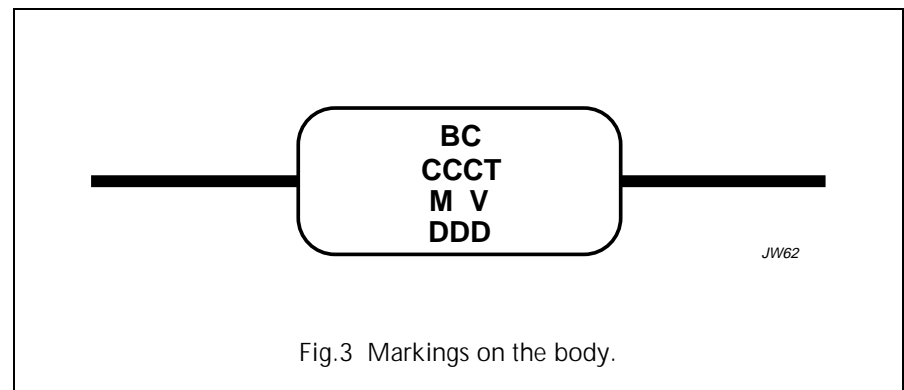
Physical dimensions

Table 1 Capacitor dimensions and mass

| SIZE | $L_{max}^{(1)}$ (mm) | $\varnothing D_{max}^{(1)}$ (mm) | MASS (g) |
|------|-------------------------|-------------------------------------|-------------|
| 15 | 3.8 (0.150) | 2.5 (0.100) | ≈0.14 |
| 20 | 5.0 (0.200) | 3.0 (0.120) | ≈0.14 |

Note

1. Dimensions between parentheses are in inches.



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CAPACITANCE RANGE CHARTS

NP0 Dielectric

| CAP. | SIZE CODE 15 | | SIZE CODE 20 | |
|---------|--------------|-------|--------------|-------|
| | 50 V | 100 V | 50 V | 100 V |
| 10 pF | | | | |
| 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 | | | | |
| 0.01 µF | | | | |

X7R Dielectric

| CAP. | SIZE CODE 15 | | | SIZE CODE 20 | | |
|------------|--------------|------|-------|--------------|------|-------|
| | 25 V | 50 V | 100 V | 25 V | 50 V | 100 V |
| 100-220 pF | | | | | | |
| 270 | | | | | | |
| 330 | | | | | | |
| 390 | | | | | | |
| 470 | | | | | | |
| 560 | | | | | | |
| 680 | | | | | | |
| 820 | | | | | | |
| 1000 | | | | | | |
| 1200 | | | | | | |
| 1500 | | | | | | |
| 1800 | | | | | | |
| 2200 | | | | | | |
| 2700 | | | | | | |
| 3300 | | | | | | |
| 3900 | | | | | | |
| 4700 | | | | | | |
| 5600 | | | | | | |
| 6800 | | | | | | |
| 8200 | | | | | | |
| 0.01 µF | | | | | | |
| 0.012 | | | | | | |
| 0.015 | | | | | | |
| 0.018 | | | | | | |
| 0.022 | | | | | | |
| 0.027 | | | | | | |
| 0.033 | | | | | | |
| 0.039 | | | | | | |
| 0.047 | | | | | | |
| 0.056 | | | | | | |
| 0.068 | | | | | | |
| 0.082 | | | | | | |
| 0.10 | | | | | | |
| 0.12 | | | | | | |
| 0.15 | | | | | | |
| 0.22 | | | | | | |

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Z5U Dielectric

| CAP. | SIZE CODE 15 | | | SIZE CODE 20 | |
|--------------|--------------|------|-------|--------------|-------|
| | 25 V | 50 V | 100 V | 50 V | 100 V |
| 1000 pF | | | | | |
| 1500 | | | | | |
| 2200 | | | | | |
| 3300 | | | | | |
| 4700 | | | | | |
| 6800 | | | | | |
| 0.01 μ F | | | | | |
| 0.015 | | | | | |
| 0.022 | | | | | |
| 0.033 | | | | | |
| 0.047 | | | | | |
| 0.068 | | | | | |
| 0.10 | | | | | |
| 0.15 | | | | | |
| 0.22 | | | | | |
| 0.33 | | | | | |
| 0.47 | | | | | |
| 0.68 | | | | | |
| 1.0 | | | | | |

Y5V Dielectric

| CAP. | SIZE CODE 15 | | SIZE CODE 20 | |
|--------------|--------------|------|--------------|------|
| | 25 V | 50 V | 25 V | 50 V |
| 0.01 μ F | | | | |
| 0.015 | | | | |
| 0.022 | | | | |
| 0.033 | | | | |
| 0.047 | | | | |
| 0.068 | | | | |
| 0.10 | | | | |
| 0.15 | | | | |
| 0.22 | | | | |
| 0.33 | | | | |
| 0.47 | | | | |
| 0.68 | | | | |
| 1.0 | | | | |

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ORDERING INFORMATION

Components may be ordered by using either a simple 15-digit clear text code, or BCcomponents 12NC.

Clear text code

EXAMPLE: A103K15X7RF5TAA

| PRODUCT TYPE | CAPACITANCE (pF) | TOLERANCE | SIZE CODE (mm) | DIELECTRIC | RATED VOLTAGE | LEAD DIA. (mm) | PACKAGING |
|----------------|---|--|--|--------------------------------|-----------------------------------|-----------------------|-------------------------------------|
| A = mono-axial | two significant digits followed by the number of zeros: 101 = 100 103 = 10000 | J = ±5% K = ±10% M = ±20% Z = +80%/-20% | 15 = 3.8 (.150") max. 20 = 5.0 (.200") max. | COG (NP0) X7R Z5U Y5V | E = 25 V F = 50 V H = 100 V | 5 = 0.5 (0.020") max. | TAA = tape & reel UAA = ammopack |

Ordering code 12NC

2 2 5 2 XX X XX XX X

Dielectric and tolerance

- 20 NP0 ±5%
- 21 NP0 ±10%
- 22 X7R ±10%
- 23 X7R ±20%
- 24 Z5U ±20%
- 25 Z5U -20/+80%
- 26 Y5V -20/+80%

Rated voltage (DC)

- 2 25 V
- 5 50 V
- 6 100 V

Multiplier

- 8 0.1
- 9 1
- 1 10
- 2 100
- 3 1 000
- 4 10 000
- 5 100 000

Capacitance (pF)
two significant digits of capacitance value

Size and packaging

- 20 size 15/tape and reel
- 21 size 15/ammo
- 40 size 20/tape and reel
- 41 size 20/ammo

JWB217

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Table 2 Capacitance, rated voltage, mechanical dimensions and ordering information

| C | U _{R(DC)} (V) | SIZE CODE | CLEAR TEXT CODE | CATALOGUE NUMBER |
|--------------------------------|---------------------------|--------------|-----------------|------------------|
| NPO (C0G) ±5% tolerance | | | | |
| 10 pF | 50 | 15 | A100J15C0GF5UAA | 2252 205 21109 |
| | 100 | 15 | A100J15C0GH5UAA | 2252 206 21109 |
| 12 pF | 50 | 15 | A120J15C0GF5UAA | 2252 205 21129 |
| 15 pF | 50 | 15 | A150J15C0GF5UAA | 2252 205 21159 |
| 18 pF | 50 | 15 | A180J15C0GF5UAA | 2252 205 21189 |
| 22 pF | 50 | 15 | A220J15C0GF5UAA | 2252 205 21229 |
| | 100 | 15 | A220J15C0GH5UAA | 2252 206 21229 |
| 27 pF | 50 | 15 | A270J15C0GF5UAA | 2252 205 21279 |
| 33 pF | 50 | 15 | A330J15C0GF5UAA | 2252 205 21339 |
| 39 pF | 50 | 15 | A390J15C0GF5UAA | 2252 205 21399 |
| 47 pF | 50 | 15 | A470J15C0GF5UAA | 2252 205 21479 |
| | 100 | 15 | A470J15C0GH5UAA | 2252 206 21479 |
| 56 pF | 50 | 15 | A560J15C0GF5UAA | 2252 205 21569 |
| 68 pF | 50 | 15 | A680J15C0GF5UAA | 2252 205 21689 |
| 82 pF | 50 | 15 | A820J15C0GF5UAA | 2252 205 21829 |
| 100 pF | 50 | 15 | A101J15C0GF5UAA | 2252 205 21101 |
| | 100 | 15 | A101J15C0GH5UAA | 2252 206 21101 |
| 150 pF | 50 | 15 | A151J15C0GF5UAA | 2252 205 21151 |
| 220 pF | 50 | 15 | A221J15C0GF5UAA | 2252 205 21221 |
| | 100 | 15 | A221J15C0GH5UAA | 2252 206 21221 |
| 330 pF | 50 | 15 | A331J15C0GF5UAA | 2252 205 21331 |
| 470 pF | 50 | 15 | A471J15C0GF5UAA | 2252 205 21471 |
| | 100 | 15 | A471J15C0GH5UAA | 2252 206 21471 |
| 680 pF | 50 | 15 | A681J15C0GF5UAA | 2252 205 21681 |
| 1000 pF | 50 | 15 | A102J15C0GF5UAA | 2252 205 21102 |
| | 100 | 20 | A102J20C0GH5UAA | 2252 206 41102 |
| 1500 pF | 50 | 15 | A152J15C0GF5UAA | 2252 205 21152 |
| 2200 pF | 50 | 15 | A222J15C0GF5UAA | 2252 205 21222 |
| 3300 pF | 50 | 20 | A332J20C0GF5UAA | 2252 205 41332 |
| 4700 pF | 50 | 20 | A472J20C0GF5UAA | 2252 205 41472 |
| 5600 pF | 50 | 20 | A562J20C0GF5UAA | 2252 205 41562 |

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| C | U _{R(DC)} (V) | SIZE CODE | CLEAR TEXT CODE | CATALOGUE NUMBER |
|---------------------------|---------------------------|--------------|-----------------|------------------|
| X7R ±10% tolerance | | | | |
| 100 pF | 50 | 15 | A101K15X7RF5UAA | 2252 225 21101 |
| | 100 | 15 | A101K15X7RH5UAA | 2252 226 21101 |
| 150 pF | 50 | 15 | A151K15X7RF5UAA | 2252 225 21151 |
| | 100 | 15 | A151K15X7RH5UAA | 2252 226 21151 |
| 220 pF | 50 | 15 | A221K15X7RF5UAA | 2252 225 21221 |
| | 100 | 15 | A221K15X7RH5UAA | 2252 226 21221 |
| 330 pF | 50 | 15 | A331K15X7RF5UAA | 2252 225 21331 |
| 470 pF | 50 | 15 | A471K15X7RF5UAA | 2252 225 21471 |
| | 100 | 15 | A471K15X7RH5UAA | 2252 226 21471 |
| 680 pF | 50 | 15 | A681K15X7RF5UAA | 2252 225 21681 |
| 1000 pF | 50 | 15 | A102K15X7RF5UAA | 2252 225 21102 |
| | 100 | 15 | A102K15X7RH5UAA | 2252 226 21102 |
| 1500 pF | 50 | 15 | A152K15X7RF5UAA | 2252 225 21152 |
| 2200 pF | 50 | 15 | A222K15X7RF5UAA | 2252 225 21222 |
| | 100 | 15 | A222K15X7RH5UAA | 2252 226 21222 |
| 3300 pF | 50 | 15 | A332K15X7RF5UAA | 2252 225 21332 |
| 4700 pF | 50 | 15 | A472K15X7RF5UAA | 2252 225 21472 |
| | 100 | 15 | A472K15X7RH5UAA | 2252 226 21472 |
| 6800 pF | 50 | 15 | A682K15X7RF5UAA | 2252 225 21682 |
| 0.01 µF | 50 | 15 | A103K15X7RF5UAA | 2252 225 21103 |
| | 100 | 15 | A103K15X7RH5UAA | 2252 226 21103 |
| 0.015 µF | 50 | 15 | A153K15X7RF5UAA | 2252 225 21153 |
| 0.022 µF | 50 | 15 | A223K15X7RF5UAA | 2252 225 21223 |
| | 100 | 15 | A223K15X7RH5UAA | 2252 226 21223 |
| 0.033 µF | 50 | 15 | A333K15X7RF5UAA | 2252 225 21333 |
| 0.047 µF | 50 | 15 | A473K15X7RF5UAA | 2252 225 21473 |
| | 100 | 20 | A473K20X7RH5UAA | 2252 226 41473 |
| 0.068 µF | 50 | 15 | A683K15X7RF5UAA | 2252 225 21683 |
| 0.1 µF | 25 | 15 | A104K15X7RE5UAA | 2252 222 21104 |
| | 50 | 15 | A104K15X7RF5UAA | 2252 225 21104 |
| | 100 | 20 | A104K20X7RH5UAA | 2252 226 41104 |
| 0.15 µF | 25 | 20 | A154K20X7RE5UAA | 2252 222 41154 |
| 0.22 µF | 25 | 20 | A224K20X7RE5UAA | 2252 222 41224 |

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| C | U _{R(DC)} (V) | SIZE CODE | CLEAR TEXT CODE | CATALOGUE NUMBER |
|-------------------------------|---------------------------|--------------|-----------------|------------------|
| Z5U ±20% tolerance | | | | |
| 1 000 pF | 50 | 15 | A102M15Z5UF5UAA | 2252 245 21102 |
| | 100 | 15 | A102M15Z5UH5UAA | 2252 246 21102 |
| 2 200 pF | 50 | 15 | A222M15Z5UF5UAA | 2252 245 21222 |
| 4 700 pF | 50 | 15 | A472M15Z5UF5UAA | 2252 245 21472 |
| 0.01 µF | 50 | 15 | A103M15Z5UF5UAA | 2252 245 21103 |
| | 100 | 15 | A103M15Z5UH5UAA | 2252 246 21103 |
| 0.022 µF | 50 | 15 | A223M15Z5UF5UAA | 2252 245 21223 |
| 0.047 µF | 50 | 15 | A473M15Z5UF5UAA | 2252 245 21473 |
| 0.1 µF | 25 | 15 | A104M15Z5UE5UAA | 2252 242 21104 |
| | 50 | 15 | A104M15Z5UF5UAA | 2252 245 21104 |
| | 100 | 20 | A104M20Z5UH5UAA | 2252 246 41104 |
| 0.22 µF | 50 | 15 | A224M15Z5UF5UAA | 2252 245 21224 |
| 0.47 µF | 50 | 20 | A474M20Z5UF5UAA | 2252 245 41474 |
| 0.68 µF | 50 | 20 | A684M20Z5UF5UAA | 2252 245 41684 |
| 1.00 µF | 50 | 20 | A105M20Z5UF5UAA | 2252 245 41105 |
| Y5V +80/-20% tolerance | | | | |
| 0.01 µF | 50 | 15 | A103Z15Y5VF5UAA | 2252 265 21103 |
| 0.022 µF | 50 | 15 | A223Z15Y5VF5UAA | 2252 265 21223 |
| 0.047 µF | 50 | 15 | A473Z15Y5VF5UAA | 2252 265 21473 |
| 0.1 µF | 25 | 15 | A104Z15Y5VE5UAA | 2252 262 21104 |
| | 50 | 15 | A104Z15Y5VF5UAA | 2252 265 21104 |
| 0.22 µF | 25 | 20 | A224Z20Y5VE5UAA | 2252 262 41224 |
| | 50 | 20 | A224Z20Y5VF5UAA | 2252 265 41224 |
| 0.47 µF | 25 | 20 | A474Z20Y5VE5UAA | 2252 262 41474 |
| | 50 | 20 | A474Z20Y5VF5UAA | 2252 265 41474 |
| 1.0 µF | 25 | 20 | A105Z20Y5VE5UAA | 2252 262 41105 |

Leaded ceramic multilayer capacitors

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ELECTRICAL CHARACTERISTICS

Table 3 Electrical data for NP0, X7R, Z5U and Y5V

The capacitors meet the essential requirements of "EIA 198".

Unless stated otherwise all electrical values apply at an ambient temperature of 25 ± 3 °C, at barometric pressures of 650 to 800 mm of mercury, and relative humidity not to exceed 75%.

| DESCRIPTION | VALUE |
|---|--|
| Capacitors with temperature coefficient NP0 | |
| Capacitance range: at 1 MHz, 1 V; where $C \leq 1000$ pF at 1 kHz, 1 V; where $C > 1000$ pF | 10 to 1000 pF 1200 to 5600 pF |
| Tolerance on the capacitance | $\pm 5\%$; $\pm 10\%$ |
| Rated DC voltage | 50 and 100 V |
| Dielectric strength | 250% of rated voltage |
| Insulation resistance at rated voltage | 100000 M Ω or 1000 M Ω \times μ F, whichever is less at rated voltage within 2 minutes of charging |
| Temperature coefficient of the capacitance | $0 \times 10^{-6}/K$ |
| Tolerance on the temperature coefficient | $\pm 30 \times 10^{-6}/K$ |
| Dissipation factor: at 1 MHz, 1 V; where $C \leq 30$ pF at 1 kHz, 1 V; where $C > 30$ pF | $< \frac{1}{(400 + 20 \times C)}$ $< 15 \times 10^{-4}$ |
| Operating temperature range | -55 to +125 °C |
| Storage temperature range | 25 ± 15 °C |
| Capacitors with temperature coefficient X7R | |
| Capacitance range at 1 kHz, 1 V | 220 pF to 0.22 μ F |
| Tolerance on the capacitance | $\pm 10\%$; $\pm 20\%$ |
| Maximum capacitance change with respect to capacitance value at 25 °C | $\pm 15\%$ |
| Rated DC voltage | 25 V, 50 V and 100 V |
| Dielectric strength | 250% of rated voltage |
| Insulation resistance at rated voltage | 100000 M Ω or 1000 M Ω \times μ F, whichever is less at rated voltage within 2 minutes of charging |
| Dissipation factor at 1 kHz, 1 V | $\leq 2.5\%$ |
| Operating temperature range | -55 to +125 °C |
| Storage temperature range | 25 ± 15 °C |
| Ageing | typical 1% per time decade |

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| DESCRIPTION | VALUE |
|---|---|
| Capacitors with temperature coefficient Z5U | |
| Capacitance range at 1 kHz, 0.5 V | 1 000 pF to 1.00 μ F |
| Tolerance on the capacitance | $\pm 20\%$; +80%/-20% |
| Maximum capacitance change with respect to capacitance value at 25 °C | +22%/-56% |
| Rated DC voltage | 25, 50 and 100 V |
| Dielectric strength | 250% of rated voltage |
| Insulation resistance at rated voltage | 10000 $M\Omega$ or 1000 $M\Omega \times \mu$ F, whichever is less at rated voltage within 2 minutes of charging |
| Dissipation factor at 1 kHz, 0.5 V | $\leq 4\%$ |
| Operating temperature range | 10 to 85 °C |
| Storage temperature range | 25 \pm 15 °C |
| Ageing | typical 6% per time decade |
| Capacitors with temperature coefficient Y5V | |
| Capacitance range at 1 kHz, 1 V | 0.01 to 1.0 μ F |
| Tolerance on the capacitance | +80%/-20% |
| Maximum capacitance change with respect to capacitance value at 25 °C | +22%/-82% |
| Rated DC voltage | 25 V and 50 V |
| Dielectric strength | 250% of rated voltage |
| Insulation resistance at rated voltage | 10000 $M\Omega$ or 1000 $M\Omega \times \mu$ F, whichever is less at rated voltage within 2 minutes of charging |
| Dissipation factor at 1 kHz, 1 V | $\leq 5\%$ |
| Operating temperature range | -30 to +85 °C |
| Storage temperature range | 25 \pm 15 °C |
| Ageing | typical 6% per time decade |

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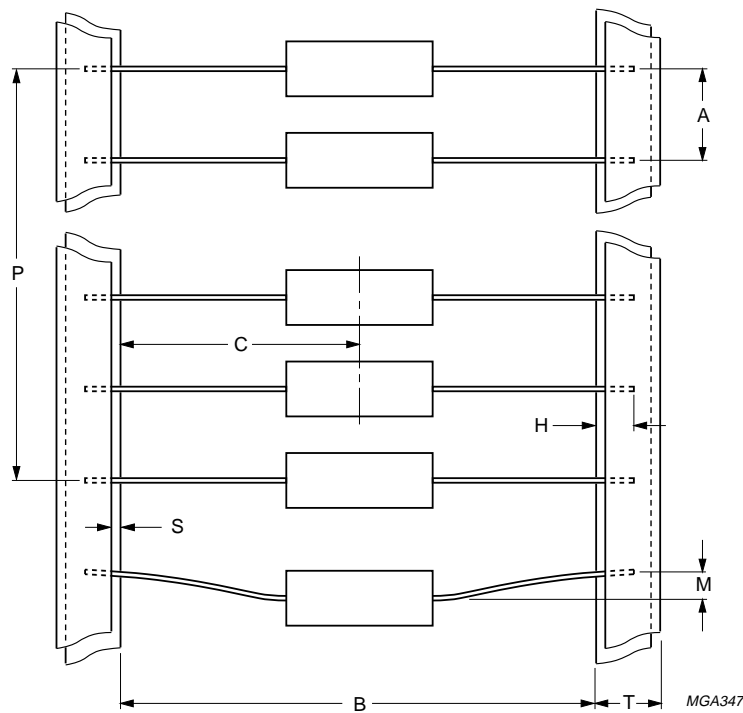
Mono-axial™ series

PACKAGING

Table 4 Packaging quantities and box dimensions; see Fig.6

| PACKAGING | SIZE CODE | SMALLEST PACKAGING QUANTITY (SPQ) | BOX DIMENSIONS L × W × H (mm) |
|--------------|-----------|-----------------------------------|-------------------------------------|
| Tape on reel | 15; 20 | 7000 | 370 × 370 × 90 |
| Ammopack | 15; 20 | 4000 | 265 × 85 × 95 |

Capacitors on bandolier



Maximum 0.1% of the total number of capacitors per reel may be missing.
 A maximum of 1 consecutive vacant position is followed by 6 consecutive components.
 Tape begins and ends with minimum of 60 empty positions (300 mm tape).
 Maximum of 5 splices per reel.
 For dimensions see Table 5.

Fig.4 Capacitors on bandolier.

Leaded ceramic multilayer capacitors

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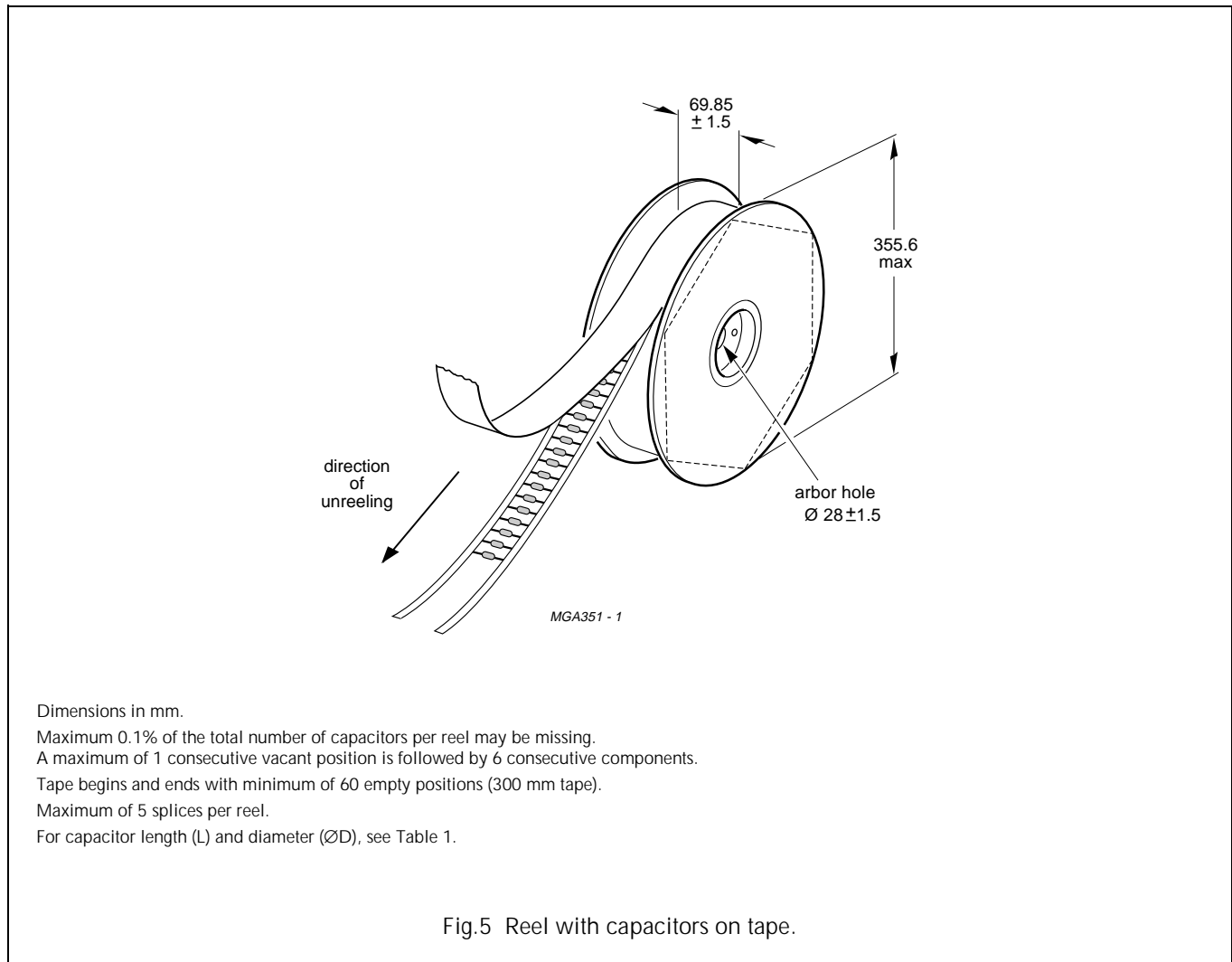
Table 5 Dimensions of bandolier: see Fig.4

| SYMBOL | PARAMETER | DIMENSIONS | |
|------------------|--|------------|--------------|
| | | mm | inch |
| B ⁽¹⁾ | inside tape spacing | 52.4 ±1.5 | 2.062 ±0.059 |
| C | centre-to-tape-spacing | ±0.8 | ±0.031 |
| P | cumulative pitch, 6 consecutive components | ±1.5 | ±0.059 |
| A | components pitch | 5 ±0.5 | 0.197 ±0.015 |
| M | lead bend | <1.2 | <0.047 |
| S | exposed adhesive | <0.51 | <0.020 |
| T | tape width | 6.35 | 0.250 |
| H | lead sandwich | >3.96 | >0.156 |

Note

1. Inside tape spacing 26.0 +1.51/−0.0 is available on request.

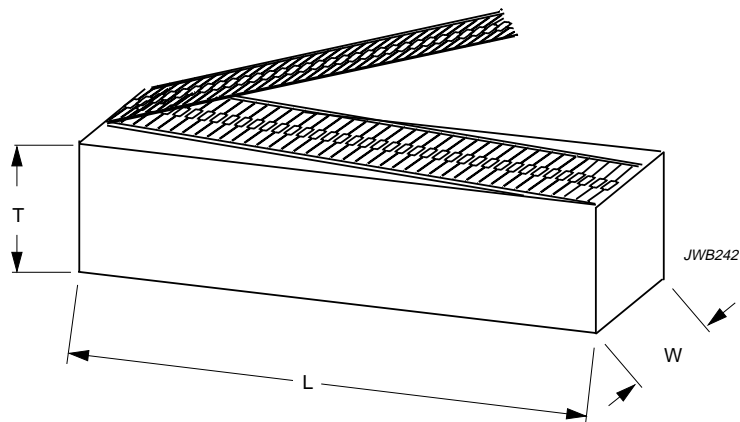
REEL DATA



Leaded ceramic multilayer capacitors

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AMMOPACK DATA



Dimensions in mm.

Maximum 0.5% of the total number of capacitors per box may be missing.

A maximum of 2 consecutive vacant positions is followed by 6 consecutive components.

Tape begins and ends with minimum of 24 empty positions (300 mm tape).

Maximum of 5 splices per box.

Cumulative pitch tolerance over 20 consecutive units not to exceed ± 1.0 mm.

Lead space (F) shall be measured at 3.6 ± 0.5 mm from the capacitor seating plane.

For dimensions see Table 4.

Fig.6 Ammopack with capacitors on tape.