■SPECIFICATIONS AND TEST METHODS

| | | | IS AND TEST WE | | | | | | |
|-----|----------------------------------|-----------------------|---|--|--|--|--|--|--|
| No. | o. Item | | Temperature Compensating Type | Specification High Dielectric Constant Type | Test Method | | | | |
| 1 | Operating Temperat | J ure Range | -55 to +125℃ | X5R: -55 to + 85°C X7R: -55 to +125°C Z5U: +10 to + 85°C Y5V: -30 to + 85°C | | | | | |
| 2 | Rated Vol | tage | See the previous pages. | | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{p,p} or V ^{O,p} , whichever is larger, shall be maintained within the rated voltage range. | | | | |
| 3 | Appearan | ice | No defects or abnormalities | es. | Visual inspection. | | | | |
| 4 | Dimensio | ns | Within the specified dimer | ision. | Using calipers. | | | | |
| 5 | Dielectric Strength | | No defects or abnormalitie | es. | No failure shall be observed when *300% of the rated voltage (C0∆ to U2J and SL) or *250% of the rated voltage (X5R, X7R, Z5U and Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V | | | | |
| 6 | Insulation (I.R.) | Resistance | More than $10,000M\Omega$ or 5 | $00Ω \cdot F$ (Whichever is smaller) | The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging. | | | | |
| 7 | Capacitar | nce | Within the specified tolera | nce. | The capacitance/Q/D.F. shall be measured at 25℃ at the | | | | |
| 8 | Q/Dissipation Factor (D.F.) | | 30pF min. : Q≧1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF) | | frequency and voltage shown in the table Char. C0Δ to U2J, SL (1000pF and below) (1000pF and below) Tequency 1±0.1MHz 1±0.1kHz 1±0.1kHz Voltage 0.5 to 5Vr.m.s. 1±0.2Vr.m.s. 0.5±0.05Vr.m.s. | | | | |
| | | Capacitance Change | Within the specified tolerance. (Table A-1) | Char. Temp. Range. Reference Temp. Cap. Change X5R -55 to + 85℃ X7R -55 to + 125℃ Within±15% X5U +10 to + 85℃ 25℃ Within±22% Y5V -30 to + 85℃ Within±22% | The capacitance change shall be measured after 5 min. at each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, (C0Δ: +25°C to +125°C; other temp. coeffs.:+25°C to +85°C) the capacitance shall be within the specified tolerance for the | | | | |
| | | Temperature | Within the specified | | temperature coefficient and capacitance change as Table A- | | | | |
| | Capacitance | Coefficient | tolerance. (Table A-1) | | The capacitance drift is calculated by dividing the differences | | | | |
| 9 | Temperature | | | | between the maximum and minimum measured values in the | | | | |
| | Characteristics | | | | step 1, 3 and 5 by the cap. value in step 3. | | | | |
| | | | | | Step Temperature (℃) 1 25±2 | | | | |
| | | | Within ±0.2% or ±0.05pF | | 2 -55±3 | | | | |
| | | | (Whichever is larger) | | 3 25±2 | | | | |
| | | Drift | *Not apply to SL/25V | | 4 125±3 (for C0∆)/85±3 (for other TC) | | | | |
| | | | | | 5 25±2 | | | | |
| | | | | | (2) High Dielectric Constant Type The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table shall be within the specified ranges. | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | I | Solder the capacitor to the test jig (glass epoxy board) shown in | | | | |
| | | | No removal of the termina | tions or other defects shall occur. | Fig. 1a using a eutectic solder. Then apply 10N* force in parallel | | | | |
| | | | | | with the test jig for 10±1 sec. | | | | |
| | | | | | The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is unifor | | | | |
| | | | | C | and free of defects such as heat shock. *5N (GRM36, GRM3 | | | | |
| 10 | Adhesive Strength of Termination | | | | Type a b c | | | | |
| 10 | | | 1/2/ 1/2/ 1/2/ | | GRM36 0.4 1.5 0.5 | | | | |
| | | | | Ø | GRM39 1.0 3.0 1.2 | | | | |
| | | | · PA PA | | GRM40 1.2 4.0 1.65 GRM42-6 2.2 5.0 2.0 | | | | |
| | | | | Solder resist | GRM42-2 2.2 5.0 2.9 | | | | |
| | | | - | Baked electrode or | GRM43-2 3.5 7.0 3.7 | | | | |
| | | | Fig | . 1a copper foil | GRM44-1 4.5 8.0 5.6 | | | | |
| | | | | | (in mm | | | | |
| | | Appearance | No defects or abnormalitie | | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly | | | | |
| | Vibration | Capacitance Q/D.F. | Within the specified tolera | | | | | | |
| | | | | Char. 25V min. 16V 10V 6.3V | | | | | |
| | | | 30pF min. : Q≧1,000 | | between the approximate limits of 10 and 55Hz. The frequency | | | | |
| 11 | Resistance | | 30pF max. : Q≥400+20C | Z5U 0.025 max. — — — | range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 minute. This motion shall be applied for a period | | | | |
| | | | C : Nominal Capacitance | 0.05 max. 0.07 max. | | | | | |
| | | | (pF) | Y5V (C<1.0μF) (C<1.0μF) 0.125 max. 0.125 max. | of 2 hours in each 3 mutually perpendicular directions (total of 6 hours). | | | | |
| | | | | 0.09 max. 0.09 max. 0.120 | | | | | |
| | | | | (0=1.0μ / (0=1.0μ / | | | | | |

| | | | | Specification | | | | | | |
|-----|---------------------------------|---|---|--|---|---|---|--|--|--|
| No. | No. Item | | Temperature Compensating Type | Test Method | | | | | | |
| | 2 Deflection | | No cracking or marking de | Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2a using a eutectic solder. Then apply a force in the direction shown in Fig.3a. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock. | | | | | | |
| 12 | | | R230 Ca 45 | Flexure : ≦1 Capacitance meter | | | a | t:1.6mm (GR b 1.5 3.0 4.0 5.0 5.0 7.0 8.0 | c 0.5 1.2 1.65 2.0 2.9 3.7 5.6 (in mm) | |
| 13 | Solderability of Termination | | 75% of the terminations is | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. | | | | | | |
| | Cap | | The measured and observe specifications in the follow No marking defects Within ±2.5% or ±0.25pF (Whichever is larger) | ed characteristics shall satisfy the ing table. X5R, X7R ······Within ±7.5% Z5U, Y5V ·····Within ±20% | Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric | | | | | |
| 14 | | 'D.F. | 30pF and over : Q≥1,000 30pF and below : Q≥400+20C C : Nominal Capacitance (pF) | Char. 25V min. 16V 10V 6.3V X5R X7R 0.025 max. 0.035 max. 0.035 max. 0.05 max. Z5U 0.025 max. — — — V5V (C<1.0μF) | • Initial measurement for high dielectric constant type Perform a heat treatment at 150 + 0 c for one hour and then lesit for 48±4 hours at room temperature. Perform the initial measurement. *Preheating for GRM42-2/43-2/44-1 Step Temperature Time 1 100 c to 120 c 1 min. | | | | | |
| | | R. electric rength | More than $10,000M\Omega$ or 50 No failure | 00Ω · F (Whichever is smaller) | 2 | 170°C to | | | min. | |
| | Temperature App Cap | 3 | The measured and observ specifications in the follow No marking defects Within ±2.5% or ±0.25pF (Whichever is larger) | ed characteristics shall satisfy the ing table. X5R, X7R ······Within ±7.5% Z5U, Y5V ·····Within ±20% | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then | | | | | |
| 15 | Q/ | /D.F. | 30pF and over : Q≥1,000 30pF and below : Q≥400+20C C : Nominal Capacitance (pF) | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | Time (min.) Initial meas Perform a he | 1 Min. Operating Temp. +3 30±3 urement for high at treatment at hours at room te | Temp. 2 to 3 h dielectric of 150 + 0 € for formula f | or one hour a | Temp. 2 to 3 | |
| | Str | R. electric rength | More than $10,000M\Omega$ or 50 No failure | 00Ω · F (Whichever is smaller) | measuremen | | | | | |
| 16 | Cap Cha | ppearance No marking defects apacitance Within $\pm 5\%$ or $\pm 0.5 pF$ (Whichever is larger) 30pF and over.: $Q \ge 350$ 10pF and over, 30pF and below: $Q \ge 275 + \frac{5}{2}C$ 10pF and below: (0.05 max) | | | Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. | | | | | |
| | I.R | ₹. | C : Nominal Capacitance (pF) | Y5V (C(1.0μF) (C(1.0μF) 0.15 max. 0.15 max. 0.15 max. (C≥1.0μF) (C≥1.0μF | | | | | | |

| No. Item Compensating Type High Dielectric Constant Type Fest Method | | | | | Specification | | | | |
|---|-----|---------------|-----------|---|---|-------------------|--|---|--|
| Specifications in the following table. Specifications in the following table. | No. | | | ' | High Dielectric | Constant | | | |
| Appearance No marking defects SFR, X7R ···· Within ±12.5% SSR, X7R ···· Within ±12.5% SSR ··· VIV max. Within ±10.0% Wi | | Humidity Load | | | | all satisfy t | | | |
| 17 | | | | • | ing table. | | · · | | |
| Capacitance Change (Whichever is targer) (Whichever is larger) (Whichever is smaller) (Whichever is larger) (Whichever is larger) (Whichever is smaller) (Whichever is smaller) | | A | ppearance | <u> </u> | | | | | |
| Change (Whichever is larger) Y5V | | | | | 1 - / | | | | |
| 17 | | | | | Y5V \begin{cases} \text{Within \begin{cases} \pm 40 \ \pm 40 \text{ (10V max.)} \\ \text{Within \pm 230 \text{ (others)}} \end{cases} | | | current is less than 50mA | |
| 17 | | | | | | | | 1 | |
| 18 | | _ | | | | | | | |
| 17 | | | | 30pF and below : Q≧100+ ¹⁰ / ₃ C | | 10V | 6.3V | 1 | |
| Appearance Capacitance Change | 17 | | | | | . 0.05 max. | 0.075 max. | · | |
| Apply 200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type. Apply 200% of the rated CD voltage for new temperature. Strength Apple and below: Apple and over: Q≥350 Charge Color max | | | | | | _ | | | |
| LR. More than 500MΩ or 25Ω · F (Whichever is smaller) | | c | Ω/D.F. | | | | - | | |
| 1.R. More than 500MΩ or 25Ω · F (Whichever is smaller) | | | | | | | 0.45 | | |
| LR. More than 500MΩ or 25Ω · F (Whichever is smaller) | | | | (pF) | 0.125 max. 0.125 ma | (. U. 15 IIIax. | 0.15 max. | | |
| Dielectric Strength No failure The measured and observed characteristics shall satisfy the specifications in the following table. Apply *200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. | | | | | (C≧1.0μF) (C≧1.0μF |) | | | |
| Dielectric Strength No failure No failure No failure The measured and observed characteristics shall satisfy the specifications in the following table. Apply *200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. | | <u> </u> | _ | | | | | | |
| Strength No failure | | | | More than 500MΩ or 25Ω | · F (Whichever is smaller) | | | | |
| High Temperature Load Appearance The measured and observed characteristics shall satisfy the specifications in the following table. Appearance No marking defects X5R, X7R - Within ±12.5% Z5U · Within ±30% (others) Change (Whichever is larger) (Whichever is larger) X5R, X7R Within ±30% (others) (Whichever is larger) (Whichever is larger | | | | No failure | | | | | |
| Load Appearance No marking defects X5R, X7R · Within ±12.5% Z5U · Within ±30% (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. Charge Soperand over, : Q≥350 (10pF and over, : Q≥275 + 5/2 (10pF and below : Q≥275 + 5/2 (10pF and below : Q≥200+10C (c) Nominal Capacitance (pF) C21.0µF C21 | | | | The measured and observ | red characteristics sha | all satisfy t | he | Apply *200% of the rated voltage for 1,000±12 hours at the | |
| $ \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | | | specifications in the follow | ing table. | • | maximum operating temperature ±3°C. Let sit for 24±2 hours | | |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | | A | ppearance | No marking defects | | | | (temperature compensating type) or 48±4 hours (high dielectric | |
| The content of the c | | | | , | | | | | |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$ | | | | | | | | | |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$ | | | | (Whichever is larger) Y5V · . { Within ±30% (others) | | | | | |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$ | | _ | | | VVithin —40% (10V max. and cap.≧1.0μF) | | | , | |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$ | | | Q/D.F. | 30pF and over. : Q≥350 | | 10V | 6.3V | ''' | |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 18 | | | 30pF and below: | 1 1 0 04 max 1 0 05 max | . 0.05 max. | 0.075 max. | | |
| Q/D.F. 10pF and below : Q≥200+10C | .0 | | | | | | | 102 - 1104 O at 10011 temperaturer i circini ililia ililoada emen | |
| $ \begin{array}{ c c c c c c }\hline & \text{lof aid below }. \\ \hline & Q \geq 200 + 10C \\ \hline & C: \text{Nominal Capacitance} \\ \hline & (pF) \\ \hline \\ \hline & I.R. & \text{More than } 1,000\text{M}\Omega \text{ or } 50\Omega \cdot F \text{ (Whichever is smaller)} \\ \hline & Dielectric \\ \hline & Strength \\ \hline \end{array} $ | | c | | | | + | | *150% for 500V | |
| $ \begin{array}{c c} \hline & C: Nominal Capacitance \\ (pF) \\ \hline \hline I.R. & More than 1,000M\Omega or 50\Omega \cdot F \text{ (Whichever is smaller)} \\ \hline Dielectric \\ Strength \\ \hline \end{array} $ | | | | ' | (O <4 O · F) (O <4 O · F | Λ I | | | |
| $ \begin{array}{ c c c c c c }\hline & (pF) & & & & & & & & \\\hline I.R. & & More than 1,000M\Omega \text{ or } 50\Omega \cdot F \text{ (Whichever is smaller)} \\\hline Dielectric & Strength & No failure & & & & & \\\hline \end{array} $ | | | | | | | 0.15 max. | | |
| I.R. More than 1,000MΩ or 50Ω · F (Whichever is smaller) Dielectric Strength No failure | | | | · | (C≧1.0μF) (C≧1.0μF |) | | | |
| Dielectric Strength No failure | | 1. | .R. | More than 1 000MQ or 50 | O · F (Whichever is sr | naller) | | | |
| | | | | | | | | | |
| 117 Notice Million meaning depended of ood viriated voltage, perform the opensy resin coating (million from the thick less) | 19 | | | | | | | resin coating (min. 1.0mm thickness) | |

Table A-1

| | Nominal Values (ppm/℃) Note 1 | Capacitance Change from 25℃ (%) | | | | | | | |
|-------|----------------------------------|---------------------------------|-------|------|-------|------|-------|--|--|
| Char. | | -5 5 | | -30 | | -10 | | | |
| | | Max. | Min. | Max. | Min. | Max. | Min. | | |
| COG | 0± 30 | 0.58 | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 | | |
| C0H | 0± 60 | 0.87 | -0.48 | 0.59 | -0.33 | 0.38 | -0.21 | | |
| P2H | -150± 60 | 2.33 | 0.72 | 1.61 | 0.50 | 1.02 | 0.32 | | |
| R2H | -220± 60 | 3.02 | 1.28 | 2.08 | 0.88 | 1.32 | 0.56 | | |
| S2H | -330± 60 | 4.09 | 2.16 | 2.81 | 1.49 | 1.79 | 0.95 | | |
| T2H | -470± 60 | 5.46 | 3.28 | 3.75 | 2.26 | 2.39 | 1.44 | | |
| U2J | -750±120 | 8.78 | 5.04 | 6.04 | 3.47 | 3.84 | 2.21 | | |
| SL | -350 to 1,000 | _ | _ | _ | _ | _ | _ | | |

Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃ (for C0∆)/85℃ (for other TC).