



MONOLITHIC CERAMIC CAPACITOR



GRM Series for General Electronic Equipment

FEATURES

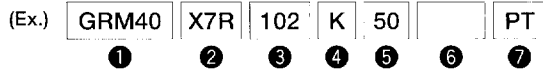
1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0Δ to Y5V.
3. A wide selection of sizes is available, from the miniature GRM36 (L×W×T : 1.0×0.5×0.5mm) to the larger sized GRM44-1 (L×W×T : 5.7×5.0×2.0mm).
GRM39, GRM40 and GRM42-6 types are suited to flow and reflow soldering.
GRM36, GRM42-2 and larger types are suited to reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
5. The GRM series is available in both paper and plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available. (GRM 36, GRM39, GRM40 (T : 0.6, 1.25))

APPLICATION

General electronic equipment.

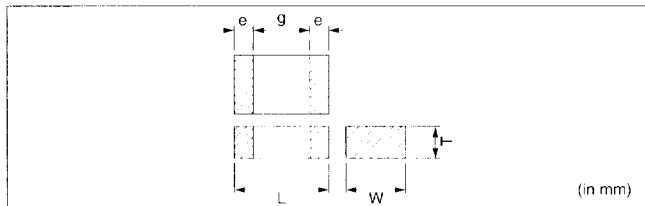
PART NUMBERING

(*Please specify the part number when ordering)



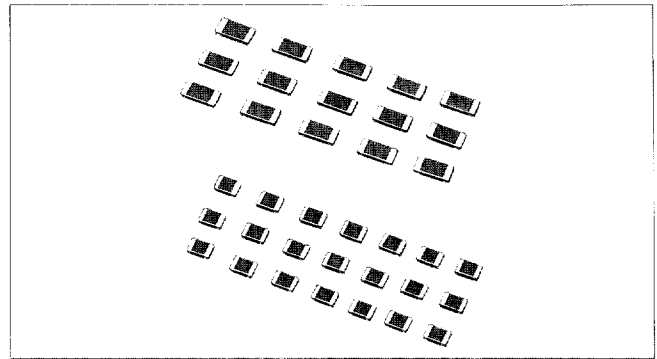
- ① Type
- ② Temperature Characteristics
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging

TYPE AND DIMENSIONS



Type (EIA Code)	L	W	T	e	g min.
GRM36 (0402)	1.0±0.05	0.5±0.05	0.5±0.05	0.15 to 0.3	0.4
GRM39* (0603)	1.6±0.1	0.8±0.1	0.8±0.1	0.2 to 0.5	0.5
GRM40 (0805)	2.0±0.1	1.25±0.1	0.6±0.1	0.2 to 0.7	0.7
			0.85±0.1		
GRM42-6 (1206)	3.2±0.15	1.6±0.15	1.15±0.1	0.3 to 0.8	1.5
			1.6±0.2		
GRM42-2 (1210)	3.2±0.3	2.5±0.2	0.85±0.1	0.3 min.	1.0
			1.15±0.1		
			1.35±0.15		
			1.8±0.2		
GRM43-2 (1812)	4.5±0.4	3.2±0.3	2.0 max.	0.3 min.	2.0
GRM44-1 (2220)	5.7±0.4	5.0±0.4	2.0 max.	0.3 min.	2.0

*Bulk case packaging is L=1.6±0.07, W,T=0.8±0.07



TEMPERATURE CHARACTERISTICS

Temperature Compensating Type

Code	C0G	C0H	P2H	R2H	S2H	T2H	U2J	SL
Temp. range	-55 to +125°C		-55 to +85°C					
Temp. coeff. (ppm/°C)	0±30	0±60	-150±60	-220±60	-330±60	-470±60	-750±120	+350 to -1000

High Dielectric Constant Type

Code	X5R	X7R	Z5U	Y5V
Temp. range	-55 to +85°C		+10 to +85°C	-30 to +85°C
Cap. change (%)	±15	±15	+22 -56	+22 -82

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	100	10
R75	0.75	101	100
010	1	103	10,000

CAPACITANCE TOLERANCE

Code	Tol.	Capacitance range
C	±0.25pF	10pF and below
D	±0.5 pF	
J	±5%	
K	±10%	More than 10pF
M	±20%	
Z	+80, -20%	

RATED VOLTAGE

Code	DC Rated voltage (V)
6.3	6.3
10	10
16	16
25	25
50	50
100	100
200	200
500	500

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging
PC	Bulk case packaging

CAPACITANCE RANGE TABLE FOR FLOW AND REFLOW SOLDERING

Temperature Compensating Type 50V/25V

Type (EIA Code) Char.	GRM36 (0402)				GRM39 (0603)								
	C0G		SL		C0G	C0H	P2H	R2H	S2H	T2H	U2J	SL	
Volt.	50	25	50	25	50	25	50	50	50	50	50	50	25
Cap. (pF)													
0.5													
0.75													
1													
1.5													
2													
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750													
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7,500													
8,200													
9,100													
10,000													
11,000													
12,000													
13,000													
15,000													
16,000													

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*1	Bulk Case (pcs./case)
GRM36	□ : 0.5±0.05	1,000	10,000	50,000
GRM39	□ : 0.8±0.1*2	1,000	4,000	15,000

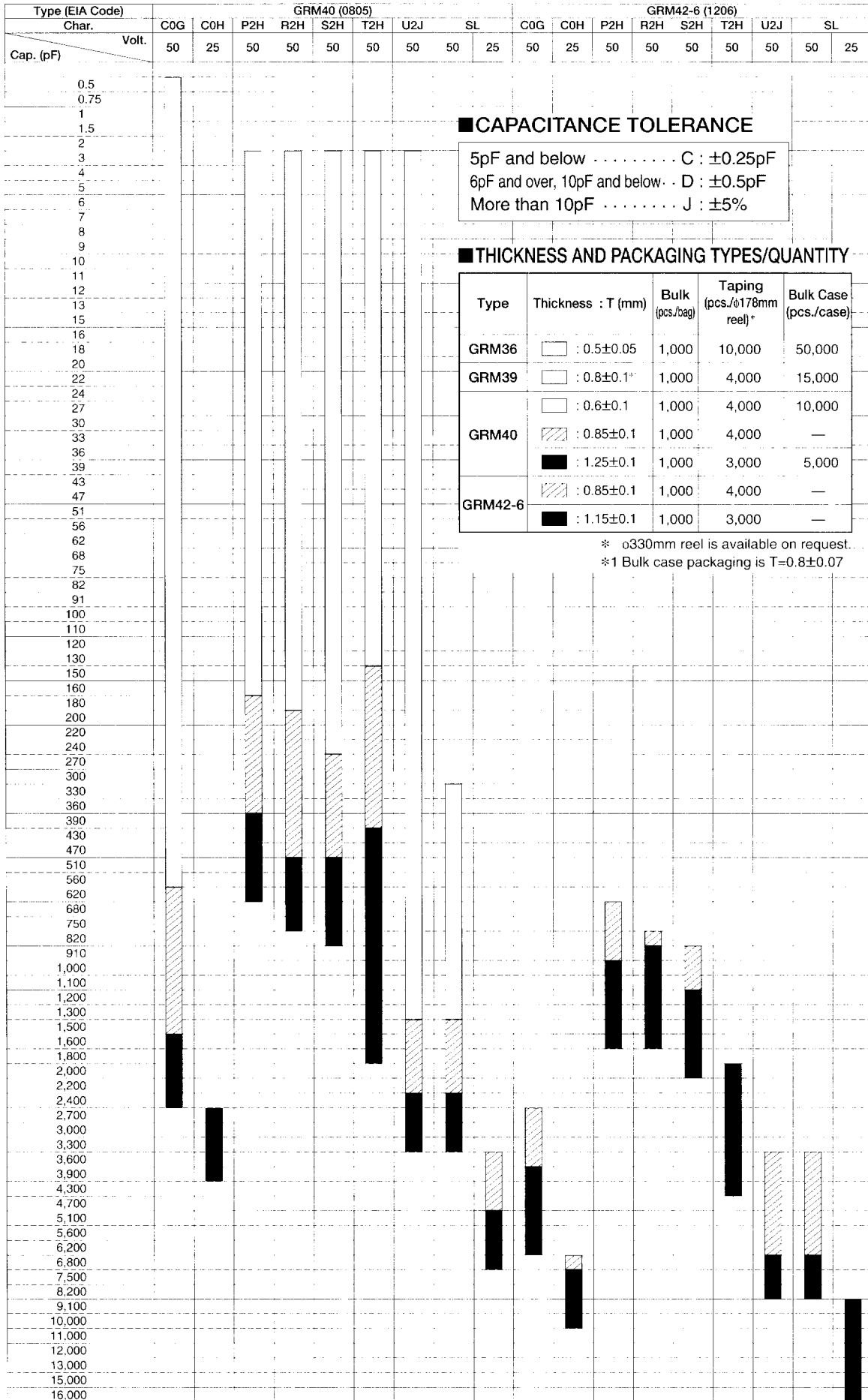
*1 φ330mm reel is available on request.
*2 Bulk case packaging is T=0.8±0.07

CAPACITANCE TOLERANCE

5pF and below C : ±0.25pF
6pF and over, 10pF and below . . . D : ±0.5pF
More than 10pF J : ±5%

*GRM36 is suited to only reflow soldering.

CAPACITANCE RANGE TABLE
FOR FLOW AND REFLOW SOLDERING
Temperature Compensating Type 50V/25V



■ CAPACITANCE TOLERANCE

5pF and below C : ±0.25pF
 6pF and over, 10pF and below . . D : ±0.5pF
 More than 10pF J : ±5%

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ø178mm reel)*	Bulk Case (pcs./case)
GRM36	□ : 0.5±0.05	1,000	10,000	50,000
GRM39	□ : 0.8±0.1*	1,000	4,000	15,000
GRM40	□ : 0.6±0.1	1,000	4,000	10,000
	▨ : 0.85±0.1	1,000	4,000	—
GRM42-6	■ : 1.25±0.1	1,000	3,000	5,000
	▨ : 0.85±0.1	1,000	4,000	—
GRM42-6	■ : 1.15±0.1	1,000	3,000	—

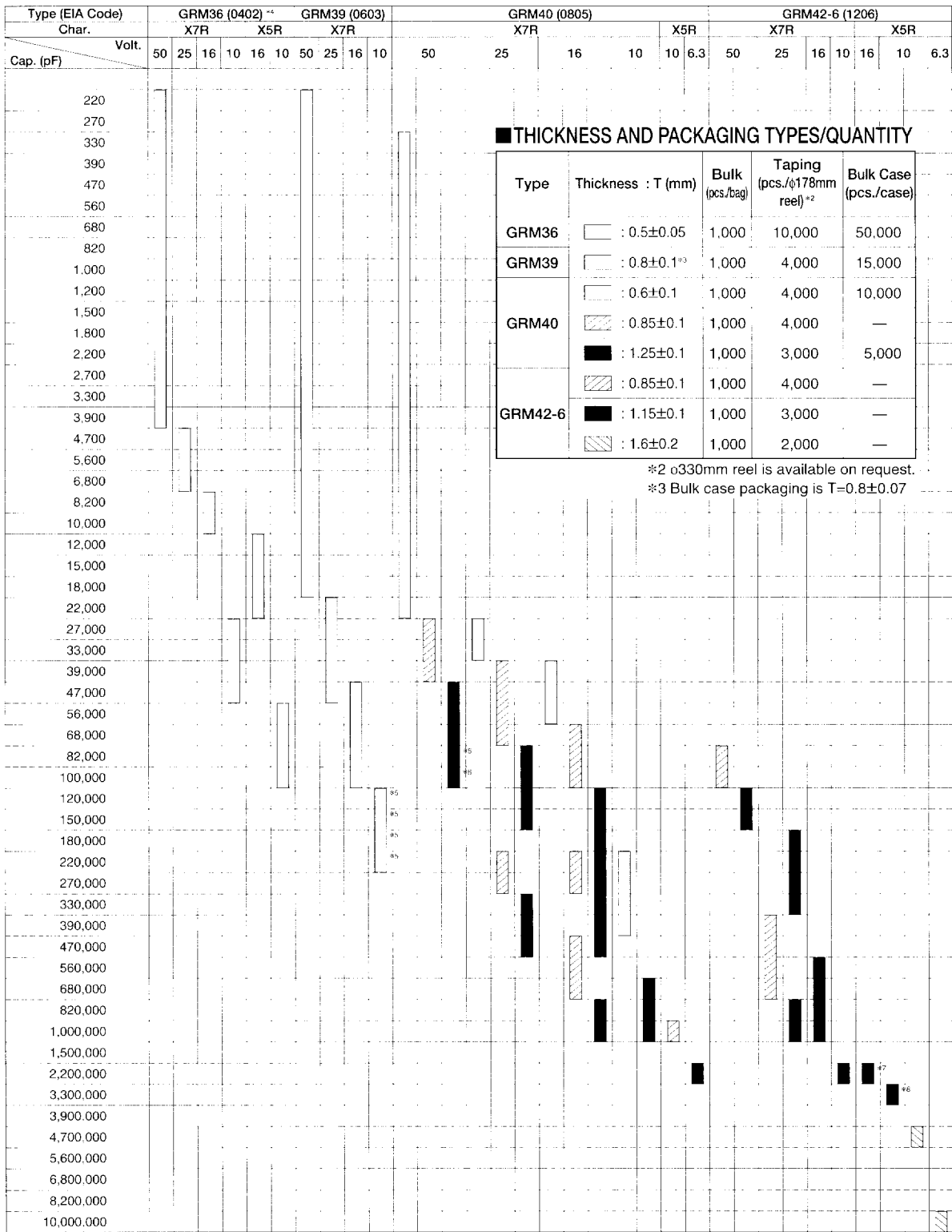
* ø330mm reel is available on request.
 *1 Bulk case packaging is T=0.8±0.07

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FOR FLOW AND REFLOW SOLDERING

High Dielectric Constant Type 50V/25V/16V/10V/6.3V Char. X7R/X5R

1



- *4 GRM36 series is suited to only reflow soldering.
- *5 Only for taping
- *6 Type : GRM40-034 (L : 2±0.15, W : 1.25±0.15, T : 1.25±0.15)
- *7 L : 3.2±0.2, W : 1.6±0.2, T : 1.15±0.15
- *8 Type : GRM42-631 (L : 3.2±0.2, W : 1.6±0.2, T : 1.3^{+0.0}-0.2)

CAPACITANCE TOLERANCE

X7R/X5R Characteristics
 K : ±10% (E12 Series)
 M : ±20% (E6 Series)

FOR FLOW AND REFLOW SOLDERING

High Dielectric Constant Type 50V Char. Z5U

Type (EIA Code)	GRM39 (0603)	GRM40 (0805)	GRM42-6 (1206)
Char.	Z5U	Z5U	Z5U
Volt.	50	50	50
Cap. (pF)	50	50	50
1,500			
2,200			
3,300			
4,700			
6,800			
10,000			
15,000			
22,000			
33,000			
47,000			
68,000			
100,000			
150,000			
220,000			

* T : 0.85mm is also available.







■ CAPACITANCE TOLERANCE

Z5U Characteristics

M: $\pm 20\%$ (E6 Series)

Z: $\pm 20\%$ (E6 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ $\phi 178$ mm reel)*	Bulk Case (pcs./case)
GRM39	 : 0.8 \pm 0.1**	1,000	4,000	15,000
	 : 0.6 \pm 0.1	1,000	4,000	10,000
GRM40	 : 0.85 \pm 0.1	1,000	4,000	—
	 : 1.25 \pm 0.1	1,000	3,000	5,000
GRM42-6	 : 0.85 \pm 0.1	1,000	4,000	—
	 : 1.15 \pm 0.1	1,000	3,000	—

* $\phi 330$ mm reel is available on request.

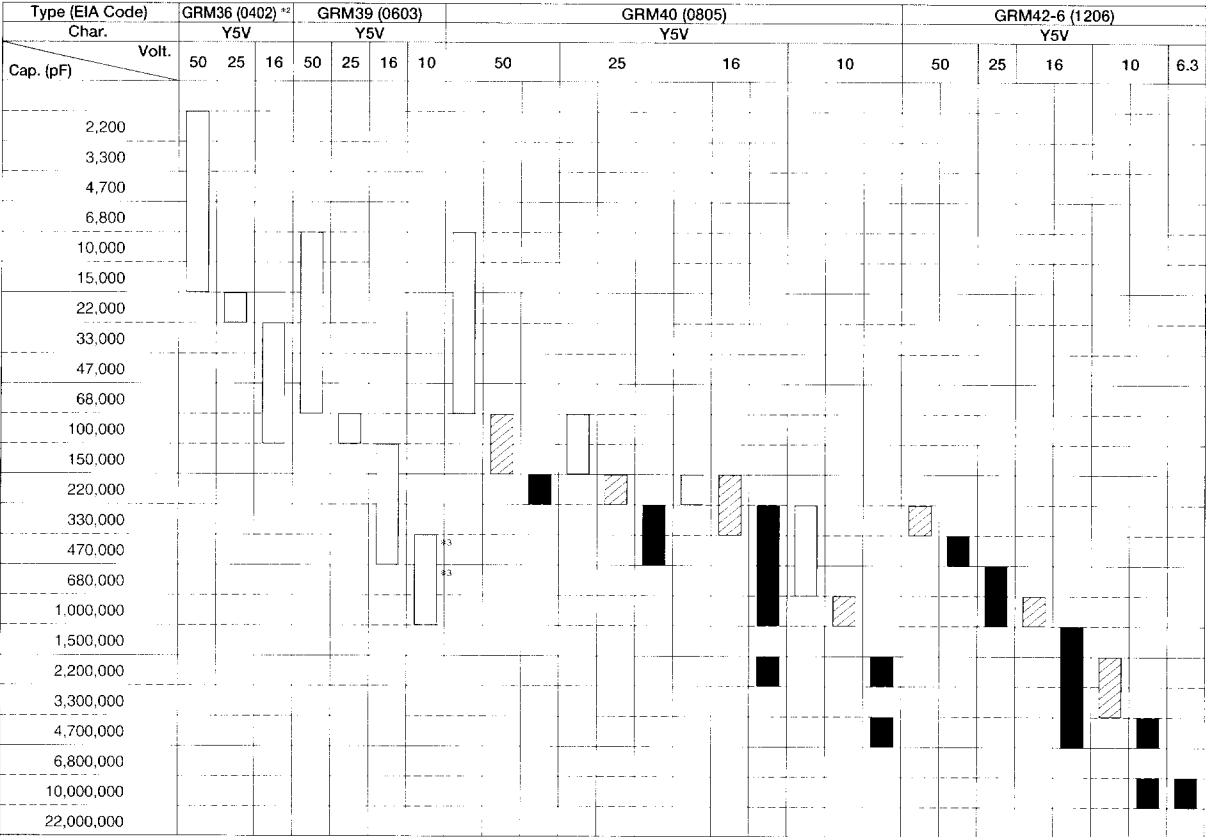
*1 Bulk case packaging is T=0.8 \pm 0.07

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FOR FLOW AND REFLOW SOLDERING

High Dielectric Constant Type 50V/25V/16V/10V/6.3V Char. Y5V

1



*2 GRM36 series is suited to only reflow soldering.
*3 Only for taping

■CAPACITANCE TOLERANCE

Y5V Characteristics
Z : $\pm 8\%$ (E6 Series)

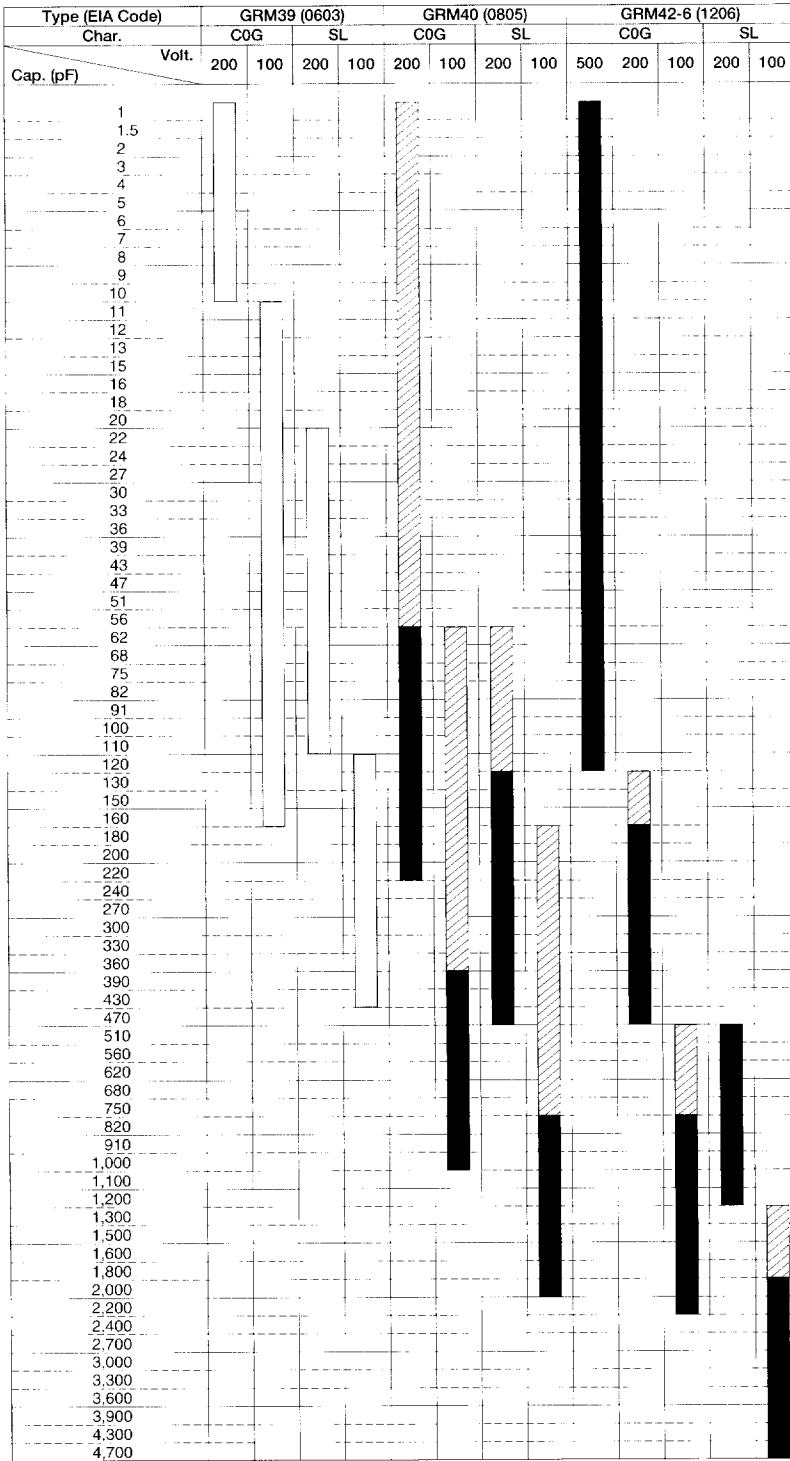
■THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) ^{*4}	Bulk Case (pcs./case)
GRM36	□ : 0.5±0.05	1,000	10,000	50,000
GRM39	□ : 0.8±0.1 ^{*5}	1,000	4,000	15,000
GRM40	□ : 0.6±0.1	1,000	4,000	10,000
	▨ : 0.85±0.1	1,000	4,000	—
GRM42-6	■ : 1.25±0.1	1,000	3,000	5,000
	▨ : 0.85±0.1	1,000	4,000	—
	■ : 1.15±0.1	1,000	3,000	—

*4 φ330mm reel is available on request.
*5 Bulk case packaging is T=0.8±0.07

FOR FLOW AND REFLOW SOLDERING

Temperature Compensating Type 500V/200V/100V



■ CAPACITANCE TOLERANCE

C0G/SL Characteristics

C : $\pm 0.25\text{pF} \dots 5\text{pF}$ and below

D : $\pm 0.5\text{pF} \dots 6\text{pF} \leq \text{cap.} \leq 10\text{pF}$

J : $\pm 5\% \dots \dots$ More than 10pF

■ THICKNESS AND PACKAGING TYPES/QUANTITY

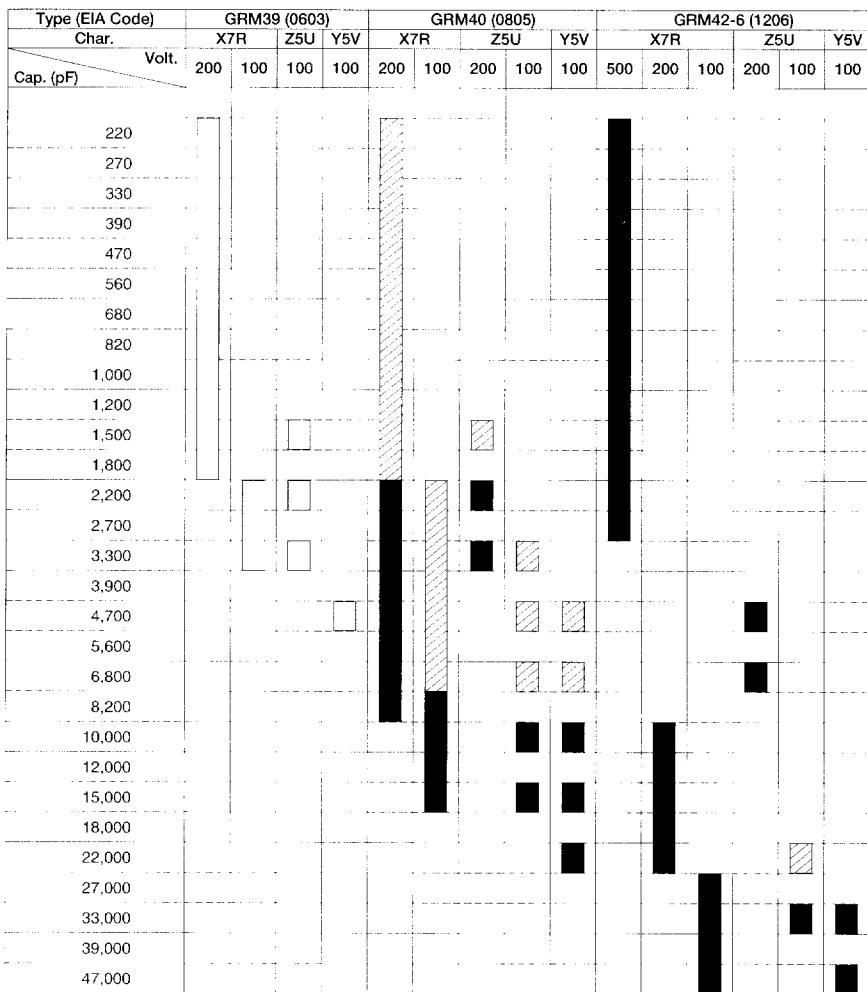
Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ $\phi 178\text{mm}$ reel)*
GRM39	□ : 0.8 ± 0.1	1,000	4,000
GRM40	▨ : 0.85 ± 0.1	1,000	4,000
	■ : 1.25 ± 0.1	1,000	3,000
GRM42-6	▨ : 0.85 ± 0.1	1,000	4,000
	■ : 1.15 ± 0.1	1,000	3,000

* $\phi 330\text{mm}$ reel is available on request.

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FOR FLOW AND REFLOW SOLDERING

High Dielectric Constant Type 500V/200V/100V



■ CAPACITANCE TOLERANCE

X7R Characteristics

K : ±10% (E12 Series)

M : ±20% (E6 Series)

Z5U Characteristics

M : ±20% (E6 Series)

Z : ±80% (E6 Series)

Y5V Characteristics

Z : ±80% (E6 Series)

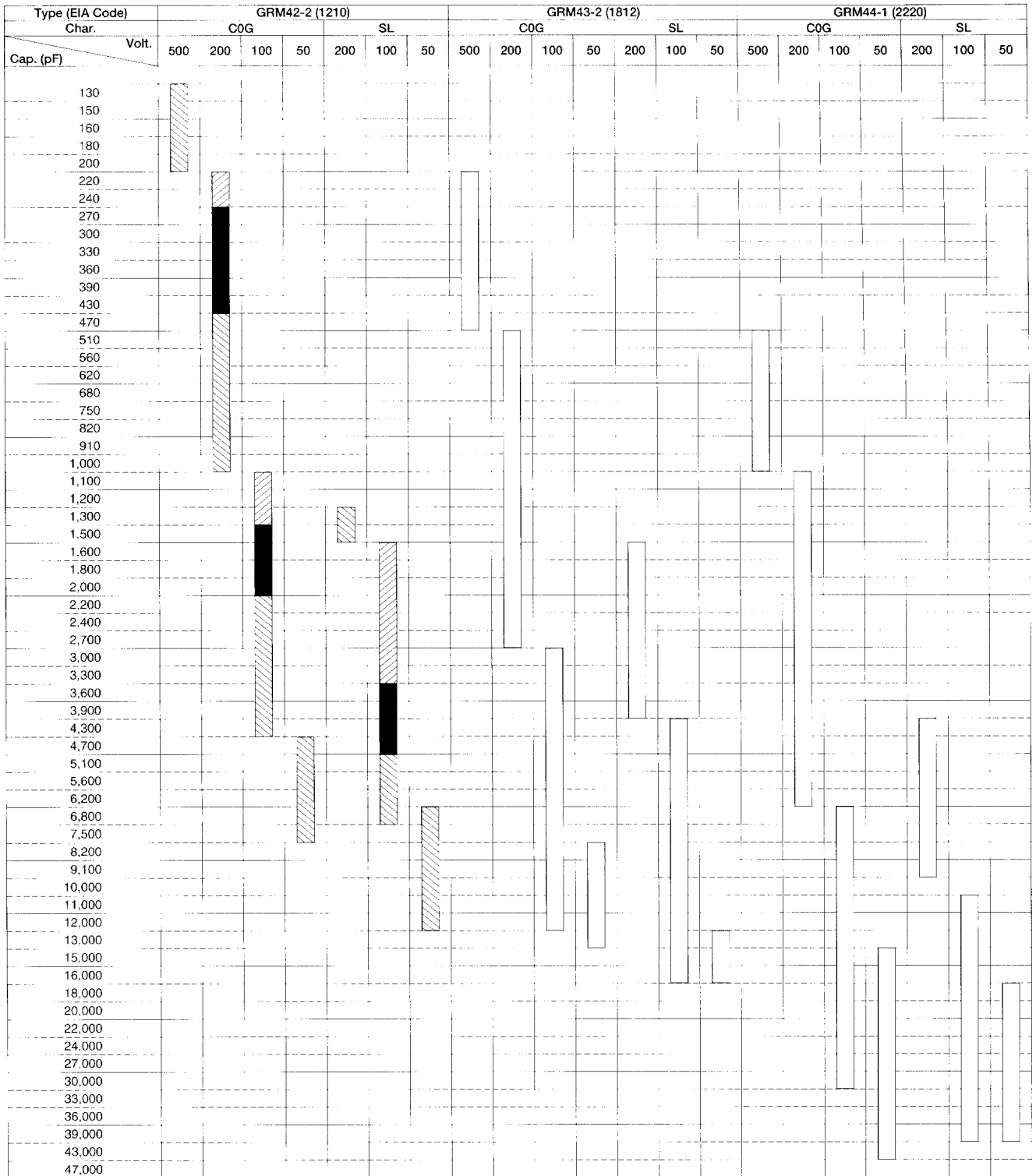
■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*1
GRM39	□ : 0.8±0.1	1,000	4,000
	▨ : 0.85±0.1	1,000	4,000
GRM40	■ : 1.25±0.1	1,000	3,000
	▨ : 0.85±0.1	1,000	4,000
GRM42-6	■ : 1.15±0.1	1,000	3,000

*1 φ330mm reel is available on request.

FOR REFLOW SOLDERING

Temperature Compensating Type 500V/200V/100V/50V



■ CAPACITANCE TOLERANCE

COG/SL Characteristics
J : ±5% (E24 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

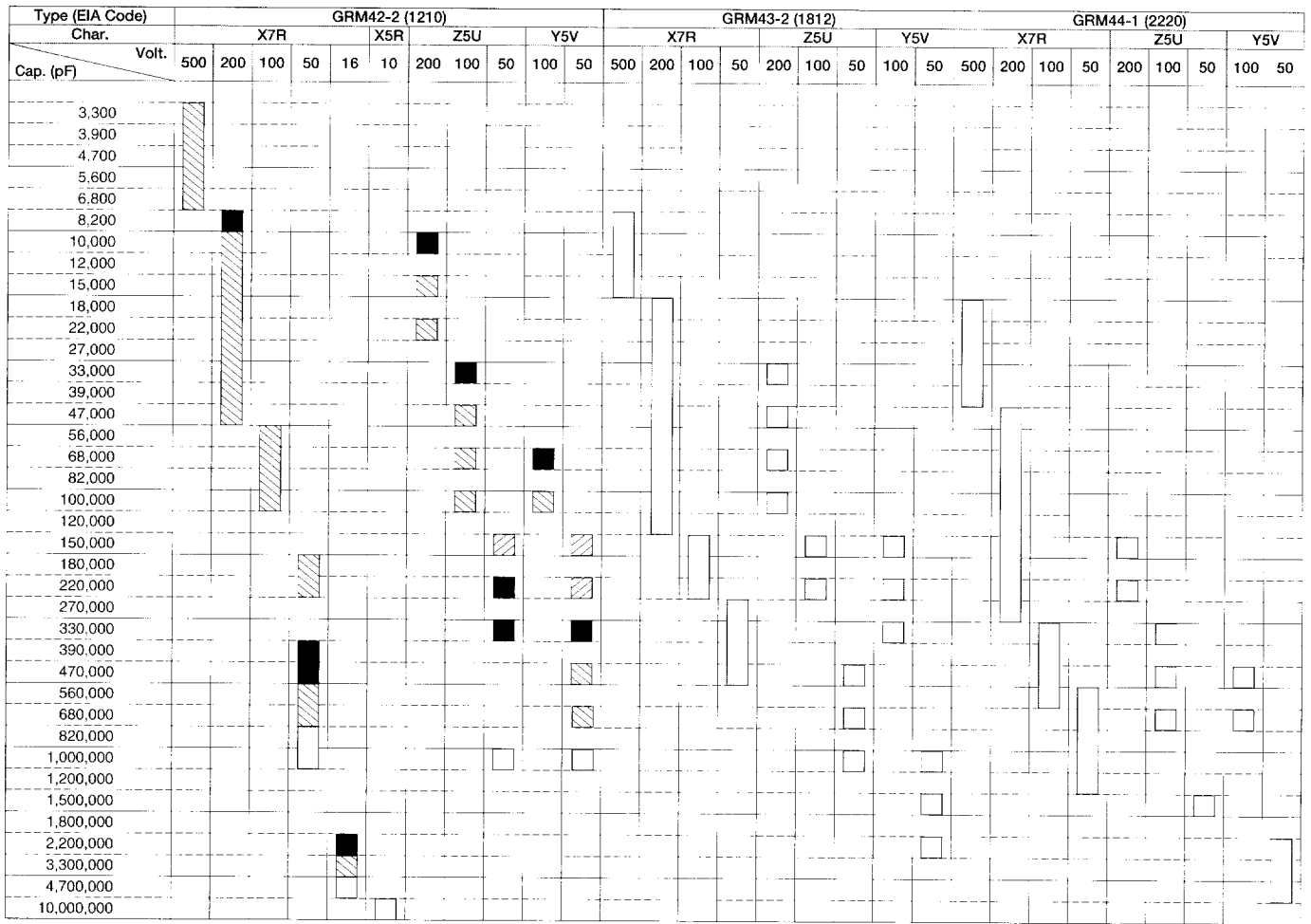
Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GRM42-2	: 0.85±0.1	1,000	4,000
	: 1.15±0.1	1,000	3,000
	: 1.35±0.15	1,000	2,000
GRM43-2	: 2.0 max.	1,000	1,000
GRM44-1	: 2.0 max.	1,000	1,000

* φ330mm reel is available on request.

FOR REFLOW SOLDERING

High Dielectric Constant Type 500V/200V/100V/50V/16V/10V

1



■ CAPACITANCE TOLERANCE

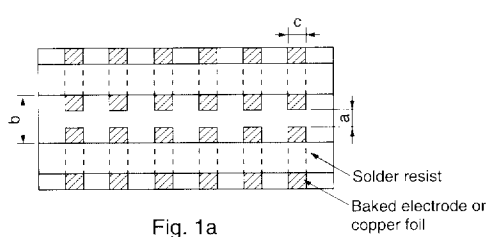
X7R/X5R Characteristics
K : ±10% (E12 Series)
M : ±20% (E6 Series)
Z5U Characteristics
M : ±20% (E6 Series)
Z : ±20% (E6 Series)
Y5V Characteristics
Z : ±20% (E6 Series)

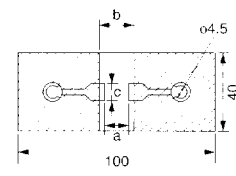
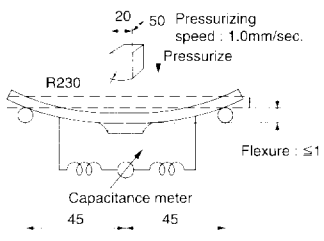
■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) *1
GRM42-2	: 0.85±0.1	1,000	4,000
	: 1.15±0.1	1,000	3,000
	: 1.35±0.15	1,000	2,000
	: 1.8±0.2	1,000	1,000
	: 2.5±0.2	1,000	1,000
GRM43-2	: 2.0 max.	1,000	1,000
GRM44-1	: 2.0 max.	1,000	1,000

*1 φ330mm reel is available on request.

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification		Test Method																																					
		Temperature Compensating Type	High Dielectric Constant Type																																						
1	Operating Temperature Range	-55 to +125°C	X5R : -55 to + 85°C X7R : -55 to +125°C Z5U : +10 to + 85°C Y5V : -30 to + 85°C																																						
2	Rated Voltage	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} or V^{D} , whichever is larger, shall be maintained within the rated voltage range.																																					
3	Appearance	No defects or abnormalities.		Visual inspection.																																					
4	Dimensions	Within the specified dimension.		Using calipers.																																					
5	Dielectric Strength	No defects or abnormalities.		No failure shall be observed when *300% of the rated voltage (C0A 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 Resistance (I.R.)	More than 10.000MΩ or 500Ω · 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	Capacitance	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 25°C at the frequency and voltage shown in the table																																					
8	Q/Dissipation Factor (D.F.)	30pF min. : $Q \geq 1,000$ 30pF max. : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> </thead> <tbody> <tr> <td>X5R</td> <td>0.025 max.</td> <td>0.035 max.</td> <td>0.035 max.</td> <td>0.05 max.</td> </tr> <tr> <td>X7R</td> <td>0.025 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max. ($C < 1.0\mu\text{F}$) 0.09 max. ($C \geq 1.0\mu\text{F}$)</td> <td>0.125 max.</td> <td>0.125 max.</td> </tr> </tbody> </table>	Char.	25V min.	16V	10V	6.3V	X5R	0.025 max.	0.035 max.	0.035 max.	0.05 max.	X7R	0.025 max.	—	—	—	Z5U	0.025 max.	—	—	—	Y5V	0.05 max.	0.07 max. ($C < 1.0\mu\text{F}$) 0.09 max. ($C \geq 1.0\mu\text{F}$)	0.125 max.	0.125 max.	<table border="1"> <thead> <tr> <th>Char.</th> <th>C0A to U2J, SL (1000pF and below)</th> <th>C0A to U2J, SL (more than 1000pF) X5R, X7R, Y5V</th> <th>Z5U</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vr.m.s.</td> <td>1±0.2Vr.m.s.</td> <td>0.5±0.05Vr.m.s.</td> </tr> </tbody> </table>	Char.	C0A to U2J, SL (1000pF and below)	C0A to U2J, SL (more than 1000pF) X5R, X7R, Y5V	Z5U	Frequency	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.
			Char.	25V min.	16V	10V	6.3V																																		
X5R	0.025 max.	0.035 max.	0.035 max.	0.05 max.																																					
X7R	0.025 max.	—	—	—																																					
Z5U	0.025 max.	—	—	—																																					
Y5V	0.05 max.	0.07 max. ($C < 1.0\mu\text{F}$) 0.09 max. ($C \geq 1.0\mu\text{F}$)	0.125 max.	0.125 max.																																					
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Frequency	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.																																						
9	Capacitance Temperature Characteristics	Capacitance Change Temperature Coefficient Capacitance Drift	<table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range.</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X5R</td> <td>-55 to + 85°C</td> <td rowspan="4">25°C</td> <td>Within±15%</td> </tr> <tr> <td>X7R</td> <td>-55 to +125°C</td> <td>Within +22% -56%</td> </tr> <tr> <td>Z5U</td> <td>+10 to + 85°C</td> <td>Within -82%</td> </tr> <tr> <td>Y5V</td> <td>-30 to + 85°C</td> <td>Within -82%</td> </tr> </tbody> </table>	Char.	Temp. Range.	Reference Temp.	Cap. Change	X5R	-55 to + 85°C	25°C	Within±15%	X7R	-55 to +125°C	Within +22% -56%	Z5U	+10 to + 85°C	Within -82%	Y5V	-30 to + 85°C	Within -82%	<p>The capacitance change shall be measured after 5 min. at each specified temperature stage.</p> <p>(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, (C0A: +25°C to +125°C ; other temp. coeffs.:+25°C to +85°C) the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3 (for C0A)/85±3 (for other TC)</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>(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.</p>	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3 (for C0A)/85±3 (for other TC)	5	25±2								
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10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.	 <p>Fig. 1a</p>	<p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using a eutectic solder. Then apply 10N force in parallel with the test jig for 10±1 sec.</p> <p>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. *5N (GRM36, GRM39)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM36</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM39</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM42-2</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43-2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM44-1</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM36	0.4	1.5	0.5	GRM39	1.0	3.0	1.2	GRM40	1.2	4.0	1.65	GRM42-6	2.2	5.0	2.0	GRM42-2	2.2	5.0	2.9	GRM43-2	3.5	7.0	3.7	GRM44-1	4.5	8.0	5.6					
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11	Vibration Resistance	Appearance Capacitance	<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> </thead> <tbody> <tr> <td>X5R</td> <td>0.025 max.</td> <td>0.035 max.</td> <td>0.035 max.</td> <td>0.05 max.</td> </tr> <tr> <td>X7R</td> <td>0.025 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max. ($C < 1.0\mu\text{F}$) 0.09 max. ($C \geq 1.0\mu\text{F}$)</td> <td>0.125 max.</td> <td>0.125 max.</td> </tr> </tbody> </table>	Char.	25V min.	16V	10V	6.3V	X5R	0.025 max.	0.035 max.	0.035 max.	0.05 max.	X7R	0.025 max.	—	—	—	Z5U	0.025 max.	—	—	—	Y5V	0.05 max.	0.07 max. ($C < 1.0\mu\text{F}$) 0.09 max. ($C \geq 1.0\mu\text{F}$)	0.125 max.	0.125 max.	<p>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 between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</p>												
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		Temperature Compensating Type	High Dielectric Constant Type																																	
12	Deflection	No cracking or marking defects shall occur.		<p>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.</p>  <p>Fig. 2a</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM36</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM39</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM42-2</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43-2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM44-1</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM36	0.4	1.5	0.5	GRM39	1.0	3.0	1.2	GRM40	1.2	4.0	1.65	GRM42-6	2.2	5.0	2.0	GRM42-2	2.2	5.0	2.9	GRM43-2	3.5	7.0	3.7	GRM44-1	4.5	8.0	5.6
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13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.		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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C.																																
14	Resistance to Soldering Heat	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>Preheat the capacitor at 120 to 150°C* for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.</p> <p>*Initial measurement for high dielectric constant type Perform a heat treatment at 150 ± 10 °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p> <p>*Preheating for GRM42-2/43-2/44-1</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100°C to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170°C to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.																							
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15	Temperature Cycle	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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 measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. ±3</td> <td>Room Temp.</td> <td>Max. Operating Temp. ±3</td> <td>Room Temp.</td> </tr> <tr> <td>Time (min.)</td> <td>30±3</td> <td>2 to 3</td> <td>30±3</td> <td>2 to 3</td> </tr> </tbody> </table> <p>*Initial measurement for high dielectric constant type Perform a heat treatment at 150 ± 10 °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. ±3	Room Temp.	Max. Operating Temp. ±3	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3																	
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16	Humidity, Steady State	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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.</p>																																
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17	Humidity Load	The measured and observed characteristics shall satisfy the specifications in the following table.				<p>Apply the rated voltage 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. The charge/discharge current is less than 50mA..</p> <p>•Initial measurement for Y5V/10V max. Apply the rated DC voltage for 1 hour at 40±20°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.</p>																									
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18	High Temperature Load	The measured and observed characteristics shall satisfy the specifications in the following table.				<p>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.</p> <p>•Initial measurement for high dielectric constant type. Apply *200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.</p> <p>*150% for 500V</p>																									
	Appearance	No marking defects																													
	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X5R, X7R ... Within ±12.5%	Z5U ... Within ±30%	Y5V ... (Within ±30% (cap.<1.0μF) Within $\pm 30\%$ (cap.≥1.0μF)																										
	Q/D.F.	30pF and over.: Q≥350 10pF and over.: Q≥275+ $\frac{5}{2}$ C 10pF and below.: Q≥200+10C C: Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> </thead> <tbody> <tr> <td>X5R</td> <td>0.04 max.</td> <td>0.05 max.</td> <td>0.05 max.</td> <td>0.075 max.</td> </tr> <tr> <td>X7R</td> <td>0.04 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Z5U</td> <td>0.04 max.</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)</td> <td>0.15 max.</td> <td>0.15 max.</td> </tr> </tbody> </table>				Char.	25V min.	16V	10V	6.3V	X5R	0.04 max.	0.05 max.	0.05 max.	0.075 max.	X7R	0.04 max.	—	—	—	Z5U	0.04 max.	—	—	—	Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	0.15 max.
	Char.	25V min.	16V	10V	6.3V																										
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Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	0.15 max.																											
I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)																														
Dielectric Strength	No failure																														
19	Notice	When mounting capacitor of 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness)																													

Table A-1

Char.	Temp. Coeff. (ppm/°C) Note 1	Capacitance Change from 25°C (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	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	—	—	—	—	—	—

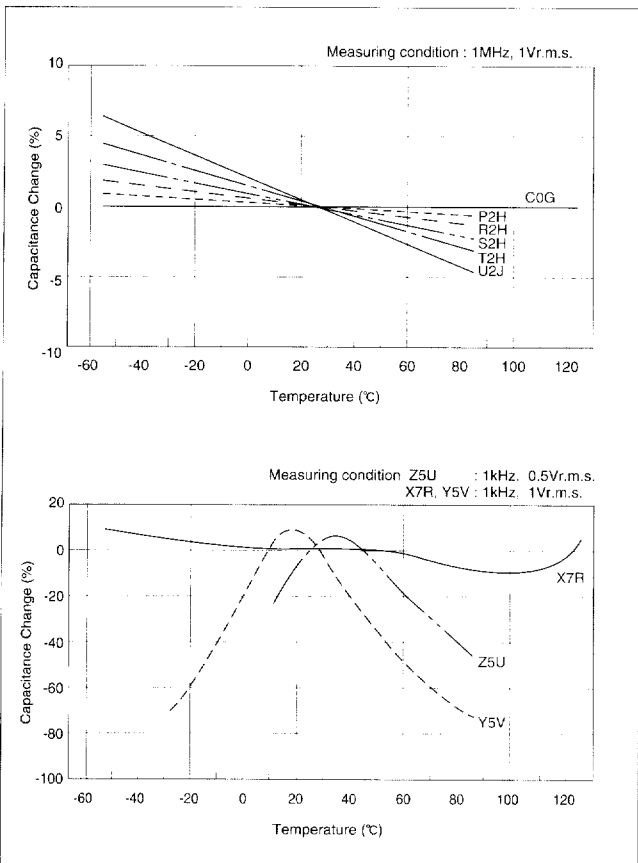
Note 1: Nominal values denote the temperature coefficient within a range of 25 to 125°C (for C0A)/85°C (for other TC).

■ CHARACTERISTICS (REFERENCE DATA)

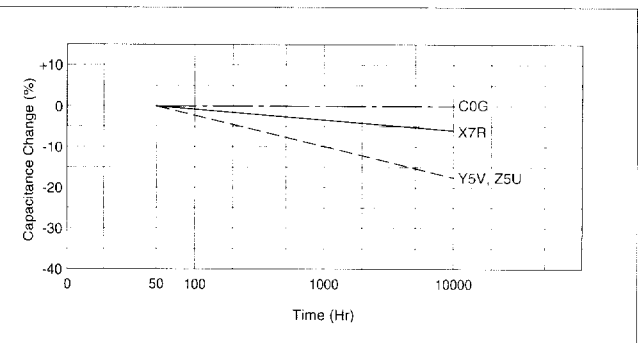
• SELECTION OF CERAMIC CAPACITORS

When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

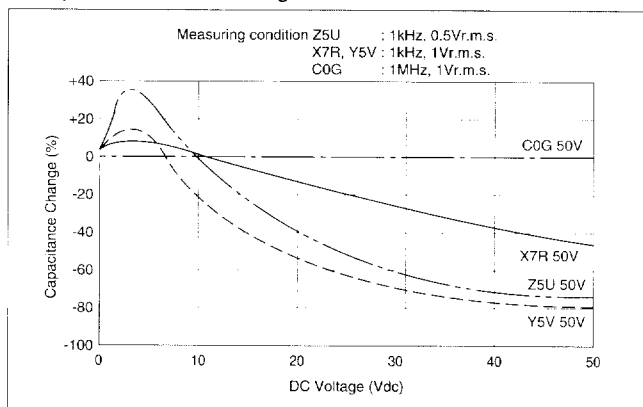
• Capacitance-Temperature Characteristics



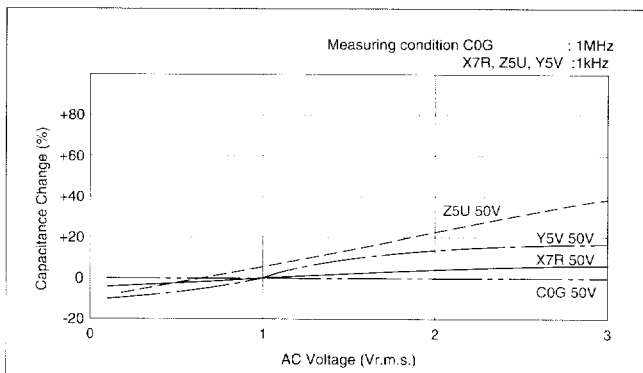
• Capacitance Change- Aging



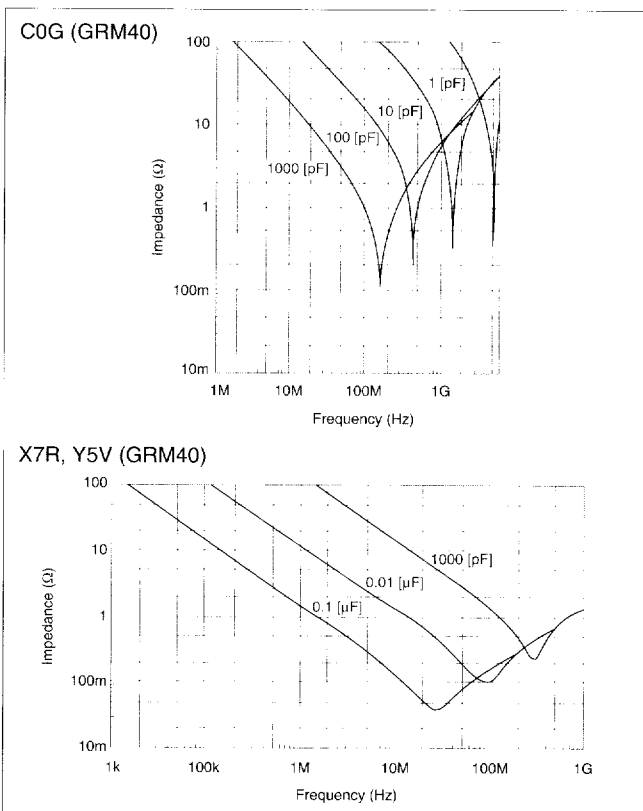
• Capacitance- DC Voltage Characteristics



• Capacitance- AC Voltage Characteristics



• Impedance- Frequency Characteristics



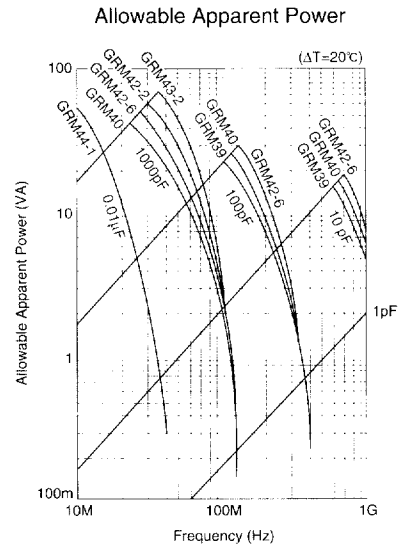
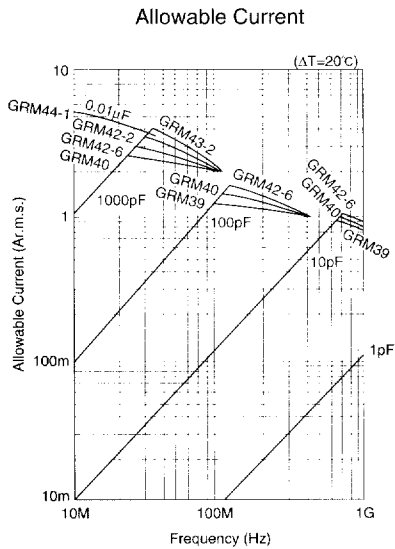
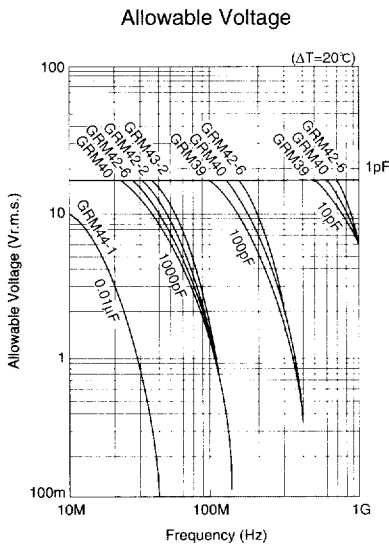
- High Frequency-Power Capacity
The monolithic ceramic capacitor has a small dielectric loss. When high frequency current is applied to the capacitor, the capacitor generates heat (power consumption) by its E.S.R. Temperature rise of the

capacitor (ΔT) should be kept below 20°C ($\Delta T \leq 20^\circ\text{C}$) in the actual circuit.

Therefore, when selecting capacitors, the applicable voltage, power and current should be considered within the following limits.

1

Temperature Compensating Type (C0G 50V)



High Dielectric Constant Type (X7R 50V)

