

# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS

## HIGH DIELECTRIC CONSTANT TYPE

### GRM36/39/40/42-6/42-2/43-2/44-1 Series



#### FEATURES

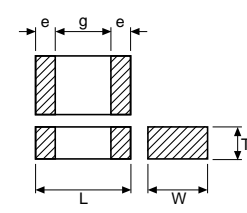
- Miniature size
- No Polarity
- Nickel Barrier Termination Standard – highly resistant to metal migration
- Uniform dimensions and configuration
- Suitable for reflow soldering
- GRM39, 40 and 42-6 suitable for wave soldering
- Minimum series inductance
- Tape and Reel Packaging
- Bulk Case Packaging available for GRM40 and smaller
- Wide selection of capacitance values and voltages
- Largest production capacity and volume in the world

#### PART NUMBERING SYSTEM

GRM40		---		X7R		103		K		050		A		D	
<b>CAPACITOR TYPE AND SIZE</b> See below and following pages.	3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.	<b>TEMPERATURE CHARACTERISTICS</b> X5R X7R Y5V	<b>CAPACITANCE VALUE</b> Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.	<b>CAPACITANCE TOLERANCE</b> X7R/X5R: K = ±10% M = ±20% Non-standard J = ±5% +80% Y5V: Z = -20%	<b>VOLTAGE</b> Identified by a three-digit number.	<b>MARKING</b> A = Unmarked	<b>PACKAGING</b>								
							Reel Diameter/ Tape Material	Code							
								7" Paper Tape	D						
								7" Plastic Tape	L						
								13" Paper Tape	J						
								13" Plastic Tape	K						
								Bulk	B						
								Bulk Cassette	C						
								7" Paper 2mm pitch	Q						
								See pages 33-36 for labeling and packaging information.							

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#### CHIP DIMENSIONS

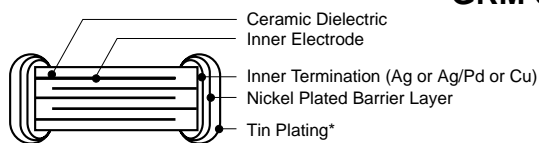
Dimensions: mm	Size	EIA Code	L Length	W Width	T Thickness	e (min.) Termination	g (min.) Insulation
	GRM36	0402	1.0 ± 0.05	0.5 ± 0.05	0.5 ± 0.05	0.15 ~ 0.3	0.4
	GRM39*	0603	1.6 ± 0.1	0.8 ± 0.1	0.8 ± 0.1	0.2 ~ 0.5	0.5
	GRM40	0805	2.0 ± 0.1	1.25 ± 0.1	0.6 ± 0.1	0.2 ~ 0.7	0.7
					0.85 ± 0.1		
					1.25 ± 0.1		
	GRM42-6	1206	3.2 ± 0.15	1.6 ± 0.15	0.85 ± 0.1	0.3 ~ 0.8	1.5
					1.15 ± 0.1		
	GRM42-2	1210	3.2 ± 0.3	2.5 ± 0.2	1.6 ± 0.2	0.3 min.	1.0
					1.15 ± 0.1		
					1.35 ± 0.15		
	GRM43-2	1812	4.5 ± 0.4	3.2 ± 0.3	1.8 ± 0.2	0.3 min.	2.0
					2.5 ± 0.2		
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.

#### CHIP TERMINATION DIAGRAMS

##### Nickel Barrier Layer (Standard)

##### GRM Series



\*Size 0402 – Solder Plated



All products on this page are available as standard through authorized Murata Electronics Distributors.

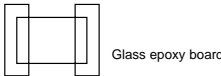
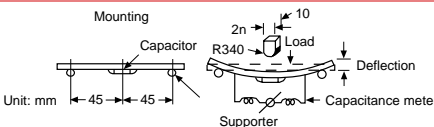
# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS HIGH DIELECTRIC CONSTANT TYPE- SPECIFICATION

GRM36/39/40/42-6/42-2/43-2/44-1 Series

## GENERAL/ELECTRICAL

<b>Capacitance Change with Temperature:</b>	X5R: $\pm 15\%$ $\Delta$ CX $-55^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ X7R: $\pm 15\%$ $\Delta$ CX $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Y5V: $^{+22}_{-32}\%$ $\Delta$ CX $-30^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	<b>Insulation Resistance (I.R.)</b>	X5R/X7R 100,000 megohms or 1000 megohms-mfd (whichever is less) Y5V 10,000 megohms or 500 megohms-mfd (whichever is less)																				
<b>Capacitance &amp; D.F. (Frequency &amp; Voltage)</b>	X5R, X7R: 1kHz $\pm 100\text{Hz}$ @ 1.0 $\pm 2\text{Vrms}$ Y5V: 1kHz $\pm 100\text{Hz}$ @ 1.0 $\pm 2\text{Vrms}$	<b>Dielectric Strength (Flash)</b>	250% of rated voltage for 5 seconds with series resistor limiting charge current to 50mA max.; 200% for 500V																				
<b>Dissipation Factor (D.F.)</b>	<table border="1"> <tr> <td></td> <td>Min. 25V</td> <td>16V</td> <td>10V</td> <td>6.3V</td> </tr> <tr> <td>X5R</td> <td>2.5%</td> <td>3.5%</td> <td>3.5%</td> <td>5%</td> </tr> <tr> <td>X7R</td> <td>2.5%</td> <td>3.5%</td> <td>3.5%</td> <td>5%</td> </tr> <tr> <td>Y5V</td> <td>5.0%</td> <td>9.0%</td> <td>12.5%</td> <td>12.5%</td> </tr> </table>		Min. 25V	16V	10V	6.3V	X5R	2.5%	3.5%	3.5%	5%	X7R	2.5%	3.5%	3.5%	5%	Y5V	5.0%	9.0%	12.5%	12.5%	<b>Typ. Aging (per Decade)</b>	X5R/X7R 3% Y5V 7%
	Min. 25V	16V	10V	6.3V																			
X5R	2.5%	3.5%	3.5%	5%																			
X7R	2.5%	3.5%	3.5%	5%																			
Y5V	5.0%	9.0%	12.5%	12.5%																			

## MECHANICAL

<b>TEST</b>	<b>TEST METHOD</b>	<b>POST TEST LIMITS</b>
<b>Terminal Adhesion</b>		<0603 1.0 lbs. $\geq$ 0805 2.2 lbs. No evidence of termination peeling
<b>Deflection</b>		1 mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits
<b>Solderability</b>	MIL-STD-202 Method 208F	Meets Requirement For specific details contact factory

## ENVIRONMENTAL

<b>TEST</b>	<b>TEST METHOD</b>	<b>POST TEST LIMITS</b>
<b>Thermal Shock (Air to Air)</b>	MIL-STD-202, Method 107, Condition A Prior to starting Thermal Shock test, capacitors shall be heat treated (deaged) for one (1) hour at $150^{\circ}\text{C}$ . Allow capacitors to stabilize at room temperature for 48 hours prior to taking initial measurements.  Post thermal Shock measurement shall be taken after 48 hours stabilization.	Appearance: No visual damage $\Delta$ C: X5R/X7R = $\pm 12.5\%$ Y5V = $\pm 30.0\%$ D.F.: X5R/X7R = 2.5% max. @ $25^{\circ}\text{C}$ , (3.5% max. @ $25^{\circ}\text{C}$ for 16V & 10V Series) (7.5% max. @ $25^{\circ}\text{C}$ for 6.3V Series) Y5V = 5.0% max. @ $25^{\circ}\text{C}$ , (9.0% max. @ $25^{\circ}\text{C}$ for 16V Series) (15% max. @ $25^{\circ}\text{C}$ for 10V & 6.3V Series) I.R.: X5R/X7R = 100,000M $\Omega$ min. of 1,000M $\Omega$ • $\mu\text{F}$ (whichever is less) Y5V = 10,000 $\Omega$ or 500M $\Omega$ • $\mu\text{F}$ min. (whichever is less)
<b>Humidity, Steady State</b>	Maintain the capacitor at $40 \pm 2^{\circ}\text{C}$ and 90 to 95% humidity for $500 \pm 12$ hours. Remove and let sit for $48 \pm 4$ hours at room temperature, then measure.	Appearance: No defects Capacitance: X5R, X7R within $\pm 12.5\%$ ; Z5U, Y5V within $\pm 30\%$ Q/D.F.: See chart below. I.R.: 1,000M $\Omega$ or 50 $\Omega$ F (whichever is less)
<b>Humidity Load</b>	Apply the rated voltage at $40 \pm 2^{\circ}\text{C}$ and 90 to 95% humidity for $500 \pm 12$ hours. Remove and let sit for $48 \pm 4$ hours at room temperature, then measure. The charge/discharge current is less than 50mA. • Initial measurement for Y5V/10V max. Apply the rated DC voltage for 1 hour at $40 \pm 20^{\circ}\text{C}$ . Remove and let sit for $48 \pm 4$ hours at room temperature. Perform initial measurement.	Appearance: No defects Capacitance: X5R, X7R within $\pm 12.5\%$ ; Z5U within $\pm 30\%$ ; Y5V within $+30/-40\%$ (10Vmax), within $\pm 30\%$ (others)
<b>Life Test</b>	Apply 200% of rated voltage for $1000 \pm 12$ hours at maximum operating temperature; 150% for 500V  Upon completion of above test wait 48 hours prior to performing post testing.	Appearance: No defects Capacitance: X5R/X7R $\pm 12.5\%$ $\Delta$ CX, Z5U/Y5V $\pm 30\%$ $\Delta$ CX D.F.: X5R/X7R = 3.0% max. @ $25^{\circ}\text{C}$ , (5% max. @ $25^{\circ}\text{C}$ for 16V & 10V Series) (7.5% max. @ $25^{\circ}\text{C}$ for 6.3V Series) Y5V = 7.5% max. @ $25^{\circ}\text{C}$ , (10% max. @ $25^{\circ}\text{C}$ for 16V Series) (15% max. @ $25^{\circ}\text{C}$ for 10V & 6.3V Series) I.R.: X5R/X7R 1,000M $\Omega$ or 50M $\Omega$ -mfd. (whichever is less) Y5V 1,000M $\Omega$ or 50M $\Omega$ -mfd. (whichever is less) Flash: 250% rated voltage

	Char.	25V min.	16V	10V	6.3V
<b>Q/D.F.</b>	X5R	0.05 max.	0.05 max.	0.05 max.	0.075 max.
	X7R	0.05 max.	—	—	—
	Z5U	0.05 max.	—	—	—
	Y5V	0.075 max.	0.1 max. (C<1.0 $\mu\text{F}$ ) 0.125 max. (C $\geq$ 1.0 $\mu\text{F}$ )	0.15 max.	0.15 max.

I.R.: 500M $\Omega$  or 25 $\Omega$  F (whichever is less)  
Dielectric Strength: No failure

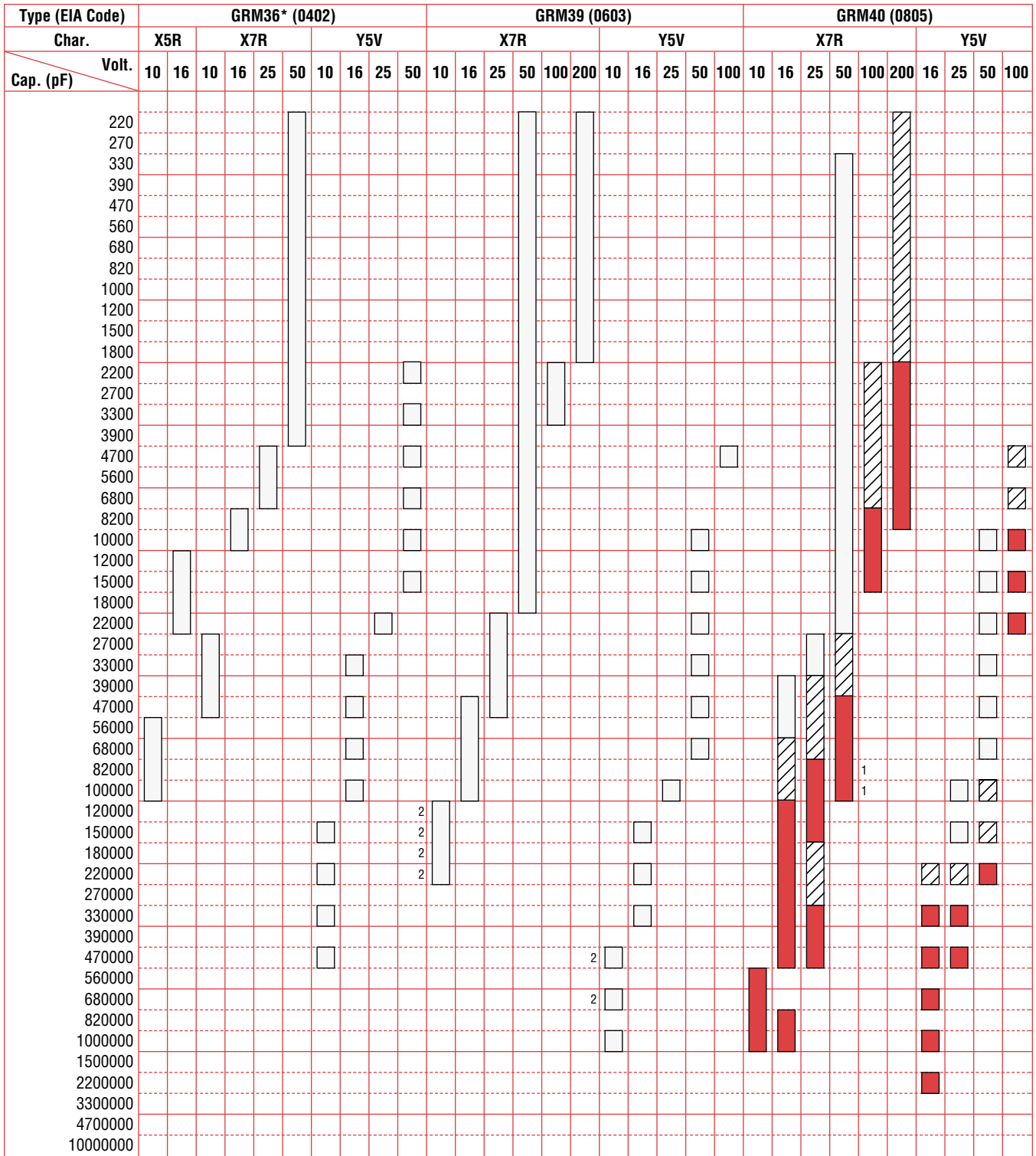
# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS

## HIGH DIELECTRIC CONSTANT X5R/X7R/Y5V TYPES



### GRM36/39/40 Series

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS



\*GRM36 Series is suited to only reflow soldering.  
<sup>1</sup>Type: GRM40-034 (L: 2 ± 0.15, W: 1.25 ± 0.15, T: 1.25 ± 0.15)  
<sup>2</sup>Only for taping

#### THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) <sup>3</sup>	Bulk Case (pcs./case)	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) <sup>3</sup>	Bulk Case (pcs./case)
GRM36	□: 0.5 ± 0.05	1000	10000	50000	GRM40	▨: 0.85 ± 0.1	1000	4000	—
GRM39	□: 0.8 ± 0.1 <sup>4</sup>	1000	4000	15000		■: 1.25 ± 0.1	1000	3000	5000
GRM40	□: 0.6 ± 0.1	1000	4000	10000					

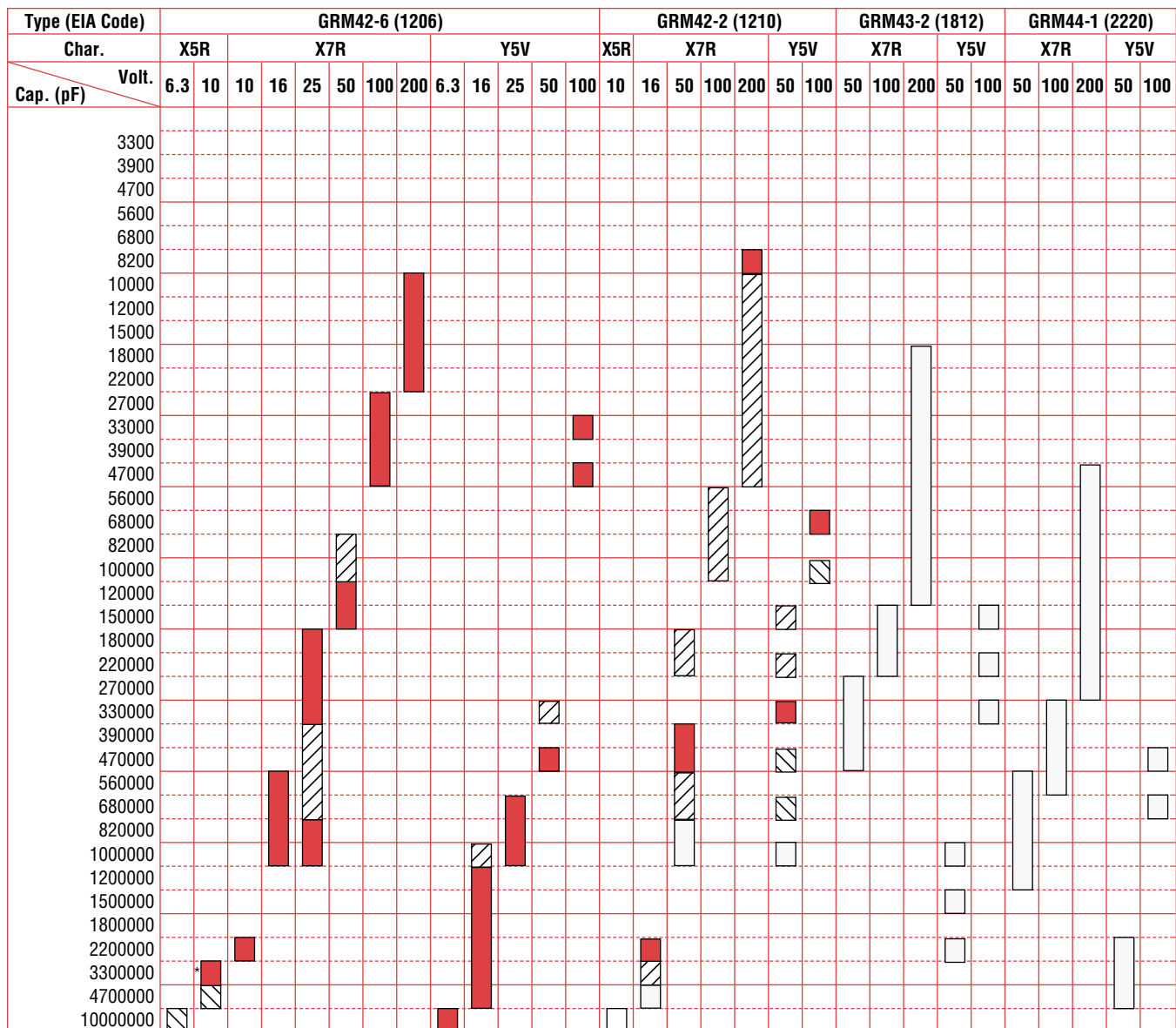
<sup>3</sup>φ330mm reel is available on request. <sup>4</sup>Bulk case packaging is T = 0.8 ± 0.07.

# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS

## HIGH DIELECTRIC CONSTANT X5R/X7R/Y5V TYPES


*Innovator in Electronics*

### GRM42-6/42-2/43-2/44-1 Series



\*Type: GRM42-631 (L: 3.2 ± 0.2, W: 1.6 ± 0.2, T: 1.3  $^{+0.2}_0$ )

### THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) <sup>1</sup>	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel) <sup>1</sup>	
GRM42-6	: 0.85 ± 0.1	1000	4000	GRM42-2	: 1.8 ± 0.2	1000	1000	
	: 1.15 ± 0.1	1000	3000		GRM43-2	: 2.5 ± 0.2	1000	1000
	: 1.6 ± 0.2	1000	2000			GRM44-1	: 2.0 max.	1000
GRM42-2	: 1.15 ± 0.1	1000	3000		: 2.0 max.		1000	1000
	: 1.35 ± 0.15	1000	2000		<sup>1</sup> φ330mm reel is available on request.			

**Note:** Capacitance Values = EIA 12 step: X7R = 10,12,15,18,22,27,33,39,47,56,68,82  
6 step: Y5V = 10,15,22,33,47,68. For other values contact your local Murata Sales Office