

# CHIPS— GRM Series

## COG AND TEMPERATURE COMPENSATING

### FEATURES

- Miniature size
- No Polarity
- Nickel Barrier Termination Standard – highly resistant to metal migration
- Uniform dimensions and configuration
- Flow and Reflow Solderable
- Minimum series inductance
- Tape and Reel Packaging
- Wide selection of capacitance values and voltages
- Largest production capacity and volume in the world

### PART NUMBERING SYSTEM

**GRM 40 --- COG 101 K 050 A D**

CAPACITOR TYPE AND SIZE	TEMPERATURE CHARACTERISTICS	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	VOLTAGE	MARKING	PACKAGING												
3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.	COG P2H R2H S2H T2H U2J SL	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. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.	(10pF or less) B=±.1pF C=±.25pF D=±.5pF F=±1pF for 10pF only (over 10pF) F=±1% G=±2% J=±5% K=±10%	Identified by a three-digit number.	A=Unmarked B=EIA Marking C=Non-standard Contact Factory.	<table border="1"> <thead> <tr> <th>Reel Diameter/ Tape Material</th> <th>Code</th> </tr> </thead> <tbody> <tr> <td>7" Paper Tape</td> <td>D</td> </tr> <tr> <td>7" Plastic Tape</td> <td>L</td> </tr> <tr> <td>13" Paper Tape</td> <td>J</td> </tr> <tr> <td>13" Plastic Tape</td> <td>K</td> </tr> <tr> <td>Bulk</td> <td>B</td> </tr> </tbody> </table>	Reel Diameter/ Tape Material	Code	7" Paper Tape	D	7" Plastic Tape	L	13" Paper Tape	J	13" Plastic Tape	K	Bulk	B
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See pages 24-25 for additional marking and packaging information T/R per EIA-481-1

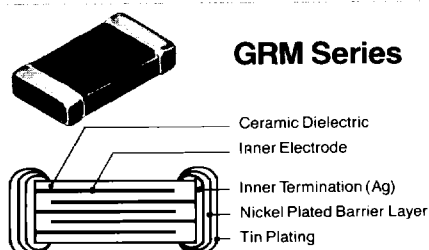
### CHIP DIMENSIONS

DIMENSIONS: in (mm)	Size	EIA Code	L Length	W Width	T Thickness	g (Min.) Insulation	e Termination
	GRM39	0603	.060 ± .066 (1.6 ± 0.15)	.030 ± .006 (0.80 ± 0.15)	Note 1: Thickness varies with capacitance value. See capacitance charts on following pages for thickness.	.020 (0.5)	.014 ± .006 (0.35 ± 0.15)
	GRM40	0805	.080 ± .006 (2.0 ± 0.15)	.050 ± .006 (1.25 ± 0.15)		.030 (0.75)	.020 ± .010 (0.5 ± 0.25)
	GRM42-6	1206	.125 ± .006 (3.2 ± 0.15)	.063 ± .006 (1.6 ± 0.15)		.040 (1.0)	.020 ± .010 (0.5 ± 0.25)
	GRM42-2	1210	.125 ± .006 (3.2 ± 0.15)	.100 ± .006 (2.5 ± 0.15)		.040 (1.0)	.020 ± .010 (0.5 ± 0.25)
	GRM43-2	1812	.180 ± .012 (4.6 ± 0.3)	.125 ± .008 (3.2 ± 0.2)		.080 (2.0)	.025 ± .015 (0.63 ± 0.38)
	GRM43-4	1825	.180 ± .012 (4.6 ± 0.3)	.250 ± .016 (6.35 ± 0.4)		.080 (2.0)	.025 ± .015 (0.63 ± 0.38)
	GRM44-1	2220*	.220 ± .012 (5.6 ± 0.3)	.200 ± .010-.025 (5.1 ± 0.25-0.5)		.080 (2.0)	.025 ± .015 (0.63 ± 0.38)
	GRM44	2225*	.220 ± .012 (5.6 ± 0.3)	.250 ± .016 (6.35 ± 0.4)		.080 (2.0)	.025 ± .015 (0.63 ± 0.38)

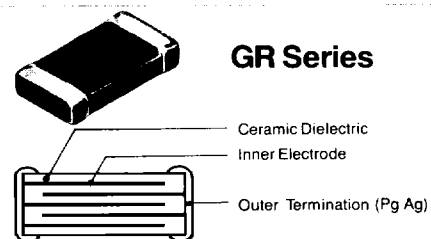
\* Non EIA—Standard Size

### CHIP TERMINATION DIAGRAMS

#### Nickel Barrier Layer (Standard)



#### Palladium Silver



Note: Other Terminations Available Upon Request. Please Contact Local Sales Office.

# SPECIFICATIONS GRM SERIES



## COG AND TEMPERATURE COMPENSATING

### GENERAL

<b>Temperature Coefficient</b> COG = 0 ± 30 ppm* P2H = N150 ± 60 ppm R2H = N220 ± 60 ppm S2H = N330 ± 60 ppm T2H = N470 ± 60 ppm U2J = N750 ± 120 ppm SL = N1000 to P350  <b>*TC Tolerance for COG</b> 0.5 to 2.0pf = ±250ppm(K) 2.1 to 3.9pf = ±120ppm(J) 4.0 to 9.9pf = ± 60ppm(H) 10 or over = ± 30ppm(G) Refer to EIA-RS198 for other limitations	<b>Temperature Range</b> -55° to +125°C -55° to +85°C -55° to +85°C -55° to +85°C -55° to +85°C -55° to +85°C
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### ELECTRICAL

<b>TEST</b>  <b>Capacitance &amp; Q (Frequency &amp; Voltage):</b>  <b>Q Limits</b>  <b>Insulation Resistance (I.R.)</b>  <b>Dielectric Strength (Flash)</b>  <b>Aging</b>	≤ 1000pF 1 KHz ± 100Hz @ 1.0 ± .2 Vrms > 1000pF 1MHz ± 100 KHz @ 1.0 ± .2 Vrms  ≤ 30pF: 400 + (20xC (pF)) > 30pF: 1000 minimum  100,000 megohms or 1000 megohms - mfd (whichever is less) with rated voltage applied for 2 minutes max with 50mA limiting current  250% of rated voltage for 5 seconds with series resistor limiting charging current to 50mA max.  Negligible
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### MECHANICAL

<b>TEST</b>  <b>Terminal Adhesion</b>  <b>Deflection</b>  <b>Break Strength</b>  <b>Solderability</b>	<b>TEST METHOD</b> <p>Terminal Adhesion: Capactor on Glass-epoxy substrate, 2.2mm gap.</p> <p>Deflection: Capactor on Mounting, R340, Load, Deflection, Capacitance meter, Supporter.</p> <p>Break Strength: Force, Holding fixture, Iron Plate, Test tool, Push out gauge, L, Force.</p> <p>Stress is applied at rate of 150mm/minute</p>	<b>POST TEST LIMITS</b>  < 0603 1.0 lbs. ≥ 0805 2.2 lbs. No evidence of termination peeling  2 mm deflection (paper phenol board) 1mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits  <table border="1"> <tr> <th rowspan="2">Thickness (mm)</th> <th colspan="2">F. minimum (lbs)</th> </tr> <tr> <td>0.7, 0.8</td> <td>1.8</td> </tr> <tr> <td>1.0</td> <td></td> <td>6.6</td> </tr> <tr> <td>≤ 1.25</td> <td></td> <td>12.0</td> </tr> </table> <table border="1"> <tr> <th colspan="5">Solder coverage GRM Type</th> </tr> <tr> <th rowspan="2">Initial</th> <th colspan="2">Under Room temperature</th> <th>Under high temperature</th> <th>Under high humidity</th> </tr> <tr> <th>6 months</th> <th>12 months</th> <td>85 C 100 hrs</td> <td>40° C, 90-95%RH 100hrs.</td> </tr> <tr> <td>95-100%</td> <td>95-100%</td> <td>95%</td> <td>90-95%</td> <td>95%</td> </tr> </table>	Thickness (mm)	F. minimum (lbs)		0.7, 0.8	1.8	1.0		6.6	≤ 1.25		12.0	Solder coverage GRM Type					Initial	Under Room temperature		Under high temperature	Under high humidity	6 months	12 months	85 C 100 hrs	40° C, 90-95%RH 100hrs.	95-100%	95-100%	95%	90-95%	95%
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### ENVIRONMENTAL

<b>TEST</b>  <b>Thermal Shock (Air to Air)</b>	<b>TEST METHOD</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°C. Allow capacitors to stabilize at room temperature for 24 hours prior to taking initial measurements.  Post thermal Shock measurement shall be taken after 24 hours stabilization.	<b>POST TEST LIMITS</b> Appearance: No visual damage  $\Delta C: = \pm 2.0\%$ or $\pm 0.5pF$ (whichever is greater) $Q: > 30pF = 1,000 \text{ min.}, \leq 30pF = 400 + [20 \times C(pF)]$ $I.R.: = 100,000M\Omega \text{ min. or } 1,000M\Omega \cdot \mu F$ (whichever is less)				
<b>Humidity</b>	<table border="1"> <tr> <th>RATED VOLTAGE</th> <th>LOW VOLTAGE</th> </tr> <tr> <td>Apply rated voltage for 500 ± 12 hours at 85°C and 85% relative humidity  See Note 1</td> <td>Apply .5 Vrms for 250 ± 12 hours at 85°C and 85% relative humidity  See Note 1</td> </tr> </table>	RATED VOLTAGE	LOW VOLTAGE	Apply rated voltage for 500 ± 12 hours at 85°C and 85% relative humidity  See Note 1	Apply .5 Vrms for 250 ± 12 hours at 85°C and 85% relative humidity  See Note 1	Appearance: No defects Capacitance: ±3% or ±.3pF (whichever is less) $Q: > 30pF = 500 \text{ min.}, \leq 30pF = 200 + [10 \times C(pF)]$ $I.R.: 10,000 \text{ megohms or } 100 \text{ megohm-mfd. (whichever is less)}$ Flash: 250% rated voltage
RATED VOLTAGE	LOW VOLTAGE					
Apply rated voltage for 500 ± 12 hours at 85°C and 85% relative humidity  See Note 1	Apply .5 Vrms for 250 ± 12 hours at 85°C and 85% relative humidity  See Note 1					
<b>Life Test</b>	Apply 200% of rated voltage for 1000 ± 12 hours at maximum operating temperature  See Note 2	Appearance: No defects Capacitance: ±3% or ±.3pF (whichever is greater) $Q: > 30pF = 500 \text{ min.}, \leq 30pF = 200 + [10 \times C(pF)]$ $I.R.: 10,000 \text{ megohms or } 100 \text{ megohm-mfd. (whichever is less)}$ Flash: 250% rated voltage				

**Note 1:** Upon completion of either above test wait 24 hours prior to performing post testing.  
**Note 2:** Upon completion of above test wait 24 hours prior to performing post testing.

MURATA ERIE DESIGNATION	GRM 39			GRM 40			GRM 42-6			GRM 42-2		
EIA TYPE DESIGNATION	0603			0805			1206			1210		
WVDC	50	100	200	50	100	200	50	100	200	50	100	200
CAPACITANCE (pF) (NOTE)												
(μF)												

Note: Capacitance values = EIA 24 Step = 10,11,12,13,15,16,18,20,22,24,27,30,33,36,39,43,47,51,56,62,68,75,82,91  
For values under 1.0pF and other values not listed, contact your local Murata Erie Sales Office

**STANDARD THICKNESS/PACKAGING SPECIFICATIONS**

Dimensions (mm)		Bulk		Tape		
		Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
			Plastic	Paper	Embossed	Paper
	T : 0.7 <sup>+0</sup> / <sub>-0.2</sub>	1000	4000	4000	10000	10000
	T : 0.8 ±0.1	1000	4000	N/A	10000	N/A
	T : 1.0 <sup>+0</sup> / <sub>-0.2</sub>	1000	4000	3000	10000	10000
	T : 1.25 <sup>+0</sup> / <sub>-0.2</sub> *	1000	N/A	3000	N/A	10000
	T : 1.5 <sup>+0</sup> / <sub>-0.2</sub>	1000	N/A	2000	N/A	8000

MURATA ERIE DESIGNATION	GRM 43-2			GRM 43-4			GRM 44-1			GRM 44		
EIA TYPE DESIGNATION	1812			1825			2220			2225		
WVDC	50	100	200	50	100	200	50	100	200	50	100	200
CAPACITANCE (pF) (NOTE)	10											
	100											
	1000	1000	330	1000	1000	560	1000	1000	820	1000	1300	680
	(μF) .01			8200								
	.1											

Note: Capacitance values = EIA 24 Step = 10,11,12,13,15,16,18,20,22,24,27,30,33,36,39,43,47,51,56,62,68,75,82,91  
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		Pcs/bag (typical)		Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel
		Plastic	Paper	Embossed	Paper	Embossed
	T : 1.25 $\begin{matrix} +0 \\ -0.2 \end{matrix}$	1000	N/A	1000	N/A	5000
	T : 1.5 $\begin{matrix} +0 \\ -0.2 \end{matrix}$	1000	N/A	1000	N/A	5000
	T : 2.0 $\begin{matrix} +0 \\ -0.2 \end{matrix}$	1000	N/A	1000	N/A	4000

TEMPERATURE COMPENSATING

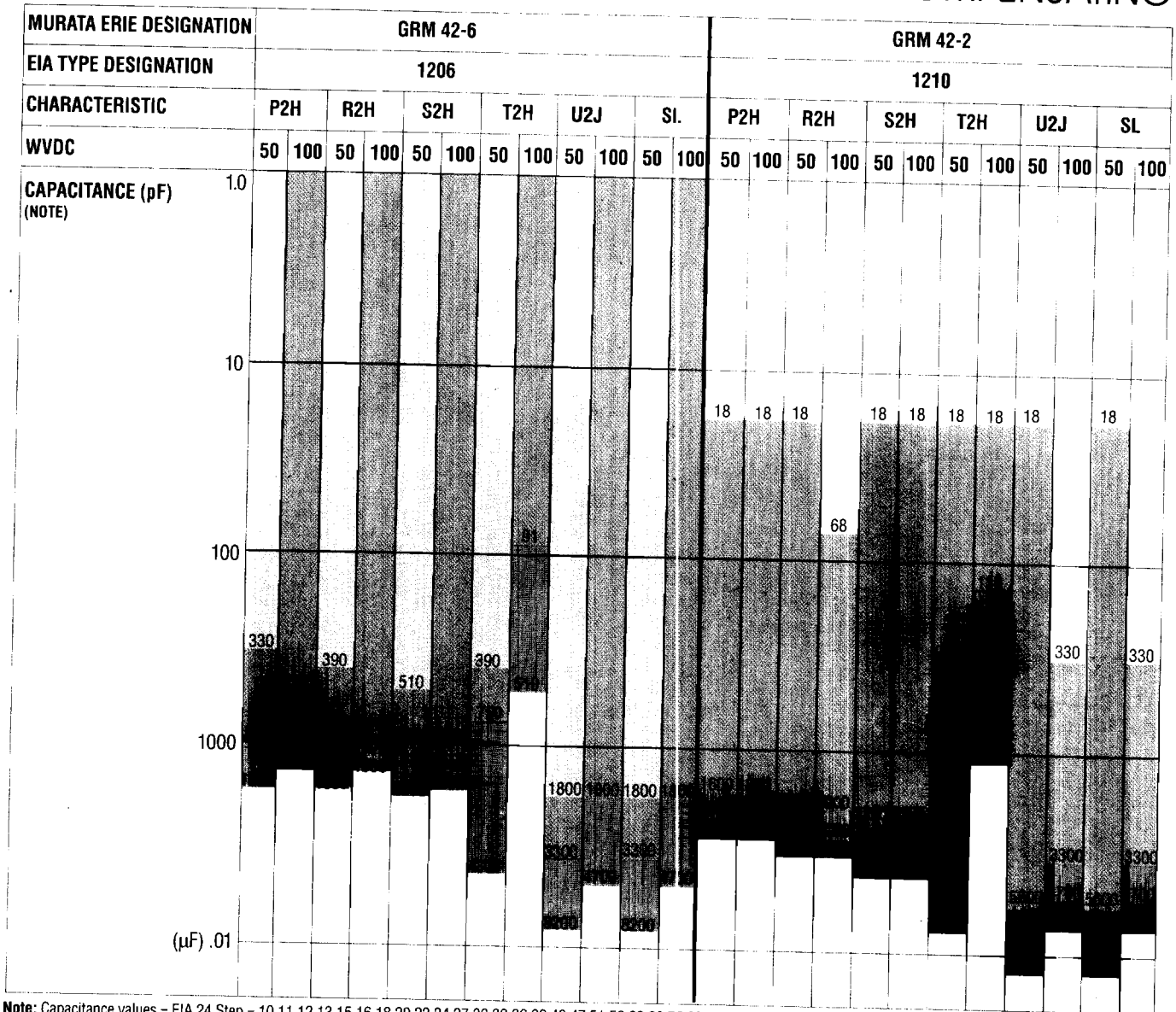
MURATA ERIE DESIGNATION	GRM 39														GRM 40											
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CHARACTERISTIC	P2H		R2H		S2H		T2H		U2H		SL		P2H		R2H		S2H		T2H		U2J		SL			
WVDC	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
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T: 1.25 $\begin{smallmatrix} +0 \\ -0.2 \end{smallmatrix}$ *	1000	N/A	3000	N/A	10000	
T: 1.5 $\begin{smallmatrix} +0 \\ -0.2 \end{smallmatrix}$	1000	N/A	2000	N/A	8000	

TEMPERATURE COMPENSATING



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	T: 1.25 <sup>+0</sup> / <sub>-0.2</sub>	1000	N/A	N/A	3000	N/A	10000
	T: 1.5 <sup>+0</sup> / <sub>-0.2</sub>	1000	N/A	N/A	2000	N/A	8000