

# Surface Mount Multilayer Ceramic Chip Capacitors High Frequency DSCC Qualified Type 05002



## FEATURES

- US Defense Supply Center approved
- Federal stock control number, CAGE CODE 2770A
- Case size 0603
- High frequency
- Excellent aging characteristics
- Tin / lead termination code "Z"
- Lead (Pb)-free terminations code "M"
- Surface mount, wet build process
- Reliable Noble Metal Electrode (NME) system
- Made with a combination of design, materials and tight process control to achieve very high field reliability
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?999912](http://www.vishay.com/doc?999912)



Available  
**RoHS\***  
Available  
**HALOGEN  
FREE**

## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

## APPLICATIONS

- Broadband wireless communication
- Satellite communication
- WiFi (802.11) and WiMax (802.16)
- VoIP networks and cellular base stations
- Subscriber based wireless devices

## ELECTRICAL SPECIFICATIONS

### Note

- Electrical characteristics at +25 °C unless otherwise specified

**Operating Temperature:** -55 °C to +125 °C

**Capacitance Range:** 1.0 pF to 100 pF

**Voltage Rating:** 50 V<sub>DC</sub> to 250 V<sub>DC</sub>

**Temperature Coefficient of Capacitance (TCC):**

BP: 0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C with zero (0) V<sub>DC</sub> applied

**Dissipation Factor (DF):**

BP: 0.05 % max. at 1.0 V<sub>RMS</sub> and 1 MHz

**Aging Rate:** 0 % maximum per decade

**Insulation Resistance (IR):**

at +25 °C and rated voltage 100 000 MΩ minimum or 1000 ΩF, whichever is less

at +125 °C and rated voltage 10 000 MΩ minimum or 100 ΩF, whichever is less

**Dielectric Strength Test:**

performed per method 103 of EIA-198-2-E.

Applied test voltages

≤ 250 V<sub>DC</sub>-rated: 200 % of rated voltage

**QUICK REFERENCE DATA**

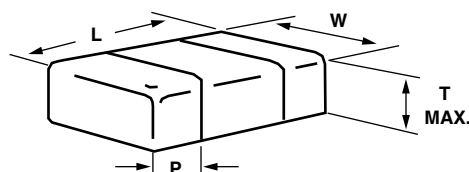
DIELECTRIC	CASE CODE	MAXIMUM VOLTAGE (V)	CAPACITANCE	
			MINIMUM	MAXIMUM
BP	0603	250	1.0 pF	100 pF

**ORDERING INFORMATION**

05002- DSCC NUMBER	1R0 CAPACITANCE NOMINAL CODE	B DC VOLTAGE RATING <sup>(1)</sup>	C CAPACITANCE TOLERANCE	Z TERMINATION	- GROUP C TESTING OPTION <sup>(2)(3)</sup>	C PACKAGING
0603 Case size High Frequency	Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. An "R" indicates a decimal point. <b>Examples:</b> 1R0 = 1.0 pF	A = 50 V B = 100 V C = 200 V K = 250 V	B = $\pm 0.10$ pF C = $\pm 0.25$ pF D = $\pm 0.50$ pF F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$ <b>Note:</b> B, C, D $\leq 6.2$ pF B, C, J, K, M 6.8 pF to 9.1 pF F, G, J, K, M $\geq 10$ pF	M = silver palladium Z = Ni barrier with tin / lead plate min. 4 % lead	C = full group C L = 2000 h life test only H = low voltage humidity test only - = group A test only  C = 7" reel / paper tape O = 7" reel / flamed paper tape J = 7" reel (low quantity) P = 11 1/4" / 13" reel / paper tape I = 11 1/4" / 13" reel / flamed paper tape B = bulk <b>Note:</b> "I" and "O" is used for "M" termination code	

**Notes**

- (1) DC voltage rating should not be exceeded in application
- (2) Selecting one of the group C options with life testing may extend the delivery time
- (3) To receive data package, add "P" to the end of the part number. For example, 05002-1R0BCZCCP.  
Group C will be completed and data included with shipment

**DIMENSIONS** in inches (millimeters)


PART ORDERING NUMBER	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	TERMINATIONS PAD (P)	
				MINIMUM	MAXIMUM
05002-	0.063 $\pm$ 0.006 (1.60 $\pm$ 0.15)	0.032 $\pm$ 0.006 (0.81 $\pm$ 0.15)	0.036 (0.91)	0.008 (0.20)	0.020 (0.50)



SELECTION CHART						
DIELECTRIC		BP				
STYLE		05002				TOLERANCE
CASE CODE		0603				
VOLTAGE (V <sub>DC</sub> )		50	100	200	250	
VOLTAGE CODE		A	B	C	K	
CAP. CODE	CAP.					
1R0	1.0 pF	••	••	••	••	B, C
1R1	1.1 pF	••	••	••	••	B, C, D
1R2	1.2 pF	••	••	••	••	B, C, D
1R3	1.3 pF	••	••	••	••	B, C, D
1R4	1.4 pF	••	••	••	••	B, C, D
1R5	1.5 pF	••	••	••	••	B, C, D
1R6	1.6 pF	••	••	••	••	B, C, D
1R7	1.7 pF	••	••	••	••	B, C, D
1R8	1.8 pF	••	••	••	••	B, C, D
1R9	1.9 pF	••	••	••	••	B, C, D
2R0	2.0 pF	••	••	••	••	B, C, D
2R1	2.1 pF	••	••	••	••	B, C, D
2R2	2.2 pF	••	••	••	••	B, C, D
2R4	2.4 pF	••	••	••	••	B, C, D
2R7	2.7 pF	••	••	••	••	B, C, D
3R0	3.0 pF	••	••	••	••	B, C, D
3R3	3.3 pF	••	••	••	••	B, C, D
3R6	3.6 pF	••	••	••	••	B, C, D
3R9	3.9 pF	••	••	••	••	B, C, D
4R3	4.3 pF	••	••	••	••	B, C, D
4R7	4.7 pF	••	••	••	••	B, C, D
5R1	5.1 pF	••	••	••	••	B, C, D
5R6	5.6 pF	••	••	••	••	B, C, D
6R2	6.2 pF	••	••	••	••	B, C, D
6R8	6.8 pF	••	••	••	••	B, C, J, K, M
7R5	7.5 pF	••	••	••	••	B, C, J, K, M
8R2	8.2 pF	••	••	••	••	B, C, J, K, M
9R1	9.1 pF	••	••	••	••	B, C, J, K, M
100	10 pF	••	••	••	••	F, G, J, K, M
110	11 pF	••	••	••	••	F, G, J, K, M
120	12 pF	••	••	••	••	F, G, J, K, M
130	13 pF	••	••	••	••	F, G, J, K, M
150	15 pF	••	••	••	••	F, G, J, K, M
180	18 pF	••	••	••	••	F, G, J, K, M
200	20 pF	••	••	••	••	F, G, J, K, M
220	22 pF	••	••	••	••	F, G, J, K, M
240	24 pF	••	••	••	••	F, G, J, K, M
270	27 pF	••	••	••	••	F, G, J, K, M
300	30 pF	••	••	••	••	F, G, J, K, M
330	33 pF	••	••	••	••	F, G, J, K, M
360	36 pF	••	••	••	••	F, G, J, K, M
390	39 pF	••	••	••	••	F, G, J, K, M
430	43 pF	••	••	••	••	F, G, J, K, M
470	47 pF	••	••	••	••	F, G, J, K, M
510	51 pF	••	••			F, G, J, K, M
560	56 pF	••	••			F, G, J, K, M
620	62 pF	••	••			F, G, J, K, M
680	68 pF	••	••			F, G, J, K, M
750	75 pF	••	••			F, G, J, K, M
820	82 pF	••	••			F, G, J, K, M
910	91 pF	••	••			F, G, J, K, M
101	100 pF	••	••			F, G, J, K, M

## Notes

•• RoHS-compliant except when supplied with lead (Pb)-containing termination, code "Z"

•• Paper carrier tape

**DSCC PACKAGING QUANTITIES <sup>(1)</sup>**

CASE CODE	TAPE SIZE	7" REEL QUANTITIES		11 1/4" AND 13" REEL QUANTITIES	BULK
		PACKAGING CODE "C" / "O"	PACKAGING CODE "J"	PACKAGING CODE "P" / "I"	VIAL PACKAGING CODE "B"
0603	8 mm	4000	1000	10 000	100

**Note**

<sup>(1)</sup> Reference: EIA Standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"

**STORAGE AND HANDLING CONDITIONS**

(1) Store the components at 5 °C to +40 °C ambient temperature and ≤ 70 % related humidity conditions.

(2) The product is recommended to be used within a time-frame of 2 years after shipment.

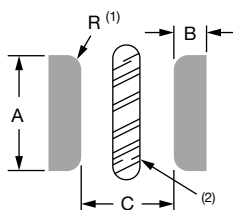
Check solderability in case extended shelf life beyond the expiry date is needed.

## Precautions:

- Do not store products in an environment containing corrosive elements, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. This may cause corrosion or oxidization of the terminations, which can easily lead to poor soldering.
- Store products on the shelf and avoid exposure to moisture or dust.
- Do not expose products to excessive shock, vibration, direct sunlight and so on.

## Solder Pad Dimensions for Vishay Surface-Mount Multilayer Ceramic Chip Capacitors

### DIMENSIONS in millimeters



CASE CODE	A	B	C
0402	0.50	0.50	0.40
0505	1.35	1.00	0.60
0603	0.90	1.00	1.00 <sup>(3)</sup>
0805	1.30	1.20	1.00
1111	2.90	1.30	1.75
1206	1.80	1.20	2.10
1210	2.80	1.30	1.90
1808	2.40	1.50	3.00
1812	3.60	1.50	3.00
1825	6.50	1.50	3.00
2008	2.70	1.50	4.08
2220	5.50 <sup>(4)</sup>	1.50	4.20
2225	6.50	1.50	4.20
2525	6.60	1.50	4.50
3040	10.80	2.00	5.50
3640	10.80	2.00	7.00
3838	10.20	2.00	7.50
4044	12.30	2.00	8.00

#### Notes

- <sup>(1)</sup> For safety capacitors and voltages above 3000 V, corner rounding (R) of 0.5 mm is recommended to suppress arcing
- <sup>(2)</sup> Add a 1 mm slot in PCB between pads to allow cleaning and coating under MLCC
- <sup>(3)</sup> For VJ HiFREQ Series, this dimension is 0.6 mm
- <sup>(4)</sup> For safety capacitors, the A dimension should be 5.80 mm



## PRINTED CIRCUIT BOARD PCB DESIGN CONSIDERATIONS FOR HIGH VOLTAGE SURFACE-MOUNT MLCCS

Special assembly process and design considerations should be employed for today's high voltage rating MLCCs. As case sizes remain the same and voltage ratings increase, MLCC manufacturers must design, evaluate, and qualify their capacitors using methods that reduce the occurrence of corona discharge and arcover events. To meet similar capability in high voltage applications, users should employ similar cautionary design and assembly methods.

### MLCC PAD LAYOUT

A capacitor's arcover inception point can degrade due to factors such as the MLCC termination, PCB pad design, PCB cleanliness, solder flux residue, surface contamination / deposits and environmental conditions. PCB pads and their design affect the air gap distance between the opposing polarities of the MLCC termination. For voltage rating greater than 1500 V<sub>DC</sub> add a corner radius to the inward facing edge of the MLCC pads and as large a gap as possible between the pads. Too small of a pad gap distance will reduce the capacitor's own arcover inception voltage level. Refer to the Figure and Table Figure 1.0, MLCC Pad Layout and Table 1.0, Vishay MLCC Solder Pad Dimensions for the recommended MLCC solder pad dimensions.

### SLOT OR TRENCH BETWEEN PADS

PCB assembly can deposit dust, trap solder balls, or flux residue underneath the capacitors. These contaminants will reduce conductive clearances and the arcover inception level. Assembly methods must include a final PCB cleaning process. A slot or trench can be cut into the PCB in between the pads to allow cleaners to penetrate underneath the MLCC. The slot will also allow conformal or epoxy coatings to flow underneath the MLCC and build an insulative barrier between pads. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.

### COATING PRINTED CIRCUIT BOARD

Coating a printed circuit board with materials such as acrylic, silicone and urethane resins provide a protective dielectric barrier that is non-conductive and will enhance the resistance to arcing. Various processes exist which include dipping, brushing, and spraying. Optimal performance will come from coating the MLCC on all sides, top and bottom. The PCB slot in between the pads should extend slightly beyond the width of the MLCC. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.



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