



Ceramic Chip Capacitors Environmental Information

Frequently Asked Questions regarding the Environmental Aspects of TDK's MLCC

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Abstract

With the reduced lead-time between product development and mass production, TDK customers need accurate and timely environmental information regarding TDK's electronic components. This paper will provide the TDK Components USA, Inc. Environmental position and information regarding multi-layer ceramic capacitors constituents.

Multilayer Ceramic Chip Capacitors Environmental Information and Environmental Aspects.

Frequently asked questions regarding the constituents of a MLCC.

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Question 1: Do TDK capacitors contain banned or restricted substances?

No. TDK's capacitors are lead free, RoHS, and REACH and WEEE conforming. TDK MLCC's do not contain any listed or banned substances nor does TDK use any of the substances listed during manufacturing.

Question 2: How much lead is in TDK capacitors?

Capacitors manufactured by TDK Components USA, Inc. have been lead-free since 1999. Lead is not included in concentrations exceeding those defined by the RoHS Directive.

Question 3: What are the materials used to construct a capacitor?

The breakdown of a typical capacitor is described in Figure 1.

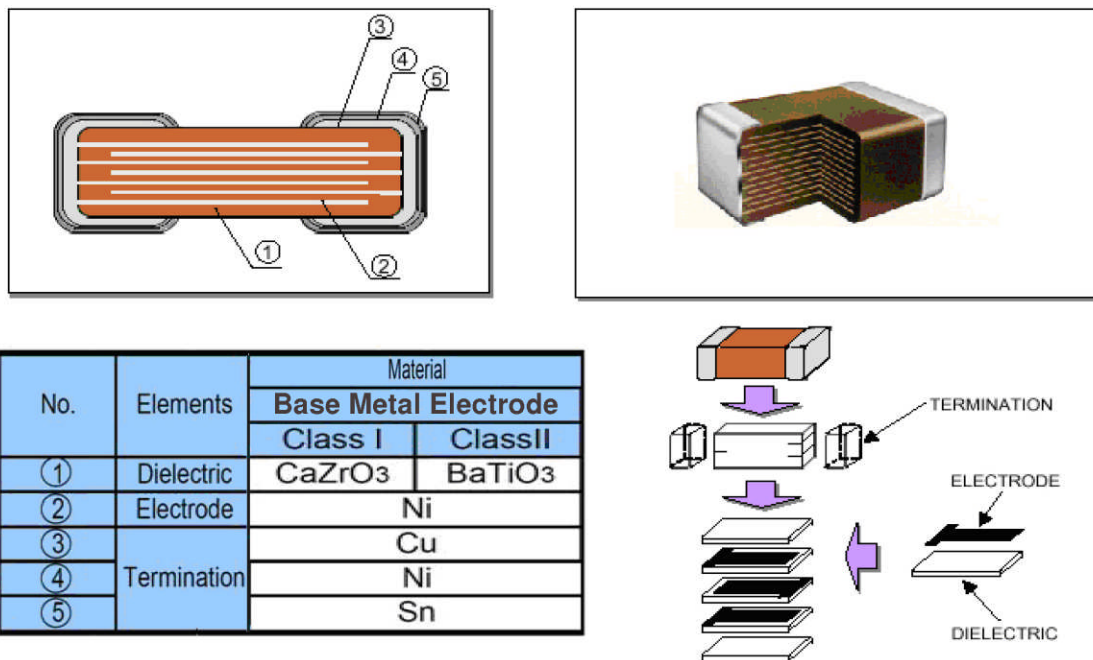


Figure 1: Materials used to construct a capacitor

- 1. Dielectric:** (Barium Titanate CAS #12047-27-7) - The bare ceramic body is made primarily of multiple layers of barium titanate, with other metal oxides. Small amounts of dopants are added to shift or depress the temperature curve characteristics. These materials are included in the Miscellaneous category and are below reporting thresholds and are proprietary.
- 2. Electrode:** (Nickel CAS #7440-02-0)- The Dielectric is alternated with nickel electrode layers.
- 3. Termination:** (Copper CAS #7440-50-8)- Copper paste is applied on the capacitor as an external electrode.
- 4. Termination:** Thermal Barrier - (Nickel CAS #7440-02-0) - Nickel is electroplated onto the capacitor external electrode as a thermal barrier against solder heat.
- 5. Termination:** Solder - (Tin CAS #7440-31-5) - External Electrode Base - - Matte Tin (4 μm $\mu \pm 1 \mu\text{m}$) is electroplated onto nickel thermal barrier to improve solderability performance characteristics.

Question 4: What are the material percentages of TDK capacitors by type and size?

Table 1 below references the total chip weight and the constituent weight percentages for representative case sizes.

Case Size	Temperature Characteristics	Representative Thickness (mm)	Total Weight (mg)	Electrode Components						Dielectric Components											
				Ni		Sn		Cu		BaO		CaO		SrO		TiO ₂		ZrO ₂		Misc.	
				mg	%	mg	%	mg	%	mg	%	mg	%	mg	%	mg	%	mg	%	mg	%
0603	X5R	0.03	0.32	0.03	8.1	0.01	2.5	0.10	32.1	0.12	36.76					0.06	19.0			0.01	1.6
1005	C0G	0.05	1.25	0.07	5.6	0.03	2.4	0.40	32.0	0.01	0.9	0.15	12.0	0.12	9.5	0.01	0.8	0.44	35.01	0.02	1.7
1005	C0G	0.05	1.25	0.06	4.8	0.03	2.4	0.40	32.0	0.01	0.7904	0.15	12.0	0.12	9.6	0.01	0.8	0.45	35.994	0.02	1.6
1005	X7R	0.05	1.25	0.10	8.0	0.03	2.4	0.40	32.0	0.44	35.2					0.21	16.8	0.06	4.8	0.01	0.8
1608	C0G	0.80	5.12	0.14	2.7	0.07	1.4	0.86	16.8	2.59	50.585					1.37	26.8			0.09	1.8
1608	X7R	0.80	5.12	0.14	2.7	0.07	1.4	0.86	16.8	2.59	50.585	1.37	26.8							0.09	1.8
1609	X7R	0.80	5.12	0.26	5.0	0.15	3.0	0.77	15.0	2.56	50					1.28	25.0			0.10	2.0
2012	C0G	0.60	7.50	0.27	3.6	0.11	1.5	1.39	18.5	0.09	1.146	1.15	15.3	0.91	12.1	0.08	1.1	3.34	44.579	0.17	2.2
2012	X7R	0.85	10.63	0.79	7.4	0.14	1.3	1.69	15.9	5.12	48.188					2.72	25.6			0.17	1.6
2012	X7R	1.20	15.63	3.16	20.2	0.19	1.2	2.17	13.9	6.46	41.3					3.44	22.0			0.22	1.4
3216	C0G	0.85	21.76	1.96	9.0	0.17	0.8	2.05	9.4	0.26	1.2	3.53	16.2	2.76	12.7	0.26	1.2	10.38	47.7	0.39	1.8
3216	X7R	1.10	29.44	2.94	10.0	0.29	1.0	2.36	8.0	14.72	50					7.36	25.0			1.77	6.0
3216	X7R	1.60	40.96	12.70	31.0	0.41	1.0	3.28	8.0	15.97	39					8.19	20.0			0.41	1.0
3225	C0G	1.80	79.90	15.77	19.7	0.34	0.4	4.13	5.2	0.89	1.12	11.93	14.9	9.37	11.7	0.84	1.0	35.02	43.83	1.61	2.0
3225	X7R	1.80	79.90	19.98	25.0	0.80	1.0	4.39	5.5	35.96	45	15.98	20.0							2.80	3.5
4532	C0G	2.50	144.00	7.20	5.0	1.44	1.0	7.20	5.0	7.20	5	21.60	15.0	21.60	15.0			72.00	50	5.76	4.0
4520	X7R	1.60	58.50	1.76	3.0	0.59	1.0	2.93	5.0	34.52	59					17.55	30.0			1.17	2.0
5750	X7R	2.50	327.75	33.83	10.3	0.69	0.2	8.51	2.6	182.19	55.589					96.29	29.4			6.24	1.9

Table 1: Materials Weight and Percentage Examples

Question 5: I need official material declarations today, where do I go to get them.

The foregoing information is presented to give you an accurate picture of TDK MLCC's environmental aspects. As you can see, beyond the basic simple design of the capacitor, there can be many formulations with the various case sizes depending on the number of inner layers of alternating nickel and dielectric, and the characteristics of the dielectric itself. There are hundreds of combinations, and in some cases, parts are specially designed to meet customer specifications.

In order for TDK to provide accurate information on the chip you use, you must request the information through one of our authorized sales partners or from one of our regional sales offices. This information is forwarded to Quality Assurance Group: Environmental division in Japan through an on-line system. The process usually can be completed within 10 days.

Question 6: Why does TDK not provide blanket certifications online like other electronic suppliers?

In addition to the reasons stated in Question 5, we must make sure that the product is a genuine TDK part purchased through an authorized distributor. Unfortunately, in some parts of the world, counterfeit TDK capacitors have been found on the market.

Question 7: What Environmental Certifications does TDK Components USA, Inc. hold?

TDK Components USA, Inc. has been ISO 14001 Certified by Underwriters Laboratories since April 22, 1999 (Figure 2). TDK Components was also honored as a Charter Member in the National Environmental Achievement Track for our commitments to Environmental Management, continuous improvement, public outreach, and environmental compliance on December 13, 2000.



Figure 2: Certificate of compliance by Underwriters laboratories

Question 8: How can I find more information on TDK and their Environmental Programs?

Write:

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