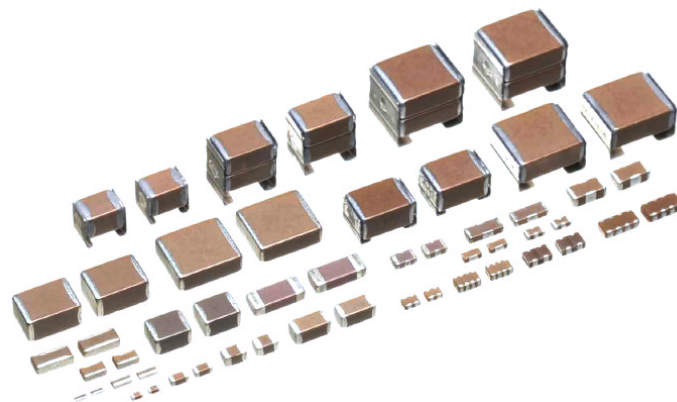


A decorative background of green foliage, including various leaves and branches, is positioned at the top of the page, partially overlapping the TDK logo.

Multilayer Ceramic Capacitor 2010 PRODUCT GUIDE

MLCC Product Line Summary with an Emphasis on New Products



Material Prepared By:

TDK Components USA, Inc.

1 TDK Boulevard :: Peachtree City, GA 30269

Tel: 770/631/0410

I. New Products List

- General Applications
- Specialty Applications
- Distribution Market Only

II. Product Line Summary

- General Application | Gen Cap // Mid Voltage // High Voltage
- Automotive Application | CGA Series
- High Temperature | X8R
- Space Saver | Cap Array 2-in-1 // Cap Array 4-in-1
- Electrolytic/Film Cap Replacement | Mega Cap // Hi Capacitance // Controlled ESR
- Low Inductance | Flip Type // Feed Through // ULI
- Board Flex | Soft Termination // Open Mode // Serial Construction
- Low ESR | High Q

III. Service

- Part Number Conversion
- VA Analysis/BOM Optimization
- Set Analysis/Electrolytic Capacitor Replacement
- TDK Local Technical Services

IV. Guides

- TDK Item Description Breakdown
- E-Series Reference
- Electrolytic/Film Capacitor Replacement Guide
- TDK Website Points of Interest
- Application Guide



New Products List

• General Applications C1005 Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C1005C0G1H561J	C1005	C0G	1H	561	J	0.5
C1005C0G1H681J	C1005	C0G	1H	681	J	0.5
C1005C0G1H821J	C1005	C0G	1H	821	J	0.5
C1005C0G1H102J	C1005	C0G	1H	102	J	0.5
C1005X7R1H103K/M	C1005	X7R	1H	103	K/M	0.5
C1005X7R1H153K/M	C1005	X7R	1H	153	K/M	0.5
C1005X7R1H223K/M	C1005	X7R	1H	223	K/M	0.5
C1005X7R1H333K/M	C1005	X7R	1H	333	K/M	0.5
C1005X7R1H473K/M	C1005	X7R	1H	473	K/M	0.5
C1005X7R1E683K/M	C1005	X7R	1E	683	K/M	0.5
C1005X7R1E104K/M	C1005	X7R	1E	104	K/M	0.5
C1005X5R1H473K/M	C1005	X5R	1H	473	K/M	0.5
C1005X5R1A155K/M	C1005	X5R	1A	155	K/M	0.5
C1005X5R1A225K/M	C1005	X5R	1A	225	K/M	0.5
C1005X5R0J225K	C1005	X5R	0J	225	K	0.5
C1005X5R0J335M	C1005	X5R	0J	335	M	0.5
C1005X5R0J475M	C1005	X5R	0J	475	M	0.5
C1005X5R0G225K	C1005	X5R	0G	225	K	0.5
C1005X5R0G335M	C1005	X5R	0G	335	M	0.5
C1005X5R0G475M	C1005	X5R	0G	475	M	0.5
C1005X6S1A105K/M	C1005	X6S	1A	105	K/M	0.5
C1005X6S0G225K	C1005	X6S	0G	225	K	0.5

• General Applications C2012 Series

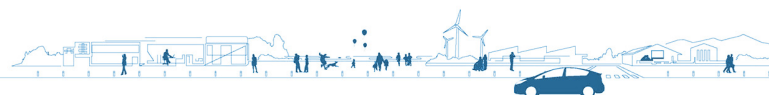
TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C2012C0G1H392J	C2012	C0G	1H	392	J	0.6
C2012C0G1H472J	C2012	C0G	1H	472	J	0.6
C2012C0G1H562J	C2012	C0G	1H	562	J	0.6
C2012C0G1H682J	C2012	C0G	1H	682	J	0.6
C2012C0G1H822J	C2012	C0G	1H	822	J	0.6
C2012C0G1H103J	C2012	C0G	1H	103	J	0.6
C2012C0G1H153J	C2012	C0G	1H	153	J	0.85
C2012C0G1H223J	C2012	C0G	1H	223	J	1.25
C2012C0G1H333J	C2012	C0G	1H	333	J	1.25
C2012X7R1H474K/M	C2012	X7R	1H	474	K/M	1.25
C2012X7R1H684K/M	C2012	X7R	1H	684	K/M	1.25
C2012X7R1H105K/M	C2012	X7R	1H	105	K/M	1.25
C2012X7R1E225K/M	C2012	X7R	1E	225	K/M	1.25
C2012X7R1C335K/M	C2012	X7R	1C	335	K/M	1.25
C2012X7R1C475K/M	C2012	X7R	1C	475	K/M	1.25
C2012X5R1H105K/M	C2012	X5R	1H	105	K/M	1.25
C2012X5R1C685K/M	C2012	X5R	1C	685	K/M	1.25
C2012X5R1C106K/M	C2012	X5R	1C	106	K/M	0.85
C2012X5R1C226K/M	C2012	X5R	1C	226	K/M	1.25
C2012X5R1A156M	C2012	X5R	1A	156	M	1.25
C2012X5R1A226M	C2012	X5R	1A	226	M	0.85
C2012X5R1A226K/M	C2012	X5R	1A	226	K/M	1.25
C2012X5R0J105K/M	C2012	X5R	0J	105	K/M	0.6
C2012X5R0J156M	C2012	X5R	0J	156	M	0.85
C2012X5R0J226M	C2012	X5R	0J	226	M	0.85
C2012X6S1A106K/M	C2012	X6S	1A	106	K/M	0.85
C2012X6S1A226K/M	C2012	X6S	1A	226	K/M	1.25
C2012X6S0J106K/M	C2012	X6S	0J	106	K/M	0.85
C2012X6S0J226K/M	C2012	X6S	0J	226	K/M	1.25
C2012X6S0G226M	C2012	X6S	0G	226	M	0.85

• General Applications C1608 Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C1608C0G1H392J	C1608	C0G	1H	392	J	0.8
C1608C0G1H472J	C1608	C0G	1H	472	J	0.8
C1608C0G1H562J	C1608	C0G	1H	562	J	0.8
C1608C0G1H682J	C1608	C0G	1H	682	J	0.8
C1608C0G1H822J	C1608	C0G	1H	822	J	0.8
C1608C0G1H103J	C1608	C0G	1H	103	J	0.8
C1608X7R1H154K/M	C1608	X7R	1H	154	K/M	0.8
C1608X7R1H224K/M	C1608	X7R	1H	224	K/M	0.8
C1608X7R1E334K/M	C1608	X7R	1E	334	K/M	0.8
C1608X7R1E474K/M	C1608	X7R	1E	474	K/M	0.8
C1608X5R1H104K/M	C1608	X5R	1H	104	K/M	0.8
C1608X5R1H154K/M	C1608	X5R	1H	154	K/M	0.8
C1608X5R1H224K/M	C1608	X5R	1H	224	K/M	0.8
C1608X5R1H334K/M	C1608	X5R	1H	334	K/M	0.8
C1608X5R1H474K/M	C1608	X5R	1H	474	K/M	0.8
C1608X5R1H684K/M	C1608	X5R	1H	684	K/M	0.8
C1608X5R1H105K/M	C1608	X5R	1H	105	K/M	0.8
C1608X5R1C225K/M	C1608	X5R	1C	225	K/M	0.5
C1608X5R1C335K/M	C1608	X5R	1C	335	K/M	0.8
C1608X5R1C475K/M	C1608	X5R	1C	475	K/M	0.8
C1608X5R1A225K/M	C1608	X5R	1A	225	K/M	0.5
C1608X5R1A475K/M	C1608	X5R	1A	475	K/M	0.5
C1608X5R1A685K/M	C1608	X5R	1A	685	K/M	0.8
C1608X5R1A106K/M	C1608	X5R	1A	106	K/M	0.8
C1608X5R0J475K/M	C1608	X5R	0J	475	K/M	0.5
C1608X5R0J685K/M	C1608	X5R	0J	685	K/M	0.8
C1608X5R0J106K	C1608	X5R	0J	106	K	0.8
C1608X6S1A225K/M	C1608	X6S	1A	225	K/M	0.5
C1608X6S1A475K/M	C1608	X6S	1A	475	K/M	0.8
C1608X6S0G225K/M	C1608	X6S	0G	225	K/M	0.5
C1608X6S0G475K/M	C1608	X6S	0G	475	K/M	0.5
C1608X6S0G106K/M	C1608	X6S	0G	106	K/M	0.8

• General Applications C3216/C3225 Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C3216C0G1H472J	C3216	C0G	1H	472	J	0.6
C3216C0G1H562J	C3216	C0G	1H	562	J	0.6
C3216C0G1H822J	C3216	C0G	1H	822	J	0.6
C3216C0G1H103J	C3216	C0G	1H	103	J	0.6
C3216C0G1H153J	C3216	C0G	1H	153	J	0.6
C3216C0G1H223J	C3216	C0G	1H	223	J	0.6
C3216C0G1H333J	C3216	C0G	1H	333	J	0.85
C3216C0G1H473J	C3216	C0G	1H	473	J	1.15
C3216C0G1H683J	C3216	C0G	1H	683	J	1.6
C3216C0G1H104J	C3216	C0G	1H	104	J	1.6
C3216X7R1H155K/M	C3216	X7R	1H	155	K/M	1.6
C3216X7R1H225K/M	C3216	X7R	1H	225	K/M	1.6
C3216X7R1E685K/M	C3216	X7R	1E	685	K/M	1.6
C3216X7R1E106K/M	C3216	X7R	1E	106	K/M	1.6
C3216X5R1E106K/M	C3216	X5R	1E	106	K/M	1.6
C3225X7R1H475K/M	C3225	X7R	1H	475	K/M	2.5
C3225X6S1H475K/M	C3225	X6S	1H	475	K/M	2.5
C3225X5R1H475K/M	C3225	X5R	1H	475	K/M	2.5
C3225X5R1A336M	C3225	X5R	1A	336	M	2
C3225X5R1A476M	C3225	X5R	1A	476	M	2.5



New Products List

• Flip Type C Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C0510X6S0G224M	C0510	X6S	0G	224	M	0.3
C0510X6S0G474M	C0510	X6S	0G	474	M	0.3
C0816X6S0G474M	C0816	X6S	0G	474	M	0.3
C0816X5R1A474K	C0816	X5R	1A	474	K	0.5

• High Temperature X8R C Series

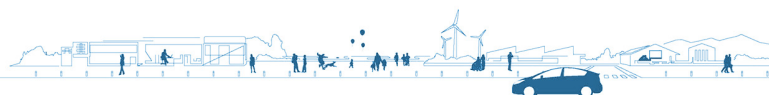
TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C1005X8R1C153K	C1005	X8R	1C	153	K	0.5
C1005X8R1C223K	C1005	X8R	1C	223	K	0.5
C1005X8R1C333K	C1005	X8R	1C	333	K	0.5
C1608X8R1C154K	C1608	X8R	1C	154	K	0.8
C1608X8R1C224K	C1608	X8R	1C	224	K	0.8

• Controlled ESR CER Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
CERD1FX5R0G106M	CERD1F	X5R	0G	106	M	0.85

• Feed Through CKD Series

TDK Part Number	Case Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
CKD61BJB0J105S	CKD61BJB	0J	105	S	0.6
CKD61BJB0J475S	CKD61BJB	0J	475	S	0.6
CKD610JB0J475S	CKD610JB	0J	475	S	0.8
CKD510JB1C474S	CKD510JB	1C	474	S	0.85
CKD510JB1A225S	CKD510JB	1A	225	S	0.85
CKD510JB1A475S	CKD510JB	1A	475	S	0.85
CKD510JB0J106S	CKD510JB	0J	106	S	0.85
CKD510JB0J226S	CKD510JB	0J	226	S	0.85
CKD310JB0J226S	CKD310JB	0J	226	S	1.3



New Products List

• F & G Tight Tolerance C Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C1005C0G1H220F/G	C1005	C0G	1H	220	F/G	0.5
C1005C0G1H470F/G	C1005	C0G	1H	470	F/G	0.5
C1005C0G1H101F/G	C1005	C0G	1H	101	F/G	0.5
C1608C0G1H220F/G	C1608	C0G	1H	220	F/G	0.8
C1608C0G1H470F/G	C1608	C0G	1H	470	F/G	0.8
C1608C0G1H101F/G	C1608	C0G	1H	101	F/G	0.8
C1608C0G1H221F/G	C1608	C0G	1H	221	F/G	0.8
C1608C0G1H471F/G	C1608	C0G	1H	471	F/G	0.8
C1608C0G1H102F/G	C1608	C0G	1H	102	F/G	0.8
C1608C0G2A101F/G	C1608	C0G	2A	101	F/G	0.8
C1608C0G2A102F/G	C1608	C0G	2A	102	F/G	0.8

• General Applications C0402 Series

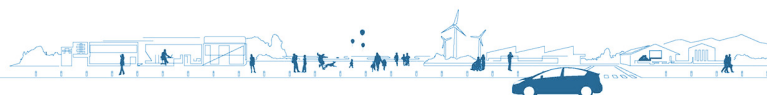
TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C0402C0G1C0R5C	C0402	C0G	1C	0R5	C	0.2
C0402C0G1C010B/C	C0402	C0G	1C	010	B/C	0.2
C0402C0G1C1R1B/C	C0402	C0G	1C	1R1	B/C	0.2
C0402C0G1C1R2B/C	C0402	C0G	1C	1R2	B/C	0.2
C0402C0G1C1R3B/C	C0402	C0G	1C	1R3	B/C	0.2
C0402C0G1C1R5B/C	C0402	C0G	1C	1R5	B/C	0.2
C0402C0G1C1R6B/C	C0402	C0G	1C	1R6	B/C	0.2
C0402C0G1C1R8B/C	C0402	C0G	1C	1R8	B/C	0.2
C0402C0G1C020B/C	C0402	C0G	1C	020	B/C	0.2
C0402C0G1C2R2B/C	C0402	C0G	1C	2R2	B/C	0.2
C0402C0G1C2R4B/C	C0402	C0G	1C	2R4	B/C	0.2
C0402C0G1C2R7B/C	C0402	C0G	1C	2R7	B/C	0.2
C0402C0G1C030B/C	C0402	C0G	1C	030	B/C	0.2
C0402C0G1C3R3B/C	C0402	C0G	1C	3R3	B/C	0.2
C0402C0G1C3R6B/C	C0402	C0G	1C	3R6	B/C	0.2
C0402C0G1C3R9B/C	C0402	C0G	1C	3R9	B/C	0.2
C0402C0G1C040B/C	C0402	C0G	1C	040	B/C	0.2
C0402C0G1C4R3B/C	C0402	C0G	1C	4R3	B/C	0.2
C0402C0G1C4R7B/C	C0402	C0G	1C	4R7	B/C	0.2
C0402C0G1C050B/C	C0402	C0G	1C	050	B/C	0.2
C0402C0G1C5R1B/C/D	C0402	C0G	1C	5R1	B/C/D	0.2
C0402C0G1C5R6B/C/D	C0402	C0G	1C	5R6	B/C/D	0.2
C0402C0G1C060B/C/D	C0402	C0G	1C	060	B/C/D	0.2
C0402C0G1C6R2B/C/D	C0402	C0G	1C	6R2	B/C/D	0.2
C0402C0G1C6R8B/C/D	C0402	C0G	1C	6R8	B/C/D	0.2
C0402C0G1C070B/C/D	C0402	C0G	1C	070	B/C/D	0.2
C0402C0G1C7R5B/C/D	C0402	C0G	1C	7R5	B/C/D	0.2
C0402C0G1C080B/C/D	C0402	C0G	1C	080	B/C/D	0.2
C0402C0G1C8R2B/C/D	C0402	C0G	1C	8R2	B/C/D	0.2
C0402C0G1C090B/C/D	C0402	C0G	1C	090	B/C/D	0.2
C0402C0G1C9R1B/C/D	C0402	C0G	1C	9R1	B/C/D	0.2
C0402C0G1C100E/D	C0402	C0G	1C	100	E/D	0.2
C0402C0G1C110G/J	C0402	C0G	1C	110	G/J	0.2
C0402C0G1C120G/J	C0402	C0G	1C	120	G/J	0.2
C0402C0G1C130G/J	C0402	C0G	1C	130	G/J	0.2
C0402C0G1C150G/J	C0402	C0G	1C	150	G/J	0.2
C0402X5R1C101K	C0402	X5R	1C	101	K	0.2
C0402X5R1C151K	C0402	X5R	1C	151	K	0.2
C0402X5R1C221K	C0402	X5R	1C	221	K	0.2
C0402X5R1C331K	C0402	X5R	1C	331	K	0.2
C0402X5R1C471K	C0402	X5R	1C	471	K	0.2

• General Applications C0402 Series (Con't)

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C0402X5R1C681K	C0402	X5R	1C	681	K	0.2
C0402X5R1A101K	C0402	X5R	1A	101	K	0.2
C0402X5R1A221K	C0402	X5R	1A	221	K	0.2
C0402X5R1A471K	C0402	X5R	1A	471	K	0.2
C0402X7R1A101K	C0402	X7R	1A	101	K	0.2
C0402X7R1A151K	C0402	X7R	1A	151	K	0.2
C0402X7R1A221K	C0402	X7R	1A	221	K	0.2
C0402X7R1A331K	C0402	X7R	1A	331	K	0.2
C0402X7R1A471K	C0402	X7R	1A	471	K	0.2
C0402X7R1A681K	C0402	X7R	1A	681	K	0.2
C0402X5R1A102K	C0402	X5R	1A	102	K	0.2
C0402X5R1A152K	C0402	X5R	1A	152	K	0.2
C0402X5R1A222K	C0402	X5R	1A	222	K	0.2
C0402X5R0J681K	C0402	X5R	0J	681	K	0.2
C0402X5R0J102K	C0402	X5R	0J	102	K	0.2
C0402X5R0J152K	C0402	X5R	0J	152	K	0.2
C0402X5R0J222K	C0402	X5R	0J	222	K	0.2
C0402X5R0J332K	C0402	X5R	0J	332	K	0.2
C0402X5R0J472K	C0402	X5R	0J	472	K	0.2
C0402X5R0J682K	C0402	X5R	0J	682	K	0.2
C0402X5R0J103K	C0402	X5R	0J	103	K	0.2

• High Q C0603 Series

TDK Part Number	Case Code	T.C. Code	Voltage Code	Capacitance Code	Tol. Code	Thickness
C0603C0G1E0R2B	C0603	C0G	1E	0R2	B	0.3
C0603C0G1E0R3B	C0603	C0G	1E	0R3	B	0.3
C0603C0G1E0R4B	C0603	C0G	1E	0R4	B	0.3
C0603C0G1E0R5B	C0603	C0G	1E	0R5	B	0.3
C0603C0G1E0R6B	C0603	C0G	1E	0R6	B	0.3
C0603C0G1E0R7B	C0603	C0G	1E	0R7	B	0.3
C0603C0G1E0R8B	C0603	C0G	1E	0R8	B	0.3
C0603C0G1E0R9B	C0603	C0G	1E	0R9	B	0.3
C0603C0G1E010B/C	C0603	C0G	1E	010	B	0.3
C0603C0G1E1R2B/C	C0603	C0G	1E	1R2	B	0.3
C0603C0G1E1R5B/C	C0603	C0G	1E	1R5	B	0.3
C0603C0G1E1R8B/C	C0603	C0G	1E	1R8	B	0.3
C0603C0G1E020B/C	C0603	C0G	1E	020	B	0.3
C0603C0G1E2R2B/C	C0603	C0G	1E	2R2	B	0.3
C0603C0G1E2R7B/C	C0603	C0G	1E	2R7	B	0.3
C0603C0G1E030B/C	C0603	C0G	1E	030	B	0.3
C0603C0G1E3R3B/C	C0603	C0G	1E	3R3	B	0.3
C0603C0G1E3R9B/C	C0603	C0G	1E	3R9	B	0.3
C0603C0G1E040B/C	C0603	C0G	1E	040	B	0.3
C0603C0G1E4R7B/C	C0603	C0G	1E	4R7	B	0.3
C0603C0G1E050B/C	C0603	C0G	1E	050	B	0.3
C0603C0G1E5R6B/C	C0603	C0G	1E	5R6	B	0.3
C0603C0G1E060B/C	C0603	C0G	1E	060	B	0.3
C0603C0G1E6R8B/C	C0603	C0G	1E	6R8	B	0.3
C0603C0G1E070B/C	C0603	C0G	1E	070	B	0.3
C0603C0G1E080B/C	C0603	C0G	1E	080	B/C	0.3
C0603C0G1E8R2B/C	C0603	C0G	1E	8R2	B/C	0.3
C0603C0G1E090B/C	C0603	C0G	1E	090	B/C	0.3
C0603C0G1E100E/D	C0603	C0G	1E	100	E/D	0.3
C0603C0G1E120G/J	C0603	C0G	1E	120	G/J	0.3
C0603C0G1E150G/J	C0603	C0G	1E	150	G/J	0.3



Product Line Summary

Applications	Product Line	Illustration	Features	Offering
General Application	General Capacitors (C Series) 		<ul style="list-style-type: none"> Thin ceramic dielectric layer capability Wide range of case size availability Superior dimensional precision Available in C0G, X7R, X5R, Y5V 	<ul style="list-style-type: none"> C1005 : up to 4.7 μF C1608 : up to 10 μF C2012 : up to 47 μF C3216 : up to 47 μF C3225 : up to 100 μF C4520 : up to 1 nF C4532 : up to 100 μF C5750 : up to 100 μF
	Mid Voltage (C Series)		<ul style="list-style-type: none"> 100V, 250V and 630V DC availability Employs unique electrode design 	<ul style="list-style-type: none"> C1005 - C5750 / C0G, X7R, X5R 100V - 630V / up to 4.7 μF
	High Voltage (C Series)		<ul style="list-style-type: none"> Up to 3000V rating Prevents corona on surface Based on ISO8802-3 for LAN 	<ul style="list-style-type: none"> C4520 - C4532 / C0G, X7R 1000V - 3000V / up to 10 nF
Automotive Application	Automotive (CGA Series) 		<ul style="list-style-type: none"> For use in automotive electronic equipment (power train, safety equipment, etc.) Follows CDF-AEC-Q200 tests 	<ul style="list-style-type: none"> C0603 - C5750 / C0G, X7R, X7S, X8R 25V - 630V / up to 47 μF
High Temperature	X8R (C Series) 		<ul style="list-style-type: none"> Stable temp char (+/-15%) up to 150C Precise temp char (+/- 7.5%) up to 125C 	<ul style="list-style-type: none"> C1005 - C3225 / X8R 16V - 100V / up to 3.3 μF
Space Saver	Cap Array (CKC Series)		<ul style="list-style-type: none"> 4-in-1 and 2-in-1 designs available Reduced PCB space and mounting time Unique electrode design reduces crosstalk 	<ul style="list-style-type: none"> C1310 - C3216 / C0G, X5R, X7R 2-in-1 : 6.3V - 50V / up to 2.2 μF 4-in-1 : 6.3V - 50V / up to 1.0 μF
Electrolytic/Film Capacitor Replacement	Mega Cap (CKG Series)		<ul style="list-style-type: none"> 2x capacitance on single foot print Low ESR and ESL Absorbs thermal and mechanical stress 	<ul style="list-style-type: none"> X5R, X7R, X7S / 16V - 630 V Single stack: up to 47 μF Double stack: up to 100 μF
	High Cap (C Series)		<ul style="list-style-type: none"> Large case size and capacitance Capacitance up to the electrolytic range Low ESR and good freq characteristics 	<ul style="list-style-type: none"> C3216 - C5750 / X7R, Y5V C1005 - C5650 / C0G 4V - 100V / up to 100 μF
	Controlled ESR (CER Series) 		<ul style="list-style-type: none"> Unique design solves "low" ESR problem Same mount method as 2 terminal design Control ESR without affecting ESL 	<ul style="list-style-type: none"> C1608 - C2012 / X5R / 4V 1μF and 10μF / ESR: 20 mΩ to 1200 mΩ
Low Inductance	Flip Type (C Series) 		<ul style="list-style-type: none"> Low inductance (less than 400 pH) Provide stabilization of power line voltage High frequency noise suppression 	<ul style="list-style-type: none"> C0510 - C1632 / X5R, X5S, X6S, X7R, X7S 4V - 50V / up to 10 μF / 100 pH - 180 pH
	Feed Through (CKD Series) 		<ul style="list-style-type: none"> EMI prevention products Optimum noise bypass Low parasitic inductance 	<ul style="list-style-type: none"> C1608 - C3216 / JB 6.3V - 50V / up to 22 μF
	Ultra Low Inductance (CLL Series)		<ul style="list-style-type: none"> Offsetting magnetic fields Lowest available inductance High speed digital IC decoupling 	<ul style="list-style-type: none"> C1608 - C2012 / X7R, X7S 4V - 10V / up to 4.7 μF / 65 pH - 70 pH
Board Flexure	Soft Termination (C Series) 		<ul style="list-style-type: none"> Improved bending resistance Improved temperature cycle performance RoHS, WEE, and REACH compliant 	<ul style="list-style-type: none"> C1005 - C3225 / C0G, X5R, X7R, X7S, X8R 10V - 630V / up to 10 μF
	Open Mode (C Series)		<ul style="list-style-type: none"> Increased resistance to bending stress Fails "open" X7R & X8R temp characteristics 	<ul style="list-style-type: none"> C2012 - C5750 / X7R, X8R 16V - 630V / up to 22 μF
	Serial Construction (CEU Series) 		<ul style="list-style-type: none"> Floating electrode construction prevents sudden insulation breakdown after flex crack formation 	<ul style="list-style-type: none"> C1608 - C2012 / X7R 50V / up to 100 nF
Low ESR	High Q (C Series) 		<ul style="list-style-type: none"> Higher Q (lower loss) than standard caps Lower price compared to High Q Caps Same C0G BME material Same production process 	<ul style="list-style-type: none"> C0603 / C0G 25V / up to 15pF

BME Technology

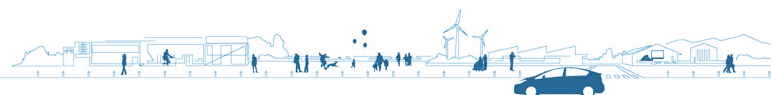
RoHS Compatible

Zero Emissions

ISO 14001

TS 16949 Compliant

Green Purchasing



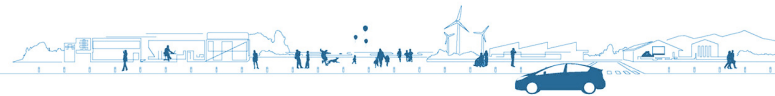
TDK MLCC Capacitance Offering

Commercial / Auto (non-Safety) | General Applications ≤ 630V Rated Voltage

Case Size JIS (EIA)		C0G [-55/+125C, 0±30ppm/C] E12 series		X7R [-55/+125C, ±15%] E6 series		X7S [-55/+125C, ±22%] E3 series		X6S [-55/+105C, ±22%] E3 series		X5R [-55/+85C, ±15%] E6 series		Y5V [-30/+85C, ±22/-82%] E1 series	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
C0402 (01005)	4V												
	6.3V										681	103	
	10V										101	222	
	16V	0R5	150	101	681						101	681	
	25V												
C0603 (0201)	4V							223	104				
	6.3V									223	104		
	10V										103		
	16V											472	103
	25V	010	101							102	222		
C1005 (0402)	4V												
	6.3V												
	10V												
	16V												
	25V			473	104								
	50V	010	102	103	104								
C1608 (0603)	4V												
	6.3V							475	106				
	10V							225	475			475	106
	16V			224	105								
	25V			104	474								
	50V	010	103	221	224								
	100V	101	122	102	223	473	104						
C2012 (0805)	4V												
	6.3V							106	226				
	10V												
	16V			684	475								
	25V			474	225								
	50V	392	333	154	105								
	100V	102	472	102	104	224	105						
C3216 (1206)	4V												
	6.3V												
	10V												
	16V												
	25V			684	106								
	50V	123	104	474	225								
	100V	392	103	333	105								
C3225 (1210)	4V												
	6.3V												
	10V												
	16V			106	226								
	25V			225	106								
	50V	393	104	155	475								
	100V	153	473	334	225								
C4532 (1812)	4V												
	6.3V												
	10V												
	16V			226	336								
	25V			475	226								
	50V	154	224	225	685								
	100V	473	104	684	225								
C5750 (2220)	4V												
	6.3V												
	10V												
	16V			336	476								
	25V			106	226								

Notes:

- Capacitance above is provided in a three digit code, designating a picofarad (pF) value. The first and second digits identify the first and second significant figures of the capacitance, the third identifies the multiplier. R indicates a decimal point (Ex. 104 = 100,000pF, or 0.1uF ; 1R8 = 1.8pF). Capacitance steps are offered in the E-series listed in the header. Red values indicates new TDK items.
- TDK offers General Application MLCCs as well as Specialty Applications MLCCs. The capacitance range for General Application MLCCs can be found here, Specialty Application MLCCs can be found in the TDK MLCC Product Guide. You may also find the cap ranges located within our catalog and website (www.tdk.com).
- This data subject to change without notice, please contact your TDK sales representative for most current revision. This datasheet is intended for customer use only - do not distribute outside of your organization.



TDK MLCC Capacitance Offering

CGA Series, CDF-AEC-Q200 Qualified (AUTO Grade) | Automotive Applications ≤ 630V Rated Voltage

Case Size JIS (EIA)	C0G [-55/+125C, 0±30ppm/C] E12 series		X7R [-55/+125C, ±15%] E6 series		X7S [-55/+125C, ±22%] E3 series		X8R [-55/+150C, ±15%] E3 series		
	Min	Max	Min	Max	Min	Max	Min	Max	
	Voltage								
C1005 (0402)	4V								
	6.3V								
	10V								
	16V			473	104			153	333
	25V			103	104			682	103
	50V	010	102	221	473			102	472
	100V				102	103			
C1608 (0603)	4V								
	6.3V								
	10V								
	16V			224	105			154	224
	25V			104	474			683	104
	50V	010	103	221	104			102	473
	100V	101	122	102	223	473	104	102	153
	250V	101	681						
	630V								
C2012 (0805)	4V								
	6.3V								
	10V						106		
	16V			684	475				105
	25V			474	225			154	334
	50V	392	333	154	105			683	104
	100V	102	472	102	104	224	105		223
	250V	821	272	102	223				
	630V								
C3216 (1206)	4V								
	6.3V								
	10V						106		
	16V				106				
	25V			684	475			334	105
	50V	123	104	474	225			154	474
	100V	392	103	333	105		225	333	154
	250V	332	822	153	104				
	630V	101	332	102	333				
C3225 (1210)	4V								
	6.3V								
	10V						226		
	16V			106	226				106
	25V			225	106			155	335
	50V	393	104	155	335		106		
	100V	153	473	334	225		335		
	250V	103	153	104	224				
	630V	392	682	473	683				

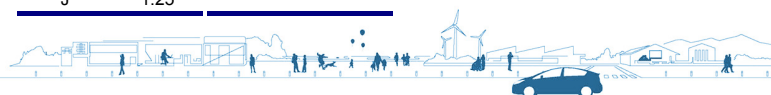
Notes:

- CGA identifies the product as CDF-AEC-Q-200 compliant but does not take into account other more specific automotive specifications and/or requirements. Customer specific requirements are identified and controlled via the traditional TDK item description plus ending code. The CGA item description also provides component thickness and life criteria.
- Capacitance above is provided in a three digit code, designating a picofarad (pF) value. The first and second digits identify the first and second significant figures of the capacitance, the third identifies the multiplier. R indicates a decimal point (Ex. 104 = 100,000pF, or 0.1uF ; 1R8 = 1.8pF). Capacitance steps are offered in the E-series listed in the header. Red values indicates new TDK items.
- TDK offers General Application MLCCs as well as Specialty Applications MLCCs. The capacitance range for General Application MLCCs can be found here, Specialty Application MLCCs can be found in the TDK MLCC Product Guide. You may also find the cap ranges located within our catalog and website (www.tdk.com).
- This data subject to change without notice, please contact your TDK sales representative for most current revision. This datasheet is intended for customer use only - do not distribute outside of your organization.

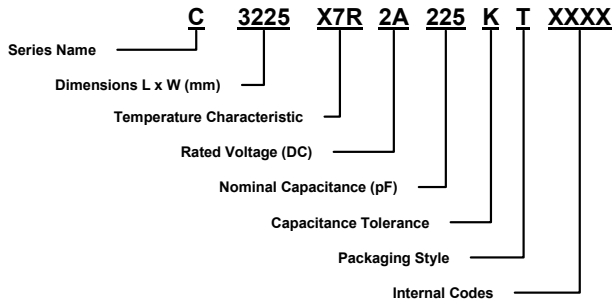
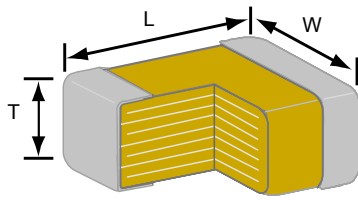
CGA Series Part No. Description

CGA 5 L 1 X7R1C106M

Style		Case Size		Thickness		Voltage Condition in the life test (Max Temp./1000hr)		
Symbol	Type	Symbol	EIA(inch)	JIS(mm)	Symbol	T (mm)	Symbol	Guaranteed
CGA	Automotive Grade	1	0201	0603	A	0.30	1	1 x R.V.
		2	0402	1005	B	0.50	2	2 x R.V.
		3	0603	1608	C	0.60	3	1.5 x R.V.
		4	0805	2012	D	0.70	4	1.2 x R.V.
		5	1206	3216	E	0.80		
		6	1210	3225	F	0.85		
		A	0306	0816	G	1.10		
		B	0508	1220	H	1.15		
		C	0612	1632	J	1.25		
					K	1.30		
					L	1.60		
					M	2.00		
					N	2.30		
					P	2.50		
					Q	2.80		
					R	3.20		
					S	0.45		



Illustration



Dimensions

Case	Length (mm)	Width (mm)	MaxThickness (mm)
C1005 (0402)	1.00 ± 0.05	0.50 ± 0.05	0.65
C1608 (0603)	1.60 ± 0.10	0.80 ± 0.10	0.95
C2012 (0805)	2.00 ± 0.20	1.25 ± 0.20	1.45
C3216 (1206)	3.20 ± 0.20	1.60 ± 0.20	1.80
C3225 (1210)	3.20 ± 0.40	2.50 ± 0.30	2.80
C4532 (1812)	4.50 ± 0.40	3.20 ± 0.40	3.50
C5750 (2220)	5.70 ± 0.40	5.00 ± 0.40	2.50

Applications

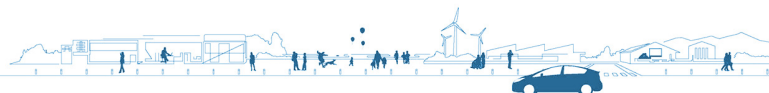
- Snubber in switching power supply
- Ringer cap in telephone set and modem
- Flash light in camera
- DSU/TA in ISDN lines
- HID (High Intensity Discharge Lamp)
- Output bypass in power supply
- Driver circuit in plasma display
- Noise bypass in automotive
- Other mid voltage applications
- Lighting

Features

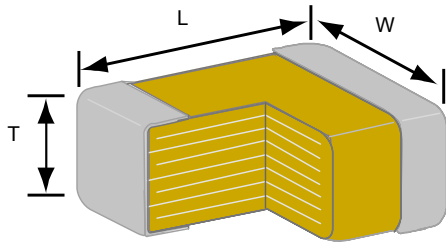
- Unique electrode design allows higher voltage application in smaller case size
- Voltage rating of 100V, 250V, and 630V
- High mechanical strength
- No polarity
- Low ESR

Capacitance Range

Capacitance (pF)	C1005 (0402)		C1608 (0603)		C2012 (0805)		C3216 (1206)			C3225 (1210)			C4532 (1812)			C5750 (2220)		
	100V (2A)	250V (2E)	100V (2A)	250V (2E)	100V (2A)	630V (2J)	250V (2E)	100V (2A)	630V (2J)	250V (2E)	100V (2A)	630V (2J)	250V (2E)	100V (2A)	630V (2J)	250V (2E)	100V (2A)	
100	C0G	C0G	C0G	C0G	C0G	C0G												
120	C0G	C0G	C0G															
150	C0G	C0G																
180	C0G	C0G																
220	C0G	C0G			C0G													
270	C0G	C0G																
330	C0G	C0G																
390	C0G	C0G																
470	C0G	C0G			C0G													
560	C0G	C0G																
680	C0G	C0G																
820		C0G		C0G														
1,000		X7R/C0G		X7R/C0G	X7R/C0G	X7R/C0G												
1,200		C0G		C0G	C0G	C0G												
1,500		X7R		X7R/C0G	X7R/C0G	X7R/C0G												
1,800				C0G	C0G	C0G												
2,200		X7R		X7R/C0G	X7R/C0G	X7R/C0G												
2,700				C0G	C0G	C0G												
3,300		X7R		X7R	X7R/C0G	X7R/C0G	C0G											
3,900				C0G			C0G	C0G										
4,700		X7R		X7R	X7R/C0G	X7R	C0G	C0G	C0G									
5,600							C0G	C0G	C0G									
6,800		X7R		X7R	X7R	X7R	X7R	C0G	C0G	C0G								
8,200							C0G	C0G						C0G				
10,000	X7S		X7R	X7R	X7R	X7R		C0G			C0G			C0G				
15,000		X7R		X7R	X7R	X7R	X7R				C0G	C0G		C0G				
22,000		X7R		X7R	X7R	X7R	X7R					C0G	C0G					
33,000					X7R	X7R	X7R					C0G		C0G				
47,000					X7R	X7R	X7R	X7R				C0G		C0G	C0G			
68,000					X7R	X7R	X7R	X7R				X7R			C0G			
100,000		X7S		X7R		X7R	X7R				X7R			X7R		C0G		
150,000								X7R			X7R			X7R			X7R	
220,000								X7R			X7R			X7R			X7R	
330,000									X7R			X7R					X7R	
470,000					X7S				X7R				X7R				X7R	
680,000										X7R					X7R		X7R	
1,000,000					X7S			X7R						X7R		X7R	X7R	
1,500,000														X7R			X7R	
2,200,000								X7S						X7R			X7R	
3,300,000														X7S			X7R	
4,700,000															X7S		X7R	
10,000,000																	X7S	



Illustration



Dimensions

Case	Length (mm)	Width (mm)	MaxThickness (mm)
C1005 (0402)	1.00 ± 0.05	0.50 ± 0.05	0.65
C1608 (0603)	1.60 ± 0.10	0.80 ± 0.10	0.95
C2012 (0805)	2.00 ± 0.20	1.25 ± 0.20	1.45
C3216 (1206)	3.20 ± 0.20	1.60 ± 0.20	1.80
C3225 (1210)	3.20 ± 0.40	2.50 ± 0.30	2.80
C4532 (1812)	4.50 ± 0.40	3.20 ± 0.40	3.20
C5750 (2220)	5.70 ± 0.40	5.00 ± 0.40	3.20

Applications

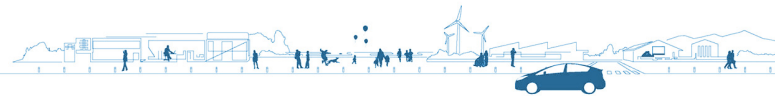
- Smoothing/Decoupling
- Filter/Time Constant circuits
- Mobile communication equipment
- General consumer products
- Oscillator/Snubber
- Power Supplies/DC-DC Converters
- Automotive electronics
- Film/Tantalum Cap replacement

Features

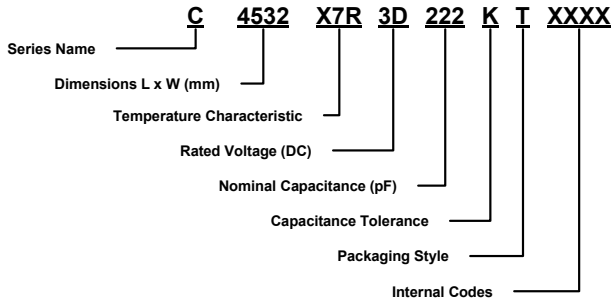
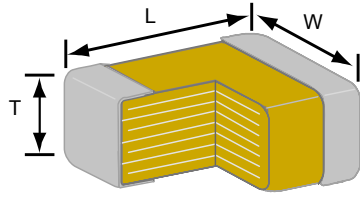
- High capacitance achieved through precision technologies enabling the use of multiple thinner ceramic dielectric layers
- Voltage rating of 4V, 6.3V, 10V, 16V, 25V, and 50V
- Impedance is linear to frequency
- Monolithic structure ensure superior mechanical strength and reliability
- Low residual inductance assures superior frequency characteristics
- Low stray capacitance ensures high conformity with nominal values
- Low ESR and no polarity
- Conformity to RoHS Directive

Capacitance Range

Capacitance (µF)	C1005 (0402)				C1608 (0603)				C2012 (0805)					C3216 (1206)					C3225 (1210)					C4532 (1812)					C5750 (2220)				
	16V (1C)	10V (1A)	6.3V (0J)	4V (0G)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	4V (0G)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)			
0.22	X5R	X5R	X5R		X5R X7R	X5R X7R	X5R X7R	X5R X7R		X7R	X7R	X7R				X7R	X7R																
0.33	X5R	X5R	X5R		X5R	X5R X7R	X5R X7R	X5R X7R		X7R	X7R	X7R				X7R	X7R																
0.47	X5R	X5R	X5R		X5R	X5R X7R	X5R X7R	X5R X7R		X7R	X7R	X7R				X7R	X7R	X7R				X7R											
0.68					X5R	X5R X7R	X5R			X7R	X7R	X7R				X7R	X7R																
1	X5R	X5R X6S	X5R X6S Y5V	X6S	X5R	X5R X6S X7R Y5V	X5R X6S X7R Y5V	X5R		X5R X7R Y5V	X5R X7R Y5V	X5R X7R Y5V	X5R X7R	X5R		X5R X7R	X7R	X7R				X7R						X7R					
1.5		X5R				X5R		X5R		X5R X7R	X7R	X7R				X7R	X7R					X7R						X7R					
2.2		X5R	X5R X6S			X5R X6S X7R Y5V	X5R X6S X7R Y5V	X6S		Y5V	X5R X7R Y5V	X5R X7R Y5V	X5R X7R	X5R		Y5V	X5R X7R	X5R X7R	X5R			X7R	X7R				X7R						
3.3			X5R	X5R		X5R	X5R	X5R				X7R	X5R X7R	X5R			X5R X7R	X5R X7R	X5R			X7R	X7R				X7R						
4.7			X5R	X5R		X5R	X5R X6S X7R Y5V	X5R X6S X7R Y5V	X6S		Y5V X5R	X5R X7R Y5V	X5R X7R Y5V	X5R		Y5V	Y5V X5R X7R	Y5V X5R X7R	X5R			Y5V X5R X7R	X7R				X7R	X7R			X7R		
6.8						X5R	X5R						X5R	X5R			X7R	X5R X7R				X7R					X7R				X7R		
10						X5R	Y5V X5R X6S	X5R X6S				X5R X7R Y5V	X5R X7R Y5V	X5R X6S X7R Y5V			Y5V X7R	Y5V X5R X7R	Y5V X5R X7R	X5R		Y5V X7S	Y5V X5R X7R	Y5V X5R X7R	X5R		Y5V	X5R X7R	X7R		X5R X7R	X7R	
15												X5R	X5R										X5R X7R	X5R			X5R X7R				X7R		
22											X5R	X5R X6S	X5R X6S Y5V				Y5V	Y5V	X5R			Y5V	Y5V X5R X7R	Y5V X5R X7R	X5R		Y5V X5R X7R	X5R X7R	X5R		Y5V X5R X7R	X5R X7R	X7R
33																								X5R	X5R			X5R X7R	X5R			X5R	
47																							Y5V X5R	Y5V X5R	X5R		Y5V X5R	X5R	X5R		Y5V X5R X7R		
68																									X5R							X5R	
100																									X5R						Y5V X5R	X5R	



Illustration



Dimensions

Case	T.C.	Length (mm)	Width (mm)	Max Thickness (mm)
C4520 (1808)	C0G	4.50 ± 0.40	2.00 ± 0.30	2.20
	X7R	4.50 ± 0.40	2.00 ± 0.30	1.50
C4532 (1812)	C0G	4.50 ± 0.40	3.20 ± 0.40	2.80
	X7R	4.50 ± 0.40	3.20 ± 0.40	2.20

Features

- Up to 3000V rated voltage
- Advanced design provides improved withstanding voltage characteristics
- TDK's proprietary internal electrode structure and the use of low-dielectric-strength material result in highly reliable performance in high-voltage applications
- Complies with ISO-8802-3 required for LAN
- Suitable for 100 Base-T corresponding LAN applications

Additional Information

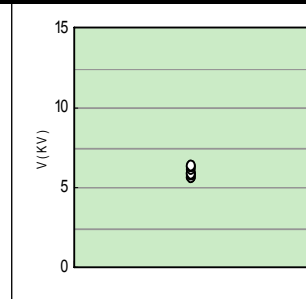
Applications

- Inverter circuits with a liquid crystal backlight
- LAN products, and general high voltage circuits

Capacitance Range

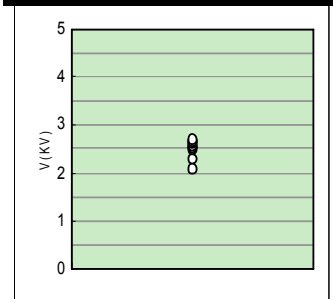
Capacitance (pF)	C4520 (1808)			C4532 (1812)		
	3000V (3F)	2000V (3D)	1000V (3A)	3000V (3F)	2000V (3D)	1000V (3A)
10	C0G					
12	C0G					
15	C0G					
18	C0G					
22	C0G					
27	C0G					
33	C0G					
39	C0G					
47	C0G					
56	C0G					
68	C0G					
82	C0G					
100	C0G			C0G		
120				C0G		
150				C0G		
180				C0G		
220				C0G		
270				C0G		
330				C0G		
470		X7R	X7R			
1,000		X7R	X7R			
2,200					X7R	
4,700						X7R
10,000						X7R

DC Break Down Voltage



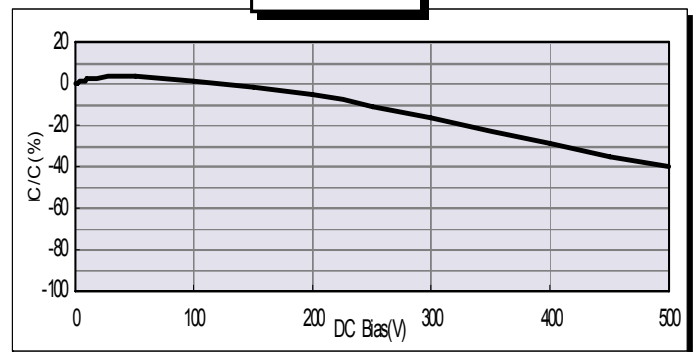
TDK P/N C4520X7R3D102K

AC Break Down Voltage



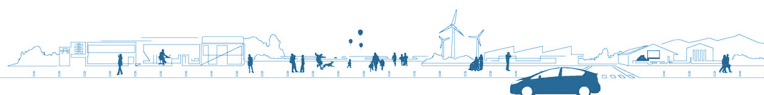
TDK P/N C4520X7R3D102K

DC-Bias

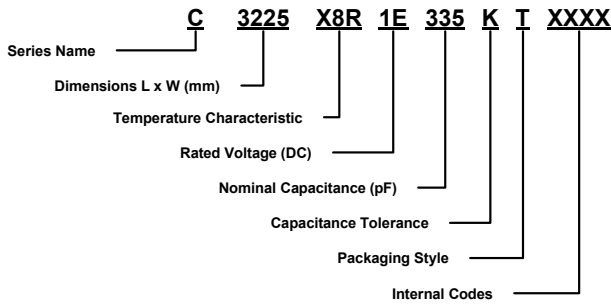
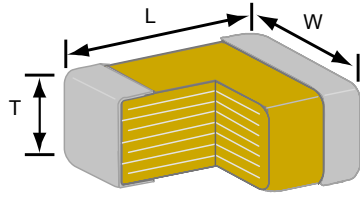


TDK P/N C4520X7R3D102K

Parameters	Limits	Unit	Measuring Conditions	
			Freq	Voltage
Capacitance	See Cap Range			
C.T.I.	10	%	1 kHz	1 Vrms
R.V.	1000 ~ 3000	Vdc		
D.F.	3	% max	1 kHz	1 Vrms
IR	4000	MΩ min.	DC	500 V
ΔC/C	15	%	1 kHz	1 Vrms



Illustration



Dimensions

Case	Length (mm)	Width (mm)	MaxThickness (mm)
C1005 (0402)	1.00 ± 0.05	0.50 ± 0.05	0.65
C1608 (0603)	1.60 ± 0.10	0.80 ± 0.10	0.95
C2012 (0805)	2.00 ± 0.20	1.25 ± 0.20	1.45
C3216 (1206)	3.20 ± 0.20	1.60 ± 0.20	1.80
C3225 (1210)	3.20 ± 0.40	2.50 ± 0.30	2.80

Features

- These products have no polarity
- Stable temperature characteristics (15%) up to 150°C
- Highly precise temperature characteristics (±7.5%) up to 125°C

Applications

- Automotive (underhood)
- Measurement instruments used at high temperature environments
- Time constant & filter circuit (up to 125°C)
- LCD display
- Sensor Module

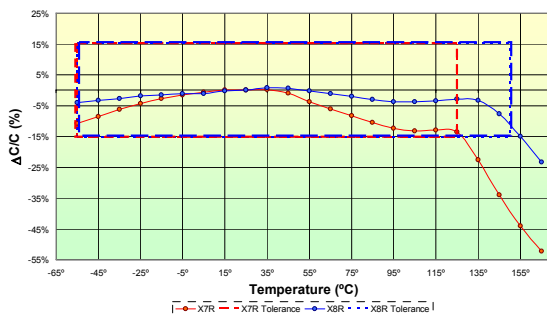
Capacitance Range

Capacitance (pF)	C1005 (0402)			C1608 (0603)			C2012 (0805)			C3216 (1206)			C3225 (1210)	
	50V (1H)	25V (1E)	16V (1C)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	100V (2A)	50V (1H)	25V (1E)	100V (2A)	50V (1H)	25V (1E)	25V (1E)
150	X8R													
220	X8R													
330	X8R													
470	X8R													
680	X8R													
1	X8R			X8R	X8R									
1.5	X8R			X8R	X8R									
2.2	X8R			X8R	X8R									
3.3	X8R			X8R	X8R									
4.7	X8R			X8R	X8R									
6.8		X8R		X8R	X8R									
10		X8R		X8R	X8R									
15			★ X8R	X8R	X8R									
22			★ X8R		X8R			X8R						
33			★ X8R		X8R									
47					X8R									
68						X8R					X8R			
0.1						X8R					X8R			
0.15							★ X8R					X8R		
0.22							★ X8R					X8R		
0.33												X8R	X8R	
0.47												X8R	X8R	
0.68													X8R	
1													X8R	
1.5														X8R
2.2														X8R
3.3														X8R

★ = new for 2010

Additional Information

Temperature Characteristic Curve (X7R vs X8R)



Temperature Characteristics of Capacitance

- Temperature characteristics of capacitance is stable (±15%) even at the higher temperature (~150°C)
- Temperature characteristics of capacitance shows highly precise performance (capacitance change of ±7.5% up to 125°C)

*Item shown: C2012X8R1H104K

Parameters

Temperature Characteristic

Specifications

-55°C to +150°C ΔC/C = ±15%

-55°C to +125°C ΔC/C = ±7.5%

Operating Temperature

-55°C to +150°C

Dissipation Factor

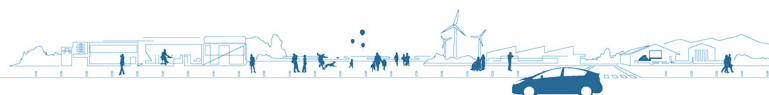
3% maximum

Insulation Resistance

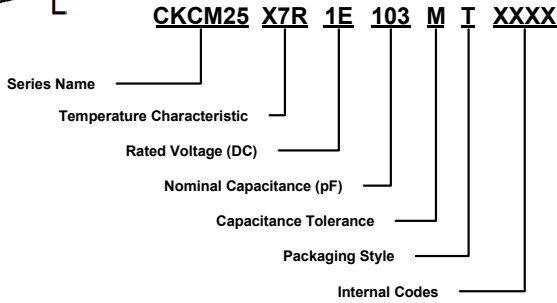
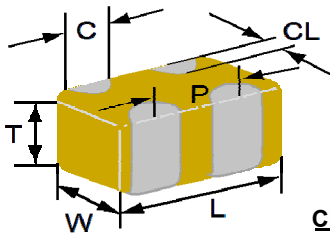
10 GΩ or 500 MΩ · μF minimum

Voltage Proof

2.5 · rated voltage for 1 to 5 sec.
Charge/Discharge ≤ 50 mA



Illustration



Dimensions

Case	L (mm)	W (mm)	P (mm)	C (mm)	CL (mm)	T Max (mm)
CKCM25 (C1310/0504)	1.37±0.15	1.00±0.15	0.64±0.10	0.36±0.10	0.20±0.10	0.7
CKCL22 (C2012/0805)	2.00±0.15	1.25±0.15	1.0±0.10	0.45±0.10	0.20+0.2-0.1	1.00

Features

- 2 capacitors in one package
- Reduced PCB space and mounting time
- Unique electrode construction reduces crosstalk
- **Also available in soft termination**

Applications

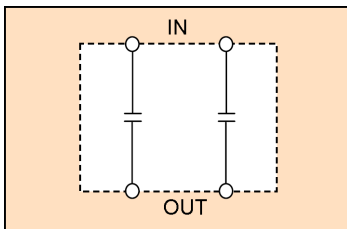
- Around interface cable in PC
- CPU bus line
- Cellular phone interface

Capacitance Range

Capacitance	CKCM25 (C1310/0504)					CKCL22 (C2012/0805)				
	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)
10	C0G					C0G				
15	C0G					C0G				
22	C0G					C0G				
33	C0G					C0G				
47	C0G					C0G				
68	C0G					C0G				
100	C0G					C0G				
150						C0G				
220						C0G				
330						C0G				
470						C0G				
680						C0G				
1,000	X7R					X7R				
2,200	X7R					X7R				
4,700	X7R					X7R				
0.010		X7R				X7R				
0.022			X5R			X7R				
0.047				X5R						
0.10					X5R		X7R			
0.22					X5R			X5R		
0.47					X5R				X5R	
1.0					X5R					X5R
2.2										X5R

Additional Information

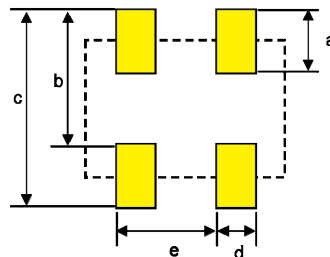
Equivalent Circuit



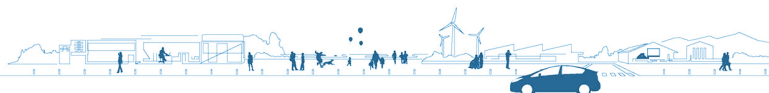
2 elements in 1 design:

- The electrostatic capacity range and shape are designed to meet the demands of the cellular phone market.

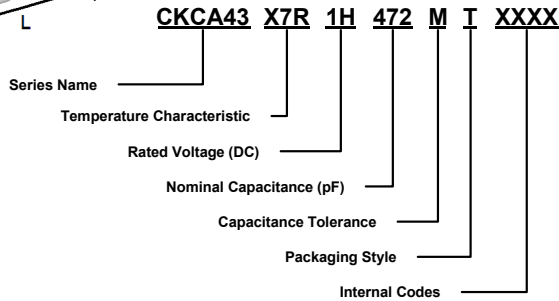
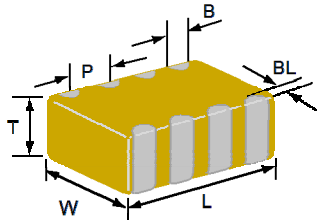
Solder Pad Dimensions



Symbol	CKCL22 (2012/0805)	CKCM25 (1310/0504)
a	0.60 mm	0.45 mm
b	1.00 mm	0.75 mm
c	1.60 mm	1.20 mm
d	0.50 mm	0.30 mm
e	1.00 mm	0.64 mm



Illustration



Dimensions

Case	L (mm)	W (mm)	P (mm)	C (mm)	CL (mm)	T Max (mm)
CKCL44 (C2012/0805)	2.00±0.15	1.25±0.15	0.50±0.10	0.25±0.10	0.15~0.4	1.0
CKCA43 (C3216/1206)	3.20±0.20	1.60±0.20	0.80±0.20	0.40±0.20	0.15~0.4	1.1

Features

- 4 capacitors in one package
- Reduced PCB space and mounting time
- Unique electrode construction reduces crosstalk

Applications

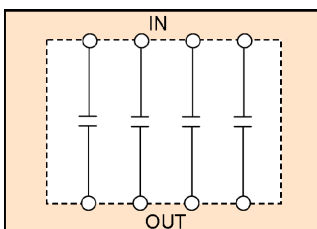
- Around interface cable in PC
- CPU bus line
- Cellular phone interface

Capacitance Range

Capacitance	CKCL44 (C2012/0805)					CKCA43 (C3216/1206)				
	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)
10	C0G					C0G				
15	C0G					C0G				
22	C0G					C0G				
33	C0G					C0G				
47	C0G					C0G				
68	C0G					C0G				
100	C0G					C0G				
150	C0G					C0G				
220	X7R					C0G				
330						C0G				
470	X7R					C0G/X7R				
680						C0G				
1,000	X7R					C0G/X7R				
2,200	X7R					X7R				
4,700	X7R					X7R				
0.010		X7R				X7R				
0.022			X7R			X7R				
0.047				X5R			X7R			
0.10					X5R			X7R		
0.22								X7R		
0.47									X5R	
1.0										X5R

Additional Information

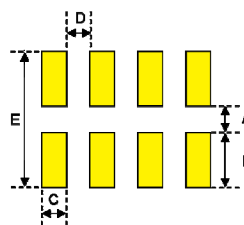
Equivalent Circuit



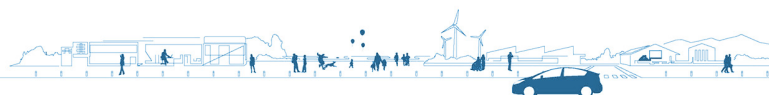
4 elements in 1 design:

- Particularly effective when used as a bypass for digital signal line noise, thereby preventing EMC around connectors.

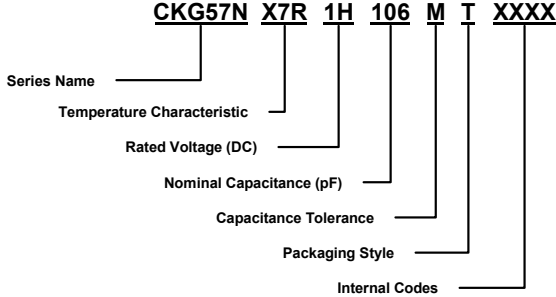
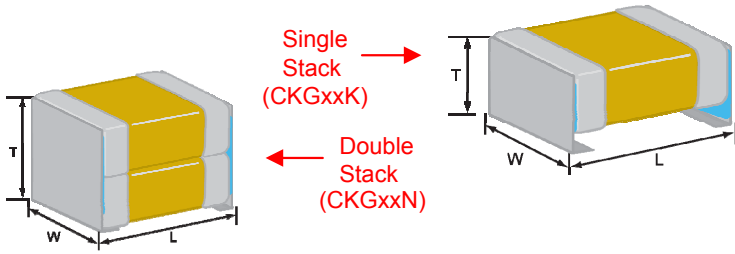
Solder Pad Dimensions



Symbol	CKCA43 (3216/1206)	CKCL44 (2012/0805)
A	1.0 mm	0.6 mm
B	0.7 mm	0.7 mm
C	0.34 mm	0.2 mm
D	0.4 mm	0.25 mm
E	2.4 mm	2.0 mm



Illustration



Dimensions

Case	Length (mm)	Width (mm)	MaxThickness (mm)
CKG32K	3.8	2.9	3.45
CKG45K	5.5	4.0	3.00
CKG57K	6.5	5.5	3.50
CKG45N	5.5	4.0	5.50
CKG57N	6.5	5.5	5.50

Features

- Twice the capacitance on single capacitor foot print
- Lower ESR and ESL than AI caps
- Capable of absorbing thermal and mechanical stress
- Improved heat generation by ripple current
- Improved vibration performance

Applications

- Smoothing circuits
- DC/DC converters
- HID/Automotive applications
- Temperature variable applications

Capacitance Range

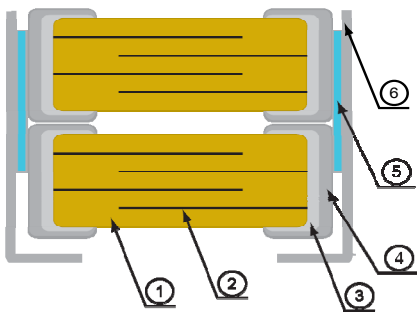
Capacitance (μF)	Single Stack CKG32K (C3829)						Single Stack CKG45K (C5540)						Single Stack CKG57K (C6555)					
	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)
0.047	X7R						X7R											
0.1		X7R						X7R										
0.22		X7R						X7R					X7R					
0.47			X7R					X7R					X7R					
1.0			X7R	X7R					X7R				X7R	X7R				
1.5										X7R								
2.2								X7R										
3.3									X7R									
4.7					X7R				X7R	X7R				X7R	X7R			
10				X7S	X7R				X7S	X7R	X7R			X7S	X7R	X7R		X7R
15																	X7R	
22																		X7R
47																		X7R

Capacitance (μF)	Double Stack CKG45N (C5540)						Double Stack CKG57N (C6555)					
	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)
0.22	X7R						X7R					
0.47		X7R						X7R				
1.0		X7R						X7R				
2.2			X7R					X7R	X7R			
3.3				X7R								
4.7			X7R					X7R				
6.8				X7R					X7R			
10			X7S	X5R	X7R			X7R	X7R			
22						X7R		X7S	X5R	X7R		
33											X7R	
47						X5R				X5R		
100										X5R		X5R

- X7R Denotes X7R: -55 to +125°C ± 15%
- X7S Denotes X7S: -55 to +125°C ± 22%
- X5R Denotes X5R: -55 to +85°C ± 15%

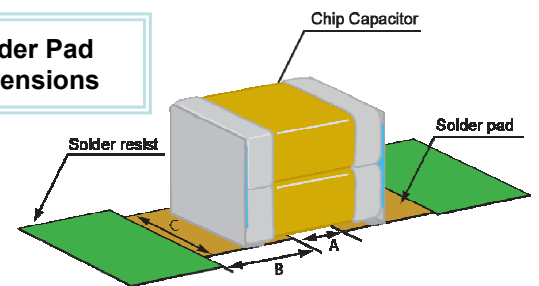
Additional Information

Structure and Material

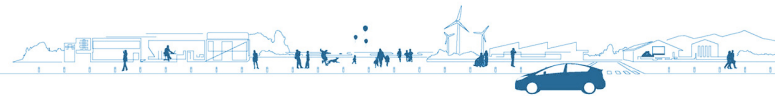


No.	Name	Material
1	Dielectric	BaTiO3
2	Electrode	Ni
3	Termination	Cu
4		Ni-Sn
5	Metal Cap Joint	High Temp. Solder
6	Metal Cap	42 Alloy

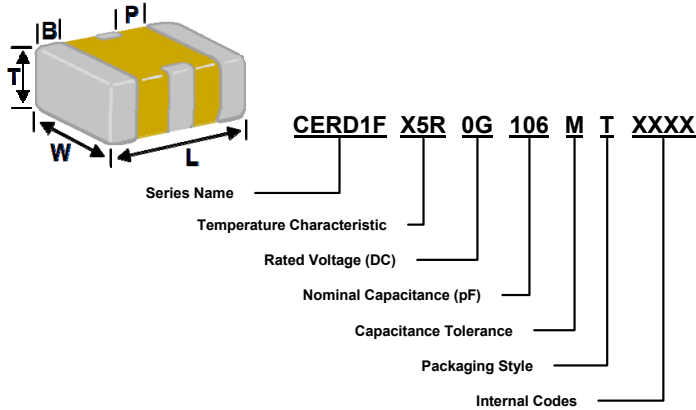
Solder Pad Dimensions



Symbol	CKG32 (mm)	CKG45 (mm)	CKG57 (mm)
A	2.4 ~ 2.8	3.3 ~ 3.7	3.9 ~ 4.3
B	1.0 ~ 1.2	1.2 ~ 1.5	1.5 ~ 2.0
C	1.9 ~ 2.5	2.7 ~ 3.2	4.5 ~ 5.0



Illustration



Dimensions

Case	L (mm)	W (mm)	T (mm)	B (mm)	P (mm)
CERB (C1608/0603)	1.60 ± 0.20	0.80 ± 0.10	0.80 ± 0.10	0.10 Min.	0.20 Min.
CERD (C2012/0805)	2.00 ± 0.20	1.25 ± 0.20	0.85 ± 0.15	0.30 ± 0.20	0.20 Min.

Features

- Unique electrode design solves ESR "low" problem
- Same mounting method as 2-terminal components
- Controlled ESR without affecting ESL

Applications

- Servers/PCs/Notebooks/PDAs
- Power decoupling and smoothing
- Voltage regulator/output filter/plane termination

Capacitance Range

Class 2 (Temperature Stable and General Purpose)

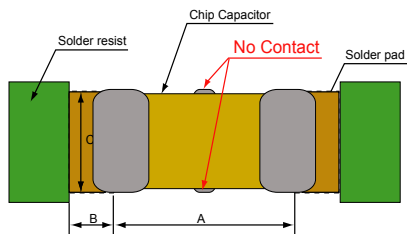
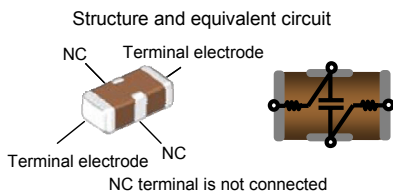
Temperature Characteristics: X5R (±15%)

Capacitance Tolerance: M (± 20%)

TDK Item Description	Case	Thickness (mm)	Voltage	Capacitance Value	Tolerance	ESR
CERB2CX5R0G105M	C1608 (0603)	0.95 max	4V	1.0 μF	± 20%	200 mΩ ± 30%
CERB2MX5R0G105M	C1608 (0603)	0.95 max	4V	1.0 μF	± 20%	650 mΩ ± 30%
CERB3UX5R0G105M	C1608 (0603)	0.95 max	4V	1.0 μF	± 20%	1200 mΩ ± 30%
CERD1CX5R0G106M	C2012 (0805)	1.40 max	4V	1.0 μF	± 20%	20 mΩ ± 30%
★ CERD1FX5R0G106M	C2012 (0805)	1.40 max	4V	10 μF	± 20%	35 mΩ ± 30%
CERD1JX5R0G106M	C2012 (0805)	1.40 max	4V	10 μF	± 20%	50 mΩ ± 30%
CERD2AX5R0G106M	C2012 (0805)	1.40 max	4V	10 μF	± 20%	100 mΩ ± 30%
CERD2CX5R0G106M	C2012 (0805)	1.40 max	4V	10 μF	± 20%	200 mΩ ± 30%
CERD2JX5R0G106M	C2012 (0805)	1.40 max	4V	10 μF	± 20%	500 mΩ ± 30%

★ = new for 2010

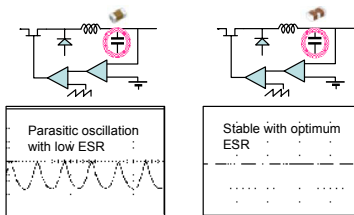
Additional Information



Type	A	B	C
CERB (C1608)	0.8 mm	0.6 mm	0.8 mm
CERD (C2012)	1.0 mm	0.7 mm	1.2 mm

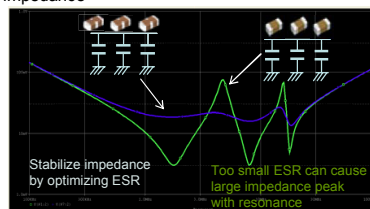
Decoupling of switching power supply

Optimal ESR value selection can prevent parasitic oscillation and secure phase margin

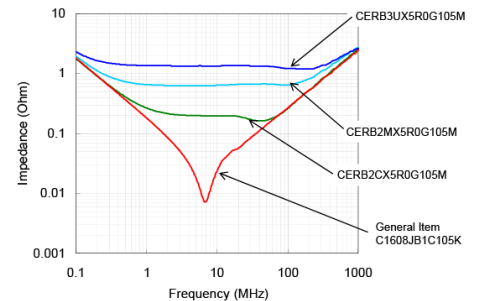


Decoupling of high current / low voltage circuit

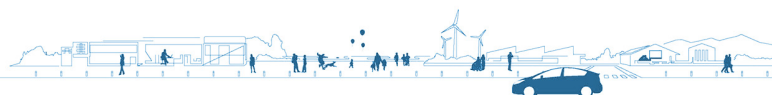
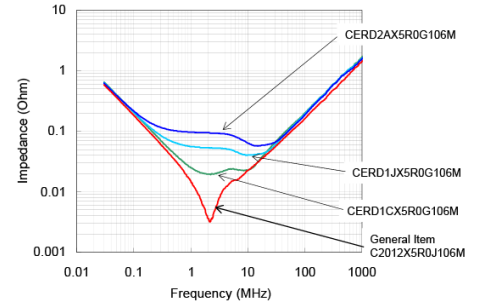
Optimal ESR value selection can prevent unnecessary resonance and stabilize power supply impedance



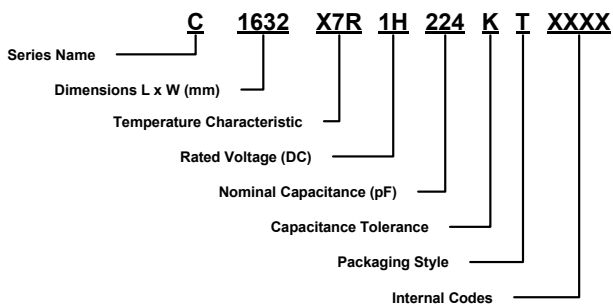
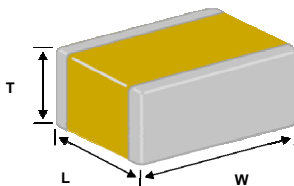
Impedance vs. Frequency (CERB)



Impedance vs. Frequency (CERD)



Illustration



Dimensions

Case	Length (mm)	Width (mm)	MaxThickness (mm)
C0510 (0204)	0.52 ± 0.05	1.00 ± 0.05	0.35
C0816 (0306)	0.80 ± 0.10	1.60 ± 0.10	0.60
C1220 (0508)	1.25 ± 0.20	2.00 ± 0.20	1.00
C1632 (0612)	1.60 ± 0.20	3.20 ± 0.20	1.45

Features

- Flipped geometry provides low inductance (less than 400 pH)
- Allows adequate high frequency current to IC
- Provides stabilization of power line voltage
- High frequency noise suppression

Applications

- Decoupling CPU power line
- High speed digital IC/decoupling
- PC, cell phones, camcorders, etc.

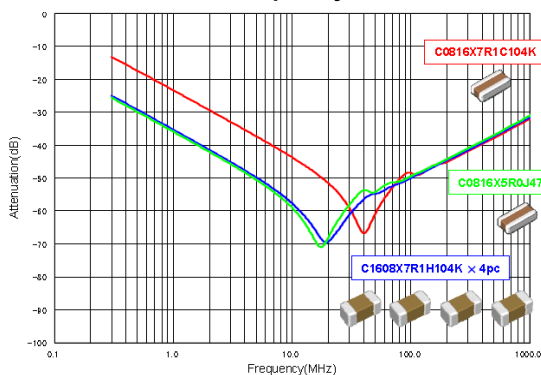
Capacitance Range

Capacitance (μF)	C0510 (0204)		C0816 (0306)				C1220 (0508)				C1632 (0612)					
	4.0V (0G)	16V (1C)	10V (1A)	6.3V (0J)	4.0V (0G)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	4.0V (0G)
0.010		X7R				X7R					X7R					
0.022		X7R				X7R					X7R					
0.047		X7R				X7R					X7R					
0.10	X6S/X5S	X7R					X7R				X7R					
0.22	★ X6S		X5R	X7R				X7R			X7R	X7R				
0.47	★ X6S		★ X5R	X5R	X7S/X6S★				X5R	X7R		X7R	X7R			
1.0				X5R	X7S				X5R	X7R			X7R	X5R	X7R	
2.2				X5R	X7S									X5R	X7R	
4.7															X5R	X7S
10															X5R	X7S

★ = new for 2010

Additional Information

Attenuation vs. Frequency Characteristics



For decoupling capacitors, the parasitic inductance generated by the capacitor needs to be small so that the resonant frequency is higher. The parasitic inductance will add noise voltage spikes to the power line voltage as shown in the following equation:

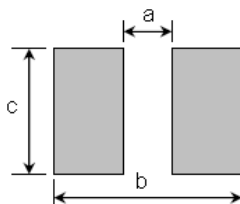
$$V = L * \frac{\delta i}{\delta t}$$

$\delta i / \delta t$ can be very large when operating under very high frequency, where L is the parasitic inductance. In order to stabilize the power line without adding anymore noise from the capacitor, parasitic inductance needs to be small. Because of the unique design of the Flip Type capacitor, the parasitic inductance is lower than the traditional multilayer ceramic capacitor (MLCC). Therefore, the Flip Type MLCC is very effective for high speed decoupling applications.

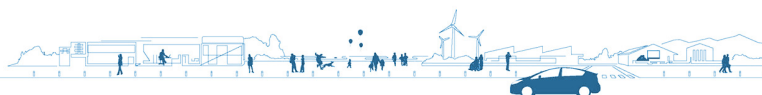
Internal structure of the standard MLCC



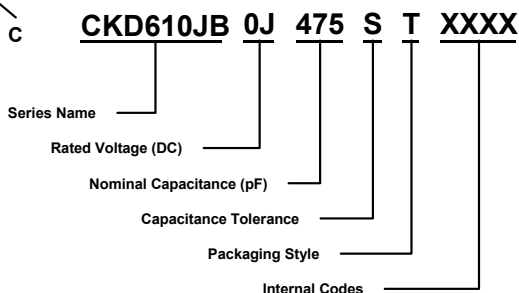
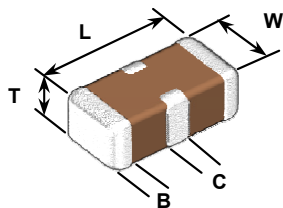
Internal structure of the Flip Type MLCC



Symbol	C0501 (0204)	C0816 (0306)	C1220 (0508)	C1632 (0612)
a	0.2 mm	0.3 mm	0.5 mm	0.75 mm
b	0.6 mm	1.0 mm	1.6 mm	2.2 mm
c	1.0 mm	1.6 mm	2.0 mm	3.2 mm



Illustration



Dimensions

Case	L (mm)	W (mm)	C (mm)	B (mm)	T (mm)
CKD610JB (0603)	1.60 ± 0.20	0.80 ± 0.10	0.40 ± 0.10	0.10 min.	0.90 max
CKD510JB (0805)	2.00 ± 0.20	1.25 ± 0.20	0.40 ± 0.3/-0.2	0.30 ± 0.20	1.00 max
CKD110JB (1205)	3.20 ± 0.20	1.25 ± 0.20	0.95 ± 0.30	0.40 ± 0.30	1.00 max
CKD310JB (1206)	3.20 ± 0.20	1.60 ± 0.20	0.95 ± 0.30	0.40 ± 0.30	1.60 max

Features

- Ultra low inductance (less than 200 pH)
- Optimized for use as a noise bypass capacitor for signal and power source circuits
- Aids in EMC compliance

Applications

- Decoupling CPU power line
- High speed digital IC/decoupling
- High impedance/high current circuits
- DC to DC converter input/output smoothing
- Power Supply

Capacitance Range

Class 2 (Temperature Stable and General Purpose)

Temperature Range: -55°C to +125°C

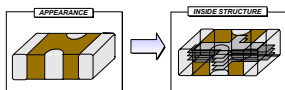
Capacitance Tolerance: S (+50/-20%)

Capacitance (pF)	CKD110JB (1205)			CKD310JB (1206)				CKD510JB (0805)			CKD610JB (0603) CKD616JB (0603)	
	25V (1E)	16V (1C)	6.3V (0J)	50V (1H)	25V (1E)	16V (1C)	10V (1A)	6.3V (0J)	6.3V (0J)	6.3V (0J)		
22	200mA, 600mΩ			400mA, 500mΩ								
47	200mA, 600mΩ			400mA, 500mΩ								
100	200mA, 600mΩ			400mA, 500mΩ								
220	200mA, 600mΩ			400mA, 500mΩ								
470	200mA, 600mΩ			400mA, 500mΩ								
1,000	200mA, 600mΩ			400mA, 500mΩ								
2,200	200mA, 600mΩ			400mA, 500mΩ								
4,700	200mA, 600mΩ			400mA, 500mΩ								
10,000	500mA, 300mΩ				1A, 80mΩ							
22,000	500mA, 300mΩ				1A, 80mΩ							
47,000	500mA, 300mΩ				1A, 80mΩ							
100,000	500mA, 300mΩ				1A, 80mΩ							
220,000		2A, 40mΩ										
470,000		2A, 40mΩ										2A, 30mΩ
1,000,000		2A, 40mΩ					★ 2A, 12mΩ					★ 2A, 30mΩ
2,200,000							★ 2A, 12mΩ					★ 2A, 12mΩ
4,700,000							★ 3A, 12mΩ					★ 2A, 12mΩ
10,000,000								★ 4A, 5mΩ				★ 2A, 12mΩ
22,000,000			★ 2A, 12mΩ					★ 4A, 5mΩ				

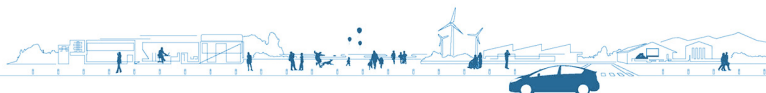
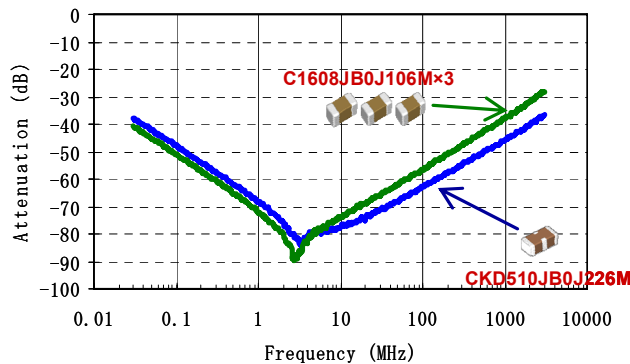
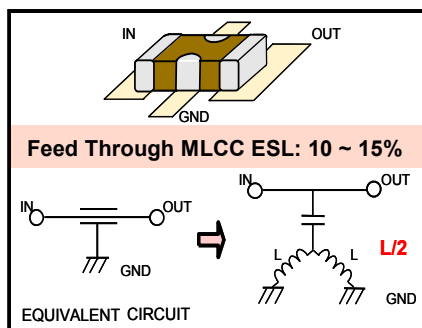
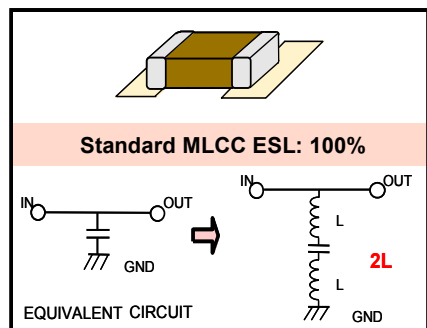
★ = new for 2010

Additional Information

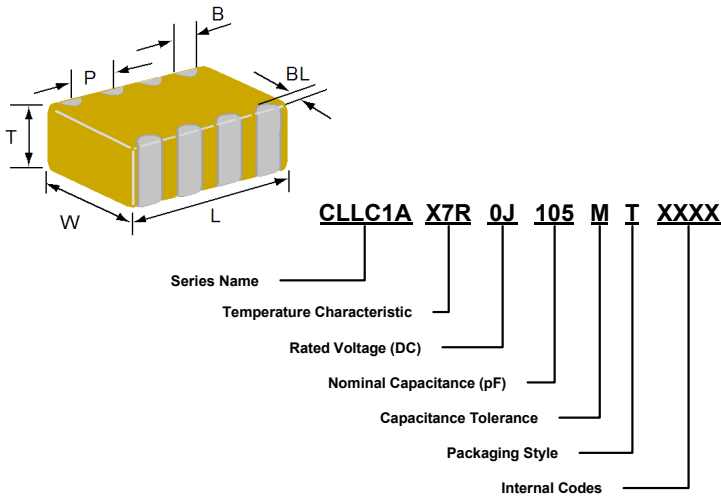
• Low ESL Feed Through type CKD series are constructed with 3 terminals which reduces the inductance greatly and extends the application to higher frequency.



• It is possible to reduce the number of components with 3-Terminal feed through capacitor because one feed through has similar attenuation characteristics as three 2-terminal capacitors.



Illustration



Dimensions

Case	L (mm)	W (mm)	P (mm)	B (mm)	BL (mm)	T Max (mm)
CLLC1A (C1608/0603)	1.60 ± 0.10	0.80 ± 0.10	0.40 ± 0.10	0.25 ± 0.10	0.15 ± 0.10	0.55
CLLE1A (C2012/0805)	2.00 ± 0.15	1.25 ± 0.15	0.50 ± 0.15	0.25 ± 0.15/-0.10	0.20 ± 0.15/-0.10	0.95

Features

- Unique internal structure that cancels magnetic fields to reduce inductance
- Compact and lightweight
- Contains no lead and supports lead-free soldering

Applications

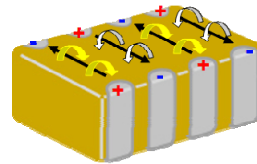
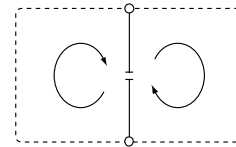
- Decoupling CPU power line
- High speed digital IC/decoupling

Capacitance Range

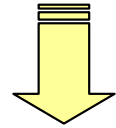
Capacitance (μF)	CLLC1A (C1608/0603)		CLLE1A (C2012/0805)	
	4.0V (0G)	10V (1A)	6.3V (0J)	4.0V (0G)
0.1		X7R		
0.15		X7R		
0.22		X7R		
0.33	X7S	X7R		
0.47	X7S		X7R	
0.68	X7S		X7R	
1.0	X7S		X7R	X7S
1.5			X7R	X7S
2.2				X7S
3.3				X7S
4.7				X7S
6.8				
10				

Structure

- 8-side terminal electrodes in one capacitor design
- Volume-weight 50% down
- Opposing magnetic fields reduce ESL



Internal structure of the Standard MLCC

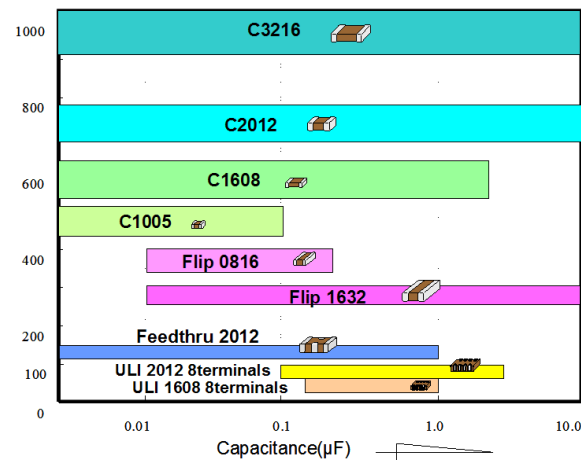


Internal structure of the ULI MLCC



Additional Information

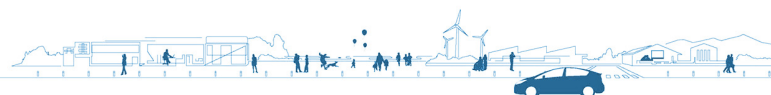
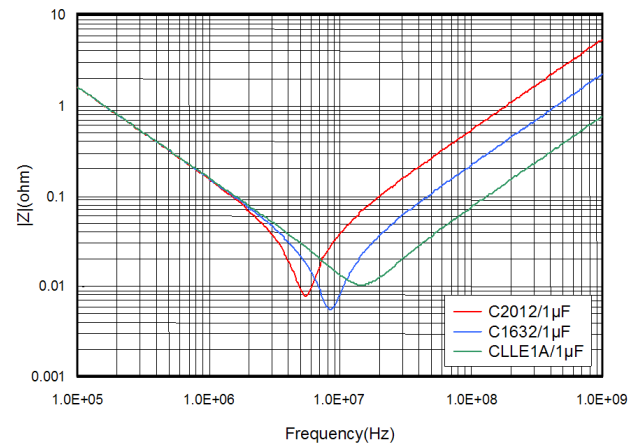
MLCC's Capacitance Range vs. ESL



Solder Pad Dimensions (mm)

Label	CLLC1A (0603)	CLLE1A (0805)
P	0.40 mm	0.50 mm
C	0.40 mm	0.60 mm
D	0.25 mm	0.30 mm
E	0.40 mm	0.50 mm

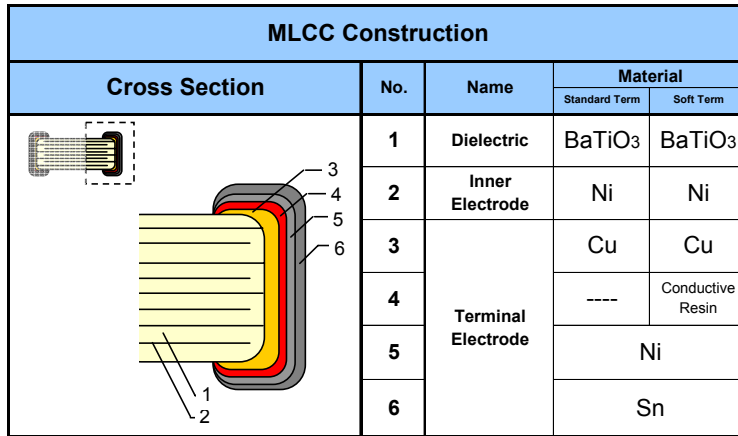
|Z| Characteristics



Product Overview

- Excessive board bending during PCB manufacturing or final assembling is common, and the brittle nature of ceramic components is especially prone to damage after being soldered to the PCB. TDK has expanded line of board flex solutions by introducing soft termination capacitor with a conductive resin terminal layer that protects the ceramic body by absorbing external stress. Soft term caps are also good protection from brittle solder fillets when using Pb-free solder.
- Please contact TDK for availability of individual item in case of specific requirement. Capacitance range will be available 2010/End.

Illustration



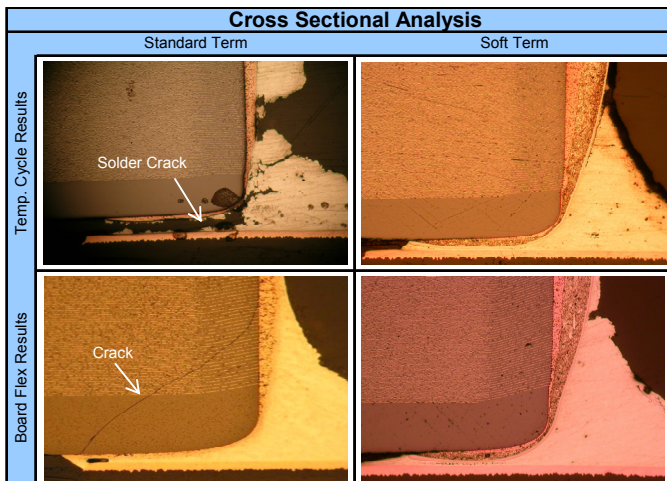
Features

- Improved bending resistance (Board Flex Resistance)
- Improved temperature cycle performance
- Soft termination is available for most TDK MLCC product lines (up to C3225 case size) and including the 2-in-1 Cap Array line
- RoHS, WEE, and REACH compliant

Applications

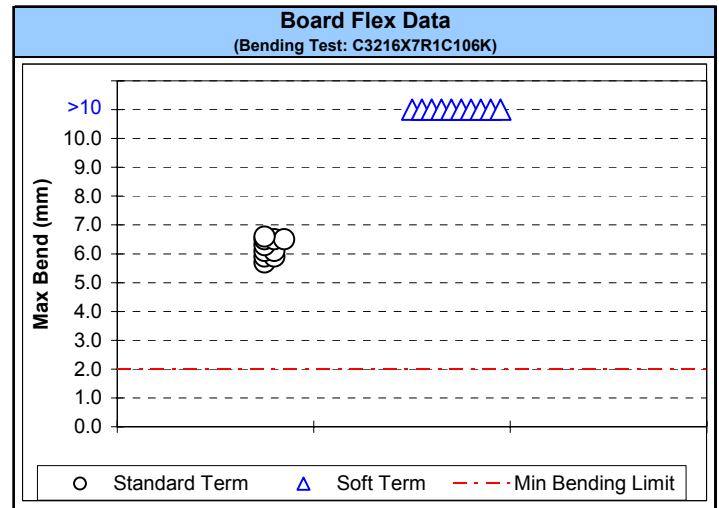
- Automotive powertrain control unit / sensor module
- Switching power supply
- Telecom base station
- Electronic circuits mounted on alumina substrate
- SMT application which requires bending robustness
- Pb-free solder application in which solder joint reliability is problematic

Failure Mode Test

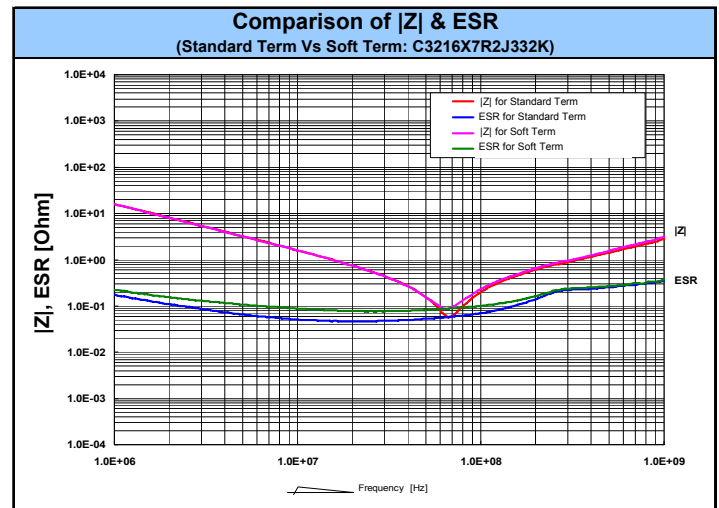


Performance Data

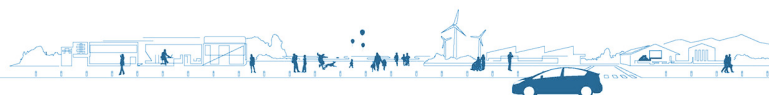
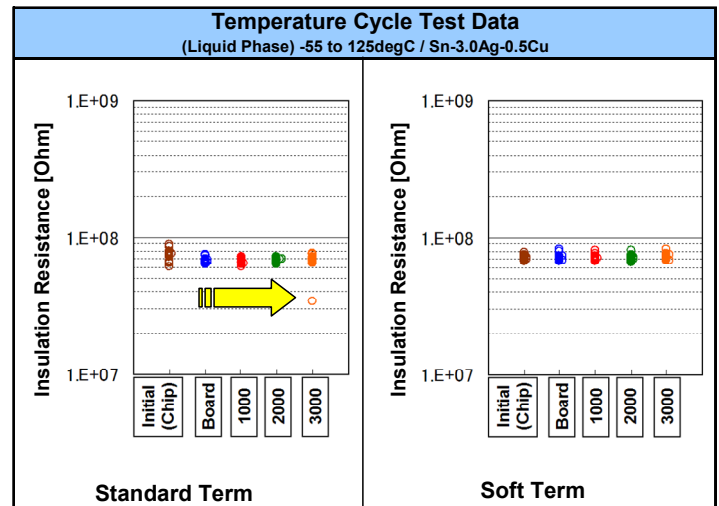
- Bending test result shows high performance.



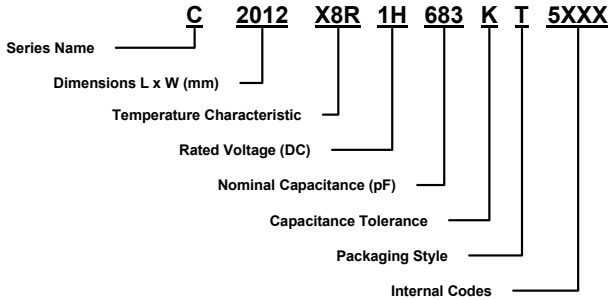
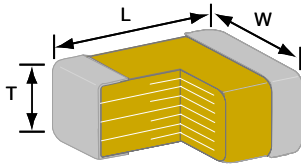
- Soft Termination offers similar performance for |Z| and ESR to standard termination capacitor.



- Soft Termination offers superior performance to standard termination in temperature cycle test.



Illustration



Dimensions

Case	Length (mm)	Width (mm)	Max Thickness (mm)
C2012 (0805)	2.00 ± 0.20	1.25 ± 0.20	1.45
C3216 (1206)	3.20 ± 0.20	1.60 ± 0.20	1.80
C3225 (1210)	3.20 ± 0.20	2.50 ± 0.30	2.80
C4532 (1812)	4.50 ± 0.40	3.20 ± 0.40	2.50
C5750 (2220)	5.70 ± 0.40	5.70 ± 0.40	3.10

Features

- Increase resistance to mechanical bending, temperature cycle, vibration, and electrical stresses
- Wider distance between the end of the opposite electrode and the termination
- Reduces the risk of short circuit failures
- X7R and X8R temperature ranges

Applications

- Automotive and other high stress applications
- Battery line circuit with high board flex stress

Capacitance Range

Capacitance	C2012 (0805)			C3216 (1206)			C3225 (1210)					C4532 (1812)					C5750 (2220)									
	250V (2E)	100V (2A)	50V (1H)	630V (2J)	250V (2E)	100V (2A)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	630V (2J)	250V (2E)	100V (2A)	50V (1H)	25V (1E)	16V (1C)	
1.0 nF	X7R	X7R		X7R																						
1.5 nF	X7R	X7R		X7R																						
2.2 nF	X7R	X7R		X7R																						
3.3 nF	X7R	X7R		X7R																						
4.7 nF	X7R	X7R		X7R																						
6.8 nF	X7R	X7R		X7R																						
10 nF	X7R	X7R		X7R																						
15 nF	X7R	X7R		X7R	X7R																					
22 nF		X7R	X8R	X7R	X7R																					
33 nF			X8R	X7R	X7R	X7R																				
47 nF			X8R	X7R	X7R		X7R																			
68 nF			X8R	X7R	X7R		X7R						X7R													
100 nF		X7R		X7R	X7R			X7R					X7R													
150nF					X7R				X7R					X7R							X7R					
220nF									X7R						X7R						X7R					
330nF										X7R					X7R							X7R				
470nF											X7R				X7R							X7R				
680nF											X7R				X7R						X7R	X7R				
1.0 uF					X7R							X7R					X7R				X7R	X7R				
1.5 uF																	X7R					X7R				
2.2 uF											X7R						X7R						X7R			
3.3 uF												X7R					X7R						X7R			
4.7 uF						X7R							X7R				X7R	X7R					X7R			
6.8 uF																		X7R					X7R			
10 uF																		X7R					X7R			
15 uF																								X7R	X7R	
22 uF																									X7R	X7R

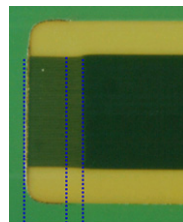
Additional Information

• When a chip capacitor is cracked by mechanical stress such as board bending, open mode construction helps users to reduce the risk of short circuits.

• The open mode design definition is securing the L-Gap. The L-Gap length shall be secured wider than terminal band width.

L Gap > Terminal band width

Terminal band width



< L Gap >
Distance between the end of the opposite electrode and the termination

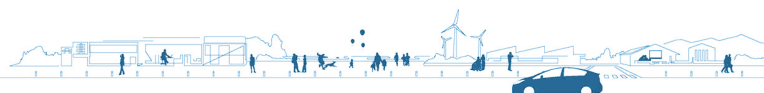
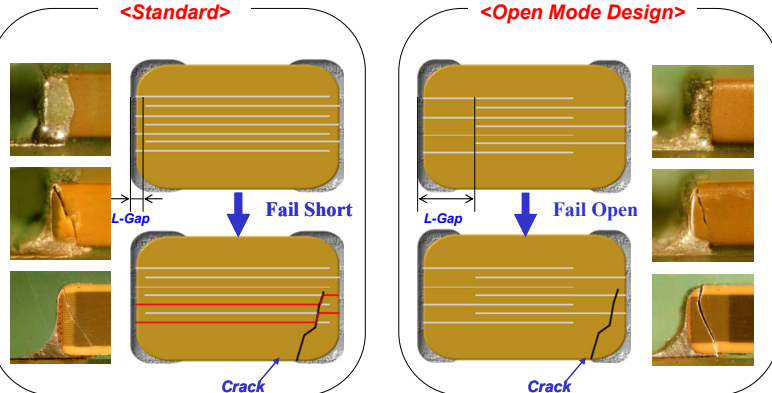
L-Gap

The "Open mode" concept does not guarantee MLCC will always fail open. This design is intended to reduce the risk of the MLCC failing short. All MLCC caution guidelines apply.

Failure Mode Reference Model

<Standard>

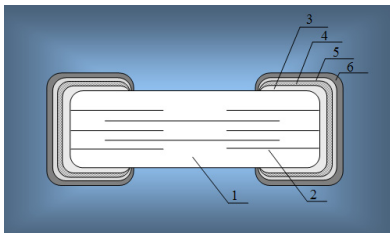
<Open Mode Design>



Product Overview

- Automotive design often employs two distinct capacitors in series on the PCB for power supply and battery line to protect the circuit from being shorts in case of cracking of the MLCC. In conjunction with our existing soft electrode technology, TDK offers 2 capacitors in 1 body construction in our CEU product line for ultra high reliability. Serial construction of inner electrode prevents sudden insulation breakdown after flex crack formation and soft termination technology allows for better absorption of external stress and protect the ceramic body.
- The combination of these technologies yield improved voltage and ESD performance over standard designs and decrease risk of short circuit failures and low IR due to mechanical flex cracks.
- CEU series are under development. (Planned schedule to release : 2010/End)**

Internal Structure



No.	Name	Material
1	Dielectric	BaTiO ₃
2	Electrode	Nickel (Ni)
3		Copper (Cu)
4	Termination	Conductive Resin (Filler: Ag)
5		Nickel (Ni)
6		Tin (Sn)

Dimensions

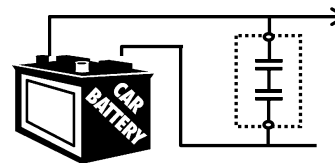
Case	L (mm)	W (mm)	T (mm)	Life Test Conditions
CEU3E2	1.60 ± 0.20	0.80 ± 0.15	0.80 ± 0.15	125°C / WV x 2 / 1000 hrs
CEU4J2	2.00 ± 0.30	1.25 ± 0.20	1.25 ± 0.20	125°C / WV x 2 / 1000 hrs

Features

- Improved bending resistance (Board Flex Resistance)
- Improved temperature cycle performance
- Allow space reduction on PCB
- Ultra high reliability
- RoHS, WEE, and REACH compliant

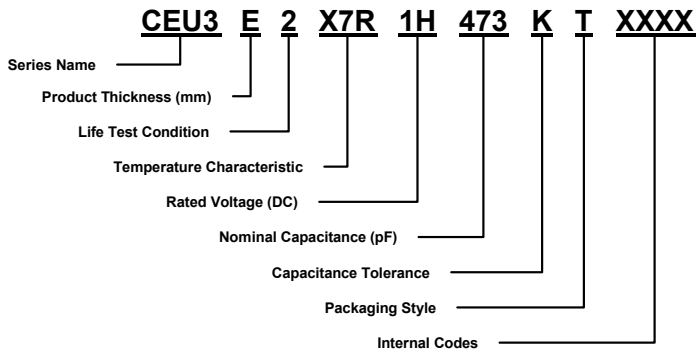
Applications

- Power supply without protective circuit
- Automotive battery line



To Electrical Control Unit / Sensor Unit

Part Number System



Capacitance Range

Type	CEU3E	CEU4J
Case size [JIS in mm/ EIA in inch]	C1608 / CC0603	C2012 / CC0805
Rated voltage	1H [50Vdc]	1H [50Vdc]
Capacitance	6.8 nF (682)	6.8 nF (682)
	10 nF (103)	10 nF (103)
	15 nF (153)	15 nF (153)
	22 nF (223)	22 nF (223)
	33 nF (333)	33 nF (333)
	47 nF (473)	47 nF (473)
	68 nF (683)	68 nF (683)
	100 nF (104)	100 nF (104)

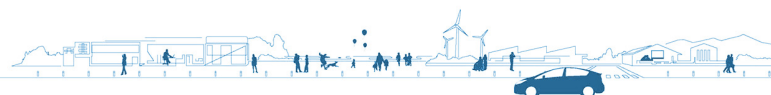
Under Development

Ordering Codes

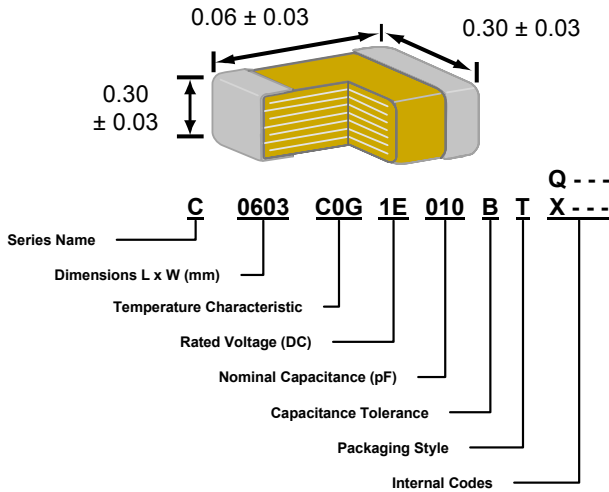
Product name	Case size JIS in mm [EIA in inch]	Temperature Characteristics	Rated voltage	Capacitance	Capacitance Tolerance	Thickness	Life condition
CEU3E2X7R1H682K	C1608 [CC0603]	[+/-15% : -55~125°C]	50V	6.8 nF	±10%	0.80±0.15	125°C / WV x 2 / 1000hr
CEU3E2X7R1H103K				10 nF			
CEU3E2X7R1H153K				15 nF			
CEU3E2X7R1H223K	C2012 [CC0805]	[+/-15% : -55~125°C]	50V	22 nF	±10%	1.25±0.20	125°C / WV x 2 / 1000hr
CEU3E2X7R1H333K				33 nF			
CEU3E2X7R1H473K				47 nF			
CEU4J2X7R1H333K	C2012 [CC0805]	[+/-15% : -55~125°C]	50V	33 nF	±10%	1.25±0.20	125°C / WV x 2 / 1000hr
CEU4J2X7R1H473K				47 nF			
CEU4J2X7R1H683K				68 nF			
CEU4J2X7R1H104K				100 nF			

Under Development. (Planned schedule for release : End of 2010)

• Production schedule and availability is as of March 2010. Availability is subject to change without notice.



Illustration



Features

- Higher Q (lower loss) than standard capacitors
- Available in standard and tight tolerance
- Same C0G(Class I) BME material
- C0603 (0201) case size

Applications

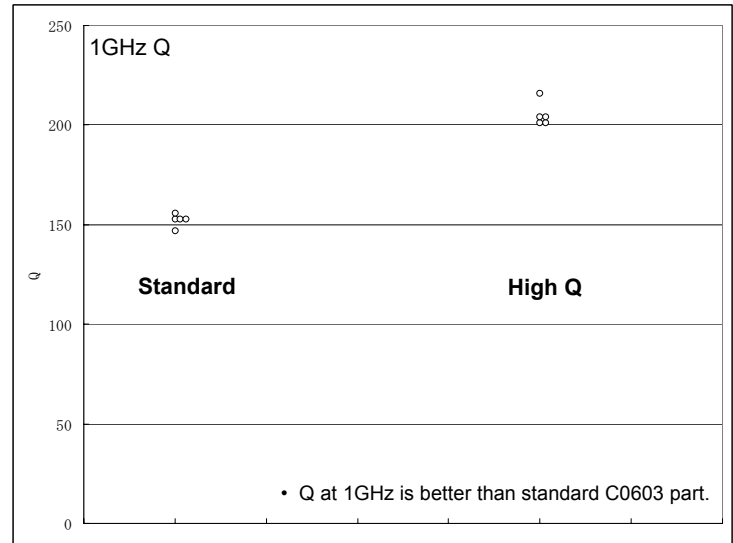
- PA module
- Wireless communications
- Mobile Phones
- Filter networks/matching networks
- DC blocking
- High frequency circuits

Additional Information

$$Q = \frac{1}{\omega C \cdot ESR}$$

Q Comparison

C0603C0G1E5R6B



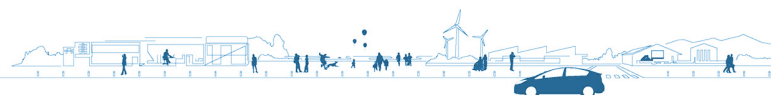
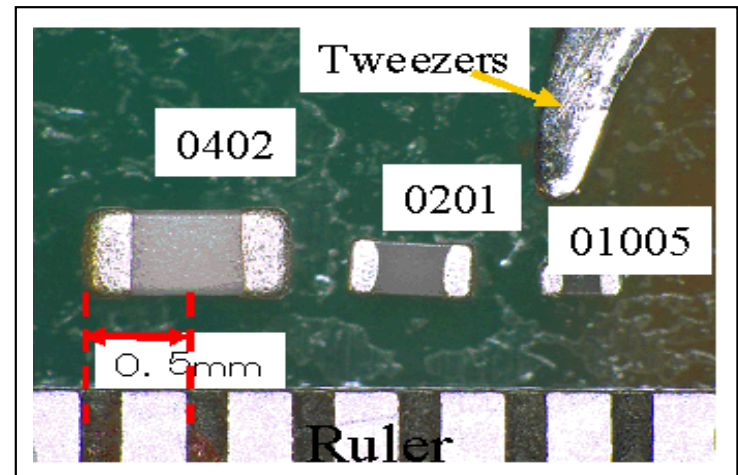
Capacitance Range

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (0 ± 30ppm/°C)
Rated Voltage DC: 25V (1E)

Capacitance (pF)	Tolerance					
	B (± 0.1pF)	C (± 0.25pF)	D (± 0.5 pF)	E (± 0.2 pF)	G (± 2%)	J (± 5%)
0.2	C0G					
0.3	C0G					
0.4	C0G					
0.5	C0G					
0.6	C0G					
0.7	C0G					
0.8	C0G					
0.9	C0G					
1.0	C0G	C0G				
1.2	C0G	C0G				
1.5	C0G	C0G				
1.8	C0G	C0G				
2.0	C0G	C0G				
2.2	C0G	C0G				
2.7	C0G	C0G				
3.0	C0G	C0G				
3.3	C0G	C0G				
3.9	C0G	C0G				
4.0	C0G	C0G				
4.7	C0G	C0G				
5.0	C0G	C0G				
5.6	C0G	C0G				
6.0	C0G	C0G				
6.8	C0G	C0G				
7.0	C0G	C0G				
8.0	C0G	C0G				
8.2	C0G	C0G				
9.0	C0G	C0G				
10.0			C0G	C0G		
12.0					C0G	C0G
15.0					C0G	C0G

Size Comparison



TDK Part Number Conversion

This is a TDK service that assists customers to convert their existing Bill of Materials (BOM) from non-TDK to TDK part numbers. TDK has the tools and expertise to return a part number conversion request in a very short time. Some key points are:

- Quick turn around for all requests
- Allows for downsizing and value added once converted to TDK PN
- Datasheet is provided with all available TDK PN conversion upon request
- FIT data can be provided immediately for evaluation
- MLCC alternatives to Tantalum capacitors can also be provided
- Abbreviated version is also available on tdk.com

TDK VA Analysis/BOM Optimization

This is a TDK a service that assist customers in staying abreast of leading edge MLCCs and for TDK to offer the best component choice MLCC for pricing and delivery. "Value Added" is beneficial because it gives the following advantages to the customer:

- Downsizing / Shrinking board space
- Improved in-circuit performance capabilities
- Replacing older technologies
- Simplifying inventory control
- Improved pricing and delivery

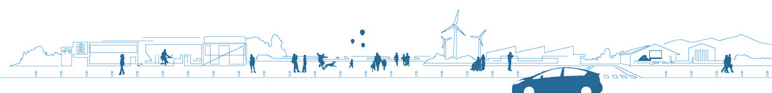
TDK Set Analysis/Electrolytic Cap Replacement

TDK offers engineering design support to assist in replacing your existing electrolytic and film capacitors with MLCCs. In order to offer best recommendations, we need to have some working knowledge of your design and circuit applications. The more you can share, the better we can offer the most cost beneficial solution options. Some information that is needed include:

- Typical and max rail voltage
- Circuit application/function
- Module function
- Design concerns/constraints
- Performance concerns/constraints
- Mechanical concerns/constraints

TDK Local Technical Services

TDK has a local MLCC manufacturing plant located in Peachtree City, GA, which can provide engineering and technical services. In addition to sampling, qualification testing/reporting and problem resolution, TDK can provide component failure analysis as well. All TDK/GA failure analysis target a 3/3/7 reply policy where an initial response is given within 3 hours, the initial failure mode within 3 days, and a final report within 7 days.

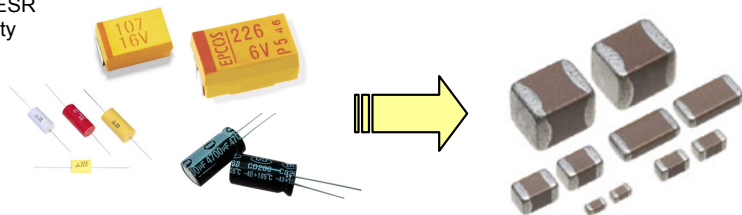


What is Electrolytic Capacitor Replacement?

- TDK can work with our customers to study the electrolytic capacitors used in their designs
- The primary focus is on decoupling and smoothing capacitors for noise suppression
- Other circuit applications such as bulk capacitance are also studied if applicable
- By measuring initial performance, TDK can recommend alternative MLCC's

What are the benefits to Electrolytic Capacitor Replacement

- Worldwide shortage of Ta caps has generated interest by many companies
- MLCC's offer a technological advantage as well as a more robust design
- In some cases, electrolytic cap replacement can result in reduced component count
- Use of MLCC's will reduce space usage on PCB and cost of components
- Cost can be further reduced during assembly
- MLCC's are not polarized
- Lower inherent ESR
- Increase reliability



Step 1

Determine the maximum working line voltage (use the chart below as a guide)

Working Voltage	Rated Voltage of MLCC	Voltage Code
3 ~ 5 V	6.3 V	0J
8 ~ 9 V	10 V	1A
12 ~ 15 V	16 V	1C
18 ~ 20 V	25 V	1E

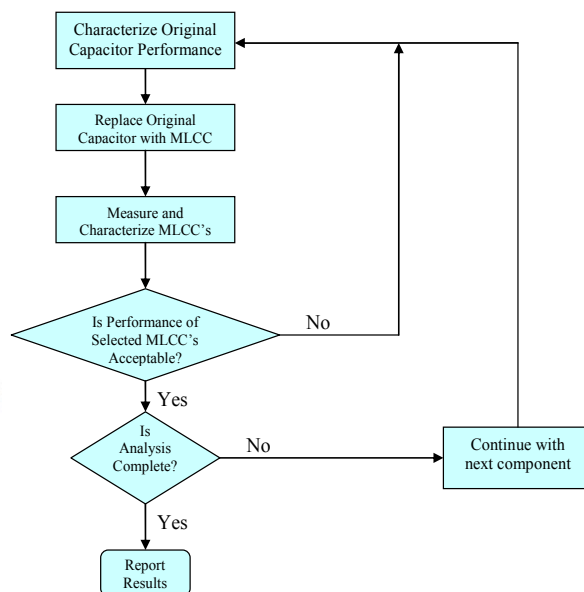
* MLCC's do not have voltage derating rule so you can use up to the full rated voltage

Step 3

Determine the right capacitance and part number based on application

Line Voltage	V ≤ 6.3V(Ex. 3V,5V)			V ≤ 10V(Ex. 8V,9V)			V ≤ 16V(Ex. 12V,15V)			V ≤ 25V(Ex. 18V,20V)			
	frequency	f ≥ 50kHz	f ≥ 100kHz	f ≥ 500kHz	f ≥ 50kHz	f ≥ 100kHz	f ≥ 500kHz	f ≥ 50kHz	f ≥ 100kHz	f ≥ 500kHz	f ≥ 50kHz	f ≥ 100kHz	f ≥ 500kHz
Aluminum Electrolytic Capacitor Capacitance (μF)	1	C1005X5R1A105*			C1005X5R1A105*			C1005X7R1C105*			C2012X7R1E105*		
	2.2		C1005X5R1A105*	C1608X7R1C224*		C1005X5R1A105*				C1608X7R1C105*	C1608X7R1C224*	C2012X7R1E105*	C2012X7R1H224*
	4.7	C1608X5R0J225*											
	10												
	22		C1608X5R0J225*	C1005X5R1A474*									
	47							C3216X7R1E225*	C3216X7R1E225*				
	100	C1608X5R0J475*											
	470		C1608X5R0J106M	C1608X5R0J225*									
Tantalum Capacitor Capacitance (μF)	1	C1005X5R1A105*			C1005X5R1A105*			C1608X7R1C105*	C1608X7R1C105*		C2012X7R1E105*	C2012X7R1E105*	
	2.2	C1608X5R0J225*	C1005X5R1A105*	C1005X5R1A474*	C1608X5R1C225*	C1005X5R1A105*	C1005X5R1A474*	C3216X7R1E225*		C2012X7R1E474*	C3216X7R1E225*		C2012X7R1E474*
	4.7	C1608X5R0J475*	C1608X5R0J225*		C1005X5R1A105*	C3216X7R1E475*	C1608X5R1C225*		C1005X5R1A105*		C1608X7R1C105*	C3216X7R1E475*	
	10												
	22	C1608X5R0J106M	C1608X5R0J475*	C1608X5R0J225*	C3216X7R1C106M	C3216X7R1E475*	C1608X5R1C225*	C3216X7R1C106M	C3216X7R1E475*	C3216X7R1E225*	C3216X7R1C105*	C3225X7R1E106M	C3216X7R1E225*
	47	C2012X5R0J226M	C1608X5R0J106M	C1608X5R0J475*	C3225X7R1C226M	C3216X7R1C106M	C3216X7R1E475*	C3225X7R1C226M	C3216X7R1C106M	C3216X7R1E475*		C4532X7R1E226M	C3216X7R1E475*
	100		C2012X5R0J226M		C4532X5R1A336M			C3225X7R1C226M					
	470	C3216X5R0J476M	C3216X5R0J476M	C1608X5R0J106M	C5750X5R1A686M	C3225X7R1C226M	C3216X7R1C106M		C5750X5R1C476M	C3225X7R1C226M			C3225X7R1E106M
Organic Semiconductor Capacitor Capacitance (μF)	10	C1608X5R0J106M	C3225X5R0J685*	C1608X5R0J475*	C3216X7R1C106M	C3216X5R1C685*	C3216X7R1E475*	C3216X7R1C106M	C3216X5R1C685*	C3216X7R1E475*	C3225X7R1E106M	C3225X7R1E106M	C3225X7R1E685*
	15	C3225X5R1A156M	C1608X5R0J106M	C1608X5R0J685*	C3225X5R1A156M	C3216X7R1C106M	C3216X5R1C685*	C3225X7R1C156M	C3216X7R1C106M	C3225X7R1C156M	C3216X7R1C106M	C4532X7R1E156M	C4532X7R1E156M
	22	C2012X5R0J226M	C3225X5R1A156M	C1608X5R0J106M	C3225X5R1A226M	C3225X5R1A156M	C3216X7R1C106M	C3225X7R1C226M	C3225X7R1C156M	C3216X7R1C106M	C4532X7R1E226M	C4532X7R1E226M	C4532X7R1E156M
	33	C3216X5R0J336M	C2012X5R0J226M	C2012X5R0J226M	C4532X5R1A336M	C3225X5R1A156M	C4532X5R1A156M	C4532X5R1C336M	C3225X7R1C156M	C3225X7R1C156M			
	47	C3216X5R0J476M	C3216X5R0J336M	C2012X5R0J226M		C4532X5R1A336M	C3225X5R1A156M	C5750X5R1C476M	C4532X5R1C336M	C3225X7R1C226M			
	66	C5750X5R1A686M	C3216X5R0J336M						C4532X5R1C336M				
	100	C3225X5R0J107M	C3225X5R0J107M	C3216X5R0J476M					C5750X5R1C476M	C4532X5R1C336M			
	220			C3225X5R0J107M						C5750X5R1A686M			

Electrolytic Cap Replacement Process Flowchart

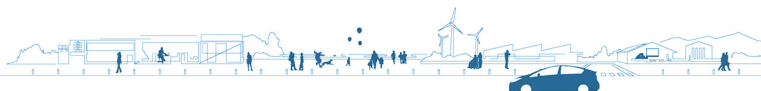


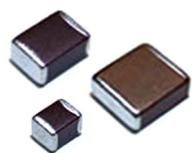
Step 2

Determine the circuit's function and replace at the minimum acceptable cap value

Application	Capacitance Guidepost	
For Decoupling	Ta Cap, Aluminum Electrolytic Caps	10 %~
	Organic Semiconductor	50 %~
For Smoothing	Ta Cap, Aluminum Electrolytic Caps	20 %~
	Organic Semiconductor	50 %~
For TimeConstant	Ta Cap, Aluminum Electrolytic Caps	100%
	Organic Semiconductor	

*Based on circuit function, MLCC cap value may not need to be a 100% replacement





C3216
 X7R
 1H
 105
 K
 T

1
 2
 3
 4
 5
 6



(1) Case Code Dimensions

Type	L (mm) x W (mm)
C0402	0.40 x 0.20
C0603	0.60 x 0.30
C1005	1.00 x 0.50
C1608	1.60 x 0.80
C2012	2.00 x 1.25
C3216	3.20 x 1.60
C3225	3.20 x 2.50
C4520	4.50 x 2.00
C4532	4.50 x 3.20
C5750	5.70 x 5.00
C0510	0.52 x 1.00
C0816	0.80 x 1.60
C1220	1.25 x 2.00
C1632	1.60 x 3.20
CKD610	1.60 x 0.80
CKD510	2.00 x 1.25
CKD110	3.20 x 1.25
CKD310	3.20 x 1.60
CKCM25	1.37 x 1.00
CKCL22	2.00 x 1.25
CKCL44	2.00 x 1.25
CKCA43	3.20 x 1.60
CKG32K	3.80 x 2.90
CKG45K	5.50 x 4.00
CKG45N	(referential dimensions)
CKG57K	6.50 x 5.50
CKG57N	(referential dimensions)
CLLC1A	1.60 x 0.80
CLLE1A	2.00 x 1.25

(2) Capacitance Temperature Characteristics

Temperature Characteristic	Temperature Range	Capacitance Change
CH	-25 ~ 85 °C	0 ± 60 ppm/°C
C0G	-55 ~ 125 °C	0 ± 30 ppm/°C
JB	-25 ~ 85 °C	± 10%
X5R	-55 ~ 85 °C	± 15%
X6S	-55 ~ 105 °C	± 22%
X7R	-55 ~ 125 °C	± 15%
X7S	-55 ~ 125 °C	± 22%
X8R	-55 ~ 150 °C	± 15%
JF	-25 ~ 85 °C	+30/-80%
Y5V	-30 ~ 85 °C	+22/-82%

(3) Rated Voltage Edc

Symbol	Rated Voltage
0G	4 VDC
0J	6.3 VDC
1A	10 VDC
1C	16 VDC
1E	25 VDC
1V	35 VDC
1H	50 VDC
2A	100 VDC
2D	200 VDC
2E	250 VDC
2J	630 VDC
3A	1000 VDC
3D	2000 VDC
3F	3000 VDC

(5) Capacitance Tolerance

Symbol	Capacitance Tolerance
C	± 0.25 pF
D	± 0.50 pF
J	± 5 %
K	± 10 %
M	± 20 %
Z	+80/-20%

(4) Nominal Capacitance

The capacitance is expressed in three digit codes and in units of pico Farads (pF). The first and second digits identify the first and second significant figures of the capacitance. The third digit identifies the multiplier. R designates a decimal point.

Symbol	Cap Value
0R5	0.5 pF
010	1 pF
100	10 pF
101	100 pF
103	10,000 pF

(6) Packaging Style

Symbol	Packaging
B	Bulk
T	Tape and Reel
C	Bulk Cassette

Additional Information

• Preferred Tolerance and Temperature Characteristics

Capacitance Tolerance	Capacitance Temperature Characteristics								
	C0G	JB	X5R	X6S	X7R	X7S	X7T	X8R	Y5V
B ± 0.1pF	※								
C ± 0.25pF	※								
D ± 0.5pF	※								
F ± 1%	※								
G ± 2%	※								
J ± 5%	※	※							
K ± 10%	※	※	※	※	※	※	※	※	
M ± 20%		※	※	※	※	※	※		
Z +80/-20%									※

• Standard Combinations of Capacitance and Tolerance

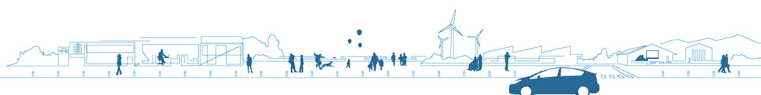
Class	T.C.	Capacitance Tolerance	Nominal Capacitance
1	C0G	≤ 10 pF	C (±0.25 pF) 1.0, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7 D (±0.5 pF) 5.6, 6.8, 8.2, 10
		12 pF ~ 10,000 pF	J (± 5%) E - 12 Series K (± 10%) E - 6 Series
		> 10,000 pF	K (± 10%) E - 6 Series
2	X5R X7R	≤ 10 μF	K (±10%) E - 6 Series
		> 10 μF	M (±20%) E - 1 Series
	Y5V	≤ 0.1 μF Z (+80%,-20%) E - 1 Series > 0.1 μF E - 3 Series	

• Tantalum to MLCC Case Size Reference

When performing a tantalum replacement study, finding the right MLCC can be difficult due to the pad spacing. The following tables list the MLCC case sizes that will work for a tantalum replacement. It should be noted that the pad size and spacing may not be correct for manufacturing, but it will be fine to use for engineering and testing.

Case Code	Case Size	Tantalum Chip Capacitor		MLCC Replacement	
		Length (mm)	Width (mm)	Best Fit	Possible Fit
J	1608	1.60 ± 0.16	0.85 ± 0.15	1608	2012
P	2012	2.00 ± 0.21	1.25 ± 0.20	2012	1608
A	3216	3.20 ± 0.21	1.60 ± 0.20	3216/2012	3225
B	3528	3.50 ± 0.21	2.80 ± 0.20	3225/3216	2012
C	6032	6.00 ± 0.31	3.20 ± 0.30	4532	3216/3225
D	7343	7.30 ± 0.30	4.30 ± 0.30	5750	4532
V	-	6.10 ± 0.21	7.30 ± 0.20	5750	N/A

Other case size MLCC's may be used but will require additional methods to compensate for the difference between pad and component size. The table above serves only as a guideline and not as an official document or specification.



What is E-Series?

- The E-Series is an EIA-5101 standard used by the industry to determine steps for capacitor and resistor values
- The E-Series is a geometric progression obtained by using a numeric base value

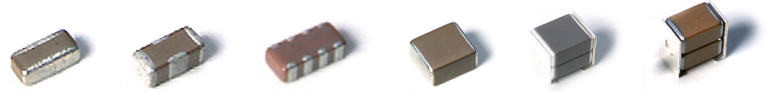
Example:

- E-3 has 3 numbers and it's base value is $\sqrt[3]{10} = 2.2$
- The E-3 series capacitance steps are taken from the base values as follows: 2.2^0 , 2.2^1 , and 2.2^2
- Therefore, an E-3 series offering would include the following values: 100pF; 220pF; 470pF; 1,000pF; 2,200pF; 4,700, etc.

E-Series Capacitance Steps

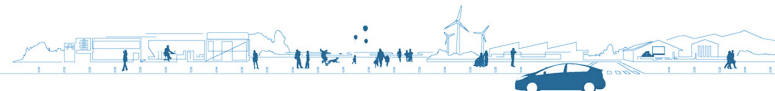
E-1	1.0											
E-3	1.0			2.2				4.7				
E-6	1.0	1.5	2.2	3.3	4.7	6.8						
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

* TDK offers C0G as E-12, X7R/X5R as E-6, X7S/X6S as E-3 and Y5V as E-1

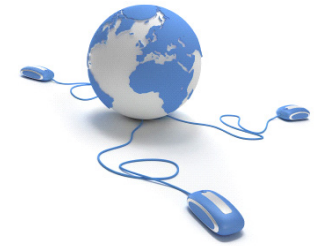
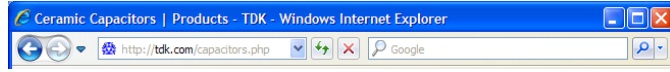


Cap Code	E-Series				pF	nF	µF
	1	3	6	12			
0R5					0.5	0.0005	0.000005
010	◆	◆	◆	◆	1.0	0.0010	0.000010
1R5			◆	◆	1.5	0.0015	0.000015
020					2.0	0.0020	0.000020
2R2		◆	◆	◆	2.2	0.0022	0.000022
030					3.0	0.0030	0.000030
3R3			◆	◆	3.3	0.0033	0.000033
040					4.0	0.0040	0.000040
4R7		◆	◆	◆	4.7	0.0047	0.000047
050					5.0	0.0050	0.000050
060					6.0	0.0060	0.000060
6R8			◆	◆	6.8	0.0068	0.000068
070					7.0	0.0070	0.000070
080					8.0	0.0080	0.000080
090					9.0	0.0090	0.000090
100	◆	◆	◆	◆	10	0.010	0.000010
120				◆	12	0.012	0.000012
150			◆	◆	15	0.015	0.000015
180				◆	18	0.018	0.000018
220		◆	◆	◆	22	0.022	0.000022
270				◆	27	0.027	0.000027
330			◆	◆	33	0.033	0.000033
390				◆	39	0.039	0.000039
470		◆	◆	◆	47	0.047	0.000047
560				◆	56	0.056	0.000056
680			◆	◆	68	0.068	0.000068
820				◆	82	0.082	0.000082
101	◆	◆	◆	◆	100	0.10	0.000010
121				◆	120	0.12	0.000012
151			◆	◆	150	0.15	0.000015
181				◆	180	0.18	0.000018
221		◆	◆	◆	220	0.22	0.000022
271				◆	270	0.27	0.000027
331			◆	◆	330	0.33	0.000033
391				◆	390	0.39	0.000039
471		◆	◆	◆	470	0.47	0.000047
561				◆	560	0.56	0.000056
681			◆	◆	680	0.68	0.000068
821				◆	820	0.82	0.000082
102	◆	◆	◆	◆	1,000	1.0	0.0010
122				◆	1,200	1.2	0.0012
152			◆	◆	1,500	1.5	0.0015
182				◆	1,800	1.8	0.0018
222		◆	◆	◆	2,200	2.2	0.0022
272				◆	2,700	2.7	0.0027
332			◆	◆	3,300	3.3	0.0033
392				◆	3,900	3.9	0.0039
472		◆	◆	◆	4,700	4.7	0.0047
562				◆	5,600	5.6	0.0056
682			◆	◆	6,800	6.8	0.0068

Cap Code	E-Series				pF	nF	µF
	1	3	6	12			
822				◆	8,200	8	0.0082
103	◆	◆	◆	◆	10,000	10	0.010
123				◆	12,000	12	0.012
153			◆	◆	15,000	15	0.015
183				◆	18,000	18	0.018
223		◆	◆	◆	22,000	22	0.022
273				◆	27,000	27	0.027
333			◆	◆	33,000	33	0.033
393				◆	39,000	39	0.039
473		◆	◆	◆	47,000	47	0.047
563				◆	56,000	56	0.056
683			◆	◆	68,000	68	0.068
823				◆	82,000	82	0.082
104	◆	◆	◆	◆	100,000	100	0.10
124				◆	120,000	120	0.12
154			◆	◆	150,000	150	0.15
184				◆	180,000	180	0.18
224		◆	◆	◆	220,000	220	0.22
274				◆	270,000	270	0.27
334			◆	◆	330,000	330	0.33
394				◆	390,000	390	0.39
474		◆	◆	◆	470,000	470	0.47
564				◆	560,000	560	0.56
684			◆	◆	680,000	680	0.68
824				◆	820,000	820	0.82
105	◆	◆	◆	◆	1,000,000	1,000	1.0
125				◆	1,200,000	1,200	1.2
155			◆	◆	1,500,000	1,500	1.5
185				◆	1,800,000	1,800	1.8
225		◆	◆	◆	2,200,000	2,200	2.2
275				◆	2,700,000	2,700	2.7
335			◆	◆	3,300,000	3,300	3.3
395				◆	3,900,000	3,900	3.9
475		◆	◆	◆	4,700,000	4,700	4.7
565				◆	5,600,000	5,600	5.6
685			◆	◆	6,800,000	6,800	6.8
825				◆	8,200,000	8,200	8.2
106	◆	◆	◆	◆	10,000,000	10,000	10
126				◆	12,000,000	12,000	12
156			◆	◆	15,000,000	15,000	15
186				◆	18,000,000	18,000	18
226		◆	◆	◆	22,000,000	22,000	22
276				◆	27,000,000	27,000	27
336			◆	◆	33,000,000	33,000	33
396				◆	39,000,000	39,000	39
476		◆	◆	◆	47,000,000	47,000	47
566				◆	56,000,000	56,000	56
686			◆	◆	68,000,000	68,000	68
826				◆	82,000,000	82,000	82
107	◆	◆	◆	◆	100,000,000	100,000	100



➔ <http://tdk.com/capacitors.php>



Product Catalog
Download PDF catalog files

Application Guide
View Block Diagrams by Application

Product Search

Search by Parts No. Search

Search by Characteristic

- Ceramic Capacitors
- 3-Terminal Feed Through Ceramic Capacitors

➤ Cross Reference
Cross Reference Application converts TDK Competitors MLCC part number to TDK equivalent part number.

➤ CCV - Components Characteristics Viewer
Online simulation tool for verifying the basic characteristics and frequency response of TDK's electronic components.

➤ SEAT - Selection Assistant of TDK components
Freeware for displaying the electrical characteristics of TDK's electronic components

➤ TVCL - TDK Virtual Component Library
A data and modeling series used in circuit simulators for a variety of TDK's electronic components.

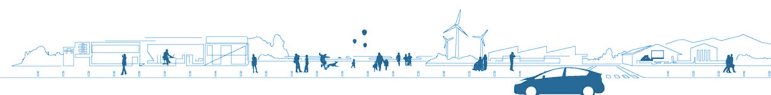
Basic Information:

- Current Cap Range
- General Spec
- Application Manual

Hot Products (September 25th 2009)

TDK offers several new ceramic chip capacitor capacitors utilize TDK's original Fine Multilayer accurate internal electrode material laminati of thinner dielectric layers. The new capacitors are ideal for the applicat sheet for specs, click on the links below:

- 1005 (EIA 0402)/X5R/6.3V/2.2uF
- 1608 (EIA 0603)/X5R/4V/10uF
- 2012 (EIA 0805)/X5R/6.3V/22uF
- 3216 (EIA 1206)/X5R/6.3V/47uF
- 3225 (EIA 1210)/X5R/6.3V/100uF
- 2012 (EIA 0805)/X7S/100V/1uF
- 3225 (EIA 1210)/X7S/50V/10uF
- 4532 (EIA 1812)/X7S/100V/4.7uF

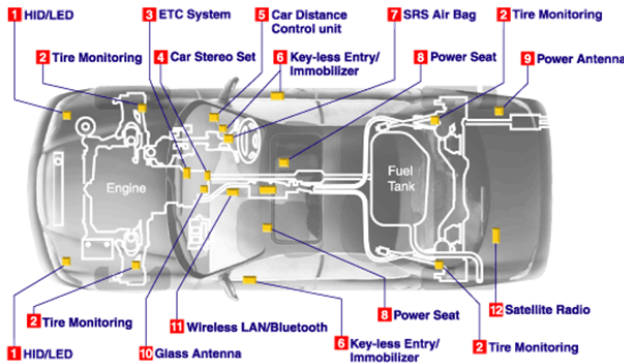


<http://www.tdk.com/application.php>

- Application guides are available on the web at the address above
- The internal structure of each set is illustrated by the block diagram and functional units
- Click on the individual section of the diagram to see commonly used components in each unit

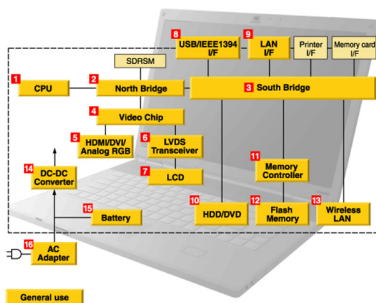
Car Electronics

- Automobile Hybrid Engine Vehicle
- Automobile Engine Control Management
- Automobile Safety & Amenity
- Car Navigation System



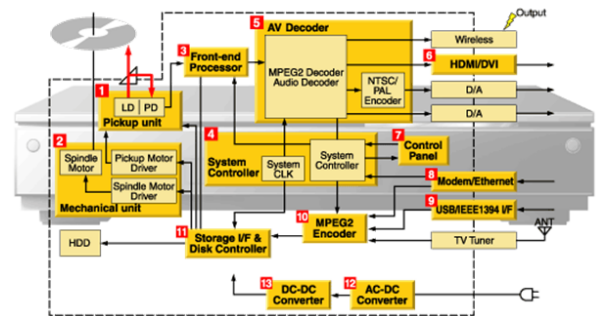
Broadband Network

- Cellular Phone
- GSM/DCS+W-CDMA
- Notebook PC
- Wireless LAN
- Ink Jet Printer



IT Home Appliance

- PDP Television
- PDP Television (Display Block)
- LCD Television
- Blu-ray Disc/DVD Recorder
- Digital Video Camera
- Digital Still Camera
- Projector
- Game Console
- Portable Game Console
- Portable Digital Audio Player
- Large LCD Panel
- Small LCD Panel
- HDD



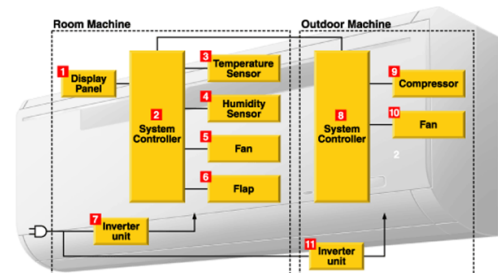
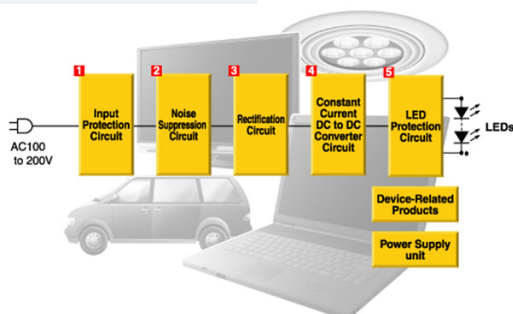
General use

Home Electric Appliance

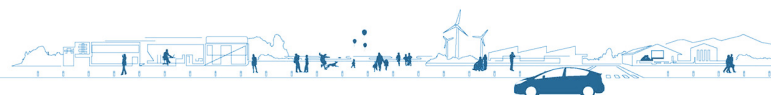
- Air Conditioner
- Refrigerator
- Washing Machine (with dryer)
- Microwave Oven
- Lighting Equipment

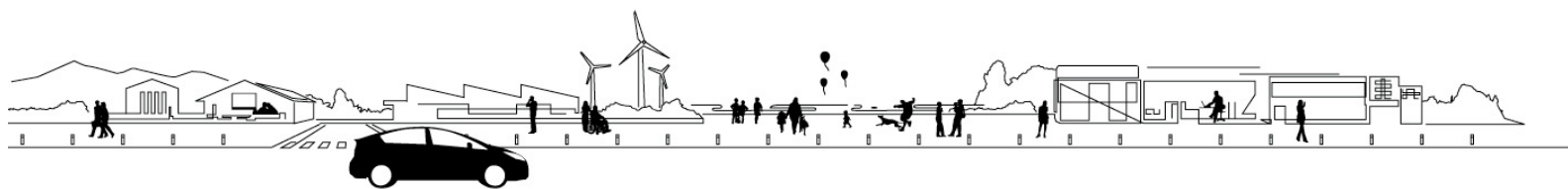
Other Categories

- LED-related products



EMC Components





Contact our office to find a local TDK
Sales Representative near you

TDK Corporation of America

1221 Business Center Drive
Mount Prospect, IL 60056
Tel: (847) 803 – 6100
Fax: (847) 803 – 6296

Attach Business Card Here



Click for helpful links

- | | |
|-----------------------------|--|
| Main Web page: | www.tdk.com |
| Product Category Search : | www.tdk.com/s_cat.php |
| Technical & Support Tools : | www.tdk.com/tst.php |
| FAQ Page : | www.tdk.com/tst_faq.php |
| Capacitor Technical Notes : | www.tdk.com/cap_technotes.php# |

