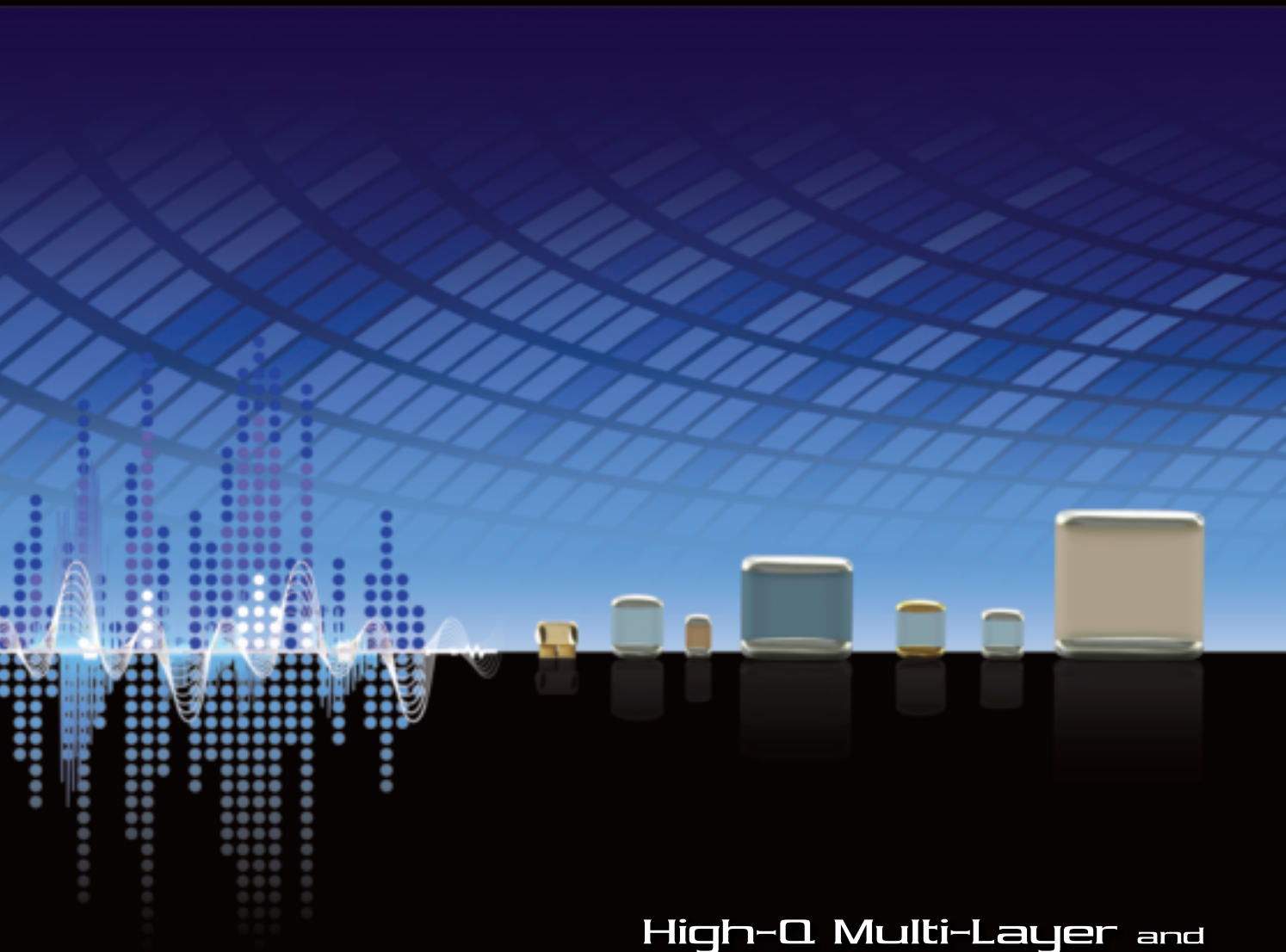
dilabs.com



High-Q Multi-Layer and Broadband Blocking Capacitors

High Speed Capacitors

DLI DIELECTRIC LABORATORIES
A DOVER COMPANY
CMP

Advancing the possibilities with the breadth and depth of our industry-leading smaller, lighter, extreme temperature stable filters, resonators, and ceramic components for military, space and commercial customers.

Company Overview

Dielectric Laboratories, Inc. (DLI) is your global partner for application specific microwave and millimeter wave components serving customers in fiber optic, wireless, medical, transportation, semiconductor, space, avionics and military markets. With over 35 years of experience, you can turn to DLI with confidence for your high frequency Single-Layer Capacitors, Multi-Layer Capacitors that are difficult to build and tight tolerance, Heat Sinks, Resonators, Filters, and Build-To-Print or Custom Thin Film Components.

DLI offers a broad range of Multi-Layer Capacitor products which are summarized in this catalog. Our products include C04, C06, C07, C08, C11, C17, C18, C22 and C40 High-Q Multi-Layer Capacitors. DLI has the world's most comprehensive array of Broadband Blocking Capacitors. We have the expertise in customizing, tight tolerances and meeting specific design targets. DLI continues to introduce exciting new innovations in custom ceramic resonator and filter technologies. These patent-protected products leverage decades of ceramic and Thin Film experience, creative and clever design expertise, and advanced prototyping and testing capabilities. Please discuss your needs with our Sales and Applications Engineering Team.

We are committed to serving you and thank you for your business.

RoHS Compliance Statement

DLI is a leading supplier to the electronic components market and is fully committed to offering products supporting Restriction of Hazardous Substances (RoHS) directive 2002/95/E. All of our Dielectric formulations are RoHS compliant and we offer a broad range of capacitors with RoHS compliant terminations. DLI complies with the requirements of the individual customer and will maintain product offerings that meet the demands of our industry.

Quality and Environmental Policy

DLI's reputation for quality and environmental responsibility is based on a commitment not only to meet our customers' requirements, but to exceed their expectations. The entire organization, beginning with top management, strives to achieve excellence in designing, manufacturing and delivering high Q capacitors and proprietary thin film components for niche high frequency applications, while maintaining safe and healthy working conditions. Furthermore, DLI commits to achieve these goals in an environmentally responsible manner through our commitment to comply with environmental regulations and implement pollution prevention initiatives. DLI strives to continually improve the effectiveness of our Quality and Environmental Management System through the establishment and monitoring of objectives and targets.

AS9100 and ISO 9001 certified
ISO 14001 certified

DIELECTRIC LABORATORIES
A DOVER COMPANY
CMP

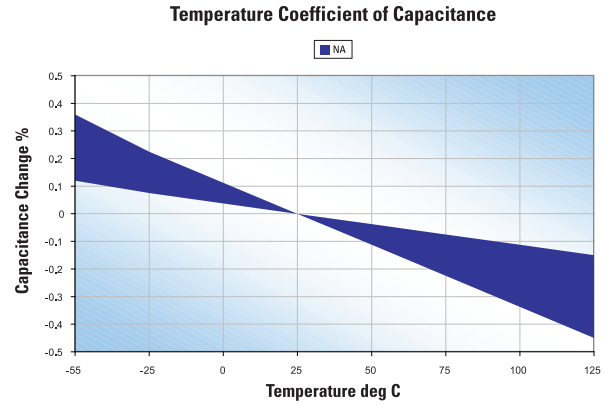
HIGH Q MULTI-LAYER AND BROADBAND BLOCKING CAPACITORS

Table of Contents

"NA" Material temperature compensating capacitors.

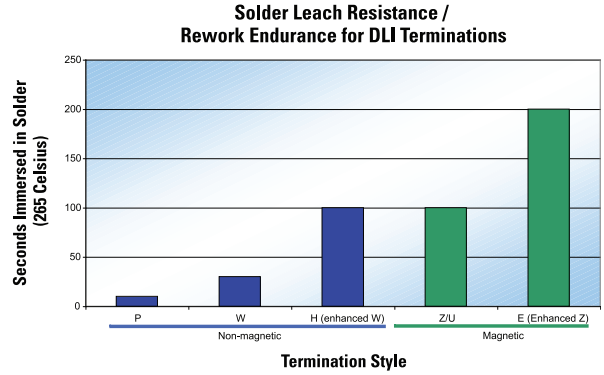
DLI is now offering our proprietary NA dielectric formulation in a variety of MLC case sizes. With its negative temperature coefficient of capacitance (N30+/-15ppm/°C), this high-Q porcelain dielectric is ideal for temperature compensating situations.

NA is offered as a drop-in replacement for most AH/CF part numbers, please contact our sales representatives for details.



Extreme leach resistant terminations.

Engineering teams like to put our parts through their paces. When design engineers told us they'd like a termination that would allow them the freedom to use harsh solder profiles and multiple reworks, we listened! DLI has qualified enhanced versions of its RoHS compliant terminations designed to handle both the rigors of the test bench and the production floor with ease. The enhanced terminations are available in both standard (term code: E) and non-magnetic (term code: H) finishes. Please contact our sales team for more details.

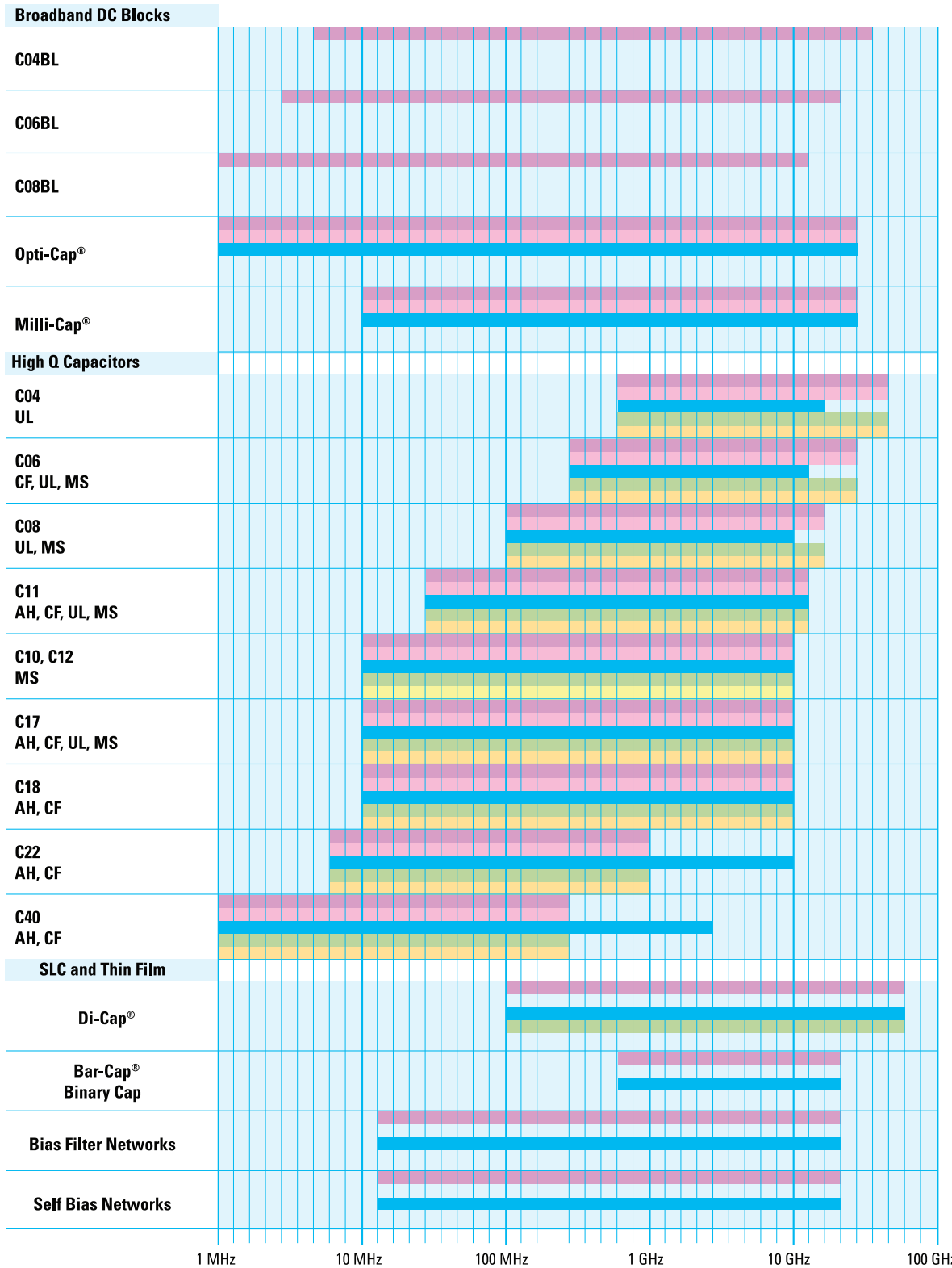


Tuning Rod Kits

DLI-designed tuning rods to utilize our C11 or C17 capacitors of a specified value attached to our High-Q insulating holder to find the optimum capacitor for a particular circuit or application without soldering capacitors. Using a range of capacitance values around the nominal value will allow for quick selection of the appropriate capacitance and then the selection of the correct surface mount capacitor from DLI.

High Voltage 1111 case size.

DLI is please to introduce the new C18 series of enhanced voltage high-Q porcelain capacitors. With voltage ratings up to 2000V, the C18 is designed to be the most robust "1111" high-Q capacitor available today. The C18 is available in both our ultra stable (0±15ppm/°C) CF and temperature compensating (+90ppm/°C) AH dielectrics, and is form-factor compatible with our existing line of C17 "1111" capacitors. See pages 11 and 13 for more information!


Broadband DC Blocks
C04BL
C06BL
C08BL
Opti-Cap®
Milli-Cap®
High Q Capacitors
C04
UL
C06
CF, UL, MS
C08
UL, MS
C11
AH, CF, UL, MS
C10, C12
MS
C17
AH, CF, UL, MS
C18
AH, CF
C22
AH, CF
C40
AH, CF
SLC and Thin Film
Di-Cap®
Bar-Cap®
Binary Cap
Bias Filter Networks
Self Bias Networks
1 MHz
10 MHz
100 MHz
1 GHz
10 GHz
100 GHz
DC Blocking
Low Noise Amplifiers
Power Amplifiers, High Power Amplifiers
Oscillators
Filters

	DLI Series	Case Size Footprint in. (mm)	Cap Value Range (pF)	Cap (pF)	Typical ESR 150 MHz	Typical ESR 500 MHz	Typical ESR 1 GHz	Series Resonance (MHz)	Working Voltage (WVDC) max
AH TCC (ppm/°C) (-55° to +125°C) Porcelain (P90) +90 ±20	C11AH	.055 x .055 (1.40 x 1.40)	0.1 to 100	1	0.067	0.080	0.136	9200	250
				10	0.044	0.071	0.104	3000	
				100	0.032	0.055	0.086	1000	
	C17AH	.110 x .110 (2.79 x 2.79)	0.1 to 1000	1	0.059	0.063	0.114	9064	1000
				10	0.039	0.060	0.085	3100	
				100	0.024	0.050	0.074	1290	
	C18AH	.110 x .110 (2.79 x 2.79)	0.1 to 1000	10	0.059	0.094	0.138	3100	1000
				100	0.028	0.069	0.109	1290	
				1000	0.023	0.063	–	400	
	C22AH	.220 x .245 (5.84 x 6.35)	1 to 2700	10	0.074	0.207	0.249	2480	2500
				100	0.048	0.116	0.190	1000	
				1000	0.028	0.140	–	320	
				2700	0.027	–	–	214	
					10MHz	**30MHz**	**100MHz**		
	C40AH	.380 x .380 (9.65 x 9.65)	1 to 5100	15	0.066	0.033	0.027	2100	7200
				100	0.018	0.026	0.052	680	
				1000	0.009	0.017	0.033	210	
				5100	0.008	0.016	0.033	95	

	DLI Series	Case Size Footprint in. (mm)	Cap Value Range (pF)	Cap (pF)	Typical ESR 150 MHz	Typical ESR 500 MHz	Typical ESR 1 GHz	Series Resonance (MHz)	Working Voltage (WVDC) max
CF TCC (ppm/°C) (-55° to +125°C) Porcelain (NP0) 0 ±15	C06CF	.063 x .030 (1.60 x 0.80)	0.1 to 47	1	0.182	0.276	0.428	10300	250
				10	0.095	0.159	0.243	3200	
				47	0.081	0.127	0.173	1400	
	C11CF	.055 x .055 (1.40 x 1.40)	0.1 to 100	1	0.073	0.089	0.146	9900	250
				10	0.049	0.075	0.107	3100	
				100	0.040	0.073	0.111	970	
	C17CF	.110 x .110 (2.79 x 2.79)	0.1 to 1000	1	0.073	0.082	0.124	9060	1000
				10	0.065	0.098	0.136	3100	
				100	0.041	0.070	0.102	1300	
				1000	0.034	0.073	–	400	
	C18CF	.110 x .110 (2.79 x 2.79)	0.1 to 1000	1	0.068	0.086	0.158	9060	1000
				10	0.058	0.087	0.118	3100	
				150	0.041	0.068	–	1000	
	C22CF	.220 x .245 (5.84 x 6.35)	1 to 2700	10	0.072	0.113	0.164	2480	2500
				100	0.047	0.079	0.119	1000	
				1000	0.036	0.067	–	320	
				2700	0.035	–	–	214	
					10MHz	**30MHz**	**100MHz**		
	C40CF	.380 x .380 (9.65 x 9.65)	1 to 5100	10	0.121	0.054	0.037	2100	7200
				100	0.044	0.038	0.045	680	
				1000	0.032	0.036	0.038	210	
				5100	0.011	0.016	0.040	95	

ESR and Resonance data is of typical performance and can vary from lot to lot.

	DLI Series	Case Size Footprint in. (mm)	Cap Value Range (pF)	Cap (pF)	Typical ESR 150 MHz	Typical ESR 500 MHz	Typical ESR 1 GHz	Series Resonance (MHz)	Working Voltage (WVDC) max
UL TCC (ppm/°C) (-55° to +125°C) Ceramic (NP0) 0 ±30	C04UL	.040 x .020 (1.0 x 0.5)	0.1 to 10	1	0.081	0.095	0.148	9820	200
				5	0.038	0.057	0.088	3930	
				10	0.036	0.058	0.087	2650	
	C06UL	.063 x .030 (1.60 x 0.80)	0.1 to 47	5	0.052	0.072	0.107	1750	250
				15	0.028	0.041	0.064	1010	
				47	0.023	0.043	0.070	570	
	C07UL	.063 x .031 (1.60 x 0.80)	0.1 to 47	5.6	0.053	0.086	0.129	5000	250
				10	0.029	0.041	0.066	3960	
				30	0.017	0.023	0.036	2540	
	C08UL	.080 x .050 (2.0 x 1.27)	0.1 to 100	5.1	0.051	0.078	0.126	6000	250
				9.5	0.041	0.060	0.094	4620	
				11	0.041	0.064	0.103	4340	
	C11UL	.055 x .055 (1.40 x 1.40)	0.1 to 100	2	0.066	0.084	0.125	7530	250
				10	0.037	0.057	0.086	3800	
				100	0.022	0.042	0.081	1430	
	C17UL	.110 x .110 (2.79 x 2.79)	0.1 to 1000	10	0.040	0.056	0.082	2940	1000
				100	0.021	0.035	0.057	910	
				470	0.016	0.029	–	420	

	DLI Series	Case Size Footprint in. (mm)	Cap Value Range (pF)	Cap (pF)	Typical ESR 150 MHz	Typical ESR 500 MHz	Typical ESR 1 GHz	Series Resonance (MHz)
MS TCC (ppm/°C) (-55° to +125°C) Ceramic (NP0) 0 ±30	C06MS	.063 x .030 (1.60 x 0.80)	0.3 to 100	1	0.090	0.135	0.207	10300
				10	0.058	0.099	0.140	3200
				100	0.040	0.073	0.104	1400
	C08MS	.080 x .050 (2.0 x 1.27)	0.2 to 470	1	0.200	0.140	0.190	10300
				10	0.065	0.090	0.140	3200
				100	0.030	0.045	0.065	1400
	C11MS	.055 x .055 (1.40 x 1.40)	0.2 to 220	1	0.160	0.110	0.120	9900
				10	0.060	0.090	0.120	3100
				100	0.035	0.045	0.070	220
	C17MS	.110 x .110 (2.79 x 2.79)	0.3 to 2200	10	0.642	0.097	0.110	3100
				100	0.041	0.076	0.090	1300
				1000	0.028	0.044	0.109	400
				2200	0.027	0.040	0.095	200

See page 21 for Working Voltage Rating (WVDC).

Consult factory for additional case size data.

Multi-Layer – Standard P/N System

C	17	CF	620	J	-	7	U	N	-	X	0	T
Multi-Layer Capacitor	Case Size	Material System	Capacitance Value	Tolerance		Voltage Code	Termination Code	Leading Code		Test Level Code	Laser Marking Code	Packaging

Case Size 17

Case	Dimensions
04	0.040" x 0.020"
06	0.060" x 0.030"
07	0.110" x 0.070"
08	0.080" x 0.050"
10	0.120" x 0.010"
11	0.055" x 0.055"
12	0.120" x 0.060"
17	0.110" x 0.110"
18	0.110" x 0.110"
20	0.220" x 0.200"
22	0.220" x 0.220"
36	0.360" x 0.040"
40	0.380" x 0.380"

Material CF

Material	Characteristics
AH	P90 High-Q
CF	NPO High-Q
MS	NPO High-Q
UL	Ultra Low ESR-NPO
BL	DC Blocking

Capacitance 620

First two digits	Significant figures in capacitance
Third digit	Additional number of zeros
R	Represents a decimal point
Examples:	620 = 62pF
	152 = 1500pF

Tolerance J

Code	Value
A	± 0.05pF
B	± 0.1pF
C	± 0.25pF
D	± 0.5pF
F	± 1%
G	± 2%
J	± 5%
K	± 10%
M	± 20%
X	GMV
S	SPECIAL

Voltage 7

Code	Voltage
5	50V
1	100V
8	150V
6	200V
9	250V
3	300V
4	500V
7	1000V
A	1500V
G	2000V
B	2500V
D	3600V
F	5000V
H	7200V
S	SPECIAL

Termination U

Code	Termination System	
T	Ag Termination, Ni Barrier Layer, Heavy SnPb Plated Solder	
U	Ag Termination, Ni Barrier Layer, SnPb Plated Solder	
S	Ag Termination, Ni Barrier Layer, Gold Flash	RoHS
Z	Ag Termination, Ni Barrier Layer, Sn Plated Solder	RoHS
E	Ag Termination, Enhanced Ni Barrier, Sn Plated Solder	RoHS
P	AgPd Termination	RoHS
Q	Polymer Termination, Ni Barrier Layer, Sn Plated Solder	RoHS
Y	Polymer Termination, Ni Barrier Layer, SnPb Plated Solder	
M	Polymer Termination, Cu Barrier Layer, Sn Plated Solder	RoHS
W	Ag Termination, Cu Barrier Layer, Sn Plated Solder	RoHS
H	Ag Termination, Enhanced Cu Barrier, Sn Plated Solder	RoHS
V	Ag Termination, Cu Barrier Layer, SnPb Plated Solder	
R	Ag Termination, Cu Barrier Layer, Heavy SnPb Plated Solder	

Leading N

Code	Lead Type
A	Axial Ribbon
B	Radial Ribbon
C	Center Ribbon
D	Specialty Customer Defined
E	Axial Wire
F	Radial Wire
N	NONE

NOTE: Consult Sales Representative for RoHS compliant leaded devices

NOTE: All fields are required.
Any specials, please consult factory.

Test Level X

Code	Testing
X	Standard
Y	Reduced Visual
A	MIL-PRF-55681 Group A
C	MIL-PRF-55681 Group C
D	Customer Specified

Laser Mark 0

Code	Laser Marking
0	No marking
1	Single-side marked
2	Double-side marked
3*	Large single-side marked
4*	Large double-side marked
5	Vertical edge marked
9	Customer Specified

*Reduces DWV Rating.

Packaging T

Code	Packaging
T	Tape & Reel – Horizontal
V	Tape & Reel – Vertical
W	Waffle Pack
B	Bulk
P	Plastic Box
R	Tube (Rail)
S	Customer Specified

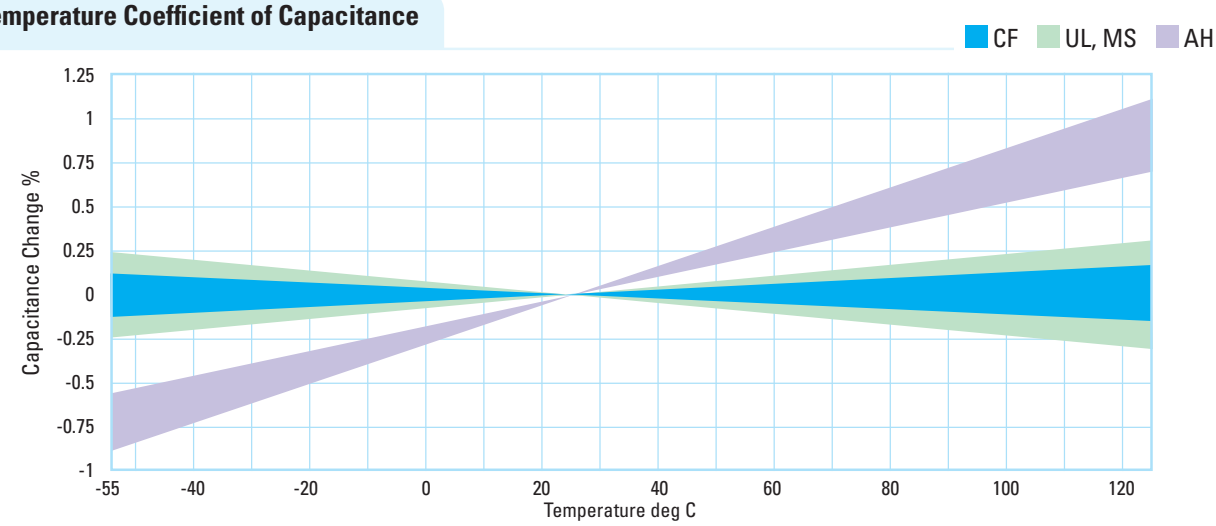
DLI Multi-Layer Dielectric Materials

Dielectric Code	Temperature Coefficient -55°C to +125°C (ppm/°C Maximum)	Dissipation Factor @ 1 MHz (% Maximum)	Insulation Resistance (MΩ)	
			@ +25°C	@ +125°C
AH	P90 ± 20	0.05	$>10^6$	$>10^5$
CF	0 ± 15	0.05	$>10^6$	$>10^5$
UL	0 ± 30	0.05	$>10^5$	$>10^4$
MS	0 ± 30	0.05	$>10^5$	$>10^4$
*BL	± 15%	2.50	$>10^4$	$>10^3$

All test conditions are per MIL-PRF-55681 revision A. Dissipation Factor applies to values of 4.7pF or greater.
*Broadband Blocks only.

Other Dielectric formulations may be available, please contact your Sales Representative.

Temperature Coefficient of Capacitance



Termination Systems

Code	Termination System	Application
T	Ag Termination Ni Barrier Layer Heavy SnPb Plated Solder	• High Reliability Applications • Hand Soldering
U	Ag Termination Ni Barrier Layer SnPb Plated Solder	• High Reliability Applications • High Volume & Hand Solder Assembly
S RoHS	Ag Termination Ni Barrier Layer Gold Flash	• Specialty Solder, Epoxy Applications • Standard for 0402
Z RoHS	Ag Termination Ni Barrier Layer Sn Plated Solder	• High Volume & Hand Solder Assembly
E RoHS	Ag Termination Enhanced Ni Barrier Sn Plated Solder	• High Volume & Hand Solder Assembly • Ultra Leach Resistant
P RoHS	AgPd Termination	• Non-Magnetic Applications
Q RoHS	Polymer Termination Ni Barrier Layer Sn Plated Solder	• Resistant to Cracking • High Volume & Hand Solder Assembly

Code	Termination System	Application
Y	Polymer Termination Ni Barrier Layer Sn Plated Solder	• Resistant to Cracking • High Reliability Applications • High Volume & Hand Solder Assembly
M RoHS	Polymer Termination Cu Barrier Layer Sn Plated Solder	• Resistant to Cracking • Non-Magnetic Application • High Volume & Hand Solder Assembly
W RoHS	Ag Termination Cu Barrier Layer Sn Plated Solder	• Non-Magnetic Application • High Volume
H RoHS	Ag Termination Enhanced Cu Barrier Sn Plated Solder	• High Volume & Hand Solder Assembly • Ultra Leach Resistant
V	Ag Termination Cu Barrier Layer SnPb Plated Solder	• Non-Magnetic Applications • High Reliability Applications • High Volume & Hand Solder Assembly
R	Ag Termination Cu Barrier Layer Heavy SnPb Plated Solder	• Non-Magnetic Applications • High Reliability Applications • Hand Soldering

General Information

Lead Termination Codes

Axial Ribbon	Radial Ribbon	Center Ribbon	Axial Wire Lead	Radial Wire Lead
Code A	Code B	Code C	Code E	Code F
				

Leads are attached with high melting point solder (HMP) at 296°C.

Test Level Codes

Test code	Inspection Description (see individual part pages for additional detail)
Y	100% IR, 1% AQL visual, 1% Electrical (DWV, Cap., DF)
X	100% IR, 100 % AQL visual, 100% Electrical (DWV, Cap., DF)
A	Group A testing per MIL – PRF – 55681
C	Group C testing per MIL – PRF – 55681
D	Customer Defined

Packaging Configurations

Case Style	Size L x W	7" Reel, 8mm Tape		7" Reel, 16mm Tape	13" Reel, 16mm Tape	2" x 2" Waffle Pack
		Horizontal Orientation	Vertical Orientation	Horizontal Orientation	Horizontal Orientation	
C04	0.040" x 0.020"	5000				
C06	0.060" x 0.030"	4000				108
C08	0.080" x 0.050"	5000	3100			108
C11	0.055" x 0.055"	3500	3100			108
C17	0.110" x 0.110"	2350	750			49
C18	0.110" x 0.110"	2350	750			49
C22	0.220" x 0.245"	500				
C40	0.380" x 0.380"	250		250	1300	

Typically a minimum 500 piece order for tape and reel packaging.
Standard Packaging: Bulk in plastic bags.
Consult factory for custom packaging solutions.

Packaging Configurations for MS

Case Style	Size L x W	7" Reel, 8mm Tape	13" Reel, 16mm Tape
		Horizontal Orientation	Vertical Orientation
C04	0.040" x 0.020"	16,000	16,000
C06	0.060" x 0.030"	4,000	16,000
C08	0.080" x 0.050"	3,000	12,000
C10	0.120" x 0.100"	2,000	8,000
C11	0.055" x 0.055"	2,500	10,000
C12	0.120" x 0.060"	2,500	10,000

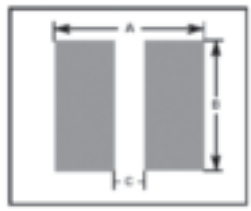
Case Style	Size L x W	7" Reel, 8mm Tape	13" Reel, 16mm Tape
		Horizontal Orientation	Vertical Orientation
C17	0.110" x 0.110"	1,000	4,000
C18	0.180" x 0.120"	1,000	4,000
C20	0.220" x 0.200"	1,000	4,000
C22	0.220" x 0.245"	1,000	4,000
C36	0.360" x 0.400"	–	500

Minimum of one full reel.
Standard Packaging: Bulk in plastic bags.
Consult factory for custom packaging solutions.

Recommended Pad Spacing Dimensions (inches)

Case Style	Internal Electrode	Reflow Soldering			Wave Soldering		
		A	B	C	A	B	C
C04	Horizontal	0.064	0.025	0.010	0.080	0.025	0.010
	Vertical		Not Recommended			Not Recommended	
C06	Horizontal	0.096	0.046	0.020	0.126	0.046	0.020
	Vertical		Not Recommended			Not Recommended	
C07	Horizontal	0.110	0.120	0.025	0.130	0.120	0.025
	Vertical		Not Recommended			Not Recommended	
C08	Horizontal	0.120	0.070	0.025	0.140	0.070	0.025
	Vertical	0.120	0.040	0.025	0.140	0.040	0.025
C11	Horizontal	0.100	0.075	0.020	0.130	0.075	0.020
	Vertical	0.100	0.060	0.020	0.130	0.060	0.020
C17	Horizontal	0.160	0.135	0.050	0.190	0.135	0.050
	Vertical	0.160	0.110	0.050	0.190	0.110	0.050
C18	Horizontal	0.170	0.145	0.070	0.190	0.145	0.070
	Vertical	0.170	0.120	0.070	0.190	0.120	0.070
C22	Horizontal	0.270	0.275	0.110	0.300	0.275	0.110
	Vertical		Not Recommended			Not Recommended	
C40	Horizontal	0.425	0.400	0.290	0.455	0.400	0.290
	Vertical		Not Recommended			Not Recommended	

Recommended Printed Wire Board Land Patterns



Printed Wire Board land pattern design for chip components is critical to ensure a reliable solder fillet, and to reduce nuisance type manufacturing problems such as component swimming and tombstoning. The land pattern suggested can be used for reflow and wave solder operations as noted. Land patterns constructed with these dimensions will yield optimized solder fillet formation and thus reduce the possibility of early failure.[1]

A = (Max Length) + 0.030" (.762mm)*
B = (Max Width) + 0.010" (.254mm)
C = (Min Length) – 2 (Solder Band)**

*Add 0.030" for Wave Solder operations.
**"C" to be no less than 0.02", change "A" to (Max Length) + 0.020".
1. Frances Classon, James Root, Martin Marietta Orlando Aerospace, "Electronics Packaging and Interconnection Handbook".

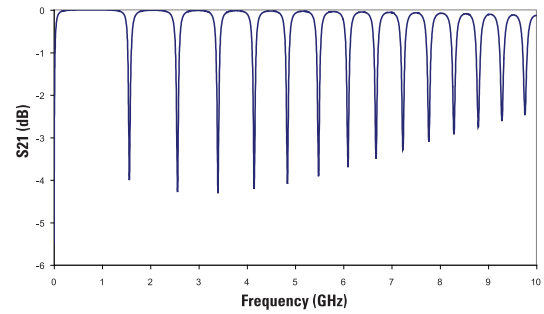
Temperature Precautions

The rate of heating and cooling must be controlled to preclude thermal cracking of ceramic capacitors. Soldering temperatures should not exceed 200°C per minute, temperature variation must not exceed 100°C maximum for any solder operation. Avoid forced cooling or contact with heat sinks, such as conveyor belts, metal tables or cleaning solutions, before the chips reach ambient temperatures.

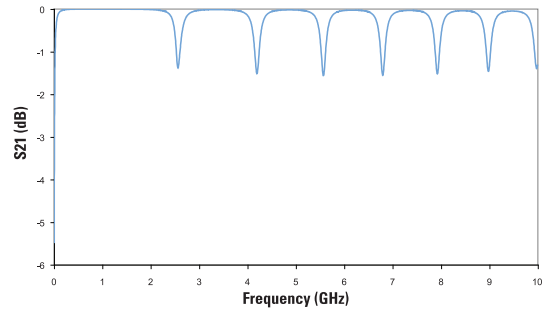
MLC Orientation - Horizontal and Vertical Mounting

The orientation of the MLC relative to the ground plane affects the devices' impedance. When the internal electrodes are parallel to the ground plane (Horizontal mounting) the impedance of the MLC resembles a folded transmission line driven from one end. The below graph shows the modeled insertion loss and parallel resonances of C17AH101K-7UN-X0T with horizontal mounting. When the internal electrodes are perpendicular to the ground plane (Vertical mounting, bottom graph) the MLC impedance resembles a folded transmission line driven from the center reducing resonance effects. C11,17 are available with vertical or horizontal orientation in tape and reel packaging. Modeling can be done in CapCad. HP/EEs of series 4 contains models for C11 and C17 in the element libraries under Dielectric Laboratories MLC.

Horizontal Orientation
C17AH101K-7UN-X0T 100.0pF Temp = 25



Vertical Orientation
C17AH101K-7UN-X0T 100.0pF Temp = 25 °C



Chip Selection

Multilayer capacitors (MLC) are categorized by dielectric performance with temperature, or "temperature coefficient", as these devices vary in behavior over temperature. The choice of component is thus largely determined by the temperature stability required of the device, i.e. type of dielectric, and the size necessary for a given capacitance and voltage rating. The following items are pertinent to chip selection:

Dielectric Type

CF: Ultra stable Class I dielectric, with negligible dependence of electrical properties on temperature, voltage, frequency and time, used in circuitry requiring very stable performance.

AH: Class 1 dielectric with a dielectric constant that increases with temperature (90ppm/°C). Useful for temperature compensation where other board components may be losing capacitance with temperature.

NA: Class 1 dielectric with a negative TCC. Useful in situations where other board components are gaining capacitance with temperature.

UL: Stable Class I dielectric, with extremely low ESR. Useful in any application where heat generation or signal loss are concerns.

BL: Stable Class II dielectric (X7R), with predictable change in properties with temperature, voltage, frequency and time. Used as blocking, de-coupling, bypassing and frequency discriminating elements. This dielectric is ferroelectric, and provides higher capacitance than Class I.

MS: Stable Class I dielectric. Particularly suited to high capacitance or high volume applications.

Capacitor Size

Size selection is based primarily on capacitance value, voltage rating, and resonance frequency. Smaller units are generally less expensive; 0603 is the most economical size. Because mass affects the thermal shock behavior of chips, size selection must consider the soldering method used to attach the chip to the board. C18 and smaller can be wave, vapor phase or reflow soldered. Larger units require reflow soldering.

Termination Material

Nickel barrier termination, with exceptional solder leach resistance is recommended for all applications involving solder. DLI offers two versions of the nickel barrier termination. The "Z" termination is a nickel barrier with 100% matte tin for a lead free capacitor. The "U" termination is a nickel barrier with 90/10 tin/lead for military applications. Non-magnetic versions of these termination finishes are also available.

Solder Leaching

DLI's termination finishes are designed to withstand RoHS attachment methods. During soldering, time above 230°C should be minimized to reduce thinning of the barrier layer and subsequent bond failure. DLI offers enhanced magnetic and non-magnetic termination finishes for applications requiring extended soldering time or repeated reflow cycles. Please consult your Sales Representative when ordering.

Packaging

Units are available in bulk, reeled or in waffle pack.

Attachment Methods

Bonding of capacitors to substrates can be categorized into two methods, those involving solder, which are prevalent, and those using other materials, such as epoxies and thermo-compression or ultrasonic bonding with wire. Please see DLI application note "Recommended Solder Attachment Techniques for Multi-Layer Chip and Pre-Thinned Capacitors" located on out website, www.dilabs.com.

Soldering

Soldering methods commonly used in the industry and recommended are Reflow Soldering, Wave Soldering, and to a lesser extent, Vapor Phase Soldering. All these methods involve thermal cycling of the components and therefore the rate of heating and cooling must be controlled to preclude thermal shocking of the devices. In general, rates which do not exceed 120°C per minute and a temperature spike of 100°C maximum for any soldering process on sizes C18 and smaller is advisable. Other precautions include post soldering handling, primarily avoidance of rapid cooling with contact with heat sinks, such as conveyors or cleaning solutions.

Large chips are more prone to thermal shock as their greater bulk will result in sharper thermal gradients within the device during thermal cycling. Units larger than C18 experience excessive stress if processed through the fast cycles typical of solder wave or vapor phase operations. Solder reflow is most applicable to the larger chips as the rates of heating and cooling can be slowed within safe limits. In general, rates that do not exceed 60°C per minute and a temperature spike of 50°C maximum for any soldering process on sizes larger than C18 is advisable.

Attachment using a soldering iron requires extra care, particularly with large components, as thermal gradients are not easily controlled and may cause cracking of the chip. Precautions include preheating of the assembly to within 100°C of the solder flow temperature, the use of a fine tip iron which does not exceed 30 watts, and limitation of contact of the iron to the circuit pad areas only.

Bonding

Hybrid assembly using conductive epoxy or wire bonding requires the use of silver palladium or gold terminations. Nickel barrier termination is not practical in these applications, as intermetallics will form between the dissimilar metals. The ESR will increase over time and may eventually break contact when exposed to temperature cycling.

Cleaning

Chip capacitors can withstand common agents such as water, alcohol and degreaser solvents used for cleaning boards. Ascertain that no flux residues are left on the chip surfaces as these diminish electrical performance.

DLI Shelf Life

Capacitors are solderable for a minimum of one year from the date of shipment if properly stored in the original packaging. Dry nitrogen storage is preferable for longer periods.

Board Design Considerations

The amount of solder applied to the chip capacitor will influence the reliability of the device. Excessive solder can create thermal and tensile stresses on the component which could lead to fracturing of the chip or the solder joint itself. Insufficient or uneven solder application can result in weak bonds, rotation of the device off line or lifting of one terminal off the pad (tombstoning). The volume of solder is process and board pad size dependent. WAVE SOLDERING exposes the devices to a large solder volume, hence the pad size area must be restricted to accept an amount of solder which is not detrimental to the chip size utilized. Typically the pad width is 66% of the component width, and the length is .030" (.760 mm) longer than the termination band on the chip. An 0805 chip which is .050" wide and has a .020" termination band therefore requires a pad .033" wide by .050" in length. Opposing pads should be identical in size to preclude uneven solder fillets and mismatched surface tension forces which can misalign the device. It is preferred that the pad layout results in alignment of the long axis of the chips at right angles to the solder wave, to promote even wetting of all terminals. Orientation of components in line with the board travel direction may require dual waves with solder turbulence to preclude cold solder joints on the trailing terminals of the devices, as these are blocked from full exposure to the solder by the body of the capacitor. Restrictions in chip alignment do not apply to SOLDER REFLOW or VAPOR PHASE processes, where the solder volume is controlled by the solder paste deposition on the circuit pads There are practical limitations on capacitor sizes that prohibit reliable direct mounting of chip capacitors larger than 2225 to a substrate. Without mechanical restriction, thermally induced stresses are released once the capacitor attains a steady state condition, at any given temperature. Capacitors bonded to substrates, however, will retain some stress, due primarily to the mismatch of expansion of the component to the substrate; the residual stress on the chip is also influenced by the ductility and hence the ability of the bonding medium to relieve the stress. Unfortunately, the thermal expansions of chip capacitors differ significantly from those of substrate materials.

Case Size Definitions

Case Size	Termination Style	Width (1) Range	Length (1) Range	Thickness (1) (Max)	Gap Min (Between Bands)	Band Min,(3) (Plated)	Band Max (3) (Plated)
04BL	U S	0.020 ± 0.006	0.040 ± 0.008	0.028	0.006	0.003	0.019
04UL	S						
06BL	U S Z	0.030 ± 0.009	0.060 ± 0.012	0.036	0.008	0.006	0.03
06CF	U S Z E P W V R						
06UL	U S Z	0.031 ± 0.011	0.063 ± 0.015	0.037	0.012	0.006	0.03
07UL	S Z	0.112 ± 0.026	0.072 ± 0.022	0.12	0.016	0.006	0.054
08BL	U S Z	0.051 ± 0.013	0.081 ± 0.020	0.061	0.008	0.012	0.0468
08UL	U S Z						
11	U S Z E P Q Y M W V R	0.056 ± 0.020	0.059 ± 0.018	0.06	0.012	0.006	0.033
	T		0.064 ± 0.023			N/A	N/A
17	U S Z E P Q Y M W V R	0.112 ± 0.026	0.116 ± 0.028	0.12	0.032	0.006	0.054
	T	0.115 ± 0.029	0.125 ± 0.035			N/A	N/A
18	U Z E W V	0.118 ± 0.032	0.125 ± 0.035	0.12	0.036	0.006	0.054
22	T U S Z E P Q Y M W V R	0.252 ± 0.040	0.226 ± 0.038	0.156	0.104	N/A	N/A
40	T U S Z E P Q Y M W V R	0.381 ± 0.049	0.384 ± 0.052	0.156	0.23	N/A	N/A

(1) Dimensions listed include the termination, not just ceramic.
(2) Gap minimum between trimmer pads is .080".
(3) Band widths are from corner to corner of part.
All dimensions are in inches.

Case Size Definitions (Leaded Parts)

Leaded Part Case Size	Lead (1) Code	Body (2) Length	Body (2) Width	Body (2) Thickness	Max Lead Coverage (fillet)	Lead Length (Minimum)	Lead Width	Lead Thickness	Offset Max
11 ribbon	A, B	.064 ± .024	.057 ± .021	0.060 max	50% max	0.2	.041 ± .009	.005 ± .002	–
17 centered axial ribbon	C	.137 ± .029	.112 ± .026	0.120 max	50% max	0.2	.086 ± .014	.004 ± .002	.030 max
17 ribbon	A, B								–
17 wire	E, F						.019 diameter	–	–
18 centered axial ribbon	C	.142 ± .034	.112 ± .026	0.120 max	50% max	0.2	.086 ± .014	.004 ± .002	.030 max
18 ribbon	A, B								–
18 wire	E, F						.019 diameter	–	–
22 centered axial ribbon	C	.232 ± .044	.252 ± .040	.156 max	50% max	0.4	.241 ± .029	.005 ± .002	.030 max
22 ribbon	A, B								–
22 wire	E, F					0.8	.038 diameter	–	–
40 centered axial ribbon	C	.389 ± .057	.381 ± .049	.156 max	50% max	0.9	.351 ± .041	.010 ± .002	.030 max
40 ribbon	A, B								–
40 wire	E, F					0.8	.038 diameter	–	–

(1) See Lead Code Definitions on page 6 for lead orientation details.
(2) Body dimensions include termination, lead and ceramic.

AH Series: P90 Porcelain Capacitors

Description

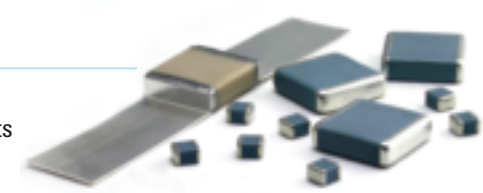
Porcelain Capacitors
Positive TC "P90"
Low ESR, High Q
Capacitance
Range 0.1 - 5100 pF
High Self-resonance
Low Noise
Established Reliability

Functional Applications

Impedance Matching
DC Blocking
Bypass
Coupling
Tuning & Feedback
Amplifier Matching Networks
VCO Frequency Stabilization
Filtering, Diplexers & Antenna Matching
High RF Power Circuits
Oscillators
Timing Circuits
Filters
RF Power
Amplifiers & Delay Lines

Benefits

Stable TC, -55° to +125°C Operating Range
High Q
SMD Compatibility
Lower ESR
Power Handling, High Voltage



Dielectric Characteristics

Dielectric Material Code	Temperature Coefficient (ppm/°C Maximum)	Dissipation Factor (% @ 1MHz Maximum)	Dielectric Withstanding Voltage		Insulation Resistance (MΩ Minimum)		Aging	Piezoelectric Effects	Dielectric Absorption
			Voltage Rating (Volts)	DWV (Volts)	@ +25°C	@ +125°C			
AH	+90 ± 20	0.05	Please see chart (pg. 10)	250% of WVDC for 5 sec unless specified in chart (pg. 10)	10^6	10^5	None	None	None

Part Number Breakdown*

C	17	AH	620	J	-	7	U	N	-	X	0	T
Multi Layer	Case Size	Material System	Capacitance Code	Tolerance Level		Voltage Code	Termination Code	Leading Code		Test Level	Marking Code	Packaging

Available Termination Types

C11	T, U, S, Z, E, P, Q, Y, M, W, H, V, R
C17	T, U, S, Z, E, P, Q, Y, M, W, H, V, R
C18	U, Z, E, Y, W, H
C22	U, S, Z, E, P, Q, Y, M, W, H, V, R
C40	T, U, S, Z, E, P, Q, Y, M, W, H, V, R

Code	Termination System
T	Ag Term, Ni Barrier Layer, Heavy SnPb Plated Solder
U	Ag Termination, Ni Barrier Layer, SnPb Plated Solder
S	Ag Termination, Ni Barrier Layer, Gold Flash, RoHS
Z	Ag Termination, Ni Barrier Layer, Sn Plated Solder, RoHS
E	Ag Termination, Enhanced Ni Barrier, Sn Plated Solder, RoHS
P	AgPd Termination, RoHS
Q	Polymer Termination, Ni Barrier Layer, Sn Plated Solder, RoHS
Y	Polymer Termination, Ni Barrier Layer, SnPb Plated Solder,
M	Polymer Termination, Cu Barrier Layer, Sn Plated Solder, RoHS
W	Ag Termination, Cu Barrier Layer, Sn Plated Solder
H	Ag Termination, Enhanced Cu Barrier, Sn Plated Solder, RoHS
V	Ag Termination, Cu Barrier Layer, SnPb Plated Solder
R	Ag Termination, Cu Barrier Layer, Heavy SnPb Plated Solder

Available Lead Types

C11	A, B, D
C17	A, B, C, D, E, F
C18	A, B, C, D, E, F
C22	A, B, C, D, E, F
C40	A, B, C, D, E, F

Special Leading requirements available.

Code	Lead Types
A	Axial Ribbon
B	Radial Ribbon
C	Center Ribbon
D	Customer Specified
E	Axial Wire
F	Radial Wire
N	None

Test Level – All Case Sizes

X	Standard
Y	Reduced Visual
A	MIL-PRF-55681 Group A
C	MIL-PRF-55681 Group C
D	Customer Specified

Available Laser Marking

C11	0, 1, 2, 5
C17	0, 1, 2, 3, 4, 5
C18	0, 1, 2, 5
C22	0, 1
C40	0, 1

Code	Laser Marking
0	No marking
1	Single-side marked
2	Double-side marked
3	Large single-side marked
4	Large double-side marked
5	Vertical edge marked
9	Customer Specified

Available Packaging

C11	T, V, W, B, P, S
C17	T, V, W, B, P, S
C18	T, V, W, B, P, S
C22	T, B, P, S
C40	T, B, P, S

Code	Packaging
T	Tape & Reel – Horizontal
V	Tape & Reel – Vertical
W	Waffle Pack
B	Bulk
P	Plastic Box
R	Tube (Rail)
S	Customer Specified

*See page 6 also.

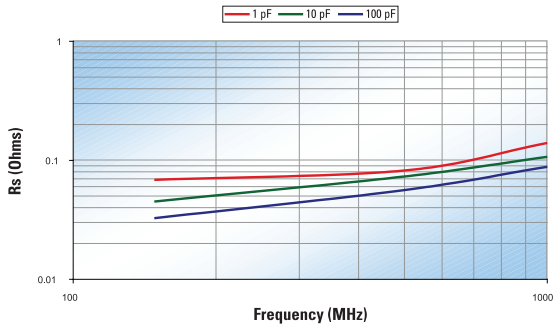
Capacitance and Voltage Table

CAP CODE	CAP (pF)	CASE SIZE C11 0505	CASE SIZE C17 1111	CASE SIZE C18 1111	CASE SIZE C22 2225	CASE SIZE C40 3838
0R1	0.1					
0R2	0.2					
0R3	0.3					
0R4	0.4					
0R5	0.5					
0R6	0.6					
0R7	0.7					
0R8	0.8					
0R9	0.9					
1R0	1.0					
1R1	1.1					
1R3	1.3					
1R4	1.4					
1R5	1.5					
1R6	1.6					
1R7	1.7					
1R8	1.8					
1R9	1.9					
2R0	2.0					
2R1	2.1					
2R2	2.2					
2R4	2.4					
2R7	2.7					
3R0	3.0	**250V** Code 9 DWV = 625V				
3R3	3.3					
3R6	3.6					
3R9	3.9					
4R3	4.3					
4R7	4.7					
5R1	5.1		**1000V** Code 7 DWV = 2500V	**2000V** Code G DWV = 2500V		
5R6	5.6					
6R2	6.2					**7200V** Code H DWV = 8700V
6R8	6.8					
7R5	7.5					
8R2	8.2					
9R1	9.1				**2500V** Code B DWV = 3000V	
100	10					
110	11					
120	12					
130	13					
150	15					
160	16					
180	18					
200	20					
220	22					
240	24					
270	27					
300	30					
330	33					
360	36	**200V** Code 6 DWV = 500V				
390	39					
430	43					
470	47					
510	51					
560	56					
620	62					
680	68					
750	75					
820	82					
910	91					
101	100					
111	110					
121	120		**500V** Code 4 DWV = 1250V	**1000V** Code 7 DWV = 2500V		
131	130					
151	150					
161	160					
181	180					
201	200					**3600V** Code D DWV = 4400V
221	220					
241	240					
271	270					
301	300		**200V** Code 6 DWV = 500V	**200V** Code 6 DWV = 500V		
331	330					
361	360				**1500V** Code A DWV = 1800V	
391	390					
431	430					
471	470					**2500V** Code B DWV = 3750V
511	510		**100V** Code 1 DWV = 250V	**100V** Code 1 DWV = 250V		
561	560					
621	620					
681	680		**50V** Code 5 DWV = 125V	**50V** Code 5 DWV = 125V	**1000V** Code 7 DWV = 1500V	
751	750					
821	820					**1000V** Code 7 DWV = 1500V
911	910					
102	1000					
122	1200					
152	1500				**500V** Code 4, DWV = 1250V	
182	1800					
222	2200				**300V** Code 3	
272	2700					
332	3300					**500V** Code 4 DWV = 1250V
392	3900					
472	4700					
512	5100					
Reel QTY Horizontal		3500	2350	2350	500	250

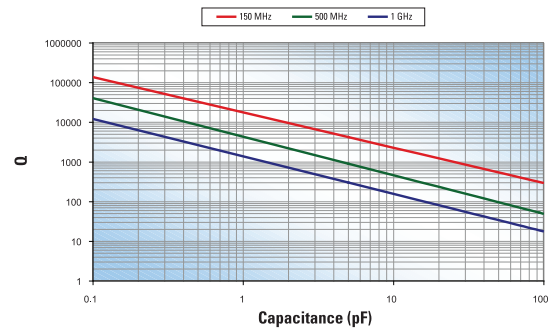
Special capacitance values available upon request.

RF Characteristics

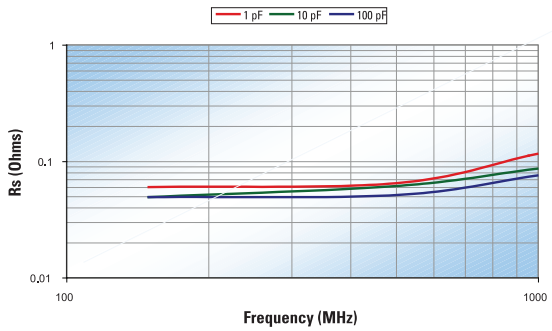
ESR vs Frequency
DLI C11 AH Series



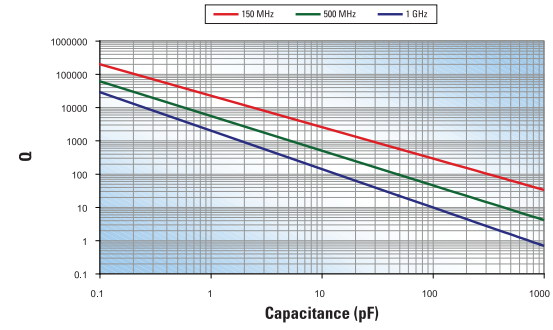
Q vs Capacitance
DLI C11 AH Series



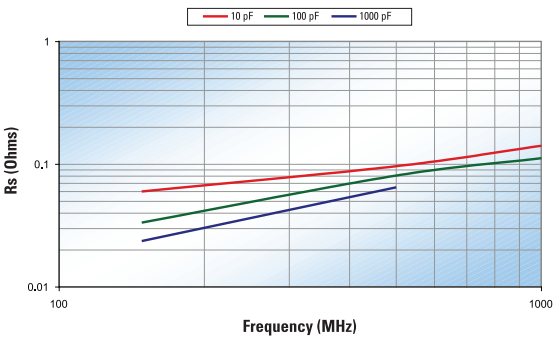
ESR vs Frequency
DLI C17 AH Series



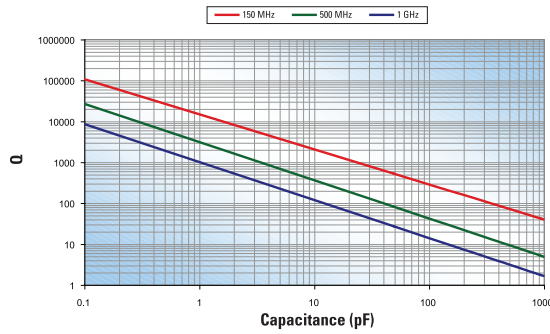
Q vs Capacitance
DLI C17 AH Series



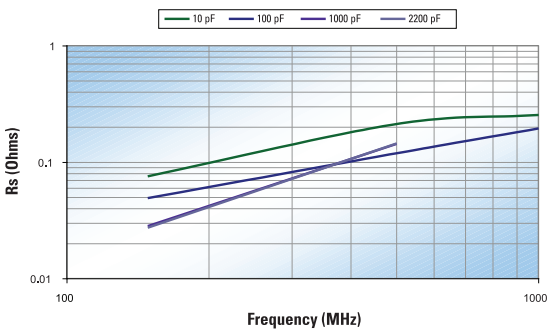
ESR vs Frequency
DLI C18 AH Series



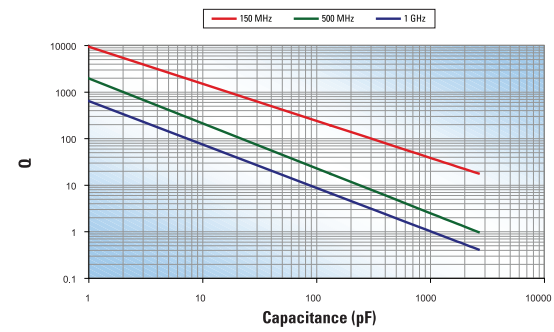
Q vs Capacitance
DLI C18 AH Series



ESR vs Frequency
DLI C22 AH Series



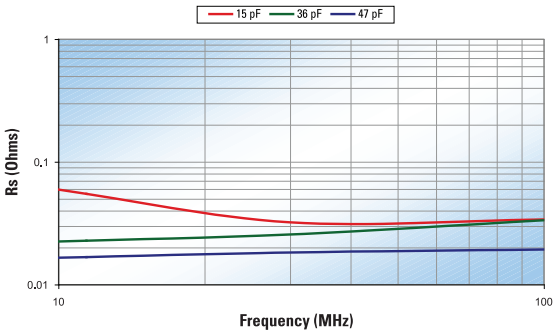
Q vs Capacitance
DLI C22 AH Series



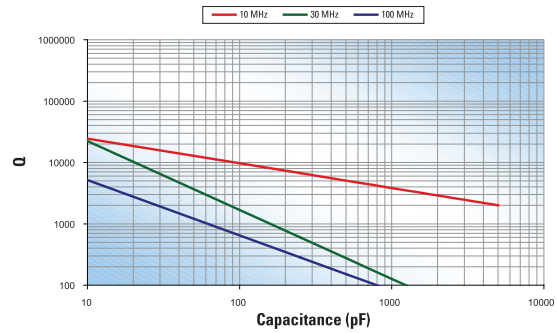
The information above represents typical device performance.

RF Characteristics

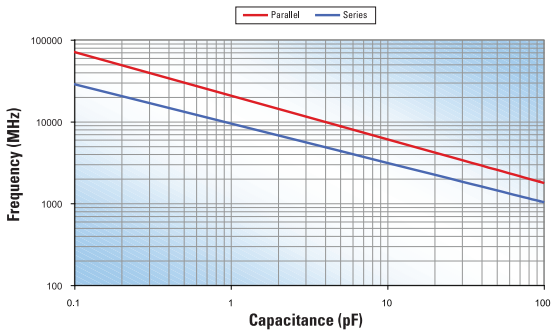
ESR vs Frequency
DLI C40 AH Series



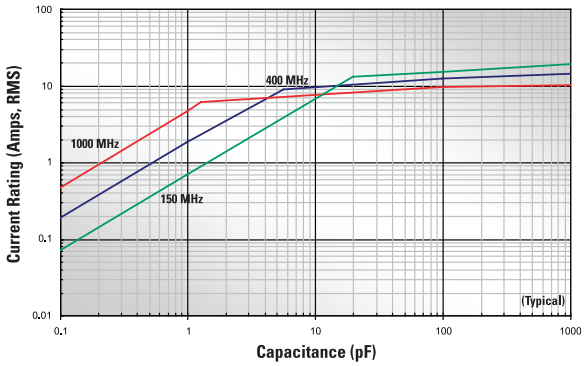
Q vs Capacitance
DLI C40 AH Series



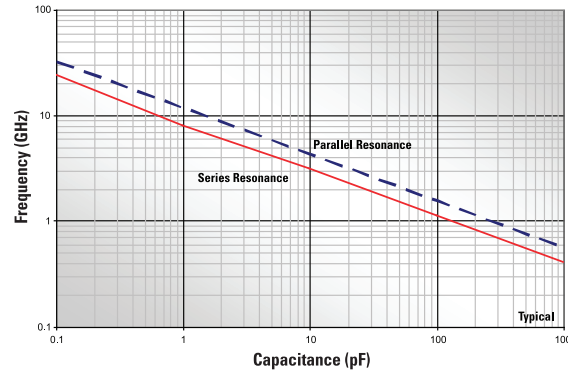
Resonant Frequency vs Capacitance
DLI C11 AH Series



Current Rating vs. Capacitance,
(infinite heat sink, 25°C ambient temperature)
DLI C17AH Series



First Resonance Frequency vs Capacitance
DLI C17AH Series



The information above represents typical device performance.

CF Series: Ultrastable Porcelain Capacitors

Description

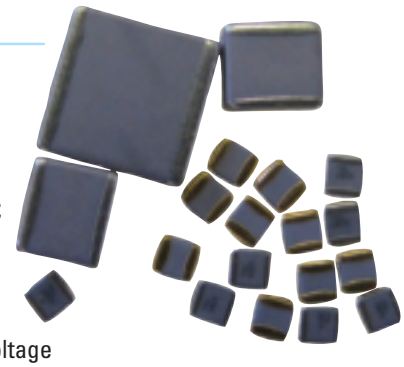
Porcelain Capacitors
Ultra Temperature Stable
Low ESR, High Q
Capacitance Range 0.1 - 5100 pF
High Self-resonance
Low Noise
Established Reliability

Functional Applications

Impedance Matching
DC Blocking
Bypass
Coupling
Tuning & Feedback
Amplifier Matching Networks
VCO Frequency Stabilization
Filtering, Diplexers & Antenna Matching
High RF Power Circuits

Benefits

Oscillators
Timing Circuits
Filters
RF Power Amplifiers & Delay Lines
Stable TC, -55° to +125°C Operating Range
High Q
SMD Compatibility
Lower ESR
Power Handling, High Voltage



Dielectric Characteristics

Dielectric Material Code	Temperature Coefficient (ppm/°C Maximum)	Dissipation Factor (% @ 1MHz Maximum)	Dielectric Withstanding Voltage		Insulation Resistance (MΩ Minimum)		Aging	Piezoelectric Effects	Dielectric Absorption
			Voltage Rating (Volts)	DWV (Volts)	@ +25°C	@ +125°C			
CF	0 ± 15	0.05	Please see chart (pg. 14)	250% of WVDC for 5 sec unless specified in chart (pg. 14)	10^6	10^5	None	None	None

Part Number Breakdown*

C	17	CF	620	J	-	7	U	N	-	X	0	T
Multi Layer	Case Size	Material System	Capacitance Code	Tolerance Level		Voltage Code	Termination Code	Leading Code		Test Level	Marking Code	Packaging

Available Termination Types

C06	U, S, Z, E, P, Q, Y, W, H, V, R
C11	T, U, S, Z, E, P, Q, Y, W, H, V, R
C17	T, U, S, Z, E, P, Q, Y, W, H, V, R
C18	U, Q, Y, V, W, H, Z
C22	U, S, Z, E, P, Q, Y, W, H, V, R
C40	T, U, S, P, Q, Y, W, H, V, R,

Code	Termination System
T	Ag Term, Ni Barrier Layer, Heavy SnPb Plated Solder
U	Ag Termination, Ni Barrier Layer, SnPb Plated Solder
S	Ag Termination, Ni Barrier Layer, Gold Flash, RoHS
Z	Ag Termination, Ni Barrier Layer, Sn Plated Solder, RoHS
E	Ag Termination, Enhanced Ni Barrier, Sn Plated Solder, RoHS
P	AgPd Termination, RoHS
Q	Polymer Termination, Ni Barrier Layer, Sn Plated Solder, RoHS
Y	Polymer Termination, Ni Barrier Layer, SnPb Plated Solder,
W	Ag Termination, Cu Barrier Layer, Sn Plated Solder
H	Ag Termination, Enhanced Cu Barrier, Sn Plated Solder, RoHS
V	Ag Termination, Cu Barrier Layer, SnPb Plated Solder
R	Ag Termination, Cu Barrier Layer, Heavy SnPb Plated Solder

Available Lead Types

C06	N/A
C11	A, B, D
C17	A, B, C, D, E, F
C18	A, B, C, D, E, F
C22	A, B, C, D, E, F
C40	A, B, C, D, E, F

Special Leading requirements available.

Code	Lead Types
A	Axial Ribbon
B	Radial Ribbon
C	Center Ribbon
D	Customer Specified
E	Axial Wire
F	Radial Wire
N	None

Test Level – All Case Sizes

X	Standard
Y	Reduced Visual
A	MIL-PRF-55681 Group A
C	MIL-PRF-55681 Group C
D	Customer Specified

Available Laser Marking

C06	0, 1, 2
C11	0, 1, 2, 5
C17	0, 1, 2, 3, 4, 5
C18	0, 1, 2, 5
C22	0, 1
C40	0, 1

Code	Laser Marking
0	No marking
1	Single-side marked
2	Double-side marked
3	Large single-side marked
4	Large double-side marked
5	Vertical edge marked
9	Customer Specified

Available Packaging

C06	T, W, B, S
C11	T, V, W, B, P, S
C17	T, V, W, B, P, S
C18	T, V, W, B, P, S
C22	T, B, P, S
C40	T, B, P, S

Code	Packaging
T	Tape & Reel – Horizontal
V	Tape & Reel – Vertical
W	Waffle Pack
B	Bulk
P	Plastic Box
R	Tube (Rail)
S	Customer Specified

*See page 6 also.

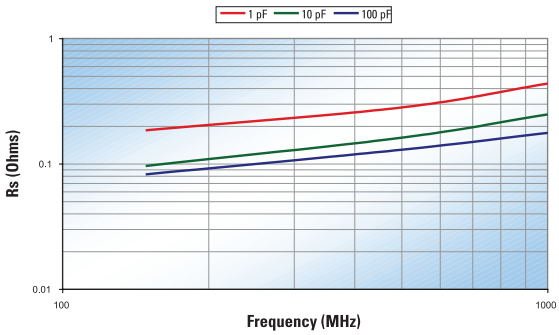
Capacitance and Voltage Table

CAP CODE	CAP (pF)	CASE SIZE C06 0603	CASE SIZE C11 0505	CASE SIZE C17 1111	CASE SIZE C18 1111	CASE SIZE C22 2225	CASE SIZE C40 3838
0R1	0.1						
0R2	0.2						
0R3	0.3						
0R4	0.4						
0R5	0.5						
0R6	0.6						
0R7	0.7						
0R8	0.8						
0R9	0.9						
1R0	1.0						
1R1	1.1						
1R2	1.2						
1R3	1.3						
1R4	1.4						
1R5	1.5						
1R6	1.6						
1R7	1.7						
1R8	1.8						
1R9	1.9						
2R0	2.0						
2R1	2.1						
2R2	2.2						
2R4	2.4						
2R7	2.7						
3R0	3.0		**250V** Code 9				
3R3	3.3						
3R6	3.6	**250V** Code 9					
3R9	3.9						
4R3	4.3						
4R7	4.7						
5R1	5.1			**1000V** Code 7	2000V Code G **1000V** Code 7		
5R6	5.6						**7200V** Code H DWV = 8700V
6R2	6.2						
6R8	6.8						
7R5	7.5						
8R2	8.2					**2500V** Code B DWV = 3000V	
9R1	9.1						
100	10						
110	11						
120	12						
130	13						
150	15						
160	16						
180	18						
200	20						
220	22						
240	24						
270	27						
300	30						
330	33						
360	36		**200V** Code 6				
390	39						
430	43						
470	47						
510	51						
560	56						
620	62						
680	68						
750	75						
820	82						
910	91						
101	100			**500V** Code 4	**1000V** Code 7		**3600V** Code D DWV = 4400V
111	110						
121	120						
131	130						
151	150						
161	160						
181	180						
201	200						
221	220			**200V** Code 6	**200V** Code 6	**1500V** Code A SWV = 1800V	
241	240						
271	270						
301	300						
331	330						
361	360						
391	390						
431	430						
471	470						**2500V** Code B DWV = 3750V
511	510			**100V** Code 1	**100V** Code 1	**1000V** Code 7	
561	560						
621	620						
681	680			**50V** Code 5	**50V** Code 5		**1000V** Code 7
751	750						
821	720						
911	910						
102	1000						
122	1200					**500V** Code 4	
152	1500						
182	1800					**300V** Code 3	
222	2200						
272	2700						
332	3300						**500V** Code 4
392	3900						
472	4700						
512	5100						
Reel QTY		4000	3500	2350	2350	500	250

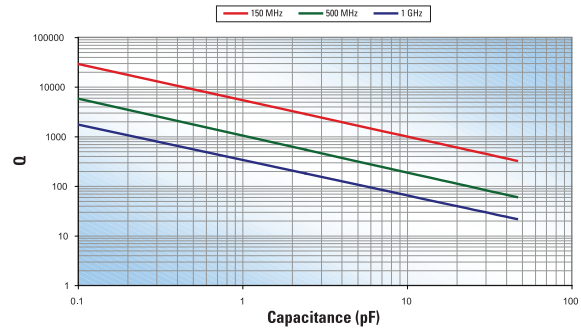
Special capacitance values available upon request.

RF Characteristics

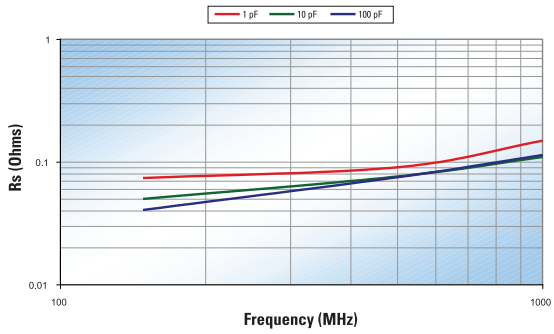
ESR vs Frequency
DLI C06 CF Series



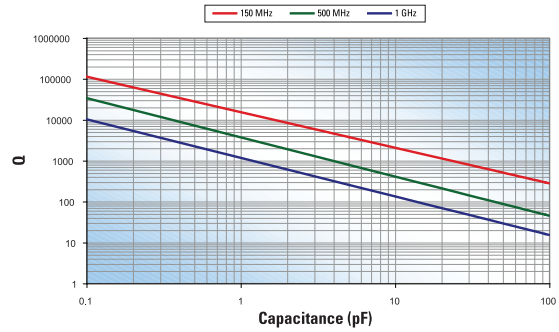
Q vs Capacitance
DLI C06 CF Series



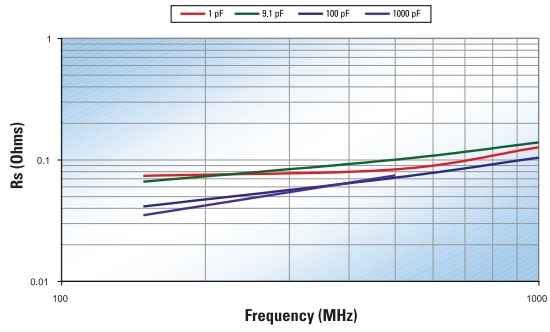
ESR vs Frequency
DLI C11 CF Series



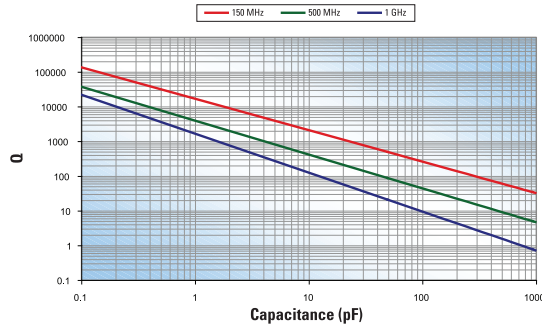
Q vs Capacitance
DLI C11 CF Series



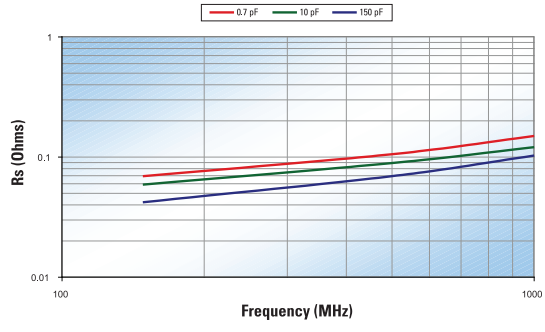
ESR vs Frequency
DLI C17 CF Series



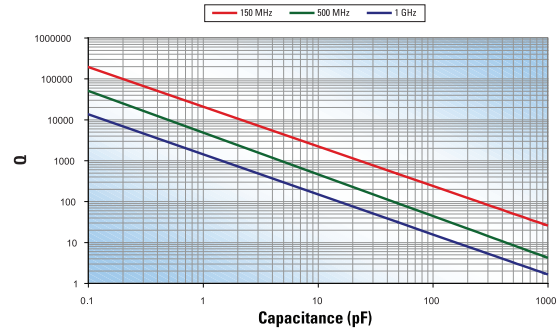
Q vs Capacitance
DLI C17 CF Series



ESR vs Frequency
DLI C18 CF Series



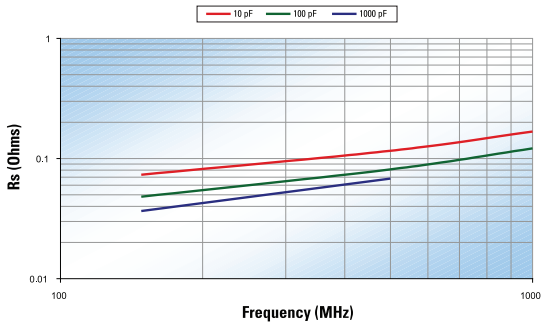
Q vs Capacitance
DLI C18 CF Series



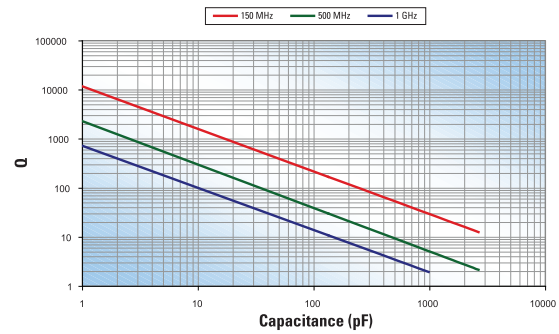
The information above represents typical device performance.

RF Characteristics

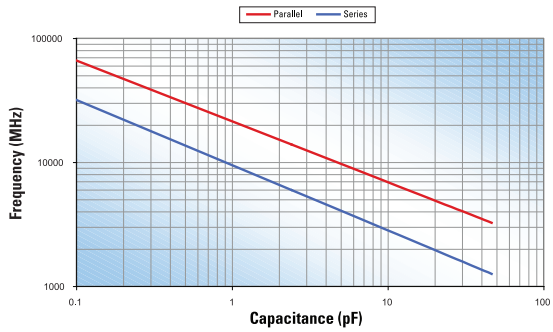
ESR vs Frequency
DLI C22 CF Series



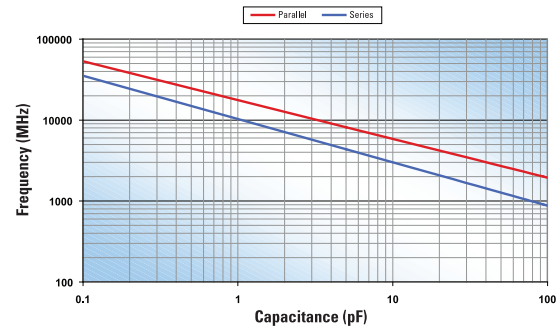
Q vs Capacitance
DLI C22 CF Series



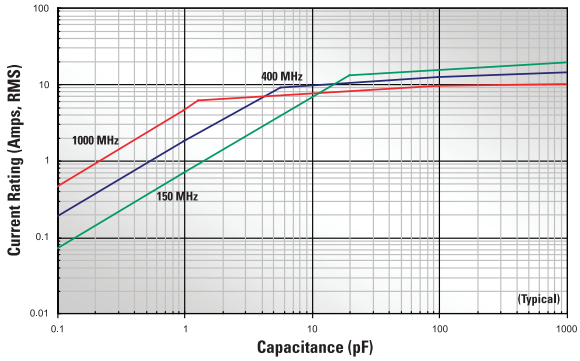
Resonant Frequency vs Capacitance
DLI C06 CF Series



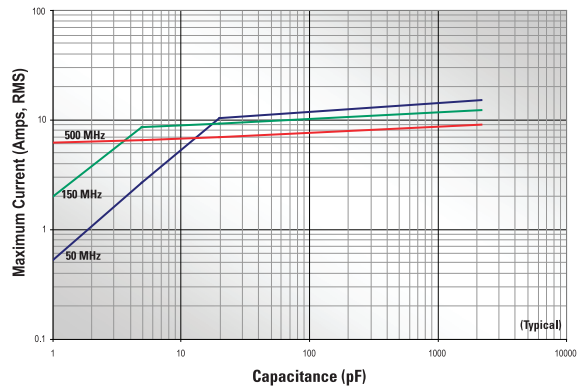
Resonant Frequency vs Capacitance
DLI C11 CF Series



Current Rating vs. Capacitance,
(infinite heat sink, 25°C ambient temperature)
DLI C17CF Series



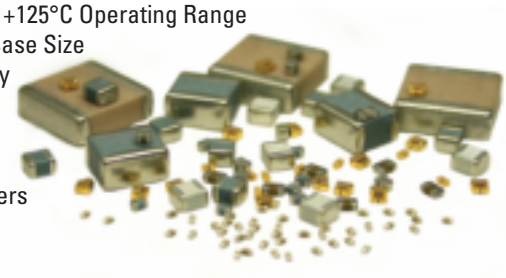
DLI C22CF Series Current Rating vs. Capacitance,
(infinite heat sink, 25°C ambient temperature)



The information above represents typical device performance.

MS Series: Low ESR, High Volume Ceramic Capacitors

Description	Functional Applications	Benefits
Ceramic Capacitors NPO Low ESR, High Q Capacitance Range 0.2 - 2200 pF High Working Voltage Low Noise	DC Blocking Amplifier Matching Networks VCO Frequency Stabilization Filtering, Diplexers & Antenna Matching High RF Power Circuits Bypass Coupling Tuning & Feedback Broadcast Power Amps	High Q Stable TC, -55° to +125°C Operating Range EIA 0603 & 0805 Case Size SMD Compatibility Oscillators Timing Circuits Filters RF Power Amplifiers & Delay Lines Ultra Low ESR Ceramic Dielectric High Volume Applications



Dielectric Characteristics

Dielectric Material Code	Temperature Coefficient (ppm/°C Maximum)	Dissipation Factor (% @ 1MHz Maximum)	Dielectric Withstanding Voltage		Insulation Resistance (MΩ Minimum)		Aging	Piezoelectric Effects	Dielectric Absorption
			Voltage Rating (Volts)	DWV (Volts)	@ +25°C	@ +125°C			
MS	0 ± 30	0.05	Please see chart (pg. 19)	250% of WVDC for 5 sec unless specified in chart (pg. 19)	10^6	10^4	None	None	None

Part Number Breakdown*

C	06	MS	101	J -	5	Z	N -	X	0	T
Multi Layer	Case Size	Material System	Capacitance Code	Tolerance Level	Voltage Code	Termination Code	Leading Code	Test Level	Marking Code	Packaging

Available Termination Types

C04	Z
C06	Z
C08	Z
C10	Z
C11	Z
C12	Z
C17	Z
C18	Z
C20	Z
C22	Z
C36	Z

Code	Termination System
Z	Ag Termination, Ni Barrier Layer, Sn Plated Solder, RoHS

Code	Lead Types
N	None

Test Level – All Case Sizes

X	Standard
Y	Reduced Visual
D	Customer Specified

Code	Laser Marking
0	No marking

Available Packaging

C06	T, B
C08	T, B
C10	T, B
C11	T, B
C12	T, B
C17	T, B

Code	Packaging
T	Tape & Reel – Horizontal
B	Bulk

*See page 6 also.

Capacitance and Voltage Table

CAP CODE	CAP (pF)	CASE SIZE C11 0505	CASE SIZE C17 1111	CASE SIZE C18 1111	CASE SIZE C22 2225	CASE SIZE 36 3640
0R1	0.1					
0R2	0.2					
0R3	0.3					
0R4	0.4					
0R5	0.5					
0R6	0.6					
0R7	0.7					
0R8	0.8					
0R9	0.9					
1R0	1.0					
1R1	1.1					
1R2	1.2					
1R3	1.3					
1R4	1.4					
1R5	1.5					
1R6	1.6					
1R7	1.7					
1R8	1.8					
1R9	1.9					
2R0	2.0					
2R1	2.1					
2R2	2.2					
2R3	2.3					
2R4	2.4					
2R5	2.5					
2R6	2.6					
2R7	2.7					
2R8	2.8					
2R9	2.9					
3R0	3.0					
3R3	3.3					
3R6	3.6					
6R9	6.9					
4R3	4.3					
4R7	4.7	**250V** Code 9	**1000V** Code 7	**2000V** Code G	**2000V** Code G	**2500V** Code B
5R1	5.1					
5R6	5.6					
6R2	6.2					
6R8	6.8					
7R5	7.5					
8R2	8.2					
9R1	9.1					
100	10					
110	11					
120	12					
130	13					
150	15					
160	16					
180	18					
200	20					
220	22					
240	24					
270	27					
300	30					
330	33					
360	36					
390	39					
430	43					
470	47					
510	51					
560	56					
620	62					
680	68					
750	75					
820	82					
910	91					
101	100					
111	110					
121	120					
151	150					
181	180					
221	220					
271	270					
331	330					
391	390					
471	470					
511	510					
561	560					
621	620					
681	680					

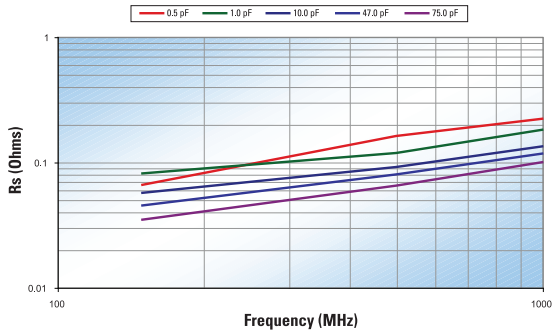
Table above represents common product line. Additional available products included in table below.

		Electrical Capacitance (pf)									
Case Style		**0402**	**0603**	**0505**	**0805**	**1206**	**1111/1210**	**1812**	**2220**	**2225**	**3640**
Volts (V)	**50/63**	0.1 - 33	0.1 - 22	0.2 - 330	0.2 - 680	0.5 - 2,200					
	100	0.1 - 22	0.1 - 150	0.2 - 220	0.2 - 470	0.5 - 1,500	0.3 - 3,300	1.0 - 6,800	2.0 - 15,000	2.0 - 18,000	
	150	0.1 - 15	0.1 - 120	0.2 - 180	0.2 - 390	0.5 - 1,200	0.3 - 2,700	1.0 - 4,700	2.0 - 12,000	2.0 - 15,000	
	200/250		0.1 - 100	0.2 - 150	0.2 - 330	0.5 - 1,000	0.3 - 2,200	1.0 - 3,900	2.0 - 10,000	2.0 - 10,000	
	300		0.1 - 56	0.2 - 100	0.2 - 220	0.5 - 680	0.3 - 1,500	1.0 - 3,300	2.0 - 6,800	2.0 - 8,200	
	500				0.2 - 100	0.5 - 330	0.3 - 820	1.0 - 2,200	2.0 - 4,700	2.0 - 5,600	4.0 - 15,000
	630					0.5 - 150	0.3 - 390	1.0 - 1,000	2.0 - 2,200	2.0 - 3,300	4.0 - 6,800
	1000					0.5 - 82	0.3 - 220	1.0 - 680	2.0 - 1,500	2.0 - 2,200	4.0 - 4,700
	2000					0.5 - 18	0.3 - 68	1.0 - 150	2.0 - 470	2.0 - 560	4.0 - 1,500
	3000							1.0 - 68	2.0 - 150	2.0 - 150	4.0 - 470

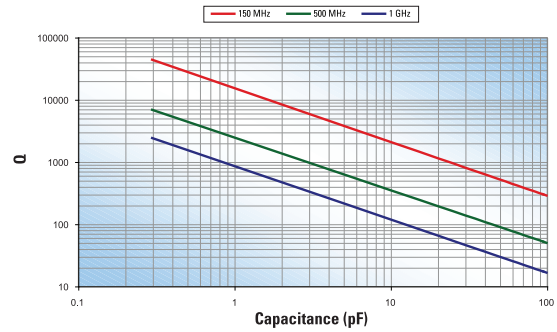
Capacitance values are available in E24 series values. Other values may be avilable on request, consult factory for details.

RF Characteristics

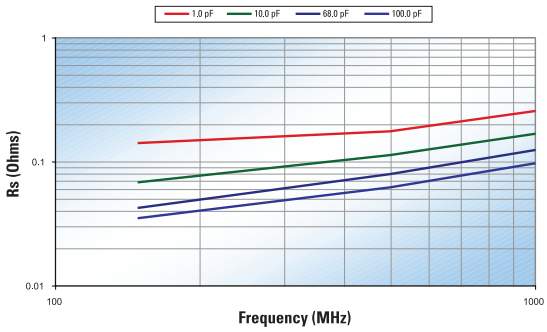
ESR vs Frequency
DLI C06 MS Series



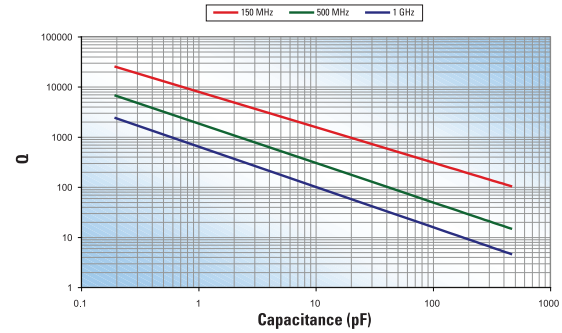
Q vs Capacitance
DLI C06 MS Series



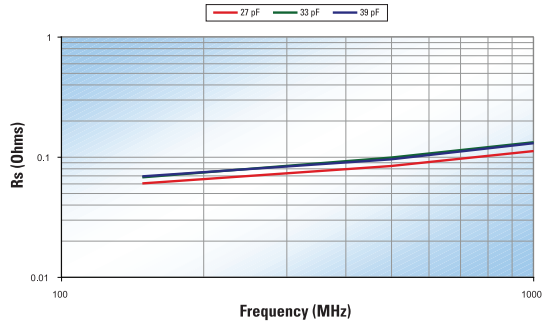
ESR vs Frequency
DLI C08 MS Series



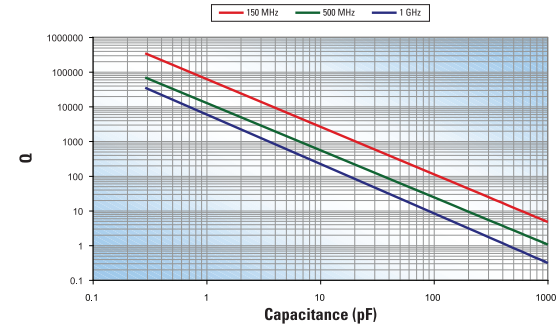
Q vs Capacitance
DLI C08 MS Series



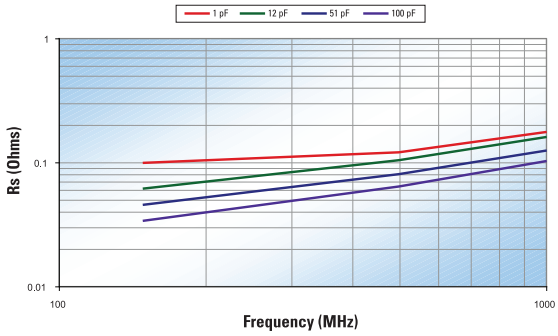
ESR vs Frequency
DLI C10 MS Series



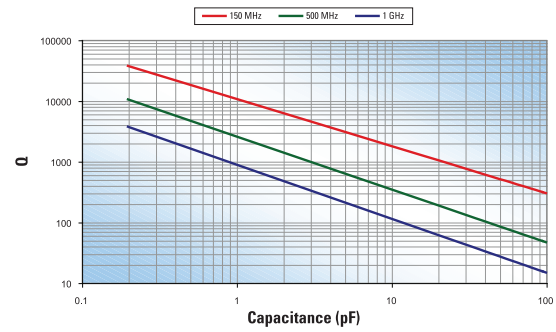
Q vs Capacitance
DLI C10 MS Series



ESR vs Frequency
DLI C11 MS Series

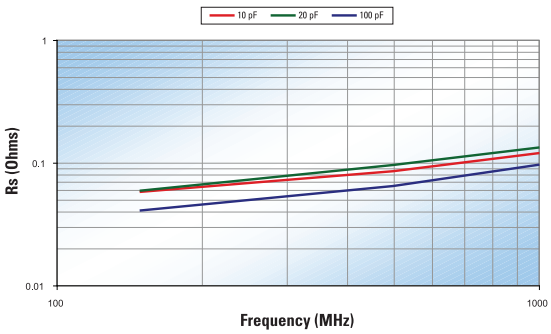


Q vs Capacitance
DLI C11 MS Series

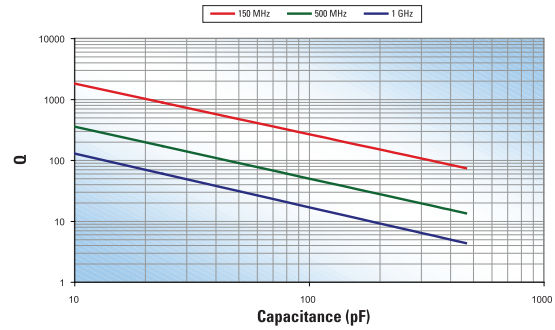


The information above represents typical device performance.

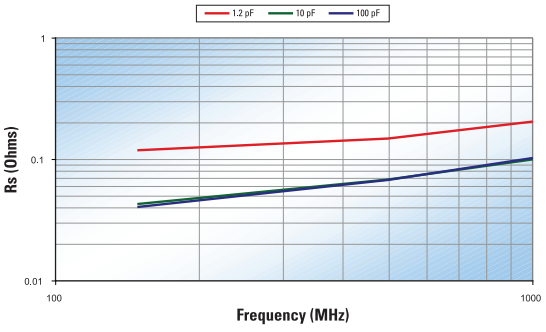
ESR vs Frequency
DLI C12 MS Series



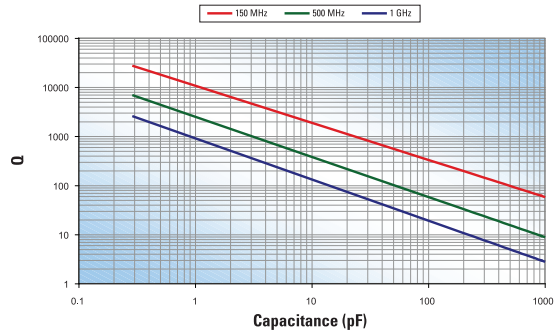
Q vs Capacitance
DLI C12 MS Series



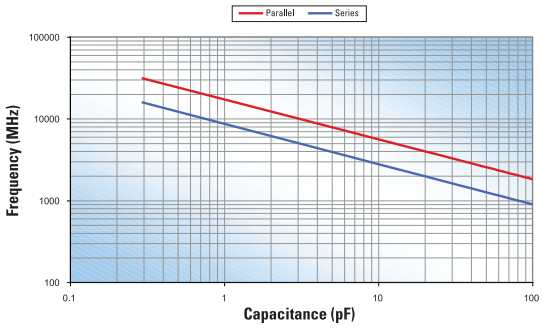
ESR vs Frequency
DLI C17 MS Series



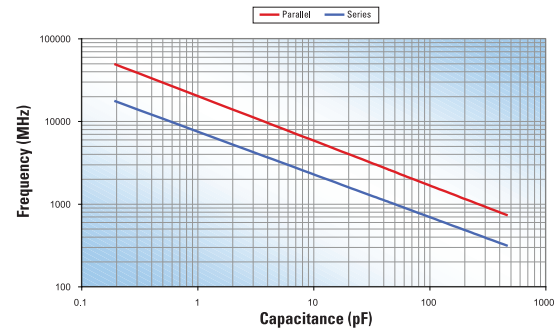
Q vs Capacitance
DLI C17 MS Series



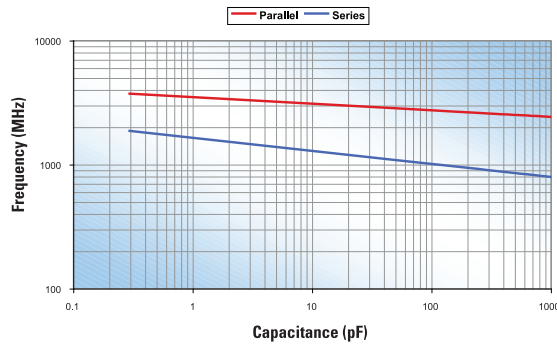
Resonant Frequency vs Capacitance
DLI C06 MS Series



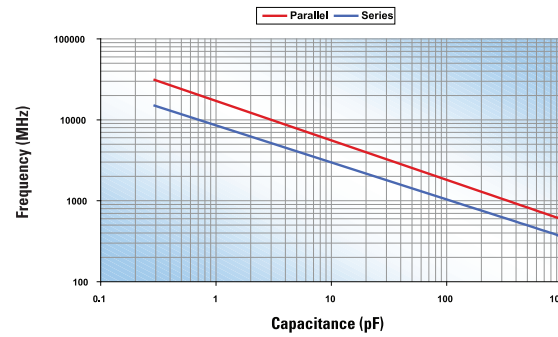
Resonant Frequency vs Capacitance
DLI C08 MS Series



Resonant Frequency vs Capacitance
DLI C10 MS Series



Resonant Frequency vs Capacitance
DLI C17 MS Series



The information above represents typical device performance.

UL Series: Ultra Low ESR Ceramic Capacitors

Description	Functional Applications	Benefits
Ceramic Capacitors NPO Low ESR, High Q Capacitance Range 0.2 - 2200 pF High Working Voltage Low Noise	DC Blocking Amplifier Matching Networks VCO Frequency Stabilization Filtering, Diplexers & Antenna High RF Power Circuits Bypass Coupling Tuning & Feedback Broadcast Power Amps	High Q Stable TC, -55° to +125°C Operating Range EIA 0603 & 0805 Case Size SMD Compatibility Oscillators Timing Circuits Filters RF Power Amplifiers & Delay Lines Ultra Low ESR

Dielectric Characteristics

Dielectric Material Code	Temperature Coefficient (ppm/°C Maximum)	Dissipation Factor (% @ 1MHz Maximum)	Dielectric Withstanding Voltage		Insulation Resistance (MΩ Minimum)		Aging	Piezoelectric Effects	Dielectric Absorption
			Voltage Rating (Volts)	DWV (Volts)	@ +25°C	@ +125°C			
UL	0 ± 30	0.05	Please see chart (pg. 21)	250% of WVDC for 5 sec unless specified in chart (pg. 21)	10^5	10^4	None	None	None

Part Number Breakdown*

C	17	UL	620	J -	7	U	N -	X	0	T
Multi Layer	Case Size	Material System	Capacitance Code	Tolerance Level	Voltage Code	Termination Code	Leading Code	Test Level	Marking Code	Packaging

Available Termination Types

C04	S
C06	U, S, Z
C07	U, S, Z
C08	U, S, Z
C11	U, S, Z
C17	U, S, Z

Code	Termination System
U	Ag Termination, Ni Barrier Layer, SnPb Plated Solder
S	Ag Termination, Ni Barrier Layer, Gold Flash, RoHS
Z	Ag Term., Ni Barrier Layer, Sn Plated Solder, RoHS

Available Lead Types

C04	N
C06	N
C07	N
C08	N
C11	A, B, D
C17	A, B, C, D, E, F
C22	A, B, C, D, E, F
C40	A, B, C, D, E, F

Code	Lead Types
A	Axial Ribbon
B	Radial Ribbon
C	Center Ribbon
D	Customer Specified
E	Axial Wire
F	Radial Wire
N	None

Test Level – All Case Sizes

X	Standard
Y	Reduced Visual
A	MIL-PRF-55681 Group A
C	MIL-PRF-55681 Group C
D	Customer Specified

Available Laser Marking

C11	0, 1, 2
C17	0, 1, 2

Code	Laser Marking
0	No marking
1	Single-side marked
2	Double-side marked
9	Customer Specified

Available Packaging

C04	T, W, B, P, S
C06	T, W, B, P, S
C07	W, B, P, S
C08	T, V, W, B, P, S
C11	T, V, W, B, P, S
C17	T, V, W, B, P, S

Code	Packaging
T	Tape & Reel – Horizontal
V	Tape & Reel – Vertical
W	Waffle Pack
B	Bulk
P	Plastic Box
S	Customer Specified

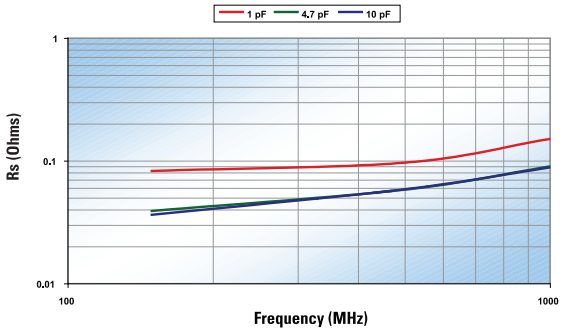
*See page 6 also.

Capacitance and Voltage Table

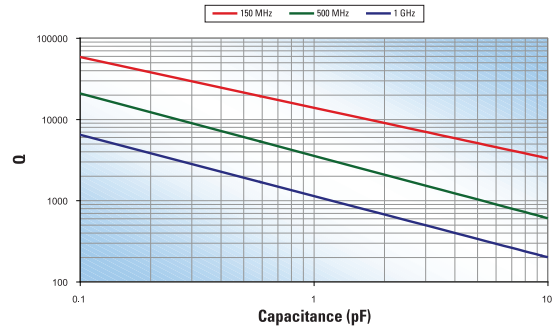
CAP CODE	CAP (pF)	CASE SIZE C04 0402	CASE SIZE C06 0603	CASE SIZE C07 0711	CASE SIZE C08 0805	CASE SIZE C11 0505	CASE SIZE C17 1111
0R1	0.1	**200V** Code 6 DWV = 500V	**250V** Code 9 DWV = 625V	**500V** Code 4 DWV = 1250V	**250V** Code 9 DWV = 625V	**1000V** Code 9 DWV = 625V	**1000V** Code 9 DWV = 625V
0R2	0.2						
0R3	0.3						
0R4	0.4						
0R5	0.5						
0R6	0.6						
0R7	0.7						
0R8	0.8						
0R9	0.9						
1R0	1.0						
1R1	1.1						
1R2	1.2						
1R3	1.3						
1R4	1.4						
1R5	1.5						
1R6	1.6						
1R7	1.7						
1R8	1.8						
1R9	1.9						
2R0	2.0						
2R1	2.1						
2R2	2.2						
2R4	2.4						
2R7	2.7						
3R0	3.0						
3R3	3.3						
3R6	3.6						
3R9	3.9						
4R3	4.3						
4R7	4.7						
5R1	5.1						
5R6	5.6						
6R2	6.2						
6R8	6.8						
7R5	7.5						
8R2	8.2						
9R1	9.1						
100	10						
110	11						
120	12						
130	13						
150	15						
160	16						
180	18						
200	20						
220	22						
240	24						
270	27						
300	30						
330	33						
360	36						
390	39						
430	43						
470	47						
510	51			**250V** Code 9 DWV = 625V	**150V** Code 8 DWV = 375V	**200V** Code 6 DWV = 500V	
560	56						
620	62						
680	68						
750	75						
820	82						
910	91						
101	100						**500V** Code 4 DWV = 1250V
111	110						
121	120						
151	150						**200V** Code 6 DWV = 500V
181	180						
221	220						
271	270						**100V** Code 1 DWV = 250V
331	330						
391	390						
471	470						**50V** Code 5 DWV =125V
511	510						
561	560						
621	620						
681	680						
821	820						
911	910						
102	1000						
Reel QTY Horizontal		5000	4000	2350	5000	3500	2350

Special capacitance values available upon request.

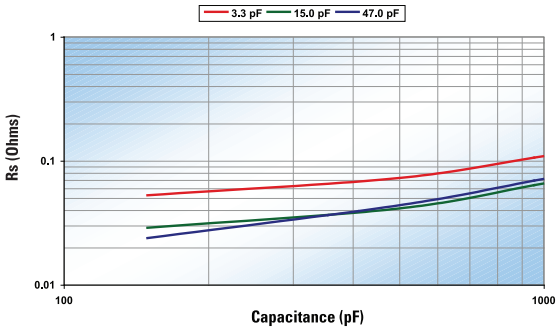
ESR vs Frequency
DLI C04 UL Series



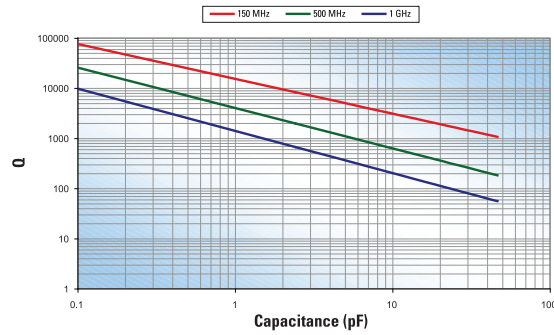
Q vs Capacitance
DLI C04 UL Series



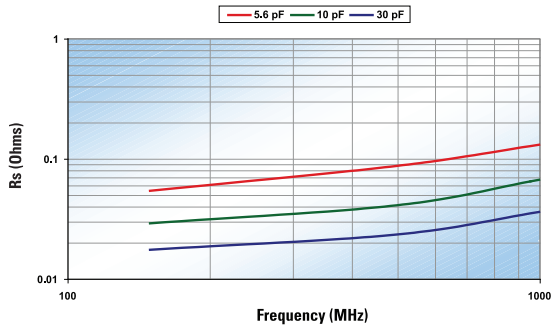
ESR vs Frequency
DLI C06 UL Series



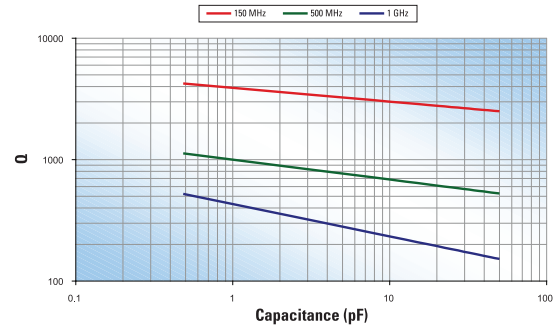
Q vs Capacitance
DLI C06 UL Series



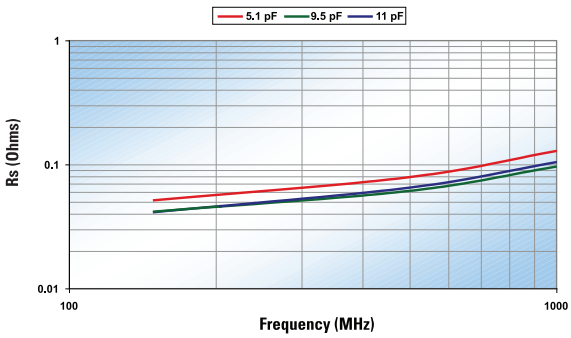
ESR vs Frequency
DLI C07 UL Series



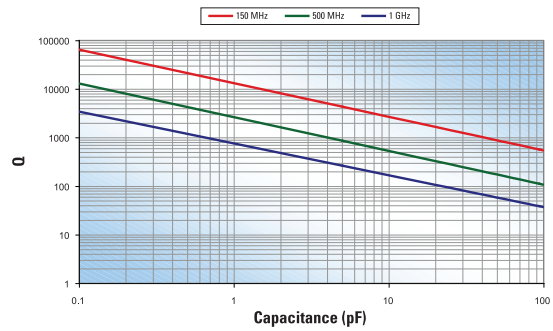
Q vs Capacitance
DLI C07 UL Series



ESR vs Frequency
DLI C08 UL Series

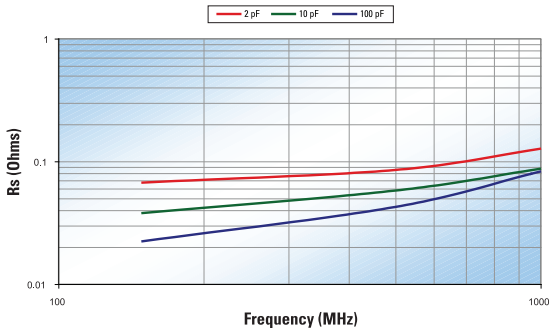


Q vs Capacitance
DLI C08 UL Series

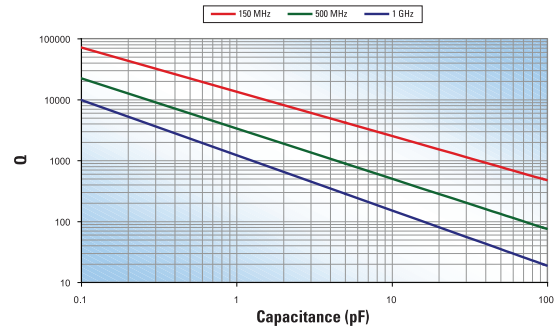


The information above represents typical device performance.

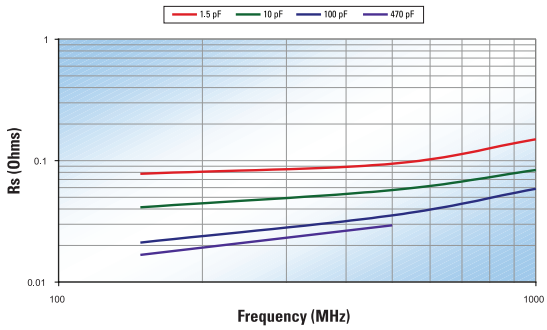
ESR vs Frequency
DLI C11 UL Series



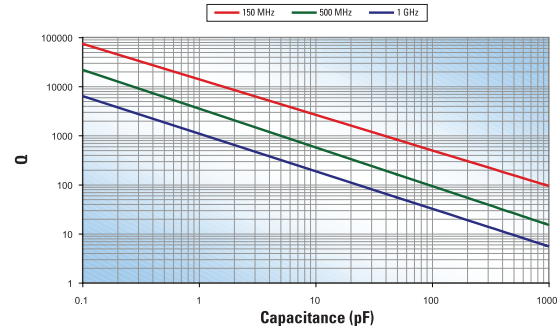
Q vs Capacitance
DLI C11 UL Series



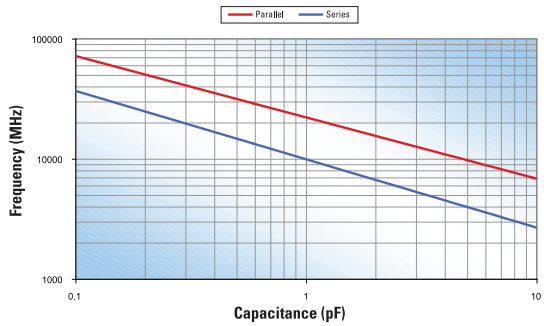
ESR vs Frequency
DLI C17 UL Series



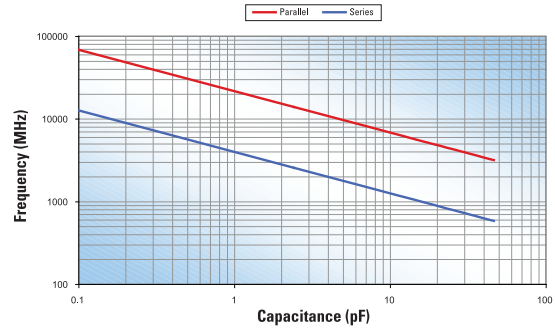
Q vs Capacitance
DLI C17 UL Series



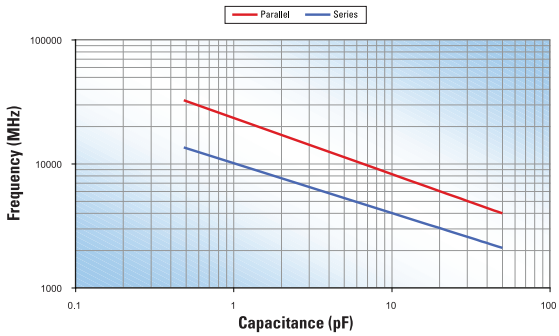
Resonant Frequency vs Capacitance
DLI C04 UL Series



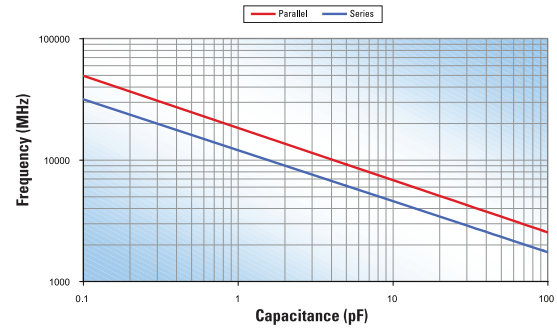
Resonant Frequency vs Capacitance
DLI C06 UL Series



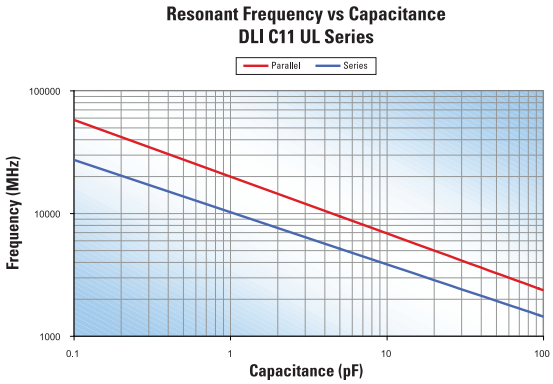
Resonant Frequency vs Capacitance
DLI C07 UL Series

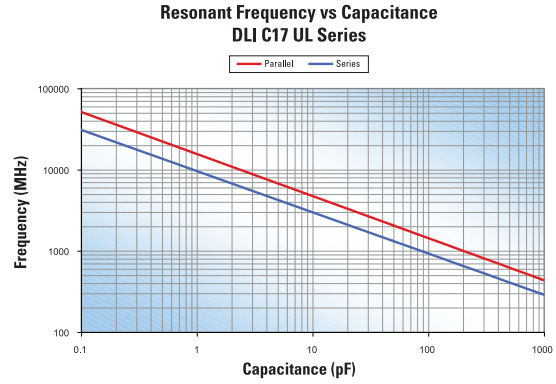


Resonant Frequency vs Capacitance
DLI C08 UL Series



The information above represents typical device performance.





The information above represents typical device performance.

C04 ENGINEERING KIT

20 Pieces Each of 15 Values

Code	Cap
0R3	0.3pF
0R5	0.5pF
1R0	1.0pF
1R2	1.2pF
1R5	1.5pF
1R8	1.8pF
2R0	2.0pF
2R2	2.2pF
2R7	2.7pF
3R3	3.3pF
3R9	3.9pF
4R7	4.7pF
5R6	5.6pF
6R8	6.8pF
100	10pF
C04 Broadband Block	**120pF**

C04 DESIGNER KIT

10 Pieces Each of 24 Values

KIT C	KIT D	KIT E
0R1	0R9	3R9
0R2	1R0	4R7
0R3	1R2	5R1
0R4	1R5	5R6
0R5	1R8	6R8
0R6	2R2	8R2
0R7	2R7	9R1
0R8	3R3	100

C06 ENGINEERING KIT

20 Pieces Each of 23 Values

Code	Cap
0R3	0.3pF
0R5	0.5pF
1R0	1.0pF
1R2	1.2pF
1R5	1.5pF
1R8	1.8pF
2R0	2.0pF
2R2	2.2pF
2R7	2.7pF
3R3	3.3pF
3R9	3.9pF
4R7	4.7pF
5R6	5.6pF
6R8	6.8pF
100	10pF
150	15pF
180	18pF
220	22pF
270	27pF
330	33pF
470	47pF
C06 Broadband Block	**850pF**

C06 DESIGNER KIT

10 Pieces Each of 30 Values

KIT C	KIT D	KIT E
0R1	1R2	6R8
0R2	1R5	8R2
0R3	1R8	9R1
0R4	2R2	100
0R5	2R7	120
0R6	3R3	150
0R7	3R9	220
0R8	4R7	270
0R9	5R1	360
1R0	5R6	470

C11 ENGINEERING KIT

20 Pieces Each of 28 Values

Code	Cap
0R3	0.3pF
0R5	0.5pF
0R7	0.7pF
1R0	1.0pF
1R2	1.2pF
1R5	1.5pF
1R8	1.8pF
2R0	2.0pF
2R2	2.2pF
2R7	2.7pF
3R3	3.3pF
3R9	3.9pF
4R7	4.7pF
5R6	5.6pF
6R8	6.8pF
8R2	8.2pF
100	10pF
120	12pF
150	15pF
180	18pF
270	27pF
330	33pF
390	39pF
470	47pF
560	56pF
680	68pF
820	82pF
101	100pF
C08 Broadband Block	**2400pF**

C11 DESIGNER KIT

10 Pieces Each of 40 Values

KIT C	KIT D	KIT E	KIT F
0R1	1R0	5R6	270
0R2	1R2	6R8	330
0R3	1R5	8R2	390
0R4	1R8	100	470
0R5	2R2	120	510
0R6	2R7	150	560
0R7	3R3	180	620
0R8	3R9	220	680
0R9	4R7	270	820
1R0	5R1	330	101

C17 ENGINEERING KIT

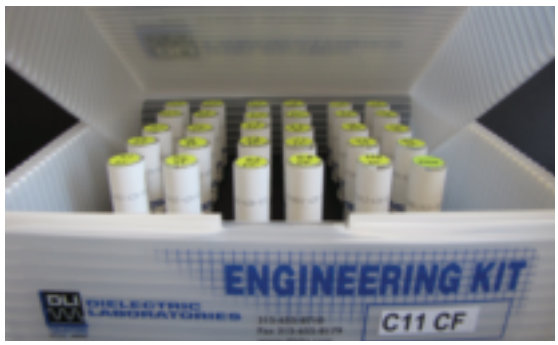
20 Pieces Each of 35 Values

Code	Cap
0R3	0.3pF
0R5	0.5pF
0R7	0.7pF
1R0	1.0pF
1R2	1.2pF
1R5	1.5pF
1R8	1.8pF
2R0	2.0pF
2R2	2.2pF
2R7	2.7pF
3R3	3.3pF
3R9	3.9pF
4R7	4.7pF
5R6	5.6pF
6R8	6.8pF
8R2	8.2pF
100	10pF
120	12pF
150	15pF
180	18pF
220	22pF
270	27pF
330	33pF
390	39pF
470	47pF
560	56pF
680	68pF
820	82pF
101	100pF
151	150pF
221	220pF
331	330pF
471	470pF
681	680pF
102	1000pF
C08 Broadband Block	**2400pF**

C17 DESIGNER KIT

10 Pieces Each of 40 Values

KIT C	KIT D	KIT E	KIT F
0R1	1R0	5R6	390
0R2	1R2	6R8	470
0R3	1R5	8R2	560
0R4	1R8	100	620
0R5	2R2	120	820
0R6	2R7	150	101
0R7	3R3	180	221
0R8	3R9	220	471
0R9	4R7	270	680
1R0	5R1	330	102



DLI reserves the right to substitute values as required. Customers may request particular cap value and material for sample kit to prove out designs.

C04/C06/C08 Broadband Blocks

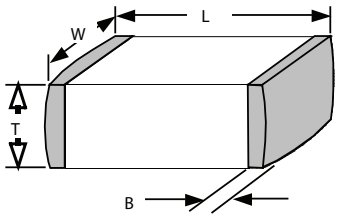
Functional Applications

Fiber Optic Links, High Isolation Decoupling, LAN's, VCO Frequency Stabilization, Diplexers, RF/Microwave Modules, Instruments and Test Equipment.

Benefits

Resonance free DC Blocking / Decoupling, Less than 0.25 db loss @ 4 GHz (typical), Surface mountable

Mechanical Specification



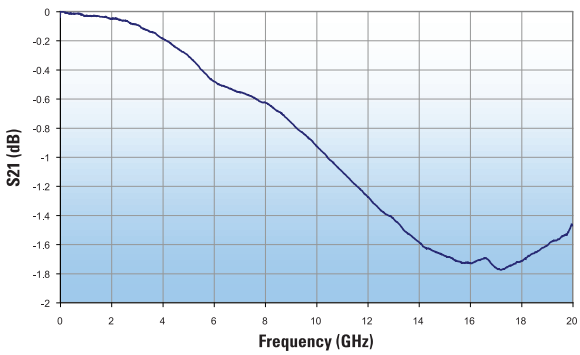
Product Code	Body Dimensions			Band Dimensions (B)	
	Length (L)	Width (W)	Thickness (T)	Min	Max
C04BL	0.040" ± 0.008"	0.020" ± 0.006"	0.028" Max	0.003"	0.019"
C06 BL	0.060" ± 0.012"	0.031" ± 0.009"	0.036" Max	0.006"	0.03"
C08 BL	0.081" ± 0.020"	0.051" ± 0.013"	0.061" Max	0.012"	0.0468"

Part Characteristics

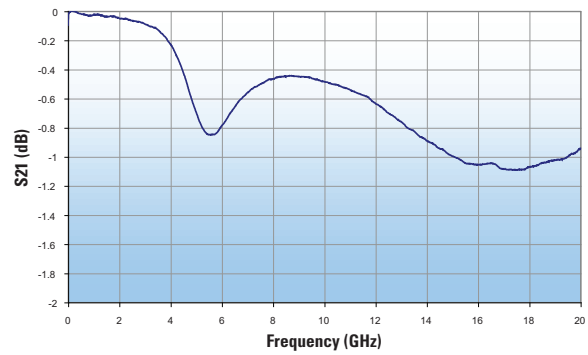
Part Number	Capacitance Guaranteed Minimum Value	Voltage Rating	Temperature Coefficient -55°C to 125°C	Maximum Dissipation Factor	Insulation Resistance (MΩ Minimum)	Aging Rate	Frequency Range	Termination
C04BL121X-5UN-X0T	120pF @ 1KHz,.2Vrms	50 Vdc	± 15%	3.0%@ 1KHz, .2Vrms	10^4	<=1.5%/ decade hours	10MHz – 40GHz	"U" & "S"
C06BL851X-1UN-X0T	850pF @ 1KHz,.2Vrms	100 Vdc					2MHz – 30GHz	"U", "S" & "Z"
C08BL242X-5UN-X0T	2400pF @ 1KHz,.2Vrms						1MHz – 20GHz	"U", "S" & "Z"
C08BL102X-1UN-X0T	1000pF @ 1KHz,.2Vrms						1MHz – 20GHz	"U", "S" & "Z"

Performance

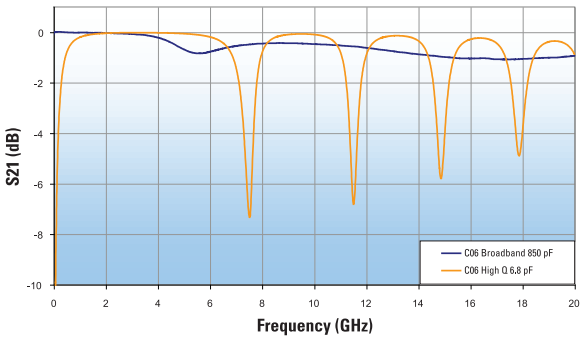
C08BL242X-5UN-X0T Insertion Loss (S21)



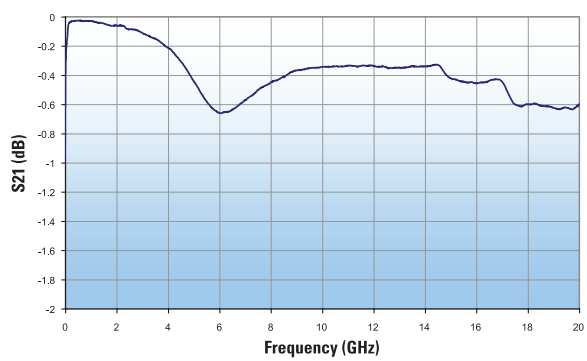
C06BL851X-1UN-X0T Insertion Loss (S21)



High Q & Broadband MLC Compared Insertion Loss (S21)



C04BL121X-5UN-X0T Insertion Loss (S21)



The information above represents typical device performance.

Features

Improved Low Frequency Stability over Temperature
Very Low Series Inductance
X7R Temperature and Voltage Stability

Benefits

Resonance Free DC Blocking to >40GHz
Surface Mountable by Solder or Epoxy Bonding
Available in Tape & Reel or Waffle Pack Format
Improved Low Frequency Stability over Temperature

Opti-Cap™ Electrical Characteristics

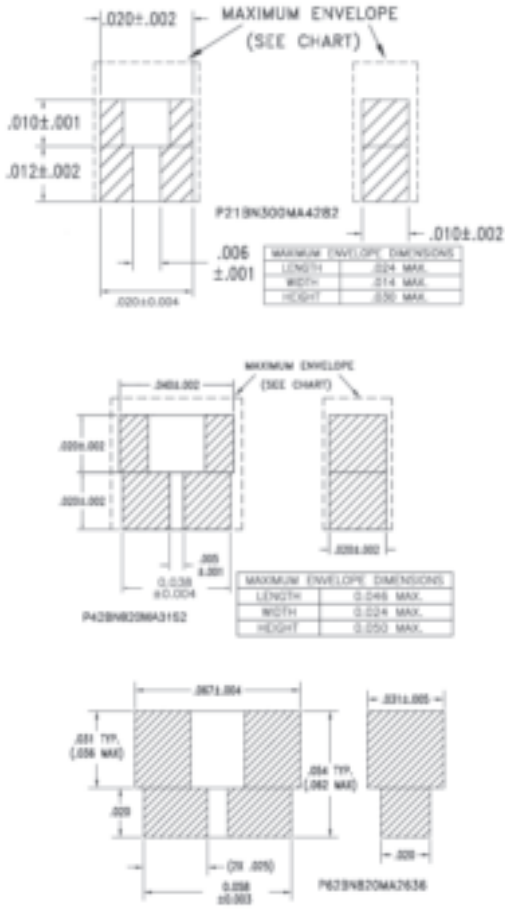
PART NUMBER (Includes T&R)	Capacitance / MLC Case Size	Voltage Rating	Temperature Coefficient	IR (@+20°C, Rated Voltage)	Max DF 1kHz	Aging Rate (% per Decade Hour Max.)	Term	Frequency Range 3dB pts. Typical	Maximum Process Temperature / Recommended Attachment method
P62BN820MA2636	100 nF ± 20% / 0603	25 Vdc	X7R ΔC max: ±15% (-55°C to 125°C)	10^2 MΩ	3.0%	1.0%	Au (Flash)	16 KHz. – >>40 GHz	250°C/ Conductive Epoxy or Solder
P42BN820MA3152	220 nF / 0402	10 Vdc	X5R ΔC max: ±15% (-55°C to 85°C)	10^2 MΩ	3.5%	1.0%	Au (Flash)	16 KHz. – >>40 GHz	Conductive Epoxy
P21BN300MA4282	22 nF / 0201	10 Vdc	X5R ΔC max: ±15% (-55°C to 85°C)	10^2 MΩ	3.5%	1.0%	Au (Flash)	16 KHz. – >>40 GHz	Conductive Epoxy

Notes:
1. Termination Metalization: 7.5 ± 4.5 micro inches Au over 50 microinches Ni min.
2. Maximum assembly process temperature: 250°C
3. For best high frequency performance, attach surface A to transmission line. For 50 ohm system, transmission line should be near or slightly greater than 20 mils. Recommended microstrip gap length is 0.015 inch.
4. Rated working voltage (WVDC) is the lesser of 25 volts (Milli.) or multilayer WVDC from Table B.
5. Recommended attachment is solder or conductive epoxy.

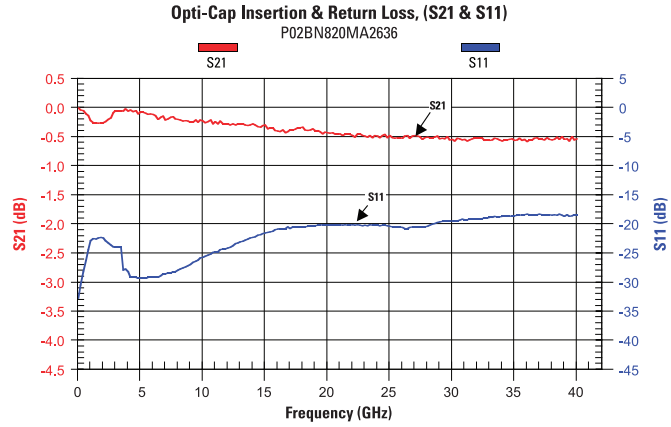
Broadband Kit

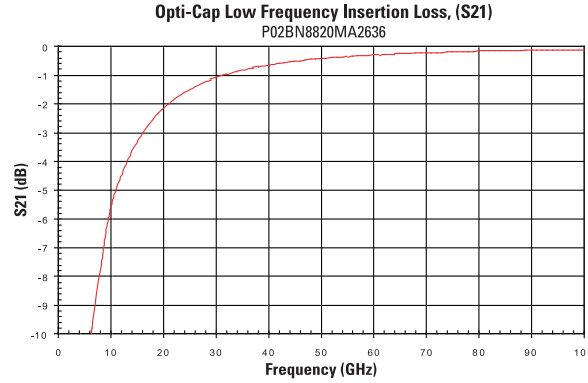
Part Number	Freq Range
P02BN820MA2636	
P02BN820Z5S	20MHz - 40GHz
P02CG1R5C5S	8GHz - 32GHz
P02CG1R0C5S	18GHz - 40GHz
P02CF0R5B5S	28GHz - 40GHz
P02CF0R3B5S	35GHz - 50GHz
C06BL851X-5UN-X0B	2MHz - 30GHz
C08BL242X-5UN-X0B	1MHz - 20GHz

Physical Characteristics



Electrical Performance





Milli-Cap® SMD Millimeter Wave Capacitor

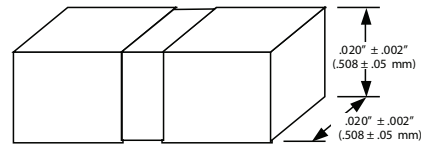
Functional Applications

0402, 0502 and 0602 Footprints, Very Low Series Inductance, Ultra High Series Resonance, Low Loss High Q part.

Benefits

Matches typical 50Ω Line Widths, Preserves Board Space, Behaves Like An Ideal Capacitor, More Usable Bandwidth

Mechanical Specification



- Terminations: Gold
- Assembly temperatures not to exceed 260°C.
- Ideal for Test Equipment, Photonics, SONET, Digital radios, and Matching Filter applications

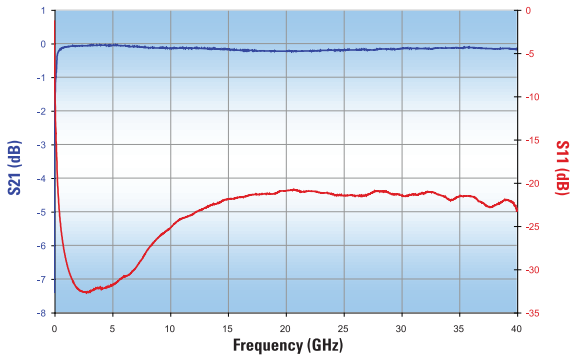
Part Characteristics

Part Number	Cap.	Voltage Rating	Temperature Coefficient -55°C to 125°C	Maximum Dissipation Factor	Insulation Resistance (MΩ Minimum)	Aging Rate	Frequency Range
P_2BN820Z5ST	82 pF	50 Vdc	± 10%	3.0%@ 1MHz, 25°C	10^5 MΩ @ 25°C at rated voltage	<=1.5%/ decade hours	20MHz– 40GHz
P_2NR3R0K5ST	3.0 pF		N1500 ±500PPM / °C	0.25%@ 1MHz, 25°C	10^6 MΩ @ 25°C at rated voltage	N / A*	4–20GHz
P_2CG1R5C5ST	1.5 pF		0 ± 30PPM	0.7%@ 1KHz, 25°C			8–32GHz
P_2CG1R0C5ST	1.0 pF						18–40GHz
P_2CD0R7B5ST	0.7 pF		N20 ±15PPM / °C	0.15%@ 1MHz, 25°C			20–46GHz
P_2CF0R5B5ST	0.5 pF		0 ±15PPM / °C	0.6%@ MHz, 25°C			28–40GHz
P_2CF0R3B5ST	0.3 pF						35–50GHz

Dimensions Key: P42 = 0402; P02 = 0502; P62 = 0602

Electrical Performance

P02BN820Z5S



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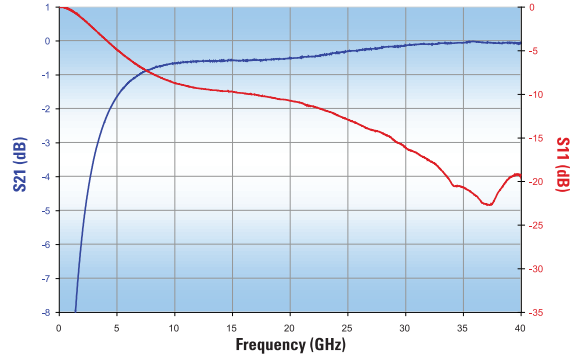

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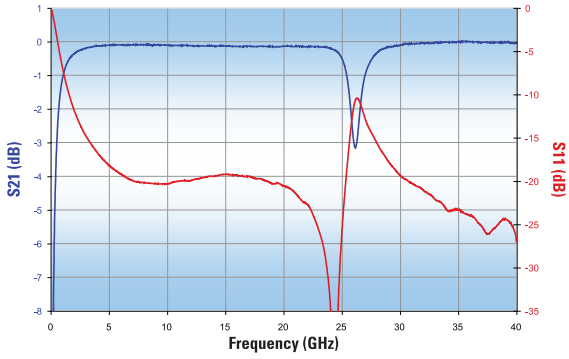

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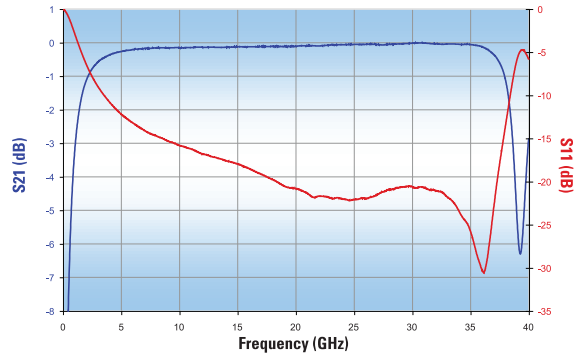

The information above represents typical device performance.

Single Layer Capacitors

Di-Cap®	Border Cap®	Gap Cap	Bar Cap®	Binary Cap	T-Cap®
Highest performance SLC for RF, MW and MMW applications from 100 MHz to 100 GHz. Most cap for size 0.02 – 4300 pF	SLC w 1- or 2-sided recessed metallization to minimize the potential for shorting during die attach. Ideal for epoxy attach. 0.02 – 1500 pF	Series configured precision SLC for elimination of wire-bonds and microstrip applications. Minimum performance variation.	Multiple decoupling/ bypass or blocking SLC configured in a single array. 1-13 GHz. Ideal for decoupling MMICs.	Multi-value – binary tunable SLC for design tuning or MIC hybrids.	DiCap® SLC used in series connected open circuited transmission line- designed for repeatable resonance behavior.

Filters/Heat Sinks/Sub Mounts/Standoffs

Filter Family	Bias Filter Network	Heatsinks, Sub Mounts and Standoffs	Build to Print
Micro-strip, cavity filters, duplexers, diplexers, GPS filters. Frequency from 500 MHz to 67 GHz. No tuning required, extremely temperature stable, miniature and lightweight. Customized designs and prototypes.	Designed to filter RF signals from bias and control line from 10MHz to 40GHz. Reduces RF feedback through bias supplies and simplifies assembly – one component replaces many.	For laser diodes, VCSEL, and others for the fiber optics industry. DLI can customize a design for high volume and be very price competitive. The next generation of "smart" heatsinks are also available using proprietary technologies.	DLI maintains an inventory of industry standard ceramics and manufactures a large selection of proprietary and/or patented custom ceramics. Plus, DLI's custom ceramics can offer significantly better thermal performance than the majority of industry standard ceramics and have the added benefit of a sufficiently higher K allowing miniaturization opportunities.

Equalizers/Duplexers/Resonators

Gain Equalizer	Duplexers and Diplexers	Cavity Resonator
Excellent, repeatable microwave performance is achieved by application of precision thin film fabrication and DLI HI-K ceramic materials. DLI's unique design solution provides near ideal R-C frequency response, far superior to "Stacked R-C chip" assemblies. RADAR application to 67 GHz.	Duplexers are three port devices used to separate and combine frequencies, having two filters with a common driving point covering two frequency bands. Diplexers are three port devices used to separate and combine frequencies, having one filter covering all frequency bands.	DLI's Cavity Resonators set a new standard for high Q resonator performance across a broad spectrum of frequencies. High Q resonators play a critical role in system noise performance, and employing the advantage is dramatically easier and less expensive than ever before. These products include extremely stable Single Frequency Cavity Resonators (SFCR), Narrow-Band and Wide-Band Tunable Ceramic Resonator, and Two-Port Resonators. Single Frequency Cavity Resonators-standard from 3GHz to >67GHz. Two Port Cavity Resonators-standard from 3GHz to >67Ghz.

Substrates

DLI manufactures and/or procures substrates to allow our customers to manufacture their own custom ceramic products*. DLI's proprietary and/or patented ceramics offer high K values, to allow for miniaturization, extreme temperature stability, space reliability and radiation hardened properties. As a direct result of the above, DLI is able to offer our customers a complete array of fabrication services for all industry standards and/or custom ceramics.

*DLI does restrict certain proprietary materials in specific applications for internal use only.

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