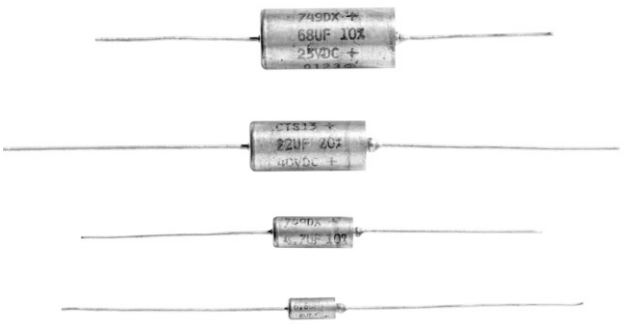
Hermetically Sealed, Axial-Lead, to CECC Specifications



FEATURES

- Terminations: Tin/lead (SnPb), 100 % Tin (RoHS compliant)
- Hermetically sealed metal case with plastic film insulation
- Extended capacitance range (type 749DX)
- High operational stability with both time and temperature
- Low leakage current
- Low dissipation factor

Available

RoHS* COMPLIANT

APPLICATIONS

Performance and reliability has been proven in a wide range of applications such as: filtering, by-pass, coupling, energy storage, timing circuits.

PERFORMANCE CHARACTERISTICS

Operating Temperature:

- 55 °C to + 85 °C (types CTS13)
- 55 °C to + 125 °C (types CTS1, 749DX)

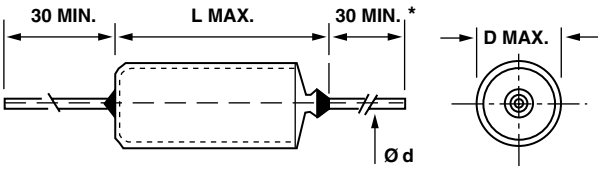
SPECIFICATIONS

CECC		BS	
30201-001	749DX	9073-N001	749DX
30201-002	CTS1		
30201-005	CTS13		
30201-011/012	749DX	**IECQ**	
30201-029	749DX		

ORDERING INFORMATION

CTS13	105	X0	040	A	2	P	E3
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	CASE CODE	STYLE NUMBER	PACKAGING	ROHS COMPLIANT
Identifies the Basic Capacitor Design CTS1 = CECC 30201-002 CTS13 = CECC 30201-005 749DX = CECC 30201-001/011/012/029	Expressed in picofarads. First two digits are significant. Third digit is the number of zeros following.	X0 = ± 20 % X9 = ± 10 % X5 = ± 5 % (Special Order)	Expressed in volts. Where necessary, zeros precede the voltage rating to complete the 3 digit block 6R3 = 6.3 V	See Table Ratings and Case Codes.	0 = Bare Case 2 = Plastic-Film Insulation	See Taping and Packaging	E3 = 100 % Tin termination (RoHS compliant) Blank = SnPb termination

DIMENSIONS in millimeters



*** 23 mm MAX. FOR TAPED CAPACITORS**

CASE CODE	BS D MAX.	NF D MAX.	L MAX.	+ 10 % Ø d - 0.05
A	3.6	3.8	10.2	0.5
B	4.9	5.1	15.0	0.5
C	7.5	7.7	20.5	0.6
D	9.1	9.3	24.0	0.6

Note:

* Pb containing terminations are not RoHS compliant, exemptions may apply

TYPE CTS1: STANDARD RATINGS AND CASE CODES

C_R µF	RATED VOLTAGE U_R (+ 85 °C)									
	6.3 V	10 V	16 V	25 V	40 V	50 V	53 V	80 V	100 V	125 V
	CATEGORY VOLTAGE U_C (+ 125 °C)									
	4 V	6.3 V	10 V	13 V	25 V	33 V	40 V	50 V	67 V	82 V
0.10							**A**	**A**	**A**	**A**
0.12							A	A	A	A
0.15							**A**	**A**	**A**	**A**
0.18							A	A	A	A
0.22							**A**	**A**	**A**	**A**
0.27						A	A	A	A	A
0.33						**A**	**A**	**A**	**A**	**A**
0.39						A	A	A	A	B
0.47					**A**	**A**	**A**	**A**	**A**	**B**
0.56					A	A	A	A	A	B
0.68					**A**	**A**	**A**	**A**	**B**	**B**
0.82					A	A	B	B	B	B
1.0					**A**	**A**	**B**	**B**	**B**	**B**
1.2					A	B	B	B	B	B
1.5				**A**	**B**	**B**	**B**	**B**	**B**	**B**
1.8			A		B	B	B	B	B	B
2.2			**A**		**B**	**B**	**B**	**B**	**B**	**B**
2.7			A		B	B	B	B	B	
3.3			**A**		**B**	**B**	**B**	**B**	**C**	
3.9		A			B	B	B	B	C	
4.7		**A**			**B**	**B**	**C**	**C**	**C**	
5.6	A				B	C	C	C	C	
6.8	**A**				**B**	**C**	**C**	**C**	**C**	
8.2				B	C	C	C	C		
10				**B**	**C**	**C**	**C**	**C**		
12			B		C	C	D	D		
15			**B**		**C**	**C**	**D**	**D**		
18			B		C	C	D			
22			**B**		**C**	**D**				
27		B		C	D					
33		**B**		**C**	**D**					
39	B		C		D					
47	**B**		**C**		**D**					
56	B		C	D						
68			**C**	**D**						
82		C	D							
100		**C**	**D**							
120	C		D							
150	**C**		**D**							
180		D								
220		**D**								
270	D									
330	**D**									

Note:
Preferred ratings are in bold characters. Non-preferred ratings are available only with a capacitance tolerance of ± 10 % or ± 5 % (special order).

TYPE CTS13: STANDARD RATINGS AND CASE CODES

C_R µF	RATED VOLTAGE U_R (+ 85 °C)							
	6.3 V	10 V	16 V	20 V	25V	40 V	50 V	63 V
0.10						**A**	**A**	**A**
0.12						A	A	A
0.15						**A**	**A**	**A**
0.18						A	A	A
0.22						**A**	**A**	**A**
0.27						A	A	A
0.33						**A**	**A**	**A**
0.39						A	A	A
0.47						**A**	**A**	**A**
0.56						A	A	A
0.68						**A**	**A**	**A**
0.82						A	A	B
1.0						**A**	**A**	**B**
1.2					A	A	B	B
1.5					**A**	**B**	**B**	**B**
1.8				A		B	B	B
2.2				**A**		**B**	**B**	**B**
2.7			A			B	B	B
3.3			**A**			**B**	**B**	**B**
3.9		A				B	B	B
4.7		**A**				**B**	**B**	**C**
5.6	A					B	C	C
6.8	**A**					**B**	**C**	**C**
8.2					B	C	C	C
10					**B**	**C**	**C**	**C**
12				B		C	C	D
15				**B**		**C**	**C**	**D**
18			B			C	C	D
22			**B**			**C**	**D**	
27		B			C	D		
33		**B**			**C**	**D**		
39	B			C		D		
47	**B**			**C**		**D**		
56	B		C		D			
68			**C**		**D**			
82		C		D				
100		**C**		**D**				
120	C		D					
150	**C**		**D**					
180		D						
220		**D**						
270	D							
330	**D**							

Note:
Preferred ratings are in bold characters. Non-preferred ratings are available only with a capacitance tolerance of ± 10 % or ± 5 % (special order).

TYPE 749DX: STANDARD RATINGS AND CASE CODES

C_R µF	RATED VOLTAGE U_R (+ 85 °C)								
	6.3 V	10 V	16 V	20 V	25 V	35 V	40 V	50 V	63 V
	CATEGORY VOLTAGE U_C (+ 125 °C)								
	4 V	6.3 V	10 V	13 V	16 V	23 V	25 V	33 V	40 V
0.068								A	
0.085								A	
0.10						**A**	**A**		**A**
0.12						A	A		A
0.15						**A**	**A**		**A**
0.18						A	A		A
0.22						**A**	**A**		**A**
0.27						A	A		A
0.33						**A**	**A**		**A**
0.39						A	A		A
0.47						**A**	**A**		**A**
0.56						A	A		A
0.68						**A**	**A**		**A**
0.82						A	A	A	B
1.0						**A**	**A**	**A**	**B**
1.2					A	B	B	B	B
1.5					**A**	**B**	**B**	**B**	**B**
1.8				A		B	B	B	B
2.2				**A**		**B**	**B**	**B**	**B**
2.7			A			B	B	B	B
3.3			**A**			**B**	**B**	**B**	**B**
3.9		A				B	B	B	B
4.7		**A**				**B**	**B**	*	**C**
5.6	A					B	B	C	C
6.8	**A**					*	*	**C**	**C**
8.2					B	C	C	C	C
10					**B**	**C**	**C**	**C**	**C**
12				B		C	C	C	D
15				**B**		**C**	**C**	**C**	**D**
18			B			C	C	C	D
22			**B**			**C**	**C**	**D**	
27		B			C	D	D		
33		**B**			**C**	**D**	**D**		
39		B		C		D	D		
47	**B**			**C**		**D**			
56	B		C		D	*			
68			**C**		**D**				
82		C		D					
100		**C**		**D**					
120		C	D						
150	**C**		**D**						
180	C	D							
220		**D**							
270	D								
330	**D**								

Note:
*See extended range page

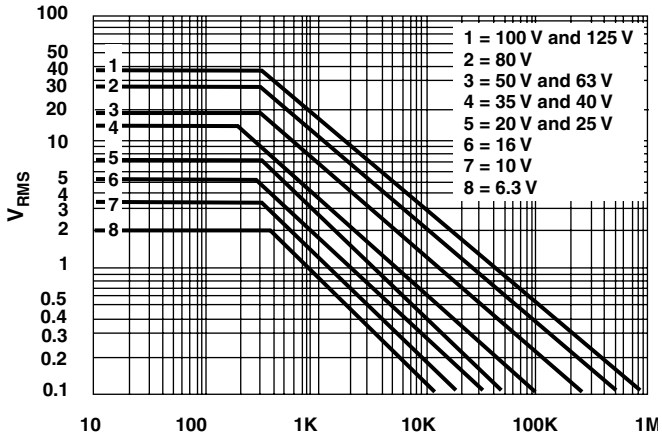
TYPE 749DX: EXTENDED RATINGS AND CASE CODES

C_R µF	RATED VOLTAGE U_R (+ 85 °C)						
	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V
	CATEGORY VOLTAGE U_C (+ 125 °C)						
	4 V	6.3 V	10 V	13 V	16 V	23 V	32 V
1.2						A	A
1.5						**A**	**A**
1.8						A	
2.2					**A**		
2.7					A		
3.3					**A**		
3.9			A	A			
4.7			**A**	**A**			**B**
5.6			A				B
6.8			**A**			**B**	
8.2		A				B	
10		**A**					
12	A				B		
15	**A**				**B**		
18				B	B		
22				**B**			**C**
27			B			C	D
33			**B**			**C**	**D**
39			B			C	D
47		**B**				**C**	
56		B			C	D	
68		**B**			**C**	**D**	
82		B			D		
100	**B**		**C**	**C**	**D**		
120	B		C	C	D		
150			**C**		**D**		
180			C	D			
220		**C**	**D**	**D**			
270		C	D				
330	**C**	**D**	**D**				
390	C	D					
470	**C**	**D**					
560		D					
680	**D**						
820	D						
1000	**D**						

Note:
Preferred ratings are in bold characters. Non-preferred ratings are available only with a capacitance tolerance of ± 10 % or ± 5 % (special order).

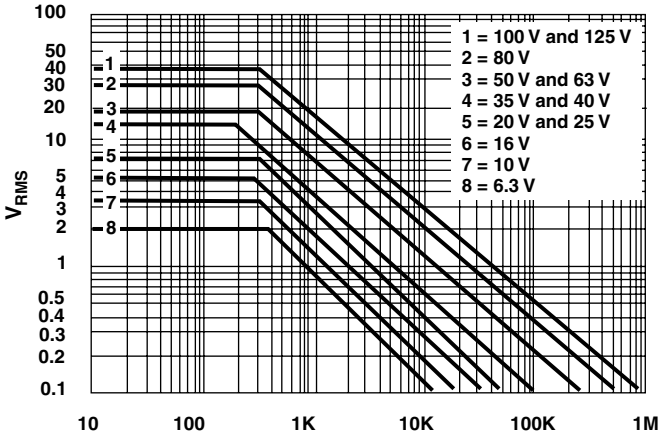
TYPICAL CURVES RIPPLE VOLTAGE AT + 25 °C

CASE "A" CAPACITORS



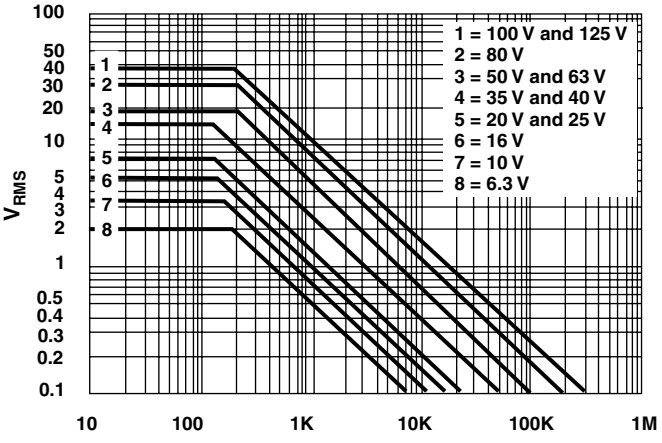
FREQUENCY IN Hz

CASE "B" CAPACITORS



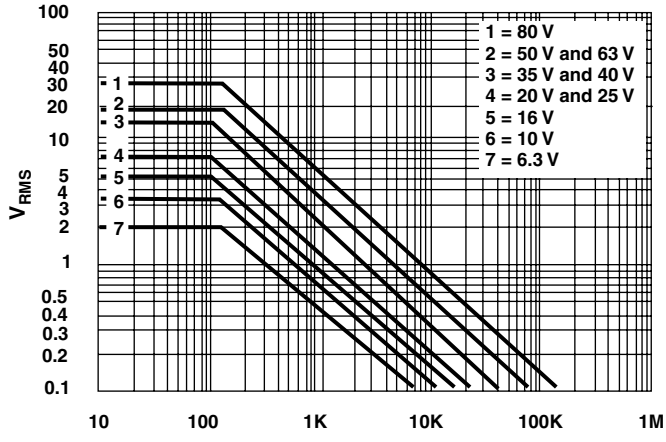
FREQUENCY IN Hz

CASE "C" CAPACITORS



FREQUENCY IN Hz

CASE "D" CAPACITORS



FREQUENCY IN Hz

PERFORMANCE CHARACTERISTICS

1. Operating Temperature:

- 55 °C to + 85 °C with rated DC voltage UR applied, + 85 °C to + 125 °C with linear voltage deratin to category voltage UC (only for types CTS1, 749DX).

2. Capacitance and Tolerance:

Capacitance measured at 100 Hz and + 25 °C shall be within the specified tolerance limits of the nominal rating. Capacitance measurement shall be made by means of a polarized capacitance bridge. The polarizing voltage shall be of 2.2 V. The maximum voltage applied during measurements shall be 1.0 V_{rms} at 100 Hz and + 25 °C.

3. Reverse Voltage:

These capacitors are capable of withstanding peak voltage in the reverse direction equal to: 15 % of the rated DC voltage at + 25 °C, 5 % of the rated DC voltage at + 85 °C.

4.Surge Voltage:

Table 1

PRODUCT TYPE	SURGE VOLTAGE AT + 85 °C	SURGE VOLTAGE AT + 125 °C
CTS13	1.30 U_R	-
749DX/CTS1	1.30 U_R	1.30 U_C

Capacitors shall withstand the surge voltage applied in series with a 1000 Ω resistor, at the rate of 1.5 minute on, 5.5 minute off, for 1000 successive test cycles at + 85 °C or at + 125 °C. After test, dissipation factor and leakage current shall meet the initial requirements at + 25 °C (see below), capacitance change shall not exceed ± 10 % of initial value at + 25 °C.

5. Leakage current:

Rated voltage UR shall be applied to capacitors during five minutes with a resistor of 1000 Ω in series with each capacitor, before making DC leakage current measurements. The leakage current shall not exceed the following limits:

Table 2

TEMPERATURE	CTS1/CTS13/749DX
+ 25 °C	0.01 C_R x U_R or 1 µA whichever is greater
+ 85 °C	0.1 C_R x U_R or 10 µA whichever is greater
+125 °C	0.125 C_R x U_R or 12.5 µA whichever is greater

6. Dissipation factor:

The dissipation factor, when measured at 100 Hz ,shall not exceed the values below:

Table 3

TEMP.	CTS1/CTS13		749DX	
	$C_RU_R \leq 1900$	$C_RU_R > 1900$	$C_R \leq 100$	$C_R > 100$
- 55 °C	9 %	11 %	8 %	10 %
+ 25 °C	6 %	8 %	6 %	8 %
+ 85 °C	9 %	11 %	-	-
+ 125 °C (1)	12 %	14 %	10 %	11 %

(1) not applicable for CTS13

7. Stability at low and high temperature:

Capacitance change with temperature shall not exceed the limits of the following table, leakage current and dissipation factor shall be within the limits specified in Tables 2 and 3.

Table 4

TEMPERATURE	CTS1/CTS13/749DX
- 55 °C	- 10 %
+ 85 °C	+ 12 %
+ 125 °C (2)	+ 15 %

(2) not applicable for CTS13

8. Impedance:

The impedance measured at 100 kHz and 25 °C shall not exceed the following values:

Table 5

CASE CODE	Z (Ω)(3)
A	10
B	5
C	2
D	1

(3) not applicable for $C_R \leq 0.68$ µF

9. Life test:

After 2000 h at + 85 °C with rated DC voltage applied, or after 2000 h at + 125 °C with category DC voltage applied (for types CTS1, 749DX only) capacitors shall meet the requirements in table 6.

Table 6

PRODUCT TYPE	CAPACITANCE CHANGE	DISSIPATION FACTOR	DC LEAKAGE CURRENT
CTS1 CTS13 749DX	Within ± 10 % of initial value at + 25 °C	Within initial requirement at + 25 °C	Within 125 % of initial requirements at + 25 °C

PERFORMANCE CHARACTERISTICS (Continued)

10.Humidity test:

After 56 days (1350 h) at + 40 °C, 90 to 95 % of relative humidity (per IEC 68-2-3) with no voltage applied, capacitors shall meet the requirements in table 7 below.

Table 7

CAPACITANCE CHANGE	Within ± 3 % of initial value
DC LEAKAGE CURRENT	Within initial requirement at + 25 °C -Table 2
DISSIPATION FACTOR	Within initial requirement at + 25 °C - Table 3

Table 8

CAPACITANCE CHANGE	Within ± 5 % of initial value at + 25 °C
DC LEAKAGE CURRENT	Within initial requirement at + 25 °C - Table 2
DISSIPATION FACTOR	Within initial requirement at + 25 °C - Table 3

Typical values of charge-discharge current (per above test conditions).

RATED VOLTAGE U_R (V)	CHARGE-DISCHARGE CURRENT (A)
6.3	13
10	20
16	32
25	50
40	80
50	100
63	126

12. Insulation test:

For capacitors with insulating sleeves, a DC voltage of 100 V shall be applied for one minute between the case of the capacitor and a metal "V" block in intimate contact with the insulating sleeve. The insulating resistance measured in these conditions shall be at least 100 MΩ.

13. Lead pull test:

Leads shall withstand the following test (IEC 68 - 2 - 2): Tensile stress of 5N (cases A and B) or 10N (cases C and D) for 10 s in any direction

One bend in each direction
Two cosecutive rotations of 180°

GUIDE TO APPLICATION

1. A-C Ripple Current:

The maximum allowable ripple current shall be determined from the formula:

1. $$I_{rms} = \sqrt{\frac{P}{R_{ESR}}}$$

where,
P = Power Dissipation in W at + 25 °C as given below
RESR = The capacitor Equivalent Series resistance at the specified frequency.

2. A-C Ripple Voltage:

The maximum allowable ripple voltage shall be determined from the formula:

$$V_{rms} = \sqrt{\frac{P}{R_{ESR}}} \times Z$$

where,
Z = The capacitor Impedance at the specified frequency.

The calculations are summarized on the graphs page 7 giving the maximum available ripple voltage as a function of frequency.

However, the sum of the peak AC voltage plus the DC voltage shall not exceed the rated DC voltage at + 85 °C of the capacitor. The sum of the negative peak AC voltage plus the DC voltage shall not allow a voltage reversal exceeding 15 % of the rated DC voltage.

3. AC Ripple Current or Voltage Derating Factor:

If these capacitors are to be operated at temperatures above + 25° C, the permissible rms ripple current or voltage shall be calculated using the derating factors in the table below:

TEMPERATURE	DERATING FACTOR
+ 25 °C	1.0
+ 55 °C	0.8
+ 85 °C	0.6
+ 125 °C	0.4

4.Power Dissipation:

Power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidial ripple current may produce heating effects which differ from those shown in the following table. It is important that the equivalent Irms value be established when calculating permissible operating levels.

CASE CODE	POWER DISSIPATION AT + 25 °C (W)
A	0.115
B	0.145
C	0.185
D	0.225

TAPE AND REEL PACKING

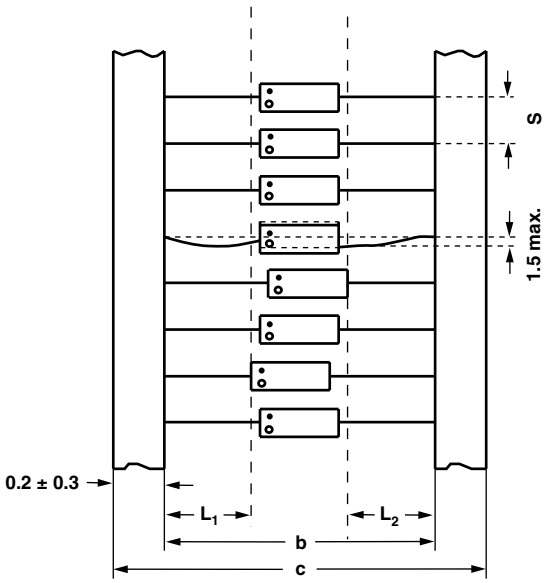
MEETS IEC 286-1

L_1 - L_2 = 1.5 mm max.

S = component spacing (cumulative tolerance on 20 units = 4 mm)

b = tape spacing

c = overall length



DIMENSIONS in millimeters

CASE SIZE	REEL AND AMMO S	REEL PACK					AMMO PACK			BULK
		OPTION P		OPTION R		QTY PER REEL	OPTION G		QTY PER BOX	QTY PER PACK
		b	c MAX.	b	c MAX.		b	c MAX.		
A	5.0 ± 0.3	63 ± 2	78	53 ± 2	68	1000	53 ± 2	68	500	100
B	5.0 ± 0.3	63 ± 2	78	53 ± 2	68	1000	53 ± 2	68	500	75
C	10.0 ± 0.3	63 ± 2	78	63 ± 2	78	500	53 ± 2	68	250	50
D	10.0 ± 0.3	63 ± 2	78	63 ± 2	78	500	53 ± 2	68	250	25
PACKAGING CODE		P		R			G			B

MARKING

Capacitors shall be marked with SPRAGUE and/or the registered trademark 2 at vendor‘s option; the type number; rated capacitance and tolerance (with a letter code, if different from ± 20 %, K = ± 10 % ; J = ± 5 %) ; rated DC voltage at + 85 °C and the date code of manufacture.

Capacitors shall be marked on one end with a “plus” sign (+) to identify the positive terminal.

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