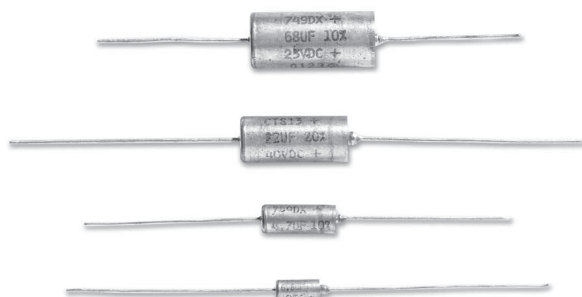


Hermetically Sealed, Axial-Lead, To CECC Specifications



FEATURES

- 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
- Capability to withstand high inrush currents (type CTS32)

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, CTS32)
- 55°C to + 125°C (types CTS1, 749DX)

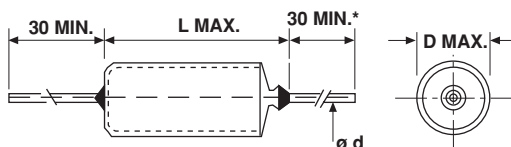
SPECIFICATIONS

CECC		BS	
30201-001	749DX	9073-N001	749DX
30201-002	CTS1		
30201-005	CTS13		
30201-011/012	749DX	IECQ	
30201-019	CTS32	300201/FR001	CTS1
30201-029	749DX		

ORDERING INFORMATION

CTS13 TYPE	105 CAPACITANCE	X0 CAPACITANCE TOLERANCE	040 DC VOLTAGE RATING @ + 85°C	A CASE CODE	2 STYLE NUMBER	P PACKAGING
Identifies the Basic Capacitor Design CTS1 = CECC 30201-002 CTS13 = CECC 30201-005 CTS32 = CECC 30201-019 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 Volts	See Table Ratings and Case Codes.	0 = Bare Case 2 = Plastic-Film Insulation	See Taping and Packaging

DIMENSIONS in millimeters



*23mm MAX. FOR TAPED CAPACITORS

CASE CODE	BS D MAX.	NF D MAX.	L MAX.	+ 10% Ød - 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



CTS1, CTS13, CTS32, 749DX

Hermetically Sealed, Axial-Lead,
To CECC Specifications

Vishay Sprague

TYPE CTS1: STANDARD RATINGS AND CASE CODES										
C _R mF	RATED VOLTAGE U _R (+ 85°C)									
	6.3V	10V	16V	25V	40V	50V	63V	80V	100V	125V
	CATEGORY VOLTAGE U _C (+125°C)									
	4V	6.3V	10V	13V	25V	33V	40V	50V	67V	82V
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									

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)							
	6.3V	10V	16V	20V	25V	40V	50V	63V
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							

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



CTS32 STANDARD RATINGS AND CASE CODES							
C_R μF	RATED VOLTAGE U_R (+85°C)						
	6.3V	10V	16V	25V	40V	50V	63V
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						

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

TYPE 749DX: STANDARD RATINGS AND CASE CODES

C _R μF	RATED VOLTAGE U _R (+ 85°C)								
	6.3V	10V	16V	20V	25V	35V	40V	50V	63V
	CATEGORY VOLTAGE U _C (+ 125°C)								
	4V	6.3V	10V	13V	16V	23V	25V	33V	40V
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								

*See extended range page



CTS1, CTS13, CTS32, 749DX

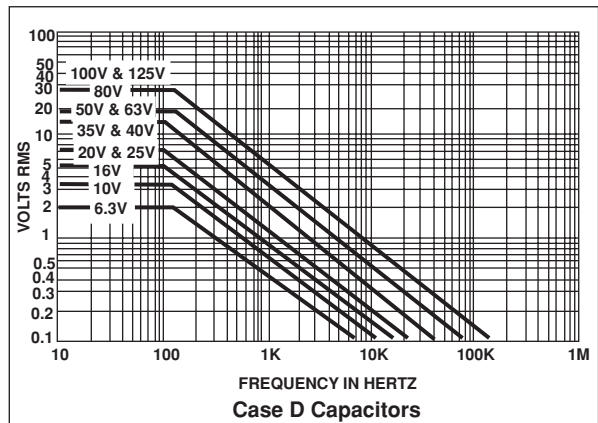
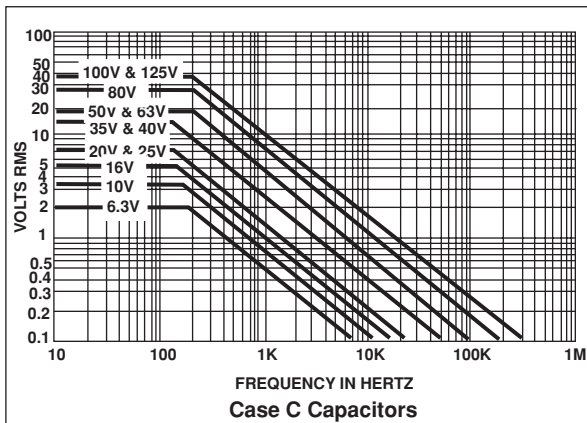
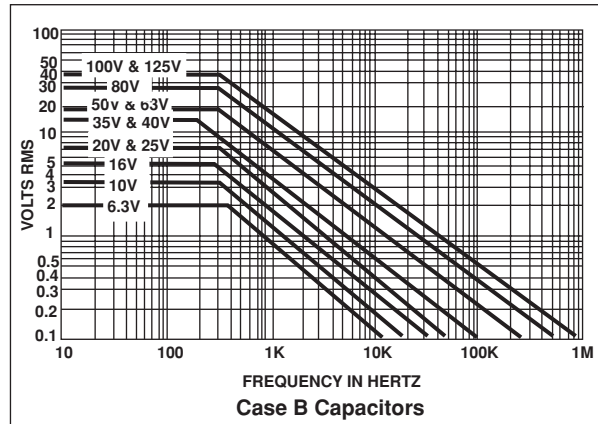
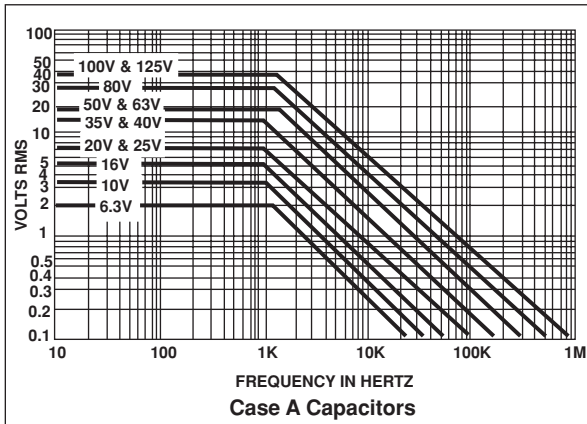
Hermetically Sealed, Axial-Lead,
To CECC Specifications

Vishay Sprague

TYPE 749DX: EXTENDED RATINGS AND CASE CODES							
C _R μF	RATED VOLTAGE U _R (+85°C)						
	6.3V	10V	16V	20V	25V	35V	50V
	CATEGORY VOLTAGE U _C (+125°C)						
	4V	6.3V	10V	13V	16V	23V	32V
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						

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 @ + 25°C



**PERFORMANCE CHARACTERISTICS**

1. Operating Temperature: - 55°C to + 85°C with rated DC voltage U_R applied. + 85°C to + 125°C with linear voltage derating to category voltage U_C (only for types CTS1, 749DX)

2. Capacitance and Tolerance: Capacitance measured at 100Hz 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 volts. The maximum voltage applied during measurements shall be 1.0 volt 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 @ + 85°C	SURGE VOLTAGE @ + 125°C
CTS13/CTS32	$1.30 U_R$	—
749DX/CTS1	$1.30 U_R$	$1.30 U_C$

Capacitors shall withstand the surge voltage applied in series with a 1000 ohm resistor, at the rate of one half-minute on, five and a half-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 $\pm 10\%$ of initial value at + 25°C.

5. Leakage current: Rated voltage U_R shall be applied to capacitors during five minutes with a resistor of 1000 ohm 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/CTS32/749DX
+ 25°C	$0.01 C_R \times U_R$ or $1\mu A$ whichever is greater
+ 85°C	$0.1 C_R \times U_R$ or $10\mu A$ whichever is greater
+125°C	$0.125 C_R \times U_R$ or $12.5\mu A$ 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/CTS32		749DX	
	$C_R U_R \leq 1900$	$C_R U_R > 1900$	$C_R \leq 100$	$C_R > 100$
- 55°C	9%	11%	8%	10%
+ 25°C	6%	8%	6%	8%
+ 85°C	9%	11%	—	—
+ 125°C*	12%	14%	10%	11%

*not applicable for CTS13/32

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/CTS32/749DX
- 55°C	- 10%
+ 85°C	+ 12%
+ 125°C *	+ 15%

*not applicable for CTS13/32

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

Table 5

CASE CODE	Z (Ω) *
A	10
B	5
C	2
D	1

* not applicable for $C_R \leq 0.68 \mu F$

9. Life test: After 2000 hours at + 85°C with rated DC voltage applied, or after 2000 hours 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 CTS32 749DX	Within $\pm 10\%$ of initial value @ +25°C	Within initial requirement @ +25°C	Within 125% of initial requirements @ +25°C

PERFORMANCE CHARACTERISTICS (CONT'D)

10. Humidity test: After 56 days (1350 hours) 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 @ +25°C - Table 2
DISSIPATION FACTOR	Within initial requirement @ +25°C - Table 3

11. Charge-discharge test (CTS32): Capacitors shall withstand 1,000,000 cycles at + 85°C of 0.5 second charge at DC rated voltage, 0.5 second discharge in an equivalent load resistance of the test fixture lower than 0.5 ohm. Following test, capacitors shall meet the requirements in table 8 below.

Table 8

CAPACITANCE CHANGE	Within ± 5% of initial value @ + 25°C
DC LEAKAGE CURRENT	Within initial requirement @ +25°C - Table 2
DISSIPATION FACTOR	Within initial requirement @ +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 volts 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 megohms.

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 seconds in any direction
- One bend in each direction
- Two consecutive rotations of 180°

GUIDE TO APPLICATION

1. AC Ripple Current: The maximum allowable ripple current shall be determined from the formula:

$$I_{rms} = \sqrt{\frac{P}{R_{ESR}}} \quad \text{where}$$

P = Power Dissipation in Watts at + 25°C as given below

R_{ESR} = The capacitor Equivalent Series Resistance at the specified frequency.

2. AC Ripple Current: The maximum allowable ripple voltage shall be determined from the formula:

$$V_{rms} = \sqrt{\frac{P}{R_{ESR}}} \times Z, \quad \text{where}$$

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:

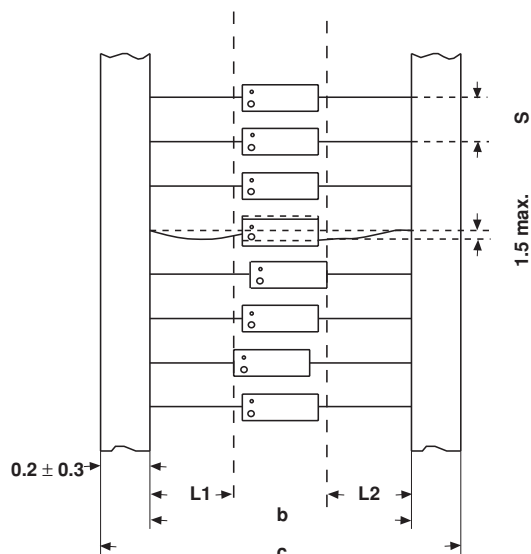
TEMPERATURE	DERATING FACTOR
+ 25°C	1.0
+ 55°C	0.8
+ 85°C	0.6
+ 125°C	0.4

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

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

**TAPE AND REEL PACKAGING**

MEETS IEC 286-1

 $L1 - L2 = 1.5\text{mm max}$ S = component spacing (cumulative
tolerance on 20 units = 4mm) b = tape spacing c = overall length**DIMENSIONS** in millimeters

CASE SIZE	REEL AND AMMO S	REEL PACK					AMMO PACK		
		OPTION P		OPTION R		QTY PER REEL	OPTION G		QTY PER BOX
		b	c MAX	b	c MAX		b	c MAX	
A	5.0 ± 0.3	63 ± 2	78	53 ± 2	68	2500	53 ± 2	68	1500
B	5.0 ± 0.3	63 ± 2	78	53 ± 2	68	2500	53 ± 2	68	1000
C	10.0 ± 0.3	63 ± 2	78	63 ± 2	78	1000	53 ± 2	68	250
D	10.0 ± 0.3	63 ± 2	78	63 ± 2	78	500	53 ± 2	68	250
PACKAGING CODE		P		R			G		

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 $\pm 20\%$, $K = \pm 10\%$; $J = \pm 5\%$) ; rated DC voltage at $+ 85^\circ\text{C}$ and the date code of manufacture.

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