



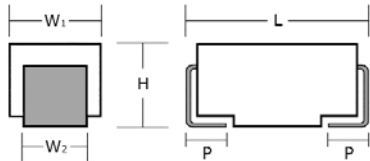
# TANTALUM CHIP CAPACITORS

## T Y P E T C C

### FEATURES

Meets or exceeds EIA 535 BAAC and IECQ standards (QC300801/US0001, IS-28)  
 Capacitance range from 0.1uF to 1500uF  
 Voltage range from 4 to 50WVDC. Down sized, extended range values.  
 Operating temperature range -55°C to +125°C, 2/3 x Vr (linear derating) above +85°C  
 Surge tested for maximum robustness  
 Precision molded case with flat surfaces for vacuum pick up  
 Laser marking and bold videocon-readable polarity stripe  
 Compliant terminations  
 Glue pad on underside for bonding to circuit board prior to soldering  
 Encapsulant material satisfies the UL94 VO flammability classification  
 MSL (moisture sensitivity level) per IPC/Jdec J-STD-020B is level 1

### DIMENSIONS



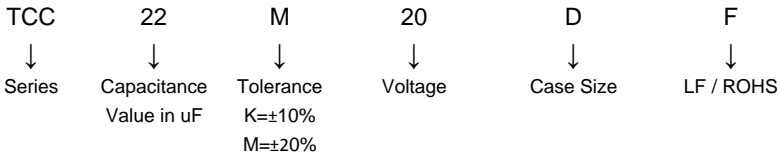
millimeters (inches)

CASE SIZE	EIA / IECQ	L ±0.2 (±0.008)	W <sub>1</sub> ±0.2 (±0.008)	H ±0.2 (±0.008)	W <sub>2</sub> ±0.1 (±0.004)	P ±0.3 (±0.012)
A	3216-18	3.20 (.126)	1.60 (.063)	1.60 (.063)	1.20 (.047)	0.80 (.031)
B	3528-21	3.50 (.138)	2.80 (.110)	1.90 (.075)	2.20 (.087)	0.80 (.031)
C	6032-28	6.00 (.236)	3.20 (.126)	2.60 (.102)	2.20 (.087)	1.30 (.051)
D	7343-31	7.30 (.287)	4.30 (.169)	2.90 (.114)	2.40 (.094)	1.30 (.051)
H	7343-43	7.30 (.287)	4.30 (.169)	4.10 (.162)	2.40 (.094)	1.30 (.051)
Z	7361-38	7.30 (.287)	6.10 (.240)	3.45±0.3 (.136±0.012)	3.10 (.120)	1.40 (.055)

### PACKAGING

CASE SIZE	EIA / IECQ	STANDARD PACKING 7" REEL
A	3216-18	2000 PCS
B	3528-21	2000 PCS
C	6032-28	500 PCS
D	7343-31	500 PCS
H	7343-43	400 PCS
Z	7361-38	400 PCS

### ORDERING INFORMATION



# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	$\tan \delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 4 V DC @ 85°C

TCC3.3K4AF	A	3.3	0.5	6	7.6
TCC4.7K4AF	A	4.7	0.5	6	6.3
TCC6.8K4AF	A	6.8	0.5	6	5.5
TCC10K4AF	A	10	0.5	6	5.1
TCC10K4BF	B	10	0.5	6	3.5
TCC15K4AF	A	15	0.5	6	3.4
TCC15K4BF	B	15	0.6	6	2.9
TCC22K4AF	A	22	0.6	6	2.9
TCC22K4BF	B	22	0.9	6	2.5
TCC22K4CF	C	22	0.9	6	1.8
TCC33K4AF	A	33	1.3	6	3.0
TCC33K4BF	B	33	1.3	6	2.0
TCC33K4CF	C	33	1.3	6	1.8
TCC47K4AF	A	47	1.9	8	2.6
TCC47K4BF	B	47	1.9	6	1.9
TCC47K4CF	C	47	1.9	6	1.8
TCC68K4AF	A	68	2.7	10	1.5
TCC68K4BF	B	68	2.7	8	1.9
TCC68K4CF	C	68	2.7	6	1.4
TCC68K4DF	D	68	2.7	6	0.8
TCC100K4AF	A	100	4.0	30	2.5
TCC100K4BF	B	100	4.0	8	1.8
TCC100K4CF	C	100	4.0	6	0.8
TCC100K4DF	D	100	4.0	6	0.7
TCC150K4BF	B	150	6.0	8	1.6
TCC150K4CF	C	150	6.0	12	0.7
TCC150K4DF	D	150	6.0	8	0.6
TCC220K4BF	B	220	8.8	12	1.5
TCC220K4CF	C	220	8.8	8	1.2
TCC220K4DF	D	220	8.8	8	0.9
TCC330K4CF	C	330	13.2	8	0.9
TCC330K4DF	D	330	13.2	8	0.9
TCC470K4CF	C	470	18.8	14	0.3
TCC470K4DF	D	470	18.8	12	0.9
TCC470K4HF	H	470	18.8	10	0.5
TCC680K4DF	D	680	27.2	14	0.5
TCC680K4HF	H	680	27.2	14	0.9
TCC1000K4DF	D	1000	40.0	60	0.2
TCC1000K4HF	H	1000	40.0	14	0.5
TCC1500K4HF	H	1500	60.0	30	0.2

M=  $\pm$  20% Tolerance

SMEC reserves the right to supply higher voltage rating, tighter tolerance and / or lower ESR in the same case size, to the same reliability standards.

# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	tan $\delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 6.3 V DC @ 85°C

TCC2.2K6.3AF	A	2.2	0.5	6	7.6
TCC3.3K6.3AF	A	3.3	0.5	6	6.3
TCC4.7K6.3AF	A	4.7	0.5	6	5.5
TCC6.8K6.3AF	A	6.8	0.5	6	5.0
TCC6.8K6.3BF	B	6.8	0.5	6	3.4
TCC10K6.3AF	A	10	0.6	6	4.0
TCC10K6.3BF	B	10	0.6	6	2.9
TCC15K6.3AF	A	15	0.9	6	3.5
TCC15K6.3BF	B	15	1.0	6	2.5
TCC15K6.3CF	C	15	0.9	6	1.8
TCC22K6.3AF	A	22	1.4	6	3.0
TCC22K6.3BF	B	22	1.4	6	2.5
TCC22K6.3CF	C	22	1.3	6	1.8
TCC33K6.3AF	A	33	2.1	8	2.5
TCC33K6.3BF	B	33	2.1	6	2.2
TCC33K6.3CF	C	33	2.1	6	1.8
TCC47K6.3AF	A	47	2.8	10	1.6
TCC47K6.3BF	B	47	3.0	6	2.0
TCC47K6.3CF	C	47	3.0	6	1.6
TCC47K6.3DF	D	47	2.8	6	0.9
TCC68K6.3BF	B	68	4.0	8	1.8
TCC68K6.3CF	C	68	4.3	6	1.5
TCC68K6.3DF	D	68	4.3	6	0.9
TCC100K6.3BF	B	100	6.3	10	1.7
TCC100K6.3CF	C	100	6.3	6	0.9
TCC100K6.3DF	D	100	6.3	6	0.9
TCC150K6.3BF	B	150	9.5	10	1.2
TCC150K6.3CF	C	150	9.5	6	1.3
TCC150K6.3DF	D	150	9.5	6	0.9
TCC220K6.3CF	C	220	13.9	8	1.2
TCC220K6.3DF	D	220	13.9	8	0.9
TCC220K6.3HF	H	220	13.9	8	0.9
TCC330K6.3CF	C	330	19.8	12	0.5
TCC330K6.3DF	D	330	20.8	8	0.6
TCC330K6.3HF	H	330	20.8	8	0.5
TCC470K6.3DF	D	470	28.0	12	0.5
TCC470K6.3HF	H	470	28.0	10	1.5
TCC680K6.3HF	H	680	42.8	10	0.5
TCC1000K6.3ZF	Z	1000	63.0	16	0.4

M=  $\pm$  20% Tolerance

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# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	tan $\delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 10 V DC @ 85°C

TCC1.5K10AF	A	1.5	0.5	6	8.0
TCC2.2K10AF	A	2.2	0.5	6	7.0
TCC3.3K10AF	A	3.3	0.5	6	6.0
TCC4.7K10AF	A	4.7	0.5	6	5.0
TCC6.8K10AF	A	6.8	0.7	6	4.2
TCC6.8K10BF	B	6.8	0.7	6	3.0
TCC10K10AF	A	10	1.0	6	3.4
TCC10K10BF	B	10	1.0	6	2.5
TCC15K10AF	A	15	1.5	6	3.2
TCC15K10BF	B	15	1.5	6	2.8
TCC22K10AF	A	22	2.2	8	3.0
TCC22K10BF	B	22	2.2	6	2.4
TCC22K10CF	C	22	2.2	6	1.8
TCC33K10AF	A	33	3.3	8	1.7
TCC33K10BF	B	33	3.3	6	1.9
TCC33K10CF	C	33	3.3	6	1.6
TCC47K10BF	B	47	4.7	8	1.8
TCC47K10CF	C	47	4.7	6	1.2
TCC47K10DF	D	47	4.7	6	0.9
TCC68K10BF	B	68	6.8	6	1.8
TCC68K10CF	C	68	6.8	6	1.3
TCC68K10DF	D	68	6.8	6	0.9
TCC100K10BF	B	100	10.0	8	2.5
TCC100K10CF	C	100	10.0	8	0.9
TCC100K10DF	D	100	10.0	6	0.9
TCC150K10CF	C	150	15.0	8	0.9
TCC150K10DF	D	150	15.0	6	0.9
TCC150K10HF	H	150	15.0	8	0.9
TCC220K10CF	C	220	22.0	8	0.5
TCC220K10DF	D	220	22.0	8	0.6
TCC220K10HF	H	220	22.0	8	0.5
TCC330K10DF	D	330	33.0	8	0.9
TCC330K10HF	H	330	33.0	8	0.9
TCC470K10HF	H	470	47.0	10	0.5

## 16 V DC @ 85°C

TCC1K16AF	A	1.0	0.5	4	11.0
TCC1.5K16AF	A	1.5	0.5	6	8.0
TCC2.2K16AF	A	2.2	0.5	6	6.5
TCC3.3K16AF	A	3.3	0.5	6	5.0
TCC3.3K16BF	B	3.3	0.5	6	4.5

M=  $\pm$  20% Tolerance

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# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	tan $\delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 16 V DC @ 85°C

TCC4.7K16AF	A	4.7	0.8	6	4.0
TCC4.7K16BF	B	4.7	0.8	6	3.5
TCC6.8K16AF	A	6.8	1.1	6	4.2
TCC6.8K16BF	B	6.8	1.1	6	2.5
TCC6.8K16CF	C	6.8	1.1	6	2.5
TCC10K16AF	A	10	1.6	8	3.0
TCC10K16BF	B	10	1.6	6	2.8
TCC10K16CF	C	10	1.6	8	2.0
TCC15K16AF	A	15	2.4	6	2.0
TCC15K16BF	B	15	2.4	6	2.5
TCC15K16CF	C	15	2.4	6	1.8
TCC22K16BF	B	22	3.5	6	2.3
TCC22K16CF	C	22	3.5	6	1.6
TCC22K16DF	D	22	3.5	6	1.1
TCC33K16BF	B	33	5.3	8	2.1
TCC33K16CF	C	33	5.3	6	1.5
TCC33K16DF	D	33	5.3	6	0.9
TCC47K16CF	C	47	7.5	6	1.4
TCC47K16DF	D	47	7.5	6	0.9
TCC68K16CF	C	68	10.9	6	1.3
TCC68K16DF	D	68	10.9	6	0.9
TCC100K16CF	C	100	16.0	8	1.0
TCC100K16DF	D	100	16.0	6	0.9
TCC100K16HF	H	100	16.0	6	0.9
TCC150K16DF	D	150	24.0	6	0.9
TCC150K16HF	H	150	24.0	6	0.3
TCC220K16HF	H	220	35.2	10	0.5

## 20 V DC @ 85°C

TCC.68K20AF	A	0.68	0.5	4	10.0
TCC1K20AF	A	1	0.5	4	9.0
TCC1.5K20AF	A	1.5	0.5	6	6.5
TCC2.2K20AF	A	2.2	0.5	6	5.3
TCC2.2K20BF	B	2.2	0.5	6	3.5
TCC3.3K20AF	A	3.3	0.7	6	5.9
TCC3.3K20BF	B	3.3	0.7	6	3.0
TCC4.7K20AF	A	4.7	0.9	6	5.0
TCC4.7K20BF	B	4.7	0.9	6	3.0
TCC6.8K20AF	A	6.8	1.4	6	4.5
TCC6.8K20BF	B	6.8	1.4	6	2.5
TCC6.8K20CF	C	6.8	1.4	6	2.0
TCC10K20BF	B	10	2.0	6	2.1
TCC10K20CF	C	10	2.0	6	1.9

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# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	tan $\delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 20 V DC @ 85°C

TCC15K20BF	B	15	3.0	6	2.3
TCC15K20CF	C	15	3.0	6	1.7
TCC22K20BF	B	22	4.4	6	2.1
TCC22K20CF	C	22	4.4	6	1.6
TCC22K20DF	D	22	4.4	6	0.9
TCC33K20CF	C	33	6.6	6	1.5
TCC33K20DF	D	33	6.6	6	0.9
TCC47K20CF	C	47	9.4	6	0.9
TCC47K20DF	D	47	9.4	6	0.9
TCC47K20HF	H	47	9.4	6	0.9
TCC68K20DF	D	68	13.6	6	0.9
TCC68K20HF	H	68	13.6	6	0.9
TCC100K20DF	D	100	20.0	8	0.9
TCC100K20HF	H	100	20.0	8	0.9
TCC150K20HF	H	150	30.0	8	0.3

## 25 V DC @ 85°C

TCC.47K25AF	A	0.47	0.5	4	12.0
TCC.68K25AF	A	0.68	0.5	4	8.4
TCC1K25AF	A	1	0.5	4	8.0
TCC1.5K25AF	A	1.5	0.5	6	7.5
TCC1.5K25BF	B	1.5	0.5	6	5.0
TCC2.2K25AF	A	2.2	0.6	6	7.0
TCC2.2K25BF	B	2.2	0.6	6	4.5
TCC3.3K25AF	A	3.3	0.8	6	3.7
TCC3.3K25BF	B	3.3	0.8	6	3.5
TCC3.3K25CF	C	3.3	0.8	6	2.8
TCC4.7K25AF	A	4.7	1.2	6	5.5
TCC4.7K25BF	B	4.7	1.2	6	2.8
TCC4.7K25CF	C	4.7	1.2	6	2.4
TCC6.8K25BF	B	6.8	1.7	6	2.8
TCC6.8K25CF	C	6.8	1.7	6	2.0
TCC10K25BF	B	10	2.5	6	2.0
TCC10K25CF	C	10	2.5	6	1.8
TCC10K25DF	D	10	2.5	6	1.2
TCC15K25CF	C	15	3.8	6	1.6
TCC15K25DF	D	15	3.8	6	1.0
TCC22K25CF	C	22	5.5	6	1.4
TCC22K25DF	D	22	5.5	6	0.9
TCC33K25DF	D	33	8.3	6	0.9
TCC33K25HF	H	33	8.3	6	0.9
TCC47K25DF	D	47	11.8	6	0.9
TCC47K25HF	H	47	11.8	6	0.9
TCC68K25HF	H	68	17.0	6	0.9
TCC100K25ZF	Z	100	25.0	8	0.4

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# TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	tan $\delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
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## 35 V DC @ 85°C

TCC.1K35AF	A	0.10	0.5	4	24.0
TCC.15K35AF	A	0.15	0.5	4	21.0
TCC.22K35AF	A	0.22	0.5	4	18.0
TCC.33K35AF	A	0.33	0.5	4	15.0
TCC.47K35AF	A	0.47	0.5	4	12.0
TCC.47K35BF	B	0.47	0.5	4	10.0
TCC.68K35AF	A	0.68	0.5	4	8.0
TCC.68K35BF	B	0.68	0.5	4	8.0
TCC1K35AF	A	1.0	0.5	4	7.5
TCC1K35BF	B	1.0	0.5	4	6.5
TCC1.5K35AF	A	1.5	0.5	6	7.5
TCC1.5K35BF	B	1.5	0.5	6	5.2
TCC1.5K35CF	C	1.5	0.5	6	4.5
TCC2.2K35AF	A	2.2	0.8	6	4.5
TCC2.2K35BF	B	2.2	0.8	6	4.2
TCC2.2K35CF	C	2.2	0.8	6	3.5
TCC3.3K35BF	B	3.3	1.2	6	3.5
TCC3.3K35CF	C	3.3	1.2	6	2.5
TCC3.3K35DF	D	3.3	1.2	6	2.5
TCC4.7K35BF	B	4.7	1.2	6	3.1
TCC4.7K35CF	C	4.7	1.6	6	2.2
TCC4.7K35DF	D	4.7	1.6	6	1.5
TCC6.8K35CF	C	6.8	2.4	6	1.8
TCC6.8K35DF	D	6.8	2.4	6	1.3
TCC10K35CF	C	10	3.5	6	1.6
TCC10K35DF	D	10	3.5	6	1.0
TCC10K35HF	H	10	3.5	6	0.9
TCC15K35CF	C	15	5.3	6	1.4
TCC15K35DF	D	15	5.3	6	0.9
TCC22K35DF	D	22	7.7	6	0.9
TCC22K35HF	H	22	7.7	6	0.9
TCC33K35DF	D	33	11.6	6	0.9
TCC33K35HF	H	33	11.6	6	0.9
TCC47K35HF	H	47	16.5	6	0.9
TCC68K35ZF	Z	68	23.8	6	0.5

M=  $\pm$  20% Tolerance

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## TANTALUM CAPACITOR PART NUMBERS AND ELECTRICAL SPECIFICATIONS

SMEC Part number	Case Size	Capacitance ( $\mu$ F)	DCL ( $\mu$ A) max.	$\tan \delta$ (%) max.	ESR @100Khz max ( $\Omega$ )
<b>50 V DC @ 85°C</b>					
TCC.1K50AF	A	0.10	0.5	4	22.0
TCC.15K50AF	A	0.15	0.5	4	15.0
TCC.15K50BF	B	0.15	0.5	4	17.0
TCC.22K50AF	A	0.22	0.5	4	18.0
TCC.22K50BF	B	0.22	0.5	4	14.0
TCC.33K50BF	B	0.33	0.5	4	12.0
TCC.47K50AF	A	0.47	0.5	4	9.5
TCC.47K50BF	B	0.47	0.7	4	9.5
TCC.47K50CF	C	0.47	0.5	4	8.0
TCC.68K50AF	A	0.68	0.5	4	7.9
TCC.68K50BF	B	0.68	0.5	4	8.0
TCC.68K50CF	C	0.68	0.5	4	7.0
TCC1K50AF	A	1.0	0.5	4	6.6
TCC1K50BF	B	1.0	0.5	4	7.0
TCC1K50CF	C	1.0	0.5	4	5.5
TCC1.5K50CF	C	1.5	0.8	4	4.5
TCC1.5K50DF	D	1.5	0.8	6	4.0
TCC2.2K50CF	C	2.2	1.1	6	3.0
TCC2.2K50DF	D	2.2	1.1	6	2.5
TCC3.3K50CF	C	3.3	1.7	6	2.5
TCC3.3K50DF	D	3.3	1.7	6	2.0
TCC4.7K50CF	C	4.7	0.5	4	1.5
TCC4.7K50DF	D	4.7	2.4	6	1.4
TCC6.8K50CF	C	6.8	3.4	6	1.0
TCC6.8K50DF	D	6.8	3.4	6	1.0
TCC10K50DF	D	10	5.0	6	0.8
TCC10K50HF	H	10	5.0	6	1.0
TCC15K50DF	D	15	7.5	4	0.6
TCC15K50HF	H	15	7.5	6	0.6
TCC15K50ZF	Z	15	11.0	8	0.6

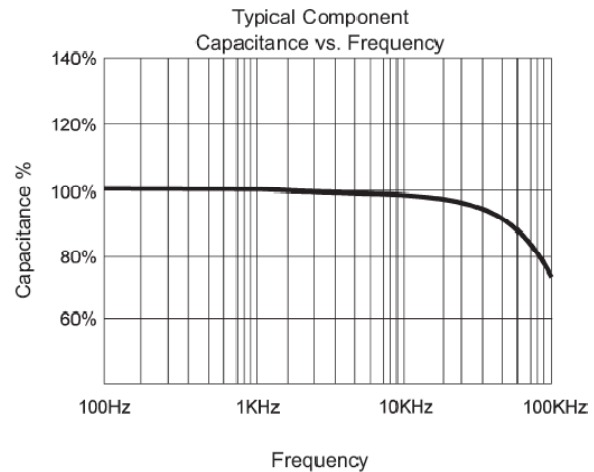
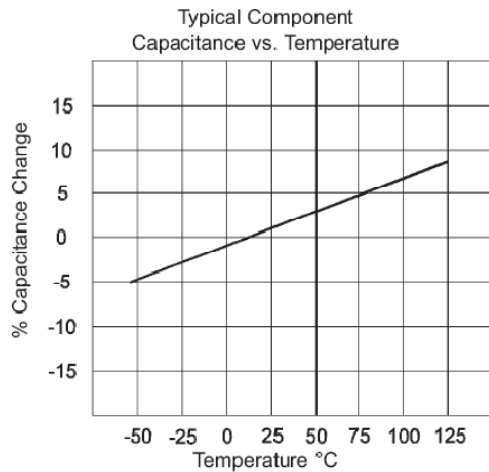
M=  $\pm$  20% Tolerance

**SMEC** reserves the right to supply higher voltage rating, tighter tolerance and / or lower ESR in the same case size, to the same reliability standards.

# GENERAL SPECIFICATIONS AND PERFORMANCE

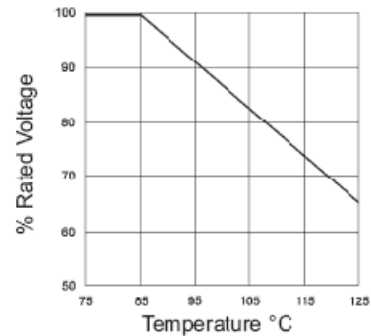
Data relates to an ambient temperature of +25° C

- **Operating temperature range** -55°C to +125°C
- 2/3 x Vr (linear derating) required for operation above +85°C.
- (linear derating) +40°C to 0.5 x Vr at +85°C and 0.2 x Vr at +125°C.
- **Capacitance** Nominal rated capacitance is measured at +25°C, 120 Hz source, free of harmonics with a maximum bias of 2.2V d.c. Capacitance decreases with increasing frequency and increases with increasing temperature.



- **Capacitance tolerances** E.I.A. standard  $\pm 20\%$  and  $\pm 10\%$ .  
Tolerance is the permissible variation of the actual value of capacitance from the rated value.
- **Stability**  $\frac{\Delta C}{C} \leq 12\%$  over the operating temperature range
- **Environmental Classification** 55/125/56 (IEC 68-2)

- **Working DC voltage range** - 4 to 50 WVDC  
Rated voltages are the maximum recommended peak DC operating voltages for continuous use from -55°C to +85°C. Operation above +85°C requires linear derating to 2/3 rated voltage at +125°C.



## GENERAL SPECIFICATIONS AND PERFORMANCE

- Reverse voltage** A small degree of reverse voltage is permissible for short periods. Limiting reverse voltage excursion to the maximum limits shown will avoid a reduction in the components life expectancy. The maximum allowable reverse voltage is summarized as follows:

25°C	10% of rated voltage nct exceeding 1.0 volt
85°C	3% of rated voltage nct exceeding 0.5 volt
125°C	1% of rated voltage nct exceeding 0.1 volt

The values quoted are not intended to cover continuous reverse operation. They are designed to cover exceptional conditions of small levels into reverse polarity.

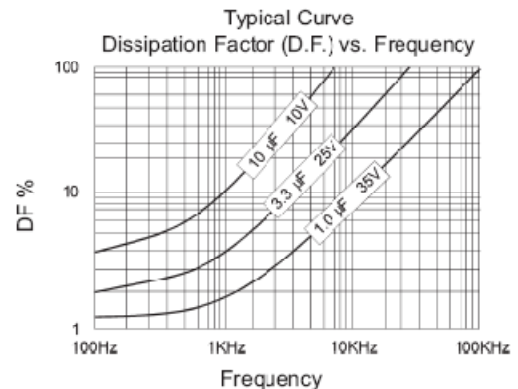
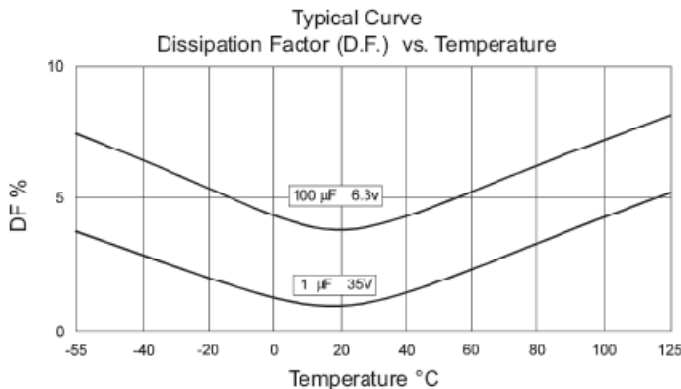
**Non-Polar operation** If higher reverse voltages are unavoidable, then two capacitors, each of twice the required capacitance and of equal tolerance and rated voltage, should be connected in a back-to-back configuration, i.e. both cathodes joined together.

- DC Leakage Current** The DC leakage current is the current that, after a three to five minute charging period, flows through a capacitor when voltage is applied. It is dependent upon the voltage applied, the time the voltage was applied and th ecomponent temperature. The leakage current increases with increasing temperature. The leakage current decreases when reduced voltages are applied. The DC leakage current is measured at +25°C with rated voltage applied, through a 1000 ohm resistor connected in series in the measuring circuit. Reforming of solid tantalum capacitors is unnecessary even after prolonged periods without the application of voltage.

@ 25°C	the DCL values are shown in part number tables
@ 85°C	the DCL should not exceed 10 times the value
@ 125°C	the DCL should not exceed 12 times the value

- Tan δ (at 120 Hz/25°C) (DF)**

Tangent of Loss Angle is a measurement of the energy loss in the capacitor. Terms also used are power factor, loss factor, quality factor, "Q" (the reciprocal of DF) and DF which is the measurement of Tan δ expressed as a percentage. Tan δ is the power loss of the capacitor divided by its reactive power at a sinusoidal voltage of a specified frequency. Measurement is carried out at +25°C and 120Hz with 2.2V DC bias max., with an a.c. voltage free of harmonics. The value of Tan δ is temperature and frequency dependent. DF increases with increasing frequency. DF loses its importance at higher frequencies where impedance and ESR are the normal parameters of concern.



Tan δ (DF) values are indicated in part number tables. The values shown in the part number tables are the limits met by the component after soldering onto the substrate.

$$\text{Tan } \delta (\text{DF}) = \frac{R}{X_c} = 2\pi fCR$$

$$\text{Tan } \delta (\text{DF}) = \text{Dissipation factor}$$

R = ESR (ohms)  
 $X_c$  = Capacitive reactance (ohms)  
 f = Frequency (Hertz)  
 C = Series capacitance (Farads)

## GENERAL SPECIFICATIONS AND PERFORMANCE

- **Life test** Capacitors are subjected to +85°C at rated voltage and +125°C at 2/3 x rated voltage for 2000 hours with 3 ohms circuit impedance. The capacitors must meet the following limits after stabilizing at 25°C.

capacitance change	within +/-10% of the initial value
Tan $\delta$ (DF)	within the initial value
DC leakage current	within 125% of the initial value

- **Humidity test** Capacitors are subjected to damp heat at steady state +40°C with 95% relative humidity. The capacitors must meet the following limits after stabilizing at 25°C.

capacitance change	within +/-5% of the initial value
Tan $\delta$ (DF)	within 125% of the initial value
DC leakage current	within 125% of the initial value

- **Thermal shock** Capacitors are subjected to 5 cycles of 30 minutes at -55°C followed by 30 minutes at +125°C. The capacitors must meet the following limits after stabilizing at 25°C.

capacitance change	within +/-5% of the initial value
Tan $\delta$ (DF)	within the initial value
DC leakage current	within the initial value

- **Surge Current** Capacitors shall withstand 3 consecutive cycles. The capacitors are charged approximately 4 seconds at rated voltage thru a low circuit resistance of approximately 1 ohm @ +25°C followed by a discharge to below 1% of rated voltage. Post test readings must meet the following criteria:

capacitance change	less than +/-5% of the initial value
Tan $\delta$ (DF)	within the initial limit
DC leakage current	within the initial limit

- **Surge Voltage** Surge voltages are performed at +25°C, +85°C and +125°C. Capacitors are subject to 1000 cycles of 1.3 x rated voltage for 30 seconds followed by a 30 second discharge period. After stabilizing at room temperature post test readings must meet the following criteria.

capacitance change	less than +/-5% of the initial value
Tan $\delta$ (DF)	within the initial limit
DC leakage current	within the initial limit

**Solderability** Meets the requirements of IEC 68 2.20 Test Ta and MIL-STD-202, Method 208.