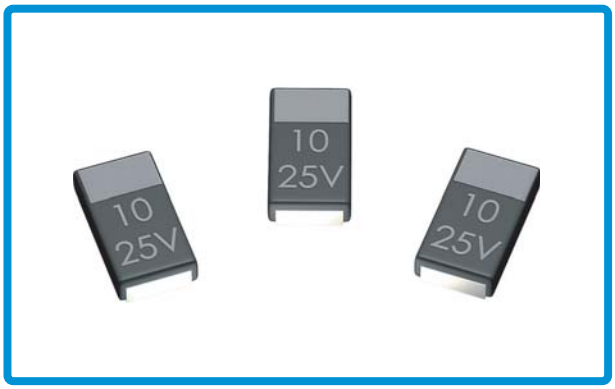
Tantalum Capacitors with Solid Electrolyte

RoHS

TC Series
Surface Mount Molded Chip

MERITEK

TC series is designed for hybrid circuit and low profile printed circuit board applications where inductance is to be minimized or where substrate space is at a premium. They can be attached to substrates or circuit boards by dip soldering, welding, re-flow soldering or other conventional methods. These units have the further advantage of being compatible with automatic assembly equipment minus the problems associated with flexible terminal lead wires.



SPECIFICATIONS

Capacitance	Range	0.1μF to 220μF						
	Tolerance	±20%(M), ±10%(K)						
Dissipation Factor (tan δ)	C ≤ 1.0μF	D.F≤ 4.0%						
	1.5uF ≤ C ≤ 6.8μF	D.F≤ 6.0%						
	10uF ≤ C ≤ 68μF	D.F≤ 8.0%						
	C ≥ 100μF	D.F≤ 10.0%						
Leakage Current		Between 0.01CV and 0.5μA, whichever is higher						
Rated Voltage(V_R)		4	6.3	10	16	20	25	35
Operating Voltage(V_O)	T≤ 85°C	4	6.3	10	16	20	25	35
	85 °C < T≤125 °C	2.5	4	6.3	10	13	16	22
Surge Voltage(V_S)	T≤ 85°C	5.2	8	13	20	25	32	44
	85 °C < T≤ 125 °C	3.2	5	8	13	16	20	28
Operating Temperature		-85°C to 125°C						

CAPACITANCE AND VOLTAGE RANGE

W.V / Cap(μF)		4	6.3	10	16	20	25	35
0.10	104							A
0.15	154							A
0.22	224							A
0.33	334						A	A
0.47	474					A	A	A,B
0.68	684				A	A	A,B	A,B
1.0	105			A	A	A,B	A,B	A,B
1.5	155			A	A,B	A,B	A,B	B,C
2.2	225	A	A	A,B	A,B	A,B	B,C	B,C
3.3	335	A	A ,B	A,B	A,B	A,B,C	B,C	B,C
4.7	475	A,B	A,B	A,B	A,B,C	B,C	B,C	C,D
6.8	685	A,B	A,B	A,B,C	B,C	B,C	C,D	C,D
10	106	A,B	A,B,C	A,B,C	A,B,C	B,C,D	C,D	D
15	156	A,B,C	B,C	B,C	B,C,D	C,D	C,D	D
22	226	A,B,C	B,C	B,C,D	C,D	C,D	D	
33	336	B,C	B,C,D	C,D	C,D	D		
47	476	B,C,D	B,C,D	C,D	D	D		
68	686	C,D	C,D	C,D	D			
100	107	C,D	C,D	D				
150	157	D	D	D				
220	227	D	D					
330	337	D	D					

Load Life: 2000 hrs +85°C (+185°F) and rated voltage
Capacitance change max :Within +10% of initial value
Dissipation Factor :Within values specified above
Leakage Current :Within values specified above

Shelf Life: After 2000 hrs no application of the rated working voltage at 85 °C capacitor shall meet the requirements of above "Load Life".

Temperature Characteristic
-55°C **C** : Within +0, -10% of initial value
tan : C 1.0μF within 6%
1.5 ≤ C ≤ 68μF within 8%

+85°C **C** : Within +10, -0% of initial value
tan : Within values specified above
I : Within 10 times of specified above

+125°C **C** : Within +15, -0% of initial value
tan : Within values specified above
I : Within 12.5 times of specified above

Humidity Test: at 40°C, 90-95% humidity, 500 hrs no voltage
C : Within +5% of initial value
tan : **Within values specified above**
I : Within values specified above

Failure Rate : 1 % / 1000hrs

Surge Voltage Test: at 85°C
C : Within +5% of initial value
tan : **Within values specified above**
I : Within values specified above

Resistance to Soldering Heat
(Solder reflow 260°C, 10 sec or solder dip 260°C, 5 sec)
C : Within +5% of initial value
tan : **Within values specified above**
I : Within values specified above

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PART NUMBER SYSTEM

TC | 105 | M | 35 | B

Meritek Series

Capacitance

CODE	473 ~ 683	105 ~ 685	106 ~ 227
μF	0.047~0.068	1.0 ~ 6.8	10 ~ 220

Tolerance

CODE	M	K
	±20%	±10%

Rated Voltage

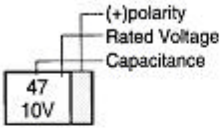
CODE	04	06	10	16	20	25	35
	4	6.3	10	16	20	25	35

Size

CODE	A	B	C	D
	3216	3528	6032	7343

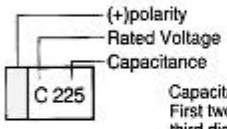
Marking

1. General Marking



ex) 10V - 47μF

2. Symbol Marking

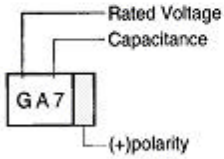


ex) 16V - 2.2μF

· Rated Voltage Code

Voltage	4	6.3	10	16	20	25	35
Code	G	J	A	C	D	E	V

Capacitance Symbol
First two digits represent capacitance and the third digit specifies the number of zeros to follow.
Capacitance unit is pF.



ex) 4V - 10μF

· Capacitance Symbol

Capacitance	Code
0.47	S5
0.68	W5
1.0	A6
1.5	E6
2.2	J6
3.3	N6
4.7	S6
6.8	W6
10	A7
15	E7
22	J7
33	N7

Allowed Ripple Voltage

Cap(μF) \ W.V		4	6.3	10	16	20	25	35
0.10	104							3.5
0.15	154							3.5
0.22	224							3.5
0.33	334					3.5	3.5	3.5
0.47	474					3.5	3.5	3.5
0.68	684				3.5	3.5	3.5	3.5
1.0	105			3.5	3.5	3.5	3.5	3.5
1.5	156		3.2	3.2	3.2	3.2	3.2	3.2
2.2	226	2.9	2.9	2.9	2.9	2.9	2.9	2.9
3.3	335	2.6	2.6	2.6	2.6	2.6	2.6	2.6
4.7	475	2.4	2.4	2.4	2.4	2.4	2.4	2.4
6.8	685	2.1	2.1	2.1	2.1	2.1	2.1	2.1
10	106	1.9	1.9	1.9	1.9	1.9	1.9	
15	156	1.7	1.7	1.7	1.7	1.7		
22	226	1.5	1.5	1.5	1.5			
33	336	1.4	1.4	1.4				
47	476	1.3	1.3					
68	686	1.1						
100	107	1.0						

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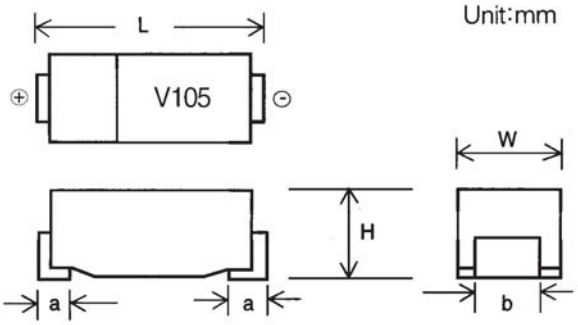
CASE SIZE AND DIMENSIONS

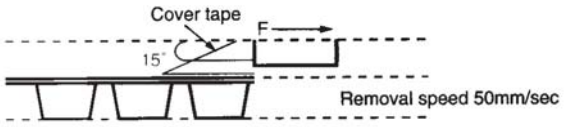


TC series

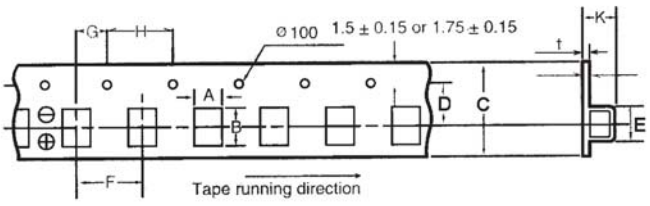
Size	Code	L1	L2	W	H	a	b
A	A	$3.2^{+0.2}_{-0.1}$	2.9± 0.1	1.6± 0.2	1.7± 0.2	0.8± 0.3	1.2± 0.2
B	T	3.5± 0.3	3.2± 0.1	2.8± 0.3	1.9± 0.3	0.8± 0.3	2.2± 0.2
C	C	6.0± 0.3	5.8± 0.1	3.2± 0.3	2.5± 0.3	1.3± 0.3	2.2± 0.2
D	D	7.3± 0.3	7.1± 0.1	4.3± 0.3	2.8± 0.3	1.3± 0.3	2.4± 0.2

REEL DIMENSION AND PACKING

The chip tantalum capacitors supplied in carrier tape for easy uses.
Tape : Semitransparent embossed plastic
Cover tape : Attached for heating press, polyester
The tension of removing cover tape F=50g ± 20g



Carrier tape



Taping standard : R TYPE

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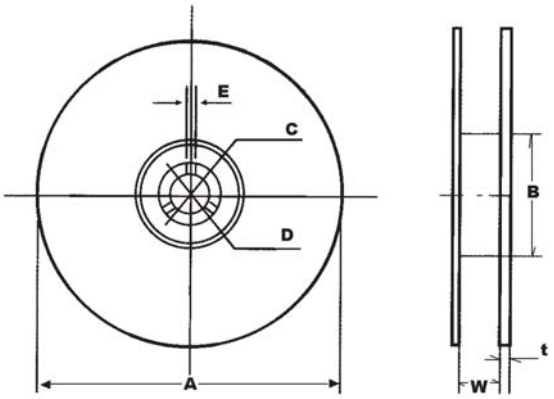
REEL DIMENSION AND PACKAGING

	Size A	Size B	Size C	Size D
A	1.82±0.1	2.95±0.1	3.69±0.1	4.8±0.1
B	3.42±0.1	5.03±0.1	6.49±0.1	7.79±0.1
C	8.0±0.3	12.0±0.3	12.0±0.3	12.0±0.3
D	3.5±0.05	5.50±0.05	5.50±0.05	5.5±0.05
E	4.7 max	6.2 max	7.3 max	8.4 max
F	4.0±0.1	4.0±0.1	8.0±0.1	8.0±0.1
G		2.0±0.05		
H		4.0±0.1		
∅J		1.5±0.1,-0.0		
t	0.23±0.02	0.23±0.02	0.28±0.02	0.28±0.2
K	1.92±0.1	2.1±0.2	2.75±0.2	3.0±0.2
Carrier Tape		Embossed		
Cover Tape		Polyester		



A	B	C
ϕ178±2.0	ϕ50mm	13.0±0.5
D	**W**	**t**
21.0±0.8	10.0±1.5(C:8.0) 14.0±1.5(C:12.0)	2.0±0.5

Quantities Per Packaged Reel

Series	Size	Reel	Inner box	Outer box
TC	A	2,000	5 Reel	50Reel
	B	2,000	5 Reel	50 Reel
	C	500	4 Reel	40 Reel
	D	500	4 Reel	40 Reel

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1. Construction

The Tantalum Capacitor is a polar electrolytic capacitor. The anode is a porous body of sintered tantalum powder. A layer of tantalum pent oxide is formed over the whole sintered anode surface by an electrolytic oxidation process. This oxide layer, which has a high dielectric constant (ε=23), functions as the dielectric medium of the capacitor. The final thickness of the layer determines the rated working voltage of the capacitor. Manganese dioxide, a solid semi-conducting electrolyte, is deposited in the porosity and on the external surface of the formed anode to serve as the cathode. Electrical connection to the cathode is effected by applying a metallic coating on the $Mn0_2$ layer. As a result of the high stability of the oxide layer the leakage current of the capacitor is very small, even after prolonged storage. The use of the solid semi-conducting electrolyte guarantees high stability of the electrical properties over long periods of time and over a wide range of temperatures and frequency.

2. Properties and Operational Attention

Surge voltage(Vs)

This is the highest voltage that may be applied to a capacitor for short periods of time. The surge voltage may be applied up to 10 times in an hour for periods of up to 30s at a time. The surge voltage must not be used as a parameter in the design of circuits in which, in the normal course of operation, the capacitor is periodically charged and discharged.

Superimposed AC voltage (VRMS)

This is the maximum r.m.s. Alternating voltage superimposed on a DC voltage, that may be applied to a capacitor. The sum of the DC voltage and the surge value of the superimposed AC voltage must not exceed the maximum continuous voltage.

Reverse polarity voltage

The peak reverse polarity voltage applied to the capacitor must not exceed:

At +20°C (+68°F) 10% of Rated Voltage
At +85°C (+185°F) 5% of Rated Voltage
or 1 V, whichever is greater.

If higher voltages of reverse polarity occur, then two capacitors with the same nominal capacitance and rated voltage should be connected in series in such a way as to form a non-polar combination. When DC voltage are switched, measures must be taken to ensure that the reverse polarized capacitor is not overloaded. This is necessary in order to avoid a reduction in its life expectancy.

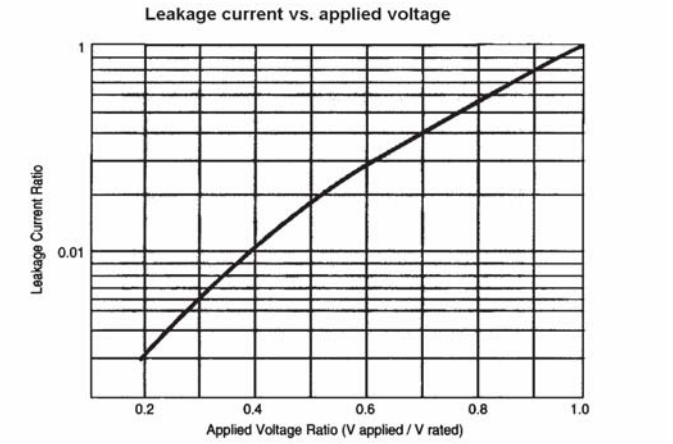
Switching operation - low impedance circuits

Low impedance circuits are defined as those having resistance in series with the capacitor measuring less than 3 ohms/volt of rated DC voltage. Such circuits can subject the capacitor to surge currents during switching operations. The effect of surge currents is to cause rapid overheating in the capacitor leading to failure through excessive leakage current of short circuit. Dependent upon available power, the short circuit failure mode can lead to ignition or burning of the capacitor. Care must be taken therefore to limit charging or discharging currents to 300mAmps maximum. Where in-series resistance is not possible due to application limitations, the rated capacitor working voltage should be derated by a minimum of the half. See figures on opposite page.

Leakage current(I)

The leakage current is measured +20°C (+68°F) with the rated voltage applied. A protective resistance of 1000Ω is connected in a series with the capacitor in the measuring circuit. Five minutes after application of the rated voltage the leakage current must not exceed the maximum values, indicated in the data.

Reforming is unnecessary even after prolonged periods without application of voltage.



Protection resistance:

The failure rate of a tantalum capacitor depends on internal resistance of the applied voltage supply. It is recommended that the internal resistance must be equal or greater than 3M. The capacitors reliability decreases for the smallest ratio (see curve). If the applied voltage is smaller than 50% of rated voltage (VR), the protection resistance can be eliminated.

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3. Operational Reliability

Continuous life testing of DEC solid tantalum capacitors is carried out at various temperatures from -55*C to +1 25'C and with application of various proportions of rated voltages. These tests are carried out for three reasons:

1. 2,000 hr. tests carried out as part of our regular Quality Assurance program.
2. 10,000-hr continuation tests to obtain reliability data.
3. Other test under derated conditions to obtain supplementary information to 1 and 2.

These data are kept under continuous review by means of an attribute analysis. In addition of the results obtained to data is given below and this is being continuously updated and augmented. It will however, be appreciated that a substantial amount of data is necessary before a complete picture can be built up of the variations of failure rate with case size and voltage rating.

Results to data indicate the mean failure rate at 60% confidence varies from approximately 0.2 percent/1,000 hrs. for capacitors tested at 700C 314 rated volts to approximately 0.7 percent/1,000 hrs, when tested at 125*C at 3/4 rated voltage.

These figures are total failure rates and include parametric and catastrophic failure : the former being the majority. (A parametric failures is any capacitor where on parameter exceeds the QA. test limits.)

These results are obtained in circuits of impedance of < 3 ohms and under these conditions the higher voltage ratings have higher failure rates than the lower voltage ratings. It would be expected that in circuits of constant ohms per volt this difference would be eliminated. Figures for particular cases can be provided. Failure rate at the 60% confidence level is based on the upper one-sided failure rate for the exponential failure distribution, 60% being chosen as the most representative true reliability figure related to sampling procedure.

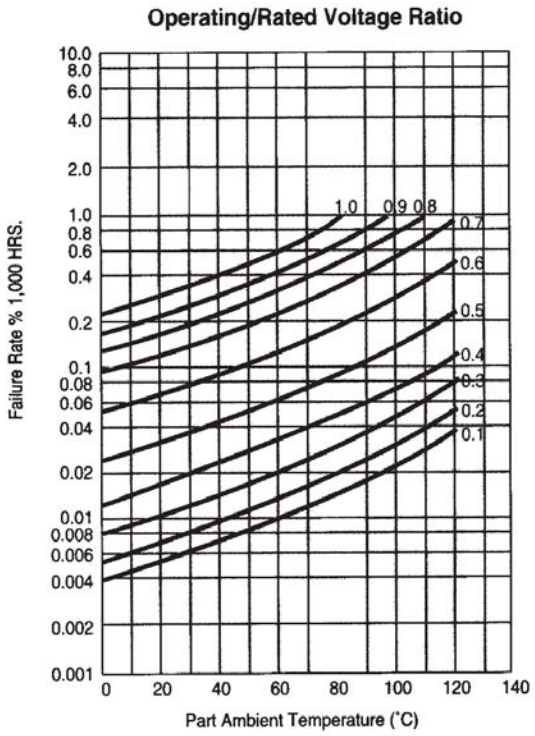
Analyses based on the Weibull distribution have shown that failure rate decreases with time.

Effect of surges

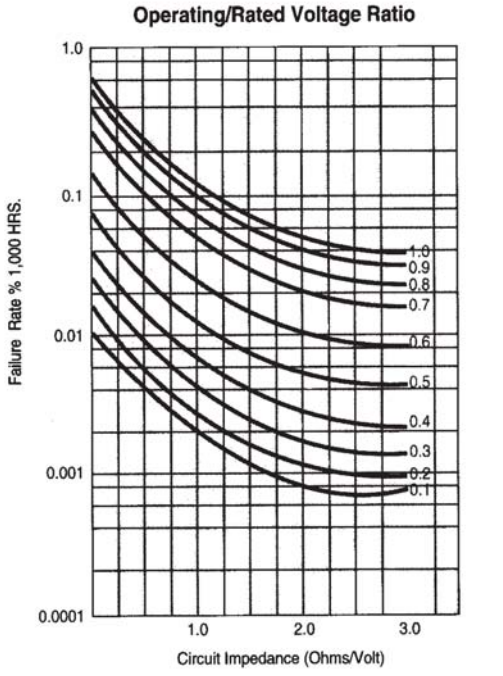
The solid tantalum capacitor has a limited ability to withstand surges (15% to 30% of rated voltage). This is in common with all electrolytic capacitors and is due to the fact that these operate at electrolytic capacitors and is due to the fact that these operate at very high electrical stress within the oxide layer. In the case of "solid" electrolytic capacitors this is further complicated by the limited selfhealing ability of the manganese dioxide semiconductor.

It is important to ensure that the voltage across the terminals of the capacitor does not exceed the surge voltage rating at any time. This is particularly so in low impedance circuits where the capacitor is likely to be subjected to the full impact of surges especially in even a slightly inductive circuit. Even an extremely short duration spike is likely to cause damage.

Effect of temperature and voltage derating on failure rate at 0.1Ω/volt.



Effect of circuit impedance and voltage on failure rate at 60 °C.



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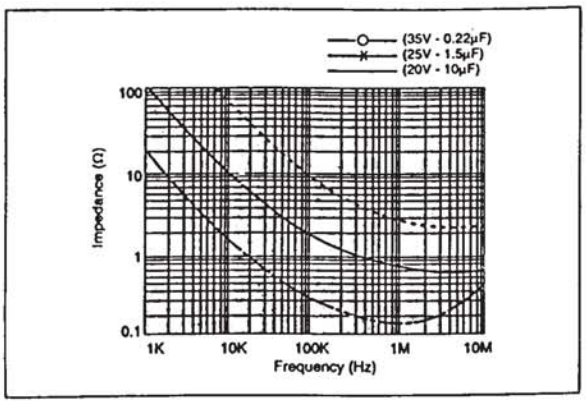
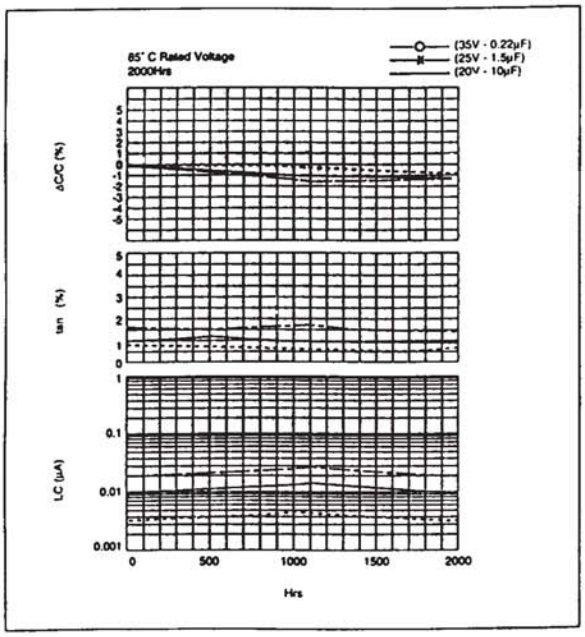
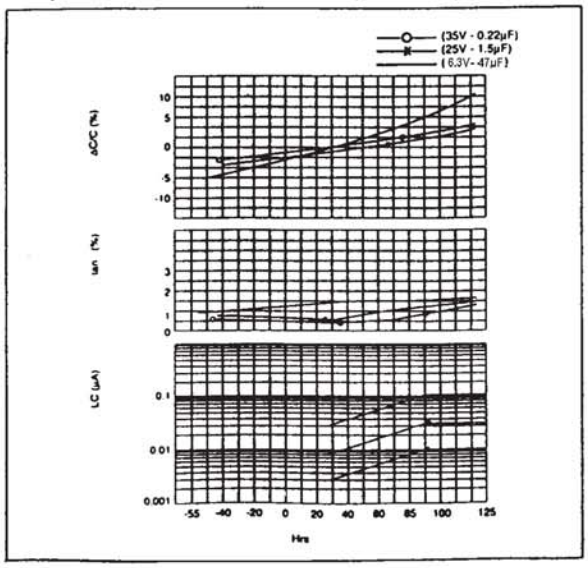


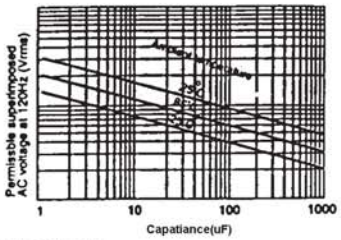
Load Life Characteristic Curves(TC Series)



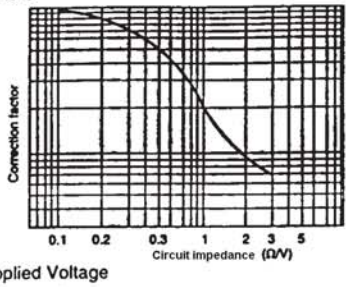
Temperature Characteristic Curves (TC Series)



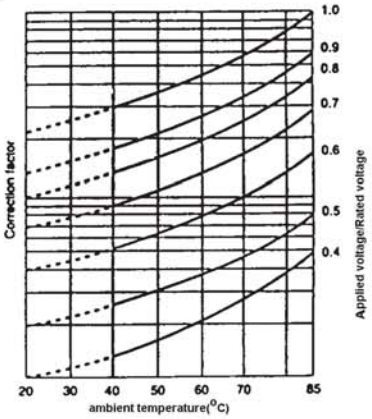
Frequency Dependence of the Permissible Superimposed AC Voltage



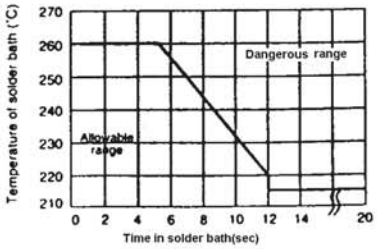
Effect of Circuit Impedance on the Failure Rate



Effect of the Applied Voltage and Ambient Temperature on the Failure Rate



Immersion Method



Reflow Method