

Type AFC, -55°C to 105°C

SMT Aluminum Electrolytic Capacitors - Low Impedance, 105°C

Low Impedance and Long-Life for Filtering, Bypassing, Power Supply Decoupling



Type AFC Capacitors are the choice for high-frequency filtering. At 100 kHz, most ratings can handle more than twice the ripple current of type AHA. With solid performance at temperatures down to -55°C, Type AFC has more than 90% capacitance retention at -20°C and 1 kHz. With low impedance to beyond 100 kHz, it is ideal for higher power DC/DC converters. The vertical cylindrical cases make for easy automatic mounting and reflow soldering, and offer big savings and higher capacitance compared to tantalum capacitors.

Highlights

- ◆ +105°C, Up to 1000 Hour Load Life
- ◆ Capacitance Range: 1 µF to 1500 µF
- ◆ Voltage Range: 6.3 Vdc to 50 Vdc

Specifications

Operating Temperature:	-55°C to +105°C
Rated Voltage:	6.3, 10, 16, 25 & 50 Vdc
Capacitance:	1.0 µF to 1500 µF
Capacitance Tolerance:	±20% @ 120 Hz and +20°C
Leakage Current:	0.01 CV or 3 µA @ +20°C, after two minutes (whichever is greater)
Ripple Current Multiplier:	Frequency

50/60 Hz	120 Hz	1 kHz	10 kHz	100 kHz
0.7	0.75	0.9	0.95	1.0

Dissipation Factor: See Ratings Table

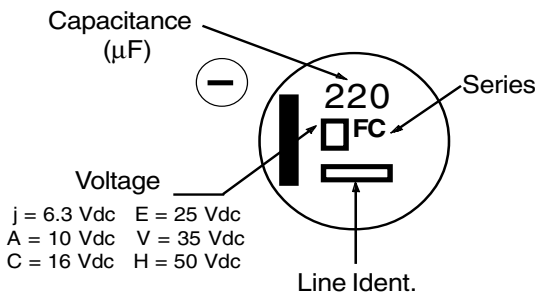
Load Life: 1000 h @ +105°C

Δ Capacitance ± 20%
DF: ≤200% of limit
DCL: ≤100% of limit

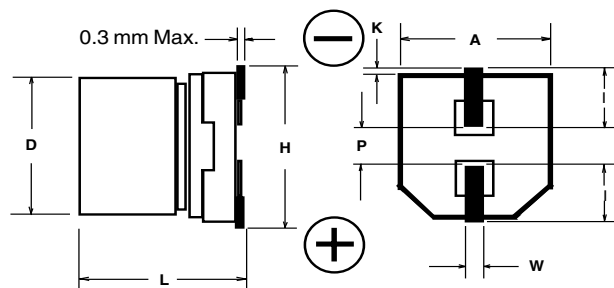
Shelf Life: 1000 h @ +105°C

Δ Capacitance ± 20%
DF: ≤200% of limit
DCL: ≤100% of limit

AFC Series Marking



Outline Drawing



Case Dimensions

Case Code	D ± 0.5	L	A ± 0.2	H (max)	I (ref)	W	P (ref)	K
B	4.0	5.4 +.1,-.2	4.3	5.5	1.8	0.65 ± 0.1	1.0	0.35 + 0.15/-0.20
C	5.0	5.4 +.1,-.2	5.3	6.5	2.2	0.65 ± 0.1	1.5	0.35 + 0.15/-0.20
D	6.3	5.4 +.1,-.2	6.6	7.8	2.4	0.65 ± 0.1	1.8	0.35 + 0.15/-0.20
E	8.0	6.2 ± 3	8.3	9.5	3.4	0.65 ± 0.1	2.2	0.35 + 0.15/-0.20
F	8.0	10.2 ± 3	8.3	10	3.4	0.90 ± 0.2	3.2	0.70 ± 0.20
G	10.0	10.2 ± 3	10.3	12	3.5	0.90 ± 0.2	4.6	0.70 ± 0.20

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Your Source For Capacitor Solutions

Type AFC, -55°C to 105°C

SMT Aluminum Electrolytic Capacitors - Low Impedance, 105°C

Ratings Table

Cap μF	Catalog Number	Max. DCL (μA/2 min)	Max. Dissipation Factor @ 120 Hz 20 °C	Max. ESR @ 120 Hz 20 °C (Ω)	Impedance @ 100 kHz 20 °C (Ω)	Max. Ripple Current @ 105°C 100 kHz (mA)	Case Code	Size (mm) D x L	Quantity per Reel
6.3 Vdc (8 Vdc Surge)									
22	AFC226M06B12T	3.0	0.26	19.6	3.0	60	B	4x5.4	2000
47	AFC476M06C12T	3.0	0.26	9.2	1.8	95	C	5x5.4	1000
100	AFC107M06D16T	6.3	0.26	4.3	1.0	140	D	6.3x5.4	1000
220	AFC227M06E16T	13.9	0.26	2.0	0.4	230	E	8x6.2	1000
330	AFC337M06F24T	20.8	0.26	1.3	0.3	450	F	8x10.2	500
1000	AFC108M06G24T	63.0	0.26	0.43	0.15	670	G	10x10.2	500
1500	AFC158M06G24T	94.5	0.26	0.29	0.15	670	G	10x10.2	500
10 Vdc (13 Vdc Surge)									
33	AFC336M10C12T	3.3	0.19	9.6	1.8	95	C	5x5.4	1000
100	AFC107M10E16T	10.0	0.19	3.2	0.4	230	E	8x6.2	1000
150	AFC157M10E16T	15.0	0.19	2.1	0.4	230	E	8x6.2	1000
220	AFC227M10F24T	22.0	0.19	1.4	0.3	450	F	8x10.2	500
470	AFC477M10G24T	47.0	0.19	0.67	0.15	670	G	10x10.2	500
1000	AFC108M10G24T	100.0	0.22	0.36	0.15	670	G	10x10.2	500
16 Vdc (20 Vdc Surge)									
10	AFC106M16B12T	3.0	0.16	26.5	3.0	60	B	4x5.4	2000
22	AFC226M16C12T	3.5	0.16	12.1	1.8	95	C	5x5.4	1000
47	AFC476M16D16T	7.5	0.16	5.7	1.0	140	D	6.3x5.4	1000
68	AFC686M16E16T	10.9	0.16	3.9	0.4	230	E	8x6.2	1000
100	AFC107M16E16T	16.0	0.16	2.7	0.4	230	E	8x6.2	1000
220	AFC227M16G24T	35.2	0.16	1.2	0.15	670	G	10x10.2	500
330	AFC337M16G24T	52.8	0.16	0.8	0.15	670	G	10x10.2	500
470	AFC477M16G24T	75.2	0.16	0.6	0.15	670	G	10x10.2	500
680	AFC687M16G24T	108.8	0.16	0.4	0.15	670	G	10x10.2	500
25 Vdc (31 Vdc Surge)									
6.8	AFC685M25B12T	3.0	0.14	34.1	3.0	60	B	4x5.4	2000
22	AFC226M25D16T	5.5	0.14	10.6	1.0	140	D	6.3x5.4	1000
33	AFC336M25D16T	8.3	0.14	7.0	1.0	140	D	6.3x5.4	1000
47	AFC476M25E16T	11.8	0.14	4.9	0.4	230	E	8x6.2	1000
68	AFC686M25F24T	17.0	0.14	3.4	0.3	450	F	8x10.2	500
100	AFC107M25F24T	25.0	0.14	2.3	0.3	450	F	8x10.2	500
220	AFC227M25G24T	55.0	0.14	1.1	0.15	670	G	10x10.2	500
330	AFC337M25G24T	82.5	0.14	0.7	0.15	670	G	10x10.2	500
470	AFC477M25G24T	117.5	0.14	0.5	0.15	670	G	10x10.2	500
35 Vdc (44 Vdc Surge)									
1	AFC105M35B12T	3.0	0.12	199	3.0	60	B	4x5.4	2000
2.2	AFC225M35B12T	3.0	0.12	90.4	3.0	60	B	4x5.4	2000
3.3	AFC335M35B12T	3.0	0.12	60.3	3.0	60	B	4x5.4	2000
4.7	AFC475M35B12T	3.0	0.12	42.4	3.0	60	B	4x5.4	2000
6.8	AFC685M35C12T	3.0	0.12	29.3	1.8	95	C	5x5.4	1000
10	AFC106M35C12T	3.5	0.12	19.9	1.8	95	C	5x5.4	1000
22	AFC226M35D16T	7.7	0.12	9.1	1.0	140	D	6.3x5.4	1000
33	AFC336M35E16T	11.6	0.12	6.0	0.4	230	E	8x6.2	1000
47	AFC476M35E16T	16.5	0.12	4.2	0.4	230	E	8x6.2	1000
100	AFC107M35G24T	35.0	0.12	2.0	0.2	670	G	10x10.2	500
220	AFC227M35G24T	77.0	0.12	0.9	0.15	670	G	10x10.2	500
330	AFC337M35G24T	115.5	0.12	0.6	0.15	670	G	10x10.2	500
50 Vdc (63 vdc Surge)									
1	AFC105M50B12T	3.0	0.12	199	5.0	30	B	4x5.4	2000
2.2	AFC225M50B12T	3.0	0.12	90.5	5.0	30	B	4x5.4	2000
3.3	AFC335M50B12T	3.0	0.12	60.3	5.0	30	B	4x5.4	2000
4.7	AFC475M50C12T	3.0	0.12	42.4	3.0	50	C	5x5.4	1000
10	AFC106M50D16T	5.0	0.12	19.9	2.0	70	D	6.3x5.4	1000
22	AFC226M50E16T	11.0	0.12	9.1	0.7	120	E	8x6.2	1000
33	AFC336M50F24T	16.5	0.12	6.0	0.6	300	F	8x10.2	500
47	AFC476M50G24T	23.5	0.12	4.2	0.3	500	G	10x10.2	500
100	AFC107M50G24T	50.0	0.12	2.0	0.3	500	G	10x10.2	500
220	AFC227M50G24T	110.0	0.12	0.9	0.3	500	G	10x10.2	500

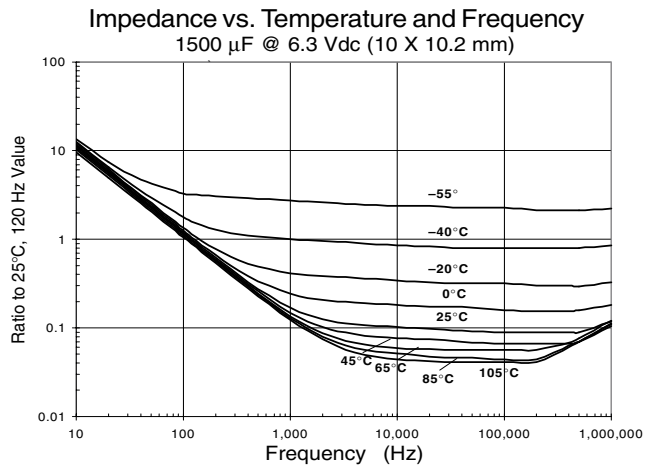
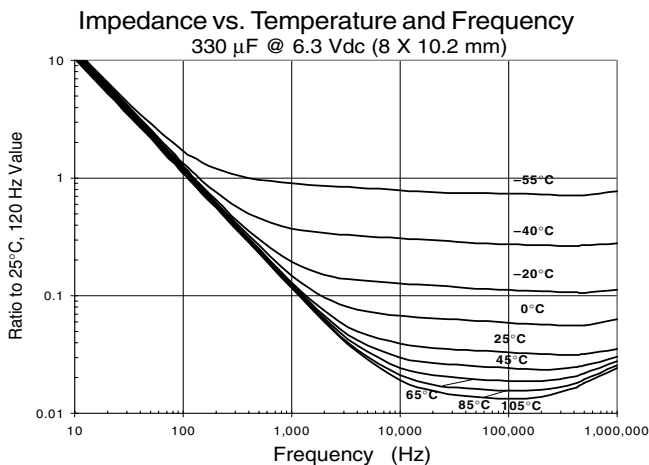
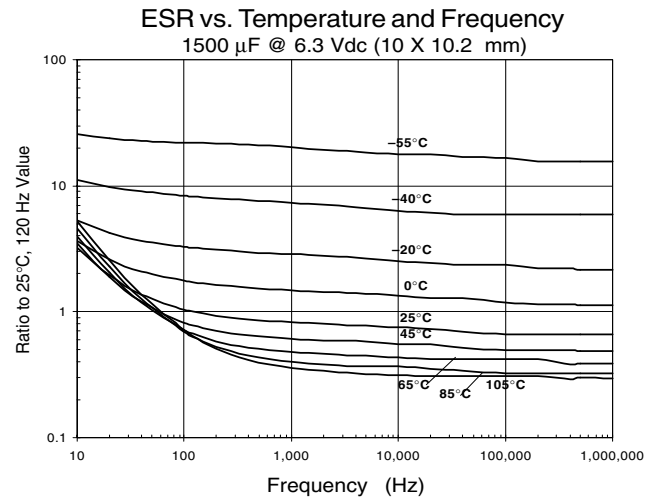
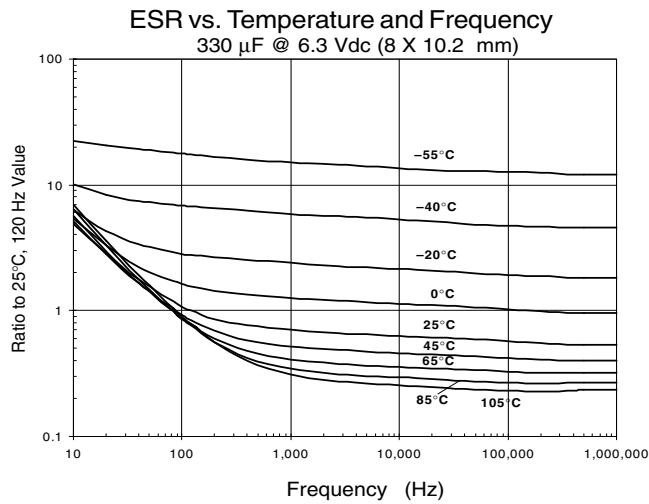
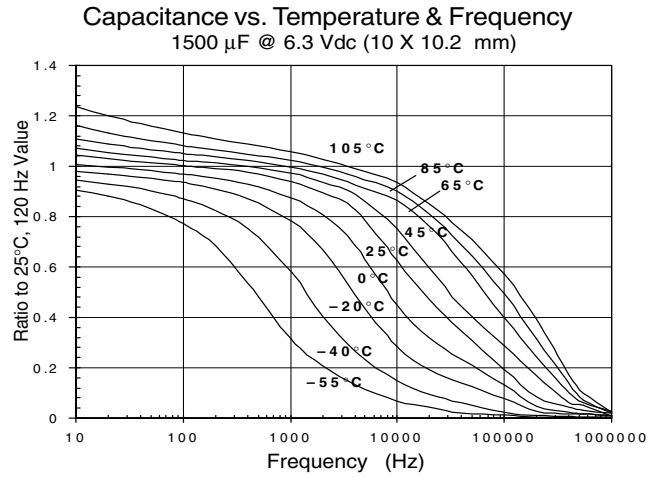
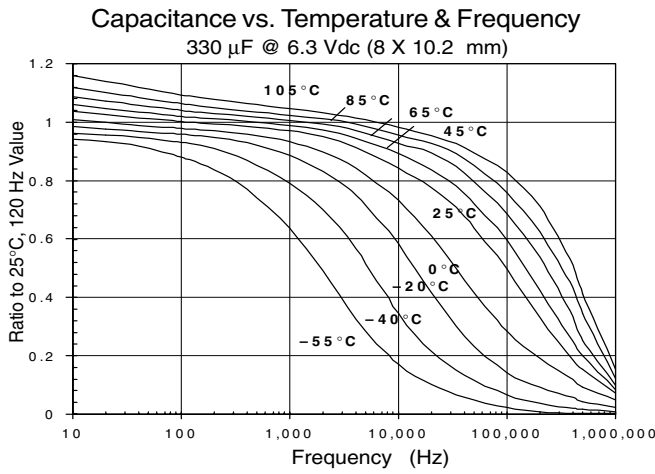
Part Numbering System

AFC Type	106 Capacitance	M Capacitance Tolerance	16 Voltage	B Case Code	12T Packaging Information
	105 = 1.0 μF 106 = 10 μF 107 = 100 μF 108 = 1000 μF	M = ±20%	10 = 10 Vdc 35 = 35 Vdc 16 = 16 Vdc 50 = 50 Vdc 25 = 25 Vdc		12 = Carrier Tape Width (mm) T = Tape & Reel B = Bulk

Type AFC, -55°C to 105°C

SMT Aluminum Electrolytic Capacitors - Low Impedance, 105°C

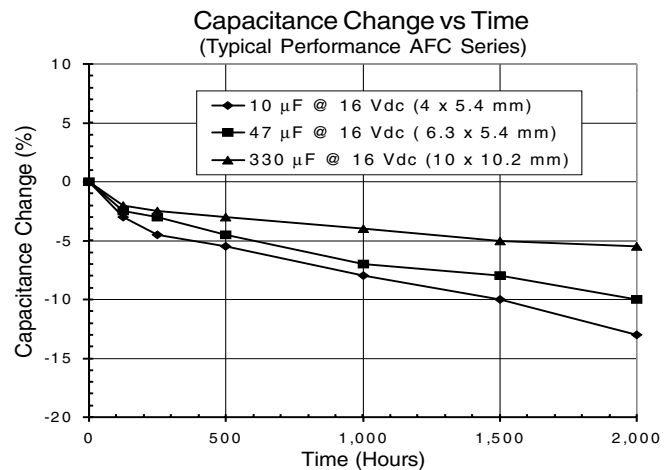
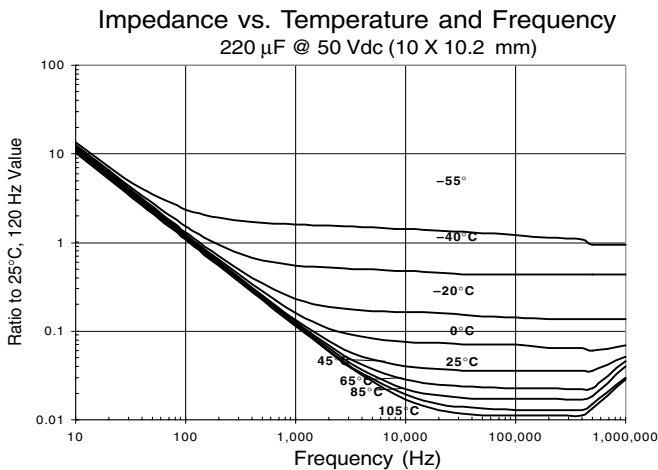
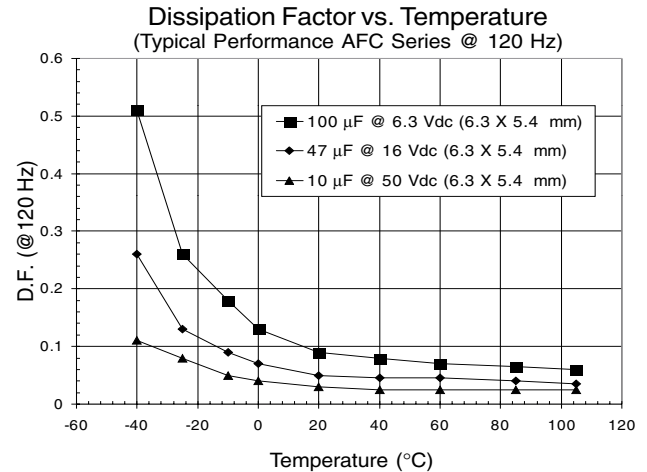
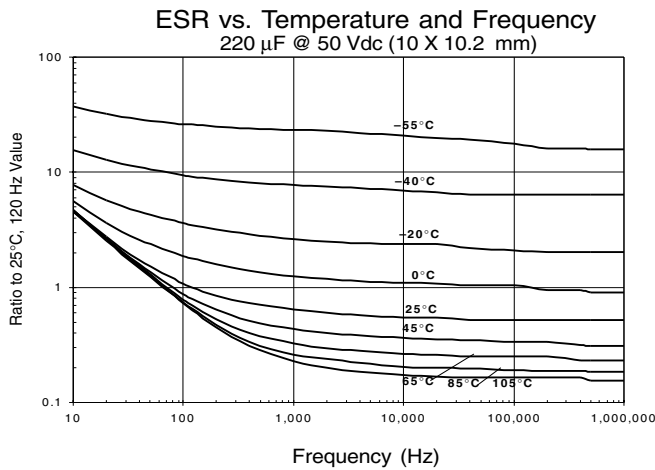
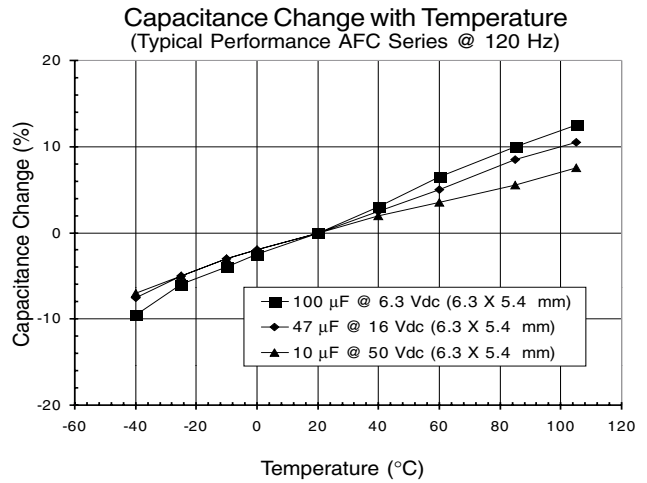
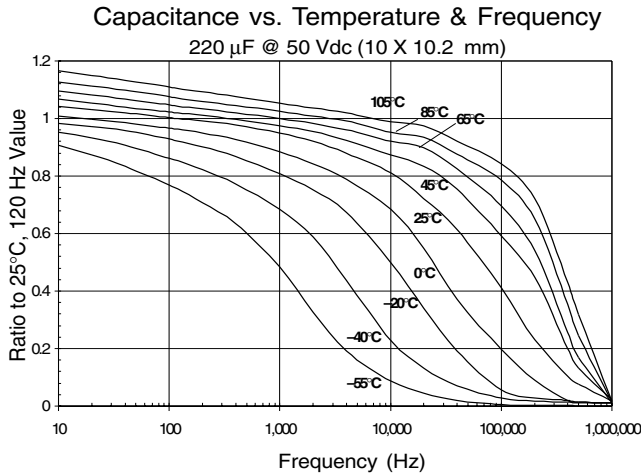
Typical Performance Curves



Type AFC

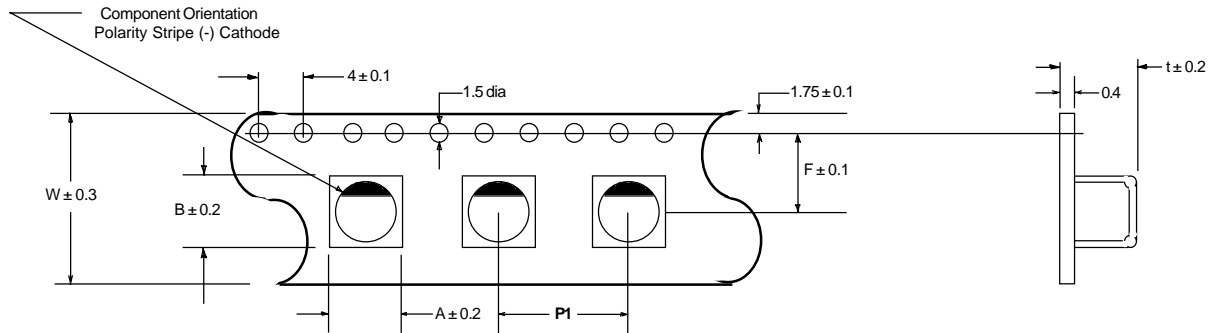
SMT Aluminum Electrolytic Capacitors - Low Impedance, 105°C

Typical Performance Curves



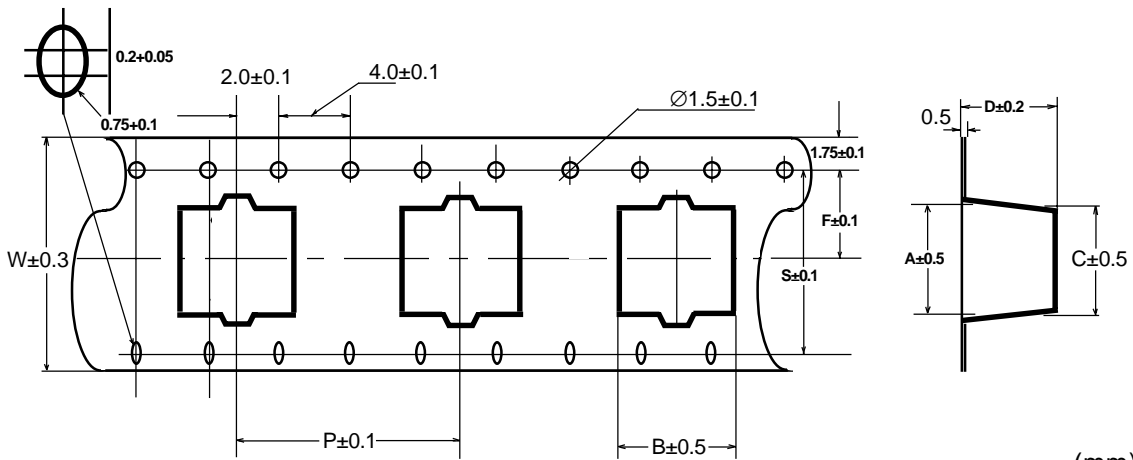
AVS, AHA, AFC, AFK, AHD, AEB Tape and Reel Specifications

Tape Specifications



(mm)

Case Code	W	A	B	P1	F	t
A	12.0	3.4	3.5	8.0	5.5	5.8
B	12.0	4.7	4.6	8.0	5.5	5.8
C	12.0	6.0	6.0	12.0	5.5	5.8
D	16.0	7.0	7.0	12.0	7.5	5.8
X	16.0	7.0	7.0	12.0	7.5	8.4
E	16.0	8.7	8.7	12.0	7.5	6.8
F	24.0	8.7	8.7	16.0	11.5	11.0
G	24.0	10.7	10.7	16.0	11.5	11.0

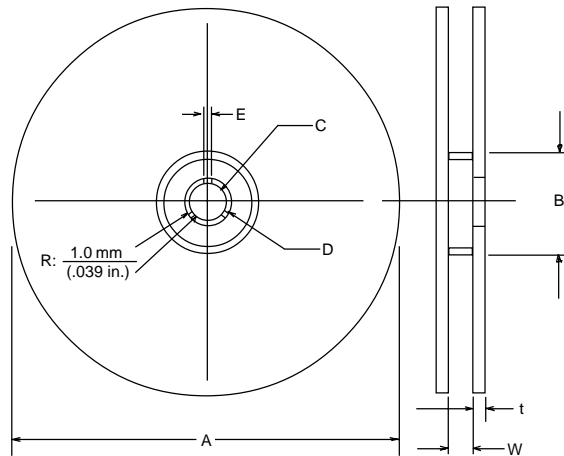


(mm)

Case Code	W	A	B	C	D	F	P	S
J	32.0	10.7	10.7	14.5	14.5	14.2	20.0	28.4
K	32.0	10.7	10.7	14.5	18.5	14.2	20.0	28.4
H	32.0	14.0	14.0	18.0	14.5	14.2	24.0	28.4
L	32.0	14.0	14.0	18.0	17.5	14.2	24.0	28.4
P	44.0	17.5	17.5	23.0	17.5	20.2	28.0	40.4
R	44.0	19.5	19.5	26.0	17.5	20.2	32.0	40.4
S	44.0	19.5	19.5	26.0	22.5	20.2	32.0	40.4
U	44	17.5	17.5	23	22.5	20.2	28	40.4

AVS, AHA, AFC, AFK, AHD, AEB Tape and Reel Specifications

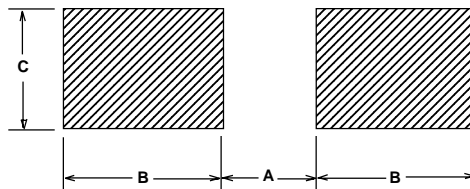
Reel Specifications



(mm)

Case Code	A	B	C	D	E	W	t
A, B size	380±2	50 min	13.0±0.5	21.0±0.8	2.0±0.5	14±1	3.0
C, D, E, X size	380±2	50 min	13.0±0.5	21.0±0.8	2.0±0.5	18±1	3.0
F, G size	380±2	50 min	13.0±0.5	21.0±0.8	2.0±0.5	26±1	3.0
J, K, H, L size	330±2	50 min	13.0±0.5	21.0±0.8	2.0±0.5	34±1	3.0
P, R, S, U size	330±2	50 min	13.0±0.5	21.0±0.8	2.0±0.5	46±1	3.0

Land Pattern:

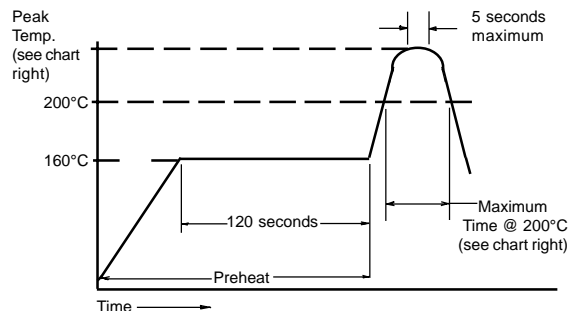


(mm)

Case Code	A	B	C
A	0.6	2.2	1.5
B	1.0	2.5	1.6
C	1.5	2.8	1.6
D	2.2	3.0	1.6
E	2.2	4.5	1.6
F	3.2	4.0	2.0
G	4.6	4.3	2.0
J, K	4	4.5	2.0
H	4.0	5.7	2.0
L	4.0	5.7	2.0
P	6.0	6.5	2.5
R, U	6.0	6.5	2.5
S	6.0	7.5	2.5

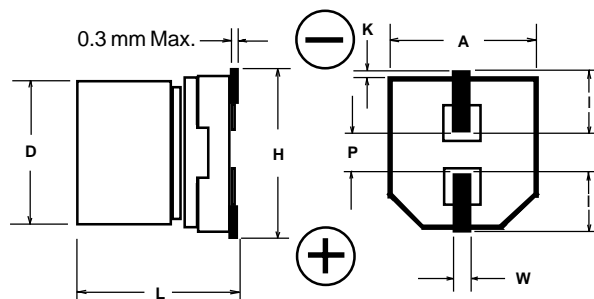
AVS, AHA, AFC, AFK, AHD, AEB Reflow Solder & Case Dimensions

Reflow Soldering Temperature Profile:



Case Code	Peak Temp (°C)	Max. Time @ 200°C (Sec.)
A, B, C, D, X	240	40
E, F, G, H J, K, L, P R, S, U	230	30

Outline Drawing



Case Dimensions

(mm)

Case Code	D ± 0.5	L	A ± 0.2	H (max)	I (ref)	W	P (ref)	K
A	3.0	5.4 +.1,-.2	3.3	4.5	1.5	0.55 ± 0.1	0.6	0.35 + 0.15/-0.20
B	4.0	5.4 +.1,-.2	4.3	5.5	1.8	0.65 ± 0.1	1.0	0.35 + 0.15/-0.20
C	5.0	5.4 +.1,-.2	5.3	6.5	2.2	0.65 ± 0.1	1.5	0.35 + 0.15/-0.20
D	6.3	5.4 +.1,-.2	6.6	7.8	2.4	0.65 ± 0.1	1.8	0.35 + 0.15/-0.20
X	6.3	7.9 ±.3	6.6	7.8	2.6	0.65 ± 0.1	1.8	0.35 + 0.15/-0.20
E	8.0	6.2 ±.3	8.3	9.5	3.4	0.65 ± 0.1	2.2	0.35 + 0.15/-0.20
F	8.0	10.2 ±.3	8.3	10	3.4	0.90 ± 0.2	3.2	0.70 ± 0.20
G	10.0	10.2 ±.3	10.3	12	3.5	0.90 ± 0.2	4.6	0.70 ± 0.20
H	12.5	13.5 ±.5	13.5	15	4.7	0.9 ± 0.3	4.4	0.70 ± 0.30
J	10	13.5	10.3	12	3.5	0.9 ± 0.2	4.6	0.70 ± 0.20
K	10	17.5	10.3	12	3.5	0.9 ± 0.2	4.6	0.70 ± 0.20
L	12.5	16.5 ±.5	13.5	15.0	4.7	0.9 ± 0.3	4.4	0.70 ± 0.30
P	16.0	16.5 ±.5	17.0	19.0	5.5	1.2 ± 0.3	6.7	0.70 ± 0.30
R	18.0	16.5 ±.5	19.0	21.0	6.5	1.2 ± 0.3	6.7	0.70 ± 0.30
S	18.0	21.5 ±.5	19.0	21.0	6.5	1.2 ± 0.3	6.7	0.70 ± 0.30
U	16.0	21.5	17.0	19.0	6.7	1.2 ± 0.3	6.7	0.70 ± 0.30

*5.8 +0.1,-0.2 for AFK and AHD Series

V-Chip Cleaning and Coating Guide

Cleaning

Below is a table describing the usable solvents for cleaning a PC board containing V-Chips.

Table 1

Solvent type	Name	Manufacturer	Recommended use level	Symtoms of Damage
Water Base				
Water	Distilled Water		1	None
Alkaline	Aqua Cleaner 210SEP	Sanei	2	None, though marking ink may fade
Surface active agent	Pine Alpha ST-100S	Aralawa Kasei Kogyo	2	
	Clean-thru 750H	Kao Corporation	2	
	Clean-thru 750L		2	
	Clean-thru 710M		2	
	Sun-elec B-12	Sanyo Kasei	2	
DK be-clean CW-5790	Dai-Ichi Kogyo Seiyaku	2		
Solvent Base				
Petroleum based	Cold-cleaner P3-375	Henkel Hokusui	3	swelling on sealing rubber rinse and dry well after cleaning
	Techno-cleaner 219	Seiwa Sangyo	3	
hydrocarbon	Axarel 32	Mitsui DFC	3	
Alcohol base	Isopropyl Alcohol		1	None
Silicon base	Techno-care FRW-17	Toshiba Corporation	3	None if used in combination
	Techno-care FRW-17		3	
	(Techno-care FRV-100)		3	
Halogenated hydrocarbon	Asashi-clean AK-225AES	Ashahi Glass	3	Contains CFC's subject to environmental regulations
	HCFC141B-MS	Dalkin Kogyo	3	
Telpen base	Telpen-cleaner EC-7R	Nippon Alpha Metals	3	swelled seal

Use level Number	Recommendation
1	Cleaning is possible
2	Cleaning is possible (markings may fade)
3	Cleaning is possible (Use caution. 1 and 2 are better choices)

V-Chips may be immersed for 5 minutes, safely, in Level 1&2 solvents. Use Level 3 solvents with caution.

Do not use chlorine-based halogenated cleaning solvents, adhesives or coating agents.

When halogenated chlorine-based solvents are used in the cleaning process, free chlorine is liberated from the solvent. This chlorine causes corrosion and deterioration of the aluminum inside the capacitor

Dangers of "Free-Chlorine":

After the solvent dries, the chlorine remains on the capacitor seal, the chlorine slowly permeates into the capacitor element causing corrosion and damage that happens slowly. It may take some time before a failure is apparent. A representation of the chemical reaction is on the following page.

V-Chip Cleaning and Coating Guide

Free-chlorine Diagram:

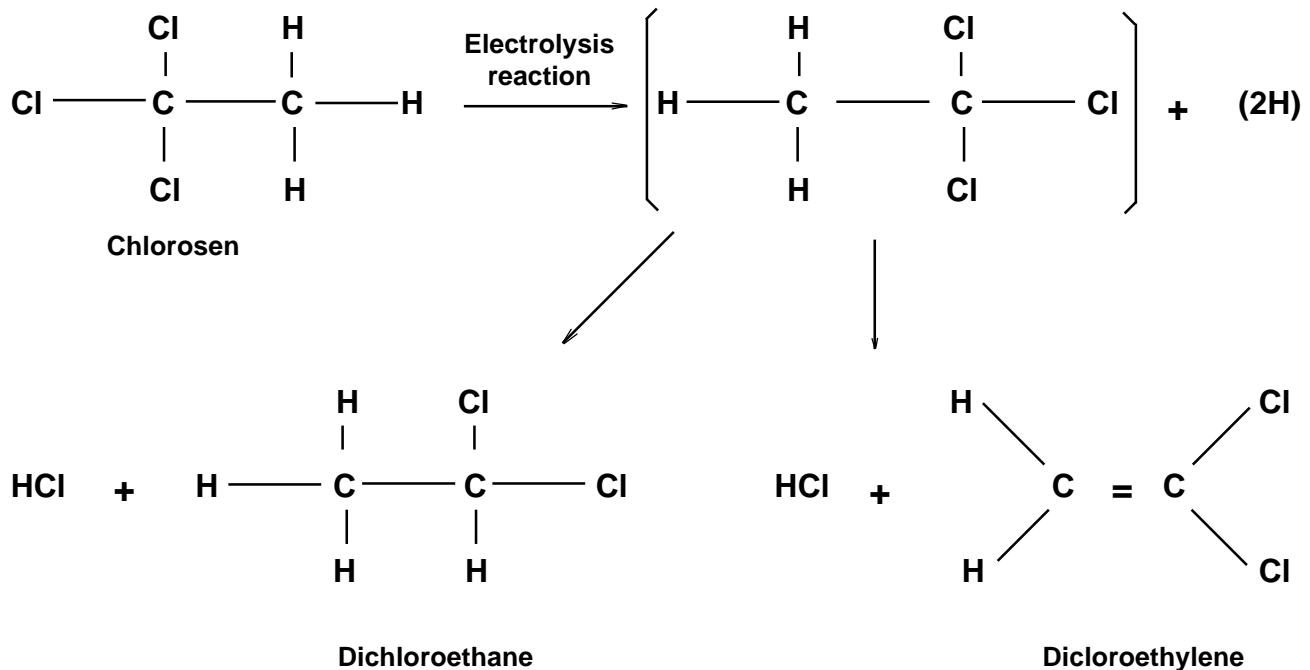
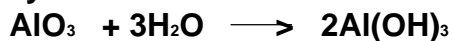


Fig. 1 Decomposed reaction of cleaning solvents (Free-chlorine)

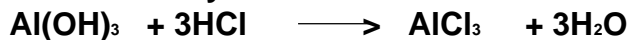
Reaction of Free-chlorine and Aluminum

Combined free chlorine and hydrogen become hydrochloric acid, but it has high dissociation and most of it becomes chlorine ions. These chlorine ions react with the aluminum. The order of the reactions is represented below.

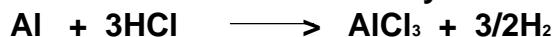
1.) Hydration of oxide film



2.) Reaction of hydrated oxide film and chlorine (Dissolution of film)



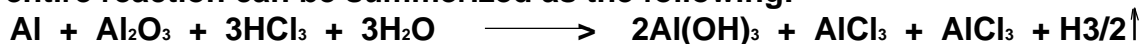
3.) Reaction of aluminum and hydrochloric acid (Dissolution of aluminum)



4.) Precipitation of aluminum hydroxide



The entire reaction can be summarized as the following:



Therefore the compounds produced by the reactions are aluminum hydroxide and hydrochloric acid from reaction #4; the hydrochloric acid is not consumed and acts as a catalyst.

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Solvents that should not be used

Table 2

Composition	Boiling Point (°C)	Common Name
1.1.1-Trichloroethane	74.1	Chlorosen
Trichloroethylene	87.2	Trichlene
Tetrachloroethylene	121.1	Perchloroethylene

Additional Cleaning Notes:

- 1.) Solvents containing CFC's destroy the ozone layer and should be avoided to protect the global environment.
- 2.) To avoid solvent residue between the capacitor's seal and the PC board, make sure the assembly is dried thoroughly immediately after cleaning.

Coating

Below is a list of coatings that are safe for use with V-Chips

Table 3

Manufacturer	Material	Coating Material Name
Hitachi Chemical	Acrylic	Taffi-1141, Taffi-1147
	Urethane	Taffi-1154
Boxy Brown	Acrylic	Humi Seal 1B66
	Urethane	Humi Seal 1A27
Dow Corning	Silicon	Perugan Z, Perugan C
Nihon Zeon	Urethane	Quinate System 160B

Influence of Coating Materials

Coating materials are typically used for insulation, waterproofing, dustproofing and rustproofing. When coating materials are selected there are factors to prevent internal corrosion (chlorine reaction with aluminum) while the capacitor is functioning. The following steps will help prevent this damage to the capacitor.

A.) Corrosion Reaction

Avoid halogen solvents which permeate the capacitor's seal, releasing chlorine which reacts with the aluminum inside the capacitor.

B.) Selecting a Coating Material

It is necessary to select a coating material that contains no chlorine.

The coating consists of the main ingredient which could be urethane resin, acrylic resin or other polymer, a solvent and other additives such as flameproofing agents.

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The coating's solvent dries and diffuses into the rubber seal of the capacitor, therefore halogenated hydrocarbon solvents containing chloride should not be used.

Similar to the solvent, additives can permeate into the capacitor through the rubber seal. Ingredients in many additives might not be listed, therefore use caution when choosing an additive.

C.) Other Concerns

Solvents and additives are subject to change without notice. Make sure ingredients are identified.

Avoid coating a substrate after cleaning it with a halogenated hydrocarbon. The coating will prevent the remaining solvent from diffusing which may cause corrosion.