T370 & T378 Micron MIL-PRF-49137/6 (CX06 Style)

Overview

The T370 and T378 Micron MIL-PRF-49137/6 (CX06 Style) capacitors are available in a variety of case styles and sizes. These capacitors are designed to operate from −55°C to +85°C at full voltage and to +125°C with derating. The KEMET Micron is qualified under MIL-PRF-49137/6 as military styles CX06 (T378).

The T370 capacitor is encapsulated in a molded, gold-colored epoxy. This encasement technique allows maximum utilization of circuit board real estate, with precisely centered leads in a microminiature case.

These molded packages also provide significant improvements in overall dimensional consistency, as well as lead wires precisely spaced to within 0.010 inches (0.25 mm). With KEMET's new molded packaging design, these capacitors can now be marked using a laser printing technique. The KEMET laser marking system ensures legibility and permanency while offering a complete alphanumeric print format. Laser print meets all requirements of the Resistance to Solvents Test, Method 215 of MIL-STD-202.

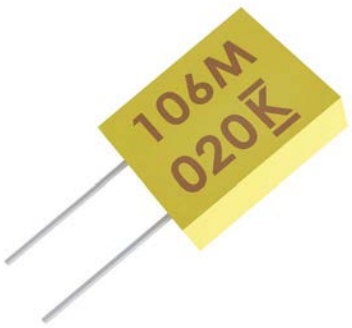
Benefits

- Taped and reeled per EIA Specification RS-468
- Laser-marked case
- Qualified to MIL-PRF-49137/6, Style CX06 (T378 only)
- T370 capacitance values of 0.68 – 220 µF
- T378 capacitance values of 2.2 – 220 µF
- Tolerances of +40% −20%, ±5%, ±10% and ±20% standard
- Voltage rating of 3 – 35 VDC
- Operating temperature range of −55°C to +85°C at rated voltage and up to 125°C with derating
- Case sizes: C, D, E, F

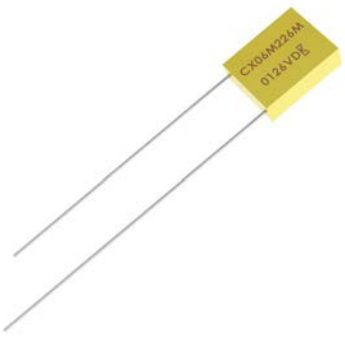
Applications

Typical applications include use in bypass, coupling, filtering, and timing circuits.

T370



T378



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Ordering Information – T370/T378

T	37X	D	475	M	035	A	S	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Failure Rate	Termination Finish	Packaging
T = Tantalum	370 378	C, D, E, F	First two digits represent significant figures. Third digit specifies number of zeros to follow.	M = ±20% K = ±10% J = ±5% L = 40%, −20%	003 = 3 004 = 4 006 = 6.3 010 = 10 015 = 15 020 = 20 025 = 25 035 = 35	Not Applicable	S = Standard (solder-coated nickel)	Blank = Bulk 7301 = Tape & Reel 7305 = Ammo 7317 = Ammo

Ordering Information – Defense MIL-PRF-49137/6 (CX06 Style)

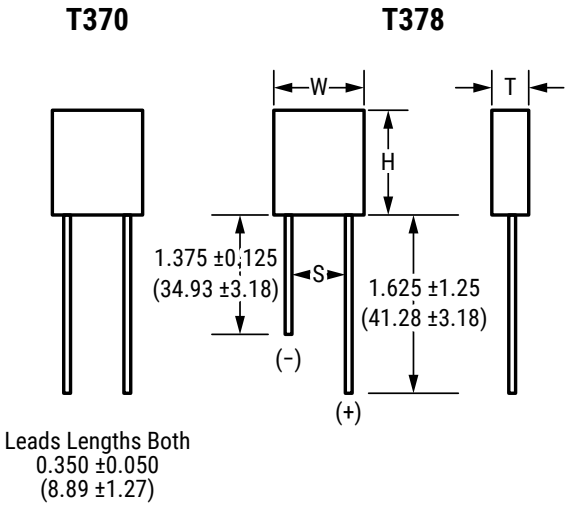
CX	06	D	335	K
Type	Style	Voltage	Capacitance Code (pF)	Capacitance Tolerance
Fixed, solid tantalum, polar, nonhermetically sealed capacitors.	06-T378 (Radial leads)	B = 3 V C = 4 V D = 6 V F = 10 V H = 15 V J = 20 V K = 25 V M = 35 V	First two digits represent significant figures. Third digit specifies number of zeros to follow.	M = ±20% K = ±10%

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	−55°C to 125°C
Rated Capacitance Range	T370: 0.68 – 220 µF at 120 Hz/25°C; T378: 2.2 – 220 µF at 120 Hz/25°C
Capacitance Tolerance	M tolerance ±20% standard, L tolerance + 40%/−20%, J tolerance ±5%, K tolerance ±10%
Rated Voltage Range	3 – 35 V
DF (120 Hz at 25°C)	Refer to Part Number Electrical Specification Table
Leakage Current	Refer to Part Number Electrical Specification Table (rated voltage up to +85°C and 2/3 of rated voltage applied at 125°C)

Dimensions – Millimeters (Inches)

Metric will govern



Case Size	H (MAXIMUM)	W (MAXIMUM)	T (MAXIMUM)	S Lead Spacing ±0.010 (±0.25)	D Lead Diameter ±0.001 (±0.03)
C	0.225 (5.72)	0.185 (4.7)	0.075 (1.91)	0.150 (3.81)	0.016 (0.41)
D	0.290 (7.37)	0.220 (5.59)	0.110 (2.79)	0.180 (4.57)	0.016 (0.41)
E	0.310 (7.87)	0.230 (5.84)	0.130 (3.30)	0.200 (5.08)	0.016 (0.41)
F	0.475 (12.07)	0.375 (9.53)	0.150 (3.81)	0.300 (7.62)	0.016 (0.41)

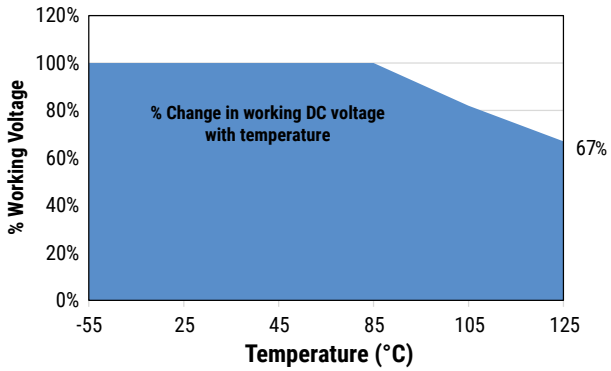
Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Capacitance	Case Code Case Size	KEMET Part Number	DC Leakage	DF % at 25°C	CX06 CAPACITORS PER MIL-PRF-49137/6	
						CX06 MILITARY PART NUMBER	KEMET MILITARY PART NUMBER
(V) 85°C	µF			µA at 25°C Maximum/5 Minutes	120 Hz Maximum		
3	220.0	F	T370F227(1)003AS	9.0	15	CX06B227(2)	T378F227(3)003AS
4	15.0	C	T370C156(1)004AS	1.0	8.0	CX06C156(2)	T378C156(3)004AS
4	47.0	D	T370D476(1)004AS	2.0	8.0	CX06C476(2)	T378D476(3)004AS
4	68.0	E	T370E686(1)004AS	3.0	8.0	CX06C686(2)	T378E686(3)004AS
6	10.0	C	T370C106(1)006AS	1.0	6.0	CX06D106(2)	T378C106(3)006AS
6	33.0	D	T370D336(1)006AS	2.0	6.0	CX06D336(2)	T378D336(3)006AS
6	47.0	E	T370E476(1)006AS	3.0	6.0	CX06D476(2)	T378E476(3)006AS
6	150.0	F	T370F157(1)006AS	9.0	10.0	CX06D157(2)	T378F157(3)006AS
10	6.8	C	T370C685(1)010AS	1.0	6.0	CX06F685(2)	T378C685(3)010AS
10	22.0	D	T370D226(1)010AS	2.0	6.0	CX06F226(2)	T378D226(3)010AS
10	33.0	E	T370E336(1)010AS	3.0	6.0	CX06F336(2)	T378E336(3)010AS
10	100.0	F	T370F107(1)010AS	9.0	8.0	CX06F107(2)	T378F107(3)010AS
15	15.0	D	T370D156(1)015AS	2.0	6.0	CX06H156(2)	T378D156(3)015AS
15	22.0	E	T370E226(1)015AS	3.0	6.0	CX06H226(2)	T378E226(3)015AS
15	68.0	F	T370F686(1)015AS	9.0	8.0	CX06H686(2)	T378F686(3)015AS
20	3.3	C	T370C335(1)020AS	1.0	6.0	CX06J335(2)	T378C335(3)020AS
20	4.7	C	T370C475(1)020AS	1.0	6.0	CX06J475(2)	T378C475(3)020AS
20	10.0	D	T370D106(1)020AS	2.0	6.0	CX06J106(2)	T378D106(3)020AS
20	15.0	E	T370E156(1)020AS	3.0	6.0	CX06J156(2)	T378E156(3)020AS
20	47.0	F	T370F476(1)020AS	9.0	8.0	CX06J476(2)	T378F476(3)020AS
25	2.2	C	T370C225(1)025AS	1.0	6.0	CX06K225(2)	T378C225(3)025AS
25	6.8	D	T370D685(1)025AS	2.0	6.0	CX06K685(2)	T378D685(3)025AS
25	10.0	E	T370E106(1)025AS	3.0	6.0	CX06K106(2)	T378E106(3)025AS
25	33.0	F	T370F336(1)025AS	9.0	6.0	CX06K336(2)	T378F336(3)025AS
35	0.68	C	T370C684(1)035AS	1.0	6.0	CX06M684(2)	T378C684(3)035AS
35	1.0	C	T370C105(1)035AS	1.0	6.0	CX06M105(2)	T378C105(3)035AS
35	1.5	C	T370C155(1)035AS	1.0	6.0	CX06M155(2)	T378C155(3)035AS
35	2.2	D	T370D225(1)035AS	2.0	6.0	CX06M225(2)	T378D225(3)035AS
35	3.3	D	T370D335(1)035AS	2.0	6.0	CX06M335(2)	T378D335(3)035AS
35	4.7	D	T370D475(1)035AS	2.0	6.0	CX06M475(2)	T378D475(3)035AS
35	6.8	E	T370E685(1)035AS	3.0	6.0	CX06M685(2)	T378E685(3)035AS
35	10.0	F	T370F106(1)035AS	9.0	6.0	CX06M106(2)	T378F106(3)035AS
35	15.0	F	T370F156(1)035AS	9.0	6.0	CX06M156(2)	T378F156(3)035AS
35	22.0	F	T370F226(1)035AS	9.0	6.0	CX06M226(2)	T378F226(3)035AS
(V) 85°C	µF	Case Size Code	µA at 25°C Maximum/5 Minutes	120 Hz Maximum	Ω at25°C 100 kHz Max	B (0.1)	C (0.01)
Rated Voltage	Rated Capacitance		DC Leakage	DF % at 25°C	ESR	MIL–PRF–39003 (CSS13 Style)	

(1) To complete KEMET part number, insert L - +40%, –20%; M - 20%; K - ±10%; J - ±5%. Designates Capacitance tolerance.
(2) To complete miitary part number, insert M - ±20%, K - ±10%. Designates Capacitance tolerance.
(3) To complete KEMET part number, insert M - ±20%, K - ±10%. Designates Capacitance tolerance.

Recommended Voltage Derating Guidelines

	−55°C to 85°C	85°C to 125°C
% Change in Working DC Voltage with Temperature	V_R	66% of V_R



Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage that may be applied is limited by following criteria:

1. Dissipated power must not exceed the limits specified for the Series.
2. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
3. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage.

Thermal capacities for the various case sizes have been determined empirically and are listed below. The "ripple voltage" permissible may be calculated from the impedance and ESR data shown in the respective product section.

Temperature Compensation Multipliers for Maximum Power Dissipation		
T ≤ 25°C	T ≤ 85°C	T ≤ 125°C
1.00	0.90	0.40

T = Environmental temperature

The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

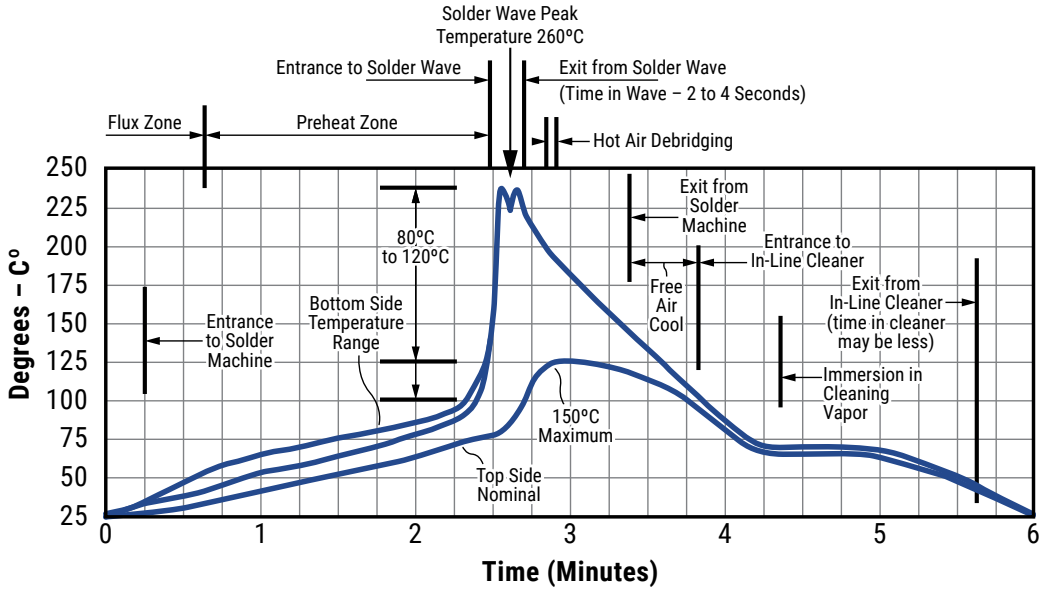
Case Size	Maximum Power Dissipation (P_{max}) Watts at 25°C
C	0.070
D	0.080
E	0.090
F	0.100

Using the P max of the device, the maximum allowable rms ripple current or voltage may be determined.

$$I(max) = \sqrt{P\ max/R}$$
$$E(max) = Z\sqrt{P\ max/R}$$

I = rms ripple current (amperes)
E = rms ripple voltage (volts)
P max = maximum power dissipation (watts)
R = ESR at specified frequency (ohms)
Z = Impedance at specified frequency (ohms)

Optimum Solder Wave Profile



Reverse Voltage

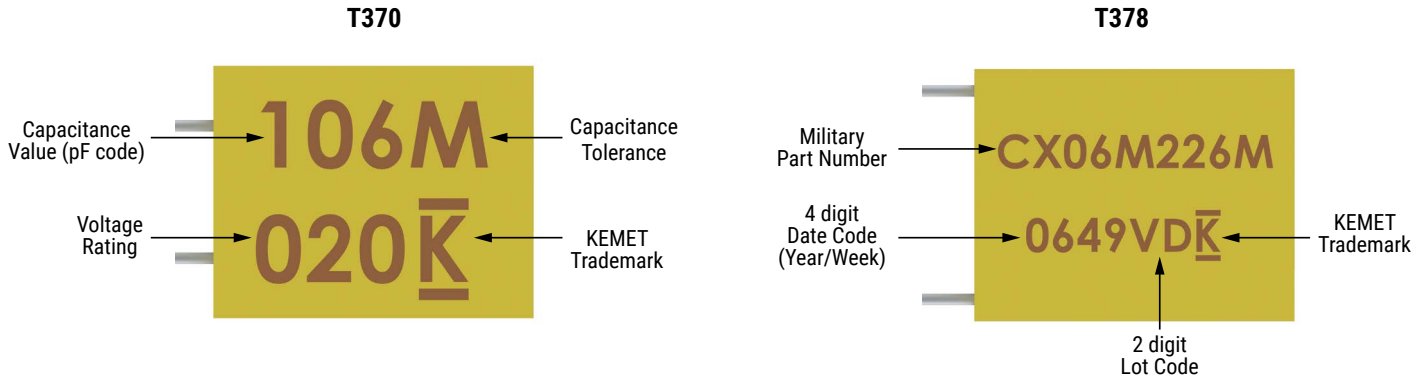
Although these are polar capacitors, some degree of transient voltage reversal is permissible, as seen below. The capacitors should not be operated continuously in reverse mode, even within these limits.

Temperature	Pecentage of Rated Voltage
+25°C	15
+85°C	5
+125°C	1

Mounting

All encased capacitors will pass the Resistance to Soldering Heat Test of MIL–STD–202, Method 210, Condition C. This test simulates wave solder of topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe treatment must be considered reflective of an improper soldering process. The above figure is a recommended solder wave profile for both axial and radial leaded solid tantalum capacitors.

Capacitor Marking



Storage

Tantalum molded radial/axial capacitors should be stored in normal working environments. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 60°C RH. Storage at high temperature may cause a small, temporary increase in leakage current (measured under standard conditions), but the original value is usually restored within a few minutes after application of rated voltage. Storage at high humidity may increase capacitance and dissipation factor. Solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. For optimized solderability capacitors stock should be used promptly, preferably within three years of receipt.

Tape & Reel Packaging Information

KEMET offers Solid Tantalum Capacitors fully compatible for use with automatic insertion machines for radial-lead components. Aris Reeling meets all requirements of EIA Standard RS-468. KEMET capacitors are wound on a precision made ARIS Reel Package. ARIS Ammo Package is also available.

Table 2 – Packaging Quantity

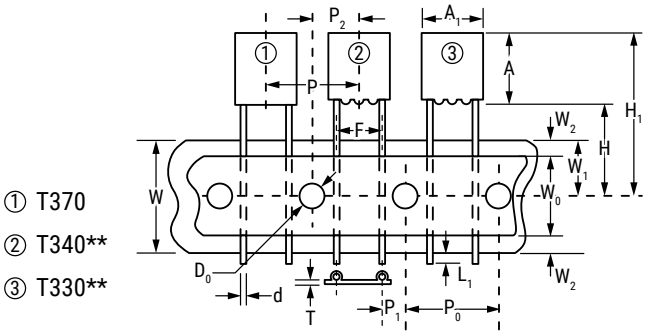
T370

Case Size	Standard Bulk Quantity	Standard Reel Quantity	Reel C-Spec
C	500	N/A	N/A
D	500	1,000	C-7301
E	500	1,000	C-7301
F	250	N/A	N/A

T378

Case Size	Standard Bulk Quantity	Standard Reel Quantity	Reel C-Spec
C	200	N/A	N/A
D	200	1,000	C-7301
E	180	1,000	C-7301
F	50	N/A	N/A

Figure 1



Dimension	Symbol	Nominal mm (inch)		Tolerance mm (inch)	
Body Height (1)	A	10.50 (0.413)		±0.38 (±0.015) Maximum	
Body Width (1)	A_1	15.24 (0.600)		±0.38 (±0.015) Maximum	
Sprocket Hole Diameter	D_0	4.0 (0.157)		±0.3 (±0.012)	
Lead Diameter	d	0.51 (0.020)	0.64 (0.025)	±0.05 (±0.001)	±0.03
Lead Center (5)	F	5.0 (0.197)	2.5 (0.098)	+0.8 (+0.032)	−0.2 (−0.008)
Component Base to Tape Center (2) (4) (6)	H	16.0 – 21.0 (0.630 – 0.827)		Reference Only	
Lead Standoff Height	H_0	N/A			
Component Height Above Tape Center	H_1	32.25 (1.270)		Maximum	
Component Alignment Front to Rear	ΔH	0		±2.0 (±0.079)	
Cut Out Length	L	11.0 (0.433)		Maximum	
Lead Protrusion	L_1	2.0 (0.079)		Maximum	
Component Pitch (5)	P	12.7 (0.500)		±1.0 (±0.039)	
Sprocket Hole Pitch (3)	P_0	12.7 (0.500)		±0.03 (±0.012)	
Sprocket Hole Center to Lead Center (4) (5)	P_1	3.85 (0.152)	4.76 (0.188)	5.1 (0.201)	±0.7 (±0.028)
Sprocket Hole Center to Component Center	P_2	6.35 (0.250)		±1.31 (±0.051)	
Body Thickness	T_0	6.35 (0.250)		±1.3 Maximum	
Total Tape Thickness	T	0.7 (0.28)		±0.02 (±0.008)	
Carrier Tape Width	W	18.0 (0.709)		+1.0/−0.5 (+0.039/−0.020)	
Hold-Down Tape Width	W_0	15 (0.561)	6 (0.236)	+1.0/−0.8 (+0.039/−0.031	
Sprocket Hole Location	W_1	9.0 (0.354)		+0.075/−0.5 (+0.030/−0.020)	
Hold-Down Tape Location	W_2	3.0 (0.118)	12.0 (0.472)	Maximum	

Notes:

(1) See Dimensions table for specific values per case size
(2) Reference only
(3) Cumulative pitch error ±1.0 mm (0.039") maximum in 20 consecutive sprocket hole locations.
(4) Measured at bottom of standoff.
(5) P, P1 and F measured at egress from carrier tape.
(6) H dimensions for T370 D and E 16.5mm ±0.5 mm (0.650" ±0.020")

On polar devices, the positive (+) lead exits from container first.
** Lead spacings are 2.5mm (0.098") center to center*
*** Lead spacings are 5.0mm (0.197") center to center.*

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