KO-CAP Polymer Capacitors

Overview

The KEMET Organic Capacitor (KO-CAP) is a solid electrolytic capacitor with a conductive polymer cathode capable of delivering very low ESR and improved capacitance retention at high frequencies. KO-CAP combines the low ESR of multilayer ceramic, the high capacitance of aluminum electrolytic, and the volumetric efficiency of tantalum into a single surface mount package. Unlike liquid electrolyte-based capacitors, KO-CAP has a very long operational life and high ripple current capabilities.

The KEMET T580/T581 series are in support of MIL-PRF-32700, with product level X (0.1% failures per 1,000 hours) and Y (0.01% failures per 1,000 hours). Each production lot is 100% tested per Group A, Subgroup 1 of MIL-PRF-32700 which includes Reflow conditioning, Thermal Shock (unmounted), Voltage Aging, and Surge Current Options A, B or C as called out in the PIN. This product is a precision-molded device, with compliant terminations and indelible laser marking. This is the military version of the global IEC/EIA standard, represented by KEMET's T580/T581. Tape & Reel per EIA 481 are standard.

Benefits

- Product Level X and Y
- Qualified to MIL-PRF-32700/1 and /2
- 100% accelerated steady state aging
- 100% Surge current testing options
- High frequency capacitance retention
- Improved humidity capability 85°C/85% RH, 1.0 VR
- Symmetrical, compliant terminations
- Termination option H
- Laser-marked case
- Tape & Reel standard packaging per EIA 481
- Surface Mount Applications



Ordering Information

T	58X	D	157	M	003	X	H	80	1A	
Capacitor Class	Series	KEMET's Case Size	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Product Level	Termination Finish	Humidity Performance	ESR & Surge Current Option	Packaging (C-Spec)
T = Tantalum	580 = single anode 581 = multiple anode	B C D X[*3]	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	2R5 = 2.5 003 = 3 004 = 4 006 = 6.3 010 = 10 016 = 16 020= 20 025 = 25 030 = 30 035 =35 050 = 50 063 = 63	A = non-ER X = 0.1%/ 1,000 hours Y = 0.01%/ 1,000 hours	H = Solder plated	80 = 500 hours test duration	1 = ESR Standard A = 25°C± 5°C[*1] B = -55°C -5°C, +0°C and 85°C ±5°C[*1] C = -55°C -5°C, +0°C and 85°C ±5°C[*2] Z =No surge current test	Blank = 7" Reel 7280 = 13" Reel 7610 = Bulk Bag 7640 = Bulk plastic box WAFL = Waffle Pack

*[*1] After Voltage Aging*
*[*2] Before Voltage Aging*
*[*3] KEMET multi-anode chip capacitors X case are equivalent to the E case as per MIL-PRF-32700/2*

MIL-PRF-32700 Ordering Table

M32700	01	D	157	M	B	H	X	C
Performance Specification Number	Specification Sheet Number	MIL Case Size	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage	Termination Finish	Product Level	Surge Current Option
M32700	01 02	B C D E	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	A = 2.5 B = 3 C = 4 D = 6.3 F = 10 H = 16 J = 20 K = 25 L = 30 M = 35 N =50 P = 63	H = Solder plated	A = Non-ER X = 0.1%/ 1,000 hours Y = 0.01%/ 1,000 hours	A = 25°C± 5°C[*1] B = -55°C -5°C, +0°C and 85°C ±5°C[*1] C = -55°C -5°C, +0°C and 85°C ±5°C[*2] Z =No surge current test

*[*1] After Voltage Aging*
*[*2] Before Voltage Aging*

Environmental Compliance

• Halogen-free
• Epoxy compliant with UL94 V–0
• Molded Epoxy complies for outgassing testing under ASTM E 595.

K-SIM

For a detailed analysis of specific part numbers, please visit ksim.kemet.com to access KEMET's K-SIM software. KEMET K-SIM is designed to simulate behavior of components with respect to frequency, ambient temperature, and DC bias levels.

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	4.7 – 1,500 µF at 120 Hz/+25°C
Capacitance Tolerance	K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	2.5 – 63V
DF (120 Hz)	Refer to Part Number Electrical Specification table
ESR (100 kHz)	Refer to Part Number Electrical Specification table
Leakage Current	≤ 0.1 CV (µA) at rated voltage after 5 minutes/ +25°C

Certification

MIL–PRF–32700/1, /2

Qualification

Test	Condition	Characteristics			
Life Test	In accordance with MIL–STD–202–108. +85°C , rated voltage, 2,000 hours +125°C, 2/3 rated voltage, 2,000 hours	Δ C/C	Within +10/–20% of initial value		
		DF	Within initial limits		
		DCL	Within 1.25 x initial limit (at +25°C)/ Within 2.0 x initial limit (at +85°C and +125°C)		
		ESR	Within 2.0 x initial limit/ Within 5.0 x initial limit (for +125°C)		
Biased Humidity	In accordance with MIL–STD–202–103. 500 hours, 85°C, 85% RH, rated voltage	Δ C/C	Within +35/–5% of initial value		
		DF	Within 1.5 x initial limit		
		DCL	Within 2.0 x initial limit		
		ESR	Within 2.0 x initial limit		
Stability at low and high temperature	Extreme temperature exposure at a succession of continuous steps at +25°C, –55°C, +25°C, +85°C, +125°C, +25°C		+25°C	–55°C	+85°C	+125°C
		Δ C/C	± 10%	± 10%*1	+30/–10%	+40/–10%
		DF	IL	IL	1.2 x IL	1.5 x IL
		ESR	IL	1.2 x IL	1.2 x IL	1.5 x IL
		DCL	IL	N/A	10 x IL	10 x IL
Solderability	In accordance with MIL–STD–202–208 Test Method B, coating durability category 2, preconditioning category C	Inspect solderable surfaces after the test			
Resistance to Soldering Heat	In accordance with MIL–STD–202–210 Test Condition J, one heat cycle	Δ C/C	Within ±20% of initial value		
		DF	Within initial limits		
		DCL	Within initial limit		
		Visual examination after the test, there shall be no evidence of mechanical damage			
Vibration	In accordance with MIL–STD–202–204 Rated voltage, test condition D (20g), 4 hours on each direction (8 hours total).	No measurements after test Visual examination after the test, there shall be no evidence of mechanical damage			
Moisture Sensitivity Level	MSL Level determined in accordance with J–STD–020 Bake, moisture soak, reflow, final visual inspection and electrical test	Δ C/C	Within ±20% of initial value		
		DF	Within initial limits		
		DCL	Within initial limits		
		ESR	Within initial limits		
		There shall be no visible external cracks.			
Additional qualification testing per MIL–PRF–32700/1, /2	Please contact KEMET for more information				

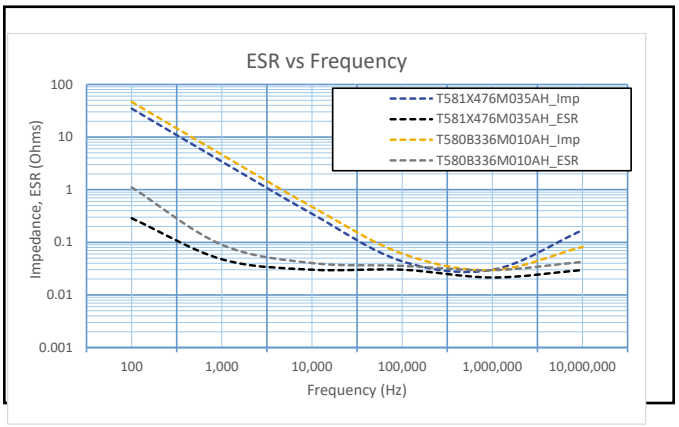
**1 For capacitors rated less than 6 Vdc, shall change not more than +10 percent, –20 percent from the step 1 measured value.*

Reliability

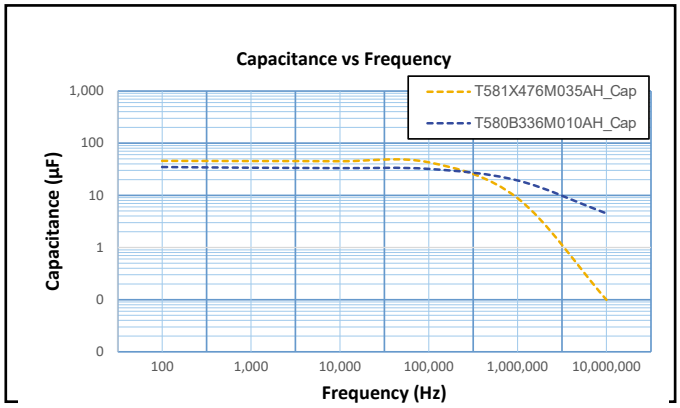
KEMET T580/T581 series are in support of MIL PRF-32700, with product failure level X (0.1% failures per 1,000 hours) and Y (0.01% failures per 1,000 hours).
For more information about acceleration factors please contact your YAGEO Group representative

Electrical Characteristics

ESR vs. Frequency



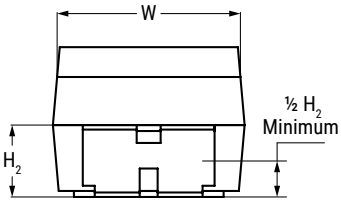
Capacitance vs. Frequency



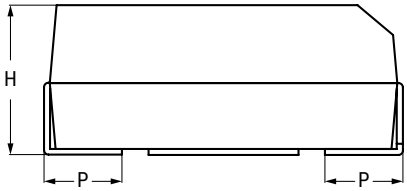
Dimensions – Millimeters (Inches)

Metric will govern

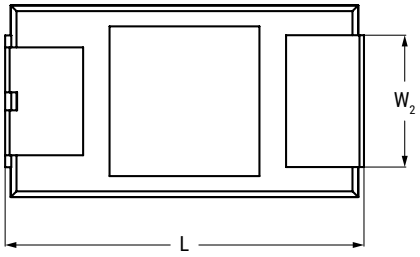
END VIEW



SIDE VIEW



BOTTOM VIEW



Cut outs and glue pad at KEMET's option.

Case Size	Component Dimensions						Typical Weight
KEMET /MIL–PRF	L	W	H	H_2 min	W_2 ±0.2 (±0.008)	P ±0.3 (±0.012)	(mg)
B	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.3 (0.110 ±0.012)	1.9 ±0.3 (0.075 ±0.012)	0.71 (0.028)	2.2 (0.087)	0.8 (0.031)	98.30
C	6.0 ±0.4 (0.236 ±0 .016)	3.20 ± 0.30 (0.126 ±0.012)	2.50 ± 0.3 (0.098 ±0.012)	0.99 (0.039)	2.2 (0.087)	1.3 (0.051)	193.46
D	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	2.8 ±0.3 (0.110 ±0.012)	0.99 (0.039)	2.4 (0.094)	1.3 (0.051)	352.36
X / E	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 ±0.4 (0.157 ±0.016)	1.98 (0.078)	2.4 (0.094)	1.3 (0.051)	588.16

Notes: These weights are provided as reference. If exact weights are needed, please contact your KEMET Sales Representative

Table 1 – Released Part Numbers Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current*	MSL	Maximum Operating Temp.
VDC at 85°C	µF	KEMET/ MIL–PRF	(See below for part options)	Part Number	µA at 25°C Maximum/ 5 minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	(rms) mA at 45°C 100 kHz		°C
35	33	X/E	T581X336(1)035(2)H(3)1(4)	M3270002E336(1)MH(2)(4)	116	10	80	2236	3	125
35	47	X/E	T581X476(1)035(2)H(3)1(4)	M3270002E476(1)MH(2)(4)	165	10	80	2236	3	125
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp.

** Please refer to the ripple current section for additional temperature calculation.*
(1) To complete KEMET or MIL- PRF part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.
(2) To complete KEMET or MIL-PRF part number, insert A = N/A , insert X = 0.1%/1,000 hours or Y = 0.01%/1,000 hours. Designates Product Level
(3) To complete KEMET part number, insert 80 = 500 hours. Designates Humidity test hours.
(4) To complete MIL-PRF/KEMET part number, insert A = 10 cycles +25°C, B= 10 cycles −55°C and +85°C (after voltage aging), C = 10 cycles −55°C and +85°C (before voltage aging), or Z = N/A. Designates surge current option

Table 2 – Under Development Part Number (to be released later)

** Please refer to the ripple current section for additional temperature calculation.*

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current*	MSL	Maximum Operating Temp.
VDC at 85°C	µF	KEMET/ MIL–PRF	(See below for part options)	Part Number	µA at 25°C Maximum/ 5 minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	(rms) mA at 45°C 100 kHz		°C
2.5	330	D	T580D337(1)2R5(2)H(3)1(4)	M3270001D337(1)AH(2)(4)	83	10	50	2258	3	125
2.5	470	D	T581D477(1)2R5(2)H(3)1(4)	M3270002D477(1)AH(2)(4)	118	10	30	3559	3	125
2.5	680	D	T581D687(1)2R5(2)H(3)1(4)	M3270002D687(1)AH(2)(4)	170	10	30	3559	3	125
2.5	1000	X/E	T581X108(1)2R5(2)H(3)1(4)	M3270002E108(1)AH(2)(4)	250	10	30	3651	3	125
2.5	1500	X/E	T581X158(1)2R5(2)H(3)1(4)	M3270002E158(1)AH(2)(4)	375	10	30	3651	3	125
3	100	B	T580B107(1)003(2)H(3)1(4)	M3270001B107(1)BH(2)(4)	30	8	100	1127	3	125
3	150	B	T580B157(1)003(2)H(3)1(4)	M3270001B157(1)BH(2)(4)	45	8	100	1127	3	125
3	330	D	T580D337(1)003(2)H(3)1(4)	M3270001D337(1)BH(2)(4)	99	10	50	2258	3	125
3	470	D	T581D477(1)003(2)H(3)1(4)	M3270002D477(1)BH(2)(4)	141	10	30	3559	3	125
3	680	D	T581D687(1)003(2)H(3)1(4)	M3270002D687(1)BH(2)(4)	204	10	30	3559	3	125
3	1000	X/E	T581X108(1)003(2)H(3)1(4)	M3270002E108(1)BH(2)(4)	300	10	30	3651	3	125
3	1500	X/E	T581X158(1)003(2)H(3)1(4)	M3270002E158(1)BH(2)(4)	450	10	28	3780	3	125
4	68	B	T580B686(1)004(2)H(3)1(4)	M3270001B686(1)CH(2)(4)	28	8	100	1127	3	125
4	100	B	T580B107(1)004(2)H(3)1(4)	M3270001B107(1)CH(2)(4)	40	8	100	1127	3	125
4	220	D	T580D227(1)004(2)H(3)1(4)	M3270001D227(1)CH(2)(4)	88	10	45	2380	3	125
4	330	D	T580D337(1)004(2)H(3)1(4)	M3270001D337(1)CH(2)(4)	132	10	60	2062	3	125
4	330	D	T581D337(1)004(2)H(3)1(4)	M3270002D337(1)CH(2)(4)	132	10	30	3559	3	125
4	470	D	T580D477(1)004(2)H(3)1(4)	M3270001D477(1)CH(2)(4)	188	10	60	2062	3	125
4	470	D	T581D477(1)004(2)H(3)1(4)	M3270002D477(1)CH(2)(4)	188	10	30	3559	3	125
4	680	X/E	T581X687(1)004(2)H(3)1(4)	M3270002E687(1)CH(2)(4)	272	10	30	3651	3	125
4	1000	X/E	T581X108(1)004(2)H(3)1(4)	M3270002E108(1)CH(2)(4)	400	10	30	3651	3	125
6.3	33	B	T580B336(1)006(2)H(3)1(4)	M3270001B336(1)DH(2)(4)	21	8	100	1127	3	125
VDC at 85°C	µF	KEMET/ MIL–PRF	(See below for part options)	Part Number	µA at 25°C Maximum/ 5 minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	(rms) mA at 45°C 100 kHz		°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp.

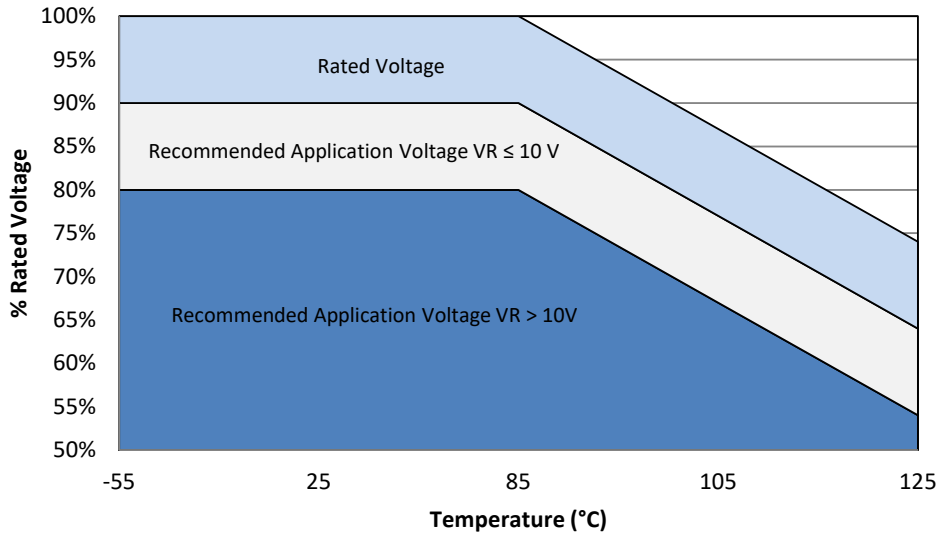
(1) To complete KEMET or MIL- PRF part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.
(2) To complete KEMET or MIL-PRF part number, insert A = N/A , insert X = 0.1%/1,000 hours or Y = 0.01%/1,000 hours. Designates Product Level
(3) To complete KEMET part number, insert 80 = 500 hours. Designates Humidity test hours.
(4) To complete MIL-PRF/KEMET part number, insert A = 10 cycles +25°C, B= 10 cycles −55°C and +85°C (after voltage aging), C = 10 cycles −55°C and +85°C (before voltage aging), or Z = N/A. Designates surge current option

Table 2 – Under Development Part Number (to be released later) cont.

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current*	MSL	Maximum Operating Temp.
VDC at 85°C	µF	KEMET/ MIL–PRF	(See below for part options)	Part Number	µA at 25°C Maximum/ 5 minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	(rms) mA at 45°C 100 kHz		°C
6.3	47	B	T580B476(1)006(2)H(3)1(4)	M3270001B476(1)DH(2)(4)	30	8	100	1127	3	125
6.3	68	B	T580B686(1)006(2)H(3)1(4)	M3270001B686(1)DH(2)(4)	43	8	100	1127	3	125
6.3	150	D	T580D157(1)006(2)H(3)1(4)	M3270001D157(1)DH(2)(4)	95	10	45	2380	3	125
6.3	220	D	T580D227(1)006(2)H(3)1(4)	M3270001D227(1)DH(2)(4)	139	10	60	2062	3	125
6.3	220	D	T581D227(1)006(2)H(3)1(4)	M3270002D227(1)DH(2)(4)	139	10	35	3295	3	125
6.3	330	D	T580D337(1)006(2)H(3)1(4)	M3270001D337(1)DH(2)(4)	208	10	50	2258	3	125
6.3	470	X/E	T581X477(1)006(2)H(3)1(4)	M3270002E477(1)DH(2)(4)	296	10	30	3651	3	125
6.3	680	X/E	T581X687(1)006(2)H(3)1(4)	M3270002E687(1)DH(2)(4)	428	10	35	3381	3	125
10	22	B	T580B226(1)010(2)H(3)1(4)	M3270001B226(1)FH(2)(4)	22	8	100	1127	3	125
10	33	B	T580B336(1)010(2)H(3)1(4)	M3270001B336(1)FH(2)(4)	33	8	100	1127	3	125
10	100	D	T580D107(1)010(2)H(3)1(4)	M3270001D107(1)FH(2)(4)	100	10	45	2380	3	125
10	150	D	T580D157(1)010(2)H(3)1(4)	M3270001D157(1)FH(2)(4)	150	10	75	1844	3	125
10	150	D	T581D157(1)010(2)H(3)1(4)	M3270002D157(1)FH(2)(4)	150	10	30	3559	3	125
10	220	D	T581D227(1)010(2)H(3)1(4)	M3270002D227(1)FH(2)(4)	220	10	35	3295	3	125
10	330	X/E	T581X337(1)010(2)H(3)1(4)	M3270002E337(1)FH(2)(4)	330	10	30	3651	3	125
10	470	X/E	T581X477(1)010(2)H(3)1(4)	M3270002E477(1)FH(2)(4)	470	10	40	3162	3	125
16	47	D	T580D476(1)016(2)H(3)1(4)	M3270001D476(1)HH(2)(4)	76	10	55	2153	3	125
16	68	D	T580D686(1)016(2)H(3)1(4)	M3270001D686(1)HH(2)(4)	109	10	95	1638	3	125
16	100	D	T580D107(1)016(2)H(3)1(4)	M3270001D107(1)HH(2)(4)	160	10	70	1909	3	125
16	150	X/E	T581X157(1)016(2)H(3)1(4)	M3270002E157(1)HH(2)(4)	240	10	45	2981	3	125
16	220	X/E	T581X227(1)016(2)H(3)1(4)	M3270002E227(1)HH(2)(4)	352	10	45	2981	3	125
16	330	X/E	T581X337(1)016(2)H(3)1(4)	M3270002E337(1)HH(2)(4)	528	10	35	3381	3	125
20	22	D	T580D226(1)020(2)H(3)1(4)	M3270001D226(1)JH(2)(4)	44	10	95	1638	3	125
20	33	D	T580D336(1)020(2)H(3)1(4)	M3270001D336(1)JH(2)(4)	66	10	95	1638	3	125
20	47	D	T580D476(1)020(2)H(3)1(4)	M3270001D476(1)JH(2)(4)	94	10	95	1638	3	125
20	100	X/E	T581X107(1)020(2)H(3)1(4)	M3270002E107(1)JH(2)(4)	200	10	50	2828	3	125
25	6.8	C	T580C685(1)025(2)H(3)1(4)	M3270001C685(1)KH(2)(4)	17	10	170	985	3	125
25	10	C	T580C106(1)025(2)H(3)1(4)	M3270001C106(1)KH(2)(4)	25	10	170	985	3	125
25	15	D	T580D156(1)025(2)H(3)1(4)	M3270001D156(1)KH(2)(4)	38	10	95	1638	3	125
25	22	D	T580D226(2)025(2)H(3)1(4)	M3270001D226(1)KH(2)(4)	55	10	95	1638	3	125
25	33	D	T580D336(1)025(2)H(3)1(4)	M3270001D336(1)KH(2)(4)	83	10	95	1638	3	125
25	68	X/E	T581X686(1)025(2)H(3)1(4)	M3270002E686(1)KH(2)(4)	170	10	70	2390	3	125
25	100	X/E	T581X107(1)025(2)H(3)1(4)	M3270002E107(1)KH(2)(4)	250	10	80	2236	3	125
30	22	D	T580D226(1)030(2)H(3)1(4)	M3270001D226(1)LH(2)(4)	66	10	95	1638	3	125
30	33	D	T580D336(1)030(2)H(3)1(4)	M3270001D336(1)LH(2)(4)	99	10	120	1458	3	125
30	47	X/E	T581X476(1)030(2)H(3)1(4)	M3270002E476(1)LH(2)(4)	141	10	70	2390	3	125
30	68	X/E	T581X686(1)030(2)H(3)1(4)	M3270002E686(1)LH(2)(4)	204	10	55	2697	3	125
30	100	X/E	T581X107(1)030(2)H(3)1(4)	M3270002E107(1)LH(2)(4)	300	10	50	2828	3	125
35	10	D	T580D106(1)035(2)H(3)1(4)	M3270001D106(1)MH(2)(4)	35	10	95	1638	3	125
35	15	D	T580D156(1)035(2)H(3)1(4)	M3270001D156(1)MH(2)(4)	53	10	95	1638	3	125
50	10	D	T580D106(1)050(2)H(3)1(4)	M3270001D106(1)NH(2)(4)	50	10	120	1458	3	125
50	22	X/E	T581X226(1)050(2)H(3)1(4)	M3270002E226(1)NH(2)(4)	110	10	95	2052	3	125
50	33	X/E	T581X336(1)050(2)H(3)1(4)	M3270002E336(1)NH(2)(4)	165	10	95	2052	3	125
63	4.7	D	T580D475(1)063(2)H(3)1(4)	M3270001D475(1)PH(2)(4)	30	10	120	1458	3	125
63	10	X/E	T581X106(1)063(2)H(3)1(4)	M3270002E106(1)PH(2)(4)	63	10	95	2052	3	125
63	15	X/E	T581X156(1)063(2)H(3)1(4)	M3270002E156(1)PH(2)(4)	95	10	70	2390	3	125
VDC at 85°C	µF	KEMET/ MIL–PRF	(See below for part options)	Part Number	µA at 25°C Maximum/ 5 minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	(rms) mA at 45°C 100 kHz		°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL–PRF–32700 1/, /2 PIN	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp.

** Please refer to the ripple current section for additional temperature calculation.*
(1) To complete KEMET or MIL- PRF part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.
(2) To complete KEMET or MIL-PRF part number, insert A = N/A , insert X = 0.1%/1,000 hours or Y = 0.01%/1,000 hours. Designates Product Level
(3) To complete KEMET part number, insert 80 = 500 hours. Designates Humidity test hours.
(4) To complete MIL-PRF/KEMET part number, insert A = 10 cycles +25°C, B= 10 cycles −55°C and +85°C (after voltage aging), C = 10 cycles −55°C and +85°C (before voltage aging), or Z = N/A. Designates surge current option

Derating Guidelines



Recommended Application Voltage

KO-CAPs are solid state capacitors that demonstrate no wearout mechanism when operated within their recommended guidelines. While the KO-CAP can be operated at full rated voltage, most circuit designers seek a minimum level of assurance in long term reliability, which should be demonstrated with data. A voltage derating can provide the desired level of demonstrated reliability based on industry accepted acceleration models. Since most applications do require long term reliability, KEMET recommends that designers consider a voltage derating, according the graphic above, for the maximum steady state voltage.

Voltage Rating	Maximum Recommended Steady State Voltage	Maximum Recommended Steady State Voltage
	-55°C to 85°C	+85°C to 125°C
$V_R \leq 10$ V	90% of V_R	60% of V_R,See Chart
$V_R > 10$ V	80% of V_R	54% of V_R,See Chart

V_R = Rated Voltage

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 which may be applied is limited by two criteria:

a. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.

b. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage.

The maximum power dissipation by case size can be determined using the table at right. The maximum power dissipation rating stated in the table must be reduced with increasing environmental operating temperatures. Refer to the table below for temperature compensation requirements.

Case Code	Maximum Power Dissipation (Pmax) mWatts at 45°C with +30°C Rise
T580B	127
T580C	165
T580D	255
T581D	380
T581X	400

Temperature Compensation Multipliers for Maximum Ripple Current		
T ≤ 45°C	45° C < T ≤ 85°C	85°C < T ≤ 125°C
1.00	0.70	0.25

T= Environmental Temperature

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

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

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

Reverse Voltage

Polymer electrolytic capacitors are polar devices and may be permanently damaged or destroyed if connected in the wrong polarity. These devices will withstand a small degree of transient voltage reversal for short periods as shown in the below table.

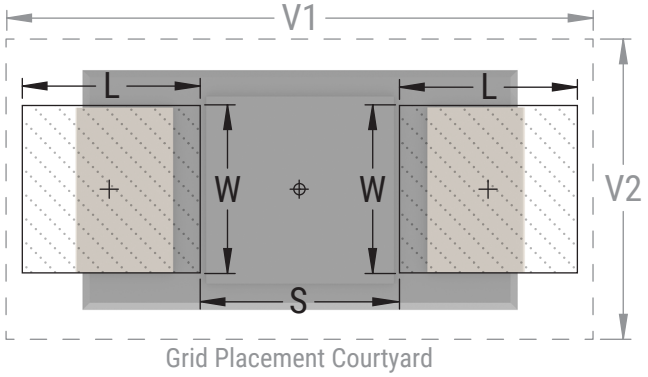
Temperature	Permissible Transient Reverse Voltage
25°C	15% of Rated Voltage
55°C	10% of Rated Voltage
85°C	5% of Rated Voltage
105°C	3% of Rated Voltage
125°C*	1% of rated voltage

**For series rated to 125°C*

Table 4 – Land Dimensions/Courtyard

KEMET	MIL	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
Case	Case	EIA	W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
B	B	3528–21	2.35	2.21	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
C	C	6032–25	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
D	D	7343–31	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
X[1]	E[1]	7343–43	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84

Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*
Density Level B: *For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.*
Density Level C: *For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC standard 7351 (IPC–7351).*
[1] Height of these chips may create problems in wave soldering.
KEMET multi-anode chip capacitors X case are equivalent to the E case as per MIL-PRF-32700/2



Soldering Process

KEMET's families of surface mount capacitors are compatible with wave (single or dual), convection, IR, or vapor phase reflow techniques. Preheating of these components is recommended to avoid extreme thermal stress. KEMET's recommended profile conditions for convection and IR reflow reflect the profile conditions of the IPC/J–STD–020D standard for moisture sensitivity testing. The devices can safely withstand a maximum of three reflow passes at these conditions.

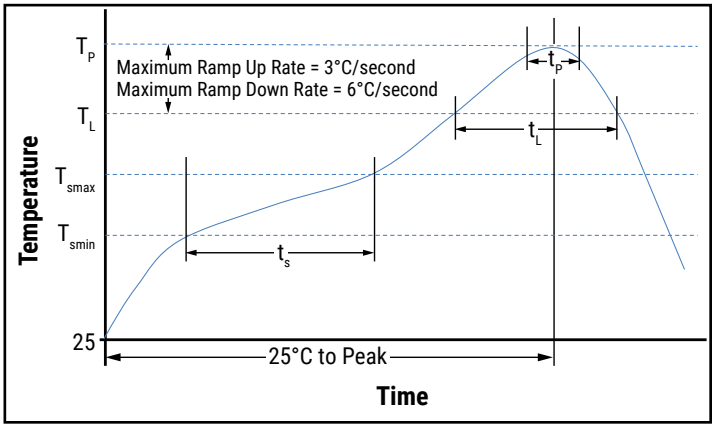
Please note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

Hand soldering should be performed with care due to the difficulty in process control. If performed, care should be taken to avoid contact of the soldering iron to the molded case. The iron should be used to heat the solder pad, applying solder between the pad and the termination, until reflow occurs. Once reflow occurs, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

Profile Feature	SnPb Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Minimum (T_{Smin})	100°C	150°C
Temperature Maximum (T_{Smax})	150°C	200°C
Time (t_s) from T_{smin} to T_{smax})	60 – 120 seconds	60 – 120 seconds
Ramp-up Rate (T_L to T_P)	3°C/seconds maximum	3°C/seconds maximum
Liquidous Temperature (T_L)	183°C	217°C
Time Above Liquidous (t_L)	60 – 150 seconds	60 – 150 seconds
Peak Temperature (T_P)	220°C* 235°C**	250°C* 260°C**
Time within 5°C of Maximum Peak Temperature (t_P)	20 seconds maximum	30 seconds maximum
Ramp-down Rate (T_P to T_L)	6°C/seconds maximum	6°C/seconds maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum

Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
** For Case Size height > 2.5 mm*
*** For Case Size height ≤ 2.5 mm*

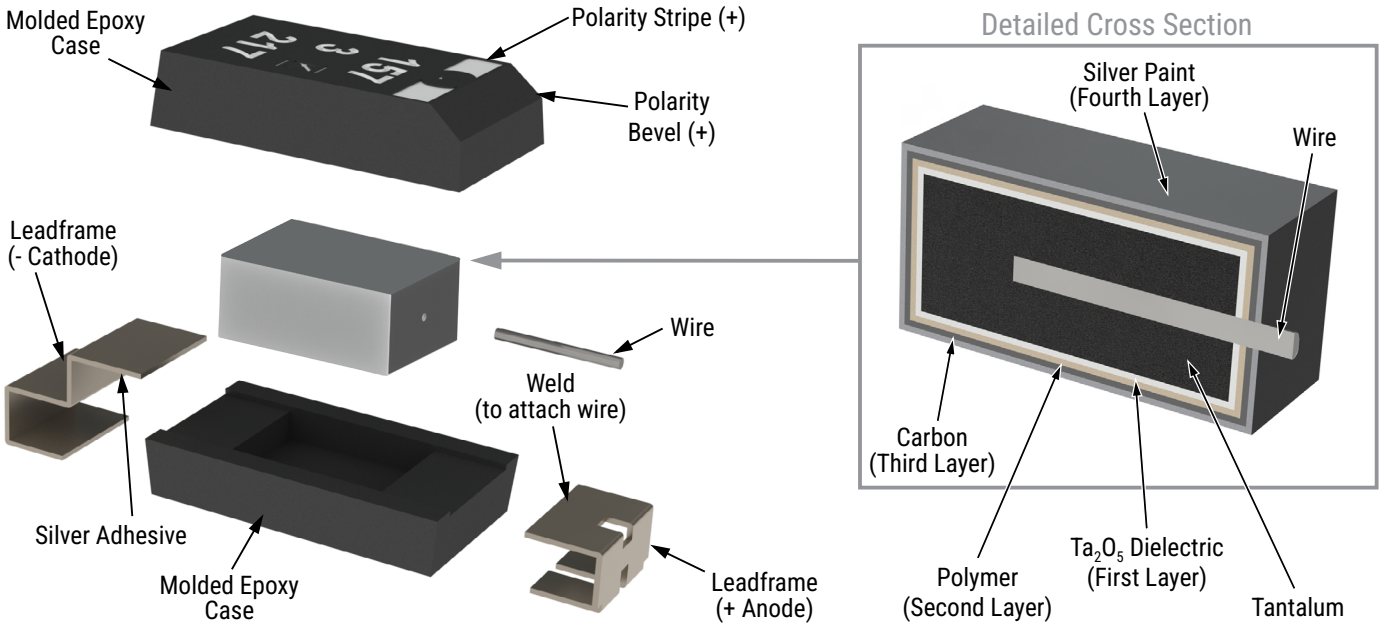


Storage

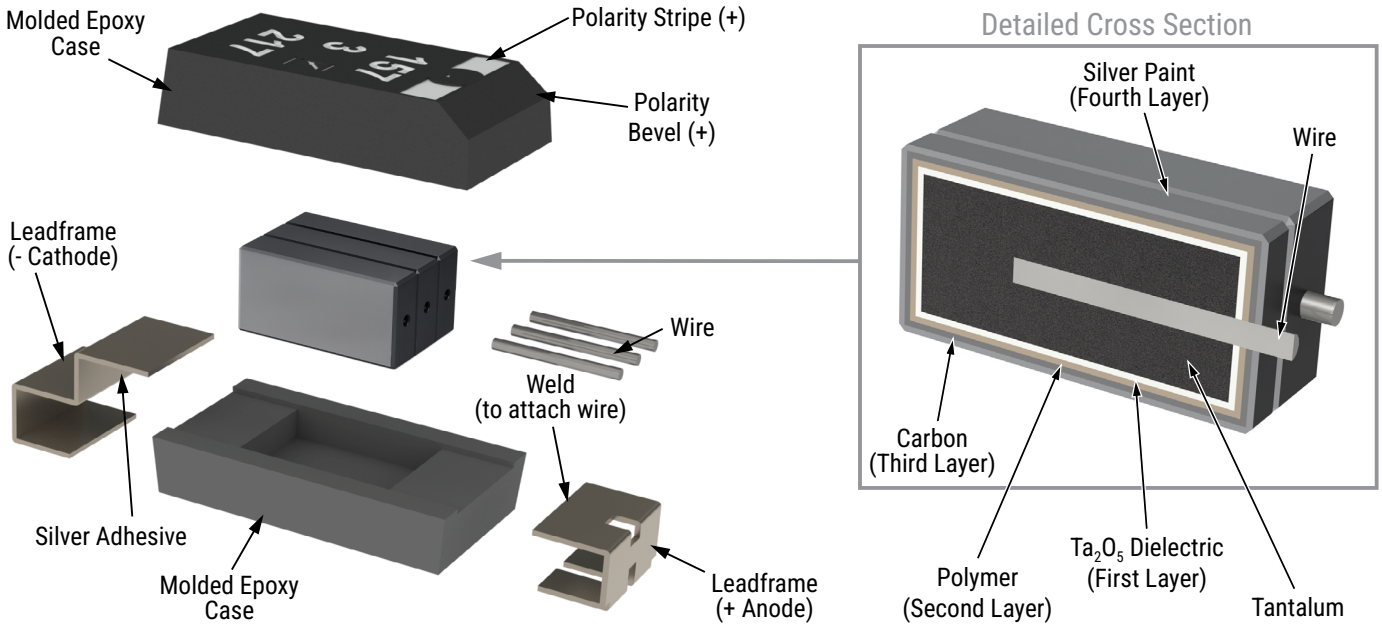
All KO-Cap Series are shipped in moisture barrier bags (MBBs) with desiccant and humidity indicator card (HIC). These parts are classified as MSL3 (Moisture Sensitivity Level 3) per IPC/JEDEC J-STD-020 and packaged per IPC/JEDEC J-STD-033.
MSL3 specifies a floor time of 168H at 30°C maximum temperature and 60% relative humidity
Unused capacitors should be sealed in a MBB with fresh desiccant.
Calculated shelf life in sealed bag:
– 12 months from bag seal date in a storage environment of < 40°C and humidity < 90% RH
– 24 months from bag seal date in a storage environment of < 30°C and humidity < 70% RH
If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure

Construction

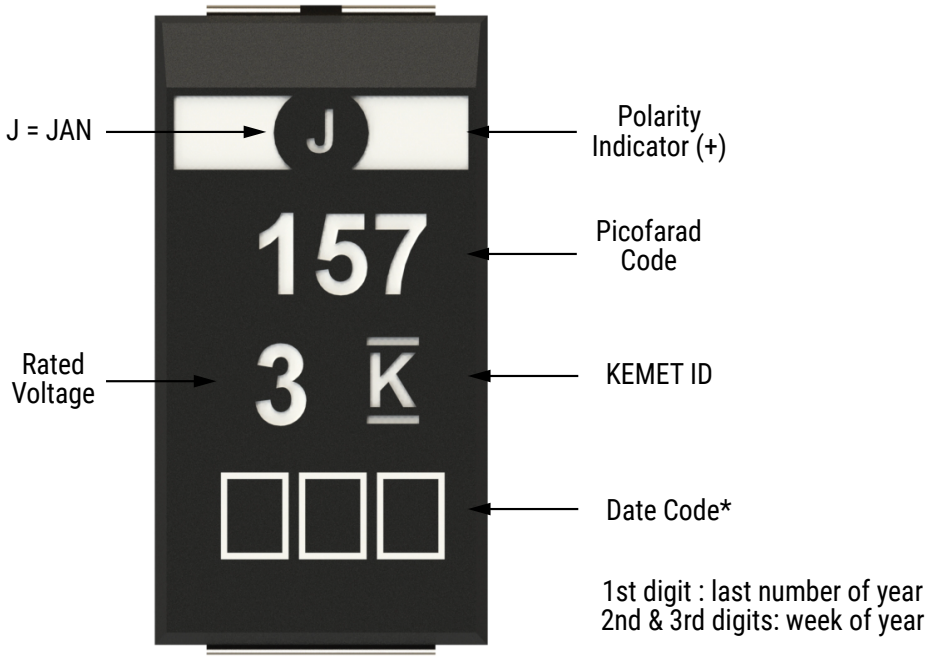
T580



T581



Capacitor Marking



Tape & Reel Packaging Information

KEMET's molded chip capacitor families are packaged in 8 and 12 mm plastic tape on 7" and 13" reels in accordance with *EIA Standard 481*: Embossed Carrier Taping of Surface Mount Components for Automatic Handling. This packaging system is compatible with all tape-fed automatic pick-and-place systems.

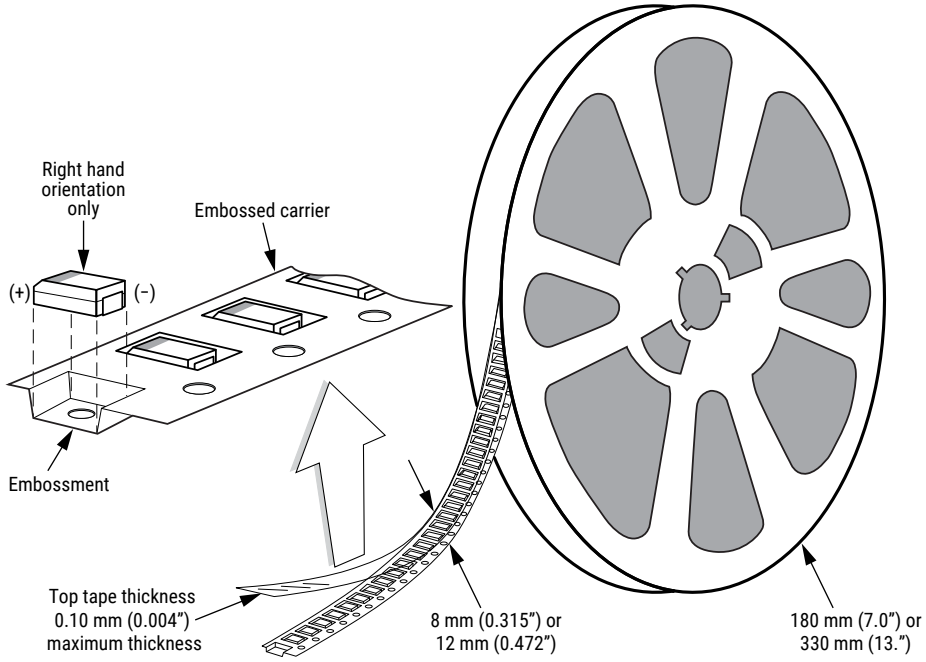


Table 3 – Packaging Quantity

Case Code		Tape Width (mm)	7" Reel*	13" Reel*
KEMET	EIA			
B	3528-21	8	2,000	8,000
C	6032-28	12	500	3,000
D	7343-31	12	500	2,500
X	7343-43	12	500	2,000

** No C-Spec required for 7" reel packaging. C-7280 required for 13" reel packaging.*

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

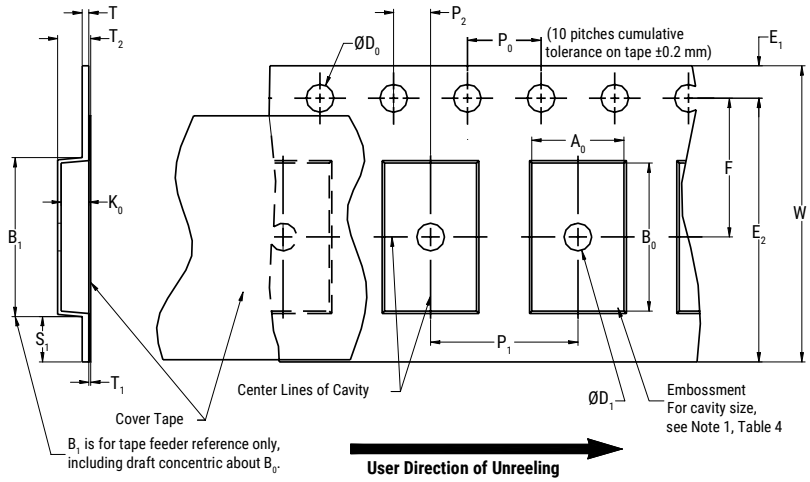


Table 4 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D_0	D_1 Minimum Note 1	E_1	P_0	P_2	R Reference Note 2	S_1 Minimum Note 3	T Maximum	T_1 Maximum
8 mm	1.5 +0.10/−0.0 (0.059 +0.004/−0.0)	1.0 (0.039)	1.75 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.05 (0.079 ±0.002)	25.0 (0.984)	0.600 (0.024)	0.600 (0.024)	0.100 (0.004)
12 mm		1.5 (0.059)				30 (1.181)			

Variable Dimensions — Millimeters (Inches)								
Tape Size	Pitch	B_1 Maximum Note 4	E_2 Minimum	F	P_1	T_2 Maximum	W Maximum	A_0, B_0 & K_0
8 mm	Single (4 mm)	4.35 (0.171)	6.25 (0.246)	3.5 ±0.05 (0.138 ±0.002)	4.0 ±0.10 (0.157 ±0.004)	2.5 (0.098)	8.3 (0.327)	Note 5
12 mm	Single (4 mm) and Double (8 mm)	8.2 (0.323)	10.25 (0.404)	5.5 ±0.05 (0.217 ±0.002)	4.0 ±0.10 (0.157 ±0.004) or 8.0 ±0.10 (0.315 ±0.004)	4.6 (0.181)	12.3 (0.484)	

1. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.

2. The tape, with or without components, shall pass around R without damage (see Figure 4).

3. If S_1 < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481–D, paragraph 4.3, section b).

4. B_1 dimension is a reference dimension for tape feeder clearance only.

5. The cavity defined by A_0, B_0 and K_0 shall surround the component with sufficient clearance that:

(a) the component does not protrude above the top surface of the carrier tape.

(b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.

(c) rotation of the component is limited to 20° maximum for 8 and 12 mm tapes (see Figure 2).

(d) lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide tape (see Figure 3).

(e) see Addendum in EIA Standard 481–D for standards relating to more precise taping requirements.

Packaging Information Performance Notes

1. Cover tape break force: 1.0 kg minimum.
2. Cover tape peel strength: The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	Peel Strength
8 mm	0.1 to 1.0 newton (10 to 100 gf)
12 mm	0.1 to 1.3 newton (10 to 130 gf)

The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ±10 mm/minute.
3. Labeling: Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. *Refer to EIA Standards 556 and 624*.

Figure 2 – Maximum Component Rotation

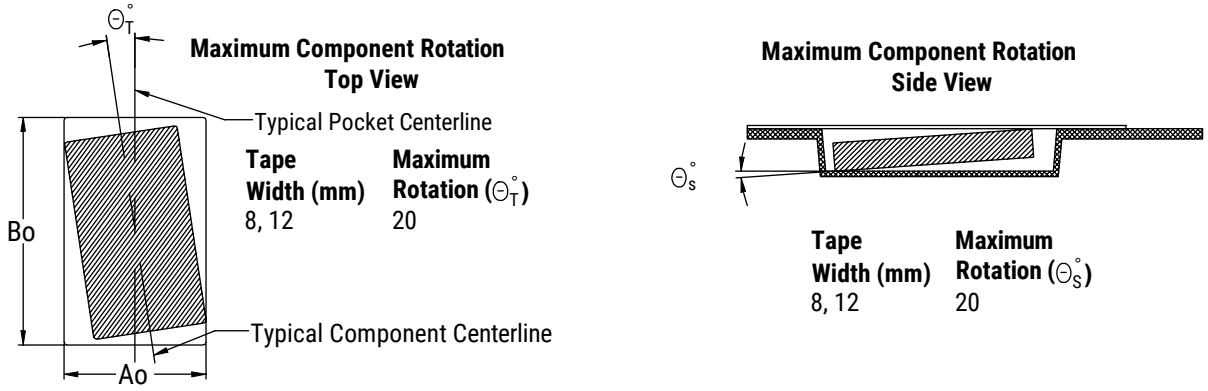


Figure 3 – Maximum Lateral Movement

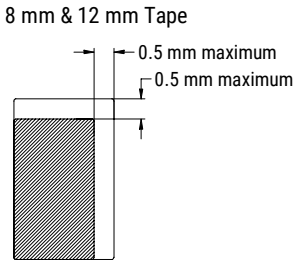


Figure 4 – Bending Radius

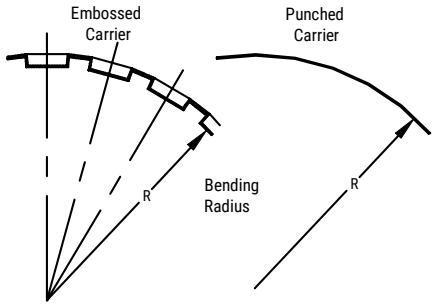
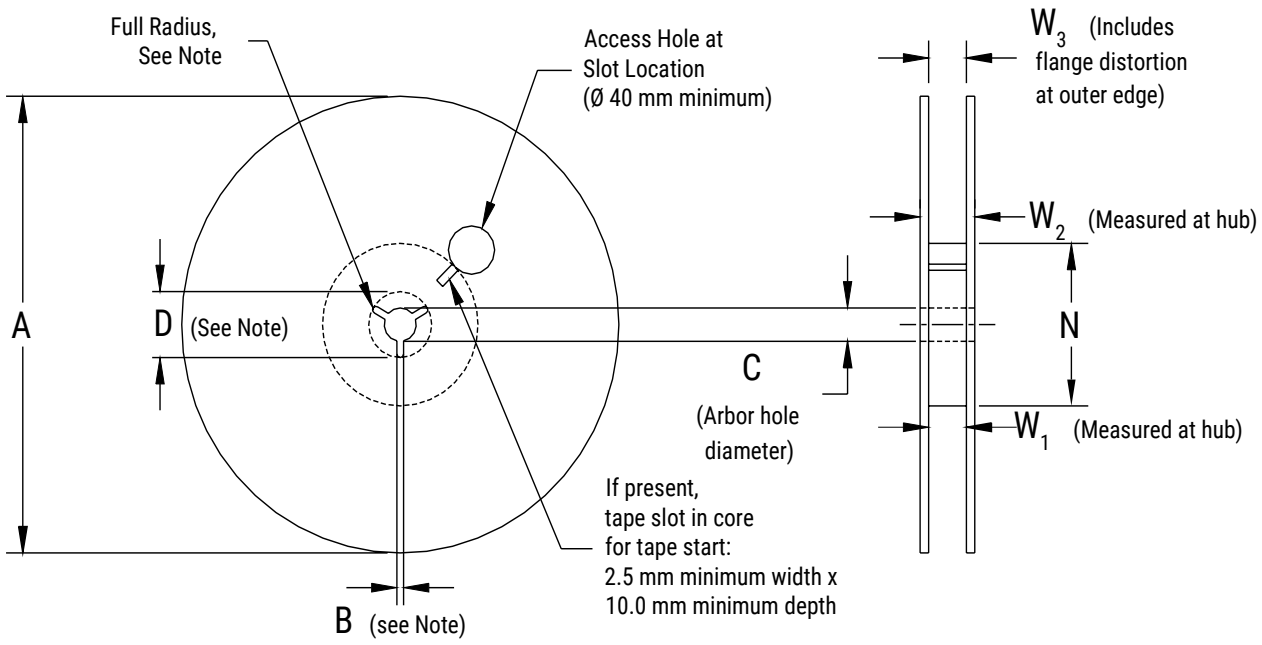


Figure 5 – Reel Dimensions



Note: Drive spokes optional; if used, dimensions B and D shall apply.

Table 5 – Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Minimum	C	D Minimum
8 mm	178 ±0.20 (7.008 ±0.008) or 330 ±0.20 (13.000 ±0.008)	1.5 (0.059)	13.0 +0.5/–0.2 (0.521 +0.02/–0.008)	20.2 (0.795)
12 mm				

Variable Dimensions — Millimeters (Inches)				
Tape Size	N Minimum	W_1	W_2 Maximum	W_3
8 mm	50 (1.969)	8.4 +1.5/–0.0 (0.331 +0.059/–0.0)	14.4 (0.567)	Shall accommodate tape width without interference
12 mm		12.4 +2.0/–0.0 (0.488 +0.078/–0.0)	18.4 (0.724)	

Figure 6 – Tape Leader & Trailer Dimensions

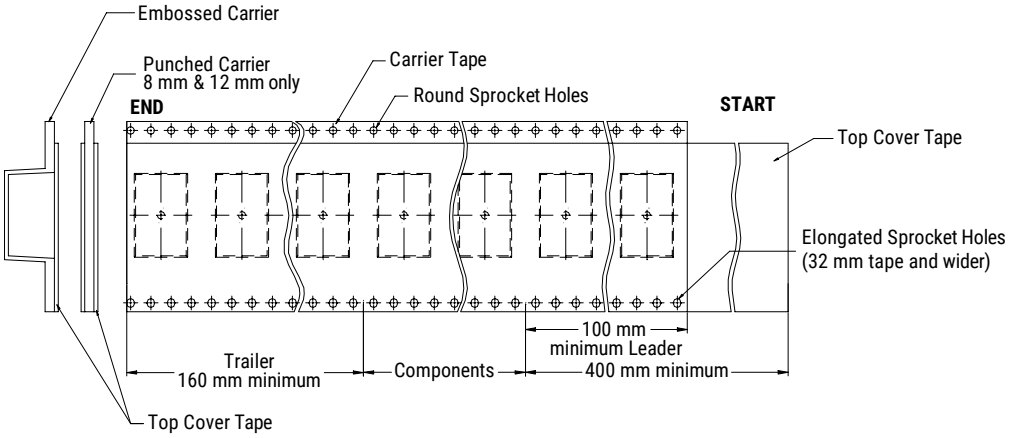
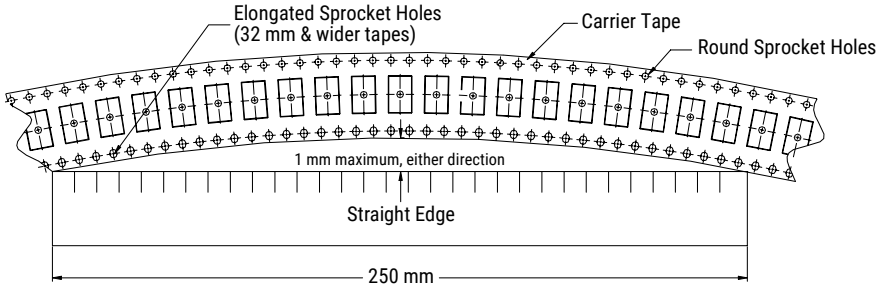


Figure 7 – Maximum Camber



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