

# Polymer Tantalum - PT Series



\*\* RoHS Compliant (6/6) according to Directive 2002/95/EC when ordered with 100% Sn solder.

## Scope

- Ta anode and Ta<sub>2</sub>O<sub>5</sub> dielectric
- Low ESR and improved capacitance retention at high frequency
- May be operated at steady state voltages up to 90% of rated voltage for part types with rated voltages ≤10V and up to 80% of rated voltage for part types >10V with equivalent or better reliability than traditional MnO<sub>2</sub> tantalum capacitors operated at 50% of rated voltage.

## Features

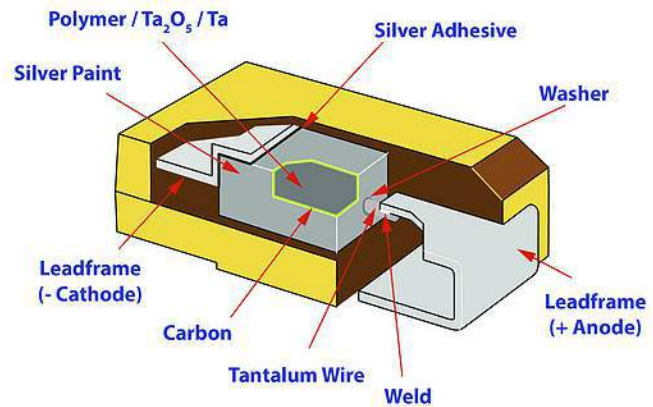
- Conductive organic polymer replaces traditionally used MnO<sub>2</sub> as cathode plate of the capacitor.
- Features benign failure mode, which eliminates the ignition failures that can occur in standard MnO<sub>2</sub> tantalum types
- Low ESR, high frequency capacitance retention, higher capacitance, benign failure mode, volumetric efficiency, surface mount capability, extremely long life
- Can reduce component counts, eliminate through-hole assembly by replacing cumbersome leaded aluminum capacitors, and offers a cost-effective and space-saving solution.

## Benefits

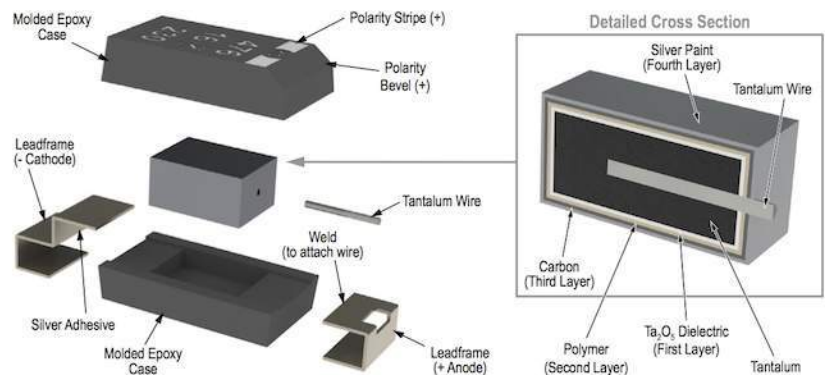
- Extremely low ESR
- -55°C to 105°C operating temperature range
- Polymer cathode technology
- High frequency capacitance retention
- Non-ignition failure mode
- Capacitance up to 1,500 uF
- 100% accelerated steady state aging
- 100% surge current tested
- Taped and reeled per EIA 481
- Volumetric efficiency
- Self-healing mechanism
- EIA standard case sizes
- Halogen Free Epoxy.

## Applications

- DC/DC converters
- Notebook PCs
- Portable Electronics
- Telecommunications (mobile phone and base station)
- Displays
- SSD, HDD and USB



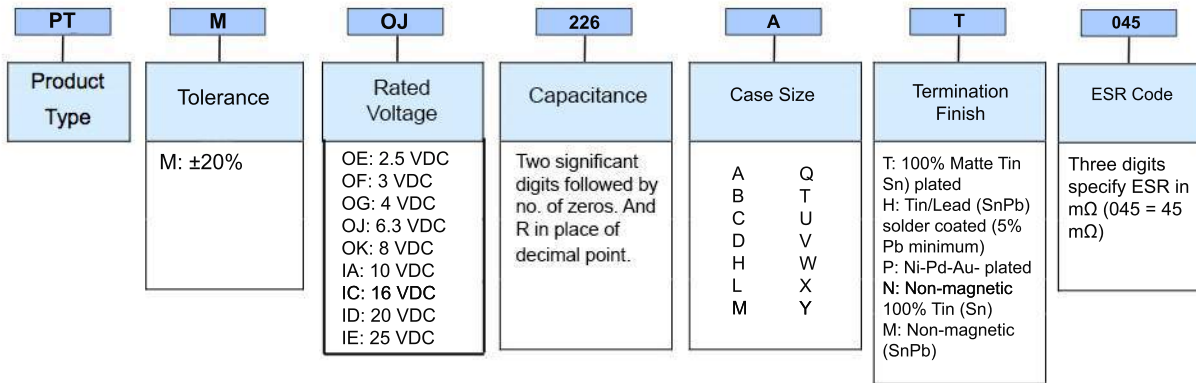
## Construction



## Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 105°C
Rated Capacitance Range	10 - 1500 uF at 120 Hz/25°C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	2.5 - 25V
DF (120 Hz)	≤ 10%
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.1 CV (uA) at rated voltage after 5 minutes

## Part Numbering



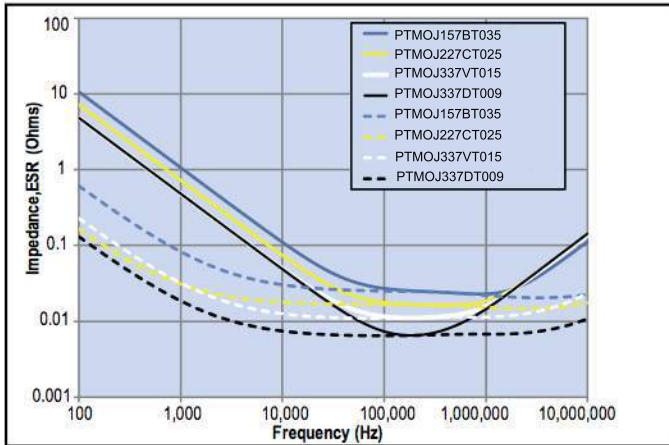
## Qualification

TEST	CONDITION	CHARACTERISTICS				
Endurance	105°C at rated voltage, 2,000 hours	Δ C/C	Within -20%/+10% of initial value			
		DF	Within initial limits			
		DCL	Within 1.25 x initial limit			
		ESR	Within 2.0 x initial limit			
Storage Life	105°C at 0 volts, 2,000 hours	Δ C/C	Within -20%/+10% of initial value			
		DF	Within initial limits			
		DCL	Within 1.25 x initial limit			
		ESR	Within 2.0 x initial limit			
Humidity	60°C, 90% RH, 500 hours, No Load	Δ C/C	Within -5%/+35% of initial value			
		DF	Within initial limits			
		DCL	Within 5.0 x initial limit			
		ESR	Within 2.0 x initial limit			
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +105°C, +25°C		+25°C	-55°C	+85°C	+105°C
		Δ C/C	IL*	±20%	±20%	±30%
		DF	IL	IL	1.2 x IL	1.5 x IL
		DCL	IL	N/A	10 x IL	10 x IL
Surge Voltage	105°C, 1.32 x rated voltage, 1,000 cycles	Δ C/C	Within -20%/+10% of initial value			
		DF	Within initial limits			
		DCL	Within initial limits			
		ESR	Within initial limits			
Mechanical Shock/Vibration	MIL-STD-202, Method 213, Condition I, 100 G peak. MIL-STD-202, Method 204, Condition D, 10 Hz to 2,000 Hz, 20 G peak	Δ C/C	Within ±10% of initial value			
		DF	Within initial limits			
		DCL	Within initial limits			

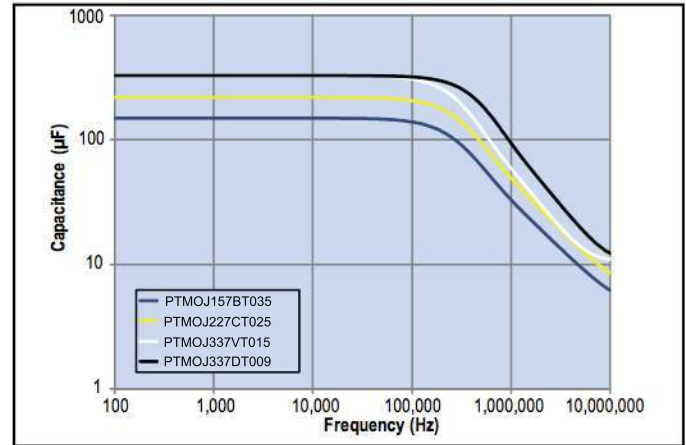
\*IL = Initial limit

## Electrical Characteristics

ESR VS. FREQUENCY



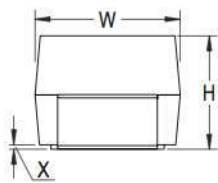
CAPACITANCE VS. FREQUENCY



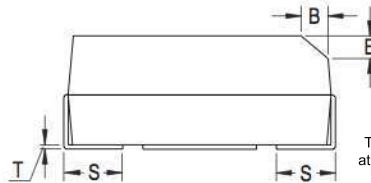
## Dimensions

mm (inches) - metric will govern

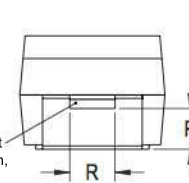
CATHODE (-) END VIEW



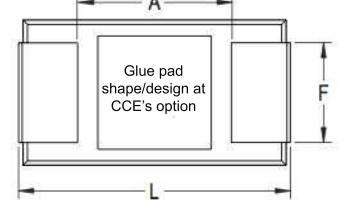
SIDE VIEW



ANODE (+) END VIEW



BOTTOM VIEW



Termination cutout at Cal-Chip's option, either end

CASE SIZE		COMPONENT										
CCE	EIA	L*	W*	H*	F* ±0.1 ±(0.004)	"S" ±0.3 ±(0.012)"	B* ±0.15 (Ref) ±0.006	X (Ref)	P (Ref)	R (Ref)	T (Ref)	A (Minimum)
A	3216-18	3.2 ±0.2 (0.126 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.2 (0.047)	0.80 (0.032)	0.4 (0.016)	0.10 ±0.10 (0.004 ±0.004)	0.4 (0.016)	0.4 (0.016)	0.13 (0.005)	1.2 (0.047)
B	3528-21	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.9 ±0.1 (0.075 ±0.004)	2.2 (0.087)	0.80 (0.032)	0.4 (0.016)	0.10 ±0.10 (0.004 ±0.004)	0.5 (0.020)	1.0 (0.039)	0.13 (0.005)	1.9 (0.075)
C	6032-28	6.0 ±0.3 (0.236 ±0.012)	3.2 ±0.3 (0.126 ±0.012)	2.5 ±0.3 (0.098 ±0.012)	2.2 (0.087)	1.30 (0.051)	0.5 (0.020)	0.10 ±0.10 (0.004 ±0.004)	0.9 (0.035)	1.0 (0.039)	0.13 (0.005)	2.9 (0.114)
D	7343-31	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	2.8 ±0.3 (0.110 ±0.012)	2.4 (0.094)	1.30 (0.051)	0.5 (0.020)	0.10 ±0.10 (0.004 ±0.004)	0.9 (0.035)	1.0 (0.039)	0.13 (0.005)	3.6 (0.142)
H	7360-20	7.3 ±0.3 (0.287 ±0.012)	6.0 ±0.3 (0.236 ±0.012)	2.0 (0.078) Maximum	4.1 (0.161)	1.3 (0.051)	N/A	0.10 ±0.10 (0.004 ±0.004)	N/A	N/A	0.13 (0.005)	3.3 (0.130)
L	6032-19	6.0 ±0.3 (0.236 ±0.012)	3.2 ±0.2 (0.110 ±0.008)	1.9 (0.075)	2.2 (0.087)	1.3 (0.051)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	2.5 (0.098)
M	3528-15	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.5 (0.059)	2.2 (0.087)	0.8 (0.031)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	1.1 (0.043)
Q	7343-12	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	1.2 (0.047) Maximum	2.4 (0.094)	1.3 (0.051)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	3.8 (0.150)
T	3528-12	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.2 (0.047)	2.2 (0.087)	0.80 (0.032)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	1.9 (0.075)
U	6032-15	6.0 ±0.3 (0.236 ±0.012)	3.2 ±0.2 (0.110 ±0.008)	1.5 (0.059)	2.2 (0.087)	1.30 (0.051)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	2.9 (0.114)
V	7343-19	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	1.8 ±0.1 (0.071 ±0.004)	2.4 (0.094)	1.30 (0.051)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	3.6 (0.142)
W	7343-15	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	1.4 ±0.1 (0.055 ±0.004)	2.4 (0.094)	1.30 (0.051)	N/A	0.05 (0.002)	N/A	N/A	0.13 (0.005)	3.6 (0.142)
X	7343-43	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 ±0.3 (0.157 ±0.012)	2.4 (0.094)	1.30 (0.051)	0.5 (0.020)	0.10 ±0.10 (0.004 ±0.004)	1.7 (0.067)	1.0 (0.039)	0.13 (0.005)	3.6 (0.142)
Y	7343-40	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 (0.157)	2.4 (0.094)	1.3 (0.051)	0.5 (0.020)	0.10 ±0.10 (0.004 ±0.004)	1.7 (0.067)	1.0 (0.039)	0.13 (0.005)	3.8 (0.150)

Notes: (Ref) – Dimensions provided for reference only. No dimensions are provided for B, P or R because low profile cases do not have a bevel or a notch.

\* MIL-PRF-55365/8 specified dimensions



## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
2.5	47	A/3216-18	PTMOE476A*090	12	8	90	1100	3	105
2.5	68	A/3216-18	PTMOE686A*070	17	8	70	1300	3	105
2.5	68	A/3216-18	PTMOE686A*080	17	8	80	1200	3	105
2.5	100	T/3528-12	PTMOE107T*040	25	8	40	1600	3	105
2.5	100	T/3528-12	PTMOE107T*070	25	8	70	1200	3	105
2.5	100	B/3528-21	PTMOE107B*025	25	8	25	2300	3	105
2.5	100	B/3528-21	PTMOE107B*035	25	8	35	1900	3	105
2.5	100	B/3528-21	PTMOE107B*040	25	8	40	1800	3	105
2.5	100	B/3528-21	PTMOE107B*040	25	8	70	1300	3	105
2.5	150	U/6032-15	PTMOE157U*055	38	8	55	1600	3	105
2.5	220	A/3216-18	PTMOE227A*035	55	8	35	1464	3	105
2.5	220	B/3528-21	PTMOE227B*015	55	8	15	2900	3	105
2.5	220	B/3528-21	PTMOE227B*018	55	8	18	2700	3	105
2.5	220	B/3528-21	PTMOE227B*021	55	8	21	2500	3	105
2.5	220	B/3528-21	PTMOE227B*025	55	8	25	2300	3	105
2.5	220	B/3528-21	PTMOE227B*030	55	8	30	2100	3	105
2.5	220	B/3528-21	PTMOE227B*035	55	8	35	1900	3	105
2.5	220	B/3528-21	PTMOE227B*055	55	8	55	1500	3	105
2.5	220	B/3528-21	PTMOE227B*070	55	8	70	1300	3	105
2.5	220	U/6032-15	PTMOE227U*055	55	8	55	1600	3	105
2.5	220	C/6032-28	PTMOE227C*025	55	8	25	2600	3	105
2.5	220	C/6032-28	PTMOE227C*045	55	8	45	1900	3	105
2.5	220	W/7343-15	PTMOE227W*025	55	10	25	2700	3	105
2.5	220	V/7343-19	PTMOE227V*006	55	10	6	5600	3	105
2.5	220	V/7343-19	PTMOE227V*007	55	10	7	5200	3	105
2.5	220	V/7343-19	PTMOE227V*009	55	10	9	4600	3	105
2.5	220	V/7343-19	PTMOE227V*012	55	10	12	3900	3	105
2.5	220	V/7343-19	PTMOE227V*015	55	10	15	3500	3	105
2.5	220	V/7343-19	PTMOE227V*025	55	10	25	2700	3	105
2.5	220	V/7343-19	PTMOE227V*045	55	10	45	2000	3	105
2.5	220	D/7343-31	PTMOE227D*007	55	10	7	5700	3	105
2.5	220	D/7343-31	PTMOE227D*040	55	10	40	2400	3	105
2.5	330	B/3528-21	PTMOE337B*009	83	8	9	3073	3	105
2.5	330	B/3528-21	PTMOE337B*012	83	8	12	2700	3	105
2.5	330	B/3528-21	PTMOE337B*015	83	8	15	2900	3	105
2.5	330	B/3528-21	PTMOE337B*018	83	8	18	2700	3	105
2.5	330	B/3528-21	PTMOE337B*035	83	8	35	1900	3	105
2.5	330	B/3528-21	PTMOE337B*045	83	8	45	1700	3	105
2.5	330	B/3528-21	PTMOE337B*070	83	8	70	1300	3	105
2.5	330	C/6032-28	PTMOE337C*015	83	8	15	3300	3	105
2.5	330	C/6032-28	PTMOE337C*018	83	8	18	3000	3	105
2.5	330	C/6032-28	PTMOE337C*025	83	8	25	2600	3	105
2.5	330	C/6032-28	PTMOE337C*045	83	8	45	1900	3	105
2.5	330	L/6032-19	PTMOE337L*009	83	8	9	4100	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at Cal-Chip's option. Voltage substitutions will be marked with the higher voltage rating. Substitutions can include better than series.



## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
2.5	330	L/6032-19	PTMOE337L*012	83	8	12	3500	3	105
2.5	330	L/6032-19	PTMOE337L*025	83	8	25	2400	3	105
2.5	330	W/7343-15	PTMOE337W*015	83	10	15	3500	3	105
2.5	330	W/7343-15	PTMOE337W*025	83	10	25	2700	3	105
2.5	330	W/7343-15	PTMOE337W*040	83	10	40	2100	3	105
2.5	330	V/7343-19	PTMOE337V*006	83	10	6	5600	3	105
2.5	330	V/7343-19	PTMOE337V*007	83	10	7	5200	3	105
2.5	330	V/7343-19	PTMOE337V*009	83	10	9	4600	3	105
2.5	330	V/7343-19	PTMOE337V*012	83	10	12	3900	3	105
2.5	330	V/7343-19	PTMOE337V*015	83	10	15	3500	3	105
2.5	330	V/7343-19	PTMOE337V*018	83	10	18	3200	3	105
2.5	330	V/7343-19	PTMOE337V*025	83	10	25	2700	3	105
2.5	330	V/7343-19	PTMOE337V*040	83	10	40	2200	3	105
2.5	330	D/7343-31	PTMOE337D*006	83	10	6	6100	3	105
2.5	330	D/7343-31	PTMOE337D*007	83	10	7	5700	3	105
2.5	470	V/7343-19	PTMOE477V*006	118	10	6	5600	3	105
2.5	470	V/7343-19	PTMOE477V*007	118	10	7	5200	3	105
2.5	470	V/7343-19	PTMOE477V*009	118	10	9	4600	3	105
2.5	470	V/7343-19	PTMOE477V*012	118	10	12	3900	3	105
2.5	470	V/7343-19	PTMOE477V*015	118	10	15	3500	3	105
2.5	470	V/7343-19	PTMOE477V*018	118	10	18	3200	3	105
2.5	470	C/6032-28	PTMOE477C*025	118	8	25	2600	3	105
2.5	470	C/6032-28	PTMOE477C*045	118	8	45	1900	3	105
2.5	470	D/7343-31	PTMOE477D*006	118	10	6	6100	3	105
2.5	470	D/7343-31	PTMOE477D*007	118	10	7	5700	3	105
2.5	470	D/7343-31	PTMOE477D*009	118	10	9	5000	3	105
2.5	680	D/7343-31	PTMOE687D*010	170	10	10	4700	3	105
2.5	680	D/7343-31	PTMOE687D*015	170	10	15	3900	3	105
2.5	680	D/7343-31	PTMOE687D*040	170	10	40	2400	3	105
2.5	680	Y/7343-40	PTMOE687Y*025	170	10	25	3100	3	105
2.5	1000	D/7343-31	PTMOE108D*006	250	10	6	6100	3	105
2.5	1000	D/7343-31	PTMOE108D*007	250	10	7	5700	3	105
2.5	1000	D/7343-31	PTMOE108D*009	250	10	9	5000	3	105
2.5	1000	D/7343-31	PTMOE108D*010	250	10	10	4700	3	105
2.5	1000	D/7343-31	PTMOE108D*015	250	10	15	3900	3	105
2.5	1000	D/7343-31	PTMOE108D*030	250	10	30	2700	3	105
2.5	1000	Y/7343-40	PTMOE108Y*010	250	10	10	4900	3	105
2.5	1000	Y/7343-40	PTMOE108Y*015	250	10	15	4000	3	105
2.5	1000	Y/7343-40	PTMOE108Y*025	250	10	25	3100	3	105
2.5	1000	X/7343-43	PTMOE108X*010	250	10	10	5000	3	105
2.5	1500	X/7343-43	PTMOE158X*015	375	10	15	4100	3	105
3	100	B/3528-21	PTMOF107B*025	30	8	25	2300	3	105
3	100	B/3528-21	PTMOF107B*030	30	8	35	1900	3	105
3	100	B/3528-21	PTMOF107B*040	30	8	40	1800	3	105
3	100	B/3528-21	PTMOF107B*070	30	8	70	1300	3	105
3	150	B/3528-21	PTMOF157B*025	45	8	25	2300	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

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Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
3	150	B/3528-21	PTMOF157B*035	45	8	35	1900	3	105
3	150	B/3528-21	PTMOF157B*040	45	8	40	1800	3	105
3	150	B/3528-21	PTMOF157B*045	45	8	70	1300	3	105
3	330	V/7343-19	PTMOF337V*009	99	10	9	4600	3	105
3	330	V/7343-19	PTMOF337V*012	99	10	12	3900	3	105
3	330	V/7343-19	PTMOF337V*015	99	10	15	3500	3	105
3	330	V/7343-19	PTMOF337V*025	99	10	25	2700	3	105
3	680	D/7343-31	PTMOF687D*015	204	10	15	3900	3	105
3	680	D/7343-31	PTMOF687D*040	204	10	40	2400	3	105
3	1000	X/7343-43	PTMOF108X*015	300	10	15	4100	3	105
3	1000	X/7343-43	PTMOF108X*030	300	10	30	2900	3	105
4	15	T/3528-12	PTMOG156T*100	6	8	100	1000	3	105
4	33	A/3216-18	PTMOG336A*070	13	8	70	1300	3	105
4	33	A/3216-18	PTMOG336A*080	13	8	80	1200	3	105
4	47	A/3216-18	PTMOG476A*070	19	8	70	1300	3	105
4	47	A/3216-18	PTMOG476A*080	19	8	80	1200	3	105
4	47	T/3528-12	PTMOG476T*070	19	8	70	1200	3	105
4	68	T/3528-12	PTMOG686T*070	27	8	70	1200	3	105
4	68	B/3528-21	PTMOG686B*025	27	8	25	2300	3	105
4	68	B/3528-21	PTMOG686B*035	27	8	35	1900	3	105
4	68	B/3528-21	PTMOG686B*040	27	8	40	1800	3	105
4	68	B/3528-21	PTMOG686B*070	27	8	70	1300	3	105
4	68	U/6032-15	PTMOG686U*055	27	8	55	1600	3	105
4	100	A/3216-18	PTMOG107A*150	40	8	150	900	3	105
4	100	A/3216-18	PTMOG107A*200	40	8	200	700	3	105
4	100	T/3528-12	PTMOG107T*070	40	8	70	1200	3	105
4	100	T/3528-12	PTMOG107T*150	40	8	150	800	3	105
4	100	B/3528-21	PTMOG107B*025	40	8	25	2300	3	105
4	100	B/3528-21	PTMOG107B*035	40	8	35	1900	3	105
4	100	B/3528-21	PTMOG107B*040	40	8	40	1800	3	105
4	100	B/3528-21	PTMOG107B*070	40	8	70	1300	3	105
4	100	U/6032-15	PTMOG107U*055	40	8	55	1600	3	105
4	150	B/3528-21	PTMOG157B*015	60	8	15	2900	3	105
4	150	B/3528-21	PTMOG157B*018	60	8	18	2700	3	105
4	150	B/3528-21	PTMOG157B*025	60	8	25	2300	3	105
4	150	B/3528-21	PTMOG157B*030	60	8	30	2100	3	105
4	150	B/3528-21	PTMOG157B*035	60	8	35	1900	3	105
4	150	B/3528-21	PTMOG157B*040	60	8	40	1800	3	105
4	150	B/3528-21	PTMOG157B*070	60	8	70	1300	3	105
4	150	U/6032-15	PTMOG157U*055	60	8	55	1600	3	105
4	150	C/6032-28	PTMOG157C*015	60	8	15	3300	3	105
4	150	C/6032-28	PTMOG157C*025	60	8	25	2600	3	105
4	150	C/6032-28	PTMOG157C*045	60	8	45	1900	3	105
4	150	C/6032-28	PTMOG157C*100	60	8	100	1300	3	105
4	150	V/7343-19	PTMOG157V*007	60	10	7	5200	3	105
4	150	V/7343-19	PTMOG157V*009	60	10	9	4600	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

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## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
4	150	V/7343-19	PTMOG157V*012	60	10	12	3900	3	105
4	150	V/7343-19	PTMOG157V*015	60	10	15	3500	3	105
4	150	V/7343-19	PTMOG157V*025	60	10	25	2700	3	105
4	150	D/7343-31	PTMOG157V*007	60	10	7	5700	3	105
4	220	B/3528-21	PTMOG227B*035	88	8	35	1900	3	105
4	220	B/3528-21	PTMOG227B*045	88	8	45	1700	3	105
4	220	B/3528-21	PTMOG227B*070	88	8	70	1300	3	105
4	220	C/6032-28	PTMOG227C*015	88	8	15	3300	3	105
4	220	C/6032-28	PTMOG227C*018	88	8	18	3000	3	105
4	220	C/6032-28	PTMOG227C*025	88	8	25	2600	3	105
4	220	C/6032-28	PTMOG227C*045	88	8	45	1900	3	105
4	220	C/6032-28	PTMOG227C*055	88	8	55	1700	3	105
4	220	L/6032-19	PTMOG227L*012	88	8	12	3500	3	105
4	220	L/6032-19	PTMOG227L*025	88	8	25	2400	3	105
4	220	W/7343-15	PTMOG227W*025	88	10	25	2700	3	105
4	220	W/7343-15	PTMOG227W*040	88	10	40	2100	3	105
4	220	V/7343-19	PTMOG227V*006	88	10	6	5600	3	105
4	220	V/7343-19	PTMOG227V*007	88	10	7	5200	3	105
4	220	V/7343-19	PTMOG227V*009	88	10	9	4600	3	105
4	220	V/7343-19	PTMOG227V*012	88	10	12	3900	3	105
4	220	V/7343-19	PTMOG227V*015	88	10	15	3500	3	105
4	220	V/7343-19	PTMOG227V*018	88	10	18	3200	3	105
4	220	V/7343-19	PTMOG227V*025	88	10	25	2700	3	105
4	220	V/7343-19	PTMOG227V*040	88	10	40	2200	3	105
4	220	V/7343-19	PTMOG227V*045	88	10	45	2000	3	105
4	220	D/7343-31	PTMOG227D*006	88	10	6	6100	3	105
4	220	D/7343-31	PTMOG227D*007	88	10	7	5700	3	105
4	220	D/7343-31	PTMOG227D*012	88	10	12	4300	3	105
4	220	D/7343-31	PTMOG227D*065	88	10	65	1900	3	105
4	330	C/6032-28	PTMOG337C*025	132	8	25	2600	3	105
4	330	C/6032-28	PTMOG337C*045	132	8	45	1900	3	105
4	330	V/7343-19	PTMOG337V*007	132	10	7	5200	3	105
4	330	V/7343-19	PTMOG337V*009	132	10	9	4600	3	105
4	330	V/7343-19	PTMOG337V*012	132	10	12	3900	3	105
4	330	V/7343-19	PTMOG337V*018	132	10	18	3200	3	105
4	330	V/7343-19	PTMOG337V*025	132	10	25	2700	3	105
4	330	V/7343-19	PTMOG337V*040	132	10	40	2200	3	105
4	330	D/7343-31	PTMOG337D*006	132	10	6	6100	3	105
4	330	D/7343-31	PTMOG337D*007	132	10	7	5700	3	105
4	330	D/7343-31	PTMOG337D*009	132	10	9	5000	3	105
4	330	D/7343-31	PTMOG337D*012	132	10	12	4300	3	105
4	330	D/7343-31	PTMOG337D*015	132	10	15	3900	3	105
4	330	D/7343-31	PTMOG337D*040	132	10	40	2400	3	105
4	330	D/7343-31	PTMOG337D*045	132	10	45	2200	3	105
4	470	D/7343-31	PTMOG477D*010	188	10	10	4700	3	105
4	470	D/7343-31	PTMOG477D*012	188	10	12	4300	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

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## Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
4	470	D/7343-31	PTMOG477D*015	188	10	15	3900	3	105
4	470	D/7343-31	PTMOG477D*018	188	10	18	3500	3	105
4	470	D/7343-31	PTMOG477D*025	188	10	25	3000	3	105
4	470	D/7343-31	PTMOG477D*040	188	10	40	2400	3	105
4	680	D/7343-31	PTMOG687D*012	272	10	12	4300	3	105
4	680	D/7343-31	PTMOG687D*015	272	10	15	3900	3	105
4	680	D/7343-31	PTMOG687D*025	272	10	25	3000	3	105
4	680	Y/7343-40	PTMOG687Y*010	272	10	10	4900	3	105
4	680	Y/7343-40	PTMOG687Y*015	272	10	15	4000	3	105
4	680	Y/7343-40	PTMOG687Y*025	272	10	25	3100	3	105
4	680	X/7343-43	PTMOG687X*010	272	10	10	5000	3	105
4	680	X/7343-43	PTMOG687X*015	272	10	15	4100	3	105
4	680	X/7343-43	PTMOG687X*035	272	10	35	2700	3	105
6.3	15	T/3528-12	PTMOJ156T*100	9	8	100	1000	3	105
6.3	22	A/3216-18	PTMOJ226A*090	14	8	90	1100	3	105
6.3	22	A/3216-18	PTMOJ226A*100	14	8	100	1100	3	105
6.3	22	T/3528-12	PTMOJ226T*100	14	8	100	1000	3	105
6.3	33	A/3216-18	PTMOJ336A*070	21	8	70	1300	3	105
6.3	33	A/3216-18	PTMOJ336A*080	21	8	80	1200	3	105
6.3	33	A/3216-18	PTMOJ336A*120	21	8	120	1000	3	105
6.3	33	T/3528-12	PTMOJ336T*070	21	8	70	1200	3	105
6.3	33	B/3528-21	PTMOJ336B*025	21	8	25	2300	3	105
6.3	33	B/3528-21	PTMOJ336B*035	21	8	35	1900	3	105
6.3	33	B/3528-21	PTMOJ336B*040	21	8	40	1800	3	105
6.3	33	B/3528-21	PTMOJ336B*070	21	8	70	1300	3	105
6.3	33	C/6032-28	PTMOJ336C*100	21	8	100	1300	3	105
6.3	47	A/3216-18	PTMOJ476A*150	30	8	150	900	3	105
6.3	47	T/3528-12	PTMOJ476T*040	30	8	40	1600	3	105
6.3	47	T/3528-12	PTMOJ476T*070	30	8	70	1200	3	105
6.3	47	B/3528-21	PTMOJ476B*025	30	8	25	2300	3	105
6.3	47	B/3528-21	PTMOJ476B*035	30	8	35	1900	3	105
6.3	47	B/3528-21	PTMOJ476B*040	30	8	40	1800	3	105
6.3	47	B/3528-21	PTMOJ476B*070	30	8	70	1300	3	105
6.3	68	A/3216-18	PTMOJ686A*150	43	8	150	900	3	105
6.3	68	T/3528-12	PTMOJ686T*070	43	8	70	1200	3	105
6.3	68	T/3528-12	PTMOJ686T*150	43	8	150	800	3	105
6.3	68	B/3528-21	PTMOJ686B*025	43	8	25	2300	3	105
6.3	68	B/3528-21	PTMOJ686B*035	43	8	35	1900	3	105
6.3	68	B/3528-21	PTMOJ686B*040	43	8	40	1800	3	105
6.3	68	B/3528-21	PTMOJ686B*070	43	8	70	1300	3	105
6.3	68	U/6032-15	PTMOJ686U*055	43	8	55	1600	3	105
6.3	68	U/6032-15	PTMOJ686U*070	43	8	70	1400	3	105
6.3	68	C/6032-28	PTMOJ686C*100	43	8	100	1300	3	105
6.3	100	A/3216-18	PTMOJ107A*070	63	8	70	1035	3	105
6.3	100	A/3216-18	PTMOJ107A*045	63	8	45	1600	3	105
6.3	100	T/3528-12	PTMOJ107T*070	63	8	70	1200	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

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## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
6.3	100	B/3528-21	PTMOJ107B*015	63	8	15	2900	3	105
6.3	100	B/3528-21	PTMOJ107B*018	63	8	18	2700	3	105
6.3	100	B/3528-21	PTMOJ107B*025	63	8	25	2300	3	105
6.3	100	B/3528-21	PTMOJ107B*035	63	8	35	1900	3	105
6.3	100	B/3528-21	PTMOJ107B*040	63	8	40	1800	3	105
6.3	100	B/3528-21	PTMOJ107B*045	63	8	45	1700	3	105
6.3	100	B/3528-21	PTMOJ107B*070	63	8	70	1300	3	105
6.3	100	U/6032-15	PTMOJ107U*055	63	8	55	1600	3	105
6.3	100	W/7343-15	PTMOJ107W*040	63	10	40	2100	3	105
6.3	100	V/7343-19	PTMOJ107V*009	63	10	9	4600	3	105
6.3	100	V/7343-19	PTMOJ107V*012	63	10	12	3900	3	105
6.3	100	V/7343-19	PTMOJ107V*015	63	10	15	3500	3	105
6.3	100	V/7343-19	PTMOJ107V*045	63	10	45	2000	3	105
6.3	100	C/6032-28	PTMOJ107C*025	63	8	25	2600	3	105
6.3	100	C/6032-28	PTMOJ107C*045	63	8	45	1900	3	105
6.3	120	B/3528-21	PTMOJ127B*035	76	8	35	1900	3	105
6.3	150	M/3528-15	PTMOJ157M*035	95	8	35	1900	3	105
6.3	150	M/3528-15	PTMOJ157M*070	95	8	70	1300	3	105
6.3	150	M/3528-15	PTMOJ157M*150	95	8	150	900	3	105
6.3	150	M/3528-15	PTMOJ157M*200	95	8	200	800	3	105
6.3	150	B/3528-21	PTMOJ157B*025	95	8	25	2300	3	105
6.3	150	B/3528-21	PTMOJ157B*035	95	8	35	1900	3	105
6.3	150	B/3528-21	PTMOJ157B*045	95	8	45	1700	3	105
6.3	150	B/3528-21	PTMOJ157B*070	95	8	70	1300	3	105
6.3	150	T/3528-12	PTMOJ157T*035	95	8	35	1700	3	105
6.3	150	C/6032-28	PTMOJ157C*015	95	8	15	3300	3	105
6.3	150	C/6032-28	PTMOJ157C*025	95	8	25	2600	3	105
6.3	150	C/6032-28	PTMOJ157C*045	95	8	45	1900	3	105
6.3	150	C/6032-28	PTMOJ157C*055	95	8	55	1700	3	105
6.3	150	U/6032-15	PTMOJ157U*045	95	8	45	1700	3	105
6.3	150	U/6032-15	PTMOJ157U*055	95	8	55	1600	3	105
6.3	150	L/6032-19	PTMOJ157L*012	95	8	12	3500	3	105
6.3	150	L/6032-19	PTMOJ157L*025	95	8	25	2400	3	105
6.3	150	W/7343-15	PTMOJ157W*025	95	10	25	2700	3	105
6.3	150	W/7343-15	PTMOJ157W*040	95	10	40	2100	3	105
6.3	150	V/7343-19	PTMOJ157V*006	95	10	6	5600	3	105
6.3	150	V/7343-19	PTMOJ157V*007	95	10	7	5200	3	105
6.3	150	V/7343-19	PTMOJ157V*009	95	10	9	4600	3	105
6.3	150	V/7343-19	PTMOJ157V*012	95	10	12	3900	3	105
6.3	150	V/7343-19	PTMOJ157V*015	95	10	15	3500	3	105
6.3	150	V/7343-19	PTMOJ157V*018	95	10	18	3200	3	105
6.3	150	V/7343-19	PTMOJ157V*025	95	10	25	2700	3	105
6.3	150	V/7343-19	PTMOJ157V*040	95	10	40	2200	3	105
6.3	150	V/7343-19	PTMOJ157V*045	95	10	45	2000	3	105
6.3	150	D/7343-31	PTMOJ157D*006	95	10	6	6100	3	105
6.3	150	D/7343-31	PTMOJ157D*007	95	10	7	5700	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

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## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
6.3	150	D/7343-31	PTMOJ157D*015	95	10	15	3900	3	105
6.3	150	D/7343-31	PTMOJ157D*025	95	10	25	3000	3	105
6.3	150	D/7343-31	PTMOJ157D*055	95	10	55	2000	3	105
6.3	220	B/3528-21	PTMOJ227B*025	139	8	25	2300	3	105
6.3	220	B/3528-21	PTMOJ227B*035	139	8	35	1900	3	105
6.3	220	B/3528-21	PTMOJ227B*045	139	8	45	1700	3	105
6.3	220	B/3528-21	PTMOJ227B*070	139	8	70	1300	3	105
6.3	220	M/3528-15	PTMOJ227M*045	139	8	45	1600	3	105
6.3	220	C/6032-28	PTMOJ227C*015	139	8	15	3300	3	105
6.3	220	C/6032-28	PTMOJ227C*018	139	8	18	3000	3	105
6.3	220	C/6032-28	PTMOJ227C*025	139	8	25	2600	3	105
6.3	220	C/6032-28	PTMOJ227C*045	139	8	45	1900	3	105
6.3	220	V/7343-19	PTMOJ227V*007	139	10	7	5200	3	105
6.3	220	V/7343-19	PTMOJ227V*009	139	10	9	4600	3	105
6.3	220	V/7343-19	PTMOJ227V*012	139	10	12	3900	3	105
6.3	220	V/7343-19	PTMOJ227V*015	139	10	15	3500	3	105
6.3	220	V/7343-19	PTMOJ227V*018	139	10	18	3200	3	105
6.3	220	V/7343-19	PTMOJ227V*025	139	10	25	2700	3	105
6.3	220	V/7343-19	PTMOJ227V*040	139	10	40	2200	3	105
6.3	220	D/7343-31	PTMOJ227D*006	139	10	6	6100	3	105
6.3	220	D/7343-31	PTMOJ227D*007	139	10	7	5700	3	105
6.3	220	D/7343-31	PTMOJ227D*009	139	10	9	5000	3	105
6.3	220	D/7343-31	PTMOJ227D*015	139	10	15	3900	3	105
6.3	220	D/7343-31	PTMOJ227D*018	139	10	18	3500	3	105
6.3	220	D/7343-31	PTMOJ227D*025	139	10	25	3000	3	105
6.3	220	D/7343-31	PTMOJ227D*040	139	10	40	2400	3	105
6.3	220	D/7343-31	PTMOJ227D*050	139	10	50	2100	3	105
6.3	330	B/3528-21	PTMOJ337B*040	208	8	40	1800	3	105
6.3	330	V/7343-19	PTMOJ337V*015	208	10	15	3500	3	105
6.3	330	V/7343-19	PTMOJ337V*018	208	10	18	3200	3	105
6.3	330	V/7343-19	PTMOJ337V*025	208	10	25	2700	3	105
6.3	330	V/7343-19	PTMOJ337V*040	208	10	40	2200	3	105
6.3	330	V/7343-19	PTMOJ337V*045	208	10	45	2000	3	105
6.3	330	D/7343-31	PTMOJ337D*009	208	10	9	5000	3	105
6.3	330	D/7343-31	PTMOJ337D*010	208	10	10	4700	3	105
6.3	330	D/7343-31	PTMOJ337D*015	208	10	15	3900	3	105
6.3	330	D/7343-31	PTMOJ337D*018	208	10	18	3500	3	105
6.3	330	D/7343-31	PTMOJ337D*025	208	10	25	3000	3	105
6.3	330	D/7343-31	PTMOJ337D*040	208	10	40	2400	3	105
6.3	330	D/7343-31	PTMOJ337D*045	208	10	45	2200	3	105
6.3	330	Y/7343-40	PTMOJ337Y*010	208	10	10	4900	3	105
6.3	330	Y/7343-40	PTMOJ337Y*015	208	10	15	4000	3	105
6.3	330	Y/7343-40	PTMOJ337Y*025	208	10	25	3100	3	105
6.3	330	Y/7343-40	PTMOJ337Y*040	208	10	40	2500	3	105
6.3	470	W/7343-15	PTMOJ477W*055	296	10	55	1800	3	85
6.3	470	W/7343-15	PTMOJ477W*035	296	9	35	2300	3	85
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at Cal-Chip's option. Voltage substitutions will be marked with the higher voltage rating. Substitutions can include better than series.



## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
6.3	470	V/7343-19	PTMOJ477V*055	296	10	55	1800	3	105
6.3	470	V/7343-19	PTMOJ477V*035	296	10	35	2300	3	105
6.3	470	Y/7343-40	PTMOJ477Y*010	296	10	10	4900	3	105
6.3	470	Y/7343-40	PTMOJ477Y*015	296	10	15	4000	3	105
6.3	470	Y/7343-40	PTMOJ477Y*018	296	10	18	3700	3	105
6.3	470	Y/7343-40	PTMOJ477Y*025	296	10	25	3100	3	105
6.3	470	Y/7343-40	PTMOJ477Y*035	296	10	35	2600	3	105
6.3	470	D/7343-31	PTMOJ477D*015	296	10	15	3900	3	105
6.3	470	D/7343-31	PTMOJ477D*025	296	10	25	3000	3	105
6.3	470	D/7343-31	PTMOJ477D*030	296	10	30	2700	3	105
6.3	470	X/7343-43	PTMOJ477X*010	296	10	10	5000	3	105
6.3	470	X/7343-43	PTMOJ477X*018	296	10	18	3700	3	105
6.3	470	X/7343-43	PTMOJ477X*035	296	10	35	2700	3	105
6.3	470	X/7343-43	PTMOJ477X*040	296	10	40	2500	3	105
6.3	680	X/7343-43	PTMOJ687X*025	428	10	25	3100	3	105
6.3	1000	H/7260-20	PTMOJ108H*055	630	20	55	1800	3	85
6.3	1500	H/7260-20	PTMOJ158H*055	945	20	55	1800	3	85
8	22	T/3528-12	PTMOK226T*070	18	8	70	1200	3	105
8	33	T/3528-12	PTMOK336T*070	26	8	70	1200	3	105
8	33	T/3528-12	PTMOK336T*080	26	8	80	1100	3	105
8	33	B/3528-21	PTMOK336B*025	26	8	25	2300	3	105
8	33	B/3528-21	PTMOK336B*035	26	8	35	1900	3	105
8	33	B/3528-21	PTMOK336B*040	26	8	40	1800	3	105
8	33	B/3528-21	PTMOK336B*070	26	8	70	1300	3	105
8	33	U/6032-15	PTMOK336U*070	26	8	70	1400	3	105
8	47	B/3528-21	PTMOK476B*035	38	8	35	1900	3	105
8	47	B/3528-21	PTMOK476B*070	38	8	70	1300	3	105
8	82	C/6032-28	PTMOK826C*025	66	8	25	2600	3	105
8	82	C/6032-28	PTMOK826C*045	66	8	45	1900	3	105
8	150	D/7343-31	PTMOK157D*025	120	10	25	3000	3	105
8	150	D/7343-31	PTMOK157D*040	120	10	40	2400	3	105
8	150	D/7343-31	PTMOK157D*055	120	10	55	2000	3	105
8	150	V/7343-19	PTMOK157V*040	120	10	40	2200	3	105
10	10	A/3216-18	PTMIA106A*080	10	8	80	1200	3	105
10	15	A/3216-18	PTMIA156A*080	15	8	80	1200	3	105
10	22	A/3216-18	PTMIA226A*080	22	8	80	1200	3	105
10	33	T/3528-12	PTMIA336T*040	33	8	40	1600	3	105
10	33	T/3528-12	PTMIA336T*070	33	8	70	1200	3	105
10	33	T/3528-12	PTMIA336T*080	33	8	80	1100	3	105
10	33	B/3528-21	PTMIA336B*025	33	8	25	2300	3	105
10	33	B/3528-21	PTMIA336B*035	33	8	35	1900	3	105
10	33	B/3528-21	PTMIA336B*040	33	8	40	1800	3	105
10	33	B/3528-21	PTMIA336B*070	33	8	70	1300	3	105
10	33	U/6032-15	PTMIA336U*070	33	8	70	1400	3	105
10	47	B/3528-21	PTMIA476B*035	47	8	35	1900	3	105
10	47	B/3528-21	PTMIA476B*070	47	8	70	1300	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at Cal-Chip's option. Voltage substitutions will be marked with the higher voltage rating. Substitutions can include better than series.

## ■ Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
10	47	U/6032-15	PTMIA476U*055	47	8	55	1600	3	105
10	47	C/6032-28	PTMIA476C*100	47	8	100	1300	3	105
10	68	U/6032-15	PTMIA686U*055	68	8	55	1600	3	105
10	68	W/7343-15	PTMIA686W*025	68	10	25	2700	3	105
10	68	W/7343-15	PTMIA686W*040	68	10	40	2100	3	105
10	68	C/6032-28	PTMIA686C*045	68	8	45	1900	3	105
10	68	V/7343-19	PTMIA686V*025	68	10	25	2700	3	105
10	68	V/7343-19	PTMIA686V*040	68	10	40	2200	3	105
10	68	V/7343-19	PTMIA686V*045	68	10	45	2000	3	105
10	68	V/7343-19	PTMIA686V*060	68	10	60	1800	3	105
10	68	V/7343-19	PTMIA686V*100	68	10	100	1400	3	105
10	68	D/7343-31	PTMIA686D*100	68	10	100	1500	3	105
10	100	B/3528-21	PTMIA107B*070	100	8	70	1300	3	105
10	100	C/6032-28	PTMIA107C*025	100	8	25	2600	3	105
10	100	C/6032-28	PTMIA107C*045	100	8	45	1900	3	105
10	100	L/6032-19	PTMIA107L*025	100	8	25	2400	3	105
10	100	W/7343-15	PTMIA107W*040	100	10	40	2100	3	105
10	100	V/7343-19	PTMIA107V*018	100	10	18	3200	3	105
10	100	V/7343-19	PTMIA107V*025	100	10	25	2700	3	105
10	100	V/7343-19	PTMIA107V*045	100	10	45	2000	3	105
10	100	V/7343-19	PTMIA107V*050	100	10	50	1900	3	105
10	100	V/7343-19	PTMIA107V*055	100	10	55	1800	3	105
10	100	D/7343-31	PTMIA107D*018	100	10	18	3500	3	105
10	100	D/7343-31	PTMIA107D*055	100	10	55	2000	3	105
10	100	D/7343-31	PTMIA107D*080	100	10	80	1700	3	105
10	150	C/6032-28	PTMIA157C*055	150	8	55	1700	3	105
10	150	V/7343-19	PTMIA157V*018	150	10	18	3200	3	105
10	150	V/7343-19	PTMIA157V*025	150	10	25	2700	3	105
10	150	V/7343-19	PTMIA157V*040	150	10	40	2200	3	105
10	150	D/7343-31	PTMIA157D*015	150	10	15	3900	3	105
10	150	D/7343-31	PTMIA157D*018	150	10	18	3500	3	105
10	150	D/7343-31	PTMIA157D*025	150	10	25	3000	3	105
10	150	D/7343-31	PTMIA157D*040	150	10	40	2400	3	105
10	150	D/7343-31	PTMIA157D*055	150	10	55	2000	3	105
10	150	Y/7343-40	PTMIA157Y*015	150	10	15	4000	3	105
10	150	Y/7343-40	PTMIA157Y*018	150	10	18	3700	3	105
10	150	Y/7343-40	PTMIA157Y*025	150	10	25	3100	3	105
10	220	V/7343-19	PTMIA227V*045	220	10	45	2000	3	105
10	220	V/7343-19	PTMIA227V*025	220	10	25	2700	3	105
10	220	D/7343-31	PTMIA227D*018	220	10	18	3500	3	105
10	220	D/7343-31	PTMIA227D*025	220	10	25	3000	3	105
10	220	D/7343-31	PTMIA227D*040	220	10	40	2400	3	105
10	220	Y/7343-40	PTMIA227Y*040	220	10	40	2500	3	105
10	330	Y/7343-40	PTMIA337Y*015	330	10	15	4000	3	105
10	330	Y/7343-40	PTMIA337Y*025	330	10	25	3100	3	105
10	330	Y/7343-40	PTMIA337Y*035	330	10	35	2600	3	105
VDC at 105°C	µF	CCE/EIA	(See below for part options)	µA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at Cal-Chip's option. Voltage substitutions will be marked with the higher voltage rating. Substitutions can include better than series.



## Ratings and Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	CCE Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp
VDC at 105°C	μF	CCE/EIA	(See below for part options)	μA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
10	330	X/7343-43	PTMIA337X*010	330	10	10	5000	3	105
10	330	X/7343-43	PTMIA337X*025	330	10	25	3100	3	105
10	330	X/7343-43	PTMIA337X*040	330	10	40	2500	3	105
16	10	B/3528-21	PTMIC106B*100	16	8	100	1100	3	105
16	22	C/6032-28	PTMIC226C*080	35	8	80	1400	3	105
16	33	W/7343-15	PTMIC336W*045	53	10	45	2000	3	105
16	33	V/7343-19	PTMIC336V*045	53	10	45	2000	3	105
16	33	V/7343-19	PTMIC336V*060	53	10	60	1800	3	105
16	33	V/7343-19	PTMIC336V*070	53	10	70	1600	3	105
16	47	W/7343-15	PTMIC476W*045	75	10	45	2000	3	105
16	47	V/7343-19	PTMIC476V*045	75	10	45	2000	3	105
16	47	V/7343-19	PTMIC476V*070	75	10	70	1600	3	105
16	47	D/7343-31	PTMIC476D*035	75	10	35	2500	3	105
16	47	D/7343-31	PTMIC476D*070	75	10	70	1800	3	105
16	68	D/7343-31	PTMIC686D*050	109	10	50	2100	3	105
16	150	X/7343-43	PTMIC157X*040	240	10	40	2500	3	105
20	22	V/7343-19	PTMIC226V*040	44	10	40	2200	3	105
20	22	V/7343-19	PTMID226V*045	44	10	45	2000	3	105
20	22	V/7343-19	PTMID226V*090	44	10	90	1400	3	105
25	15	V/7343-19	PTMIE156V*090	38	10	90	1400	3	105
25	15	D/7343-31	PTMIE156D*060	38	10	60	1900	3	105
25	15	D/7343-31	PTMIE156D*080	38	10	80	1700	3	105
VDC at 105°C	μF	CCE/EIA	(See below for part options)	μA at 25°C Maximum/5 Minutes	% at 25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 45°C 100 kHz	Reflow Temp ≤ 260°C	°C
Rated Voltage	Rated Cap	Case Code/ Case Size	Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	MSL	Maximum Operating Temp

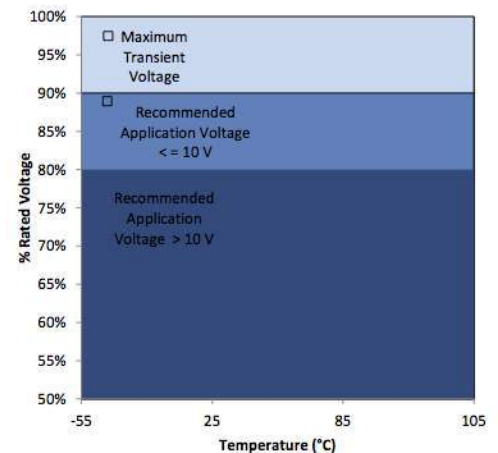
\* To complete Cal-Chip part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum), P = Ni-Pd-Au Plated, N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb).

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## Derating Guidelines

Voltage Rating	Maximum Recommended Steady State Voltage	Maximum Recommended Transient Voltage
-55°C to 105°C		
$2. V \leq V_R \leq 10 V$	90% of $V_R$	$V_R$
$12.5 V \leq V_R \leq 25 V$	80% of $V_R$	$V_R$

$V_R$  = Rated Voltage



## ■ Ripple Current/Ripple Voltage

CalChip Series and Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts at 45°C with +30°C Rise
PT□□□□T	3528-12	105
PT□□□□M	3528-15	120
PT□□□□A	3216-18	112
PT□□□□B	3528-21	127
PT□□□□U	6032-15	135
PT□□□□L	6032-19	150
PT□□□□C	6032-28	165
PT□□□□W	7343-15	180
PT□□□□V	7343-19	187
PT□□□□Q	7343-12	170
PT□□□□D	7343-31	225
PT□□□□Y	7343-40	241
PT□□□□X	7343-43	247
PT□□□□H	7360-20	187

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:

1. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
2. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage. See the Reverse Voltage section for allowable limits.

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.

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

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

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)

## ■ Reverse Voltage

Polymer tantalum 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



## ■ Land Dimensions/Courtyard

CCE	METRIC SIZE CODE	DENSITY LEVEL A: MAXIMUM LAND PROTRUSION (mm)					DENSITY LEVEL B: MEDIAN (NOMINAL) LAND PROTRUSION (mm)					DENSITY LEVEL C: MINIMUM LAND PROTRUSION (mm)				
		Case	EIA	W	L	S	V1	V2	W	L	S	V1	V2	W	L	S
A	3216-18	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
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	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	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
L	6032-19	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
M	3528-15	2.35	2.20	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
H	7360-20	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
Q	7343-12	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
T	3528-12	2.35	2.20	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
U	6032-15	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
V	7343-20	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
W	7343-15	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 <sup>1</sup>	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
Y <sup>1</sup>	7343-40	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

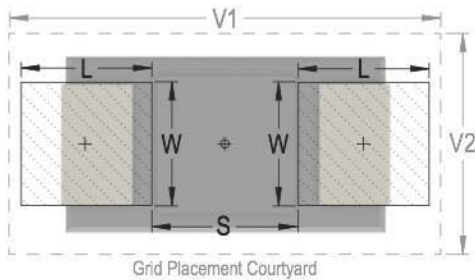
**Density Level A:** For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

**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).

<sup>1</sup> Height of these chips may create problems in wave soldering.

<sup>2</sup> Land pattern geometry is too small for silkscreen outline.



## ■ Storage

The PT series components are shipped in moisture barrier bags with a desiccant and moisture indicator card. These series are classified as MSL3 (Moisture Sensitivity Level 3). Product contained within the moisture barrier bags should be stored in normal working environments with temperatures not to exceed 40°C and humidity not in excess of 90% RH.

## Soldering Process

Cal-Chip'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. Cal-Chip'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.

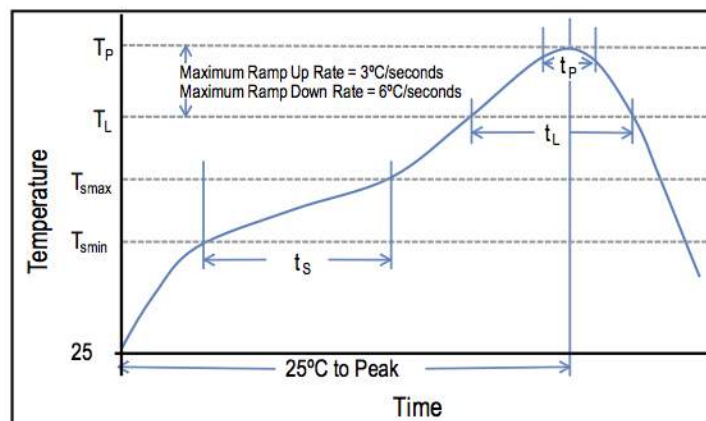
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed, which is not harmful to the product. Marking permanency is affected by this change.

Profile Feature	SnPb Assembly	Pb-Free Assembly
<b>Preheat/Soak</b>		
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.*

\*Case Size D, E, P, Y, and X

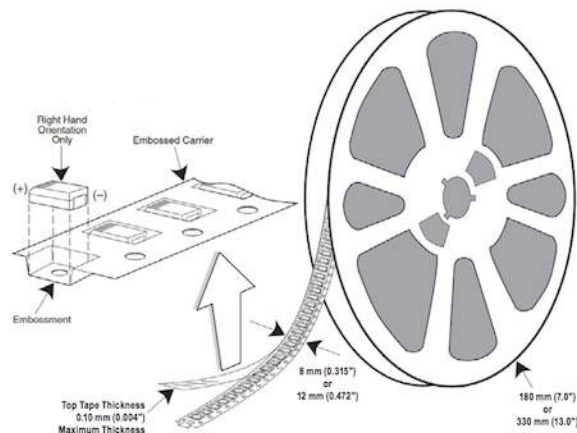
\*\*Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z





## ■ Tape and Reel Packaging Information

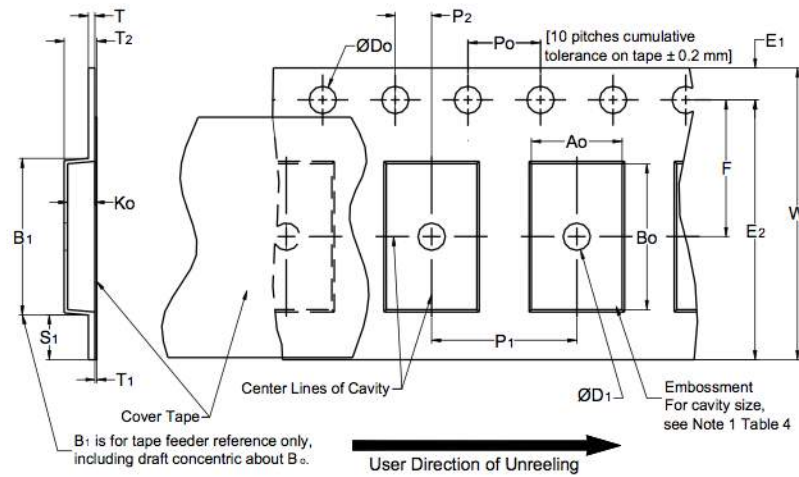
Cal-Chip's molded tantalum and aluminum chip capacitor families are packaged in 8 and 12 mm plastic tape on 7" reels in accordance with EIA Standard 481: Embossed Carrier Taping of Surface Mount Components for Automatic Handling. This packaging system is compatible with all tape-fed automatic pick-and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



Case Code		Tape Width (mm)	7" Reel
CCE	EIA		
R	2012-12	8	2,500
I	3216-10	8	3,000
S	3216-12	8	2,500
T	3528-12	8	2,500
M	3528-15	8	2,000
U	6032-15	12	1,000
L	6032-19	12	1,000
W	7343-15	12	1,000
Z	7343-17	12	1,000
Q	7343-12	12	1,000
V	7343-19	12	1,000
A	3216-18	8	2,000
B	3528-21	8	2,000
C	6032-28	12	500
D	7343-31	12	500
Y	7343-40	12	500
X	7343-43	12	500
E/T428P	7360-38	12	500
H	7360-20	12	1,000

No C-spec required for 7" reel packaging  
 \* A case with black epoxy available for all reels

## Embossed (Plastic Carrier Tape Dimensions)



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)	$1.75 \pm 0.10$ (0.069 ±0.004)	$4.0 \pm 0.10$ (0.157 ±0.004)	$2.0 \pm 0.05$ (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)			
16 mm		$2.0 \pm 0.1$ (0.079 ±0.059)							

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)	$3.5 \pm 0.05$ (0.138 ±0.002)	$2.0 \pm 0.05$ or $4.0 \pm 0.10$ (0.079 ±0.002 or 0.157 ±0.004)	2.5 (0.098)	8.3 (0.327)	Note 5
12 mm	Single (4 mm) & Double (8 mm)	8.2 (0.323)	10.25 (0.404)	$5.5 \pm 0.05$ (0.217 ±0.002)	$2.0 \pm 0.05$ (0.079 ±0.002) or $4.0 \pm 0.10$ (0.157 ±0.004) or $8.0 \pm 0.10$ (0.315 ±0.004)	4.6 (0.181)	12.3 (0.484)	
16 mm	Triple (12 mm)	12.1 (0.476)	14.25 (0.561)	$7.5 \pm 0.10$ (0.295 ±0.004)	$4.0 \pm 0.10$ (0.157 ±0.004) to $12.0 \pm 0.10$ (0.472 ±0.004)	8.0 (0.315)	16.3 (0.642)	

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 and 10° maximum for 16 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 and to 1.0 mm maximum for 16 mm tape (see Figure 3).
  - (e) see Addendum in EIA Standard 481-D for standards relating to more precise taping requirements.



**Cover Peel Break Force:** 1.0 Kg minimum

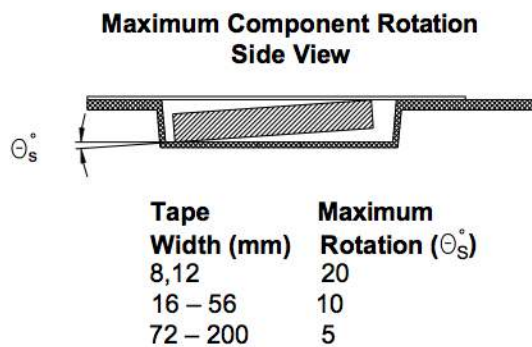
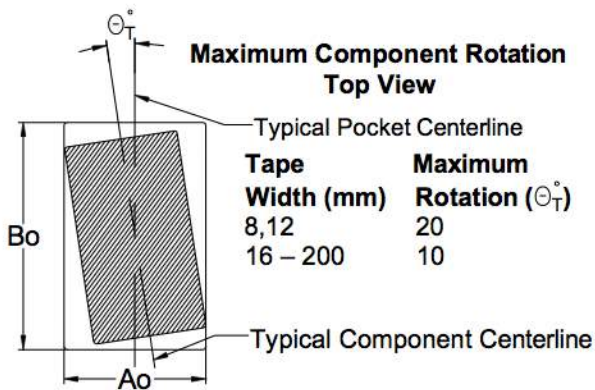
**Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	Peel Strength
8 mm	0.1 to 1.0 Newton (10 to 100 gf)
12 and 16 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.

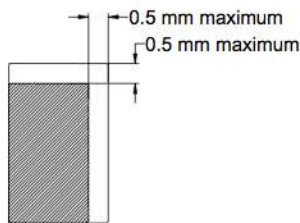
**3. Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. Refer to EIA Standards 556 and 624.

Maximum Component Rotation

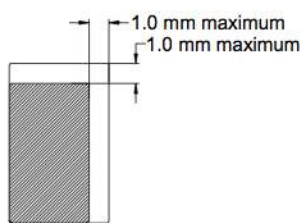


Maximum Lateral Movement

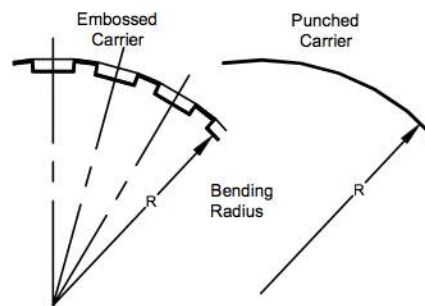
8 mm & 12 mm Tape



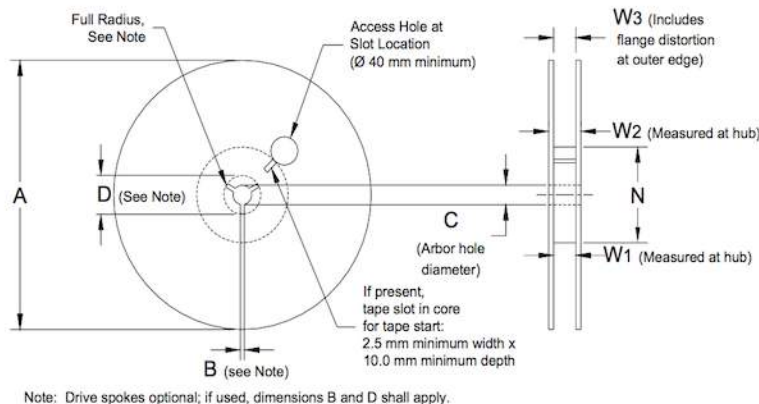
16 mm Tape



Bending Radius



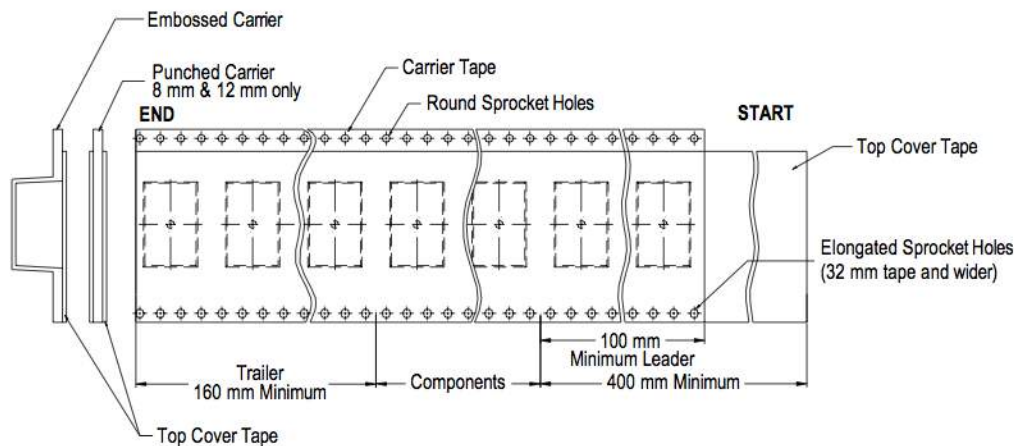
Reel Dimensions



## Reel Dimensions

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				
16 mm				
Variable Dimensions - Millimeter (Inches)				
Tape Size	N Minimum	W <sub>1</sub>	W <sub>2</sub> Maximum	W <sub>3</sub>
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)	
16 mm		16.4 +2.0/-0.0 (0.646 +0.078/-0.0)	22.4 (0.882)	

## Tape Leader & Trailer Dimensions



## Maximum Camber

