100 YEARS KEMET ESTABLISHED 1919

基美电子

Who We Are

100 YEARS KEMET ESTABLISHED 1919

FOUNDED 1919

KEM LISTED **NYSE**

15,000 employees worldwide

$1.4 billion FY19 REVENUE

54 BILLION electronic components shipped FY19

23 manufacturing facilities located in **11** countries

KEMET SUSTAINABILITY INITIATIVE

Conflict-free & vertically integrated tantalum

QUALITY FOCUS

- Zero Defects
- 100% On-Time Delivery
- Technology Leader
- Lowest Total Cost of Ownership
- World-Class Cycle Time Efficiencies

Closing Bell Ringing- NYSE June 12, 2019

Company History

100 YEARS KEMET
ESTABLISHED 1919

$1.4b
REVENUE

100 YEARS KEMET
ESTABLISHED 1919

REGIONAL PRESENCE
100+ Resources in each sales region

3 YEARS OF GROWTH

POS FOCUS

30,000+
unique parts sold

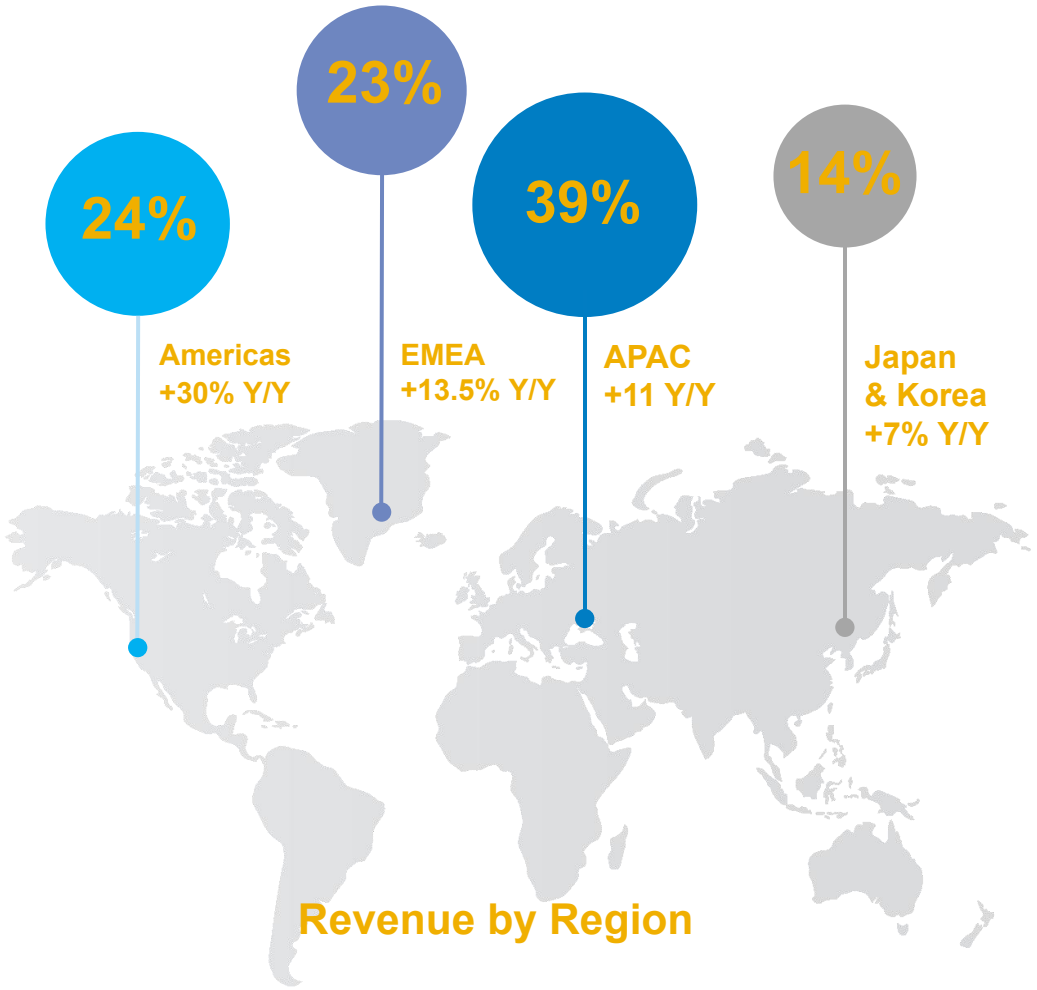
+180,000
unique customers served

OVER $700
MILLION IN POS

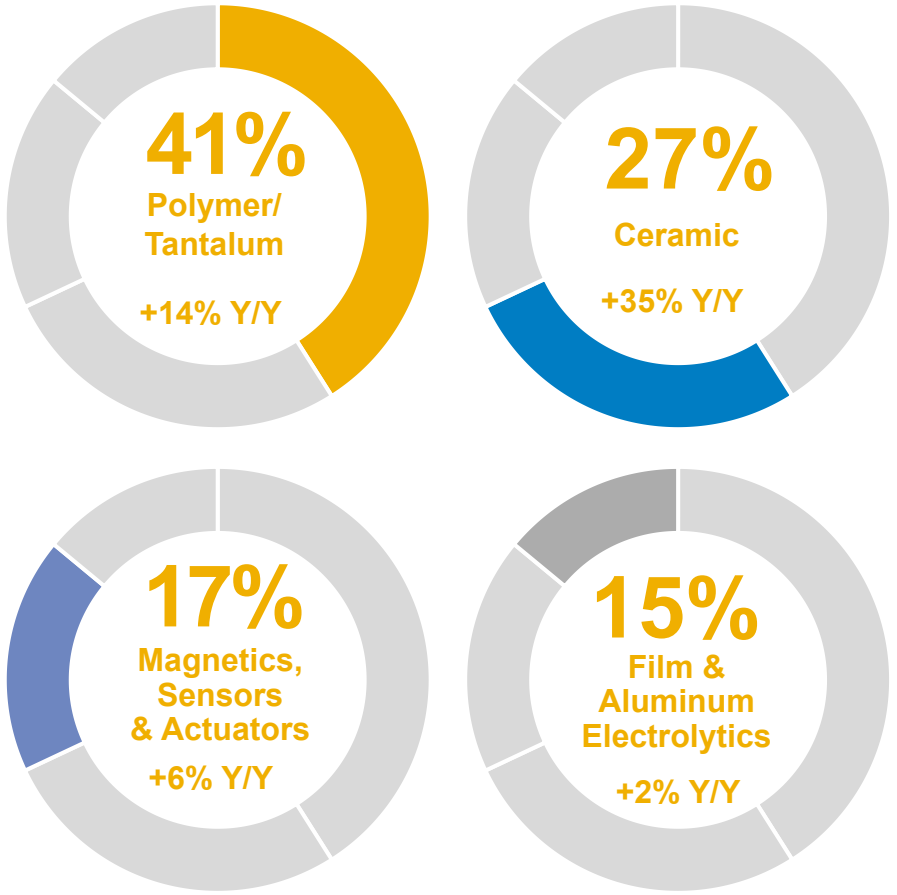
Leading in the digital platform space

Revenue at a Glance

FY19



Revenue by Region



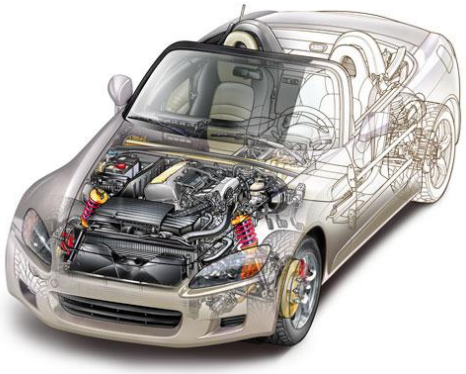
Revenue by Product Group

Tan-BG Auto Grade Product (T591/8/9)

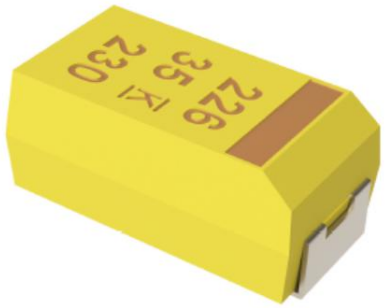
Kevin Lee

June. 2019

rev10



Automotive Grade

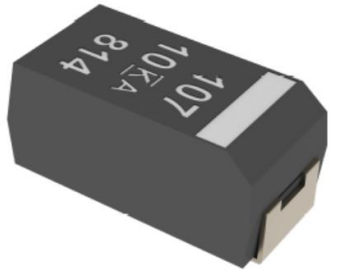


$Ta\ MnO_2$

- T491
- T495 Low ESR
- T498 150ºC
- T499 175ºC

Polymer Automotive

- T598 125ºC
  1000h 85ºC/85%RH/Vr
- T591
  500h 85ºC/85%RH/Vr
- T599 150ºC
  1000h 85ºC/85%RH/Vr

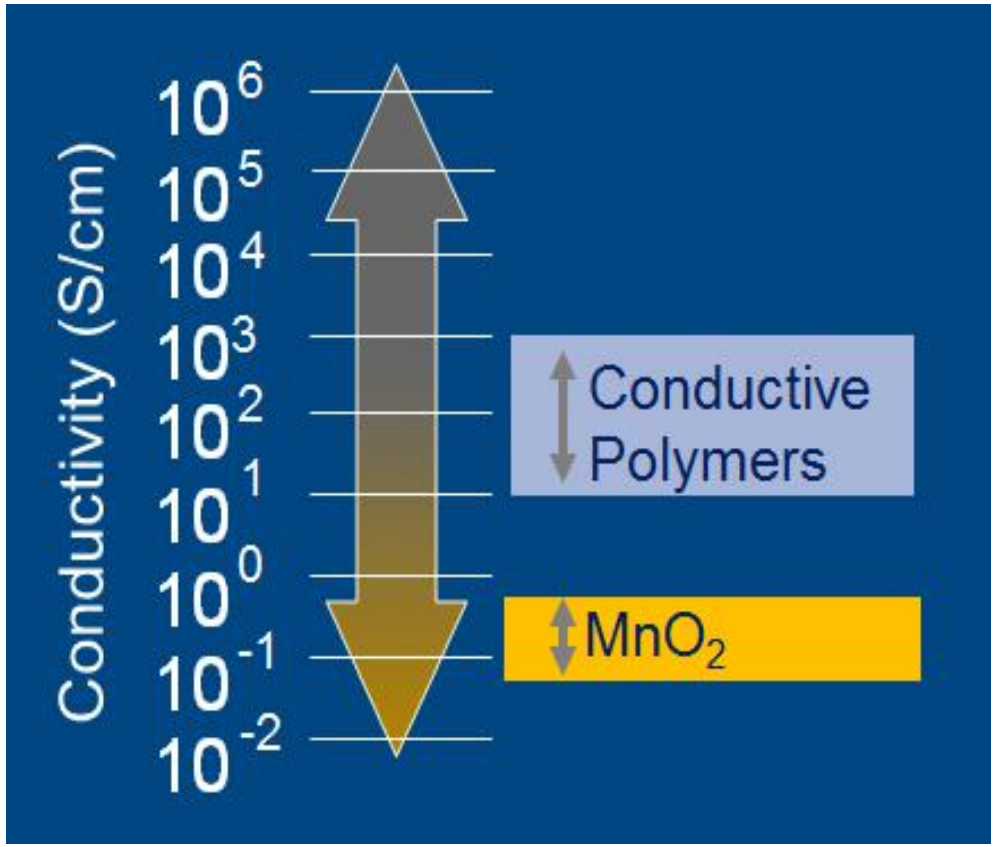


KOCAP Polymer Capacitors AUTOMOTIVE GRADE

1st to Market!

Polymer Capacitors

Historical Evolution



Non Automotive Grade

- 2000: T520 – Standard 105º C
- 2002: T530 – Multi Anode, 125ºC Rated (ultra low ESR up to 4mOhm)
- 2006: DSCC Drawing Release
- 2008: T521 – 1st High Voltage (25V)
- 2010: mF Caps – Maximum Capacitance
- 2011: T540/541 – 125ºC Polymer High Reliabiility Military COTS
- **2014: T591 Released to Market**
- **2015: T598 Polymer Capacitors with full AECQ200 qualification**
- **Begining 2018:T 599 – 1st to market 150ºC Automotive Grade**

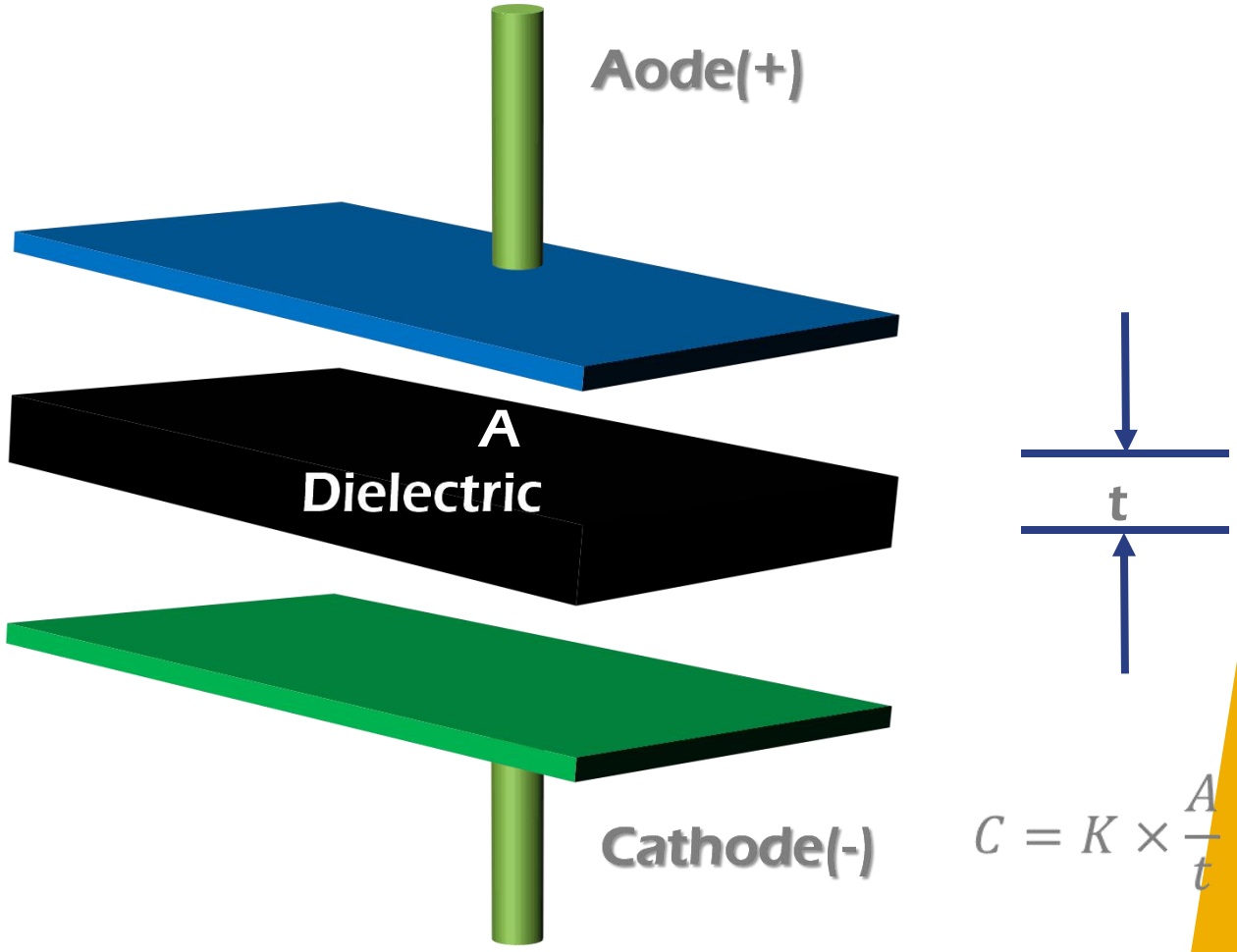
Polymer Capacitors

Click toassess details

Click to return

Polymer vs MnO2

	Tantalum	KOCAP
	Ta-MnO2	Ta-Polymer
Anode (+)	Tantalum	Tantalum
Dielectric	Ta2O5	Ta2O5
Cathode(-)	MnO2 Carbon Silver	Polymer Carbon Silver

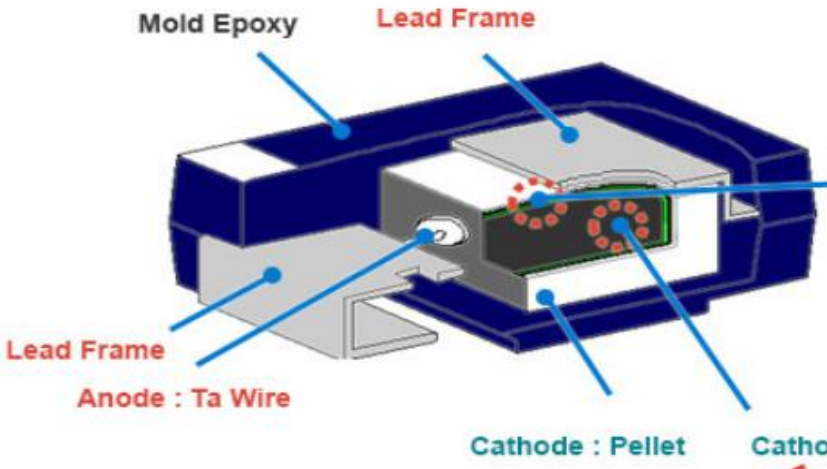


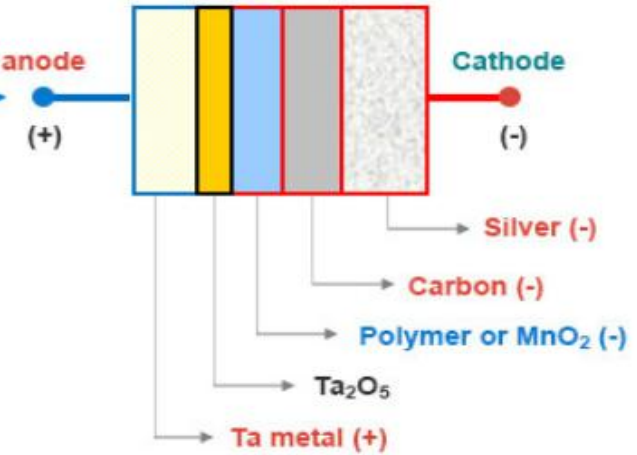
The only difference is first layer of cathode (MnO2 vs Polymer)

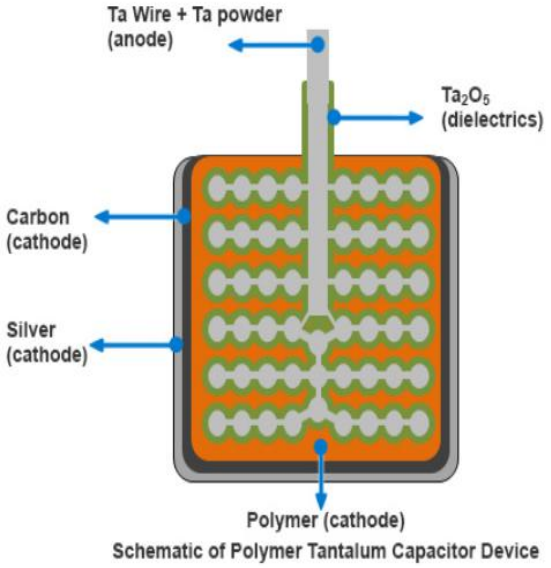
But this only difference creates many advantage of polymer against MnO2

Structure

介电质 ： Ta_2O_5 , 阳极 ： Ta, 阴极：导电聚合物或二氧化锰
产品类型 ： 按阴极材料的分类 – 聚合物类型及二氧化锰类型



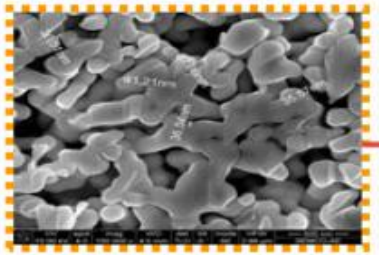


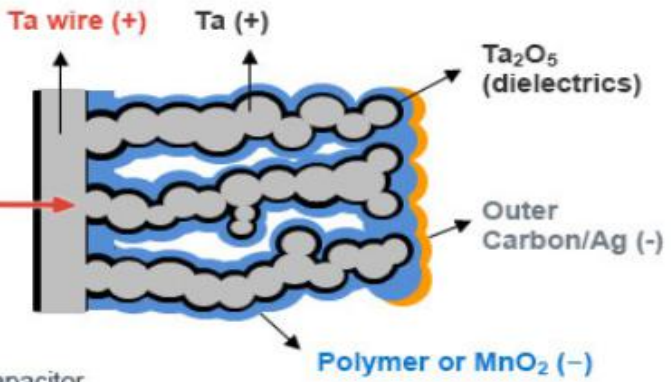


Schematic of Polymer Tantalum Capacitor Device

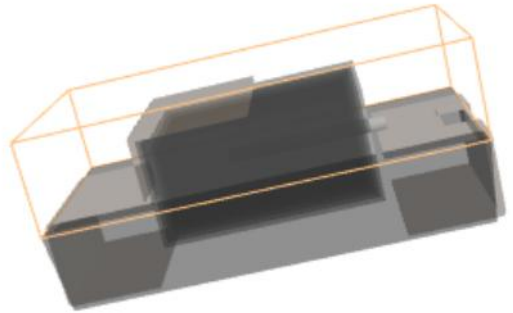
$$C \propto \varepsilon \frac{S}{d}$$

Porous structure to increase surface area



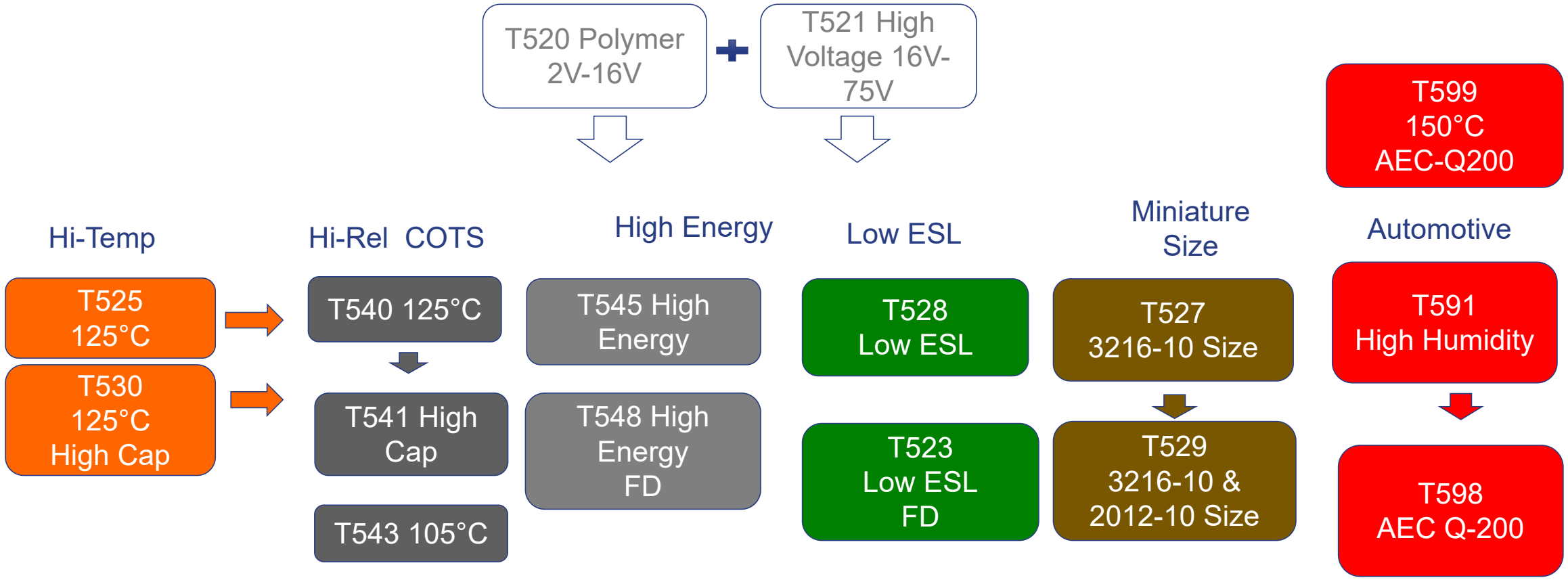


Schematic structure of Tantalum Capacitor



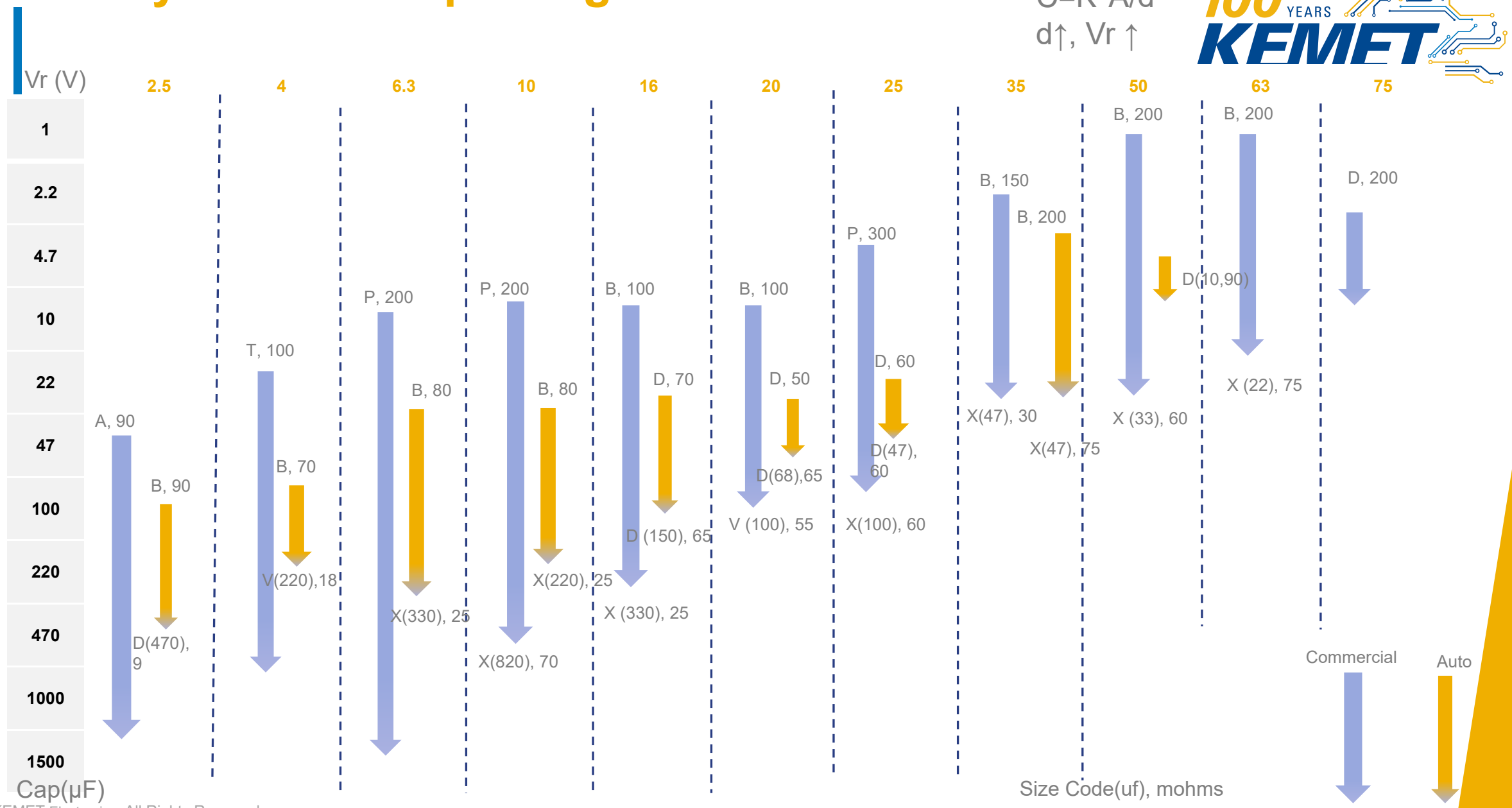
Polymer Tan-Cap Series Lineup

KOCAP Polymer Capacitors



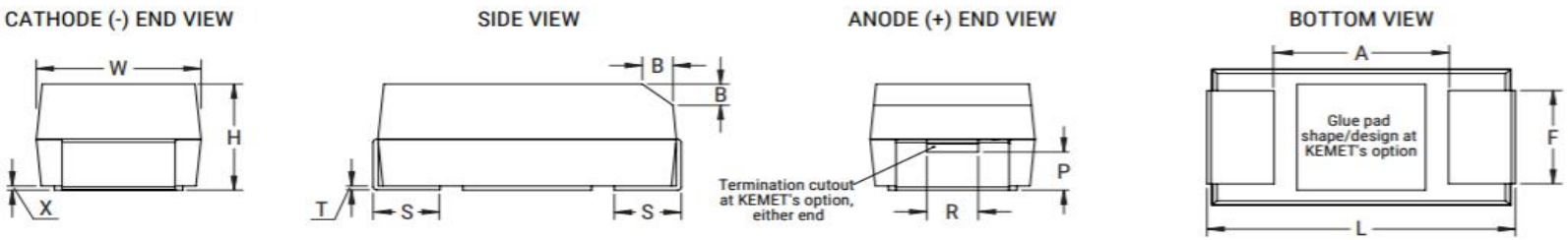
Polymer Tan-cap Range

C=K*A/d
d↑, Vr ↑



Size

LW(mm)	LW(Inch)	H(mm)	Case Code	Auto Grade
2012	0805	1.0	P	Y(2020, Q1)
3216	1206	1.0/1.2/1.8	I/S/A	Y(2020, Q1)
3528	1210	1.2/1.5/2.0	T/M/B	Y
6032	2412	1.5/2.8	U/C	N
7343	2917	1.2/1.5/2.0/3.1/4.0/4.3	Q/W/V/D/Y/X	Y
7360	2924	1.5/2.0/4.3	J/H/O	N



Case Size		Component Dimensions											Typical Weight
KEMET	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)	(mg)
B	3528–21	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.9 ±0.2 (0.075 ±0.008)	2.2 (0.087)	0.8 (0.031)	0.4 (0.016)	0.10 ±0.10 (0.004 ±0.004)	0.5 (0.020)	1.0 (0.039)	0.13 (0.005)	1.1 (0.043)	95
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)	1.3 (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)	3.8 (0.150)	435
V	7343-20	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	1.9 ±0.1 (0.075 ±0.004)	2.4 (0.094)	1.3 (0.051)	N/A	0.05 (0.002)	N/A	0.13 (0.005)	3.8 (0.150)	3.8 (0.150)	274
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)	1.3 (0.051)	0.5 (0.020)	0.10 ±0.10 (0.004 ±0.004)	1.7 (0.067)	0.13 (0.005)	3.6 (0.142)	3.8 (0.150)	554

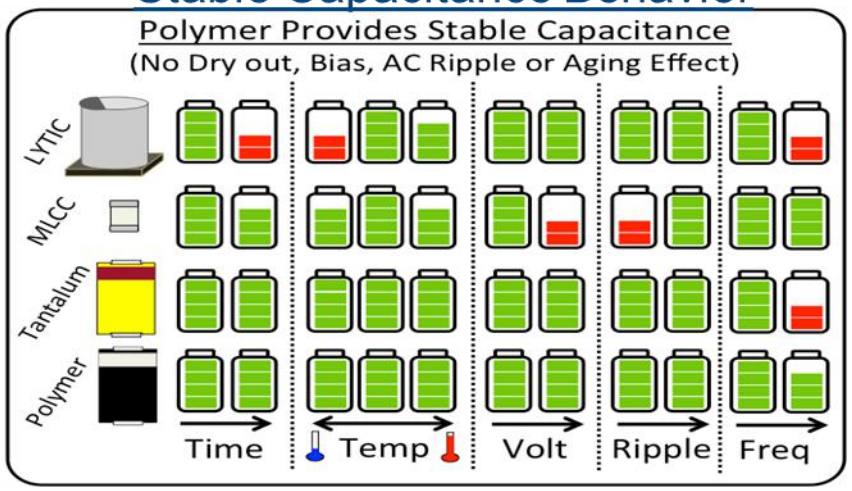
Why power?

Why Polymer?

Polymer is the successor of Tantalum MnO_2 Capacitors

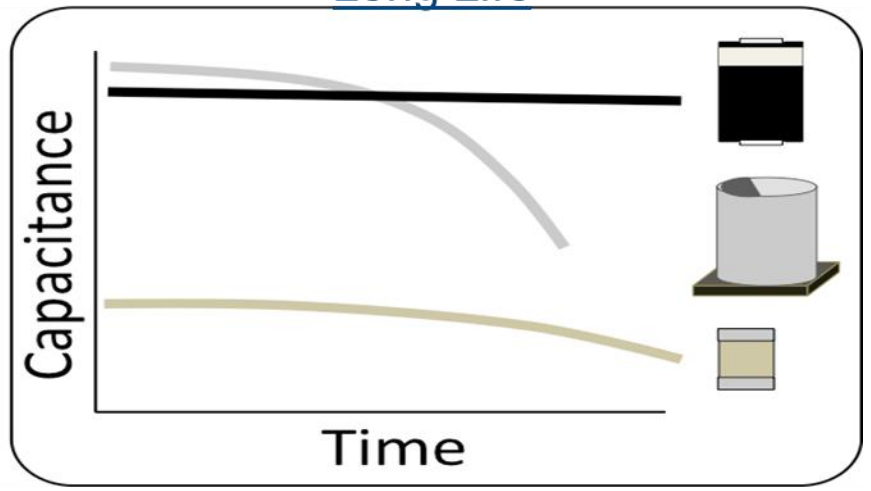
- PEDT as cathode counter electrode material
- Low oxygen index - no ignition failure mode
- Single digit ESR in mili-Ω range - less self heating!
- Cost saving potential
- 150ºC samples with double digit µF (22µF and 33µF)

Stable Capacitance Behavior



Want 100µF? – Get 100µF!

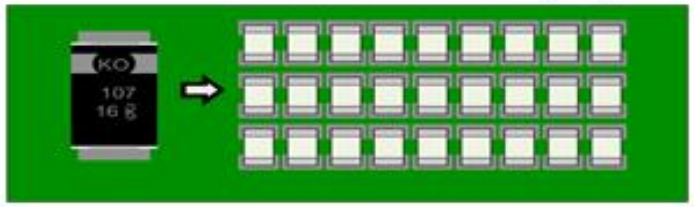
Long Life

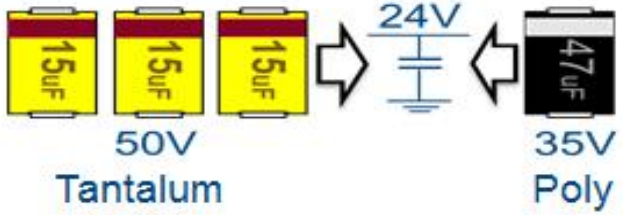


No Dry Out! – No Aging Effect!

高可靠性（长寿命）
高稳定（温度，时间，电压都无影响）

High Capacitance





Low Profile

Higher Application Voltage Range

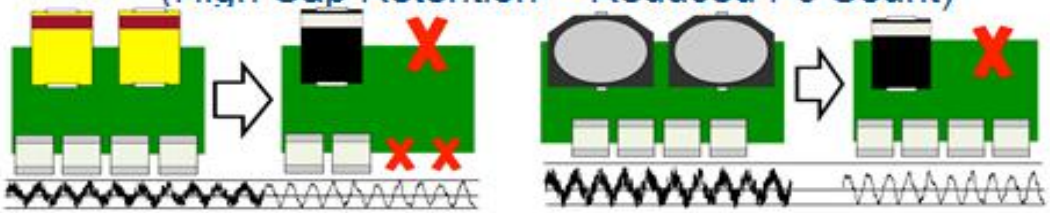
Safe Failure Mode

Improved Voltage Derating

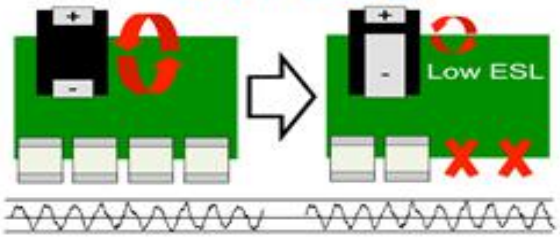
Tantalum = 50% Derating
Poly = 10-20% Derating

Low ESR

(High Cap Retention = Reduced Pc Count)



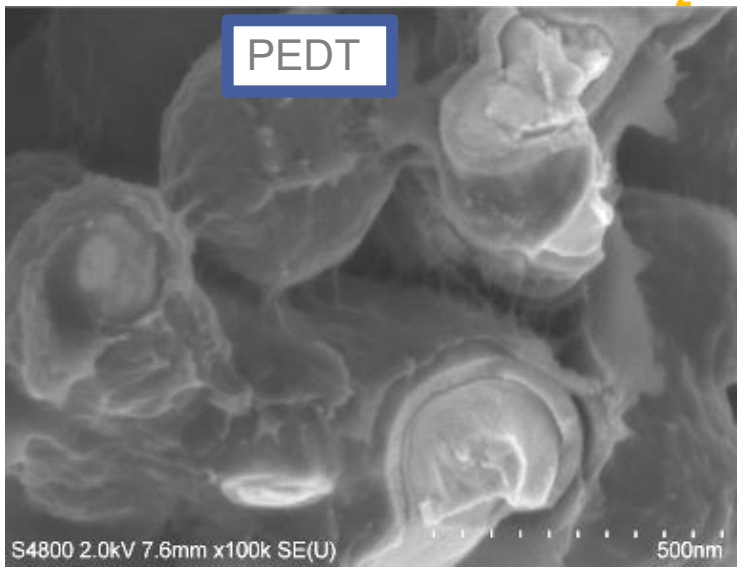
Low ESL

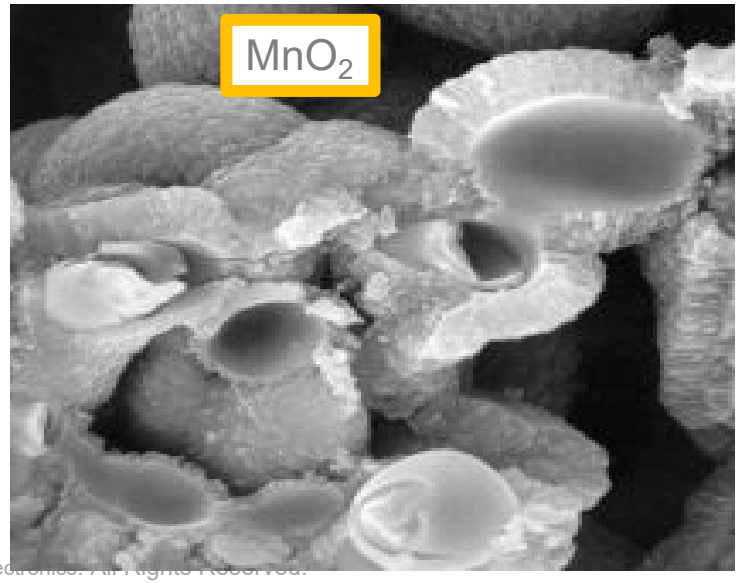


Replacement for MLCC Piezo Noise

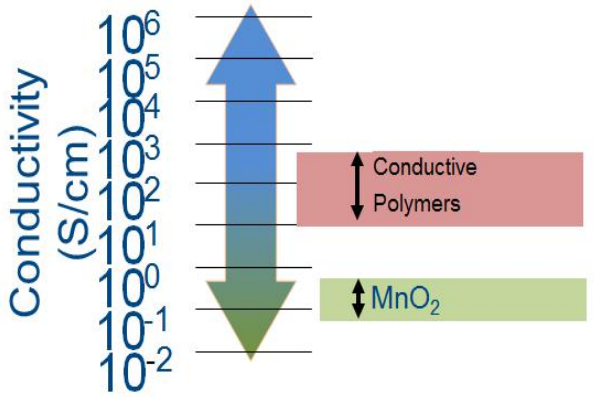
Polymer Capacitors

Cathode Differences – MnO_2 vs Pol





- PEDT is a conductive organic polymer
  Polymerization reaction with monomer and oxidant at lower temperature;
  'soft thin film' – NON-STRESS INTERFACE



- MnO_2 is Manganese Dioxide

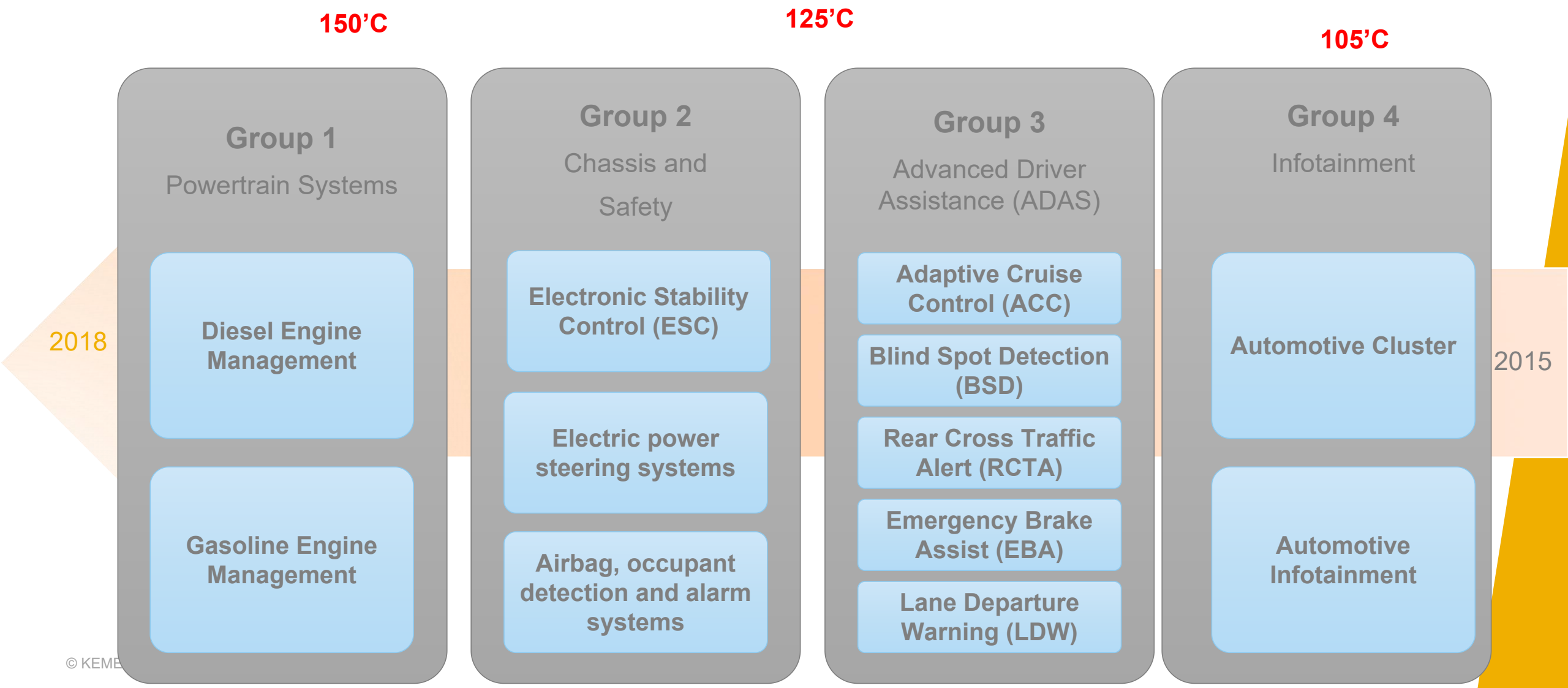
  Brittle semiconductor material obtained by thermal decomposition at ~260ºC of manganese nitrate – STRESSED INTERFACE

Application

Click to assess details

Click to return

Polymer Promotion and Placement Strategy



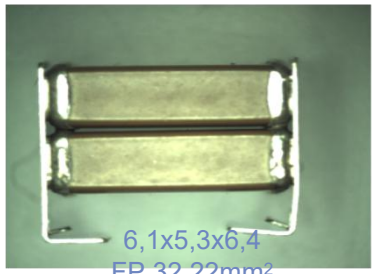
AUTO Polymer

Safety Application

MLCC Stack High CV component Replacement

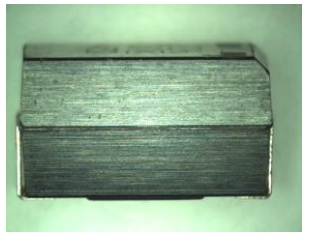
New Applications Field – 12V

- Application voltage max 15V
- MLCC X7R **47uF25V** vs **33uF35V** Polymer (T598X336M035ATE065)



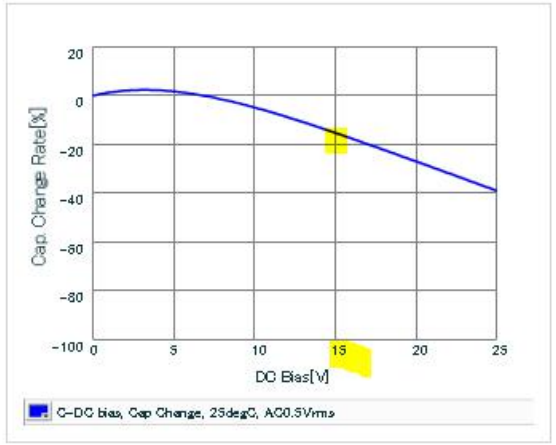
6,1x5,3x6,4
FP 32,22mm²
H6,4mm

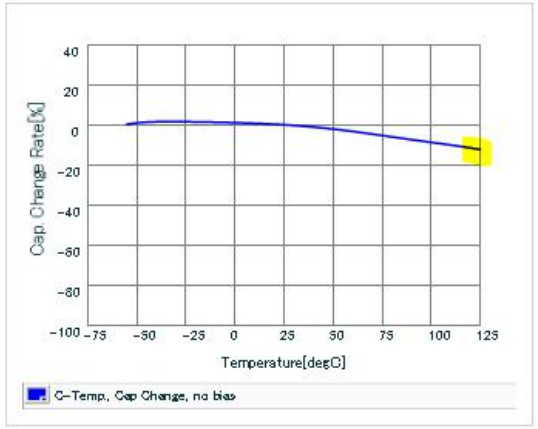
Cap drop in Temperature & Voltage → **~31uF**

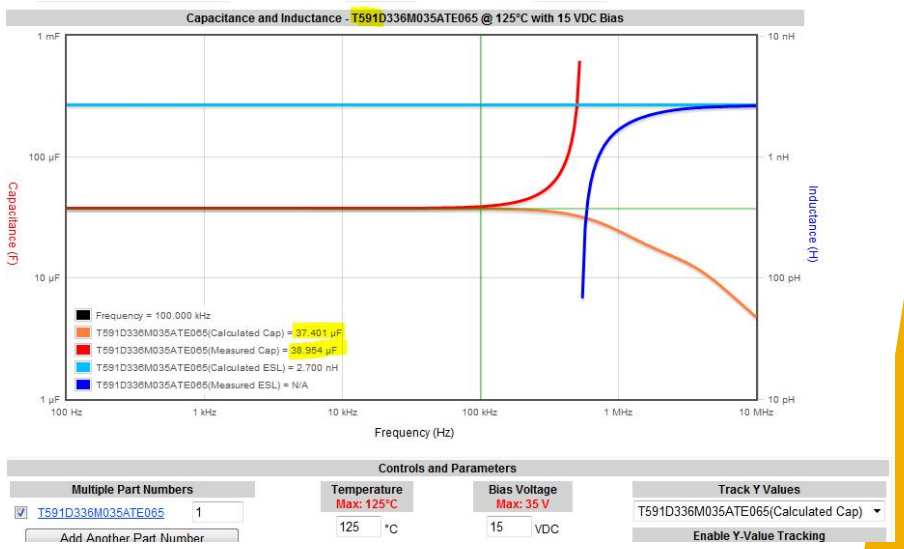


7,3x4,3x4,3
FP 31,39mm²
H4,3mm

No Cap drop in Temparature & Voltage → **~37uF**







AUTO Polymer

Rain Sensor

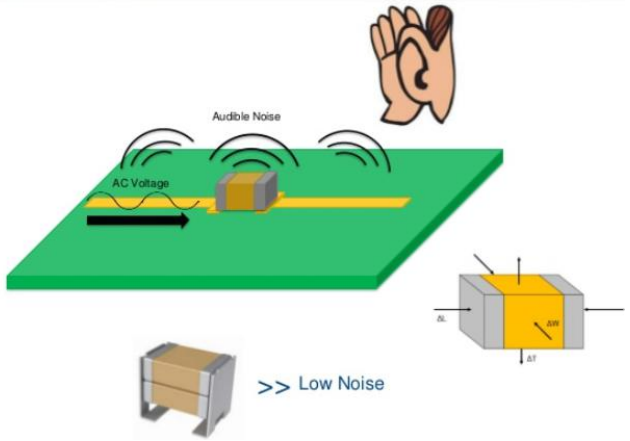
MLCC 10uF50V Replacement due to Piezo

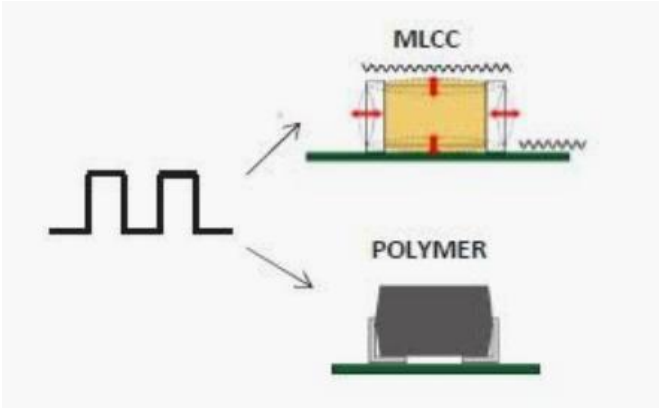
Piece Count Reduction from 3 to 1 component

New Applications Field – 12V

Replacement of HI CV MLCC 10uF 50V

- **No Piezo Noise**
- **Piece Count Reduction**





3 pieces

- 1206_10uf_50V MLCC

1 piece

T598D226M035ATE065
7343-31 22uF35V

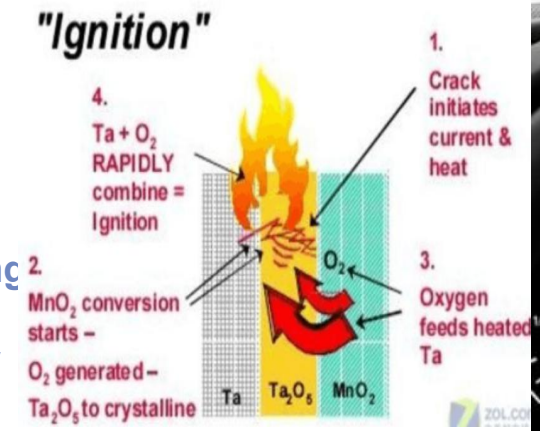
AUTO Polymer

Dashboard

MnO2 68uF10V Replacement due to Ignition

Replacement of MnO2 Tan-cap

- **No Ignition**
- **Lower ESR**
- **Better filtering**
- **Reduced Qty**
- **Reduced Cost**



- 5 pieces
  1210_68uf_10V MnO2

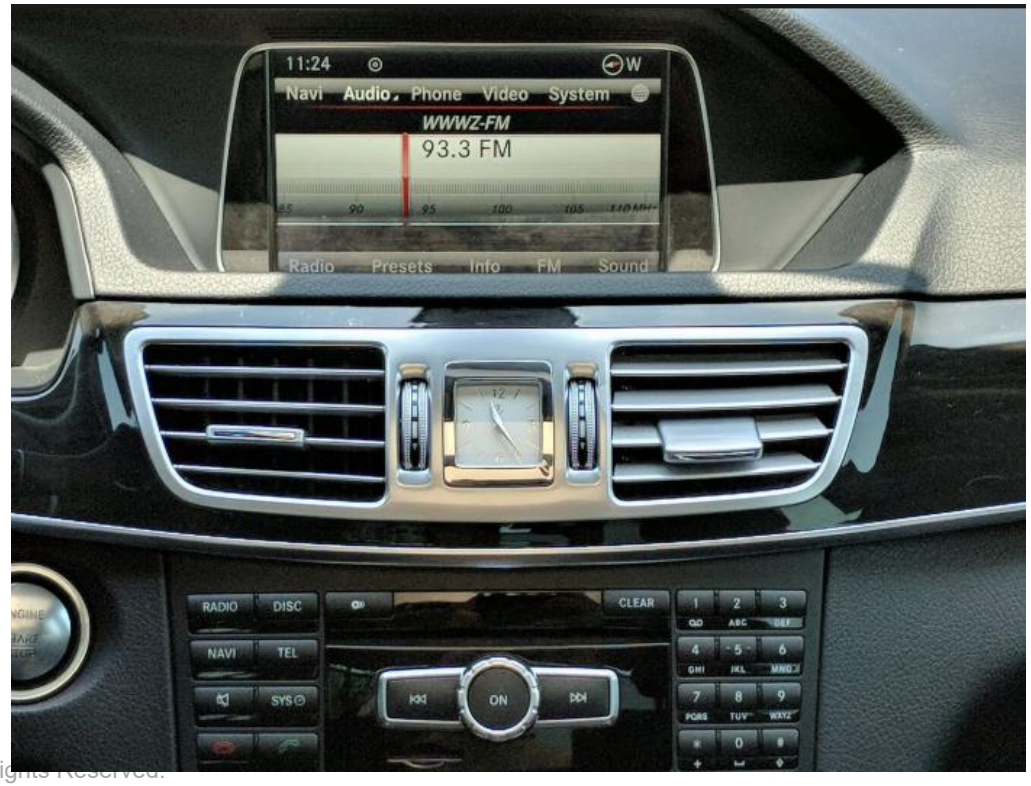
3 pieces

T598B686M006ATE070

AUTO Polymer

CID

MLCC 10uF35V Replacement due to Noise



- **High reliability in harsh environment**
- **No acoustic noise**
- **Downsizing**

KEMET PN:
T598D106M050ATE090
T598D336M035ATE065—12V rail

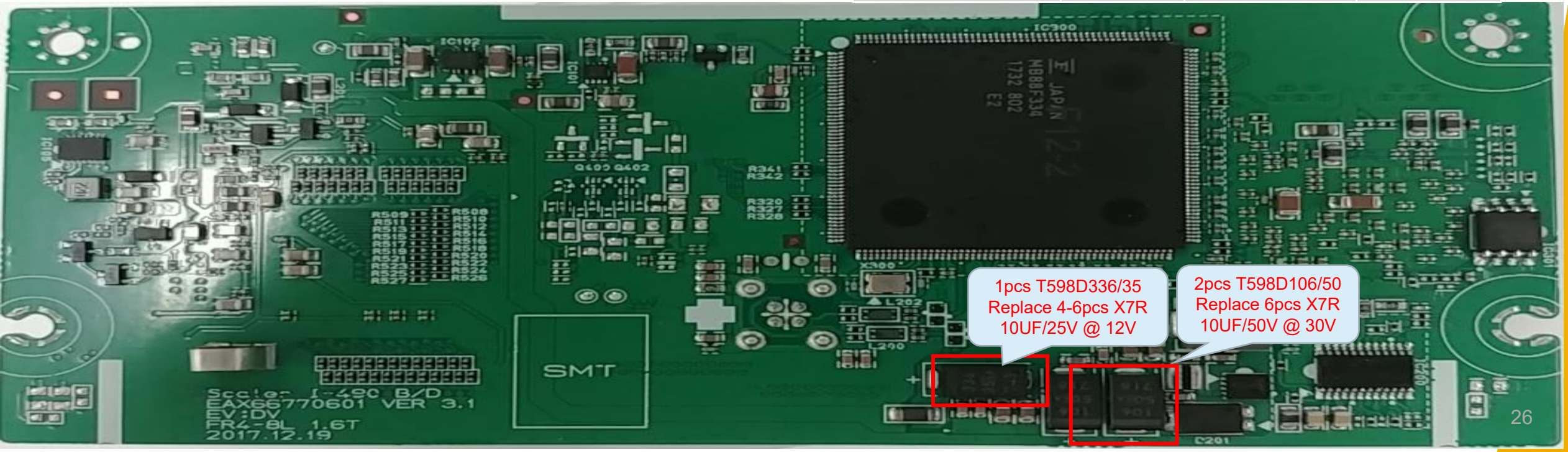
T598D337M006ATE040—3.3V
T598D227M010ATE025—5V

Successful Case KO AUTO Replace MLCC

Center Information Display (CID)

KOCAP vs. X7R MLCC		
Capacitor	Class II X7R MLCC	KOCAP AUTO
AEC-Q200	YES	YES
Acoustic Noise	YES	NO
Cap Loss DC Bias	YES	NO
Cap Loss Temperature	YES	NO
Aging	3~7% /Decade Hrs	NO

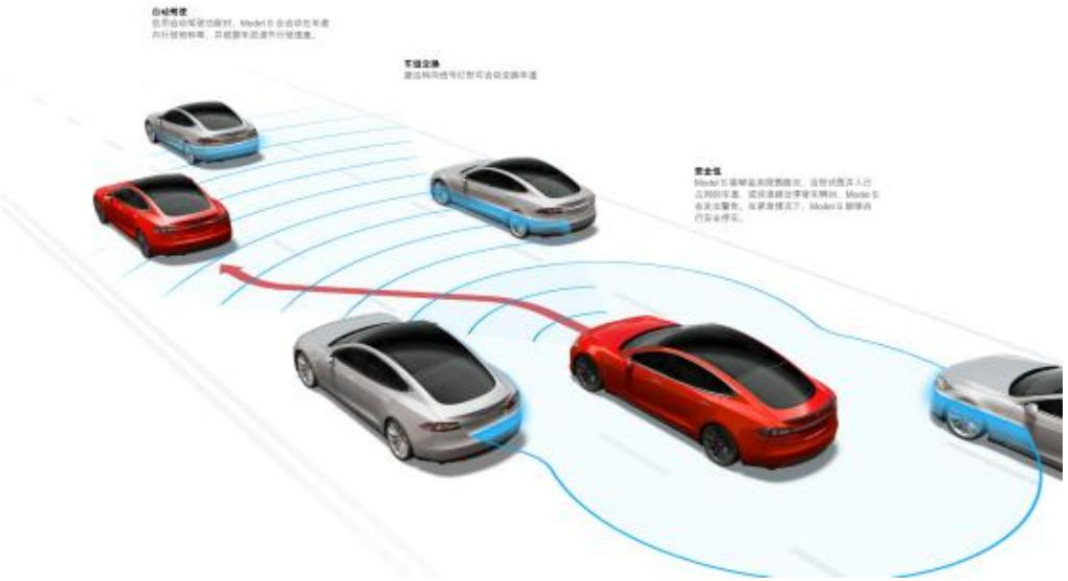
KOCAP vs Class II MLCC			
Series	X7R AUTO	X7R AUTO	T598 AUTO
Rated Voltage	25V	16V	35V
Capacitance	10uF	10uF	33uF
Capacitance @12V	7uF	5.6uF	33uF
Qty	4	6	1
	7x4=28uF	5.6x6=33.6uF	33x1=33uF
Acoustic Noise	Yes	Yes	No



Autonomous Driving

NVIDIA DRIVE PX

KEMET Inside



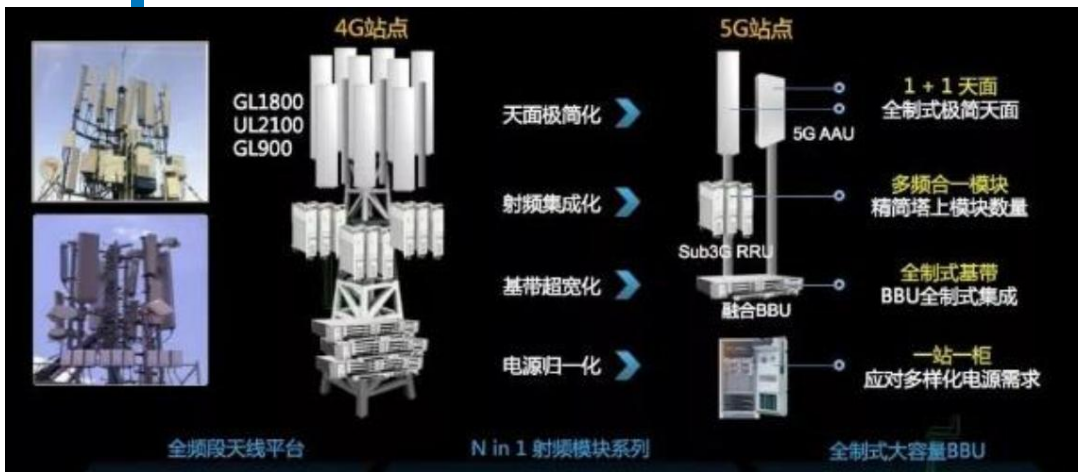
Strong Computing Unit

T591V227M2R5ATE009
T591V337M2R5ATE012
T591V337M2R5ATE009(UD)
T598D477M2R5ATE009

12V
T598D336M035ATE065

3.3/5V
T598B107M006ATE070
T598B476M010ATE070
T598B476M006ATE070

Telecom (5G Base Station)



Request to capacitors:

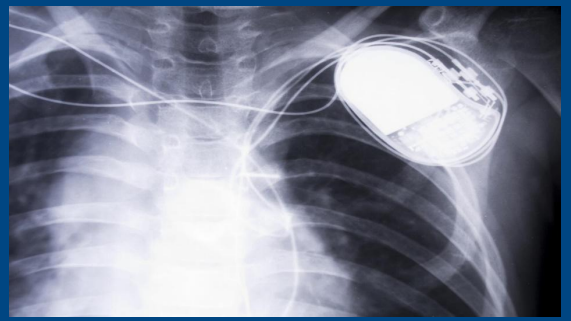
- High reliability, 10yrs Guarantee life
- High working temp, 90C+
- Low Profile (<2mm prefer)
- High CV (Less is more)
- High robustness to HTHH (85C/85%)

Temp	P/N	Size	Cap(uf)	Working voltage
150C/2000hrs	T599D157M006ATE025	7343-28	150	3.3/5V
	T599D337M2R5ATE025	7343-28	330	
125C/2000hrs	T598D477M2R5ATE009	7343-28	470	
	T591V337M2R5ATE012	7343-19	330	1V+
	T591V337M2R5ATE009	7343-19	330	
	T591V107M010ATE025	7343-19	100	5V
	T598D337M006ATE025	7343-28	330	3.3/5V
	T591V686M020ATE050	7343-19	68	
	T521V107M020ATE055	7343-19	100	
	T521V107M016ATE050	7343-19	100	12V
	T591D157M016ATE065	7343-28	150	

Qualified Life	KEMET P/N	(mm)	(inch)	Cap(uf)
125C/2000hrs	T591B476M006ATE070	3528-21	1210	47
	T591B107M006ATE070	3528-21	1210	100
	T591B157M006ATE070	3528-21	1210	150
	T591B227M006ATE070	3528-21	1210	220
	T598B476M010ATE070	3528-21	1210	47
105C/2000hrs (BBU)	T520A107M006ATE070	3216-18	1206	100
	T520B107M006ATE040	3528-21	1210	100
	T520B157M006ATE035	3528-21	1210	150
	T520B227M006ATE045	3528-21	1210	220
	T529P476M006APE150	2012-10	'0805	47
	T520B107M010ATE070	3528-21	1210	100

Mission Critical
Electronics

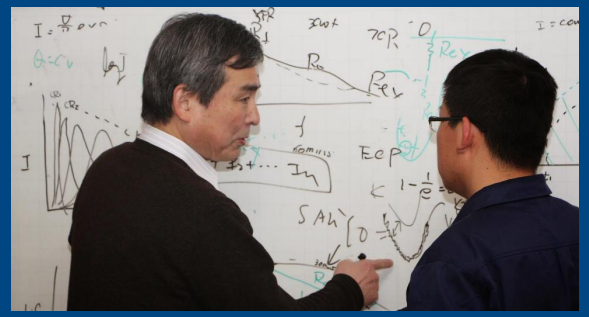
High-Performance
Power Management



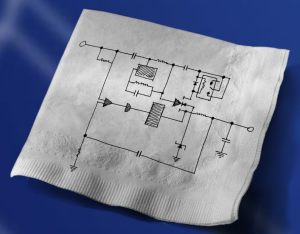
Where Failure is
Not an Option

Breakthrough Technology

Unparalleled Borderless Service



Smart People



Innovative Products that Solve Customer Challenges

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