



**KEMET MIL-PRF-32535 Series for Defense and
Aerospace Applications**

- *Defense and Aerospace Background*
- *MIL-PRF-55681 and MIL-PRF-123 Overview*
- *MLCC Advances in Commercial and Automotive Applications*
 - *Any why Defense and Aerospace have not followed*
- *Introduce MIL-PRF-32535 Specification*
- *KEMET Product Offering for MIL-PRF-32535*
- *Ordering Information*

Defense and Aerospace



MLCCs for D&A Applications

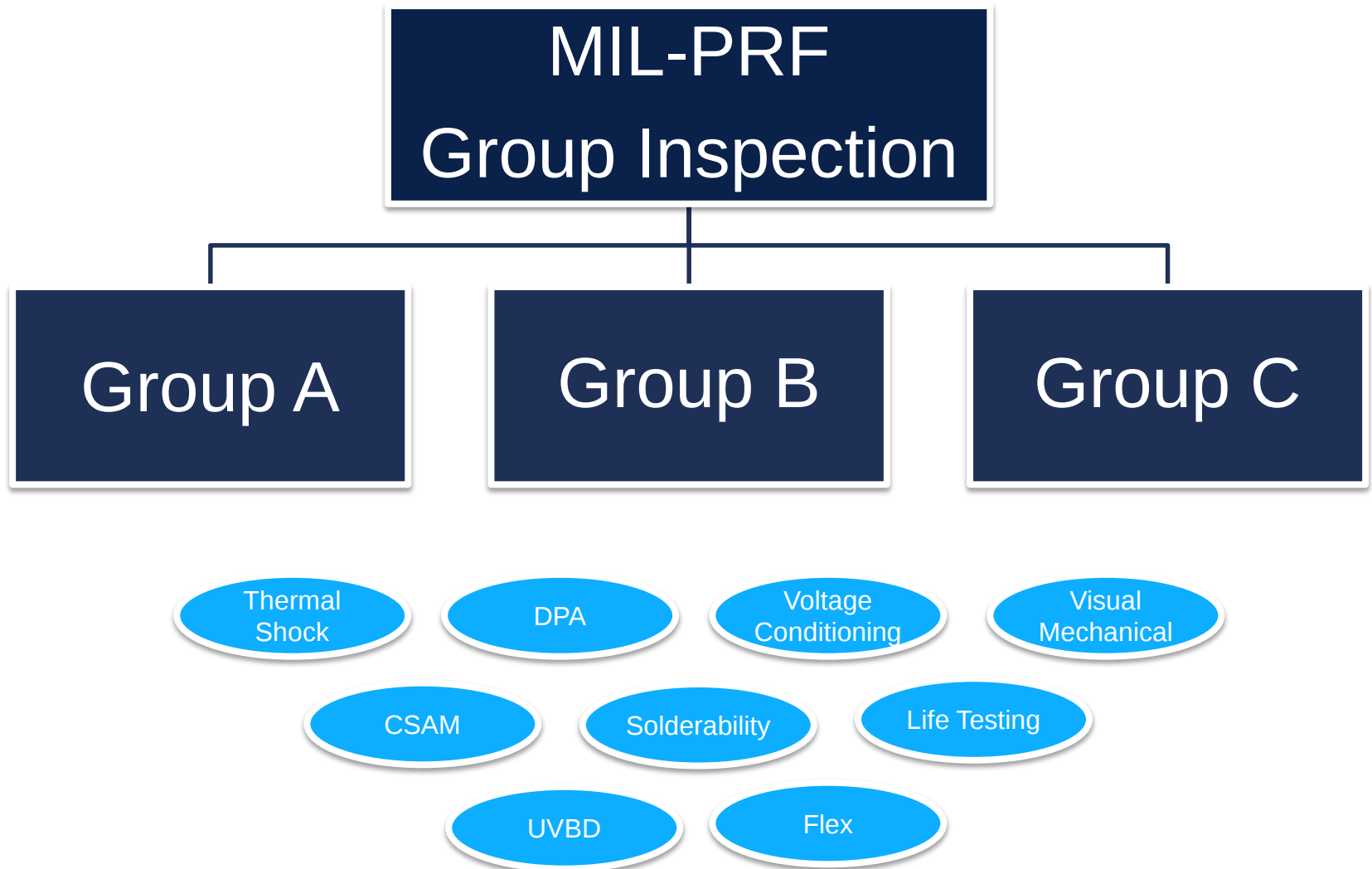
- 
- ☐ Conservative designs
 - ☐ Constructed and screened per military standard
 - ☐ Design and change control
 - ☐ Full material traceability
 - ☐ Verified electrical and environmental performance
 - ☐ Periodic maintenance testing
 - ☐ Strict oversight on materials and processes

Military vs Space Grade

What's the difference?

	Military Grade	Space Grade
Also Known As	Standard and Established Reliability	High Reliability
Applications	Non-critical military applications such as communications devices, ground weapons, military equipment not used for navigation and Safety 	Space, missiles, avionic safety and navigation equipment 
Special Requirements	Periodic inspection for electrical, environmental, and mechanical inspection.	Every lot receives electrical, environmental, and mechanical inspection.

Group Testing Overview

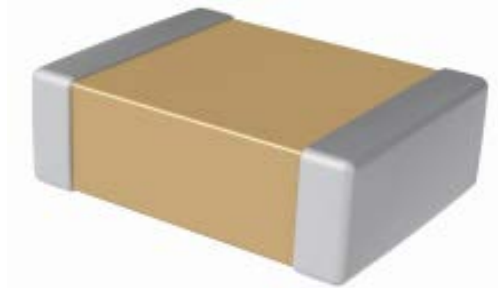


MIL-PRF-55681 (CDR)

Military Grade - Established Reliability

Overview

- Military Grade - Established Reliability
- Military & Avionics applications
- >25 year field history
- Legacy PME
- 50 & 100V rating available
- NP0/BP and BR/BX Dielectrics
- 0805 – 2225 Case Sizes
- Group A and C Testing



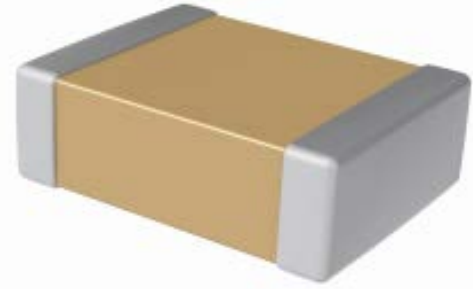
CDR01	B	P	101	B	K	Z	M
Style & Size Code	Rated Temperature	Dielectric	Capacitance	Rated Voltage	Tolerance	Termination Finish	Failure Rate

MIL-PRF-123 (CKS)

Space Grade (High Reliability)

Overview

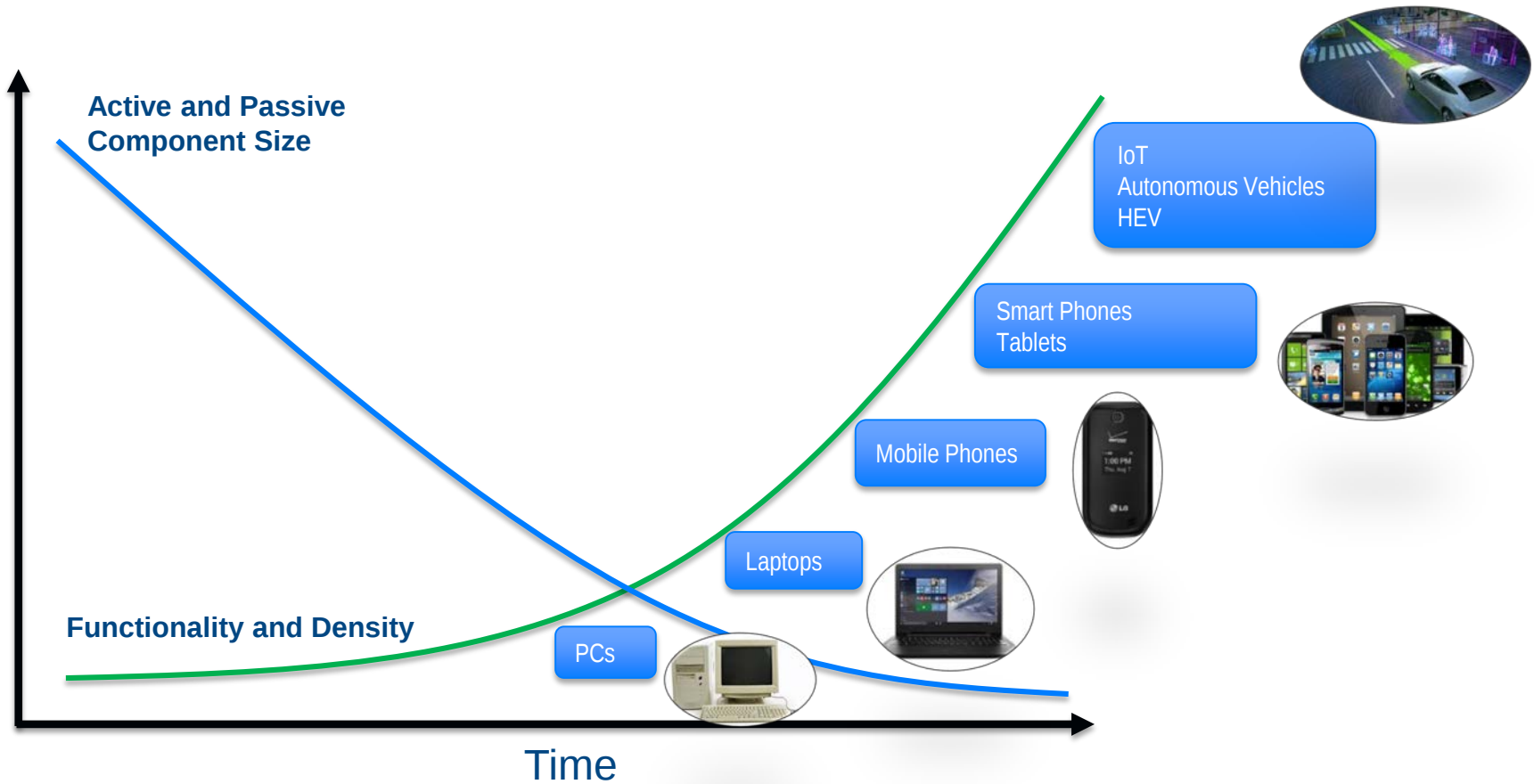
- Space Grade (High Reliability)
- Space, Missile, and other Hi Rel Applications
- >25 year field history
- Prevents Nickel electrode system (No BME)
- 50 & 100V rating available
- NP0/BP and BR/BX Dielectrics
- 0805 – 2225 Case Sizes, Leaded
- Group A, B, and C Testing



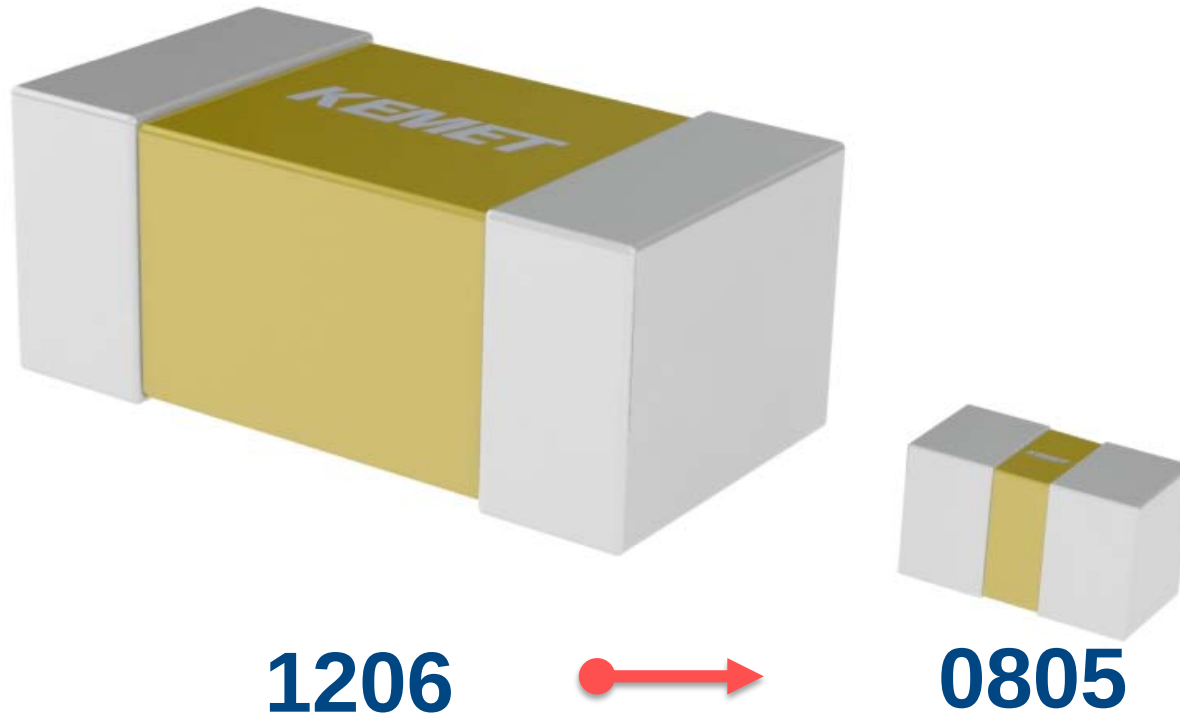
M123	A	10	BX	B	472	K	Z
Military Spec Number	Modification Number	Slash Sheet	Temperature Characteristic	Rated Voltage	Capacitance	Tolerance	Termination Finish

Electronics Industry Trends

Commercial and Automotive

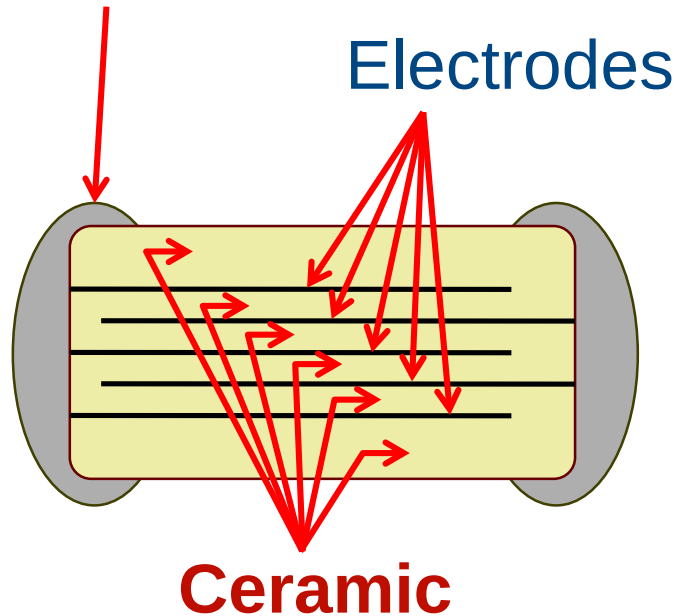


MLCC Miniaturization

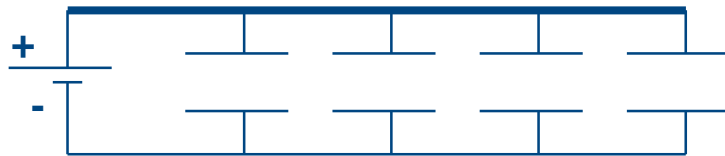


MLCC Miniaturization

Termination



- C** = Design Capacitance
- K** = Dielectric Constant
- A** = Overlap Area
- d** = Ceramic Thickness
- n** = Number of Electrodes



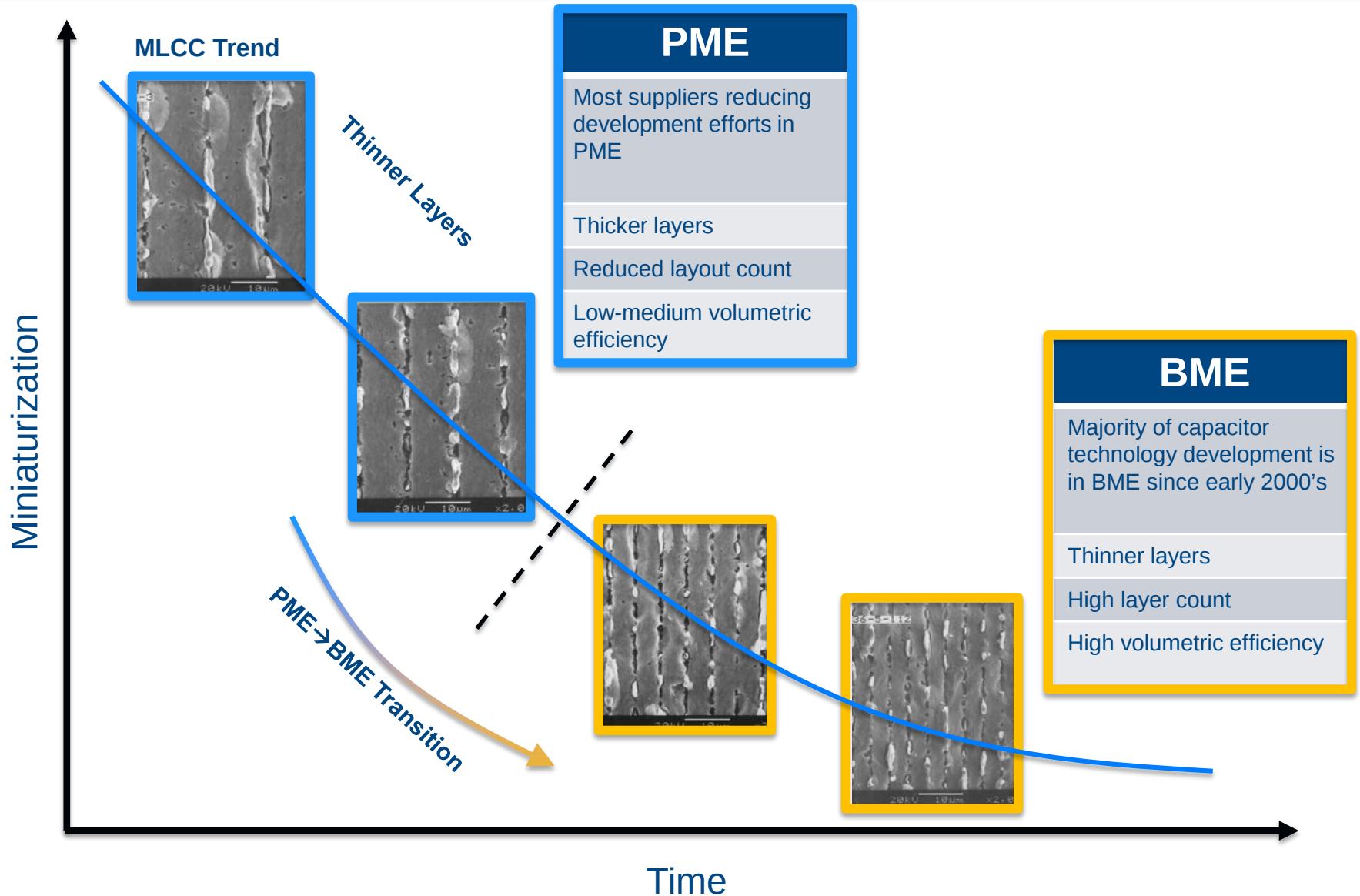
Capacitances in parallel are additive

$$C_T = C_1 + C_2 + C_3 + \dots C_n$$

$$C = \frac{\epsilon_0 K A (n-1)}{d}$$

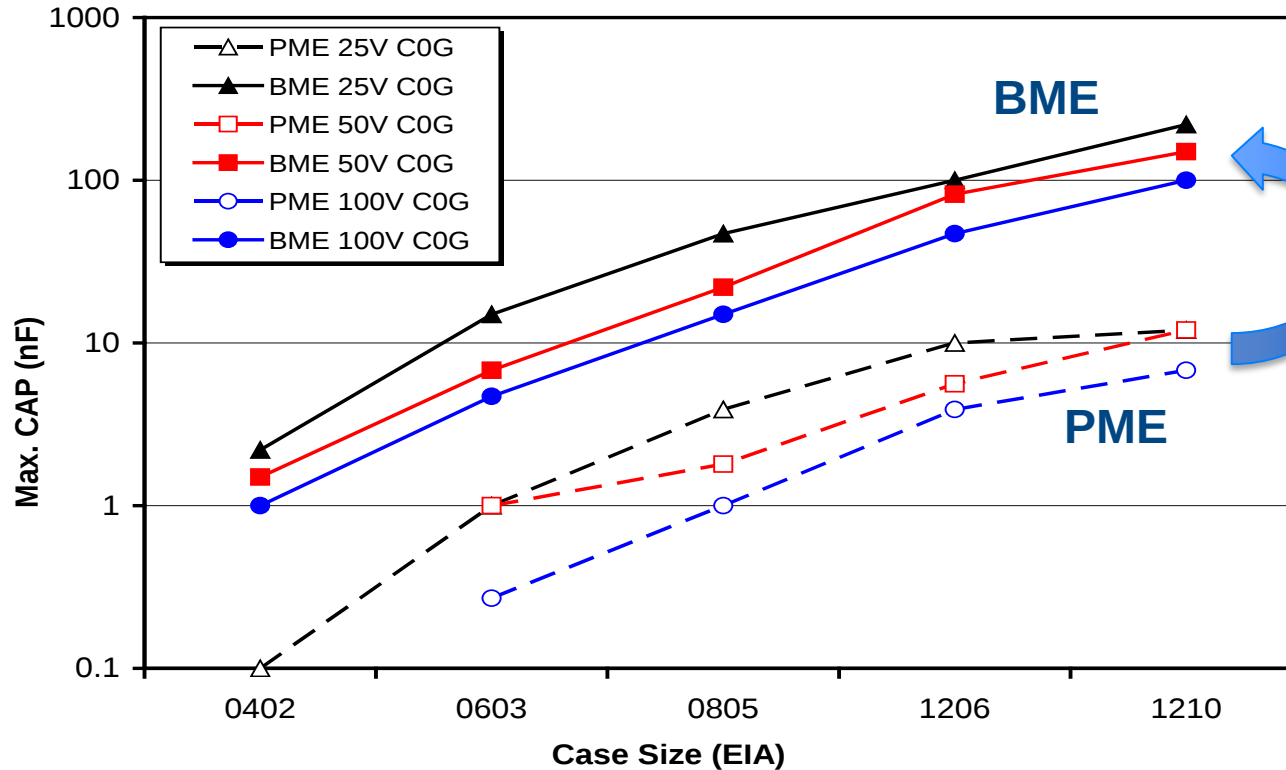
MLCC Trends

Movement towards BME



MLCC Trends

Movement towards BME

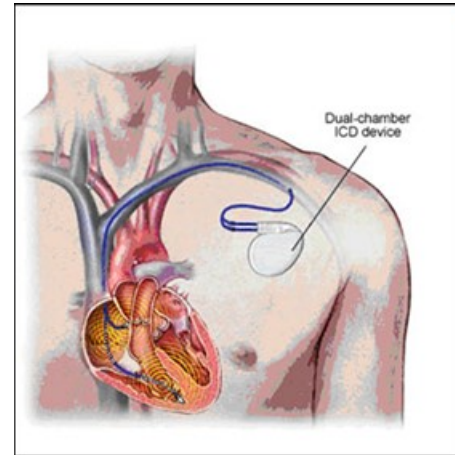


10x cap increase in
BME over PME

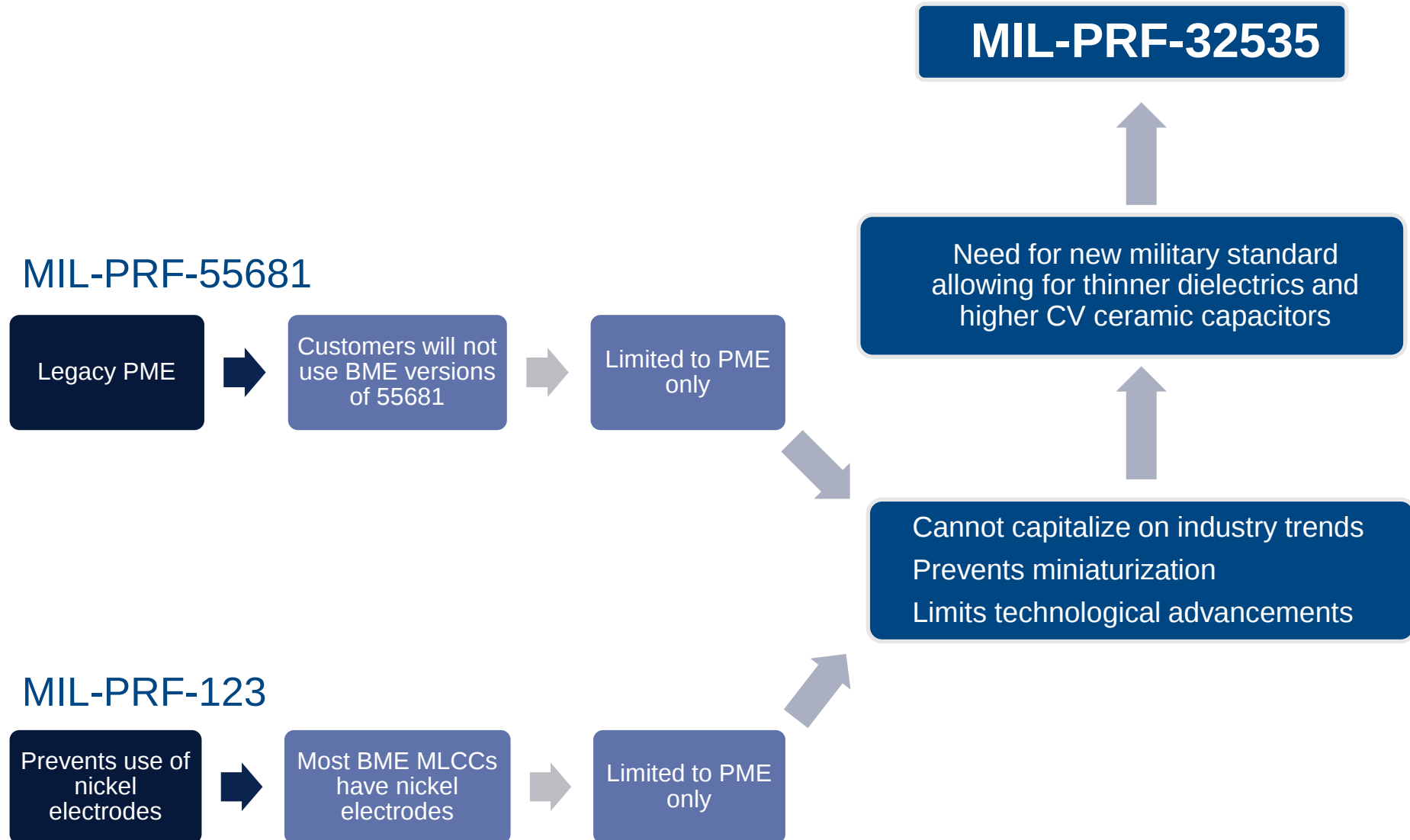
BME Reliability

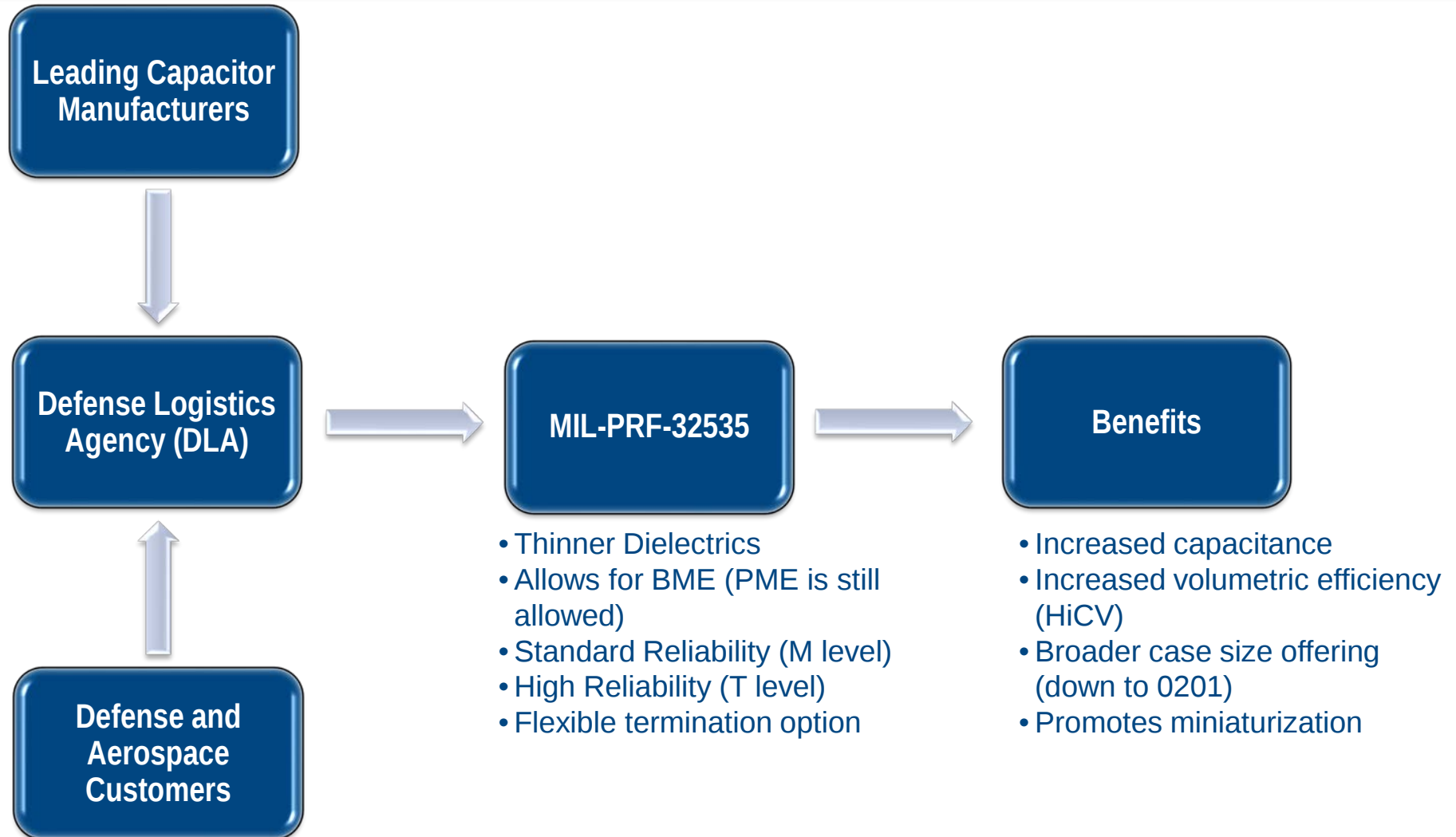
BME MLCC's are used in many applications where reliability is critical

- Automotive (>15 years)
- Medical instrumentation and implantable (10+ years)



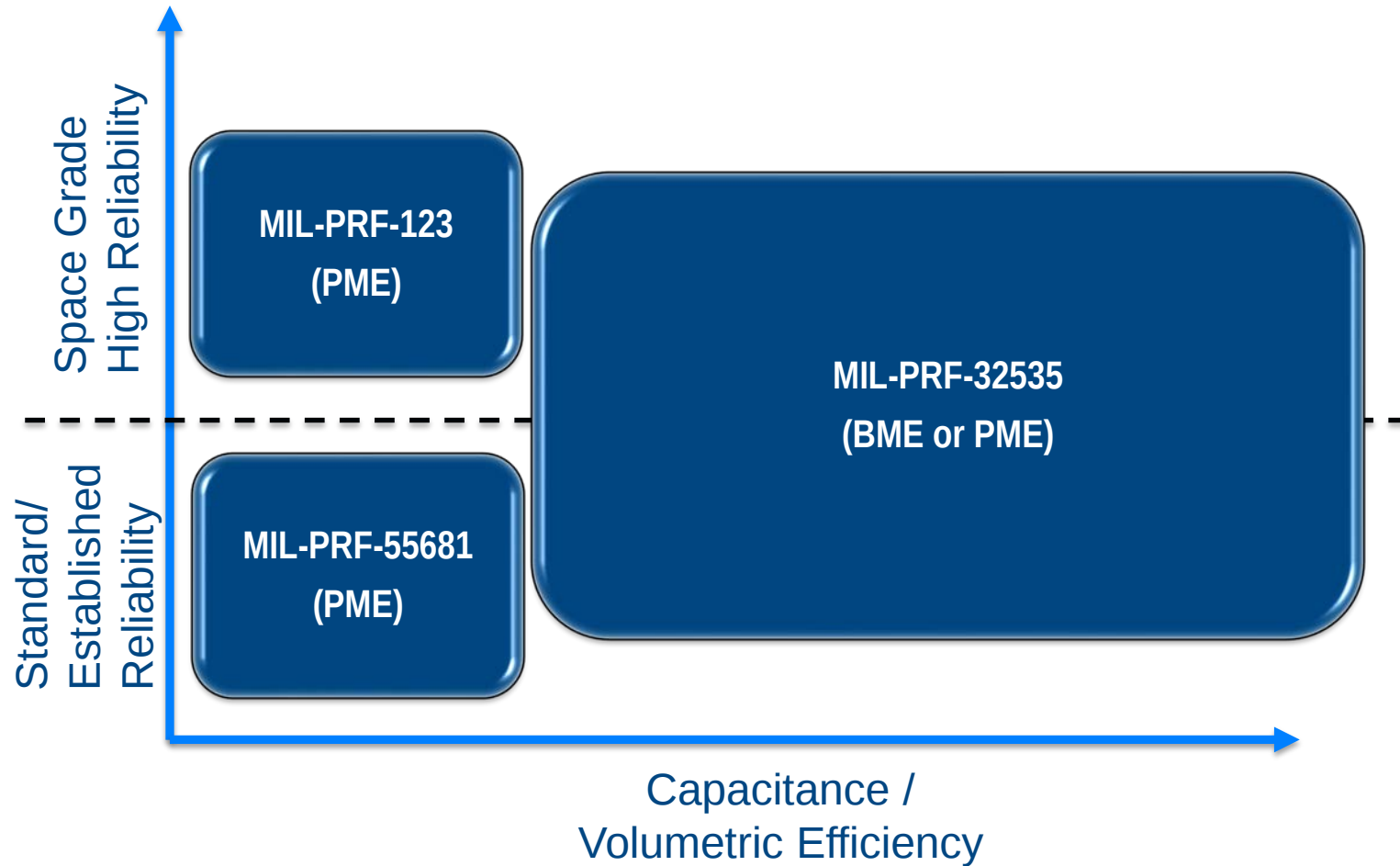
MIL-PRF-55681 and MIL-PRF-123 Restrictions





MIL-PRF-32535

Does Not Replace MIL-PRF-55681 and MIL-PRF-123





Industry's First Military Qualified BME Ceramic Capacitors

QPL listed per MIL-PRF-32535

- Defense & Aerospace Applications
 - High Reliability



- High Capacitance
- Broad Case Size & Voltage Range

High CV Military/ Space Grade MLCCs

MIL-PRF-32535 C0G/BP

NEW HiCV Military / Space Grade

Standard reliability ("M" Level)
High reliability ("T" Level)

Up to a 18-fold increase in capacitance

Standard and Flexible Terminations

C0G/BP Dielectrics

0402 - 2220 Case Sizes

4 – 200 Vdc Ratings



Dielectric	TCC @0V	TCC @ Rated V
C0G	0 ±30 ppm/°C	Not Required
BP	0 ±30 ppm/°C	0 ±30 ppm/°C

High CV Military/ Space Grade MLCCs

MIL-PRF-32535 X7R

NEW HiCV Military / Space Grade

Standard reliability ("M" Level)
High reliability ("T" Level)

Up to a 55-fold increase in capacitance

Standard and Flexible Terminations

X7R Dielectric

0402 - 2220 Case Sizes

4 – 100 Vdc Ratings

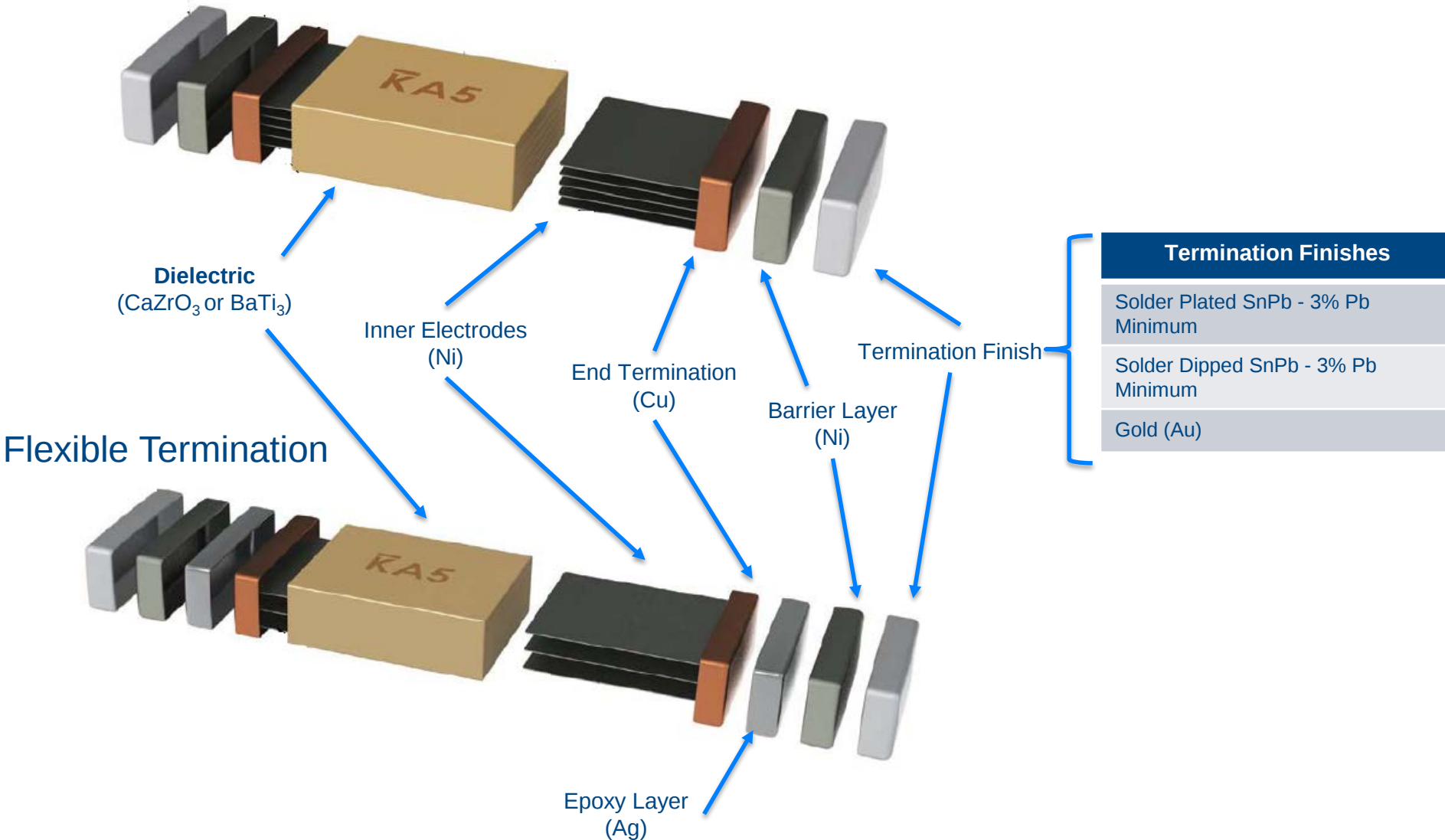
**COMING
SOON**



BME

Base Metal Electrode Technology

Standard Termination



MIL-PRF-32535

What Advantages?

C0G/BP

Capacitance

330pF 100V

3.3nF 50V

8.2nF 50V

PME

(MIL-PRF123 or MIL-PRF-55681)

1206

1210

2225

BME

(MIL-PRF-32535)

0402

0603

0805

X7R

Capacitance

56nF 100V

27nF 100V

18nF 100V

PME

(MIL-PRF123 or MIL-PRF-55681)

1812

1210

1206

BME

(MIL-PRF-32535)

0805

0805

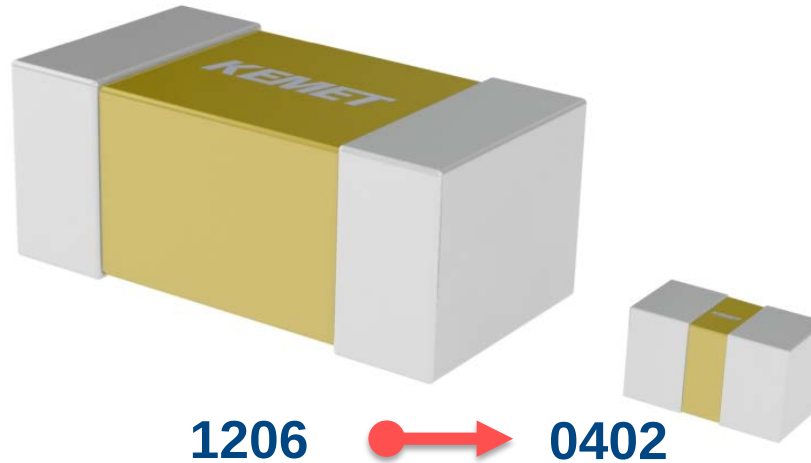
0603

MIL-PRF-32535

What Advantages?

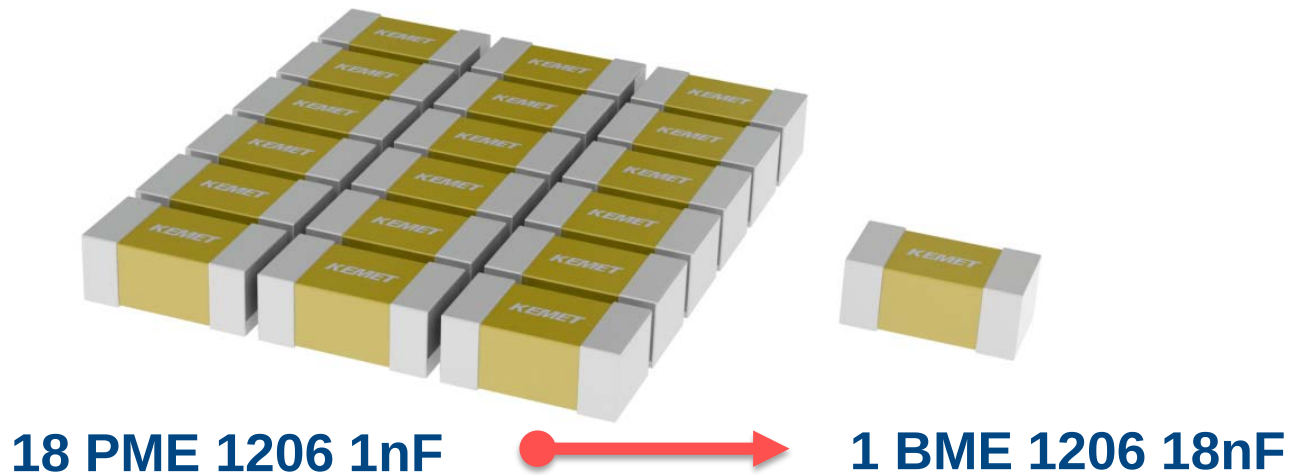
Desired Capacitor:

C0G/BP 330pF 100V



Desired Capacitor:

C0G/BP 18nF 100V



MIL-PRF-32535

What Advantages – C0G/BP Offering

Case Size (Inches)	Case Size (mm)	Rated Voltage (Vdc)	Maximum Available Capacitance (nF)		CAP Increase
			MIL-PRF-55681 MIL-PRF-123	MIL-PRF-32535	
0402	1005	4 / 6.3 / 10 / 16 / 25	-	1.0	New Offering
		50	-	0.68	
		100	-	0.33	
0603	1608	4 / 6.3 / 10 / 16 / 25	-	5.6	New Offering
		50	-	3.9	
		100	-	2.2	
		200	-	0.82	
0805	2012	4 / 6.3 / 10 / 16 / 25	0.68	10	15x
		50	0.68	8.2	12x
		100	0.47	8.2	17x
		200	-	0.47	New Offering
1206	3216	4 / 6.3 / 10 / 16 / 25	2.2	27	12x
		50	2.2	18	8x
		100	1.0	18	18x
		200	-	1.8	New Offering
1210	3216	4 / 6.3 / 10 / 16 / 25	3.3	47	14x
		50	3.3	33	10x
		100	2.2	33	15x
		200	-	3.3	New Offering
1812	4532	4 / 6.3 / 10 / 16 / 25	10.0	100	10x
		50	10.0	68	7x
		100	4.7	56	12x
		200	-	6.8	New Offering
2220	5650	4 / 6.3 / 10 / 16 / 25	-	180	New Offering
		50	-	150	
		100	-	100	
		200	-	27	



HOME



BROWSE



VIEW PARTS



BUY PARTS

◀ BACK TO MILITARY/HIGH RELIABILITY

M3253502E1B101JZMB

No Inventory Available

[VIEW ALTERNATE PARTS →](#)

(C0402K101J1EML)

[Request Samples for this part](#)

[Specsheet](#) | [SMD MIL C0G PRF32535 Datasheet](#) | [STEP](#)

[+ ADD TO COMPARE QUEUE](#)

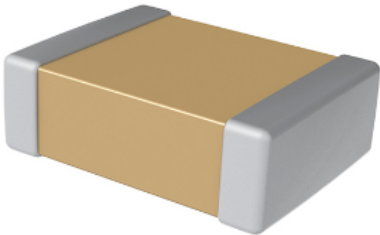


Image for reference only.

Capacitance
100 pF

Capacitance Tolerance
5%

Voltage DC
100 V

Temperature Range
-55/+125C

Temperature Coefficient
C0G

RoHS
No

Termination
Solder Plated

Failure Rate
N/A

Approvals
MIL-PRF-32535 M-Level

Chip Size
0402

Packaging
Waffle Pack

Packaging Quantity
368

MIL-PRF-32535

How to Order

MIL-PRF-32535 Ordering Information

M32535	04	E1	Z	104	J	R	M	B
MIL Prefix	Slash Sheet	Characteristic/Dielectric	Rated Voltage (VDC)	Capacitance Code (pF)	Capacitance Tolerance	Termination ^{1,2}	Product Level	Electrode
	02 = 0402 03 = 0603 04 = 0805 05 = 1206 06 = 1210 07 = 1812 08 = 2220	E1 = C0G BP = BP	V = 4 W = 6.3 X = 10 Y = 16 Z = 25 A = 50 B = 100 C = 200	Two significant digits and number of zeros. Use 9 for 1.0 – 9.9 pF e.g., 2.2 pF = 229	B = ±0.1 pF C = ±0.25 pF D = ±0.5 pF F = ±1% G = ±2% J = ±5% K = ±10%	D = Sn/Pb solder dipped G = Nickel gold plating R = Flexible termination with solder plating V = Flexible termination with nickel gold plating Z = Solder plated	M = M Level T = T Level	B = BME

¹ Termination options D, R, V, and L are not available in EIA 0402 case size.

² Termination option D is not available in EIA 0603 case size.

KEMET Part Number Equivalent (For Reference Only)

C	1206	K	104	J	3	G	M	L	--
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ²	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish	Packaging/ Grade (C-Spec)
	0402 0603 0805 1206 1210 1812 2220	K = MIL-PRF-32535	Two significant digits and number of zeros. Use 9 for 1.0 – 9.9 pF Use 8 for 0.5 – 0.99 pF ex. 2.2 pF = 229 ex. 0.5 pF = 508	B = ±0.1 pF C = ±0.25 pF D = ±0.5 pF F = ±1% G = ±2% J = ±5% K = ±10%	7 = 4 9 = 6.3 8 = 10 4 = 16 3 = 25 5 = 50 1 = 100 2 = 200	E = C0G G = BP	M = M Level, standard termination N = M Level, flexible termination T = T Level, standard termination V = T Level, flexible termination	L = Solder plated H = Sn/Pb solder dipped G = Nickel gold plating	See "Packaging C-Spec Ordering Options Table" below

Packaging C-Spec Ordering Options Table

Packaging Type ¹	Packaging/Grade Ordering Code (C-Spec)
Standard Packaging (Waffle Tray)	Not required (Blank)
7" Tape & Reel	Contact Sales