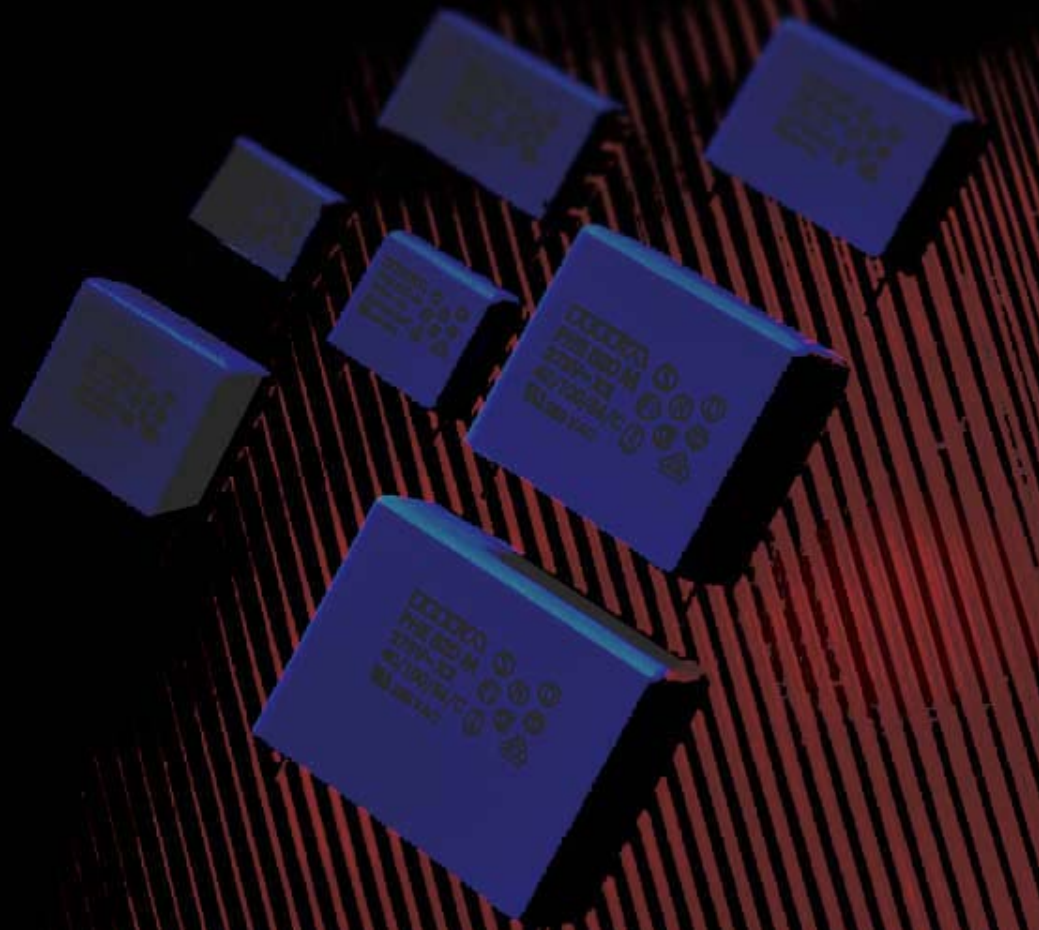
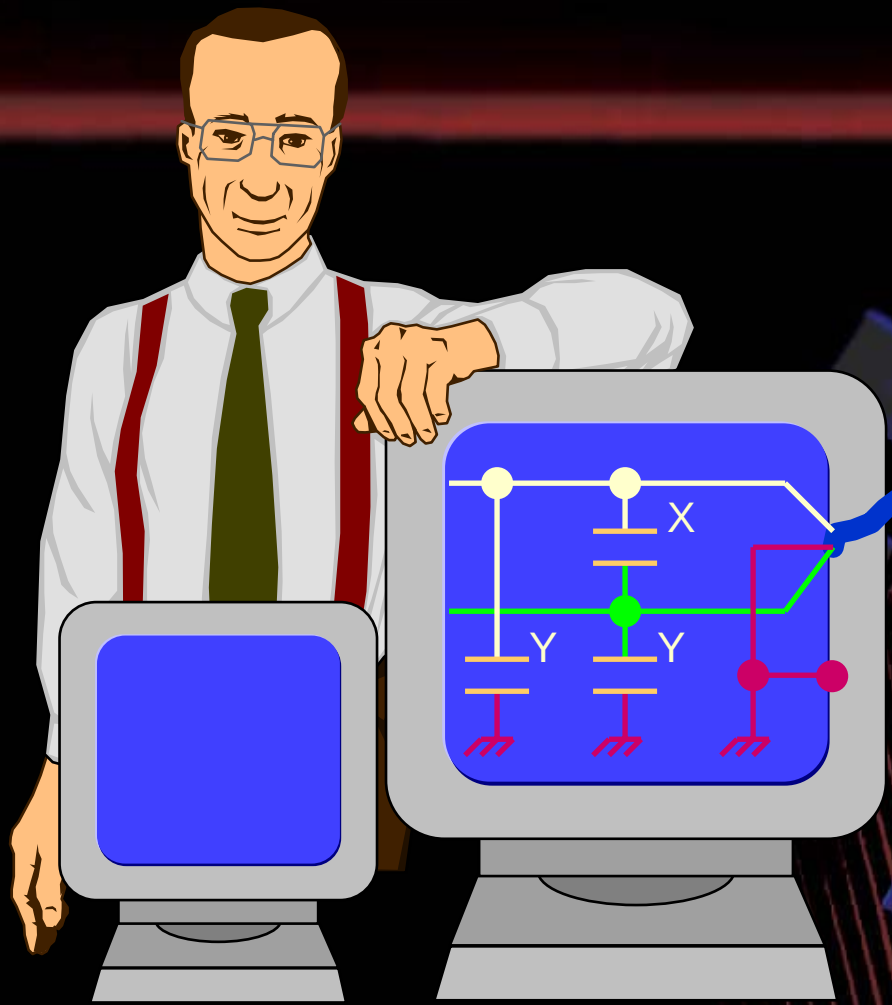
X and Y Capacitors



EMI Capacitors on the AC Line



X capacitors are across the line. If they short-circuit, the risk is fire.

Y capacitors are from line to chassis. If they short-circuit, the risk is a shock to the user.

Because of the risks, X and Y capacitors are safety agency tested.

Self-healing

- Metallized film capacitors can repair themselves after a voltage spike.

Breakdown occurs after surge.

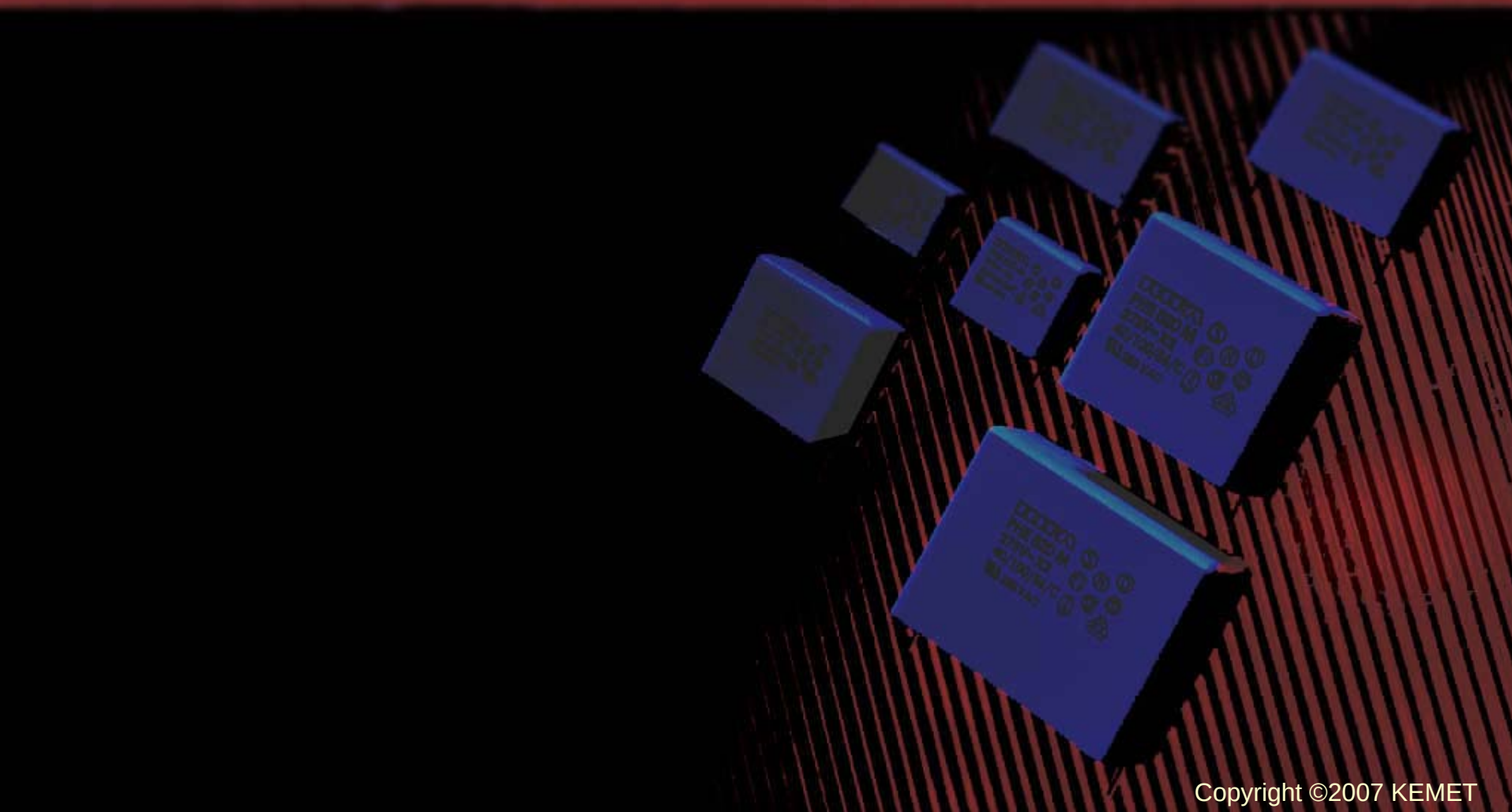
Thin metallization heats up and melts.

Area around breakdown is isolated. No short circuit!

Self-healing

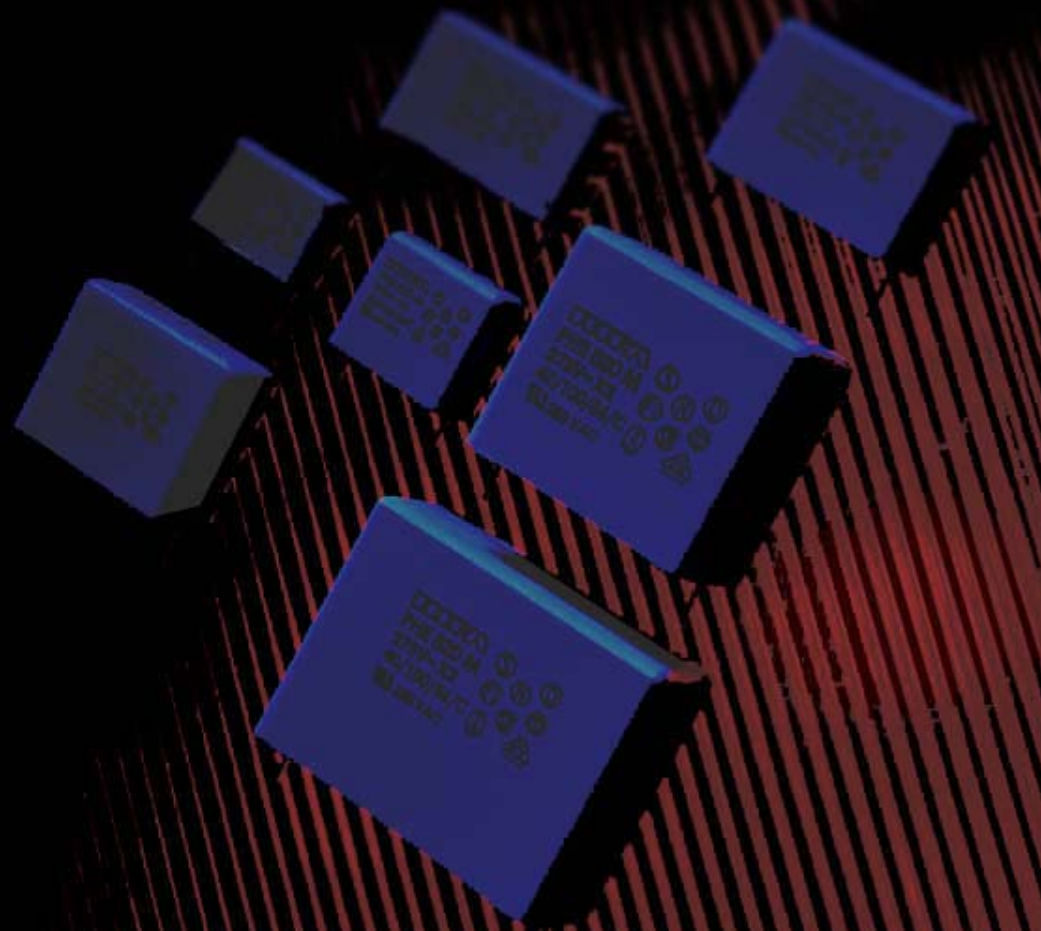
- Metallized film capacitors can repair themselves after a voltage spike.
- Ceramic caps cannot. Their failure mode can be a short circuit, with risk of shock in the case of a Y capacitor.

X Capacitors



X2 Capacitor PHE840M

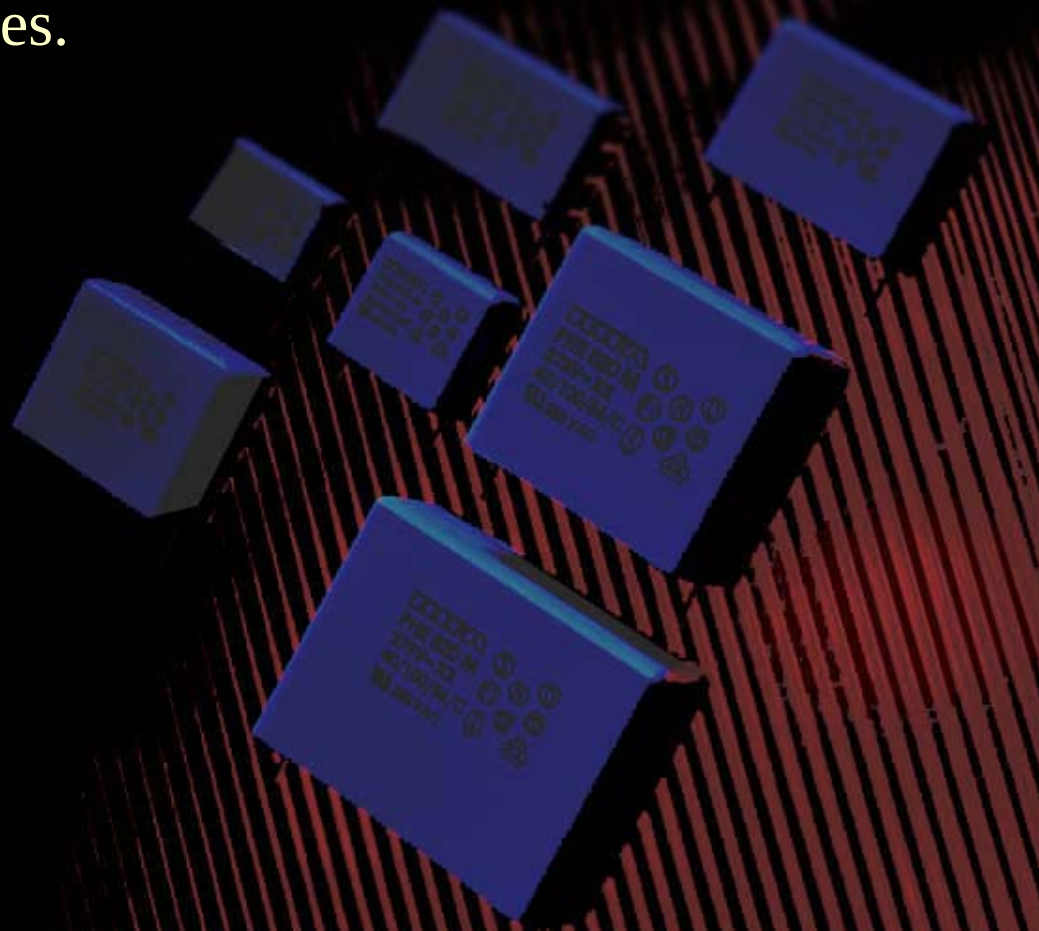
Benefits for the designer



X2 Capacitor PHE840M

Benefits for the designer

- Lower prices, smaller sizes.



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- Many values in “standard” leadspacings plus new smaller alternates.
  - 1µF in 27.5mm and new 22.5.
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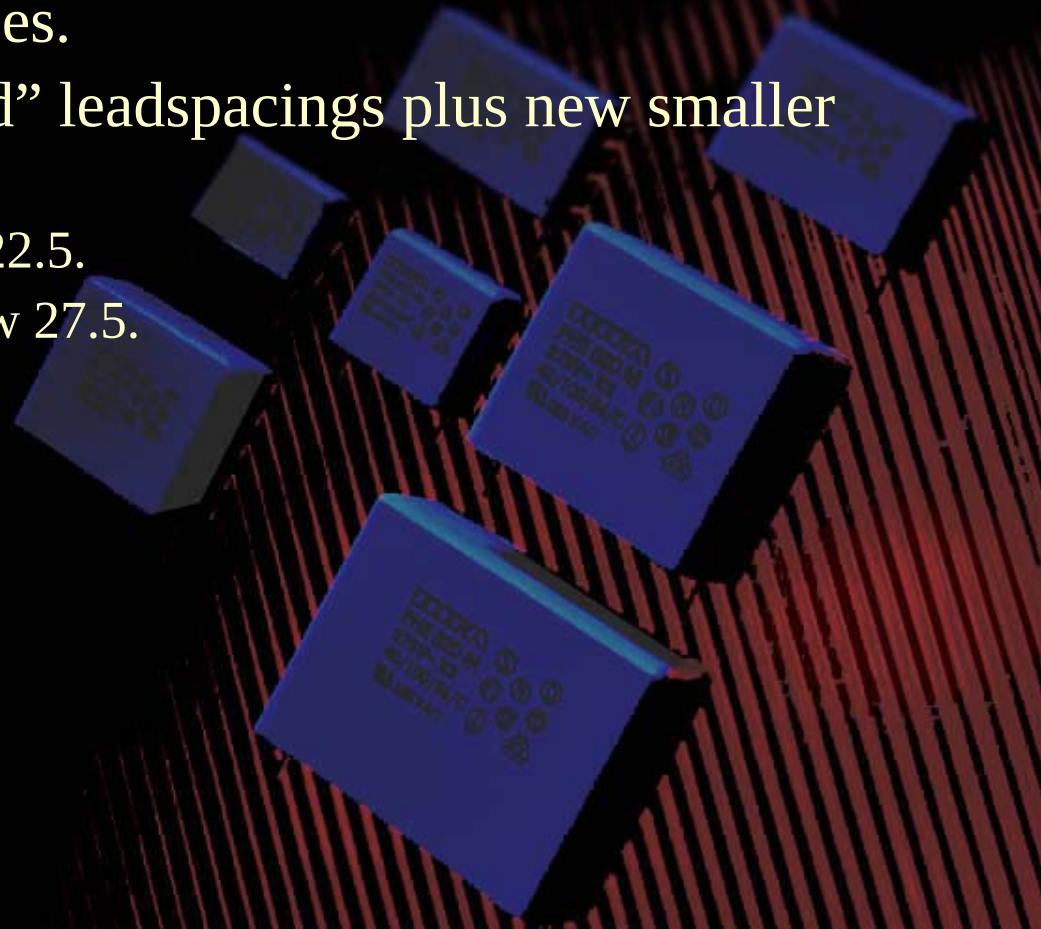

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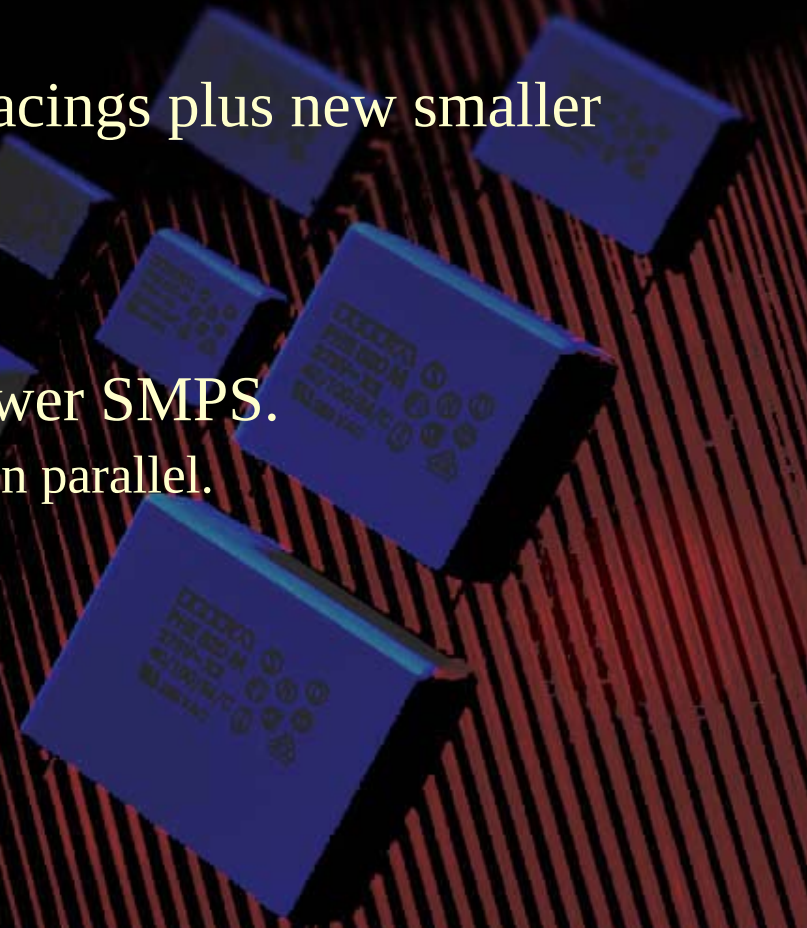
  - Eliminates the need for 2 capacitors in parallel.



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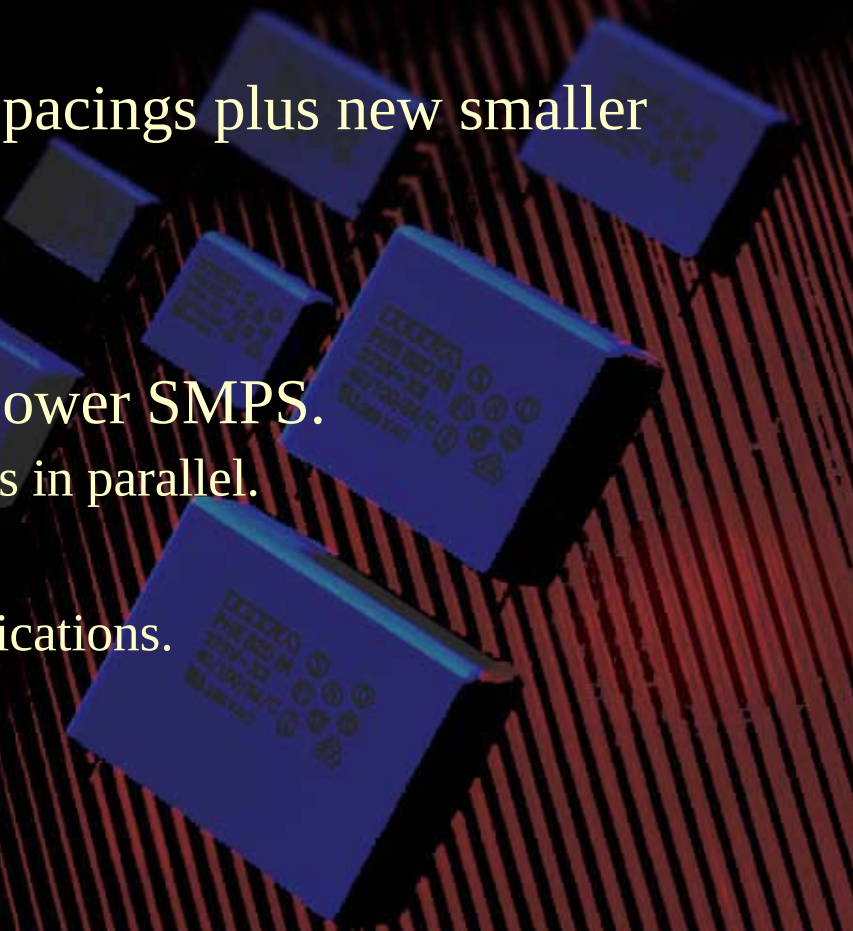
  - Eases design-ins for 277VAC applications.



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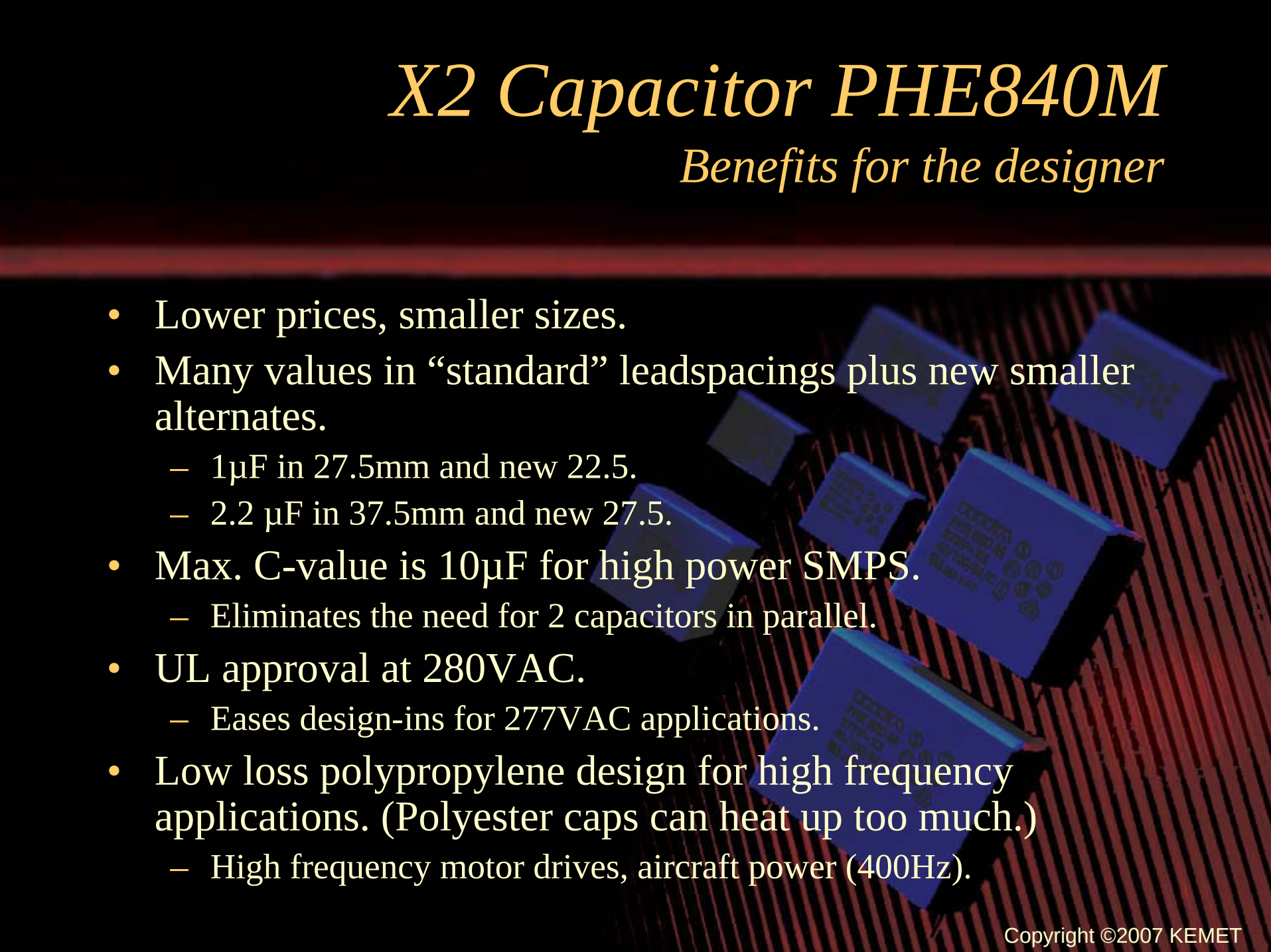

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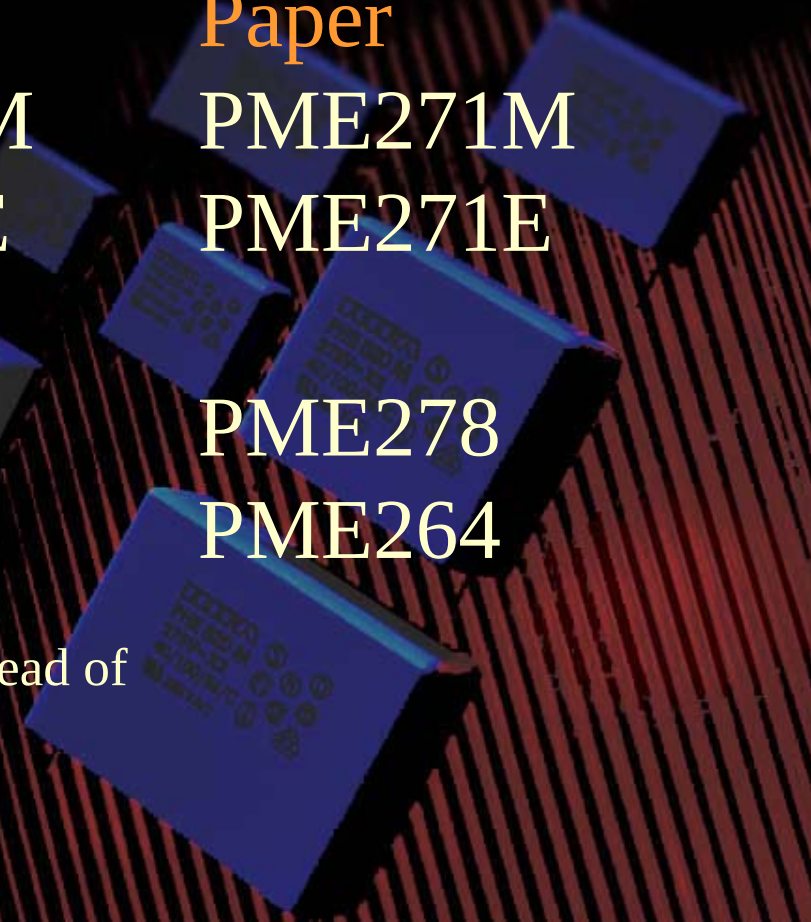
- Max. C-value is 10µF for high power SMPS.
  - Eliminates the need for 2 capacitors in parallel.
- UL approval at 280VAC.
  - Eases design-ins for 277VAC applications.
- Low loss polypropylene design for high frequency applications. (Polyester caps can heat up too much.)
  - High frequency motor drives, aircraft power (400Hz).

A Product for Every Voltage

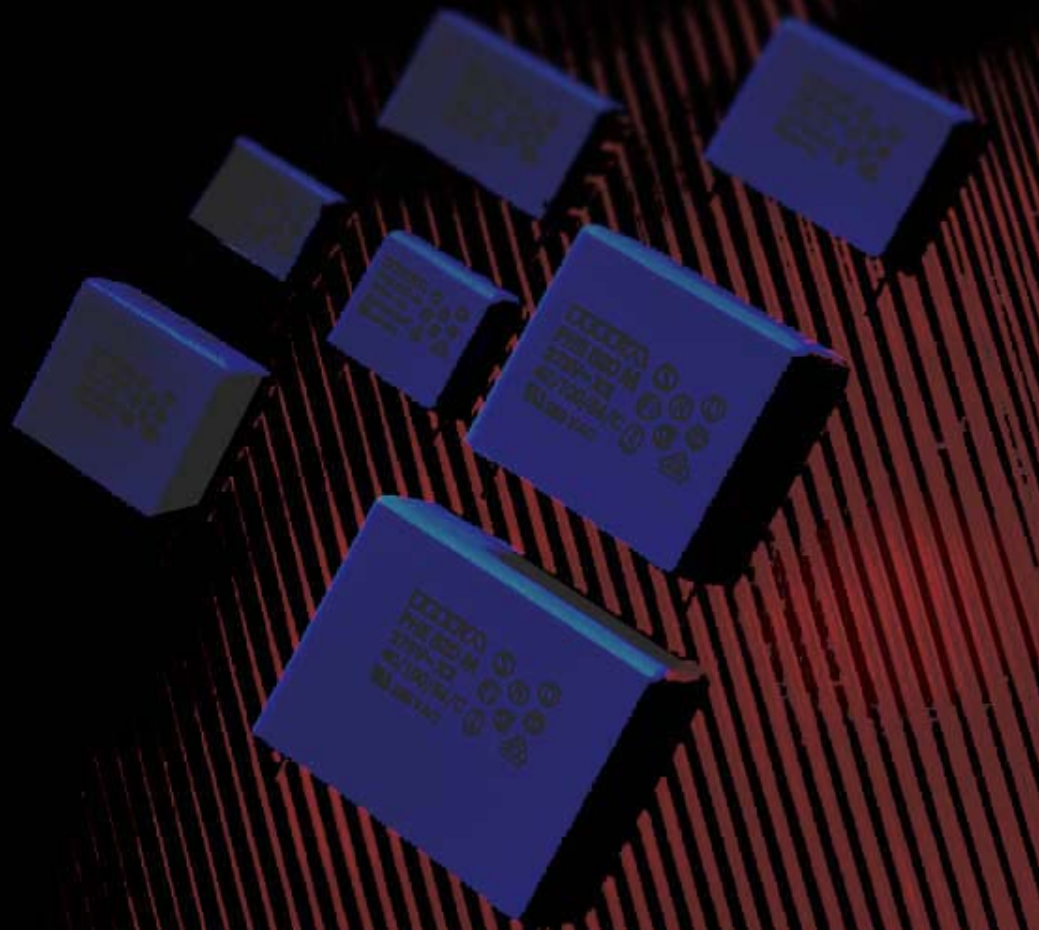
X caps for industrial applications

AC voltage	Film	Paper
275/280	PHE840M	PME271M
300	PHE840E	PME271E
330	PHE841	
440/480	PHE844	PME278
600 & up	PHE845	PME264

Use one capacitor of the correct voltage instead of two low-voltage parts in series.



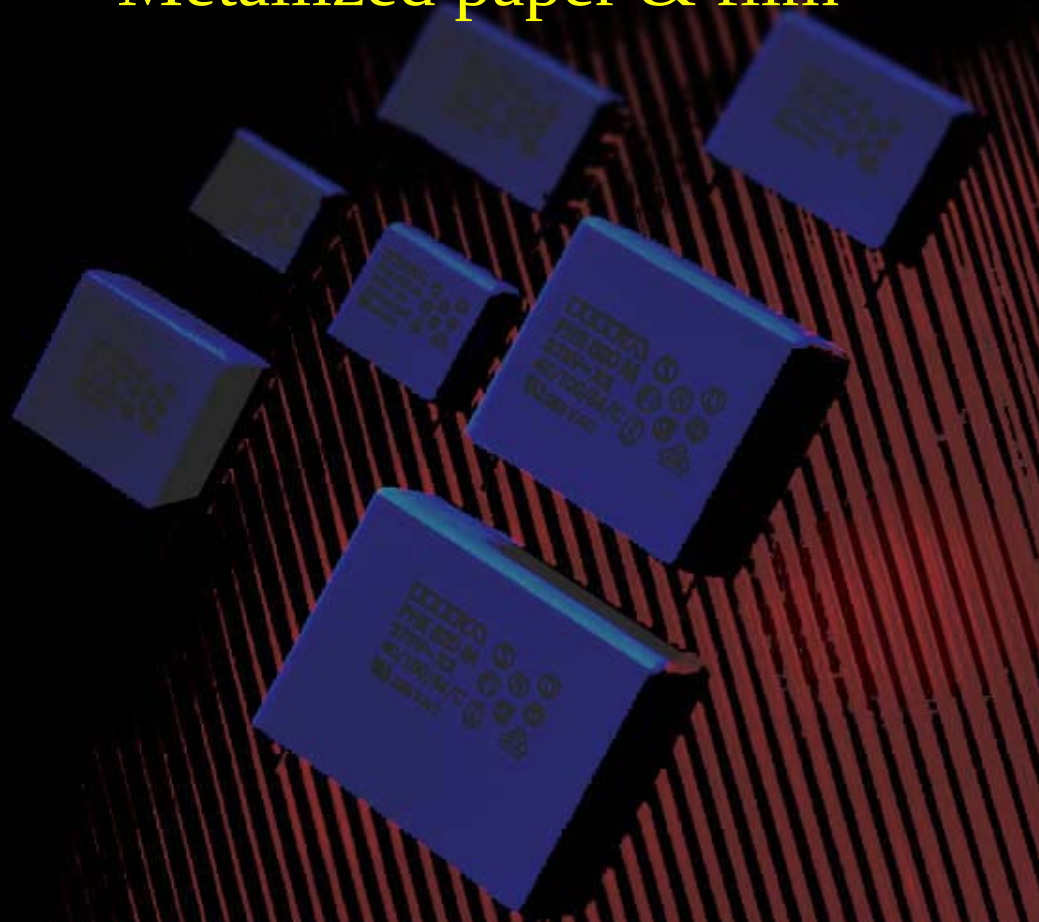
Y Capacitors



Y Capacitor Comparison

Ceramic

Metallized paper & film

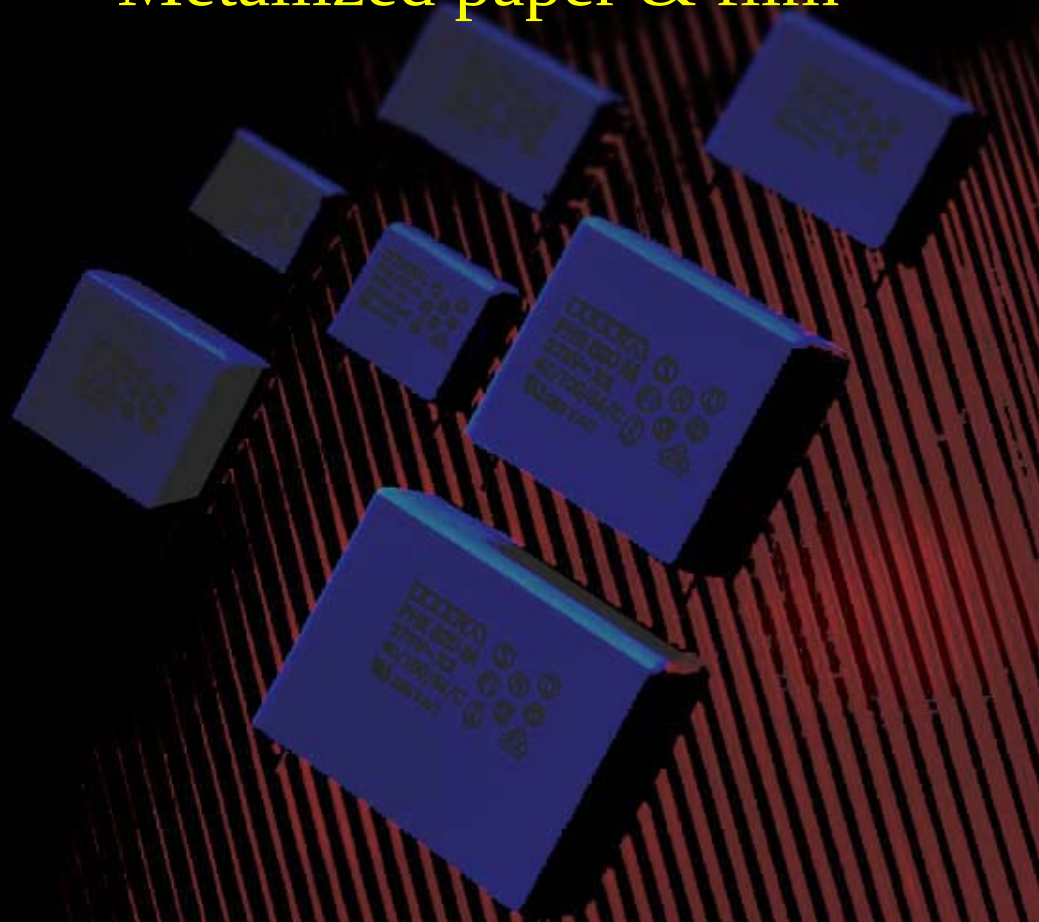


Y Capacitor Comparison

Ceramic

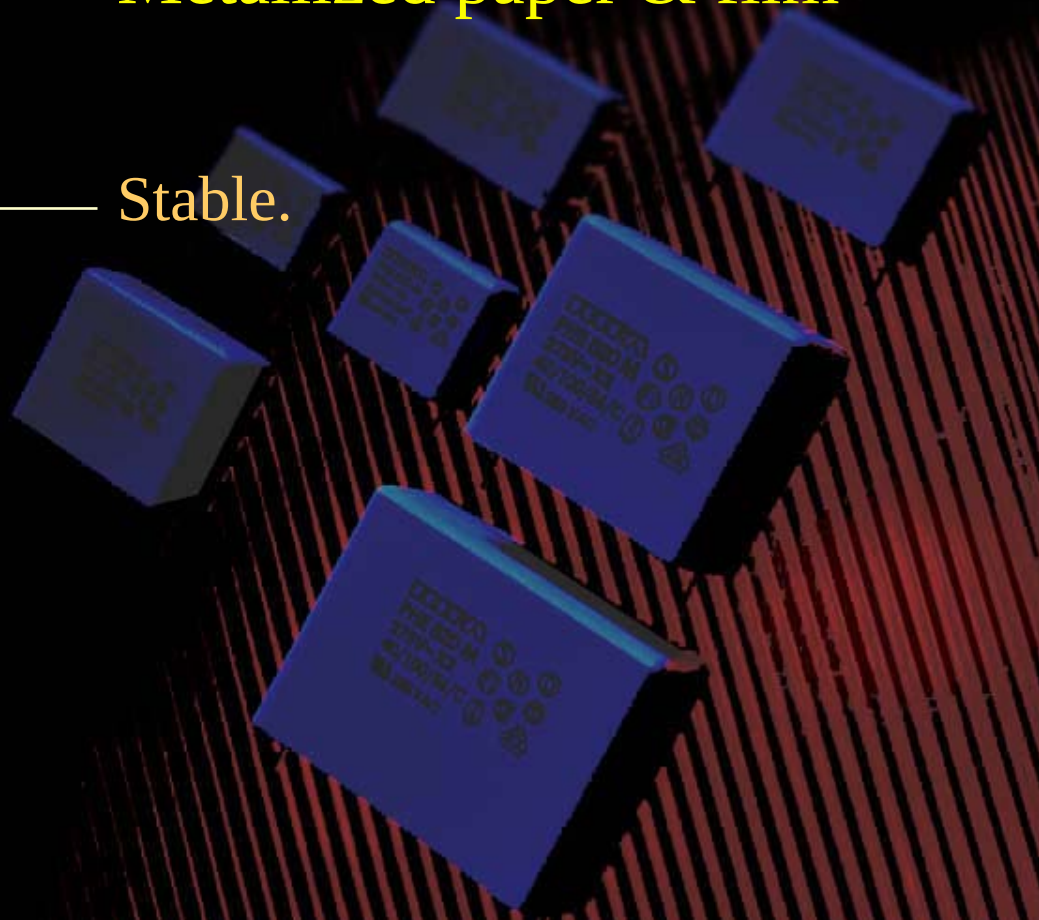
Less expensive.

Metallized paper & film



Y Capacitor Comparison

Ceramic	Metallized paper & film
Less expensive.	
Unstable over time and temperature.	Stable.



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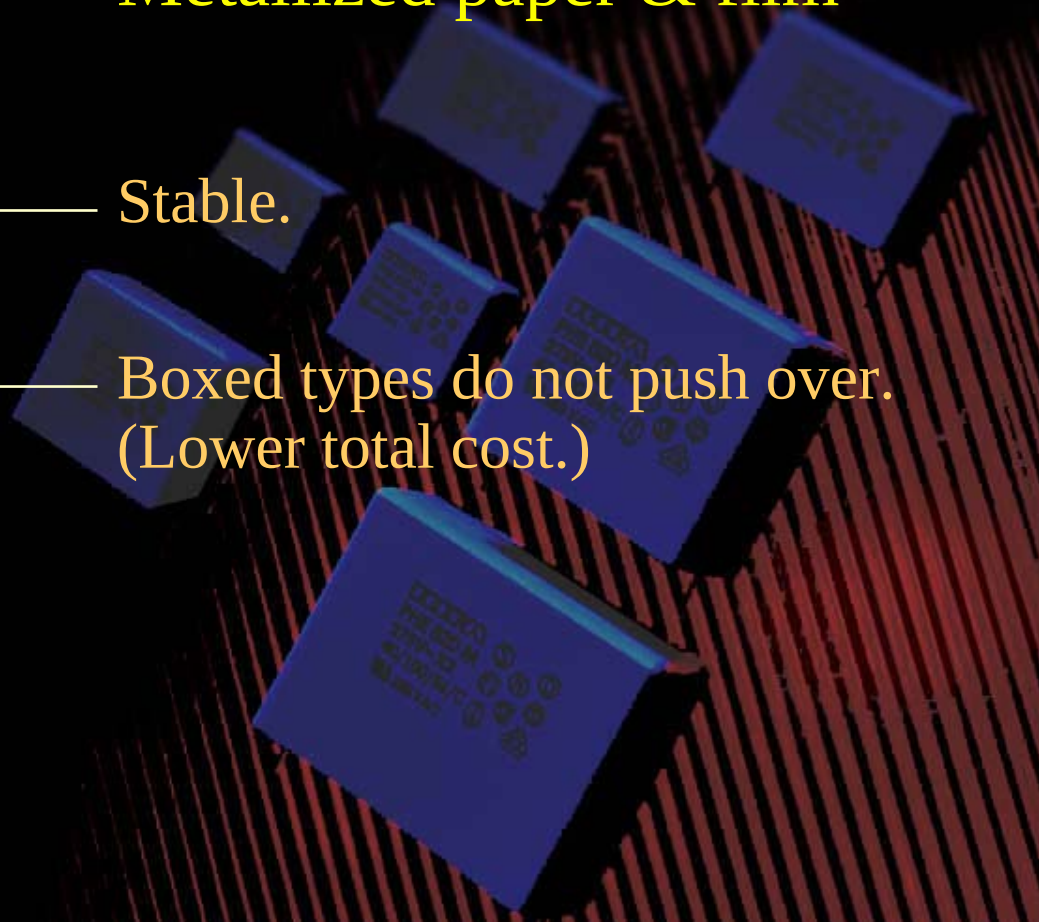

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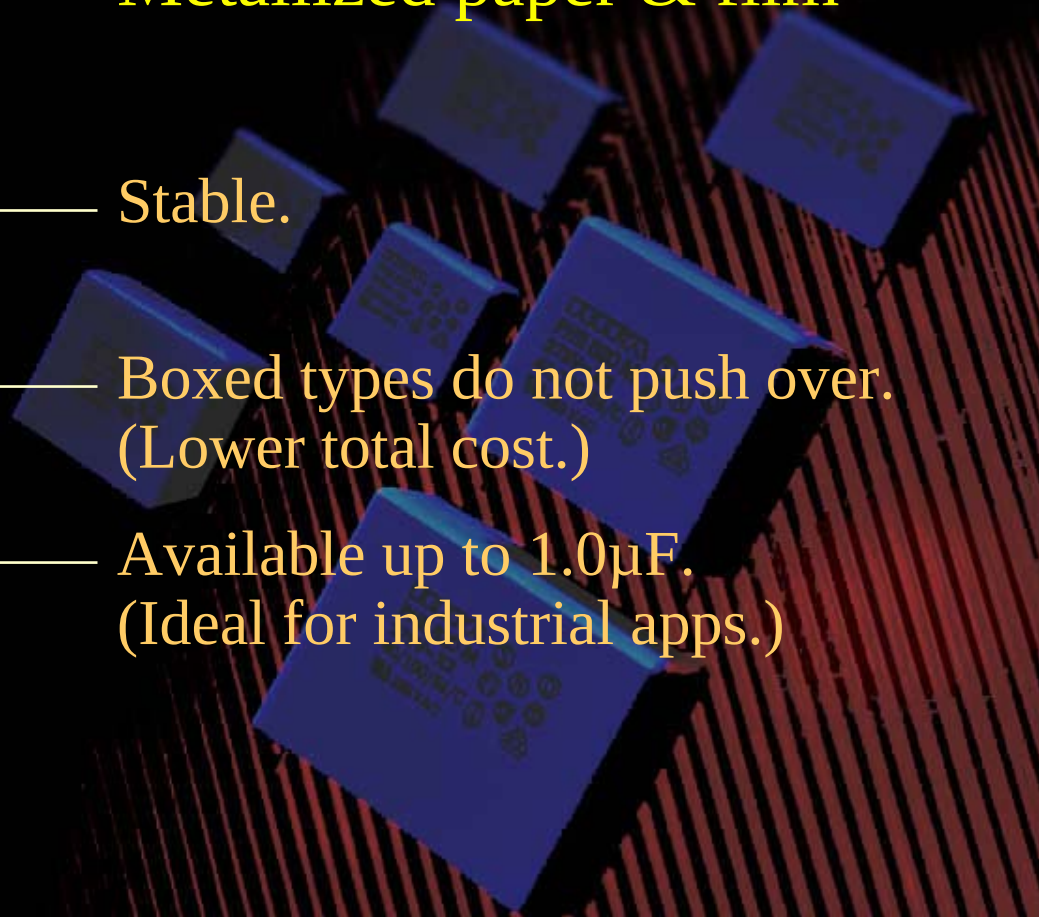

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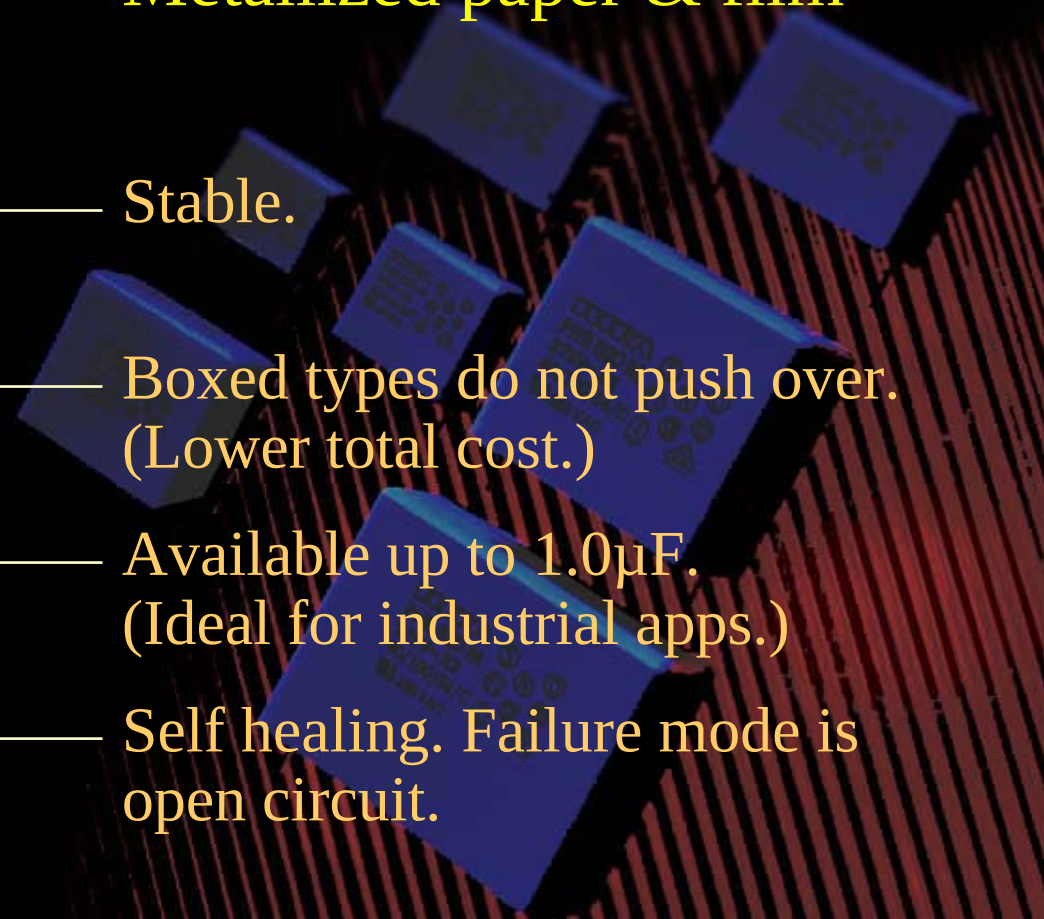
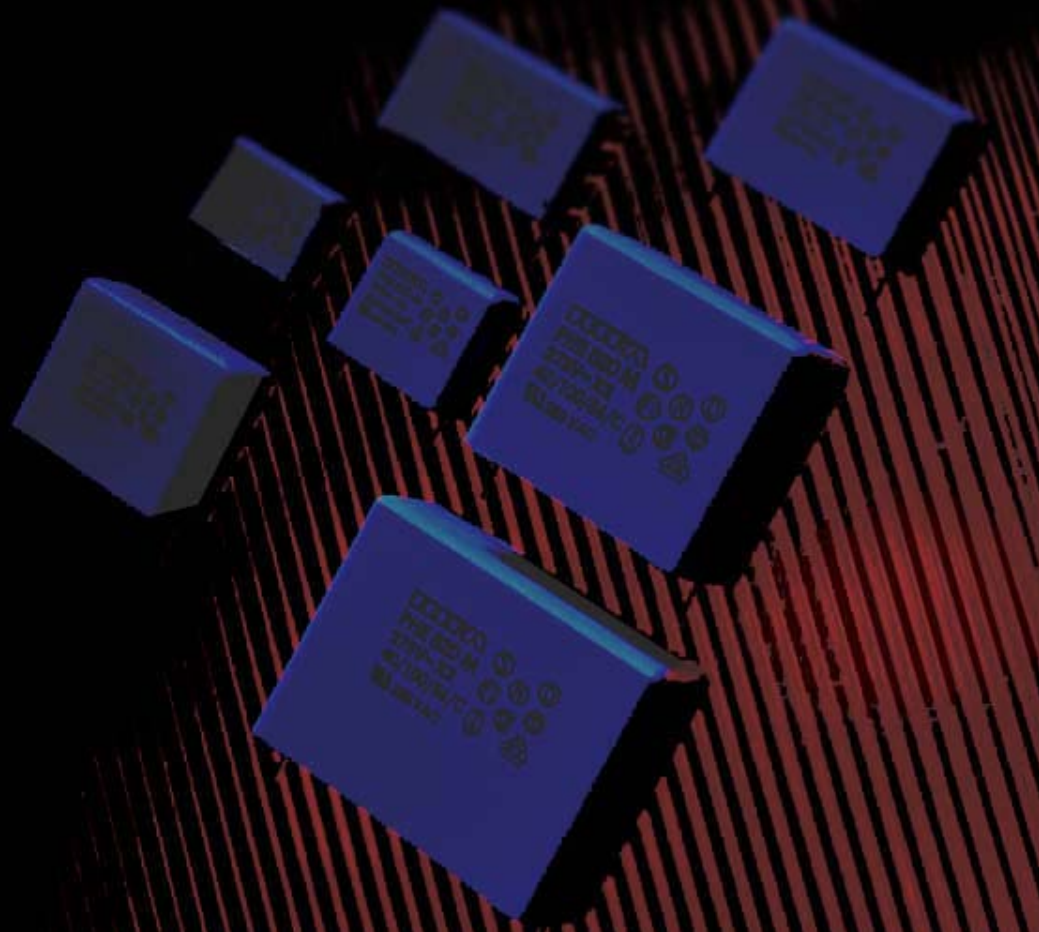
Failure mode tends toward short circuit.	Self healing. Failure mode is open circuit.



NEW!

New film Y cap PHE850

Alternative to ceramics



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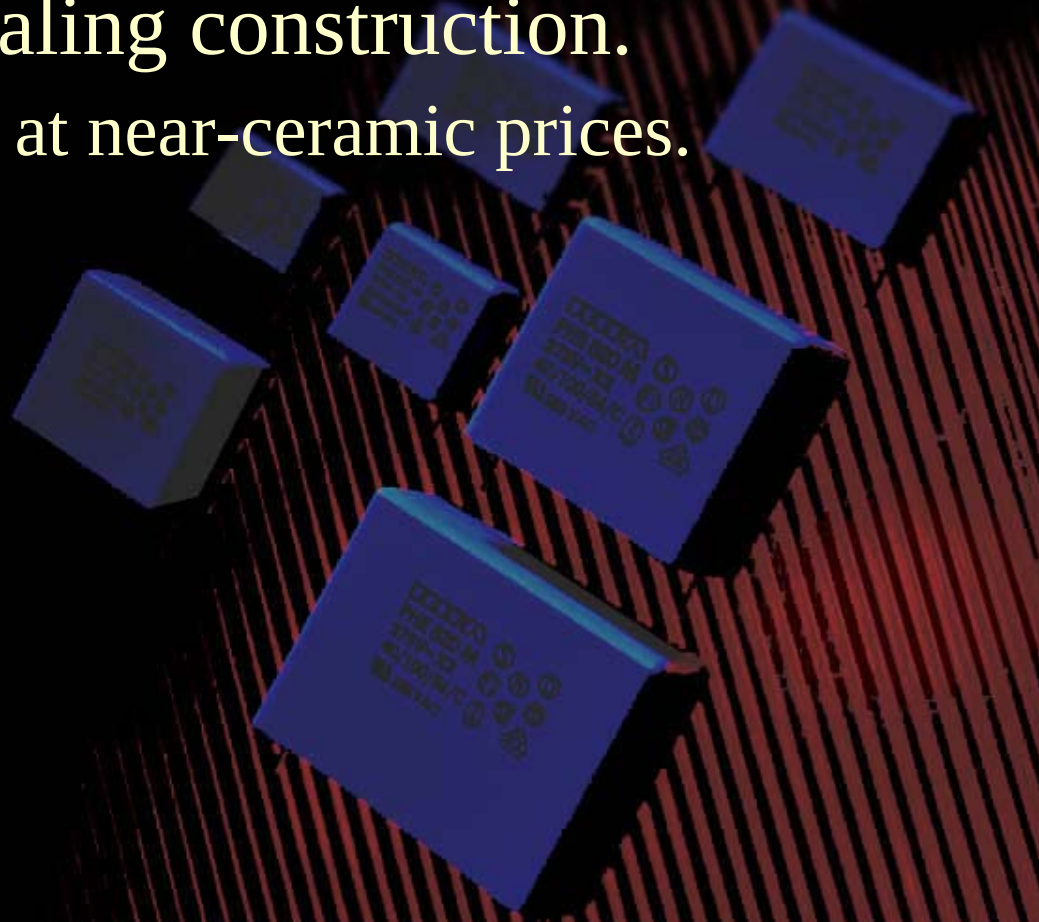
- Metallized, self-healing construction.
  - Safer failure mode at near-ceramic prices.



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- Metallized, self-healing construction.
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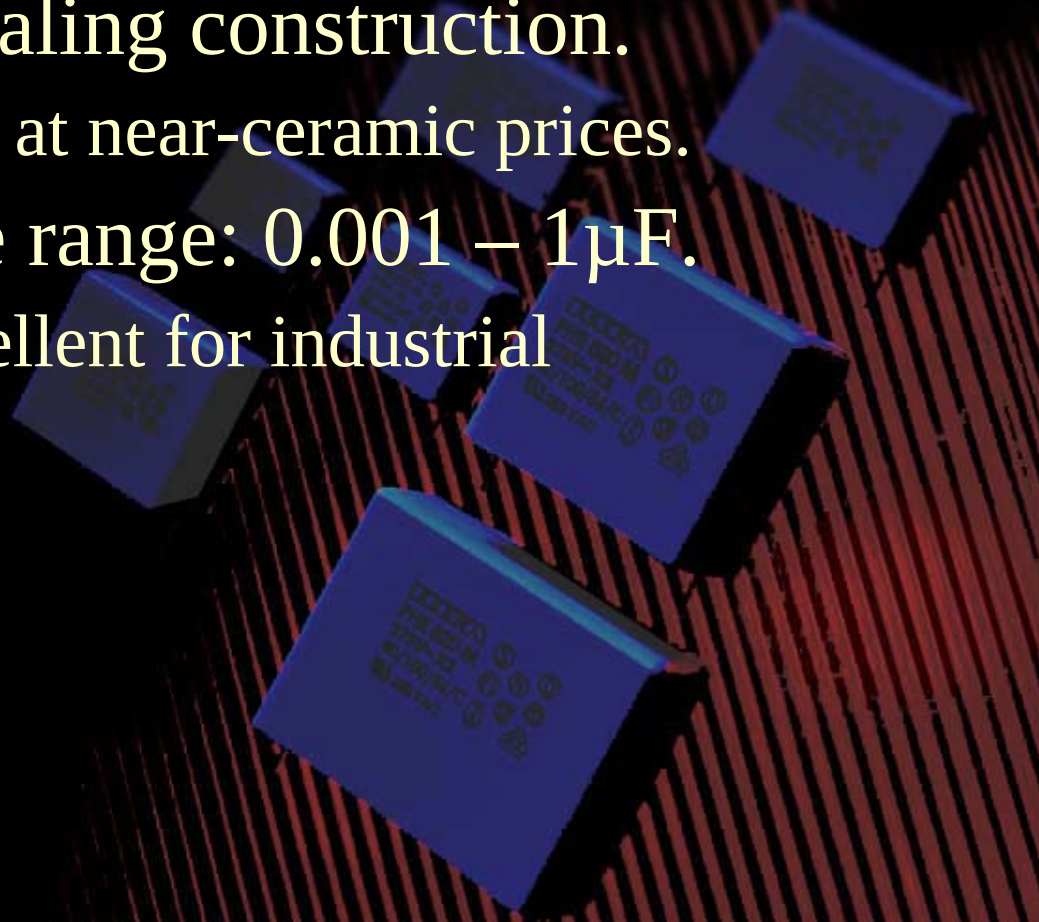
- Very wide C-value range: 0.001 – 1µF.
  - Higher values excellent for industrial applications.



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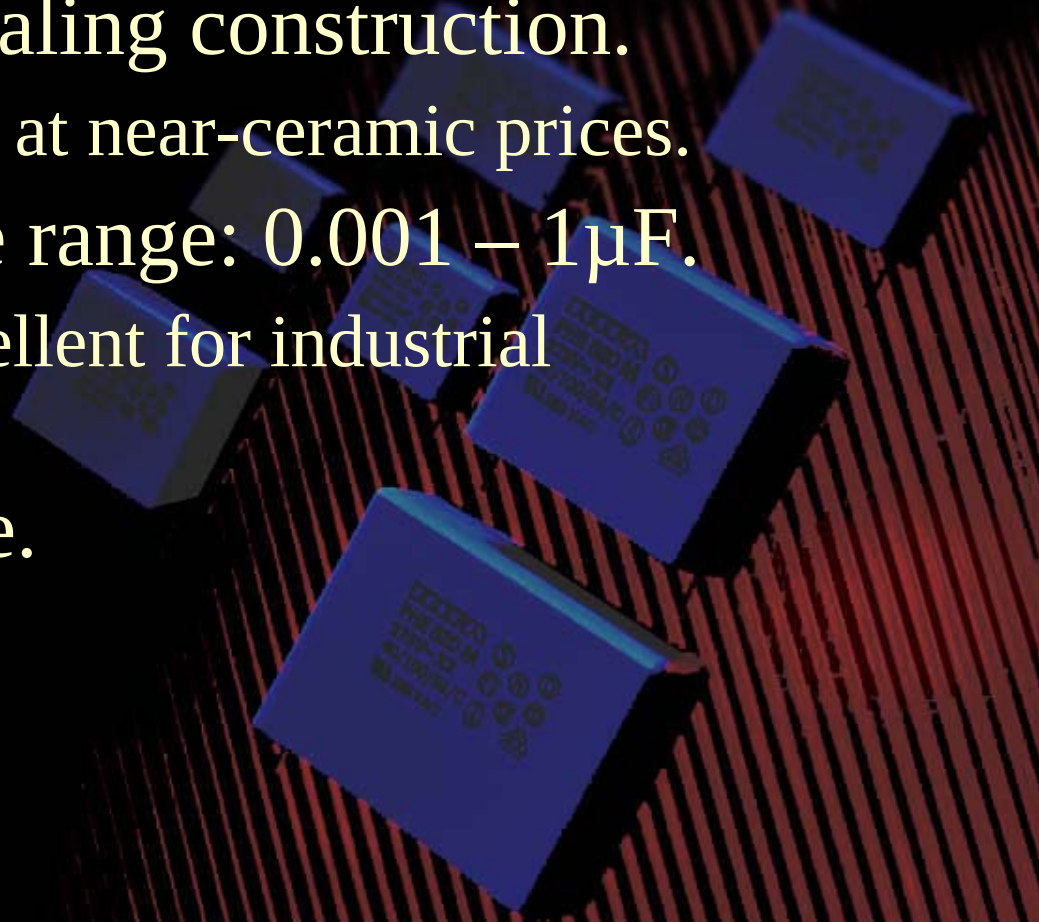

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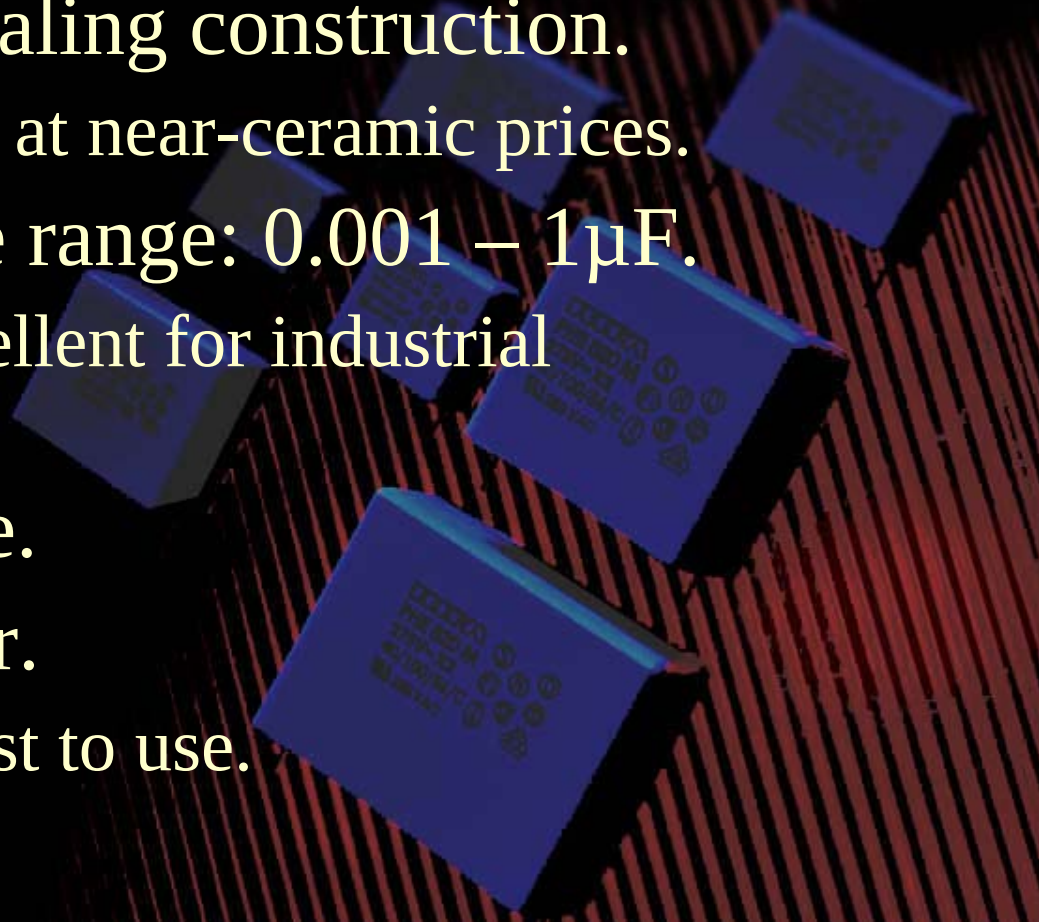
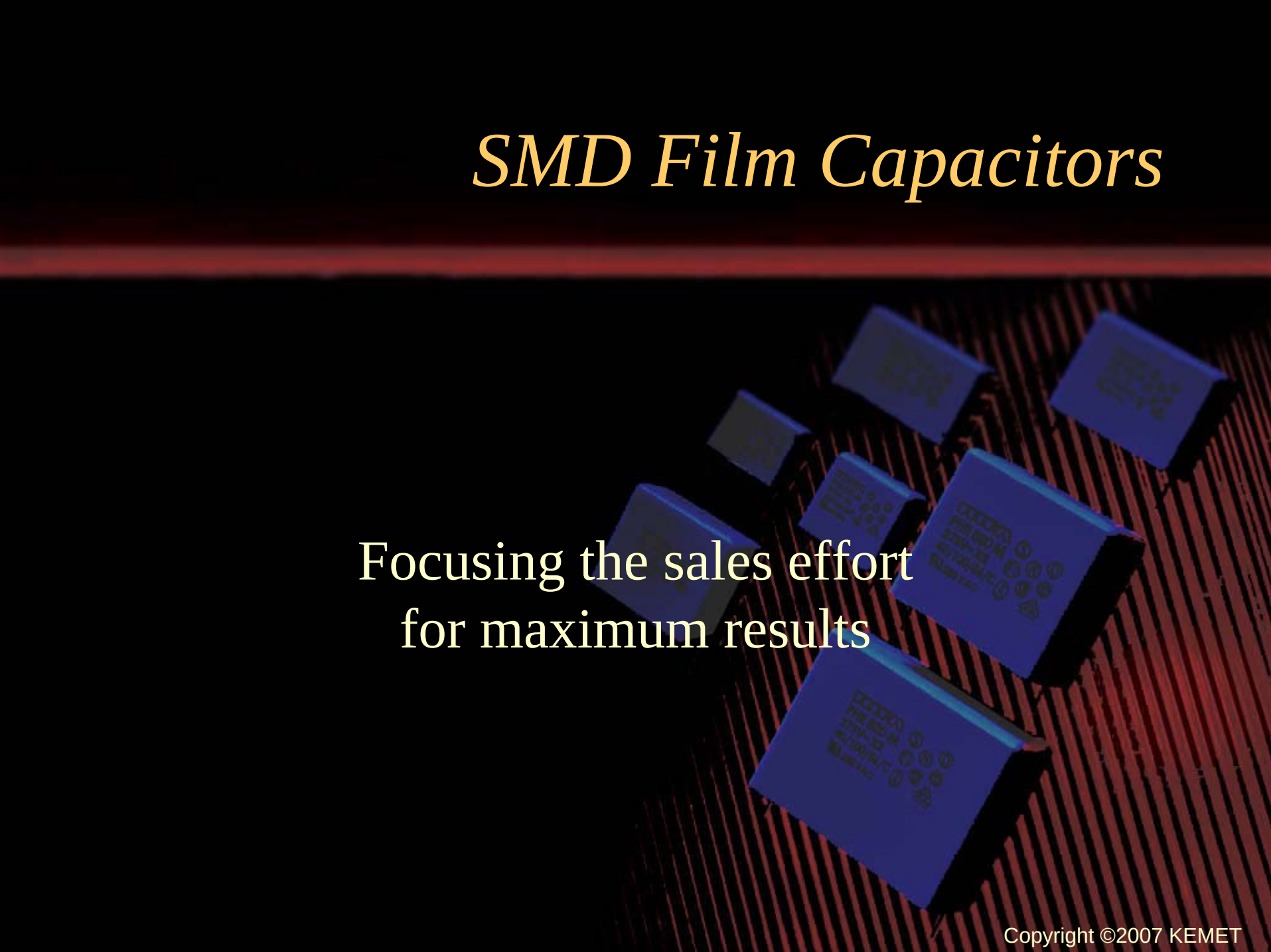
- Metallized, self-healing construction.
  - Safer failure mode at near-ceramic prices.
- Very wide C-value range: 0.001 – 1µF.
  - Higher values excellent for industrial applications.
- Small physical size.
- Does not push over.
  - Can lower total cost to use.

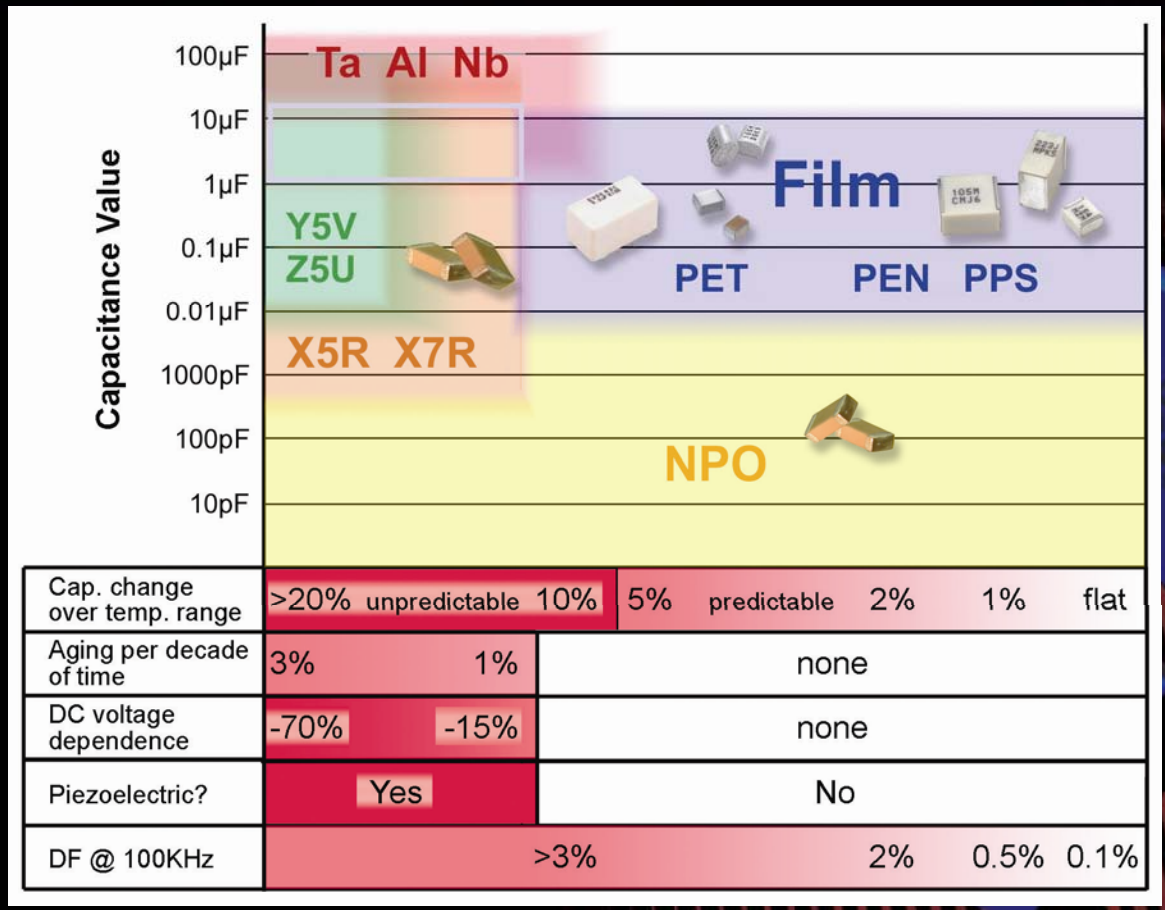


SMD Film Capacitors



Focusing the sales effort
for maximum results

SMD Application Chart



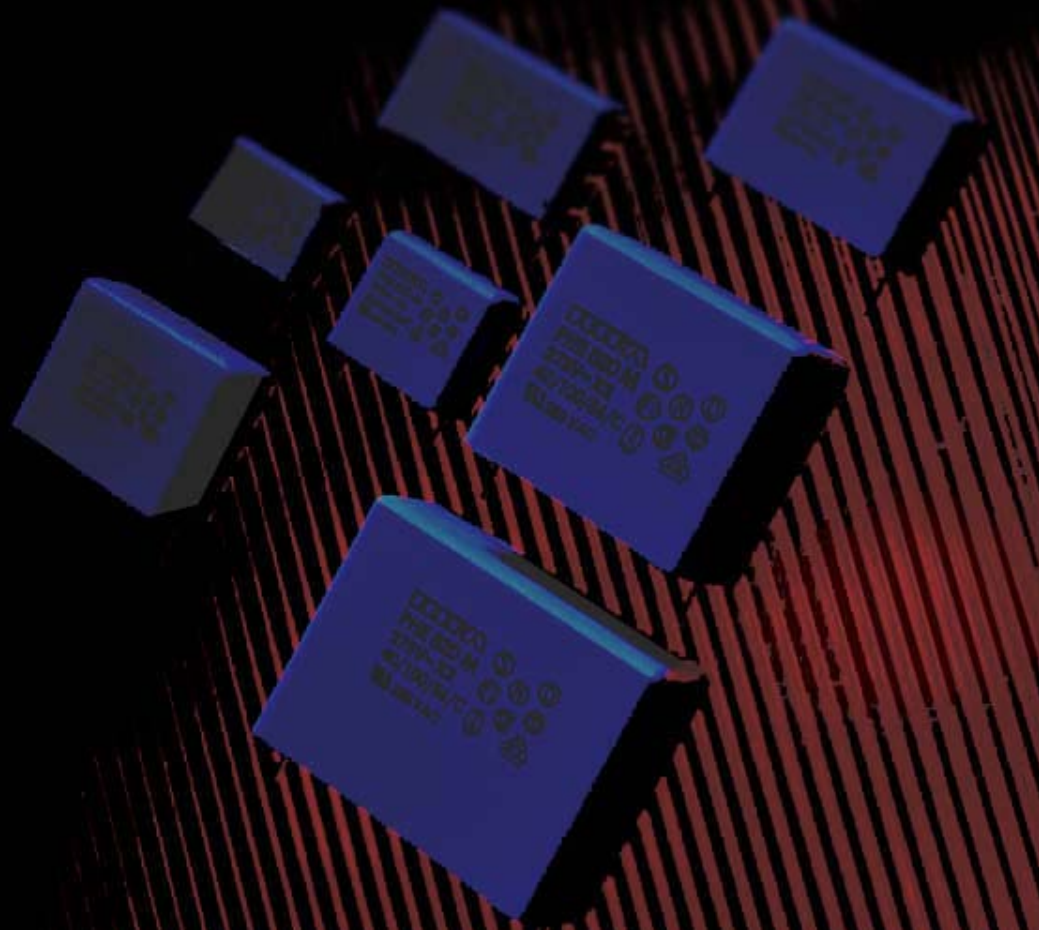
Cap. change over temp. range	>20%	unpredictable	10%	5%	predictable	2%	1%	flat
Aging per decade of time	3%		1%	none				
DC voltage dependence	-70%		-15%	none				
Piezoelectric?	Yes			No				
DF @ 100KHz	>3%					2%	0.5%	0.1%

Solder Withstand is a Critical Factor

- Economical Pb-free solders require higher soldering temperatures. Also small parts heat more than large ones.
- More care is needed in choosing an SMD film cap. Cost vs. higher allowed temperature.
- The catalog is a good general guideline of the worst case, but some sizes handle more heat than others.

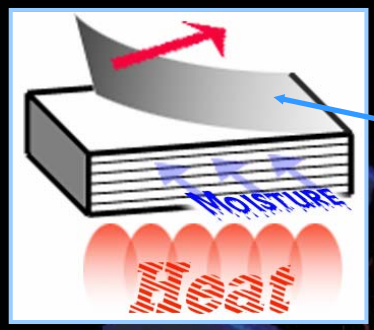
  If unsure get the customer's solder profile.

Comparing Naked and Encapsulated



Delamination in Naked Stacked SMD Capacitors

Naked stacked construction



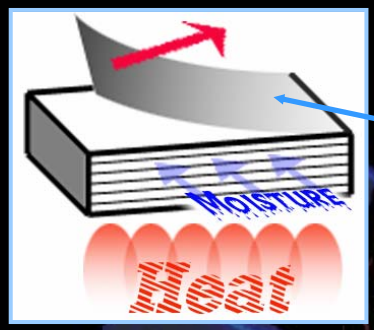
Potential delamination of stack with heat and moisture. More a potential problem in large sizes.

"In case of high humidity storage and short cycle reflow soldering profiles, it is recommended that the capacitors be pre-conditioned in an 85ºC oven for a minimum of 12 hours prior to reflow soldering to minimize any effects caused by the rapid vaporization of the moisture."

Source: ITW Paktron Film Capacitor Catalog

Wound & Encapsulated Capacitors Do Not Delaminate

Naked stacked construction



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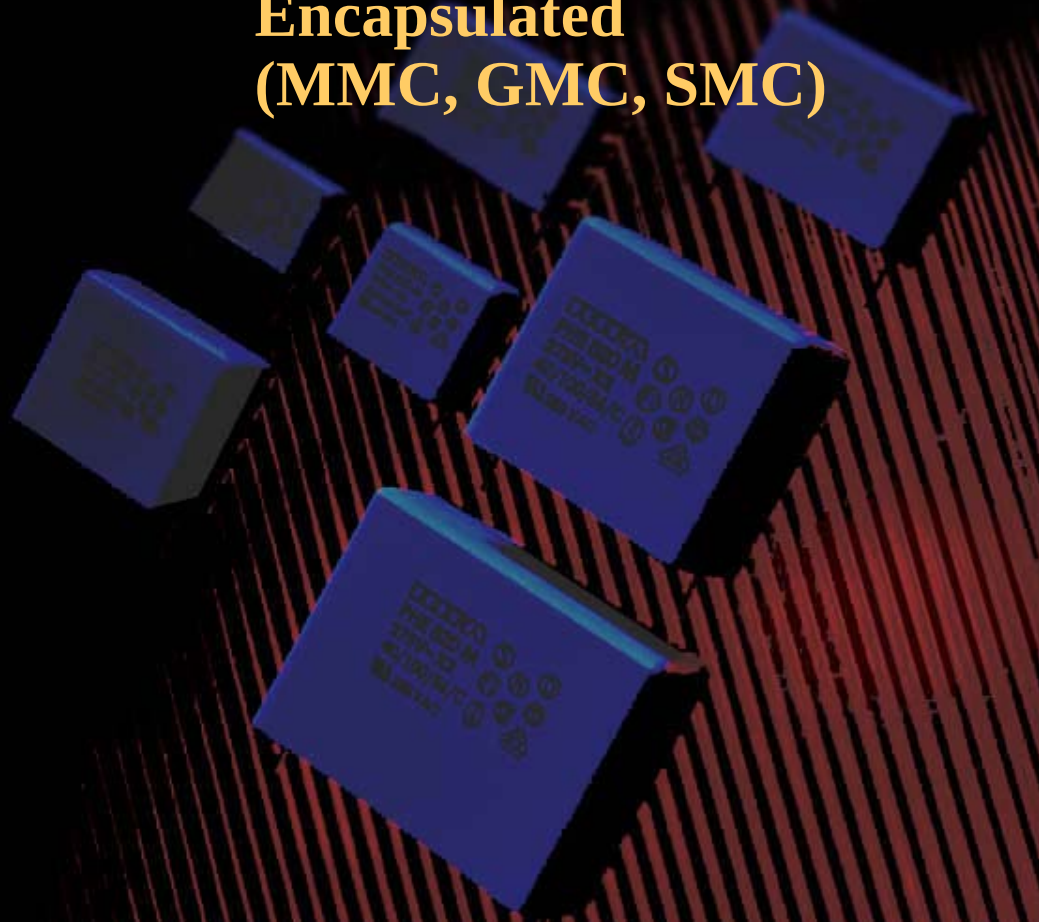
Wound construction

Winding holds itself together. No delamination.

SMD Film Technologies

Naked stacked
(Arco LDE, LDB)

Encapsulated
(MMC, GMC, SMC)

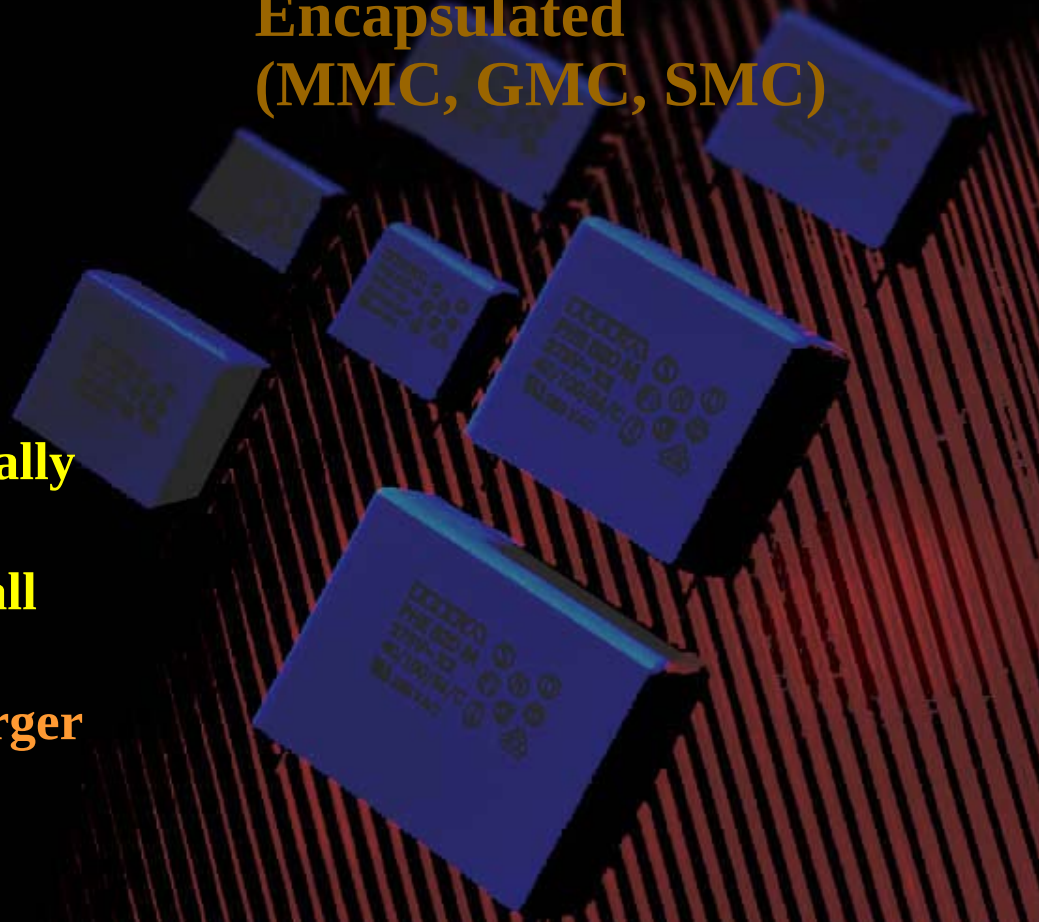


SMD Film Technologies

Naked stacked (Arco LDE, LDB)

- **Good solder withstand.**
- **Acceptable environmental performance in many applications.**
- **Smaller physical size, especially in low voltages.**
- **Potentially lower cost in small sizes.**
- **Potential delamination in larger sizes.**

Encapsulated (MMC, GMC, SMC)



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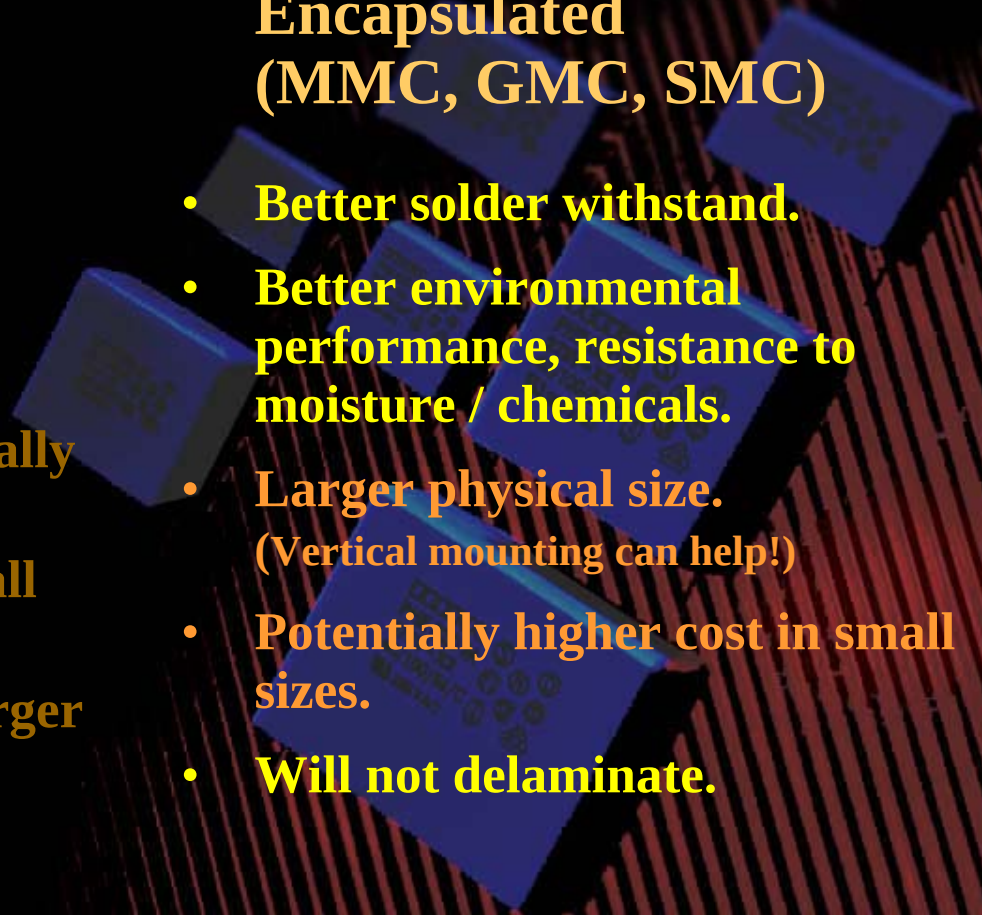
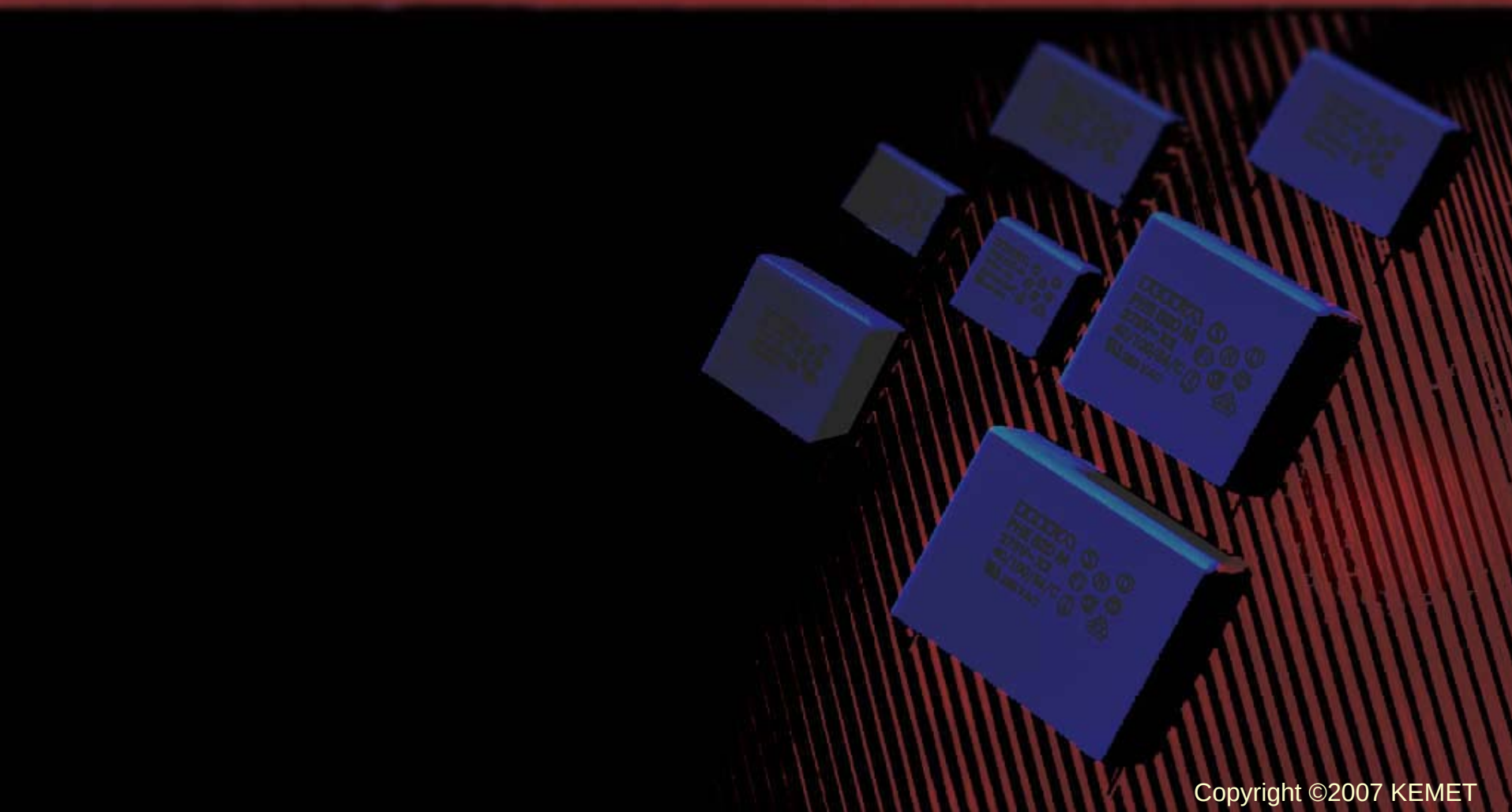
- Acceptable environmental performance in many applications.
- Smaller physical size, especially in low voltages.
- Potentially lower cost in small sizes.
- Potential delamination in larger sizes.

Encapsulated (MMC, GMC, SMC)

- Better solder withstand.
- Better environmental performance, resistance to moisture / chemicals.
- Larger physical size. (Vertical mounting can help!)
- Potentially higher cost in small sizes.
- Will not delaminate.



A Focused Sales Effort Will Yield Results!



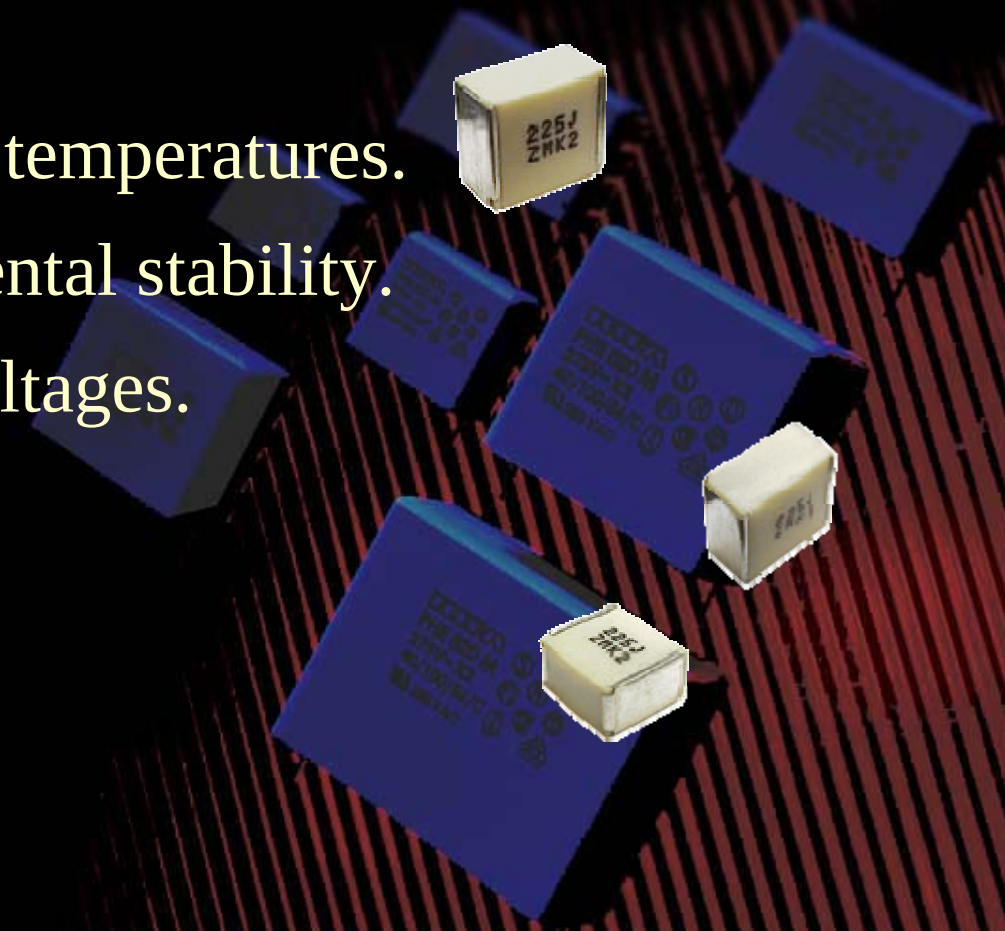
Film SMD will be used when...

- Stable properties are needed and the C-value is too large for NPO ceramic.
- The films are the last leaded parts on the board. (Otherwise a leaded film will do.)
- Thermal expansion stress is damaging large ceramics.

There is a place for naked and encapsulated:

Encapsulated:

- For higher soldering temperatures.
- For better environmental stability.
- Higher C-values / voltages.



There is a place for naked and encapsulated:

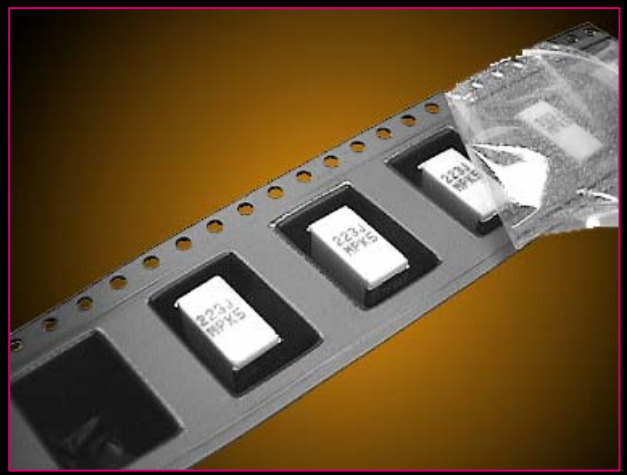
Encapsulated:

- For higher soldering temperatures.
- For better environmental stability.
- Higher C-values / voltages.

Naked:

- Low voltage / small C-values.
- Moderate soldering conditions.
- Few environmental concerns.
- Where small size is paramount.

Vertical mounting of encapsulated parts.



Series GMC
1.0µF / 100V

Size 6560, footprint 16.5 x 15
247mm^2

Vertical mounting

Size 6528, footprint 16.5 x 7
116mm^2

New products enhance our SMD offering.

- Series GPC for pulse applications.
  dV/dt values up to 2200 V/µS.
- Series SPC – like GPC but better at high frequencies.
- Series SMP253, safety agency approved Y2 capacitor.

Key Selling Points
(Why Kemet SMD Film?)

- Broad product range:
  - Choose from multiple dielectrics.
  - Naked or encapsulated.
  - SMD pulse/AC capacitors GPC and SPC.
  - SMD Y capacitor SMP253.
- Superior solder withstand.
- Superior environmental protection.
- No thermal expansion stress problem.
- Vertical mounting option saves footprint.