Vol I Issue X / 2005

Charge

A Technical News Journal from Deki Electronics Ltd

May 2005

Editor's Desk

Dear Reader,

Deki has been consistently introducing new types of Film Capacitors in the market to meet the needs of our customers. The turnover from new products is tracked monthly and we have been consistently generating over 30% of our turnover from them for the last three years. By our definition, a new product is one which has been introduced less than three years ago.

Last year one of the new products that we introduced was Mixed Dielectric (PEP) capacitor. Owing to its ability to withstand high temperature whilst retaining its ability to function at high frequency, this capacitor has replaced the PP capacitor in CFLs. While normal PP capacitors can withstand 85°C for 1000 hours whereas this PEP capacitor can withstand 105° C for 1000 hours.

Another type of PEP capacitor offers a much higher capacitance stability than PP capacitors and finds an application in timing circuits where capacitance stability is of prime importance.

This issue of Charge talks about the PEP capacitor in detail.

As usual, we look forward to your comments and suggestions.

Anil Bali

Deki at Electronica, Munich

Deki participated in the Electronica 2004 trade fair held at Munich from 8th to 11th November 2004. The event attracted over 3000 exhibitors from 48 countries with 75,000 visitors, 42% of whom were non-German.

This was the second time that Deki participated in Electronica as part of the CBI's export development programme. CBI is a Dutch organisation that encourages SMEs from developing countries to export. Deki has worked with CBI for more than four years now.

The 2004 programme of CBI had 36 participants in addition to Deki with 1100 contacts made by all of them at Electronica.

From L to R: Mr Raza Mehdi, Mr Vinod Sharma and Mr P Shanker Raj

Deki was represented by our Managing Director, Mr Vinod Sharma, Senior Manager - Technical, Mr P Shanker Raj and Manager - Sales, Mr Raza Mehdi. The Deki theme of 'The Great Indian Capacitor Dream', based on the ancient Indian art of snake charming was a hit with the visitors.

Deki's Capacitors are ROHS compliant.

Deki has worked with Sony and Osram for the past two years and today all Deki capacitors are ROHS compliant, meeting the following criteria:

Epoxy

Lead (Pb) < 100 PPM, Cadmium(Cd) < 5 PPM, Mercury (Hg) < 5 PPM, Chromium (Cr) < 2 PPM, PBB/PBDE-nil.

Tinned Lead Wire & Zinc/Zinc Tin Spray Wire

Lead (Pb) < 1000 PPM, Cadmium (Cd) < 5 PPM, Mercury (Hg) < 5 PPM, Chromium (Cr) < 2 PPM.

Packaging Material

Lead (Pb) < 30 PPM, Cadmium (Cd) < 5 PPM, Mercury (Hg) < 5 PPM, Chromium (Cr) < 2 PPM.

Customer Satisfaction Survey (July to Dec 2004)

The Customer Satisfaction Survey (CSS) was sent to the top thirty-two customers by email and results showed a marginal dip in performance of 2.5% with the main issue being price.

We will be working on the price aspect in a concerted way as we want to be a value-for-money producer of film capacitors.

In the previous survey we had been marked low on deliveries. We focussed on it and the reducing TPT and improving CLIP of all three lines has resulted in an increase in the delivery score by 8% points. This shows that the PDCA approach that we follow for CSS is successful.

Deki's Expansion Plan

To meet the global challenge thrown up by the 'Zero Duty' regime Deki is planning a massive capacity increase.

The current capacity of 156 million pieces per annum is being increased to 450 million pieces per annum from August 1, 2005. This will make us India's largest manufacturer of plastic film capacitors and give us the ability to take on International competition.

For your **FREE** subscription, please contact **Deki Electronics Ltd**, B-20 Sector 58, NOIDA 201 301. *Phone* (0120) 2585457, 2585458, *Fax* (0120) 2585289 *E-mail* bali@dekielectronics.com
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PEP Capacitors for High Temperature Application

Recent developments in CFL (Compact Fluorescent Lamp) Ballast require component rating of 110°C.The requirement is for ballasts smaller in size and higher in wattages which increases the temperature inside the capsule. Typically, the temperature inside the capsule reaches 100°C in some lamps.

Generally a CFL circuit consists of two types of capacitors

1) Plastic Film Capacitors.
2) Electrolytic Capacitors

Plastic film capacitors are used for the following applications

1) Coupling
2) Snubber Application
3) Striking capacitor.

For general purpose applications like blocking and coupling applications, plain polyester and metalised polyester film capacitors are used.

For applications like snubber and striking, plain polypropylene film capacitors are used because of higher voltage and high frequency requirement.

The only problem with plain PP capacitor is temperature withstanding capability at 110°C. PP film starts shrinking leading to poor bonding strength between film and epoxy resin and subsequent cracking of epoxy.

In order to meet high temperature requirements of 110°C and at the same time to provide better power handling capability and better capacitance stability PEP capacitors were developed by Deki.

PEP capacitor is a combination of both plain polyester film and plain polypropylene which is nothing but mixed dielectric capacitor. We can optimise the performance of the capacitor by the right mix of PET and PP films.

Plain Polypropylene + Plain Polyester Film (PEP) Capacitors

Application: Oscillator, timing and LC/RC filter circuits, snubber circuits, high frequency coupling of fast digital and analog ICs. Mainly used in CFL and where stable temperature characteristics are required.

Construction: Film/foil inductive type construction with aluminum foil as electrode and PET + PP film as mixed dielectric coated with flame retardant epoxy resin.

Climatic Category: 40/100/56

Maximum Operating Temperature: 110°C

Capacitance Value, Rated Voltage (DC): Refer dimension chart

Capacitance Tolerance: ±1%, ±2%, ±2.5%, ±5%, ±10%

Rated Voltage: 100VDC, 250 VDC, 400 VDC

Voltage Proof: Between terminals - 2 times of rated voltage.

Tan δ: 0.25% (maximum) at 1.0 kHz. 0.50% at 100 kHz.

Insulation Resistance:

Minimum Insulation Resistance R_{IS}	V_R	$C_R \leq 0.33$ mF	$C_R > 0.33$ mF
(or) time constant $T=C_R \times R_{IS}$	≤100 V DC	100 GΩ	100 GΩ
at 25° C, relative humidity ≤ 70%	≥250 V DC	100 GΩ	100 GΩ

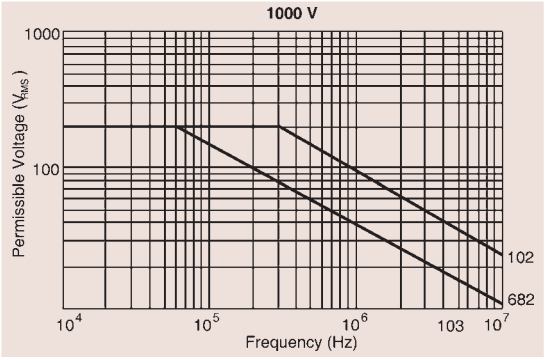
Life Test Condition: (Loading at elevated temperature) Loaded at 1.5 times of rated voltage at 85°C or 1.5 times of category voltage at 100°C for 1000 hours. Category voltage is 80% of rated voltage.

After the test

Δc/c: ≤ 3%±5 pfd of initial value.

Change in Tan δ: ≤ 1.4 times the value measured before the test.

Insulation resistance: ≥ 50% of the value mentioned in IR chart.



Comparative Data of PET/PP/PEP capacitors.

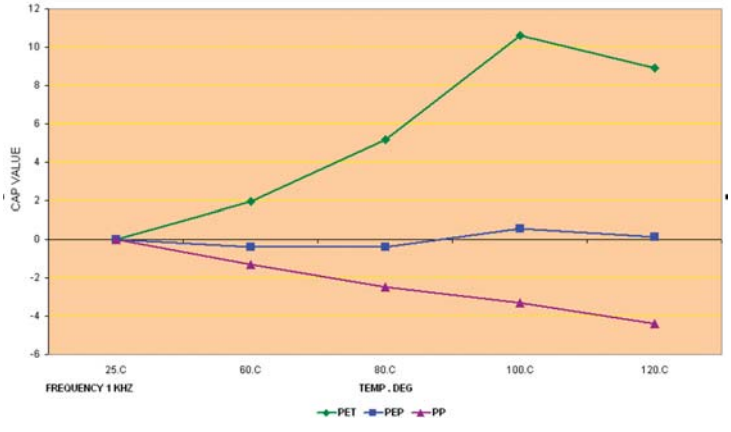
This table contains the actual readings of 0.0027/1000VDC/10% Tolerance capacitors for the following parameters.

1) Capacitance value at Different Temp and Diff Frequency.
2) Loss Factor (Tanδ) at Different Temp and Diff Frequency

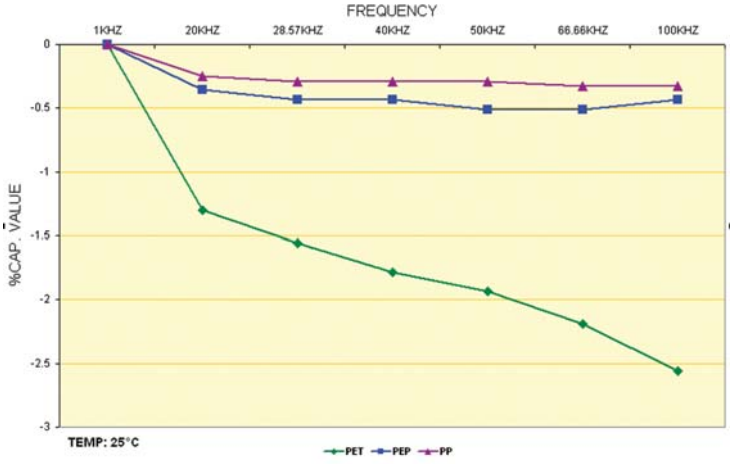
For all three types of capacitors:

PET	1KHZ		20KHZ		40KHZ		50KHZ		66.66KHZ	
TEMP	CAP	TD	CAP	TD	CAP	TD	CAP	TD	CAP	TD
25°C	269.3	0.31	265.8	1.04	264.5	1.24	264.1	1.31	263.4	1.36
60°C	274.6	0.19	272.0	0.61	271.3	0.79	271.1	0.85	270.7	0.91
80°C	283.2	0.81	279.2	0.77	278.4	0.84	278.2	0.9	277.8	0.92
100°C	297.9	2.02	289.4	1.36	287.8	1.35	287.4	1.35	286.8	1.36
120°C	293.5	2.06	284.6	1.33	283.1	1.31	282.6	1.31	282	1.3
PEP	**1KHZ**		**20KHZ**		**40KHZ**		**50KHZ**		**66.66KHZ**	
TEMP	CAP	TD	CAP	TD	CAP	TD	CAP	TD	CAP	TD
25°C	254.5	0.14	253.6	0.2	253.4	0.24	253.2	0.26	253.2	0.27
60°C	253.5	0.12	252.7	0.18	252.2	0.21	252.1	0.27	252.1	0.22
80°C	253.6	0.29	251.8	0.29	251.6	0.29	251.6	0.3	251.5	0.29
100°C	256	0.74	252.8	0.53	252.3	0.49	252.1	0.48	252	0.46
120°C	254.2	0.72	251	0.52	250.4	0.51	250.3	0.5	250.2	0.47
PP	**1KHZ**		**20KHZ**		**40KHZ**		**50KHZ**		**66.66KHZ**	
TEMP	CAP	TD	CAP	TD	CAP	TD	CAP	TD	CAP	TD
25°C	277.6	0.02	276.9	0.07	276.8	0.08	276.8	0.09	276.7	0.08
60°C	273.9	0.01	273.2	0.06	273.2	0.07	273.1	0.06	273.1	0.07
80°C	270.7	0.04	270.2	0.06	270.1	0.07	270.1	0.07	270.1	0.07
100°C	268.4	0.09	267.6	0.11	267.5	0.11	267.5	0.1	267.5	0.09
120.C	265.4	0.14	264.5	0.13	264.4	0.16	264.4	0.16	264.3	0.18

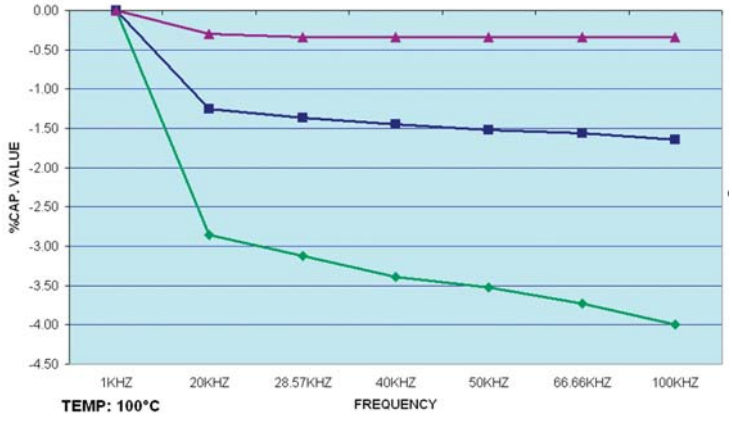
Capacitance Change w.r.t. Temperature



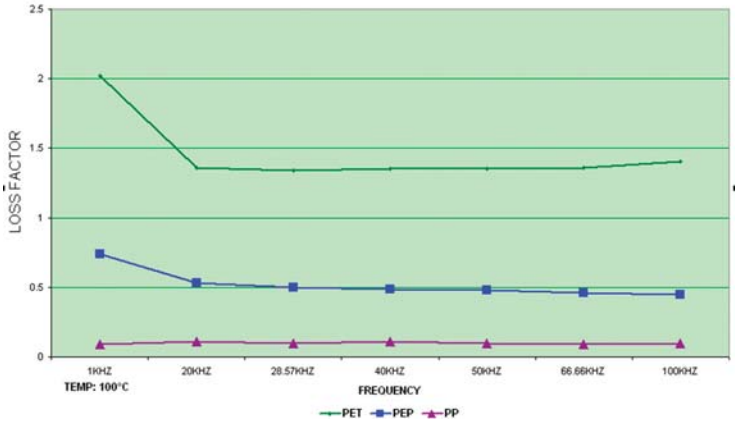
Capacitance Change w.r.t. Frequency



Capacitance Change and Loss Factor Change at 100°C w.r.t. Frequency



Change in Tanδ at 100°C w.r.t. Frequency



Looking at the data you will observe that the capacitance value of a PEP capacitor is much more stable compared to PET or PP at different frequencies and at different temperatures.The capacitance change is well within 1.0% band. This makes it ideal for applications like timer and tuning circuits at high temperature and high frequency.

When we use a capacitor for AC application, we have to ensure that the power handling capability of the capacitor is adequate.

Power Dissipation: The heat dissipated by a capacitor in AC application is

$P = 2 \times 3.14 \times f \times C \times V^2_{rms} \times Tan\delta$ watts.

V_{rms} = Root mean square value of the AC voltage.

f = Frequency of the wave form.

C = Capacitence value in Farad.

Tanδ = Dissipation factor corresponding to the frequency of the pulse.

Temperature Rise = Power Dissipation / 0.004

0.004 is specific dissipation in watts / Degree above the ambient temperature for 5.0mm pitch capacitors.

If you put all these values then if you see the results for the condition mentioned below:

V_{rms} = 250 V, Frequency = 50 kHz and ambient temperature is 100°C.

Say Tanδ for PET at 100°C at 50 kHz = 0.013, PP = 0.001, PEP = 0.005

$Pd = 2 \times 3.14 \times 50 \times 10e^3 X\ 0.0027e^{-06} \times 0.013 \times 250 \times 250$

Pd = 688.8 milliwatts = 0.688 watts

Temperature rise = 0.688/0.004 = 172°C

Temperature rise for PET is 172°C

Similarly, if you calculate the Power dissipation for PEP and PP it will be:

PEP : 66°C.

PP : 13°C.

If the V_{rms} is 125V, Frequency is 50kHz

Temperature rise for PET is 43°C.

For PEP = 17°C.

PP = 3.25°C.

Temperature rise + Ambient temperature < Operating Temperature of the capacitor.

After looking at the above, the PP capacitor is the ideal choice provided the ambient temperature is ≤ 85°C.

If the ambient temperature is more than 100°C and the V_{rms} < 80V, then PET is the cost-effective solution.

But if the V_{rms} is more than 80 V and the temperature is around 100°C then the ideal choice is the PEP capacitor.

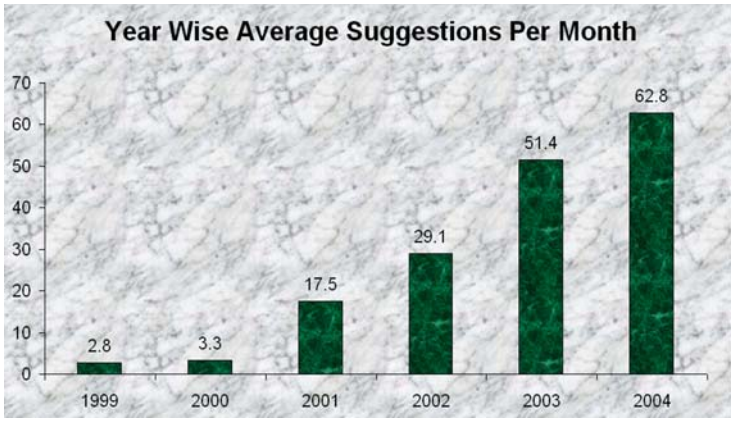
Deki's Focus on Training

With a clear-cut mandate for a well-trained and motivated workforce, there has been a substantial increase in the hours spent on training. In the year 2004 we averaged about 879 hours per month which is nearly 27% more than hours spent in 2003.

Deki's Suggestion Scheme

There has been a steady improvement in the number and quality of suggestions received over the past few years. From an average of 51.4 suggestions per month received in 2003 we have received 64 suggestions in 2004 which is an increase of 23%.

With an increase in the number of prizes on offer we feel that we will receive a minimum of 80 suggestions per month in 2005.



Deki–Onida Single Digit PPM Agreement

A high level team from Onida visited Deki on January 10, 2005 to kick-off the 'Vendor Innovation Movement-Towards 100 PPM'.

In his opening talk Mr L M Narkhede, Manager-QA at Onida spoke about the difference between the prevailing practice at the Vendor end and the proposed method to be followed. The main focus is on 'Root Cause Analysis', 'Foolproofing' and '4M Control and Intimation to Customer'. As per the 4M Change Management Guideline the vendor has to inform Onida whenever there is any major change in Man, Machine, Materials or Method. Depending upon the nature of the change samples will have to be submitted to Onida for re-approval.

The aim is to reduce the online rejection at Onida by 50% in 2005 as compared to 2004, by improving the Supplier Quality Rating from 95% to 98% in 2005.

Mr Kalyankar, GM - Purchase explained how the vendors need to gear themselves.

The benefits of this approach is a win-win situation for both Onida and Deki. Deki will gain by:

1) Reduction in cost of non-quality
2) Increased business
3) Increased sales and profit.

Onida will gain by

1) Reduction in cost of non-quality
2) Increased sales and profit
3) Better quality of TVs and resultant better brand image.

Onida sends the SQR and OLR to the Vendors every fortnight and asks for an improvement plan if the rating is below 98%.

After the presentation by Mr Narkhede, Mr S Kalyankar,GM - Purchase spoke about the increasing expectations of the customer and how the vendors need to gear themselves up to meet the challenges of the future.

At the end of the programme, Mr Vinod Sharma, MD, Deki Electronics and Mr Kalyankar, GM - Purchase, Onida signed the VIM-Target 100PPM agreement.

Finally an oath was taken by all members of the Deki team committing to work towards achieving 10 (not 100 PPM) PPM which is Deki's target.

Deki's Employee Satisfaction Survey

There was an improvement of 2% in the February 2005 survey compared to August 2004 with an improvement in fourteen out of the fifteen points that are covered in the survey.

We will be going into all the individual cases where workers have said that they are not getting adequate resources to do their job efficiently.