

# CHARGE

January 2026

A Technical News Journal from Deki Electronics Ltd

## Editor's Desk

Dear Readers,

At Deki, our work focuses on developing film capacitor solutions that address the practical challenges of modern electronic and power systems. As applications move toward higher power levels and longer operating lifetimes, capacitors play an increasingly critical role in ensuring stable and reliable system performance.

DC-Link capacitors are central to this evolution, as they stabilise the DC bus voltage, manage ripple currents, and operate reliably under continuous electrical and thermal stress. At Deki, we have been actively engaged in developing and validating DC-Link film capacitors for a wide range of power electronic applications.

In this edition of **Charge**, we present a detailed overview covering the range of **DC-Link Film Capacitors for Advanced Power Electronics**, focusing on key design, reliability, and application considerations. Readers are welcome to contact us for further discussion on this topic.

We sincerely hope you will find this information useful and welcome your thoughts and suggestions as we continue to improve **Charge** to better serve you.

*Shankar Raj*



## Deki Electronics Approved Under Third Tranche of ECMS

Deki Electronics Limited has received approval under the third tranche of the **Electronics Component Manufacturing Scheme (ECMS)**, granted by the **Ministry of Electronics and Information Technology**. The approval underscores the strategic importance of domestic electronic component manufacturing in strengthening India's electronics ecosystem.

### ECMS Approval – Third Tranche (Ministry of Electronics and Information Technology)

The formal approval was received by Mr. Vinod Sharma, Managing Director, Deki Electronics Ltd., from Shri Ashwini Vaishnaw, Hon'ble Minister for Electronics & Information Technology and Railways, during the official ECMS approval ceremony held in New Delhi.



The **Electronics Component Manufacturing Scheme (ECMS)** is a key government initiative aimed at building a robust, scalable, and technology-driven supply chain for electronic components. Deki's inclusion under the third tranche reflects its long-standing commitment to engineering discipline, manufacturing consistency, and sustained investment in capacitor technologies aligned with global performance and compliance standards.

The approval also reflects Deki Electronics' continued emphasis on process robustness, quality assurance, and compliance with evolving industry standards. By strengthening in-house capabilities in design and manufacturing discipline, the company is positioned to support increasing volumes and application complexity while maintaining consistency in performance and reliability across product lines.

Capacitors play a critical role across automotive and electric mobility platforms, industrial and power electronics, telecommunications infrastructure, renewable energy systems, and IT hardware. As system-level efficiency and reliability requirements continue to rise, the need for locally manufactured, application-specific components has become increasingly significant.

At Deki Electronics, manufacturing is guided by a focus on reliability, electrical integrity, and lifecycle performance. The ECMS approval further strengthens the company's contribution to India's electronics manufacturing ambitions by supporting domestic capacity expansion and resilient supply chains for OEMs operating at scale.

**Designed in India. Made in India. Engineered for reliability.**



Deki is proud to contribute to powering tomorrow—one capacitor at a time.

## DC-Link Film Capacitors for Advanced Power Electronics

### Design Considerations, Reliability, and Deki Electronics Portfolio

#### Abstract

**DC-link capacitors** are critical components in modern power electronic converters, responsible for stabilising the DC bus, handling high ripple currents, and improving overall system reliability. With the rapid growth of electric mobility, renewable energy systems, railway traction, and high-power industrial converters, DC-link capacitors are exposed to increasingly severe electrical, thermal, and mechanical stresses. This paper presents a comprehensive overview of DC-link film capacitor technology, including operating principles, construction, design requirements, reliability aspects, and application considerations. Particular emphasis is placed on **metallised polypropylene film capacitors** and the expanded **DC-link capacitor portfolio** developed by **Deki Electronics** through continuous research and development, as well as stringent quality-driven practices.

#### Introduction

**DC-link capacitors** are indispensable in applications such as industrial motor drives, renewable energy inverters, traction converters, electric and hybrid vehicles (EV/HEV), UPS systems, battery chargers, and high-power industrial converters. As power electronics continues to evolve towards higher switching frequencies, more compact layouts, and increased power density, the electrical, thermal, and mechanical demands placed on DC-link capacitors have intensified. Consequently, **capacitor technology, material selection, and reliability engineering** have become decisive factors influencing system efficiency, lifetime, and safety.

#### Typical DC-Link Configuration in Power Electronic Systems

In voltage-source converter topologies, the **DC-link capacitor** is connected across the positive and negative DC rails, between the rectifier or DC/DC stage and the inverter. The capacitor maintains a stiff DC bus by absorbing voltage ripple and supplying instantaneous current during switching events. Additionally, it provides a low-inductance current return path, thereby minimising voltage overshoot and **electromagnetic interference (EMI)**.

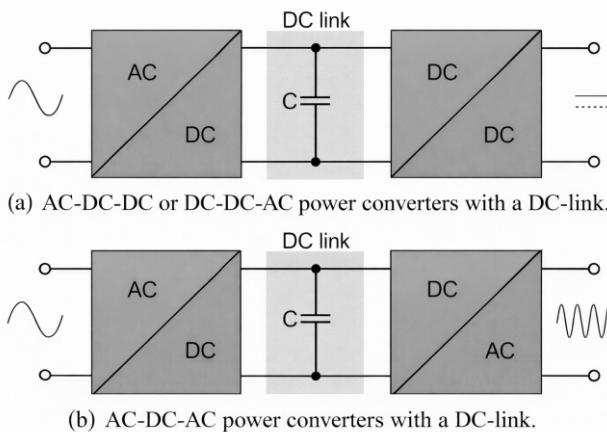


Figure 1 illustrates a typical DC-link configuration used in power electronic converters.

#### Construction and Operating Principle of DC-Link Film Capacitors

**DC-link film capacitors** typically employ **polypropylene (PP)** film as the dielectric material, combined with vacuum-deposited **metallised electrodes**. Polypropylene is widely used due to its excellent dielectric strength, low dielectric losses, high insulation resistance, and long-term stability.

A key advantage of **metallised film capacitors** is their **self-healing capability**. In the event of a localised dielectric breakdown, the metallised electrode around the fault vaporises, electrically isolating the defect without catastrophic failure. This results in a gradual and predictable reduction in capacitance rather than a short circuit, enabling safe and reliable long-term operation.

#### Reliability and Temperature Performance

**Industrial-grade DC-link capacitors** are designed for wide temperature operation, typically from **-40 °C to +85 °C**, with extended operation up to **+105 °C or +125 °C** under voltage derating. With optimised dielectric materials, thermal design, and controlled electrical stress, **service lifetimes exceeding 100,000 hours** can be achieved.

In demanding applications such as **EV/HEV traction, railway converters, and renewable energy systems**, DC-link capacitors are exposed to high ripple currents, elevated temperatures, vibration, and cyclic loading. **Robust mechanical construction and effective thermal management** are therefore essential to ensure stable performance and long-term reliability.

#### Ripple Voltage Reduction and Ripple Current Capability in DC-Link Capacitors

The **DC-link capacitor** smooths the rectified DC voltage and stabilises the DC bus, as shown in **Figure 2**. This function results in **AC ripple current** flowing through the capacitor, which is the primary electrical and thermal stress factor in **PWM-driven converters**.

**Deki Electronics' MPP DC-link capacitors**, featuring **low ESR** and an optimised **metallisation design**, are engineered to handle high **RMS ripple currents** with minimal self-heating and a long service life. While **ripple voltage reduction** is a system requirement, **ripple current capability is the key reliability-determining parameter for DC-link capacitors**.

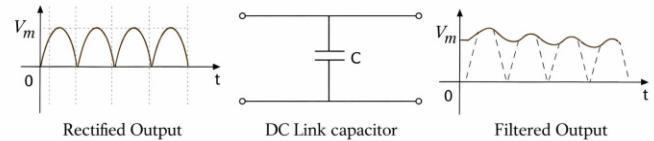


Figure 2 illustrates DC bus ripple voltage reduction and the associated ripple current stress within the capacitor.

#### Applications

**DC-link film capacitors** are used in a wide range of power electronic systems, including:

- Solar and wind energy inverters
- Railway, metro, and traction converters
- Electric and hybrid vehicles (EV/HEV), including traction inverters, onboard chargers, and DC/DC converters
- Industrial motor drives and automation systems
- UPS and energy storage systems
- Battery chargers and welding equipment
- Medical equipment such as defibrillators and diagnostic systems
- High-power industrial and transportation converters

#### Deki Electronics DC-Link Capacitor Portfolio

**Deki Electronics** offers an expanded portfolio of **DC-link film capacitors** covering voltage ratings up to **3000 VDC** and capacitance values suitable for both compact, high-frequency designs and high-energy buffering applications. The product range includes **box-type** and **cylindrical constructions** optimised for **low ESR**, **high ripple current capability**, and robust mechanical performance.

All **DC-link capacitors** are designed and validated in compliance with **IEC 61071** through comprehensive in-house testing. For special application requirements, including **railway and automotive applications**, DC-link capacitors can be developed and qualified to meet **IEC 61881**, **IEC TS 63337**, and **AEC-Q200** standards based on specific customer specifications.

Series No.	Capacitor Type	Voltage Range	Capacitance Range
91	DC-Link Box Plastic	450-1600 VDC	0.68 $\mu$ F - 210 $\mu$ F
292 / 293	DC-Link Round Plastic	600-2000 VDC	20 $\mu$ F - 270 $\mu$ F
297	DC-Link Round Aluminum Can	700-3000 VDC	45 $\mu$ F - 5500 $\mu$ F
398	Customized DC-Link for EV	450-1200 VDC	300 $\mu$ F - 1000 $\mu$ F

## Key Features and Technical Characteristics – DC-Link Capacitors | Deki Electronics

Feature	Deki DC-Link Polypropylene Film Capacitors
<b>Self-Healing Technology</b>	Controlled self-healing capability with built-in safety functions
<b>Dielectric Material</b>	High temperature grade polypropylene film selected for long-term reliability
<b>Polarization</b>	Non-polarized
<b>Voltage Rating</b>	450 VDC to 3000 VDC
<b>ESR</b>	Very low (milliohm range)
<b>ESL</b>	Low inductance (nanohenry range)
<b>Ripple Current Capability</b>	Very high, suitable for inverter and converter applications
<b>Frequency Response</b>	Excellent up to ~100 kHz
<b>Operating Temperature</b>	-55 °C to +85 °C (up to +105 °C / +125 °C with voltage derating)
<b>Capacitance Stability</b>	No dependency on DC bias
<b>Expected Lifetime</b>	Exceeding 100,000 hours under recommended conditions

Note: Detailed datasheets for specific capacitance and voltage ratings are available upon request

## R&D-Driven Design and Application-Focused Quality at Deki Electronics

Deki Electronics' DC-link capacitor performance and reliability are driven by continuous **research and development (R&D)** focused on materials, design optimisation, and application-specific engineering.

- Advanced metallisation design:** Optimised electrode thickness, segmentation patterns, and edge margins are developed to achieve **low ESR** while maintaining controlled **self-healing behaviour** and stable end-of-life characteristics.
- Application-specific collaboration:** Close collaboration with customers enables the development of tailored DC-link solutions for **EV/HEV systems, railway traction converters, renewable energy installations, and industrial drives**.
- Railway and traction development focus:** Special design considerations address **vibration resistance, extended operating temperature, long service life**, and compliance with transportation standards.
- Thermal and dielectric optimisation:** In-house evaluation of film properties, impregnation systems, and winding geometries enhances **heat dissipation** and reduces internal hot spots.
- Lifetime modelling and validation:** Accelerated life testing and **Arrhenius-based models** are employed to predict service life under combined electrical and thermal stress.
- Rigorous quality testing:** **100% routine testing** and extensive type testing ensure consistent electrical performance and long-term field reliability.

## Conclusion

DC-link film capacitors are key enablers of reliable and efficient power electronic systems. Their **low ESR** and **ESL**, **high ripple current capability**, **wide operating temperature range**, and inherent **self-healing characteristics** make them well suited for demanding applications in industrial drives, renewable energy systems, EV/HEV platforms, and railway traction. Through continuous **research and development**, **advanced metallisation design**, and stringent **quality assurance practices**, Deki Electronics delivers DC-link capacitor solutions with stable electrical performance and predictable long-term reliability, supported by **more than four decades of experience** in capacitor design and manufacturing.



Deki Electronics Ltd. – Engineering Confidence in Every Capacitor



## Deki Organises Its Third Alumni Meet

Deki Electronics Ltd. organised its **third Alumni Meet** on 11 October 2025, bringing together former and current members of the organisation to reflect on decades of shared growth, collaboration, and contribution to Deki's journey.

Addressing the gathering, **Mr. Vinod Sharma, Managing Director**, expressed his appreciation for the continued association of alumni members with Deki. He highlighted that the company's strong position in capacitor manufacturing and the progress of its SureSolutions division have been built on the collective efforts of its people over the years, including alumni who have contributed at different stages of the organisation's growth.

The programme included reflections from senior leaders and alumni members on Deki's organisational culture and future direction, followed by a plant visit and informal interactions. The event, organised by the **HR team**, provided an opportunity for alumni members to reconnect and share memories.

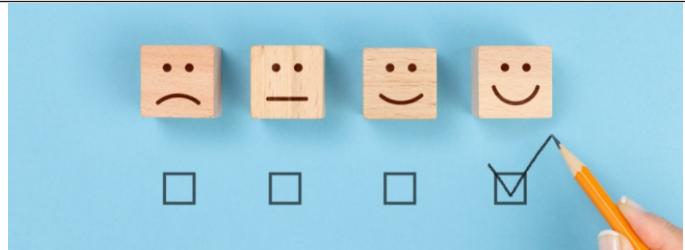


## Deki Supports Goonj Through a Collection Drive

In November, Deki Electronics organised a **Goonj Collection Drive** as part of its continued commitment to social responsibility and community welfare. Employees across departments actively participated by donating usable clothes and essential household items for responsible reuse.

Through this collective effort, **231 kg of materials** were gathered, carefully sorted, and packed by the team. The collected items were handed over to **Goonj** at their Sarita Vihar centre, Delhi on 7th November, ensuring they reached communities where they are most needed.

This initiative reflects Deki's strong culture of empathy, sustainability, and social engagement. The enthusiastic involvement of employees once again demonstrated how small, thoughtful actions can create a meaningful impact beyond the workplace.



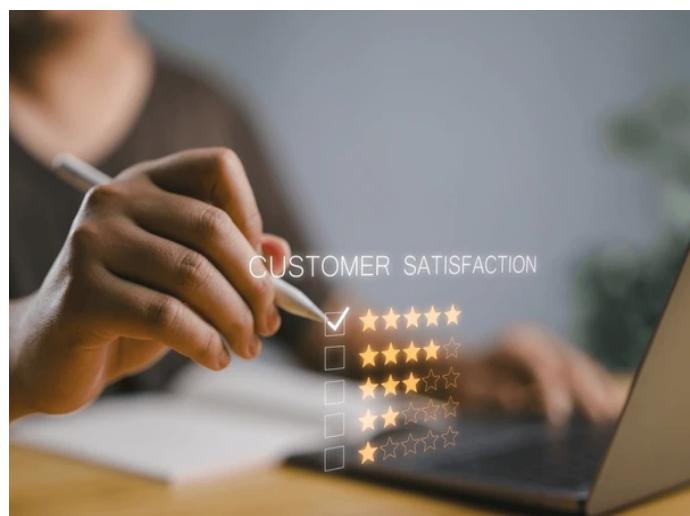
## Employee Satisfaction Survey – August 2025

The Employee Satisfaction Survey conducted in **August 2025** indicates a consistently motivated and engaged workforce. Between **2017 and 2025**, overall satisfaction levels have remained strong, ranging from **82% to 89%**. The latest result of **88%** reinforces the positive sentiment and confidence employees have in the organisation.

### Key observations include:

- Overall satisfaction has remained stable over the years, with most results falling between **86% and 89%**, reflecting a healthy and sustained engagement trend.
- While minor year-on-year variations were observed, the overall pattern demonstrates steady progress in employee perception of the workplace experience.
- Core satisfaction drivers—such as the **workplace environment, facility support, and effective supervision**—continue to receive positive feedback.

These findings highlight a strong and evolving organisational culture characterised by trust, commitment, and high levels of employee satisfaction. The positive trend in recent years reflects the effectiveness of initiatives focused on employee well-being, workplace enhancements, and strengthened managerial support.



## External Customer Satisfaction Survey

At Deki Electronics, the **External Customer Satisfaction Survey** is a biannual initiative that has supported our continuous improvement journey for over **two decades**. This long-standing practice enables us to gather direct feedback from our customers, helping us identify both our strengths and areas for further improvement.

We are pleased to share the results of the most recent survey conducted in **June 2025**, based on responses from our valued customers. The survey recorded an **overall customer satisfaction score of 91.52%**, reflecting sustained performance across key areas such as **quality, delivery, professionalism, and overall customer experience**.

An encouraging outcome of the survey is a **Net Promoter Score (NPS) of 84%**, indicating a strong level of customer loyalty and a continued willingness among customers to recommend Deki. These results reaffirm the trust our customers place in us and highlight the effectiveness of our customer-focused initiatives.

We sincerely thank our customers for their continued support and valuable feedback. Their insights remain central to our efforts to enhance performance and strengthen long-term partnerships.