

Application Guide

Products for Traction Applications

Solutions for Propulsion, Auxiliary Power and HVAC inverters

Business groups supporting both TDK and EPCOS brand products, organized according to product categories.

Magnetics

- Ferrites
- Transformers
- Power Inductors
- Signal Use Inductors
- Multilayer Inductors
- Signal EMC Filters
- Power EMC Filters
- EMC and RF Engineering

Capacitors

- Screw Terminal Aluminum Electrolytic
- Snap-In Aluminum Electrolytic
- DC Box Film
- DC Plastic and Metal Can
- AC Box Film
- AC Plastic and Metal Can
- Power Electronic Film
- Power Factor Correction Film
- Power Quality Solutions

Sensors

- NTC Sensors
- Pressure Sensors
- Applied Sensors

Ceramic Capacitors

- General and Small Capacitors
- High Capacitance Capacitors
- Applied Products
- Dielectric Materials and Products

Protection Devices


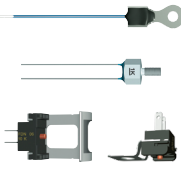
- Piezo
- Inrush Current Limiters
- PTC
- Thermistors
- Disk Varistors
- Multilayer Varistors
- Surge Arresters

SAW and BAW Filter Products

- Multilayer Modules
- MEMS Products
- Multilayer HF Components
- Dielectric Components
- Isolators and Circulators




Product Guide

| Series | Technical Data | Features | Series / Type | Input Protection | Conversion | Output Filtering |
|--|---|--|--|---|------------|------------------|
| Aluminum Electrolytic Capacitors | | | | | | |
| Screw Terminal |  | V_R : 200 ... 600 V DC C_R : 560 ... 33000 μ F Useful life up to +105 °C, 8000 h or +85 °C, 15000 h | <ul style="list-style-type: none"> High ripple current capability Long useful life, > 20 years possible Compact can size Special design for base cooling Self-extinguishing electrolyte available | B4345x B434x4 B435x4 B437x0 | • | • |
| 4-/5-pin Snap-in Terminals & Solder Pins |  | V_R : 350 ... 500 VDC C_R : 330 ... 3300 μ F | <ul style="list-style-type: none"> High ripple current capability Long useful life, > 20 years possible Compact can size | B435x0 B435x1 B435x5 | • | • |
| Snap-in |  | V_R : 160 ... 600 V DC C_R : 47 ... 3300 μ F | <ul style="list-style-type: none"> High ripple current capability Long useful life, > 20 years possible Compact can size | B43305, B4350x B4354x, B43601 B4364x | • | • |
| DC Film Capacitors | | | | | | |
| MKP Snubber |  | V_R : 850 ... 2000 V DC C_R : 47nF ... 3.3 μ F | <ul style="list-style-type: none"> Operating temperature up to +110 °C Service life 200 kh at 1.0 · V_R, +85 °C Various terminal configurations High dv/dt, current, & frequency | B32656S | • | • |
| MFP Snubber | | V_R : 1000 ... 2000 V DC C_R : 22nF ... 0.68 μ F | | B32686S | • | • |
| MKP DC |  | V_R : 700 ... 1980 V DC C_R : 30 ... 1500 μ F T_{op} : -55 ... +70 °C UL810, file# E183224 | <ul style="list-style-type: none"> High peak current capability Aluminum can Optional plastic cap for increased creepage and clearance distances | B2562x | • | • |
| MKP DC LSI |  | V_R : 500 ... 1200 V DC C_R : 50 ... 400 μ F T_{op} : -55 ... +70 °C | <ul style="list-style-type: none"> High peak current capability Low self inductance UL 94 V0 plastic can | B2563x | • | • |
| MKK DC MKK DCI PCC HP |  | V_R : 700 ... 6 000 V C_R : 100 ... 30 000 μ F | <ul style="list-style-type: none"> DC link and series resonant circuits Rapeseed oil or dry gas impregnation | B25655A B25650 B25750 | • | • |
| MKK DCR PCC LP |  | V_R : 800 ... 1500 V DC C_R : to 12 500 μ F T_{op} : -25 ... +80 °C | <ul style="list-style-type: none"> Low ESL Resin filled | B25640 | • | • |
| AC Film Capacitors | | | | | | |
| MKP AC |  | V_{RMS} : 250 ... 1500 V AC C_R : 3 ... 600 μ F, 3PH to 150 μ F T_{op} : -40 ... +70 °C UL 810, file# E106388 | <ul style="list-style-type: none"> High peak current capability Customized configurations Overpressure disconnecter Aluminum can | B32360 ... B32364 | • | • |
| MKP AC HP | | | | B25360 | • | • |
| MKK MKP MKV |  | V_R : 230 ... 3400 V AC C_R : 0.1 ... 250 μ F T_{op} : -40 ... +85 °C | <ul style="list-style-type: none"> High peak current capability High dielectric strength Overpressure disconnecter Aluminum can | B25834, B32836 B25856, B25667 B25673, B32344 | • | • |
| Protection Devices | | | | | | |
| Varistors |  | I_{max} : 25 ... 100 kA (8/20 μ s) V_{RMS} : 75 ... 1100 V I_{max} : 40 ... 75 kA (8/20 μ s) V_{RMS} : 130 ... 550 V I_{max} : 0.8 ... 20 kA (8/20 μ s) V_{RMS} : 130 ... 550 V I_{max} : 400 ... 2 500 A V_{RMS} : 130 ... 550 V | <ul style="list-style-type: none"> Block MOV, 32 ... 80mm Chassis mount Strap MOV, 40 ... 50mm Chassis or PCB mount Disc MOV, 5 ... 25mm PCB mounted ;eaded CU3225, CU4032, CU4648 | B32, B40, B60, B80 LS40, LS41, LS42 LS50 S5, S7, S10, S14 S20, S25 B726... | • | • |
| Surge Arrester |  | V_{RMS} : 255 VAC I_{pulse} : 25 ... 100 kA | <ul style="list-style-type: none"> EN 61643-11 class I, II or III types Chassis or PCB mount | B88069 | • | • |
| Sensing Devices | | | | | | |
| NTC Temp sensors |  | T_{op} : -55 ... +200 °C $R_{25°C}$: 5 k Ω ... 100 k Ω T_{op} : -55 ... +125 °C $R_{25°C}$: 1 k Ω ... 150 k Ω T_{op} : -10 ... +100 °C $R_{100°C}$: 3300 Ω | <ul style="list-style-type: none"> Thermal coupling through metal tag UL approval (E69802) for M703 Thermal coupling through screw case 10 000hr at 100°C, <5% $\Delta R_{25}/R_{25}$ Glass NTC element, surface probe Thermal time constant ~5s | B57703 (M703 & M1703 types) B57045K (K45 type) B58100 (T120 & F120 type) | • | • |

Examples of Capacitors used for Light and Metro Rail

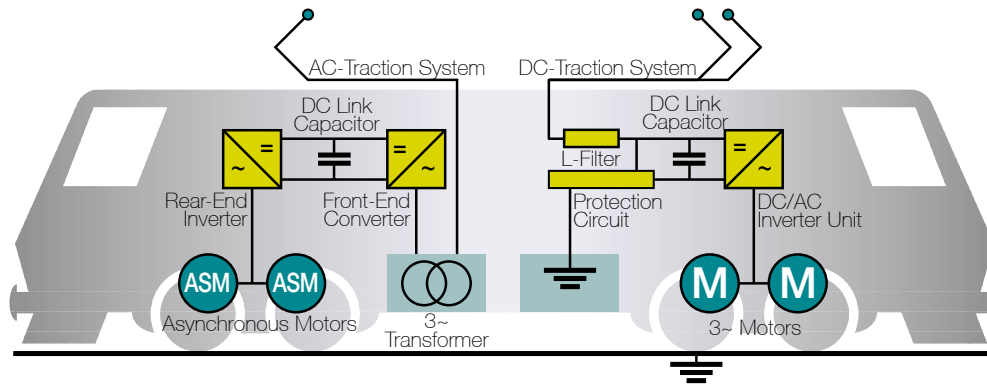
| Module OEM | Capacitor Ratings | Function | Capacitor Type | Series / Type |
|---|-------------------|------------------|--------------------------------------|----------------|
| Propulsion | | | | |
| <i>The main power electronics for propelling the vehicle. This system will use either aluminum electrolytic or power electronic film capacitors for the DC link circuit. There may also be potentials for snubbing or commutating capacitors on the IGBTs.</i> | | | | |
| ABB | 5,200µF, 450VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43564S5528... |
| Alstom | 16,000µF, 350VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43564S4169... |
| Bombardier | 11,000µF, 400VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S9119... |
| | 4,700µF, 350VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43564B4478... |
| General Electric | 17,000µF, 350VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S4179... |
| Siemens | 1,800µF, 1200VDC | DC Link | Power Film Capacitor, Round Can | B25653V0188... |
| | 1,500µF, 1200VDC | DC Link | Power Film Capacitor, Round Can | B25653V0158... |
| | 2,040µF, 1100VDC | DC Link | Power Film Capacitor, Round Can | B25653V0208... |
| Rohr | 1,500µF, 1500VDC | DC Link | Power Film Capacitor, Round Can | B25653V0158... |
| Low Voltage (LVPS) or Auxiliary (APS) Power Supply | | | | |
| <i>These systems are for converting high voltage DC to standard AC voltage for running control systems, lighting, heating ventilation and air conditioning. Common components for these systems are both low voltage and high voltage aluminum electrolytic capacitors as well as AC capacitors and inductors for filtering the low frequency harmonics on the AC power line.</i> | | | | |
| Alstom | 3x153µF 380VAC | AC Output Filter | AC Film Capacitor, Round Can | B32344E3251... |
| SEPSA | 68,000µF, 63VDC | DC Link | Screw Terminal Aluminum Electrolytic | B41456S8689... |
| | 15,000µF, 400VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S9159... |
| Toshiba | 10,000µF, 400VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S9109... |
| HVAC Inverter | | | | |
| <i>Newer air conditioning systems often utilize inverter based systems for controlling compressors and blower fans for better efficiency and a higher degree of control. These inverter systems normally use aluminum electrolytic capacitors for the DC bus in the inverter.</i> | | | | |
| Mistubishi Electric | 8,200µF, 450VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43564S5828... |
| | 10,000µF, 450VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S5109... |
| SEPSA | 8,200µF, 450VDC | DC Link | Screw Terminal Aluminum Electrolytic | B43456S5828... |

Similar Traction Applications

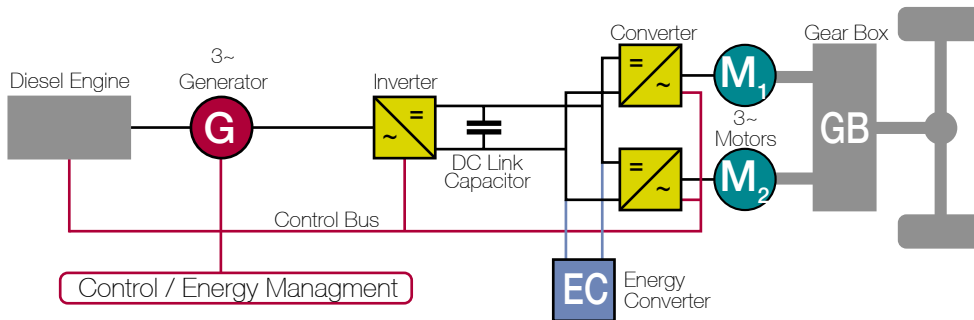
| Application | Example | Application Features | Capacitor Products |
|------------------------|---|---|---|
| Mining Truck |  | Medium voltage drives for propulsion of the vehicle as well as actuation of additional moving components such as dumping truck bed or lifting shovels. | <ul style="list-style-type: none"> • MKK DC • MKK DCI • MKK DCR • PCC HP |
| Mining Shuttle Car |  | Medium voltage drives for propulsion of the vehicle. May also drive conveyor systems, or run cutting plows for longwall mining. | <ul style="list-style-type: none"> • MKK DC • MKK DCI • MKK DCR • PCC HP |
| Electric Bus / Trolley |  | Low voltage or medium voltage drives for propulsion of vehicle as well as powering auxiliary AC power for running lighting, control systems, heating, ventilation and air conditioning. | <ul style="list-style-type: none"> • MKP DC LSI • MKK DCR • PCC HP • PCC LP |
| Locomotive |  | In diesel locomotives the diesel engine is merely a generator of electricity, with the design similar to a series hybrid vehicle. A medium voltage drive is used for propulsion since extraordinary levels of torque are required for pulling heavy cargo. | <ul style="list-style-type: none"> • MKK DC • MKK DCI • MKK DCR |
| Farm Equipment |  | Low voltage or medium voltage drives for propulsion of the vehicle as well as actuation of additional moving components such rotating cutting tools. | <ul style="list-style-type: none"> • MKK DCR • Screw Terminal Alu • PCC LP |
| Military Vehicle |  | Low voltage or medium voltage drives for propulsion of the vehicle. These may be either series or parallel hybrid systems for either complete electric traction or electric assist for climbing steep grades. May also be parked and used as generators for field hospitals or temporary camps. | <ul style="list-style-type: none"> • MKP DC • MKP DC LSI • MKK DCR • PCC HP, PCC LP |

Solutions for Traction Applications

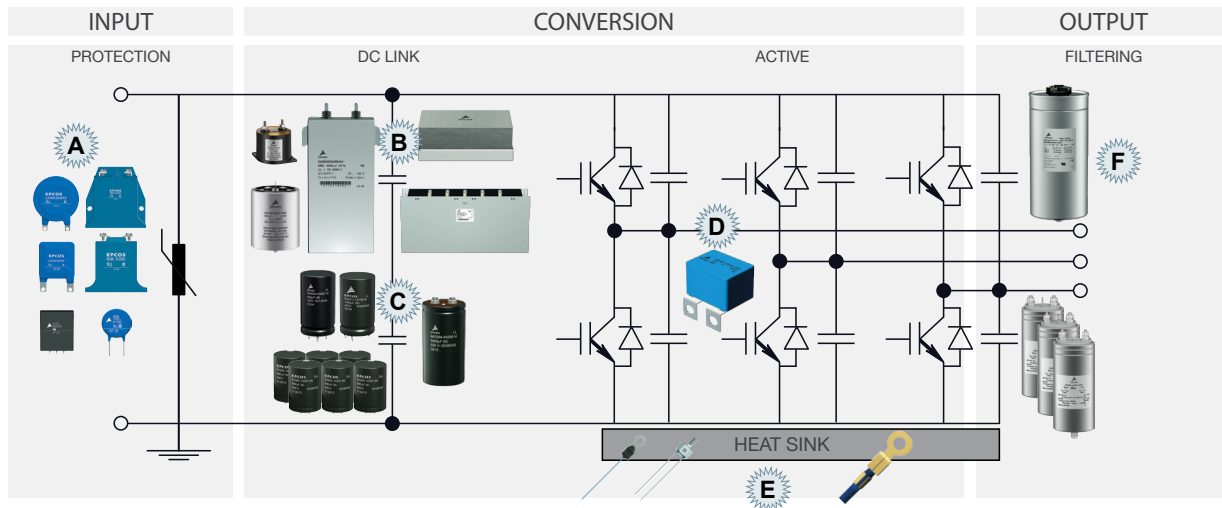
Light Rail Propulsion



Hybrid Bus Propulsion



Traction Converter



- A: Varistors (leaded, strap & block)
- B: DC Link Film; MKP, PCC, MKV, or MKK
- C: DC Link AI Snap-in or Screw Terminal

- D: Snubbing or commutating capacitors
- E: Temperature sensors (NTC or PTC)
- F: Output Filtering Capacitors

For further information please contact your TDK Sales Office or Distribution Partner