Toshiba’s transportation system technology is widely-used all over the world.

Toshiba Locomotives

Find out more about Toshiba transportation solutions on http://toshiba-railway.com

Toshiba Infrastructure Systems & Solutions Corporation

72-34, Horikawa-cho, Saiwai-ku, Kawasaki-shi, Kanagawa 212-8585, Japan

Railway Systems Division | TEL +81-(0)44-331-3609

Headquarters
• Headquarter (Kawasaki, Japan)

Main Factory
• Toshiba Complex (Kawasaki, Japan)

Sales & Engineering Office
• Toshiba Railway Systems Co., Ltd. (Singapore)

Sales & Engineering Office
• Toshiba Railway Systems Co., Ltd. (Hisaya-cho, Japan)

Sales & Engineering Office
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Auxiliary Power System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Clean Energy System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Electric Locomotives
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Traction System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Auxiliary Power System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Power Supply System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Traction Motor System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Control System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

HVAC System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

PMSM Propulsion System
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Performance
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Low Temp.
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Safety
• Toshiba Railway Systems Co., Ltd. (Kawasaki, Japan)

Aiming to Meet Your Needs

Manufacturing Facilities
• Manufacturing Facilities
• Manufacturing Facilities
• Manufacturing Facilities

Toshiba Locomotives

Performance Long Life

Efficient Traction Motor

Efficient Traction Motor

Performance Long Life

Low Temp.

Safety

Specifications

Maximum Power

Specifications

Specifications

Auxiliary Power System

Line 1 of Wuhan Metro Group

Train information system for

● Toshiba Infrastructure Systems & Solutions Co., Ltd.

or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIWA or others.

The information contained herein is subject to change without notice.

Guangzhou Toshiba Baiyun Electrical Equipment Co., Ltd. (Guangzhou, China)

Air-conditioning systems Toshiba Carrier Corporation (Fuji, Japan)

Kashiwazaki Operations (Kashiwazaki, Japan)

Hamakawasaki Operations (Kawasaki, Japan)

Electric locomotives, traction control equipment, auxiliary power supply equipment, Convertor/inverter system, air-conditioning system, DC traction power substation, Train information system, Permanent Magnet Synchronous Motor (PMSM) Propulsion System for

and performance.

Weight

Maximum Power at Tread

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications

Specifications
Toshiba Locomotives: Aiming to Meet Your Needs

High Availability with Water-Cooled Power Converter

Independent control is applied for high availability and performance.

Low-emission Transformer

Nitrogen gas sealed transformer technology reduces need for insulation oil exchange.

Efficient Traction Motor

PMSM (Permanent Magnet Synchronous Motor) technology realizes high efficiency of up to 97%.*

Hybrid Locomotive

Specifications

<table>
<thead>
<tr>
<th>EL72</th>
<th>EL96</th>
<th>EL45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catenary Voltage</td>
<td>25 kV/50Hz</td>
<td>25 kV/50Hz</td>
</tr>
<tr>
<td>Maximum Power on Track</td>
<td>4,000 kW</td>
<td>4,500 kW</td>
</tr>
<tr>
<td>Weight</td>
<td>Standard</td>
<td>Standard</td>
</tr>
<tr>
<td>120 – 160 km/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Arrangement</td>
<td>Co-Co</td>
<td></td>
</tr>
<tr>
<td>Maximum speed</td>
<td>120 km/h</td>
<td></td>
</tr>
</tbody>
</table>

Diesel Electric Locomotive

Specifications

<table>
<thead>
<tr>
<th>DE415</th>
<th>DE151</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power (Engine Output)</td>
<td>3,500 hp (2,600 kW)</td>
</tr>
<tr>
<td>Gauge</td>
<td>Standard</td>
</tr>
<tr>
<td>Weight</td>
<td>96 – 120 tons</td>
</tr>
<tr>
<td>Single Arrangement</td>
<td>Co-Co</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>120 km/h</td>
</tr>
</tbody>
</table>

* The efficiency of PMSM was calculated with loss measurement based on IEC 00340-2 at the temperature below 40°C from 6/23/2009 to 9/23/2010.

Safe and Durable Lithium-ion Main Battery

SCIB™ Toshiba’s lithium-ion battery realizes safety, long life and good performance, even in low-temperature environments.

Main Battery

- 96 – 120 tons
- Safety, long life and good performance, even in low-temperature environments.
**History**

**Toshiba's first electric locomotive**

Toshiba’s glorious locomotive business began with supplying electric components for the 40-ton electric locomotive built by Ishikawajima Shipbuilding & Engineering Co in 1923. The first locomotive Toshiba manufactured was the 73-ton locomotive in 1926. This locomotive was used for coal transportation. Since then, Toshiba has supplied 600 complete locomotives or electric components for locomotives for Japanese customers.

**Overseas business in early times**

Toshiba locomotive business has entered into the global market by supplying electric locomotives to Indian Railways. This was followed by supplying 5 electric locomotives to New Zealand in 1968. Since then, more than 2,000 locomotives or their components had been supplied to customers outside Japan.

**Diesel electric locomotive**

Toshiba’s first diesel electric locomotive was built in 1934, equipping a 750 HP diesel engine. Since 1969, Toshiba had manufactured 26 locomotives (500 HP/1050 HP) for Zambia and Brazil. Since 1981, 24 locomotives with two 500 HP engines had been shipped to New Zealand. In 1987, 24 locomotives with 2400 HP were delivered to Malaysia in collaboration with Kawasaki Heavy Industry, ltd. The locomotives for steelworks with radio remote control were manufactured in 1991 and some were delivered to various locations in Japan.

**Key Technologies for Locomotives**

**Power Converters**

- Modular design power converter cubicle for locomotive – The optimum configuration can be realized.
- Main Power Unit up to 1,400 kW and convertible to APU (up to 500 kW)
- Auxiliary Power Unit (230 kVA)
- Cooling Unit

**Other existing IGBT power converters**

Power Converters for Electric Locomotives – Wide range of tractive power can be covered.

<table>
<thead>
<tr>
<th>Power / axle</th>
<th>500 kW / axle</th>
<th>750 kW / axle</th>
<th>1,400 kW / axle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>2-MPU (1,400 kW), 1-APU (500 kW)</td>
<td>2-MPU (1,400 kW), 1-APU (230 kW)</td>
<td>2-MPU (1,400 kW)</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td><strong>Diesel Electric Locomotive</strong> (New Zealand Railways Corporation)</td>
<td><strong>Diesel Electric Locomotive</strong> (Malayan Railway Administration)</td>
<td><strong>Diesel Electric Locomotive with Radio Remote Control</strong> (For Steelworks)</td>
</tr>
<tr>
<td><strong>Rated power</strong></td>
<td>3,000 kW (continuous) at tread</td>
<td>4,500 kW (continuous) at tread</td>
<td>7,200 kW (continuous) at tread</td>
</tr>
<tr>
<td><strong>Catenary</strong></td>
<td>50k Vac-50Hz</td>
<td>50k Vac-50Hz</td>
<td>25k Vac-50 Hz</td>
</tr>
<tr>
<td><strong>Number of locomotives</strong></td>
<td>110</td>
<td>44+32</td>
<td>44+32</td>
</tr>
<tr>
<td><strong>Locomotive weight</strong></td>
<td>180 tons</td>
<td>180 tons</td>
<td>180 tons</td>
</tr>
<tr>
<td><strong>Axle arrangement</strong></td>
<td>Co-Co</td>
<td>Co-Co</td>
<td>Co-Co</td>
</tr>
<tr>
<td><strong>Maximum speed</strong></td>
<td>120 km/h</td>
<td>120 km/h</td>
<td>120 km/h</td>
</tr>
<tr>
<td><strong>Engine power</strong></td>
<td>4,500 kW (continuous) at tread</td>
<td>4,500 kW (continuous) at tread</td>
<td>4,500 kW (continuous) at tread</td>
</tr>
</tbody>
</table>
Diesel electric locomotive

**History**

Manufactured in 1991 and some were delivered to various locations in Japan. Collaboration with Kawasaki Heavy Industry, Ltd. The locomotives for steelworks with radio remote control were engines had been shipped to New Zealand. In 1987, 24 locomotives with 2400 HP were delivered to Malaysia in 1981, 24 locomotives with two 500 HP or their components had been supplied to customers outside Japan. This was followed by supplying 5 electric locomotives to New Zealand in 1968. Since then, more than 2,000 locomotives Toshiba locomotive business has entered into the global market by supplying electric locomotives to Indian Railways.

**Toshiba’s first electric locomotive**

Electric components for locomotives for Japanese customers. Since then, Toshiba has supplied 600 complete locomotives or in 1926. This locomotive was used for coal transportation. Toshiba’s first locomotive Toshiba manufactured was the 73-ton locomotive electric components for the 40-ton electric locomotive built by Toshiba’ s glorious locomotive business began with supplying **Other existing IGBT power converters**

- **Power Converters for Electric Locomotives** – Wide range of tractive power can be covered. The optimum configuration can be realized. Modular design power converter cubicle for locomotive –
  - **Cooling Unit**
  - **Auxiliary Power Unit (230 kVA)**
  - **Main Power Unit up to 1,400 kW and 3-MPU (1,400 kW), 1-APU (230 kVA) configuration**

**Main Battery**

SCiB™ anode material LTO (Lithium Titanium Oxide) makes the battery good performance, versatility and durability.

**Main Alternator**

Main alternator for diesel electric locomotive

**Recent Products**

- **Electric Locomotive**
  - **Application:** Freight
  - **Number of locomotives:** 1,090
  - **Engine power:** 7,200 kW (continuous) at tread
  - **Axle arrangement:** Co-Co
  - **Locomotive weight:** 138 tons, 150 tons
  - **Maximum speed:** 120 km/h
  - **Toshiba supplied electrical equipment**

- **Class 15E Electric Locomotive**
  - **Application:** Freight (heavy ion)
  - **Number of locomotives:** 44-32
  - **Engine power:** 4,500 kW (continuous) at tread
  - **Axle arrangement:** Co-Co
  - **Locomotive weight:** 180 tons
  - **Maximum speed:** 98 km/h
  - **Manufactured in collaboration with a local locomotive builder**

- **Class 15E Electric Locomotive**
  - **Application:** Freight (coal)
  - **Number of locomotives:** 110
  - **Line Voltage:** 25k Vac-50 Hz / 3,000 Vdc
  - **Rated power:** 3,000 kW (continuous) at tread
  - **Axle arrangement:** Bo-Bo
  - **Locomotive weight:** 100 tons
  - **Maximum speed:** 120 km/h
  - **Manufactured in collaboration with a local locomotive builder**

- **Class 29 Diesel Electric Locomotive**
  - **Application:** Freight
  - **Number of locomotives:** 20
  - **Engine power:** 2,580 kW
  - **Axle arrangement:** Co-Co
  - **Maximum speed:** 120 km/h
  - **Toshiba supplied electrical equipment**

- **Class 29 Diesel Electric Locomotive**
  - **Application:** Shunting
  - **Number of locomotives:** 31
  - **Maximum power:** 500 kW at tread
  - **Axle arrangement:** Bo-Bo
  - **Locomotive weight:** 60 tons
  - **Maximum speed:** 45 km/h
  - **Toshiba supplied electrical equipment**