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

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

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.

Hybrid Locomotive

Specifications
- Power: 1,088 kW
- Maximum Power: 700 kW
- Length: 135 m
- Weight: 80 – 150 tons
- Bogie Arrangement: Bo-Bo
- Maximum Speed: 120 km/h

Electric Locomotive

<table>
<thead>
<tr>
<th>Specifications</th>
<th>E-72</th>
<th>E-02</th>
<th>E-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catenary Voltage</td>
<td>25kVc, 50/60Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Power at Tread</td>
<td>7,200 kW</td>
<td>5,500 kW</td>
<td>4,500 kW</td>
</tr>
<tr>
<td>Design</td>
<td>Standard, Standard, Narrow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>170 – 190 tons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bogie Arrangement</td>
<td>Co-Co</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>120 – 160 km/h</td>
<td>120 km/h</td>
<td></td>
</tr>
</tbody>
</table>

Efficient Traction Motor

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

Diesel Electric Locomotive

Specifications
- DL115 | DL125 |
| Maximum Power (Engine Output): | 4,500 BHP | 3,500 BHP |
| Brake Torque (Traction Motor): | 12,000 Nm | 12,000 Nm |
| Gauge | Standard, Narrow |
| Weight | 120 – 150 tons | 90 – 120 tons |
| Bogie Arrangement | Co-Co |
| Maximum Speed | 120 km/h |
**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 78-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.

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**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 kVA)
- 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</th>
<th>500 kW / axle</th>
<th>750 kW / axle</th>
<th>1,400 kW / axle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-MPU (1,400 kW), 1-APU (500 kVA)</td>
<td>2-MPU (1,400 kW), 1-APU (230 kVA)</td>
<td>2-MPU (1,400 kW)</td>
<td></td>
</tr>
</tbody>
</table>

Toshiba supplied electrical equipment for diesel electric locomotive (New Zealand Railways Corporation), Diesel Electric Locomotive (Malayan Railway Administration), Diesel Electric Locomotive with Radio Remote Control (for Steelworks).
Diesel electric locomotive

Overseas business in early times

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History

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PMSM (Permanent Magnet Synchronous Motor)

PMSM technology with reduced energy loss realizes high efficiency up to 97%.* This high efficiency also realizes smaller size or higher power compared with our conventional products.

* The efficiency of PMSM was calculated with loss measurement based on IEC 60349-2 at the temperature below 40˚C from 8/25/2009 to 9/25/2009.

Recent Products

**Electric Locomotive**

- Application: Freight
- Number of locomotives: 1,090
- Catenary: 25k Vac-50Hz
- Rated 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

**Diesel Electric Locomotive**

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

**Hybrid Locomotive**

- Application: Freight
- 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: 180 tons
- Maximum speed: 90 km/h
- Manufactured in collaboration with a local locomotive builder

**Main Battery**

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

**Main Alternator**

Main alternator for diesel electric locomotive

**TCMS**

Distribution of Powering/Regenerative braking command to other locomotives in the same train set with wired/wireless communication.