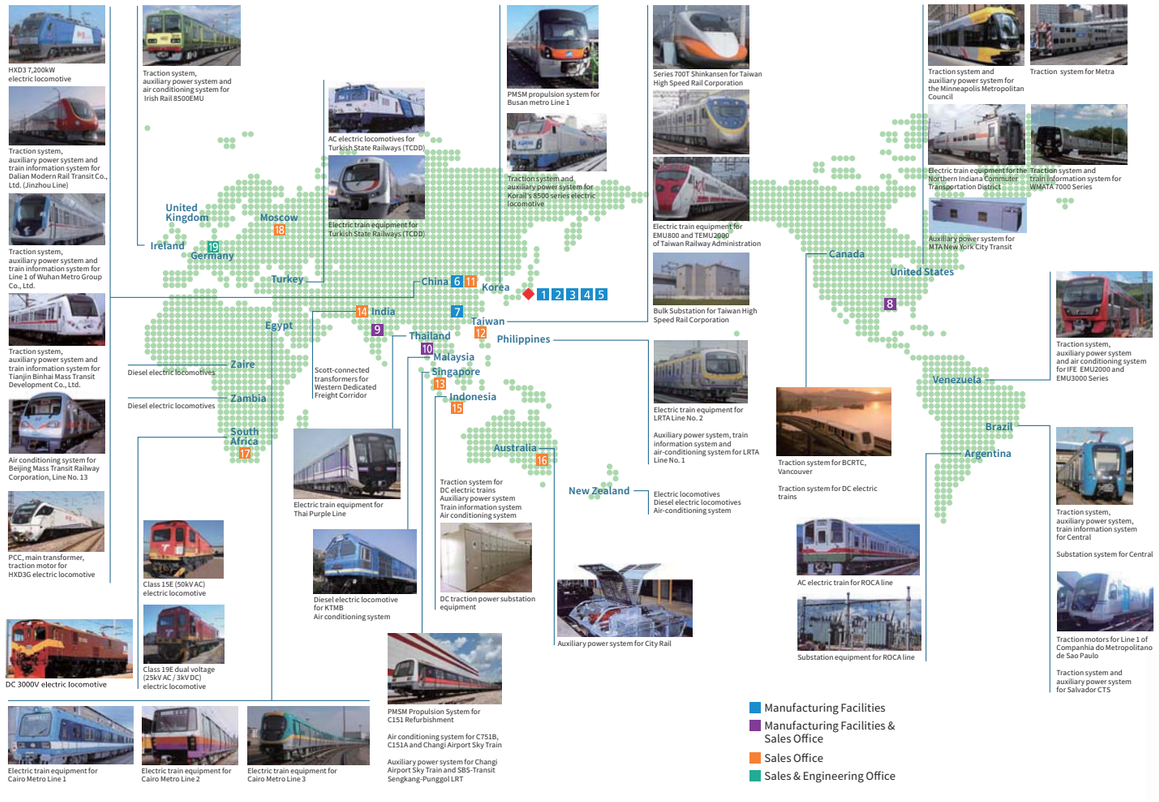
Toshiba's transportation system technology is widely-used all over the world.



Headquarters

◆ Headquarters (Kawasaki, Japan)

Manufacturing Facilities

1 Fuchu Complex (Tokyo, Japan)
Electric locomotives, traction control equipment, auxiliary power supply equipment, traction motor, train information system, ATC/ATS system, etc.

2 Mie Operations (Mie, Japan)
Transformers, motor control centers

3 Hamakawasaki Operations (Kawasaki, Japan)
Transformers, switchgears, surge arresters

4 Kashiwazaki Operations (Kashiwazaki, Japan)
Rechargeable Battery

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

6 Dalian Toshiba Locomotive Electric Equipment Co., Ltd. (Dalian, China)
Drive systems for locomotives, DC train drive systems, auxiliary power supply, traction motor, train information system, etc.

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

Manufacturing Facilities & Sales Office

8 Toshiba International Corporation (Houston, U.S.A.)
Motors, adjustable speed drives (inverters), UPSs, switchgears, transportation systems, etc.

9 Toshiba Transmission & Distribution Systems (India) Pvt. Ltd. (Telangana, India)
Convertor/inverter system, Auxiliary convertors, Train control and monitoring system, Control electronics

10 Toshiba Transmission & Distribution Systems Asia Sdn. Bhd. (Petaling Jaya, Malaysia)
MV Switchgears, EPC of Substations

Sales Office

11 Toshiba China Co., Ltd. (Dalian, China)
12 Toshiba Electronic Components Taiwan Corporation (Taipei, Taiwan)
13 Toshiba Asia Pacific Pte Ltd (Singapore)
14 Toshiba India Private Ltd. (Gurgaon, India)
15 PT. Toshiba Asia Pacific Indonesia (Jakarta, Indonesia)
16 Toshiba International Corporation Pty Ltd (Sydney, Australia)
17 Toshiba Africa (Pty) Ltd. (Sandton, South Africa)
18 Toshiba Rus LLC (Moscow, Russia)

Sales & Engineering Office

19 Toshiba Railway Europe GmbH (Kiel/Düsseldorf, Germany)
Hybrid Locomotive

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

Toshiba Infrastructure Systems & Solutions Corporation

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Railway Systems Division TEL.+81-(0)44-331-1600

TOSHIBA

Traction and Auxiliary Power Systems

Toshiba Application

Commuter Train
High-Speed Train
Locomotive
Tram

Traction Converter Product Line-up 1/2

Application	Electric System	Output Power (Continuous)	Cooling Method	Characteristics/Features	Page No.
Commuter Train	600 V DC	120 kW*1 x 4	Natural cooling	Unit of Control: 1C1M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 400 V AC - 198 A	5 , 6
	750 V DC	135 kW x 4	Natural cooling	Unit of Control: 1C2M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 550 V AC - 360 A	2
		170 kW*1 x 4	Natural cooling	Unit of Control: 1C2M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 440 V AC - 260 A	1
		135 kW x 4	Natural cooling	Unit of Control: 1C2M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 495 V AC - 700 A	3
	1500 V DC	140 kW*1 x 4	Natural cooling	Unit of Control: 1C1M× 4 Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 990 V AC - 153 A	7
		175 kW*1 x 4	Natural cooling	Unit of Control: 1C2M or 1C4M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 940 V AC - 132 A	8
		175 kW*1 x 4	Natural cooling	Unit of Control: 1C1M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 990 V AC - 252 A	11
		140 kW*1 x 4	Natural cooling	Unit of Control: 1C4M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1100 V AC - 413 A	10

*1 : Rating is 1 hour

Traction Converter Product Line-up 2/2

Application	Electric System	Output Power (Continuous)	Cooling Method	Characteristics/Features	Page No.
Commuter Train	3000 V DC	210 kW x 4	Forced air cooling	Unit of Control: 1C4M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 2300 V AC - 268 A	15
	25 kV AC – 60 Hz	200 kW x 4	Natural cooling	Unit of Control: 1C4M Circuit configuration: 3 Level, single phase, voltage type VVVF Converter + 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1370 V AC - 412 A	17
Cruise Train	Diesel Electric Hybrid (600V)	130kW*1 x 4	Water cooling	Unit of Control: 1C1M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 450 V AC - 215 A	18
	Diesel Electric 1500 V DC 20,000 V AC – 50Hz/60Hz 25,000 V AC – 50Hz	140kW*1 x 4	Natural cooling	Unit of Control: 1C4M Circuit configuration: 2 level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1100 V AC - 372 A	19
High-Speed Train	25 kV AC – 60 Hz	285 kW x 4	Forced air cooling	Unit of Control: 1C4M Circuit configuration: 3 level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1850 V AC - 448	20
Locomotive	20 kV AC – 50 Hz 25 kV AC – 50 Hz	565kW*1 x	Forced air cooling	Unit of Control: 1C2M Circuit configuration: 3 Level, single phase, voltage type VVVF Converter + 3 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1550 V AC - 1100 A	22
	25 kV AC – 50 Hz	1250 kW x 3	Water cooling	Unit of Control: 1C1M Circuit configuration: 2 Level, single phase, voltage type VVVF Converter + 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 2150 V AC - 390 A	23
	25 kV AC – 50 Hz	1430 kW x 2	Water cooling	Circuit Configuration: 2 Level, single phase, voltage type PWM Converter + 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 1780 V AC - 552 A	24
Tram	750 V DC	140 kW x 2	Forced air cooling	Unit of Control: 1C2M Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter Output Rating: 3 phase - 550 V AC - 412 A	26

*1 : Rating is 1 hour

Auxiliary Power Unit Product Line-up 1/1

Application	Electric System	Capacity	Cooling Method	Characteristics/Features	Page No.
Commuter Train	750 V DC	140 kVA	Natural cooling	Input Voltage: 750 V DC Circuit Configuration: 2 Level Inverter Output Rating: 3 phase - 300 V AC - 50 Hz Endurable Overload: 150% - 10 sec	2
	1500 V DC	260 kVA	Natural cooling	Input Voltage: 1500 V DC Circuit Configuration: 3 Level Inverter Output Rating: 3 phase - 440 V AC - 60 Hz Endurable Overload: 150% - 10 sec	10
	3000 V DC	206 kVA	Forced air cooling	Input Voltage: 3000 V DC Circuit configuration: 2 Level Inverter Output Rating: 3 phase - 380 V AC - 50 Hz Endurable Overload: 160% - 10 sec	15
	25 kV AC – 60 Hz	195 kVA	Natural cooling	Input Voltage: 469 V AC Circuit configuration: Converter + 2 Level Inverter Output Rating: 3 phase - 440 V AC - 60 Hz Endurable Overload: 150% - 10 sec	17
		110 kVA	Forced air cooling	Input Voltage: 404 V AC Circuit Configuration: Converter + 2 Level Inverter Output Rating: 3 phase - 220 V AC - 60 Hz Endurable Overload: 200% - 10 sec	16
High-Speed Train	25 kV AC – 50 Hz	DC: 36 kW, AC: 5 kVA	Natural cooling	Input Voltage: 440 V AC Circuit configuration: Converter + Inverter Output Rating: single phase - 110 V AC - 60 Hz, DC 100 V Endurable Overload: 5.5 kVA - 50 sec	20
Locomotive	25 kV AC – 50 Hz	230 kVA	Water cooling	Input Voltage: 399 V AC Circuit configuration: Converter + 2 Level CVCF/ VVVF Inverter Output Rating: 3 phase - 380 V AC - 50 Hz Endurable Overload: 350 kVA - 10 sec	23
	25 kV AC – 50 Hz	230 kVA	Water cooling	Input Voltage: 304 V AC Circuit configuration: Converter + 2 Level CVCF/ VVVF Inverter Output Rating: 3 phase - 380 V AC - 50 Hz Endurable Overload: 350 kVA - 10 sec	24
	20kV AC - 50 Hz 25kV AC - 50 Hz	150 kVA	Forced air cooling	Input Voltage: 1366/ 1389 V AC Circuit configuration: Converter + Inverter Output Rating: 3 phase - 440 V AC - 60 Hz Endurable Overload: 300 kVA - 30 sec	22
Tram	750 V DC	30 kVA	Forced air cooling	Input Voltage: 750 V DC Circuit configuration: 2 Level Inverter Output Rating: 3 phase - 208 V AC - 60 Hz, 1 phase - 120 V AC - 60 Hz Endurable Overload: 45 kVA - 30 sec	26

*1 : Rating is 1 hour

Traction Motor Product Line-up 1/1

Application	IM (ASM)*1 or PMSM*2	Continuous Rating	Cooling Method	Characteristics/Features	Page No.
Commuter Train	IM (ASM)	135 kW	Self-ventilation	Truck-mounted 4P - 3 phase - 550 V - 180 A - 2040 rpm Class 200	2
		140 kW	Self-ventilation	Truck-mounted 4P - 3 phase - 490 V - 215 A - 2745 rpm Class 200	4
		190kW(1h)*3	Totally-enclosed	Truck-mounted 4P - 3 phase - 940 V - 134 A - 2080 rpm Class H	12
		140 kW(1h)*3	Self-ventilation	Truck-mounted 4P - 3 phase - 1050 V - 108 A - 2380 rpm Class H	10
		240 kW	Self-ventilation	Truck-mounted 4P - 3 phase - 1380 V - 125 A - 3755 rpm Class H	16
	PMSM	140kW(1h)*3	Totally-enclosed	Truck-mounted 6P – 3 phase – 990V - 153 A -2000 rpm Class 200	7
		190 kW(1h)*3	Totally-enclosed	Truck-mounted 6P - 3 phase - 980 V - 134 A - 2000 rpm Class 200	9
		190kW(1h)*3	Totally-enclosed	Truck-mounted 6P - 3 phase - 990 V - 130 A - 2000 rpm Class 200	8
		205 kW(1h)*3	Totally-enclosed	Truck-mounted 6P - 3 phase - 880 V - 168 A - 2300 rpm Class H	5 , 6
High-Speed Train	IM (ASM)	285 kW	Forced air cooling	Truck-mounted 4P - 3 phase - 1850 V - 112 A - 3400 rpm Class 200	20
Locomotive	IM (ASM)	1150 kW	Forced air cooling	Nose-suspended 6P - 3 phase - 2000 V - 410 A - 1585 rpm Class 200	25
		565 kW(1h)*3	Forced air cooling	Nose-suspended 6P - 3 phase - 1100 V - 370 A - 1470 rpm Class H	22
		1430 kW	Forced air cooling	4P - 3 phase - 1780 V - 552 A - 1663 rpm Class 200	24
	PMSM	80 kW(1h)*3	Totally-enclosed	Nose-suspended 6P - 3 phase - 440 V - 117 A - 550 rpm Class 200	21
Tram	750 V DC	140 kW	Totally-enclosed (Outer fan cooling)	Truck-mounted 6P - 3 phase - 550 V - 206 A - 2770 rpm Class 200	26

*1 : AC Induction Motor (Asynchronous Motor)
*2: Permanent Magnet Synchronous Motor
*3: Rating is 1 hour

Electric Equipment for Kita-Osaka Kyuko Railways 9000 Series, Japan

Toshiba supplied traction system, train information system, auxiliary power system, air-conditioning system, and other electric equipment to Kita-Osaka Kyuko Railways for their 9000 Series commuter cars.

In April 2014, commercial operation has started.

Vehicle Manufacturer	Kinki Sharyo
Operator	Kita-Osaka Kyuko Railways
Start of Supply	2014
Country	Japan
Electric System	750 V DC
Track Gauge	1435 mm
Maximum Operating Speed	70 km/h
Vehicle Weight	322.0 t (Train configuration: 4M6T)

Compact and Light-weight Traction Inverter

Output Power (kW)	170 x 4
Weight (kg)	1300
Dimensions (W x D x H mm)	3850 x 1195 x 674
Cooling Method	Natural cooling

Traction Motor

PMSM

Output Power (kW)	170
Weight (kg)	605
Dimensions (Ø x W mm)	540 x 510
Cooling Method	Totally-enclosed

Electric Equipment for Purple Line, Thailand

In 2015, Toshiba, together with Marubeni Corporation, provided a railway system as a full package, including rolling stock, power supply systems, signaling and control systems and communication systems to the Mass Rapid Transit Authority of Thailand for the Thailand MRT Purple Line. For the train electric equipment, Toshiba provided traction and auxiliary power systems for 21 train sets comprised of 63 cars.

Vehicle Manufacturer	J-TREC (Tokyu Sharyo)
Operator	Bangkok Expressway and Metro Public Company Limited
Start of Supply	2015
Country	Thailand
Electric System	750 V DC
Track Gauge	1435 mm
Maximum Operating Speed	80 km/h
Vehicle Weight	113.8 t (Mc-car: 39.8 t, T-car: 34.2 t, Train configuration: 2M1T)

Traction Inverter

Output Power (kW)	135 x 4
Weight (kg)	900
Dimensions (W x D x H mm)	3850 x 1055 x 710
Cooling Method	Natural cooling

Long and Compact Traction Motor

IM/ASM

Output Power (kW)	135
Weight (kg)	546
Dimensions (Ø x W mm)	436 x 779.5
Cooling Method	Self-ventilation

Auxiliary Power Unit with Dead Battery Starter

Output Power (kW)	140
Weight (kg)	1690
Dimensions (Ø x W mm)	3610 x 850 x 670
Cooling Method	Natural cooling

Electric Equipment for Singapore C151 Series, Singapore

In line with the initiative of Singapore's SMRT Trains Ltd. to refurbish its C151 series trains, Toshiba started to supply PMSM (Permanent Magnet Synchronous Motor) and Traction Inverter for eight C151 series cars in 2015.

Vehicle Manufacturer	Vehicle refurbished by Toshiba
Operator	SMRT Trains Limited
Start of Supply	2015
Country	Singapore
Electric System	750 V DC
Track Gauge	1435 mm
Maximum Operating Speed	80 km/h
Vehicle Weight	222.2 t (Train configuration: 4M2T)

Compact, Light-weight, Line Breaker Equipped Traction Inverter

Output Power (kW)	135 x 4
Weight (kg)	925
Dimensions (W x D x H mm)	2500 x 1660 x 550
Cooling Method	Natural cooling

Traction Motor

PMSM

Output Power (kW)	135
Weight (kg)	585
Dimensions (Ø x W mm)	496 x 720
Cooling Method	Totally-enclosed

Traction System and Train Information Systems for WMATA 7000 Series, USA

Toshiba supplies traction system and train information system for the 7000 Series Railcars of the Washington Metropolitan Area Transit Authority (WMATA) in the Washington DC Area, USA. Base contract is 364 cars.

Vehicle Manufacturer	Kawasaki Rail Car (KRC)
Operator	Washington Metropolitan Area Transit Authority (WMATA)
Start of Supply	2012
Country	USA
Electric System	700 V DC
Track Gauge	1429 mm (4 ft., 8-1/4 in.)
Maximum Operating Speed	121 km/h (75mph)
Vehicle Weight	154 t (340,000 lbs.) (M-car: 38.5 t (85,000 lbs.), Basic train configuration: 4M)

Light-weight Traction Inverter

Output Power (kW)	140 x 4
Weight (kg)	737
Dimensions (W x D x H mm)	2100 x 2360 x 590
Cooling Method	Natural cooling

Light-weight Traction Motor

IM/ASM

Output Power (kW)	140
Weight (kg)	420
Dimensions (Ø x W mm)	546 x 5075
Cooling Method	Self-ventilation

PMSM Traction Systems for Tokyo Metro Co., Ltd., Japan

Toshiba supplied PMSM traction system for 240 commuter cars of Tokyo Metro's 1000 Series.

For 16000 Series, Toshiba also supplied PMSM traction system for 160 commuter cars.

1000 Series

Vehicle Manufacturer	Nippon Sharyo
Operator	Tokyo Metro Co., Ltd.
Start of Supply	2011
Country	Japan
Electric System	600V DC
Track Gauge	1435 mm
Maximum Operating Speed	65 km/h
Vehicle Weight	169.5 t (Train configuration: 2.5M3.5T)

1600 Series

Vehicle Manufacturer	Hitachi, Kawasaki Heavy Industries
Operator	Tokyo Metro Co., Ltd.
Start of Supply	2010
Country	Japan
Electric System	1500V DC
Track Gauge	1500 mm
Maximum Operating Speed	100 km/h
Vehicle Weight	299.8 t (Train configuration: 4M6T)

Traction Inverter for 1000 Series

Output Power (kW)	120 x 4
Weight (kg)	1620
Dimensions (W x D x H mm)	2600 x 2292 x 670
Cooling Method	Natural cooling

Traction Motor for 1000 Series

PMSM

Output Power (kW)	120
Weight (kg)	615
Dimensions (Ø x W mm)	540 x 510
Cooling Method	Totally-enclosed

Traction Inverter for 16000 Series

Output Power (kW)	205 x 4
Weight (kg)	1820
Dimensions (W x D x H mm)	3200 x 2620 x 700
Cooling Method	Natural cooling

Light-weight, High Capacity Traction Motor for 16000 Series

PMSM

Output Power (kW)	205
Weight (kg)	560
Dimensions (Ø x W mm)	600 x 496
Cooling Method	Totally-enclosed

Emergency Battery for 1000 Series

Output Power (kW)	22
Weight (kg)	645
Dimensions (Ø x W mm)	2000 x 760 x 610
Cooling Method	Self-cooling

Electric Equipment for Busan Metro Line 1, Korea

Traction system using permanent magnet synchronous motors (PMSMs) have entered service on the Metro Line 1, operated by the Busan Transportation Corporation in the southeastern Korean city of Busan.
PMSM and other key components in the traction inverters used to control the PMSM system, were delivered to Hyundai Rotem Company, the car manufacturer, via Woojin Industrial System Co., Ltd. With this system, the trains are able to achieve a reduction of power consumption of over 30% compared to conventional traction systems.

Vehicle Manufacturer	Hyundai Rotem Company
Operator	Busan Transportation Corporation
Start of Supply	2018
Country	Korea
Electric System	1500 V DC
Track Gauge	1435 mm
Maximum Operating Speed	80 km/h
Vehicle Weight	250 t / 4M4T

Traction Inverter

Manufactured with Woojin Industrial System Co., Ltd.

Output Power (kW)	150 x 4
Weight (kg)	660
Dimensions (W x D x H mm)	2080 x 730 x 695
Cooling Method	Natural cooling

Traction Motor

PMSM

Output Power (kW)	140
Weight (kg)	625
Dimensions (Ø x W mm)	540 x 515
Cooling Method	Totally-enclosed

Electric Equipment for Tobu Railway Co., Ltd. 500 Series, Japan

Toshiba supplied PMSM traction system for Tobu 500 Series.

Regenerative energy of the PMSM main circuit system is used to improve the train operation performance throughout the line. This allows also the train to run on sections with step gradient in mountain areas.

Vehicle Manufacturer	Kawasaki Heavy Industries
Operator	Tobu Railway Co., Ltd.
Start of Supply	2017
Country	Japan
Electric System	1500V DC
Track Gauge	1067 mm
Maximum Operating Speed	120 km/h
Vehicle Weight	119.7t/ 2M1T

Traction Inverter

Output Power (kW)	190 x 4
Weight (kg)	620
Dimensions (W x D x H mm)	1980 x 1103.4 x 700
Cooling Method	Natural cooling

Traction Motor

PMSM

Output Power (kW)	190
Weight (kg)	637
Dimensions (Ø x W mm)	540 x 524.5
Cooling Method	Totally-enclosed

PMSM System for Hankyu Railways 1000 Series, Japan

Toshiba supplied PMSM traction system, train information system, and auxiliary power system for 1000 Series commuter cars of Hankyu Railways.

Vehicle Manufacturer	Hitachi
Operator	Hankyu Railways
Start of Supply	2013
Country	Japan
Electric System	1500 V DC
Track Gauge	1435 mm
Maximum Operating Speed	115 km/h
Vehicle Weight	251.4 t (Train Configuration: 4M4T)

4-in-1 Traction Inverter

Output Power (kW)	190 x 4
Weight (kg)	1190
Dimensions (W x D x H mm)	3750 × 1070 × 700
Cooling Method	Natural cooling

High-capacity Traction Motor

PMSM

Output Power (kW)	190
Weight (kg)	635
Dimensions (Ø x W mm)	540 x 566.5
Cooling Method	Totally-enclosed (Outer fan cooling)

Electric Equipment for JR East E235 Series, Japan

Toshiba supplied East Japan Railway Company electrical equipment comprising of auxiliary power system, traction motor, and traction inverters for the E235 Series Railcars.

Vehicle Manufacturer	J-TREC (Japan Transport Engineering Company)
Operator	JR East (East Japan Railway Company)
Start of Supply	2015
Country	Japan
Electric System	1500V DC
Track Gauge	1067 mm
Maximum Operating Speed	120 km/h
Vehicle Weight	342 t (Train configuration: 6M5T)

High Efficiency SiC Traction Inverter

Output Power (kW)	140 x 4
Weight (kg)	410
Dimensions (W x D x H mm)	1750 x 1124 x 690
Cooling Method	Natural cooling

High Efficiency Traction Motor

IM/ASM

Output Power (kW)	140
Weight (kg)	530
Dimensions (Ø x W mm)	540 x 621.5
Cooling Method	Self-ventilation

High Redundancy and Low Noise Auxiliary Power Unit

Output Power (kW)	260
Weight (kg)	2365
Dimensions (W x D x H mm)	2315 × 2290 × 700
Cooling Method	Natural cooling

Electric Equipment for Nishi-Nippon Railroad Co., Ltd. 3000 Series, Japan

Toshiba supplied traction system, auxiliary power system, train information system, ATS system, air- conditioning system, and other electric equipment for 60 cars of Nishi-Nippon Railroad Co., Ltd.

Vehicle Manufacturer	Kawasaki Heavy Industries
Operator	Nishi-Nippon Railroad Co., Ltd.
Start of Supply	2006
Country	Japan
Electric System	1500 V DC
Track Gauge	1435 mm
Maximum Operating Speed	100 km/h
Vehicle Weight	Front car: 26-28 t, Middle cars: 35 t, (3 train configurations: Mc-Tc, Tc1-M-Tc2, Tc1-M1-T-M2-Tc2)

Triple Mode Type Combined Power Conversion Unit

Output Power (kW)	175 x 4
Static Inverter Capacity (kVA)	80
Weight (kg)	1306
Dimensions (W x D x H mm)	4040 x 900 x 700
Cooling Method	Natural cooling

Traction Motor

IM/ASM

Output Power (kW)	175
Weight (kg)	650
Dimensions (Ø x W mm)	540 x 682
Cooling Method	Totally-enclosed (Outer fan cooling)

Electric Equipment for Nishi-Nippon Railroad CO., Ltd. 9000 Series, Japan

Toshiba supplied traction system, master controller, air-conditioning system and ATS(Automatic Train Stop) system for the 9000 Series trains.
Energy savings and low maintenance were achieved through the use of traction converter using SiC (Silicon Carbide) and high-efficiency asynchronous motors installed in the main circuit system.
Traction inverter and auxiliary power unit are mounted in the same unit, which makes the system works on “triple-mode”(1C2M-VVVF, 1C4M-VVVF or CVCF control). Thus, reliability can be achieved in case of failure.

Vehicle Manufacturer	Kawasaki Heavy Industries
Operator	Nishi-Nippon Railroad CO., Ltd
Start of Supply	2017
Country	Japan
Electric System	1500V DC
Track Gauge	1435 mm
Maximum Operating Speed	110 km/h
Vehicle Weight	60.6t/ 1M1T 90.7t/ 1M2T

Triple Mode Type Combined Power Conversion Unit

Output Power (kW)	175 x 4
Weight (kg)	1300
Dimensions (W x D x H mm)	3740 x 900 x 700
Cooling Method	Natural cooling

Traction Motor

IM/ASM

Output Power (kW)	175
Weight (kg)	650
Dimensions (Ø x W mm)	420 x 618
Cooling Method	Totally-enclosed (Outer fan cooling)

Electric Equipment for Tokyu Corporation 7500 • 7550 Series, Japan

In 2012, Toshiba supplied traction motors and combined power conversion units to J-TREC for their 7500 Series power car and 7550 Series inspection car.

7550 Series

7500 Series

Vehicle Manufacturer	J-TREC (Tokyu Sharyo)
Operator	Tokyu Corporation
Start of Supply	2012
Country	Japan
Electric System	1500 V DC
Track Gauge	1067 mm
Maximum Operating Speed	110 km/h
Vehicle Weight	7500 Series: 36.1 t 7550 Series: 37.7 t

Combined Power Conversion Unit with Standby Redundancy Mode

Output Power (kW)	190 x 4
Static Inverter Capacity (kVA)	80
Weight (kg)	1135
Dimensions (W x D x H mm)	3350 x 1150 x 700
Cooling Method	Natural cooling

High-capacity Traction Motor

IM/ASM

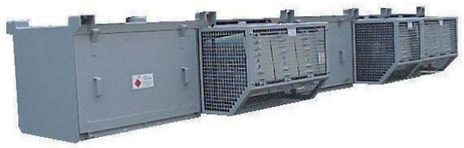
Output Power (kW)	190
Weight (kg)	690
Dimensions (Ø x W mm)	610 x 637.5
Cooling Method	Totally-enclosed (Outer fan cooling)

Electric Equipment for Tianjin Binhai Mass Transit Tianjin Binhai Line, China

In 2003, Toshiba supplied traction system, auxiliary power system, train information system for Tianjin Binhai Mass Transit’ s Tianjin Binhai Line.

Vehicle Manufacturer	CNR-Changchun Railway Vehicles
Operator	Tianjin Binhai Mass Transit
Start of Supply	2003
Country	China
Electric System	1500 V DC
Track Gauge	1435 mm
Maximum Operating Speed	100 km/h
Vehicle Weight	146.2 t (Mc-car: 39.7 t, T-car: 33.4 t, Train configuration: 2M2T)

Line Breaker Equipped Traction Inverter



Output Power (kW)	200 x 4
Weight (kg)	1050
Dimensions (W x D x H mm)	4200 x 1145 x 650
Cooling Method	Natural cooling

Voltage Divider Type Auxiliary Power Unit

Output Power (kW)	140
Weight (kg)	1630
Dimensions (Ø x W mm)	3500 x 850 x 650
Cooling Method	Natural cooling

High-capacity Traction Motor

IM/ASM

Output Power (kW)	200
Weight (kg)	670
Dimensions (Ø x W mm)	540 x 637
Cooling Method	Self-ventilation

Electric Equipment for CENTRAL 3000 Series, Brazil

Starting 2011, Toshiba has been supplying Rio de Janeiro State Company of Engineering of Transport and Logistics of Brazil with electric equipment (traction inverters, traction motors, auxiliary power systems, and train information systems) for their 3000 Series cars. In total, electric equipment for 400 cars will be supplied.

Vehicle Manufacturer	CNR Changchun Railway Vehicles Co., Ltd.
Operator	SuperVia
Start of Supply	2011
Country	Brazil
Electric System	3000 V DC
Track Gauge	1600 mm
Maximum Operating Speed	100 km/h
Vehicle Weight	183.26 t (Mc-car: 48.0 t, T-car: 43.63 t, Train configuration : 2M2T)

Traction Inverter

Output Power (kW)	210 x 4
Weight (kg)	1400
Dimensions (W x D x H mm)	2900 x 1500 x 650
Cooling Method	Forced air cooling

High-capacity Traction Motor

IM/ASM

Output Power (kW)	210
Weight (kg)	750
Dimensions (Ø x W mm)	554 x 665.5
Cooling Method	Self-ventilation

2 Level Auxiliary Power Unit

Output Power (kW)	206
Weight (kg)	2550
Dimensions (W x D x H mm)	3100 x 1650 x 650
Cooling Method	Forced air cooling

Electric Equipment for Caracas Suburban Railway, Venezuela

Toshiba provided a railway system comprising of traction system, auxiliary power system, train information system and air conditioning system to Instituto Ferrocarriles del Estado for Venezuela Railways in 2014. Among these systems, Toshiba provided traction converters, traction motors, and auxiliary power supplies to 52 cars.

Vehicle Manufacturer	Nippon Sharyo, Ltd.
Operator	IFE (Instituto Ferrocarriles del Estado)
Start of Supply	2014
Country	Venezuela
Electric System	25 kV AC
Track Gauge	1435 mm
Maximum Operating Speed	100 km/h
Vehicle Weight	186 t (Tc-car: 44 t, M-car: 49 t, Train Configuration: 2M2T)

Traction Inverter for Caracas

Output Power (kW)	240 x 4
Weight (kg)	2900
Dimensions (W x D x H mm)	3980 x 2760 x 700
Cooling Method	Natural cooling

Traction Motor for Caracas

IM/ASM

Output Power (kW)	240
Weight (kg)	610
Dimensions (Ø x W mm)	540 x 510
Cooling Method	Self-ventilation

Auxiliary Power Unit for Caracas

Output Power (kW)	110
Weight (kg)	1390
Dimensions (Ø x W mm)	3050 x 1100 x 700
Cooling Method	Forced ventilation

Electric Equipment for Taiwan Railway Administration EMU800 & TEMU2000, Taiwan

Toshiba provided electric equipment consisting of main transformer, traction converter inverter, traction motor, auxiliary power supply, and train information system to Taiwan Railway Administration for 296 cars of EMU800 series train and 136 cars of TEMU2000 series.

EMU800

TEMU200

	EMU800	TEMU200
Vehicle Manufacturer	Nippon Sharyo/ Taiwan Rolling Stock	Nippon Sharyo
Operator	Taiwan Railway Administration	
Start of Supply	2013	2012
Country	Taiwan	
Electric System	25,000 V AC – 60 Hz	
Track Gauge	1067 mm	
Maximum Operating Speed	130 km/h	140 km/h
Vehicle Weight	330 t (Train Configuration: 4M4T)	332 t

Electric Equipment for JR West TWILIGHT EXPRESS MIZUKAZE, Japan

Toshiba and JR West developed a new small hybrid propulsion system to fit the luxury sleeper train design.
(i.e., traction system using electricity from a diesel generator and traction battery system)
The traction converters can be installed on the roof of the train, thanks to its compacted design using water cooling system.
Traction motor is also totally enclosed, which allows bearing replacement without disassembling it, thereby minimizing maintenance requirements and noise.

Vehicle Manufacturer	Kinki Sharyo/ Kawasaki Heavy Industries
Operator	JR West (West Japan Railway Company)
Start of Supply	2017
Country	Japan
Electric System	Diesel Electric Hybrid (600 V DC)
Track Gauge	1067 mm
Maximum Operating Speed	110 km/h
Vehicle Weight	485.8 t/ 4M6T

Main Transformer

Output Power (kW)	1980
Weight (kg)	3450
Dimensions (W x D x H mm)	3175 x 2325 x 720
Cooling Method	Forced oil cooling

Traction Converter Inverter

Output Power (kW)	200 x 4
Weight (kg)	1280
Dimensions (Ø x W mm)	4200 x 794 x 770
Cooling Method	Natural cooling

Compact Traction Converter Inverter

Output Power (kW)	130 x 4
Weight (kg)	1420
Dimensions (W x D x H mm)	3450 x 1600 x 715
Cooling Method	Water cooling

Compact Traction Motor

IM/ASM

Output Power (kW)	130
Weight (kg)	585
Dimensions (Ø x W mm)	524 x 548
Cooling Method	Totally-enclosed

High-capacity Traction Motor

IM/ASM

Output Power (kW)	220
Weight (kg)	580
Dimensions (W x D x H mm)	540 x 550
Cooling Method	Self-ventilation

Light-weight, High-Capacity Auxiliary Power Unit

Output Power (kW)	195
Weight (kg)	1090
Dimensions (Ø x W mm)	3500 x 844 x 650
Cooling Method	Natural cooling

Traction Battery

Output Power (kW)	20 x 2
Weight (kg)	1670
Dimensions (Ø x W mm)	1810 x 2100 x 650
Cooling Method	Forced air cooling

Electric Equipment for JR East TRAIN SUITE SHIKI-SHIMA, Japan

Toshiba supplied a traction system for East Japan Railway Company' s flagship cruise train.

The system is bi-mode (electric and diesel) and multi-tension (1500 V DC, 20kV AC 50Hz-60Hz, 25 kV AC 50Hz). Therefore, it is able to run on both various electrified tracks and non-electrified sections.

Photo courtesy of East Japan Railway Company

Vehicle Manufacturer	Kawasaki Heavy Industries/ J-TREC (Japan Transport Engineering Company)
Operator	JR East (East Japan Railway Company)
Start of Supply	2017
Country	Japan
Electric System	Diesel Electric / 1500 V DC 20,000 V AC – 50Hz/60Hz 25,000 V AC – 50Hz
Track Gauge	1067 mm
Maximum Operating Speed	110 km/h
Vehicle Weight/ Train configuration	536.7 t/ 6M4T

High Speed Rail System for Taiwan High Speed Rail Corporation 700T Series, Taiwan

This is Toshiba' s pioneer high-speed rail overseas project. Starting 2004, Toshiba supplied Taiwan High Speed Rail Corporation with a high-speed rail system (traction system, auxiliary power system, train information system, air-conditioning system, and etc.) as a turn-key contractor for 360 cars.

Vehicle Manufacturer	Kawasaki Heavy Industries/ Nippon Sharyo/Hitachi
Operator	Taiwan High Speed Rail Corporation
Start of Supply	2007
Country	Taiwan
Electric System	25,000 V AC – 60 Hz
Track Gauge	1435mm
Maximum Operating Speed	300 km/h
Vehicle Weight	503 t

Asynchronous generator

Output Power (kWA)	1247
Weight (kg)	3410
Dimensions (Ø x W mm)	850.9 x 1177
Cooling Method	Natural cooling

Traction Converter Inverter

Output Power (kW)	143.5 x 4
Weight (kg)	1670
Dimensions (W x D x H mm)	2750 x 2490 x 690
Cooling Method	Natural cooling

Traction Converter Inverter

Output Power (kW)	285 x 4
Weight (kg)	1675
Dimensions (W x D x H mm)	3200 x 2300 x 640
Cooling Method	Forced air cooling

Compact, Light-weight Traction Motor

IM/ASM

Output Power (kW)	285
Weight (kg)	397.5
Dimensions (Ø x W mm)	520 x 512
Cooling Method	Forced air cooling

Light-weight Auxiliary Power Unit

Capacity	DC: 36kW AC: 5 kVA
Weight (kg)	645
Dimensions (W x D x H mm)	2400 x 850 x 640
Cooling Method	Natural cooling

Class HD300 Diesel Hybrid Shunting Locomotive for Japan Freight Railway Co., Japan

The Class HD300 is a hybrid diesel/battery Bo-Bo wheel arrangement shunting locomotive type operated by Japan Freight Railway Company (JR Freight) in Japan. Following the delivery and evaluation of a prototype locomotive in March 2010, the first full-production locomotive entered service in February 2012. Toshiba has currently supplied 16 cars, and still continues to supply production cars. Powering is possible even with just the battery. Energy not regenerated during braking is stored in the batteries.

Vehicle Manufacturer	Toshiba
Operator	Japan Freight Railway Company
Start of Supply	2010
Country	Japan
Electric System	Diesel Electric Hybrid (750 V DC)
Track Gauge	1067 mm
Maximum Operating Speed	55 km/h (At no-load condition: 110km/h)
Vehicle Weight	60.0 t

Engine

Manufacturer	Cummins Inc.
Output Power (kW)	242
Weight (kg)	738
Rotating Speed (rpm)	1600

Induction Generator

Output Power (kW)	160
Weight (kg)	756
Cooling Method	Natural cooling

Compact and Light-weight Traction Inverter

Traction Inverter Output Power (kW)	80 x 4
Auxiliary Power Unit Capacity (kVA)	55
Weight (kg)	2970
Dimensions (W x D x H mm)	2875 x 1600 x 1600
Cooling Method	Natural cooling

Traction Motor

PMSM

Output Power (kW)	80
Weight (kg)	1245
Dimensions (Ø x W mm)	630 x 685
Cooling Method	Totally-enclosed

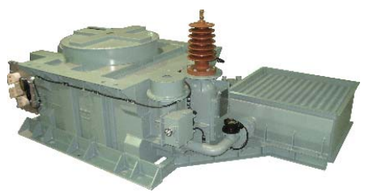
Class EH800 Electric Locomotive for Japan Freight Railway Co., Japan

Toshiba developed together with JR Freight the EH800 series locomotive.
Seamless run is possible on shared Shinkansen tracks (AC25kV) as well as on standard tracks (AC20kV).

Two traction converter inverter are installed on the locomotive, each of them controlling two traction motors.
In the event of a failure of one traction converter inverter, the remaining one can still provide power to the locomotive.

Vehicle Manufacturer	Toshiba
Operator	Japan Freight Railway Company
Start of Supply	2013
Country	Japan
Electric System	25,000 V AC - 50 Hz 20,000 V AC – 50 Hz
Track Gauge	1067 mm
Maximum Operating Speed	110 km/h
Vehicle Weight	134.4 t (16.8 t/axle)

Main Transformer



Capacity (kVA)	2598
Weight (kg)	3850
Dimensions (W x D x H mm)	2967 x 1875 x 1286
Cooling Method	Forced oil cooling

Traction Converter Inverter

Output Power (kW)	565 x 2
Weight (kg)	2400
Dimensions (Ø x W mm)	3200 x 900 x 1750
Cooling Method	Forced air cooling

Traction Motor

Output Power (kW)	565
Weight (kg)	1603
Dimensions (W x D x H mm)	758 x 596.5
Cooling Method	Forced air cooling

Auxiliary

Output Power (kW)	150
Weight (kg)	2200
Dimensions (W x D x H mm)	1500 x 2450 x 815
Cooling Method	Forced air cooling

Electric Equipment for Locomotives of China Railway Corporation, China

Dalian Toshiba Locomotive Electric Equipment Co., Ltd (DTL), a joint company by Toshiba and CRRC DALIAN, supplied power converters, traction motors, and train information system to China Railway Corporation for their HXD3, HXD3A, HXD3C, and HXD3D Series locomotive cars.
There are more than 2000 cars currently in service, including the HXD3D Series produced by CRRC DALIAN shown in the photo above.

Vehicle Manufacturer	CNR-Dalian Locomotive and Rolling Stock Co., Ltd.
Operator	China Railway Corporation
Start of Supply	2012
Country	China
Electric System	25,000 V AC – 50 Hz
Track Gauge	1435 mm
Maximum Operating Speed	160 km/h
Vehicle Weight	126 t

Power Converter for HXD3D

Main Power Unit (MPU) Output Power (kW)	1250 x 3
Auxiliary Power Unit (APU) Capacity (kVA)	230
Weight (kg)	3400 + coolant (200)
Dimensions (W x D x H mm)	3900 x 960 x 2050
Cooling Method	Water cooling

Light-weight, Membrane Coupling type Traction Motor

IM/ASM

Output Power (kW)	1250
Weight (kg)	2150
Dimensions (ϕ x W mm)	815 x 837.5
Cooling Method	Forced air cooling

Electric Equipment for Locomotives of China Railway Corporation, China

Dalian Toshiba Locomotive Electric Equipment Co., Ltd (DTL), a joint company by Toshiba and CRRC DALIAN, supplied power converters, traction motors, and transformers to China Railway Corporation for locomotive pulling passenger train.

Thanks to these key components, the successful development of this locomotive was an important mark of modernization of China railway equipment locomotive technology, and meets the demand for passenger transportation at 200km/h.

Vehicle Manufacturer	CRRC Dalian Locomotive and Rolling Stock Co., Ltd.
Operator	China Railway Corporation
Start of Supply	2017
Country	China
Electric System	25 kV AC – 50 Hz
Track Gauge	1435 mm
Maximum Operating Speed	200 km/h
Vehicle Weight	156 t

Main Transformer

Capacity (kVA)	7051
Weight (kg)	8600
Dimensions (W x D x H mm)	2560 x 2920 x 930
Cooling Method	Forced oil cooling

Traction Motor

IM/ASM

Output Power (kW)	1430
Weight (kg)	2180
Dimensions (Ø x W mm)	835 x 796
Cooling Method	Forced air cooling

Power Converter

Main Power Unit (MPU) Output Power (kW)	1400 x 3
Auxiliary Power Unit (APU) Capacity (kVA)	230
Weight (kg)	2490 + coolant (200)
Dimensions (W x D x H mm)	3280 x 860 x 2050
Cooling Method	Water cooling

Electric Equipment for Korail Class 8500 Electric Locomotive, Korea

Korea Railroad Corporation (Korail) has replaced its older electric locomotives with the new 8500 Series. Toshiba supplied major equipment for the new locomotives, including the main transformers, power converters, traction motors, wheel sets, and cooling blowers.

Vehicle Manufacturer	Hyundai Rotem
Operator	Korail
Start of Supply	2011
Country	Korea
Electric System	25,000 V AC – 60 Hz
Track Gauge	1435 mm
Maximum Operating Speed	150 km/h
Vehicle Weight	132 t (22 t/axle)

Power Converter

Main Power Unit (MPU) Output Power (kW)	1150 x 3
Auxiliary Power Unit (APU) Capacity (kVA)	230
Weight (kg)	3550 + coolant (200)
Dimensions (W x D x H mm)	4000 x 1020 x 2050
Cooling Method	Water cooling

Light-weight, Membrane Coupling typeTraction Motor

IM/ASM

Output Power (kW)	1150
Weight (kg)	2150
Dimensions (ϕ x W mm)	800 x 800
Cooling Method	Forced air cooling

Electric Equipment for Minneapolis Metropolitan Council Blue (Hiawatha) Line, USA

In 2004, Toshiba supplied Minneapolis Metropolitan Council with low floor type Ⅸ(roof-mounted) Combined Power Conversion Unit (C-PCU) and traction motors for 27 vehicles.

Vehicle Manufacturer	Bombardier
Operator	Minneapolis Metropolitan Council
Start of Supply	2004
Country	USA
Electric System	750 V DC
Track Gauge	1435 mm
Maximum Operating Speed	89 km/h (55 mph)
Vehicle Weight	105 ton (210,000 lbs.) (M-car: 52.5 ton (105,000 lbs.), Basic Train Configuration: 2M)

Compact and Light-weight Traction Inverter

Traction Inverter Output Power (kW)	140 x 2
Auxiliary Power Unit Capacity (kVA)	30
Weight (kg)	685
Dimensions (W x D x H mm)	1600 x 1800 x 500
Cooling Method	Forced air cooling

Traction Motor

IM/ASM

Output Power (kW)	140
Weight (kg)	470
Dimensions (W x D x H mm)	470 x 654
Cooling Method	Totally-enclosed (Outer fan cooling)