6616 Torex Semiconductor

Sessa Investment Research

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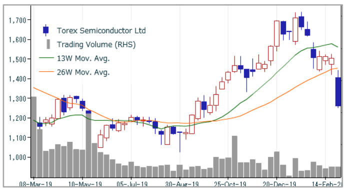
March 9, 2020

Initiation Report

Key Indicators	
Share price (3/5)	1,219
YH (20/1/14)	1,743
YL (19/5/21)	982
10YH (14/11/6)	3,187.5
10YL (14/5/20)	725.8
Mkt cap (¥ bn)	14.09
Shares out. (mn)	11.55
Equity ratio (Sep 30)	71.4%
Treas. shrs (Sep 30)	5.3%
Net cash / mkt cap	35.6%
FY3/20 P/E (CE)	24.1x
FY3/19 P/B (act)	0.70x
FY3/19 ROE (act)	6.15%
FY3/20 DY (CE)	3.28%

Share price 52 weeks



Source: SPEEDA

Chris Schreiber CFA
Company Specialist
research@sessapartners.co.jp

Power management IC specialist pursuing growth opportunities from IoT and the electrification of cars

SUMMARY

'Powerfully Small': Rising star in the global market for power management ICs

Torex Semiconductor has world-class design capability in power management ICs, featuring proprietary Ultra-Small Package (USP) technology and high energy efficiency. The Group has a unique business model comprised of fabless design and sales of power management ICs by Torex, complemented by wholly owned subsidiary Phenitec's sole foundry service in Japan, employing CMOS process for discrete and power semiconductors. In addition to providing custom consignment manufacturing per customer specifications, Phenitec also offers production of original in-house developed products. Over the last 3 years since acquiring Phenitec, the Group has achieved an average EBITDA margin of 11.9%, and it is significant that the Group managed to raise its stake in Phenitec to 100%, while deploying a major capex program to integrate Phenitec's Head Office Plant and Daiichi (No.1) Plant, all while raising the FY3/19 shareholders' equity ratio to 69.0%, with net cash equivalent to one-third of shareholders' equity.

IoT, 5G and the electrification of cars are entering high-growth periods

Microcontroller unit (MCUs) and automotive ECU modules incorporate power supplies which require power management ICs, and they are set to get a strong boost in demand from growth in the number of worldwide IoT-connected devices accelerating, global deployment of 5G infrastructure ramping up sharply over the next 3 years, and sales of BEVs and PHEVs entering a new high growth period. The Torex Group is focusing efforts on capturing the opportunities from these promising areas.

YoY Profit growth to resume 2H 3/21 on Phenitec utilization recovery

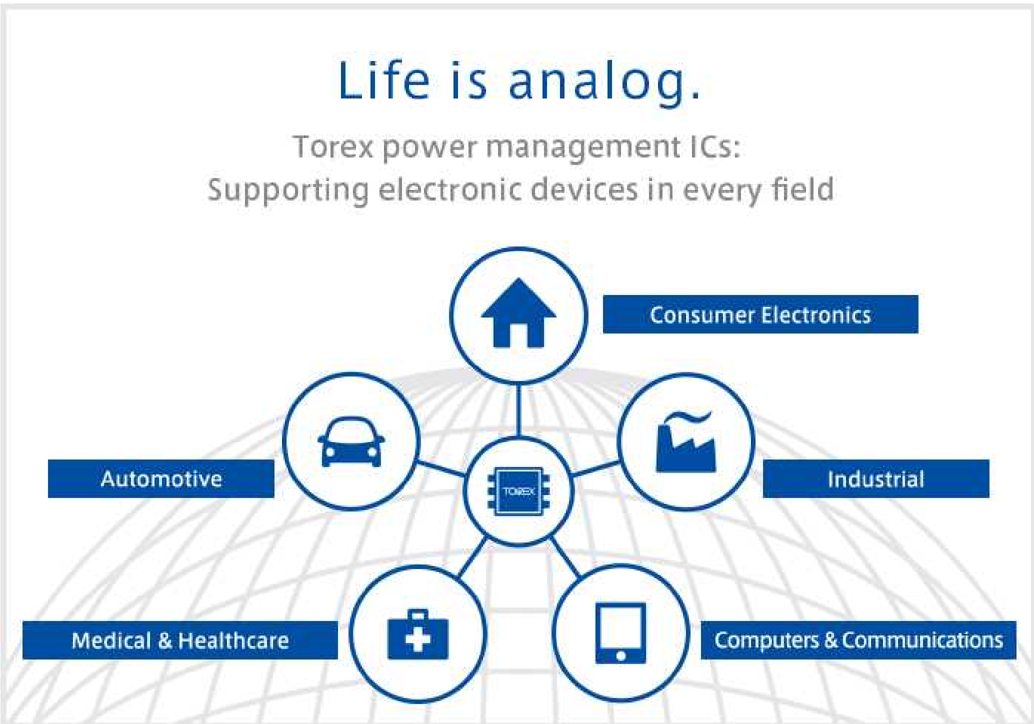
Despite the high growth profile over the next 5 years, short-term there are stiff headwinds from the slowdown in global trade stemming from the US-China trade war, the rapid spread of the novel coronavirus affecting global supply chains, and a long overdue cyclical adjustment following the record expansion period since the global financial crisis. FY3/20 profits are under pressure due to the decline in utilization rates at Phenitec, coupled with a 42% YoY increase in depreciation associated with major capex integrating Phenitec's two main plants. During 1H 3/20, the company implemented a 5.2% share buyback, demonstrating that its strong net cash B/S is well-positioned to weather the current downturn. Both the Chairman and President are among the top 10 shareholders, and the average consolidated payout ratio of 36.9% over the last 2 years with consecutive dividend hikes is indicative of management's continuing efforts to achieve its stated policy of targeting DOE of roughly 3.0%.

Torex Semiconductor Consolidated Earnings Trend

JPY mn, %	Net Sales	YoY %	EBITDA	margin %	Oper Profit	YoY %	Ord Profit	Profit ATOP	YoY %
FY3/14 act	9,391	9.2	1,882	20.0	1,414	149.5	1,339	1,357	607.7
FY3/15 act	9,972	6.2	1,753	17.6	1,350	(4.5)	1,679	1,248	(8.1)
FY3/16 act	10,621	6.5	1,581	14.9	1,140	(15.6)	971	580	(53.5)
→ *Phenitec consolidated*									
FY3/17 act	21,560	—	2,470	11.5	1,251	—	906	2,931	—
FY3/18 act	23,997	11.3	3,146	13.1	2,212	76.8	1,998	902	(69.2)
FY3/19 act	23,897	(0.4)	2,636	11.0	1,551	(29.9)	1,820	1,049	16.3
FY3/20 revised CE	22,000	(7.9)	2,382	10.8	850	(45.2)	800	550	(47.6)

JPY mn, %	EPS (¥)	Div. Pmt	DPS (¥)	Share. Equity	BPS (¥)	Average Shr Eqty	ROE %	DOE %	Payout %
FY3/14 act	148.0	91	40.0	7,869	858.3	7,122	19.1	1.3	6.8
FY3/15 act	118.1	291	110.0	10,844	1,020.9	9,357	13.3	3.1	23.3
FY3/16 act	54.6	340	32.0	10,885	1,022.3	10,865	5.3	3.1	58.6
→ *Phenitec consolidated*									
FY3/17 act	308.8	305	32.0	11,432	1,267.7	11,159	26.3	2.7	10.7
FY3/18 act	99.4	341	34.0	14,503	1,338.7	12,968	7.0	2.6	34.2
FY3/19 act	95.9	425	38.0	19,594	1,717.9	17,049	6.2	2.5	39.6
FY3/20 revised CE	50.5	—	40.0	—	—	—	—	2.2	79.2

*Note: act = actual, CE = company estimates.
Figures shown here are rounded to the nearest million yen.



TOREX
Phenitec

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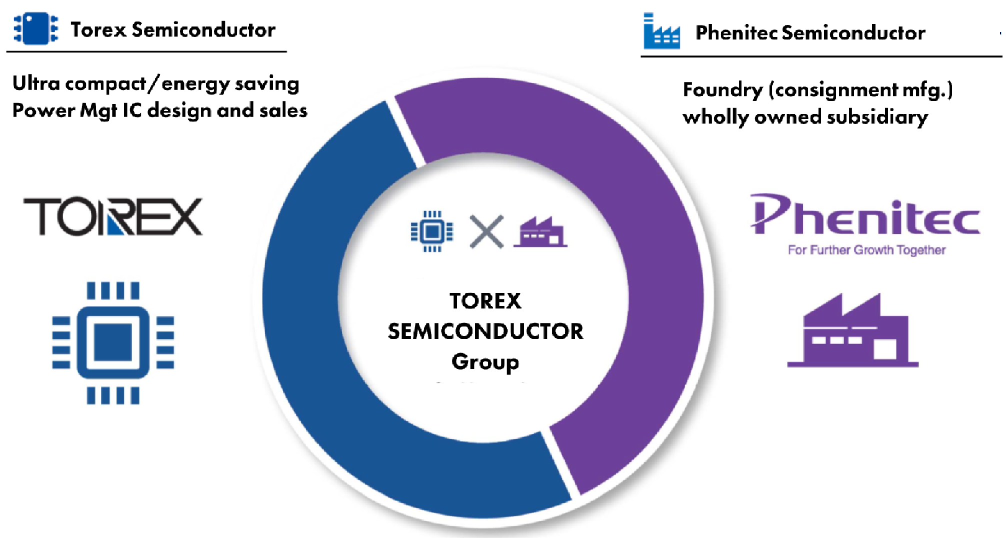
❶ Company Profile and Business Model

Torex Semiconductor Group Overview

In March 2020, the company will celebrate its 25TH anniversary since founding. As shown in the graphic below, the Torex Group has a unique business model, with Torex on the one hand having a fabless business model specializing in the design and sales of analog ICs, specifically power management ICs, which are ICs used to control the voltage supplied to various electronic components, and they are used in not only the company's focus applications of industrial equipment and automotive, but they are also used in all types of consumer electronics and other applications. Voltage transmitted from dry cell or automotive batteries has subtle fluctuations due to decreases in stored electrical energy and changes in the environment such as temperature and electromagnetic noise. If voltage is left unregulated, it may lead to malfunction of electronic equipment, and therefore power management ICs are indispensable for all types of electronic components. The introduction to an old corporate brochure uses the analogy that a where a CPU is the 'brain' of an electronic device, the power supply is its 'heart.' All microcontroller and ECU units/modules which have a power supply require power management ICs, and the medium-term demand outlook is bright with growth in the number of IoT-connected devices accelerating, 5G infrastructure set to ramp up globally, and diffusion of electric vehicles entering a new growth phase.

Phenitec on the other hand offers a unique foundry service in Japan using CMOS process technology for discrete and power semiconductors. Its comprehensive front end wafer processing services include: 1) consignment manufacturing of custom products to customer specifications, 2) production of in-house developed original products, and 3) various partial micromachining of silicon wafers such as laser trimming, test & probe, back surface processing and dicing. By providing foundry solutions to meet customer needs, Phenitec is achieving low cost, high quality products. As the table on the next page shows, Phenitec was founded in October 1968 as Shinko Electric Co., Ltd., celebrating its 50TH anniversary since founding last October. It began manufacturing discrete devices in the late 1970s and early 1980s, with a commitment to Total Productive Maintenance (TPM) activities and emphasis on continually raising quality standards.



Source: company business briefing presentation materials

Phenitec Corporate History

Date	Event / Milestone
1968/10	Shinko Electric Co., Ltd. established in Ibara, Okayama Pref.
1976/3	Diode device manufacturing commenced
1983/12	Zener diode device manufacturing commenced
1984/9	Transistor device manufacturing commenced
1988/5	Total Productive Maintenance (TPM) activities commenced
1989/5	EPI (epitaxial wafer) Plant completed
1990/8	Daiichi (No.1) Plant Fab-1 completed, power MOS, CMOS production commenced
1990/9	Received the PM Business Excellence award
1990/10	Bipolar IC manufacturing commenced
1997/8	Obtained ISO 9002 certification, JQA-1829
1998/10	Company name changed to Phenitec Semiconductor co., Ltd.
1998/11	QS9000: obtained 1998 certification
1999/10	Obtained VDA6 certification (German version of QS9000)
1999/12	Daiichi (No.1) Plant Fab-2 completed
2001/8	Mass production commenced on 6-inch line
2002/4	Obtained ISO 14001 certification
2002/8	Kyoto Design Center established
2003/11	Upgrade to ISO 9001 certification
2003/12	Daiichi (No.1) Plant Fab-3 completed
2004/5	ISO/TS16949: obtained 2002 certification
2015/10	Acquired Kagoshima Plant from Yamaha Corp., commenced production
2016/4	Concluded a capital alliance with Torex Semiconductor, becoming a subsidiary
2017/4	ISO 14001: obtained 2015 certification
2018/4	Increased capital to JPY 1.6 billion, Torex stakeraised to 69.1%
2018/8	Daiichi (No.1) Plant Fab-4 completed
2018/9	IATF16949: obtained 2016 certification (Head Office Plant, Daiichi Plant)
2018/11	ISO9001: obtained 2015 certification

Source: Phenitec website

Torex Semiconductor Group Corporate History

The history of the company began in October 1989 when the former Torex Semiconductor Co., Ltd. was established as a company responsible for sales of the foundry business of Shinko Electric Co., Ltd. (currently Phenitec Semiconductor Co., Ltd.). In order to expand the company's business scale, it was necessary to develop core business other than foundry sales, so the company focused on the field of analog power supply ICs, an under-covered area by major semiconductor manufacturers. The decision to focus on analog power supply ICs was due to expectations that the development of final applications that run on batteries would accelerate in the future, and for such products, multiple analog power supply ICs would be required to control battery power management.

In 1992 the company launched the XC61AN series voltage detector offering extremely precise detection and low power consumption. The XC61AN series was introduced for use on a portable cassette player with nickel-hydrogen rechargeable batteries. At the time, the ability to accurately detect the minimum 0.8V needed to run the player was a highly requested feature, and meeting this requirement made much longer play time possible.

XC61AN Series High Precision Low Power Consumption Voltage Detector

Torex Corporate History

Date	Event / Milestone
1995/3	Established as a subsidiary of Shinko Electric Co., Ltd. (currently Phenitec Semiconductor Co., Ltd.) in Ibara, Okayama Pref. Established head office in Echujima, Koto-ku, Tokyo
1996/11	Established TOREX SEMICONDUCTOR (S) PTE LTD in Singapore as the first overseas base
1997/3	Established Torex Device Co., Ltd.
2000/6	Established TOREX SEMICONDUCTOR DEVICE (HONG KONG) LIMITED (currently ISM ASIA LIMITED)
2000/9	Established TOREX USA Corp.
2001/3	Established TOREX SEMICONDUCTOR EUROPE LIMITED
2002/5	Made TOREX SEMICONDUCTOR (S) PTE LTD a wholly owned subsidiary
2002/8	Head office moved to Nihonbashi Kayabacho, Chuo-ku, Tokyo
2002/10	Established Kansai branch office in Ibaraki, Osaka
2003/3	Obtained ISO 14001 certification (head office)
2003/5	Established Shanghai office
2004/4	Opened Sapporo Technology Center in Sapporo, Hokkaido
2004/6	Reorganized the Shanghai office, and established (TOREX SEMICONDUCTOR DEVICE (Shanghai) CO., LTD.)
2005/12	Established Taiwan office Opened Kanto West Sales Office in Tachikawa, Tokyo
2006/3	Kansai branch office moved to Yodogawa-ku, Osaka
2006/10	Absorbed through merger Torex Device Co., Ltd. Due to the absorption-type merger of Torex Device Co., Ltd., its wholly owned subsidiary Device Engineering Co., Ltd. (established 1992/2) became a wholly owned subsidiary of Torex
2007/2	Established TOREX (HONG KONG) LIMITED
2007/3	TOREX SEMICONDUCTOR DEVICE (HONG KONG) LIMITED (currently ISM ASIA LIMITED) shares sold
2007/4	The Taiwan office was reorganized, and established TOREX SEMICONDUCTOR TAIWAN LTD. Established TOS Device Co., Ltd.
2008/8	Obtained ISO 9001 certification (head office and all Japan bases)
2008/9	Opened Tokyo Technical Center in Chuo-ku, Tokyo
2009/4	Acquired 10% share capital of VIETNAM SEIBI SEMICONDUCTOR CO., LTD. (currently TOREX VIETNAM SEMICONDUCTOR CO., LTD)
2009/11	Acquired 80% share capital of VIETNAM SEIBI SEMICONDUCTOR CO., LTD. (currently TOREX VIETNAM SEMICONDUCTOR CO., LTD), making it a subsidiary
2010/5	Increased capital of VIETNAM SEIBI SEMICONDUCTOR CO., LTD (currently TOREX VIETNAM SEMICONDUCTOR CO., LTD), raising stake to 92.5%
2010/9	Kanto West Sales Office consolidated into the head office
2012/7	Merged Device Engineering Co., Ltd. and TOS Device Co., Ltd., with Device Engineering Co., Ltd. As the surviving entity Head office moved to Shinkawa, Chuo-ku, Tokyo
2014/4	Listed on the TSE JASDAQ Standard Market
2014/9	Increased capital of VIETNAM SEIBI SEMICONDUCTOR CO., LTD (currently TOREX VIETNAM SEMICONDUCTOR CO., LTD), raising stake to 93.8%
2015/3	Absorbed through merger Device Engineering Co., Ltd.
2015/4	Increased capital of TOREX USA Corp., raising stake to 100.0% VIETNAM SEIBI SEMICONDUCTOR CO., LTD. company name changed to TOREX VIETNAM SEMICONDUCTOR CO., LTD.
2015/10	Listing designation moved from JASDAQ to the TSE Second Section
2016/4	Capital alliance with Phenitec Semiconductor Co., Ltd., making it a subsidiary (51.0% of voting rights) Opened TOREX USA Corp. R&D Center in California, USA
2016/5	Opened Kansai Technology Center in Suita, Osaka
2017/6	Established Nagoya Sales Office
2018/3	Listing designation moved from the TSE Second Section to the TSE First Section
2019/2	Made Phenitec Semiconductor Co., Ltd. A wholly owned subsidiary

Source: YUHO financial statements

TOREX SEMICONDUCTOR (Singapore) PTE LTD

TOREX VIETNAM SEMICONDUCTOR CO.,LTD

However, after that, product development did not progress as planned, and due to overlapping with the semiconductor recession (see graph on P8), a large amount of debt was accumulated, and the former Torex Semiconductor Co., Ltd. was closed down through special liquidation. The current Torex Semiconductor Co., Ltd. was established in March 1995 by taking over the business related to analog power supply IC design and sales. Just 1½ years later, the company established its first overseas base in Singapore in November 1996. Ignoring the fact that the market for battery-powered ultra-compact and low-energy consumption power ICs was still small in scale with few market entrants and concerns about being premature, this marked the first step toward developing the Group's global reach today. In 1997, in order to reduce noise for pager wireless communications devices, Torex proposed a counter-intuitive internal oscillation circuit which intentionally sacrificed some efficiency, culminating in launching the XC6373/XC6383 Series of DC/DC converters.

Over the next 4 years the company established bases in Irvine, California in the US, gaining a presence near Silicon Valley, and in Leicestershire, UK in Europe. Over the following 5 years during the mid-2000s, the company established bases in Shanghai, Taiwan and Hong Kong. Then in April 2009, the company acquired a 10% stake in VIETNAM SEIBI SEMICONDUCTOR CO., LTD. (currently TOREX VIETNAM SEMICONDUCTOR CO., LTD), raising its stake to 80% in November 2009, making it a subsidiary. With the increase of mobile devices, many companies began entering the compact power IC industry. In order to differentiate itself from competitors, Torex began its push toward 'ultra compact', developing a unique technology known as USP (ultra-small packages). Torex secured its own factory in Vietnam as a USP production base for back end package assembly.

At the time of the IPO listing its shares on the TSE JASDAQ standard Market in April 2014, Phenitec Semiconductor Co., Ltd. was the largest shareholder with a 19.2% stake. The company successfully moved its listing designation to the TSE Second Section 1½ years later in October 2015, moving up to the TSE First Section in March 2018. The company concluded a capital alliance with Phenitec Semiconductor in April 2016, acquiring a 51.0% stake and making it a subsidiary. Through a capital increase in April 2018, Torex raised its stake in Phenitec to 69.1%. Then in February 2019, the company raised its stake to 100%, making Phenitec a wholly owned subsidiary.

Some may question the meaning of fabless Torex also having foundry business which comes with high fixed costs, however, management ultimately decided to make the acquisition based on emphasizing stable supply of products to customers. At the time of acquisition, the company had decided to focus on target applications of industrial equipment and automotive, but automotive customers in particular paid close attention to stable supply capability. Also, there is a tendency of external third-party foundries to be reluctant to accept the time-consuming hassle from small-lot trial production for proprietary products. The Group having its own foundry business not only resolves these issues, but since Phenitec has its own customer base, it also does not rely on Torex for orders and it can maintain stable business operations on its own. Even now Torex accounts for only a small portion of Phenitec sales. The business combination with Phenitec was a watershed milestone in the Group's corporate history. The table on the following page provides a summary of financial performance for the consolidated group, Torex and Phenitec, and other significant subsidiaries, before and after the combination from FY3/17 onward. In section 2 on Earnings Analysis, we look at why Phenitec is not necessarily a drag on profitability.

TOREX SEMICONDUCTOR Group Companies

JPY million, %	FY3/09	FY3/10	FY3/11	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
TOREX SEMICONDUCTOR LTD.											
▪ Consolidated mgt. indicators											
Net sales	—	—	—	9,161	8,600	9,391	9,972	10,621	21,560	23,997	23,897
Operating profit	—	—	—	41	567	1,414	1,350	1,140	1,251	2,212	1,551
OPM (%)	—	—	—	*0.5*	*6.6*	*15.1*	*13.5*	*10.7*	*5.8*	*9.2*	*6.5*
Ordinary profit	—	—	—	4	445	1,339	1,679	971	906	1,998	1,820
Ratio to sales (%)	—	—	—	*0.0*	*5.2*	*14.3*	*16.8*	*9.1*	*4.2*	*8.3*	*7.6*
Profit (loss) ATOP	—	—	—	(129)	192	1,357	1,248	580	2,931	902	1,049
Total assets	—	—	—	10,286	10,567	10,801	13,171	12,973	25,210	27,995	28,386
Net assets	—	—	—	6,069	6,406	7,905	10,889	10,929	15,598	19,085	19,638
Equity ratio (%)	—	—	—	*58.7*	*60.3*	*72.9*	*82.3*	*83.9*	*45.3*	*51.8*	*69.0*
ROE (%)	—	—	—	*nm*	*3.1*	*19.1*	*13.3*	*5.3*	*26.3*	*7.0*	*6.2*
Employees (persons)	—	—	—	352	309	329	342	343	981	982	1,017
▪ TOREX non-consol. (filing co.)											
Net sales	11,848	10,271	9,340	8,755	7,812	8,624	9,059	9,626	9,329	9,180	9,202
Operating profit (loss)	N/A	N/A	N/A	27	401	1,252	1,191	1,230	517	463	479
OPM (%)	—	—	—	*0.3*	*5.1*	*14.5*	*13.1*	*12.8*	*5.5*	*5.0*	*5.2*
Ordinary profit (loss)	(203)	(178)	(466)	201	357	1,217	1,534	1,009	604	502	740
Ratio to sales (%)	*(1.7)*	*(1.7)*	*(5.0)*	*2.3*	*4.6*	*14.1*	*16.9*	*10.5*	*6.5*	*5.5*	*8.0*
Profit (loss)	(535)	(67)	(850)	43	130	1,217	1,170	743	902	388	566
Total assets	11,057	10,772	9,602	9,696	9,776	9,732	11,729	11,864	12,088	14,160	15,205
Net assets	6,541	6,459	5,583	5,624	5,729	6,949	9,569	9,948	8,438	11,148	11,989
Equity ratio (%)	*59.2*	*60.0*	*58.1*	*58.0*	*58.6*	*71.4*	*81.6*	*83.8*	*69.8*	*78.7*	*78.8*
ROE (%)	—	—	—	*0.8*	*2.3*	*19.2*	*14.2*	*7.6*	*9.8*	*4.0*	*4.9*
Employees (persons)	188	195	190	185	134	141	146	160	160	159	168

Significant subsidiaries (over 10% of sales or purchasing)

JPY million, %	FY3/09	FY3/10	FY3/11	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Phenitec Semiconductor Co., Ltd.					—	—	—	—	*51.0%*	*51.0%*	*100.0%*
Net sales	—	—	—	—	10,130	13,235	14,272	13,746	12,851	15,365	15,452
Operating profit	—	—	—	—	355	1,921	1,144	921	611	1,555	917
Ordinary profit	—	—	—	—	592	2,198	1,626	807	490	1,493	1,052
Ratio to sales (%)	—	—	—	—	*5.8*	*16.6*	*11.4*	*5.9*	*3.8*	*9.7*	*6.8*
Profit (loss)	—	—	—	—	544	2,064	1,021	904	2,100	1,042	757
Total assets	—	—	—	—	11,574	13,205	13,640	16,933	14,642	15,474	17,857
Net assets	—	—	—	—	3,568	5,094	4,499	7,271	8,341	9,204	12,004
TOREX (HONG KONG) LIMITED					*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Net sales	—	—	—	—	2,301	2,454	2,481	2,828	2,637	2,493	—
Ordinary profit (loss)	—	—	—	—	22	42	11	(43)	9	7	—
Ratio to sales (%)	—	—	—	—	*1.0*	*1.7*	*0.4*	*(1.5)*	*0.4*	*0.3*	—
Profit (loss)	—	—	—	—	19	35	9	(36)	9	6	—
Total assets	—	—	—	—	961	1,065	1,218	972	897	808	—
Net assets	—	—	—	—	297	360	431	370	274	265	—
TOREX SEMICONDUCTOR TAIWAN					*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Net sales	—	—	—	—	1,422	1,768	1,888	1,610	—	—	—
Ordinary profit (loss)	—	—	—	—	10	22	57	28	—	—	—
Ratio to sales (%)	—	—	—	—	*0.7*	*1.2*	*3.0*	*1.7*	—	—	—
Profit (loss)	—	—	—	—	7	17	43	21	—	—	—
Total assets	—	—	—	—	614	786	725	693	—	—	—
Net assets	—	—	—	—	166	195	268	264	—	—	—
TOREX VIETNAM SEMICONDUCT.					*92.5%*	*92.5%*	*93.8%*	*93.8%*	*93.8%*	*93.8%*	*93.8%*
TOREX USA Corp.					—	—	—	—	*100.0%*	*100.0%*	*100.0%*
Significant customer											
IXYS Corporation	—	—	—	—	—	—	—	—	2,628	3,249	3,189

Source: YUHO financial statements

Sales Breakdowns by Destination and Product/Service

Regional sales by destination

JPY million, %	FY3/09	FY3/10	FY3/11	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Net sales	—	—	—	**9,161**	**8,600**	**9,391**	**9,972**	**10,621**	**21,560**	**23,997**	**23,897**
▪ Japan	—	—	—	2,948	2,360	2,487	2,515	2,820	6,156	6,024	6,687
▪ Asia	—	—	—	5,341	5,380	5,799	6,096	6,342	—	—	—
▪ China	—	—	—	—	—	—	—	—	7,334	8,209	8,159
▪ Taiwan	—	—	—	—	—	—	—	—	2,339	3,047	2,575
▪ Europe	—	—	—	510	462	599	708	844	—	—	—
▪ North America	—	—	—	361	398	506	653	616	3,727	4,456	4,203
▪ Other	—	—	—	—	—	—	—	—	2,004	2,261	2,274
Overseas sales ratio (%)	—	—	—	*67.8%*	*72.6%*	*73.5%*	*74.8%*	*73.5%*	*71.4%*	*74.9%*	*72.0%*

Sales by product/service

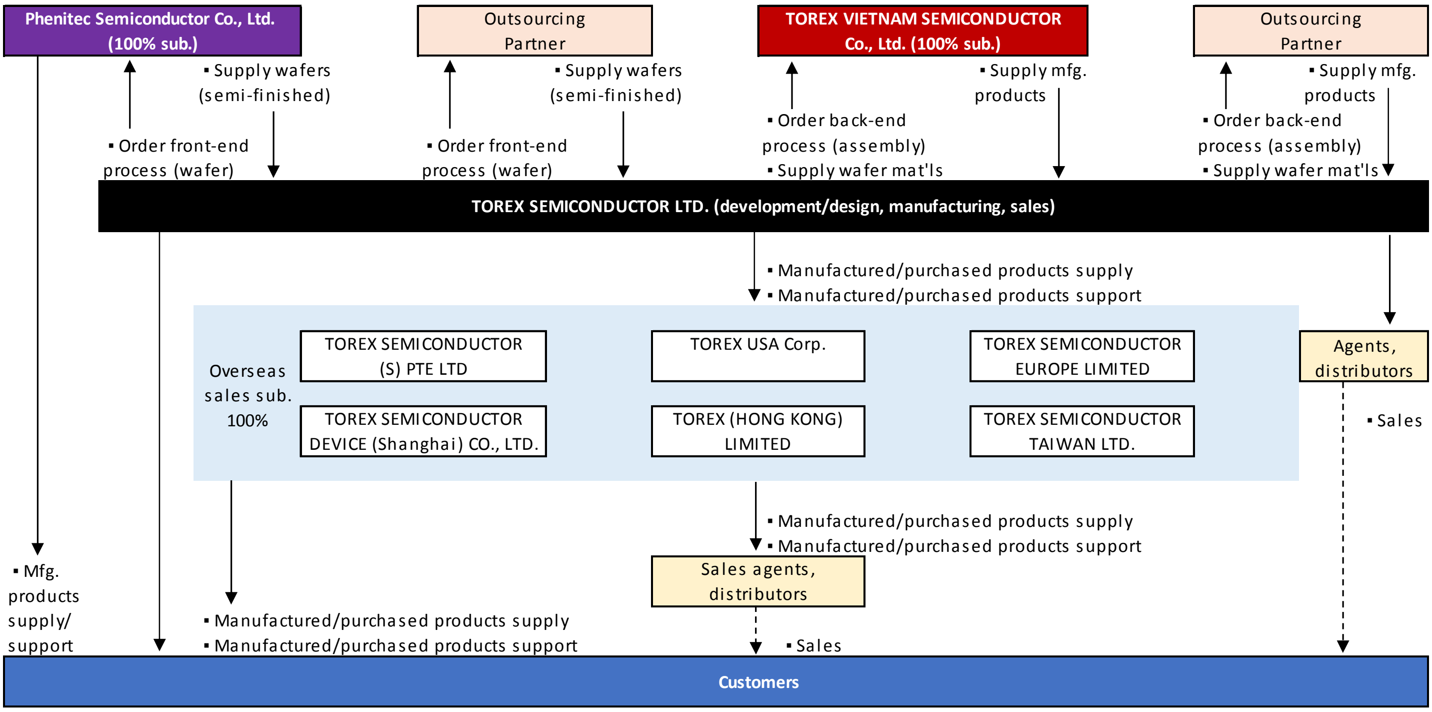
JPY million, %	FY3/09	FY3/10	FY3/11	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Net sales	—	—	—	**9,161**	**8,600**	**9,391**	**9,972**	**10,621**	**21,560**	**23,997**	**23,897**
▪ Voltage detectors (VD)	—	—	—	1,433	1,359	1,764	1,776	1,641	1,565	1,586	1,672
▪ Voltage regulators (VR)	—	—	—	4,738	4,314	4,614	4,942	5,094	4,872	5,165	4,834
▪ DC/DC converters (DC/DC)	—	—	—	2,233	2,221	2,297	2,357	2,694	2,997	2,889	3,092
▪ Discrete	—	—	—	—	—	—	—	—	10,942	14,063	13,732
▪ Other	—	—	—	757	706	716	898	1,191	1,183	294	566

Source: YUHO financial statements

The top two tables show the trend of sales by shipment destination and by product type. In section 2 on Earnings Analysis, we look at a management tool called 'Design-in Sales', based on adjusting revenue to reflect customer orders received rather than destination. As China is the 'factory for the world,' net sales data shown above and in official reporting segments tends to overstate China and Asia relative to real actual demand.

The diagram and map on the following page summarize the TOREX SEMICONDUCTOR Group's organizational chart and global sales and manufacturing network. The Group has 8 bases in Japan and 9 bases overseas. Regarding manufacturing bases, it is worth noting that while the three plants of Phenitec offer front-end wafer process foundry services to customers outside of the Group, the Vietnam plant's back-end package assembly is dedicated for Torex only.

TOREX SEMICONDUCTOR Group Organization Chart

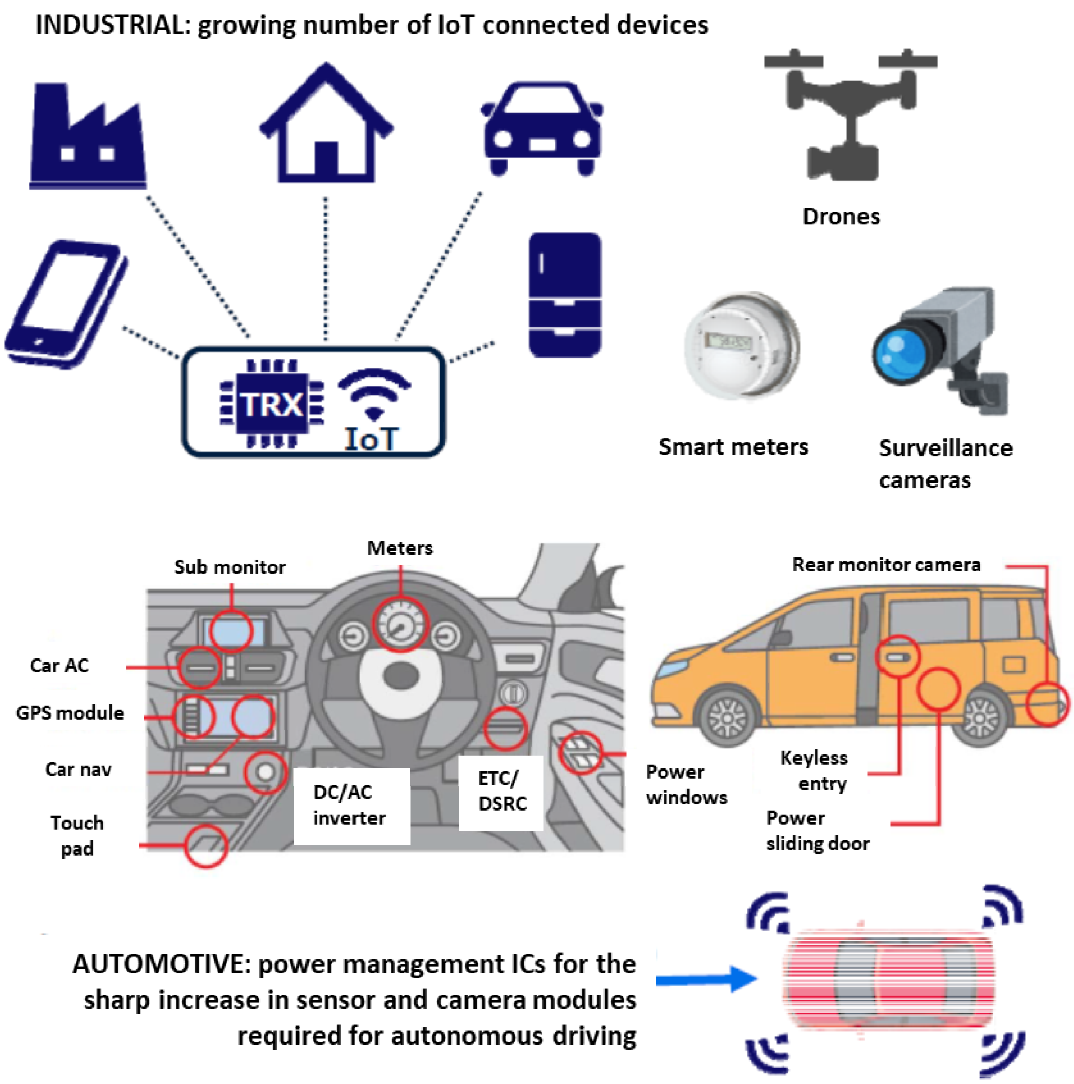


Source: compiled from YUHO financial statements

TOREX SEMICONDUCTOR Group Global Sales and Manufacturing Network:
➡ 8 bases in Japan, 9 bases overseas

Source: company business briefing presentation materials

Torex Business Model: Power Management IC Applications Summary



Power Management IC Applications

INDUSTRIAL

Industrial robots / POS registers / POS terminals / Industrial measuring instruments / Smart meters / Security equipment

AUTOMOTIVE

Car navigation systems / Car audio systems / Power windows / Power seats / In-vehicle ETC systems / Dashboard cameras / Rear-view monitor cameras

MEDICAL & HEALTHCARE

Electronic thermometers / Scales / Blood pressure monitors / ECGs / Blood glucose monitors / Monitoring equipment

WEARABLES

Smartwatches / Smartglasses / Smart cards / Wearable cameras / Wearable devices

CONSUMER ELECTRONICS

LCD TVs / Beauty care products / Consumer game consoles / Home appliances / Home theaters / LED lighting

COMPUTERS & COMMUNICATIONS

Smartphones / PC peripherals / IC recorders / Digital cameras / Laptops / Electronic dictionaries / E-readers / Portable game devices

Source: results briefing materials

Torex Business Initiatives for FY3/20

Further focus on priority markets (automotive, industrial)

- Expanded lineup of XD products (automotive)
  ➞ Established a new department specialized in developing automotive products
  ➞ Develop existing products to meet automotive quality standards and release as XD series
- Target early release of high voltage/high current compatible products for industrial applications

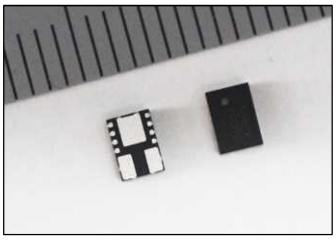
Actively deploy resources to develop and sell high value-added products

- Focus on XCL (coil integrated DC / DC converter)
  ➞ Established a new department specialized in developing XCL which is posting strong sales, and expanding the lineup
- Development of power devices through collaboration between Torex and Phenitec
  ➞ Target early commercialization and expansion of IGBT modules and SiC (silicon carbide) compound semiconductors

A next-generation keyword in the automotive industry is CASE, an acronym which stands for Connectivity, Autonomous, Sharing and Electrification, all major growth drivers. One issue for customers is the sharp increase in electronic control units (ECUs), requiring miniaturization on the circuit board, measures to deal with heat dissipation and noise, and increased man hours for evaluation and testing.

Among the company's products, DC/DC converters are a major strategic product group accounting for a significant amount of sales, and we have developed 4 types with the differing special characteristics of low noise, low cost, large current/low profile and high heat dissipation, creating a line-up of product groups capable of satisfying any client demands. In Jan-2019 Torex launched the XDL601/XDL602 series of 1.5A coil-integrated step-down "micro DC/DC" converters for automotive applications.

XDL601/XDL602 series of coil-integrated step-down "micro DC/DC" converters

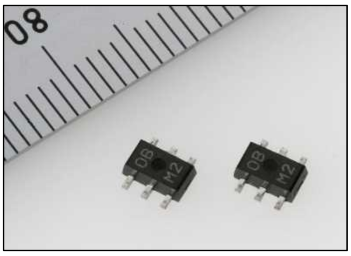


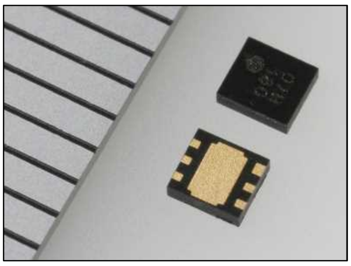
Simply adding two ceramic capacitors to their external components can make it possible to create a power supply circuit with a maximum of 1.5A, and a 50% or greater reduction in space compared to structures using stand-alone DC/DC converters. Since the coil is built-in, board layouts can be simplified to minimize malfunctions, noise, and other problems arising from component placement or wire routing. Features include an ultra compact package DFN3625-11A (3.6 x 2.5 x h1.6mm), outstanding heat dissipation and low noise. The XDL601/XDL602 series is compliant with AEC-Q100 Grade 2, at an operating temperature range of -40℃ to +105℃.

Since FY3/17, sales of the coil-integrated "micro DC/DC" series have been posting high growth: FY3/18 +23%, FY3/19 +31%, and targeting +51% in FY3/20. there is a broad range of applications in industrial and IoT connected devices, as well as automotive, addressing the aforementioned issues requiring reduced mounting area, heat dissipation and low noise.

An example of the other initiative of developing existing products to meet the more demanding quality standards for automotive use and then market them as XD series is shown on the following page: XD9267/9268 Synchronous Step-Down DC/DC Converters, and mass production was begun Jul-2019.

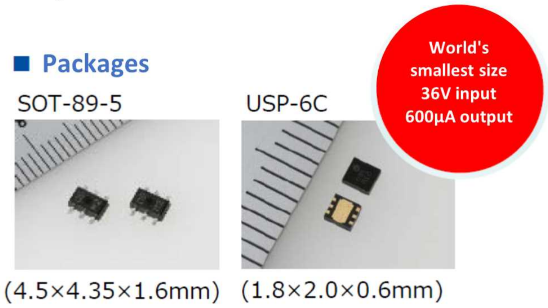
XD9267/9268 Series Synchronous Step-Down DC/DC Converters





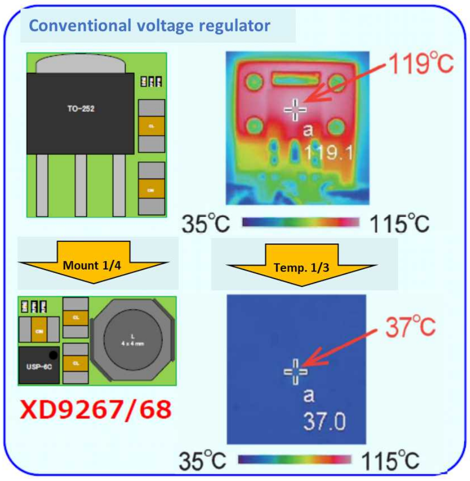
FY3/20 new automotive sales expansion focus product: XD9267/9268 Synchronous Step-Down DC/DC Converters
➡ Ultra compact, high efficiency, low noise

Mass production commenced Jul-2019



Adoption decided by major car manufacturers in Japan and Germany

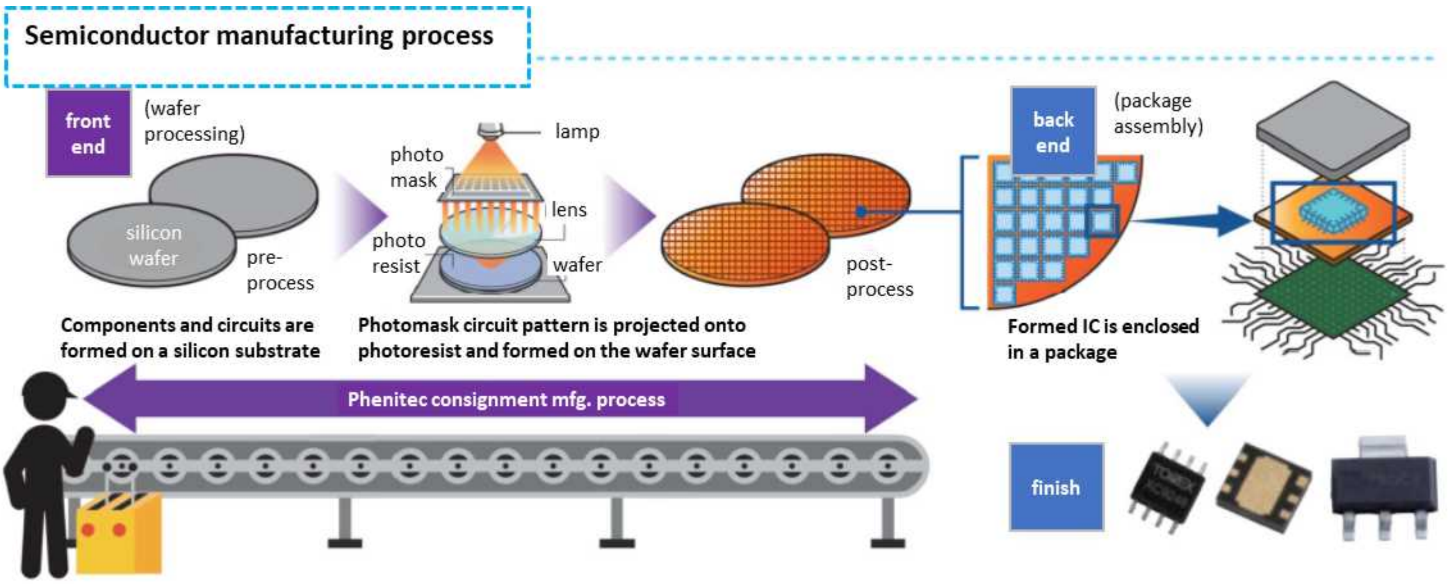
Low heat generation through high power conversion efficiency



Phenitec Business Model

The graphic below shows a general overview of the semiconductor manufacturing process. Phenitec is involved in the left-hand side for front end wafer processing. Going back to the Group's organization chart on P10, from the perspective of Torex, it uses both Phenitec and outside outsourcing partners to procure semi-finished wafers. Similarly, for back end package assembly, Torex uses both the Vietnam Plant as well as outside outsourcing partners. Therefore, the largest component of COS for Torex is outsourcing expense, while the largest components of COS for Phenitec are fixed costs including labor and depreciation, in addition to the variable cost of silicon wafers.

Phenitec is the sole provider of foundry service in Japan focused on discrete and CMOS process



Summary of Phenitec's comprehensive foundry solutions services

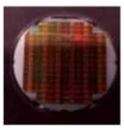
Type	Original products foundry	Custom products foundry	Silicon micromachining
Products • Services	MOSFET IGBT Bipolar Transistor Diodes TVS SiC Devices (under development)	MOSFET Bipolar Transistors JFET Diodes IGBT Laser diode Bipolar IC CMOS IC MEMS (acceleration sensors) TVS	Laser trimming Wafer Test & Probe Back surface processing Dicing
Features	Many types		Also cover partial machining
	Handle small-lot orders		

Many customers become long-term users

Source: FY3/16 results briefing presentation materials

The exhibit above summarizes the foundry services and products supplied by Phenitec, and the exhibit below summarizes the advantages and disadvantages of acquiring Phenitec. Unique technology and process management capabilities refined over 50 years allow Phenitec to manufacture products that meet customer's detailed requirements while reducing production costs. The production system meets high quality standards internationally. Also, located in Okayama Prefecture, there is excellent access to rail, highway and airports, and significantly lower exposure to natural disasters like earthquakes and typhoons, supporting stable product supply. Making Phenitec a subsidiary creates a high level of efficiency in managing production methods and quality controls while being able to ensure meeting delivery times. It also allows some flexibility in managing capacity for mass production.

Advantages and disadvantages of making Phenitec a subsidiary

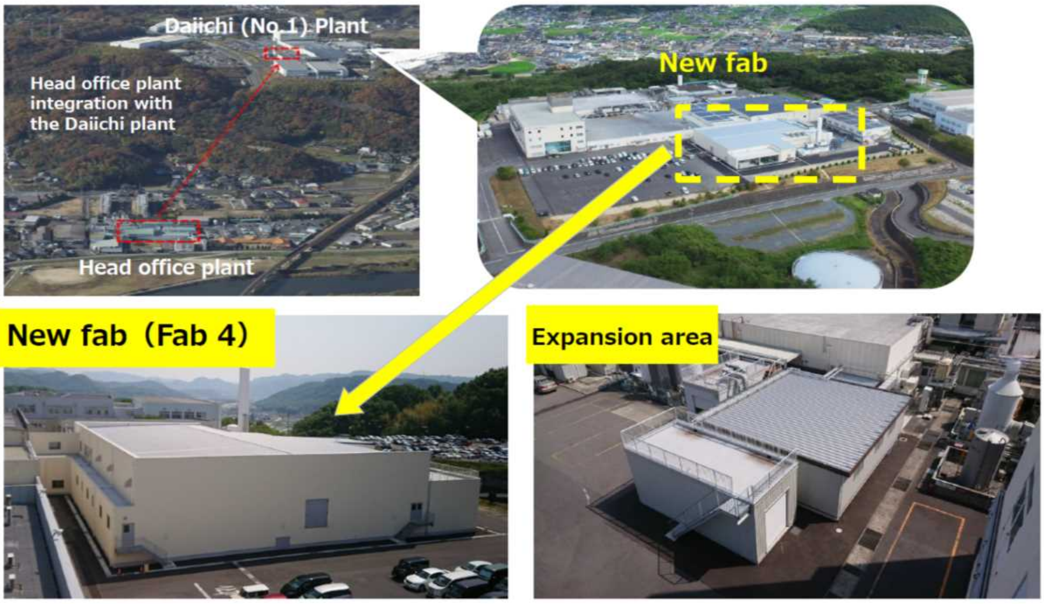
			Quality	Cost		Delivery	
	Overview	Choice	Mfg tech/ quality	COS	Investment	Delivery date	New process time required
front end	 Form circuits on silicon substrate	Own	○	△	×	○	×
		Fabless	△	○	○	△	○

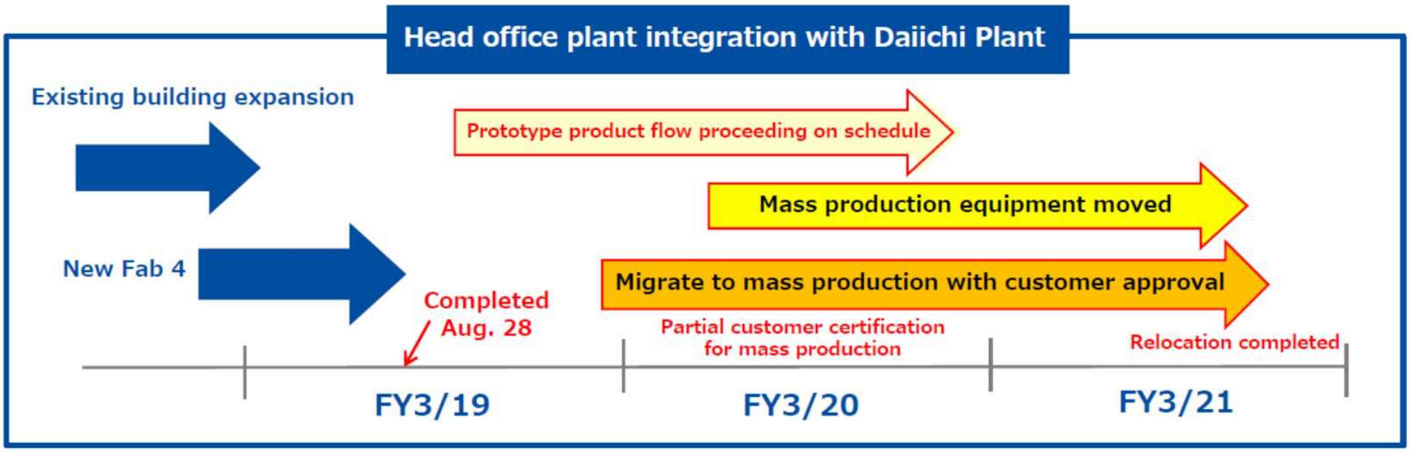
Aiming to be a company which can ensure stable long-term supply of high value-added products

Source: FY3/16 results briefing presentation materials

Head Office Plant Integration with the Daiichi (No.1) Plant

Since Phenitec's Okayama Plant is divided into the Head Office Plant and the Daiichi (No.1) Plant, it has been hard to raise operational efficiency, and due to the additional requirement of measures to address aging facilities in the Head Office Plant, the company began work on the project to integrate the two fabs in FY3/18. Raising productivity will also be achieved by raising the ratio of 6-inch wafers. The project has taken time since work has progressed without reducing utilization rates, however the migration of all mass production will be completed by FY3/21.





Integration effect Daiichi Plant expansion

- Continue long-term stable product supply system
- Raise production efficiency by migrating from 5-inch to 6-inch wafers (raise 6-inch ratio from 24% → 64% post integration)
- Raise production efficiency with the right equipment and layout
- Reduce manufacturing cost through energy saving plant structure
- Maintain and raise quality standards for automotive and industrial equipment
- New fab has precious metal (gold, platinum) processing capability as in the head office plant

Source: FY3/19 results briefing presentation materials

FY3/19 was the peak for capex

JPY mn	FY 3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20 CE
Capex	266	586	602	988	1,149	3,323	1,651
Depreciation	468	403	441	1,219	934	1,085	1,532
R&D	132	166	204	229	405	357	N/D

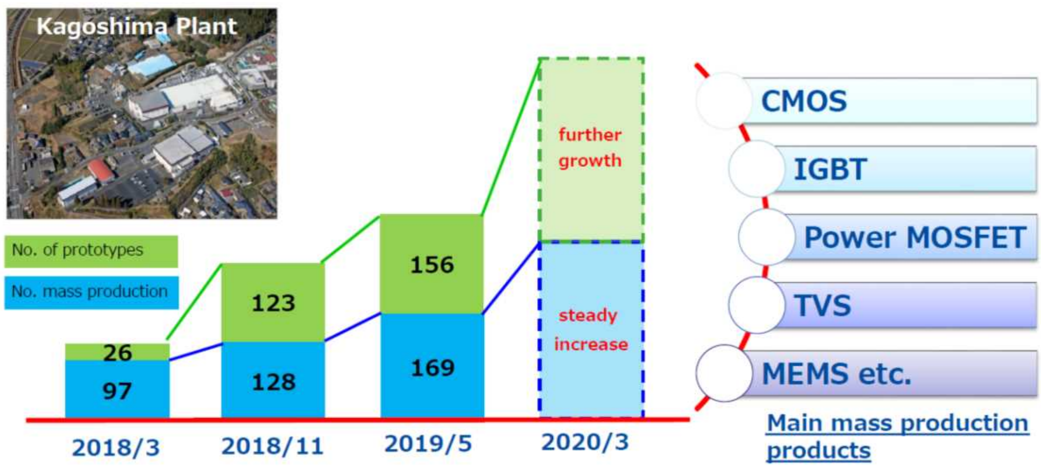
Source: YUHO financial statements, CE = company estimates

Start-up and development of the Kagoshima Plant acquired from Yamaha in Oct-2015 appears to be on schedule. At the time of acquisition, the plant started out with zero backlogs since the company only took over the facilities and employees, however since then the company has steadily won new orders, and the plant is on course to turn profitable on a single month basis by the end of FY3/20, aiming for a positive contribution to earnings on a full-term basis from FY3/21. The graph below shows the trend of the number of prototype products, which is a leading indicator for mass production, however, according to the company, growth is running at a pace ahead of expectations.

The Kagoshima Plant acquired from Yamaha Corp. in October 2015, in addition to being able to handle Group focus automotive applications, serves a key function in business contingency planning (BCP), since it employs similar process equipment used at the Daiichi (No.1) Plant in Okayama, and could take up slack in the event of power outage or other production disruption. ISO/TS 16949 from 2009, a technical specification for automotive sector quality management systems, has become one of the most widely used international standards in the global automotive supply chain. ISO/TS 16949, is evolving with the publication of a new global industry standard by the International Automotive Task Force (IATF). On October 3, 2016, IATF 16949:2016 was published by the IATF, defining the requirements of a Quality Management System for organizations in the automotive industry. The company plans to obtain IATF 16949 certification at the Kagoshima Plant in 2020.

The table above shows large-scale capex associated with integration of the Head Office Plant and Daiichi (No.1) Plant peaked in FY3/19. The issue at the moment for earnings is the sharp increase in depreciation associated with the large-scale integration project. We examine this in the next section on Earnings Analysis.

Kagoshima Plant Trend of Products by Prototypes and Mass Production



Source: FY3/19 results briefing presentation materials

❷ Earnings Analysis

Understanding the Torex Consolidated Group

In the previous section we covered the background history and updated status of the Torex Semiconductor Group, and its unique business model of fabless power management IC design, manufacture and sales of Torex combined with the unique and sole Japan foundry service of original and custom discrete products of Phenitec. The key to understanding growth trends and profitability of the group is understanding each of these two core building blocks separately.

The table below summarizes the trend of consolidated revenue and profits for the Torex Semiconductor Group. As noted in the previous section, Torex concluded a capital alliance with its top shareholder Phenitec, acquiring a 51% stake on April 1, 2016. Therefore results through FY3/16 are for Torex Semiconductor, and from FY3/17 onward are for the combined group. Although not required in officially submitted financial statements, results briefing presentation materials provide invaluable supplemental disclosures giving revenue and OP breakdowns by Torex and the Phenitec contribution which excludes intra-company transactions.

First, let's examine the cost structure before and after the business combination. In the 3 years through FY3/16, as a fabless design house, Torex had average GPM of 47.4%, a high level absent the fixed costs associated with plant operations including depreciation. In the 3 years from FY3/17 onward, average GPM dropped to 28.2% reflecting the fixed costs associated with Phenitec's foundry operations.

Torex Semiconductor Consolidated Results Trend

JPY million, %	FY3/14 act	FY3/15 act	FY3/16 act	FY3/17 act	FY3/18 act	FY3/19 act
Net sales	**9,391**	**9,972**	**10,621**	**21,560**	**23,997**	**23,897**
YoY	*9.2*	*6.2*	*6.5*	—	*11.3*	*(0.4)*
▪ Phenitec contribution	—	—	—	11,378	13,828	13,792
YoY	—	—	—	—	*21.5*	*(0.3)*
▪ Torex	—	—	—	10,181	10,168	10,104
YoY	—	—	—	—	*(0.1)*	*(0.6)*
COS	5,054	5,150	5,558	15,659	16,820	17,403
Ratio to sales	53.8	51.6	52.3	72.6	70.1	72.8
Gross profit	4,337	4,822	5,063	5,900	7,177	6,494
GPM	46.2	48.4	47.7	27.4	29.9	27.2
SG&A	2,922	3,472	3,923	4,649	4,964	4,943
Ratio to sales	31.1	34.8	36.9	21.6	20.7	20.7
Operating profit	**1,414**	**1,350**	**1,140**	**1,251**	**2,212**	**1,551**
YoY	149.5	(4.5)	(15.6)	—	76.8	(29.9)
OPM	15.1	13.5	10.7	5.8	9.2	6.5
▪ Phenitec contribution	—	—	—	571	1,579	904
YoY	—	—	—	—	176.5	(42.7)
OPM	—	—	—	5.0	11.4	6.6
▪ Torex	—	—	—	680	633	646
YoY	—	—	—	—	(6.9)	2.1
OPM	—	—	—	6.7	6.2	6.4
Ordinary profit	1,339	1,679	971	906	1,998	1,820
Profit before income tax	1,324	1,679	1,024	3,435	1,971	1,805
Profit	1,359	1,251	581	3,105	1,410	1,321
Profit ATOP	1,357	1,248	580	2,931	902	1,049

Source: YUHO financial statements and results briefing presentations.

At the same time, in the 3 years through FY3/16, Torex had an average SG&A ratio of 34.4%, reflecting higher R&D and head office administration-related costs. In the 3 years from FY3/17 onward, the average SG&A ratio dropped to 21.0%, reflecting lower R&D and head office administration-related costs of Phenitec.

Ultimately, average OPM in the 3 years through FY3/16 of 13.0% declined to 7.2% in the 3 years from FY3/17 onward, but that does not necessarily mean that profitability of Phenitec is a drag on overall profitability. From the table we can see that in FY3/18, Phenitec contribution OPM reached 11.4%, well above the 6.2% for Torex. Given the plant operations specific to Phenitec, it is clear that profitability is driven in large part by capacity utilization rates. In FY3/18, note that Phenitec contribution revenue rose by +21.5% YoY, an increase of ¥2,450 million. Of that increase, roughly ¼ is attributed to its major North American customer IXYS Corporation, a California-based specialist in power semiconductors, discrete MOSFETs and IGBT modules, focused on automotive and industrial applications, which itself was acquired by Littelfuse Corporation in 2018. The sharp boost in utilization rates drove profitability significantly higher. This can also be confirmed in the segment sales breakdown for Phenitec in the table on the next page, with North America revenue growing by +33.9% in FY3/18.

Torex and Phenitec Sales Trends by Application

JPY million, %	FY3/18	FY3/19	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20
Torex sales	**10,168**	**10,104**	**2,476**	**2,727**	**2,432**	**2,469**	**2,202**	**2,649**
IND (Industrial)	3,728	3,927	966	1,063	945	953	784	912
CAR (Automotive)	1,708	1,525	381	384	362	398	350	615
MED (Medical)	108	125	36	26	26	37	25	21
WEA (Wearable)	233	238	71	74	37	56	53	66
Other	4,391	4,279	1,022	1,180	1,062	1,015	990	1,035
Torex sales YoY	**(0.1)**	**(0.6)**	**0.1**	**5.7**	**(4.6)**	**(3.7)**	**(11.1)**	**(2.9)**
IND YoY	8.2	5.3	9.8	14.3	(0.1)	(2.0)	(18.8)	(14.2)
CAR YoY	6.2	(10.7)	(3.5)	(3.3)	(18.1)	(16.0)	(8.1)	60.2
MED YoY	0.9	15.7	80.0	(13.3)	(23.5)	54.2	(30.6)	(19.2)
WEA YoY	18.3	2.1	10.9	19.4	(31.5)	5.7	(25.4)	(10.8)
Other YoY	(9.0)	(2.6)	(8.3)	1.5	(1.0)	(2.5)	(3.1)	(12.3)
IND + CAR wgt.	*53.5%*	*54.0%*	*54.4%*	*53.1%*	*53.7%*	*54.7%*	*51.5%*	*57.6%*

JPY million, %	FY3/18	FY3/19	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20
Phenitec sales*	**15,364**	**15,452**	**4,136**	**3,973**	**4,075**	**3,268**	**2,983**	**3,251**
IND (Industrial)	3,394	3,262	759	705	1,100	698	408	412
CAR (Automotive)	3,088	3,560	908	873	923	856	876	921
MED (Medical)	357	390	98	63	145	84	70	48
Other	8,525	8,240	2,371	2,332	1,907	1,630	1,629	1,870
Phenitec sales YoY	**19.6**	**0.6**	**14.9**	**1.3**	**5.1**	**(17.6)**	**(27.9)**	**(18.2)**
IND YoY	35.2	(3.9)	(15.3)	(8.7)	29.4	(20.3)	(46.2)	(41.6)
CAR YoY	(3.2)	15.3	49.1	11.6	9.8	0.0	(3.5)	5.5
MED YoY	8.2	9.2	22.5	(52.6)	70.6	42.4	(28.6)	(23.8)
Other YoY	25.0	(3.3)	17.7	4.4	(9.3)	(25.0)	(31.3)	(19.8)
IND + CAR wgt.	*42.2%*	*44.1%*	*40.3%*	*39.7%*	*49.6%*	*47.6%*	*43.0%*	*41.0%*

*Note: Phenitec sales here includes intra-company transactions with Torex. Classifications subject to change.

Torex 'Design-in' Sales and Phenitec Regional Sales Trends

JPY million, %	FY3/18	FY3/19	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20
Torex D-in* sales	**10,168**	**10,104**	**2,476**	**2,727**	**2,432**	**2,469**	**2,202**	**2,649**
Japan	4,296	4,401	1,086	1,159	1,070	1,086	950	1,090
Asia	3,329	3,312	791	896	818	807	724	1,001
Europe	1,491	1,430	345	402	304	379	305	329
N America	1,052	961	254	270	240	197	223	229
Torex D-in* YoY	**(0.1)**	**(0.6)**	**0.1**	**5.7**	**(4.6)**	**(3.7)**	**(11.1)**	**(2.9)**
Japan YoY	(4.3)	2.4	8.8	6.5	0.4	(5.1)	(12.5)	(6.0)
Asia YoY	4.1	(0.5)	(0.3)	13.0	(8.7)	(4.7)	(8.5)	11.7
Europe YoY	1.4	(4.1)	(19.0)	0.5	(7.9)	13.1	(11.6)	(18.2)
N America YoY	2.9	(8.7)	(1.2)	(10.0)	(6.6)	(17.2)	(12.2)	(15.2)

JPY million, %	FY3/18	FY3/19	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20
Phenitec sales**	**15,364**	**15,452**	**4,136**	**3,973**	**4,075**	**3,268**	**2,983**	**3,251**
Japan	5,010	5,529	1,479	1,362	1,356	1,332	1,346	1,410
Asia	3,709	3,306	1,019	1,070	750	467	495	661
Europe	765	789	198	182	204	205	199	224
N America	5,880	5,828	1,440	1,359	1,765	1,264	943	956
Phenitec YoY**	**19.6**	**0.6**	**14.9**	**1.3**	**5.1**	**(17.6)**	**(27.9)**	**(18.2)**
Japan YoY	6.8	10.4	27.5	5.6	8.2	1.9	(9.0)	3.5
Asia YoY	18.1	(10.9)	25.0	17.8	(23.9)	(53.3)	(51.4)	(38.2)
Europe YoY	21.4	3.1	8.8	(20.9)	7.4	25.8	0.5	23.1
N America YoY	33.9	(0.9)	(0.1)	(9.0)	21.7	(15.5)	(34.5)	(29.7)

*Note: Torex 'Design-in' based sales = regional sales adjusted on orders received basis

**Note: Phenitec sales includes intra-company transactions with Torex. Classifications subject to change.

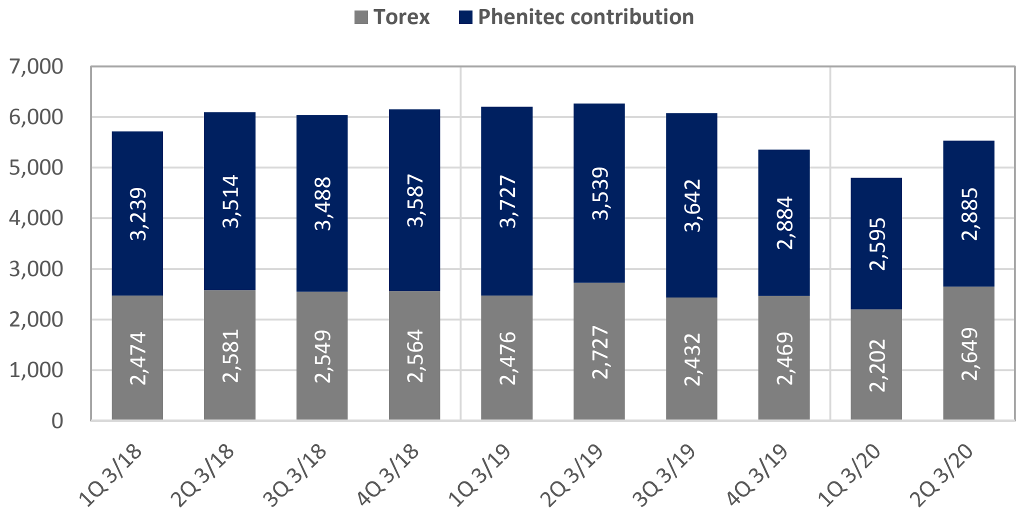
As required under J-GAAP accounting, the company discloses segment information in officially submitted financial statements, but the company acknowledges that the utility of segment information is limited, since segments outside of Japan reflect performance of overseas sales subsidiaries. The company also provides regional revenue breakdowns, however that information is also of limited utility as a management tool since it tends to understate Japan and to overstate China as a major destination for product shipments, but which is not the main source of customer orders.

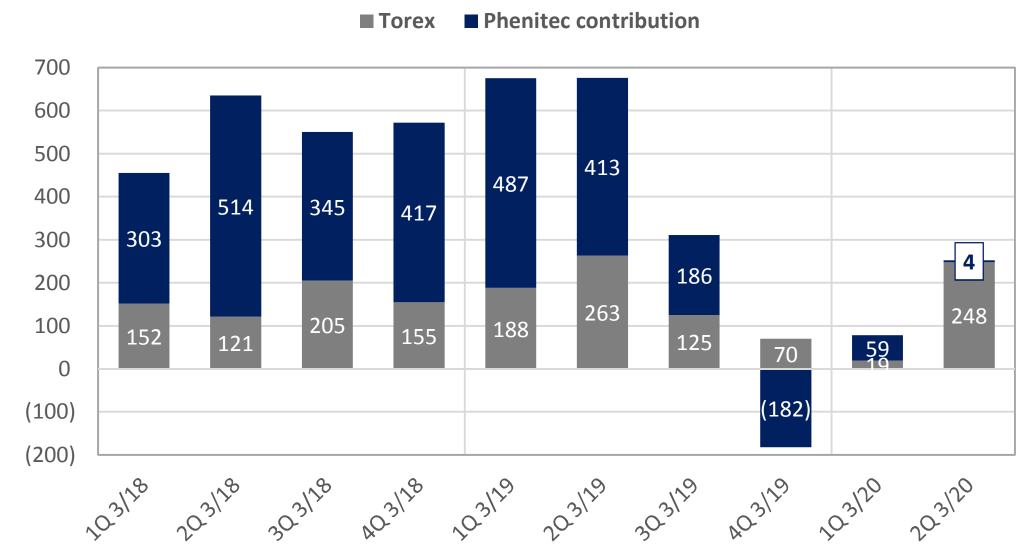
The company provides supplementary disclosures in results briefing materials, shown in the table above and on the bottom of the previous page. As we discuss in section four, understanding trends in application segments is key to understanding what is actually driving business, which can be seen from the table on P35, as well as on the previous page. Regarding segment revenue shown in the table above, Torex introduced a management indicator called 'design-in' based revenue. This is adjusted on an orders-received basis, which is a better reflection of actual demand trends.

FY3/19 results

FY3/19 was a 'tale of two halves.' Relative to initial 1H 3/19 guidance for 1H revenue +4.2% and 1H OP -58.7%, actual results were revenue +5.6% and OP +23.9%, a substantial overshoot to even the upward revision on strong 1Q results.

Quarterly Trend of Consolidated Sales (upper) and OP (lower)





Unit: JPY million. Source: compiled from results briefing presentations.

Relative to conservative initial guidance factoring in margin pressure on Phenitec in particular from increased capex from integration work on the head office and No.1 plants in Okayama, as well as rising wafer costs, Phenitec actually achieved higher utilization on strong orders for discrete and automotive applications. While the 1H was marked by successive upward revisions, the 2H marked a dramatic reversal of those trends as the affects from the US-China trade dispute begin to impact orders.

Relative to full-term FY3/19 OP revised up from initial guidance for ¥1,900 million (-14.1%) to ¥2,200 million (-0.6%), the actual result came in at ¥1,550 million (-29.9%). The two graphs above show the quarterly trend of sales and OP for each company highlight exactly what happened: the sharp decline in utilization for Phenitec resulted in 3Q OP declining -46.1%, followed by an operating loss in the 4Q. Coming into FY3/20, there is the additional headwind of depreciation rising +41.2% YoY to ¥1,532 million on the back of major capex for the plant integration.

Torex Semiconductor Quarterly Consolidated Results

JPY million, %	1Q 3/18 act	2Q 3/18 act	3Q 3/18 act	4Q 3/18 act	1Q 3/19 act	2Q 3/19 act	3Q 3/19 act	4Q 3/19 act	1Q 3/20 act	2Q 3/20 act
Net sales	**5,714**	**6,095**	**6,036**	**6,152**	**6,203**	**6,266**	**6,074**	**5,353**	**4,797**	**5,534**
YoY	*9.3*	*19.8*	*10.3*	*6.6*	*8.6*	*2.8*	*0.6*	*(13.0)*	*(22.7)*	*(11.7)*
▪ Phenitec contribution	3,239	3,514	3,488	3,587	3,727	3,539	3,642	2,884	2,595	2,885
YoY	*28.2*	*30.1*	*17.0*	*13.2*	*15.1*	*0.7*	*4.4*	*(19.6)*	*(30.4)*	*(18.5)*
▪ Torex	2,474	2,581	2,549	2,564	2,476	2,727	2,432	2,469	2,202	2,649
YoY	*(8.4)*	*8.3*	*2.2*	*(1.5)*	*0.1*	*5.7*	*(4.6)*	*(3.7)*	*(11.1)*	*(2.9)*
COS	4,026	4,215	4,224	4,355	4,282	4,374	4,545	4,202	3,528	4,112
Ratio to sales	*70.5*	*69.2*	*70.0*	*70.8*	*69.0*	*69.8*	*74.8*	*78.5*	*73.5*	*74.3*
Gross profit	1,687	1,880	1,812	1,797	1,921	1,892	1,529	1,151	1,269	1,422
GPM	*29.5*	*30.8*	*30.0*	*29.2*	*31.0*	*30.2*	*25.2*	*21.5*	*26.5*	*25.7*
SG&A	1,232	1,245	1,263	1,224	1,246	1,216	1,218	1,263	1,191	1,170
Ratio to sales	*21.6*	*20.4*	*20.9*	*19.9*	*20.1*	*19.4*	*20.1*	*23.6*	*24.8*	*21.1*
Operating profit	**455**	**635**	**550**	**572**	**675**	**676**	**311**	**(112)**	**79**	**252**
YoY	*123.1*	*246.6*	*14.3*	*49.4*	*48.3*	*6.5*	*(43.4)*	*TR*	*(88.4)*	*(62.8)*
OPM	*8.0*	*10.4*	*9.1*	*9.3*	*10.9*	*10.8*	*5.1*	*(2.1)*	*1.6*	*4.5*
▪ Phenitec contribution	303	514	345	417	487	413	186	(182)	59	4
YoY	*TB*	*85.7x*	*49.4*	*10.3*	*60.7*	*(19.6)*	*(46.1)*	*TR*	*(87.9)*	*(99.0)*
OPM	*9.4*	*14.6*	*9.9*	*11.6*	*13.1*	*11.7*	*5.1*	*(6.3)*	*2.3*	*0.1*
▪ Torex	152	121	205	155	188	263	125	70	19	248
YoY	*(38.7)*	*(31.6)*	*(17.7)*	*25.8x*	*23.7*	*117.4*	*(39.0)*	*(54.8)*	*(89.9)*	*(5.7)*
OPM	*6.1*	*4.7*	*8.0*	*6.0*	*7.6*	*9.6*	*5.1*	*2.8*	*0.9*	*9.4*
Ordinary profit	466	641	606	285	924	819	227	(149)	11	267
Profit before income tax	481	608	606	276	923	812	220	(150)	10	222
Profit ATOP	234	267	293	108	496	469	123	(39)	12	146

Source: YUHO financial statements and results briefing presentations.

FY3/20 progress

Given the current external environment, and citing lack of reasonable basis, the company declined to issue 1H guidance for the first time since listing. Initial full-term guidance was for sales -1.2% and OP -29.1%, however the company revised down full-term guidance on 1H results to sales -7.9% and OP -45.2%. External factors including the US-China trade dispute being prolonged and the UK's Brexit problem dragging on continue to weigh on the overall sector. However, it is worth noting that Torex design-in basis Asia segment sales rebounded from -8.5% in the 1Q to +11.7% in the 2Q, posting a positive +2.3% for the 1H. By applications, while Industrial Equipment remained weak, Automotive sales rebounded from -8.1% in the 1Q to +60.2% in the 2Q, posting a positive +26.1% in the 1H. According to the company, this was attributed to strong demand for drive recorders in Japan and from China's targeted initiative for rapid adoption of ETC toll collection on highways nationwide by the end of 2019.

Tie-ups with overseas players

Cirel Systems Pvt. Ltd. (India)

The company announced a capital tie-up with India's Cirel Systems on September 17, 2019. Cirel Systems is a fabless semiconductor maker with strengths in digital-analog mixed signal ASICs. By merging Torex's strengths in energy-saving and ultra-compact technologies in product development, the company aims to speed up new product development and to enhance the line-up of sourced products. In addition, in recent years it has become increasingly difficult to secure analog semiconductor design staff, and the company aims to increase its development capability through sharing human resources with Cirel. The investment amount is not disclosed, but the company said this will not have an impact on earnings for the time being.

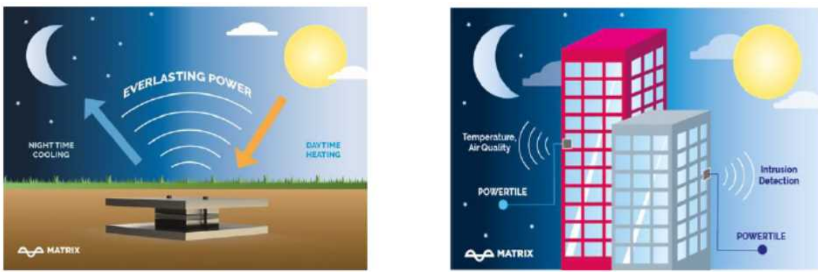
Matrix Industries Inc. (US)

Around the same time on September 13, 2019, the company announced a business tie-up with Matrix Industries of the US, a manufacturer of efficient thermoelectric products for energy harvesting. Energy harvesting is a technology that generates electricity from collecting tiny ambient thermoelectric energy in the environment from sources such as sunlight, vibration and heat. The strength of Matrix is in commercialization of harvesting energy wherever a temperature difference is available and achieving the highest conversion efficiency, an example being commercialization of its PowerWatch, a smart watch which is powered entirely by differences in body temperature with atmospheric temperature, eliminating the need for charging.

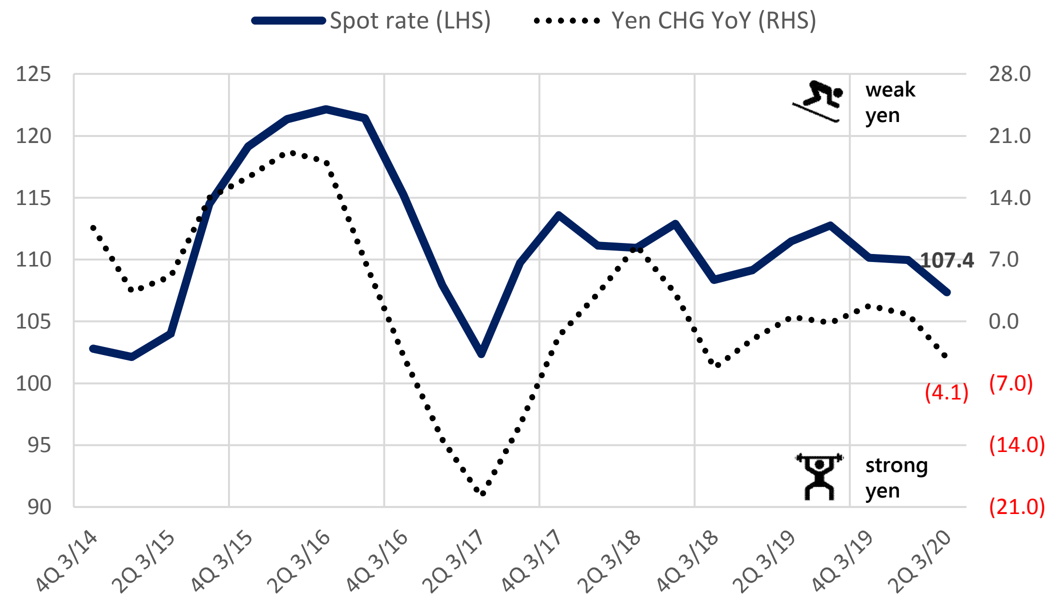
MATRIX PowerWatch Launched in Japan Apr-2018

There are many examples of things in the world where surface temperatures differ from internal temperatures, however expertise in low power consumption and highly efficient power management is indispensable in making those into power sources. These are precisely the strengths of Torex, and there are expectations for commercialization of applications through collaboration by the two companies. Matrix Industries is one of Silicon Valley's hottest technology start-ups, and it was founded in 2011 as a pioneer in materials science, made up of PhDs and engineers from California Institute of Technology, MIT, and Harvard. Matrix selecting Torex as a partner in the field of power management is likely a testament to the company's world class technology (low power consumption, high energy efficiency).

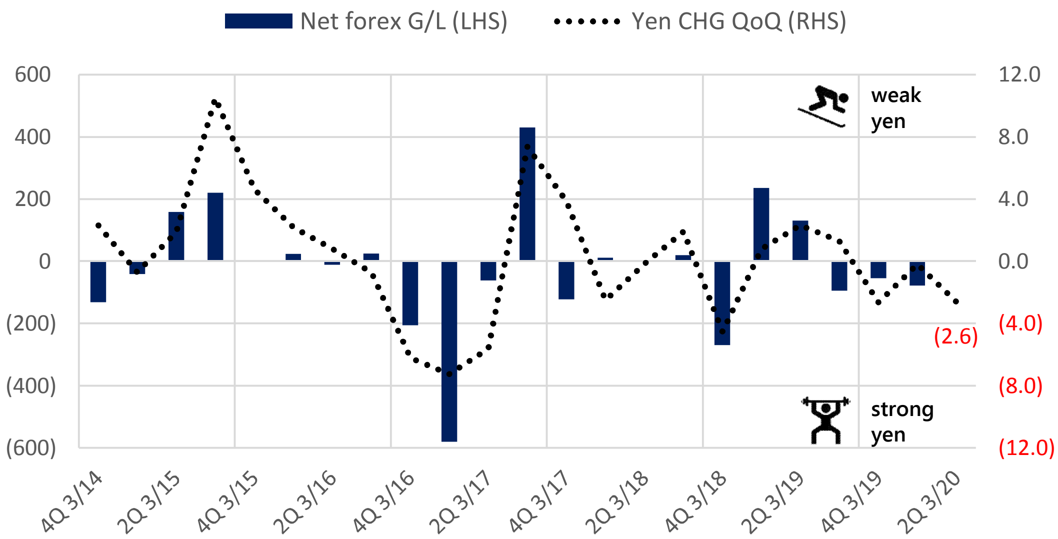
MATRIX Power Tile: Example use/ application of thermoelectric power generation technology



YoY Quarterly Trend of the Yen-Dollar Spot Rate



High correlation between yen QoQ change and net forex gains/losses



Source: TANSHIN financial statements, Yahoo Finance Japan. Note: 2Q 3/20 assumes remaining 2 weeks of Sep-2019 = USD 108.0.

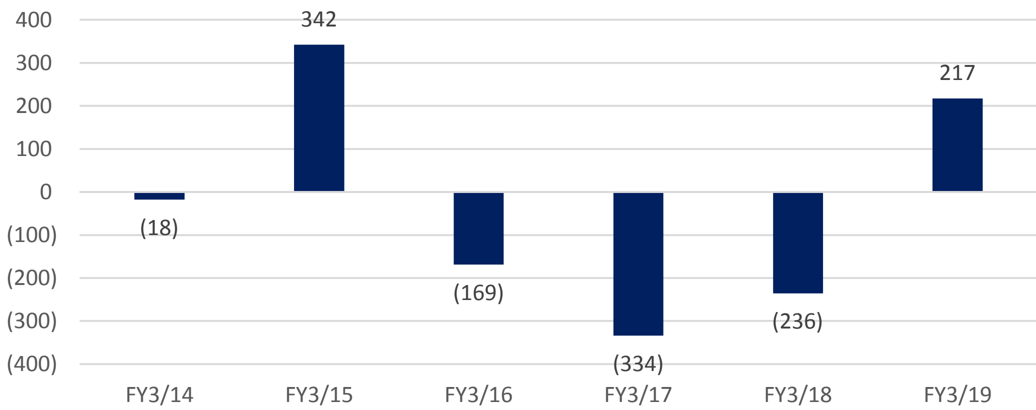
Impact of currency on earnings

FY3/19 revenue had an overseas sales ratio of 71.8%. According to the company, sensitivity for a 1-yen annual fluctuation is roughly ¥140 million for revenue and ¥100 million for OP. In addition, the biggest swing item in non-operating income and non-operating expenses by far is net foreign exchange gains and losses. Relative to the actual USD rate of 110.7 in FY3/19, the company's assumption for FY3/20 is 108.0. The actual rate for 1H FY3/20 was 109.0, strengthening by 1 yen from 110.0 the previous year, and the company booked a foreign exchange loss of ¥62mn in 1H FY3/20. It is our observation that the QoQ change in the yen has a high correlation with forex gains or losses, at least in capturing the direction, with sharp swings having proportionally bigger impacts.

The purpose of this exercise is not to try to game the quarterly forex gains or losses, rather to recognize that one risk to earnings is a strengthening yen. This not only impacts company transactions directly, but also has an indirect negative impact on the majority of the company's Japanese customers in their end markets.

The chart below shows the yen-dollar rate has flirted with the 105 level on 3 occasions over the last 2 years, and any breakdown of the 105 level (i.e. yen strengthening) due to the yen's perceived 'safe haven' status, potentially due to a series of interest rate cuts in the US in an attempt to stave off recession, or even unforeseen complications or breakdown in US-China trade talks. In any case, a stronger yen would represent a risk to the company's business in general.

Annual Trend of Forex Gains and Losses (JPY million)



Source: YUHO financial statements

❸ Shareholders and Capital Allocation Policy

Top management are among the top 10 shareholders

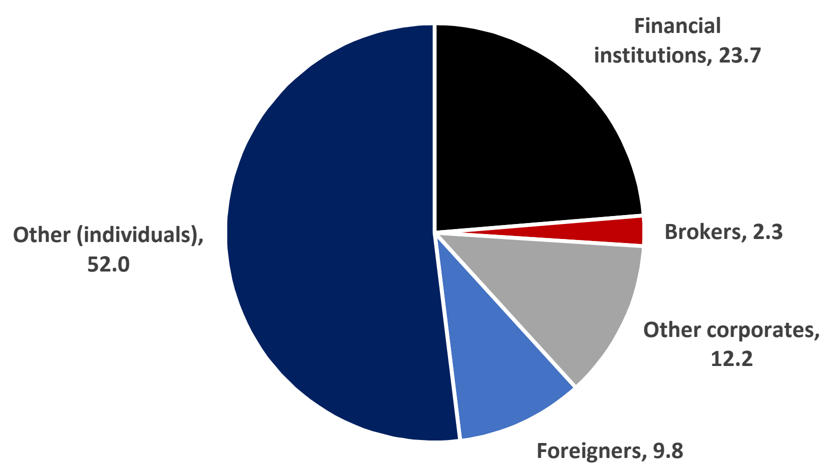
As investors, it is always encouraging to see top management among the company's top shareholders as their financial interests are aligned with the economic interests of all shareholders. As can be seen from the table of major shareholders shown below, both Torex Chairman Tomoyuki Fujisaka and Torex President Koji Shibamiya are among the top 10 shareholders. It is also worth noting that the company has a stock option plan for directors and selected employees, as well as directors of subsidiaries, incentivizing execution of management policy with a view toward maximizing shareholder value. As can be seen from the graph on the following page, foreign investors own 9.8% of the company as of March 31, 2019, up from 5.5% a year earlier.

Major Shareholders as of March 31, 2019

	Shareholder	shares	% out.
1	The Master Trust Bank of Japan Trust Account	1,305,700	11.30
2	Bank of New York 133652	551,900	4.76
3	**Tomoyuki Fujisaka (Torex Chairman)**	**499,300**	**4.32**
4	The Chugoku Bank, Limited (8382 TSE1)	472,190	4.08
5	ARS Co., Ltd.	452,000	3.91
6	Takanori Ozaki	321,500	2.78
7	**Koji Shibamiya (Torex President)**	**291,700**	**2.52**
8	Japan Trustee Services Bank, Ltd. Trust Account	248,420	2.15
9	Kimiko Ozaki	205,700	1.78
10	Tsuyoshi Naka	162,000	1.40
11	Hideaki Tani	135,010	1.15
12	Zenzaburo Namba	135,000	1.15
13	Barclays Bank Segregated PB Cayman	132,200	1.13
14	Japan Trustee Services Bank, Ltd. Trust Account 5	131,900	1.13
15	Kibi Kogyo Co., Ltd.	127,730	1.10
16	Japan Trustee Services Bank, Ltd. Trust Account 9	115,800	1.00
17	Kunitaro Yoshida	104,100	0.90
18	Takashi Maekawa	102,600	0.88
19	AOI ELECTRONICS Co., Ltd. (6832 TSE2)	100,000	0.86
20	Highway Information (ETC corporate cards) Cooperative	100,000	0.86
21	Torex Semiconductor (treasury shares account)	98,228	0.85
22	Oeya Co., Ltd.	95,090	0.82
23	Japan Trustee Services Bank, Ltd. Trust Account 1	90,600	0.78
24	Tomoko Jojo	88,800	0.76
25	Hiromitsu Taguchi	88,475	0.76
26	Japan Trustee Services Bank, Ltd. Trust Account 2	83,400	0.72
27	Sumitomo Mitsui Banking Corporation (8316 TSE1)	80,000	0.69
28	Masayoshi Inaka	78,810	0.68
29	Mikio Hayashi	65,800	0.56
30	Takakazu Yanase	62,688	0.54
	Top 10		39.00
	Top 20		49.16
	Top 30		56.32

Source: Toyo Keizai SHIKIHO Online

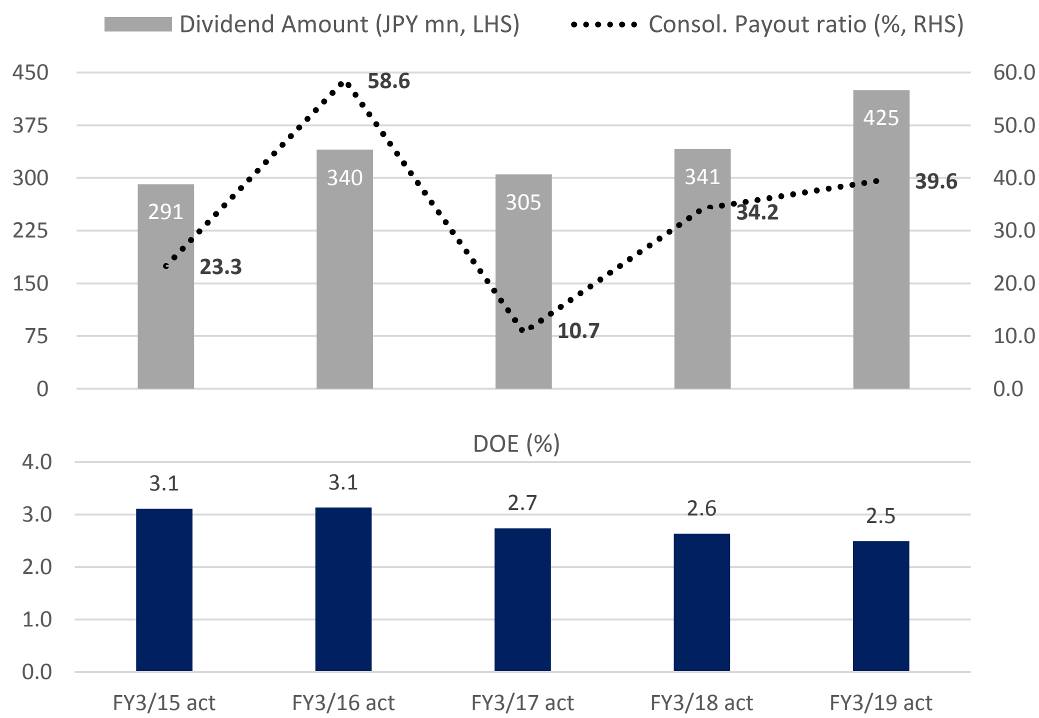
Shareholder Breakdown by Investor Type (as of March 31, 2019)



Source: YUHO financial statements.

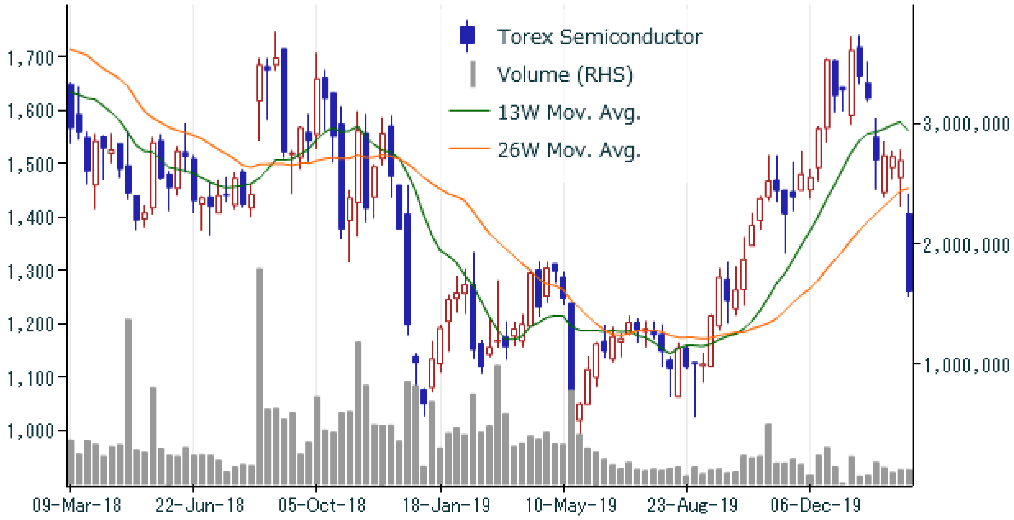
Since listing, the company has steadily increased dividend payments, consistent with its guideline targeting DOE of 3.0%. The payout ratio in FY3/17 appears depressed due to the extraordinary gain from negative GW from the business combination with Phenitec that year. The company announced on March 5, 2019 that the Board of Directors resolved to buy back 600,000 shares (5.2% of outstanding), completing 90,200 in March, and 509,800 in April – July, at an average price of 1,165. We believe the company is well-positioned to weather the downturn and continue dividend payments given its high level of net cash and retained earnings.

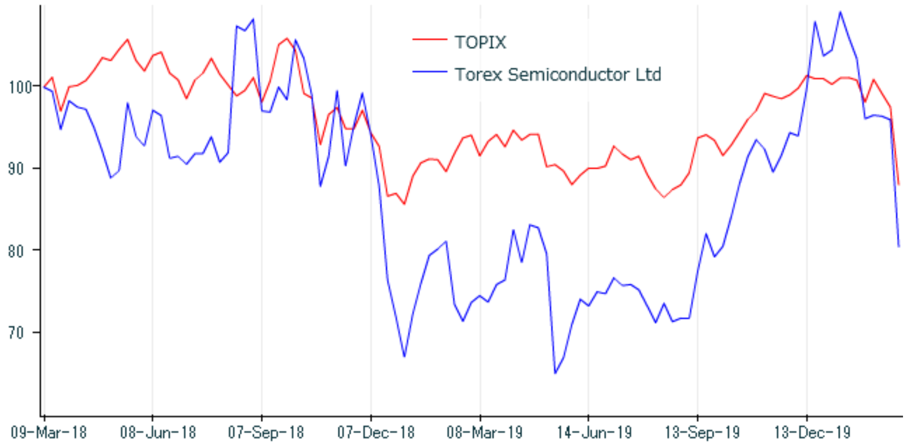
Healthy investor rebate program since listing on April 8, 2014



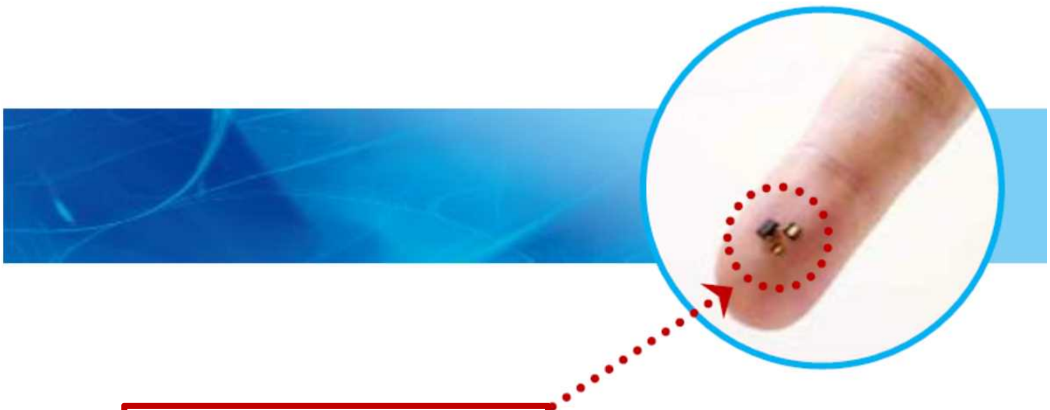
Source: TANSHIN financial statements.

Share Price and Relative Performance





Source: SPEEDA



Torex Power Mgt ICs:
- Ultra compact
- Highly energy efficient, low power consumption

❹ MARKET: Analog ICs and Discrete Semiconductors

Introduction: 'Life is analog.'
The TOREX SEMICONDUCTOR Group is engaged in the design, manufacture and sale of analog ICs and discrete semiconductors employing CMOS process, specializing in power management ICs including voltage regulators and step-up and step-down DC/DC converters. But what does all that mean? Before looking at relevant market trends affecting the company's business, we should go over some basics about the different types of semiconductor circuits in order to understand the nature of the company's products.

First, it is important to understand the difference between analog and digital, and between discrete and integrated circuits. The word 'analog' can often have a slightly negative connotation as old technology, such as audio recordings on vinyl records or magnetic cassette tapes versus digital optical disks. However, the difference between analog and digital semiconductors is inputs and outputs. Analog semiconductors are designed to accept and process analog signals of real-world phenomena such as light, temperature, humidity, sound, speed, force/touch and electrical current. Common functions are amplifiers and filters, such as taking an analog input of sound and making an output of louder sound. They are also referred to as linear ICs because inputs and outputs take on a continuous range of values, and outputs are generally proportional to inputs.

In comparison, digital ICs only accept signals which are binary logic states, such as high or low, true or false etc., which correspond to digital 1s and 0s. Digital signals are only ON (high logic level voltage like 3.3V) or OFF (low logic level voltage like 0V/ground). Analog signals can be a voltage in-between on and off like 1.8V. Analog signals are also continuous values which means they can be an infinite range. Analog ICs are indispensable for interacting with many types of sensors and other devices taking real-world analog signal inputs.

Second is the difference between discrete and integrated circuits. Before the invention of integrated circuits (ICs), all the individual transistors, diodes, resistors, capacitors, and inductors were discrete in nature. Any circuit or a system can produce a desired output based on input. A discrete circuit is constructed of discrete components which are manufactured separately for a single function. The transistor is one of the primary components used in discrete circuits.

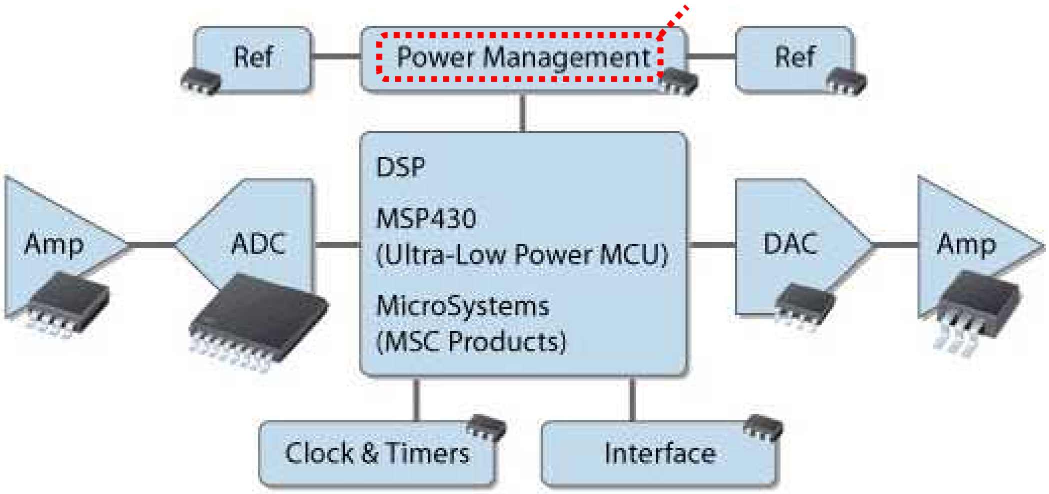
An integrated circuit is a microscopic array of electronic circuits (transistors, diodes etc.) and electronic components (resistors, capacitors etc.) that are diffused or implanted onto the surface of semiconductor material such as a silicon wafer. A microcontroller (MCU) is an advanced integrated circuit that is incorporated with additional peripherals. A microcontroller unit can be treated as a small computer on a single integrated circuit that consists of a small central processing unit, crystal oscillator, timers, watchdog and analog I/O. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in PCs or other general-purpose applications. The majority of MCUs in use today are embedded in industrial equipment, automobiles, appliances and PC peripherals.

An MCU application example is a solar charge controller circuit. Hardware components used for a solar charge controller circuit include: microcontroller, analog digital converter, voltage regulator IC, power semiconductor switch MOSFET, LCD display, rechargeable battery, charge control, dusk to dawn sensor and load control. An Electronic Control Unit (ECU) is any embedded system in automotive electronics that controls one or more of the electrical systems or subsystems in a vehicle, such as controlling the engine, powertrain, transmission, braking system etc.

Finally, what is a power semiconductor? Power semiconductors are components used to convert energy from one form to another at various stages between the points of energy generation and energy consumption. A power semiconductor component can take the form of a discrete transistor, thyristor, or diode; or if a higher level of current or integration is required, the component can take the form of a multi-chip module, such as IGBTs.

TOREX SEMICONDUCTOR specializes in power management ICs. A voltage regulator performs the function of making output voltage less variable than input voltage (e.g. from an input of 5 volts ±50% → to a logic board of 5 volts ±2%). A DC/DC converter converts a source of direct current from one voltage level to another. A step-down or buck converter lowers the output voltage, while a step-up or boost converter raises output voltage. CMOS process technology fabricates both P- and N-channels on the same die to provide ICs which consume less power than other MOS or bipolar processes. Since one transistor of the pair is always off, the series combination draws significant power only momentarily during switching between on and off states. (See glossary of terms at the end of this report.)

➞ Microcontroller (and ECU) units require Power Management ICs



Source: Elprocus. Key elements of MCUs include: core CPU, program and data memory, input output (I/O) ports, bus connectors, serial interface (communication), clock & timers, ADC/DAC. power management, interrupts.

Global market for analog ICs and discrete semiconductors

According to World Semiconductor Trade Statistics (WSTS), founded in 1986 as a non-profit organization of semiconductor product companies, and recognized source for monthly industry shipment statistics, total worldwide billings of semiconductors in 2018 were just shy of $470bn, +13.7% YoY. The combined total of analog ICs and discrete semiconductors was $82.9bn, +10.9% YoY, accounting for 17.7% of the total. Analog ICs alone were $58.8bn, +10.7% YoY, accounting for 12.5% of the total.

The world's largest supplier of analog ICs, Texas Instruments, had 2018 revenue of $15.8bn, +4.9% YoY, of which Analog was $10.8bn, +9.1% YoY, giving it just over 18% market share of the analog IC market. According to the 2018 ranking of leading global analog IC suppliers by IC Insights, a prominent semiconductor market research firm, the market is highly fragmented, with No.2 supplier Analog Devices having a 9% share, dropping to the No.10 supplier Renesas Electronics (formerly NEC Electronics) having a 1% share. The top 10 firms account for roughly 60% of the market.

2018 Leading Analog IC Suppliers (revenue in $mn)

	Company	HQ	2017	2018	YoY	share
1	Texas Instruments	US	9,900	10,801	9.1	18.4%
2	Analog Devices*	US	5,159	5,505	6.7	9.4%
3	Infineon Technologies	Germany	3,355	3,810	13.6	6.5%
4	Skyworks Solutions	US	3,710	3,686	(0.6)	6.3%
5	STMicroelectronics	Switzerland	2,551	3,208	25.8	5.5%
6	NXP Semiconductors	Netherlands	2,415	2,645	9.5	4.5%
7	Maxim Integrated	US	2,025	2,125	4.9	3.6%
8	ON Semiconductor*	US	1,800	1,990	10.6	3.4%
9	Microchip Technology*	US	1,140	1,389	21.8	2.4%
10	Renesas Electronics*	Japan	915	900	(1.6)	1.5%

Source: IC Insights, May 9, 2019. *Note: figures include sales from acquired firms in 2017 and 2018.

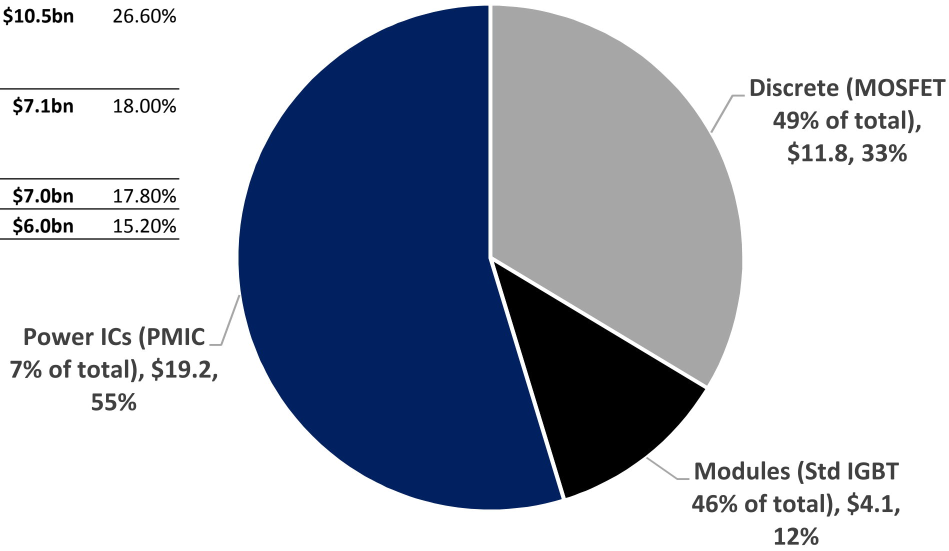
Torex Semiconductor consolidated revenue for the same 12-month period translated at USD 110 was $225mn, +4.6% YoY. Roughly 40% of Torex Group consolidated revenue is in analog ICs, or $90mn, specifically power management ICs including voltage regulators, DC/DC converters and voltage detectors, the remaining 60% in discrete. On the surface, the concept of comparing a specialist niche player like Torex with analog IC revenue of $90mn to global No.1 supplier TI with analog IC revenue of $10,801mn (i.e. 120x larger) may seem reckless and lacking a credible basis, but we will show that not only are their revenues correlated, at least in terms of direction, the correlation is valid largely due to both having the same 4 application categories with emphasis on industrial and automotive.

Power semiconductors are a subset of analog ICs and discrete. In this report we rely on WSTS data to understand market trends as the data is readily available to all investors to monitor, and information specific to power semiconductors is only available through prohibitively expensive subscriptions. Diagrams on the following page provide a handy reference for the power semiconductor market composition.

IHS Markit 2016 Global Market for Power Semiconductors: $35.1bn

2018 End-Market Application Ests.	USD bn	% WGT
Industrial (modules used in motor drives, PV inverters, efficient buildings, lighting)	**$10.5bn**	26.60%
Automotive (onboard systems, ADAS, HV/EV inverters, power steering)	**$7.1bn**	18.00%
Wireless Communications	**$7.0bn**	17.80%
Consumer Electronics	**$6.0bn**	15.20%

Source: IHS Markit update Dec-2017.



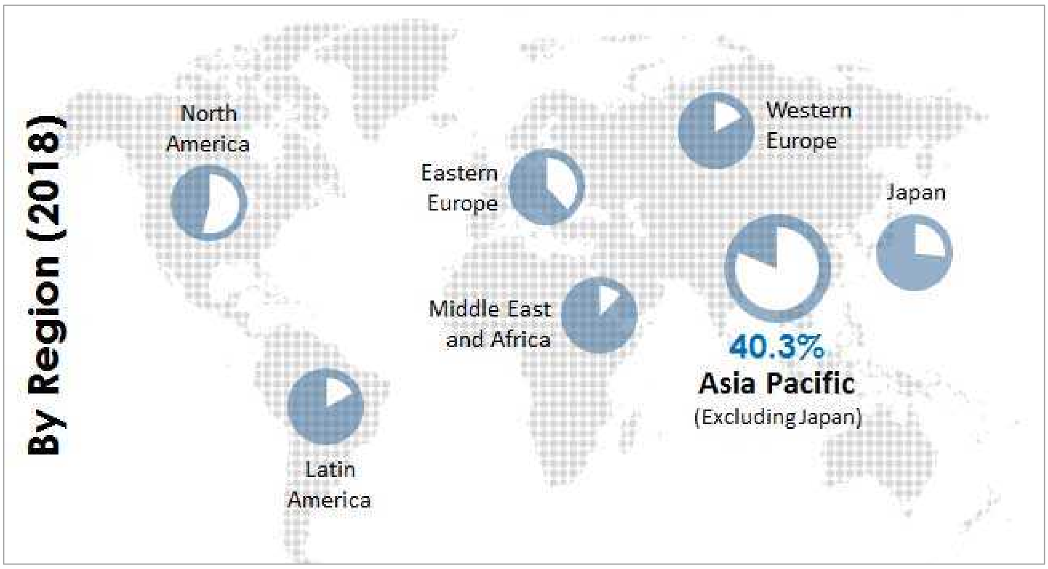
Power ICs		Discretes and Modules
AC-DC switching regulators	Hot swap controller ICs	Bipolar power transistors
DC-DC switching regulators	USB switches and power delivery ICs	Standard MOSFETs, incl SiC & GaN
Isolated switching controllers	Battery management ICs	Rectifier diodes
Non-isolated switching controllers	Integrated power stages	Alternator diodes
Low drop out regulators (LDOs)	Intelligent power switches	Thyristors
Traditional linear regulators	PFC controller ICs	GTOs, GCTs & IGCTs
Voltage reference ICs	Power management ICs (PMICs)	Standard (non-integr) IGBT modules
Supply voltage supervisors	Power over ethernet (PoE) controllers	Power integrated modules
Gate Driver ICs	Squib driver ICs	IGBT-IPM modules

High growth in Asia Pac being driven by:

- Industrial IoT
- Electrification of cars
- 5G infrastructure
- Smart cities, smart grid

2018 Global Power Management IC shares by sales region

- 7.9% CAGR (2018–2028)



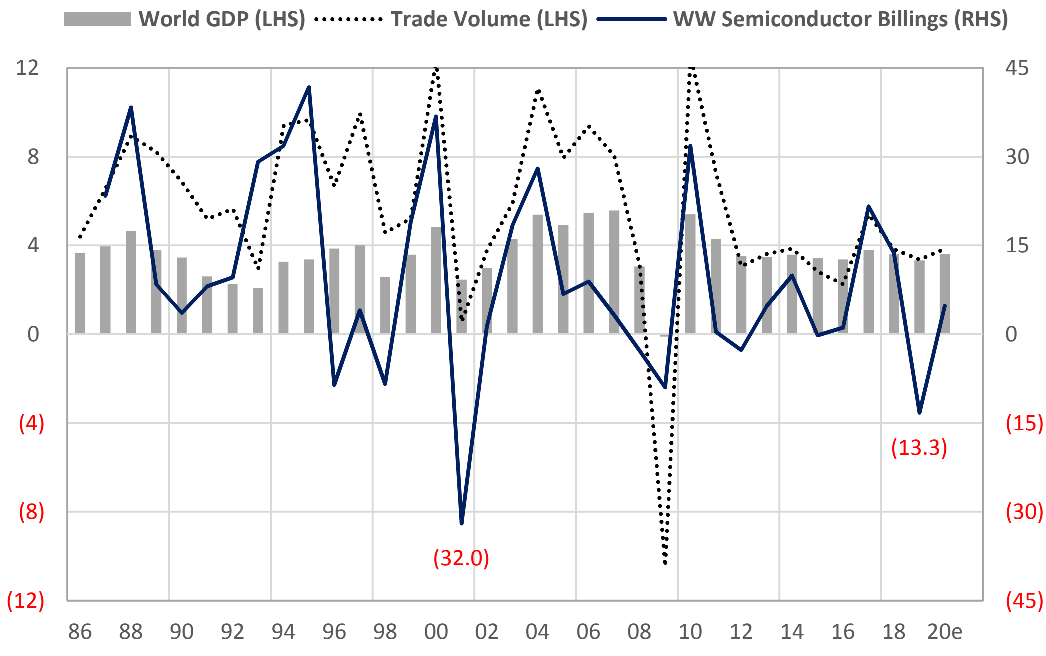
Source: Future Market Insights (FMI). Note: market shares depicted are not actual scale, Europe labels reversed.

Semiconductor industry cyclicality

Semiconductor makers have a cyclical component of business that is a necessary part of high growth medium-term. In the past, the so-called 'silicon cycle' often corresponding with the 4-year Olympics was largely driven by the inventory cycle for PCs. However, this cyclicality has changed in recent years due to diversification of semiconductor demand to include industrial and automotive applications driving growth. The key point for investors is that adjustments tend to be short and sharp, a leading indicator of coming macro slowdown, followed by recovery ahead of the macro recovery, as the productivity gains and cost savings from deploying the underlying technologies are pursued vigorously to address the prevailing slowdown.

WSTS data shows that over the last 34 years there was only 1 instance of the global semiconductor market contracting for 2 consecutive years in 2008-09 during the financial crisis. The only other comparable correction was in 2001-02 after the collapse of the dot-com bubble, however 2002 actually rose +1.3%. Stripping out the +31.8% in 2010 following the 2-year contraction, average growth following a down year is +6%. Another key point for Torex is that analog ICs are less volatile than memory due to the highly fragmented market and more stable pricing.

➞ Adjustments lead macro slowdowns, and upturns lead recoveries



Source: WSTS, IMF World Economic Outlook (WEO) database. 2019 and 2020 are WSTS and IMF ests.

WSTS data shows the current adjustment in worldwide shipments began in December 2018 at -7.7%, sharply slowing double-digit growth of +15.8% in the 3Q to +0.6% in the 4Q. 1Q 2019 was -12.1% and 2Q was -16.8%. Incorporating 1H actual results, the forecast for 2019 is -13.3%, the largest YoY decline since 2001 following the collapse of the dot-com bubble. The adjustment is attributed in part to the estimated -31.0% decline in memory ICs due to weak handset sales, as well as overall negative impact on global trade from the US-China trade war.

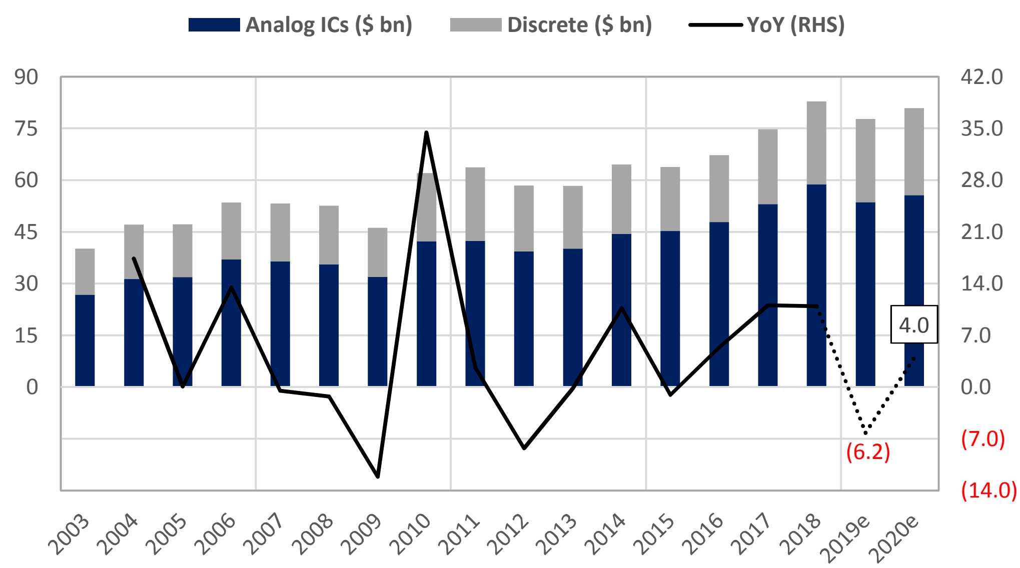
WSTS Worldwide Semiconductor Market Trend by Region and Product Types

USD bn	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019e	2020e
Americas	32.3	39.1	40.7	44.9	42.3	37.9	38.5	53.7	55.2	54.4	61.5	69.3	68.7	65.5	88.5	103.0	74.9	78.9
Europe	32.3	39.4	39.3	39.9	41.0	38.2	29.9	38.1	37.4	33.2	34.9	37.5	34.3	32.7	38.3	43.0	40.3	41.6
Japan	38.9	45.8	44.1	46.4	48.8	48.5	38.3	46.6	42.9	41.1	34.8	34.8	31.1	32.3	36.6	40.0	36.1	37.6
Asia Pacific	62.8	88.8	103.4	116.5	123.5	124.0	119.6	160.0	164.0	163.0	174.4	194.2	201.1	208.4	248.8	282.9	255.3	268.0
WW TOTAL	**166.4**	**213.0**	**227.5**	**247.7**	**255.6**	**248.6**	**226.3**	**298.3**	**299.5**	**291.6**	**305.6**	**335.8**	**335.2**	**338.9**	**412.2**	**468.8**	**406.6**	**426.1**
Discrete	13.3	15.8	15.2	16.6	16.8	16.9	14.2	19.8	21.4	19.1	18.2	20.2	18.6	19.4	21.7	24.1	24.1	25.3
Optoelectronics	9.5	13.7	14.9	16.3	15.9	17.9	17.0	21.7	23.1	26.2	27.6	29.9	33.3	32.0	34.8	38.0	39.8	43.1
Sensors*	3.6	4.8	4.5	5.3	5.1	5.1	4.8	6.9	8.0	8.0	8.0	8.5	8.8	10.8	12.6	13.4	13.4	14.1
Integrated Circuits	140.0	178.8	192.8	209.5	217.8	208.7	190.3	249.9	247.1	238.2	251.8	277.3	274.5	276.7	343.2	393.3	329.2	343.6
▪ Analog	26.8	31.4	31.9	36.9	36.5	35.6	32.0	42.3	42.3	39.3	40.1	44.4	45.2	47.8	53.1	58.8	53.6	55.6
▪ Micro	43.5	50.7	54.7	53.9	56.2	53.1	48.3	60.6	65.2	60.2	58.7	62.1	61.3	60.6	63.9	67.2	63.5	64.9
▪ Logic	37.1	49.5	57.7	60.2	67.3	73.5	65.2	77.4	78.8	81.7	85.9	91.6	90.8	91.5	102.2	109.3	103.0	108.0
▪ Memory	32.5	47.1	48.5	58.5	57.9	46.3	44.8	69.6	60.7	57.0	67.0	79.2	77.2	76.8	124.0	158.0	109.1	115.1
Product TOTAL	**166.4**	**213.0**	**227.5**	**247.7**	**255.6**	**248.6**	**226.3**	**298.3**	**299.5**	**291.6**	**305.6**	**335.8**	**335.2**	**338.9**	**412.2**	**468.8**	**406.6**	**426.1**

% YoY	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019e	2020e
Americas	3.4	20.8	4.3	10.3	(5.7)	(10.5)	1.7	39.3	2.8	(1.5)	13.1	12.7	(0.8)	(4.7)	35.0	16.4	(27.3)	5.4
Europe	16.3	22.0	(0.4)	1.6	2.7	(6.6)	(21.9)	27.4	(1.7)	(11.3)	5.2	7.4	(8.5)	(4.5)	17.1	12.1	(6.1)	3.1
Japan	27.7	17.5	(3.7)	5.3	5.2	(0.7)	(21.0)	21.6	(7.9)	(4.3)	(15.2)	0.1	(10.7)	3.8	13.3	9.2	(9.7)	4.0
Asia Pacific	22.8	41.3	16.5	12.7	6.0	0.4	(3.5)	33.8	2.5	(0.6)	7.0	11.4	3.5	3.6	19.4	13.7	(9.8)	5.0
WW TOTAL	**19.3**	**28.0**	**6.8**	**8.9**	**3.2**	**(2.8)**	**(9.0)**	**31.8**	**0.4**	**(2.7)**	**4.8**	**9.9**	**(0.2)**	**1.1**	**21.6**	**13.7**	**(13.3)**	**4.8**
Discrete	8.1	18.1	(3.3)	8.8	1.3	0.7	(16.3)	39.7	8.0	(10.5)	(4.9)	10.8	(7.7)	4.3	11.5	11.3	0.1	4.7
Optoelectronics	40.6	43.8	8.6	9.2	(2.3)	12.6	(4.8)	27.3	6.4	13.4	5.3	8.3	11.3	(3.8)	8.8	9.2	4.8	8.2
Sensors*	NA	33.6	(4.7)	17.6	(4.0)	(0.3)	(7.0)	45.2	15.5	0.5	0.3	5.8	3.7	22.7	16.2	6.2	0.6	4.8
Integrated Circuits	16.1	27.7	7.8	8.7	4.0	(4.2)	(8.8)	31.3	(1.1)	(3.6)	5.7	10.1	(1.0)	0.8	24.0	14.6	(16.3)	4.4
▪ Analog	12.0	17.1	1.8	15.7	(1.3)	(2.2)	(10.2)	32.1	0.1	(7.2)	2.1	10.6	1.9	5.8	10.9	10.7	(8.8)	3.7
▪ Micro	14.3	16.6	7.8	(1.4)	4.2	(5.5)	(9.1)	25.5	7.5	(7.6)	(2.6)	5.8	(1.2)	(1.2)	5.5	5.2	(5.6)	2.3
▪ Logic	18.1	33.4	16.4	4.3	11.9	9.3	(11.3)	18.6	1.8	3.7	5.2	6.6	(1.0)	0.8	11.7	6.9	(5.8)	4.9
▪ Memory	20.2	45.0	2.9	20.5	(1.1)	(19.9)	(3.3)	55.4	(12.7)	(6.2)	17.6	18.2	(2.6)	(0.6)	61.5	27.4	(31.0)	5.5
Product TOTAL	**18.3**	**28.0**	**6.8**	**8.9**	**3.2**	**(2.8)**	**(9.0)**	**31.8**	**0.4**	**(2.7)**	**4.8**	**9.9**	**(0.2)**	**1.1**	**21.6**	**13.7**	**(13.3)**	**4.8**

Source: WSTS database, 2019e and 2020e WSTS forecasts updated to include 2Q 2019 actual results, press release August 27, 2019.

Analog ICs and discrete are less volatile than memory ICs



Source: WSTS database, 2019e and 2020e WSTS forecasts updated to include 2Q 2019 actual results.

★End-market applications are the key to understanding

To the uninitiated generalist investor, semiconductor stocks can present a daunting challenge just to understand a target company's products and markets. So far we have covered a basic overview of analog ICs and discrete, size and trend of the market relative to other types of semiconductors, and some details on the company's specialty in Power Management ICs. However, all of this discussion about voltage regulators, DC/DC converters, power MOSFETs and IGBT modules etc. is still somehow unsatisfying, and it does not answer basic questions like how are the company's products used and what are the growth drivers.

The final piece to getting beyond the various superior energy-saving and detailed performance specifications of individual products is actually looking at revenue from end-market applications in order to 'see the forest for the trees.' As it turns out, even with the highly fragmented market for analog ICs and discrete, end-market applications can basically be broken down into 4 main groups, which holds for the No.1 player globally all the way down to SME specialist niche players like Torex Semiconductor, due to similar function and purpose of these products used in advanced ICs like microcontrollers and other modules. The 4 main end-market application groups are: ① Industrial, ② Automotive, ③ Personal Electronics and ④ ICT.

The table below provides a detailed list of end-market applications and products for Texas Instruments. Actually, TI classifies Communications Equipment and Enterprise Systems separately, however in principle they both fall under ICT, which many of the other top 10 suppliers adopt. The point is that each maker has a portfolio of products which fall under these 4 main categories, each with differing weights depending on both technical and customer/end-market strengths.

Texas Instruments End-Market Applications and Products

• INDUSTRIAL	• AUTOMOTIVE	• PERSONAL ELECTRONICS	• ICT*
Aerospace & defense	Advanced driver assist systems (ADAS)	Connected peripherals & printers	**Communications equipment**
Appliances	Camera surround view system ECU	Data storage	Broadband fixed-line access
Building automation	Radar ECU	Gaming	Datacom module
Electronic point of sale (EPOS)	Sensor fusion ECU	Home theater & entertainment, TV	Wired networking
Factory automation & control	Body electronics & lighting	Mobile phones	Wireless infrastructure
Grid infrastructure	Remote keyless entry	PC & notebooks	
Indus transport (non-car/light truck)	Hybrid, electric & powertrain systems	Portable electronics	**Enterprise systems***
Lighting	Battery management systems	Tablets	Data center & enterprise computing
Medical	Inverter & motor controls	Wearables (non-medical)	Enterprise machine
Motor drives	All types of powertrain sensors		Enterprise projectors
Power delivery	Infotainment & cluster		
Pro audio, video & signage	Instrument / center display modules		
Test & measurement	Telematics (black box sys for cars)		**TI classifies Enterprise separately*

TI Products			
Amplifiers	DLP® products	Motor drivers	Space & harsh environment
Audio	Interface	Power management	Switches & multiplexers
Clock & timing	Isolation	Processors	Wireless connectivity
Data converters	Logic	RF & microwave	
Die & wafer services	Microcontrollers	Sensors	Calculators & education

Source: company website and IR materials

Texas Instruments Revenue Breakdown by End-Market Applications

USD mn, %	2014	2015	2016	2017	2018	4Y CAGR
Net sales	13,045	13,000	13,370	14,961	15,784	4.9
Industrial	4,044	4,030	4,412	5,236	5,682	**8.9**
Automotive	1,696	1,950	2,407	2,843	3,157	**16.8**
Personal electronics	3,783	3,900	3,476	3,740	3,630	(1.0)
Communications equipt.	2,218	1,690	1,738	1,795	1,736	(5.9)
Enterprise Systems	783	780	802	898	1,105	9.0
Breakdown						
Industrial	31%	31%	33%	35%	36%	—
Automotive	13%	15%	18%	19%	20%	—
Total IND + CAR	**44%**	**46%**	**51%**	**54%**	**56%**	—

Source: company financial statements. Note: business segments incl. Analog, Embedded Processing and Other

According to Torex Semiconductor, over the last 6 years, it has seen the highest growth in industrial and automotive. Regarding industrial applications, security equipment such as surveillance cameras, smart meters, industrial robots, POS registers and POS terminals, and electronic money debit card readers account for a significant portion. IoT is an extremely promising area going forward, which we discuss in the next section. Automotive is mainly comprised of car navigation and infotainment systems. The electrification of cars is entering a high growth period, and in addition to ADAS, autonomous driving will require among other things a sharp increase in the number of cameras and sensors, and management is focusing R&D efforts on these two highly promising areas.

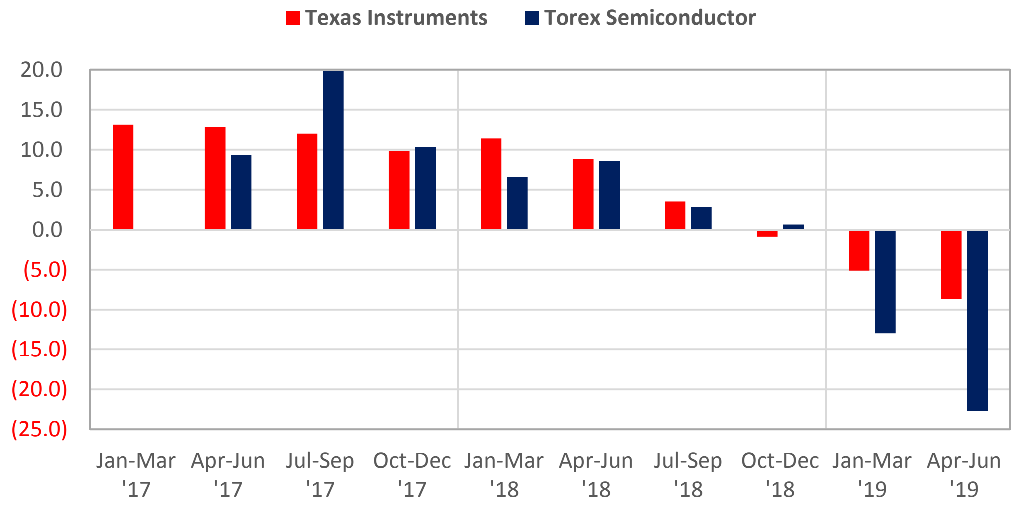
Earlier we made the assertion that comparing a specialist niche player like Torex to the global No.1 supplier may seem somewhat reckless and lacking a credible basis, but here we can see that **not only are their revenues correlated**, at least in terms of direction (see graph on the top of the next page), **the correlation is valid largely due to both having similar growth profiles in industrial and automotive**. Since Texas Instruments reports quarterly results roughly 3 weeks ahead of Torex, we believe TI revenue is one data point worth following.

Torex Semiconductor (parent) Revenue by End-Market Applications

JPY mn, %	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	4Y CAGR
Net sales	9,971	10,621	10,181	10,168	10,104	0.3
Industrial	2,378	2,918	3,444	3,728	3,927	**13.4**
Automotive	1,241	1,429	1,608	1,708	1,535	**5.5**
Wearables	80	120	197	233	238	31.3
Medical	87	96	106	108	125	9.5
Digital AV	1,847	1,843	—	—	—	minus
Home & beauty	713	624	—	—	—	minus
PCs and peripherals	1,212	895	—	—	—	minus
Communications	712	423	—	—	—	minus
Other	1,701	2,273	4,826	4,391	4,279	nm
Breakdown						
Industrial	24%	27%	34%	37%	39%	—
Automotive	12%	13%	16%	17%	15%	—
Total IND + CAR	**36%**	**41%**	**50%**	**53%**	**54%**	—

Source: company IR results briefing materials

Despite the huge size gap, there is some correlation in quarterly revenue trends YoY



Source: company financial statements. Note: 4Q3/17 YoY for Torex is omitted due to the business combination with Phenitec the previous year, more than doubling revenue.

IndexPro is the largest engineering trade portal for electronic and industrial components in Japan, with sister sites in English and German. The monthly click-share rankings below shed some insight on the company's direct competitors. The takeaway from this data is Torex consistently places 4TH or 5TH in the top group which includes the global No.1 and No.2 makers.

Multi-channel Power Management ICs (PMIC) click-share ranking (17 cos.)

	June 2019	share		July 2019	share		August 2019	share
1	Texas Instruments	13.4%	1	Texas Instruments	18.4%	1	Ricoh Electronic Devices	20.0%
1	Analog Devices	13.4%	2	Ricoh Electronic Devices	14.9%	2	Texas Instruments	16.0%
3	Ricoh Electronic Devices	11.9%	3	NXP Japan	14.0%	3	ROHM	12.0%
4	**Torex Semiconductor**	**9.2%**	**4**	**Torex Semiconductor**	**11.4%**	**3**	**Torex Semiconductor**	**12.0%**
5	NXP Japan	7.6%	5	ROHM	10.5%	5	NXP Japan	10.0%
6	Seiko NPC	6.7%	6	Analog Devices	7.0%	5	Analog Devices	10.0%
7	IDT	5.9%	7	Cypress	5.3%	7	THine Electronics	6.0%
8	Cypress	4.2%	8	Seiko NPC	4.4%	8	Nexell	4.0%
8	ROHM	4.2%	9	ams	2.6%	9	SKYWORKS	2.0%
8	THine Electronics	4.2%	9	Enpirion	2.6%	9	IDT	2.0%

Boost and Buck-Boost DC/DC Converter ICs click-share ranking (46 cos.)

	June 2019	share		July 2019	share		August 2019	share
1	Texas Instruments	24.4%	1	Texas Instruments	21.5%	1	Texas Instruments	23.5%
2	Analog Devices	8.9%	2	New Japan Radio	8.6%	2	Ricoh Electronic Devices	8.4%
3	**Torex Semiconductor**	**7.1%**	3	ROHM	7.9%	3	Analog Devices	7.0%
4	New Japan Radio	6.6%	4	Analog Devices	6.6%	3	New Japan Radio	7.0%
5	ROHM	5.8%	**5**	**Torex Semiconductor**	**5.8%**	**5**	**Torex Semiconductor**	**6.6%**
5	Ricoh Electronic Devices	5.8%	6	Maxim Integrated	3.9%	6	ROHM	5.6%
7	Maxim Integrated	5.0%	7	Asahi Kasei Microdevices	3.3%	7	Maxim Integrated	4.7%
8	ON Semiconductor	3.7%	7	Ricoh Electronic Devices	3.3%	8	Infineon	3.7%
9	Asahi Kasei Microdevices	3.4%	9	Vicor	2.4%	9	Microchip	3.5%
10	ABLIC	3.1%	10	Infineon	2.3%	10	ABLIC	3.1%

Source (upper and lower): IndexPro website.

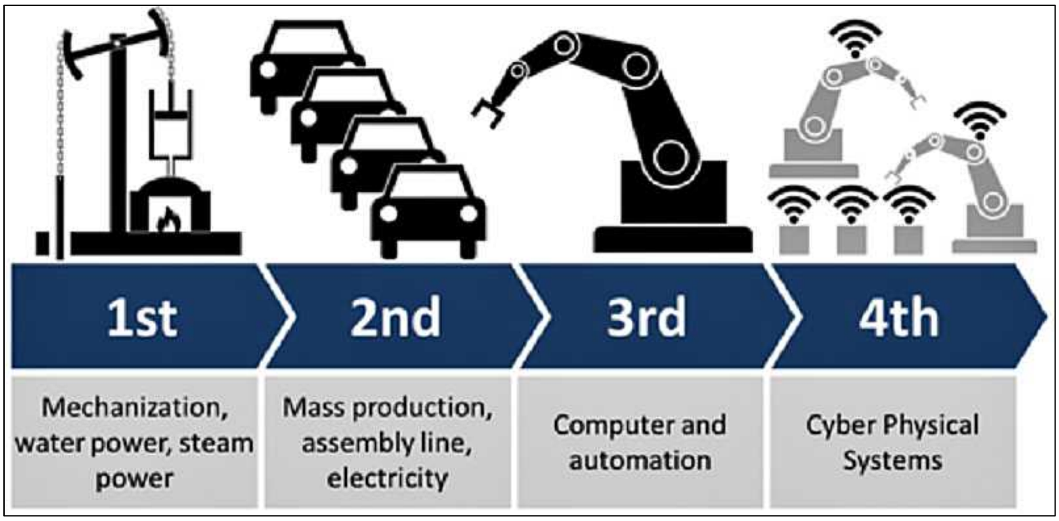
❺ OUTLOOK: Growth Drivers

IoT and Industry 4.0

The Internet of Things (IoT) refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other internet-enabled devices and systems. Industrial Internet of Things (IIoT) is a subset of IoT, aimed specifically at industrial applications. IIoT is about connecting machines to other machines/data management and the optimization and productivity that is possible to make 'smart factories.' Industry 4.0 (coined in Europe) means the same as IIoT and refers to the fourth industrial revolution, as shown in the graphic below.

The first industrial revolution happened between the late 1700s and early 1800s, when manufacturing evolved from manual work by people and animals to using water, steam-powered engines and machine tools. The second industrial revolution occurred in the early 1900s with the introduction of steel and use of electricity in factories. The introduction of electricity raised manufacturing efficiency, and mass production on assembly lines raised productivity. The third industrial revolution started in the late 1950s with the introduction of electronic and eventually computer technology in factories. The emphasis was a shift from mechanical technology to digital technology and automation software.

The fourth industrial revolution has emerged since the new millennium with the help of interconnectivity through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems. Industry 4.0 smart manufacturing applications include 1) supply chain management and optimization, 2) predictive maintenance/analytics and 3) asset tracking and optimization. M2M (machine-to-machine) refers to the communication that happens between two separate machines through wireless or wired networks. Going forward, the roll-out of 5G is expected to accelerate development of M2M applications in smart factories. The cloud, big data, AI and advances in sensors and robotics are all integral to Industry 4.0.



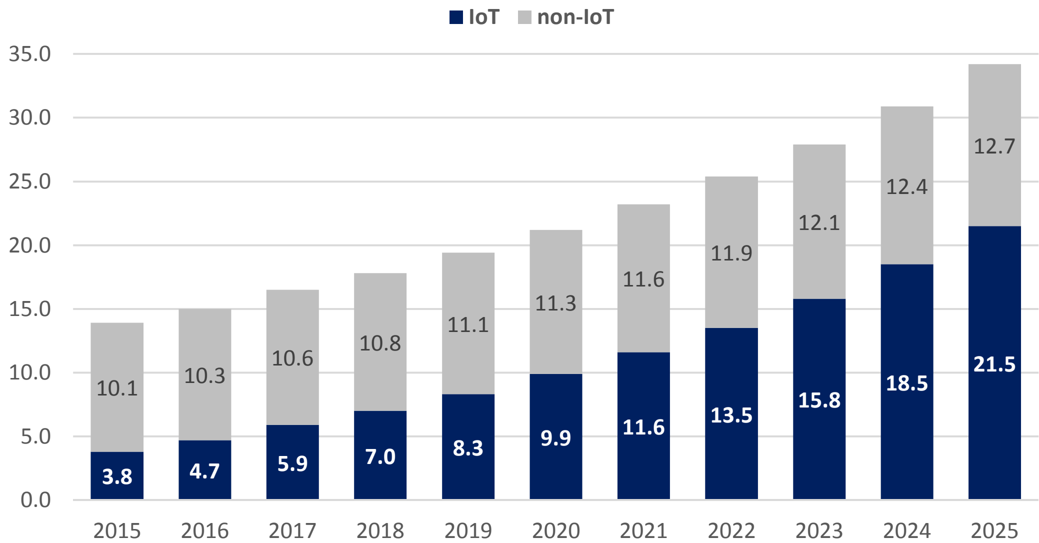
Source: FierceElectronics, September 4, 2018.

IoT has been a buzzword for almost a decade, but corporate spending programs focused on IoT appear to be gaining momentum, as successes and failures of early adopters allow managers to focus programs on specific outcomes to achieve desired productivity gain and cost-saving goals. IDC is a global market research provider on all things related to information technology, and it publishes the IDC Worldwide Semiannual Internet of Things Spending Guide. The most recent guide published in June 2019 slightly lowers the 2019 forecast from $745bn (+15.4%) to $726bn (+12.4%), but its new 2023 forecast of $1.17trn gives 4Y CAGR of +12.6%.

The top commercial sectors ranked by 2019 spending are: discrete manufacturing ($119bn), process manufacturing ($78bn), transportation ($71bn) and utilities ($61bn). Here discrete manufacturing refers to manufacturing specific products or components such as autos and electronics, and process manufacturing refers to bulk production such as pharma and food/beverages. Manufacturing spending is focusing on operations support and asset management. Transportation is focused on freight monitoring and fleet management, and utilities spending is dominated by smart grid. 2019 consumer IoT will reach $108bn, the second largest sector, driven by smart home, personal wellness and connected vehicle infotainment. The IDC forecast for 2023 consumer IoT spending has the highest 4-year CAGR of +16.8%, and this forecast sees consumer overtaking discrete manufacturing to become the top IoT spending sector in 2023.

Another way to think about the growth outlook for IoT is in the number of connected devices. IoT Analytics is a German market research and consulting firm dedicated entirely to IoT. The forecast shown in the graph below was published in Aug-2018. The forecast assumes 7Y CAGR of +9.8% through 2025. The key takeaway from this data however is that the growth is being entirely driven by IoT, +17.4% CAGR, versus non-IoT at +2.3% CAGR. IoT refers to consumer and industrial connected devices that are not traditional mobile devices like smartphones, tablets and PCs.

Total Number of Active Device Connections Worldwide (bn units)



Source: IoT Analytics Aug-2018. Note: non-IoT includes mobile phones, tablets, PCs, notebooks and fixed-line phones. IoT includes all consumer and B2B connected devices.

Gartner, another global market research provider on all things related to information technology, recently published a forecast for worldwide enterprise and automotive IoT endpoints to reach 5.8bn in 2020, +20.8% YoY. Gartner's classification differs slightly with IoT Analytics in that it does not include consumer applications. The key takeaway from this data is that it basically corroborates the outlook for high double-digit growth in IoT connected devices going forward.

IoT Endpoint Market by Segment, Worldwide (bn units)

Segment	2018	2019	2020	YoY	share
Utilities	0.98	1.17	1.37	17.1	23.6%
Government	0.40	0.53	0.70	32.1	12.0%
Building Automation	0.23	0.31	0.44	41.9	7.6%
Physical Security	0.83	0.95	1.09	14.7	18.8%
Mfg & Natural Resources	0.33	0.40	0.49	22.5	8.4%
Automotive	0.27	0.36	0.47	30.6	8.1%
Healthcare Providers	0.21	0.28	0.36	28.6	6.2%
Retail & Wholesale Trade	0.29	0.36	0.44	22.2	7.6%
Information	0.37	0.37	0.37	0.0	6.4%
Transportation	0.06	0.07	0.08	14.3	1.4%
Total	**3.96**	**4.81**	**5.81**	**20.8**	**100.0%**

Source: Gartner, Aug-2019

Gartner also recently published its update forecast for worldwide wireless infrastructure revenue, expecting spending on 5G to increase 3.6x YoY to $2.2bn in 2019, and then to nearly double to $4.2bn in 2020. 3Y CAGR through 2021 is +123.1%. 5G deployment has major implications for development of new IoT smart factory M2M applications. 5G is 10–20x faster than 4G/LTE. 5G networks are based on small cells supporting the high frequency millimeter wave bands for point-to-point communications, which will require installation of a lot more, smaller base stations compared with 4G cell towers. We also include the Gartner forecast for wearables, which is a high-growth area for Torex Semiconductor.

Wireless Infrastructure Revenue Forecast, Worldwide ($ mn)

Segment	2018	2019	2020	2021	3Y CAGR
2G	1,503	698	407	285	(42.5)
3G	5,578	3,694	2,464	1,558	(34.6)
LTE and 4G	20,455	19,322	18,278	16,353	(7.2)
5G	613	2,211	4,176	6,806	123.1
Small Cells	4,786	5,378	5,858	6,473	10.6
Mobile Core	4,599	4,621	4,787	5,010	2.9
Total	**37,534**	**35,925**	**35,971**	**36,484**	**(0.9)**

Source: Gartner, Aug-2019

Source: Lifewire, "How 5G cell towers work," Jun-2019

Wearable Devices Shipments Forecast, Worldwide (mn units)

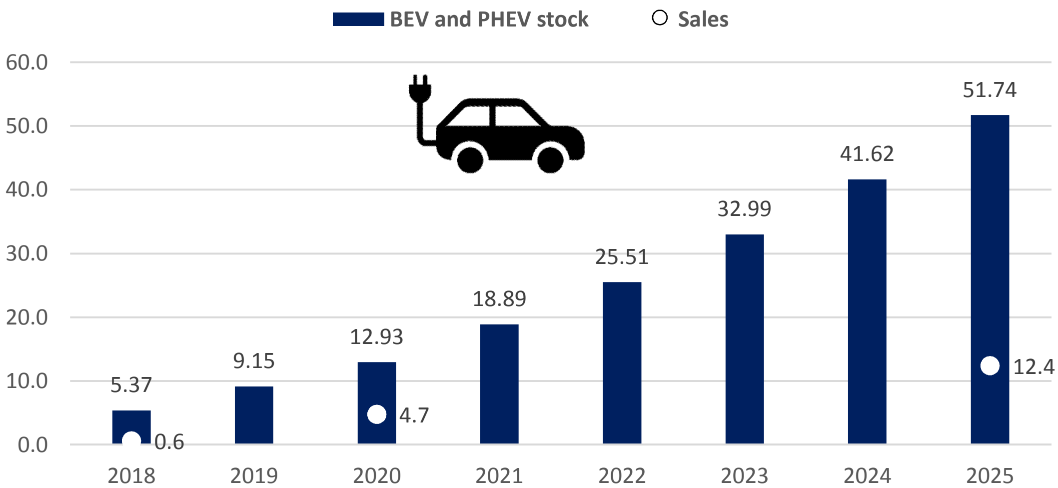
Device	2017	2018	2019	2022	4Y CAGR
Smartwatch	41.50	53.00	74.09	115.20	21.4
Head-mounted display	19.08	28.40	34.83	80.18	29.6
Smart clothing	4.12	5.65	6.94	19.91	37.0
Ear-worn	21.49	33.44	46.12	158.43	47.5
Wristband	36.00	38.97	41.86	51.73	7.3
Sports watch	18.63	19.46	21.28	27.74	9.3
Total	**140.82**	**178.92**	**225.12**	**453.19**	**26.2**

Source: Gartner, Nov-2018

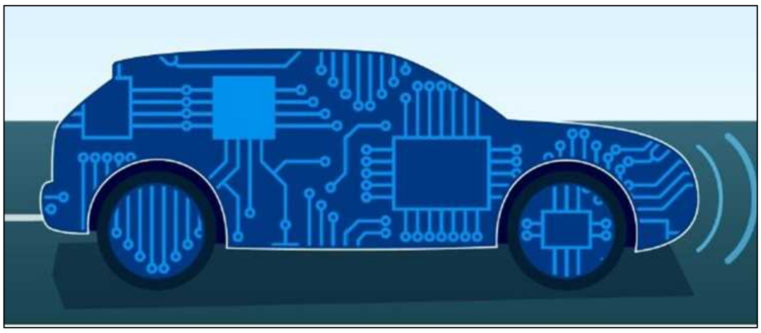
Electrification of cars is also entering a new high-growth phase

The IEA's new 232pp Global EV Outlook 2019 published in May includes a detailed forecast model for xEV electric vehicle stock and sales based on new models announced by OEMs. Needless to say, along with IoT, the electrification of cars is also entering a new high growth phase, which offers highly promising growth opportunities for power management ICs. Torex Semiconductor is introducing new products which can withstand higher voltages and handle large currents, targeting body control ECUs, ADAS camera systems and EV drive parts including motor and inverters, in addition to existing car navigation and infotainment systems.

Projected Global xEV (rechargeable vehicle) Owned Stock and New Sales (mn units)



Source: International Energy Agency (IEA), Global EV Outlook 2019 (May 2019)
Note: the New Policies Scenario assumes announced policies are implemented.



Source: Torex Semiconductor IR results briefing materials

❻ FINANCIAL STATEMENTS: Consolidated Statements of Income

JPY million, %	FY3/14	mrg	FY3/15	mrg	FY3/16	mrg	FY3/17	mrg	FY3/18	mrg	FY3/19	mrg
Net sales	9,391	100.0	9,972	100.0	10,621	100.0	21,560	100.0	23,997	100.0	23,897	100.0
YoY	*9.2*		*6.2*		*6.5*		*103.0*		*11.3*		*(0.4)*	
Cost of sales	5,054	53.8	5,150	51.6	5,558	52.3	15,659	72.6	16,820	70.1	17,403	72.8
Gross profit	4,337	46.2	4,822	48.4	5,063	47.7	5,900	27.4	7,177	29.9	6,494	27.2
Selling, general and administrative expenses	2,922	31.1	3,472	34.8	3,923	36.9	4,649	21.6	4,964	20.7	4,943	20.7
Operating profit	1,414	15.1	1,350	13.5	1,140	10.7	1,251	5.8	2,212	9.2	1,551	6.5
YoY	*149.5*		*(4.5)*		*(15.6)*		*9.8*		*76.8*		*(29.9)*	
Non-operating income												
Interest and dividend income	6		6		16		31		25		30	
Foreign exchange gains	—		342		—		—		—		217	
Royalty income	6		5		9		10		12		10	
Gain on sale of non-current assets	—		—		8		—		—		—	
Refunded premium on canceled insurance	—		—		—		—		27		—	
Rent income	—		—		—		8		21		29	
Secondment income	5		0		—		—		—		—	
Other	4		11		3		19		17		27	
Total non-operating income	21		364		34		69		101		313	
Non-operating expenses												
Interest expense	23		4		2		42		32		30	
Foreign exchange losses	18		—		169		334		236		—	
Commission expense	13		—		28		8		38		8	
IPO listing expense	—		25		—		—		—		—	
Business liquidation loss	23		—		—		—		—		—	
Other	19		7		5		30		9		5	
Total non-operating expenses	97		35		204		414		315		43	
Ordinary profit	1,339	14.3	1,679	16.8	971	9.1	906	4.2	1,998	8.3	1,820	7.6
YoY	*201.2*		*25.4*		*(42.2)*		*(6.7)*		*120.6*		*(8.9)*	
Extraordinary income												
Gain on sale of non-current assets	—		—		—		—		—		2	
Gain arising from negative goodwill	—		—		—		1,967		—		—	
Subsidy income	—		—		—		48		30		3	
Insurance claim income	—		—		105		27		4		3	
Compensation income	—		—		85		519		—		—	
Total extraordinary income	—		—		190		2,561		34		8	
Extraordinary losses												
Loss on tax purpose reduction of NC assets	—		—		—		14		14		—	
Loss on sale and retirement of NC assets	—		—		—		—		42		23	
Insurance cancellation loss	15		—		—		—		—		—	
Loss on damage compensation	—		—		85		—		—		—	
Condolence money	—		—		32		—		—		—	
Impairment loss	—		—		20		—		—		—	
Loss on disaster	—		—		—		17		5		0	
Total extraordinary losses	15		—		137		31		62		23	
Profit before income taxes	1,324		1,679		1,024		3,435		1,971		1,805	
Income taxes - current	120		461		336		544		459		481	
Income taxes - deferred	(155)		(33)		106		(214)		103		3	
Total income taxes	(35)		428		442		331		561		484	
Profit	1,359		1,251		581		3,105		1,410		1,321	
Profit attributable to non-controlling int.	1		3		1		174		507		272	
Profit attributable to owners of parent	1,357	14.5	1,248	12.5	580	5.5	2,931	13.6	902	3.8	1,049	4.4
YoY	*607.7*		*(8.1)*		*(53.5)*		*404.9*		*(69.2)*		*16.3*	

Note: figures reported in thousand yen are rounded to the nearest million yen.

Consolidated Balance Sheets-1: Assets

JPY million, %	14.3.31	wgt	15.3.31	wgt	16.3.31	wgt	17.3.51	wgt	18.3.31	wgt	19.3.31	wgt
Current assets												
Cash and deposits	5,647	52.3	6,202	47.1	6,617	51.0	7,769	30.8	10,835	38.7	10,982	38.7
Notes and accounts receivable - trade	1,845		1,937		1,922		4,195		4,363		4,017	
Marketable securities	–		500		300		2,300		1,600		–	
Merchandise and finished goods	1,465		1,615		1,530		1,680		1,554		1,731	
Work in progress	116		143		119		1,235		1,661		1,460	
Raw materials and supplies	37		49		30		1,162		1,299		1,411	
Uncollected income tax refund	1		7		6		–		–		–	
Deferred tax assets	136		115		80		–		–		–	
Other	165		185		216		336		359		309	
Allowwance for doubtful accounts	(1)		(0)		(1)		(3)		(2)		(3)	
Total current assets	9,410	87.1	10,753	81.6	10,818	83.4	18,675	74.1	21,669	77.4	19,907	70.1
Non-current assets												
Property, plant and equipment												
Buildings and structures	571		636		636		–		–		–	
Accumulated depreciation	(241)		(294)		(320)		–		–		–	
Buildings and structures, net	330		343		315		1,527		1,451		2,647	
Machinery, equipment and vehicles	556		669		770		–		–		–	
Accumulated depreciation	(391)		(516)		(575)		–		–		–	
Machinery, equipt and vehicles, net	165		152		194		531		527		1,423	
Tools, furniture and fixtures	2,029		2,176		2,369		–		–		–	
Accumulated depreciation	(1,598)		(1,731)		(1,935)		–		–		–	
Tools, furniture and fixtures, net	431		445		434		800		645		655	
Land	–		–		–		1,148		1,148		1,147	
Leased assets	23		23		23		–		–		–	
Accumulated depreciation	(4)		(9)		(13)		–		–		–	
Leased assets, net	19		14		10		123		76		41	
Construction in progress	49		92		167		136		448		335	
Total property, plant and equipment	994	9.2	1,046	7.9	1,120	8.6	4,266	16.9	4,294	15.3	6,249	22.0
Intangible assets												
Goodwill	–		–		–		–		–		–	
Software	34		203		203		209		224		164	
Other	3		40		1		4		10		293	
Total intangible assets	43	0.4	207	1.6	204	1.6	213	0.8	234	0.8	457	1.6
Investments and other assets												
Investment securities	3		739		461		1,125		883		740	
Assets related to retirement benefits	–		–		–		–		24		–	
Deferred tax assets	27		69		25		542		494		613	
Other	322		357		372		415		422		446	
Allowance for doubtful accounts	–		–		(27)		(27)		(25)		(26)	
Total investments and other assets	353	3.3	1,165	8.8	831	6.4	2,056	8.2	1,797	6.4	1,773	6.2
Total non-current assets	1,390	12.9	2,418	18.4	2,155	16.6	6,535	25.9	6,326	22.6	8,479	29.9
Total assets	10,801	100.0	13,171	100.0	12,973	100.0	25,210	100.0	27,995	100.0	28,386	100.0

Note: figures reported in thousand yen are rounded to the nearest million yen.

Consolidated Balance Sheets-2: Liabilities and Shareholders' Equity

JPY million, %	14.3.31	wgt	15.3.31	wgt	16.3.31	wgt	17.3.51	wgt	18.3.31	wgt	19.3.31	wgt
Current liabilities												
Notes and accounts payable - trade	718		890		798		1,067		985		910	
Short-term loans payable	1,008		4		3		2,423		2,483		1,903	
Current portion of long-term loans payable	17		–		–		1,174		1,103		1,021	
Current portion of bonds	96		108		–		–		–		–	
Lease obligations	5		5		5		49		45		20	
Accounts payable - other	265		264		459		780		1,162		1,080	
Income taxes payable	119		416		133		259		258		327	
Provision for bonuses	100		112		97		346		451		388	
Other	84		89		128		208		370		562	
Total current liabilities	2,413	22.3	1,887	14.3	1,622	12.5	6,306	25.0	6,857	24.5	6,211	21.9
Non-current liabilities												
Long-term loans payable	–		–		–		2,496		1,394		1,748	
Bonds payable	108		–		–		–		–		–	
Lease obligations	15		10		5		80		34		25	
Long-term accounts payable - other	169		169		161		292		246		224	
Retirement benefit liability	184		207		237		317		264		414	
Provision for stock benefits	6		7		9		–		27		34	
Asset retirement obligations	1		1		2		78		79		81	
Deferred tax liabilities	–		0		–		35		1		1	
Other	–		–		8		8		9		12	
Total non-current liabilities	483	4.5	395	3.0	421	3.2	3,306	13.1	2,053	7.3	2,537	8.9
Total liabilities	2,896	26.8	2,282	17.3	2,044	15.8	9,612	38.1	8,910	31.8	8,748	30.8
Shareholders' equity												
Capital stock	985		1,810		1,820		1,838		2,968		2,968	
Capital surplus	3,452		4,277		4,287		2,825		3,928		8,303	
Retained earnings	3,416		4,440		4,691		7,337		7,950		8,607	
Treasury shares	–		–		–		(829)		(416)		(206)	
Total shareholders' equity	7,853	72.7	10,527	79.9	10,797	83.2	11,172	44.3	14,429	51.5	19,671	69.3
Accumulated other comprehensive income												
Valuation difference on avail.-for-sale sec	1		23		(31)		94		(10)		(87)	
Foreign currency translation adjustment	16		294		120		93		26		74	
Remeasurements of defined benefit plans	–		–		–		73		59		(64)	
Total accumulated other comp. income	17	0.2	317	2.4	89	0.7	260	1.0	75	0.3	(77)	(0.3)
Non-controlling interests	36	0.3	45	0.3	43	0.3	4,165	16.5	4,582	16.4	44	0.2
Total net assets	7,905	73.2	10,889	82.7	10,929	84.2	15,598	61.9	19,085	68.2	19,638	69.2
Total liabilities and net assets	10,801	100.0	13,171	100.0	12,973	100.0	25,210	100.0	27,995	100.0	28,386	100.0

Note: figures reported in thousand yen are rounded to the nearest million yen.

Trend of Key Financial Indicators

JPY million, %	14.3.31	15.3.31	16.3.31	17.3.51	18.3.31	19.3.31
Cash and deposits	5,647	6,202	6,617	7,769	10,835	10,982
Marketable securities	0	500	300	2,300	1,600	0
Total cash and equivalents	5,647	6,702	6,917	10,069	12,435	10,982
Short-term loans payable	1,008	4	3	2,423	2,483	1,903
Current portion of long-term loans payable	17	0	0	1,174	1,103	1,021
Current portion of bonds	96	108	0	0	0	0
Lease obligations	5	5	5	49	45	20
Long-term loans payable	0	0	0	2,496	1,394	1,748
Bonds payable	108	0	0	0	0	0
Lease obligations	15	10	5	80	34	25
Total interest-bearing debt	1,249	126	13	6,223	5,059	4,716
Net cash (net debt)	4,397	6,576	6,903	3,847	7,376	6,266
Total net assets	7,905	10,889	10,929	15,598	19,085	19,638
Non-controlling interests	36	45	43	4,165	4,582	44
Total equity	7,869	10,844	10,886	11,432	14,503	19,594
Total assets	10,801	13,171	12,973	25,210	27,995	28,386
Shareholders' equity ratio	72.9%	82.3%	83.9%	45.3%	51.8%	69.0%
Net cash / total equity	55.9%	60.6%	63.4%	33.6%	50.9%	32.0%

JPY million, %	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Capex	266	586	602	988	1,149	3,323
Depreciation	468	403	441	1,219	934	1,085
R&D	132	166	204	229	405	357
CFO	1,437	1,736	1,302	1,635	2,335	2,699
CFI	(189)	(1,412)	(169)	2,714	(697)	(3,256)
FCF	1,248	324	1,133	4,349	1,638	(557)
CFF	(1,237)	290	(422)	(994)	1,151	(928)
C&E	5,556	6,478	6,855	9,714	12,280	10,883

persons, %	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Employees (parent)	141	146	160	160	159	168
Employees (consolidated)	329	342	343	981	982	1,017
% Foreign shareholders	1.2	2.5	8.7	9.4	5.5	9.8

APPENDIX: Selected Glossary for Analog ICs and Discrete

analog
A continuous representation of phenomena in terms of points along a scale, each point merging imperceptibly into the next. An analog voltage, for example, may take any value. Real world phenomena, such as heat and pressure, are analog. Compare digital.

analog semicustom
Analog integrated circuits that can be specified by a designer using semicustom design techniques to meet a specific design requirement. An area of Renesas specialization. Compare custom integrated circuit

analog signal processing
Processing of analog signals in the analog domain. Includes the capability of amplification, filtering, signal conditioning, multiplication. and comparison of analog signals.

assembly
The step in semiconductor manufacturing in which the device is encased in a plastic, ceramic, or other package. In some cases, the chip is assembled directly on a printed circuit board.

back end
In semiconductor manufacturing, the package assembly and test stages of production. Includes burn-in and environmental test functions. Compare front end.

bandwidth
The width measure of a signal or signal-carrying channel from the lowest to the highest frequency (or bit rate). For analog signals, the width is in the frequency domain, expressed in Hz. For digital signals, the width is in the time domain, expressed in bits per second. In semiconductor devices, the bandwidth is the range of frequency (or bit rate) in which the performance characteristics are within specified limits.

bipolar transistor
An active semiconductor device formed by two P-N junctions whose function is amplification of an electric current. Bipolar transistors are of two types: NPN and PNP, depending on the manner in which the two P-N junctions are combined. Bipolar transistors have three sections: emitter, base, and collector. Operation of a bipolar transistor depends on the migration of both electrons and holes, in contrast to field-effect transistors, where only one polarity carrier predominates.

boost converter
A boost converter is a DC-DC power converter which increases (steps up or boost) its input voltage to produce an output voltage with a higher magnitude. The boost converter is capable of increasing its input voltage by a factor of more than 5 times depending upon the switch duty cycle ratio and the circuit losses.

channel
The region separating the source and drain of a field-effect transistor. The channel is designed to be normally "on" (conducting) for depletion-mode FETs, or normally "off" (insulating) for enhancement-mode FETs. With the application of a voltage to the gate electrode, the conducting properties of the channel are altered, thereby controlling the current across the channel. The length of the channel is an important parameter in determining the current of the FET, as well as its speed. See also drain, FET, gate, and source.

CMOS
Complementary Metal-Oxide Semiconductor. A MOS technology in which both P-channel and N-channel components are fabricated on the same die to provide integrated circuits that use less power than those made with other MOS (metal oxide semiconductor) or bipolar processes.

complementary
A term describing integrated circuits that employ components of both polarity types connected in such a way that operation of either is complemented. A complementary bipolar circuit would employ both NPN and PNP transistors, and a complementary MOS circuit (CMOS) would employ both N-channel and P-channel devices. In general, complementary devices operate with opposite polarity voltages and currents--advantageous in many circuit applications.

current
The flow of electrons or holes. Usually measured in amperes (amp or A) or in fractions of an ampere (milli-amps or micro-amps). Current can be induced by application of an electric field through a conductor or by changing the electric field across a capacitor (displacement current.)

custom integrated circuit
An integrated circuit that requires a full set of masks specifically designed for a particular function or application. A custom IC is usually developed for a specific customer and may have to withstand harsh environments.

DC-DC converter
DC-DC converter or DC-to-DC converter is a broad term for any microcircuit, module, or board assembly which converts a source of direct current (DC) from one voltage level to another. A step-down or buck converter steps the voltage down so that the output voltage is lower than the input voltage. A step-up or boost converter boosts the voltage so that the output voltage is higher than the input voltage. A buck-boost converter can provide a constant output voltage when the input voltage range is above or below the output voltage. This is commonly used in battery applications. Most DC-DC converters also regulate the output voltage and can be referred to as "regulators." Two types of regulators are linear regulators and switching regulators.

depletion-mode FET
A FET designed so that the channel is in the "on" state with no voltage applied to the gate. See also channel, enhancement-mode FET, FET, gate and source.

digital
Represented in terms of discrete digits, each distinct from the next. A method of representing and manipulating information by switching current on or off. Compare analog.

digital integrated circuit
A class of integrated circuits that process digital information (expressed in binary numbers). The processing operations are arithmetic (such as addition, subtraction, multiplication, and division) or logical (in which the circuit senses certain patterns of input binary information and indicates the presence or absence of those patterns by appropriate output binary signals).

diode
A two-terminal semiconductor (rectifying) device that exhibits a non-linear current-voltage characteristic. The function of a diode is to allow current in one direction and to block current in the opposite direction. The terminals of a diode are called the anode and cathode. There are two kinds of semiconductor diodes: a P-N junction diode, which forms an electrical barrier at the interface between N- and P-type semiconductor layers, and a Schottky diode, whose barrier is formed between metal and semiconductor regions.

discrete device
A class of electronic components, such as power MOSFETs, bipolar power transistors, surgectors, MOVs, optoelectronic devices, rectifiers, power hybrid circuits, intelligent power discretes, and transistors. Typically, these devices contain one active element, such as a transistor or diode. However, hybrids, optoelectronic devices, and intelligent discretes may contain more than one active element. In contrast, integrated circuits (ICs) typically contain hundreds, thousands, or even millions of active elements in a single die.

DSP
Digital-Signal Processing. Digital circuits designed to address a broad class of problems in signal reception and analysis that have traditionally been solved using analog components. DSP is rapidly replacing analog signal processing functions where requirements for stability over time and temperature variations are critical. DSP is used to enhance, analyze, filter, modulate, or otherwise manipulate standard real-world functions, such as images, sounds, radar pulses, and other such signals by analyzing and transforming wave-forms (e.g., transmitting data over phone lines via modem).

enhancement-mode FET
An FET designed so that its channel is fully depleted. It is in the "off" state with zero voltage applied to the gate. This configuration is attractive for low quiescent power. See also channel, depletion-mode FET, FET, gate and source.

fab
Fabrication. In semiconductor manufacturing, fabrication usually refers to the front-end process of making devices and integrated circuits in semiconductor wafers, but does not include the package assembly (back-end) stages.

FET
Field Effect Transistor. A solid-state device in which current is controlled between source and drain terminals by voltage applied to a non-conducting gate terminal. See also channel, drain, gate and source.

foundry
A wafer production and processing plant. Usually used to denote a facility that is available on a contract basis to companies that do not have wafer fab capability of their own, or that wish to supplement their own capabilities.

front end
In semiconductor manufacturing, the fabrication process in which the integrated circuit is formed in and on the wafer. Compare back end.

IGBT
Insulated Gate Bipolar Transistor. A four-layer discrete power device that combines the characteristics of a power MOS transistor and a thyristor. IGBT devices are usually found in high-voltage circuits (above 300V) because they can be prepared with significantly lower values of RDS(on) than a power MOSFET with the same die size. Also referred to as "COMFETs," "GEMFETs" and "IGTs".

integrated circuit (IC)
An electronic circuit in which many active or passive elements are fabricated and connected together on a continuous substrate, as opposed to discrete devices, such as transistors, resistors, capacitors and diodes.

junction
The interface plane within a semiconductor crystal, at which the number of P- and N-type carriers are exactly equal, with a surplus of P-type on one side of the junction and N-type on the other.

junction field effect transistor (JFET)
A semiconductor device that operates by altering the conductivity of a region of the semiconductor (the channel) between two contacts (source and drain) by application of a voltage to a third terminal (gate). The current flow between source and drain is controlled by the gate voltage. In a JFET device, the gate voltage is applied to the channel across a P-N junction, in contrast to its application across an insulator in a conventional MOSFET. JFETs are of two types: P-channel and N-channel, depending on whether the channel is N-type or P-type. See FET, MOSFET.

junction isolation (JI)
A fabrication technique by which components in an integrated circuit are separated or electrically isolated from each other by P-N junctions. Bipolar ICs generally begin with a P-type wafer into which a buried layer pattern is first diffused. Then the N-type epitaxial layer is grown, and P-type isolation wells are diffused around each area that is to be electrically isolated from the other circuitry. Compare dielectric isolation.

LED
Light-Emitting Diode. A semiconductor P-N junction diode that emits light under forward-bias conditions. The wavelength of the emitted light is a function of the semiconductor material. The crystal structure of silicon does not provide useful levels of light emission, but the structure of GaAs does, with an infrared emission wavelength.

linear
(1) Having an output that varies in direct proportion to the input. (2) A ratio in which a change in one of two related quantities is accompanied by a directly proportional change in the other.

linear device
An amplifying-type, analog device with a linear input/output relation, as opposed to a non-linear, digital device, which is either completely "on" or completely "off" over large ranges of input signals.

linear integrated circuit
A circuit whose output is an amplified, linear version of its input or whose output is a predetermined variation of its input. A class of integrated circuits that process analog information expressed as voltages or currents.

linear regulators
Linear regulators use linear, non-switching techniques to regulate the voltage output from the power supply. The regulator's resistance varies according to the load and results in a constant output voltage. All linear regulators require an input voltage at least some minimum amount higher than the desired output voltage. That minimum amount is called the dropout voltage. A low-dropout or LDO regulator is a DC linear regulator which can regulate the output voltage even when the supply voltage is very close to the output voltage. Linear regulators are a great choice for powering very low powered devices or applications where the difference between the input voltage and output voltage is small. They are a simple and cheap solution, but linear regulators are normally inefficient because the difference between the input voltage and regulated output voltage is continually dissipated as heat.

LSI
Large-Scale Integration. Integrated circuits containing between 100 and 5000 gate equivalents, or 1000 to 16,000 bits of memory. Over the years, integration levels have progressed from SSI (small-scale integration), MSI (medium-scale integration), and LSI, to today's VLSI (very-large scale integration).

MCT
MOS Controlled Thyristor. A power device that combines a MOS transistor as the gate and a thyristor as the power source. This composite device has the lowest forward voltage drop of any voltage-controlled power source, including power MOSFETs and IGBTs.

microcomputer
(1) A computer system whose processing unit is a microprocessor; (2) A microprocessor, complete with stored program memory--read-only memory (ROM), random-access memory (RAM), and input/output (I/O) logic on a single chip. Microcomputers are capable of performing useful work without additional supporting logic.

microcontroller
A single-chip microcomputer with on-board program ROM and I/O that can be programmed for various control functions.

microprocessor
(1) A central processing unit (CPU) fabricated on one or more chips, containing the basic arithmetic, logic, and control elements of a computer that are required for processing data; (2) An integrated circuit that accepts coded instructions, executes the instructions received, and delivers signals that describe its internal status. The instructions may be entered or stored internally. Also called "MPU" (microprocessor unit). Widely used as control devices for household appliances, business machines, toys, etc., as well as for microcomputers.

mixed signal IC
An integrated circuit that has both digital and analog functions on the same semiconductor chip, permitting a high degree of system integration. Mixed signal ICs are of three types: (1) In those optimized for analog, the major part of the design is analog with a small digital content; (2) In those optimized for power, the circuit has analog, digital and power functions; (3) In those optimized for digital, the major part of the design is digital with some analog content.

monolithic circuit
Same as integrated circuit. A circuit fabricated within a single body of semiconductor material. This single body of material is referred to as an integrated circuit die. Compare hybrid circuit.

MOSFET
Metal Oxide Semiconductor Field Effect Transistor. A class of voltage-driven devices that do not require the large input drive currents of bipolar devices. MOSFETs are a type of field-effect transistor that operates and functions similar to a junction field effect transistor. The distinction is that in the MOS device the controlling gate voltage is applied to the channel region across an oxide insulating material, rather than across a P-N junction. The term can be applied either to transistors in an IC or to discrete power devices. The major advantage of a MOSFET is low power due to its insulation from source and drain. Other

advantages are its process simplicity, savings in chip real estate, and the ease of interconnection on chip. MOSFETs are of both P-channel and N-channel types. Sometimes called "insulated gate field effect transistor" (IGFET). See channel, drain, gate and source.

multi-chip module
A hybrid-type package containing a number of integrated circuits and other components. Used instead of printed circuit boards for applications calling for very high packing densities, high frequencies and high speeds of operation.

multiplexing
A process of transmitting more than one signal over a single link, route, or channel. Of the two methods in use, parallel processing frequency-shares the bandwidth of a channel in the same way hurdlers run and jump in their assigned lanes, thus permitting a number of contestants to compete simultaneously on the same track. The second method, called serial processing, time-shares multiple signals in the same way that pole vaulters vault over the same bar one after the other. Although serial processing may not seem simultaneous, the signal speed is so fast that it is possible to multiplex four different numbers through a single decoder-driver and have them appear on four different displays without a flicker.

multiplier
A circuit whose output state is the arithmetic product of two input signals. Important in DSP (digital signal processing) technology for signal processing and power control applications. See DSP and signal processing.

optoelectronic device
A device that is responsive to or that emits or modifies light waves. Examples are LEDs, optical couplers, laser diodes, and photo detectors.

package
The protective container or housing for an electronic component or die, with external terminals to provide electrical access to the components inside. Packages provide for power and signal distribution, power dissipation, and physical and chemical protection of the circuits.

passive component
An electrical component without gain or current-switching capability. Commonly used when referring to resistors, capacitors and inductors.

P-N junction
The basic structure formed by the intimate contact of P-type and N-type semiconductors. The important characteristic of a P-N junction is that it will conduct electric current with one polarity of applied voltage (forward bias) but will not conduct with the opposite polarity (reverse bias).

power control circuit
System power supply control functions and output drive, allowing electronic systems to do actual work for such diverse applications as motors, video, and computer disk drives. Examples of power control ICs are voltage regulators, rectifiers, and high current drivers.

power discrete
See discrete device and intelligent discrete.

power MOSFET
A MOSFET circuit capable of handling current ratings of more than 1 ampere. Renesas power MOSFETs have current-handling capabilities as high as 100A and voltage-handling capabilities up to 1200V. See MOSFET.

power transistor
A transistor capable of being used at current ratings of more than 1 ampere. Renesas bipolar and MOS power transistors have current handling capabilities up to 100A and voltage handling capabilities to 1200V.

signal processing
A broad class of electronic functions that enhance the representations of physical or electrical phenomena. Temperature, pressure, vibration, acceleration and flow are examples of physical properties

that rely on signal processing enhancements. The detection and conversion of RF, X-ray or ultrasonic energy into images and sound is another form of signal processing. See analog signal processing and digital signal processing.

surgector
Solid-state devices formed by combining a thyristor and a Zener diode. It is designed to protect circuitry and equipment from damage due to transient surges, such as contact with power lines, lightning strikes, induced voltages due to magnetic or electric fields, and static discharges. Protection is provided by diverting the surge current through a low-impedance path around the vulnerable components. Ideal for data communication and telecommunication applications, but cannot be used in DC circuits where available current exceeds holding current. Compare MOV.

switch
As pertaining to semiconductors, an analog IC (typically CMOS) which, on command, either passes or blocks an electrical signal. Renesas is the leading worldwide supplier of DI (dielectric isolation) and JI (junction isolation) analog switches. See DI and JI.

switched capacitor
A technique commonly used in analog signal processing to create filtering and signal conditioning circuits.

switching regulators
Switching regulators rapidly switches a series element on and off. They can operate with both synchronous and non-synchronous switches (FETs). These devices store the input energy temporarily and then releasing that energy to the output at a different voltage level. The switch's duty cycle sets the amount of charge transferred to the load. Switching regulators are efficient because the series element is either fully conducting or switched off so it dissipates almost no power. Switching regulators are able to generate output voltages that are higher than the input voltage or of opposite polarity, unlike linear regulators. The versatility of these converters allow configuration for buck, boost, buck-boost, flyback, inverting in isolated and non-isolated applications. Integrated FET regulators are a subset of switching regulators. These microcircuits have integrated the power MOSFET and are considered a whole solution; whereas controllers employ external power MOSFETs. Both configurations are classified as switching regulators because they regulate the output voltage.

system-level integration
(1) In semiconductor design and fabrication, packing more and more devices into an IC or designing multi-chip modules that are more and more complex. (2) In electronics in general, the progressive linking and testing of system components into a complete system. See multi-chip module.

thyristor
A four-layered solid-state device with two to four leads made up and alternate N and P-type layers. Thyristors act as switches to conduct after a current trigger and while they are forward biased.

transistor
A three-terminal active semiconductor device that provides current amplification. A bipolar transistor is comprised of base, emitter and collector and is a current-controlled device with a low input impedance. A field-effect transistor has gate, source, and drain electrodes and is a high-impedance, voltage controlled device. The first transistor was invented at Bell Laboratories in 1947 by Nobel-Prize physicists John Bardeen, William Shockley and Walter Bratain.

varistor
From "variable-resistor". A non-linear, voltage-dependent device whose electrical behavior provides transient suppression performance. The device absorbs the potentially destructive energy of incoming transient pulses, thereby protecting vulnerable circuit components.

voltage
Electromotive force (EMF). One volt is equal to the EMF required to force one ampere of current through one ohm of resistance. Symbol: V.

voltage regulator
A circuit (either an IC or a portion of an IC) whose purpose is to make the output voltage less variable than the input voltage. As an example, a voltage regulator might provide an output of 5 volts ±2% to a logic board from an input of 5 volts ±50%.

wire bonding
Process used to make connections between a semiconductor and packaging.

Zener diode
A semiconductor P-N junction diode that has a controlled reverse-bias breakdown voltage, and it is used to supply (clamp) a specific voltage for other protected components (for example in an IC). The Zener effect describes a tunnel breakdown phenomenon that is restricted to less than 5V. However, Zener diodes are traditionally used to describe any reverse-bias P-N junction device used to supply a specific voltage, even those of several hundred volts.

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Sessa Partners Inc.
Horiguchi Building 5F
2-2-3 Nihonbashi Ningyocho, Chuo-Ku, Tokyo
info@sessapartners.co.jp