6616 TOREX SEMICONDUCTOR

Sponsored Research
September 1, 2021

Sessa Investment Research

New Growth Phase on Convergence of Drivers

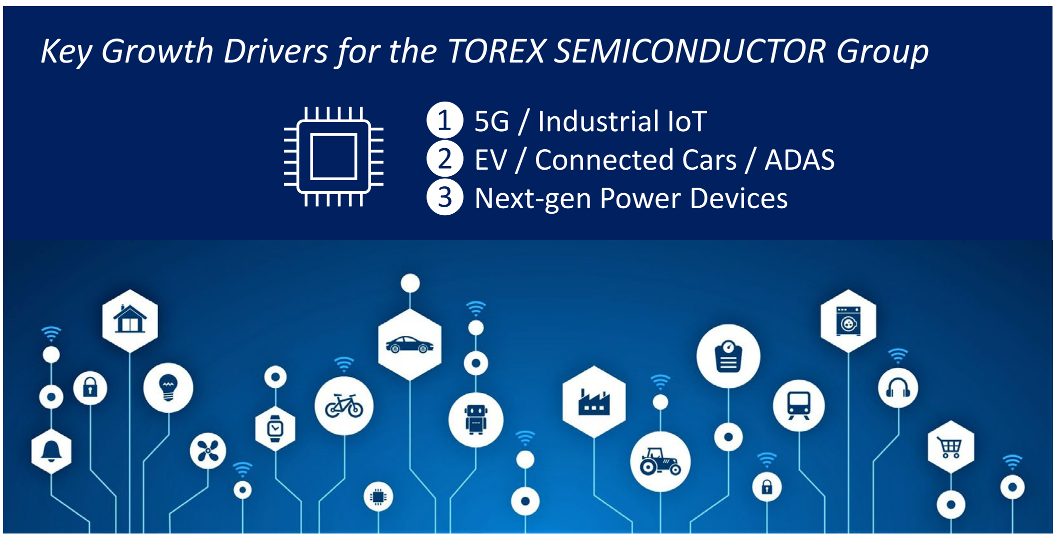
‘Fifty Shades of Green’ in Power Management ICs and Power Discrete

SUMMARY

- High growth in Torex Semiconductor Group net sales and profits was temporarily interrupted by the significant slowdown in global trade in CY2019 due to escalation of the US-China tariff dispute, followed by initial adverse impact on global economic activities under the pandemic during 1H 2020. The Group reported FY3/20 results of net sales -10.0% and OP -56.3%, followed by 1H 3/21 results of OP down a further -21.0%. However, business conditions improved rapidly from the 2H, and despite weak 1H results, the Group reported full-term FY3/21 net sales +10.3% and OP +78.3%, with the global reset period now squarely in the rear-view mirror.

- The sheer speed of the turnaround can best be illustrated by the exhibit on P3 of new 5-year MTP targets just released in February along with the 3Q upward revision, only to see full-term guidance revised up again in the 4Q, along with significantly higher forecasts for FY3/22. These upward revisions for FY3/21 and FY3/22 overlayed on the initial 5-year MTP targets would imply a decline in FY3/23, which of course the company does not expect. Initial company estimates for FY3/22 are for consolidated net sales +9.6%, OP +65.4% and OPM rising from 5.1% → 7.7%. MTP targets include raising OPM to 10.0% in FY3/24 and 11.4% in FY3/26 (year 5).

- Since the company has entered a new phase of accelerated growth, nearly half of this report is devoted to examining the current status and outlooks for three key medium-term growth drivers listed below, along with Torex and Group subsidiary Phenitec product solutions to meet needs arising from these various applications. The new MTP promotes ‘GX green transformation’ through promoting power-saving circuits, reducing mounting board area and promoting low power-loss devices that suppress heat generation, along with early commercialization of next-generation power devices which will contribute greatly to addressing climate change.



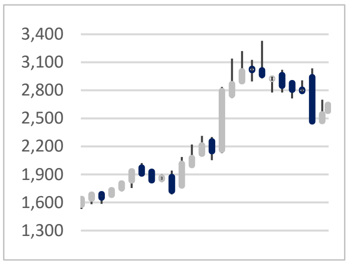
Full Report

Focus Points:

Power management IC specialist with attractive growth profile from new applications driven by 5G, IoT-connected devices and the electrification of cars.

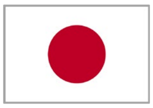
Key Indicators	
Share price (8/31)	2,645
YH (21/7/14)	3,330
YL (21/1/14)	1,285
10YH (21/7/14)	3,330
10YL (14/5/20)	725.8
Shrs out. (mn shrs)	11.55
Mkt cap (¥ bn)	30.56
EV (¥ bn)	27.23
Shr eqty ratio (6/30)	64.5%
22,3 P/E (CE)	16.5x
22.3 EV/EBITDA (CE)	6.5x
21.3 ROE (act)	4.9%
21.3 P/B (act)	1.45x
22.3 DY (CE)	1.51%

6M weekly share price



Source: SPEEDA

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



TOREX SEMICONDUCTOR Consolidated Financial Highlights

[J-GAAP]	FY3/17*	FY3/18	YoY	FY3/19	YoY	FY3/20	YoY	FY3/21	YoY	FY3/22	YoY	FY3/22	YoY
JPY mn, %	act	act	pct	act	pct	act	pct	act	pct	init CE	pct	rev'd CE	pct
Net sales	**21,560**	**23,997**	**11.3**	**23,897**	**(0.4)**	**21,501**	**(10.0)**	**23,713**	**10.3**	**26,000**	**9.6**	**28,500**	**20.2**
Gross profit	5,900	7,177	21.6	6,494	(9.5)	5,452	(16.0)	5,959	9.3	—		—	
GPM	*27.4%*	*29.9%*		*27.2%*		*25.4%*		*25.1%*					
SG&A expenses	4,649	4,964	6.8	4,943	(0.4)	4,774	(3.4)	4,750	(0.5)	—		—	
ratio to sales	*21.6%*	*20.7%*		*20.7%*		*22.2%*		*20.0%*					
EBITDA	2,470	3,147	27.4	2,636	(16.2)	1,990	(24.5)	2,418	21.5	3,549	46.8	4,169	72.4
ratio to sales	*11.5%*	*13.1%*		*11.0%*		*9.3%*		*10.2%*		*13.7%*		*14.6%*	
Operating profit	**1,251**	**2,212**	**76.8**	**1,551**	**(29.9)**	**678**	**(56.3)**	**1,209**	**78.3**	**2,000**	**65.4**	**2,500**	**106.7**
OPM	*5.8%*	*9.2%*		*6.5%*		*3.2%*		*5.1%*		*7.7%*		*8.8%*	
Non-operating income	69	101		313		79		95		—		—	
Forex gains	—	—		217		—		—		—		—	
Non-operating expenses	414	315		43		81		98		—		—	
Forex losses	334	236		—		38		46		—		—	
Ordinary profit	**906**	**1,998**	**120.6**	**1,820**	**(8.9)**	**676**	**(62.9)**	**1,206**	**78.4**	**2,000**	**65.8**	**2,500**	**107.3**
ratio to sales	*4.2%*	*8.3%*		*7.6%*		*3.1%*		*5.1%*		*7.7%*		*8.8%*	
Extraordinary income	2,561	34		8		32		27		—		—	
Extraordinary losses	31	62		23		117		62		—		—	
Profit before income taxes	3,435	1,971		1,805		592		1,171		—		—	
Total income taxes	331	561		484		174		238		—		—	
Profit	3,105	1,410		1,321		417		934		—		—	
Profit ATOP	**2,931**	**902**	**(69.2)**	**1,049**	**16.3**	**418**	**(60.2)**	**934**	**123.6**	**1,400**	**50.0**	**1,750**	**87.4**
ratio to sales	*13.6%*	*3.8%*		*4.4%*		*1.9%*		*3.9%*		*5.4%*		*6.1%*	
Cash and deposits	**7,769**	**10,835**	**39.5**	**10,982**	**1.4**	**9,281**	**(15.5)**	**11,737**	**26.5**	**—**		**—**	
ST loans payable	2,423	2,483		1,903		2,902		2,902		—		—	
Current portion of LP	1,174	1,103		1,021		605		1,030		—		—	
Current and LT lease oblig.	129	80		45		99		93		—		—	
LT loans payable	2,496	1,394		1,748		1,143		3,363		—		—	
Total interest-bearing debt	**6,223**	**5,059**	**(18.7)**	**4,716**	**(6.8)**	**4,749**	**0.7**	**7,387**	**55.6**	**—**		**—**	
Net IBD (net cash)	**(1,547)**	**(5,776)**	**273.4**	**(6,266)**	**8.5**	**(4,533)**	**(27.7)**	**(4,350)**	**(4.0)**	**—**		**—**	
Total shareholders' equity	11,172	14,429	29.2	19,671	36.3	19,053	(3.1)	19,634	3.0	—		—	
Treasury shares	(829)	(416)		(206)		(788)		(750)		—		—	
Accumul. other comp. inc.	260	75		(77)		(381)		156		—		—	
Foreign currency transl. adj.	93	26		(64)		(251)		189		—		—	
Non-controlling interests	4,165	4,582		44		—		—		—		—	
Total net assets	**15,598**	**19,085**	**22.4**	**19,638**	**2.9**	**18,672**	**(4.9)**	**19,790**	**6.0**	**—**		**—**	
Total liab. and net assets	**25,210**	**27,995**	**11.0**	**28,386**	**1.4**	**27,847**	**(1.9)**	**31,512**	**13.2**	**—**		**—**	
Equity Ratio (%)	45.3%	51.8%		69.0%		67.1%		62.8%		—		—	
ROE (%)	26.3%	7.0%		6.2%		2.2%		4.9%		—		—	
DOE (%)	2.7%	2.6%		2.5%		2.3%		2.0%		—		—	
Capex	925	1,150	24.4	3,324	188.9	1,497	(55.0)	1,179	(21.2)	2,019	71.2	2,630	123.1
Depreciation	1,219	934	(23.4)	1,085	16.2	1,312	20.9	1,208	(7.9)	1,549	28.2	1,669	38.1
R&D expense	229	405	76.9	357	(11.9)	403	12.9	457	13.4	504	10.3	—	
Total dividends paid	305	341	11.8	425	24.6	438	3.1	396	(9.6)	—		—	
CF from operating activities	**1,635**	**2,335**	**42.8**	**2,700**	**15.6**	**1,145**	**(57.6)**	**1,790**	**56.4**	**—**		**—**	
CF from investing activities	2,715	(697)		(3,257)		(1,550)		(1,546)		—		—	
Free cash flow (FCF)	4,350	1,638		(557)		(405)		245		—		—	
CF from financing activities	(994)	1,152		(928)		(1,177)		2,175		—		—	
Shares issued and out. (000)	9,539.2	11,089.2		11,554.2		11,554.2		11,554.2		—		—	
Treasury shares (000)	520.8	255.6		148.2		649.6		614.3		—		—	
EPS (¥)	308.77	99.44		95.89		38.03		85.42		127.97		159.96	
DPS (¥)	32.00	34.00		38.00		40.00		36.00		40.00		40.00	
BPS (¥)	1,267.65	1,338.74		1,717.90		1,712.30		1,808.96		—		—	
Yen-dollar rate (USD)	108.9	110.8		110.7		109.1		106.2		109.0		109.0	
Overseas sales ratio**	71.9%	71.0%		71.8%		67.2%		70.5%		—		—	

*Note: the Company announced on March 14, 2016 that the Board of Directors had resolved to make PHENITEC SEMICONDUCTOR a consolidated subsidiary by underwriting a PHENITEC capital increase through third-party placement, and it completed the transaction on April 1, 2016.

Source: compiled by Sessa Partners from YUHO financial statements and IR results briefing materials. **FC-denominated sales.

New 5-Year MTP 2021 – 2025

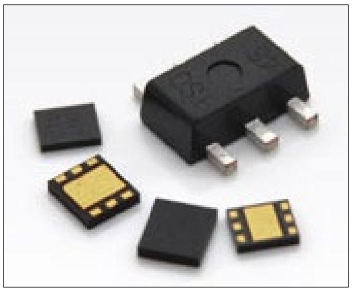
[FY3/22 – FY3/26]

The new MTP promotes **'GX green transformation'** through promoting power-saving circuits, reducing mounting board area and promoting low power-loss devices that suppress heat generation.

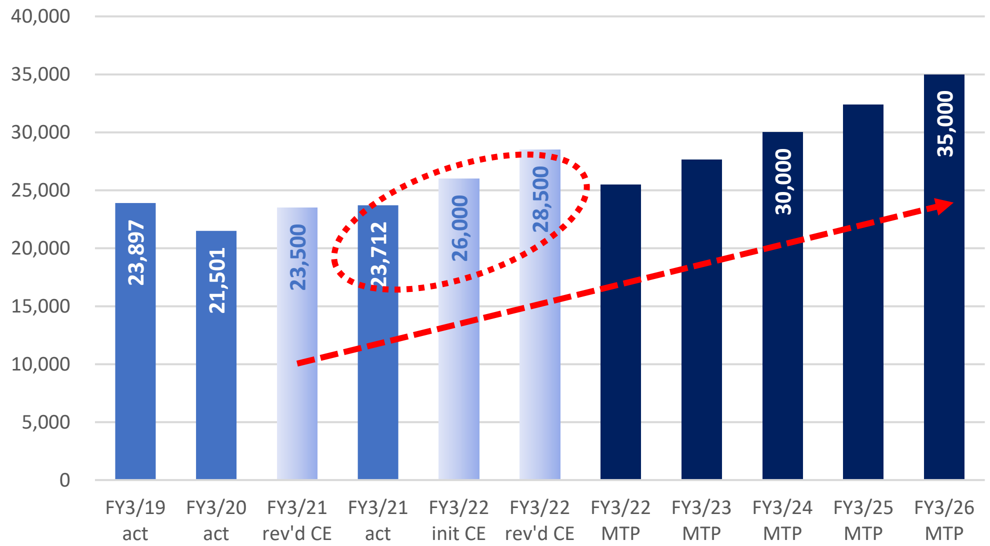
Parent Torex will continue to focus on developing high value-added power management ICs, including further share expansion of inductor built-in micro DC/DC converters, products specialized for 5G/IoT, solutions for solid-state and semi solid-state batteries, ultra-compact large-capacity packages, etc.

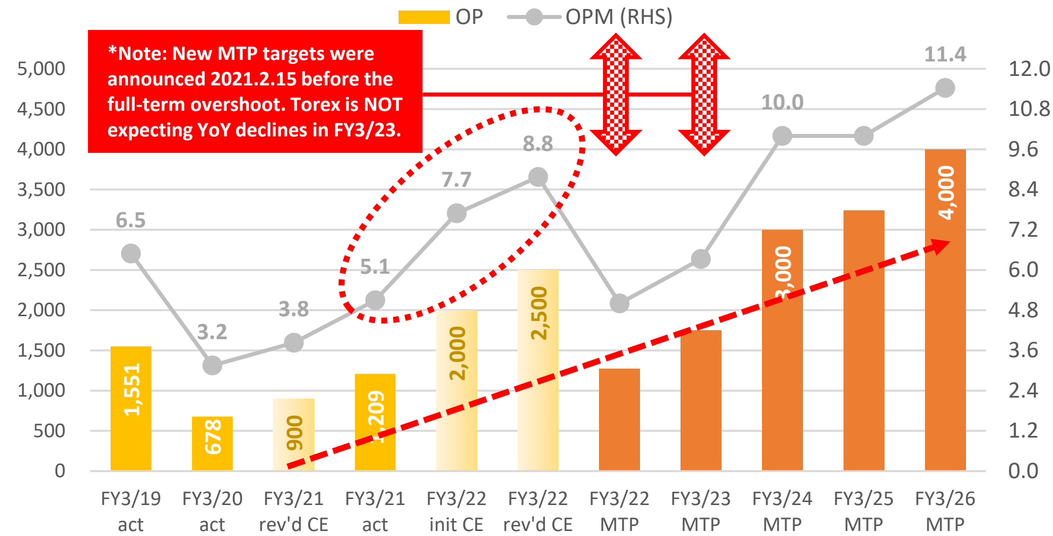
Initiatives for Phenitec include development of silicon-based power devices and compound semiconductors at Kagoshima, and working on completion of the Daiichi Plant integration project at Okayama.

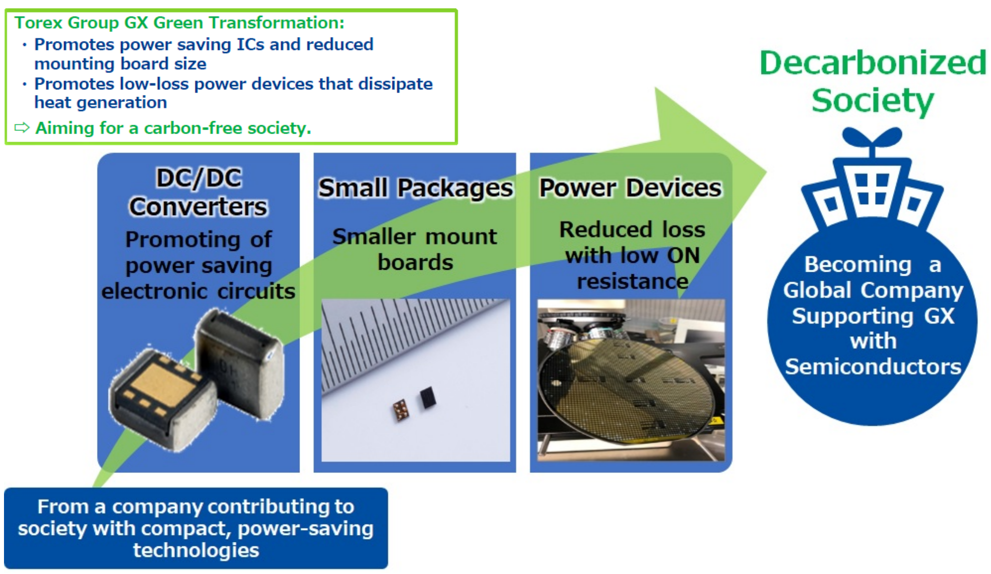
Initially announced targets had implied 5Y CAGR of sales +8.3% and OP +34.8%, and re-calculated to reflect FY3/21 actual results are sales +8.0% and OP +27.0%.



TOREX Group Net Sales, OP and OPM New MTP 2021 – 2025 Targets (JPY mn)



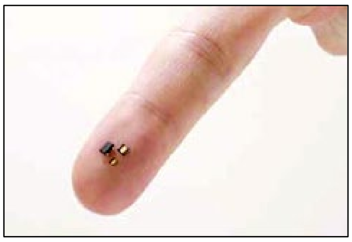


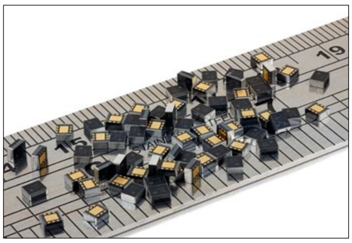


Source: compiled by Sessa Partners from New MTP briefing materials published February 15, 2021.
*Note: announced targets only reflect revised estimates as of 3Q FY3/21 results.

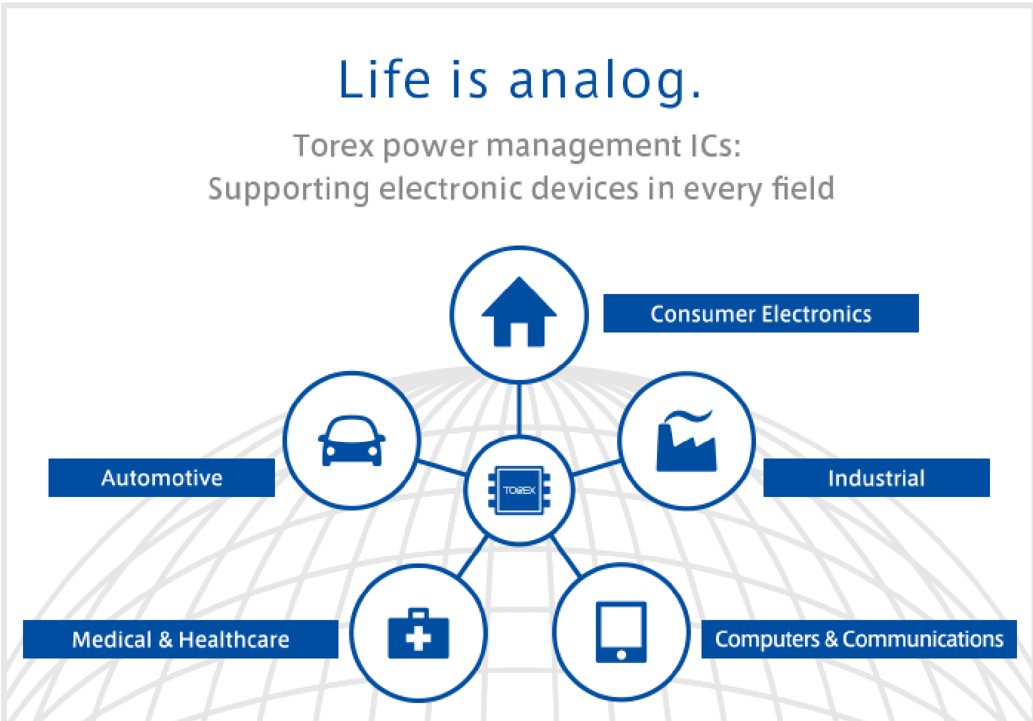
Table of Contents

Powerfully small.





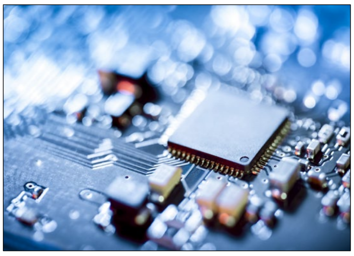
"Micro DC/DC" XCL Series
Ultra small DC/DC converters that integrate a coil and a control IC. Simultaneously achieve **space-saving, high efficiency, low noise, high heat dissipation, and low cost**.



Source: company website

PART ONE:

Introduction to Analog ICs and Power Mgt ICs



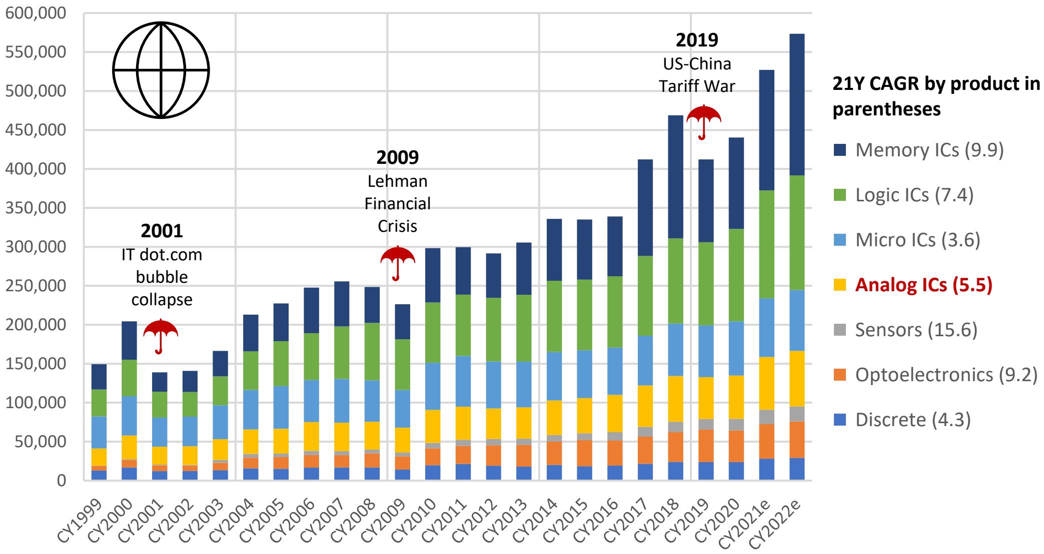
Relative to highly volatile memory ICs for example, **analog ICs** have demonstrated stable growth over the medium-term, which is attributed to demand more in line with the macroeconomy, as they are used in applications in virtually every field.

Power management ICs are a key subset of analog ICs, and PMICs are required in all microcontroller modules (MCUs), performing functions such as **voltage regulation, undervoltage protection and voltage conversion.**

Introduction: 'Life is analog.'

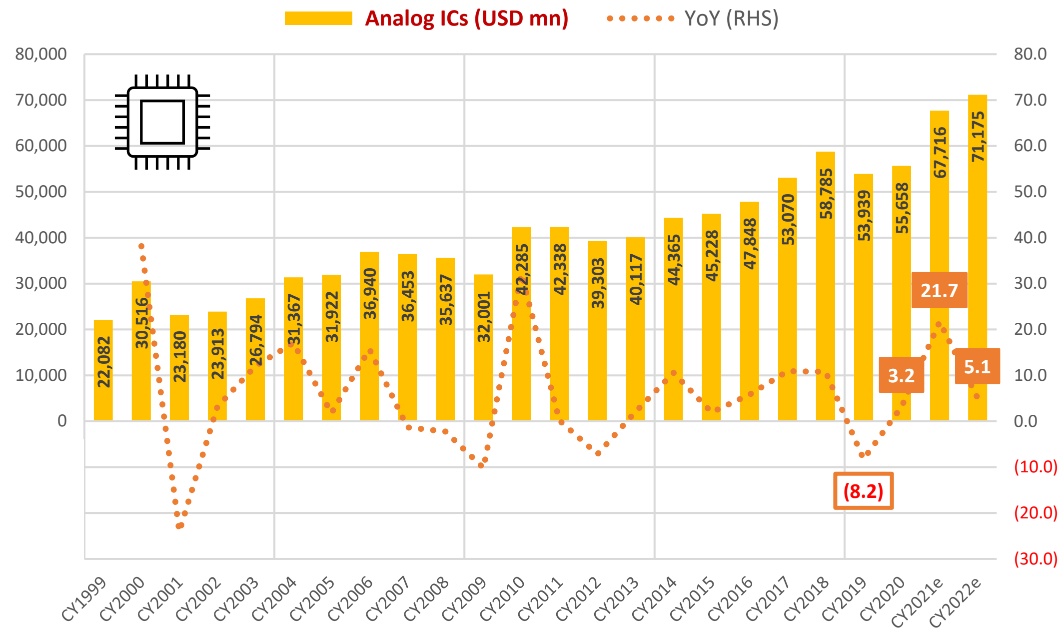
The TOREX SEMICONDUCTOR Group is engaged in the design, manufacture and sale of analog ICs and discrete semiconductors employing CMOS process, specializing in power management ICs, including voltage regulators and step-up and step-down DC/DC converters. Analog ICs account for roughly 13% of the $500bn+ global market for semiconductors, and power management ICs (or PMICs) are a key subset of analog. Electrical devices often have multiple internal voltages (5V, 3.3V, 1.8V etc.) and multiple sources of external power (wall outlet, battery). PMICs are required in all microcontroller modules for embedded applications, which contain one or more CPUs, memory and programmable input/output peripherals. PMICs perform functions such

WSTS Worldwide Semiconductor Billings by Product ($ mn, LHS): 21Y CAGR = 7.0%



Source: compiled by Sessa Partners from World Semiconductor Trade Statistics (WSTS) data. 21Y CAGR from CY2001.

WSTS YoY Trend for Analog ICs ($ mn, LHS): 21Y CAGR = 5.5%



Source: compiled by Sessa Partners from World Semiconductor Trade Statistics (WSTS) data.

WSTS Worldwide Semiconductor Billings by Product

USD mn, %	CY1999	CY2000	CY2001	CY2002	CY2003	CY2004	CY2005	CY2006	CY2007	CY2008	CY2009	CY2010	CY2011
WW Semiconductors	**149,379**	**204,394**	**138,963**	**140,713**	**166,426**	**213,027**	**227,484**	**247,716**	**255,645**	**248,603**	**226,313**	**298,315**	**299,521**
• Discrete	13,070	16,923	12,185	12,345	13,347	15,762	15,244	16,587	16,809	16,935	14,175	19,802	21,387
• Optoelectronics	5,778	9,805	7,372	6,790	9,545	13,726	14,902	16,280	15,901	17,902	17,043	21,702	23,092
• Sensors	313	721	913	1,056	3,569	4,767	4,541	5,339	5,126	5,111	4,753	6,903	7,970
• Analog ICs	22,082	30,516	23,180	23,913	26,794	31,367	31,922	36,940	36,453	35,637	32,001	42,285	42,338
• Micro ICs	41,275	50,322	37,270	38,067	43,526	50,734	54,687	53,939	56,211	53,140	48,330	60,633	65,204
• Logic ICs	34,575	46,880	33,166	31,502	37,139	49,535	57,670	60,158	67,292	73,531	65,215	77,377	78,782
• Memory ICs	32,286	49,227	24,875	27,041	32,506	47,136	48,519	58,473	57,854	46,348	44,797	69,614	60,749
Product Breakdown													
WW Semiconductors	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
• Discrete	8.7	8.3	8.8	8.8	8.0	7.4	6.7	6.7	6.6	6.8	6.3	6.6	7.1
• Optoelectronics	3.9	4.8	5.3	4.8	5.7	6.4	6.6	6.6	6.2	7.2	7.5	7.3	7.7
• Sensors	0.2	0.4	0.7	0.8	2.1	2.2	2.0	2.2	2.0	2.1	2.1	2.3	2.7
• Analog ICs	14.8	14.9	16.7	17.0	16.1	14.7	14.0	14.9	14.3	14.3	14.1	14.2	14.1
• Micro ICs	27.6	24.6	26.8	27.1	26.2	23.8	24.0	21.8	22.0	21.4	21.4	20.3	21.8
• Logic ICs	23.1	22.9	23.9	22.4	22.3	23.3	25.4	24.3	26.3	29.6	28.8	25.9	26.3
• Memory ICs	21.6	24.1	17.9	19.2	19.5	22.1	21.3	23.6	22.6	18.6	19.8	23.3	20.3
YoY Trend													
WW Semiconductors	–	**36.8**	**(32.0)**	**1.3**	**18.3**	**28.0**	**6.8**	**8.9**	**3.2**	**(2.8)**	**(9.0)**	**31.8**	**0.4**
• Discrete	–	29.5	(28.0)	1.3	8.1	18.1	(3.3)	8.8	1.3	0.7	(16.3)	39.7	8.0
• Optoelectronics	–	69.7	(24.8)	(7.9)	40.6	43.8	8.6	9.2	(2.3)	12.6	(4.8)	27.3	6.4
• Sensors	–	130.4	26.6	15.7	238.0	33.6	(4.7)	17.6	(4.0)	(0.3)	(7.0)	45.2	15.5
• Analog ICs	–	38.2	(24.0)	3.2	12.0	17.1	1.8	15.7	(1.3)	(2.2)	(10.2)	32.1	0.1
• Micro ICs	–	21.9	(25.9)	2.1	14.3	16.6	7.8	(1.4)	4.2	(5.5)	(9.1)	25.5	7.5
• Logic ICs	–	35.6	(29.3)	(5.0)	17.9	33.4	16.4	4.3	11.9	9.3	(11.3)	18.6	1.8
• Memory ICs	–	52.5	(49.5)	8.7	20.2	45.0	2.9	20.5	(1.1)	(19.9)	(3.3)	55.4	(12.7)

USD mn, %	CY2012	CY2013	CY2014	CY2015	CY2016	CY2017	CY2018	CY2019	CY2020	CY2021e	CY2022e	3Y CAGR	21Y CAGR
WW Semiconductors	**291,562**	**305,584**	**335,843**	**335,168**	**338,931**	**412,221**	**468,778**	**412,307**	**440,389**	**527,223**	**573,440**		
• Discrete	19,138	18,201	20,170	18,612	19,418	21,651	24,102	23,881	23,804	28,154	29,226		
• Optoelectronics	26,175	27,571	29,868	33,256	31,994	34,813	38,032	41,561	40,397	44,376	46,684		
• Sensors	8,009	8,036	8,502	8,816	10,821	12,571	13,356	13,511	14,962	18,321	19,309		
• Analog ICs	39,303	40,117	44,365	45,228	47,848	53,070	58,785	53,939	55,658	67,716	71,175		
• Micro ICs	60,238	58,688	62,072	61,298	60,585	63,934	67,233	66,440	69,678	75,297	78,160		
• Logic ICs	81,703	85,928	91,633	90,753	91,498	102,209	109,303	106,535	118,408	138,578	147,175		
• Memory ICs	56,995	67,043	79,232	77,205	76,767	123,974	157,967	106,440	117,482	154,782	181,710		
Product Breakdown													
WW Semiconductors	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**		
• Discrete	6.6	6.0	6.0	5.6	5.7	5.3	5.1	5.8	5.4	5.3	5.1		
• Optoelectronics	9.0	9.0	8.9	9.9	9.4	8.4	8.1	10.1	9.2	8.4	8.1		
• Sensors	2.7	2.6	2.5	2.6	3.2	3.0	2.8	3.3	3.4	3.5	3.4		
• Analog ICs	13.5	13.1	13.2	13.5	14.1	12.9	12.5	13.1	12.6	12.8	12.4		
• Micro ICs	20.7	19.2	18.5	18.3	17.9	15.5	14.3	16.1	15.8	14.3	13.6		
• Logic ICs	28.0	28.1	27.3	27.1	27.0	24.8	23.3	25.8	26.9	26.3	25.7		
• Memory ICs	19.5	21.9	23.6	23.0	22.6	30.1	33.7	25.8	26.7	29.4	31.7		
YoY Trend													
WW Semiconductors	**(2.7)**	**4.8**	**9.9**	**(0.2)**	**1.1**	**21.6**	**13.7**	**(12.0)**	**6.8**	**19.7**	**8.8**	**11.6**	**7.0**
• Discrete	(10.5)	(4.9)	10.8	(7.7)	4.3	11.5	11.3	(0.9)	(0.3)	18.3	3.8	7.0	4.3
• Optoelectronics	13.4	5.3	8.3	11.3	(3.8)	8.8	9.2	9.3	(2.8)	9.8	5.2	4.0	9.2
• Sensors	0.5	0.3	5.8	3.7	22.7	16.2	6.2	1.2	10.7	22.5	5.4	12.6	15.6
• Analog ICs	(7.2)	2.1	10.6	1.9	5.8	10.9	10.8	(8.2)	3.2	21.7	5.1	9.7	5.5
• Micro ICs	(7.6)	(2.6)	5.8	(1.2)	(1.2)	5.5	5.2	(1.2)	4.9	8.1	3.8	5.6	3.6
• Logic ICs	3.7	5.2	6.6	(1.0)	0.8	11.7	6.9	(2.5)	11.1	17.0	6.2	11.4	7.4
• Memory ICs	(6.2)	17.6	18.2	(2.6)	(0.6)	61.5	27.4	(32.6)	10.4	31.7	17.4	19.5	9.9

Source: compiled by Sessa Partners from World Semiconductor Trade Statistics (WSTS) data.
Updated to include WSTS Semiconductor Market Forecast Spring 2021 announced June 8, 2021.

as a **voltage regulator** making output voltage less variable than input voltage (e.g. from an input of 5V ±50% → to a logic board of 5V ±2%), and a **DC/DC converter** dynamically scaling input of direct current from one voltage level to another output voltage. A step-down or buck converter lowers the output voltage, while a step-up or boost converter raises output voltage.

Analog vs. digital

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.

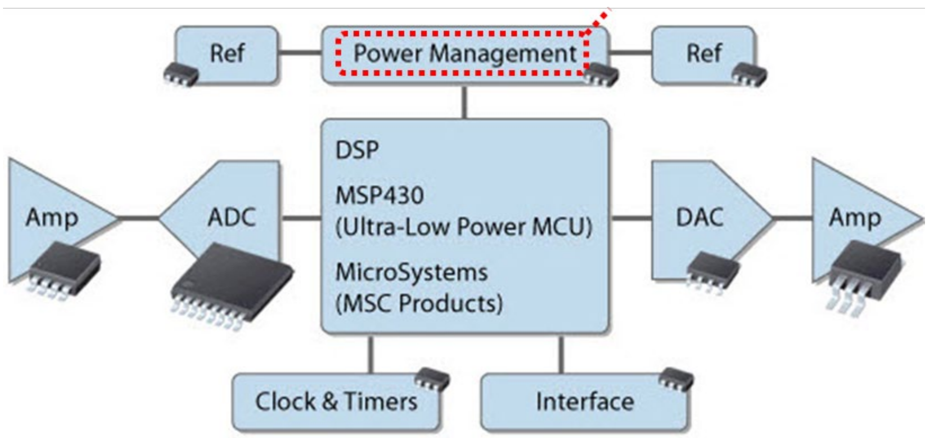
In comparison, digital ICs only accept signals which are binary logic states, such as high or low, true or false etc., which correspond to digital 1s and 0s. Digital signals are only ON (high logic level voltage like 3.3V) or OFF (low logic level voltage like 0V/ground). Analog signals can be a voltage 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.

Discrete vs. integrated circuits (ICs)

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. All microcontroller modules require PMICs.

Microcontroller (MCU) module example diagram



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.

Leading Global Analog IC Supplers (USD mn, % share)

	CY2018	$ mn	shr		CY2019	$ mn	shr		CY2020	$ mn	shr
①	Texas Instruments	10,801	18%	①	Texas Instruments	10,223	19%	①	Texas Instruments	10,886	19%
②	Analog Devices*	5,505	9%	②	Analog Devices	5,169	10%	②	Analog Devices	5,132	9%
③	Infineon	3,810	6%	③	Infineon	3,755	7%	③	Skyworks Solutions	3,970	7%
④	Skyworks Solutions	3,686	6%	④	ST	3,283	6%	④	Infineon	3,820	7%
⑤	ST	3,208	5%	⑤	Skyworks Solutions	3,205	6%	⑤	ST	3,259	6%
⑥	NXP	2,645	4%	⑥	NXP	2,564	5%	⑥	NXP	2,466	4%
⑦	Maxim	2,125	4%	⑦	Maxim	1,850	4%	⑦	Maxim	2,000	4%
⑧	ON Semi*	1,990	3%	⑧	ON Semi	1,740	4%	⑧	ON Semi	1,606	3%
⑨	Microchip*	1,389	2%	⑨	Microchip	1,532	3%	⑨	Microchip	1,420	2%
⑩	Renesas*	900	1%	⑩	Renesas	860	2%	⑩	Renesas	890	2%

Source: IC Insights annual press releases, company reports. *Note: names marked with an asterisk include sales from acquisitions.

indexPro Monthly Click Share Ranking for Boost Converter IC & Buck-Boost Converter IC

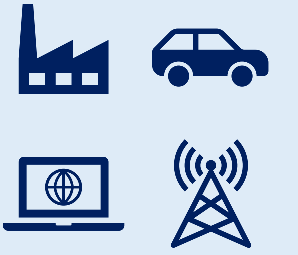
	March 2021			April 2021			May 2021	
①	Texas Instruments (TI)	10.2%	①	Texas Instruments (TI)	13.3%	①	Texas Instruments (TI)	15.5%
②	Ricoh Electronic Devices	7.0%	②	Ricoh Electronic Devices	7.8%	②	ROHM	9.2%
③	ROHM	5.9%	③	**Torex Semiconductor**	**6.7%**	③	**Torex Semiconductor**	**8.9%**
④	**Torex Semiconductor**	**5.8%**	④	Maxim Integrated	6.6%	④	Ricoh Electronic Devices	7.1%
⑤	New Japan Radio	4.8%	⑤	New Japan Radio	5.9%	⑤	New Japan Radio	6.5%
⑥	Analog Devices	4.5%	⑥	Analog Devices	5.6%	⑥	Analog Devices	6.5%
⑦	ABLIC	4.3%	⑦	ROHM	5.3%	⑦	Maxim Integrated	4.5%
⑧	Maxim Integrated	4.2%	⑧	ON Semiconductor	4.4%	⑧	ON Semiconductor	4.5%
⑨	ON Semiconductor	4.2%	⑨	Asahi Kasei Microdevices	3.7%	⑨	Infineon Technologies	4.0%
⑩	Infineon Technologies	3.7%	⑩	ABLIC	3.6%	⑩	ABLIC	3.9%

Source: monthly click share rankings by indexPro under Electronic Components: Analog & Mixed Signal

In CY2020, the top 10 global suppliers of analog ICs accounted for 63% of the total market, with Texas Instruments accounting for nearly 20% (see upper table above). Sadly, short of paying thousands of dollars for specialized market research, there is no readily available data for analog subset power management ICs. However, indexPro is Japan's largest portal for trade information on electronic and industrial components, targeting designers, developers and production engineers, collating product information of roughly 5,000 manufacturers and 4,000 sales agents/distributors, with over 10,000 users per day (with sister sites in Europe and China).

Global no.1 TI as a bellwether for the state of general conditions in the global PMIC market

The monthly click-share rankings above shed some insight into the Company's direct competitors. Out of 46 manufacturers in the category of 'Boost Converter IC & Buck-Boost Converter IC (DC/DC converters)', Torex Semiconductor consistently places no.4 or no.3, which is up one notch from our initiation report in Mar-2020. While this ranking includes many of the global top 10 analog IC suppliers in the upper table, after global no.1 TI, the top 5 consists of Ricoh Electronic Devices, Torex, ROHM and New Japan Radio. ROHM is both a competitor and client of Group subsidiary Phenitec. Since Ricoh Electronic Devices, New Japan Radio, ABLIC and Asahi Kasei Microdevices are unlisted, reported trends at global no.1 TI can offer some insight on industry conditions.



4 Main Electronics Application Groups:

- INDUSTRIAL
- AUTOMOTIVE
- CONSUMER ELECTRONICS
- COMMUNICATIONS (ICT)

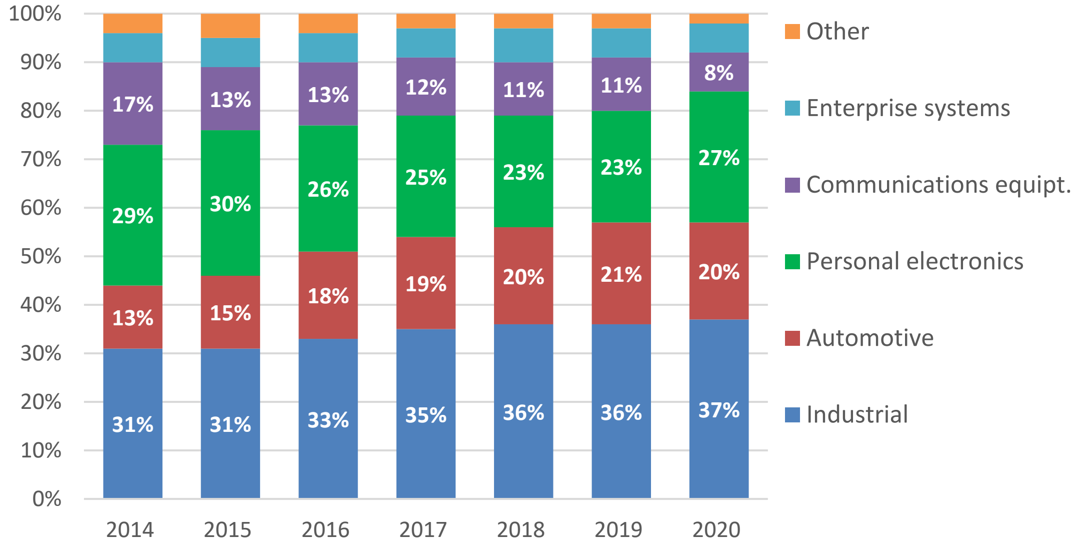
★ Applications are key to understanding and monitoring demand trends

The 4 main applications shown on the left comprise a standard classification system for the global electronic components supply chain overall, not just analog ICs and power management ICs. It is an intelligent and efficient way to organize the vast billions of electronic components by end market applications as part of understanding and monitoring demand trends for final products. In FY12/20, global no.1 analog IC supplier Texas Instruments with a 20% global share had Analog segment revenue of $10,886mn, and total revenue of $14,461mn. In FY3/21, Torex Semiconductor had consolidated revenue of ¥23,712mn ($224mn @USD 106). Is it valid to compare a specialist niche player like Torex to the global no.1 supplier TI, which is 65x larger in scale?

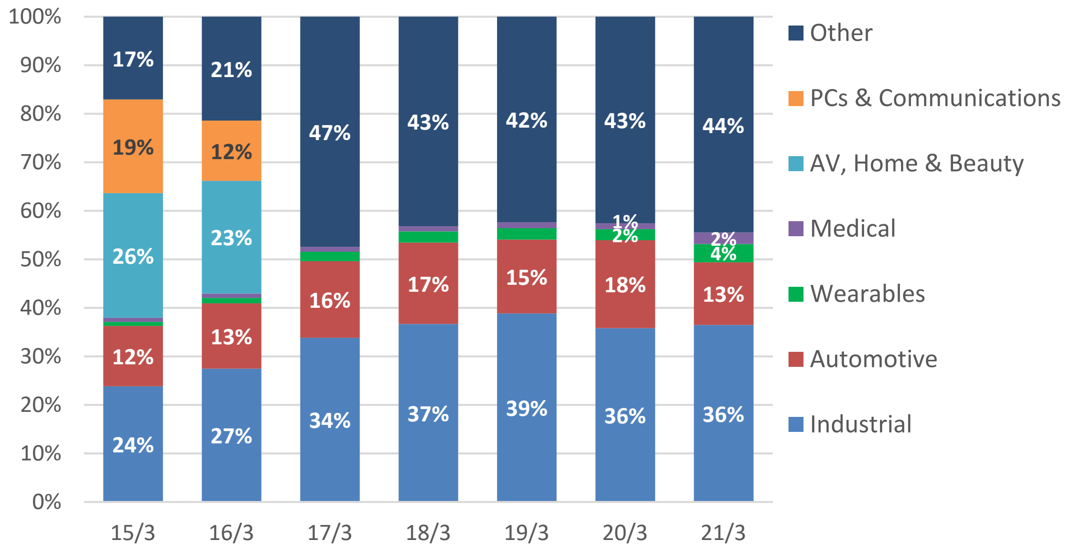
The answer is yes, because semiconductors are a global industry, subject to the same demand trends across the global market. The graph below shows the trend of revenue breakdown for TI by applications. The 4 main applications shown to the left accounted for 92% in 2020. The key takeaway from this graph is that out of the 4, the weights of industrial and automotive are rising, while the weights of personal electronics and that

INDUSTRIAL and AUTOMOTIVE are growth applications, while the weights of CONSUMER ELECTRONICS and COMMUNICATIONS (ICT) have been gradually shrinking.

Texas Instruments End Market (Application) Revenue Mix



Torex Semiconductor Parent End Market (Application) Revenue Mix



Source: compiled by Sessa Partners from respective company data.

The US-China Trade War put pressure on INDUSTRIAL in 2019, followed by severe pressure on AUTOMOTIVE in 2020 due to production cuts as a result of the pandemic, coinciding with a rebound in CONSUMER ELECTRONICS due to special demand from the shift to working at home.

Texas Instruments Power Management: Applications by Market Segment and Sector

AUTOMOTIVE	INDUSTRIAL	INDUSTRIAL (continued)
• Advanced Driver Assistance Systems (ADAS)	**• Appliances**	**• Display**
Camera - front camera	Appliance battery chargers	Digital signage
Radar - front long-range radar	Appliance battery packs	Lighting: LCD backlight
Camera - rear camera	Cooker hoods	Lighting: signage
Camera - multi-camera system w/central processing	Cordless handheld garden tools	**• Electronic Point of Sale**
Ultrasound -ultrasound park assist	Dish washers	ATMS (automated teller machines)
• Body Electronics and Lighting	Mains powered tools	Barcode scanner
Body control module and gateway - BCM	Refrigerators and freezers	Currency counter
Small motors - door	Vacuum cleaners	Electronic shelf label
Automotive lighting - exterior lighting - headlight	Vacuum robots	EPOS, ECR and cash drawer
Automotive lighting - exterior lighting - rear light	Washers and dryers	Portable data terminal
Heating and cooling - HVAC blower and damper	**• Building automation**	**• Factory Automation and Control**
Automotive lighting - interior lighting	Air quality and gas detection	Analog input module
Security systems - passive entry passive start (PEPS Fob)	Analog security camera	Analog output module
Mirrors - side	Daylight harvester	Barcode readers
• Hybrid, Electric and Power Train Systems	Digital alarm communicator	Camera
Engine management - actuators - engine fan	Door and window sensor	Communications module
Engine management - actuators - pump	Door keypads and readers	CPU (PLC controller)
Engine management - actuators - E Turbo/charger	Fire alarm control panel (FACP)	Digital input module
Eng mgt - ECU - gasoline and diesel eng platform	Fire safety sounder, speaker, strobe	Digital output module
HEV/EV - battery management system (BMS)	Gas detector	Displacement transmitter (angular, linear, axial)
HEV/EV - DC/DC converter	Glass break detector	Flow transmitter
HEV/EV - inverter and motor control	Home remote control	Industrial monitor
HEV/EV - on-board (OBC) and wireless charger	HVAC motor control	Level transmitter
Powertrain sensors - HEV/EV	HVAC sensor transmitter (4-20ma)	Lighting
Transmission - ECU - automatic	HVAC system controller	Other PLC
• Infotainment and Cluster	HVAC valve and actuator control	Portable monitor
Cluster - mid-range 4 to 7-inch hybrid	Intrusion control panel	Pressure transmitter
HMI and display - touch display	Intrusion HMI keypad	Process analytics (PH, gas, concent., force, humidity)
Head unit - with integrated display	IP network camera	Single board computer
Head unit - with remote display	Key Fob or panic button	Special function module (encoder etc.)
Heads-up display	Motion detector (PIR, UWAVE etc.)	Temperature transmitter
Media interface - media hub	People counting	Transducer module
Media interface - USB charge	Remote annunciator	**• Grid Infrastructure**
Telematics - telematics control unit	Smart plug	Distribution automation - fault indicators
	Smoke and heat detector	Distribution automation - secondary power distrib.
	Thermostat	Distribution automation - terminal unit
	Video doorbell	Protection relay - bay control
	Video recorder (NVR, DVR etc.)	Protection relay - distribution feeder protection
	Water leak detector	Protection relay - transmission line protection
	Wireless environmental sensor	Substation automation - transducer

AUTOMOTIVE

INDUSTRIAL

Texas Instruments Power Management: Applications by Market Segment and Sector (continued)

INDUSTRIAL (continued)

- **Medical, Healthcare and Fitness**
  - Dialysis machines
  - Fitness machines
  - Insulin pumps
- **Motor Drives**
  - AC inverter and VF drives
  - Active front ends for industrial drives
  - Building and industrial pumps
  - CNC drives
  - E-Mobility (E-bike, E-scooter, elec util vehicles)
  - Industrial stepper drive
  - Non-military drones
  - Position encoders and resolvers
  - Servo drives and motion control
- **Other Industrial**
  - Down hole drilling
- **Power Delivery**
  - Industrial AC-DC
  - Medical PSU
  - Merchant DC-DC
  - Merchant din rail power supply
  - Merchant telecom rectifiers
  - Power transfer units
  - Single phase UPS
  - Three phase UPS
- **Space, Avionics and Defense**
  - Military and avionics imaging
  - Military munitions and targeting
  - Weather radar
- **Test and Measurement**
  - Oscilloscopes (DSO)
  - Scales and weight
  - Semiconductor test equipment
  - Signal analyzers (vector signal analyzers - VSA)
  - Signal generators (vector signal generators - VSG)
  - Spectroscopy
  - Spectrum analyzers

PERSONAL ELECTRONICS

- **Mobile Phones**
  - Handset: smartphone
  - Power: battery management
  - Wireless chargers
- **PCs and Notebooks**
  - Desktop PC
  - Embedded PC
  - Mobile internet device
  - Notebook PC
  - Power supply: AC/DC, isolated, no PFC, <90W
- **Printers and Other Peripherals**
  - 3D printers
  - Digital picture frame (DPF)
  - Mouse
  - Network projector front end
  - Power bank solutions
  - Printer
  - Scanner
  - Speaker: USB
- **Storage**
  - Solid state drive (SSD): client
- **Tablets**
  - Tablet: multimedia
- **TV, Set-Top Box and Audio**
  - Audio dock: basic
  - Audio dock: performance
  - Audio dock: portable
  - AV receiver
  - Digital still camera (DSC)
  - Digital video camera (DVC)
  - DVD recorder and player
  - Embedded camera system
  - GPS: personal navigation device
  - Internet radio player
  - MP3 player/recorder (portable audio)
  - Portable DVD player
  - Portable media player
  - STB, DVR and streaming media
  - TV: LCD/digital
  - Wireless headset
- **Wearables (Non-Medical)**
  - Smart clothing
  - Smart glasses, ID tags and augmented reality (AR)
  - Smart patches
  - Smart watches

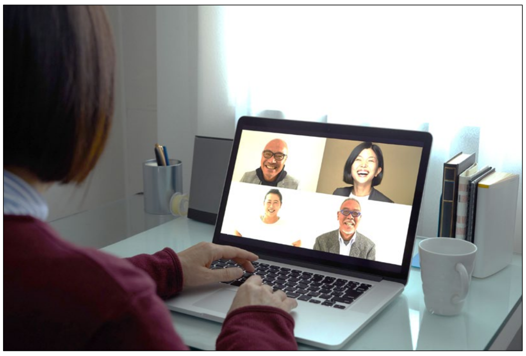
COMMUNICATIONS EQUIPMENT

- **Enterprise Switching**
  - Ethernet switch
  - IP phone: wired
  - Wireless access point system
- **Telecom Infrastructure**
  - AC/DC power supply: dual analog controller
  - AC/DC power supply: dual digital controller
  - AC/DC power supply: single analog controller
  - AC/DC power supply: single digital controller
  - Optical line card
  - Optical networking: EPON
  - Optical networking: video over fiber
  - Power over ethernet (PoE)
  - Power: telecomm DC/DC module: analog
  - Power: telecomm DC/DC module: digital
  - Telecom base band unit
  - Telecom shelter: filter unit
  - Telecom shelter: power distribution unit (PDU)
  - Telecom shelter: wireless battery monitoring
  - Telecom tower: remote electrical tilt unit (RET)
  - Telecom tower: remote radio unit (RRU)
  - Telecom tower: tower mounted amplifier (TMA)
  - Video broadcasting and infra: scalable platform
  - Video bc and infra: IP-based multi-format transcoder
  - Video communications system
  - Video conferencing: IP-based HD
- **Wireless Infrastructure**
  - Backhaul: microwave backhaul
  - Digital repeater
  - Small cells - enterprise FEMTO base station
  - Small cells - micro base station
  - Software defined radio (SDR)
  - Tetra base station

ENTERPRISE SYSTEMS

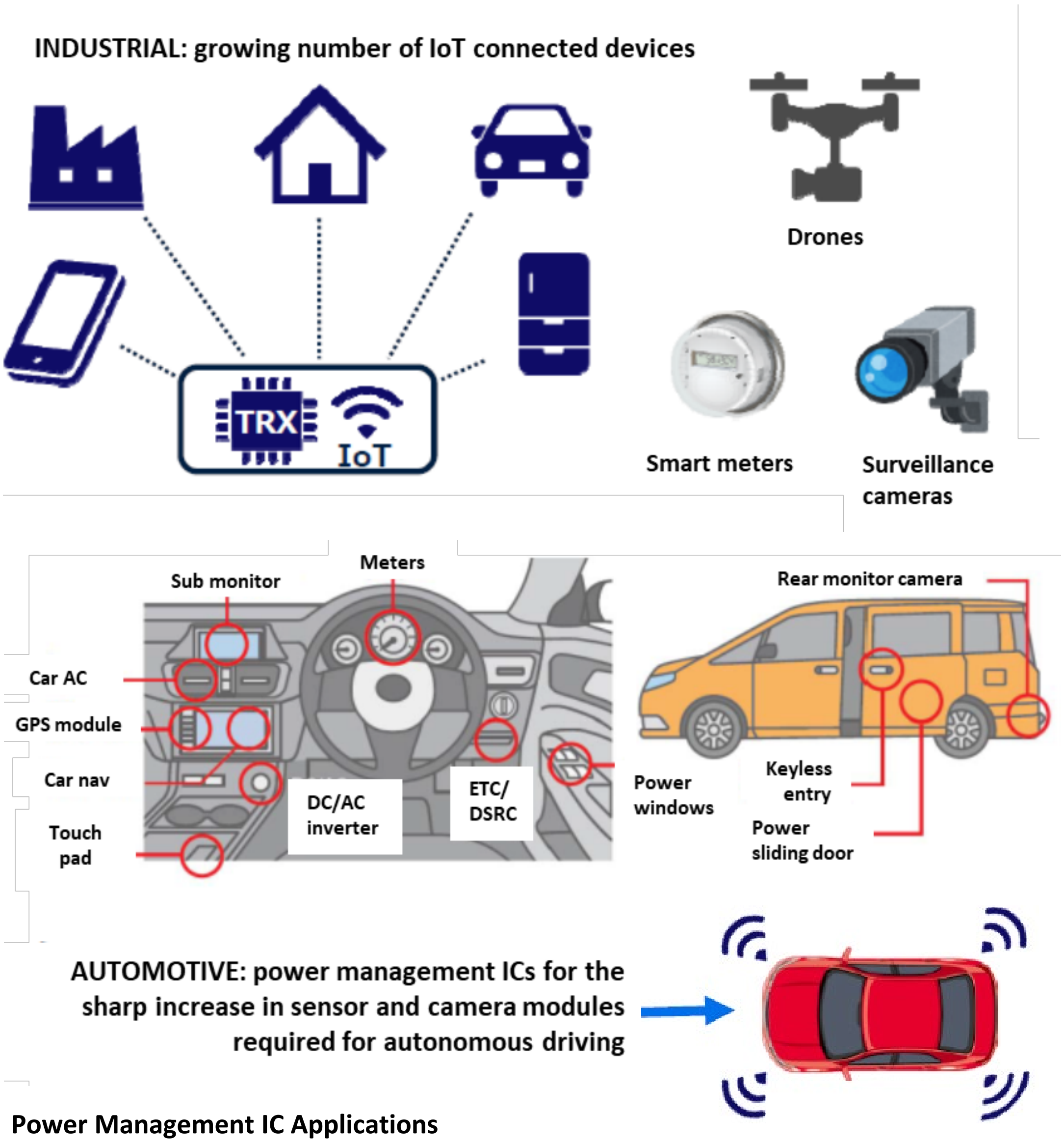
- **Servers**
  - Network attached storage
  - Server motherboard
  - Server PSU
  - Solid state drive (SSD): enterprise
  - Video analytics server

PERSONAL ELECTRONICS



COMMUNICATIONS EQUIPMENT

TOREX Power Management IC Applications Brief 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 / Drive recorders
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

Sales Breakdown by Product/Service: PMICs account for roughly 40%

[J-GAAP] JPY mn, %	FY3/17 act	FY3/18 act	YoY pct	FY3/19 act	YoY pct	FY3/20 act	YoY pct	FY3/21 act	YoY pct
Net sales	21,560	23,997	11.3	23,897	(0.4)	21,501	(10.0)	23,713	10.3
• DC/DC Converters	2,997	2,889	(3.6)	3,092	7.1	3,162	2.2	3,025	(4.3)
• Voltage Regulators	4,872	5,165	6.0	4,834	(6.4)	4,520	(6.5)	4,503	(0.4)
• Voltage Detectors	1,565	1,586	1.4	1,672	5.4	1,572	(6.0)	1,640	4.4
• Discrete	10,942	14,063	28.5	13,732	(2.4)	11,362	(17.3)	13,825	21.7
• Other	1,183	294	(75.1)	566	92.4	885	56.4	720	(18.7)
Net sales	100.0%	100.0%	—	100.0%	—	100.0%	—	100.0%	—
• DC/DC Converters	13.9%	12.0%	—	12.9%	—	14.7%	—	12.8%	—
• Voltage Regulators	22.6%	21.5%	—	20.2%	—	21.0%	—	19.0%	—
• Voltage Detectors	7.3%	6.6%	—	7.0%	—	7.3%	—	6.9%	—
• Discrete	50.8%	58.6%	—	57.5%	—	52.8%	—	58.3%	—
• Other	5.5%	1.2%	—	2.4%	—	4.1%	—	3.0%	—

Source: compiled by Sessa Partners from YUHO financial statements

…continued from P8

of communications equipment are shrinking. The coronavirus pandemic in 2020 had a temporary negative impact on automotive growth, while seeing a special jump in personal electronics from demand due to 'stay at home' changing workstyles, but the aforementioned trends remain intact.

The EXACT SAME application trends are observed by the global no.1 supplier as well as the small niche player because semiconductors are a global market affected by the same demand factors.

The lower graph on P8 shows the trend of revenue breakdown for parent Torex by applications. As it turns out, the EXACT SAME trends for the 4 main applications can be observed for specialist niche player Torex, only 1.5% the scale of global no.1 TI. This is supplementary information provided voluntarily by the Company, and after acquiring the majority stake in Phenitec, the Company decided from FY3/17 results to provide information concentrating on focus growth applications, so figures for consumer electronics and communications equipment are lumped together under 'Other,' but according to the Company, the trend for both is similar to those reported by TI.

Torex also experienced similar positive and negative impacts in 2020 under the pandemic. Note however that the decline in Torex automotive might appear somewhat exaggerated, but that was due to the previous year getting a special boost from China's initiative to install ETC in highway toll booths and vehicles nationwide, as well as high growth in drive recorders in Japan. This was a prime example of how being a small and nimble niche player helped outperform the underlying market, which was suffering from automotive production cutbacks resulting from the US-China tariff war. Of course, this makes a high base for comparison in the following period, making above average growth difficult to sustain over the medium-term.

The table above is further supplemental disclosure by Torex of the trend in net sales by product/service. However, compared with data on the trend by applications, there is very little utility in the trend of sales for the 3 major types of power management ICs. The key takeaway from this data is simply that PMICs account for roughly 40% of consolidated net sales, versus roughly 60% for discrete by Group subsidiary Phenitec.

Next, we have identified two very useful checkpoints for monitoring general earnings conditions for the industry, as well as the general state of the global electronics supply chain, in the absence of readily available industry data on power management ICs.

Texas Instruments Quarterly Earnings Trend since Escalation of the US-China Tariff War

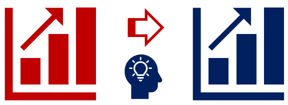
USD mn, %	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021
Revenue	4,261	3,717	3,594	3,668	3,771	3,350	3,329	3,239	3,817	4,076	4,289	4,580
• Analog	2,907	2,638	2,518	2,534	2,674	2,497	2,460	2,434	2,865	3,127	3,280	3,464
• Embedded Processing	894	791	796	790	724	633	653	546	651	720	767	780
• Other	460	288	280	344	373	220	216	259	301	229	242	336
Revenue YoY	3.5	(0.9)	(5.1)	(8.7)	(11.5)	(9.9)	(7.4)	(11.7)	1.2	21.7	28.8	41.4
• Analog YoY	7.7	4.1	(1.9)	(5.8)	(8.0)	(5.3)	(2.3)	(3.9)	7.1	25.2	33.3	42.3
• Embedded Proc. YoY	(4.0)	(11.7)	(14.0)	(16.2)	(19.0)	(20.0)	(18.0)	(30.9)	(10.1)	13.7	17.5	42.9
• Other YoY	(5.5)	(9.7)	(5.7)	(10.4)	(18.9)	(23.6)	(22.9)	(24.7)	(19.3)	4.1	12.0	29.7
Operating Profit	1,937	1,516	1,379	1,506	1,589	1,249	1,244	1,228	1,609	1,813	1,939	2,213
• Analog	1,447	1,233	1,088	1,108	1,231	1,050	1,025	1,053	1,320	1,514	1,646	1,778
• Embedded Processing	309	234	249	265	233	160	182	125	187	249	287	312
• Other	181	49	42	133	125	39	37	50	102	50	6	123
OP YoY	8.3	(3.0)	(10.9)	(12.0)	(18.0)	(17.6)	(9.8)	(18.5)	1.3	45.2	55.9	80.2
• Analog YoY	14.1	3.8	(6.7)	(12.3)	(14.9)	(14.8)	(5.8)	(5.0)	7.2	44.2	60.6	68.9
• Embedded Proc. YoY	(4.9)	(23.8)	(24.1)	(20.7)	(24.6)	(31.6)	(26.9)	(52.8)	(19.7)	55.6	57.7	149.6
• Other YoY	(7.2)	(27.9)	(22.2)	15.7	(30.9)	(20.4)	(11.9)	(62.4)	(18.4)	28.2	(83.8)	146.0
OPM	45.5%	40.8%	38.4%	41.1%	42.1%	37.3%	37.4%	37.9%	42.2%	44.5%	45.2%	48.3%
• Analog	49.8%	46.7%	43.2%	43.7%	46.0%	42.1%	41.7%	43.3%	46.1%	48.4%	50.2%	51.3%
• Embedded Proc.	34.6%	29.6%	31.3%	33.5%	32.2%	25.3%	27.9%	22.9%	28.7%	34.6%	37.4%	40.0%
• Other	39.3%	17.0%	15.0%	38.7%	33.5%	17.7%	17.1%	19.3%	33.9%	21.8%	2.5%	36.6%

*Note: operating profit before restructuring and acquisition charges. Source: compiled by Sessa Partners from TI IR website.

Torex Semiconductor Quarterly Earnings Trend since Escalation of the US-China Tariff War

JPY mn, %	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20	3Q 3/20	4Q 3/20	1Q 3/21	2Q 3/21	3Q 3/21	4Q 3/21	1Q 3/22
Net sales	6,267	6,074	5,353	4,797	5,534	5,599	5,571	5,858	5,551	5,762	6,542	7,013
YoY	2.8	0.6	(13.0)	(22.7)	(11.7)	(7.8)	4.1	22.1	0.3	2.9	17.4	19.7
Operating profit	676	312	(112)	79	251	205	143	195	66	433	515	636
YoY	6.3	(43.2)	TR	(88.3)	(62.9)	(34.3)	TB	146.8	(73.7)	111.2	260.1	226.2
OPM	10.8%	5.1%	-2.1%	1.6%	4.5%	3.7%	2.6%	3.3%	1.2%	7.5%	7.9%	9.1%

Source: compiled by Sessa Partners from SPEEDA earnings database.



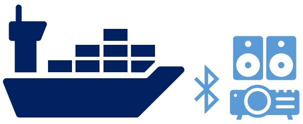
TI quarterly results are one highly useful checkpoint to identify potential positive or negative surprises in Torex results.

★ Texas Instruments reports quarterly results roughly 3 weeks ahead of Torex

TI reports quarterly earnings results roughly 3 weeks ahead of Torex, making it a useful checkpoint to identify any potential positive or negative surprises for Torex results. The most recent two quarters offer a prime example. The tables above show the trend of quarterly results for Texas Instruments and Torex Semiconductor since escalation of the US-China tariff war in Jul-Sep 2018.

On January 26, 2021, TI reported strong 4Q results with total revenue +22% and OP +45%. Of direct implication for Torex, the YoY trend of Analog revenue by quarter was 2Q -3.9%, 3Q +7.1% and 4Q +25.2%, posting a stronger than expected finish in the 4Q. At 16:30 on February 12, 2021, Torex revised up full term FY3/21 guidance: net sales by ¥500mn (+2.2%), and OP by ¥400mn (+80.0%), clearly a positive surprise. Torex reported 3Q results on February 15, net sales +2.9% YoY and OP +111.2% YoY.

On April 27, 2021, TI reported strong 1Q results, posting record quarterly sales and OP. Of direct implication for Torex, following on from brisk 4Q results, 1Q Analog revenue rose +33%, and OP rose +61% YoY. At 16:30 on May 10, Torex revised up full-term guidance again: net sales by ¥200mn (+0.9%), and OP by ¥300mn (+33.3%), another positive surprise. Torex reported 4Q results on May 17, net sales +17.4% YoY and OP +260.1% YoY. We examine the Company's earnings trend in more detail in PART THREE, but the key takeaway here is that there is some utility in checking TI results to identify potential positive or negative surprises ahead of Torex results.

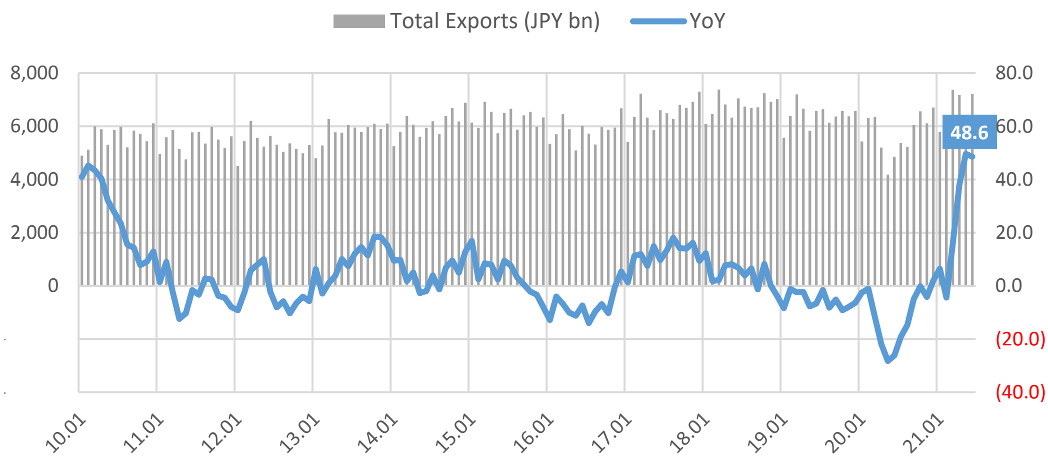


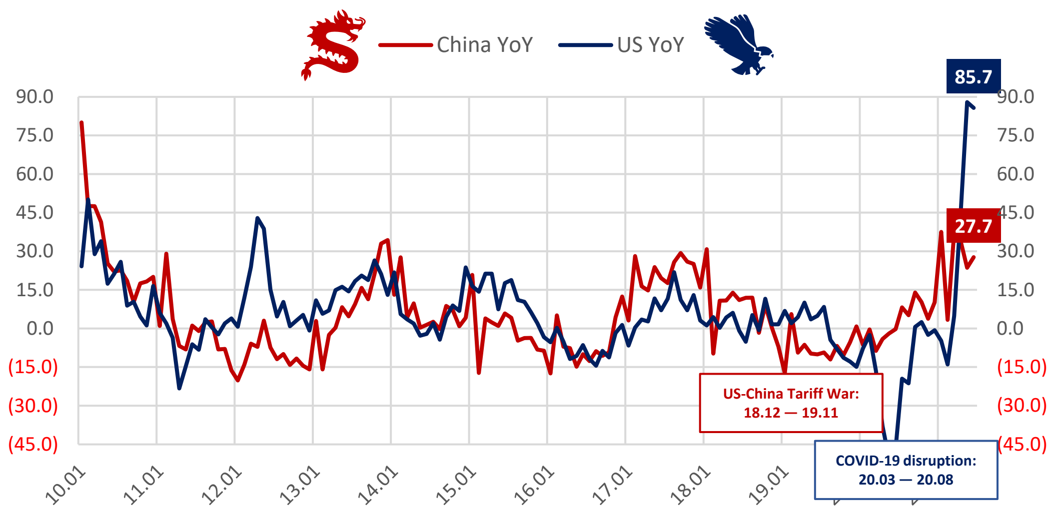
Japan exports to China as a reliable proxy for the general health of the global electronics supply chain

★ Another useful checkpoint is monthly Japan exports to China
This second checkpoint is not based on an empirical academic study, rather, our own observations from poring over multiple sources of macro input variables in search of a factor or factors that would help us monitor the general health of the global electronics supply chain. To be sure, we find monthly statistics published by the Japan Electronics and Information Technology Industries Association (JEITA) on production and shipments for a myriad of electronics products extremely helpful in monitoring the domestic market in Japan. Each country has its own body of industry statistics, but with the exception of World Semiconductor Trade Statistics (WSTS), there is very little easily accessible data on the global market. Ultimately, we observed that trade activity was a reliable indicator of real-time trends in business activity, highlighting regional differences in relative strength and weakness.

The upper graph below shows Japan total exports in June 2021 posted growth of +48.6% YoY, exceeding the level in 2010 in the wake of the recovery after the financial crisis. The lower graph shows exports to its no.1 trading partner China rose +27.7% driven by chipmaking equipment, hybrid vehicles and scrap copper. While growth to its no.2 partner the US was a higher +85.7%, driven by autos and car parts, the US figure is a reactionary rise to the sharp COVID decline, while the China figure reflects full-fledged recovery after the effect of the US-China tariff war in 2019.

MOF Monthly Trade Statistics of Japan: Exports





Source: compiled by Sessa Partners from MOF Trade Statistics of Japan (monthly press releases).

Robust Statistical Correlation

parameter	since 2014	since 2018
correlation coefficient (r)	0.841	0.921
coefficient of determination (r^2)	0.706	0.848

Note: r measures the strength and direction of the linear relationship between two variables. r^2 measures the goodness of fit of a linear regression model (variance of one variable explained by the other). Of course, correlation does not imply causation.

Source: compiled and calculated by Sessa Partners.

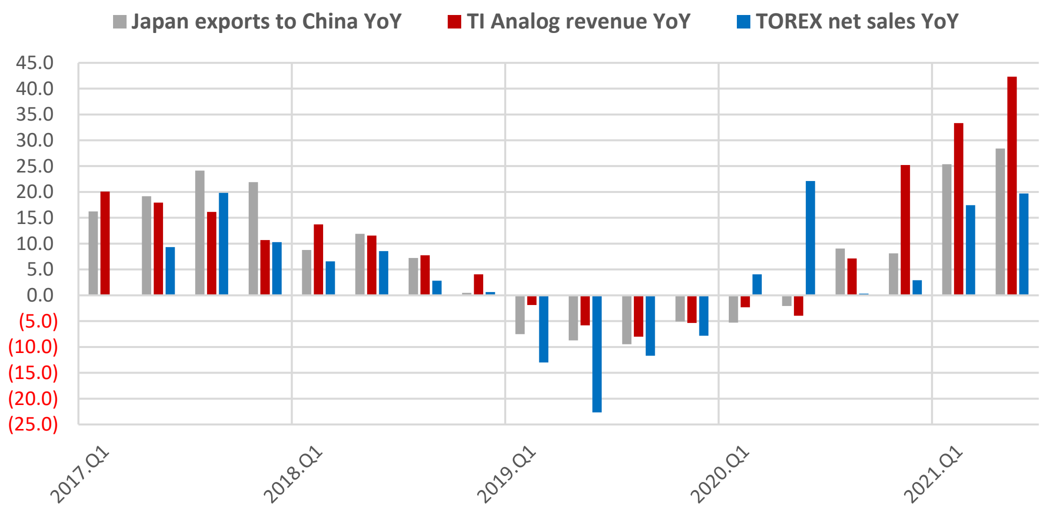
Occasional outsized moves by Torex compared with TI in 2019 and 2020 likely reflect the positive (small and nimble) and negative (less essential) aspects of being an SME. Nevertheless, the robust correlation with Japan exports to China can be seen for both companies.

Risks to this correlation include natural disasters or geopolitical flare-ups which could interrupt normal trade

Quarterly YoY Trend of Japan Exports to China and TI Analog Revenue

Source: compiled by Sessa Partners from MOF Trade Statistics of Japan and TI earnings releases.

Quarterly YoY Trend of Japan Exports to China, TI Analog Revenue and Torex Revenue



Source: compiled by Sessa Partners from MOF Trade Statistics of Japan and TI / Torex earnings releases.

Statistical data shown in the upper left table for r and r^2 confirm there is indeed a robust correlation between TI analog revenue and Japan exports to China. In the absence of an empirical study, our thesis to explain this correlation is based on two observations/assumptions. First, while Japan has ceded dominance in mass market consumer electronics to South Korea and China, **Japan is still the global leader in many critical electronic components and functional materials that go into those products. Second, while many 'cutting edge' electronics products are designed overseas, final assembly is done in China.** Monthly data enables real time checking.

It is worth noting that since 2010, this relationship broke down only twice: the 3 quarters following the 3.11 Tohoku earthquake/tsunami disaster due to supply chain disruptions caused by power shortages from the entire nuclear grid shutdown, and again in the 2H of 2012 due to trade frictions between Japan and China as a result of the Senkaku Islands (called Diaoyu Islands in the P.R.C.) territorial dispute.

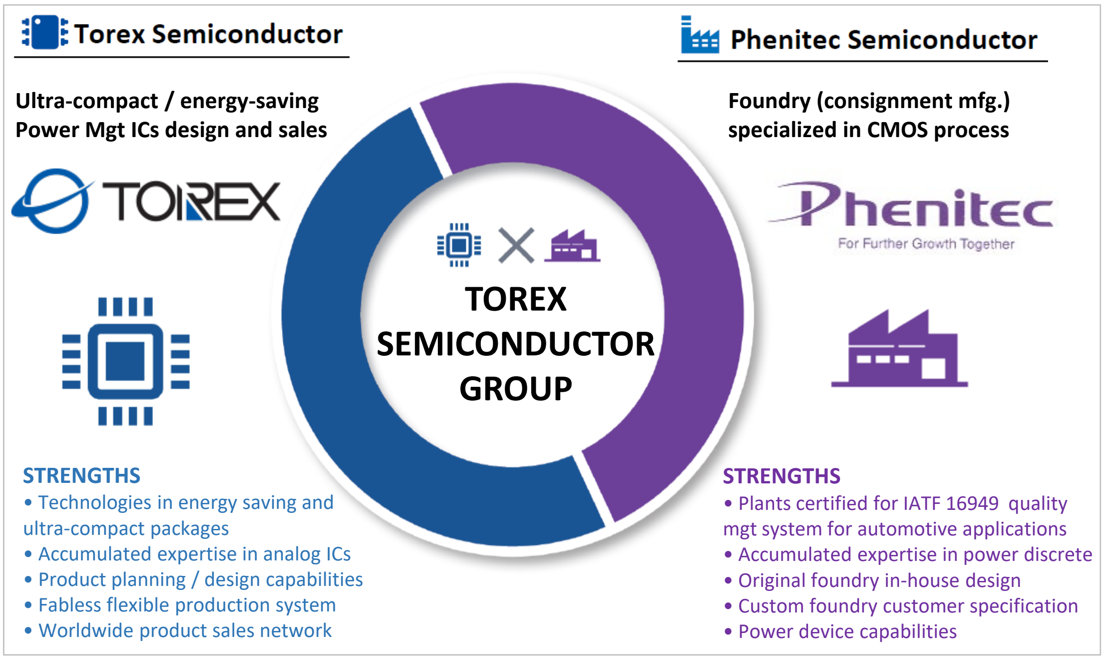
PART TWO:
Torex Group Overview, History and Business Models

Torex Semiconductor Group Overview

The Torex Group has a unique business model, where the parent Torex has a fabless business model specializing in the design and sales of analog ICs, specifically power management ICs, which are required in all microcontroller units (MCUs)/modules, performing functions such as voltage regulation, undervoltage protection and voltage conversion. 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 and products. The medium-term demand outlook is bright with growth in the number of IoT-connected devices accelerating, 5G infrastructure ramping up globally, diffusion of electric vehicles (EVs) entering a new growth phase, and technology advances in connected cars and ADAS (advanced driver-assistance systems).

Subsidiary Phenitec 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 in October 2018. 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.

Torex Semiconductor Group Business Models



Source: company IR materials

Phenitec
For Further Growth Together

October 2018
50TH Anniversary

PHENITEC SEMICONDUCTOR Corp. 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	QS 9000: obtained 1998 certification
1999/10	Obtained VDA6 certification (German version of QS 9000)
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/TS 16949: 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 stake raised to 69.1%
2018/8	Daiichi (No.1) Plant Fab-4 completed
2018/9	IATF 16949: obtained 2016 certification (Head Office Plant, Daiichi Plant)
2018/11	ISO 9001: obtained 2015 certification
2020/3	ISO 45001: obtained 2018 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 Corp.). 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 management 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 management ICs would be required to control battery power management.

XC61AN Series
High Precision Low Power Consumption Voltage Detector

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.

TOREX

March 2020
25TH Anniversary

TOREX SEMICONDUCTOR LTD. Corporate History

Date	Event / Milestone
1995/3	Established as a subsidiary of Shinko Electric Co., Ltd. (currently PHENITEC SEMICONDUCTOR Corp.) in Ibara, Okayama Pref. Established head office in Echujima, Koto-ku, Tokyo
1996/11	Established TOREX SEMICONDUCTOR (S) PTE LTD in Singapore (81%) as the first overseas base
1997/3	Established Torex Device Co., Ltd.
2000/6	Established TOREX SEMICONDUCTOR DEVICE (HONG KONG) LTD (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 Shanghai office, and estab. 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. As a result of this merger, Device Engineering Co., Ltd. became a wholly owned subsidiary
2007/2	Established TOREX (HONG KONG) LIMITED
2007/3	TOREX SEMICONDUCTOR DEVICE (HONG KONG) LTD (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 Corp., made a subsid (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 Corp. a wholly owned subsidiary
2019/8	Made TOREX VIETNAM SEMICONDUCTOR CO., LTD. a wholly owned subsidiary
2019/9	Capital Alliance with Cirel Systems Pvt Ltd. Registered as a remote support department of IATF 16949 certified factory PHENITEC SEMICONDUCTOR Corp. (Kansai Technology Center)
2020/6	Capital Alliance with Novel Crystal Technology, Inc.
2020/12	Registered as a remote support department of IATF 16949 (Head Office added)

Source: YUHO financial statements, Torex website.

However, after that, product development did not progress as planned, and due to overlapping with the semiconductor recession, 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 management 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.

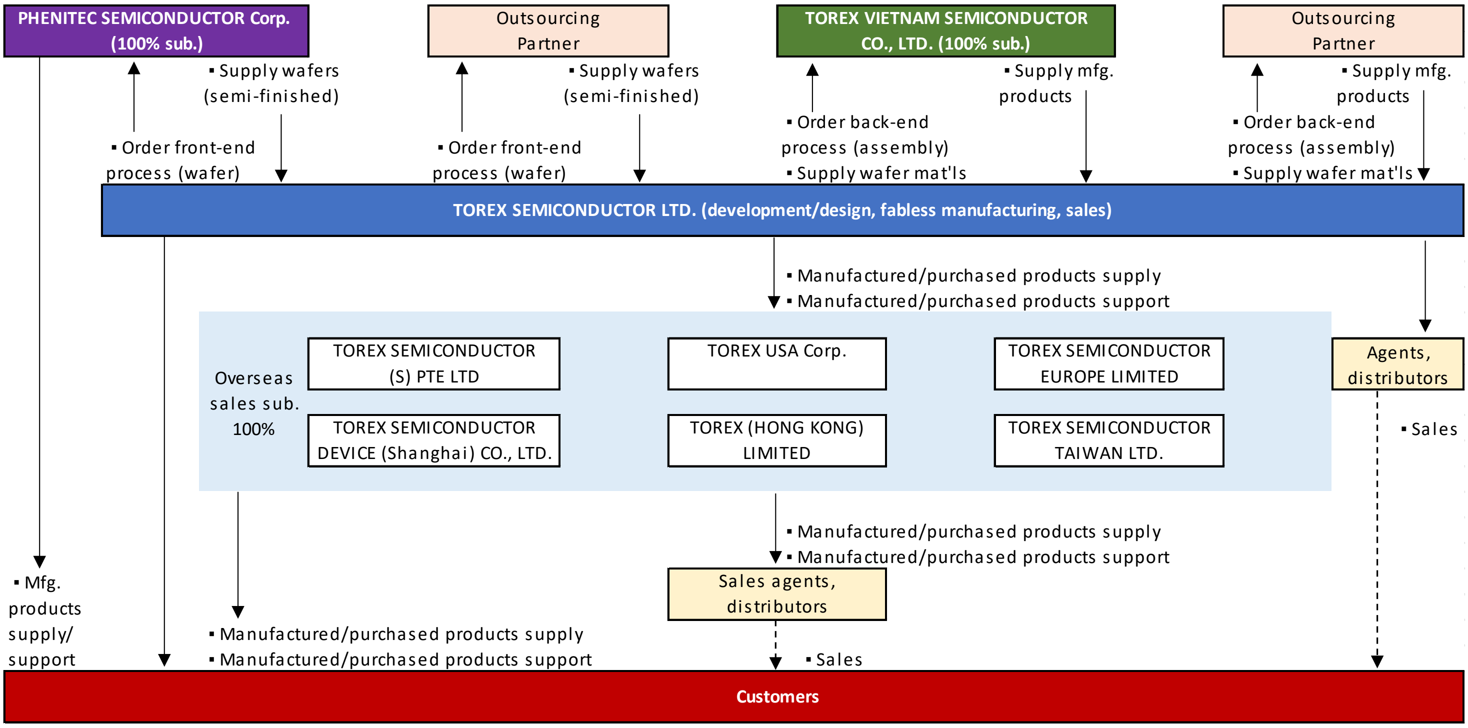
TOREX VIETNAM SEMICONDUCTOR CO., LTD.

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 SEMI-CONDUCTOR 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 management 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 Corp.. 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, 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 while 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, and 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. In PART THREE on earnings analysis, we look at why Phenitec is NOT a drag on profitability. The exhibit on the top of the following page shows an organization chart for the 9 principal companies in the TOREX SEMICONDUCTOR Group.

TOREX SEMICONDUCTOR Group Organization Chart



Source: compiled by Sessa Partners from YUHO financial statements

PHENITEC SEMICONDUCTOR Corp. Manufacturing Facilities: Okayama Head Office Fab

Wafer size	5-inch
Mfg. Capacity	45k pcs/month

Main foundry products	Process rule
Switching diode	≥ 5㎛
Zener diode	≥ 5㎛
Shottky barrier diode	≥ 5㎛
Photo diode	≥ 5㎛
TVS	≥ 5㎛
Bipolar transistor	≥ 5㎛

Source: Phenitec website

Okayama Daiichi (No.1) Fab

Wafer size	5-inch
Mfg. Capacity	22k wfs/month

Main foundry products	Process rule
Bipolar transistor	≥ 5㎛
Bipolar IC	≥ 1.5㎛
MOSFET	≥ 1.0㎛

Wafer size	6-inch
Mfg. Capacity	22k wfs/month

Main foundry products	Process rule
TVS	≥ 0.6㎛
MOSFET	≥ 0.4㎛
IGBT	≥ 0.6㎛
CMOS IC	≥ 0.6㎛

Source: Phenitec website

Tools and Equipment
Stepper (g-line and i-line), trench etcher, laser trimming
PDK available, test・probe available, dicing possible

Kagoshima Fab

Wafer size	6-inch
Mfg. Capacity	15k wfs/month

Main foundry products	Process rule
CMOS IC	≥ 0.35㎛
MOSFET	≥ 0.2㎛
IGBT	≥ 0.6㎛
SiC	≥ 0.6㎛

Source: Phenitec website

Tools and Equipment
Stepper (KrF and i-line), high-energy implant, CMP (W, SiO, Si),
HDP-CVD, DEEP RIE, backside grinding, backside sputter
High-temperature implant, activation annealer, RIE, pre-production

Overview of Foundry Business

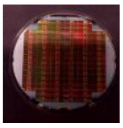
Summary of Phenitec's comprehensive foundry solutions services

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

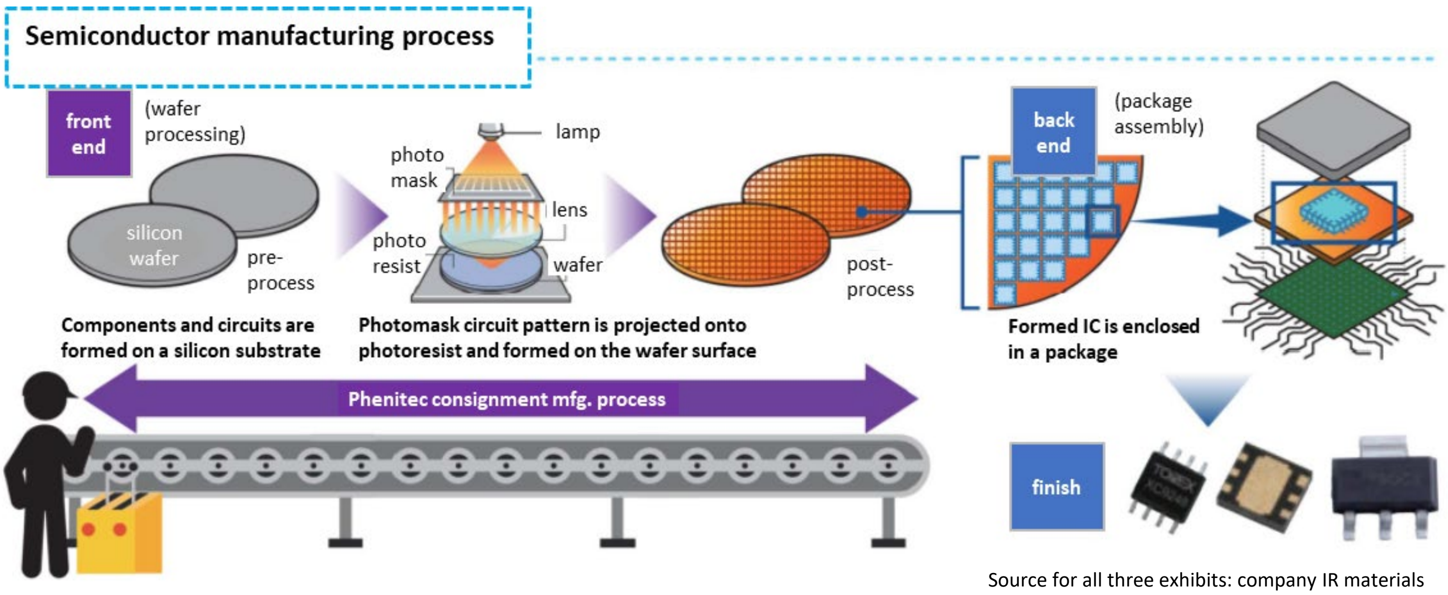
3 key considerations for the acquisition of Phenitec
① Automotive customers in particular place high priority on stable supply capability. The graphic on the right highlights control of quality and delivery.
② Many industrial customers ask for small-lot trial production of custom designs (outside foundries discourage)
③ Phenitec has its own customer base, not reliant on Torex. Its largest customer IXYS Corp. (US) accounted for 10.8% of total FY3/21 Group sales.

Merits / demerits of owning a Group foundry

	Overview	Choice	Quality: Mfg tech/ quality	Cost: COS	Cost: Investment	Delivery: Delivery date	Delivery: 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

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



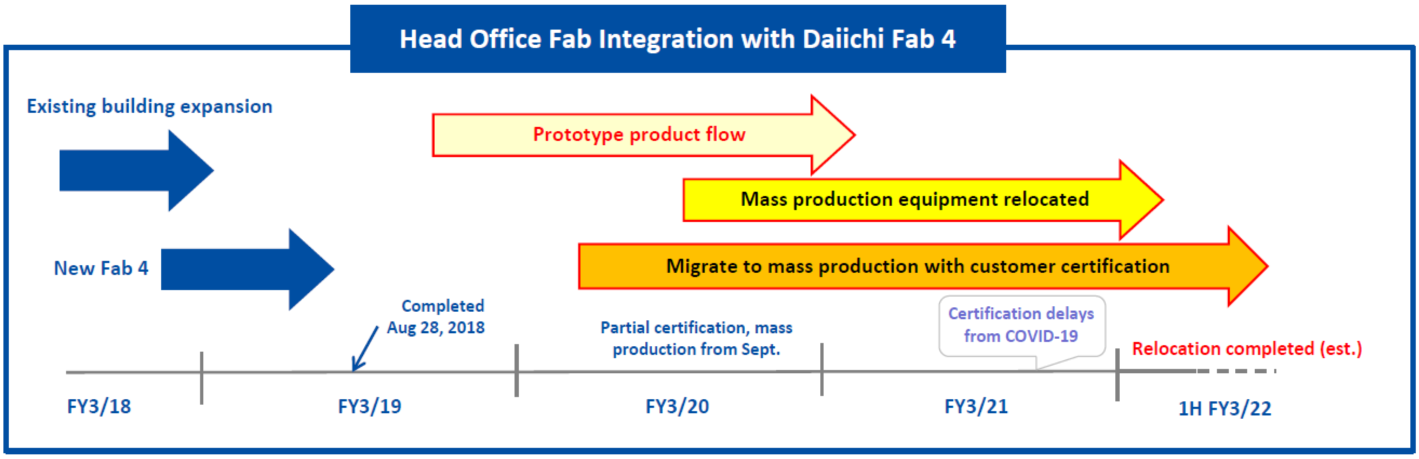
Source for all three exhibits: company IR materials

Okayama Plant Integration Project

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

Since Phenitec's Okayama Plant is divided into the Head Office Fab and the Daiichi (No.1) Fab, it has been hard to raise operational efficiency, and due to the additional requirement of measures to address aging facilities in the Head Office Fab, 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, and completion was unavoidably pushed back due to the recent sharp recovery in demand.

Source: company IR materials



Integration Effect

- 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%)
- Optimize efficiencies with the right equipment and the right layout
- Reduce manufacturing cost through energy-saving plant structure
- Continue to raise quality standards for automotive and industrial equipment applications
- New Fab 4 has precious metal (gold, platinum) processing capability as in the Head Office Fab

Head Office Fab

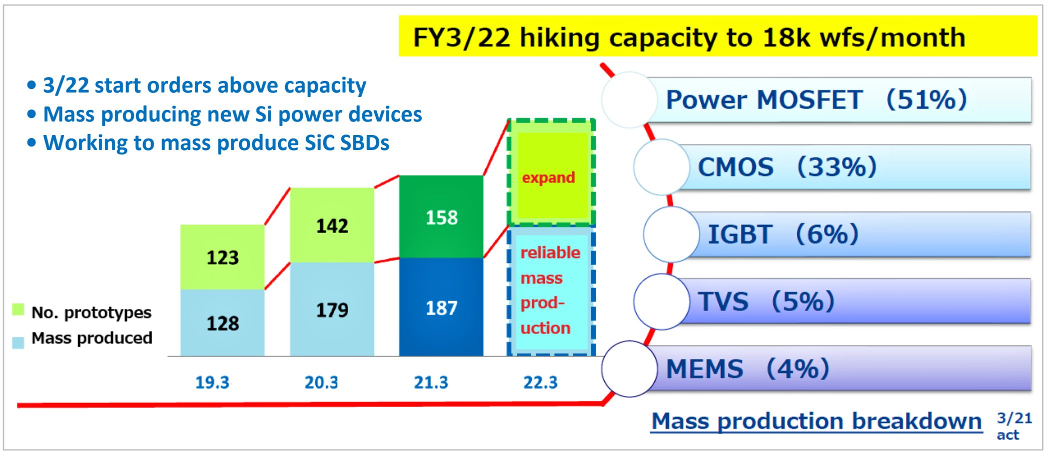
- Use small diameter (4-inches and below) facilities for development of next-generation power devices
- Utilization at small volume mass production

The Kagoshima Plant is ramping up development of **next-generation SiC power devices toward mass production.**

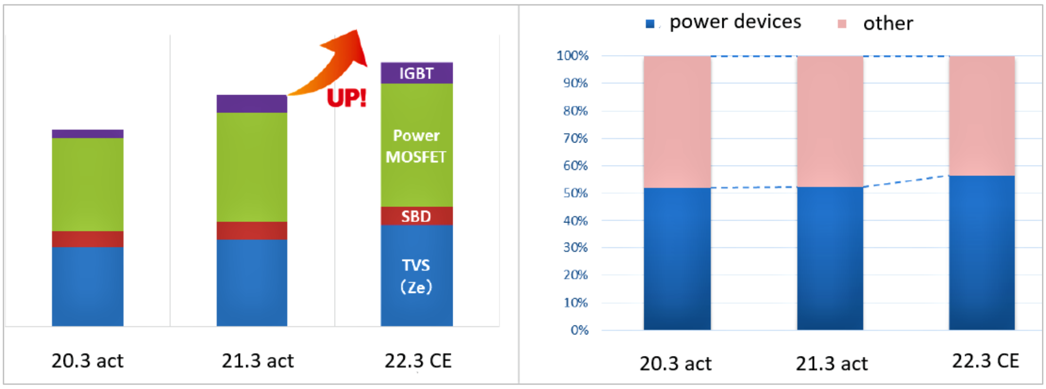
Kagoshima Plant Overview and Update
Start-up and development of the Kagoshima Plant acquired from Yamaha in Oct-2015 appears to be on schedule. At the time of acquisition, the plant started out with zero backlogs since the company only took over the facilities and employees, however since then the company has steadily won new orders, and the plant has begun turning profitable on a single month basis. The graph below shows the trend of the number of prototype products, which is a leading indicator for mass production, and apparently progress is running at a healthy pace.

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 a portion of the 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 obtained IATF 16949 certification at the Kagoshima Plant in 2020.

Kagoshima Plant Trend of Products by Prototypes and Mass Production



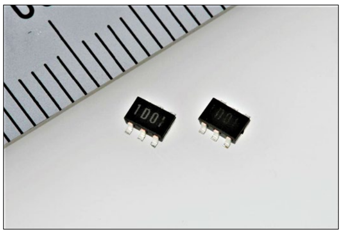
Power Device Sales and Sales Ratio (%)



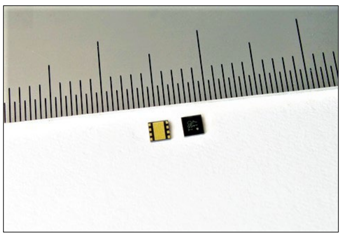
Source: excerpt from 4Q results briefing materials.

Ultra-low power consumption, small step-down DC/DC converter XC9276 series wins "ECCJ Chairman's Award" of 2020 Energy Conservation Grand Prize in the Product & Business Model Category

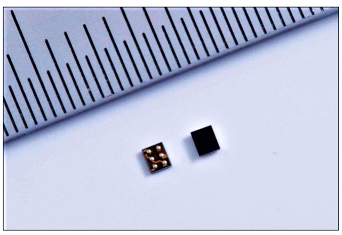
SOT package
(small-outline transistor)



USP package
(ultra-small package)



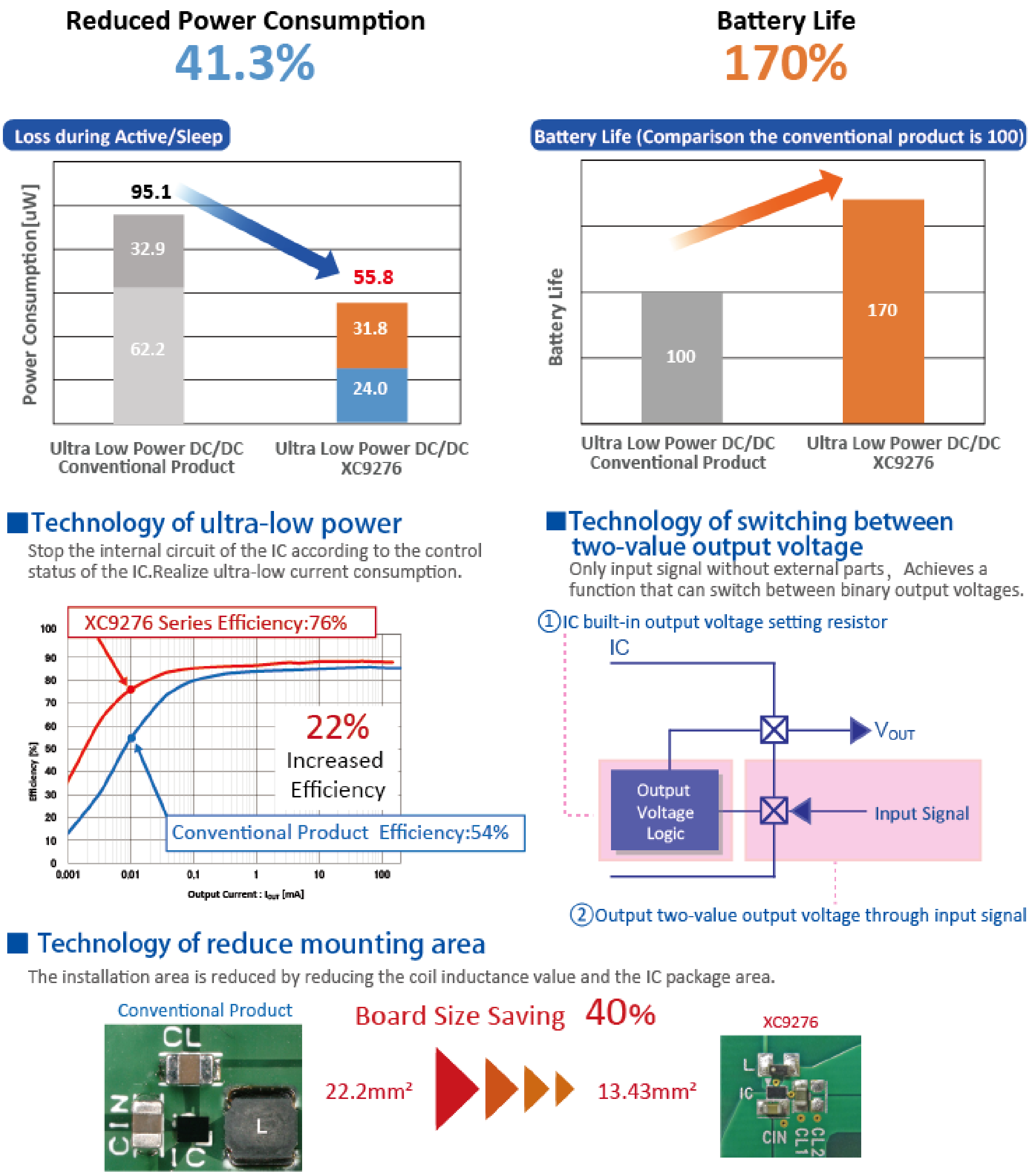
WLP package
(wafer-level package)



Torex Power Mgt ICs competitive strengths: ultra-compact and energy-saving

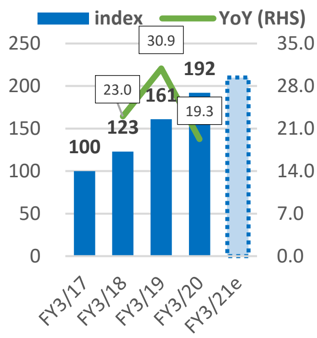
The company announced on December 24, 2020 that its step-down DC/DC converter XC9276 Series was awarded the "ECCJ Chairman's Award," FY2020 Energy Conservation Grand Prize in the Product & Business Model category, which has 200nA ultra-low quiescent current and 1.7X longer battery life with output voltage selectable function, by the Energy Conservation Center of Japan (ECCJ).

The XC9276 series greatly improves the efficiency below IOUT=1mA through the current consumption of 200nA. Compared with traditional products, the efficiency of IOUT=10μA is increased by more than 20%. In addition, the newly developed VSET function is used to switch the output voltage. By switching the 2-value output voltage, the XC9276 series reduces power consumption by 41.3% and increases battery life by 1.7 times compared with traditional products. This product is expected to be deployed in products such as small IoT devices and wearable devices that are small and need to be driven for a long time.



Source: excerpts from company website.

Inductor built-in micro DC/DC converters

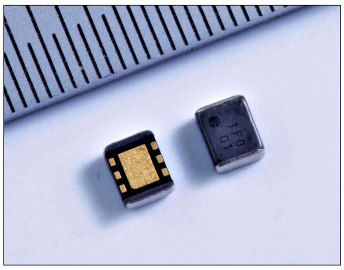


Note: indexed to FY3/17 = 100.

One of the strengths of Torex and a factor driving growth is aggressive new product development of inductor built-in micro DC/DC converters, which have the properties of 1) ultra-compact, 2) low power consumption, 3) high efficiency and 4) low EMI noise, and different package types emphasize the required property. The graph above shows this category has been growing at +24.3% CAGR over the last 3 years.

The XCL303/XCL304 series below targets high-speed optical transceivers for 5G applications, and it is the first inductor built-in micro DC/DC converter product on the market to handle negative output voltage.

XCL303/XCL304 Series

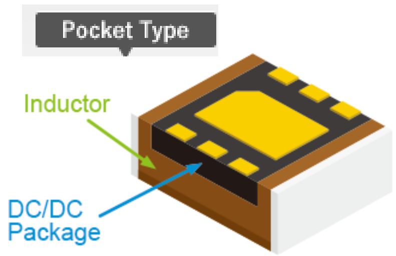


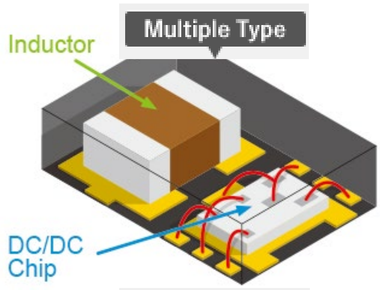
High-growth focus product: inductor built-in micro DC/DC converters

The micro DC/DC XCL Series is ultra small DC/DC converters that integrate a coil and a control IC using Torex's unique technology, which realize devices that **simultaneously achieve space-saving, high efficiency, low noise, high heat dissipation, and low cost.**

Wireless and GPS functions are being added to a wide variety of devices, and radio-frequency interference and noise have become key concerns in electrical circuit design. Torex's micro DC/DC XCL Series is optimized to achieve a lower noise than with a discrete DC/DC converter configuration.

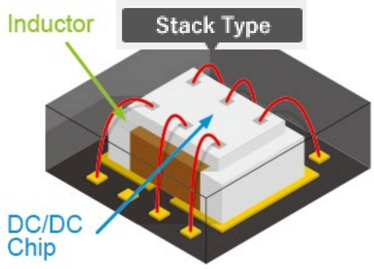
Improving power conversion efficiency is a key point in miniaturizing a power circuit. When semiconductor and electronic components are made smaller, the resistance component increases and the loss appears as heat generation. The micro DC/DC XCL Series reduces the loss of efficiency that accompanies miniaturization.

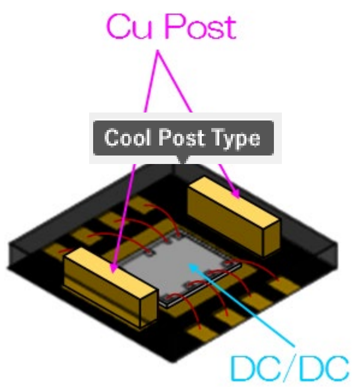




Comparison of 4 package type features

Type of package	Small	High heat dissipation	Low noise	Type
Pocket Type	◎	○	◎	Low EMI
Multipul Type	○	◎	○	Large current
Stack type	◎	△	△	Low cost
Cool post type	○	◎	◎	High withstand voltages



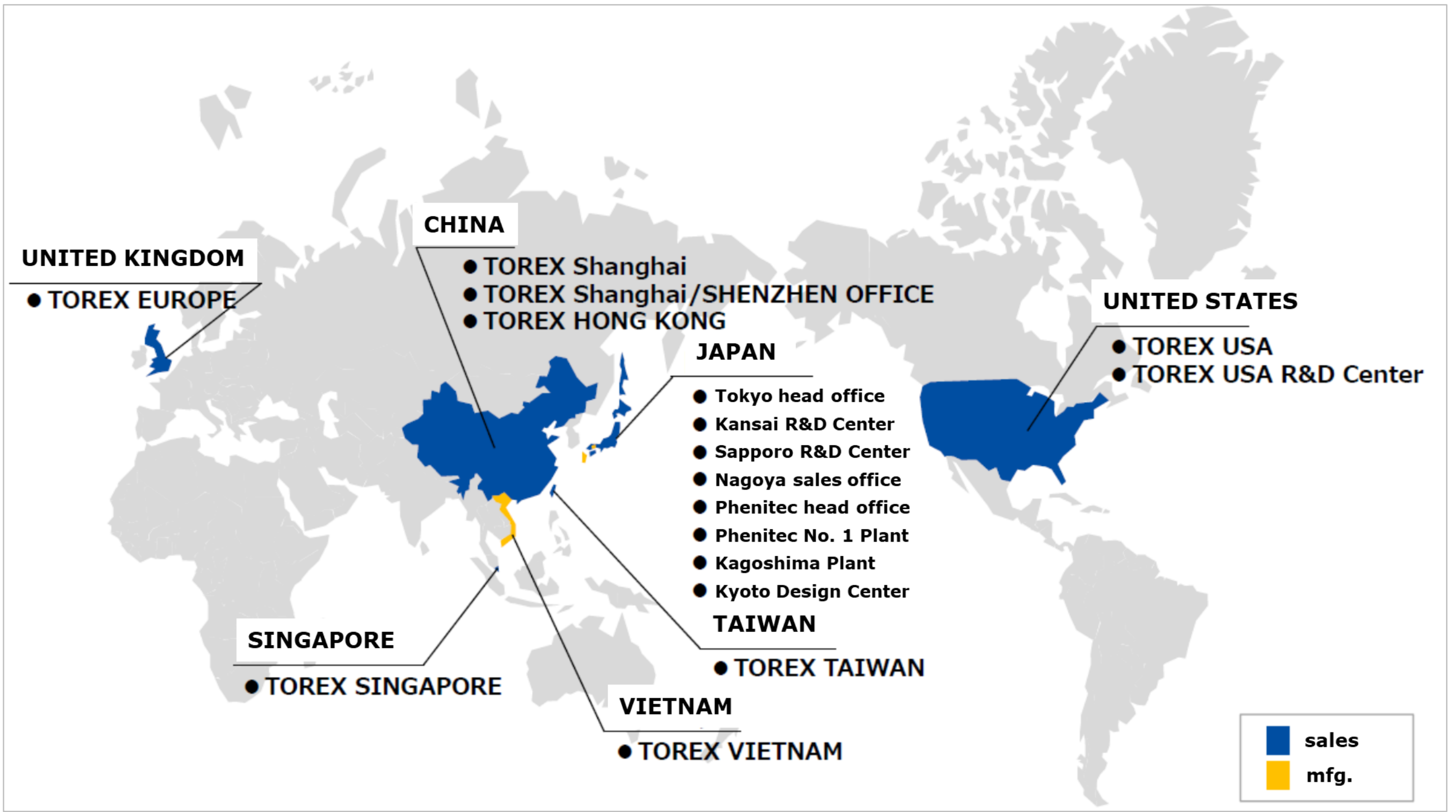


Source: excerpt from company website.

Inductor built-in micro DC/DC converter target markets / applications

Personal Electronics	Industrial Equipment	Automotive Equipment	Medical Equipment
Wireless earphones	5G optical transcievers	Drive recorders	Blood pressure monitors
Wearables	Microcontroller boards	ETC onboard units	Blood sugar monitors
Beauty care products	Sensor modules	Car navigtion	Fingertip pulse oximeters
Bluetooth, WiFi, GPS modules	Camera modules	AV main units	Healthcare equipment
	Home security	Camera and sensor modules	
	POS terminals	Keyless entry	
	IoT device modules	Power sliding doors	
		Sub displays	

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



Source: company IR materials

Brief explanation about geographic breakdowns of Group net sales
The table on the following page shows three different classifications for regional sales breakdowns. The top rung is official reporting segments. In Japan, Torex is engaged in the manufacture and sales of power mgt. ICs, and Phenitec accepts orders, manufactures, ships, and sells wafers. The three overseas segments are organized around the 6 local sales subsidiaries shown in the organization chart on the top of P21.

"Design-in" base sales reflect where electronic devices etc. equipped with company products were planned and designed, and in which orders were actually won. It is used as an important analytical tool for management decision making on business strategy.

The lower rung is regional sales based on the location of the customer.

TOREX SEMICONDUCTOR Group Number of Employees

persons	FY3/17 act	FY3/18 act	YoY chg	FY3/19 act	YoY chg	FY3/20 act	YoY chg	FY3/21 act	YoY chg
Consolidated Group	**981**	**982**	**1**	**1,017**	**35**	**1,016**	**(1)**	**1,016**	**0**
• Japan	799	799	0	819	20	830	11	831	1
• Asia	160	159	(1)	174	15	167	(7)	166	(1)
• Europe	14	14	0	15	1	10	(5)	11	1
• N America	8	10	2	9	(1)	9	0	8	(1)
Parent	**160**	**159**	**(1)**	**168**	**9**	**172**	**4**	**175**	**3**

Source: compiled by Sessa Partners from YUHO financial statements.

*Design-in base sales effectively scale back the large weight of China mainly due to final assembly of electronic products there, aiming to reflect business in 'real terms.'

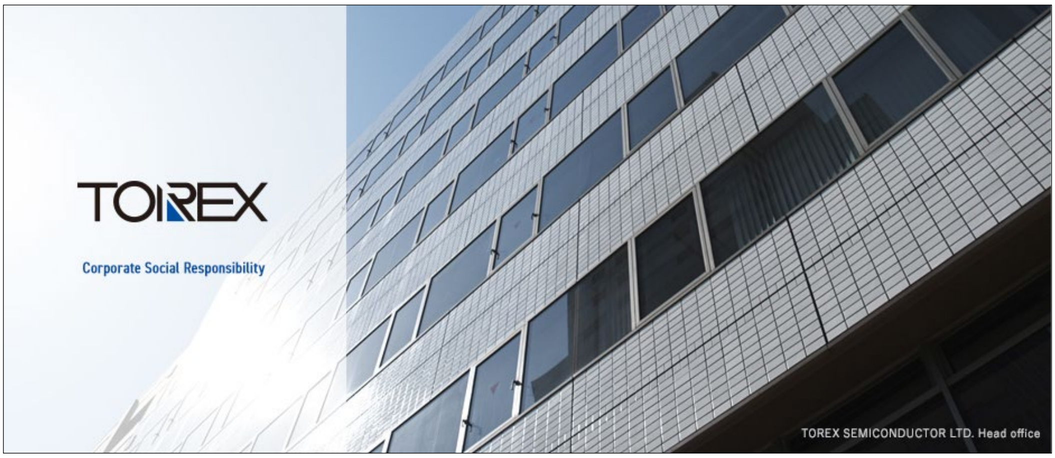
Geographic Sales Breakdown: As Reported, Design-in Base and by Customer Location

[J-GAAP] JPY mn, %	FY3/17 act	FY3/18 act	YoY pct	FY3/19 act	YoY pct	FY3/20 act	YoY pct	FY3/21 act	YoY pct
Reported segments									
Net sales	21,560	23,997	11.3	23,897	(0.4)	21,501	(10.0)	23,713	10.3
• Japan	14,611	16,772	14.8	16,935	1.0	14,778	(12.7)	16,963	14.8
• Asia	5,551	5,696	2.6	5,444	(4.4)	5,461	0.3	5,527	1.2
• Europe	809	892	10.2	880	(1.3)	718	(18.4)	698	(2.8)
• N America	588	637	8.2	638	0.1	545	(14.6)	526	(3.4)
Net sales	100.0%	100.0%	—	100.0%	—	100.0%	—	100.0%	—
• Japan	67.8%	69.9%	—	70.9%	—	68.7%	—	71.5%	—
• Asia	25.7%	23.7%	—	22.8%	—	25.4%	—	23.3%	—
• Europe	3.8%	3.7%	—	3.7%	—	3.3%	—	2.9%	—
• N America	2.7%	2.7%	—	2.7%	—	2.5%	—	2.2%	—
****Design-in base***									
Net sales	21,560	23,997	11.3	23,897	(0.4)	21,501	(10.0)	23,713	10.3
• Japan	15,867	18,124	14.2	18,193	0.4	16,026	(11.9)	17,986	12.2
• Asia	3,199	3,330	4.1	3,312	(0.5)	3,405	2.8	3,611	6.0
• Europe	1,471	1,491	1.3	1,431	(4.0)	1,212	(15.3)	1,189	(1.9)
• N America	1,023	1,052	2.9	961	(8.6)	859	(10.7)	927	7.9
Net sales	100.0%	100.0%	—	100.0%	—	100.0%	—	100.0%	—
• Japan	73.6%	75.5%	—	76.1%	—	74.5%	—	75.8%	—
• Asia	14.8%	13.9%	—	13.9%	—	15.8%	—	15.2%	—
• Europe	6.8%	6.2%	—	6.0%	—	5.6%	—	5.0%	—
• N America	4.7%	4.4%	—	4.0%	—	4.0%	—	3.9%	—
By customer location									
Net sales	21,560	23,997	11.3	23,897	(0.4)	21,501	(10.0)	23,713	10.3
• Japan	6,156	6,024	(2.1)	6,687	11.0	6,865	2.7	6,698	(2.4)
• China	7,334	8,209	11.9	8,159	(0.6)	7,326	(10.2)	8,180	11.7
• Taiwan	2,339	3,047	30.3	2,575	(15.5)	2,496	(3.1)	3,413	36.7
• N America	3,727	4,456	19.6	4,203	(5.7)	2,904	(30.9)	3,530	21.6
• Other	2,004	2,261	12.8	2,274	0.6	1,910	(16.0)	1,893	(0.9)
Net sales	100.0%	100.0%	—	100.0%	—	100.0%	—	100.0%	—
• Japan	28.6%	25.1%	—	28.0%	—	31.9%	—	28.2%	—
• China	34.0%	34.2%	—	34.1%	—	34.1%	—	34.5%	—
• Taiwan	10.8%	12.7%	—	10.8%	—	11.6%	—	14.4%	—
• N America	17.3%	18.6%	—	17.6%	—	13.5%	—	14.9%	—
• Other	9.3%	9.4%	—	9.5%	—	8.9%	—	8.0%	—

Source: compiled by Sessa Partners from YUHO financial statements.

Head Office:
3F DAIHO ANNEX
1-24-1 Shinkawa
Chuo-Ku, Tokyo

• Tokyo Sales Division:
6F DAIHO ANNEX
(also Osaka and Nagoya)
• Asia Sales Offices:
Shanghai, Hong Kong,
Taipei, Singapore
• UK Sales Office:
Leicestershire
• US Sales Office:
Irvine, California



PART THREE:
Earnings Trend, FY12/21 Outlook and New MTP

Phenitec Acquisition Impact on Margins

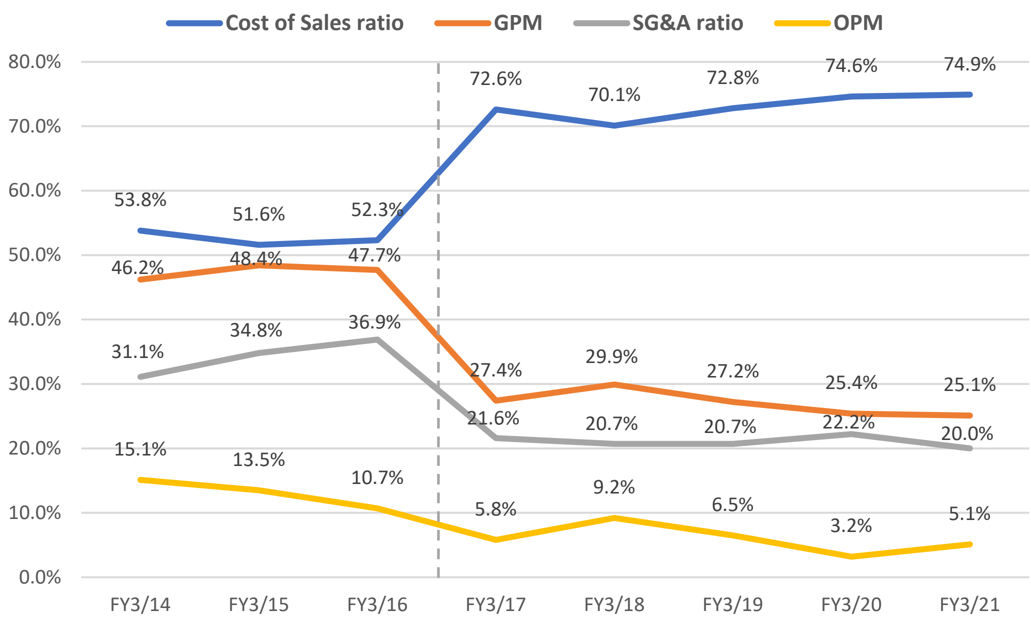
In PART TWO we covered the background history and updated status of the Torex Semiconductor Group, and its unique business model of fabless power management IC design, manufacture and sales of Torex combined with the sole Japan foundry service of original and custom discrete products of Phenitec. The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

OPM Comparison by Torex Parent and Phenitec Contribution

[J-GAAP]	FY3/17	FY3/18	YoY	FY3/19	YoY	FY3/20	YoY	FY3/21	YoY
JPY mn, %	act	act	pct	act	pct	act	pct	act	pct
Net sales	21,560	23,997	11.3	23,897	(0.4)	21,501	(10.0)	23,713	10.3
Gross profit	5,900	7,177	21.6	6,494	(9.5)	5,452	(16.0)	5,959	9.3
GPM	*27.4%*	*29.9%*		*27.2%*		*25.4%*		*25.1%*	
SG&A expenses	4,649	4,964	6.8	4,943	(0.4)	4,774	(3.4)	4,750	(0.5)
ratio to sales	*21.6%*	*20.7%*		*20.7%*		*22.2%*		*20.0%*	
EBITDA	2,470	3,147	27.4	2,636	(16.2)	1,990	(24.5)	2,418	21.5
ratio to sales	*11.5%*	*13.1%*		*11.0%*		*9.3%*		*10.2%*	
Operating profit	1,251	2,212	76.8	1,551	(29.9)	678	(56.3)	1,209	78.3
OPM	*5.8%*	*9.2%*		*6.5%*		*3.2%*		*5.1%*	
Torex parent sales	10,181	10,168	(0.1)	10,104	(0.6)	9,663	(4.4)	9,605	(0.6)
Phenitec contribution	11,378	13,828	21.5	13,792	(0.3)	11,837	(14.2)	14,107	19.2
Torex parent OP	680	633	(6.9)	646	2.1	453	(29.9)	516	13.9
Phenitec contribution	571	1,579	176.5	904	(42.7)	225	(75.1)	693	208.0
Torex parent OPM (%)	*6.7%*	*6.2%*		*6.4%*		*4.7%*		*5.4%*	
Phenitec contribution	*5.0%*	*11.4%*		*6.6%*		*1.9%*		*4.9%*	
Capex	925	1,150	24.4	3,324	188.9	1,497	(55.0)	1,179	(21.2)
Depreciation	1,219	934	(23.4)	1,085	16.2	1,312	20.9	1,208	(7.9)
R&D expense	229	405	76.9	357	(11.9)	403	12.9	457	13.4

Source: compiled by Sessa Partners from TANSHIN financial statements and IR results briefing materials

Cost Structure Before and After the Phenitec Acquisition



Source: compiled by Sessa Partners from TANSHIN financial statements

The table on the previous page summarizes the trend of consolidated net sales and profits for the Torex Semiconductor Group. As noted in PART TWO, Torex concluded a capital alliance with its top shareholder Phenitec, acquiring a majority 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 disclosure in officially submitted financial statements, results briefing presentation materials provide invaluable supplemental disclosures giving net sales and OP breakdowns by Torex and the Phenitec contribution which exclude 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.

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.

Phenitec contribution OP and OPM:

1Q 3/19	¥487mn	13.1%
2Q 3/19	¥413mn	11.7%
⋮		
4Q 3/21	¥415mn	11.3%

The table and graph on the following page illustrate this mechanism clearly. The same phenomenon occurred in 4Q 3/21. As noted at the top of the cover page, high growth in Group net sales and profits was temporarily interrupted by the significant slowdown in global trade in CY2019 due to escalation of the US-China tariff dispute, followed by initial adverse impact on global economic activities under the pandemic during 1H 2020. From the table, we can see that Phenitec contribution OP in the two quarters before the outbreak of the US-China tariff war was ¥487mn and ¥413mn (1Q and 2Q 3/19), with double-digit OPM respectively. In the bar chart below the master table, Phenitec contribution OP is designated by the yellow bars.

The key takeaway is that Phenitec profitability is largely a function of capacity utilization rates, and on any given quarter, OPM can be significantly higher than Torex. Other factors can include a spike in raw materials cost, such as the recent spike in gold prices.

After the tariff dispute escalated, we can see that Phenitec contribution OP deteriorated rapidly with the coinciding decline in capacity utilization rates. Note that it posted an operating loss in 4Q 3/19, when Japan exports to China turned negative YoY. As noted in PART ONE, we have found Japan exports to China to be a reliable proxy for the general health of the global electronics supply chain. The bar chart shows that Phenitec contribution OP continued to struggle for 9 quarters. Then in 4Q 3/21, in part due to strong orders from its major North American client IXYS Corporation, the recovery in utilization rates supported the significant recovery to ¥415mn, with OPM vaulting back to 11.3%. For reference, 4Q 3/21 OPM for Torex was only 3.5%.

TOREX SEMICONDUCTOR Quarterly Consolidated Earnings

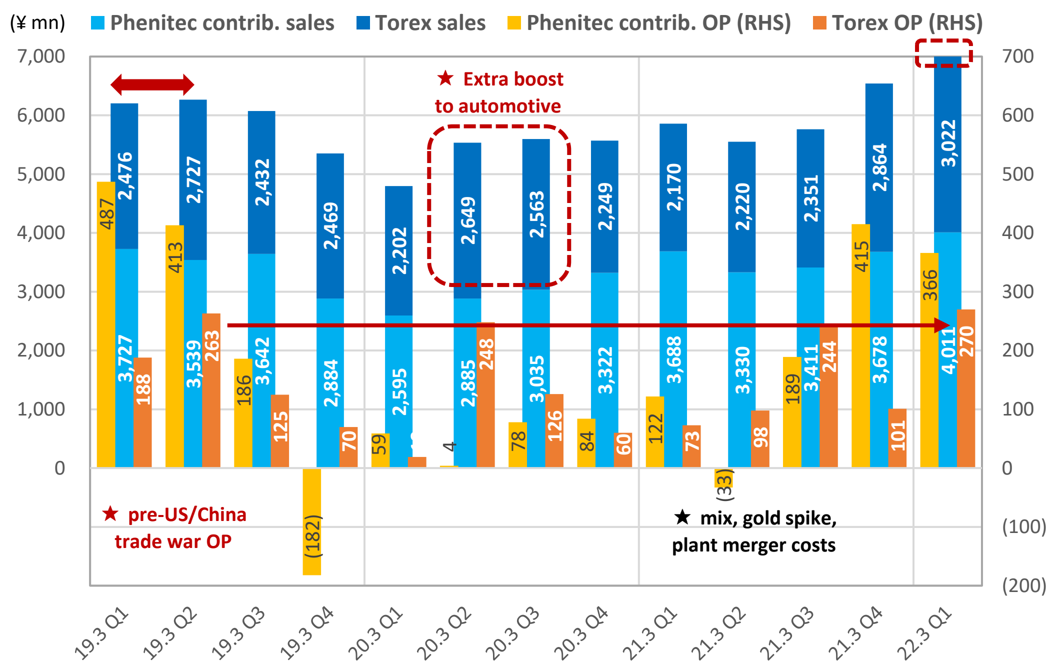
JPY mn, %	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20	3Q 3/20	4Q 3/20	1Q 3/21	2Q 3/21	3Q 3/21	4Q 3/21	1Q 3/22
	act	act	act	act	act	act	act	act	act	act	act	act	act
Net sales	**6,203**	**6,266**	**6,074**	**5,353**	**4,797**	**5,534**	**5,598**	**5,571**	**5,858**	**5,550**	**5,762**	**6,541**	**7,013**
YoY	8.6	2.8	0.6	(13.0)	(22.7)	(11.7)	(7.8)	4.1	22.1	0.3	2.9	17.4	19.7
• Phenitec contrib.	3,727	3,539	3,642	2,884	2,595	2,885	3,035	3,322	3,688	3,330	3,411	3,678	4,011
YoY	15.1	0.7	4.4	(19.6)	(30.4)	(18.5)	(16.7)	15.2	42.1	15.4	12.4	10.7	8.8
• Torex	2,476	2,727	2,432	2,469	2,202	2,649	2,563	2,249	2,170	2,220	2,351	2,864	3,002
YoY	0.1	5.7	(4.6)	(3.7)	(11.1)	(2.9)	5.4	(8.9)	(1.5)	(16.2)	(8.3)	27.3	38.3
Gross profit	**1,921**	**1,892**	**1,530**	**1,151**	**1,269**	**1,422**	**1,446**	**1,315**	**1,325**	**1,210**	**1,606**	**1,817**	**1,942**
GPM	*31.0%*	*30.2%*	*25.2%*	*21.5%*	*26.5%*	*25.7%*	*25.8%*	*23.6%*	*22.6%*	*21.8%*	*27.9%*	*27.8%*	*27.7%*
SG&A	1,246	1,216	1,218	1,263	1,191	1,170	1,241	1,172	1,129	1,146	1,174	1,301	1,306
Ratio to sales	*20.1%*	*19.4%*	*20.1%*	*23.6%*	*24.8%*	*21.1%*	*22.2%*	*21.0%*	*19.3%*	*20.6%*	*20.4%*	*19.9%*	*18.6%*
Depreciation	195	239	300	351	305	317	335	355	269	278	325	336	283
YoY	(11.8)	4.4	29.9	38.7	56.4	32.6	11.7	1.1	(11.8)	(12.3)	(3.0)	(5.4)	5.2
EBITDA	**870**	**915**	**612**	**239**	**384**	**568**	**540**	**498**	**464**	**343**	**758**	**851**	**919**
YoY	28.7	5.8	(21.5)	(71.0)	(55.9)	(37.9)	(11.8)	108.4	21.1	(39.6)	40.4	70.9	98.1
Ratio to sales	*14.0%*	*14.6%*	*10.1%*	*4.5%*	*8.0%*	*10.3%*	*9.6%*	*8.9%*	*7.9%*	*6.2%*	*13.2%*	*13.0%*	*13.1%*
Operating profit	**675**	**676**	**311**	**(112)**	**78**	**252**	**204**	**144**	**195**	**65**	**433**	**515**	**636**
YoY	48.4	6.5	(43.5)	TR	(88.4)	(62.7)	(34.4)	TB	148.9	(74.2)	112.3	257.6	226.2
OPM	*10.9%*	*10.8%*	*5.1%*	*-2.1%*	*1.6%*	*4.6%*	*3.6%*	*2.6%*	*3.3%*	*1.2%*	*7.5%*	*7.9%*	*9.1%*
• Phenitec contrib.	487	413	186	(182)	59	4	78	84	122	(33)	189	415	366
YoY	60.7	(19.6)	(46.1)	TR	(87.9)	(99.0)	(58.1)	TB	106.8	TR	142.3	394.0	200.0
OPM	*13.1%*	*11.7%*	*5.1%*	*-6.3%*	*2.3%*	*0.1%*	*2.6%*	*2.5%*	*3.3%*	*-1.0%*	*5.5%*	*11.3%*	*9.1%*
• Torex	188	263	125	70	19	248	126	60	73	98	244	101	270
YoY	23.7	117.4	(39.0)	(54.8)	(89.9)	(5.7)	0.8	(14.3)	284.2	(60.5)	93.7	68.3	269.9
OPM	*7.6%*	*9.6%*	*5.1%*	*2.8%*	*0.9%*	*9.4%*	*4.9%*	*2.7%*	*3.4%*	*4.4%*	*10.4%*	*3.5%*	*9.0%*
Ordinary profit	924	819	227	(150)	11	268	240	157	180	(3)	348	680	676
YoY	98.3	27.8	(62.5)	TR	(98.8)	(67.3)	5.7	TB	16.4x	TR	45.0	333.1	275.6
Profit ATOP	496	469	123	(39)	12	146	133	127	168	(11)	230	545	476
YoY	112.0	75.7	(58.0)	TR	(97.6)	(68.9)	8.1	TB	13.9x	TR	72.9	329.1	183.3

Source: compiled by Sessa Partners from company IR results briefing presentation materials.

Torex posted the highest quarterly sales since listing due to the booming semiconductor market which has continued from 2H last term, with all regions posting strong performance.

Phenitec posted growth in sales and profits driven by strong orders boosting utilization rates, posting the highest sales since becoming a consolidated subsidiary.

Torex posted strong results in all regions, and recorded the highest sales since listing



Torex Sales Trend by Application and Design-in based* Region with Heat Map

JPY mn, %	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20	3Q 3/20	4Q 3/20	1Q 3/21	2Q 3/21	3Q 3/21	4Q 3/21	1Q 3/22
by Application													
Torex sales	**2,476**	**2,727**	**2,432**	**2,469**	**2,202**	**2,649**	**2,563**	**2,249**	**2,170**	**2,220**	**2,351**	**2,864**	**3,002**
• Industrial equipt.	966	1,063	945	953	784	912	933	834	872	763	805	1,064	1,033
• Automotive equipt.	381	384	362	408	350	615	457	327	241	249	352	398	400
• Medical equipt.	36	26	26	37	25	21	29	43	73	44	43	66	49
• Wearable equipt.	71	74	37	56	53	66	54	47	50	100	100	112	86
• Other	1,022	1,180	1,062	1,015	990	1,035	1,090	998	934	1,064	1,051	1,224	1,434
YoY													
Torex sales	**0.1**	**5.7**	**(4.6)**	**(3.7)**	**(11.1)**	**(2.9)**	**5.4**	**(8.9)**	**(1.5)**	**(16.2)**	**(8.3)**	**27.3**	**38.3**
• Industrial equipt.	9.8	14.3	(0.1)	(2.0)	(18.8)	(14.2)	(1.3)	(12.5)	11.2	(16.3)	(13.7)	27.6	18.5
• Automotive equipt.	(3.5)	(3.3)	(18.1)	(13.9)	(8.1)	60.2	26.2	(19.9)	(31.1)	(59.5)	(23.0)	21.7	66.0
• Medical equipt.	80.0	(13.3)	(23.5)	54.2	(30.6)	(19.2)	11.5	16.2	192.0	109.5	48.3	53.5	(32.9)
• Wearable equipt.	10.9	19.4	(31.5)	5.7	(25.4)	(10.8)	45.9	(16.1)	(5.7)	51.5	85.2	138.3	72.0
• Other	788.7	(45.4)	(1.0)	(2.5)	(3.1)	(12.3)	2.6	(1.7)	(5.7)	2.8	(3.6)	22.6	53.5
by Region													
Torex D-in* sales	**2,476**	**2,727**	**2,432**	**2,469**	**2,202**	**2,649**	**2,563**	**2,249**	**2,170**	**2,220**	**2,351**	**2,864**	**3,002**
• Japan	1,086	1,159	1,070	1,086	950	1,090	1,104	1,043	896	895	958	1,129	1,160
• Asia	791	896	818	807	724	1,001	980	700	781	849	876	1,105	1,197
• Europe	345	402	304	379	305	329	268	310	259	242	304	384	383
• North America	254	270	240	197	223	229	211	196	234	234	213	246	262
YoY													
Torex D-in* sales	**0.1**	**5.7**	**(4.6)**	**(3.7)**	**(11.1)**	**(2.9)**	**5.4**	**(8.9)**	**(1.5)**	**(16.2)**	**(8.3)**	**27.3**	**38.3**
• Japan	8.8	6.5	0.4	(5.1)	(12.5)	(6.0)	3.2	(4.0)	(5.7)	(17.9)	(13.2)	8.2	29.5
• Asia	(0.3)	13.0	(8.7)	(4.7)	(8.5)	11.7	19.8	(13.3)	7.9	(15.2)	(10.6)	57.9	53.3
• Europe	(19.0)	0.5	(7.9)	13.1	(11.6)	(18.2)	(11.8)	(18.2)	(15.1)	(26.4)	13.4	23.9	47.9
• North America	(1.2)	(10.0)	(6.6)	(17.2)	(12.2)	(15.2)	(12.1)	(0.5)	4.9	2.2	0.9	25.5	12.0

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

Despite the downturn, or perhaps more accurately in response to it, the Board of Directors approved a 5.2% share buyback during FY3/20. **This highlights the importance of the Chairman of Phenitec and the President of Torex among the top 10 shareholders.**

FY3/20 Results

As mentioned earlier, due to escalation of the tariff dispute between the US and China resulting in significant slowdown in global trade, FY3/20 was a difficult year with net sales -10.0% and OP -56.3%, revising down full-term guidance at 1H results, and still posting a slight shortfall. However, to be fair, FY3/20 results could more accurately be described as a series of underlying successes in the face of a truly severe external environment.

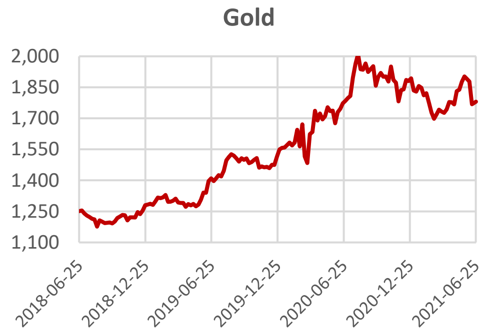
As explained in PART ONE, understanding the trend in demand by applications is key to grasping what is actually happening. Parent Torex sales in FY3/20 declined -4.4% YoY. Sales for the two focus growth applications were INDUSTRIAL EQUIPT. -11.8% and AUTOMOTIVE EQUIPT. +13.9%. Weakness in industrial was mainly seen in surveillance cameras, satellite communications and FA-related. Strength in automotive in the 2Q and 3Q (see table above) was attributed to China's vertical ramp-up of ETC nationwide, and high growth in drive recorders in Japan. This reflected one of the company's strengths as a dedicated small and nimble PMIC supplier despite the tough market.

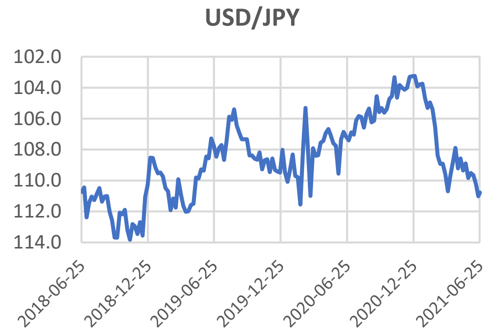
Phenitec sales declined -13.9%. Largely due to the sharp decline in INDUSTRIAL EQUIPT. -38.4%. Looking at the breakdown of the -56.3% decline in OP, by company it was Torex -29.9% and Phenitec -75.1%, which was attributed to the decline in utilization rates as well as increase in depreciation associated with the Okayama Plant integration project. **The real noteworthy success was conducting a 5.2% share buyback, hiking the dividend, and paying down LT loans, all while advancing large-scale capex, with net cash still accounting for 25% of net assets, and healthy equity ratio of 67.1%.**

FY3/21 Results

The breakdown of the +10.3% increase in net sales by company was Torex -0.6%, in part attributed to the reactionary decline in automotive (see table on the previous page) and Phenitec +19,.2%, attributed to the sharp recovery in industrial orders from its major North American client as well as China. The breakdown of the +78.3% increase in OP by company was Torex +13.9%, attributed to successfully controlling SG&A, and Phenitec +208% on higher utilization rates and lower than expected depreciation.

The gold price spiked to over $2,000/oz during the 2Q, raising raw materials costs. Although forex losses increased in the 3Q due to the strong yen, depreciation expense came in lower than initially planned due to strong orders and busy utilization rates forcing the company to push out completion of the Daiichi Plant integration project into 1H FY3/22. The yen depreciated significantly during the 4Q.





Source: Yahoo! Finance (US site)

Phenitec Sales Trend by Application and Region with Heat Map**

JPY mn, %	1Q 3/19	2Q 3/19	3Q 3/19	4Q 3/19	1Q 3/20	2Q 3/20	3Q 3/20	4Q 3/20	1Q 3/21	2Q 3/21	3Q 3/21	4Q 3/21	1Q 3/22
by Application													
Phenitec sales**	**4,136**	**3,973**	**4,075**	**3,268**	**2,983**	**3,251**	**3,435**	**3,628**	**3,982**	**3,703**	**3,732**	**4,077**	**4,536**
• Industrial equipt.	759	705	1,100	698	408	412	493	696	911	630	588	653	676
• Automotive equipt.	908	873	923	856	876	921	892	915	838	738	869	942	1,044
• Medical equipt.	98	63	145	84	70	48	54	116	60	32	34	39	36
• Other	2,371	2,332	1,907	1,630	1,629	1,870	1,996	1,901	2,173	2,303	2,241	2,443	2,780
YoY													
Phenitec sales**	**14.9**	**1.3**	**5.1**	**(17.6)**	**(27.9)**	**(18.2)**	**(15.7)**	**11.0**	**33.5**	**13.9**	**8.6**	**12.4**	**13.9**
• Industrial equipt.	(15.3)	(8.7)	29.4	(20.3)	(46.2)	(41.6)	(55.2)	(0.3)	123.3	52.9	19.3	(6.2)	(25.8)
• Automotive equipt.	49.1	11.6	9.8	0.0	(3.5)	5.5	(3.4)	6.9	(4.3)	(19.9)	(2.6)	3.0	24.6
• Medical equipt.	22.5	(52.6)	70.6	42.4	(28.6)	(23.8)	(62.8)	38.1	(14.3)	(33.3)	(37.0)	(66.4)	(40.0)
• Other	17.7	4.4	(9.3)	(25.0)	(31.3)	(19.8)	4.7	16.6	33.4	23.2	12.3	28.5	27.9
by Region													
Phenitec sales**	**4,136**	**3,973**	**4,075**	**3,268**	**2,983**	**3,251**	**3,435**	**3,628**	**3,982**	**3,703**	**3,732**	**4,077**	**4,536**
• Japan	1,479	1,362	1,356	1,332	1,346	1,410	1,427	1,403	1,280	1,277	1,307	1,654	1,983
• Asia	1,019	1,070	750	467	495	661	803	805	914	869	1,088	1,193	1,118
• Europe	198	182	204	205	199	224	261	236	268	244	194	183	230
• North America	1,440	1,359	1,765	1,264	943	956	944	1,184	1,520	1,313	1,143	1,047	1,205
YoY													
Phenitec sales**	**14.9**	**1.3**	**5.1**	**(17.6)**	**(27.9)**	**(18.2)**	**(15.7)**	**11.0**	**33.5**	**13.9**	**8.6**	**12.4**	**13.9**
• Japan	27.5	5.6	8.2	1.9	(9.0)	3.5	5.2	5.3	(4.9)	(9.4)	(8.4)	17.9	54.9
• Asia	25.0	17.8	(23.9)	(53.3)	(51.4)	(38.2)	7.1	72.4	84.6	31.5	35.5	48.2	22.3
• Europe	8.8	(20.9)	7.4	25.8	0.5	23.1	27.9	15.1	34.7	8.9	(25.7)	(22.5)	(14.2)
• North America	(0.1)	(9.0)	21.7	(15.5)	(34.5)	(29.7)	(46.5)	(6.3)	61.2	37.3	21.1	(11.6)	(20.7)

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

TOREX SEMICONDUCTOR Revised FY3/22 Conslidated Financial Forecasts

[J-GAAP] JPY mn, %	FY3/21 act	YoY pct	FY3/22 init CE	YoY pct	FY3/22 revised	YoY pct	AMT CHG	PCT CHG	FY3/24 MTP	2Y CAGR	FY3/26 MTP	2Y CAGR
Net sales	**23,713**	**10.3**	**26,000**	**9.6**	**28,500**	**20.2**	**2,500**	**9.6**	**30,000**	**7.4**	**35,000**	**8.0**
EBITDA	2,418	21.5	3,549	46.8	4,169	72.4	620	17.5				
ratio to sales	*10.2%*		*13.7%*		*14.6%*							
Operating profit	**1,209**	**78.3**	**2,000**	**65.4**	**2,500**	**106.7**	**500**	**25.0**	**3,000**	**22.5**	**4,000**	**15.5**
OPM	*5.1%*		*7.7%*		*8.8%*				*10.0%*		*11.4%*	
Ordinary profit	**1,206**	**78.4**	**2,000**	**65.8**	**2,500**	**107.3**	**500**	**25.0**				
ratio to sales	*5.1%*		*7.7%*		*8.8%*							
Profit ATOP	**934**	**123.6**	**1,400**	**50.0**	**1,750**	**87.4**	**350**	**25.0**				
ratio to sales	*3.9%*		*5.4%*		*6.1%*							
Capex	1,179	(21.2)	2,019	71.2	2,630	123.1	611	30.3				
Depreciation	1,208	(7.9)	1,549	28.2	1,669	38.1	120	7.7				
R&D expense	457	13.4	504	10.3	—							
EPS (¥)	85.42		127.97		159.96							

Source: compiled by Sessa Partners from IR results briefing materials

Balance of Borrowings from Main Lending Institutions

JPY mn, %	FY3/17 act	FY3/18 act	YoY pct	FY3/19 act	YoY pct	FY3/20 act	YoY pct	FY3/21 act	YoY pct
Chugoku Bank	5,465	4,488	(17.9)	4,331	(3.5)	3,972	(8.3)	5,842	47.1
SMBC	450	351	(22.0)	251	(28.5)	451	79.7	831	84.3
Mizuho Bank	175	139	(20.6)	88	(36.7)	225	155.7	420	86.7

Source: compiled by Sessa Partners from AGM Notices of Convocation documents.

The sheer speed of the turnaround in FY3/21 can best be illustrated by the exhibit on P3 of new 5-year MTP targets just released in February along with the 3Q upward revision, only to see full-term guidance revised up again in the 4Q, along with significantly higher forecasts for FY3/22. These upward revisions for FY3/21 and FY3/22 overlayed on the initial 5-year MTP targets would imply a decline in FY3/23, which of course the company does not expect. Initial company estimates for FY3/22 are for consolidated net sales +9.6%, OP +65.4% and OPM rising from 5.1% → 7.7%. MTP targets include raising OPM to 10.0% in FY3/24 (year 3) and 11.4% in FY3/26 (year 5).

The new MTP promotes ‘green transformation’ through promoting power-saving circuits, reducing mounting board area and promoting low power-loss devices that suppress heat generation. The parent will continue to focus on developing high value-added power management ICs, including further share expansion of inductor built-in micro DC/DC converters, products specialized for 5G/IoT, solutions for solid-state and semi solid-state batteries, ultra-compact large-capacity packages, etc. Initiatives for Phenitec include development of silicon-based power devices and compound semiconductors at Kagoshima, and thorough measures for manufacturing cost reduction, following completion of the Daiichi Plant integration project at Okayama.

PART FOUR:

Key Growth Drivers: 5G / Industrial IoT, EV / Connected Cars / ADAS, Next-gen Power Devices

3 Key Features of 5G:
- higher speed and capacity
- higher reliability / lower latency (instantaneous)
- supports many simultaneous connections

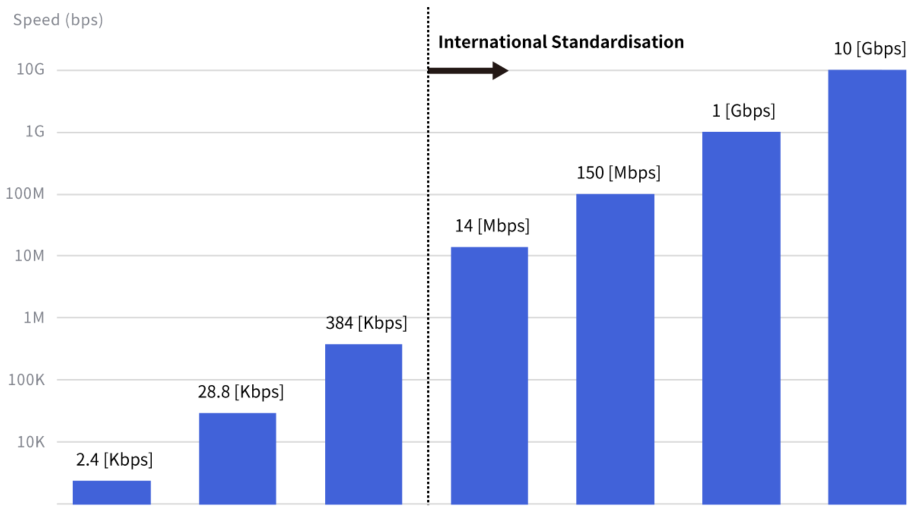
5G / Industrial IoT

5G NR (New Radio) is the new radio access technology (RAT) developed by 3GPP (consortium of standards organizations which develop protocols for mobile telecommunications) for the fifth-generation mobile network, designed to be the global standard for the air interface of 5G networks. 5G NR uses two frequency ranges: Frequency Range 1 (FR1), including sub-6 GHz frequency bands, and Frequency Range 2 (FR2), including frequency bands in the mmWave range (24–100 GHz).

Mobile communication systems tend to evolve into a new generation every ten years on average, along with the evolution of mobile phones and the increase in data traffic. Mobile communication standards started with analog system 1G used in the 1980s. However, with the advance of 2G digital systems in the 1990s, data communication became more widespread, especially email. With the arrival of 3G in the 2000s, data communication speeds improved significantly, and it was during this period that communication standards were unified globally. The 4G LTE (Long Term Evolution) technology has become a strong tailwind for smartphones, which are now in widespread use.

Next generation 5G is characterized by three major features: ① enhanced Mobile Broadband (eMBB: ultra-high speed, larger capacity), ② URLLC (Ultra-Reliable and Low Latency Communications), and ③ mMTC (massive Machine Type Communication: multiple simultaneous connections). The maximum speeds offered by 5G are expected to be more than ten times faster than the current 4G standard. 5G standard specification Release 17, which includes enhancements to mMTC, was due to be completed in mid-2021, but was delayed due to the impact of the COVID-19 and is now scheduled to be completed in June 2022 (see graph on next page).

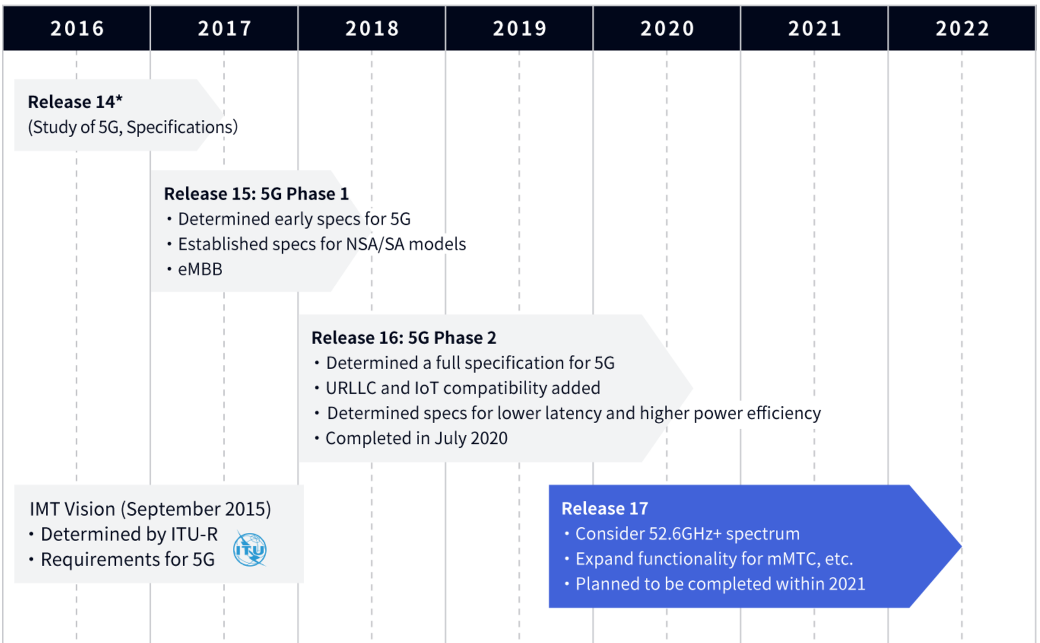
Evolution of Mobile Communications by Generation



Period	1980–1990	1991–2000	From 2001	From 2006	From 2010	From 2015	From 2019
Generation	1G	2G	3G	3.5G	3.9G	4G	5G
Standard	Analogue	cdmaOne (North America) GSM (Europe) PDC (Japan)	W-CDMA CDMA2000	HSPA EV-DO	LTE	LTE-Advanced	5G-NR

Source: "Electronic Components and Materials for 5G" (March 2021) compiled by Uzabase.

Development of 5G Standardization by 3GPP (3rd Generation Partnership Project)

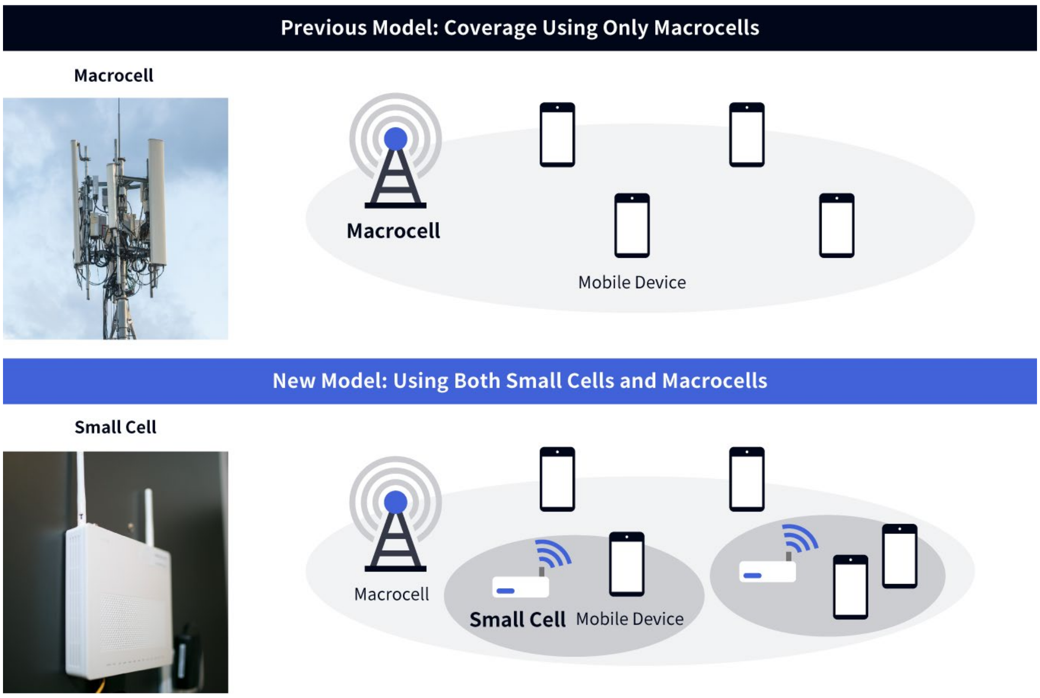


Source: “Electronic Components and Materials for 5G” (March 2021) compiled by Uzabase.

In order to enable higher speeds and larger volumes of data, 5G uses high-frequency millimetre waves. High frequency spectrum has its own disadvantages, such as a higher atmospheric attenuation and susceptibility to obstructions such as buildings. In the past, macrocells were used to cover a wide area, but a stable communication network for 5G can only be achieved by installing a large number of small cells which have relatively narrow coverage but low power consumption and small size.

5G cellular repeater

Example of 5G Infrastructure Using Small Cells



Source: “Electronic Components and Materials for 5G” (March 2021) compiled by Uzabase.

★ **Massive MIMO** is a technology that utilizes more than a hundred antennas (as opposed to just a few in previous generations) and allocates a dedicated wave to each user, which is already commercially available.

Beamforming is a technique for shifting high-frequency millimetre-wave signals along with the movement of the user, to be used in combination with Massive MIMO.

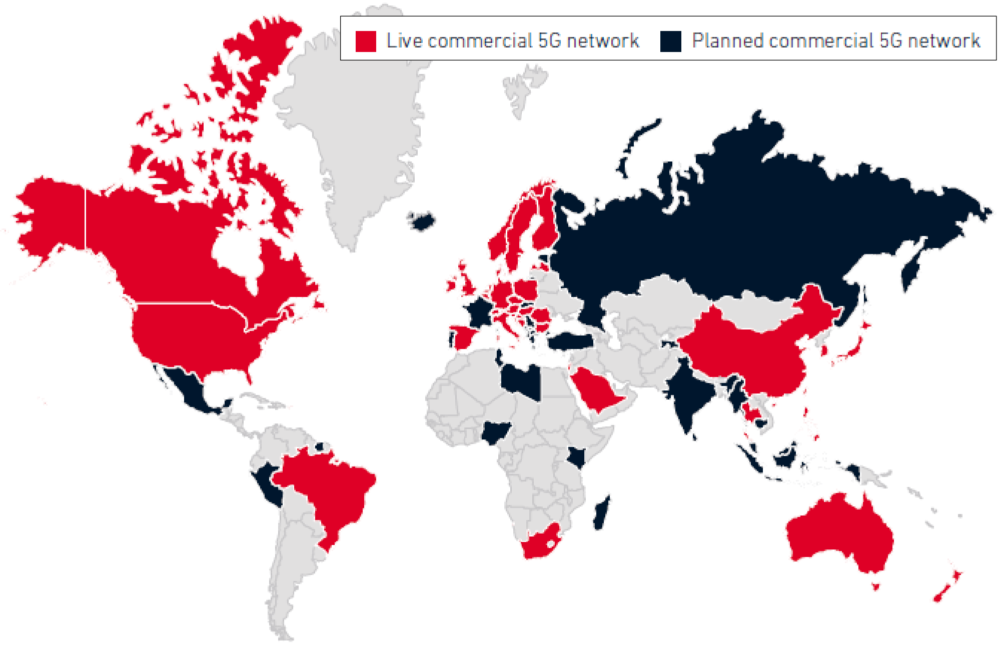
Key technologies which enable 5G

Technology	Main Features	Details
Massive MIMO	Larger capacity, ultra-high speed	While conventional MIMO (Multiple-Input and Multiple-Output) technology increases communication quality via 2 to 4 antennas on the transmitting and the receiving side, Massive MIMO allows for more than 100 antennas to be installed. With that, a base station can receive and transmit a large number of signals simultaneously, which should improve the capacity of the network. On the other hand, there is a higher chance of interference if the signals of two complex antennas cross.
Beamforming	Ultra-high speed and reliability	This technology directs a signal in a particular direction by adjusting the power and the phase of a wave transmitted from an antenna. This enables multiple devices to use the same frequency. Implementing this technology in Massive MIMO would decrease interference and increase speed.
Full Duplex	Larger capacity	Full Duplex allows the receiving device to both transmit and receive signals simultaneously, as opposed to conventional technology where only one can be done at a time. With this implemented, the usable frequency band would essentially double, and the capacity of the entire wireless network would double as well.
Heterogeneous Network	Larger capacity	Improves the capacity of the entire network via small cells placed to cover narrow areas where traffic is particularly heavy, within the wider coverage zone of macrocells.
Dual Connectivity (C/U Plane Split)	Ultra-high speed, larger capacity	This technology splits the transmission of signalling protocols traffic (C-plane) and user data (U-plane), whereby the former is transmitted using macrocells with wider coverage, while the latter is sent through small cells that allow for higher speeds, thus increasing the overall speed and capacity of a network.

Source: "Electronic Components and Materials for 5G" (March 2021) compiled by Uzabase.

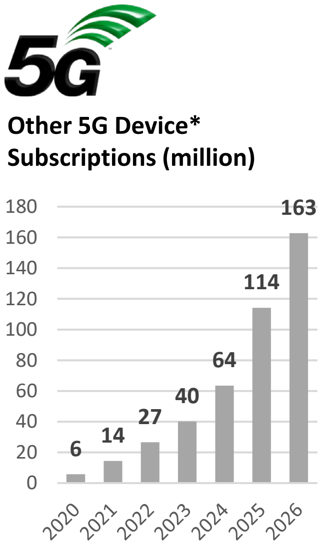
There are now 113 operators with 5G networks across 48 countries (Sep-2020). These operators collectively account for **40% of the global mobile subscriber base**. Launches so far have been concentrated in China, South Korea and the US.

Despite the global pandemic, global 5G network rollouts progressed during 2020



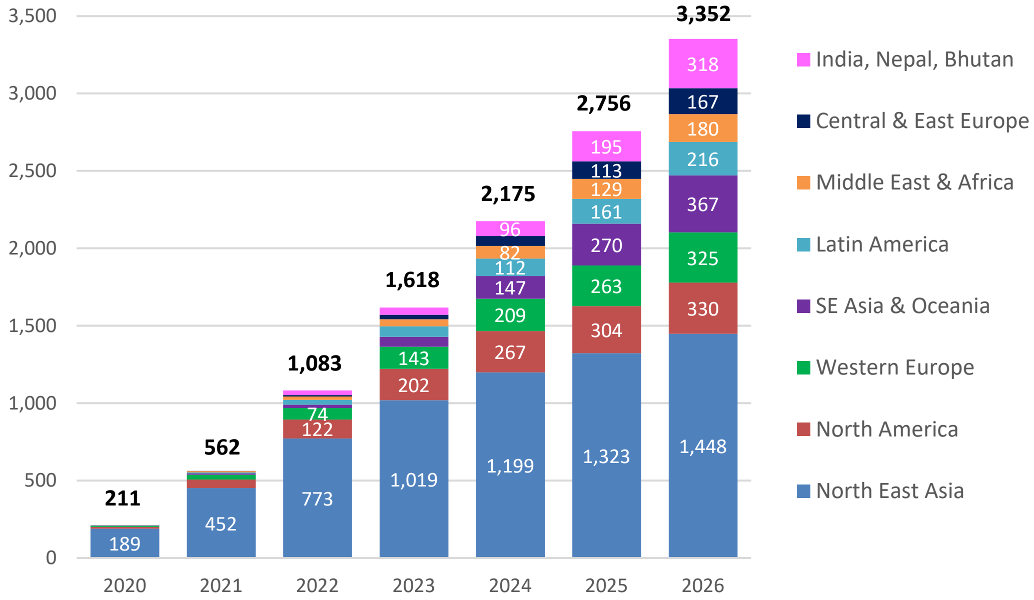
Source: Global Mobile Trends 2021, GSMA™ Intelligence (as of 30 September 2020).

Other 5G Device* Subscriptions (million)



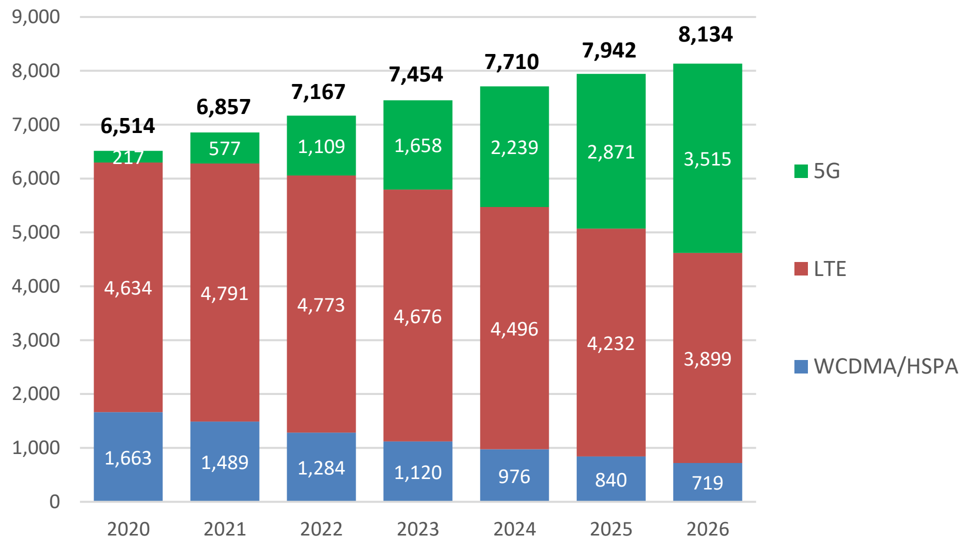
Source: Ericsson Mobility Report
*Note: mobile PCs, tablets, routers

Worldwide 5G Smartphone Subscriptions 2020 – 2026 (million) by Region



Source: Ericsson Mobility Report June 2021. Note: includes smartphones.

Worldwide Mobile Subscriptions 2020 – 2026 (million, all devices) by Technology



Source: Ericsson Mobility Report June 2021. Note: includes smartphones, feature phones, mobile PCs, tablets, routers.

According to the Ericsson Mobility Report June 2021, 5G subscriptions with a 5G-capable device grew by 70 million during 1Q 2021, to reach around 290 million. Ericsson estimates 580 million total 5G device subscriptions by the end of this year. 5G subscription uptake is expected to be faster than that of 4G following its launch in 2009. Key factors include China's earlier engagement with 5G compared to 4G, as well as the timely availability of devices from several vendors. By the end of 2026, Ericsson forecasts 3.5 billion 5G subscriptions globally, accounting for around 40 percent of all mobile subscriptions at that time. **The next 3 pages summarize the main implications for high growth in IoT applications, followed by Torex power management IC example product solutions for industrial IoT.**

The brief summaries on the right include excerpts combined from “The Impact of 5G on the United States Economy” by Accenture Strategy (February 2021) and “The 5G Economy in a Post-COVID-19 Era” by IHS Markit / OMDIA (November 2020).

The points below were highlighted in the Accenture analysis as transformative changes from 5G connectivity ramping up from 2021 – 2025.

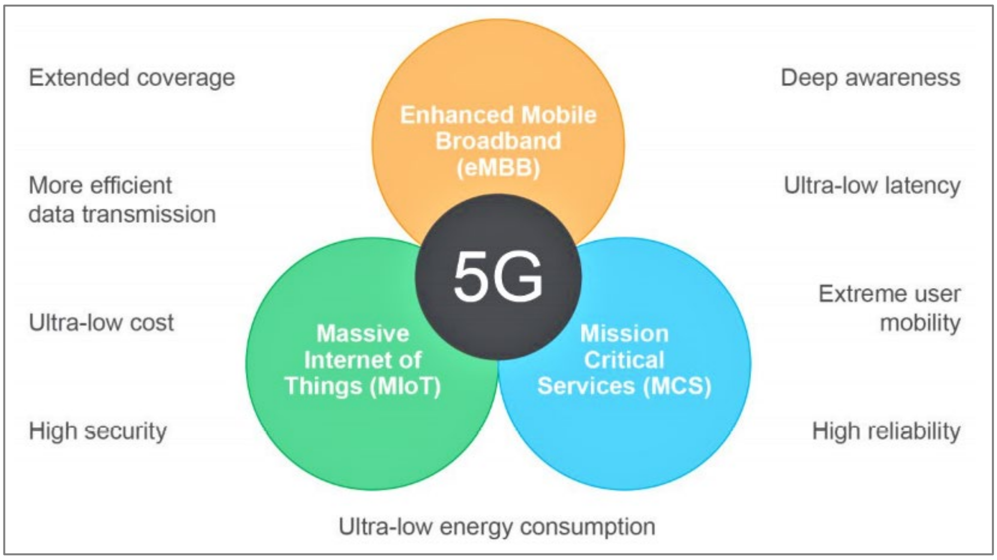
Benefits for MANUFACTURING
• 20 – 30% productivity gains
• 50% improvement in assembly efficiency
• 20% increase in production assets life
• 90% defect detection

Benefits for AUTOMOTIVE
• 80% reduction in accidents
• Big savings in repair costs
• 25% reduction in traffic

Benefits for HEALTHCARE
• 30% savings in transition to remote / home-based care

Environment / Sustainability
• Increased energy efficiency: 5G-enabled mIOT devices have longer battery and device useful lives

The Promise of 5G: the Three Main Use Cases



Source: The 5G Economy in a Post-COVID-19 Era (November 2020), IHS Markit, OMDIA.

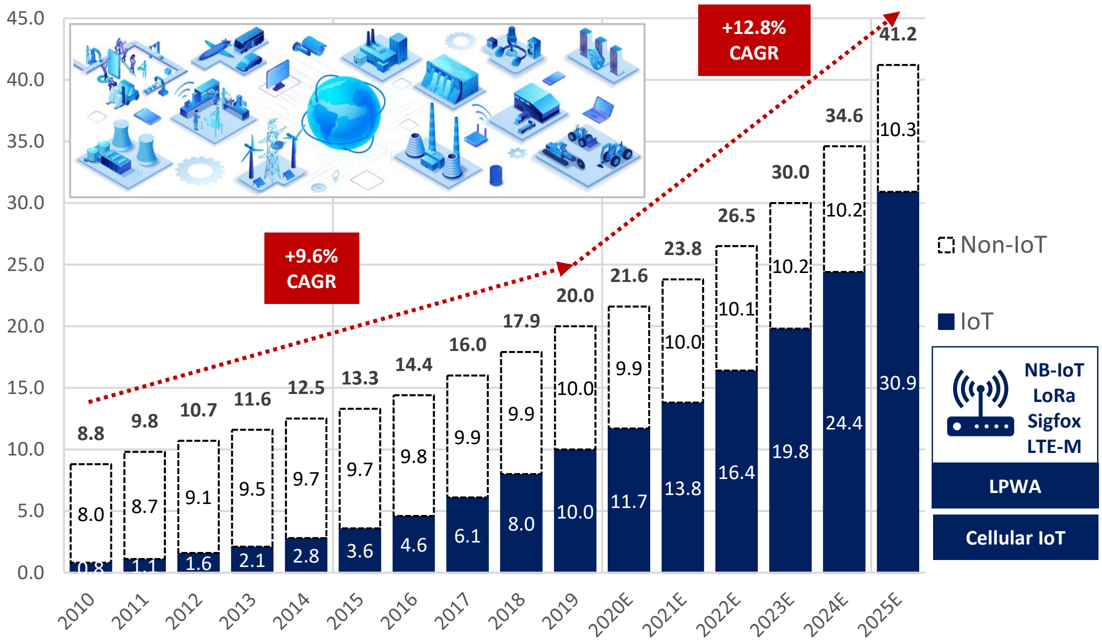
Enhanced Mobile Broadband (eMBB)
5G can deliver high bandwidth and speed to enable rich bi-directional transfer of high-definition video and high-volume data. High speed mobile broadband is foundational for enabling applications like augmented reality (AR) and virtual reality (VR) that require rich data transfer in both directions and will unlock entirely new ways of engaging with people and information in the age of computer vision (CV) and machine learning (ML). Two key facets of eMBB will drive adoption and value creation in the 5G economy. The first is extending cellular coverage into a broader range of structures, including office buildings, industrial parks, shopping malls, and large venues. The second is improved capacity to handle a significantly greater number of devices using high volumes of data, especially in localized areas. These improvements to the network will enable more-efficient data transmission, resulting in lower cost per bit for data transmission, which will be an important driver for increased use of broadband applications on mobile networks.

Massive Internet of Things (mIOT)
5G can provide simultaneous connectivity to potentially one million connections per square kilometer. This massively dense connectivity is essential to the effective implementation of advanced industrial Internet of things (IIoT) applications. One example of this is enabling large networks of sensors and machines to capture the rich data sets necessary to apply AI in smart power plants. 5G will build upon earlier investments in traditional machine-to-machine (M2M) and IoT applications to enable significant increases in economies of scale that drive adoption and utilization across all sectors. 5G’s improved low-power requirements, ability to operate in licensed and unlicensed spectrum, and ability to provide deeper and more flexible coverage will drive significantly lower costs within MIoT settings. This will, in turn, enable the scale of MIoT and drive a much greater uptake of mobile technologies to address MIoT applications.

Mission-Critical Services (MCS)
For mission-critical applications such as automated vehicles or remote intensive care units (ICUs), the reliability and speed of the connection are crucial. 5G can carry network traffic with latencies as low as 1 ms, safely supporting use cases for which a fraction of an instant can make the difference between life and death. MCS represents a new market opportunity for mobile technology. This significant growth area for 5G will support applications that require high reliability, ultra-low latency connectivity with strong security and availability. This will allow wireless technology to provide an ultra-reliable connection that is indistinguishable from wireline to support applications such as autonomous vehicles and remote operation of complex automation equipment where failure is not an option.

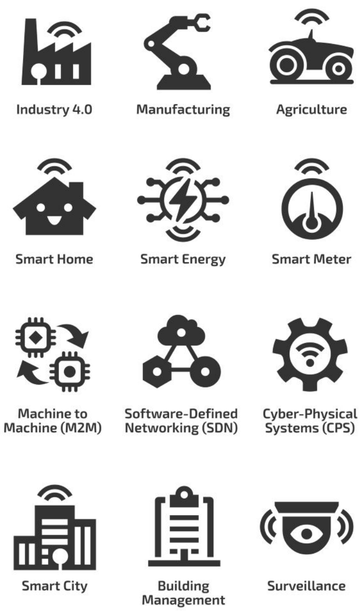
★ **IoT Analytics revised up its 2025 target for total global connected IoT devices from 21.5bn → 30.9bn, raising CAGR for all connected devices (IoT and Non-IoT) through 2025 to +12.8%.**

Global Active Device Connections (billion): IoT surpasses Non-IoT in 2020



Source: IoT Analytics – Cellular IoT and LPWA Connectivity Market Tracker 2010 – 2025
Note: Non-IoT includes all mobile phones, PCs, laptops and fixed line phones.

Excerpts from "State of the IoT 2020: 12 billion IoT connections, surpassing non-IoT for the first time" (November 2020) by IoT Analytics, which is a leading provider of market insights for the Internet of Things (IoT), M2M, and Industry 4.0.



IoT Analytics – Cellular IoT and LPWA Connectivity Market Update (November 2020)

Despite the ongoing Covid-19 pandemic, the market for the Internet of Things continues to grow. In 2020, for the first time, there are more IoT connections (e.g., connected cars, smart home devices, connected industrial equipment) than there are non-IoT connections (smartphones, laptops, and computers). Of the 21.7 billion active connected devices worldwide, 11.7 billion (or 54%) will be IoT device connections at the end of 2020. By 2025, it is expected that there will be more than 30 billion IoT connections, almost 4 IoT devices per person on average.

Compared to an analysis performed in mid-2018, IoT Analytics has now raised its forecast for the number of connected IoT devices in 2025 (from 21.5 billion to 30.9 billion). Several factors are driving the growth, most notably:

Cellular IoT – China

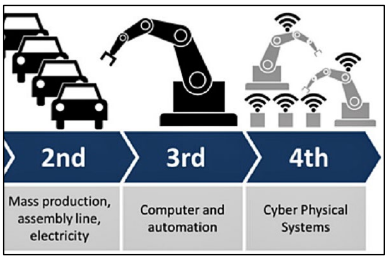
IoT has been booming in China at levels that seemed unimaginable a few years ago. While in 2015, for example, Chinese telecom companies accounted for roughly one quarter (27%) of all cellular IoT connections, this number has shot up to 75% in 2020 with China Telecom, China Unicom, and China Mobile leading the global cellular IoT connections market.

Personal and home devices

The pervasive use of personal IoT devices such as fitness wearables further accelerated in the last 2 years and is expected to continue to do so. The introduction and subsequent adoption of a new generation of ecosystem-enabled smart home devices such as the Amazon Echo led to faster adoption of connected home devices than previously assumed.

LPWA

Counting a mere 10 million connections in 2015, the global market for low-power wide-area (LPWA) connectivity was quasi non-existent 5 years ago. LPWA enables IoT connections for remote battery-powered devices such as smart meters, containers in logistics, or critical infrastructure like fire hydrants in cities. In 2020 this market reached 423 million IoT connections and is expected to grow at a CAGR of 43% to reach 2.5 billion IoT connections by 2025. The picture in 2020 is that of a two-horse race. LoRa (and LoraWAN) technology, which is operating in the unlicensed spectrum and largely driven by the Lora Alliance, is in a head-to-head battle with NB-IoT, which is operating in the licensed spectrum and mostly driven by leading telecommunication firms around the world.



★ **Smart Factories** can connect multiple devices and systems and share data in real-time (IoT). Companies can now integrate multiple IT systems and collect, monitor, and track data across the factory floor as well as from the suppliers and customers across the value chain, achieving significant cost savings and productivity gains.

Other IoT-related Trends:
- Smart Logistics
- Smart Grids
- Smart Cities
- Smart Homes
- Smart Farming
- Smart Construction
- Remote Surveillance
- Edge Computing

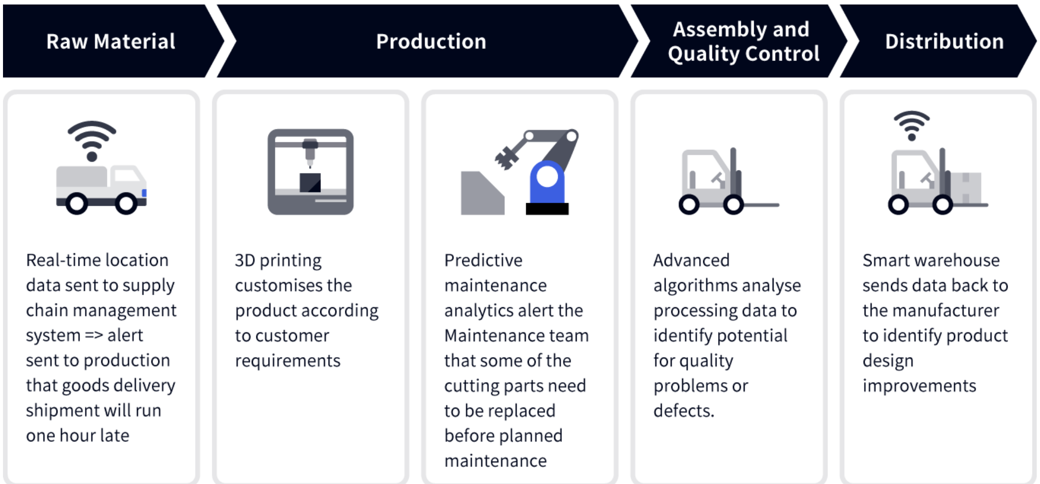
Sensors used in smart factories have self-diagnosis and self-calibration capabilities, which, for example within production systems, can predict maintenance requirements based on the vibration frequencies of the machines or changes in heat generated. This enables companies to benefit from extended machine life and decreased machine downtime.

Industrial IoT and Industry 4.0 'Smart Factories'

	Automated Factory (Industry 3.0)	Smart Factory (Industry 4.0)
Data Collection & Sharing	• Sensors deliver limited amounts of information due to low processing power. • Does not possess the capabilities of self-adjusting to real time changes.	• Sensors have higher capabilities resulting in the ability to communicate more accurate and larger amounts of data in real time. • Leverages onboard microprocessors to perform in-place/on-site diagnostics.
Form of labour	• Highly specialised machine operators.	• Data analysts to monitor and make decisions based on data flowing through various systems. • Job losses in some labour categories especially at the more low-end, low-skill levels.
Automation	• Automation of various tedious and mundane tasks carried out by humans. • Unable to make decisions autonomously. Would require reprogramming.	• Advanced robotics used in smart factories possess higher capabilities of integrability and adaptability, autonomous decision-making, and self-optimising capabilities. (Enabled through advanced machine learning algorithms)

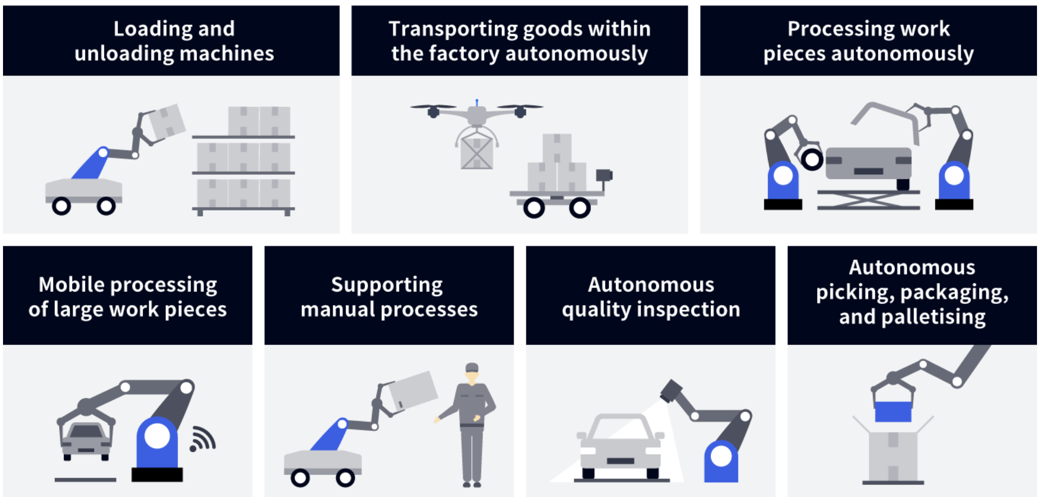
Source: "Smart Factories – The Imminent Transformation in Manufacturing" (February 2021) compiled by Uzabase.

Smart Factory concept spans the entire production value chain



Source: Sierra Wireless, compiled by Uzabase.

Transition enabled by advancements in sensors, robotics, and data analytics



Source: BCG Global Advanced Robotics Survey, compiled by Uzabase.

Optical Transceiver

IoT Devices
(Battery operation, Low power consumption)

Industrial Sensors
(12V / 24V power supply)

Small Li batteries rechargeable by LDO
(nominal 2V to 3V)

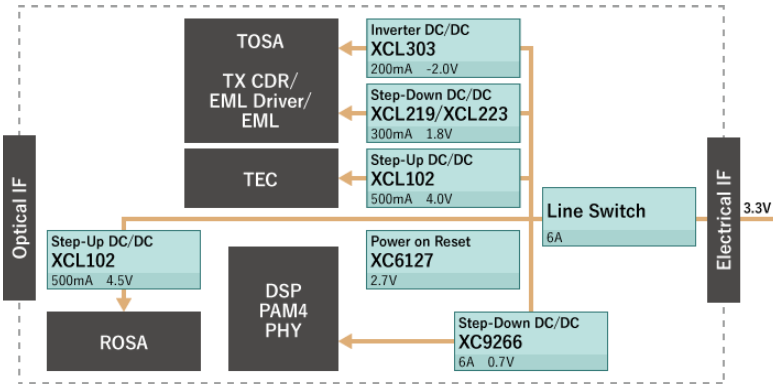
Torex Power Management Applications and Solutions for Industrial / IoT

The following is a brief summary of Torex product solutions targeting Industrial / IoT applications from the Company's website.

Optical Transceiver

Optical transceivers are commonly used for high-speed data communications, and they normally conform to industry standard form factors. This results in designers often needing to incorporate multiple power supply rails into a small predetermined physical space. Efficiency and power dissipation become very important and the latest optical transceiver chipsets demand supplies with low output noise performance and excellent transient response.

QSFP-DD is a module and cage/connector system similar to current QSFP (stands for four-lane Quad Small Form-factor Pluggable system), but with an additional row of contacts providing for an eight-lane electrical interface. It provides solutions up to 200 Gbps or 400 Gbps aggregate and uses PAM4 (4-level Pulse Amplitude Modulation) as well as NRZ modulation. Typically, QSFP-DD designs include an additional Digital Signal Processor (DSP) for PAM4, and they also require a negative voltage rail for the PAM4 EML (a laser source plus electro-absorptive modulator).



Recommended Torex ICs

- XCL303: Inductor built-in Negative Output Voltage DC/DC
- XCL219 / XCL223: Inductor built-in HiSAT-COT step-down DC/DC
- XCL102: Inductor built-in step-up DC/DC
- XC6127: High accurate voltage detector
- XC9266: 6A high speed transient response HiSAT-COT step-down DC/DC

IoT Devices

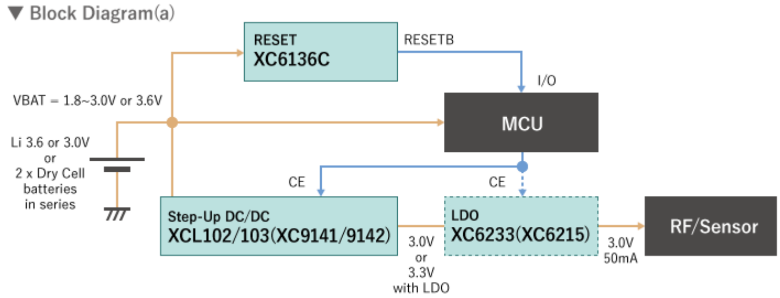
IoT modules are increasingly used in industrial equipment, medical care and home automation. Normally in a small form factor, IoT modules monitor their surroundings and communicate the information over the internet. An IoT module will typically be battery powered and include various sensors, an MCU and a Radio for wireless communication. The use of small batteries is common, and the efficiency of the power supply is often very important for the designer.

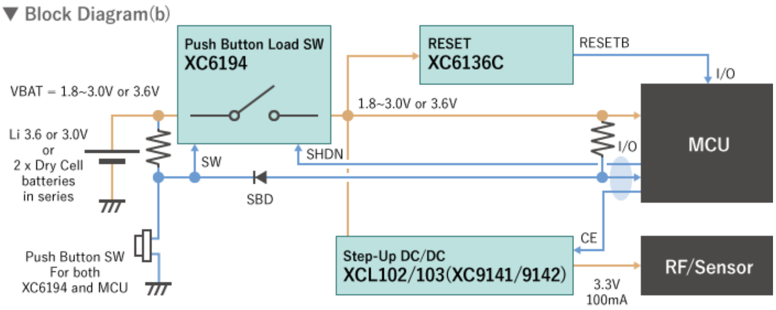
1) Primary Battery

Many IoT devices use primary batteries which are non-rechargeable. The expected lifetime can still be long, so the power management solution chosen must have ultra-low power consumption to ensure efficient use of the battery to extend the operational lifetime. Torex offers may ultra-low power IC and in the example solution circuit we demonstrate a function that cuts the power consumption by disconnecting the battery during transportation and when the IoT module is not in use.

The block diagram (a) on the next page shows a typical application where the microprocessor (MCU) is directly connected to the battery. This architecture is often used for simple IoT devices, wearables and medical products. In recent years, the operating voltage range for MCU has also become wider and 3.3 V ~ 1.8 V or lower is now common. As a result, many MCUs can now be connected directly to the battery without needing additional power supply IC. However, Radio IC and Sensors often still require a fixed 3.3V supply and even if the operating voltage is wider, the supply Voltage needs to be carefully controlled and often the devices work better at higher Voltages, therefore a step-up DC/DC is sometimes necessary to boost the battery Voltage.

IoT Device – Primary Battery





Recommended Torex ICs
• XC6136: Ultra low consumption RESET
• XCL102 / XCL103: Inductor built-in step-up DC/DC, PWM (XCL102), PWM/PFM (XCL103)
• XC6233 (XC6215): Fast transient response / high PSRR voltage regulator
• XC6194: Push Button Intelligent Load SW

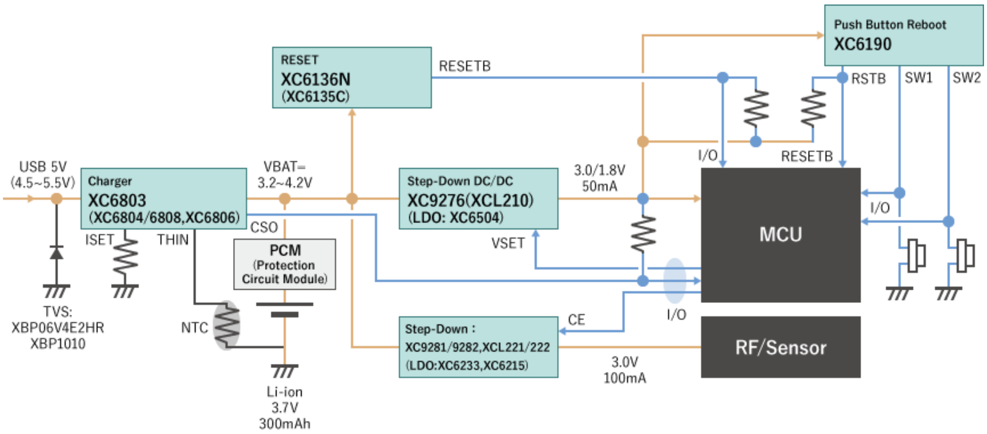
Normally, Radio IC and Sensors are not operated continuously, and the application firmware will be used to turn them ON and OFF as needed. For example, a Radio IC may only need to transmit and receive one time per day, possibly only for a few seconds, so it is more efficient to turn off the IC for the rest of the time to prolong battery life. During standby or sleep mode, when the Radio IC and Sensors are OFF and disabled, the operation of the power management IC used to supply them will also be turned OFF to conserve energy. This can be controlled easily using the devices CE or EN pin. Fixed frequency PWM mode ensures maximum efficiency at higher output loads and offers the lowest output ripple with easier noise management. Alternatively, PFM/PWM automatic switching can be used for improved efficiency during light loads. An inductor built-in type is also available, with better EMI suppression and smaller PCB area.

Low Drop Out (LDO) Voltage Regulators are often used to clean up a supply rail immediately after a DC/DC. The aim is to reduce noise and interference in the power supplies to the Radio and Sensors. For these Regulators, High Speed operation, with high levels of Power Supply Ripple Rejection (PSRR) is important together with Low Output Noise and fast transient response performance. With Torex 'Green Operation' (GO) the designer can combine these attributes with ultra-low quiescent current, because GO LDO will adapt their performance to the required output load. In some cases, the noise performance at higher frequencies can be important, and in these instances, a simple low speed, low quiescent current LDO may be a better choice.

A RESET IC or Voltage Supervisor, is often used to monitor the battery Voltage, if the Voltage drops below a predetermined level the RESET IC generates a signal for the MCU. These devices are always operating, so ultra-low quiescent current is an important consideration. If the MCU Voltage is the same as the monitored Voltage, a CMOS Output type can be used. The CMOS Output does not require an external pull-up Resistor which helps to reduce unnecessary losses. When the MCU Voltage is different to the monitored Voltage an N-ch Output type should be used. An N-ch Output type will need an external pull-up Resistor and this will result in slightly higher current consumption across the resistor during reset. Some MCU have a built-in Under Voltage Lock Out (UVLO) or Analog to Digital Converters (ADC) which can be used to monitor the supply Voltage. However, it is often advantageous to have a separate IC to monitor critical Voltages independently of the MCU.

Block diagram (b) illustrates how a Push-Button Load Switch IC can be used to help maximize battery life, by disconnecting the battery from the rest of the circuit. The Schottky Barrier Diode (SBD) to the right of the SW pin in the diagram and the pull-up resistor to the VDD of the MCU are implemented so the push button can be shared with the MCU.

IoT Device – Li-ion Polymer



Recommended Torex ICs

- XC6190: Push Button reboot controller
- XC6136N (XC6135C): Ultra low consumption RESET
- XC9276 (XCL210): Ultra-Low Quiescent Current step-down DC/DC with selectable output voltage
- XC6803 (XC6804 / XC6808 / XC6806): Linear Li-ion Charger
- XC9281 / XC9282: Ultra small HiSAT-COT step-down DC/DC, PWM(XC9281), PWM/PFM(XC9282)

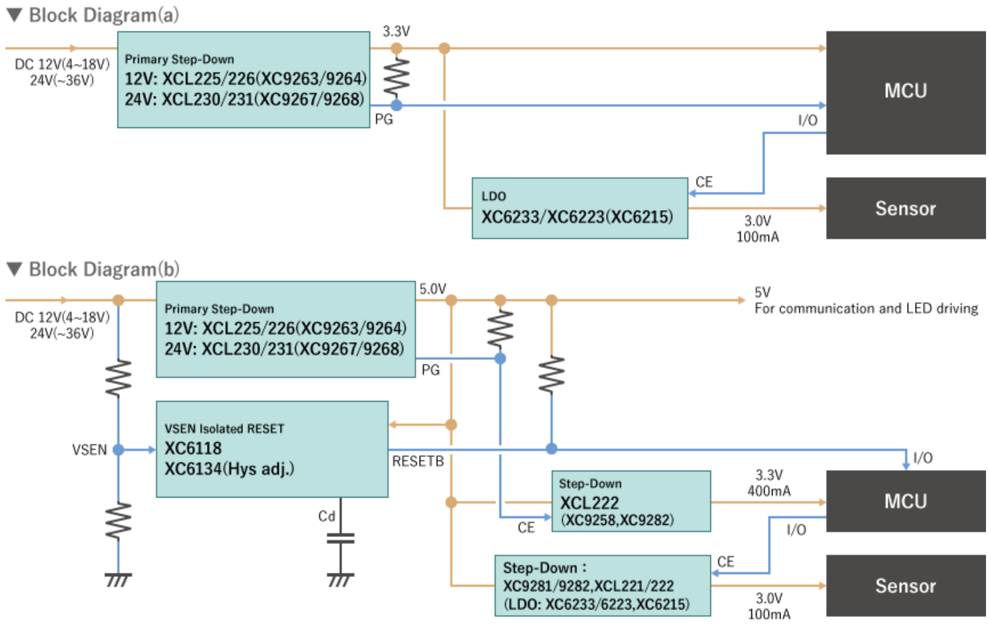
2) Li-ion Polymer Battery

Some IoT devices are powered by rechargeable batteries and Li-ion and Li-Polymer are popular choices. These chemistries require dedicated charging IC and in our example solution circuit we illustrate the different options available from Torex. IoT devices powered by Li-ion or Li-Polymer batteries need a Charger IC and normally use step-down DC/DC or LDO Voltage Regulators to reduce the battery Voltage to a lower level required by the microprocessor (MCU) and peripheral IC. First, we will discuss the different types of Charger IC. When selecting a Charger IC we should consider the required Charge Voltage (CV) and Charge Current (CC). Often the CC is fixed externally using a Resistor (RISET) as shown in the block diagram. The CV is normally factory set by laser trimming.

With Li-ion or Li-Polymer batteries a PCM (battery Protection Circuit Module) is almost always required. These PCM can be integrated into the battery pack or placed on the PCB. The battery temperature can be monitored using a Thermistor (NTC) placed close to the battery on the PCB or inside the battery pack. For smaller batteries, temperature monitoring is not always required, and the Charge Status Output (CSO) function can be used to monitor the charge condition. The CSO pin has an N-ch Open Drain Output with external pull-up resistor. The output signal will be pulled 'HIGH' to march the level of MCU I/O Voltage. An LED can also be used to display the charge status and it is advisable to drive the LED through a current limiting resistor that is connected to VIN, to ensure the LED is not driven by the charge current supplied by the Charger IC. When the battery is used as part of a back-up circuit, a Charger IC with Current Path function may be desirable so that power can be supplied to the system while the battery is being charged.

The CV for Li-ion or Li-Polymer batteries is normally around 4.2V and the maximum input Voltage for the MCU is typically 3.8V or less, so a step-down DC/DC or Voltage Regulator is required to lower the battery Voltage for use within the system. Today's MCUs can operate in sleep or standby modes for long periods of time so high efficiency is required over a wide range of IOUT conditions from a few uA during sleep mode to 100mA or more when the MCU is operating fully. Using DC/DC with ultra-low quiescent current helps ensure high levels of efficiency when the MCU is in sleep mode and further savings can be realized by lowering the DC/DC output Voltage using a VSET function when the MCU enters sleep mode. Reducing the operating Voltage, even with the same quiescent current will significantly improve the overall system efficiency. When normal MCU operation is required, the DC/DC Voltage will need to be increased again, because many of the standard MCU functions require higher input Voltages to operate correctly. The MCU can switch between the different Voltage levels using the VSET pin. By varying the DC/DC Voltage in this way, we maximize the efficiency and help to prolong battery life.

Industrial Sensors



Recommended Torex ICs
• XCL225 / XCL226: Inductor built-in step-down DC/DC, PWM (XCL225), PWM/PFM (XCL226)
• XCL230 / XCL231: Inductor built-in step-down DC/DC, PWM (XCL230), PWM/PFM (XCL231)
• XC6233 / XC6223 (XC6215): Fast transient response / high PSRR voltage regulator
• XC6118 (XC6134): Low consumption voltage detector with separated sense pin and capacitor delay function
• XCL222: Inductor built-in step-down DC/DC HiSAT-COT PWM/PFM
• XC9258 (XC9282): Ultra-small HiSAT-COT step-down DC/DC, PWM/PFM, PWM/PFM(XC9282)

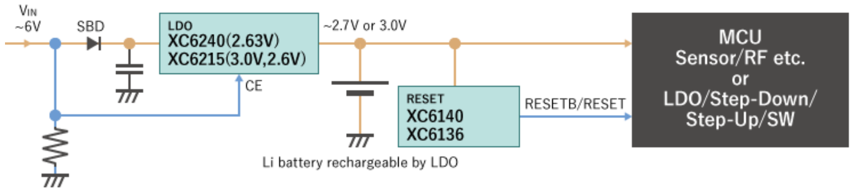
Industrial Sensors
Industrial sensors are typically powered by the host machine, so the input voltage is often 12V, 24V or more. They normally include various sensors, an MCU and a means of communication (either wired or wireless). Solutions with small physical size and high reliability are required and applications include building automation and security, monitoring of machinery, robotics etc. Although the number of applications is large, the typical circuit configuration is often similar and designers value efficiency, low output noise, low EMI and small size.

Industrial equipment will often be powered from a 12V or 24V primary power rail. Typical applications include, industrial sensors, factory automation and control equipment and robotics. Increasingly these application demand ever smaller, lower power solutions where efficiency and power dissipation become critically important. Block diagram (a) shows an example circuit where the primary DC/DC is directly powering the MCU. If the system spends periods of time in a low power mode, a DC/DC which switches automatically between PWM and PFM should be selected to maximize the efficiency under different load conditions. Alternatively, a DC/DC with fixed PWM mode can be used if a constant frequency is preferred or if the output load is always at a higher level. If the input Voltage is likely to drop to levels at or below the output Voltage, then a DC/DC with internal Pch switch, capable of operating with 100% duty cycle, should be used in order to maintain the output Voltage for as long as possible under adverse conditions.

In our example, the Voltage rail required to drive the sensor is close to the system Voltage so a LDO Voltage Regulator can be used efficiently. As a general rule, if Voltage Regulator is used, a high speed LDO Regulator, with high Power Supply Ripple Rejection (PSRR) and fast load transient response should be chosen to ensure a clean supply.

In a system where there are two distinct Voltage levels, we often refer to the initial power stage as the 'Primary' and the the next stage as the 'Secondary'. For example, the 'primary' stage in our diagram is the initial step-down from DC to 5.0V. The 'Secondary' stage includes all the subsequent rails powered from 5.0V, so in our example the two 3.3V rails are both 'Secondary’. The primary side is the same as Block diagram (a) above. However, for the secondary stage, it is possible to use lower Voltage DC/DC which are often smaller and more compact. Designers often prefer PWM/PFM auto switching DC/DC to maintain higher efficiencies at lower loads.

Small Li batteries rechargeable by LDO (nominal 2V to 3V)



Recommended Torex ICs
• XC6240 / XC6215: Low consumption small voltage regulator
• XC6140 / XC6136: Ultra-low consumption voltage detector

Small Li batteries rechargeable by LDO (nominal 2V to 3V)
A new generation of Li rechargeable, semi solid-state batteries which typically operate with a nominal voltage between 2V and 3V are now becoming common. These batteries can often be charged with a Constant Voltage using a simple LDO Voltage Regulator and the charging Voltage is normally set at a fixed level between 2.5V to 3.0V. Utilizing these batteries, a designer can realize a simple charging solution without the complexity normally associated with dedicated Li-ion charger IC. Our example solution circuit illustrates how this can be achieved. Applications include, powering small IoT devices and as a battery back up for industrial devices.

Benefits over traditional Li-Ion products:
• Ready for constant voltage charging by LDO. No need for a dedicated expensive CV / CC charging IC.
• Resistant to over-discharge and can be used with simple low voltage detection
• Because it is a battery, it can maintain a constant voltage around 2.2V to 2.3V for a long time. Energy can be used more easily and efficiently than a Supercap, which drops the voltage linearly.
• There are also products that can handle high temperatures such as 70° C and 105° C.
• Reflow / Hot laminating compatible products are also available.

A low consumption LDO Voltage Regulator is suitable to use with a large capacity secondary batteries as load. The battery is charged by a constant voltage provided by the LDO Voltage Regulator. The battery voltage rises to the LDO voltage regulator output voltage in a short period of time after the start of charging, and then the battery is gradually charged. It is not necessary to detect full charge, and it is generally not necessary to turn off the voltage regulator after full charge.

When the VIN is cut, the CE of the Voltage Regulator becomes 'Low' and the LDO turns off. The leakage current from the Li battery to the LDO becomes very small, this is called as the V_{OUT} sink current. Reverse current from the battery to V_{IN} is prevented by the SBD, and the pull-down resistor connected to the anode of the SBD switches the VE of the LDO to "L," and puts the voltage regulator into a standby state.

Ultra-low consumption voltage detectors can be used to monitor the battery voltage.
There are two main uses. When the battery voltage drops, the Voltage Detector stoppes the operation of MCU or next-stage power supply ICs. This prevents malfunctions of the operation of MCU when tbattery voltage drops. It is important to be able to suppress the quiescent current to a low level after detecting. Another way to reduce current consumption is to use the output of the voltage detector and Pch SW to cut off the power supply line.

If the battery voltage reaches or exceeds the release voltage of the voltage detector, a signal is output to start operation of the MCU or next-stage power supply IC. This makes it possible to prevent the system from repeatedly turning on and off due to internal impedance and inrush current when using a secondary battery with high internal impedance. A CMOS output type, which does not require a pull-up resistor, is suitable to reduce the quiescent current while operation is stopped.

PHEV

EV / Connected Cars / ADAS (advanced driver-assistance systems)

The electrification of all categories of vehicles (passenger cars and light trucks, commercial trucks and buses) is entering a new phase of accelerated momentum, in addition to steady advances in technology, driven by: ① tightened emissions standards in place before the pandemic, ② enhanced EV incentives as part of stimulus measures to deal with economic stress caused by the pandemic, and ③ a generally heightened sense of urgency to combat the unrelenting deterioration from climate change (see the summary table on the following page).

According to the IEA's recently updated annual publication "Global EV Outlook 2021" (April 2021), despite the global slump in auto sales which declined -16% in 2020, new EV registrations of 3 million units increased +41% YoY, accounting for a 4.6% share of total auto sales (see table below), which lifted global EV stock to 10.2 million units (see graph on the next page). EV sales in Europe topped those of China for the first time as the world's largest EV market, with sales of BEVs doubling and sales of PHEVs tripling, driven by: ① stimulus measures specifically targeting uptake of EVs through purchase incentives and subsidy extensions, as well as cash-for-clunkers scrappage programs, and ② a more integrated approach to the transport sector by supporting charging infrastructure, EV public transport etc.

Out of the world's top 20 vehicle manufacturers, which represented around 90% of new car registrations in 2020, 18 have stated plans to widen their portfolio of models and to rapidly scale up the production of light-duty electric vehicles. Consumer spending on electric car purchases increased to USD 120 billion in 2020. In parallel, governments across the world spent USD 14 billion to support electric car sales, up 25% from 2019, mostly from stronger incentives in Europe. In the first-quarter of 2021, global electric car sales rose by around 140% compared to the same period in 2020, driven by sales in China of around 500k vehicles and in Europe of around 450k.

The EV market in Europe exceeded that of China for the first time in 2020, boosted by stimulus measures focused specifically on EVs (Germany did not provide any subsidies for conventional cars).

Prospects for Global EV Sales under Two Main Scenarios

EV car sales units, %	IEA 2019	IEA 2020	YoY pct	STEPS 2025	STEPS 2030	SDS 2025	SDS 2030
Unit sales							
China BEV	834,197	931,291	11.6	3,363,610	6,599,817	5,742,530	8,380,270
China PHEV	226,106	228,291	1.0	1,184,041	2,337,131	2,019,110	2,321,434
Europe BEV	363,404	746,819	105.5	1,450,402	2,822,682	2,600,454	7,438,233
Europe PHEV	204,297	625,459	206.2	1,819,723	3,066,301	2,504,401	3,841,058
USA BEV	241,912	231,088	(4.5)	836,408	1,740,156	1,522,642	5,420,855
USA PHEV	84,732	64,311	(24.1)	386,353	759,813	619,786	1,745,347
Other BEV	103,354	98,826	(4.4)	1,463,842	3,208,023	2,073,834	7,448,366
Other PHEV	55,589	50,973	(8.3)	836,376	1,597,989	917,054	3,076,351
World BEV	1,542,867	2,008,024	30.1	7,114,262	14,370,678	11,939,460	28,687,724
World PHEV	570,724	969,034	69.8	4,226,493	7,761,233	6,060,351	10,984,190
World EV	**2,113,591**	**2,977,058**	**40.9**	**11,340,755**	**22,131,911**	**17,999,811**	**39,671,914**
Sales share							
China EV	4.79%	5.75%	—	20.09%	33.77%	35.01%	42.44%
Europe EV	3.21%	9.99%	—	19.23%	35.83%	32.87%	77.58%
USA EV	1.74%	2.04%	—	7.77%	15.69%	14.41%	49.58%
India EV	0.07%	0.06%	—	6.50%	10.88%	8.96%	29.24%
World EV	**2.73%**	**4.61%**	**—**	**10.36%**	**17.31%**	**18.86%**	**36.02%**

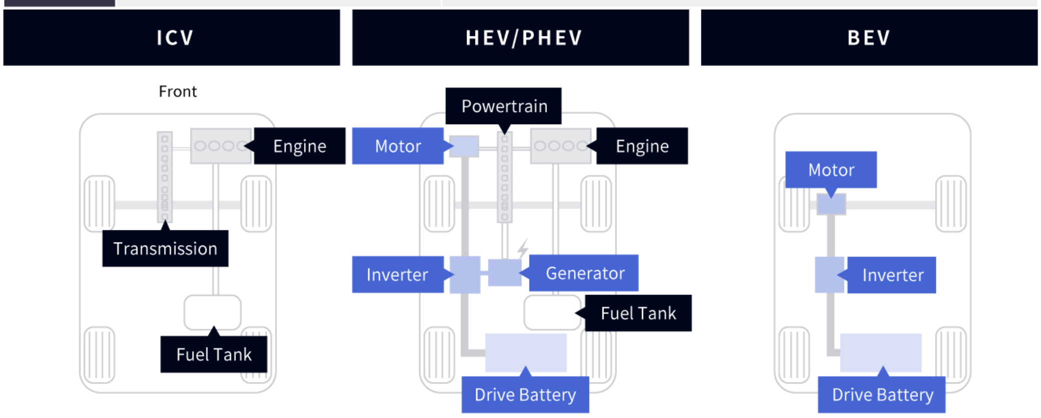
Source: "Global EV Outlook 2021" (April 2021), International Energy Agency (IEA)
Note: Stated Policy Scenario (STEPS) – baseline with all existing announced initiatives
Sustainable Development Scenario (SDS) – meet climate goals of Paris Agreement

EV30@30 Campaign

The EV30@30 Campaign was launched at the CEM (Clean Energy Ministerial) meeting in 2017 to spur the deployment of EVs. It sets a collective aspirational goal for EVs to reach 30% sales share by 2030 across all signatory countries. Fourteen countries endorsed the campaign: Canada, Chile, China, Finland, France, Germany, India, Japan, Mexico, Netherlands, Norway, Portugal, Sweden and United Kingdom.

Tightened regulatory policies on automobiles and enhanced EV incentive programs

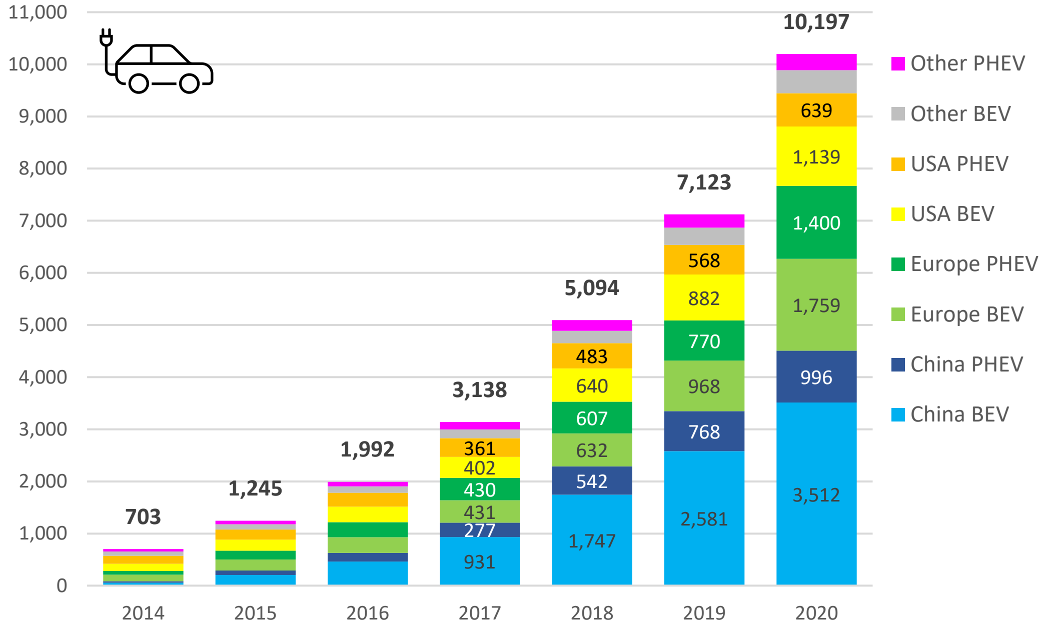
Country	Policy	Government Incentives and Benefits
USA	• 10 states including California, Massachusetts, and New York introduced a ZEV programme, imposing a minimum ZEV requirement of 16% or more on manufacturers with annual sales of more than 4,500 vehicles.	• Tax credit of up to USD 7,500 for EV purchase. (EVs and PHEVs equipped with batteries of 4 kWh or more, actual amount varies depending on the state)
Germany	• Bundestag adopted a resolution to ban sales of all diesel and petrol engine cars by 2030 (not legally binding, but adopted with overall support).	• Subsidies of up to EUR 6,000 (~USD 7,200) for BEVs and up to EUR 4,500 (~USD 5,400) for PHEVs, registered from June 2020 until end-2025. • EVs registered from 2016 onwards are exempt from car tax for 10 years.
France	• Government intends to ban all sales of petrol and diesel vehicles by 2040.	• In June 2020, introduced subsidies of up to EUR 7,000 (~USD 8,400) for new BEVs and EUR 2,400 (~USD 2,400) for PHEVs with a cruising range of at least 50 km and a price of up to EUR 50,000 (~USD 60,000, duration extended until end-June 2021 in December 2020. • An environmental incentive of EUR 1,000 (~USD 833) for the purchase of used EVs introduced from December 2020. • Vehicles with CO2 emissions of 120g/km or more will be subject to a registration tax at the time of purchase.
UK	• Government intends to ban all sales of passenger cars and vans with diesel and petrol engines from 2040.	• While continuing to provide subsidies of GBP 3,000 (~USD 3,600) for purchases of BEVs, fully abolished subsidies for PHEVs in October 2018. • Automobiles with CO2 emissions of 100 g/km or less are exempt from vehicle taxes. Additional taxes to be introduced gradually for automobiles with emissions exceeding 100 g/km.
China	• Introduced "NEV regulations" that mandate that 10% (2019) of production/import volume be NEVs (EV, PHEV, FCV) for OEMs with annual production/import volume in China of 30,000 units or more.	• Extended subsidies and vehicle purchase tax exemptions until 2022. • Subsidies of CNY 16,200 to CNY 230,000 (~USD 2,500-3,500; varies depending on cruising range) for BEVs with a crusing range of 300 km or more and CNY 9,000 (~USD 1,300) for PHEVs. Additional subsidies from local governments prohibited from June 2019. • Subsidies for vehicles with price up to CNY 300,000 (~USD 46,000), except for models with replaceable batteries. • Limits on licence plates applied in major cities are relaxed for EVs
Japan	• Government intends to mandate a fuel efficiency improvement of around 30% compared to FY2016 data (19.2 km/litre > 25.4 km/litre) for new cars.	• Subsidies of up to JPY 400,000 (~USD 3,600) for the purchase of BEVs and JPY 200,000 (~USD 1,800) for PHEVs. For vehicles registered after December 2020, the maximum subsidy amount increased to JPY 800,000 (~USD 7,200) for BEVs and JPY 400,000 (~USD 3,600) for PHEVs. • Exempt from automobile acquisition tax. • Incentives from some municipalities, including car tax credits for a certain period.



Source: “Electric Vehicles” (March 2021), compiled by Uzabase.

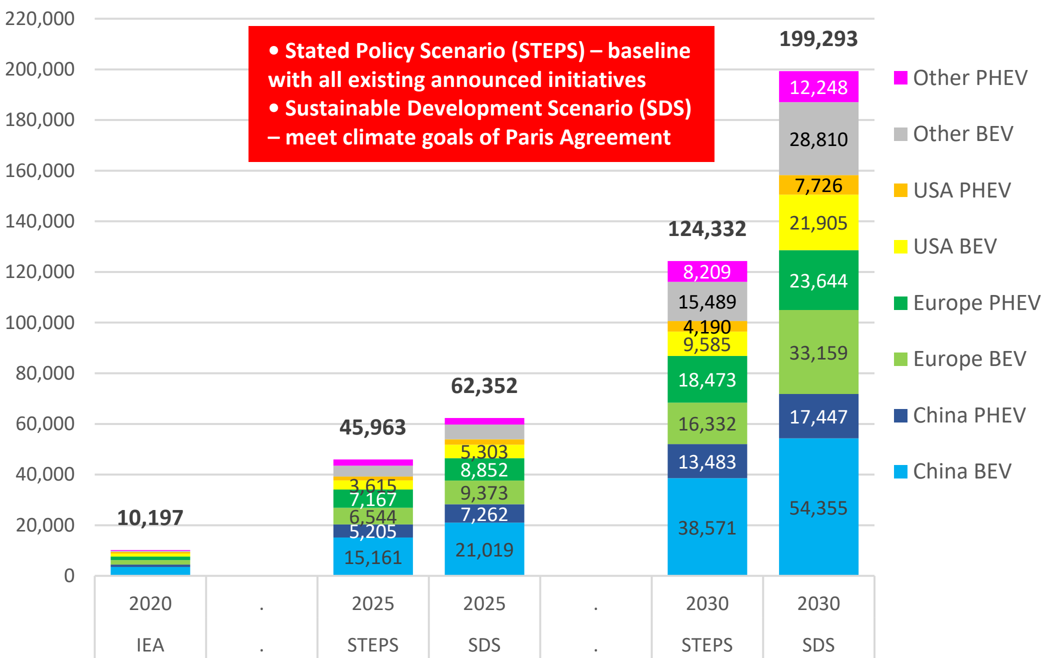
Despite the global slump in auto sales which declined -16% in 2020, new EV registrations of 3 million units increased +41% YoY, accounting for a 4.6% share of total auto sales, which lifted global EV stock to over 10 million units.

Global EV Stock 2014 – 2020 (thousand cars) by Region / Powertrain



Entering a new era of accelerated uptake of EVs driven by policy initiatives and ambitious plans of leading automakers for new model launches

Global EV Stock Outlook 2025 – 2030 (thousand cars) by Scenario



Source: “Global EV Outlook 2021” (April 2021), International Energy Agency (IEA)

As mentioned at the beginning of PART ONE, power management ICs (PMICs) are required in all microcontroller modules (MCUs), performing functions such as voltage regulation, undervoltage protection and voltage conversion. In addition to electrification of vehicles, related themes of connected cars and ADAS (advanced driver-assistance systems) offer promising demand for Automotive applications for power management ICs in sensor and camera modules. **The next 2 pages summarize the main features of these applications, followed by Torex power management IC example product solutions for Automotive.**

Connected Cars represent one of the four major areas of development shaping the future of the global automotive sector, which are collectively known as "CASE" (Connected, Autonomous, Shared, and Electric).

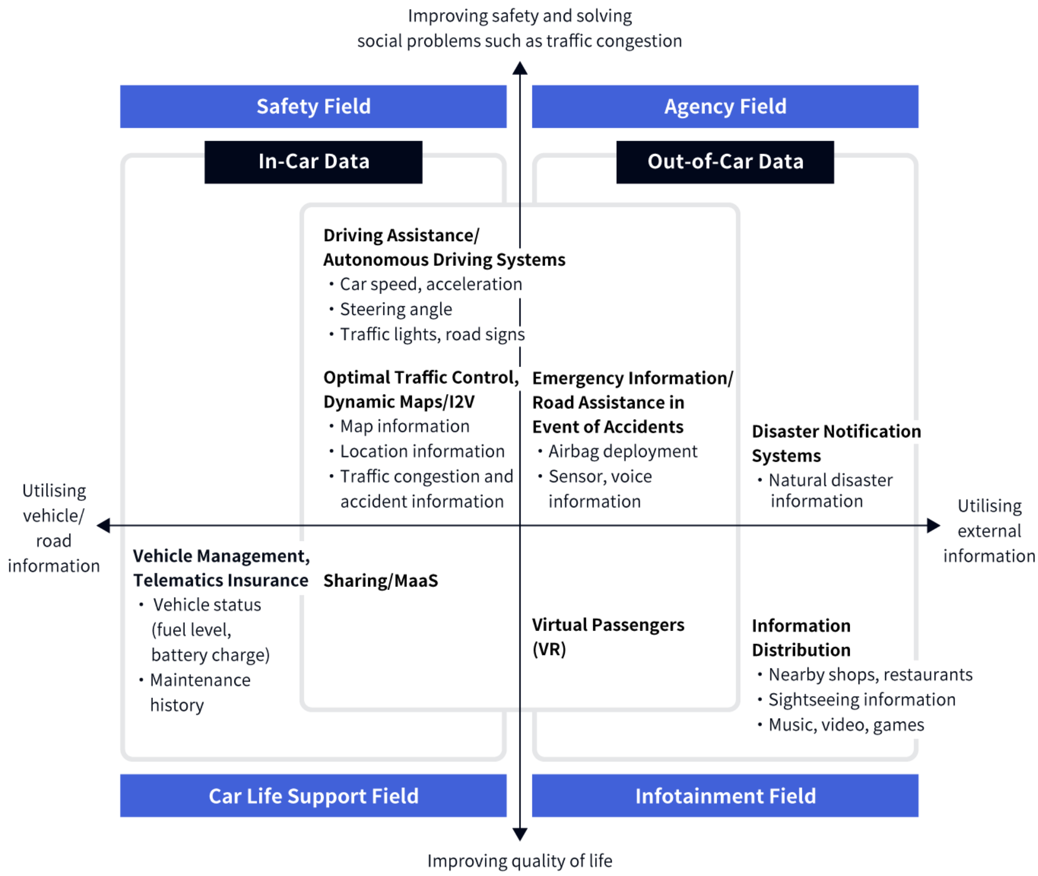
Full LCD display rear view mirror-type drive recorder (DR)

Source: MAXWIN

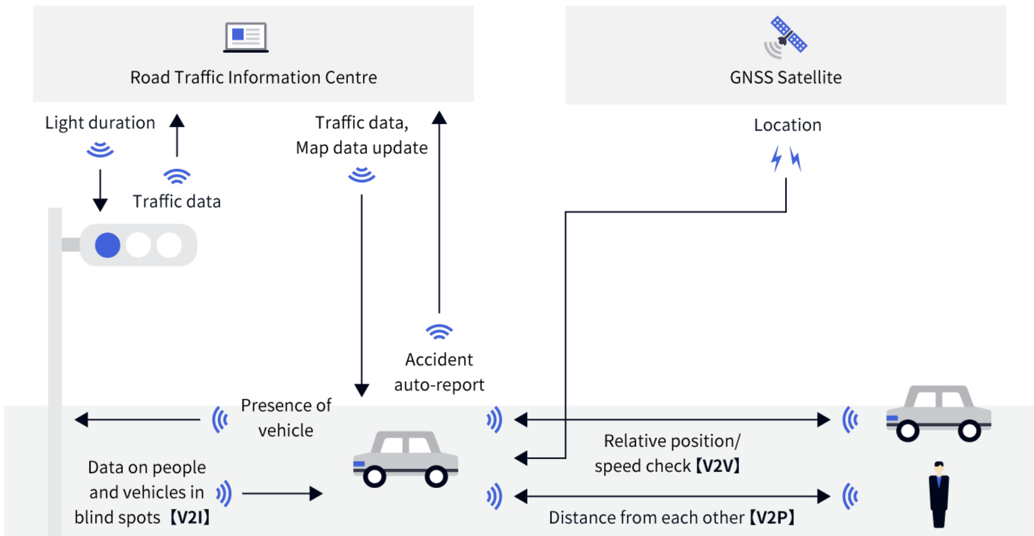
Telematics refers to systems that connect cars with the external environment

Integration of internal vehicle data is accelerating the shift to 'Connected Cars'
Through bidirectional wireless communication, internal vehicle data, as well as external information on other vehicles on the road, road infrastructure, and maps can be exchanged between vehicles and applications in real time. Connected cars are not only connected to the internet, but also to various other devices with which they exchange information.

ITS (intelligent transport systems) services related to Connected Cars



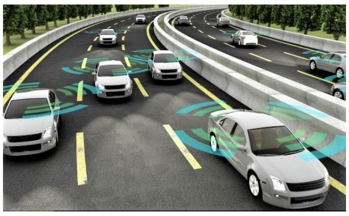
Connected Cars: Map of Connections



Source: "Connected Cars" (March 2021), compiled by Uzabase.

ADAS systems allow for the replacement of human perception, judgment, and operation through a combination of multiple technologies. Perception can be broadly divided into location awareness and external environment awareness. The key to autonomous driving, however, is to combine data obtained from **various sensors to allow for accurate awareness of the external environment and to make appropriate driving decisions** based on this data-based awareness.

★ There is promising demand for power management ICs in sensor and camera modules



ADAS Level 5 is full autonomous driving

ADAS Driving Levels

Control	Category	Level	Overview	Example	Status
Driver		0	Human driver carries out all driving operations	-	Current
Driver	Driving Assistance	1	System provides support for either steering or acceleration/deceleration operations	Automatic braking system Adaptive cruise control (ACC) Lane keep assist	Current
Driver	Driving Assistance	2	System provides support for both steering and acceleration/deceleration operations	Tesla Auto Pilot (2015) Nissan ProPILOT (2016	Current
System	Autonomous Driving	3	System carries out all driving operations in specific environments, such as highways, but requests that a human driver immediately intervene when it comes into difficulty	Audi A8 (2018) Honda Legend (planned launch in 2020)	Legislation Required
System	Autonomous Driving	4	System carries out all driving operations in specific environments, such as highway	Waymo One	Legislation Required
System	Autonomous Driving	5	System carries out all driving operations in all environments	-	Legislation Required

Main sensors used to perceive the external environment by ADAS systems

Perception			Judgement	Operation
Location Information	**Location Awareness (Satellite Positioning)**	**External Environment Awareness (Sensors)**		
• 2D Maps (lanes, signs, etc.) • 3D Maps	• GPS, GNSS • Quasi-Zenith Satellite System (QZSS)	• Cameras, LiDARs, millimetre-wave radars, ultrasonic radars, etc.	• Machine Learning • Semiconductors	• Acceleration/ Deceleration, Braking • Steering

	Camera	Millimetre Wave Radar	LiDAR	Ultrasonic Sonar
Close Range Detection (>1m)	△	△	△	◎
Detection at 100m	○	◎	◎	×
Distance Accuracy	○	◎	◎	△
White Road Markings	◎	×	△	×
Traffic Lights/Signs	○	×	×	×
Rainy/Snowy Conditions	△	◎	○	○
Foggy Conditions	△	◎	○	○
Nighttime	○	◎	◎	◎

◎: Very Good ○: Good △: Usable ×: Unusable

Source: "Autonomous Driving" (December 2020), compiled by Uzabase.

Compact units directly connected to 12V battery

Compact units connected to 8V secondarly rail

Automotive camera modules

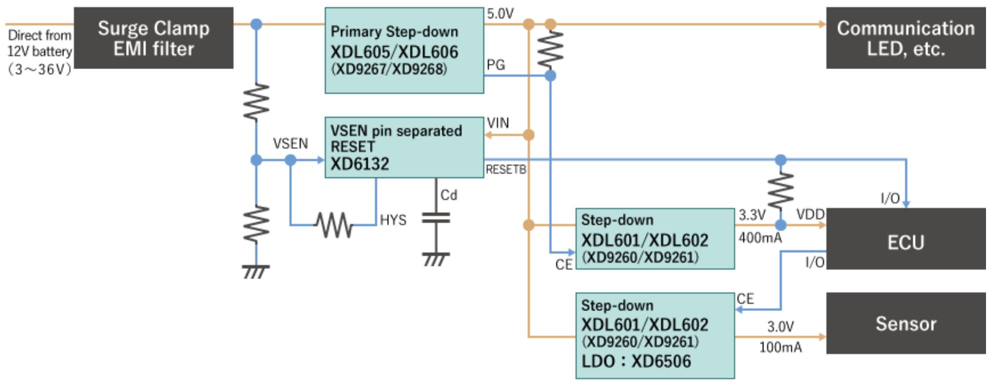
Torex Power Management Applications and Solutions for Automotive

The following is a brief summary of Torex product solutions targeting Automotive applications from the Company's website. Torex's automotive products (XD series) comply with the guidelines of AEC-Q100. This standard, which was established by the AEC (Automotive Electronics Council), prescribes reliability tests and quality tests for integrated circuits. Stricter requirements are adopted than for consumer electronics to ensure high quality in automotive products.

Compact units directly connected to 12V battery

Examples of various types of compact units, sensors, and modules to be directly connected to 12V battery. Requirements for power supplies are becoming more severe particularly for compact sizes, low noise, and low power consumption, due to an increase in the number of various sensors, controllers, modules, and units controlled by ECU and used in internal automobile components, as well as advancements in their functionality.

Primary step-down DC/DC generally have a structure where the voltage is decreased to the common voltage at the first stage, and then decreased further at the second stage to the individual required voltages to be supplied. These are referred to as the primary power supply and secondary power supply respectively. For primary DC/DC, use a switching frequency of 2MHz or greater in consideration for EMI. If a light load condition will be experienced for a long time, and a decrease in frequency during that time is allowed, select the PWM/PFM automatic switching type. If it is desired to keep the operating frequency constant regardless of the load condition, select the PWM fixed type. Also, starting from conditions such as cold cranks or idling stops, or elements such as long harnesses, will cause the power supply line voltage to decrease significantly, so the Pch SW type, which supports a duty ratio of 100% and can easily maintain the output voltage even when there is a drop in input voltage, is suitable in such cases.



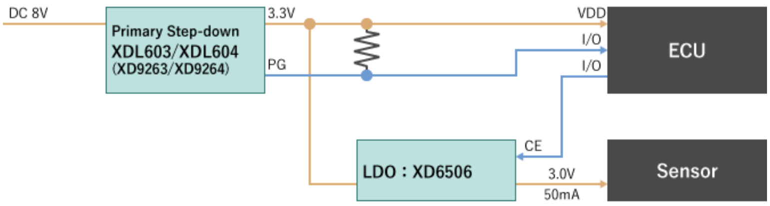
Recommended Torex ICs

- XDL605 / XDL606 (XD9267 / XD9268): Inductor built-in step-down DC/DC, PWM (XDL605), PWM/PFM (XDL606)
- XD6132: Separated sense (VSEN) pin and capacitor delay type low-power voltage detector
- XDL601 / XDL602 (XD9260 / XD9261): Inductor built-in HiSAT-COT step-down DC/DC, PWM (XDL601), PWM/PFM (XDL602)
- XD6506: Low consumption, low noise voltage regulator

It is recommended to use a compact, high-speed response, low-noise DC/DC to the secondary power supply for ECU. Although it is common to use a value of 2MHz or greater for the DC/DC switching frequency, since it is not directly connected to the outside using a harness as with a primary DC/DC, a relatively lower frequency may be used in some cases for greater efficiency. The XD9260 and XD9261 include both 3.0MHz and 1.2MHz types for this reason. Due to their low noise, the same DC/DCs used in ECUs are suitable for sensor power supplies as well.

Voltage detector with a separated sense (VSEN) pin is used for monitoring the input voltage on the primary side. Monitoring the input Voltage to helps to ensure stable operation and is useful for power sequencing (when implementing start-up and shut-down sequences). The VSEN pin uses divider resistors which are connected to the primary side input voltage supply. The divider circuit allows the Voltage Detector to monitor voltages that exceed the absolute maximum voltage range of the IC. The voltage detector signal is needed when the MCU is operational, so the voltage detector is powered from the primary output. And the RESETB output is connected to the MCU's I / O and is monitored by the MCU.

Compact units connected to 8V secondary rail



Recommended Torex ICs
• XDL603 / XDL604: Inductor built-in step-downDC/DC, PWM (XDL603), PWM/PFM (XDL604)
• XD6506: Low consumption, low noise voltage regulator

Compact units connected to 8V secondary rail
Examples of various types of sensors and modules operated by a power supply of roughly 8V, generated from 12V battery through a primary power supply. Simple, ultra-compact power supplies with low noise are introduced. There are many cases where various sensors and modules connected to main units for infotainment are supplied by a power supply of roughly 8V created by a primary DC/DC within those main units.

For primary step-down DC/DC, the voltage is already stabilized to a constant value of 8V and then input, so it can be directly decreased to the ECU voltage of 3.3V. Since there are some cases where the harness will be longer, in such cases use a DC/DC with a switching frequency of 2MHz or greater in consideration for EMI. If a light load condition will be experienced for a long time, and a decrease in frequency during that time is allowed, select the PWM/PFM automatic switching type. If it is desired to keep the operating frequency constant regardless of the load condition, select the PWM fixed type. Also, during cold cranks, due to a decrease of this 8V and fluctuations caused by long harnesses, the Pch SW type, which supports a duty ratio of 100% and can easily maintain the output voltage even when there is a drop in input voltage, is suitable in such cases.

The PG (Power Good) pin of the primary DC/DC can be used as the RESET output for monitoring the power supply voltage of the ECU. By signaling that the voltage has risen up sufficiently before starting operation of the ECU, and also signaling when there is a drop in voltage, ECU malfunctions can be prevented.

Obtaining power supplies for sensors in this way from the power rail for the ECU using LDOs is a simple and efficient method of controlling heat generation characteristics. Since low noise and ripple are important, LDOs which have low power and low noise are ideal. The sensor is only turned ON when necessary, so the CE signal is controlled by the ECU.

The Kansai Technology Center is an R&D facility for high-function, high-performance analog power management ICs for automobiles. Previously the product design, mass-production technology and quality assurance functions were decentralized in Sapporo and Okayama, but in May 2016 they were consolidated in Osaka. This allows Torex to achieve both better quality and faster start of mass production.

Applications of automotive products

From car infotainment to general automotive accessories, we will release products for a wide range of applications.

Examples of applications of our products

- DC/AC Inverter
- GPS Module
- Car Navigation System
- Sub monitor
- Back monitor camera
- Power sliding door
- Meter
- Car-mounted camera
- ETC/DSRC
- Air Conditioner
- Keyless Entry
- Remote touch
- Power windows
- Head-up display
- Monitor for rear seat

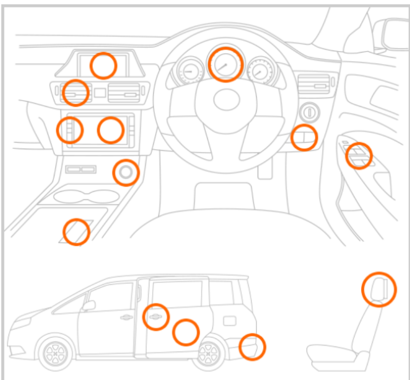
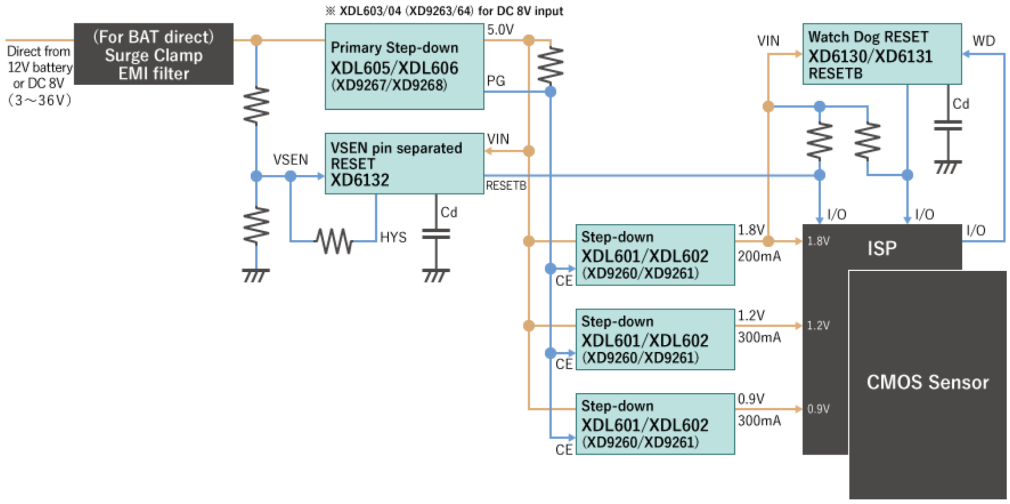


Image of application location

Automotive camera modules



Recommended Torex ICs

- XDL605 / XDL606 (XD9267 / XD9268): Inductor built-in step-down DC/DC, PWM (XDL605), PWM/PFM (XDL606)
- XD6132: Separated sense (VSEN) pin and capacitor delay type low-power voltage detector
- XDL601 / XDL602 (XD9260 / XD9261): Inductor built-in HiSAT-COT step-down DC/DC, PWM (XDL601), PWM/PFM (XDL602)
- XD6130 / XD6131: Voltage detector with watchdog function

Automotive camera modules

There are two possible cases for automotive camera modules: directly connected to 12V battery or supplied by a primary power supply output of roughly 8V. Examples of solutions suitable for automotive camera modules, whose miniaturization is continuing to advance, are presented. A large number of camera modules are now used in automobiles, with requirements for their power supplies to have even smaller sizes, higher efficiency, lower noise, and lower power consumption.

Primary step-down DC/DC generally have a structure where the voltage is decreased to the common voltage at the first stage, and then decreased further at the second stage to the individual required voltages to be supplied. These are referred to as the primary power supply and secondary power supply respectively. For primary DC/DC, use a switching frequency of 2MHz or greater in consideration for EMI. If a light load condition will be experienced for a long time, and a decrease in frequency during that time is allowed, select the PWM/PFM automatic switching type. If it is desired to keep the operating frequency constant regardless of the load condition, select the PWM fixed type. Also, starting from conditions such as cold cranks or idling stops, or elements such as long harnesses, will cause the power supply line voltage to decrease significantly, so the Pch SW type, which supports a duty ratio of 100% and can easily maintain the output voltage even when there is a drop in input voltage, is suitable in such cases.

Step-down DC/DC for ISP and CMOS sensor with compact sizes, high-speed response, and low noise are recommended for each secondary power supply rail. Although it is common to use a value of 2MHz or greater for the DC/DC switching frequency, since it is not directly connected to the outside using a harness as with a primary DC/DC, a relatively lower frequency may be used in some cases for greater efficiency. The XD9260 and XD9261 include both 3.0MHz and 1.2MHz types for this reason.

Voltage detector with a separated sense (VSEN) pin is used for monitoring the input voltage on the primary side. Monitoring the input Voltage to helps to ensure stable operation and is useful for power sequencing (when implementing start-up and shut-down sequences). The VSEN pin uses divider resistors which are connected to the primary side input Voltage supply. The divider circuit allows the Voltage Detector to monitor voltages that exceed the absolute maximum voltage range of the IC. The VIN supply for the Voltage Detector is connected to the output side of the primary DC/DC (5.0V in our example).

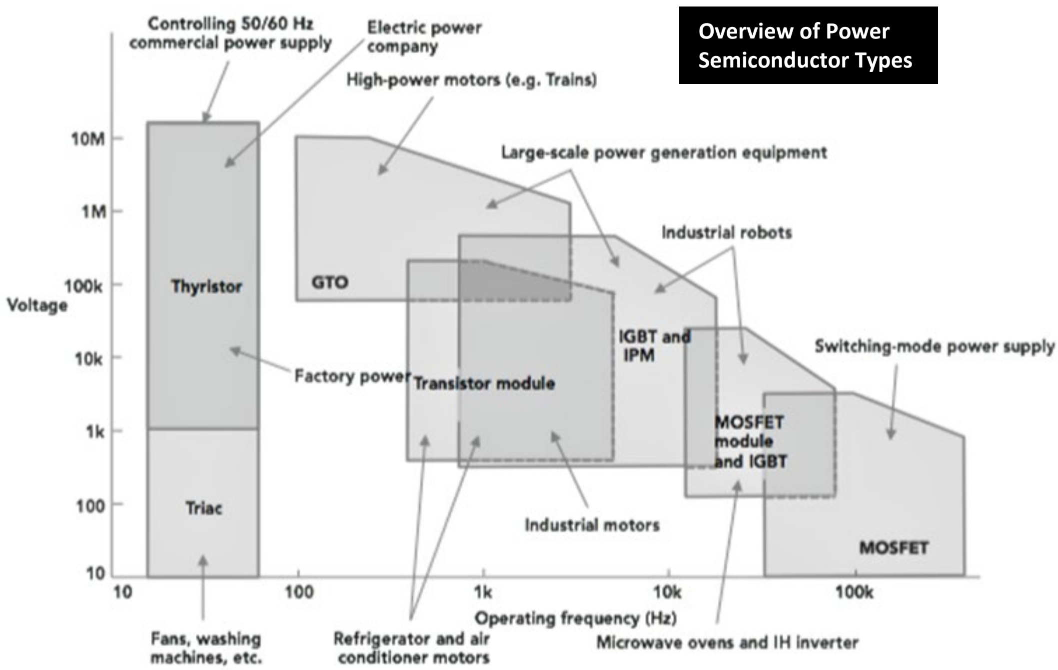
One RESET IC with the watchdog function can monitor both the ISP power supply voltage and normal operation. The voltage monitoring function signals when the secondary DC/DC output voltage has risen up sufficiently, begins operation of the ISP, and also signals when the voltage drops to prevent malfunction of the ISP. After ISP start-up, if a pulse from the ISP reaches the WD pin at regular interval, the operation is judged to be normal. If that signal is not received, the ISP is judged to be out of control, and it is restarted by applying a RESET signal.

Next-gen Power Devices

Introduction to Power Devices

Power semiconductors are used in electronic devices to reduce power loss from a circuit, and thus reduce the consumption of electricity. One representative device in which a power semiconductor is included is an inverter. Demand for power semiconductors has expanded mainly in the markets for in-vehicle components, electrical/electronic equipment, machine tools, and industrial motor drives for industrial robots. Electric vehicles (EVs) are equipped with an electric motor which requires an inverter to operate, and power semiconductors are an essential component for motor inverters.

Overview of Power Semiconductor Types



Source: excerpt from "Power Device Industry Overview – Japan" (June 2020) compiled by Uzabase.

Low- and medium-voltage MOSFETs are used to provide power switching functions in portable electronic devices, PC power supply units etc. High-voltage MOSFETs are used in LCD TV driver units. IGBTs are used in the power switching elements of inverter circuits, which convert direct current into alternating current. They have a variety of applications, from amplifying voltage to controlling motive power. These chips are generally used in higher voltage power ranges than MOSFETs. Applications include home appliances, DSCs, trains, machine tools and electric vehicles (EVs).

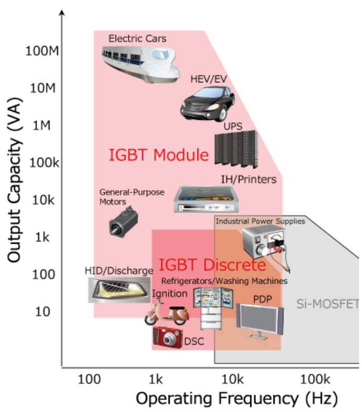
MOSFET (Metal Oxide Semiconductor Field Effect Transistor) is a class of voltage-driven devices that do not require the large input drive currents of bipolar devices.

IGBT (Insulated Gate Bipolar Transistor) combines the characteristics of a power MOS transistor and a thyristor. IGBT devices are usually found in high-voltage circuits (above 300V).

Functions and Capabilities of Power Semiconductors

Type of Power Semiconductor	IC Functions	Converter	Converter Functions
Diode	Rectification	Rectifier	Rectification
Thyristor	Automatic power-on	PAM Inverter	AC output
Transistor, GTO thyristor	Automatic power-off	PWM Inverter	Precision, efficiency, reduced size
MOSFET IGBT	High-speed switching	High-frequency PWM inverter	Precision, efficiency, miniaturization
RB-IGBT	Low-loss and small bi-directional switching	Matrix converter	Precision, efficiency, miniaturization of bidirectional AC output

Source: Fuji Electric, excerpt from "Power Device Industry Overview – Japan" (June 2020) compiled by Uzabase.

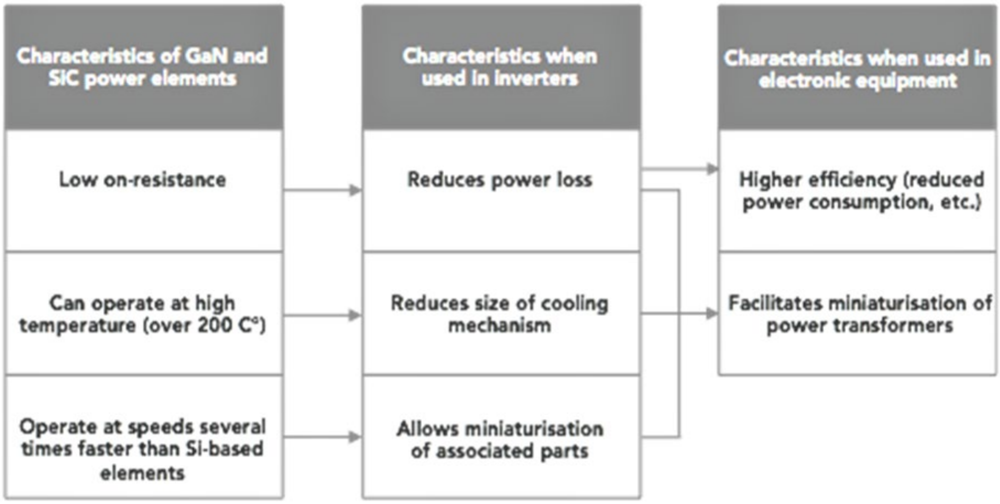


Source: ROHM Semiconductor

Next-gen SiC and GaN compound semiconductors are taking the place of Si which is reaching its theoretical limits to lower ON resistance (to lower power loss)

Until recently, performance of power devices was enhanced through structural improvements, such as deep-trench Super-Junction MOSFETs. However, these improvements are said to be reaching theoretical limits due to the physical properties of the material used to make the devices (silicon and polysilicon). New materials silicon carbide (SiC) and gallium nitride (GaN) offer lower ON resistance properties and can reduce power loss significantly. Since they can handle high voltages, they are they are suited for use in high-voltage applications such as power generation, trains, and industrial equipment, and are particularly well suited for use in vehicle engines, which require high-voltage power supplies of around 1 kilovolt (kV). The issue has been the high cost of producing bulk single crystals from compound materials like SiC, but technological advances are making mass production feasible.

Key Advantages of SiC and GaN Power Semiconductor Devices



Source: excerpt from “Power Device Industry Overview – Japan” (June 2020) compiled by Uzabase.

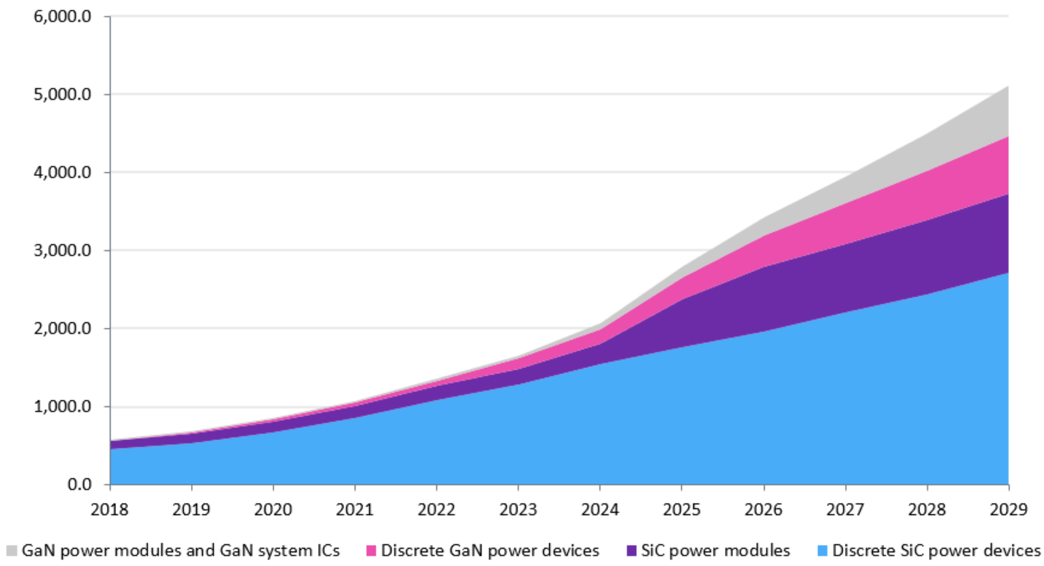
Omdia forecasts SiC and GaN power device market to reach $1 billion in 2021

According to Omdia which specializes in telecommunications, media and technology market research, GaN is a wide-bandgap material offering similar performance benefits as SiC, but with a higher cost-reduction potential because GaN power devices can be grown on either silicon or sapphire substrates, which are less expensive than SiC. The emerging market for silicon carbide (SiC) and gallium nitride (GaN) power semiconductors is forecast to pass $1 billion in 2021, **driven by demand from hybrid and electric vehicles, power supplies, and photovoltaic (PV) inverters**.

The two graphs on the top of the next page show that Omdia forecasts this market to grow at **CAGR of +22.3% to $5 billion by 2029**, with SiC power modules and discrete SiC power devices leading growth by technology, and by application, hybrid and electric vehicles and power supplies.

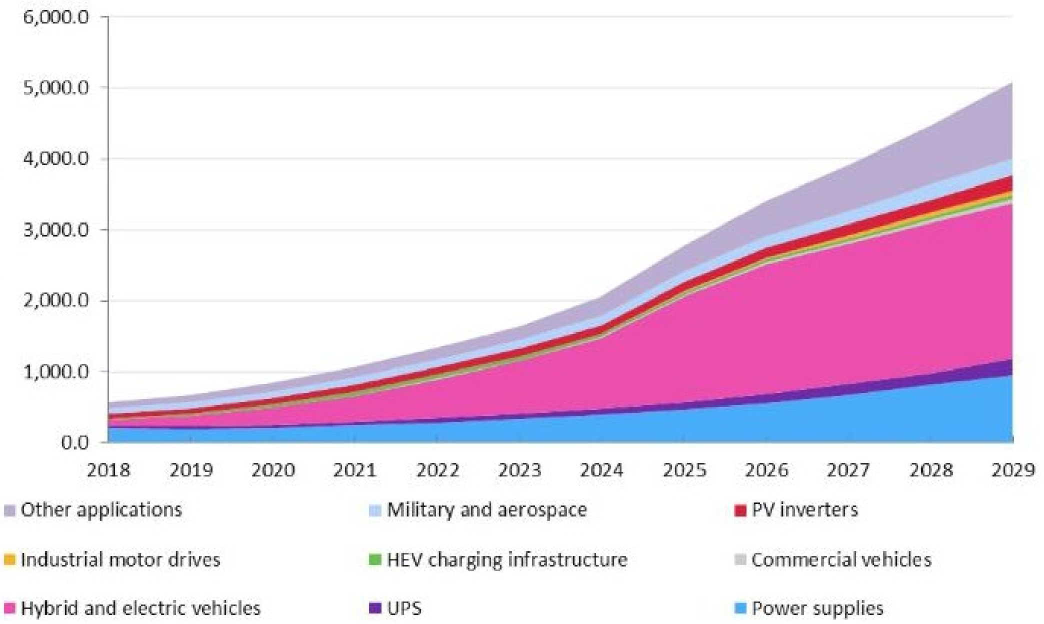
Another point highlighted by Omdia is that this emerging market for silicon carbide (SiC) and gallium nitride (GaN) power semiconductors is rapidly evolving from a startup-dominated business to one led by large-established power semiconductor manufacturers.

SiC and GaN Power Semiconductors by Technology ($ million)



Source: excerpt from "The evolving GaN and SiC power semiconductor market landscape" (July 2020), by Omdia.

SiC and GaN Power Semiconductors by Application ($ million)



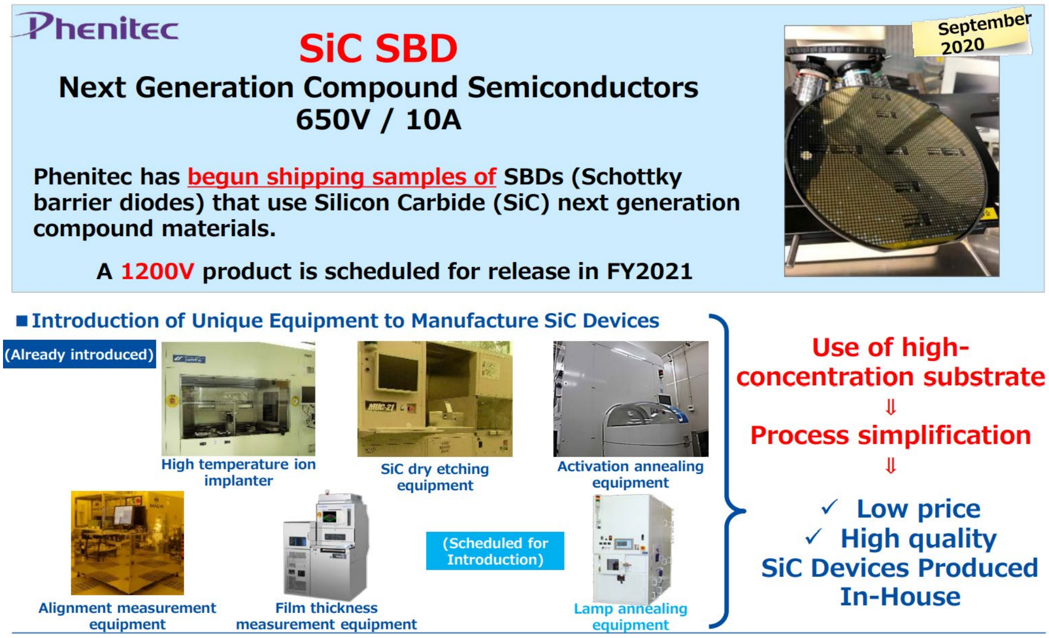
Source: excerpt from "GaN & SiC power semiconductor markets set to pass $1 billion mark in 2021" (July 2020), by Omdia.

While Japan has ceded dominance in certain areas of semiconductors, leading manufacturers like RENESAS Electronics (6723 TSE1), ROHM Semiconductor (6963 TSE1), Mitsubishi Electric (6503 TSE1), DENSO Corporation (6902 TSE1) etc. are global leaders in next-generation power devices.

Here its is worth noting that established US player Littelfuse acquired SiC start-up Monolith Semiconductor, and then bought established company IXYS Corporation in 2018. As noted earlier in PART TWO, Phenitec's largest customer IXYS Corporation (owned by Littelfuse NASDAQ LFUS) accounted for 10.8% of total FY3/21 Group sales.

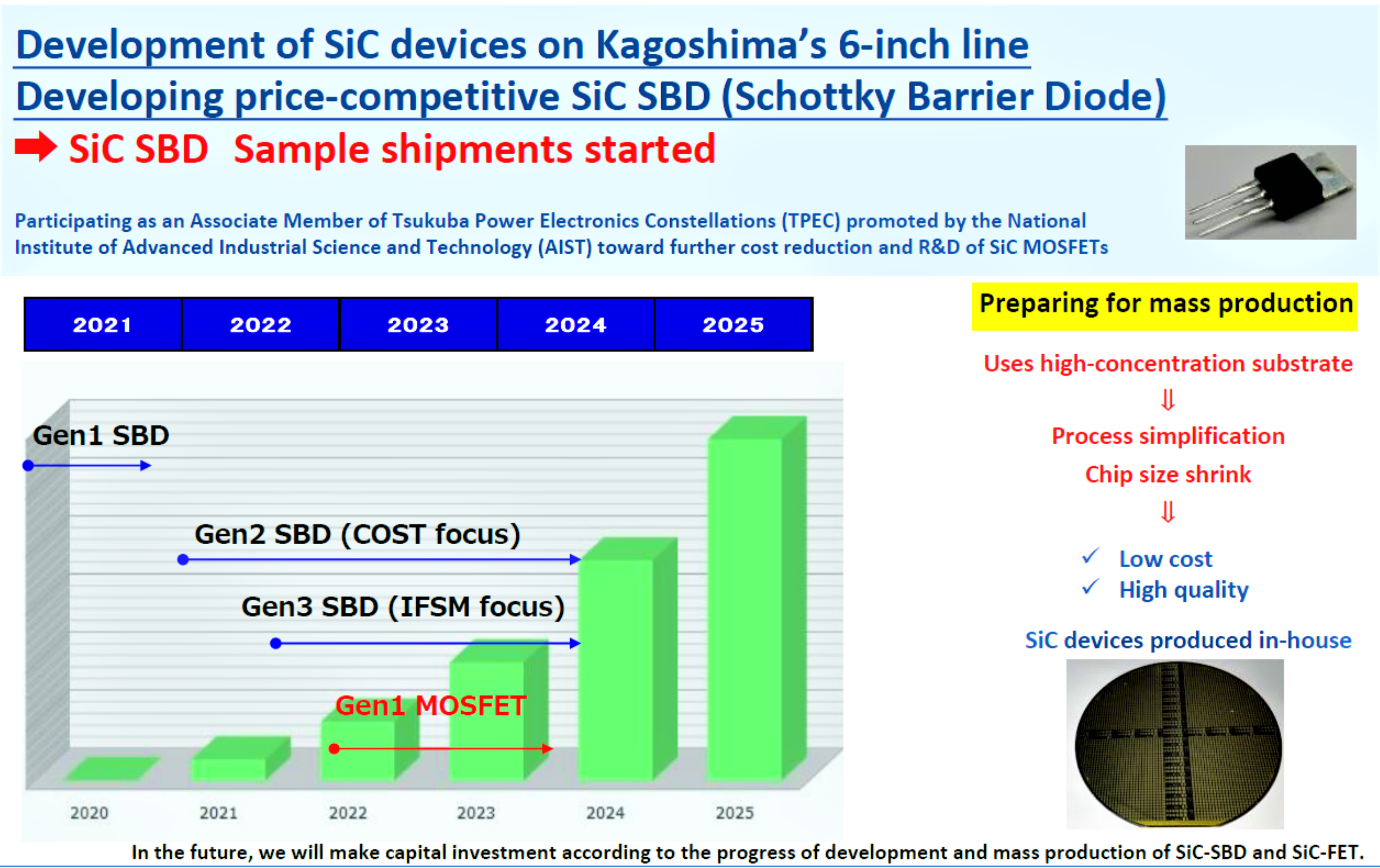
Phenitec
For Further Growth Together

Phenitec strengthening development of SiC power devices



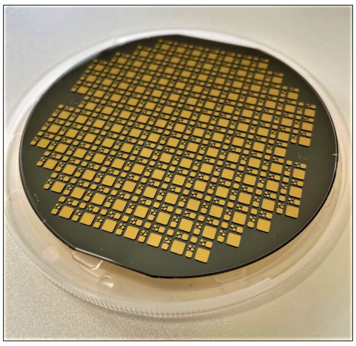
Source: excerpt from IR material "FY2021 – 2025 Mid-Term Management Plan," February 15, 2021.

Schedule for advancing development of next-generation SiC power devices



Source: excerpt from 4Q FY3/21 IR results briefing materials, May 24, 2021.

NCT 4-inch beta-gallium oxide β-Ga_2O_3 epitaxial wafer

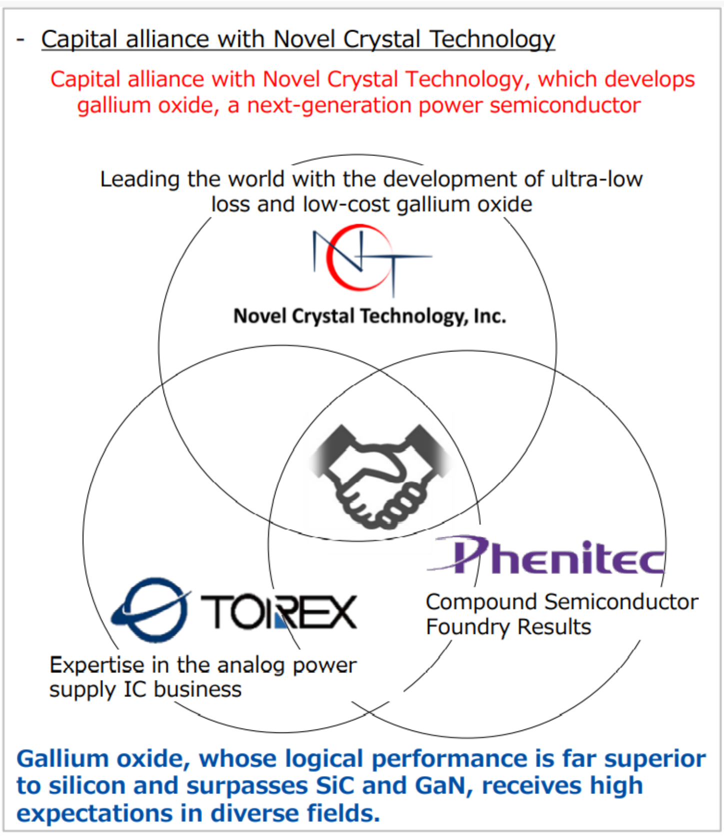


Source: Novel Crystal Technology June 16, 2021 press release.

Torex capital tie-up partner Novel Crystal Technology achieves world's first mass production of 100mm (4-inch) beta-gallium oxide (β-Ga_2O_3) epitaxial wafers, making it possible to mass produce next-generation power devices (June 16, 2021)
Previously Novel Crystal Technology had announced in April 2019 that it succeeded in developing high-quality 50mm (2-inch) beta-gallium oxide (β-Ga_2O_3) epitaxial wafers, and it has been manufacturing them and selling them since then, but they are limited to use for R&D since mass production is not economically viable with 2-inch wafers. Compared with silicon carbide (SiC) and gallium nitride (GaN), beta-gallium oxide (β-Ga_2O_3) has large band gap energy of 4.5eV (electron volts) which translates to lower loss of power, making it ideal for applications such as electric vehicles (EV) and other industrial equipment. In addition, beta-gallium oxide bulk single crystals are grown using the melt growth method, which is 100 times faster than the vapor growth method used for SiC and GaN. Finally, since beta-gallium oxide has a hardness similar to silicon, it can be processed (cutting and polishing) using existing equipment for silicon wafers (reducing the capex burden for customers).

NCT succeeded in demonstrating beta-gallium oxide low-loss Schottky barrier diodes (SBD) with a trench structure in September 2017, and it will continue to build mass production technology for trench-type SBDs on the 100mm line. The company plans to supply 150mm (6-inch) beta-gallium oxide (β-Ga_2O_3) epitaxial wafers in 2023.

Torex announced a capital tie-up with Novel Crystal Technology on June 30, 2020, as Group subsidiary Phenitec is also working on developing next-generation power devices, and the market for ultra low-loss and low-cost power devices is expected to grow rapidly over the next decade. NCT's β-Ga_2O_3 is summarized on the next 2 pages.



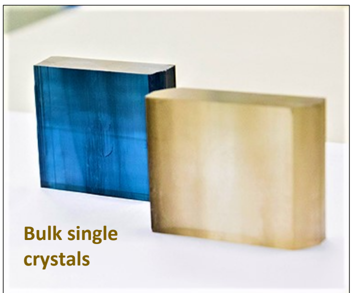
Source: excerpt from IR material "FY2021 – 2025 Mid-Term Management Plan," February 15, 2021.

Business Description
- Manufacture and sale of substrates with gallium oxide epitaxial film
- Manufacture and sale of single crystals and their applied products
- Manufacture and sale of semiconductors and their applied products

Head Office
2-3-1 Hirosedai, Sayama City, Saitama (41 employees 2020.6)

President and CEO
Akito Kuramata

Large band gap energy of 4.5eV (electron volts) means lower loss of power. Silicon is reaching its theoretical limit to lower ON resistance.



NCT Shareholders:
- Tamura Corp. (6768): 38%
- Individual investors: 36%
- Corporate investors: 26%

Corporate investors:
- AGC (5201)
- TDK (6762)
- Iwatani Venture Capital
- Satori Electric (7420)
- Shindengen Electric (6844)
- JX Nippon Mining & Metals
- Sojitz Machinery Corp.
- **Torex Semiconductor (6616)**
- Yaskawa Electric (6506)

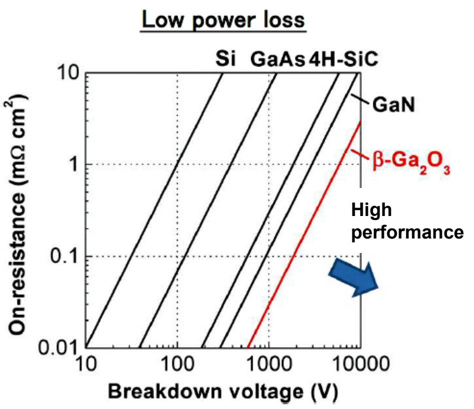
Source: NEDO Project Review: Practical Development of Ampere-grade Gallium Oxide Power Device <July 2018 – May 2020>

Summary of Novel Crystal Technology's next-generation power device material beta-gallium oxide (β-Ga_2O_3) epitaxial wafers and bulk single crystal growth technology

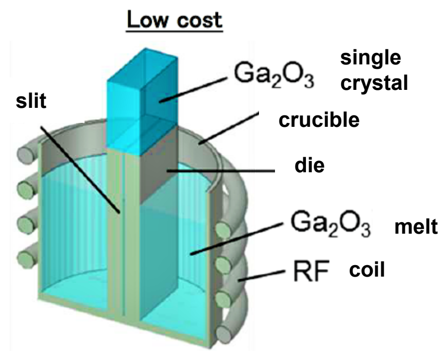
Established in June 2015, Novel Crystal Technology Inc. is a carve-out venture of Tamura Corporation (6768 TSE1) and a technology transfer venture of NICT (National Institute of Information and Communications Technology), and along with the Tokyo University of Agriculture and Technology, it is advancing research on beta-gallium oxide, a promising next generation power device material, aiming to IPO in 2023.

Novel Crystal Technology Inc. is developing and manufacturing β-Ga_2O_3 substrates and epitaxial wafers. It also leads the world in bulk single crystal growth technology, epitaxial film-forming techniques and power device fabrication technology. With the growing call for a carbon-free society, renewable energy development and efficient power usage are expected to build momentum. β-Ga_2O_3 power devices have promising applications in electric vehicles, robots and a host of other industrial equipment, contributing to sustainable society.

Features of β-Ga_2O_3: Promising Next-Generation Power Device Material
– Comparison with other wide band-gap semiconductor materials



High dielectric breakdown electric field (8 MV/cm)



Single crystal growth method diagram

High growth rate due to melt growth (30 mm/h)

The closer to the bottom-right corner, the greater the material's ability to realize a device that both saves energy and has a high breakdown voltage. Silicon is the material currently used for power devices, yet it is reaching its performance limits. Silicon carbide (SiC) and gallium nitride (GaN) have wider band gaps and greater theoretical values than Si, yet beta gallium oxide (β-Ga_2O_3) surpasses them both.

★Cost / performance advantages of beta-gallium oxide (β-Ga_2O_3)

❶ Difference in bulk crystal growth speed

With SiC and GaN, bulk single crystals are generally grown using the vapor growth method. However, the issues with this method are that only several hundred micrometers can be grown per hour, and high-quality crystals are difficult to produce. Meanwhile, beta gallium oxide (β-Ga_2O_3) is grown using the melt growth method. With a growth rate of several dozen millimeters per hour, this method is approximately 100 times faster than the vapor growth method, enabling the production of high-quality bulk single crystals. The speed at which the bulk single crystals can be grown translates to noticeably lower crystal growth costs.

Source: NCT company website

New Energy and Industrial Technology Development Organization

❷ Easy to process (cutting, polishing)

Because both SiC and GaN are extremely hard materials, the process of cutting out substrates from bulk single crystals and polishing them is time-consuming and labor intensive. Meanwhile, β-Ga_2O_3 has a hardness similar to silicon. This means it can be processed easily in the same facilities as silicon.

❸ Development of large-diameter substrates has progressed rapidly

With SiC, it took roughly 15 years to develop a 6-inch substrate (1997 – 2012). With β-Ga_2O_3, the same was achieved in just 5 years (2012 – 2017).

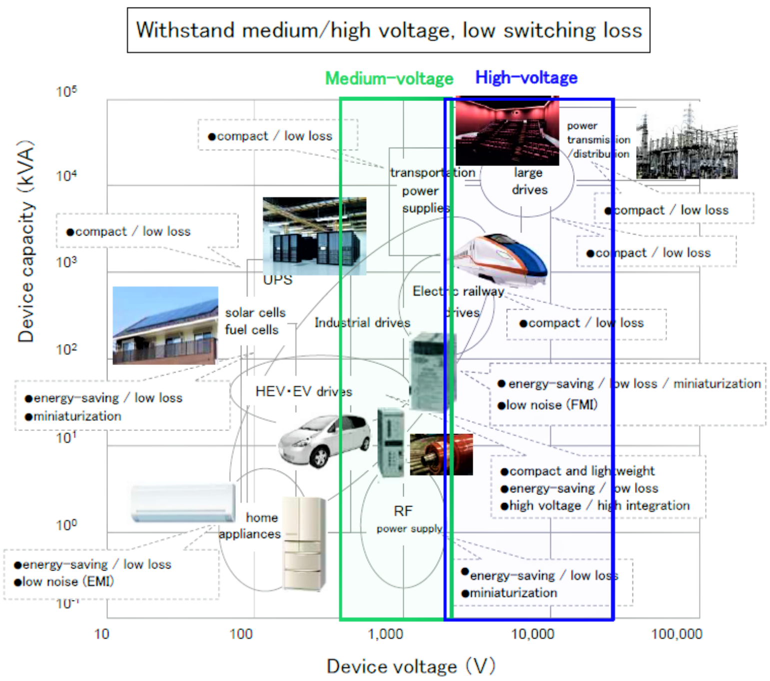
Summary of beta-gallium oxide (β-Ga_2O_3) characteristics:

1) Energy saving / high breakdown voltage (ultra low-loss)
2) Bulk single crystals can be grown rapidly (100x faster than the vapor method)
3) The material is easy to process on existing equipment for silicon wafers
4) Large diameter substrates were achieved in a short time period

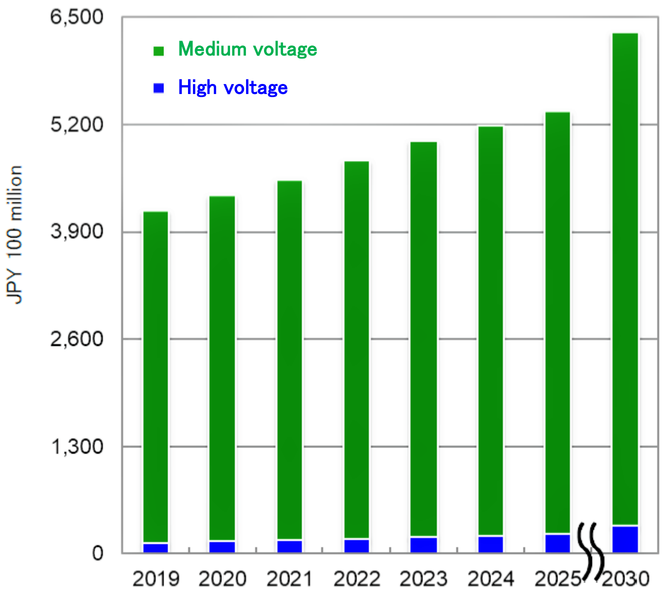
NEDO Project: Practical Development of Ampere-grade Gallium Oxide Power Device <July 2018 – May 2020>

- NCT (project co-leader): killer defect evaluation, epiwafer, polishing, diode proving
- Fujikoshi Machinery Corp. (project co-leader): Vertical Bridgman (VB) technique for growing beta gallium oxide crystals
- Saga University: killer defect evaluation
- Shinshu University: VB technique for growing beta gallium oxide crystals
- AGC (5201): polishing
- TDK (6762): killer defect evaluation, diode proving
- Cooperating companies: Tamura Corporation (6768), Nippon Sanso Holdings (4091)

Target Markets



Next-generation Power Device Market Forecast



Note: Forecast market size is calculated based on the current status and future outlook of the 2020 edition of Next-generation Power Device & Power Electronics-related Equipment Market (by Fuji Keizai Co., Ltd.)

Source: excerpt from NEDO Project Review: Practical Development of Ampere-grade Gallium Oxide Power Device <July 2018 – May 2020>

PART FIVE:
Share Price, Valuations and Shareholder Rebates

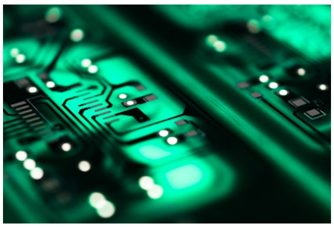
Performance and Valuations: SESSA Smart Charts

- Despite the sharp rise in the share price, valuations are not extended, and the P/E is trading below its historical average.
- Ultimately this is the nature of powerful cyclical recoveries, and current-term forecasts cannot capture the true upside potential, in our view.
- The three key medium-term growth drivers examined in detail in PART FOUR point to a robust growth period as they converge during the current 5-year MTP.

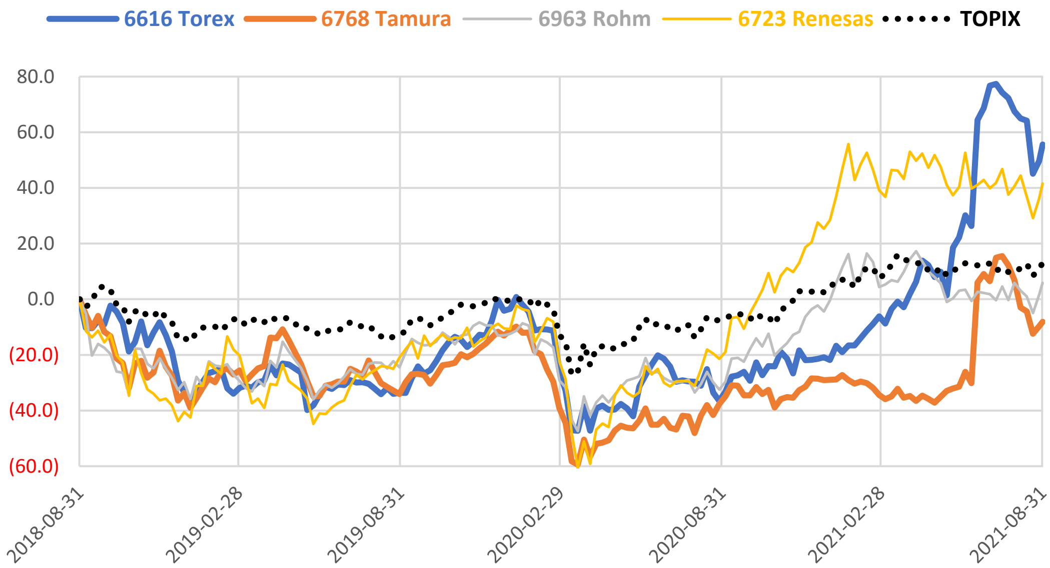
Analyst's view

Sessa Smart Charts: 3-Year Weekly Share Price and Valuations Trend

Source: compiled by Sessa Partners from SPEEDA historical earnings and price data. Valuations calculated based on CE.



3-Year Weekly Relative Performance



Source: compiled by Sessa Partners from SPEEDA historical price data.

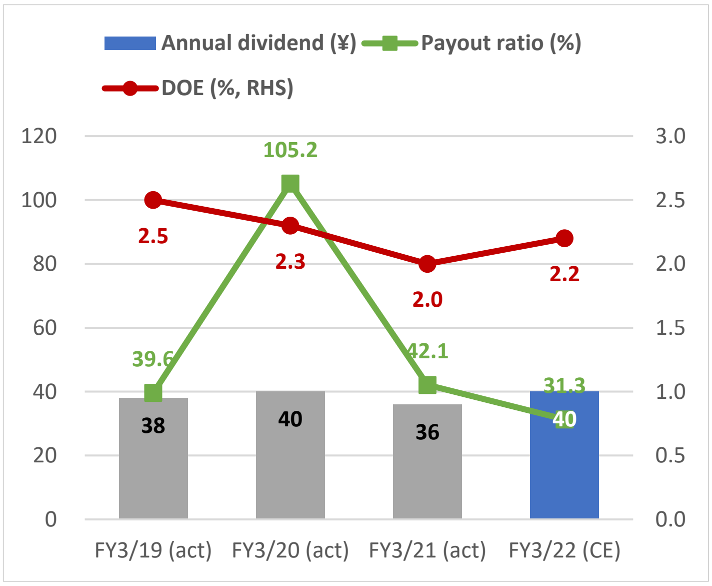
The lower left table shows that **both Phenitec Chairman Fujisaka and Torex President Shibamiya are in the top 10 shareholders, whose interests are aligned with all shareholders, an attractive point that cannot be understated in our view.**

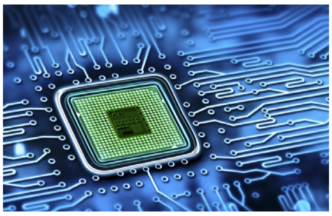
The company's stated dividend policy is highlighted in the graph below: consolidated dividend payout ratio of at least 20%, aiming for DOE of 3.0%. Like many Japanese companies, a common point of frustration among foreign shareholders is policy which emphasizes 'stable' dividends. It is also true that Torex has a large net cash position, and given that its business is highly cash generative, the unrelenting increase in shareholders' equity will make the DOE target of 3.0% increasingly difficult to achieve. HOWEVER, it is also true that management did not hesitate to approve a 5.2% share buyback, and in that respect, is not the same as many Japanese companies, nor is two top managers among the top 10 shareholders. "Actions speak louder than words."

TOREX SEMICONDUCTOR Major Shareholders (2021/03/31)

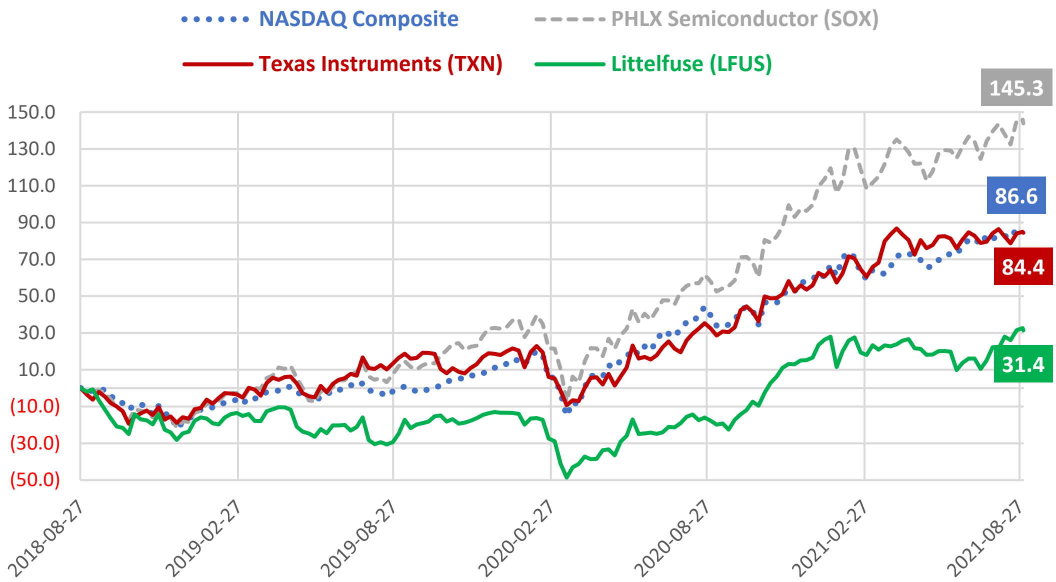
Rank	Shareholder	(%)
1	The Master Trust Bank of Japan, Ltd. (Trust Acct)	9.01%
2	Custody Bank of Japan, Ltd. (Trust Acct)	7.02%
3	THE BANK OF NEW YORK 133652	6.93%
4	**Tomoyuki Fujisaka (Phenitec Chairman)**	**4.60%**
5	The Chugoku Bank, Limited	4.28%
6	ARS Co., Ltd.	4.10%
7	Kibi Kogyo Co., Ltd.	3.61%
8	Takanori Ozaki	2.91%
9	**Koji Shibamiya (Torex President)**	**2.67%**
10	Kimiko Ozaki	1.86%
Top 10	**—**	**46.99%**

Source: FY3/21 YUHO financial statements.





Peer and Key N. America Client 3-Year Weekly Relative Performance



Source: compiled by Sessa Partners from Yahoo Finance US historical price data.

Monthly Share Price

Source: compiled by Sessa Partners from SPEEDA price data.

★Timing of next-generation power device business actually turning profitable (into the black) likely holds one of the keys for the future direction of the share price. In the meantime, since valuations have not yet become overheated, we expect there is high potential the share price will settle into and establish a new trading range, reflecting strong underlying earnings momentum, in our view.

Consolidated Balance Sheets ①

Thousands of yen

	Previous FY-end As of March 31, 2020	Current FY-end As of March 31, 2021
Assets		
Current assets		
Cash and deposits	9,281,215	11,737,170
Notes and accounts receivable - trade	4,020,517	4,629,998
Merchandise and finished goods	2,042,628	1,734,438
Work in process	1,900,144	2,448,495
Raw materials and supplies	1,064,040	1,287,325
Other	540,103	590,124
Allowance for doubtful accounts	(2,983)	(5,948)
Total current assets	18,845,666	22,421,604
Non-current assets		
Property, plant and equipment		
Buildings and structures, net	2,525,605	2,429,076
Machinery, equipment and vehicles, net	1,228,729	1,259,066
Tools, furniture and fixtures, net	494,403	375,861
Land	1,147,187	1,247,258
Leased assets, net	155,134	148,070
Construction in progress	653,463	506,612
Total property, plant and equipment	6,204,524	5,965,946
Intangible assets		
Software	170,524	870,668
Other	630,949	48,683
Total intangible assets	801,474	919,351
Investments and other assets		
Investment securities	913,366	966,440
Retirement benefit asset	–	321,973
Deferred tax assets	693,158	535,578
Other	414,452	407,657
Allowance for doubtful accounts	(25,680)	(26,422)
Total investments and other assets	1,995,296	2,205,227
Total non-current assets	9,001,295	9,090,525
Total assets	27,846,962	31,512,129

Source: TANSHIN financial statements.

Consolidated Balance Sheets ②

	Previous FY-end As of March 31, 2020	Current FY-end As of March 31, 2021
		Thousands of yen
Liabilities		
Current Liabilities		
Notes and accounts payable - trade	1,065,830	1,344,974
Short-term borrowings	2,901,627	2,901,661
Current portion of long-term borrowings	605,036	1,030,000
Lease obligations	56,114	47,560
Accounts payable - other	1,503,574	1,052,957
Income taxes payable	51,380	203,234
Provision for bonuses	355,975	424,979
Other	403,059	673,724
Total current liabilities	6,942,598	7,679,092
Non-current Liabilities		
Long-term borrowings	1,142,500	3,362,500
Lease obligations	43,283	45,248
Long-term accounts payable - other	202,648	68,476
Retirement benefit liability	656,153	344,767
Provision for share awards	53,546	49,109
Asset retirement obligations	81,965	83,336
Deferred tax liabilities	41,455	60,769
Other	10,908	28,906
Total non-current liabilities	2,232,461	4,043,114
Total liabilities	9,175,060	11,722,207
Net assets		
Shareholders' equity		
Share capital	2,967,934	2,967,934
Capital surplus	8,297,198	8,299,941
Retained earnings	8,576,276	9,115,933
Treasury shares	(788,207)	(749,981)
Total shareholders' equity	19,053,202	19,633,828
Accumulated other comprehensive income		
Valuation difference on available-for-sale securities	(145,538)	(146,619)
Foreign currency translation adjustment	15,011	113,934
Remeasurements of defined benefit plans	(250,774)	188,778
Total accumulated other comprehensive income	(381,300)	156,093
Total net assets	18,671,901	19,789,922
Total liabilities and net assets	27,846,962	31,512,129

Source: TANSHIN financial statements.

Consolidated Statements of Income

	For the FY ended March 31, 2020	For the FY ended March 31, 2021
		Thousands of yen
Net sales	21,500,955	23,712,981
Cost of sales	16,049,185	17,753,827
Gross profit	5,451,769	5,959,153
Selling, general and administrative expenses	4,773,608	4,749,858
Operating profit	678,161	1,209,294
Non-operating income		
Interest and dividend income	26,095	18,651
Royalty gain	8,104	4,548
Rental income	27,353	31,705
Subsidy income	–	9,672
Other	17,188	30,712
Total non-operating income	78,741	95,290
Non-operating expenses		
Interest expenses	26,587	42,583
Foreign exchange losses	37,541	46,077
Commission expenses	8,000	8,000
Other	8,551	1,713
Total non-operating expenses	80,680	98,374
Ordinary profit	676,222	1,206,211
Extraordinary income		
Subsidy income	20,340	7,333
Insurance claim income	9,013	19,808
Surrender value of insurance policies	2,988	–
Total extraordinary income	32,342	27,141
Extraordinary losses		
Loss on sale and retirement of non-current assets	2,587	17,217
Loss on disaster	4,500	7,297
Guarantee loss	109,691	25,072
Loss on cancellation of insurance policies	–	11,736
Other	–	903
Total extraordinary losses	116,779	62,227
Profit before income taxes	591,785	1,171,125
Income taxes - current	105,603	252,574
Income taxes - deferred	68,861	(15,040)
Total income taxes	174,464	237,533
Profit	417,321	933,591
Loss attributable to non-controlling interests	(192)	–
Profit attributable to owners of parent	417,513	933,591

Source: TANSHIN financial statements.

Consolidated Statements of Comprehensive Income

		Thousands of yen
	For the FY ended March 31, 2020	For the FY ended March 31, 2021
Profit	417,321	933,591
Other comprehensive income		
Valuation difference on available-for-sale securities	(58,133)	(1,081)
Foreign currency translation adjustment	(60,266)	98,922
Remeasurements of defined benefit plans, net of tax	(187,053)	439,552
Total other comprehensive income	(305,453)	537,394
Comprehensive income	111,868	1,470,985
Comprehensive income attributable to		
Comprehensive income attributable to owners of parent	113,276	1,470,985
Comprehensive income attributable to non-controlling interests	(1,408)	–

Source: TANSHIN financial statements.

Consolidated Statements of Cash Flows ①

Thousands of yen

	For the FY ended March 31, 2020	For the FY ended March 31, 2021
Cash flows from operating activities		
Profit before income taxes	591,785	1,171,125
Depreciation	1,312,244	1,208,486
Loss on disaster	4,500	7,297
Guarantee loss	109,691	25,072
Loss (gain) on sale and retirement of non-current assets	2,587	17,217
Loss (gain) on cancellation of insurance policies	–	11,736
Insurance claim income	(9,013)	(19,808)
Surrender value of insurance policies	(2,988)	–
Subsidy income	(20,340)	(7,333)
Increase (decrease) in allowance for doubtful accounts	609	2,441
Increase (decrease) in provision for bonuses	(31,732)	68,066
Increase (decrease) in provision for share awards	19,980	(4,436)
Decrease (increase) in retirement benefit asset	–	(321,973)
Increase (decrease) in retirement benefit liability	241,996	(311,386)
Interest and dividend income	(26,095)	(18,651)
Interest expenses	26,587	42,583
Foreign exchange losses (gains)	113,291	(66,251)
Decrease (increase) in trade receivables	(26,006)	(535,975)
Decrease (increase) in inventories	(412,928)	(450,782)
Increase (decrease) in trade payables	127,239	279,271
Increase (decrease) in long-term accounts payable - other	(11,596)	(115,865)
Other, net	(389,043)	975,184
Subtotal	1,620,769	1,956,019
Interest and dividends received	26,095	18,651
Interest paid	(25,273)	(45,219)
Income taxes refund (paid)	(498,021)	(42,676)
Proceeds from insurance income	9,013	19,808
Proceeds from surrender value of Insurance	2,988	–
Subsidies received	20,340	7,333
Guarantee loss paid	(11,079)	(111,644)
Payments associated with disaster loss	–	(11,797)
Net cash provided by (used in) operating activities	1,144,832	1,790,473

Source: TANSHIN financial statements.

Consolidated Statements of Cash Flows ②

		Thousands of yen
	For the FY ended March 31, 2020	For the FY ended March 31, 2021
Cash flows from investing activities		
Net decrease (increase) in time deposits	(11,004)	52,981
Purchase of property, plant and equipment	(741,254)	(1,241,697)
Purchase of intangible assets	(516,519)	(243,256)
Purchase of investment securities	(253,033)	(54,598)
Proceeds from cancellation of insurance funds	–	20,070
Payments of leasehold and guarantee deposits	(2,417)	(11,446)
Proceeds from refund of leasehold and guarantee deposits	2,029	3,632
Other, net	(27,638)	(71,518)
Net cash provided by (used in) investing activities	(1,549,839)	(1,545,832)
Cash flows from financing activities		
Net increase (decrease) in short-term borrowings	998,895	–
Proceeds from long-term borrowings	–	4,000,000
Repayments of long-term borrowings	(1,021,033)	(1,355,036)
Purchase of treasury shares	(598,999)	–
Purchase of shares of subsidiaries not resulting in change in scope of consolidation	(44,744)	–
Proceeds from disposal of treasury shares from exercise of subscription rights to shares	6,409	16,555
Repayments of lease obligations	(52,164)	(65,776)
Dividends paid	(447,659)	(394,324)
Other, net	(17,377)	(26,396)
Net cash provided by (used in) financing activities	(1,176,672)	2,175,021
Effect of exchange rate change on cash and cash equivalents	(129,297)	83,020
Net increase (decrease) in cash and cash equivalents	(1,710,976)	2,502,683
Cash and cash equivalents at beginning of period	10,883,205	9,172,228
Increase in cash and cash equivalents resulting from inclusion of subsidiaries in consolidation	–	6,797
Cash and cash equivalents at end of period	9,172,228	11,681,709

Source: TANSHIN financial statements.

LEGAL DISCLAIMER

This report is intended to provide information about the subject company, and it is not intended to solicit or recommend investment. Although the data and information contained in this report have been determined to be reliable, we do not guarantee their authenticity or accuracy.

This report has been prepared by Sessa Partners on behalf of the concerned company for which it has received compensation. Officers and employees of Sessa Partners may be engaged in transactions such as trading in securities issued by the company, or they may have the possibility of doing so in the future. For this reason, the forecasts and information contained in this report may lack objectivity. Sessa Partners assumes no liability for any commercial loss based on use of this report. The copyright of this report belongs to Sessa Partners. Modification, manipulation, distribution or transmission of this report constitutes copyright infringement and is strictly prohibited.

Sessa Partners Inc.

5-3-18, Hiroo, Shibuya-ku, Tokyo
info@sessapartners.co.jp