

# TOREX SEMICONDUCTOR | 6616

Sponsored Research  
August 18, 2023



## Phenitec 1Q OP returned to profit after 4Q loss 1Q consol. results largely in line → guidance unchanged

### SUMMARY

- ▶ TOREX Semiconductor announced 1Q FY24/3 consolidated financial results at 15:30 on 8/10. Headline numbers were net sales -25.5% YoY, operating profit -87.2% YoY, and profit attributable to owners of parent -94.3% YoY. Ordinary profit posted a slight loss due to recording a loss on foreign exchange. The TANSWIN Summary noted that the electronics market, of which the Group is a part, experienced a slowdown in demand and inventory adjustments in a wide range of fields, including consumer electronics, communications equipment, and PC-related, due to the reactionary decline from special demand during COVID-19 pandemic, and the Chinese economy losing steam.
- ▶ By entity, TOREX (parent) net sales declined -34.3% YoY, citing greater than expected declines in the China market, with all application categories down YoY: Industrial Equipment -29.3%, Other (includes, consumer electronics, communications and PC-related, etc.) -37.2% and Automotive Equipment -40.8%. By region, Asia suffered the greatest decline of -45.9%. TOREX (parent) OP declined -92.5% YoY, citing inventory valuation write-downs in addition to the decline in sales. Phenitec contribution net sales declined -17.7% YoY, citing declines in China similar to TOREX, with particular weakness in general consumer electronics. By application, Other declined -50.5%, and Automotive Equipment was down -8.0%, however Industrial Equipment recorded a +50.0% gain YoY, apparently in large part from North America (+30.4%). Asia declined -69.2% YoY. **While Phenitec contribution OP declined -81.9% YoY, it is noteworthy that OP returned to profit after dipping into loss in the 4Q.**
- ▶ WSTS worldwide semiconductor billings bottomed in CY23 Q1, with the value ticking higher in Q2 and the YoY decline shrinking from -21.3% → -17.3% (see P2). **Just based on new MTP targets for FY26/3, OP is set to grow from the depressed base in FY24/3 by 2-year CAGR of +91.5% (up 3.67x in 2 years).** While admittedly the implied OPM of 14.8% is a challenging level, SIR believes current valuations are compelling. Management continues to execute on increased capex investments to secure capacity for the next upcycle from 2024. Extended MTP targets to FY29/3 on P8 show total capex of ¥12.6bn to boost capacity for sales up 1.5x.

### 1Q Follow-up



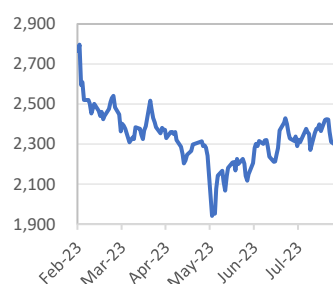
#### Focus Points:

Power management IC specialist with attractive growth profile from new applications driven by 5G/IoT, EV/ADAS and highly energy efficient next-gen power devices.

#### Key Indicators

Share price (8/17)	2,171
YH (23/2/10)	2,843
YL (23/5/15)	1,912
10YH (21/11/30)	3,960
10YL (14/5/20)	725.8
Shrs out. (mn shrs)	11.554
Mkt cap (¥ bn)	25.800
EV (¥ bn)	25.353
Equity ratio (6/30)	63.7%
24.3 P/E (CE)	23.4x
24.3 EV/EBITDA (CE)	6.0x
23.3 ROE (act)	9.2%
23.3 P/B (act)	1.00x
24.3 DY (CE)	2.51%

#### 6M daily share price trend



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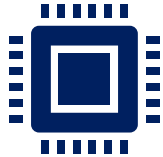


This report was prepared by Sessa Partners on behalf of TOREX SEMICONDUCTOR, LTD. Please refer to the legal disclaimer at the end for details.

### Torex Semiconductor Group 1Q FY24/3 Results and Full-term Forecasts

[J-GAAP]	FY23/3	FY23/3	FY23/3	FY23/3	FY24/3	FY23/3	FY24/3
JPY mn, %	1Q act	2Q act	3Q act	4Q act	1Q act	act	init CE
Net sales	8,593	8,791	7,699	6,873	6,404	31,956	29,000
YoY	22.5	10.3	(3.0)	(13.5)	(25.5)	3.5	(9.3)
• TOREX (parent)	4,028	4,119	3,469	3,078	2,647	14,694	
• Phenitec contribution	4,565	4,661	4,230	3,795	3,757	17,262	
Operating profit	1,743	1,667	879	(313)	222	3,976	1,500
YoY	174.1	45.3	(21.1)	TR	(87.2)	2.0	(62.3)
OPM %	20.3%	19.0%	11.4%	-4.6%	3.5%	12.4%	5.2%
• TOREX (parent)	880	941	614	132	66	2,567	
TOREX (parent) OPM %	21.8%	22.8%	17.7%	4.3%	2.5%	17.5%	
• Phenitec contribution	863	726	265	(445)	156	1,409	
Phenitec contrib. OPM %	18.9%	15.6%	6.3%	-11.7%	4.2%	8.2%	
Ordinary profit	1,757	1,774	737	(287)	(12)	3,981	1,500
Profit ATOP	1,238	1,223	512	(794)	70	2,179	1,050
• Capex	517	391	2,586	1,356	1,311	4,850	5,917
• Depreciation	353	385	416	491	413	1,645	2,487

Source: compiled by SIR from IR results briefing materials.



Over three decades of billings statistics from the WSTS Blue Book are available for free download in MS Excel format and provide monthly data, as well as 3M moving averages. Based on actual quarterly data shown on the right, worldwide billings bottomed in CY23 Q1. For reference, monthly data based on 3MMA show the peak was in May-2022 at \$51.7bn, and the subsequent bottom was in Feb-2023 at \$39.7bn, and Apr-2023 in terms of YoY at -21.4%. YoY comps will get easier going forward, potentially turning positive in 4Q or 1Q 2024.

Source: <https://www.wsts.org/67/Historical-Billings-Report>

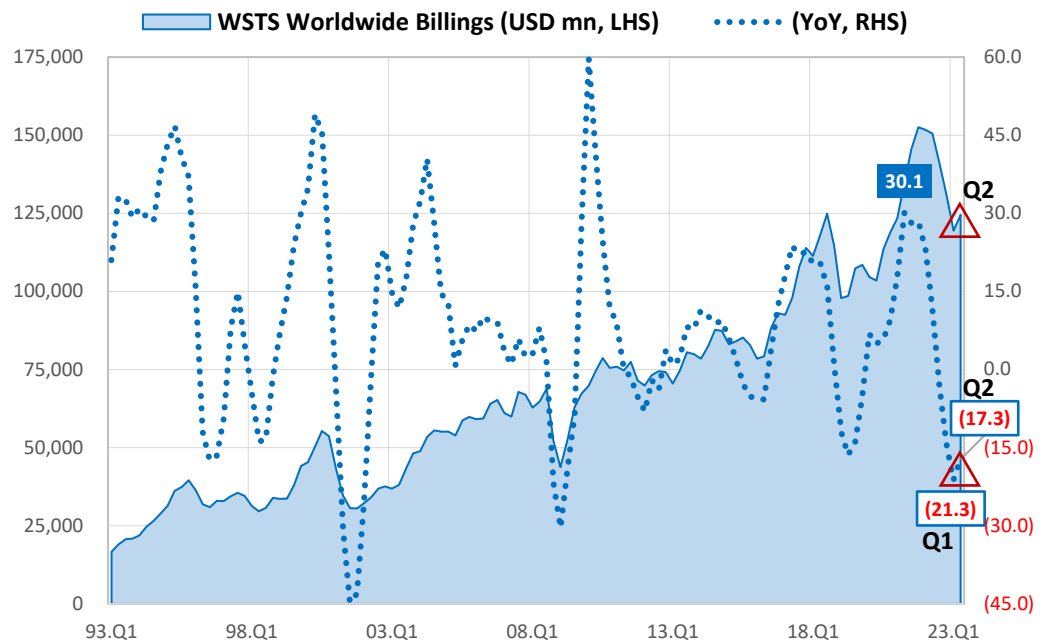


Japan exports to China have been a **reliable proxy** for the general health of the global electronics supply chain, likely a function in SIR's view of Japan's ongoing leadership in critical electronic components and advanced materials.

Source: Texas Instruments archive <https://investor.ti.com/financial-information/financial-data-non-gaap-reconciliations>  
MOF Trade Statistics of Japan <https://www.customs.go.jp/toukei/shinbun/happyyou.htm>

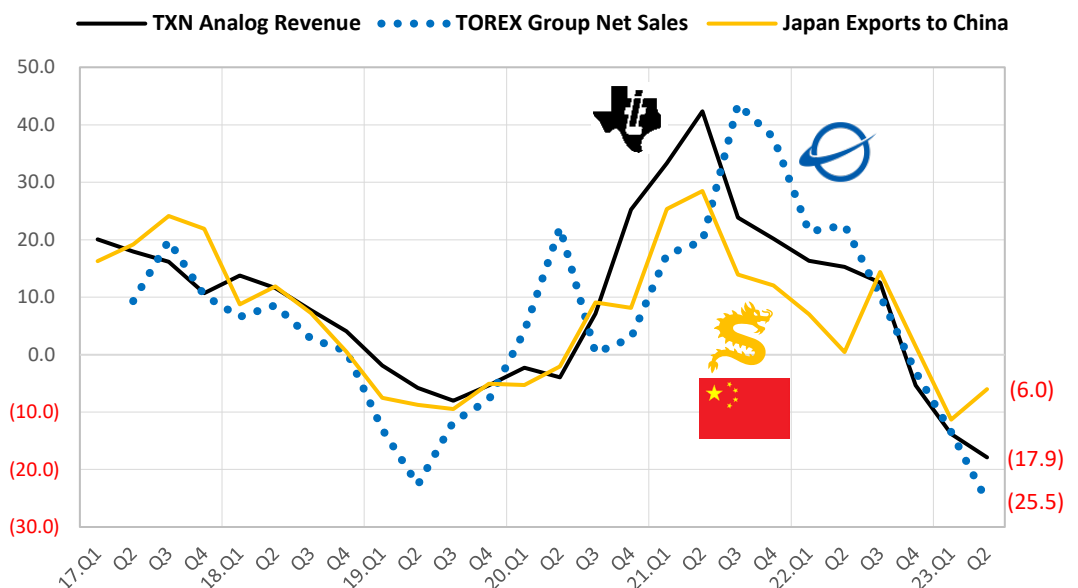
**WSTS forecasts robust growth of the global semiconductor market in 2024 of +11.8%** While 2023 is forecast to decline -10.3%, the first decline in 4 years since 2019, mainly due to memory from the slump in high-end smartphones, and adjustment in PCs and consumer electronics post-COVID, automotive applications are benefitting from the global ramp in EVs, and discrete power devices in particular are benefitting from brisk demand for renewable energy applications. The global semiconductor market is expected to surge +11.8% in 2024 assuming a global recovery after high inflation, and strong rebound in memory, with virtually all product categories set to post solid gains.

### Quarterly Trend of WSTS Worldwide Semiconductor Billings → bottom in CY23 Q1



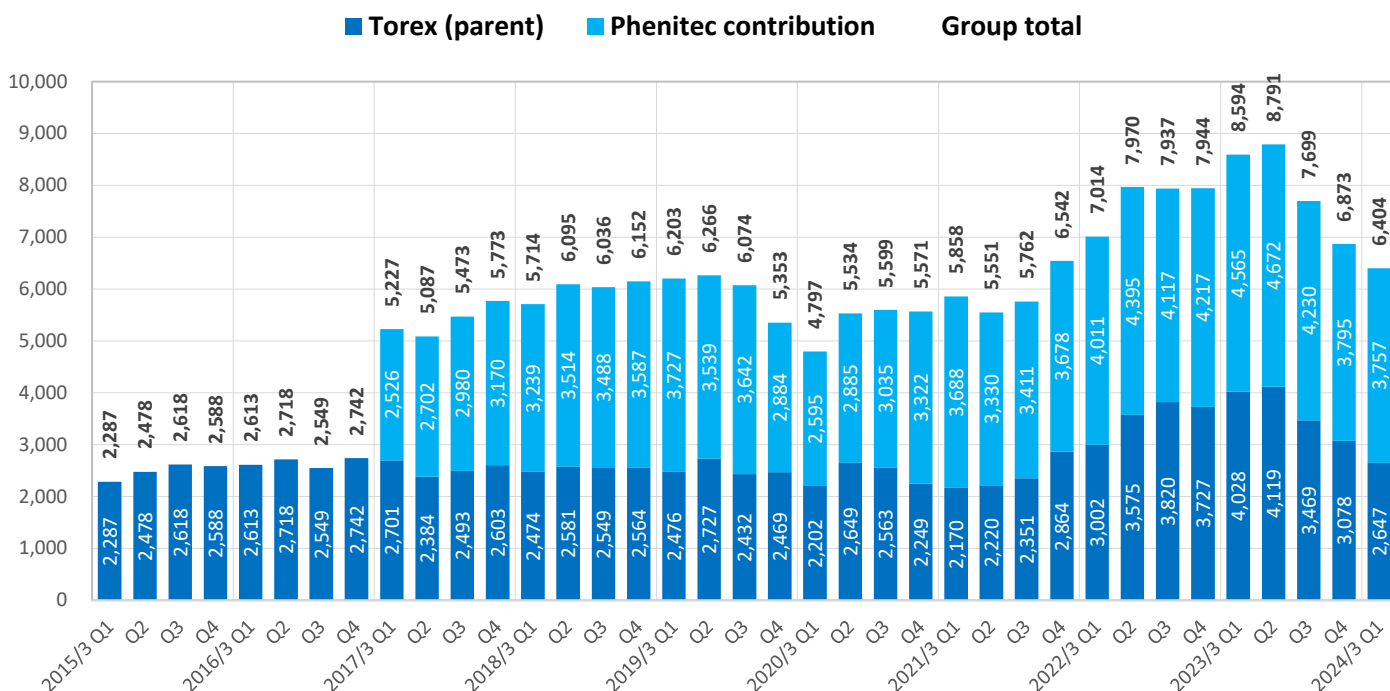
Source: compiled by SIR from WSTS Worldwide Semiconductor Quarterly Historical Billings Report.

### Quarterly Trend of SESSA 2 Checkpoints: TI Analog Revenue and Japan Exports to China

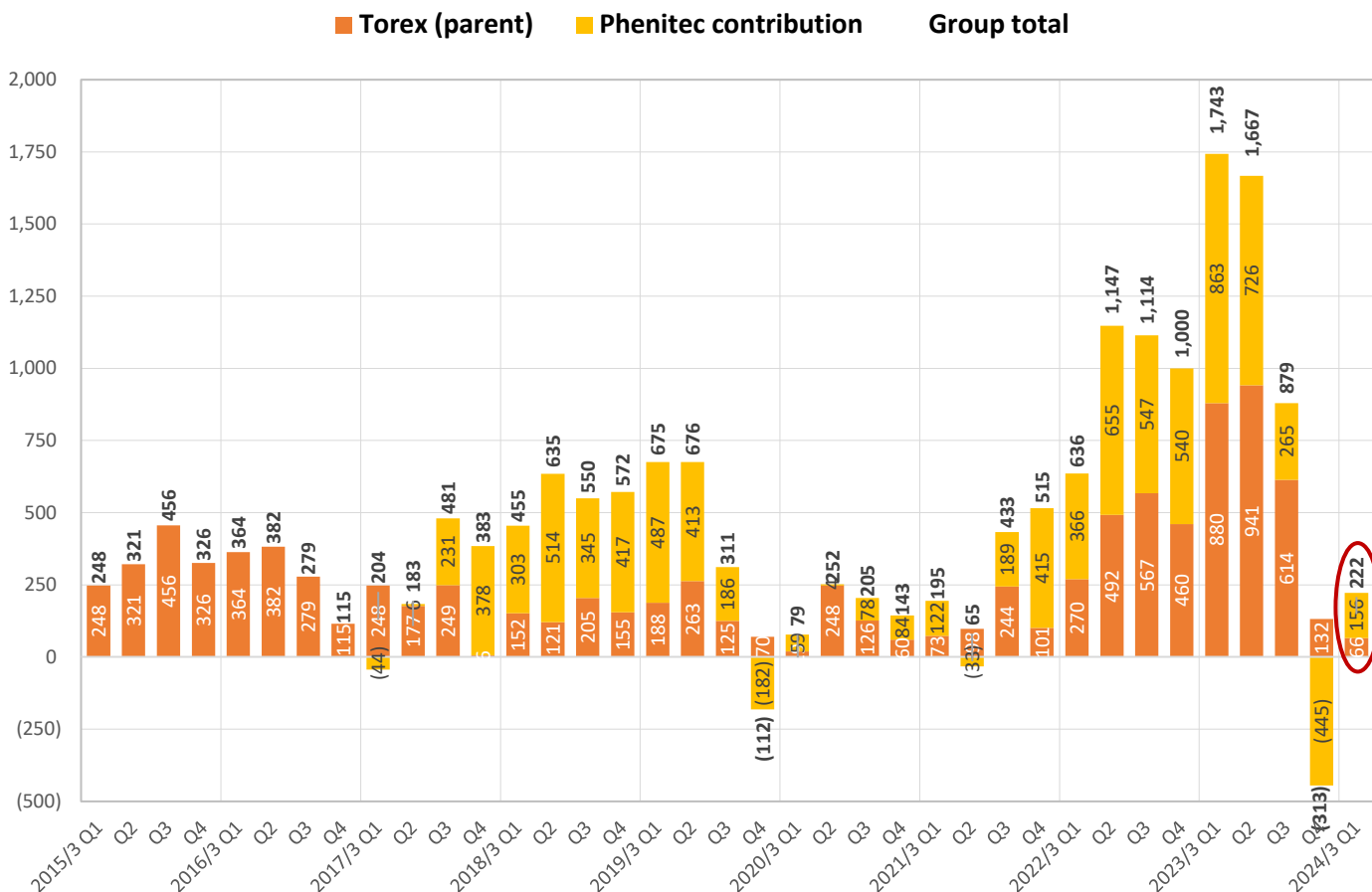


Source: compiled by SIR from Texas Instruments Segment Revenue & OP archives, MOF trade statistics and TOREX IR results briefing materials. Note: TOREX 1Q corresponds to calendar quarter Q2.

## TOREX Group Quarterly Trend of Consolidated Net Sales by Entity (JPY million)



## TOREX Group Quarterly Trend of Consolidated Operating Profit/Loss by Entity (JPY million)



Source: compiled by SIR from IR results briefing materials.



Novel Crystal Technology, Inc.

Link to Japanese press release:

<https://www.novelcrystal.co.jp/%e6%9c%aa%e5%88%86%e9%a1%9e/4366/>

#### September 2022

World's first prototype gallium oxide inverted DI-MOS transistor

#### December 2022

Developed imaging technology for crystal defects in the next-generation power semiconductor beta gallium oxide.

#### April 2023

Succeeded in the first actual operation of a current-continuous type power factor correction circuit with gallium oxide Schottky barrier diode output power of 350 W in Japan.

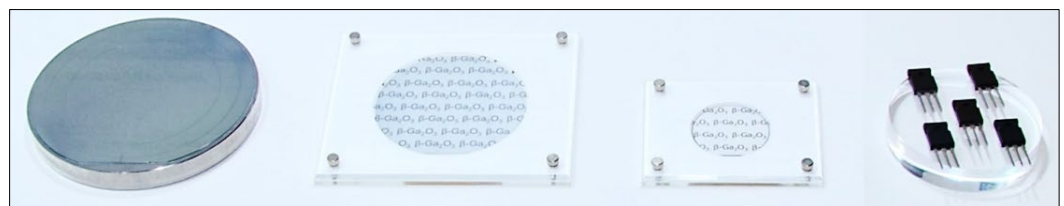
### TOPICS: Novel Crystal Technology announces new fundraising of ¥950mn

July 28, 2023 press release (notice of capital increase through 3<sup>rd</sup> party placement)

Novell Crystal Technology Inc. develops, manufactures, and sells  $\beta$ -gallium oxide ( $\beta$ -Ga<sub>2</sub>O<sub>3</sub>) single-crystal substrates and epitaxial wafers, which are attracting attention as semiconductors for new-generation power devices. Currently, all of NCT's  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> wafers are sold for research and development, and NCT's market share in such research and development applications is almost 100%. NCT has also reported world-leading results in the characteristics of diodes and transistors under development.

In recent years, silicon carbide (SiC) and gallium nitride (GaN) have been actively investigated as new materials that exceed the performance of silicon (Si) semiconductors.  $\beta$ -gallium oxide ( $\beta$ -Ga<sub>2</sub>O<sub>3</sub>) has excellent material properties that greatly exceed those of Si and GaN. Moreover, the "melt-growth method" can produce high-quality single-crystal substrates at a low cost. These features will enable the practical use of  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> power devices to further reduce losses and costs in power electronics equipment such as home appliances, electric vehicles, railway cars, industrial equipment, solar power generation, wind power generation, etc., and R&D is accelerating at companies and research institutes in Japan and overseas. Please refer to SIR's FULL REPORT on TOREX Semiconductor dated July 25, 2023, for a detailed overview of this promising technology (pp 34-36).

### Novel Crystal Technology Main Products



150mm substrate  
(under development)

100mm epi wafer and  
substrate (under development)

2-inch epi wafer and  
substrate (under development)

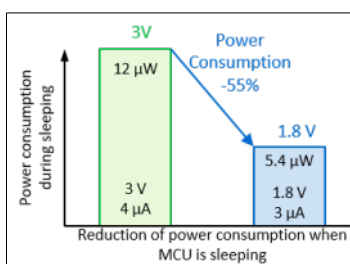
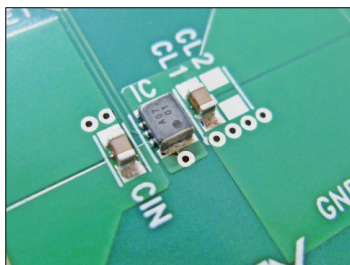
Power devices  
(under development)

### TOREX XCL233 new series of inductor built-in step-down DC/DC converter:

#### 200nA Ultra-Low Quiescent Current Output Voltage Selectable Function Step-Down DC/DC Converter

June 21, 2023 product release

The XCL233 Series is a 150mA step-down synchronous rectification "micro DC/DC" converter which has an output voltage selectable function with an ultra-low power consumption circuit and PFM control. The VSET function is a function that switches between two output voltages by signal input. When this function is mounted on a low-power MCU with a wide operating voltage range, it provides low voltage during standby and high voltage during operations such as sensor communication to efficiently drive devices. Dramatically extend the battery life of small appliances (see figure on left).



#### Product Features:

- High power conversion efficiency from standby current
- Output current: 150mA
- Binary switching of output voltage with VSET function
- Ultra-compact, low EMI package (pocket type)

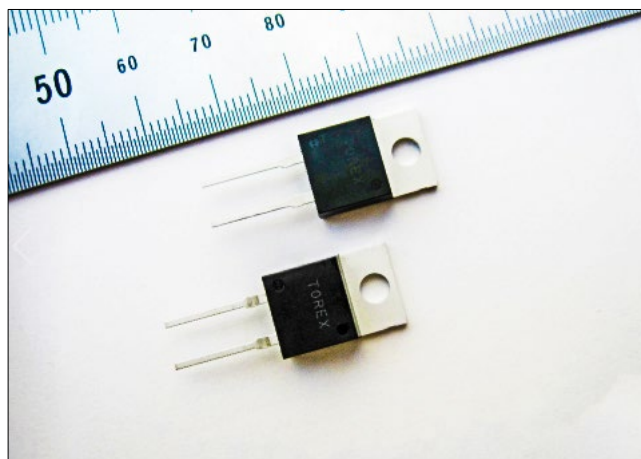
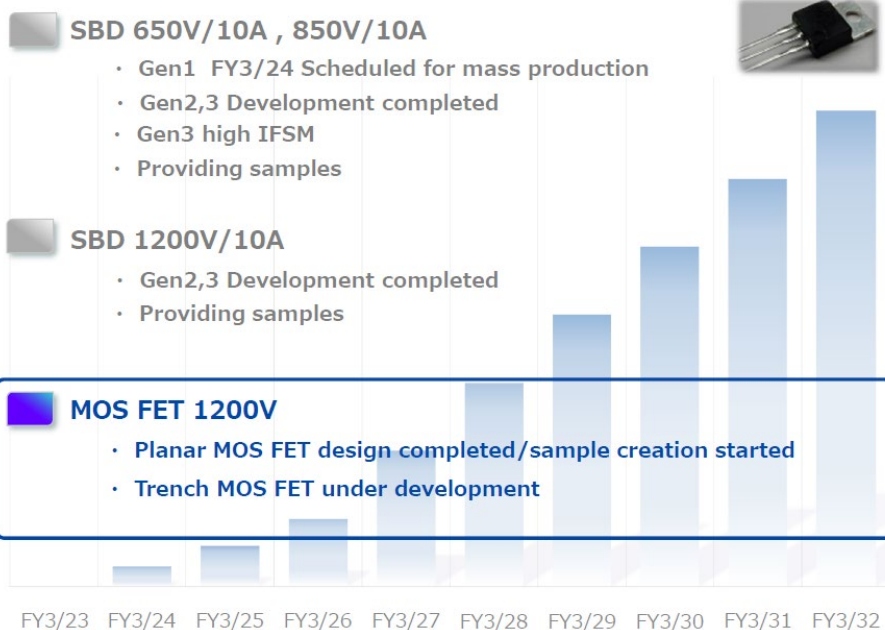
#### Target Applications:

- Smart watches, smart meters, wearables
- Various sensor modules, IoT devices
- Energy Harvesting


**TOPICS: TOREX announces first next-gen power device product SiC SBD**

On May 12, TOREX announced it has started providing samples of the 850V/10A Schottky barrier diode XBSC11A108CS using SiC (silicon carbide) as a new power semiconductor product that contributes to the reduction in power consumption and size of power supply systems such as air conditioners and EV chargers. This product is aimed at mass production in 2023. The 850V sample is for test marketing, and the Company plans to develop products with 650V~1200V that will be introduced to the market in turn.

According to the Company, it uses Sicoxs' direct bonded SiC (silicon carbide) substrate SiCkrest®, which 1) reduces cost for substrates, 2) enables process simplification and 3) shrinking of chip size, which in turn lead to being able to offer products at a competitive low price with high quality. This is a major new step for Torex entering the power device market, and the graphic below highlights the development schedule going forward.


**► Progress in SiC next-gen power device development going into FY24/3**
**Starting to provide samples of SBD Gen3 650V/10A**




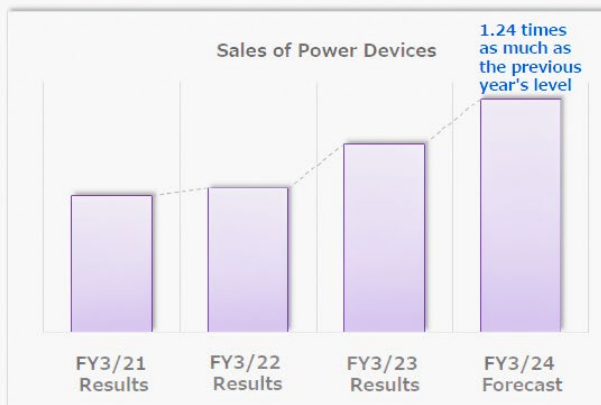
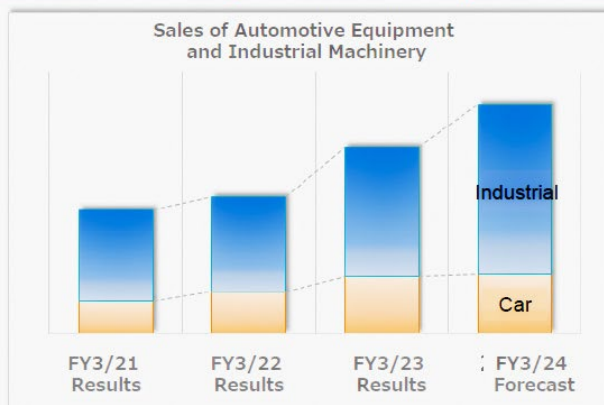


Strengthening the Development of Power Devices and Promoting Sales

### Orders and new inquiries for Si power devices are strong.

Factors: Electrification of vehicles, strong demand for industrial devices, new energy, 5G, home appliances, etc.

Devices: **IGBT, Power MOSFET, SBD**



### Developing process technology for compound semiconductor materials to meet demand for power semiconductors

Target materials: **Silicon carbide (SiC)**, gallium oxide ( $\text{Ga}_2\text{O}_3$ ), gallium nitride (GaN)

We aim to increase sales by developing power devices that will meet the needs of the market.

Strengthening the Development of Si Power Devices and Promoting Sales

### Si power devices development plan

March 2023	March 2024	March 2025	March 2026
Aiming to increase sales by developing new power devices			
Sales will increase			
<b>★ Low V<sub>th</sub> Power MOSFET</b> <ul style="list-style-type: none"> <li>- We will develop low-voltage-driven (1.5 V or less) products used in high-density mounting equipment such as medical and industrial uses.</li> <li>- Products are being evaluated by customers.</li> </ul>			
<b>★ Split Gate-Type MOSFET</b> <ul style="list-style-type: none"> <li>- We will achieve extremely low on-resistance and high current density in a smaller package (contributing to longer battery life).</li> <li>- A prototype is being evaluated.</li> </ul>			
<b>★ Field-Stop Type IGBT</b> <ul style="list-style-type: none"> <li>- We target our development at achieving cutting-edge performance from a field-stop (FS) IGBT with high input impedance, fast switching speed and low on-resistance even at high voltages.</li> <li>- Samples are planned to be shipped in Q4 of the fiscal year ending March 2023.</li> </ul>			
<b>★ High-performance Schottky barrier diode</b> <ul style="list-style-type: none"> <li>- We will significantly improve the VF/IR trade-off by changing the device structure.</li> <li>- Samples are planned to be shipped in Q3 of the fiscal year ending March 2023.</li> <li>- We will be able to ensure a junction temperature of 150°C by curbing the leakage current.</li> </ul>			

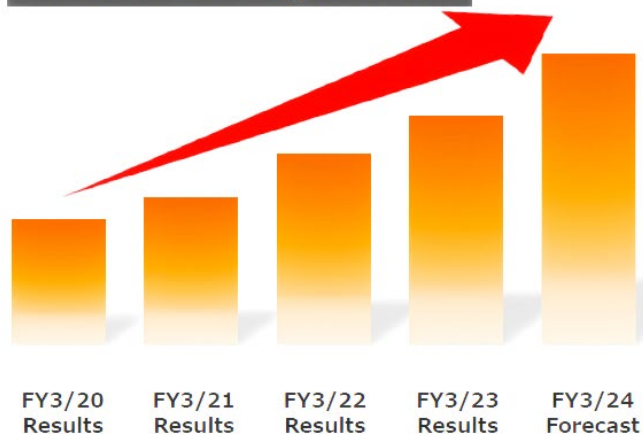
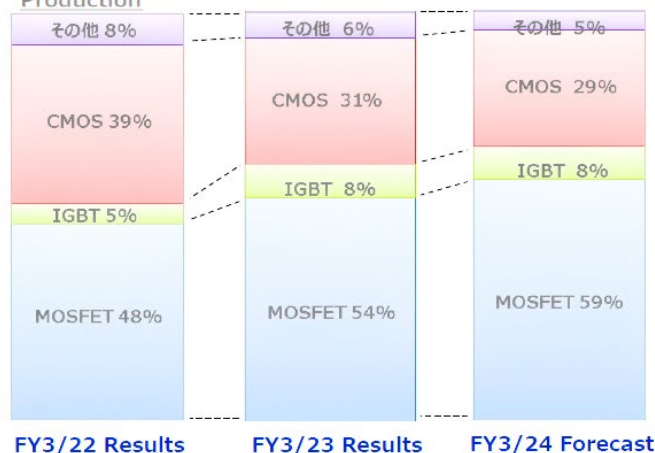


## Current Status of Kagoshima Fab

Initiatives at Kagoshima Fab

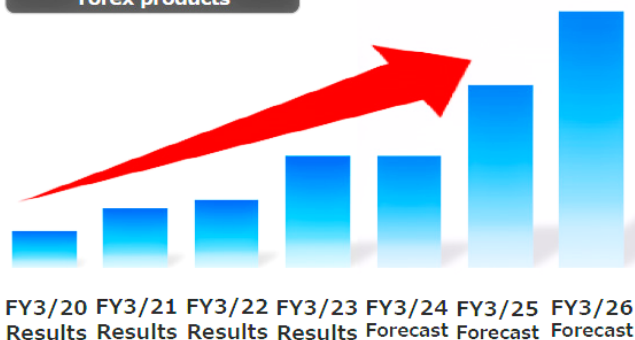
- ✓ Increasing production capacity to achieve business plan targets
- ✓ Ensuring a stable profit by reducing fixed operating expenses
- ✓ Establishing a welfare building (operations commencing in November) to improve the work environment

Working to establish a system for stable production of 20,000 wafers per month in FY3/23

Trends in sales at Kagoshima FabMain Mass Produced Products and Shares of Total ProductionIncreasing the capacity of Kagoshima Fab as one of the main fabrication plants of Torex

- Increase production capacity for CMOS power supply ICs
- Investment in other equipment to increase production 4.4 billion yen in total
- Plan a capital expenditure of 4.3 billion yen for Torex in the fiscal year ending March 2024
- Plan to start work to expand the clean room in May 2023  
Completion scheduled in January 2024

2023/4/6  
Ceremonial prayer for safety

Change in production of Torex products

Achieve a stable supply of Torex products for the long term

Create a clean room on the third floor of Building 5 of Kagoshima Fab







## Extended MTP targets to FY29/3

Total capex of ¥12.6bn to boost capacity for sales up 1.5x

### CAPEX SUMMARY

#### ▶ Signed a long-term production contract agreement with an overseas foundry

Fabless TOREX will invest ¥1.8bn in the contractor's fab to secure dedicated 8-inch production capacity necessary for the development of new high-performance products, including medium- to high-breakdown voltage power device products. This line is scheduled to start mass production in Mar-2025.

#### ▶ Extending the production line for TOREX at Phenitec's Kagoshima Fab

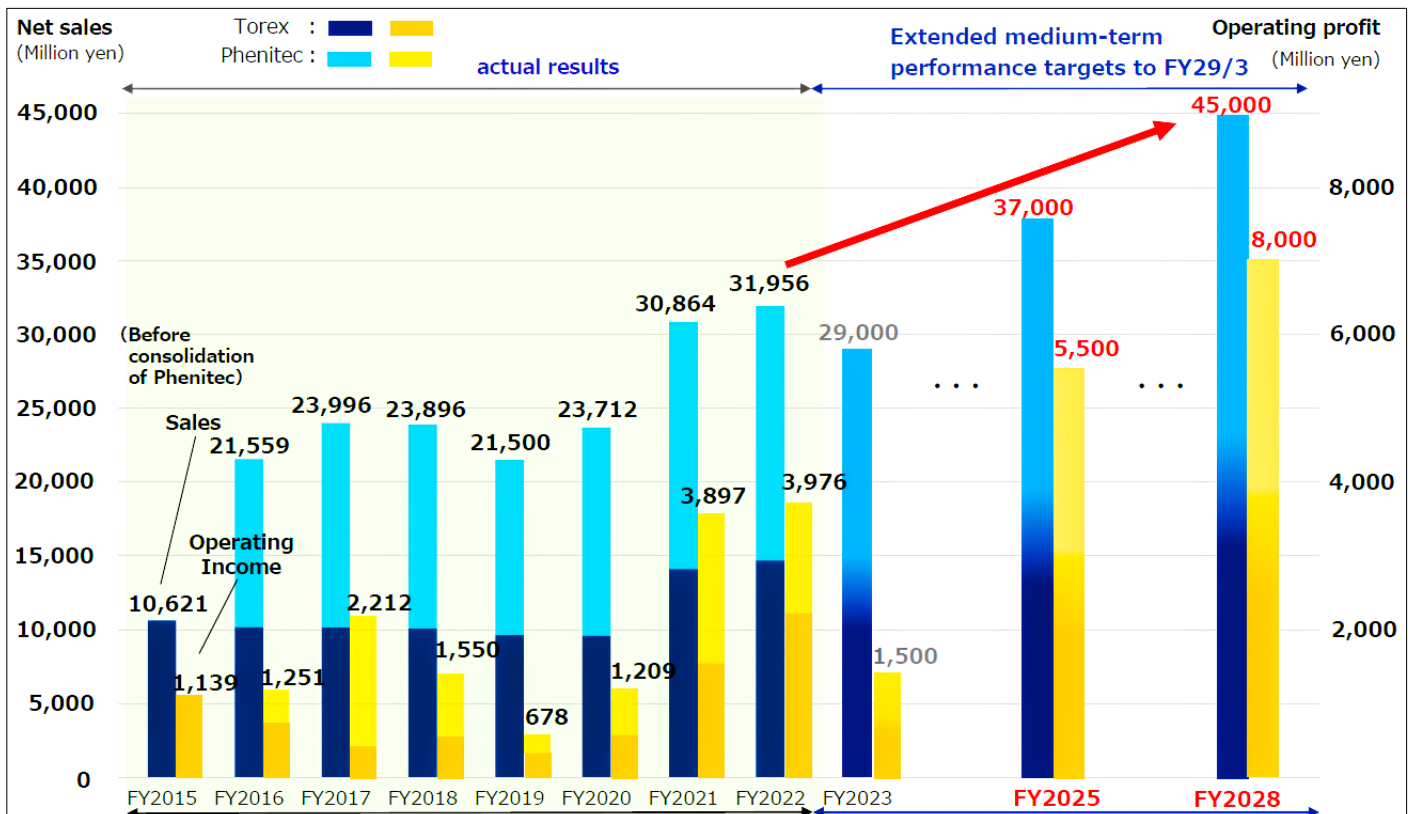
Investing ¥4.4bn in an existing line to expand dedicated capacity for TOREX. Expanding clean room floor space to expand capacity including for TOREX products.

#### ▶ Other capex to boost capacity at the Okayama Fab No. 1 and Kagoshima Fab

Investing ¥2.0bn to meet demand in a brisk semiconductor market. Additionally deploying ¥4.4bn capex for plant maintenance, etc. Total capex of ¥12.6bn to boost capacity for sales to increase 1.5x.

▶ Just based on new MTP targets for FY26/3, OP is set to grow from the depressed base in FY24/3 by 2-year CAGR of +91.5% (up 3.67x). While admittedly the implied OPM of 14.86% is a challenging level, SIR believes current valuations are extremely compelling. Considering the semiconductor market is likely at the trough of the current reset cycle now, and share prices tend to discount roughly 1 year in advance, SIR believes TOREX Semiconductor is attractive at the current level.

## Medium-term net sales and OP performance targets extended to FY29/3



Source: excerpt from FY23/3 IR results briefing materials.



## TOREX Semiconductor Consolidated Financial Summary

[J-GAAP]	FY13/3	FY14/3	FY15/3	FY16/3	FY17/3	FY18/3	FY19/3	FY20/3	FY21/3	FY22/3	FY23/3	FY24/3
JPY mn, %	act	act	act	act	act	act	act	act	act	act	act	init CE
Net sales	8,600	9,391	9,972	10,621	21,560	23,997	23,897	21,501	23,713	30,864	31,957	29,000
YoY	(6.1)	9.2	6.2	6.5	103.0	11.3	(0.4)	(10.0)	10.3	30.2	3.5	(9.3)
• TOREX (parent)	—	—	—	—	10,181	10,168	10,104	9,663	9,605	14,124	14,694	
• Phenittec contribution	—	—	—	—	11,378	13,828	13,792	11,837	14,107	16,740	17,262	
Gross profit	3,218	4,337	4,822	5,063	5,900	7,177	6,494	5,452	5,959	9,474	10,021	
SG&A expenses	2,651	2,922	3,472	3,923	4,649	4,964	4,943	4,774	4,750	5,577	6,045	
Depreciation, GW amort.	432	468	410	442	1,219	934	1,085	1,312	1,208	1,311	1,646	2,487
EBITDA	999	1,882	1,760	1,582	2,470	3,146	2,636	1,990	2,417	5,209	5,622	3,987
Operating profit	567	1,414	1,350	1,140	1,251	2,212	1,551	678	1,209	3,898	3,976	1,500
YoY	1,282.9	149.4	(4.5)	(15.6)	9.7	76.8	(29.9)	(56.3)	78.3	222.4	2.0	(62.3)
OPM %	6.6%	15.1%	13.5%	10.7%	5.8%	9.2%	6.5%	3.2%	5.1%	12.6%	12.4%	5.2%
• TOREX (parent)	—	—	—	—	680	633	646	453	516	1,789	2,567	
• TOREX (parent) OPM %	—	—	—	—	6.7%	6.2%	6.4%	4.7%	5.4%	12.7%	17.5%	
• Phenittec contribution	—	—	—	—	571	1,579	904	225	693	2,108	1,409	
• Phenittec contrib. OPM %	—	—	—	—	5.0%	11.4%	6.6%	1.9%	4.9%	12.6%	8.2%	
Ordinary profit	445	1,339	1,679	971	906	1,998	1,820	676	1,206	4,125	3,981	1,500
Extraordinary Gain	—	—	—	190	2,561	34	8	32	27	396	—	
Extraordinary Loss	227	15	—	137	31	62	23	117	62	107	993	
Profit before income taxes	217	1,324	1,679	1,024	3,435	1,971	1,805	592	1,171	4,414	2,988	
Total income taxes	25	(35)	428	442	331	561	484	174	238	1,257	809	
Profit ATOP	192	1,357	1,248	580	2,931	902	1,049	418	934	3,157	2,180	1,050
Attributed to minority int.	1	1	3	1	174	507	272	0	—	—	—	
Profit	193	1,359	1,251	581	3,105	1,410	1,321	417	934	3,157	2,180	1,050
Total assets	10,567	10,801	13,171	12,973	25,210	27,995	28,386	27,847	31,512	34,770	37,049	
• Current assets	9,057	9,410	10,753	10,818	19,166	21,669	19,907	18,846	22,422	24,880	24,715	
• Non-current assets	1,510	1,390	2,418	2,155	6,043	6,326	8,479	9,001	9,091	9,890	12,334	
Net IBD (net cash)	(3,059)	(4,385)	(6,576)	(6,904)	(3,846)	(7,376)	(6,266)	(4,532)	(4,350)	(4,382)	(690)	
• Cash/deposits, ST inv.	5,508	5,647	6,702	6,917	10,069	12,435	10,982	9,281	11,737	10,220	8,573	
• Int. bearing debt	2,449	1,262	126	13	6,223	5,059	4,716	4,749	7,387	5,838	7,883	
Total liabilities	4,160	2,896	2,282	2,044	9,612	8,910	8,748	9,175	11,722	12,041	12,455	
• Current liabilities	3,581	2,413	1,887	1,622	6,306	6,857	6,211	6,943	7,679	8,977	7,382	
• Non-current liabilities	579	483	395	421	3,306	2,053	2,537	2,232	4,043	3,064	5,073	
Total net assets	6,406	7,905	10,889	10,929	15,598	19,085	19,638	18,672	19,790	22,729	24,594	
• Total shareholders' eqty	6,375	7,869	10,844	10,886	11,433	14,503	19,594	18,672	19,790	22,729	24,594	
• Non-controlling interest	31	36	45	43	4,165	4,582	44	—	—	—	—	
ROE (%)	3.1	19.1	13.3	5.3	26.3	7.0	6.2	2.2	4.9	14.8	9.2	
ROIC (%)	6.3	16.1	9.1	6.4	5.6	7.2	4.4	2.1	3.8	9.5	10.4	
FY-end employees	309	329	342	343	981	982	1,017	1,016	1,016	1,034	1,063	
Capital expenditures	276	266	586	602	988	1,149	3,323	1,497	1,179	1,916	4,850	5,917
Forex rate	¥82.3	¥99.7	¥109.8	¥120.1	¥108.9	¥110.8	¥110.7	¥109.1	¥106.2	¥112.9	¥134.9	¥130.0

Source: compiled by SIR from Annual Securities Reports (YUHO financial statements) and IR results briefing materials.



## Dividend Policy, DOE and Payout Ratio

JPY mn, %	FY15/3	FY16/3	FY17/3	FY18/3	FY19/3	FY20/3	FY21/3	FY22/3	FY23/3	FY24/3
	act	act	act	act	act	act	act	act	act	init CE
Shareholders' equity	10,527	10,797	11,172	14,429	19,671	19,053	19,634	22,335	24,100	24,500
Total dividends paid	291	340	305	341	425	438	396	485	621	621
DOE	2.7%	3.1%	2.7%	2.6%	2.5%	2.3%	2.0%	2.3%	2.6%	2.5%
Profit ATOP	1,248	580	2,931	902	1,049	418	934	3,157	2,180	1,050
Payout ratio	23.4%	58.6%	10.4%	34.2%	39.6%	105.2%	42.1%	15.2%	28.2%	58.7%

Note: compiled by SIR from Summary of Financial Results (TANSHIN financial statements).



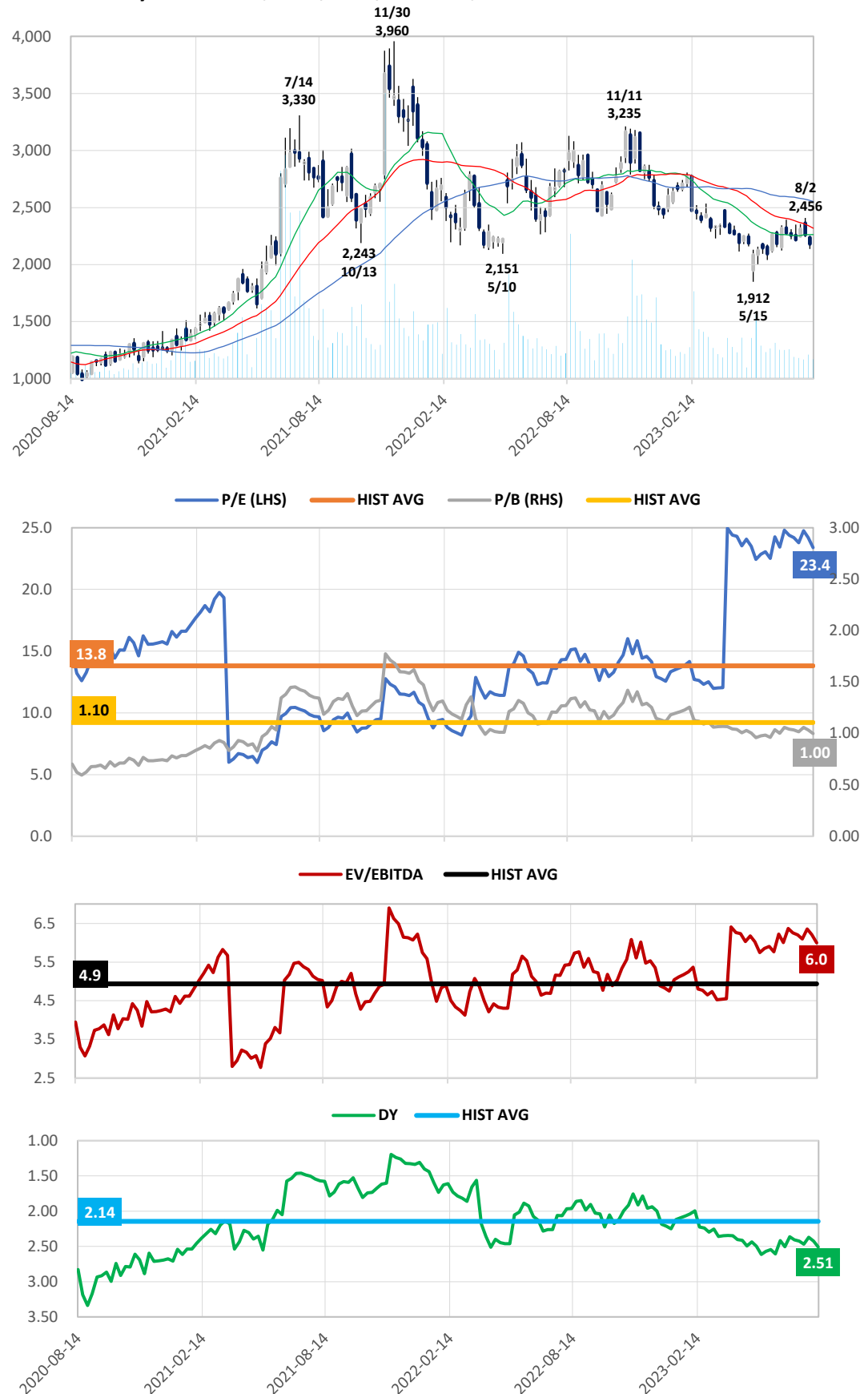
### Performance and Valuations: SESSA Smart Charts

- ✓ The current P/E of 23.4x and EV/EBITDA of 6.0x reflect depressed current term earnings.
- ✓ From experience, signals point strongly toward looking for a new entry point now on any weakness.
- ✓ Structural growth drivers for TOREX include 5G rollout/IoT device proliferation, EV/hybrid ramp, and demand for next-gen power devices to combat climate change.



Analyst's view

### 3-Year Weekly Share Price, 13W/26W/52W MA, Volume and Valuations Trend



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



Focus on  
promoting  
GX

### TOREX Group 5Y MTP 2021 – 2025 [FY3/22 – FY3/26]

The MTP announced February 15, 2021 promotes 'GX green transformation' through promoting power-saving circuits, reducing mounting board area and promoting low power-loss devices that suppress heat generation. (Details of new extended LT targets though FY29/3 announced May 18, 2023, are shown on P8)

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 Phenitex 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.

2020 Energy Conservation Grand Prize  
Product & Business Model Category



**Torex Group GX Green Transformation:**

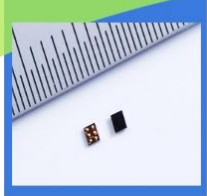
- Promotes power saving ICs and reduced mounting board size
- Promotes low-loss power devices that dissipate heat generation

⇒ Aiming for a carbon-free society.

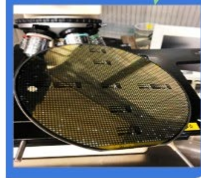
**DC/DC Converters**  
Promoting of power saving electronic circuits



**Small Packages**  
Smaller mount boards



**Power Devices**  
Reduced loss with low ON resistance



From a company contributing to society with compact, power-saving technologies

**Decarbonized Society**



Becoming a  
Global Company  
Supporting GX  
with  
Semiconductors

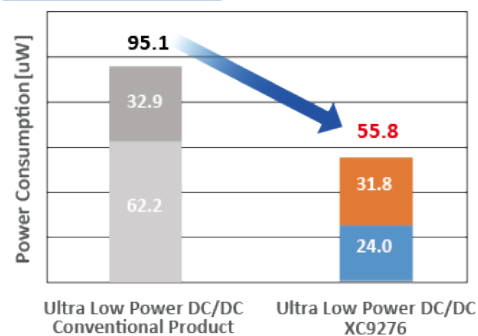
### Contributing to the realization of a net zero carbon-neutral society through:

#### ① Development of highly efficient, energy-saving power mgt. IC products

The step-down DC/DC converter XC9276 Series was awarded the 2020 Energy Conservation Grand Prize in the Product & Business Model category, by the Energy Conservation Center of Japan. By using the newly developed VSET function for 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.

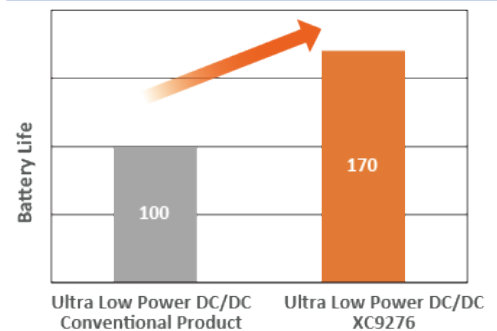
**Reduced Power Consumption**  
**41.3%**

Loss during Active/Sleep



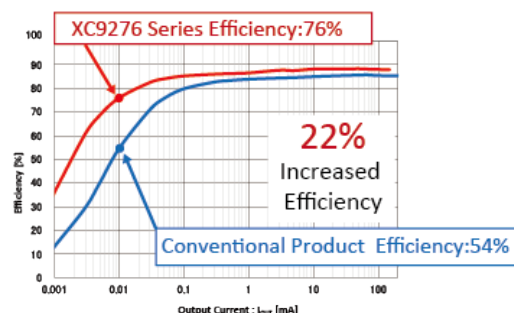
**Battery Life**  
**170%**

Battery Life (Comparison the conventional product is 100)



#### ■ Technology of ultra-low power

Stop the internal circuit of the IC according to the control status of the IC. Realize ultra-low current consumption.

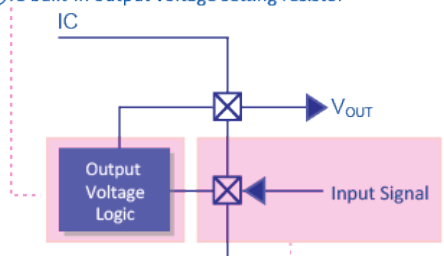


Source: company website.

#### ■ Technology of switching between two-value output voltage

Only input signal without external parts, Achieves a function that can switch between binary output voltages.

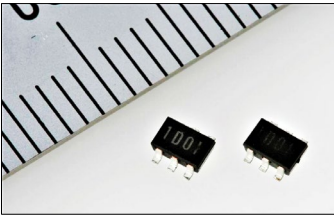
① IC built-in output voltage setting resistor



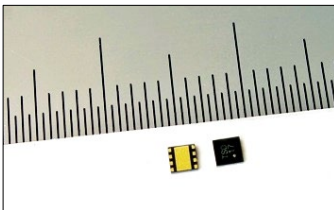
② Output two-value output voltage through input signal



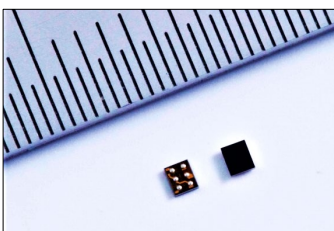
SOT package  
(small-outline transistor)



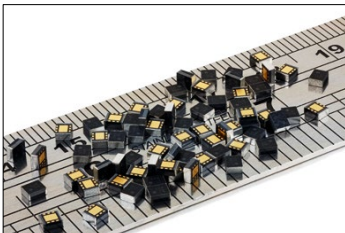
USP package  
(ultra-small package)



WLP package  
(wafer-level package)



*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.**

## ② Resource conservation with PKG miniaturization and space-saving design

The XC9276 series 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.

### ■ Technology of reduce mounting area

The installation area is reduced by reducing the coil inductance value and the IC package area.

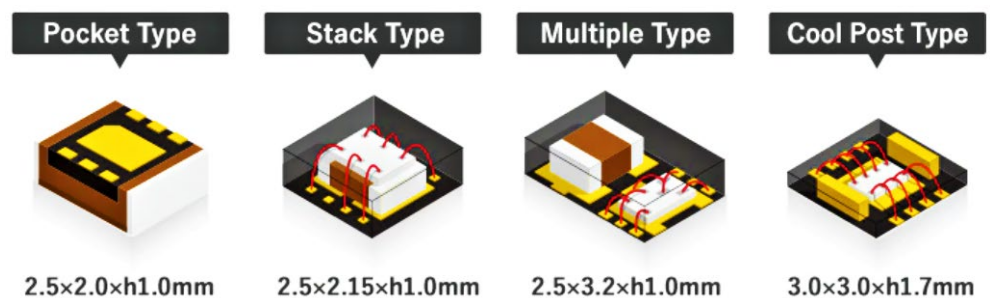


## High-growth focus product: Inductor Built-in Micro DC/DC converters

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.

Different package types emphasize the required properties of 1) low EMI noise, 2) small, low-cost, 3) high efficiency/heat dissipation for large current, and 4) high heat dissipation and low noise for high withstand voltages.



The XCL303/XCL304 series 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.

## ③ Reduced power loss with low ON resistance\* through development and sales promotion of next-generation silicon carbide (SiC) and gallium oxide (β-Ga<sub>2</sub>O<sub>3</sub>) power devices

**\*ON Resistance:** The resistance value between the Drain and Source of a MOSFET during operation (ON) is called the ON Resistance  $R_{DS(on)}$ . The smaller the value, the lower the power loss.

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