Company Profile

Imprinting the future
with advanced technologies

TOPPAN PHOTOMASK CO., LTD.

Thank you very much for your continuous understanding and support for Toppan Photomask Co., Ltd.

Our strengths are the outstanding capabilities for technological development, collaborative production among sites supported by our teamwork, and our corporate culture always valuing the growth of customers. With the production network connecting eight countries/regions in the world, we support customers with our technologies and work to achieve excellent QCD (quality, cost, delivery) targets. As a result of our efforts, we are aiming for being the 1st choice of customers and also going beyond their expectations.

Further, as a company working for the benefits of society, we will strive to fulfill our corporate social responsivities. Through our fair and sound business activities, we aim to achieve a sustainable growth by promoting actions for the global environment and human rights and fulfilling our responsibilities as a member of the world's corporations.

While respecting the diversity of each employee and adopting new ways of working, we make aggressive investments in human resources and enhance teamwork to create an appealing working environment that draws manpower from around the world. Furthermore, with our solid management for the rapidly-changing semiconductor industry, and by combining global information and the wisdom of our employees, we are confidence of achieving a further growth.

We are aiming for a future IPO as one of our milestones, and backed by funding from the market, we continue to provide support for the semiconductor industry whose long-term growth is expected. This is a rapidly changing industry. However, by listening to customers and supporting them to grow, we also hope to grow together.

We are looking forward to working with you as we will continue to create a new value with aggressive challenges and constant improvements, and thank you for your continuing support.

President & Representative Director Teruo Ninomiya

Photomasks

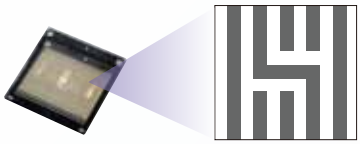
Contributing to the semiconductor industry with cutting edge lithography technology

A photomask is an essential device used as the master plate in the manufacturing process for semiconductor chips such as LSI. Circuit patterns drawn by electron beams or laser beams are etched onto composite quartz glass on which a metal (such as chrome) light shielding film is formed. Toppan has photomask manufacturing bases in seven countries around the world and offers high quality photomasks to customers all over the world.

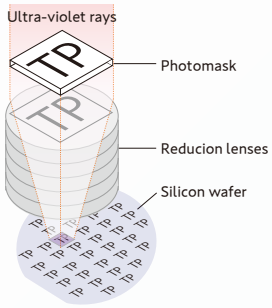
How is a photomask used?

Using ultraviolet light, the semiconductor circuit pattern formed on the surface of a photomask is transferred onto the photo resist (photosensitive resin) that is coated over the surface of a silicon wafer. The pattern is usually reduced to a quarter size through reduction lenses on the stepper (exposure device).

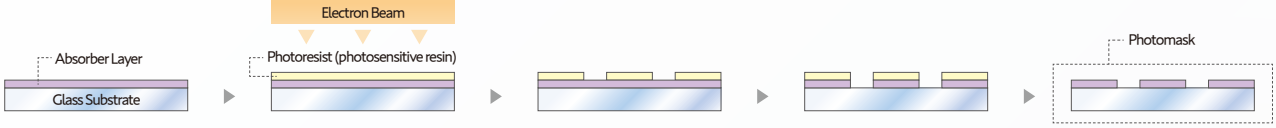
[Enlarged image of photomask surface]



[Exposure process]



Photomask manufacturing processes



1. Photomask Blanks

An absorber layer with a thickness of tens of nanometers is formed by depositing a substance such as chrome on the quartz substrate. The quartz substrate in this state is called a photomask blank.

2. Exposure (Patterning)

Photoresist (photosensitive resin) is uniformly coated over the surface of a photomask blank. Then an LSI circuit pattern is drawn by using an electron beam or a laser beam.

3. Development

The portions of resist exposed to the electron beam are removed through the development process (positive tone resist). Depending on the type of resist, there are cases in which non-exposed portions of resist are removed.

4. Etching

The portions where resist was removed by the development process and the absorber layer is exposed are then etched through a chemical reaction by dry etching (negative tone resist).

5. Resist Removal

A photomask is completed upon removal of the resist and cleaned, and is finally shipped after passing several strict inspection processes.

Types of photomasks

Binary Masks

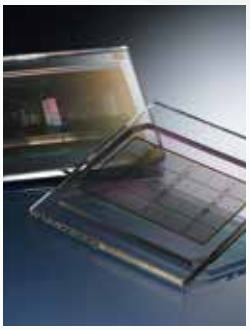
Structure of binary mask is simple; it is a photomask blank covered with patterned layer of opaque material. Its transmission characteristics are either transparent or non-transparent. Binary mask is used for building a pattern in which line width being larger than the exposure wave length.
However, it is learnt that the binary mask is superior to the half-tone phase shift mask used for immersion lithography for 32nm half-pitch or beyond.
Toppan Photomask and its blanks vendor have co-developed new type of binary blanks with superior workability (OMOG: Opaque MoSi on Glass). They have managed to create blanks for binary masks with better CD performance and higher resolution.

Phase Shift Masks

Phase-shifting mask (PSM) has achieved improved wafer printability with higher resolution and increased DOF (Depth of Focus), by controlling the phase shift and the transmission rate. This is a standard technology for lithography in which line width being smaller than the exposure wave length.
Most well known PSM is half-tone mask (Attenuated PSM) and Levenson mask (Alternating PSM).

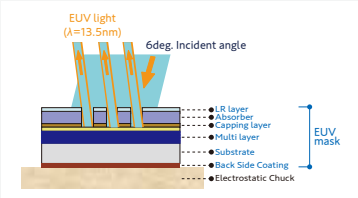
Half-tone Phase Shift Mask

Half-tone mask includes chrome layer and semitransparent layer that shift the phase angle of an incoming light by 180 degree.
When light passing through materials, its speed is altered, which in turn, its phase angle is shifted. This material, a semitransparent layer is called "phase shifter".
Half-tone masks have achieved higher resolution, utilizing the interference of light created by a phase differences between with-phase shifter and without-phase shifter on the photomask blank.



EUV Masks

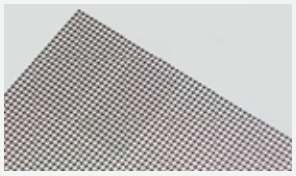
EUV is a number one candidate of next generation lithography technique. EUV lithography uses EUV light (13.45nm), shorter wave length than existing DUV (ArF: 193nm), in which enabling us to fabricate smaller patterns. Unlike conventional DUV, EUV lithography requires reflective optics for wafer exposure systems and for masks, as EUV technology cannot focus light via conventional lens optics.

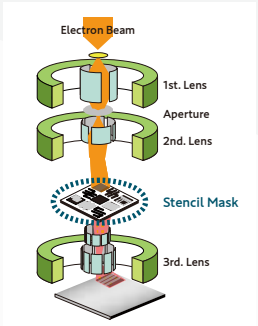


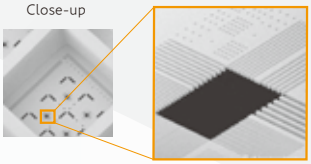
Toppan Photomask is committed to building a supply system in anticipation of the emergence of the merchant market for EUV masks.

Stencil Masks

Silicon stencil mask is a photomask for Electron Beam Lithography, with nanometer size apertures to fabricate nanometer scale patterns.
EB lithography has extensively studied in the semiconductor industry, exploring the replacement of optical lithography.
Toppan has been developing stencil masks as a core technology of micro-fabrication and establishing a supply system.

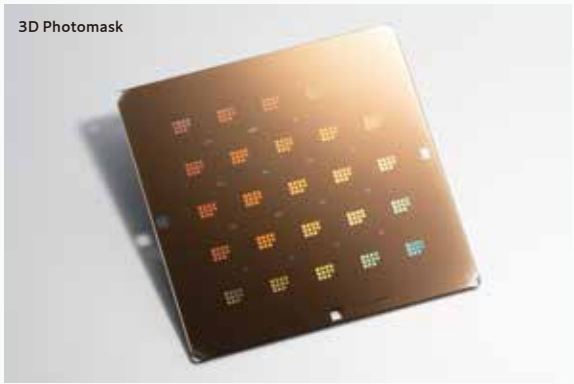






Photomasks for various applications

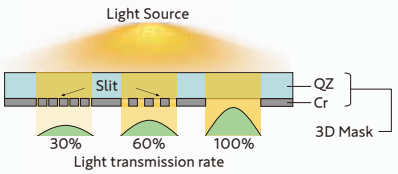
Toppan Photomask provides high-definition and reliable photomasks for a wide range of applications, such as for various industrial and R&D purposes etc.



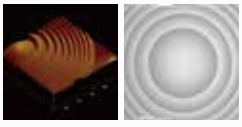
3D Photomasks (Gray-tone masks)

By using a pattern smaller than the resolution limit, half-tones are expressed without resolving the pattern on an object such as a wafer. High quality 3D structure can be formed.

Controlling the transmittance by changing the size of the opening



Example of pattern



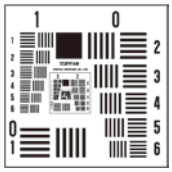
Instances of Supply.

- Masks for IC (bump)
- Masks for LED
- Mask for Device Accuracy control
- Masks for MEMS
- Masks for Semiconductor Packaging Substrates
- Master masks for High-resolution Printing
- Masks for various R&D
- Masks for Thermal Head
- Masks for Micro-lens Array
- Test Chart etc.

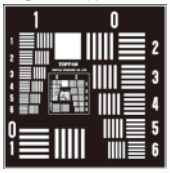
TEST CHART

Test chart is the photomask which formed the basic-shaped pattern on the glass substrate. It is available in the uses such as accuracy management of equipment, a resolution check, and a valuation basis at photo-resist selection.

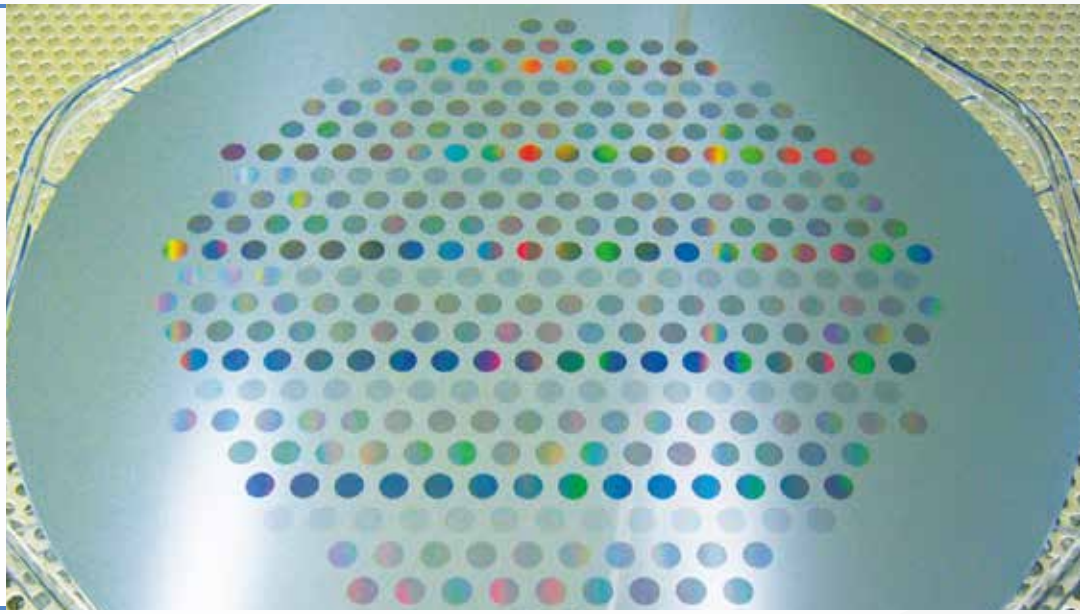
positive type



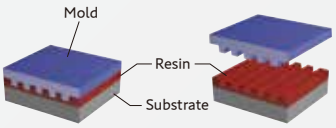
negative type



Nanoimprint Solutions



Supplying highly fine precision templates (molds) for next-generation micro fabrication technologies



Nanoimprint lithography is a microfabrication technology used to transfer patterns that measure a few dozen nanometers by placing resin between a mold and a substrate and hardening the resin. Its process is so simple that it is expected to enable inexpensive and highly repeatable mass volume manufacturing of microstructures. Toppan Photomask develops and produces high-precision molds for nanoimprint lithography, applying lithography technologies that have been developed in the company's semiconductor photomask business.

Methods of nanoimprint lithography

Nanoimprint lithography can be roughly classified into two types: "UV method" and "Thermal Method."

UV Nanoimprint Method

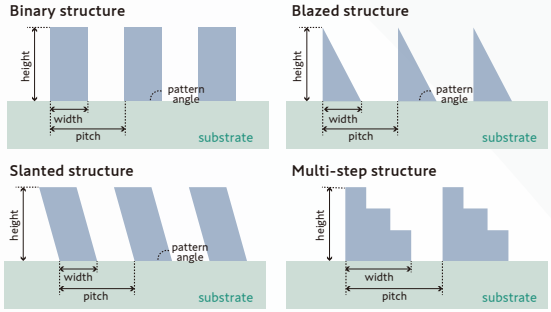
The UV nanoimprint method replicates patterns by pressing the pattern on the mold against UV-curable resin, which is then hardened by UV irradiation.
Working at normal temperature is possible, giving this method the unique nature of allowing a high level of precision in the replication of patterns.

Thermal Nanoimprint Method

The thermal nanoimprint method replicates patterns by pressing the pattern on the mold strongly against thermoplastic resin, which is then cooled after being heated. Direct processing is possible for a variety of products if they are made of materials that are softened by heating.

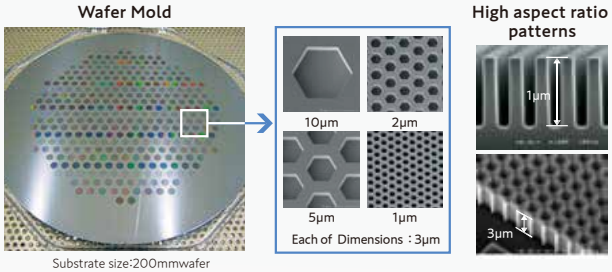
Pattern shape examples

We have already had extensive achievements as Toppan Photomask is offering various molds satisfying customers' needs. We are also focusing on research and development, including the development of three-dimensional structure patterns.
Please feel free to consult us regarding your desired pattern shape, etc.



Silicon molds

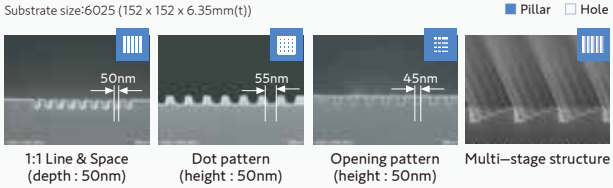
Silicon molds are mainly used in the thermal nanoimprint method. Patterns are drawn with an electron beam on a silicon substrate that has been coated with photosensitive resin. Dry etching is then used to make the patterns deeper.
The manufacturing process, same as that of Quartz molds, allows to form fine precision patterns. Silicon molds with high aspect ratio patterns are under development.



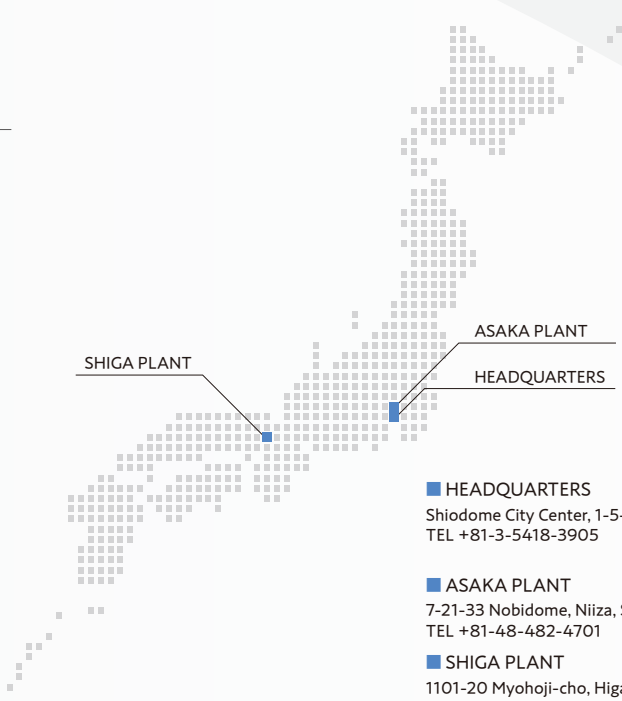
Substrate size:200mmwafer

Quartz molds

Quartz molds are mainly used in the UV nanoimprint method. Quartz is used as the material for semiconductor photomasks. It is characterized by high rigidity and flatness. The manufacturing process, same as that of semiconductor photomasks, allows to fabricate fine level patterns that measure a few dozen manometers.
Toppan Photomask also develops and manufactures multistage structure molds.



location




Shiodome City Center (Tokyo), where headquarters is located

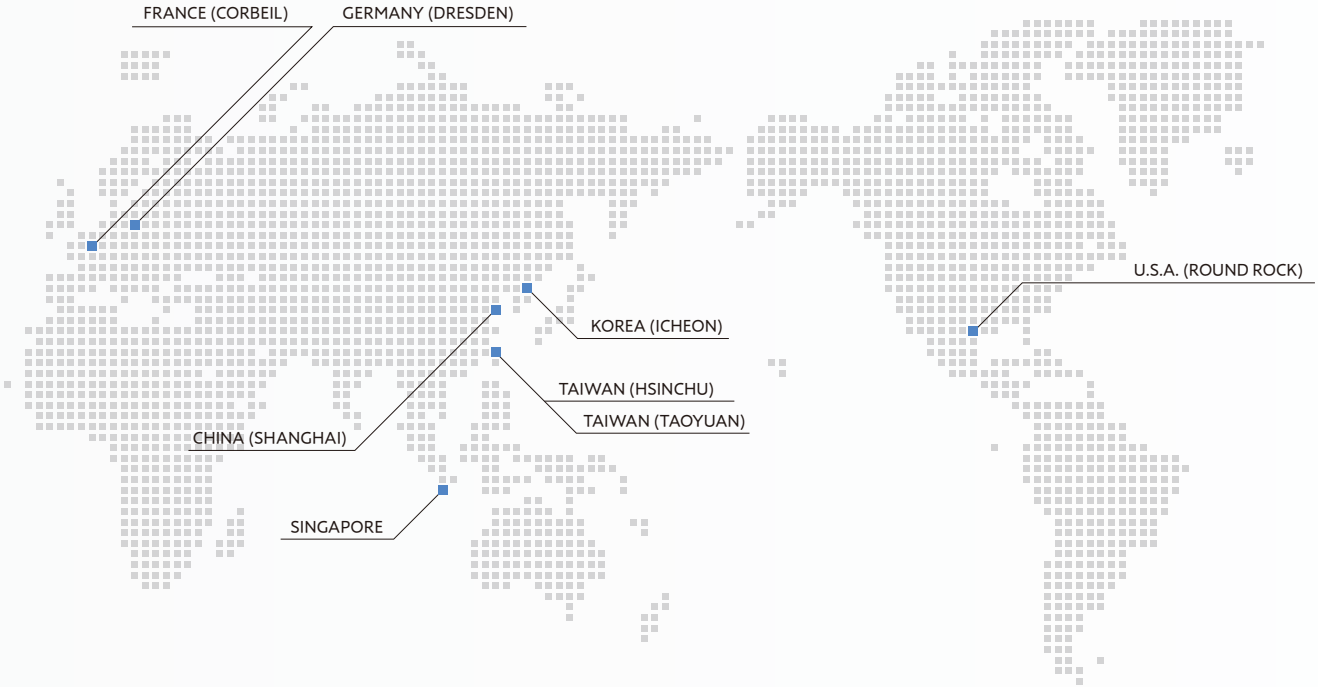

Asaka Plant (Saitama)


Shiga Plant (Shiga)

■ HEADQUARTERS
Shiodome City Center, 1-5-2 Higashi-Shimbashi, Minato-ku, Tokyo, 105-7133 Japan
TEL +81-3-5418-3905

■ ASAKA PLANT
7-21-33 Nobidome, Niiza, Saitama, 352-0011 Japan
TEL +81-48-482-4701

■ SHIGA PLANT
1101-20 Myohoji-cho, Higashi-ohmi, Shiga, 527-0046 Japan
TEL +81-748-24-3432



■ U.S.A.
TOPPAN PHOTOMASKS (ROUND ROCK)
TOPPAN PHOTOMASKS ROUND ROCK (ROUND ROCK)

■ GERMANY
TOPPAN PHOTOMASKS GERMANY (DRESDEN)
ADVANCED MASK TECHNOLOGY CENTER (DRESDEN)

■ FRANCE
TOPPAN PHOTOMASKS FRANCE (CORBEIL)

■ TAIWAN
TOPPAN CHUNGHWA ELECTRONICS (TAOYUAN)
TOPPAN CHUNGHWA ELECTRONICS HSINCHU BRANCH (HSINCHU)

■ KOREA
TOPPAN PHOTOMASKS KOREA (ICHEON)

■ CHINA
TOPPAN PHOTOMASKS COMPANY LIMITED, SHANGHAI (SHANGHAI)

■ SINGAPORE
TOPPAN SEMICONDUCTOR SINGAPORE


U.S.A. (ROUND ROCK)


TAIWAN (TAOYUAN)


GERMANY


KOREA


FRANCE


CHINA

Please refer to our website for further information such as addresses and contact details.
https://www.photomask.co.jp/english/profile/

Company profile

Company name	Toppan Photomask Co., Ltd.
Location	Shiodome City Center, 1-5-2 Higashi-Shimbashi, Minato-ku, Tokyo
Business start date	April 1st, 2022
President & Representative Director	Teruo Ninomiya
Capital	400 million yen
Shareholders	Toppan Ink.: 50.1%, Integral: 49.9%
Headcount	1,794 (consolidated) (as of April 1st, 2023)
Business	Manufacturing and distribution of semiconductor photomasks
URL	https://www.photomask.co.jp/english/

History

1900 Established Toppan Printing Limited Partnership.
1908 Reorganized as Toppan Printing CO., LTD.
1961 Succeeded in making a photomask prototype for silicon transistors.
1968 Completed a clean room in the Precision Components building at Asaka Plant.
Started the volume production of photomasks for transistors.
1970 Completed the Shiga Precision plant.
1974 Completed the Asaka 1st Precision Electronics plant.
1980 Completed the Kumamoto Precision building.
1986 Completed the Asaka 2nd Precision Electronics plant.
1990 Established Toppan Printonics (U.S.A.) Incorporated.
1997 Established Toppan Chunghwa Electronics Co., Ltd.
1998 Completed a new photomask plant at Shiga Plant.
2003 Completed the 3rd plant in Asaka
2005 Acquired all outstanding shares of DuPont Photomasks Inc. and launched Toppan Photomask, Inc.
2008 Started to mass-produce photomasks for 32nm node.
2010 Established the manufacturing process of photomasks for 22nm- and 20nm-node chips.
2015 Completed a new plant of TOPPAN PHOTOMASKS COMPANY LIMITED, SHANGHAI.
2022 Set up Toppan Photomask Co., Ltd.
2023 Relocated headquarters to Shiodome City Center

Shiodome City Center (Tokyo), where headquarters is located

Certification

ISO9001 Scope of establishments and quality management systems registered for examination in Japan

Toppan Inc. Electronics Division
Toppan Photomask Co., Ltd.

Toppan Photomask Co., Ltd. Asaka plant
Toppan Photomask Co., Ltd. Shiga plant
Toppan Electronics Products Co., Ltd. Niigata plant
Toppan Electronics Products Co., Ltd. Mie plant (Kameyama) (Hisai)
Toppan Electronics Products Co., Ltd. Kumamoto plant
Toppan TOMOEGAWA Optical films Co., Ltd. Shiga plant
Toppan TOMOEGAWA Optical films Co., Ltd. Sizuoka plant
Toppan Inc. Electronics Division Shibaura office
Toppan Inc. Electronics Division Kyoto office
Toppan Inc. Electronics Division Nagoya office
Toppan Inc. Electronics Division Nishi-nihon office
Toppan TOMOEGAWA Optical films Co., Ltd. sales department

Scope of Registration	Design, development and manufacture of photomasks, photo etched products, lead frames, on-chip color filters, FC-BGA substrates, color filters, and anti-reflection films.
Registrar	Japan Quality Assurance Organization (JQA)
Certified standards	ISO9001:2015 (JIS Q 9001:2015)
Registration date	15/Nov/1993
Registration number	JQA-QMA15894

ISO14001 Scope of business establishments and environmental management systems registered for examination in Japan

Toppan Inc. Electronics Division
Toppan Photomask Co., Ltd.

Certified Sites	Toppan Photomask Co., Ltd. Asaka Plant Toppan Photomask Co., Ltd. Shiga Plant Toppan Inc. Electronics Division Toppan Electronics Products Co., Ltd. Shiga plant Toppan Electronics Products Co., Ltd. Kumamoto plant Toppan Electronics Products Co., Ltd. Niigata plant Toppan Electronics Products Co., Ltd. Mie plant Toppan TOMOEGAWA Optical films Co., Ltd. Shiga plant Toppan Technical Design Center Co., Ltd. Asaka design center
Scope of Registration Activity	Design, development and manufacture of color filters, copper touch sensors, anti-reflection films, on-chip color filters, photomasks, lead frames, FC-BGA substrates, photo etched products, light control films, and LSI circuit design
Registrar	Japan Quality Assurance Organization (JQA)
Certified Standards	ISO14001:2015 (JIS Q 14001:2015)
Registration Date	03/Jul/1998
Registration Number	JQA-EM7467

ISO/IEC27001 Scope of business establishments registered for examination and registration in Japan and information security management systems

Toppan Photomask Co., Ltd.

Scope of Registration	The following activities on Photomask for Semiconductor at Toppan Photomask Co., Ltd. (Asaka Plant and Shiga Plant) ,and activities on Design and Development as well as Outsourcing and Management for semiconductor manufacturing and electrical and electronic equipment at Toppan Technical Design Center. Co., ltd.

1.Production Planning / Control, 2.Tech Planning, 3.Manufacturing (including Shipping), 4.Investigation, Implementation and Release of Technology Development and Equipment, 5.Quality Assurance, 6.Planning, Design, Development, Operation and Maintenance for In-House information Systems, 7.General affairs ,8.Design and Development and Outsourcing Management for semiconductor products, 9.Design and Development and Outsourcing

Statement of Applicability	Statement of Applicability, issued on 27/Apr/2022, Version 16
Registrar	BSI Group Japan K.K.
Certified Standards	ISO/IEC 27001:2013 (JIS Q 27001:2014)
Registration Date	01/Aug/2008
Registration Number	IS 530416

TOPPAN PHOTOMASK CO., LTD.
http://www.photomask.co.jp/english/