



# Independent Assurance Opinion

Verification Opinion No.:  
C663860-2023-AG-TWN-DNV

Issued date:  
12 April, 2024

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This is to verify initiate reporting of Greenhouse Gas Inventory Management Report (2023) of

## TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD.

### Scope of Verification

DNV Business Assurance (DNV) has been commissioned by TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD. ('tsmc' or 'the Company') to perform a verification of the greenhouse gas statements of Greenhouse Gas Inventory Management Report (2023) (hereafter the "Inventory Report") in Taiwan, ROC with respect to the sites listed in Appendix A

The Reporting Boundary for the verification including direct GHG emissions and removals, indirect GHG emissions from imported energy, indirect GHG emissions from products used by the Organization and indirect GHG emissions associated with purchased fuels and energy, but not included in Categories 1 and 2. The scope of indirect emissions, other than Imported Energy with specified/limited list of sources, was defined by tsmc's own pre-determined criteria for significance of indirect emissions, considering the intended use of the GHG inventory The further descriptions for the Reporting Boundary listed in Appendix B.

### Verification Criteria and GHG Programme

The verification was performed on the basis of ISO 14064-1:2018 as well as criteria given to provide for consistent GHG emission identification, calculation, monitoring and reporting. The verification was conducted in accordance with ISO 14066:2011, ISO 14065:2020 and ISO 14064-3:2019.

### Verification Opinion

It is DNV's opinion that the Inventory Report (2023), which was published in March 2024, is free from material discrepancies in accordance with the verification criteria identified as stated above. The reliability of the information within the Inventory Report (2023) were verified with a specific level of assurance as listed below.

- For the Direct (Category 1) and Indirect GHG emissions from imported energy (Category 2), the reliability of the information within the Inventory Report (2023) were verified with reasonable level of assurance.
- For the other indirect GHG emissions, the involved information was verified and tested using agreed-upon procedures, AUP, defined in Inventory Report.

Sophia Kim  
GHG Verifier

Place and date:  
Taipei, 12 April, 2024

For the issuing office:  
**DNV Business Assurance Co., Ltd.**  
29Fl., No. 293, Sec. 2, Wenhua Rd.,  
Banqiao District, New Taipei City 220,  
Taiwan

Management Representative

## Supplement to Verification Opinion

### Process and Methodology

The reviews of the Inventory Report and relevant documents, and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the fulfilment of stated criteria. The Inventory Report correctly complies with the requirement of ISO 14064-1:2018.

### Quantification of Greenhouse Gas Emission

The Inventory Report covering the period 1<sup>st</sup> January 2023 to 31<sup>st</sup> December 2023, it is DNV's opinion that relevant GHG emissions and removals identified within the Reporting Boundary has been included in the Inventory Report as claimed in accordance with the verification criteria identified as stated above, and results in quantification of GHG emissions that are real, transparent, and measurable.

### Organizational Boundary of Verification

Financial Management Control  Operational Management Control  Equity Share

### GHGs Verified

CO<sub>2</sub>  CH<sub>4</sub>  N<sub>2</sub>O  HFCs  PFCs  SF<sub>6</sub>  NF<sub>3</sub>

The Quantification of GHG emissions and removals in Direct and Indirect Emission Source:

Category	tonnes CO <sub>2</sub> -e
1. Direct emissions	1,307,965.7545
2. Indirect GHG emissions from imported energy	10,150,251.6066

\*: Unless other indicated, the Indirect Emissions was calculated based on 2022 electricity emission factor of 0.495 kg CO<sub>2</sub>-e/kwh, which was announced by Bureau of Energy, Ministry of Economic Affairs. The Global Warming Potential (GWP) defined in IPCC AR5 (2013) has been choose and correctly referred by the Organization.

The Quantification of other indirect emissions:

Indirect Emissions Category	Subcategory	tonnes CO <sub>2</sub> -e
Transportation (Category 3)	Not reported	-
Products used by organization (Category 4)	CDP1 Purchased goods and services	4,623,205.0065
	CDP3 Fuel-and-energy-related activities (not included in Scope 1 or 2)	2,060,202.1339
The use of products from the organization (Category 5)	Not reported	-

\*\* :the details subcategory of each category could be refer later in the APPENDIX B.

The greenhouse gas statements of TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD. Greenhouse Gas Inventory Management Report (2023) with respect to each site are verified as listed in Appendix C and D.

The Company avoids carbon emissions from electricity and nature gas usages of all office buildings, 183,282,106 kWh and 2,123,179 cubic meters respectively in 2023, by:

- purchasing 1059.224 million kWh renewable energy electricity together with its certificate T-RECs, equal to avoiding 524,315.88 tonnes CO<sub>2</sub>e emission in 2023;
- purchasing 133,978,961 cubic meters carbon neutral nature gases, equal to avoiding 271,418.3 tonnes CO<sub>2</sub>e emission in 2023.

### Verification Opinion

Verified without Qualification



Appendix A to Verification Opinion No.: C663860-2023-AG-TWN-DNV

## APPENDIX A

The greenhouse gas assertion of TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD. Greenhouse Gas Inventory Management Report (2023) with respect to the following sites:

Site	Address
F2	No. 121 Park Ave. III, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F3	No. 9, Creation Rd. I, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F5	No. 121 Park Ave. III, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F6	No. 1, Nan-Ke North Rd., Tainan Science Park, Tainan, Taiwan, R.O.C.
F8	No. 25, Li-Hsin Rd., Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F3E	No. 6, Creation Rd. II, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P1/2	No. 8, Li-Hsin Rd. VI, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P3	No. 6, Creation Rd. II, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P4/5	No. 168, Park Ave. II, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P6	No. 166, Park Ave. II, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P7	No. 188, Park Ave. II, Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F12 P8	No. 168, Kehuan Rd., Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.
F14A	No. 1-1&1-2, Nan-Ke North Rd., Tainan Science Park, Tainan, Taiwan, R.O.C. No. 5, Section 2, Huanxi Rd., Tainan Science Park, Tainan, Taiwan, R.O.C.
F14B	No. 17, Nan-Ke 9 <sup>th</sup> Rd., Tainan Science Park, Tainan, Taiwan, R.O.C.
F14 P7	No.1, Sanbaozhu Rd., Tainan Science Park, Tainan, Taiwan, R.O.C.
F14 P8	No.1, Sanbaozhu Rd., Tainan Science Park, Tainan, Taiwan, R.O.C. (Phase 8)
F15	No. 1, Keya 6 <sup>th</sup> Rd., Daya Dist., Taichung City, Taiwan, R.O.C.
F15B	No. 1, Xinke Rd., Daya Dist., Taichung City, Taiwan, R.O.C.
F18P1	No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 745, Taiwan, R.O.C.
F18P2	(Phase 2) No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 745, Taiwan, R.O.C.
F18P3	(Phase 3) No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 746, Taiwan, R.O.C.
F18P4	(Phase 4) No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 747, Taiwan, R.O.C.
F18P5	(Phase 5) No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 747, Taiwan, R.O.C.
F18P6	(Phase 6) No. 8, Beiyuan 2nd Rd., Anding Dist., Tainan City 747, Taiwan, R.O.C.
F18P7	(Phase 7) No. 1, North Park Road, Sulinli, Anding District, Tainan City 745, Taiwan, R.O.C.
F18P8	(Phase 8) No. 5, Anshun 1st Road, Shanhua District, Tainan City 741, Taiwan, R.O.C.
AP2B	No. 18-1, Nanke 7th Rd., Shanhua Dist., Tainan City 741014, Taiwan (R.O.C.)
AP2C	(Phase 2)No. 18-1, Nanke 7th Rd., Shanhua Dist., Tainan City 741014, Taiwan (R.O.C.)
AP3	No.101, Longyuan 6th Rd., Longtan Dist., Taoyuan City 325, Taiwan, R.O.C
AP5	No. 5, Keya West Rd., Daya Dist., Taichung City, Taiwan, R.O.C.
AP6	1, Kezhuan 1st Rd., Zhunan Township, Hsinchu Science Park, Miaoli County 350012, Taiwan

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

This Verification Opinion is based on the information made available to us and the engagement conditions detailed above. Hence, DNV cannot guarantee the accuracy or correctness of the information. DNV cannot be held liable by any party relying or acting upon this Verification Opinion.

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DNV ZNATW-OP-F50, Rev.10, 2023-2



## APPENDIX B

### The Reporting Boundary of TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD. Greenhouse Gas Inventory Management Report (2023)

Category	Reporting Boundary
Direct GHG emissions and removals	Mainly from Fluorinated GHG emissions from semiconductor manufacturing, other GHG sources or sinks inside organizational boundaries and that are owned or controlled by the organization
Indirect GHG emissions from imported energy	the amount of greenhouse gas emissions produced by the input of electricity and energy.
Indirect GHG emissions from transportation	Not significant, Not reported
Indirect GHG emissions from products used by the Organization	<ul style="list-style-type: none"> <li>- Upstream (cradle-to-gate) emissions of selected purchased goods, such as main raw material-wafer /auxiliary raw material material/Bulk gas/packaging material. The selection principle and emission factor are from the tsmc's carbon footprint report verified by a third party</li> <li>- Upstream (cradle-to-gate) emissions of purchased fuels (gasoline, diesel, and NG) and electricity</li> </ul>
Indirect GHG emissions associated with the use of products from the Organization	Not significant, Not reported

The scope of indirect emissions, other than Imported Energy with specified/limited list of sources, was defined by tsmc's own pre-determined criteria for significance of indirect emissions, considering the intended use of the GHG inventory

## APPENDIX C

### Quantification of Direct GHG emissions and Indirect GHG emissions from Imported Energy (Tonnes CO<sub>2</sub>-e):

Site	Direct emissions and removals	Indirect GHG emissions from imported energy	Fluorinated GHG emissions from semiconductor manufacturing	Reduced Fluorinated GHG emissions by abatement system
F2	35,502.0630	74,849.1985	32,821.1645	59,025.7881
F3	53,797.2036	161,242.4880	48,719.8215	119,909.2500
F5	36,646.8127	92,205.9467	27,731.3542	38,209.0574
F6	81,885.8056	178,663.7596	53,130.2976	47,141.3386
F8	88,845.3332	172,325.9627	74,495.6639	79,254.6320
F3E	6,570.5479	61,329.9644	3,917.5666	75,610.9500
F12 P1/2	39,056.6980	253,111.3606	21,487.1582	146,694.4930
F12 P3	10,022.2683	130,705.4836	5,278.7170	106,368.6750
F12 P4/5	33,706.3233	310,159.2587	12,541.7247	94,429.4110
F12 P6	18,186.9055	247,313.0880	4,432.6762	71,537.9330
F12 P7	36,198.6079	376,600.7520	10,047.3181	169,474.0800
F12 P8	14,590.9217	211,685.7600	4,496.4715	78,621.9640
F14A	148,518.1751	738,448.9200	83,318.9264	451,951.1860
F14B	71,501.2380	661,885.9286	28,598.5046	244,487.7630
F14 P7	40,205.9355	344,795.6160	23,091.2951	151,972.2060
F14 P8	8,697.8247	127,705.3826	3,768.8510	26,669.5360
F15	126,644.0546	832,044.9925	53,351.8812	606,295.1150
F15B	140,512.7201	1,570,846.4640	63,993.7662	423,482.0090
F18P1	37,468.0585	513,631.9965	20,146.0780	264,765.5010
F18P2	45,794.5224	483,325.9200	27,094.2157	313,008.9070
F18P3	42,725.2688	465,300.0000	28,199.6053	283,370.2700
F18P4	37,347.5008	353,952.1349	19,242.9100	136,789.6770
F18P5	41,783.7255	378,184.4535	24,790.3353	141,290.7700
F18P6	33,948.2395	371,500.3537	19,587.4204	104,170.0050
F18P7	16,720.9262	265,275.6480	5,772.9017	41,402.1540
F18P8	19,524.0122	247,078.9728	8,957.6684	50,021.7590
AP2B	18,450.4039	93,043.7056	12,595.3888	73,049.5790
AP2C	1,137.2807	28,404.7736	524.7801	3,654.2820
AP3	12,737.1590	204,462.7200	696.2531	20,268.1610
AP5	758.8846	88,322.3676	0.0000	0.0000
AP6	8,480.3337	111,848.2339	6,643.0091	24,372.7250
<b>Total</b>	<b>1,307,965.7545</b>	<b>10,150,251.6066</b>	<b>729,473.7244</b>	<b>4,447,299.1771</b>

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

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## APPENDIX D

### Quantification of Indirect GHG emissions from products used by organization(Tonnes CO2-e):

Site	Upstream (cradle-to-gate) emissions of purchased goods	Upstream (cradle-to-gate) emissions of purchased fuels (gasoline, diesel, and NG) and electricity	Total indirect GHG emissions from products used by the Organization
F2	8,968.5419	15,495.2165	24,463.7584
F3	79,404.3450	32,214.0110	111,618.3560
F5	22,955.5722	19,179.1002	42,134.6724
F6	40,019.6445	35,597.4251	75,617.0696
F8	43,918.0624	35,575.8101	79,493.8725
F3E	28,032.2566	12,753.3963	40,785.6529
F12 P1/2	44,061.8805	51,000.3067	95,062.1872
F12 P3	42,208.6662	26,757.9972	68,966.6634
F12 P4/5	101,911.5984	63,857.0232	165,768.6216
F12 P6	78,707.8151	51,699.8018	130,407.6169
F12 P7	86,962.6978	78,617.7462	165,580.4440
F12 P8	43,988.3465	44,673.1581	88,661.5046
F14A	296,299.1358	148,048.1260	444,347.2618
F14B	172,573.1958	133,724.8211	306,298.0169
F14 P7	142,050.3198	69,328.4886	211,378.8084
F14 P8	11,126.0754	26,122.6998	37,248.7752
F15	453,234.4454	166,711.8332	619,946.2786
F15B	464,486.5819	316,758.2638	781,244.8457
F18P1	441,883.4655	103,588.7448	545,472.2103
F18P2	403,352.6693	97,414.4476	500,767.1169
F18P3	388,388.1481	93,282.8806	481,671.0287
F18P4	367,483.0407	73,113.0132	440,596.0539
F18P5	167,777.5298	77,624.1016	245,401.6314
F18P6	162,684.2043	75,791.5252	238,475.7295
F18P7	263,204.1720	54,326.8025	317,530.9745
F18P8	113,866.4124	50,357.9729	164,224.3853
AP2B	77,339.7329	18,720.4617	96,060.1946
AP2C	10,024.0810	5,678.8104	15,702.8914
AP3	63,245.7759	41,982.3997	105,228.1756
AP5	2,615.4045	17,500.5427	20,115.9472
AP6	431.1889	22,705.2061	23,136.3950
<b>Total</b>	<b>4,623,205.0065</b>	<b>2,060,202.1339</b>	<b>6,683,407.1404</b>

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