

# Fluorinated Greenhouse Gas (F-GHGs) Emissions Reduction Declaration for Y2019

Taiwan Semiconductor Manufacturing Company, Ltd. (the "TSMC") has made following efforts to ensure the semiconductor manufacturing process in accordance with the Part A and B of IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays (IEEE Std 1680.1TM-2018) Criterion 4.1.10.2 Optional - Reduce fluorinated greenhouse gas emissions from semiconductor production. The fluorinated greenhouse gas (F-GHG) emissions inventory has been reported and F-GHG emissions have been reduced for all TSMC's 300mm process semiconductor manufacturing facilities, which including [Fab 12A](#), [Fab 12B](#), [Fab 14A](#), [Fab 14B](#), [Fab 15A](#), [Fab 15B](#), [Fab 18](#) and Advanced Backend Fab3 (the "Fabs in scope").

## For Part A

TSMC develops a F-GHG emissions inventory by the method of the IPCC 2006 Tier 2b methodology, multiply the IPCC 2006 Tier 2b emissions by a factor of 1.13 to obtain adjusted IPCC 2006 Tier 2b emissions from etching and chamber cleaning processes with 100-year global warming potentials (GWPs) from the IPCC Fourth Assessment (IPCC AR4). In addition, TSMC annually commissions a third-party to perform a verification of greenhouse gas assertions, including emissions of fluorinated GHGs used in plasma etching/wafer cleaning, chamber cleaning processes and heat transfer fluid use, on the basis of ISO [14064-1: 2016](#), and publicly reports the result on our CSR report.

## For Part B

Our abatement equipment is electrically heated, fuelled-combustion, plasma, and catalytic devices that are specifically designed to abate F-GHGs, are used within the manufacturer's specified process window and in accordance with specified maintenance schedules, and whose DREs have been measured and confirmed under actual process conditions, using a technically sound protocol, which accounts for known measurement errors including, for example,  $CF_4$  by-product formation during  $C_2F_6$  abatement as well as the effect of dilution, the use of oxygen or both in combustion abatement systems.

We calculate that F-GHG emissions based on the equation stated below and the reduction percentage we are adopted is >75% as the fluorinated heat transfer fluids (F-HTFs) are excluded from the reduction assessment.

$$\text{Percent of Total Reduction Emissions} = 100\% \times \left[ 1 - \left[ \frac{\sum TE_{FAB}}{\sum BE_{FAB}} \right] \right]$$

where:

$TE_{FAB}$  is the total emissions per fab in scope calculated using the methodology in Part A.

$BE_{FAB}$  is the baseline emissions per fab calculated using the following equation.

**BE<sub>FAB</sub> equation per fab:**

$$BE_{FAB} = 1.15 \times [(C_{EW} \times WF_{EW}) + (C_{CC} \times WF_{CC})]$$

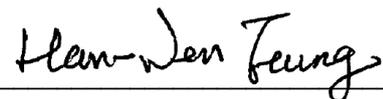
where:

- 1.15** is the factor to account for fluorinated heat transfer fluid emissions (omit if excluding HTFs)
- C<sub>EW</sub>** is the total consumption of all F-GHGs by all etching and wafer cleaning processes within the fab in reporting year.
- WF<sub>EW</sub>** is the weighting factor for etching and wafer cleaning that is **5940**.
- C<sub>CC</sub>** is the total consumption of all F-GHGs by all CVD chamber cleaning processes within the fab in reporting year.
- WF<sub>CC</sub>** is the weighting factor for CVD chamber cleaning that is **8260**.

**F-GHG Reduction Emissions Result for Y2019 to the Fabs in Scope**

Fabs in Scope	Fab 12A	Fab 12B	Fab 14A	Fab 14B	Fab 15A	Fab 15B	Fab 18	Advanced Backend Fab 3
<b>Percentage reduced = 1 - (TE<sub>FAB</sub>/BE<sub>FAB</sub>)</b>	<b>91.9%</b>	<b>97.1%</b>	<b>93.8%</b>	<b>95.9%</b>	<b>96.7%</b>	<b>95.5%</b>	<b>96.7%</b>	<b>90.6%</b>
<b>TE<sub>FAB</sub> (MT CO<sub>2</sub>e)</b>	101,366	16,843	139,950	96,438	77,762	131,845	6,382	2,718
<b>BE<sub>FAB</sub> (MT CO<sub>2</sub>e)</b>	1,255,337	579,810	2,241,763	2,380,852	2,383,877	2,956,904	192,870	29,054
<b>C<sub>EW</sub> (kg)</b>	43,878	23,854	77,665	78,664	65,304	174,906	3,733	4,748
<b>C<sub>CC</sub> (kg)</b>	120,424	53,041	215,549	231,669	241,643	232,199	20,666	103

**Taiwan Semiconductor Manufacturing Company**



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