Annex A: ECCN Categories

The ECCNs listed below have been taken from the US "Commerce Control List" which can be accessed at this link: https://www.ecfr.gov/current/title-15/subtitle-B/chapter-VII/subchapter-C/part-774

3B001 Equipment for the manufacturing of semiconductor devices or materials, as follows (see List of Items Controlled) and "specially designed" "components" and "accessories"

Items:

a. Equipment designed for epitaxial growth as follows:

a.1. Equipment designed or modified to produce a layer of any material other than silicon with a thickness uniform to less than ± 2.5% across a distance of 75 mm or more;

Note:

3B001.a.1 includes atomic layer epitaxy (ALE) equipment.

a.2. Metal Organic Chemical Vapor Deposition (MOCVD) reactors designed for compound semiconductor epitaxial growth of material having two or more of the following elements: aluminum, gallium, indium, arsenic, phosphorus, antimony, or nitrogen;

a.3. Molecular beam epitaxial growth equipment using gas or solid sources;

b. Equipment designed for ion implantation and having any of the following:

b.1. [Reserved]

b.2. Being designed and optimized to operate at a beam energy of 20 keV or more and a beam current of 10 mA or more for hydrogen, deuterium, or helium implant;

b.3. Direct write capability;

b.4. A beam energy of 65 keV or more and a beam current of 45 mA or more for high energy oxygen implant into a heated semiconductor material "substrate"; *or*

b.5. Being designed and optimized to operate at beam energy of 20keV or more and a beam current of 10mA or more for silicon implant into a semiconductor material "substrate" heated to 600 °C or greater;

c. [Reserved]

d. [Reserved]

e. Automatic loading multi-chamber central wafer handling systems having all of the following:

e.1. Interfaces for wafer input and output, to which more than two functionally different 'semiconductor process tools' controlled by 3B001.a.1, 3B001.a.2, 3B001.a.3 or 3B001.b are designed to be connected; *and*

e.2. Designed to form an integrated system in a vacuum environment for 'sequential multiple wafer processing';

Note:

3B001.e does not control automatic robotic wafer handling systems "specially designed" for parallel wafer processing.

Technical Notes:

1. For the purpose of 3B001.e, 'semiconductor process tools' refers to modular tools that provide physical processes for semiconductor production that are functionally different, such as deposition, implant or thermal processing.

2. For the purpose of 3B001.e, 'sequential multiple wafer processing' means the capability to process each wafer in different 'semiconductor process tools', such as by transferring each wafer from one tool to a second tool and on to a third tool with the automatic loading multi-chamber central wafer handling systems.

f. Lithography equipment as follows:

f.1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods and having any of the following:

f.1.a. A light source wavelength shorter than 193 nm; *or*

f.1.b. Capable of producing a pattern with a "Minimum Resolvable Feature size" (MRF) of 45 nm or less;

Technical Note:

The 'Minimum Resolvable Feature size' (MRF) is calculated by the following formula:

$$MRF = \frac{(\text{an exposure light source wavelength in nm}) \times (K \text{ factor})}{\text{numerical aperture}}$$

where the K factor = 0.35

f.2 Imprint lithography equipment capable of production features of 45 nm or less;

Note:

3B001.f.2 includes:

- *Micro contact printing tools*

- *Hot embossing tools*

- *Nano-imprint lithography tools*

- *Step and flash imprint lithography (S-FIL) tools*

f.3. Equipment "specially designed" for mask making having all of the following:

f.3.a. A deflected focused electron beam, ion beam or "laser" beam; *and*

f.3.b. Having any of the following:

f.3.b.1. A Full-Width Half-Maximum (FWHM) spot size smaller than 65 nm and an image placement less than 17 nm (mean + 3 sigma); *or*

f.3.b.2. [Reserved]

f.3.b.3. A second-layer overlay error of less than 23 nm (mean + 3 sigma) on the mask;

f.4. Equipment designed for device processing using direct writing methods, having all of the following:

f.4.a. A deflected focused electron beam; *and*

f.4.b. Having any of the following:

f.4.b.1. A minimum beam size equal to or smaller than 15 nm; *or*

f.4.b.2. An overlay error less than 27 nm (mean + 3 sigma);

g. Masks and reticles, designed for integrated circuits controlled by 3A001;

h. Multi-layer masks with a phase shift layer not specified by 3B001.g and designed to be used by lithography equipment having a light source wavelength less than 245 nm;

Note:

3B001.h. does not control multi-layer masks with a phase shift layer designed for the fabrication of memory devices not controlled by 3A001.

N.B.:

For masks and reticles, "specially designed" for optical sensors, see 6B002.

i. Imprint lithography templates designed for integrated circuits by 3A001;

j. Mask "substrate blanks" with multilayer reflector structure consisting of molybdenum and silicon, and having all of the following:

j.1. "Specially designed" for 'Extreme Ultraviolet (EUV)' lithography; *and*

j.2. Compliant with SEMI Standard P37.

Technical Note:

'Extreme Ultraviolet (EUV)' refers to electromagnetic spectrum wavelengths greater than 5 nm and less than 124 nm.

3B002 Test equipment "specially designed" for testing finished or unfinished semiconductor devices as follows (see List of Items Controlled) and "specially designed" "components" and "accessories"

Items: a. For testing S-parameters of items specified by 3A001.b.3;

b. [Reserved]

c. For testing microwave integrated circuits controlled by 3A001.b.2.

3B090 Semiconductor manufacturing equipment, not Controlled by 3B001, as follows (see List of Items Controlled) and "specially designed" "parts," "components," and "accessories"

Items:

a. Semiconductor manufacturing deposition equipment, as follows:

a.1. Equipment for depositing cobalt through electroplating processes.

a.2. Chemical vapor deposition equipment capable of deposition of cobalt or tungsten fill metal having a void/seam having a largest dimension less than or equal to 3 nm in the fill metal using a bottom-up fill process.

a.3 Equipment capable of fabricating a metal contact within one processing chamber by:

a.3.a. Depositing a layer using an organometallic tungsten compound while maintaining the wafer substrate temperature between 100 °C and 500 °C; and

a.3.b. Conducting a plasma process where the chemistries include hydrogen, including H_2+N_2 and NH_3.

a.4. Equipment capable of fabricating a metal contact in a vacuum environment by:

a.4.a. Using a surface treatment during a plasma process where the chemistries include hydrogen, including H_2, H_2+N_2, and NH_3, while maintaining the wafer substrate temperature between 100 °C and 500 °C;

a.4.b. Using a surface treatment consisting of a plasma process where the chemistries include oxygen (including O_2 and O_3) while maintaining the wafer substrate temperature between 40 °C and 500 °C; and

a.4.c. Depositing a tungsten layer while maintaining the wafer substrate temperature between 100 °C and 500 °C.

a.5. Equipment capable of depositing a cobalt metal layer selectively in a vacuum environment where the first step uses a remote plasma generator and an ion filter, and the second step is the deposition of the cobalt layer using an organometallic compound.

Note:

This control does not apply to equipment that is non-selective.

a.6. Physical vapor deposition equipment capable of depositing a cobalt layer with a thickness of 10 nm or less on a top surface of a copper or cobalt metal interconnect.

a.7. Atomic layer deposition equipment capable of depositing a 'work function metal' for the purpose of adjusting transistor electrical parameters by delivering an organometallic aluminum compound and a titanium halide compound onto a wafer substrate.

Technical note:

'Work function metal' is a material that controls the threshold voltage of a transistor.

a.8. Equipment capable of fabricating a metal contact in a vacuum environment by depositing all of the following:

a.8.a. A titanium nitride (TiN) or tungsten carbide (WC) layer using an organometallic compound while maintaining the wafer substrate temperature between 20 °C and 500 °C;

a.8.b. A cobalt layer using a physical sputter deposition technique where the process pressure is 1-100 mTorr while maintaining the wafer substrate temperature below 500 °C; and

a.8.c. A cobalt layer using an organometallic compound, where the process pressure is 1-100 Torr, and the wafer substrate temperature is maintained between 20 °C and 500 °C.

a.9. Equipment capable of fabricating copper metal interconnects in a vacuum environment that deposits all of the following:

a.9.a. A cobalt or ruthenium layer using organometallic compound where the process pressure is 1-100 Torr, and the wafer substrate temperature is maintained between 20 °C and 500 °C; and

a.9.b. A copper layer using a physical vapor deposition technique where the process pressure is 1-100m Torr and the wafer substrate temperature is maintained below 500 °C.

a.10. Equipment capable of area selective deposition of a barrier or liner using an organometallic compound.

Note:

3B090.a.10 includes equipment capable of area selective deposition of a barrier layer to enable fill metal contact to an underlying electrical conductor without a barrier layer at the fill metal via interface to an underlying electrical conductor.

a.11. Atomic layer deposition equipment capable of producing a void/seam free fill of tungsten or cobalt in a structure having an aspect ratio greater than 5:1, with openings smaller than 40 nm, and at temperatures less than 500 °C.

3B611 Test, inspection, and production commodities for military electronics, as follows (see List of Items Controlled)

Items: a. Test, inspection, and production end items and equipment "specially designed" for the "development," "production," repair, overhaul or refurbishing of items controlled in ECCN 3A611 (except 3A611.y) or USML Category XI that are not enumerated in USML Category XI or controlled by another "600 series" ECCN.

b. through w. [Reserved]

x. "Parts," "components," "accessories" and "attachments" that are "specially designed" for a commodity listed in this entry and that are not enumerated on the USML or controlled by another "600 series" ECCN.

3B991 Equipment, not controlled by 3B001 or 3B090, for the manufacture of electronic "parts," "components" and materials, and "specially designed" "parts," "components" and "accessories"

List of Items Controlled

Related Controls: N/A

Related Definitions: 'Sputtering' is an overlay coating process wherein positively charged ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on the substrate. (Note: Triode, magnetron or radio frequency sputtering to increase adhesion of coating and rate of deposition are ordinary modifications of the process.)

Items:

a. Equipment "specially designed" for the manufacture of electron tubes, optical elements and "specially designed" "parts" and "components" therefor controlled by 3A001 or 3A991;

b. Equipment "specially designed" for the manufacture of semiconductor devices, integrated circuits and "electronic assemblies", as follows, and systems incorporating or having the characteristics of such equipment:

Note:

3B991.b also controls equipment used or modified for use in the manufacture of other devices, such as imaging devices, electro-optical devices, acoustic-wave devices.

b.1. Equipment for the processing of materials for the manufacture of devices, "parts" and "components" as specified in the heading of 3B991.b, as follows:

Note:

3B991 does not control quartz furnace tubes, furnace liners, paddles, boats (except "specially designed" caged boats), bubblers, cassettes or crucibles "specially designed" for the processing equipment controlled by 3B991.b.1.

b.1.a. Equipment for producing polycrystalline silicon and materials controlled by 3C001;

b.1.b. Equipment "specially designed" for purifying or processing III/V and II/VI semiconductor materials controlled by 3C001, 3C002, 3C003, 3C004, or 3C005 except crystal pullers, for which see 3B991.b.1.c below;

b.1.c. Crystal pullers and furnaces, as follows:

Note:

3B991.b.1.c does not control diffusion and oxidation furnaces.

b.1.c.1. Annealing or recrystallizing equipment other than constant temperature furnaces employing high rates of energy transfer capable of processing wafers at a rate exceeding 0.005 m^2 per minute;

b.1.c.2. "Stored program controlled" crystal pullers having any of the following characteristics:

b.1.c.2.a. Rechargeable without replacing the crucible container;

b.1.c.2.b. Capable of operation at pressures above 2.5×10^5 Pa; *or*

b.1.c.2.c. Capable of pulling crystals of a diameter exceeding 100 mm;

b.1.d. "Stored program controlled" equipment for epitaxial growth having any of the following characteristics:

b.1.d.1. Capable of producing silicon layer with a thickness uniform to less than ±2.5% across a distance of 200 mm or more;

b.1.d.2. Capable of producing a layer of any material other than silicon with a thickness uniformity across the wafer of equal to or better than ± 3.5%; *or*

b.1.d.3. Rotation of individual wafers during processing;

b.1.e. Molecular beam epitaxial growth equipment;

b.1.f. Magnetically enhanced 'sputtering' equipment with "specially designed" integral load locks capable of transferring wafers in an isolated vacuum environment;

b.1.g. Equipment "specially designed" for ion implantation, ion-enhanced or photo-enhanced diffusion, having any of the following characteristics:

b.1.g.1. Patterning capability;

b.1.g.2. Beam energy (accelerating voltage) exceeding 200 keV;

b.1.g.3 Optimized to operate at a beam energy (accelerating voltage) of less than 10 keV; *or*

b.1.g.4. Capable of high energy oxygen implant into a heated "substrate";

b.1.h. "Stored program controlled" equipment for the selective removal (etching) by means of anisotropic dry methods (*e.g.,* plasma), as follows:

b.1.h.1. Batch types having either of the following:

b.1.h.1.a. End-point detection, other than optical emission spectroscopy types; *or*

b.1.h.1.b. Reactor operational (etching) pressure of 26.66 Pa or less;

b.1.h.2. Single wafer types having any of the following:

b.1.h.2.a. End-point detection, other than optical emission spectroscopy types;

b.1.h.2.b. Reactor operational (etching) pressure of 26.66 Pa or less; *or*

b.1.h.2.c. Cassette-to-cassette and load locks wafer handling;

Notes:

1. "Batch types" refers to machines not "specially designed" for production processing of single wafers. Such machines can process two or more wafers simultaneously with common process parameters, e.g., RF power, temperature, etch gas species, flow rates.

2. "Single wafer types" refers to machines "specially designed" for production processing of single wafers. These machines may use automatic wafer handling techniques to load a single wafer into the equipment for processing. The definition includes equipment that can load and process several wafers but where the etching parameters, e.g., RF power or end point, can be independently determined for each individual wafer.

b.1.i. "Chemical vapor deposition" (CVD) equipment, *e.g.,* plasma-enhanced CVD (PECVD) or photo-enhanced CVD, for semiconductor device manufacturing, having either of the following capabilities, for deposition of oxides, nitrides, metals or polysilicon:

b.1.i.1. "Chemical vapor deposition" equipment operating below 10^5 Pa; *or*

b.1.i.2. PECVD equipment operating either below 60 Pa (450 millitorr) or having automatic cassette-to-cassette and load lock wafer handling;

Note:

3B991.b.1.i does not control low pressure "chemical vapor deposition" (LPCVD) systems or reactive "sputtering" equipment.

b.1.j. Electron beam systems "specially designed" or modified for mask making or semiconductor device processing having any of the following characteristics:

b.1.j.1. Electrostatic beam deflection;

b.1.j.2. Shaped, non-Gaussian beam profile;

b.1.j.3. Digital-to-analog conversion rate exceeding 3 MHz;

b.1.j.4. Digital-to-analog conversion accuracy exceeding 12 bit; *or*

b.1.j.5. Target-to-beam position feedback control precision of 1 micrometer or finer;

Note:

3B991.b.1.j does not control electron beam deposition systems or general purpose scanning electron microscopes.

b.1.k. Surface finishing equipment for the processing of semiconductor wafers as follows:

b.1.k.1. "Specially designed" equipment for backside processing of wafers thinner than 100 micrometer and the subsequent separation thereof; *or*

b.1.k.2. "Specially designed" equipment for achieving a surface roughness of the active surface of a processed wafer with a two-sigma value of 2 micrometer or less, total indicator reading (TIR);

Note:

3B991.b.1.k does not control single-side lapping and polishing equipment for wafer surface finishing.

b.1.l. Interconnection equipment which includes common single or multiple vacuum chambers "specially designed" to permit the integration of any equipment controlled by 3B991 into a complete system;

b.1.m. "Stored program controlled" equipment using "lasers" for the repair or trimming of "monolithic integrated circuits" with either of the following characteristics:

b.1.m.1. Positioning accuracy less than ± 1 micrometer; *or*

b.1.m.2. Spot size (kerf width) less than 3 micrometer.

b.2. Masks, mask "substrates," mask-making equipment and image transfer equipment for the manufacture of devices, "parts" and "components" as specified in the heading of 3B991, as follows:

Note:

The term "masks" refers to those used in electron beam lithography, X-ray lithography, and ultraviolet lithography, as well as the usual ultraviolet and visible photo-lithography.

b.2.a. Finished masks, reticles and designs therefor, except:

b.2.a.1. Finished masks or reticles for the production of unembargoed integrated circuits; *or*

b.2.a.2. Masks or reticles, having both of the following characteristics:

b.2.a.2.a. Their design is based on geometries of 2.5 micrometer or more; *and*

b.2.a.2.b. The design does not include special features to alter the intended use by means of production equipment or "software";

b.2.b. Mask "substrates" as follows:

b.2.b.1. Hard surface (*e.g.,* chromium, silicon, molybdenum) coated "substrates" (*e.g.,* glass, quartz, sapphire) for the preparation of masks having dimensions exceeding 125 mm x 125 mm; *or*

b.2.b.2. "Substrates" "specially designed" for X-ray masks;

b.2.c. Equipment, other than general purpose computers, "specially designed" for computer aided design (CAD) of semiconductor devices or integrated circuits;

b.2.d. Equipment or machines, as follows, for mask or reticle fabrication:

b.2.d.1. Photo-optical step and repeat cameras capable of producing arrays larger than 100 mm x 100 mm, or capable of producing a single exposure larger than 6 mm x 6 mm in the image (*i.e.,* focal) plane, or capable of producing line widths of less than 2.5 micrometer in the photoresist on the "substrate";

b.2.d.2. Mask or reticle fabrication equipment using ion or "laser" beam lithography capable of producing line widths of less than 2.5 micrometer; *or*

b.2.d.3. Equipment or holders for altering masks or reticles or adding pellicles to remove defects;

Note:

3B991.b.2.d.1 and b.2.d.2 do not control mask fabrication equipment using photo-optical methods which was either commercially available before the 1st January, 1980, or has a performance no better than such equipment.

b.2.e. "Stored program controlled" equipment for the inspection of masks, reticles or pellicles with:

b.2.e.1. A resolution of 0.25 micrometer or finer; *and*

b.2.e.2. A precision of 0.75 micrometer or finer over a distance in one or two coordinates of 63.5 mm or more;

Note:

3B991.b.2.e does not control general purpose scanning electron microscopes except when "specially designed" and instrumented for automatic pattern inspection.

b.2.f. Align and expose equipment for wafer production using photo-optical or X-ray methods, *e.g.,* lithography equipment, including both projection image transfer equipment and step and repeat (direct

step on wafer) or step and scan (scanner) equipment, capable of performing any of the following functions:

Note:

3B991.b.2.f does not control photo-optical contact and proximity mask align and expose equipment or contact image transfer equipment.

b.2.f.1. Production of a pattern size of less than 2.5 micrometer;

b.2.f.2. Alignment with a precision finer than ± 0.25 micrometer (3 sigma);

b.2.f.3. Machine-to-machine overlay no better than ± 0.3 micrometer; *or*

b.2.f.4. A light source wavelength shorter than 400 nm;

b.2.g. Electron beam, ion beam or X-ray equipment for projection image transfer capable of producing patterns less than 2.5 micrometer;

Note:

For focused, deflected-beam systems(direct write systems), see 3B991.b.1.j or b.10.

b.2.h. Equipment using "lasers" for direct write on wafers capable of producing patterns less than 2.5 micrometer.

b.3. Equipment for the assembly of integrated circuits, as follows:

b.3.a. "Stored program controlled" die bonders having all of the following characteristics:

b.3.a.1. "Specially designed" for "hybrid integrated circuits";

b.3.a.2. X-Y stage positioning travel exceeding 37.5 x 37.5 mm; *and*

b.3.a.3. Placement accuracy in the X-Y plane of finer than ± 10 micrometer;

b.3.b. "Stored program controlled" equipment for producing multiple bonds in a single operation (*e.g.,* beam lead bonders, chip carrier bonders, tape bonders);

b.3.c. Semi-automatic or automatic hot cap sealers, in which the cap is heated locally to a higher temperature than the body of the package, "specially designed" for ceramic microcircuit packages controlled by 3A001 and that have a throughput equal to or more than one package per minute.

Note:

3B991.b.3 does not control general purpose resistance type spot welders.

b.4. Filters for clean rooms capable of providing an air environment of 10 or less particles of 0.3 micrometer or smaller per 0.02832 m^3 and filter materials therefor.

3B992 Equipment not controlled by 3B002 for the inspection or testing of electronic "components" and materials, (see List of Items Controlled) and "specially designed" "parts," "components" and "accessories"

List of Items Controlled

Related Controls: See also 3A992.a.

Related Definitions: N/A

Items: a. Equipment "specially designed" for the inspection or testing of electron tubes, optical elements and "specially designed" "parts" and "components" therefor controlled by 3A001 or 3A991;

b. Equipment "specially designed" for the inspection or testing of semiconductor devices, integrated circuits and "electronic assemblies", as follows, and systems incorporating or having the characteristics of such equipment:

Note:

3B992.b also controls equipment used or modified for use in the inspection or testing of other devices, such as imaging devices, electro-optical devices, acoustic-wave devices.

b.1. "Stored program controlled" inspection equipment for the automatic detection of defects, errors or contaminants of 0.6 micrometer or less in or on processed wafers, "substrates", other than printed circuit boards or chips, using optical image acquisition techniques for pattern comparison;

Note:

3B992.b.1 does not control general purpose scanning electron microscopes, except when "specially designed" and instrumented for automatic pattern inspection.

b.2. "specially designed" "stored program controlled" measuring and analysis equipment, as follows:

b.2.a. "specially designed" for the measurement of oxygen or carbon content in semiconductor materials;

b.2.b. Equipment for line width measurement with a resolution of 1 micrometer or finer;

b.2.c. "specially designed" flatness measurement instruments capable of measuring deviations from flatness of 10 micrometer or less with a resolution of 1 micrometer or finer.

b.3. "Stored program controlled" wafer probing equipment having any of the following characteristics:

b.3.a. Positioning accuracy finer than 3.5 micrometer;

b.3.b. Capable of testing devices having more than 68 terminals; *or*

b.3.c. Capable of testing at a frequency exceeding 1 GHz;

b.4. Test equipment as follows:

b.4.a. "Stored program controlled" equipment "specially designed" for testing discrete semiconductor devices and unencapsulated dice, capable of testing at frequencies exceeding 18 GHz;

Technical Note:

Discrete semiconductor devices include photocells and solar cells.

b.4.b. "Stored program controlled" equipment "specially designed" for testing integrated circuits and "electronic assemblies" thereof, capable of functional testing:

b.4.b.1. At a 'pattern rate' exceeding 20 MHz; *or*

b.4.b.2. At a 'pattern rate' exceeding 10 MHz but not exceeding 20 MHz and capable of testing packages of more than 68 terminals.

Notes:

3B992.b.4.b does not control test equipment "specially designed" for testing:

1. memories;

2. "Assemblies" or a class of "electronic assemblies" for home and entertainment applications; and

3. Electronic "parts," "components," "assemblies" and integrated circuits not controlled by 3A001 or 3A991 provided such test equipment does not incorporate computing facilities with "user accessible programmability".

Technical Note:

For purposes of 3B992.b.4.b, 'pattern rate' is defined as the maximum frequency of digital operation of a tester. It is therefore equivalent to the highest data rate that a tester can provide in non-multiplexed mode. It is also referred to as test speed, maximum digital frequency or maximum digital speed.

b.4.c. Equipment "specially designed" for determining the performance of focal-plane arrays at wavelengths of more than 1,200 nm, using "stored program controlled" measurements or computer aided evaluation and having any of the following characteristics:

b.4.c.1. Using scanning light spot diameters of less than 0.12 mm;

b.4.c.2. Designed for measuring photosensitive performance parameters and for evaluating frequency response, modulation transfer function, uniformity of responsivity or noise; *or*

b.4.c.3. Designed for evaluating arrays capable of creating images with more than 32 × 32 line elements;

b.5. Electron beam test systems designed for operation at 3 keV or below, or "laser" beam systems, for non-contactive probing of powered-up semiconductor devices having any of the following:

b.5.a. Stroboscopic capability with either beam blanking or detector strobing;

b.5.b. An electron spectrometer for voltage measurements with a resolution of less than 0.5 V; *or*

b.5.c. Electrical tests fixtures for performance analysis of integrated circuits;

Note:

3B992.b.5 does not control scanning electron microscopes, except when "specially designed" and instrumented for non-contactive probing of a powered-up semiconductor device.

b.6. "Stored program controlled" multifunctional focused ion beam systems "specially designed" for manufacturing, repairing, physical layout analysis and testing of masks or semiconductor devices and having either of the following characteristics:

b.6.a. Target-to-beam position feedback control precision of 1 micrometer or finer; *or*

b.6.b. Digital-to-analog conversion accuracy exceeding 12 bit;

b.7. Particle measuring systems employing "lasers" designed for measuring particle size and concentration in air having both of the following characteristics:

b.7.a. Capable of measuring particle sizes of 0.2 micrometer or less at a flow rate of 0.02832 m^3 per minute or more; *and*

b.7.b. Capable of characterizing Class 10 clean air or better.

Parts "3D" and "3E"

D. "Software"

3D001 "Software" "specially designed" for the "development" or "production" of commodities controlled by 3A001.b to 3A002.h, 3A090, or 3B (except 3B001.a.4, c, d, f.1, f.5, k to n, p.2, p.4, r, 3B002.c, 3B903, 3B904, 3B991, 3B992, 3B993, or 3B994).

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to "software" for equipment controlled by 3B001.q	Worldwide control. *See § 742.4(a)(5) and (b)(10) of the EAR.*
RS applies to "software" for equipment controlled by 3B001.q	Worldwide control. *See § 742.6(a)(10) and (b)(11) of the EAR.*
NS applies to "software" for commodities controlled by 3A001.b to 3A001.h, 3A001.z, and 3B (except as specified in the heading)	NS Column 1.
RS applies to "software" for commodities controlled by 3A001.z.1.a, z.2.a, z.3.a, z.4.a and 3A090.a	To or within any destination worldwide. *See* § 742.6(a)(6)(iii)(A) of the EAR.
RS applies to "software" for commodities controlled by 3A001.z. 1.b, z.2.b, z.3.b, z.4.b and 3A090.b	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. *See* § 742.6(a)(6)(iii)(B) of the EAR.
RS applies to "software" for commodities controlled by 3A090.c	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. *See* § 742.6(a)(6)(i) of the EAR.
AT applies to entire entry	AT Column 1.

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes, except for "software" "specially designed" for the "development" or "production" of Traveling Wave Tube Amplifiers described in 3A001.b.8 having operating frequencies exceeding 18 GHz; or commodities specified in 3A090.

AIA: Yes for "software" for commodities controlled by 3A001.z.1.a, z.2.a, z.3.a, z.4.a, and 3A090.a

ACM: Yes for "software" for commodities controlled by 3A001.z

Note:

See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for ECCN 3D001 "software" for commodities controlled by 3A001.z and 3A090.

IEC: Yes, for "software" for equipment controlled by 3B001.q, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" "specially designed" for the "development" or "production" of equipment specified by 3A090.a or 3B001. q to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR); and 3A090.b or 3A002.g.1 to any of the destinations listed in Country Group A:6.

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D002 "Software" "specially designed" for the "use" of equipment controlled by 3B001.a to .f, or 3B002.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1.
NS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

License Requirements Note:

See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes, except N/A for RS.

IEC: Yes, for "software" for equipment controlled by 3B001.c.1.a and 3B001.c.1.c, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" "specially designed" for the "use" of equipment specified by 3B001.c.1.a or c.1.b to any of the destinations listed in Country Group A:5 or A:6 (See supplement no.1 to part 740 of the EAR)

List of Items Controlled

Related Controls: Also see 3D991.

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D003 'Computational lithography' "software" "specially designed" for the "development" of patterns on "EUV"-lithography masks or reticles.

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes

List of Items Controlled

Related Controls: N/A

Related Definitions: For the purposes of 3D003, 'computational lithography' is the use of computer modelling to predict, correct, optimize and verify imaging performance of the lithography process over a range of patterns, processes, and system conditions.

Items:

The list of items controlled is contained in the ECCN heading.

3D004 "Software" "specially designed" for the "development" of equipment controlled by 3A003.

License Requirements

Reason for Control: NS, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: Yes

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D005 "Software" "specially designed" to restore normal operation of a microcomputer, "microprocessor microcircuit" or "microcomputer microcircuit" within 1 ms after an Electromagnetic Pulse (EMP) or Electrostatic Discharge (ESD) disruption, without loss of continuation of operation.

License Requirements

Reason for Control: NS, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

The list of items controlled is contained in the ECCN heading.

3D006 ' Electronic Computer-Aided Design ' (' ECAD ') " software" "specially designed" for the "development" of integrated circuits having any "Gate-All-Around Field-Effect Transistor " (" GAAFET ") structure, and having any of the following (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (see supp. No. 1 to part 738)
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for Description of All License Exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. "Specially designed" for implementing 'Register Transfer Level' ('RTL') to 'Geometrical Database Standard II' ('GDSII') or equivalent standard; *or*

b. "Specially designed" for optimization of power or timing rules.

Technical Notes:

For the purposes of 3D006:

1. 'Electronic Computer-Aided Design' ('ECAD') is a category of "software" tools used for designing, analyzing, optimizing, and validating the performance of an integrated circuit or printed circuit board.

2. 'Register Transfer Level' ('RTL') is a design abstraction which models a synchronous digital circuit in terms of the flow of digital signals between hardware registers and the logical operations performed on those signals.

3. 'Geometrical Database Standard II' ('GDSII') is a database file format for data exchange of integrated circuit or integrated circuit layout artwork.

3D101 "Software" "specially designed" or modified for the "use" of equipment controlled by 3A101.b.

License Requirements

Reason for Control: MT, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D201 "Software" "specially designed" for the "use" of equipment described in ECCN 3A225.

License Requirements

Reason for Control: NP, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NP applies to entire entry	NP Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: See ECCN 3E202 ("development," "production," and "use") for "technology" for items controlled under this entry.

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D202 "Software" "specially designed" to enhance or release the performance characteristics of frequency changers or generators to meet or exceed the level of the performance characteristics described in ECCN 3A225.

License Requirements

Reason for Control: NP, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NP applies to entire entry	NP Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: See ECCN 3E202 ("development," "production," and "use") for "technology" for items controlled under this entry.

Related Definitions: N/A

Items: a. "Software" or encryption keys/codes "specially designed" to enhance or release the performance characteristics of equipment not controlled by ECCN 3A225, so that such equipment meets or exceeds the performance characteristics of equipment controlled by that ECCN.

b. "Software" "specially designed" to enhance or release the performance characteristics of equipment controlled by ECCN 3A225.

3D611 "Software" "specially designed" for military electronics, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT, UN

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry except 3D611.y	NS Column 1.
RS applies to entire entry except 3D611.y	RS Column 1.
RS applies to 3D611.y	China, Russia, or Venezuela (see § 742.6(a)(7)).
AT applies to entire entry	AT Column 1.

Control(s)	Country chart (see Supp. No. 1 to part 738)
UN applies to entire entry except 3D611.y	See § 746.1(b) for UN controls.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: 1. Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any "software" in 3D611.

2. Except for "build-to-print" software, License Exception STA is not eligible for software enumerated in ECCN 3D611.b.

List of Items Controlled

Related Controls: "Software" directly related to articles enumerated in USML Category XI is controlled in USML Category XI(d).

Related Definitions: N/A

Items:

a. "Software" "specially designed" for the "development," "production," operation, or maintenance of commodities controlled by ECCN 3A611 (other than 3A611.y) and 3B611.

b. "Software" "specially designed" for the "development," "production," operation or maintenance of technology in ECCN 3E611.b.

c. through x. [Reserved]

y. "Software" "specially designed" for the "production," "development," operation or maintenance of commodities enumerated in ECCNs 3A611.y.

3D901 "Software", not specified elsewhere, "specially designed" or modified for the "development" or "production" of items specified in ECCN 3A901.b, 3B903, or 3B904.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	Worldwide control. *See § 742.4(a)(5) and (b)(10) of the EAR.*

Control(s)	Country chart (see Supp. No. 1 to part 738)
RS applies to entire entry	Worldwide control. *See § 742.6(a)(10) and (b)(11) of the EAR.*
AT applies to entire entry	AT Column 1.

Special Reporting: Deemed exports and deemed reexports of "software" specified in this ECCN for commodities in ECCNs 3A901.b, and 3B904 are subject to reporting requirements in accordance with § 743.8 of the EAR.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D907 "Software" designed to extract "GDSII" or equivalent standard layout data and perform layer-to-layer alignment from SEM images, and generate multi-layer "GDSII" data or the circuit netlist.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	Worldwide control. *See § 742.4(a)(5) and (b)(10) of the EAR.*
RS applies to the entire entry	Worldwide control. *See § 742.6(a)(10) and (b)(11) of the EAR.*
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: An example of an equivalent standard to "GDSII" would be Open Artwork System Interchange Standard (OASIS).

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D980 "Software" "specially designed" for the "development," "production" or "use" of commodities controlled by 3A980 and 3A981.

License Requirements

Reason for Control: CC, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
CC applies to entire entry	CC Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D991 "Software" "specially designed" for the "development," "production" or "use" of electronic devices, "parts" or "components" controlled by 3A991, general purpose electronic equipment controlled by 3A992, or manufacturing and test equipment controlled by 3B991 and 3B992; or "software" "specially designed" for the "use" of equipment controlled by 3B001.g and .h.

License Requirements

Reason for Control: AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
AT applies to entire entry	AT Column 1

License Requirements Note:

See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3D992 "Software" for the "development" or "production" of commodities specified in 3B001.a.4, c, d, f.1, f.5, f.6, k to n, p.2, p.4, r, or 3B002.c and "software" as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to the entire entry	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. *See* § 742.4(a)(4) of the EAR.

Control(s)	Country Chart (see Supp. No. 1 to part 738)
RS applies to the entire entry	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(6)(i) of the EAR.
NS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, for "software" for equipment controlled by 3B001.c.1.a and 3B001.c.1.c, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See supplement no.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: For additional controls that apply to this ECCN, see also § 744.11(a)(2)(v) and (a)(3) and § 744.23(a)(4)(iii) of the EAR.

Related Definitions: N/A

Items:

a. "Software" "specially designed" for the "development" or "production," of commodities specified in 3B001.a.4, c, d, f.1, f.5, f.6, k to n, p.2, p.4, r, or 3B002.c.

b. 'Electronic Computer-Aided Design' ('ECAD') "software" designed for the integration of multiple dies into a 'multi-chip' integrated circuit, and having all of the following:

b.1. Floor planning; *and*

b.2. Co-design or co-simulation of die and package.

Technical Note:

For the purposes of 3D992.b, 'multi-chip' includes multi-die and multi-chiplet.

c. "Software" not specified by 3D992.a designed or modified to perform all of the following in or with deep-ultraviolet immersion photolithography equipment:

c.1. Decrease the minimum resolvable feature specified by 3B001.f.1.b; and

c.2. Decrease the maximum 'dedicated chuck overlay' of deep-ultraviolet immersion lithography equipment below or equal to 1.5 nm.

3D993 "Software" for the "development" or "production" of commodities specified in 3B993 and "software" as follows (see List of Items Controlled).

License Requirements

Reason for Control: RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
RS applies to entire entry	See § 742.6(a)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (see supplement no.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: For additional controls that apply to this ECCN, see also § 744.11(a)(2)(v) and (a)(3) and § 744.23(a)(4)(iii) of the EAR.

Related Definitions: N/A

Items:

a. "Software" "specially designed" for the "development" or "production" of commodities specified in 3B993.

b. 'Electronic Computer-Aided Design' ('ECAD') "software" designed or modified for the "development" or "production" of integrated circuits using multipatterning.

c. 'Computational lithography' "software" designed or modified for the "development" or "production" of patterns on DUV lithography masks or reticles.

Technical Note:

For the purposes of 3D993, 'computational lithography' is the use of computer modelling to predict, correct, optimize and verify imaging performance of the lithography process over a range of patterns, processes, and system conditions.

d. "Software" designed or modified to increase the number of wafers processed per hour, averaged over any time interval, by greater than 1%, of equipment specified in 3B001.f.1 or 3B993.f.1.

e. "Software" not specified by 3D993.a designed or modified to perform all of the following in or with deep-ultraviolet immersion photolithography equipment:

e.1. Decrease the minimum resolvable feature specified by 3B993.f.1.b.1; *and*

e.2. Decrease the maximum 'dedicated chuck overlay' of deep-ultraviolet immersion lithography equipment above 1.5 nm and below or equal to 2.4 nm.

3D994 "Software" "specially designed" for the "development" or "production" of commodities specified in 3B994 and "software" as follows (see List of Items Controlled).

License Requirements

Reason for Control: RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
RS applies to entire entry	See § 742.6(a)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (see supplement no. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: For additional controls that apply to this ECCN, see also § 744.11(a)(2)(v) and (a)(3) and § 744.23(a)(4)(iii) of the EAR.

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

E. "Technology"

Note 1 to Cat 3 Product Group E:

3E001 and 3E905 do not apply to 'Process Design Kits' ('PDKs') unless they include libraries implementing functions or technologies for items specified by 3A001.

Technical Note:

For the purposes of 3E001 and 3E905, a 'Process Design Kit' ('PDK') is a software tool provided by a semiconductor manufacturer to ensure that the required design practices and rules are taken into account in order to successfully produce a specific integrated circuit design in a specific semiconductor process, in accordance with technological and manufacturing constraints (each semiconductor manufacturing process has its particular 'PDK').

3E001 "Technology" according to the General Technology Note for the "development" or "production" of commodities controlled by 3A (except 3A069, 3A901, 3A904, 3A980, 3A981, 3A991, 3A992, or 3A999), 3B (except 3B001.a.4, c, d, f.1, f.5, k to n, p.2, p.4, r, 3B002.c, 3B903, 3B904, 3B991, 3B992, 3B993, or 3B994) or 3C (except 3C907, 3C908, 3C909, or 3C992).

License Requirements

Reason for Control: NS, MT, NP, RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to "technology" for commodities controlled by 3A001, 3A002, 3A003, 3B001 (except as noted in the heading), 3B002 (except 3B002.c), or 3C001 to 3C006	NS Column 1.
MT applies to "technology" for commodities controlled by 3A001 or 3A101 for MT Reasons	MT Column 1.
NP applies to "technology" for commodities controlled by 3A001, 3A201, or 3A225 to 3A234 for NP reasons	NP Column 1.
RS applies to "technology" for commodities controlled in 3A090, when exported from	Worldwide (see § 742.6(a)(6)(ii)).

Control(s)	Country Chart (see Supp. No. 1 to part 738)
Macau or a destination specified in Country Group D:5	
RS applies to "technology" for commodities controlled by 3A001.z, 3A090 (except for 3A090.c)	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
RS applies to "technology" for commodities controlled by 3A090.c	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(6)(i)(B) of the EAR.
RS applies to "technology" for commodities controlled by 3A001.a.15 or b.13, 3A004, 3B003, 3C007, 3C008, or 3C009	RS Column 2.
AT applies to entire entry	AT Column 1.

License Requirements Note:

See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes, except N/A for MT, and "technology" for the "development" or "production" of: (a) vacuum electronic device amplifiers described in 3A001.b.8, having operating frequencies exceeding 19 GHz; (b) solar cells, coverglass-interconnect-cells or covered-interconnect-cells (CIC) "assemblies," solar arrays and/or solar panels described in 3A001.e.4; (c) "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers in 3A001.b.2; (d) discrete microwave transistors in 3A001.b.3; and (e) commodities described in 3A090.

Note:

See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for ECCN 3E001 "technology" for commodities controlled by 3A001.z, 3A090.

IEC: Yes, for "technology" for equipment controlled by 3B001.q, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for Strategic Trade Authorization (STA)

STA: License Exception STA may not be used to ship or transmit "technology" according to the General Technology Note for the "development" or "production" of equipment specified by ECCNs 3A002.g.1 or 3B001.a.2 to any of the destinations listed in Country Group A:6 (see supplement no.1 to part 740 of the EAR). License Exception STA may not be used to ship or transmit "technology" according to the General Technology Note for the "development" or "production" of components specified by ECCN 3A001.b.2, b.3, commodities specified in 3A090, to any of the destinations listed in Country Group A:5 or A:6 (see supplement no. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: (1) "Technology" according to the General Technology Note for the "development" or "production" of certain "space-qualified" atomic frequency standards described in Category XV(e)(9), MMICs described in Category XV(e)(14), and oscillators described in Category XV(e)(15) of the USML are "subject to the ITAR" (see 22 CFR parts 120 through 130). See also ECCNs 3E101, 3E201 and 9E515. (2) "Technology" for "development" or "production" of "Microwave Monolithic Integrated Circuits" ("MMIC") amplifiers in 3A001.b.2 is controlled in this ECCN 3E001; 5E001.d refers only to that additional "technology" "required" for telecommunications.

Related Definition: N/A.

Items: The list of items controlled is contained in the ECCN heading.

Note 1:

3E001 does not control "technology" for equipment or "components" controlled by 3A003.

Note 2:

3E001 does not control "technology" for integrated circuits controlled by 3A001.a.3 to a.14 or z, having all of the following:

(a) Using "technology" at or above 0.130 µm; and

(b) Incorporating multi-layer structures with three or fewer metal layers.

3E002 " Technology " according to the General Technology Note other than that controlled in 3E001 for the " development " or " production " of a " microprocessor microcircuit ", " micro-computer microcircuit " and microcontroller microcircuit core, having an arithmetic logic unit with an access width of 32 bits or more and any of the following features or characteristics (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (see supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

License Requirements Note:

See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. A 'vector processor unit' designed to perform more than two calculations on 'floating-point' vectors (one-dimensional arrays of 32-bit or larger numbers) simultaneously;

Technical Note:

For the purposes of 3E002.a, a 'vector processor unit' is a processor element with built-in instructions that perform multiple calculations on 'floating-point' vectors (one-dimensional arrays of 32-bit or larger numbers) simultaneously, having at least one vector arithmetic logic unit and vector registers of at least 32 elements each.

b. Designed to perform more than four 64-bit or larger 'floating-point' operation results per cycle; *or*

c. Designed to perform more than eight 16-bit 'fixed-point' multiply-accumulate results per cycle (*e.g.,* digital manipulation of analog information that has been previously converted into digital form, also known as digital "signal processing").

Note 1:

3E002 does not control "technology" for multimedia extensions.

Note 2: 3E002 does not control "technology" for microprocessor cores, having all of the following:

a. Using "technology" at or above 0.130 μm; and

b. Incorporating multi-layer structures with five or fewer metal layers.

Note 3:

3E002 includes "technology" for the "development" or "production" of digital signal processors and digital array processors.

Technical Notes:

1. For the purposes of 3E002.a and 3E002.b, 'floating-point' is defined by IEEE-754.

2. For the purposes of 3E002.c, 'fixed-point' refers to a fixed-width real number with both an integer component and a fractional component, and which does not include integer-only formats.

3E003 Other "technology" for the "development" or "production" of the following (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes, except .f and .g

List of Items Controlled

Related Controls: See 3E001 for Silicon-On-Insulation (SOI) technology for the "development" or "production" related to radiation hardening of integrated circuits.

Related Definitions: N/A

Items:

a. Vacuum microelectronic devices;

b. Hetero-structure semiconductor electronic devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;

Note: 3E003.b does not control "technology" for high electron mobility transistors (HEMT) operating at frequencies lower than 31.8 GHz and hetero-junction bipolar transistors (HBT) operating at frequencies lower than 31.8 GHz.

c. "Superconductive" electronic devices;

d. Substrates of diamond for electronic components;

e. Substrates of Silicon-On-Insulator (SOI) for integrated circuits in which the insulator is Silicon Dioxide (SiO_2);

f. Substrates of Silicon Carbide (SiC) for electronic components;

g. "Vacuum electronic devices" operating at frequencies of 31.8 GHz or higher;

h. Substrates of Gallium Oxide (Ga_2O_3) for electronic components.

3E004 "Technology" "required" for the slicing, grinding and polishing of 300 mm diameter silicon wafers to achieve a 'Site Front least sQuares Range' ('SFQR') less than or equal to 20 nm at any site of 26 mm x 8 mm on the front surface of the wafer and an edge exclusion less than or equal to 2 mm.

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 1.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: Yes

List of Items Controlled

Related Controls: N/A

Related Definitions: For the purpose of 3E004, 'Site Front least sQuares Range' ('SFQR') is the range of maximum deviation and minimum deviation from front reference plane, calculated by least square method with all front surface data including site boundary within a site.

Items:

The list of items controlled is contained in the ECCN heading.

3E069 "Technology" according to the General Technology Note for the "development" or "production" of items controlled by 3A069.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 2.
RS applies to entire entry	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(13) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: Yes, except N/A for Macau, destinations in Country Group D:5, or destinations subject to the RS control in 3A999.

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" controlled by 3A001.a.1 or .2, 3A101, or 3D101.

License Requirements

Reason for Control: MT, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E102 "Technology" according to the General Technology Note for the "development" of "software" controlled by 3D101.

License Requirements

Reason for Control: MT, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E201 "Technology" according to the General Technology Note for the "use" of equipment controlled by 3A001.e.2 or .e.3, 3A201 or 3A225 to 3A234.

License Requirements

Reason for Control: NP, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
NP applies to "technology" for equipment controlled by 3A001.e.2, or .e.3, 3A201 or 3A225 to 3A234 for NP reasons	NP Column 1.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E202 "Technology" according to the General Technology Note for the "development," "production," or "use" of "software" controlled by 3D201 or 3D202.

License Requirements

Reason for Control: NP, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NP applies to entire entry	NP Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E611 "Technology" "required" for military electronics, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT, UN

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to entire entry except 3E611.y	NS Column 1.
RS applies to entire entry except 3E611.y	RS Column 1.
RS applies to 3E611.y	China, Russia, or Venezuela (see § 742.6(a)(7)).

Control(s)	Country Chart (see Supp. No. 1 to part 738)
AT applies to entire entry	AT Column 1.
UN applies to entire entry except 3E611.y	See § 746.1(b) for UN controls.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: 1. Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any "technology" in 3E611.

2. Except for "build-to-print technology," License Exception STA is not eligible for "technology" enumerated in ECCN 3E611.b.

List of Items Controlled

Related Controls: Technical data directly related to articles enumerated in USML Category XI is controlled in USML Category XI(d).

Related Definitions: N/A

Items:

a. "Technology" (other than that controlled by 3E611.b or 3E611.y) "required" for the "development," "production," operation, installation, maintenance, repair, overhaul, or refurbishing of commodities or software controlled by ECCN 3A611, 3B611 or 3D611.

b. "Technology" "required" for the "development," "production," operation, installation, maintenance, repair, overhaul, or refurbishing of the following if controlled by ECCN 3A611, including 3A611.x:

b.1. Helix traveling wave tubes (TWTs);

b.2. Transmit/receive or transmit modules.

c. through x. [Reserved]

y. "Technology" "required" for the "production," "development," operation, installation, maintenance, repair, overhaul, or refurbishing of commodities or software enumerated in ECCNs 3A611.y or 3D611.y.

3E901 "Technology" according to the General Technology Note for the "development" or "production" of items controlled by ECCN 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, or 3C909.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	Worldwide control. *See § 742.4(a)(5) and (b)(10) of the EAR.*
RS applies to the entire entry	Worldwide control. *See § 742.6(a)(10) and (b)(11) of the EAR.*
AT applies to entire entry	AT Column 1.

Special Reporting: Deemed exports and deemed reexports of "technology" specified in this ECCN are subject to reporting requirements in accordance with § 743.8 of the EAR.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

The list of items controlled is contained in the ECCN heading.

3E905 "Technology" according to the General Technology Note for the "development" or "production" of integrated circuits or devices, using "Gate all-around Field-Effect Transistor" ("GAAFET") structures.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry	Worldwide control. *See § 742.4(a)(5) and (b)(10) of the EAR.*
RS applies to the entire entry	Worldwide control. *See § 742.6(a)(10) and (b)(11) of the EAR.*
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

Note:

See General Order No. 6 in supplement no. 1 to part 736 for additional authorization that may apply for exports, reexports, or transfers (in-country) of this item.

List of Items Controlled

Related Controls: 1. ECCN 3E905 applies to process "technology" exclusively for the "development" or "production" of GAAFET structures of integrated circuits at a semiconductor wafer production facility. ECCN 3E905 does not, for example, control an integrated circuit design such as the physical layout file in "GDSII" format or EDA tools, or any other technology used to produce the physical layout file for integrated circuit design. 2. ECCN 3E905 does not apply to vertical GAAFET architectures, *e.g.,* those used for 3D NAND.

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

Note 1:

3E905 includes 'process recipes'.

Note 2:

3E905. does not apply for tool qualification or maintenance.

Technical Note:

For the purposes of Note 1 to 3E905, a 'process recipe' is a set of conditions and parameters for a particular process step.

3E980 "Technology" "specially designed" for "development," "production" or "use" of commodities controlled by 3A980 and 3A981.

License Requirements

Reason for Control: CC, AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
CC applies to entire entry	CC Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E991 "Technology" for the "development," "production" or "use" of electronic devices, "parts" or "components" controlled by 3A991, general purpose electronic equipment controlled by 3A992, or manufacturing and test equipment controlled by 3B991 or 3B992, or materials controlled by 3C992.

License Requirements

Reason for Control: AT

Control(s)	Country Chart (See Supp. No. 1 to part 738)
AT applies to entire entry	AT Column 1

License Requirements Note:

See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those

incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

3E992 "Technology" for the "production" or "development" of commodities specified in 3B001.a.4, c, d, f.1, f.5, f.6, k to n, p.2, p.4, r; and 3B002.c; and "technology" as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
NS applies to the entire entry	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.4(a)(4) of the EAR.
RS applies to the entire entry	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(6)(i) of the EAR.
NS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to "software" for equipment controlled by 3B001.c.1.a or c.1.c	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

IEC: Yes, for "technology" for equipment controlled by 3B001.c.1.a, and 3B001.c.1.c, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "technology" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (see supplement no. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. "Technology" "specially designed" for the "development" or "production" of commodities specified in 3B001.a.4, c, d, f.1, f.5, f.6, k to n, p.2, p.4, r; or 3B002.c.

b. "Technology" not specified by 3E992.a designed or modified to perform all of the following in or with deep-ultraviolet immersion photolithography equipment:

b.1. Decrease the minimum resolvable feature specified by 3B001.f.1.b; *and*

b.2. Decrease the maximum 'dedicated chuck overlay' of deep-ultraviolet immersion lithography equipment below or equal to 1.5 nm.

3E993 "Technology" for the "development" or "production" of commodities specified in 3B993; and "technology" as follows (see List of Items Controlled).

License Requirements

Reason for Control: RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
RS applies to entire entry	See § 742.6(a)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "technology" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (see supplement no. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: For additional controls that apply to this ECCN, see also § 744.11(a)(2)(v) and (a)(3) and § 744.23(a)(4)(iii) of the EAR.

Related Definitions: N/A

Items:

a. "Technology" "specially designed" for the "development" or "production" of commodities specified by 3B993.

b. "Technology" designed or modified to increase the number of wafers processed per hour, averaged over any time interval, by greater than 1%, of equipment specified in 3B001.f.1 or 3B993.f.1.

c. "Technology" not specified by 3E993.a designed or modified to perform all of the following in or with deep-ultraviolet immersion photolithography equipment:

c.1. Decrease the minimum resolvable feature specified by 3B993.f.1.b.1; *and*

c.2. Decrease the maximum 'dedicated chuck overlay' of a deep-ultraviolet immersion lithography equipment above 1.5 nm and below or equal to 2.4 nm.

3E994 "Technology" "specially designed" for the "development" or "production" of commodities specified in 3B994 and "technology" as follows (see List of Items Controlled).

License Requirements

Reason for Control: RS, AT

Control(s)	Country Chart (see Supp. No. 1 to part 738)
RS applies to entire entry	See § 742.6(a)(11) of the EAR.
AT applies to entire entry	AT Column 1.

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

TSR: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "technology" specified in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (see supplement no. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: For additional controls that apply to this ECCN, see also § 744.11(a)(2)(v) and (a)(3) and § 744.23(a)(4)(iii) of the EAR.

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.