WSTS Product Classification 2018

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1. Outline of Product Classification 2018

This Product Classification 2018 describes the classifications and their definitions of semiconductor products as well as the definitions of 5 regions of the world market for those semiconductor products, which are applicable to Blue Book Reports and Green Book Reports to be issued monthly for the year 2018.
Other WSTS reports to be issued in 2018 have some different base conditions as explained below.

(a) **Blue Book Reports** and **Green Book Reports** for 2018:
(i) Semiconductor product classifications described in this Product Classification 2018 are fully applicable.
(ii) Definitions of 5 regions of the world market described in this Product Classification 2018 are fully applicable.

(b) **End Use Report 2017**:
End Use Report 2017, to be issued around the end of February 2018, is generated based on the annual total 2017 market data compiled in the Blue Book reports for 2017. Thus, End Use Report 2017 will be based on (i) higher level of product classifications for 2017 and (ii) 5 regions of the world market defined for 2017, both of which were described in the Product Classification 2017 issued about a year ago.

(c) **Market Forecast**:
Market Forecasts to be issued in 2018 will be generated based on the actual past shipment data up to the last quarter prior to the date when the forecast is made. Thus, Market Forecasts 2018 will be based on (i) higher level of product classifications for the years 2018 and before, and (ii) classification of 4 regions of the world market defined for the years 2013 and before.

1.1. Changes from Product Classification 2017

As compared to the last year's Product Classification 2017, there is only the following change adopted in this Product Classification 2018.

(1) Section 1.2. Product Categories Hierarchy 2018.
In the Hierarchy Table, product categories "H1, H2, H3, H4, H6" are moved from "PRODUCTS" to "SUBPRODUCTS" under the "SENSORS AND ACTUATORS" category.

Please note that, due to reclassification, some product codes may have another meaning than they had in prior years. The capacity of product codes is running out due to increasing number of product categories, and there can be cases where previously existing product codes have to be reused for a new or modified definition of product category.

1.2. Product Categories Hierarchy 2018

Product categories for 2018 are as follows with a correction of "H1, H2, H3, H4, H6" moved from "PRODUCTS" to "SUBPRODUCTS" as shown in red, under the "SENSORS AND ACTUATORS" category..

PRODUCTS	REGIONS & WORLD DATA		WORLD DATA ONLY
	PRODUCT TOTALS	PRODUCTS	SUBPRODUCTS
DIODES		A99	A5, A2, A3, A3a, A3b, A4
SMALL SIGNAL TRANSISTORS		B99	B4, B2, B3
POWER TRANSISTORS		C99 (C9, C10, CA, CB, CC)	C1, C11, C5, C6, C7c, C7d, C7e, C7f, C7g, C8,
RECTIFIERS		D99	D1, D2, D3
THYRISTORS		E99	E1, E2
ALL OTHER DISCRETES		G99	
TOTAL DISCRETES	S3		
OPTOELECTRONICS	F99	F1, F2, F3, F5, F6, F7, F8, F9, F10	F3a, F3b, F5a, F5b
SENSORS AND ACTUATORS	H99		H1, H2, H3, H4, H6
AMPLIFIERS/COMPARATORS		J9	
INTERFACE		J4	J4a, J4b

PRODUCTS	REGIONS & WORLD DATA		WORLD DATA ONLY
	PRODUCT TOTALS	PRODUCTS	SUBPRODUCTS
POWER MANAGEMENT		J6	J6a, J6b, J6d, J6f, J6g, J6e
SIGNAL CONVERSION		J7	
TOTAL GENERAL PURPOSE ANALOG	J0		
CONSUMER		JB	JBa, JBc, JBb
COMPUTER		JC	JCc, JCd, JCe, JCf
COMMUNICATIONS		JD	JDa, JDb, JDc, JDd, JDe
AUTOMOTIVE		JE	JEa, JEb
INDUSTRIAL & OTHERS		JF	JFd, JFe, JFa
TOT APPLICATION SPECIFIC ANALOG	JA		
TOTAL ANALOG IC	J99		
MOS MPU		P1	P1c, P1f
			P5a, P5b, P5c, P5e;
		P5	P5m, P5n (P5j, P5k, P5l) P5o, P5p, P5q,
			P5r, P5s, P5t (P5x, P5y), P5z
MOS MCU P2 (=P5 + P6)			P6a, P6b, P6c, P6e;
		P6	P6m, P6o, P6z
			P6v, P6w, P6u
MOS DSP		P4	P4a, P4b (P4j, P4k, P4l), P4c, P4d, P4f,
			P4g, P4h, P4i
TOTAL MOS MICRO IC	P99		
DIGITAL BIPOLAR		L1	
MOS GENERAL PURPOSE LOGIC		L2a	
MOS GATE ARRAY		L2b	
MOS STD CELL & FIELD PROG LOGIC		L2c	L2e, L2f, L2g, L2h, L2i, L2j
MOS DISPLAY DRIVERS		L3	L3a, L3b, L3c
MOS TOUCH SCREEN CONTROLLER		L4	
CONSUMER		L5	L5a, L5c, L5b
COMPUTER & PERIPHERALS		L6	L6g, L6h, L6i
COMMUNICATION		L7	L7a, L7b, L7c, L7d, L7f, L7e
AUTOMOTIVE		L8	L8a, L8b
MULTIPURPOSE AND OTHER		L9	
MOS SPECIAL PURPOSE LOGIC	LA		
TOTA LOGIC IC (MOS & BIPOLAR)	L99		
MOS DRAM		M1	M1g, M1h, M1j, M1k, M1m, M1n, M1o, M1x
MOS SRAM		M2B, M2A, M2	M2f, M2m, M2o, M2k, M2n, M2p,
			M2r, M2s, M2t
MOS MASK PROG ROM & EPROM		M8	
MOS FLASH MEMORY		M7A, M7B, M7	M7Aa, M7Ab, M7Ac, M7Ad, M7Ae, M7Af,
			M7Ag, M7Ah
			M7Bk, M7Bl, M7Bm, M7Bn, M7Bo, M7Bp,
			M7Bq, M7Br, M7Bs, M7Bx, M7By, M7Bz
MOS OTHER MEMORY		M6	M6a, M6b, M6c
TOTAL MOS MEMORY IC	M99		
CONSUMER			Q1
COMPUTER & PERIPHERALS			Q2
WIRELESS COMMUNICATION			Q3a
WIRED COMMUNICATION			Q3b
AUTOMOTIVE INFOTAINMENT			Q4a
OTHER AUTOMOTIVE			Q4b
IC CARD			Q5
MULTIPURPOSE & OTHER			Q6
TOTAL APPLICATION SPECIFIC IC	Q99		
TOTAL MONOLITHIC IC	S2		
TOTAL SEMICONDUCTOR	T99		

2. General Definitions

2.1. Semiconductor Materials/Technologies

The semiconductor products covered by the WSTS reports may be fabricated, using various process technologies, from any material or compounds of materials, which exhibit semiconductor properties.

Examples: Germanium, silicon, III V compounds such as gallium arsenide or polycrystalline materials such as selenium, silicon carbide, cadmium sulfide, zinc oxide, organic compounds.

2.2. Semiconductor Products

Semiconductor Products are defined in two forms:

1. Packaged or encapsulated die or chips with leads or contacts, which are tested and marked (or identified) to meet the product specifications (finished products).
2. Die, chips or wafers, which have not been encapsulated but have been tested to meet the product specifications and are identified by the container or package in which they are shipped.

Products Falling Into More Than One Category
Multichip packages and other more complex assembly and interconnect technologies may combine building blocks of semiconductor products that belong to more than one product category listed below. Billings on such products should, whenever possible, be prorated and split into the applicable parental product categories. In case this is not possible, the billings of the entire compound product may be reported in one of the product categories listed below that represents functional characteristics of the compound product in the most relevant manner.

3. Definitions of Product Classification

3.1. Discretes

A. Diodes. General-purpose signal and switching diodes (rated less than 0.5 AMP), zener diodes, transient protection diodes and RF & microwave diodes.

A5 Small Signal Diodes - General purpose signal and switching diodes and assemblies thereof (rated less than 0.5 AMP), excluding those designed for RF or microwave applications.

A2 Zener Diodes - Diodes used primarily to regulate load voltages against changes in input voltages and load currents. Includes such diodes used in assemblies.

A3. Transient Protection Devices - Devices performing exclusively the function to protect vulnerable circuits from electrical overstress such as that caused by ESD, inductive load switching and induced lightning transients. Two types of protection devices are distinguished by subcategories:

A3a. Avalanche Breakdown Diodes
A TVS diode used to protect vulnerable circuits from electrical transient over-voltage stresses, by clamping over-voltages to a maximum safe level. Available in discrete form (single diode) or within arrays (e.g. ESD Arrays)

A3b. Thyristor Surge Suppressor (TSS) or Crowbar Surge Protection Devices
A TSS that switches transient over-voltages from a high voltage to a low voltage state when reaching a given voltage threshold, and diverts the surge current to ground by clipping and crow barring actions.

They may either be a two-leaded self-triggering thyristor diode or multi-leaded gated thyristors that are used for over-voltage protection.

Available in discrete form (single thyristor) or within arrays (e.g. protection circuits for line cards)

A4. RF And Microwave Diodes - Diodes designed specifically for RF or microwave applications.

B. Small Signal and Switching Transistors. Transistors with a power dissipation of less than 1W (the power dissipation represents, for lead mounted types, the rating at 25 degrees C free air or ambient temperature and, for chassis mounted types, the rating at 25 degrees C case temperature). This category includes all RF and microwave small signal transistors, dual transistors, field effect transistors and all general-purpose bipolar small signal transistors.

B4. Bipolar Small Signal Transistors - Same definition as the above, but excludes field effect transistors and those designed for RF or microwave applications.

B2. Field Effect Transistors - includes MOS Insulated gate FETS, insulated gate bipolar transistors (IGBT) and junction gate FETS which are not designed for RF or microwave applications.

B3. RF & Microwave Small Signal Transistors - All small signal transistors designed specifically for RF or microwave applications.

C. Power Transistors. Transistors with a power dissipation of 1W or more (the power dissipation represents, for lead mounted types, the rating at 25 degrees C free air or ambient temperature; and, for chassis mounted types, the rating at 25 degrees C case temperature). This category includes RF and microwave power transistors, bipolar general purpose power transistors, field effect general purpose power transistors, insulated gate bipolar transistors (IGBT), Darlington power transistors, multiple chip devices which behave as a single chip device except for higher current and power rating, and modules assembled from these transistors.

C1. RF & Microwave Power Transistors – Single transistors, which have a minimum power dissipation rating of 1W or more and are designed specifically for operation at RF or microwave frequencies.

C11. RF & Microwave Power Transistor Modules - Modules assembled using RF or Microwave Power Transistors.

C5. Bipolar General Purpose Power Transistors - Bipolar transistors with a power dissipation rating of 1W or more. This category excludes RF & microwave power transistors, field effect transistors, and modules assembled using these power transistors.

C6. Bipolar General Purpose Power Transistor Modules - Modules assembled using Bipolar General Purpose Power Transistors.

C7c, C7d, C7e, C7f, C7g
Field Effect General Purpose Power Transistors - Transistors including MOS insulated gate FETs and junction gate FETs with a power dissipation rating of 1W or more. This category excludes RF & microwave power transistors, bipolar power transistors, insulated gate bipolar transistors (IGBT), and modules assembled using these field effect transistors. By the voltage range, this product has the following 5 categories.

C7c. Field Effect General Purpose Power Transistors (≤ 40V)
– up to and including 40V.

C7d. Field Effect General Purpose Power Transistors (≤ 100V)
– more than 40V and up to and including 100V.

C7e. Field Effect General Purpose Power Transistors (≤ 200V)
– more than 100V and up to and including 200V.

C7f. Field Effect General Purpose Power Transistors (≤ 400V)
– more than 200V and up to and including 400V.

C7g. Field Effect General Purpose Power Transistors (>400V)
– more than 400V.

C8. Field Effect General Purpose Power Transistor Modules - Modules assembled using Field Effect General Purpose Power Transistors.

The following product categories, C9 and C10, have regional data.

C9. Insulated Gate Bipolar Transistors (IGBT) - Discrete insulated gate bipolar transistors (IGBT) with a power dissipation rating of 1W or more. This category excludes RF & microwave power transistors, bipolar power transistors, field effect general-purpose power transistors, and modules assembled using these power transistors.

C10. Insulated Gate Bipolar Transistor (IGBT) Modules - Modules assembled using IGBTs.

In addition to classification into the above subcategories C1, C11, C5, C6, C7c, C7d, C7e, C7f, C7g C8, C9 and C10 based on device types, all Power Transistors under this category C shall be classified into the following three products groups, and total dollar value sold in each region and Total Worldwide, and the Total Worldwide Units shall be reported for each of the three product groups.

CA. Bipolar and Other Power Transistors - including C1, C11,, C5 and C6.

CB. Insulated Gate Bipolar Transistors – including C9 and C10.

CC. MOSFET Power Transistors – including C7c, C7d, C7e, C7f, C7g and C8.

D. Rectifiers (Power Diodes). Includes all discrete rectifiers (rated at 0.5 AMPS average or greater) and assemblies/modules composed thereof.

D1. 0.5 - 3.0 AMPS - All devices at specified current per element.

D2. 3.1 - 35.0 AMPS - All devices at specified current per element.

D3. 35.1 AMPS and over - All devices at specified current per element.

NOTE A. Modular units and other rectifier assemblies are reported as complete product. The value of the assembly will be reported and each assembly is counted as one unit. Thyristor/rectifier combinations will be reported in the appropriate Thyristor category.

NOTE B. Specialty discrete rectifiers, modules, or assemblies with individual element current ratings less than 0.5 AMP average, but specifically characterized for rectification function shall be reported per D1 above (Examples: high-voltage, low current rectifier assemblies for cathode ray tube, precipitrons, etc.).

E. Thyristors. Includes all unidirectional and bi-directional thyristors and assemblies/modules composed primarily thereof.

E1. 0 - 55.0 AMPS (RMS) - All devices at specified current per element.

E2. 55.1 AMPS (RMS) and over - All devices at specified current per element.

NOTE A. Modular Units (Power Modules) and other thyristor and thyristor-rectifier assemblies composed of any combination of thyristors and rectifiers in either "chip" and/or discrete form shall be reported in the thyristor product category.

NOTE B. Modular units and other thyristor assemblies are reported as complete product. The value of the assembly will be reported and each assembly is counted as one unit.

NOTE C. Thyristors designed for and used in transient protection applications are to be reported in category A3b.

G. All Other Discretes. Includes varactor tuning diodes, selenium rectifiers and other polycrystalline devices, and any other discrete semiconductor device not specifically listed above.

S3. Total Discretes. Total of items A, B, C, D, E and G.

3.2. Optoelectronics

F. Optoelectronics. Includes displays, lamps, couplers, and other opto-sensing and emitting semiconductor devices (excludes liquid crystal devices and displays, incandescent lamps and displays, etc.).

F1. Displays - Single or Multiple Digit character displays are reported as complete assemblies.

F2. Lamps - Discrete solid-state light source (visible only) of any size, shape, color and light intensity.

F3. Couplers/Isolators & Switches - Devices consisting of an optical emitter and detector integrated into single package.

F3a. Opto Couplers & Isolators - The device consisting of optical emitting die (mostly infrared) and a silicon detector which is optically coupled with the emitter. The device may be a phototransistor, opto triac or opto IC, integrated into a single package. Coupling devices are designed for signal transmission between two electrically separated circuits. Isolaters perform galvanic and electrical isolation between input and output circuitry by using isolating material. The change of the output signal is driven by the change of the input signal. These devices are primarily used to protect the microcontroller from interferences from the power side of the circuitry, in such applications as power supplies, line receivers, computer interfaces, etc.

F3b. Optical Switches (Transmissive/Reflective) – Transmissive switches include an emitting die (mostly infrared) and a detector located on the opposite side of the optical axes in a single package, and the light path is broken or modified by an external physical object. Transmissive switches are used for small distances and narrow objects. Reflective switches have the emitter positioned next to the detector, and the signal transmission goes by reflection of a dedicated media. Reflective switches are used for a wide range of distances and objects of different shapes. Interrupters convert mechanical movements into electrical signals. With these devices, the change of the output signal is made by interrupt or reflection of an infrared beam with a media. These devices are predominantly used where mechanical movement has to be converted into an electrical signal, in such applications as

mobile phones, vending machines, validators, printers, copy machines, tachometer, glucose meter, steering wheel, etc.

F8. Laser Pick-up – Devices generating coherent radiation whose wavelength is generally 0.8um and less, mainly used for optical disk drives.

F9. Laser Transmitter – Devices generating coherent radiation whose wavelength is generally greater than 0.8um, mainly used for optical communications.

F5. Image Sensors - Monolithic integrated circuit capable of translating light into electrical voltages or currents for generating an image. Includes area, circular and linear types using device structures such as charge coupled device (CCD), charge injection device (CID), charge coupled photodiode (CCP), charge priming device (CPD), metal oxide semiconductor (MOS) such as CMOS Image Sensor, self scanning photodiode (SSP), etc. Devices may be fabricated from any semiconductor technology.

F5a. CCD & Other Image Sensors – CCD and all Image Sensors not included under F5b below.

F5b. CMOS Image Sensors – Image sensors in CMOS technology including ancillary analog and/or digital circuit functions on the same chip.

F7. Infrared - Infrared emitters and all detectors. Includes both discrete devices and assembled modules. IR LED Emitter for Light Sensors included in the same package as the sensor shall be reported in product category F10.

F10. Light Sensors – Monolithic and assembled modules that detect presence of light and change it into electrical voltages or currents. Such devices include discrete and combo sensors, such as Ambient Light Sensors (ALS), Proximity Sensors (including IR LED Emitter in a same package), Color Sensors (RGB), Ultraviolet Sensors, Heart Rate Sensors, etc.

F6. Other Optoelectronics - All other optoelectronics devices not specifically listed above, including fiber optic components and solar cells.

F99 Total Optoelectronics. Total of items F1, F2, F3, F5, F6, F7, F8, F9 and F10

3.3. Sensors and Actuators

H. Sensors & Actuators. Semiconductor devices whose electrical properties are designed to correlate to temperature, pressure, displacement, velocity, acceleration, stress, strain or any other physical, chemical or biological property.

H1 Temperature & Other Sensors - All devices for measurement of temperature in gases, liquids or solids, and all other non-optical sensors not included in H2, H3, H4 and H6.

H2 Pressure Sensors - All devices for direct measurement of pressure.

H3 Acceleration and Yaw Rate Sensors - All devices for direct measurement of acceleration and yaw rate or spin rate.

H4 Magnetic Field Sensors - All devices for measuring any kind of magnetic field

H6. Actuators – Devices with the primary purpose to translate electrical signals into physical actions. These devices may also contain complex digital and/or analog circuitry that controls the specific actions. This includes, but is not limited to, ink jet nozzles, micro mirrors, solid-state relays, and SAW filters.

NOTE: All optical sensors are to be reported in the appropriate category of Optoelectronics.

H99 Total Sensors and Actuators. Total of items H1, H2, H3, H4 and H6.

3.4. Integrated Circuits

Circuits combining digital and analog techniques are classified into digital circuits or analog circuits according to the chip area devoted to the respective technique. Circuits having greater than 50 percent of their chip area devoted to digital techniques are classified as digital circuit. Conversely, analog circuits must have greater than 50 percent of their chip area devoted to analog techniques. If the chip area ratio cannot be determined exactly, a circuit may as well be deemed “analog” if the essential functions of the circuit are related to the processing of analog signals.

The terms “Devices” and “ICs” are used inter-changeably in this Section 3.4, both with the same meaning of the “Integrated Circuits”.

3.4.1. Analog

J. Analog. Devices are classified as ANALOG if at least 50% of the total die area of the integrated circuit(s) in the device is occupied by ANALOG circuitry. Where the total die area of the integrated circuit(s) in the device cannot be accurately determined to be at least, but is close to, 50%, the device may be classified as ANALOG if the essential function of the device is to process analog signals, AND at least one of the following is applicable; in the intended use of the device, the signal at the input of the device is analog in nature, or the signal at the output of the device is analog in nature. An analog signal is defined as a signal in which the relevant data is continuously varying in voltage or current over time, and is not a digital signal with discrete levels. For example, analog conditioning of a digital signal for transmission over a cable is considered as an analog function.

Analog devices include those which contain multiple integrated circuits/chips in a monolithic package. But Analog ICs may, according to their semiconductor content, be classified to one of the module categories in C – Power Transistors. "Semi-custom" devices such as Analog Arrays or other Linear Networks are included in J Analog. Excluded are hybrid circuits, board level products, and discrete components. Devices can be classified as Analog regardless of the device manufacturing process technology used, such as Bipolar, MOS, BiMOS, etc.

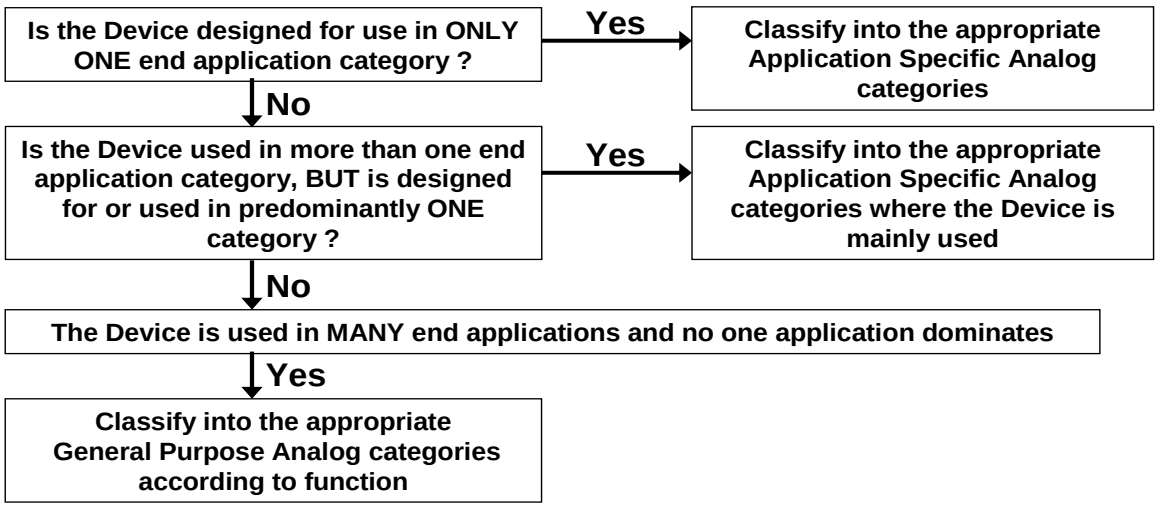
Chip development charges, such as non-recurring engineering (NRE) charges for custom and semi-custom devices, are part of the value to be reported.

This Analog category contains General Purpose Analog (code J0) and Application Specific Analog (code JA) subcategories.

The General Purpose Analog category is sub-divided into specific functional subcategories of Amplifiers/Comparators (Signal Conditioning), Signal Conversion, Interface, and Power Management ICs. These categories are defined in terms of functionality instead of a specific device type, thereby allowing a device containing a mixture of different circuits, such as amplifiers, A-to-D converters, and power management circuitry, for example, to be classified as either a Signal Conditioning device, Signal Conversion device, or a Power Management device depending on its primary or dominant function. Further descriptions and examples of what devices constitute these subcategories are given in the definitions of the appropriate subcategories below. In general, however, if a device includes an A-D converter as well as amplifiers, the converter circuit will most probably be the most important function of the device and therefore it would be classified as a signal conversion circuit. A similar case will generally apply to devices with multiple functions which includes power management. In most cases, these would be classified as Power Management devices. There may be cases which are not so clear-cut. For example, a device with amplification and line driving circuits may be classified under Signal Conditioning or Interface. The classification of the device should be determined by the function which is the most important part of the device.

Application Specific Analog is sub-divided by the specific end applications for which the device is designed for. Where the end application for the device cannot be specifically determined or where the device is used in many applications without one end-application dominating, the device should be classified into the General Purpose Analog category according to its primary or dominant function. This is further explained below, together with a guideline to help in classification as shown in figure 1.

Figure 1: Guideline for Classification



J0. General Purpose Analog – General Purpose Analog is sub-divided into specific functional subcategories of Amplifiers/Comparators (Signal Conditioning), Signal Conversion, Interface, and Power Management ICs. These subcategories are defined in terms of functionality instead of a specific circuit type. A device should be classified into one of the following subcategories depending on its primary or dominant function, regardless of the mix of circuitry used in the device. Devices which are intended primarily for a specific application should be classified into one of the Application Specific Analog IC subcategories (JB-JF).

J9. Amplifiers/Comparators (Signal Conditioning) **-** General Purpose Analog ICs whose primary or dominant function is to condition or modify the incoming Analog signal to enhance it for further processing such as signal conversion or interfacing. This category includes devices which provide functions such as signal filtering, signal amplification, level shifting, buffering or comparison. Current sense amplifiers and trans-impedance amplifiers are included in this category.

J7. Signal Conversion - General Purpose Analog ICs whose primary or dominant function is to convert the signal from one form to another for further processing by other ICs including digital ICs such as a microprocessor or FPGA. The signal before or after conversion should be analog. These include general purpose devices whose primary function is Analog-to-Digital conversion, Digital-to-Analog conversion, and Voltage-to-Frequency conversion. Discrete sample-and-hold circuits are part of this category. However, this function is generally integrated into the signal conversion circuit. Analog switches and multiplexers which are often used with the above converters are included in this category.

J4. Interface - General Purpose Analog ICs whose primary or dominant function is to modify or shape the signal in order to ensure signal integrity for transmission over a distance through a physical medium such as a wire, cable, waveguide, or tracks within a printed circuit board. These include devices which shape the signal for transmission over the medium or which reconstructs the received signal after transmission to recover the intended signal integrity. A device may be classified into this category if at least one of the following is true; the signal at the input of the device is analog in nature, or the signal at the output of the device is analog in nature. An analog signal is defined as a signal which is continuously varying in voltage or current over time, and is not a digital signal with discrete levels. This subcategory includes general purpose Line Drivers and Receivers. Application specific devices should be classified into one of the Application Specific Analog categories (JB-JF). Devices whose primary function is basic ESD protection or EMI filtering are classified into category A3 under A Diodes, and should be excluded.

J4a. Interface Logic and Amplification – line drivers, receivers, keyboard encoders, error checking circuits, and display drivers.

J4b. Interface Conditioning and Protection – ESD protection and EMI filtering using specific passive integration technologies, excluding basic ESD protection devices classified under category A3.

J6. Power Management - General Purpose Analog ICs whose primary or dominant function is to convert, control or distribute DC power. This category includes devices which convert a source voltage into another voltage which can be used for powering other integrated circuits and which include a management capability to control the output voltage. AC to DC power conversion should be included in this category. General purpose LED drivers are classified into the appropriate Regulator category. Only products which are integrated circuits should be classified in this Power Management category. Discrete devices such as transformers, bridges and inductors used for power conversion should be classified into one of Discrete categories A-E. Power management ICs designed for use in a specific end application should be classified into the appropriate Application Specific Analog category of JB-JF.

J6a. Linear Regulators - General purpose converter ICs that use a non-switching circuit such a variable resistor or divider network for voltage conversion. These include Low Drop Out regulators (LDO).

J6b. Switching Regulators - General purpose converter ICs that use a switching circuit to up convert and/or down convert a voltage source to a different voltage for powering other ICs. Devices can be with or without integrated FETs, and include buck regulators, boost regulators, and buck-boost regulators.

J6d. Voltage References - General Purpose Analog ICs that provide a constant voltage source to the load irrespective of variations in output current or input voltage.

J6f. Supervision, Sequencing and Control – General Purpose Analog ICs that source or sink power specifically over physical medium/interfaces and include Hot Swap controllers, USB Power ICs, and Power-over-Ethernet (PoE) power source and sink ICs. These devices may also include circuitry to supervise, control and sequence power to these interfaces.

J6g. Battery Charging and Management – General Purpose Analog ICs that source and manage power for charging batteries such as Lithium Ion batteries for portable equipment. These may include either linear or switching regulators specifically designed for battery charging and management. These devices may include complementary battery management functions such as charge monitors, gas gauges, and battery protection and authentication.

J6e. Other Power Management - All other General Purpose Analog ICs with Power Management functions not falling into any of the other subcategories under this J6 Power Management category.

JA. Application Specific Analog Circuits – Among all analog circuits according to the general definition (see the first paragraph of 3.4.1. Analog), this category includes those, which are uniquely designed for a specific application and fall in one of the following categories from JB to JF. These circuits may be customer specific or catalog products for multiple customers sharing the same application. They may be based on any technology and on any methodology of design.

JB. Consumer – Application Specific Analog ICs designed specifically for and used in consumer applications / end equipment. Consumer end equipment is defined as those which are intended for personal or home use, is usable by all demographics, and are generally used for entertainment, capturing/storing of images and audio/video for personal consumption, and for home convenience. They are generally designed for use in the home but are increasingly becoming more and more portable. Included in this category are Digital TVs (DTV), Digital Still Cameras, MP3 players, DVD players, Set Top Boxes (STB), Game Consoles, Hi-Fi Audio/Video products, Home Entertainment Systems and White Goods. Devices should be reported into one of the following subcategories based on the end equipment which it is designed for.

JBa. Audio/Video – Application Specific Analog ICs designed for and used in portable and non-portable equipment with audio and/or video capture and display functionality.
Portable equipment include MP3 Players, Digital Video Cameras (excluding Digital Still Cameras and Camcorders), Portable DVD players, Personal Voice / Memo Recorders, Handheld GPS devices, and Digital Radio Receivers,. Devices designed for end equipment which have voice communication as the primary function are classified under Cellular Phones in JDa.
Non-Portable/Home Entertainment equipment include DVD players, DTVs, STBs, A/V Hi-Fi Receivers, and Home Theater Systems.

JBc. DSC/Camcorder - Application Specific Analog ICs designed for and used in Digital Still Cameras (DSC) and Camcorders.

JBb. Other Consumer – Application Specific Analog ICs designed for and used in all other consumer equipment not falling into other subcategories under this JB Consumer. For example, this JBb includes Application Specific Analog ICs designed for and used in White Goods (Air Conditioners, Washing Machines, Driers, Refrigerators, Cookers, Ovens, and other Home/Kitchen Appliances) and other products such as Personal Weighing Scales, Hair Driers, Electronic Toothbrushes, Electronic Toys, Musical Instruments, Smart Watches and Fitness Monitors.
Those Application Specific Analog ICs designed for and used in Gaming Consoles (both portable and non-portable) are classified into this category.

JC. Computer - Application Specific Analog ICs designed for and used in Computing and Computer applications including computer peripherals. ICs in this category are reported into the following subcategories based on the function for which they are designed.

JCc. Computer Systems and Displays – Application Specific Analog ICs designed for and used in all computer systems including Desktop PC, Notebook/Laptop PC, Tablet PC, Handheld/Net PC, Mainframe Computers, Servers, and Workstations. Monitors including LCD displays for use with computers fall into this computer systems category.

JCd. Storage Devices - Application Specific Analog ICs designed for and used in data storage equipment associated with computers. These include magnetic, optical, and solid state storage, Hard Disk Drives, Tape Drives, CD-RW/DVD-RW drives and RAID devices. This subcategory does not include dedicated music CD or DVD-related ICs, which are included under Consumer applications. Devices usable in both consumer and storage equipment shall be classified into this Storage Devices subcategory. Devices in this subcategory include read/write amplifiers, read channel devices, head positioning controllers, spindle motor control ICs, mass storage pre-amps, etc.

JCe. Computer Peripherals – Application Specific Analog ICs designed for and used in peripheral equipment associated with computers. These include Printers (including MFP or Multi-Function Printers), Copiers, Scanners, Keyboards, Mice, Networking cards/equipment, as well as Broadband/Wireless Modems and Wireless Routers designed for or used with computers.

JCf. Other Computing - Application Specific Analog ICs designed for and used in all other computer products not falling into any of the above subcategories

JD. Communications - Application Specific Analog ICs designed for and used in non-military voice and data communications end equipment and infrastructure. ICs under this category shall be classified into one of the following subcategories depending on the application for which they are designed.

JDa. Cellular Phones - Application Specific Analog ICs designed for and used in Cellular phones and Multi-function (voice/web/email) Handheld Devices which have voice communications capability as a primary function. These phones are designed for use in wide area cellular networks including 2G, 3G, Wimax and using wide area transmission formats such CDMA, GSM and upgrade versions thereof.

JDb. Wireless Infrastructure. Application Specific Analog ICs designed for and used in equipment which provides the fixed infrastructure required to support wireless communications with cellular phones and other handheld wireless devices. These include wireless infrastructure end equipment used in both public and enterprise networks. This category includes all types of Wireless Base stations (GSM, WCDMA, WiFi, WIMAX etc.)

JDc. Wireless Communication – Short Range - Application Specific Analog ICs designed for and used in short range wireless equipment. These include wireless terminals such as cordless phones, combination cordless phone/answering machines, DECT cordless phones, and other wireless Customer Premise Equipment (CPE) or portable wireless communications devices using short range wireless transmission formats such as Bluetooth, WLAN, UWB, and Zigbee.

JDd. Other Wireless Communication - Application Specific Analog ICs designed for and used in all other wireless communications equipment not falling into any of the above categories JDa, JDb and JDc. These include portable 2-way radio communication equipment, long-range Private Network Communication Radios, and Satellite Radios.

JDe. Wired Communications/Infrastructure and Other Communications – Application Specific Analog ICs designed for and used in equipment for wired communications. These include wired infrastructure end equipment used in both public and enterprise networks. Public network infrastructure includes Central Office Switches, SDH equipment, Optical Switches, WANs, MANs, LANs, DSL line cards, Routers, and Cable Head ends. Enterprise network infrastructure include LAN, PBX, Ethernet Routers and Switches.

This subcategory JDe also includes Application Specific Analog ICs designed for and used in all other communications products not falling into any of the above subcategories JDa, JDb, JDc and JDd. These include corded phones/speakerphones, wired Customer Premise Equipment (CPE), wired communications terminals, Audio/Video conferencing

terminals, corded phone/answering machines, Broadcast & Professional Video Editing Equipment, TV and Radio Broadcast Switching and Routing Equipment.

JE. Automotive - Application Specific Analog ICs designed for and used in Automotive end equipment. These ICs are classified into the following subcategories:

JEa. Infotainment (Information & Entertainment Systems) - ICs designed for and used in Automotive end equipment for driver information and passenger entertainment electronics (e.g. speed/mileage display systems ("dash-board information"), factory installed GPS for car navigation, and radio/satellite receivers). Portable GPS equipment, which can be used in a car, is classified as Consumer, whereas GPS systems installed in the car by the car manufacturer are classified as Automotive. ICs for car audio applications, which are equally or predominately used in home audio equipment, shall be classified into JB Consumer.

JEb. Other Automotive - ICs designed for and used in Automotive end equipment including cabin/control electronics, safety electronics (e.g. airbags, ABS, LIDAR, back-up and circumferential camera systems (*excluding displays, see Note below.*)), power train/engine management electronics, security electronics, body electronics (e.g. active suspension), and lighting (including LED lighting for automotive head/tail lights). Devices containing semiconductor sensor elements should be classified into H99-Sensors, irrespective of the analog or logic content of the IC.

(Note) All ICs for the display system of a GPS shall be reported into the JEa Infotainment category, independent of a possible circumferential camera system.

JF. Industrial & Others - Application Specific Analog ICs designed for and used in Industrial end equipment as defined below, or other applications not specified in JB-JE above. ICs containing semiconductor sensor elements together with analog circuitry shall be classified into the appropriate category in H99-Sensors, irrespective of the analog content and functions of the circuit. ICs in this category are reported into the following subcategories based on the function for which they are designed.

JFd. RFID Transponders - Application Specific Analog transmitter/receiver ICs designed for and used in all active and passive RFID transponders regardless of frequency. These ICs may transmit unique identifier (ID) only or other data. Passive transponders are powered solely by the antenna field of the separate reader/writer device and do not require its own power source such as a local battery as in the case of active transponders. A passive transponder is activated by the reception of a pre-determined signal from the reader/writer. Only the value of the analog IC used in the transponder should be reported in this subcategory.

JFe. Medical/Healthcare - Application Specific Analog ICs designed for and used in Medical Diagnostic, Monitoring, and Therapeutic applications. These include but are not limited to the following:

Medical Imaging including Magnetic Resonance Imaging (MRI) scanners, Computerized Axial Tomography (CAT) scanners, Ultrasound equipment, Positron emission tomography (PET) scanners, and X-ray equipment.

Clinical Medical equipment including Blood Analyzers, Vision Testing equipment, and Dialysis Machines.

Personal Healthcare including Blood Pressure Monitors, Thermometers, Diabetes Testers, and Hearing Aids.

Other medical equipment and products including Surgical equipment, Remote Surgical Stations, Vision Correction Surgery equipment, Skin Surgery/Cosmetic Surgery equipment, External Defibrillators, Laboratory Equipment, Spectrometers, Centrifuges, Sterilizers, and Pacemakers.

JFa. All Other Industrial - Application Specific Analog ICs designed for and used in all other Industrial applications including the following, which are not specified in JFd or JFe above.

Factory/Process Automation: Application Specific Analog ICs designed for and used in Motor Control, Machine Vision, Computer Numerical Controllers (CNC), Distributed Control Systems (DSC), Programmable Logic Controllers (PLC), Programmable Automation Controllers (PAC), I/O Modules, Industrial Networking (wired and wireless), Flow Meters, Liquid/Gas Measurement equipment, Industrial Weighing Scales and process control Sensors.

Test & Measurement: Application Specific Analog ICs designed for and used in Semiconductor ATE, Oscilloscope, Spectrum Analyzers, Telecom Test Equipment, Automotive Test Equipment, Video Test Equipment, other specialized test equipment, and handheld measurement meters.

Security: Application Specific Analog ICs designed for and used in Airport Scanners, Cargo Container Scanners, Biological Hazard Detectors, Video Surveillance Systems and Cameras, Electronic Surveillance equipment, Home Security equipment, Alarm Systems, Homeland Security equipment, Access Control equipment, and Security Networks.

Military/Space: Application Specific Analog ICs used in Military/Space applications including Communications, (Land Based Radio, Space/Satellite Communications equipment, and Mobile Radio equipment), Detection & Surveillance (RADAR Systems, SONAR Equipment, Unmanned Surveillance Drones, Perimeter Security Systems, Infra-Red Imaging Equipment, Night Vision Equipment, Mine Detection equipment and IED Detection Equipment) Weapons Systems (Missile Systems, Electronic Counter Measure) and Navigation/Guidance Systems (Vehicle Electronics including Avionics, GPS Equipment and LADAR).

Other Industrial/Other Application: Application Specific Analog ICs designed for and used in all other industrial products not falling into any of the above categories, including Heating Ventilation and Air Conditioning (HVAC) equipment, Environment/Building Controls, Gaming / Slot Machines, Fitness Equipment, Non-Automotive LIDAR, Oil Exploration Equipment, Vending Machines, Utility Meters, Electronic Point-of-Sale Equipment (POS), Barcode Scanners, Toll Road Transponders, Automatic Teller Machines (ATM), Electronic Fund Transfer Terminals (EFT), Inventory Control and Portable Data Collection Terminals.

J99 Total Analog. Total of items J0 and JA.

3.4.2. MOS Micro

P. MOS Micro (MPU, MCU and DSP) - All MOS and BiMOS logic ICs that are microcomputer related and have more than 50% of chip area dedicated to digital logic functions, including devices which may have less than 50% of chip area dedicated to digital logic functions but by their nature cannot be classified into other categories. MOS is defined as MOS technology including CMOS, NMOS and PMOS, and any combination of these MOS types with Bipolar such as BiCMOS.

This category contains three subcategories, i.e. MOS Microprocessor (MPU) (code P1), MOS Microcontroller (MCU) (code P2), and Digital Signal Processor (DSP) (code P4).

BIT SIZE OR WORD LENGTH - The sub-products of MPUs and MCUs are classified as to bit width of the external data bus with which it can operate, regardless of the width of the internal data bus which may be higher or lower in bit count.

ICs with a 16-bit external data bus are classified as 16 bit products even though the internal systems are 32 bit wide. Those, which are 32-bit internal and work with 32-bit external bus are 32-bit products. There may be a device, which is a one bit serial machine internally, but looks like 8-bit externally.

MOS Micro shall include (i) “pure” MPU, MCU and DSP products and (ii) MPU-, MCU-, or DSP-dominant products, i.e. functionally majority circuit is MPU-, MCU- or DSP-core but has augmentative peripheral circuits, all of which are designed by or whose designs are controlled by the semiconductor manufacturers. These ICs include those fabricated by Gate Array, Standard Cell and/or FPL based technology, or any combination thereof.

Application Specific ICs, based on pure MPU, MCU or DSP circuitry or MPU-, MCU- or DSP-dominant circuitry, designed by semiconductor manufacturer are also to be reported in the appropriate MOS Micro

category, even though they are fabricated by Gate Array, Standard Cell and/or FPL based technology, or any combination thereof.

ICs, designed by semiconductor manufacturer and having multiple functional cores including MPU-, MCU- or DSP-core, are NOT to be reported in this MOS Micro category, but to be reported under appropriate MOS Logic categories (code L), independent of whether they are fabricated by Gate Array, Standard Cell and/or FPL based technology, or any combination thereof.

P1. MOS Microprocessor (MPU) - The MPU category includes ICs which execute external instructions and perform system control functions as programmed via software with the assembly language instructions retrieved from external memory with data read from and written to external RAM devices to perform system functions. This set up allows the MPU to receive a variety of input commands, manipulate data, direct storage of data and initiate application commands to the outside world. The most common usage is in Multi-Task Computer systems such as PCs. The ICs in this category include Complex Instruction Set Computers (CISC) and Reduced Instruction Set Computers (RISC).

The architecture is optimized for general-purpose data processing and includes an instruction decoder, arithmetic logic unit, registers and additional logic to support operation per an assembly language. There is no addressable ROM or RAM within the device, but may include dedicated registers, ROM for micro code and/or on-chip cache.

P1c. 8 BIT & 16 BIT MPU - Operates with 8 BIT or 16 BIT external data bus.

P1f. 32 BIT or Greater MPU - Operates with 32 BIT or greater external data bus.

P2. MOS Microcontroller (MCU) - These ICs are stand-alone devices, which perform dedicated or embedded computer functions within an overall electronic system without the need of other support circuits. Like microprocessors these include an instruction decoder, arithmetic logic unit, registers and support logic (UARTs, Counter Timers, Comparators, etc.). Unlike microprocessors, MCUs contain some form of ROM, EPROM or Flash Memory, which are programmed to store customer-supplied instructions. The MCU also incorporates read-write memory (RAM) for temporary storage.

The embedded instructions cause the MCU to perform pre-determined tasks such as controlling functions in TV, VCR, microwave ovens and automobile engines. In more complex applications the device may need peripheral logic devices or external memory but for simple tasks the device is self-sufficient.

MCUs are classified into the following categories:
P5. General MCU
P6. Smart Card MCU

P5. General MCU - All MCUs including those designed for specific applications and general purposes, other than Smart Cards (i.e. IC cards). Total of the General MCU is classified into the following two (2) sets of subcategories, i.e. (i) by Data Bus and (ii) by Application, as follows:

P5. (i) General MCU classification by Data Bus:

P5a. 4 BIT General MCU - Operates with 4 BIT external data bus.

P5b. 8 BIT General MCU - Operates with 8 BIT external data bus.

P5c. 16 BIT General MCU - Operates with 16 BIT external data bus.

P5e. 32 BIT or greater General MCU - Operates with 32 BIT or greater external data bus.

P5. (ii) General MCU classification by Application:
In addition to the above classification by Data Bus, total General MCU (including all Data Bus width) shall be also classified and reported into the following subcategories according to the application for which the MCU is designed. MCU-based Touch Screen Controller devices should be reported to L4 MOS Touch Screen Controller.

P5m. Consumer - Application specific MCUs designed specifically for use in consumer equipment such as entertainment, radio, TV, HDTV, Set Top Box, VCR, DVD Player, personal or home appliance, camera, game, Smart Watches, Fitness Monitors, etc.

P5n. Computer & Peripherals - Application-specific MCUs designed specifically for use in computer equipment or computer peripherals. MCUs in this category are reported into the following subcategories P5j, P5k and P5l, based on the function for which they are designed.

P5j. Computer Systems - Application specific MCUs designed specifically for use in computer systems, such as desktop PCs, notebook PCs, PDAs, servers, workstations, mainframes, etc.

P5k. Storage - Application specific MCUs designed specifically for use in rotating computer magnetic and optical disk storage or tape mass storage media such as Floppy Disk Drives, Hard Disk Drives, Laser Disk Drives (CD-ROM, CD-R/W, DVD-ROM, DVD-R/W), tape drives, storage systems, etc. This subcategory does not include MCUs designed for dedicated music CD or DVD, which are included in P5m Consumer applications. MCUs usable in both consumer and storage applications shall be classified into this subcategory P5k.

P5l. Other Peripherals - Application specific MCUs designed specifically for use in computer periphery applications, such as printers, scanners, monitors, keyboards, mice, etc.

P5o. Wireless Communication - Cellular Phone: MCUs designed for application in Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc.

P5p. Wireless Communication - Infrastructure: MCUs designed for application in Mobile Base Stations for 1G to 3G, Hot Spots, etc.

P5q. Wireless Communication - Short Range Wireless: MCUs designed for application in WLAN, Bluetooth, UWB, ZigBee, etc.

P5r. Wireless Communication - All Other: MCUs designed for application in 2-way Radio, Cordless Phone, etc.

P5s. Wired Communication: MCUs designed for application in PBX, Modem, VOIP, Central Office, etc.

P5t. Automotive - MCUs designed for application in automotive entertainment, navigation, driver information, engine controls and all other automotive applications. These MCUs are classified into the following subcategories:

P5x. Infotainment (Information & Entertainment Systems) - MCUs designed for and used in Automotive end equipment for driver information and passenger entertainment electronics (e.g. speed/mileage display systems ("dash-board information"), factory installed GPS for car navigation, and radio/satellite receivers). Portable GPS equipment, which can be used in a car, is classified as Consumer, whereas GPS systems installed in the car by the car manufacturer are classified as Automotive. MCUs for car audio applications, which are equally or predominately used in home audio equipment, shall be classified into P5m Consumer.

P5y. Other Automotive - MCUs designed for and used in Automotive end equipment including cabin/control electronics, safety electronics (e.g. airbags, ABS, LIDAR, back-up and circumferential camera systems (*excluding displays, see Note below.*)), power train/engine management electronics, security electronics, body electronics (e.g. active suspension), and lighting (including LED lighting for automotive head/tail lights). ICs containing semiconductor sensor elements should be classified into H99-Sensors, irrespective of the analog or logic content of the IC.

(Note) All MCUs designed for the display system of a GPS shall be reported into the P5x Infotainment category, independent of a possible circumferential camera system.

P5z. Multipurpose & Others - MCUs designed for multiple applications or for industrial, instrument, military or other applications.

P6. Smart Card MCU - MCUs specifically designed for use in Smart Cards (i.e. IC cards). Total of the Smart Card MCU is classified into the following three (3) sets of subcategories, i.e. (i) by Data Bus, (ii) by Application, and (iii) by Interface, as follows:

P6. (i) Smart Card MCU classification by Data Bus:

P6a. 4 BIT Smart Card MCU - Operates with 4 BIT external data bus.

P6b. 8 BIT Smart Card MCU - Operates with 8 BIT external data bus.

P6c. 16 BIT Smart Card MCU - Operates with 16 BIT external data bus.

P6e. 32 BIT or greater Smart Card MCU - Operates with 32 BIT or greater external data bus.

P6. (ii) Smart Card MCU classification by Smart Card Application:
In addition to the above classification by Data Bus, total Smart Card MCU (including all Data Bus width) shall be also classified and reported into the following subcategories according to the application of Smart Card for which the MCU is designed.

P6m. Consumer - MCUs designed specifically for Smart Cards used with consumer equipment such as entertainment, radio, TV, HDTV, Set Top Box, VCR, DVD Player, personal or home appliance, camera, game, Smart Watches, Fitness Monitors, etc.

P6o. Wireless Communication - Cellular Phone: MCUs designed for Smart Cards used with Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc.

P6z. Automotive, Industrial & Others - MCUs designed for the Smart Cards used with automotive, industrial, instrument, military or any other applications not categorized into P6m or P6o.

Automotive include Infotainment (Information & Entertainment Systems) equipment, such as end equipment for driver information and passenger entertainment, and other automotive end equipment, such as cabin/control electronics, safety electronics, power train/engine management electronics, security electronics, etc.
Portable GPS equipment, which can be used in a car, is classified as Consumer, whereas GPS systems installed in the car by the car manufacturer are classified as Automotive.
All MCUs designed for Smart Cards used with the display system of a GPS shall be reported into this P6z category, independent of a possible circumferential camera system.
MCUs for Smart Cards used with car audio applications, which are equally or predominantly used in home audio equipment, shall be classified into P6m Consumer.
MCUs containing semiconductor sensor elements should be classified into H99-Sensors, irrespective of the analog or logic content of the IC.

P6. (iii) Smart Card MCU classification by Interface:
Total Smart Card MCUs are further classified by Interface, as follows:

P6v. Contactless (RF) Type - MCUs desined for Smart Cards with a Radio Frequency communication interface operating at 13.56 MHz. These Smart Cards typically require close proximity placement (within a few inches) to a reader to work. The MCUs for these Smart Cards allow for adding, deleting, or manipulating information in memory, allowing for a variety of applications, cryptographic functions and dynamic read/write capabilities. These MCUs are passive (no battery, solely powered by the antenna field of reader/writer devices) and are typically used in those Smart Cards used for contact-less payments, personal ID applications (such as electronic passports), etc.

P6w. Dual Type - MCUs designed for Smart Cards with the capability of both (i) Contactless interface and (ii) Contact interface.

P6u. All Other Type - MCUs designed for Smart Cards which do not fall in the above subcategories P6v or P6w.

P4. Digital Signal Processors (DSP) Unlike other processors, which usually are embedded in some digital Microcomputer system, DSPs are most commonly used in analog systems to process real time data. Such systems require conversion of the analog signals to digital and hence the systems need A-D and D-A converters, which may be integrated on the chip of the DSP used in such systems. The DSPs use parallel multipliers with separate program and data areas (Harvard type architecture), which provide very high-speed performance required in "Sum-of-Product" operations.
DSPs shall be classified into one of the following subcategories P4a to P4i depending on the application for which the DSP architecture is designed. General purpose DSPs (that means an architecture without dedication to a specific application) and DSPs for other applications than the ones defined in subcategories P4a to P4h shall be classified into subcategory P4i.
ICs designed by semiconductor manufacturer, using dual core architectures combining an MCU and a DSP core on one chip, shall be assigned to the appropriate MOS Logic categories (such as L3 or LA) according to the function for which it is designed.

P4a. Consumer – Application specific DSPs designed specifically for use in consumer equipment such as entertainment, radio, TV, HDTV, Set Top Box, VCR, DVD Player, personal or home appliance, camera, game, Smart Watches, Fitness Monitors, etc.

P4b. Computer & Peripherals – Application specific DSPs designed specifically for use in computer equipment or computer peripherals. ICs in this category are reported into the following subcategories P4j, P4k and P4l, based on the function for which they are designed.

P4j Computer Systems – Application specific DSPs designed specifically for use in computer systems, such as desktop PCs, notebook PCs, PDAs, servers, workstations, mainframes, etc.

P4k. Storage - Application specific DSPs designed specifically for use in rotating computer magnetic and optical disk storage or tape mass storage media such as Floppy Disk Drives, Hard Disk Drives, Laser Disk Drives (CD-ROM, CD-R/W, DVD-ROM, DVD-R/W), tape drives, storage systems, etc. This subcategory does not include dedicated music CD or DVD-related DSPs, which are included under Consumer applications. Devices usable in both consumer and storage applications shall be classified into this subcategory.

P4l. Other Peripherals – Application specific DSPs designed specifically for use in computer periphery applications, such as printers, scanners, monitors, keyboards, mice, etc.

P4c. Wireless Communication - Cellular Phone. DSPs designed for application in Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc.

P4d. Wireless Communication – Infrastructure. DSPs designed for application in Mobile Base Stations for 1G to 3G, Hot Spots, etc.

P4f. Wireless Communication – All Other. DSPs designed for application in Short Range Wireless (WLAN, Bluetooth, UWB, ZigBee, etc.) and DSPs designed for all other wireless communication application (2-way Radio, Cordless Phone, etc.)

P4g. Wired Communications. DSPs designed for application in PBX, Modem, VOIP, Central Office, etc.

P4h. Automotive - DSPs designed for application in auto entertainment, navigation, driver information, engine controls and all other automotive applications.

P4i. Multipurpose and Others - DSPs designed for multiple applications or for industrial, instrument, military or other applications.

P99 Total MOS Micro. Total of items P1, P2 (P5 and P6) and P4.

3.4.3. Total Logic (MOS & Bipolar)

L. Total Logic (MOS & Bipolar) – ICs in this category are all non-Micro MOS Logic ICs and Bipolar Logic ICs (including standard, semi-custom, dedicated function and full custom ICs) which have more than 50% of chip area dedicated to digital logic functions, including devices which may have less than 50% of chip area dedicated to digital logic functions but by their nature cannot be classified into other categories. MOS is defined as MOS technology including CMOS, NMOS and PMOS, and any combination of these MOS types with Bipolar such as BiCMOS.

This category contains the following subcategories;
Digital Bipolar (code L1)
MOS General Purpose Logic (code L2a)

MOS Gate Arrays (code L2b)
MOS Standard Cells and Field Programmable Logic (code L2c)
MOS Display Drivers (code L3)
MOS Touch Screen Controller (code L4)
MOS Special Purpose Logic (code LA)

L1. Digital Bipolar. Includes all digital logic and memory product that is made with bipolar integrated circuitry technology (TTL, ECL, DTL, IIL, RTL, etc.). Included are general purpose logic (including CML, ECL, EFL, TTL Schottky, Advance Schottky, Standard TTL and other bipolar logic devices), Gate Array, Standard Cell, bipolar memory and all other bipolar logic circuits (such as FPL, MPU, MCU, micro peripherals, etc.). Analog bipolar circuits (see definition in the first paragraph of 3.4.1 Analog) are to be reported in the appropriate category of J Analog.

L2a. MOS General Purpose Logic - Devices in this classification are standard commodity catalog products, usually simple gates, flip-flop circuits and registers. These are used in a wide range of equipment for applications in various market segments. Excluded are catalog products of any programmable device or any Special Purpose Application Specific (ASIC) device.

L2b. MOS Gate Arrays - Devices in this classification are logic circuits consisting of fixed and regular arrangement of transistor cells forming a matrix of logic gates of various standard densities. These devices are Customer Specific Integrated Circuits (CSIC) whose design is controlled by customer and are usually proprietary to a specific customer. The manufacturer provides a standard library of logic gates and provides the necessary design tools needed to generate a final metallization interconnect mask set.

The customer uses the design tools to transform the customer's unique logic circuit specification into the design of the finished product.

The manufacturer reports billings including Non Recurring Engineering (NRE) charges received from the customer for the use of the design tools. When the product is finished and shipped to the specific customer, the manufacturer reports shipments.

Charges for NRE or Computer Aided Design tools used for feasibility or research studies are not to be reported. Also excluded are charges received from third parties for the use of design centers and/or software.

Note: All and only Gate Array technology-based Customer Specific ICs (CSIC) whose design is controlled by customer are to be reported in this category even if they may have MPU-, MCU- or DSP- core(s).

Exclude Gate Array technology-based Application Specific ICs designed and produced as finished catalog products by semiconductor manufacturer. Among such devices, those which are MPU-, MCU- or DSP- dominant are to be reported in the appropriate MOS Micro category. Other devices, including those which may have MPU-, MCU-, DSP- and/or other core(s), are to be reported under the appropriate MOS Logic categories (such as L3 or LA).

If at some time the customer waives proprietary rights and allows the manufacturer to sell the device as Gate Array technology-based catalog product in the open market, the part is reclassified and reported under another appropriate device category.

L2c. MOS Standard Cells and Field Programmable Logic –

Standard Cells are circuits consisting of a user-specified arrangement of predefined and fixed sub-circuits of any function (analog, logic or memory, etc.).

These devices are Customer Specific Integrated Circuits (CSIC) whose design is controlled by customer and are usually proprietary to a specific customer.

The manufacturer provides a standard library of fixed analog and digital circuit functions called cells or macro cells. The manufacturer also provides the necessary design tools needed to implement a final circuit design.

The customer specifies the circuit design and chooses the necessary cells and, using the design tools, transforms and interconnects the cells to complete a finished product in single die form.

The manufacturer reports billings including Non Recurring Engineering (NRE) charges received from the customer for the use of the design tools. When the product is finished and shipped to the specific customer, the manufacturer reports shipments.

Charges for NRE or Computer Aided Design tools used for feasibility or research studies are not to be reported. Also excluded are charges received from third parties for the use of design centers and/or software.

Note: All and only Standard Cell technology-based Customer Specific ICs (CSIC) whose design is controlled by customer are to be reported in this category even if they may have MPU-, MCU- or DSP cores.

Exclude Standard Cell technology-based Application Specific ICs designed and produced as finished catalog products by semiconductor manufacturer. Among such devices, those which are MPU-, MCU- or DSP- dominant are to be reported in the appropriate MOS Micro category. Other devices, including those which may have MPU-, MCU-, DSP- and/or other core(s), are to be reported under the appropriate MOS Logic categories (such as L3 or LA). Touch Screen Controller devices based on Standard Cell technology shall be reported to L4 MOS Touch Screen Controller.

If at some time the customer waives proprietary rights and allows the manufacturer to sell the device as Standard Cell technology-based catalog product in the open market, the part is reclassified and reported in another appropriate device category.

Field Programmable Logic Devices (FPLDs) are standard catalog products consisting of one or more switch matrices, which can be configured into higher-level logic patterns by programming. Some devices may be "one time" programmable via built-in fusible link technologies; others may use software and hardware allowing "multiple-time" programming.

These devices are converted from standard catalog products to Customer Specific Integrated Circuits (CSIC) upon initiating the program, either by the customer or under customer's control, which converts the switch matrices into a specific logic pattern for a specific customer.

Note: All and only the FPL devices that are sold as standard devices, which will be programmed in the field by customer or under customer's control, are to be included in this category. Some typical examples are Programmable Logic Devices (PLD), Programmable Array Logics (PAL) and Field Programmable Gate Arrays (FPGA).

The manufacturer reports the shipments as the products are shipped to the customers or distributors. Programming Software and Equipment sold to a customer are not to be reported.

Exclude FPL technology-based Application Specific ICs designed and produced as finished catalog products by semiconductor manufacturer. Among such devices, those which are MPU-, MCU- or DSP-dominant are to be reported in the appropriate MOS Micro category. Other devices, including those which may have MPU-, MCU-, DSP- and/or other core(s), are to be reported under the appropriate MOS Logic categories (such as L3 or LA). Touch Screen Controller devices based on FPL technology shall be reported to L4 MOS Touch Screen Controller.

Though the design of Standard Cells and Field Programmable Logic Devices are specified by the customers, these devices shall be reported into the subcategories listed below according to the application for which the Standard Cell is designed or, in case of an FPLD, if the topology of the un-programmed device is dedicated to and suggests the use in a specific subcategory. If the application is unknown or generic, such devices shall be reported in the subcategory of Multipurpose & Other or Unknown.

L2e. Consumer – MOS Standard Cells and FPLDs designed specifically for use in consumer equipment including audio, video and other consumer, such as entertainment, radio, TV, HDTV, Set Top Box, VCR, DVD Player, personal or home appliance, camera, game, Smart Watches, Fitness Monitors, etc.

L2f. Computer & Peripherals – MOS Standard Cells and FPLDs designed specifically for use in computer equipment or computer peripherals, such as computer systems, storage, other peripherals, etc.

L2g. Wireless Communication – MOS Standard Cells and FPLDs designed specifically for application in Cellular Phone (Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc.), Infrastructure (Mobile Base Stations for 1G to 3G, Hot Spots, etc.), Short Range Wireless (WLAN, Bluetooth, UWB, ZigBee, etc.), and other wireless communication (2-way Radio, Cordless Phone, etc.)

L2h. Wired Communication – MOS Standard Cells and FPLDs designed specifically for application in PBX, Modem, VOIP, Central Office, etc.

L2i. Automotive - MOS Standard Cells and FPLDs designed specifically for use in auto entertainment, navigation, driver information, engine controls and all other automotive applications.

L2j. Multipurpose & Other or Unknown – MOS Standard Cells and FPLDs designed for multiple applications or for industrial, instrument, military or other applications. Those MOS Standard Cells with unknown design shall be reported in this subcategory, too.

L3. MOS Display Drivers – Devices specifically designed to control and drive flat panel displays such as LCD (liquid crystal display), PDP (plasma display panels), etc.

L3a. Driver for Large Sized LCD. Devices which control and drive LCD panel sized 10.4 inches and larger. These devices are applicable for Portable PC, LCD Monitor, LCD TV, etc.

L3b. Driver for Mobile Phone Display. Devices which control and drive displays (not only LCD but others) used in mobile phones such as cellular, PHS/digital cordless and smart-phone. Drivers for organic EL or other kinds of display used in mobile phones should also be classified into this category.

L3c. Other Display Drivers. Devices which control and drive other flat panel displays not specified under L3a and L3b, such as displays for portable PCs with less than 10.4 inch size; displays for PDAs, car navigation, portable games, remote controls, camcorders or digital still cameras; plasma display panels, etc.

L4. MOS Touch Screen Controller – Controller devices which accompany touch screen displays and are capable of determining the location of single or multi-touch gestures, styli and gloves, using capacitive, resistive or other sensing technologies. These devices are used for interfacing with user's touches on screen displays, i.e. the technology typically prevalent in gaming consoles, media tablets, smartphones, notebook PCs, PDAs, satellite navigation devices, digital still cameras (DSC), etc. Touch screen controllers designed based on any technology, such as firmware, MCU, or logic circuits, should be reported into this category L4, even though they may have been reported into other categories, such as P5 General MCU, L7a Wireless Communication, Cellular Phone (under LA MOS Special Purpose Logic), etc.

LA. MOS Special Purpose Logic – The devices in this category are either (i) Application Specific Standard Products (ASSP) designed by semiconductor manufacturer or (ii) Customer Specific Integrated Circuits (CSIC) designed by the customer, all of which are specifically designed for one of the application segments listed below. In addition to logic circuitry, these ICs may include other functions such as analog, micro or memory, and all or part of the circuitry of the products may be based on multiple cores, Gate Array technology, Standard Cell technology, FPL technology, or any combination thereof. Touch Screen Controller devices shall be reported to L4 MOS Touch Screen Controller, including ASSP and CSIC, and those based on any technology.

Application Specific Standard Products (ASSP) are designed or their design is controlled by the semiconductor manufacturer to fill an application specific need in a given market segment. The manufacturer lists the devices in catalogs and sells them to any customer. A device may prove so popular that several manufacturers may make and sell the same or similar device thus becoming an industry standard. These ICs are sometimes called "Dedicated Functions".

Customer Specific ICs (CSIC) are initiated by a specific customer's specification. The manufacturer assumes circuit design responsibility and may use Gate Array methodology, a Standard Cell approach, an FPL approach, a unique circuit design or any combination of these alternatives. These ICs are sometimes called "Full Custom".

This category should only include those CSICs for which the application is obviously evident to semiconductor manufacturer and for which the application market is relatively sizable, such as ICs for watches. All other CSICs shall be classified in MOS Gate Arrays (code L2b) or MOS Standard Cells (code L2c).

The manufacturer reports the shipments to the specific customer. Any "development" charges specific to the design and development of a particular CSIC should also be reported.

MOS Special Purpose Logic (code LA) contains the following subcategories, i.e. Consumer (code L5), Computer and Peripherals (code L6), Communication (code L7), Automotive (code L8) and Multipurpose and Other (code L9).

L5. Consumer – MOS logic ICs designed specifically for use in consumer equipment such as entertainment, radio, TV, HDTV, Set Top Box, VCR, DVD Player, personal or home appliance, camera, game, etc. ICs in this category are reported into the following subcategories based on the function for which they are designed.

L5a. Audio/Video – ICs designed specifically for use in Radio (IF, RF, Phase-Lock Loop), Audio Op-Amp/Pre-Amp, Audio Control, Noise Reduction, Frequency Synthesizer, Compact Disc Controls, TV (Video, Sound, Chroma), VCR, etc.

L5c. DSC/Camcorder - ICs designed specifically for use in Digital Still Cameras (DSC) and Camcorders.

L5b. Other Consumer – ICs designed specifically for use in all other consumer equipment not falling into other subcategories under this L5 Consumer. For example, this L5b includes those ICs designed specifically for Personal or Home Appliances, White Goods, Gaming Consoles (both portable and non-portable), Smart Watches, Fitness Monitors, etc.

L6. Computer & Peripherals – MOS ICs designed specifically for use in computer equipment or computer peripherals. ICs in this category are reported into the following subcategories based on the function for which they are designed.

L6g. Computer Systems – Application specific ICs designed specifically for use in computer systems, such as desktop PCs, notebook PCs, PDAs, servers, workstations, mainframes, etc.

L6h. Storage - Application specific ICs designed specifically for use in rotating computer magnetic and optical disk storage or tape mass storage media such as Floppy Disk Drives, Hard Disk Drives, Laser Disk Drives (CD-ROM, CD-R/W, DVD-ROM, DVD-R/W), tape drives, storage systems, etc. This subcategory does not include dedicated music CD or DVD-related ICs, which are included under Consumer applications. Devices usable in both consumer and storage applications shall be classified into this subcategory.

L6i. Other Peripherals – Application specific ICs designed specifically for use in computer periphery applications, such as printers, scanners, monitors, keyboards, mice, etc.

L7. Communication - MOS ICs designed specifically for voice or data communications applications. These applications include telecommunication network products such as switching equipment, multiplexing equipment, repeaters and line-conditioning equipment; customer premise equipment such as Centrex, key systems, PBX; personal communications products (telephone sets including wireless/cellular), modems, facsimile and answering machines, and tablets. ICs in this category are reported into the following subcategories based on the function for which they are designed.

L7a. Wireless Communication - Cellular Phone. ICs designed for application in Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc. Such ICs which are classified into L7f shall not be reported to this category L7a.

L7b. Wireless Communication – Infrastructure. ICs designed for application in Mobile Base Stations for 1G to 3G, Hot Spots, etc.

L7c. Wireless Communication – Short Range Wireless. ICs designed for application in WLAN, Bluetooth, UWB, ZigBee, etc.

L7d. Wireless Communication – All Other. ICs designed for application in 2-way Radio, Cordless Phone, etc.

L7f. Wireless Communication – Application Processor. ICs designed for low power applications, especially smartphones, tablets, portable media players, etc., which integrate multiple components including central processing unit, graphic processing unit and connectivity, as well as multimedia codec. Application Processors which also integrate a modem should be reported in this category L7f, too.

L7e. Wired Communication - ICs designed for application in PBX, Modem, VOIP, Central Office, etc.

L8. Automotive - ICs designed specifically for use in auto entertainment, navigation, driver information, engine controls and all other automotive applications. These ICs are classified into the following subcategories:

L8a. Infotainment (Information & Entertainment Systems) - ICs designed for and used in Automotive end equipment for driver information and passenger entertainment electronics (e.g. speed/mileage display systems (“dash-board information”), factory installed GPS for car navigation, and radio/satellite receivers). Portable GPS equipment, which can be used in a car, is classified as Consumer, whereas GPS systems installed in the car by the car manufacturer are classified as Automotive. ICs for car audio applications, which are equally or predominately used in home audio equipment, shall be classified into L5 Consumer.

L8b. Other Automotive - ICs designed for and used in Automotive end equipment including

cabin/control electronics, safety electronics (e.g. airbags, ABS, LIDAR, back-up and circumferential camera systems (*excluding displays, see Note below*.)), power train/engine management electronics, security electronics, body electronics (e.g. active suspension), and lighting (including LED lighting for automotive head/tail lights). Devices containing semiconductor sensor elements should be classified into H99-Sensors, irrespective of the analog or logic content of the IC.

(Note) All ICs for the display system of a GPS shall be reported into the L8a Infotainment category, independent of a possible circumferential camera system.

L9. Multipurpose & Others - ICs designed for multiple applications or for industrial, instrument, military or other applications.

L99 Total Logic. Total of items L1, L2a to L2c, L3, L4 and LA (L5 to L9).

3.4.4. MOS Memory

M. Digital MOS Memory. Includes all monolithic Memory devices made with NMOS, PMOS or CMOS, or any combination of MOS technologies including BiMOS, and which have half or more of the chip area made up of digital circuitry and intended as a Memory function.

Does not include devices with a majority of the chip area being memory but the device function is a specific circuit or sub-system application wherein the memory is used to support circuit activities. Examples are MPU core devices, Standard Cells and certain MOS Special Purpose Logic devices. Such circuits should be reported in other appropriate category.

Memory density is defined such that "megabit or kilobit" includes all device types belonging to that generation of density. For example, "4M Bit" includes such devices organized as 4M x 1, 1M x 4, 512K x 8, 512K x 9, 256K x 16 and 256K x 18.

With the memory devices having multi-value per each single memory cell, total bit count of such devices shall be equal to the number of total cells multiplied by multi-value.

Memory Modules (multiple devices of the same bit size contained in a single module or package) are reported in the bit size category of the basic device within the module. For a given modular product, the dollar value of the total modules sold is reported. To obtain the proper basic component count (units), the number of modules sold are multiplied by the number of individual devices within the module. This principle should be applied *mutatis mutandis* when different types of memories are combined in one module. For other cases of combined products in modules, refer to the general provision of clause 0 “Products Falling Into More Than One Category”.

For example: A company makes a DRAM module containing nine 128M DRAM devices. The company sells 50,000 modules in a month, and, on the M1h line, reports the total dollar value sold in each region and TOTAL WORLDWIDE, and reports 450,000 units in the TOTAL WORLDWIDE UNIT column.

When different types of memories are contained on one monolithic substrate, the product should be classified into the memory category which represents the most relevant function of the product.

When partially good devices of a specific type of memory are sold, following rules should be applied for reporting:

1. Partially good memories should be reported in the category where the native product belongs. This means, a 256MB DRAM that is only 50% good should be reported in the 256MB DRAM category, not in the 128MB category.

2. The quantity (units) reported for partially good memories should be prorated. This means if 1000 units of products are shipped that have 50% of bits functional, the quantity reported to WSTS should be 500 units.

3. The revenues from partially good memories aggregated into the parent category should be the actual revenues.

MOS Memory contains the following subcategories;

DRAM (M1)
SRAM (M2)
Mask Programmable ROM & EPROM (M8)
Flash Memory (M7)
Other Memory (M6)

M1. DRAM (Read/Write) - Dynamic Random Access Memory devices in which bit words (1 bit or longer word length) can be written, stored and read randomly in any desired sequence. The memory information is volatile and is lost when the power supply voltage is removed.

M1g. 64 M Bit & less - DRAM up to and including 64 megabits of memory.

M1h. 128 M Bit & less (>64 M) – DRAM containing more than 64 megabits and up to and including 128 megabits of memory.

M1j. 256 M Bit & less (>128 M) - DRAM containing more than 128 megabits and up to and including 256 megabits of memory.

M1k 512 M Bit & less (>256 M) – DRAM containing more than 256 megabits and up to and including 512 megabits of memory.

M1m. 1G Bit & less (>512 M) – DRAM containing more than 512 megabits and up to and including 1 gigabits of memory.

M1n. 2G Bit & less (>1G) – DRAM containing more than 1 gigabits and up to and including 2 gigabits of memory.

M1o. Greater than 2G Bit – DRAM containing more than 2 gigabits of memory.

In addition to classification into the above subcategories M1g, M1h, M1j, M1k, M1m, M1n and M1o, the Worldwide unit count of each of these subcategories shall be translated into 1 Gigabit-equivalent unit count, which shall then be aggregated to make Total DRAM Worldwide Unit Count (1 Gigabit equivalent) and reported under the following category code. (Example: One unit of 16M Bit translates to 1/64 unit, and one unit of 256M Bit translates to 1/4 unit, respectively, in 1 Gigabit equivalent.)

M1x. DRAM Total Units (1 Gigabit Equivalent)

M2. SRAM (Read/Write) - Static Random Access Memory devices are similar to DRAMs except that SRAMs are based on a minimum four transistor memory cell which is configured into a flip-flop circuit. Some SRAMs do not need to have the memory cells refreshed since the bit information is represented by a steady state current in one side of the flip-flop and no current in the other, however "Pseudo SRAMs" have a built-in oscillator which enables self refreshment. Pseudo SRAMs hence behave as a DRAM but are included in M2 for reporting purposes.

M2B. MOS SRAM

M2f. 2M Bit & less 30ns & greater - SRAM containing up to and including 2 megabit of memory with access time of 30ns or greater.

M2m. 4M Bit & less (>2M) 30ns & greater - SRAM containing more than 2 megabits and up to and including 4 megabit of memory with access time of 30ns or greater.

M2o. Greater than 4M Bit 30ns & greater - SRAM containing more than 4 megabit of memory with access time of 30ns or greater.

M2k. 2M Bit & less less than 30ns - SRAM containing up to and including 2 megabit of memory with access time less than 30ns.

M2n. 4M Bit & less (>2M) less than 30ns - SRAM containing more than 2 megabits and up to and including 4 megabit of memory with access time less than 30ns.

M2p. Greater than 4M Bit less than 30ns - SRAM containing more than 4 megabits of memory with access time less than 30ns.

M2A. MOS Pseudo-SRAM

M2r Pseudo SRAM 16M Bit &less – Pseudo SRAM containing up to and including 16 megabits of memory.

M2s Pseudo SRAM 32M Bit & less (>16M) – Pseudo SRAM containing more than 16 megabits and up to and including 32 megabits of memory

M2t Pseudo SRAM Greater than 32M Bit – Pseudo SRAM containing more than 32 megabits of memory

M8. Mask Programmable ROM & EPROM

Mask Programmable Read Only Memory are non-volatile circuits which have single transistor memory cells that are locked on or off in a pre-determined pattern by means of a masking procedure during the fabrication process.

EPROM - Electrically Programmable Read Only Memory devices are non-volatile circuits similar to Mask PROMs except that the memory data pattern is programmed by electrical means rather than a fixed mask. Included are OTP, One Time Programmable devices, from which the programmed memory data pattern is not erasable. EPROMs other than OTPs have a window in the package whereby the programmed memory data pattern may be erased using ultra-violet light and then electrically reprogrammed.

There is no classification by memory bit count in this category.

M7. Flash Memory - A type of EEPROM (Electrically Erasable and Programmable Read Only Memory) in which the memory data is electrically erased by large arrays of bits rather than by fractions such as bit by bit.

M7A. NOR-Type Flash Memory (including ORNAND Flash Memory):

M7Aa. 2M Bit & less - NOR-Type Flash Memory containing up to and including 2 megabits of memory.

M7Ab. 4M Bit & less (>2M) – NOR-Type Flash Memory containing more than 2 megabits and up to and including 4 megabits of memory.

M7Ac. 8M Bit & less (>4M) – NOR-Type Flash Memory containing more than 4 megabits and up to and including 8 megabits of memory.

M7Ad. 16 M Bit & less (>8M) – NOR-Type Flash Memory containing more than 8 megabits and up to and including 16 megabits of memory.

M7Ae. 32 M Bit & less (>16M) – NOR-Type Flash Memory containing more than 16 megabits and up to and including 32 megabits of memory.

M7Af. 64 M Bit & less (>32M) – NOR-Type Flash Memory containing more than 32 megabits and up to and including 64 megabits of memory.

M7Ag. 128 M Bit & less (>64M) – NOR-Type Flash Memory containing more than 64 megabits and up to and including 128 megabits of memory.

M7Ah. Greater than 128 M Bit – NOR-Type Flash Memory containing more than 128 megabits of memory.

M7B. NAND-Type Flash Memory (including OneNAND Flash Memory):

M7Bk. 512 M Bit & less – NAND-Type Flash Memory containing up to and including 512 megabits of memory.

M7Bl. 1 G Bit & less (>512M) – NAND-Type Flash Memory containing more than 512 megabits and up to and including 1 gigabits of memory.

M7Bm. 2 G Bit & less (>1G) – NAND-Type Flash Memory containing more than 1 gigabits and up to and including 2 gigabits of memory.

M7Bn. 4 G Bit & less (>2G) – NAND-Type Flash Memory containing more than 2 gigabits and up to and including 4 gigabits of memory.

M7Bo. 8 G Bit & less (>4G) – NAND-Type Flash Memory containing more than 4 gigabits and up to and including 8 gigabits of memory.

M7Bp. 16 G Bit & less (>8G) – NAND-Type Flash Memory containing more than 8 gigabits and up to and including 16 gigabits of memory.

M7Bq. 32 G Bit & less (>16G) – NAND-Type Flash Memory containing more than 16 gigabits and up to and including 32 gigabits of memory.

M7Br. 64 G Bit & less (>32G) – NAND-Type Flash Memory containing more than 32 gigabits and up to and including 64 gigabits of memory.

M7Bs. Greater than 64 G Bit – NAND-Type Flash Memory containing more than 64 gigabits of memory.

In addition to classification into the above subcategories M7k through M7s, the Worldwide unit count of each of these subcategories shall be translated into the following kinds of "Equivalent" unit counts, which shall then be aggregated to make Total NAND Worldwide Unit Count by each of the following different "Equivalent" unit counts, which shall be reported under the following category codes. (Example: In 2 Gigabit equivalent, one unit of 256M Bit translates to 1/8 unit, and one unit of 512M Bit translates to 1/4 unit, respectively.)

M7Bx. NAND Total Units (2 Gigabit Equivalent)

M7By. NAND Total Units (16 Gigabit Equivalent)

M7Bz. NAND Total Units (1 Gigabyte Equivalent) (1 byte = 8 bits)

M6. Other Memory - Electrically Erasable PROMs (except Flash Memory) and all other MOS Memory devices not defined in M1, M2, M8 and M7. Specifically includes serial FIFOs and LIFOs as well as EAROM (Electrically Alterable ROM) and NOVRAM (Non Volatile RAM). Devices in this category are reported into the following subcategories based on the function for which they are designed.

M6a. All Other Memory - All other memory devices that comply with the definition for M6 but not included in M6b or M6c below.

M6b. All Other Memory IC cards - Fixed logic IC's with memory designed for application in IC cards not specified by M6c below.

M6c. Contactless (RF) Memory IC cards - Fixed logic IC's with memory that have a Radio Frequency communication interface operating at 13.56 MHz, designed for application in IC cards. These devices can store data, but do not have a processor in itself, and may contain other communication interfaces. These devices are passive (no battery, solely powered by the antenna field of reader/writer devices). These devices are typically used for mass transit and commercial building access control applications, contact-less payments, etc.

M99 Total MOS Memory. Totals of items M1, M2, M6, M7 and M8.

3.4.5. Total Application Specific ICs

Q99 Total Application Specific ICs – Total of items JA (JB to JF), P2 (P5 and P6), P4, L2c (L2e to L2j), LA (L5 to L9)

Q1 Consumer – Total of items JB, P5m, P6m, P4a, L2e and L5

Q2 Computer and Peripherals – Total of items JC, P5n, P4b, L2f and L6

Q3a Wireless Communication – Total of items JDa, JDb, JDc, JDd, P5o, P5p, P5q, P5r, P6o, P4c, P4d, P4f, L2g and L7a, L7b, L7c, L7d and L7f.

Q3b Wired Communication – Total of items JDe, P5s, P4g, L2h and L7e

Q4a Automotive Infotainment (Information & Entertainment Systems) – Total of items JEa, P5x, L8a.

Q4b Other Automotive – Total of items JEb, P5y, P4h, L2i, and L8b

Q5 IC Card – Recapitulation of items P6v, P6w and P6u

Q6 Multipurpose and Others - Total of items JF, P5z, P6z, P4i, L2j and L9

Note: Items in Q99 (i.e. Q1 to Q6) are NOT to be reported by member companies. They are mathematical aggregation of world totals of those product categories listed under each of Q1 to Q6. Mathematical aggregation is performed by Data Collecting Agencies (DCAs).

3.4.6. Total ICs

S2 Total Monolithic Integrated Circuits. Total of items J, P, L, and M.

3.5. Total Semiconductor

T99 Total Semiconductor. Total of items A, B, C, D, E, G, F, H, J, P, L, and M. Also, equals the total of subtotals S3, F99, H99 and S2.

4. Definitions of Regions

Regions of the world are defined as follows for the WSTS market statistics reports. The WSTS reporting region is the location to which the semiconductor manufacturer ships the semiconductor products to an end customer, distributor or consignee, regardless of the region where the shipping semiconductor manufacturer may be located and regardless of the location where the shipped semiconductor products were manufactured.

1. Americas: United States of America and its possessions (including Puerto Rico), Canada, Mexico, Brazil and rest of Latin America (all other countries in Central and South America).

2. Europe: Continental Europe including Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Monaco, Netherlands, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom (including its possessions, e.g. Cayman Islands), Vatican City; Africa, the Middle East including Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen and following other countries assigned to the region: Afghanistan, Armenia, Azerbaijan, Georgia, Kyrgyzstan, Kazakhstan, Turkmenistan, Uzbekistan.

3. Japan

4. Asia Pacific/China: People's Republic of China (including Hong Kong and Macau)

5. Asia Pacific/All Other: All other Asia (including, without limitation, Korea (south and north), Republic of China (Taiwan), Singapore, Malaysia, Thailand, Indonesia and all other Asia), Australia and New Zealand. All other Asia includes countries such as Cambodia, Vietnam, Philippines, India, Pakistan, Myanmar and others.