WSTS Product Classification 2007

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1. OUTLINE OF PRODUCT CLASSIFICATION 2007

1-1. Changes from Product Classification 2006

New product category reclassifications made for 2007 are as follows.

Transient Protection Devices (A3)

New subcategories A3a and A3b are added under this category.

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.
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)

Power Transistor (C99)

New subcategories, CA, CB, CC are added under this category.
Under each of these added subcategories, total dollar value sold in each region and Total Worldwide, and the Total Worldwide Units are reported for the following groups of subcategories.

CA. Bipolar and Other Power Transistors - including C1, C11,, C5 and C6.
CB. Insulated Gate Bipolar Transistots – including C9 and C10.
CC. MOSFET Power Transistors – including C7a, C7b and C8.

CCD & Other Image Sensors (F5)

1. Category is renamed to “Image Sensors” without change of category code F5.
2. The following two subcategories are created under F5.

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.

Interface (J4)

The following two subcategories are created under J4. In relation to this, category definition of Transient Protection Device (A3) is slightly modified.

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.

MOS MPU (P1)

8 BIT MPU (P1a) and 16 BIT MPU (P1b) are merged to a single subcategory, 8 BIT & 16 BIT MPU (P1c).

Digital Signal Processor (P4)

Wireless Communication – Short Range Wireless (P4e) is merged into Wireless Communication – All Other (P4f).

Mask Programmable ROM & EPROM (M8)

Mask Programmable ROM (M3) and EPROM (M5) are merged into a single category, Mask Programmable ROM & EPROM (M8).

DRAM Unit Count

A line is added for reporting the worldwide total DRAM units in 1 Gigabit equivalent.

M1x. DRAM Total Units (1 Gigabit Equivalent)

NAND Unit Count

A line is added for reporting the worldwide total NAND units in 2 Gigabit equivalent.

M7x. NAND Total Units (2 Gigabit Equivalent)

Please note that, due to reclassification, some product codes may have another meaning than they had in 2006 and before. 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 2007

New product categories in 2007 are highlighted in ***bold italic.***

PRODUCTS	REGIONS & WORLD DATA		WORLD DATA ONLY
	PRODUCT TOTALS	PRODUCTS	SUBPRODUCTS
DIODES	A99		.A2. A3. ***A3a. A3b***、A4. A5
SMALL SIGNAL TRANSISTORS	B99		B4, B2, B3
POWER TRANSISTORS	C99	***CA, CB, CC***	C1, C11, C5, C6, C7a, C7b, C8, C9, C10
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	***F5a, F5b***
SENSORS AND ACTUATORS	H99		H1, H2, H3, H4, H5, H6
AMPLIFIERS		J1	
INTERFACE		J4	***J4a, J4b***
VOLTAGE REGULATORS & REF		J6	J6a, J6b, J6c
DATA CONVERSION CIRCUITS		J7	
COMPARATORS		J8	
TOTAL STANDARD LINEAR	J0		
CONSUMER		JB	JBa, JBb
COMPUTER & PERIPHERALS		JC	JCc, JCd, JCe
COMMUNICATION		JD	JDa, JDb, JDc, JDd, JDe
AUTOMOTIVE		JE	
MULTIPURPOSE & OTHERS		JF	JFa, JFb, JFc,
TOT APPLICATION SPECIFIC ANALOG	JA		
TOTAL ANALOG IC	J99		
MOS MPU		P1	***P1c (P1a & P1b merged)***, P1f
MOS MCU		P2	P2a, P2b, P2c, P2e; P2m, P2n (P2j, P2k, P2l) P2o, P2p, P2q, P2r, P2s, P2t, P2u, P2v, P2z
MOS DSP		P4	P4a, P4b (P4j, P4k, P4l), P4c, P4d, ***P4f (merged P4e)***, P4g, P4h, P4i
TOTAL MOS MICRO IC	P99		
DIGITAL BIPOLAR		L1	L1a, L1b, L1c
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
CONSUMER		L5	L5a, L5b
COMPUTER & PERIPHERALS		L6	L6g, L6h, L6i
COMMUNICATION		L7	L7a, L7b, L7c, L7d, L7e
AUTOMOTIVE		L8	
MULTIPURPOSE AND OTHER		L9	
MOS SPECIAL PURPOSE LOGIC & MPR	LA		
TOTA LOGIC IC (MOS & BIPOLAR)	L99		
MOS DRAM		M1	M1f, M1g, M1h, M1j, M1k, M1m, ***M1x***
MOS SRAM		M2	M2f, M2m, M2o, M2k, M2n, M2p, M2r, M2s, M2t
MOS MASK PROG ROM & EPROM		***M8 (M3 & M5 merged)***	
MOS FLASH MEMORY		M7A, M7B, M7	M7a, M7b, M7c, M7d, M7e, M7f, M7g, M7h M7i, M7j, M7k, M7l, M7m, ***M7x***
MOS OTHER MEMORY		M6	M6a, M6b, M6c
TOTAL MOS MEMORY IC	M99		
CONSUMER			Q1
COMPUTER & PERIPHERALS			Q2
WIRELESS COMMUNICATION			Q3a
WIRED COMMUNICATION			Q3b
AUTOMOTIVE			Q4
IC CARD			Q5
MULTIPURPOSE & OTHER			Q6
TOTAL APPLICATION SPECIFIC IC	Q99		
TOTAL MONOLITHIC IC	S2		
TOTAL SEMICONDUCTOR	T		

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.

2-3. 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.

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.

C7a. Field Effect General Purpose Power Transistors ($\leq$ 200v) - Transistors including MOS insulated gate FETs and junction gate FETs with a power dissipation rating of 1W or more and a voltage of $\leq$ 200v. This category excludes RF & microwave power transistors, bipolar power transistors, insulated gate bipolar transistors (IGBT), and modules assembled using these field effect transistors.

C7b. Field Effect General Purpose Power Transistors (>200v) - Transistors including MOS insulated gate FETs and junction gate FETs with a power dissipation rating of 1W or more and a voltage of >200v. This category excludes RF & microwave power transistors, bipolar power transistors, insulated gate bipolar transistors (IGBT), and modules assembled using these field effect transistors.

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

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, C7a, C7b, 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 Transistots – including C9 and C10.

CC. MOSFET Power Transistors – including C7a, C7b 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).

F3. Couplers (including interrupters) - Devices consisting of an emitter and sensor integrated into single package.

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.

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

F7. Infrared - Infrared emitters and all detectors. Report both discrete devices and assembled modules.

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

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 Sensors - All devices for measurement of temperature in gases, liquids or solids.

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

H5. Other Sensors - All other non-optical sensors

H6. Actuators – Devices with the primary purpose to translate 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 Optolelectronics.

H99 Total Sensors and Actuators. Total of items H1, H2, H3, H4, H5 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.

3-4-1. Analog

J. Analog. Excluded are hybrid circuits and board products. Analog ICs may, according to their semiconductor content, be assigned to one of the module categories in C – Power Transistors. Devices are classified as ANALOG if more than one half of the chip area is devoted to ANALOG circuitry. 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. Analog circuits can be Bipolar, MOS or BiMOS. Included are "Semi-custom" devices such as Analog Arrays or other Linear Networks. Chip development charges, such as non-recurring engineering (NRE) charges, are part of the value to be reported. This category contains both Standard Linear (code J0) and Application Specific Analog (code JA) subcategories.

J0. Standard Linear – All general purpose analog integrated circuits belonging to one of the following subcategories:

J1. Amplifiers - Operational Amplifiers, Instrumentation Amplifiers, Buffers, General-Purpose Video Amplifiers, RF IC (MMIC), etc.

J4. Interface - Driver Circuits (line drivers, receivers, keyboard encoders, error checking circuits, display drivers, ESD protection, EMI filtering, etc.).

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. Voltage Regulators and References - A device or a control device for the circuit, which provides a constant output voltage to the load irrespective of variations in output current or input voltage. Includes switching (switch mode) regulators.

J6a. Linear Voltage Regulators - includes positive and negative regulators, as well as low dropout voltage (LDO) regulators. Although less efficient than switching regulators, linear voltage regulators typically offer better transient response and less noise, and are less complex. LDOs minimize the necessary input voltage differential for proper regulation, making these ideal for battery-powered applications.

J6b. Switching Voltage Regulators - Includes buck and boost regulators, charge pumps, AC-DC converters, DC-DC converters, inverters and pulse width modulated (PWM) and pulse frequency modulated (PFM) control circuits.

J6c. Voltage References & Other - A device or a control device for the circuit, which provides a constant output voltage to the load irrespective of variations in output current or input voltage. Excludes linear voltage regulators and switching voltage regulators.

J7. Data Conversion Circuits - Includes "mixed signal" circuits (Analog/Digital) containing more than 50% of the chip area as ANALOG. If the majority of the chip area is DIGITAL (usually logic) the device should be classified as MOS Special Purpose Logic (category LA). Examples are: Analog-to-Digital (A-D), Digital-to-Analog (D-A), Sample-and-Hold, Analog Switches, Multiplexors, Voltage-to-Frequency (V-F), Frequency-to-Voltage (F-V), Synchro-to-Digital (S-D), Digital-to-Synchro (D-S). Excluded are CODEC and reference circuits.

J8. Comparators - All analog ICs designated as voltage comparators.

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

JBa. Audio/Video – Application specific analog 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, etc. / TV (Video, Sound, Chroma), VCR/Camcorder, etc.

JBb. Other Consumer – Application specific analog ICs designed specifically for use in Personal or Home Appliances, White Goods, Still Cameras, Games, etc.

JC. Computer & Peripherals - Application-specific analog 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.

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

JCd. Storage - Application specific analog 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. Devices in this subcategory include read/write amplifiers, read channel devices, head positioning controllers, spindle motor control ICs, mass storage pre-amps, etc.

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

JD. Communications - Analog ICs designed specifically for voice or data communications applications. These applications include telecommunication network equipment 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. Examples of analog ICs in this category include SLICs, CODECs (less than 16 bits), telecom filters, fax and modem ICs, power management, RF and IF circuits for cordless and mobile telephones. ICs under this category shall be classified into one of the following subcategories depending on the application for which they are designed.

JDa. Wireless Communication - Cellular Phone. Analog ICs designed for application in 1G, 2G, 2.5G, 3G mobile telephones, Smart Phones, etc.

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

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

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

JDe. Wired Communications – Analog ICs designed for application in PBX, Modem, VOIP, Central Office, etc.

JE. Automotive - Application specific analog ICs designed specifically for automotive applications including engine and power train controls, entertainment circuits (i. e. radio, etc.), safety (air bags, antilock brakes, etc.), active suspension, display controls, navigation circuits, body electric, engine control/powertrain, motor control and noise cancellation, and any other analog ICs dedicated to automotive use (for instance, automotive application specific linear regulators). ICs for car audio applications, which are, equally or predominately used in home audio equipment shall be classified into another sub-category (JBa) above. ICs containing semiconductor sensor elements together with analog signal conditioning circuitry shall be classified into the appropriate category in H99-Sensors, irrespective of the analog content and functions of the circuit.

JF. Multipurpose & Others - Application specific analog ICs designed specifically for industrial applications or other applications not specified in JB to JE above. ICs containing semiconductor sensor elements together with analog signal conditioning circuitry shall be classified into the appropriate category in H99-Sensors, irrespective of the analog content and functions of the circuit. This category includes Radio Frequency Identification (RFID) transponder circuits (analog transmitter-receiver IC's activated for transmission by reception of a predetermined signal from a reader/writer). These transponders may be passive (no battery, solely powered by the antenna field of reader/writer devices) or active (powered by a battery or other external power source). Only the value of the IC on the transponder should be reported. ICs in this category are reported into the following subcategories based on the function for which they are designed.

JFa. All Other Multipurpose & Others - Application specific analog ICs designed specifically for industrial applications or other applications not specified in JB to JE above or JFb and JFc below. This category JFa includes analog ICs designed specifically for active RFID transponders of all frequencies.

JFb. RFID Transponders – UHF & Higher Frequency – Application specific analog ICs designed specifically for Passive RFID Transponders operating in the 860-960 MHz band (Ultra High Frequency) and those operating in higher frequency range such as 2.45GHz. These RFIDs may transmit unique identifier (ID) only or other data.

JFc. RFID Transponders – LF & HF – Application specific analog ICs designed specifically for Passive RFID Transponders operating at 125 KHz or 135 KHz (Low Frequency) or 13.56 MHz (High Frequency). These RFIDs may transmit unique identifier (ID) only or other data.

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.

P2a. 4 BIT MCU - Operates with 4 BIT external data bus.

P2b. 8 BIT MCU - Operates with 8 BIT external data bus.

P2c. 16 BIT MCU - Operates with 16 BIT external data bus.

P2e. 32 BIT or greater MCU - Operates with 32 BIT or greater external data bus.

In addition to classification into the above subcategories P2a, P2b, P2c and P2e based on bit width of the external bus, total MOS MCU (including all external data bus width) shall be reclassified and reported into the following subcategories according to the application for which the product is designed.

P2m. 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, etc.

P2n. Computer & Peripherals - Application-specific MCUs designed specifically for use in computer equipment or computer peripherals. ICs in this category are reported into the following subcategories P2j, P2k and p2l, based on the function for which they are designed.

P2j. Computer Systems – Application specific MCUs designed specifically for use in computer systems, such as desktop PCs, notebook PCs, PDAs, servers, workstations, mainframes, etc.

P2k. 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 dedicated music CD or DVD-related MCUs, which are included under Consumer applications. Devices usable in both consumer and storage applications shall be classified into this subcategory.

P2l. Other Peripherals – Application specific MCUs designed specifically for use in computer periphery applications, such as printers, scanners, monitors, keyboards, mice, etc.

P2o. Wireless Communication - Cellular Phone. MCUs designed for application in Mobile Phones for 1G, 2G, 2.5G, 3G, Smart Phones, etc.

P2p. Wireless Communication – Infrastructure. MCUs designed for application in Mobile Base Stations for 1G to 3G, Hot Spots, etc.

P2q. Wireless Communication – Short Range Wireless. MCUs designed for application in WLAN, Bluetooth, UWB, ZigBee, etc.

P2r. Wireless Communication – All Other. MCUs designed for application in 2-way Radio, Cordless Phone, etc.

P2s. Wired Communication – MCUs designed for application in PBX, Modem, VOIP, Central Office, etc.

P2t. Automotive - MCUs designed for application in auto entertainment, navigation, driver information, engine controls and all other automotive applications.

P2u. All Other IC cards - MCUs designed for application in IC cards not specified by P2v below.

P2v. Contactless (RF) IC cards - MCUs with a Radio Frequency communication interface operating at 13.56 MHz, designed for application in IC cards. These MCUs typically require close proximity placement (within a few inches) to a reader to work. These MCUs allow for adding, deleting, or manipulating information in memory, allowing for a variety of applications, cryptographic functions and dynamic read/write capabilities. These MCUs may also support other communication interfaces (e.g. contact). These MCUs are passive (no battery, solely powered by the antenna field of reader/writer devices) and are typically used for contact-less payments, personal ID applications (such as electronic passports), etc.

P2z. Multipurpose & Others - MCUs designed for multiple applications or for industrial, instrument, military or other applications.

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, 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 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 (P2a to P2e) 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 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.). 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.

L1a. General Purpose Logic – ECL – All negative power supply, non-saturating, high speed logic devices with CML, ECL, EFL or similar input/output logic levels, among the digital bipolar devices that are standard and/or catalog parts for use in a wide range of equipments and applications. This category includes shift registers and register files.

L1b. General Purpose Logic – Schottky/Other – All TTL Schottky, all Advance Schottky, all Standard TTL and all other Non-ECL bipolar logic devices, among the digital bipolar devices that are standard and/or catalog parts for use in a wide range of equipments and applications. This category includes shift registers and register files.

L1c. Gate Array, Standard Cell & Other Digital Bipolar –

A Gate Array is a logic circuit consisting of fixed and regular arrangement of transistor cells that are interconnected according to a user-specific metallization pattern.

A Standard Cell is an integrated circuit consisting of a user-specific arrangement of predefined and fixed sub-circuits, so called “cells”.

Gate Array and Standard Cell products are considered to be "semi-custom" since the final metallization or inter-connection of cells from a library of existing cells is uniquely customized to make a proprietary device for a single customer.

The non-recurring-engineering (NRE) charges that are associated with production are to be included as part of the reported value. Charges or fees for research, feasibility studies, design center or software usage should not be reported.

If a device made by Gate Array or Standard Cell techniques is designated non-proprietary by the customer and allowed to be sold to any customer, it should be reclassified into L1a (General Purpose Logic – ECL), L1b (General Purpose Logic – Schottky/Other) or L1c (Other Digital Bipolar).

Other Digital Bipolar includes bipolar memory and all other bipolar logic circuit (such as FPL, MPU, MCU, micro peripherals, etc.) not included in L1a or L1b, and those which are not categorized as bipolar Gate Array or Standard Cell. This subcategory includes proprietary (full custom) as well as application specific devices aimed at a specific market.

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).

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 programmning. 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).

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 unprogrammed 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, 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.

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.

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, etc. / TV (Video, Sound, Chroma), VCR/Camcorder, etc.

L5b. Other Consumer – ICs designed specifically for use in Personal or Home Appliances, White Goods, Still Cameras, Games, 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. 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.

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.

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.

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 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 mutandi* 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 2-3. 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.

M1f. 16M Bit & less - DRAM up to and including 16 megabits of memory.

M1g. 64 M Bit & less (>16 M) - DRAM containing more than 16 megabits and 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. Greater than 512 M Bit – DRAM containing more than 512 megabits of memory.

In addition to classification into the above subcategories M1f, M1g, M1h, M1j, M1k and M1m, 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.

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.

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):

M7a. 2M Bit & less - NOR-Type Flash Memory containing up to and including 2 megabits of memory.

M7b. 4M Bit & less (>2M) – NOR-Type Flash Memory containing more than 2 megabits and up to and including 4 megabits of memory.

M7c. 8M Bit & less (>4M) – NOR-Type Flash Memory containing more than 4 megabits and up to and including 8 megabits of memory.

M7d. 16 M Bit & less (>8M) – NOR-Type Flash Memory containing more than 8 megabits and up to and including 16 megabits of memory.

M7e. 32 M Bit & less (>16M) – NOR-Type Flash Memory containing more than 16 megabits and up to and including 32 megabits of memory.

M7f. 64 M Bit & less (>32M) – NOR-Type Flash Memory containing more than 32 megabits and up to and including 64 megabits of memory.

M7g. 128 M Bit & less (>64M) – NOR-Type Flash Memory containing more than 64 megabits and up to and including 128 megabits of memory.

M7h. 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):

M7i. 128 M Bit & less – NAND-Type Flash Memory containing up to and including 128 megabits of memory.

M7j. 256 M Bit & less (>128M) – NAND-Type Flash Memory containing more than 128 megabits and up to and including 256 megabits of memory.

M7k. 512 M Bit & less (>256M) – NAND-Type Flash Memory containing more than 256 megabits and up to and including 512 megabits of memory.

M7l. 1 G Bit & less (>512M) – NAND-Type Flash Memory containing more than 512 megabits and up to and including 1 gigabits of memory.

M7m. Greater than 1 G Bit – NAND-Type Flash Memory containing more than 1 gigabits of memory.

In addition to classification into the above subcategories M7i, M7j, M7k, M7l and M7m, the Worldwide unit count of each of these subcategories shall be translated into 2 Gigabit-equivalent unit count, which shall then be aggregated to make Total NAND Worldwide Unit Count (2 Gigabit equivalent) and reported under the following category code. (Example: One unit of 128M Bit translates to 1/16 unit, and one unit of 512M Bit translates to 1/4 unit, respectively, in 2 Gigabit equivalent.)

M7x. NAND Total Units (2 Gigabit Equivalent)

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, P2, P4, L2c, LA

Q1 Consumer – Total of items JB, P2m, P4a, L2e and L5

Q2 Computer and Peripherals – Total of items JC, P2n, P4b, L2f and L6

Q3a Wireless Communication – Total of items JDa, JDb, JDc, JDd, P2o, P2p, P2q, P2r, P4c, P4d, P4f, L2g and L7a, L7b, L7c, L7d.

Q3b Wired Communication – Total of items JDe, P2s, P4g, L2h and L7e

Q4 Automotive – Total of items JE, P2t, P4h, L2i and L8

Q5 IC Card – Recapitulation of items P2u and P2v

Q6 Multipurpose and Others - Total of items JF, P2z, P4i, L2j and L9

Note: Items in Q99 (including 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

T. 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 reports. The region means that the semiconductor products are shipped and billed to end customer or distributor located in a specific region, regardless of the region where the 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: Western Europe (including, without limitation, Andorra, Austria, Benelux, Croatia, Cyprus, Denmark, Eire, Estonia, Germany, Finland, France, Greece, Greenland, Iceland, Ireland including Northern Ireland, Italy, Liechtenstein, Latvia, Lithuania, Monaco, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom), Eastern Europe (including without limitation, Poland, Romania, Czech Republic, Slovakia, Hungary, Yugoslavia or other Eastern Europe), Africa, the Middle East (including Afghanistan, Armenia, Iraq, Iran, Israel, Jemen, Jordania, Kuwait, Lebanon, Oman, Pakistan, Palestine, Qatar, Saudi-Arabia, Syria andTurkey) and the legacy countries of the former Soviet Union including Russia.
3. Japan
4. Asia Pacific: Asia (including, without limitation, Korea, Republic of China (Taiwan), People's Republic of China (including Hong Kong), 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.