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**“Class S equivalent” for CMOS4000B and 54HCMOS series**

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**Introduction**

This document provides detailed information on the STMicroelectronics® “Class S equivalent” qualification and manufacturing flow. This flow was developed to ease the use of the ST ESCC 9000 qualified CMOS4000 and 54HCMOS parts by customers requiring the MIL-STD-883 TM5005 Class S quality level.

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# 1 Reference documents

- MIL-STD-883 TM5004/TM5005
- ESCC 9000: generic specification for integrated circuits, monolithic, hermetically sealed
- ESCC 22900: Total dose steady-state irradiation test method
- ADCS 0038618: Dedicated irradiation test flow for CMOS family
- ADCS 0043082: Dedicated irradiation test flow for HCMOS to 50 krad
- ESCC specifications for each device, as listed in the ESCC QPL
- Aerospace report TOR-2006(8583)-5236: TECHNICAL REQUIREMENTS FOR ELECTRONIC PARTS, MATERIALS, AND PROCESSES USED IN SPACE AND LAUNCH VEHICLES
- MIL-STD-883 test method standard microcircuits
- HCC40xxx, HCC45xxx: Rad-hard, high voltage, CMOS logic series datasheet
- M54HCxxx, M54HCTxxx: Rad-hard high speed 2 to 6 V CMOS logic series datasheet

## 2 Procedure

The “Class S equivalent” qualification and manufacturing flow proposed by STMicroelectronics is based on the ESCC 9000 assembly, test, and quality conformance inspection (QCI) flows. Specific additional tests were performed to align the ESCC flow to the Class S requirements. The reference document, TOR-2006(8583)-5236 revision A, appendix C, provides details on the “Alternate QCI Test and Sampling Plan”.

*Table 1* through to *Table 4* present the “Class S equivalent” flow in the far right columns. *Table 1* shows the “screening test comparison”: “Class S” and “ESCC 9000 flow chart F3”. *Table 2*, *Table 3*, and *Table 4* show the “QCI comparison”: “Group A/B/D tests for Class S” and “ESCC 9000”.

*Figure 1* describes all the steps of the “Class S equivalent” screening flow.

*Figure 2* describes the QCI flow which was applied with reference to the ESCC 9000 QCI (chart F4 subgroup 1, 2, and 3) and additional tests.

### 2.1 Screening flow

**Table 1. Comparison between Class S, ESCC 9000 flow chart F3, and ST “Class S equivalent” flow**

Screen	Screening test comparison		ST “Class S equivalent” flow
	Class S	ESCC 9000 flow chart F3	
Wafer lot acceptance	883 TM5007	Process monitoring review according to ST SPC <sup>(1)</sup> rules + SEM <sup>(2)</sup> per ESCC 21400 + total dose radiation testing (if applicable) ESCC 22900	
Non destructive bond pull	883 TM2023	In process destructive test under SPC control 883 TM2011	
Internal visual	883 TM2010 cond. A	ESCC 20400 and 2049000	883 TM2010 cond. A 100%
Stabilization bake		883 TM1008, 24 hours at maximum storage temperature rating.	
Temperature cycling	883 TM1010 cond. C		
Constant acceleration	883 TM2001 cond. E	Not performed	883 TM2001 cond. E
Visual inspection			As per 883 TM2001 cond. E
PIND <sup>(3)</sup>	883 TM2020 cond. A		
Serialization	Required		
Pre burn-in electrical measurements	Per applicable SMD <sup>(4)</sup>	Per applicable ESCC detailed specification	Per applicable ESCC detailed specification <sup>(5)</sup>



**Table 1. Comparison between Class S, ESCC 9000 flow chart F3, and ST “Class S equivalent” flow (continued)**

Screen	Screening test comparison		ST “Class S equivalent” flow
	Class S	ESCC 9000 flow chart F3	
Burn-in test	883 TM1015 240 hours at 125 °C per minute	883 TM1015 240 hours at 125 °C <sup>(6)</sup>	883 TM1015 240 hours at 125 °C <sup>(7)(6)</sup>
Interim electrical measurements	Per applicable SMD, with deltas	Per applicable ESCC detailed specification with deltas	Per applicable ESCC detailed specification with deltas <sup>(5)</sup>
Reverse bias burn-in	883 TM1015 72 hours at 150 °C	883 TM1015 cond. A 72 hours NMOS <sup>(8)</sup> +72 hours PMOS <sup>(9)</sup> at 125 °C	883 TM1015 cond. A 72 hours NMOS+72 hours PMOS at 125 °C <sup>(7)</sup>
Final electrical tests at room temperature	Per applicable SMD, with deltas	Per applicable ESCC detailed specification with deltas	Per applicable ESCC detailed specification with deltas <sup>(5)</sup>
PDA <sup>(10)</sup> calculation	5% with 3% max. functional failure	5% applied at the end of screening flow	
Final electrical test of three temperatures	Static, dynamic, and AC's		Static, dynamic, and AC's <sup>(11)</sup>
Seal (fine and gross)	883 TM1014 condition A2 (fine leaks) and condition C1 (gross leaks)		
Radiographic	883 TM2012	Not performed	883 TM2012
External visual	883 TM2009	ESA <sup>(12)</sup> # 20500, 205900, and 883 TM2009	ESA # 20500, 205900, and 883 TM2009 paragraph 3.3.6(b) and 3.3.7(A)
Solderability	883 TM2003 (five parts, all leads)		

1. SPC = tool which ensures that the precision machined components manufactured for the aerospace and defense industries meet customer requirements.
2. SEM = scanning electron microscope.
3. PIND = particle impact noise detection.
4. SMD = standard microcircuit drawing.
5. With functional test at V<sub>CC</sub> = 20 V for CMOS4000B devices. See [Table 6](#) for delta.
6. Burn-in is done after reverse bias burn-in.
7. Performed at V<sub>CC</sub> = 20 V for CMOS4000B devices.
8. NMOS = NMOS logic.
9. PMOS = PMOS logic.
10. PDA = percent defective allowable
11. At 25 °C: static, functional and switching tests. At +125 °C and -55 °C: static and functional tests.
12. ESA = European space agency.

**Table 2. Comparison between Group A tests for Class S, ESCC 9000, and ST “Class S equivalent” flow**

QCI comparison		ST “Class S equivalent” flow
Group A electrical tests for Class S	ESCC 9000	
Subgroup 1: static at 25 °C	Not performed	
Subgroup 2: static at T max.		
Subgroup 3: static at T min.		
Subgroup 4: dynamic at 25 °C		
Subgroup 5: dynamic at T max.		
Subgroup 6: dynamic at T min.		
Subgroup 7: functional at 25 °C		
Subgroup 8: functional at T max.		
Subgroup 9: functional at T min.		
Subgroup 10: switching at 25 °C		
Subgroup 11: switching at T max.		
Subgroup 12: switching at T min.		

**Table 3. Comparison between Group B tests for Class S, ESCC 9000, and ST “Class S equivalent” flow**

QCI comparison						ST “Class S equivalent” flow	
Group B tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 1a: physical dimensions	883 TM2016	2/0	ESCC detailed specification	3/0 (if failure, 100% check)	Chart F2 before screening (chart F3)	ESCC detailed specification	3/0 (if failure, 100% check)
Sub. 1b: internal gas analysis	883 TM1018	3/0 or 5/1	Not performed			883 TM1018	3/0 or 5/1
Sub. 2a: resistance to solvents	883 TM2015	3/0	ESCC 24800	15/0	Chart F4 subgroup 2	Not done as laser marking was applied	

**Table 3. Comparison between Group B tests for Class S, ESCC 9000, and ST “Class S equivalent” flow (continued)**

QCI comparison						ST “Class S equivalent” flow	
Group B tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 2b: internal visual and mechanical	883 TM2013 and 2014	2/0	ESCC 20400 + 2049000	5/0	Chart F4 subgroup 3	ESCC 20400 + 2049000	3/0
Sub. 2c: bond strength	883 TM2011	22/0	883 TM2011	Two devices all wires/0		883 TM2011	Three devices all wires/0
Sub. 2d: die shear	883 TM2019 or 2027	3/0	883 TM2019	2/0		883 TM2019	3/0
Sub. 3: solderability	883 TM2003	22/0	883 TM2003	5/0	Chart F3	883 TM2003	
Sub. 4a: lead integrity	883 TM2004	45/0	883 TM2004 B2	Five devices minimum three leads by device/0	Chart F4 subgroup 3	883 TM2004 B2	Two devices all leads/0
Sub. 4b: seal (fine and gross)	883 TM1014 condition A2 and C1		Not performed			Not performed	
Sub. 4c: lid torque	883 TM2024		Not performed			Not performed	
Sub. 5a: endpoint electrical	883 TM1005		ESCC detailed specification	15/0	Chart F4 subgroup 2	ESCC detailed specification	22/0
Sub. 5b: steady state life	883 TM1005 1000 hours		883 TM1005 2000 hours		883 TM1005 2000 hours	22/0 <sup>(1)</sup>	
Sub. 5c: endpoint electrical			ESCC detailed specification		Chart F4 subgroup 2	ESCC detailed specification	22/0

**Table 3. Comparison between Group B tests for Class S, ESCC 9000, and ST “Class S equivalent” flow (continued)**

QCI comparison						ST “Class S equivalent” flow	
Group B tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 6a: endpoint electrical		15/0	ESCC detailed specification	15/0	Chart F4 subgroup 1	ESCC detailed specification	4/0
Sub. 6b: temperature cycle	883 TM1010 cond. C, 100 cycles		Not performed			883 TM1010, cond. C 100 cycles	
Sub. 6c: constant acceleration	883 TM2001 cond. E		883 TM2001 E	15/0	Chart F4 subgroup 1	883 TM2001 cond. E	
Sub. 6d: seal (fine and gross)	883 TM1014 condition A2 and C1		883 TM1014 condition A2 and C1			883 TM1014 condition A2 and C1	
Sub. 6e: endpoint electrical			ESCC detailed specification			ESCC detailed specification	

1. Performed on each line item order

**Table 4. Comparison between Group D tests for Class S, ESCC 9000, and ST “Class S equivalent” flow**

QCI comparison						ST “Class S equivalent” flow	
Group D tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 1: physical dimensions	883 TM2016	15/0	ESCC detailed specification	3/0 (if failure 100% check)	Chart F2 before screening (chart F3)	ESCC detailed specification	3/0 (if failure 100% check)
Sub. 2a: lead integrity	883 TM2004	45/0 leads	883 TM2004 B2	Five devices minimum three leads by device/0	Chart F4 subgroup 3	Done in group B	
Sub. 2b: seal (fine and gross)	883 TM1014		Not performed after lead integrity				





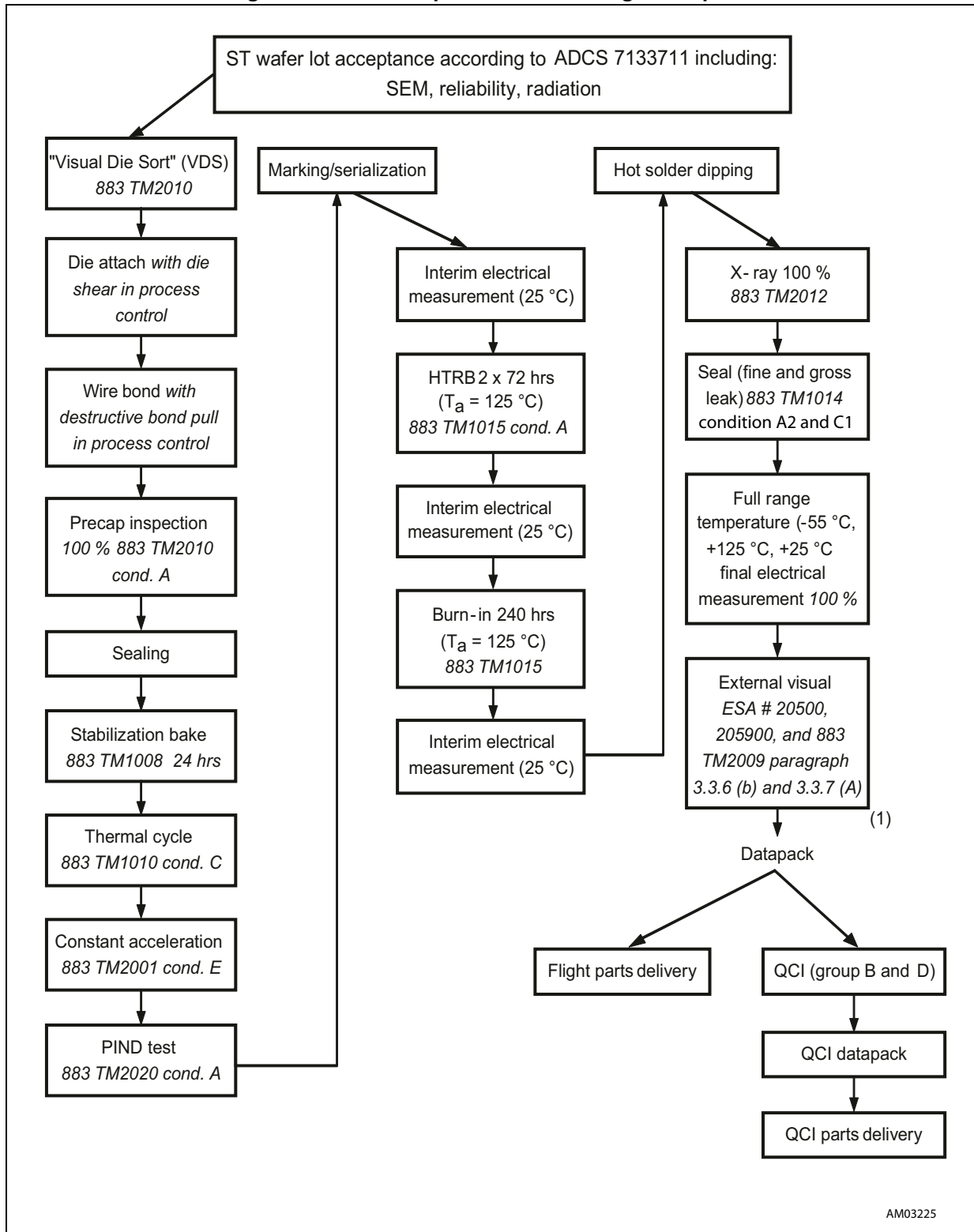
**Table 4. Comparison between Group D tests for Class S, ESCC 9000, and ST “Class S equivalent” flow (continued)**

QCI comparison						ST “Class S equivalent” flow	
Group D tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 3a: thermal shock	883 TM1011	15/0	883 TM1011 C	15/0	Chart F4 subgroup 1	883 TM1011 C	5/0
Sub. 3b: temperature cycle	883 TM1010		Not performed			Done in group B	
Sub. 3c: moisture resistance	883 TM1004		883 TM1004	15/0	Chart F4 subgroup 1	883 TM1004	5/0
Sub. 3d: visual examination	883 TM1004 and 1010		ESCC 20400 + 2049000			ESCC 20400 + 2049000	
Sub. 3e: seal (fine and gross)	883 TM1014 condition A2 and C1		883 TM1014 condition A2 and C1			883 TM1014 condition A2 and C1	
Sub. 3f: endpoint electrical			ESCC detailed specification			ESCC detailed specification	
Sub. 4a: mechanical shock	883 TM2002		883 TM2002 B			883 TM2002B	
Sub. 4b: vibration	883 TM2007		883 TM2007 A	883 TM2007 A			
Sub. 4c: constant acceleration	883 TM2001 cond. E		883 TM2001E	883 TM2001 E			

**Table 4. Comparison between Group D tests for Class S, ESCC 9000, and ST “Class S equivalent” flow (continued)**

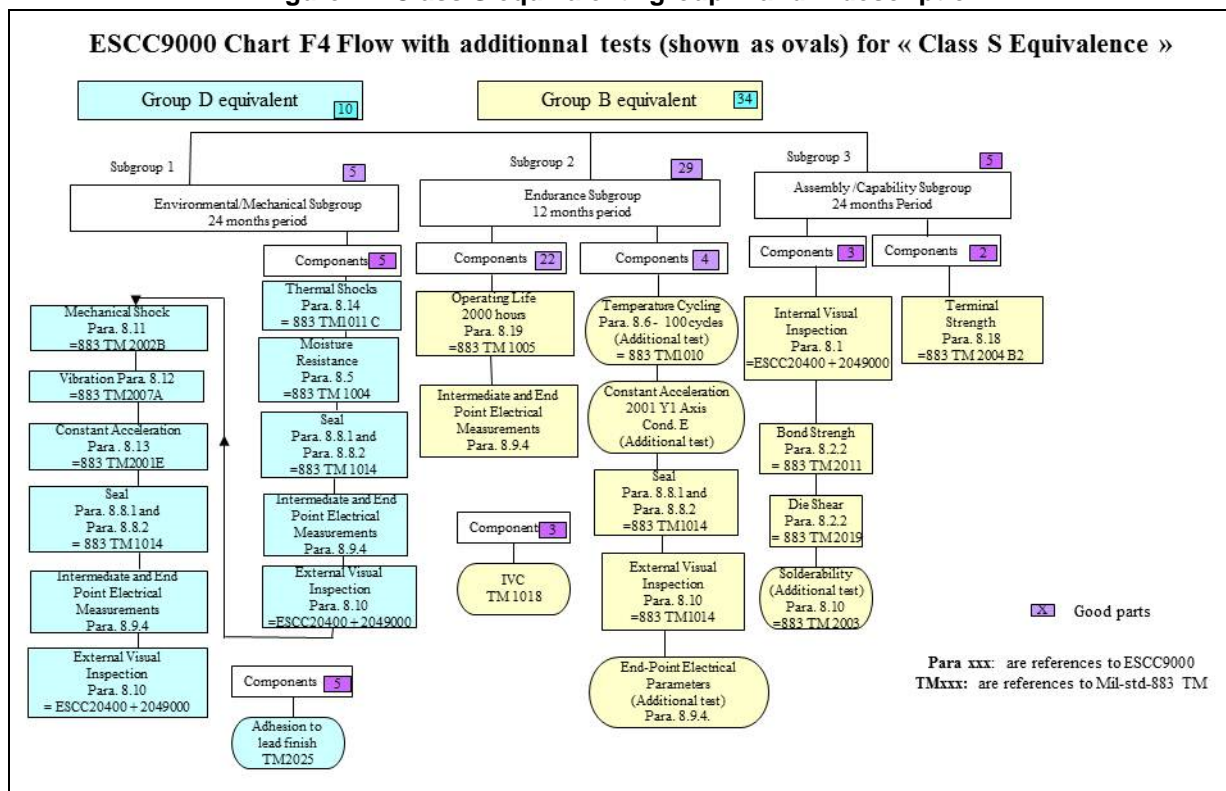
QCI comparison						ST “Class S equivalent” flow					
Group D tests for Class S			ESCC 9000								
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria				
Sub. 4d: seal (fine and gross)	883 TM1014 condition A2 and C1	15/0	883 TM1014 condition A2 and C1	15/0	Chart F4 subgroup 1	883 TM1014 condition A2 and C1	5/0				
Sub. 4e: visual examination	883 TM1010 or 1011		ESCC 20400 + 2049000			ESCC 20400 + 2049000					
Sub. 4f: endpoint electrical	883 TM1005		ESCC detailed specification			ESCC detailed specification					
Sub. 5a: salt atmosphere	883 TM1009		Not performed							Not performed	
Sub. 5b: visual examination											
Sub. 5c: seal (fine and gross)	883 TM1014 condition A2 and C1	3/0 or 5/1									Done in group B
Sub. 6: internal gas analysis	883 TM1018										
Sub. 7: adhesion of lead finish	883 TM2025	15/0				883 TM2025	5/0				
Sub. 8: lid torque	883 TM2024	5/0				Not performed					

Figure 1. "Class S equivalent" screening description



1. 44 parts for group B and D.

Figure 2. “Class S equivalent” group B and D description



1. Legend:  
 Para xxx are references to ESCC 9000  
 TMxxx are references to MIL-STD-883 TM.
2. For internal gas analysis (IGA), terminal strength, bond strength/die shear and solderability, adhesion to the lead finish, ST can use rejects which do not jeopardize the test result.

## 2.2 Specific electrical requirements for CMOS4000B

Table 5. Specific electrical requirements for CMOS4000B

Characteristics	Symbols	Maximum ratings	Unit	Note
Supply voltage	$V_{DD}$	-0.5 to 22 V	V	(1)
Input voltage	$V_{IN}$	-0.5 to $V_{DD} + 0.5$		Power on <sup>(1)</sup>

1. The device is functional for  $3\text{ V} \leq V_{DD} \leq 20\text{ V}$ .

### Parameter drift values

The following limits supersede those of each ESCC detailed specification.



**Table 6. Parameter drift values**

Characteristic	Symbols	Limits		Unit	
		Drift value	Absolute		
			Min.		Max.
Threshold voltage N-channel	$V_{THn}$	±0.6	-0.7	-3	V
Threshold voltage P-channel	$V_{THp}$		0.7	3	

### 2.3 Radiation

The radiation guarantee depends on the product series:

- M54HCMOS series: each wafer is tested to a total dose of 50 krad according to the ESCC 22900. The corresponding radiation verification test (RVT) report is included in the documentation provided with each shipment.
- CMOS4000B series: each wafer lot is tested to a total dose of 100 krad according to the ST internal specification. The corresponding RVT report is included in the documentation provided with each shipment.

### 2.4 Package

By default, the flat packages used for the “Class S equivalent” flow are ESCC packages. Their mechanical dimensions are slightly different to their QML counterparts (see the ST datasheets HCC40xxx, HCC45xxx and M54HCxxx, M54HCTxxx, or the relevant ESCC detailed specifications). It is recommended to check that the footprint used is compatible with ESCC Flat.

### 2.5 Marking

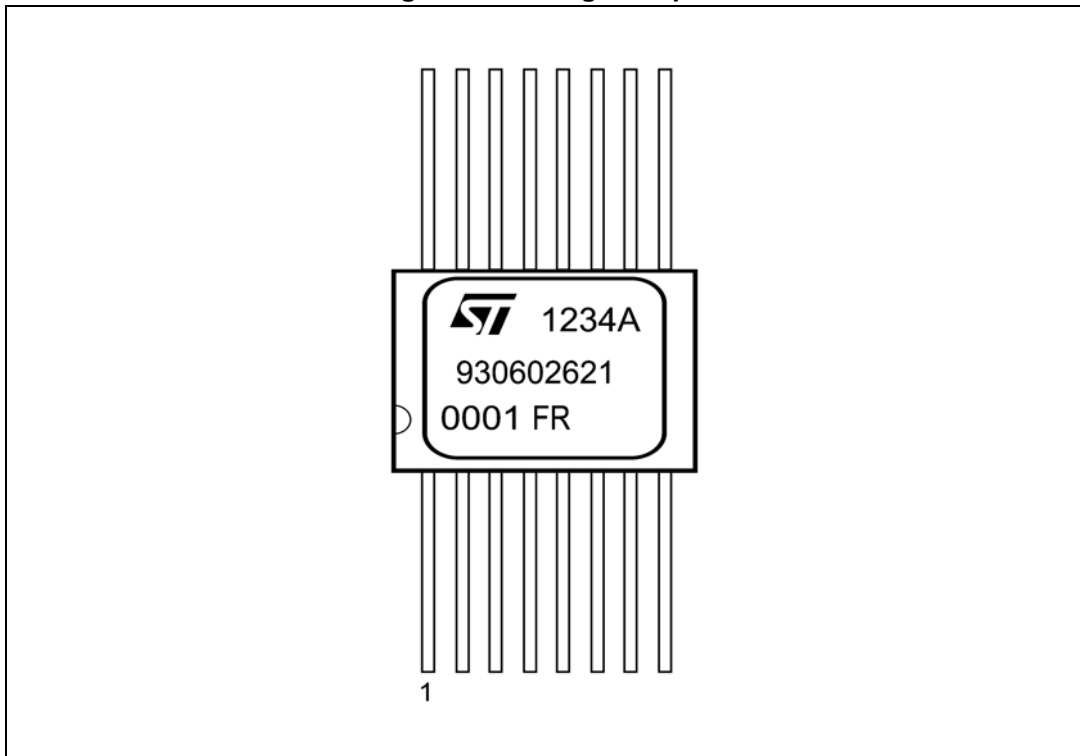
The devices are marked as follows (see also [Figure 3](#)):

- Date code/ST logo/country of origin (e.g. FR = France)
- ESCC detailed specification number + specific variant as shown in [Table 7](#)

**Table 7. Variant table**

Package	Gold finish	Hot solder dipped
Flat	21	23

Figure 3. Marking example



In the example of [Figure 3](#), the ESCC detailed specification number is 9306/026, corresponding to the HCC4094BK. A variant 21 is given by ST to the “Class S equivalent” version of the product with a gold finish.

ESCC specification numbers can be found on ESCC web site:  
[www.escies.org/specfamily/viewArchived](http://www.escies.org/specfamily/viewArchived)

### 3 Quality requirements

All documentation or traceability information corresponding to each item supplied to the customer by STMicroelectronics is retained for 10 years in a safe storage area. The information and documentation can be reviewed on an ST premises upon request. A copy of the documentation and traceability information can be provided at a cost.

## 4 Ordering information

Each order includes three line items:

- ST part number with a minimum order quantity of 100 parts
- ST part number for 44 additional parts for Group B and D tests
- Order code for a fixed qualification fee: ST part number is CLASS-S-71

ST part numbers are built as follows:

- CMOS4000B
  - HCC4xxxBHVKG for a flat version gold plated
  - HCC4xxxBHVKT for a flat version hot solder dipped
- 54HCMOS
  - M54HCyySKG for the HC series in a flat version with a gold finish
  - M54HCyySKT for the HC series in a flat version with a hot solder dipped finish
  - M54HCTyySKG for the HCT series in a flat version with a gold finish
  - M54HCTyySKT for the HCT series in a flat version with a hot solder dipped finish

All the ESCC qualified CMOS4000B and 54HCMOS devices supported by ST can be procured in a “Class S equivalent” version. The complete list of supported products is provided in the CMOS4000B and 54HC/HCT datasheets. [Table 8](#) and [Table 9](#) (which are for reference only) provide the corresponding part numbers available at the time of printing.





**Table 8. Ordering information for rad-hard CMOS400B series**

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
HCC4001BHVKG	9201/041/01	Class S equivalent	Flat-14	Gold	920104121	0.70	Strip pack
HCC4001BHVKT	9201/041/02			Solder dip	920104123		
HCC4002BHVKG	9201/042/01			Gold	920104221		
HCC4002BHVKT	9201/042/02			Solder dip	920104223		
HCC4008BHVKG	9202/039/01		Flat-16	Gold	920203921		
HCC4008BHVKT	9202/039/02			Solder dip	920203923		
HCC4011BHVKG	9201/043/01		Flat-14	Gold	920104321		
HCC4011BHVKT	9201/043/02			Solder dip	920104323		
HCC4013BHVKG	9203/023/01			Gold	920302321		
HCC4013BHVKT	9203/023/02			Solder dip	920302323		
HCC4014BHVKG	9306/014/01		Flat-16	Gold	930601421		
HCC4014BHVKT	9306/014/02			Solder dip	930601423		
HCC4015BHVKG	9306/015/01			Gold	930601521		
HCC4015BHVKT	9306/015/02			Solder dip	930601523		
HCC4017BHVKG	9204/020/01			Gold	920402021		
HCC4017BHVKT	9204/020/02			Solder dip	920402023		
HCC4018BHVKG	9204/021/01			Gold	920402121		
HCC4018BHVKT	9204/021/02			Solder dip	920402123		
HCC4019BHVKG	9202/051/01			Gold	920205121		
HCC4019BHVKT	9202/051/02			Solder dip	920205123		
HCC4020BHVKG	9204/022/01	Gold		920402221			
HCC4020BHVKT	9204/022/02	Solder dip		920402223			



Table 8. Ordering information for rad-hard CMOS400B series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
HCC4021BHVKG	9306/016/01	Class S equivalent	Flat-16	Gold	930601621	0.70	Strip pack
HCC4021BHVKT	9306/016/02			Solder dip	930601623		
HCC4022BHVKG	9204/023/01			Gold	920402321		
HCC4022BHVKT	9204/023/02			Solder dip	920402323		
HCC4024BHVKG	9204/024/01		Flat-14	Gold	920402421		
HCC4024BHVKT	9204/024/02			Solder dip	920402423		
HCC4027BHVKG	9203/022/01		Flat-16	Gold	920302221		
HCC4027BHVKT	9203/022/02			Solder dip	920302223		
HCC4028BHVKG	9205/010/01			Gold	920501021		
HCC4028BHVKT	9205/010/02			Solder dip	920501023		
HCC4029BHVKG	9204/025/01			Gold	920402521		
HCC4029BHVKT	9204/025/02			Solder dip	920402523		
HCC4030BHVKG	9201/047/01		Flat-14	Gold	920104721		
HCC4030BHVKT	9201/047/02			Solder dip	920104723		
HCC4040BHVKG	9204/026/01		Flat-16	Gold	920402621		
HCC4040BHVKT	9204/026/02			Solder dip	920402623		
HCC4041UBHVKG	9202/040/01		Flat-14	Gold	920204021		
HCC4041UBHVKT	9202/040/02			Solder dip	920204023		



**Table 8. Ordering information for rad-hard CMOS400B series (continued)**

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing	
HCC4043BHVKG	9202/042/01	Class S equivalent	Flat-16	Gold	920204221	0.70	Strip pack	
HCC4043BHVKT	9202/042/02			Solder dip	920204223			
HCC4044BHVKG	9202/043/01			Gold	920204321			
HCC4044BHVKT	9202/043/02			Solder dip	920204323			
HCC4046BHVKG	9202/044/01			Gold	920204421			
HCC4046BHVKT	9202/044/02			Solder dip	920204423			
HCC4047BHVKG	9207/003/01		Flat-14	Gold	920700321			
HCC4047BHVKT	9207/003/02			Solder dip	920700323			
HCC4049UBHVKG	9202/045/01		Flat-16	Gold	920204521			
HCC4049UBHVKT	9202/045/02			Solder dip	920204523			
HCC4050BHVKG	9202/046/01			Gold	920204621			
HCC4050BHVKT	9202/046/02			Solder dip	920204623			
HCC4051BHVKG	9202/047/01			Gold	920204721			
HCC4051BHVKT	9202/047/02			Solder dip	920204723			
HCC4052BHVKG	9202/048/01			Gold	920204821			
HCC4052BHVKT	9202/048/02			Solder dip	920204823			
HCC4053BHVKG	9202/049/01			Gold	920204921			
HCC4053BHVKT	9202/049/02			Solder dip	920204923			
HCC4060BHVKG	9204/052/01			Gold	920405221			
HCC4060BHVKT	9204/052/02			Solder dip	920405223			
HCC4063BHVKG	9209/001/01			Gold	920900121			
HCC4063BHVKT	9209/001/02			Solder dip	920900123			
HCC4066BHVKG	9408/005/01			Flat-14	Gold			940800521
HCC4066BHVKT	9408/005/02				Solder dip			940800523



Table 8. Ordering information for rad-hard CMOS4000B series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing	
HCC4067BHVKG	9408/009/01	Class S equivalent	Flat-24	Gold	940800921	1.70	Strip pack	
HCC4067BHVKT	9408/009/02			Solder dip	940800923			
HCC4068BHVKG	9201/061/01		Flat-14	Flat-14	Gold	920106121		0.70
HCC4068BHVKT	9201/061/02				Solder dip	920106123		
HCC4069UBHVKG	9401/010/01				Gold	940101021		
HCC4069UBHVKT	9401/010/02				Solder dip	940101023		
HCC4070BHVKG	9201/048/01				Gold	920104821		
HCC4070BHVKT	9201/048/02				Solder dip	920104823		
HCC4071BHVKG	9201/063/01				Gold	920106321		
HCC4071BHVKT	9201/063/02				Solder dip	920106323		
HCC4072BHVKG	9201/082/01				Gold	920108221		
HCC4072BHVKT	9201/082/02				Solder dip	920108223		
HCC4073BHVKG	9201/064/01				Gold	920106421		
HCC4073BHVKT	9201/064/02				Solder dip	920106423		
HCC4075BHVKG	9201/065/01				Gold	920106521		
HCC4075BHVKT	9201/065/02				Solder dip	920106523		
HCC4076BHVKG	9306/022/01		Flat-16	Flat-16	Gold	930602221		
HCC4076BHVKT	9306/022/02				Solder dip	930602223		
HCC4077BHVKG	9201/055/01		Flat-14	Flat-14	Gold	920105521		
HCC4077BHVKT	9201/055/02				Solder dip	920105523		
HCC4081BHVKG	9201/052/01				Gold	920105221		
HCC4081BHVKT	9201/052/02				Solder dip	920105223		
HCC4093BHVKG	9409/002/01				Gold	940900221		
HCC4093BHVKT	9409/002/02				Solder dip	940900223		



**Table 8. Ordering information for rad-hard CMOS4000B series (continued)**

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
HCC4094BHVKG	9306/026/01	Class S equivalent	Flat-16	Gold	930602621	0.70	Strip pack
HCC4094BHVKT	9306/026/02			Solder dip	930602623		
HCC4098BHVKG	9206/003/01			Gold	920600321		
HCC4098BHVKT	9206/003/02			Solder dip	920600323		
HCC40103BHVKG	9204/036/01			Gold	920403621		
HCC40103BHVKT	9204/036/02			Solder dip	920403623		
HCC40106BHVKG	9409/005/01		Flat-14	Gold	940900521		
HCC40106BHVKT	9409/005/02			Solder dip	940900523		
HCC40107BHVKG	9401/013/01			Gold	940101321		
HCC40107BHVKT	9401/013/02			Solder dip	940101323		
HCC40109BHVKG	9407/003/01		Flat-16	Gold	940700321		
HCC40109BHVKT	9407/003/02			Solder dip	940700323		
HCC40161BHVKG	9204/054/01			Gold	920405421		
HCC40161BHVKT	9204/054/02			Solder dip	920405423		
HCC40174BHVKG	9203/038/01			Gold	920303821		
HCC40174BHVKT	9203/038/02			Solder dip	920303823		
HCC40193BHVKG	9204/041/01			Gold	920404121		
HCC40193BHVKT	9204/041/02			Solder dip	920404123		
HCC4503BHVKG	9401/030/01			Gold	940103021		
HCC4503BHVKT	9401/030/02			Solder dip	940103023		
HCC4512BHVKG	9408/006/01			Gold	940800621		
HCC4512BHVKT	9408/006/02			Solder dip	940800623		



Table 8. Ordering information for rad-hard CMOS400B series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
HCC4514BHVKG	9408/012/01	Class S equivalent	Flat-24	Gold	940801221	1.70	Strip pack
HCC4514BHVKT	9408/012/02			Solder dip	940801223		
HCC4515BHVKG	9205/011/01			Gold	920501121		
HCC4515BHVKT	9205/011/02			Solder dip	920501123		
HCC4516BHVKG	9204/045/01		Flat-16	Gold	920404521	0.70	
HCC4516BHVKT	9204/045/02			Solder dip	920404523		
HCC4520BHVKG	9204/028/01			Gold	920402821		
HCC4520BHVKT	9204/028/02			Solder dip	920402823		
HCC4532BHVKG	9202/065/01			Gold	920206521		
HCC4532BHVKT	9202/065/02			Solder dip	920206523		
HCC4538BHVKG	9207/007/01			Gold	920700721		
HCC4538BHVKT	9207/007/02			Solder dip	920700723		
HCC4555BHVKG	9408/011/01			Gold	940801121		
HCC4555BHVKT	9408/011/02			Solder dip	940801123		
HCC4556BHVKG	9408/025/01			Gold	940802521		
HCC4556BHVKT	9408/025/02			Solder dip	940802523		

1. Specific marking only. Refer to [Section 2.5: Marking](#) for complete marking information.



Table 9. Ordering information for rad-hard 54HC and 54HCT series

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
M54HC00SKG	9201/105/01F	Class S equivalent	Flat-14	Gold	920110521	0.70	Strip pack
M54HC00SKT	9201/105/02F			Solder dip	920110523		
M54HC02SKG	9201/113/01F			Gold	920111321		
M54HC02SKT	9201/113/02F			Solder dip	920111323		
M54HC03SKG	9201/114/01F			Gold	920111421		
M54HC03SKT	9201/114/02F			Solder dip	920111423		
M54HC04SKG	9401/033/01F			Gold	940103321		
M54HC04SKT	9401/033/02F			Solder dip	940103323		
M54HC08SKG	9201/106/01F			Gold	920110621		
M54HC08SKT	9201/106/02F			Solder dip	920110623		
M54HC10SKG	9201/107/01F			Gold	920110721		
M54HC10SKT	9201/107/02F			Solder dip	920110723		
M54HC11SKG	9201/117/01F			Gold	920111721		
M54HC11SKT	9201/117/02F			Solder dip	920111723		
M54HC14SKG	9409/007/01F			Gold	940900721		
M54HC14SKT	9409/007/02F			Solder dip	940900723		
M54HC21SKG	9201/108/01F			Gold	920110821		
M54HC21SKT	9201/108/02F			Solder dip	920110823		
M54HC27SKG	9201/109/01F			Gold	920110921		
M54HC27SKT	9201/109/02F			Solder dip	920110923		
M54HC30SKG	9201/110/01F	Gold	920111021				
M54HC30SKT	9201/110/02F	Solder dip	920111023				
M54HC32SKG	9201/111/01F	Gold	920111121				



Table 9. Ordering information for rad-hard 54HC and 54HCT series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
M54HC32SKT	9201/111/02F	Class S equivalent	Flat-14	Solder dip	920111123	0.70	Strip pack
M54HC73SKG	9203/071/01F			Gold	920307121		
M54HC73SKT	9203/071/02F			Solder dip	920307123		
M54HC74SKG	9203/050/01F			Gold	920305021		
M54HC74SKT	9203/050/02F			Solder dip	920305023		
M54HCT74SKG	9203/070/01F			Gold	920307021		
M54HCT74SKT	9203/070/02F			Solder dip	920307023		
M54HC75SKG	9203/065/01F		Flat-16	Gold	920306521		
M54HC75SKT	9203/065/02F			Solder dip	920306523		
M54HC85SKG	9209/004/01F			Gold	920900421		
M54HC85SKT	9209/004/02F		Solder dip	920900423			
M54HC86SKG	9201/119/01F		Flat-14	Gold	920111921		
M54HC86SKT	9201/119/02F			Solder dip	920111923		
M54HC109SKG	9306/048/01F		Flat-16	Gold	930604821		
M54HC109SKT	9306/048/02F			Solder dip	930604823		
M54HC123SKG	9207/006/01F			Gold	920700621		
M54HC123SKT	9207/006/02F			Solder dip	920700623		
M54HC125SKG	9401/039/01F		Flat-14	Gold	940103921		
M54HC125SKT	9401/039/02F			Solder dip	940103923		
M54HC132SKG	9201/120/01F			Gold	920112021		
M54HC132SKT	9201/120/02F			Solder dip	920112023		
M54HC138SKG	9408/046/01F		Flat-16	Gold	940804621		
M54HC138SKT	9408/046/02F			Solder dip	940804623		





**Table 9. Ordering information for rad-hard 54HC and 54HCT series (continued)**

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
M54HC139SKG	9205/017/01F	Class S equivalent	Flat-16	Gold	920501721	0.70	Strip pack
M54HC139SKT	9205/017/02F			Solder dip	920501723		
M54HC148SKG	9410/017/01F			Gold	941001721		
M54HC148SKT	9410/017/02F			Solder dip	941001723		
M54HC151SKG	9408/054/01F			Gold	940805421		
M54HC151SKT	9408/054/02F			Solder dip	940805423		
M54HC153SKG	9408/038/01F			Gold	940803821		
M54HC153SKT	9408/038/02F			Solder dip	940803823		
M54HC154SKG	9205/023/01F		Flat-24	Gold	920502321	1.70	
M54HC154SKT	9205/023/02F			Solder dip	920502323		
M54HC157SKG	9408/057/01F		Flat-16	Gold	940805721	0.70	
M54HC157SKT	9408/057/02F			Solder dip	940805723		
M54HC161SKG	9204/059/01F			Gold	920405921		
M54HC161SKT	9204/059/02F			Solder dip	920405923		
M54HC164SKG	9306/041/01F		Flat-14	Gold	930604121		
M54HC164SKT	9306/041/02F			Solder dip	930604123		
M54HC165SKG	9306/042/01F		Flat-16	Gold	930604221		
M54HC165SKT	9306/042/02F			Solder dip	930604223		
M54HC166SKG	9306/043/01F			Gold	930604321		
M54HC166SKT	9306/043/02F			Solder dip	930604323		
M54HC174SKG	9306/052/01F			Gold	930605221		
M54HC174SKT	9306/052/02F			Solder dip	930605223		
M54HC175SKG	9203/052/01F			Gold	920305221		


**Table 9. Ordering information for rad-hard 54HC and 54HCT series (continued)**

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing		
M54HC175SKT	9203/052/02F	Class S equivalent	Flat-16	Solder dip	920305223	0.70	Strip pack		
M54HC191SKG	9204/066/01F			Gold	920406621				
M54HC191SKT	9204/066/02F			Solder dip	920406623				
M54HC193SKG	9204/065/01F			Gold	920406521				
M54HC193SKT	9204/065/02F			Solder dip	920406523				
M54HC237SKG	9205/021/01F			Gold	920502121				
M54HC237SKT	9205/021/02F			Solder dip	920502123				
M54HC240SKG	9401/034/01F		Flat-20	Gold	940103421	0.90			
M54HC240SKT	9401/034/02F			Solder dip	940103423				
M54HCT240SKG	9401/045/01F			Gold	940104521				
M54HCT240SKT	9401/045/02F			Solder dip	940104523				
M54HC244SKG	9401/048/01F			Gold	940104821				
M54HC244SKT	9401/048/02F			Solder dip	940104823				
M54HCT244SKG	9402/009/01F			Gold	940200921				
M54HCT244SKT	9402/009/02F			Solder dip	940200923				
M54HC245SKG	9405/013/01F			Gold	940501321				
M54HC245SKT	9405/013/02F			Solder dip	940501323				
M54HCT245SKG	9405/014/01F			Gold	940501421				
M54HCT245SKT	9405/014/02F			Solder dip	940501423				
M54HC251SKG	9408/048/01F			Flat-16	Gold			940804821	0.70
M54HC251SKT	9408/048/02F				Solder dip			940804823	
M54HC257SKG	9408/047/01F		Gold		940804721				
M54HC257SKT	9408/047/02F		Solder dip		940804723				



Table 9. Ordering information for rad-hard 54HC and 54HCT series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing
M54HC259SKG	9203/073/01F	Class S equivalent	Flat-16	Gold	920307321	0.70	Strip pack
M54HC259SKT	9203/073/02F			Solder dip	920307323		
M54HC273SKG	9203/053/01F		Flat-20	Gold	920305321	0.90	
M54HC273SKT	9203/053/02F			Solder dip	920305323		
M54HC283SKG	9202/075/01F		Flat-16	Gold	920207521	0.70	
M54HC283SKT	9202/075/02F			Solder dip	920207523		
M54HC373SKG	9203/059/01F		Flat-20	Gold	920305921	0.90	
M54HC373SKT	9203/059/02F			Solder dip	920305923		
M54HC374SKG	9203/060/01F			Gold	920306021		
M54HC374SKT	9203/060/02F			Solder dip	920306023		
M54HC393SKG	9204/074/01F			Gold	920407421	0.70	
M54HC393SKT	9204/074/02F			Solder dip	920407423		
M54HC540SKG	9401/049/01F			Gold	940104921	0.90	
M54HC540SKT	9401/049/02F			Solder dip	940104923		
M54HC541SKG	9401/047/01F			Gold	940104721		
M54HC541SKT	9401/047/02F			Solder dip	940104723		
M54HC573SKG	9202/072/01F			Gold	920207221		
M54HC573SKT	9202/072/02F			Solder dip	920207223		
M54HC574SKG	9203/054/01F		Gold	920305421			
M54HC574SKT	9203/054/02F		Solder dip	920305423			
M54HC595SKG	9306/051/01F	Flat-16	Gold	930605121	0.70		
M54HC595SKT	9306/051/02F		Solder dip	930605123			
M54HC597SKG	9306/054/01F		Gold	930605421			
M54HC597SKT	9306/054/02F		Solder dip	930605423			



Table 9. Ordering information for rad-hard 54HC and 54HCT series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking <sup>(1)</sup>	Mass (g)	Packing	
M54HC688SKG	9209/005/01F	Class S equivalent	Flat-20	Gold	920900521	0.90	Strip pack	
M54HC688SKT	9209/005/02F			Solder dip	920900523			
M54HC4020SKG	9204/070/01F		Flat-16		Gold	920407021		0.70
M54HC4020SKT	9204/070/02F				Solder dip	920407023		
M54HC4040SKG	9204/069/01F				Gold	920406921		
M54HC4040SKT	9204/069/02F				Solder dip	920406923		
M54HC4049SKG	9401/037/01F				Gold	940103721		
M54HC4049SKT	9401/037/02F				Solder dip	940103723		
M54HC4050SKG	9401/038/01F				Gold	940103821		
M54HC4050SKT	9401/038/02F				Solder dip	940103823		
M54HC4051SKG	9408/064/01F				Gold	940806421		
M54HC4051SKT	9408/064/02F				Solder dip	940806423		
M54HC4053SKG	9408/065/01F				Gold	940806521		
M54HC4053SKT	9408/065/02F				Solder dip	940806523		
M54HC4060SKG	9204/076/01F				Gold	920407621		
M54HC4060SKT	9204/076/02F				Solder dip	920407623		
M54HC4066SKG	9408/052/01F		Flat-14		Gold	940805221		
M54HC4066SKT	9408/052/02F				Solder dip	940805223		
M54HC4094SKG	9306/050/01F		Flat-16		Gold	930605021		
M54HC4094SKT	9306/050/02F				Solder dip	930605023		
M54HC4514SKG	9205/019/01F	Flat-24		Gold	920501921	1.70		
M54HC4514SKT	9205/019/02F			Solder dip	920501923			

1. Specific marking only. Refer to [Section 2.5: Marking](#) for complete marking information.

## 5 Documentation

Each shipment of “Class S equivalent” parts is accompanied by the following documentation on CD-ROM:

1. Certificate of conformance (CoC)
2. Particle impact noise detection (PIND) test report
3. Failure analysis report
4. Precap report
5. IN/OUT quantity at each screening step (attribute data)
6. Screening electrical data
7. SEM inspection report
8. X-ray pictures
9. RVT report
10. QCI related documentation:
  - a) Certificate of conformance
  - b) IN/OUT quantity at each QCI (group B and D) step (attribute data)
  - c) QCI electrical data

## 6 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
15-Mar-2013	1	Initial release.
22-May-2013	2	Small text changes in Introduction, Section 1: Reference documents, Section 2: Procedure, Table 1, Table 2, Table 3, Table 4, Section 2.3: Radiation, Section 2.4: Marking, Section 3: Quality requirements, and Section 5: Documentation. Updated Figure 1 and Figure 2. Updated Section 4: Ordering information and added Table 8 and Table 9.
15-Jul-2013	3	Table 3: updated "Pass criteria" for Tests Sub.5a and Sub.5c
25-Nov-2013	4	Updated: Table 3, Figure 2 and the disclaimer on the last page.
01-Feb-2017	5	Updated information concerning 883TM1014 in <i>Table 1, Table 3, Table 4, and Figure 1</i> . <i>Added Section 2.4: Package</i> <i>Table 8: Ordering information for rad-hard CMOS4000B series:</i> removed following part numbers: HCC4012BHVKG, HCC4012BHVKT, HCC4023BHVKG, HCC4023BHVKT, HCC4025BHVKG, HCC4025BHVKT, HCC4034BHVKG, HCC4034BHVKT, HCC4042BHVKG, HCC4042BHVKT, HCC4078BHVKG, HCC4078BHVKT, HCC4082BHVKG, and HCC4082BHVKT. <i>Table 9: Ordering information for rad-hard 54HC and 54HCT series:</i> removed following part numbers: M54HC20SKG, M54HC20SKT, M54HC137SKG, M54HC137SKT, M54HC158SKG, M54HC158SKT, M54HC194SKG, M54HC194SKT, M54HC367SKG, M54HC367SKT, M54HCT373SKG, M54HCT373SKT, M54HC590SKG, M54HC590SKT, M54HC4078SKG, and M54HC4078SKT. <i>Section 5: Documentation:</i> added text about CD-ROM availability
21-Feb-2017	6	Minor update
06-Feb-2018	7	Updated <a href="#">Table 6: Parameter drift values</a> .

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