
“Class S equivalent” for CMOS4000B and 54HCMOS series

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.

Contents

1 **Reference documents** **3**

2 **Procedure** **4**

 2.1 Screening flow 4

 2.2 Specific electrical requirements for CMOS4000B 12

 Parameter drift values 12

 2.3 Radiation 13

 2.4 Marking 13

3 **Quality requirements** **15**

4 **Ordering information** **16**

5 **Documentation** **30**

6 **Revision history** **31**



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 volt 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 ⁽¹⁾ rules + SEM ⁽²⁾ 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 ⁽³⁾	883 TM2020 cond. A		
Serialization	Required		
Pre burn-in electrical measurements	Per applicable SMD ⁽⁴⁾	Per applicable ESCC detailed specification	Per applicable ESCC detailed specification ⁽⁵⁾

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 ⁽⁶⁾	883 TM1015 240 hours at 125 °C ⁽⁷⁾⁽⁶⁾
Interim electrical measurements	Per applicable SMD, with deltas	Per applicable ESCC detailed specification with deltas	Per applicable ESCC detailed specification with deltas ⁽⁵⁾
Reverse bias burn-in	883 TM1015 72 hours at 150 °C	883 TM1015 cond. A 72 hours NMOS ⁽⁸⁾ +72 hours PMOS ⁽⁹⁾ at 125 °C	883 TM1015 cond. A 72 hours NMOS+72 hours PMOS at 125 °C ⁽⁷⁾
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 ⁽⁵⁾
PDA ⁽¹⁰⁾ 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 ⁽¹¹⁾
Seal (fine and gross)	883 TM1014		
Radiographic	883 TM2012	Not performed	883 TM2012
External visual	883 TM2009	ESA ⁽¹²⁾ # 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 $V_{CC} = 20$ V for CMOS4000B devices. See [Table 6](#) for delta.
6. Burn-in is done after reverse bias burn-in.
7. Performed at $V_{CC} = 20$ 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		Not performed			Not performed	
Sub. 4c: lid torque	883 TM2024					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 ⁽¹⁾
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		883 TM1014			883 TM1014	
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				

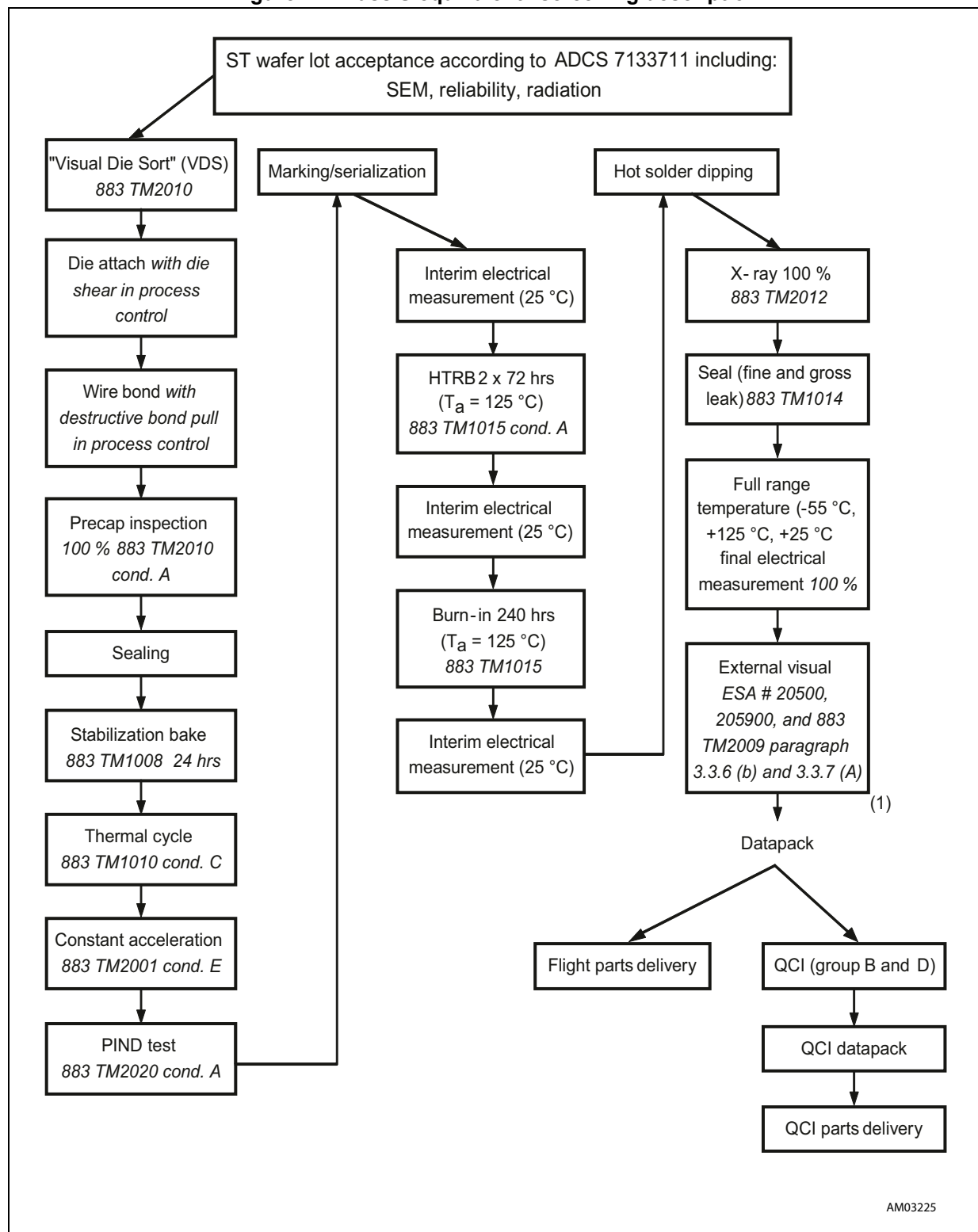
Table 4. Comparison between Group D tests for Class S, ESCC 9000, and ST “Class S equivalent” flow (continued)

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		883 TM1014			883 TM1014	
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)

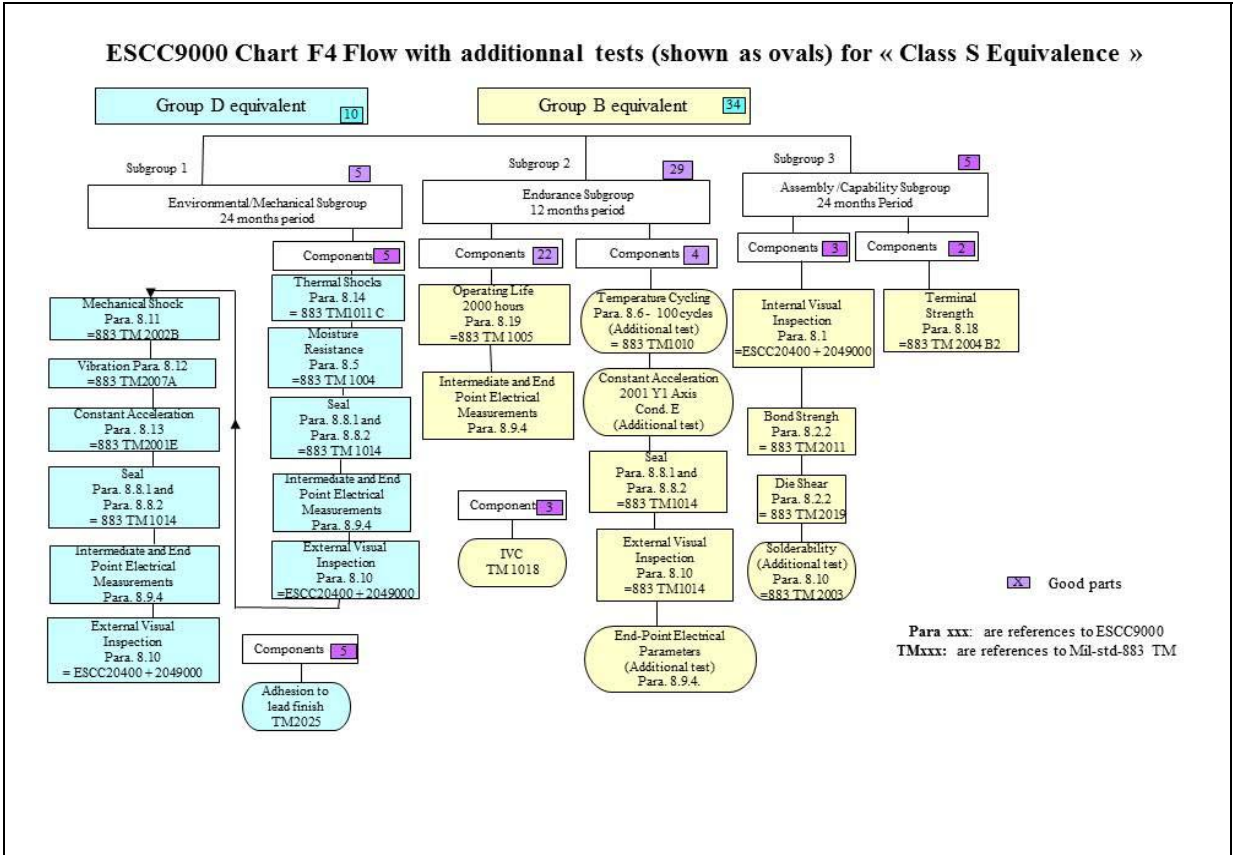
QCI comparison						ST “Class S equivalent” flow	
Group D tests for Class S			ESCC 9000				
Test	Test method	Pass criteria	Test method	Pass criteria	Test performed during	Test method	Pass criteria
Sub. 4d: seal (fine and gross)	883 TM1014	15/0	883 TM1014	15/0	Chart F4 subgroup 1	883 TM1014	5/0
Sub. 4e: 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						
Sub. 6: internal gas analysis	883 TM1018	3/0 or 5/1				Done in group B	
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



- Legend:
Para xxx are references to ESCC 9000
TMxxx are references to MIL-STD-883 TM
- 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	Units	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 ⁽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			Units
		Drift value	Absolute		
			Min.	Max.	
Threshold voltage N-channel	V _{THn}	±0.4	-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 Marking

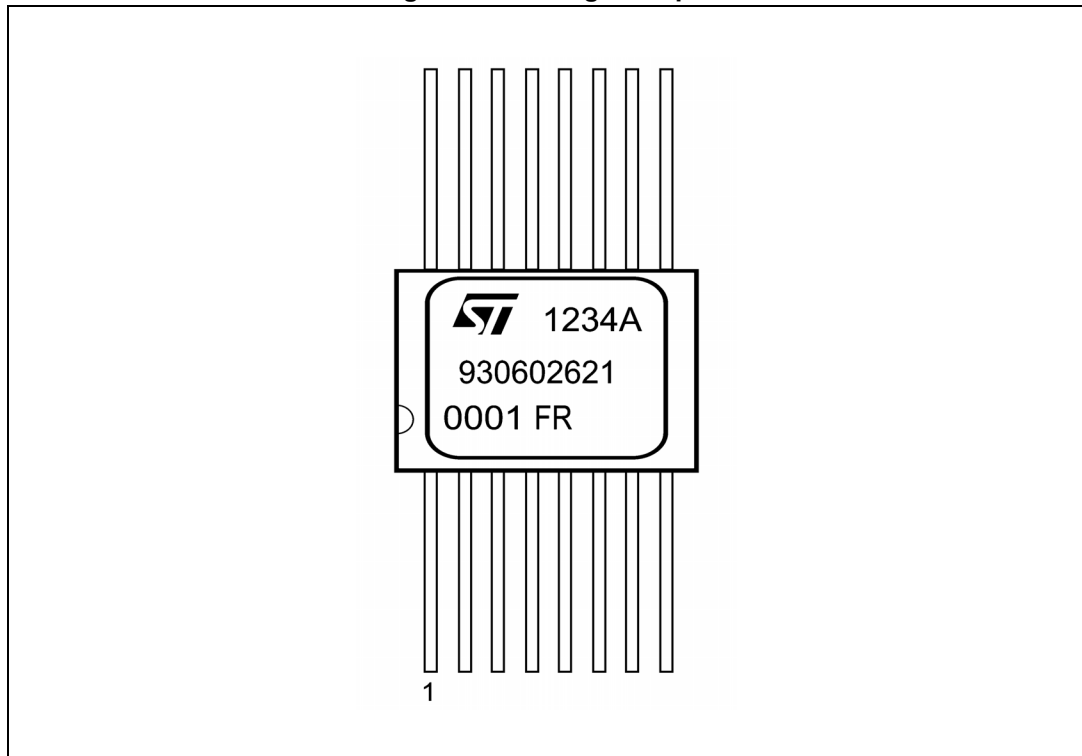
The devices are marked as follows (see also [Figure 3](#)):

- 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

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 CMOS4000B series

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	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		
HCC4012BHVKG	9201/044/01			Gold	920104421		
HCC4012BHVKT	9201/044/02			Solder dip	920104423		
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 CMOS4000B series (continued)

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	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				
HCC4023BHVKG	9201/045/01		Flat-14	Gold	920104521			0.70	
HCC4023BHVKT	9201/045/02			Solder dip	920104523				
HCC4024BHVKG	9204/024/01			Gold	920402421				
HCC4024BHVKT	9204/024/02			Solder dip	920402423				
HCC4025BHVKG	9201/046/01			Gold	920104621				
HCC4025BHVKT	9201/046/02			Solder dip	920104623				
HCC4027BHVKG	9203/022/01		Flat-16	Gold	920302221				1.70
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			0.70	
HCC4030BHVKT	9201/047/02			Solder dip	920104723				
HCC4034BHVKG	9306/025/01		Flat-24	Gold	930602521	1.70			
HCC4034BHVKT	9306/025/02			Solder dip	930602523				
HCC4040BHVKG	9204/026/01		Flat-16	Gold	920402621	0.70			
HCC4040BHVKT	9204/026/02			Solder dip	920402623				
HCC4041UBHVKG	9202/040/01		Flat-14	Gold	920204021				



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

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	Packing
HCC4041UBHVKT	9202/040/02	Class S equivalent	Flat-14	Solder dip	920204023	0.70	Strip pack
HCC4042BHVKG	9202/041/01		Flat-16	Gold	920204121		
HCC4042BHVKT	9202/041/02			Solder dip	920204123		
HCC4043BHVKG	9202/042/01			Gold	920204221		
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		



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

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	Packing
HCC4063BHVKT	9209/001/02	Class S equivalent	Flat-16	Solder dip	920900123	0.70	Strip pack
HCC4066BHVKG	9408/005/01		Flat-14	Gold	940800521		
HCC4066BHVKT	9408/005/02			Solder dip	940800523		
HCC4067BHVKG	9408/009/01		Flat-24	Gold	940800921	1.70	
HCC4067BHVKT	9408/009/02			Solder dip	940800923		
HCC4068BHVKG	9201/061/01		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	Gold	930602221		
HCC4076BHVKT	9306/022/02			Solder dip	930602223		
HCC4077BHVKG	9201/055/01		Flat-14	Gold	920105521		
HCC4077BHVKT	9201/055/02			Solder dip	920105523		
HCC4078BHVKG	9201/062/01			Gold	920106221		



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

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	Packing
HCC4078BHVKT	9201/062/02	Class S equivalent	Flat-14	Solder dip	920106223	0.70	Strip pack
HCC4081BHVKG	9201/052/01			Gold	920105221		
HCC4081BHVKT	9201/052/02			Solder dip	920105223		
HCC4082BHVKG	9201/066/01			Gold	920106621		
HCC4082BHVKT	9201/066/02			Solder dip	920106623		
HCC4093BHVKG	9409/002/01			Gold	940900221		
HCC4093BHVKT	9409/002/02			Solder dip	940900223		
HCC4094BHVKG	9306/026/01		Flat-16	Gold	930602621		
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		



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

ST part number	Equivalent ESCC detailed specification	Quality level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	Packing
HCC40193BHVKT	9204/041/02	Class S equivalent	Flat-16	Solder dip	920404123	0.70	Strip pack
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		
HCC4514BHVKG	9408/012/01		Flat-24	Gold	940801221	1.70	
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 2.4: 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 ⁽¹⁾	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		
M54HC20SKG	9201/118/01F			Gold	920111821		
M54HC20SKT	9201/118/02F			Solder dip	920111823		
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		



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 ⁽¹⁾	Mass (g)	Packing
M54HC32SKG	9201/111/01F	Class S equivalent	Flat-14	Gold	920111121	0.70	Strip pack
M54HC32SKT	9201/111/02F			Solder dip	920111123		
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		
M54HC137SKG	9205/013/01F		Flat-16	Gold	920501321		
M54HC137SKT	9205/013/02F			Solder dip	920501323		



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 ⁽¹⁾	Mass (g)	Packing
M54HC138SKG	9408/046/01F	Class S equivalent	Flat-16	Gold	940804621	0.70	Strip pack
M54HC138SKT	9408/046/02F			Solder dip	940804623		
M54HC139SKG	9205/017/01F			Gold	920501721		
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		
M54HC158SKG	9408/059/01F			Gold	940805921		
M54HC158SKT	9408/059/02F			Solder dip	940805923		
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		



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 ⁽¹⁾	Mass (g)	Packing
M54HC174SKG	9306/052/01F	Class S equivalent	Flat-16	Gold	930605221	0.70	Strip pack
M54HC174SKT	9306/052/02F			Solder dip	930605223		
M54HC175SKG	9203/052/01F			Gold	920305221		
M54HC175SKT	9203/052/02F			Solder dip	920305223		
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		
M54HC194SKG	9306/047/01F			Gold	930604721		
M54HC194SKT	9306/047/02F			Solder dip	930604723		
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		



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 ⁽¹⁾	Mass (g)	Packing
M54HC251SKG	9408/048/01F	Class S equivalent	Flat-16	Gold	940804821	0.70	Strip pack
M54HC251SKT	9408/048/02F		Flat-16	Solder dip	940804823		
M54HC257SKG	9408/047/01F		Flat-16	Gold	940804721		
M54HC257SKT	9408/047/02F		Flat-16	Solder dip	940804723		
M54HC259SKG	9203/073/01F		Flat-16	Gold	920307321		
M54HC259SKT	9203/073/02F		Flat-16	Solder dip	920307323		
M54HC273SKG	9203/053/01F		Flat-20	Gold	920305321	0.90	
M54HC273SKT	9203/053/02F		Flat-20	Solder dip	920305323		
M54HC283SKG	9202/075/01F		Flat-16	Gold	920207521	0.70	
M54HC283SKT	9202/075/02F		Flat-16	Solder dip	920207523		
M54HC367SKG	9401/044/01F		Flat-16	Gold	940104421		
M54HC367SKT	9401/044/02F		Flat-16	Solder dip	940104423	0.90	
M54HC373SKG	9203/059/01F		Flat-20	Gold	920305921		
M54HC373SKT	9203/059/02F		Flat-20	Solder dip	920305923		
M54HCT373SKG	9203/064/01F		Flat-20	Gold	920306421		
M54HCT373SKT	9203/064/02F		Flat-20	Solder dip	920306423		
M54HC374SKG	9203/060/01F		Flat-20	Gold	920306021		
M54HC374SKT	9203/060/02F		Flat-20	Solder dip	920306023		
M54HC393SKG	9204/074/01F		Flat-14	Gold	920407421	0.70	
M54HC393SKT	9204/074/02F		Flat-14	Solder dip	920407423		
M54HC540SKG	9401/049/01F		Flat-20	Gold	940104921	0.90	
M54HC540SKT	9401/049/02F		Flat-20	Solder dip	940104923		
M54HC541SKG	9401/047/01F		Flat-20	Gold	940104721		
M54HC541SKT	9401/047/02F		Flat-20	Solder dip	940104723		



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 ⁽¹⁾	Mass (g)	Packing
M54HC573SKG	9202/072/01F	Class S equivalent	Flat-20	Gold	920207221	0.90	Strip pack
M54HC573SKT	9202/072/02F		Flat-20	Solder dip	920207223		
M54HC574SKG	9203/054/01F		Flat-20	Gold	920305421		
M54HC574SKT	9203/054/02F		Flat-20	Solder dip	920305423		
M54HC590SKG	9204/071/01F		Flat-16	Gold	920407121	0.70	
M54HC590SKT	9204/071/02F		Flat-16	Solder dip	920407123		
M54HC595SKG	9306/051/01F		Flat-16	Gold	930605121		
M54HC595SKT	9306/051/02F		Flat-16	Solder dip	930605123		
M54HC597SKG	9306/054/01F		Flat-16	Gold	930605421	0.90	
M54HC597SKT	9306/054/02F		Flat-16	Solder dip	930605423		
M54HC688SKG	9209/005/01F		Flat-20	Gold	920900521		
M54HC688SKT	9209/005/02F		Flat-20	Solder dip	920900523		
M54HC4020SKG	9204/070/01F		Flat-16	Gold	920407021	0.70	
M54HC4020SKT	9204/070/02F		Flat-16	Solder dip	920407023		
M54HC4040SKG	9204/069/01F		Flat-16	Gold	920406921		
M54HC4040SKT	9204/069/02F		Flat-16	Solder dip	920406923		
M54HC4049SKG	9401/037/01F		Flat-16	Gold	940103721		
M54HC4049SKT	9401/037/02F		Flat-16	Solder dip	940103723		
M54HC4050SKG	9401/038/01F		Flat-16	Gold	940103821		
M54HC4050SKT	9401/038/02F		Flat-16	Solder dip	940103823		
M54HC4051SKG	9408/064/01F		Flat-16	Gold	940806421		
M54HC4051SKT	9408/064/02F		Flat-16	Solder dip	940806423		
M54HC4053SKG	9408/065/01F		Flat-16	Gold	940806521		
M54HC4053SKT	9408/065/02F		Flat-16	Solder dip	940806523		

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 ⁽¹⁾	Mass (g)	Packing
M54HC4060SKG	9204/076/01F	Class S equivalent	Flat-16	Gold	920407621	0.70	Strip pack
M54HC4060SKT	9204/076/02F			Solder dip	920407623		
M54HC4066SKG	9408/052/01F		Flat-14	Gold	940805221		
M54HC4066SKT	9408/052/02F			Solder dip	940805223		
M54HC4078SKG	9201/123/01F			Gold	920112321		
M54HC4078SKT	9201/123/02F			Solder dip	920112323		
M54HC4094SKG	9306/050/01F		Flat-16	Gold	930605021	1.70	
M54HC4094SKT	9306/050/02F			Solder dip	930605023		
M54HC4514SKG	9205/019/01F		Flat-24	Gold	920501921		
M54HC4514SKT	9205/019/02F			Solder dip	920501923		

1. Specific marking only. Refer to [Section 2.4: Marking](#) for complete marking information.

5 Documentation

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

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 <i>Introduction</i> , <i>Section 1</i> , <i>Section 2: Procedure</i> , <i>Table 1</i> , <i>Table 2</i> , <i>Table 3</i> , <i>Table 4</i> , <i>Section 2.3: Radiation</i> , <i>Section 2.4: Marking</i> , <i>Section 3: Quality requirements</i> , and <i>Section 5: Documentation</i> . Updated <i>Figure 1</i> and <i>Figure 2</i> . Updated <i>Section 4: Ordering information</i> and added <i>Table 8</i> and <i>Table 9</i> .
15-Jul-2013	3	<i>Table 3</i> : updated "Pass criteria" for Tests Sub.5a and Sub.5c
25-Nov-2013	4	Updated: <i>Table 3</i> , <i>Figure 2</i> and the disclaimer on the last page.

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