

Description

The HCC40xxx and HCC45xxx series are composed of 70 types of high voltage CMOS functions, offering a set of highly noise tolerant gates, Flip-Flops, multiplexers, counters, bus interfaces, and several other functions. The radiation hardness, single event latch-up (SEL), single event upset (SEU) immunity, and the housing in hermetic packages of all types of both series make them usable in the most difficult environmental conditions.

The complete specification of each type is available from the European Space Components Coordination (ESCC) website: <https://spacecomponents.org/>. ST guarantees full compliance of qualified parts with these ESCC detailed specifications.

Features

- 3 to 20 V max operating voltage
- Buffered inputs and outputs
- Standardized symmetrical outputs characteristic
- 50 ns typical propagation delays
- 100 nA max 25 °C input current
- 100 % tested 20 V quiescent current
- 5-10-15 V parametric testing
- Hermetic packages
- Rad-hard 100 kRad TID at 11rad/sec dose rate
- SEL and SET immune up to 119 MeV/cm²/mg
- SEU immune up to 36 or 119 MeV/cm²/mg
- ESCC qualified

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1 HCC family overview

Table 1. Device summary

Part number	Description	Radiation level	Agency qualification	SEE class (1)	EPPL	ESCC specification	Package
HCC4001B	Rad-hard quad 2-input NOR gate	100 krad (Si)	ESCC	3	Y	9201/041	Flat-14 and DIL-14
HCC4002B	Rad-hard dual 4-input NOR gate				-	9201/042	
HCC4008B	Rad-hard 4-bit full adder			3	9202/039	Flat-16 and DIL-16	
HCC4011B	Rad-hard quad 2-input NAND gate			1	Y	9201/043	Flat-14 and DIL-14
HCC4012B	Rad-hard dual 4-input NAND gate				-	9201/044	
HCC4013B	Rad-hard dual D Flip-Flop				9203/023		
HCC4014B	Rad-hard 8-stage static synchronous shift register			2	Y	9306/014	Flat-16 and DIL-16
HCC4015B	Rad-hard dual 4-stage static shift register				9306/015		
HCC4017B	Rad-hard decade counter/divider			9204/020	-	9204/021	
HCC4018B	Rad-hard presettable divide-by N counter			3	9202/051		
HCC4019B	Rad-hard quad AND/OR select gate			4	9204/022		
HCC4020B	Rad-hard 14-stage binary/ripple counter			1	Y	9306/016	
HCC4021B	Rad-hard 8-stage static shift register				9204/023		
HCC4022B	Rad-hard divide-by-8 counter/divider			2	-	9201/045	Flat-14 and DIL-14
HCC4023B	Rad-hard triple 3-input NAND gate			3	Y	9204/024	
HCC4024B	Rad-hard 7-stage binary/ripple counter			4	-	9201/046	Flat-16 and DIL-16
HCC4025B	Rad-hard triple 3-input NOR gate				9203/022		
HCC4027B	Rad-hard dual J-K master-slave Flip-Flop			3	Y	9205/010	
HCC4028B	Rad-hard BCD-to-decimal decoder				9204/025		
HCC4029B	Rad-hard presettable up/down counter				9204/025		



Table 1. Device summary (continued)

Part number	Description	Radiation level	Agency qualification	SEE class ⁽¹⁾	EPPL	ESCC specification	Package
HCC4030B	Rad-hard quad exclusive OR gate	100 krad (Si)	ESCC	3	Y	9201/047	Flat-14 and DIL-14
HCC4034B	Rad-hard 8-stage static bidirectional bus register			1	-	9306/025	Flat-24 and DIL-24
HCC4040B	Rad-hard 12-stage binary/ripple counter			4	Y	9204/026	Flat-16 and DIL-16
HCC4041UB	Rad-hard quad true/complement buffer			3	-	9202/040	Flat-14 and DIL-14
HCC4042B	Rad-hard quad clocked D latch					9202/041	Flat-16 and DIL-16
HCC4043B	Rad-hard quad 3-state NOR R/S latch					9202/042	
HCC4044B	Rad-hard quad 3-state NAND R/S latch					9202/043	
HCC4046B	Rad-hard micropower phase locker loop			9202/044			
HCC4047B	Rad-hard monostable/astable multivibrator			3	Y	9207/003	Flat-14 and DIL-14
HCC4049UB	Rad-hard hex inverting buffer/converter					9202/045	Flat-16 and DIL-16
HCC4050B	Rad-hard hex non-inverting buffer/converter					9202/046	
HCC4051B	Rad-hard single 8-channel analog mux/demux					9202/047	
HCC4052B	Rad-hard different 4-channel analog mux/demux					9202/048	
HCC4053B	Rad-hard triple 2-channel analog mux/demux					9202/049	
HCC4060B	Rad-hard 14-stage counter/divider AND oscillator					9204/052	
HCC4063B	Rad-hard 4-bit magnitude comparator					9209/001	
HCC4066B	Rad-hard quad bilateral switch	2	Y	9408/005	Flat-14 and DIL-14		
HCC4067B	Rad-hard single 16-channel analog mux/demux			9408/009	Flat-24 and DIL-24		
HCC4068B	Rad-hard 8-input NAND/AND gate			9201/061	Flat-14 and DIL-14		



Table 1. Device summary (continued)

Part number	Description	Radiation level	Agency qualification	SEE class ⁽¹⁾	EPPL	ESCC specification	Package	
HCC4069UB	Rad-hard hex inverter	100 krad (Si)	ESCC	3	Y	9401/010	Flat-14 and DIL-14	
HCC4070B	Rad-hard quad exclusive OR gate				-	9201/048		
HCC4071B	Rad-hard quad 2-input OR gate				Y	9201/063		
HCC4072B	Rad-hard dual 4-input OR gate				-	9201/082		
HCC4073B	Rad-hard triple 3-input AND gate				Y	9201/064		
HCC4075B	Rad-hard triple 3-input OR gate				-	9201/065		
HCC4076B	Rad-hard 4-bit D-type register			1	9306/022	Y	9306/022	Flat-16 and DIL-16
HCC4077B	Rad-hard quad exclusive NOR gate			3	ESCC	-	9201/055	Flat-14 and DIL-14
HCC4078B	Rad-hard 8-input NOR/OR gate					-	9201/062	
HCC4081B	Rad-hard quad 2-input AND gate					Y	9201/052	
HCC4082B	Rad-hard dual 4-input AND gate					-	9201/066	
HCC4093B	Rad-hard quad 2-input NAND Schmitt trigger			1	ESCC	Y	9409/002	Flat-16 and DIL-16
HCC4094B	Rad-hard 8-stage shift-and-store bus register					-	9306/026	
HCC4098B	Rad-hard dual monostable multivibrator			3	ESCC	Y	9206/003	Flat-14 and DIL-14
HCC40103B	Rad-hard presettable 8-bit binary down counter						9204/036	
HCC40106B	Rad-hard hex schmitt trigger						9409/005	
HCC40107B	Rad-hard dual 2-input NAND buffer/driver	9401/013						
HCC40109B	Rad-hard quad low-to-high voltage level shifter	9407/003						
HCC40161B	Rad-hard binary counter with asynchronous clear	9204/054						
HCC40174B	Rad-hard hex D Flip-Flop	9203/038	Flat-16 and DIL-16					
HCC40193B	Rad-hard presettable 4-bit binary up-down counter	9204/041						
HCC4503B	Rad-hard hex buffer 3-state non-inverter	9401/030						
HCC4512B	Rad-hard 8-channel data select with 3-state output	Y	9408/006					



Table 1. Device summary (continued)

Part number	Description	Radiation level	Agency qualification	SEE class ⁽¹⁾	EPPL	ESCC specification	Package
HCC4514B	Rad-hard 4-bit Latch / 4-to-16 line decoder output high	100 krad (Si)	ESCC	3		9408/012	Flat-24 and DIL-24
HCC4515B	Rad-hard 4-bit Latch / 4-to-16 line decoder output low					9205/011	
HCC4516B	Rad-hard presettable 4-bit binary up/down counter					9204/045	
HCC4520B	Rad-hard dual binary up-down counter					9204/028	
HCC4532B	Rad-hard 8-input priority encoder				Y	Flat-16 and DIL-16	
HCC4538B	Rad-hard dual precision monostable multivibrator				9202/065		
HCC4555B	Rad-hard dual 1-of-4 decoder/demux output high				9207/007		
HCC4556B	Rad-hard dual 1-of-4 decoder/demux output low				9408/011		
					-	9408/025	

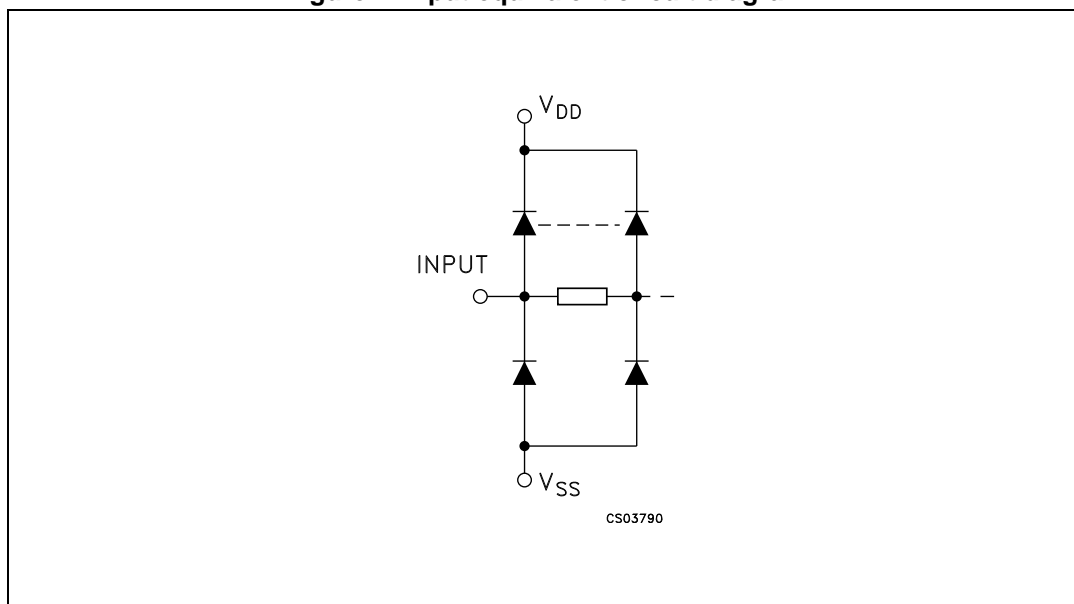
1. See Section 4.2: Single event effects (SEE)

Note: Contact the ST sales office for information about the specific conditions for other CMOS4000 part numbers and products in die form.



2 Input equivalent circuit diagram

Figure 1. Input equivalent circuit diagram



3 Maximum ratings

Stressing the device above the rating listed in the “absolute maximum ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage	-0.5 to 22	V
V_I	DC input voltage	-0.5 to $V_{DD} + 0.5$	V
I_I	DC input current	± 10	mA
P_D	Power dissipation per package	200	mW
T_{OP}	Operating temperature	-55 to +125	°C
T_{STG}	Storage temperature	-65 to +150	°C

Note: All voltage values are referred to V_{SS} pin voltage.

3.1 Recommended operating conditions

Table 3. Recommended operating conditions

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage	20	V
V_I	Input voltage	0 to V_{DD}	V
T_{OP}	Operating temperature	-55 to +125	°C

4 Radiations

4.1 Total ionizing dose (TID)

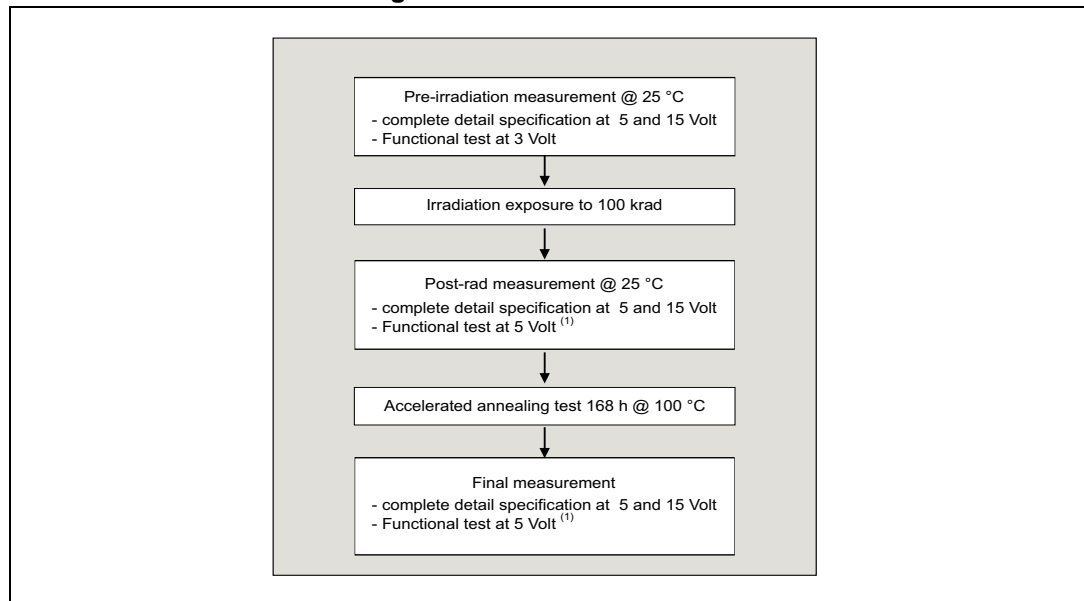
All devices of the HCC series are 100 krad guaranteed as per the test methods described in [Table 4](#).

Table 4. TID test conditions for the CMOS4000B family

Test parameter	Test conditions
Total dose	100 krad(Si)
Dose rate	40 krad(Si)/h
Sampling	4 biased parts by wafer on 3 wafer per diffusion lot plus 1 control part to qualify the wafer lot. In case one wafer fails, qualification is done wafer per wafer on 4 biased parts
Bias conditions ⁽¹⁾	$V_{DD} = 10\text{ V}^{(2)}$ inputs at $V_{DD}^{(3)}$
Limits	$ \Delta V_{THN} < 2\text{ V}, \Delta V_{THP} < 2\text{ V}$
	$V_{THN}, V_{THP}, I_{OL}, I_{OH}, T_{PHL}, T_{PLH}, V_{OL}, V_{OH}, V_N, V_P, V_H$: see section 2.3.1 of the "ESCC detail specification", limits $\pm 35\%$ for high and low limits
	Others tests performed as defined in section 2.3.1 of the "ESCC detail specification" with corresponding limits

1. During irradiation
2. $V_{DD} = 10\text{ Volt}$ has been demonstrated to be the worst case condition during characterization
3. Whenever functionally pertinent

Figure 2. Irradiation test flow



1. The post rad guaranteed $V_{CC\ min}$ is therefore 5 V.

4.2 Single event effects (SEE)

The HCC logic series is characterized under heavy ions through four test vehicles, representative of all the products with the same functional specification as described in [Table 5](#). The SEE class of each product is also provided in [Table 5](#). The SEE performance of any HCC device of the series is the performance of the class it belong to.

Table 5. HCC series, SEE class summary

Test vehicle	SEE class
HCC4014B	1
HCC4017B	2
HCC4093B	3
HCC4020B	4

The SEE performance of each SEE class is provided in [Table 6](#).

Table 6. SEE performance of SEE classes

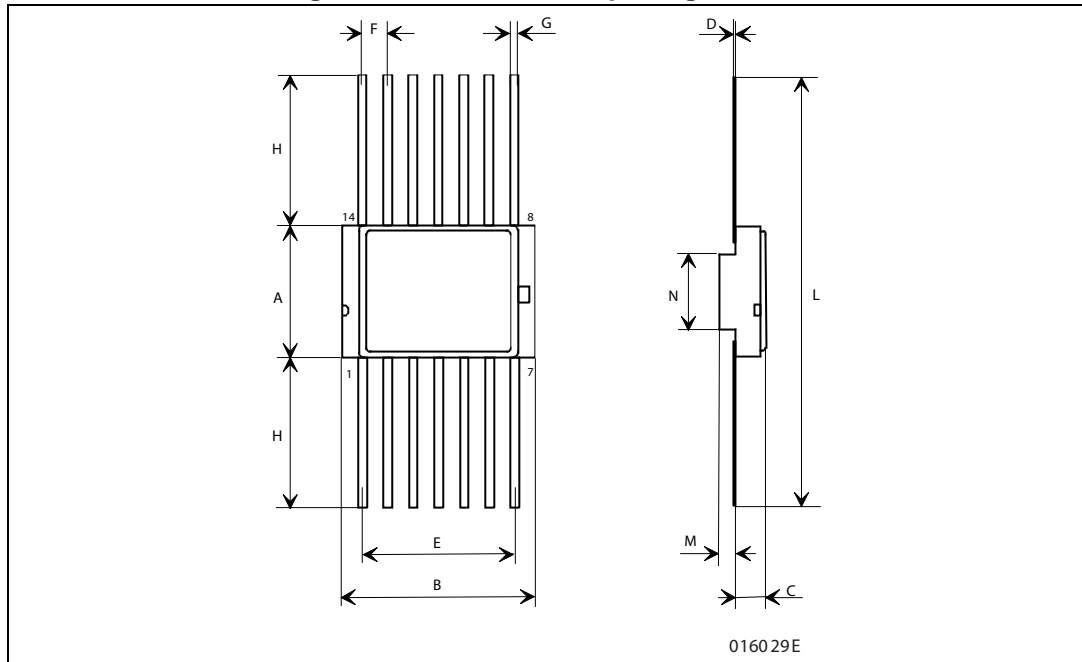
Type	Class	Condition	Result
SEL	1, 2, 3, 4	125 °C, $V_{CC} = 20\text{ V}$, LET = 119 MeV.cm ² /mg, ion range = 20 μm, 45 ° tilt	No event
SEU	1	25 °C, LET = 61 MeV.cm ² /mg, $V_{CC} = 5\text{ V}$, $V_{IN} = 2.5\text{ V} \pm 2.5\text{ V}$, $f_{IN} = 50\text{ kHz}$, $f_{CLOCK} = 500\text{ kHz}$, $V_{CC} = 15\text{ V}$, $V_{IN} = 7.5\text{ V} \pm 7.5\text{ V}$, $f_{IN} = 100\text{ kHz}$, $f_{CLOCK} = 1\text{ MHz}$, ion range = 20 μm, 45 ° tilt	LET _{th} > 60 MeV.cm ² /mg, $\sigma_{sat} = 8 \times 10^{-6}\text{ cm}^2$
	2, 3	25 °C, LET = 119 MeV.cm ² /mg, $V_{CC} = 5\text{ V}$, $V_{IN} = 2.5\text{ V} \pm 2.5\text{ V}$, $f_{IN} = 50\text{ kHz}$, $f_{CLOCK} = 500\text{ kHz}$, $V_{CC} = 15\text{ V}$, $V_{IN} = 7.5\text{ V} \pm 7.5\text{ V}$, $f_{IN} = 100\text{ kHz}$, $f_{CLOCK} = 1\text{ MHz}$, ion range = 20 μm, 45 ° tilt	No event
	4	25 °C, LET = 36 MeV.cm ² /mg, $V_{CC} = 5\text{ V}$, $V_{IN} = 2.5\text{ V} \pm 2.5\text{ V}$, $f_{IN} = 50\text{ kHz}$, $f_{CLOCK} = 500\text{ kHz}$, $V_{CC} = 15\text{ V}$, $V_{IN} = 7.5\text{ V} \pm 7.5\text{ V}$, $f_{IN} = 100\text{ kHz}$, $f_{CLOCK} = 1\text{ MHz}$, ion range = 20 μm, 45 ° tilt	LET _{th} > 36 MeV.cm ² /mg, $\sigma_{sat} = 1 \times 10^{-4}\text{ cm}^2$
SET	1, 2, 3, 4	25 °C, LET = 119 MeV.cm ² /mg, Trigger = ± 50 mV $V_{CC} = 5\text{ V}$, $V_{IN} = 2.5\text{ V} \pm 2.5\text{ V}$, $f_{IN} = 50\text{ kHz}$, $V_{CC} = 15\text{ V}$, $V_{IN} = 7.5\text{ V} \pm 7.5\text{ V}$, $f_{IN} = 100\text{ kHz}$	No event

5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

5.1 Ceramic Flat-14 package information

Figure 3. Ceramic Flat-14 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

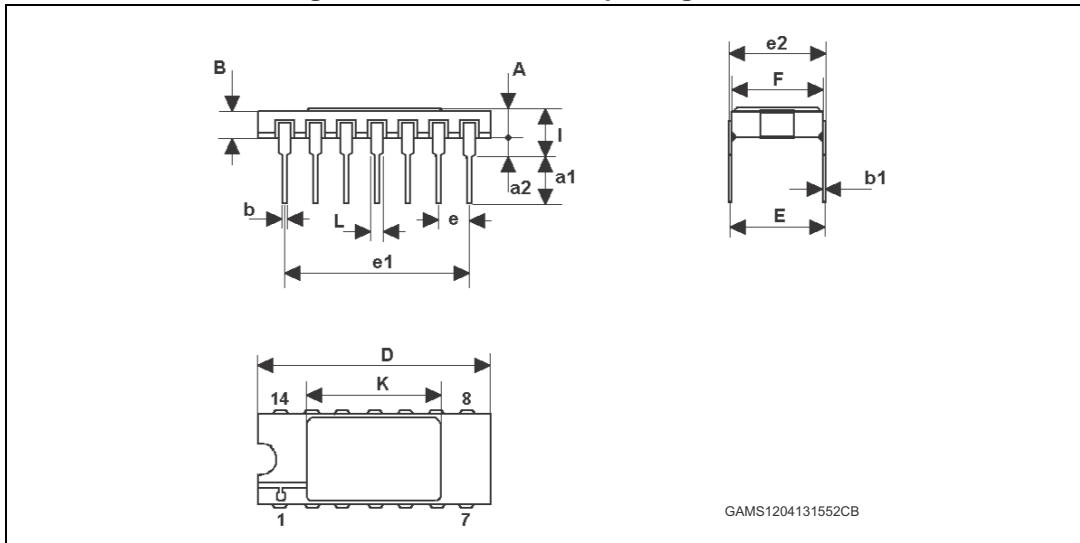
Table 7. Ceramic Flat-14 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	6.75	6.91	7.06	0.266	0.272	0.278
B	9.76	9.95	10.14	0.384	0.392	0.399
C	1.49		1.95	0.059		0.077
D	0.10	0.127	0.15	0.004	0.005	0.006
E	7.50	7.62	7.75	0.295	0.300	0.305
F		1.27			0.050	
G	0.38	0.43	0.48	0.015	0.017	0.019
H		6.0			0.236	
L	18.75	en	22.0	0.738	en	0.866
M		0.38			0.015	
N		4.31			0.170	

1. Values in inches are rounded to three decimal digits.

5.2 Ceramic DIL-14 package information

Figure 4. Ceramic DIL-14 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

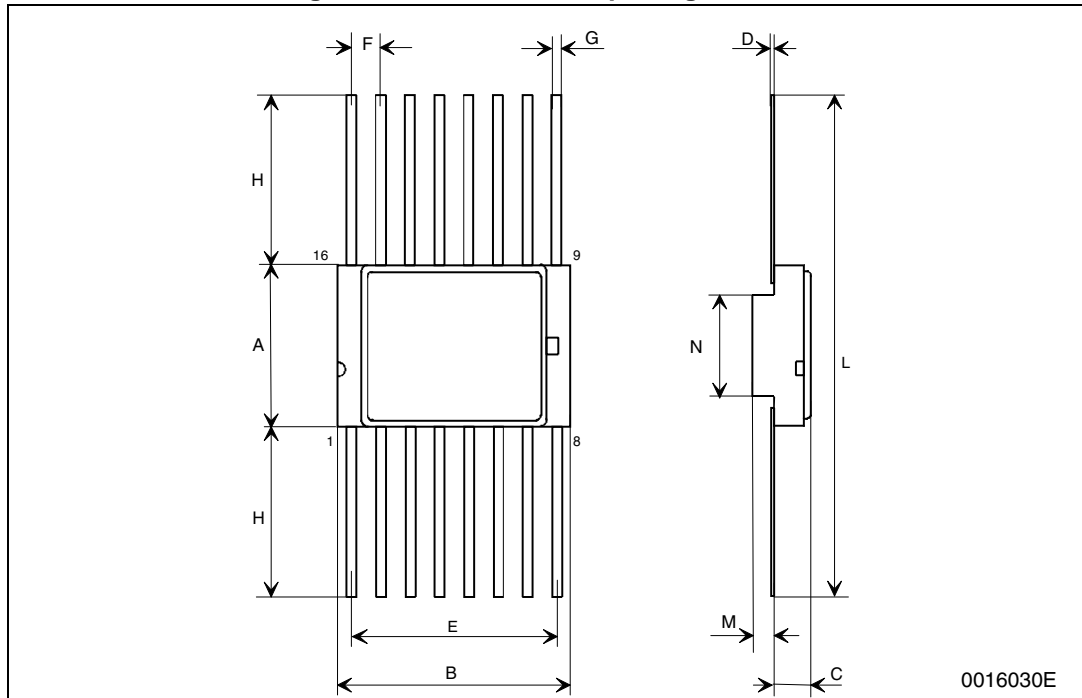
Table 8. Ceramic DIL-14 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	2.1		2.54	0.083		0.100
a1	3.00		3.70	0.118		0.146
a2	0.63	0.88	1.14	0.025	0.035	0.045
B	1.82	2.03	2.39	0.072	0.080	0.094
b	0.40	0.45	0.50	0.016	0.018	0.020
b1	0.20	0.254	0.30	0.008	0.010	0.012
D	18.79	19.00	19.20	0.740	0.748	0.756
E	7.36	7.62	7.87	0.290	0.300	0.310
e		2.54			0.100	
e1	15.11	15.24	15.37	0.595	0.600	0.605
e2	7.62	7.87	8.12	0.300	0.310	0.320
F	7.11		7.75	0.280		0.305
I			3.70			0.146
K	10.90		12.1 n	0.429		0.476 n
L	1.14	1.27	1.5		0.050	0.059

1. Values in inches are rounded to three decimal digits.

5.3 Ceramic Flat-16 package information

Figure 5. Ceramic Flat-16 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

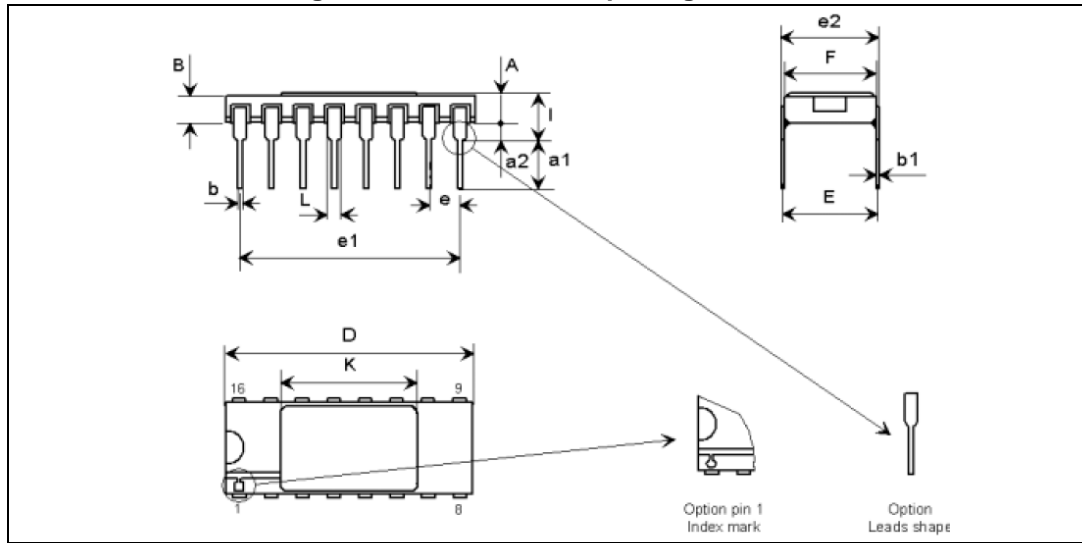
Table 9. Ceramic Flat-16 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	6.75	6.91	7.06	0.266	0.272	0.278
B	9.76	9.94	10.14	0.384	0.391	0.399
C	1.49		1.95	0.059		0.077
D	0.102	0.127	0.152	0.004	0.005	0.006
E	8.76	8.89	9.01	0.345	0.350	0.355
F		1.27			0.050	
G	0.38	0.43	0.48	0.015	0.017	0.019
H	6.0			0.236		
L	18.75	en	22.0	0.738	en	0.866
M	0.33	0.38	0.43	0.013	0.015	0.017
N		4.31			0.170	

1. Values in inches are rounded to three decimal digits.

5.4 Ceramic DIL-16 package information

Figure 6. Ceramic DIL-16 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

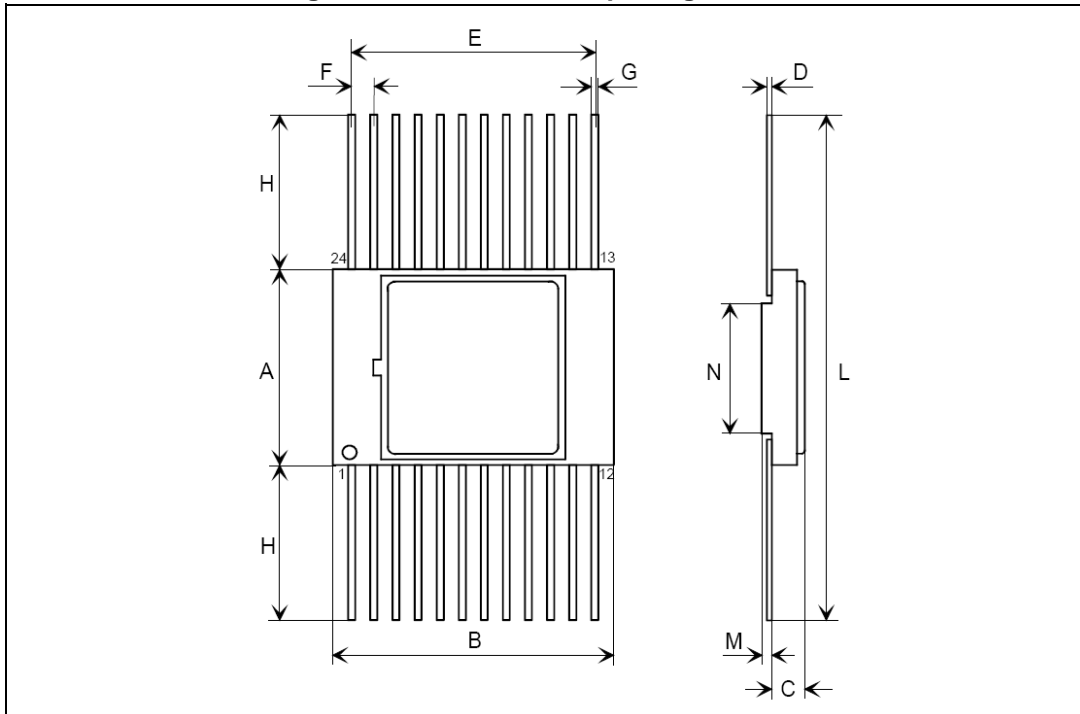
Table 10. Ceramic DIL-16 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	2.10		2.71	0.083		0.107
a1	3.00		3.70	0.118		0.146
a2	0.63	0.88	1.14	0.025	0.035	0.045
B	1.82		2.39	0.072		0.094
b	0.40	0.45	0.50	0.016	0.018	0.020
b1	0.20	0.254	0.30	0.008	0.010	0.012
D	20.06	20.32	20.58	0.790	0.800	0.810
E	7.36	7.62	7.87	0.290	0.300	0.310
e		2.54			0.100	
e1	17.65	17.78	17.90	0.695	0.700	0.705
e2	7.62	7.87	8.12	0.300	0.310	0.320
F	7.29	7.49	7.70	0.287	0.295	0.303
I			3.83			0.151
K	10.90		12.10	0.429		0.476
L	1.14		1.50	0.045		0.059

1. Values in inches are rounded to three decimal digits.

5.5 Ceramic Flat-24 package information

Figure 7. Ceramic Flat-24 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

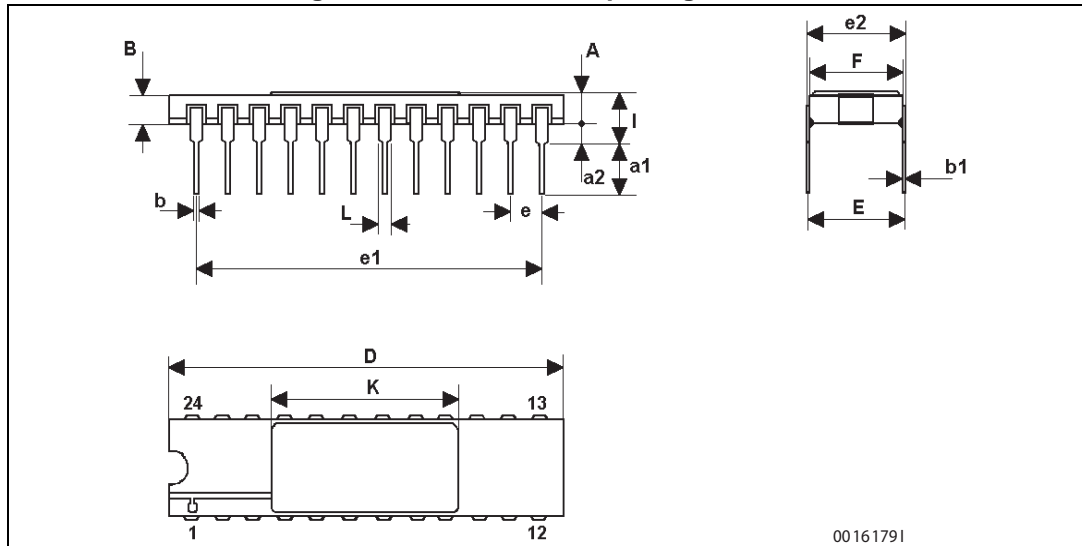
Table 11. Ceramic Flat-24 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	10.70	11.00	11.30	0.421	0.433	0.445
B	15.30	15.49	15.70	0.602	0.610	0.618
C	1.45		1.90	0.057		0.075
D	0.23	0.254	0.30	0.009	0.010	0.012
E	13.84	13.97	14.10	0.545	0.550	0.555
F	1.22	1.27	1.32	0.048	0.050	0.052
G	0.45	0.508	0.55	0.018	0.020	0.022
H	7.25		8.25	0.285		0.325
L	25.00		28.00	0.984		1.102
M	0.45	0.508	0.55	0.018	0.020	0.022
N		7.01			0.276	

1. Values in inches are rounded to three decimal digits.

5.6 Ceramic DIL-24 package information

Figure 8. Ceramic DIL-24 package outline



1. The upper metallic lid is not electrically connected to any pins, nor to the IC die inside the package. Connecting unused pins or metal lid to ground or to the power supply does not affect the electrical characteristics.

Table 12. Ceramic DIL-24 mechanical data

Ref	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Min	Typ	Max	Min	Typ	Max
A	2.159	1.931	2.387	0.085	0.076	0.094
a1	1.270	1.016	1.524	0.050	0.040	0.060
a2	0.307	0.274	0.340	0.012	0.011	0.013
B	1.270			0.050		
b1	0.457	0.407	0.507	0.018	0.016	0.020
b2	.254	0.229	0.304	0.010	0.009	0.012
C	2.466	2.205	2.727	0.097	0.087	0.107
D	30.48	30.17	30.78	1.200	1.188	1.212
E	15.24	14.98	15.49	0.600	0.590	0.610
e	2.540	2.410	2.670	0.100	0.095	0.105
e3	27.94	27.81	28.06	1.100	1.095	1.105
F	15.11	14.85	15.36	0.595	0.585	0.605
K	12.80	12.60	13.00	0.504	0.496	0.512
K1	12.80	12.60	13.00	0.504	0.496	0.512
L	3.300	3.000	3.800	0.130	0.118	0.150

1. Values in inches are rounded to three decimal digits.

6 Order codes

Table 13. Ordering information

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4001BKG	9201/041/01	ESCC flight	100 krad	Flat-14	Gold	920104101	0.70	Y	Strip pack
HCC4001BKT	9201/041/02				Solder dip	920104102			
HCC4001BDG	9201/041/03			Gold	920104103	2.20			
HCC4001BDT	9201/041/04			Solder dip	920104104				
HCC4002BKG	9201/042/01	ESCC flight	100 krad	Flat-14	Gold	920104201	0.70	-	Strip pack
HCC4002BKT	9201/042/02				Solder dip	920104202			
HCC4002BDG	9201/042/03			Gold	920104203	2.20			
HCC4002BDT	9201/042/04			Solder dip	920104204				
HCC4008BKG	9202/039/01	ESCC flight	100 krad	Flat-16	Gold	920203901	0.70	-	Strip pack
HCC4008BKT	9202/039/02				Solder dip	920203902			
HCC4008BDG	9202/039/08			Gold	920203908	2.20			
HCC4008BDT	9202/039/09			Solder dip	920203909				
HCC4011BKG	9201/043/01	ESCC flight	100 krad	Flat-14	Gold	920104301	0.70	Y	Strip pack
HCC4011BKT	9201/043/02				Solder dip	920104302			
HCC4011BDG	9201/043/03			Gold	920104303	2.20			
HCC4011BDT	9201/043/04			Solder dip	920104304				
HCC4012BKG	9201/044/01	ESCC flight	100 krad	Flat-14	Gold	920104401	0.70	-	Strip pack
HCC4012BKT	9201/044/02				Solder dip	920104402			
HCC4012BDG	9201/044/03			Gold	920104403	2.20			
HCC4012BDT	9201/044/04			Solder dip	920104404				



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4013BKG	9203/023/01	ESCC flight	100 krad	Flat-14	Gold	920302301	0.70	Y	Strip pack
HCC4013BKT	9203/023/02				Solder dip	920302302			
HCC4013BDG	9203/023/03			DIL-14	Gold	920302303			
HCC4013BDT	9203/023/04				Solder dip	920302304			
HCC4014BKG	9306/014/01	ESCC flight	100 krad	Flat-16	Gold	930601401	0.70	Y	Strip pack
HCC4014BKT	9306/014/02				Solder dip	930601402			
HCC4014BDG	9306/014/08			DIL-16	Gold	930601408			
HCC4014BDT	9306/014/09				Solder dip	930601409			
HCC4015BKG	9306/015/01	ESCC flight	100 krad	Flat-16	Gold	930601501	0.70	Y	Strip pack
HCC4015BKT	9306/015/02				Solder dip	930601502			
HCC4015BDG	9306/015/08			DIL-16	Gold	930601508			
HCC4015BDT	9306/015/09				Solder dip	930601509			
HCC4017BKG	9204/020/01	ESCC flight	100 krad	Flat-16	Gold	920402001	0.70	Y	Strip pack
HCC4017BKT	9204/020/02				Solder dip	920402002			
HCC4017BDG	9204/020/08			DIL-16	Gold	920402008			
HCC4017BDT	9204/020/09				Solder dip	920402009			
HCC4018BKG	9204/021/01	ESCC flight	100 krad	Flat-16	Gold	920402101	0.70	-	Strip pack
HCC4018BKT	9204/021/02				Solder dip	920402102			
HCC4018BDG	9204/021/08			DIL-16	Gold	920402108			
HCC4018BDT	9204/021/09				Solder dip	920402109			
HCC4019BKG	9202/051/01	ESCC flight	100 krad	Flat-16	Gold	920205101	0.70	Y	Strip pack
HCC4019BKT	9202/051/02				Solder dip	920205102			
HCC4019BDG	9202/051/08			DIL-16	Gold	920205108			
HCC4019BDT	9202/051/09				Solder dip	920205109			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4020BKG	9204/022/01	ESCC flight	100 krad	Flat-16	Gold	920402201	0.70	Y	Strip pack
HCC4020BKT	9204/022/02				Solder dip	920402202			
HCC4020BDG	9204/022/08			DIL-16	Gold	920402208	2.20	-	
HCC4020BDT	9204/022/09				Solder dip	920402209			
HCC4021BKG	9306/016/01	ESCC flight	100 krad	Flat-16	Gold	930601601	0.70	Y	Strip pack
HCC4021BKT	9306/016/02				Solder dip	930601602			
HCC4021BDG	9306/016/08			DIL-16	Gold	930601608	2.20	-	
HCC4021BDT	9306/016/09				Solder dip	930601609			
HCC4022BKG	9204/023/01	ESCC flight	100 krad	Flat-16	Gold	920402301	0.70		Strip pack
HCC4022BKT	9204/023/02				Solder dip	920402302			
HCC4022BDG	9204/023/08			DIL-16	Gold	920402308	2.20	-	
HCC4022BDT	9204/023/09				Solder dip	920402309			
HCC4023BKG	9201/045/01	ESCC flight	100 krad	Flat-14	Gold	920104501	0.70	Y	Strip pack
HCC4023BKT	9201/045/02				Solder dip	920104502			
HCC4023BDG	9201/045/03			DIL-14	Gold	920104503	2.20	-	
HCC4023BDT	9201/045/04				Solder dip	920104504			
HCC4024BKG	9204/024/01	ESCC flight	100 krad	Flat-14	Gold	920402401	0.70	Y	Strip pack
HCC4024BKT	9204/024/02				Solder dip	920402402			
HCC4024BDG	9204/024/03			DIL-14	Gold	920402403	2.20	-	
HCC4024BDT	9204/024/04				Solder dip	920402404			
HCC4025BKG	9201/046/01	ESCC flight	100 krad	Flat-14	Gold	920104601	0.70		Strip pack
HCC4025BKT	9201/046/02				Solder dip	920104602			
HCC4025BDG	9201/046/03			DIL-14	Gold	920104603	2.20	-	
HCC4025BDT	9201/046/04				Solder dip	920104604			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4027BKG	9203/022/01	ESCC flight	100 krad	Flat-16	Gold	920302201	0.70	Y	Strip pack
HCC4027BKT	9203/022/02				Solder dip	920302202			
HCC4027BDG	9203/022/08			DIL-16	Gold	920302208			
HCC4027BDT	9203/022/09				Solder dip	920302209			
HCC4028BKG	9205/010/01	ESCC flight	100 krad	Flat-16	Gold	920501001	0.70	Y	Strip pack
HCC4028BKT	9205/010/02				Solder dip	920501002			
HCC4028BDG	9205/010/08			DIL-16	Gold	920501008			
HCC4028BDT	9205/010/09				Solder dip	920501009			
HCC4029BKG	9204/025/01	ESCC flight	100 krad	Flat-16	Gold	920402501	0.70	Y	Strip pack
HCC4029BKT	9204/025/02				Solder dip	920402502			
HCC4029BDG	9204/025/08			DIL-16	Gold	920402508			
HCC4029BDT	9204/025/09				Solder dip	920402509			
HCC4030BKG	9201/047/01	ESCC flight	100 krad	Flat-14	Gold	920104701	0.70	Y	Strip pack
HCC4030BKT	9201/047/02				Solder dip	920104702			
HCC4030BDG	9201/047/03			DIL-14	Gold	920104703			
HCC4030BDT	9201/047/04				Solder dip	920104704			
HCC4034BKG	9306/025/01	ESCC flight	100 krad	Flat-24	Gold	930602501	1.70	-	Strip pack
HCC4034BKT	9306/025/02				Solder dip	930602502			
HCC4034BDG	9306/025/03			DIL-24	Gold	930602503			
HCC4034BDT	9306/025/04				Solder dip	930602504			
HCC4040BKG	9204/026/01	ESCC flight	100 krad	Flat-16	Gold	920402601	0.70	Y	Strip pack
HCC4040BKT	9204/026/02				Solder dip	920402602			
HCC4040BDG	9204/026/08			DIL-16	Gold	920402608			
HCC4040BDT	9204/026/09				Solder dip	920402609			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4041UBKG	9202/040/01	ESCC flight	100 krad	Flat-14	Gold	920204001	0.70	-	Strip pack
HCC4041UBKT	9202/040/02				Solder dip	920204002			
HCC4041UBDG	9202/040/03			DIL-14	Gold	920204003	2.20		
HCC4041UBDT	9202/040/04				Solder dip	920204004			
HCC4042BKG	9202/041/01	ESCC flight	100 krad	Flat-16	Gold	920204101	0.70	-	Strip pack
HCC4042BKT	9202/041/02				Solder dip	920204102			
HCC4042BDG	9202/041/08			DIL-16	Gold	920204108	2.20		
HCC4042BDT	9202/041/09				Solder dip	920204109			
HCC4043BKG	9202/042/01	ESCC flight	100 krad	Flat-16	Gold	920204201	0.70	-	Strip pack
HCC4043BKT	9202/042/02				Solder dip	920204202			
HCC4043BDG	9202/042/08			DIL-16	Gold	920204208	2.20		
HCC4043BDT	9202/042/09				Solder dip	920204209			
HCC4044BKG	9202/043/01	ESCC flight	100 krad	Flat-16	Gold	920204301	0.70	-	Strip pack
HCC4044BKT	9202/043/02				Solder dip	920204302			
HCC4044BDG	9202/043/08			DIL-16	Gold	920204308	2.20		
HCC4044BDT	9202/043/09				Solder dip	920204309			
HCC4046BKG	9202/044/01	ESCC flight	100 krad	Flat-16	Gold	920204401	0.70	-	Strip pack
HCC4046BKT	9202/044/02				Solder dip	920204402			
HCC4046BDG	9202/044/08			DIL-16	Gold	920204408	2.20		
HCC4046BDT	9202/044/09				Solder dip	920204409			
HCC4047BKG	9207/003/01	ESCC flight	100 krad	Flat-14	Gold	920700301	0.70	Y	Strip pack
HCC4047BKT	9207/003/02				Solder dip	920700302			
HCC4047BDG	9207/003/03			DIL-14	Gold	920700303	2.20		
HCC4047BDT	9207/003/04				Solder dip	920700304			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4049UBKG	9202/045/01	ESCC flight	100 krad	Flat-16	Gold	920204501	0.70	Y	Strip pack
HCC4049UBKT	9202/045/02				Solder dip	920204502			
HCC4049UBDG	9202/045/08			Gold	920204508				
HCC4049UBDT	9202/045/09			Solder dip	920204509				
HCC4050BKG	9202/046/01	ESCC flight	100 krad	Flat-16	Gold	920204601	0.70	Y	Strip pack
HCC4050BKT	9202/046/02				Solder dip	920204602			
HCC4050BDG	9202/046/08			Gold	920204608				
HCC4050BDT	9202/046/09			Solder dip	920204609				
HCC4051BKG	9202/047/01	ESCC flight	100 krad	Flat-16	Gold	920204701	0.70	Y	Strip pack
HCC4051BKT	9202/047/02				Solder dip	920204702			
HCC4051BDG	9202/047/08			Gold	920204708				
HCC4051BDT	9202/047/09			Solder dip	920204709				
HCC4052BKG	9202/048/01	ESCC flight	100 krad	Flat-16	Gold	920204801	0.70	-	Strip pack
HCC4052BKT	9202/048/02				Solder dip	920204802			
HCC4052BDG	9202/048/08			Gold	920204808				
HCC4052BDT	9202/048/09			Solder dip	920204809				
HCC4053BKG	9202/049/01	ESCC flight	100 krad	Flat-16	Gold	920204901	0.70	-	Strip pack
HCC4053BKT	9202/049/02				Solder dip	920204902			
HCC4053BDG	9202/049/08			Gold	920204908				
HCC4053BDT	9202/049/09			Solder dip	920204909				
HCC4060BKG ⁽²⁾	9204/052/01	ESCC flight	100 krad	Flat-16	Gold	920405201	0.70	-	Strip pack
HCC4060BKT ⁽²⁾	9204/052/02				Solder dip	920405202			
HCC4060BDG ⁽²⁾	9204/052/08			Gold	920405208				
HCC4060BDT ⁽²⁾	9204/052/09			Solder dip	920405209				



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4063BKG	9209/001/01	ESCC flight	100 krad	Flat-16	Gold	920900101	0.70	Y	Strip pack
HCC4063BKT	9209/001/02				Solder dip	920900102			
HCC4063BDG	9209/001/08			Gold	920900108				
HCC4063BDT	9209/001/09			Solder dip	920900109				
HCC4066BKG	9408/005/01	ESCC flight	100 krad	Flat-14	Gold	940800501	0.70	Y	Strip pack
HCC4066BKT	9408/005/02				Solder dip	940800502			
HCC4066BDG	9408/005/03			Gold	940800503				
HCC4066BDT	9408/005/04			Solder dip	940800504				
HCC4067BKG	9408/009/01	ESCC flight	100 krad	Flat-24	Gold	940800901	1.70		Strip pack
HCC4067BKT	9408/009/02				Solder dip	940800902			
HCC4067BDG	9408/009/03			Gold	940800903				
HCC4067BDT	9408/009/04			Solder dip	940800904				
HCC4068BKG	9201/061/01	ESCC flight	100 krad	Flat-14	Gold	920106101	0.70		Strip pack
HCC4068BKT	9201/061/02				Solder dip	920106102			
HCC4068BDG	9201/061/03			Gold	920106103				
HCC4068BDT	9201/061/04			Solder dip	920106104				
HCC4069UBKG	9401/010/01	ESCC flight	100 krad	Flat-14	Gold	940101001	0.70	Y	Strip pack
HCC4069UBKT	9401/010/02				Solder dip	940101002			
HCC4069UBDG	9401/010/03			Gold	940101003				
HCC4069UBDT	9401/010/04			Solder dip	940101004				
HCC4070BKG	9201/048/01	ESCC flight	100 krad	Flat-14	Gold	920104801	0.70		Strip pack
HCC4070BKT	9201/048/02				Solder dip	920104802			
HCC4070BDG	9201/048/03			Gold	920104803				
HCC4070BDT	9201/048/04			Solder dip	920104804				



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4071BKG	9201/063/01	ESCC flight	100 krad	Flat-14	Gold	920106301	0.70	Y	Strip pack
HCC4071BKT	9201/063/02				Solder dip	920106302			
HCC4071BDG	9201/063/03			DIL-14	Gold	920106303			
HCC4071BDT	9201/063/04				Solder dip	920106304			
HCC4072BKG	9201/082/01	ESCC flight	100 krad	Flat-14	Gold	920108201	0.70	-	Strip pack
HCC4072BKT	9201/082/02				Solder dip	920108202			
HCC4072BDG	9201/082/03			DIL-14	Gold	920108203			
HCC4072BDT	9201/082/04				Solder dip	920108204			
HCC4073BKG	9201/064/01	ESCC flight	100 krad	Flat-14	Gold	920106401	0.70	Y	Strip pack
HCC4073BKT	9201/064/02				Solder dip	920106402			
HCC4073BDG	9201/064/03			DIL-14	Gold	920106403			
HCC4073BDT	9201/064/04				Solder dip	920106404			
HCC4075BKG	9201/065/01	ESCC flight	100 krad	Flat-14	Gold	920106501	0.70	-	Strip pack
HCC4075BKT	9201/065/02				Solder dip	920106502			
HCC4075BDG	9201/065/03			DIL-14	Gold	920106503			
HCC4075BDT	9201/065/04				Solder dip	920106504			
HCC4076BKG	9306/022/01	ESCC flight	100 krad	Flat-16	Gold	930602201	0.70	Y	Strip pack
HCC4076BKT	9306/022/02				Solder dip	930602202			
HCC4076BDG	9306/022/08			DIL-16	Gold	930602208			
HCC4076BDT	9306/022/09				Solder dip	930602209			
HCC4077BKG	9201/055/01	ESCC flight	100 krad	Flat-14	Gold	920105501	0.70	-	Strip pack
HCC4077BKT	9201/055/02				Solder dip	920105502			
HCC4077BDG	9201/055/03			DIL-14	Gold	920105503			
HCC4077BDT	9201/055/04				Solder dip	920105504			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4078BKG	9201/062/01	ESCC flight	100 krad	Flat-14	Gold	920106201	0.70	-	Strip pack
HCC4078BKT	9201/062/02				Solder dip	920106202			
HCC4078BDG	9201/062/03			DIL-14	Gold	920106203	2.20		
HCC4078BDT	9201/062/04				Solder dip	920106204			
HCC4081BKG	9201/052/01	ESCC flight	100 krad	Flat-14	Gold	920105201	0.70	Y	Strip pack
HCC4081BKT	9201/052/02				Solder dip	920105202			
HCC4081BDG	9201/052/03			DIL-14	Gold	920105203	2.20		
HCC4081BDT	9201/052/04				Solder dip	920105204			
HCC4082BKG	9201/066/01	ESCC flight	100 krad	Flat-14	Gold	920106601	0.70	-	Strip pack
HCC4082BKT	9201/066/02				Solder dip	920106602			
HCC4082BDG	9201/066/03			DIL-14	Gold	920106603	2.20		
HCC4082BDT	9201/066/04				Solder dip	920106604			
HCC4093BKG	9409/002/01	ESCC flight	100 krad	Flat-14	Gold	940900201	0.70	Y	Strip pack
HCC4093BKT	9409/002/02				Solder dip	940900202			
HCC4093BDG	9409/002/03			DIL-14	Gold	940900203	2.20		
HCC4093BDT	9409/002/04				Solder dip	940900204			
HCC4094BKG	9306/026/01	ESCC flight	100 krad	Flat-16	Gold	930602601	0.70	Y	Strip pack
HCC4094BKT	9306/026/02				Solder dip	930602602			
HCC4094BDG	9306/026/08			DIL-16	Gold	930602608	2.20		
HCC4094BDT	9306/026/09				Solder dip	930602609			
HCC4098BKG	9206/003/01	ESCC flight	100 krad	Flat-16	Gold	920600301	0.70	Y	Strip pack
HCC4098BKT	9206/003/02				Solder dip	920600302			
HCC4098BDG	9206/003/08			DIL-16	Gold	920600308	2.20		
HCC4098BDT	9206/003/09				Solder dip	920600309			



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC40103BKG	9204/036/01	ESCC flight	100 krad	Flat-16	Gold	920403601	0.70	Y	Strip pack
HCC40103BKT	9204/036/02				Solder dip	920403602			
HCC40103BDG	9204/036/08			Gold	920403608				
HCC40103BDT	9204/036/09			Solder dip	920403609				
HCC40106BKG	9409/005/01	ESCC flight	100 krad	Flat-14	Gold	940900501	0.70	Y	Strip pack
HCC40106BKT	9409/005/02				Solder dip	940900502			
HCC40106BDG	9409/005/03			Gold	940900503				
HCC40106BDT	9409/005/04			Solder dip	940900504				
HCC40107BKG	9401/013/01	ESCC flight	100 krad	Flat-14	Gold	940101301	0.70	Y	Strip pack
HCC40107BKT	9401/013/02				Solder dip	940101302			
HCC40107BDG	9401/013/03			Gold	940101303				
HCC40107BDT	9401/013/04			Solder dip	940101304				
HCC40109BKG	9407/003/01	ESCC flight	100 krad	Flat-16	Gold	940700301	0.70	Y	Strip pack
HCC40109BKT	9407/003/02				Solder dip	940700302			
HCC40109BDG	9407/003/08			Gold	940700308				
HCC40109BDT	9407/003/09			Solder dip	940700309				
HCC40161BKG	9204/054/01	ESCC flight	100 krad	Flat-16	Gold	920405401	0.70	Y	Strip pack
HCC40161BKT	9204/054/02				Solder dip	920405402			
HCC40161BDG	9204/054/08			Gold	920405408				
HCC40161BDT	9204/054/09			Solder dip	920405409				
HCC40174BKG	9203/038/01	ESCC flight	100 krad	Flat-16	Gold	920303801	0.70	Y	Strip pack
HCC40174BKT	9203/038/02				Solder dip	920303802			
HCC40174BDG	9203/038/08			Gold	920303808				
HCC40174BDT	9203/038/09			Solder dip	920303809				



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC40193BKG	9204/04/1/01	ESCC flight	100 krad	Flat-16	Gold	920404101	0.70	-	Strip pack
HCC40193BKT	9204/04/1/02				Solder dip	920404102			
HCC40193BDG	9204/04/1/08			Gold	920404108				
HCC40193BDT	9204/04/1/09			Solder dip	920404109				
HCC4503BKG	9401/030/01	ESCC flight	100 krad	Flat-16	Gold	940103001	0.70	Y	Strip pack
HCC4503BKT	9401/030/02				Solder dip	940103002			
HCC4503BDG	9401/030/08			Gold	940103008				
HCC4503BDT	9401/030/09			Solder dip	940103009				
HCC4512BKG	9408/006/01	ESCC flight	100 krad	Flat-16	Gold	940800601	0.70	Y	Strip pack
HCC4512BKT	9408/006/02				Solder dip	940800602			
HCC4512BDG	9408/006/08			Gold	940800608				
HCC4512BDT	9408/006/09			Solder dip	940800609				
HCC4514BKG	9408/012/01	ESCC flight	100 krad	Flat-24	Gold	940801201	1.70	-	Strip pack
HCC4514BKT	9408/012/02				Solder dip	940801202			
HCC4514BDG	9408/012/03			Gold	940801203				
HCC4514BDT	9408/012/04			Solder dip	940801204				
HCC4515BKG ⁽²⁾	9205/011/01	ESCC flight	100 krad	Flat-24	Gold	920501101	1.70	-	Strip pack
HCC4515BKT ⁽²⁾	9205/011/02				Solder dip	920501102			
HCC4515BDG ⁽²⁾	9205/011/03			Gold	920501103				
HCC4515BDT ⁽²⁾	9205/011/04			Solder dip	920501104				
HCC4516BKG	9204/045/01	ESCC flight	100 krad	Flat-16	Gold	920404501	0.70	-	Strip pack
HCC4516BKT	9204/045/02				Solder dip	920404502			
HCC4516BDG	9204/045/08			Gold	920404508				
HCC4516BDT	9204/045/09			Solder dip	920404509				



Table 13. Ordering information (continued)

Order code	ESCC detailed specification	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Mass (g)	EPPL	Packing
HCC4520BKG	9204/028/01	ESCC flight	100 krad	Flat-16	Gold	920402801	0.70	-	Strip pack
HCC4520BKT	9204/028/02				Solder dip	920402802			
HCC4520BDG	9204/028/08			Gold	920402808				
HCC4520BDT	9204/028/09			Solder dip	920402809				
HCC4532BKG	9202/065/01	ESCC flight	100 krad	Flat-16	Gold	920206501	0.70	-	Strip pack
HCC4532BKT	9202/065/02				Solder dip	920206502			
HCC4532BDG	9202/065/08			Gold	920206508				
HCC4532BDT	9202/065/09			Solder dip	920206509				
HCC4538BKG	9207/007/01	ESCC flight	100 krad	Flat-16	Gold	920700701	0.70	-	Strip pack
HCC4538BKT	9207/007/02				Solder dip	920700702			
HCC4538BDG	9207/007/08			Gold	920700708				
HCC4538BDT	9207/007/09			Solder dip	920700709				
HCC4555BKG	9408/011/01	ESCC flight	100 krad	Flat-16	Gold	940801101	0.70	Y	Strip pack
HCC4555BKT	9408/011/02				Solder dip	940801102			
HCC4555BDG	9408/011/08			Gold	940801108	-			
HCC4555BDT	9408/011/09			Solder dip	940801109				
HCC4556BKG	9408/025/01	ESCC flight	100 krad	Flat-16	Gold	940802501	0.70	-	Strip pack
HCC4556BKT	9408/025/02				Solder dip	940802502			
HCC4556BDG	9408/025/08			Gold	940802508				
HCC4556BDT	9408/025/09			Solder dip	940802509				

1. Specific marking only. Complete marking includes the following: ST logo; ESA logo; Date code (details of the date code are provided in [Section 7.1: Date code](#)); ESCC part number (as mentioned in above table); Country of origin (FR = France); Part serial number within the assembly lot.

2. Not recommended for new design (NRND)

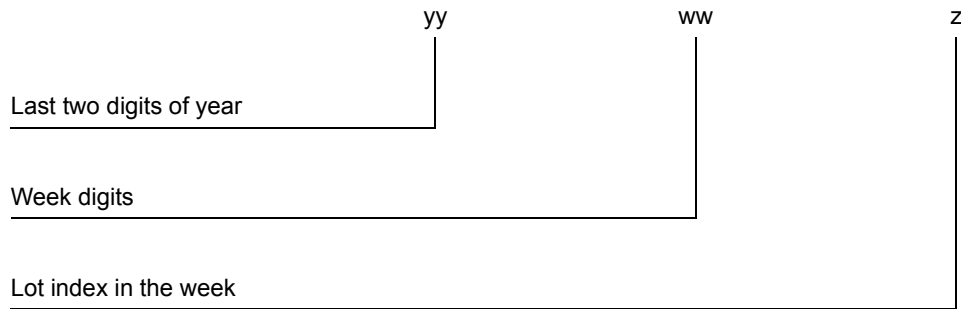
Note: Contact the ST sales office for information about the specific conditions for other CMOS4000 part numbers and products in die form.



7 Other information

7.1 Date code

The data code for “ESCC flight” is structured as follows: yywwz, where:



7.2 Documentation

Table 14. Documentation provided for ESCC flight

Quality level	Documentation
ESCC flight	Certificate of conformance
	0.1 rad/s radiation verification test report

8 Revision history

Table 15. Document revision history

Date	Revision	Changes
24-Mar-2010	1	First release
29-Mar-2010	2	Updated cover page description
10-Aug-2011	3	Added note 1. on page 12, note 1. on page 13, note 1. on page 14, note 1. on page 15, note 1. on page 16, note 1. on page 17 and in the "Pin connections" diagram on the cover page.
26-Apr-2013	4	Small text change to Description. Table 1: Device summary: removed part numbers HCC4016B, HCC4035B, HCC4099B, HCC4502B, and HCC4508B; updated ESCC specification for HCC4098B (9206/003 instead of 9206/002). Added "inches" dimensions to Table 4, Table 5, Table 6, Table 7, Table 8, and Table 9. Updated Table 11: Documentation provided for ESCC flight. Added Section 6: Other information.
01-Apr-2014	5	Table 10: Ordering information: all order codes changed to new ST ordering code scheme, updated footnote 1.
15-Feb-2016	6	Features: updated SEL and SEU immunity; added SET immunity Table 1: Device summary: added "SEE class" and footnote 1 Added Section 4: Radiations Section 5: Package information: updated terminology Table 13: Ordering information: removed "ESCC" from column "Radiation level", added footnote 2.
28-Jul-2017	7	Updated Section 4.1: Total ionizing dose (TID)

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