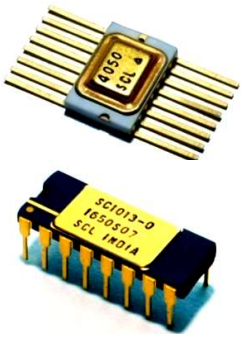
HIGH SPEED NON-INVERTING HEX BUFFER (5V) (SC1013-0) (Radiation Hardened)



DATA SHEET

Version 2.2, October 2021

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PRODUCT DESCRIPTION:

SC1013-0 is Radiation Hardened, High Speed Non-Inverting Hex Buffer. It consists of 6 buffer stages, providing high noise immunity and a stable output.

Devices have a modified input protection structure that enables these parts to be used as logic level translators which convert high-level logic to a low level logic while operating off the low-level logic supply. For example, 5V input pulse levels can be down-converted to 0V to 3V logic levels.

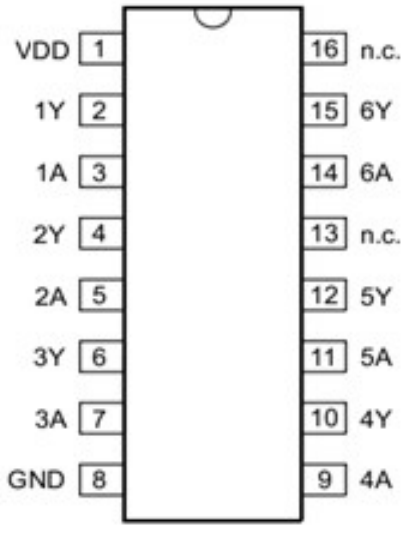
APPLICATIONS:

- Wave and pulse shapers
- High-noise-environment systems
- Monostable multivibrators
- Astable multivibrators
- NAND logic

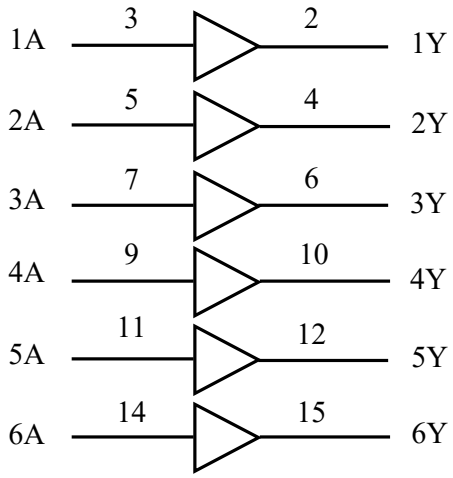
FEATURES:

- **Operating Supply Voltage 2.5V to 5.5V**
- **Cold Sparing feature at inputs**
- **High-to-Low Voltage Level Converter up to V_{IN}=5.5V**
- **Typical Propagation Delay : 5.5 ns at V_{DD}=5.0V, C_L=30pF, T_A=25ºC**
- **Low Power Dissipation, I_{DD} (typ.) < 1µA**
- **Balanced Propagation Delays and transition times**
- **Symmetrical Output loading I_{OH} = I_{OL}= 8mA**
- **Radiation Hardened up to 100 KRad TID**
- **SET/SEL immune up to LET 50 MeV-cm2/mg.**
- **Operating Temperature: -55ºC to 125ºC.**
- **Pin compatible with HC4050**
- **Package Θ_{JC} = 3.1ºC/Watt**
- **Ceramic Flat package (FP-16), DIP-16**
- **ESD Sensitivity Level: HBM Class 1B (500V to 999V), passed up to 500V**
- **SCL's 180nm CMOS Technology**

PIN CONFIGURATION:



Device Pin diagram



Device Logic Diagram

PIN DESCRIPTION:

Symbol	Pin No.	Description
1A to 6A	3, 5, 7, 9, 11, 14	Input
1Y to 6Y	2, 4, 6, 10, 12, 15	Output
V_{DD}	1	Supply Voltage
V_{SS}	8	Ground (0V)
NC	13,16	Not Connected

FUNCTIONAL TABLE:

Input	Output
nA	**nY**
L	L
H	H

ABSOLUTE MAXIMUM RATINGS (1):

Over operating free-air temperature range (unless otherwise noted),

Parameter	Symbol	Ratings	Remarks
Supply Voltage Range	V_{DD}	–0.5V to 6.5V	
Input/ Output Voltage Range	V_{IO}	–0.5V to 6.5V	
Supply Current (2)	I_{DD}	84 mA	
Power Dissipation	P_D	462 mW	84mA*5.5V
Max. Junction Temperature	T_J	150°C	
Storage Temperature Range	T_{STG}	–65°C to 150°C	

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

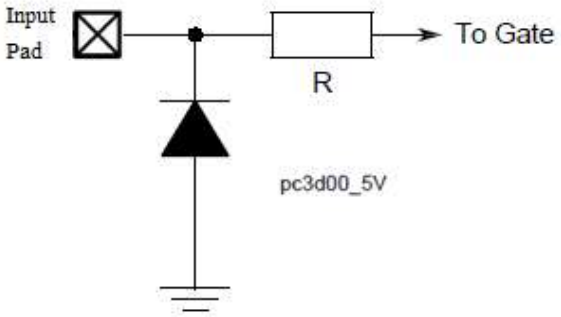
(2) Maximum supply current that can be drawn from V_{DD} pin for output loading requirement.

RECOMMENDED OPERATING CONDITIONS:

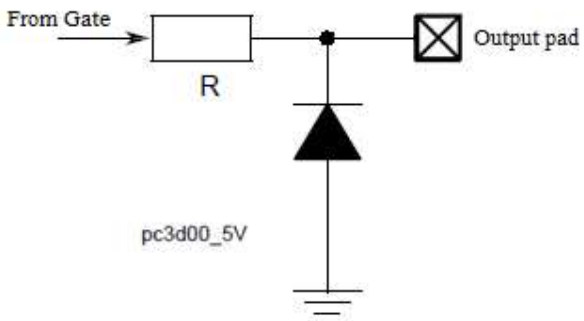
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage	2.5	3.3	5.5	V
V_I	Input Voltage	0	-	5.5	V
V_O	Output Voltage	0	-	V_{DD}	V
I_O	Output Source/Sink	-	-	8	mA
t_{rise} / t_{fall}	Input rise and fall time (V_{DD} = 5.5V)	-	-	50	nsec
T_A	Operating Free Air Temperature	-55	25	+125	ºC

PROTECTION NETWORKS

INPUT PROTECTION



OUTPUT PROTECTION



Device I/O pads ESD Diagram

DC ELECTRICAL SPECIFICATIONS:

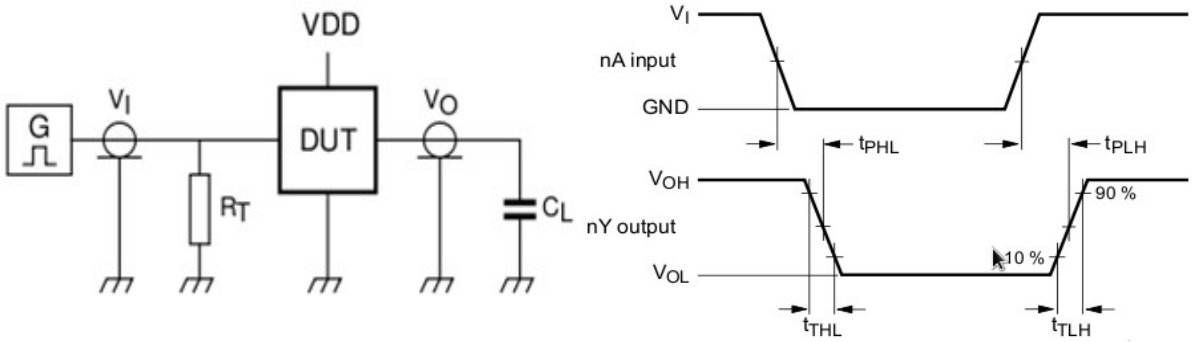
V_{DD} =2.5V to 5.5V, V_{SS}=0V, T_{AMB} = -55°C to +125°C (unless otherwise noted)

Symbol	Parameter	Test Conditions	Test Results			Units
			Min	Typ.	Max	
I_{DD}	Static Supply Current	V_{IL} =0V, V_{IH} =5.5V V_{DD} = 5.5V (All Outputs Open)	-	-	2	uA
I_{IL}	Low Level Input Leakage Current	V_{DD}=5.5V V_{IN} = 0V	-	-	-1	uA
I_{IH}	High Level Input Leakage Current	V_{DD}=5.5V V_{IN} = 5.5V	-	-	1	uA
V_{OL1}	Low Level Output Voltage 1	V_{IL}=0.5V, I_{OL}=20uA V_{DD}=2.5V, V_{SS}=0V	-	-	100	mV
V_{OL2}	Low Level Output Voltage 2	V_{IL}=0.9V, I_{OL}=20uA V_{DD}=4.5V, V_{SS}=0V	-	-	100	mV
V_{OL3}	Low Level Output Voltage 3	V_{IL}=1.1V, I_{OL}=20uA V_{DD}=5.5V, V_{SS}=0V	-	-	100	mV
V_{OL4}	Low Level Output Voltage 4	V_{IL}=0.5V, I_{OL}=8mA V_{DD}=2.5V, V_{SS}=0V	-	190	400	mV
V_{OL5}	Low Level Output Voltage 5	V_{IL}=0.9V, I_{OL}=8mA V_{DD}=4.5V, V_{SS}=0V	-	180	400	mV
V_{OL6}	Low Level Output Voltage 6	V_{IL}=1.1V, I_{OL}=8mA V_{DD}=5.5V, V_{SS}=0V	-	170	400	mV
V_{OH1}	High Level Output Voltage 1	V_{IH}=1.75V, I_{OL}=20uA V_{DD}=2.5V, V_{SS}=0V	2.4	2.48	-	V
V_{OH2}	High Level Output Voltage 2	V_{IH}=3.15V, I_{OL}=20uA V_{DD}=4.5V, V_{SS}=0V	4.4	4.48	-	V
V_{OH3}	High Level Output Voltage 3	V_{IH}=3.85V, I_{OL}=20uA V_{DD}=5.5V, V_{SS}=0V	5.4	5.48	-	V
V_{OH4}	High Level Output Voltage 4	V_{IH}=1.75V, I_{OL}=8mA V_{DD}=2.5V, V_{SS}=0V	1.7	2.3	-	V
V_{OH5}	High Level Output Voltage 5	V_{IH}=3.15V, I_{OL}=8mA V_{DD}=4.5V, V_{SS}=0V	3.7	4.3	-	V
V_{OH6}	High Level Output Voltage 6	V_{IH}=3.85V, I_{OL}=8mA V_{DD}=5.5V, V_{SS}=0V	4.7	5.3	-	V

DC ELECTRICAL SPECIFICATIONS (Continued..)

Symbol	Parameter	Test Conditions		Test Results			Units
				Min	Typ.	Max	
I_{OFF}	Power Off Input Leakage Current (Cold Spare)	V_{DD} = 0V	V_{IN} = 2.5V	-5	0.5	5	uA
			V_{IN} = 0V	-5	0.1	5	uA
			V_{IN} = 5.5V	-	100	150	uA
Functional (Truth Table Verification)	Functional Test 1	V_{IL}=0.5V,V_{IH}=1.75V V_{DD}=2.5V, (No Load)		-	-	-	-
	Functional Test 2	V_{IL}=0.9V,V_{IH}=3.15V V_{DD}=4.5V, (No Load)		-	-	-	-
	Functional Test 3	V_{IL}=1.1V,V_{IH}=3.85V V_{DD}=5.5V, (No Load)		-	-	-	-
	Functional Test 4	V_{IL}=0.5V,V_{IH}=5.5V V_{DD}=2.5V, (No Load)		-	-	-	-
t_{PHL}	Propagation Delay High to Low (50% to 50%)	V_{DD}=5.0V, 1MHz, C_L=30pF V_{IL}=0V, V_{IH} = 5.0V		-	5.5	17	ns
t_{PLH}	Propagation Delay Low to High (50% to 50%)	V_{DD}=5.0V, 1MHz, C_L=30pF V_{IL}=0V, V_{IH} = 5.0V		-	5.5	17	ns
t_r	V_{OUT} rise time (10% to 90%)	V_{DD}=5.0V, 1MHz, T_A=25ºC, C_L=30pF V_{IL}=0V, V_{IH} = 5.0V		-	8.6	-	ns
t_f	V_{OUT} fall time (90% to 10%)	V_{DD}=5.0V, 1MHz, T_A=25ºC, C_L=30pF V_{IL}=0V, V_{IH} = 5.0V		-	8.5	-	ns

TEST CIRCUIT AND SWITCHING WAVEFORM:

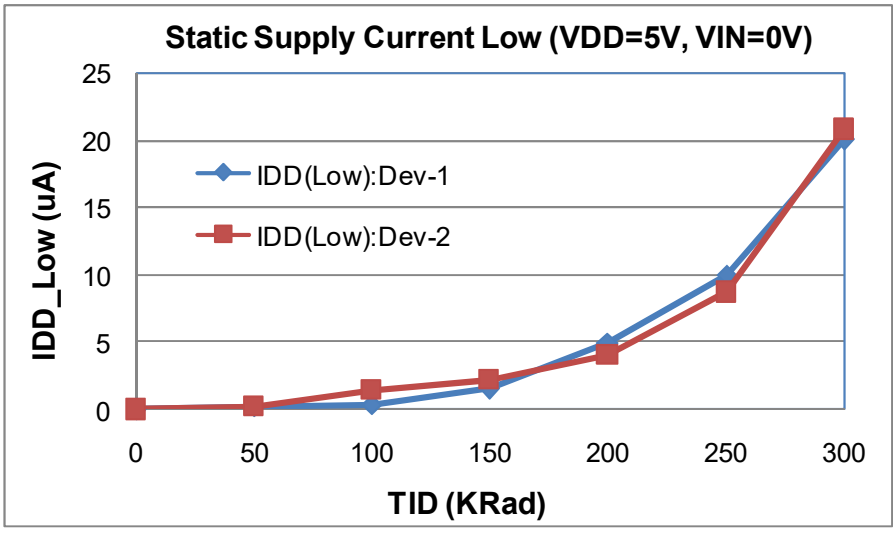


RADIATION CHARACTERISTICS:

❖ Total Ionization Dose (TID) Testing

TID testing of Hex Buffer (SC1013-0) is performed for radiation level upto 300KRad.

- No functional degradation was observed upto 300 Krad.
- No significant change in device parameters such as IIL, IIH, VOL & VOH was observed upto 300KRad.
- Typical static supply current remains around 2 uA upto 150 krad.



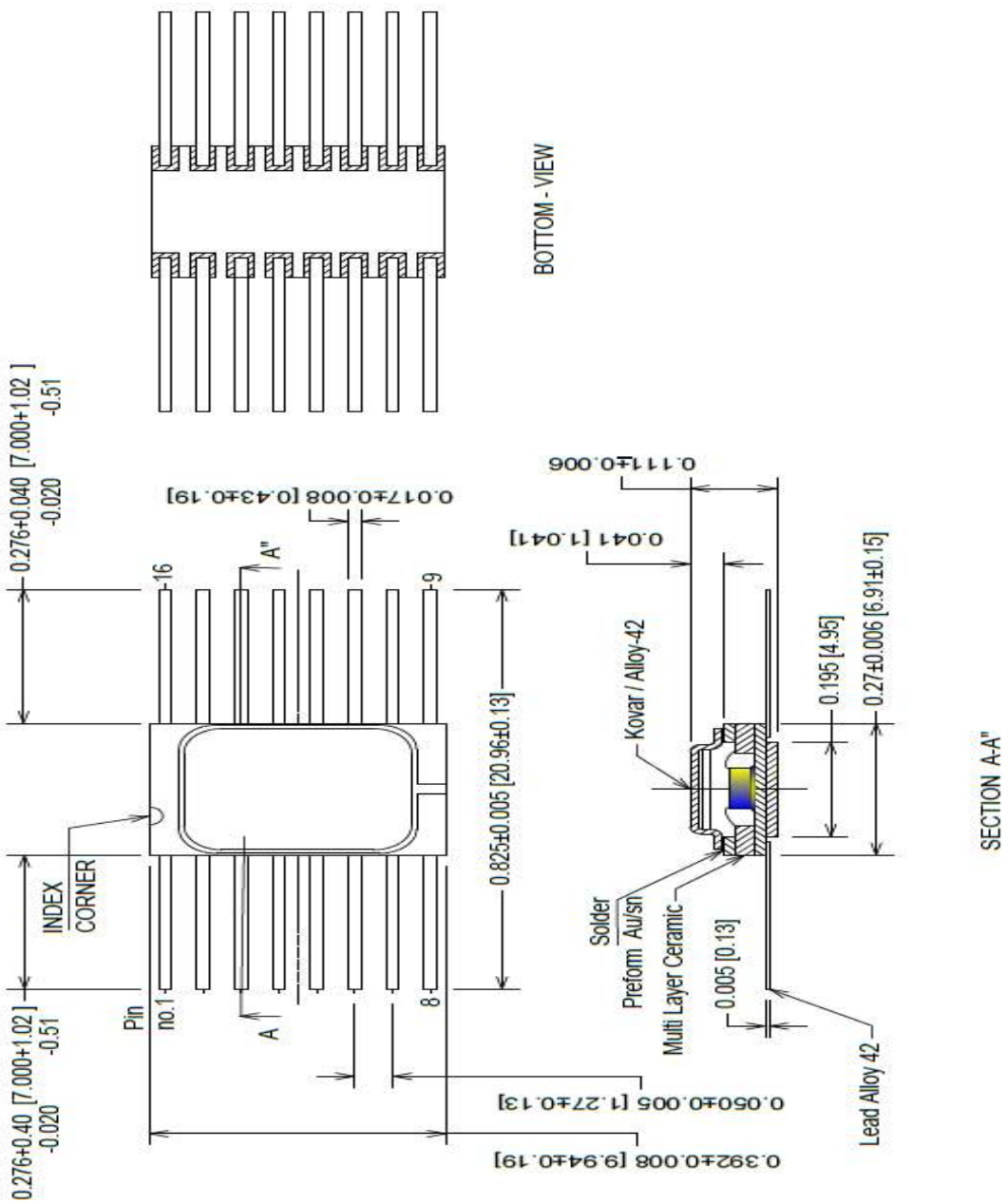
❖ Single Event Effect (SEE) Testing

SEE testing of Hex Buffer (SC1013-0) is performed at three different LET energy ion beams Ti+ (21 MeV-cm2/mg), Ni+ (30 MeV-cm2/mg) and Ag+ (50 MeV-cm2/mg) for a Fluence of 10^6 ions/cm^2.

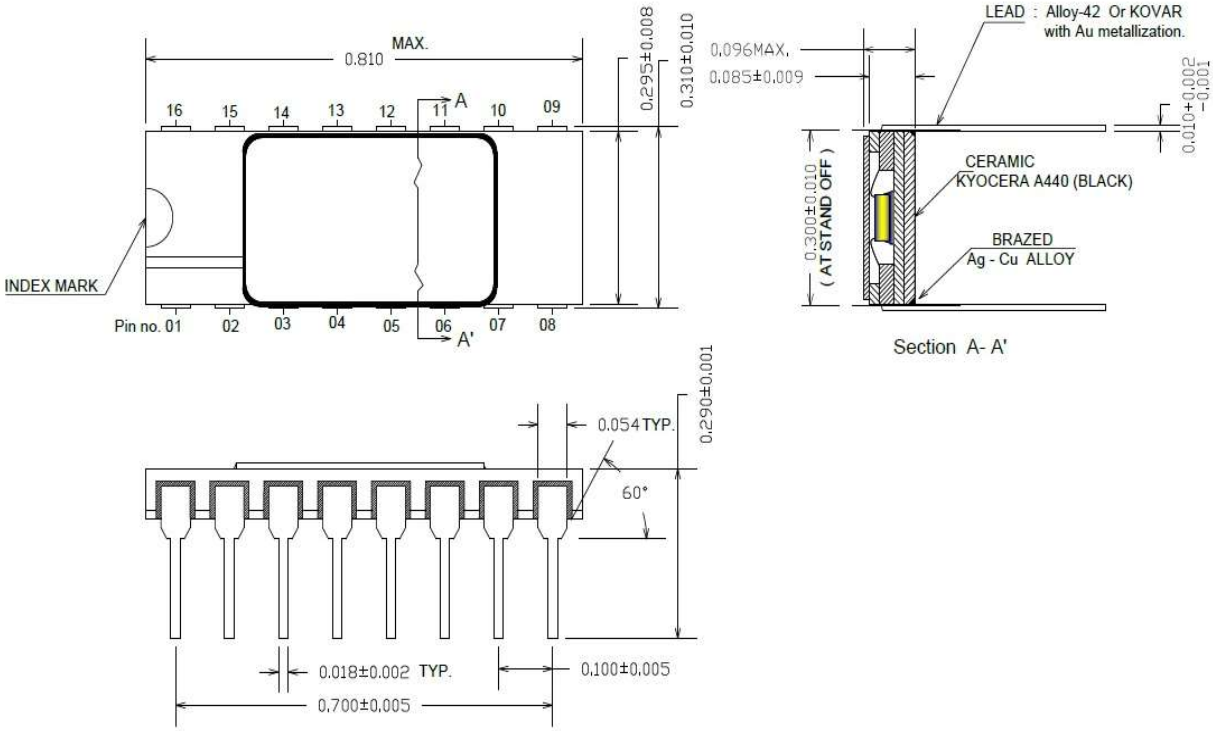
- No Single Event latch-up (SEL) was observed upto LET of 50 MeV-cm2/mg. Supply current (IDD) remains within specification throughout testing.
- No Single Event transient (SET) was observed upto LET of 50 MeV-cm2/mg.

PACKAGE DRAWING (16-Pin Ceramic-Dual-Flat pack)

NOTE: All linear dimensions are in inches (mm.)



PACKAGE DRAWING (Ceramic DIP-16)



Revision History			
S. No.	**Version**	**Date of release**	**Description**
1	1.0	15 March 2019	First Release (V_{DD}=4.5V to 5.5V)
2	2.0	30 Nov. 2019	Extended V_{DD} from 2.5V to 5.5V, Added Radiation test results
3	2.1	March 2021	Title name Changed Added DIP-16 Package Information
4	2.2	21 October 2021	Added ESD Levels & SEE results. Modified TID level