QUAD 2-INPUT NAND SCHMITT-TRIGGER (5V)

SC1125-0

(Radiation Hardened)

DATA SHEET

(Version 1.0, March 2020)

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PRODUCT DESCRIPTION:

SC1125 is a Radiation Hardened Quad Two input NAND gate with Schmitt trigger action on both inputs. Schmitt trigger is a comparator which triggers at different points for positive and negative going signals and the difference between positive voltage (V_T^+) and negative voltage (V_T^-) is the Hysteresis voltage (V_H). All outputs have equal source and sink currents.

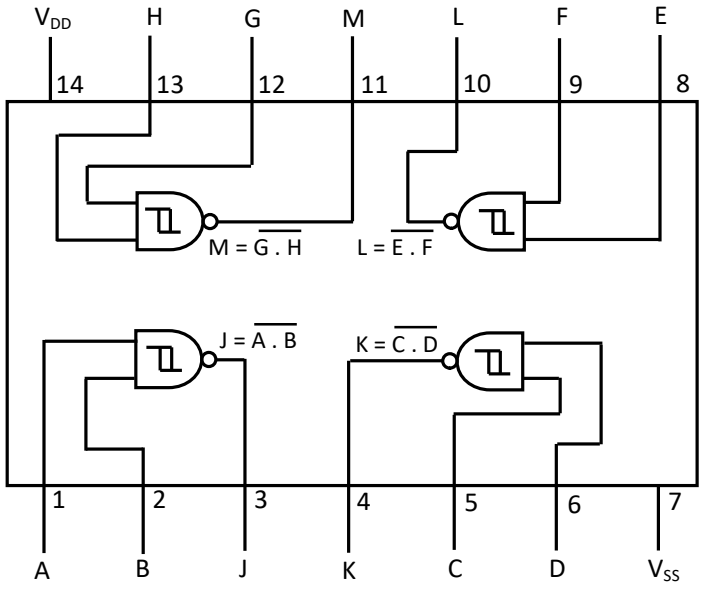
APPLICATIONS:

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

FEATURES:

- **Operating Supply Voltage 5V ± 0.5V**
- **Schmitt-trigger on each input with no external components.**
- **Noise immunity greater than 50%**
- **Equal source and sink currents**
- **No limit on input rise and fall time**
- **Hysteresis voltage V_H = 1.6V (V_{DD} = 5.0V) T_A = 25°C (Typical)**
- **Operating Temperature: -55ºC to 125ºC**
- **Radiation Hardened up to 200 KRad TID**
- **SET/SEL immune up to 50 MeV-cm²/mg**
- **14 Pin CSOP / 14 pin CDIP / Customized package options / Die**
- **Thermal Resistance (CSOP), Θ_{JC} = 7.47 °C/ W**
- **Pin compatible with CD4093**
- **ESD Sensitivity Level: Class 0 (< 250V) HBM**
- **SCL's 180nm CMOS Technology**

DEVICE PIN CONFIGURATION:



PIN DESCRIPTION:

PIN NUMBER	PIN NAME	DESCRIPTION
14	V_{DD}	Positive Power Supply
7	V_{SS}	Ground
1, 2, 5,6, 8,9, 12, 13	A, B, C, D, E, F, G, H	Input
3,4,10, 11	J, K, L, M	Output

FUNCTIONAL TABLE:

TRUTH TABLE OF NAND GATE		
INPUT-1 (A, C, E, G)	**INPUT-2 (B, D, F, H)**	**OUTPUT (J, K, L, M)**
1	1	0
1	0	1
0	1	1
0	0	1

ABSOLUTE MAXIMUM RATINGS (1):

Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage	-0.5 to 6.5	V
$V_{I/O}$	Voltage at any Pin	-0.5 to 6.5	V
T_J	Max. Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 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.

RECOMMENDED OPERATING CONDITIONS:

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	4.5 to 5.5	V
V_{IN}	Input Voltage	0 to V_{DD}	
I_{OH}	High level output current (Source)	-3.5	mA
I_{OL}	Low level output current (Sink)	3.5	
T_A	Operating Temperature	-55 to 125	°C

DC ELECTRICAL CHARACTERISTICS

Test condition: V_{DD} = 5V ±0.5V, V_{SS}=0V, T_{AMB} = -55°C to +125°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Test Limits			
			Min.	Typ.[1]	Max.	Unit
I_{DD}	Static Supply Current	V_{IN} = V_{SS} or V_{DD}	-	0.1	3.0	uA
I_{IL}	Input Gate Leakage Current Low	V_{DD}=5.5V V_{IN} = V_{SS}	-	±20	-100	nA
I_{IH}	Input Gate Leakage Current High	V_{DD}=5.5V V_{IN} = V_{DD}	-	±20	100	nA
V_{OL}	Output Voltage Level Low	V_{DD}=5.0V (No Load)	-	0.01	0.05	V
		V_{DD}=5.0V (I_{OL}= 3.5mA)	-	0.2	0.4	V
V_{OH}	Output Voltage Level High	V_{DD}=5.0V (No Load)	4.95	4.99	V_{DD}	V
		V_{DD}=5.0V (I_{OH}= -3.5mA)	4.6	4.75	V_{DD}	V
V_{T+}	Positive going threshold voltage[1]	V_{DD}=5.0V V_{IN1} = V_{RAMP} (0 to V_{DD} & V_{DD} to 0) V_{IN2} = V_{DD} and V_{IN2} = V_{RAMP} (0 to V_{DD} and V_{DD} to 0) V_{IN1} = V_{DD}	2.2	3.2	3.6	V
V_{T-}	Negative going threshold voltage[1]		0.9	1.5	2.8	V
V_H	Hysteresis Voltage [2] **$V_H = (V_{T+}-V_{T-})$**		0.6	1.6	2.0	V
Functional	Verify Truth Table without Load	V_{DD}=5V±0.5V Functional Verification at 1 MHz V_{IL}=0V, V_{IH}= V_{DD} V_{OH}≥V_{DD}-0.5V, V_{OL}≤0.5V				

[1] Typical Values are measured at V_{DD}=5.0V, T_{AMB} = 25°C

[2] IN1 = B, D, F and H and IN2 = A, C, E and G.

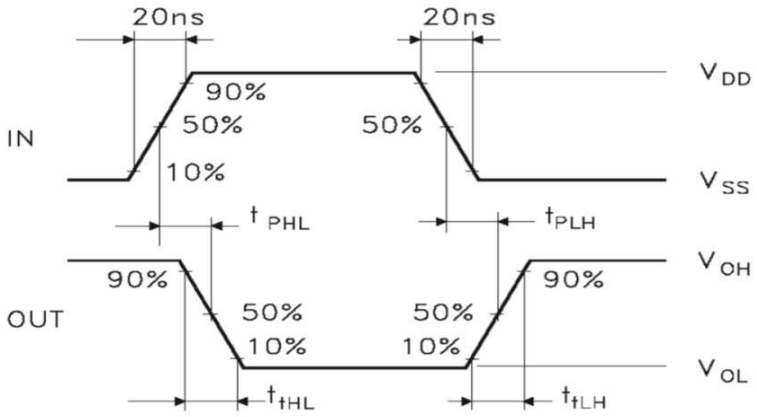
AC ELECTRICAL SPECIFICATIONS:

Test condition: V_{DD}=5.0V, V_{IL}=0V, V_{IH}= 5V, (t_R and $t_F \leq$ 15ns), Duty Cycle = 50%,
T_{AMB} = -55 °C to 125 °C, Load: C_L=30pf

Symbol	Parameter	Test Results			
		Min.	Typ.[3]	Max.	Units
t_{PHL}	Propagation Delay Time (High to Low)	-	15	50	ns
t_{PLH}	Propagation Delay Time (Low to High)	-	15	50	ns
T_{THL}	Output Transition Time (High to Low)	-	5	-	ns
T_{TLH}	Output Transition Time (Low to High)	-	5.5	-	ns

[3] Typical Values are measured at V_{DD}=5.0V, T_{AMB} = 25°C

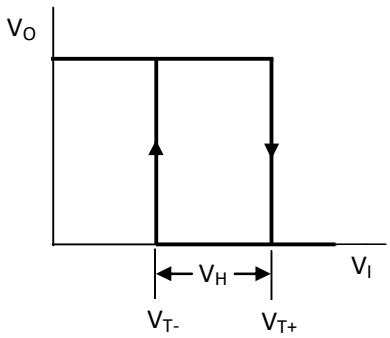
TEST CIRCUIT AND SWITCHING WAVEFORM:

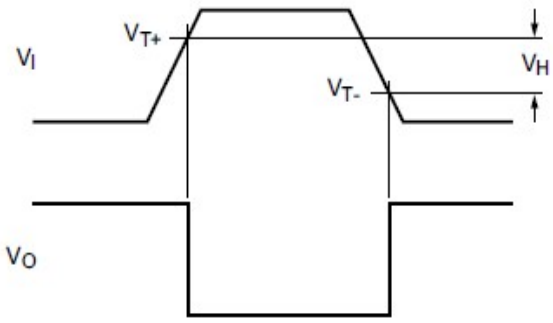


HYSTERESIS CURVE:

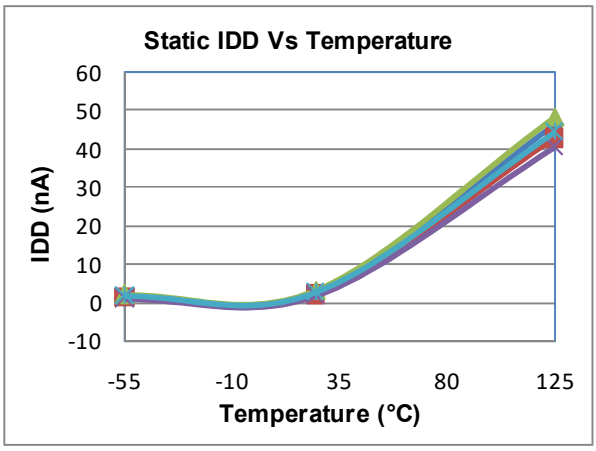
Test Conditions:

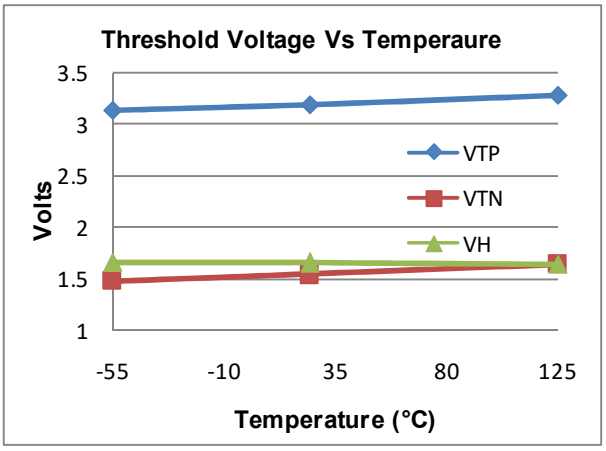
V_{DD} =5V, V_{IN1}=5V & V_{IN2} = Square wave (20 ns rise / fall time), freq. = 1MHz, Amplitude = 5 V_{PP}

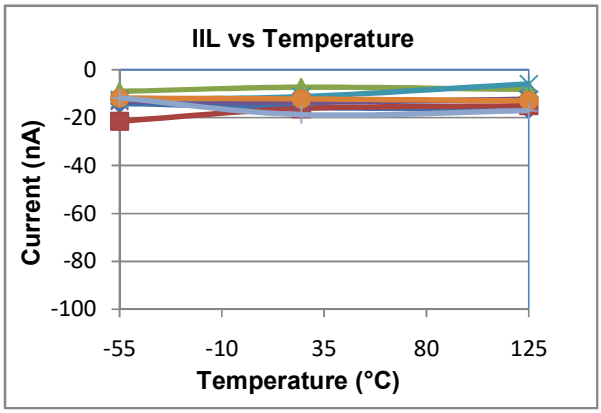


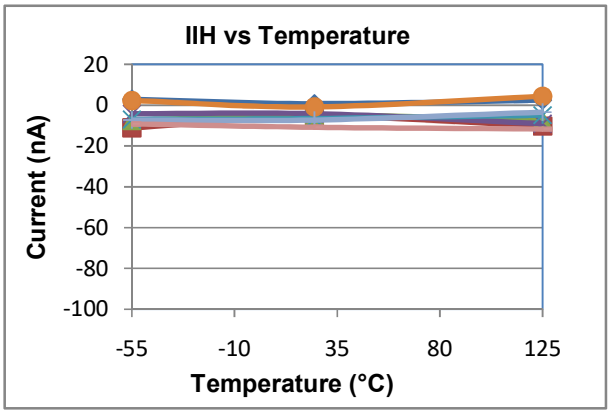


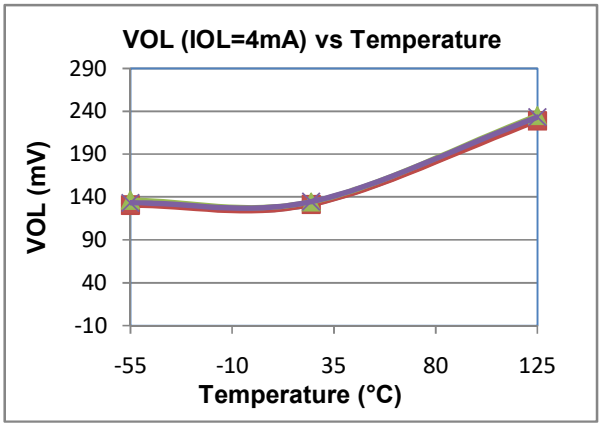
ELECTRICAL CHARACTERISTICS:

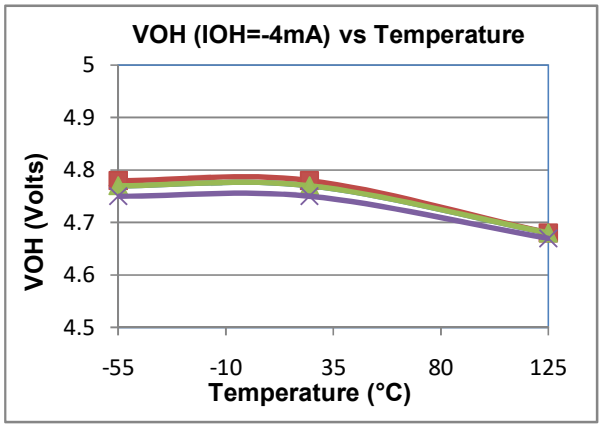






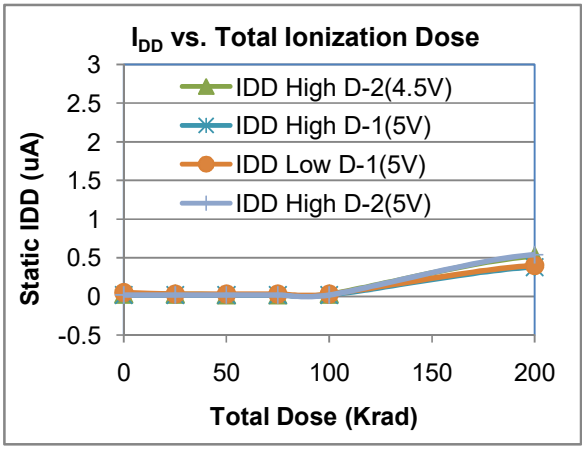


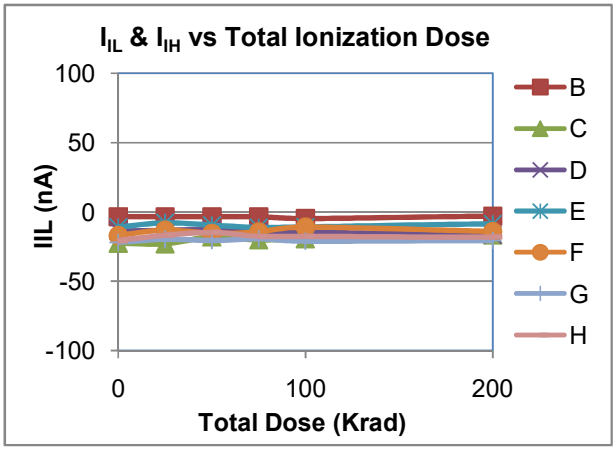




RADIATION CHARACTERISTICS:

Total Ionization Dose (TID)





TID Test Conclusion:

- No significant change in supply current observed upto 100 Krad. Typical I_{DD} remains within 500 nA at 200 Krad which is well within specifications.
- There is no substantial change in device parameters (leakages, output levels, hysteresis voltage) up to 200KRad.
- The device is fully functional up to 200 Krad.

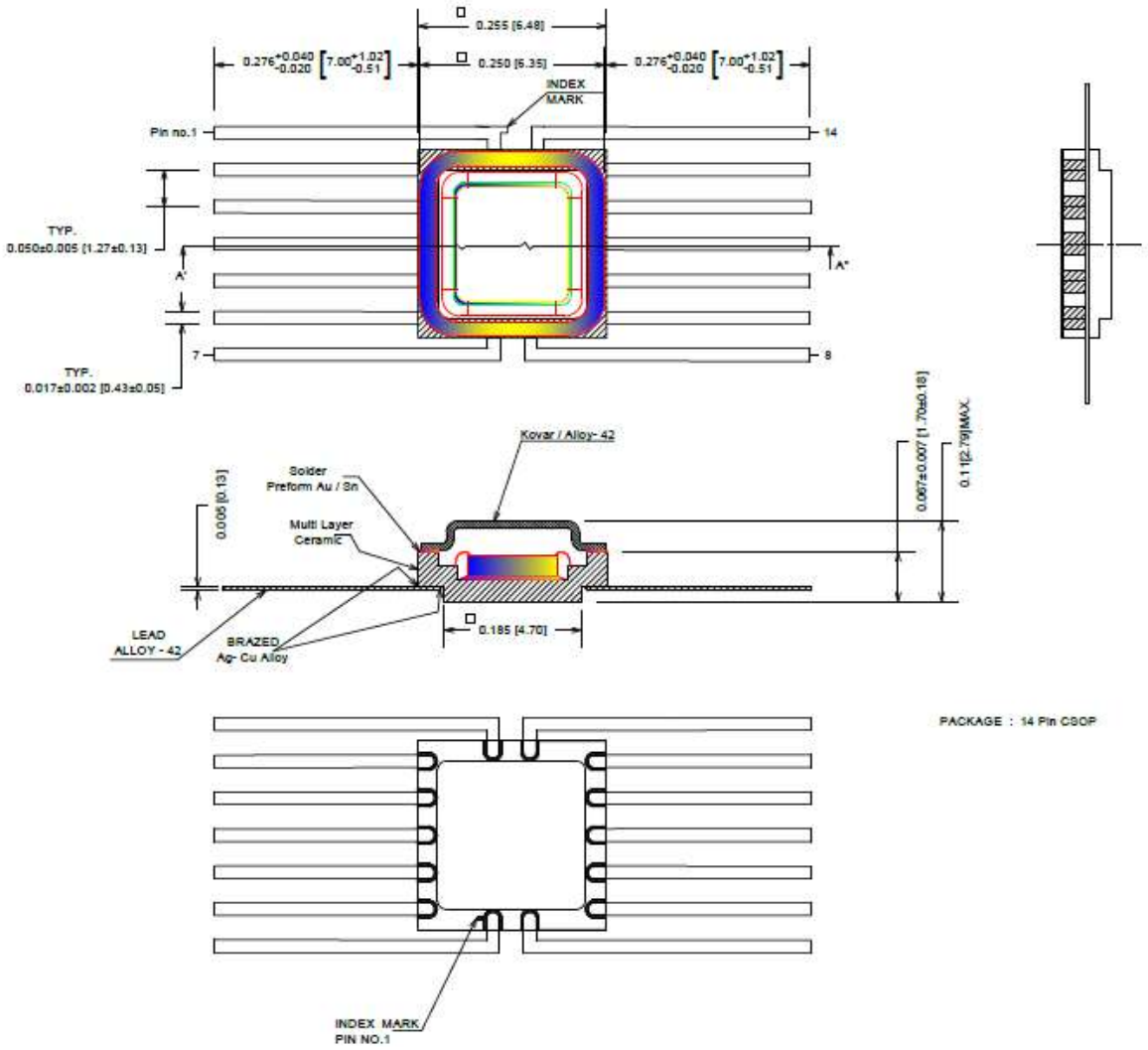
Single Event Effect (SEE)

Single Event Effects	LET in Si (MeV-cm2/mg)	
	22.9	50.7
Transient (SET)	PASS	PASS
Latch-Up (SEL)	PASS	PASS

SEE Test Conclusion:

- SEE testing of Quad 2-Input NAND Schmitt Trigger (SC1125-0) is done at two different LET 22.9 & 50.7 MeV-cm2/mg for a fluence of 10^6 ions/cm^2.
- No transient and Latch-up observed during irradiation.
- The Device is passed in SET, SEL up to LET of 50 MeV-cm2/mg.

MECHANICAL DRAWING OF PACKAGE (14 PIN FLAT PACKAGE)



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