

T-51-11

3003A

CMOS Standard Logic LC4000B Series

Quad Bilateral Switch

©1024C

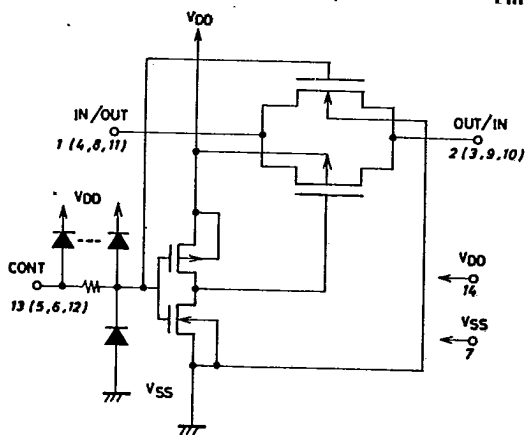
The LC4016B is a bilateral switch (also called analog switch) IC (meeting EIA/JEDEC standards) having such features as wide operating voltage range, high noise margin, low power dissipation, etc. It has 4 independent bilateral switches. Setting control input (CONT) at "H" level causes the switches to be conducting, thereby resulting in a low impedance between input and output; and setting control input (CONT) at "L" level causes the switches to be nonconducting, thereby resulting in a high impedance between input and output.

On Resistance (R_{on}) 500Ω (typ): V_{DD}=10V
 250Ω (typ): V_{DD}=15V
 Off Resistance (R_{off}) R_{off} (typ) >10⁹Ω

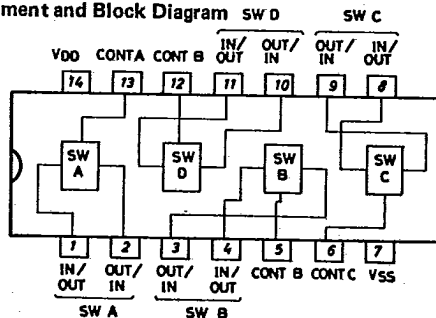
Absolute Maximum Ratings/T _a =25°C, V _{SS} =0V		unit
Maximum Supply Voltage	V _{DD} max	-0.5 to +20 V
Input Voltage	V _{IN} max	-0.5 to V _{DD} +0.5 V
Input Current	I _{IN}	±10 mA
Allowable Power Dissipation	P _d max T _a ≤ 85°C	300 mW
Operating Temperature	T _{opg}	-40 to +85 °C
Storage Temperature	T _{stg}	-65 to +150 °C
Lead Temperature. Time	T _{sol} t=10sec	260 °C

Allowable Operating Conditions/T _a =-40 to +85°C, V _{SS} =0V		unit
Supply Voltage	V _{DD}	3 to 18 V
Input Voltage	V _{IN}	0 to V _{DD} V

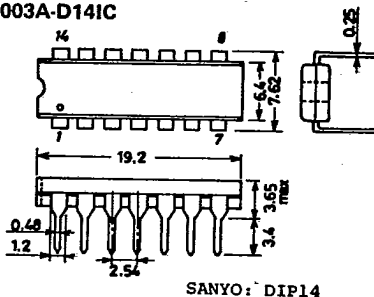
Equivalent Circuit (1/4 LC4016B)



Pin Assignment and Block Diagram



Case Outline 3003A-D141C (unit: mm)



4306KI/4214III/2093 KI, TSIII No. 1024-1/4

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Electrical Characteristics/ $T_a=25^{\circ}\text{C}\pm 2^{\circ}\text{C}$, $V_{SS}=0\text{V}$			min	typ	max	unit
Input "H" Level Control Voltage	V_{IH}	$V_{DD}=5\text{V}$, Current between input and output= $10\mu\text{A}$	3.5	2.4		V
		$V_{DD}=10\text{V}$, "	7.0	4.8		V
		$V_{DD}=15\text{V}$, "	11.0	7.2		V
Input "L" Level Control Voltage	V_{IL}	$V_{DD}=5\text{V}$, Current between input and output= $10\mu\text{A}$		1.7	1.0	V
		$V_{DD}=10\text{V}$, "		1.7	1.0	V
		$V_{DD}=15\text{V}$, "		1.7	1.0	V
ON Resistance	R_{ON}	$V_{DD}=5\text{V}$, $V_{IN}=5\text{V}$		600		Ω
		$V_{DD}=5\text{V}$, $V_{IN}=2.5\text{V}$		6000		Ω
		$V_{DD}=5\text{V}$, $V_{IN}=0.25\text{V}$		600		Ω
		$V_{DD}=10\text{V}$, $V_{IN}=10\text{V}$		250	700	Ω
		$V_{DD}=10\text{V}$, $V_{IN}=5\text{V}$		600	1500	Ω
		$V_{DD}=10\text{V}$, $V_{IN}=0.25\text{V}$		250	700	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=15\text{V}$		200	500	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=7.5\text{V}$		300	950	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=0.25\text{V}$		200	500	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=5\text{V}$		250	700	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=\pm 0.25$		600	1500	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=-5\text{V}$		250	700	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=7.5\text{V}$		200	500	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=\pm 0.25\text{V}$		300	950	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=-7.5\text{V}$		200	500	Ω
ON-State Resistance between any 2 Switches	ΔR_{ON}	$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$		15		Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$		10		Ω
Input/Output Leak Current (Switch off)	I_{OFF}	$V_{DD}=10\text{V}$, $V_{IN}=10\text{V}$, $V_{OUT}=0\text{V}$	± 0.01	± 125		nA
		$V_{DD}=10\text{V}$, $V_{IN}=0\text{V}$, $V_{OUT}=10\text{V}$	± 0.01	± 125		nA
		$V_{DD}=18\text{V}$, $V_{IN}=18\text{V}$, $V_{OUT}=0\text{V}$	± 0.1	± 250		nA
		$V_{DD}=18\text{V}$, $V_{IN}=0\text{V}$, $V_{OUT}=18\text{V}$	± 0.1	± 250		nA
Quiescent Current Dissipation	I_{DD}	$V_{DD}=5\text{V}$, $V_{CIN}=V_{DD}$, V_{SS}	0.001	1.0		μA
		$V_{DD}=10\text{V}$, "	0.001	2.0		μA
		$V_{DD}=15\text{V}$, "	0.001	4.0		μA
Control Input Current	I_{IH} I_{IL}	$V_{DD}=18\text{V}$, $V_{IN}=18\text{V}$		10^{-5}	0.3	μA
		$V_{DD}=18\text{V}$, $V_{IL}=0\text{V}$		-10^{-5}	-0.3	μA
Electrical Characteristics/ $T_a=-40^{\circ}\text{C}$, $V_{SS}=0\text{V}$			min	typ	max	unit
Input "H" Level Control Voltage	V_{IH}	$V_{DD}=5\text{V}$, Current between input and output= $10\mu\text{A}$	3.5			V
		$V_{DD}=10\text{V}$, "	7.0			V
		$V_{DD}=15\text{V}$, "	11.0			V
Input "L" Level Control Voltage	V_{IL}	$V_{DD}=5\text{V}$, Current between input and output= $10\mu\text{A}$			1.0	V
		$V_{DD}=10\text{V}$, "			1.0	V
		$V_{DD}=15\text{V}$, "			1.0	V
ON Resistance	R_{ON}	$V_{DD}=10\text{V}$, $V_{IN}=10\text{V}$			600	Ω
		$V_{DD}=10\text{V}$, $V_{IN}=5\text{V}$			1300	Ω
		$V_{DD}=10\text{V}$, $V_{IN}=0.25\text{V}$			600	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=15\text{V}$			430	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=7.5\text{V}$			800	Ω
		$V_{DD}=15\text{V}$, $V_{IN}=0.25$			430	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=5\text{V}$			600	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=\pm 0.25\text{V}$			1300	Ω
		$V_{DD}=5\text{V}$, $V_{SS}=-5\text{V}$, $V_{IN}=-5\text{V}$			600	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=7.5\text{V}$			430	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=\pm 0.25$			800	Ω
		$V_{DD}=7.5\text{V}$, $V_{SS}=-7.5\text{V}$, $V_{IN}=-7.5\text{V}$			430	Ω

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			min	typ	max	unit
Input/Output Leak Current (Switch off)	I_{OFF}	$V_{DD}=18V, V_{IN}=18V, V_{OUT}=0V$			± 250	nA
		$V_{DD}=18V, V_{IN}=0V, V_{OUT}=18V$			± 250	nA
Quiescent Current Dissipation	I_{DD}	$V_{DD}=5V, V_{CIN}=V_{DD}, V_{SS}$			1.0	μA
		$V_{DD}=10V, "$			2.0	μA
		$V_{DD}=15V, "$			4.0	μA
Control Input Current	I_{IH}	$V_{DD}=18V, V_{IN}=18V$			0.3	μA
	I_{IL}	$V_{DD}=18V, V_{IN}=0V$			-0.3	μA
Electrical Characteristics/$T_a=+85^\circ C, V_{SS}=0V$						
Input "H" Level Control Voltage	V_{IH}	$V_{DD}=5V, \text{Current between input and output}=10\mu A$	3.5			V
		$V_{DD}=10V, "$	7.0			V
		$V_{DD}=15V, "$	11.0			V
Input "L" Level Control Voltage	V_{IL}	$V_{DD}=5V, \text{Current between input and output}=10\mu A$			1.0	V
		$V_{DD}=10V, "$			1.0	V
		$V_{DD}=15V, "$			1.0	V
ON Resistance	R_{ON}	$V_{DD}=10V, V_{IN}=10V$			900	Ω
		$V_{DD}=10V, V_{IN}=5V$			2000	Ω
		$V_{DD}=10V, V_{IN}=0.25V$			900	Ω
		$V_{DD}=15V, V_{IN}=15V$			650	Ω
		$V_{DD}=15V, V_{IN}=7.5V$			1200	Ω
		$V_{DD}=15V, V_{IN}=0.25V$			650	Ω
		$V_{DD}=5V, V_{SS}=-5V, V_{IN}=5V$			900	Ω
		$V_{DD}=5V, V_{SS}=-5V, V_{IN}=\pm 0.25V$			2000	Ω
		$V_{DD}=5V, V_{SS}=-5V, V_{IN}=-5V$			900	Ω
		$V_{DD}=7.5V, V_{SS}=-7.5V, V_{IN}=7.5V$			650	Ω
		$V_{DD}=7.5V, V_{SS}=-7.5V, V_{IN}=\pm 0.25V$			1200	Ω
Input/Output Leak Current (Switch off)	I_{OFF}	$V_{DD}=18V, V_{IN}=18V, V_{OUT}=0V$			± 1000	nA
		$V_{DD}=18V, V_{IN}=0V, V_{OUT}=18V$			± 1000	nA
		$V_{DD}=5V, V_{CIN}=V_{DD}, V_{SS}$			7.5	μA
Quiescent Current Dissipation	I_{DD}	$V_{DD}=10V, "$			15	μA
		$V_{DD}=15V, "$			30	μA
		$V_{DD}=18V, V_{IN}=18V$			1.0	μA
Control Input Current	I_{IH}	$V_{DD}=18V, V_{IN}=18V$			1.0	μA
	I_{IL}	$V_{DD}=18V, V_{IL}=0V$			-1.0	μA
Current Direction + (no sign): Flowing into device - : Flowing out of device						

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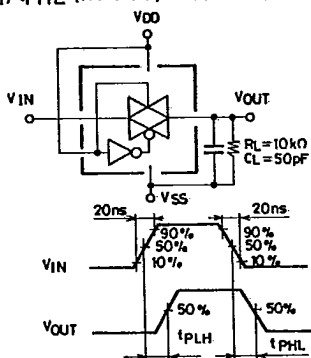
Switching Characteristics/ $T_a=25\pm 2^\circ\text{C}$,

			min	typ	max	unit
Propagation Delay Time (INPUT-OUTPUT)	t_{PLH}	$V_{DD}=5V, R_L=10k\Omega, C_L=50pF$		50	100	ns
	t_{PHL}	$V_{DD}=10V, \text{ " "}$		20	40	ns
		$V_{DD}=15V, \text{ " "}$		16	30	ns
Propagation Time (Control-OUTPUT)	t_{PLH}	$V_{DD}=5V, R_L=10k\Omega, C_L=50pF$		100	140	ns
	t_{PHL}	$V_{DD}=10V, \text{ " "}$		40	60	ns
		$V_{DD}=15V, \text{ " "}$		35	50	ns
Maximum Control Input Frequency	$f_{max}(C)$	$V_{DD}=5V, C_L=15pF$		4.0		MHz
		$V_{DD}=10V, \text{ " "}$		10.0		MHz
		$V_{DD}=15V, \text{ " "}$		12.0		MHz
Maximum Input/Output Propagation Frequency	$f_{max}(I/O)$	$V_{DD}=5V, V_{SS}=-5V, R_L=2k\Omega, C_L=15pF \text{ ※1}$		8.5		MHz
		$V_{DD}=5V, V_{SS}=-5V, R_L=10k\Omega, \text{ "}$		7.5		MHz
		$V_{DD}=5V, V_{SS}=-5V, R_L=100k\Omega, \text{ "}$		5.0		MHz
Sine Wave Propagation Distortion Ratio Feedthrough (Switch off)		$V_{DD}=5V, V_{DD}=-5V, R_L=10k\Omega, f=1MHz \text{ ※2}$		0.3		%
		$V_{DD}=5V, V_{SS}=-5V, R_L=1k\Omega \text{ ※3}$		600		KHz
Input Capacitance	C_{IN}	Control input		5		pF
		Switch I/O		4		pF

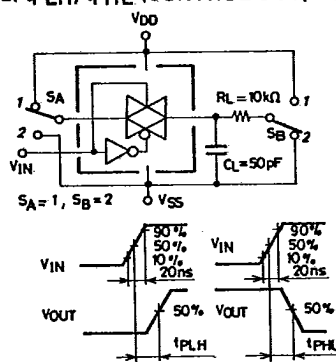
※1 $V_{is}: \pm 2.5V_{p-p}$ sine wave $f_{max}(I/O): 20 \log(V_{os}/V_{is}) = -3dB$
 ※2 $V_{is}: \pm 2.5V_{p-p}$ sine wave $f_{FEEDTHROUGH}: 20 \log(V_{os}/V_{is}) = -50dB$
 ※3 $V_{is}: \pm 2.5V_{p-p}$ sine wave

Electrical Characteristics Test Circuits and Waveforms

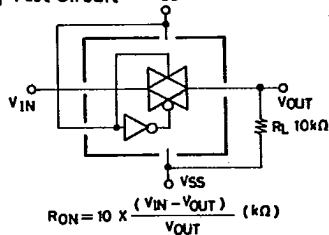
1. t_{PLH}, t_{PHL} (IN-OUT) Test Circuit



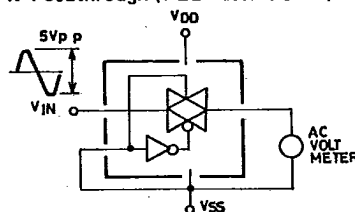
2. t_{PLH}, t_{PHL} (CONTROL-OUT) Test Circuit



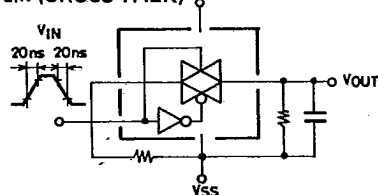
3. RON Test Circuit



4. Feedthrough (FEEDTHROUGH) Test Circuit



5. Cross Talk (CROSS TALK) Test Circuit



6. Frequency Response (f_{max}) Distortion

