

T-4607-08

3003A CMOS Standard Logic LC4000B Series

Dual D-Type Flip-Flop

©876C

The LC4013B is an IC that consists of two independent D-type flip-flops (EIA/JEDEC standards-met IC product) having such features as wide operating voltage range, high noise margin, low power dissipation.

Absolute Maximum Ratings at $T_a=25^\circ\text{C}, V_{SS}=0\text{V}$

Parameter	Symbol	Condition	Unit
Maximum Supply Voltage	$V_{DD\text{max}}$	$V_{SS}-0.5$ to $V_{SS}+20$	V
Input Voltage	$V_{IN\text{max}}$	$V_{SS}-0.5$ to $V_{DD}+0.5$	V
Output Voltage	$V_{OUT\text{max}}$	$V_{SS}-0.5$ to $V_{DD}+0.5$	V
Input Current	I_{IN}		± 10 mA
Allowable Power Dissipation	$P_{D\text{max}}$	$T_a \leq 85^\circ\text{C}$	300 mW
Operating Temperature	T_{opg}		-40 to $+85$ $^\circ\text{C}$
Storage Temperature	T_{stg}		-65 to $+150$ $^\circ\text{C}$
Lead Temperature and Time	T_{sol}	$t=10\text{sec}$	260 $^\circ\text{C}$

Allowable Operating Conditions at $T_a=25^\circ\text{C}, V_{SS}=0\text{V}$

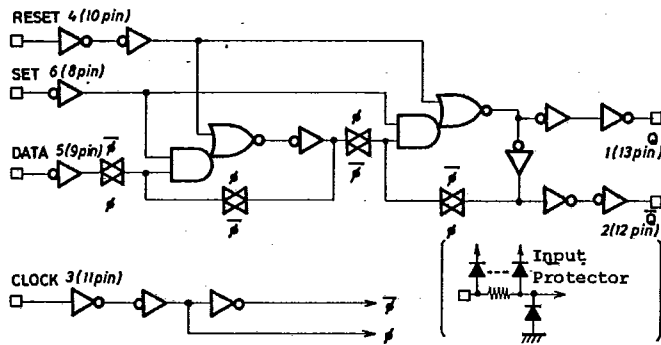
Parameter	Symbol	min	typ	max	unit
Supply Voltage	V_{DD}	3		18	V
Input Voltage	V_{IN}	0		V_{DD}	V

Truth Table

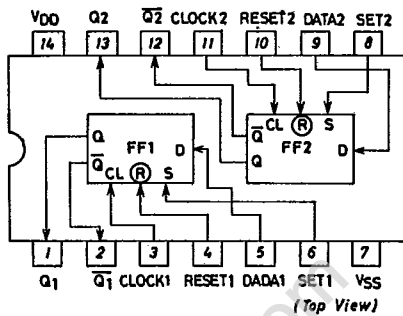
INPUTS				OUTPUTS	
CL Δ	D	S $\text{\textcircled{R}}$		Q_{n+1}	\bar{Q}_{n+1}
*	*	H	L	H	L
*	*	L	H	L	H
*	*	H	H	L	H
$\bar{\Delta}$	L	L	L	L	H
$\bar{\Delta}$	H	L	L	H	L
$\bar{\Delta}$	*	L	L	Q_n^*	\bar{Q}_n^*

* : Don't Care
 Δ : Level Change
 $\text{\textcircled{R}}$: No Change

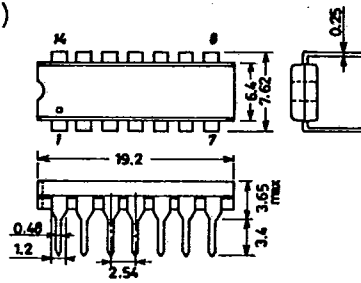
Logic Diagram (1/2 LC4013B)



Pin Assignment and Block Diagram



Case Outline 3003A-D14IC (unit:mm)



SANYO: DIP14

4306KI/4204/4143KI, TS/4091KI No.876-1/4

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		min	typ	max	unit
Data Setup Time	$t_{\text{set up}}$ VDD=5V	160			ns
	VDD=10V	80			ns
	VDD=15V	40			ns
Clock Frequency	fclk VDD=5V	DC		1.0	MHz
	VDD=10V	DC		2.0	MHz
	VDD=15V	DC		3.0	MHz
Clock Rise/Fall Time	t_r clk, VDD=5V			20	us
	t_f clk VDD=10V			2.5	us
	VDD=15V			1.0	us
Set/Reset Pulse Width	t_w S,R VDD=5V	300			ns
	VDD=10V	200			ns
	VDD=15V	160			ns

Electrical Characteristics at $T_a=25^\circ\text{C}\pm 2^\circ\text{C}$, $V_{SS}=0\text{V}$		min	typ	max	unit
"H" Level Output Voltage	V_{OH} VDD=5V, $ I_{OUT} < 1\mu\text{A}$, $V_{IN}=V_{SS}$, VDD	4.95	5.00		V
	VDD=10V, " "	9.95	10.00		V
	VDD=15V, " "	14.95	15.00		V
"L" Level Output Voltage	V_{OL} VDD=5V, $ I_{OUT} < 1\mu\text{A}$, $V_{IN}=V_{DD}$	0.00	0.05		V
	VDD=10V, " "	0.00	0.05		V
	VDD=15V, " "	0.00	0.05		V
"H" Level Output Current	I_{OH} VDD=5V, $V_O=4.6\text{V}$, $V_{IN}=V_{SS}$, VDD	-0.16			mA
	VDD=10V, $V_O=9.5\text{V}$, " "	-0.4			mA
	VDD=15V, $V_O=13.5\text{V}$, " "	-1.2			mA
"L" Level Output Current	I_{OL} VDD=5V, $V_O=0.4\text{V}$, $V_{IN}=V_{DD}$	0.44			mA
	VDD=10V, $V_O=0.5\text{V}$, " "	1.1			mA
	VDD=15V, $V_O=1.5\text{V}$, " "	3.0			mA
"H" Level Input Voltage	V_{IH} VDD=5V, $V_O=0.5\text{V}$ or 4.5V , $ I_O < 1\mu\text{A}$	3.5	2.75		V
	VDD=10V, $V_O=1\text{V}$ or 9V , " "	7.0	5.5		V
	VDD=15V, $V_O=1.5\text{V}$ or 13.5V , " "	11.0	8.25		V
"L" Level Input Voltage	V_{IL} VDD=5V, $V_O=0.5\text{V}$ or 4.5V , $ I_O < 1\mu\text{A}$	2.25	1.5		V
	VDD=10V, $V_O=1\text{V}$ or 9V , " "	4.5	3.0		V
	VDD=15V, $V_O=1.5\text{V}$ or 13.5V , " "	6.75	4.0		V
Input Leak Current	I_{IH} VDD=18V, $V_{IH}=18\text{V}$	10^5	0.3		uA
	I_{IL} VDD=18V, $V_{IL}=0\text{V}$	-10^5	-0.3		uA
Quiescent Device Current	I_{DD} VDD=5V, $V_{IN}=V_{SS}$, VDD	0.01	4.0		uA
	VDD=10V, " "	0.01	8.0		uA
	VDD=15V, " "	0.01	16.0		uA

Electrical Characteristics at $T_a=-40^\circ\text{C}$, $V_{SS}=0\text{V}$		min	typ	max	unit
"H" Level Output Voltage	V_{OH} VDD=5V, $ I_{OUT} < 1\mu\text{A}$, $V_{IN}=V_{SS}$, VDD	4.95			V
	VDD=10V, " "	9.95			V
	VDD=15V, " "	14.95			V
"L" Level Output Voltage	V_{OL} VDD=5V, $ I_{OUT} < 1\mu\text{A}$, $V_{IN}=V_{SS}$, VDD		0.05		V
	VDD=10V, " "		0.05		V
	VDD=15V, " "		0.05		V
"H" Level Output Current	I_{OH} VDD=5V, $V_O=4.6\text{V}$, $V_{IN}=V_{SS}$, VDD	-0.2			mA
	VDD=10V, $V_O=9.5\text{V}$, " "	-0.5			mA
	VDD=15V, $V_O=13.5\text{V}$, " "	-1.4			mA
"L" Level Output Current	I_{OL} VDD=5V, $V_O=0.4\text{V}$, $V_{IN}=V_{SS}$, VDD	0.52			mA
	VDD=10V, $V_O=0.5\text{V}$, " "	1.3			mA
	VDD=15V, $V_O=1.5\text{V}$, " "	3.6			mA
"H" Level Input Voltage	V_{IH} VDD=5V, $V_O=0.5\text{V}$ or 4.5V , $ I_{OUT} < 1\mu\text{A}$	3.5			V
	VDD=10V, $V_O=1.0\text{V}$ or 9.0V , " "	7.0			V
	VDD=15V, $V_O=1.5\text{V}$ or 13.5V , " "	11.0			V
"L" Level Input Voltage	V_{IL} VDD=5V, $V_O=0.5\text{V}$ or 4.5V , $ I_{OUT} < 1\mu\text{A}$		1.5		V
	VDD=10V, $V_O=1.0\text{V}$ or 9.0V , " "		3.0		V
	VDD=15V, $V_O=1.5\text{V}$ or 13.5V , " "		4.0		V
Input Leak Current	I_{IH} VDD=18V, $V_{IH}=18\text{V}$		0.3		uA
	I_{IL} VDD=18V, $V_{IL}=0\text{V}$		-0.3		uA

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			min	typ	max	unit
Quiescent Device Current	I _{DD}	V _{DD} =5V, V _{IN} =V _{SS} , V _{DD}			4.0	uA
		V _{DD} =10V, "			8.0	uA
		V _{DD} =15V, "			16.0	uA
Electrical Characteristics at T _a =±85°C, V _{SS} =0V			min	typ	max	unit
"H" Level Output Voltage	V _{OH}	V _{DD} =5V, I _{OUT} < 1uA, V _{IN} =V _{SS} , V _{DD}	4.95			V
		V _{DD} =10V, " "	9.95			V
		V _{DD} =15V, " "	14.95			V
"L" Level Output Voltage	V _{OL}	V _{DD} =5V, I _{OUT} < 1uA, V _{IN} =V _{DD}			0.05	V
		V _{DD} =10V, " "			0.05	V
		V _{DD} =15V, " "			0.05	V
"H" Level Output Current	I _{OH}	V _{DD} =5V, v _O =4.6V, V _{IN} =V _{SS} , V _{DD}	-0.12			mA
		V _{DD} =10V, v _O =9.5V, "	-0.3			mA
		V _{DD} =15V, v _O =13.5V, "	-1.0			mA
"L" Level Output Current	I _{OL}	V _{DD} =5V, v _O =0.4V, V _{IN} =V _{DD}	0.36			mA
		V _{DD} =10V, v _O =0.5V, "	0.9			mA
		V _{DD} =15V, v _O =1.5V, "	2.4			mA
"H" Level Input Voltage	V _{IH}	V _{DD} =5V, v _O =0.5V or 4.5V, I _O < 1uA	3.5			V
		V _{DD} =10V, v _O =1V or 9V, "	7.0			V
		V _{DD} =15V, v _O =1.5V or 13.5V, "	11.7			V
"L" Level Input Voltage	V _{IL}	V _{DD} =5V, v _O =0.5V or 4.5V, I _O < 1uA			1.5	V
		V _{DD} =10V, v _O =1V or 9V, "			3.0	V
		V _{DD} =15V, v _O =1.5V or 13.5V, "			4.0	V
Input Leak Current	I _{IH}	V _{DD} =18V, V _{IH} =18V			1.0	uA
		V _{DD} =18V, V _{IL} =0V			-1.0	uA
Quiescent Device Current	I _{DD}	V _{DD} =5V, V _{IN} =V _{SS} , V _{DD}			30	uA
		V _{DD} =10V, "			60	uA
		V _{DD} =15V, "			120	uA

(Note) Current direction (+, no sign : Flowing into device
 - : Flowing out of device)

Switching Characteristics at T _a =25°C, V _{SS} =0V, C _L =50pF			min	typ	max	unit
Output Rise Time	T _{TLH} (t _r)	V _{DD} =5V		130	400	ns
		V _{DD} =10V		65	200	ns
		V _{DD} =15V		50	160	ns
Output Fall Time	T _{THL} (t _f)	V _{DD} =5V		100	200	ns
		V _{DD} =10V		50	100	ns
		V _{DD} =15V		40	80	ns
Data Setup Time (t _{set up mini})	t _{set up}	V _{DD} =5V		40	160	ns
		V _{DD} =10V		20	80	ns
		V _{DD} =15V		10	40	ns
Clock Rise/Fall Time	t _r clk t _f clk	V _{DD} =5V			20	us
		V _{DD} =10V			2.5	us
		V _{DD} =15V			1.0	us
Clock Frequency (f max)	f _{clk}	V _{DD} =5V	1.0	2.0		MHz
		V _{DD} =10V	2.0	4.0		MHz
		V _{DD} =15V	3.0	6.0		MHz
"H" Level Propagation Delay Time (clk → Q, Q̄)	t _{PLH}	V _{DD} =5V		350	700	ns
		V _{DD} =10V		150	300	ns
		V _{DD} =15V		100	200	ns
"L" Level Propagation Delay Time (clk → Q, Q̄)	t _{PHL}	V _{DD} =5V		300	600	ns
		V _{DD} =10V		150	300	ns
		V _{DD} =15V		100	200	ns
"H" Level Propagation Delay Time (RESET, SET → Q, Q̄)	t _{PLH}	V _{DD} =5V		250	500	ns
		V _{DD} =10V		150	300	ns
		V _{DD} =15V		100	200	ns
"L" Level Propagation Delay Time (RESET, SET → Q, Q̄)	t _{PHL}	V _{DD} =5V		250	500	ns
		V _{DD} =10V		150	300	ns
		V _{DD} =15V		100	200	ns

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Reset Pulse Width	t_{WR} , $V_{DD}=5V$	min	typ	max	unit
Set Pulse Width	t_{WS} , $V_{DD}=10V$		150	300	ns
	$V_{DD}=15V$		100	200	ns
			80	160	ns

Switching Time Test Waveforms

1. $f_{max\phi}$, t_{PLH} , t_{PHL} (CF-Q, \bar{Q}), t_r , t_f , $t_{r\phi}$, $t_{f\phi}$ 2. t_w , t_{PLH} , t_{PHL} (CL, FR-Q, \bar{Q})

