



## UTC4013

CMOS IC

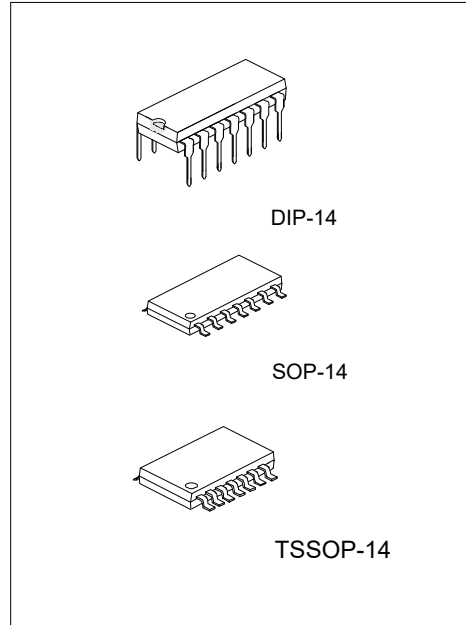
### DUAL D-TYPE FLIP-FLOP

#### DESCRIPTION

The UTC4013 is a dual D-type flip-flop which has two independent circuits and each flip-flop features independent data, set, reset, and clock inputs and outputs. The input level applied to DATA input are transferred to Q and  $\bar{Q}$  output by rising edge of the clock pulse. When SET input is "H", and RESET input is "L", outputs become Q="H" and  $\bar{Q}$ ="L". When SET input is "L" and RESET input is "H", outputs become Q="L" and  $\bar{Q}$ ="H". When both SET input and RESET input are at "H", outputs become Q="H" and  $\bar{Q}$ ="H".

#### FEATURES

- \* Power supply voltage 3V to 18V
- \* Maximum quiescent supply current is 4 $\mu$ A

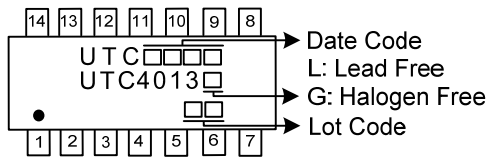


#### ORDERING INFORMATION

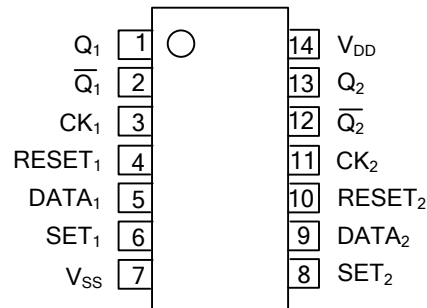
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTC4013L-D14-T	UTC4013G-D14-T	DIP-14	Tube
UTC4013L-S14-R	UTC4013G-S14-R	SOP-14	Tape Reel
UTC4013L-P14-R	UTC4013G-P14-R	TSSOP-14	Tape Reel

<p>UTC4013G-D14-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) D14: DIP-14, S14: SOP-14, P14: TSSOP-14 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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#### MARKING



## PIN CONFIGURATION

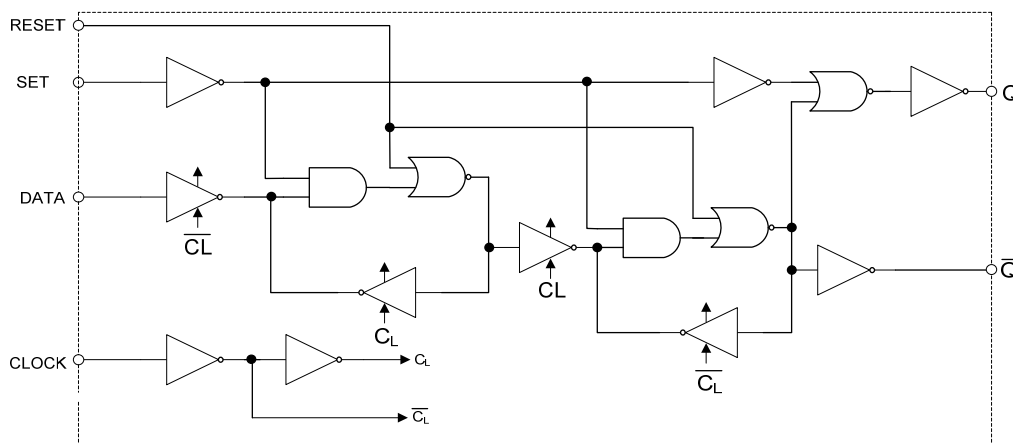


## FUNCTION TABLE

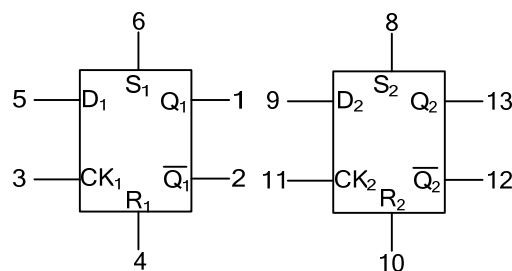
INPUTS				OUTPUTS	
RESET	SET	DATA	CK*	Q <sub>n+1</sub>	$\bar{Q}_{n+1}$
L	H	-	-	H	L
H	L	-	-	L	H
H	H	-	-	H	H
L	L	L	$\downarrow$	L	H
L	L	H	$\downarrow$	H	L
L	L	-	$\downarrow$	No Change	No Change

Notes: - : Don't Care.  
\* : Level Change.

## LOGIC DIAGRAM



## BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T<sub>A</sub>=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
DC Supply Voltage		V <sub>DD</sub>	V <sub>SS</sub> -0.5 to V <sub>SS</sub> +20	V
Input Voltage		V <sub>IN</sub>	V <sub>SS</sub> -0.5 to V <sub>DD</sub> +0.5	V
Output Voltage		V <sub>OUT</sub>	V <sub>SS</sub> -0.5 to V <sub>DD</sub> +0.5	V
DC Input Current		I <sub>IN</sub>	±10	mA
Power Dissipation	DIP-14	P <sub>D</sub>	750	mW
	SOP-14		550	
	TSSOP-14		450	mW
Operation Temperature		T <sub>OPR</sub>	-40 ~ +85	°C
Storage Temperature		T <sub>STG</sub>	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS (V<sub>SS</sub>=0, T<sub>A</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage	V <sub>DD</sub>	3 ~ 18	V
Input Voltage	V <sub>IN</sub>	0 ~ V <sub>DD</sub>	V

■ D.C. CHARACTERISTICS (V<sub>SS</sub>=0, T<sub>A</sub>=25°C, unless otherwise specified)

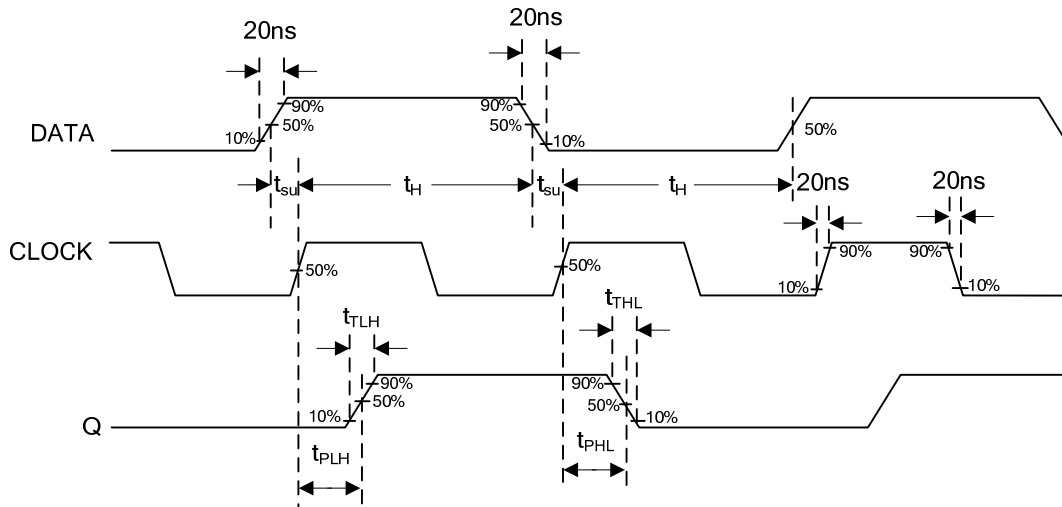
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	High	V <sub>IH</sub>	V <sub>OUT</sub> =0.5V, 4.5V; V <sub>DD</sub> =5V,  I <sub>OUT</sub>   < 1μA	3.5			V
			V <sub>OUT</sub> =1.0V, 9.0V; V <sub>DD</sub> =10V,  I <sub>OUT</sub>   < 1μA	7.0			V
			V <sub>OUT</sub> =1.5V, 13.5V; V <sub>DD</sub> =15V,  I <sub>OUT</sub>   < 1μA	11.0			V
	Low	V <sub>IL</sub>	V <sub>OUT</sub> =0.5V, 4.5V; V <sub>DD</sub> =5V,  I <sub>OUT</sub>   < 1μA			1.5	V
			V <sub>OUT</sub> =1.0V, 9.0V; V <sub>DD</sub> =10V,  I <sub>OUT</sub>   < 1μA			3.0	V
			V <sub>OUT</sub> =1.5V, 13.5V; V <sub>DD</sub> =15V,  I <sub>OUT</sub>   < 1μA			4.0	V
Output Voltage	High	V <sub>OH</sub>	V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =5V	4.95	5.00		V
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =10V	9.95	10.00		V
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =15V	14.95	15.00		V
	Low	V <sub>OL</sub>	V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =5V		0.00	0.05	V
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =10V		0.00	0.05	V
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ;  I <sub>OUT</sub>   < 1μA; V <sub>DD</sub> =15V		0.00	0.05	V
Input Current	High	I <sub>IH</sub>	V <sub>IH</sub> =18V, V <sub>DD</sub> =18V			0.1	μA
	Low	I <sub>IL</sub>	V <sub>IL</sub> =0V, V <sub>DD</sub> =18V			-0.1	μA
Output Current	High	I <sub>OH</sub>	V <sub>OH</sub> =4.6, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =5V	-0.51	-1.0		mA
			V <sub>OH</sub> =2.5, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =5V	-2.10	-4.0		mA
			V <sub>OH</sub> =9.5, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =10V	-1.30	-2.2		mA
			V <sub>OH</sub> =13.5, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =15V	-3.40	-9.0		mA
	Low	I <sub>OL</sub>	V <sub>OL</sub> =0.4, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =5V	0.51	1.2		mA
			V <sub>OL</sub> =0.5, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =10V	1.30	3.2		mA
V <sub>OL</sub> =1.5, V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =15V			3.40	12.0		mA	
Quiescent Supply Current		I <sub>DD</sub>	V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =5V			1	μA
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =10V			2	μA
			V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub> ; V <sub>DD</sub> =15V			4	μA

■ A.C. CHARACTERISTICS ( $V_{SS}=0$ ,  $C_L=50pF$ ,  $T_A=25^\circ C$ , unless otherwise specified)

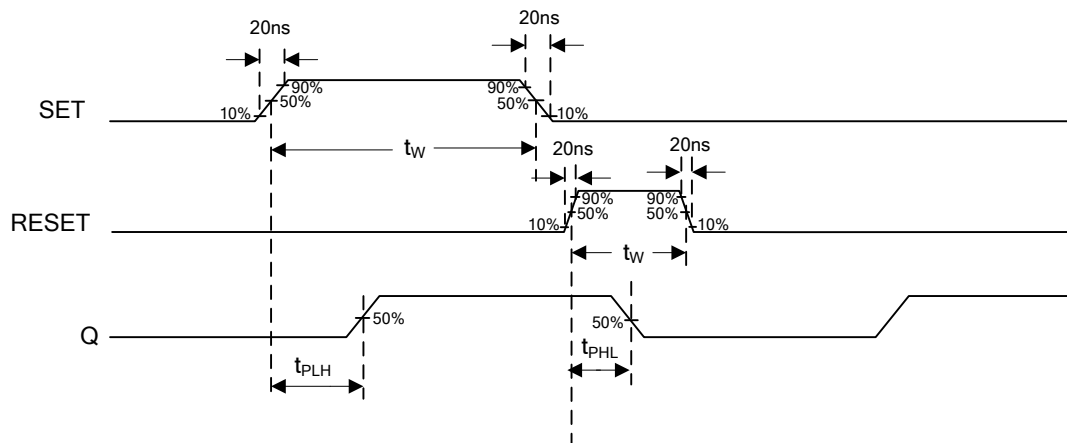
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Output Transition Time	Low to High	$t_{TLH}$	$V_{DD}=5V$		70	200	ns
		$V_{DD}=10V$		35	100	ns	
		$V_{DD}=15V$		30	80	ns	
	High to Low	$t_{THL}$	$V_{DD}=5V$		70	200	ns
		$V_{DD}=10V$		35	100	ns	
		$V_{DD}=15V$		30	80	ns	
Propagation Delay Time (CK – Q, $\bar{Q}$ )	$t_{pLH}$ $t_{pHL}$	$V_{DD}=5V$		130	300	ns	
		$V_{DD}=10V$		65	130	ns	
		$V_{DD}=15V$		50	90	ns	
Propagation Delay Time (SET, RESET – Q, $\bar{Q}$ )	$t_{pLH}$	$V_{DD}=5V$		110	300	ns	
		$V_{DD}=10V$		50	130	ns	
		$V_{DD}=15V$		40	90	ns	
	$t_{pHL}$	$V_{DD}=5V$		110	300	ns	
		$V_{DD}=10V$		50	130	ns	
		$V_{DD}=15V$		40	90	ns	
Max. Clock Frequency	$f_{CL}$	$V_{DD}=5V$	3.5	8.0		MHz	
		$V_{DD}=10V$	8.0	16.0		MHz	
		$V_{DD}=15V$	12.0	20.0		MHz	
Clock Input Rise or Fall Time	$t_{rCL} / t_{fCL}$	$V_{DD}=5V$			15	$\mu s$	
		$V_{DD}=10V$			10	$\mu s$	
		$V_{DD}=15V$			5	$\mu s$	
Min. Pulse Width (SET, RESET)	$t_w$	$V_{DD}=5V$		60	180	ns	
		$V_{DD}=10V$		30	80	ns	
		$V_{DD}=15V$		25	50	ns	
Min. Clock Pulse Width	$t_w$	$V_{DD}=5V$		60	140	ns	
		$V_{DD}=10V$		30	60	ns	
		$V_{DD}=15V$		25	40	ns	
Min. Set-up Time (DATA - CK)	$t_{su}$	$V_{DD}=5V$			40	ns	
		$V_{DD}=10V$			20	ns	
		$V_{DD}=15V$			15	ns	
Min. Hold Time (DATA-CK)	$t_H$	$V_{DD}=5V$		20	40	ns	
		$V_{DD}=10V$		10	20	ns	
		$V_{DD}=15V$		6	15	ns	
Min. Removal Time (SET, RESET-CK)	$t_{rem}$	$V_{DD}=5V$			40	ns	
		$V_{DD}=10V$			20	ns	
		$V_{DD}=15V$			15	ns	
Input Capacitance	$C_{IN}$			5	7.5	pF	

## PARAMETER MEASUREMENT INFORMATION

### 1. DATA-CLOCK, Q



### 2. SET-RESET, Q



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