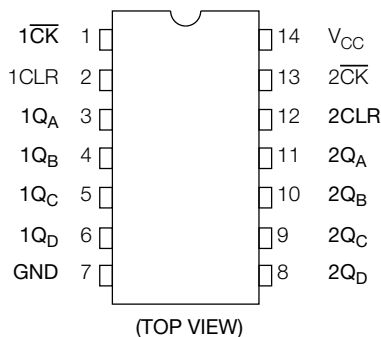


### Features:

- **High Speed:**  $f_{MAX} = 180\text{MHz}$  (typ.) at  $V_{CC} = 5\text{V}$
- **Low Power Dissipation:**  $I_{CC} = 8\mu\text{A}$  (max.) at  $T_a = 25^\circ\text{C}$
- **High Noise Immunity:**  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min.)
- **Symmetrical Output Impedance:**  $I_{OH} = I_{OL} = 24\text{mA}$  (min.). Capability of driving  $50\Omega$  transmission lines.
- **Balanced Propagation Delays:**  $t_{pLH} = t_{pHL}$
- **Wide Operating Voltage Range:**  $V_{CC}$  (opr.) =  $2\text{V} \sim 5.5\text{V}$
- **Pin and Function Compatible with 74HC393**
- **Available in 14-pin DIP and 150 mil SOIC**

### Pin Assignment



The TC74AC393 is an advanced high speed CMOS DUAL BINARY COUNTER fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL, while maintaining the CMOS low power dissipation.

It contains two independent counter circuits in one package, so that counting or frequency division of eight binary bits can be achieved with one IC.

This device changes state on the negative going transition of the CLOCK pulse. The counter can be reset to "0" (Q0~Q3="L") by a high at the CLEAR input regardless of other inputs.

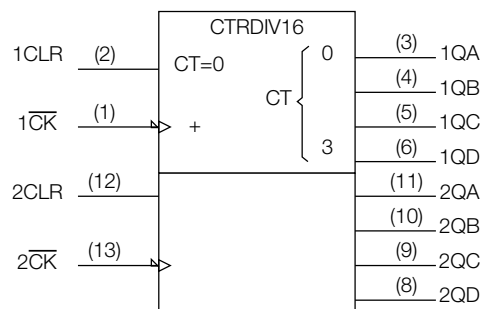
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Truth Table

INPUTS		OUTPUTS			
$\overline{CK}$	CLR	QA	QB	QC	QD
X	H	L	L	L	L
	L	COUNT UP			
	L	NO CHANGE			

X: Don't Care

### IEC Logic Symbol



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## Absolute Maximum Ratings

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7.0	V
DC Input Voltage	$V_{IN}$	-0.5~ $V_{CC} + 0.5$	V
DC Output Voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input Diode Current	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 50$	mA
DC Output Current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	$\pm 200$	mA
Power Dissipation	$P_D$	500 (DIP) */180 (SOP)	mW
Storage Temperature	$T_{stg}$	-65~150	°C
Lead Temperature 10sec	$T_L$	300	°C

\* 500mW in the range of  $T_a = -40^{\circ}\text{C} \sim 65^{\circ}\text{C}$ .  
From  $T_a = 65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  a derating factor of  
-10mW/°C should be applied up to 300mW.

## Recommended Operating Conditions

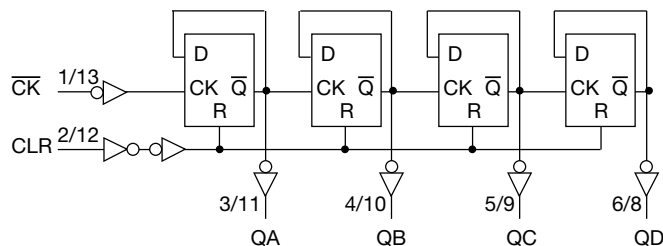
PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	2.0~5.5	V
Input Voltage	$V_{IN}$	0~ $V_{CC}$	V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	dt/dv	0~100 ( $V_{CC} = 3.3 \pm 0.3\text{V}$ ) 0~20 ( $V_{CC} = 5 \pm 0.5\text{V}$ )	ns/v

## DC Electrical Characteristics

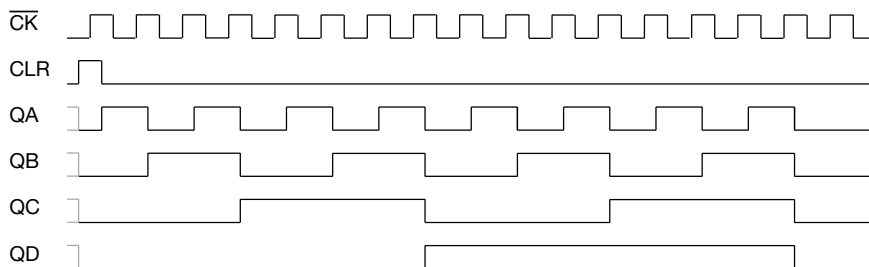
PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C				Ta = -40~85°C		UNIT
				VCC	Min.	Typ.	Max.	Min.	Max.	
High-Level Input Voltage	VIH	—		2.0	1.50	—	—	1.50	—	V
				3.0	2.10	—	—	2.10	—	
				5.5	3.85	—	—	3.85	—	
Low-Level Input Voltage	VIL	—		2.0	—	—	0.50	—	0.50	V
				3.0	—	—	0.90	—	0.90	
				5.5	—	—	1.65	—	1.65	
High-Level Output Voltage	VOH	VIN = VIH or VIL	IOH = -50μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			IOH = -4mA	3.0	2.58	—	—	2.48	—	
			IOH = -24mA	4.5	3.94	—	—	3.80	—	
			IOH = -75mA*	5.5	—	—	—	3.85	—	
Low-Level Output Voltage	VOL	VIN = VIH or VIL	IOL = 50μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			IOL =12mA	3.0	—	—	0.36	—	0.44	
			IOL = 24mA	4.5	—	—	0.36	—	0.44	
			IOL = 75mA*	5.5	—	—	—	—	1.65	
Input Leakage Current	IIN	VIN = VCC or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	ICC	VIN = VCC or GND		5.5	—	—	8.0	—	80.0	

\* This spec indicates the capability of driving  $50\Omega$  transmission lines.  
One output should be tested at a time for a 10ms maximum duration.

## System Diagram



## Timing Chart

Timing Requirements (Input  $t_r = t_f = 3n$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta=25°C		Ta= -40~85°		UNIT
			V <sub>CC</sub>	Typ.	Max.	Max.	
Minimum Pulse Width ( $\overline{CK}$ )	$t_{W(H)}$	—	3.0±0.3	—	7.0	7.0	ns
	$t_{W(L)}$		5.0±0.5	—	5.0	5.0	
Minimum Pulse Width (CLR)	$t_{W(H)}$	—	3.0±0.3	—	7.0	7.0	
	$t_{W(L)}$		5.0±0.5	—	5.0	5.0	
Minimum Removal Time	$t_{rem}$	—	3.0±0.3	—	6.0	6.0	
	$t_{rem}$		5.0±0.5	—	3.0	3.0	

AC Electrical Characteristics (C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω, Input  $t_r = t_f = 3ns$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C				Ta = -40~85°C		UNIT
			V <sub>CC</sub>	Min.	Typ.	Max.	Min.	Max.	
Propagation Delay Time (CK→QA)	t <sub>pLH</sub>	—	3.0±0.3	—	8.0	13.2	1.0	15.0	ns
	t <sub>pHL</sub>		5.0±0.5	—	5.0	8.3	1.0	9.5	
Propagation Delay Time (CK→QB)	t <sub>pLH</sub>	—	3.0±0.3	—	10.1	16.7	1.0	19.0	
	t <sub>pHL</sub>		5.0±0.5	—	5.9	10.5	1.0	12.0	
Propagation Delay Time (CK→QC)	t <sub>pLH</sub>	—	3.0±0.3	—	12.0	20.2	1.0	23.0	
	t <sub>pHL</sub>		5.0±0.5	—	6.8	12.3	1.0	14.0	
Propagation Delay Time (CK→QD)	t <sub>pLH</sub>	—	3.0±0.3	—	13.0	23.0	1.0	26.0	
	t <sub>pHL</sub>		5.0±0.5	—	7.5	13.2	1.0	15.0	
Propagation Delay Time (CLR→Qn)	t <sub>pHL</sub>	—	3.0±0.3	—	8.0	13.2	1.0	15.0	
			5.0±0.5	—	5.1	8.8	1.0	10.0	
Maximum Clock Frequency	f <sub>MAX</sub>	—	3.0±0.3	65	125	—	65	—	MHz
			5.0±0.5	100	160	—	100	—	
Input Capacitance	C <sub>IN</sub>	—	—	—	5	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> <sup>1</sup>	—	—	—	36	—	—	—	

Note (1): C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.  
Average operating current can be obtained by the equation:  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2$  (per Counter).