



## U74HC595A

CMOS IC

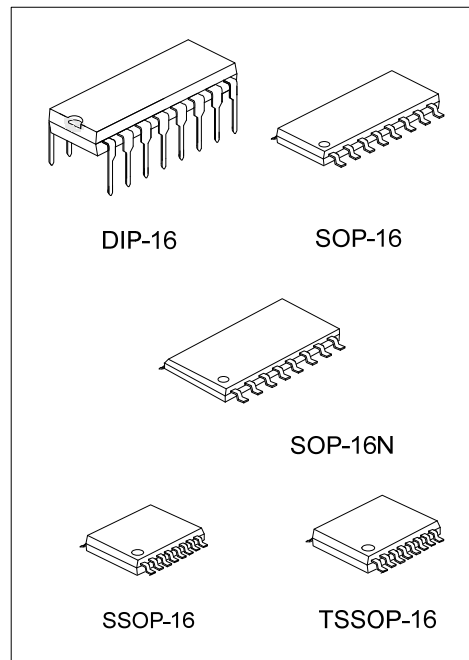
### 8-BIT SERIAL-IN SHIFT REGISTER WITH LATCHED 3-STATE PARALLEL OUTPUTS, PROVIDING SERIAL OUTPUT

#### DESCRIPTION

The UTC **74HC595A** contains an 8-bit register with asynchronous reset input and an 8-bit latch with output. The Serial Data Input (SER) will shift into the internal shift register during every LOW-to-HIGH transition on the Shift Clock. The latch will latch the 8-bit data from the shift register during the LOW-to-HIGH transition on the Latch Clock. The shift register also provides a serial output.

#### FEATURES

- \* Operation Voltage Range: 2~6V
- \* High Noise Immunity
- \* Output Compatibility with CMOS and TTL
- \* Specified from -40 ~ +125°C



#### ORDERING INFORMATION

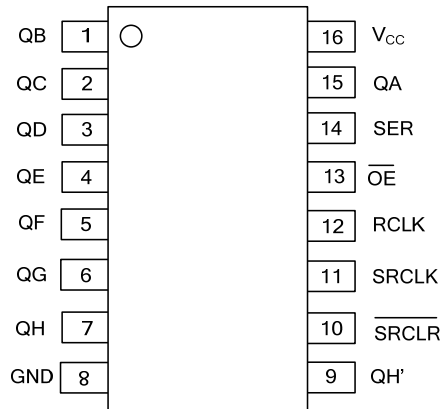
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC595AL-D16-T	U74HC595AG-D16-T	DIP-16	Tube
-	U74HC595AG-S16-R	SOP-16	Tape Reel
U74HC595AL-S16N-R	U74HC595AG-S16N-R	SOP-16N	Tape Reel
-	U74HC595AG-R16-R	SSOP-16	Tape Reel
-	U74HC595AG-P16-R	TSSOP-16	Tape Reel

<p>U74HC595AL-D16-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) D16: DIP-16, S16: SOP-16, S16N: SOP-16N R16: SSOP-16, P16: TSSOP-16 (3) L: Lead Free, G: Halogen Free and Lead Free</p>
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#### MARKING

DIP-16	SOP-16 / SOP-16N / SSOP-16 / TSSOP-16
<p>UTC □□□□ → Date Code L: Lead Free G: Halogen Free □□ → Lot Code</p>	<p>UTC □□□□ → Date Code U74HC595AG □□ → Lot Code</p>

■ PIN CONFIGURATION

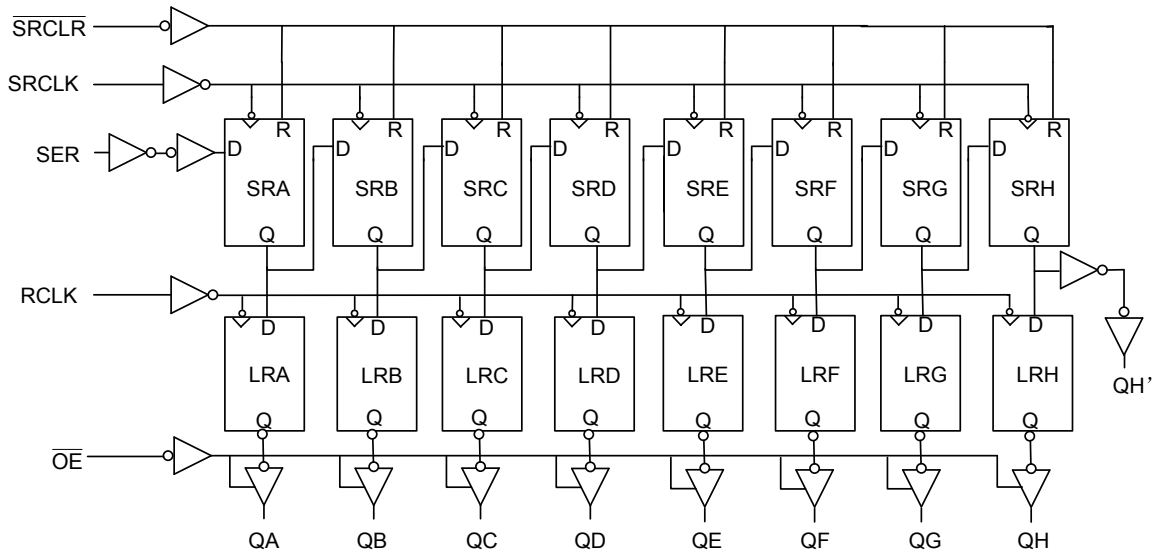


■ FUNCTION TABLE

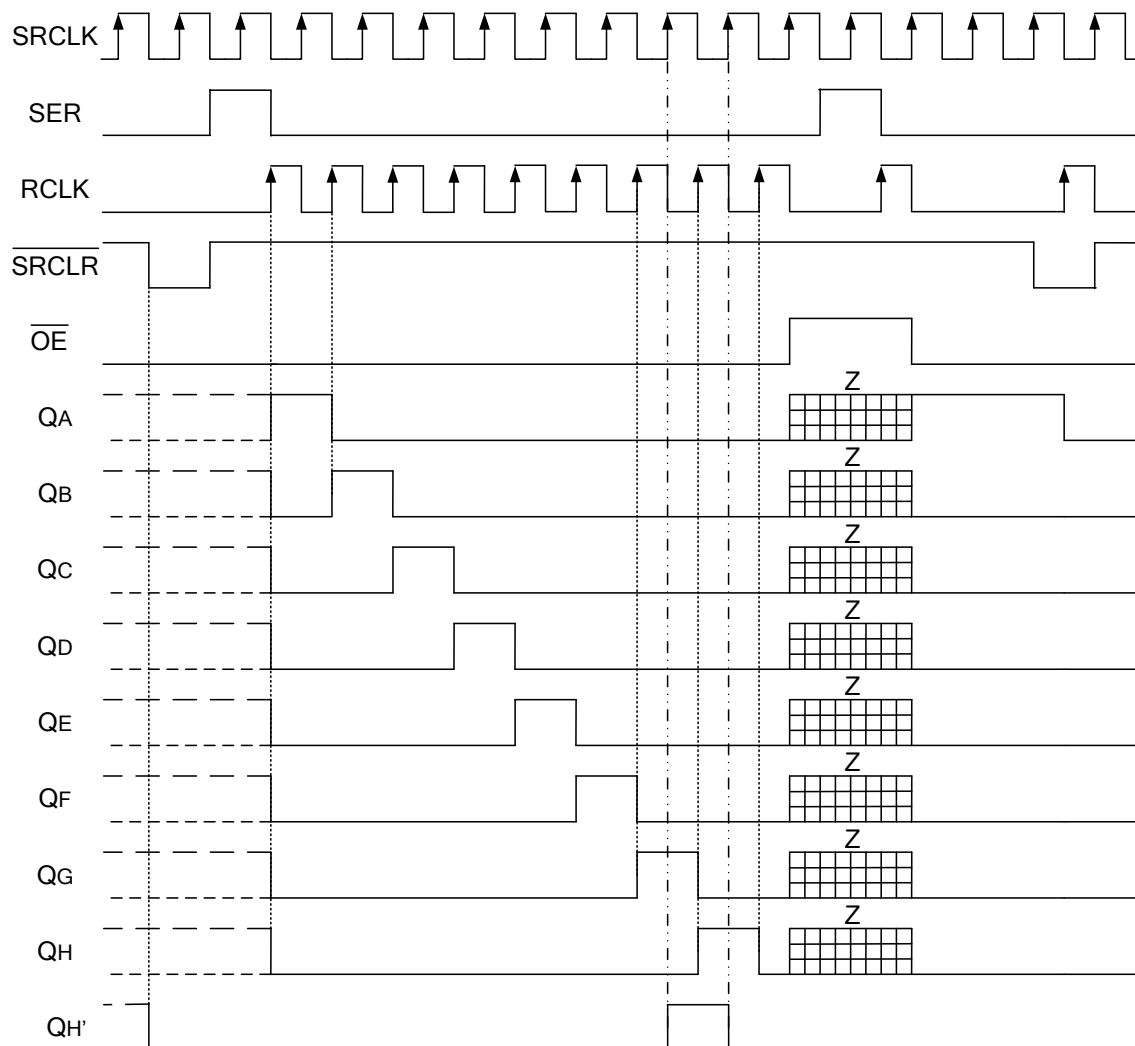
FUNCTION	INPUTS					OUTPUTS	
	SRCLK	RCLK	$\overline{OE}$	$\overline{SRCLR}$	SER	QH'	Qn
A Low-Level on $\overline{SRCLR}$ only affects the shift registers.	X	X	L	L	X	L	NC
Empty shift register loaded into storage register.	X	↑	L	L	X	L	L
Shift register clear. Parallel outputs in high-impedance OFF-state	X	X	H	L	X	L	Z
Logic high level shifted into the first shift register. Contents of all shift register stages shifted through, e.g. previous state of stage G(internal QG') appears on the serial output(QH').	↑	X	L	H	H	QG'	NC
Contents of shift register stages (internal Qn') are transferred to the storage register and parallel output stages.	X	↑	L	H	X	NC	Qn'
Contents of shift register shifted through. Previous contents of the shift register is transferred to the storage register and the parallel output stages.	↑	↑	L	H	X	QG'	Qn'

Note:H : HIGH voltage level.  
 L : LOW voltage level.  
 X : Don't care.  
 Z : High impedance OFF-state.  
 NC: No change.  
 ↑ : Low-to-High transition.  
 ↓ : High-to-Low transition.

■ LOGIC DIAGRAM



■ TIMING DIAGRAM



■ ABSOLUTE MAXIMUM RATING (unless otherwise specified)(Note 2)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		$V_{CC}$	-0.5~7.0	V
Input Clamp Current ( $V_{IN} < 0$ )		$I_{IK}$	$\pm 20$	mA
Output Clamp Current ( $V_{OUT} < 0$ )		$I_{OK}$	$\pm 20$	mA
Output Current		$I_{OUT}$	$\pm 35$	mA
$V_{CC}$ or GND Current		$I_{CC}$	$\pm 75$	mA
Power Dissipation	DIP-16	$P_D$	750	mW
	SOP-16		500	mW
	SOP-16N		550	mW
	SSOP-16		450	mW
	TSSOP-16			
Storage Temperature		$T_{STG}$	-65 ~ +150	°C

Notes: 1. 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.

2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

■ RECOMMENDED OPERATING COMDITIONS

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage		$V_{CC}$	2		6	V
Input Voltage		$V_{IN}$	0		$V_{CC}$	V
Output Voltage		$V_{OUT}$	0		$V_{CC}$	V
Operating Temperature		$T_A$	-40		125	°C
Input Transition Rise or Fall Rate	$V_{CC}=2V$	$\Delta t/\Delta v$			1000	ns
	$V_{CC}=4.5V$				500	ns
	$V_{CC}=6V$				400	ns

## ■ ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2V$	1.5			V
		$V_{CC}=3V$	2.1			V
		$V_{CC}=4.5V$	3.15			V
		$V_{CC}=6V$	4.2			V
LOW-level output voltage	$V_{IL}$	$V_{CC}=2V$			0.5	V
		$V_{CC}=3V$			0.9	V
		$V_{CC}=4.5V$			1.35	V
		$V_{CC}=6V$			1.8	V
High-Level Output Voltage, $Q_A$ - $Q_H$	$V_{OH}$	$V_{CC}=2V, I_{OH}=-20\mu A$	1.9	2.0		V
		$V_{CC}=4.5V, I_{OH}=-20\mu A$	4.4	4.5		V
		$V_{CC}=6V, I_{OH}=-20\mu A$	5.9	6.0		V
		$V_{CC}=3V, I_{OH}=-2.4mA$	2.48			V
		$V_{CC}=4.5V, I_{OH}=-6mA$	3.98			V
		$V_{CC}=6V, I_{OH}=-7.8mA$	5.48			V
Low-Level Output Voltage, $Q_A$ - $Q_H$	$V_{OL}$	$V_{CC}=2V, I_{OL}=20\mu A$		0.002	0.1	V
		$V_{CC}=4.5V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=6V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=3V, I_{OL}=2.4mA$			0.26	V
		$V_{CC}=4.5V, I_{OL}=6mA$			0.26	V
		$V_{CC}=6V, I_{OL}=7.8mA$			0.26	V
High-Level Output Voltage, $Q_H$	$V_{OH}$	$V_{CC}=2V, I_{OH}=-20\mu A$	1.9	2.0		V
		$V_{CC}=4.5V, I_{OH}=-20\mu A$	4.4	4.5		V
		$V_{CC}=6V, I_{OH}=-20\mu A$	5.9	6.0		V
		$V_{CC}=3V, I_{OH}=-2.4mA$	2.48			V
		$V_{CC}=4.5V, I_{OH}=-4mA$	3.98			V
		$V_{CC}=6V, I_{OH}=-5.2mA$	5.48			V
Low-Level Output Voltage, $Q_H$	$V_{OL}$	$V_{CC}=2V, I_{OL}=20\mu A$		0.002	0.1	V
		$V_{CC}=4.5V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=6V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=3V, I_{OL}=2.4mA$			0.26	V
		$V_{CC}=4.5V, I_{OL}=4mA$			0.26	V
		$V_{CC}=6V, I_{OL}=5.2mA$			0.26	V
Input Leakage Current	$I_{I(LEAK)}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND			$\pm 0.1$	$\mu A$
Output OFF -state current	$I_{OZ}$	$V_{CC}=6V, V_{OUT}=V_{CC}$ or GND			$\pm 0.5$	$\mu A$
Quiescent Supply Current	$I_{CC}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND, $I_{OUT}=0$			4	$\mu A$
Input Capacitance	$C_{IN}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND			10	pF

### ■ DYNAMIC CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Maximum clock pulse frequency	$f_{max}$	$C_L=50pF$	$V_{CC}=2V$	6	26		MHz
			$V_{CC}=4.5V$	30	38		MHz
			$V_{CC}=6V$	35	42		MHz
Propagation delay from input (SRCLK) to output ( $Q_H$ )	$t_{PD}$	$C_L=50pF$	$V_{CC}=2V$		50	140	ns
			$V_{CC}=4.5V$		17	28	ns
			$V_{CC}=6V$		14	24	ns
Propagation delay from input (RCLK) to output ( $Q_A-Q_H$ )	$t_{PD}$	$C_L=50pF$	$V_{CC}=2V$		50	140	ns
			$V_{CC}=4.5V$		17	28	ns
			$V_{CC}=6V$		14	24	ns
		$C_L=150pF$	$V_{CC}=2V$		60	200	ns
			$V_{CC}=4.5V$		22	40	ns
			$V_{CC}=6V$		19	34	ns
Propagation delay from input (SRCLR) to output ( $Q_H$ )	$t_{PHL}$	$C_L=50pF$	$V_{CC}=2V$		51	145	ns
			$V_{CC}=4.5V$		18	29	ns
			$V_{CC}=6V$		15	25	ns
Propagation delay from input ( $\overline{OE}$ ) to output ( $Q_A-Q_H$ )	$t_{en}$	$C_L=50pF$	$V_{CC}=2V$		40	135	ns
			$V_{CC}=4.5V$		15	27	ns
			$V_{CC}=6V$		13	23	ns
		$C_L=150pF$	$V_{CC}=2V$		70	200	ns
			$V_{CC}=4.5V$		23	40	ns
			$V_{CC}=6V$		19	34	ns
Propagation delay from input ( $\overline{OE}$ ) to output ( $Q_A-Q_H$ )	$t_{dis}$	$C_L=50pF$	$V_{CC}=2V$		42	150	ns
			$V_{CC}=4.5V$		23	30	ns
			$V_{CC}=6V$		20	26	ns
Propagation delay to output ( $Q_A-Q_H$ )	$t_t$	$C_L=50pF$	$V_{CC}=2V$		28	60	ns
			$V_{CC}=4.5V$		8	12	ns
			$V_{CC}=6V$		6	10	ns
		$C_L=150pF$	$V_{CC}=2V$		45	210	ns
			$V_{CC}=4.5V$		17	42	ns
			$V_{CC}=6V$		13	36	ns
Propagation delay to output ( $Q_H$ )	$t_t$	$C_L=50pF$	$V_{CC}=2V$		28	75	ns
			$V_{CC}=4.5V$		8	15	ns
			$V_{CC}=6V$		6	13	ns

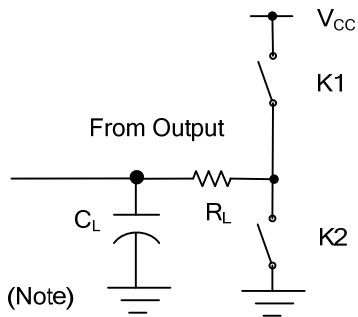
■ TIMING REQUIREMENTS (T<sub>A</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Pulse duration, SRCLK or RCLK high or low	t <sub>w</sub>	V <sub>CC</sub> =2V	80			ns
		V <sub>CC</sub> =4.5V	16			ns
		V <sub>CC</sub> =6V	14			ns
Pulse duration, $\overline{\text{SRCLR}}$ Low		V <sub>CC</sub> =2V	80			ns
		V <sub>CC</sub> =4.5V	16			ns
		V <sub>CC</sub> =6V	14			ns
Setup Time, SER before SRCLK↑	t <sub>su</sub>	V <sub>CC</sub> =2V	100			ns
		V <sub>CC</sub> =4.5V	20			ns
		V <sub>CC</sub> =6V	17			ns
Setup Time, SRCLK↑ before RCLK↑		V <sub>CC</sub> =2V	75			ns
		V <sub>CC</sub> =4.5V	15			ns
		V <sub>CC</sub> =6V	13			ns
Setup Time, $\overline{\text{SRCLR}}$ low before RCLK↑		V <sub>CC</sub> =2V	50			ns
		V <sub>CC</sub> =4.5V	10			ns
		V <sub>CC</sub> =6V	9			ns
Setup Time, $\overline{\text{SRCLR}}$ high (inactive) before SRCLK↑		V <sub>CC</sub> =2V	50			ns
		V <sub>CC</sub> =4.5V	10			ns
		V <sub>CC</sub> =6V	9			ns
Hold Time, SER after SRCLK↑	t <sub>h</sub>	V <sub>CC</sub> =2V	3			ns
		V <sub>CC</sub> =4.5V	3			ns
		V <sub>CC</sub> =6V	3			ns

■ OPERATING CHARACTERISTIC

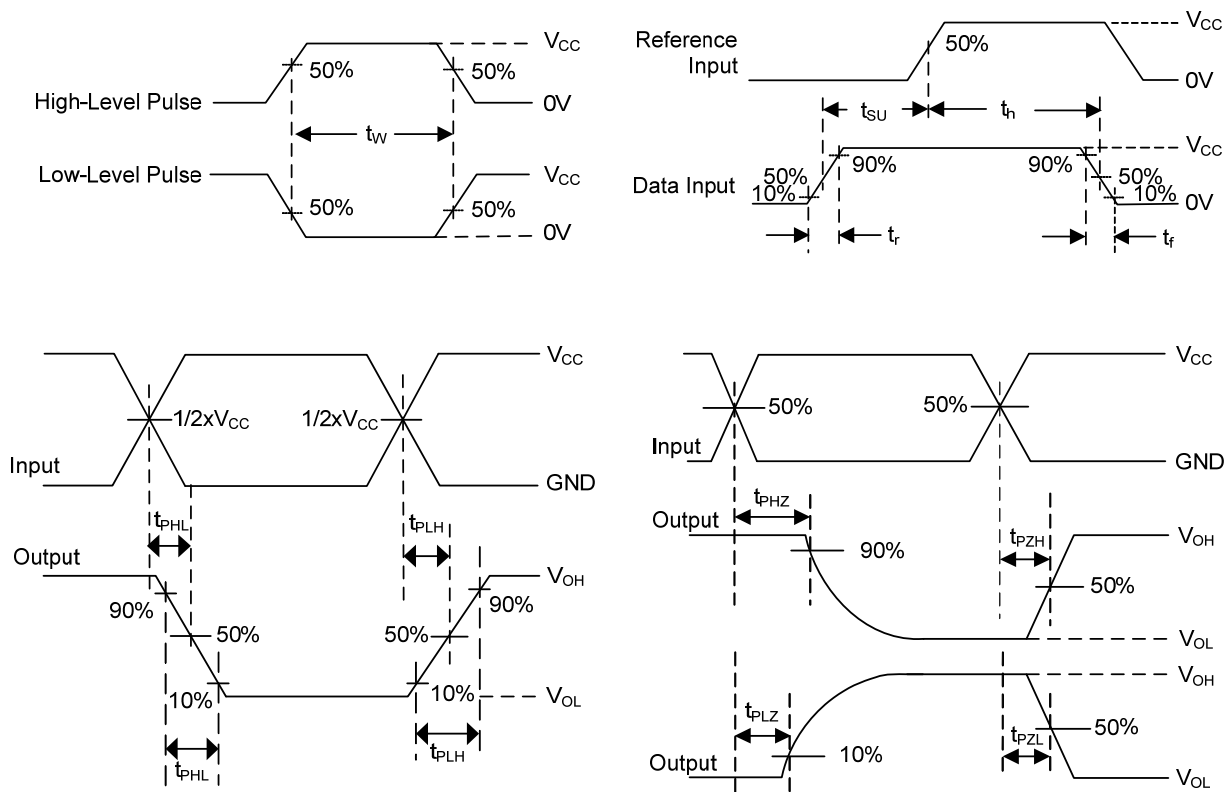
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C <sub>PD</sub>	No load		400		pF

## TEST CIRCUIT AND WAVEFORMS



TEST	K1	K2
$t_{PLH}/t_{PHL}$	Open	Open
$t_{PHZ}/t_{PZH}$	Open	Close
$t_{PLZ}/t_{PZL}$	Close	Open

Note:  $C_L$  includes probe and jig capacitance.  $C_L=50\text{pF}$ ,  $R_L=1\text{K}\Omega$



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