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**NTE74HC595**  
**NTE74HC595T**  
**Integrated Circuit**  
**TTL – High Speed CMOS,**  
**8–Bit Serial–In or Parallel–Out Shift Register w/3–State Outputs**

**Description:**

The NTE74HC595 (16–Lead DIP) and NTE74HC595T (SOIC–16) are 8–stage serial shift registers with storage register and 3–state outputs. The registers have separate clocks. These high–speed Si–gate CMOS devices and are pin compatible with Low–power Schottky TTL (LSTTL).

Data is shifted on the positive–going transitions of the shift register clock input (SHCP). The data in each register is transferred to the storage register on a positive–going transition of the storage register clock input (STCP). If both clocks are connected together, the shift register will always be one lock pulse ahead of the storage register.

The shift register has a serial input (DS) and a serial standard output (Q7S) for cascading. It is also provided with asynchronous reset (active LOW) for all 8 shift register stages. The storage register has 8 parallel 3–state bus driver outputs. Data in the storage register appears at the output whenever the output enable input ( $\overline{OE}$ ) is LOW.

**Features:**

- 8–Bit Serial Input
- 8–Bit Serial or Parallel Output
- Storage Register with 3–State Outputs
- Shift Register with Direct Clear
- 100Mhz (typical) Shift Out Frequency
- Negative–Edge Clocking

**Applications:**

- Serial–to–Parallel Data Conversion
- Remote Control Holding Register

**Absolute Maximum Ratings:** (Voltages referenced to GND (ground = 0V))

Supply Voltage, $V_{CC}$ .....	–0.5 to +7.0V
Input Clamping Current ( $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ ), $I_{IK}$ .....	±20mA
Output Clamping Current ( $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ ), $I_{OK}$ .....	±20mA
Output Current ( $V_O = -0.5V$ to $(V_{CC} + 0.5V)$ ), $I_O$	
Pin Q7S .....	±25mA
Pins Qn .....	±35mA
Supply Current, $I_{CC}$ .....	70mA
Minimum Ground Current, $I_{GND}$ .....	–70mA
Total Power Dissipation, $P_{tot}$	
NTE74HC595 .....	750mW
Derate Linearly Above +70°C .....	12mW/K
NTE74HC595T .....	500mW
Derate Linearly Above +70°C .....	8mW/K
Maximum Junction Temperature Range, $T_J$ .....	–40°C to +125°C
Storage Temperature Range, $T_{stg}$ .....	–65°C to +150°C

### Recommended Operating Conditions:

Parameter	Symbol	Min	Typ	Max	Unit	
Supply Voltage	$V_{CC}$	2.0	5.0	6.0	V	
Input Voltage	$V_I$	0	-	$V_{CC}$	V	
Output Voltage	$V_O$	0	-	$V_{CC}$	V	
Input Transition Rise and Fall Rate $V_{CC} = 2.0V$	$\pm t/\pm V$	-	-	625	ns/V	
		$V_{CC} = 4.5V$	-	1.67	139	ns/V
		$V_{CC} = 6.0V$	-	83	-	ns/V
Ambient Temperature Range	$T_A$	-40	+25	+125	°C	

### Static Characteristics: (At recommended operating conditions; voltages are referenced to GND (ground = 0V))

Parameter	Symbol	Test Conditions	-40° to +85°C			-40° to +125°C		Unit		
			Min	Typ	Max	Min	Max			
HIGH Level Input Voltage	$V_{IH}$	$V_{CC} = 2.0V$	1.5	1.2	-	1.5	-	V		
		$V_{CC} = 4.5V$	3.15	2.4	-	3.15	-	V		
		$V_{CC} = 6.0V$	4.2	3.2	-	4.2	-	V		
LOW Level Input Voltage	$V_{IL}$	$V_{CC} = 2.0V$	-	0.8	0.5	-	0.5	V		
		$V_{CC} = 4.5V$	-	2.1	1.35	-	1.35	V		
		$V_{CC} = 6.0V$	-	2.8	1.8	-	1.8	V		
HIGH Level Output Voltage All Outputs	$V_{OH}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_O = -20\uparrow A$	$V_{CC} = 2.0V$	1.9	2.0	-	1.9	-	V	
			$V_{CC} = 4.5V$	4.4	4.5	-	4.4	-	V	
			$V_{CC} = 6.0V$	5.9	6.0	-	5.9	-	V	
		Q7S Output	$V_I = V_{IH}$ or $V_{IL}$	$I_O = -4mA, V_{CC} = 4.5V$	3.84	4.32	-	3.7	-	V
				$I_O = -5.2mA, V_{CC} = 6.0V$	5.34	5.81	-	5.2	-	V
		Qn Bus Driver Outputs	$V_I = V_{IH}$ or $V_{IL}$	$I_O = -6mA, V_{CC} = 4.5V$	3.84	4.32	-	3.7	-	V
$I_O = -7.8mA, V_{CC} = 6.0V$	5.34			5.81	-	5.2	-	V		
LOW Level Output Voltage All Outputs	$V_{OL}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_O = 20\uparrow A$	$V_{CC} = 2.0V$	-	0	0.1	-	0.1	V	
			$V_{CC} = 4.5V$	-	0	0.1	-	0.1	V	
			$V_{CC} = 6.0V$	-	0	0.1	-	0.1	V	
		Q7S Output	$V_I = V_{IH}$ or $V_{IL}$	$I_O = 4mA, V_{CC} = 4.5V$	-	0.15	0.33	-	0.4	V
				$I_O = 5.2mA, V_{CC} = 6.0V$	-	0.16	0.33	-	0.4	V
		Qn Bus Driver Outputs	$V_I = V_{IH}$ or $V_{IL}$	$I_O = 6mA, V_{CC} = 4.5V$	-	0.15	0.33	-	0.4	V
				$I_O = 7.8mA, V_{CC} = 6.0V$	-	0.16	0.33	-	0.4	V
		Input Leakage Current	$I_I$	$V_I = V_{CC}$ or GND, $V_{CC} = 6.0V$	-	-	$\pm 1.0$	-	$\pm 1.0$	$\uparrow A$
		OFF-State Output Current	$I_{OZ}$	$V_I = V_{IH}$ or $V_{IL}, V_{CC} = 6.0V, V_O = V_{CC}$ or GND	-	-	$\pm 5.0$	-	$\pm 10$	$\uparrow A$
Supply Current	$I_{CC}$	$V_I = V_{CC}$ or GND, $I_O = 0A, V_{CC} = 6.0V$	-	-	80	-	160	$\uparrow A$		
Input capacitance	$C_I$		-	3.5	-	-	-	pF		

**Dynamic Characteristics:** (Voltages are referenced to GND (ground = 0V))

Parameter	Symbol	Test Conditions	+25°C (Note 1)			-40° to +85°C		-40° to +125°C		Unit	
			Min	Typ	Max	Min	Max	Min	Max		
Propagation Delay SHCP to Q7S  STCP to Qn  MR to Q7S	t <sub>pd</sub>	Note 2	V <sub>CC</sub> = 2.0V	-	50	160	-	200	-	240	ns
			V <sub>CC</sub> = 4.5V	-	19	32	-	40	-	48	ns
			V <sub>CC</sub> = 6.0V	-	15	27	-	34	-	41	ns
		Note 2	V <sub>CC</sub> = 2.0V	-	55	175	-	220	-	265	ns
			V <sub>CC</sub> = 4.5V	-	20	35	-	44	-	53	ns
			V <sub>CC</sub> = 6.0V	-	16	30	-	37	-	45	ns
		Note 3	V <sub>CC</sub> = 2.0V	-	47	175	-	220	-	265	ns
			V <sub>CC</sub> = 4.5V	-	17	35	-	44	-	53	ns
			V <sub>CC</sub> = 6.0V	-	14	30	-	37	-	45	ns
Enable Time OE to Qn	t <sub>en</sub>	Note 4	V <sub>CC</sub> = 2.0V	-	47	150	-	190	-	225	ns
			V <sub>CC</sub> = 4.5V	-	17	30	-	38	-	45	ns
			V <sub>CC</sub> = 6.0V	-	14	26	-	33	-	38	ns
Disable Time OE to Qn	t <sub>en</sub>	Note 5	V <sub>CC</sub> = 2.0V	-	41	150	-	190	-	225	ns
			V <sub>CC</sub> = 4.5V	-	15	30	-	38	-	45	ns
			V <sub>CC</sub> = 6.0V	-	12	27	-	33	-	38	ns
Pulse Width SHCP HIGH or LOW  STCP HIGH or LOW  MR LOW	t <sub>w</sub>	V <sub>CC</sub> = 2.0V		75	17	-	95	-	110	-	ns
		V <sub>CC</sub> = 4.5V		15	6	-	19	-	22	-	ns
		V <sub>CC</sub> = 6.0V		13	5	-	16	-	19	-	ns
		V <sub>CC</sub> = 2.0V		75	11	-	95	-	110	-	ns
		V <sub>CC</sub> = 4.5V		15	4	-	19	-	22	-	ns
		V <sub>CC</sub> = 6.0V		13	3	-	16	-	19	-	ns
		V <sub>CC</sub> = 2.0V		75	17	-	95	-	110	-	ns
		V <sub>CC</sub> = 4.5V		15	6	-	19	-	22	-	ns
		V <sub>CC</sub> = 6.0V		13	5	-	16	-	19	-	ns
Set-Up Time DS to SHCP  SHCP to STCP	t <sub>su</sub>	V <sub>CC</sub> = 2.0V		50	11	-	65	-	75	-	ns
		V <sub>CC</sub> = 4.5V		10	4	-	13	-	15	-	ns
		V <sub>CC</sub> = 6.0V		9	3	-	11	-	13	-	ns
		V <sub>CC</sub> = 2.0V		75	22	-	95	-	110	-	ns
		V <sub>CC</sub> = 4.5V		15	8	-	19	-	22	-	ns
		V <sub>CC</sub> = 6.0V		13	7	-	16	-	19	-	ns
Hold Time DS to SHCP	t <sub>h</sub>	V <sub>CC</sub> = 2.0V		3	-6	-	3	-	3	-	ns
		V <sub>CC</sub> = 4.5V		3	-2	-	3	-	3	-	ns
		V <sub>CC</sub> = 6.0V		3	-2	-	3	-	3	-	ns

Note 1. Typical values are measured at nominal supply voltage.

Note 2. t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

Note 3. t<sub>pd</sub> is the same as t<sub>PHL</sub> only.

Note 4. t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

Note 5. t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

**Dynamic Characteristics:** (Voltages are referenced to GND (ground = 0V))

Parameter	Symbol	Test Conditions	+25°C (Note 1)			-40° to +85°C		-40° to +125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
Recovery Time MR to SHCP	t <sub>rec</sub>	V <sub>CC</sub> = 2.0V	50	-19	-	65	-	75	-	ns
		V <sub>CC</sub> = 4.5V	10	-7	-	13	-	15	-	ns
		V <sub>CC</sub> = 6.0V	9	-6	-	11	-	13	-	ns
Maximum Frequency SCHP to STCP	f <sub>max</sub>	V <sub>CC</sub> = 2.0V	9	30	-	4.8	-	4	-	MHz
		V <sub>CC</sub> = 4.5V	30	91	-	24	-	20	-	MHz
		V <sub>CC</sub> = 6.0V	35	108	-	28	-	24	-	MHz
Power Dissipation Capacitance	C <sub>PD</sub>	f <sub>i</sub> = 1Mhz, V <sub>I</sub> = GND to V <sub>CC</sub> , Note 6, Note 7	-	115	-	-	-	-	-	pF

Note 1. Typical values are measured at nominal supply voltage.

Note 6. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in ↑W).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in Mhz;

f<sub>o</sub> = output frequency in Mhz;

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V.

Note 7. All 9 outputs switching.

**Functional Description:**

Control				Input	Output		Function
SHCP	STCP	OE	MR	DS	Q7S	Qn	
X	X	L	L	X	L	NC	a LOW-level on MR only affects the shift registers
X	↑	L	L	X	L	L	empty shift register loaded into storage register
X	X	H	L	X	L	Z	shift register clear; parallel outputs in high-impedance OFF-state
↑	X	L	H	H	Q6S	NC	logic HIGH-level shifted into shift register stage 0. Contents of all shift register stages shifted through, e.g. previous state of stage 6 (internal Q6S) appears on the serial output (Q7S).
X	↑	L	H	X	NC	QnS	contents of shift register stages (internal QnS) are transferred to the storage register and parallel output stages.
↑	↑	L	H	X	Q6S	QnS	contents of shift register shifted through; previous contents of the shift register is transferred to the storage register and th parallel output stages

H = HIGH voltage state;

L = LOW voltage state;

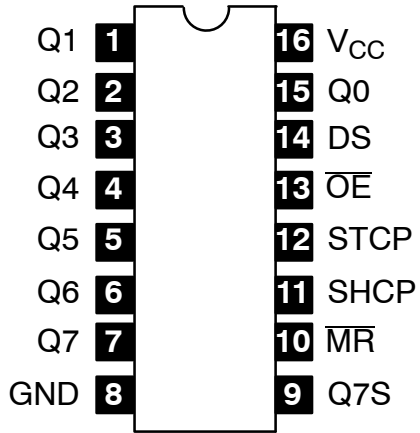
↑ = LOW-to-HIGH transition;

X = don't care;

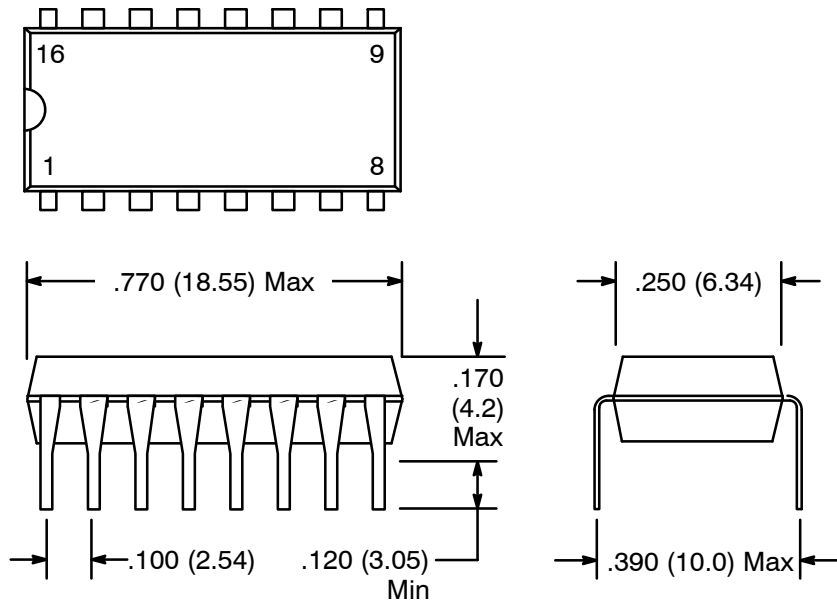
NC = no change;

Z = high-impedance OFF-state

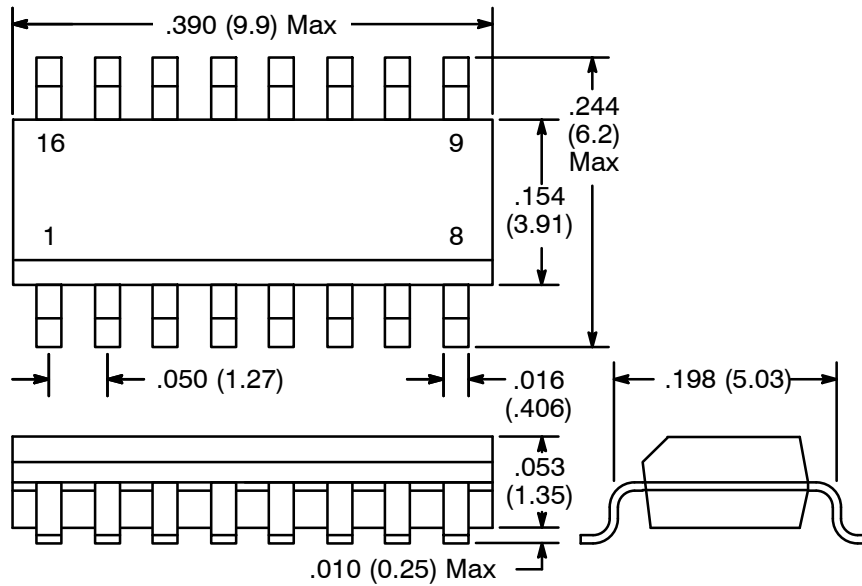
### Pin Connection Diagram



### NTE74HC595



### NTE74HC595T



NOTE: Pin1 on Beveled Edge