8-BIT SHIFT REGISTER WITH 8-BIT OUTPUT REGISTER

Description

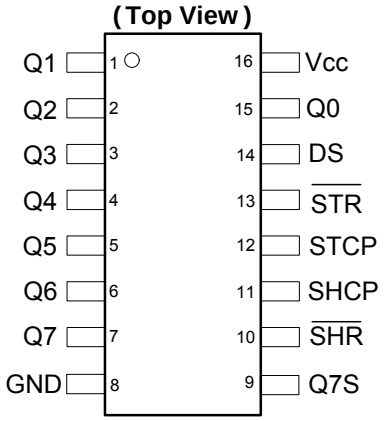
The 74HC594 is a high speed CMOS device.

An eight bit shift register accepts data from the serial input (DS) on each positive transition of the shift register clock (SHCP). When asserted low, the shift regisister reset function ($\overline{SHR}$) sets all shift register values to zero and is independent of all clocks. Also when asserted low, the storage register reset function ($\overline{STR}$) sets all shift register values to zero and is independent of all clocks.

Data from the input serial shift register is placed in the output register with a rising pulse on the storages resister clock (STCP). The storage resister includes output Q7S which is used for cascading information between devices. As the information moves into the storage register, it is asserted on the push-pull outputs Q0-Q7.

All registers capture data on rising edge and change output on the falling edge. If both clocks are connected together, the input shift register is always one clock cycle ahead of the output register.

Pin Assignments



SO-16 / TSSOP-16

Features

- Wide Supply Voltage Range from 2.0V to 6.0V
- Sinks or sources 8mA at V_{CC}= 4.5V
- CMOS low power consumption
- Schmitt Trigger Action at All Inputs
- Inputs accept up to 6.0V
- ESD Protection Tested per JESD 22
  - Exceeds 200-V Machine Model (A115-A)
  - Exceeds 2000-V Human Body Model (A114-A)
  - Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 250mA per JESD 78, Class II
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- General Purpose Logic
- Serial to Parallel Data conversion
- Capture and hold data for extended periods of time.
- Allow simple serial bit streams from a microcontroller to control as many peripheral lines as needed.
- Wide array of products such as:
  - Computer Peripherals
  - Appliances
  - Industrial Control

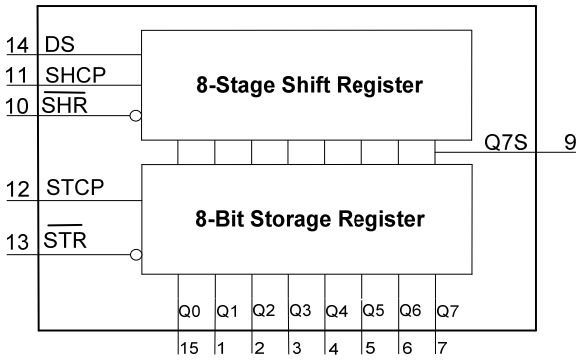
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Click here for ordering information, located at the end of datasheet

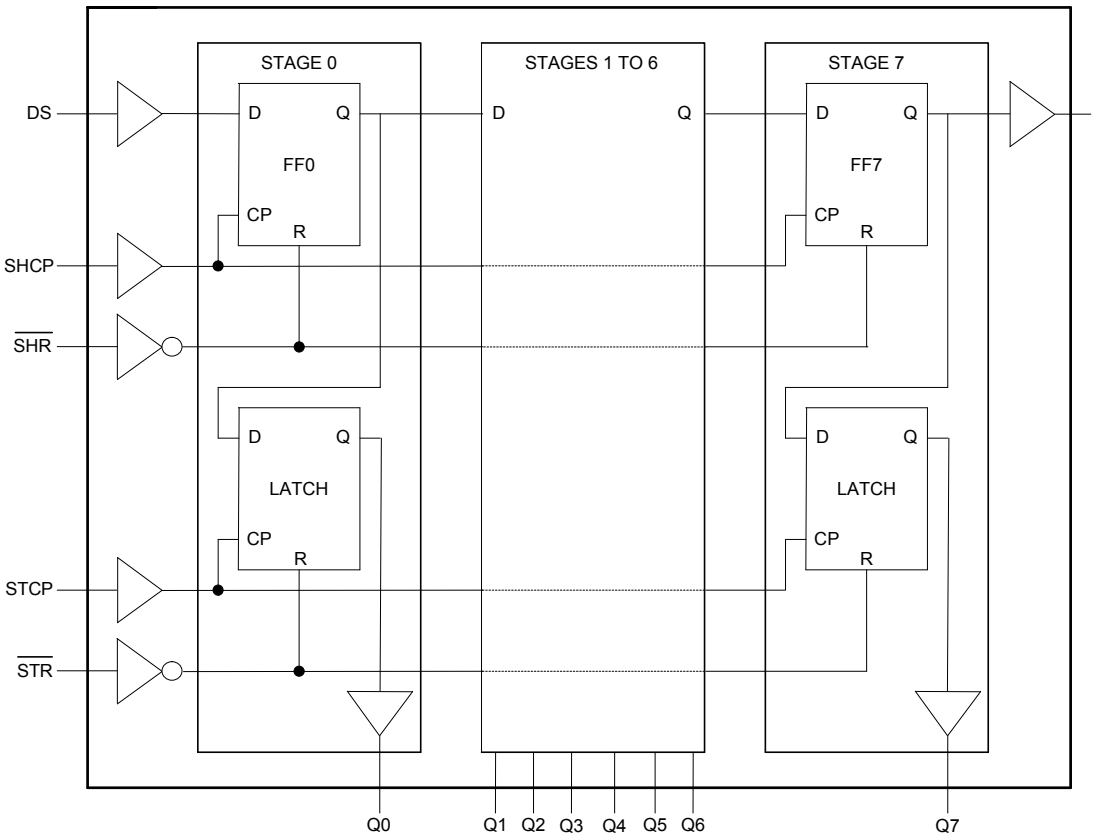
Pin Descriptions

Pin Number	Pin Name	Description
1	Q1	Parallel Data Output 1
2	Q2	Parallel Data Output 2
3	Q3	Parallel Data Output 3
4	Q4	Parallel Data Output 4
5	Q5	Parallel Data Output 5
6	Q6	Parallel Data Output 6
7	Q7	Parallel Data Output 7
8	GND	Ground
9	Q7S	Serial Data Output
10	$\overline{SHR}$	Shift Register Reset active low
11	SHCP	Shift Register Clock Input
12	STCP	Storage Register Clock Input
13	$\overline{STR}$	Storage Register Reset active low
14	DS	Serial Data input
15	Q0	Parallel Data Output 0
16	V_{CC}	Supply Voltage

Functional Diagram



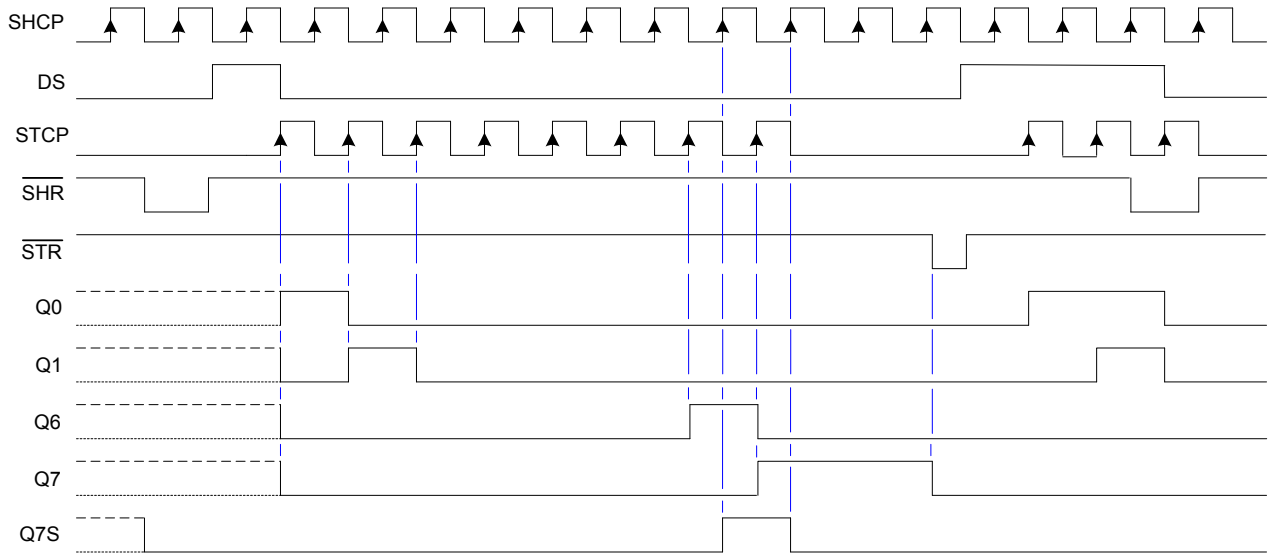
Logic Diagram



Functional Description and Timing Diagram

Control				Input	Output		Function
$\overline{SHR}$	$\overline{STR}$	SHCP	STCP	DS	Q7S	Qn	
L	X	X	X	X	L	NC	Clear Shift Register
X	L	X	X	X	NC	L	Clear Storage Register
H	X	↑	L	H or L	Q6S	NC	Loads DS into shift register stage 0. All Q_S shifted
H	H	X	↑	X	NC	Qs	Contents of shift register moved to starge register all Q_S -> Q_N
H	H	↑	↑	H or L	Q6S	QnS	Shift Register one pulse count ahead of storage register.

H=HIGH voltage state
L=LOW voltage state
↑=LOW to HIGH transition
X= don't care – high or low (not floating)
NC= No change



Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Symbol	Description		Rating	Unit
ESD HBM	Human Body Model ESD Protection		2	KV
ESD CDM	Charged Device Model ESD Protection		1	KV
ESD MM	Machine Model ESD Protection		200	V
V_{CC}	Supply Voltage Range		-0.5 to +7.0	V
V_I	Input Voltage Range		-0.5 to +7.0	V
V_o	Voltage applied to output in high or low state		-0.3 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I < -0.5V		-20	mA
I_{IK}	Input Clamp Current VI > Vcc +0.5V		20	mA
I_{OK}	Output Clamp Current V_O <-0.5V		-20	mA
I_{OK}	Output Clamp Current V_O > V_{CC} + 0.5V		20	mA
I_O	Continuous output current	Q7 standard output	±25	mA
		Qn bus driver outputs	±35	mA
I_{CC}	Continuous current through Vcc		70	mA
I_{GND}	Continuous current through GND		-70	mA
T_J	Operating Junction Temperature		-40 to +150	°C
T_{STG}	Storage Temperature		-65 to +150	°C
P_{TOT}	Total Power Dissipation		500	mW

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage	–	2.0	6.0	V
V_I	Input Voltage	–	0	Vcc	V
V_O	Output Voltage	–	0	V_{CC}	V
Δt/ΔV	Input transition rise or fall rate	V_{CC} = 2.0V	–	1000	ns/V
		V_{CC} = 4.5V	–	500	
		V_{CC} = 6.0V	–	400	–
T_A	Operating free-air temperature	–	-40	+125	°C

Note: 5. Unused inputs should be held at V_{CC} or Ground.

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	High-level Input Voltage	–	2.0V	1.5	1.2	–	1.5	–	1.5	–	V
		–	4.5V	3.15	2.4	–	3.15	–	3.15	–	
		–	6.0V	4.2	3.2	–	4.2	–	4.2	–	
V_{IL}	Low-level input voltage	–	2.0V	–	0.8	0.5	–	0.5	–	0.5	V
		–	4.5V	–	2.1	1.35	–	1.35	–	1.35	
		–	6.0V	–	2.8	1.8	–	1.8	–	1.8	
V_{OH}	High Level Output Voltage	I_{OH} = -20μA All outputs	2.0V	1.9	2.0	–	1.9	–	1.9	–	V
			4.5V	4.4	4.5	–	4.4	–	4.4	–	
			6.0V	5.9	6.0	–	5.9	–	5.9	–	
	Q7S output	I_{OH} = -4mA	4.5V	3.98	4.32	–	3.84	–	3.7	–	
		I_{OH} = -5.2mA	6.0V	5.48	5.81	–	5.34	–	5.2	–	
	Qn Bus Outputs	I_{OH} = -6.0mA	4.5V	3.98	4.32	–	3.84	–	3.7	–	
		I_{OH} = -7.8mA	6.0V	5.48	5.81	–	5.34	–	5.2	–	
V_{OL}	Low-level Output Voltage	I_{OL} = 20μA All outputs	2.0V	–	0	0.1	–	0.1	–	0.1	V
			4.5V	–	0	0.1	–	0.1	–	0.1	
			6.0V	–	0	0.1	–	0.1	–	0.1	
	Q7S output	I_{OL} = 4.0mA	4.5V	–	.15	0.26	–	0.33	–	0.4	
		I_{OL} = 5.2mA	6.0V	–	.16	0.26	–	0.33	–	0.4	
	Qn Bus Outputs	I_{OL} = 6.0mA	4.5V	–	.15	0.26	–	0.33	–	0.4	
		I_{OL} = 7.8mA	6.0V	–	.16	0.26	–	0.33	–	0.4	
I_I	Input Current	V_I = GND to 5.5V	6.0V	–	–	±0.1	–	± 1	–	± 1	μA
I_{CC}	Supply Current	V_I = GND or V_{CC} I_O = 0	6.0V	–	–	8.0	–	80	–	160	μA
C_i	Input Capacitance	V_i = V_{CC} – or GND	6.0V	–	3.5	10	–	10	–	10	pF

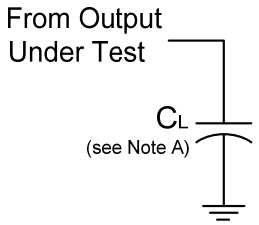
Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V_{CC} = 5V	Unit
			Typ	
C_{pd}	Power dissipation capacitance	f = 1 MHz all outputs switching-no load	51	pF

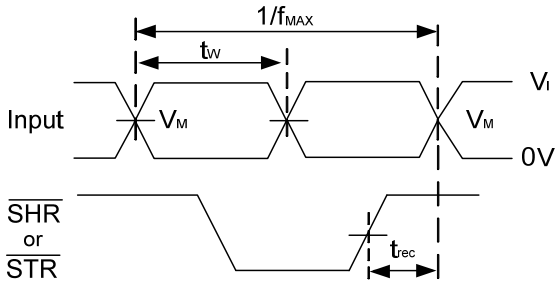
Switching Characteristics

Symbol / Parameter	Pins	Test Conditions	V_{CC}	T_A = +25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
f_{MAX} Maximum Frequency	SHCP or STCP	Figure 2	2.0V	6	30	–	4.8	–	4	–	MHz
			4.5V	30	92	–	24	–	20	–	
			5.0V		100	–		–		–	
			6.0V	35	109	–	28	–	24	–	
t_W Pulse Width	SHCP HIGH or LOW	Figure 2	2.0V	80	10	–	100	–	120	–	ns
			4.5V	16	4	–	20	–	24	–	
			6.0V	14	3	–	17	–	20	–	
	STCP HIGH or LOW	Figure 2	2.0V	80	10	–	100	–	120	–	
			4.5V	16	4	–	20	–	24	–	
			6.0V	14	3	–	17	–	20	–	
	$\overline{SHR}$ and $\overline{STR}$ HIGH or LOW	Figure 2	2.0V	80	14	–	100	–	120	–	
			4.5V	16	5	–	20	–	24	–	
			6.0V	14	4	–	17	–	20	–	
t_{SU} Set-up Time	DS to SHCP	Figure 2	2.0V	100	10	–	125	–	150	–	ns
			4.5V	20	4	–	25	–	30	–	
			6.0V	17	3	–	21	–	26	–	
	$\overline{SHR}$ to STCP	Figure 2	2.0V	100	14	–	125	–	150	–	ns
			4.5V	20	5	–	25	–	30	–	
			6.0V	17	4	–	21	–	26	–	
	SHCP to STCP	Figure 2	2.0V	100	17	–	125	–	150	–	ns
			4.5V	20	6	–	25	–	30	–	
			6.0V	17	5	–	21	–	26	–	
t_{PD} Propagation Delay	SHCP to Q7S	Figure 2	2.0V	–	44	150	–	185	–	225	ns
			4.5V	–	16	30	–	37	–	45	
			5.0V	–	13	–	–	–	–	–	
			6.0V	–	14	26	–	31	–	38	
	STCP to Qn	Figure 2	2.0V	–	44	150	–	185	–	225	ns
			4.5V	–	16	30	–	37	–	45	
			5.0V	–	13	–	–	–	–	–	
			6.0V	–	14	26	–	31	–	38	
t_H Hold Time	DS to SHCP	Figure 2	2.0V	25	-8	–	30	–	35	–	ns
			4.5V	5	-3	–	6	–	7	–	
			6.0V	4	-2	–	5	–	6	–	
t_{REC} Recovery Time	$\overline{SHR}$ to SHCP and $\overline{STR}$ to STCP	Figure 2	2.0V	50	-14	–	65	–	75	–	ns
			4.5V	10	-5	–	13	–	15	–	
			6.0V	9	-4	–	11	–	13	–	
t_{PHL} Propagation Delay	$\overline{SHR}$ to Q7S	Figure 2	2.0V	–	39	150	–	185	–	225	ns
			4.5V	–	14	30	–	37	–	45	
			5.0V	–	11	–	–	–	–	–	
			6.0V	–	12	26	–	31	–	38	
	$\overline{STR}$ to Qn	Figure 2	2.0V	–	39	125	–	155	–	185	ns
			4.5V	–	14	25	–	31	–	37	
			5.0V	–	11	–	–	–	–	–	
			6.0V	–	12	21	–	26	–	31	
t_{THL} Transition Time	Serial data output Q7S	Figure 2	2.0V	–	19	75	–	95	–	110	ns
			4.5V	–	7	15	–	19	–	22	
			6.0V	–	6	13	–	16	–	19	
	Parallel Data Outputs Q_N	Figure 2	2.0V	–	14	60	–	75	–	90	ns
			4.5V	–	5	12	–	15	–	18	
			6.0V	–	4	10	–	13	–	15	

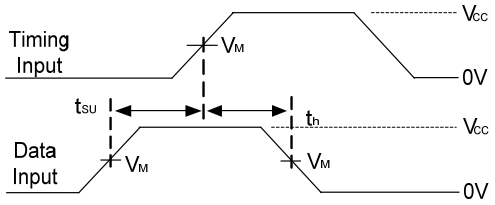
Parameter Measurement Information



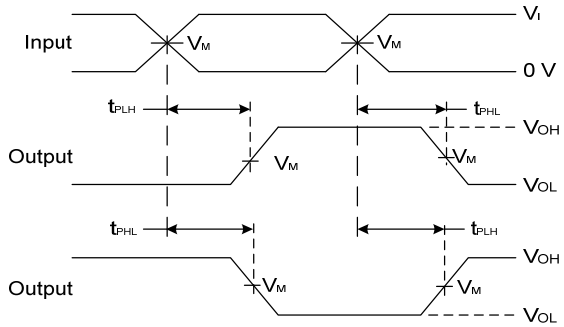
V_{CC}	Inputs		V_M	C_L
	V_I	t_r/t_f		
2.0V	V_{CC}	6ns	$V_{CC}/2$	50pF
4.5V	V_{CC}	6ns	$V_{CC}/2$	50pF
5.0V	V_{CC}	6ns	$V_{CC}/2$	15pF
6.0V	V_{CC}	6ns	$V_{CC}/2$	50pF



Voltage Waveform
Pulse Duration and Recovery Time



Voltage Waveform
Set-up and Hold Times

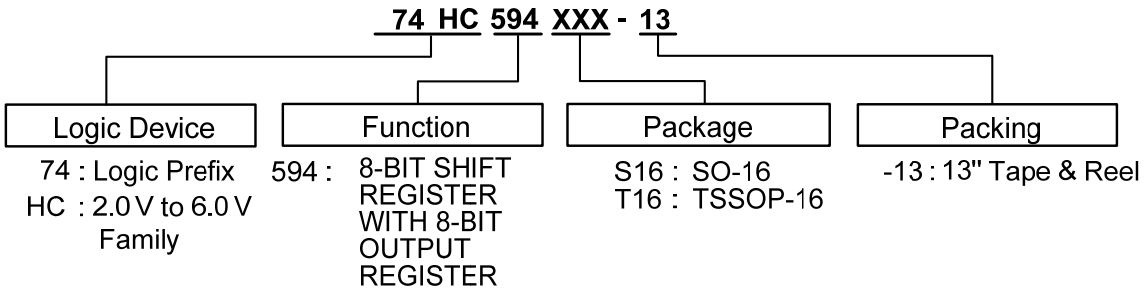


Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs

Notes:
A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
C. Inputs are measured separately one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{PD}.

Figure 2 Load Circuit and Voltage Waveforms

Ordering Information

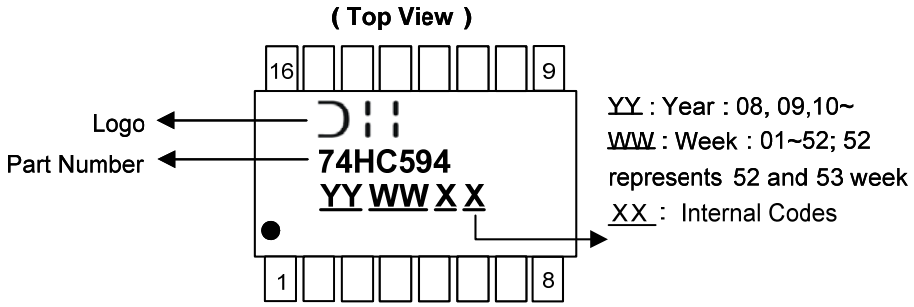


Part Number	Package Code	Packaging	7" Tape and Reel (Note 6)	
			Quantity	Part Number Suffix
74HC594S16-13	S16	SO-16	2500/Tape & Reel	-13
74HC594T16-13	T16	TSSOP-16	2500/Tape & Reel	-13

Note: 6. The taping orientation is located on our website at http://www.diodes.com/datasheets/ap02007.pdf

Marking Information

(1) SO-16, TSSOP16

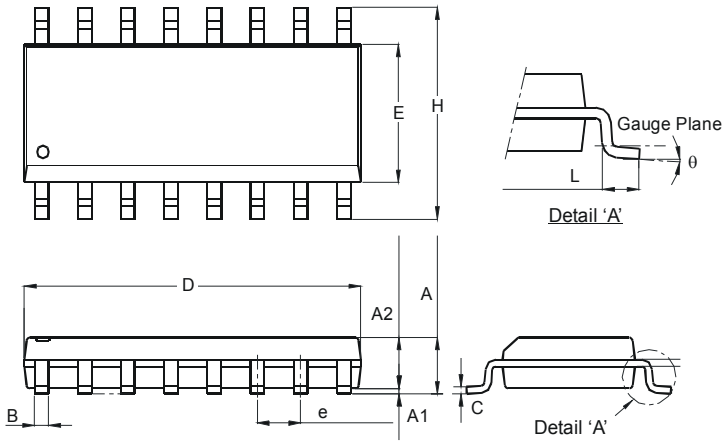


Part Number	Package
74HC594S16	SO-16
74HC594T16	TSSOP-16

Package Outline Dimensions (All dimensions in mm.)

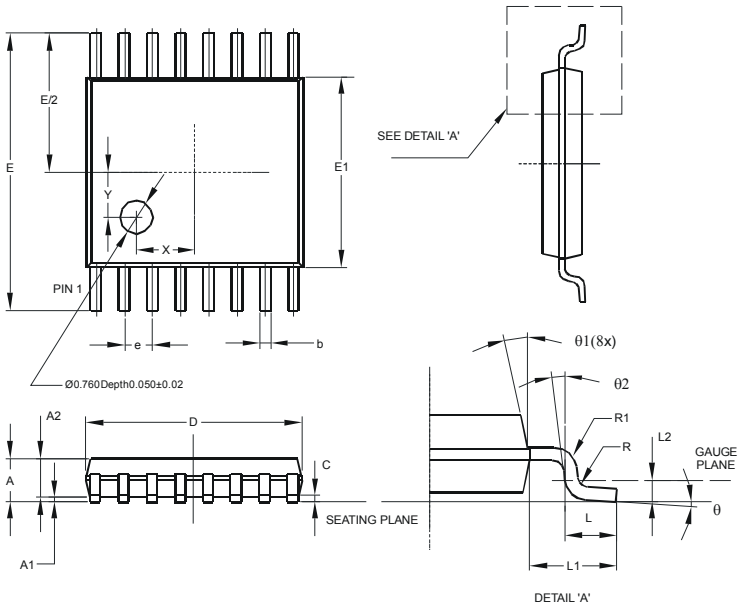
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: SO-16



SO-16		
Dim	**Min**	**Max**
A	1.40	1.75
A1	0.10	0.25
A2	1.30	1.50
B	0.33	0.51
C	0.19	0.25
D	9.80	10.00
E	3.80	4.00
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

Package Type: TSSOP-16

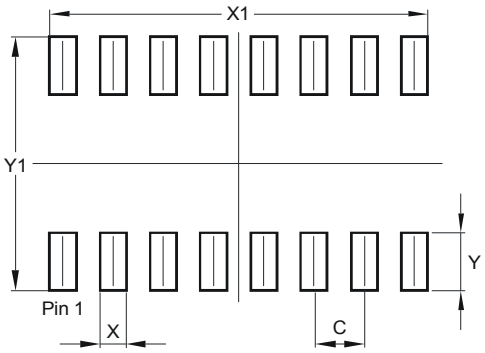


TSSOP-16			
Dim	**Min**	**Max**	**Typ**
A	-	1.08	-
A1	0.05	0.15	-
A2	0.80	0.93	-
b	0.19	0.30	-
c	0.09	0.20	-
D	4.90	5.10	-
E	6.40 BSC		
E1	4.30	4.50	-
e	0.65 BSC		
L	0.45	0.75	-
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
R1	0.09	-	-
X	-	-	1.350
Y	-	-	1.050
θ	0°	8°	-
θ1	5°	15°	-
θ2	0°	-	-
All Dimensions in mm			

Suggested Pad Layout

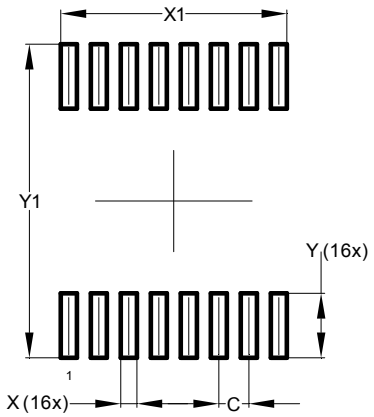
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

Package Type: SO-16



Dimensions	Value (in mm)
C	1.270
X	0.670
X1	9.560
Y	1.450
Y1	6.400

Package Type: TSSOP-16



Dimensions	Value (in mm)
C	0.650
X	0.350
X1	4.900
Y	1.400
Y1	6.800

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