

## 8-BIT SHIFT REGISTER (SERIAL INPUT, 3S PARALLEL OUTPUT WITH LATCHES)

### DESCRIPTION

SC74HC595 utilizes advanced CMOS technology, and has 8-bit shift register with serial input, serial/parallel output and 8-bit tri-state output flip-latch. The pin configuration is in accord with the 54LS/74LS series, and the operating speed is similar to 54LS/74LS. This circuit has the protecting circuit for all the inputs and outputs to avoid the damage caused by the static discharge. And it has the ability of driving load and features high noise immunity.

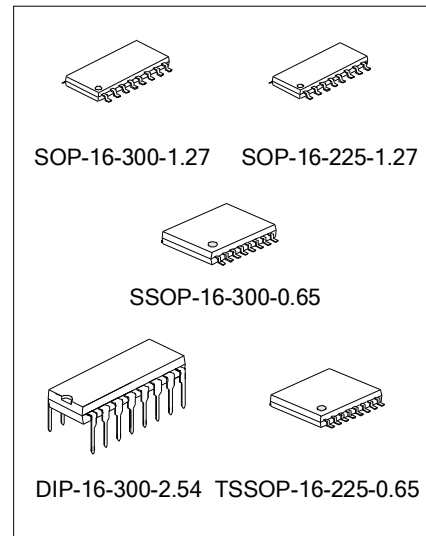
The register and flip-latch both have separate clock inputs (SCK and RCK). The serial input data (IS) is stored into register at the rising edge of SCK; the data of register is stored into flip-latch at the rising edge of RCK. The low level of clear port ( $\overline{\text{SCLR}}$ ) only reset the register, and is no effect to flip-latch. When the control enable ( $\overline{\text{G}}$ ) is high level, the parallel-out is level Z.

### FEATURES

- \* Wide operating voltage range      2~6V
- \* Low input current                      1 $\mu$ A
- \* High output driving ability          15 LS-TTL loads
- \* High operating speed(Typical)       $f_{\text{max}}=55\text{MHz}$  ( $V_{\text{CC}}=5\text{V}$ )
- \* Low supply current                    80 $\mu$ A

### APPLICATIONS

- \* LED screen



### ORDERING INFORMATION

Device	Package
SC74HC595	DIP-16-300-2.54
SC74HC595A	SOP-16-225-1.27
SC74HC595B	SOP-16-300-1.27
SC74HC595C	TSSOP-16-225-0.65
SC74HC595D	SSOP-16-300-0.65

### RECOMANDED OPERATING CONDITIONS

Characteristics	Symbol	Ratings		Unit
Power Supply Voltage	$V_{\text{CC}}$	2~6		V
Input Voltage	$V_{\text{IN}}$	0~ $V_{\text{CC}}$		V
Output Voltage	$V_{\text{OUT}}$	0~ $V_{\text{CC}}$		V
Operating Temperature	$T_{\text{opr}}$	-40~+85		$^{\circ}\text{C}$
Input Rise and Fall Time	$T_{\text{r}}, T_{\text{f}}$	$V_{\text{CC}}=2.0\text{V}$	0~1000	ns
		$V_{\text{CC}}=4.5\text{V}$	0~500	ns
		$V_{\text{CC}}=6.0\text{V}$	0~400	ns

**DC ELECTRICAL CHARACTERISTICS** ( $T_{amb}=25^{\circ}C$ )

Characteristics	Symbol	Testing conditions			Min.	Typ.	Max.	Unit
		VCC(V)	Conditions					
High Level Input Voltage	V <sub>IH</sub>	2.0			1.5	--	--	V
		4.5			3.15	--	--	
		6.0			4.2	--	--	
Low Level Input Voltage	V <sub>IL</sub>	2.0			--	--	0.5	V
		4.5			--	--	1.35	
		6.0			--	--	1.8	
High Level Output Voltage (OH')	V <sub>OH</sub>	2.0	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>O</sub> =-20μA	1.9	2.0	--	V
		4.5			4.4	4.5	--	
		6.0			5.9	6.0	--	
		4.5		I <sub>O</sub> =-4.0mA	4.18	4.31	--	
		6.0		I <sub>O</sub> =-5.2mA	5.68	5.8	--	
High Level Output Voltage (QA~QH)	V <sub>OH</sub>	2.0	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>O</sub> =-20μA	1.9	2.0	--	V
		4.5			4.4	4.5	--	
		6.0			5.9	6.0	--	
		4.5		I <sub>O</sub> =-6.0mA	4.18	4.31	--	
		6.0		I <sub>O</sub> =-7.8mA	5.68	5.8	--	
Low Level Output Voltage (OH')	V <sub>OL</sub>	2.0	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>O</sub> =20μA	--	0.0	0.1	V
		4.5			--	0.0	0.1	
		6.0			--	0.0	0.1	
		4.5		I <sub>O</sub> =4.0mA	--	0.17	0.26	
		6.0		I <sub>O</sub> =5.2mA	--	0.18	0.26	
Low Level Output Voltage (QA~QH)	V <sub>OL</sub>	2.0	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>O</sub> =20μA	--	0.0	0.1	V
		4.5			--	0.0	0.1	
		6.0			--	0.0	0.1	
		4.5		I <sub>O</sub> =6.0mA	--	0.17	0.26	
		6.0		I <sub>O</sub> =7.8mA	--	0.18	0.26	
Input Leakage Current	I <sub>I</sub>	6.0	V <sub>IN</sub> =V <sub>CC</sub> or GND		--	--	±0.1	μA
Tri-state Output Current	I <sub>OZ</sub>	6.0	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> =V <sub>CC</sub> or GND		--	--	±0.5	μA
Quiescent Supply Current	I <sub>CC</sub>	6.0	V <sub>IN</sub> =V <sub>CC</sub> or GND		-	--	4	μA

**DC ELECTRICAL CHARACTERISTICS** ( $T_{amb}=-40\sim 85^{\circ}\text{C}$ )

Characteristics	Symbol	Testing conditions		Min.	Typ.	Max.	Unit	
		Vcc(V)	Conditions					
High Level Input Voltage	$V_{IH}$	2.0		1.5	--	--	V	
		4.5		3.15	--	--		
		6.0		4.2	--	--		
Low Level Input Voltage	$V_{IL}$	2.0		--	--	0.5	V	
		4.5		--	--	1.35		
		6.0		--	--	1.8		
High Level Output Voltage (OH')	$V_{OH}$	2.0	$V_{IN}=V_{IH}$ or $V_{IL}$	$I_O=-20\mu\text{A}$	1.9	--	--	V
		4.5			4.4	--	--	
		6.0			5.9	--	--	
		4.5		$I_O=-4.0\text{mA}$	4.13	--	--	
		6.0		$I_O=-5.2\text{mA}$	5.63	--	--	
High Level Output Voltage (QA~QH)	$V_{OH}$	2.0	$V_{IN}=V_{IH}$ or $V_{IL}$	$I_O=-20\mu\text{A}$	1.9	--	--	V
		4.5			4.4	--	--	
		6.0			5.9	--	--	
		4.5		$I_O=-6.0\text{mA}$	4.13	--	--	
		6.0		$I_O=-7.8\text{mA}$	5.63	--	--	
Low Level Output Voltage (OH')	$V_{OL}$	2.0	$V_{IN}=V_{IH}$ or $V_{IL}$	$I_O=20\mu\text{A}$	--	--	0.1	V
		4.5			--	--	0.1	
		6.0			--	--	0.1	
		4.5		$I_O=4.0\text{mA}$	--	--	0.33	
		6.0		$I_O=5.2\text{mA}$	--	--	0.33	
Low Level Output Voltage (QA~QH)	$V_{OL}$	2.0	$V_{IN}=V_{IH}$ or $V_{IL}$	$I_O=20\mu\text{A}$	--	--	0.1	V
		4.5			--	--	0.1	
		6.0			--	--	0.1	
		4.5		$I_O=6.0\text{mA}$	--	--	0.33	
		6.0		$I_O=7.8\text{mA}$	--	--	0.33	
Input Leakage Current	$I_I$	6.0	$V_{IN}=V_{CC}$ or GND		--	--	$\pm 0.1$	$\mu\text{A}$
Tri-state Output Current	$I_{OZ}$	6.0	$V_{IN}=V_{IH}$ or $V_{IL}$ $V_{OUT}=V_{CC}$ or GND		--	--	$\pm 0.5$	$\mu\text{A}$
Quiescent Supply Current	$I_{CC}$	6.0	$V_{IN}=V_{CC}$ or GND		--	--	4	$\mu\text{A}$

**AC ELECTRICAL CHARACTERISTICS**(CL=50pF, INPUT Tr=Tf=6ns, Tamb=25°C)

Characteristics	Symbol	Testing conditions			Min.	Typ.	Max.	Unit	
		Vcc(V)	CL(pF)						
Output Transition Time (Qn)	tTLH tTHL	2.0	50		--	25	60	ns	
		4.5		--	7	12			
		6.0		--	6	10			
Output Transition Time (QH')	tTLH tTHL	2.0	50		--	30	75	ns	
		4.5		--	8	15			
		6.0		--	7	13			
Propagation Delay Time(SCK-QH')	tPLH tPHL	2.0	50		--	45	125	ns	
		4.5		--	15	25			
		6.0		--	13	21			
Propagation Delay Time (SCLR-QH')	tPLH tPHL	2.0	50		--	60	175	ns	
		4.5		--	18	35			
		6.0		--	15	30			
Propagation Delay Time (RCK-QN)	tPLH tPHL	2.0	50		--	60	150	ns	
		4.5		--	20	30			
		6.0		--	17	26			
			2.0	150		--	75	190	ns
			4.5		--	25	38		
			6.0		--	22	32		
Tri-state Output Enable Time	tPZL tPZH	2.0	50	RL=1kΩ	--	45	135	ns	
		4.5		--	15	27			
		6.0		--	13	23			
			2.0	150	RL=1kΩ	--	60	175	ns
			4.5		--	20	35		
			6.0		--	17	30		
Tri-state Output Disable Time	tPLZ tPHZ	2.0	50	RL=1kΩ	--	30	150	ns	
		4.5		--	15	30			
		6.0		--	14	26			
Maximum Clock	fMAX	2.0	50		6.0	17	--	ns	
		4.5		30	50	--			
		6.0		35	59	--			
		2.0	150		5.2	14	--	ns	
		4.5		26	40	--			
		6.0		31	45	--			

(To be continued)

(Continued)

Characteristics	Symbol	Testing conditions			Min.	Typ.	Max.	Unit
		Vcc(V)	CL(pF)					
Minimum Pulse Width (SCK, RCK)	tw(H)	2.0	50		--	17	75	ns
		4.5		--	6	15		
		6.0		--	6	13		
Minimum Pulse Width (SCLR)	tw(L)	2.0	50		--	20	75	ns
		4.5		--	6	15		
		6.0		--	6	13		
Minimum Set-up Time (SI-SCK)	ts	2.0	50		--	25	50	ns
		4.5		--	5	10		
		6.0		--	4	9		
Minimum Set-up Time (SCK-RCK)	ts	2.0	50		--	35	75	ns
		4.5		--	8	15		
		6.0		--	6	13		
Minimum Set-up Time (SCLR-RCK)	ts	2.0	50		--	40	100	ns
		4.5		--	10	20		
		6.0		--	7	17		
Minimum Hold Time	tH	2.0	50		--	--	0	ns
		4.5		--	--	0		
		6.0		--	--	0		
Minimum Clear Time	tREM	2.0	50		--	15	50	ns
		4.5		--	3	10		
		6.0		--	3	9		
Input Capacitance	CIN				--	5	10	pF
Power Dissipation Capacitance	CPD(*)				--	184		pF

(\*): CPD is defined as the internal equivalent capacitance of the IC. It is calculated from the operating current without load; and the average operating current can be obtained by the equation:  $I_{CC} (opr) = CPD * f_{IN} + I_{CC}$ .

**AC ELECTRICAL CHARACTERISTICS**( $C_L=50\text{pF}$ , INPUT  $T_r=T_f=6\text{ns}$ ,  $T_{\text{amb}}=-40\sim 85^\circ\text{C}$ )

Characteristics	Symbol	Testing conditions			Min.	Typ.	Max.	Unit	
		Vcc(V)	CL(pF)						
Output Transition Time (Qn)	tTLH tTHL	2.0	50		--	--	75	ns	
		4.5			--	--	15		
		6.0			--	--	13		
Output Transition Time (QH')	tTLH tTHL	2.0	50		--	--	95	ns	
		4.5			--	--	19		
		6.0			--	--	16		
Propagation Delay Time (SCK-QH')	tPLH tPHL	2.0	50		--	--	155	ns	
		4.5			--	--	31		
		6.0			--	--	66		
Propagation Delay Time (SCLR-QH')	tPLH tPHL	2.0	50		--	--	220	ns	
		4.5			--	--	44		
		6.0			--	--	37		
Propagation Delay Time (RCK-QN)	tPLH tPHL	2.0	50		--	--	190	ns	
		4.5			--	--	38		
		6.0			--	--	32		
			2.0	150		--	--	240	ns
			4.5			--	--	48	
			6.0			--	--	41	
Tri-state Output Enable Time	tPZL tPZH	2.0	50	RL=1kΩ	--	--	170	ns	
		4.5			--	--	34		
		6.0			--	--	29		
			2.0	150	RL=1kΩ	--	--	220	ns
			4.5			--	--	44	
			6.0			--	--	37	
Tri-state Output Disable Time	tPLZ tPHZ	2.0	50	RL=1kΩ	--	--	190	ns	
		4.5			--	--	38		
		6.0			--	--	32		
Maximum Clock	fMAX	2.0	50		4.8	--	--	ns	
		4.5			24	--	--		
		6.0			28	--	--		
		2.0	150		4.2	--	--	ns	
		4.5			21	--	--		
		6.0			25	--	--		

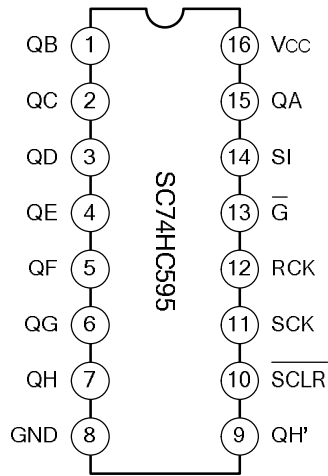
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Characteristics	Symbol	Testing conditions			Min.	Typ.	Max.	Unit
		Vcc(V)	CL(pF)					
Minimum Pulse Width (SCK, RCK)	tw(H)	2.0	50		--	--	95	ns
		4.5		--	--	19		
		6.0		--	--	16		
Minimum Pulse Width (SCLR)	tw(L)	2.0	50		--	--	95	ns
		4.5		--	--	19		
		6.0		--	--	16		
Minimum Set-up Time (SI-RCK)	ts	2.0	50		--	--	65	ns
		4.5		--	--	13		
		6.0		--	--	11		
Minimum Set-up Time (SCK-RCK)	ts	2.0	50		--	--	95	ns
		4.5		--	--	19		
		6.0		--	--	16		
Minimum Set-up Time (SCLR-RCK)	ts	2.0	50		--	--	125	ns
		4.5		--	--	25		
		6.0		--	--	21		
Minimum Hold Time	tH	2.0	50		--	--	0	ns
		4.5		--	--	0		
		6.0		--	--	0		
Minimum Clear Time	tREM	2.0	50		--	--	65	ns
		4.5		--	--	13		
		6.0		--	--	11		
Input Capacitance	CIN				--	--	10	pF
Power Dissipation Capacitance	CPD(*)				--	--	--	pF

(\*): CPD is defined as the internal equivalent capacitance of the IC. It is calculated from the operating current without load; and the average operating current can be obtained by the equation:  $I_{CC} (opr) = CPD * f_{IN} + I_{CC}$ .

**PIN CONFIGURATION**

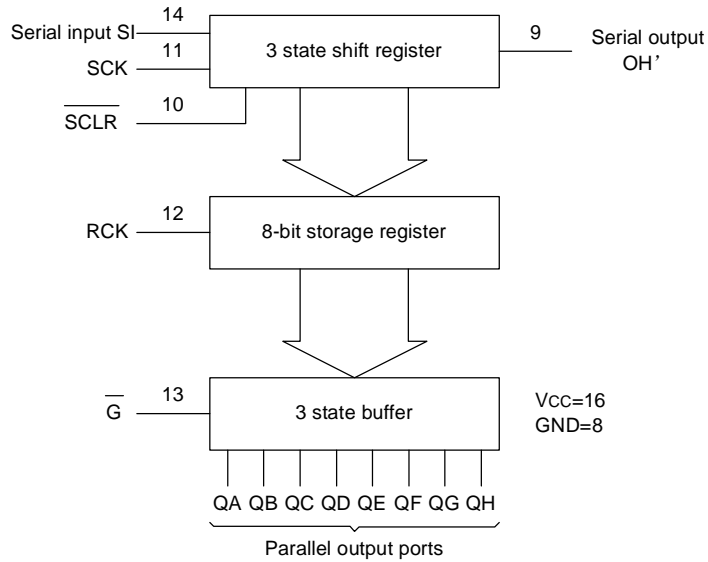


**PIN DESCRIPTION**

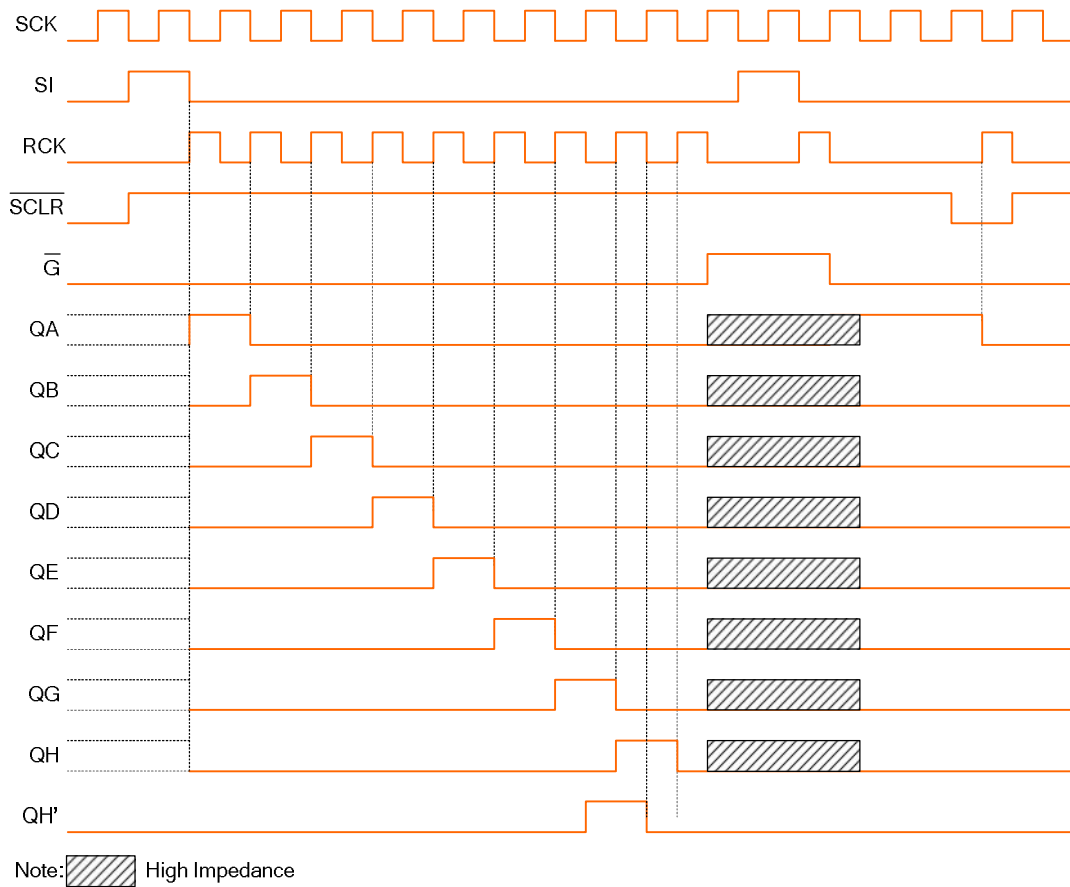
Pin no.	Name	I/O	Pin description
1~7, 15	QA ~ QH	O	Parallel data output
9	QH'	O	Serial data output
10	SCLR	I	Reset signal of register
11	SCK	I	Register clock
13	$\bar{G}$	I	Data output enable
14	SI	I	Serial data input
12	RCK	I	Flip-latch clock
8	GND	I/O	Ground
16	VCC	I/O	Power supply







**LOGIC DIAGRAM**



**TIMING CHART**



TRUTH TABLE

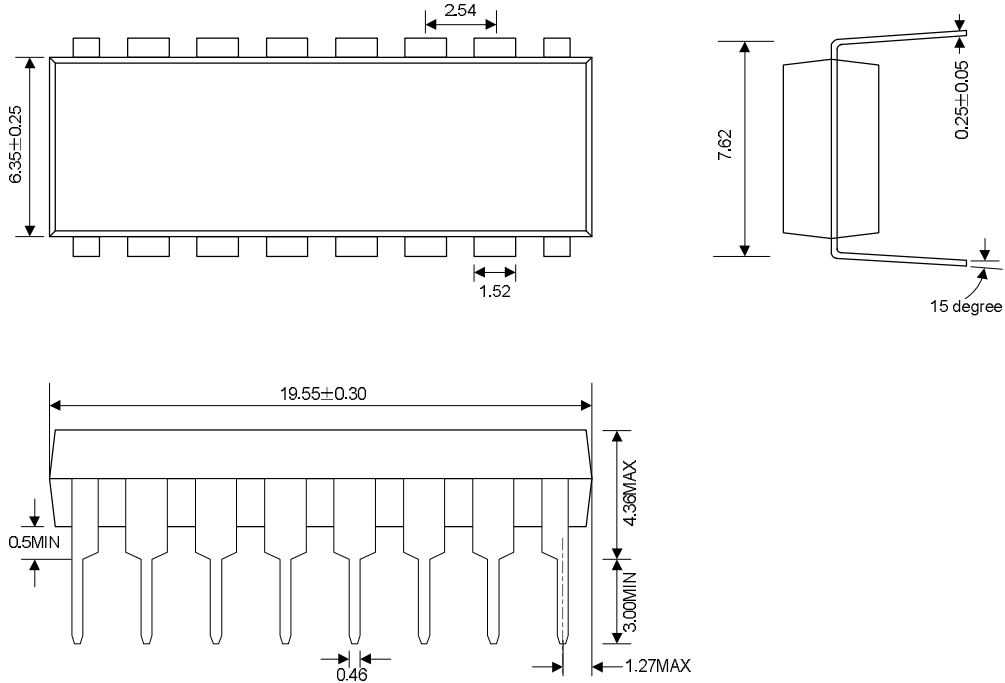
Input					Output
SI	SCK	$\overline{\text{SCLR}}$	RCK	$\overline{\text{G}}$	
X	X	X	X	H	QA ~QH outputs disable
X	X	X	X	L	QA ~QH outputs enable
X	X	L	X	X	Register reset
X		H	X	X	Storage the data into register at the rising edge of SCK
X		H	X	X	The state of register is unchangeable
X	X	X		X	Storage the data into flip-latch at the rising edge of RCK
X	X	X		X	The state of flip-latch is unchangeable

X: irrelevant

**PACKAGE OUTLINE**

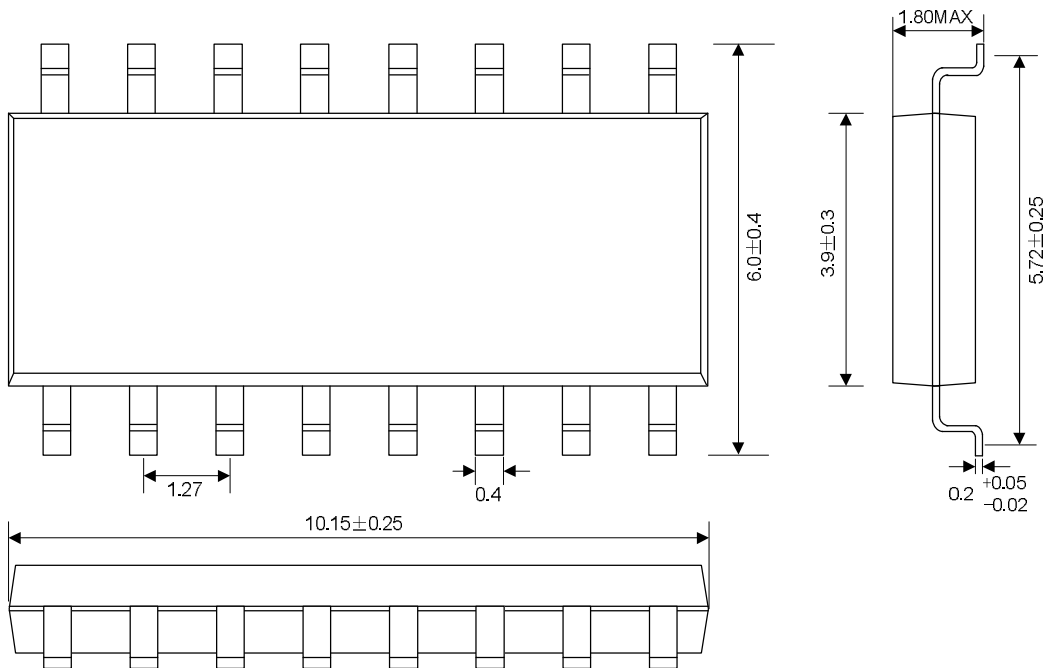
**DIP-16-300-2.54**

**UNIT: mm**



**SOP-16-225-1.27**

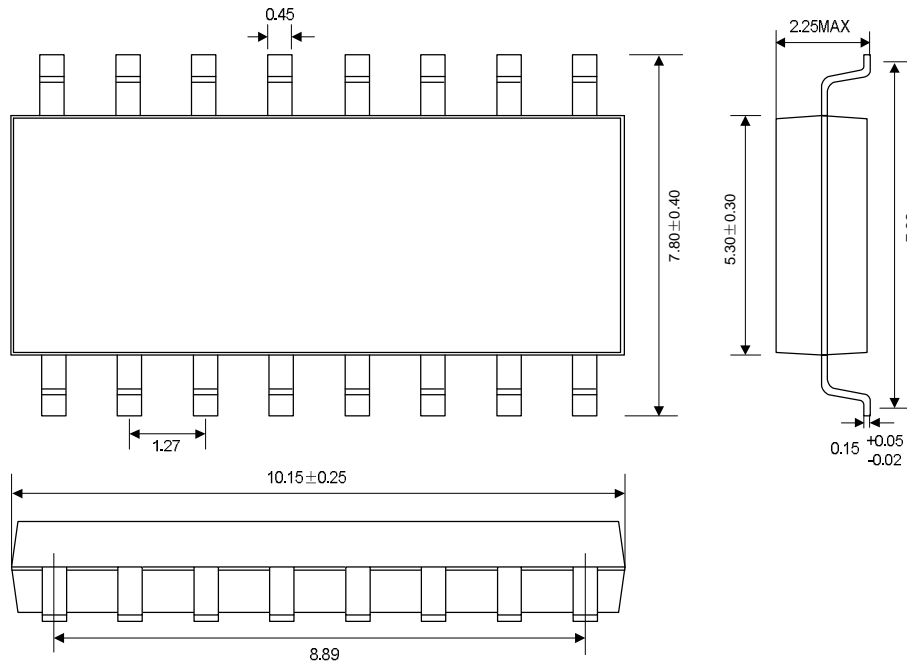
**UNIT: mm**



**PACKAGE OUTLINE**

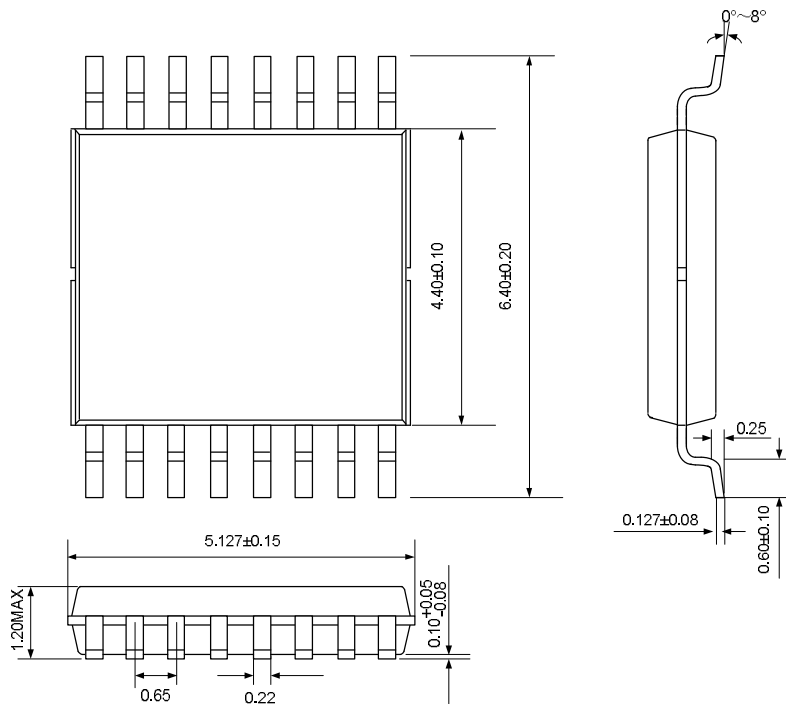
SOP-16-300-1.27

UNIT: mm



TSSOP-16-225-0.65

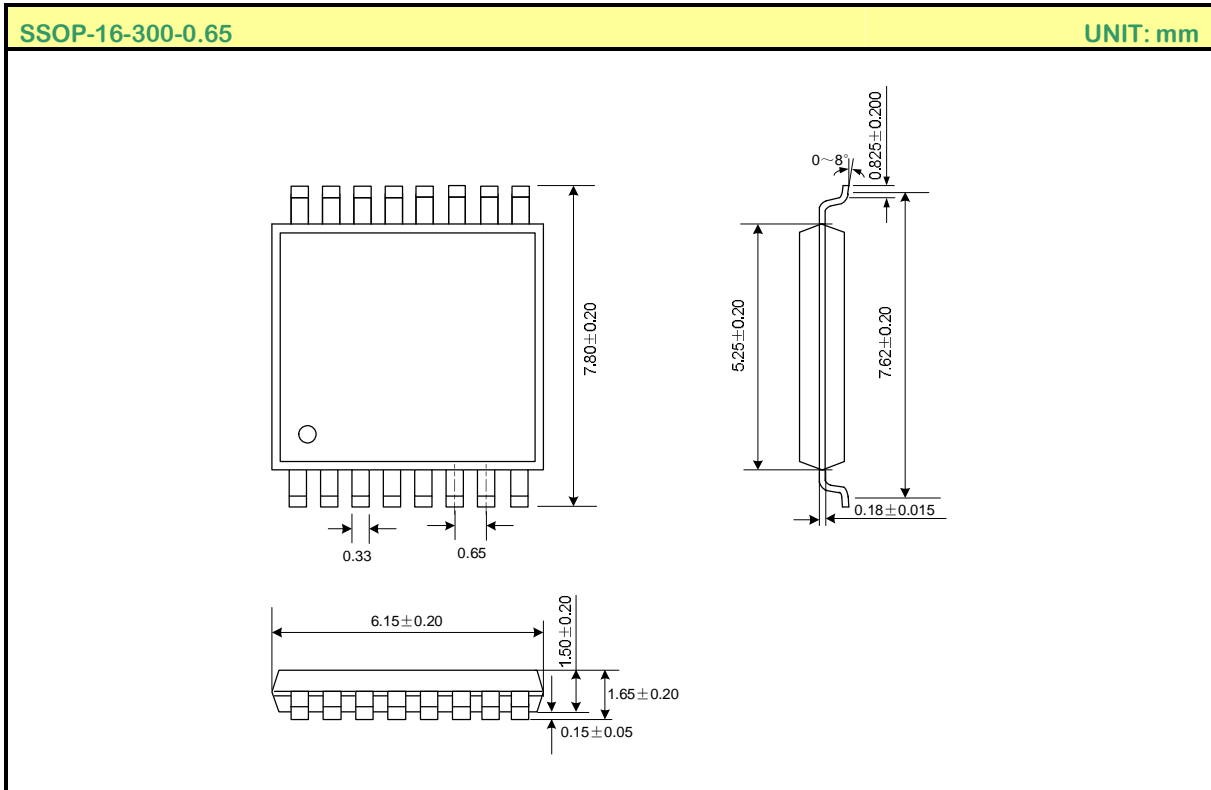
UNIT: mm



**PACKAGE OUTLINE**

SSOP-16-300-0.65

UNIT: mm



**HANDLING MOS DEVICES:**

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.