

# DATA SHEET

## **74F598**

8-bit shift register with input storage registers (3-State)

Product specification

1991 Oct 21

IC15 Data Handbook

# 8-bit shift register with input storage registers (3-State)

74F598

## FEATURES

- High impedance PNP base input for reduced loading (20µA in High and Low states)
- 8-bit parallel storage register
- Shift register has asynchronous direct overriding reset
- Shift load  $\overline{\text{SHLD}}$  is functional when SHCP is Low and locked out when SHCP is High.
- Guaranteed shift frequency DC to 105MHz
- Parallel 3-State I/O storage register inputs and shift register parallel outputs

## DESCRIPTION

The 74F598 consists of an 8-bit storage register feeding a parallel-in/serial-in, parallel-out/serial-out 8-bit shift register. Both the storage register and shift register have positive edge-triggered clocks. The shift register has asynchronous reset and when SHCP is Low, it has asynchronous load.

The shift register load function has been modified to load when both  $\overline{\text{SHLD}}$  and SHCP are Low. When SHCP is High the shift register load operation is not performed. Data will be properly shifted on the rising edge of SHCP when  $\overline{\text{SHLD}}$  is High.

TYPE	TYPICAL SHCP $f_{\text{max}}$	TYPICAL SUPPLY CURRENT (TOTAL)
74F598	100MHz	75mA

## ORDERING INFORMATION

DESCRIPTION	ORDER CODE	PKG DWG #
	COMMERCIAL RANGE $V_{\text{CC}} = 5V \pm 10\%$ , $T_{\text{amb}} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$	
20-pin plastic DIP	N74F598N	SOT146-1
20-pin plastic SOL	N74F598D	SOT163-1

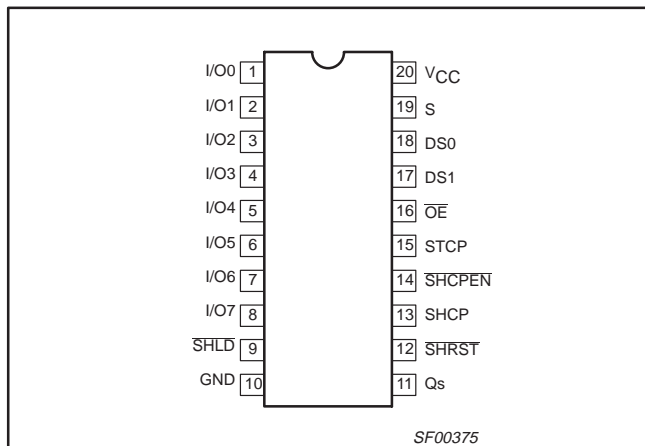
## INPUT AND OUTPUT LOADING AND FAN OUT TABLE

PINS	DESCRIPTION	74F (U.L.) High/Low	LOAD VALUE High/Low
I/On	Parallel data input	1.0/0.033	20µA/20µA
Ds0, Ds1	Serial data inputs	1.0/0.033	20µA/20µA
SHCP	Shift register clock pulse input	1.0/0.033	20µA/20µA
STCP	Storage register clock pulse input	1.0/0.033	20µA/20µA
SHCPEN	Shift register clock pulse enable input	1.0/0.033	20µA/20µA
SHLD	Shift register load input (active Low)	1.0/0.033	20µA/20µA
$\overline{\text{SHRST}}$	Shift register reset input (active Low)	1.0/0.033	20µA/20µA
S	Serial data select input	1.0/0.033	20µA/20µA
$\overline{\text{OE}}$	Output enable input	1.0/0.033	20µA/20µA
Qs	Serial data output	50/33	1.0mA/20mA
I/On	Parallel data outputs	150/40	3.0mA/24mA

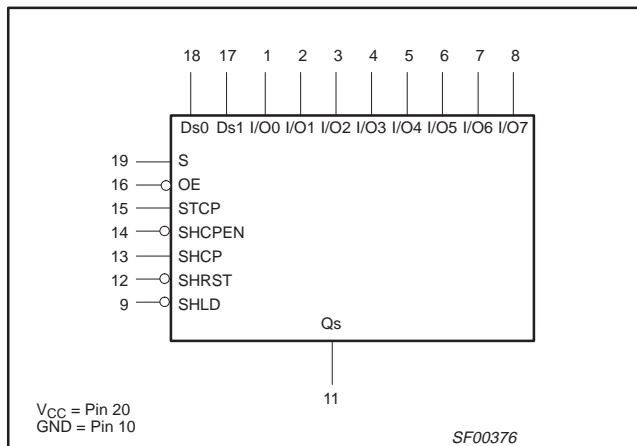
### Note to input and output loading and fan out table

1. One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

## PIN CONFIGURATION



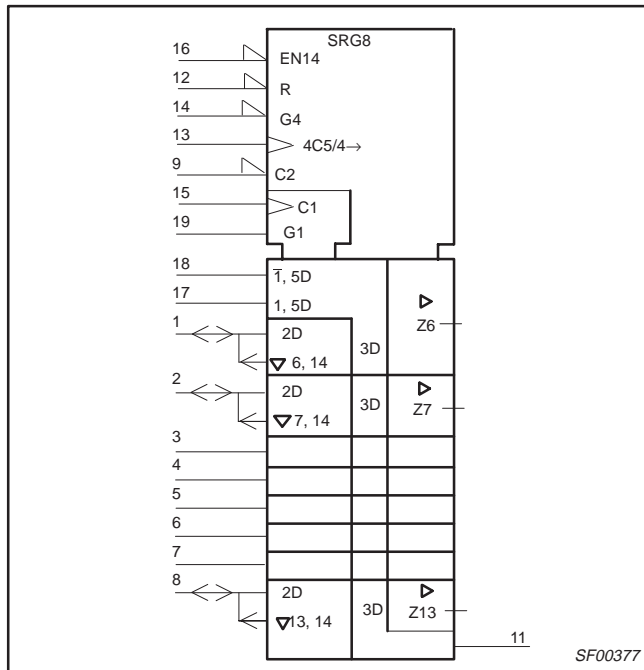
## LOGIC SYMBOL



# 8-bit shift register with input storage registers (3-State)

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## IEC/IEEE SYMBOL



## FUNCTION TABLE

INPUTS						INPUTS/OUTPUTS									OPERATING MODE
SHRST	STCP	SHCP	SHLD	S	OE*	I/O0	I/O1	I/O2	I/O3	I/O4	I/O5	I/O6	I/O7	Q7	
L	X	L	H	X	L	L	L	L	L	L	L	L	L	L	Clear shift register
L	X	L	L	X	L										Invalid, state of shift register indeterminate when signal is removed
X	↑	X	X	X	H	I0	I1	I2	I3	I4	I5	I6	I7	O7	Load data to storage register
H	X	↑	H	L	L	Ds0	O0	O1	O2	O3	O4	O5	O6	O6	Shift right
H	X	↑	H	H	L	Ds1	O0	O1	O2	O3	O4	O5	O6	O6	
H	↑	L	L	X	H	I0	I1	I2	I3	I4	I5	I6	I7	O7	Load data directly to shift register
H	↑	L	L	X	X	O0	O1	O2	O3	O4	O5	O6	O7	O7	Data transferred from storage register to shift register
X	X	X	X	X	H	Z	Z	Z	Z	Z	Z	Z	Z	NC	3-State
H	↑	X	H	X	X	NC	NC	NC	NC	NC	NC	NC	NC	NC	Hold
H	↑	H	X	X	X	NC	NC	NC	NC	NC	NC	NC	NC	NC	Hold (no storage or shift register load)

### Notes to function table

D0 – D7 = The level of the steady state inputs to the serial multiplexer.

H = High voltage level

I0 – I7 = The level of the steady state input at the respective I/O terminal is loaded into the flip-flop while the flip-flop outputs (except Q7) are isolated from the I/O terminal.

L = Low voltage level

NC = No change

O0 – O7 = The level of the respective Qn flip-flop prior to the last clock Low-to-High transition

X = Don't care

Z = High impedance "off" state

\* = When the OE input is High, all I/O terminals are at the High impedance state, sequential operation or cleaning of the register is not affected.

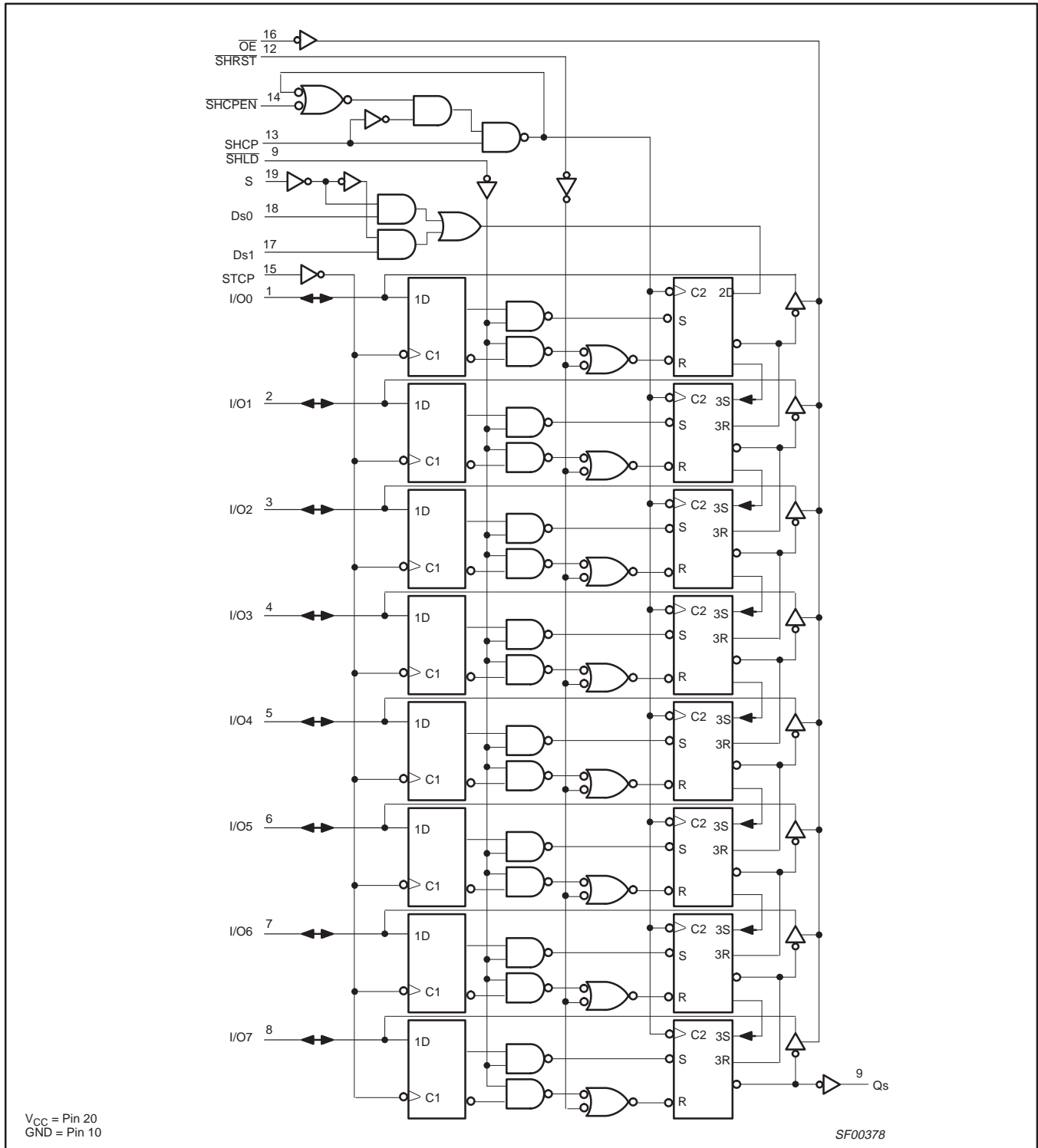
↑ = Low-to-High clock transition

↑ = Not Low-to-High clock transition

# 8-bit shift register with input storage registers (3-State)

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## LOGIC DIAGRAM



## 8-bit shift register with input storage registers (3-State)

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**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT	
$V_{CC}$	Supply voltage	-0.5 to +7.0	V	
$V_{IN}$	Input voltage	-0.5 to +7.0	V	
$I_{IN}$	Input current	-30 to +5	mA	
$V_{OUT}$	Voltage applied to output in High output state	-0.5 to $V_{CC}$	V	
$I_{OUT}$	Current applied to output in Low output state	Qs	40	mA
		I/O0 – I/O7	48	mA
$T_{amb}$	Operating free air temperature range	0 to +70	°C	
$T_{stg}$	Storage temperature range	-65 to +150	°C	

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5.0	5.5	V
$V_{IH}$	High-level input voltage	2.0			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{Ik}$	Input clamp current			-18	mA
$I_{OH}$	High-level output current	Qs		-1	mA
		I/O0 – I/O7		-3	mA
$I_{OL}$	Low-level output current	Qs		20	mA
		I/O0 – I/O7		24	mA
$T_{amb}$	Operating free air temperature range	0		+70	°C

## 8-bit shift register with input storage registers (3-State)

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**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS <sup>1</sup>			LIMITS			UNIT
						MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	Qs	V <sub>CC</sub> = MIN, V <sub>IH</sub> = MAX, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -1mA	±10%V <sub>CC</sub>	2.5			V	
				±5%V <sub>CC</sub>	2.7	3.4		V	
		I/On	V <sub>IH</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -3mA	±10%V <sub>CC</sub>	2.4			V	
				±5%V <sub>CC</sub>	2.7	3.3		V	
V <sub>OL</sub>	Low-level output voltage		V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX	±10%V <sub>CC</sub>		0.30	0.50	V	
				±5%V <sub>CC</sub>		0.30	0.50	V	
V <sub>IK</sub>	Input clamp voltage		V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-0.73	-1.2	V	
I <sub>I</sub>	Input current at maximum input voltage	others	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V				100	μA	
		I/On	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5V				1	mA	
I <sub>IH</sub>	High-level input current		V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V				20	μA	
I <sub>IL</sub>	Low-level input current		V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V				-20	μA	
I <sub>OZH</sub> + I <sub>IH</sub>	Off-state output current, High-level voltage applied	I/On	V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7V				70	μA	
		only	V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V				-70	μA	
I <sub>OZL</sub> + I <sub>IL</sub>	Off-state output current, Low-level voltage applied		V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V				-70	μA	
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>		V <sub>CC</sub> = MAX			-60		-150	mA
I <sub>CC</sub>	Supply current (total)	I <sub>CCH</sub>	V <sub>CC</sub> = MAX				68	100	mA
		I <sub>CCL</sub>					80	110	mA
		I <sub>CCZ</sub>					73	105	mA

**Notes to DC electrical characteristics**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, the use of High-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

## 8-bit shift register with input storage registers (3-State)

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## AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER		TEST CONDITION	LIMITS					UNIT
				T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
				MIN	TYP	MAX	MIN	MAX	
f <sub>max</sub>	Maximum clock frequency	SHCP	Waveform 1	85	100		70		MHz
		STCP		140	160		130		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay SHCP to Qs		Waveform 1	9.5 6.5	11.5 8.5	14.0 11.5	8.5 6.0	16.0 12.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay STCP to Qs (SHLD = Low)		Waveform 1	10.0 7.0	11.5 8.5	14.5 11.5	9.0 6.5	16.0 12.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay SHLD to Qs		Waveform 1	9.0 6.0	11.0 8.0	13.5 10.5	8.0 5.5	15.5 11.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay SHCP to I/On		Waveform 1	8.5 5.0	10.5 7.0	13.5 9.5	7.0 4.5	15.5 10.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay SHLD to I/On		Waveform 1	7.5 6.0	9.5 8.0	12.5 11.0	6.5 6.0	14.5 11.5	ns
t <sub>PHL</sub>	Propagation delay, $\overline{\text{SHRST}}$ to I/On		Waveform 2	6.5	9.0	12.0	6.0	12.5	ns
t <sub>PHL</sub>	Propagation delay, $\overline{\text{SHRST}}$ to Qs		Waveform 2	6.0	7.5	10.5	5.0	11.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output enable time to High or Low		Waveform 5 Waveform 6	3.5 3.0	5.5 5.0	8.5 7.5	3.0 2.5	9.5 8.5	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output disable time to High or Low		Waveform 5 Waveform 6	1.5 4.0	3.5 6.0	6.5 9.0	1.5 4.0	7.5 9.5	ns

## 8-bit shift register with input storage registers (3-State)

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## AC SETUP REQUIREMENTS

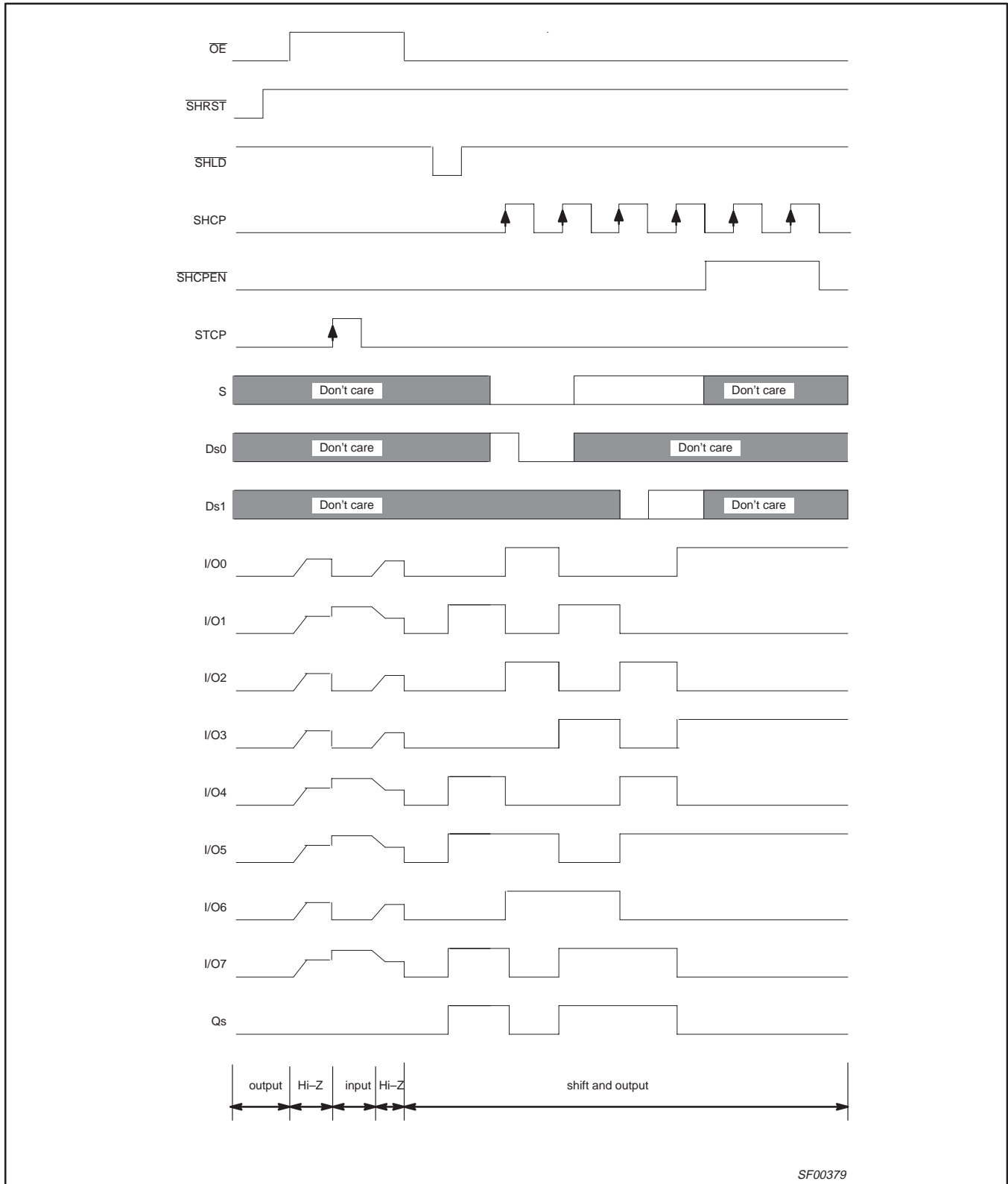
SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low Dsn to SHCP	Waveform 3	0.0 3.5			1.5 4.5		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low DSn to SHCP	Waveform 3	0.0 2.5			0.0 3.0		ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low I/On to STCP	Waveform 3	2.5 2.5			2.5 3.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low I/On to STCP	Waveform 3	0.0 0.0			1.5 2.0		ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low S to SHCP	Waveform 3	3.5 3.0			4.0 3.5		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low S to SHCP	Waveform 3	2.5 3.0			3.0 3.0		ns
t <sub>s</sub> (H)	Setup time, High, STCP to $\overline{\text{SHLD}}$	Waveform 4	7.0			8.0		ns
t <sub>h</sub> (L)	Hold time, Low, STCP to $\overline{\text{SHLD}}$ (hold mode)	Waveform 4	0.0			0.0		ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low, $\overline{\text{SHCPEN}}$ to SHCP	Waveform 3	0.0 2.0			0.0 2.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low, $\overline{\text{SHCPEN}}$ to SHCP	Waveform 3	0.0 4.5			0.0 5.5		ns
t <sub>s</sub> (H)	Setup time, High, $\overline{\text{SHLD}}$ to SHCP↑	Waveform 3	7.5			8.5		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	SHCP Pulse width, High or Low	Waveform 1	5.5 4.0			6.5 4.0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	STCP Pulse width, High or Low	Waveform 1	4.5 4.0			5.5 4.0		ns
t <sub>w</sub> (L)	$\overline{\text{SHRST}}$ Pulse width, Low	Waveform 1	4.0			4.0		ns
t <sub>w</sub> (L)	$\overline{\text{SHLD}}$ Pulse width, Low	Waveform 1	4.0			5.0		ns
t <sub>rec</sub>	Recovery time, $\overline{\text{SHRST}}$ to SHCP	Waveform 2	0.0			0.0		ns



# 8-bit shift register with input storage registers (3-State)

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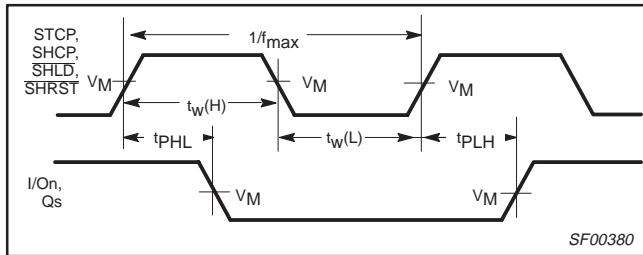
## TYPICAL TIMING DIAGRAM



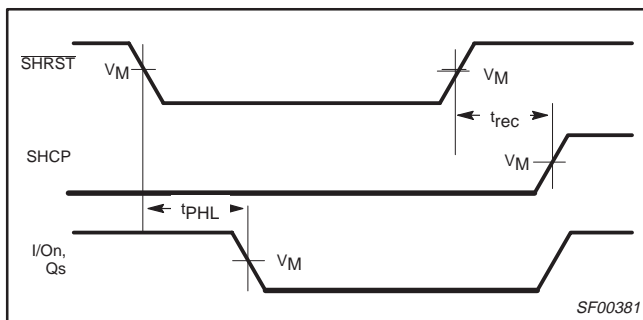
# 8-bit shift register with input storage registers (3-State)

74F598

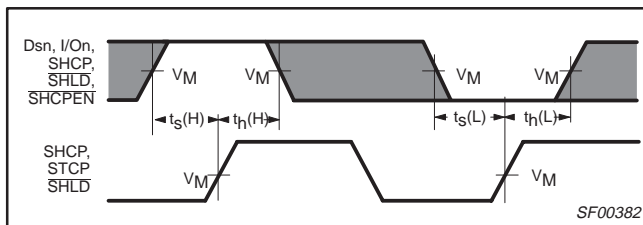
## AC WAVEFORMS



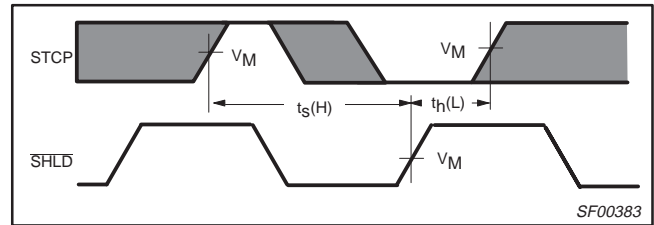
**Waveform 1. Propagation delay for clock input to output, clock pulse widths, and maximum clock frequency, shift register reset and load inputs to serial data output**



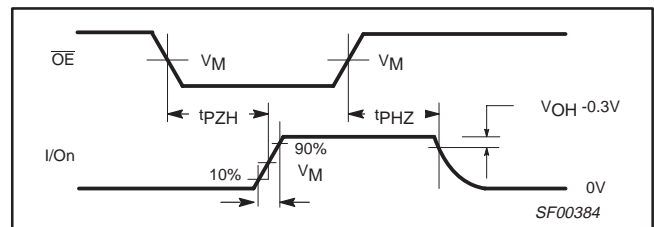
**Waveform 2. Propagation delay for shift register reset to serial data output, shift register reset to shift register, shift register input recovery time**



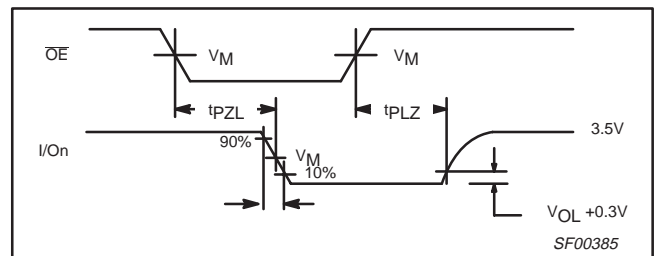
**Waveform 3. Setup time and hold times**



**Waveform 4. Setup time and hold time**



**Waveform 5. 3-State output enable time to High level, output disable time from High level and transition time to High level**



**Waveform 6. 3-State output enable time to Low level, output disable time from Low level and transition time to Low level**

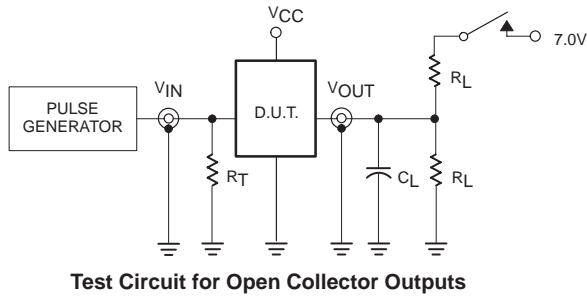
### Notes to AC waveforms

1. For all waveforms,  $V_M = 1.5V$ .
2. The shaded areas indicate when the input is permitted to change for predictable output performance.

# 8-bit shift register with input storage registers (3-State)

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## TEST CIRCUIT AND WAVEFORMS

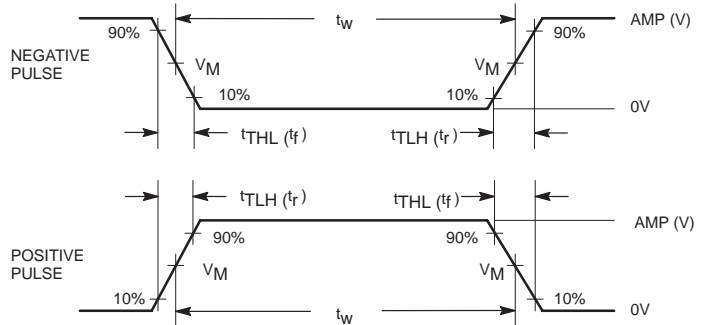


**SWITCH POSITION**

TEST	SWITCH
$t_{PLZ}$	closed
$t_{PZL}$	closed
All other	open

**DEFINITIONS:**

- $R_L$  = Load resistor; see AC electrical characteristics for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.



family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

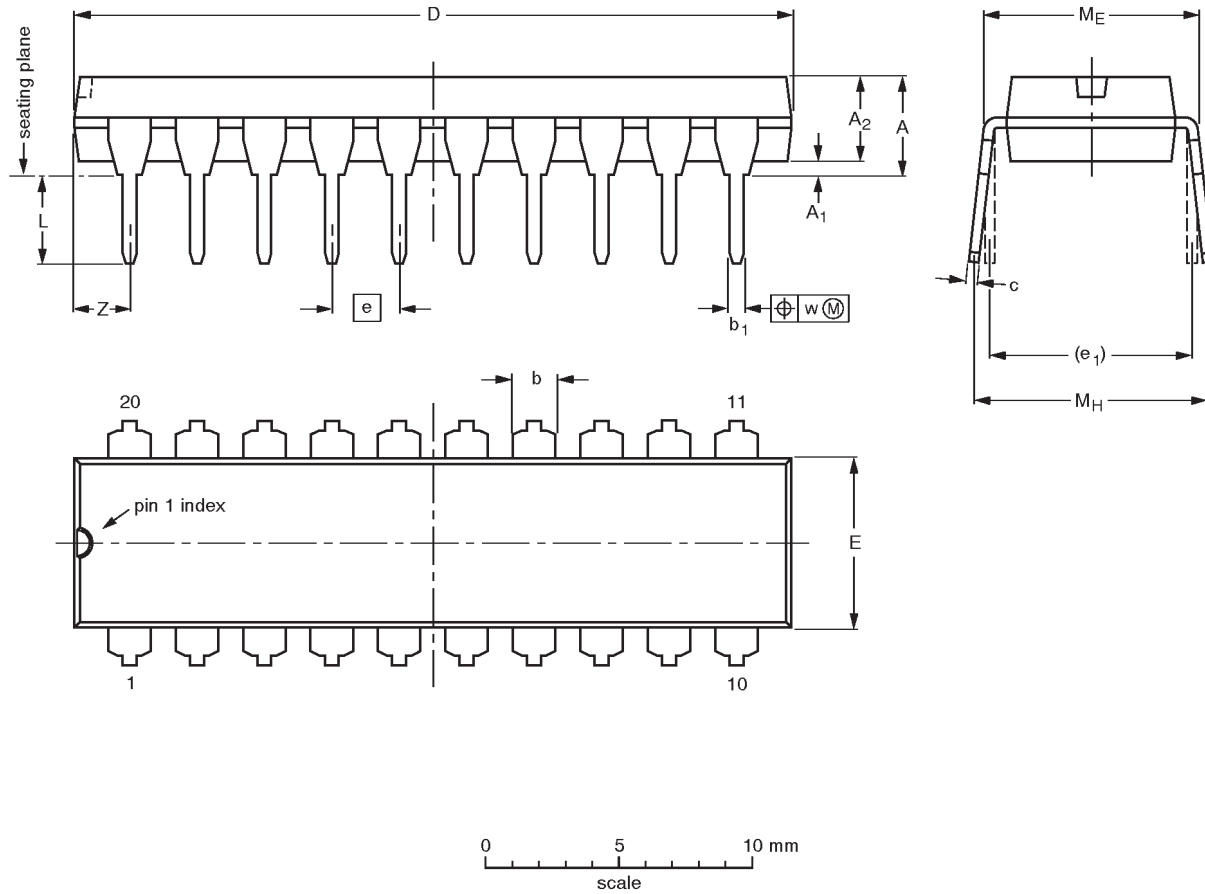
SF00128

# 8-bit shift register with input storage registers (3-State)

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DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

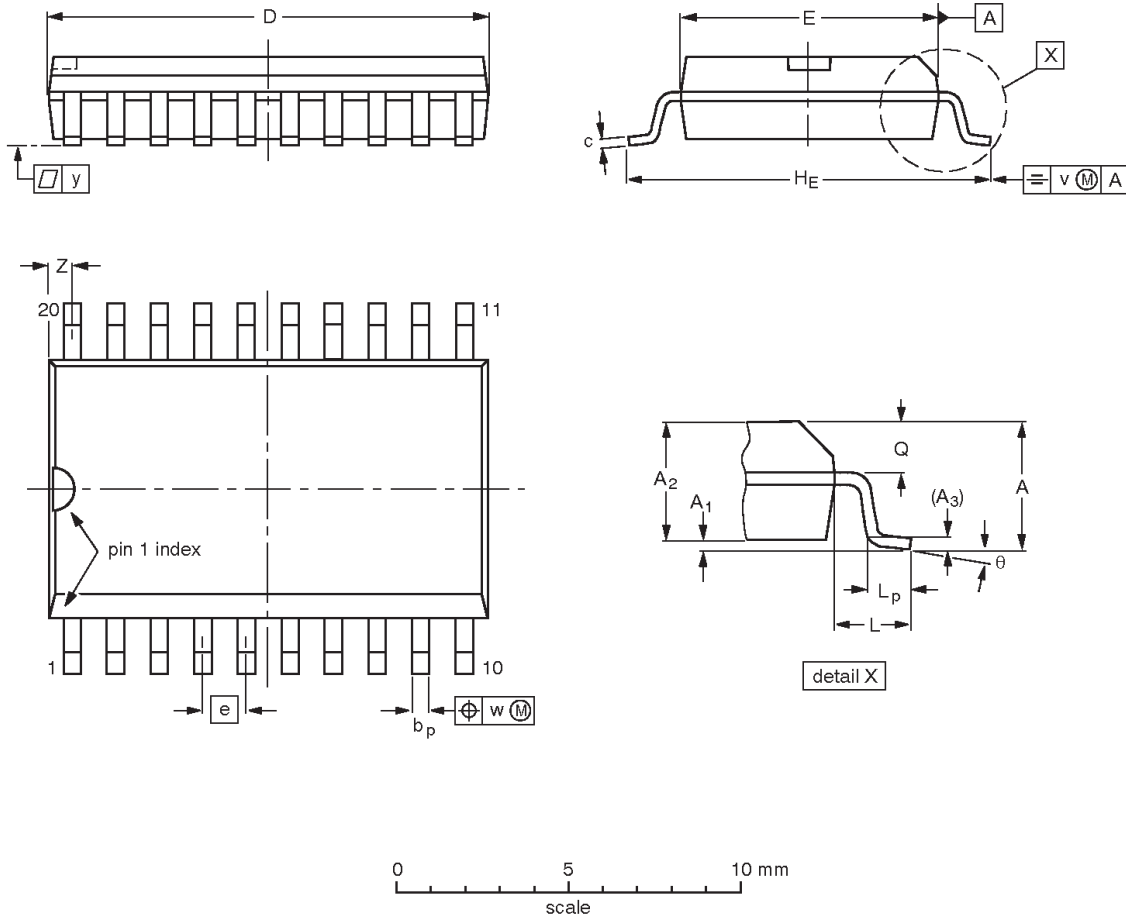
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT146-1			SC603			92-11-17 95-05-24

# 8-bit shift register with input storage registers (3-State)

## 74F598

**SO20:** plastic small outline package; 20 leads; body width 7.5 mm

**SOT163-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				95-01-24 97-05-22

## 8-bit shift register with input storage registers (3-State)

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## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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