

DATA SHEET

74LVT534

**3.3 V Octal D-type flip-flop; inverting
(3-State)**

Product data
Supersedes data of 1998 Feb 19

2004 Aug 25

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

FEATURES

- 3-State outputs for bus interfacing
- Common output enable
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- No bus current loading when output is tied to 5 V bus
- Power-up 3-State
- Power-up reset
- Latch-up protection exceeds 500mA per JEDEC Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

DESCRIPTION

The LVT534 is a high-performance BiCMOS product designed for V_{CC} operation at 3.3 V.

This device is an 8-bit, edge triggered register coupled to eight 3-State output buffers. The two sections of the device are controlled independently by the clock (CP) and Output Enable (\overline{OE}) control gates. The state of each D input (one set-up time before the LOW-to-HIGH clock transition) is transferred to the corresponding flip-flop's Q output.

The 3-State output buffers are designed to drive heavily loaded 3-State buses, MOS memories, or MOS microprocessors. The active-LOW Output Enable (\overline{OE}) controls all eight 3-State buffers independent of the clock operation.

When \overline{OE} is LOW, the stored data appears at the outputs. When \overline{OE} is HIGH, the outputs are in the high-impedance "off" state, which means they will neither drive nor load the bus.

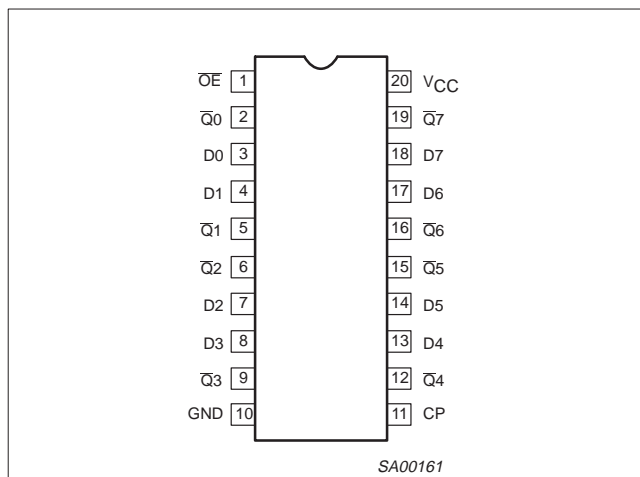
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25\text{ }^{\circ}\text{C}; \text{GND} = 0\text{ V}$	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay CP to Q_n	$C_L = 50\text{ pF};$ $V_{CC} = 3.3\text{ V}$	3.0 3.5	ns
C_{IN}	Input capacitance	$V_I = 0\text{ V or }3.0\text{ V}$	4	pF
C_{OUT}	Output capacitance	Outputs disabled; $V_{I/O} = 0\text{ V or }3.0\text{ V}$	7	pF
I_{CCZ}	Total supply current	Outputs disabled; $V_{CC} = 3.6\text{ V}$	0.13	mA

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	TYPE NUMBER	DWG NUMBER
20-Pin Plastic SOL	-40 °C to +85 °C	74LVT534D	SOT163-1
20-Pin Plastic SSOP Type II	-40 °C to +85 °C	74LVT534DB	SOT339-1
20-Pin Plastic TSSOP Type I	-40 °C to +85 °C	74LVT534PW	SOT360-1

PIN CONFIGURATION



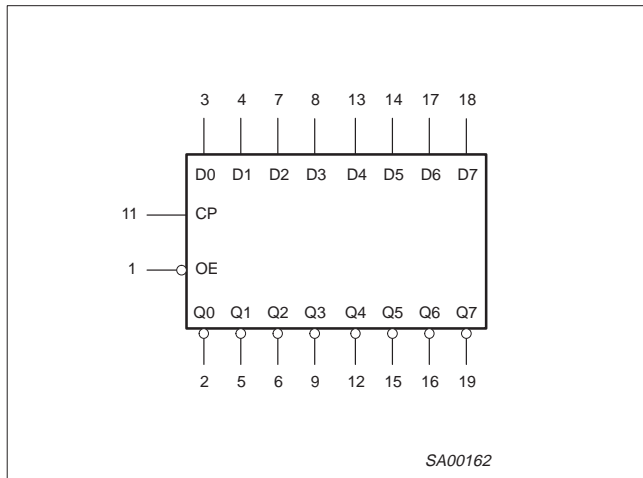
PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	\overline{OE}	Output enable input (active-LOW)
3, 4, 7, 8, 13, 14, 17, 18	D0 to D7	Data inputs
2, 5, 6, 9, 12, 15, 16, 19	$\overline{Q0}$ to $\overline{Q7}$	Inverting 3-State outputs
11	CP	Clock pulse input (active rising edge)
10	GND	Ground (0 V)
20	V_{CC}	Positive supply voltage

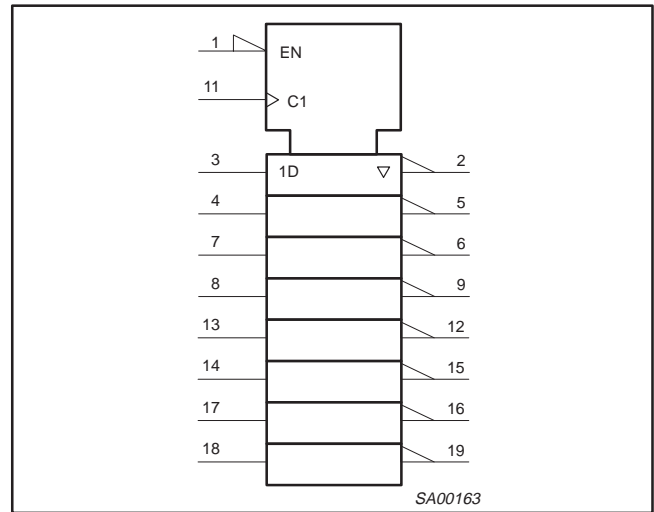
3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)

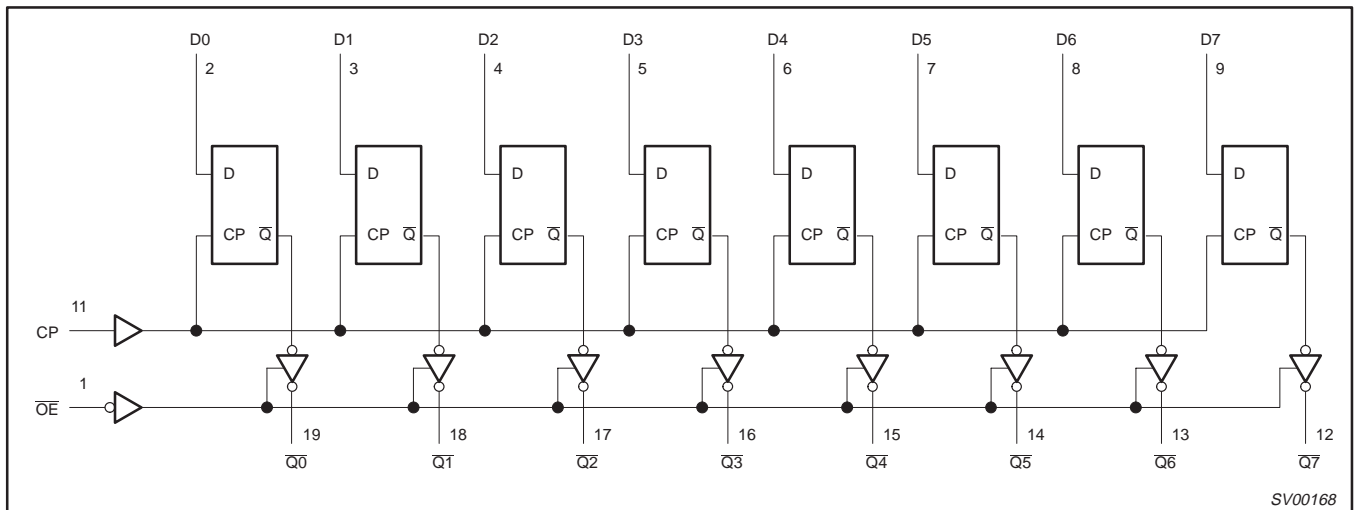


FUNCTION TABLE

INPUTS			INTERNAL REGISTER	OUTPUTS	OPERATING MODE
OE	CP	Dn		Q0 to Q7	
L	↑	l	L	H	Latch and read register
L	↑	h	H	L	
L	↑	X	NC	NC	Hold
H	↑	X	NC	Z	Disable outputs
H	↑	Dn	Dn	Z	

H = HIGH voltage level
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition
 L = LOW voltage level
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition
 NC= No change
 X = Don't care
 Z = high-impedance "off" state
 ↑ = LOW-to-HIGH clock transition
 ↑ = not a LOW-to-HIGH clock transition

LOGIC DIAGRAM



3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

ABSOLUTE MAXIMUM RATINGS^{1, 2}

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V _{CC}	DC supply voltage		-0.5 to +4.6	V
I _{IK}	DC input diode current	V _I < 0 V	-50	mA
V _I	DC input voltage ³		-0.5 to +7.0	V
I _{OK}	DC output diode current	V _O < 0 V	-50	mA
V _{OUT}	DC output voltage ³	Output in Off or HIGH state	-0.5 to +7.0	V
I _{OUT}	DC output current	Output in LOW state	128	mA
		Output in HIGH state	-64	
T _{stg}	Storage temperature range		-65 to +150	°C

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V _{CC}	DC supply voltage	2.7	3.6	V
V _I	Input voltage	0	5.5	V
V _{IH}	HIGH-level input voltage	2.0	-	V
V _{IL}	Input voltage	-	0.8	V
I _{OH}	HIGH-level output current	-	-32	mA
I _{OL}	LOW-level output current	-	32	mA
	LOW-level output current; current duty cycle ≤ 50 %, f ≥ 1 kHz	-	64	
Δt/Δv	Input transition rise or fall rate; outputs enabled	-	10	ns/V
T _{amb}	Operating free-air temperature range	-40	+85	°C

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT	
			$T_{amb} = -40^{\circ}\text{C to }+85^{\circ}\text{C}$				
			MIN	TYP ¹	MAX		
V_{IK}	Input clamp voltage	$V_{CC} = 2.7\text{ V}; I_{IK} = -18\text{ mA}$	–	–0.9	–1.2	V	
V_{OH}	HIGH-level output voltage	$V_{CC} = 2.7\text{ V to }3.6\text{ V}; I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC} - 0.1$	–	V	
		$V_{CC} = 2.7\text{ V}; I_{OH} = -8\text{ mA}$	2.4	2.5	–	V	
		$V_{CC} = 3.0\text{ V}; I_{OH} = -32\text{ mA}$	2.0	2.2	–	V	
V_{OL}	LOW-level output voltage	$V_{CC} = 2.7\text{ V}; I_{OL} = 100\text{ }\mu\text{A}$	–	0.1	0.2	V	
		$V_{CC} = 2.7\text{ V}; I_{OL} = 24\text{ mA}$	–	0.3	0.5	V	
		$V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$	–	0.25	0.4	V	
		$V_{CC} = 3.0\text{ V}; I_{OL} = 32\text{ mA}$	–	0.3	0.5	V	
		$V_{CC} = 3.0\text{ V}; I_{OL} = 64\text{ mA}$	–	0.4	0.55	V	
V_{RST}	Power-up output low voltage ⁵	$V_{CC} = 3.6\text{ V}; I_O = 1\text{ mA}; V_I = \text{GND or }V_{CC}$	–	0.13	0.55	V	
I_I	Input leakage current	$V_{CC} = 0\text{ V or }3.6\text{ V}; V_I = 5.5\text{ V}$	–	1	10	μA	
		$V_{CC} = 3.6\text{ V}; V_I = V_{CC}\text{ or GND}$	Control pins	–	± 0.1	± 1	μA
		$V_{CC} = 3.6\text{ V}; V_I = V_{CC}$	Data pins ⁴	–	0.1	1	μA
		$V_{CC} = 3.6\text{ V}; V_I = 0\text{ V}$		–	–1	–5	μA
I_{OFF}	Output off current	$V_{CC} = 0\text{ V}; V_I\text{ or }V_O = 0\text{ V to }4.5\text{ V}$	–	1	± 100	μA	
I_{HOLD}	Bus Hold current A inputs ⁷	$V_{CC} = 3\text{ V}; V_I = 0.8\text{ V}$	75	150	–	μA	
		$V_{CC} = 3\text{ V}; V_I = 2.0\text{ V}$	–75	–150	–	μA	
		$V_{CC} = 0\text{ V to }3.6\text{ V}; V_{CC} = 3.6\text{ V}$	± 500	–	–	μA	
I_{EX}	Current into an output in the HIGH state when $V_O > V_{CC}$	$V_O = 5.5\text{ V}; V_{CC} = 3.0\text{ V}$	–	60	125	μA	
$I_{PU/PD}$	Power-up/down 3-State output current ³	$V_{CC} \leq 1.2\text{ V}; V_O = 0.5\text{ V to }V_{CC}; V_I = \text{GND or }V_{CC}; \text{OE/OE} = \text{Don't care}$	–	1	± 100	μA	
I_{OZH}	3-State output HIGH current	$V_{CC} = 3.6\text{ V}; V_O = 3\text{ V}; V_I = V_{IL}\text{ or }V_{IH}$	–	1	5	μA	
I_{OZL}	3-State output LOW current	$V_{CC} = 3.6\text{ V}; V_O = 0.5\text{ V}; V_I = V_{IL}\text{ or }V_{IH}$	–	1	–5	μA	
I_{CCH}	Quiescent supply current ³	$V_{CC} = 3.6\text{ V}; \text{Outputs HIGH}; V_I = \text{GND or }V_{CC}; I_O = 0\text{ mA}$	–	0.13	0.19	mA	
I_{CCL}		$V_{CC} = 3.6\text{ V}; \text{Outputs LOW}; V_I = \text{GND or }V_{CC}; I_O = 0\text{ mA}$	–	3	12	mA	
I_{CCZ}		$V_{CC} = 3.6\text{ V}; \text{Outputs Disabled}; V_I = \text{GND or }V_{CC}; I_O = 0\text{ mA}$ ⁶	–	0.13	0.19	mA	
ΔI_{CC}	Additional supply current per input pin ²	$V_{CC} = 3\text{ V to }3.6\text{ V}; \text{One input at }V_{CC} - 0.6\text{ V}; \text{Other inputs at }V_{CC}\text{ or GND}$	–	0.1	0.2	mA	

NOTES:

- All typical values are at $V_{CC} = 3.3\text{ V}$ and $T_{amb} = 25^{\circ}\text{C}$.
- This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.
- This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 msec. From $V_{CC} = 1.2\text{ V}$ to $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ a transition time of 100 μsec is permitted. This parameter is valid for $T_{amb} = 25^{\circ}\text{C}$ only.
- Unused pins at V_{CC} or GND.
- For valid test results, data must not be loaded into the flip-flops (or latches) after applying power.
- I_{CCZ} is measured with outputs pulled to V_{CC} or down to GND.
- This is the bus hold overdrive current required to force the input to the opposite logic state.

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

AC CHARACTERISTICSGND = 0 V; $t_R = t_F = 2.5$ ns; $C_L = 50$ pF; $R_L = 500$ Ω ; $T_{amb} = -40$ °C to +85 °C.

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			$V_{CC} = 3.3$ V \pm 0.3 V			$V_{CC} = 2.7$ V		
			MIN	TYP ¹	MAX	MIN	MAX	
f_{MAX}	Maximum clock frequency	1	100	150	–	100	–	ns
t_{PLH} t_{PHL}	Propagation delay CP to Qn	1	1.7 2.2	3.0 3.5	4.6 4.9	– –	5.4 5.2	ns
t_{PZH} t_{PZL}	Output enable time to HIGH and LOW level	3 4	1.7 1.7	3.2 3.3	5.4 5.5	– –	7.0 5.6	ns
t_{PHZ} t_{PLZ}	Output disable time from HIGH and LOW level	3 4	2.1 2.1	3.5 3.4	4.8 4.8	– –	5.3 4.6	ns

NOTE:1. All typical values are at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C.**AC SETUP REQUIREMENTS**GND = 0 V; $t_R = t_F = 2.5$ ns; $C_L = 50$ pF; $R_L = 500$ Ω ; $T_{amb} = -40$ °C to +85 °C.

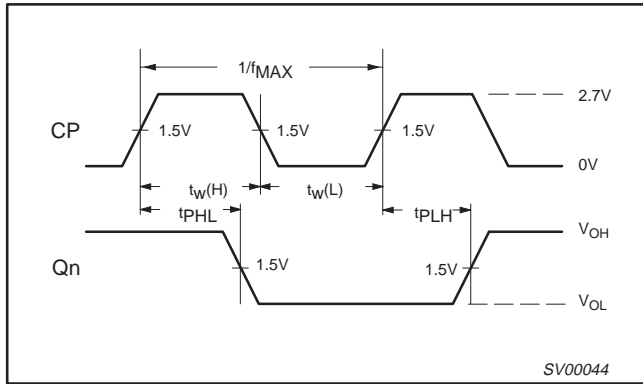
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$V_{CC} = 3.3$ V \pm 0.3 V		$V_{CC} = 2.7$ V	
			MIN	TYP	MIN	
$t_{S(H)}$ $t_{S(L)}$	Setup time, HIGH or LOW, Dn to CP	2	2.0 2.6	1.0 1.3	2.0 3.2	ns
$t_{H(H)}$ $t_{H(L)}$	Hold time, HIGH or LOW, Dn to CP	2	0 0	–1.3 –0.9	0 0	ns
$t_{W(H)}$ $t_{W(L)}$	CP pulse width HIGH or LOW	1	1.5 4.2	0.8 3.0	1.5 5.0	ns

3.3 V Octal D-type flip-flop, inverting (3-State)

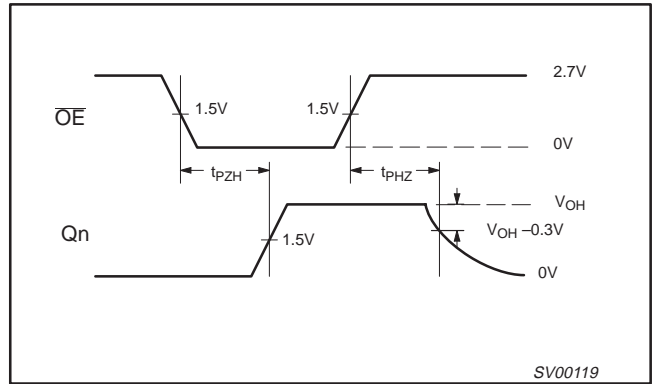
74LVT534

AC WAVEFORMS

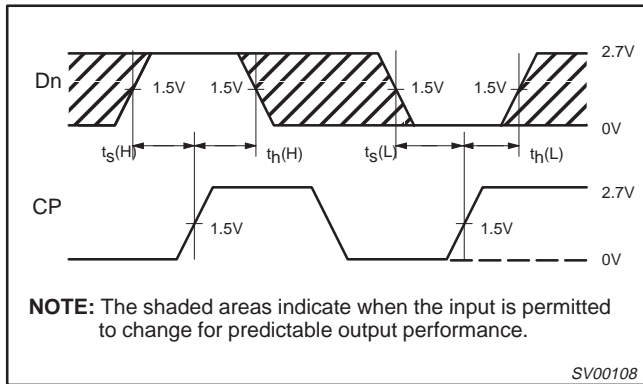
$V_M = 1.5\text{ V}$, $V_{IN} = \text{GND to } 2.7\text{ V}$



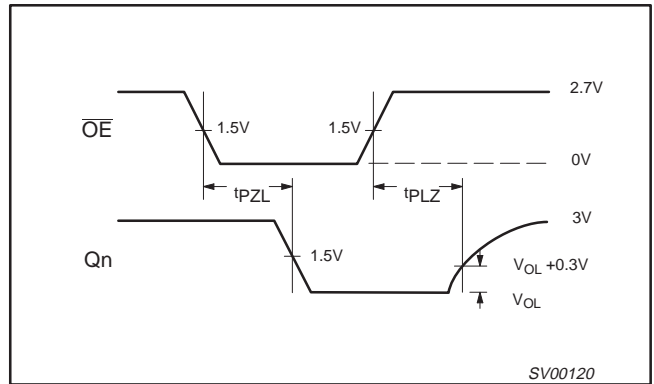
Waveform 1. Propagation delay, clock input to output, clock pulse width, and maximum clock frequency



Waveform 3. 3-State Output Enable time to HIGH level and Output Disable time from HIGH level



Waveform 2. Data setup and hold times

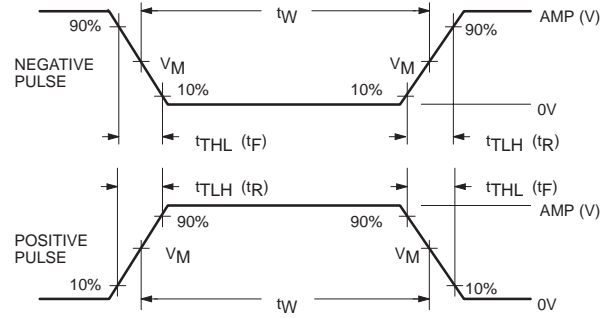
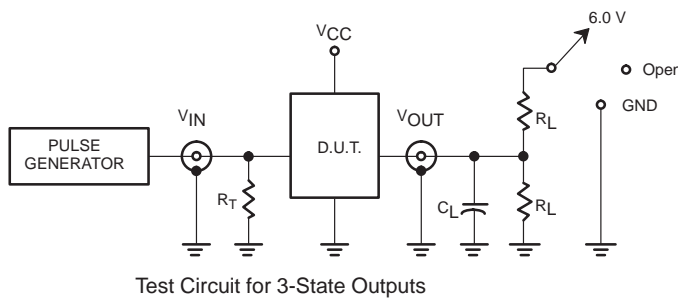


Waveform 4. 3-State Output Enable time to LOW level and Output Disable time from LOW level

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

TEST CIRCUIT AND WAVEFORM



$V_M = 1.5\text{ V}$
Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6V
t_{PHZ}/t_{PZH}	GND

DEFINITIONS

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

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74LVT	2.7 V	$\leq 10\text{ MHz}$	500 ns	$\leq 2.5\text{ ns}$	$\leq 2.5\text{ ns}$

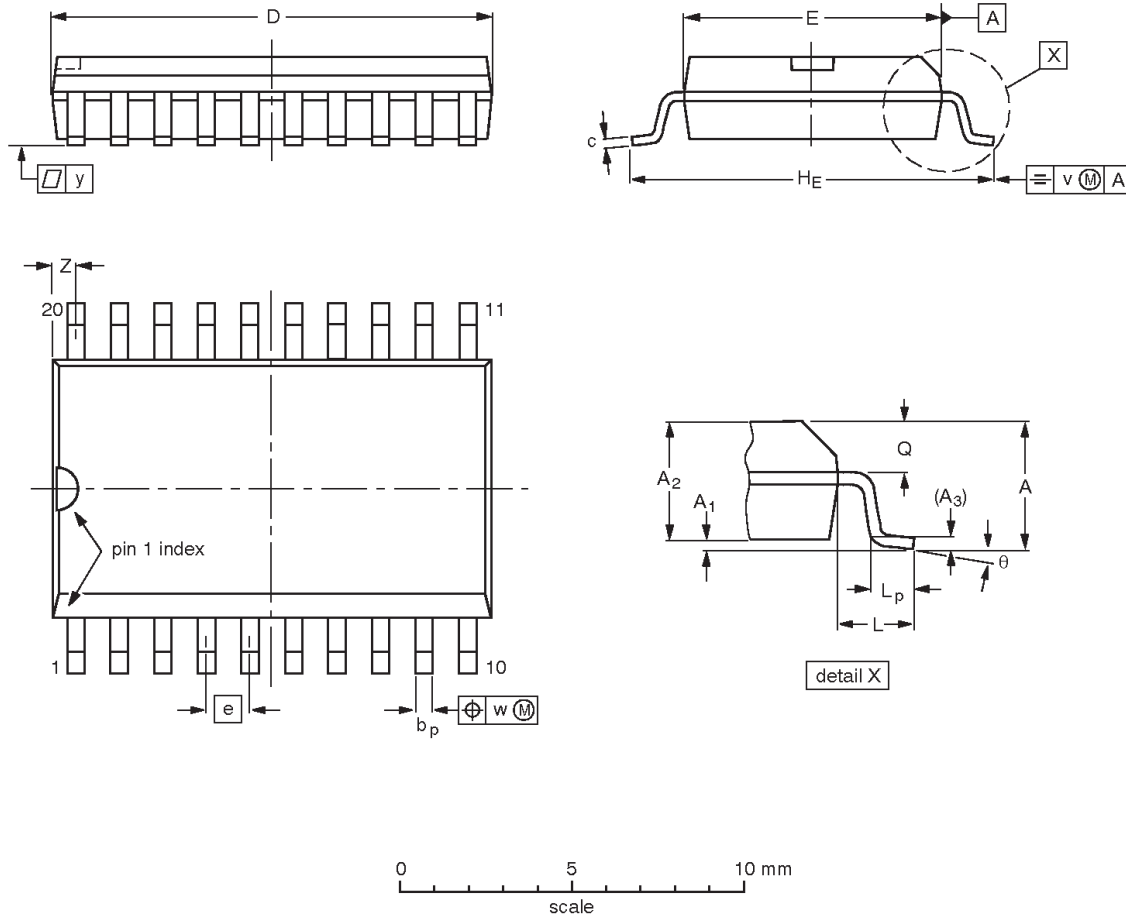
SV00092

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	2.65	0.3 0.1	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	0.1	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	0.05	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 (0.006 inch) maximum per side are not included.

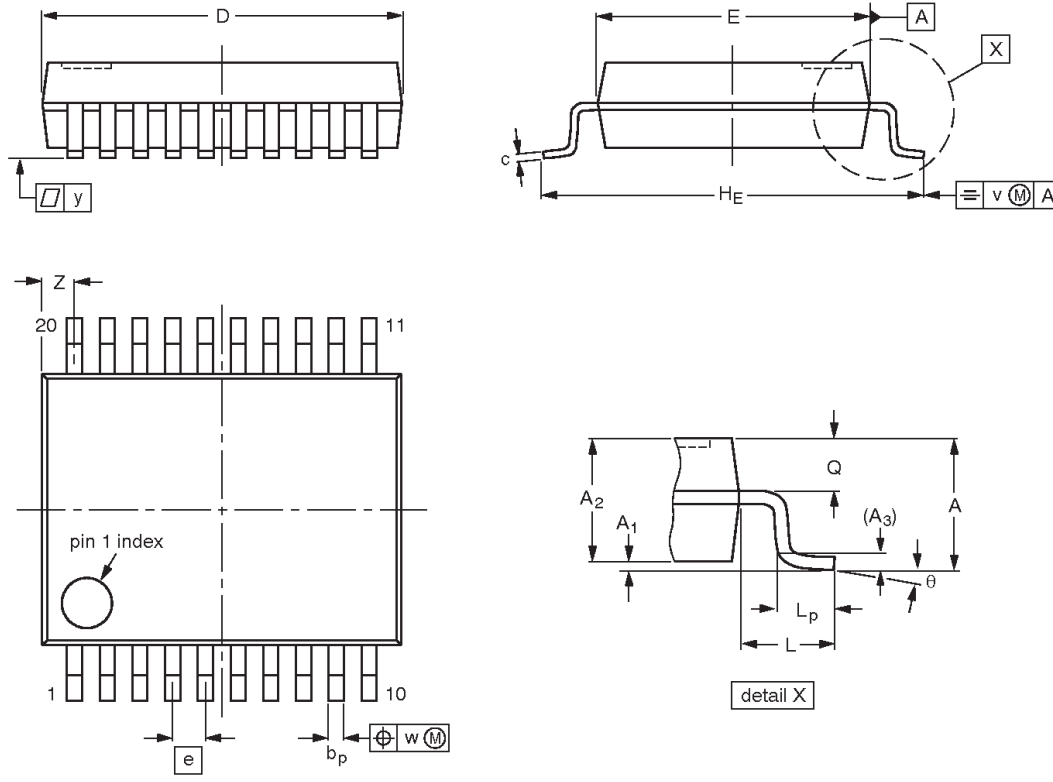
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				-99-12-27 03-02-19

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	HE	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

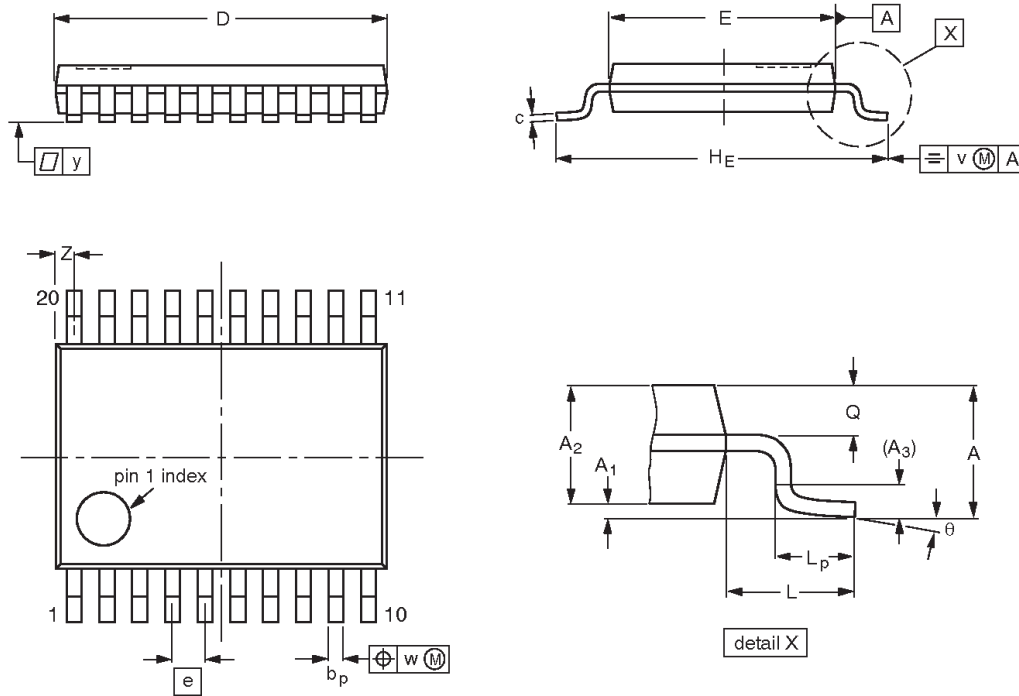
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				99-12-27 03-02-19

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT360-1		MO-153				99-12-27 03-02-19

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

REVISION HISTORY

Rev	Date	Description
3	20040825	<p>Product data sheet (9397 750 14004). Supersedes Product specification of 1998 Feb 19 (9397 750 03536).</p> <p>Modifications:</p> <ul style="list-style-type: none"> ● Ordering information table on page 2: <ul style="list-style-type: none"> – remove 'North America' column – change column heading 'Outside North America' to 'Type Number' ● AC characteristics table on page 6: change Max. value of t{PHZ} from '3.0 ns' to '4.8 ns'
_2	19980219	<p>Product specification (9397 750 03536). ECN 853-1855 18988 of 19 February 1998.</p> <p>Supersedes data of 1996 Aug 13.</p>
_1	19960813	

3.3 V Octal D-type flip-flop, inverting (3-State)

74LVT534

Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definitions
I	Objective data sheet	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data sheet	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data sheet	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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