DATA SHEET

74LVT273
3.3V Octal D flip-flop

Product specification
Supersedes data of 1994 May 11
IC23 Data Handbook

1998 Feb 19

Philips
Semiconductors

PHILIPS

3.3V Octal D flip-flop 74LVT273

FEATURES

- Eight edge-triggered D-type flip-flops
- Buffered common clock
- Buffered asynchronous Master Reset
- Output capability: +64mA/–32mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Power-up reset
- Live insertion/extraction permitted
- No bus current loading when output is tied to 5V bus
- Latchup protection exceeds 500 mA per JEDEC Std 17
- ESD protection exceeds 2000V per Mil Std 883 Method 3015 and 200V per Machine Model.

DESCRIPTION

The LVT273 is a high-performance BiCMOS product designed for V_{CC} operation at 3.3V.

This device has eight edge-triggered D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) and Master Reset ($\overline{MR}$) inputs load and reset (clear) all flip-flops simultaneously.

The register is fully edge-triggered. The state of each D input, one setup time before the Low-to-High clock transition, is transferred to the corresponding flip-flop's Q output.

All outputs will be forced Low independent of Clock or Data inputs by a Low voltage level on the $\overline{MR}$ input. The device is useful for applications where the true output only is required and the CP and $\overline{MR}$ are common elements.

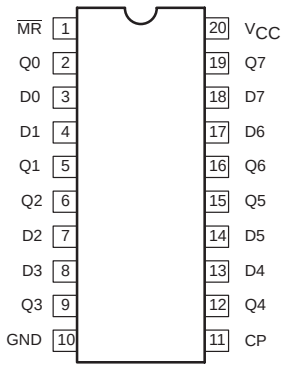
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25°C; GND = 0V	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay CP to Qn	C_L = 50pF; V_{CC} = 3.3V	3.5 3.5	ns
C_{IN}	Input capacitance	V_I = 0V or 3.0V	4	pF

ORDERING INFORMATION

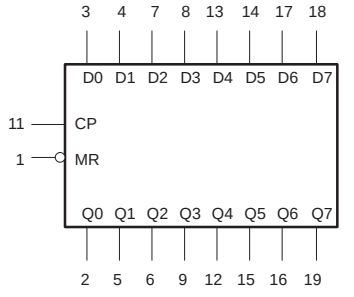
PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
20-Pin Plastic SOL	–40°C to +85°C	74LVT273 D	74LVT273 D	SOT163-1
20-Pin Plastic SSOP Type II	–40°C to +85°C	74LVT273 DB	74LVT273 DB	SOT339-1
20-Pin Plastic TSSOP Type I	–40°C to +85°C	74LVT273 PW	74LVT273PW DH	SOT360-1

PIN CONFIGURATION



SV00017

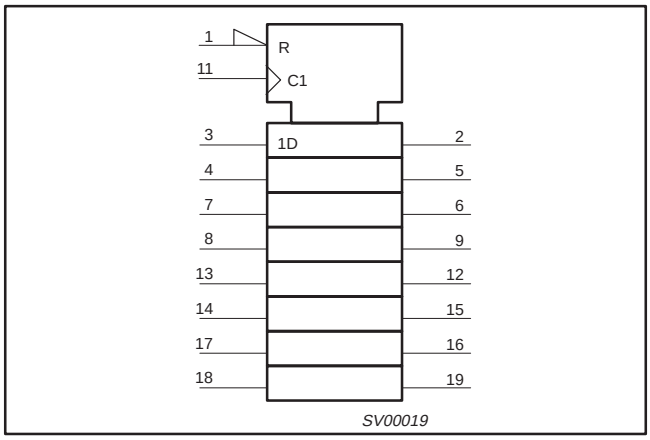
LOGIC SYMBOL



SV00018

3.3V Octal D flip-flop 74LVT273

LOGIC SYMBOL (IEEE/IEC)



SV00019

FUNCTION TABLE

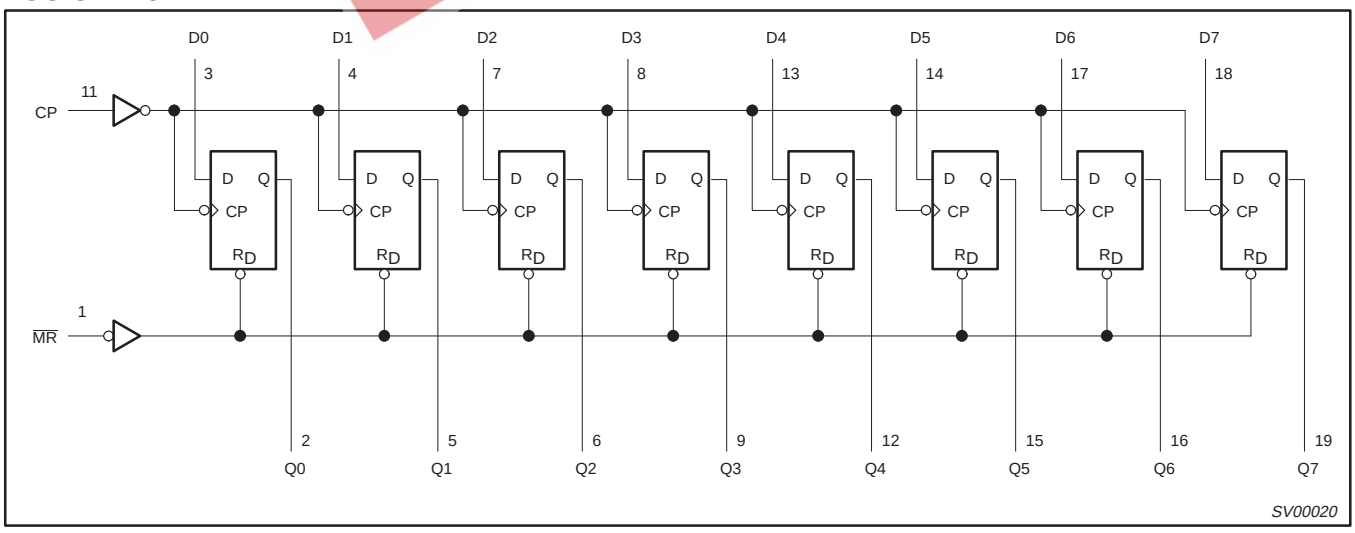
INPUTS			OUTPUTS	OPERATING MODE
$\overline{MR}$	CP	D_n	Q0 – Q7	
L	X	X	L	Reset (clear)
H	↑	h	H	Load “1”
H	↑	l	L	Load “0”
H	L	X	Q_0	Retain state

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
X = Don’t care
↑ = Low-to-High clock transition
Q_0 = Output as it was

PIN DESCRIPTION

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

LOGIC DIAGRAM



SV00020

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	$V_I < 0$	–50	mA
V_I	DC input voltage[3]		–0.5 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	–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:
1. 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.
2. 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.
3. The input and output voltage ratings may be exceeded if the input and output 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}	Low-level Input voltage		0.8	V
I_{OH}	High-level output current		–32	mA
I_{OL}	Low-level output current		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate; Outputs enabled		10	ns/V
T_{amb}	Operating free-air temperature range	–40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP[1]	MAX	
V_{IK}	Input clamp voltage	V_{CC} = 2.7V; I_{IK} = –18mA			–0.9	–1.2	V
V_{OH}	High-level output voltage	V_{CC} = 2.7 to 3.6V; I_{OH} = –100µA		V_{CC}-0.2	V_{CC}–0.1		V
		V_{CC} = 2.7V; I_{OH} = –8mA		2.4	2.5		
		V_{CC} = 3.0V; I_{OH} = –32mA		2.0	2.2		
V_{OL}	Low-level output voltage	V_{CC} = 2.7V; I_{OL} = 100µA			0.1	0.2	V
		V_{CC} = 2.7V; I_{OL} = 24mA			0.3	0.5	
		V_{CC} = 3.0V; I_{OL} = 16mA			0.25	0.4	
		V_{CC} = 3.0V; I_{OL} = 32mA			0.3	0.5	
		V_{CC} = 3.0V; I_{OL} = 64mA			0.4	0.55	
V_{RST}	Power-up output low voltage[4]	V_{CC} = 3.6V; I_O = 1mA; V_I = GND or V_{CC}			0.13	0.55	V
I_I	Input leakage current	V_{CC} = 0 or 3.6V; V_I = 5.5V			1	10	µA
		V_{CC} = 3.6V; V_I = V_{CC} or GND	Control pins		±0.1	±1	
		V_{CC} = 3.6V; V_I = V_{CC}	Data pins[3]		0.1	1	
		V_{CC} = 3.6V; V_I = 0	Data pins[3]		–1	-5	
I_{OFF}	Output off current	V_{CC} = 0V; V_I or V_O = 0 to 4.5V			1	±100	µA
I_{HOLD}	Bus Hold current A inputs[5]	V_{CC} = 3V; V_I = 0.8V		75	150		µA
		V_{CC} = 3V; V_I = 2.0V		–75	–150		
		V_{CC} = 0V to 3.6V; V_{CC} = 3.6V		±500			
I_{EX}	Current into an output in the High state when $V_O > V_{CC}$	V_O = 5.5V; V_{CC} = 3.0V			60	125	µA
I_{CCH}	Quiescent supply current	V_{CC} = 3.6V; Outputs High, V_I = GND or V_{CC}, I_O = 0			0.13	0.19	mA
I_{CCL}		V_{CC} = 3.6V; Outputs Low, V_I = GND or V_{CC}, I_O = 0			3	12	
ΔI_{CC}	Additional supply current per input pin[2]	V_{CC} = 3V to 3.6V; One input at V_{CC} -0.6V, Other inputs at V_{CC} or GND			0.1	0.2	mA

NOTES:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND
3. Unused pins at V_{CC} or GND.
4. For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.
5. This is the bus hold overdrive current required to force the input to the opposite logic state.

AC CHARACTERISTICS

GND = 0V; t_R = t_F = 2.5ns; C_L = 50pF, R_L = 500Ω; T_{amb} = –40°C to +85°C.

SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			V_{CC} = 3.3V ±0.3V			V_{CC} = 2.7V	
			MIN	TYP[1]	MAX	MAX	
f_{MAX}	Maximum clock frequency	1	150				MHz
t_{PLH} t_{PHL}	Propagation delay CP to Qn	1	1.7 1.9	3.5 3.5	5.5 5.5	6.3 5.9	ns
t_{PHL}	Propagation delay $\overline{MR}$ to Qn	2	1.3	3.2	6.2	6.2	ns

NOTE:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.

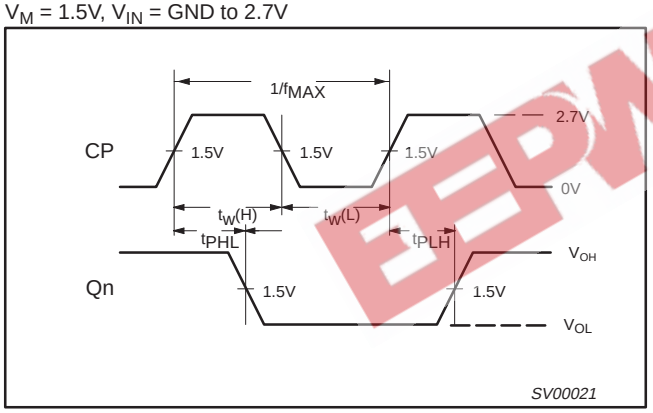
AC SETUP REQUIREMENTS

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

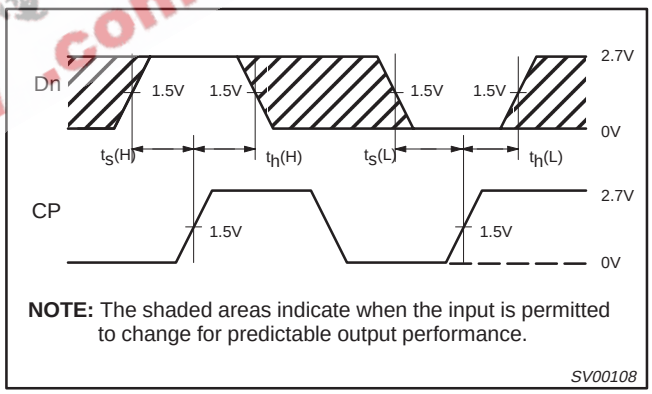
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			V_{CC} = +3.3 ± 0.3V		V_{CC} = 2.7V	
			MIN	TYP	MIN	
$t_s(H)$ $t_s(L)$	Setup time, High or Low Dn to CP	3	2.3 2.3	1.0 1.0	2.7 2.7	ns
$t_h(H)$ $t_h(L)$	Hold time, High or Low Dn to CP	3	0 0	–0.6 –0.6	0 0	ns
$t_w(H)$ $t_w(L)$	Clock pulse width High or Low	1	3.3 3.3	1.5 1.5	3.3 3.3	ns
$t_w(L)$	Master Reset pulse width, Low	2	3.3	1.5	3.3	ns
t_{REC}	Recovery time $\overline{MR}$ to CP	2	2.7	1.0	3.2	ns

AC WAVEFORMS

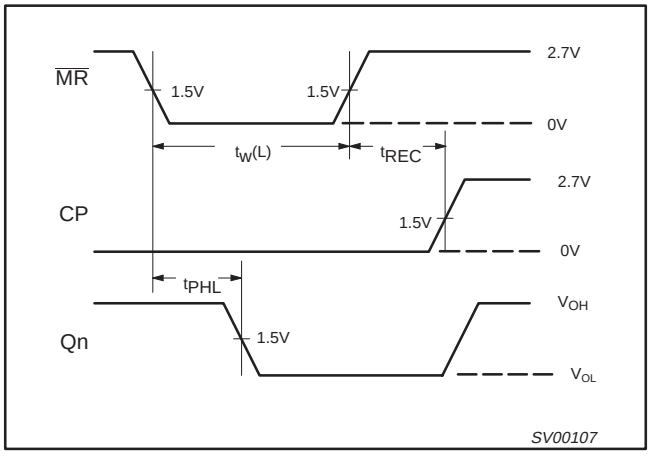
V_M = 1.5V, V_{IN} = GND to 2.7V



Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency

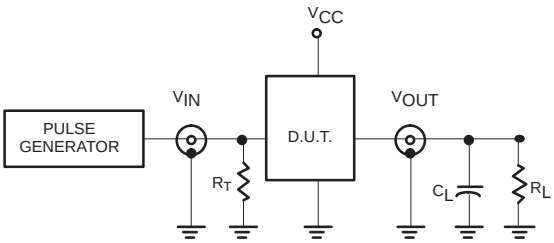


Waveform 3. Data Setup and Hold Times

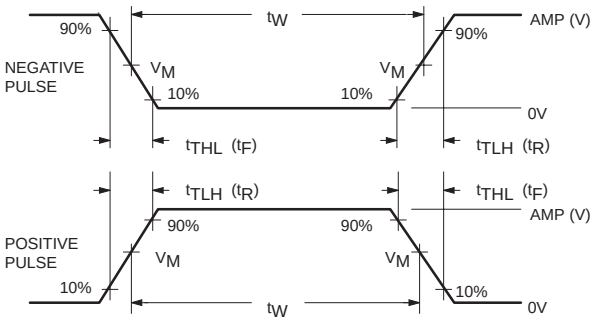


Waveform 2. Master Reset Pulse Width, Master Reset to Output Delay and Master Reset to Clock Recovery Time

TEST CIRCUIT AND WAVEFORMS



Test Circuit for Outputs



V_M = 1.5V
Input Pulse Definition

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

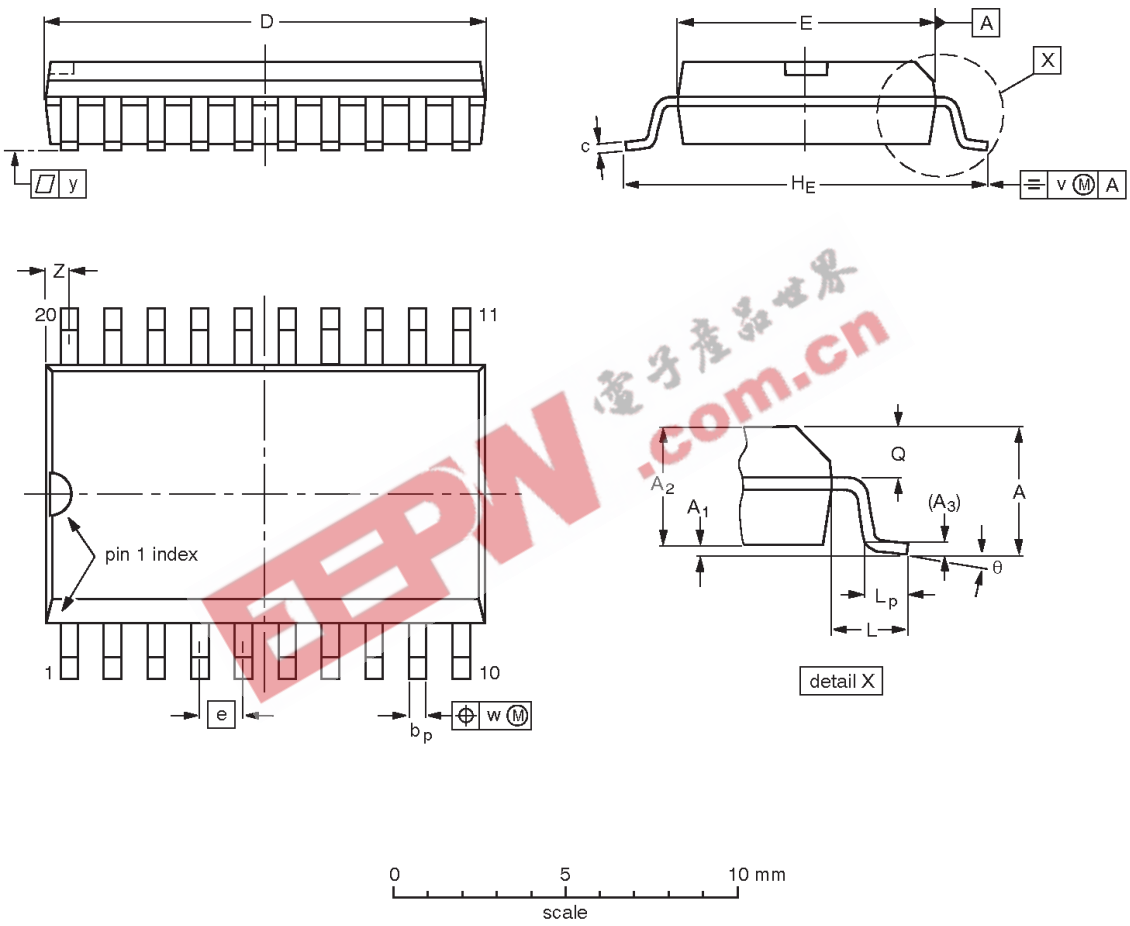
C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

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	2.7V	≤10MHz	500ns	≤2.5ns	≤2.5ns

SV00022

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



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

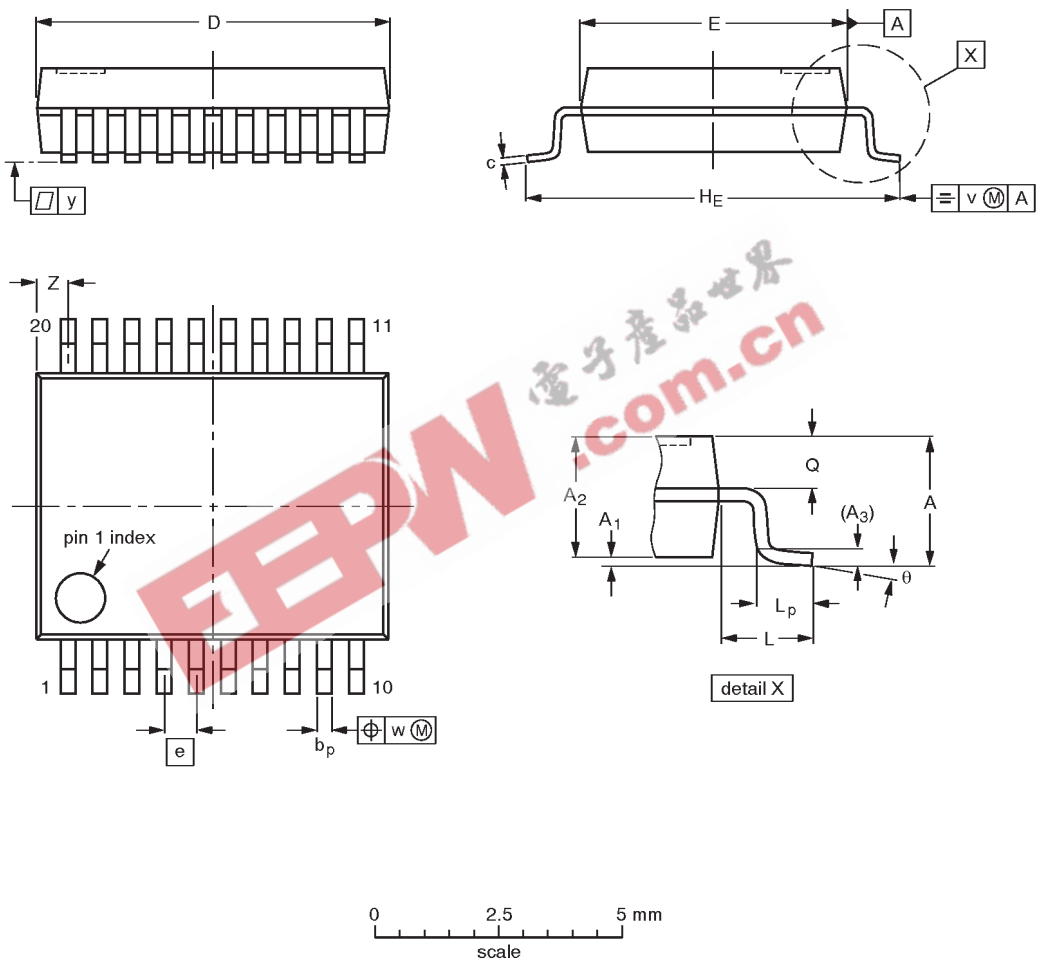
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	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

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm **SOT339-1**



DIMENSIONS (mm are the original dimensions)

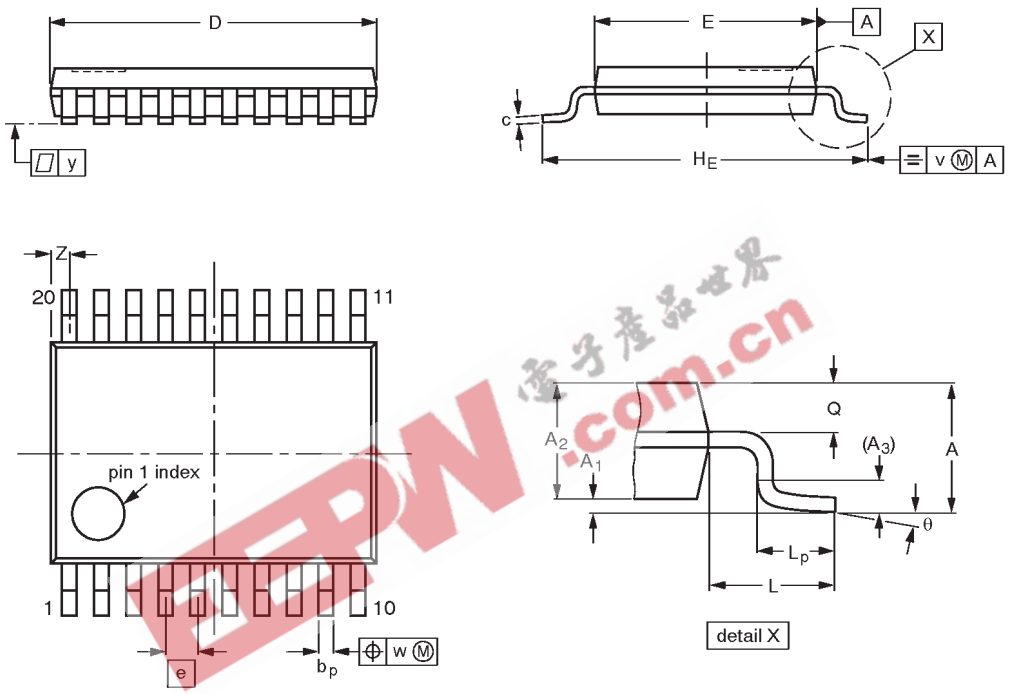
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

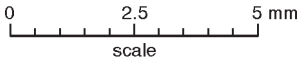
Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				~~93-09-08~~ 95-02-04

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	1.10	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	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	EIAJ			
SOT360-1		MO-153AC				~~93-06-16~~ 95-02-04

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 chages 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.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Disclaimers

Life support — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors
811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088–3409
Telephone 800-234-7381

print code Date of release: 05-96

Document order number: 9397-750-03534

Let's make things better.

Philips Semiconductors

PHILIPS