

# DATA SHEET

**74LVT14**

**3.3V Hex inverter Schmitt trigger**

Product specification

1996 Aug 28

IC24 Data Handbook

# 3.3V Hex inverter Schmitt trigger

# 74LVT14

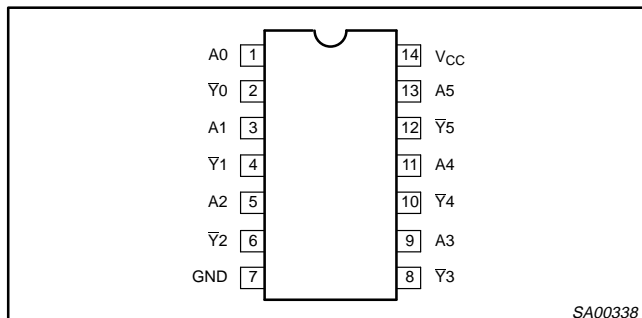
## DESCRIPTION

The 74LVT14 is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3V. They are capable of transforming slowly changing input signals into sharply defined, jitter free output signals. In addition, they have greater noise margin than conventional inverters. Each circuit contains a Schmitt trigger followed by a Darlington level shifter and a phase splitter driving a TTL totem-pole output. The Schmitt trigger uses positive feedback to effectively speed-up slow input transitions, and provide different input threshold voltages for positive-going and negative-going input threshold (typically 600mV) is determined internally by resistor ratios and is insensitive to temperature and supply voltage variations.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}C$ ; $GND = 0V$	TYPICAL	UNIT
$t_{PLH}$ $t_{PHL}$	Propagation delay An to $\bar{Y}_n$	$C_L = 50pF$ ; $V_{CC} = 3.3V$	3.2 3.0	ns
$C_{IN}$	Input capacitance	$V_I = 0V$ or $3.0V$	3	pF
$I_{CCL}$	Total supply current	Outputs low; $V_{CC} = 3.6V$	1.5	mA

## PIN CONFIGURATION



## PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 3, 5, 9, 11, 13	$A_n$	Data inputs
2, 4, 6, 8, 10, 12	$\bar{Y}_n$	Data outputs
7	GND	Ground (0V)
14	$V_{CC}$	Positive supply voltage

## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
14-Pin Plastic SO	-40°C to +85°C	74LVT14 D	74LVT14 D	SOT108-1
14-Pin Plastic SSOP	-40°C to +85°C	74LVT14 DB	74LVT14 DB	SOT337-1
14-Pin Plastic TSSOP	-40°C to +85°C	74LVT14 PW	74LVT14 PWDH	SOT402-1

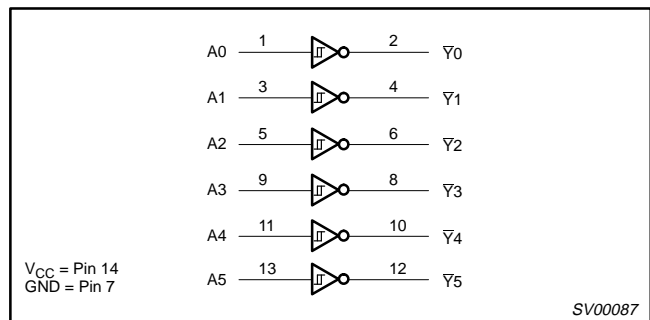
## FUNCTION TABLE

INPUTS	OUTPUT
$D_n$	$\bar{Q}_n$
L	H
H	L

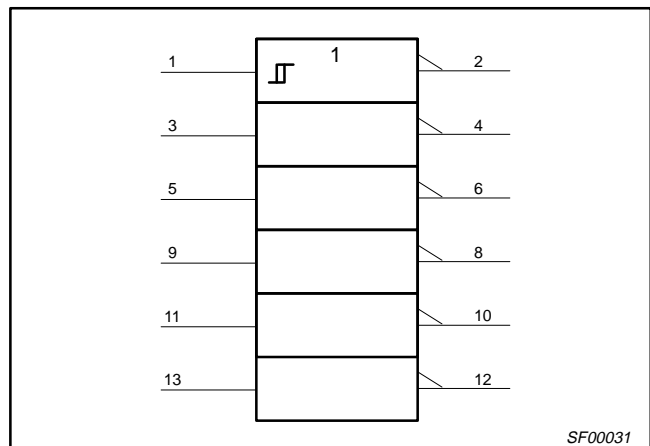
### NOTES:

- H = High voltage level
- L = Low voltage level

## LOGIC DIAGRAM



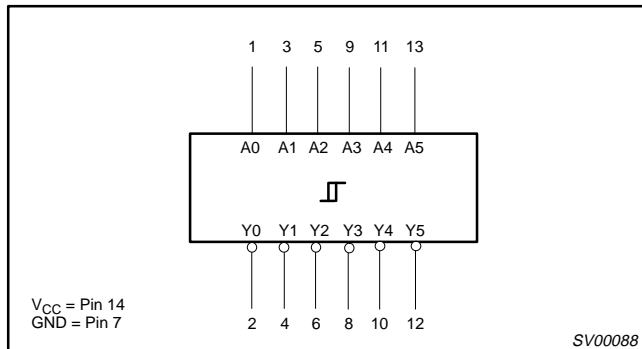
## IEC/IEEE SYMBOL



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## LOGIC SYMBOL

ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V <sub>CC</sub>	DC supply voltage		-0.5 to +4.6	V
I <sub>IK</sub>	DC input diode current	V <sub>I</sub> < 0	-50	mA
V <sub>I</sub>	DC input voltage <sup>3</sup>		-0.5 to +7.0	V
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> < 0	-50	mA
V <sub>OUT</sub>	DC output voltage <sup>3</sup>	Output in Off or High state	-0.5 to +7.0	V
I <sub>OUT</sub>	DC output current	Output in High state	-32	mA
		Output in Low state	64	
T <sub>stg</sub>	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 <sub>CC</sub>	DC supply voltage	2.7	3.6	V
V <sub>I</sub>	Input voltage	0	5.5	V
V <sub>IH</sub>	High-level input voltage	2.0		V
V <sub>IL</sub>	Low-level Input voltage		0.8	V
I <sub>OH</sub>	High-level output current		-20	mA
I <sub>OL</sub>	Low-level output current		32	mA
Δt/Δv	Input transition rise or fall rate; Outputs enabled		10	ns/V
T <sub>amb</sub>	Operating free-air temperature range	-40	+85	°C

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**DC ELECTRICAL CHARACTERISTICS**

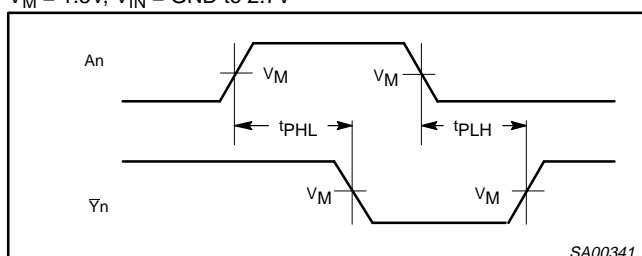
Over recommended operating conditions

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP <sup>1</sup>	MAX	
$V_{T+}$	Positive-going threshold	$V_{CC} = 3.3V$	1.5	1.7	2.0	V
$V_{T-}$	Negative-going threshold	$V_{CC} = 3.3V$	0.9	1.1	1.3	V
$\Delta V_T$	Hysteresis	$V_{CC} = 3.3V$	0.4	0.6		V
$V_{IK}$	Input clamp voltage	$V_{CC} = 2.7V; I_{IK} = -18mA$			-1.2	V
$V_{OH}$	High-level output voltage	$V_{CC} = 2.7$ to $3.6V; I_{OH} = -100\mu A$	$V_{CC}-0.2$			V
		$V_{CC} = 2.7V; I_{OH} = -6mA$	2.4			
		$V_{CC} = 3.0V; I_{OH} = -20mA$	2.0			
$V_{OL}$	Low-level output voltage	$V_{CC} = 2.7V; I_{OL} = 100\mu A$			0.2	V
		$V_{CC} = 2.7V; I_{OL} = 24mA$			0.5	
		$V_{CC} = 3.0V; I_{OL} = 32mA$			0.5	
$I_I$	Input leakage current	$V_{CC} = 0$ or $3.6V; V_I = 5.5V$			10	$\mu A$
		$V_{CC} = 3.6V; V_I = V_{CC}$ or GND			$\pm 1$	
$I_{OFF}$	Output off current	$V_{CC} = 0V; V_I$ or $V_O = 0$ to $4.5V$			$\pm 100$	$\mu A$
$I_{CCH}$	Quiescent supply current	$V_{CC} = 3.6V; \text{Outputs High, } V_I = \text{GND or } V_{CC}, I_O = 0$			0.02	mA
$I_{CCL}$		$V_{CC} = 3.6V; \text{Outputs Low, } V_I = \text{GND or } V_{CC}, I_O = 0$		1.5	3	
$\Delta I_{CC}$	Additional supply current per input pin <sup>2</sup>	$V_{CC} = 3V$ to $3.6V; \text{One input at } V_{CC}-0.6V, \text{Other inputs at } V_{CC}$ or GND			0.2	$\mu A$
$C_I$	Input capacitance	$V_I = 3V$ or 0		3		pF

**NOTES:**1. All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .2. This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND**AC ELECTRICAL CHARACTERISTICS**

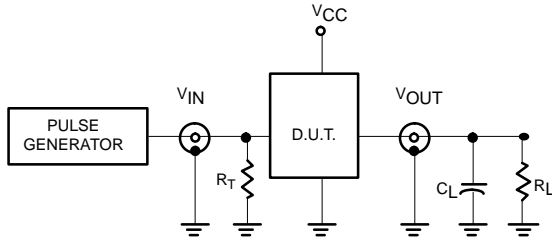
SYMBOL	PARAMETER	TEST CONDITION	LIMITS				UNIT
			$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$	
			MIN	TYP	MAX	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay An to $\bar{Y}_n$	Waveform 1	1.0 1.0	3.8 3.2	5.7 4.5	6.9 4.1	ns

**AC WAVEFORMS** $V_M = 1.5V, V_{IN} = \text{GND to } 2.7V$ **Waveform 1. Propagation delay for inverting outputs**

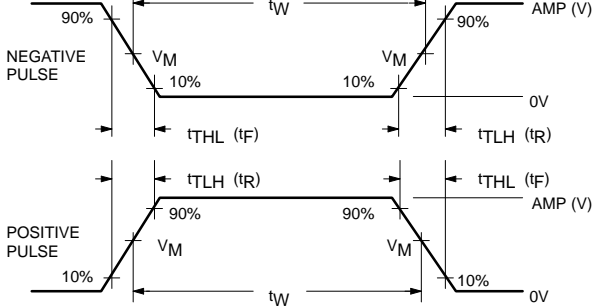
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#### TEST CIRCUIT AND WAVEFORMS



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	$\leq 10\text{MHz}$	500ns	$\leq 2.5\text{ns}$	$\leq 2.5\text{ns}$

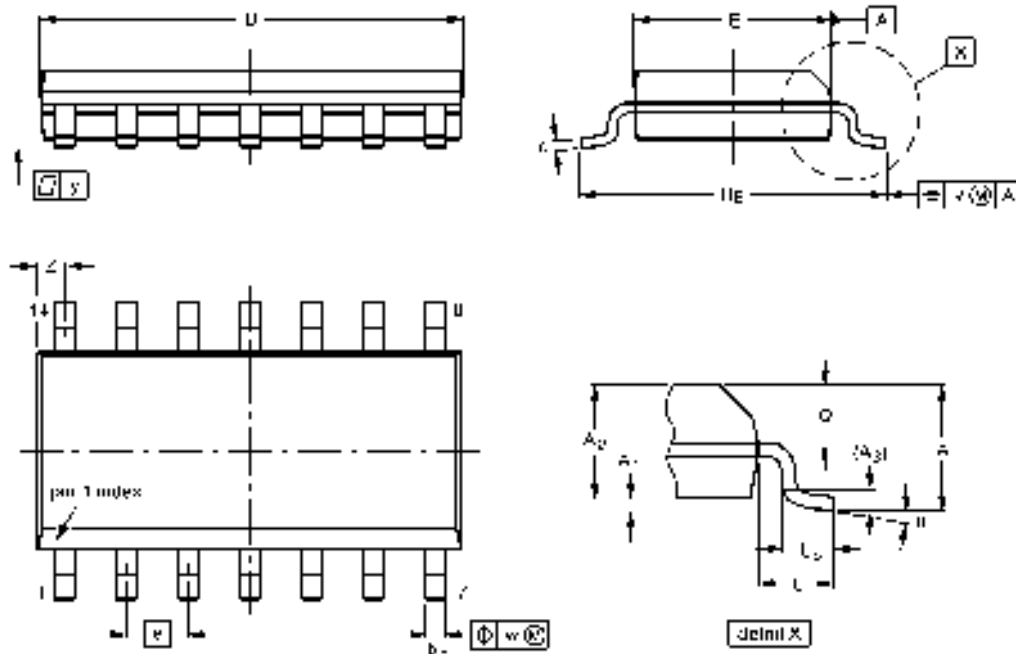
SV00022

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SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



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>	e	Ø <sup>(1)</sup>	Ø <sup>(1)</sup>	+	HE	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	+
mm	1.75	0.25 0.10	1.45 1.25	0.20	0.45 0.30	0.25 0.19	8.75 8.50	4.0 3.0	1.27	5.2 5.0	11.5	1.0 0.8	0.7 0.6	0.25	0.25	0.1	0.7 0.3	+
inches	0.069	0.0098 0.0039	0.057 0.049	0.008	0.018 0.014	0.0099 0.0075	0.34 0.34	0.16 0.12	0.050	0.21 0.20	0.45	0.039 0.031	0.028 0.024	0.01	0.01	0.004	0.028 0.012	+

Note

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

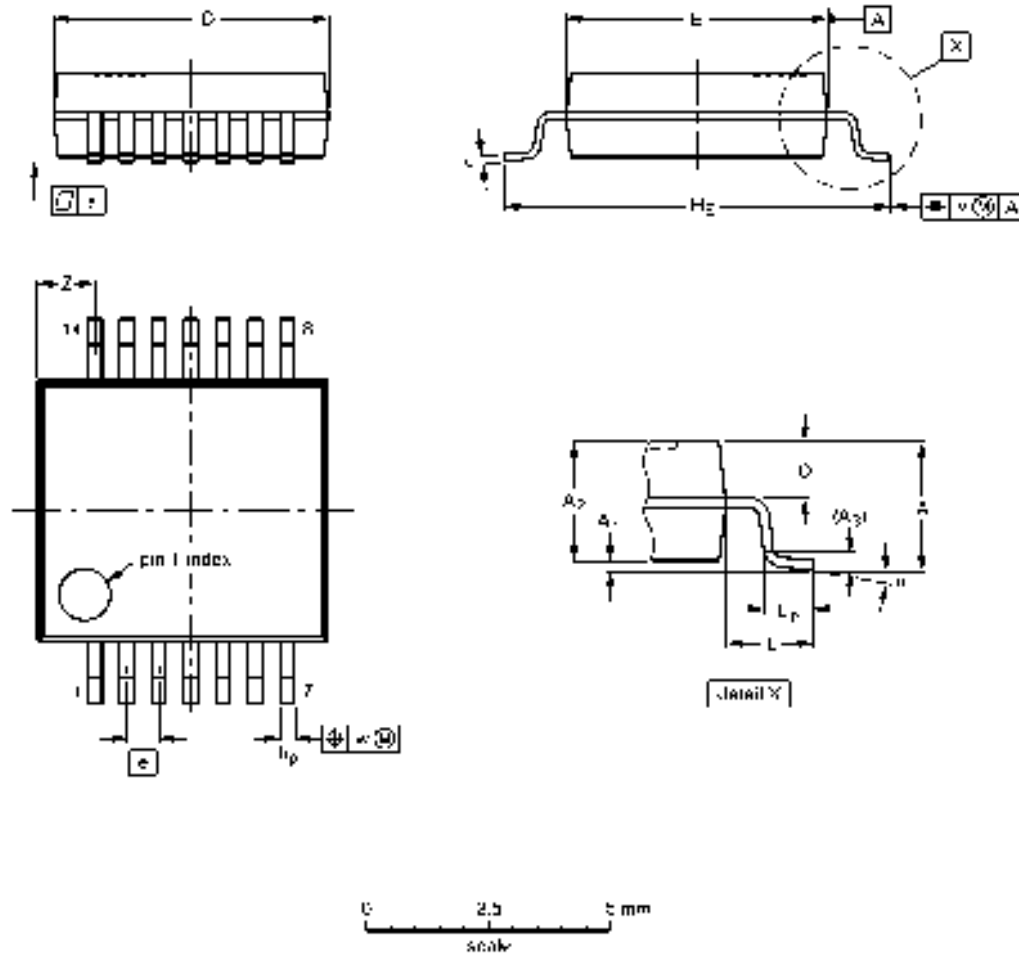
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT108-1	076E065	MS-012AB			94-08-19 95-01-23

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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	a <sub>3</sub>	b <sub>p</sub>	c	Ø <sup>(1)</sup>	e <sup>(1)</sup>	e	H <sub>2</sub>	L	L <sub>p</sub>	Ø	γ	w	y	z <sup>(1)</sup>	r
mm	2.0	0.71 0.75	1.83 1.05	0.25	0.38 0.25	0.20 0.39	6.4 0.0	5.4 5.2	0.63	7.0 7.5	1.25	1.02 0.62	0.8 0.7	0.2	0.12	0.1	1.4 0.9	0° 0°

Note

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

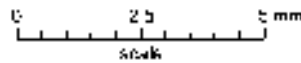
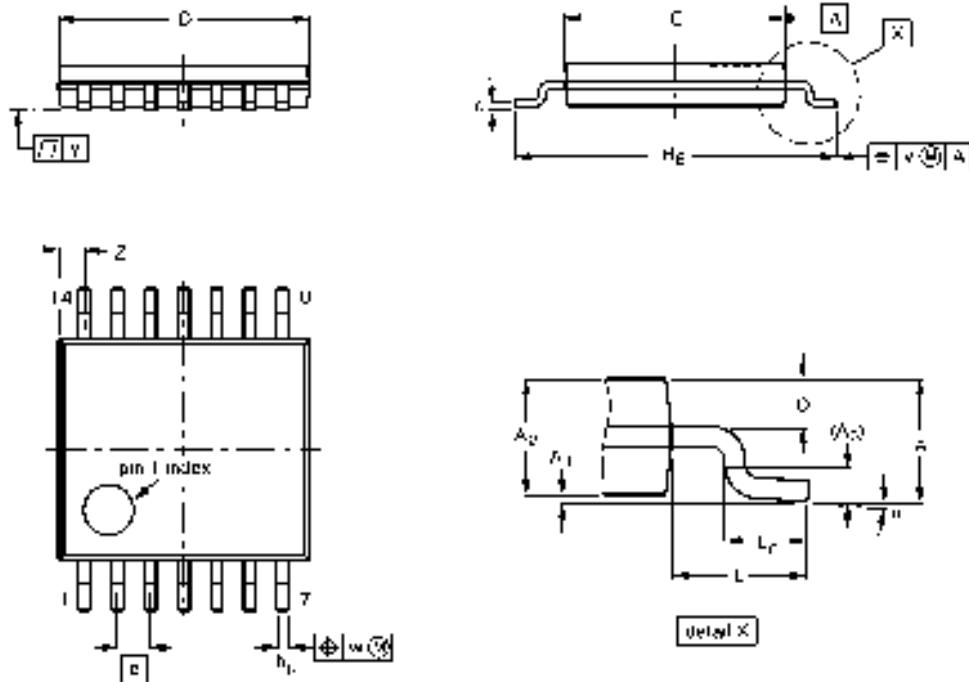
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT337-1		M0-150AB			95-02-04 96-01-19

3.3V Hex inverter Schmitt trigger

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TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



DIMENSIONS (mm are the original 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>(2)</sup>	e	H <sub>c</sub>	L	L <sub>P</sub>	Q	v	w	y	Z <sup>(1)</sup>	u
mm	1.10	0.15 0.25	0.05 0.00	0.25	0.30 0.19	0.7 0.1	5.1 4.9	4.5 4.3	0.55	6.6 6.2	1.0	0.75 0.57	0.4 0.3	0.2	0.13	0.1	0.72 0.38	0° 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			
SOT402-1		MO-150				94-07-12 95-11-01



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**NOTES**

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## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	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.
<i>Product Specification</i>	<b>Full Production</b>	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.

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