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74LVC821A

10-bit D-type flip-flop with 5 V tolerant inputs/outputs; positive-edge trigger; 3-state

Rev. 03 — 11 May 2004 Product data sheet

1. General description

The 74LVC821A is a high performance, low power, low voltage Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3 V or 5 V devices. In 3-state operation, outputs can handle 5 V. This feature allows the use of these devices as translators in a mixed 3.3 V and 5 V environment.

The 74LVC821A is a 10-bit D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A clock input (pin CP) and an output enable input (pin $\overline{OE}$) are common to all flip-flops. The ten flip-flops will store the state of their individual D-inputs that meet the set-up and hold times requirements on the LOW-to-HIGH CP transition. When pin $\overline{OE}$ is LOW, the contents of the ten flip-flops is available at the outputs.

When pin $\overline{OE}$ is HIGH, the outputs go to the high-impedance OFF-state. Operation of the $\overline{OE}$ inputs does not affect the state of the flip-flops.

2. Features

- 5 V tolerant inputs and outputs; for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Flow-through pin-out architecture
- 10-bit positive edge-triggered register
- Independent register and 3-state buffer operation
- Complies with JEDEC standard JESD8-B
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from –40 °C to +85 °C and –40 °C to +125 °C.

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3. Quick reference data

Table 1: Quick reference data

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f \leq 2.5$ ns.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t_{PHL}, t_{PLH}	propagation delay CP to Qn	C_L = 50 pF; V_{CC} = 3.3 V		-	3.7	-	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to Qn	C_L = 50 pF; V_{CC} = 3.3 V		-	3.5	-	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to Qn	C_L = 50 pF; V_{CC} = 3.3 V		-	3.0	-	ns
f_{max}	maximum clock frequency	C_L = 50 pF; V_{CC} = 3.3 V		-	200	-	MHz
C_I	input capacitance			-	5.0	-	pF
C_{PD}	power dissipation capacitance per gate	V_{CC} = 3.3 V	[1] [2]				
		outputs enabled		-	17	-	pF
		outputs disabled		-	11	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in Volts;
N = total load switching outputs;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

[2] The condition is V_I = GND to V_{CC}.

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC821AD	–40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC821ADB	–40 °C to +125 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC821APW	–40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74LVC821ABQ	–40 °C to +125 °C	DHVQFN24	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body 3.5 × 5.5 × 0.85 mm	SOT815-1

5. Functional diagram

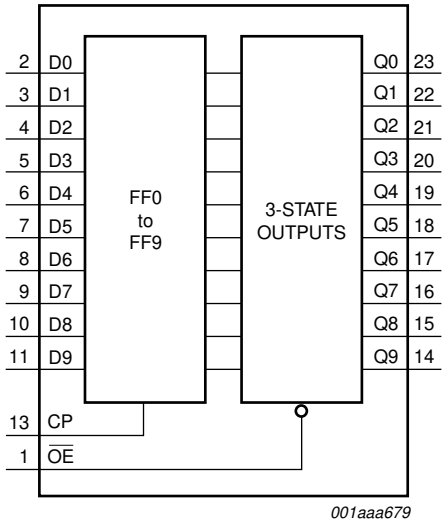


Fig 1. Functional diagram.

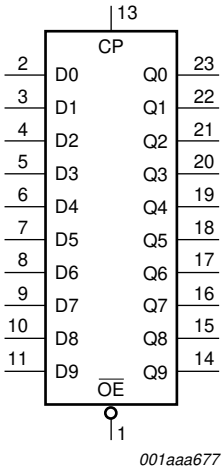


Fig 2. Logic symbol.

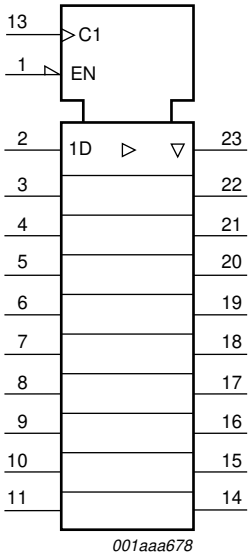


Fig 3. IEC logic symbol.

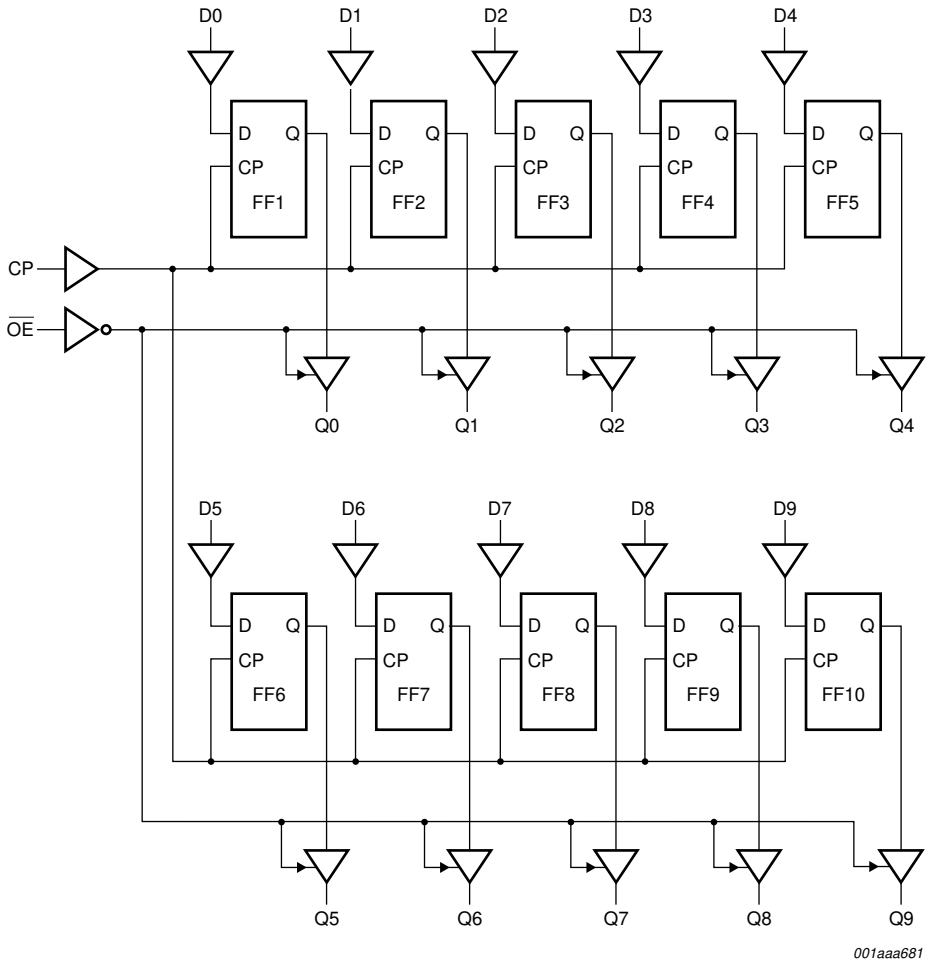


Fig 4. Logic diagram.

6. Pinning information

6.1 Pinning

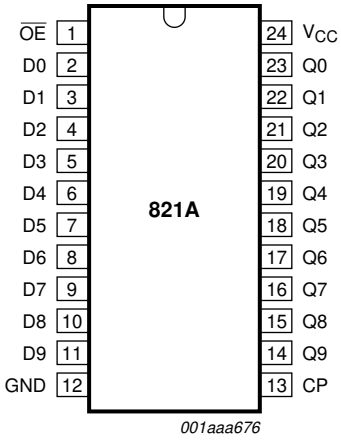
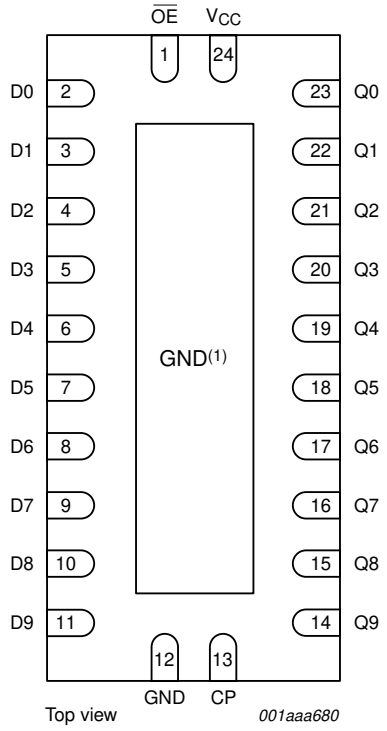


Fig 5. Pin configuration SO24 and (T)SSOP24.



(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig 6. Pin configuration DHVQFN24.

6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
$\overline{OE}$	1	output enable input (active LOW)
D0	2	data input
D1	3	data input
D2	4	data input
D3	5	data input
D4	6	data input
D5	7	data input
D6	8	data input
D7	9	data input
D8	10	data input
D9	11	data input

Table 3: Pin description *...continued*

Symbol	Pin	Description
GND	12	ground (0 V)
CP	13	clock input (LOW-to-HIGH, edge-triggered)
Q9	14	3-state flip-flop output
Q8	15	3-state flip-flop output
Q7	16	3-state flip-flop output
Q6	17	3-state flip-flop output
Q5	18	3-state flip-flop output
Q4	19	3-state flip-flop output
Q3	20	3-state flip-flop output
Q2	21	3-state flip-flop output
Q1	22	3-state flip-flop output
Q0	23	3-state flip-flop output
V_{CC}	24	supply voltage

7. Functional description

Table 4: Function table [1]

Operating mode	Input			Internal flip-flops	Output
	$\overline{OE}$	CP	Dn		Qn
Load and read register	L	↑	l	L	L
	L	↑	h	H	H
Load register and disable outputs	H	↑	l	L	Z
	H	↑	h	H	Z
Hold	L	H or L	X	NC	NC

[1] H = HIGH voltage level;
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;
L = LOW voltage level;
l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
Z = high-impedance OFF-state;
l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
NC = no change;
X = don't care.

8. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+6.5	V
I_{IK}	input diode current	$V_I < 0$ V		-	–50	mA
V_I	input voltage		[1]	–0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA

Table 5: Limiting values *...continued*

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Max	Unit
V_O	output voltage	HIGH or LOW state	[1]	−0.5	V_{CC} + 0.5	V
		3-state	[1]	−0.5	+6.5	V
I_O	output source or sink current	V_O = 0 V to V_{CC}		-	±50	mA
I_{CC}, I_{GND}	V_{CC} or GND current			-	±100	mA
T_{stg}	storage temperature			−65	+150	°C
P_{tot}	power dissipation	T_{amb} = −40 °C to +125 °C	[2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SO24 package: above 70 °C derate linearly with 8 mW/K.
For SSOP24 and TSSOP24 packages: above 60 °C derate linearly with 5.5 mW/K.
For DHVQFN24 package: above 60 °C derate linearly with 4.5 mW/K.

9. Recommended operating conditions

Table 6: Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	for maximum speed performance	2.7	-	3.6	V
		for low-voltage applications	1.2	-	3.6	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage	HIGH or LOW state	0	-	V_{CC}	V
		3-state	0	-	5.5	V
T_{amb}	operating ambient temperature	in free air	−40	-	+125	°C
t_r, t_f	input rise and fall times	V_{CC} = 1.2 V to 2.7 V	0	-	20	ns/V
		V_{CC} = 2.7 V to 3.6 V	0	-	10	ns/V

10. Static characteristics

Table 7: Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]						
V_{IH}	HIGH-level input voltage	V_{CC} = 1.2 V	V_{CC}	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.2 V	-	-	GND	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	V

Table 7: Static characteristics *...continued*

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		$I_O = -100$ µA; $V_{CC} = 2.7$ V to 3.6 V	[2]	$V_{CC} - 0.2$	V_{CC}	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V		$V_{CC} - 0.5$	-	-	V
		$I_O = -18$ mA; $V_{CC} = 3.0$ V		$V_{CC} - 0.6$	-	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V		$V_{CC} - 0.8$	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		$I_O = 100$ µA; $V_{CC} = 2.7$ V to 3.6 V	[2]	-	GND	0.2	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V		-	-	0.4	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V		-	-	0.55	V
I_{LI}	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 3.6$ V		-	±0.1	±5	µA
I_{OZ}	3-state output OFF-state current	$V_I = V_{IH}$ or V_{IL}; $V_O = 5.5$ V or GND; $V_{CC} = 3.6$ V		-	0.1	±5	µA
I_{off}	power-off leakage supply current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V		-	0.1	±10	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 3.6$ V		-	0.1	10	µA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.7$ V to 3.6 V	[2]	-	5	500	µA
C_I	input capacitance			-	5.0	-	pF
$T_{amb} = -40$ °C to +125 °C							
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.2$ V		V_{CC}	-	-	V
		$V_{CC} = 2.7$ V to 3.6 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.2$ V		-	-	0	V
		$V_{CC} = 2.7$ V to 3.6 V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		$I_O = -100$ µA; $V_{CC} = 2.7$ V to 3.6 V		$V_{CC} - 0.3$	-	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V		$V_{CC} - 0.65$	-	-	V
		$I_O = -18$ mA; $V_{CC} = 3.0$ V		$V_{CC} - 0.75$	-	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V		$V_{CC} - 1$	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		$I_O = 100$ µA; $V_{CC} = 2.7$ V to 3.6 V		-	-	0.3	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V		-	-	0.6	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V		-	-	0.8	V
I_{LI}	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 3.6$ V		-	-	±20	µA
I_{OZ}	3-state output OFF-state current	$V_I = V_{IH}$ or V_{IL}; $V_O = 5.5$ V or GND; $V_{CC} = 3.6$ V		-	-	±20	µA
I_{off}	power-off leakage supply current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V		-	-	±20	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 3.6$ V		-	-	40	µA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.7$ V to 3.6 V		-	-	5000	µA

[1] All typical values are measured T_{amb} = 25 °C.

[2] These typical values are measured at V_{CC} = 3.3 V.

11. Dynamic characteristics

Table 8: Dynamic characteristics

GND = 0 V; $t_r = t_f \leq 2.5$ ns; C_L = 50 pF; R_L = 500 Ω; for test circuit see Figure 10

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]							
t_{PHL}, t_{PLH}	propagation delay CP to Qn	see Figure 7					
		V_{CC} = 1.2 V		-	18	-	ns
		V_{CC} = 2.7 V		1.5	-	8.5	ns
		V_{CC} = 3.0 V to 3.6 V	[2]	1.5	3.7	7.3	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to Qn	see Figure 9					
		V_{CC} = 1.2 V		-	20	-	ns
		V_{CC} = 2.7 V		1.5	-	8.8	ns
		V_{CC} = 3.0 V to 3.6 V	[2]	1.3	3.5	7.6	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to Qn	see Figure 9					
		V_{CC} = 1.2 V		-	9.0	-	ns
		V_{CC} = 2.7 V		1.5	-	6.8	ns
		V_{CC} = 3.0 V to 3.6 V	[2]	1.5	3.0	6.2	ns
t_W	clock pulse width HIGH or LOW	see Figure 7					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		3.3	-	-	ns
		V_{CC} = 3.0 V to 3.6 V	[2]	3.3	1.7	-	ns
t_{su}	set-up time Dn to CP	see Figure 8					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		0.9	-	-	ns
		V_{CC} = 3.0 V to 3.6 V	[2]	1.9	0.6	-	ns
t_h	hold time Dn to CP	see Figure 8					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		1.5	-	-	ns
		V_{CC} = 3.0 to 3.6 V	[2]	1.5	0.0	-	ns
f_{max}	maximum clock frequency	see Figure 7					
		V_{CC} = 1.2 V		-	-	-	MHz
		V_{CC} = 2.7 V		150	-	-	MHz
		V_{CC} = 3.0 V to 3.6 V	[2]	150	200	-	MHz
$t_{sk(0)}$	skew	V_{CC} = 3.0 V to 3.6 V	[3]	-	-	1.0	ns
C_{PD}	power dissipation capacitance per gate	V_{CC} = 3.3 V	[4] [5]				
		outputs enabled		-	17	-	pF
		outputs disabled		-	11	-	pF

Table 8: Dynamic characteristics *...continued*

GND = 0 V; $t_r = t_f \leq 2.5$ ns; $C_L = 50$ pF; $R_L = 500\ \Omega$; for test circuit see Figure 10

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = −40 °C to +125 °C							
t_{PHL}, t_{PLH}	propagation delay CP to Qn	see Figure 7					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		1.5	-	11.0	ns
		V_{CC} = 3.0 V to 3.6 V		1.5	-	9.5	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to Qn	see Figure 9					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		1.5	-	11.0	ns
		V_{CC} = 3.0 V to 3.6 V		1.3	-	9.5	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to Qn	see Figure 9					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		1.5	-	8.5	ns
		V_{CC} = 3.0 V to 3.6 V		1.5	-	8.0	ns
t_W	clock pulse width HIGH or LOW	see Figure 7					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		3.3	-	-	ns
		V_{CC} = 3.0 V to 3.6 V		3.3	-	-	ns
t_{su}	set-up time Dn to CP	see Figure 8					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		0.9	-	-	ns
		V_{CC} = 3.0 V to 3.6 V		1.9	-	-	ns
t_h	hold time Dn to CP	see Figure 8					
		V_{CC} = 1.2 V		-	-	-	ns
		V_{CC} = 2.7 V		1.5	-	-	ns
		V_{CC} = 3.0 V to 3.6 V		1.5	-	-	ns
f_{max}	maximum clock frequency	see Figure 7					
		V_{CC} = 1.2 V		-	-	-	MHz
		V_{CC} = 2.7 V		150	-	-	MHz
		V_{CC} = 3.0 V to 3.6 V		150	-	-	MHz
$t_{sk(0)}$	skew	V_{CC} = 3.0 V to 3.6 V	[3]	-	-	1.0	ns

[1] All typical values are measured T_{amb} = 25 °C.

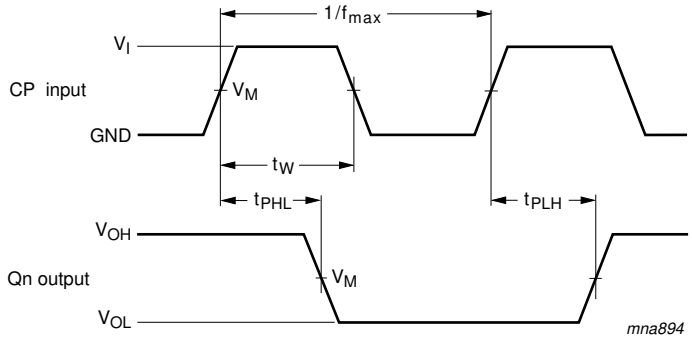
[2] These typical values are measured at V_{CC} = 3.3 V.

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in Volts;
N = total load switching outputs;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

[5] The condition is V_I = GND to V_{CC}.

12. Waveforms



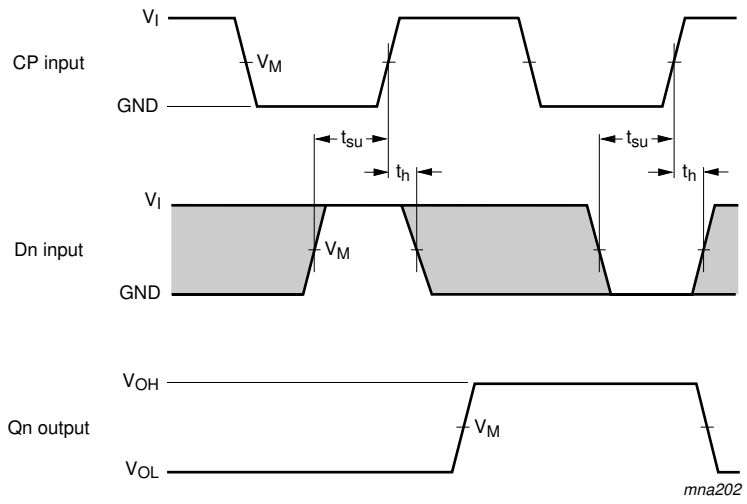
Measurement points are given in Table 9.

V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

Fig 7. Clock (CP) to output (Qn) propagation delays, the clock pulse width and the maximum clock pulse frequency.

Table 9: Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_M
< 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
≥ 2.7 V	1.5 V	1.5 V



Measurement points are given in Table 10.

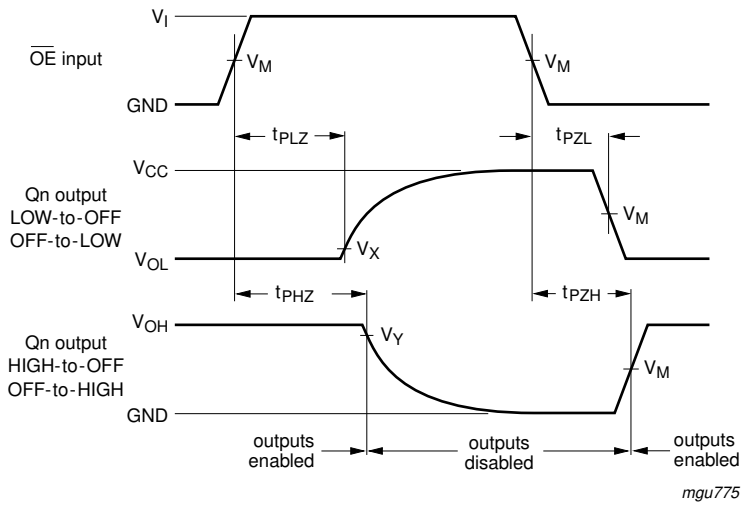
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

The shaded areas indicate when the input is permitted to change for predicable output performance.

Fig 8. Data set-up and hold times for the Dn input to the CP input.

Table 10: Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_M
< 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
≥ 2.7 V	1.5 V	1.5 V



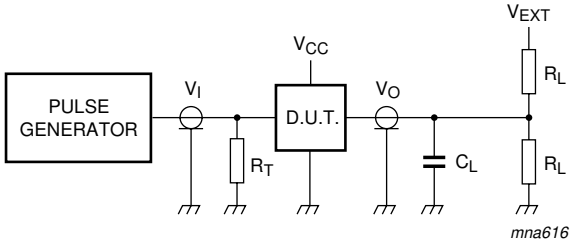
Measurement points are given in Table 11.

V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

Fig 9. 3-state enable and disable times.

Table 11: Measurement points

Supply voltage	Input	Output		
V_{CC}	V_M	V_M	V_X	V_Y
< 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 \times V_{CC}$	$V_{OH} - 0.1 \times V_{CC}$
≥ 2.7 V	1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} − 0.3 V



Data test circuit (see Table 12).

R_L = Load resistor.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig 10. Load circuitry for switching times.

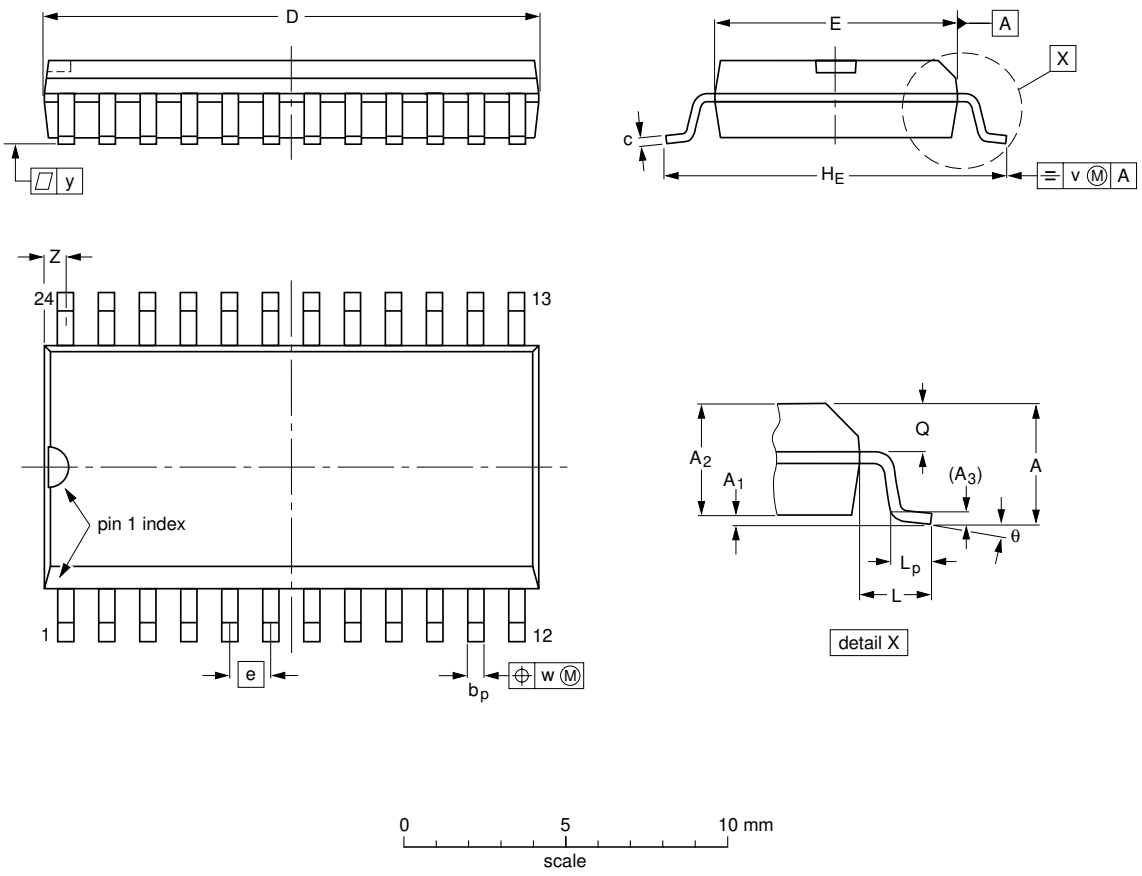
Table 12: Test data

Supply voltage	Input	Load		V_{EXT}		
V_{CC}	V_I	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
1.2 V	V_{CC}	50 pF	500 Ω [1]	open	GND	$2 \times V_{CC}$
2.7 V	2.7 V	50 pF	500 Ω	open	GND	$2 \times V_{CC}$
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	$2 \times V_{CC}$

[1] The circuit performs better when R_L = 1000 Ω.

13. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



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	15.6 15.2	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	0.61 0.60	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	

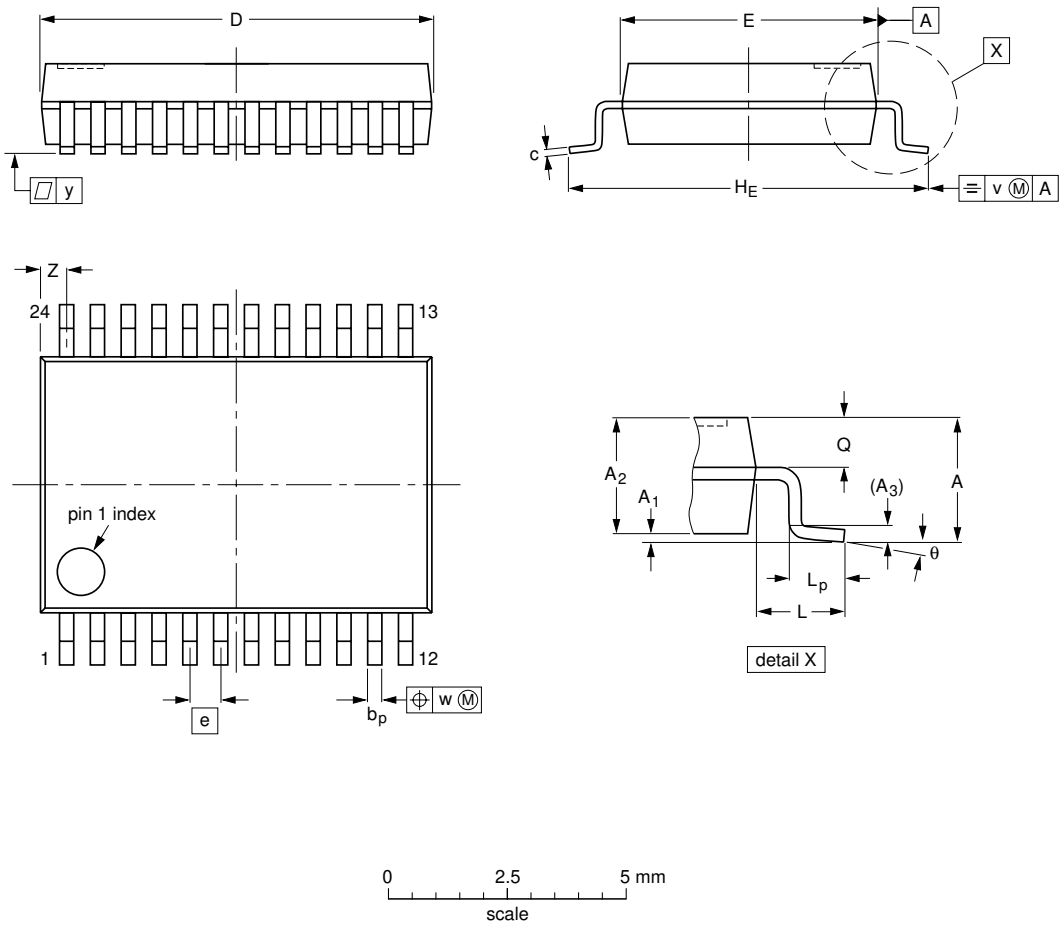
Note

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			
SOT137-1	075E05	MS-013				~~99-12-27~~ 03-02-19

Fig 11. Package outline SO24.

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm **SOT340-1**



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	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	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	0.8 0.4	8^o 0^o

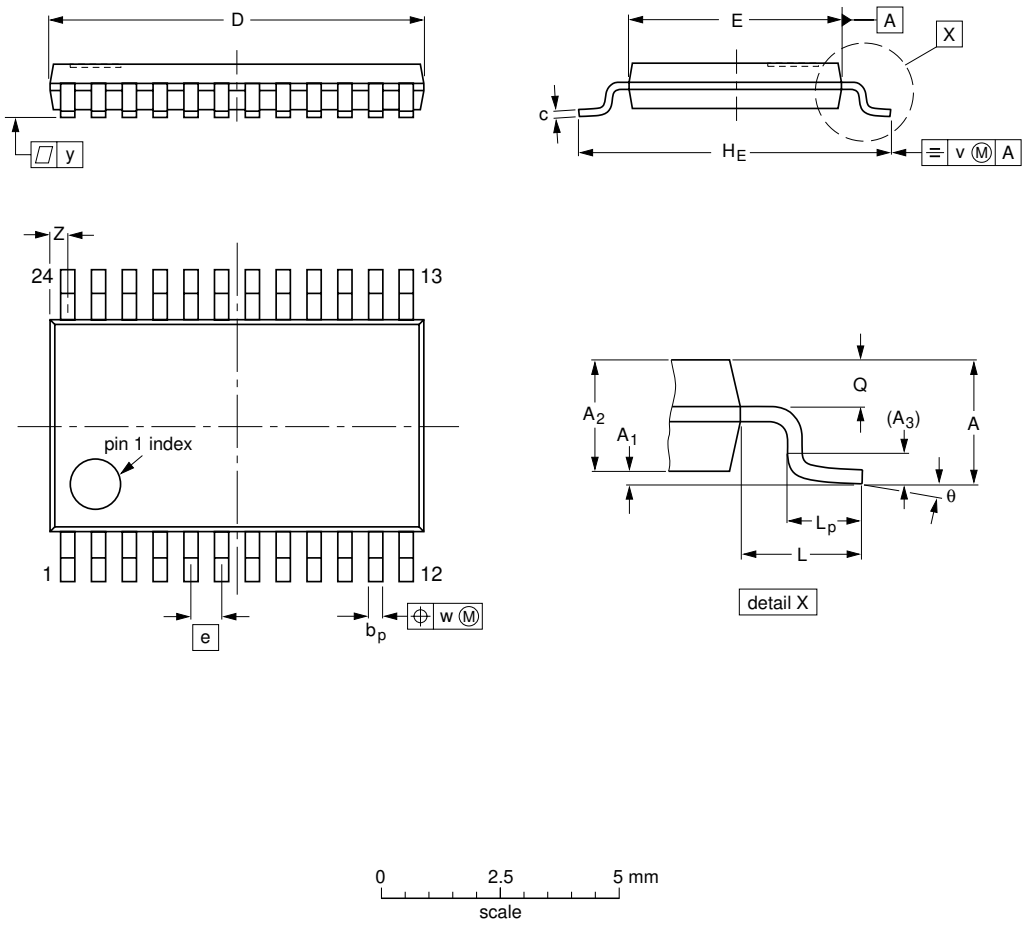
Note

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			
SOT340-1		MO-150				~~99-12-27~~ 03-02-19

Fig 12. Package outline SSOP24.

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm **SOT355-1**



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	7.9 7.7	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°

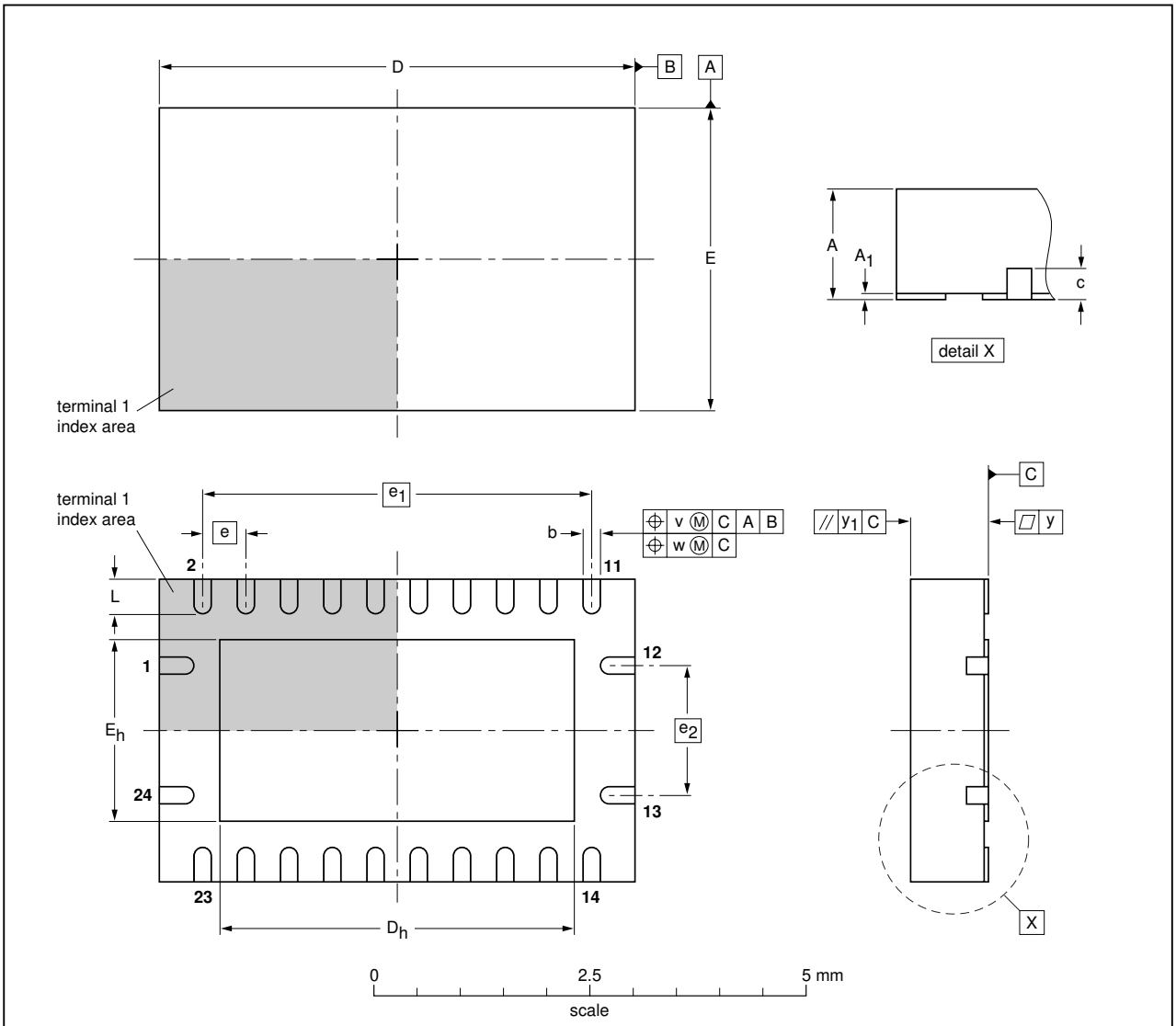
Notes

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			
SOT355-1		MO-153				~~99-12-27~~ 03-02-19

Fig 13. Package outline TSSOP24.

DHVQFN24: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body 3.5 x 5.5 x 0.85 mm **SOT815-1**



DIMENSIONS (mm are the original dimensions)

UNIT	$A^{(1)}$ max.	A_1	b	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	e_2	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	5.6 5.4	4.25 3.95	3.6 3.4	2.25 1.95	0.5	4.5	1.5	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT815-1	- - -	- - -	- - -			03-04-29

Fig 14. Package outline DHVQFN24.

14. Revision history

Table 13: Revision history

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
74LVC821A_3	20040511	Product data	-	9397 750 13276	74LVC821A_2
Modifications:	• Figure 4: corrected.				
74LVC821A_2	20040415	Product data	-	9397 750 13047	74LVC821A_1
74LVC821A_1	19980925	Product specification	-	9397 750 04584	-

15. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	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	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	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.

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19. Contents

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