

Hex inverter

74AC04
74ACT04

FEATURES

- 74ACT04 has TTL-compatible inputs
- 74AC04 has CMOS-compatible inputs
- Meets or exceeds JEDEC standard standard for 74AC(T)XX family
- Superior ground bounce noise immunity
- Output source/sink 24mA

DESCRIPTION

The 74AC/T04 provides six inverting buffers.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			V _{CC} = 3.3V	V _{CC} = 5.0V	V _{CC} = 5.0V	
t _{PHL} /t _{PLH}	Propagation delay nA to nY	C _L = 50pF	3.0	2.2	3.3	ns
C _I	Input capacitance		4.5			pF
C _{PD}	Power dissipation capacitance per gate	V _I = GND to V _{CC} ¹	39		44	pF

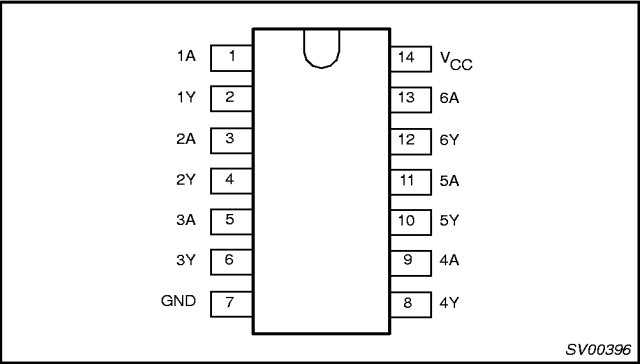
NOTE:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
P_D = C_{PD} × V_{CC}² × f_i + Σ (C_L × V_{CC}² × f_o) where:
f_i = input frequency in MHz; C_L = output load capacity in pF;
f_o = output frequency in MHz; V_{CC} = supply voltage in V;
Σ (C_L × V_{CC}² × f_o) = sum of outputs.

ORDERING AND PACKAGE INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DRAWING NUMBER
14-Pin Plastic SO	−40°C to +85°C	74AC04D 74ACT04D	74AC04D 74ACT04D	SOT108-1
14-Pin Plastic SSOP Type II	−40°C to +85°C	74AC04DB 74ACT04DB	74AC04DB 74ACT04DB	SOT337-1
14-Pin Plastic TSSOP Type I	−40°C to +85°C	74AC04PW 74ACT04PW	74AC04PW DH 74ACT04PW DH	SOT402-1

PIN CONFIGURATION



PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1, 3, 5, 9, 11, 13	1A – 6A	Data inputs
2, 4, 6, 8, 10, 12	1Y – 6Y	Data outputs
7	GND	Ground (0 V)
14	V _{CC}	Positive supply voltage

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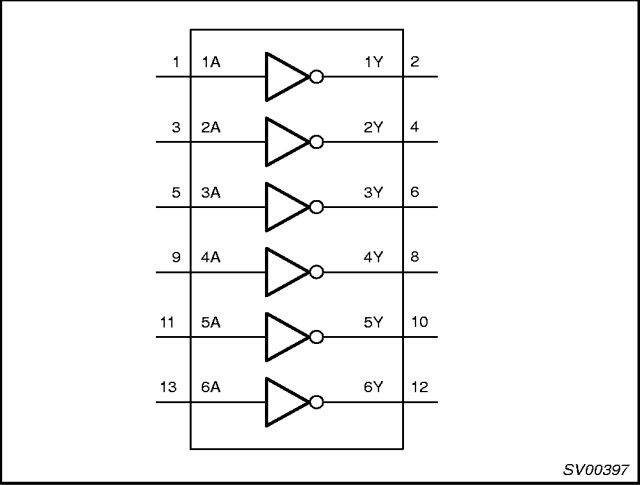
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FUNCTION TABLE

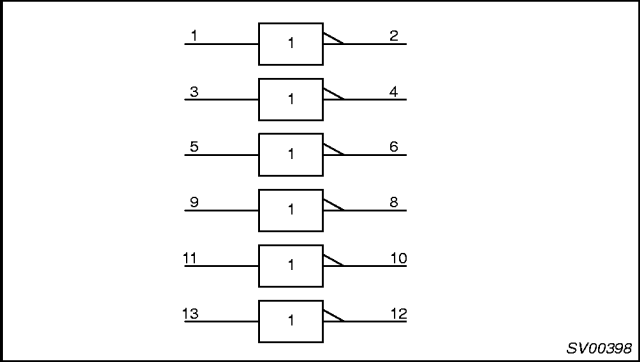
INPUTS	OUTPUTS
nA	nY
L	H
H	L

NOTES:
H = HIGH voltage level
L = LOW voltage level

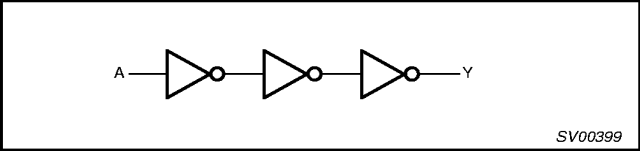
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V _{CC}	DC supply voltage for 'AC	2.0	6.0	V
V _{CC}	DC supply voltage for 'ACT	4.5	5.5	V
V _{IN}	DC input voltage range	0	V _{CC}	V
V _O	DC output voltage range	0	V _{CC}	V
T _{amb}	Operating free-air temperature range	-40	+85	°C
ΔV/Δt	Minimum input edge rate — AC devices V _{IN} from 30% to 70% of V _{CC} V _{CC} @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices V _{IN} from 0.8V to 2.0V V _{CC} @ 4.5V, 5.5V	125		

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74ACT04**ABSOLUTE MAXIMUM RATINGS¹**

in accordance with the Absolute Maximum Rating System (IEC134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_{IN} = -0.5V$	-20	mA
		$V_{IN} = V_{CC} + 0.5V$	+20	
V_{IN}	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
I_{OK}	DC output diode current	$V_O = -0.5V$	-20	mA
		$V_O = V_{CC} + 0.5V$	+20	
V_O	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
I_O	DC output source or sink current		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current per output		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current		± 200	mA
T_{stg}	Storage temperature range		-65 to +150	°C
P_{TOT}	Power dissipation per package			
	– plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	500 500	mW

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.

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74ACT04**DC CHARACTERISTICS FOR THE AC FAMILY**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	3.0	2.1	1.5		V
			4.5	3.15	2.25		
			5.5	3.85	2.75		
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	3.0		1.5	0.9	V
			4.5		2.25	1.35	
			5.5		2.75	1.65	
V _{OH}	HIGH level output voltage	I _{OUT} = –50 μA	3.0	2.9	2.99		V
			4.5	4.4	4.49		
			5.5	5.4	5.49		
		V _{IN} = V _{IL} or V _{IH} ; I _{OH} = –12mA ¹	3.0	2.46			
		V _{IN} = V _{IL} or V _{IH} ; I _{OH} = –24mA ¹	4.5	3.76			
		V _{IN} = V _{IL} or V _{IH} ; I _{OH} = –24mA ¹	5.5	4.76			
V _{OL}	LOW level output voltage	I _{OUT} = 50 μA	3.0		0.01	0.1	V
			4.5		0.01	0.1	
			5.5		0.01	0.1	
		V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 12mA ¹	3.0			0.44	
		V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 24mA ¹	4.5			0.44	
		V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} , GND	5.5			± 1.0	μA
I _{OLD}	Dynamic output current ²	V _{OLD} = 1.65V max	5.5	75			mA
I _{OHD}	Dynamic output current ²	V _{OHD} = 3.85V min	5.5			–75	mA
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			40	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0 ms; one output loaded at a time

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74ACT04**DC CHARACTERISTICS FOR THE ACT FAMILY**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	4.5	2.0	1.5		V
			5.5	2.0	1.5		
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V _{OH}	HIGH level output voltage	I _{OUT} = –50 µA	4.5	4.4	4.49		V
			5.5	5.4	5.49		
		V _{IN} = V _{IL} or V _{IH} ; I _{OH} = –24mA ¹	4.5	3.76			
		V _{IN} = V _{IL} or V _{IH} ; I _{OH} = –24mA ¹	5.5	4.76			
V _{OL}	LOW level output voltage	I _{OUT} = 50 µA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 24mA ¹	4.5			0.44	
		V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} , GND	5.5			± 1.0	µA
ΔI _{CC}	Additional quiescent supply current per input pin	V _{IN} = V _{CC} – 2.1V Other inputs at V _{CC} or GND; I _{OUT} = 0	5.5			1.5	mA
I _{OLD}	Dynamic output current ²	V _{OLD} = 1.65V max	5.5	75			mA
I _{OHD}	Dynamic output current ²	V _{OHD} = 3.85V min	5.5			–75	mA
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			40	µA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0ms, one output loaded at a time

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AC CHARACTERISTICS FOR 74AC04

GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V _{CC} ¹	LIMITS					UNIT	WAVEFORM
			T _{amb} = +25°C			T _{amb} = −40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t _{PLH}	Propagation delay nA to nY	3.3 5.0	2.0 1.5	3.2 2.4	8.5 6.0	1.5 1.0	9.5 6.5	ns	1, 2
t _{PHL}	Propagation delay nA to nY	3.3 5.0	2.0 1.5	2.6 2.0	8.5 6.0	1.5 1.0	9.5 6.5	ns	

NOTE:

1. Voltage range 3.3V is V_{CC} = 3.3V ± 0.3V
Voltage range 5.0V is V_{CC} = 5.0V ± 0.5V

AC CHARACTERISTICS FOR 74ACT04

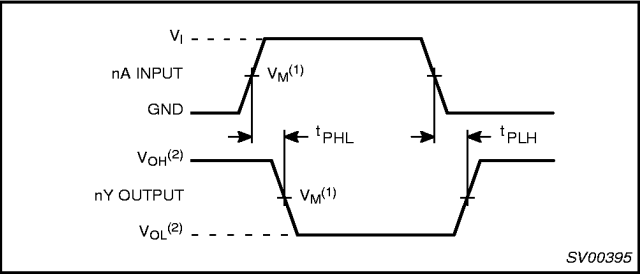
GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V _{CC} ¹	LIMITS					UNIT	WAVEFORM
			T _{amb} = +25°C			T _{amb} = −40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t _{PLH}	Propagation delay nA to nY	5.0	2.0	3.2	7.5	1.5	8.5	ns	1, 2
t _{PHL}	Propagation delay nA to nY	5.0	2.0	3.5	7.5	1.5	8.5	ns	

NOTE:

1. Voltage range 5.0V is V_{CC} = 5.0V ± 0.5V

AC WAVEFORMS

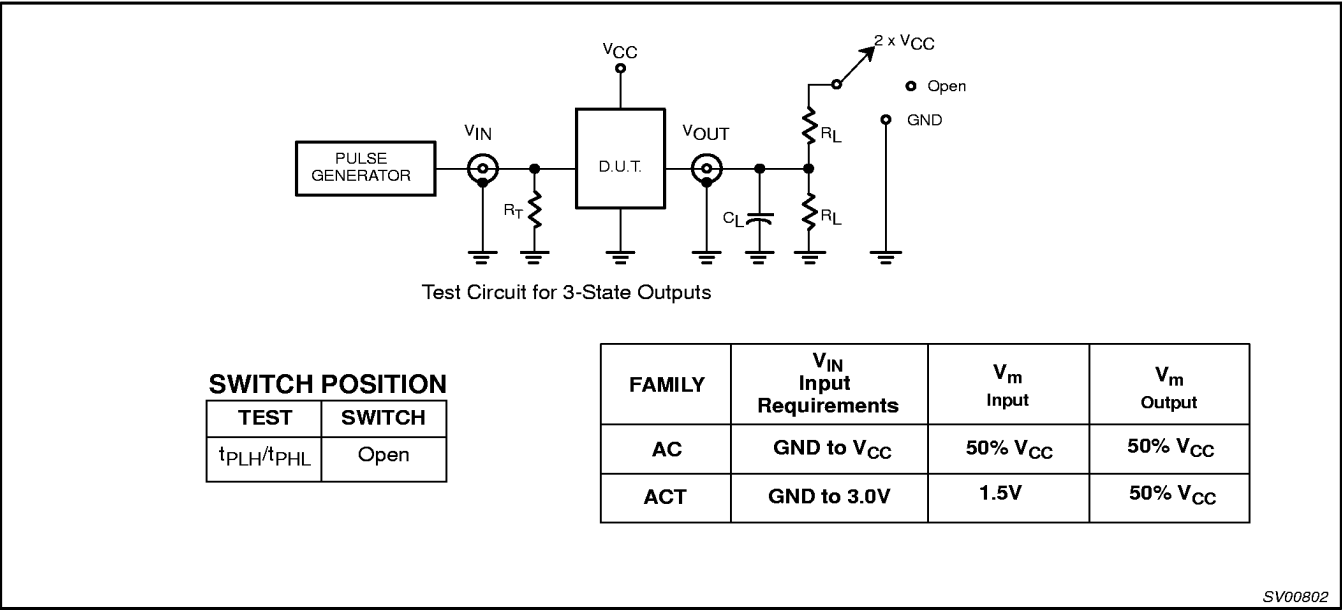


Waveform 1. Inputs (nA, nB) to output (nY) propagation delays

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TEST CIRCUIT



Waveform 2. Load circuitry for switching times

DEFINITIONS

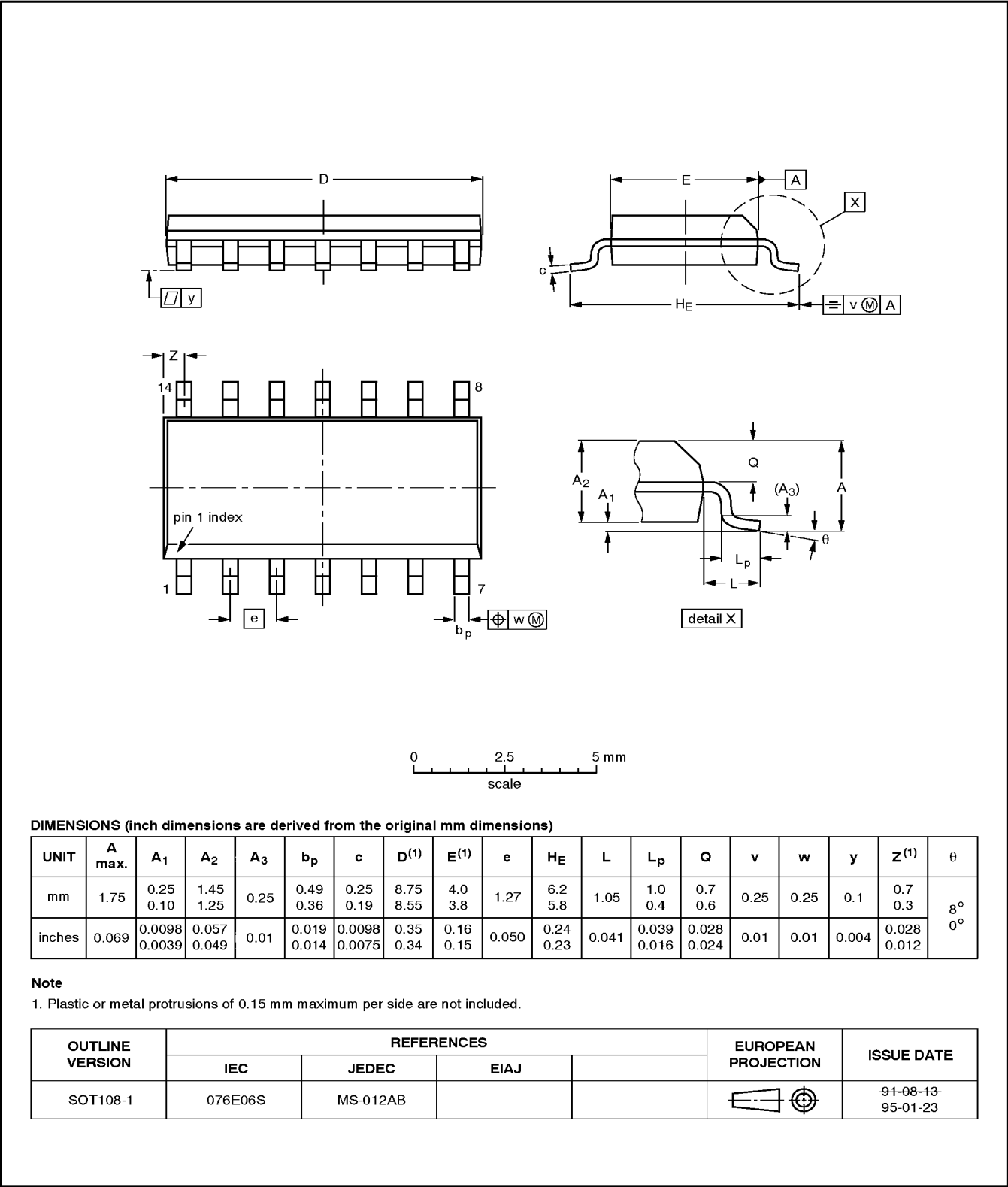
R_L = Load resistor; see AC Characteristics for value
 C_L = Load capacitance; see AC Characteristics
Termination resistance should be equal to Z_{OUT} of pulse generators

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

SOT108-1

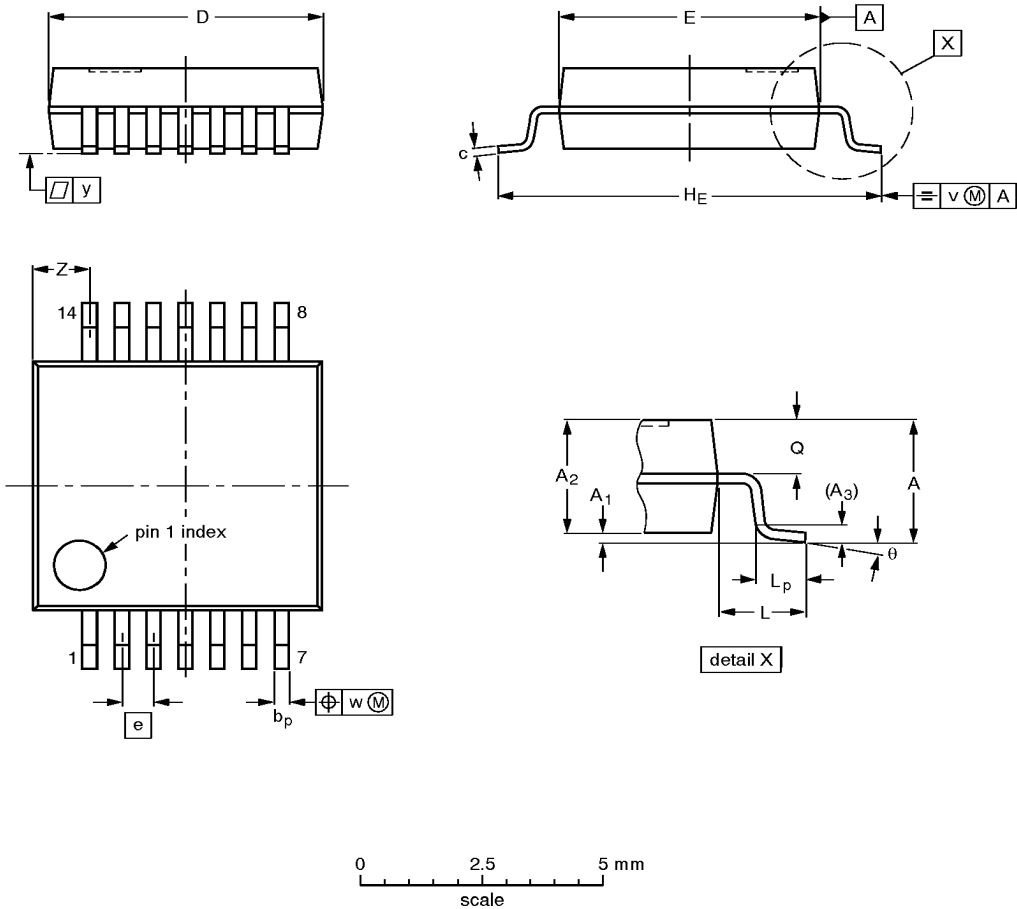


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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



DIMENSIONS (mm are the original dimensions)

UNIT	A _{max.}	A 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	6.4 6.0	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	1.4 0.9	8° 0°

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

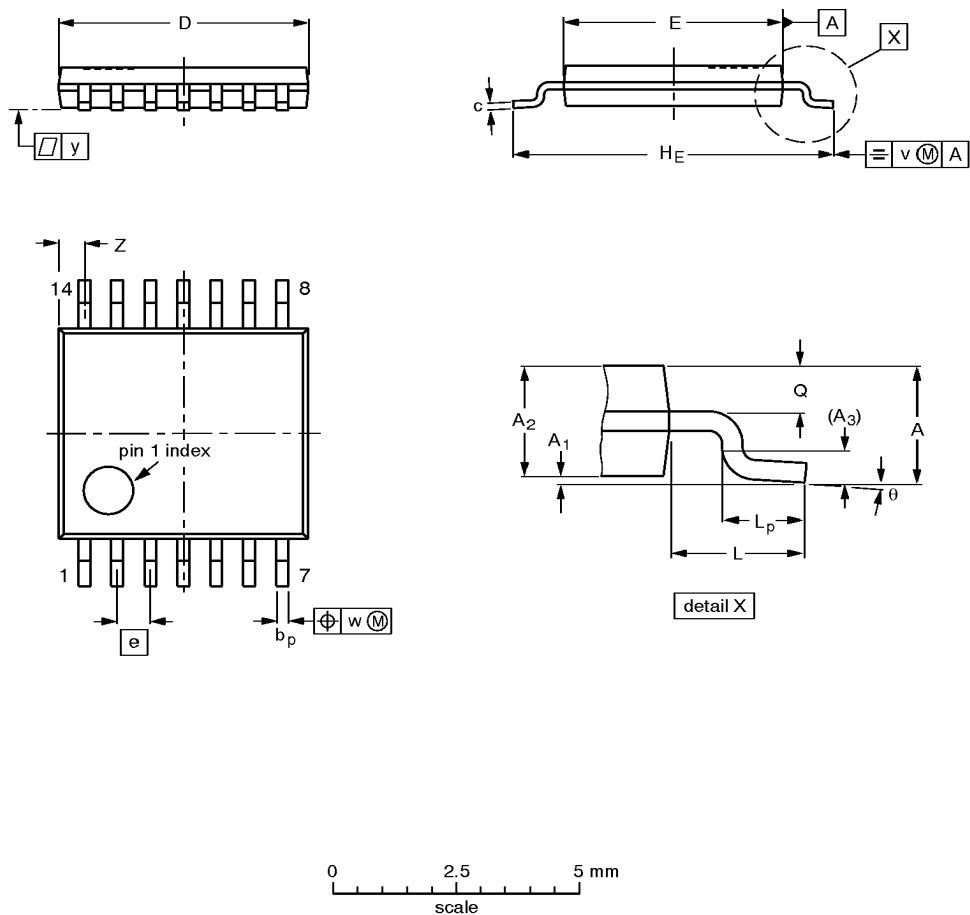
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT337-1		MO-150AB				95-02-04 96-01-18

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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 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	5.1 4.9	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	0.72 0.38	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			
SOT402-1		MO-153				-94-07-12- 95-04-04