



# Advanced CMOS Logic – 54AC240

Octal 3-State Inverting Buffer / Line Driver / Line Receiver in bare die form

Rev 1.1  
30/11/21

## Description

The 54AC240 is produced on a 1.5µm 5V CMOS process combining high speed LSTTL performance with CMOS low power. The device can be used as two 4-bit buffers or one 8-bit buffer & features inverting inputs with two output enables, each controlling four of the 3-state outputs. The device is designed to improve performance & density in clock drivers, 3-state memory address drivers & bus orientated transmitters and receivers. Inputs accept standard CMOS outputs or LSTTL outputs using pull-up resistors. Inputs are also equipped with protection circuits against static discharge and transient excess voltage.

## Features:

- Outputs Sink/Source 24mA
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2V to 6V
- CMOS High Noise Immunity
- Function compatible with 54LS240
- Full Military Temperature Range.

## Ordering Information

The following part suffixes apply:

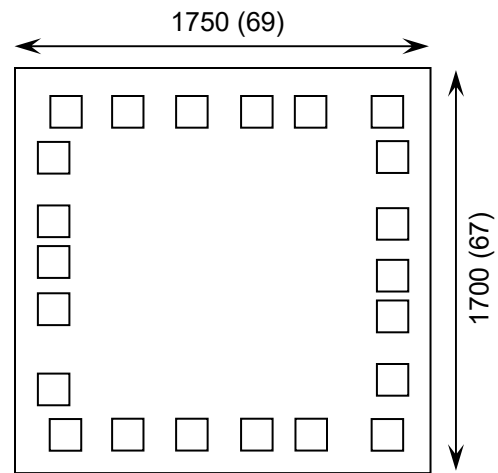
- No suffix - MIL-STD-883 /2010B Visual Inspection
- “H” - MIL-STD-883 /2010B Visual Inspection  
+ MIL-PRF-38534 Class H LAT
- “K” - MIL-STD-883 /2010A Visual Inspection (Space)  
+ MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

[www.siliconsupplies.com/quality/bare-die-lot-qualification](http://www.siliconsupplies.com/quality/bare-die-lot-qualification)

## Die Dimensions in µm (mils)



## Supply Formats:

- Default – Die in Waffle Pack (100 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <=> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

## Mechanical Specification

Die Size (Unsawn)	1750 x 1700 69 x 67	µm mils
Minimum Bond Pad Size	130 x 130 5.12 x 5.12	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

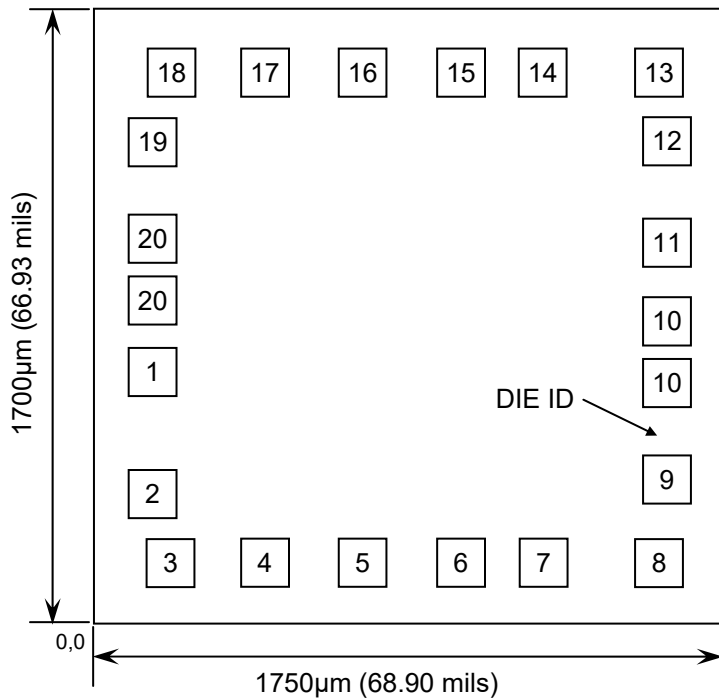




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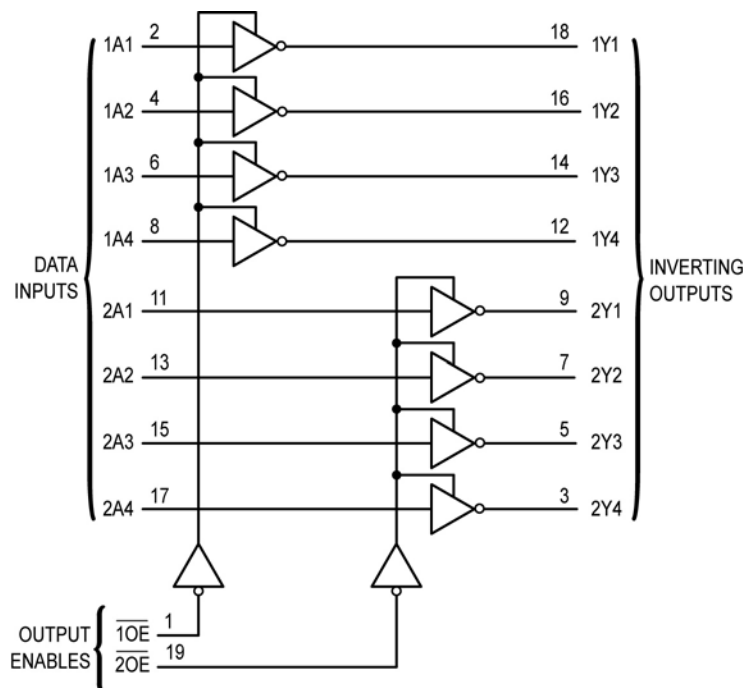
## Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	$\overline{1OE}$	0.100	0.630
2	1A1	0.100	0.290
3	$\overline{2Y4}$	0.150	0.100
4	1A2	0.410	0.100
5	$\overline{2Y3}$	0.680	0.100
6	1A3	0.950	0.100
7	$\overline{2Y2}$	1.180	0.100
8	1A4	1.500	0.100
9	$\overline{2Y1}$	1.520	0.330
10	GND	1.520	0.600
10	GND	1.520	0.770
11	2A1	1.520	0.990
12	$\overline{1Y4}$	1.520	1.270
13	2A2	1.500	1.460
14	$\overline{1Y3}$	1.180	1.460
15	2A3	0.950	1.460
16	$\overline{1Y2}$	0.680	1.460
17	2A4	0.410	1.460
18	$\overline{1Y1}$	0.150	1.460
19	$\overline{2OE}$	0.100	1.270
20	V <sub>CC</sub>	0.100	1.000
20	V <sub>CC</sub>	0.100	0.830

CONNECT CHIP BACK TO V<sub>CC</sub> OR FLOAT

## Logic Diagram



## Truth Table

INPUTS		OUTPUTS
$\overline{1OE}$ $\overline{2OE}$	1A, 2A	1Y, 2Y
L	L	H
L	H	L
H	X	Z

H = High level (steady state)  
L = Low level (steady state)  
X = Don't care, Z = High impedance





## Pad Descriptions

### ADDRESS INPUTS

1A1, 1A2, 1A3, 1A4, 2A1, 2A2, 2A3, 2A4  
(Pads 2, 4, 6, 8, 11, 13, 15, 17)

Data input pins. Data on these pins appear in inverted form on the corresponding Y outputs, when the outputs are enabled.

### CONTROL INPUTS

1OE, 2OE (Pads 1, 19)

Output enables (active–low). When a low level is applied to these pins, the outputs are enabled and the devices function as inverters. When a high level is applied, the outputs assume the high impedance state.

### OUTPUTS

1Y1, 1Y2, 1Y3, 1Y4, 2Y1, 2Y2, 2Y3, 2Y4  
(Pads 18, 16, 14, 12, 9, 7, 5, 3)

Device outputs. Depending upon the state of the output enable pins, these outputs are either inverting outputs or high–impedance outputs.

## Absolute Maximum Ratings<sup>1</sup>

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage (Referenced to GND)	$V_{CC}$	-0.5 to +7.0	V
DC Input Voltage (Referenced to GND)	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
DC Output Voltage (Referenced to GND)	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
DC Input Current, per pin	$I_{IN}$	±20	mA
DC Output Current, per pin	$I_{OUT}$	±50	mA
DC $V_{CC}$ or GND Current, per pin	$I_{CC}$	±50	mA
Power Dissipation in Still Air <sup>2</sup>	$P_D$	750	mW
Storage Temperature Range	$T_{STG}$	-65 to 150	°C

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. 2. Measured in plastic DIP package, results in die form are dependent on die attach and assembly method.

## Recommended Operating Conditions<sup>3</sup> (Voltages referenced to GND)

PARAMETER	SYMBOL	MIN	MAX	UNITS	
DC Supply Voltage	$V_{CC}$	2	6	V	
DC Input or Output Voltage	$V_{IN}, V_{OUT}$	0	$V_{CC}$	V	
Operating Temperature Range	$T_J$	-55	+125	°C	
Output Current – High	$I_{OH}$	-	-24	mA	
Output Current – Low	$I_{OL}$	-	24	mA	
Input Rise and Fall Time ( $V_{IN}$ from 30% to 70%)	$V_{CC} = 3.0V$	$t_r, t_f$	0	150	ns/V
	$V_{CC} = 4.5V$		0	40	
	$V_{CC} = 5.5V$		0	24	

3. This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{IN}$  and  $V_{OUT}$  should be constrained to the range  $GND \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.





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## DC Electrical Characteristics (Voltages Referenced to GND)

PARAMETER	SYMBOL	V <sub>CC</sub>	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE <sup>4</sup>	
Minimum High-Level Input Voltage	V <sub>IH</sub>	3.0V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V  I <sub>OUT</sub>   ≤ 20μA	2.1	2.1	2.1	V
		4.5V		3.15	3.15	3.15	
		5.5V		3.85	3.85	3.85	
Maximum Low-Level Input Voltage	V <sub>IL</sub>	3.0V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V  I <sub>OUT</sub>   ≤ 20μA	0.9	0.9	0.9	V
		4.5V		1.35	1.35	1.35	
		5.5V		1.65	1.65	1.65	
Minimum High-Level Output Voltage	V <sub>OH</sub>	3.0V	I <sub>OUT</sub> = -50μA	2.9	2.9	2.9	V
		4.5V		4.4	4.4	4.4	
		5.5V		5.4	5.4	5.4	
	3.0V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -12 mA	2.56	2.46	2.40		
	4.5V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24mA <sup>5</sup>	3.86	3.76	3.70		
	5.5V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24mA <sup>5</sup>	4.86	4.76	4.70		
	5.5V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -50mA <sup>6</sup>	-	-	3.85		
Maximum Low-Level Output Voltage	V <sub>OL</sub>	3.0V	I <sub>OUT</sub> = 50μA	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		5.5V		0.1	0.1	0.1	
	3.0V	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 12mA	0.36	0.44	0.5		
	4.5V	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 24mA <sup>5</sup>	0.36	0.44	0.5		
	5.5V	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 24mA <sup>5</sup>	0.36	0.44	0.5		
	5.5V	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   50mA <sup>6</sup>	-	-	1.65		
Maximum Input Leakage Current	I <sub>IN</sub>	5.5V	V <sub>IN</sub> = V <sub>CC</sub> or GND	±0.1	±1.0	±1.0	μA
Maximum 3-State Leakage Current	I <sub>OZ</sub>	5.5V	V <sub>OUT</sub> =V <sub>CC</sub> or GND V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	±0.5	±2.5	±5	μA
Minimum Dynamic Output Current <sup>7</sup>	I <sub>OLD</sub>	5.5V	V <sub>OLD</sub> = 1.65V Max	-	75	50	mA
	I <sub>OHD</sub>	5.5V	V <sub>OHD</sub> = 3.85V Min	-	-75	-50	
Maximum Quiescent Supply Current	I <sub>CC</sub>	5.5V	V <sub>IN</sub> = V <sub>CC</sub> or GND I <sub>OUT</sub> = 0μA	8	80	160	μA

4. -55°C ≤ T<sub>J</sub> ≤ +125°C 5. All outputs loaded; thresholds on input associated with output under test. 6. Test time 1sec max, measurement made by forcing indicated current and measuring voltage to minimize power dissipation. Test verifies a minimum 75Ω transmission-line drive capability at 125°C 7. Maximum test duration 2ms, one output loaded at a time





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## AC Electrical Characteristics<sup>8</sup> ( $V_{CC} 3.3V \pm 0.3V, V_{CC} 5V \pm 0.3V$ )

PARAMETER	SYMBOL	$V_{CC}$	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE <sup>4</sup>	
Maximum Propagation Delay Input A to Output Y (Figure 1,3)	$t_{PLH}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	8.0	9.0	11.0	ns
		5.0V		6.5	7.0	8.5	
	$t_{PHL}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	8.0	8.5	10.5	ns
		5.0V		6.0	6.5	8.0	
Output Enable Time OE to 1Y or 2Y (Figure 2,4)	$t_{PZH}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	10.5	11.0	11.5	ns
		5.0V		7.0	8.0	9.0	
	$t_{PZL}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	10.0	11.0	13.0	ns
		5.0V		8.0	8.5	10.5	
Output Enable Time OE to 1Y or 2Y (Figure 2,4)	$t_{PHZ}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	10	10.5	12.5	ns
		5.0V		9.0	9.5	10.5	
	$t_{PLZ}$	3.3V	$C_L = 50pF$ , Input $t_r = t_f = 3ns$	10.5	11.5	13.5	ns
		5.0V		9.0	9.5	11.0	
Maximum Input Capacitance	$C_{IN}$	-	-	4.5	4.5	4.5	pF
Power Dissipation Capacitance <sup>9</sup>	$C_{PD}$	-	$T_J = 25^\circ C$ , $V_{CC} = 5.0V$	TYPICAL			
				45			pF

8. Not production tested in die form, characterized by chip design

9. Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .





## Switching Waveforms

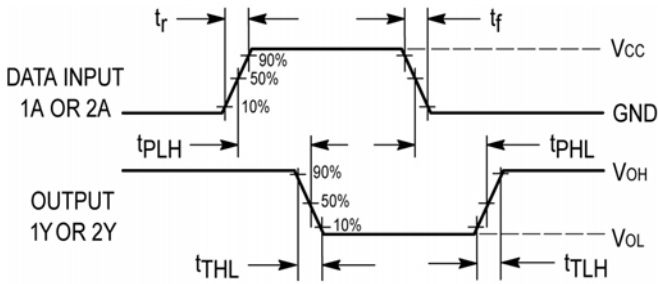


Figure 1 – Propagation Delay  
Input 1A or 2A to Output 1Y or 2Y

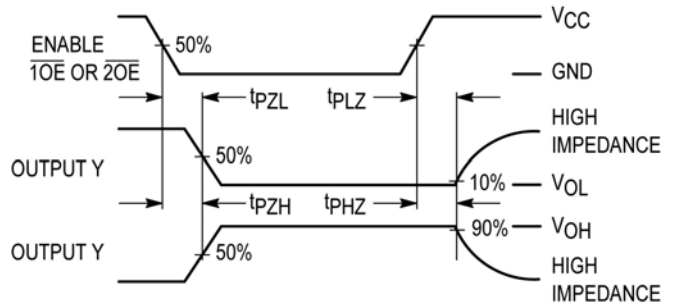
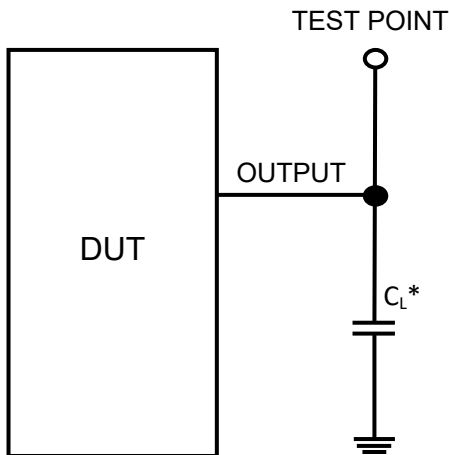


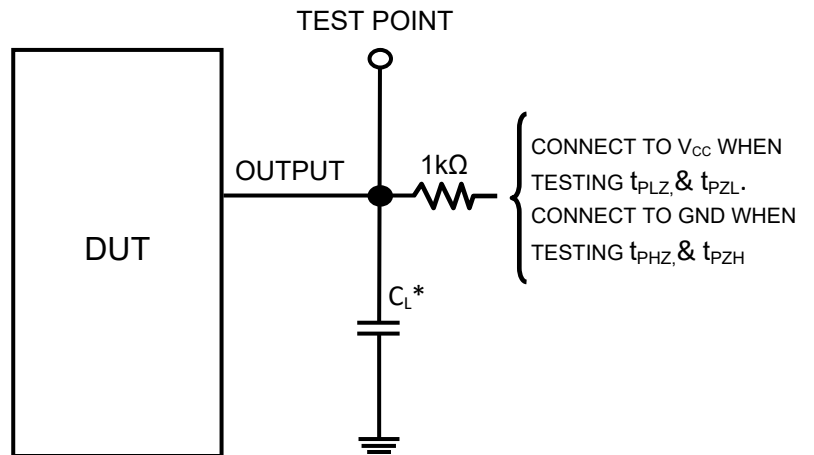
Figure 2 – Propagation Delay  
Output Enable to Output 1Y or 2Y

## Test Circuits



\* Includes all probe and jig capacitance

Figure 3



\* Includes all probe and jig capacitance

Figure 4

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