74HC240; 74HCT240

Octal buffer/line driver; 3-state; inverting

1. General description

The 74HC240; 74HCT240 is a high-speed Si-gate CMOS device and is pin compatible with Low-Power Schottky TTL (LSTTL).

The 74HC240; 74HCT240 is a dual octal inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ causes the outputs to assume a high impedance OFF-state.

The 74HC240; 74HCT240 is similar to the 74HC244; 74HCT244 but has inverting outputs.

2. Features

- Inverting 3-state outputs
- Multiple package options
- Complies with JEDEC standard no. 7 A
- ESD protection:
  - HBM JESD22-A114-D exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from −40 °C to +85 °C and from −40 °C to +125 °C

3. Ordering information

Table 1.   Ordering information

Type number	Package				
	Temperature range	Name	Description		Version
74HC240					
74HC240N	−40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)		SOT146-1
74HC240D	−40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm		SOT163-1
74HC240DB	−40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm		SOT339-1
74HC240PW	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm		SOT360-1
74HC240BQ	−40 °C to +125 °C	DHVQFN20	plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm		SOT764-1
74HCT240					
74HCT240N	−40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)		SOT146-1

Table 2. **Pin description** …continued

Symbol	Pin	Description
2A0	17	data input
1Y0	18	bus output
2$\overline{\text{OE}}$	19	output enable input (active LOW)
V_{CC}	20	supply voltage

6. Functional description

Table 3. **Function table**[1]

Input		Output
n$\overline{\text{OE}}$	nAn	nYn
L	L	H
L	H	L
H	X	Z

[1]   H = HIGH voltage level;
   L = LOW voltage level;
   X = don't care;
   Z = high-impedance OFF-state.

7. Limiting values

Table 4. **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	+7	V
I_{IK}	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	-	±20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ V	-	±35	mA
I_{CC}	supply current		-	70	mA
I_{GND}	ground current		−70	-	mA
T_{stg}	storage temperature		−65	+150	°C
P_{tot}	total power dissipation	[1]			
	DIP20 package		-	750	mW
	SO20, SSOP20, TSSOP20 and DHVQFN20 packages		-	500	mW

[1]   For DIP20 packages: above 70 °C, P_{tot} derates linearly with 12 mW/K.
   For SO20 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.
   For SSOP20 and TSSOP20 packages: above 60 °C, P_{tot} derates linearly with 5.5 mW/K.
   For DHVQFN20 packages: above 60 °C, P_{tot} derates linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5.   Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74HC240						
V_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 2.0 V	-	-	625	ns/V
		V_{CC} = 4.5 V	-	1.67	139	ns/V
		V_{CC} = 6.0 V	-	-	83	ns/V
T_{amb}	ambient temperature		−40	-	+125	°C
74HCT240						
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 4.5 V	-	1.67	139	ns/V
T_{amb}	ambient temperature		−40	-	+125	°C

9. Static characteristics

Table 6.   Static characteristics

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC240										
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V_{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V_{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V_{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V_{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		I_O = −20 μA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I_O = −20 μA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = −20 μA; V_{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I_O = −6.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I_O = −7.8 mA; V_{CC} = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V

Table 6. **Static characteristics** …*continued*

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = 20$ µA; $V_{CC} = 2.0$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20$ µA; $V_{CC} = 4.5$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20$ µA; $V_{CC} = 6.0$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0$ mA; $V_{CC} = 4.5$ V	-	0.15	0.26	-	0.33	-	0.4	V
		$I_O = 7.8$ mA; $V_{CC} = 6.0$ V	-	0.16	0.26	-	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0$ V	-	-	±0.1	-	±1.0	-	±1.0	µA
I_{OZ}	OFF-state output current	per input pin; $V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND; other inputs at V_{CC} or GND; $V_{CC} = 6.0$ V; $I_O = 0$ A	-	-	±0.5	-	±5.0	-	±10	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	8.0	-	80	-	160	µA
C_I	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT240										
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}; $V_{CC} = 4.5$ V								
		$I_O = -20$ µA	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -6$ mA	3.98	4.32	-	3.84	-	3.7	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}; $V_{CC} = 4.5$ V								
		$I_O = 20$ µA	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0$ mA	-	0.16	0.26	-	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	±0.1	-	±1.0	-	±1.0	µA
I_{OZ}	OFF-state output current	per input pin; $V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND; other inputs at V_{CC} or GND; $V_{CC} = 5.5$ V; $I_O = 0$ A	-	-	±0.5	-	±5.0	-	±10	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V; $I_O = 0$ A	-	-	8.0	-	80	-	160	µA
ΔI_{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A								
		nAn or inputs	-	150	540	-	675	-	735	µA
		nOE input	-	70	252	-	315	-	343	µA
C_I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7.   Dynamic characteristics
GND = 0 V; for load circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C		Unit
				Min	**Typ**	**Max**	**Max (85 °C)**	**Max (125 °C)**	
74HC240									
t_{pd}	propagation delay	nAn to nYn; see Figure 6	[1]						
		V_{CC} = 2.0 V		-	30	100	125	150	ns
		V_{CC} = 4.5 V		-	11	20	25	30	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	9	-	-	-	ns
		V_{CC} = 6.0 V		-	9	17	21	26	ns
t_{en}	enable time	n$\overline{OE}$ to nYn; see Figure 7	[2]						
		V_{CC} = 2.0 V		-	39	150	190	225	ns
		V_{CC} = 4.5 V		-	14	30	38	45	ns
		V_{CC} = 6.0 V		-	11	26	33	38	ns
t_{dis}	disable time	n$\overline{OE}$ to nYn or see Figure 7	[3]						
		V_{CC} = 2.0 V		-	41	150	190	225	ns
		V_{CC} = 4.5 V		-	15	30	38	45	ns
		V_{CC} = 6.0 V		-	12	26	33	38	ns
t_t	transition time	see Figure 6	[4]						
		V_{CC} = 2.0 V		-	14	60	75	90	ns
		V_{CC} = 4.5 V		-	5	12	15	18	ns
		V_{CC} = 6.0 V		-	4	10	13	15	ns
C_{PD}	power dissipation capacitance	per transceiver; V_I = GND to V_{CC}	[5]	-	30	-	-	-	pF

Table 7. **Dynamic characteristics** *…continued*
GND = 0 V; for load circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C		Unit
				Min	Typ	Max	Max (85 °C)	Max (125 °C)	
74HCT240									
t_{pd}	propagation delay	nAn to nYn; see Figure 6	[1]						
		V_{CC} = 4.5 V		-	11	20	25	30	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	9	-	-	-	ns
t_{en}	enable time	n$\overline{OE}$ to nYn; V_{CC} = 4.5 V; see Figure 7	[2]	-	13	30	38	45	ns
t_{dis}	disable time	n$\overline{OE}$ to nYn; V_{CC} = 4.5 V; see Figure 7	[3]	-	13	25	31	38	ns
t_t	transition time	V_{CC} = 4.5 V; see Figure 6	[4]	-	5	12	15	18	ns
C_{PD}	power dissipation capacitance	per transceiver; V_I = GND to V_{CC} − 1.5 V	[5]	-	30	-	-	-	pF

[1] t_{pd} is the same as t_{PHL} and t_{PLH}.

[2] t_{en} is the same as t_{PZH} and t_{PZL}.

[3] t_{dis} is the same as t_{PHZ} and t_{PLZ}.

[4] t_t is the same as t_{THL} and t_{TLH}.

[5] 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 V;

N = number of inputs switching;
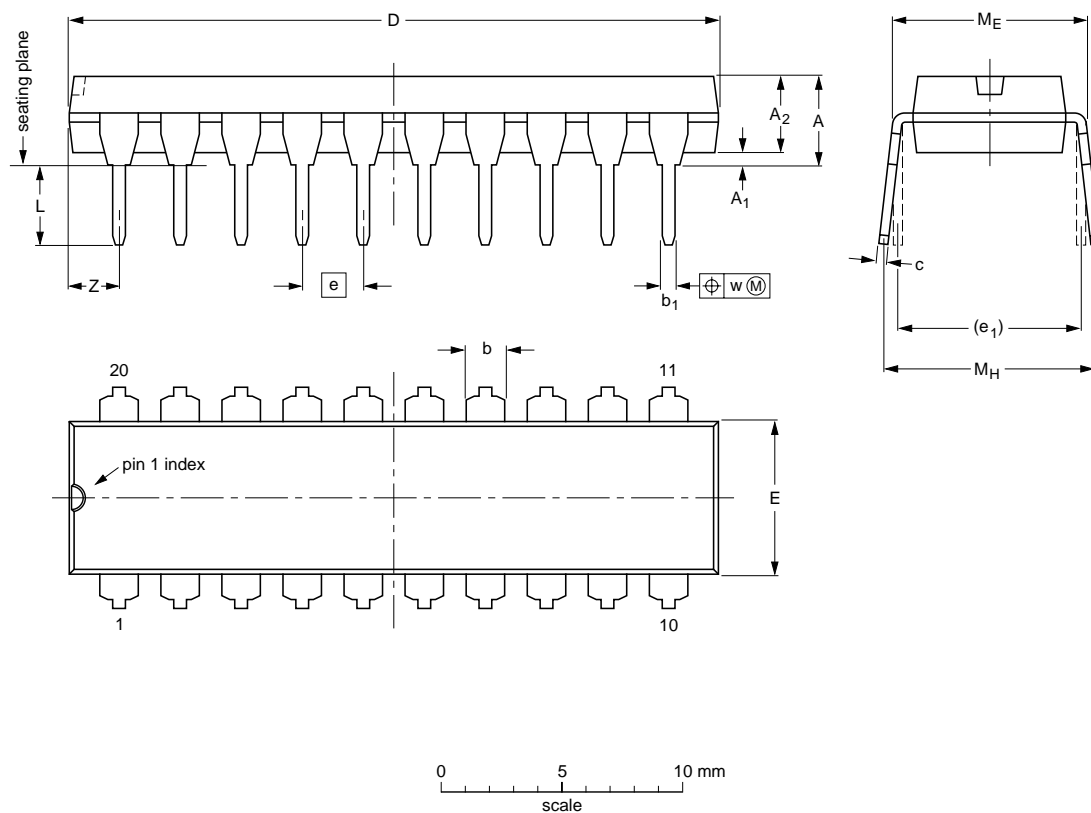
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11. Waveforms

Measurement points are given in Table 8.

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

Fig 6.   Input (nAn) to output (nYn) propagation delays and output transition times
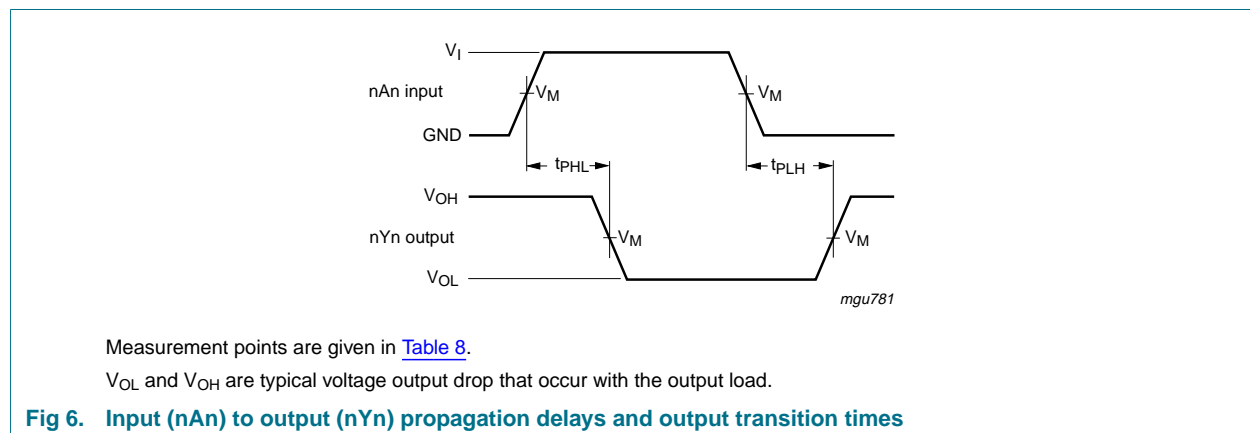
12. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**

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

| UNIT	A max.	A₁ min.	A₂ max.	b	b₁	c	D⁽¹⁾	E⁽¹⁾	e	e₁	L	M_E	M_H	w	Z⁽¹⁾ max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2
inches	0.17	0.02	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	
	IEC	JEDEC	JEITA			
SOT146-1		MS-001	SC-603			

Fig 9.   Package outline SOT146-1 (DIP20)

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1
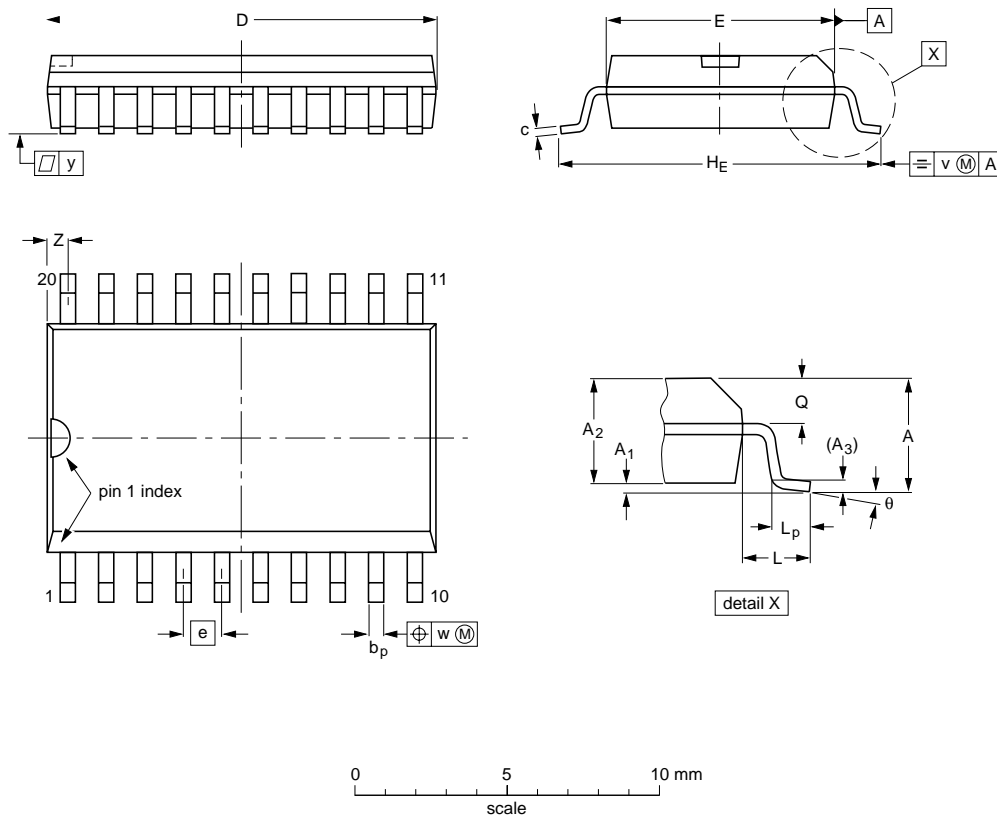
DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D[1]	E[1]	e	Hₑ	L	Lₚ	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	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° 0°
inches	0.1	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	0.05	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	
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				

Fig 10. Package outline SOT163-1 (SO20)