

DATA SHEET

74F240/74F240A

Octal inverter buffer (3-State)

74F241/74F241A

Octal buffer (3-State)

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Product specification

1001 Jan 02

IC15 Data Handbook

Buffers

74F240/74F240A/ 74F241/74F241A

FEATURES

- Octal bus interface
- 3-State buffer outputs sink 64mA
- 15mA source current
- Guaranteed output skew less than 2.0ns (74F240A/74F241A)
- Reduced ground bounce (74F240A/74F241A)
- Reduced I_{CC} (74F241A only)
- Reduced loading (74F240A $I_{IL} = 100\mu\text{A}$, 74F241A $I_{IL} = 40\mu\text{A}$)

DESCRIPTION

The 74F240 and 74F241 are octal buffers that are ideal for driving bus lines of buffer memory address registers. The outputs are all capable of sinking 64mA and sourcing up to 15mA. The device features two output enables, each controlling four of the 3-state outputs.

The 74F240A and 74F241A are functionally equivalent to their non-A counterparts. They have been designed to reduce effects of ground noise. Other advantages are noted in the features.

| TYPE | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|---------|---------------------------|--------------------------------|
| 74F240 | 4.3ns | 37mA |
| 74F240A | 3.8ns | 40mA |
| 74F241 | 5.0ns | 53mA |
| 74F241A | 4.5ns | 32mA |

ORDERING INFORMATION

| DESCRIPTION | ORDER CODE | PKG DWG # |
|------------------------|--|-----------|
| | COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ | |
| 20-pin plastic DIP | N74F240N, N74F240AN, N74F241N, N74F241AN | SOT146-1 |
| 20-pin plastic SOL | N74F240D, N74F240AD, N74F241D, N74F241AD | SOT163-1 |
| 20-pin plastic SSOP II | N74F240DB | SOT339-1 |

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

| PINS | DESCRIPTION | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|--|---|---------------------|-------------------------------------|
| lan, lbn | Data inputs (74F240) | 1.0/1.67 | 20 μA /1.0mA |
| | Data inputs (74F240A) | 1.0/0.167 | 20 μA /100 μA |
| | Data inputs (74F241) | 1.0/2.67 | 20 μA /1.6mA |
| | Data inputs (74F241A) | 1.0/0.067 | 20 μA /40 μA |
| $\overline{\text{OE}}\text{a}, \overline{\text{OE}}\text{b}$ | Output enable inputs (active low) (74F240) | 1.0/0.33 | 20 μA /0.2mA |
| | Output enable inputs (active low) (74F240A) | 1.0/0.167 | 20 μA /100 μA |
| $\overline{\text{OE}}\text{a}, \text{OEb}$ | Output enable input (74F241) | 1.0/1.67 | 20 μA /1.0mA |
| | Output enable input (74F241A) | 1.0/0.067 | 20 μA /40 μA |
| Yan, Ybn | Data outputs (74F241, 74F241A) | 750/106.7 | 15mA/64mA |
| $\overline{\text{Y}}\text{an}, \overline{\text{Y}}\text{bn}$ | Data outputs (74F240, 74F240A) | 750/106.7 | 15mA/64mA |

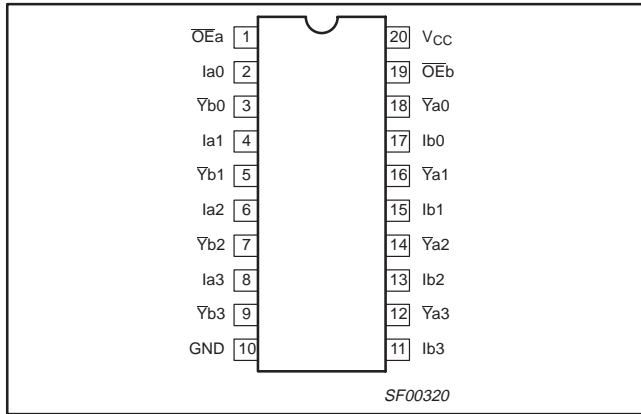
Note to input and output loading and fan out table

One (1.0) FAST unit load is defined as: 20 μA in the high state and 0.6mA in the low state.

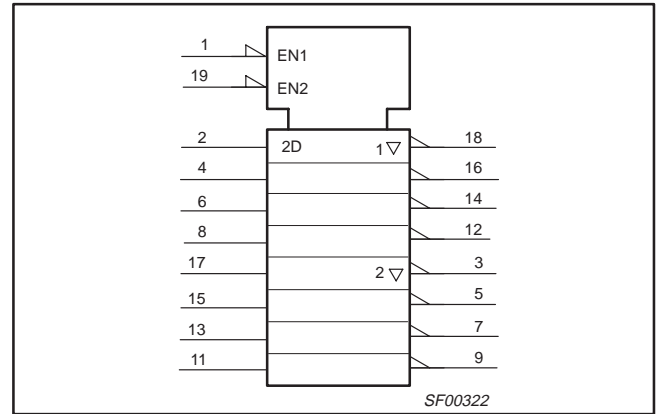
Buffers

74F240/74F240A/ 74F241/74F241A

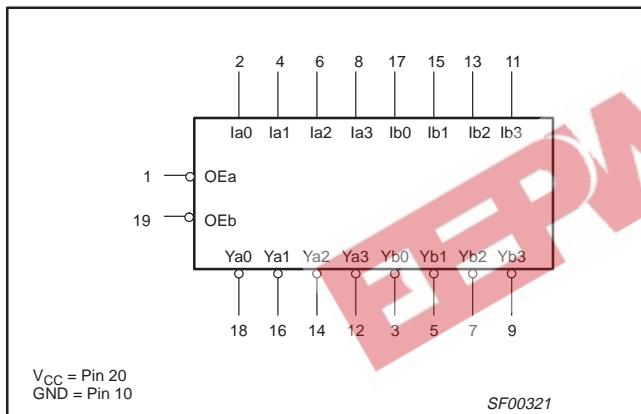
PIN CONFIGURATION FOR 74F240/74F240A



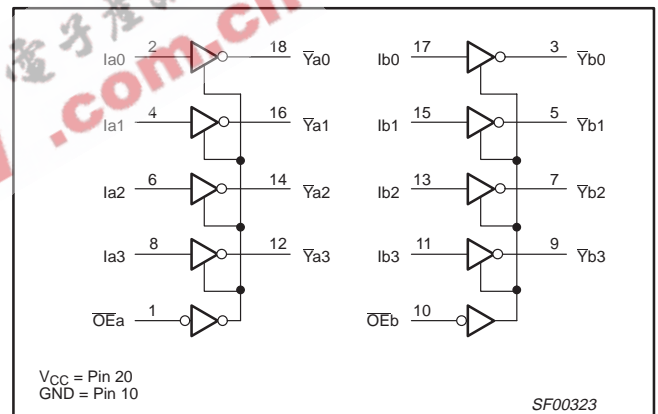
IEC/IEEE SYMBOL FOR 74F240/74F240A



LOGIC SYMBOL FOR 74F240/74F240A



LOGIC DIAGRAM FOR 74F240/74F240A



FUNCTION TABLE FOR 74F240/74F240A

| INPUTS | | | | OUTPUTS | |
|------------------|------|------------------|------|-----------------|-----------------|
| $\overline{OE}a$ | la | $\overline{OE}b$ | lb | $\overline{Y}a$ | $\overline{Y}b$ |
| L | L | L | L | H | H |
| L | H | L | H | L | L |
| H | X | H | X | Z | Z |

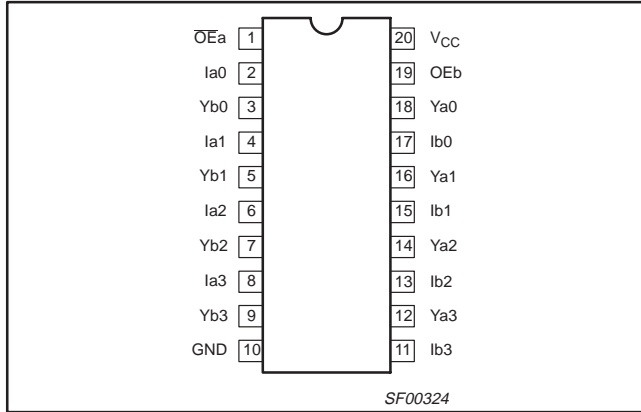
Notes to function table for 74F240/74F240A

- H = High voltage level
- L = Low voltage level
- X = Don't care
- Z = High impedance "off" state

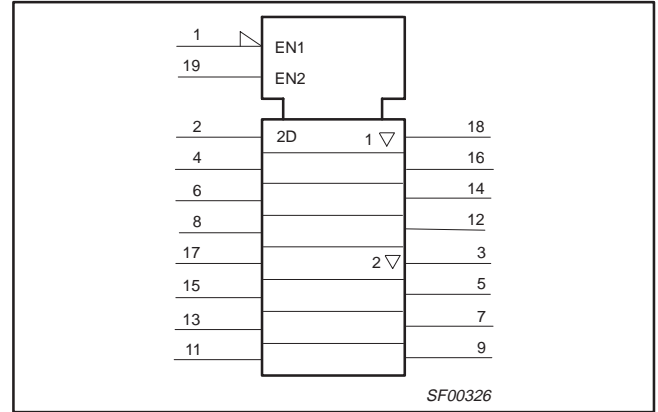
Buffers

74F240/74F240A/
74F241/74F241A

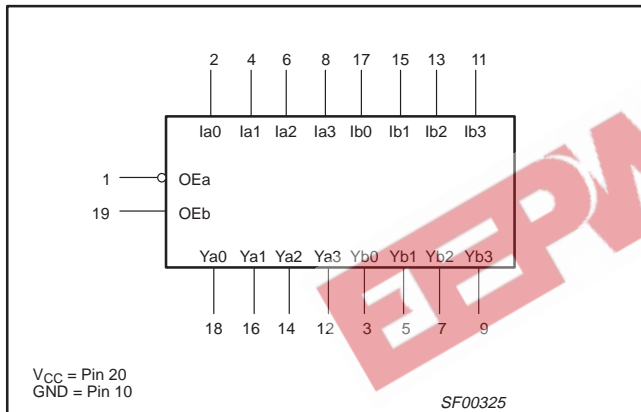
PIN CONFIGURATION FOR 74F241/74F241A



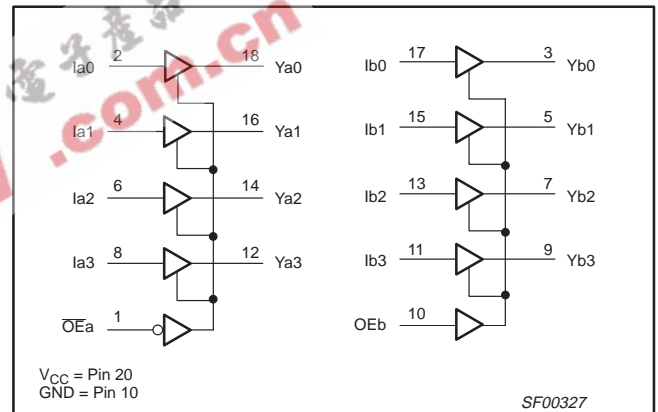
IEC/IEEE SYMBOL FOR 74F241/74F241A



LOGIC SYMBOL FOR 74F241/74F241A



LOGIC DIAGRAM FOR 74F241/74F241A



FUNCTION TABLE FOR 74F241/74F241A

| INPUTS | | | | OUTPUTS | |
|--------|----|-----|----|---------|----|
| OEa | Ia | OEb | Ib | Ya | Yb |
| L | L | H | L | L | L |
| L | H | H | H | H | H |
| H | X | L | X | Z | Z |

Notes to function table for 74F241/74F241A

- H = High voltage level
- L = Low voltage level
- X = Don't care
- Z = High impedance "off" state

Buffers

74F240/74F240A/
74F241/74F241A**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

| SYMBOL | PARAMETER | RATING | UNIT |
|------------------|--|-------------------------|------|
| V _{CC} | Supply voltage | -0.5 to +7.0 | V |
| V _{IN} | Input voltage | -0.5 to +7.0 | V |
| I _{IN} | Input current | -30 to +5 | mA |
| V _{OUT} | Voltage applied to output in high output state | -0.5 to V _{CC} | V |
| I _{OUT} | Current applied to output in low output state | 128 | mA |
| T _{amb} | Operating free air temperature range | 0 to +70 | °C |
| T _{stg} | Storage temperature range | -65 to +150 | °C |

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | | UNIT |
|------------------|--------------------------------------|--------|-----|-----|------|
| | | MIN | NOM | MAX | |
| V _{CC} | Supply voltage | 4.5 | 5.0 | 5.5 | V |
| V _{IH} | High-level input voltage | 2.0 | | | V |
| V _{IL} | Low-level input voltage | | | 0.8 | V |
| I _{Ik} | Input clamp current | | | -18 | mA |
| I _{OH} | High-level output current | | | -15 | mA |
| I _{OL} | Low-level output current | | | 64 | mA |
| T _{amb} | Operating free air temperature range | 0 | | +70 | °C |

Buffers

74F240/74F240A/
74F241/74F241A

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | | TEST CONDITIONS ¹ | | | LIMITS | | | UNIT | |
|------------------|--|--|--|------------------------|--|-----------------------|------------------|------|------|----|
| | | | | | | MIN | TYP ² | MAX | | |
| V _{OH} | High-level output voltage | | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN | I _{OH} = -3mA | ±10%V _C | 2.4 | | | V | |
| | | | | | ±5%V _{CC} | 2.7 | 3.4 | | V | |
| | | | I _{OH} = -15mA | ±10%V _C | 2.0 | | | V | | |
| | | | | ±5%V _{CC} | 2.0 | | | V | | |
| V _{OL} | Low-level output voltage | | V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN, | I _{OL} = MAX | ±10%V _C | | | 0.50 | V | |
| | | | | | ±5%V _{CC} | | 0.42 | 0.50 | V | |
| V _{IK} | Input clamp voltage | | V _{CC} = MIN, I _I = I _{IK} | | | | -0.73 | -1.2 | V | |
| I _I | Input current at maximum input voltage | | V _{CC} = MAX, V _I = 7.0V | | | | | 100 | μA | |
| I _{IH} | High-level input current | | V _{CC} = MAX, V _I = 2.7V | | | | | 20 | μA | |
| I _{IL} | Low-level input current | | 74F240 all inputs | | V _{CC} = MAX, V _I = 0.5V | | | -1.0 | mA | |
| | | | 74F240A all inputs | | | | | -100 | μA | |
| | | | 74F241 $\overline{O}Ea$, $\overline{O}Eb$ | | | | | -1.0 | mA | |
| | | | 74F241 I _{an} , I _{bn} | | | | | -1.6 | mA | |
| | | | 74F241A all inputs | | | | | -40 | μA | |
| I _{ozH} | Off-state output current, high-level voltage applied | | V _{CC} = MAX, V _O = 2.7V | | | | | 50 | μA | |
| I _{ozL} | Off-state output current, low-level voltage applied | | V _{CC} = MAX, V _O = 0.5V | | | | | -50 | μA | |
| I _{OS} | Short-circuit output current ³ | | V _{CC} = MAX | | | -100 | | -225 | mA | |
| I _{CC} | Supply current (total) | | 74F240 | I _{CC} H | V _{CC} = MAX | | 12 | 18 | mA | |
| | | | | I _{CC} L | | | 50 | 70 | mA | |
| | | | | I _{CC} Z | | | 35 | 45 | mA | |
| | | | 74F240A | I _{CC} H | | | 28 | 37 | mA | |
| | | | | I _{CC} L | | | 58 | 75 | mA | |
| | | | | I _{CC} Z | | | 34 | 50 | mA | |
| | | | 74F241 | I _{CC} H | | V _{CC} = MAX | | 40 | 60 | mA |
| | | | | I _{CC} L | | | | 60 | 90 | mA |
| | | | | I _{CC} Z | | | | 65 | 90 | mA |
| | | | 74F241A | I _{CC} H | | | | 20 | 30 | mA |
| | | | | I _{CC} L | | | | 49 | 65 | mA |
| | | | | I _{CC} Z | | | | 26 | 40 | mA |

Notes to DC electrical characteristics

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
- Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

Buffers

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74F241/74F241A

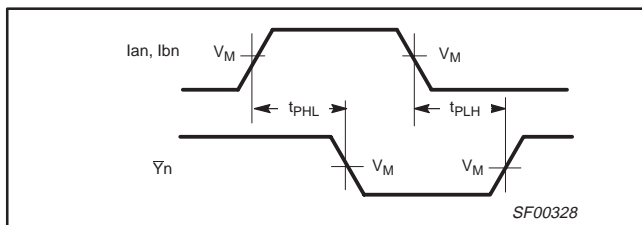
AC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | | | | | UNIT |
|--------------------------------------|---|--------------------------|---|-----|-----|--|-----|-----|------|
| | | | T _{amb} = +25°C V _{CC} = +5.0V C _L = 50pF, R _L = 500Ω | | | T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω | | | |
| | | | MIN | TYP | MAX | MIN | MAX | | |
| t _{PLH} t _{PHL} | Propagation delay I _{an} , I _{bn} to \bar{Y}_n | Waveform 1 | 74F240 | 3.0 | 4.5 | 6.5 | 3.0 | 7.5 | ns |
| t _{PZH} t _{PZL} | Output enable time to high or low level | | | 2.0 | 3.0 | 4.5 | 2.0 | 5.0 | |
| t _{PHZ} t _{PLZ} | Output disable time from high or low level | | | 3.0 | 5.0 | 7.5 | 3.0 | 9.0 | |
| t _{PLH} t _{PHL} | Propagation delay I _{an} , I _{bn} to \bar{Y}_n | Waveform 3 Waveform 4 | 74F240A | 3.0 | 5.5 | 7.0 | 3.0 | 7.5 | ns |
| t _{PZH} t _{PZL} | Output enable time to high or low level | | | 3.0 | 5.0 | 7.0 | 3.0 | 7.5 | |
| t _{PHZ} t _{PLZ} | Output disable time from high or low level | | | 2.0 | 3.5 | 6.0 | 1.5 | 6.5 | |
| t _{sk(0)} | Output skew ^{1, 2} | Waveform 4 | | 1.5 | | | 2.0 | ns | |
| t _{PLH} t _{PHL} | Propagation delay I _{an} , I _{bn} to \bar{Y}_n | Waveform 2 | 74F241 | 2.5 | 4.0 | 5.2 | 2.5 | 6.2 | ns |
| t _{PZH} t _{PZL} | Output enable time to high or low level | | | 2.5 | 4.0 | 5.2 | 2.5 | 6.5 | |
| t _{PHZ} t _{PLZ} | Output disable time from high or low level | | | 2.0 | 4.0 | 5.7 | 2.0 | 6.7 | |
| t _{PLH} t _{PHL} | Propagation delay I _{an} , I _{bn} to \bar{Y}_n | Waveform 3 Waveform 4 | 74F241A | 2.0 | 5.0 | 7.0 | 2.0 | 8.0 | ns |
| t _{PZH} t _{PZL} | Output enable time to high or low level | | | 2.0 | 4.0 | 6.0 | 2.0 | 7.0 | |
| t _{PHZ} t _{PLZ} | Output disable time from high or low level | | | 2.0 | 4.0 | 6.0 | 2.0 | 7.0 | |
| t _{sk(0)} | Output skew ^{1, 2} | Waveform 4 | | 1.5 | | | 2.0 | ns | |

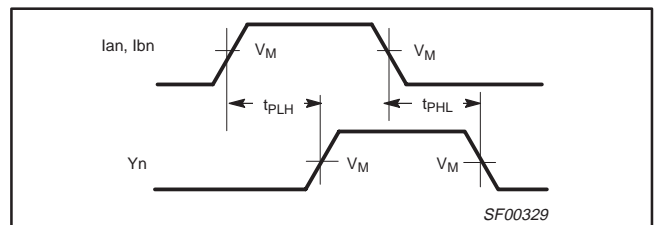
Notes to AC electrical characteristics

1. | t_{PN} actual – t_{PM} actual | for any output compared to any other output where N and M are either LH or HL.
2. Skew times are valid only under same test conditions (temperature, V_{CC}, loading, etc..).

AC WAVEFORMS



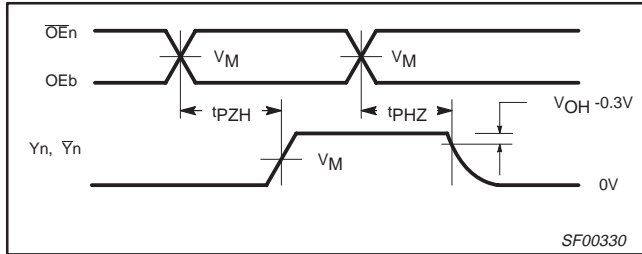
Waveform 1. Propagation delay for inverting outputs



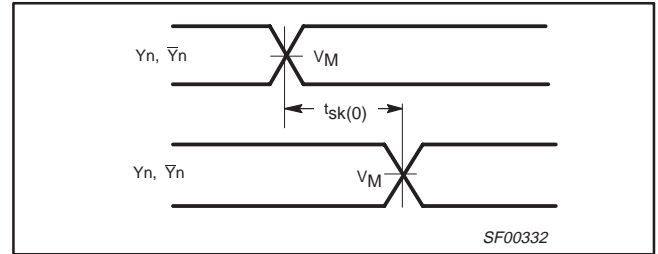
Waveform 2. Propagation delay for non-inverting outputs

Buffers

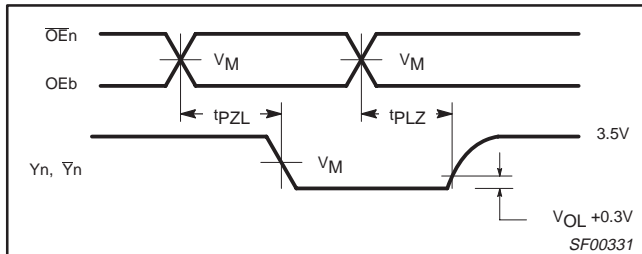
74F240/74F240A/
74F241/74F241A



Waveform 3. 3-state output enable time to high level and output disable time from high level



Waveform 5. Output skew



Waveform 4. 3-state output enable time to low level and output disable time from low level

Notes to AC waveforms

1. For all waveforms, $V_M = 1.5V$.
2. The shaded areas indicate when the input is permitted to change for predictable output performance.

TEST CIRCUIT AND WAVEFORMS

Test Circuit for Open Collector Outputs

| SWITCH POSITION | |
|-----------------|--------|
| TEST | SWITCH |
| t_{PLZ} | closed |
| t_{PZH} | closed |
| All other | open |

DEFINITIONS:
 R_L = Load resistor; see AC electrical characteristics for value.
 C_L = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
 R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

Input Pulse Definition

| family | INPUT PULSE REQUIREMENTS | | | | | |
|--------|--------------------------|-------|-----------|-------|-----------|-----------|
| | amplitude | V_M | rep. rate | t_w | t_{TLH} | t_{THL} |
| 74F | 3.0V | 1.5V | 1MHz | 500ns | 2.5ns | 2.5ns |

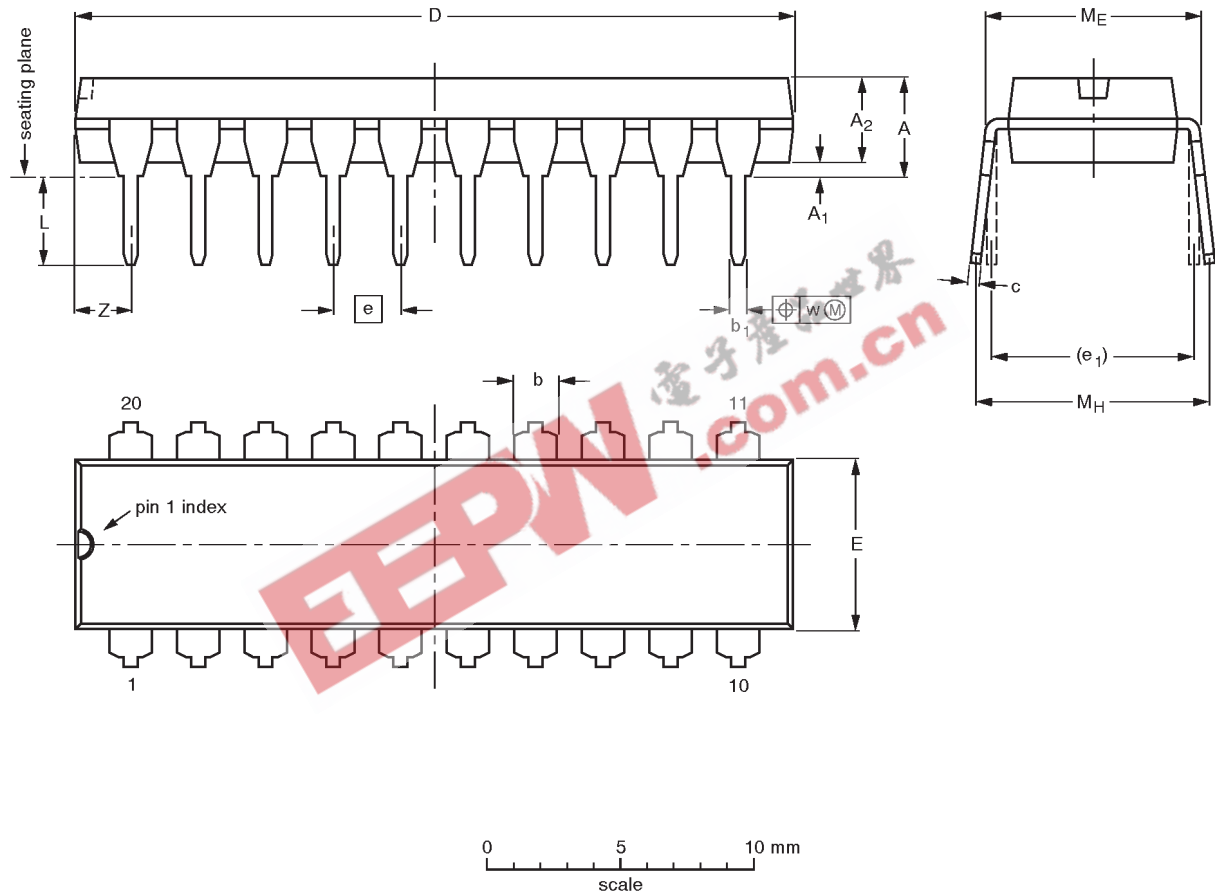
SF00128

Buffers

74F240/74F240A
74F241/74F241A

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. | A ₁ min. | A ₂ max. | b | b ₁ | c | D ⁽¹⁾ | E ⁽¹⁾ | e | e ₁ | 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 | 2.0 |
| inches | 0.17 | 0.020 | 0.13 | 0.068 0.051 | 0.021 0.015 | 0.014 0.009 | 1.060 1.045 | 0.25 0.24 | 0.10 | 0.30 | 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 maximum per side are not included.

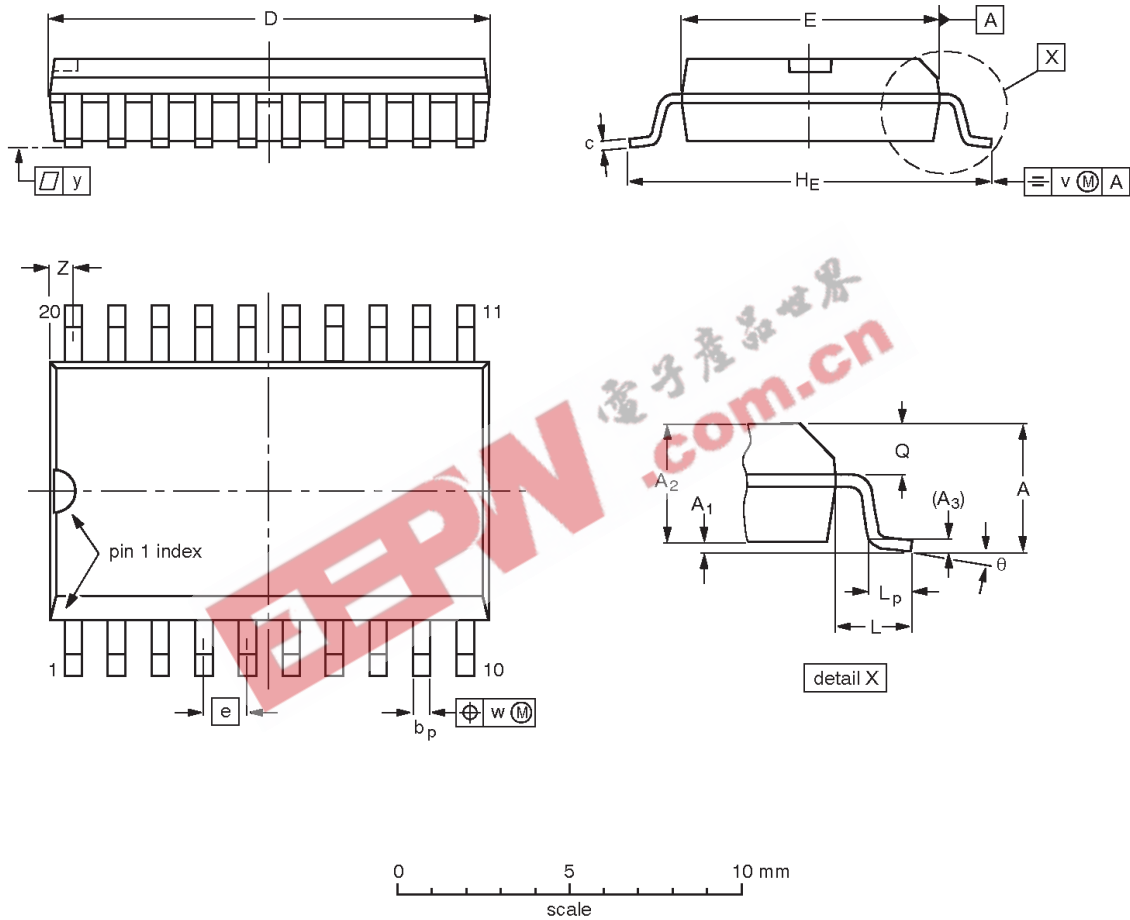
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT146-1 | | | SC603 | | | 92-11-17 95-05-24 |

Buffers

74F240/74F240A
74F241/74F241A

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. | 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 | 0.30 0.10 | 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 | 0.10 | 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 | 0.050 | 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 maximum per side are not included.

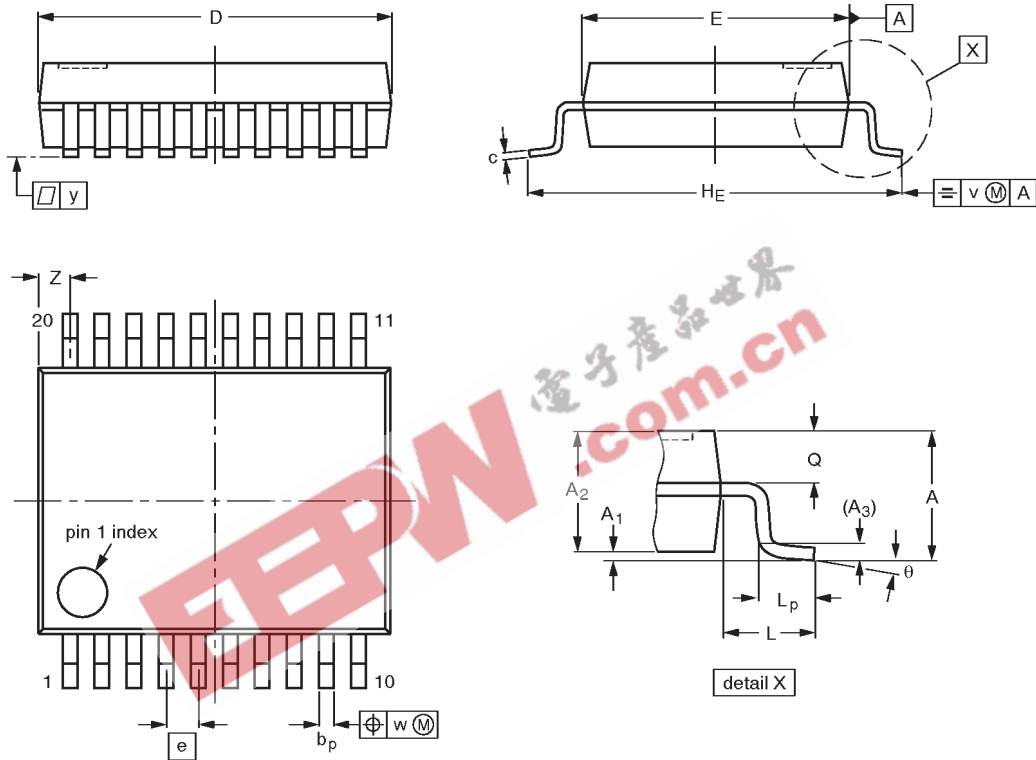
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT163-1 | 075E04 | MS-013AC | | | | 95-01-24 97-05-22 |

Buffers

74F240/74F240A
74F241/74F241A

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



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 | 7.4 7.0 | 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 | 0.9 0.5 | 8° 0° |

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT339-1 | | MO-150AE | | | | 93-09-08 95-02-04 |

Buffers

74F240/74F240A
74F241/74F241A

Data sheet status

| Data sheet status | Product status | Definition [1] |
|---------------------------|----------------|--|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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