

# DATA SHEET

## **74F06, 74F06A, 74F07, 74F07A** Inverter/buffer drivers

Product specification

1992 Jul 24

IC15 Data Handbook

# Hex inverter/buffer drivers (open-collector)

# 74F06, 74F06A, 74F07, 74F07A

### FEATURES OF 74F06, 74F07

- Open Collector output drive 64mA
- High speed
- 12V output termination voltage
- Symmetrical propagation delays

### FEATURES OF 74F06A, 74F07A

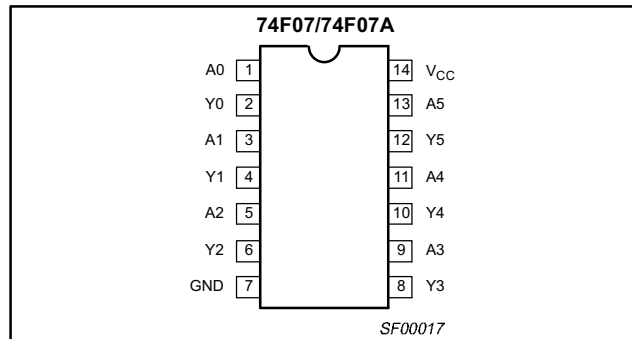
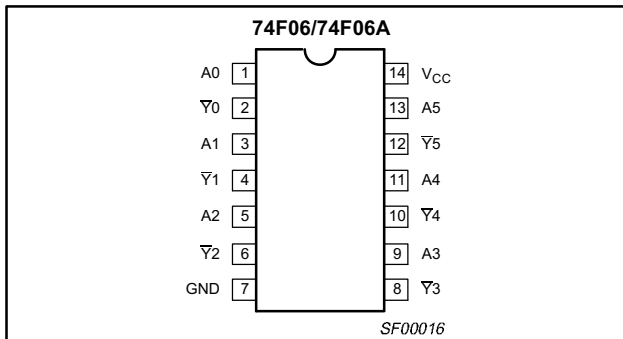
- Open Collector output drive 48mA
- High speed
- 30V output termination voltage
- Replaces 74F06 and 74F07
- Improved performance upgrade for 74F06 and 74F07
- Reduced  $I_{OH}$  leakage @ 30V

| TYPE   | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|---------------------------|--------------------------------|
| 74F06  | 3.5ns                     | 30mA                           |
| 74F06A | 9.0ns                     | 30mA                           |
| 74F07  | 4.5ns                     | 32mA                           |
| 74F07A | 10.0ns                    | 32mA                           |

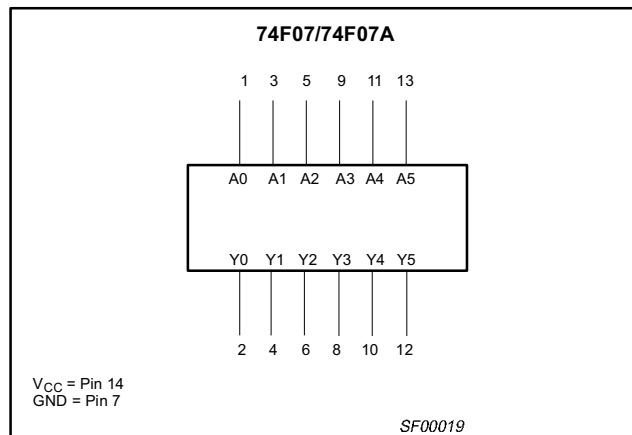
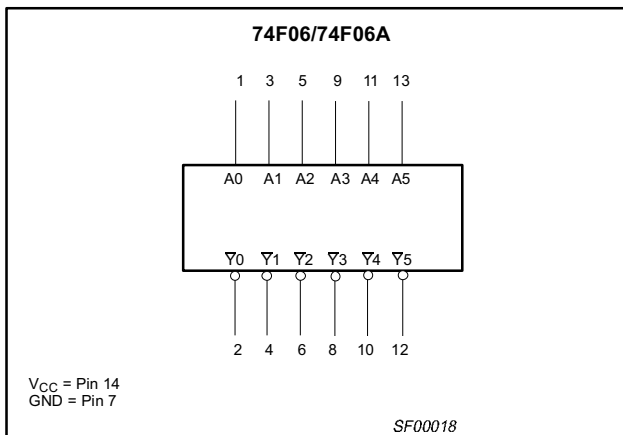
### ORDERING INFORMATION

| DESCRIPTION                         | COMMERCIAL RANGE<br>$V_{CC} = 5V \pm 10\%$ ,<br>$T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ | PKG DWG # |
|-------------------------------------|--|-----------|
| 14-pin plastic Dual In-line Package | N74F06N, N74F06AN  | SOT27-1   |
| 14-pin plastic Small Outline        | N74F07D, N74F07AD  | SOT108-1  |

### PIN CONFIGURATIONS



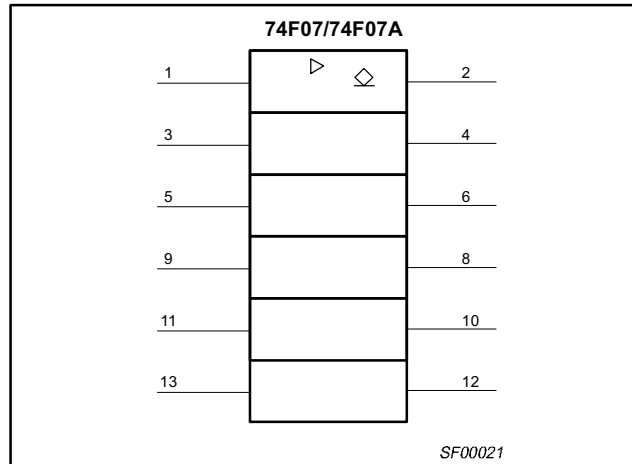
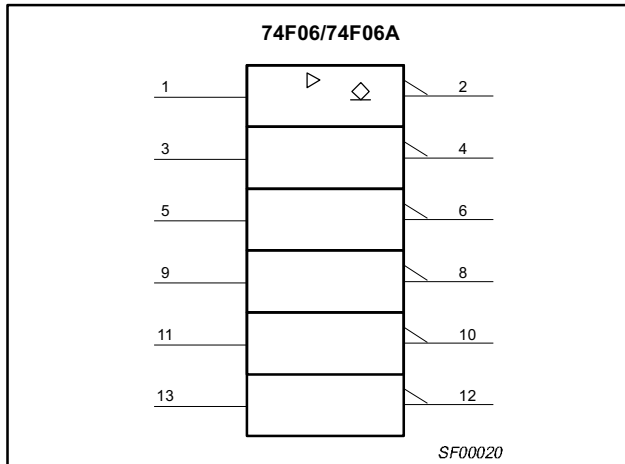
### LOGIC SYMBOLS



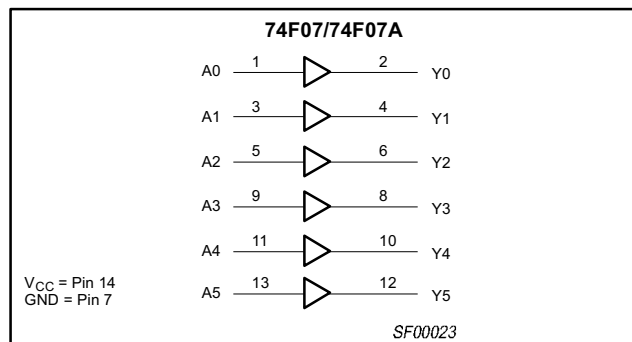
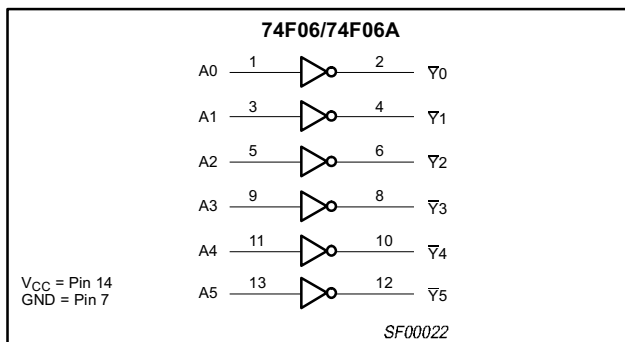
Hex inverter/buffer drivers (open-collector)

74F06, 74F06A,  
74F07, 74F07A

IEC/IEEE SYMBOLS



LOGIC DIAGRAMS



INPUT AND OUTPUT LOADING AND FAN OUT TABLE

| PINS        | DESCRIPTION                | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|-------------|----------------------------|---------------------|---------------------|
| An          | Data inputs ('F06, 'F07)   | 1.0/1.0             | 20µA/0.6mA          |
| An          | Data inputs ('F06A, 'F07A) | 1.0/0.7             | 20µA/0.4mA          |
| $\bar{Y}_n$ | Data outputs ('F06)        | OC/106.7            | OC/64mA             |
| $\bar{Y}_n$ | Data outputs ('F06A)       | OC/80               | OC/48mA             |
| Yn          | Data outputs ('F07)        | OC/106.7            | OC/64mA             |
| Yn          | Data outputs ('F07A)       | OC/80               | OC/48mA             |

NOTES:

- One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.
- OC = Open Collector

FUNCTION TABLE

| INPUTS | OUTPUTS     |             |
|--------|-------------|-------------|
|        | 'F06, 'F06A | 'F07, 'F07A |
| An     | $\bar{Y}_n$ | Yn          |
| L      | H           | L           |
| H      | L           | H           |

NOTES:

- H = High voltage level
- L = Low voltage level

## Hex inverter/buffer drivers (open-collector)

74F06, 74F06A,  
74F07, 74F07A**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 <sub>CC</sub>  | Supply voltage                                 |              | -0.5 to +7.0 | V    |
| V <sub>IN</sub>  | Input voltage                                  |              | -0.5 to +7.0 | V    |
| I <sub>IN</sub>  | Input current                                  |              | -30 to +5    | mA   |
| V <sub>OUT</sub> | Voltage applied to output in High output state | 'F06, 'F07   | -0.5 to 12   | V    |
|                  |  | 'F06A, 'F07A | -0.5 to 30   | V    |
| I <sub>OUT</sub> | Current applied to output in Low output state  | 'F06, 'F07   | 128          | mA   |
|                  |  | 'F06A, 'F07A | 96           | mA   |
| T <sub>amb</sub> | Operating free air temperature range           |              | 0 to +70     | °C   |
| T <sub>stg</sub> | Storage temperature range                      |              | -65 to +150  | °C   |

**RECOMMENDED OPERATING CONDITIONS**

| SYMBOL           | PARAMETER                            | LIMITS       |     |     | UNIT |
|------------------|--------------------------------------|--------------|-----|-----|------|
|                  |                                      | MIN          | NOM | MAX |      |
| V <sub>CC</sub>  | Supply voltage                       | 4.5          | 5.0 | 5.5 | V    |
| V <sub>IH</sub>  | High-level input voltage             | 2.0          |     |     | V    |
| V <sub>IL</sub>  | Low-level input voltage              |              |     | 0.8 | V    |
| I <sub>IK</sub>  | Input clamp current                  |              |     | -18 | mA   |
| V <sub>OH</sub>  | High-level output voltage            | 'F06, 'F07   |     | 12  | V    |
|                  |                                      | 'F06A, 'F07A |     | 30  | V    |
| I <sub>OL</sub>  | Low-level output current             | 'F06, 'F07   |     | 64  | mA   |
|                  |                                      | 'F06A, 'F07A |     | 48  | mA   |
| T <sub>amb</sub> | Operating free air temperature range | 0            |     | +70 | °C   |

## Hex inverter/buffer drivers (open-collector)

74F06, 74F06A,  
74F07, 74F07A

## DC ELECTRICAL CHARACTERISTICS

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

| SYMBOL          | PARAMETER                              |                  | TEST CONDITIONS <sup>1</sup>  |                       |                      | LIMITS |                  |      | UNIT |    |
|-----------------|--|------------------|---|-----------------------|----------------------|--------|------------------|------|------|----|
|                 |  |                  |   |                       |                      | MIN    | TYP <sup>2</sup> | MAX  |      |    |
| I <sub>OH</sub> | High-level output current              | 'F06, 'F07       | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,<br>V <sub>OH</sub> = MAX, V <sub>IH</sub> = MIN |                       |                      |        |                  | 250  | μA   |    |
|                 |  | 'F06A, 'F07A     |   |                       |                      |        |                  | 100  | μA   |    |
| V <sub>OL</sub> | Low-level output voltage               |                  | V <sub>CC</sub> = MIN,<br>V <sub>IL</sub> = MAX,<br>V <sub>IH</sub> = MIN                     | I <sub>OL</sub> = MAX | ±10% V <sub>CC</sub> |        | 0.30             | 0.50 | V    |    |
|                 |  |                  |   |                       | ±5% V <sub>CC</sub>  |        | 0.30             | 0.50 | V    |    |
| V <sub>IK</sub> | Input clamp voltage                    |                  | V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>                                       |                       |                      |        | -0.73            | -1.2 | V    |    |
| I <sub>I</sub>  | Input current at maximum input voltage |                  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V  |                       |                      |        |                  | 100  | μA   |    |
| I <sub>IH</sub> | High-level input current               |                  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V  |                       |                      |        |                  | 20   | μA   |    |
| I <sub>IL</sub> | Low-level input current                | 'F06, 'F07       | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V  |                       |                      |        |                  | -0.6 | mA   |    |
|                 |  | 'F06A, 'F07A     |   |                       |                      |        |                  | -0.4 | mA   |    |
| I <sub>CC</sub> | Supply current (total)                 | 74F06,<br>74F06A | I <sub>CCH</sub>  | V <sub>CC</sub> = MAX |                      |        |                  | 5.0  | 8.0  | mA |
|                 |  |                  | I <sub>CCL</sub>  |                       |                      |        |                  | 30   | 43   | mA |
|                 |  | 74F07,<br>74F07A | I <sub>CCH</sub>  |                       |                      |        |                  | 10   | 14   | mA |
|                 |  |                  | I <sub>CCL</sub>  |                       |                      |        |                  | 32   | 45   | mA |

## NOTES:

- 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<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, 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<sub>OS</sub> tests should be performed last.

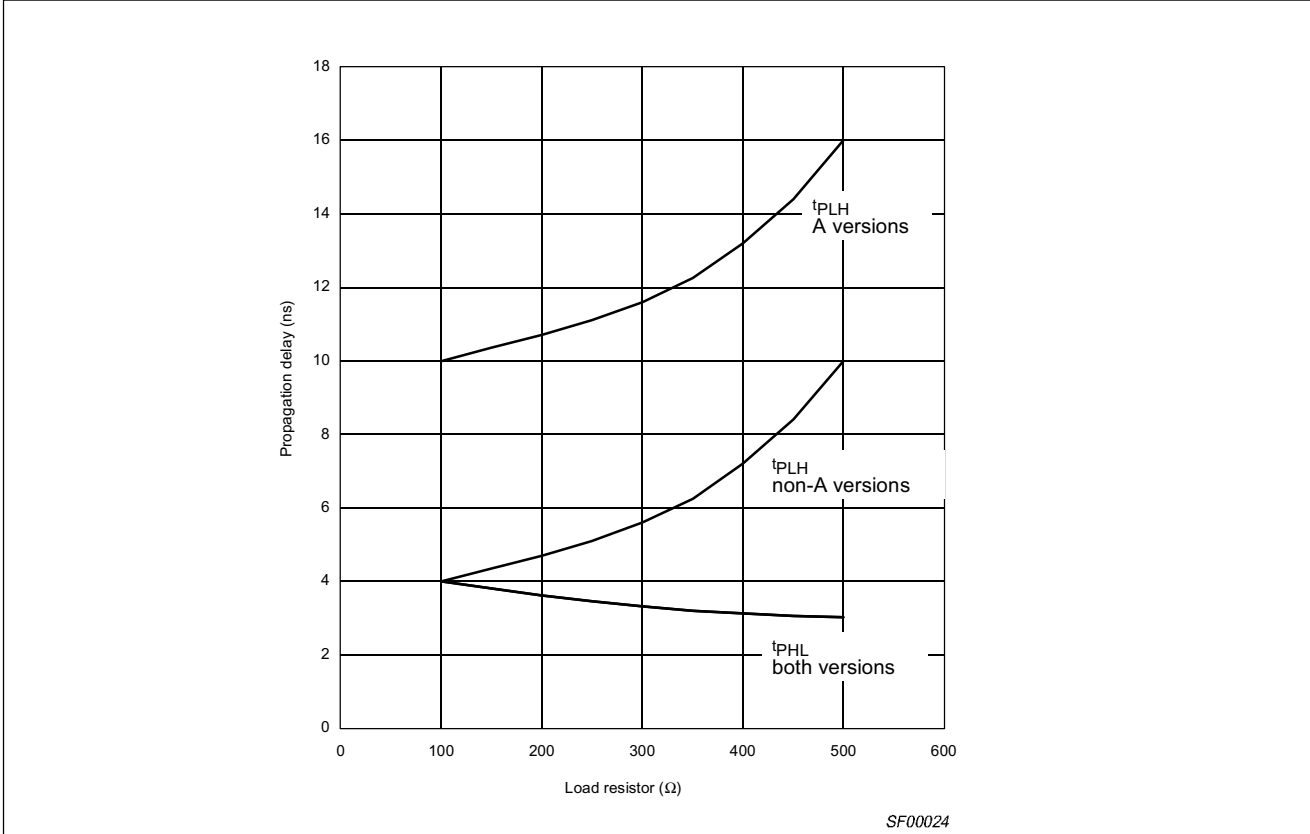
## AC ELECTRICAL CHARACTERISTICS

| SYMBOL                               | PARAMETER   |       | TEST CONDITION | LIMITS  |      |      |  |      | UNIT |
|--------------------------------------|---|-------|----------------|---|------|------|--|------|------|
|                                      |   |       |                | V <sub>CC</sub> = +5.0V<br>T <sub>amb</sub> = +25°C<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 100Ω |      |      | V <sub>CC</sub> = +5.0V ± 10%<br>T <sub>amb</sub> = 0°C to +70°C<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 100Ω |      |      |
|                                      |   |       |                | Min   | Typ  | Max  | Min  | Max  |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>A <sub>n</sub> to Y <sub>n</sub> | 'F06  | Waveform 1     | 2.0   | 3.5  | 6.0  | 1.5  | 6.5  | ns   |
|                                      |   | 'F06A |                | 1.5   | 3.0  | 5.5  | 1.0  | 6.0  |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>A <sub>n</sub> to Y <sub>n</sub> | 'F07  | Waveform 2     | 5.0   | 9.0  | 11.0 | 4.0  | 15.0 | ns   |
|                                      |   |       |                | 2.0   | 4.0  | 6.0  | 2.0  | 8.0  |      |
|                                      |   | 'F07A |                | 2.0   | 4.0  | 6.0  | 2.0  | 6.5  | ns   |
|                                      |   |       |                | 3.0   | 5.0  | 7.0  | 2.5  | 7.5  |      |
|                                      |   |       |                | 6.0   | 10.5 | 13.0 | 5.0  | 17.0 | ns   |
|                                      |   |       |                | 5.0   | 7.5  | 10.0 | 4.0  | 13.0 |      |

Hex inverter/buffer drivers (open-collector)

74F06, 74F06A,  
74F07, 74F07A

TYPICAL PROPAGATION DELAYS VERSUS LOAD FOR OPEN COLLECTOR OUTPUTS

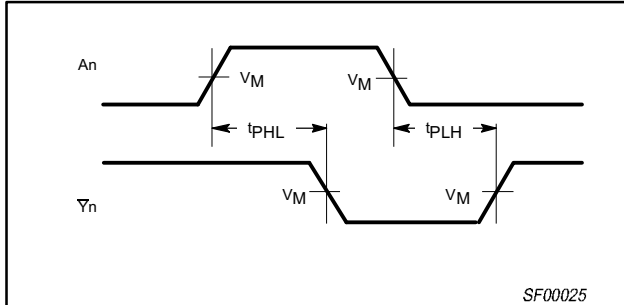


**NOTE:** When using Open-Collector parts, the value of the pull-up resistor greatly affects the value of the  $t_{PLH}$ . For example, changing the specified pull-up resistor value from 500Ω to 100Ω will improve the  $t_{PLH}$  up to 50% with only a slight increase in the  $t_{PHL}$ . However, if the value of the pull-up resistor is changed, the user must make certain that the total  $I_{OL}$  current through the resistor and the total  $I_{IL}$ 's of the receivers does not exceed the  $I_{OL}$  maximum specification.

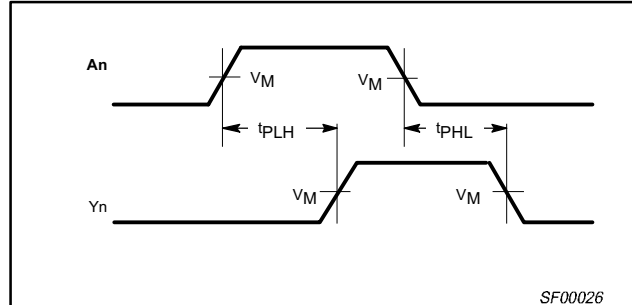
# Hex inverter/buffer drivers (open-collector)

74F06, 74F06A,  
74F07, 74F07A

## AC WAVEFORMS



Waveform 1. Propagation delay for inverting outputs

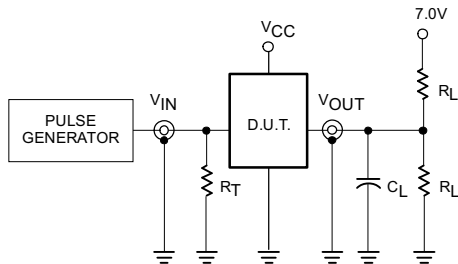


Waveform 2. Propagation delay for non-inverting outputs

**NOTE:**

For all waveforms,  $V_M = 1.5V$ .

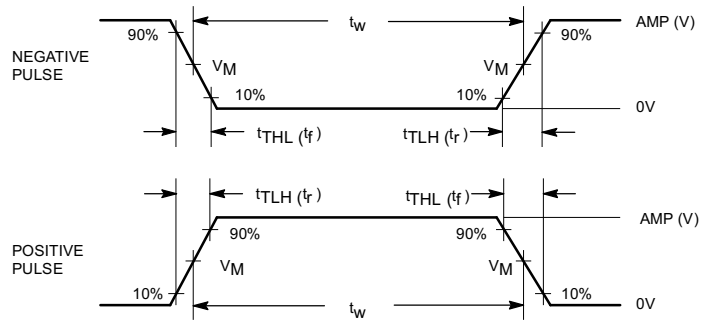
## TEST CIRCUIT AND WAVEFORMS



Test Circuit for Open Collector Outputs

**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     |

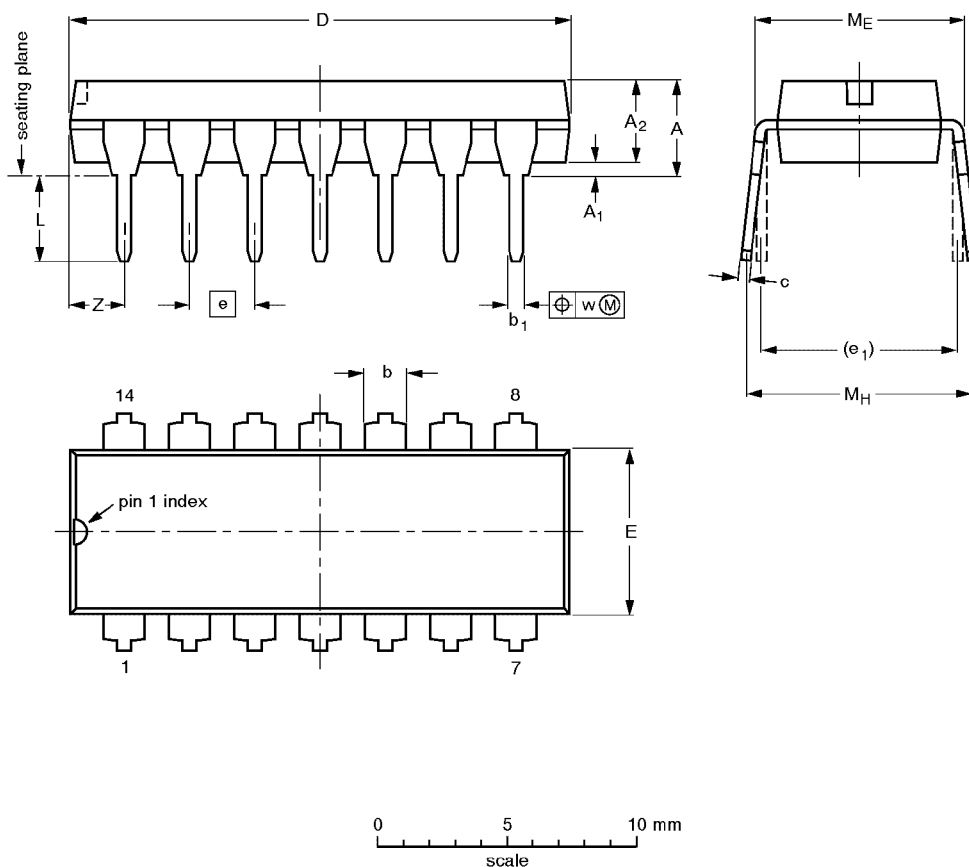
SF00027

Inverter/buffer drivers

74F06, 74F06A,  
74F07, 74F07A

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1



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

| UNIT   | A max. | A <sub>1</sub> min. | A <sub>2</sub> max. | b              | b <sub>1</sub> | c              | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | e <sub>1</sub> | L            | M <sub>E</sub> | M <sub>H</sub> | w     | Z <sup>(1)</sup> max. |
|--------|--------|---------------------|---------------------|----------------|----------------|----------------|------------------|------------------|------|----------------|--------------|----------------|----------------|-------|-----------------------|
| mm     | 4.2    | 0.51                | 3.2                 | 1.73<br>1.13   | 0.53<br>0.38   | 0.36<br>0.23   | 19.50<br>18.55   | 6.48<br>6.20     | 2.54 | 7.62           | 3.60<br>3.05 | 8.25<br>7.80   | 10.0<br>8.3    | 0.254 | 2.2                   |
| inches | 0.17   | 0.020               | 0.13                | 0.068<br>0.044 | 0.021<br>0.015 | 0.014<br>0.009 | 0.77<br>0.73     | 0.26<br>0.24     | 0.10 | 0.30           | 0.14<br>0.12 | 0.32<br>0.31   | 0.39<br>0.33   | 0.01  | 0.087                 |

Note

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

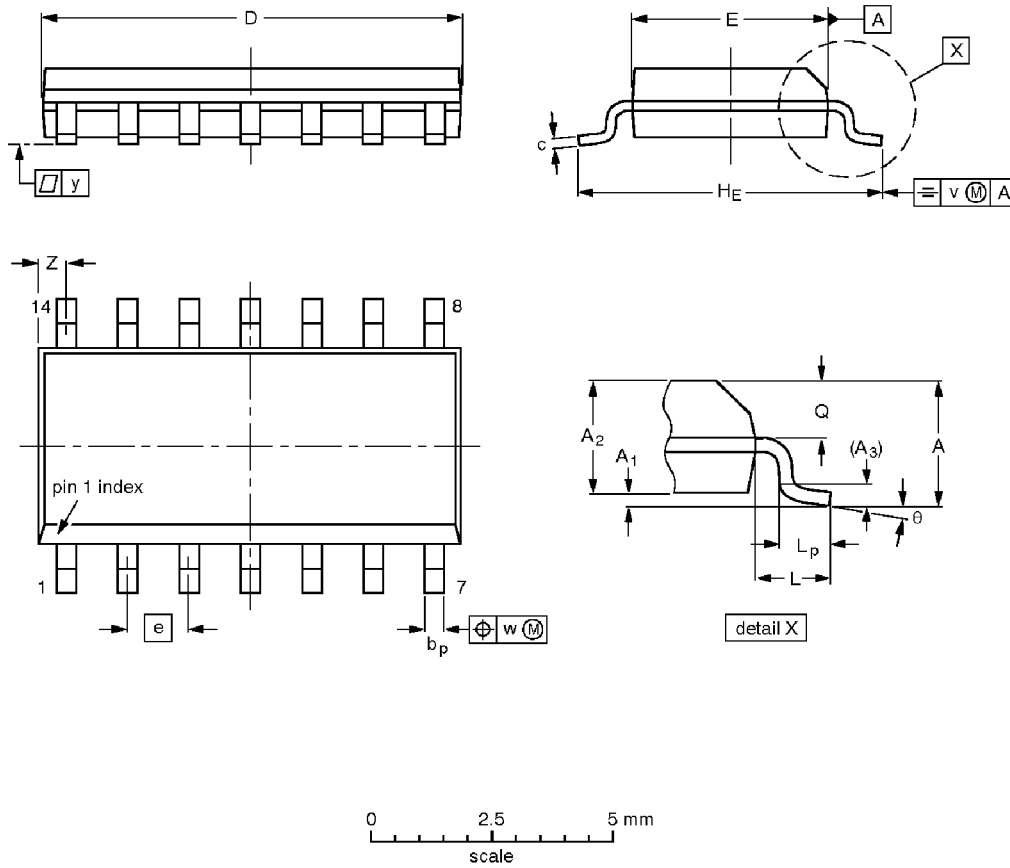
| OUTLINE VERSION | REFERENCES |          |      | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------|------|---------------------|----------------------|
|                 | IEC        | JEDEC    | EIAJ |                     |                      |
| SOT27-1         | 050G04     | MO-001AA |      |                     | 92-11-17<br>95-03-11 |

Inverter/buffer drivers

74F06, 74F06A,  
74F07, 74F07A

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

SOT108-1



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

| UNIT   | A max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | Z <sup>(1)</sup> | θ        |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10   | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 8.75<br>8.55     | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.010<br>0.004 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34     | 0.16<br>0.15     | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

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 |                     |                      |
| SOT108-1        | 076E06S    | MS-012AB |      |                     | 95-01-23<br>97-05-22 |

## Inverter/buffer drivers

74F06, 74F06A,  
74F07, 74F07A

## 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.

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Philips Semiconductors  
811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

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print code

Date of release: 10-98

Document order number:

9397-750-05054

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