

# DATA SHEET

**74F148**

8-input priority encoder

Product specification

1990 Mar 01

IC15 Data Handbook

# 8-input priority encoder

# 74F148

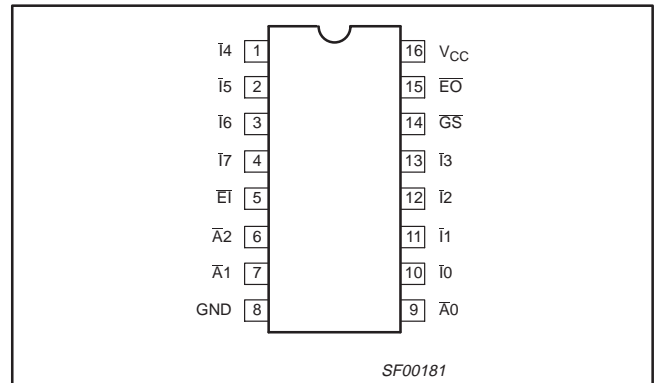
## FEATURES

- Code conversions
- Multi-channel D/A converter
- Decimal-to-BCD converter
- Cascading for priority encoding of "N" bits
- Input enable capability
- Priority encoding-automatic selection of highest priority input line
- Output enable-active Low when all inputs are High
- Group signal output-active when any input is Low

## DESCRIPTION

The 74F148 8-input priority encoder accepts data from eight active-Low inputs and provides a binary representation on the three active-Low outputs. A priority is assigned to each input so that when two or more inputs are simultaneously active, the input with the highest priority is represented on the output, with input line  $\bar{I}7$  having the highest priority. A High on the Enable Input ( $\bar{E}I$ ) will force all outputs to the inactive (High) state and allow new data to settle without producing erroneous information at the outputs. A Group Signal ( $\bar{G}S$ ) output and an Enable Output ( $\bar{E}O$ ) are provided with the three data outputs. The  $\bar{G}S$  is active-Low when any input is Low: this indicates when any input is active. The  $\bar{E}O$  is active-Low when all inputs are High. Using the Enable Output along with the Enable Input allows priority encoding of N input signals. Both  $\bar{E}O$  and  $\bar{G}S$  are active-High when the Enable Input is High.

## PIN CONFIGURATION



| TYPE   | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|---------------------------|--------------------------------|
| 74F148 | 6.0ns                     | 23mA                           |

## ORDERING INFORMATION

| DESCRIPTION        | COMMERCIAL RANGE<br>$V_{CC} = 5V \pm 10\%$ ,<br>$T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ | PKG DWG # |
|--------------------|--|-----------|
| 16-pin plastic DIP | N74F148N   | SOT38-4   |
| 16-pin plastic SO  | N74F148D   | SOT109-1  |

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

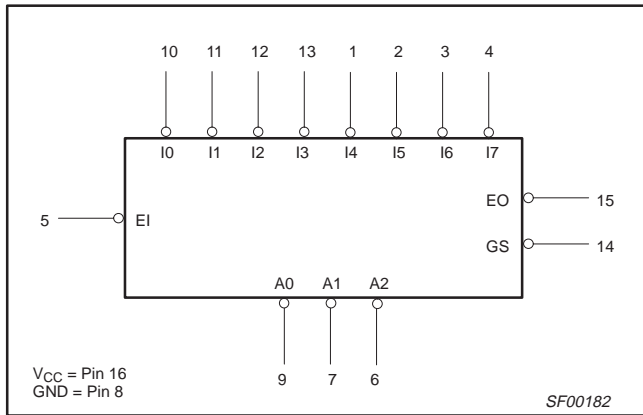
| PINS                  | DESCRIPTION                      | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|-----------------------|----------------------------------|---------------------|---------------------|
| $\bar{I}1 - \bar{I}7$ | Priority inputs (active Low)     | 1.0/2.0             | 20 $\mu$ A/1.2mA    |
| $\bar{I}0$            | Priority input (active Low)      | 1.0/1.0             | 20 $\mu$ A/0.6mA    |
| $\bar{E}I$            | Enable input (active Low)        | 1.0/2.0             | 20 $\mu$ A/1.2mA    |
| $\bar{E}O$            | Enable output (active Low)       | 50/33               | 1.0mA/20mA          |
| $\bar{G}S$            | Group select output (active Low) | 50/33               | 1.0mA/20mA          |
| $\bar{A}0 - \bar{A}2$ | Address outputs (active Low)     | 50/33               | 1.0mA/20mA          |

**NOTE:** One (1.0) FAST unit load is defined as: 20 $\mu$ A in the High state and 0.6mA in the Low state.

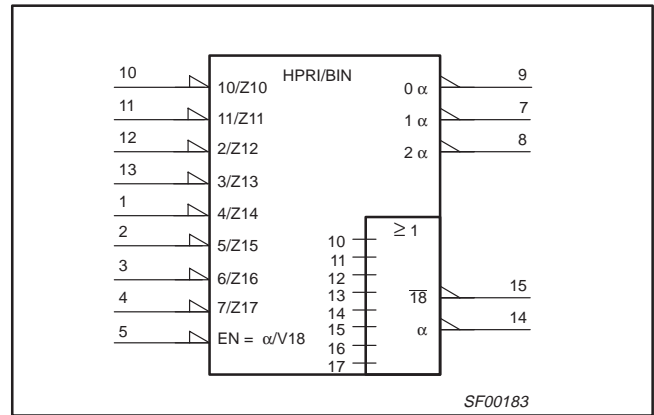
# 8-input priority encoder

## 74F148

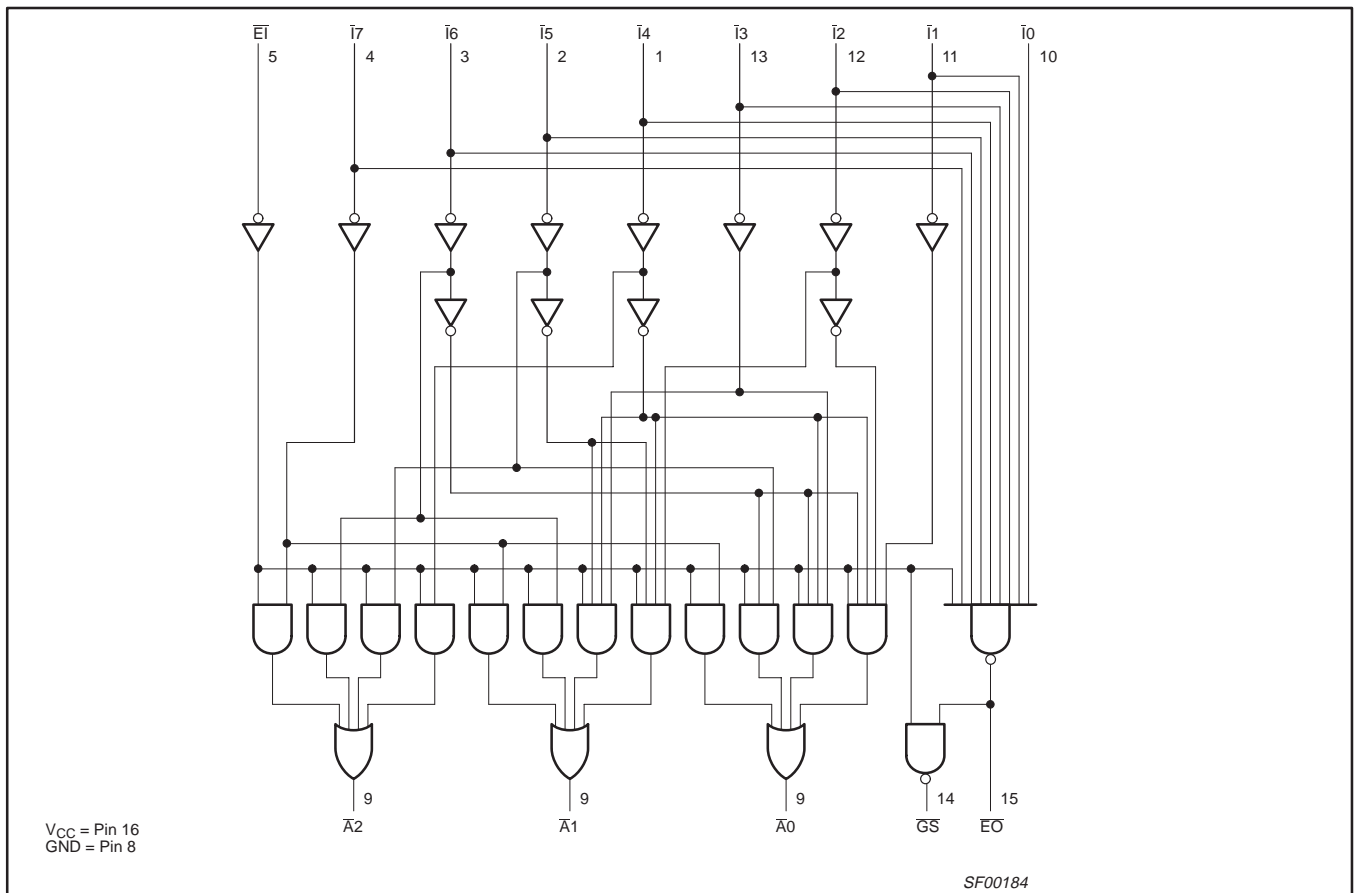
### LOGIC SYMBOL



### IEC/IEEE SYMBOL



### LOGIC DIAGRAM



# 8-input priority encoder

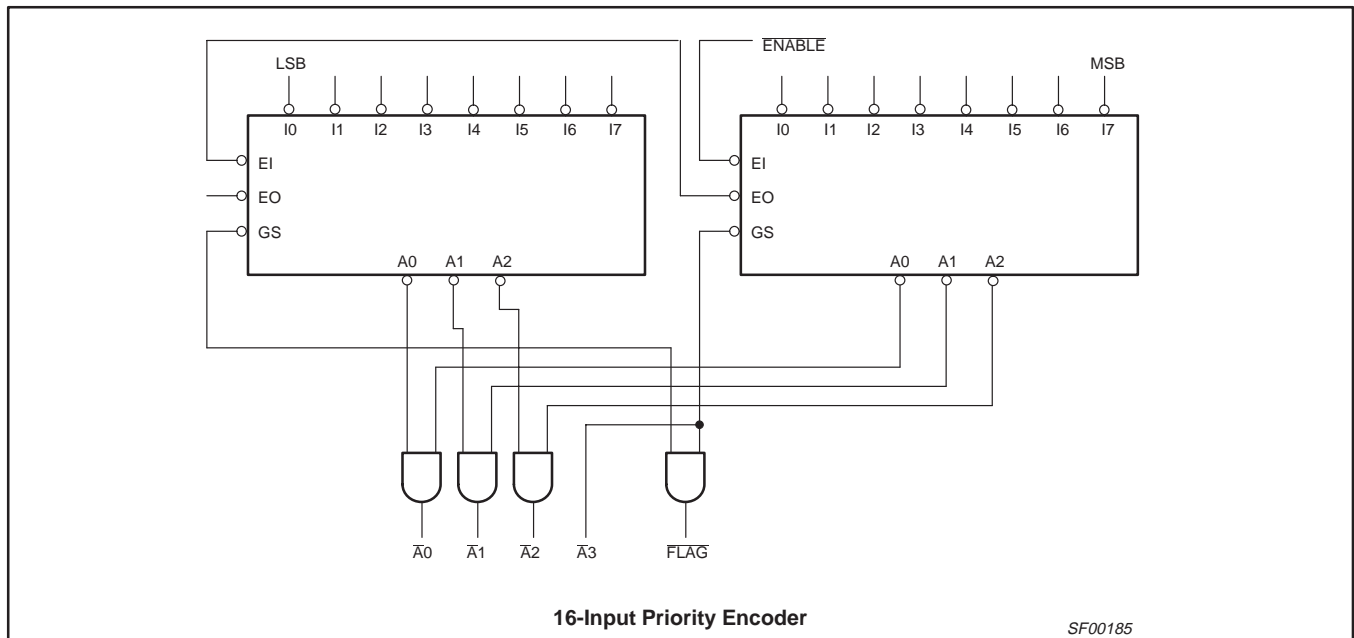
74F148

## FUNCTION TABLE

| INPUTS      |             |             |             |             |             |             |             |             | OUTPUTS |             |             |             |             |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------|-------------|-------------|-------------|-------------|
| E $\bar{I}$ | I $\bar{0}$ | I $\bar{1}$ | I $\bar{2}$ | I $\bar{3}$ | I $\bar{4}$ | I $\bar{5}$ | I $\bar{6}$ | I $\bar{7}$ | GS      | A $\bar{0}$ | A $\bar{1}$ | A $\bar{2}$ | E $\bar{O}$ |
| H           | X           | X           | X           | X           | X           | X           | X           | X           | H       | H           | H           | H           | H           |
| L           | H           | H           | H           | H           | H           | H           | H           | H           | H       | H           | H           | H           | L           |
| L           | X           | X           | X           | X           | X           | X           | X           | L           | L       | L           | L           | L           | H           |
| L           | X           | X           | X           | X           | X           | X           | L           | H           | L       | H           | L           | L           | H           |
| L           | X           | X           | X           | X           | L           | H           | H           | H           | L       | L           | H           | L           | H           |
| L           | X           | X           | X           | L           | H           | H           | H           | H           | L       | L           | L           | H           | H           |
| L           | X           | X           | L           | H           | H           | H           | H           | H           | L       | H           | L           | H           | H           |
| L           | X           | L           | H           | H           | H           | H           | H           | H           | L       | L           | H           | H           | H           |
| L           | L           | H           | H           | H           | H           | H           | H           | H           | L       | H           | H           | H           | H           |

H = High voltage level  
 L = Low voltage level  
 X = Don't care

## APPLICATION



## 8-input priority encoder

74F148

**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limits 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 | -0.5 to V <sub>CC</sub> | V    |
| I <sub>OUT</sub> | Current applied to output in Low output state  | 40                      | 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   |
| I <sub>OH</sub>  | High-level output current            |        |     | -1  | mA   |
| I <sub>OL</sub>  | Low-level output current             |        |     | 20  | mA   |
| T <sub>amb</sub> | Operating free-air temperature range | 0      |     | +70 | °C   |

**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  |      |
| V <sub>OH</sub> | High-level output voltage                 | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX            | ±10%V <sub>CC</sub>                          | 2.5              |      | V    |
|                 |   | V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX            | ±5%V <sub>CC</sub>                           | 2.7              | 3.4  |      |
| V <sub>OL</sub> | Low-level output voltage                  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX            | ±10%V <sub>CC</sub>                          |                  | 0.30 | V    |
|                 |   | V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX            | ±5%V <sub>CC</sub>                           |                  | 0.30 |      |
| 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                   | I <sub>0</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V |                  | -0.6 | mA   |
|                 |   | I <sub>1</sub> - I <sub>7</sub> , E <sub>I</sub>        |  |                  | -1.2 | mA   |
| I <sub>OS</sub> | Short-circuit output current <sup>3</sup> | V <sub>CC</sub> = MAX                                   |  | -60              | -150 | mA   |
| I <sub>CC</sub> | Supply current (total) <sup>4</sup>       | V <sub>CC</sub> = MAX                                   |  | 23               | 35   | 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.
- To measure I<sub>CC</sub>, outputs must be open, V<sub>IN</sub> on all inputs = 4.5V.

# 8-input priority encoder

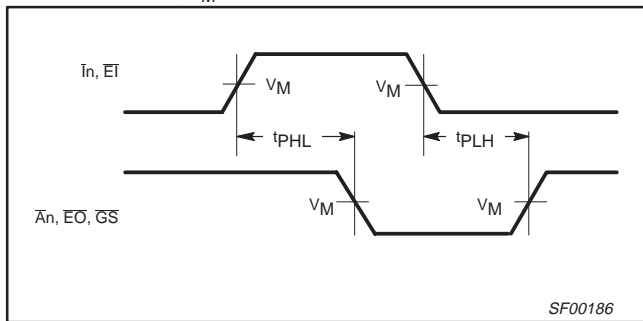
74F148

## AC ELECTRICAL CHARACTERISTICS

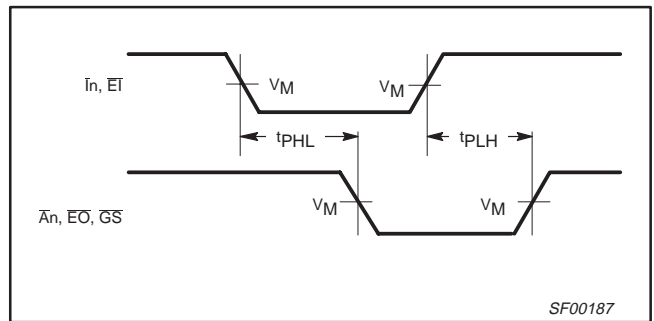
| SYMBOL                               | PARAMETER                              | TEST CONDITION | LIMITS  |            |            |  |              | UNIT |
|--------------------------------------|--|----------------|---|------------|------------|--|--------------|------|
|                                      |  |                | V <sub>CC</sub> = +5.0V<br>T <sub>amb</sub> = +25°C<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω |            |            | 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> = 500Ω |              |      |
|                                      |  |                | MIN   | TYP        | MAX        | MIN  | MAX          |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>In to $\bar{A}_n$ | Waveform 2     | 3.5<br>3.5  | 6.0<br>6.0 | 9.0<br>9.0 | 3.5<br>3.5   | 10.0<br>10.0 | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>In to EO          | Waveform 1     | 1.5<br>1.5  | 3.0<br>2.5 | 6.5<br>6.5 | 1.5<br>1.5   | 7.5<br>7.5   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>In to $\bar{G}_S$ | Waveform 2     | 2.0<br>2.0  | 4.0<br>4.0 | 8.0<br>8.0 | 2.0<br>2.0   | 9.0<br>9.0   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>EI to $\bar{A}_n$ | Waveform 2     | 3.5<br>3.0  | 6.0<br>5.5 | 8.5<br>8.0 | 3.5<br>3.0   | 9.5<br>9.0   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>EI to $\bar{G}_S$ | Waveform 2     | 2.5<br>3.0  | 4.5<br>5.5 | 7.0<br>7.5 | 2.5<br>3.0   | 8.0<br>8.5   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>EI to EO          | Waveform 2     | 3.0<br>3.5  | 5.0<br>5.0 | 7.0<br>7.5 | 3.0<br>3.5   | 8.0<br>9.0   | ns   |

## AC WAVEFORMS

For all waveforms, V<sub>M</sub> = 1.5V.



Waveform 1. For Inverting Outputs



Waveform 2. For Non-Inverting Outputs

## TEST CIRCUIT AND WAVEFORMS

**Test Circuit for Totem-Pole Outputs**

**Input Pulse Definition**

**DEFINITIONS:**

- R<sub>L</sub> = Load resistor; see AC ELECTRICAL CHARACTERISTICS for value.
- C<sub>L</sub> = Load capacitance includes jig and probe capacitance; see AC ELECTRICAL CHARACTERISTICS for value.
- R<sub>T</sub> = Termination resistance should be equal to Z<sub>OUT</sub> of pulse generators.

| family | INPUT PULSE REQUIREMENTS |                |           |                |                  |                  |
|--------|--------------------------|----------------|-----------|----------------|------------------|------------------|
|        | amplitude                | V <sub>M</sub> | rep. rate | t <sub>w</sub> | t <sub>TLH</sub> | t <sub>THL</sub> |
| 74F    | 3.0V                     | 1.5V           | 1MHz      | 500ns          | 2.5ns            | 2.5ns            |

SF00006

# 8-input priority encoder

## 74F148

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4



**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> | b <sub>2</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>1.30   | 0.53<br>0.38   | 1.25<br>0.85   | 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 | 0.76                  |
| inches | 0.17   | 0.020               | 0.13                | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 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  | 0.030                 |

**Note**

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

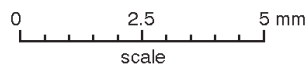
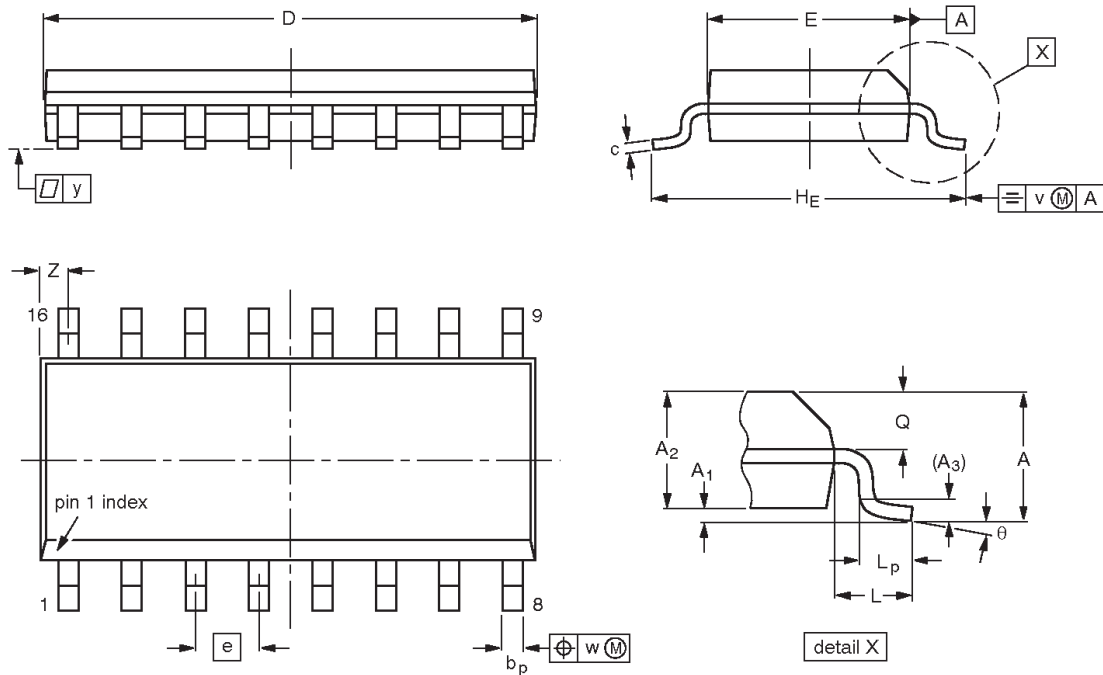
| OUTLINE VERSION | REFERENCES |       |      |  | EUROPEAN PROJECTION | ISSUE DATE            |
|-----------------|------------|-------|------|--|---------------------|-----------------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |                       |
| SOT38-4         |            |       |      |  |                     | -92-11-17<br>95-01-14 |

# 8-input priority encoder

# 74F148

**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

**SOT109-1**



**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<br>0.10   | 0.25<br>1.25   | 1.45<br>0.049  | 0.25<br>0.019  | 0.49<br>0.36   | 0.25<br>0.19    | 10.0<br>9.8      | 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<br>0.004 | 0.010<br>0.049 | 0.057<br>0.014 | 0.01<br>0.0075 | 0.019<br>0.014 | 0.010<br>0.0075 | 0.39<br>0.38     | 0.16<br>0.15     | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 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 |                     |                      |
| SOT109-1        | 076E07S    | MS-012AC |      |                     | 95-01-23<br>97-05-22 |



---

8-input priority encoder

74F148

---

**NOTES**

## 8-input priority encoder

74F148

## 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.  |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification     | Production     | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.   |

[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.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## Disclaimers

**Life support** — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

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

© Copyright Philips Electronics North America Corporation 1998  
All rights reserved. Printed in U.S.A.

print code

Date of release: 10-98

Document order number:

9397-750-05078

*Let's make things better.*