PC Board Layout for Floating-Point Units

National Semiconductor
Application Brief 40
Itzhak Nashelsky
January 1989

For applications requiring floating-point capability, National Semiconductor offers two options:

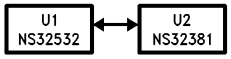
1. The NS32381: A low-cost floating-point unit (FPU) which interfaces directly to the NS32532 microprocessor.
2. The Weitek W3164: A high-performance floating-point solution which uses the NS32580 floating-point controller (FPC) to interface with the NS32532.

This application brief briefly explains how to lay-out a printed circuit (PC) board incorporating the NS32532 microprocessor and either FPU option. The board design provides maximum flexibility and can be used for either option.

Note: For detailed information regarding either the NS32381 FPU or the NS32580 FPC, refer to their data sheets.

The two FPU options are presented in *Figures 1* and *2*. To provide both floating-point options with minimal printed circuit board real estate, the NS32580's pin-out was designed to be fully compatible with that of the NS32381 FPU. *Figure 3* illustrates this pin compatibility and the location of the keying pins.

As a result, the layout of the PC board can be prepared using Option 2, leaving the decision for the final floating-point configuration to the user. Users who prefer Option 1, will therefore be able to insert the NS32381 into the NS32580's socket, leaving U3's socket unpopulated. This method was implemented in the VME532 board designed by National Semiconductor.

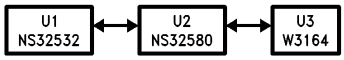


TL/EE/10351–1

FIGURE 1. Option 1, Using the NS32381 FPU

Note: Since the NS32381's package is smaller than that of the NS32580, special care should be taken while inserting the NS32381 into the NS32580's socket.

Also, to prevent damage cause by ''shifted'' insertion, it is recommended that four keying-pins be installed in the NS32580 socket in the center area (see *Figure 3*).



TL/EE/10351–2

FIGURE 2. Option 2, Using the W3164 and NS32580 FPC

```
o o o o o o o o o o o o o o o
o o o o o o o o o o o o o o o
o o x x x x x x x x x x x o o
o o x x x x x x x x x x x o o
o o x x k               k x x o o
o o x x                   x x o o
o o x x                   x x o o
o o x x                   x x o o
o o x x                   x x o o
o o x x                   x x o o
o o x x k               k x x o o
o o x x x x x x x x x x x o o
o o x x x x x x x x x x x o o
o o o o o o o o o o o o o o o
o o o o o o o o o o o o o o o
```

TL/EE/10351–3

x = Pins common to both NS32580 and NS32381.
o = Pins belonging to the NS32580 only.
k = Keying pins for the NS32381.

FIGURE 3. NS32580/NS32381 Pin-Out Compatibility

RRD-B30M105/Printed in U. S. A.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408