

## Guidelines for Handling and Using Intelligent Display<sup>®</sup> Devices

### Appnote 18

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#### IMPORTANT!

**This appnote contains vital information for optimum design and performance of Intelligent Displays Devices.**

Siemens Optoelectronics Intelligent Displays Devices and Programmable Displays are one, four, eight, or ten digit LED display modules with dot matrix and on-board CMOS integrated circuits. The CMOS chip provides dot or segment decoding, drivers, multiplexing and memory for easy interfacing to most microprocessors.

This application note is a guide for the design and handling considerations of Intelligent and Programmable Displays.

#### System Design Consideration

In the practical circuit (i.e., design of PCB, etc.) the voltage to any input must never exceed the power inputs (i.e.,  $GND < V_{IN} < V_{CC}$ ). If these conditions are not met, then malfunction, or at worst, device destruction can occur. The most common cause of these conditions is circuit noise on the inputs and transient power supply changes.

#### Good Circuit Layout

The principles of good circuit layout are identical to any logic circuitry, but the deviation tolerance of MOS devices is much less than that of bipolar logic. Keeping the signal path lengths as short as possible is important to reduce the coupling effect between signals.

#### Buffering

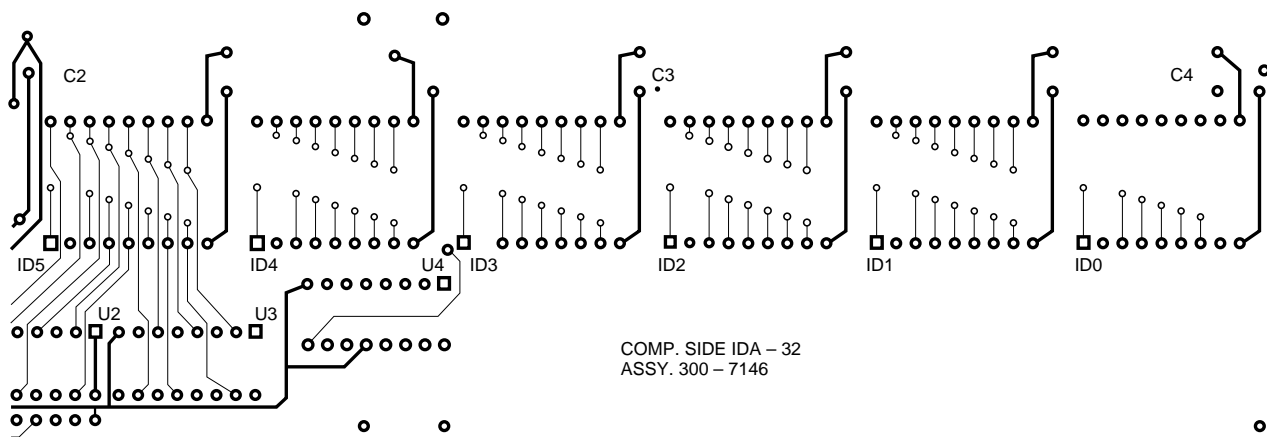
Although the use of parallel tracking is usually considered good design practice, avoid PCB designs which allow an interconnection track to run parallel to another. This is particularly true if one of the tracks is a high power bus when the fluctuations of power supply current can cause inductive or capacitive coupled charge onto an adjacent input signal.

Possibly the worst example of parallel tracking is the ribbon cable. While physically neat and convenient, ribbon cables can be electrically destructive for MOS circuits. It is often necessary, because of the very nature of Intelligent Displays Devices, to use a ribbon cable from the CPU board to the display assembly board. In those circumstances for PCB trace lengths plus cable lengths over 15.5 cm (6 inches), use a buffer for each input. This is especially true for noisy systems which have motors, relays, etc. The buffers should be physically as close as possible to the displays, maintaining a minimum distance between their outputs and the display inputs. Long cables can be poor transmission lines for speed pulses. Line drivers, line receivers, or Schmitt trigger gates may be required to shape pulses.

#### Voltage Transients

It has become common practice to provide 0.01  $\mu\text{f}$  bypass capacitors liberally in digital systems. For Intelligent Displays Devices, the emphasis is on adequate decoupling. Like other CMOS circuitry, the Intelligent Display controller chip has a very low power consumption and the usual 0.01  $\mu\text{f}$  capacitor would be adequate were it not for the LEDs. The module can, in some conditions (depending on the displayed characters), use up to 500 mA pk (average, multiplexed). To prevent power supply transients, use capacitors with low inductance and high capacitance at high frequencies, i.e., a solid tantalum or ceramic disc for high frequency bypass. For longer display lengths, distribute the bypass capacitors evenly keeping capacitors as close to display power pins as possible. Do not rely on onboard decoupling; use a 10  $\mu\text{f}$  and a 0.01  $\mu\text{f}$  capacitor for every three or four Intelligent Displays Devices to decouple the displays themselves, at the displays. See Figure 1.

Figure 1. PCB layout of a line DLX2416 Intelligent Displays Devices



Capacitors are spaced evenly and close to the displays with room for additional capacitors if required.

### Functional Limitations

Several parameters of an Intelligent/Programmable Display which may affect your design are listed below. While some parameters may not be destructive, some may affect reliability and/or functional operation. (Check latest data sheets.)

1. No more than 20 LEDs/character may be lit for HDSP200XLP, Serial Input Displays.
2. The timing parameters at 25°C will increase (slower) with increased temperature.
3. The timing parameters will decrease (faster) with increased  $V_{CC}$ .

### Manufacturing Considerations Handling

The static voltages generated by friction with synthetic materials (i.e., carpets, clothing, device carriers, etc.) are often measured in thousands of volts. Although these static charges usually have little energy, it is sufficient to cause destruction to CMOS circuitry if applied to circuit inputs. Our CMOS circuits have input protection diodes which can minimize their vulnerability to these static voltages, but there is a limit to their protection capabilities. Under certain conditions, static charges can exceed that limit. The most effective protection is to avoid generation of static charges. When static charges are unavoidable, prevent that charge from coming into contact with the device pins.

1. **Avoid touching the pins; handle the body only.**
2. **Keep the devices in anti-static tubes or conductive material when transporting.**
3. **Use conductive and grounded working area** (conductive flooring, conductive workbench tops, conductive individual wrist straps, etc.).

### Intensity Brightness Codes

Display uniformity is a concern when two or more displays are in a system. Siemens has adopted a letter code (indicating a brightness range) to maintain a uniform display. We recommend a single letter code be used per system. Because this may be difficult to always achieve due to yield and delivery, adjacent codes (i.e., D with E or E with F) can be used with minimal problems. Jumping over a code (i.e., D with F) may be noticeable.

### Soldering

Because of the plastic housing of the Intelligent Displays Devices, it is necessary to control the solder temperature, soldering time, and soldering distance. Refer to data sheet for maximum limits. An additional requirement during wave soldering: the temperature of the plastic package should not exceed the maximum rated storage temperature of the device type.

In general, Intelligent Displays cannot be reflowed as an SMT component.

### Cleaning

Refer to Appnote 19, "Cleaning LED Opto Products."