



By **W.K. Cheung**
Product Engineering
Microcontroller Division
Hong Kong

Introduction

This engineering bulletin provides methods to overcome induced noises on the serial peripheral interface (SPI) bus, on the MC14489B multi-character LED display/lamp driver.

Incorrect display outputs may occur when the MC14489B is operated in a noisy environment, such as in high current switching circuits. At first, this may seem to be a device fault. In fact, most of the incorrect display outputs are related to noise induced onto the SPI bus. When this happens, the data received by MC14489B was not the intended data sent by SPI master. The methods described below helps to overcome this noise induced problem.

Improving Noise Immunity

Noise may cause incorrect device operation and incorrect data reception. Careful circuit design and PCB layout prevents much of the problems. For the MC14489B, noise immunity can be improved using the following methods:

- Use decoupling capacitors at the device power supply pins.
- Keep SPI lines on the PCB away from noisy lines and devices such as switchers.
- Terminate SPI lines at the device using termination resistors and decouple with capacitors, as shown in [Figure 1](#).

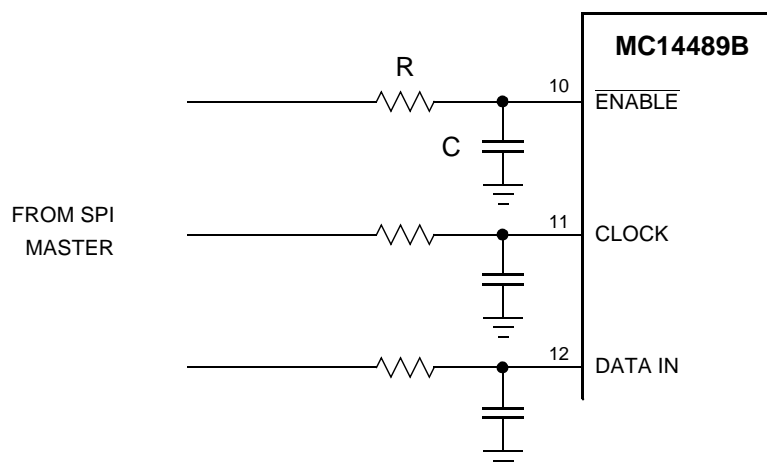


Figure 1. SPI Bus Termination and Decoupling

The values of R and C depend on the transmission speed of the SPI bus. For a transmission speed of around 100kHz, an R of 100Ω and C of 1nF is suggested. For higher transmission speeds, the values of R and C should be reduced accordingly. But if the operating environment is very noisy, larger values of R and C must be selected, and the transmission speed should be reduced.

Display Correction by Software

In extremely noisy environments, the prevention described above may not solve the incorrect display output problem. The data for the display may have to be re-transmitted by the SPI master. In severe cases, the corrupted data received by the MC14489B may cause it to enter test mode. In this case, re-transmitting the correct display data will not solve the problem. The device needs to exit test mode first, and then the display data re-transmitted.

To exit test mode, the SPI master needs to send the signal (three zero bits) as shown in [Figure 2](#).

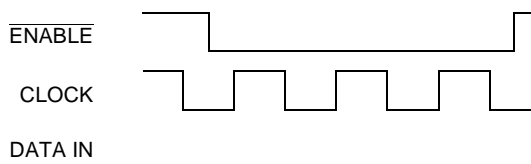


Figure 2. Exit Signal for Test Mode

Therefore, to overcome the possibility of the device entering test mode, in the user firmware, three zero bits should be sent prior to sending the display data.

Notes:

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