Model Establishment and Crosstalk Analysis of the Common-Leg Multiconductor Transmission Line

Chi-Fang Huang* and Yun-Chih Chao
Graduate Institute of Communication Engineering, Tatung University
40, Chungshan N. Rd., 3rd Sec., Taipei 104, TAIWAN
TEL: +886-937-008-883; FAX: +886-945-868-442, , Email: ras@ttu.edu.tw

I. Introduction

Due to that the differential transmission line has the effect of "common-mode rejection" to the noise signal, it is suitable for signal of high speed and low voltage to propagate for long distance. However, in the high-speed digital system, for instance, the equipments of telecommunication transmission, the number of kinds of address/data bus will increase along with the raise of complexity, among which the differential signal line structures are much more complicated. Furthermore, in the system of high density, a large amount of the transmission line will lead to huge number of I/O pins in package of semiconductor devices, for example, of 500 600 pins. To overcome this problem, in other words, to cut down the pin number of ASIC, a new method in engineering is to combine one of each pair of the differential transmission line from transmitter to receiver in the light of one group of differential transmission address/data bus, refer to Fig. 1.

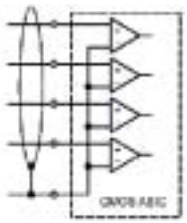

Fig. Circuit representation of a common-leg multiconductor transmission line

The purpose of this paper is to put forward the model establishment and crosstalk analysis for this kind of transmission line structure. In the experiment, the prototypes of different length and line spacing are made for analyzing the relation between the parameters of the structure and the coupling of signals. In the simulation, to economize the calculated memory of computer and simulated time, lumped element equivalent circuit is applied for the establishment of model. At the last, the results of simulation will be proved by the result of measurement.

II. Test bed and modelling

Referring to the profile of the structure, the Fig. 2, when the common-leg multiconductor transmission line are realized in a multiplayer PCB, the signal path of the common one is named as the 'reference', and the other signals are shielded by it as well. However, all of them are covered shielded by the ground planes.

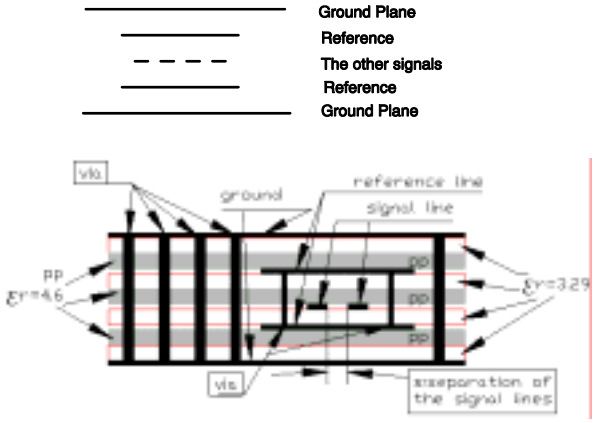

Fig. 2 Cross-section of the transmission line

Consequently, the reference line is to act as a low impedance line. This structure is surely operating as a heavily coupled one. There are two kinds of test bed with different signal path lengths under study, namely, short line of 61.195 mm length and long line of 130.6232 mm length. Both of them have three line spacing cases: s = 1w, s = 1.5w, and s = 2w with w = 0.1584mm (signal line width).