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The Bus Extension Module of POSAFE-Q Using LVDS

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1. Introduction

Recently, Safety-Related PLC (Programmable Logic Controller) develops new technology to handle many data promptly. The simple method to handle effective many data reduces operating voltage on 3.3V or under 3.3V, so that is possible to handle data high speed data. This method to reduce operating voltage is effective handling high speed data, but ultimately it has electromagnetic problem.(EMI/EMC)

The paper attributes to high-speed data processing, and electromagnetic waves in order to meet the manner of handling the existing data signal Transistor-Transistor Logic (TTL) in the data processing capacity and good electromagnetic characteristics Low Voltage Differential Signal (LVDS) method using the SUN 1,2 is applied to Safe-related PLC (POSFE-Q) on the implementation of the bus expansion module is described.

2. Methods and Results

In this chapter, the basic LVDS and POSAFE-Q applied to the actual bus expansion module explain the structure and behavior.

2.1 Low Voltage Differential Signal (LVDS)

The basic hardware structure of LVDS is shown below.

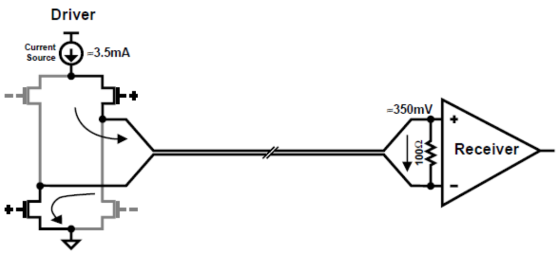


Fig. 1. Standard Logic of LVDS

LVDS driver consists of structures such as Fig 1 in the transmitter to configure Differential structure and receiver to configure termination resister. Typical LVDS driver is a differential structure, and includes a current source of 3.5mA.

As Fig 1 shown, on case of logic high('1'), the MOS transistor to consist of differential structure turned on, so receiver generates approximately 350mV through the termination resistor in the receiver 100Ohm using a current source of 3.5mA.

On case of logic Low('0'), nMOS transistor of transmitter turned on, so receiver generated -350mV.

The good feature of LVDS is effective a handling data because of low voltage swing and is strong electromagnetic than TTL because of differential signal data.

2.2 Bus Extension Module Using LVDS

The bus extension module purpose of POSAFE-Q controls input/output module of extension station. Bus expansion modules are implemented as a master and slave. The module is mounted on the CPU station is master and the module is mounted on the extended station is slave. Bus expansion modules can be extended up to seven stations, and Fig 2 is shown.

The Bus expansion modules, data transfer between master and slave mode is used for LVDS.

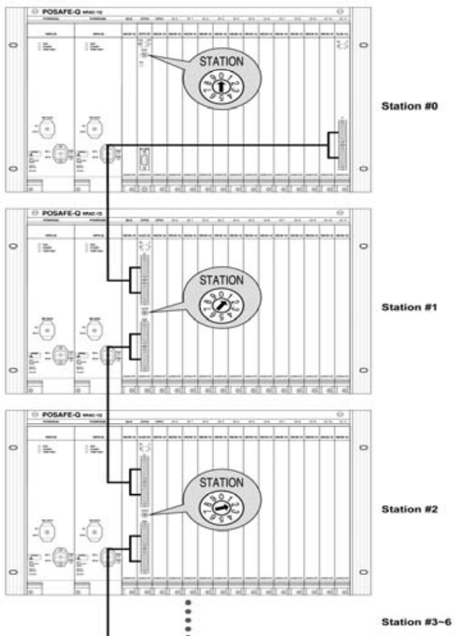


Fig. 2. Bus Extension Module System .

The block diagram of the bus expansion module Fig 3, Fig 4 is shown.

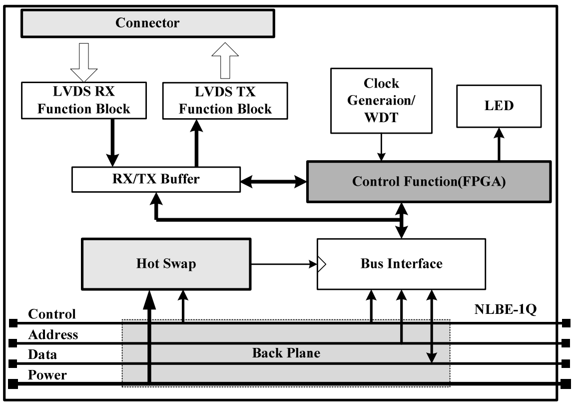


Fig. 3. Block Diagram of Bus Extension Master Module

Fig 3 is block diagram of Master module. The master module inputs control signal, address and data from back plane. By decoding the address, if decoding address is not master data, master module opens RX/TX buffer and transmits/receives data sub-station.

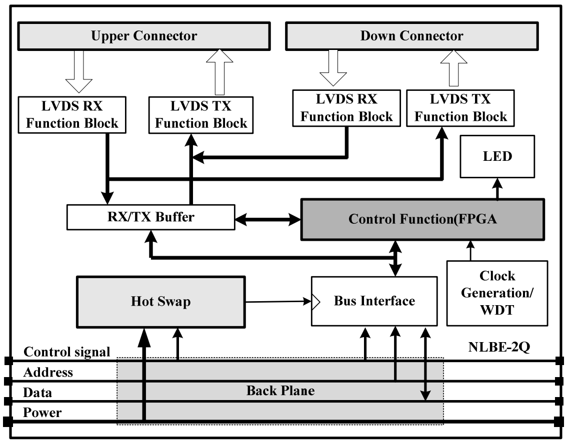


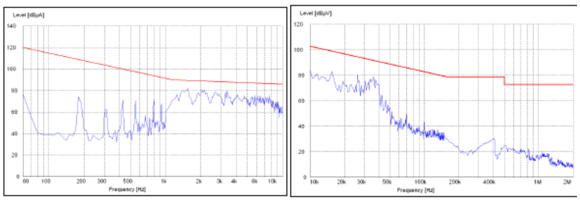
Fig. 4. Block Diagram of Bus Extension Slave Module

Fig 4 is block diagram of slave module. The slave module inputs control signal, address and data from back plane or sub-station. By decoding the address from master module, if decoding address is matched, slave module opens RX/TX buffer so the control signal, data and address transmit I/O module, but decoding address is not matched, the signals is by-pass to other sub-station. The signals from the other sub-station transmit a master module.

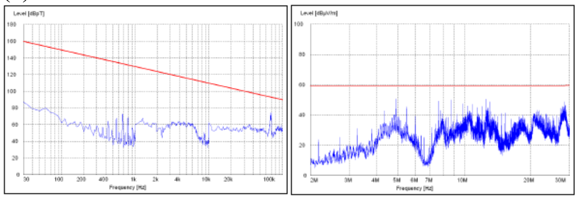
2.3 EMI/EMC Test of Bus Extension Module

The bus extension module designed POSCO-ICT tested function and electromagnetic (EMI/EMC) by Korea Testing Laboratory (KTL).

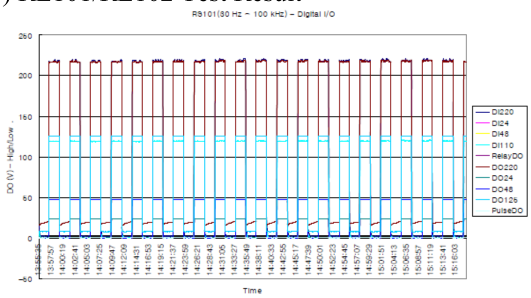
Fig 5 is EMI/EMC results of POSAFE-Q including bus extension module in Regulatory Guide 1.180



(a) CE101/CE102 Test Result



(b) RE101/RE102 Test Result



(c) RS101 Test Result (30Hz ~ 100KHz)

Fig. 5. EMI/EMC Test Result

3. Conclusions

The extension module of POSAFE-Q using LVDS was not a problem to transmit/receive data processing within EMI / EMC environments.

LVDS technology is good features for high-speed data processing and EMI / EMC. But application field of this technology is safety-related controller, so this technology will improve a higher reliability of module redundancy or redundancy of data transfer.

REFERENCES

[1] IEEE Standard for Low-Voltage Differential Signals (LVDS) for Scalable Coherent Interface (SCI), 1596.3 SCI-LVDS Standard, IEEE Std. 1596.3-1996, 1994.

[2] Electrical characteristics of low-voltage differential-signalling (LVDS) interface circuits, TIA/EIA-644, National Semiconductor Corp., ANSI/TIA/EIA, 1996.

[3] Andrea Boni, et al. "LVDS I/O interface for Gb/s-per-Pin Operation in 0.35μm CMOS", IEEE Journal of Solid-State Circuits, vol. 36, pp. 706-711, April 2001.

[4] Kush Gulati, et al. "A High-Swing CMOS Telescopic Operational Amplifier", IEEE Journal of Solid-State Circuits, vol. 33, no. 12, December 1998.

[5] Unekawa, Y, et al. "A 5 Gb/s 8×8 ATM switch element CMOS LSI supporting five quality-of-service classes with 200 MHz LVDS interface", Solid-State Circuits Conference, 1996. Digest of Technical Papers. 43rd ISSCC., 1996 IEEE International 8-10 Feb. 1996 Page(s):118 - 119, 428