

Lifting the City's Workers with CANbus

Introduction

Are you in a hurry all the time? Do you depend on reliable devices to work without a hitch? Does the building elevator always meet your expectations? It is sometimes difficult to cope with delay disappointments, but if you knew the electronics behind the scenes you would have a greater respect for the elevator's physical backbone communications network (Figure 1).



Figure 1. I'm late

A conventional elevator control system has several disadvantages. These could include complicated circuits, a large number of wires, and noise sensitivity. The elevator system's complexity is a consequence of juggling the number of cabins, floors, customer's requested destinations, while meeting customer safety standards. The reason for many elevator breakdowns is at the grass roots level of the elevators's communication network.

There can be inadequate levels of ruggedness and reliability in the system's physical communication electronics. In this article, we will address this problem by presenting a proven yet possibly unexpected hardware solution.

The Elevator System

The elevator control system manages communication to and from several sub-systems. On the outside of the system, the elevator maintenance technician and passenger personnel send and receive information or requests. At this level, and

throughout the interior electronic blocks, the communication channels must remain free of interfering signals (Figure 2).

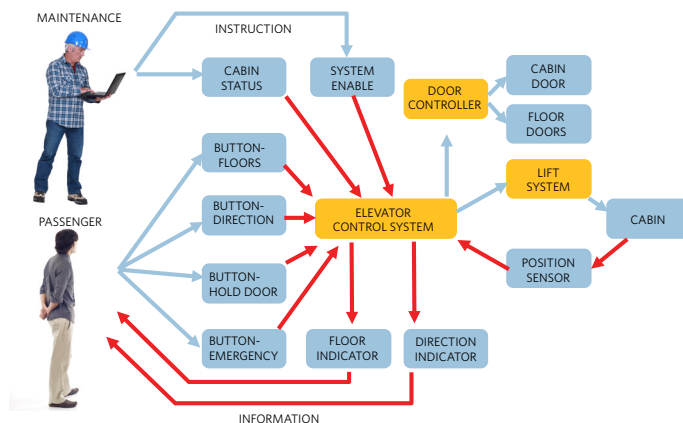


Figure 2. General Block Diagram of an Elevator System

The passenger cannot access the elevator electronics; however, the elevator maintenance or technician may touch the electronic circuits in such a way to cause accidental short circuits or overvoltage events. If these incidences occur, the elevator circuit experiences an Electrical Overstress (EOS) event.

Electrical Overstress

An EOS venerable circuit is where there is exposure to the outside world or noise from a magnetic source, such as motors. Typically, the physical communication layer, such as the CANbus system, will have exposure to magnetic events and connectors to the outside world (Figure 3).

In Figure 3, the transmitting communication signal for the system is V_{CANH} and V_{CANL} . The MAX13054A CAN transceiver receives these signals as well as the EOS event, V_{EOS} .

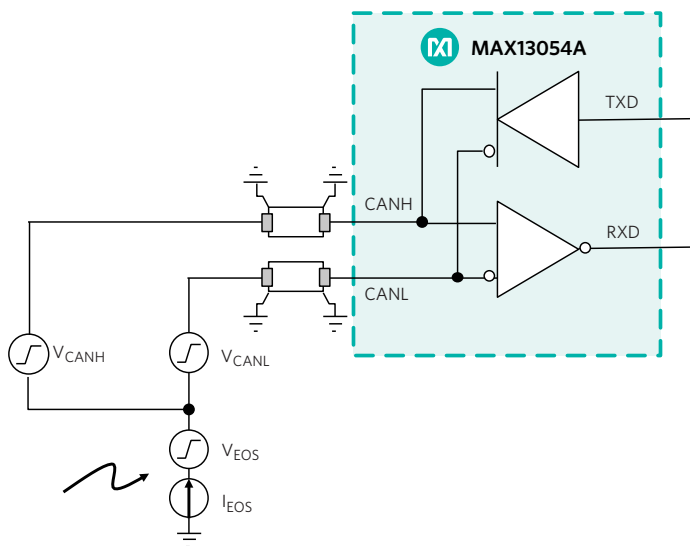


Figure 3. CANbus Transceiver With Communication Network Signals (V_{CANH} , V_{CANL}) and an External EOS Voltage Event (V_{EOS})

One type of EOS event is an in-circuit exposure to current or voltage beyond a device's maximum ratings. This type of low-voltage stress has a lower voltage magnitude and longer duration than an ESD event.

The EOS event can exceed the active circuits' I/O voltage limits (Figure 4).

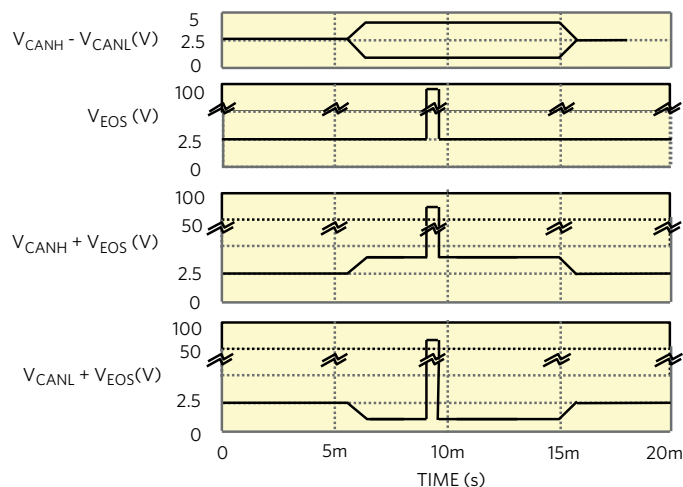


Figure 4. The V_{CANH} and V_{CANL} Signals Combined with the V_{EOS} Signal Overshoot the MAX13054A Power Supply

In Figure 4, the example of the EOS event is significantly slower as it lasts more than several milliseconds. A typical ESD event lasts approximately 75ns to 200ns. Additionally, in this figure, the EOS' voltage maximum of approximately 60V is significantly lower than an ESD event. ESD voltage minimums start at several thousands of volts.

This type of EOS damage includes the destruction of the silicon gates and vaporizing chip metal traces.

EOS Prevention

The key specification with CAN bus transceivers that addresses this type of EOS is fault protection. Fault protection is another way of saying overvoltage protection for this type of EOS event. This specification provides protection for the data lines (CANH/CANL) from shorts to power supplies.

Devices that can survive the EOS event in Figure 4 need a fault tolerance greater than 50V. An example device that would survive this event is the MAX13054A 5V, 2Mbps CAN transceiver. This device has $\pm 65V$ fault tolerance, $\pm 25V$ CMR, and $\pm 25kV$ integrated ESD protection.

Lifting the Elevators to Higher Reliability Levels

The protection of data lines from shorts, power supplies, and external voltages is paramount as technicians and/or maintenance staff access the elevator's electronics. A direct path to the physical communication electronics level is through the connectors, cables, and sockets. If there is a CAN bus transceiver in the signal path, there exists protection from these errors. CAN transceivers that exceed the specified fault protection performance, such as the MAX13054A, will lift your elevator to a new level of robustness and reliability. This is a good feeling, isn't it?

Glossary

CAN: Control area network

EOS: Electrical overstress, a phenomenon where electrical signals applied to a circuit or a device exceed normal operating parameters.

ESD: Electrostatic Discharge

Learn more:

[MAX13054A +5V, 2Mbps CAN Transceiver with \$\pm 65V\$ Fault Protection, \$\pm 25V\$ CMR, and \$\pm 25kV\$ ESD](#)

Design Solutions No. 80

Rev 0; January 2018

[Visit the Maxim Support Center](#)
[Find More Design Solutions](#)

Maxim Integrated
160 Rio Robles
San Jose, CA 95134 USA
408-601-1000

maximintegrated.com/design-solutions

