



Introducing the IS32LT3183A LIN Standards Compliant RGB+W LED Controller

INTRODUCTION

The use of ambient lighting is becoming an integral element of automotive interior design because it improves comfort, safety, styling, and brand recognition. The trend is to have many strategically located RGB LEDs to provide not only ambient lighting but also to direct the driver's visual attention to the navigation system or other important areas such as the instrument cluster.

RGB lighting interconnected with a LIN serial bus can provide this visualization information. Lumissil is taking to market the IS32LT3183A, a fully integrated LIN RGB+W LED controller consisting of a LIN transceiver, a LIN protocol engine, four configurable high voltage GPIO outputs and a programmable MCU; ideal for cost-effective ambient light modules connected to the automotive LIN bus. It is compliant with all the latest LIN standards assuring interoperability with current and future automotive lighting requirements.

The IS32LT3183A is designed for ambient and animated automotive lighting applications compliant with LIN 2.0/2.1/2.2A as well as SAE J2602 bus standards. For accurate color rendition, the integrated math co-processor and flash memory handle color calibration, software animation patterns, LED fade and color transition functions. The four independent outputs have built-in direct and indirect temperature monitoring that enables temperature compensation to ensure accurate color and brightness levels over the full operating temperature range of -40°C to 125°C.

The LIN bus is a low-cost serial communication protocol used in automotive and industrial networks to reduce and simplify the wiring architecture. It requires only power, ground and a single communication wire. LIN was designed to be used in automotive applications where a single command device (such as a body control module) needs to communicate with multiple responding devices (such as door locks, windows, and LED lights). The half-duplex communication system uses a commander/responder architecture. The commander device sends commands to the responder devices and the responder devices respond with the requested data or acknowledge the command.

WHAT IS LIN BUS?

LIN is a slow 20 kbps bus meaning it can't be used in external safety related applications that require a fast response. CAN is a fast automotive differential bus used as a backbone for high-speed communication between many CAN and LIN nodes. Due to its slower speed, LIN is a sub-bus that leverages CAN's robust architecture and speed. For this reason, most LIN applications are relegated to inside cabin 'function' and 'comfort' related applications, see Figure 1.

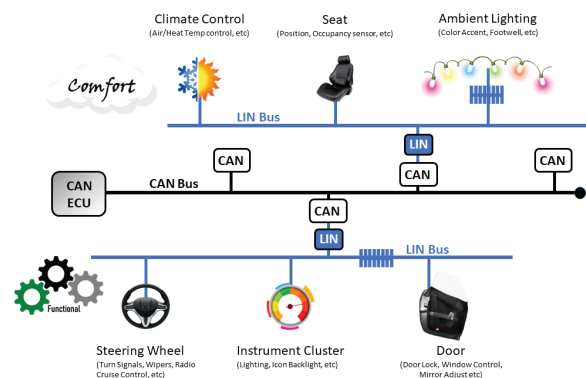


Figure 1 CAN & LIN Bus Architecture

LIN BUS SYSTEM

LIN RGB lighting consists of a LIN Commander (previously known as the Master) and up to 16 Responder Nodes (previously known as Slaves). Figure 2 shows an ambient lighting application where the responder nodes are IS32LT3183A LIN LED drivers. Each LIN responder is interconnected in a serial daisy chain

fashion with LIN_OUT connected to the next LIN_IN. The Bus Shunt Method is used at power up for detecting the node position with each node assigned a unique address. Each responder node connected to a LIN commander can be either ON or OFF, display a different color, and different brightness levels.

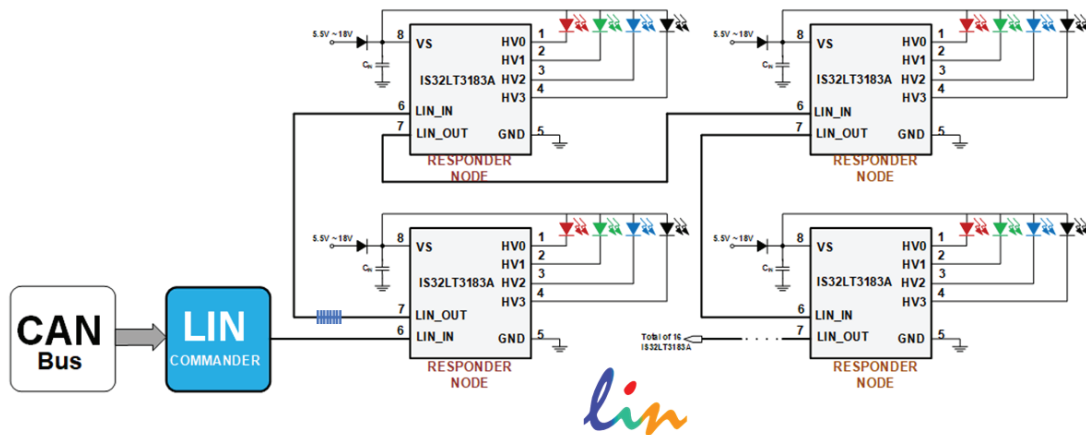
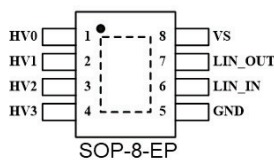


Figure 2 LIN Bus Nodes

LUMISSIL IS32LT3183A

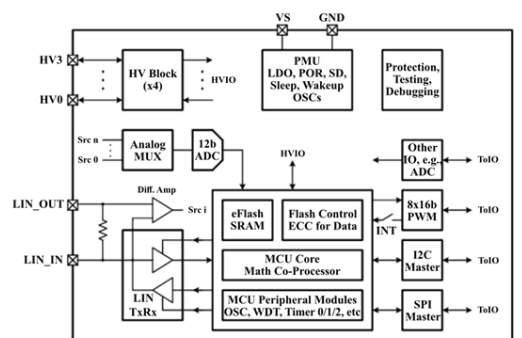
The IS32LT3183A comes in a small 8 pin thermally enhanced SOIC package, Figure 3A. The four HV pins are designed as 60 milli amp current sinks for RGB LED's; they can be used for driving LEDs or configured as GPIOs. In fact; all four HV pins can be independently re-configured as LED current sinks, I2C or SPI bus masters, PWM IO; or analog inputs with 12-bit resolution.

The IS32LT3183A integrates all the required LIN modules such as LIN transceiver, compliant to all the latest standards; up to 2.2A and SAE J2602, a LIN termination resistor, voltage regulator LDO, MCU, memory storage, and certified LIN-compliant software stack. Each nibble of 32 kB flash memory code is protected by double bit ECC for reliable operation under harsh automotive conditions, Figure 3B.



No.	Pin	Volt Range	Description
1~4	HV0~HV3	IOHV	High voltage I/O, 60mA current sink
5	GND	Power	Ground pin
6	LIN_IN	Analog HV	Connection to LIN bus, LIN bus input
7	LIN_OUT	Analog HV	LIN bus output
8	VS	Power HV	Battery supply voltage; external protection against reserve polarity needed
	Thermal Pad	-	Connect to GND

Figure 3A: SOIC Package pinout



Internally I/O's are routed to HV pins (via level shifters)

Figure 3B: Functional Block Diagram

LIN RGB MODULE EXAMPLE

Figure 4 shows an example of a LIN RGB module. The main components are the 8pin IS32LT3183A LIN driver and the packaged RGB LEDs. Other discrete components are protection diodes, noise filter capacitors and voltage drop resistors. These resistors are required since the LED's common anode is connected directly to the 12V supply. Not having the voltage drop resistors will cause the IS32LT3183A's

current sinks to overheat due to $V \cdot I$ thermal increase. There are two four pin connectors; CN 1 is for power and LIN bus while CN 2 is for connecting external LEDs. Remove R1, R2 and R3 when using external LEDs. Also note there are no crystals or ceramic resonators as required by the CAN bus because there is no need for time synchronization since LIN has no bus arbitration.

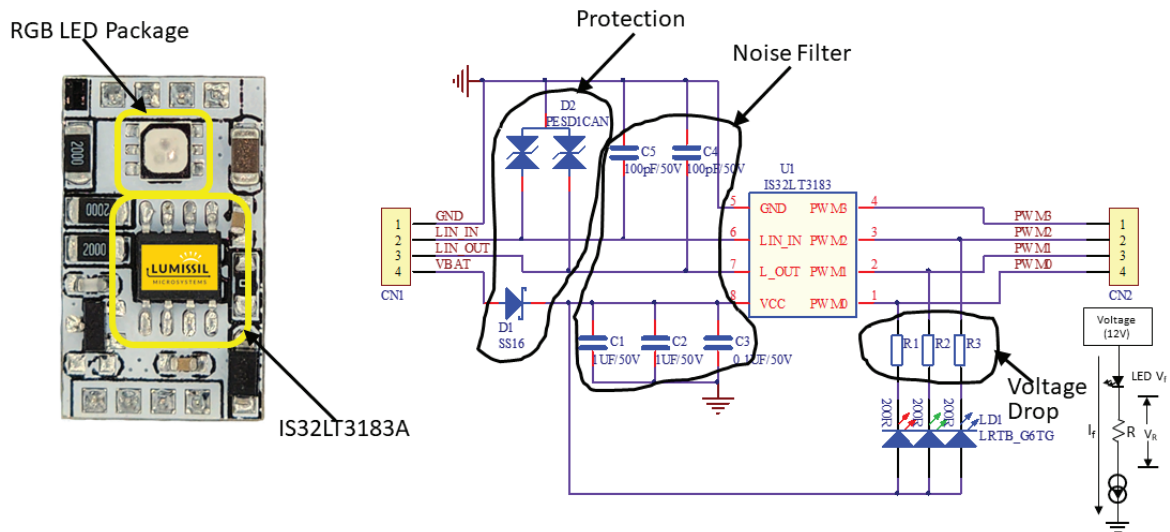


Figure 4 IS32LT3183A LIN Module

DEVELOPMENT ENVIRONMENT

To help accelerate application development, Lumissil is making available resources consisting of evaluation boards, GUI for calibration, C-Compiler package, and sample software that includes LIN driver, color mixing, math library, and IC initialization routines. The development environment consists of a windows-based GUI that communicates over a USB cable, to the Lumissil LIN emulator box powered by a 12 Volt DC

adapter, Figure 5. The emulator operates as the LIN commander node and sends message frames to the IS32LT3183A LIN responder nodes over three wires. Communication is over a single wire leaving the other two wires for 12 Volt power and ground. In some cases, the vehicle's chassis is used as the current return path to eliminate the ground wire.

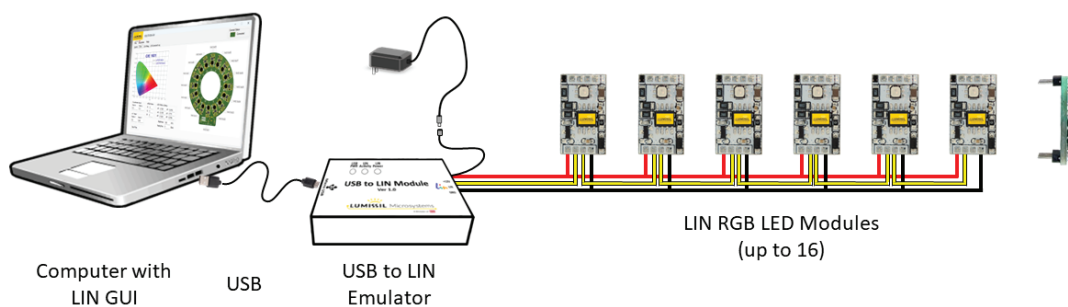


Figure 5 IS32LT3183A Development Setup

IS32LT3183A GUI

Lumissil's LIN GUI is a software configuration tool for exercising certain functions on the IS32LT3183A LIN modules. After assigning addresses to each LIN responder module, it can selectively notify nodes to change color by either mouse clicking on the CIE 1931 graph or by manually entering color or brightness levels. Other programmable parameter settings are LED ON/OFF, color cross-fade and playback of stored lighting effects.

CONCLUSION

Lumissil has been a recognized leader for high performance RGB LED drivers that go into gaming, consumer and other markets requiring accurate LED color management. The IS32LT3183A is the first of more to come smart interconnected RGB lighting for the automotive market.

For more information, email marketing@lumissil.com or Aaron Reynoso, areynoso@lumissil.com

See the IS32LT3183A Youtube video,
<https://www.youtube.com/watch?v=JuGj8pb82yw>