

# DIGITAL INTERFACE LED DRIVING MODULE DESIGN FOR AUTOMOTIVE APPLICATIONS

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## **Abstract**

*The theme of this project is to design a product that provides an efficient solution for automotive applications such as interactive tail-light clusters that is used to communicate between the vehicles and vehicle design by using two linear led drivers. The digital interface led driving module design is developed by using the Xpedition tool.*

## **I. INTRODUCTION**

A printed circuit board which mechanically supports and electrically connects electronics components using traces, track pads. The components in the printed circuit board should be soldered to board which provides mechanically supports and electrically connects.

The printed circuit boards are used in the most of the applications such as communication devices, medical devices and so on. This PCB technology is useful to reduce the cost and size of the devices. This design incorporates two linear led drivers, CAN bus and LED. This reference design provides a cost-effective solution for automotive rear-light applications such as interactive tail-light clusters.

### **Printed circuit Board**

The printed circuit boards which is mechanically supports and electrically connects electronic components are used in the some of the electrical components such as passive switch boxes. The electronic components in the printed circuit boards are connected through the tracks, pads which is conductive that is etched from one or more layers of copper laminated on or between the sheet layers of nonconductive substrate. The printed circuit board requires additional support to design on the layer of the circuit.

Alternative to printed circuit boards include wire wrap are used once popular but now it rarely used specialized software is used to design the layout. Mass production of circuit with PCBs are cheaper. In this type of production components are wired in one operation. The layout design has to done only once by using this design fabricate the large number of PCBs at the same time. PCB can be made manually in small quantities, it provides low benefit. The copper layer is used as the substrate layer in the PCB. The multilayer PCB are mostly used higher component density. In multilayer PCB make repair, analysis and field modification circuit is very difficult and usually impractical.

### **PCB Characteristics**

#### **A. Through Hole Technology**

#### **B. Surface mount Technology**

#### **A. Through Hole Technology**

Earlier the printed circuit boards produced by through hole technology where electronic components are mounted with leads inserted through hole and soldered on the other side of board. Based on the

requirements board can single sided or double-sided components placed. The through hole parts can installed horizontally with two leads. The components are inserted are one side of board and soldered on the other side. The remaining part of soldered end is trimmed off.

### **B. Surface Mount Technology**

Surface mount technology was introduced in 1960s and became commonly used in 1990s instead of through hole components came with small caps that soldered into PCBs surface. The components placement on both side of the PCB is common choice then through hole technologies. In high component density circuit, the component is placed on the both side of the PCBs by using surface mount technology. The surface mount components are ten times smaller than the through hole component Surfaces mounted devices have a leg over through over through hole devices because of low cost.

## **II. PCB DESIGN TOOL**

Many tools are available for PCB design. Such as

- Altium Designer.
- Autodesk EAGLE.
- Ki Cad EDA.
- SolidWorks PCB.
- Express PCB Plus.
- OrCAD Capture.
- Mentor graphics Xpedition tool.

### **Xpedition Tool**

Xpedition Designer gives a total schematic plan answer for structure creation, definition, and reuse. It gives everything expected to circuit structure and re enhancement, part choice, library the board and sign honesty arranging in a simultaneous group-based plan condition. The incorporated work area empowers building groups to play out each key structure creation task in a solitary, adaptable, simultaneous and constant cooperation condition.

Advantage

- It is more powerful and high speed to design a complex board.
- These tools are used to make product design

Disadvantage

- This tool is very difficult to learn.
- This tool's cost is high.

## **III. DESIGN PROCESS**

### **A. Create System Specification**

The starting advance of any PCB produce is, obviously, the structure. PCB assembling and configuration consistently start with an arrangement the architect spreads out a plan for the PCB that satisfies every one of the prerequisites as laid out. After every one of the checks are finished, the PCB configuration can be printed. Dissimilar to other plans, as engineering drawings, PCB plans don't print out on an ordinary 8.5 x 11 sheet of paper. Rather, a unique sort of printer, known as a plotter printer, is utilized. A plotter printer makes a "film" of the PCB. The last result of this "film" looks a lot of like

the transparencies that used to be utilized in schools — it's basically a photograph negative of the board itself.

Within layers of the PCB are spoken to in two ink hues:

- Black Ink: Used for the copper follows and circuits of the PCB
- Clear Ink: Denotes the non-conductive territories of the PCB, similar to the fiberglass base

On the external layers of the PCB structure, this pattern is turned around — clear ink alludes to the line of copper pathways, however dark ink additionally alludes to territories where copper will be evacuated.

### **B. Select PCB Board Type**

Each PCB layer and the going with patch cover gets its own film, so a straightforward two-layer PCB needs four sheets - one for each layer and one each for the going with weld veil.

After the film is printed, they're arranged and an opening, known as an enlistment gap, is punched through them. The enrollment opening is utilized as manual for adjust the movies later on all the while.

### **C. Data Management**

PCB Artist is provided with a lot of libraries. These libraries can be utilized, altered and added to as required. You can blend and match new and existing library things together to make your very own arrangement of one of a kind library. The following barely any sections focus on kicking you off with making your very own libraries. After the keep going part on planning Components, there is more insight regarding how to utilize the Library Manager.

### **D. Design Entry**

A schematic is a circuit chart. It utilizes concurred images to speak to parts and shows how they are electrically associated. A PCB configuration shows the copper track and opening format of a printed circuit board and ordinarily demonstrates the area of parts and their qualities/codes with a silk screen printed layer.

### **E. Layout Design**

The PCB format and configuration are a pro aptitude requiring information on not just of the PCB structure programming and PCB CAD framework, yet additionally an assortment of models and methods used to guarantee that the essential circuit configuration is effectively moved to a general printed circuit board.

### **F. Gerber File Generation**

The Gerber file is an open vector groups for printed circuit board (PCB) structures. It is the accepted standard utilized by PCB industry programming to produce the printed circuit board pictures: such as copper layers, patch veil, legend, drill information, and so forth in all over the world.

### **G. Silk Screen**

Silkscreen is a layer of ink follows used to recognize segments, test focuses, portions of the PCB, notice images, logos and imprints and so forth. This silkscreen is normally applied on the part side; anyway, utilizing silkscreen on the bind side is likewise normal. Be that as it may, this may expand the expense. Basically, a nitty gritty PCB silkscreen can help both the maker and the architect to find and recognize every one of the segments.

### **Red Color**

Red patch veil shading will in general be striking and expert. The difference present between planes, spaces and follows are very acceptable. On the as opposed to the green printed circuit board, the difference is lower. Any amplification is utilized for assessing the board follows in the event of imperfections. In spite of the fact that red looks alluring, eye-getting and striking, green is as yet thought about the best.

### **Blue Color**

If there should arise an occurrence of blue bind cover shading, amplification is viewed as essential and is required for investigating the deformities of manufacturing. However, it is to be noticed that the differentiation between the patch veil and silkscreen is very high that is the in addition to point for utilizing blue shading.

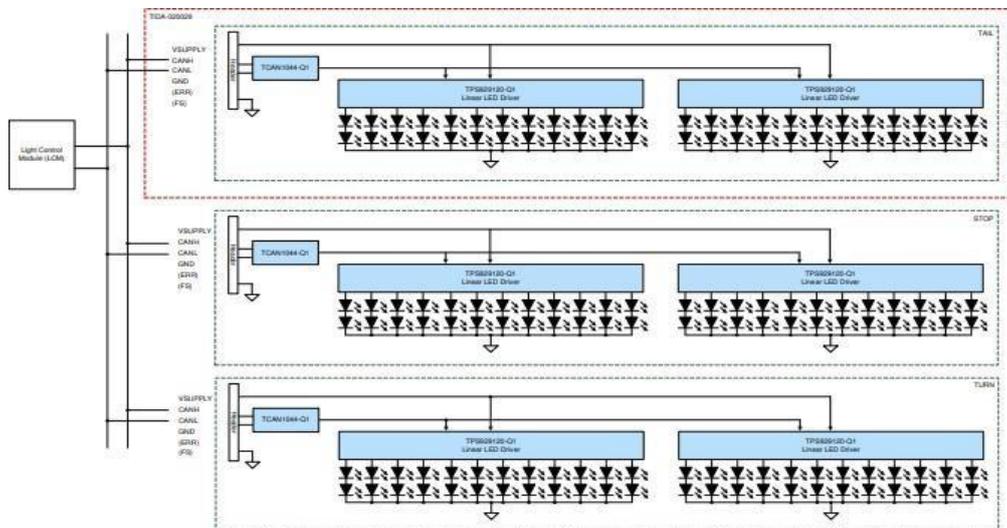
### Black Color

Powerful amplification is required for the review of this board. Investigating it is simply a bad dream as it needs a tilted plot for throwing shadow to discover follows. Another issue with dark PCB shading is its warmth ingestion during the procedure of reflow.

### Green Color

A 'green' printed circuit board isn't really green completely through. The main green part is the external covering of tar called the weld veil or patch oppose/oil. This is a solidified tar with hued shades that is applied to the sheets in a silkscreen design. The reason for bind cover is to shield the electronic follows underneath from dampness and dust and to control the progression of liquid patch.

## PROPOSED SYSTEM



To improve this reference structure and to expand flexibility for use in an assortment of utilizations, the board comprises of two linear LED drivers that are associated with a similar correspondence transport and use LIN or CAN handset for off-board correspondence. This board position has a straightforward connector interface, which permits this reference configuration to be assessed with any choose MCU-Control board with a handset on it. For simplicity of testing, the reference configuration board remembers 48 LEDs with two for each yield channel. Each channel can be controlled exclusively.

### A. Light Control Module

A light control system is the network that provides the communication between the transmitter and receiver. The light control module consists of central processing unit for computing devices. The lighting control system are used in the indoor purposes and outdoor purposes such as commercial, industrial spaces. The light control module is useful to deliver the light where in need with correct amount. The light control systems are mostly used to reduce the consumption of energy in the lighting systems. The light control module is also known as smart lighting system. The lighting control

module is used to control the lighting in the applications. This may consist of various sensors, photocells to control the lightings. The adjustment of lighting is done manually according to each location where the device is available. The efficient of market for residential lighting control is huge. The lighting control system is intelligent system which is based on network of the lighting devices. The adjustment of the light control system and at central computer location via program by the software. In 1980s there was more requirement to make lighting control system which is energy efficient. At first this was done with analog control module, dimmers. The cabling was complicated in this system. Tridonic is the early company that uses digital system with protocol as it transmitted to change the brightness of lighting. There are two types of lighting. They are

- Analog light control
- Digital light control.

### **Analog Lighting Module**

The application of analog lighting control is analog dimming. In analog dimming 10 v is used to dim the light. In this situation, direct current voltage is given to the electronic driver which convert ac voltage. In this module led dimming occur with corresponding to ac voltage.

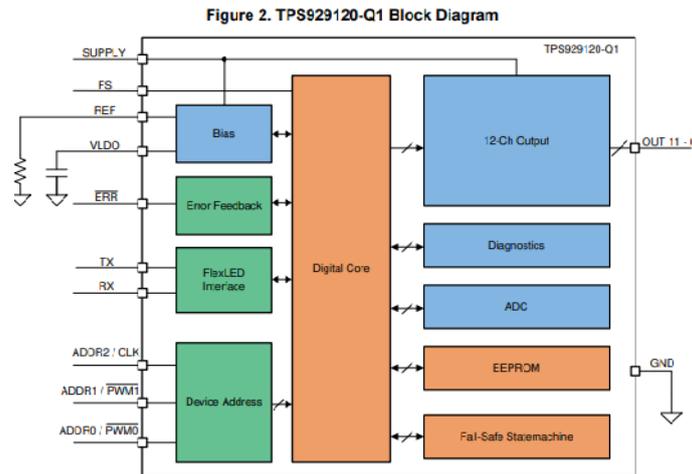
### **Digital Light Module**

The application of digital lighting control is digital dimming. In digital dimming, the light is dim according to the digital signal which send by driver.

### **B. Linear LED Driver**

The linear LED driver used in this project is TPS929120-Q1. It has 12 channel,40V high side LED driver that controls 8 bits and 12-bit of PWM. A suitable guard dog likewise naturally sets safeguard states to the MCU association is lost and it consist of programmable EEPROM, TPS929120-Q1 is deftly be set for various situations in applications.

It shows the circuit outline for one direct LED driver utilized in this reference structure. Driven driver circuit is helpful to control the delivery of the light. The voltage that flow through LED is dropped around a steady of current at which working. A small increment in applied voltage significantly creates the current in this way. Exceptionally the straight and forward currents are used for the low-power marker LEDs. Increasingly mindboggling circuit which consist of source for current are required for high power LED for bright lighting. With expanding interest for movement in car lighting, LEDs must be controlled freely. Along these lines, LED drivers with advanced interfaces are basic to adequately drive pixel-controlled lighting applications. In outside lighting, various light capacities are regularly situated on various PCB sheets with off-board wires associated with one another. It is hard for a conventional single-finished interface to meet the exacting EMC necessities.



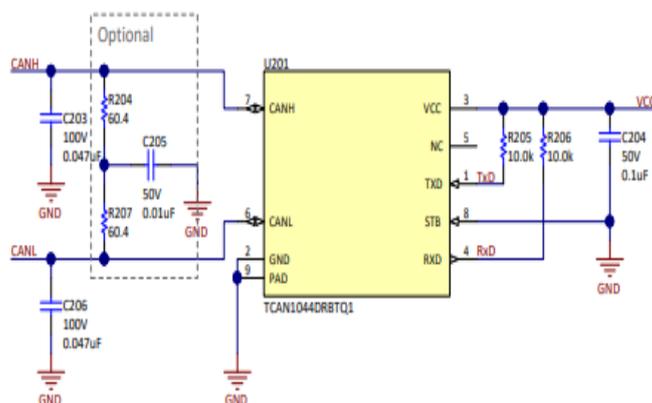
### C. CAN Transceiver

The CAN transceiver family meets the ISO 11898. This CAN handset family meets the ISO11898-2 rapid CAN (Controller Area Network) physical layer standard. All gadgets are intended for use in CAN FD organizes up to 2 Mbps (megabits every second). Gadgets with part numbers that incorporate the G postfix are intended for information rates up to 5 Mbps, and forms with the V addition have an optional force supply contribution for I/O level moving the information pin edges and RXD yield level. This family has a low force backup mode with a remote wake demand highlight. Also, all gadgets incorporate numerous insurance highlights to improve gadget and system vigor. A Controller Area Network is a standard transport that consist of microcontrollers and other parts with every others application without PC. It is system that is based on message, which is used for multiplex wiring that is used in autos however can likewise be used in various settings. For every gadget the information in a parcel is transmitted successively yet so that if more than one gadget transmits simultaneously the most elevated need gadget can proceed while the others back off. Parcels are gotten by all gadgets, including by the transmitting gadget. With both rapid and low speed CAN, the speed of the change is quicker when a passive to prevailing progress happens since the CAN wires are by and large effectively determined. The speed of the predominant to passive progress relies essentially upon the length of the CAN arrange and the capacitance of the wire utilized. Fast CAN is generally utilized in car and modern applications where the transport runs from one finish of nature to the next. Deficiency tolerant CAN is frequently utilized where gatherings of hubs should be associated together. The details require the transport be kept inside mum and most extreme regular mode transport voltage, yet don't characterize how to keep the transport inside this range. The CAN transport must be ended. The end resistors are expected to stifle reflections just as return the transport to its latent or inert state. Fast CAN utilizes a 120 Ω resistor at each finish of a direct transport.

### Automotive high-speed CAN Transceiver

The automotive high-speed CAN Transceiver is TCAN1044x-Q1 devices. These devices are high speed controller area network that meets the physical layer. This provides the interface between CAN bus and CAN protocol controller.

Figure 5. TCAN1044-Q1 CAN Transceiver Schematic



#### D. Linear LED Driver

The gadget meets numerous guideline necessities with LED open-circuit, short-to-ground, and single LED cut off. A suitable guard dog likewise naturally sets safeguard have states of MCU association is lost and it consist of programmable EEPROM, TPS929120-Q1 is deftly be set for various situations in applications. This segment portrays how to structure with the TPS929120-Q1 direct LED driver. It shows the circuit outline for one direct LED driver utilized in this reference structure. Driven driver circuit is helpful to control the delivery of the light. The voltage that flow through LED is dropped around a steady of current at which working. With expanding interest for movement in car lighting, LEDs must be controlled freely. Along these lines, LED drivers with advanced interfaces are basic to adequately drive pixel-controlled lighting applications. In outside lighting, various light capacities are regularly situated on various PCB sheets with off-board wires associated with one another. It is hard for a conventional single-finished interface to meet the exacting EMC necessities. The TPS929120-Q1 has 12-channel, 40V LED driver that controls the 8-piece yield ebb and flow and 12-piece PWM obligation cycles.

#### E. Light Emitting Diode

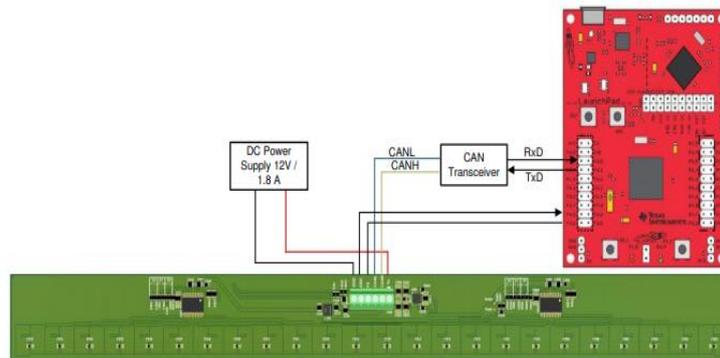
A light-emitting diode (LED) is a semiconductor device which emits light when current flows through it. When the electron in semiconductor material recombine with the holes by discharging photons. The light intensity of the semiconductor is based on band-gap between holes and electron. White light is delivered by using specific type of semiconductors or phosphorous is used in upper layer of light emitting diode. The first LED are used to produce low infrared light. The infrared led are used in the remote control circuit that is used to control the electronic-gadget through wireless. The main noticeable light LEDs were low force and it is restricted to the red color. Present day LEDs are bright, and it is present in infrared wavelengths, with delivery of high amount of light. The LEDs in early were used as marker lights, supplanting little radiant bulbs, and in decorations. Later advancements have delivery of high amount of white light. LEDs are used for the room and open-air zone lighting. The LEDs have high favorable circumstances of radiant light, including lower usage, its lifetime is longer, improved by physical structure, smaller in size, and exchanging occurs quicker. LEDs are used in applications such as flying light, vehicles head lamp, general lighting, traffic signals, plant developing light, and medicinal gadgets. In different to a laser, the light emitted in a LED is neither frightfully nor monochromatic.

#### E.LED Array

A LED cluster or module alludes to a get together of LED bundles (parts), or bites the dust (or chips) on a printed circuit load up or substrate, as a rule with optical components whereby light created by the in any event a LED can have an ideal example of appropriation. Driven exhibits are gatherings of LED bundles or bites the dust that can be fabricated utilizing a few strategies. Every strategy depends on the way and degree to which the chips themselves are bundled by the LED semiconductor maker. Figures that are meant to appear in color, or shades of black/gray. Such figures may include photographs, illustrations, multicolor graphs, and flowcharts.

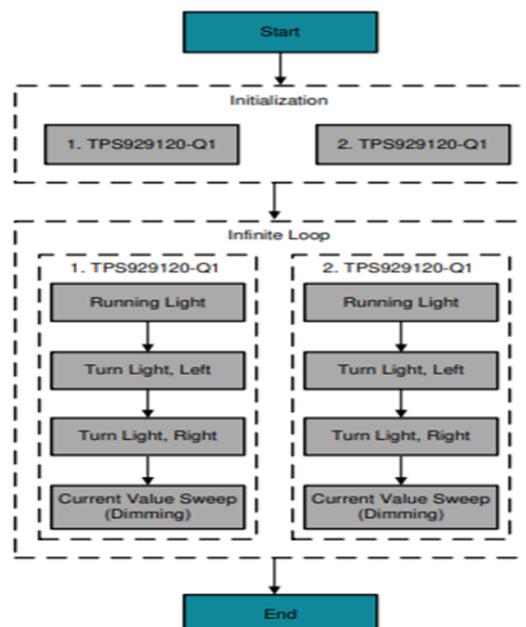
**F. Hardware Setup**

This reference configuration must be associated with a 12-V power supply and to a correspondence bus. This shows the default test arrangement of this reference structure. In this test arrangement, a MSP430 Launch Pad™ is utilized as an ace gadget, which is additionally associated with a similar correspondence transport through a TCAN1044-Q1 gadget.



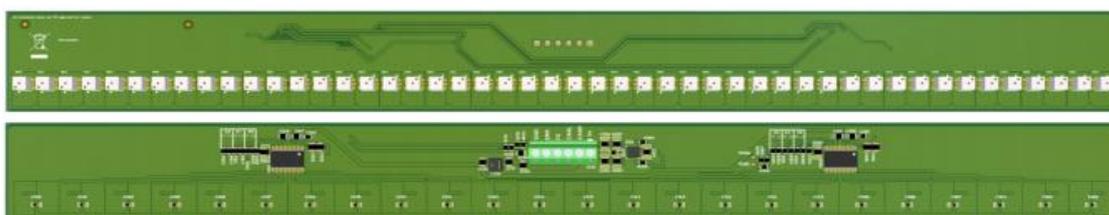
**G.SOFTWARE**

Exceptional testing programming was made for this plan controls the LED drivers through the UART (Flex Wire). The product is organized so that the MCU first instates both TPS929120-Q1 and afterward sets the qualities for the arrangement of registers with the goal that each of the 48 LEDs (24 channels) can speak to different examples, for example, successive turn light, darkening.



## GERBER FILE

3D Model of PCB This reference configuration utilizes a two-layer printed circuit board (PCB) where the LEDs are put on the top layer and the entirety of different parts are put on the base layer. The PCB incorporates 48 LEDs with two LEDs on each channel that can be controlled exclusively. The PCB isn't proposed to fit a specific structure factor and has measurements of 26.75 mm x 133.75 mm. The essential goal of the structure with respect to the PCB is to make an answer that is minimal while as yet giving an approach to test the exhibition of the board. The size of the arrangement can be additionally diminished in this structure. Figure 4 shows a 3D rendering of the PCB. Because each Flex Wire transport can bolster 16 gadgets, it is conceivable to utilize them on one correspondence transport in up to 8 reference.



## CONCLUSION

This project is helpful in automotive light applications. The reference design model is converted into a printed circuit board. This board is useful to connect and control the light of automotive. This board is developed in Printed circuit board simulation tool. In future this project will be enhanced by reducing the board size and increase its feature and efficiency.

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