LED 显示屏系统解决方案
Display Power Solutions for LED signage

www.ti.com/signage
Display Power
LED Drivers—Signage/Linear

TI’s signage and linear LED drivers offer constant-current-sink, RGB and/or white LED lamp drivers for applications requiring multichannel drives.

LED Dot-Matrix Display Drivers for Signage
The TLC592x/4x/5x series drives LED dot-matrix displays in LED signage Applications such as stadium video/score screens, roadside advertisements and station/airport information boards. The TLC592x series uses simple on/off control for flexible system design with high performance image processors. The TLC594x/5x series uses an integrated PWM generator for reduced controller power.

RGB and White LED Architectural/Illumination Linear Drivers
The TLC597x series supports nontypical LED dot-matrix display applications such as rainbow-colored wall lightings/decorations for buildings; LED “mesh” displays; and RGB LED illuminations.

<table>
<thead>
<tr>
<th>LED Type</th>
<th>Ch</th>
<th>Brightness</th>
<th>Control</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLC5916</td>
<td>8ch</td>
<td>brightness</td>
<td>control</td>
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<td>TLC59116</td>
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<td>interface,</td>
<td>brightness</td>
<td>control</td>
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<td>TLC59108</td>
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<td>control</td>
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<tr>
<td>TLC5948A</td>
<td>16ch</td>
<td>full-diagonal</td>
<td>brightness</td>
<td>control</td>
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<td>TLC59711</td>
<td>16ch</td>
<td>built-in,</td>
<td>brightness</td>
<td>control</td>
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<td>TLC59713</td>
<td>16ch</td>
<td>On-one, interface,</td>
<td>brightness</td>
<td>control</td>
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</table>

LED drivers from Texas Instruments are used in video displays throughout the world.

Get more information: [www.ti.com/signage](http://www.ti.com/signage)
TI’s 48CH LED Driver
Family Introduction

48CH Benefit No.1
Easy PCB layout
Lower cost and better performance

- Simpler PCB routing
  - Less PCB layer
  - Better EMI performance
- Smaller PCB area
  - Reduce PCB area limitation
  - More suitable for higher density application than 16CH products
- Simplify system design
  - Only 1 IREF RES for R/G/B
  - Programmable white balance by software
  - Less electronic component number, reduce manufacturing cost and time

One 48CH vs. Three 16CH
1个48通道与3个16通道

16 Channel LED Driver
48 Channel LED Driver

Number of Driver IC for 64x64 Pixel Module: 1/12 or 1/6

<table>
<thead>
<tr>
<th>Multiplexing Ratio</th>
<th>X8</th>
<th>X16</th>
<th>X32</th>
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<tbody>
<tr>
<td>16 CH Driver IC</td>
<td>96</td>
<td>48</td>
<td>24</td>
</tr>
<tr>
<td>48 CH Driver IC</td>
<td>32</td>
<td>16</td>
<td>8</td>
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</table>

Number of RED LED RES for 64x64 Pixel Module: ¼ or ½

<table>
<thead>
<tr>
<th>Multiplexing Ratio</th>
<th>X3</th>
<th>X16</th>
<th>X32</th>
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<tbody>
<tr>
<td>No. of Red RES</td>
<td>512</td>
<td>256</td>
<td>128</td>
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</table>

1/3 Number of IREF RES for 48CH vs. 16CH

Get more information: www.ti.com/signage
48CH Benefit No.2
Programmable White Balance

Software to configure white balance

Red + Green + Blue = White?

9bits * 3 groups Color Control Register for White Balance

48 Channel LED Driver Family

<table>
<thead>
<tr>
<th></th>
<th>TLC5954</th>
<th>TLC5955</th>
<th>TLC5957</th>
<th>TLC5958</th>
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<tr>
<td>Price</td>
<td>LOW</td>
<td>MID</td>
<td>MID</td>
<td>HIGH</td>
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<td>Control Scheme</td>
<td>ON/OFF</td>
<td>16bit PWM</td>
<td>16bit PWM</td>
<td>16bit PWM + SRAM</td>
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<td></td>
<td>Flexible to control</td>
<td>Easy to use Better Gray-scale Performance</td>
<td>Low Gray-scale Enhancement</td>
<td>Low Gray-scale Enhancement High Refresh Rate</td>
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<tr>
<td>Key Features</td>
<td>LOD/LSD</td>
<td>LOD/LSD Dot Correction</td>
<td>LOD Pre-charge FET LGSE Caterpillar Removal</td>
<td>LOD Pre-charge FET LGSE</td>
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<tr>
<td>Typical application</td>
<td>Static or Dynamic Multiplexing Mid Scan Line</td>
<td>Static</td>
<td>Dynamic Multiplexing Mid Scan Line (Support up to 32 scans)</td>
<td></td>
</tr>
</tbody>
</table>

Get more information: www.ti.com/signage
TLC5958
48ch, 16bit PWM LED Driver with 48Kbit SRAM, LOD and pre-charge FET

Features
- 48 Outputs
- 16bit PWM Constant-Current with 3x9bit CC and 3bit BC supporting 125mA, only 1 external resistor.
- IC Supply Voltage Range: 3.0 – 5.5V
- 48Kbit SRAM supporting 32-multiplexing.
- Precise Constant Current Regulation: C to C: ± 1 % (typ) D to D: ± 1 % (typ)
- Low gray scale enhancement
- Pre-charge FET for ghost cancelling
- LED Open Detection

Benefits
- Best to drive 16 RGB LED lamps, easy layout
- Maximum flexibility with software programming to achieve high quality video output,
- 3V and 5V logic interface
- Support high density panel application
- Improves LED display image with uniform brightness
- Improve low GS performance and 1st line issue
- No ghost and Improves image quality
- Reduces maintenance cost

TLC5958 Benefit No.1
Refresh Rate Advantage

Get more information: www.ti.com/product/tlc5958
**TLC5958 Benefit No.2**
Low-Grey Enhancement (LGSE)

Condition: 32 Multiplexing Ratio; GS=8 (out of 65536 full GS);

![No Low GS Enhancement](image1)

![Low GS Enhancement](image2)

**TLC5958 Benefit No.3**
Ghost Removal

8 Scan Ordinary PWM IC

32 Scan TLC5958

More information, please refer to http://www.edn.com/design/led/4432914/
How-to-design-LED-signage-and-LED-matrix-displays
TLC5957
48ch, 16bit PWM LED Driver with LOD, Pre-charge FET and Poker mode

Features
- 48 Outputs
- 16bit PWM Constant-Current with 3x9bit CC and 3bit BC supporting 1.25mA, only 1 external resistor.
- PWVM BIT 9-16 with Poker Mode.
- Precise Constant Current Regulation: C to C: ± 1 % (typ) D to D: ± 1 % (typ)
- Low gray scale enhancement
- Pre-charge FET for ghost cancelling
- Caterpillar cancelling
- LED Open Detection

Benefits
- Best to drive 16 RGB LED lamps, easy layout
- Maximum flexibility with software programming to achieve high quality video output,
- Increase refresh rate in multiplexing
- Improves LED display image with uniform brightness
- Improve low GS performance and 1st line issue
- No ghost and Improves image quality
- No caterpillar effect caused by LED open
- Reduces maintenance cost

TLC5957 Benefit No.1
Low Knee Voltage

![Graph showing Low Knee Voltage](image)

TLC5957 Benefit No.2
Caterpillar Removal

Below two photos, (9,27) LED is open

Data of open LED is on, Caterpillar issue
Data of open LED is off, no Caterpillar issue

TLC5957 Benefit No.3
Higher Refresh Rate

- The refresh rate, to a greater extent, is limited by the data transfer time
- Various ways to shorten the data transfer time
  - SCLK Double-edge Mode
    - The rising edge and the falling edge of SCLK can transmit data simultaneously, reducing the original to required SCLK cycle numbers by half
  - Unique Data Transfer Format in the Poker Mode
    - For the PWM display scattered by ES-PWM mode, the Poker mode decreases the data transfer time by shortening the data transfer bits in each subperiod

Get more information: [www.ti.com/product/tlc5957](http://www.ti.com/product/tlc5957)
TLC5954
48ch, Constant-Current LED Driver with 3x7bit BC, 3bit MC, LOD & LSD

Features
- 48 Outputs
- ON/OFF Constant-Current with 3x7bit BC and 3bit MC
- Control for 35mA, no external resister.
- IC Supply Voltage Range: 3.0 – 3.6V
- LED Voltage Range: 10V
- Precise Constant Current Regulation:
  - Channel-to-Channel: ± 1 % (typ)
  - Device-to-Device: ± 2 % (typ)
- Output Current Switching Delay
- LED Open/Short Detection

Benefits
- Best to drive 16 RGB LED lamps, easy layout
- Maximum flexibility with software programming to achieve high quality video output, easy brightness settings in 2 ways
- 3V-3.6V logic interface, drives multiple of LED lamps in series
- Improves LED display image with uniform brightness
- Reduces Inrush Current, less EMI
- Reduces maintenance cost

TLC5954 Benefit No.1
Max flexibility for current setting with software programming, Rref removal

Software to configure white balance

TLC5954 Benefit No.2
LED Open Detect/LED Short Detect for low maintain cost

Monitor the status of LED panel

Traffic information boards
Application

Get more information: www.ti.com/product/tlc5954
**TLC5955**
48ch, 16bit PWM LED Driver with 3x7bit BC, 3bit MC, 7bit DC & LOD

**Features**
- 48 Outputs
- 16bit PWM Constant-Current with 3x7bit BC and 3bit MC for 35mA, no external resistor.
- IC Supply Voltage Range: 3.0 – 5.5V
- 7bit DC for each output.
- Precise Constant Current Regulation: Channel-to-Channel: ± 2 % (typ) Device-to-Device: ± 2 % (typ)
- Low Knee voltage: 0.25V@19mA
- LED Open Detection

**Benefits**
- Best to drive 16 RGB LED lamps, easy layout
- Maximum flexibility with software programming to achieve high quality video output, more smooth grayscale performance.
- 3V and 5V logic interface
- Improves uniformity for the LED display
- Improves LED display image with uniform brightness
- Reduces system power consumption
- Reduces maintenance cost

**TLC5955 Benefit No.1**
7bit Dot correction for each channel, improve the uniformity of LED panel

![TLC5955 Benefit No.1 Diagram](image)

Top Graph: 16 LED’s driven by the same forward current. Each LED has a different intensity due to manufacturing differences.

Bottom Graph: 16 LED’s after Dot Correction is applied. Now all have different forward currents but the same intensity.

**TLC5955 Benefit No.2**
Low Knee Voltage, reduce power consumption of the whole system

![TLC5955 Benefit No.2 Diagram](image)

Get more information: [www.ti.com/product/tlc5955](http://www.ti.com/product/tlc5955)
Precharged FETs deliver an anti-ghost noise function in LED matrix display systems. The TLC59283 eliminates unwanted lighting of LED lamps. For the example shown below, only two white lines were programmed. The traditional solution on the left shows unwanted lamps turned on, whereas the solution using the TLC59283 shows them turned off.

Get more information: [www.ti.com/product/TLC59283](http://www.ti.com/product/TLC59283)
Display Power
LED Drivers—Signage/Linear

3-Channel, 12-Bit, PWM Constant-Current LED Driver with Single-Wire Interface (EasySet™)

**TLC5973**

Key Features
- Three constant-current-sink channels with 4096-step PWM each
- Only three wires (VCC, GND and data) for cascading
- Built-in shunt regulator to self-bias the IC from a higher LED voltage rail

Get more information: [www.ti.com/product/TLC5973](http://www.ti.com/product/TLC5973)

12-Channel, 16-Bit, Enhanced-Spectrum PWM, RGB LED Driver with 3.3-V Linear Regulator and Watchdog Timer

**TLC59711**

Key Features
- 12 constant-current-sink channels (four RGB lamps) with 16-bit PWM each
- Only four wires (VCC, GND, data and clock) for cascading
- Built-in LDO regulator to self-bias the IC from a higher LED voltage rail

Get more information: [www.ti.com/product/TLC59711](http://www.ti.com/product/TLC59711)
## Display Power

### LED Drivers—Signage/Linear

### Selection Guide

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of Chan.</th>
<th>V&lt;sub&gt;D&lt;/sub&gt; Min (V)</th>
<th>V&lt;sub&gt;D&lt;/sub&gt; Max (V)</th>
<th>Output Current I&lt;sub&gt;L&lt;/sub&gt; (mA)</th>
<th>Channel-to-Channel Accuracy (%)</th>
<th>Duty-to-Duty Accuracy (%)</th>
<th>Recharge FET Drive</th>
<th>Short Detection</th>
<th>Overtemperature Detection</th>
<th>Brightness Control (Bits)</th>
<th>Power Management Control (Bits)</th>
<th>Interface</th>
<th>Comments</th>
<th>Price*</th>
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<td>≤±6 (Max)</td>
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<td>≤±6 (Max)</td>
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<td>—</td>
<td>—</td>
<td>0.60</td>
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</table>

*New devices are listed in bold red.

1. Output current with V<sub>D</sub> ≤ 3.6 V
2. Output current with V<sub>D</sub> > 3.6 V
3. 16E = 16-bit enhanced-spectrum PWM, 16E/C or 12E/C = 16-bit or 12-bit enhanced-spectrum or conventional PWM selectable.
4. *Suggested resale price in U.S. dollars in quantities of 1,000.
64x64 Full Color (R/G/B) LED Matrix with High Multiplexing Reference Design

Description

This reference design is a complete 64 pixel x 64 pixel Red/Green/Blue LED panel with TLC5958 driver IC. Due to its higher integration and high time multiplexing support, this design drives total 12,288 individual LED lamps (= 64 x 64 x 3color) by only 8pcs of TLC5958 IC. Still this LED panel maintains very high video output quality.

Features

- Complete large full color LED panel solution with 1/32 time multiplexing
- Small number of components on the panel, less than 1/3 of traditional solutions.
- Only 4 layers of PCB support 12,228 LED lamp connection where it is difficult to achieve the same connection with 8 layer PCB with traditional solutions.
- The TLC5958 provides multiple of image enhancement features offering better video compared with traditional solutions.

Fig 1. Top view of LED module
Fig 2. Bottom view of LED module

Get more information: www.ti.com/tool/tida-00161
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