LED 显示屏系统解决方案

Display Power Solutions for LED signage

Texas Instruments

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.

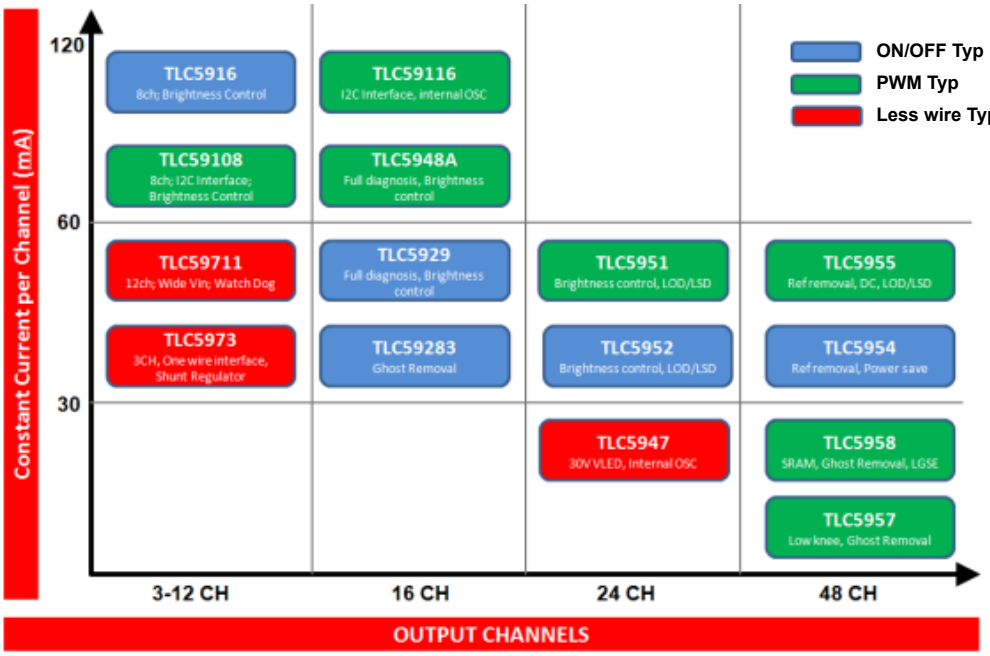
LED Dot-Matrix Display Drivers for Signage

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.

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

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.

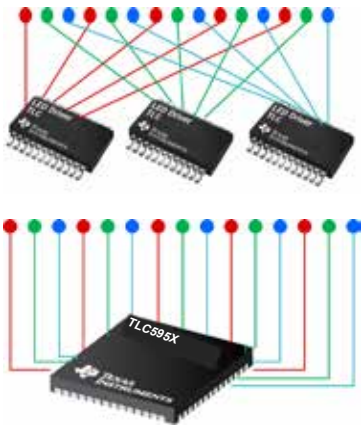


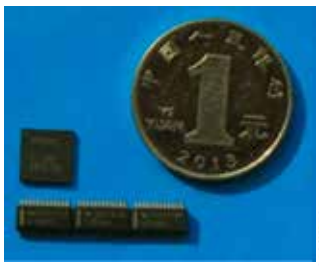
Get more information:**www.ti.com/signage**

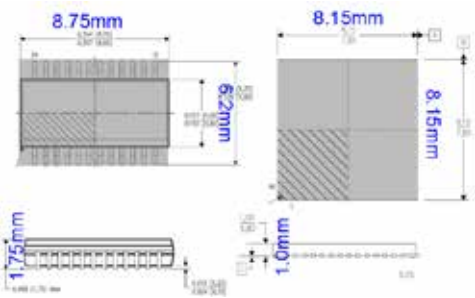
TI's 48CH LED Driver
Family Introduction

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

- Simplier 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





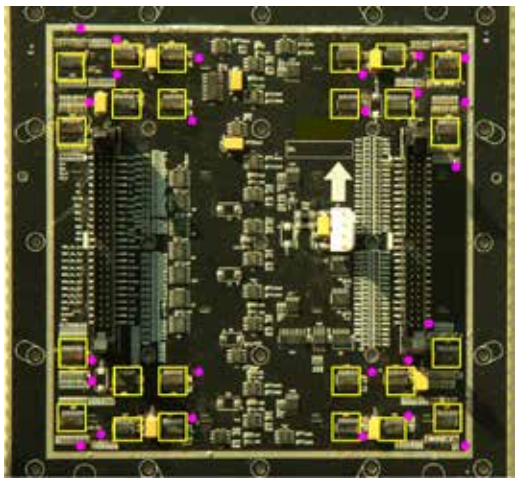


One 48CH vs. Three 16CH
1个48通道 与 3个16通道

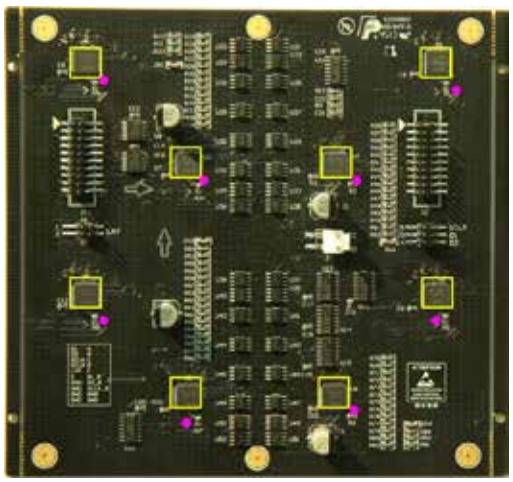
SMALL!
60% Package Area Reduction per RGB Pixel

SSOP-24 → QFN-56

16 Channel LED Driver



48 Channel LED Driver



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

Multiplexing Ratio	X8	X16	X32
16 CH Driver IC or IREF RES	96	48	24
48 CH Driver IC or IREF RES	32	16	8

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

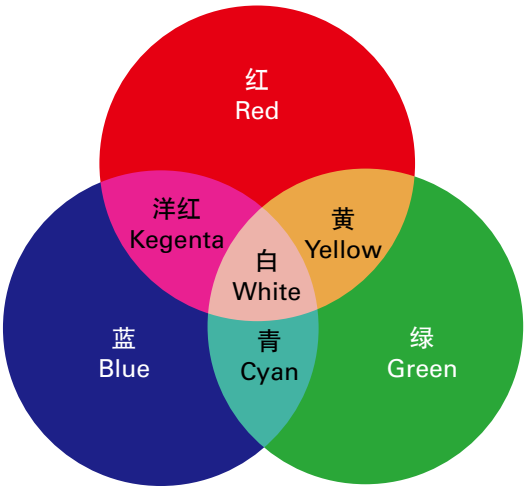
Multiplexing Ratio	X8	X16	X32
No. of Red RES	512	256	128

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

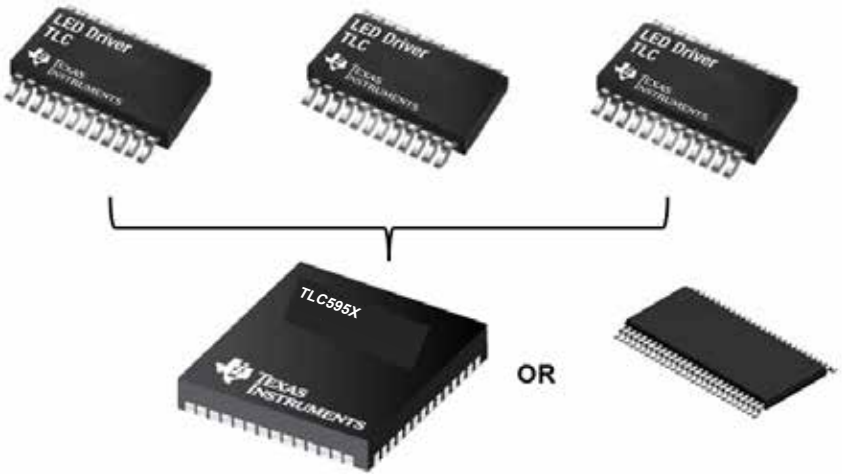
Get more information: **www.ti.com/signage**

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

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

Get more information: **www.ti.com/signage**

TLC5958

48ch, 16bit PWM LED Driver with 48Kbit SRAM, LOD and pre-charge FET

Features

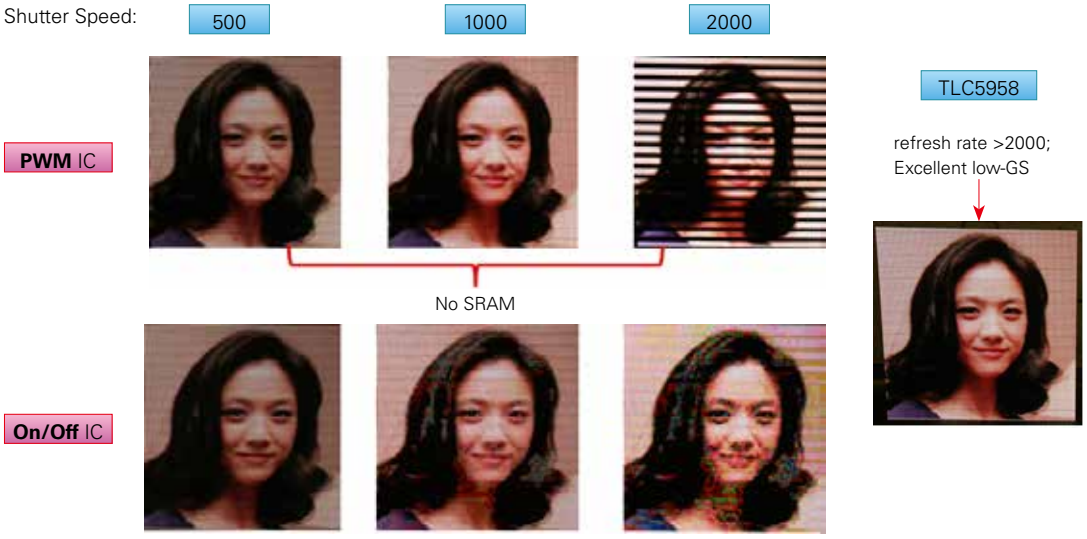
- 48 Outputs
- 16bit PWM Constant-Current with3x9bit CC and 3bit BC supporting 1-25mA,only 1 external resistor.
- IC Supply Voltage Range:3.0 – 5.5V
- 48Kbit SRAM supporting 32-multiplexing.
- Precise Constant Current Regulation:C to C: ± 1 % (typ) D to D: ± 1 % (typ)
- Low gray scale enhancement
- Pre-charge 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

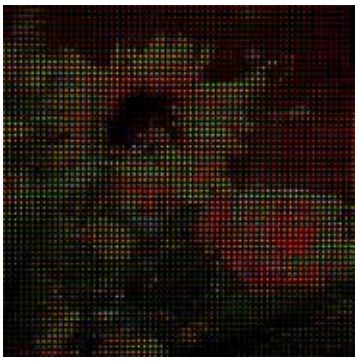
Refresh Rate Advantage



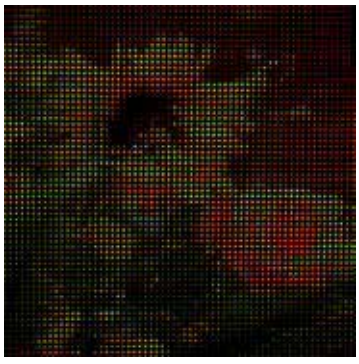
PWM IC without SRAM
X8 Multiplexing Ratio
Shutter Speed: 2000

TLC5958
X32 Multiplexing Ratio
GCLK 25Mhz

Shutter Speed: 2500



Shutter Speed: 3000

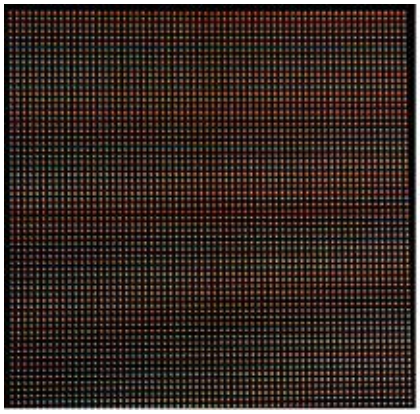


Get more information: **www.ti.com/product/tlc5958**

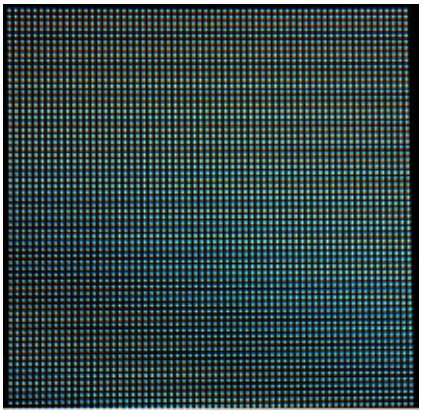
TLC5958 Benefit No.2
Low-Grey Enhancement (LGSE)

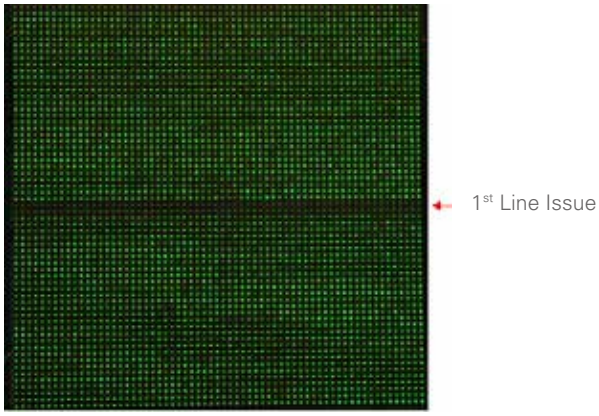
Condition: 32 Multiplexing Ratio; GS=8 (out of 65536 full GS);

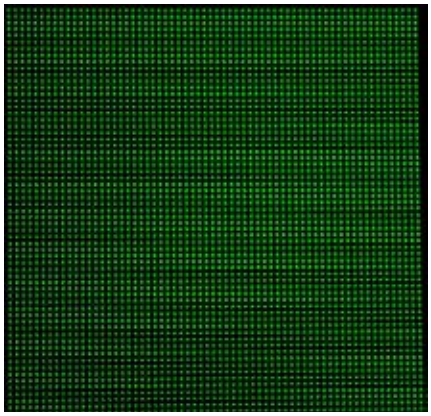
No Low GS Enhancement



TLC5958
Low GS Enhancement





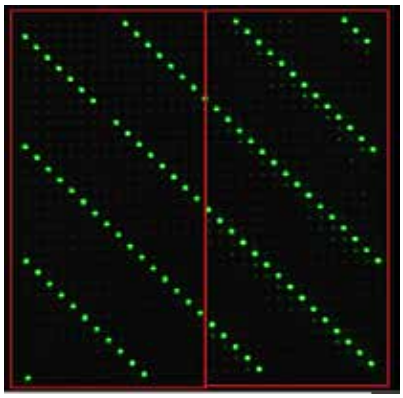


TLC5958 Benefit No.3
Ghost Removal

8 Scan Ordinary PWM IC

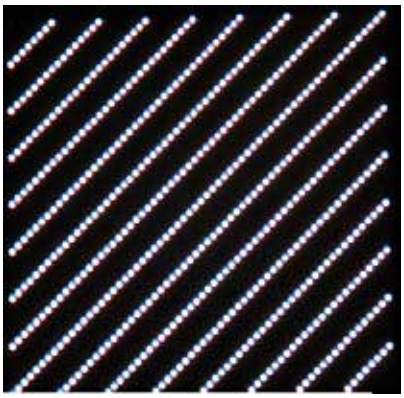
TLC59483
X8 Multiplexing

TLC59482
X8 Multiplexing



32 Scan TLC5958

TLC5958
X32 Multiplexing



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

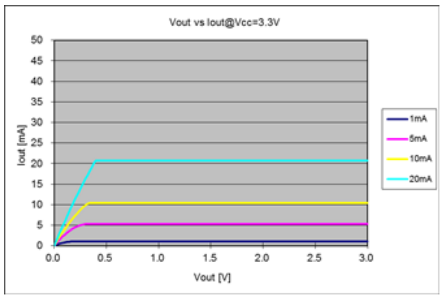
- 48 Outputs
- 16bit PWM Constant-Current with3x9bit CC and 3bit BC supporting 1-25mA, only 1 external resistor.
- PWM BIT 9-16 with Poker Mode.
- Precise Constant Current Regulation:C to C: ± 1 % (typ) D to D: ± 1 % (typ)
- Low gray scale enhancement
- Pre-charge FET for ghost cancelling
- Caterpillar 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

TLC5957
0.24V @10mA



Low Knee Voltage @ 10mA
- Allow VLED 3.9V

(max LED VF of 3.5V & 0.1V VDS margin)

TLC5957 Benefit No.3
Higher Refresh Rate

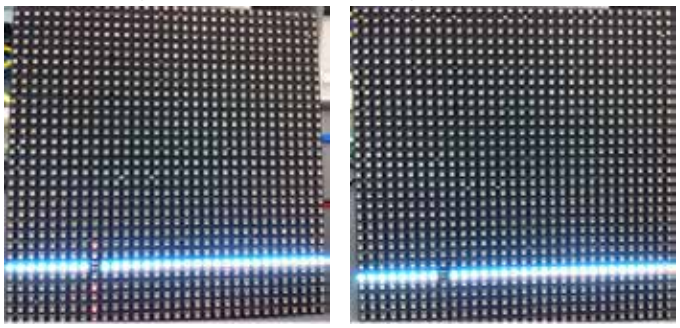
- The refresh rate, to a greater extent, is limited by the data transfer time
- Various ways to shorten the data transfer time
  - **SCLK Double-edge Mode**

    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

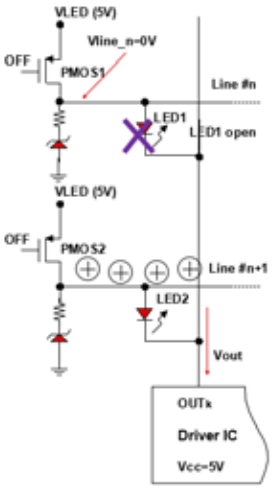
TLC5957 Benefit No.2
Caterpillar Removal

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



Get more information: **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 with3x7bit 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

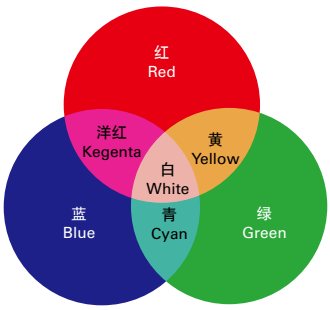
Benefits

- 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

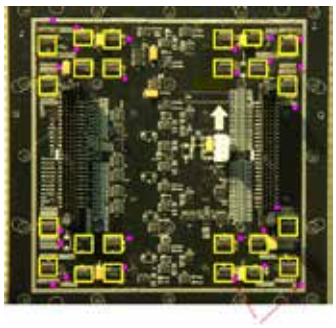
TLC5954 Benefit No.1

Max flexibility for current setting with software programming, Rref removal

Software to configure white balance



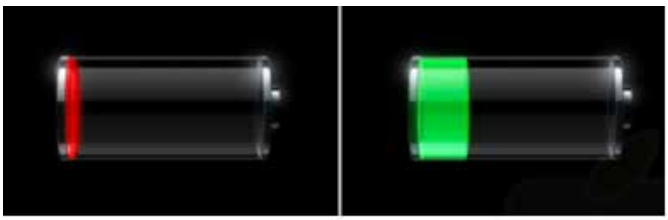
Red + Green + Blue = White?



IREF RES Removal

TLC5954 Benefit No.3

Power Save Mode



ICC = 16mA @ 18mA Iout
Without power save

ICC = 15uA @ 18mA Iout
With power save

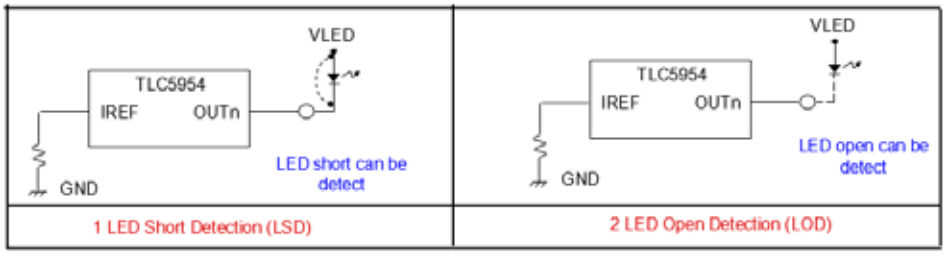
1060X power saving at GS=0000h

TLC5954 Benefit No.2

LED Open Detect/LED Short Detect for low maintain cost

Traffic information boards Application

Monitor the status of LED panel



Get more information: **www.ti.com/product/tlc5954**

TLC5955

48ch, 16bit PWM LED Driver with 3x7bit BC, 3bit MC, 7bit DC & LOD

Features

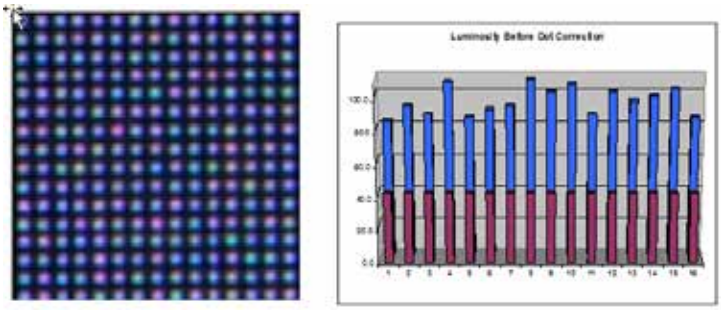
- 48 Outputs
- 16bit PWM Constant-Current with3x7bit BC and 3bit MC for 35mA,no external resistor.
- IC Supply Voltage Range:3.0 – 5.5V
- 7bit DC for each output.
- Precise Constant Current Regulation:Channel-to-Channel: ± 2 % (typ)Device-to-Device: ± 2 % (typ)
- Low knee voltage: 0.25V@19mA
- LED Open Detection

Benefits

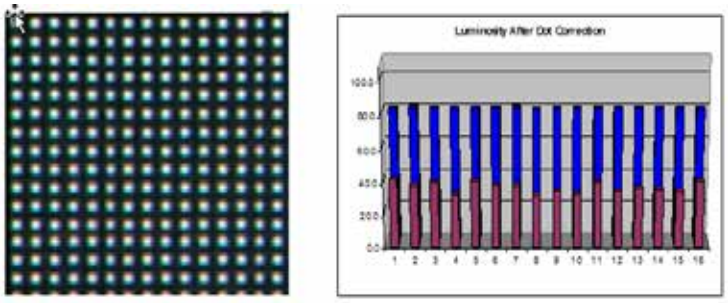
- Best to drive 16 RGB LED lamps, easy layout
- Maximum flexibility with software programming to achieve high quality video output,more smooth grayscale performance.
- 3V and 5V logic interface
- Improves uniformity for the LED display
- Improves LED display image with uniform brightness
- Reduces system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

TLC5955 Benefit No.1

7bit Dot correction for each channel, improve the uniformity of LED panel



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

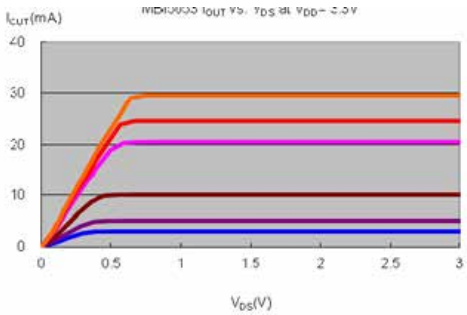


Bottom Graph: 16 LED’s after Dot Correction is applied. Now all have different forward currents but the same intensity.

TLC5955 Benefit No.2

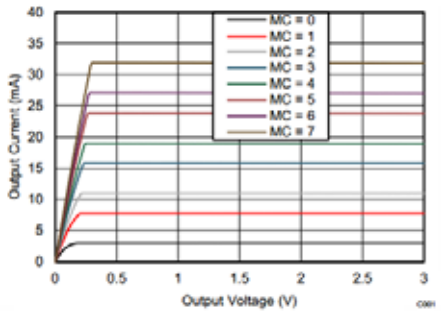
Low Knee Voltage, reduce power consumption of the whole system

Competitor Part w/SRAM
~0.5V @10mA



- Low Knee Voltage @ 10mA
- Allow VLED 4.2V
- (max LED VF of 3.5V & 0.1V VDS margin)

TLC5955
0.22V @10mA



Low Knee Voltage @ 10mA
- Allow VLED 3.9V

(max LED VF of 3.5V & 0.1V VDS margin)

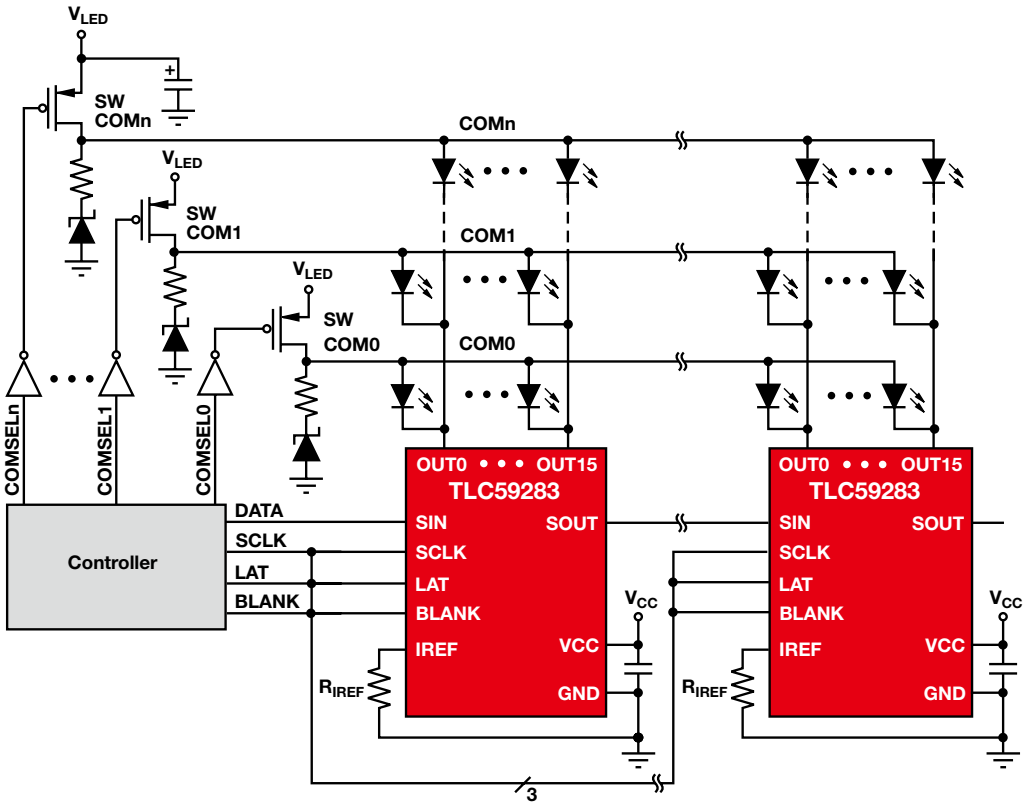
Get more information: **www.ti.com/product/tlc5955**

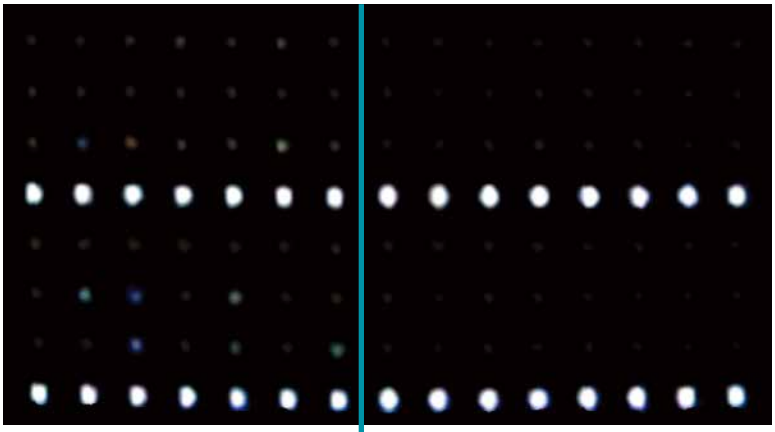
Display Power
LED Drivers—Signage/Linear

16-Channel, Constant-Current LED Driver with Precharged FETs

TLC59283

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.





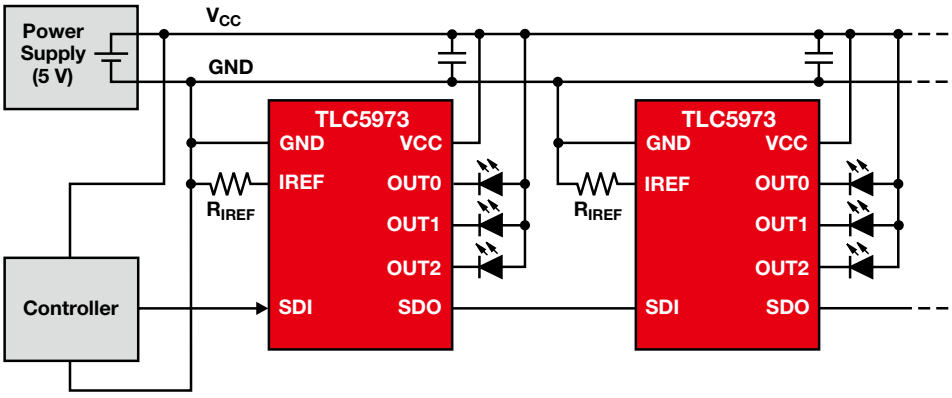
Device without anti-ghost function | TLC59283 with anti-ghost function

Get more information:**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



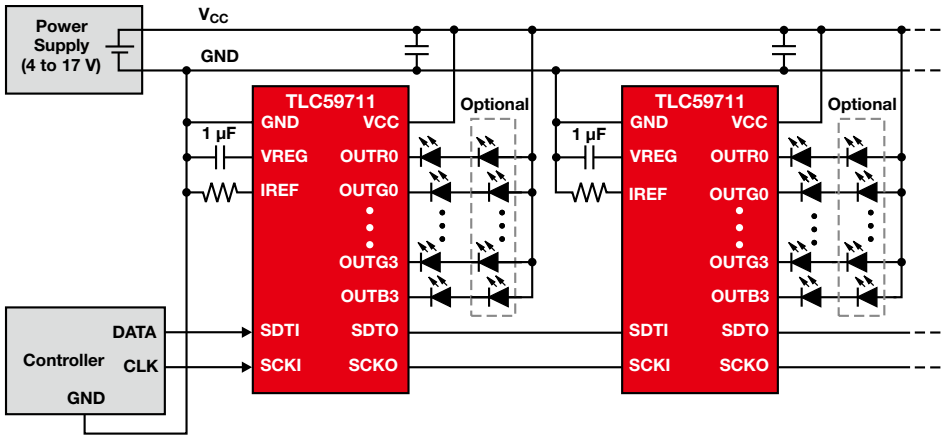
Key Features

- 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**

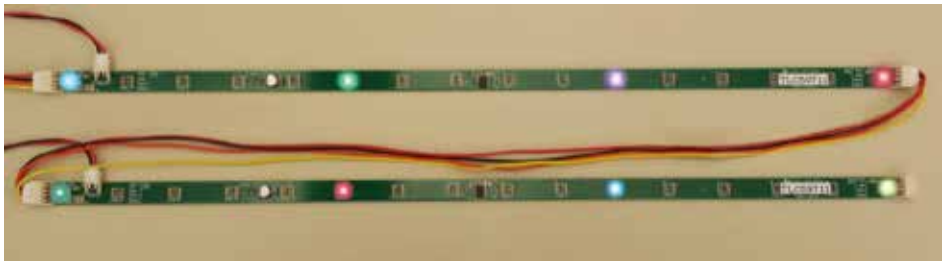
12-Channel, 16-Bit, Enhanced-Spectrum PWM, RGB LED Driver with 3.3-V Linear Regulator and Watchdog Timer

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**

Display Power
LED Drivers—Signage/Linear

Selection Guide

Device	No. of Chan.	V_{IN} Min (V)	V_{IN} Max (V)	Output Current I_{LED} (mA)	Channel-to-Channel Accuracy (%)	Dev.-to-Dev. Accuracy (%)	Recharged FET	Short Detection	Open Detection	Overtemperature Detection	Brightness Control (Bits)	Dot Correction (Bits)	PWM Grayscale Control (Bits)	Interface	Comments	Price*
TL4242	1	4.5	42	500	—	—		✔	✔	✔				—		0.35
TLC5916	8	3.3	5.5	120	±3 (Max)	±6 (Max)			✔	✔	8			SPI		0.47
TLC5917	8	3.3	5.5	120	±3 (Max)	±6 (Max)		✔	✔	✔	8			SPI		0.60
TLC59108	8	3	5.5	100	±3 (Max)	—			✔	✔	8		8	I^2C	Constant-current output	0.80
TLC59108F	8	3	5.5	100	±3 (Max)	—			✔	✔	8		8	I^2C	Open-drain output	0.80
TLC59208F	8	3	5.5	50	±3 (Max)	—			✔	✔	8		8	I^2C	Open-drain output, programmable I^2C address	0.65
TLC59116	16	3	5.5	100	±6 (Max)	—			✔	✔	8		8	I^2C	Constant-current output	1.45
TLC59116F	16	3	5.5	100	±6 (Max)	—			✔	✔	8		8	I^2C	Open-drain output	1.45
TLC59210	8	3	5.5	200	—	—								Parallel	Clear function and clock pin for data latch	0.60
TLC59211	8	3	5.5	200	—	—								Parallel	No clear function and clock pin for data latch	0.55
TLC59212	8	3	5.5	40	—	—								Parallel		0.48
TLC59213/A	8	3	5.5	–500	—	—								Parallel	"A" version has 15 ns (non-"A" is 25 ns)	0.70
TLC5921	16	4.5	5.5	80	±1	±4 (Max)			✔	✔				SPI		1.25
TLC5922	16	3	5.5	80	±1	±4						7		SPI		1.35
TLC5923	16	3	5.5	80	±1	±4			✔	✔		7		SPI		1.40
TLC5924	16	3	5.5	80	±1	±4	✔		✔	✔		7		SPI		1.50
TLC5925	16	3	5	45	±4 (Max)	±6 (Max)				✔				SPI		0.50
TLC59025	16	3	5	45	±4 (Max)	±6 (Max)				✔				SPI		0.55
TLC5926	16	3	5.5	120	±6 (Max)	±6 (Max)			✔	✔	8			SPI		0.60
TLC5927	16	3	5.5	120	±6 (Max)	±6 (Max)		✔	✔	✔	8			SPI		0.65
TLC5928	16	3	5.5	35	±1	±1			✔	✔				SPI		0.50
TLC59281	16	3	5.5	35	±1	±1								SPI		0.43
TLC59283	16	3	5.5	45	±1.4	±2	✔							SPI	4-channel grouped delay	0.55
TLC59284	16	3	5.5	45	±1.4	±2								SPI	4-channel grouped delay	0.45
TLC5929	16	3	5.5	50	±1	±2		✔	✔	✔	7			SPI	Full protection/monitor for remote-controlled systems	0.85
TLC5940	16	3	5.5	120[1]/60[2]	±1	±2/–2.7			✔	✔		6	12	SPI		1.20
TLC59401	16	3	5.5	120[1]/80[2]	±1	+2/–2.7			✔	✔		6	12	SPI		1.20
TLC5941	16	3	5.5	80	±1	+2/–2.7			✔	✔		6	12	SPI		0.95
TLC5942	16	3	5.5	50	±1.5	±3			✔	✔		7	12	SPI		1.00
TLC5943	16	3	5.5	50	±1.5	±3			✔	✔	7		16E[3]	SPI	4-channel grouped delay, LED open auto-off	1.20
TLC5944	16	3	5.5	60	±1	±3	✔		✔	✔		6	12	SPI	4-channel grouped delay, LED open auto-off	1.05
TLC5945	16	3	5.5	80	±1	+2/–2.7			✔	✔		6	12	SPI		1.00
TLC5946	16	3	5.5	40	±1	±2			✔	✔		6	12	SPI	4-channel grouped delay, LED open auto-off	0.95
TLC59461	16	3	5.5	40	±1	±2			✔	✔		6	12	SPI	4-channel grouped delay	0.95
TLC5947	24	3	5.5	30	±2	±2				✔			12	SPI	30-V V_{LED}, internal oscillator	1.95
TLC5948A	16	3	5.5	60[1]/45[2]	±0.6	±1		✔	✔	✔	7	7	16E/C[3]	SPI	Full protection/monitor for remote-controlled systems	1.30
TLC59482	16	3	5.5	45[1]/35[2]	±1	±2					6		16E[3]	SPI	4-channel grouped delay	1.15
TLC5949	16	3	3.6	45	±0.6	±1		✔	✔	✔	7		12E/C[3]	SPI	Full protection/monitor for remote-controlled systems	1.25
TLC5951	24	3	5.5	40	±1.5	±3		✔	✔	✔	8	7	12, 10, 8	SPI	For 8 RGB LED lamps	1.55
TLC5952	24	3	5.5	35	±1	±3		✔	✔	✔	7			SPI	For 8 RGB LED lamps	1.35
TLC5971	12	3	17	60	±1	±1				✔	7		16E[3]	SPI	Integrated LDO and oscillator for PWM	1.20
TLC59711	12	3	17	60	±1	±1				✔	7		16E[3]	SPI	Integrated LDO and oscillator for PWM, WDT	1.30
TLC5973	3	3	6	50	±0.5	±0.5							12	Single-wire	Shunt regulator, internal PWM clock	0.45
TLC59731	3	3	6	50	—	—							8	Single-wire	Open-drain output, shunt regulator, internal PWM clock	0.28
TLC5954	48	3	3.6	34.9	±1	±2		✔	✔		BC 3,CC 7*3(groups)			SPI	Rref removal; Power Save Mode	2.40
TLC5955	48	3	5.5	31.9	±2	±2		✔	✔		BC 3,CC 7*3(groups)	7	16	SPI	Rref removal; Low-knee Voltage	2.85
TLC5957	48	3	5.5	25	±1	±1	✔	✔		✔	BC 3,CC 9*3(groups)		16	SPI	Low-Knee Voltage; Caterpillar Removal;LGSE	2.85
TLC5958	48	3	5.5	25	±1	±1	✔	✔		✔	BC 3,CC 9*3(groups)		16	SPI	Integrated SRAM;LGSE	4.50

[1]Output current with V_{CC} > 3.6 V.
[2]Output current with V_{CC} ≤ 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.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

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.

Fig1. Top view of LED module

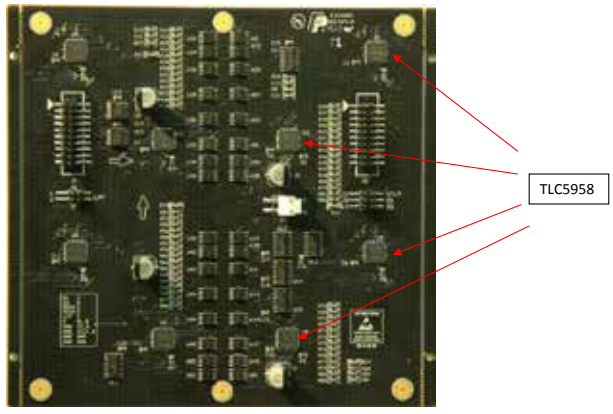
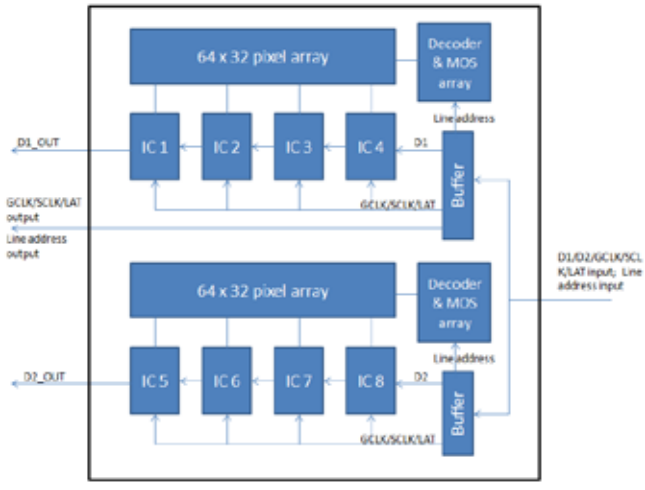


Fig2. Bottom view of LED module



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