

Welcome to the Texas Instruments New Product Update

We will begin promptly at 1 min past the hour- thank you for your patience
Phone lines will be muted during the presentation.

We are now using web-ex VOIP audio. There is no telephone dial in.

Please post questions on the chat Web-Ex Chat
or contact your sales person or field applications engineer

LED Driver For Industrial Market

Jun 27, 2019

Agenda

- LED functions summary
- Hero products
- TI designs and videos

LED Functions Summary

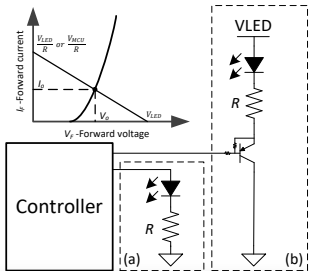


LED Indication

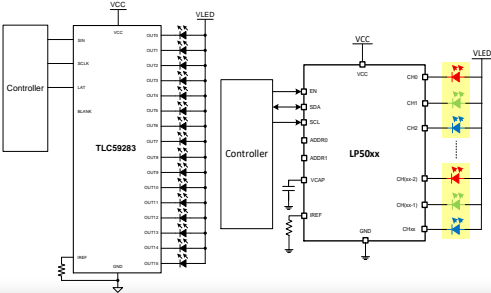
Current Solutions

TI Solutions and Benefits

LED indicators:



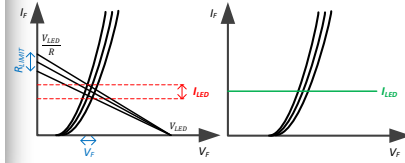
GPIO/
GPIO + Transistor



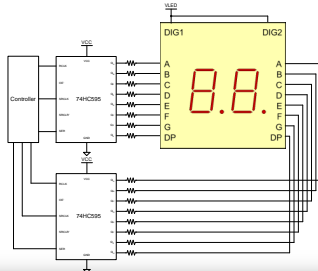
TLC59283
or
LP50xx (PWM)



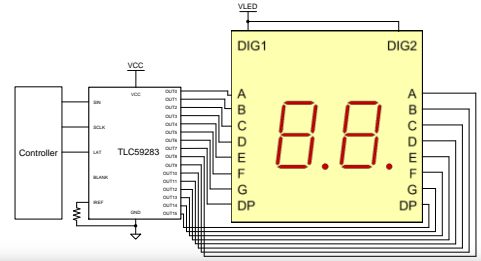
✓ Constant current
(Better brightness uniformity regardless R_{LIMIT} and V_F variation)



7-Segments:



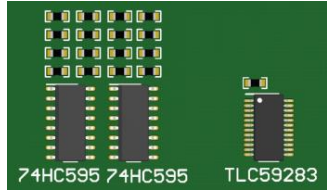
Shift register:
74HC595/
74HC164



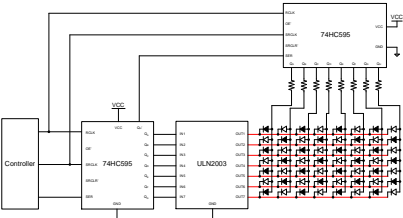
TLC59283



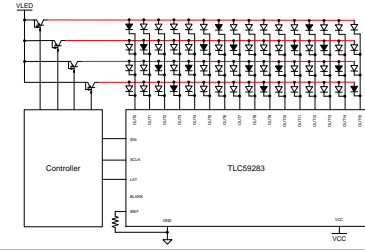
✓ Smaller size
(Less resistors and bonding pads)



Dot-matrix:



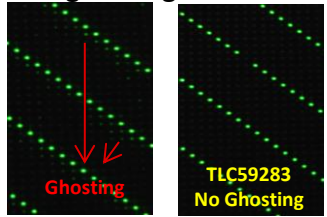
74HC595/
74HC164
+
ULN2003



TLC59283

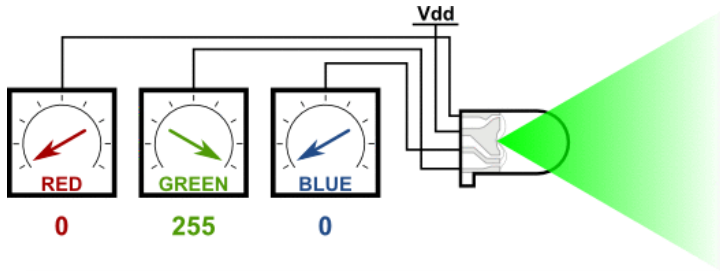


✓ No ghosting



LED Animation

Typical applications



Requirements:

- ❖ Precise PWM or Analog dimming
- ❖ I²C or SPI interface
- ❖ Low Iq for battery powered applications
- ❖ Ease of use (Easy coding + GUI)

TI Solutions and Benefits:

LP50xx

- ✓ 9/12/18/24/30/36 channels, I²C interface
- ✓ PWM dimming: 8 bit color + 8 bit brightness
- ✓ 29kHz PWM frequency: Zero audio noise
- ✓ Low Iq: 1uA max in shutdown mode and 10uA in power save mode
- ✓ GUI + Linux driver + TI design

TIDA-050011



LP5569

- ✓ 9 channels, I²C, 1x/1.5x charge pump
- ✓ PWM dimming(12 bit, 20kHz) + Analog dimming(8 bit)
- ✓ Engine control, SRAM + instructions can off-load MCU
- ✓ Low Iq: 2uA in standby / 10uA in power save
- ✓ GUI + TI design

TIDA-01559

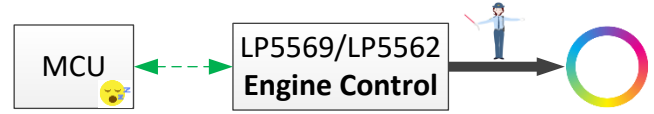
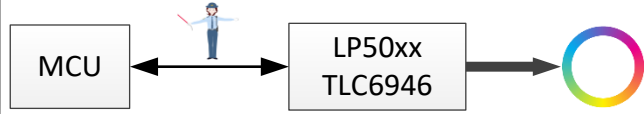


TLC6946

- ✓ 16 channels, SPI interface
- ✓ PWM dimming: 16 bit
- ✓ Time-multiplexing supported

LP5562

- ✓ 4 channels, I²C interface
- ✓ PWM dimming(8 bit, 20kHz) + Analog dimming(8 bit)
- ✓ Engine control, SRAM + instructions can off-load MCU
- ✓ Low Iq: 0.2uA in standby mode and 10uA in power save mode

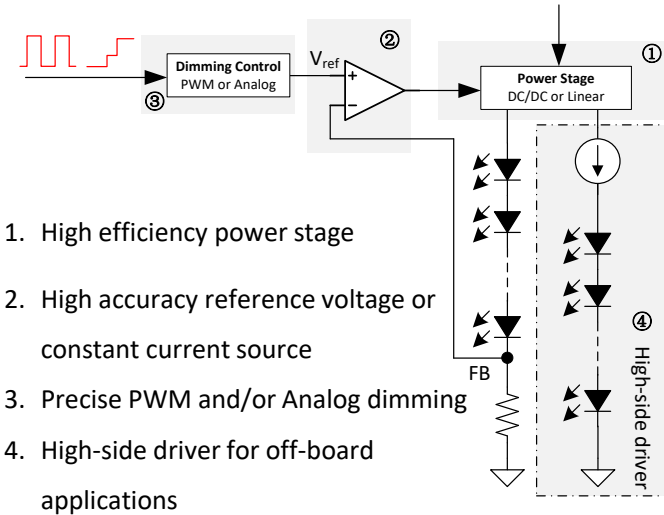


LED Illumination

General Illumination:



Block Diagram and Requirements



1. High efficiency power stage
2. High accuracy reference voltage or constant current source
3. Precise PWM and/or Analog dimming
4. High-side driver for off-board applications

TI Solutions and Benefits

TPS92200

- ✓ 4-30V Vin / 1.5A, Sync Buck, up to 95% efficiency
- ✓ Accurate PWM dimming and Analog dimming
- ✓ 100 mV ± 3mV reference voltage
- ✓ 1MHz switching frequency
- ✓ Ultra-low Iq: 1uA shut down current
- ✓ Full protections

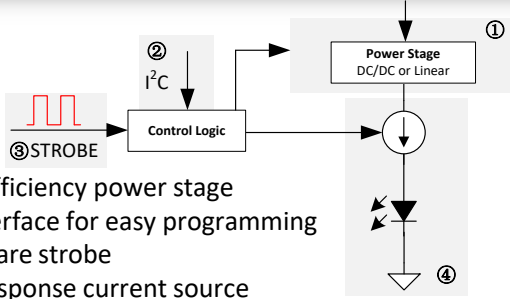
TPS61165

- ✓ 3-18V Vin / 1.2A, Boost / SEPIC, up to 94% efficiency
- ✓ PWM + flexible One-Wire interface
- ✓ 200 mV ± 4mV reference voltage
- ✓ 1.2MHz switching frequency

TPS92612

- ✓ 4.5-40V Vin / 150mA, Linear driver, PWM dimming
- ✓ High accuracy constant current source: ±4.6%
- ✓ Low drop out voltage: 400mV at 70mA
- ✓ Low standby current: < 250uA
- ✓ High-side driver

Flash:



1. High efficiency power stage
2. I²C interface for easy programming
3. Hardware strobe
4. Fast response current source

LM3644

- ✓ 2.5-5.5V Vin, Boost or Linear, I²C(400kHz)
- ✓ Dual accurate 1.4mA - 1.5 A current source
- ✓ High efficiency up to 87%
- ✓ Hardware strobe enable (STROBE)
- ✓ Fast response current source: MIN rising time < 40 us
- ✓ Flash timeout up to 1.6 seconds
- ✓ Small solution size: < 16 mm²



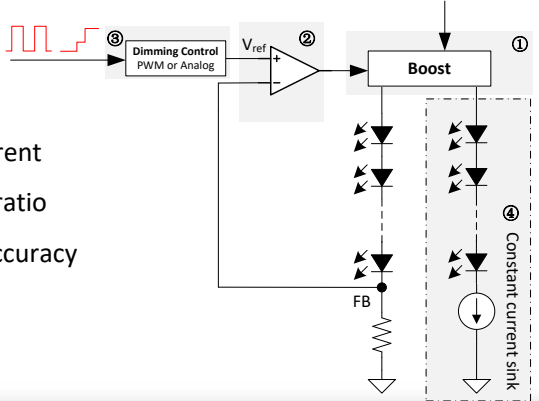
LED Backlight

Typical applications



Requirements:

1. High efficiency boost to support LED in series
2. High accuracy reference voltage to generate constant current
3. Precise PWM and/or Analog dimming with high dimming ratio
4. Constant current sources/sinks help to improve current accuracy
5. LED open / short detection and protection
6. Small size and less external components



TI Solutions and Benefits:

TPS61042

- ✓ 1 CH, 1.8-6V Vin / 0.5A, Boost + constant current source, 30V OVP
- ✓ Up to 85% efficiency
- ✓ Precise PWM/Analog brightness control
- ✓ 252 mV ± 8mV reference voltage
- ✓ 1MHz switching frequency
- ✓ 3 mm × 3 mm QFN

TPS61165

- ✓ 1 CH, 3-18V Vin / 1.2A, Boost / SEPIC, 38V OVP
- ✓ Up to 94% efficiency
- ✓ PWM + flexible One-Wire interface
- ✓ 200 mV ± 4mV reference voltage
- ✓ 1.2MHz switching frequency
- ✓ SOT-23 / 2 mm × 2 mm WSON

TPS61169

- ✓ 1 CH, 2.7-5.5V Vin / 1.8A, Boost, 38V OVP
- ✓ Up to 88% efficiency
- ✓ PWM brightness control
- ✓ 204 mV ± 16mV reference voltage
- ✓ 1.2MHz switching frequency
- ✓ 2 mm × 1.25 mm SOT(5)

TPS61194

- ✓ 4 CH, 4.5-40V Vin, 100mA/CH, Boost / SEPIC+ constant current sinks, 42V OVP
- ✓ Up to 90% efficiency
- ✓ High PWM dimming ratio: 10 000:1 at 100 Hz
- ✓ Switching frequency: 300 kHz to 2.2 MHz

TPS61196

- ✓ 6 CH, 8-30V Vin, 200mA/CH, Boost controller, Vout up to 120V
- ✓ Up to 95% efficiency
- ✓ High PWM dimming ratio: 5000:1
- ✓ Switching frequency: 100 kHz to 800 kHz
- ✓ Full protections



Hero Products



TLC59283

16-Channel, Constant-Current LED Driver with Pre-Charge FET

Features

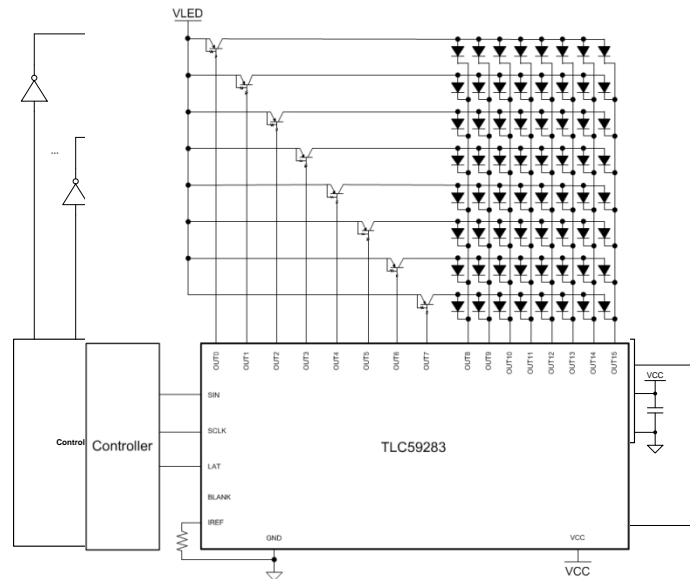
- 16 Channel Constant-Current Sink Output with ON/OFF Control
- IC Supply Voltage Range: 3 – 5.5V
LED Voltage Range: 10V
- Integrated Pre-Charge FET
- Constant Current Sink Capability:
45mA (VCC > 3.6V), 35mA (VCC < 3.6V)
- 2ns Grouped Switching Delay
- Precise Constant Current Regulation:
Channel-to-Channel: $\pm 1.4\%$ (typ)
Device-to-Device: $\pm 2\%$ (typ)
- Pre-charge FET for ghost cancelling
- Output Current Switching Delay
- TSSOP 28 Package (DBQ) / QFN 24 Package (RGE)
- Operating Junction Temperature Range: -40 C to +85C

Applications

- LED Video Displays
- LED Message Boards
- General Purpose LED Indicator Lamps

Benefits

- Flexible Operating Sequence
- Remove ghost phenomenon
- Group delay to reduce Inrush Current, less EMI
- 50ns minimum blank to increase refresh rate in multiplexing



TLC59291

8/16-Channel, Constant-Current LED Driver with Full Self-Diagnosis

Features

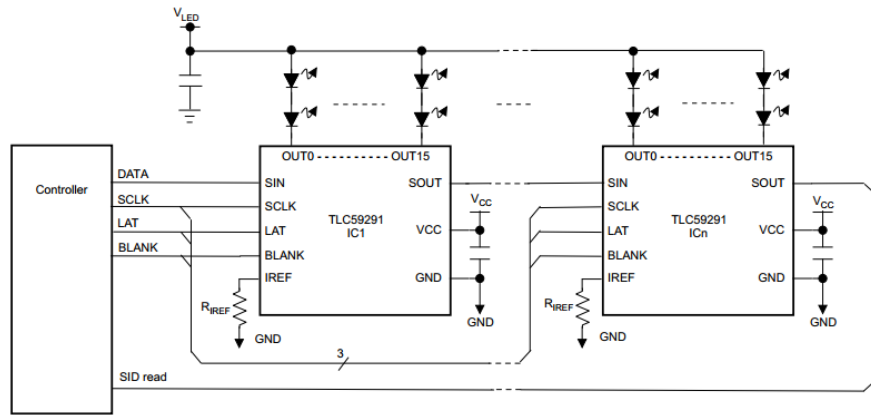
- LED Open (LOD), LED Short (LSD), Output Leak Detection (OLD), Pre-Thermal Warning (PTW), Thermal Shutdown (TSD), and Reference Terminal Short Flag (ISF)
- Power Save Mode (PSMODE)
- 16 Channel Constant-Current ON/OFF
50mA ($V_{CC} > 3.6V$), 40mA ($V_{CC} < 3.6V$)
- IC Supply Voltage Range: 3 – 5.5V
LED Voltage Range: 10V
- Precise Constant Current Regulation:
Channel-to-Channel: $\pm 3\%$ (typ)
Device-to-Device: $\pm 2\%$ (typ)
- Output Current Switching Delay
- 8CH/16CH flexible Operating Mode
- TSSOP 28 Package (DBQ) / QFN 24 Package (RGE)
- Operating Junction Temperature Range: -40 C to +85C

Applications

- LED Video Displays
- LED Message Boards
- General Purpose LED Indicator Lamps

Benefits

- Full set of protections keep the system and IC from damage caused by all common failure modes, error information from serial port supports remote diagnosis.
- Significantly reduces power consumption
- Simple solution and maximum flexibility, optimized for recent low current and bright LED
- 3V and 5V logic interface, optimized for recent low VF LED lamps
- Improves LED display image with uniform brightness



LP50xx

36/30/24/18/12/9-Ch I2C RGB LED Driver

Features

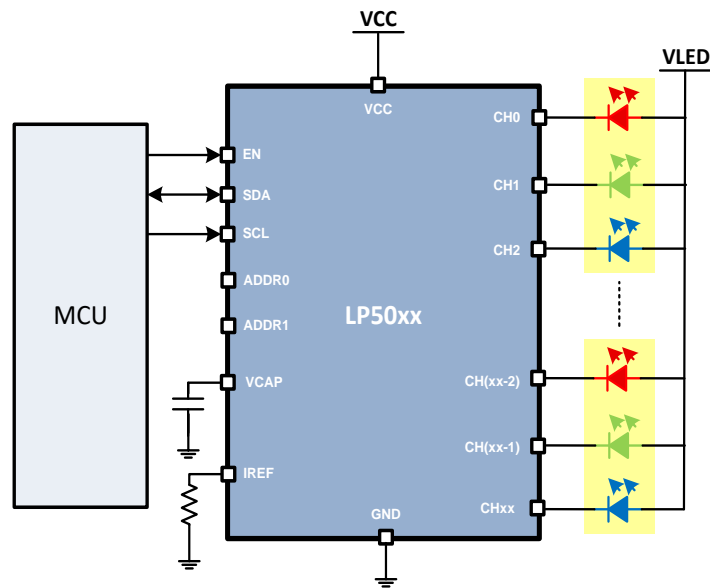
- Operating Voltage Range:
 - Vcc Range: 2.7V to 5.5V
 - EN, SDA and SCL pins compatible with 1.8V, 3.3V and 5V Power rails
 - Output Maximum Voltage: 6V
- Constant Current Sinks with High Precision
 - 25.5 mA Maximum per Channel when VCC in full range
 - 35 mA Maximum per Channel when VCC \geq 3.3V
 - Device-to-Device Error: $\pm 5\%$; Channel-to-Channel Error: $\pm 5\%$
- **Ultralow Quiescent Current**
 - Shutdown Mode: 1uA (Max.) when EN = LOW
 - Power Saving Mode: 10uA (Typ.) when EN = HIGH & All LEDs Off > 30ms
- **Integrated 12 Bit, 29 kHz PWM Generator for each channel**
 - Independent Color Mixing Register per channel
 - Independent Brightness Control Register per RGB LED Module
 - Optional Logarithmic- or Linear-Scale Brightness Control
 - Integrated 3-Phase-Shifting PWM Scheme
- **3 Programmable Banks (R/G/B) for Easy Software Control of each Color**
- Two External Hardware Address Pins for Connection up to 4 Devices
- Broadcast Slave Address for Configuring Multiple Devices Simultaneously
- Auto-Increment Writing or Reading Consecutive Registers within one Transmission
- Up to 400K Hz Fast-Mode I2C Speed

Applications

- Smart Speaker, Smart Home Appliance
- Doorbell, Electric Lock
- Smoke Detector, Thermostat
- Set-Top Box, Smart Router
- Bluetooth® Headset, Handheld Device

Benefits

- Easy and Optimized Design for Color Mixing and Brightness Smooth Control with high resolution PWM generators in each channel
- 26KHz internal PWM Generators offer enough margin to eliminate the audible noise
- Easy Software Control of Each Color and Good Channels Synchronization with 3 programmable banks
- Balance System Level Power Consumption without Side Effect for LED Animation by ultralow quiescent current in Power Save Mode
- Minimize the Input Power Budget with 3 phases PWM shifting



TLC6946

16-channel, 32 Multiplexing, 16-bit PWM LED Driver

Features

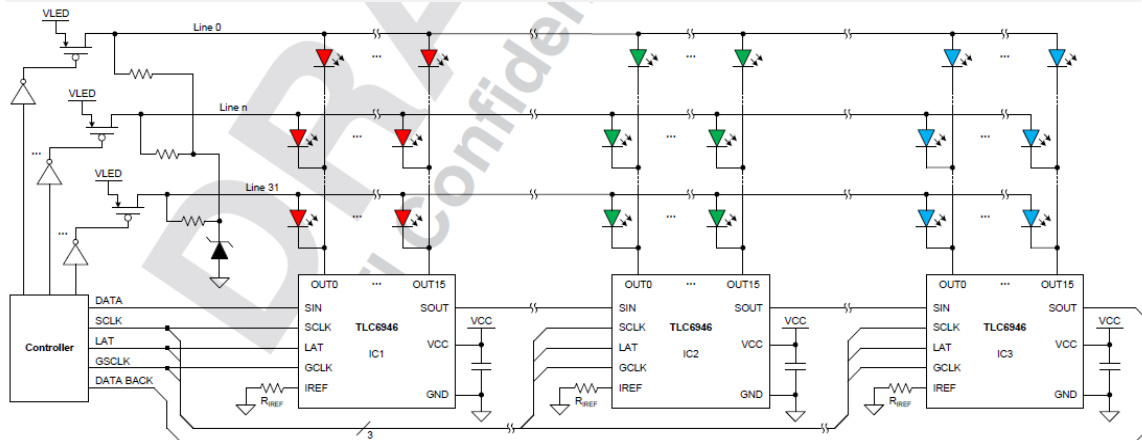
- Power Supply Voltage Range
 - Vcc Voltage Range: 3 V ~ 5.5 V
 - Vled Maximum Voltage: 17 V
- 16 Constant-Current Sink Channels
 - 0.3 mA to 25 mA ($3\text{ V} \leq V_{CC} \leq 5.5\text{ V}$)
 - Low Knee Voltage: 0.3 V (typ) @10mA
 - Channel-to-channel Accuracy, $\pm 1.5\%$ (typ), $\pm 3\%$ (max)
 - Device-to-device Accuracy, $\pm 1.5\%$ (typ), $\pm 3\%$ (max)
- 7-Bit (128 steps) Global Brightness Control (BC)
- 16-Bit (65,536 steps) Enhanced Spectrum PWM Grayscale Control
- Built-in 24-Kbit Memory to support 1~48-multiplexing (TLC6948)
- Built-in 16-Kbit Memory to support 1~32-multiplexing (TLC6946)
- High Speed Serial Data Communication
 - Data Transfer Clock (SCLK): 33 MHz (max)
 - Grayscale Control Clock (GCLK): 33 MHz (max)
 - Internal Grayscale Control Rate: 50 MHz (max)
- Enhanced Circuitry for LED Display Performance Improvement
 - Low Grayscale Uniformity Improvement
 - Low Grayscale Coupling Issue Elimination
 - Pre-Charge FET for Ghosting Removal
 - Caterpillar Elimination
- Diagnostics and Protection
 - LED-Open Detection (LOD)
 - IREF Resistor Short Protection (ISP)
 - Thermal Shutdown (TSD)
- Intelligent Power-saving Mode
- Package: SSOP-24, QFN-24

Applications

- Mono-Color, Multi-Color, Full-Color LED Displays
- High-Refresh-Rate LED Video Displays
- High-Density, Fine-Pitch LED Matrix Displays

Benefits

- As low as 0.3mA output current with high accuracy is optimized for fine pitch LED Display applications with low brightness
- TI patented circuit to solve low grayscale coupling issue helps achieve outstanding UHD display performance
- Market leading 48 Multiplexing with 24Kb on-chip SRAM for cost saving with system simplification & PCB layers reduction
- Maximum 50MHz internal grayscale control rate increases the display refresh rate and get delicate display effect



LP5569

9-Channel I2C RGB LED Driver With Engine Control and Charge Pump

Features

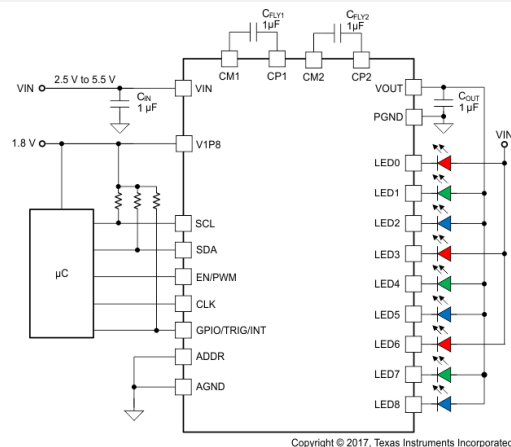
- Supply Voltage Range: **2.5-5.5V**
- 9 High-Accuracy Current Sinks
 - 25.5 mA Maximum per Channel
 - 8-Bit Individual Current Control
 - **12-Bit 20-kHz** Internal Individual PWM Control Without Audio Noise
- **Three Programmable LED Engines**
 - Independent Illumination Control Without Active Microcontroller Control
 - Synchronization Among Multiple Devices
 - Up to 256 Instructions in SRAM for Storing Sequences of Lighting Patterns
 - LP5523- and LP55231-Device-Compatible Command Set
- Flexible Dimming Control
 - I2C Dimming Control
 - Engine Dimming Control
 - **PWM Direct Input Dimming** (100-Hz to 20-kHz)
- **Adaptive Charge-Pump** to Drive High-VF LEDs With Low Battery Voltage
- Master Fader Control Allows Dimming of Multiple LEDs by Writing to Only One Register to Reduce the I2C Bus Traffic
- **2- μ A Low Standby Current and 10- μ A in Automatic Power-Save Mode When LEDs Are Inactive**
- POR, UVLO, and TSD Protection

Applications

- Smart Speaker, Smart Home Appliance
- Doorbell, Electric Lock
- Smoke Detector, Thermostat
- Set-Top Box, Smart Router
- Bluetooth® Headset, Handheld Device

Benefits

- Ultra smooth color changing and fading with high PWM resolution and dot correction
- Autonomous operation reduces system power consumption when the processor in sleep mode
- Easy coding for Flexible LED lighting Patterns
- Full functionality over battery voltage range
- Easy manufacturability with integrated diagnostic



PART NUMBER	GROUP	I2C SLAVE ADDRESS
LP5569RTWR	0	32h-35h and 40h (40h is broadcast address)
LP5569ARTWR	1	42h-45h and 40h (40h is broadcast address)



LP5562 Quad CHs I2C Bus Constant-Current LED Drivers

Features

- I2C Interface Common Anode LED Drivers
- 4 CHs Constant Current Range: 0 – 25.5mA
- 8-Bit Individual Dot Correction
- 8-Bit Individual PWM Dimming
- Output Current Error: +-5%
- Channel to Channel Error: +-2%
- Autonomous Operation With Program Execution Engines
 - SRAM Memory for Sequences
 - LOOPS, RAMPS, TRIGGERS, INT
- Ultra Low Power Operation
 - Standby supply current (EN = 0, CHIP_EN = 0): 200nA
 - Automatic Power-Save Mode With External Clock: 10uA
- Packages: DSBGA (12)

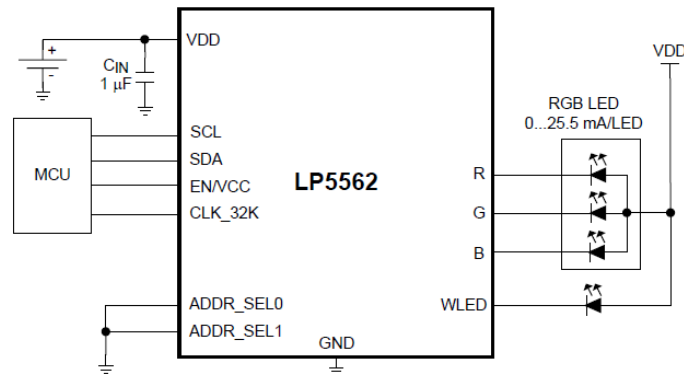
Applications

- Smart phones
- Tablets
- Performance Displays
- Conference phones
- LCD sub-display backlighting
- Keypad RGB backlighting and phone cosmetics
- Vibra, speakers, waveform generator

Benefits

- RGB LED support with extra message indicator or 4 channel keyboard backlight support
- Flexible lighting effects and run times for system efficiency savings and autonomous operation
- Low power
- System power savings when in shutdown or active

Typical Application Diagram



TPS92200D1 / D2

4V to 30V / 1.5-A Synchronous Buck LED Driver

Features

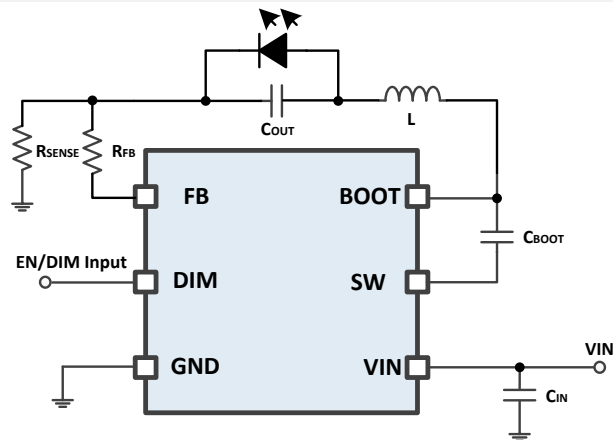
- **4V to 30V Wide Input Range**
- Integrated 150mΩ/90mΩ MOSFETs
- **1MHz** Switching Frequency
- Ultra-Low shutdown current: **1-μA**
- Ultra-Low discharge current: **1-μA**
- **Maximum PWM duty up to 99%**
- **Flexible Dimming Options for different applications**
- Ultra-low and Accurate FB Voltage: **100mV/+/-3mV**
- Peak Current mode with Internal Compensation
- Protections:
 - LED open protection **with maximum duty ON**
 - LED+ short to GND
 - LED+ / LED- short circuitry
 - Sense resistor open/short Protection
 - Thermal Shutdown
- **SOT23-6 (2.8 x 2.9 mm) // SON-6 (2 x 2mm)**

Applications

- **IP Camera IR LED Driver**
- **Facial Recognition IR LED Driver**
- **General Illumination LED Driver**
- **General AA/Li-ion Battery Charger**

Benefits

- **Ultra-low FB voltage for high Efficiency**
- **Ultra-low shutdown current (<1uA)**
- **Flexible Dimming Options for different applications**
- **Smallest / Lowest** external component count to optimize board space, and less cost



DIM Pin	Constant High	Constant Low	Dimming Type	Dimming Input Type
			PWM Dimming	Digital Signal (amplitude: $V_H > 1.4V$ and $V_L < 0.4V$)
TPS9220D1	device full on	device turn-off	Analog Dimming	Analog Voltage (amplitude: 0.65V - 1.2V)
TPS9220D2			Analog Dimming	Digital Signal (frequency: 25KHz-100KHz)



TPS61169

Single Channel, Easy to use and Low Cost LED Driver

Features

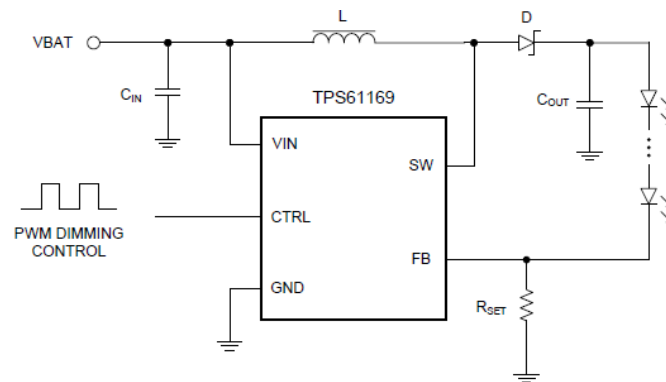
- Supply Voltage Range: 2.7-5.5V
- Low Pass Filtered PWM Dimming Control
- 1.2-A Minimum Switch Current Limit
- 38V Max Output Voltage
- 1.2MHz Switching Frequency
- Internal Compensation
- 204mV low Reference Voltage
- PFM mode at Low Load
- Tiny solution 2.00mm*1.25mm SC70 Package

Applications

- Smart Phones
- Tablets and Gaming Tablets
- Home Automation Panels
- Home Appliance User Interface
- Portable/ Small Media Form Factor Displays
- EPOS
- Handheld Medical Equipment
- Thermostat Display
- Blood Glucose Meters
- Video Surveillance Camera

Benefits

- High Efficiency help to increase battery endurance time
- Small solution size for mobile applications
- Pure Analog Control eliminate any audible noise



TPS61165

High Brightness White LED Driver in 2mm x 2mm WSON package

Features

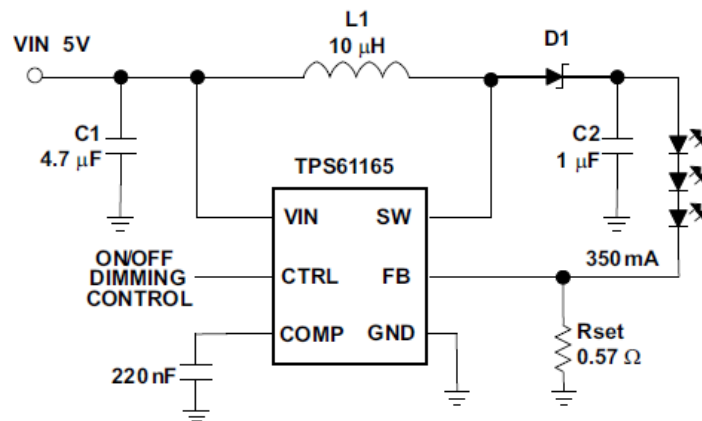
- Wide Input Voltage Range: 3 -18V
- 38-V Open LED Protection
- Up to 90% Efficiency
- 200-mV Reference Voltage With 2% Accuracy
- Down to 1% Dimming Brightness
- 1.2-A Switch FET With 1.2-MHz Switching Frequency
- One-Wire Control Interface (EasyScale™)
- 2.0 mm*2.0 mm WSON-6 Package with Thermal Pad and SOT-23 Package

Applications

- Smart Phones
- Tablets and Gaming Tablets
- Home Automation Panels
- Home Appliance User Interface
- Portable/ Small Media Form Factor Displays
- EPOS
- Handheld Medical Equipment
- Thermostat Display
- Blood Glucose Meters
- Video Surveillance Camera

Benefits

- Works with different power sources (Industrial Rail, Li-ion Battery)
- Smooth Brightness Transition
- 1% dimming ration can covers day/night ambient brightness conditions
- High Efficiency help to increase battery endurance time
- Small package for compact solutions and industrial applications



LM3643(A)

Synchronous Boost Dual LED Flash Driver with 1.5A High-Side Current Sources

Features

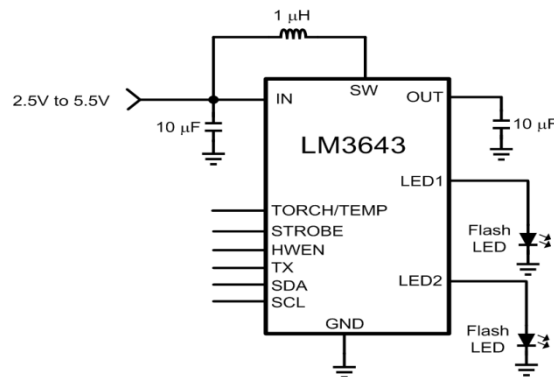
- Supply Voltage Range: 2.5-5.5V
- **1.5A Total Allowed LED Current During Operation (I_{LED1}+I_{LED2}=1.5A)**
 - Dual Independent LED Current Source Programmability
 - Accurate and Programmable Flash LED Current Range from 1.4mA to 1.5A
 - Torch Current up to 179mA(LM3644) or 360mA(LM3644TT)
 - Flash Timeout Value up to 400ms(LM3644) or 1600ms(LM3644TT)
 - Optimized Flash LED Current During Low Battery Conditions(IVFM)
 - >85% Efficiency in Torch Mode(@100mA) and Flash Mode(@1A to 1.5A)
 - Grounded Cathode LED Operation for Improved Thermal Management
- **Flexible Control**
 - Hardware Strobe Enable(STROBE) for high speed application
 - Synchronization Input for RF Power Amplifier Pulse Events(TX)
 - Hardware Torch Enable(TORCH/TEMP)
 - Remote NTC Monitoring(TORCH/TEMP)
- 400-kHz I2C Compatible Interface
 - LM3643(I2C Address=0x63)
 - LM3643A(I2C Address=0x67)
- 1.69mm*1.31mm Small DSBGA-12 Package

Applications

- Camera Phone White LED Flash
- Digital Still Cameras
- Fire-Alarm Notification
- Emergency Strobe Lighting
- Intruder Alert Notification
- Barcode Scanners
- Handheld Data Terminals

Benefits

- Flexibility to have one part in the library for multiple phone platform, single or dual flash
- Easier LED routing/connection, thermal dissipation
- Smaller inductor size, small solution size
- Flexibility and easy control of features
- IVFM saves battery power when low
- Allows synchronizing to RF PA, reduce battery drain
- <16mm² total solution size



LM3644(TT)

Dual 1.5-A Current Source Camera Flash LED Driver

Features

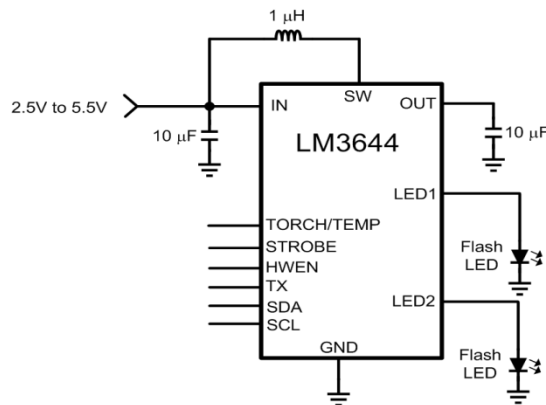
- Supply Voltage Range: 2.5-5.5V
- **Dual 1.5A Allowed LED Current During Operation(I_{Led1}+I_{Led2}=2.5A)**
 - Dual Independent 1.5A LED Current Source Programmability
 - Accurate and Programmable LED Current Range from 1.4mA to 1.5A
 - Torch Current up to 179mA(LM3644) or 360mA(LM3644TT)
 - Flash Timeout Value up to 400ms(Lm3644) or 1600ms(LM3644TT)
 - Optimized Flash LED Current During Low Battery Conditions(IVFM)
 - >85% Efficiency in Torch Mode(@100mA) and Flash Mode(@1A to 1.5A)
 - Grounded Cathode LED Operation for Improved Thermal Management
- **Flexible Control**
 - Hardware Strobe Enable(STROBE) for high speed application
 - Synchronization Input for RF Power Amplifier Pulse Events(TX)
 - Hardware Torch Enable(TORCH/TEMP)
 - Remote NTC Monitoring(TORCH/TEMP)
- 400-kHz I2C Compatible Interface
 - I2C Address=0x63
- 1.69mm*1.31mm Small DSBGA-12 Package

Applications

- Camera Phone White LED Flash
- Digital Still Cameras
- Fire-Alarm Notification
- Emergency Strobe Lighting
- Intruder Alert Notification
- Barcode Scanners
- Handheld Data Terminals

Benefits

- Flexibility to have one part in the library for multiple phone platform, single or dual flash
- Easier LED routing/connection, thermal dissipation
- Smaller inductor size, small solution size
- Flexibility and easy control of features
- IVFM saves battery power when low
- Allows syncing to RF PA, reduce battery drain
- <16mm² total solution size



LM36010

Synchronous-Boost, Single-LED Flash Driver With 1.5-A High-Side Current Source

Features

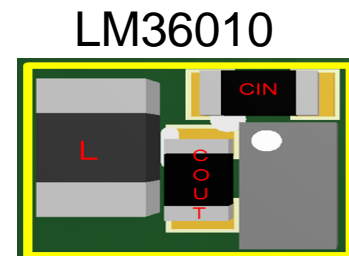
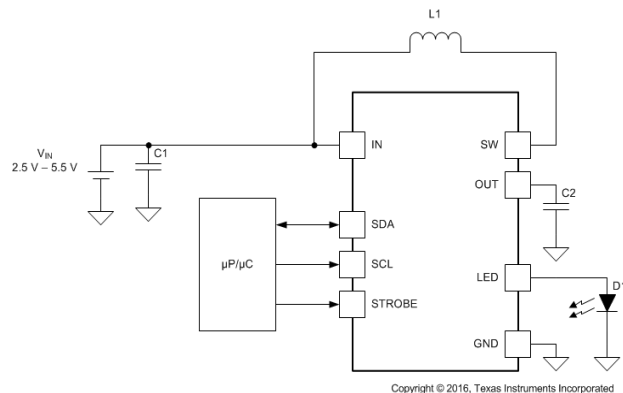
- Supply Voltage Range: 2.5-5.5V
- **Accurate and Programmable LED Currents**
 - Flash/IR Currents Ranging from 11mA up to 1.5A(128 Levels)
 - Torch Current Ranging from 2.4mA up to 376mA(128 Levels)
 - Flash Time-Out up to 1.6s
 - Flash Timeout Value up to 400ms(Lm3644) or 1600ms(LM3644TT)
 - Optimized Flash LED Current During Low Battery Conditions(IVFM)
 - Grounded Cathode LED Operation for Improved Thermal Management
- Hardware Strobe Enable(STROBE) for high speed application
- 400-kHz I2C Compatible Interface
 - I2C Address=0x64
- 1.512mm*0.800mm Small DSBGA-8 Package

Applications

- Camera Phone White LED Flash
- Tablets
- IR LED Driver
- Video Surveillance: IP Camera
- Barcode Scanner
- Portable Data Terminal

Benefits

- Allows for High Brightness, High Quality Flash
- True 1.5A Flash Current over the input voltage range
- High Flash & Torch resolution to prevent over-exposure
- Protects the IC, Inductor, LED and reports faults
- <7mm² total solution size



6.5 mm²



LM36011

Inductor-less, Single-LED Flash Driver With 1.5-A High-Side Current Source

Features

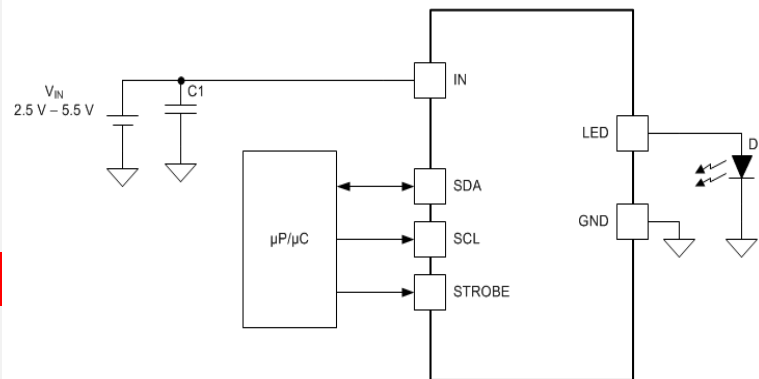
- Supply Voltage Range: 2.5-5.5V
- **Accurate and Programmable LED Currents**
 - Flash/IR Currents Ranging from 11mA up to 1.5A(128 Levels)
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 - Grounded Cathode LED Operation for Improved Thermal Management
- Hardware Strobe Enable(STROBE) for high speed application
- 400-kHz I2C Compatible Interface
 - I2C Address=0x64
- 1.512mm*0.800mm Small DSBGA-8 Package

Applications

- Camera Phone White LED Flash
- Tablets
- IR LED Driver
- Video Surveillance: IP Camera
- Barcode Scanner
- Portable Data Terminal

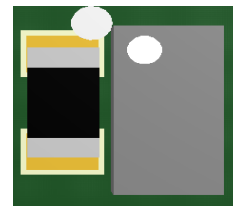
Benefits

- Allows for High Brightness, High Quality Flash
- True 1.5A Flash Current over the input voltage range
- High Flash & Torch resolution to prevent over-exposure
- Protects the IC, Inductor, LED and reports faults
- <4mm² total solution size



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LM36011



TPS61042

Low Input Voltage LED Driver Supports AA Battery

Features

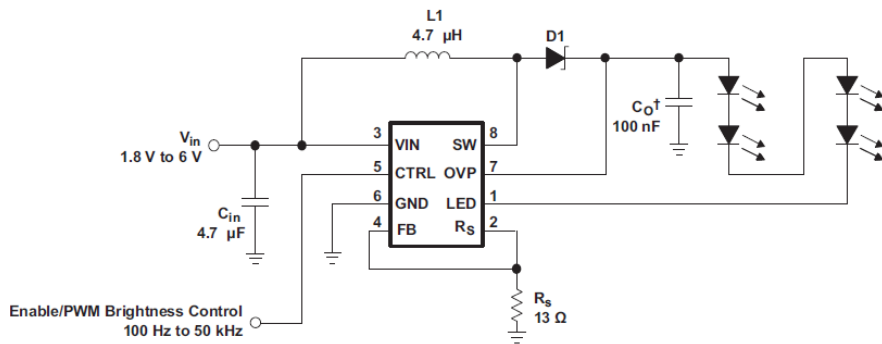
- Wide Input Voltage Range: 1.8 -6V
- Support up to 27.5V Output Voltage
- Disconnects LEDs During Shutdown
- No Load Quiescent Current: 38 μ A Typical
- Precise Control using PWM Signal or Analog Signal
- Wide PWM Dimming Frequency Range 100Hz to 50kHz
- 3.0 mm*3.0 mm SON-8 Package

Applications

- Smart Phones
- Tablets and Gaming Tablets
- Home Automation Panels
- Home Appliance User Interface
- Portable/ Small Media Form Factor Displays
- EPOS
- Handheld Medical Equipment
- Thermostat Display
- Blood Glucose Meters
- Video Surveillance Camera

Benefits

- **Ultra low Input Voltage Support AA battery power supply**
- High Efficiency help to increase battery endurance time
- Small package for compact solutions and industrial applications



TPS61194

High-Performance Four-Channel LED Driver

Features

- Supply Voltage Range: 4.5-40V
- **Four High-Precision Current Sinks**
 - Current Matching 1%(Typ)
 - LED String Current up to 100mA per channel
 - Output can be Combined Externally for Higher Current per String
- High Dimming Ratio of 10 000:1 at 100 Hz
- Direct PWM dimming rom 100-Hz to 20-KHz
- **Integrated Boost/SEPIC Converter for LED String Power**
 - Output Voltage up to 45V
 - Switching Frequency 300kHz to 2.2MHz
 - Switching Synchronization Input
 - Spread Spectrum for Lower EMI
- **Extensive Fault Detection Features**
 - Fault Output
 - Input Voltage OVP and UVLO
 - Open and Shorted LED Fault Detection
 - Thermal Shutdown
- Minimum Number of External Components
- 4.5 mm × 6 mm x 1.2 mm HTSSOP-20 Package

Applications

- Industrial Backlighting Systems in Control Panels
- Industrial PC
- Test and measurement Equipment

Benefits

- Wide VIN and VOUT range
- SEPIC(VIN below and above VOUT) supported
- Simple configuration for different application: LED configuration, DC/DC Fsw
- EMI control: optional boost sync and spread spectrum, wide boost switching frequency range
- Small solution size



TPS61196

6-String 400-mA WLED Driver with Independent PWM Dimming for Each String

Features

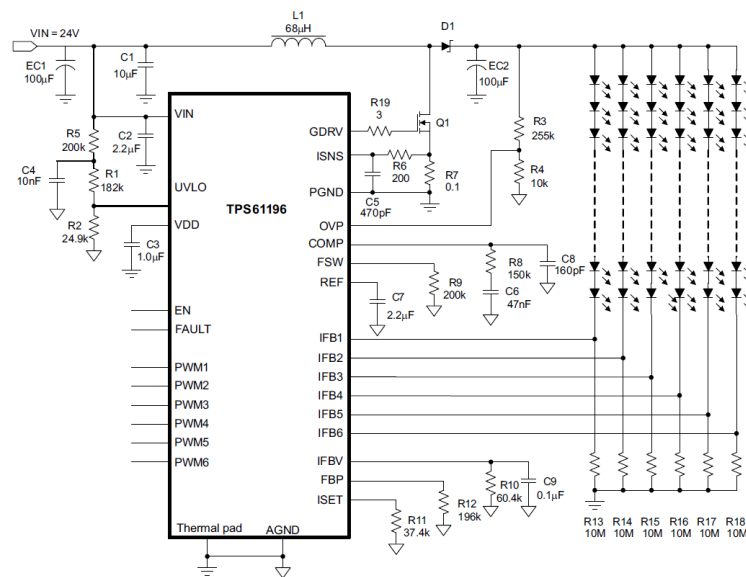
- Supply Voltage Range: 8-30V
- Up to 120-V output Voltage
- 100-KHz to 800-KHz Programmable Switching Frequency
- Adaptive Boost Output for Each String
- **Six Current Sinks**
 - 200-mA Continuous Output for each Strings
 - 400-mA Pulse Output for Each Strings
 - $\pm 1.5\%$ Current Matching Between Strings
 - High precision PWM Dimming Resolution up to 5000:1
 - Programmable Overvoltage Threshold at Output and Each Current Sink
- Programmable Under-voltage Threshold at Input with Adjustable Hysteresis
- Adjustable Soft Start Time Independent of Dimming Duty Cycle
- Direct PWM dimming from 90-Hz to 22-KHz
- **Protection**
 - Built-in LED Open and LED Short Protection
 - Built-in Schottky Diode Open/Short Protection
 - Built-in ISET Short Protection
 - Built-in IFB Short Protection
 - Thermal Shutdown
- 9.7 mm \times 4.4 mm HTSSOP-28 Package

Applications

- LCD TV backlight
- Scan Mode LCD TV Backlight

Benefits

- Highly integrated solution for LCD TV backlight
- Independent PWM dimming function for Local Dimming



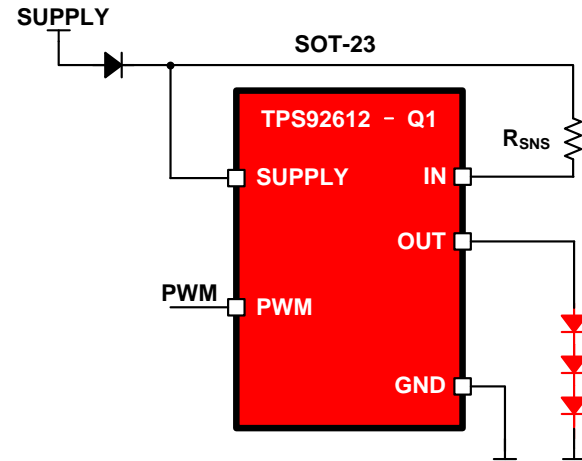
TPS92612-Q1

Features

- AEC-Q100 Qualified for Automotive Applications
- Wide voltage input range from 4.5 – 40 V
- **Single channel high side current driving and sensing**
 - Constant Current output up to 150 mA
 - Analog current setting via external resistor
 - Heat Sharing with external resistors
 - PWM dimming by PWM input or SUPPLY
 - Optimized slew rate for better EMC
 - Max Dropout Voltage 200mV @ 10mA
- **High Precision LED Driving**
 - Current accuracy 4.6%
 - 100mV Reference Resistor Headroom
- **Protection and Diagnostics**
 - **LED Short protection**
 - Thermal Shutdown protection
- SOT23-5 package (200.7 C/W)
- Operating Junction Temperature Range: -40 C to +150 C

Benefits

- Complete high side architecture supports off-board LED driving and LED bin capability



Applications

- Rear Light – Tail/Stop Light, Turn Light, Fog Light, Reverse Light, CHMSL
- Interior Light – Dome Lamp, Glove Box Lamp
- Side Marker, Blind Spot Detection LED Indicator, Charging Inlet Indicator

Key Parameter Overview

Output Channel	1	
VIN Operating Voltage	4.5 ~ 40	V
Per Channel Max. Output Current	150	mA
Output Current Accuracy	4.6	%

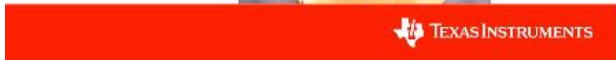
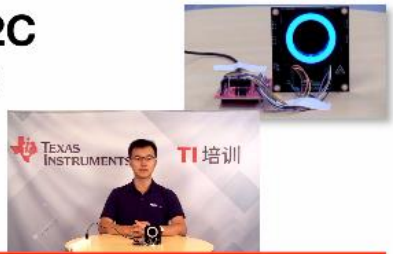
TI Designs and Videos



TI Designs and Videos

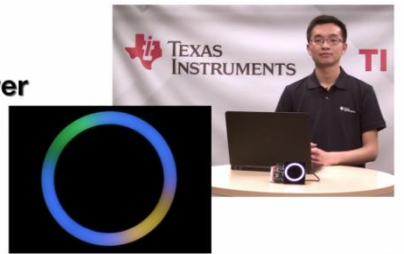
LED Ring

**LP5569 I2C
RGB LED
Driver
Demo**



[LP5569 LED driver demo](#)

**Market First
Specialized
RGB LED Driver
LP50xx Demo**



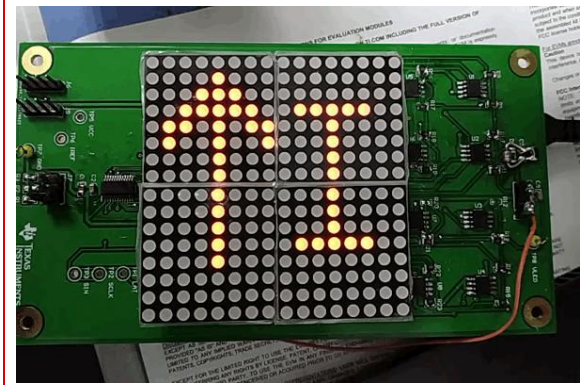
[LP50xx LED driver demo](#)

User Interface with
Proximity Sensing and LED Animation



[TIDA-01559](#)

16x16 Mono Color LED Matrix



[TIDA-01617](#)

Notes:
One TLC59283 + N×P-MOS/PNP can
drive N×16 LEDs



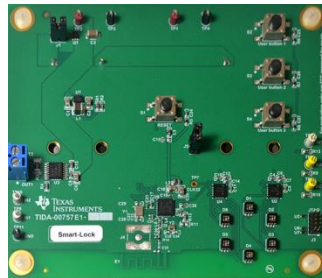
TI Designs and Videos

Various LED Ring Lighting Patterns



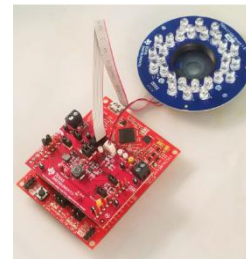
[TIDA-050011](#)

Smart Lock Reference Design



[TIDA-00757](#)

IR/White LED Illumination



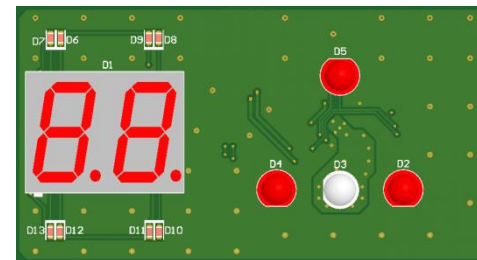
[TIDA-01586](#)

Touch Keypad Backlighting



[BOOSTXL-CAPKEYPAD](#)

Cost Optimized Proximity and Simple Gesture Recognition for Major Appliances



[TIDA-010021](#)



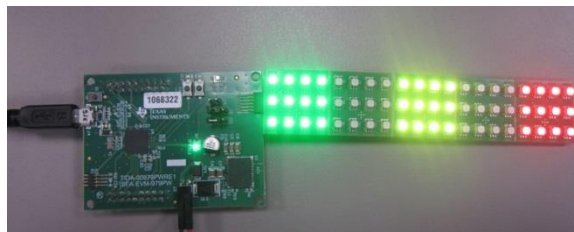
TI Designs and Videos

Status Indication Reference Design
with LED and Audio Feedback



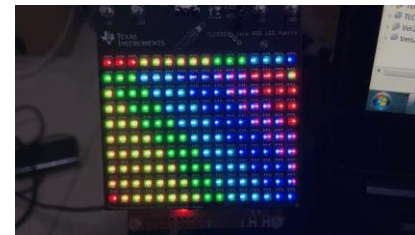
[TIDA-03026](#)

RGB LED Signal Tower



[TIDA-00979](#)

10x16 Full-Color RGB LED Matrix



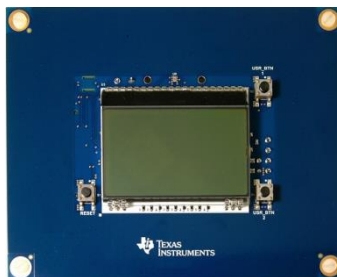
[TIDA-01615](#)

TLC5955 LED Ring



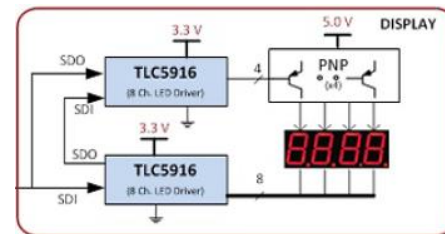
[TIDA-01591](#)

Backlight and Smart Lighting Control
by Ambient Light and Proximity Sensor



[TIDA-01364](#)

7-Segment LED Display



[TIDA-00737](#)



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#		Title	Duration	Overview
1.1		MSP430 sensing and measurement MCUs: New product update	26:41	A short overview of our MSP430 sensing & measurement MCUs. Learn about our expanding portfolio of CapTIvate capacitive sensing MCUs and ultrasonic sensing...

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