LED Lighting Solutions for Traffic Signals
LED Lighting Solutions for Traffic Signals

ST Position:
• #1 in Lighting Segment*
• #2 in Power Management**

ST Expertise:
• System Solutions
• Technology Integration and Innovation
• Excellent Technical Support

*STMicroelectronics, Datapoint and Darnell - 2008
**iSupply - 2010
Content

- LED Lighting Solutions for Traffic Signals
  - LED Array Driver Features/Benefits
    - Error Detection/Diagnostics
    - Auto Power Savings/Shutdown
    - High Precision
    - Balanced Turn-on/off
  - System Evaluation Boards and Tools
    - HB LED driver solution with Diagnostics (32, 40 LEDs)
    - 16 x 32 LED Matrix Display Panel
    - RGB LED driver for Color Displays and Backlighting
    - High Brightness LED Array Dimmer Solution
    - RGB Moving Message Display System
    - LED Driver w/PWM Dimming and Boost Converter Solution
LED Lighting Solutions for Traffic Signals

Main LED applications:
- Traffic Panels/Matrix
- Aviation
- Rail
- Navigation
- Emergency/Police Signals
- Cross Light

STP08DP05, STP16DP*05, STP24DP05 Families, LED7706/7

STPXX Array Drivers
- Constant-current drivers, set by only one external resistor
- Serial data and clock resynchronization
- High current and high precision
- Thermal shutdown
- Error detection and auto power-saving

LED7706/7 DC/DC Converters
### LED Array Driver general portfolio

#### STPXXYY05 Series Features
- Absolute Output Voltage up to 20V
- Output Enable frequency up to 1MHz
- SDI and CLK re-synchronized device by device w/o use of CLK falling edge
- Analog Thermal Shutdown protection
- Clock frequency over 30MHz,
- TSSOP package with exposed pad

#### Part Number | Description | Iout | Bit Prec. | Chip Prec. | Evaluation Board
---|---|---|---|---|---
STP08CP05 | 8-bit C.C. LED driver | 5-100mA | +/-1% | +/-3% | STEVAL-ILL009V5
STP08DP05 | 8-bit C.C. LED driver w/Diagnostics | 5–100mA | +/-1.5% | +/-5% | STEVAL-ILL002V3, STEVAL-ILL002V4
STP16CP(P)(S)05* | 16-bit w/AutoPower-Saving | 5–100mA | +/-1.5% | +/-5% | STEVAL-ILL003V2
STP16DP(P)(S)05 | 16-bit with Diagnostics | 5–100mA | +/-1.5% | +/-5% | STEVAL-ILL025V1
STP1612PW05 | 16-bit w/12/16 bit e-PWM | 3–80mA | +/-1.5% | +/-6% | STEVAL-ILL028V1
STP24DP05 | 24-bit with Diagnostics | 3–80mA | +/-3% | +/-8% | STEVAL-ILL015V1

*Also available as STP16CPC05, STP16CPC26 with balanced turn-on/turn-off feature
LED Array Drivers Portfolio w/Features

- Standard constant current LED array drivers
  - STP08CP05, STP16CP05, STP16CPC26

- Low current/high accuracy LED array drivers
  - STP16CPP05, STP16DPP05, STP16CPPS05, STP16DPPS05

- LED array drivers with Error Detection
  - STP08DP05, STP16DP05, STP16DPP05, STP16DPS05, STP16DPPS05

- LED array drivers with Auto Shut-Down
  - STP16CPS05, STP16CPPS05, STP16DPS05, STP16DPPS05

- LED array drivers with Balanced $T_{\text{ON}}/T_{\text{OFF}}$
  - STP16CPC05, STP16CPC26

- LED array drivers with PWM brightness control
  - STP1612PW05

- LED array drivers for RGB solutions
  - STP24DP05
STP08DP05 – 8 ch, 5-100ma Drivers

Key Features:
- Short and open output error detect
- Low-voltage power supply (3V – 5.5V)
- 8 constant-current output channels
- 8-bit shift register
- Serial data IN/parallel data OUT
- Output current: 5-100 mA
- Adjustable output current thru ext resistor
- Maximum clock frequency: 30 MHz
- 3.3V microcontroller driver-able
- Current accuracy: +/-1.5% between bits
  - STP08CP05: +/-3% between ICs
  - STP08DP05: +/-5% between ICs
- ESD protection: 2.5 kV HBM, 200V MM
- Extended thermal shut-down and protection features
STP08DP05 LED Driver w/Diagnostics

Evaluation Board Solutions

Key Features:
- 40 LED Matrix with
  - Error detection
  - Current regulation
  - Adjustable brightness
  - Animated text implemented
  - Adjustable blinking speed
  - GUI SW for LEDs diagnostic
  - Input voltage from 7V to 32V
  - DC/DC Converter for high efficiency
  - Standard supply connector

Key Products:
- STP08DP05  LED constant current driver
- ST7FLite39  8-bit microcontroller (10-bit ADC, SPI, SCI communication)
- LE50AB  Linear voltage regulator
- ST3232C  RS-232 Drivers and Receivers
- L5970D  DC/DC Converter

<table>
<thead>
<tr>
<th>Evaluation board</th>
<th>App note</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEVAL-ILL002V3 (Osram LEDs)</td>
<td>AN2478, AN2415</td>
<td>High-brightness LED driver with diagnostics (40 LEDs) demonstration board</td>
</tr>
<tr>
<td>STEVAL-ILL002V4 (Vishay LEDs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STP16CP(S)05 or STP16DP(S)05

16 channel, 5-100mA LED Array Drivers

Key Features:
- Low-voltage power supply: (3V to 5.5V)
- 16 constant-current output channels
- 16-bit shift register
- Output current:
  - 5 to 100mA for STP16*P05 series
  - Adj output current - ext resistor
- 3.3 V microcontroller drivable
- Maximum clock frequency: 30 MHz
- Current accuracy:
  - +/-1.5% between bits
  - +/-3% between ICs
- ESD protection: 2.5 kV HBM, 200V MM
- Extended thermal range and protection features
- Short and open output ERROR DETECT:
  - STP16DP05 and STP16DPS05
- Auto Shut-Down:
  - STP16CPS05 and STP16DPS05
- Bal output rise/fall time, typ 100ns:
  - STP16CPC05
Key Features:
32 LED Matrix with
- Current regulation
- Adjustable brightness
- Animated text capability
- Adjustable blinking speed
- GUI SW for LEDs diagnostic
- Input voltage from 5V to 35V
- DC/DC Converter for high efficiency

Key Products:
- STP16CP05 LED constant current driver
- STP16CPS05 LED constant current driver w/auto power saving/shut down
- ST7FLite09 8-bit microcontroller
- L78L33AC Voltage regulator
- STPS340U Schottky diode
- L5970D DC/DC converter

<table>
<thead>
<tr>
<th>Evaluation board</th>
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</tr>
</thead>
<tbody>
<tr>
<td>STEVAL-ILL003V2</td>
<td>AN2141</td>
<td>High-brightness 32-LED evaluation board without diagnostic based on the STP16CP05 LED driver</td>
</tr>
</tbody>
</table>
STP16DP05 LED Driver w/Diagnostics

Evaluation Board Solution

Key Features:
- 16 x 32 LED Matrix display with STP16DP05
- Mother/slave board for LED display based on STM32 uCtlr
- Supports up to 8 add’l display units in series
- Controlled by a single control unit supporting up to 254 display units
- Configurable through Windows HyperTerminal via serial interface and thru PS2 keyboard
- GPS Interface
- Audio Output - Playback of Pre-recorded .wav files

Key Products:
- STP16DP05         LED display driver
- STM32F103         32-bit ARM-based microcontroller
- STM1001            Reset IC
- ESDALC6V1W        Quad Transil

<table>
<thead>
<tr>
<th>Evaluation boards</th>
<th>User Manual</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEVAL-ILL024V1/STEVAL-ILL025V1</td>
<td>UM0767</td>
<td>Demonstration boards based on the STP16DP05 LED matrix driver and the STM32F103VB</td>
</tr>
</tbody>
</table>

STMicroelectronics
Error Detection/Diagnostic Mode

NORMAL MODE
Device works like a Constant Current LED Driver

DIAGNOSTIC MODE
The LED Driver enters the Diagnostic mode by using a Digital Key input to the SERIAL DATA IN

<table>
<thead>
<tr>
<th>Detection conditions</th>
<th>Detection results</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{ODEC} \leq 0.5 \times I_O$</td>
<td>OPEN LINE (1) or OUTPUT SHORT TO GND (2) detected</td>
</tr>
<tr>
<td>$I_{ODEC} \geq 0.5 \times I_O$</td>
<td>NO ERROR DETECTED</td>
</tr>
<tr>
<td>$V_O \geq 2.4V$</td>
<td>SHORT ON LED (3) or SHORT TO $V_O$ (4)</td>
</tr>
<tr>
<td>$V_O \leq 2.2V$</td>
<td>NO ERROR DETECTED</td>
</tr>
</tbody>
</table>

Vo=LEDs voltage supply

Error Detection availability: STP08DP05, STP16DP05, STP16DPS05, STP16DPP05, STP16DPPS05, and STP24DP05, STP24GPL05, and STP1612PW05
AutoPower Saving/Shutdown Mode

NO Active Data Latched ➞ Automatically Shuts Down
First Active Data Latched ➞ Automatically Powers Up

At Io = 80mA,
- Active: $I_{DD(ON)} = 11.7\,mA$ (typ)
- Not Active: $I_{DD(Shut-down)} = 100\mu A$ (typ)

$I_{DD(Shut-down)}$ is 117 times less than $I_{DD(ON)}$

**EXAMPLE**
- LED panel size: 10m x 5m
- Estimated number of LED Drivers: 10,000 pcs
- LED drivers active at any one time: ~ 20%
  - Using std LED driver ➞ All 10,000 will consume high current (approx 117 A)
  - Using STP16DPS05 ➞ Only 2,000 will consume high current (approx 23 A)

Power savings using STP16CPS05 is ~ 80%
High Accuracy LED drivers

Key Features:
- Low-voltage power supply: (3V to 5.5V)
- 16 constant-current output channels
- 16-bit shift register
- Serial data in/parallel data out
- 3.3V microcontroller driver-able
- Maximum clock frequency: 30 MHz

Output current:
- 3 to 40mA (adjustable through external resistor)

Current accuracy:
- +/-0.5% @ 20mA
- +/-2% @ 3mA

ESD protection: 2.5 kV HBM, 200 V MM
- Extended thermal range and protection features

Auto Shut-Down available:
STP16CPPS05 and STP16DPPS05
STP24DP05 – 24 channel, 5-80mA

Key Features:
- Low-voltage power supply: from 3V-5.5V
- 24-bit shift registers
- Serial data in/parallel data out
- 3 groups (RGB) of 8 constant-current output channels from 5-80mA
- Short and Open output error detection
- Adjustable output current through external resistor for each group of 8-channel
- Gradual output delay (30ns for each group RGB)
- 3.3 V microcontroller driveable
- Maximum clock frequency: 25 MHz
- ESD protection: 2.5 kV HBM, 200 V MM
- Thermal Shutdown with flag pin

Applications:
- Full color high resolution LED panel displays
- Colored traffic signs
HB RGB Dimmer Evaluation Board
Based on STP24DP05 and STM32F103C6

Key Features:
- Two STP24DP05 (TQFP48) w/16 RGB high brightness LEDs connected (48 LEDs in total)
- STM32 with cost-effective internal HS osc
- High efficient switching power supply DC/DC ST1S10 with input voltage range of 7.5V - 18V, current 0.7A.
- Error Detection Feature/Over-Temp Flag
- Adjustable Brightness
- JTAG interface for C firmware updates
- Mini USB connector for PC GUI connection
- Imp signal test points for lab evaluation
- Buttons and a knob to control the board
- 3 jumpers each for simulating disconnection and simulating shortage of 3 LEDs

Key Products:
- STP24DP05
- STM32F103
- ST1S10

Demo Kit Support:
- STEVAL-ILL015V1 with OSRAM LEDs
- CD with User Manual, Application Note, Datasheets
- C Library for dimming control of every single LED
- Demo Firmware and PC Software:
- Stand alone: A game, color dimming effects, Error Detection
- USB demo: Error Detection over USB

<table>
<thead>
<tr>
<th>Evaluation board</th>
<th>App Notes /User Manuals</th>
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</tr>
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<tbody>
<tr>
<td>STEVAL-ILL015V1</td>
<td>AN2841, UM0574, UM0588</td>
<td>High Brightness RGB LED Array dimmer demo board based on the STP24DP05 and STM32</td>
</tr>
</tbody>
</table>
**Multicolor LED Display Panel Eval Board**

**RGB Moving Message Display System with STP24DP05 and STM32F103**

**Key Features:**
- Control unit with PS2 keyboard interface for data entry
  - LCD on control unit for showing the display text and background color options
  - 4xSTP24DP05 for each display panel
- 8 panels can be cascaded in series through flat ribbon cable
- System configuration in typing data mode or in audio playback mode or in demo mode

**Key Products:**
- STP24DP05 LED Display Driver
- STM32F103 32-bit microcontroller on control board
- STM1001 Reset IC
- STPS3L60 Schottky Diode
- ST3232C 3V RS232 com interface

**Support:**
- Full color Display Panels
- Airport and Railway information system
- Bank currency conversion rate boards

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<tbody>
<tr>
<td>STEVAL-ILL032V1, STEVAL-ILL033V1</td>
<td>UM1449</td>
<td>STM32-based RGB LED Matrix Display Demo</td>
</tr>
</tbody>
</table>
## LED Array Driver Feature Summary

<table>
<thead>
<tr>
<th>Part Number</th>
<th>#ch</th>
<th>$I_{LED}$ (mA)</th>
<th>$\Delta I_{LED}$</th>
<th>Channel to channel (MAX)</th>
<th>IC to IC (MAX)</th>
<th>Error detection</th>
<th>Auto Power Saving</th>
<th>Balanced Turn ON/OFF</th>
<th>Gray-scale Brightness control</th>
<th>Current Gain Adjustment</th>
<th>Staggered output delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP08CP05</td>
<td>8</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>6%</td>
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<tr>
<td>STP08DP05</td>
<td>8</td>
<td>5 – 100</td>
<td>3% (20 100mA)</td>
<td>6%</td>
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<tr>
<td>STP16CP05</td>
<td>16</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>5%</td>
<td></td>
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<tr>
<td>STP16CPS05</td>
<td>16</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>5%</td>
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<tr>
<td>STP16DP05</td>
<td>16</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>5%</td>
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<tr>
<td>STP16DPS05</td>
<td>16</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>5%</td>
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<tr>
<td>STP16CPP05</td>
<td>16</td>
<td>3 - 40</td>
<td>3% (20 40mA)</td>
<td>5%</td>
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<tr>
<td>STP16CPPS05</td>
<td>16</td>
<td>3 - 40</td>
<td>3% (20 40mA)</td>
<td>5%</td>
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<tr>
<td>STP16DPP05</td>
<td>16</td>
<td>3 - 40</td>
<td>3% (20 40mA)</td>
<td>5%</td>
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<tr>
<td>STP16DPPS05</td>
<td>16</td>
<td>3 - 40</td>
<td>3% (20 40mA)</td>
<td>5%</td>
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<tr>
<td>STP16CPC05</td>
<td>16</td>
<td>5 - 100</td>
<td>3% (20 100mA)</td>
<td>5%</td>
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<tr>
<td>STP16CPC26</td>
<td>16</td>
<td>5 - 90</td>
<td>3%</td>
<td>6%</td>
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<td>STP24DP05</td>
<td>24</td>
<td>5 - 80</td>
<td>6% (5 15mA)</td>
<td>6%</td>
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<tr>
<td>STP1612PW05</td>
<td>16</td>
<td>3 - 60</td>
<td>1.5% (3 60mA)</td>
<td>6%</td>
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</table>
## Array Driver Eval Boards Summary

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Order Code</th>
<th>Description</th>
<th>Feature</th>
<th>App Notes</th>
<th>Power Supply</th>
</tr>
</thead>
</table>
| STP16CP05     | STEVAL-ILL003V2 | 32 LEDs Array Reference Board                                                 | - Adjustable Brightness, Blinking Speed  
                              |                                                        | AN2241              | Std Supply Connector |
| STP16CPS05    |              |                                                                            | - Animated Text  
                              |                                                        |          |              |
|                |              |                                                                            | - GUI SW for LEDs diagnostics                                         |           |              |
| STP16DP05     | STEVAL-ILL024V1 | Mother/slave board for LED display based on STM32 16x32 LED matrix         | - Animated Text  
                              |                                                        | UM0767              | 5V, 0.5A  
                              |                                                        |            | 3.5V-5V, 3A |
| STP16DP05     | STEVAL-ILL025V1 | Mother/slave board for LED display based on STM32 16x32 LED matrix         | - Adjustable Blinking Speed  
                              |                                                        | UM0767              | 5V, 0.5A  
                              |                                                        |            | 3.5V-5V, 3A |
| STP1612PW05   | STEVAL-ILL028V1 | RGB LED Driver w/Indep PWM for Color Display via STM32 SPI                 | - Adjustable Color  
                              |                                                        | UM0882              | Std Supply Connector |
|               |              |                                                                            | - JTAG interface for C firmware update                                | UM0885    |              |
| STP08DP05     | STEVAL-ILL002V3 | 40 LEDs Diagnostic Reference Board Using OSRAM Blue LEDs                    | - Adjustable Brightness, Blinking Speed  
                              |                                                        | AN2415 AN2478       | Std Supply Connector |
|               |              |                                                                            | - Animated Text  
                              |                                                        |           |              |
|               |              |                                                                            | - Error Detection Feature                                              |           |              |
| STP08DP05     | STEVAL-ILL002V4 | 40 LEDs Diagnostic Reference Board Using Vishay Green LEDs                  | - Adjustable Brightness, Blinking Speed  
                              |                                                        | AN2415 AN2478       | Std Supply Connector |
|               |              |                                                                            | - Animated Text  
                              |                                                        |           |              |
|               |              |                                                                            | - Error Detection Feature                                              |           |              |
| STP24DP05     | STEVAL-ILL015V1 | 16 RGB LED Array based on STP24DP05 and STM32F103C6                         | - Adjustable Brightness  
                              |                                                        | UM0574              | Std Supply Connector |
|               |              |                                                                            | - JTAG interface for C firmware update                                |           |              |
|               |              |                                                                            | - Mini USB connector for PC GUI                                        |           |              |
|               |              |                                                                            | - Error Detection Feature                                              |           |              |
| STP24DP05     | STEVAL-ILL032V1 | STM32-based RGB LED Matrix Display Demo                                    | - Adjustable text color and speed  
                              |                                                        | UM1449              | Std Supply Connector |
|               | STEVAL-ILL033V1 |                                                                            | - Adjustable background color                                          |           |              |
|               |              |                                                                            | - Audio Playback Mode                                                   |           |              |
Monolithic solutions offer high efficiency and compactness, wide input voltage range, high current capability for a variety of applications, and high dimming performance for superior brightness uniformity.
Optimized LED driving solution

LED7706 and LED7707

- Serial
  - simpler architecture
  - brightness uniformity
  - high voltage to manage

- Parallel
  - low voltage
  - high complexity due to current matching
  - high power dissipation on current generators

- Multiple channel

LED770x Trade-off based on:
- technology availability (rated voltage)
- efficiency
- LED current regulation

- Typical input bus available → 24V
- LEDs to drive → up to 10 (e.g. considering 40V technology)

NEED FOR BOOST CONVERSION
LED7706/7: LED Controllers

**BOOST SECTION**
- 4.5V to 36V Input Voltage range
- Internal +5V LDO
- Internal Power-MOSFET
- Up to 93% Efficiency
- Up to 36V Output Voltage
- 200kHz to 1MHz Switching Frequency
- Fixed $F_{SW}$ Peak Current Mode control
- Programmable Soft-Start Duration
- Programmable OV and OC Protections
- Single Ceramic Output Capacitor
- External sync for multi-device application

**BACKLIGHT DRIVER SECTION**
- Six ROWs capable of driving multiple LEDs in series (e.g. up to ten WLEDs per ROW)
- Programmable Output Current per ROW
  - Up to 30mA (LED7706)
  - Up to 85mA (LED7707)
- PWM Dimming
  - 500ns minimum dimming ON time (LED7706)
  - 10µS minimum dimming ON time (LED7707)
- 2% Current Matching between ROWs
- Shorted LED Fault Detection
- Open ROW Fault Detection
- Capability to Disconnect Unused ROWs

**Ideal for:**
- Industrial: traffic signals, lighting, and displays
- Industrial: mid to large size LCD TV, MNT
- Automotive: navigation displays and dash board
LED7706/7: Adaptive Output Voltage

- **Fixed output voltage**
- **Adaptive output voltage**
- **Higher power dissipation**
  - $V_F$ spread

Output voltage depends on the active LED string with highest $V_F$

**Example**

- $V_{IN} = 12V$
- 6 strings of 8 LEDs
- $V_{F,LED} = 3.5 \ 0.2V$
- $f_{SW} = 600kHz$
- $I_{ROW} = 75mA$

$\eta = 84.2\%$ (fixed $V_{OUT}$ approach)

$\eta = 87.3\%^*$ (adaptive $V_{OUT}$ approach)

*0.5% lower every 100mV of increase of the voltage across the master generators
LED7706/7: Boost topology

- **Wide input voltage range**: V\text{IN}= 4.5V to 36V
- **V\text{OUT}= up to 36V**
- **PWM Dimming**
- **High efficiency**
- **Fault Enable**
- **Up to 10 white LEDs per row**

**Input voltage**: 4.5V to 36V
- **Maximum RMS switch current**: 2.5A
- **Parallelable channels for higher current** (LED7707)

**LED current**: 
\[ I_{\text{LED}} = \frac{K_R}{R_{\text{RILIM}}} \]
- **LED7707**: up to 85mA/ch
- **Channel to channel current mismatch**: ±2%
- **Up to 20kHz PWM dimming** (1%-100%, LED7706)

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![Image of circuit diagram with STMicroelectronics logo]
**LED Faults & Dimming Waveforms**

1) **ROW0 Opens**

2) The output voltage increases

3) If 95% is crossed, the faulty ROW is disconnected

1) **LED Short Circuit:** the ROW0 Voltage Increases

2) If the 3.4V threshold is crossed, the device is turned off (MODE=0)

**Detecting and Managing Faults in LED7706/7**

- **20µs Dimming On-Time**
- **500ns Dimming On-Time**

(f_{DIM}=10kHz, D_{DIM}=20%, f_{SW}=630kHz, LED current=20mA)

**Managing Dimming Waveforms in LED7706/7**
LED7706/7 LED Driver Application Examples

Typical application schematic

High-Brightness LED driving solution

Multi-device applications with external Synchronization
LED Driver w/Boost Converter Solution

Based on the LED7706 and LED7707

Key Features:
- **Boost section**
  - 4.5 V to 36 V input voltage range
  - Internal power MOSFET
  - Internal +5 V LDO for device supply
  - Up to 36 V output voltage
  - Constant frequency peak current-mode control
  - 200/250 kHz to 1 MHz adjustable switching frequency (LED7706/7)
  - External sync for multi-device application
  - Pulse-skip power saving mode at light load
  - Programmable soft-start
  - Programmable OVP protection
  - Single ceramic output capacitor
  - Non-latched thermal shutdown

- **LED driver section**
  - Six rows with 30/85 mA maximum current capability (adjustable) LED7706/7
  - Up to 10 white LEDs per row
  - Rows disable option
  - Less than 500 ns minimum dimming time (1% minimum dimming duty-cycle at 20 kHz dimming frequency - LED7706,
    - Less than 10 μs minimum dimming time at 1kHz dimming frequency - LED7707
  - 2.0% current matching between rows
  - LED failure (open and short circuit) detection

<table>
<thead>
<tr>
<th>Part #</th>
<th>Evaluation Board</th>
<th>Vin</th>
<th>Ioutmax</th>
<th>Description</th>
<th>App Notes</th>
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<tbody>
<tr>
<td>LED7706</td>
<td>STEVAL-ILL020V1</td>
<td>4.5V to 36V</td>
<td>20mA per channel</td>
<td>LEDs Driver with Boost Converter for LCD Panels Backlight</td>
<td>AN2809</td>
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<tr>
<td>LED7707</td>
<td>STEVAL-ILL021V1</td>
<td>4.5V to 36V</td>
<td>60mA per channel</td>
<td>LEDs Driver with Boost Converter for LCD Panels Backlight</td>
<td>AN2810</td>
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</table>
Energy-Efficient Solutions for Traffic Signals on st.com

LED Lighting Brochure

LED Application web pages

ST's lighting solutions are split into five main categories: dimmer, fluorescent, halogen, HID and LED.


For more information, visit:

www.st.com > home > support > tools & resources
www.st.com > LED Drivers for Traffic Signals

Thank you