

LED7706/7/8



STMicroelectronics

LED drivers for backlighting and lighting applications

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Advanced power management to drive LEDs

STMicroelectronics, a world leader in power management solutions, leveraging its leading-edge expertise in power technologies, offers complete solutions to drive LEDs in a variety of applications.

The LED770x family is composed of three monolithic, high-efficiency LED drivers intended for arrays used in the backlight of LCD panels in consumer, industrial and automotive applications, and in architectural lighting applications.

Housed in compact QFN packages, the ICs integrate a boost converter and a LED array driver consisting of several PWM-dimmable current generators giving excellent dimming performances, suitable for all LCD backlighting applications.

The boost converter is based on a constant switching-frequency, peak current-mode architecture. The devices keep the lowest row's voltage regulated at the internal reference voltage, and adapt the boost output voltage to reduce power losses across the current generators. The boost-converter default switching frequency is fixed at about 650 kHz. This is a good compromise in terms of efficiency, size and cost of the power elements and of the overall application, but it can also be set anywhere in the 250 kHz to 1 MHz range by simply connecting an external resistor, if more flexibility is required.

The LED770x family, with an input voltage range from 3.6 V or 4.5 V up to the output voltage, covers the most common voltage buses (5 V, 12 V and 24 V). Additional flexibility is guaranteed by a full set of adjustable protection functions, together with complete and flexible fault management, a wide input voltage range and high switching frequency, to reduce the size and cost of the total application.

LED7706/7: six rows of up to 10 white LEDs, with adjustable maximum current

Downstream from the boost converter stage, the LED7706 and LED7707 have six controlled-current generators (rows) that are externally programmable to sink up to 30 mA (LED7706) and 85 mA (LED7707) and can be dimmed via a PWM signal.

In the LED7707, the six lines may also be put in parallel to drive a single LED string to a total current in excess of 500 mA.

The devices can manage an output voltage of up to 36 V powering up to 10 white LEDs per row.

Row failures (open and shorted LEDs) are detected and managed in a safe way and basic protection of the power stage (output overvoltage, internal MOSFET overcurrent and thermal shutdown) are provided.

The devices are housed in small VFQFPN4x4-24L packages.

Key features

Boost controller

- 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
- 250 kHz to 1 MHz adjustable switching frequency
- External synchronization for multi-device application
- Pulse-skip power saving mode at light load
- Programmable soft-start
- Programmable OVP protection
- Stable with ceramic output capacitors
- Thermal shutdown

Backlight driver

- Six rows up to 10 white LEDs each, with adjustable maximum current:
 - 30 mA max for LED7706
 - 85 mA max for LED7707
- Rows disable option
- Less than 10 μ s minimum dimming on-time for LED7707, 500 ns for LED7706
- ± 2 % current matching between rows
- LED failure (open and short-circuit) detection

Key benefits

- Monolithic and flexible solution
- High efficiency
- Superior dimming capability
- Complete and flexible fault management

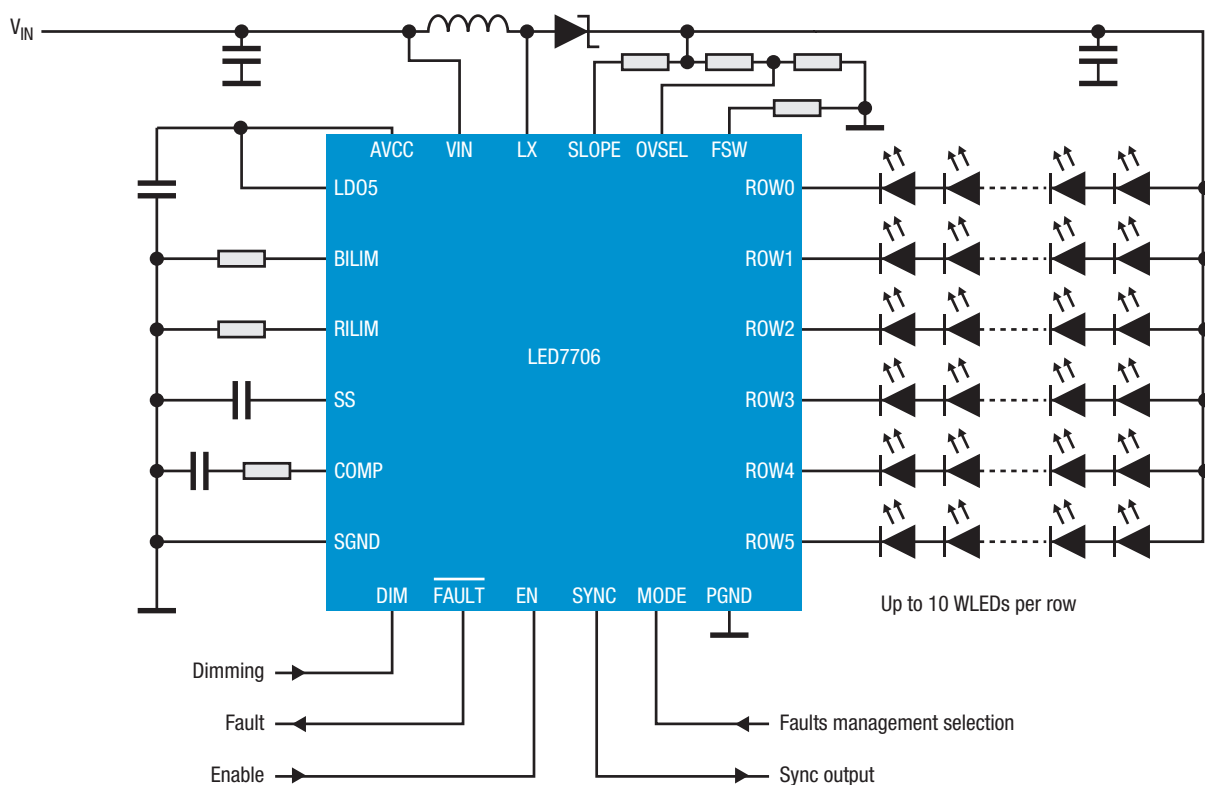
Targeted applications

- Consumer: small to mid size LCD TVs, monitors
- Automotive: navigation displays and dashboards
- Industrial: lighting, displays, e-signage



VFQFPN-24 4x4

Application diagram

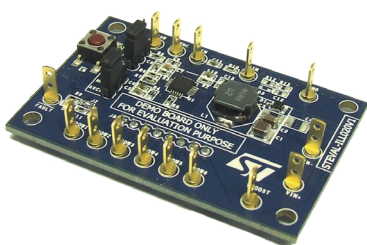


LED7706/7 product table

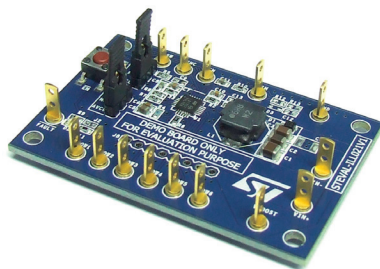
Part number	V _{in} (V)	V _{OUT} (V)	Irows (mA)	Rows	Min dimming time	Max LEDs per row	Fsw (kHz)	Package
LED7706	4.5 to 36	Up to 36	Up to 30	6	500 ns	10 (white)	200 to 1000	VFQFPN4x4-24L
LED7707	4.5 to 36	Up to 36	Up to 85	6	10 μs	10 (white)	200 to 1000	VFQFPN4x4-24L

Evaluation boards

Part number	Description	Related documentation
STEVAL-ILLO20V1	LED7706: 6-row, 30 mA LED driver with boost converter	AN2809
STEVAL-ILLO21V1	LED7707: 6-row, 85 mA LED driver with boost converter	AN2810



STEVAL-ILL020V1



STEVAL-ILL021V1

LED7708: 16-channel, 85 mA LED driver with boost controller and 4-wire serial interface

The LED7708 has been specifically designed to supply several LEDs from a single low-voltage rail in order to address TV and monitor backlights, medium- and large-size LCD panel backlights and RGB/RGGB backlight applications.

It has sixteen current generators rated at 40 V and a 4-wire serial interface to control LED brightness.

These channels can be put in parallel for higher output currents. A selectable 12-bit or 16-bit gray-scale brightness control allows independent PWM on each channel.

A programmable on-chip dimming oscillator is provided to simplify external circuitry. The device has dedicated pins to lock synchronize with other devices (master or slave) for noise reduction in multi-device applications.

The LED7708 implements basic protection (OVP, OCP and thermal shutdown), as well as LED-array protection. It can detect and manage open-LED and shorted-LED faults, and different fault management options are available in order to cover most application needs.

Key features

Boost controller section

- 3.6 V to 36 V input voltage range (with internal LDOs)
- Adaptive output voltage
- OVP, OCP and thermal protection
- External synchronization for multi-device applications
- Over-temperature alert and thermal shutdown

LED array driver section

- 16 paralleable channels with 85 mA/ch current capability
- $\pm 2\%$ channel current accuracy (full range)
- $\pm 2\%$ max channel-to-channel current matching
- 4% max chip-to-chip current accuracy
- LED short-circuit and open-channel fault detection and disconnection
- 4 wire, 30 MHz serial interface
- 16x 16-bit, 1x 256-bit or 1x 192-bit serial data format
- 12/16-bit resolution PWM dimming on each channel
- Programmable internal dimming oscillator
- 128-step overall current generator adjustment

Key benefits

Advanced power management

Minimizes overall system power dissipation and maximizes efficiency

Advanced control of color and brightness

Individual PWMs give independent control of average current in each string, adjusting brightness mismatches among the LED strings in synergy with programmable current generators to provide best color and brightness uniformity

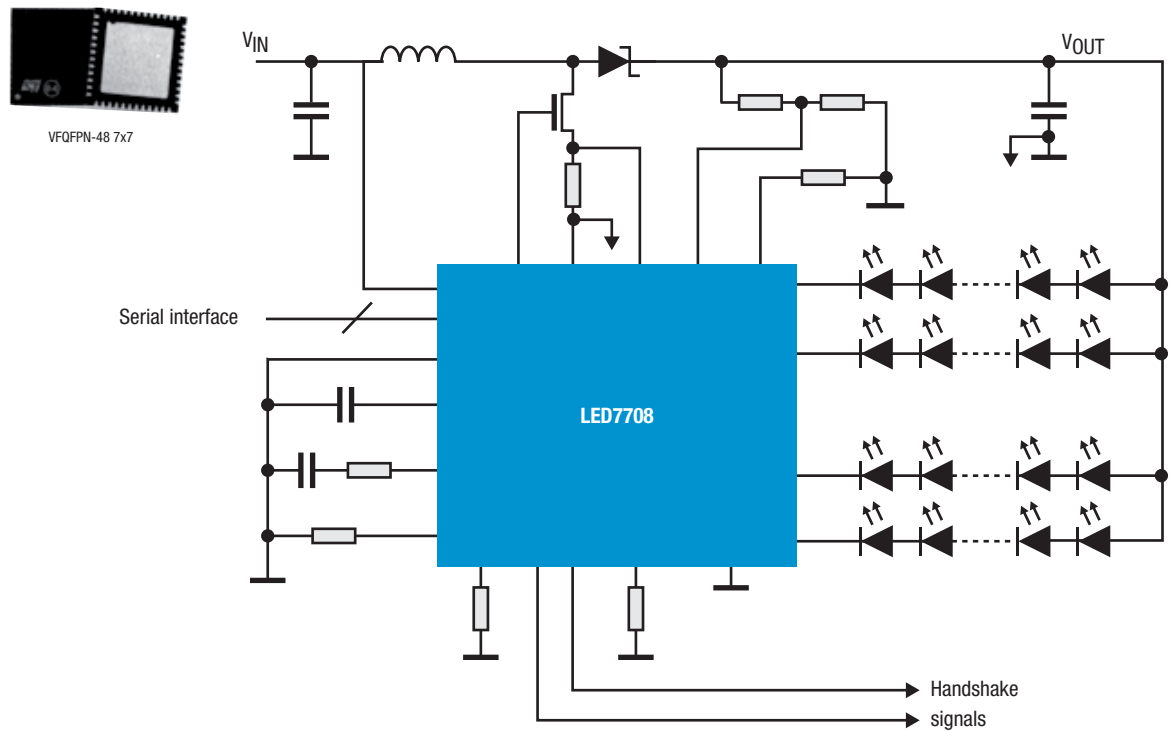
Advanced backlight features

The advanced features enable it to support both local dimming and scanning backlights, and enhanced active LED fault management allows real-time status monitoring to prevent backlight damage through automatic string disconnection

Targeted applications

- TV and monitor backlight units for LCD panels
- Medium- and large-size LCD panel backlighting
- RGB/RGGB backlight solutions

Application diagram

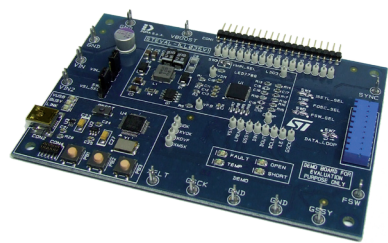


LED7708 product table

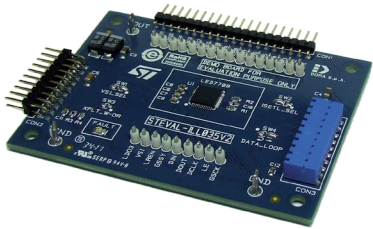
Part number	V_{IN} (V)	V_{OUT} (V)	I_{CH} (mA)	Channels	Interface	Local dimming	I_{CH} adj	Package
LED7708	3.6 to 36	Up to 60	Up to 85	16	4-wire SI	12/16-bit PWM	200 to 1000	VFQFPN-48 7x7

Evaluation boards

Part number	Description	Related documentation
STEVAL-ILL035V1	LED7708 16-row, up to 85 mA master board LED driver with boost converter	
STEVAL-ILL035V2	LED7708 16-row, up to 85 mA slave board LED driver	

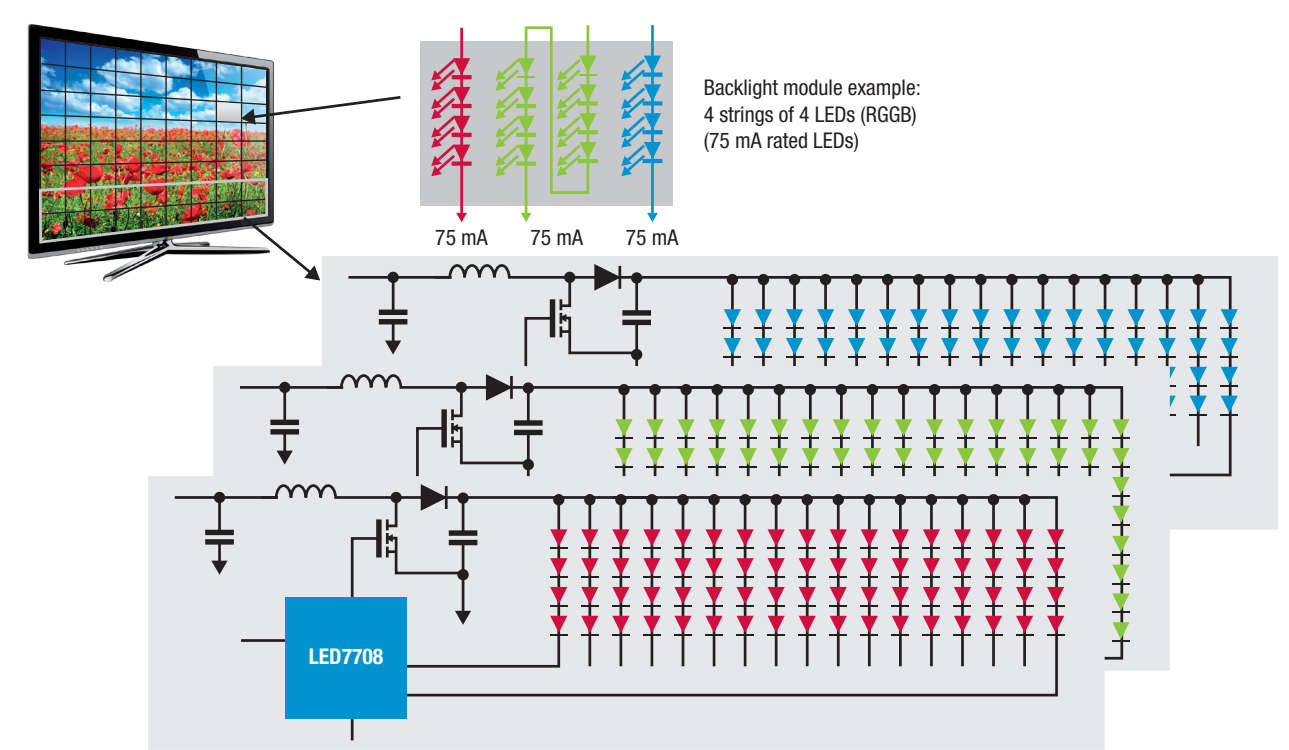


STEVAL-ILL035V1 (master)



STEVAL-ILL035V2 (slave)

LED7708 application example: RGGB Backlight





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