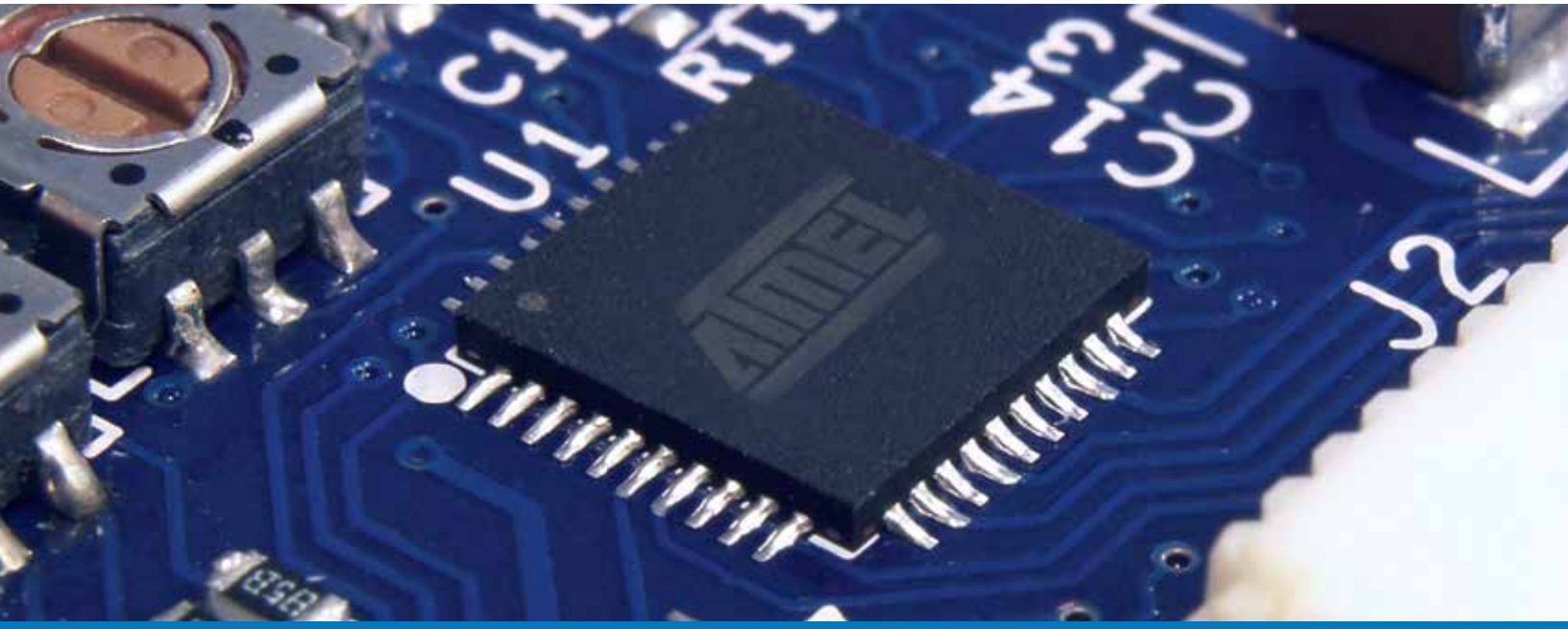
Atmel®



Atmel LED Driver Technology

Smart LED Power Management for
Efficiency, Programmability and Scalability

Atmel LED Driver Technology

Atmel® LED drivers offer system-centric, mixed-signal LED driver ICs for the backlighting and solid-state lighting markets. This broad-based and rapidly growing market includes LCD TVs, PC monitors, specialty panels (industrial, military, medical, avionics, etc.) and general illumination (commercial, residential, industrial and government).

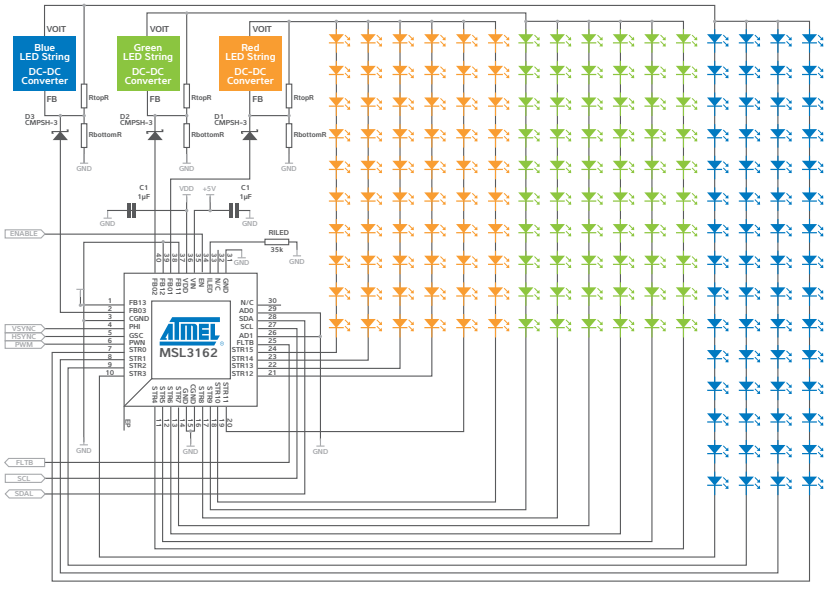
Our LED drivers utilize a proprietary and patented combination of analog and digital circuit techniques. The products provide solutions for local and global dimming, power management, signal conditioning and smart interfacing. Using these drivers, electronic equipment manufacturers can significantly enhance product features, while improving power efficiency, reliability and cost/performance.

Multi-string Solution

Our compact, high-power LED drivers are ideal for multi LED string applications such as direct backlight/edge-lit LCD panels and high-brightness solid-state lighting applications. The LED drivers consist of three product families:

- The highest integration LED driver family offers internal boost controller and internal current control MOSFET to sink up to 30mA per string. These devices can drive up to 6 strings with up to 12 white LEDs per string, for a total of 72 LEDs per device, scalable up to 4 devices. These solutions address the design simplicity, small BOM and internal digital compensation requirements of the notebook, industrial and medical LCD panel markets.
- The second LED driver family offers efficiency, power, controllability and programmability, all in one compact solution. These devices adaptively control the DC-DC/AC-DC converters that power the LED strings, using Atmel's Efficiency Optimizer technology. These Efficiency Optimizers minimize power consumption while maintaining LED current accuracy. The high-power LED string drivers use internal current control MOSFETs to sink up to 100mA per string, and can drive 16 parallel strings of 10 white LEDs each, for a total of 160 white LEDs per device. Sixteen interconnected devices control up to 2,560 white LEDs. Each string can be controlled individually to enable area (zone) dimming for highest dynamic range and significantly reduced power usage. These devices address direct backlight LCD panels and monitor applications.
- The third LED driver family also features Efficiency Optimizer technology, but uses external current control MOSFETs to sink up to 1A per string. The devices can drive up to eight parallel strings of LEDs and offer fault detection and management of open-circuit and short-circuit LEDs. These devices address the edge-lit and high-brightness solid-state lighting applications which require higher power as well as dimming via either external PWM signals or an analog current adjustable with an internal 8-bit DAC.

Typical Application Circuit for RGB Lighting/Backlighting



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Efficiency Optimizer

The Efficiency Optimizer technology consists of proprietary circuitry which controls a wide range of different architectures of external DC/DC and AC/DC converters. Multiple drivers in a system communicate with each other in real time to select an optimized operating voltage for the LEDs. This allows you to design the power supply for the worst case LED forward voltage (V_f) without worrying about excessive power dissipation issues.

During the start-up sequence, the LED drivers automatically reduce the power supply voltage to the minimum voltage required to keep the LEDs in current regulation. The devices can be configured to periodically perform this optimization to compensate for changes in the LED forward voltage, and to assure continued optimum power savings.

Programmability

An on-chip E^2PROM holds all the default control register values. At power-up, the data in the E^2PROM automatically copies directly to the control registers, setting up the device for operation.

Scalability

A number of LED drivers feature a 20MHz SPI serial interface, or 1MHz I^2C serial interface. Both interfaces support video frame-by-frame LED string intensity control for up to 16 interconnected devices to allow active area dimming. The devices include an advanced PWM engine that easily synchronizes to a video signal, and per-string phase adjustment to reduce unwanted LCD artifacts such as motion blur.

Atmel LED Driver Parametric Table

Atmel's LED Driver Ics																
				Strings						Dimming						
										String Current		String PWM				
Part Number	Application	DC/DC EO	Boost	#	FETs	Istr	# of LEDs Per String	Matching Max	Fault Detec	Global	Per String	Global	Per String	String Phasing	External VSYNC	Interface
MSL1060	Notebooks, Industrial and Medical	-	internal 1.1MHz	6	Internal	30mA	12	1.5%	OC, SC	4 bits + R	-	8 bits	-	-	-	PWM
MSL1061											-		-	-	-	I^2C
MSL1064											-		-	-	-	-
MSL2041	Edgelit and Solid State Lighting	1	External	4	External	1A	DENR	2.2%	OC, SC	4 bits + R	-	8 bits	-	Auto	=PWM	4 PWM
MSL2042		1		4							-		-	Auto	=PWM	PWM
MSL2100		3		8				1.0%			-		-	8 bits	Yes	I^2C
MSL3082		1		8							-		-	8 bits	Yes	I^2C
MSL3085		1		8				1.5%		R	-		-	12 bits	Yes	I^2C
MSL2160		3		16						8 bits	-		12 bits	12 bits	Yes	SPI
MSL3162	Direct Backlight	3	External	16	Internal	100mA	10	3%	OC, SC	R	8 bits	6 bits	8 bits	8 bits	Yes	I^2C
MSL3163		3		16						8 bits + R	8 bits	8 bits	12 bits	12 bits	Yes	I^2C
MSL3164		3		16						8 bits + R	8 bits	8 bits	12 bits	12 bits	Yes	SPI
MSL3165A	Monitor	1		16		30mA				R	-	-	PWM	-	=PWM	PWM I^2C
MSL3166A		1		16						R	-	-	PWM	Auto	=PWM	PWM I^2C
MSL3167		1		16						R	-	-	PWM	-	=PWM	PWM I^2C
MSL3168		1		16						R	-	-	PWM	Auto	=PWM	PWM I^2C
MSL4164		1		16		60mA				R	-	-	PWM	Auto	=PWM	PWM I^2C

EO=Effeciency Optimizer, DENR=Determine by External NFET Ratings, OC=Open Circuit, SC=Short Circuit, R=External Resistor

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