

3-Channel Constant-Current RGB LED Driver with Individual PWM Dimming

CAT4109, CAV4109

Description

The CAT4109/CAV4109 is a 3-channel constant-current LED driver, requiring no inductor. LED channel currents up to 175 mA are programmed independently via separate external resistors. Low output voltage operation of 0.4 V at 175 mA allows for more power efficient designs across wider supply voltage range. The three LED pins are compatible with high voltage up to 25 V supporting applications with long strings of LEDs.

Three independent control inputs PWM1, PWM2, PWM3, control respectively LED1, LED2, LED3 channels. The device also includes an output enable (OE) control pin to disable all three channels independently of the PWMx input states.

Thermal shutdown protection is incorporated in the device to disable the LED outputs whenever the die temperature exceeds 150°C.

The device is available in a 16-lead SOIC package.

Features

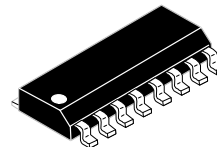
- 3 Independent Current Sinks up to 175 mA rated 25 V
- LED Current Set by External Low Power Control Resistors
- Individual PWM Control per Channel
- Low Dropout Current Source (0.4 V at 175 mA)
- Output Enable Input for Dimming
- “Zero” Current Shutdown Mode
- 3 V to 5.5 V Logic Supply
- Thermal Shutdown Protection
- 16-lead SOIC Package
- CAV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Application

- Multi-color LED, Architectural Lighting
- LED Signs and Displays
- LCD Backlight

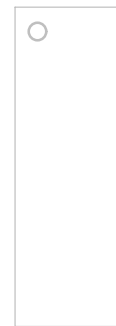


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SOIC-16
V SUFFIX
CASE 751BG

PIN CONNECTIONS



MARKING DIAGRAM



CAT4109, CAV4109

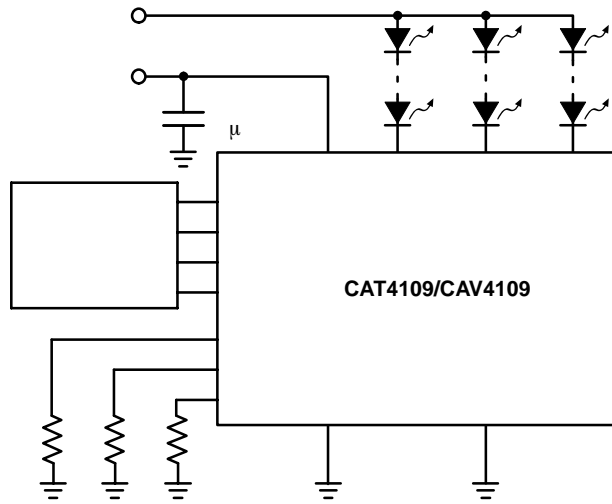


Figure 1. Typical Application Circuit

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Units
	-	
	-	°
	-	°
		°

ESD RATING

CAT4109, CAV4109

Table 3. ELECTRICAL OPERATING CHARACTERISTICS

Symbol	Name	Conditions	Min	Typ	Max	Units
DC CHARACTERISTICS						
		Ω				
		Ω				
		Ω				
		Ω				
						μ
			-			μ
	-					Ω
			-			μ
						°
						°

Table 4. RECOMMENDED TIMING

Symbol	Name	Conditions	Min	Typ	Max	Units
	-					μ
	-					
	-					
						μ
						μ

CAT4109, CAV4109

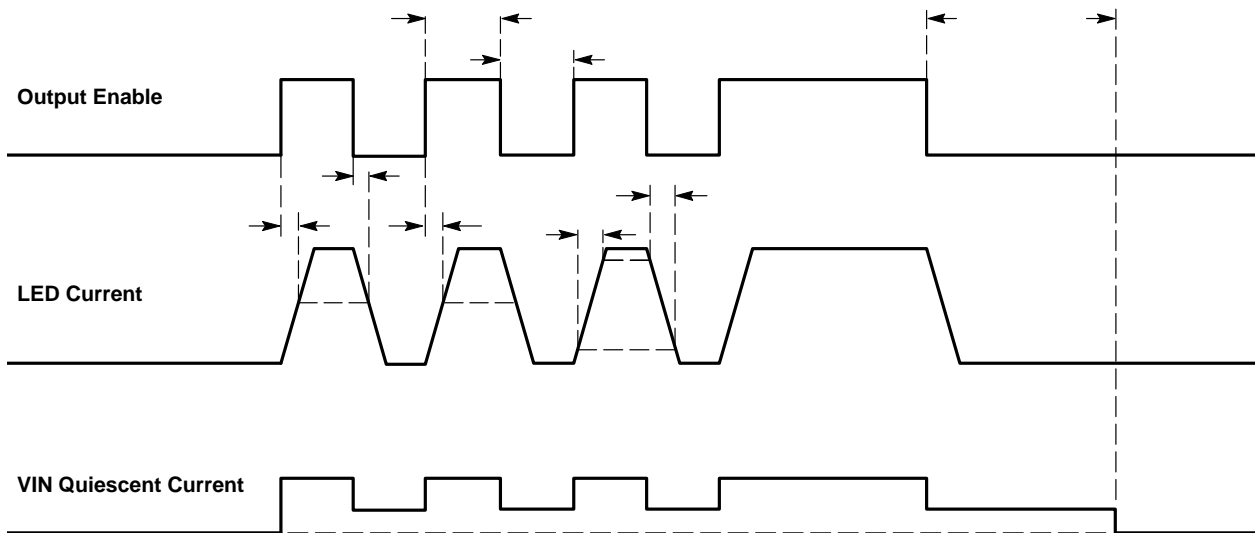


Figure 2. CAT4109/CAV4109 OE Timing

OE Operation

The Output Enable (OE) pin has two primary functions. When the OE input goes from high to low, all three LED channels are turned off. If OE remains low for longer than t_{PWRDWN} , the device enters shutdown mode drawing “zero current” from the supply.

The OE input can be used to adjust the contrast of the RGB LED by applying an external PWM signal. The device has a very fast turn-on time (from OE rising to LED on) allowing “instant on” when dimming LEDs.

When applying PWM signals to the three PWMx inputs and using the OE pin for dimming, the OE PWM frequency should be much lower to preserve the color mixing.

Accurate linear dimming on OE is compatible with PWM frequencies from 100 Hz to 5 kHz for PWM duty cycle down to 1%. PWM frequencies up to 50 kHz can be supported for duty cycles greater than 10%.

When performing a combination of low frequencies and small duty cycles, the device may enter shutdown mode. This has no effect on the dimming accuracy, because the turn-on time t_{PS} is very short, in the range of 1 μ s.

To ensure that PWM pulses are recognized, pulse width low time t_{LO} should be longer than 1 μ s. The driver enters a “zero current” shutdown mode after a 4 ms delay (typical) when OE is held low.

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TYPICAL PERFORMANCE CHARACTERISTICS

CAT4109, CAV4109

TYPICAL PERFORMANCE CHARACTERISTICS

μ °

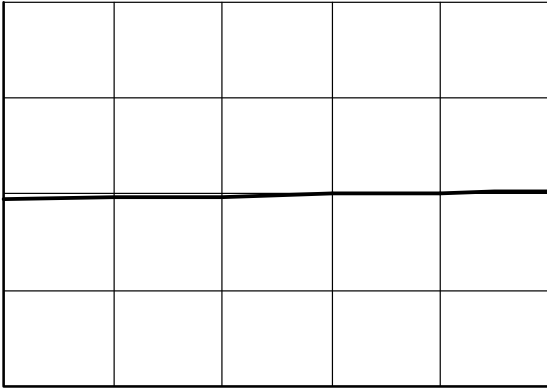


Figure 9. RSET Pin Voltage vs. Input Voltage

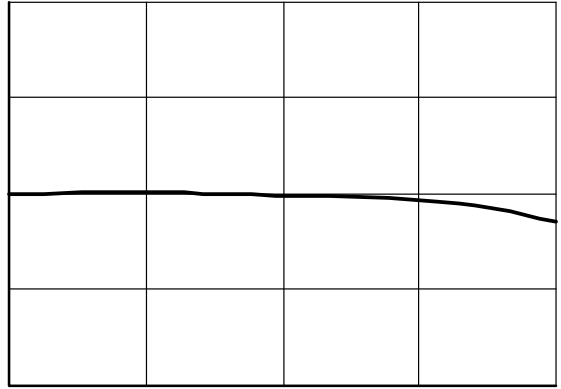


Figure 10. RSET Pin Voltage vs. Temperature

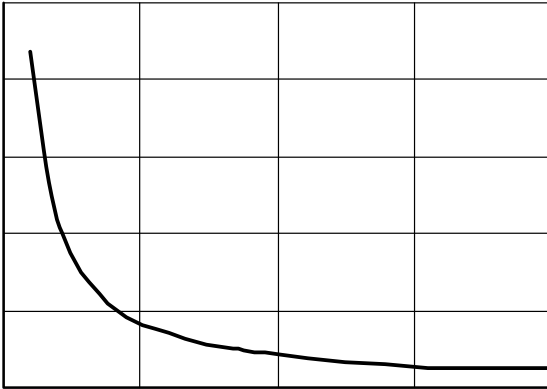


Figure 11. LED Current vs. RSET Resistor



Figure 12. OE Transient Response at 1 kHz

Ω

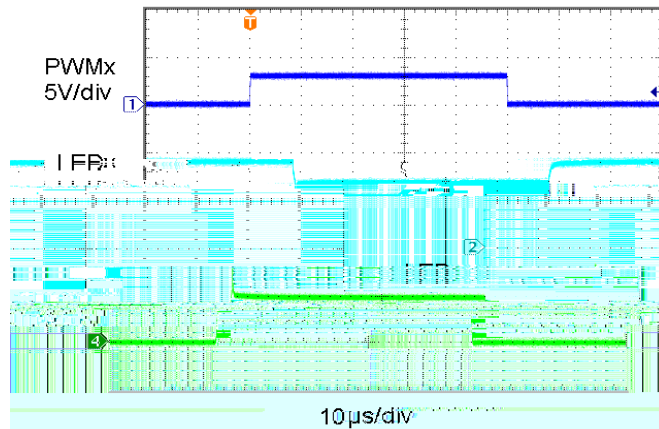


Figure 13. PWMx Transient Response

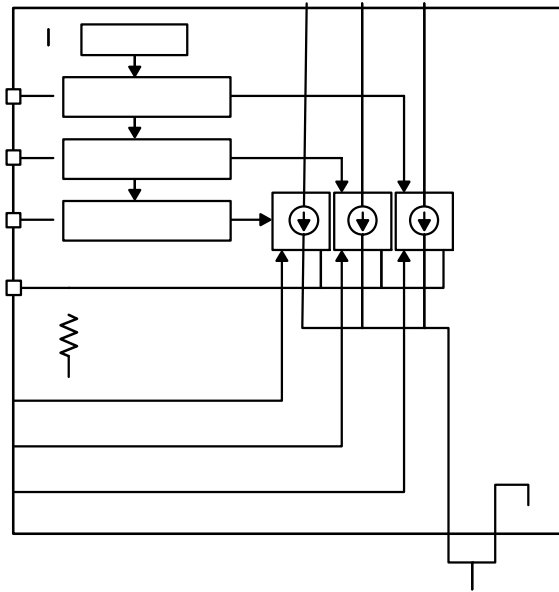
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Table 5. PIN DESCRIPTIONS

Name	Pin Number	Function

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BLOCK Diagram



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Application Information

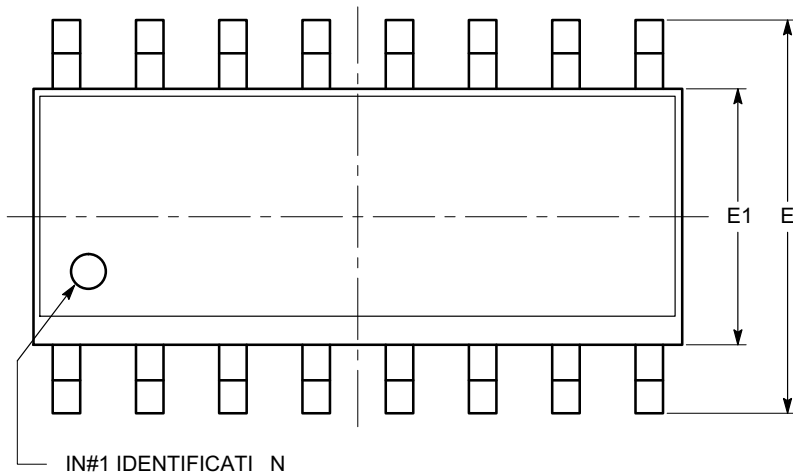
Power Dissipation

The power dissipation (P_D) of the CAT4109/CAV4109 can be calculated as follows:

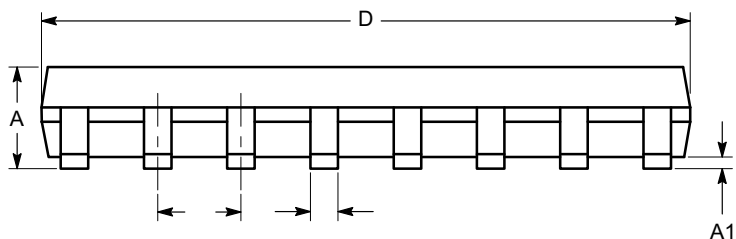
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SOIC-16, 150 mils
CASE 751BG-01
ISSUE O

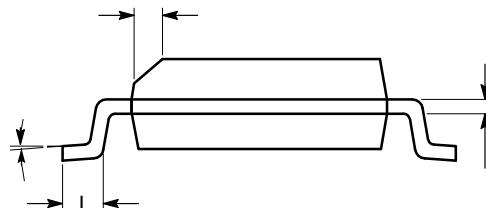
DATE 19 DEC 2008



TOP VIEW



SIDE VIEW



END VIEW

Notes:

- (1) All dimensions are in millimeters. All dimensions are in millimeters.
- (2) Compliance with JEDEC MS-012.

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