

8-Channel Constant Current LED Driver

CAT4008

Description

The CAT4008 is an 8 channel constant current driver for LED billboard and other general display applications. LED channel currents are programmed together via an external RSET resistor. Low output voltage operation on the LED channels as low as 0.4 V (for 2 to 100 mA LED current) allows for more power efficient designs.

A high–speed 4–wire serial interface of up to 25 MHz clock frequency controls each individual channel using a shift register and latch configuration. A serial output data pin (SOUT) allows multiple devices to be cascaded and programmed via one serial interface. The device also includes a blanking control pin (BLANK) that can be used to disable all channels independently of the interface.

Thermal shutdown protection is incorporated in the device to disable the LED outputs if the die temperature exceeds a set limit.

The device is available in the TSSOP package.

Features

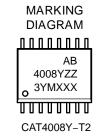
- 8 Constant Current-sink Channels
- Serial Interface up to 25 MHz Clock Frequency
- 3 V to 5.5 V Logic Supply
- LED Current Range from 2 mA to 100 mA
- LED Current set by External RSET Resistor
- 300 mV LED Dropout at 30 mA
- Thermal Shutdown Protection
- Available in 16–lead SOIC (150 and 300 mil wide), and TSSOP Packages
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

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Applications

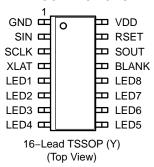
- Billboard Display
- Marquee Display
- Instrument Display
- General Purpose Display





A = Assembly Location
3 = Lead Finish - Matte-Tin
B = Product Revision (Fixed as "B")
4008Y = Device Code
Z or ZZ = Leave Blank
Y = Production Year (Last Digit)
M = Production Month (1-9, O, N, D)
XXX or XXXX = Last Three of Four Digits of
Assembly Lot Number

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

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Table 3. ELECTRICAL OPERATING CHARACTERISTICS (V_{DD} = 5.0 V, T_{AMB} = 25° C, over recommended operating conditions unless specified otherwise.)

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Symbol	Name	Conditions	Min	Тур	Max	Units
DC CHARA	CTERISTICS	•				
I _{LED-ACC}	LED Current (any channel)	V_{LED} = 1 V, R_{SET} = 3.08 k Ω	18	20	22	mA
		V_{LED} = 1 V, R_{SET} = 1.54 k Ω	36	40	44	
		V_{LED} = 1 V, R_{SET} = 769 Ω		80		1
I _{LED-MAT}	LED Current Matching (I _{LED} – I _{LEDAVR}) / I _{LEDAVR}	V_{LED} = 1 V, R_{SET} = 3.08 k Ω		±1.5		%
		V_{LED} = 1 V, R_{SET} = 1.54 k Ω	-6.0	±1.5	+6.0	
		V_{LED} = 1 V, R_{SET} = 769 Ω		±2.0		1
ΔI_{VDD}	LED current regulation vs. V _{DD}	V _{DD} within 4.5 V and 5.5 V LED current 30 mA		±0.1		% / V
ΔI_{VLED}	LED current regulation vs. V _{LED}	V _{LED} within 1 V and 3 V LED current 30 mA		±0.05		% / V
I _{DDOFF}		LED current 30 mA				

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Table 4. TIMING CHARACTERISTICS (For 3.0 V \leq V_{DD} \leq 5.5 V, T_{AMB} = 25°C, unless specified otherwise.)

Symbol	Name	Conditions	Min (Note 1)	Typ (Note 2)	Max (Note 1)	Units
CLK						
f _{clk}	CLK Clock Frequency				25	MHz
t _{cwh}	CLK Pulse Width High		20			ns
t _{cwl}	CLK Pulse Width Low		20			ns
SIN						
t _{ssu}	Setup time SIN to CLK		4			ns
t _{sh}	Hold time SIN to CLK		4			ns
LATCH						
t _{lwh}	LATCH Pulse width		20			ns
T _{lh}	Hold time LATCH to CLK		4			ns
T _{Isu}	Setup time LATCH to CLK	Channel Stagger Delay	400			ns
LEDn						
t _{ld}	LED1 Propagation delay	LATCH to LED1 off/on		40	300	ns
t _{ls}	LED Propagation delay stagger	LED(n) to LED(n+1)		17	40	ns
t _{lst}	LED Propagation delay stagger total	LED1 to LED8		120		ns
t _{bd}	BLANK Propagation delay	BLANK to LED(n) off/on		60	300	ns
t _{lr}	LED rise time (10% to 90%)	Pull–up resistor = 50Ω to $3.0 V$		40	200	ns
t _{lf}	LED fall time (90% to 10%)	Pull–up resistor = 50Ω to $3.0 V$		30	250	ns
SOUT						
t _{or}	SOUT rise time (10% to 90%)	C _L = 15 pF		5		ns
t _{of}	SOUT fall time (90% to 10%)	C _L = 15 pF		5		ns
t _{od}	Propagation delay time SOUT	CLK to SOUT	8	15	25	ns

All min and max values are guaranteed by design.
 V_{DD} = 5 V, LED current 30 mA.

Figure 2. Test Circuit for AC Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

(V_{DD} = 5.0 V, LED CURRENT 30 MA, ALL LEDS ON, T_{AMB} = 25°C UNLESS OTHERWISE SPECIFIED.)

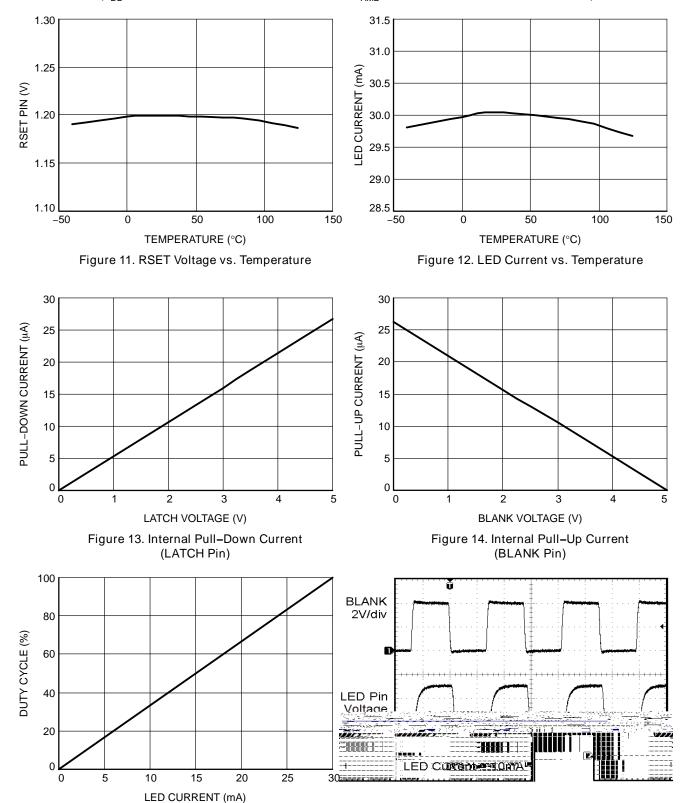


Figure 15. PWM Dimming on BLANK Pin (f = 10 kHz)

Figure 16. BLANK Transient Response

Table 5. PIN DESCRIPTION

Name	Function	
GND	Ground	
SIN	Serial data input pin	
CLK	Serial clock input pin	
LATCH	Latch serial data to output registers	
LED1-LED8	LED channel 1 to 8 cathode terminals	
BLANK	Enable / disable all channels	
SOUT	Serial data output pin.	
RSET	LED current set pin	
VDD	Positive supply Voltage	

PIN FUNCTION

GND is the ground reference pin for the device. This pin must be connected to the ground plane on the PCB.

SIN is the serial data input. Data is loaded into the internal register on each rising edge of CLK.

CLK is the serial clock input. On each rising CLK edge, data is transferred from SIN to the internal 8-bit serial shift register.

LATCH is the latch data input. On the rising edge of LATCH, data is loaded from the 8-bit serial shift register into the output register latch. On the falling edge, this data is latched in the output register and isolated from the state of the serial shift register.

LED1 – LED8 are the LED current sink channels. These pins are connected to the LED cathodes. The current sinks drive the LEDs with a current equal to about 51 times RSET pin current. For the LED sink to operate correctly, the voltage on the LED pin must be above 0.4 V.

CURRENT SETTING RESISTOR

Table 6 lists standard resistor values for various LED current settings.

Table 6. LED CURRENT

BLANK is the LED channel enable and disable input pin. When low, LEDs are enabled according to the output latch register content. When high, all LEDs are off, while preserving the data in the output latch register.

SOUT is the serial data output of the 8-bit serial shift register. This pin is used to cascade several devices on the serial bus. The SOUT pin is then connected to the SIN input of the next device on the serial bus to cascade.

RSET is the LED current setting pin. A resistor is connected between this pin and ground. Each LED channel current is set to about 51 times the current pulled out of the pin. The RSET pin voltage is regulated to 1.2 V.

VDD is the positive supply pin voltage for the entire device. A small 1 μ F ceramic is recommended close to pin.

BLOCK DIAGRAM

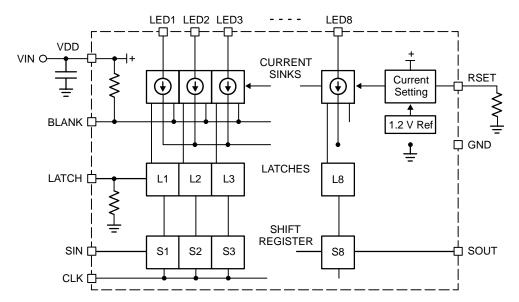


Figure 17. CAT4008 Functional Block Diagram

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