

16-Channel Constant Current LED Driver

CAT4016, CAV4016

Description

The CAT4016 is a 16 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 24-lead TSSOP and the compact TQFN 4 x 4 mm packages.

Features

- 16 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 24-lead TSSOP and 4 x 4 mm TQFN Packages
- 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

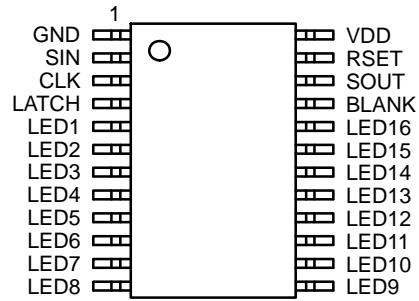
Applications

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

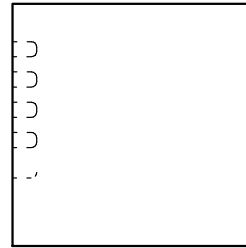
MARKING DIAGRAMS

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PIN CONNECTIONS



24-Lead TSSOP (Y)



24-Lead TQFN (HV6)

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Table 3. ELECTRICAL OPERATING CHARACTERISTICS

($V_{DD} = 5.0\text{ V}$, $T_{AMB} = 25^{\circ}\text{C}$, over recommended operating conditions unless specified otherwise.)

Symbol	Name	Conditions	Min	Typ	Max	Units
DC CHARACTERISTICS						
$I_{LED-ACC}$	LED Current (any channel)	$V_{LED} = 1\text{ V}$, $R_{SET} = 3\text{ k}\Omega$	18	20	22	mA
		$V_{LED} = 1\text{ V}$, $R_{SET} = 1.5\text{ k}\Omega$	36	40	44	
		$V_{LED} = 1\text{ V}$, $R_{SET} = 750\ \Omega$		80		
$I_{LED-MAT}$	LED Current Matching ($I_{LED} - I_{LEDAVR}$) / I_{LEDAVR}	$V_{LED} = 1\text{ V}$, $R_{SET} = 3\text{ k}\Omega$		± 1.5		%
		$V_{LED} = 1\text{ V}$, $R_{SET} = 1.5\text{ k}\Omega$	-6.0	± 1.5	+6.0	
		$V_{LED} = 1\text{ V}$, $R_{SET} = 750\ \Omega$		± 2.0		
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}	Supply Current (all outputs off)	$R_{SET} = 3\text{ k}\Omega$		3	8	mA
		$R_{SET} = 750\ \Omega$		8.5		

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Table 4. TIMING CHARACTERISTICS

(For $3.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$, $T_{AMB} = 25^\circ\text{C}$, 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_{cw}h0394 Tm-.0009 71 .9071 6 36.907 .9071 re9307 r5471 a49 655.2.907 .9071 ref240 M 6.320009 71 .907T8 0ef51

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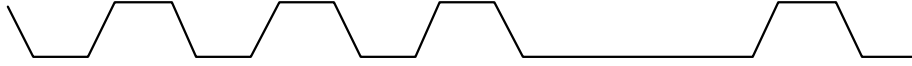


Figure 3. Serial Input Timing Diagram

TYPICAL PERFORMANCE CHARACTERISTICS

($V_{DD} = 5.0\text{ V}$, LED current 30 mA, all LEDs On, $T_{AMB} = 25^{\circ}\text{C}$ unless otherwise specified.)

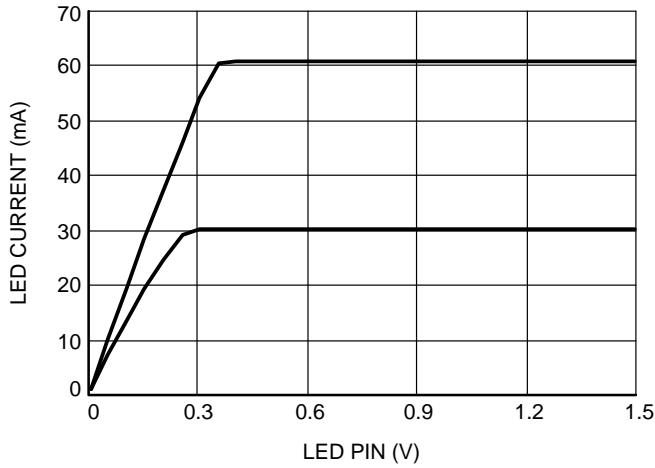


Figure 5. LED Current vs. LED Pin Voltage

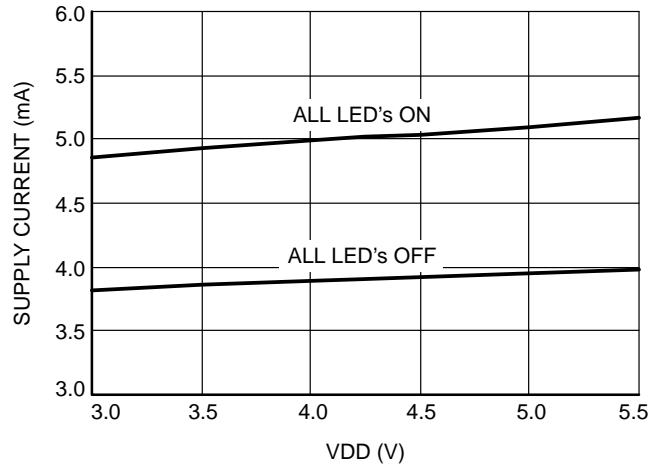


Figure 6. Supply Current vs. VDD Pin Voltage

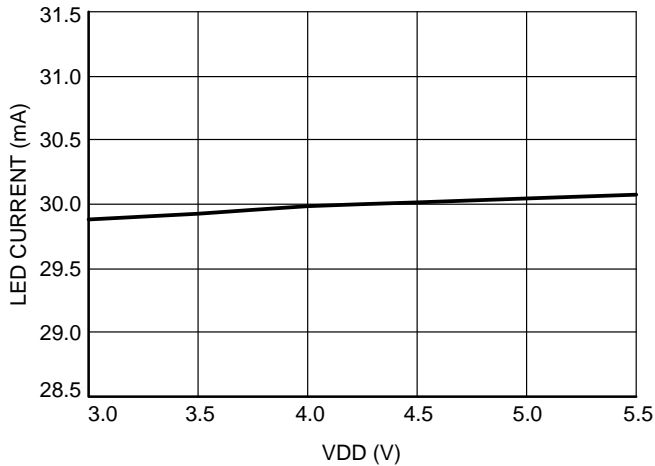


Figure 7. LED Current vs. VDD Pin Voltage

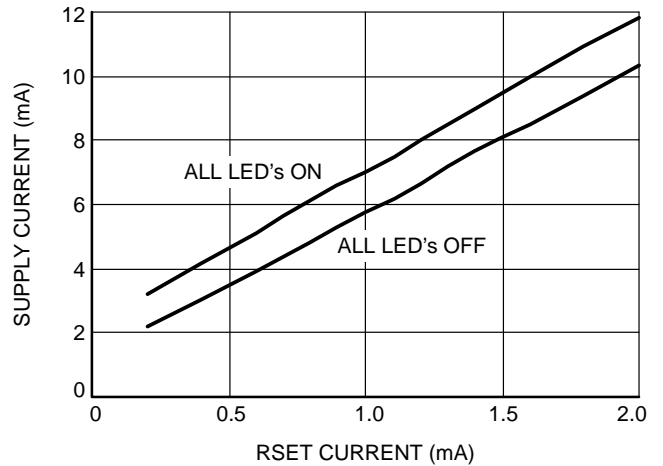


Figure 8. Supply Current vs. RSET Current

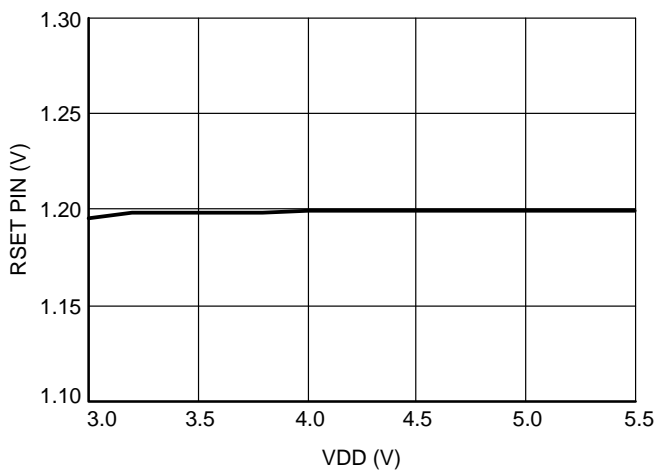


Figure 9. RSET Voltage vs. VDD Pin Voltage

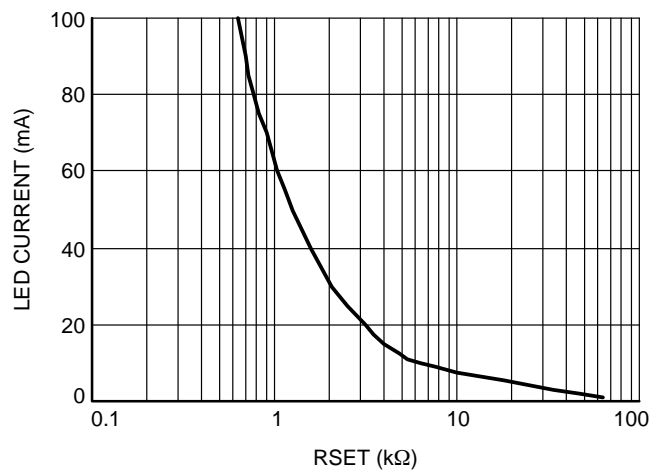
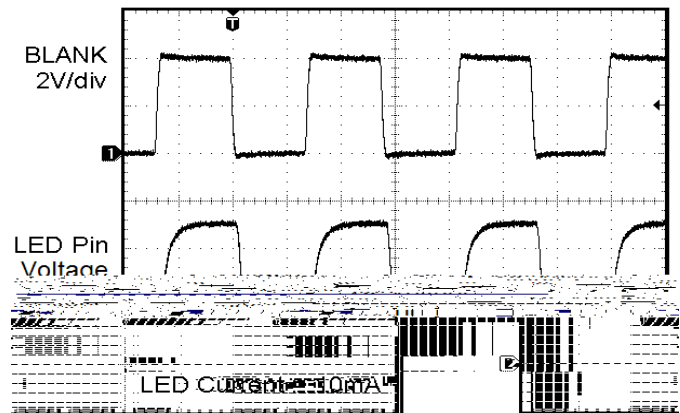
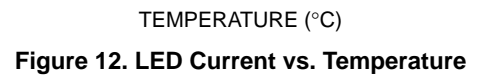
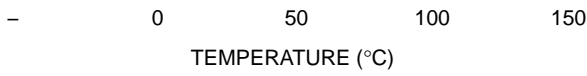


Figure 10. LED Current vs. RSET Resistor

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TYPICAL PERFORMANCE CHARACTERISTICS

($V_{DD} = 5.0\text{ V}$, LED current 30 mA, all LEDs On, $T_{AMB} = 25^\circ\text{C}$ unless otherwise specified.)



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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–LED16	LED channel 1 to 16 cathode terminals
BLANK	Enable / disable all channels
SOUT	Serial data output pin.
RSET	

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Block Diagram

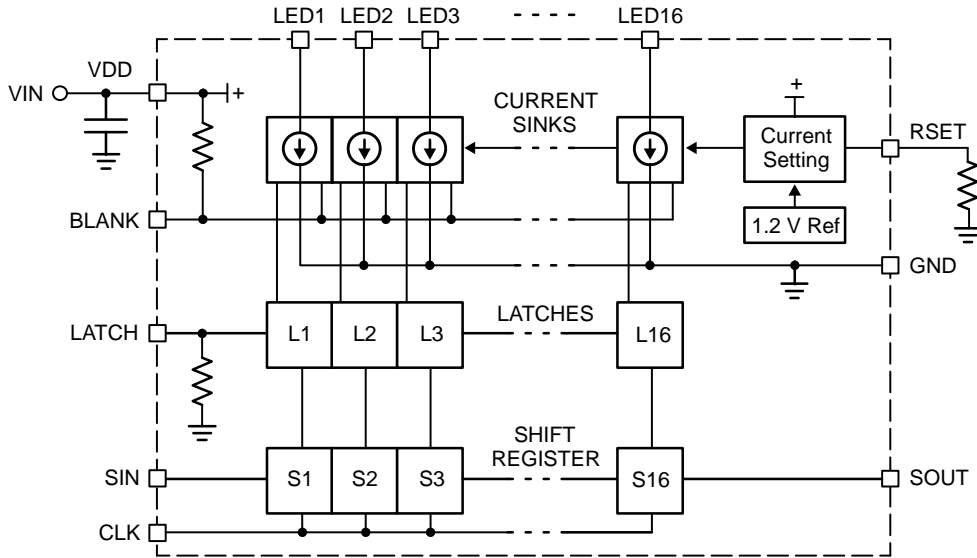


Figure 17. CAT4016 Functional Block Diagram

Basic Operation

The CAT4016 uses 16 tightly matched current sinks to accurately regulate the LED current in each channel. The external resistor, R

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Table 6. ORDERING INFORMATION

Part Number	Package Marking	Package	Shipping†
CAT4016Y-T2	CAT4016Y	TSSOP24 (Note 7) (Pb-Free)	2000 / Tape & Reel
CAT4016HV6-T2	LAAA	TQFN24 (Note 7) (Pb-Free)	2000 / Tape & Reel
CAV4016HV6-T2 (Note 3)	VAAA	TQFN24 (Note 7) (Pb-Free)	2000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizePF†

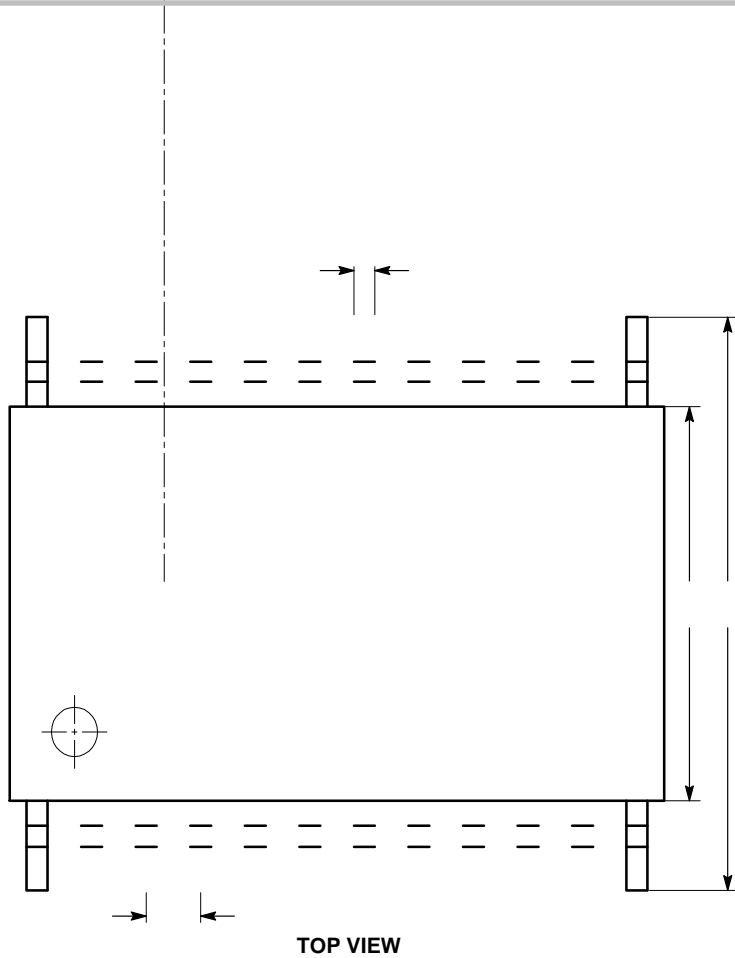
TSSOP24, 4.4x7.8
CASE 948AR-01
ISSUE A

DATE 17 MAR 20090101

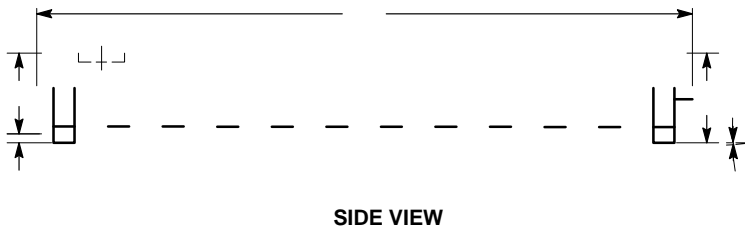
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Set
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SYMBOL	MIN	NOM	MAX
A			1.20
A1	0.05		0.15
A2	0.80		1.05
b	0.19		0.30
c	0.09		0.20
D	7.70	7.80	7.90
E	6.25	6.40	6.55
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.50	0.60	0.70
L1	1.00 REF		



Notes:

1. All dimensions are in millimeters.
2. Dimension A1 is measured to the top of the lead.
3. Dimension A2 is measured to the bottom of the lead.
4. Dimension L is measured to the end of the lead.
5. Dimension L1 is measured to the center of the lead.

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