Constant Current parallel LED Driver With PCC Brightness Control

DESCRIPTION

The SN3225 is capable of driving up to four channels of LEDs at 20mA per channel from a 2.7V to 5.5V input. The current sources may be operated individually or in parallel for driving higher current LEDs. A low external parts count makes this part ideally suited for small, battery-powered applications.

The PCC (Pulse Count Control) serial digital input is used to enable, disable, and set current for each LED with 8 settings.

A low-current shutdown feature disconnects the load from the input and reduces quiescent current to less than 3μA.

The SN3225 is available in a Pb-free, space-saving DFN-8 package.

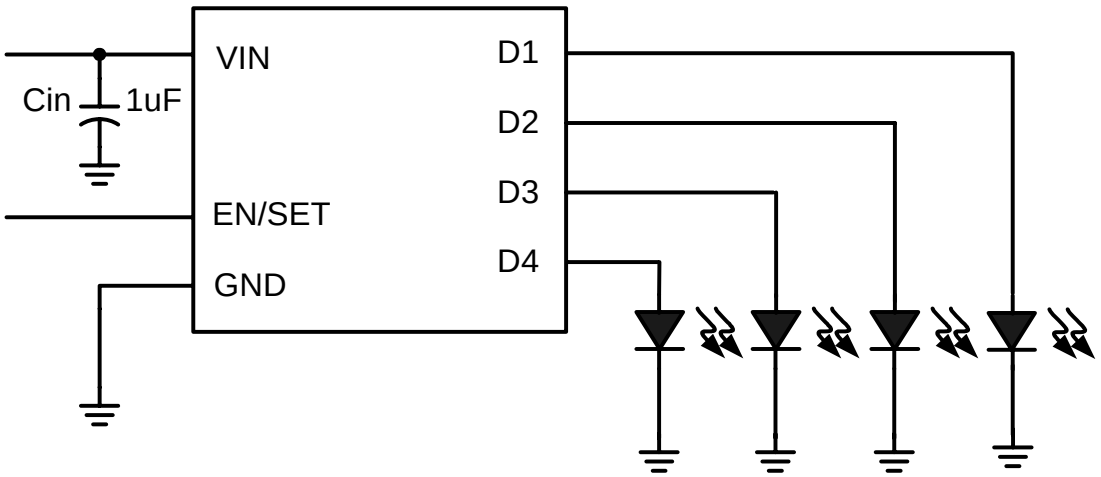
FEATURES

- V_{IN} Range: 2.7V to 5.5V
- Fully Programmable Current with Single Wire ——8 Curent Levels
- Drives up to Four Channels of LEDs
- No Inductors or charge pump, No Noise Operation
- Small Application Circuit
- Built-In Thermal Protection
- I_{SHDN} <3μA in Shutdown
- DFN-8 Package

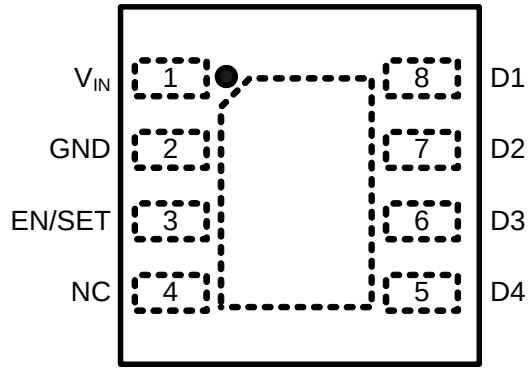
APPLICATIONS

- White LED Backlighting
- Color (RGB) Lighting
- Programmable Current sources
- White Photo Flash for Digital Still Cameras

TYPICAL APPLICATION CIRCUIT



Pin Configurations

Package	Pin Configurations(Top View)
DFN-8	

Pin Description

PIN	PIN	DESCRIPTION
VIN	1	Input power supply. Requires 1μF capacitor connected between this pin and ground.
GND	2	Ground.
EN/SET	3	PCC wire serial interface control pin.
D4	5	Current source output #4.
D3	6	Current source output #3.
D2	7	Current source output #2.
D1	8	Current source output #1.

Ordering Information

Order Number	Package Type	Marking	Operating Temperature range
SN3225JIR1	DFN-8	xxxxx 3225D	-40°C to 85°C

SN3225 □ □ □ □

Lead Free Code
1: Lead Free

Packing
R: Tape & Reel

Operating temperature range
I: Industry Standard

Package Type
J: DFN-8

Absolute Maximum Ratings

- Input Voltage to GND, V_{IN} ---------- -3 to 6V
- EN/SET Voltage to GND,$V_{EN/SET}$ ---------- -0.3 V to V_{DD} +0.3V
- Maximum DC Output Current, I_{OUT}[2] ----- 150mA
- Junction Temperature, T_J ---------- -40 to 150°C
- Maximum Soldering Temperature(at lead, 10 sec), T_{LEAD} ---------- 300°C
- Maximum Power Dissipation ---------- 0.625W
- Maximum Thermal Resistance θ_{JA} ------- 160°C/W

Electrical Characteristics

V_{IN} = 3.6V, C_{IN} = 1.0μF, T_A = 25°C, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Power Supply						
V_{IN}	Operation Range		2.7		5.5	V
I_D	Average Output Current of The 4 Channels	2.0V<V_{LED}< (V_{IN} -0.4V)	18	20	24	mA
$I_{(D-Match)}$	Current Matching	V_F :D1:D4=3.6V		±3		%
V_{HR}	Current Source Headroom Voltage	I_{LED} = 20mA		121		mV
I_Q	Quiescent Supply Current	I_{LED} = 20mA		466	600	uA
I_{SHDN}	Shutdown Current	$V_{EN/SET}$ = 0V		1	3	uA
EN/SET						
V_{EN-H}	EN/SET Input Logic High	2.7V<V_{IN}<5.5V	1.3		V_{IN}	V
V_{EN-L}	EN/SET Input Logic Low	2.7V<V_{IN}<5.5V	0		0.4	V
T_{EN/SET_LO}	EN/SET Low Time		0.3		75	us
T_{EN/SET_HI}	EN/SET High Time		0.05		75	us
T_{OFF}	EN/SET Off Timeout				500	us
T_{LAT}	EN/SET Latch Timeout				500	us
$R_{EN/SET}$	EN/SET Input Impedance			200		KΩ

Typical Operating Characteristics

V_{IN}=3.6V, T_A=25°V unless otherwise noted.

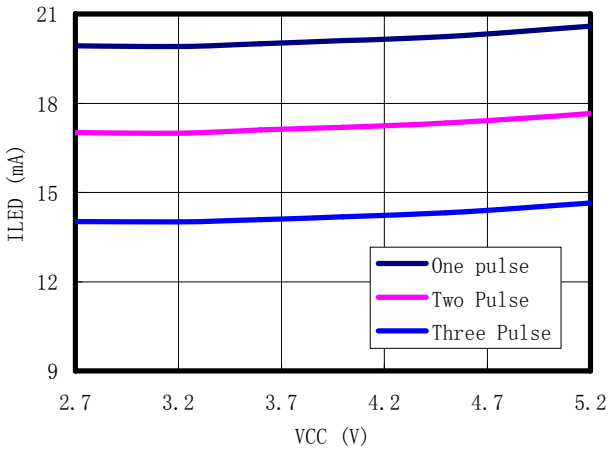


Figure 1. ILED vs. VCC

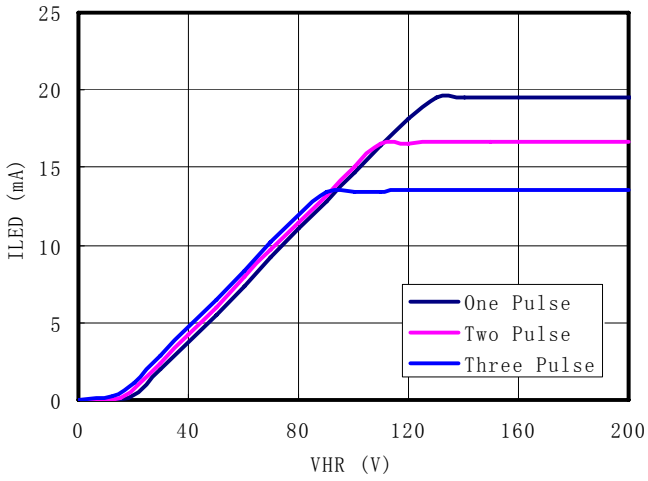


Figure 2. I_{LED} vs. V_{HR}

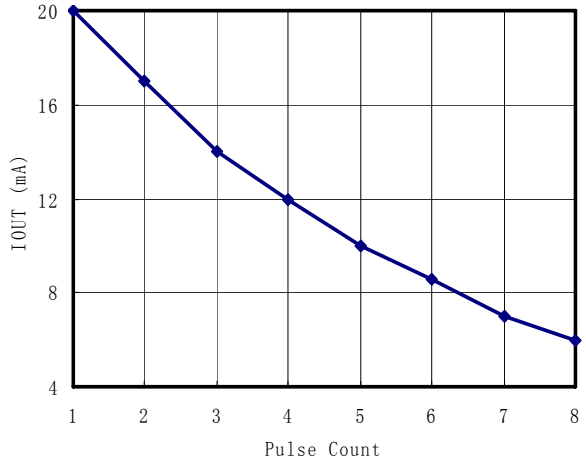


Figure 3. I_{OUT} vs. Pulse Count

Functional Description

The four constant current source outputs (D1 to D4) can drive four individual LEDs with a maximum current of 20mA each. The PCC wire serial interface enables the SN3225 and sets the current source magnitudes.

Constant Current Output Level Settings

The constant current source levels for D1 to D4 are set via the serial interface according to a logarithmic scale. For the whole 8 codes, each code is approximately 1.5dB lower than the previous code. In this manner, LED brightness appears linear with each increasing code count. Because the outputs D1 to D4 are true independent constant current sources, the voltage observed on any single given output will be determined by the actual forward voltage (VF) for the LED being driven.

Since the output current sources of the SN3225 are programmable, no PWM (pulse width modulation) or additional control circuitry is needed to control LED brightness. This feature greatly reduces the burden on a microcontroller or system IC to manage LED or display brightness, allowing the user to "set it and forget it." With its high-speed serial interface (1MHz data rate), the output current of the SN3225 can be changed successively to brighten or dim LEDs, in smooth transitions (e.g., to fade-out) or in abrupt steps, giving the user complete programmability and real-time control of LED brightness.

PCC wire Serial Interface

The current level magnitude is controlled by Pulse Count Control (PCC wire) serial interface. The interface records rising edges of the EN/SET pin and decodes them into 8 different states. The 8 current level settings available are indicated in Table 1.

Data	Output(mA/Ch)
1	20.0
2	17.0
3	14.0
4	12.0
5	10.0
6	8.6
7	7.0
8	6.0

Table 1: Current Level Settings.

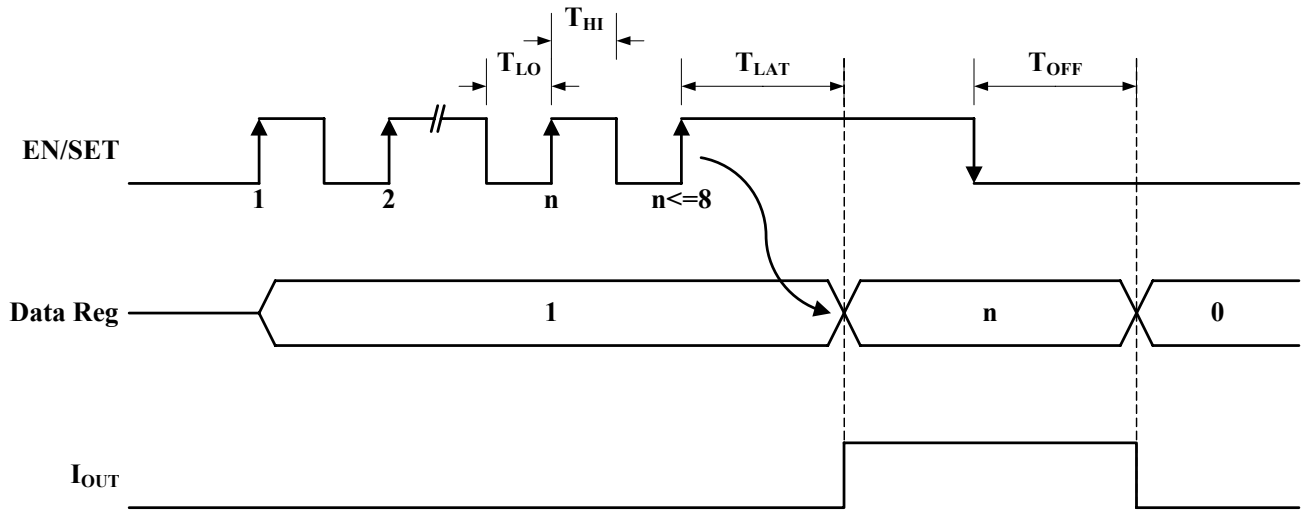
The PCC wire serial interface has flexible timing. Data can be clocked-in at speeds greater than 1MHz, or much slower, such as 15 kHz. After data is submitted, EN/SET is held high to latch the data. Once EN/SET has been held in the logic high state for time TLAT, the programmed current becomes active and the internal data register is reset to zero. For subsequent current level programming, the number of rising edges corresponding to the desired code must be entered on the EN/SET pin.

When EN/SET is held low for an amount of time greater than TOFF, the SN3225 enters into shutdown mode and draws less than 2μA from VIN. The internal data register is reset to zero during shutdown.

Thermal Protection

The SN3225 has a thermal protection circuit that will shut down the chip if the die temperature rises above the thermal limit.

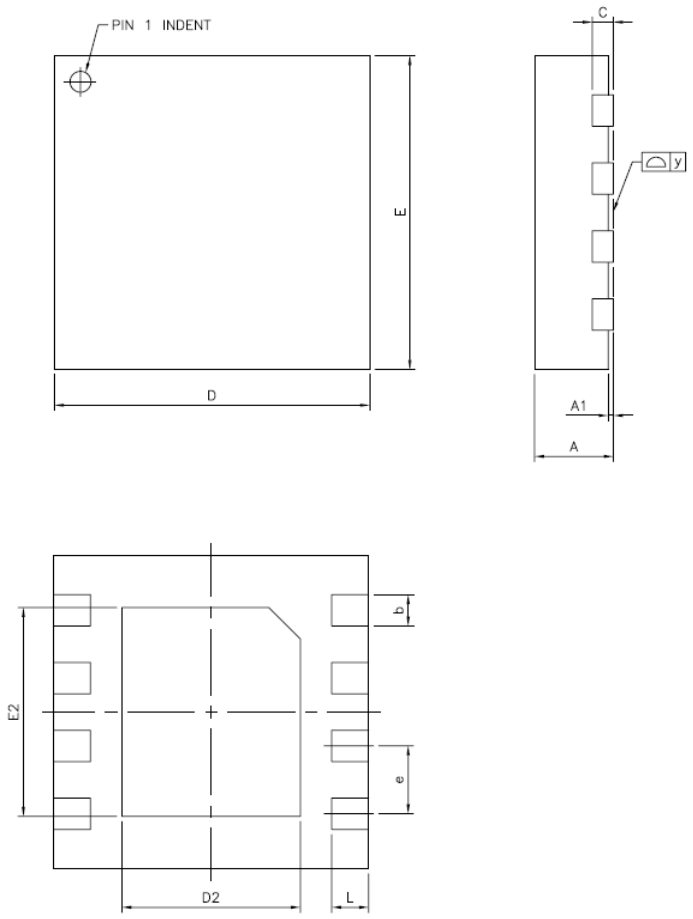
PCC wire Serial Interface Timing



Although the SN3225 is designed for driving white LEDs, the device also can be used to drive most types of LEDs with forward voltage specifications ranging from 2.0V to 4.7V. LED applications may include main and sub-LCD display backlighting, camera photo-flash applications, color (RGB) LEDs, infrared (IR) diodes for remotes, and other loads benefiting from a controlled output current generated from a varying input voltage. Since the D1 to D4 output current sources are matched with negligible voltage dependence, the LED brightness will be matched regardless of the specific LED forward voltage (VF) levels. In some instances (e.g., in high luminous output applications such as photo flash), it may be necessary to drive high-VF type LEDs. The low dropout current sources in the SN3225 make it capable of driving LEDs with forward voltages as high as 4.7V at full current from an input supply of 5.0V. Outputs can be paralleled to drive high-current LEDs without complication.

Packaging Information

DFN-8



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
b	0.25	0.30	0.35
C	——	0.20 REF.	——
D	2.90	3.00	3.10
D2	1.65	1.70	1.75
E	2.90	3.00	3.10
E2	1.95	2.00	2.05
e	——	0.65	——
L	0.30	0.35	0.40
y	0.00	——	0.075

NOTE

The thermal #1 identifier is a laser marked feature