

# BCT3119

## 9-Channel 64steps Constant-Current LED Driver with SPI Control

### General Description

The BCT3119 is a constant current driver incorporating shift register and data latch. This CMOS device is designed for LED display applications.

The max output constant current can be set using an external resistor, and 64 steps of current could be set through a SPI interface with MCU. Any channel output could have any step current levels.

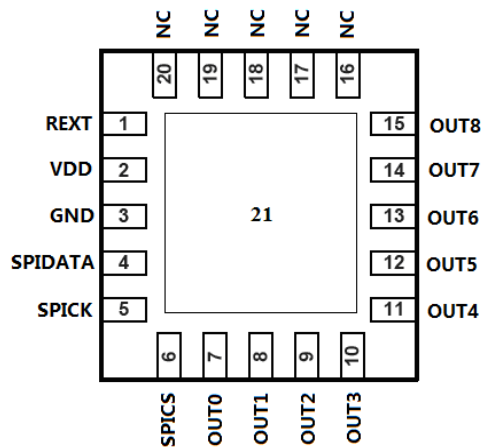
### Applications

- Cell Phones
- Multicolor LED lighting
- Display backlighting
- Toys/Mp3/Mp4/CD/minidiskplayers

### Features

- ◆ 9 channel constant-current outputs, up to 40mA each
- ◆ Each channel current could be controlled through a SPI interface with MCU
- ◆ Power-On Reset(POR), all register bits=0
- ◆ For common-anode LEDs
- ◆ High data input rate: < 20MHz
- ◆ 2.7V to 5.5V Supply Voltage Range
- ◆ RoHS Compliant and 100% Lead (Pb)-Free

### Pin Configurations (Top view)



### Ordering Information

| PART          | PIN-PACKAGE      | Temp-Range     | Top Mark |
|---------------|------------------|----------------|----------|
| BCT3119EGP-TR | QFN-20 ( 3x3mm ) | -40°C to +85°C | 3119     |

# 9-Channel 64steps Constant-Current LED Driver

## Functional Pin Description

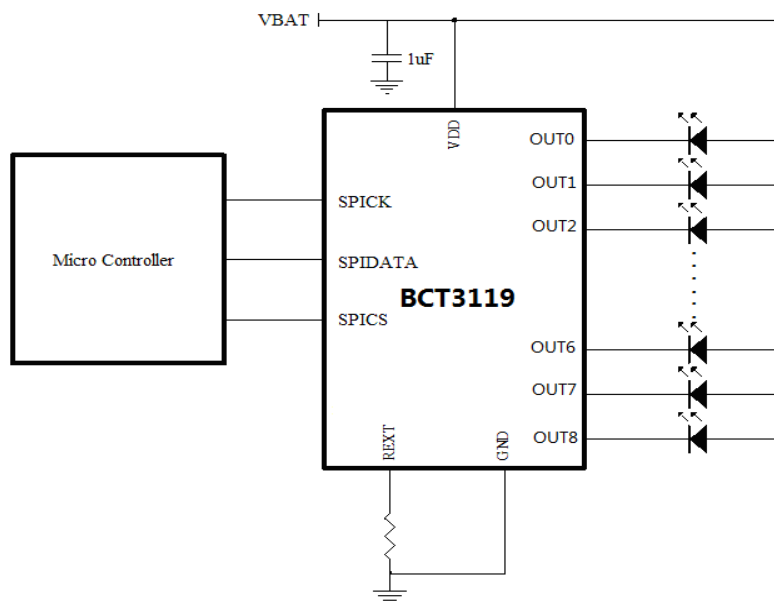
| Pin      | Name         | Function  |
|----------|--------------|---|
| 1        | REXT         | Reference current terminal; set maximum output current for all channels |
| 2        | VDD          | Logic Supply terminal   |
| 3        | GND          | Logic supply ground and load supply ground                              |
| 4        | SPIDATA      | Serial bus data input   |
| 5        | SPICK        | Serial bus clock input  |
| 6        | SPICS        | Serial bus selection input  |
| 7 to 15  | OUT0 to OUT8 | Constant current outputs  |
| 16 to 20 | NC           | No connect  |

## Absolute Maximum Ratings

| Characteristic                  | Symbol  | Notes | Rating          | Unit |
|---------------------------------|---------|-------|-----------------|------|
| Supply Voltage                  | VDD     |       | -0.3 to 5.5     | V    |
| OUTx Current(any single output) | IO      |       | 40              | mA   |
| Input Voltage Range             | VI      | VSPI  | -0.3 to VDD+0.3 | V    |
| Operating Temperature Range     | TA      |       | -40 to 85       | °C   |
| Junction Temperature            | TJ(max) |       | 150             | °C   |
| Storage Temperature Range       | Tstg    |       | -55 to 150      | °C   |

Note: "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied

## Typical Application Circuit



## 9-Channel 64steps Constant-Current LED Driver

### ELECTRICAL CHARACTERISTICS

(VIN = 2.7V to 5.5V, TA =25°C, unless otherwise noted)

| PARAMETER               | SYMBOL           | CONDITIONS                                    | MIN | TYP | MAX | UNITS |
|-------------------------|------------------|---|-----|-----|-----|-------|
| Supply Voltage Range    | VDD              | operating                                     | 2.7 |     | 5.5 | V     |
| Supply Current          | I <sub>VDD</sub> | REXT=4K, Out0~Out8 NC, VDD=5.5V               |     | 1.6 | 2   | mA    |
| Shut Down Current       | ISHUT            | System enter shutdown mode, VDD=5.5V          |     |     | 2   | uA    |
| Output current accuracy | I <sub>o</sub>   | REXT=2K , Vdropout=1V                         | 35  | 40  | 45  | mA    |
|                         |                  | REXT=4K , Vdropout=1V                         | 18  | 20  | 22  |       |
| Output current match    |                  | REXT=2K , Vdropout =1V , I <sub>o</sub> =40mA |     | ±1  | ±3  | %     |
|                         |                  | REXT=4K , Vdropout =1V , I <sub>o</sub> =20mA |     | ±1  | ±3  |       |
| Dropout voltage         | Vdrop            | VDD=3.3V , I <sub>o</sub> =40mA               |     | 400 | 500 | mV    |
|                         |                  | VDD=3.3V , I <sub>o</sub> =20mA               |     | 300 | 500 |       |
| Logic Input-Logic High  | V <sub>IH</sub>  |   | 1.5 |     |     | V     |
| Logic Input-Logic Low   | V <sub>IL</sub>  |   |     |     | 0.7 | V     |

### Serial Port Interface (SPI)

This module is used to receive the commands transmitted by Micro Controller. It will decode the received data and send corresponding commands to signal processing and analog blocks. The 16-bit serial interface uses three pins –“SPICS/SPIDATA / SPICK” to enter data. Data read is not available with the serial interface and data entered must be 16 bits.

The description of three pins is:

| Signal Name | Attribute      | Direction    | Description       |
|-------------|----------------|--------------|-------------------|
| SPICK       | Edge Triggered | MCU->BCT3119 | Serial bus clock  |
| SPIDATA     | Level          | MCU->BCT3119 | Serial data       |
| SPICS       | Active Low     | MCU->BCT3119 | SPI bus selection |

## 9-Channel 64steps Constant-Current LED Driver

Figure 2 shows the timing diagram of this serial interface. When the block is idle, SPICK is forced LOW and SPICS is forced HIGH. Once the data register contains data and the interface is enabled, SPICS is pulled LOW and remains LOW for the duration of the transmission.

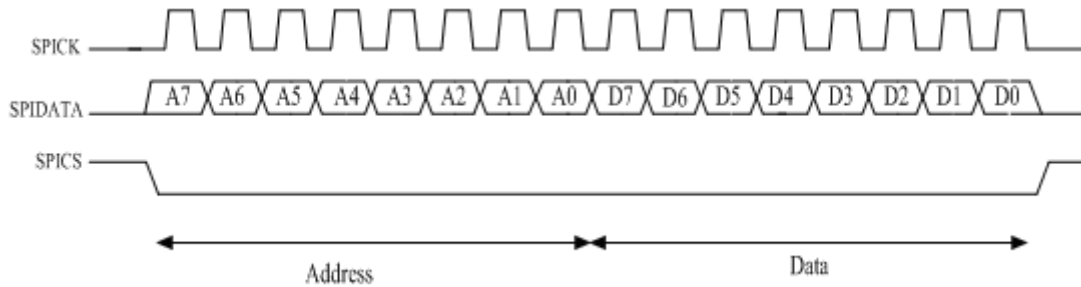


Figure 2. SPI Interface Transfer Diagram(normal operation)

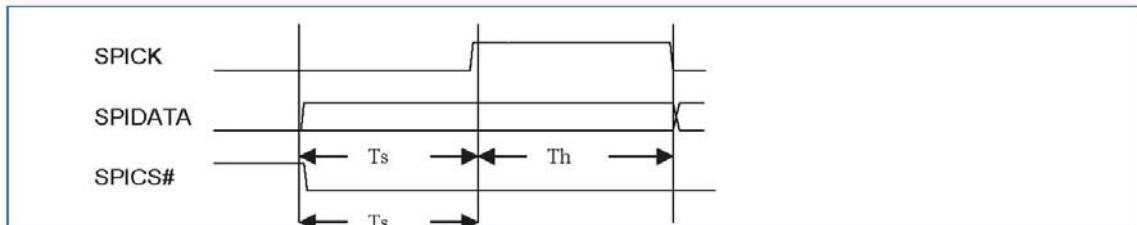


Figure 3. SPI Interface Timing Diagram

### Serial Port Interface Timing

| Symbol | Parameter                   | Min | Tye | Max | Unit |
|--------|-----------------------------|-----|-----|-----|------|
| Ts     | SPIDATA to SPICK setup time | 4   |     |     | ns   |
| Th     | SPIDATA to SPICK hold time  | 20  |     |     | ns   |

## Register Definitions

### Output Channel Control Register

| A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | Output Channel |
|----|----|----|----|----|----|----|----|----------------|
| 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | Out0           |
| 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | Out1           |
| 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | Out2           |
| 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | Out3           |
| 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | Out4           |
| 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | Out5           |
| 0  | 0  | 0  | 0  | 0  | 1  | 1  | 0  | Out6           |
| 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | Out7           |
| 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | Out8           |

# 9-Channel 64steps Constant-Current LED Driver

## DIMMING Control Register

| D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Status    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----------|
| 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | off       |
| 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 2/64 max  |
| 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 3/64 max  |
| 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 4/64 max  |
| 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 5/64 max  |
| 0   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 6/64 max  |
| 0   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 7/64 max  |
| 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 8/64 max  |
| ... | ... | ... | ... | ... | ... | ... | ... | ....      |
| 0   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | 58/64 max |
| 0   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | 59/64 max |
| 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | 60/64 max |
| 0   | 0   | 1   | 1   | 1   | 1   | 0   | 0   | 61/64 max |
| 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 62/64 max |
| 0   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | 63/64 max |
| 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 64/64 max |

**Note:** “n/64 max” means  $\text{Output Current} = (\text{max current value} \times n) \div 64$

## SHUTDOWN MODE CONTROL REGISTER

| A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | System enter shutdown mode |
|----|----|----|----|----|----|----|----|----------------------------|
| 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |                            |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |                            |
| 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |                            |

## Maximum output current setting

The maximum output current per channel is set by a single external resistor, REXT, which is placed between the REXT pin and GND pin. The maximum channel output current can be calculated as:

$$I_o(\text{max}) = 0.4 * 200 / \text{REXT}$$

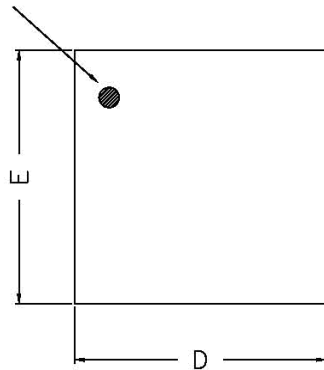
The max output current REXT values

| REXT(K Ω) | IOmax(mA) |
|-----------|-----------|
| 2         | 40        |
| 3         | 27        |
| 4         | 20        |
| 5         | 16        |

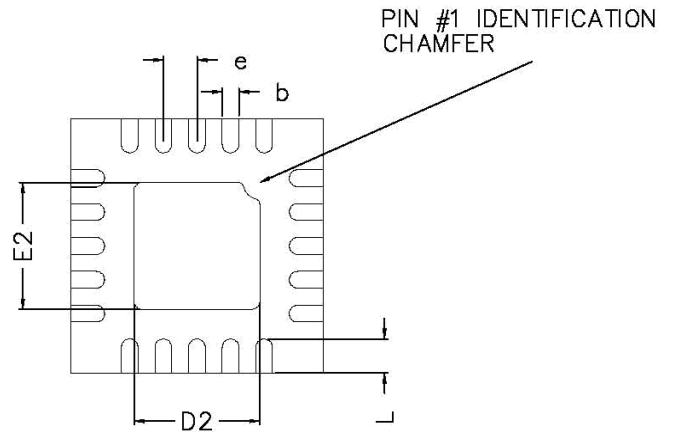
# 9-Channel 64steps Constant-Current LED Driver

## Package Information

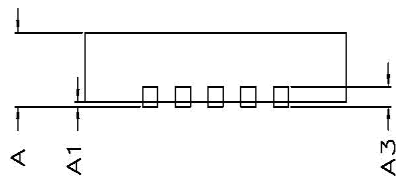
PIN 1 DOT  
BY MARKING



TOP VIEW



BOTTOM VIEW



SIDE VIEW

| COMMON DIMENSIONS(MM) |                   |      |      |
|-----------------------|-------------------|------|------|
| PKG.                  | W: VERY VERY THIN |      |      |
| REF.                  | MIN.              | NOM. | MAX  |
| A                     | 0.70              | 0.75 | 0.80 |
| A1                    | 0.00              | —    | 0.05 |
| A3                    | 0.2 REF.          |      |      |
| D                     | 2.95              | 3.00 | 3.05 |
| E                     | 2.95              | 3.00 | 3.05 |
| b                     | 0.15              | 0.20 | 0.25 |
| L                     | 0.30              | 0.40 | 0.50 |
| D2                    | 1.35              | 1.50 | 1.60 |
| E2                    | 1.35              | 1.50 | 1.60 |
| e                     | 0.40 BSC          |      |      |