## *LPD1886 IC Datasheet*

LPD1886 is single-line three-channel with 4096 levels PWM programmable constant current LED driver chip.  It is a three-channel dedicated circuit for LED driving and control, internally integrated the bandgap reference, digital interface, PWM control and constant current driving circuit. It can achieve multicolor emitting system of the outdoor led displays, led guardrail tubes and led strips, via the control of peripheral circuit.

## Features

1. Output three-channel constant current driving, the constant driving current is 17mA, Voltage output up to 12V.

2. Intergrated constant voltage circuit, workable from 5V to 24V by connecting electric resistance in series.

3. Single line transmission mode, the speed of DATA is changeable, the MAX is 16MHz.

4. Regeneration mechanism of interior wave form, the signal driving ability is very strong, can support more than 1700pixels'(25FPS) cascade connection, the distance between any two pixels can be more than 6m.

5. Double oscillating circuits are built in, support FREE-RUN mode, the renovate frequency is more than 400Hz. Distinctive design of timing sequence, convenient for the lower cost controller programmable design.

6. Each channel has independent linear PWM grayscale control circuit,  4096 grayscales effect can be really achieved.

7. Intergrated the holistic locking and saving function, each frame data will be locked and saved automatically 10us later after sending out, to avoid the picture's inconsistent appearance.

8. The reserved driving current of the red color channel is 1.5mA more than the blue color channel's, it makes the colour balance effect is better.

8. Industrial level design, makes the anti-interference capability is stronger.

8. Encapsulation: DIP8 and SOP8.

## Applications

1. LED decorative lighting system

2. PWM signal generator

3. LCD backlight driver

## Pin Figure
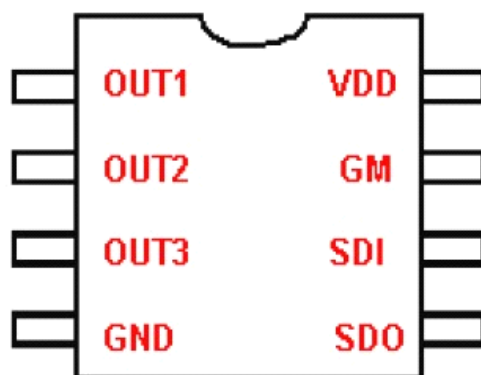


## Pin Descriptions

SDI: Serial data input

SDO: Serial data output ,the strong internal drive output

GM: 256levels when it hangs in the air; 4096levels when it connects with low electrical levels

OUT1: Drive output, the current is constant, 17mA, advice to connect with red color light.

OUT2, OUT3: Drive output, the current is constant, 15.5mA, advice to connect with blue and green color light.

VDD: Power supply, the voltage range is 5-24V, have to connect one piece dropping resistor in series and connect one piece decoupling capacitor in paralleling at the same time.

GND: Ground

## Limit Parameters

| Parameter | symbol | Range | Unit |
|---|---|---|---|
| supply voltage | $V_{cc}$ | 5～24 | V |
| LED's voltage | $V_{LED}$ | 5～12 | V |
| max drive current | $I_{OMAX}$ | 18 | mA |
| power consumption | $P_{DMAX}$ | 500 | mW |
| solder temperature | $T_M$ | 250(8S) | ℃ |
| operation temperature | $T_{OP}$ | -40～+80 | ℃ |
| storage temperature | $T_{ST}$ | -65～+150 | ℃ |

## Recommended Working Parameters

| Parameter | symbol | Range | Unit |
|---|---|---|---|
| supply voltage | $V_{DD}$ | 5 | V |
| input voltage | $V_{IN}$ | $-0.4 \sim V_{DD}+0.4$ | V |
| dat/clk frequency | $F_{CLK}$ | 1.25 | MHz |
| input voltage in high level | $V_{IH}$ | $0.7*V_{DD} \sim V_{DD}$ | V |
| input voltage in low level | $V_{IL}$ | $0 \sim 0.3*V_{DD}$ | V |
| power consumption | $P_D$ | $<350$ | mW |
| operation temperature | $T_{OP}$ | $-20 \sim +60$ | ℃ |

## ON/OFF Parameters (T=25℃, $V_{CC}$=5V)

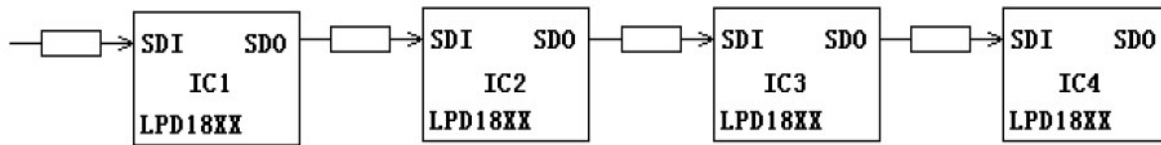| Parameter | symbol | Range | Unit |
|---|---|---|---|
| DATA tempo | $T_{DAT}$ | $0.1 \sim 1.6$ | MHz |
| time of convey delay | $T_{CAS}$ | representative value: 100 | ns |
| the MIN time width of PWM on | $T_{ONMIN}$ | 500 | ns |
| input capacitance | $C_I$ | 15 | pF |

## Application Description

The circuit adopts single line communication mode to make cascade connection. The DATA adopts return-to-zero coding mode. When the power is on, the DATA will be input from the SDI pin, and each chip has 3channels output data(1team RGB data). Each channel needs 12levels grandscale, totally 36levels. Each level grandscale data adopts 4bits+8bits format, the high level is in front and the low level behind. When the input data achieves 36levels, it will be retransmitted to the next level circuit via SDO pin.

The retransmitted data are all decoded and regenerated, so when transmitting in series, the number of cascade connection won't be influenced easily by the aberrant signals, but only restricted by the datas' tempos and refreshing speed. Under the limit circumstance, 1.6M data can achieve 1778pixels' control.

 (1600000/each pixel 36levels/each second 25FPS=1778)

After all the datas are transmitted, input the low levels into the chip, more than 10us. It will touch off the intergrated automatically locking and saving mechanism. The data just input will be saved to the PWM array. Then the datas of all the chips will be refreshed at the same time.

To identify each frame's beginning status, you need to supply more than 24us low level to the chip, as reset code. And the coming input datas will be distributed successively to each chip automatically.

| SDI | SDO | | SDI | SDO | | SDI | SDO | | SDI | SDO |
|---|---|---|---|---|---|---|---|---|---|---|
| IC1 | | | IC2 | | | IC3 | | | IC4 | |
| LPD18XX | | | LPD18XX | | | LPD18XX | | | LPD18XX | |

**Typical Connection Mode**

| | the first 36bits | the second 36bits | the third 36bits | the forth 36bits | 10us | NEXT RESET CODE |
|---|---|---|---|---|---|---|
| SDI1 : RESET CODE | the first 36bits | the second 36bits | the third 36bits | the forth 36bits | 10us | NEXT RESET CODE |
| SDI2 : | | the second 36bits | the third 36bits | the forth 36bits | saving& locking automatically | |
| SDI3 : | | | the third 36bits | the forth 36bits | | |
| SDI4 : | | | | the forth 36bits | | |

**Transmittion of DATA(4chips example)**

| R1.3 | R1.2 | R1.1 | R1.0 | R1.11 | R1.10 | R1.9 | R1.8 | R1.7 | R1.6 | R1.5 | R1.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G1.3 | G1.2 | G1.1 | G1.0 | G1.11 | G1.10 | G1.9 | G1.8 | G1.7 | G1.6 | G1.5 | G1.4 |
| B1.3 | B1.2 | B1.1 | B1.0 | B1.11 | B1.10 | B1.9 | B1.8 | B1.7 | B1.6 | B1.5 | B1.4 |

**36bits data sequence of each chip**

## DATA Code Pattern Description

0 Code
TOH  TOL

1 Code
T1H  T1L

RESET Code
Treset
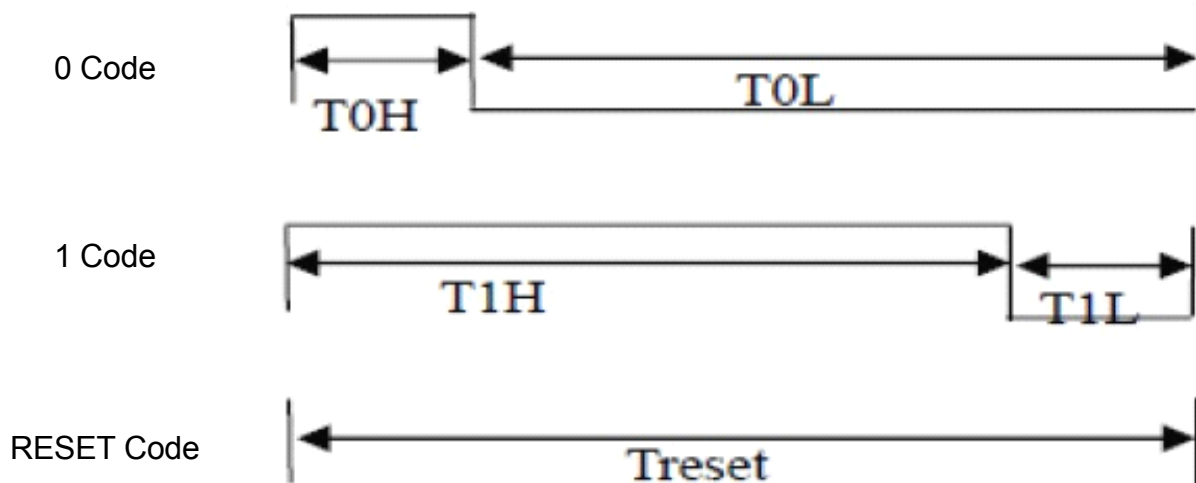
| | Description | MIN, ns | MAX, ns | recommended value, ns | Note |
|---|---|---|---|---|---|
| T0H | high level time of 0 code | 150 | 280 | 200 | T0H+T0L, T1H+T1L should be more than 800ns |
| T0L | low level time of 0 code | 500 | 10000 | 600 | |
| T1H | high level time of 1 code | 450 | 9000 | 600 | |
| T1L | low level time of 1 code | 150 | 10000 | 200 | |
| Treset | reset code, low level time | 24000 | | | |

## Power Supplier Configuration

After connection with resitors in series to the chip, can use 5V to 24V power supply, meanwhile, 1pc 104 capacitor parallelly connected with VDD anti to earth is better. And the capacitor should be as close to the IC as possible. The connected resistors in series should choose defferent values, depended on the supply voltage.

| supply voltage | the value of connected resistors in series(ohm,1/4W) |
|---|---|
| 5V | 50 |
| 12V | 1.8K |
| 24V | 4.5K |

Tips:
The chip consumes less than 2mA current by itself, but if there is a long signal line between the chips, a lower value resistor is recommended, to gain the better cascade connection performance.

## Typical Application Circuit : Constant Current Driving Mode
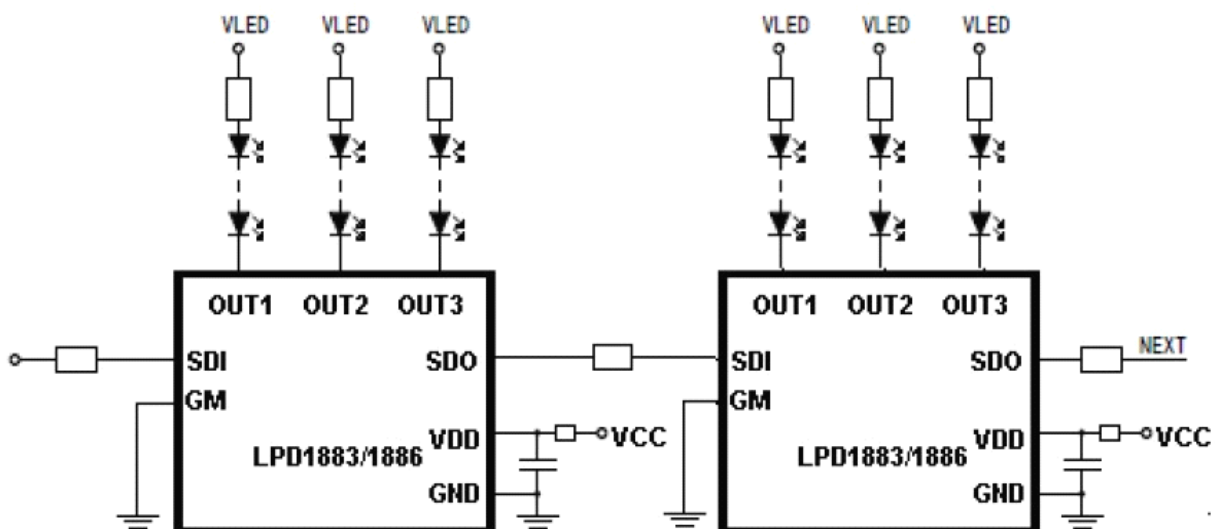
This mode suits for most single light application. $V_{LED}$ is 5V to 12V. When current constant, the $I_{LED}$=15.5/17mA(Pls NOTE the output voltage to ground should be more than 8V when the circuit is closed). The resistors connected in series here, cann't adjust the $I_{LED}$ value, they are used to share responsibility for the chip's power consumption PD, to improve the working stability(When the power consumption is enough, they can be omitted).

When designing the circuits, pls note that the power dissipation $P_D$ should not bigger than the maximum $P_{DMAX}$, the $P_D$ = = $\Sigma I_{LEDX}$ * $V_{OUTX}$ + $P_{IC}$(PIC is the basic power comsuption of the IC, normally no more than 15mW ) .

## Cascade signal's driving and connecting:

   Considering the cascade transmission distance may be very long among the chips, the output ends of  the SDO is designed with strong push-pull type drive circuits,
Tests show that it can drive more than 10M signal line. To protect the chips and avoid the signal reflection, pls series connect a about 33ohms to 100ohms resistor at the end, and then output to the next level during your application. If using in led guardrail tubes, there is only need to have protecting resistors at the into tube place and out tube place.

## Dimensions (SOP8)
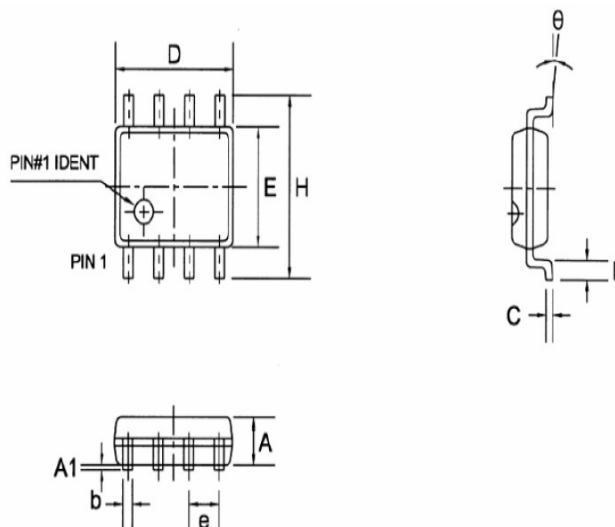


| Symbol | Dimensions In Millmeters | | | Dimensions In Inches | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | 1.30 | 1.50 | 1.70 | 0.051 | 0.059 | 0.067 |
| A1 | 0.06 | 0.16 | 0.26 | 0.002 | 0.006 | 0.010 |
| b | 0.30 | 0.40 | 0.55 | 0.012 | 0.016 | 0.022 |
| C | 0.15 | 0.25 | 0.35 | 0.006 | 0.010 | 0.014 |
| D | 4.72 | 4.92 | 5.12 | 0.186 | 0.194 | 0.202 |
| E | 3.75 | 3.95 | 4.15 | 0.148 | 0.156 | 0.163 |
| e | — | 1.27 | — | — | 0.050 | — |
| H | 5.70 | 6.00 | 6.30 | 0.224 | 0.236 | 0.248 |
| L | 0.45 | 0.65 | 0.85 | 0.018 | 0.026 | 0.033 |
| θ | 0° | — | 8° | 0° | — | 8° |