# WS2815C

## Intelligent control LED integrated light source

### Features and Benefits

- The control circuit and RGB chip are integrated in a 5050 components, to form an external control pixel.
- 12V power supply voltage can effectively reduce the working current of the whole pixel, reduce the voltage drop of the circuit board, and maximize the consistency of the mixed light when the pixel is transmitted over a long distance.
- Using the built-in signal reshaping circuit to achieve the signal waveform shaping, and no distortion of waveform of signal takes place.
- Each pixel of the three primary color can achieve 256 brightness display, completed 16777216 color full color display, and scan frequency is of 4KHz.
- Cascading port transmission signal by single line.
- Any two point the distance not more than 5m transmission signal without any increase circuit.
- When the refresh rate is 30fps, cascade number are not less than 1024 pixels.
- Send data at speeds of 800Kbps.
- The color of the light is highly consistent, cost-effective.

### Applications

- Full-color module, LED full-color soft/hard light bar, LED guardrail tube.
- LED point light source, LED pixel screen, special-shaped screen.

### General description

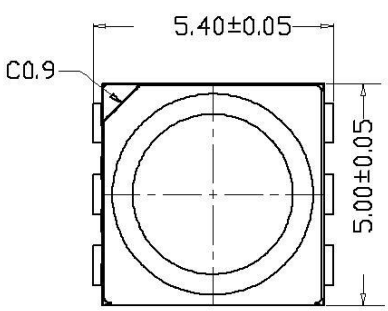
WS2815C is a intelligent control LED light source that the control circuit and RGB chip are integrated in a package of 5050 components.It internal include intelligent digital port data latch and signal reshaping amplification drive circuit.Also include a precision internal oscillator and a voltage programmable constant current control part, effectively ensuring the pixel point light color height consistent.Realize two-way signal transmission, in the case of damage to a single pixel, it does not affect the display of the overall color.

The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent to the next cascade pixel through the DO port. After transmission for each pixel, the signal to reduce 24bit. pixel adopt auto reshaping transmit technology, making the pixel cascade number is not limited the signal transmission, only depend on the speed of signal transmission.

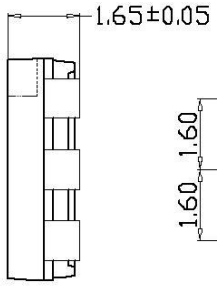
Refresh Frequency updates to **4KHz**, Low Frame Frequency and No Flicker appear in HD Video Camera,It is very suitable for high-speed mobile products.

RESET time>**280μs** , it won't cause wrong reset while interruption, it supports the lower frequency and inexpensive MCU.

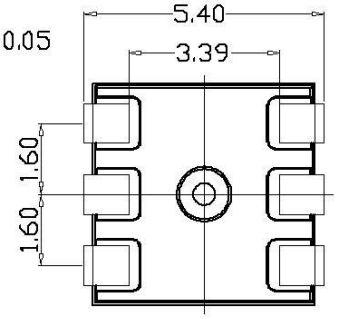
## Mechanical Dimensions(Unit:mm)



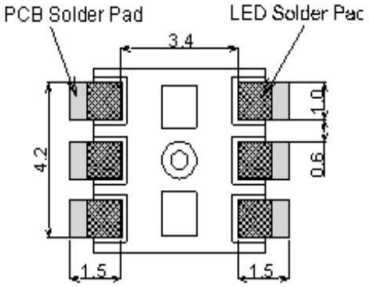

Top View




Side View

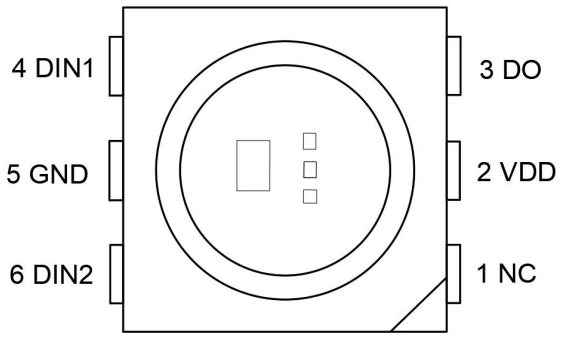



Back view




Solder Pad

## PIN Configuration




## PIN Function

| NO. | Symbol | PIN | Function description |
|---|---|---|---|
| 1 | NC | NC | Suspended PIN |
| 2 | VDD | LED POWER SUPPLY | LED POWER SUPPLY, connect to “+12V” |
| 3 | DO | Data Output | Control data signal output |
| 4 | DIN1 | Data-1 Input | Control data-1 signal input |
| 5 | GND | GROUND | Ground, data & power grounding |
| 6 | DIN2 | Data-2 Input | Control data-2 signal input |

## Absolute Maximum Ratings ($T_A$=25℃, $V_{SS}$=0V, unless otherwise specified)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Power supply voltage | $V_{DD}$ | +9.5~+13.5 | V |
| Power Consumption | P | 0.1~0.18 | W |
| Logical Input Voltage | $V_I$ | -0.3~5.7 | V |
| Working Temperature | Topt | -40 ~ +65 | ℃ |
| Storage Temperature | Tstg | -40~+85 | ℃ |

**Electrical Characteristics** （$T_A$=25℃, $V_{DD}$=12V, $V_{SS}$=0V, unless otherwise specified）

| Parameter | Symbol | Min | Tpy | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| Input current | $I_I$ | —— | —— | ±1 | μA | $V_I$=$V_{DD}$/$V_{SS}$ |
| High Voltage Input | $V_{IH}$ | 2.7 | —— | 5.7 | V | $D_{IN}$, SET |
| Low Voltage Input | $V_{IL}$ | -0.3 | —— | 1.5 | V | $D_{IN}$, SET |

**Switching Characteristics** （$T_A$=25℃, $V_{DD}$=12V, $V_{SS}$=0V, unless otherwise specified）

| Parameter | Symbol | Min | Tpy | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Transmission delay time | $t_{PLZ}$ | —— | —— | 300 | ns | CL=15pF, DIN→DOUT,RL=10KΩ |
| Fall time | $t_{THZ}$ | —— | —— | 120 | μs | CL=300pF, OUTR/OUTG/OUTB |
| Input capacity | $C_I$ | —— | —— | 15 | pF | —— |

**LED Characteristics**

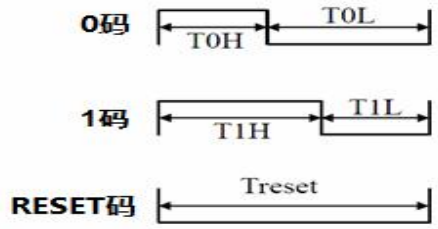
| Parameter | Symbol | Color | Quiescent Current < 2mA | | | | Testing Condition DC=12V |
|---|---|---|---|---|---|---|---|
| | | | Mini | Typ | Max | Unit | Working current |
| **Brightness** | IV | Red | 44 | 55 | 65 | mcd | 2.5mA |
| | | Green | 170 | 220 | 260 | | |
| | | Blue | 36 | 45 | 55 | | |
| **Wavelength** | λd | Red | 620 | 622 | 625 | nm | 2.5mA |
| | | Green | 515 | 517 | 518 | | |
| | | Blue | 467 | 469 | 471 | | |

**Data Transfer Time**

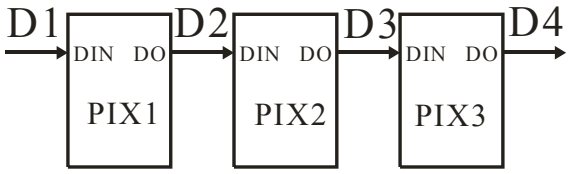
| | | |
|---|---|---|
| T0H | 0 code, high voltage time | 220ns~380ns |
| T1H | 1 code, high voltage time | 580ns~840ns |
| T0L | 0 code, low voltage time | 900ns~5000ns |
| T1L | 1 code, low voltage time | 600ns~5000ns |
| RES | Frame unit, low voltage time | >280μs |
| $T_{DATA}$ | Data cycling time | ⩾1.25μs |

### Timing Waveform

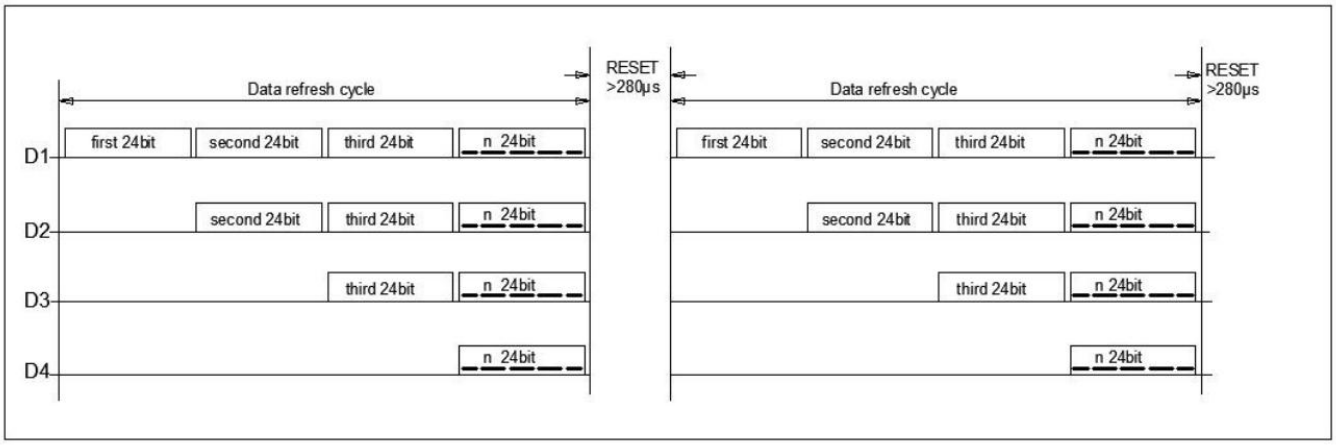
### Sequence Chart




### Cascade Method




### Data Transmission Method



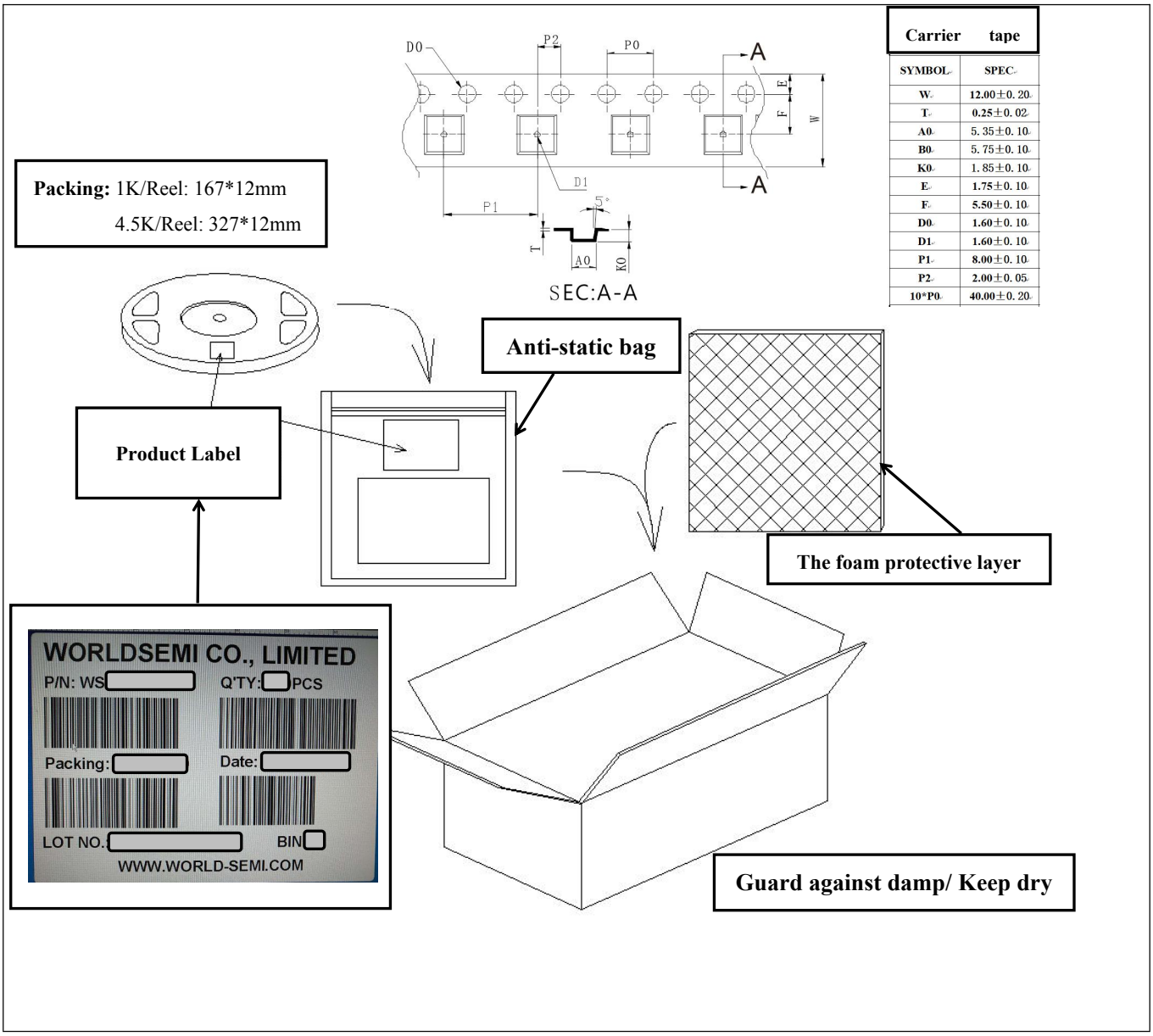

Note: The data of D1 is send by MCU, and D2, D3, D4 through pixel internal reshaping amplification to transmit.

### Composition of 24bit Data

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |

Note: Data transmit in order of GRB, high bit data at first.

## Packing Standard



# Top SMD LED Using Instructions

1. **Summary**

To make the best use of WORLDSEMI's LED, please refer to the below precautions, they are of same usage method as other electronic components.

**2. Cautions**

2.1. Dust & Cleaning

The surface of the LED is encapsulated with modified epoxy resin because it plays a very good role in protecting the optical performance and aging resistance. The modified epoxy resin is easy to stick with dust and must be kept clean. When there's a certain amount of dust on the surface of the LED, it won't affect brightness, but dust proof should be taken care of. Promoting the use of unsealed package in preference to others and the assembled LEDs should be placed in a clean container.

Avoid using the organic solvents to clean the dust on the LED surface and it's necessary to confirm whether the cleaning fluid will dissolve the LED.

Do not clean the LEDs by the ultrasonic. Some parameters affecting the LED performance must be evaluated if have no alternative but to the ultrasonic cleaning method, such as ultrasonic power, baking time and assembly conditions, etc.

2.2. Moisture-proof packaging

TOP SMD LEDs are moisture sensitive components. LEDs are packaged in aluminum foil bag to prevent the from absorbing moisture during transport and storage. A desiccant is placed in the bags to absorb moisture. If the LED absorbs moisture, then it evaporates and expands when in reflow process, which may break the colloid from the bracket and damage the optical performance of LED. For this reason, moisture-proof packaging is to prevent the from absorbing moisture during transport and storage. The moisture resistance rating of WORLDSEMI's LED is: **LEVEL 5a.**

**Tabel I - IPC/JEDEC J-STD-020 Moisture/Reflow Sensitivity Classification**

| **MSL Level** | **Workshop Life** | |
|---|---|---|
| | **Time** | **Conditions** |
| LEVEL1 | Unlimited | ≤30℃/85%RH |
| LEVEL2 | 1 Year | ≤30℃/60%RH |
| LEVEL2a | 4 Weeks | ≤30℃/60%RH |
| LEVEL3 | 168 Hours | ≤30℃/60%RH |
| LEVEL4 | 72 Hours | ≤30℃160%RH |
| LEVEL5 | 48 Hours | ≤30℃/60%RH |
| **LEVEL5a** | **24 Hours** | **≤30℃/60%RH** |
| LEVEL6 | Take-out and Use immediately | ≤30℃/60%RH |

2.3 SMT Requirement:

2.3.1 It is recommended to unpack the LED before SMT and put the whole roll into the oven for dehumidification and drying (baking at 70 ~ 75 ℃ for ≥ 24h);

2.3.2 The product is taken out of the oven to the completion of high-temperature soldering (including multiple high-temperature operations/operations such as reflow soldering, tin immersion, wave soldering, and heating maintenance), and the time period is controlled within 24 hours (under the conditions of T<30℃, RH<60%) ;

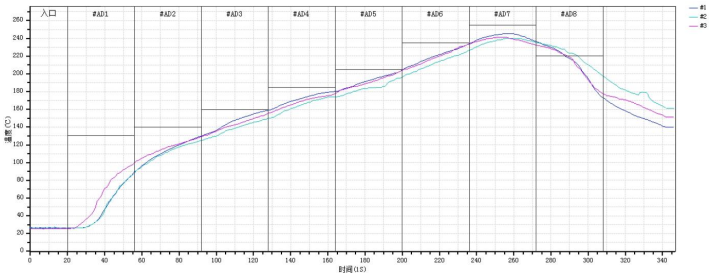
2.3.3SMT shall be completed as soon as possible for LED pastes on PCBA after printing solder paste, and it is recommended not to exceed 1H;

2.3.4 Bulk LEDs such as production surplus, machine throwing materials, and maintenance materials cannot be used directly if they are exposed to the air for a long time. It is recommended to dehumidify and dry before use. Whole roll baking: 70 ~ 75℃*≧24H or bulk material baking: 120℃*4H.

**3. SMT Reflow**

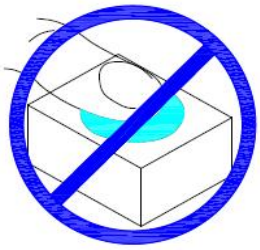
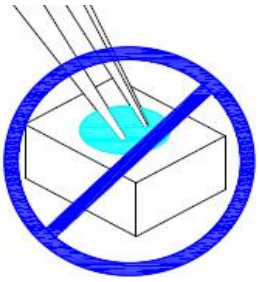
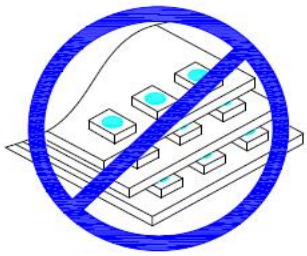
Refer to the parameters listed below, the experimental results prove that the TOP SMD LED meets the JEDEC J-STD-020C standards. As a general guideline, it is recommended to follow the SMT reflow temperature curve recommended by the solder paste manufacturer.

| Temperature curve description | Range |
|---|---|
| 30 ℃ ~ 150 ℃ preheating slope | 1 ~ 4 ℃/s |
| 30 ℃ ~ 150 ℃ preheating time | 60 ~ 120 s |
| Constant temperature slope of 150 ℃ ~ 200 ℃ | 0 ~ 3 ℃/s |
| Constant temperature time of 150 ℃ ~ 200 ℃ | 60 ~ 120 s |
| LIQUID REGION temperature | 217℃ |
| Peak Temperature (Tp) | 245℃ |
| Reflow slope | 0 ~ 3 ℃/s |
| Reflow time | 45-90 s |
| cooling rate | -4 ~ 0 ℃/s |
| Room Temperature to Peak Holding Time | <6 min |



Remarks: All temperatures referred are measured on the surface of the package body.

## 4. Assembly Precautions

| 1. Clip the LED from its side. | 2. Neither directly touch the gel surface with the hand or sharp instrument, it may damage its internal circuit. | 3. Not to be double stacked, it may damage its internal circuit. | 4. Can not be stored in or applied in the acidic sites of PH<7. |
|---|---|---|---|
|  |  |  |  |

**Modify Record**

| Version № | Status Bar | Modify Content Summary | Date | Reviser | Approved |
|---|---|---|---|---|---|
| V1.0 | N | New | 20231215 | Hu Jin | Yin HuaPing |
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**Remarks:** Initial version: V1.0; Version number plus "0.1" after each revision;

Status bar: N--New, A--Add, M--Modify, D--Delete.