General Description

APA102-2020 is a new model of APA102 IC for the three-color RGB Dimming control strip and string. This IC uses the CMOS process to provide three-color RGB LED output drivers to adjust the output with 256 gray scale and 32 brightness adjustment. APA with 2 signal output ways, one is clock, another is data, the clock and data are synchronized, so that the crystal cascade piece of output movement is synchronized.

Application Circuit
SUPER LED

PRODUCT FEATURES

Our LED is integrated with driver IC and wide application
Increases safety by better device reliability and visibility
Save energy and maintenance cost
Create more than one billion colors
Entire cabinet comply with IP65
Replace LED and display LED

APPLICATION

Architectural lighting
Landscape lighting
Signage
LED display

PRODUCT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model number</th>
<th>Color</th>
<th>Milllilumens</th>
<th>refresh rate</th>
<th>Applied voltage</th>
<th>Power consumption</th>
<th>View angle</th>
<th>weight (g)</th>
<th>Dimensions (mm)</th>
<th>Operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPER LED APA-102-2020</td>
<td>Full Color 1677215</td>
<td>R 300-330, G 420-460, B 160-180</td>
<td>400 cycle</td>
<td>5VDC</td>
<td>0.1W (MAX: 0.5W)</td>
<td>H: 160</td>
<td>0.025</td>
<td>2.0 x 2.0 x 0.9</td>
<td>-40°C to 70°C</td>
</tr>
</tbody>
</table>

PHYSICAL DIMENSIONS
APA102-2020 Super LED

Shenzhen LED Color Opto Electronic CO., LTD.
Global bit : 5-bit (32 level) brightness setting, while controlling R, G, B three-color constant current output value, if set the Global bit for the 10000(16/31) is the output current is half again the original PWM settings.

<table>
<thead>
<tr>
<th>DATA MSB→LSB</th>
<th>Driving Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000</td>
<td>0/31</td>
</tr>
<tr>
<td>00001</td>
<td>1/31</td>
</tr>
<tr>
<td>00010</td>
<td>2/31</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>11110</td>
<td>30/31</td>
</tr>
<tr>
<td>11111</td>
<td>31/31 (max)</td>
</tr>
</tbody>
</table>

PWM input and output signals Relations

<table>
<thead>
<tr>
<th>DIN</th>
<th>MSB</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CKI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data MSB—</th>
<th>Duty Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000000</td>
<td>0/255, min</td>
</tr>
<tr>
<td>00000001</td>
<td>1/255</td>
</tr>
<tr>
<td>00000010</td>
<td>2/255</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>11111101</td>
<td>253/255</td>
</tr>
<tr>
<td>11111110</td>
<td>254/256</td>
</tr>
<tr>
<td>11111111</td>
<td>255/256 (max)</td>
</tr>
</tbody>
</table>

2) The number of pixels per second sent to CKI frequency (FCKI) minus the Start Frame bit divided by the number 40 the number of LED Frame bit 32, if CKI frequency (FCKI) to 512KHz, the pixel number (512000÷40)÷32=15996, if the 50 second update Views can be connected in series LED number 19998÷50÷319. To increase the number of cascaded IC CKI frequency to be increased.

(3) POLAR to empty, R, G, B for the negative output; POLAR access VSS, R, G, B is positive output.

(4) VEN: Self-detection
Data Field to the middle of 3bit were B, G, R in the MSB of the opposite phase, otherwise regarded as invalid data. VEN close to empty when the self-detection; when VEN VSS then activated self-detection.

(5) CSEL to empty when the CKD and CK1RP; CSEL connected with VSS when the CKO compared with CKI.
# RELIABILITY PLAN:

* The reliability of products shall be satisfied with items listed below.

**Confidence Level:** 90%  
**LT50:** 10%

<table>
<thead>
<tr>
<th>No</th>
<th>Test Item</th>
<th>Description &amp; Condition</th>
<th>Sample size</th>
<th>Ac/Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solderability</td>
<td>TSLD = 235±5°C, 10sec</td>
<td>1 time</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>Low/High Temperature Storage</td>
<td>Ta = -40°C / Ta = 100°C</td>
<td>1000 hrs</td>
<td>22</td>
</tr>
</tbody>
</table>
| 3  | ESD HBM Contact Discharge Air Discharge | Vs = 5000V ; Tr = 10ns  
Vs = 2K~2KV; Tr = 1ns | 45 times  
10 times | 3  
3 | 0/1  
0/1 |
| 4  | Temperature Cycle | -40°C ~ 25°C ~ 100°C ~ 25°C  
30 min 5 min 30 min 5 min | 300 cycles | 22 | 0/1 |

# CAUTIONS:

1. **Storage:**
   - Before opening the package:
     - The LEDs should be kept at 30°C or less and 30%RH-85%RH. The LEDs should be used within a year. When storing the LEDs, moisture proof packaging with desiccant (Silica gel) is recommended.
   - After opening the package:
     - The LEDs should be kept at 30°C or less and 30%RH-70%RH. The LEDs should be soldered within 168 hours (7 days) after opening the package. If unused LEDs remain, they should be stored in moisture proof packages, such as sealed containers with packages of moisture desiccant (Silica gel), or reseal the moisture proof bag again.
     - If the moisture desiccant (Silica gel) has faded away or the LEDs have exceeded the storage time, baking treatment should be performed using the following conditions:
       - Baking treatment: 24 hours at 60°C on tap and reel, 7 hours at 125°C. Note: No reel&tap.
       - Please avoid conditions which may cause the LED to corrode, tarnish or discolor. This corrosion or discoloration might lower solderability or might effect on optical characteristics. Please avoid rapid transitions in ambient temperature, especially in high-humidity environments where condensation can occur.
   - **Moisture Proof package**
     - When moisture is absorbed into the SMT package, it may vaporize and expand during soldering. There is a possibility that this can cause exfoliation of the contacts and damage to the optical characteristics of the LEDs. For this reason, the moisture proof package is used to keep moisture to a minimum in the package. A package of a moisture desiccant (Silica gel) is inserted into the moisture proof bag. The silica gel changes its color from blue to pink as it absorbs moisture.
(2) Static Electricity
   • Static electricity or surge voltage damages the LEDs. It is recommended that a wrist band or an
     anti-static glove and shoe be used when handling the LEDs.
   • All devices, equipment and machinery must be properly grounded. It is recommended that
     measures be taken against surge voltage to the equipment that mounts the LEDs.
   • When inspecting the final products in which LEDs were assembled, it is recommended to check
     whether the assembled LEDs are damaged by static electricity or not. It is easy to find
     static-damaged LEDs by a light-on test or a $V_I$ test at a lower current (below 1 mA).
   • Damaged LEDs will show some unusual characteristics such as the leak current remarkably
     increases, the forward voltage becomes lower, or the LEDs do not light at the low current.
     (Criteria: $V_p < 2.0V$ at $I_s = 0.5mA$.)

(3) Heat Generation
   • Please consider the heat generation of the LED when making the system design that it’s very
     importance. The coefficient of temperature increase per input electric power is effected by the
     thermal resistance of the circuit board and density of LED placement on the board, and other
     components. It is necessary to avoid intense heat generation and operate within the maximum
     ratings given in this specification.
   • The operating current should be decided after considering the ambient maximum temperature of
     LEDs.

(4) Others
   • Care must be taken to ensure that the reverse voltage will not exceed the absolute maximum
     rating when using the LEDs with matrix drive.
   • The LED light output is strong enough to injure human eyes. Precautions must be taken to
     prevent looking directly for more than a few seconds. Flashing lights have been known to
     cause discomfort in people; you can prevent this by taking precautions during use. Also,
     people should be cautious when using equipment that has had LEDs incorporated into it.

SOLDERING CONDITIONS:
(1) Recommended Re-flow profile

![Soldering profile diagram]

Super Led