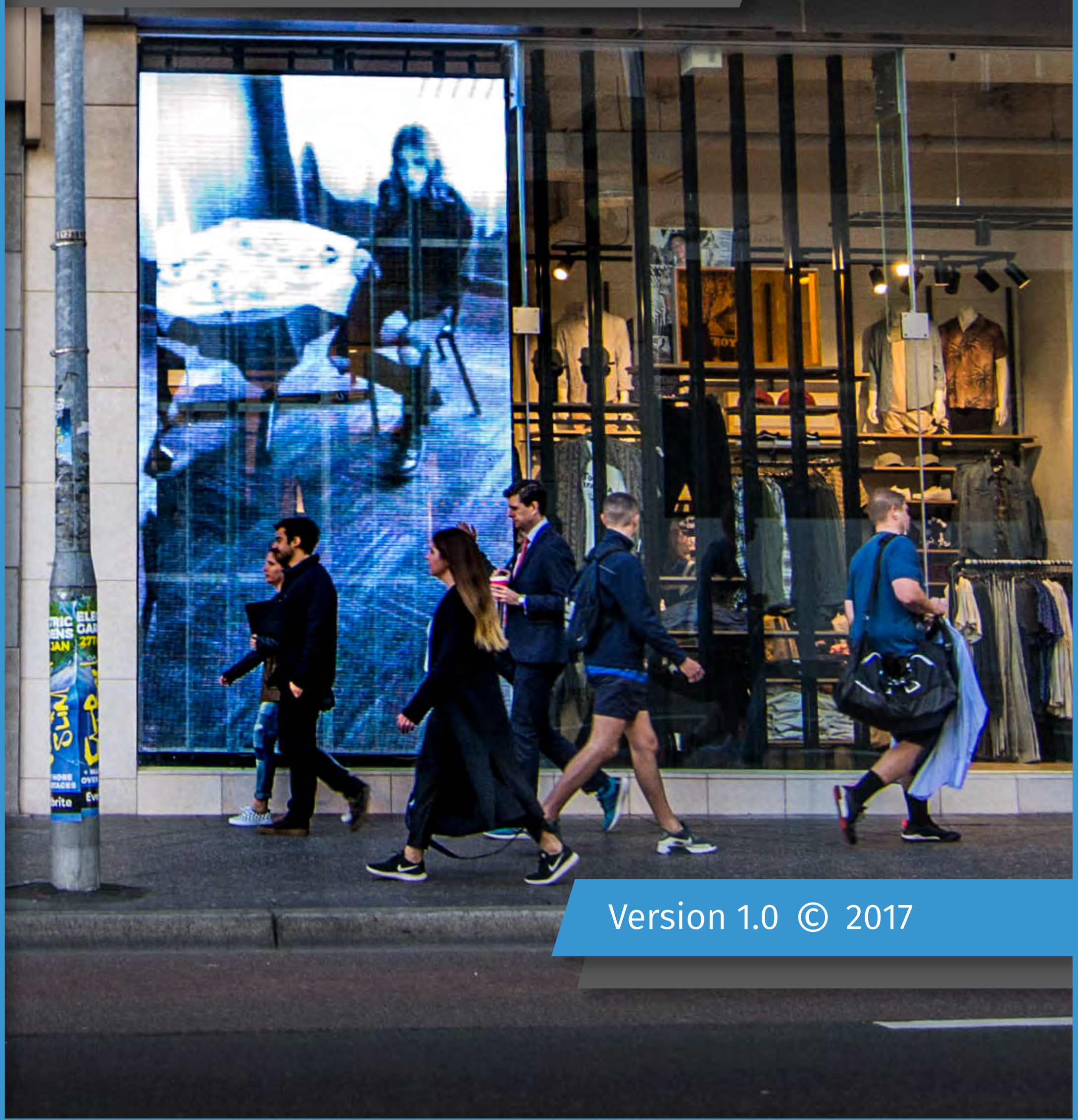
Custom LED products

Mesh, Curtain, Flexible and Glass LEDs



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Custom LED Products- Mesh, Curtain, Flexible and Glass LEDs

Contents

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One World LED Transparent Screens

Special and custom designed digital LED screens are used for both indoor and outdoor applications. These designs are continuously evolving with the advances of the various underlying technologies. These advances continue to drive the prices down whilst increasing quality and flexibility in an ever expanding market. These screens can be architecturally incorporated, used for advertising and public communication.

One World LED Indoor Transparent LED Screen Designs

The basic designs of the LED modules and components have rapidly evolved, which has encouraged the design of more exciting and innovative products suitable for a wider range of applications to support advanced marketing and architectural designs. The following figure provides a summary comparison of three generations of Transparent LED module designs from earliest to current.

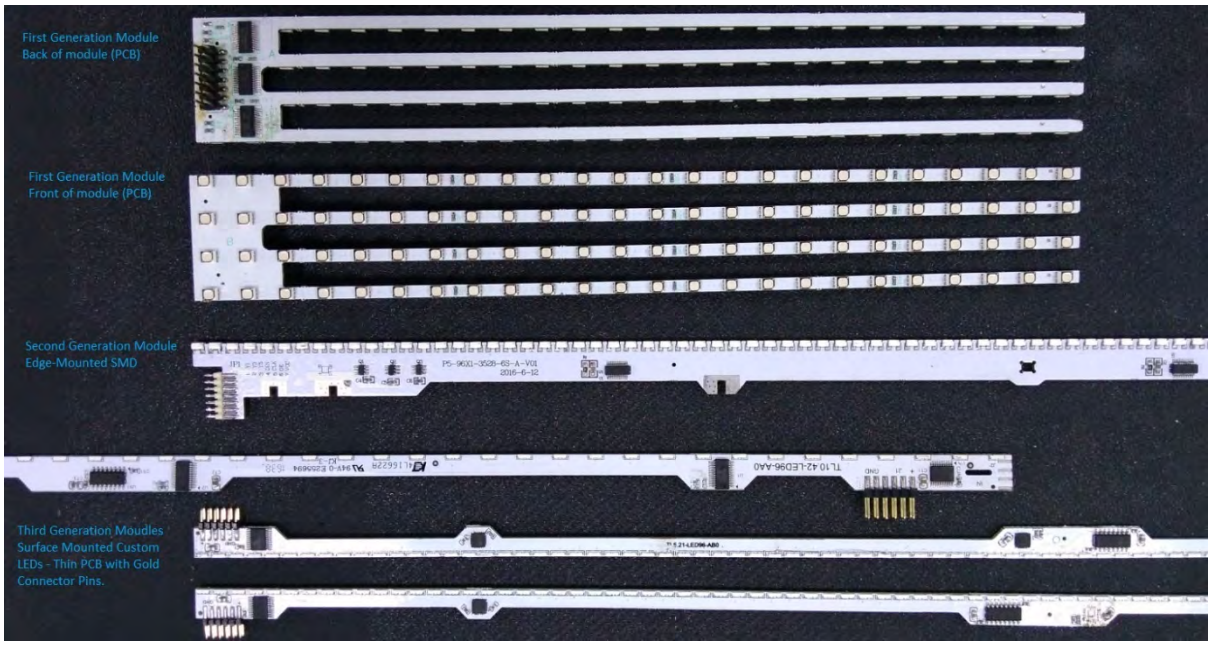

Fig. 1 – Advancing Designs, Three Generations of Transparent LED Modules

The advances of the related technologies that most impact the leaps forward as compared to marginal advances include 1) LED component advances, 2) Driver IC advances and, 3) PCB Design advances. Following sections detail the key differences of the underlying technologies in different designs of transparent LED screens.

First generation was characterized by PCB (printed circuit board) cut outs to create transparency while second generation used PCB light strips to allow transparency and the third generation is designed based on specialized LED and driver IC components on thin PCB strips.

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First Generation

Custom Mesh and PCB designs to support off-the-shelf DIP and SMD components to allow varying degrees of transparency.

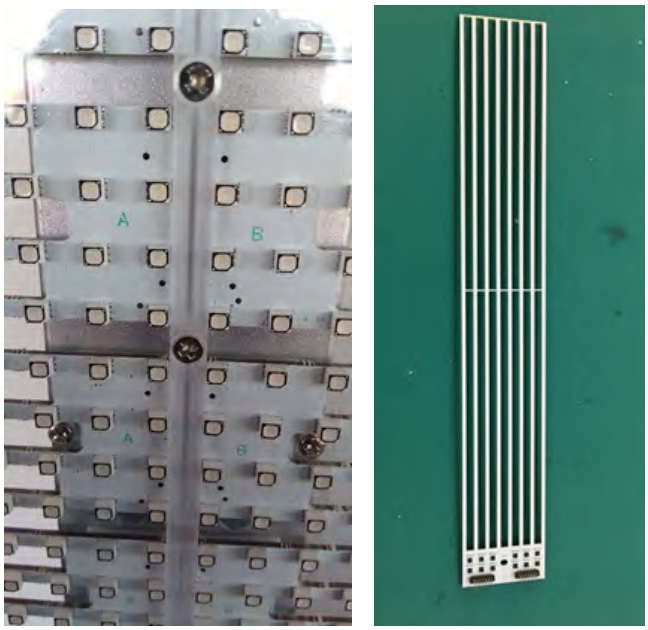

Fig. 2 - First Generation One World LED Transparent Indoor Module Designs

Original designs of the transparent led screens allowed typically 30- 50% transparency factors. This transparency was achieved by cutting away or hollowing the module's unused areas of the PCB to create transparency. These modules then were plugged into a backplane for service and accessibility.

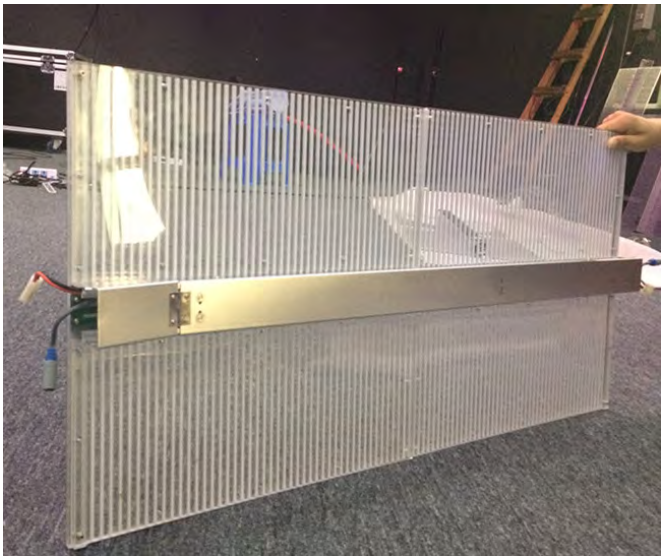

Fig. 3 - Typical First Generation Transparent Indoor LED Panel

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Second Generation OWL Transparent LED Design

Specialised PCB strip designs with edge-mounted off-the-shelf DIP and SMD components to allow higher degree of transparency and flexibility for service.

This design innovation allowed strips of PCB to be turned sideways to create a much narrower and lower profile module. An example of this design is reproduced below from the LED Hero catalogue. This design was based on a variation of façade lighting strips ported to Led screens for imaging and multimedia video displays.

Fig. 4 – Edge-mounted Standard SMD components

These second generation designs required elaborate manufacturing process for three sided PCB to support the PCB-edge installation of SMD components designed for surface mounting on LED modules. This increased difficulty of manufacturing and servicing significantly increased the cost per square meter of the transparent screens.

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Fig. 4 – Various Models of Edge-mounted LED

However, the improved design elevated the marketing and application value of this technology and justified this added costs. As shown in a supplier brochure above.

Second Generation Challenges

The second generation transparent LED products lacked, A) Application specific LED component which required use of the LEDs designed for other indoor and outdoor applications, B) No SPWM Driver IC or QFN (Quad Flat No-lead) IC packaging, and 3) Wide PCB requirement not conducive to transparent applications, 4) Modified and enhanced graphics and videos to compensate for non-standard pixel.

These known challenges have been tackled by key industry technology suppliers. The most critical problems were addressed by Macroblock's introduction of MBI5041 QFN packaged driver IC. Following is the Macroblock MBI5041 IC mini-specification detailing Driver IC advances.

Macroblock Preliminary Datasheet MBI5041

16-Channel SPWM Constant Current LED Driver

Features

- 16 constant-current output channels
- 16-bit color depth PWM control
- Scrambled-PWM technology to improve refresh rate
- 6-bit programmable output current gain
- Constant output current range: 2~30mA
  2~30mA at 5.0V/3.3V supply voltage
- Output current accuracy:
  Between channels: <±1.5% (typ.), and
  Between ICs: <±3% (typ.)
- Staggered delay of output, preventing from current surge
- Maximum data clock frequency: 30MHz
- Maximum gray scale clock frequency: 33MHz
  Refresh rate doubled by innovative rising/falling edge trigger GCLK
- Schmitt trigger input
- 3.0V-5.5V supply voltage

Product Description

MBI5041 is designed for LED video applications using internal Pulse Width Modulation (PWM) control with selectable 16-bit color depth which features a 16-bit shift register which converts serial input data into each pixel gray scale of output port. The output current can be preset through an external resistor. Moreover, the preset current of MBI5041 can be further programmed to 64 gain steps for LED global brightness adjustment.

With Scrambled-PWM (S-PWM) technology, MBI5041 enhances Pulse Width Modulation by scrambling the "on" time into several "on" periods. The enhancement equivalently increases the visual refresh rate. When building a 16-bit color depth video, S-PWM reduces the flickers and improves the fidelity. MBI5041 offloads the signal timing generation of the host controller which just needs to feed data into drivers. MBI5041 drives the corresponding LEDs to the brightness specified by image data. With MBI5041, all output channels can be built with 16-bit color depth (65,536 gray scales). Each LED's brightness can be calibrated enough from minimum to maximum brightness with compensated gamma correction or LED deviation information inside the 16-bit image data.

Fig. 5 – Macroblock's SPWM 16 Channel Driver QFN Pack

The MBI5041 which addressed the key challenges of second generation transparent LED designs combined with application-specific LED light designs for transparent LED have also helped improve Transparency by over 30%, increase resolution by 50% and eliminate the need for special graphics designs as horizontal and vertical pitch are equal. Following is an example of flat form SMD LED light component as compared to the second generation LEDs.

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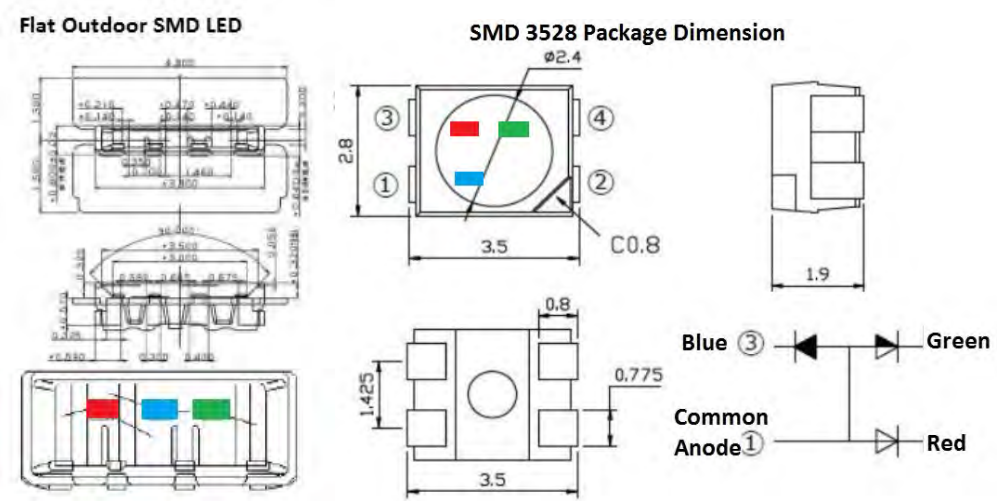

Fig. 6 - Application Specific Outdoor Flat SMD vs SMD35xx

Note that the diagrams are not to scale and the new SMD light component packages add only .6 mm to the thickness of the PCB as compared to the 4mm of the other manufacturers. Just like the recent Reestar High Brightness SMD introduced by One World, this is another design available only from One World Technology in Australia.

The underlying factor contributing to additional costs was use of the LED components not intended for nor naturally conducive to this design upgrade. This resulted in development of new LED components for transparent LED screen applications.

Some manufacturers resorted to using smaller indoor components in second generation screens to solve the size problems of the standard outdoor LED components. This solution limited the application of transparent LEDs to indoor only application where transparency offers no advantage. Transparency is a requirement of glass and showroom window LEDs where most of the application must be classified as semi-outdoor or outdoor depending on facing direction of screen. The overdriving of the components to increase brightness beyond the recommended specification results in shorter life-cycle for the screen and increased failure rates.

The popularity of the transparent LED screen has resulted in increased demand. This increased demand has resulted in resulted in increased competition which in turn has driven the innovation and development of specialized components and devices to meet specific requirements of this application. On such innovation is development of 38xx SMD. This innovation has helped advance the transparent LED design a quantum leap forward into the third generation. 38XX LED packing requirement and device specification details are provided below.

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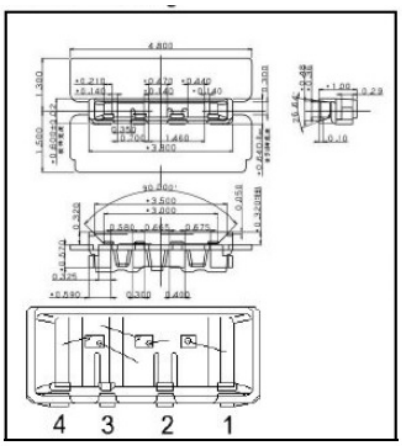

Above is a diagram showing custom SMD used for transparent displays (SMD3806).

Typical Electrical & Optical Characteristics (Ta = 25℃)

Parameter	Condition	Symbol	Values			Unit
			R	G	B	
Dominant wavelength	R, If=20mA; G, If=20mA, B, If=10mA	λ_{dom}	615～630	515～530	465～475	nm
Spectral bandwidth at 50% Iv max		$\Delta\lambda$	24	38	28	nm
Viewing angle at 50% IV		$2\theta_{1/2}$	110	110	110	Deg.
Forward voltage		$V_{F(avg)}$	1.5	2.5	2.5	V
		$V_{F(max)}$	2.0	3.0	3.0	V
Luminous Intensity		IV(Min)	400	900	180	mcd
		IV(Avg)	530	1300	200	mcd
Reverse current (max.)	Vr=10V	I_R	0.5	0.5	0.5	uA

Items	Symbol	Absolute maximum Rating			Unit
		R	G	B	
Forward Current	I_F	**50**	**25**	**25**	mA
Peak Forward Current*	I_{FP}	**200**	**90**	**90**	mA
Reverse Voltage	V_R	**5**			V
Total Power Dissipation	P_{tot}	**150**			mW
Operation Temperature	T_{opr}	**-30~+85**			℃
Storage Temperature	Tstg	**-40~ +100**			℃
Junction Temperature	Tj	**100**			℃
Soldering Temperature	Tsld	Reflow Soldering: 260℃ for 10s			
		Hand Soldering: 315℃ for 3s			
Junction/ambient 3 chips on*	$R_{th\ JA}$	**833**			℃/W
Junction/solder point 3 chips on	$R_{th\ JS}$	**500**			℃/W

Note the superior design ratings of Operating Temperature range -30 to +85 degrees and storage requirements. Specific instructions are listed below.

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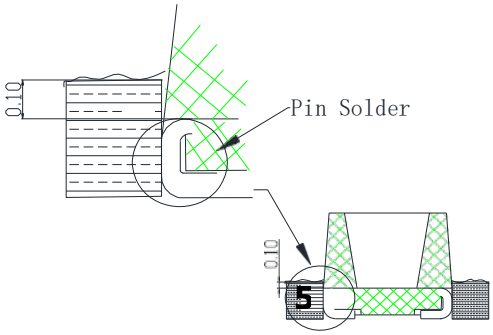
Storage

- Moisture proof, anti-electrostatic package and moisture absorbent material are used, to keep moisture to a minimum. Humidity indicator card inside to test if the products are moistened.
- Storage environment: Before opening the package, the product should be kept at 30℃ or less and humidity less than 60% RH, When the storage time more than 2 months, need to be used to bake.
- Before using, please check whether there is any air leakage or not, If the bag has leaked air, Please bake the product with below condition.
- Before soldering, the product must be stored under the condition of <30℃ and <60 ％RH. Under these conditions the SMD LEDs must be used (subject to reflow oven) within 12 hours.
- Baking conditions: (70±5）℃×24h.

Glue potting

The reliability of LEDs are easy to be influenced by water vapour. Therefore the outdoor diodes must be protected by glue potting. The height of glue above the pins should be higher than 0.10mm, in order to isolate water vapour.



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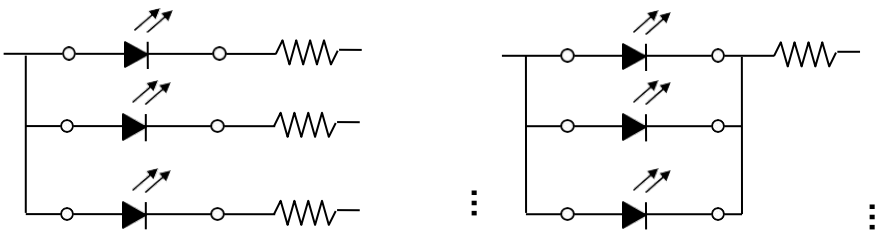
Static Electricity

- Static electricity or surge voltage damages the LEDs. Damaged LEDs will show some unusual characteristics such as low forward voltage, diode and driver failure. Measures should be taken when handling components to ensure static electricity does not damage them.
- All devices, equipment and machineries must be properly grounded, at the same time to prevent anti-static and voltage surge.
- It is also recommended that anti-electrostatic wrist bands, pads, uniforms, gloves or containers be used when dealing with the LEDs.

Design Considerations

- In designing a circuit, the current through each LED must not exceed the absolute maximum rating specified for each LED. In the meanwhile, resistors for protection should be applied, otherwise slight voltage shift will cause big current change which is likely to cause damage.
- It is recommended to use Circuit A which regulates the current flowing through each LED rather than Circuit B. When driving LEDs with a constant voltage in Circuit B, the current through the LEDs may vary due to the variation in Forward Voltage (VF) of the LEDs. In the worst case, some LED may be subjected to stress in the excess of the Absolute Maximum Rating.



(A) **(B)**

- Thermal Design is of paramount importance because heat generation may result in decline of visual performance, such as brightness decrease, colour change and so on. Please consider the heat dissipation when making the system design.

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Reverse voltage protection

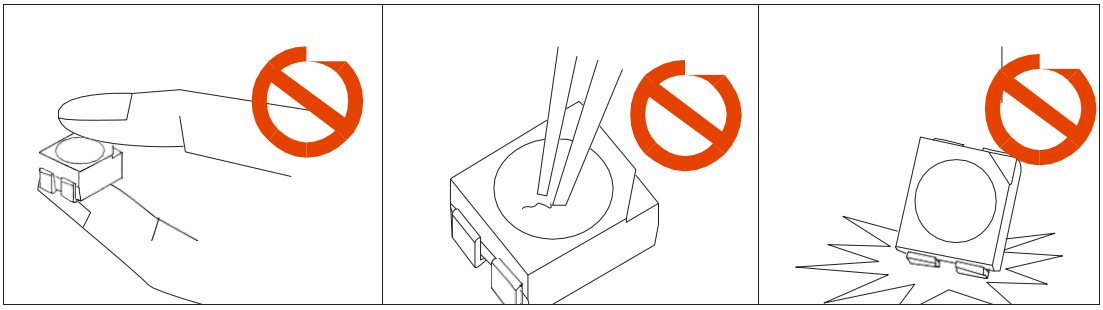
- In general, the reverse current of LED is very small, which won't affect the normal use of components. But when it is often suffered the reverse voltage which exceeds the limit of the component then it will be damaged. Such as the reverse current increase rapidly. And it will cause the string light when the screen is black. So please pay attention to controlling the reverse voltage which less than 5V is recommended.

The safe temperature for LEDs working

- High temperatures will make the LEDs' luminous Intensity decreased radically. If LEDs are used in a hot environment for a long time, their integrity and reliability will be compromised. When LEDs are used in a high density array, we suggest that the LEDs' surface temperature should be lower than 55℃ and the legs' temperature should be lower than 75℃.

Others

- When handling the product, touching the encapsulation with bare hands will not only contaminate its surface, but also have an effect on its optical characteristics. Excessive force to the encapsulation might result in catastrophic failure of the LEDs due to die breakage or wire deformation. For this reason, please do not put excessive stress on LEDs, especially when the LEDs are heated (for example during reflow soldering).



The epoxy resin of encapsulation is fragile, so please avoid scratches or friction over the epoxy resin surface. While handling the product with tweezers, do not hold by the epoxy resin.

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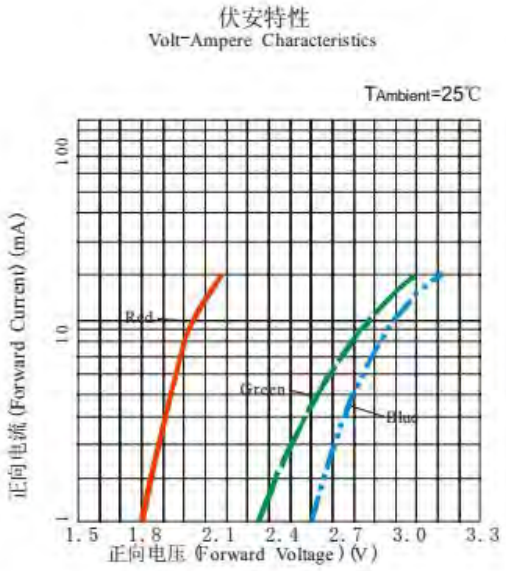
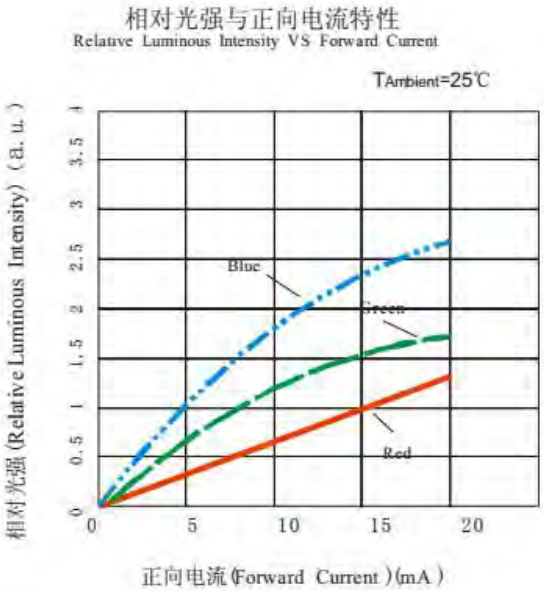
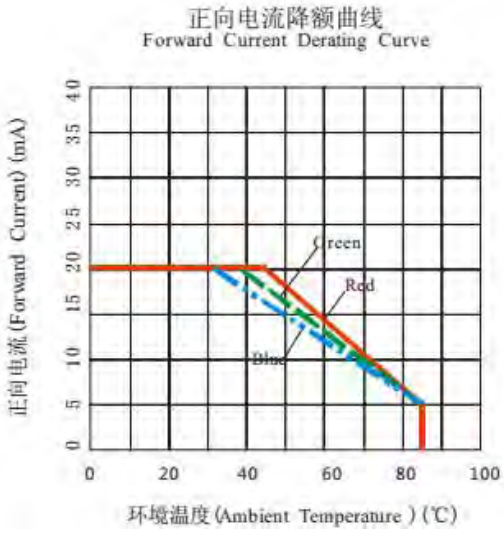
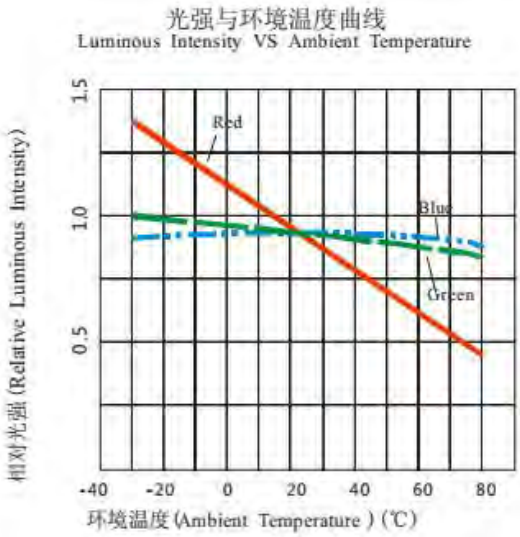
Electrical Requirements









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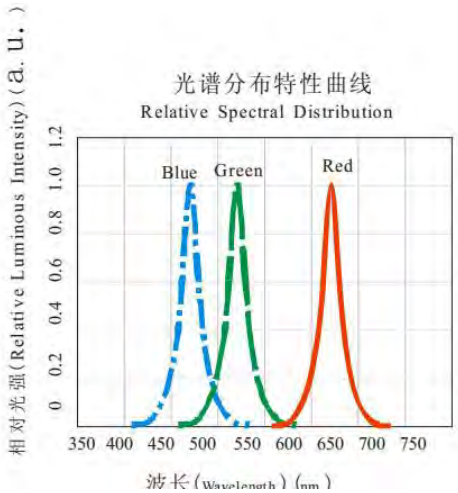
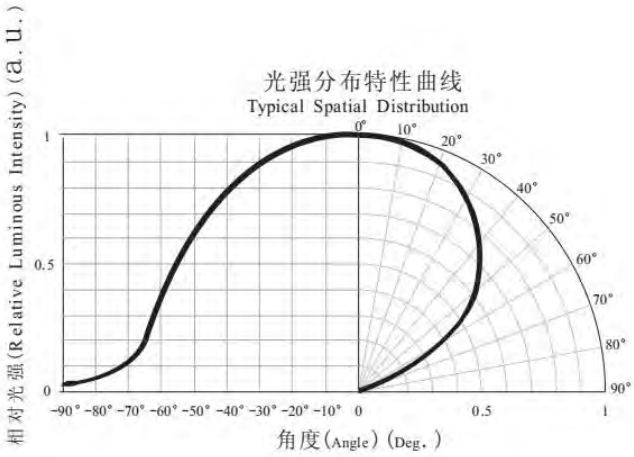
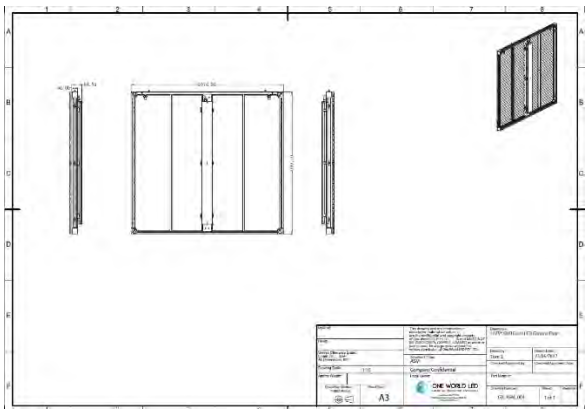
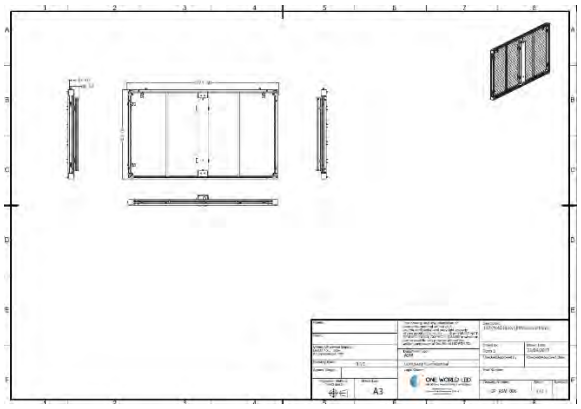




Cabinet Designs

Sample design of Transparent LED Cabinet designs for 3rd Generation modules are shown below.





Third Generation

Specialized PCB, S-PWM driver IC and, specialized SMD components are developed to meet advanced needs of Transparent LED specifications. These advances in Transparent LED technologies provide a new platform for architectural design, serviceability and green energy requirements that are the hallmarks of the current generation of transparent LED screen designs.

Fig. 7 – Third Generation Glass LED Screen

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These third generation innovations allow exciting new customization for up to 6-meter-wide logical sections with thin PCB, state of the art MBI5041 16-Channel SPWM driver IC and top-edge mounted LED components especially designed for transparent LED Screens. For example, the typical 3528 components are repacked into thin profile SMDs for this application allowing reconfiguration of the rectangular pixel sites of the second generation into normal square pixel sites which eliminate required video manipulation of the second generation screens. This significantly reduces the support cost and TCO of the third generation screens. See comparison shown below.

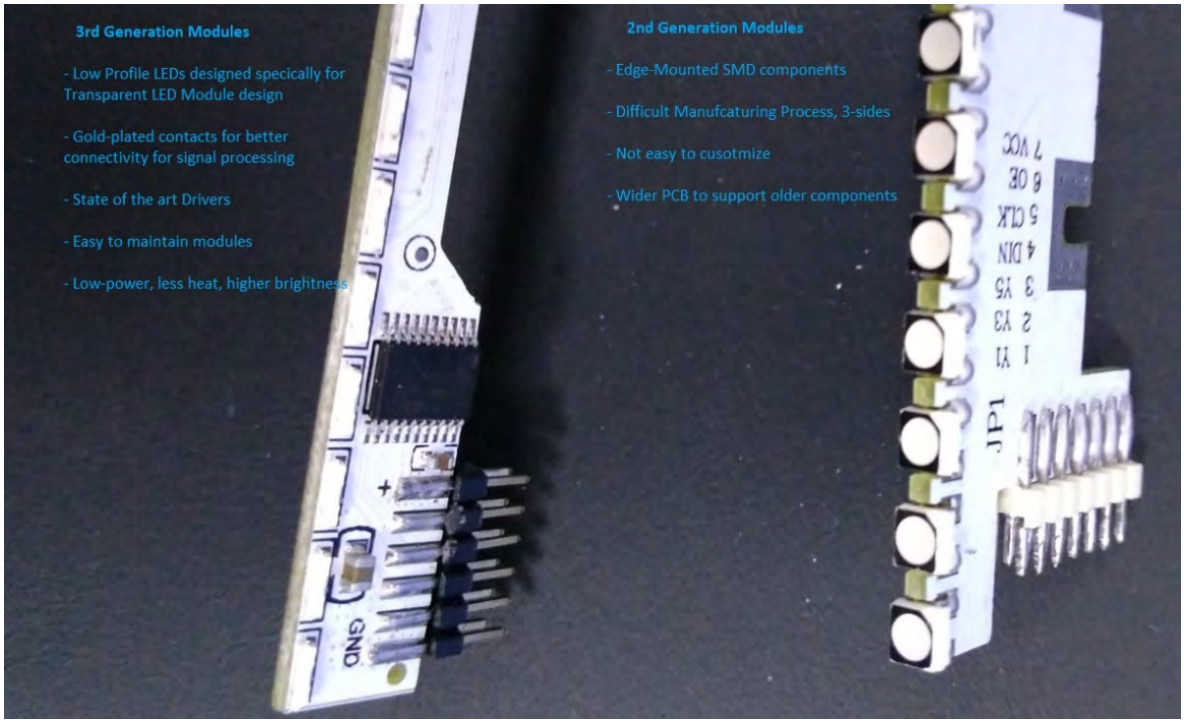

Fig. 8 – Comparison of 3rd and 2nd Generation Glass LED Modules

Third generation designs allow design of symmetrical pixels and square pixel sites that eliminate the problems of the second generation screen's rectangular pixel sites.

Fig. 9 – Application dictates glass LED requirement

Additionally, the gold-plated contacts (pins and sockets) provide a more reliable connection and eliminates intermittent connections of second generation designs. Another important element of the 3rd generation glass LED design is shown below.

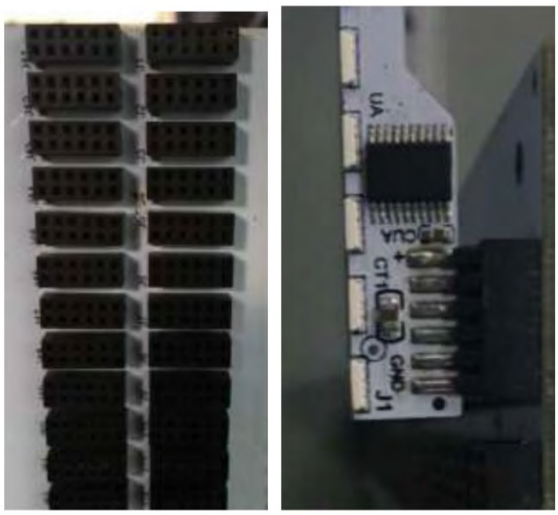

Fig. 10 – 3rd Generation Module Connector and Sockets

The sockets are a key component of the design and require spring-loaded gold plated contactors to eliminate intermittent disconnects of the standard contacts.

Fig. 11 - Macroblocks' QFN Packaged IC & Latest 3806 LEDs

The QFNs allow closer spacing of the connectors which facilitates the square pixel design. This means the 3rd generation product has reduced the thickness of the modules by about 50 per cent. A similar design previously installed P6.25 indoor screen is shown below.

Fig. 12 – Glass LED Showroom Window Application

These innovative technologies have combined to move the third generation transparent LED products a quantum leap forward. The showroom glass overlay highlights and provide communication means for making statements as needed to stimulate the market. Below is a 3rd generation standard installation.

Fig. 13 – Another Showroom Glass Window Highlighter

Other applications and project examples will be provided upon request. The custom design will incorporate custom modules for architectural fit to highlight state of the art showrooms as required by the application.

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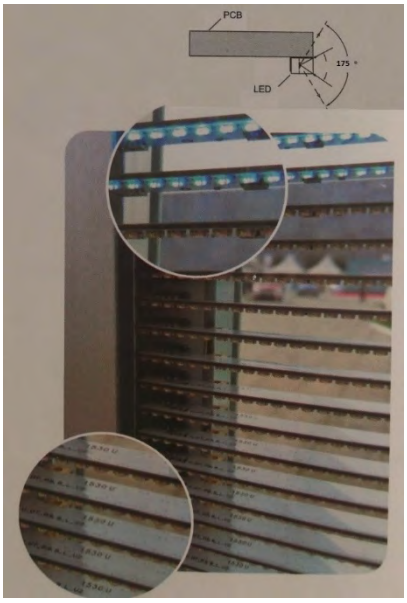
Conclusion

Third generation improvements provide best image and angle of view due to advanced application specific components and thinner PCB offer numerous advantages including:

Higher image fidelity,	Lower module thickness and profile,
Higher transparency,	Lower power consumption,
Higher Brightness,	Lower heat dissipation,
Higher reliability,	Lower TCO (Total Cost of Ownership),
Higher image quality,	Lower production/graphics costs,
Higher transparency,	Lower failure rate,
	Lower weights.

These advantages now justify the customization of the screens to virtually any architectural environment and application. The market-leaders now can take advantage of this leading-edge marketing and communication solution to increase the competitive advantage and solidify market-leadership position without many risks of the prior art.

The advantages of the latest technology make this an obvious choice for showroom windows within close view of the foot traffic as well as drive by traffic where viewer is at angle below the image. See the image below highlighting the viewing angle.



One World LED strongly recommends upgrade to the third generation transparent LED screens for both standard and custom applications in showrooms and building facades to maximize viewing impact, wow-effects and market excitement.

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User Notes: Typical Production Schedule

Manufacturing Timeline Sheet

Order Transparent Screen					
No.	Type	Pitch	Cabinet	Quantity	size
XS20170527001	Glass panel	6.25	customized	13PCS	28.68 SQM
Details					
Task	Date				Note
Proposed Design	15/04/2017				
Order Specification	1/06/2017				
PCB BOM Design	15/06/2017				
Cabinet BOM Design	15/06/2017				
Order PCB	16/06/2017				
Order Components	16/06/2017				
PCB Sample to test	9/07/2017				
Receive PCB	12/07/2017				
Receive Components	12/07/2017				
SMD Process	13/07/2017				
Assemble	2017/07/14-2017/7/19				
Test	2017/07/19-2017/07/25				
Pack	26/07/2017				
Ready to Ship	27/07/2017				

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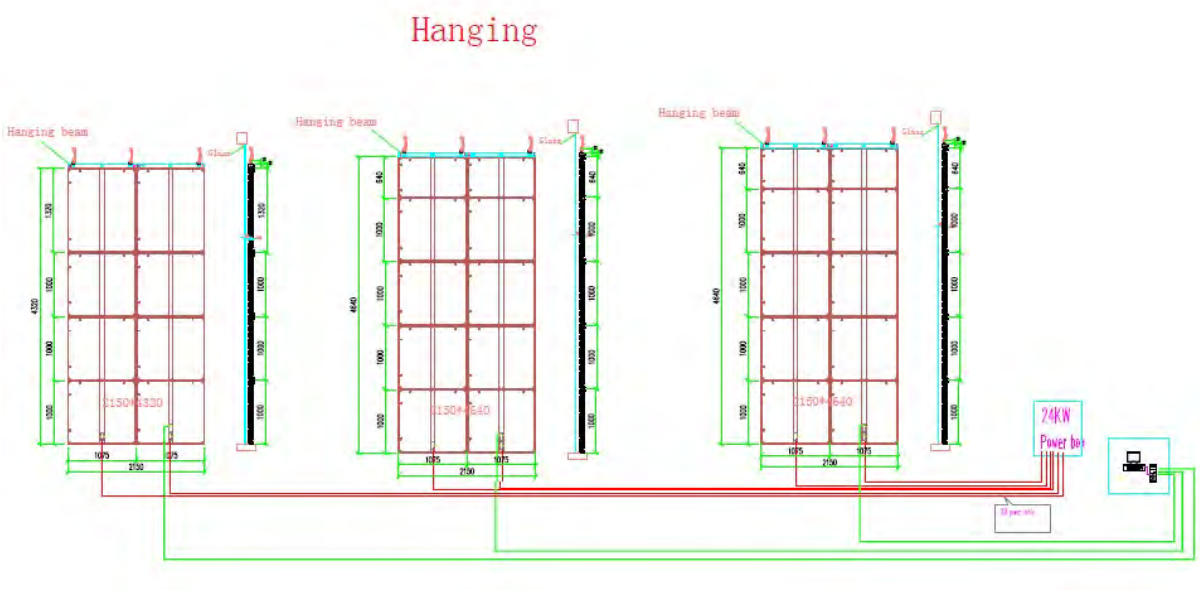
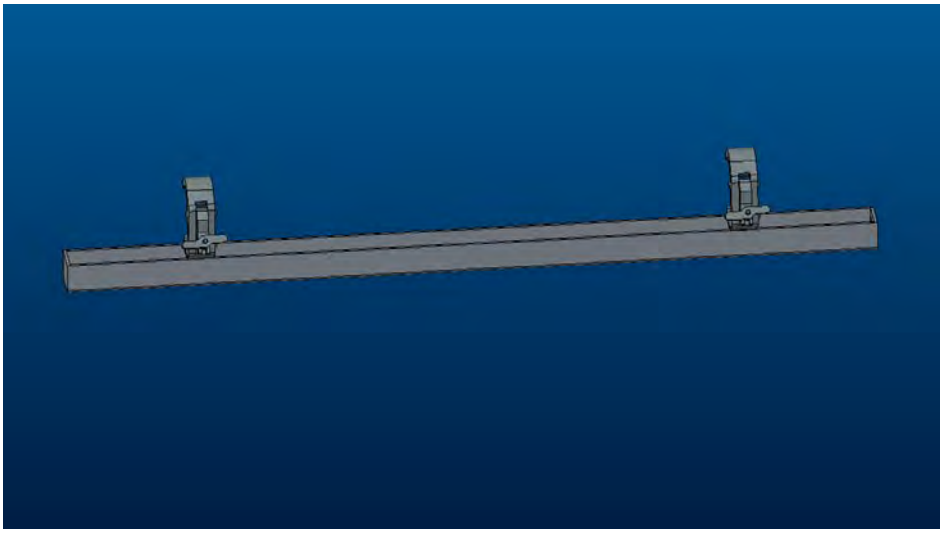
Aria Digital Showcase Application Justification

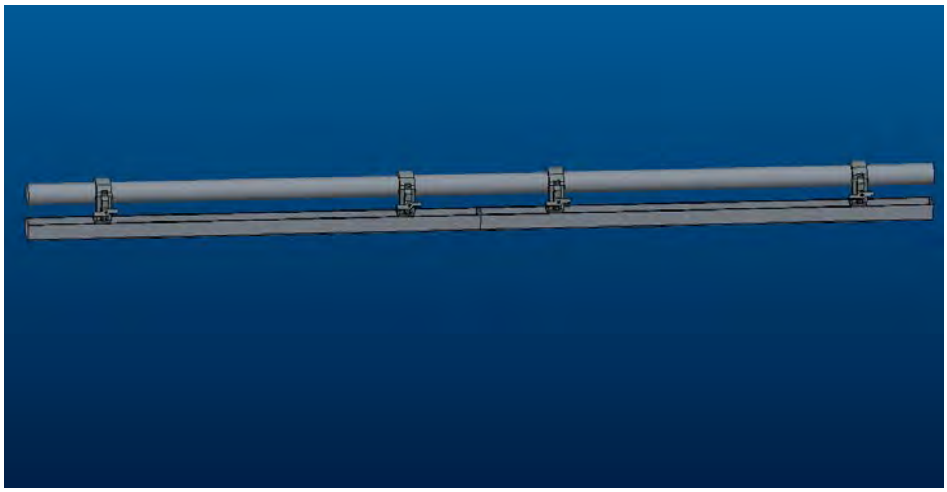
One World LED has recommended the custom designed Transparent LED Screen based on the third generation technology as outlined above.

Following is the proposed diagram of the transparent LED screen designed for Aria Digital.



Detailed Design and installation instructions to be provided…





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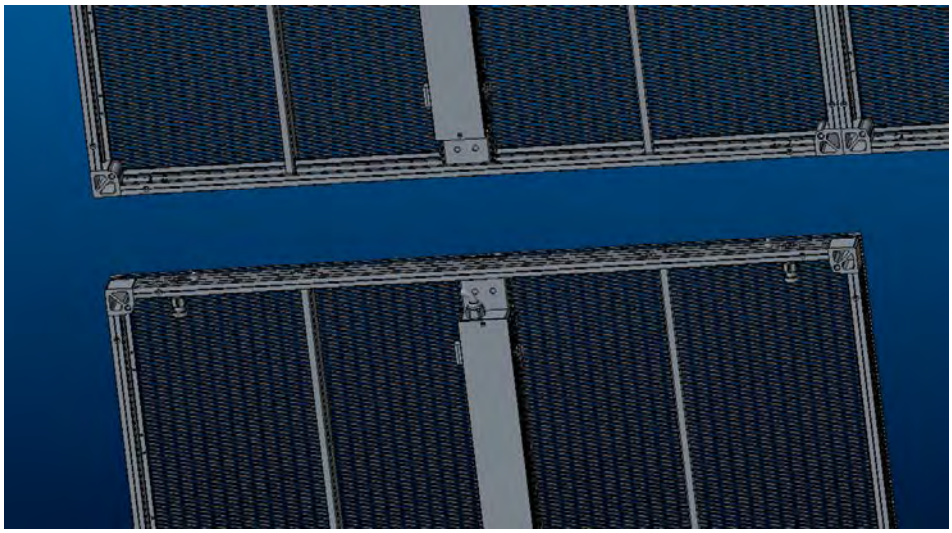

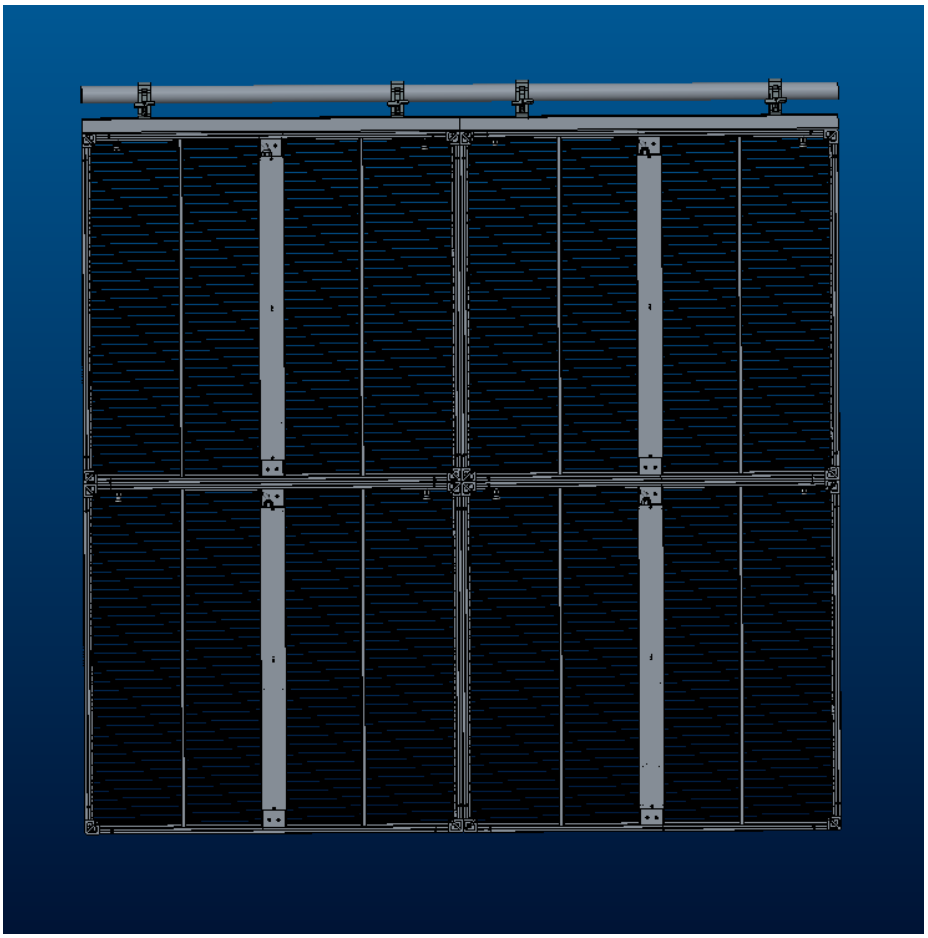

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PCB Design and Manufacture

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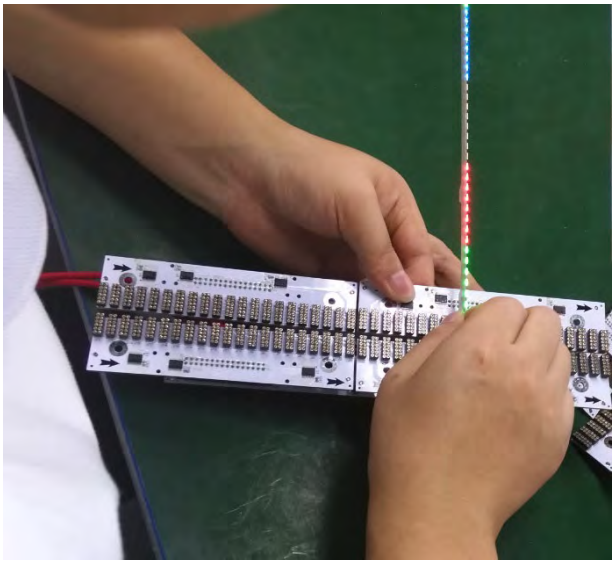
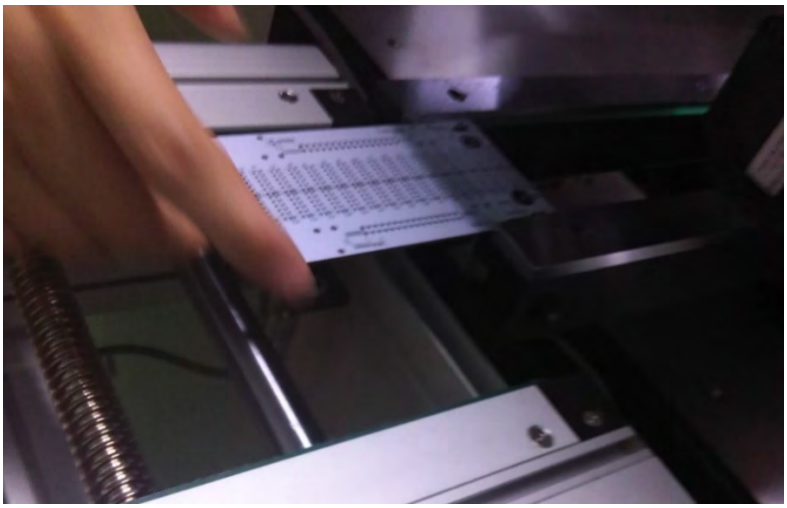
Control System

Below, pictures show the constructed Control Systems and Q/C control and testing of the HUB Backplane connectors.



Below is the picture of Backplane Hubs Processing and testing before mounting of the Module connector sockets.



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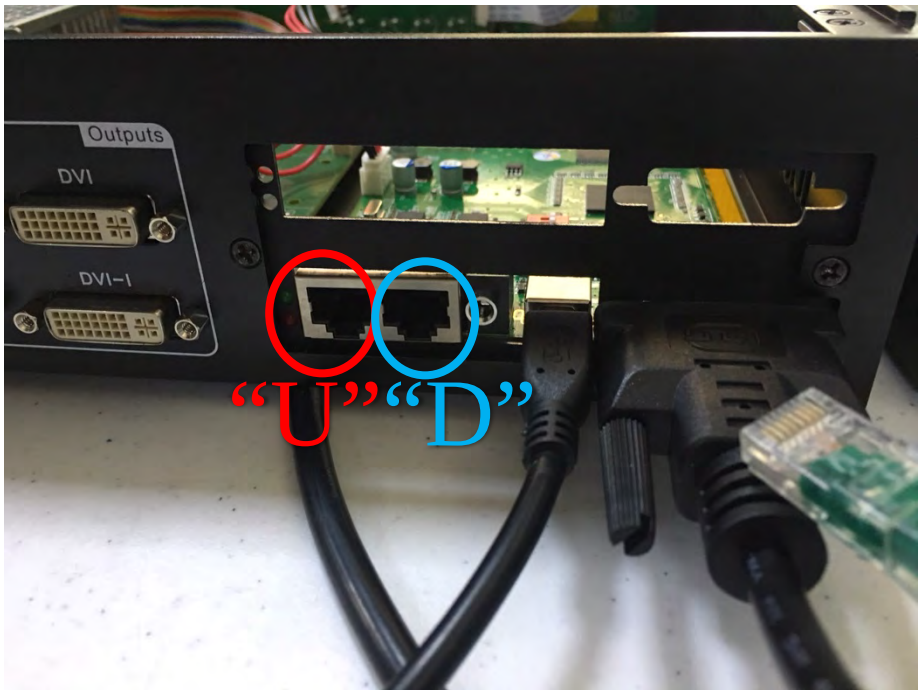
Control System Configuration

N.b, this section is only relevant if specifying proprietary, third party content management software.

It is critical to note that because the LED control systems are designed mostly to manage very large screens by vertical division and proprietary digital signage software that user wishes to use does not support vertical divisions of screen then this document provides a solution to get around that limitation.

U & D refer to Up and Down for vertical division and in this case they will be assigned to Left and Right.

According to tests at showroom, the main reason of causing display issues of Bondi is the incorrect connection set by software.



Fig, Ports "U" and "D".

There are 2 ports "U" and "D" on sending card, see above. According to actual and physical wire of screens to sending card, the connection of cabinets is supposed to go through port "U" first, then port "D". As it was set for Bondi screen, see below.

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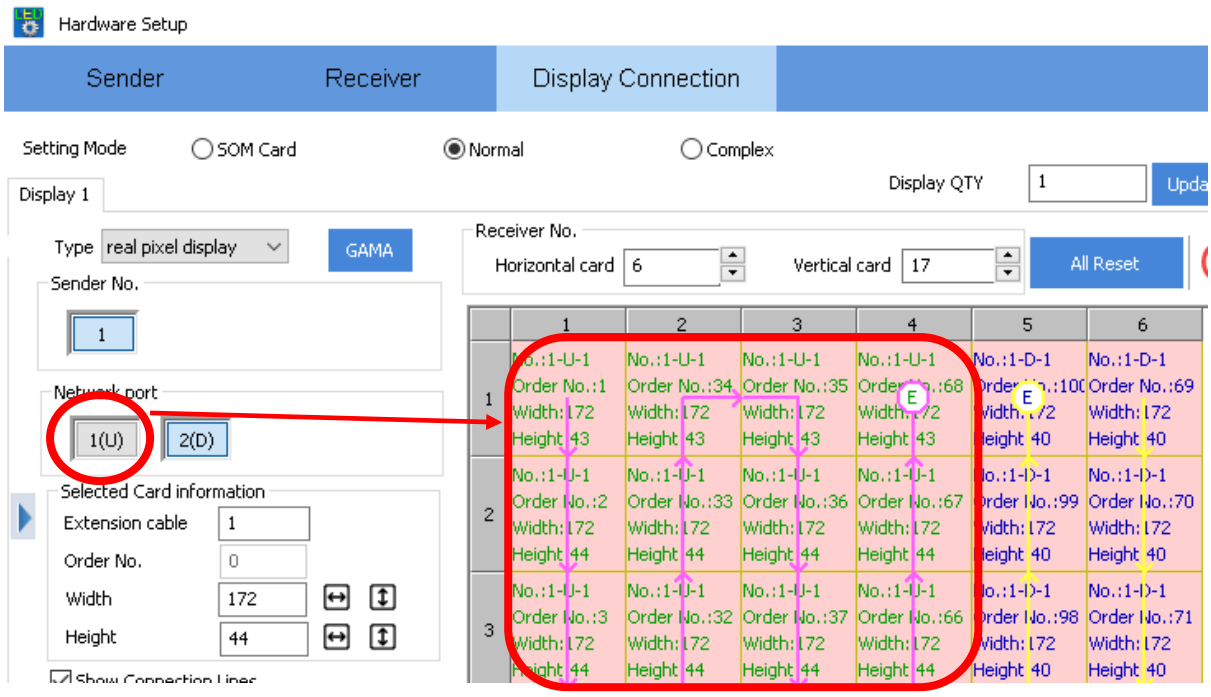

But, when it uses 2 ports (“U” and “D”) to control screens, port “D” should always be set firstly, then, setting port “U” for the rest of cabinets. If not, based on the set of Bondi screens (setting port “U” first, and “D” second), when checking the complex connection, the 16 “pixels” offset happened because the actual position of the first cabinet of 3rd screen should be at 688 not 704. It could be manually changed back to 688 (the actual and correct position). But, it won’t send to sending card and will be changed back to 704 again.

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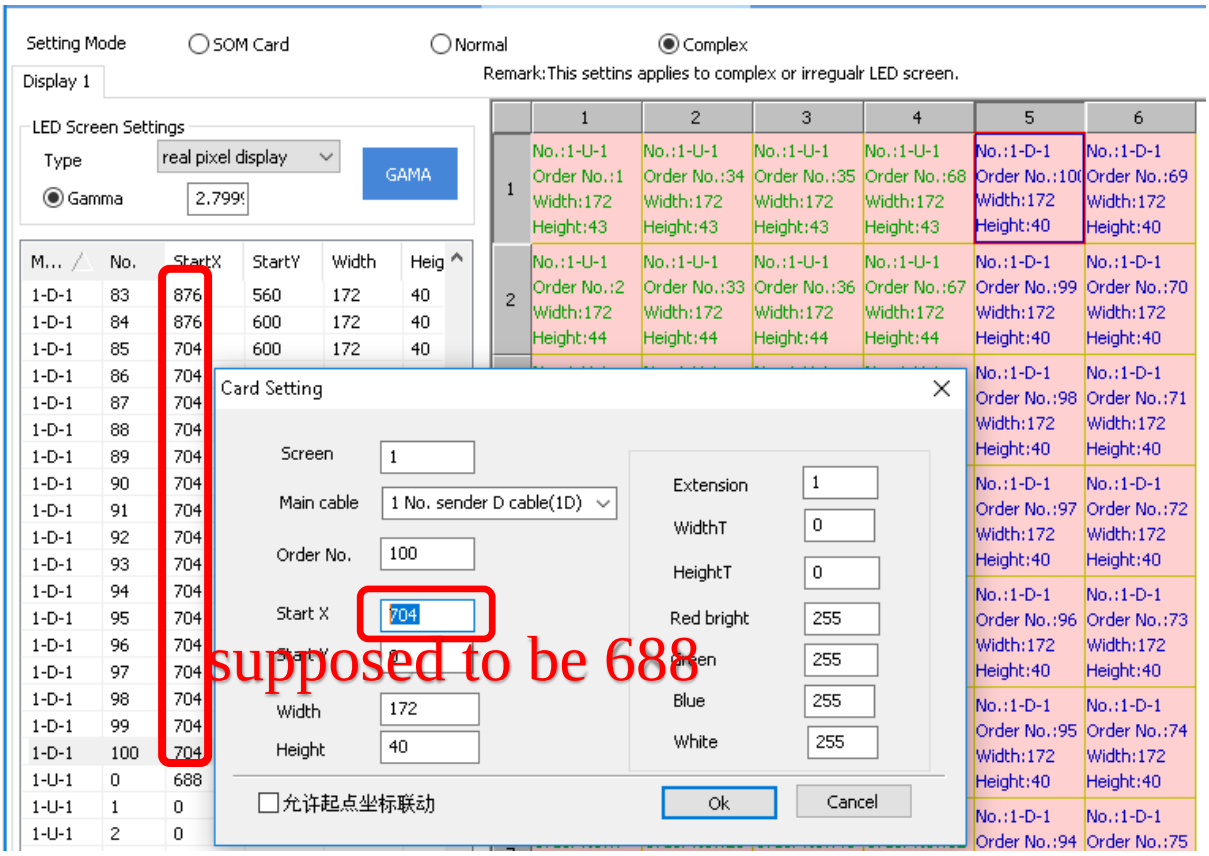

Fig, 16 “pixels ” offset happens.

Thus, to avoid such issue, the new connection file has been made by relocating positions of “software screens”. It still keeps the previous physical connection from sending card to cabinets thus no further step needs to be physically done. But, all cabinets (3rd screen) connected to port “D” were set in the first place in “LEDSet”, followed by port “U” controlling 1st and 2nd screens.

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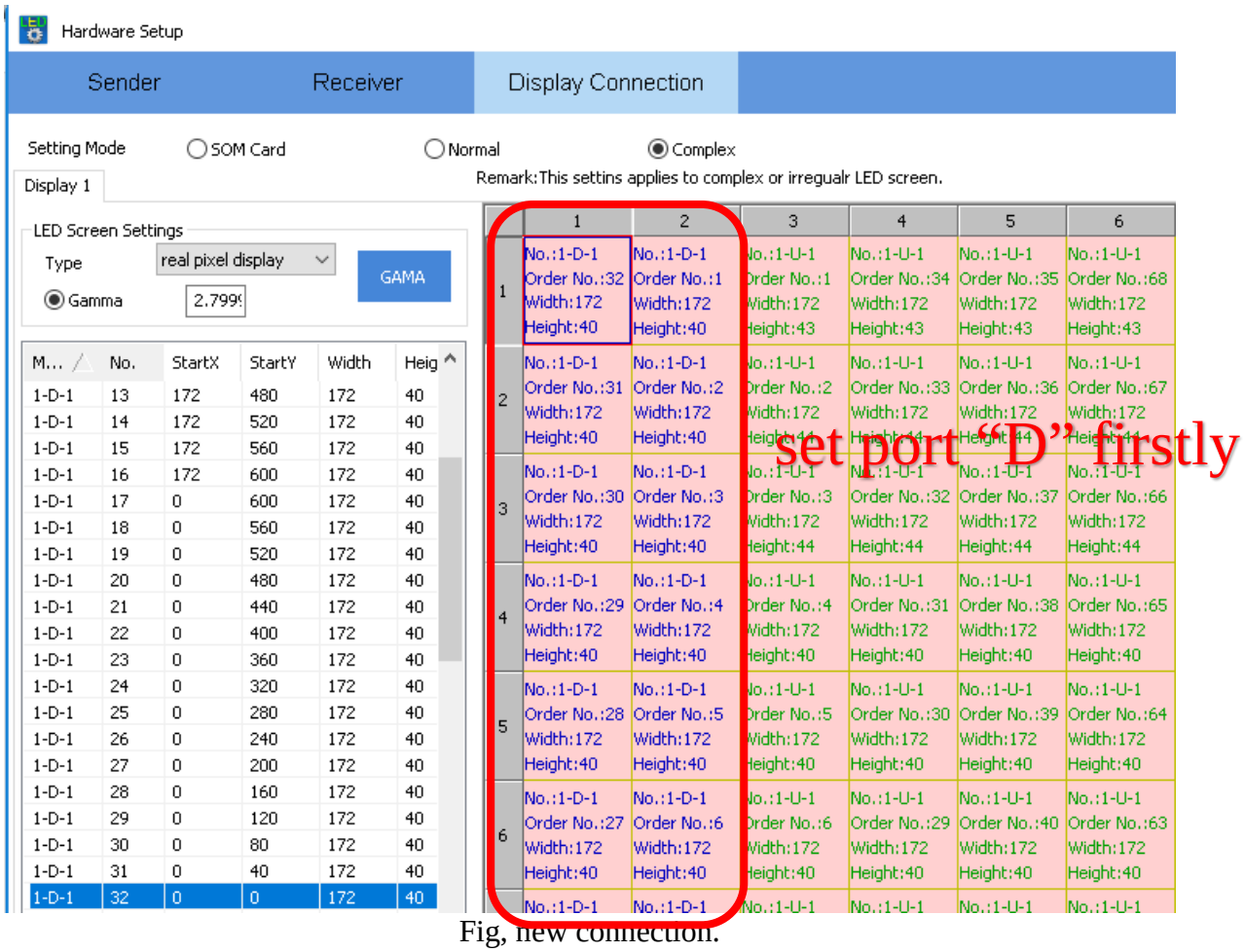
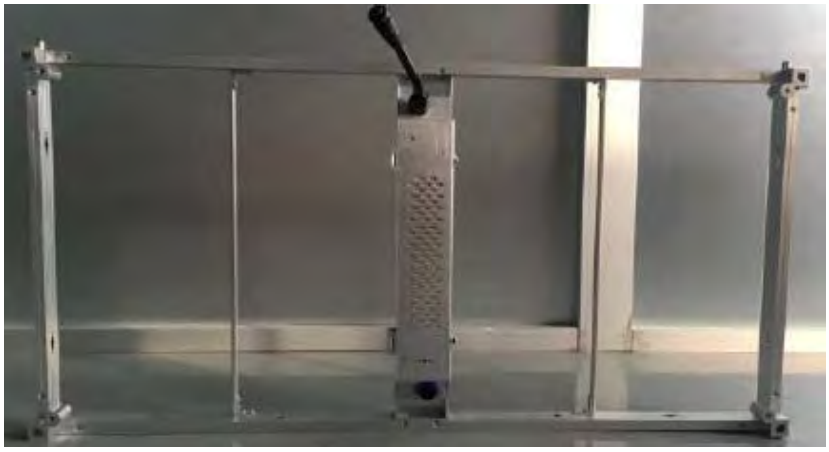


Fig, new connection.

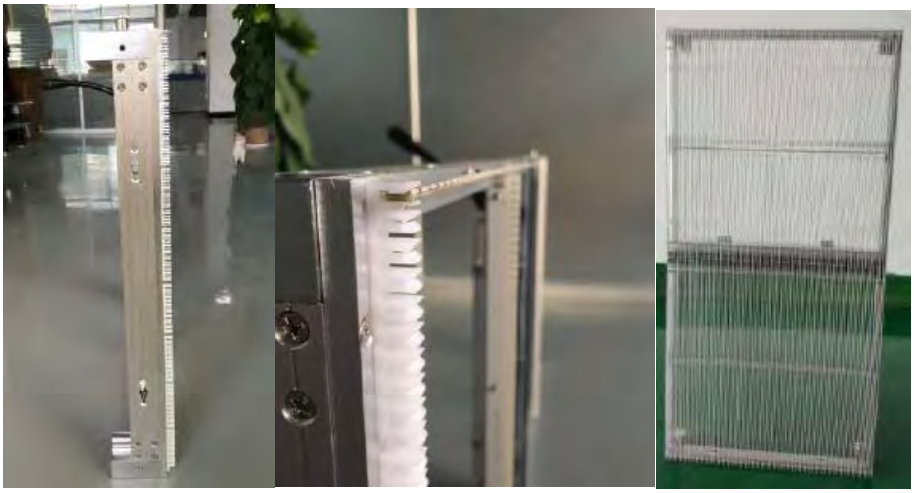
The solution of Bondi screen is, move the window of 3rd screen to the origin, then followed by 1st and 2nd screens, the new connection will be directly sent to sending card. That will fix the screen remotely.

User to provide power and data connections.

Front View of Aluminium Cabinet



Back View of Cabinet Power Supply and Controller Box



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Cabinet Frame Module Mounting Accessories

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Final Custom Product Burn-in, Quality Control and Testing

Please refer to video of final testing, screens are displaying clients' multimedia contents.

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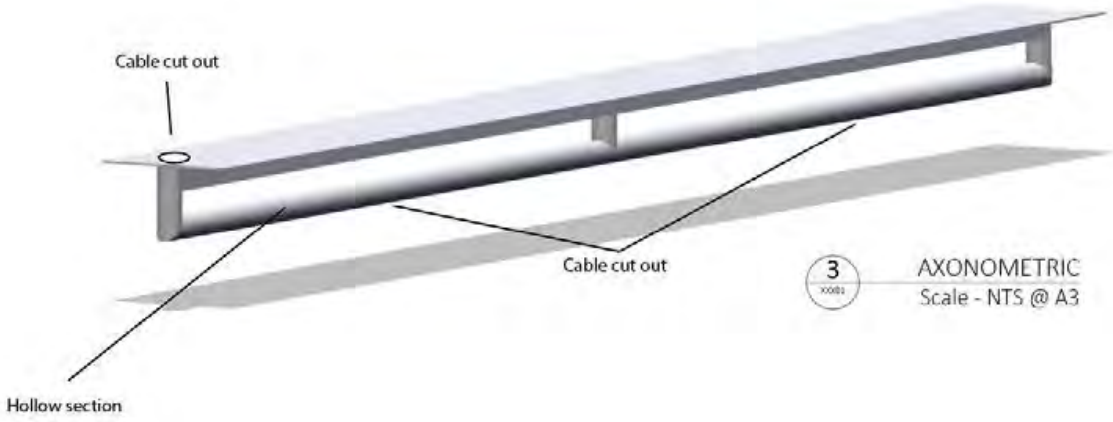
Installation by Mullion Hangers

Following is an example of a screen hung using mullions

Following is an example of hanger structure for the Transparent LED Screen.



Below is the catch part that hangs the screen from the structural rod shown in the figure above.

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Safe handling and Operation Notes

Operational Requirements

Following lists the operational requirements of the One World third generation Transparent LED screens.

Brightness

The red operation zones damage after installation is protected by the maximum brightness setting as follows:

For years 1 & 2 do not exceed 80%

For years 3 & 4 do not exceed 85%

For years 5 & 6 do not exceed 90%

For years 6+, brightness is increased as needed to compensate for loss.

The aging of the SMD requires brightness compensation overtime. However, excessive brightness setting with new screens will impact longevity and premature component aging and possible failures.

White Background

The optimum white color application is explained below. The full white background and large white background must be avoided in favour of white frames for viewer attractions. The full white background makes inefficient utilization of the transparent LED screen and may cause viewer irritation and counteract the actual intended advertising objectives.

Please refer to One World LED Contents Primer for details of content optimization to achieve best results. See this primer at the link: http://oneworldled.com/wp-content/uploads/2016/03/LED-Screens-Contents-Primer-1.pdf

Use of **black background** (off) and vivid colors messaging and imaging in foreground animations provide for optimum communication and advertising methods with Transparent LED Screens. This also significantly improves the energy efficiency by minimizing environmental impact.

For additional design, architecture and maintenance information refer to other resources at: http://oneworldled.com/products/support-download/

Do not hesitate to consult One World LED support for any questions or advice.

The third generation transparent LED screen design has incorporated design assumptions that require adherence to care instruction listed in this section for effective and reliable operation.

Installation and operation notes

Installation and operation details should be provided by the representative Reseller on a project basis.

Subject to project specific architecture, design and requirements. OWLED cannot provide user information regarding third party software as specified by Resellers or users.

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One World LED Outdoor Curtain and Mesh

Mesh and OWLdot LED

OWL T-BAR Curtain LED

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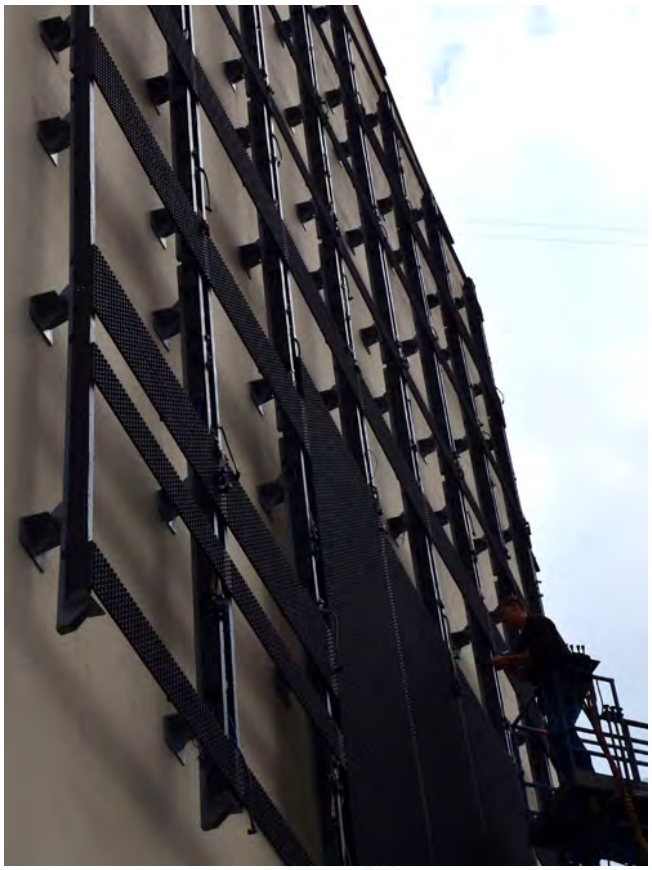

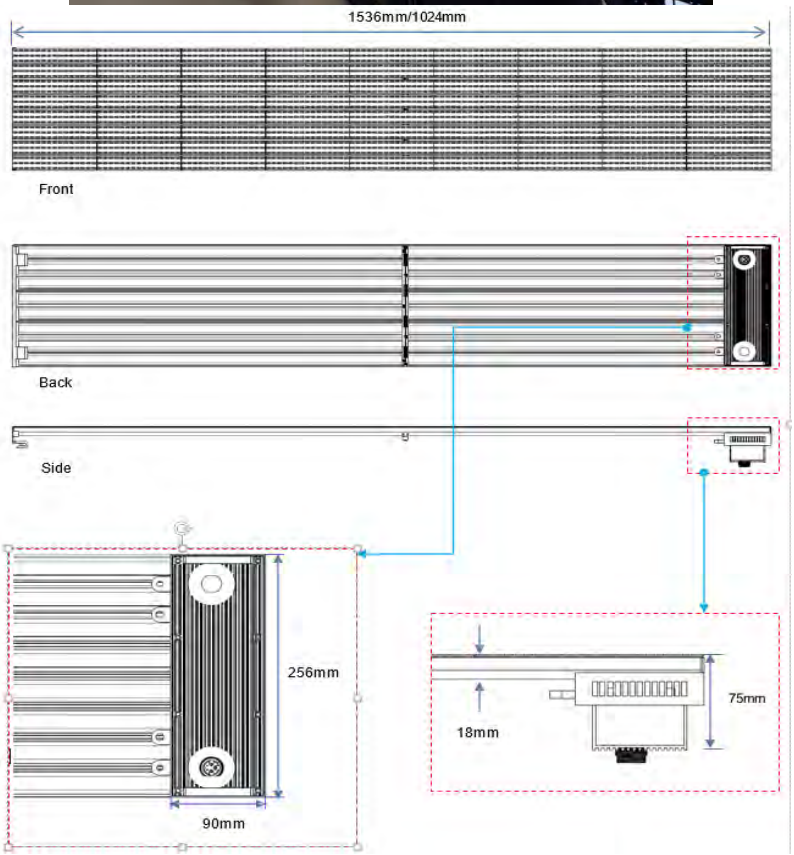

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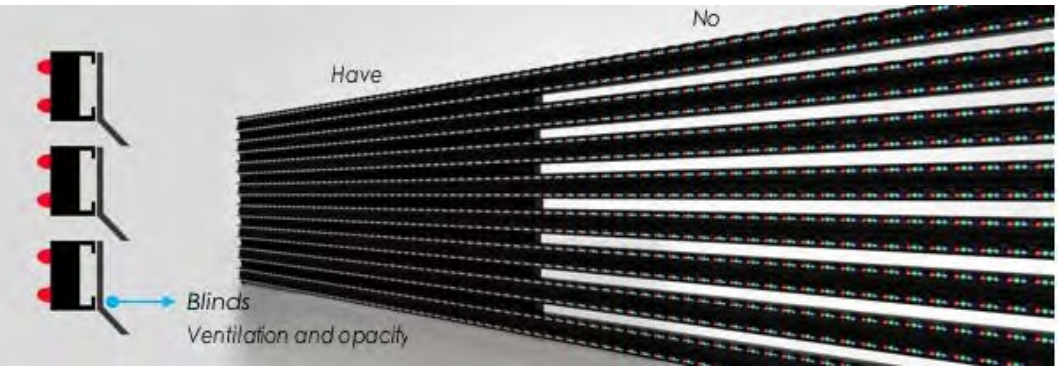
T-BAR Curtain LED

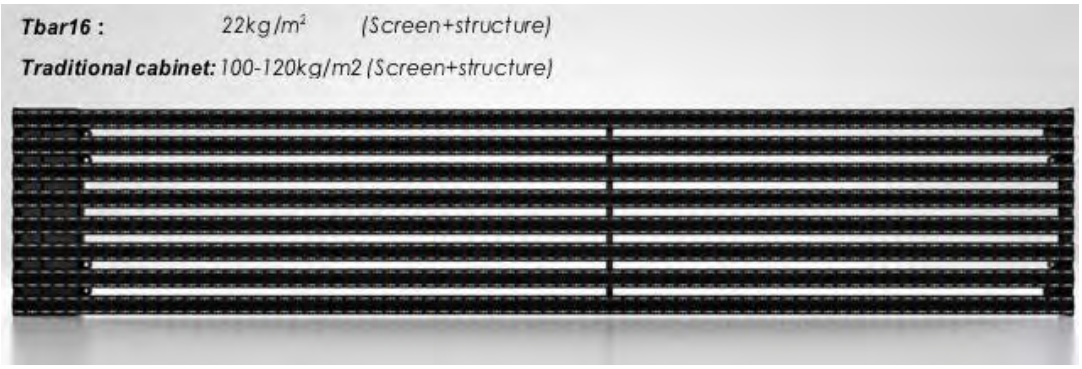
T-Bar curtain is the ideal product for high elevation facades and can be serviced from front or back. This product provides a light weight, low power consumption alternative for outdoor applications that require high through visibility and low wind-sail factor.

Parameter	Tbar-16
Pixel LED Configuration	1R1G1B
Unit Size	1536×256mm; 1024×256mm;
Pixel Pitch	16mm
Resolution	3906 dot/m^2
Resolution/unit	96dot×16dot; 64dot×16dot
Transparency	30%
Brightness	≥7500 nit
Weight	18kg/
Max. Power Consumption	400w/ m^2
Stick Permutation	Horizontal/Vertical
Viewing Angle	H120°/V60°
Ingress Protection	IP66

T-BAR Typical Specifications



T-BAR Vented Module



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Typical Weight Compared to Regular Iron Cabinet

Most innovative LED structures have been designed by One World LED incorporating T-Bar curtain LEDs for Sky High Branding. These designs will be available to One World LED authorized resellers for high exposure sites and extreme heights demanding low sail factor LED screens.

Custom Application Example