



PRODUCT COMPARISON THROUGH-HOLE & SMD LED TECHNOLOGY

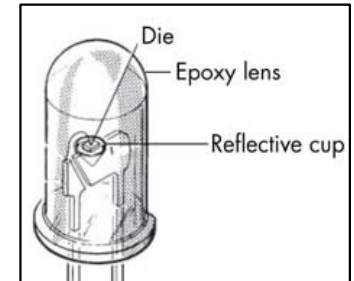
TECH NOTE

THROUGH-HOLE VS. SURFACE-MOUNT LEDs

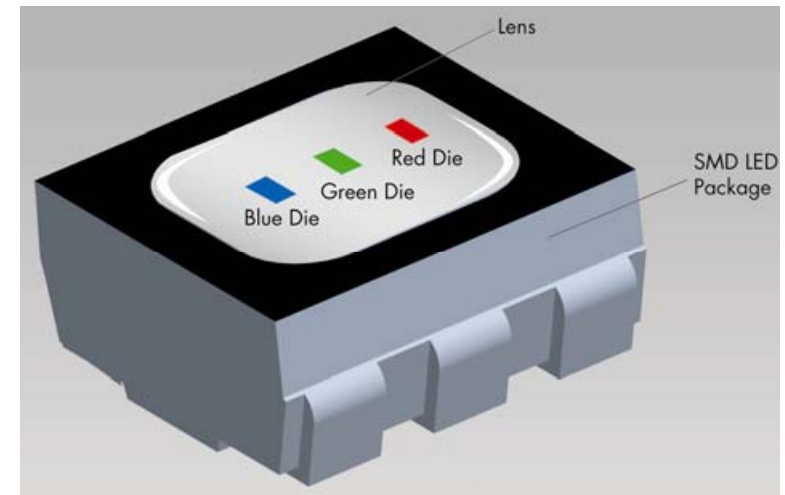
Manufacturers use several types of LEDs to construct large-screen video displays. The two most common are through-hole LEDs and surface-mount device (SMD) LEDs, also known as surface-mount technology (SMT) LEDs. Each type has its respective advantages that make them preferable for different large-screen video applications.

VIEWING ANGLES

Through-hole LEDs use a reflector cup and an epoxy lens package. The combination of the two elements, as well as the type of die used, plays a role in determining the elliptical viewing cone produced. Much like a floodlight, a through-hole LED's reflector cup focuses the light emitted by the die into a specific viewing area. This area defines the LED's viewing angle.



SMD LEDs, on the other hand, do not have a directional reflector cup to focus light. While the total light emitted is similar to a through-hole LED, it is not as concentrated in a focused area. Instead, it disperses more evenly across both horizontal and vertical angles, providing a wider horizontal and vertical viewing angle compared to through hole. This characteristic makes SMD LEDs an excellent choice for most indoor applications as well as some tighter pitch outdoor applications. Recent technology advancements enabled manufacturers to install SMD LED technology outdoors, thanks to a brighter SMD LED as well as weatherproofing enhancements.

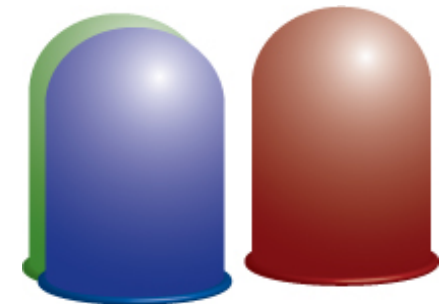


RESOLUTION

Through-hole LEDs use one red, one green and one blue LED to make up a full-color pixel, each mounted directly to the face of a circuit card. SMDs are similar in that they mount to the face of a circuit card, but different in that the red, green and blue element are confined to a single package. Using one single package enables manufacturers to space LEDs extremely close to one another to form displays with extremely tight resolutions.

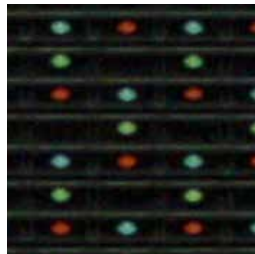
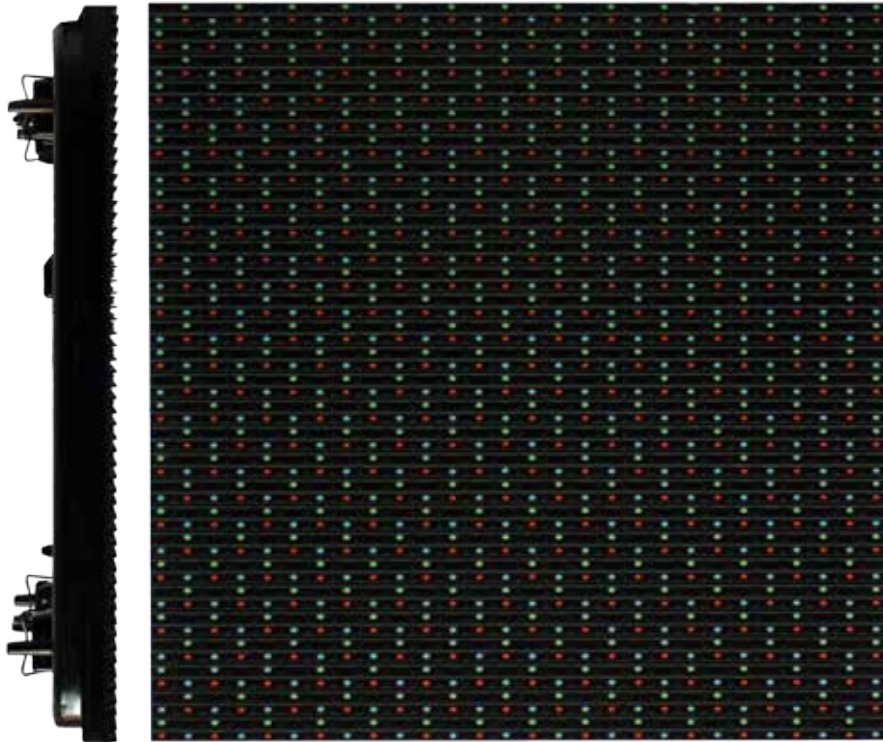
LED SHOULDERING

Through-hole LEDs use a domed epoxy lens to direct light, making it stand taller off the circuit card than SMD LEDs. For tighter resolution displays, the dome of one LED can physically obstruct the light emitted from the die of an adjacent LED, resulting in LED shouldering. In the example at the right, the blue and green LEDs are extremely close together. In off viewing angles, the location of the blue LED physically blocks the light produced by the green LED, causing a color shift. SMD LEDs avoid this obstruction due to their closeness to the circuit card surface and the design of the LED package.

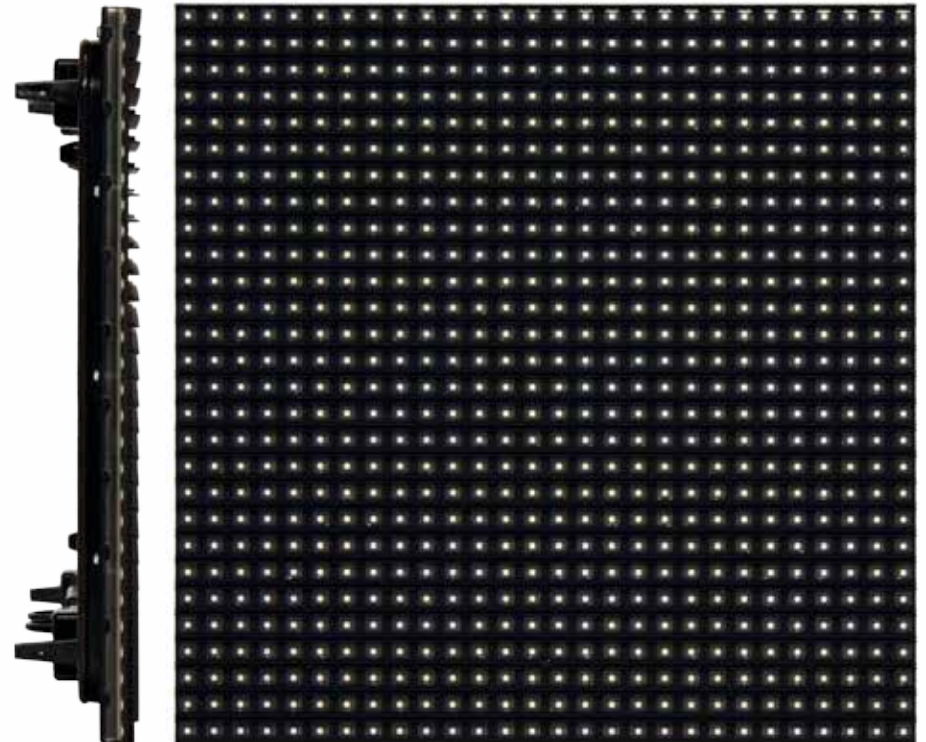


MODULE COMPARISON

THROUGH-HOLE VS. SURFACE-MOUNT LEDs



THROUGH-HOLE LED MODULE



SURFACE-MOUNT LED MODULE

DISPLAY VIEWING DISTANCES

Daktronics uses two measuring concepts for determining an appropriate pixel pitch for a display, minimum viewing distance and smooth image distance. The graph on page 5 illustrates the viewing ranges of each display with the bottom bar depicting the minimum viewing distance and the top bar, smooth image distance.

MINIMUM VIEWING DISTANCE:

The minimum viewing distance is the closest distance at which the colors from an individual pixel begins to blend with the surrounding pixels. The chart below lists the minimum viewing distances for some common sizes.

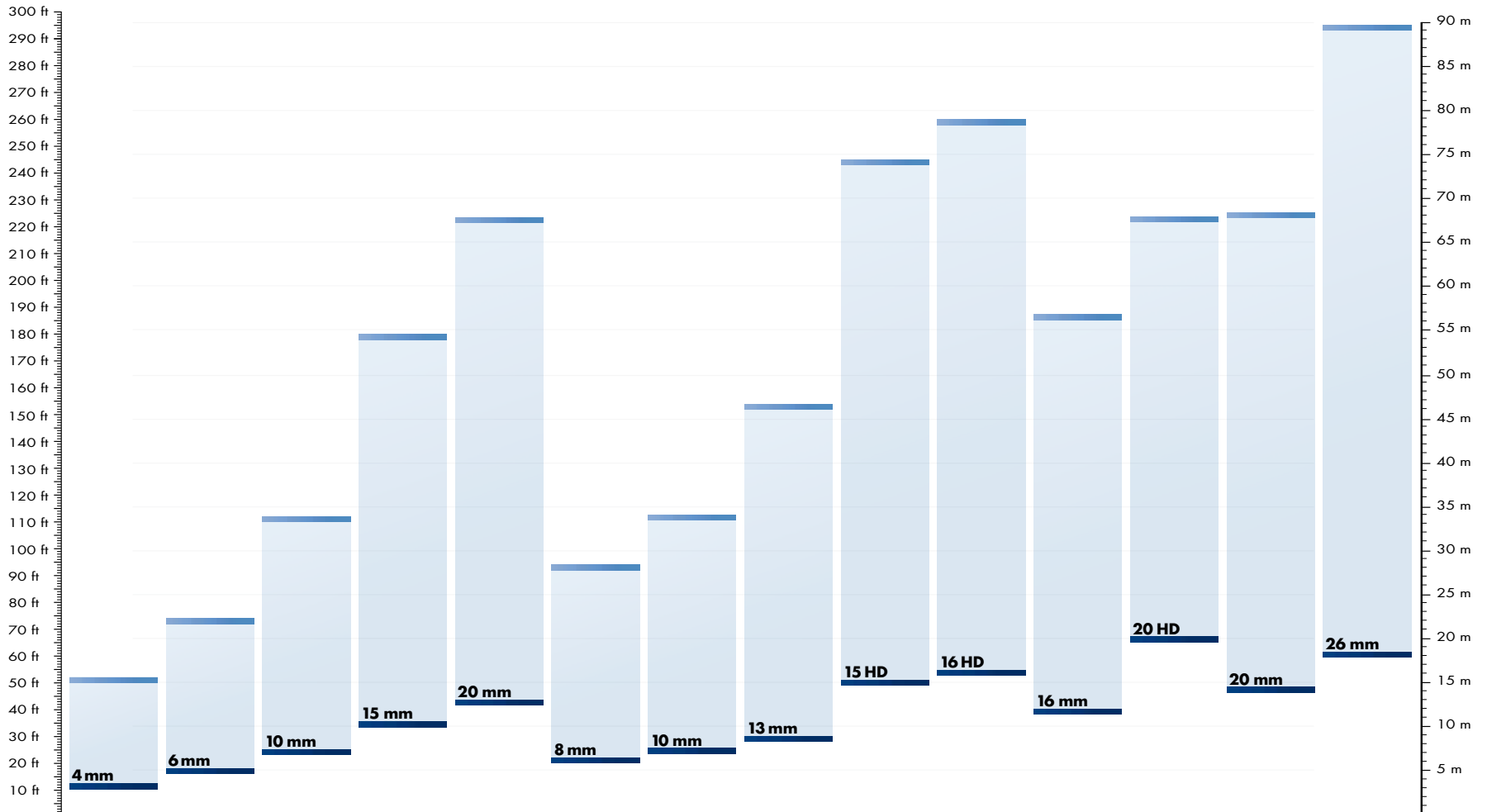
SMOOTH IMAGE DISTANCE:

The point in which the video display is at its purist distance in relation to where the viewer is standing.

Model:	Actual Pixel Pitch	Minimum Viewing Distance		Smooth Image Viewing Distance	
	(mm)	(ft)	(m)	(ft)	(m)
LED Video Displays - Indoor					
DVN-4	4.66	10.51	3.2	52.56	16.02
DVN-6	6.60	14.89	4.54	74.44	22.69
DVN-10	9.90	22.33	6.81	111.66	34.03
DVN-15	15.85	35.75	10.9	178.77	54.49
DVN-20	19.81	44.69	13.62	223.4	68.09
LED Video Displays - Outdoor					
DVX-8 SMD *	8.30	18.72	5.71	93.61	28.53
DVX-10 SMD	10.71	22.56	6.88	112	34.1
DVX-13 HD	13.06	30.68	9.35	153.39	46.75
DVX-15 HD	15.24	49.16	14.98	243	74.1
DVX-16 HD	16.63	51.61	15.73	255	77.8
DVX-16 MT	16.63	37.22	11.34	186	56.8
DVX-20 HD	20.32	64.51	19.7	222.19	67.72
DVX-20 MT	20.32	45.83	13.97	223	68.1
DVX-26 MT	26.13	58.92	17.96	295	89.8

* Consistent with Daktronics policy of continuing product development, specifications on this product are pending final development.

DISPLAY VIEWING DISTANCES



	INDOOR					OUTDOOR								
Pixel Pitch	4 mm	6 mm	10 mm	15 mm	20 mm	8 mm	10 mm	13 HD	15 HD	16 HD	16 mm	20 HD	20 mm	26 mm
True Pixel Pitch	4.66 mm	6.60 mm	9.90 mm	15.85	19.81	8.30 mm	10.71 mm	13.06 mm	15.24 mm	16.63 mm	16.63 mm	20.32 mm	20.32 mm	26.13 mm
Min Viewing Distance	10.51 ft. 3.2 m	14.89 ft. 4.54 m	22.33 ft. 6.81 m	35.75 ft. 10.9 m	44.69 ft. 13.62 m	18.72 ft. 5.71 m	22.56 ft. 6.88 m	30.68 ft. 9.35 m	49.15 ft. 14.98 m	51.61 ft. 15.73 m	37.22 ft. 11.34 m	64.51 ft. 19.7 m	45.83 ft. 13.97 m	58.92 ft. 17.96 m
Smooth Image Distance	52.56 ft. 16.02 m	74.44 ft. 22.69 m	111.66 ft. 34.03 m	178.77 ft. 54.49 m	223.4 ft. 68.09 m	93.61 ft. 28.53 m	112 ft. 34.1 m	153.39 ft. 46.75 m	243 ft. 74.1 m	255 ft. 77.8 m	186 ft. 56.8 m	222.19 ft. 67.72 m	223 ft. 68.1 m	295 ft. 89.8 m

THROUGH-HOLE & SMD LED

INSTALLATIONS

THROUGH-HOLE INSTALLATION

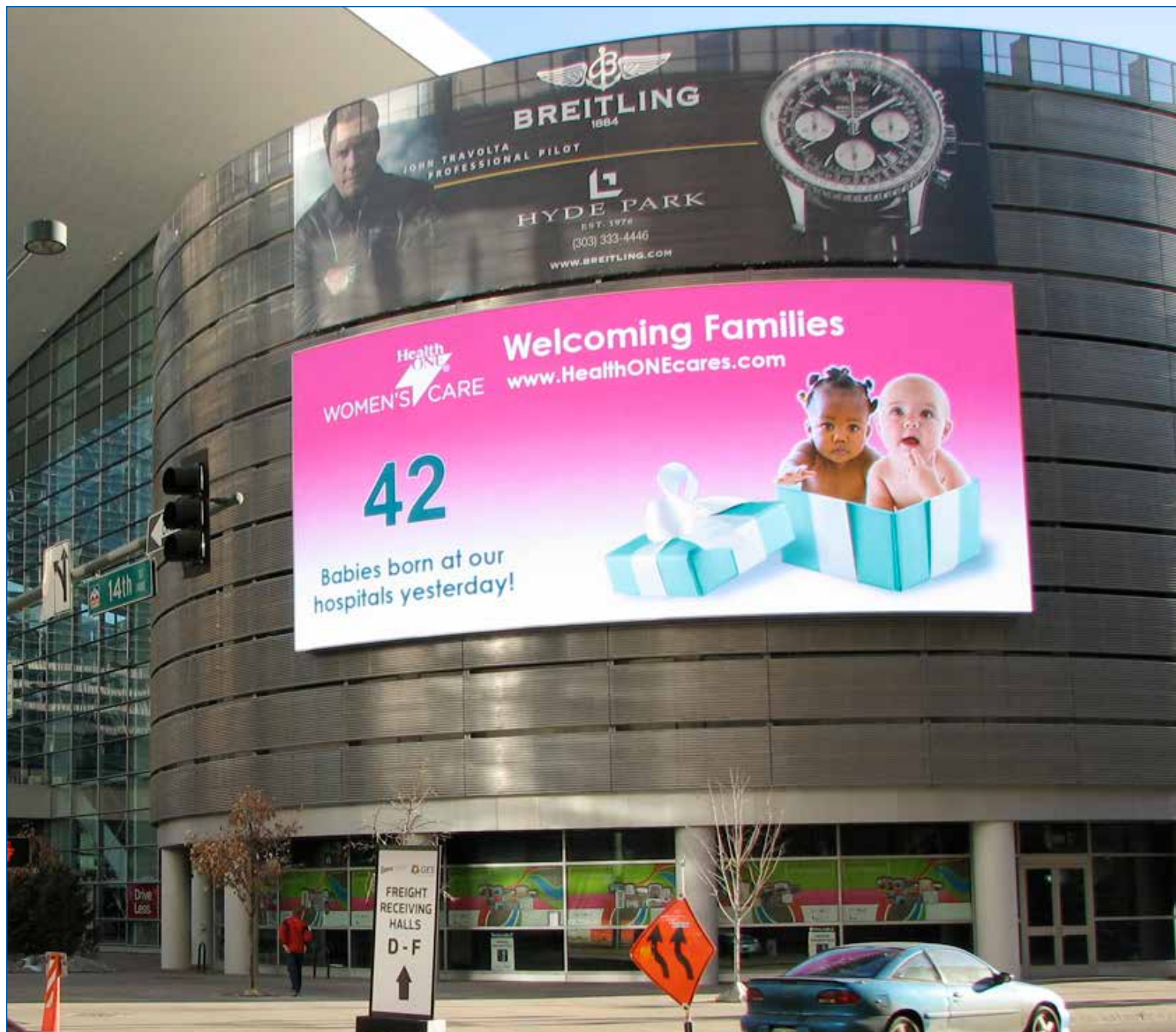


BANK OF AMERICA NEW YORK, NY

Full-Color LED Video Display
Through-Hole LED Technology
Pixel Spacing: 13 mm
Dimensions: 19'2" x 50'4"

Full-Color LED Video Display
Through-Hole LED Technology
Pixel Spacing: 13 mm
Dimensions: 18' x 102'

THROUGH-HOLE INSTALLATION



BRANDED CITIES - DENVER CONVENTION CENTER DENVER, CO

Full-Color LED Video Display
Through-Hole LED Technology
Pixel Spacing: 1.6 mm
Dimensions: 25'2" x 60'

THROUGH-HOLE INSTALLATION



MIAMI MARLINS MIAMI, FL

Full-Color LED Video Display
Through-Hole LED Technology
Pixel Spacing: 15 mm
Dimensions: 50' x 99'

THROUGH-HOLE INSTALLATION



UNIVERSITY OF SOUTH CAROLINA COLUMBIA, SC

Full-Color LED Video Display
Through-Hole LED Technology
Pixel Spacing: 13 mm
Dimensions: 36' x 123'



SONY/NEWS CORPORATION TIMES SQUARE, NY

Full-Color LED Video Display
SMD LED Technology
Pixel Spacing: 10 mm
Dimensions: 34'6" x 37'4"



HYUNDAI MOTOR AMERICA TIMES SQUARE, NY

Full-Color LED Video Display (4)
SMD LED Technology
Pixel Spacing: 10 mm
Dimensions: multiple dimensions



NEW YORK YANKEES BRONX, NY

Full-Color LED Video Display (2)
SMD LED Technology
Pixel Spacing: 10 mm
Dimensions: 4'9" x 368'6" | 23'6" x 34'6"



SANTA ANITA PARK ARCADIA, CA

Full-Color LED Video Display
SMD LED Technology
Pixel Spacing: 10 mm
Dimensions: 9' x 16'

www.daktronics.com