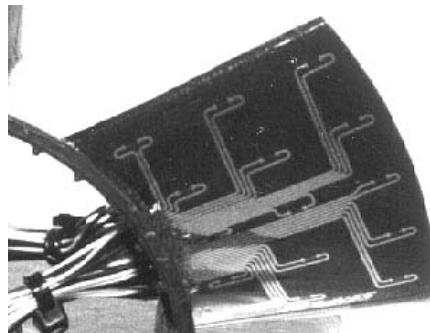
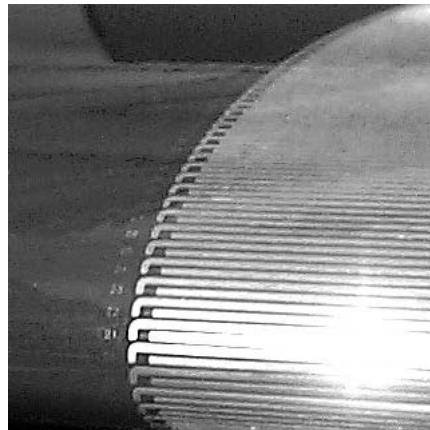


SENFLEX[®]

Multi-Element Surface Hot-Film Sensors



General Information and Catalog of Standard Arrays



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Senflex is a registered trademark of Tao of Systems Integration, Inc.

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Loctite and Hysol are registered trademarks of Loctite Corporation.

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Specifications

Substrate

0.002" thick Upilex[®] S polyimide film.

Leads

Copper leads are designed to customer specifications. Length, width and thickness of leads contribute to resistance. Most arrays are manufactured with a standard lead thickness of 0.0005" (½ mil) and a lead width of 0.030". The resulting lead resistance is <0.05Ω/in. There is a minimum order of \$1000 for lead thicknesses other than ½ mil.

Sensor Elements

Nickel sensor elements are electron beam deposited onto the polyimide substrate to a thickness of approximately 0.20 μm. Standard arrays contain elements approximately 0.004" wide by 0.057" long. These dimensions yield a cold resistance of about 6-8 ohms, capable of withstanding a maximum current of 120 mA, depending on ambient conditions. Resistance may be adjusted for custom arrays by varying sensor dimensions.

Application Information

Adhesive

This information will not replace customer evaluation and testing.

Senflex[®] sensors are bonded to models with an adhesive suitable for the test environment. Tao Systems recommends MACtac[®] MACfilm IF-2043 acrylic pressure sensitive adhesive where test conditions permit. Samples of IF-2043, in quantities adequate to apply the arrays ordered, are supplied by Tao Systems.

MACfilm IF-2043 is a 3 mil thick film of pressure sensitive adhesive protected by a release treated, polycoated kraft liner on one side and a clear, release treated polyethylene film on the other.

The following physical properties of MACfilm IF-2043 are reproduced from the MACfilm IF-2043 Performance Guide:

Test Parameter	Typical Result	MACtac [®] Test Method
Quick Tack, lb/in ² (kPa), Stainless Steel	4 (28)	MACtac [®] CTM-25
Peel Adhesion, lb/in (N/m) Stainless Steel — 30 min. residence	4.5 (788)	PSTC-3
Shear, Hours to Fail Stainless Steel — 1000 g/sq. in. at 72°F	300+	PSTC-7
Thickness, inches (mm), Adhesive Only	0.003 (0.076)	

Temperature Ranges

Application: Above 50°F (10°C) for best performance
End use: -40°F to 250°F (-40°C to 121°C)

Sensor temperatures in excess of above specifications may be used without causing the array to loosen from model surface. The exact limit of the effect of sensor temperature on bonding depends on sensor design, spacing of sensors, ambient temperature and heat transfer properties of the model material.

To apply sensors with MACtac[®] IF-2043, cut a piece of the film adhesive slightly larger than the dimensions of the sensor array. Remove the polycoated kraft liner. Place the film adhesive on the surface of the model. While peeling the clear polyethylene film from the film adhesive,

carefully apply the array to the surface starting at one end, working towards the other as the polyethylene film is removed. Gently smooth the surface during application to remove any air bubbles, taking care not to disturb the sensors. No drying time is required, so lead wires may be attached immediately after the array is mounted.

Arrays bonded with MACfilm IF-2043 can be removed from most surfaces without damage to the model.

Where more strength is required, Hysol[®] EA 9309.3NA from Loctite Aerospace may be a suitable alternative. Hysol[®] 9309.3NA is a two-part paste adhesive containing 5 mil glass beads for thickness control. It features high shear and peel strength to aluminum. Details may be found on the web: <http://www.loctiteaero.com>.

Tao Systems does not sell MACtac[®], Loctite[®] nor any other brands of adhesives. Tao Systems does not supply samples of Hysol[®] EA 9309.3NA.

Lead Attachment

For typical 30 mil wide leads spaced 50 mils apart, use a SN63PB37 rosin core solder of 31 mils (21 AWG) or less diameter. Use of a liquid activated rosin flux is optional. Use a soldering iron with a fine tip and keep it below 650°F (343°C); higher temperatures may cause leads to detach from the substrate.

Choose leadwires which have an outer diameter less than the lead spacing. PVC insulated 28 AWG hookup wire is typically less than 50 mils, and has a resistance of approximately 0.07 ohms per foot (note that two leads are required per element, so the total resistance for 28 AWG wiring is 0.14 ohms per foot of distance between array and anemometer).

Tin both leads and leadwires first. Place tinned leadwire onto tinned lead and apply 650° soldering iron just long enough to melt and fuse the solder. Applying a small drop of liquid activated rosin flux to the leads and leadwires before tinning, and to the tinned leads before attaching the leadwires may improve solder flow, especially for arrays which have been in storage.

Anemometers

Senflex[®] sensors may be used with Tao Systems' patented constant voltage anemometer (CVA) as well as conventional constant current and constant temperature hot-film anemometers. Sensor elements in custom arrays can be designed to meet the resistance and overheat requirements of various anemometers.

Custom Arrays

For a one-time setup fee of \$500, Senflex[®] can be configured to virtually any pattern to meet your requirements. Elements can be spaced in angular units, spaced in even increments along the chord of an airfoil, or precisely placed at specific points of interest. Sensor element resistance can be customized from 1 to 2000 ohms.

Custom arrays suited for use on a variety of surfaces, rather than a specific geometry, may eventually be listed as "standard" arrays.

Minimum order for custom designs is \$1000, including setup fee.

Prices

Prices are based on metallized and overall area, and number of sensors. No special fee is charged for customizing the amount of border material; however, the price per array will change accordingly. Please contact Tao Systems for the current price list for standard arrays.

Shipment and Delivery

Delivery will be within 8 weeks after receipt of an official purchase order. Transportation and shipping charges will be added to the invoice.

International Orders

Unless instructed otherwise, Tao Systems ships all international orders by FedEx. Shipping charges, including any duties/taxes paid by the shipper on Tao Systems' behalf, will be added to the billing invoice.

Payment

Payment is in US dollars only and due within 30 days from the date of invoice. We offer several payment methods for your convenience: check (in US dollars drawn on a US bank), wire transfer or MasterCard[®]/VISA[®]. Contact Tao Systems for additional information.

Warranty Policy

Senflex[®] hot-film sensors are sold with the understanding that the buyer will test them in actual use and determine the adaptability of the product to the intended uses. Tao Systems warrants to the buyer that Senflex[®] products are free from defects in material and workmanship, but limits its obligation under this warranty to replacement of the product shown to Tao Systems' satisfaction to be defective at the time of sale. THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATIONS OR LIABILITY ON TAO SYSTEMS' PART. UNDER NO CIRCUMSTANCES WILL TAO SYSTEMS BE LIABLE FOR ANY LOSS, DAMAGE, EXPENSE OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING IN CONNECTION WITH THE USE OF, OR INABILITY TO USE, TAO SYSTEMS' PRODUCTS.

Standard Arrays



Senflex[®] SF9902 is a single-element hot film sensor on a 120 mm x 20 mm substrate. Illustration shown full scale. Also available is SF0303, same as above except sensor element is rotated 90°.

Patterns of all standard multi-element arrays are appended, in full scale unless otherwise noted. Patterns that could not fit on a standard page have been scaled by 71%; these may be photocopied at 141% onto a larger page to approximate full size. A brief description of each follows:

Array No. 9101: 50 elements, 0.1 inch (2.54 mm) spacing

Array No. 9102: 32 elements, 0.1 inch (2.54 mm) spacing

Array No. 9109: 40 elements, 0.1 inch (2.54 mm) spacing, short leads

Array No. 92071: 50 elements, 0.2 inch (5.08 mm) spacing.

Array No. 92072: 40 elements, 0.2 inch (5.08 mm) spacing.

Array No. 92074: 68 elements, 0.1 inch (2.54 mm) spacing.

Array No. 93021: 28 elements, 0.25 inch (6.35 mm) spacing.

Array No. 93022: 50 elements 0.03 inch (0.762 mm) spacing.

Array No. 93032: 18 elements; 5 mm spacing between elements 1-3, 2.5 mm spacing between elements 3-8, 5 mm spacing between elements 8-10, 7.5 mm spacing between elements 10-18.

Array No 93111: 10 elements, 5 mm spacing.

Array No. 93112: 10 elements, 2.5 mm spacing.

Array No. SF9501: 32 elements, 0.1 inch (2.54 mm) spacing.

Array No. SF9502: 100 elements, 0.1 inch (2.54 mm) spacing.

Array No. SF9607: 30 elements, 0.03 inch (0.762 mm) spacing.

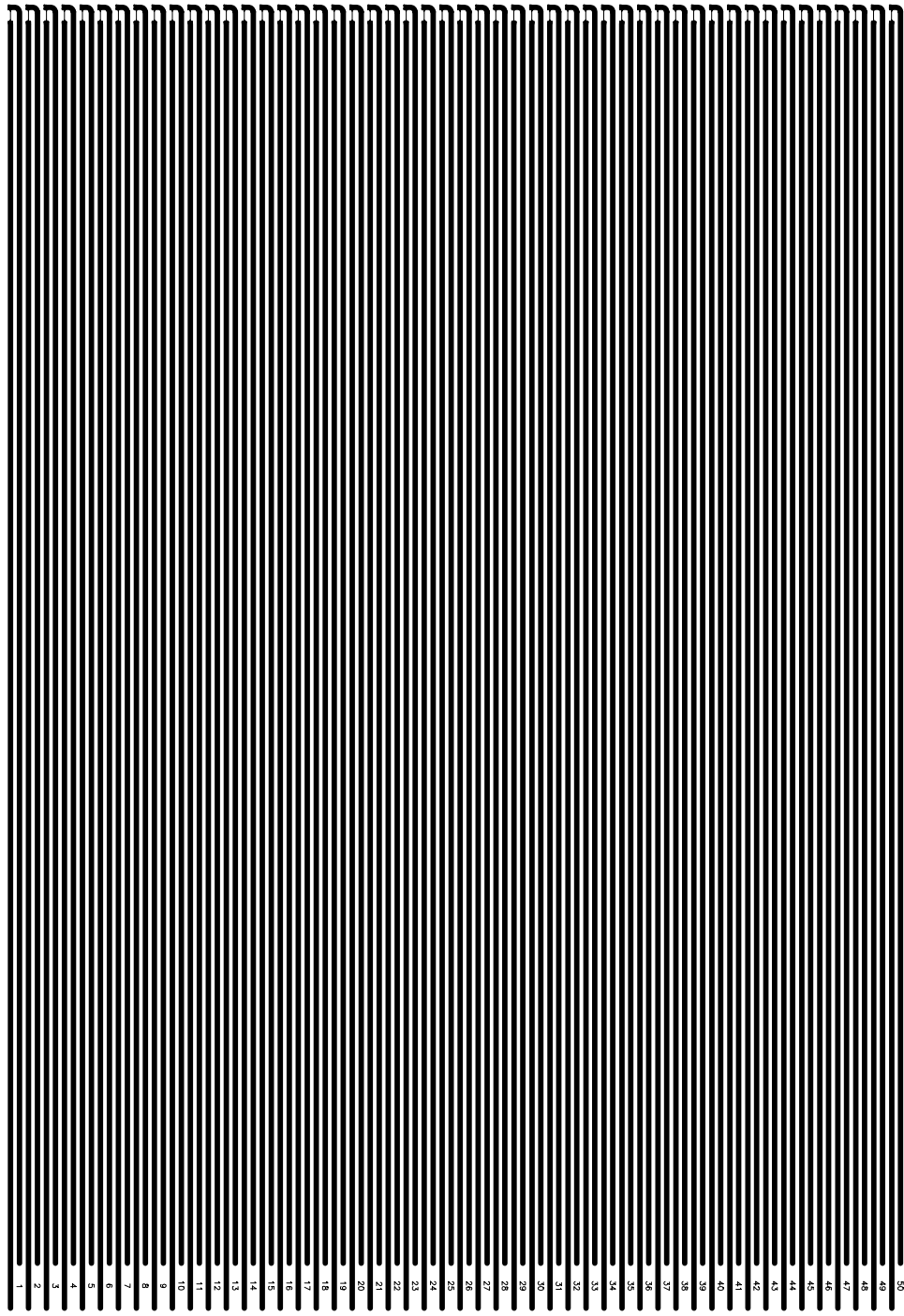
Array No. SF9611: 70 elements, 2.4 mm spacing.

Array No. SF9813: 52 elements; 0.05 inch (1.27 mm) spacing between elements 1-5, 0.02 inch (0.508 mm) spacing between elements 5-29, 0.05 inch spacing between elements 29-52. Elements are staggered to prevent heat transfer from occurring due to the close spacing. The element in the center of the closely spaced sensors, element 17, is identified at the edges of the array by pointed lead ends.

Array No. SF9905: 24 elements, 2 mm spacing.

Array No. SF0006: 32 elements; 2.5 mm spacing between elements 1-4, 1.5 mm spacing between elements 4-18, 2.5 mm spacing between elements 18 and 32.

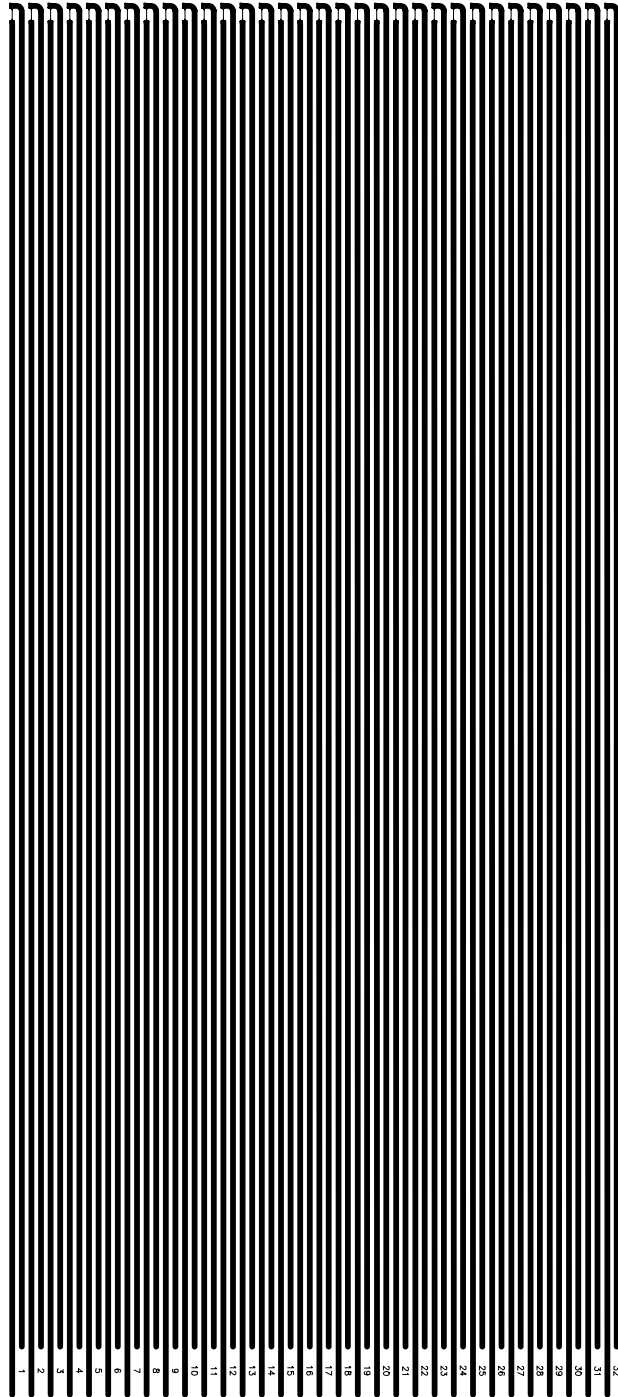
Array No. SF0217: 64 elements; 0.1 inch (2.54 mm) spacing between elements 1-16, 0.05 inch (1.27 mm) spacing between elements 16-49, 0.1 inch (2.54 mm) spacing between elements 49-64.



SEWELIX™

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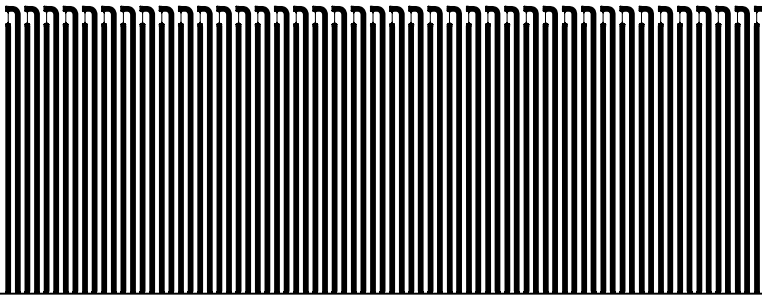


SENSELEX™

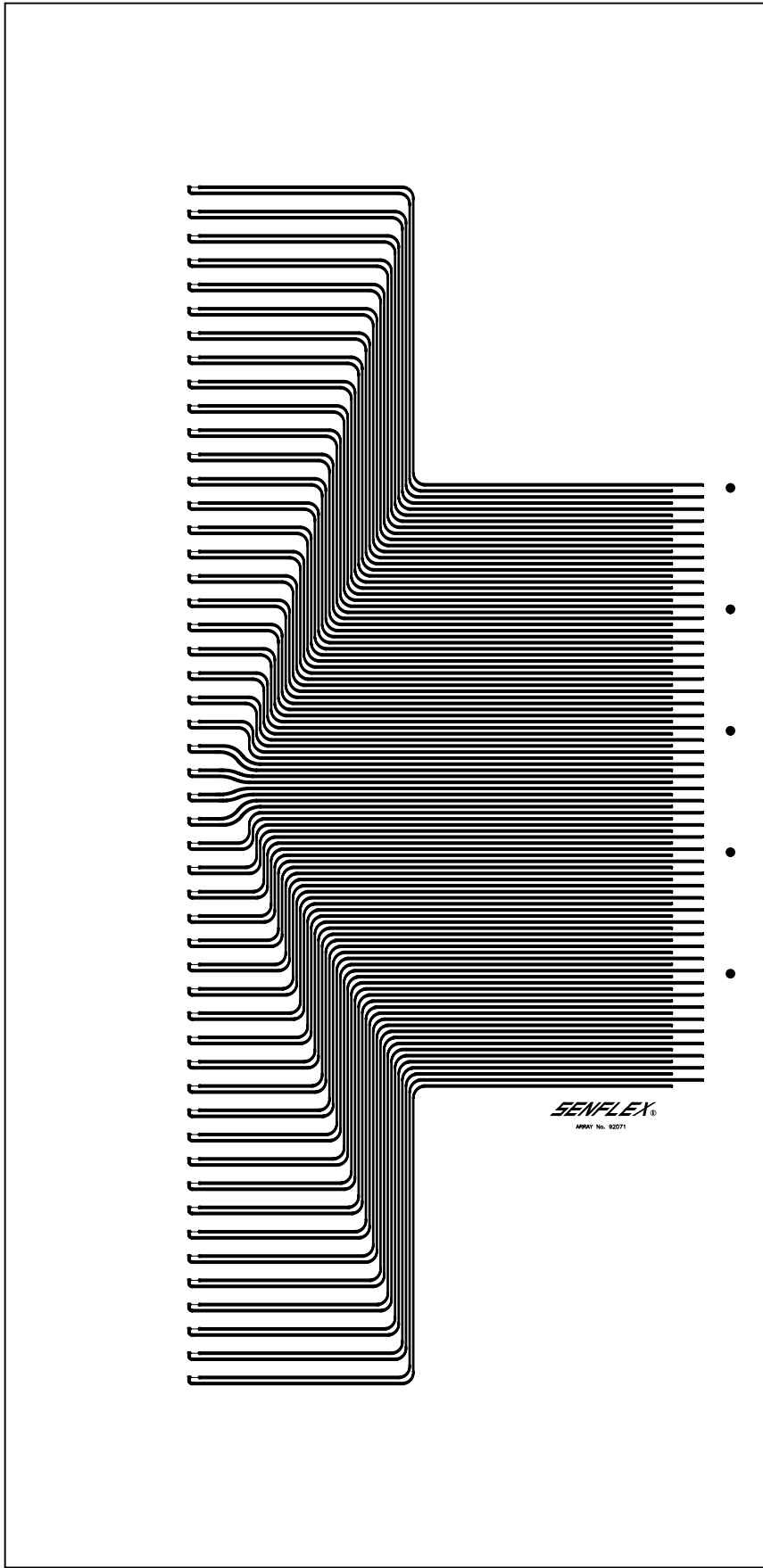
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SENSELEX™
MODEL 9109



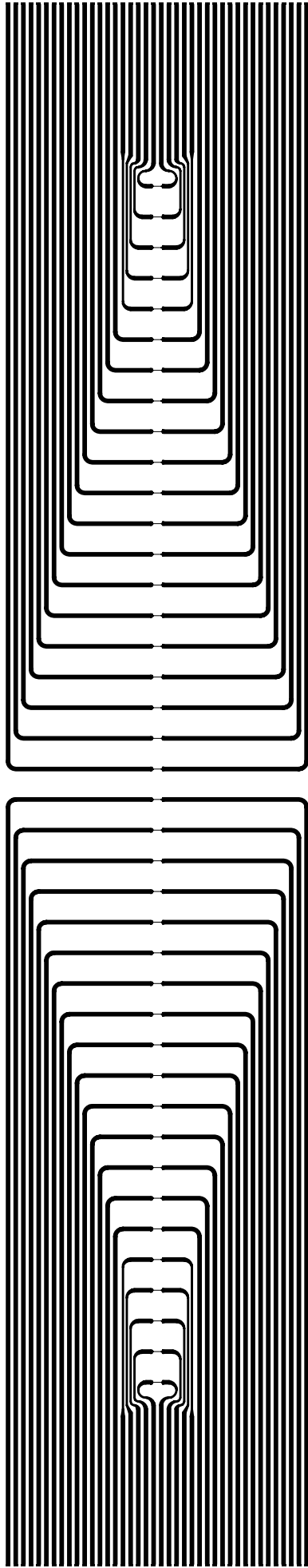
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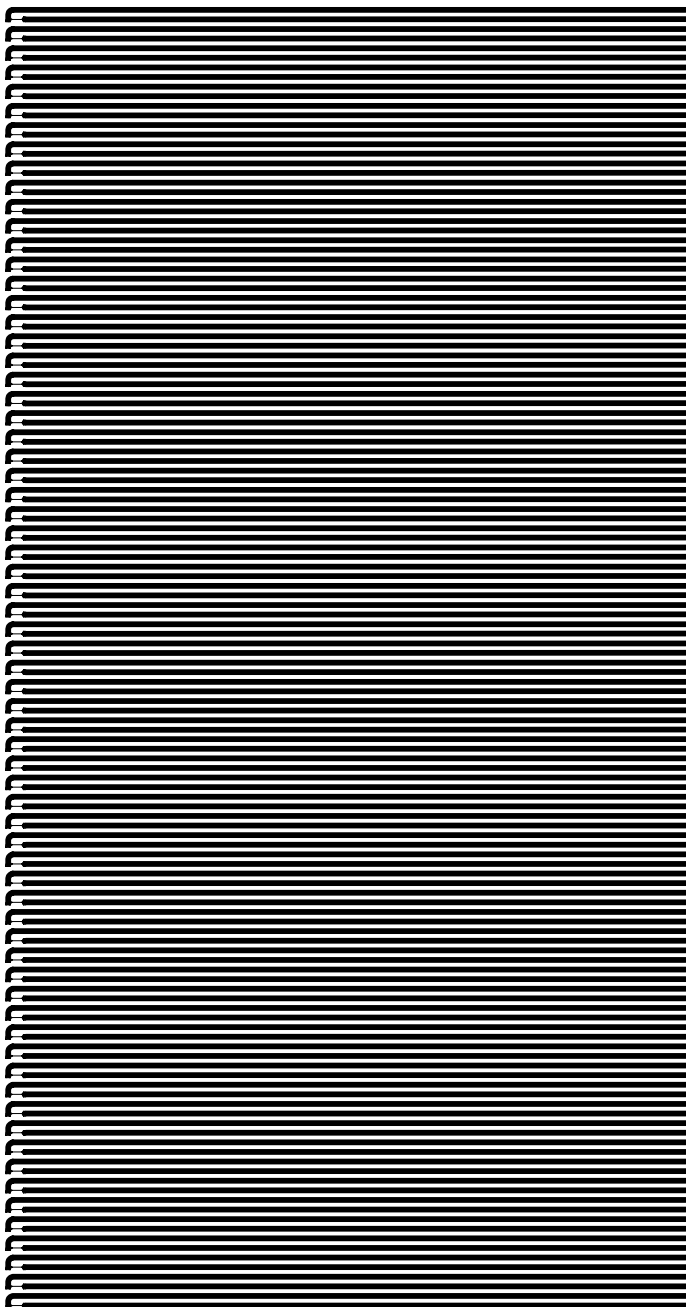
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SEWELER
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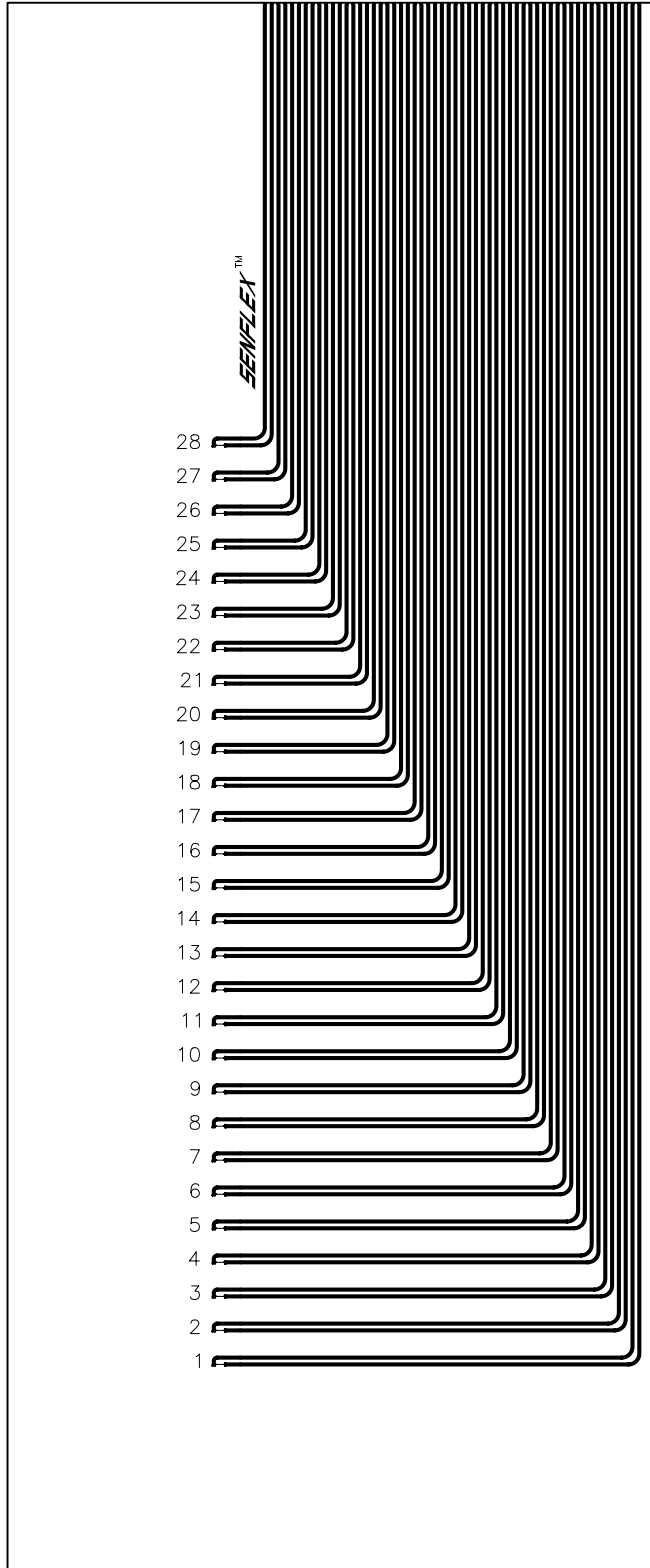


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SENFLEX[™]

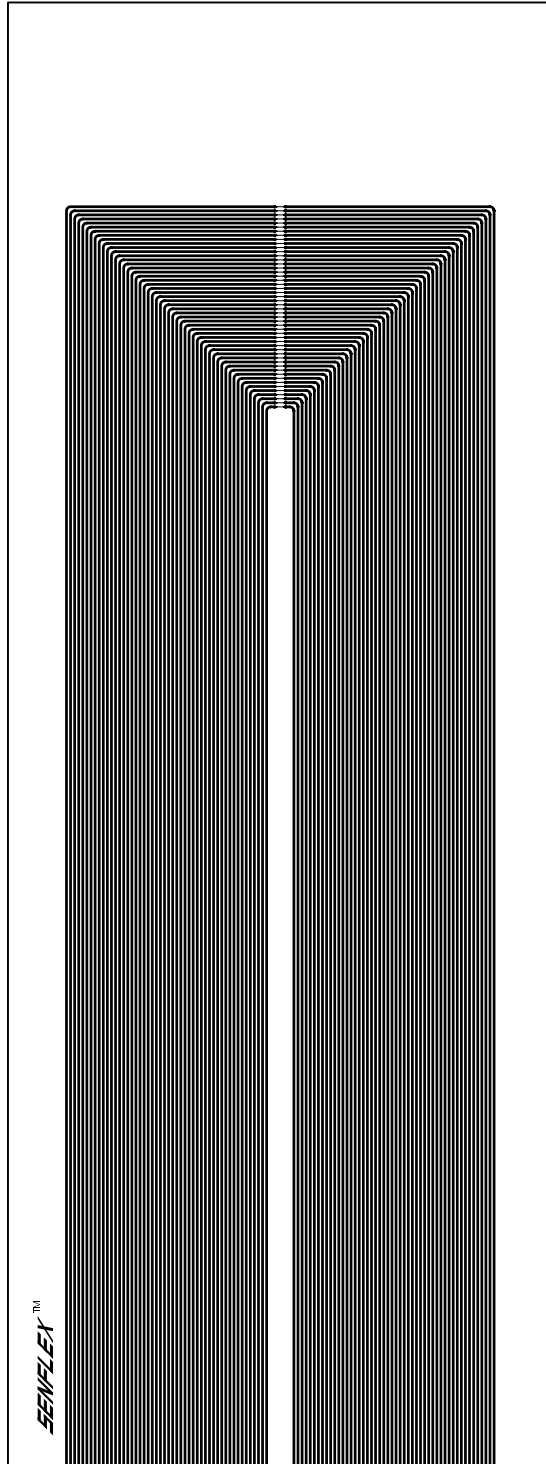


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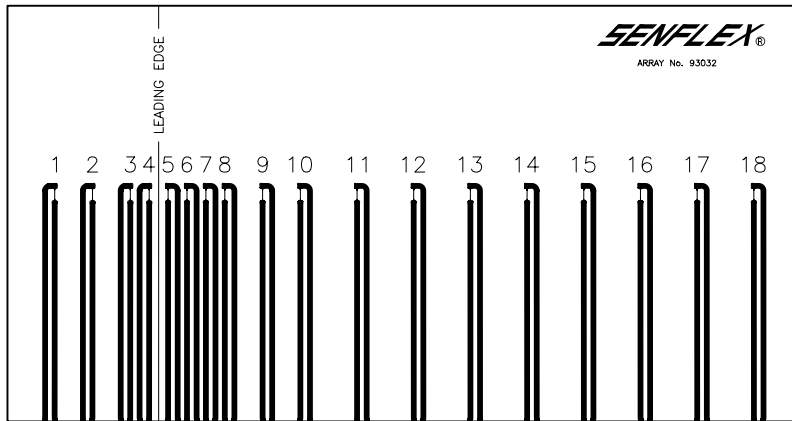
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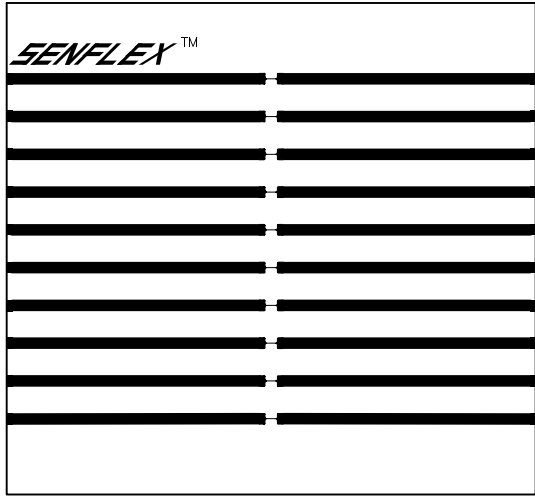


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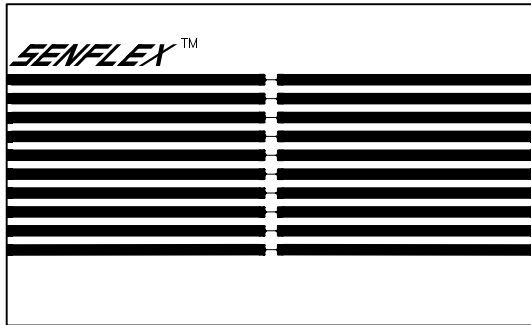
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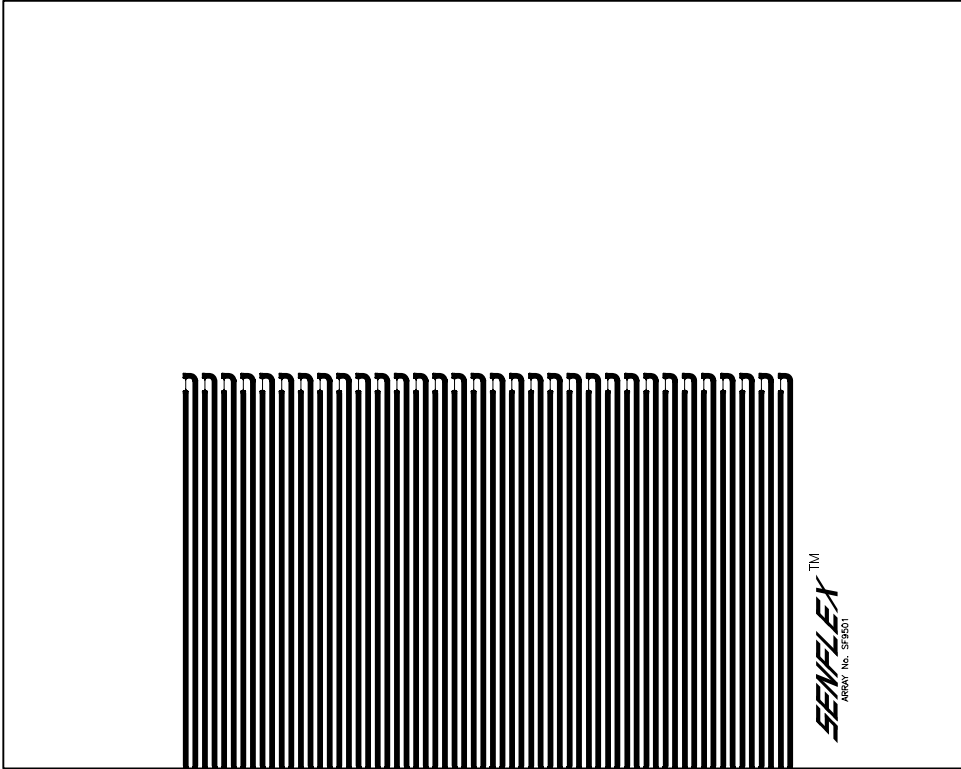
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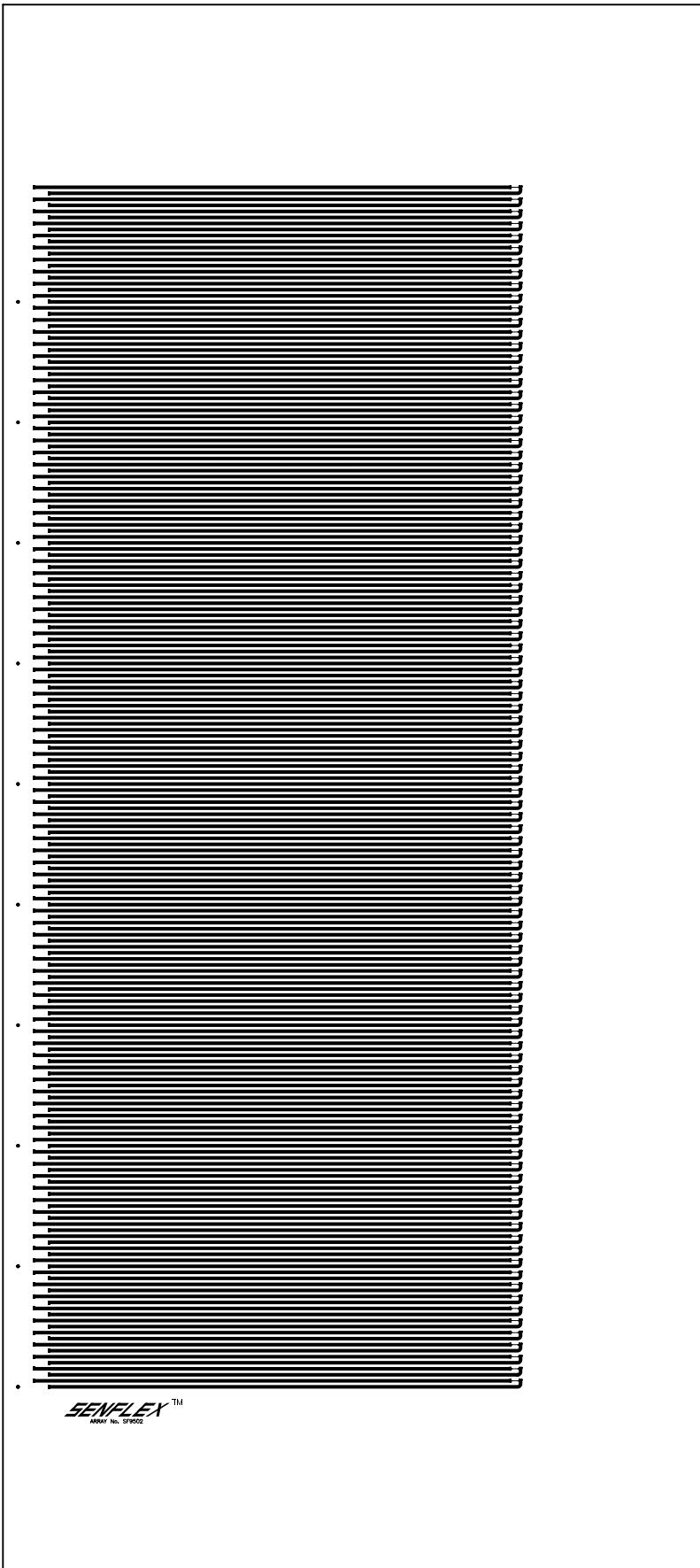
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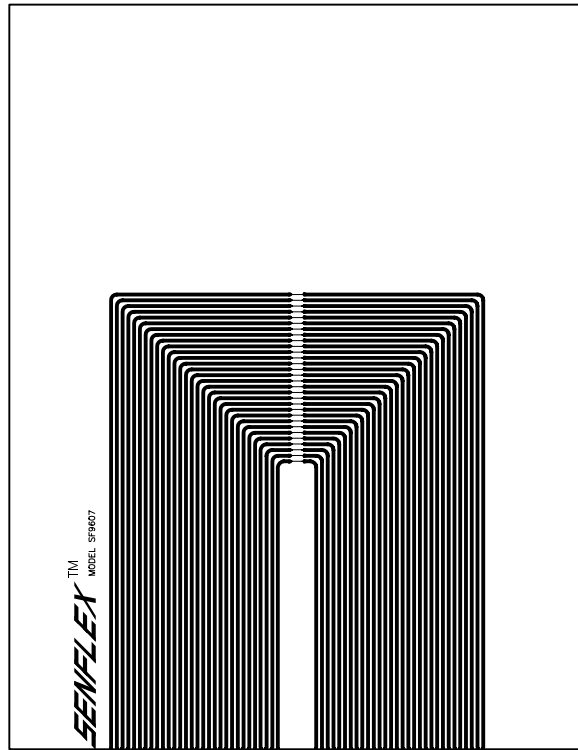
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SENFLEX™
ARRAY No. SF9502

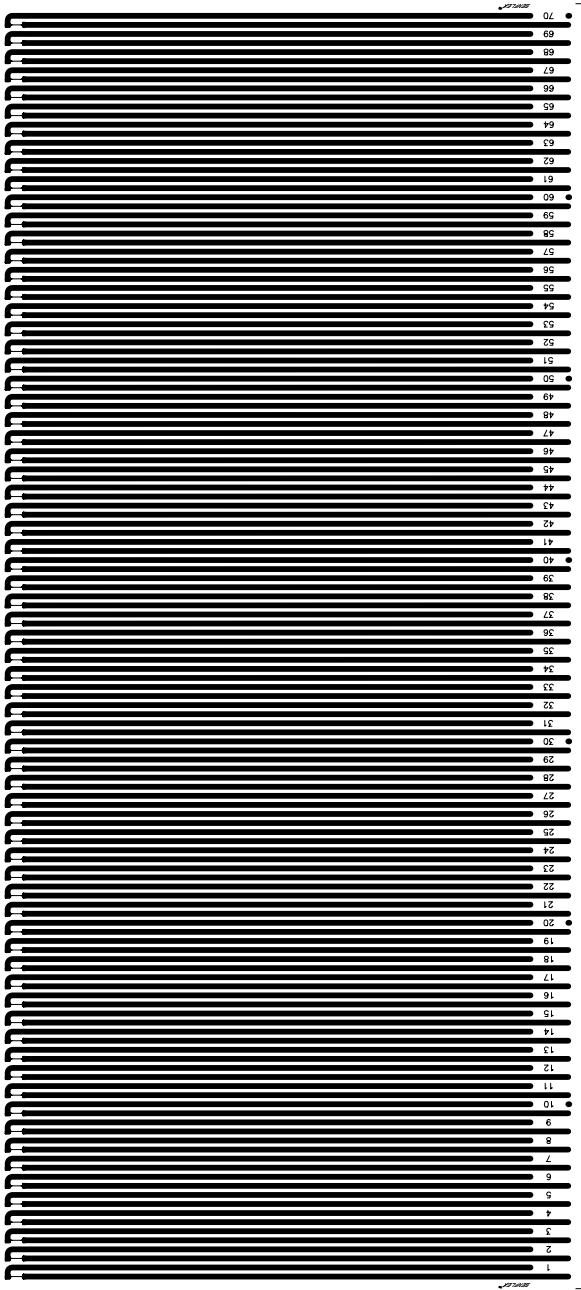
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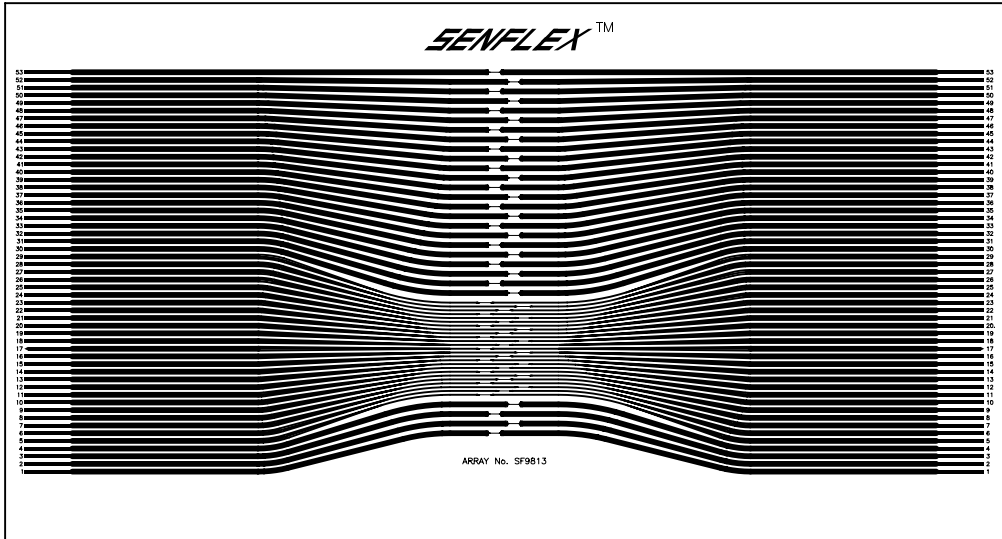


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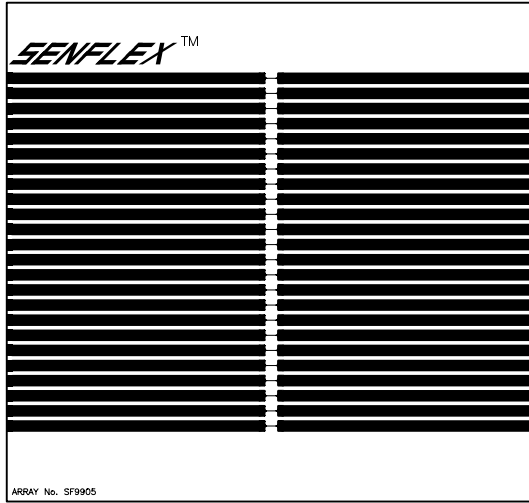
SENFLEX™
MODEL SF9611



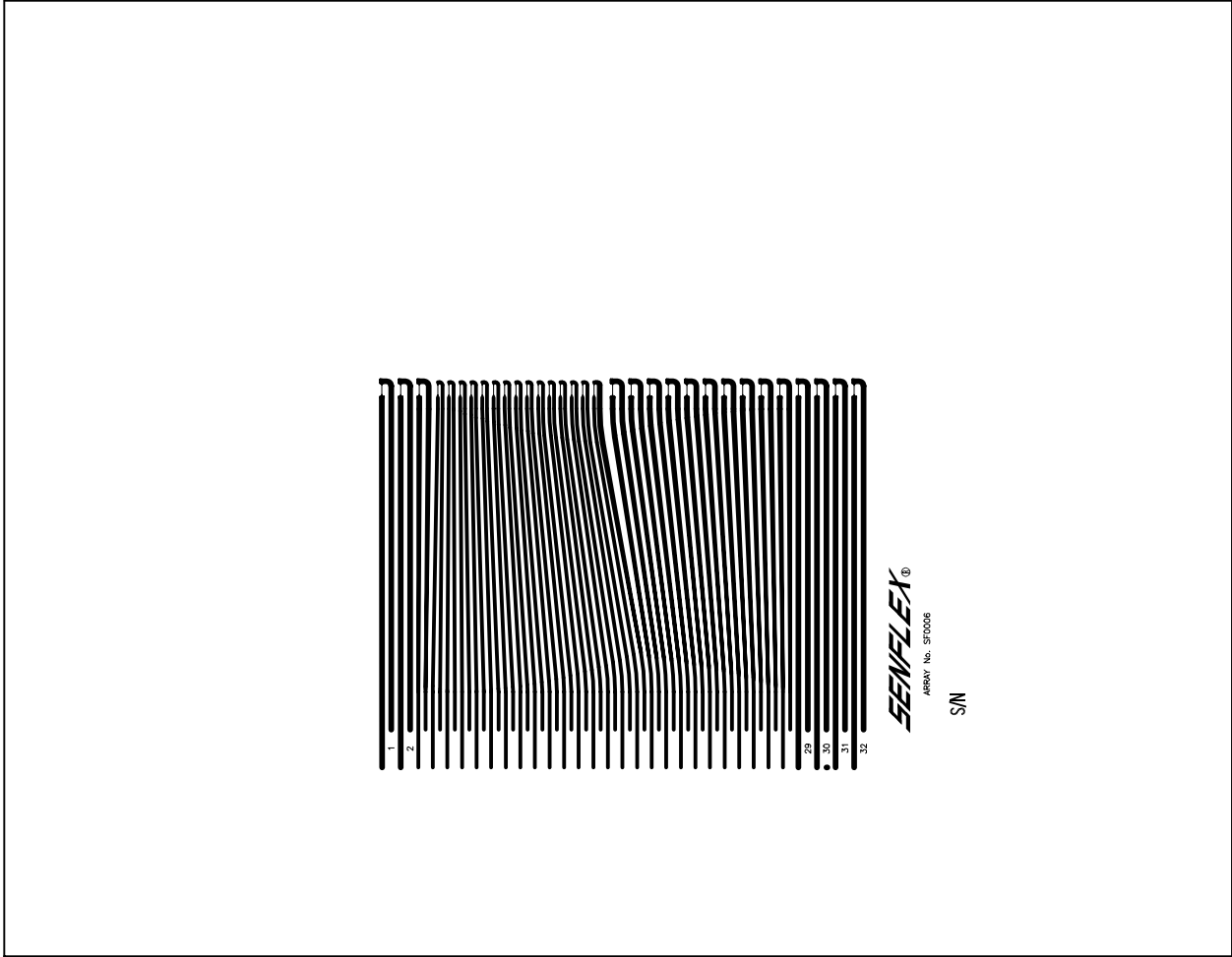
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SF9813



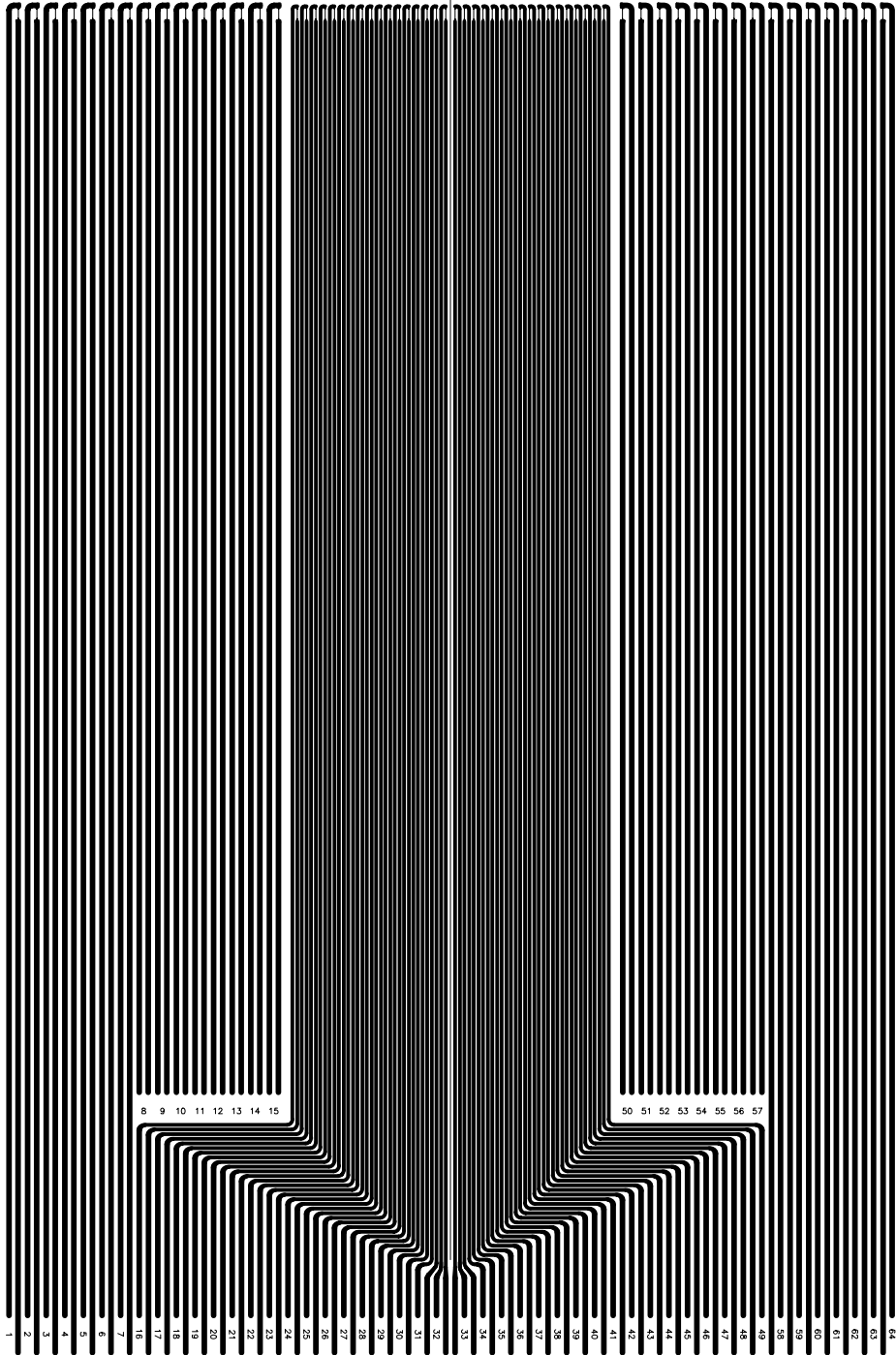
SF9905



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SEWLEK[®]

APPAR. No. SF0217



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