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The Loomia Electronic Layer Nominal Datasheet

LOOMIA

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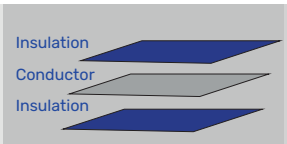
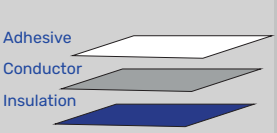
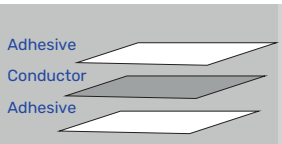
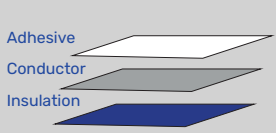
for test reports or for additional information

About the LEL

The Loomia Electronic Layer (LEL) is a specialty circuit that can enable next-generation products in wearables, automotive and beyond.

The LEL comes in a few different stackups that are optimized for different performance features.

Stackup	Robustness Optimized Stack-ups		Cost Optimized Stack-up	Hybrid Stack-up
Stackup	As low as $.20 per square inch or $.031 per square cm	As low as $.16 per square inch or $.025 per square cm	As low as $.05 per square inch or $.008 per square cm	As low as $.11 per square of $.017 per square cm
Stackup Code	40275-7	40275-13	40275-16	40275-00
Brief Decription	Ideal for washable, sew-in applications that require long-term robustness. Also ideal for applications that require very low resistance like antennas	Ideal for applications that will be laminated in and may or may not require washing.	Ideal for cost-sensitive applications that do not need to be washed	Ideal for applications that will be laminated in and may or may not require washing.
Avg. Resistance	0.03 Ω/sq	0.03 Ω/sq	0.1 Ω/sq	0.1 Ω/sq
Stackup Image				
Stackup Layers				

Each Design is Custom

This datasheet provides nominal expected performance for a Loomia Electronic Layer (LEL) hybrid stackup. Each component's actual performance will vary based on component design and stackup.

How we are Different

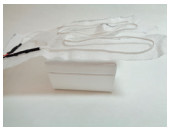
The LEL is more drapable than flex PCBs, wires on mesh, or most other flexible electronics options. We have a similar flexibility to printed ink on TPU, but our technology is not printed, allowing us to achieve low resistance conductors that do not easily change resistance when stretched.

The Loomia Electronic layer can also be used to combine functionalities such as heating, switching and lighting all into one component that directly integrates into a surface textile or material of your choice.

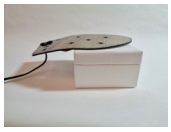
Unlike most other circuit technologies, our electronics are designed to integrate into products without the need for a plastic housing.

Compare the LEL's flexibility to other options.

Carbon Fiber Heater



Wire Heater



Printed Polyester Heater

The Loomia Electronic Layer

Kapton Flex PCB

Additional Wire Heater

LEL Functionalities

- Resistive Heating
- Lighting (can support a range of white and RGB LED components)

  Antennas
- Data and Power Cabling
- Mechanical Switching
- Pressure Sensing (single sensing and matrix sensing)

Common LEL Applications

- Automotive interior smart surfaces
- Cabling for wearable technology projects
- Pressure sensing for robotic end effectors
- Heating for outdoor / performance gear

Electrical Properties

Max Voltage: 28V *trace design may allow for more
Max Current: 6A *trace design may allow for more

Data Protocols:

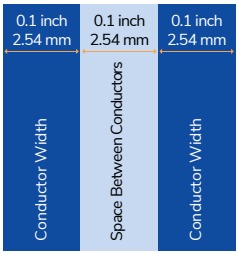
Interfaces which are OK with the LEL

- RS-485
- CAN
- LIN
- Short runs (<12") of I2C, SPI, UART depending on outside environmental influence

Interfaces not generally recommended with the LEL

- USB
- HDMI
- Ethernet

Size and Layer Limitations



Lower limit for width and space between the traces

Max Size in Production	20” x 24” or 50cm x 60cm
Max Layers	30 Layers
Density	0.22g/ Square Inch or .09g/ square mm
Max Elongation	20% for serpentine designs
Minimum Trace Width	.1” or 2.54mm
Thickness	See table below for thickness based on number of layers

Standard LEL Assembly (12 square inches or 77 square centimeters)

Number of layers	Weight (g)	Thickness (inch)	Thickness (mm)
1	2.67	0.010	0.254
2	4.17	0.016	0.406
3	5.64	0.022	0.559
4	7.10	0.028	0.711
5	8.54	0.033	0.838
6	9.97	0.039	1.00

Production Information

We have partnered with Eastprint, inc. for scale production in **Juarez, Mexico**. Eastprint is an ISO 9001 and ISO 13485 manufacturer who produces specialty electronics for a range of large customers.

Their capabilities for our LEL are as follows:

Tooling Time	8-12 Weeks
Avg Tooling Cost	Less than $10,000
Throughput	20,000 units per week (for single layer stackup)

Testing Overview

Test Description	Standard	Result
Flammability	FED-STD-191A	Avg 96mm/minute *laminated to automotive trim
Ballyflex After UV Exposure	ISO 5402	No delam / pass
UV Exposure	AATCC 16	Pass
Bend Stiffness	ASTM D1388-18	1.25 gf cm^2/cm
Dynamic Fatigue	AATCC D4033	Pass
Tensile Testing	ISO 13934-1	88 Newtons (for straight bus – more for serpentine)
Environmental Cycling (-20C to 85C)	Custom Test	Pass
High heat and humidity (85C , 90% RH)	Custom Test	Pass
FCC	FCC/CE Consumer Testing	Pass for heating geometry
10,000 button presses	ASTM 1578	Pass
Stretchability	GME60305	Up to 20% for serpentine geometries with acceptable resistance change
Crocking	AATCC 8	Pass - 5
Colorfastness to Chlorine	AATCC TS-001	Pass - 5
Washability	AATCC 135	Up to 50 cycles on cold wash
Biocompatibility	N/A	Polyurethane , our main insulation, is recognized as a biocompatible material
Avg Heater Wattage	N/A	400W/ m^2
Max Operating Tempature	N/A	200°F / 93 °C

Design Possibilities

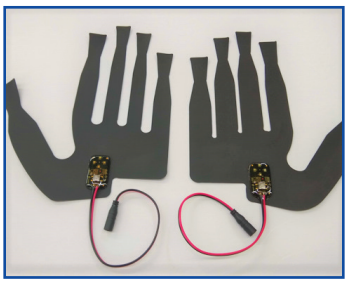
Termination / Connectors

The LEL can be designed to include a connector of your choice. Termination and connector options include, but are not limited to, the following:

- Magnetic pogo pin Connector
- Barrel jack Connector
- USB Connector
- Snaps
- Wire termination

See example terminations below:

Magnetic pogo pin connector termination



PCB and wire cable termination

PCB Termination

**magnetic pogo pin connector and encapsulated PCB integration have been tested for 50 cycles of AATCC cold wash*

Stretch and Strength

Our technology is not inherently stretchable, but can obtain stretch by being patterned into a serpentine geometry. The data below provides details on possible stretch for different trace designs.

Thicker and thinner serpentine LEL bus stretch performance:

0.2” serpentine 4 wire bus can stretch up to	59%	with minimal to no change in resistance at 18 lbs
0.1” serpentine 4 wire bus can stretch up to	34%	with minimal to no change in resistance at 5 lbs
0.2” serpentine 4 wire bus can stretch up to	69%	before high resistance values (>4 ohm) at 20 lbs
0.1” serpentine 4 wire bus can stretch up to	58%	before high resistance values (>4 ohm) at 10lbs

Thicker and thinner straight LEL bus strain performance:

0.2” straight 4 wire bus can carry up to	18lbs	with minimal to no change in resistance
0.1” straight 4 wire bus can carry up to	5lbs	with minimal to no change in resistance
0.2” straight 4 wire bus can carry up to	10lbs	before high resistance values (>4 ohm)
0.1” straight 4 wire bus can carry up to	20lbs	before high resistance values (>4 ohm)

Integration

Example of an LEL component with a flex PCB termination and pressure sensitive adhesive film applied for integration

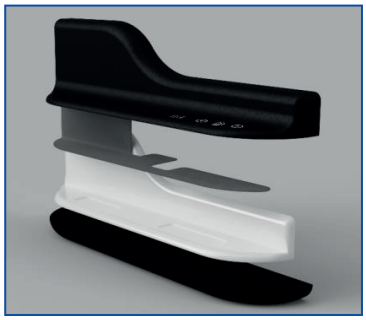
The LEL can be sewn or bonded to the surface of your choice. There are a few options:

Heat activated adhesive
The LEL can be produced with a layer of heat activated adhesive that bonds around 250F/121C at 100PSI.

Pressure sensitive adhesive
The LEL can be produced with a sheet of 3M pressure sensitive adhesive with an attached liner for peel-and-stick integration

Sewing
The LEL can include seam allowance or sew tabs, dedicated sections for sewing in the LEL. The LEL can be sewn with a standard sewing machine with a teflon food attachment.

Example Integration: Automotive Door Panel using heat activated adhesive

		Our Way	The Traditional Way
IMAGE			
LAYERS	**TOP MATERIAL**	Automotive Textile	Automotive Textile
	SECOND LAYER	The Loomia Electronic Layer with heat activated adhesive	Traditional automotive HMI unit- top fabric must be cut for integration. All electronics in a plastic box
	THIRD LAYER	Plastic Door Panel Form	Plastic Door Panel Form
DESCRIPTION		The LEL integrates right under the trim, enabling smart surfaces with minimal tooling. We can also include heating and additional functions.	Traditional HMI cannot integrate into textiles and includes hefty tooling costs – sometimes upwards of $700,000. This structure does not allow for easy integration of additional functions and uses injection molded plastic for the user interface

Note: Our LEL stackups change as we further develop our product, and the data reported here is from several different stackups. We recommend that each customer fully tests their resulting circuit design for adherence to their own performance standards and does not rely on this datasheet for product performance testing. For questions, please contact us at **Loomia.com/contact**