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ELECTRONIC PRODUCTS & TECHNOLOGY

APRIL 2023

CANADA'S INFORMATION LEADER FOR ELECTRONIC ENGINEERS AND DESIGNERS

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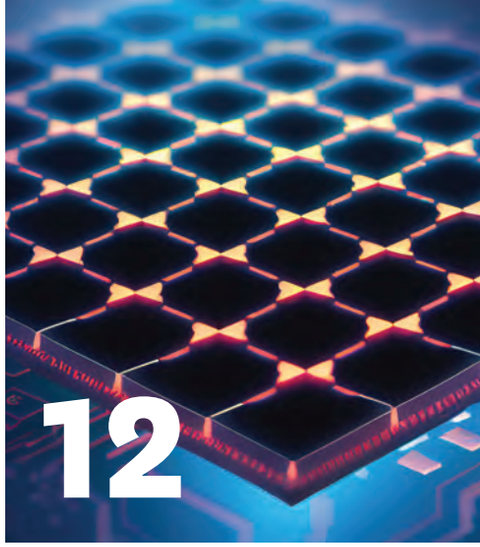

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EP&T
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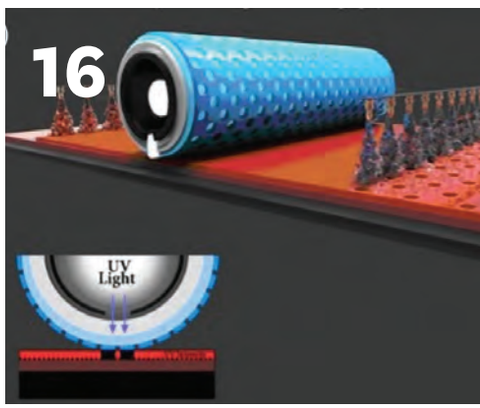

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COVER STORY

Cover photo: Omnetics Connector Corp.
Photos (this page, from top): Omnetics; Adobe; Titan Haptics; Meta Materials

Tech players tremble as bank industry wobbles

Failure of Silicon Valley Bank sends collateral effects rippling

With instability and uncertainty emerging within the banking sector this past March, members of Canada's technology industry have indicated that they're worried - and for good reason. Tech investments have been under pressure for almost a year as consumers shift back to pre-pandemic habits, forcing companies to rethink growth projections and interest rates are repeatedly hiked, increasing borrowing costs. These conditions have made it difficult for fledgling and experienced entrepreneurs alike to drum up cash and many have had to resort to workforce reductions.

Already concerned about cash-flow, some Canadian start-ups are fretting how they'll raise their next round of funding after U.S. regulators closed the Silicon Valley Bank (SVB) last month – representing the second-biggest bank failure in U.S. history. According to SVB's 2021 annual report, the bank's technology and life science portfolio totaled $68.2 billion, representing 77% of its loan portfolio.

Canuck start-ups bank with SVB

Silicon Valley Bank established a beachhead in Canada in 2019. It had grown into the 16th largest bank in the United States by turning relationship building with venture-stage technology companies into a lucrative long-term banking business, and its arrival stoked interest in Canada's innovation sector. Known for its expertise in providing financial services to tech companies, SVB has a significant presence in the Canadian market. Canuck-based tech start-ups with financial tethers to SVB have been privy to capital, specialized financial services and networking opportunities with other technology companies.

The recent distressing news on SVB has these same Canadian-based tech start-ups facing challenges in obtaining financing and accessing other financial services. Most will be required to seek out alternative banking partners, which could be difficult in a market that is already competitive for the provision of financial services to technology companies.

> ***"Canada has a highly educated workforce and a robust tech ecosystem that has produced many successful tech entrepreneurs and executives"***

If you were to go looking for a good side to this story, Canadian tech firms do tend to operate somewhat differently than their U.S. peers. The management quality of tech firms can vary widely based on a number of factors, including the industry, size, stage of development and leadership team.

Biz differences

There are certain characteristics of Canadian tech firms that may contribute to effective management and success. For example:

- **Focus on innovation:** Canadian tech firms tend to prioritize innovation and research and development, which can lead to the development of new products and services, and ultimately drive growth and profitability.
- **Strong talent pool:** Canada has a highly educated workforce and a robust tech ecosystem that has produced many successful tech entrepreneurs and executives. This talent pool can help Canadian tech firms attract and retain top talent, which is critical for effective management.
- **Collaborative culture:** Canadian tech firms often have a collaborative culture that values teamwork and a strong sense of community. This can lead to more effective communication, problem-solving, and decision-making.
- **Government support:** The Canadian government provides support to the tech industry through various initiatives, including tax incentives, research grants, and funding for incubators and accelerators. This can provide Canadian tech firms with resources and support to help them grow and succeed.

As business entrepreneurs and start-ups tread these current turbulent waters, most will have to wait and see what the trickle-down ultimately brings. The bigger question swirling throughout the country's start-up ecosystem is whether Canada's dominant five banks will take a chance on nascent tech players — or will it deepen their hesitancy. As the Canadian government and its big banks give reassurances that the impact of SVB's crash will be minimal, some in the start-up community are concerned that the incident will chill tech investment, with lenders playing it safe after this latest setback.

It seems, most observers are just unsure at this point. **EP&T**

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EP&T
ELECTRONIC PRODUCTS & TECHNOLOGY
Canada's information leader for electronic engineers and designers

APRIL 2023
Volume 45, Number 3

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EP&T is published eight times per year by

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Suite 400
Toronto, ON M2H 3R1
Tel (416) 442-5600
Fax (416) 510-5134
annexbusinessmedia.com

SUBSCRIPTION RATES
Canada – $58.50 one year; $94.00 two years
USA – $134.00 (CAD) per year
International – $183.50 (CAD) per year
Single copy – Canada $15

ISSN 0708-4366 (print)
ISSN 1923-3701 (digital)

PUB. MAIL AGREEMENT NO. 40065710
Return undeliverable Canadian addresses to:
EP&T Circulation Department,
111 Gordon Baker Rd. Suite 400,
Toronto, ON M2H 3R1

PRINTED IN CANADA
Funded by the Government of Canada | Canada

Calgary-based EMS provider Dynamic Source Manufacturing has added a new SMT production line.

CEM

DSM GROWS PRODUCTION CAPACITY

In an effort to better serve its existing customer base and create additional capacity for new customers, Calgary based electronic manufacturing services (EMS) provider Dynamic Source Manufacturing (DSM) Inc. has added new SMT production lines. Driven by organic growth in DSM's strongest design sectors - communications and industrial – DSM added a new line in Calgary, based on the ASM Assembly platform.

"We are growing really well with our current customers. Installing this new SMT line is another step towards Industry 4.0, as we further grow our capacity for new opportunities," says DSM president & CEO Duane Macauley, adding that the firm also recently added two new lines to its EMS facility in Tempe, Arizona.

ARTAFLEX EXPANDS EMS SERVICES

Artaflex Inc., a Toronto-based electronics manufacturing service (EMS) provider, recently announced its acquisition of Custom Rapid Solutions (CRS) Inc., a leading provider of quick turn printed circuit board (pcb) assemblies - also in the Toronto area.

"When you couple the addition of five SMT lines from CRS and their focus around power, sustainable/renewable energy and the industrial automation markets with our focus on higher volume pcb assembly, box build, systems integrations and test (SIT), this combination will provide a very comprehensive suite of services in Southern Ontario," enthused Gerry Iuliano, EVP of business development for Artaflex.

The acquisition comes on the heels of a prior deal, which saw Artaflex attain GSNetworks Inc., a leading manufacturer of high reliability cables, harness and interconnect assemblies in Ottawa.

Toronto CEM acquires CRS pcb board shop.

NEURONICWORKS HOSTS TECH DAYS EVENT

In an effort to help bolster the growth of the electronic product development community in Canada, Toronto-based engineering design firm NeuronicWorks held its first Tech Day event recently, hosting product innovators and entrepreneurs to a full day of workshops.

NeuronicWorks design and production facility hosted Tech Days event on site, including workshops and plant tours .

"We understand the challenges innovators, entrepreneurs and start-ups face when they set out to realize their product dream and with this in mind, we are planning on organizing a few more of these one-day workshops through 2023," says Titu Botos, president & CEO of NeuronicWorks.

Held at the firm's Toronto office location, the workshops were presented by leading industry experts, and were open to all start-ups and entrepreneurs interested in gaining the necessary expertise and guidance they will need in their product-to-market journey, according to Botos.

MEDICAL

VENTURELAB OPENS HARDWARE LAB FOR MEDICAL DEVICES

ventureLAB recently opened a new Hardware Catalyst Initiative (HCI) MedTech Lab at Sterling Industries, a facility that focuses on the development of hardware devices for medical applications.

Tailored to the needs of start-ups in the medical hardware space, the Vaughan ON lab is equipped with industry standard equipment and testing facilities that can be used to develop and test the functionality of the products designed for medical

ventureLAB celebrates the launch of its hardware catalyst MedTech Lab at Sterling Industries. Source: ventureLAB.

Photo: DSM; NeuronicWorks; ventureLAB

purposes. With the goal to showcase what is possible at the intersection of medtech, AI and hardware, the project aims to bring together the knowledge and experience of individuals and organizations with a strong background in cutting edge hardware development and medical technology, in order to create an environment that will attract MedTech start-ups to York Region and Ontario, and ultimately benefit patients and healthcare providers alike.

MED-TECH FIRM LANDS $40M EDC INVESTMENT

Synaptive Medical Inc., a Toronto-based medical technology innovator, secured a USD $40 million investment from Export Development Canada (EDC), Canada's export credit agency. EDC leads a USD $50 million financing round to accelerate Synaptive's proprietary innovative portfolio.

The commitment from EDC will boost Synaptive's development and commercial capabilities while expanding clinician access to the company's fully integrated technologies.

Synaptive Medical develops surgical digital robotic exoscopes.

Developed and manufactured in Canada, the company's products include a surgical digital robotic exoscope, integrative data platforms and comprehensive imaging technology. Synaptive's devices are connecting clinicians in operating rooms across mid-field MRI, surgical planning and surgical visualization platforms.

"Our shared vision and purpose are to provide our industry leading and patient focused technologies to as many people as we can globally," said Cameron Piron, president and co-founder of Synaptive Medical.

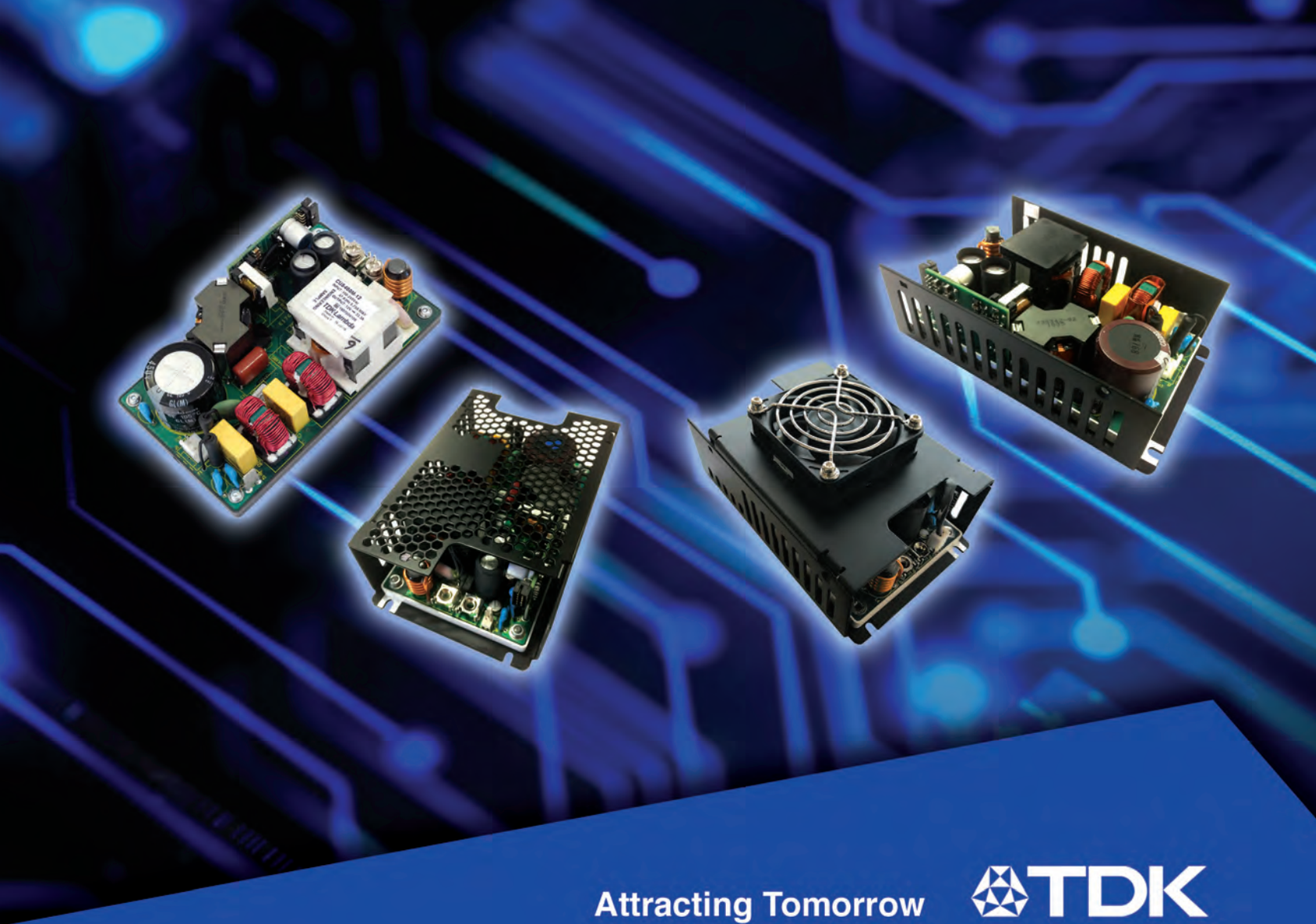
AEROSPACE

FEDS INVEST IN NEXT GEN AEROSPACE WORKERS

FedDev Ontario has announced an investment of over $3.8 million for McMaster University to deliver a two-year targeted training program that is designed and instructed in collaboration with industry for aerospace professionals in southern Ontario. The goal is to help SMEs in this sector strengthen the workforce and grow our economy.

The curriculum was created through partnerships with organizations like Mohawk College Enterprise, Downsview Aerospace Innovation and Research, the Ontario Aerospace Council, Women in Aerospace Canada.

Photo: Synaptive Medical



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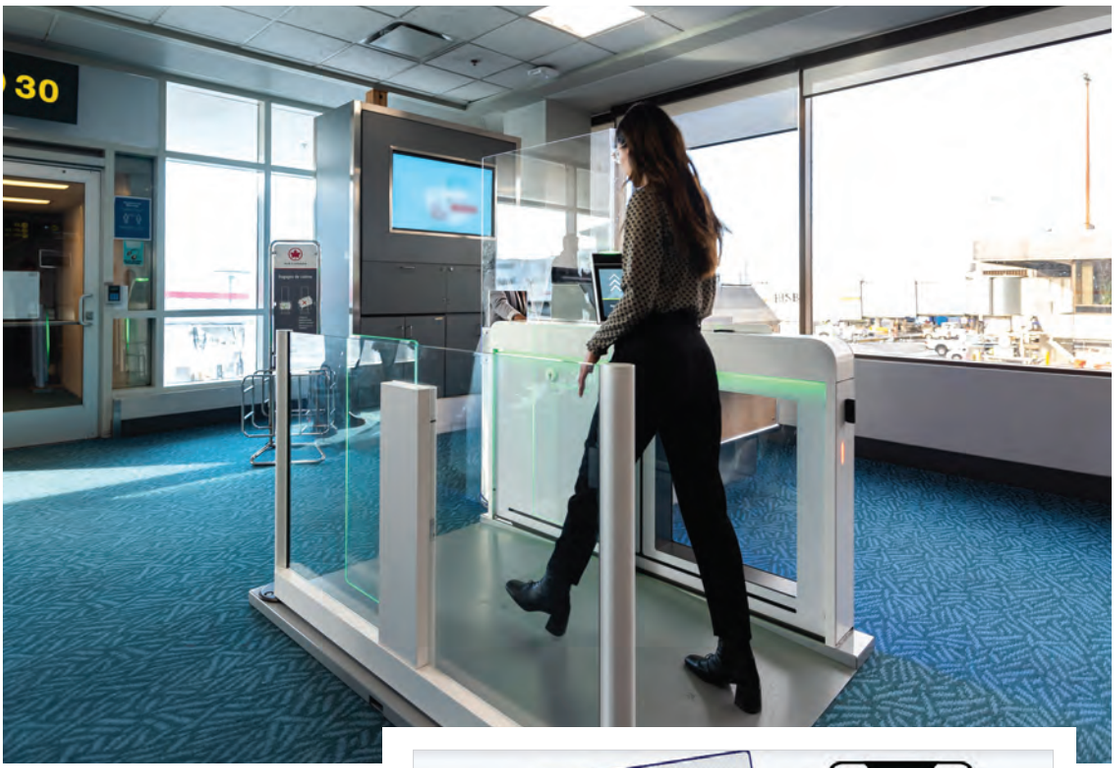
Facial recognition takes flight with Air Canada

National airline pilots digital identification in Vancouver airport

Air Canada announced it has launched digital identification, becoming the first airline in Canada with approval to offer customers the safety and convenience of a new option using facial recognition technology to confirm identification.

In a pilot project currently underway, Air Canada's digital identification is now available for customers departing from Vancouver International Airport (YVR) when boarding select flights to Winnipeg, and for eligible customers entering the Air Canada Café at Toronto Pearson International Airport.

Air Canada plans to expand digital identification options to select Canadian airports and Maple Leaf Lounges as part of its pilot project phase.



B.C. fashion designer Chloe Angus (left) helped advise Human in Motion Robotics Inc. co-founder & CEO Siamak Arzanpour in the design of XoMotion next gen exoskeleton.

Validate customer identification

"Many of our customers already utilize digital credentials to simplify their daily activities such as unlocking mobile phones, entering workplaces, verifying identification during financial transactions and more," said Craig Landry, executive vice president and chief operations officer at Air Canada.

"We are very excited to now take a leadership position in Canada and test digital identification using facial recognition technology to validate customer identification quickly, securely and accurately at select airport touchpoints," Landry adds.

Participation in digital identification is voluntary.

Customers choosing to use digital identification will benefit from a simplified and seamless process at the gate and when entering our Maple Leaf Lounges," Landry continued.

"Our government and Canadian airlines and airports are eager to move forward with innovative solutions and technologies to modernize the traveller journey in airports across the country, which would enable a more seamless and efficient air transportation system," said Omar Alghabra, Minister of Transport,Government of Canada. "Air Canada's pilot project will speed up processes at YVR, and other airports where it's established, while respecting robust privacy measures and security standards. This project has great potential in making gate boarding easier and faster for Canadian passengers, while maintaining strong safety measures," added Alghabra.

Digital faceprint

Customers eligible to utilize the Air Canada Café in Toronto and customers on select flights from Vancouver to Winnipeg will receive an invitation to use the digital identification option, and instructions on how to create their secure digital faceprint prior to arriving at the airport.

Customers who do not wish to utilize digital identification may simply board as they currently do now by presenting their boarding pass and government-issued photo ID for manual ID check and processing.

Likewise, customers may elect to continue scanning their boarding cards manually as they do now to enter the Air Canada Café at Toronto Pearson.

Digital identification is a single enrollment feature on the Air Canada app. Biometric data is encrypted and stored only on the customer's mobile phone. Customers must provide additional consent for the data to be used day-of travel and will only be retained for up to 36 hours subject to Air Canada's rigorous privacy and security standards.

Air Canada's digital identification is strictly an optional, consent-based Air Canada program. It is not related to any government-sponsored program like NEXUS, Global Entry or US CBP Mobile Passport Control (MPC). **EP&T**

"Biometric data is encrypted and stored only on the customer's mobile phone"

Photo: Air Canada

Making the switch

Can we manage the electrification of everything?

BY RUSS GARCIA, CEO, MENLO MICRO

The recently passed Inflation Reduction Act represents the largest climate investment in U.S. history. As with any major piece of legislation, it has its share of critics. Politicians, pundits and experts will continue to argue over the specifics of climate action, but the fundamental goal has become clear—transitioning quickly from carbon fuels to more sustainable, climate-friendly ways of powering our lives.

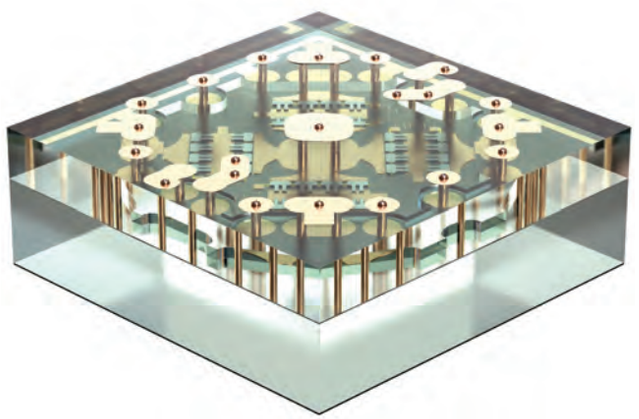
While the 'electrification of everything' movement is a critical element of climate action, it presents some new challenges. Most of us have grown accustomed to cheap, reliable sources of energy, but recent events like the winter storm that shut down the grid in Texas and wildfires in California have made it clear that our nation's electric grid is in poor shape.

Removing carbon-based fuels from the equation will reduce greenhouse gas emissions, but electrification will also dramatically increase the load on the grid. Take electric vehicles (EVs), for example. Experts have concluded we've reached the EV tipping point, but mass adoption of EVs means America's drivers will consume much more electricity. As we move steadily toward electrifying everything, from cars to kitchens, that load on the grid will grow rapidly.

Decarbonizing our energy sources is an extremely important step, but the ability to efficiently and economically transmit and distribute electric power is equally vital. An often-overlooked component of the electrification conversation is the need for reliable, low-power switch and relay technology that can enable the energy grid to sustain large-scale electrification.

Controlling the flow<sh>

An electric switch is like electricity itself—it's something we use constantly but rarely think about. There are trillions of switches facilitating everyday life, from light switches in our homes and myriad electronic devices to huge relays managing the flow of electricity across state and regional power grids.



Menlo Micro's Ideal Switch technology accelerates the 'Electrification of Everything'.

For most of the grid's 120-year history, electric power only moved in one direction: from large power plants to homes, buildings, cities and factories. Today, with decentralized energy sources such as rooftop solar panels on the rise, the grid faces the challenge of managing the bi-directional flow of electricity. This means our grid must handle larger transmissions as well as more sophisticated distribution networks often over longer distances to reach far-flung solar and wind farm substations. Meeting this challenge will require better switching technology.

Making the switch

Today's commonly used electromechanical relays (EMRs) stem from the circuit breaker invented by Thomas Edison in 1879. The next major innovation in switching technology didn't come until the 1950s with the advent of solid-state or semiconductor switches. But both types of switching technologies have drawbacks. EMRs can handle high levels of power, but they are large, slow and unreliable over time. Solid-state switches are smaller, faster and more reliable, but they leak power and generate heat.

Given those drawbacks, technology innovators have been pushing to develop next-generation switches that solve these problems. The first breakthrough since the invention of solid-state switches came in the form of microelectromechanical systems (MEMS). Buoyed by the silicon revolution, MEMS reached large-scale commercialization by the 1980s.

The benefits of switch technology designed for the 21st century are hard to overstate. Using switches that are dramatically more efficient than existing alternatives (while also being cost-effective to produce and deploy) will bring major benefits to energy companies, utilities and the environment. For example, eight billion switches are deployed in factories each year, and replacing these conventional switches and relays with MEMS devices could save an estimated $7 trillion in operating costs by 2050. And with an environmental benefit?

Given the ubiquitous nature of switches, especially across systems like our electric grid, it won't be quick to swap out old technology for better alternatives. But, it's certainly doable, and certainly worth the effort.

Large organizations should consider staggered modernization that relies on retrofitting, as opposed to wholesale production line and transportation changes. MEMS is inherently efficient but, just as importantly, it's also an enabling technology that allows for the integration of communications, sensing, and logic into a very compact footprint. This makes retrofitting and surgical modernization investments much easier to accomplish.

Once an organization has a retrofittable modernization plan, it should work with consultants and OEM suppliers on specific ways to take advantage of highly integrated functions and put in place a plan for measuring the results. Targets are more easily measured at the system level (for example, a utility might aim for fully dispatchable genloads) but one of the biggest advantages of MEMS technology is that transition timelines that were previously measured in decades can now be halved. **EP&T**

www.MenloMicro.com

***Russ Garcia** is CEO of Menlo Micro, with more than 30 years of experience in the electronic systems and semiconductor industries.*

Photo: Menlo Micro

SWAP IT OUT

Size, Weight and Power: a driving force behind interconnect design

Today's design engineers have a strong directive when it comes to designing new connectors and cables in a mission critical environment, and aside from the sheer reliability necessary, the next shoe to drop relates to SWaP.

SWaP which equates to: Size, Weight, and Power, is a major driving force behind the development of modern electrical and computer equipment. Whether the computing device is physically worn by a soldier on the battlefield or flying 1,200 miles above Earth in Low Earth Orbit, the physical size, weight and power of the device is critical for determining its effectiveness in any scenario.

Space Exploration is a prime example of this unfolding in real-time, and while this market (often referred to as the "New Wild West"), features design engineers navigating their way through problems, no engineer has ever faced prior. In some cases, yesterday's solutions, although proven, are just that…yesterday's solution. This too is true with cables and connectors; as designers have found their proverbial real estate shrinking down from the size of a school bus, to a refrigerator, down to a fraction of a shoe box and while reliability will continue to be "King", it is safe to say, weight would be the proverbial "Queen" as it is estimated that each gram involved within a space application equates to $1,000 USD.

While the price to play is a steep one as it relates to Space Exploration, demands too continue to increase with reduced processor and memory sizes, and this carries onto the battlefields as well as soldiers themselves are now carrying more computer processing power on their bodies than what would've once filled an entire building and today's digital designs require less voltage and current, thus enabling the use of smaller wires, and therefore, smaller connectors. The end result is a smaller, lighter, and more functional piece of equipment, but the toughest part for a designer is how do we get there and what do we lose?

How do we get there?

The main challenge when designing SWaP optimized electronics is finding the delicate balance between size, weight, and power consumption without physically compromising the devices overall performance, durability, and reliability. Omnetics Connector Corp. has served the market with variations of their standard Micro-miniature and Nano-miniature products lines.

By offering design engineers the ability to quick and painlessly combine elements of past design successes with new technology, enables designers to save both size and weight by over 50% without jeopardizing performance expectations in a singular footprint vs. a multiple interconnect solution. This approach allows designers to take the confidence previously instilled by traditional MIL-Spec style contacts such as M38999 & M24308's and package them in a Micro-D form-factor or smaller. This has allowed engineers to uncork a whole new approach when assessing their own interconnect conundrum.

hy·brid: A thing made by combining two different elements

A Hybrid connector solution offers designers power contacts suitable to handle up to 10 Amps per contact, while allowing customizable data-transmission through the same high quality mil spec contacts. These contacts, rated at 3 amps per contact, can withstand over 2,000 mating cycles and while the sheer shape and number of power/signal contacts may be specified to provide the greatest flexibility in circuit design, the connector focus is always kept to the absolute minimum necessary in terms of size. This hybrid combination eliminates the need to have a larger bulk-head style d-sub type or other higher power connector present, making it easier for the operator who now only needs to mate single connector vs. multiple arrays. These hybrid connectors are available in wired or thru hole pcb mount termination types and can be packaged in the conventional screw together type Micro-D/Nano-D shells or the quick latching form factor. Hybrid circulars are also available in a standard, threaded, ratcheting, twist lock and quick disconnect breakaway shell type.

Metal braided shields can be used effectively to keep the size and wieght down and increase flexibility .

Photo: Omnetics Connector

What do we lose?

Putting aside the size and weight challenge, one additional wild card remains the overall environment. Taking an even deeper dive brings us to; environmental protection. This is a major challenge for today's engineer invested in utilizing miniature connectors, as a majority cables designed previously for transmission of electrical power or high voltage signals are relatively unaffected by EMI.

Electromagnetic interference also known as the ugly acronym EMI, is unwanted noise or interference in an electrical path and/or circuit caused by an outside source. Why is this such a big deal? Well, EMI is also known for causing electronics to operate poorly, malfunction and in some cases, stop working completely and which designer has the time for this?

Micro and Nano sized cables on their own are rarely designed in with the intentions of transmitting high power, but rather LVDS (low voltage differential signals), so if precautionary measures are not taken into consideration during the design phase, these cables can have disastrous results for an engineering team. This issue in particular is requiring many military and space programs to specifically require EMP or Electromagnetic Pulse

protection. Designing against EMP is basically the same as designing against EMI and that generally starts with the physical cable used vs. the connector selected. The first line of defense is generally twisted pairs. Twisted pair cable is good for transferring balanced differential signals and the process itself dates back to the early days of telegraph and radio. However, if twisted pairs aren't cutting it, the next step is physically shielding your wire bundle. Yesterday's technology may have had us believe the best cable shields for EMI were solid materials such as conduit, however, where lightweight connectors are being considered, metal braided shields can be used effectively to keep the size and weight down and increase flexibility. In fact, with cabling carrying more low voltage data signals than ever before, proper shielding is of prime importance if the integrity of the transmitted data is to be maintained and therefore consistent.

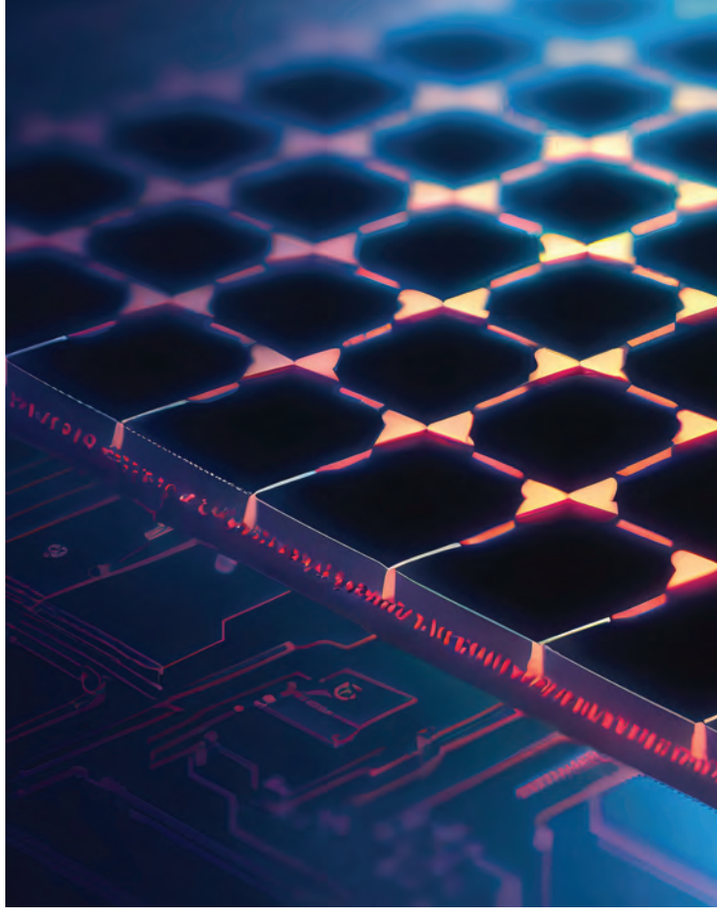
While new issues will continue to place many demands on connector performance as well as constraints on connector design, in the end; reliability trumps all in mission critical applications and markets like space exploration to geophysical explorations continue to operate within some of the harshest environments known to humankind as it relates electrical components survivability. From launch vibration, to the overall operating temperature cycling. These are all challenges mission critical connectors must overcome. Make sure you pick the right one. **EP&T**

This article was written and submitted by Omnetics Connector Corp., a global miniature connector design and manufacturing company. https://www.omnetics.com/

How photonic ICs are evolving

At a time when data demands are increasing rapidly

BY DR. DANNY RITTMAN, CTO OF GBT TECHNOLOGIES



Over the coming decade, it is clear that photonic chips will become the preferred choice in the data and telecom sectors.

First developed in the late 1950s, the integrated circuit (IC) – also known as a chip or microchip – is the key building block in just about every electronic device in use today. Fabricated out of a semiconductor wafer and powered by electricity, most modern IC chips are now measured in square millimeters and can consist of thousands or millions of tiny resistors, capacitors, diodes, and transistors.

However, as chips have become increasingly miniaturized, we are fast approaching the point where it will become physically impossible to fit any more components on a wafer. This post-Moore's Law world, as it's been called, may be upon us by as early as the year 2036 and could pose serious challenges for further advances in semiconductor engineering.

Worse yet, current IC chips are already coming under a lot of strain from an exponential increase in data usage through big data, Internet of Things (IoT) devices, and artificial intelligence (AI). Simply put, current IC architecture is not up to the challenge of increasing data demands, which has led to bandwidth bottlenecks and decreased data transmission speeds.

Fortunately, advances in the field of integrated photonics have expanded rapidly in recent years and will likely form the foundation of a new type of IC architecture, one that uses light rather than electricity to send signals and drive components.

What is integrated photonics?

A photonic integrated circuit (PIC), also known as a photonic chip, is a microchip that uses two or more photonic components to form a functioning circuit. What sets a photonic chip apart from an electronic one is that it uses light particles (photons) rather than electricity (electrons) to sense and transmit information.

Photons allow for greater bandwidth than is possible with an electronic chip. Furthermore, photons do not encounter any resistance from one another, as electrons do, which translates into faster data transmission speeds and lower thermal effects.

Another thing that sets photonic chips apart from their electronic counterparts is the substrate material used in their construction. In most electronic chips, silicon is the preferred choice due to its high conductivity, low cost, and well-established processing techniques.

However, with photonics, silicon is not a viable material because it is a poor light emitter. Instead, three different substrates – or "flavors" – have emerged in photonic development, namely indium phosphide (InP), silicon nitride (SiN), and silicon/silica photonics (SiP). Whatever material a chip manufacturer chooses to use will depend on the intended application of the chip, as each substrate has its own strengths and weaknesses. In theory, it may one day be possible to combine all three materials to create the ultimate PIC, but given the limited size of the current PIC market, it doesn't make economic sense for manufacturers to pursue such an endeavor just yet.

Photonics in data and telecom

One of the key benefits of photonic chips is improved data communications, which has led to many applications for PICs in a diverse range of industry sectors, including autonomous driving, biomedical, astronomy, defense, and aerospace. But the two sectors with perhaps the most to gain from advances in photonics are the data management and telecom sectors. This is where photonic chips are likely to have the biggest effect on data communications in the coming decades.

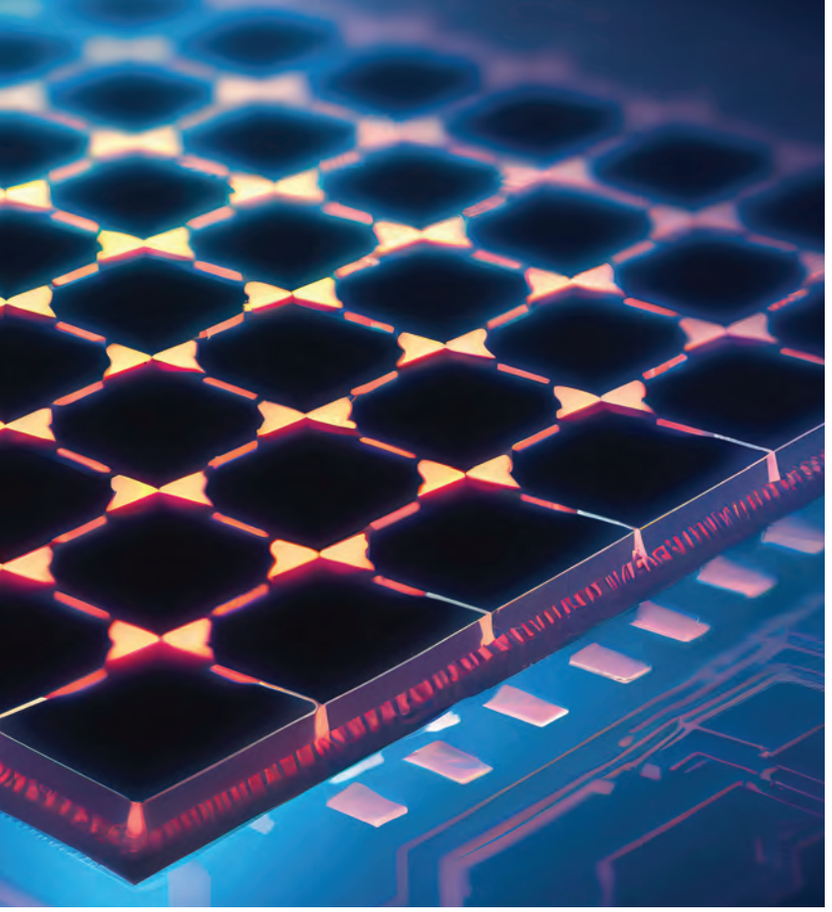
Integrated photonics in data centers

Between 2010 and 2018, global internet traffic grew more than tenfold, while global data center storage capacity increased by a factor of 25. This vast growth in the amount of data being generated and consumed every day is only set to continue as new possibilities open up from the development of AI, big data, and IoT. As a result of these increasing data demands, the conventional copper cables used to connect servers are suffering from bandwidth bottlenecks that affect the entire system.

While copper cables tend to hit their bandwidth limits within a few Gbps, the limits of an optic fiber are nearly unlimited, allowing for transfer speeds of hundreds of Gbps or Tbps with ultra-low latencies. Moreover, data centers can also integrate photonic chips with onboard components such as high-bandwidth transmitters and receivers, allowing for a significant improvement in system performance and reliability.

Energy use cost savings

One of the consequences of the resistance encountered between electrons when passing through a copper wire



is that large amounts of heat are generated. This can be highly problematic for the silicon used in electronic chips, which tends to rapidly break down under heat stress. For this reason, large amounts of cooling are required to keep data centers operational, which in turn leads to heavy energy consumption and high carbon emissions. It's been estimated that cooling alone accounts for 33 percent of the energy consumed by a data center.

By contrast, PICs generate far less heat. In fact, they generate so little heat that they don't require any dedicated cooling system. This extreme energy efficiency is likely to become even more important in the coming years as pressure builds for data centers to cut down on their energy consumption as part of the fight to reduce carbon emissions.

Next generation 6G networks

Even as 5G continues to roll out across the world, telecom companies are already discussing potential designs for 6G, which promises to be orders of magnitude faster than 5G. Expected to be launched at the end of the decade, 6G could provide speeds of up to 1 Tbps, opening the doors to new advances in 3D holographic videos, 8K streaming, and improved artificial reality (AR) and virtual reality (VR) devices. Photonics is certain to be the defining technology of 6G, as it can provide a significant improvement over electronics in both bandwidth and transmission speeds.

Final thoughts

Over the coming decade, it's clear that photonic chips will become the preferred choice in the data and telecom sectors. Their ability to provide lightning-fast speeds on a wide bandwidth with low thermal effects makes them the best solution for handling the increasing data demands of a rapidly digitizing society. That said, it must be kept in mind that this is just the beginning for photonics. Increasing data demands are certain to push their development even further, leading to new use cases and an expanded market that could reach new heights within the next five years. **EP&T**

https://gbtti.com/

Dr. Danny Rittman *is chief technology officer at GBT Technologies, a solution dedicated to enabling the rollout of Internet of Things (IoT), global mesh networks, artificial intelligence (AI) and for applications relating to integrated circuit (IC) design.*

Preventing workplace injury with haptics

BY KYLE SKIPPON, HEAD OF ENGINEERING, TITAN HAPTICS

At its core, technology is supposed to make people's lives better, however, this can take many forms. Beyond just interconnecting people and finding new ways to entertain us, advances in technology truly have the potential to keep us safer and healthier than ever before.

One place where this is glaringly apparent is in the world of workplace injury. Today, injuries in the workplace are an epidemic, bringing significant detriment to the lives of millions of workers and cutting into the productivity of thousands of businesses. To answer this call, one field of technology with the potential to have a huge positive impact on preventing workplace injury is haptics.

Recently, Titan Haptics supported a hackathon at the Delft University of Technology, and it was here that the creativity of students really highlighted the role that haptics can play in preventing workplace injury. In this piece, we'll discuss the growing role of tech in preventing workplace injury, a background on haptics, and dive deeper into the novel projects developed by the Delft University of Technology students.

Tech role in workplace grows

Today, workplace injuries are becoming an alarmingly prominent issue in a variety of industries, but most specifically, in the blue-collar workplace. Fields requiring manual labour, like construction and warehouse work, are particularly afflicted - seeing a growing number of bodily injuries resulting from falling objects, improper technique, and general negligence.

From the employee's perspective, a workplace injury can leave them injured, strip them of their livelihood, and significantly impact their quality of life. For the employer, workplace injury strains the employer-employee relationship and can cut into business productivity and profitability. In fact, it is estimated that over $250B is spent on workplace injuries every year in the US, while the global cost of workplace illnesses, injuries, and deaths totals $2.99 trillion dollars.

As this epidemic continues to mount, many organizations are now turning to modern technology as a solution. For example, recent years have seen a handful of companies beginning to invest in worker-worn wearable safety devices. These devices are often equipped with a number of sensors that allow the device to track a worker's movements and use advances in artificial intelligence and machine learning (AI/ML) to determine the wearer's level of safety. In a situation like this, a wearable device might determine that a worker is using improper form (e.g., bending their back at an unsafe angle) and can alert the worker of the danger before any injury occurs.

Others in the industry are looking to prevent workplace injury by embracing the concepts of Industry 4.0 and Industry 5.0. Here, workplaces like factories and warehouses are beginning to integrate robotics and other forms of machine automation into the workplace to operate alongside human employees. In doing this, workplaces are increasing automation and offloading more dangerous tasks from humans to improve their safety.

With the proliferation of technologies like these, the industry is addressing many of these concerns and creating a safer and more productive workspace.

A primer on haptics

Among these solutions, one field that is a large contributor to workplace tech is haptic technologies. Haptics technologies are devices and systems that enable users to experience touch and tactile feedback in virtual and real-world environments. On the whole, these systems tend to involve the use of sensors, actuators, and software algorithms integrated into a feedback loop to simulate touch sensations.

At the heart of a haptic system is the haptic actuator, which is the part of the system which physically creates forces or vibrates to produce tactile sensations. In general, haptic actuators are driven by a voltage waveform, the characteristics of which (i.e., amplitude, pulse width, duration), will directly influence the vibrations of the actuator. Some types of legacy haptic actuators include linear resonant actuators (LRAs) and eccentric rotating mass actuators (ERMs). More recently, advances in technology have led to the advent of voice coil motors (VCMs), and linear magnetic rams (LMRs), both of which offer a broader range of haptic feedback than legacy solutions.

Thanks to advances in haptics, the technology has found itself used in a plethora of devices and applications. More common uses for haptics include smartphones or AR/VR glasses, where the vibration caused by a haptic actuator can be used to alert a user of a notification or to create a realistic tactile experience. Now, however, many people are starting to integrate haptic technology into workplace tech as well.

In this context, many applications of haptics operate by using the haptics as a notification

Photos: Titan Haptics

Many haptics applications operate as an alarm to notify workers of dangerous scenarios .

or alarm mechanism, alerting workers of dangerous scenarios or environments. Sticking with our example from earlier, a haptic-enabled workplace wearable might vibrate in a certain way when a wearer is detected to be bending their back in an unsafe way.

Student project on haptics

Recently, Titan Haptics supported a hackathon at the Delft University of Technology in which students competed to develop haptic-based projects. Here, two groups of students each particularly impressed the crowd with novel projects that directly tackled the challenge of workplace injury.

The first of these projects was a modular construction vest that was equipped with haptic feedback. Research shows that one of the most common causes of injury to a construction worker is being hit by random and falling objects. The goal of this project was to address this threat by creating a vest that would vibrate when it detected a nearby object endangering a wearer. To do this, the project integrated proximity sensors which could detect the presence of a nearby object, upon which haptic feedback would alert the wearer of the impending danger through vibrations. Akin to a "sixth sense" on the construction site, this project, showed tremendous potential in directly addressing a common cause of workplace injury in the construction industry.

The second hackathon project that addressed workplace injury came in the form of an intelligent safety helmet for construction workers. For this project, students sought to address the issue of workers getting overheated and dehydrated on the job which can lead to a significant risk of harm. To address this, the students devised a haptic-enabled construction helmet that consisted of a suite of sensors, including temperature sensors that could detect when a worker was overheating or overworking. In response to these triggers, the helmet would provide a variety of different tactile feedback that depended on the severity of the situation. For example, if the detected temperature was high, but not immediately dangerous, the helmet might provide the wearer with a pulsating vibration to indicate a small warning. If workers reached a serious risk of injury from overheating, however, the helmet might provide more aggressive and noticeable vibrations to warn the wearer of the danger.

In both instances, students successfully demonstrated how innovative technology equipped with haptic feedback could directly improve lives and prevent injury in the workplace.

Conclusion

Haptic technology is finding itself more and more integral to the solution, providing a way to physically alert workers of dangerous scenarios and environments.

EP&T

https://titanhaptics.com/

Titan Haptics develops advanced haptic motors for smartphones, consoles and touchscreen devices.

Conductive film set to alter design landscap

Invisible, nanostructured metal mesh is fabricated onto glass or plastic surface

BY DR. RAGIP PALA, DR. EFTHYMIOS KALLOS, DR. DONG HAN, DR. JONATHAN WALDERN, META MATERIALS INC.

NANOWEB is an extremely thin, transparent, conductive film that consists of an invisible, nanostructured metal mesh fabricated onto a glass or plastic surface. With its transparency, conductivity and flexibility, the patented functional film holds good potential for both passive and powered use cases, with applications including electromagnetic interference shielding, antennas, 5G/6G redirection systems for elimination of dead spots and deicing/defogging devices for vehicle windows and eyewear.

NANOWEB technology

Transparent conductors are critical components in a wide range of electronic devices, including touchscreens, organic light-emitting diodes (OLEDs) and photovoltaics. They are also used in the optical components of sensors and display systems, including electromagnetic interference (EMI) shielding and transparent heating elements.

Existing transparent conductive electrode (TCE) materials, such as indium tin oxide (ITO) and silver nanowires, suffer from several drawbacks, including poor mechanical stability, low optical transmissivity, low electrical conductivity, high cost, and limited supply. These constraints (or limitations), together with the ever-growing demand for electronic products, have encouraged efforts to explore alternative solutions.

One outcome of such efforts is NANOWEB, a transparent thin-film conductor developed by Meta Materials Inc., based in Dartmouth, Nova Scotia.

Comprising a precisely arranged mesh of invisible submicron metal wires formed on a glass or plastic substrate, the product provides enhanced electrical and optical properties compared to conventional transparent conductor films. Distinct from currently available options, the material's transparency is determined by its nanostructured wire mesh geometric spacing and submicron dimensions. As a result, it can be manufactured from almost any metal, including but not limited to silver, aluminum, nickel, copper and platinum, all to deliver expansive specifications and capabilities, while maintaining exceptional visibility.

In many cases, the material can function as a substitute for ITO, which is arguably the most commonly used TCE material. Furthermore, the material also outperforms ITO-based components in terms of sustainability and manufacturing energy consumption.

Another key advantage that differentiates NANOWEB from conventional solutions is its flexible mesh pattern design that can be customized and optimized to satisfy various application requirements. It is often impossible to cost-effectively pattern (etch) ITO much less than 20µm in thickness, whereas NANOWEB is printed from its roll-to-roll manufacturing line (not requiring any post-patterning etch step) with submicron features.

Rolling mask lithography

NANOWEB achieves its performance and versatility from its fabrication process called Rolling Mask Lithography (RML), which may be best described as a proprietary continuous near-field optical nanolithography process. Combining the benefits of phase-shift and soft lithography with roll-to-roll patterning,2,3,4 RML provides the capability to produce subwavelength structures for large-area applications in a cost-effective, scalable fashion. Through the use of a cylindrical elastomeric mask, a wide selection of materials (e.g., silver, gold, and copper) can be fabricated on both rigid (e.g., glass and sapphire) and flexible (e.g., plastic and flexible glass) substrates.

The RML process involves an exposure tool that consists of an in-line ultraviolet (UV) light source enclosed by a quartz cylinder, a soft mask made of a compliant material and featuring a phase-shift pattern and a substrate coated with a hard, thin, photosensitive resist layer. The mask is mounted over the cylinder and contacts the resist on the substrate, using precise pressure.

During the exposure process, collimated UV light emanating from the UV light source is guided through an intervening slit in front of the mask and into the resist. The phase-shift pattern of the mask facilitates resist exposure in the near field of the patterned UV light. Subsequently, the resist is developed, and the substrate is rinsed.

The linewidth, thickness, and mesh design parameters of the mask used in the RML process is normally tuned to meet individual transparency and conductivity requirements. With its high conductivity and best-in-class optical transparency including low haze, NANOWEB can serve a broad range of both passive and powered applications.

EMI shielding

The increasing use of electronic devices has intensified the concern for EMI, which is unwanted noise or interference in an electrical path or circuit caused by an outside source. Also known as radio-frequency (RF) interference, EMI can cause electronics to operate poorly, malfunction, or stop working completely and poses a threat to both electronic equipment and the human body.

Current transparent EMI shielding systems rely mostly on transparent conductive oxides (TCOs) or metallic wire meshes (MWMs). Dopant-density-limited conductivity precludes

Photos: Meta Materials Inc.

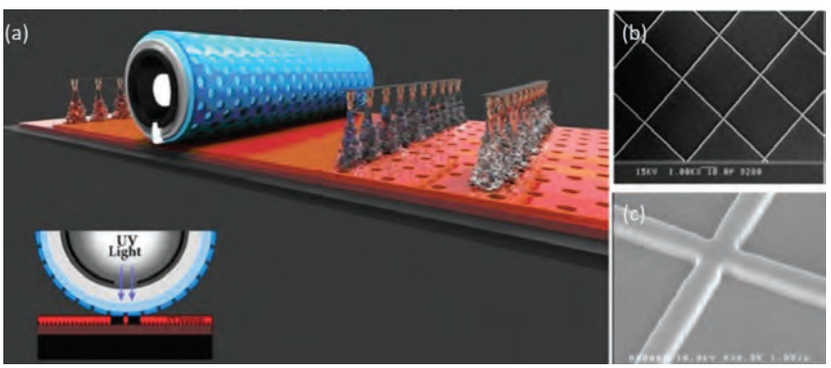


Figure 1 (a) Artist's impression of the RML technique, while (b) and (c) SEM images of a NANOWEB pattern fabricated using RML.

Figure 2: Examples of three NANOWEB transparent antennas each formed on a polyethylene terephthalate (PET) film substrate.

Figure 3: NANOWEB-based anti-fog eyeglasses and windshield deicing systems serves a variety of high-performance applications.

TCOs (e.g., ITO) from achieving adequate shielding effectiveness (SE). On the other hand, due to their enhanced SE and transparency, MWMs are a time-tested, reliable choice of EMI shielding, particularly for microwave-range interference. The applicability of available MWMs is, however, circumscribed by their linewidths, which are large enough (several microns) to be resolved by the human eye.

RML can effectively address the problem of discernible wires associated with the current MWM-based EMI shielding technology. Typically featuring a linewidth that does not exceed one micron, NANOWEB fabricated using RML is impossible to see with the naked eye, thereby offering a significant transparency improvement on industry-standard perforated metal screens or micron-scale MWMs.

Transparent antennas

Another notable application of NANOWEB is optically transparent antennas. Transparent antennas are useful for integrating antenna functionality into transparent surfaces, such as windshields and windows, while maintaining visibility.

High transparency in these antennas is attained without sacrificing the electromagnetic behavior. This key benefit, along with minimum installation space requirements, propels them to the forefront of antenna choices for many application scenarios. They include 5G antennas for smartphones, smartwatches, and vehicles; Bluetooth antennas for wearables and Internet-of-things (IoT) devices; and satellite antennas mounted on solar panels.

With both aesthetic and space advantages over traditional opaque and obtrusive options, NANOWEB transparent antennas, designed for the frequency range from 400MHz to 92GHz, are anticipated to play a significant role in next-generation telecommunications infrastructure.

RF redirection films

As the backbone of smart cities, ubiquitous and reliable connectivity relies on extensive, high-performance (5G/6G) wireless cellular networks capable of handling vast numbers of simultaneous connections with low latency and high data speeds.

Known for high directivity, short ranges, and susceptibility to obstruction, RF communication signals present unique challenges for realizing full network coverage in dense urban areas. The increasing adoption of windows made of energy-saving low-emissivity glass in modern buildings also impedes signal transmission, as these windows cause signal attenuation.

Countering this impediment, additional network infrastructure is deployed to improve network coverage, but this is a costly and space-demanding approach. Moreover, network towers are becoming increasingly objectionable to city residents, often devaluing their real estate.

NANOWEB-based RF redirection films present a passive and more sustainable alternative solution for eliminating wireless dead spots. Applicable virtually anywhere, these ultra-thin, transparent, and flexible films can selectively transmit and/or reflect signals in the sub-6-GHz and mmWave ranges.

For factories and hospitals where wireless IoT devices and tools are increasingly employed, another added advantage of passive redirection over-active signal relay is that the passive solution does not add any electronic signal lag. Traditionally, relaying a 5G signal through a building with many corridors and rooms may add seconds of nonuniform signal delay, an important consideration in circumstances where all IoT devices may need to work in unison.

Deicing/defogging

As a one- or two-dimensional nanowire-based film configured as a resistant heater element, NANOWEB can deliver uniform heat in a variety of novel high-performance applications. From eyeglasses to windshields, the ability to ensure constant visibility in inclement conditions like fog, ice, and snow is ever more critical.

Next-gen cars, especially those now employing advanced driver-assistance system (ADAS) levels 3, 4, and 5, will use 20 or more scanners and sensors, all requiring sensor signal visibility. With growing driver reliance and the ever-pressing demand for vehicle safety, sensor heaters must react fast and be transparent and uniform to ensure maximum signal-to-noise integrity in inclement conditions.

Owing to its low resistance, the product achieves its power density for heating applications with low voltage. For example, as a heating element for windows, NANOWEB can reach up to 70°C in less than a minute with 12 volts or less applied.

Condensation occurs when water droplets form as warm air comes in contact with a cold surface. This phenomenon is particularly problematic for masks and eyewear as it drastically reduces visibility. Heating can effectively address this problem by eliminating the temperature gradient between the mask/eyewear lenses and the surrounding air. Compared to other film-based heating solutions (e.g., ITO), NANOWEB is more efficient at defogging due to a heat density as high as over 10,000W/m2, while maintaining high transparency.

In addition, use of automotive RADAR sensors is completely blocked by conventional ITO heaters, whereas NANOWEB linear one-dimensional nanowire arrays are polarized, allowing 100% RADAR transmission. These arrays are impossible to be patterned on ITO invisibly. For LIDAR, the high optical transmission afforded by NANOWEB results in significant signal-to-noise real-world detection, building a higher-resolution point cloud and realizing environmental detection so critical to ADAS level 4 and 5 autonomy.

Conclusion

Meta's NANOWEB offers an alternative to conventional transparent conductive materials. The breakthrough solution serves wide-ranging applications like 5G, automotive, and consumer products alike. **EP&T**

https://metamaterial.com/products/nanoweb

Based in Dartmouth, NS, Meta Materials Inc. designs, develops and manufactures sustainable, high-performance, functional materials for a wide range of applications.

SECURE ELEMENT SIMPLIFIES SECURITY FOR MATTER DEVICES

NXP SEMICONDUCTORS

EdgeLock SE051H secure element integrates NFC functionality to simplify secure onboarding of Matter devices in a smart home. Single chip solution simplifies secure and seamless onboarding of Matter devices, enabling new user experiences. Product is optimized to support these requirements, including the algorithms and cryptographic functions needed for Matter, permitting device OEMs to incorporate the necessary security protections into end devices.

https://www.nxp.com

PERFORMANCE VECTOR TESTER REDUCES FOOTPRINT

ROHDE & SCHWARZ

R&S PVT360A is a VSG/VSA single-box vector tester optimized for FR1 base station, small cell and RF component testing in production and characterization environments. Two independent signal generators and analyzers enable fast parallelized measurements. Products provide a frequency range of up to 8GHz, flexible bandwidth configuration and an optional second TRX channel boosting performance and enabling flexible adaptation in a small form factor. Both TRX channels come with independent signal generators and analyzers.

https://www.rohde-schwarz.com/us

PROTECTION ICS ADDRESS DIVERSE, DEMANDING DESIGNS

LITTELFUSE

eFuse Protection ICs product line utilizes an innovative design suitable for a wide range of power inputs (3.3V to 28V) with highly integrated protection. The semiconductor-based electronic fuses provide robust overvoltage, overcurrent, short circuit and inrush current protection. Product features reverse current blocking, UVLO, soft start and overtemperature protection with real-time diagnostics—all in one compact chip. ICs deliver accuracy and integration, speed response time, boost current limiting accuracy.

www.Littelfuse.com

DEV KIT SERVES IOT SENSOR ENGINEERING

HENKEL

Sensor INKxperience dev kit is tailor-made for IOT engineering across industries. The novel Henkel Qhesive Solutions Sensor INKxperience Kit provides four different printed electronics technologies that are pre-configured with hardware and software for prototyping and engineering ideation. Kit enables engineers to quickly and efficiently explore and experiment with the technology of printed electronics for the development of IOT sensor solutions.

https://www.inkxperiencekit.com

DDR4 MEMORY SOLUTION IS RADIATION-TOLERANT

TELEDYNE & TI

Teledyne e2v and Texas Instruments (TI) collaborated on a new radiation-tolerant DDR4 modular platform to help satellite OEMs to streamline their system development work, as well as reducing the time and engineering effort involved. The field-proven hardware consists of a 4GB/8GB capacity DDR4ToxG72 DDR4 memory from Teledyne e2v accompanied by a TI TPS7H3301-SP DDR termination low drop-out (LDO) voltage regulator that provides a stable supply for the DDR4 module. Optimized for implementations where there are acute size, weight and power (SWaP) constraints to factor in, the platform is compact and convenient to use.

https://semiconductors.teledyneimaging.com/en/products/memory/space-radiation-tolerant-4gb-8gb-ddr4/

MOSFETS PROTECT SMARTPHONE BATTERY CIRCUIT MODULES

MAGNACHIP SEMICONDUCTOR

Two seventh-generation MXT Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs), built on Super-Short Channel technology, for the battery protection circuit modules in smartphones. Device shortens the channel length between the source and the drain to significantly reduce RDS(on) and conduction losses during on-state operation. Firm is applying this technology first to the 12V MOSFET (MDWC12D028ERH) and 24V MOSFET (MDWC24D031ERH). The technology has reduced the sizes of the MOSFETs by 20%, while the RDS(on) is lowered by 40% and 24%, respectively.

www.magnachip.com

HIGH STATIC PRESSURE SERVER FANS ARE 1U

JARO THERMAL

1U ultra-high-static-pressure, dual-bearing (12V, 4-pin, three phase) brushless, dc cooling fans provide one of the highest levels of airflow (35.02-41.2 CFM) in the industry. Products deliver super-cool air, for a variety of challenging, server environments and come in 30,000 and 35,000 RPM options. Product delivers 40 X 40 X 28mm dimensions with full PWM fan speed and control. Equipped with low vibration and noise, devices meet environmental compliance standards, while delivering 70,000 hour longevity.

https://jarothermal.com

GAN SIP YIELDS COMPACT, FAST-TO-MARKET SOLUTION

TRANSPHORM / WELTREND

WT7162RHUG24A GaN System-in-Package (SiP) is an integrated circuit designed for use in 45 to 100 watt USB-C PD power adapters charging smartphones, tablets, laptops, and smart devices. SIP

provides peak power efficiency of greater than 93%. SiP enables a less expensive system solution given fewer parts are required, along with a smaller pcb. It also reduces system development time.

http://www.weltrend.com

32-BIT MCUS AID COST-SENSITIVE APPLICATIONS

STMICROELECTRONICS

STM32C0 series microcontrollers makes 32-bit capabilities accessible to all developers at a convenient price. IAR (authorized partner) Embedded Workbench for Arm has improved capacities for building an optimized and compact code and extensive debugging and analysis possibilities. Device lowers the hurdle when working with 8 or 16-bit MCUs to move to more competitively priced 32-bit devices. Modern design permits faster response, extra functions and network connection.

www.iar.com/arm

Four technologies have been incorporated into Renesas' R-Car S4 vehicle communication gateway SoC.

SEMICONDUCTOR

MICROCHIP INVESTS $880M ON SIC, SILICON CAPACITY

Microchip Technology Inc. provider of smart, connected and secure embedded control solutions, plans to invest $880-million to expand its silicon carbide (SiC) and silicon (Si) production capacity at its Colorado Springs manufacturing facility over the next several years.

One phase of the expansion will be to develop and upgrade its 50-acre, 580,000-square-foot Colorado Springs campus for increased SiC manufacturing for use in automotive/E-Mobility, grid infrastructure, green energy, and aerospace and defense applications.

RENESAS DEVELOPS TECH FOR AUTOMOTIVE SOCS

Renesas Electronics Corp., has announced four technologies for system-on-chip (SoC) devices for in-vehicle communication gateways. These SoCs are expected to play a crucial role in defining the next-generation electrical/electronic (E/E) architecture in automotive systems.

SoCs for automotive gateways must provide both high performance to implement new applications such as cloud services and low power consumption when they are not in use. They also need to deliver fast CAN response to support instant start-up. Additionally, these SoCs need to provide power-efficient communication technology that enables network functions as a gateway using limited power and security technology to enable safe communication outside the vehicle. To meet these requirements, Renesas has developed an architecture that changes the circuit operation timing to match the vehicle conditions with optimized performance and power consumption, fast start-up technology by partitioning and powering essential programs only, a network accelerator that achieves a power efficiency of 10 gigabits per second/watt (Gbps/W), and security technology that prevents communication interference by recognizing and protecting vital in-vehicle communication related to vehicle control.

Konrad Garhammer, COO and CTO at congatec (left) and Michael Riegert, CEO Kontron Europe GmbH and COO IoT Europe, executive board member at Kontron AG (right).

SEMI COUNCIL TO ADVANCE AN AGILE, RESILIENT SUPPLY CHAIN

With a mission to build an agile, resilient supply chain, Industry association SEMI has formed an Industry Advisory Council (IAC), a group of industry leaders that will guide its initiatives impacting the global electronics supply chain. The Council will develop solutions to help SEMI members better withstand supply chain disruptions and make proactive decisions to protect their businesses and supplier networks.

The IAC will expand to up to 20 member companies across a diverse range of segments and geographies this year. The Council will then form regional councils and working groups to produce tangible solutions.

COMPUTING

KONTRON AND CONGATEC CO-CREATE CARRIER BOARD SPECS

Two German embedded and edge computing heavyweights, congatec and Kontron, have concluded a co-operation agreement to standardize the design schematics of COM-HPC evaluation carrier boards from both companies, and to publish most of these schematics in public design guides. The goal is to improve design security through standardization, to reduce OEMs' NRE costs, and to accelerate their time-to-market for new modular high-performance embedded and edge computing solutions based on the new COM-HPC standard.

To solve the customer's challenges, both competitors also worked to raise supply security through dual sourcing strategies. The combined design and engineering expertise addresses the need for high supply chain security by improving interoperability through joint carrier board design initiatives. congatec and Kontron have put specific focus on plug & play capabilities so that Computer-on-Modules from either vendor can be used on any evaluation carrier board.

EXPETO COLLABORATES WITH INTEL

Expeto Inc., Vancouver-based provider of Enterprise First networking over private and public mobile networks, is now working with Intel to support enterprise 4G/5G network-powered connectivity for a wide range of industry verticals.

The effort benefits medium to large enterprises that want a complete solution (i.e., cloud hosting of network workloads, mobile networks, remote edge computing devices and vertical application partnerships) to deliver business outcomes such as increased productivity, reduced carbon footprint and improved worker safety.

Expeto's NeXtworking platform is available as a PaaS-based service running end-to-end on Intel powered private and hyperscale clouds and provides connectivity to smart edge devices running on Intel architecture.

Expeto is working with Intel to support 4G/5G networks.

CONNECTORS

HIROSE OPENS NEW AMERICAS HQ

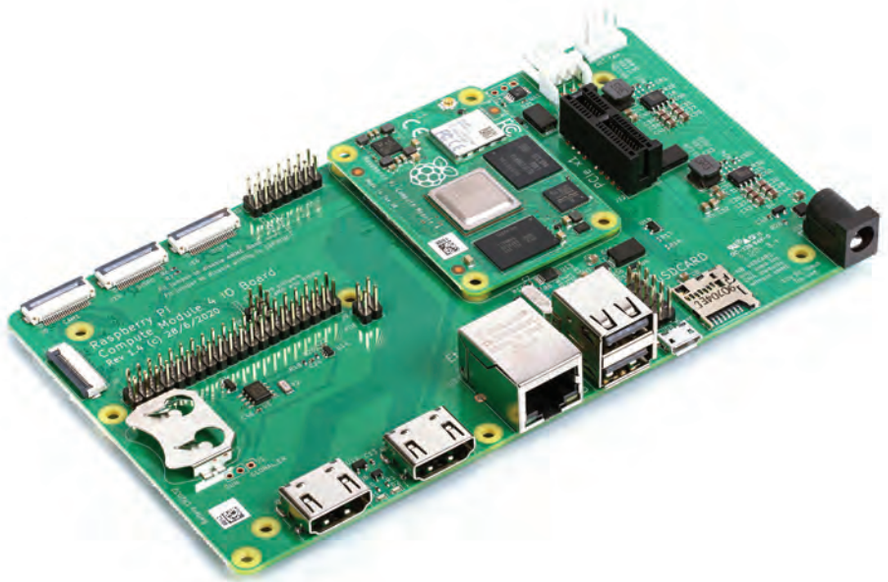
Hirose, manufacturers of connector solutions, has opened a new Americas corporate headquarters near Chicago, IL. The new state-of-the-art facility features key elements to support customer development life cycle. This includes an expanded engineering lab with application support services and a new leading-edge customer imagination center. The 18,000-square-foot facility also has a dedicated training center for customers, sales reps and distribution partners.

PRODUCT SOURCE GUIDE

AD INDEX

Compute Module 4 Dev Board

VENDOR: RASPBERRY PI
RASPBERRY PI MODEL 4 IN A COMPACT FORM FACTOR



Raspberry Pi Compute Module 4 offers the compute power of the popular Raspberry Pi 4 Model B in a compact form factor suitable for integration into products.

Key features include a high-performance 64-bit quad-core Arm Cortex-A72 processor, dual-display support at resolutions up to 4K, hardware video decode at up to 4Kp60, up to 8GB of RAM, Gigabit Ethernet, USB 2.0, dual camera interfaces, and PCIe Gen 2 x1 interface. Compute Module 4 offers a range of eMMC flash options and is available with or without wireless connectivity.

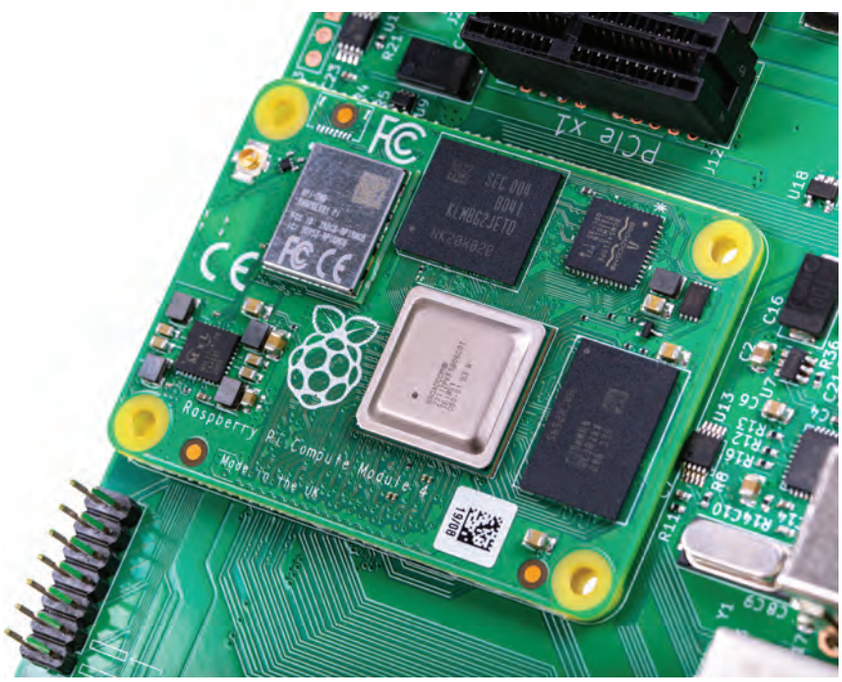
The optional dual-band 2.4/5.0GHz wireless LAN and Bluetooth 5.0 have modular compliance certification. This allows the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market. Either the onboard antenna or an external antenna kit can be used. Optional on-board eMMC of 8GB, 16GB or 32GB is available.

Supporting products

Raspberry Pi offers two products to support OEMs to design with Compute Module 4:

The Raspberry Pi Compute Module 4 IO Board is an invaluable development tool. Exposing every interface from Compute Module 4, the IO Board provides both a development platform and a reference base-board design.

The Raspberry Pi Compute Module 4 Antenna Kit is certified for use with Raspberry Pi Compute Module 4, and allows OEMs to avoid the need to arrange the separate certification that would be required if using a different antenna.



Design applications

Raspberry Pi Compute Module 4 is a flexible platform that's used in a range of applications from industrial control and automation to digital signage and IoT, as well as in consumer electronics.

Explore customer applications at raspberrypi.com/for-industry/powered-by/product-catalogue

Features

- Broadcom BCM2711 quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- H.265 (HEVC) (up to 4Kp60 decode), H.264 (up to 1080p60 decode, 1080p30 encode)
- OpenGL ES 3.1, Vulkan 1.0
- Options for 1GB, 2GB, 4GB or 8GB LPDDR4-3200 SDRAM
- Options for 0GB ("Lite"), 8GB, 16GB or 32GB eMMC flash memory
- Option for fully certified radio module: 2.4 GHz, 5.0 GHz IEEE 802.11 b/g/n/ac wireless; Bluetooth 5.0, BLE
- On-board electronic switch to select either external or PCB trace antenna
- Onboard Gigabit Ethernet PHY supporting IEEE1588
- 1 × USB 2.0 interface, PCIe Gen 2 x1 interface, 28 GPIO signals
- SD card interface for SD card or external eMMC (for use only with Compute Module 4 variants without eMMC)
- Operating temperature -20°C to +85°C
- 55 mm × 40 mm form factor

Scan here to view and download the full data sheet in pdf format.

Photos: Raspberry Pi

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