EP&T

ELECTRONIC PRODUCTS & TECHNOLOGY

OCTOBER 2018

CANADA'S INFORMATION LEADER FOR ELECTRONIC ENGINEERS AND DESIGNERS

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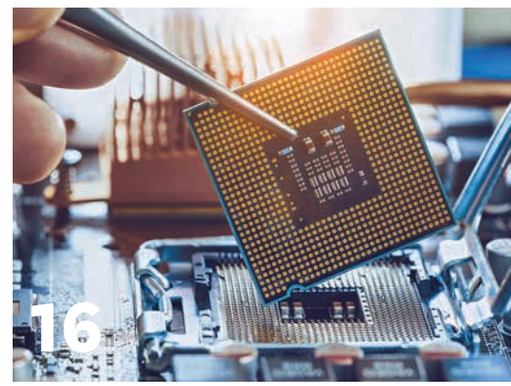

Cover photo: Myant Technologies
Photos (this page, from top) Myant, Rohde & Schwarz, Getty Images, da Vinci Robotic Systems

Smart fabrics evolve beyond the runway

In development for decades, the integration of electronics and textiles known as electronic textiles (e-textiles) or smart fabrics have begun to achieve some commercial success.

Textile computing refers to the integration of biometric sensors and actuators into the very yarns or fibres of a textile product. Alongside those sensors and actuators is hardware with built-in software that transmits the data from your body via Bluetooth to your phone, watch or other device.

While e-textiles markets remain in relative infancy today, many industry players are lining up to offer the next generation of smart textile products. From clothing to bandages, bed linen to industrial fabrics, new products are appearing throughout a variety of verticals as this technology area is increasingly explored.

According to industry researchers IDC, market forecasts show underwhelming results thus far globally. However, the slowdown represents more of a sign that the market is in transition.

"Vendors are slowly moving beyond first-generation devices and experiences. The wearables of tomorrow will play a more prominent role in communication, digital health care, home IoT, and enterprise productivity that will make last year's options look quaint," says Ramon Llamas, research director at IDC.

In the last few years, research group IDTechEx has witnessed a developing maturity in the e-textiles value chain. While companies have been able to manufacture and sell e-textile products for decades, challenges around reliability, cross-compatibility & standards, equipment suitability, materials availability and overhead costs have been prohibitive in many emerging market opportunities. However, thanks to significant investment and partnerships, some of these barriers are being lowered, with more players able to make more advanced e-textile products at less prohibitive prices. These developments improve the chances that emerging e-textile products have against incumbent options, according to an IDTechEx report.

> ***There is an unquestionable potential when combining the comfort, feel and look of textiles with the functionality, connectivity and intelligence of electronics***

As with e-textiles, there is tremendous reliance on the success of the extended emerging technology ecosystem; which includes conductive inks, stretchable electronics, wearable technology, printed electronics, printed and flexible sensors, Internet of Things, emerging energy storage, and many more.

The big picture for e-textiles is extremely exciting. There is an unquestionable potential when combining the comfort, feel and look of textiles with the functionality, connectivity and intelligence of electronics, and these broad-brush industry sectors give only part of the picture. E-textile products are being explored in many exciting niches, from body motion capture, to prevention of diseases and side effects, to improving road safety, and many more.

The best part is that Canada can boast having a leading player in this emerging sector – Toronto-based Myant Technologies Inc., which operates an 80,000-square-foot facility that houses advanced robotic knitting machines. Supported by state-of-the-art 3D digital fabrication, Myant enables the world's only end-to-end textile computing capacity, from research and development through end production.

Since its formation in 2010, Myant has forged its way by assembling multi-disciplinary teams of designers, engineers and scientists, to create the form factors and the hardware and software that will deliver both the sensing capacity and the user experience that will deliver real value-ad for its partners and their customers. In addition, Myant's R&D team remains focused on finding and developing next generation yarns and fibers, as well as new sensing and actuation processes.

Among its most recent initiatives, Myant has focused on partnering with companies and institutions in order to democratize manufacturing in the functional and computing textile industry, and support innovation to make it more accessible to educators, inventors, students, medical professionals, researchers, and idea makers. The goal for Myant CEO Tony Chahine is that it will enhance the fabric of Canada in the long run.

To get a better sense of what Myant is doing to create a beachhead in E-textiles, be sure to turn to page 10 for our exclusive Q&A interview.

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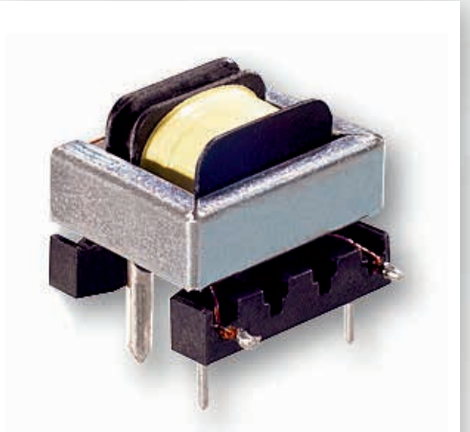

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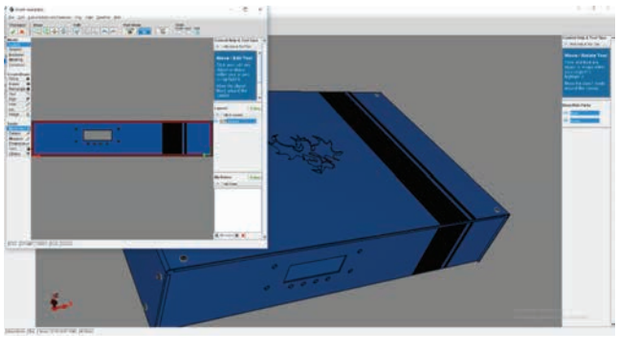

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NEWSWATCH

FLEXIBLE ELECTRONICS

QUEEN'S U UNVEILS ROLLABLE TOUCH-SCREEN

A Queen's University research team has taken a page from history, rolled it up and created the MagicScroll – a rollable touch-screen tablet designed to capture the seamless flexible screen real estate of ancient scrolls in a modern-day device.

Led by bendable-screen pioneer Dr. Roel Vertegaal, this new technology is set to push the boundaries of flexible device technology into brand new territory.

The device is comprised of a high-resolution, 7.5" 2K resolution flexible display that can be rolled or unrolled around a central, 3D-printed cylindrical body containing the device's computerized inner-workings. Two rotary wheels at either end of the cylinder allow the user to scroll through information on the touch screen. When a user narrows in on an interesting piece of content that they would like to examine more deeply, the display can be unrolled and function as a tablet display. Its light weight and cylindrical body makes it much easier to hold with one hand than an iPad. When rolled up, it fits your pocket and can be used as a phone, dictation device or pointing device.

"We were inspired by the design of ancient scrolls because their form allows for a more natural, uninterrupted experience of long visual timelines," says Dr. Vertegaal, Professor of Human-Computer Interaction and Director of the Queen's University Human Media Lab. The MagicScroll's scroll wheel allows for infinite scroll action for quick browsing through long lists. Unfolding the scroll is a tangible experience that gives a full screen view of the selected item. Picture browsing through your Instagram timeline, messages or LinkedIn contacts this way."

The MagicScroll rollable touch-screen tablet fits in your pocket when rolled-up and can be used as a phone. dictation device or pointing device

ENVIRONMENTAL TEST

TEST LAB FOCUSED ON SHOCK & VIB ENVIRONMENTAL

Putting specific focus on environmental related regulatory services in the test arena, Garry Lee says he is trying to fill a void in the Canadian electronic OEM marketplace.

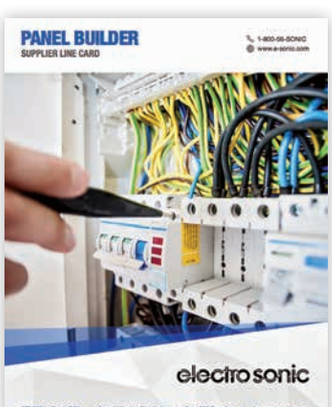
A test industry veteran in Canada for 23 years, Lee is behind the launch of EMTS Lab Inc., an ISO accredited engineering firm that provides compliance services. The company also delivers technically diverse independent testing for the automotive, military, aerospace, medical, industrial and consumer electronics industries. Testing which covers thermos shock, vibration, salt & fog, corrosion, ingressive of dust, etc.

Located northeast of Toronto in Stouffville ON, EMTS Labs has developed in-house software to accommodate testing programs, while meeting IEC, NEMA, ASTM and MIL standards.

"We are committed from start-up execution to finalizing a quality control program, governance procedures and related infrastructure," Lee says. "Our services include review of qualification plan, testing procedures and execution of testing per standards. We provide turnkey solutions for all approvals, which mean that we often work with the certification bodies in this industry.".

25

product suppliers are included in the Electro Sonic panel builders line card.



DISTRIBUTION

ELECTRO SONIC DEBUTS LINE CARD FOR PANEL BUILDERS

Responding to rising customer demand, Electro Sonic, a Markham ON-based component distributor, recently introduced a product line card specifically tailored for panel builders.

Targeting firms that design and manufacture automation and control systems, Electro Sonic has put specific focus on serving those in the panel builder arena, according to national sales manager, Niall Flanagan.

"When we took a close look at panel builders, we noted they integrate off-the-shelf modular product solutions to the maximum extent possible," Flanagan says. "Most often, they use products which mount to industry standard DIN rails, directly to cabinet walls, or to sub-panels within cabinets."

ENTERPRISE OF THINGS

BLACKBERRY UNVEILS EOT PLATFORM

BlackBerry Ltd. has unveiled BlackBerry Spark, a complete Enterprise of Things (EoT) platform designed and built for ultra-secure hyperconnectivity from the kernel to the edge.

Defined as the interconnectedness of people, organizations and machines, hyperconnectivity, industry pundits anticipate it to revolutionize the way people work and live.

BlackBerry's platform enables:

- OEMs to make complex 'things', like autonomous vehicles and industrial equipment which must have the highest levels of security and safety-certification, as well as consumer-friendly interfaces to complex processes and artificial intelligence (AI), such as voice-activated speakers with privacy protection designed in at the start.
- Enterprises to leverage AI and manage smart 'things' regardless of operating system (i.e., Android, iOS, Linux, QNX and Windows) via a single pane of glass, as well as snap-in existing platform services such as Android Things, AWS, Azure, and Watson.
- People to use and trust any hyperconnected 'thing' and the new experiences they enable by making military-grade security easy and intuitive to use. As the workforce continues to evolve, BlackBerry Spark will provide end-users with the flexibility to move seamlessly and securely between their personal and work profiles.

BlackBerry Spark platform is designed and built for ultra-security and industry-specific safety-certifications, such as ISO 26262 in automobiles. As an open and extensible platform, BlackBerry Spark ships ready to 'snap-in' IoT and other solutions from partners that include AWS, Baidu, Google, Microsoft, NVIDIA, Qualcomm, and Samsung.

Photos: Queen's University, Electro Sonic

CVAN bridges gaps for entrepreneurs

BY SOHAIL KAMAL

Late last year, UBC entered into a memorandum of understanding (MOU) calling for increased collaboration to support a regional innovation zone known as the Cascadia Innovation Corridor. The Cascadia Venture Acceleration Network (CVAN) was launched to nurture entrepreneurship between private, non-profit and research teams within British Columbia, Washington, and Oregon.

"I think a big part of it for entrepreneurship@UBC was a desire to build relationships and capitalize on the experience and resources of the other members," says Sean Lumb, director, New Ventures.

With an early focus on Life Sciences, the goal of CVAN is to facilitate a free flow of information and foster collaborative efforts in information technology, life sciences, and clean-tech sectors. Lumb explains that CVAN aims to open up opportunities for cross-border capital and other resources to support new ventures: "We're all trying to do the same thing: Build innovative and lasting ventures, and there is strength in numbers and the collective experience."

With teams working across borders towards shared goals, CVAN unites the region's talents. Lumb went on to detail how e@UBC fits into this MOU.

"UBC is one of the founding members and through e@UBC, UBC will share best practices, venture, and investor networking opportunities, provide space, meeting rooms, and will host other members as they visit and interact in Vancouver," he says.

Business does not like to recognize boundaries or borders, and by sharing knowledge and resources, everyone in the Cascadia region can benefit. CVAN also aims to build on the existing momentum through a future website and regular member meetings. Members can network, establish lines of communication and build relationships to leverage resources and new venture opportunities.

Key goals for CVAN include:

- Target innovations ready for commercialization.
- Expose cross-border funding, support and trade opportunities.
- Redirecting non-commercial-ready innovations to research organizations.
- Sharing workshops, seminars, educational networking events.

"CVAN works to make the world a smaller place," Lumb says. "The early stages can be tough. Making the world smaller for that critical, high-risk stage, where fundraising can be a serious challenge, can be priceless for a tech entrepreneur." EP&T

***Sohail Kamal** is EP&T's West Coast correspondent.*
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Myant Technologies weaves its way into wearable tech

Toronto-based textile computing firm emerges as a global leader in the creation of fabrics containing electronic IoT sensors, acutators BY STEPHEN LAW, EDITOR

Toronto-based textile computing company Myant Inc. is an emerging global leader in the integration of technology, namely biosensors and actuators, into the yarns and fibers that comprise a textile product. From clothing to car seats, bedding, flooring and more, Myant's technology creates the intelligent interface between individuals and the world around them.

Believed to be the world's only true end-to-end company developing and producing textile computing products, Myant employs a diverse team of 65 engineers, scientists, technicians and designers. Myant collaborates closely with local post-secondary institutions and research organizations to create and discover incredible innovations, from fibre level development to examining physiological influencers on the end product.

EP&T takes this opportunity to pose some questions to Myant chief executive officer Tony Chahine.

Textile isn't usually thought of as the most 'innovative' technology – tell us why you chose to focus on it?
Great question, and you're right. Textile hasn't traditionally been viewed as a place for innovation. Yet, textile is the most natural medium for technology given it's around us 24/7. You sleep on textile, you wear textile, you sit on textile, you walk on textile, etc. It's the perfect interface in a world of connected devices and connected technologies to link the human body – to the IoT.

Q Using textile as the form factor that connects humans to the Internet of Things, describe the inner workings of Myant's Textile Computing platform.
Textile computing refers to the integration of biometric sensors and actuators (heat, cooling & electric stimulus) into the very yarns or fibers of a textile product. Alongside those sensors and actuators is hardware with built-in software that transmits the data from your body via Bluetooth to your phone or other device. The result is a continuous and bi-directional digital connection to the human body through textile.

With more than 80,000 sq. ft. of advanced manufacturing capacity, describe how Myant's facility provides an end-to-end textile computing supply chain.
Myant is comprised of nearly 80 team members both here in Etobicoke, and in Ottawa at our satellite office. This team provides the full staff for textile computing – from research and development on yarns and fibers; through biomechanical, chemical, and electrical engineering expertise; data science capabilities; right through to prototyping facilities and nearly 100 of the most advanced robotic knitting machines in the world. In addition, we have partnerships with Stoll A.G. for exclusive access to the world's best robotic knitting machines, and with Carlisle Interconnect Technologies for access to the most conductive, washable and strongest yarns. All of this combines to make us the go-to provider of textile computing expertise.

As a leader in this emerging industry sector, detail some of the 'life-changing' products Myant has created since its inception in 2010.
Textile computing represents a new way to change the modality people use to interact with technology with the potential to have revolutionary impacts on human life. In the immediate future we think that textile computing is going to fundamentally transform healthcare by allowing for remote monitoring and remote diagnostics regardless of geography, and we'll be launching our SKIIN brand of products later this year, with a focus on heart health and wellness. Our SKIIN product line will engage people in their own health by making it easier for individuals to understand what's going on in their bodies in real time and, by sharing that information with their medical team, proactively address any issues. Our work on electromuscle stimulation, or neuro-orthosis, is potentially even more transformative as we are bringing back mobility and confidence to individuals who have lost the ability to move.

Outline Myant's use of electronics, and some of the challenges this poses.

PE Myant's 80,000 square foot facility in Etobicoke (Toronto) houses the world's most advanced robotic knitting machines, enabling the world's only end-to-end textile computing capacity, from research and development through end production.

Photo: Myant Technologies

Since this is a brand new technology, our team of experts and engineers have to invent new ways to connect traditional textiles to electronics.Creating the power, networking and computing capacity on a miniature device already isn't an easy task, let alone building the connections between this hardware and the sensors that are embedded in the conductive yarns and fibers we develop and use. That's why we have a multidisciplinary team in house who builds our technologies as well as work in partnership with great companies like Celestica to overcome some of the challenges we face.

Detail Myant's processes of product creation, as it relates to research, design & engineering, as well as product testing.

A Myant has two channels in its business model – we have a direct to consumer SKIIN brand that we are launching shortly, along with a B2B model where we 'power' other brands and form factors with our Textile Computing technology and intellectual property. We work closely with our partners to understand the needs of their customers and the user experience that is required. From there we create multi-disciplinary teams of designers, engineers and scientists to create the form factors and the hardware and software that will deliver both the sensing capacity and the user experience that will deliver real value-ad for our partners and their customers. And, behind all of this is our research and development team that is continuously focused on finding and developing next generation yarns and fibers, as well as new sensing and actuation processes.

Describe the importance partnerships play in Myant's success?
We are very fortunate to be located within a few kilometres of great post-secondary institutions and research organizations. Our relationships with Toronto Rehabilitation Institute, Ryerson University, George Brown College, Sheridan College, McMaster and others help to ensure that we are building a deep ecosystem of talent, ideas and expertise related to the many disciplines that come together to form textile computing. As we grow, we will lean on that network for next generation ideas, IP and talent to become part of our workforce. Our partnerships with leading companies like Carlisle Interconnect Technologies and Stoll AG also guarantees us access to the highest quality conductive yarns on the market and robotic knitting technology that make us the world's go-to provider of textile computing expertise and manufacturing capacity.

How will the Digital Textile Factory benefit entrepreneurs and innovators seeking support in the creation of their own designs?
The Digital Textile Factory is a great example of our partnership with Stoll A.G., the world's leading manufacturer of robotic knitting machines. Together we provide both the machine capability and the know-how, from research and development related to engineering and material science all the way to scalable manufacturing and shipping, to help entrepreneurs and other industry players adopt and experiment on the connection of textiles to the world of IoT. The Digital Textile Factory is about democratizing access to this new category of technology and the necessary know-how to engage successfully with it.

Outline Myant's role as a key partner in the advanced manufacturing supercluster in the Toronto-Waterloo Innovation Corridor (TWIC).
We are very excited by this initiative. As a result of the work of NGM Canada we have already made connections with new partners, both supply chain and potential customers. We hope to move forward later this year with a Centre of Excellence for Textile Computing that will help stamp the GTA as the world's leading location for both research and commercialization related to textile computing and its application in industries like aerospace, automotive and healthcare.

Can you describe or detail the types of products Myant is working on for future release.
Myant will launch the first generation of the SKIIN Smart Underwear later this year. This product includes the following sensing technologies: ECG (Heart rate, HRV), breathing rate, atrial fibrillation, activity (steps, calories, activity recognition – walking, running, sitting/standing), sleep quality, stress level and temperature. Also in 2019 we'll roll out more features including slip and fall detection, fatigue detection, ovulation sensing, blood pressure and much more. We'll also be launching a heated base layer that auto-adjusts to deliver heat when and where you need it, regardless of your lifestyle. Whether at the bus stop or on the slopes, SKIIN Heat will deliver wire-free, automated temperature control. EP&T

Myant's patented processes see biometric sensors and actuators embedded into fibers and yarns at the nano-scale. The result is a washable, comfortable interface for bidirectional (two-way), human-computer interaction

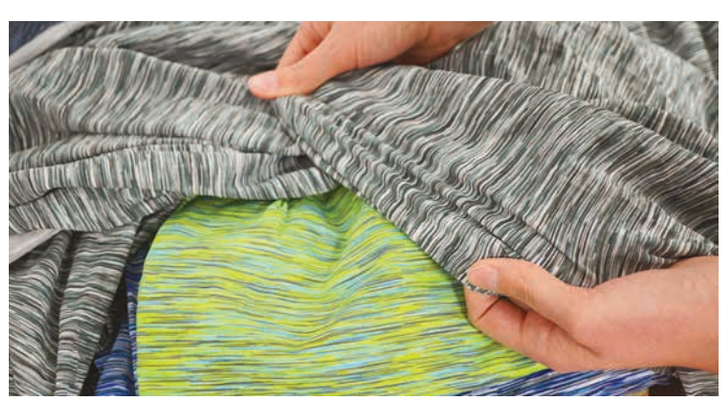

Photo: Myant Technologies

How to add RF and lower compliance costs

It's almost oxymoronic, but it's possible to add RF capability and lower compliance costs by following some basic steps. **BY RICH MARKLEY**

With more devices requiring radios, EMI and EMC increase in importance, particularly as designs move to faster clock speeds, smaller form factors, lower power rails and more data lines. However, the combination of power supplies, sensitive electronic circuits and RF components increases the potential for costly compliance test failures, which are already at 90 percent for first-time tests.

To speed time to market and lower risk, designers need to do pre-compliance testing of their devices to increase the odds of passing the formal compliance test. This testing and associated debugging can be done using relatively low-cost spectrum analyzers and oscilloscopes.

This assumes a solid understanding of the equipment under test (EUT) and that some core best practices are followed.

The need for pre-compliance testing

Compliance testing to one or more specifications, as defined by the FCC, CISPR, CE or other bodies, is standard practice to ensure devices do not interfere with nearby equipment and that they are not susceptible to external interferers. However, the Internet of things (IoT) and subsequent technologies such as machine learning and artificial intelligence (AI) have resulted in the proliferation of RF technologies to gather data.

As many designers quickly find out, incorporating RF is not easy. Custom designs usually take longer than expected, and while RF modules are an easier route, they too come with added complexity of circuits that both cause and are susceptible to on-board and external EMI. This adds to the many other potential sources of EMI problems, such as power supply and LCD emissions, ground impedance, poor cable shielding, stray internal coupling paths, component parasitics and ESD in metallized enclosures.

All these factors contribute to increasing the odds of a device failing formal compliance testing, which adds time and cost (Figure 1). Studies put first-time failure rates at 90 percent. This failure comes at high cost, as over-the-air and conductive testing with a third-party test house can cost $10,000, or more, and takes place over a number of days.

The goal from the designer's point of view is to decrease the odds of compliance test failure to the point of only needing to do this test once. This is where pre-compliance testing comes in.

Pre compliance testing using standard equipment

There are two main reasons that designers don't do pre-compliance testing. The first is that they don't think it's worth it, given the time-to-market windows and delivery schedules. The second is that they think it requires expensive EMI receivers. Both can be addressed using a standard, low-cost spectrum analyzer, an ably-equipped oscilloscope, and some EMI test and debug best practices. While the EMI receivers cannot be completely replaced by a lower cost spectrum analyzer, the lower cost approach can do the work of some of the EMI compliance functions and help to identify potential problem areas before discovering these later in the EMI compliance lab.

To perform pre-compliance testing, the first challenge is to isolate the device under test from ambient RF interferers, including FM radio broadcasts, TV broadcasts, cellular signals, Wi-Fi and Bluetooth. The quieter the environment, the better, whether it's out in a field or in the basement.

It's hard to isolate the EUT completely, so the key is to get a baseline measurement against the limit line set up on the spectrum analyzer, accounting for signals that are present. When setting compliance limits for the spectrum analyzer, this can be done manually or using Elektra PC EMI test software on the FPC1000 analyzer. This will help identify problem areas to be investigated further. A respectable spectrum analyzer is likely the closest to a full-compliance EMI receiver a designer will get at low cost (Figure 2). A full EMI receiver is top-tier equipment with lots of expensive filters to

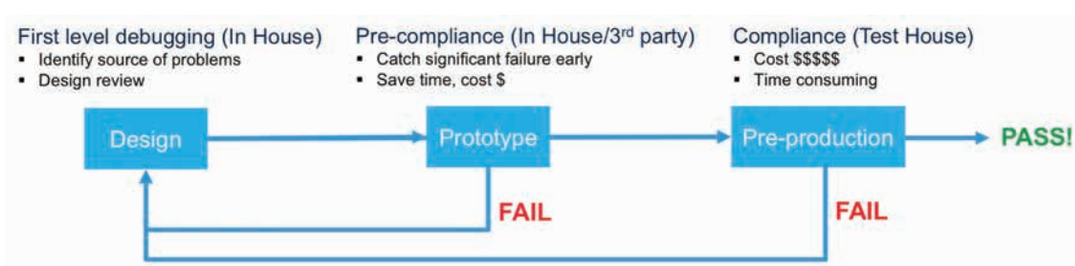

Figure 1: Catching EMC issues early in the design cycle can decrease the cost of compliance testing.

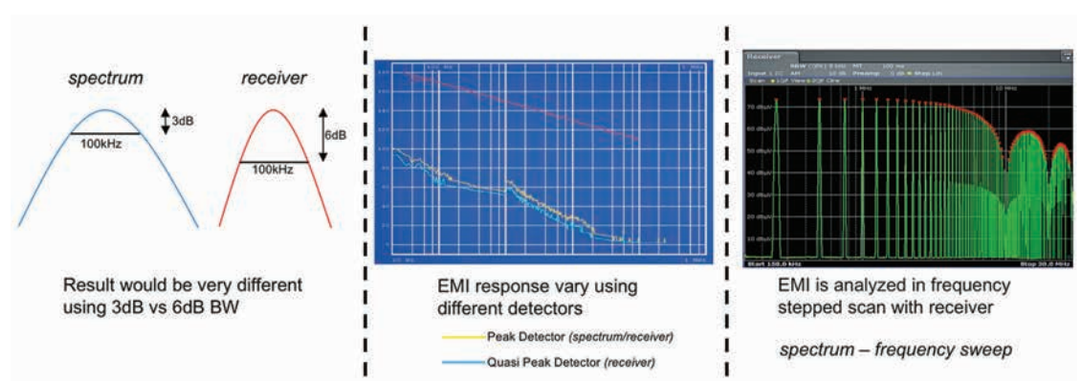

Figure 2: In receive mode, spectrum analyzers imitate higher cost EMI receivers and can be used for pre-compliance testing.

Photo: Rohde & Schwarz

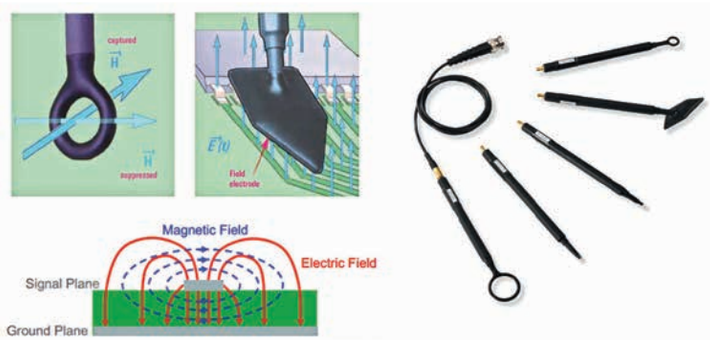

Figure 3: The larger the size of the E-field and H-field probes, the greater their sensitivity, at the cost of precision. It helps to zero in on the EMI source by reducing the size of the probe.

help with dynamic range.

The spectrum analyzer itself will need at least a quasi-peak (QP) detector with a directional antenna as part of the minimum viable feature sets to approximate a full EMI-compliant receiver. The goal is to not over-design the device. Without enough accuracy in the power measurement with the QP, designers run the risk of adding additional shielding or over-designing the device, which adds weight, time, power consumption and direct costs. The trick is be just good enough to pass the test for full compliance, without going overboard.

The analyzer should have a frequency range from 5 kHz to 1 GHz (upgradable to 3 GHz if need be), and a built-in vector network analyzer (VNA). The VNA is a useful feature as this can be used to match the antenna impedance to the RF module if there isn't an RF antenna built in.

To perform pre-compliance testing, the first challenge is to isolate the device under test from ambient RF interferers

Some spectrum analyzers go further and actually integrate a signal generator to form a 'three-in-one' instrument. The signal generator can be used to generate an additional signal in the presence of the intended transmitter signal. This 'interferer' tests to make sure there is sufficient blocking at the receiver to allow the intended signal to get through.

To start pre-compliance testing, do a limit-line test, or max hold sweep, with a max hold detector, as that's a fast and easy test. Then, use the QP detector to do spot checks on any potential problem areas. Use electric field (E-field) and magnetic field (H-field) near-field probes (Figure 3). The magnetic field probe has a loop through, which the magnetic field passes perpendicularly, inducing a detectable voltage.

When using the probes, it's important to keep in mind that the output of the probe very much depends upon the orientation of the probe relative to the emitters. Also, there is a trade-off to be made: the larger the probe, the greater the sensitivity, but the precision decreases. So, as the source of EMI gets more clearly defined, reduce the size of the probe in order to zero in on the source and verify that the readings are below the maximum allowable power levels.

This requires having a solid knowledge of the design to know where these might be. Many EMIs can be anticipated by factoring in the clock frequencies, the power supply's switching frequency, and the expected harmonics.

Figure 4: RTO2000 oscilloscopes used for EMI Debug.

Knowing the layout is critical as it helps to know when a clock line might be too close to an RF module. This becomes something to watch for as it might be what's coupling in and causing another spur that's in a different part of the spectrum.

However, no matter how good a designer's knowledge of the physical layout and the circuit's design parameters, nothing beats running the system software and time-correlating the EMI to the running code.

Time-correlated EMI testing and debug with an oscilloscope

While a spectrum analyzer is an affordable option to a full EMI compliance receiver, the venerable oscilloscope has a critical role to play here, especially during debug. Look for an oscilloscope with these key characteristics: 50Ω coupling impedance to ensure sufficient bandwidth; a sample rate >2x the maximum frequency (i.e., start with 2.5 Gsamples/s for 0 to 1 GHz); low noise; good vertical sensitivity capable of being set to 1 to 5 mV per division while maintaining full bandwidth.

As the probe will be moving around the board or system, it's important that the scope's response time be fast so there's no delay when trying to correlate EMI back to the time domain. Some scope's hardware accelerate the FFT to ensure the time and frequency domain are seen in real time. As the source of the EMI becomes clearer, the time-domain view should allow the EMI source to be correlated to changes such as bus level switching.

Other features to look for on a scope include a color table and screen persistence to easily detect and distinguish continuous wave signals and burst signals; signal zoom and fast Fourier transform (FFT) gating to easily isolate spurious spectral components in the time domain. These are features typical of the RTE1000 or RTO2000 oscilloscopes (Figure 4).

It's possible to use lower cost scopes, but that sacrifices some frequency-domain capability which is important during EMI debug.

Conclusion

Adding RF to an IoT device is tricky, even if RF modules are used. The module may be EMI compliant by itself, but, when added to a real-world system, with power supplies, clocks and parasitics, all in smaller form factors at lower power rails, the whole system needs to be checked. While compliance testing is expensive, it can be limited to one formal test by performing pre-compliance testing using basic equipment and some classic best practices. **EP&T**

Rich Markley *is product manager for Rohde & Schwarz's Value Instruments.*

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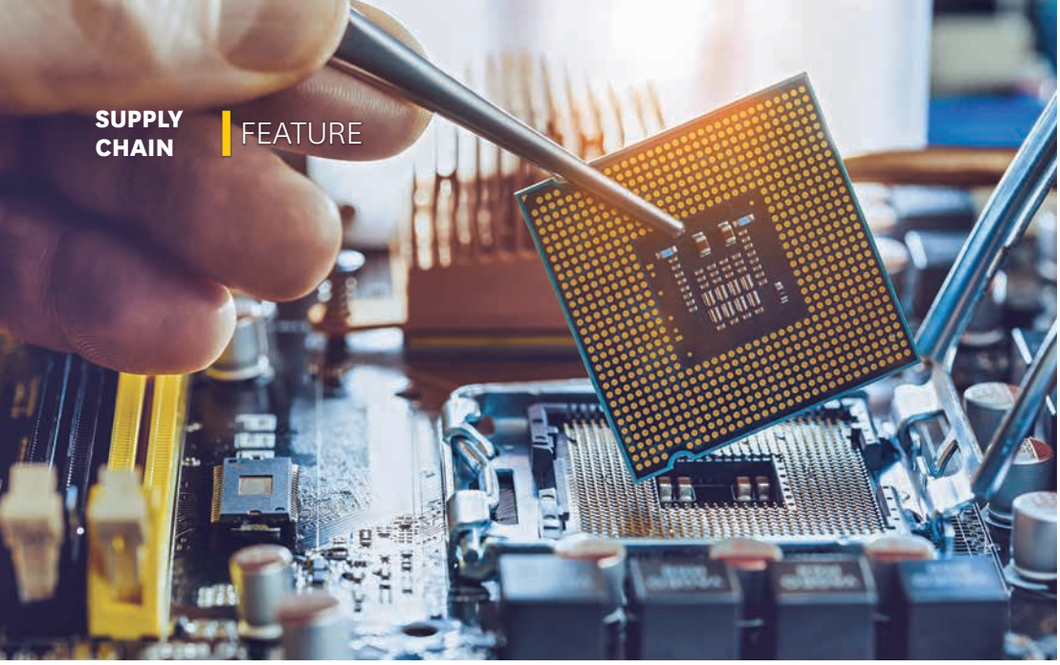


How to insulate your products against the electronics shortage

BY GRAHAM SCOTT

While recent headlines crow about the steady approach of autonomous and electric vehicles, the Internet of Things (IoT) and the latest smart phone, a different, markedly darker story has been unfolding at the other end of the supply chain for over a year. Companies that manage the electronic components have confronted successive waves of supply shortages, price hikes and lengthening lead times. Worse, it is difficult to predict when this will change.

Technology headlines aside, electronics companies and integrators are navigating a market caught in a perfect storm between supply and demand. On the demand side, there is a shortage of materials and parts – especially for legacy components within commodities such as multilayer ceramic capacitors (MLCC), resistors, transistors, diodes, and even memory. Suppliers are shifting capacity away from these legacy components to pursue the opportunities afforded by more profitable, headline technologies.

In short, capacity is constrained and demand for standard electronic components continues to grow as more evolved products are needed to make once conventional products smart, and smart products even more functional. Many suppliers continue to quote lead times between six to 12 months at best.

You should continually evolve your product designs to keep pace with suppliers' technology roadmap

Market by Market

Compared to the automotive and smart phone market, the IoT represents a comparatively small ripple in demand for electronic components today. But, the tide is rapidly rising according to research group Gartner Inc., which predicts this market will grow by more than 100% to encompass over 20 billion IoT devices within just two years as sensors and connectivity are added to household appliances, packaging, medical devices, industrial equipment and pretty much any other analog product.

This trend overlaps somewhat with the automotive industry, as vehicles become more autonomous and connected. Though even without the confluence of the IoT and transportation, other automotive trends would still be fueling higher demand for electronic components. Cars driven by conventional combustion engines today integrate somewhere between 2,000 to 3,000 capacitors. However, these cars are increasingly sharing the road with electric vehicles that may have up to 22,000 MLCCs onboard. This number will continue to grow, as more cars and automotive functions become electrified.

This increases demand for all electronics. But, the higher price-points for advanced automotive components and the relative stability of that market makes it an attractive target for passive suppliers to focus their capacity there.

While the IoT and automotive markets both dangle tremendous new opportunities for suppliers, smart phone manufacturers remain the most significant source of demand for passive components and memory products. The math is simple: Approximately 1.5 billion smart phones are manufactured per year, with flagship models containing roughly 1,000 capacitors each. Multiply those two figures together and you will approximate half the total global output for MLCCs, which is estimated to be roughly three trillion pieces per year. Nor will demand from smart phone makers fade any time soon. Each new model integrates more components to keep up with consumer demands for functionality and speed.

While all of these trends spell exciting new products for consumers, they signal higher risk for suppliers that continue to produce mature, less-profitable passive components. That risk extends to OEMs down the supply chain who are slow to transition to updated components.

Why? Because any recovery in supply over the next five years will likely take root first with electronics products that represent the most attractive investments to suppliers – namely, those supporting the latest and greatest technologies. Relief may come as soon as late 2019 for these technologies.

Surviving a Component Supply Shortage as an OEM

It is not enough, however, to simply seek shelter and wait for the storm to pass. OEMs who take early action will likely see the earliest signs of recovery. Those who wait may not recover even after supply has fully restored.

There are several actions companies should consider to prepare the way for success:

- Continually evolve their product design to keep pace with suppliers' technology and production roadmaps
- Continue to grow new alternative suppliers
- Minimize reliance on single-sourced parts

Increase collaboration and visibility between product design, procurement and supply chain organization.

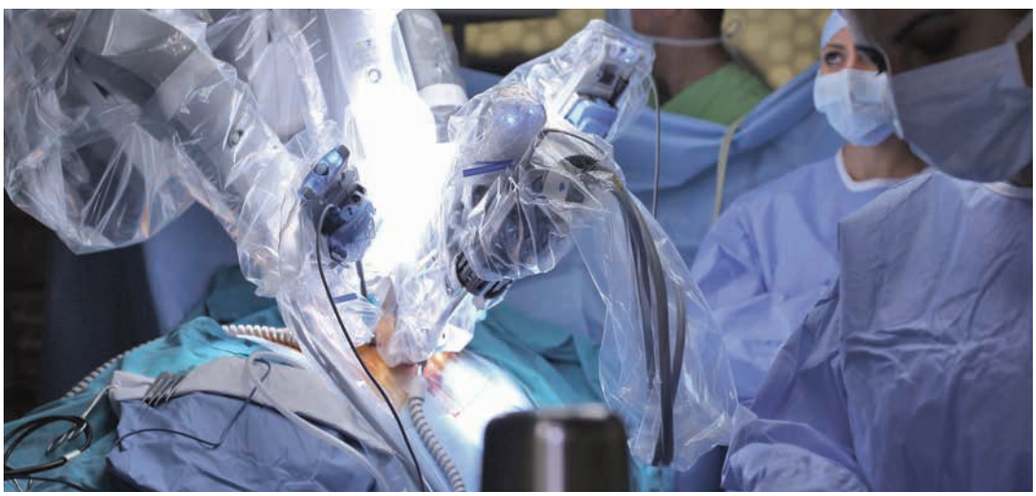
This last point cannot be understated. Maintaining strong supplier relationships is key, as suppliers impose allocation measures. Constant contact with suppliers is critical in such circumstances to ensure you receive components for the product you need versus the product the supplier wants to support. Further, the vital importance of these relationships only increases as stability returns to the supply side, as the most effective time to build them is during a buyer's market. EP&T

Graham Scott *is senior director of global commodity management, Jabil Inc., an EMS provider in St. Petersburg FL.*

Photo: Getty Images

Preparing for the surgical robot boom

Growth of the robotics market will improve the precision and effectiveness of complex, minimally-invasive surgeries



The da Vinci robotic surgical system.

With greater investment from healthcare organizations and surgical robot technology about to become generic, the conditions are perfect for a boom in the surgical robotics market. But, how can design engineers and technical medical staff ensure these new systems operate reliably and safely? Michele Windsor, global marketing manager at surgical robot battery manufacturer Accutronics, has a solution.

While they may sometimes feel like a new medical technology, surgical robots have actually been around for several decades. The first robot system successfully conducted a neurosurgical biopsy in 1985, while the US Food and Drug Administration (FDA) approved its first surgical robot — the da Vinci surgical system — in 2000.

However, it's only in the past few years that we've seen this technology really take off. In the UK, the number of surgical robots used in prostate cancer centres at National Health Services (NHS) hospitals tripled between 2010 and 2017. The NHS subsequently invited companies to tender for over CND$513M surgical robot contract in January 2018, showing that the number of robot surgeons in the UK will continue to grow in the coming years.

This same growth is happening across the world, and the popularity of the da Vinci system is an effective barometer of the growing popularity. According to Intuitive Surgical, the company behind the system, the da Vinci robot had sold 4,271 units globally as of September 30, 2017. More than 50 per cent of these were installed in the US alone.

As The Economist reported in 2017, many of Intuitive Surgical's patents are due to expire soon, which will bring with it greater competition from start-ups and established companies. This is ideal for the prosperity of the robot market and will improve the precision and effectiveness of complex, minimally-invasive surgeries. However, it does bring challenges with it.

If new companies enter the surgical robot market, it is critical that those systems are designed to the same quality and safety standards as those produced by companies with more experience. This means that design engineers working on the project must understand the importance of each component in the system, especially critical back-up power components such as batteries.

Traditionally, robot systems have used sealed lead acid (SLA) batteries as a back-up power source. This is because, in hospital environments with increasingly complex electrical requirements, ac power alone is not always reliable. The critical nature of the application means that even a momentary loss of power can have disastrous, even fatal, consequences.

Healthcare organizations continue to make greater investments into surgical robot technology.

However, the traditional SLA batteries used in robotic systems have their drawbacks. The batteries are bulky and unwieldy, offer relatively low energy density and require frequent maintenance and servicing every two years. When you consider the associated costs of this, it makes for a relatively high total cost of ownership — which is understandably undesirable for healthcare environments where a strong return on investment is important.

Fortunately, new movers into the surgical robots market have an opportunity to bypass these traditional problems by designing smart SLA replacement batteries into the system.

The role of design engineers in ensuring the safety of the next generation of surgical robots is to consider the proper critical backup power-supply early in the design process. By considering alternatives to traditional SLAs, design engineers can help their projects outperform traditional systems, for longer, while maximizing patient safety.

The surge in the number of medical technology manufacturers active in the surgical robot market in the coming years is sure to drive innovation in this space. **EP&T**

*This article is supplied by **Accutronics Ltd.**, a UK supplier, designer and manufacturer of batteries & chargers for portable and handheld electronic devices.*

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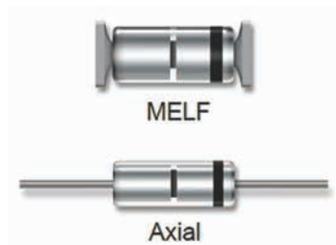

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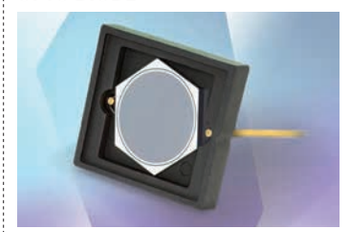

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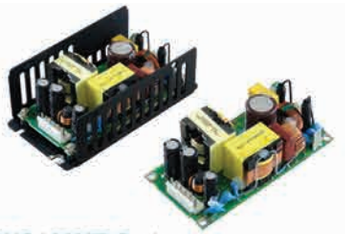

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Oppo Find X on the rise

BY JIM MIELKE, VP TEARDOWNS, ABI RESEARCH

ABI Research has been tearing down devices since 2011 and for the most part, we find that smartphones are all beginning to resemble each other. While it is getting difficult to differentiate product features, there are still a few unique features that most manufacturers are striving for. Edge-to-Edge display is one of them. However, there are several factors complicating the production of a true edge-to-edge display product such as the front camera, home button, fingerprint ID, and earpiece. Oppo has found a way around each of these obstacles in the Find X. The Find X takes the easy way out for the home button and fingerprint sensor simply by eliminating them. The home button is not a big deal since a virtual one can be created on the display, but the fingerprint sensor elimination can be frustrating since some apps now allow the user to access accounts by simply using the fingerprint sensor instead of entering passwords (Apple eliminated the fingerprint sensor in its latest version, too). The earpiece is still on the top front of the Find X, but it is just a small sliver of a hole at the top of the device (hardly noticeable as it blends in well with the very slim bezel). It's obvious that the front camera was where Oppo spent its real engineering time on the Find X. The front camera, rear camera and front facial recognition are all within a camera module, which is the full width of the phone, and rises out of the phone about 1cm when needed (unlocking the phone with facial recognition or the use of the front or rear cameras). The module retracts when not in use. Here is a look at the major electrical components that make up the Oppo Find X.

RF

The RF front end of the Oppo Find X is comprised of all the major RF players: Qorvo handling most of the RF switching (including Antenna tuning), Skyworks with 2G and multi-mode power amplifiers (PAs), Avago with one PA, and Qualcomm with LNA banks and an envelope tracking power supply. Qualcomm also provides the core chipset which includes the SDR845 transceiver.

Modem/ Application processor

As mentioned above, the core chipset is from Qualcomm. The main component of the chipset is the 10nm SDM845 modem/application processor The SDM845 chip includes an X20 LTE modem (1.2Gbps downlink/150Mbps uplink), an octa-core CPU from Qualcomm (Kryo 385 cores), Spectra 280 ISP, Adreno 630 visual processor, Aqstic audio, WiFi baseband, and a secure processing unit. Samsung provides both the 8GB DRAM and the 128GB Flash memory.

Connectivity

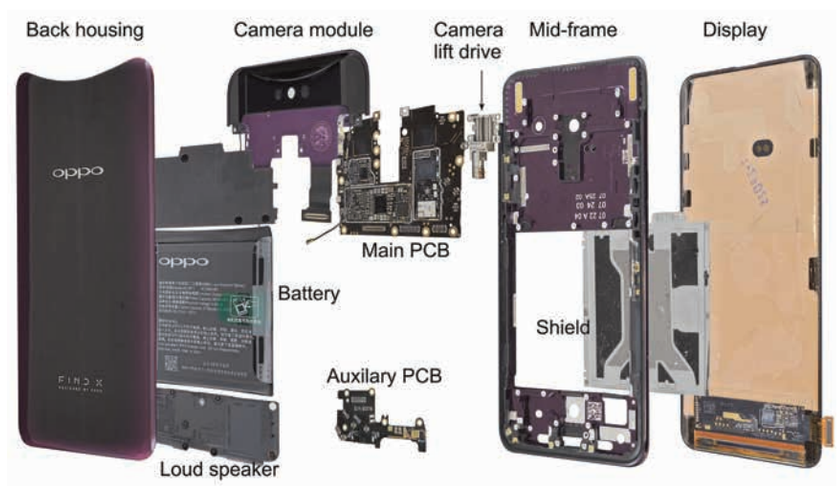
The connectivity portion of the Oppo Find X utilizes the Qualcomm WCN3990 combination connectivity chip that includes WiFi/ BT and FM. Other supporting ICs are two of Qorvo's dual band front ends (QM48859), NXP GPS LNA, and two GPS filters (Murata and Wisol).

Sensors

The Oppo Find X is loaded with camera pixels. There are two rear cameras: 16Mp and 20Mp with Optical image stabilization (OIS) and a 25Mp front camera. There is also an IR camera in the front that works with the dot projector for facial recognition. Other sensors include two Knowles mems microphones, AKM compass, Bosch accelerometer/ gyro, and two MagnaChip hall sensors for detecting the camera module movement.

Audio & Power management

The power management within the Oppo Find X is made up of 4 chips that are part of Qualcomm's platform (PM845 PMU, WCD9341 audio codec, PMI8998 interface, and PM8005 transceiver power management). The platform chips are further supported by miscellaneous regulators, amplifiers, and drivers from TI, Richtek, Fairchild, ON Semi, and Maxim.



*These findings are from **ABI Research's Teardowns** (https://teardowniq.com/), which include high-resolution photos and x-rays, pinpoint power measurements, detailed parts lists, and block diagrams.*

Photo: ABI Research