FOCUS MAGAZINE

ISSUE 40

AVNET® ABACUS 50 YEARS

/ EV CHARGING

The Challenge and Opportunity

ACCELERATING TIME TO MARKET IN THE EV CHARGING RACE

THE ROLE OF CONNECTIVITY IN EV CHARGING

KEEPING eMOBILITY MOVING

FOCUS MAGAZINE

Focus is the quarterly magazine from Avnet Abacus, featuring in-depth trend and technology reviews, new product spotlights, Avnet community news and interviews with market leaders.

ISSUE 40

Avnet Abacus is a pan-European distributor committed to supporting customers from design to fulfilment. Our exceptional linecard features globally recognised manufacturers and an extensive product range that includes interconnect, passive, electromechanical, power supply, energy storage, wireless, and sensor products and solutions.

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If you have any comments or questions on the technologies featured in this edition, or wish to speak to one of our technical specialists, you can get in touch at **avnet-abacus.eu/ask-an-expert**

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AVNET ABACUS 50 YEARS

FOCUS MAGAZINE

Rudy Van Parijs
President, Avnet Abacus

This new edition of our Focus magazine looks at the numerous different technical and logistical implications of the widespread adoption of electric vehicles (EVs)

EV uptake has ramped up significantly over the last two years, with figures published by EV Volumes now putting unit shipments easily above 500,000/month throughout the whole of 2022. Auto Trader expects EVs to overtake ICE (internal combustion engine) vehicles in terms of new sales by 2025 – that date being brought dramatically forward from previous analyst projections, which had not thought this would occur until the end of the decade.

The articles featured in this edition cover a broad array of dynamics that are all having an influence on EV charging strategy. They set out exactly what still needs to be done to make transport electrification ubiquitous.

Keeping up with rapidly rising demand is the subject chosen for our first article, **Accelerating Time to Market in the EV Charging Race.** Here Hagen Goetze, Senior Director Marketing Avnet Abacus, discusses the opportunities for new entrants to get involved in the EV charging market, and the additional engineering support plus advice/guidance that will be called for if they are to make a real impact within a short time frame.

For our second article, **The Role of Connectivity in EV Charging,** Sara Ghaemi, Director Technical Development Avnet Abacus, explains the value that secure, constantly updated data will have to charging infrastructure. Not only will this enable the charging parameters of individual EVs to be defined, so they are charged at an optimal rate, it will also provide communication between the grid and charging stations – enabling capacity fluctuations to be addressed, the assigning of correct tariffs and locations to be identified where more investment in infrastructure will be necessary.

In our last article, **Keeping eMobility Moving,** Marc Eichhorn – Product Manager Batteries, Avnet Abacus underlines the need for a greater density of EV charging stations, so as to address people's concerns about range anxiety. This article also makes clear the importance of faster charging times and increased charging-point availability at stations to ensure maximum user convenience.

Through this edition of Focus, readers will gain further insight into all the aspects affecting the design and roll-out of charging infrastructure – with the respective standpoints of vehicle owners, charging-point operators and grid operators all being taken into consideration.

AVNET ABACUS

Across Europe, up to 14,000 public charging points for electric cars need to be installed per week between now and 2030, compared to just 2,000 per week currently, according to the European Automobile Manufacturers' Association. Meanwhile up to 6.8 million public charging points are required by 2030 to meet the EU's CO2 reduction targets.

This need presents a huge gap and an opportunity many businesses are keen to fill. There are some significant players in the EV charging market, from fossil fuel giants to rapidly growing tech companies, and numerous start-ups are entering the race and making significant strides.

There are many proposals of different concepts and technologies to fill the gap. Chargers need to be produced in greater numbers, improving time to market will help establish a foothold, and all the organisations entering the race, regardless of background and stage of development, need to focus on their business models and how they're going to deliver value.

ARE CONTENDERS READY?

Many customers are looking to enter the EV charging race, each with a different skill set and expertise. While some customers are bringing hardware to the game, others are bringing software and integration. There are even some that don't have either.

Banks, supermarkets, and other owners of parking spaces are also getting involved. They know it's the future and want to be involved, but they don't know where to start.

Buying a whole off-the-shelf solution requires advanced technical knowledge in many diverse areas, so they need experts to consult from every angle.

Just a limited number of the players in the market have expertise in every area required to provide an effective EV charging solution. They all need a partner, or team of partners, to help bring their product to market.

ACCELERATING TIME TO MARKET IN THE EV CHARGING RACE

The EV charging challenge and opportunity

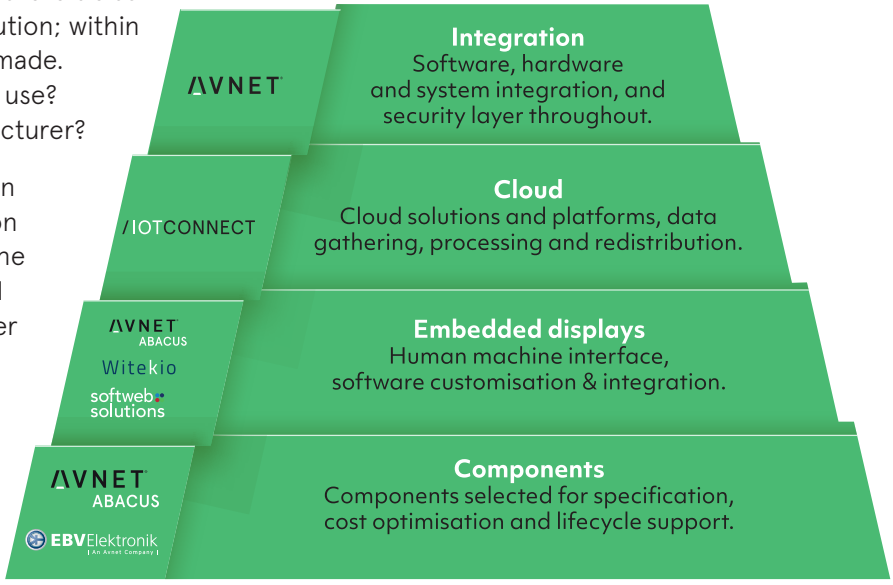
Hagen Götze, Senior Director Marketing, Avnet Abacus

THE FOUR LAYERS OF AN EV CHARGING SOLUTION

There are four layers involved in producing a complete EV charging solution »

Additionally to these four layers, there's also design, manufacture and distribution; within each, many decisions are to be made. Which technology and design to use? Which design house and manufacturer?

There's so much to think about in producing an EV charging solution that it would be ineffective for the market entrants to try to do it all themselves. It would be far better for each to concentrate on their core concept and area of expertise and find partners with the right fit to provide the rest.



ACCELERATING TIME TO MARKET IN THE EV CHARGING RACE

CORE COMPONENTS: A CRITICAL CHOICE

As always, the choice of components is paramount and more complex than it might initially appear. Companies want to balance the right level of performance without over-engineering their product, all while keeping an eye on cost.

They'll also want to ensure they choose the right components for the proper use case and the operating environment. And they'll need additional insight into the product life cycle: which components are coming onto the market, which will continue to be available for a long time, and which will soon become obsolete?

All these decisions will affect the product design, and the choices made at this stage will affect everything down the line.

When it comes to sourcing the right components, there are apparent supply chain challenges to contend with at the moment too. Together with markets and components knowledge, relationships and influence with each supplier are more critical than ever to ensure the continued supply for manufacturing any product.

With a project like EV charging, design engineers want to ensure their designs have longevity – that they'll be able to get the components for the next 15 to 20 years, and there will be extended lifecycle support for their software, hardware and manufacturing setup.

EMBEDDED DISPLAYS: A MORE AGILE APPROACH

Every solution will need an embedded display, a way for the customer to interact with the EV charger: a human-machine interface. These will need to be designed, manufactured and assembled.

They can be created from individual components, custom modules or off-the-shelf solutions, and there will be trade-offs to weigh up for each approach.

"To help speed up the design and manufacturing of the human-machine interface, we work with customers to quickly compile a proof-of-concept," explains Bevan Braude, Business Development Manager for Avnet Embedded."You can get a board designed, put together with a display and delivered to you in just a few weeks.

In 6 to 8 weeks, you could have a fully custom design, and another couple of months could see these units into manufacturing.

"Beyond the hardware design, there's much more to consider, including wireless certification, customisation, and the software interface. In the broadest sense, we help connect the different pieces for the businesses we work with."

ACCELERATING TIME TO MARKET IN THE EV CHARGING RACE

CONNECTING TO THE CLOUD: DELIVERING MORE VALUE

While the businesses entering the EV charging space might have a background in software or hardware, they often don't have much expertise in connecting to the cloud.

Or even if they do, their system may not be capable of supporting the solution as it scales to tens of thousands of devices and beyond.

"With Artificial Intelligence running across it all, you could determine what's wrong with the unit and translate the inputs into actionable outputs.

These actions can then be delivered into an enterprise resource planning system, which generates a report and a work item for a mechanic to go out and fix the relevant unit."

Tim Bassford, IoT Business Development Manager at Avnet Abacus explains how the platform Avnet's IoTConnect can be used to develop solutions and generate additional value: "IoTConnect can become the central hub where to pull data. You can visualise the data within the platform and generate insights. And via companies like Softweb or Witekio, both part of the Avnet group, you can get software designed to provide custom interfaces for your business users and the end customer. Once the data is pulled into a platform like IoTConnect, it's really a question of what you want to do with it."

Tim explains, "For example, if you want to set up predictive maintenance, you can do it easily. You could have the system running, collecting data anomalies from the charging stations, and deal with those anomalies on the cloud side."

INTEGRATION: PULLING IT ALL TOGETHER

None of the new entrants to the EV charging market will be experts in every layer required to provide a complete solution.

Each provider will be missing different pieces of the puzzle and must find various organisations complementing their core offering.

Finding these partner organisations, pulling them together and getting them working with each other is a serious undertaking in itself. Communication between all the layers becomes another critical factor in the project's success.

ACCELERATING TIME TO MARKET IN THE EV CHARGING RACE

"For years now, the distributor's role has evolved," Sara Ghaemi, Director of Technical Development at Avnet Abacus, explains. "Yes, there are still catalogue houses where you look up part numbers and compare costs, but that's a very different model for quite the diverse customer.

"For those looking for technical expertise and in-depth consultation on their project, the individual suppliers have fewer resources available to assist each of their customers. And even if you do have a way to open the door with a key supplier, are you really going to go to each in turn for every component you need?

"The distributor's role is not just to provide components, but to provide access - to the right combination of knowledge, insight, expertise and support throughout design, manufacture and beyond.

"In line with this evolution, the Avnet group has expanded to acquire a number of organisations that assist horizontally and vertically, including software support, hardware support, embedded support, supply chain, design, manufacturing, and more.

"This way, we can provide a flexible solution and the right parts of the puzzle for each different customer. When a company has an idea or a product we believe in, we invest our time and expertise in the project. Everybody wins by helping to get the product to market faster and make it a success.

"Distributors have been pulling together information, components and expertise for years. This is what we've always done. But the role and the scope have evolved, much like today's complex marketplaces and products. We continue to help guide engineers and businesses with an idea to turn it into a reality and get it out into the world."

GETTING YOUR IDEA TO MARKET FASTER

There is an extreme need for a variety of solutions to meet the demand for EV charging. This opportunity, the innovative technologies involved, and the different backgrounds of the entrants make it a very dynamic and exciting space.

With so much opportunity, there will be more than one winner. But providing a complete solution is a complex challenge, with many different parts that need to be connected, from the hardware and software to the wireless communication and connection to the grid.

Pulling all the various partners together to provide the whole package and get the end product out onto the forecourt adds unnecessary complexity to the process.

If you're working on an EV charging project and you'd like to discuss how we can help bring your idea and product to market, you can get in touch with us at **avnet-abacus.eu/ask-an-expert**

SUPERIOR INTERCONNECTS WILL PROVE ESSENTIAL TO EV CHARGING EQUIPMENT

Uptake of electric vehicles (EVs) is reaching unprecedented levels, with the current high fuel costs adding another dimension to the environmental motivations that were already driving their adoption.

To keep up with projected demand, more emphasis will be needed to ensure that sufficient supporting charging infrastructure is deployed.

The EU, for instance, has set the ambitious goal of having three million public EV charging points in operation across its member states by 2030.

Fast-acting AC chargers located at roadside charging stations will enable quick and convenient replenishment of battery reserves.

150kW units now starting to be installed at stations have brought the average charging time down to below 30 minutes, while the next generation 350kW rated units will reduce this still further, taking less than 10 minutes to fully charge an EV battery.

Alongside AC chargers, there will be the DC wallboxes for home installation, which will have longer periods to work over.

Access to innovative interconnect solutions that are also standards compliant will be pivotal to future EV charger design.

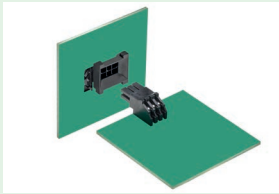
Connectors must therefore be readily available which address OEMs' needs for both design versatility and accelerated development times.

Compactness, elevated performance benchmarks (whether in relation to power, signal integrity or data rate), long-term reliability and cost effectiveness are all certain to be key selection criteria.

Rated to 23A per contact, the 5.7mm-pitch **Mega-Fit** series from Molex delivers elevated power capabilities while taking up only minimal board space.

The terminal interface has six independent points of contact, so interconnection reliability is always assured.

Thanks to sacrificial contacts, this solution is hot-pluggable on 48V systems.



There are also the **Micro-Fit** BMI power interconnects, supporting 5A currents, with full isolated terminals.

These high-density components have a 3mm-pitch, with customers able to select from 2 to 24 contact options.

Mating misalignments up to 2.54mm can be accommodated, meaning that they are highly suited to situations where blind mating is necessary.

Versions for surface-mount and through-hole attachment can be supplied.

It is not just about the power aspect though; charging infrastructure needs constantly updated data on numerous different parameters.

This is where the Molex Easy-On FFC/FPC connectors are beneficial. These small pitch components (from 0.2mm to 2mm) are compact enough to deal with space-limited design requirements and have the robustness to withstand temperatures from 40°C to +125°C.

Their dual-contact arrangement means secure mating is always achieved, while the lock-nail mechanism provides strong cable retention.

Available in both vertical and horizontal configurations to offer greater adaptability, the Molex DuraClik can be supplied in 2 to 15 contact versions.

These connectors feature an inertia lock mechanism and have a 100N retention force.

Their wide solder tabs are tested to rigorous SAE vibration standards, making them highly suited to uncompromising automotive environments.

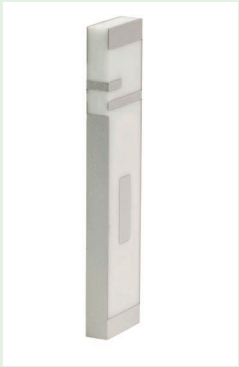
Discover Molex's range of products suitable for EV and charging applications, available from Avnet Abacus, here: Molex Vehicle Electrification Solutions | Avnet Abacus

molex

PRODUCT SPOTLIGHT: LTE CELLULAR CERAMIC ANTENNA

Low profile, high performance cellular ceramic internal antennas, suitable for EV charging designs.

Achieving excellent performance and meeting desired data rates with a small-sized antenna in compact applications remains a major technical challenge for manufacturers. Meeting the design requirements of high radiation efficiency and gain with maximum PCB real estate savings poses additional challenges.



Molex LTE Cellular Antennas offer a low-profile ceramic cellular antenna, with a compact solution that meets all design requirements of high radiation efficiency with high peak gain while providing maximum PCB real estate savings.

Additional advantages include:

- Compact, lightweight advantages and easy installation
- High Peak Gain and >70% Radiation Efficiency
- Frequency range of 698 MHz to 2.7 GHz

Molex is one of the leading antenna component manufacturers, with a diverse portfolio of ready-to-use antennas to support growing demand across industries. Avnet Abacus' is working closely with Molex to bring you the highest level of product and technical support.

If you're looking for an antenna solution and require technical support, or if you're ready to take the next step with your design, get in touch with the Avnet Abacus team to discuss your needs.

For more information visit
avnet-abacus.eu/molex

muRata
INNOVATOR IN ELECTRONICS

MURATA EV INFRASTRUCTURE OPTIMIZATION

Murata and EVs
A global leader in EV infrastructure optimization, Murata offers a wide range of reliable, durable products supporting this growing market.

This includes ultra-compact transformers, highly reliable coin batteries, power products, and high-level sensors.

These small-sized, reliable products maximize performance at a reasonable cost.

Product Highlight
Sensor – CT100 current sensor- CT100 captures the magnetic field generated by the current traveling in the current carrying bottom PCB layer. Power – The NXE & NXJ series Isolated DC-DC & MGJ series Isolated DC-DC converter for gate drive.

CT100 current sensor

FEATURES & BENEFITS

- Contactless and isolated current sensor
- Excellent linearity performance with minimal heat loss
- Stable performance over temperature
- Large bandwidth and tolerant to current transients/spikes
- Low power consumption: < 100 µA
- Wide voltage supply range: 1.0 V to 5.5 V
- PCB limited: 100 mA to 100 A

The NXE & NXJ series Isolated DC-DC

FEATURES & BENEFITS

- Ultra low capacitance
- Higher Isolation test voltages in industry standard footprint
- 260°C reflow temperature as per J-STD-020 for multiple reflows
- Higher level of insulation with reinforced insulation up to 250Vrms

MGJ series Isolated DC-DC converter for gate drive

FEATURES & BENEFITS

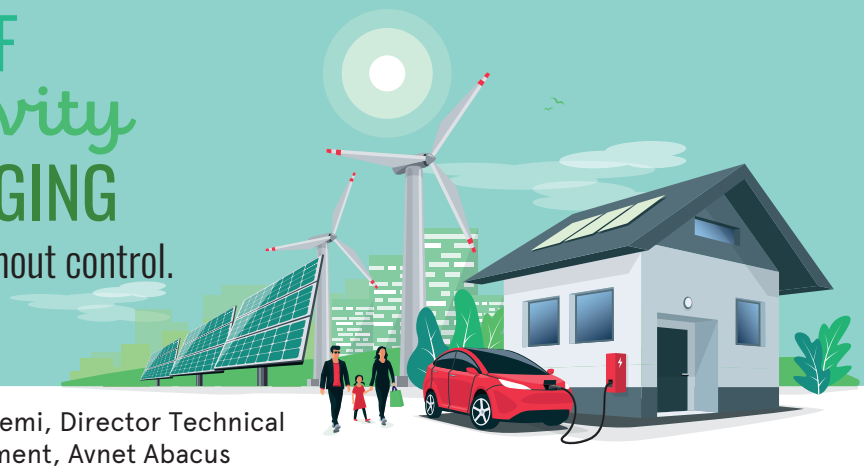
- Ultra low isolation capacitance typ 3pF
- Continuous barrier withstand voltage up to 3kVDC
- Partial discharge characterised
- High dV/dt immunity
- Optimized Voltages for IGBT, SiC & GaN
- Power rating: 1-6W

For more information visit
avnet-abacus.eu/murata

THE ROLE OF *Connectivity* IN EV CHARGING

Power is nothing without control.

Sara Ghaemi, Director Technical Development, Avnet Abacus



The emerging EV charging infrastructure must be capable of delivering vast quantities of power to electric vehicles to keep drivers (and economies) moving in the post-fossil age.

Careful management of power flowing, both to and from EVs connected to the grid, is needed to ensure usability for vehicle owners and stability for the renewable-fed grid.

The process demands intensive communication between the vehicle, the grid, and the cloud using various wired and wireless technologies.

INTRODUCTION: CHARGING INFRASTRUCTURE TO WORK HARDER AND SMARTER

We are all familiar with the phrase work smarter, not harder. Well, the EV charging infrastructure needs to be hardworking and intelligent to meet the needs of vehicle users and the communities impacted by them.

The hard work is associated with distributing enormous quantities of energy, as the number of EVs on the roads increases massively over the next few years.

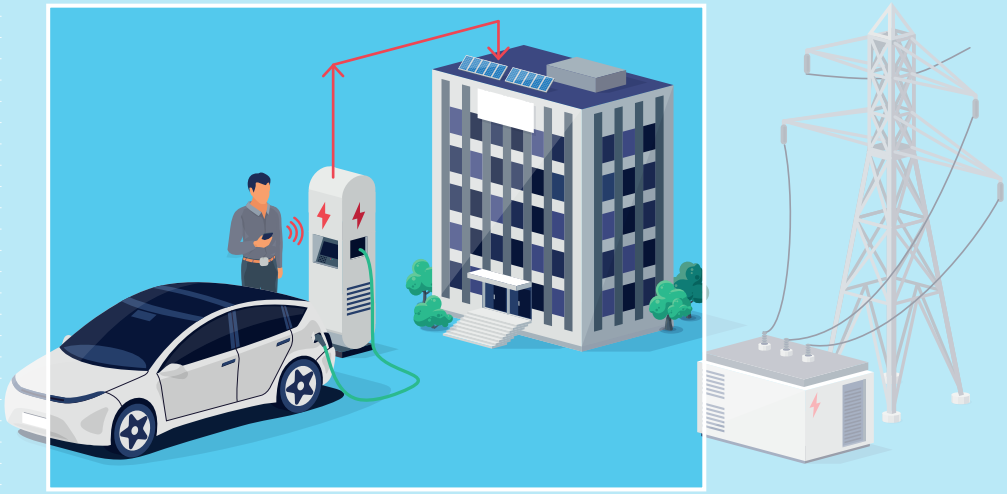
On the other hand, managing that energy and ensuring the right quantities are available in the right places at the right times is no simple task.

Also, safety, accurate billing, and security are critical must-haves.

Smart infrastructure is essential to support the accessible and convenient mobility to which we have become accustomed while safeguarding the grid's stability and achieving everything – as far as possible – using energy from renewable sources.

These, by their nature, are transitory and provide limited electricity that must be captured when available and accumulated, then released over time in a controlled fashion.

This process relies on appropriate interactions between the various parties and items of equipment in the process: the vehicle owner or charging-account holder, the charging point or EV service equipment (EVSE), the vehicle itself charging through the on-board charger (OBC) or direct DC charging, the charging-point operator, and the grid operator.



ACCOUNT HOLDER TO CHARGE-POINT OPERATOR

ACCOUNT HOLDER TO CHARGE-POINT OPERATOR

When a vehicle arrives at a public charge point needing charging, the charging account holder must provide credentials to begin charging.

A practical and convenient channel is a contactless near-field communication (NFC) connection using a smartphone and app or tokens like a smartcard or smart key fob. The EVSE can then contact the charge-point operator to verify the customer's credentials, typically using a standard wired Internet connection.

At this point, the EVSE can check necessary information like the account status and available credit on the operator's database before authorising charging.

The charge-point operator also needs information from the grid operator about the current status of the grid and the availability of energy for charging.

Tariffs and maximum allowable charging rates will change during the day as demand changes continuously and the available solar and wind energy levels fluctuate.

There may also be problems in the grid system, such as equipment failures that may be localised or may affect a large area.

If there are problems with generators or demand is high relative to supply when the session is requested to start, the charge-point operator may restrict the maximum charging rate.

In addition, they need to communicate any restrictions to the customer, such as the maximum charging rate in kW.

Alternatively, the charge-point operator may calculate an expected end time for the charging session.

THE ROLE OF CONNECTIVITY IN EV CHARGING

EV TO EVSE

The EV and EVSE must communicate to confirm the correct connection and start, manage, and terminate the charging session when the vehicle is connected.

The EVSE needs to identify the vehicle's charging parameters, including the maximum charging rate and battery state of charge.

The EVSE and vehicle charging system need to agree on the charging rate, which may be up to the maximum allowed by the battery/charging-management system, subject to any supply-related restrictions.

A secure and correct connection can be verified using information shared through essential communication such as coding resistors.

However, more sophisticated communication is needed to manage the charging session.

Typical standards for the EV-to-EVSE connection include SAE J2847 (US) and ISO 15118 (Europe).

The interface contains power connections for AC and DC charging, as well as a proximity signal and control pilot signal.

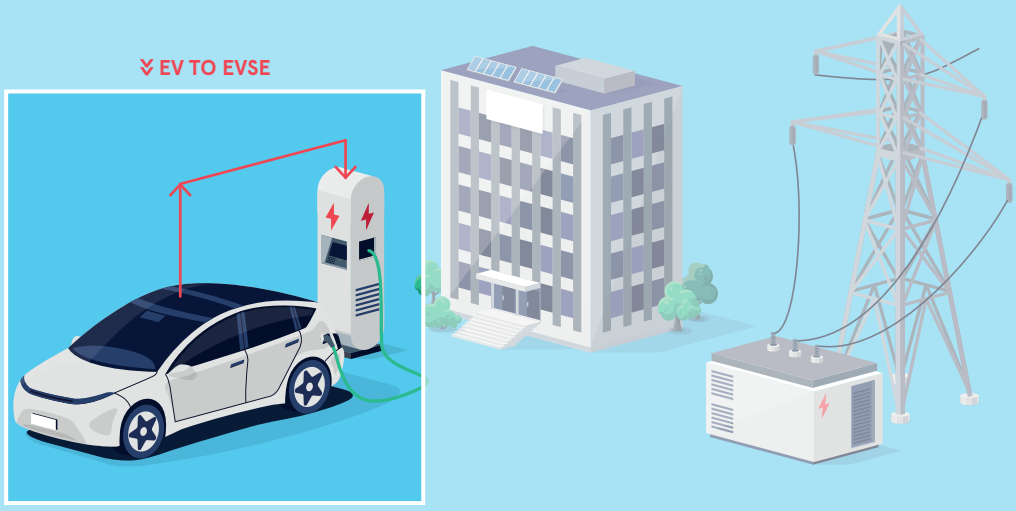
For the control pilot, which carries the main digital communication between the EV and EVSE to initiate, manage, and terminate charging, the SAE and ISO standards have each adopted Power-Line Communication (PLC) as defined in the HomePlug Green PHY specification.

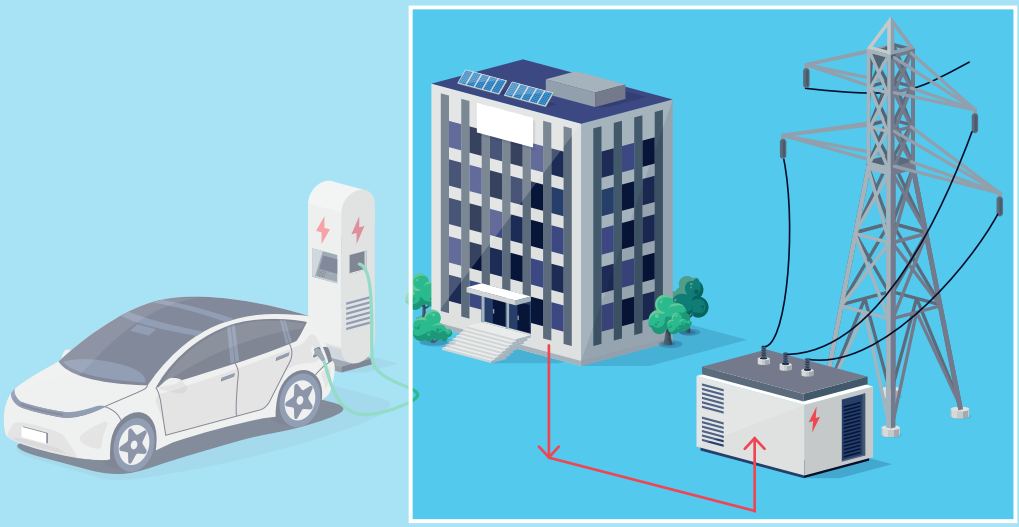
The battery charging may stop when fully charged, or the session terminated early if the user decides or the account credit becomes depleted.

Connections to individual EVSE are needed, from the charging-point operator's point of view, to manage the EVSE fleet and authenticate and maintain the subscriber's account.

The process helps identify when maintenance or repairs are needed and accumulates information such as popular charging locations.

This, in turn, helps plan future infrastructure expansion: where to add extra charging points, which ones to upgrade, e.g. to a higher power output, and to help identify potentially profitable new sites.





CHARGE-POINT OPERATOR TO GRID OPERATOR

CHARGE-POINT OPERATOR TO GRID OPERATOR

The grid operator needs regularly updated information from charge-point operators to control the supply of electricity to charging points, and balance energy flows throughout the grid to maintain stability as the effective installed generating capacity varies throughout the day.

From the grid operator's standpoint, the EV charging-point operators are one party among many others - both residential and industrial - constantly demanding energy. They have different demand intensity, usage patterns, and priorities.

The grid operator works to satisfy all demands to the greatest extent possible.

A smart and green grid presents a far more complex management challenge than a grid supplied by conventional generators powered by fossil fuels such as gas or oil.

Green grids do not have the same ability to generate extra electricity at peak demand and must rely on battery energy storage systems (BESS) to satisfy demand when generating capacity is low.

As the number of EVs in regular use increases, a grid that would allow large numbers of vehicles to take power from the grid in an uncontrolled manner risks instability and blackouts.

THE ROLE OF CONNECTIVITY IN EV CHARGING

V2G

On the other hand, controlling the flow of power from vehicles to the grid enables EVs to provide a stabilising resource by returning unused energy when not in use, acting as grid-connected battery energy storage.

This process creates the case for implementing V2G communication, which allows vehicles to supply energy from their batteries to the grid when connected but not in use.

A prime example is when the vehicle is connected to charge in the evening after the owner returns from work.

Most likely, the vehicle will not be used until the following morning to repeat the commute to the owner's workplace.

A smart grid that knows the owner's typical usage pattern can automatically delay charging the vehicle if there is an elevated demand until demand has reduced.

Charging can then commence without risking instability in the grid. If any significant charge remains in the battery when it is connected, this, too, can be communicated to the charge-point operator and grid operator.

They can then utilise this energy if needed to keep the grid stable and reward the EV owner for the service provided.

The smart, informed grid can automatically ensure that the EV is charged and ready for the next time the owner needs to travel.

CONCLUSION

The various parties in the charging session have certain expectations.

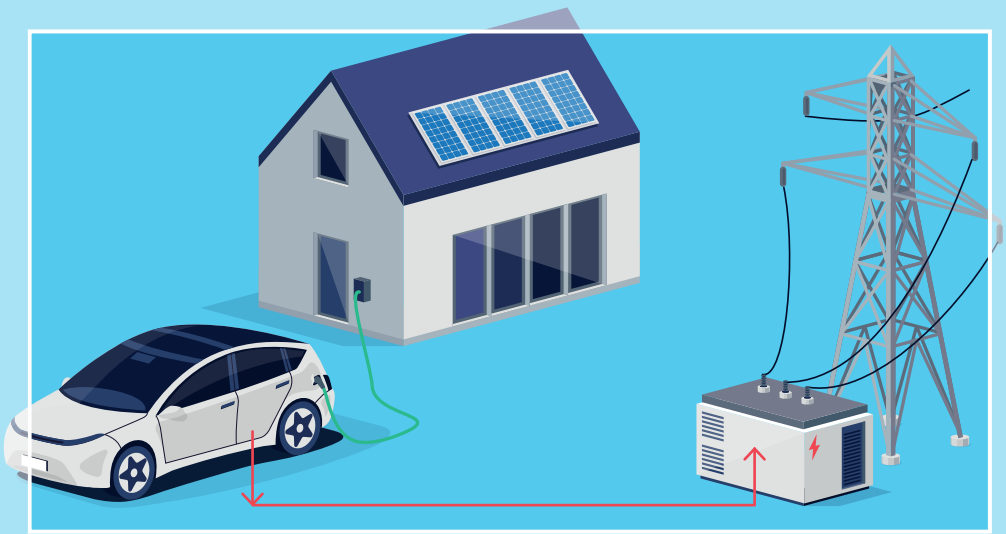
The owner, charge-point operator, and grid operator have their own needs and interests. The end-user only wants to charge the vehicle as quickly and efficiently as possible.

The charge-point operator seeks to ensure the network's success by delivering value for customers and safeguarding profitable operation.

The grid operator must meet agreed environmental targets by maintaining a safe and stable energy supply.

It is critical to meet all needs as fully as possible through the end-to-end exchange of appropriate information.

This process encompasses essential functional communication between the vehicle and the EVSE using short-range mobile communications such as NFC between the customer and EVSE and any combination of long-range, cellular, and WAN connections between the EVSE, charge-point operator, and grid operator.



V2G

/BEL FUSE 0ADE SERIES COMPACT FUSES

Bel's 0ADE series of fast acting fuses come in a compact 6.3 x 32mm package and are available in cartridge and pigtail axial lead options for AC-DC high voltage and high interrupting rating applications.

The 6x32 mm 0ADEC ceramic cartridge fuses and the 6x32 mm 0ADEP pigtail, axial leaded fuses are designed for customer applications which require a high voltage rating and high interrupting rating, such as high current/high power supplies and bus grids, but would also benefit from a smaller form factor than today's traditional fuses can provide.

The 0ADE Series is rated 500VAC with a 30kA interrupting rating and 500VDC with a 20kA interrupting rating.

FEATURES

- Fast acting, high breaking capacity fuse
- Available in cartridge and pigtail axial lead
- Meet Underwriters Laboratories Standard UL 248-14
- RoHS 2 Compliant
- Halogen Free
- Leadfree

APPLICATIONS

- Industrial Power Supply
- DC/DC module

EV Charging

Amphenol offers the most efficient interconnect solutions for the modern EV charging station.

Amphenol has a wide portfolio of power products supporting 15A-1000A ratings, low contact resistance, high thermal support and component modularity

We offer the most efficient solutions for the modern EV charging station. Our energy efficient connectivity extends from level 2 chargers to Level 3 Super-fast chargers capable of charging an EV battery in less than 30 minutes, in addition to IP67 sealed connectivity for underground wireless charging.

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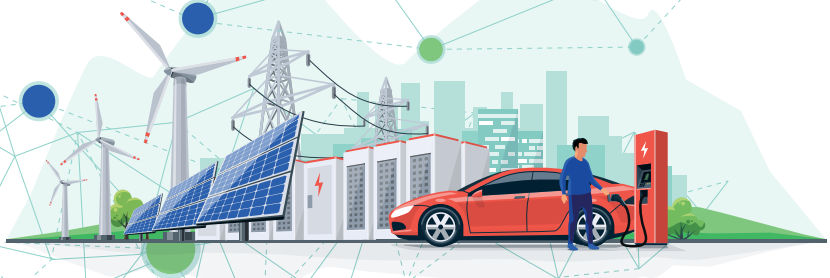
KEEPING eMOBILITY MOVING

EV Charging Needs and Future Trends



Marc Eichhorn, Product Manager - Batteries, Avnet Abacus

The engineering of electric vehicles has come a long way toward alleviating range anxiety, which has been a barrier to widespread EV adoption.

However, worries about insufficient infrastructure and long charging times remain.

This article looks at the current situation regarding EV charging and the indicators for progress toward a fast and reliable EV charging infrastructure.

INTRODUCTION

Range anxiety has been a significant barrier to the widespread adoption of electric vehicles.

However, typical travelling for commuting and other routine trips is about 50-100 kilometres per day.

Helping drivers to understand this, combined with the engineering talents of vehicle makers to extend the range of affordable EVs, could ease some of these fears and encourage sales of new EVs.

EVs have indeed become more efficient. Information published by the **European Energy Agency** suggests that the average energy consumption of a battery electric vehicle (BEV) decreased from 264 kWh in 2010 to 170 kWh in 2019, while the average mass increased from 1,200 kg to 1,723 kg.

This weight increase could result from several factors, such as fitting larger batteries and motors and additional comfort features, as well as mid-size SUVs representing a growing share of an increasingly mainstream market.

However, range concern also applies to the charging infrastructure.

KEEPING eMOBILITY MOVING

The market needs to be confident that authorities will provide enough public charging points in suitable locations for drivers to charge as required, avoiding long waiting times for a charger to become free.

Opportunities for fast charging during longer journeys are also needed.

Moreover, their reliability and uptime need to be assured: imagine arriving at a charging station with little battery energy, only to find the equipment is out of service.

BUILDING OUT THE INFRASTRUCTURE

Charging infrastructure is a work in progress: the infrastructure must be adequate to persuade large numbers of users to make the switch while, on the other hand, investors need to know that there will be a viable user base.

Western governments' announcement of their desire to ban sales of new fossil-fuelled vehicles from 2030 could well lead to the number of EV users proliferating over the next few years.

Several charging approaches are proposed, including cabled charging with various plug standards and wireless charging either at the roadside or on the go through power transmitters embedded in the road.

CHARGING STANDARDS, POWER, AND SPEED

In a European residential setting, supplied by normal single-phase AC power at about 230V, a home charging setup could charge an EV battery at about 3.5kW on a 15A circuit or as quickly as 7kW at 30A.

The vehicle's onboard charger (OBC) converts the AC input to a DC charging voltage suitable for the battery.

This voltage value is battery dependent and, therefore, likely to vary between manufacturers and models.

Theoretically, fully charging a depleted EV battery of, say, 40kWh (the capacity of a Nissan Leaf battery) could take almost 13-14 hours at 3.5kW, factoring in losses in the AC charger, or about half that time at 7kW.

CHARGING AT HOME THROUGHOUT THE EVENING AND OVERNIGHT PRESENTS MINIMAL APPARENT PROBLEMS FOR THE DRIVER: THE VEHICLE WILL EASILY BE READY TO USE IN THE MORNING FOR THE NEXT JOURNEY TO WORK.

KEEPING eMOBILITY MOVING

Charging at home throughout the evening and overnight presents minimal apparent problems for the driver: the vehicle will easily be ready to use in the morning for the next journey to work.

A basic home charger for this type of duty can be supplied and installed for anywhere between a few hundred and two thousand Euros.

Conveniently, topping the vehicle up from a similar charger, operating at a low rate, can be done while parked at a workplace.

While on the move, however, drivers are likely to need to recharge more quickly to resume their journeys, particularly if travelling long distances at motorway speeds (at 130km/h only 60-70% of WLTP range are realistic to achieve).

In a dedicated charging location fitted with a 3-phase supply, an AC charger can operate at up to 43kW.

This provision is known as AC fast charging and is the maximum rate possible using the standardised type-2 EV-charging socket.

The socket has seven pins to handle power and provides the required communication between the vehicle and charger to set up and manage the charging session.

Even at 43kW, however, the 40kWh battery will need close to one hour for an 80% charge.

DC rapid charging solves this shortfall by presenting a high DC voltage to charge the battery directly.

KEEPING eMOBILITY MOVING

The vehicle's OBC does not limit charging and can support a rate of 50kW and higher, including the state-of-the-art rate of 350kW.

EVs in Europe commonly have a combined charging socket (CCS) that integrates the standard 7-pin type-2 connection and the two high-power inputs needed for DC rapid charging.

It accepts the standard type-2, and CCS plugs, allowing owners to choose AC charging or DC rapid charging depending on their needs and the charging equipment available at any given time.

CCS chargers are found typically in locations like motorway service stations.

A 2020 report found over 8000 CCS chargers installed throughout Europe.

Market research by Mobility Foresights put the figure at over 13,000 in Europe, with about 230,000 installed globally.

Mobility Foresights' report, **Global Electric Vehicle DC Fast Charger Market 2022-2027,** also suggested that many state-of-the-art EVs have about 75kWh battery capacity and can handle a charging rate of 100-200kW.

The improvements in vehicle efficiency and charging speed could be enough for even long-distance travel by EV to become practicable.

A full recharge may be needed every 160 or 320 kilometres (depending on the vehicle and driving style) and could take less than 30 minutes.

Rising sales of EVs suggest that EV ownership is gaining mainstream acceptance.

According to the EEA, total registrations of new EVs in Europe rose to 2.3 million in 2021, from only 700 in 2010.

Just a year later, the figure surpassed one million.

Commentary by technical consulting firm **Arthur D. Little** projects a total fleet of over 40 million EVs in Europe by 2030.

Analysis by **Eurelectric** goes further, suggesting that 130 million EVs will be in circulation in Europe by 2035.

However, the same report indicates that nine million public charging stations will be needed to keep them moving, in addition to 56 million residential units.

INFRASTRUCTURE CHALLENGE

But suppliers face challenges in providing suitable charging facilities.

Five EVs at a fast-charging service station, recharging at 200kW, will draw about 1MW from the grid, local battery storage, or a combination of the two.

New infrastructure is needed, which must supply the overall demand of the service station.

Moreover, there are calls for managed charging to preserve grid stability.

The experiences of service providers differ significantly as they work to build out their charging infrastructures across Europe.

KEEPING eMOBILITY MOVING

While the UK, Netherlands, Norway and Germany have the largest numbers of charging stations per 100km, planning hurdles in other countries restrict access to real estate to build new charging stations.

In addition, gaining the necessary permissions to connect to the grid can take time.

Wireless charging is an alternative option, although subject to many typical obstacles that face rolling out conventional charging infrastructure.

By embedding wireless charging points in the road surface at traffic light stops or other waiting places (such as taxi ranks), a battery can receive a brief charge boost without driver intervention while the vehicle is stationary.

Some potential barriers include the dependence on the correct positioning of the vehicle over the charging transmitter on the road and the fact that the transmitter must withstand harsh environmental conditions and heavy loads passing over.

Wireless charging on the go may be best suited to public transport, for charging buses and coaches when waiting at stops or driving on specially installed **"electric roads"**.

CONCLUSION

Prospective EV buyers can be reasonably sure that the vehicles on offer today (and increasingly in the future) will be able to fulfil typical daily mobility needs.

However, if EVs are to become the only permitted mode of personal transport, consumers will expect to be able to charge their vehicles whenever and wherever they need.

This development calls for access to fast and reliable public charging points.

It is an ambitious task to install large numbers of high-power charging points and the infrastructure needed to supply them.

The rollout needs to keep pace with the expected accelerating growth of the EV user base over the coming years.

/ THE SMALL BOX FOR THE WALL BOX

Panasonic INDUSTRY

Quad power - one eighth power loss: Panasonic Industry releases 40A printed HE-R relay for 3 phase systems with feedback contact. A perfect - and proven - match for EV charging wall boxes.

A successful paradigm shift in our driving habits...

...crucially depends on the available charging infrastructure.
In future, the latter won't be possible with public charging offers alone.

Affordable and clever domestic wall box solutions for garages and carports are utterly required - and so are components like Panasonic Industry's new HE-R relay that meets the specific needs of next-gen 3 phase systems.

Let's start with a look back: Whenever it came to the task of handling high loads, application engineers suffered some headache in terms of relays.

High power environments usually required the use of rather large, stand-alone contactors that had to be mounted as separate units with wired connections to a control board.

In the end, this resulted in higher component and material costs, additional manual assembly efforts and sometimes even the risk of poor operational reliability, because every single connection from the board to the cables and the socket to the relay connection can turn out to cause reliability issues.

HE: A new generation of PCB based power relays

To overcome these shortcomings and to serve the growing demands for safe, robust and energy-efficient ways to switch relatively large amounts of power on the PCB, Panasonic Industry introduced its HE relay series nearly 20 years ago, at this time with a focus on the solar energy plants market.

The lineup grew over the years, and now in 2022 HE relays can handle loads up to 120A (HE-N) and up to 1000VDC (HE-V) in ambient temperatures of up to 85°C.

This makes the PCB relay series a perfect choice for high power applications, such as solar inverters, automotive charging stations, or battery storage systems – while coming in remarkably compact dimensions. HE-S, for instance is as compact as 30x36x40mm.

HE-R: The small box for the wall box

Now, Panasonic Industry presented an interesting new member for the HE relays family: The new HE-R is the world's first PCB relay that can be used as the main switching element in three-phase systems.

Designed specifically for mode 3 AC charging stations up to 22kW, the HE-R is meant to take charging technology safety to the next level: Each of the four normally open contacts is designed for carrying and switching 40A within the series' usual temperature range of up to +85°C.

An optional NC contact, designed as a mirror contact according to IEC 60947-4-1, switches signal loads up to 10mA / 5VDC.

In addition to the HE-R's small size of 35 x 58 x 47mm, its minimal power consumption would be a key feature.

This could be achieved by using a pulse width modulation to reduce the coil voltage to only 35% of the nominal voltage.

This results in a remarkably low power dissipation of only 490mW.

Positive side effect: A lower waste heat renders ventilation redundant in most of the cases.

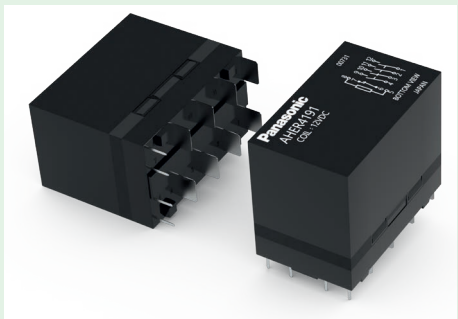
Size, performance, and robustness

The IEC62955 VDE-certified HE-R relay now allows to implement three-phase systems with just one relay directly on the PCB.

This is not only an option for demanding garage and carport wall box designs, but also for public charging stations and completely different application areas such as industrial automation or energy harvesting.

HE-R FEATURES OVERVIEW

- Unique contact arrangement of 4a or 4a1b
- 1xNC contact as a mirror contact
- Low initial contact resistance ≤5 mΩ
- Contact rating 40A / 480VAC resistive
- Extreme low coil holding power of 490mW
- Clearance & creepage distance >8.0 mm
- Ambient temperature - 40°C to +85°C
- PCB soldering terminal type
- UL/C-UL, VDE certified



Compact housing, IEC 62955- certified – and outstanding features: New 40A HE-R from Panasonic Industry.

For more information visit
avnet-abacus.eu/panasonic

OMRON G7L-X PCB POWER RELAY

The OMRON G7L-X are compact PCB power relays (52.5mm × 35.5mm × 41.0mm) that achieve high-capacity, bidirectional double breaking and switching up to 1,000VDC. Designed for safety with a min. 6.0mm contact gap (poles serialized). Models include 20A or 25A *maximum switching current. Other features include low and stable contact resistance (**initial less than 10mΩ) which suppresses heat generation, and a low coil power consumption of approximately 0.6W with 50% rated holding voltage. It also has a wide ambient operating temperature from -40°C to +85°C.

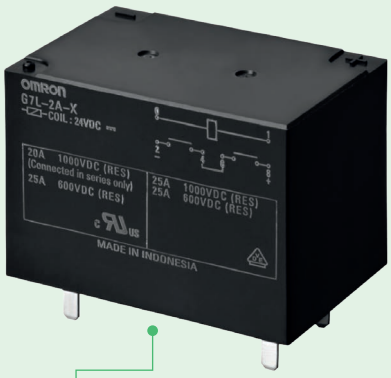
Applications include energy storage systems (ESS), DC mode 4 electrical vehicle chargers (EVC) power conditioning systems (PCS), uninterruptible power supplies (UPS), other related inverter products including DC links.

FEATURES

- Double break, 2 pole bidirectional breaking and switching up to 1000VDC
- Designed for safety with a min. 6.0mm contact gap (polarized poles serialized)
- Conforms to UL and EN

APPLICATIONS

- Energy storage systems (ESS)
- Electric vehicle chargers (EVC)
- Power conditioning systems (PCS)
- Uninterruptible power supply (UPS)
- Other inverter related systems including DC links



OMRON G7L-X
PCB Power Relay

*600VDC 30A, 1000 hrs at 85oC
UL certification pending

**initial less than 10mΩ under confirmation

OMRON G9KB PCB POWER RELAY

The OMRON G9KB is a 600VDC, 50A high capacity power relay with bidirectional switching, making it an ideal option for charge/discharge applications. Due to OMRON's latest advancement in arc cut-off technology, the G9KB realizes dependable DC disconnect. Single pole (non-polarized) double break contact with gap larger than 3.6mm enables versatile application. It features a low and stable contact resistance (initial less than 5mΩ) which suppresses heat generation, and a low coil power consumption of approximately 0.57W with 45% rated holding voltage. It also has a wide ambient operating temperature from -40°C to +85°C.

The G9KB is ideal for application in bidirectional high power switching systems, such as residential and low power commercial energy storage systems (ESS), conventional EV chargers, including vehicle to home and grid (V2H/V2G) and fast charger PDU's (power distribution units).

FEATURES

- *600VDC, 50A bidirectional switching (one pole double break)
- OMRON advanced arc cut-off technology
- Low initial contact resistance ≤5 mΩ
- Low coil power consumption ~ 0.57W
- Wide ambient operating temperature from -40°C to +85°C
- UL 60947-4-1 and EN 61810-10 certified (required for ESS)

APPLICATIONS

- Energy storage systems (ESS)
- Conventional EV chargers including vehicle to home/grid (V2H/V2G)
- EV fast charger PDU (power distribution units)

OMRON G9KB PCB
Power Relay

*capability to 1000VDC.
Please contact OMRON for further details.

For more information visit
avnet-abacus.eu/omron

ENABLING TECHNOLOGY EVERYWHERE

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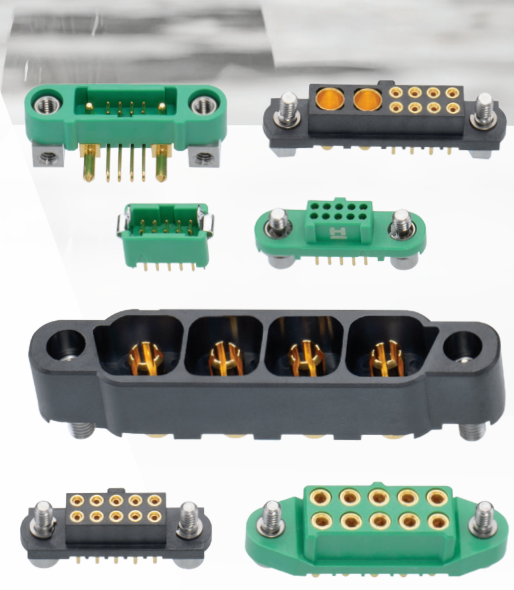
harwin.com

Harwin's connector products are proven to perform in extreme conditions, with shock, vibration and temperature range rigorously tested.

Micro connectors start at 1.25mm pitch delivering 2A per contact, up to 8.5mm and 60A - covering a wide range of applications from charging infrastructure to battery management systems.

With our quality, service, support, and highly reliable products, you can depend on Harwin.



Engineer to Engineer – Harwin won't let you down.

HIROSE ELECTRIC EUROPE B.V.

DF60 SERIES, 10.16MM PITCH, HIGH CURRENT, WIRE-TO-BOARD CONNECTOR

The connector range consists of cable mount female crimp sockets and board mount vertical, right angle and panel mount in-line male headers that have the capacity to handle up to 65A (max) current rating.

The overall size of the DF60 series has been designed with space saving in mind, the plug and receptacle housings are low profile with a mated height of only 30mm using the vertical header. The footprint dimensions are minimised by the small pitch size of 10.16mm.

The robust lock provides a positive tactile sensation and an audible click when mated. This confirms the connector is fully engaged guaranteeing complete electrical and mechanical connection. The lock is on the centre of the housing to avoid uneven locking and cable entanglement which is common with side locks. In addition, multiple connectors can be mounted closer together side by side.

The cable mount female socket housing utilises crimp contacts that have a unique 5-point contact internal structure.Two of the contact points are fixed in the upper section.

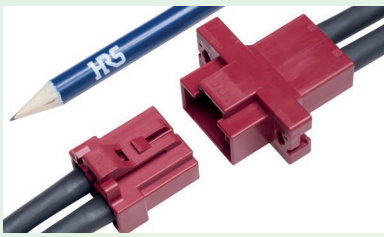
The other three are in the lower section and are spring based allowing movement to follow the flat structure of the male contact during the mating operation.

This provides high contact reliability, secure connection, and strong resistance against vibration.

Keying variations are available to prevent incorrect insertion when multiple connectors are used. DF60 series is part of the EnerBee product family.

The EnerBee family features wire-to-board and wire-to- wire power connectors to provide technically advanced connectivity solutions for industrial power sources.

EnerBee™



FEATURES

- 1 - 6 contact positions (Right angle, in-line, vertical versions)
- Contact pitch: 10.16 mm
- Current rating: 65A (max)
- Cable size: AWG 8-12
- Operating temperature -55 to +105°C
- 30 mating cycles
- Voltage rating: AC/DC 1000V
- UL, C-UL, TÜV Certified

Suitable applications are robots, automotive devices, medical, servers, servo amplifiers & motors.

For more information visit avnet-abacus.eu/hirose

LAIRD PERFORMANCE MATERIALS

Laird™
Smart Technology, Delivered.™

The Electric vehicle market continues to be on an upcycle with fossile fuel energy prices and CO2 awareness increasing. Range and fast charging of PHEV and BEV are the key differentiating factors for the business success of the different car models. Additionally, the availability for the relevant fast charging infrastructure increasingly becomes an issue under 2 aspects.

1. Charging possibilities for commuting and short distance.

2 Fast charging for longer distance travelling

In any design that is related to higher power, faster charging speed, the management of "waste energy" w.r.t heat is a topic that must be addressed to secure functioning and stabilizing of the relevant electronics for improved operations and life-time.

Automotive manufacturers are increasingly embracing the usefulness of electric vehicle technologies.

The experts at Laird a DuPont business have offered guidance, assistance, and tailored solutions.

Laird materials science experts specialize in helping Tier 1 automotive suppliers resolve the most complex electronica design challenges where the module structure meets heat channeling and EMI suppression.

Laird's engineering experts are designers who help designers limit wasted time, effort, and costs while expediting time to market for key automotive components. Let's take a closer look at some of Laird's solutions for the automotive industry.

EV/PHEV Powertrain Electronics
The team at Laird boasts extensive knowledge about automotive thermal solutions designed to protect components from heat issues and manage thermal cycling including EMI mitigation.

A few key products from Laird's EV Powertrain Electronics line include:

- Low Profile DCDC SMD Power Inductor engineered with the lowest-cost design goal.
- Broadband Wire Mound Common Mode Chokes enable higher-switching mode designs and features a nanocrystalline core.
- Tflex™ 300 with high compliancy gives total blanket of components, enhancing thermal transfer.

EV/PHEV Battery and charging
Laird offers multiple EV/PHEV battery pack components tosatisfy design constraints while meeting economics.

- Tflex Thermally Conductive Gap Pads are silicone-free solutions that deliver industry-leading thermal conductivity.
- Tflex 400 Thermal Pad is a high deflection gap filler with 1.8W/mK conductivity.

AVNET ABACUS SWEEPS MOLEX 2021 DISTRIBUTOR OF THE YEAR AWARDS

During this year's Molex European Distribution Conference held in the UK in June, Avnet Abacus achieved a 'grand slam' in Molex distribution awards based on 2021 performance.

For the first time in Avnet history, Avnet Abacus won all four of the supplier's Distributor of the Year awards for categories in which we were competing:

- **Avnet Abacus EMEA** was named Molex's 2021 best performing distributor
- **Avnet Abacus France** earned Molex's South Europe Distributor of the Year award
- **Avnet Abacus Germany** won Distributor of the Year for Central Europe
- **Avnet Abacus Netherlands** was named Molex's North Europe Distributor of the Year

These awards are testaments to the Avnet Abacus team's clear understanding of both companies' shared focus areas and customers' needs, and our strong commitment to nurturing our tenured relationships as we deliver value, drive demand creation and demonstrate our strong technical capabilities.

"It speaks volumes that Molex, a global electronics leader and connectivity innovator, has awarded Avnet Abacus its Distributor of the Year for 2021, not only across the entire EMEA region but also in the local markets of Central, South and Northern Europe," said Rudy Van Parijs, president at Avnet Abacus.

"It is a clear demonstration of our reputation, technical ability and reach for us to win in all four categories entered. We are honored to bring innovative Molex solutions to customers in Europe and look forward to continuing to work closely with them in 2022."

ENGINEERS' INSIGHT: THE AVNET ABACUS BLOG

Identifying challenges, demonstrating solutions

Avnet Abacus' technical blog, Engineers Insight, aims to provide experts with the opportunity to highlight and solve key, often highly complex, challenges from across the breadth of our markets and technologies.

Past Engineers' Insight themes have investigated many of the latest industry discussion points, such as:

- Specifying the most effective components in industrial and building automation.
- Healthcare and the interconnection technology repercussions.
- What miniaturisation means for connector selection.
- Electrifying tractors, mining equipment and other high-power, practical machinery.

...as well as many, many more!

Discover the blog written for engineers, by engineers, today!

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