



**LOW-VOLTAGE
BATTERY PACK
CONNECTOR SOLUTIONS**

molex

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Helping Boost Electric Vehicle Safety and Mileage While Saving Comprehensive Costs

Safety, mileage and cost have always drawn the attention of the consumer and the market throughout the development of electric vehicles. As a result, these are key aspects that call for continuous improvement by carmakers and auxiliary product suppliers. The battery pack is one of the core components of an electric vehicle. It includes the battery system in the EIC system and part of the electronic control system. It plays a critical role in the electrical architecture of the vehicle, serving as the key to improving safety and mileage and reducing costs.

In recent years, battery pack design has been working toward a higher level of safety, while also becoming more lightweight and compact. On the one hand, battery manufacturers and automobile assembly plants pursue higher safety levels and more energy density while reducing comprehensive costs with innovations in anode material and cell integration. On the other hand, this industry has added new requirements for the electrical connection options within the battery pack.

For example, to increase safety, the number of monitoring signals in the battery management system continues growing, and the number of circuit connections required increases accordingly. Thanks to their light weight, thinness and ease for automated assembly, flexible printed circuits (FPCs) are gradually replacing traditional cabling and printed circuit boards (PCBs) in the battery cell's voltage and temperature monitoring applications. This development has raised new requirements for connectors, such as being short circuit-proof, miniaturized and more. Furthermore, those single-function devices that were originally discrete in the battery pack are evolving into highly integrated comprehensive equipment, increasing demand for larger-pin-count connectors. To improve assembly efficiency and reduce manufacturing costs, electrical connection options should facilitate manual operation or be suitable for automatic assembly.

After listening to our customers and developing a deep understanding of the industry's pain points, Molex has responded to new demands from the market, and we have taken into consideration the characteristics of electrical connection applications within the battery pack. As a result, Molex has launched connection solutions dedicated to battery pack connectivity, helping our customers improve product competitiveness.

Based on this research and industry feedback, as well as the competitive advantages of our products, Molex is now offering dedicated connector solutions for these eight battery pack applications:

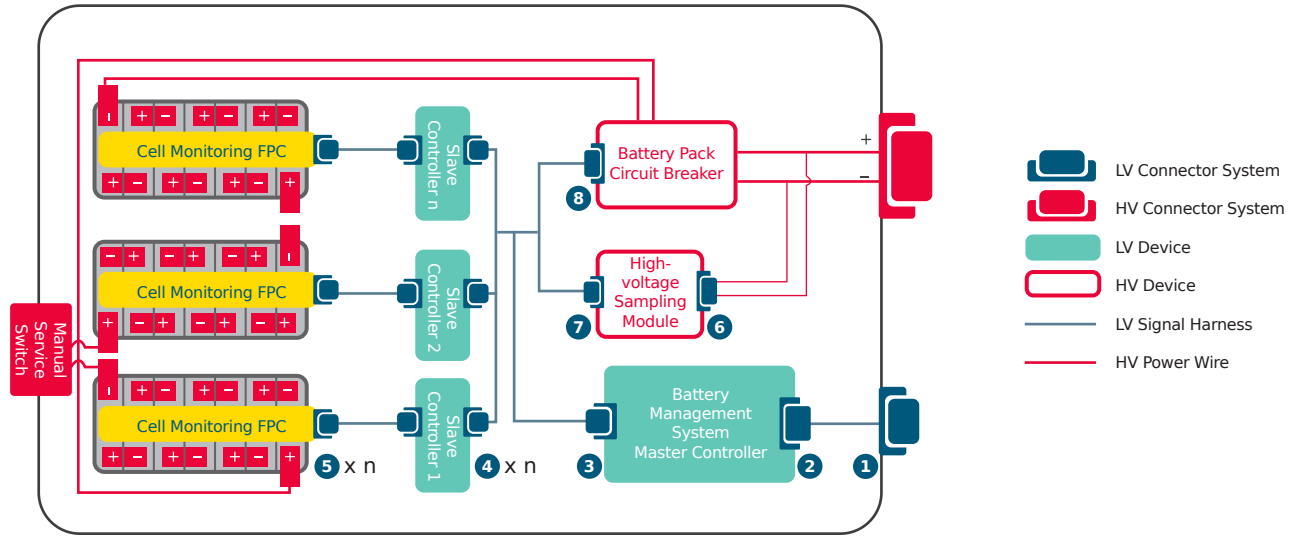
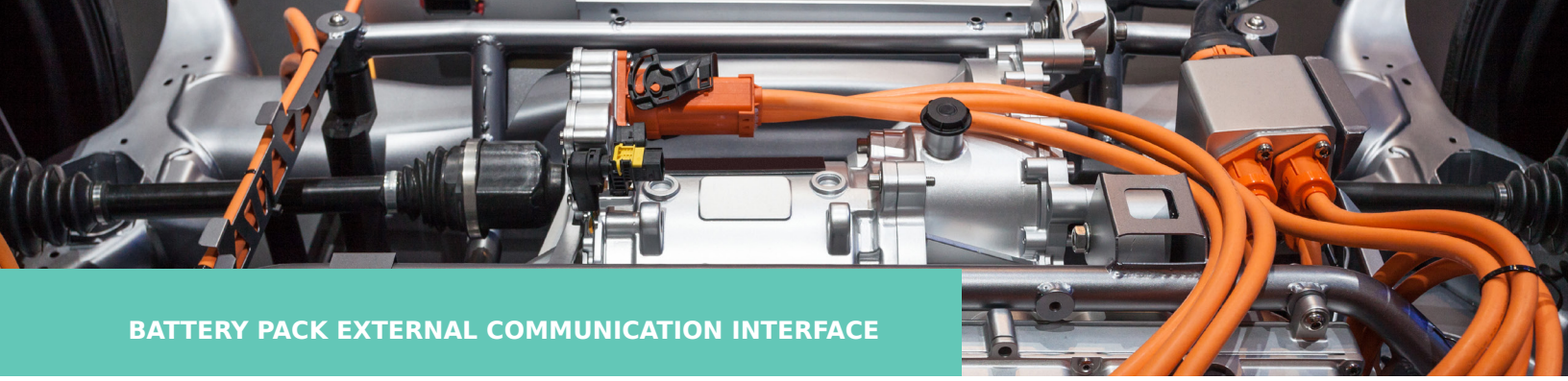


Figure 1 - Typical electrical architecture for battery pack

	APPLICATION SCENARIO	MOLEX PRODUCT
1	Battery Pack External Communication Interface	MX150 or CMC Wire-to-Wire Waterproof Connector
2	Master-Controller-to-Vehicle-Control-Unit Communication Interface	Mini50 or ConnTAK50 Wire-to-Board Connector
3	Master-Controller-to-Battery-Pack Internal Communication Interface	
4	Slave-Controller-to-Master-Controller Communication Interface	
5	Cell Voltage/Temperature Monitoring Interface	Mini50 Wire-to-Board Connector
6	High-Voltage Sampling Input Interface	
7	High-Voltage Sampling Output Interface	H-DAC 64 Wire-to-Wire Connector
8	Circuit Breaker Monitoring Interface	

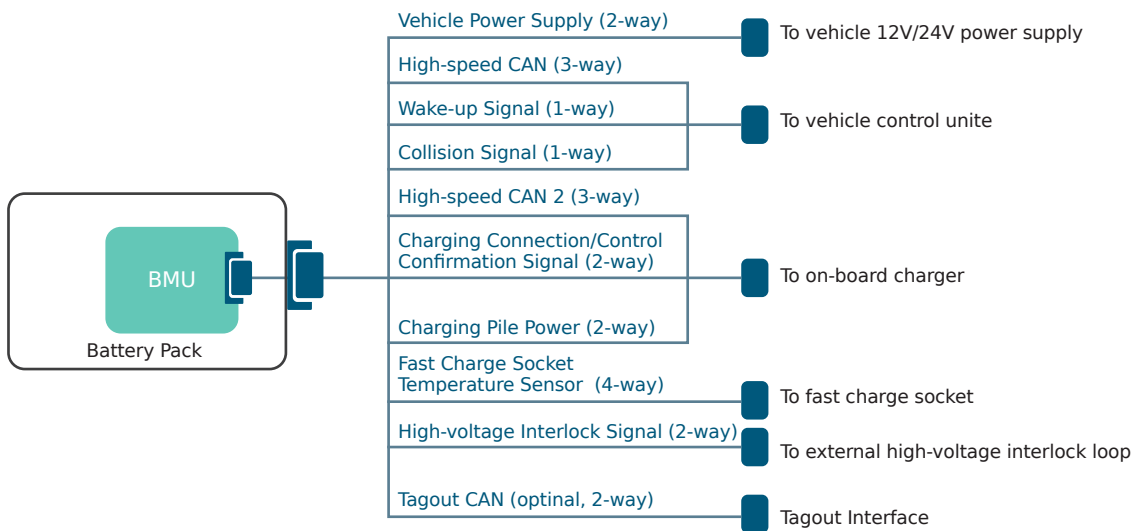


BATTERY PACK EXTERNAL COMMUNICATION INTERFACE

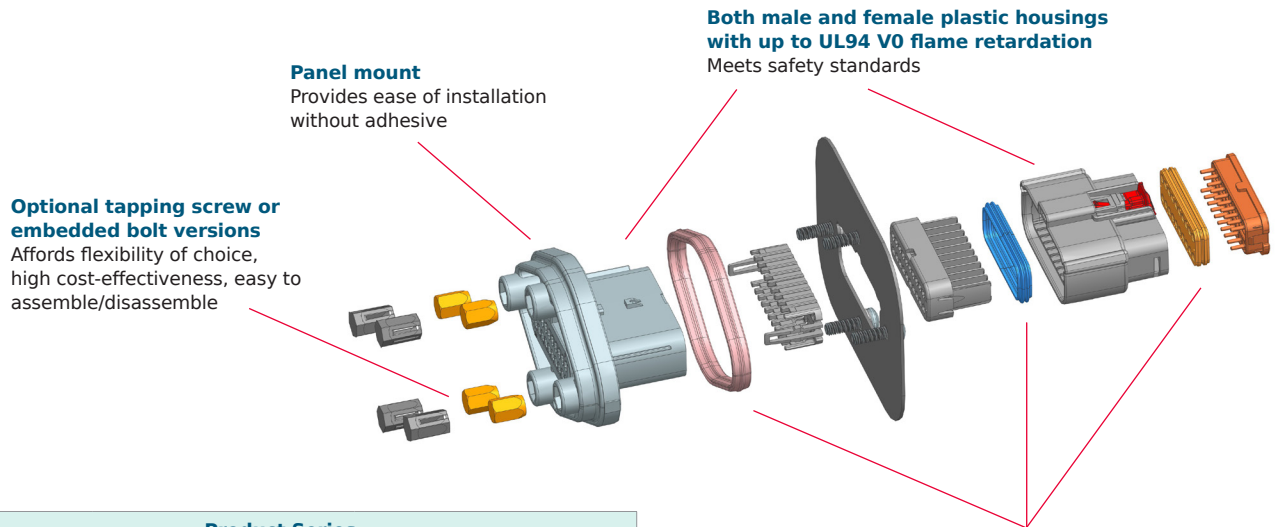
The battery pack external communication interface is for the battery management unit (BMU) to communicate with devices such as the vehicle control unit (VCU), on-board charger (OBC) and others. The BMU provides real-time monitoring of the total current, total voltage, cell voltage, temperature, state of charge (SOC) and state of health (SOH) of the battery pack. It also allows information synchronization with the VCU and OBC via the battery pack's external communication interface, and the BMU executes charging and discharging according to VCU and OBC commands

Connector design requirements:

- Installation and connection method: The external communication connector for a battery pack is mounted on the battery pack housing through a panel mount and is paired on a wire-to-wire basis.
- Dustproof and waterproof requirements: The battery pack is mounted onto the vehicle chassis, which has a harsh operating environment. So, the connectors must have protection ratings of IP67 and IPX9K.
- The external communication interface for a battery pack requires 16 to 20 signal pins and 4 power pins (12 or 24V, 5.0A max.) in total.

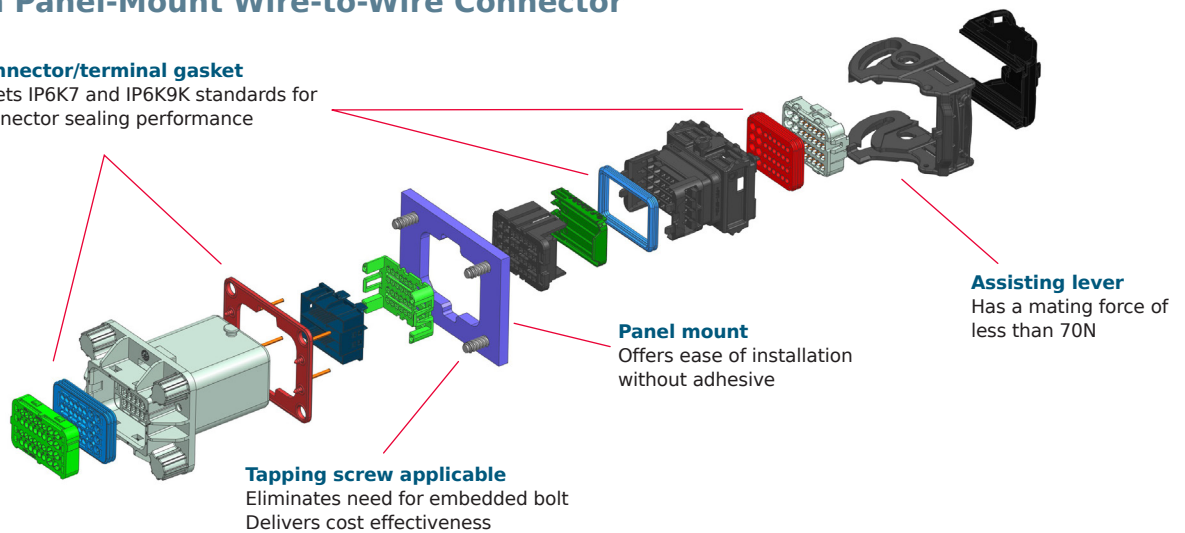


SOLUTION 1
MX150 12-/20-Pin Panel-Mount Wire-to-Wire Connector



Product Series		
	Male Plastic Housing	Female Plastic Housing
20-circuit	214468-2009	160074-000x
12-circuit	47725-90x0	160074-600x

SOLUTION 2
CMC 32-Pin Panel-Mount Wire-to-Wire Connector

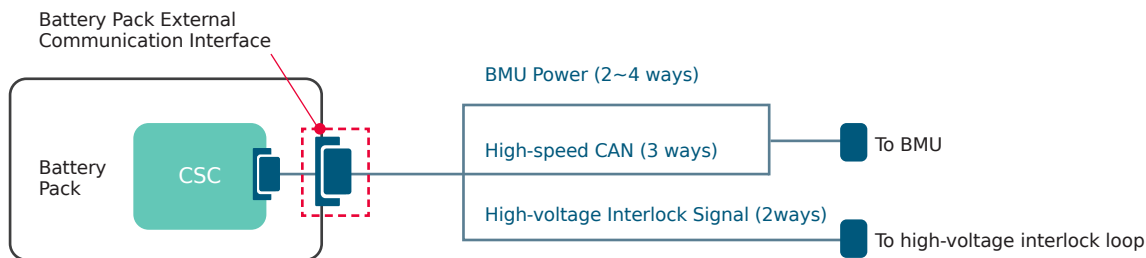


Product Series		
	Male	Female
0.64mm terminal (x24)	501827-0101	64322-10x9
1.50mm terminal (x8)	501828-01x1	64323-10x9
Plastic housing	501820-3231	64319-x211

The BMU is located on the outside of a battery pack for battery systems in the bus and some of the small passenger vehicles. In those applications, the slave controller for battery management within the battery pack needs to be supplied by BMU via the battery pack external connector, and uploads the cell voltage and temperature signals that are sampled in real time to the BMU via CAN bus.

Connector design requirements:

- Installation and connection method: The external communication connector for a battery pack is mounted on the battery pack housing through panel mount and is paired on a wire-to-wire basis.
- Connector must be dust proof and waterproof.
- The battery pack is mounted onto the vehicle chassis, which has a harsh operating environment, so the connectors must reach the protection ratings of IP67 and IPX9K.
- The external communication interface for a battery pack requires 5 signal pins and 2 to 4 power pins (12 or 24V, 5.0A max.) in total.



SOLUTION

MX150 12- and 20-Pin Panel-Mount Wire-to-Wire Connector

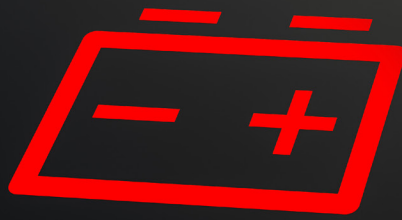
Panel mount
Provides ease of installation without adhesive

Optional tapping screw or embedded bolt versions
Affords flexibility of choice, high cost-effectiveness, easy to assemble/disassemble

Both male and female plastic housings with up to UL94 V0 flame retardation
Meets safety standards

Connector sealing washer
Meets IP67 and IPX9K standards for sealing performance of connector system upon mating

Product Series		
	Male Plastic Housing	Female Plastic Housing
20-circuit	214468-2009	160074-000x
12-circuit	47725-90x0	160074-600x



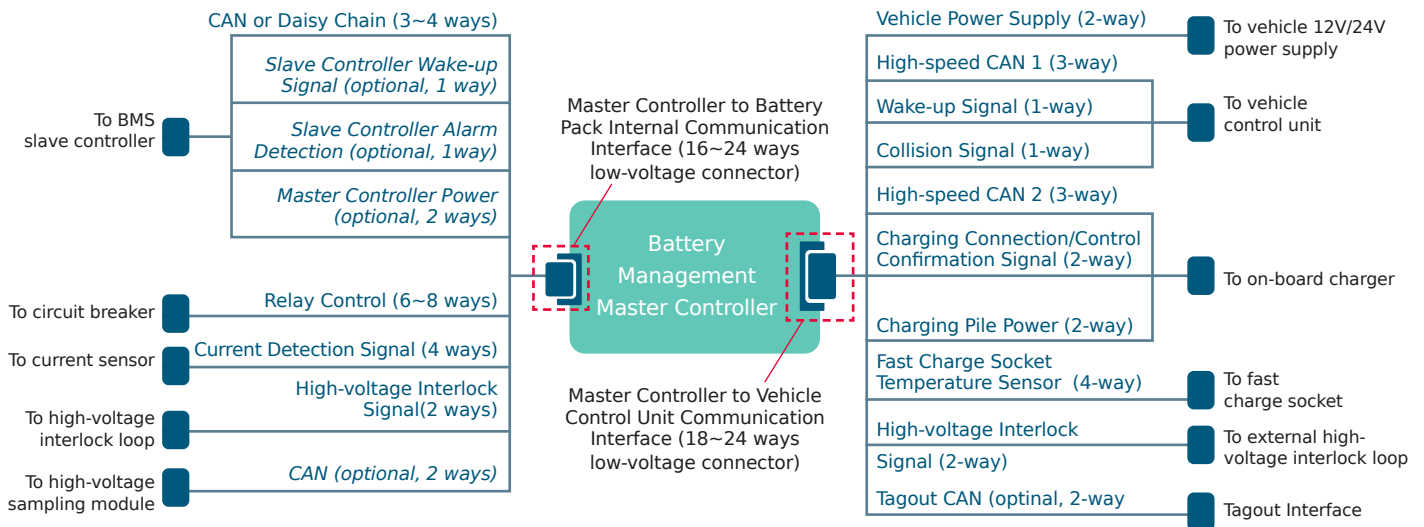
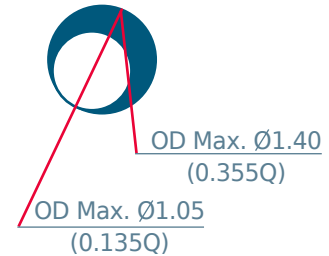
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BMU COMMUNICATION INTERFACE

The BMU is the core control unit for a battery pack. Internally, it communicates with a slave controller via a CAN bus or daisy chain (or is directly connected to the cell sampling circuit). It also monitors cell voltage and module temperature in real time, and it outputs relay switching signals to the circuit breaker. Additionally, it manages the charging and discharging status for the battery pack and oversees total voltage, total current and the state of insulation for the battery pack. Externally, the BMU engages in information interaction with the VCU and OBC, it and it receives the charging and discharging commands from the VCU and OBC for the battery pack.

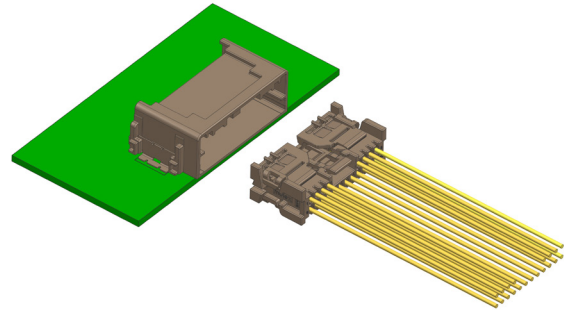
Connector design requirements:

- Small footprint: slim and compact design
- Lightweight: suitable for small-diameter conductor (0.13mm² conductor)
- Safety: UL V0 flame retardation
- Ergonomics: ease of assembly with polarization
- Pin requirement: 16 to 24 pins for internal communication, 18 to 24 pins for external communication



SOLUTION 1 Mini50 16-, 20- and 24-Pin Connector

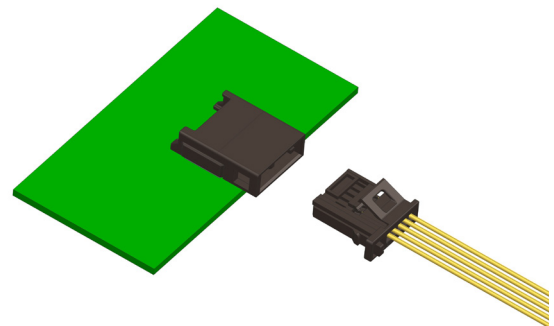
- 12.17mm connector height
- Physical polarization with gray, black and dark gray color options for visualized fail-safe management
- Optional SMT/through-hole mounting
- Connector secondary lock for 100N locking force minimum
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 specification listed
- CTX50 0.50mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively



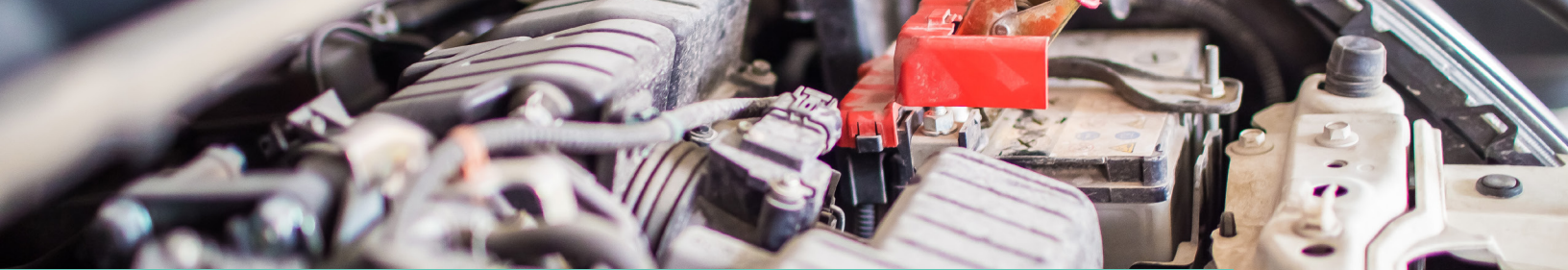
Product Series	
Female plastic housing	34824-XXXX
Male sockets	34826-XXXX (HB, through-hole welding) 34897-XXXX (HB, SMT) <i>Consult Molex sales engineer for V0 version</i>

SOLUTION 2 ConnTAK50 20- and 22-Pin Connector

- 10.49mm connector height
- Physical polarization with gray, black, blue and purple color options for visualized fail-safe management
- SMT mounting
- Optional connector secondary lock (occupying 2 pins)
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 and LV214 specification listed
- TAK50 0.50mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively



Product Series	
Female plastic housing	205825-XXXX (without secondary lock) 205826-XXXX (with secondary lock)
Male sockets	206958-XXXX

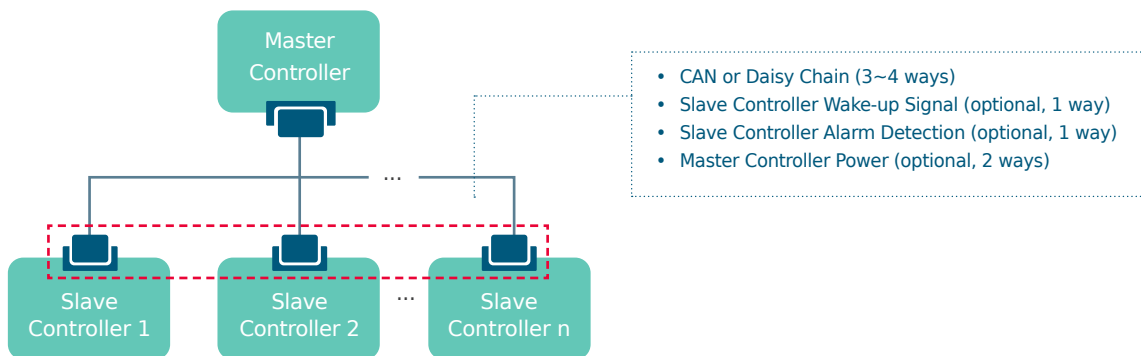
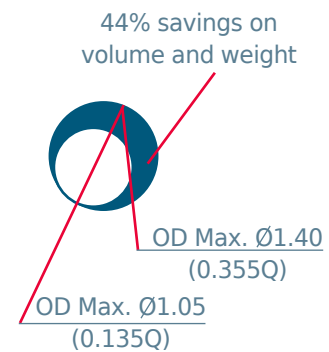


SLAVE-CONTROLLER-TO-MASTER-CONTROLLER COMMUNICATION INTERFACE

The battery management slave controller is utilized in the distributed battery management system, which collects cell voltage and temperature in real time with cell sampling FPC. It also converts the voltage and temperature information to digital signals and then transmits the signals to the battery management system's master controller via CAN bus or daisy chain communication protocol.

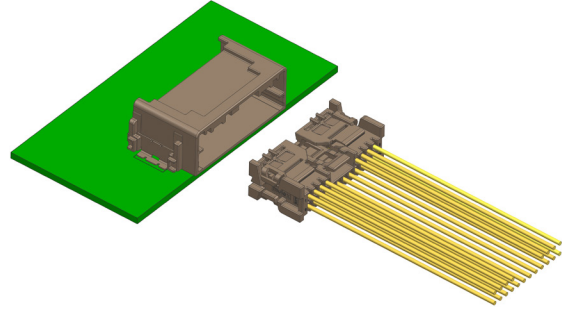
Connector design requirements:

- Small footprint: slim and compact design
- Lightweight: suitability for small-diameter conductor (0.13mm² conductor)
- Signal pins needed: 3 to 8 pins
- Safety: UL V0 flame retardation



SOLUTION 1
Mini50 4- and 8-Pin Connector

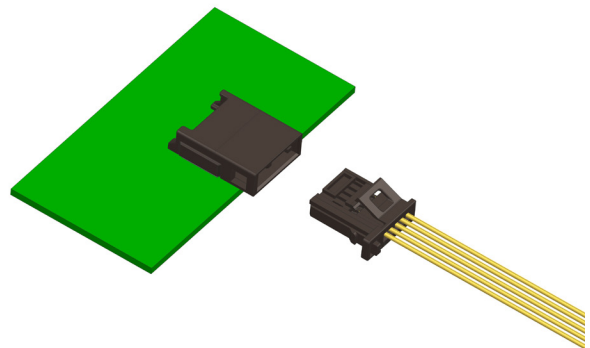
- 9.94mm connector height
- Physical polarization with gray, black and dark gray color options for visualized fail-safe management
- Optional SMT/through-hole mounting
- Connector secondary lock for 100N locking force minimum
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 specification listed
- CTX50 0.50mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively



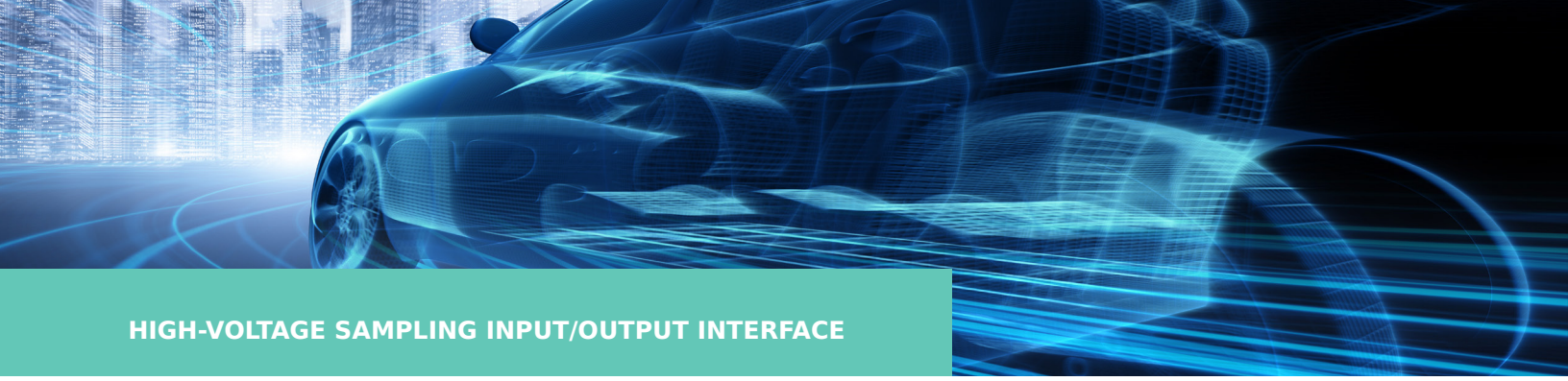
Product Series	
Female terminal	560023-04XX
Female plastic housing	34791-XXXX
Male socket	215426-XXXX (V0, through-hole welding) 34793-XXXX (HB, through-hole welding) 34912-XXXX (HB, SMT) <i>Consult Molex sales engineer for V0 SMT version</i>

SOLUTION 2
ConnTAK50 2-, 3-, 4-, 5- and 6-Pin Connector

- 6.05mm connector height
- 2 to 6 pins for flexibility of selection
- Physical polarization with gray, black, blue and purple color options for visualized fail-safe management
- SMT mounting
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 and LV214 specification listed
- TAK50 0.50mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively



Product Series	
Female terminal	200096-0XX1
Female plastic housing	205827-XXXX
Male socket	208034-XXXX



HIGH-VOLTAGE SAMPLING INPUT/OUTPUT INTERFACE

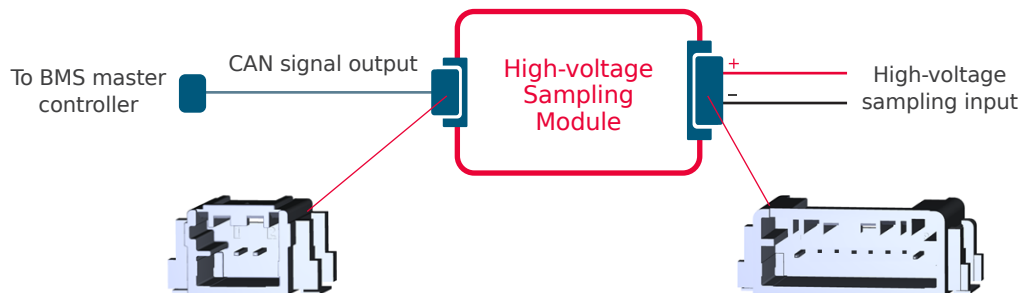
The high-voltage sampling module provides real-time monitoring of high-voltage busbars. It converts high-voltage analog to digital signals and then transmits these signals to the battery management system's master control panel via CAN bus.

Connector design requirements:

- Small footprint: slim and compact design
- Safety: UL V0 flame retardation
- Lightweight: suitability for small-diameter conductor (0.13mm² conductor)
- Signal pins needed: Input interface: 2 pins (300 to 700V DC high-voltage sampling signal); Output interface: 2 pins (CAN bus)

SOLUTION 1

Mini50 8- and 2-Pin Connector



High-voltage sampling output: Mini50 2-Pin Connector

- 9.94mm height only
- Connector secondary lock for 100N locking force minimum
- Mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 specification listed
- CTX50 0.50mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively

High-voltage sampling input: Mini50 8-Pin Connector

Pin application, 14.00mm spacing between left and right terminals, meeting the Class 3 pollution requirement in IEC 60664-1 and the creepage distance requirement at 1000V

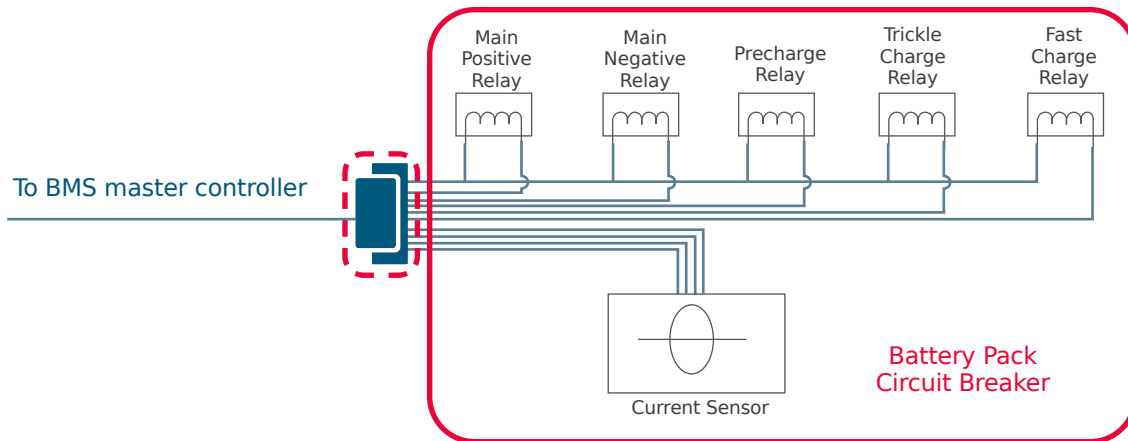
Product Series	
Female terminal	560023-04XX
Female plastic housing	34791-XXXX
Male socket	34912-XXXX (HB version) <i>Consult Molex sales engineer for V0 SMT version</i>

CIRCUIT BREAKER INTERFACE

The battery pack circuit breaker provides integration of multiple relays and current sensors. The battery management system's master controller controls the closed state of the relays by using switching signals, allowing the switching of charging and discharging states of the battery pack. Meanwhile, the master controller reads out current sensor signals and monitors the charging and discharging current.

Connector design requirements:

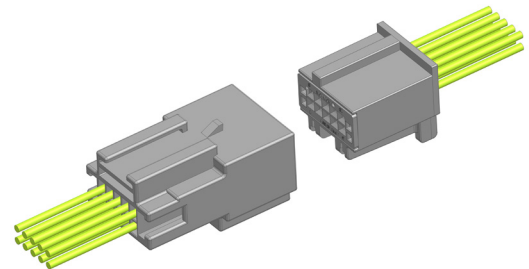
- Small footprint: fit for compact mounting space
- Signal pins needed: 10 to 12 pins (i.e., relay control: 6 to 8 pins; current sensor: 4 pins)
- Pairing: wire-to-wire connector



SOLUTION

HDAC64 10- and 12-Pin Connector

- Wire-to-wire connector; card slot available for securing harness
- Mating force less than 70N
- USCAR-2 specification listed



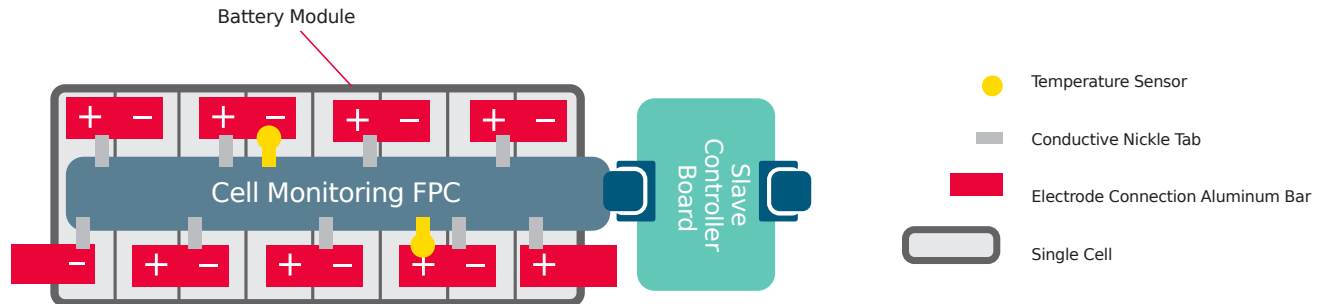
Product Series	
Female plastic housing	30700-XXXX
Male plastic housing	30968-XXXX
Male and female terminals	Consult Molex sales engineer

CELL VOLTAGE/TEMPERATURE MONITORING CONNECTOR

Several individual battery cells form a battery module with a specific method, in series or in parallel, in a battery pack. The cell monitoring circuit provides real-time sampling and monitoring for the voltage and temperature of individual cells. The battery management system switches over working status of battery packs according to the monitoring data and provides balancing control over the cell life. When a cell encounters accidents, such as thermal runaway, the battery management system cuts off the circuit according to established procedures, reducing the loss. It then reports the fault to the VCU on a timely basis, acquiring valuable escape time for people in the vehicle. In this application, an unsealed wire-to-board connector with large pin count transmits signals. In terms of its footprint, a miniaturized connector is a very effective solution for maximum space savings for the good of the cell module.

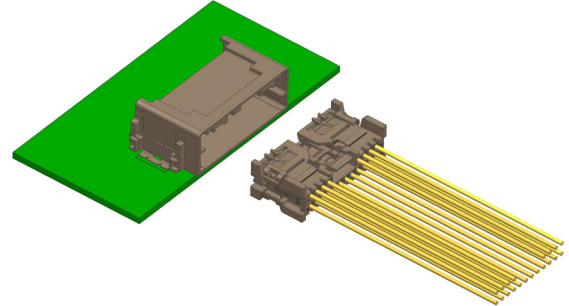
Connector design requirements:

- Small footprint: connector height no more than 10.00mm
- Short circuit proof: connector terminal protection is designed to avoid accidental short circuit
- Signal pins needed: 12-channel monitoring chip: 24 pins 18-channel monitoring chip: 32 pins
- Safety: UL V0 flame retardation



SOLUTION 1
Mini50 12-, 16-, 20-, 24-, 34-, 38-Pin Connector

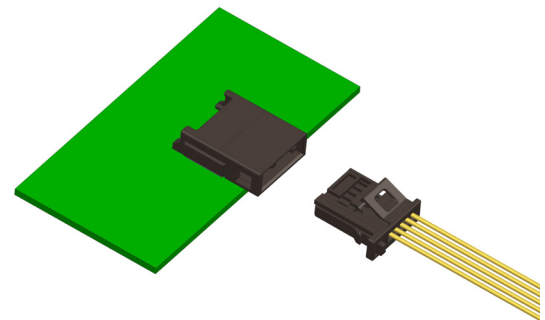
- 12.17mm connector height
- Physical polarization with gray, black and dark gray color options for visualized fail-safe management
- Optional SMT/through-hole mounting
- Connector secondary lock for 100N locking force minimum
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 specification listed
- 3-row design for 34/38 pins version, saving PCBA footprint
- Splicing design for 34/38 pins version, with splicing of up to three interfaces supported and scalable up to 114 pins



Product Series	
Female plastic housing	34824-XXXX, 34959-XXX
Male socket	(HB, through-hole welding) 34897-XXXX (HB, SMT) 34961-XXXX <i>Consult Molex sales engineer for V0 version</i>

SOLUTION 2
ConnTAK50 20- and 22-Pin Connector

- 10.49mm connector height
- Physical polarization with gray, black, blue and purple color options for visualized fail-safe management
- SMT mounting
- Optional connector secondary lock (occupying 2 pins)
- Connector mating force less than 70N
- UL V0 flame-resistant material
- USCAR-2 and LV214 specification listed
- TAK50 0.5mm miniaturized terminal suitable for 0.13mm² conductor, reducing harness weight effectively



Product Series	
Female plastic housing	205825-XXXX (without secondary lock) 205826-XXXX (with secondary lock)
Male socket	206958-XXXX

Stay tuned for the upcoming 32- and 36-pin series.

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