TECH BRIEF

LIGHT-EMITTING DIODE (LED) HEADLAMP **SYSTEM CONNECTORS**

Since the automotive manufacturer Lexus first introduced LED light sources for low beam lights in 2006, LED use as a light source has developed rapidly in various industries. LED lighting systems offer high brightness, long-life service, reliable performance, energy savings and many other advantages. Today, the use of LED headlamps is standard for many medium- and high-configuration vehicle models. This technology has also penetrated the market for various low-configuration models. As vehicles become safer and smarter, LED headlamp systems continue to evolve, undertaking more functionalities such as ADB, AFS and the integration of multiple sensors as part of the autonomous driving system. It is anticipated that the rapid development of uses for LED headlamp systems will continue its momentum, and these types of systems will soon be used in an even wider range of applications.

An LED headlamp system is a module comprised of various electrical components that include many connectors. Those connectors are divided into two categories in terms of their application location: the LED drive (controller) connector and the LED lamp panel connector. As the LED headlamp evolves, new requirements and challenges arise for the connectors used within them. Those requirements are primarily of interest in two aspects: first, the pins for LED drive (controller) connector are increasingly in demand mainly due to the influence of additional functions and the trend of integration; second, the connector footprint is increasingly shrinking and the shape for LED headlamps is becoming more diversified. In recent years, the appearance of headlamps have become “sharper,” resulting in more internal space restrictions in the headlamp.

Restricted Internal Space of Lampshade

The internal circuit for the LED headlamp system could be divided into two categories: the drive (control) circuit and the lamp panel circuit. The latter has the following requirements:

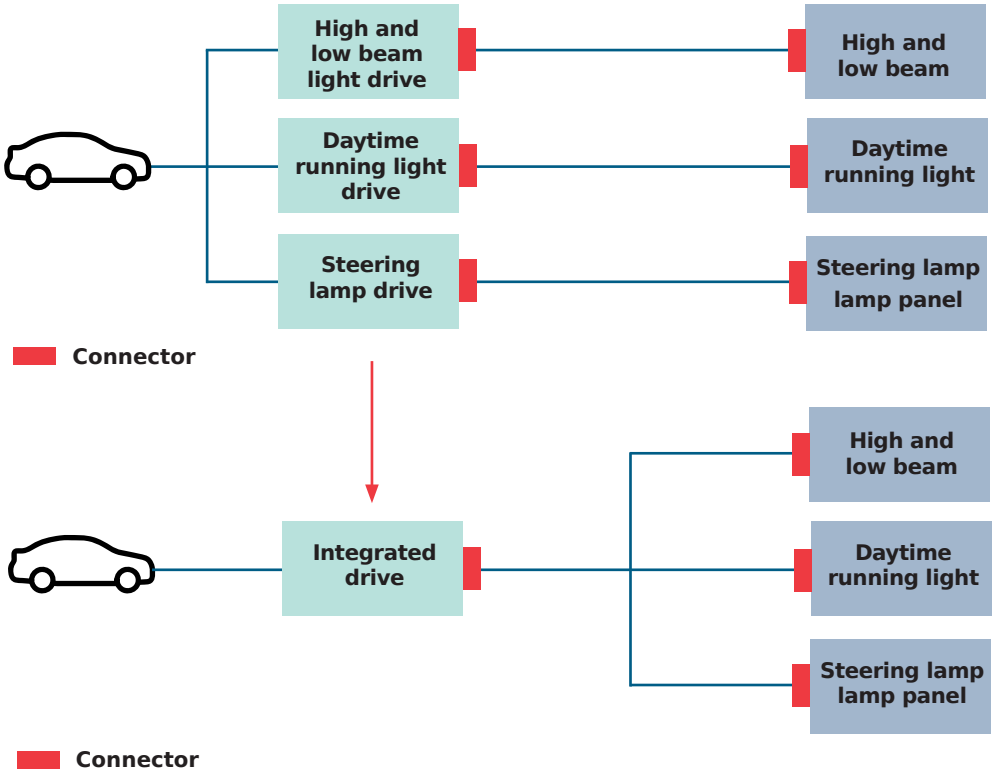
- Compact connector construction, due to the flat shape of the car light that occupies the internal space
- Low connector profile due to the combination of multiple PCBs or FPCs required by the 3-dimensional curves typically found in most daytime running lights
- Specific type of connection called for between lamp panels, with 2 to 8 pins needed
- Separate control over individual LED lamp beads for waterfall steering lamp, with 6 to 15 pins
- Improved PCB utilization and welding productivity

Increased Connector Current Rating and Number of Pins

The internal connectors for car lamps have an increasing demand for the number of pins, especially in terms of the drive or control circuits, which are expected to need more than 30 pins.

- Penetration of ADAS feature into ADB/AFS
- Matrix headlamp system with motor control
- Increased power requiring greater current-carrying capability of the connector

Integrated drives can save internal spaces and reduce the number of parts and components needed for the LED headlamp, saving module costs, reducing fault rates and shortening development cycles.



The Demand for a Reliable Connection

The complex operating environment for the connectors within a car light includes:

- Vehicle vibration, thermal shock, high temperature and humidity
- An operating temperature of at least 105°F, required because of LED heat dissipation
- Sufficient mechanical strength

The connector, therefore, must be subject to rigorous tests, to help ensure reliable electrical connections in various environments and work conditions.

DuraClik Connectors

Smaller footprint
- Lower profile – single row of pin design on DuraClik, with only a 6.40mm overall height
- Narrower, 2.00mm pin spacing, embedded weld aid leg, further reducing the width

SMT welding
- Improved PCB utilization with the back panel freed up
- Reflow process with greater welding efficiency

Sufficient pin options
- Specific pin options without waste of any single pin
- 2 to 15 pins, with products available for each pin number

Mini50 and stAK50h Drive (Controller) Connectors

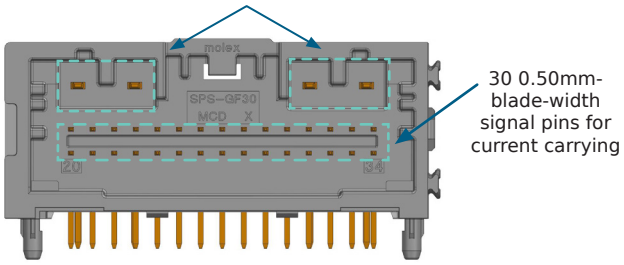
Smaller footprint, larger pin counts, higher current-carrying capability

Integrated Controller Solution 1

Mini50 34-Pin Mixed-Pin Connector

- One of the smallest 0.50mm terminal system in the industry with a reduced connector footprint
- Mixed pin design, with 4 large current pins for providing greater current-carrying capability for power and grounding purposes
- Through-hole reflow support, reducing overall process cost

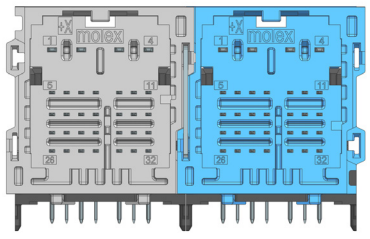
A 1.20mm blade width power pin with 16.0A current-carrying capability for the output of module power, ground and high- and low-beam



Integrated Controller Solution 2

stAK50h Mixed-Pin Connector

- 0.50mm terminal system and mixed pin design combining 1.20mm terminal system
- 5-row terminal layout utilizing longitudinal space with as many as 64 pins, providing more pins while saving PCB footprint room
- Through-hole reflow supported, reducing overall process cost



Automotive Grade Connectors for Widespread LED Headlamp Applications

- Mini50 Connectors are engineered per USCAR-2 standards, and stAK50h connectors are engineered per GWM3191 standards, with rigorous mechanical, electrical and environmental tests passed
- DuraClik ISL version validated through LV214, with up to 125°F temperature resistance
- Mini50 and DuraClik Connectors are both equipped with terminal secondary locks for enhanced terminal retention
- Solder tabs for improved connector retention

MX150 — LED HEADLAMP ASSEMBLY EXTERNAL INTERFACE CONNECTOR

In addition to the unsealed connectors used on lamp panels and controllers, an LED headlamp assembly also needs a sealed connector as an external interface for the assembly. The headlamp assembly needs to be IPX7- or IPX9K-rated in terms of sealing performance, since it will be mounted in the wet zone of a manufactured vehicle.

MX150

Convenience for Headlamp Assembly Installation

The casing for a headlamp assembly is often injection-molded; therefore, the external interface connector is required to achieve seal fit into the assembly casing appropriately. The twist-lock version of MX150 is specifically designed for the headlamp. The twist-lock method provides the following advantages:

- The connector is installed from the outside in, so the connector seal ring can be fully blocked by plastic casing without any accidental damage, and any slot that may accumulate water can be eliminated accordingly
- The rotary mounting operation provides ease of installation without the need for any other parts such as screws or clips, helping ensure efficient connector assembly
- Rotary clip interface design inhibits stress relaxation of the clip, providing greater connection reliability

In addition, the female connector has a waterproof design with a self-contained sealing gasket, protecting the sealing ring clamp and enhancing the productivity of the harness.

Superior Sealing Performance

Sealing performance marks an important performance indicator for the external interface connector of a headlamp assembly. MX150 Connectors have a stable sealing construction design from Molex, and its product performance has been validated through GMW3191, so the sealing performance can still be measured through a variety of environmental tests for the connector, including high temperature and humidity, thermal shock, long-time aging, etc. The sealing rating maximum is S3, the highest standard, which meets extreme sealing requirements such as high-pressure water jetting.

Product Part Numbers

6-hole: 34840-3410
8-hole: 34840-4410
12-hole: 34840-6410
16-hole: 34840-8410

Mini50 Connectors

Board End S/Ns	Harness End S/Ns	Terminal Rows	Board End Direction	Type of Pins	Pins
34792	34791	Single row	Vertical	Through hole	4, 8
34793					
34912			Horizontal	SMT	2, 4, 8
34825	34824	Double row	Vertical	Through hole	12, 16, 20, 24
34826					
34897			Horizontal	SMT	
34958	34959	Triple row	Vertical	Through hole	34, 38
34961			Horizontal		

PERFORMANCE PARAMETERS

Terminal Plating	Tin
Contact Resistance (max.)	20 milliohms
Current-carrying Capability	4.0A
Crimping Diameter	0.13 to 0.35mm

Operating Voltage	14V
Operating Temperature	-40 to 105°F
Vibration Level	USCAR-2 V1
Insulation Resistance (min.)	100 Megaohms

DuraClik Connectors

Board End S/Ns	Harness End S/N TPA	Harness End S/N ISL	Board End Direction	Type of Pins	Pins
502352	505151	560123	Horizontal	SMT	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
560020			Vertical		

PERFORMANCE PARAMETERS

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Insulation Resistance (min.)	100 Megaohms

stAK50h Connectors*

Connector Pins	0.50mm Pins	1.20mm Pins	Board End Connector Part Numbers		Harness End Connector Part Numbers
			Vertical	Horizontal	
27	19	8	2005010271	2005020271	1600290011
28	21	7	2005010281	2005020281	1600140011
32	28	4	2005010321	2005020321	1600280011

* stAK50h series allows free splicing on the board end, on which several other board ends can be spliced into a connector

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Астрахань (8512)99-46-04
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