

ULS – Aluminium Housed Resistors Product Specifications



ABOUT

The ULS product series of Ultra Low Profile Slim Power Resistors is the latest product offering from KWK Resistors. These Aluminium housed wire wound resistors are designed for applications which demand extremely small form factors of the resistive element.

This document covers the various design, production and application specifications of the product range. The unique positioning of this product in the market and the challenges overcome during the design are also discussed. Detailed Technical Specifications, Standards and compliance are listed in the Appendix.

This document is meant for disseminating information on the ULS Power Resistors product range to the design, manufacturing, sales and support teams of electrical equipment vendors.

Market Positioning

Power resistors are used in a wide variety of applications. They come in various models depending on the wattage, resistance and physical dimensional requirements. KWK already has an existing range of power resistors in the product range.

Original requirement

Mahindra Electric Mobility Limited approached us with a specialised requirement for a power resistor with a very small profile size dimension, to be used in their Electric Vehicles. This was for a bulk order completion to be delivered as per the request of the Government of Delhi.

As part of the pre-charge circuit in the Electric Vehicles Design, there was a requirement for a pre-charge resistor to limit the inrush current. This resistor would perform the critical function of withstanding high pulse energy and

safeguarding the internal circuits and motor from damage.

As end consumer products like EVs give high priority to compact size, sleek appearance and continuously improving performance, an agreement was made to design a completely new resistor product for this purpose.

Ultra Low Profile Resistors From KWK

KWK team came up with the design for a brand new Ultra Low Profile – Slim Resistor product for their requirement.

The ULS resistor has the distinction of being one of the slimmest power resistors in the market across the world. It comes with a 6mm profile thickness encased in a sleek and sturdy Aluminium body.

The ULS series of Ultra Low Profile Power resistors was introduced into the market in 2019. Since then the ULS resistors range has found wide application in Electric Mobility, Power Electronics, Automation / Test equipment, Drivers, Frequency Converters, Medical Electronics and Industrial Automation.

Product Overview



KWK Resistors is a global market leader in resistor solutions with satisfied customers all over the world. High power resistors, Braking resistors, Thin Film, Wire wounds, Punched Grids, Metal Clad resistors – whatever the type of resistor solutions customers are looking for are available. Solutions can cater to a broad spectrum of resistance requirements – from a fraction of a watt to hundreds of kiloWatts.


With world class Resistors design and manufacturing capabilities in-house, KWK excels in understanding customer's needs and delivering customized solutions to suit them perfectly. An industry pioneer with over 40 years of experience, KWK resistors is a Joint Venture between three leading Power Resistor manufacturers – K S Instruments Pvt Ltd India, Krah Group Germany, and Widap Switzerland.

ULS Series

ULS series are Ultra Slim Power Resistors where the resistive element is encased in an ultra-slim Aluminium profile. They are wire wound resistors with a metallic wire wound around a non-conductive core. The ULS series are the world's slimmest Power Resistors in the Wire Wound Type.

The wire conductor is made of high quality alloy materials suited for the resistance requirements. The resistance is wound around a durable, insulating ceramic core with good thermal properties.

These resistors are typically suited for low frequency applications which require high precision of resistance values. The resistance offered depends on the length and diameter of the wire. Longer wires offer higher resistance as transmission loss in the current is higher. Wider wires offer lesser resistance as current flows easily with greater surface area. To create a high resistance, the wire diameter needs to be very small and the length very long. Since these parameters can be accurately controlled, high precision can be achieved.



The ULS is designed to have medium to high energy capacity for a metal clad resistor, decent range of resistance values and a good electrical insulation. This makes it very useful in high power, high accuracy applications such as electrical vehicles, pulsed operations, discharge applications and test/measurement equipment.

Product Features:

- Ultra Slim, about 6mm profile thickness
- Resistance range supported : 3.3Ω – 1KΩ
- Best suited in applications where space really matters
- Sturdy and sleek Aluminium body
- Excellent short term overload & continuous power performance
- Excellent Electrical stability, reliability and mechanically very rigid
- CE Marking for export market
- UL approved cables used for terminations
- RoHS compliant product
- Have good environmental protection – IP60
- Customizable terminations upon customer request

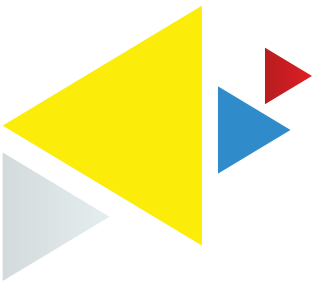
Product Variations

ULS 50

- Wire wound resistors with 50W power rating
- 50mm length, 75mm width and 5.7mm thickness

ULS 100

- Wire wound resistors with 100W power rating
- 100mm length, 75mm width and 5.7mm thickness





Customer Quip!

A senior customer representative of one of our esteemed customers made this interesting observation on seeing the sleek and stylish design of the ULS Product Range for the first time. He was on a visiting tour of our manufacturing unit in Bengaluru, India.

“IT LOOKS LIKE AN IPHONE!”

Delta Electronics

MNC with business in varied applications such as Wind Energy, Drives, Railways and Power Electronics

Design Considerations

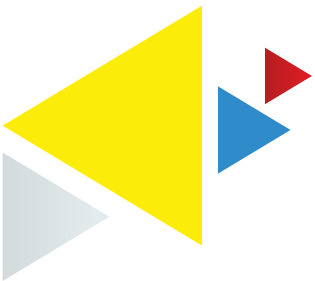
It has been designed to push the profile size to a bare minimum. The ULS has a profile height of under 6mm making it one of the thinnest metal clad resistors available.

With the ever evolving design forms of new electrical equipment pushing higher specifications in smaller form factors, we believe the ULS will help in this direction.

The ULS is designed to have medium to high energy capacity for a metal clad resistor, decent range of resistance values and a good electrical insulation.

The Ultra-low profile of ULS power resistors is visibly smaller compared to other regular catalogue products. The round ceramic core for winding was not suitable for these resistors since it cannot be inserted inside the slim Aluminium profile. So the complete design for winding the element and material construction was different and newly designed especially for this product. The resistance wire is wound on a suitable slim non-conductive former for the ULS.

The design team successfully met the challenge of designing the resistor element suitable for the ultra slim profile, meeting all electrical parameters required.



Design constraints due to ultra-low profile size

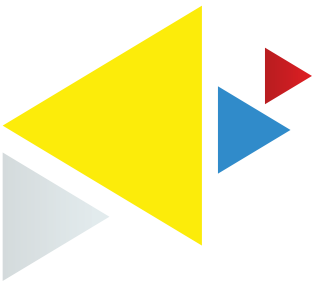
1. Restricted Ohmic value supported ranges between 3.3Ω to 1K ohms. This is in contrast with our other product ranges with slightly higher profile size (KHA series – 0.01 ohms to 100K ohms, KABR series – 0.02 to 1K ohms).
2. Slightly limited energy capacity compared to slightly bigger profiles in our product range.
3. Insulation level is limited up to 2.5KV AC RMS, whereas on a normal higher profile resistor it would be greater than 10KV AC RMS depending on the profile and application.

Production Challenges

Developing a die for the Aluminium Housing was a challenging task because of the extremely low profile and thickness. However, the KWK team successfully developed the low profile housing and a new former suitable for this profile.

The initial order size was on a large scale with urgent delivery deadlines. The entire lifecycle from design, production, testing to delivery was completed in record time. The first batch of the ULS resistors were delivered in 2019.

Resistor Selection Criteria





- Product Series +
- Power +
- Resistance +
- Construction +
- Mounting +
- Application +



ULS 50

Ultra Slim Resistors - Aluminum Housed Resistors - 3.3Ω - 1KΩ - 50W - ±150 PPM/°C: ULS - Series

Construction
Wire Wound,

Mounting
Chassis/ Heat Sinkable
Mount, Screw Mount,

Learn More

ULS 100

100 W

3.3 Ω - 1K Ω

Find Resistor

Advance Search →



- Product Series +
- Power +
- Resistance +
- Construction +
- Mounting +
- Application +



ULS 100

Ultra Slim Resistors - Aluminum Housed Resistors - 3.3Ω - 1KΩ - 100W - ±150 PPM/°C: ULS - Series

Construction
Wire Wound,

Mounting
Chassis/ Heat Sinkable
Mount, Screw Mount,

Learn More

KWK Resistors has come up with a set of simple DO-IT-YOURSELF resistor guides for identifying the appropriate resistor for different applications. For instance, the ULS product range will be suggested as the best fit for the given Wattage and Ohmic value ranges.

Explore our website <https://www.kwk-resistors.in> for more on this.

For choosing the right resistor for other applications, we also have some very useful resource utilities on our website:

- BRAKING RESISTOR CALCULATOR
- DISCHARGE RESISTOR CALCULATOR
- RESISTOR FINDER TOOL

Industry application

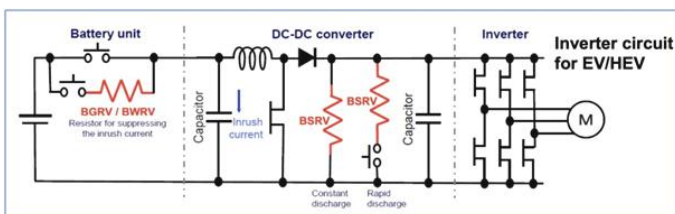
The initial requirement for the ULS product range was in the Electric Vehicles Industry for Pre-charge circuits of Electric Vehicles. However, the ULS resistors range has found wide application in Electric Mobility, Power Electronics, Automation / Test equipment, Drivers, Frequency Converters, Industrial Automation and Medical equipment.


Electric Vehicles

In the Electric Vehicle (EV) industry, High power resistors are used in a variety of applications. Power converters for charging systems, power control units, power distribution units, motor control units and battery modules are the most important uses.

The following circuit diagram shows the original requirement for ULS Power resistors in the pre-charge circuit of Electric Vehicles.

ULS Resistors used for Pre-charge application in Electric Vehicles





A pre-charge resistor is a device that slowly charges the capacitors inside an electronic speed controller before it is powered up. Without this resistor, closing the contactor would generate a large amount of inrush current causing the contacts to arc, resulting in a poor connection and diminish vehicle performance.

Pre-charge and Discharge application is used in Renewable Energy sector too, but with a different circuit diagram.

Applications for ULS wire wound power resistors in the EV and renewable energy industry sectors are listed below:

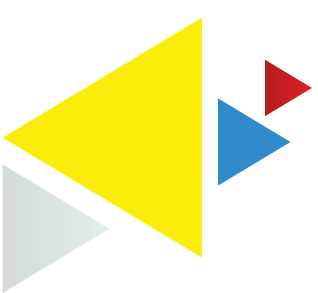
- Converters in charging systems – Pre-charge and discharge resistors
- Variable speed drive systems – Dynamic Braking resistors
- Engine cooling – Resistors with or without a heat sink
- Renewable Energy – Pre-charge and discharge resistors

Industrial Automation

Industrial automation is unimaginable without power resistors. AC Drive panels, Variable Frequency Drives (VFD), Microprocessor Frequency Controllers and Inverters are all devices which employ resistors for motor starting, braking and speed control functions.

Due to high power and high precision capabilities, wire wound resistors are often used for current control applications in industrial automation and heavy equipment. They can be used as circuit breakers or as fuses.

Use of ULS wire wound power resistors in the Industrial Automation sector is primarily for dynamic braking and current control in the circuits. These applications are listed below:

- As load
 - Motor Controller
 - Material Handling
 - Robotics
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- Electric Drive
 - Process Engineering
 - Temperature sensors, Resistor Potentiometers and other test equipment

Power Electronics

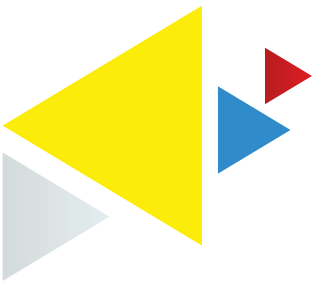
Wire wound resistors find wide application in Power electronics for absorbing motor regeneration power and generating appropriate braking torque from motors. Because of its low profile height, the ULS power resistors can easily be mounted at the back side of a VFC (Voltage Frequency Converter). Specific applications are listed below:

- Frequency Inverters –
- Inverters
- Capacitor Circuits
- Servo Motor Controller
- DC link Application
- Transducers and televisions

Medical equipment

For several equipment used in medical electronics, resistor components provide two critical functions – tolerance to high voltage and surge protection. They are vital to equipment design and their safe, efficient functioning.

ULS power resistors, due to their ultra-slim profile size are very suitable for compact and portable medical equipment, even for home deployment and human contact devices. The resistors find wide application in diagnostic and imaging equipment. Specific applications are listed below:

- Human contact devices – defibrillators, Electro-Cardiogram (ECG) and Electro-Encephalogram (EEG) devices.
 - Imaging systems and diagnostic equipment – X-Ray, CT-Scan, Ultra-sound and MRI scans.
 - Analytical Equipment and Instrumentation – In-vitro devices (IVD) and other laboratory apparatus.
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Preventive Maintenance

Resistors are generally low maintenance parts, provided the right voltage and electrical parameters are always applied.

ULS product range from KWK resistors are designed and extensively tested to withstand the voltage and current ranges as defined in the technical specifications for a continuous application.

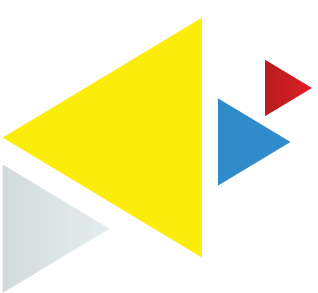
When equipment manufacturers ensure current and voltage regulation, the resistors will work for years without drop in performance, thereby maintaining the life of the equipment too.

Customisations available

Terminals:

- Customisation is possible on the cable length.

Mounting:

- Standard mounting involves simple screw fixing in the defined mounting pitch.
 - Please refer the product series datasheet in Appendix I for mounting pitch of each series (ULS 50 / ULS 100).
 - If the order quantities are considerable, the fixing and mounting of the product can be altered to suit the customer's specific needs.
 - Please use heat sink as recommended in datasheet.
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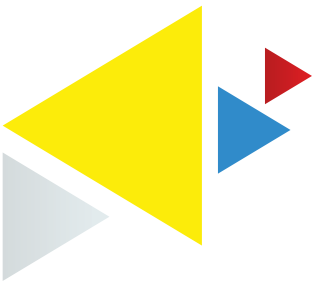


Appendix I – Product Technical Specifications

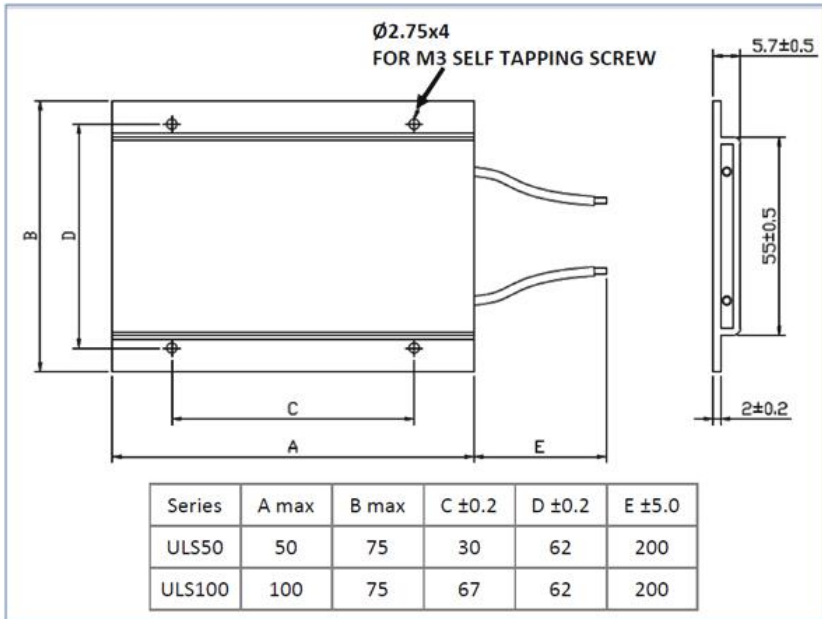
From Datasheet

TECHNICAL SPECIFICATIONS

Rated Power (W)	50W / 100W
Resistance Range	3.3Ω – 1KΩ
Termination type	Cable lead-out
Application	Discharge, Dynamic Braking, Filter Resistors, Anti – Surge / Pulse Withstanding, High Power
Construction	Wire Wound
Mounting	Chassis/ Heat Sinkable Mount, Screw Mount



DIMENSIONS



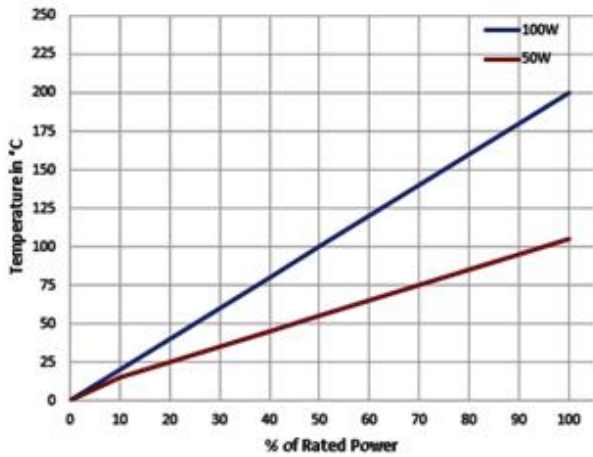
Note: All dimension are in mm.

Disclaimer: Product specifications, data and dimensions are subject to change without any prior notice to improve performance, reliability and design.

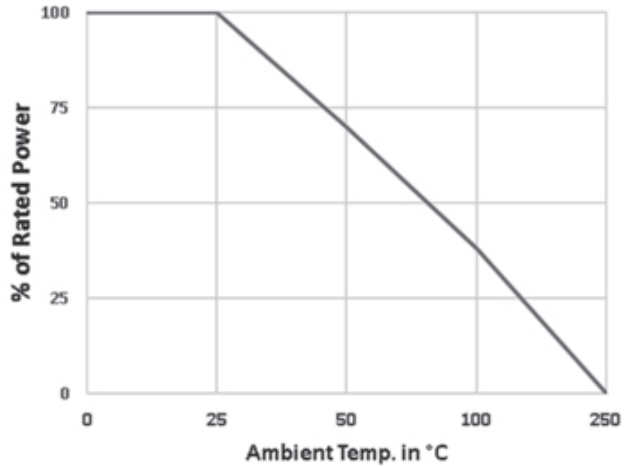
ELECTRICAL SPECIFICATIONS

Characteristics	Condition			Compliance
	Series	With Heatsink	With out Heatsink	
Rated Power	ULS50	50W	25W	@25°C
	ULS100	100W	50W	
Resistance Range	3.3Ω to 1KΩ			
Tolerance	±5% & ±10%			
Temperature Co-efficient				±150 PPM/°C
Insulation Resistance	@500V DC			> 100 MΩ
Short Term Overload	5 x Rated Power for 5sec			ΔR < ±(2% + 0.05Ω)
Dielectric Strength	2500VAC rms for 1minute			No Breakdown or Flashover
Operating temperature	-25°C to 250°C			
Degree of Protection	IP60			
Recommended Heatsink	300(W) x 300 (L) x 3 (H) in mm			

SURFACE TEMPERATURE INCREASE v/s POWER & POWER DERATING CURVE



Temperature Rise Curve (With Heatsink)



Appendix II – Standards and Compliance

- Built as per industry standards world wide
- CE Marking for export market
- UL approved cables used for terminations
- RoHS compliant product
- Have good environmental protection – IP60
- KHA product series is LCSO certified

Authors:



Ashwin Koorgailu

Marketing Director at KWK Resistors India Pvt Ltd

Strategizing sales and marketing requirements, and targets coupled with deep experience in brand management, identifying and establishing Industrial relationships and go-to-market strategies.




Anuradha C

An integral part of the content creation team at KWK Resistors, Anuradha is a corporate trainer in the IT/telecom domain with over 18 years of experience. She served in senior technical and management positions in Huawei and TCS for 10+ years



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