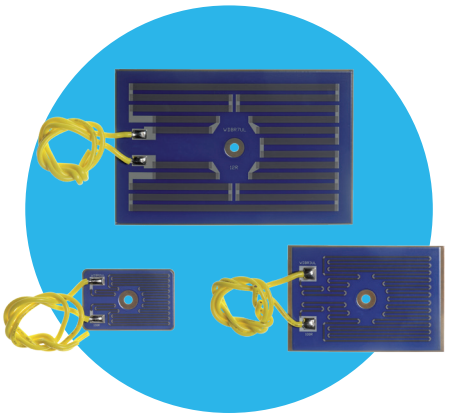
# Resistors

# Ultra Low Profile Power Resistors

**WDBR-UL Series**

- Ultra low profile thick-film on steel
- Up to 7kW peak power
- Single fixing heatsink mountable
- Ideal for dynamic braking, inrush limit and snubber circuits
- Choice of flying lead or solder terminations
- Low inductance design
- High isolation, even after failsafe overload fusing
- RoHS compliant, non-flammable construction
- UL508 certified - UL file E238661



All Pb-free parts comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)

## Electrical Data

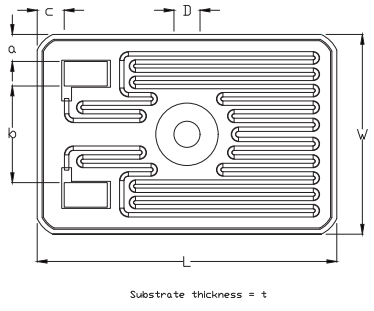
| | | WDBR1UL | WDBR2UL | WDBR3UL | WDBR5UL | WDBR7UL |
|---|---|---|---|---|---|---|
| Resistance range[5] | ohms | 12, 15, 20, 22, 25, 47, 50, 100, 150 | | | | |
| Resistance tolerance | % | 10 | | | | |
| Pulse power rating [1] | kW | 1.5 | 2.0 | 3.5 | 5.0 | 7.0 |
| Power rating on heatsink [2] | W | 170 | 190 | 240 | 250 | 260 |
| Power rating on fan-cooled heatsink [3] | W | 660 | 740 | 850 | 950 | 1410 |
| TCR | ppm/°C | < +600 | | | | |
| Maximum element temperature | °C | 450 | | | | |
| Ambient temperature range (heatsink) | °C | -55 to +200 | | | | |
| Dielectric withstand [4] | V (dc/ac peak) | 2500 | | | | |
| Inductance (typical) | µH | <3 | | <4 | <5 | <6 |

Notes:
1. For details of pulse condition see Fig. 1 in Performance Data.
2. Mounted on a 0.53°C/W heatsink with no forced air cooling, air temperature 25°C.
3. Mounted on a 0.53°C/W heatsink with 5m/s forced air cooling, air temperature 25°C.
4. Based on 100% production test, duration 2s minimum
5. Other ohmic values upon request

## Physical Data

Dimensions in mm, weight without terminations in g

| | L ±0.25 | W ±0.25 | t ±0.1 | ΦD nom | a ±1 | b ±1 | c ±1 | Wt. nom |
|---|---|---|---|---|---|---|---|---|
| WDBR1UL | 49.3 | 35.9 | 0.9 | 3.2 | 4.2 | 17.6 | 4.2 | 12.6 |
| WDBR2UL | 61 | 40.6 | | 5.3 | 5.5 | 19.7 | 5.5 | 17.1 |
| WDBR3UL | 101.6 | 70 | | | 14.5 | 24.8 | 10.1 | 50.8 |
| WDBR5UL | 122 | 70 | 1.5 | | 15.3 | 27 | 8.6 | 101.2 |
| WDBR7UL | 152.4 | 101.6 | | | 39.3 | 10.7 | 11.8 | 181.8 |



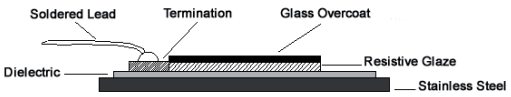

Fixing hole is located centrally.

In addition to the central fixing hole, WDBR7UL has two corner holes. These are present for manufacturing purposes only and should not be used as fixing holes.

### Construction

A high integrity dielectric layer is applied to a machined stainless steel substrate. Thick-film conductor and resistor patterns are printed and fired, then protected with a high temperature overglaze. The termination pads are tinned with solder and optional leads are soldered on.

**Construction Cross Section**




**General Note**

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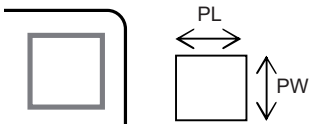
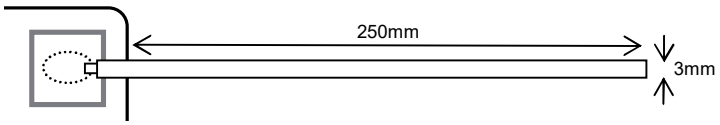
### Terminations

The following termination options are available

| Option | Code | Nominal Dimensions (mm) |
|---|---|---|
| Solder pad only [1] | I |  |
| Flying leads, UL3134/5, 40A, 600V | L |  |

| WDBR-UL Size | 1 & 2 | 3 | 5 & 7 |
|---|---|---|---|
| Pad Length, PL | 8.8 | 8.1 | 9.1 |
| Pad Width, PW | 5 | 8.1 | 6.1 |

Notes:
1. Two options exist for solder type. The standard is SnAg (96SC) which is Pb-free and the second (HT) is high temperature HMP alloy which is Pb-bearing. Both are RoHS compliant, but the second relies on the RoHS exemption for high temperature solders and is targeted at specialist high temperature applications.

## Thermal Performance

| | | Maximum |
|---|---|---|
| Pulsed load at full pulse power rating 50,000 cycles (see Fig 1)<br>Mounted on a 0.53°C/W heatsink with 5m/s forced air cooling, air temperature 25°C. | ΔR% | 5 |
| Derating at heatsink temperatures >160°C | | See Fig. 2 |

Fig. 1: Duty Cycle Waveform

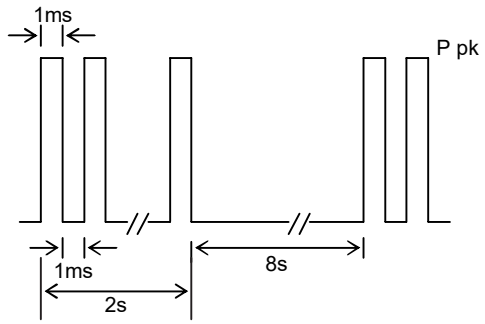
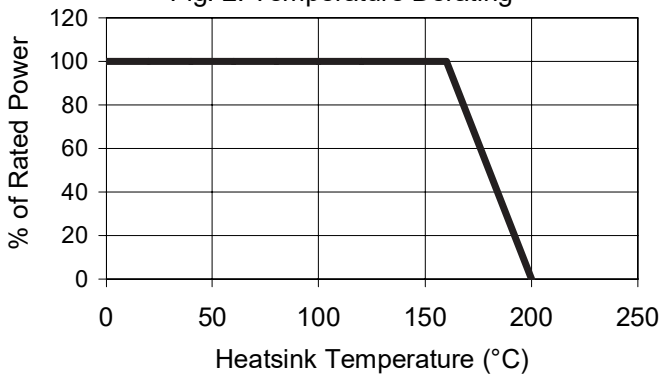



Fig. 2: Temperature Derating



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# Application Notes

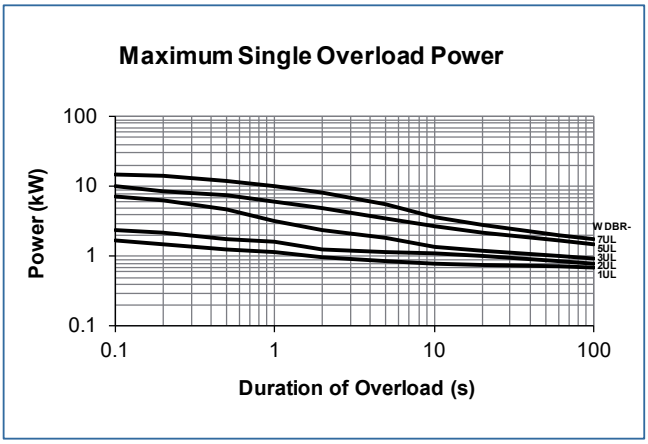
A heatsink with thermal resistance ≤0.53°C/W will enable the component to operate at its continuous power rating. Sufficient thermal grease (e.g. Dow Corning DC340) to give void-free coverage, or a 0.5mm thick compliant thermal pad (e.g. T Global TG-X) should be used and the heatsink should have a surface finish of <6.3µm with flatness of <0.05mm. The resistor should be mounted using an appropriate bolt as listed in the table below. This should be tightened so as to bring the whole area of the steel substrate into intimate contact with the heatsink. The unmounted part is slightly bowed so that the centre is above the edges. Inadequate tightening will leave the centre out of contact with the heatsink, whilst over tightening can cause the edges to rise. The tightening torque required will depend on the fixings and heatsink used, but typical figures are given for guidance. WDBR-UL resistors will fail safe (open circuit) under overload fault conditions and still maintain a 1kV dielectric withstand.

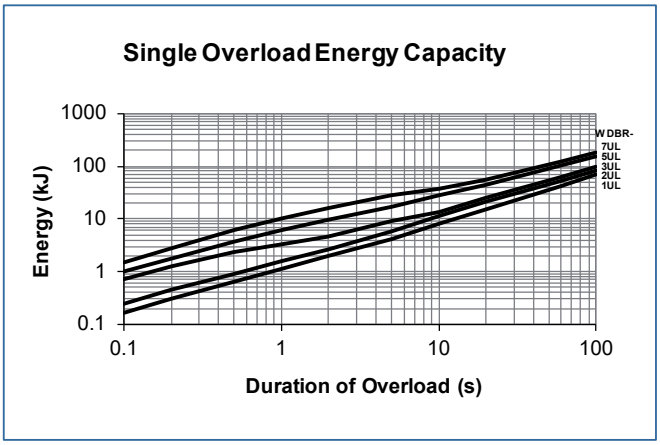
| | Bolt Size | Typical Tightening Torque (Nm) |
|---|---|---|
| WDBR1UL | M3 | 2 |
| WDBR2UL | M5 | 2.5 |
| WDBR3UL | M5 | 2.5 |
| WDBR5UL | M5 | 3.5 |
| WDBR7UL | M5 | 4 |

WDBR resistors may be customised in various ways including:
- Alternative shapes and dimensions up to 406mm x 406mm
- Integration of temperature measurement elements
- Alternative ohmic values, tolerance & TCR
- Increased dielectric withstand voltage
- Custom braking resistors with UL approval

For a full Applications Note for dynamic braking see http://www.ttelectronics.com/themes/ttelectronics/datasheets/resistors/literature/WDBR.pdf

# Overload Conditions




Mounted on a 0.53°C/W heatsink with 5m/s forced air cooling, air temperature 25°C. ΔR ≤ 5%.

# Maximum peak current (A)

| Value | 12R – 25R | 47R – 150R |
|---|---|---|
| WDBR1UL | 21.6 | 8.1 |
| WDBR2UL | 20.5 | 9.0 |
| WDBR3UL | 25.4 | 11.4 |
| WDBR5UL | 27.8 | 10.2 |
| WDBR7UL | 44.5 | 20.3 |

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# Ordering Procedure

**Example: WDBR2UL-100RKLW** (WDBR2UL, 100 ohms ±10%, with flying leads, Pb-free)

| W | D | B | R | 2 | U | L | | | - | 1 | 0 | 0 | R | K | L | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 2 | | 3 | | | 4 | | | | 5 | 6 | 7 |

| 1<br>Size | 2<br>Certification | 3<br>Solder Type | 4<br>Value | 5<br>Tolerance | 6<br>Terminations | 7<br>Packing | | |
|---|---|---|---|---|---|---|---|---|
| WDBR1<br>WDBR2<br>WDBR3<br>WDBR5<br>WDBR7 | UL = UL508 | Omit for 96SC, standard Pb-free<br>HT = HMP, high temperature | 3/4 characters<br>R = ohms | K = ±10% | I = solder pads<br>L = flying leads | W | WDBR1UL….I<br>WDBR2UL….I | 100/box |
| | | | | | | | WDBR1UL…L<br>WDBR2UL…L<br>WDBR3UL…I<br>WDBR5UL….I | 40/box |
| | | | | | | | WDBR3UL….L<br>WDBR5UL….L<br>WDBR7UL….I<br>WDBR7UL….L | 20/box |

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