

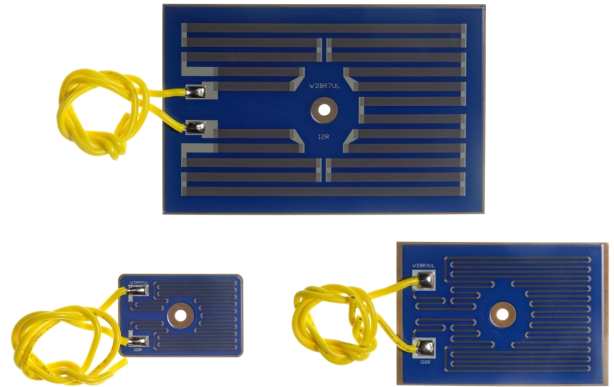
# Ultra Low Profile Power Resistors

WDBR-UL Series



## Features:

- 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 <sup>5</sup>                    | Ω            | 12, 15, 20, 22, 25, 47, 50, 100, 150 |         |         |         |         |
| Resistance tolerance                             | %            | 10                                   |         |         |         |         |
| Pulse peak power rating <sup>1</sup>             | kW           | 1.5                                  | 2       | 3.5     | 5       | 7       |
| Power rating on heatsink <sup>2</sup>            | W            | 170                                  | 190     | 240     | 250     | 260     |
| Power rating on fan cooled heatsink <sup>3</sup> | 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 <sup>4</sup>                | V (dc/ac pk) | 2500                                 |         |         |         |         |
| Inductance                                       | μH           | <3                                   |         | <4      | <5      | <6      |

Note 1: For details of pulse condition see Fig. 1 in Performance Data.

Note 2: Mounted on a 0.53°C/W heatsink with no forced air cooling, air temperature 25°C.

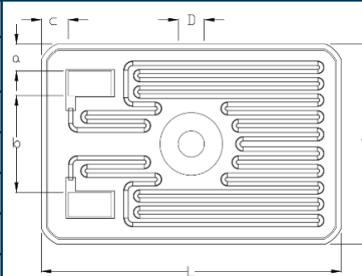
Note 3: Mounted on a 0.53°C/W heatsink with 5m/s forced air cooling, air temperature 25°C.

Note 4: Based on 100% production test, duration 2s minimum.

Note 5: Other ohmic values upon request.

## Physical Data

| Dimensions in mm and weight without terminations in g |           |           |           |           |          |          |          |          |            |       |
|---|-----------|-----------|-----------|-----------|----------|----------|----------|----------|------------|-------|
| Type  | L<br>±0.1 | W<br>±0.1 | t<br>±0.1 | ∅D<br>nom | a<br>nom | b<br>nom | c<br>nom | d<br>min | Wt.<br>nom |       |
| WDBR1UL   | 49.3      | 35.9      | 0.9       | 3.2       | 4.2      | 17.6     | 4.2      | 2.9      | 12.6       |       |
| WDBR2UL   | 61        | 40.6      |           | 5.3       |          | 5.5      | 19.7     | 5.5      | 4.5        | 17.1  |
| WDBR3UL   | 101.6     | 70        |           |           |          | 14.5     | 24.8     | 10.1     | 7.5        | 50.8  |
| WDBR5UL   | 122       | 70        | 1.5       |           |          | 15.3     | 27       | 8.6      | 7.5        | 101.2 |
| WDBR7UL   | 152.4     | 101.6     |           |           |          | 39.3     | 10.7     | 11.8     | 10.5       | 181.8 |



t = substrate thickness.

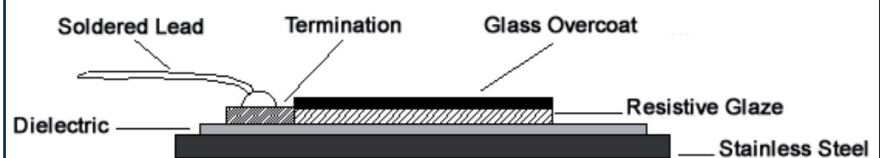
d = clearance between exposed conductor and exposed steel substrate.

The fixing hole is centrally located.

## 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

TT Electronics reserves the right to make changes in product specification without notice or liability.

All information is subject to TT Electronics' own data and is considered accurate at time of going to print.

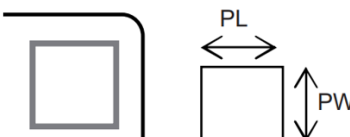
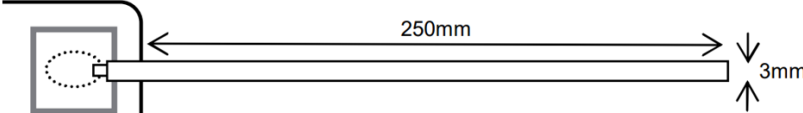
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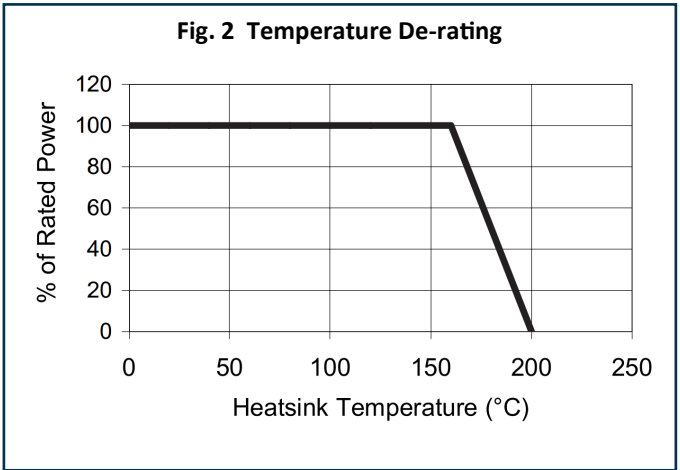
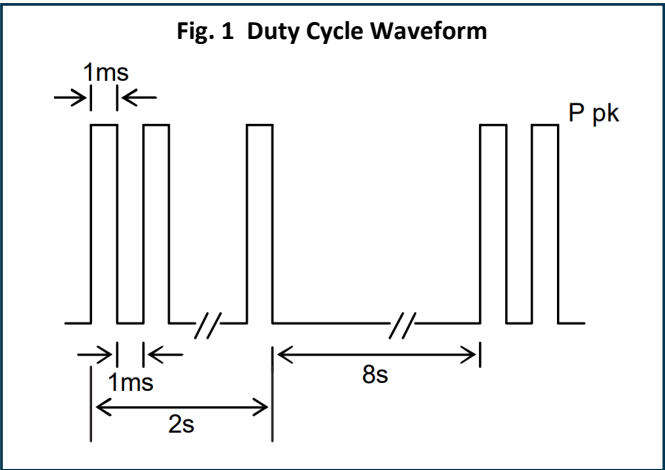
Termination Options

| Option                                | Code  | Nominal Dimensions (mm)  |  |              |       |   |       |                |     |     |     |               |   |     |     |  |  |
|---------------------------------------|-------|--|--|--------------|-------|---|-------|----------------|-----|-----|-----|---------------|---|-----|-----|--|--|
| Solder pads only                      | I     |   | <table><tr><th>WDBR-UL Size</th><th>1 &amp; 2</th><th>3</th><th>5 &amp; 7</th></tr><tr><td>Pad Length, PL</td><td>8.8</td><td>8.1</td><td>9.1</td></tr><tr><td>Pad Width, PW</td><td>5</td><td>8.1</td><td>6.1</td></tr></table> | 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 |  |  |
| 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  |              |       |   |       |                |     |     |     |               |   |     |     |  |  |
| Flying leads<br>UL3134/5<br>40A, 600V | L     |  |  |              |       |   |       |                |     |     |     |               |   |     |     |  |  |

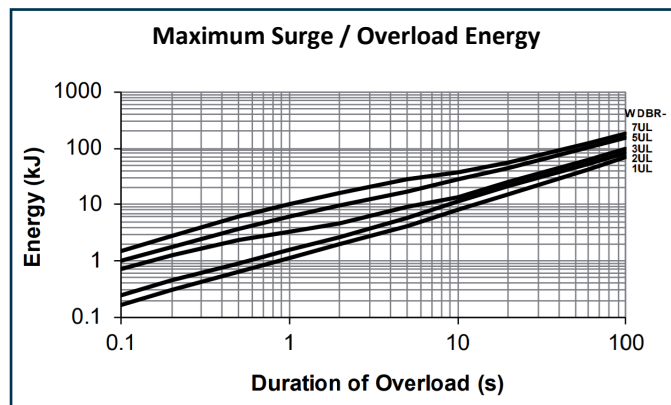
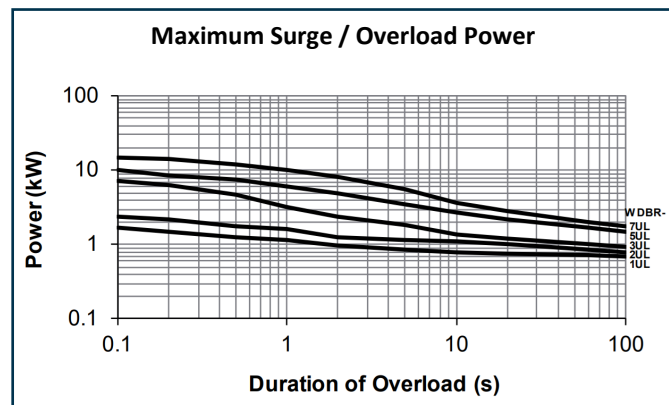
Note: Two options exist for solder type. The standard is SnAg (965C) which is Pb-free and the second (HT) is high temperature HMP alloy which is Pb-bearing. Both are RoHS compliant, but the second relies on the RoHS exemption for high temperature solders and is targeted at specialist high temperature applications.

Performance Data

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



### Pulse and Overload Performance



Note: Mounted on a 0.53°C/W heatsink with 5m/s forced air cooling, air temperature 25°C. Single pulse or low repetition rate, such that mean power  $\leq 10\%$  of rated power.  $\Delta R \leq 5\%$ .

#### Maximum Peak Current

| Type    | Maximum Peak Current (A) |            |
|---------|--------------------------|------------|
|         | 12R – 25R                | 47R – 150R |
| WDBR1UL | 21.6                     | 8.1        |
| WDBR2UL | 20.5                     | 9          |
| WDBR3UL | 25.4                     | 11.4       |
| WDBR5UL | 27.8                     | 10.2       |
| WDBR7UL | 44.5                     | 20.3       |

### Application Notes

A heatsink with thermal resistance  $\leq 0.53^\circ\text{C/W}$  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  $<6.3\mu\text{m}$  with flatness of  $<0.05\text{mm}$ . 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.

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

WDBR-UL resistors will fail safe (open circuit) under overload fault conditions and still maintain a 1kV dielectric withstand.

Soldering of solder pad (termination I) variants requires the use of a hot plate. Hand solder process recommendations are available.

WDBR-UL resistors may be customised in various ways including:

- Alternative shapes and dimensions up to 406mm x 406mm
- Integration of temperature measurement elements and thermal cutouts
- Alternative ohmic values and tolerances
- Increased dielectric withstand voltage
- Custom braking resistors with UL approval
- Integration of multiple power resistors

Ordering Procedure

Example: WDBR2UL-100RKLW (WDBR2UL with standard solder and flying lead terminations, 100 ohms ±10%, Pb-free)



| 1     | 2             | 3                        | 4                          | 5         | 6                       | 7                    |          |           |  |  |
|-------|---------------|--------------------------|----------------------------|-----------|-------------------------|----------------------|----------|-----------|--|--|
| Size  | Certification | Solder Option            | Value                      | Tolerance | Termination             | Packing              |          |           |  |  |
| WDBR1 | UL = UL508    | Omit for standard (96SC) | 3/4 characters<br>R = ohms | K = ±10%  | I = Solder pads<br>only | W = Standard packing |          |           |  |  |
| WDBR2 |               |                          |                            |           |                         | Term. I              | Term. L  | Bulk pack |  |  |
| WDBR3 |               | HT = High<br>Temperature |                            |           | L = Flying<br>leads     | 1 & 2                |          | 100/box   |  |  |
| WDBR5 |               |                          |                            |           |                         | 3 & 5                | 1 & 2    | 40/box    |  |  |
| WDBR7 |               |                          |                            |           |                         | 7                    | 3, 5 & 7 | 20/box    |  |  |

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