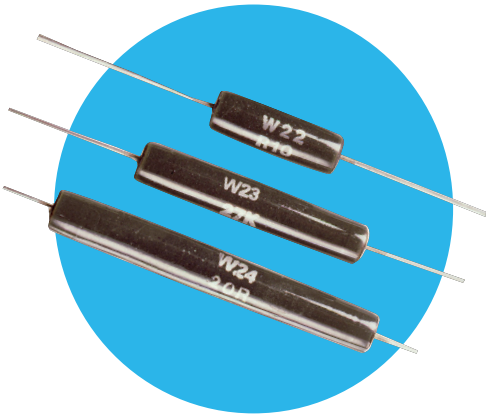
# Resistors

# Vitreous Enamelled Wirewound Resistors




### W20 Series

- CECC approved
- Suitable for harsh environments
- Impervious lead free vitreous enamel coating
- Overload characteristics ideal for protection circuits
- High stability and reliability
- High power dissipation for size

All Pb-free parts comply with EU Directive 2011/65/EU (RoHS2)

## Electrical Data

| Commercial | | | W21 | W215 | W22 | W23 | W24 |
|---|---|---|---|---|---|---|---|
| Power rating at 25°C | | watts | 3.0 | 5.0 | 7.0 | 10.5 | 14.0 |
| Resistance range at | 1% tolerance | ohms | 1R to 10K | 1R to 15K | 1R to 22K | 1R to 60K | 1R to 100K |
| | 2% tolerance | ohms | 0R5 to 10K | 0R5 to 15K | 0R5 to 22K | 1R to 60K | 1R to 100K |
| | 5% tolerance | ohms | 0R1 to 10K | 0R1 to 15K | 0R1 to 22K | 0R15 to 60K | 0R2 to 100K |
| TCR (-55° to 200°C) | | ppm/°C | Typically: <+-75 | | | Maximum: +-200 | |

| BS CECC 40-201-002 Requirements | | Style | JB | HB | KB | LB | MB |
|---|---|---|---|---|---|---|---|
| Power rating at 25°C | | watts | 2.9 | 5.0 | 7.0 | 10.5 | 14.0 |
| Power rating at 70°C | | watts | 2.5 | 4.3 | 6.0 | 9.0 | 12.0 |
| Resistance range at | 1% tolerance | ohms | 1R to 10K | 1R to 15K | 1R to 20K | 1R to 56K | 1R to 100K |
| | 2% tolerance | ohms | 0R5 to 10K | 0R5 to 15K | 0R5 to 20K | 1R to 56K | 1R to 100K |
| | 5% tolerance | ohms | 0R1 to 10K | 0R1 to 15K | 0R1 to 20K | 0R15 to 56K | 0R2 to 100K |
| TCR (-55° to 200°C) | | ppm/°C | ≥5 ohms < 10 ohms: ±400 | | | ≥10 ohms: ±200 | |

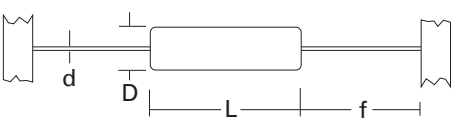
This table indicates the CECC specification requirements, and these are met or exceeded by the corresponding W20 series products

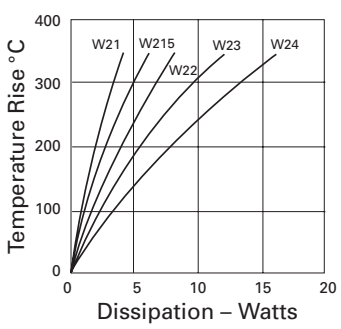
| Applicable to commercial and approved ranges | | | | | | | |
|---|---|---|---|---|---|---|---|
| Limiting element voltage | | volts | 100 | 160 | 200 | 500 | 750 |
| Standard values | | | E24 preferred. Other values to special order | | | | |
| Thermal impedance | | °C/watt | 88 | 58 | 44 | 29 | 22 |
| Ambient temperature range | | °C | -55 to 200 | | | | |

## Physical Data

**Dimensions (mm) and Weight (g)**

| Type | L max | D max | f min | d nom | Wt.nom |
|---|---|---|---|---|---|
| **W21** | 12.7 | 5.6 | 22.75 | 0.8 | 1 |
| **W215** | 22.0 | 7.0 | 23.1 | 0.8 | 2 |
| **W22** | 22.0 | 8.0 | 23.1 | 0.8 | 2 |
| **W23** | 38.0 | 8.0 | - | 0.8 | 3.5 |
| **W24** | 53.5 | 8.0 | - | 0.8 | 5 |




### Construction

A high purity ceramic substrate is assembled with interference fit end caps to which are welded the termination wires. The resistive element is wound on the substrate and welded to the caps; the vitreous enamel protective coating is then applied.

### Terminations

**Material** Copper clad steel wire, nickel plated and solder-coated.
**Strength** The terminations meet the requirements of IEC 68.2.21.
**Solderability** The terminations meet the requirements of IEC 115-1,– Clause 4.17.3.2.
**Length** W23's and W24's are not supplied on tape. Minimum lead length is 30 mm.

### Marking

The resistors are legend marked with type reference, resistance value and tolerance. Values are marked in accordance with IEC 62.

**General Note**

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

The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuits

### Flammability

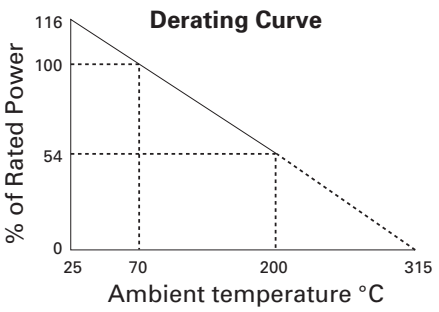
All materials used in the construction of W20 series resistors are inorganic and inherently non-burning.

# Performance Data

| | | CECC 40201-002 | Actual Performance | |
|---|---|---|---|---|
| | | Requirements | Maximum | Typical |
| Load at commercial rating: 1000 hrs at 25°C | ΔR% | | 5 | 3.5 |
| Load at CECC rating: 1000 hours at 25°C | ΔR% | 5 | 5 | 3.5 |
| Dry heat: 1000 hours at 200°C | ΔR% | 5 | 2 | 1 |
| Shelf life: 12 months at room temperature | ΔR% | not specified | 0.03 | 0.02 |
| Derating | | see derating curve | | |
| Short term overload | ΔR% | 1 | 1.0 | 0.2 |
| Climatic | ΔR% | 5 | 0.5 | 0.2 |
| Climatic category | ΔR% | 55/200/56 | | |
| Long term damp heat | ΔR% | 5 | 0.05 | 0.02 |
| Temperature rapid change | ΔR% | 1 | 0.5 | 0.2 |
| Resistance to solder heat | ΔR% | 1 | 0.25 | 0.03 |
| Vibration and bump | ΔR% | 1 | 0.25 | 0.05 |
| Noise (in decade of frequency) | μv/v | not specified | zero | zero |
| Robustness | ΔR% | 1 | 0.4 | 0.05 |
| Insulation resistance | ohms | not specified | > 1G ohm | > 1G ohm |
| Voltage Proof | volts | not specified | 500 min | 500 min |
| Pulse handling | data available at http://www.ttelectronics.com/themes/ttelectronics/datasheets/resistors/literature/Pulse-Overload_AN.pdf | | | |

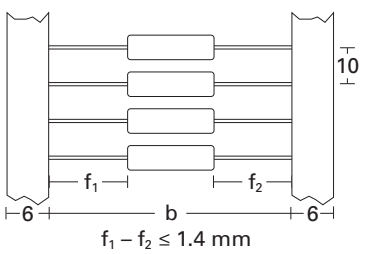
# Application Notes

The termination should not be bent closer than 1.6mm from the body, and the recommended minimum bend radius is 1.2mm. The terminations are solderable to within 4mm from the body. When cold, vitreous enamel has excellent insulation resistance. In common with all insulants the specific resistance of the enamel decreases with increase in temperature. Therefore, resistors operated at near maximum temperature cannot be classed as insulated and should not be used in contact with any conducting material. Care must be taken when determining clearance distance between the resistor body and the printed circuit board or other components to ensure these are not over heated. Resistance is measured 6mm from body.




## Packaging

For W21 and W215 the standard method of packaging is taped in Ammo Packs. For W22 the standard method of packaging is taped and reeled. W23's and W24's are available only as loose packed in boxes.




$f_1 - f_2 \leq 1.4$ mm

| Type | b |
|---|---|
| **W21** | 63±2 |
| **W215** | 73±2 |
| **W22** | 73±2 |

**General Note**

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# Ordering Procedure

**Example: W22-3K3JI** (W22, 3.3 kilohms ±5%, Pb-free)

| W | 2 | 2 | - | 3 | K | 3 | J | I |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | 2 | | | 3 | 4 |

| 1<br>Type | 2<br>Value | 3<br>Tolerance | 4<br>Packing & Termination Finish | |
|---|---|---|---|---|
| W21 | E24 = 3/4 characters | F = ±1% | I = Standard packing & Pb-free | |
| W215 | R = ohms | G = ±2% | PB = Standard packing & SnPb | |
| W22 | K = kilohms | J = ±5% | W21, W215 | 1000/box |
| W23 | | | W22 | 700/reel |
| W24 | | | W23, W24 | 50/box |

For CECC released product state on order the CECC number and style. Example: **W22-3K3JI CECC40201-002 KB**

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TT Electronics:

W22-27R0JLF W21-R10JI W215-R500-JALF W24-5K-JI W225R60JR W236R80JB W2120R0JA W221500JR W2152700JA W211501JA W233302JB W221R20JR W2154700JA W232200JB W214R70JA W2152701JA W232202JB W231500JB W2156801JA W232201JB W246R80JB W216R80JA W234700JB W2155601JA W2115R0JA W243301JB W2310R0JB W211200JA W216800JA W21R150JA W2155R60JA W228R20JR W215R120JA W231000JB W21R180JA W211500JA W244R70JB W215R100JA W223301JR W2215R0JR W21100RJA W2139R0JA W2158200JA W2122R0JA W211801JA W2112R0JA W227500JR W2152201JA W2333R0JB W221502JR W233300JB W222R70JR W222002JR W211R80JA W21R330JA W222700JR W211R20J W221002JR W218200JA W225600JR W2151000JA W214701JA W2152R70JA W213R90JA W21533R0JA W233301JB W223900JR W211002JA W2415R0JB W213301JA W211001JA W21527R0JA W2153300JA W221202JR W211201JA W231501JB W2153901JA W2156R0JA W212200JA W213901JA W2110R0JA W213R30JA W234702JB W21R560JA W222200JR W2168R0JA W214700JA W246800JB W222R20JR W2256R0JR W224700JR W221001JR W241502JB W2151801JA W241002JB W2153R30JA W2268R0JR W21510R0JA W2347R0JB W2410R0JB