



**THE DATASHEET OF  
WR20X000 PTL**



# APPROVAL SHEET

**WR20, WR25**

**±1%, ±5%**

Thick Film Power Chip Resistors

Size 2010, 2512

Automotive Compliant

\*Contents in this sheet are subject to change without prior notice.

## FEATURE

1. Automotive grade AEC Q-200 compliant
2. 100% CCD inspection
3. RoHS compliant and Lead free

## APPLICATION

- Automotive application
- Consumer electrical equipment
- EDP, Computer application
- Telecom application

## DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is Tin (lead free) alloy.

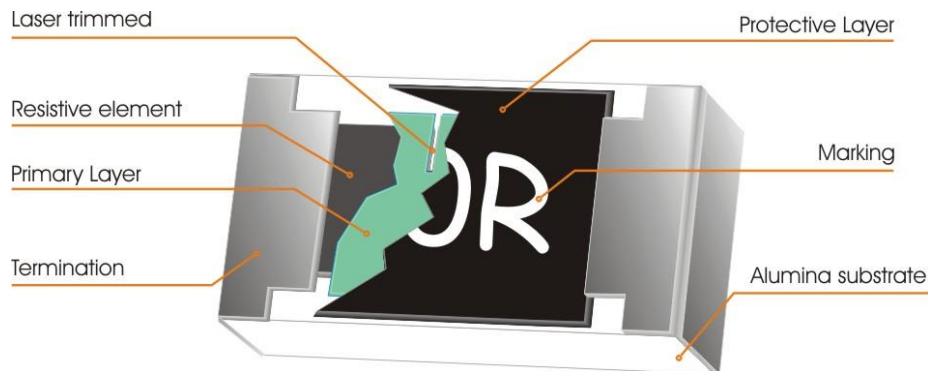


Fig 1. Construction of 2512, 2010 Chip-R

**QUICK REFERENCE DATA**

| Item   | General Specification       |              |
|--|-----------------------------|--------------|
|  | Series No.                  | WR20X(W)     |
| Size code  | 2010 ( 5025 ),              | 2512(6432)   |
| Resistance Tolerance   | ±5% (E24);<br>±1% (E24+E96) |              |
| Resistance Range   | 1Ω ~ 10MΩ, Jumper (0Ω)      |              |
| TCR (ppm/°C) : 10Ω ≤ Rn < 1MΩ<br>1Ω ≤ Rn < 9.76Ω & 1MΩ ≤ Rn ≤ 10MΩ | ± 100 ppm/°C                | ± 100 ppm/°C |
|  | ± 200 ppm/°C                | ± 200 ppm/°C |
| Max. dissipation at T <sub>amb</sub> =70°C                         | 0.75 W                      | 1W           |
| Max. Operation Voltage (DC or RMS)                                 | 200V                        | 250V         |
| Max. Overload Voltage (DC or RMS)                                  | 400V                        | 500V         |
| Climatic category (IEC 60068)                                      | 55/155/56                   |              |

Test conditions for jumper ( 0 ohm )

| Type                  | WR20X(W)    | WR25X(W)    |
|-----------------------|-------------|-------------|
| Power Rating At 70C   | 3/4 W       | 1 W         |
| Resistance            | Max. 50mR   | Max. 50mR   |
| Rated Current         | 3.2 A       | 4.5 A       |
| Peak Current          | 8 A         | 11 A        |
| Operating Temperature | -55C ~ 155C | -55C ~ 155C |

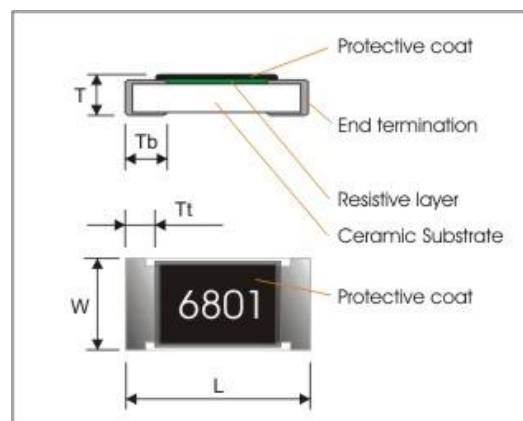
Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

**MECHANICAL DATA (unit : mm)**

| TYPE | WR20X(W)  | WR25X(W)  |
|------|-----------|-----------|
| L    | 5.00±0.20 | 6.40±0.20 |
| W    | 2.50±0.20 | 3.20±0.20 |
| T    | 0.55±0.10 | 0.60±0.10 |
| Tt   | 0.65±0.25 | 0.65±0.25 |
| Tb   | 0.60±0.25 | 0.90±0.25 |



## MARKING

Each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value.

Example:

$$\begin{aligned} 1R00 &= 1\Omega \\ 1001 &= 1000\Omega \\ 0000 &= 0\Omega \end{aligned}$$

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E96 & E24 series for resistors with a tolerance of  $\pm 5\%$  &  $\pm 1\%$ . The values of the E24/E96 series are in accordance with "IEC publication 60063".

### Derating curve

The power that the resistor can dissipate depends on the operating temperature; see Fig.3

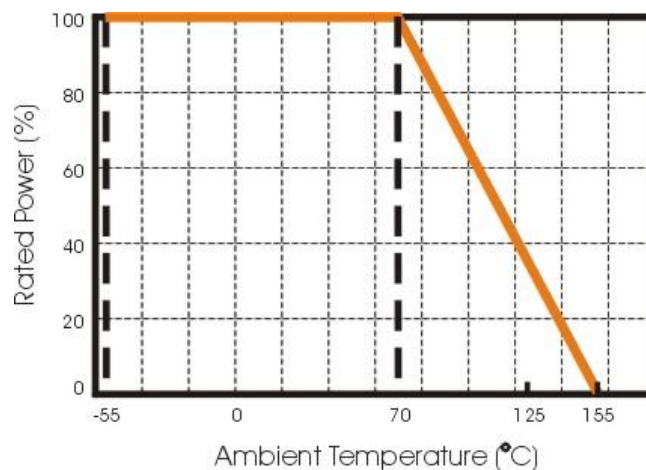


Figure 3. Maximum dissipation in percentage of rated power as a function of the ambient temperature.

## MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

### SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 4.

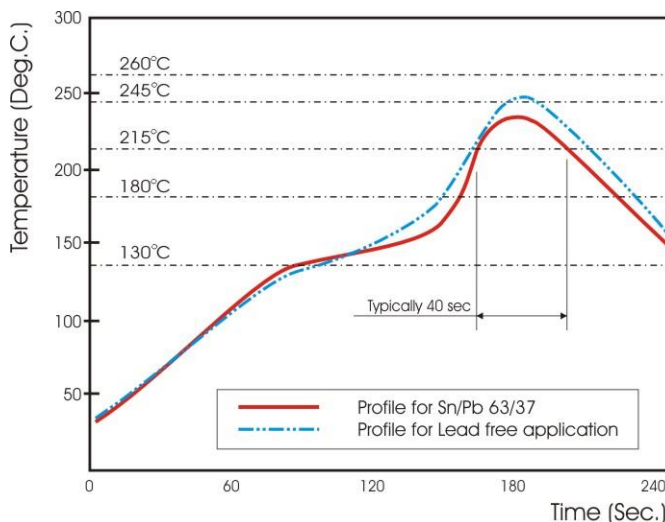


Fig 4. Infrared soldering profile for Chip Resistors

### CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

| WR20                       | X  | 472_  | J                                | T                     | L                       | J   |
|----------------------------|--|---|----------------------------------|-----------------------|-------------------------|---|
| <b>Size code</b>           | <b>Type code</b>   | <b>Resistance code</b>  | <b>Tolerance</b>                 | <b>Packaging code</b> | <b>Termination code</b> | <b>Special code</b>                                       |
| WR25 : 2512<br>WR20 : 2010 | X :<br>±5%: 1Ω-10MΩ<br>±1%: 10Ω-1MΩ<br>W :<br>1% :<br><10Ω or >1MΩ | <b>5% E24</b> : 2 significant digits followed by no. of zeros and a blank<br>4.7Ω =4R7_<br>10Ω =100_<br><b>1% E24+E96</b> : 3 significant digits followed by no. of zeros<br>102Ω =1020<br>37.4KΩ =3742 | J : ±5%<br>F : ±1%<br>P : Jumper | T : 7" Reel taping    | L = Sn base (lead free) | J =<br>1. 100% CCD visual check<br>2. Meet AEC Q-200 test |

WR25, WR20:

1. Reeled tape packaging : 12mm width plastic taping 4,000pcs per 7" reel,

## TEST AND REQUIREMENTS (AEC Q200)

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category **LCT/UCT/56** (rated temperature range : Lower **Category Temperature**, Upper **Category Temperature**; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, subclause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15 °C to 35 °C.

Relative humidity: 45% to 75%.

Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

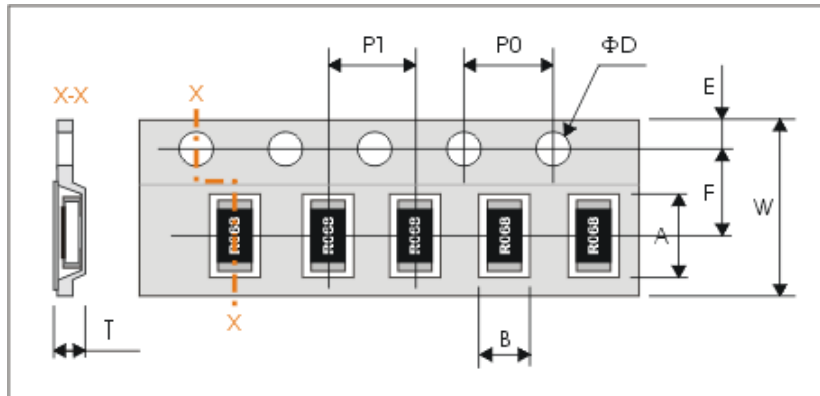
All soldering tests are performed with midly activated flux.

| TEST   | PROCEDURE / TEST METHOD  | REQUIREMENT   |       |
|--|--|---|-------|
|  |  | Resistor  | 0Ω    |
| Electrical Characteristics<br><b>JISC5201-1: 1998</b><br>Clause 4.8  | - DC resistance values measurement<br>- Temperature Coefficient of Resistance (T.C.R)<br>Natural resistance change per change in degree centigrade.<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)} \quad t_1 : 20^\circ\text{C} + 5^\circ\text{C} - 1^\circ\text{C}$<br>R <sub>1</sub> : Resistance at reference temperature<br>R <sub>2</sub> : Resistance at test temperature | Within the specified tolerance<br>Refer to "QUICK REFERENCE DATA" | <50mΩ |
| Resistance to soldering heat(R.S.H)<br><b>MIL-STD-202 method 210</b> | Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270°C±5°C  | ΔR/R max. ±(1.0%+0.05Ω)<br>no visible damage                      | <50mΩ |
| Solderability<br><b>J-STD-002</b>                                    | a) Bake the sample for 155°C dwell time 4hrs/ solder dipping 235°C / 5sec.<br>b) Steam the sample dwell time 1 hour/ solder dipping 260°C / 7sec.  | 95% coverage min., good tinning and no visible damage             |       |
| Temperature cycling<br><b>JESD22 Method JA-104</b>                   | 1000 cycles, -55°C ~ +155°C, dwell time 5~10min  | ΔR/R max. ±(1.0%+0.05Ω)<br>No visible damage                      | <50mΩ |
| Moisture Resistance<br><b>MIL-STD-202 method 106</b>                 | 65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle   | ΔR/R max. ±(1.0%+0.05Ω)<br>No visible damage                      | <50mΩ |
| Bias Humidity<br><b>MIL-STD-202 method 103</b>                       | 1000+48/-0 hours; 85°C, 85% RH, 10% of operation power   | ΔR/R max. ±(2.0%+0.10Ω)<br>No visible damage                      | <50mΩ |
| Operational Life<br><b>MIL-STD-202 method 108</b>                    | 1000+48/-0 hours; 35% of operation power, 125±2°C  | ΔR/R max. ±(2.0%+0.1Ω)<br>No visible damage                       | <50mΩ |

| TEST   | PROCEDURE / TEST METHOD  | REQUIREMENT   |       |
|--|--|---|-------|
|  |  | Resistor  | 0Ω    |
| High Temperature Exposure<br><b>MIL-STD-202 Method 108</b>   | 1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C   | ΔR/R max. ±(2.0%+0.10Ω)<br>No visible damage        | <50mΩ |
| Board Flex<br><b>AEC-Q200-005</b>                            | Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 10sec.  | ΔR/R max. ±(1.0%+0.05Ω)<br>No visible damage        | <50mΩ |
| Terminal strength<br><b>AEC-Q200-006</b>                     | Pressurizing force: 1Kg, Test time: 60±1sec.   | No remarkable damage or removal of the terminations |       |
| Thermal shock<br><b>MIL-STD-202 method 107</b>               | Test -55 to 155°C/ dwell time 15min/ Max transfer time 20sec 300cycles   | ΔR/R max. ±(1.0%+0.05Ω)<br>No visible damage        | <50mΩ |
| ESD<br><b>AEC-Q200-002</b>                                   | Test contact 1.0KV (0.5KV for 0402 only)   | ΔR/R max. ±(1.0%+0.05Ω)<br>No visible damage        | <50mΩ |
| Short Time Overload<br><b>JISC5201-1: 1998 Clause 4.13</b>   | 2.5 times RCWV or max. overload voltage, for 5seconds  | ΔR/R max. ±(2.0%+0.10Ω)<br>No visible damage        | <50mΩ |
| Load life in Humidity<br><b>JISC5201-1: 1998 Clause 4.24</b> | 1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off | ΔR/R max. ±(2%+0.10Ω)<br>No visible damage          | <50mΩ |
| Load life (endurance)<br><b>JISC5201-1: 1998 Clause 4.25</b> | 1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off   | ΔR/R max. ±(2%+0.10Ω)<br>No visible damage          | <50mΩ |

**PACKAGING**

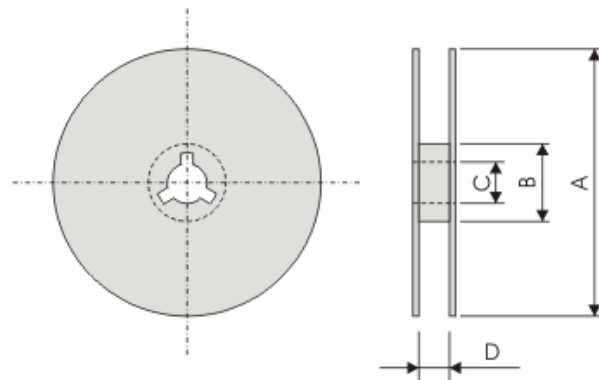
Plastic Tape specifications (unit :mm)



| Type | A         | B         | W          | F         | E         |
|------|-----------|-----------|------------|-----------|-----------|
| WR25 | 6.90±0.20 | 3.60±0.20 | 12.00±0.30 | 5.50±0.10 | 1.75±0.10 |
| WR20 | 5.50±0.20 | 2.80±0.20 |            |           |           |

| Type | P1        | P0        | ΦD                                    | T      |
|------|-----------|-----------|---------------------------------------|--------|
| WR25 | 4.00±0.10 | 4.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | MAX1.2 |
| WR20 | 4.00±0.10 |           |                                       |        |

**Reel dimensions**



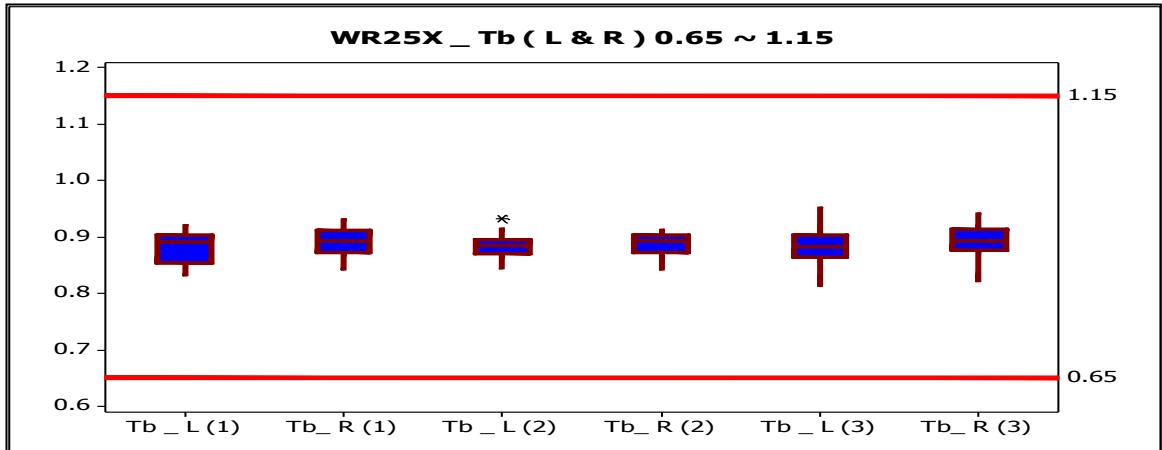
| Symbol      | A          | B         | C        | D        |
|-------------|------------|-----------|----------|----------|
| (unit : mm) | Φ178.0±2.0 | Φ60.0±1.0 | 13.0±0.2 | 14.0±0.2 |

**Taping quantity**

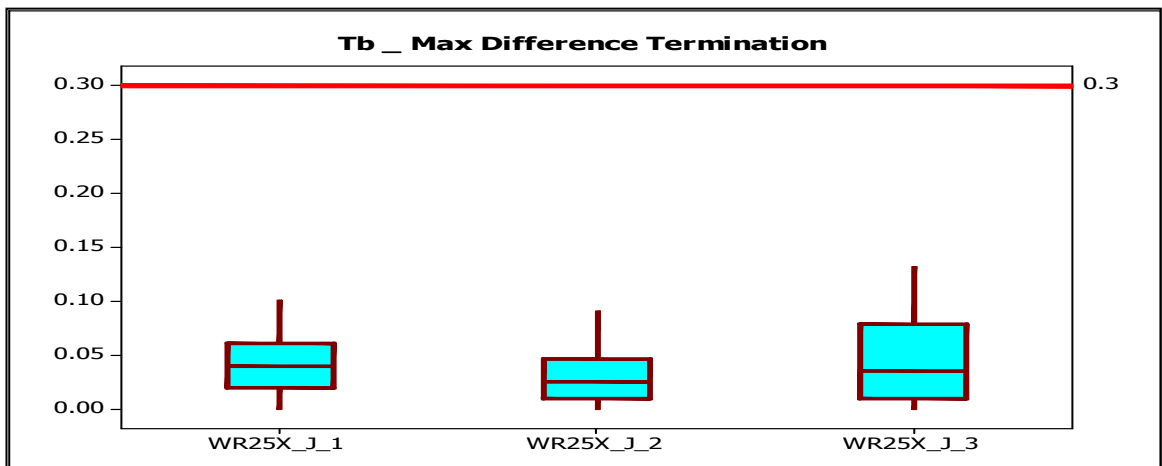
WR20, WR25 by plastic tape taping 4,000 pcs per reel.

## A. WR25X – J \_ Tb & Max Difference Termination

- ◆ Tb Spec. ( 0.90 +/- 0.25 mm ) \_ Box Plot ( 3 lots \_ Tb Left & Right )

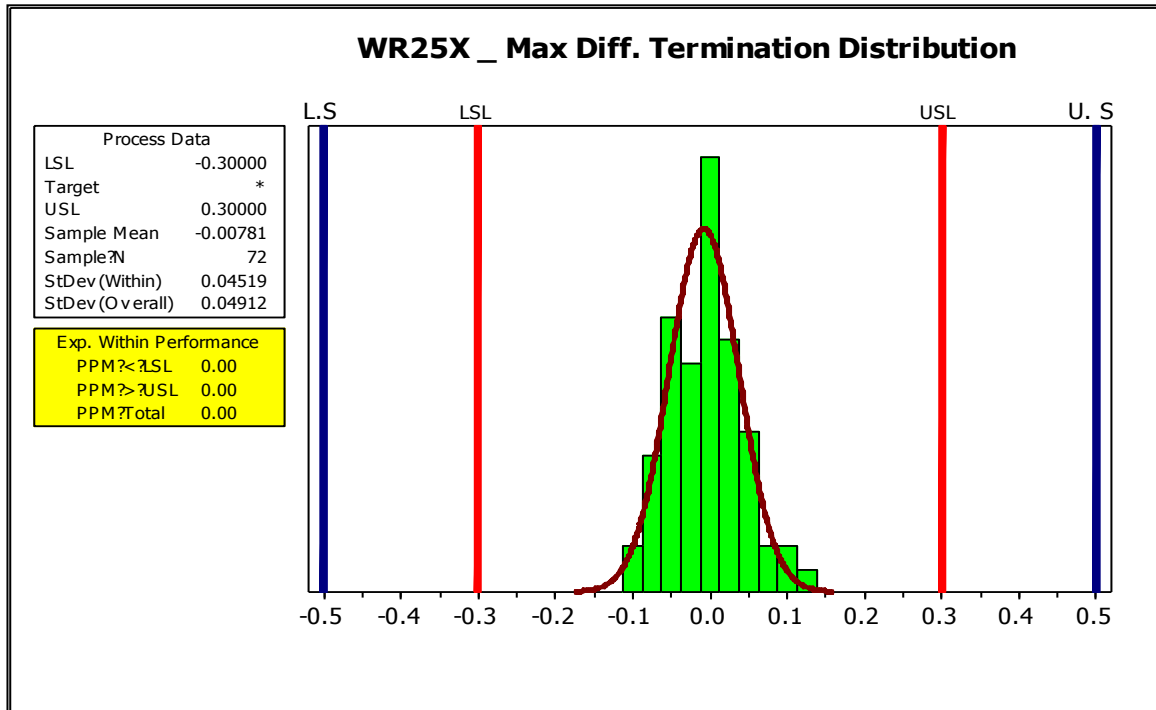


- ◆ Max Difference Termination ( 0.3 mm ) \_ Box Plot ( 3 lots )



## B. WR25X \_ J - Tb \_ Process Capability

- ◆ For Max. Diff. termination Spec.  $\pm 0.3\text{mm}$ , Estimation PPM approaches zero defect.



## Looking for pricing, stock, or lifecycle information?

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