

# AUTO GRADE CURRENT SENSING CHIP RESISTOR

## - CRS SERIES -

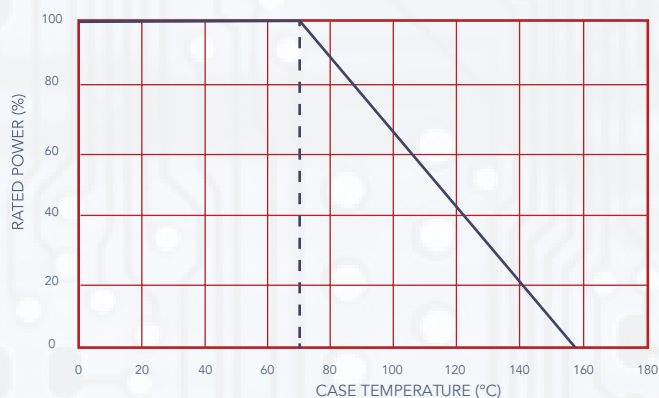
### FEATURES

- 3 Watts power rating in 1 Watt size, 1225 package
- Low TCR of  $\pm 100$  PPM/ $^{\circ}$ C
- Resistance value from 1m to 1 ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating

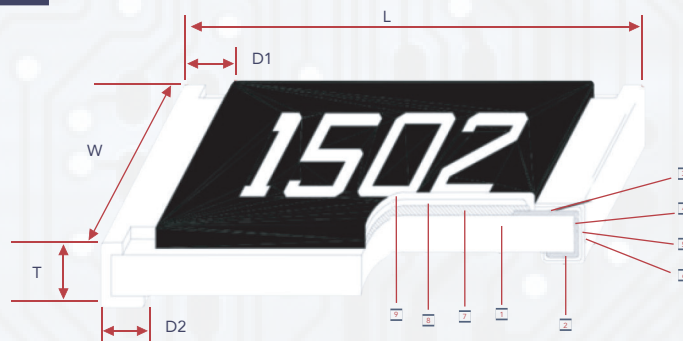
### APPLICATIONS

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adapter
- Automotive Engine Control
- Disk Driver
- Portable Devices (PDA, Cell Phone)

### DERATING CURVE



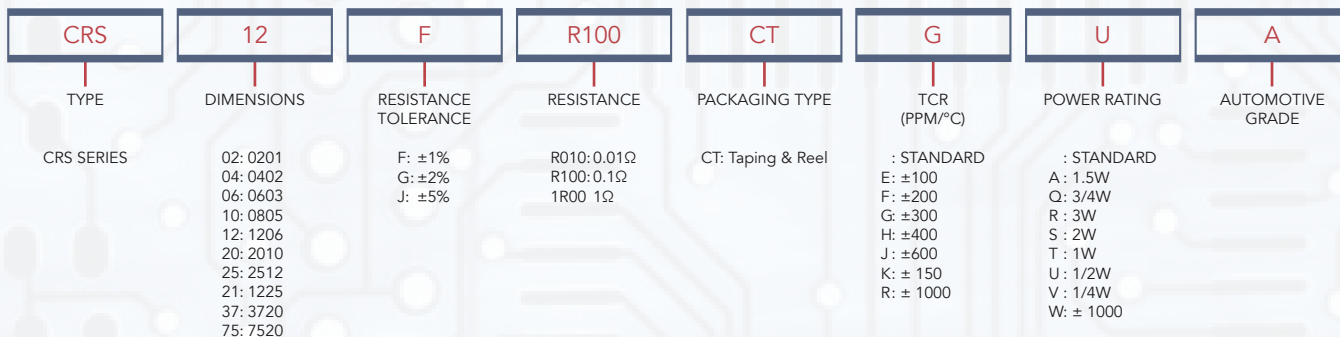
### CONSTRUCTION



- 1 Alumina Substrate
- 2 Bottom Electrode (Ag)
- 3 Top Electrode (Ag-pd)
- 4 Edge Electrode (NiCr)
- 5 Barrier Layer (Ni)
- 6 External Electrode (Sn)
- 7 Resistor Layer (Ag/Pd)
- 8 Primary Overcoat (epoxy)
- 9 Marking

| TYPE       | SIZE (INCH)             | L               | W               | T               | D1              | D2              | WEIGHT (G) (1000PCS) |
|------------|-------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------------|
| CRS02      | 0201                    | 0.58 $\pm$ 0.05 | 0.29 $\pm$ 0.05 | 0.23 $\pm$ 0.05 | 0.12 $\pm$ 0.05 | 0.15 $\pm$ 0.05 | 0.18                 |
| CRS04      | 0402                    | 1.00 $\pm$ 0.05 | 0.50 $\pm$ 0.05 | 0.32 $\pm$ 0.10 | 0.25 $\pm$ 0.10 | 0.20 $\pm$ 0.10 | 0.7                  |
| CRS06      | 0603                    | 1.60 $\pm$ 0.10 | 0.80 $\pm$ 0.10 | 0.45 $\pm$ 0.10 | 0.30 $\pm$ 0.20 | 0.30 $\pm$ 0.20 | 1.99                 |
| CRS10      | 0805                    | 2.00 $\pm$ 0.15 | 1.25 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.50 $\pm$ 0.30 | 0.40 $\pm$ 0.25 | 5.3                  |
| CRS12      | 1206                    | 3.05 $\pm$ 0.15 | 1.55 $\pm$ 0.15 |                 |                 |                 | 8.82                 |
| CRS14      | 1210                    | 3.00 $\pm$ 0.15 | 2.50 $\pm$ 0.15 | 0.60 $\pm$ 0.15 | 0.60 $\pm$ 0.30 | 0.50 $\pm$ 0.25 | 15.5                 |
| CRS20      | 2010                    | 5.00 $\pm$ 0.20 | 2.45 $\pm$ 0.15 |                 |                 | 27.03           |                      |
| CRS25      | 2512                    | 6.35 $\pm$ 0.20 | 3.15 $\pm$ 0.15 | 0.60 $\pm$ 0.10 | 0.60 $\pm$ 0.30 | 0.55 $\pm$ 0.25 | 43.08                |
| CRS25 (2W) | 2512 10-99m $\Omega$    |                 |                 | 0.74 $\pm$ 0.10 |                 | 53.08           |                      |
| CRS25 (2W) | 2512 100-1000m $\Omega$ |                 |                 |                 |                 | 2.10 $\pm$ 0.10 |                      |
| CRS21      | 1225                    | 3.10 $\pm$ 0.15 | 6.30 $\pm$ 0.15 | 0.90 $\pm$ 0.15 |                 | 0.55 $\pm$ 0.25 | 64.88                |
| CRS37      | 3720                    |                 | 3.75 $\pm$ 0.20 | 0.60 $\pm$ 0.10 | 0.40 $\pm$ 0.20 | 0.40 $\pm$ 0.20 | 19.96                |
| CRS75      | 7520                    |                 | 7.50 $\pm$ 0.30 |                 |                 |                 | 35.71                |

### PART NUMBERING



## STANDARD ELECTRICAL SPECIFICATIONS

| TYPE  | ITEM | POWER RATING AT 70°C | OPERATING TEMP RANGE | RESISTANCE RANGE (mΩ)                                |                                      |                       | T.C.R. (PPM / °C) |
|-------|------|----------------------|----------------------|--|--------------------------------------|-----------------------|-------------------|
|       |      |                      |                      | ±1%  | ±2%                                  | ±5%                   |                   |
| CRS02 | 0201 | 1/20W                | -55~+155°C           |  | 100 - 149<br>150 - 500<br>501 - 1000 | ±1000<br>±600<br>±300 |                   |
| CRS04 | 0402 | 1/16W                |                      | 50 - 100<br>101 - 500<br>501 - 1000                  | ±400<br>±300<br>±200                 |                       |                   |
| CRS06 | 0603 | 1/10W                |                      | 20 - 50<br>51 - 100<br>101 - 500<br>501 - 1000       | ±600<br>±400<br>±300<br>±200         |                       |                   |
| CRS10 | 0805 | 1/8W                 |                      |  |                                      |                       |                   |
| CRS12 | 1206 | 1/4W                 |                      |  |                                      |                       |                   |
| CRS14 | 1210 | 1/2W                 |                      | 10 - 20<br>21 - 50<br>51 - 99<br>100 - 1000          |                                      |                       |                   |
| CRS20 | 2010 | 3/4W                 |                      |  |                                      |                       |                   |
| CRS25 | 2512 | 1W                   |                      |  |                                      |                       |                   |
| CRS21 | 1225 | 3W                   |                      | 3 - 5<br>6 - 20<br>21 - 30<br>31 - 250<br>251 - 8000 | ±300<br>±200<br>±150<br>±100<br>±200 |                       |                   |
| CRS37 | 3720 | 1W                   |                      | 10 - 19<br>20 - 500                                  | ±300<br>±150                         |                       |                   |
| CRS75 | 7520 | 2W                   |                      | -  | 1 - 4                                | ±300                  |                   |
|       |      |                      |                      | 5 - 10<br>11 - 350                                   | ±200<br>±150                         |                       |                   |

## HIGH POWER RATING ELECTRICAL SPECIFICATIONS

| TYPE  | ITEM | POWER RATING AT 70°C | OPERATING TEMP RANGE | RESISTANCE RANGE (mΩ)                       |                                     |                      | T.C.R. (PPM / °C) |
|-------|------|----------------------|----------------------|---|-------------------------------------|----------------------|-------------------|
|       |      |                      |                      | ±1%   | ±2%                                 | ±5%                  |                   |
| CRS06 | 0603 | 1/8W                 | -55~+155°C           |   | 51 - 100<br>101 - 500<br>501 - 1000 | ±400<br>±300<br>±200 |                   |
| CRS10 | 0805 | 1/4W                 |                      |   |                                     |                      |                   |
| CRS12 | 1206 | 1/2W                 |                      |   |                                     |                      |                   |
| CRS14 | 1210 | 3/4W                 |                      | 10 - 20<br>21 - 50<br>51 - 99<br>100 - 1000 | ±600<br>±400<br>±300<br>±200        |                      |                   |
| CRS20 | 2010 | 1W                   |                      |   |                                     |                      |                   |
| CRS25 | 2512 | 1.5W                 |                      |   |                                     |                      |                   |
| CRS25 | 2512 | 2W                   |                      |   |                                     |                      |                   |

## LOW TCR ELECTRICAL SPECIFICATIONS

| TYPE  | ITEM | POWER RATING AT 70°C | OPERATING TEMP RANGE | RESISTANCE RANGE (mΩ) |            |      | T.C.R. (PPM / °C) |
|-------|------|----------------------|----------------------|-----------------------|------------|------|-------------------|
|       |      |                      |                      | ±1%                   | ±2%        | ±5%  |                   |
| CRS12 | 1206 | 1/4W                 | -55~+155°C           |                       | 100 - 1000 | ±100 |                   |
| CRS14 | 1210 | 1/2W                 |                      |                       |            |      |                   |
| CRS20 | 2010 | 3/4W                 |                      |                       |            |      |                   |
| CRS25 | 2512 | 1W                   |                      | 20 - 1000             |            |      |                   |
| CRS37 | 3720 |                      |                      | 100 - 500             |            |      |                   |
| CRS75 | 7520 | 2W                   |                      | 50 - 350              |            |      |                   |

Operating Voltage -  $\sqrt{(P \cdot R)}$ ; Overload Voltage -  $2.5 \cdot \sqrt{(P \cdot R)}$ ; Operating Current -  $\sqrt{(P \cdot R)}$   
 Cal-Chip is capable of manufacturing the optional spec based on customer's requirement.



## MARKING FOR 0603

| CODES | TYPE   |
|-------|--------|
| 1R0   | 1.000Ω |
| R10   | 0.100Ω |
| R01   | 0.010Ω |
| 101   | 0.101Ω |
| 035   | 0.035Ω |

## ENVIRONMENTAL CHARACTERISTICS

| ITEMS  | REQUIREMENT                 | TEST METHOD   |
|--|-----------------------------|---|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.                    | +25°C/-55/+25/+125/+25°C  |
| Short Time Overload                            | ±0.5                        | RCWW*2.5 or Max. overload voltage for 5 seconds   |
|  | ΔR±1% for high power rating |   |
| Insulation Resistance                          | ≥1000MΩ                     | Apply 100V <sub>DC</sub> for 1 minute   |
| Endurance                                      | ±1                          | 70±2°C, Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"             |
| Damp Heat with Load                            | ±0.5%                       | 40±2°C, 90~95% R.H. Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| Dry Heat                                       | ±0.5%                       | at +155°C for 1000 hrs  |
| Bending Strength                               | As Spec.                    | Bending amplitude 3mm for 10 seconds  |
| Solderability                                  | 95% coverage Min.           | 245±5°C for 3 seconds   |
| Resistance to Soldering Heat                   | 0.5%                        | 260±5°C for 10 seconds  |
| Dielectric Withstand Voltage                   | By Type                     | Apply Max. Overload Voltage for 1 minute  |
| Thermal Shock                                  | ±0.5%                       | -55°C ~150°C, 100 cycles  |
| Low Temperature Operation                      | ±0.5%                       | 1 hour, -65°C followed by 45 minutes of RCWW  |

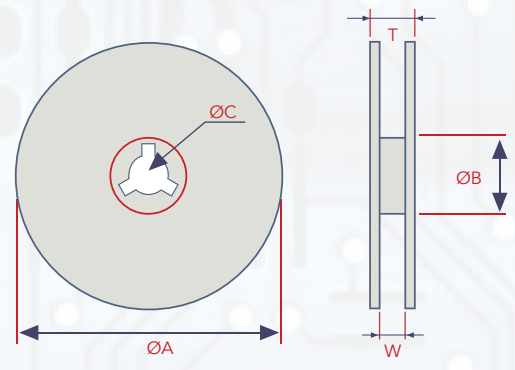
Reference Standards: MIL-STD-202, JIS-C 5201-1  
 Storage Temperature: 25±3°C: Humidity <80%RH

## PACKAGING

- Packaging Quantity & Reel Specifications

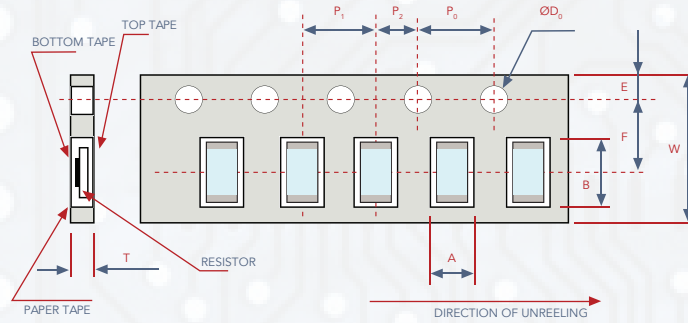
UNIT: MM

| TYPE       | ØA          | ØB         | ØC         | W          | T          | PAPER TAPE (EA) | EMBOSSED PLASTIC TAPE (EA) |   |       |
|------------|-------------|------------|------------|------------|------------|-----------------|----------------------------|---|-------|
| CRS02      | 178.0 ± 1.0 | 60.0 ± 1.0 | 13.5 ± 0.7 | 9.5 ± 0.1  | 11.5 ± 1.0 | 10,000          | -                          |   |       |
| CRS04      |             |            |            |            |            | -               |                            |   |       |
| CRS06      |             |            |            |            |            | -               |                            |   |       |
| CRS10      |             |            |            |            |            | -               |                            |   |       |
| CRS12      |             |            |            |            |            | -               |                            |   |       |
| CRS14      |             |            |            | 5,000      | -          |                 |                            |   |       |
| CRS20      |             |            |            | -          | 4,000      |                 |                            |   |       |
| CRS25      |             |            |            | -          | -          |                 |                            |   |       |
| CRS25 (2W) |             |            |            | 13.5 ± 1.0 | 15.5 ± 1.0 | -               | -                          | - | 2,000 |
| CRS21      |             |            |            | -          | -          | -               | -                          | - | -     |
| CRS37      | -           | -          | -          | -          | -          | -               |                            |   |       |
| CRS75      | -           | -          | -          | 17.5 ± 1.0 | 19.5 ± 1.0 | -               | -                          |   |       |



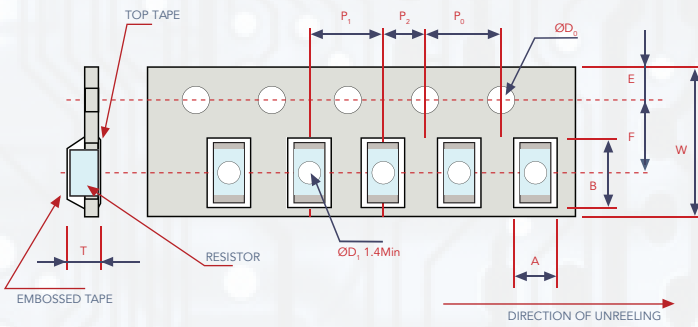
# PACKAGING

## - Paper Tape Specifications



| TYPE  | A           | B           | W          | E           | F           | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T           |
|-------|-------------|-------------|------------|-------------|-------------|----------------|----------------|----------------|-----------------|-------------|
| CRS02 | 0.38 ± 0.05 | 0.68 ± 0.05 | 8.0 ± 0.20 | 1.75 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10    | 4.00 ± 0.05    | 2.00 ± 0.05    | 1.50 + 0.1, -0  | 0.42 ± 0.20 |
| CRS04 | 0.65 ± 0.10 | 1.15 ± 0.10 |            |             |             |                |                |                |                 | 0.45 ± 0.20 |
| CRS06 | 1.10 ± 0.10 | 1.90 ± 0.10 |            |             |             |                |                |                |                 | 0.70 ± 0.10 |
| CRS10 | 1.60 ± 0.10 | 2.40 ± 0.20 |            |             |             |                |                |                |                 | 0.85 ± 0.10 |
| CRS12 | 1.90 ± 0.10 | 3.50 ± 0.20 |            |             |             |                |                |                |                 |             |
| CRS14 | 2.80 ± 0.10 |             |            |             |             |                |                |                |                 |             |

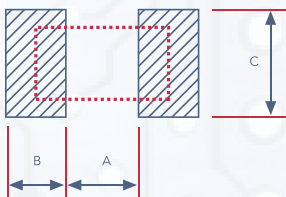
## - Embossed Plastic Tape Specifications



| TYPE       | A           | B           | W           | E           | F           | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T           |             |             |
|------------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|-----------------|-------------|-------------|-------------|
| CRS14      | 2.85 ± 0.10 | 5.45 ± 0.10 | 12.0 ± 0.10 | 1.75 ± 0.10 | 5.5 ± 0.05  | 4.00 ± 0.05    | 4.00 ± 0.10    | 2.00 ± 0.05    | 1.50 + 0.10     | 1.00 ± 0.20 |             |             |
| CRS25      | 3.40 ± 0.10 | 6.65 ± 0.10 | 12.0 ± 0.30 |             | 5.5 ± 0.10  | 4.00 ± 0.10    |                |                | 1.55 ± 0.05     | 1.45 ± 0.20 |             |             |
| CRS25 (ZW) | 3.38 ± 0.10 | 6.68 ± 0.10 |             |             | 5.5 ± 0.10  | 4.00 ± 0.10    |                |                | 4.00 ± 0.10     | 2.00 ± 0.05 | 1.55 ± 0.05 | 1.45 ± 0.20 |
| CRS21      | 2.50 ± 0.20 | 4.45 ± 0.20 |             |             | 5.5 ± 0.05  | 4.00 ± 0.05    |                |                | 1.50 + 0.20     | 1.20 ± 0.20 |             |             |
| CRS37      |             | 8.30 ± 0.20 |             |             | 16.0 ± 0.30 | 7.8 ± 0.05     |                |                |                 |             | 4.00 ± 0.05 |             |
| CRS75      |             | 8.30 ± 0.20 |             |             | 16.0 ± 0.30 | 7.8 ± 0.05     |                |                |                 |             | 4.00 ± 0.05 |             |

## RECOMMEND LAND PATTERN

- Pad Layout (Except for CRS25: High Power Rating Series)



| TYPE  | A    | B    | C          |
|-------|------|------|------------|
| CRS02 | 0.25 | 0.30 | 0.40 ± 0.2 |
| CRS04 | 0.50 | 0.50 | 0.60 ± 0.2 |
| CRS06 | 0.80 | 1.00 | 0.90 ± 0.2 |
| CRS10 | 1.00 | 1.00 | 1.35 ± 0.2 |
| CRS12 | 2.00 | 1.15 | 1.70 ± 0.2 |
| CRS14 | 2.00 | 1.15 | 2.50 ± 0.2 |
| CRS20 | 3.60 | 1.40 | 2.50 ± 0.2 |
| CRS25 | 4.90 | 1.60 | 3.10 ± 0.2 |
| CRS21 | 2.00 | 2.00 | 6.40 ± 0.2 |
| CRS37 | 1.00 | 1.80 | 3.90 ± 0.2 |
| CRS75 | 1.00 | 1.80 | 7.60 ± 0.2 |

- Pad Layout (For CRS25: High Power Rating Series)

| TYPE  | RESISTANCE RANGE | A   | B    | C         |
|-------|------------------|-----|------|-----------|
| CRS25 | 10 - 99mΩ        | 4.9 | 1.6  | 3.1 ± 0.2 |
| CRS25 | 100 - 1000mΩ     | 1.0 | 3.55 | 3.1 ± 0.2 |

