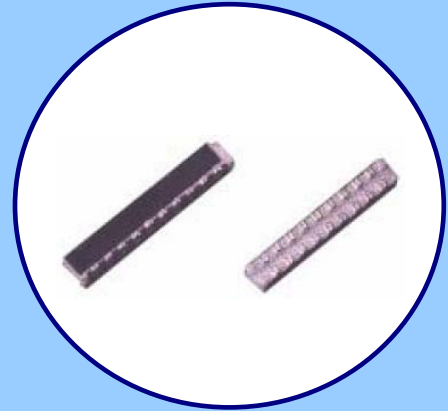


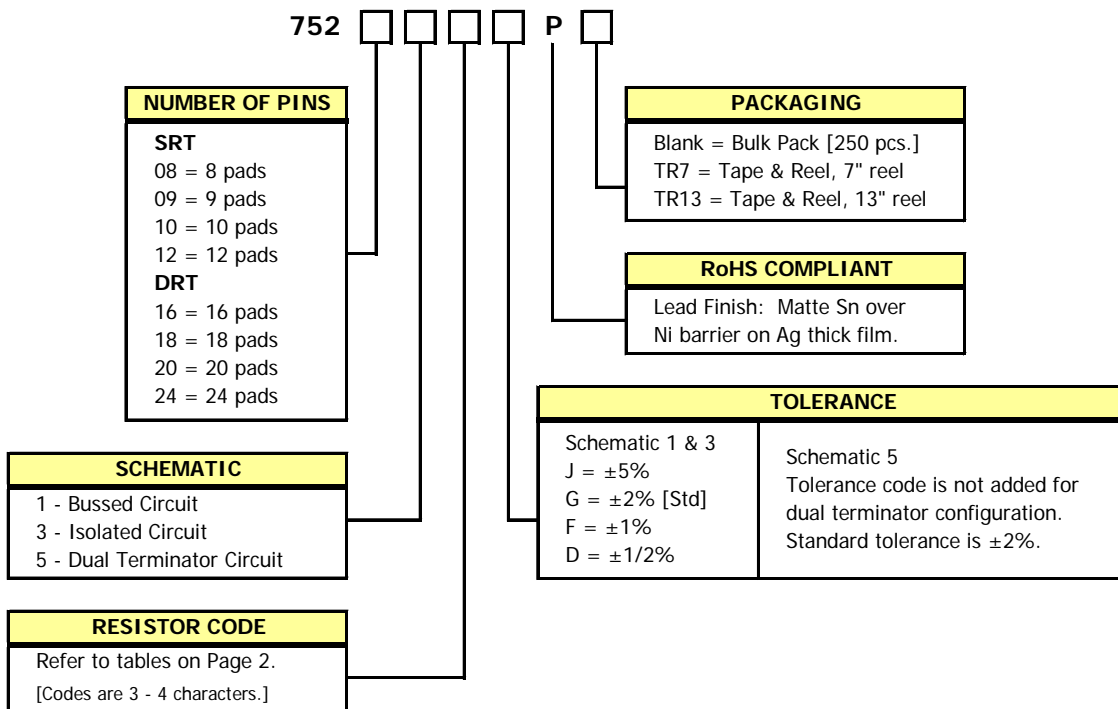


**FEATURES**

- **High Density Packaging**
- **Low Profile**
- **Inputs/Outputs Available**
  - Single Row Terminations [SRT] – 08, 09, 10, 12
  - Dual Row Terminations [DRT] – 16, 18, 20, 24
- **Nickel Barrier Solder-Coated Pads**
- Designed for Visual Inspection of Solder Joints
- Designed for Board Cleaning
- Application Specific Circuits are Available
- Compatible with Solder Reflow Process
- Tape and Reel Packaging
- **RoHS Compliant in Accordance with EU Directive 2005/95/EC**
  - Lead-Free Termination Finish
  - Exemption 5 for Pb in glass material and resistor elements



**ORDERING INFORMATION**



Notes:

1. No dashes or spaces to appear in part number.
2. Example Part Numbers;
  - Tape & Reel, 752091103GPTR13.
  - Bulk, 752103221GP.

**Not all performance combinations and resistor values may be available.  
Contact your local CTS Representative or CTS Customer Service for availability.**

## ORDERING INFORMATION

### AVAILABLE RESISTOR VALUES & EIA CODES

| Ohms | Code | Ohms | Code | Ohms | Code | Ohms | Code | Ohms | Code | Ohms | Code |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 0    | 000X | 68   | 680  | 470  | 471  | 3.3K | 332  | 27K  | 273  | 220K | 224  |
| 10   | 100  | 75   | 750  | 510  | 511  | 3.9K | 392  | 33K  | 333  | 270K | 274  |
| 12   | 120  | 82   | 820  | 560  | 561  | 4.7K | 472  | 39K  | 393  | 330K | 334  |
| 15   | 150  | 100  | 101  | 680  | 681  | 5.1K | 512  | 47K  | 473  | 390K | 394  |
| 18   | 180  | 110  | 111  | 820  | 821  | 5.6K | 562  | 51K  | 513  | 470K | 474  |
| 22   | 220  | 120  | 121  | 1K   | 102  | 6.8K | 682  | 56K  | 563  | 510K | 514  |
| 27   | 270  | 150  | 151  | 1.2K | 122  | 8.2K | 822  | 68K  | 683  | 560K | 564  |
| 33   | 330  | 180  | 181  | 1.5K | 152  | 10K  | 103  | 82K  | 823  | 680K | 684  |
| 39   | 390  | 220  | 221  | 1.8K | 182  | 12K  | 123  | 100K | 104  | 820K | 824  |
| 47   | 470  | 270  | 271  | 2.0K | 202  | 15K  | 153  | 120K | 124  | 1M   | 105  |
| 51   | 510  | 330  | 331  | 2.2K | 222  | 18K  | 183  | 150K | 154  |      |      |
| 56   | 560  | 390  | 391  | 2.7K | 272  | 22K  | 223  | 180K | 184  |      |      |

### DUAL TERMINATOR RESISTOR VALUES – Schematic 5

Standard CTS Dual Terminator products contain 2[N-2] resistors of two different values with resistor value connected to a common buss. The part number includes the EIA Code value of the Thevenin equivalent resistances of R<sub>1</sub> and R<sub>2</sub>. The Thevenin equivalent resistance is calculated in the following way: [The suffix letter relates only to the sequence of variations that equal the same equivalent resistance.]

$$R_{EO} = R_1 * R_2 / (R_1 + R_2)$$

| Example    |                           |                           |                            |
|------------|---------------------------|---------------------------|----------------------------|
| 752095131A | R <sub>1</sub> = 220 Ohms | R <sub>2</sub> = 330 Ohms | R <sub>EO</sub> = 132 Ohms |
| 752095191A | R <sub>1</sub> = 330 Ohms | R <sub>2</sub> = 470 Ohms | R <sub>EO</sub> = 194 Ohms |
| 752095131C | R <sub>1</sub> = 180 Ohms | R <sub>2</sub> = 470 Ohms | R <sub>EO</sub> = 130 Ohms |

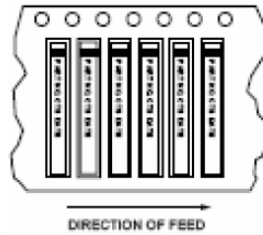
[Pad 1 is common to R<sub>2</sub> and Pin N is common to R<sub>1</sub>.]

| R1 Ohms | R2 Ohms | Thevenin Equivalent | CTS Code | R1 Ohms | R2 Ohms | Thevenin Equivalent | CTS Code | R3 Ohms | R4 Ohms | Thevenin Equivalent | CTS Code |
|---------|---------|---------------------|----------|---------|---------|---------------------|----------|---------|---------|---------------------|----------|
| 25      | 50      | 17 ohms             | 150A     | 330     | 680     | 222 ohms            | 221A     | 180     | 220     | 99 ohms             | 101A     |
| 30      | 50      | 19 ohms             | 190A     | 330     | 390     | 179 ohms            | 181A     | 560     | 1K      | 359 ohms            | 361A     |
| 30      | 620     | 29 ohms             | 290A     | 330     | 220     | 132 ohms            | 131D     | 680     | 1K      | 405 ohms            | 401A     |
| 33      | 4.7K    | 33 ohms             | 330A     | 330     | 330     | 165 ohms            | 171B     | 750     | 750     | 375 ohms            | 381A     |
| 36      | 620     | 34 ohms             | 340A     | 360     | 720     | 240 ohms            | 241B     | 750     | 2.3K    | 566 ohms            | 571A     |
| 43      | 620     | 40 ohms             | 400A     | 360     | 600     | 225 ohms            | 231A     | 1K      | 3.3K    | 767 ohms            | 771A     |
| 68      | 189     | 50 ohms             | 500B     | 390     | 620     | 239 ohms            | 241A     | 1K      | 2K      | 667 ohms            | 671A     |
| 75      | 620     | 67 ohms             | 670A     | 470     | 1K      | 320 ohms            | 321A     | 1.1K    | 2.2K    | 733 ohms            | 731A     |
| 80      | 220     | 59 ohms             | 590A     | 470     | 680     | 278 ohms            | 281A     | 1.2K    | 1.2K    | 600 ohms            | 601A     |
| 81      | 130     | 50 ohms             | 500A     | 470     | 940     | 313 ohms            | 311A     | 1.5K    | 1.5K    | 750 ohms            | 751A     |
| 81      | 2.2K    | 78 ohms             | 780A     | 500     | 500     | 250 ohms            | 251A     | 1.5K    | 3.3K    | 1031 ohms           | 102A     |
| 100     | 200     | 67 ohms             | 670B     | 560     | 910     | 347 ohms            | 351A     | 2K      | 2K      | 1000 ohms           | 102B     |
| 100     | 430     | 81 ohms             | 810A     | 110     | 220     | 73 ohms             | 730A     | 2.2K    | 5.6K    | 1579 ohms           | 162A     |
| 100     | 150     | 60 ohms             | 600A     | 118     | 178     | 71 ohms             | 710A     | 2.2K    | 4.4K    | 1467 ohms           | 152A     |
| 106     | 169     | 65 ohms             | 650A     | 120     | 200     | 75 ohms             | 750B     | 2.2K    | 3.3K    | 1320 ohms           | 132A     |
| 200     | 1.5K    | 176 ohms            | 171D     | 120     | 180     | 72 ohms             | 720A     | 3K      | 6.2K    | 2022 ohms           | 202A     |
| 220     | 330     | 132 ohms            | 131A     | 120     | 120     | 60 ohms             | 600B     | 3K      | 2K      | 1200 ohms           | 122A     |
| 220     | 270     | 121 ohms            | 121B     | 150     | 150     | 75 ohms             | 750A     | 3.3K    | 4.7K    | 1939 ohms           | 192A     |
| 220     | 220     | 110 ohms            | 111D     | 160     | 260     | 99 ohms             | 990A     | 3.9K    | 3.3K    | 1788 ohms           | 182A     |
| 240     | 170     | 100 ohms            | 101C     | 160     | 240     | 96 ohms             | 960A     | 4.7K    | 22K     | 3873 ohms           | 392A     |
| 240     | 620     | 173 ohms            | 171C     | 160     | 270     | 100 ohms            | 101D     | 5K      | 5K      | 2500 ohms           | 252A     |
| 250     | 250     | 125 ohms            | 131B     | 162     | 260     | 100 ohms            | 101B     | 6.8K    | 22K     | 5194 ohms           | 522A     |
| 270     | 470     | 171 ohms            | 171A     | 180     | 300     | 113 ohms            | 111B     | 10K     | 51K     | 8361 ohms           | 842A     |
| 270     | 180     | 108 ohms            | 111C     | 180     | 470     | 130 ohms            | 131C     | 50K     | 100K    | 33,333 ohms         | 333A     |
| 271     | 131     | 88 ohms             | 880A     | 180     | 390     | 123 ohms            | 121A     |         |         |                     |          |
| 330     | 470     | 194 ohms            | 191A     | 180     | 270     | 108 ohms            | 111A     |         |         |                     |          |

1. All tolerances +/-2%.
2. Other values available on request.
3. Suffix letter has no significance - assigned in sequential order.

**PACKAGING INFORMATION**

| Tape & Reel    |       |       |
|----------------|-------|-------|
| Reel Diameter  | 7"    | 13"   |
| Tape Width     | 24mm  |       |
| Tape Pitch     | 4mm   |       |
| No. Parts/Reel | 1,000 | 5,000 |



**ELECTRICAL CHARACTERISTICS**

**GENERAL REQUIREMENTS**

**Resistance Range:**

Standard: 10 Ohms to 1M Ohms

**Resistance Tolerance:**

Standard:  $\pm 2\%$  or 0.5 Ohms [whichever is greater]

Special:  $\pm 1\%$  or 0.3 Ohms [whichever is greater]

**Operating Temperature Range:**

-55°C to +125°C

**Dielectric Strength:**

100 V<sub>AC</sub>

**Temperature Coefficient:**

Standard:  $\pm 200$ ppm/°C

Special [33 Ohms to 1M Ohms]:  $\pm 100$ ppm/°C

**Maximum Operating Voltage:**

25 V, not to exceed rated power

**POWER RATING**

[Total Network Power, number of inputs/outputs (Watts)]

| SRT   | 8 Pad | 9 Pad | 10 Pad | 12 Pad | -      | -      | -      | -      |
|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| DRT   | -     | -     | -      | -      | 16 Pad | 18 Pad | 20 Pad | 24 Pad |
| @25°C | 1.2W  | 1.3W  | 1.4W   | 1.7W   | 1.4W   | 1.5W   | 1.6W   | 2.0W   |
| @70°C | 0.08W | 0.85W | 0.9W   | 1.1W   | 0.9W   | 0.95W  | 1.0W   | 1.3W   |

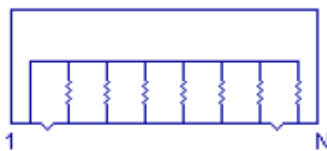
**MAXIMUM RESISTOR POWER**

[Not to exceed total network power]

| Schematic | 1     | 3     | 5     |
|-----------|-------|-------|-------|
| @25°C     | 0.12W | 0.24W | 0.12W |
| @70°C     | 0.08W | 0.16W | 0.08W |

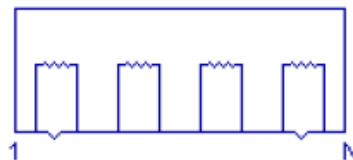
**CIRCUIT TYPES**

**BUSSED SRT [Schematic 1]**



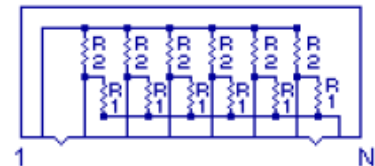
**ISOLATED SRT [Schematic 3]**

(Not Available in 9 Pads Configuration)

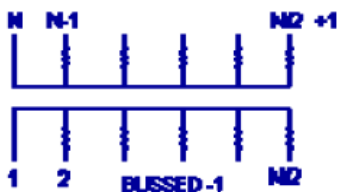


**DUAL TERMINATOR SRT [Schematic 5]**

(Not Available in DRT)



**BUSSED DRT [Schematic 1]**



**ISOLATED DRT [Schematic 3]**

(Not Available in 18 Pads Configuration)



**MECHANICAL SPECIFICATION**

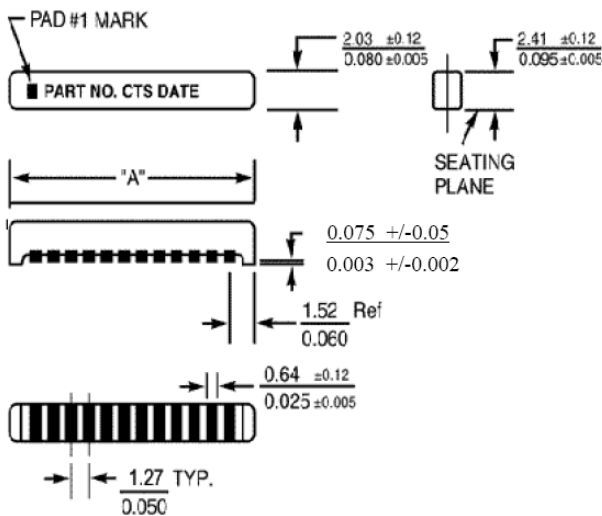
**PACKAGE DRAWING**

| No. of Pads<br>SRT/DRT | "A" Dimension |              |
|------------------------|---------------|--------------|
|                        | mm            | inch         |
| 08/16                  | 11.81 ±0.12   | 0.465 ±0.005 |
| 09/18                  | 13.08 ±0.12   | 0.515 ±0.005 |
| 10/20                  | 14.35 ±0.12   | 0.565 ±0.005 |
| 12/24                  | 16.89 ±0.12   | 0.665 ±0.005 |

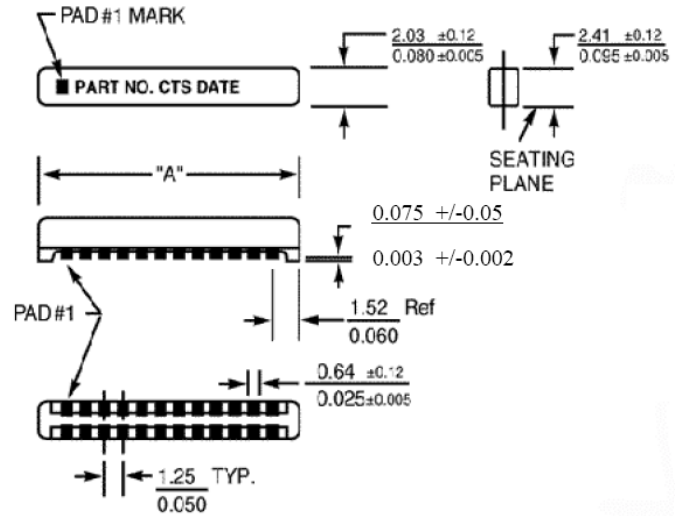
Notes:

1. Pad termination (e3). Barrier plating is nickel (Ni) over silver (Ag) thick film pad with Matte tin (Sn) finish.
2. Reflow conditions per JEDEC-J-STD-020, +260°C maximum.
3. MSL = 1.

**Single Row Termination (SRT)**



**Dual Row Termination (DRT)**



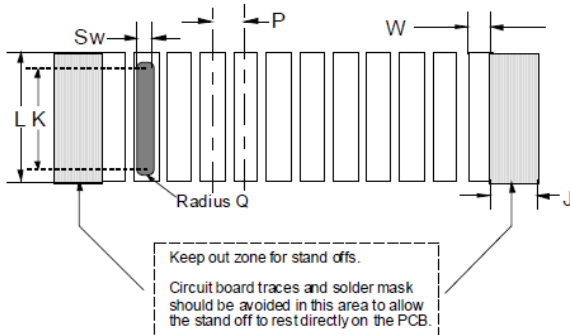
**RECOMMENDED LAND PATTERN**

| Recommended Land Pattern |     |      |      |       |      |      |       |
|--------------------------|-----|------|------|-------|------|------|-------|
| Dimension                |     | D    | P    | L     | W    | J    | S     |
| 752                      | mm  | 1.27 | 1.27 | 3.18  | 0.76 | 1.27 | 0.64  |
|                          | in. | 0.05 | 0.05 | 0.125 | 0.03 | 0.05 | 0.025 |

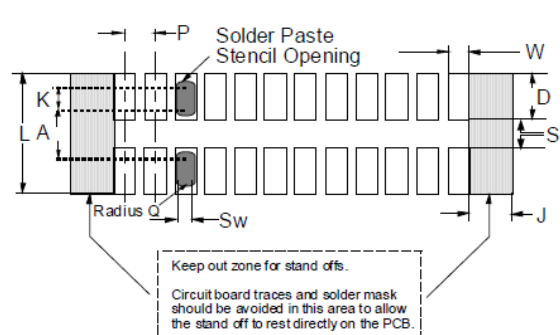
| SRT Solder Paste Stencil Opening |     |       |       |    |       |
|----------------------------------|-----|-------|-------|----|-------|
| Dimension                        |     | K     | Sw    | A  | Q     |
| 4 mil                            | mm  | 2.40  | 0.76  | NA | 0.38  |
|                                  | in. | 0.095 | 0.03  | NA | 0.015 |
| 6 mil                            | mm  | 1.90  | 0.63  | NA | 0.33  |
|                                  | in. | 0.075 | 0.025 | NA | 0.013 |

| DRT Solder Paste Stencil Opening |     |       |       |       |       |
|----------------------------------|-----|-------|-------|-------|-------|
| Dimension                        |     | K     | Sw    | A     | Q     |
| 4 mil                            | mm  | 0.66  | 0.76  | 1.52  | 0.38  |
|                                  | in. | 0.026 | 0.03  | 0.06  | 0.015 |
| 6 mil                            | mm  | 0.51  | 0.63  | 1.40  | 0.30  |
|                                  | in. | 0.02  | 0.025 | 0.055 | 0.012 |

**Single Row Termination**



**Dual Row Termination**



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