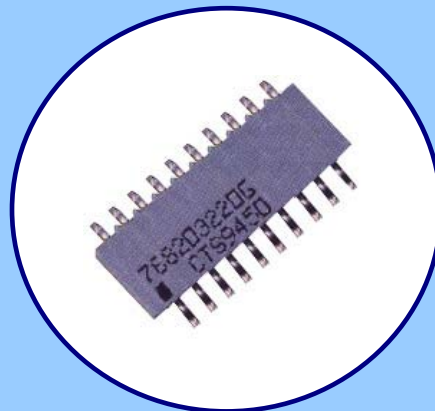


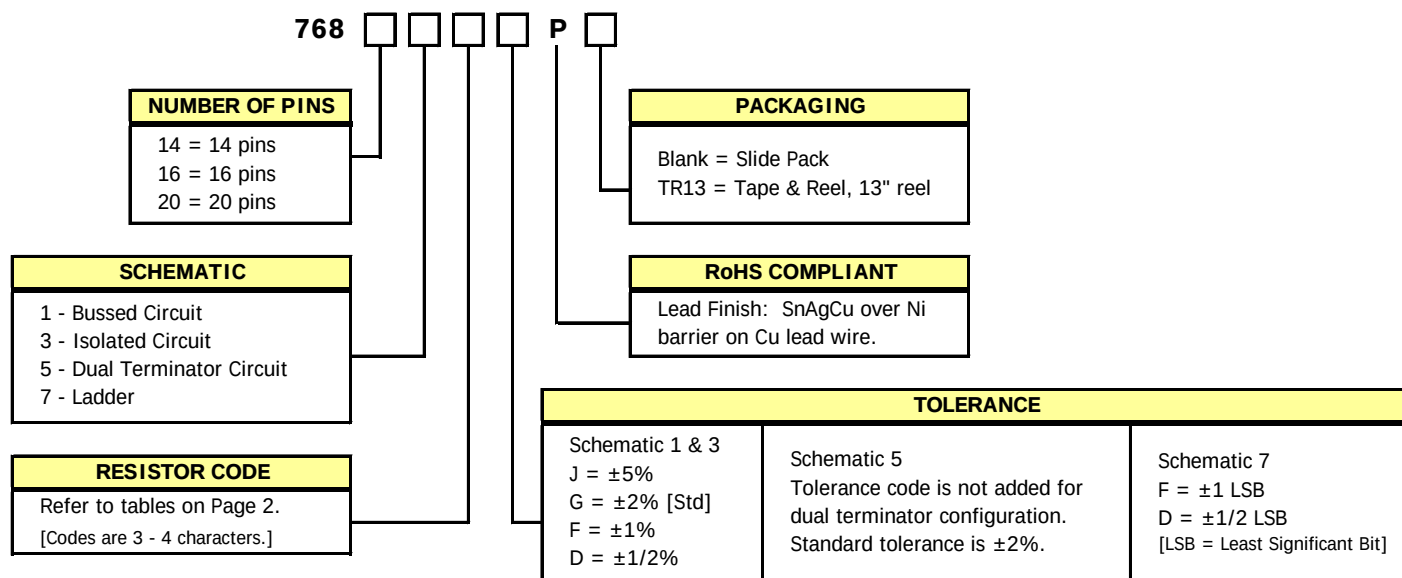


## FEATURES

- **Medium Body Design**
- **Surface Mount Gull Wing Design**
- **Low Profile, Board to Network Clearance – 0.0075” ±0.0025”**
- **Solid Ceramic Construction**
- **No Internal Dendrite Growth**
- Meets EIA PDP-100 SOGN-0002 Outline
- Application Specific Circuits are Available
- Compatible with Solder Reflow Process
- Tape and Reel Packaging or Slide Packs
- **RoHS Compliant in Accordance with EU Directive 2011/65/EU**
  - Lead-Free Termination Finish
  - Exemption 7(c)-I, Electrical and electronic components containing lead [Pb] in glass



## ORDERING INFORMATION



Notes:

1. No dashes or spaces to appear in part number.
2. Example Part Numbers;  
Tape & Reel, 768141103GPTR13.  
Slide Pack, 768141103GP.

**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  | 22K  | 223  | 180K | 184  |
| 10   | 100  | 75   | 750  | 510  | 511  | 3.9K | 392  | 27K  | 273  | 220K | 224  |
| 12   | 120  | 82   | 820  | 560  | 561  | 4.7K | 472  | 33K  | 333  | 270K | 274  |
| 15   | 150  | 100  | 101  | 680  | 681  | 5.1K | 512  | 39K  | 393  | 330K | 334  |
| 18   | 180  | 110  | 111  | 820  | 821  | 5.6K | 562  | 47K  | 473  | 390K | 394  |
| 22   | 220  | 120  | 121  | 1K   | 102  | 6.8K | 682  | 51K  | 513  | 470K | 474  |
| 27   | 270  | 150  | 151  | 1.2K | 122  | 8.2K | 822  | 56K  | 563  | 510K | 514  |
| 33   | 330  | 180  | 181  | 1.5K | 152  | 10K  | 103  | 68K  | 683  | 560K | 564  |
| 39   | 390  | 220  | 221  | 1.8K | 182  | 12K  | 123  | 82K  | 823  | 680K | 684  |
| 47   | 470  | 270  | 271  | 2.0K | 202  | 15K  | 153  | 100K | 104  | 820K | 824  |
| 51   | 510  | 330  | 331  | 2.2K | 222  | 18K  | 183  | 120K | 124  | 1M   | 105  |
| 56   | 560  | 390  | 391  | 2.7K | 272  | 20K  | 203  | 150K | 154  |      |      |

### DUAL TERMINATOR RESISTOR VALUES – Schematic 5

The Series 766 part number includes the EIA Code value of the Thevenin equivalent resistances of  $R_1$  and  $R_2$ . 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.]

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

| Example    |                          |                          |                             |
|------------|--------------------------|--------------------------|-----------------------------|
| 768205131C | $R_1 = 180 \text{ Ohms}$ | $R_2 = 470 \text{ Ohms}$ | $R_{EQ} = 130 \text{ Ohms}$ |

[Pin N/2 is common to  $R_2$  and Pin N is common to  $R_1$ .]

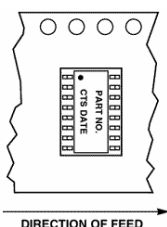
| R1 Ohms | R2 Ohms | Thevenin Equivalent | CTS Code | R1 Ohms | R2 Ohms | Thevenin Equivalent | CTS Code | R3 Ohms | R4 Ohms | Thevenin Equivalent | CTS Code |
|---------|---------|---------------------|----------|---------|---------|---------------------|----------|---------|---------|---------------------|----------|
| 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 | 14 Pin | 16 Pin | 20 Pin |
|-------------|--------|--------|--------|
| Tape Width  | 24mm   | 24mm   | 24mm   |
| Tape Pitch  | 12mm   | 12mm   | 12mm   |

| Reel Diameter  | 13"   | 13"   | 13"   |
|----------------|-------|-------|-------|
| No. Parts/Reel | 2,000 | 2,000 | 2,000 |



| Slide Packs          | 14 Pin | 16 Pin | 20 Pin |
|----------------------|--------|--------|--------|
| Tube Length          | 20"    | 20"    | 20"    |
| No. Parts/Slide Pack | 48     | 43     | 35     |

# ELECTRICAL & ENVIRONMENTAL CHARACTERISTICS

## GENERAL REQUIREMENTS

### Resistance Range:

Standard: 10 Ohms to 1M Ohms

### Operating Temperature Range:

-55°C to +125°C

### Temperature Coefficient:

10 Ohms to 99 Ohms -  $\pm 200$ ppm/°C typical  
100 Ohms to 1M Ohms -  $\pm 100$ ppm/°C typical

### Resistance Tolerance:

Standard:  $\pm 2\%$  or 0.5 Ohms [whichever is greater]  
Special:  $\pm 0.25\%$  or 0.3 Ohms [whichever is greater]

### Dielectric Strength:

100 V<sub>AC</sub>

### Maximum Operating Voltage:

50 V, not to exceed rated power

## POWER RATING

[Total Network Power]

| Temperature | 14 Pin | 16 Pin | 20 Pin |
|-------------|--------|--------|--------|
| @25°C       | 2.0W   | 2.3W   | 3.0W   |
| @70°C       | 1.3W   | 1.5W   | 2.0W   |

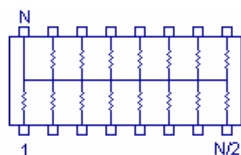
## MAXIMUM RESISTOR POWER

[Not to exceed total network power]

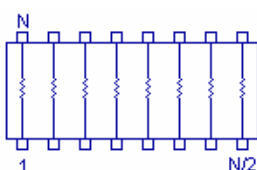
| Schematic | 1     | 3     | 5     | 7     |
|-----------|-------|-------|-------|-------|
| @25°C     | 0.15W | 0.30W | 0.15W | 0.15W |
| @70°C     | 0.10W | 0.20W | 0.10W | 0.10W |

## CIRCUIT TYPES

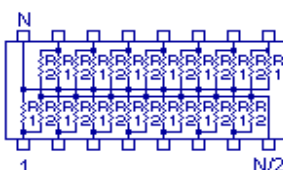
### BUSSED [Schematic 1]



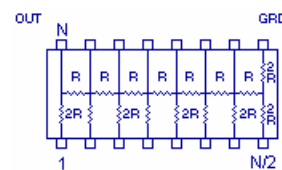
### ISOLATED [Schematic 3]



### DUAL TERMINATOR [Schematic 5]



### R/2R LADDER [Schematic 7]



## ENVIRONMENTAL

| TEST                      | MAXIMUM % DELTA R | MIL-STD 202 METHOD | TEST CONDITION/DESCRIPTION                          |
|---------------------------|-------------------|--------------------|-----------------------------------------------------|
| Temperature Cycling       | 0.25%             | 107                | Condition B; 5 cycles, -65°C to +125°C              |
| Short Time Overload       | 0.25%             |                    | 2 1/2 times rated voltage, 5 seconds [100V maximum] |
| Moisture Resistance       | 0.50%             | 106                | 240 hours, -10°C to +65°C, 90% RH, 0.1 rated load   |
| Load Humidity             | 1.00%             |                    | 1000 hours, +70°C, 85-92% RH, 0.1 rated load        |
| High Temperature Exposure | 1.00%             |                    | 240 hours @ +125°C, no load                         |
| Load Life                 | 1.00%             | 108                | Condition F; 2000 hours @ +70°C, rated load         |
| Resistance to Solder Heat | 0.25%             |                    | 30 seconds @ +218°C, dwell                          |
| Mechanical Shock          | 0.25%             | 213                | Condition I; 100g, 1m second, 3 shocks each plane   |
| Vibration                 | 0.25%             | 204                | Condition D; 20g, 10-2000Hz, 4 hours/plane          |
| Terminal Strength         | 0.25%             |                    | 24 hours @ -65°C, no load                           |
| Low Temperature Storage   | 0.25%             |                    | 45 minutes @ -65°C, no load                         |
| Low Temperature Operation | 0.25%             |                    | 94V-0                                               |
| Flammability              | N/A               |                    | 20g, 10-2000Hz, 4 hours/plane                       |
| Non-Fungus                | Pass              |                    | MIL-STD 810C                                        |
| Resistance to Solvents    | Pass              |                    | Isopropyl alcohol                                   |
| Solderability             | Pass              |                    | RMA Flux, +230°C, 5 seconds dip, 95% coverage       |

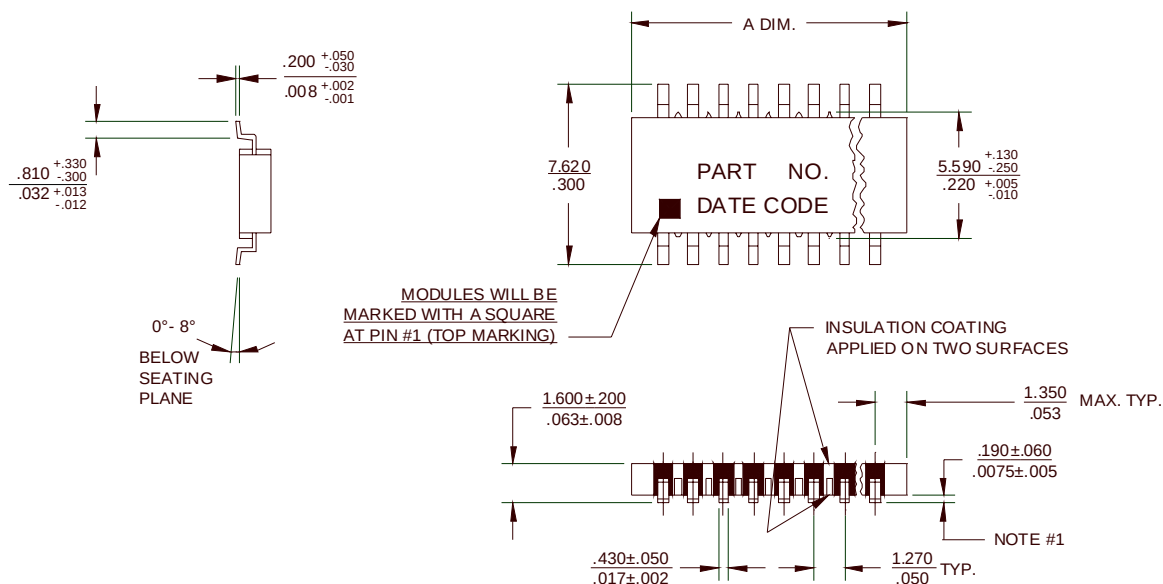
## MECHANICAL SPECIFICATION

## PACKAGE DRAWING

| No. of Pins | "A" Dimension |              |
|-------------|---------------|--------------|
|             | mm            | inch         |
| 14          | 9.91 ±0.25    | 0.390 ±0.010 |
| 16          | 11.18 ±0.24   | 0.440 ±0.009 |
| 20          | 13.70 ±0.25   | 0.540 ±0.010 |

Notes:

1. Lead Co-Planarity - 0.10mm maximum [0.039in.]
2. General Tolerances -  $\pm 0.25\text{mm}$  [ $\pm 0.010\text{in.}$ ]
3. Lead termination (e1). Barrier plating is nickel (Ni) with tin/silver/copper (Sn Ag Cu) finish.
4. Reflow conditions per JEDEC-J-STD-020, +260°C maximum.



## RECOMMENDED LAND PATTERN

| LEAD COUNT |     | A    | B    | C    | D     |
|------------|-----|------|------|------|-------|
| 14 Pin     | mm  | 5.34 | 7.37 | 9.40 | 7.60  |
|            | in. | 0.21 | 0.29 | 0.37 | 0.30  |
| 16 Pin     | mm  | 5.34 | 7.37 | 9.40 | 8.90  |
|            | in. | 0.21 | 0.29 | 0.37 | 0.35  |
| 20 Pin     | mm  | 5.34 | 7.37 | 9.40 | 11.40 |
|            | in. | 0.21 | 0.29 | 0.37 | 0.45  |

