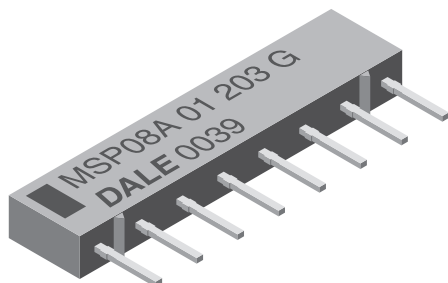


# Thick Film Resistor Networks, Single-In-Line, Molded SIP



## FEATURES

- Isolated, bussed and dual terminator schematics available
- 0.195" (4.95 mm) "A" or 0.350" (8.89 mm) "C" maximum seated height
- Thick film resistive elements
- Low temperature coefficient (- 55 °C to + 125 °C)  $\pm 100$  ppm/°C
- Rugged, molded case construction
- Reduces total assembly costs
- Compatible with automatic insertion equipment and reduces PC board space
- Wide resistance range (10  $\Omega$  to 2.2 M $\Omega$ )
- Available in tube pack or side-by-side pack
- Compliant to RoHS directive 2002/95/EC



Available


**RoHS\***  
COMPLIANT

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL/ SCHEMATIC | PROFILE | POWER RATING ELEMENT<br>$P_{70^\circ\text{C}}$<br>W | RESISTANCE RANGE<br>$\Omega$ | TOLERANCE (2)<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>(- 55 °C to + 125 °C)<br>$\pm$ ppm/°C | TCR TRACKING (1)<br>(- 55 °C to + 125 °C)<br>$\pm$ ppm/°C | MAXIMUM WORKING VOLTAGE (3)<br>V <sub>DC</sub> |
|-------------------------|---------|-----------------------------------------------------|------------------------------|---------------------------|------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------|
| MSPxxx01                | A<br>C  | 0.20<br>0.25                                        | 10 to 2.2M                   | 1, 2, 5                   | 100                                                              | 50                                                        | 100                                            |
| MSPxxx03                | A<br>C  | 0.30<br>0.40                                        | 10 to 2.2M                   | 1, 2, 5                   | 100                                                              | 50                                                        | 100                                            |
| MSPxxx05                | A<br>C  | 0.20<br>0.25                                        | 10 to 2.2M                   | 1, 2, 5                   | 100                                                              | 150                                                       | 100                                            |

### Notes

(1) Tighter tracking available

(2)  $\pm 2 \%$  standard,  $\pm 1 \%$  and  $\pm 5 \%$  available

(3) Continuous working voltage shall be  $\sqrt{P \times R}$  or maximum working voltage, whichever is less

## GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: MSP06A031K00GDA (preferred part numbering format)

|              |                                                       |                                    |                                              |                                                                                                                          |                                                                   |                                                  |                                                                             |   |   |   |   |   |   |   |  |  |  |
|--------------|-------------------------------------------------------|------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------|---|---|---|---|---|---|---|--|--|--|
| M            | S                                                     | P                                  | 0                                            | 6                                                                                                                        | A                                                                 | 0                                                | 3                                                                           | 1 | K | 0 | 0 | G | D | A |  |  |  |
| GLOBAL MODEL | PIN COUNT                                             | PACKAGE HEIGHT                     | SCHEMATIC                                    | RESISTANCE VALUE                                                                                                         | TOLERANCE CODE                                                    | PACKAGING                                        | SPECIAL                                                                     |   |   |   |   |   |   |   |  |  |  |
| MSP          | 06 = 6 pin<br>08 = 8 pin<br>09 = 9 pin<br>10 = 10 pin | A = "A" profile<br>C = "C" profile | 01 = Bussed<br>03 = Isolated<br>00 = Special | R = $\Omega$<br>K = k $\Omega$<br>M = M $\Omega$<br>10R0 = 10 $\Omega$<br>680K = 680 k $\Omega$<br>1M00 = 1.0 M $\Omega$ | F = $\pm 1 \%$<br>G = $\pm 2 \%$<br>J = $\pm 5 \%$<br>S = Special | EJ = Lead (Pb)-free, tube<br>DA = Tin/lead, tube | Blank = Standard (Dash Number) (Up to 3 digits) From 1 to 999 as applicable |   |   |   |   |   |   |   |  |  |  |

Historical Part Number example: MSP06A03102G (will continue to be accepted)

|                  |           |                |           |                  |                |           |
|------------------|-----------|----------------|-----------|------------------|----------------|-----------|
| MSP              | 06        | A              | 03        | 102              | G              | D03       |
| HISTORICAL MODEL | PIN COUNT | PACKAGE HEIGHT | SCHEMATIC | RESISTANCE VALUE | TOLERANCE CODE | PACKAGING |

New Global Part Numbering: MSP08C05131AGDA (preferred part numbering format)

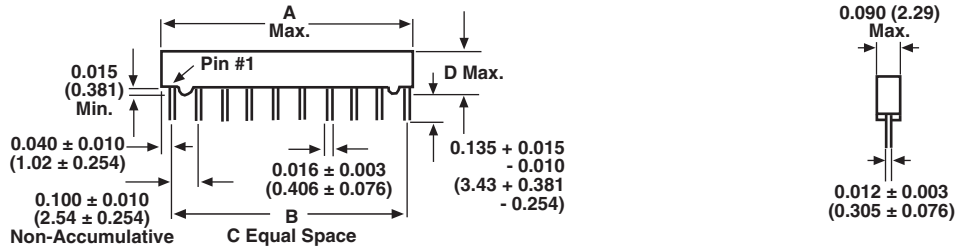
|              |                                                       |                                    |                      |                                                                                |                                                    |                                                  |                                                                             |   |   |   |   |   |   |   |  |  |  |
|--------------|-------------------------------------------------------|------------------------------------|----------------------|--------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------|---|---|---|---|---|---|---|--|--|--|
| M            | S                                                     | P                                  | 0                    | 8                                                                              | C                                                  | 0                                                | 5                                                                           | 1 | 3 | 1 | A | G | D | A |  |  |  |
| GLOBAL MODEL | PIN COUNT                                             | PACKAGE HEIGHT                     | SCHEMATIC            | RESISTANCE VALUE                                                               | TOLERANCE CODE                                     | PACKAGING                                        | SPECIAL                                                                     |   |   |   |   |   |   |   |  |  |  |
| MSP          | 06 = 6 pin<br>08 = 8 pin<br>09 = 9 pin<br>10 = 10 pin | A = "A" profile<br>C = "C" profile | 05 = Dual terminator | 3 digit impedance code, followed by alpha modifier (see Impedance Codes table) | F = $\pm 1 \%$<br>G = $\pm 2 \%$<br>J = $\pm 5 \%$ | EJ = Lead (Pb)-free, tube<br>DA = Tin/lead, tube | Blank = Standard (Dash Number) (Up to 3 digits) From 1 to 999 as applicable |   |   |   |   |   |   |   |  |  |  |

Historical Part Number example: MSP08C05221331G (will continue to be accepted)

|                  |           |                |           |                    |                    |           |           |
|------------------|-----------|----------------|-----------|--------------------|--------------------|-----------|-----------|
| MSP              | 08        | C              | 05        | 221                | 331                | G         | D03       |
| HISTORICAL MODEL | PIN COUNT | PACKAGE HEIGHT | SCHEMATIC | RESISTANCE VALUE 1 | RESISTANCE VALUE 2 | TOLERANCE | PACKAGING |

\* Pb containing terminations are not RoHS compliant, exemptions may apply

**DIMENSIONS** in inches (millimeters)



| GLOBAL MODEL | A (Max.)      | B             | C | D (Max.)                                       |
|--------------|---------------|---------------|---|------------------------------------------------|
| MSP06        | 0.590 (14.99) | 0.500 (12.70) | 5 | MSPxxA = 0.195 (4.95)<br>MSPxxC = 0.350 (8.89) |
| MSP08        | 0.790 (20.07) | 0.700 (17.78) | 7 |                                                |
| MSP10        | 0.990 (25.15) | 0.900 (22.86) | 9 |                                                |
| MSP09        | 0.890 (22.61) | 0.800 (20.32) | 8 | 0.195 (4.95) only                              |

## TECHNICAL SPECIFICATIONS

| PARAMETER                                              | UNIT             | MSP SERIES          |
|--------------------------------------------------------|------------------|---------------------|
| Package Power Rating<br>Maximum at + 25 °C and + 70 °C |                  | See Derating Curves |
| Voltage Coefficient of Resistance                      | V <sub>eff</sub> | < 50 ppm typical    |
| Dielectric Strength                                    | V <sub>AC</sub>  | 200                 |
| Isolation Resistance (03 Schematic)                    | Ω                | > 100 M             |
| Operating Temperature Range                            | °C               | - 55 to + 125       |
| Storage Temperature Range                              | °C               | - 55 to + 150       |

## MECHANICAL SPECIFICATIONS

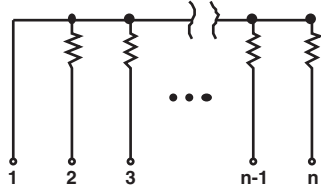
|                                |                                                                       |                                                    |
|--------------------------------|-----------------------------------------------------------------------|----------------------------------------------------|
| Marking Resistance to Solvents | Permanency testing per MIL-STD-202, Method 215                        |                                                    |
| Solderability                  | Per MIL-STD-202, Method 208E, RMA flux                                |                                                    |
| Body                           | Molded epoxy                                                          |                                                    |
| Terminals                      | Copper alloy, solder plated                                           |                                                    |
| Weight                         | MSP06A = 0.4 g<br>MSP08A = 0.5 g<br>MSP09A = 0.55 g<br>MSP10A = 0.6 g | MSP06C = 0.7 g<br>MSP08C = 0.9 g<br>MSP10C = 1.1 g |

## IMPEDANCE CODES

| CODE | R <sub>1</sub> (Ω) | R <sub>2</sub> (Ω) | CODE | R <sub>1</sub> (Ω) | R <sub>2</sub> (Ω) |
|------|--------------------|--------------------|------|--------------------|--------------------|
| 500B | 82                 | 130                | 141A | 270                | 270                |
| 750B | 120                | 200                | 181A | 330                | 390                |
| 800C | 130                | 210                | 191A | 330                | 470                |
| 990A | 160                | 260                | 221B | 330                | 680                |
| 101C | 180                | 240                | 281B | 560                | 560                |
| 111C | 180                | 270                | 381B | 560                | 1.2K               |
| 121B | 180                | 390                | 501C | 620                | 2.7K               |
| 121C | 220                | 270                | 102A | 1.5K               | 3.3K               |
| 131A | 220                | 330                | 202B | 3K                 | 6.2K               |

## CIRCUIT APPLICATIONS

### 01 Schematic



5, 7, 8 <sup>(1)</sup> or 9 resistors with one pin common

The MSPxxx01 circuit contains 5, 7, 8 <sup>(1)</sup> or 9 nominally equal resistors, each connected between a common pin (pin no. 1) and a discrete PC board pin. Commonly used in the following applications:

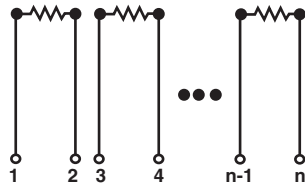
- "Wired OR" Pull-up
- Power Gate Pull-up
- TTL Input Pull-down
- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- TTL Unused Gate Pull-up

#### Note

<sup>(1)</sup> Available in "A" Profile only

Standard E-24 resistance values stocked. Consult factory.

### 03 Schematic

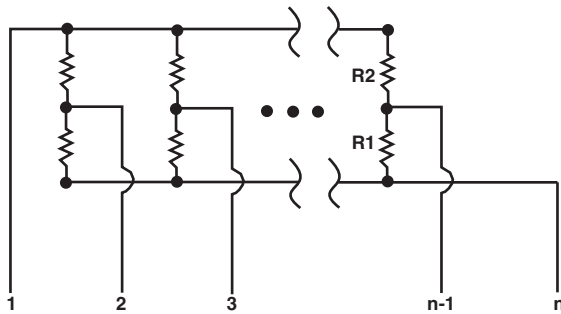


3, 4 or 5 isolated resistors

The MSPxxx03 circuit contains 3, 4 or 5 resistors of nominally equal value in a compact package. Each resistor is connected to two discrete PC pins.

Standard E-24 resistance values stocked. Consult factory.

### 05 Schematic



Pulse squaring and TTL dual-line terminators

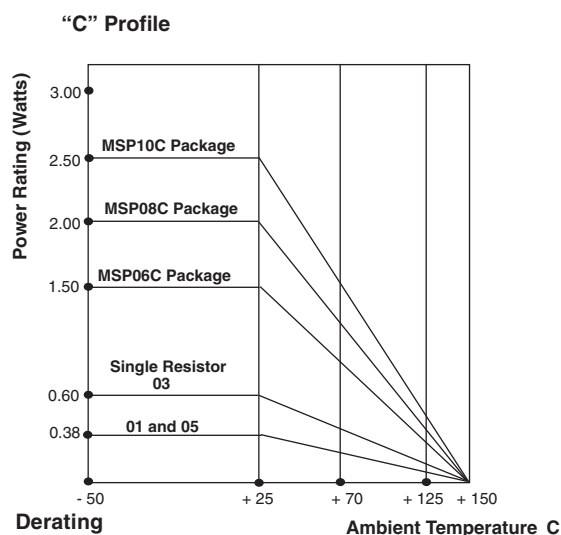
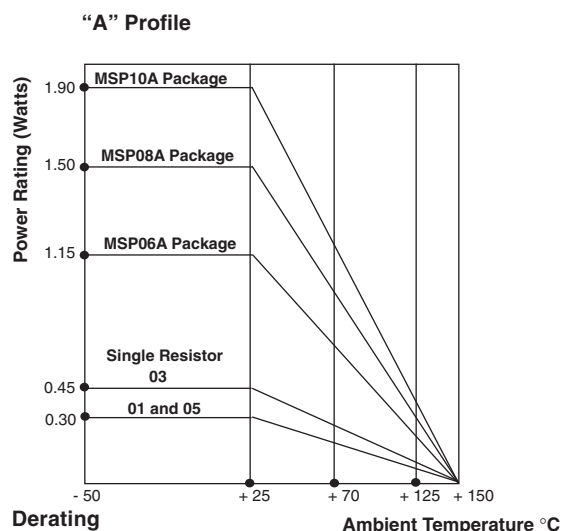
The MSPxxx05 circuits contain 4, 6, 7 <sup>(2)</sup> or 8 series pair of resistors. Each series pair is connected between two common lines. The junction of these resistor pairs is connected to the input terminals.

The 05 circuits are designed for TTL dual-line termination and pulse squaring.

#### Note

<sup>(2)</sup> Available in "A" Profile only

Many dual terminator resistance values stocked. Consult factory.


**“A” PROFILE + 70 °C PACKAGE RATINGS**

|        |        |
|--------|--------|
| MSP10A | 1.25 W |
| MSP09A | 1.12 W |
| MSP08A | 1.00 W |
| MSP06A | 0.75 W |

**“C” PROFILE + 70 °C PACKAGE RATINGS**

|        |        |
|--------|--------|
| MSP10C | 1.60 W |
| MSP08C | 1.30 W |
| MSP06C | 1.00 W |

**Note**

- Higher power ratings available. Contact factory.

**PERFORMANCE**

| TEST                            | CONDITIONS                                                                                                             | MAX. $\Delta R$ (TYPICAL TEST LOTS) |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Power Conditioning              | 1.5 x rated power, applied 1.5 h “ON” and 0.5 h “OFF” for 100 h $\pm$ 4 h at + 25 °C ambient temperature               | $\pm$ 0.50 % $\Delta R$             |
| Thermal Shock                   | 5 cycles between - 65 °C and + 125 °C                                                                                  | $\pm$ 0.50 % $\Delta R$             |
| Short Time Overload             | 2.5 x rated working voltage 5 s                                                                                        | $\pm$ 0.25 % $\Delta R$             |
| Low Temperature Operation       | 45 min at full rated working voltage at - 65 °C                                                                        | $\pm$ 0.25 % $\Delta R$             |
| Moisture Resistance             | 240 h with humidity ranging from 80 % RH to 98 % RH                                                                    | $\pm$ 0.50 % $\Delta R$             |
| Resistance to Soldering Heat    | Leads immersed in + 260 °C solder to within 1/16” of device body for 10 s                                              | $\pm$ 0.25 % $\Delta R$             |
| Shock                           | Total of 18 shocks at 100 g's                                                                                          | $\pm$ 0.25 % $\Delta R$             |
| Vibration                       | 12 h at maximum of 20 g's between 10 Hz and 2000 Hz                                                                    | $\pm$ 0.25 % $\Delta R$             |
| Load Life                       | 1000 h at + 70 °C, rated power applied 1.5 h “ON”, 0.5 h “OFF” for full 1000 h period. Derated according to the curve. | $\pm$ 1.00 % $\Delta R$             |
| Terminal Strength               | 4.5 pound pull for 30 s                                                                                                | $\pm$ 0.25 % $\Delta R$             |
| Insulation Resistance           | 10 000 M $\Omega$ (minimum)                                                                                            | -                                   |
| Dielectric Withstanding Voltage | -                                                                                                                      | -                                   |



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