SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: 19th June 1997

RoHS COMPLIANT CARBON FILM FIXED RESISTOR

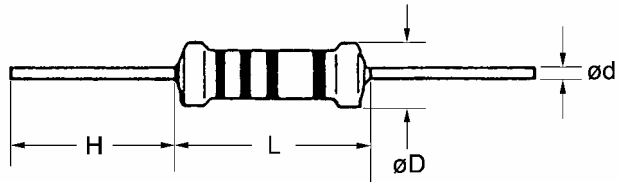
Data Sheet:

SEL-RGD-1001(1)

1. FEATURES

- High quality at competitive prices
- Meet JIS-C-5202 & USA MIL-R-22684B specifications
- Flame retardant type available on request
- Automatically insertable, also available pre-cut and formed for Panasert/Avisert
- Can be bulk-packed, tape/box or tape/reel
- Resistor with special weldable-leads and 38mm lead length available on request
- Too low or too high ohmic value can be supplied only case by case
- Tolerance available: ± 5%, ± 2%, ± 1%
- **RoHS Compliant**

2. DIMENSION



Sub-Miniature-Size & Micro-size Resistor

Style	Dimension (mm)				
	Rating	L	D	d +0.02 -0.05	H ± 3
CR-12	1/8W	3.5±0.2	1.5±0.2	0.45ø	28±3.0
CR-12S	1/4W	3.5±0.2	1.5±0.2	0.45ø	28±3.0
CR-25	1/4W	6.5±0.5	2.3±0.2	0.54ø	28±3.0
CR-33S	1/3W	6.5±0.5	2.3±0.2	0.54ø	28±3.0
CR-50SS	1/2W	6.5±0.5	2.3±0.2	0.54ø	28±3.0

Sub-Miniature-Size & Micro-size Resistor

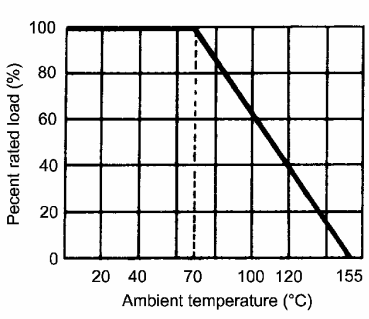
Style	Dimension (mm)				
	Rating	L	D	d +0.02 -0.05	H ± 3
CR-50S	1/2W	8.5±0.5	2.7±0.5	0.54ø	28±3.0
CR-100S	1.0W	9.0±0.5	3.5±0.5	0.70ø	28±3.0
CR-100	1.0W	11±1.0	4.0±0.5	0.70ø	35±3.0
CR-200S	2.0W	11±1.0	4.0±0.5	0.75ø	35±3.0
CR-200	2.0W	15±1.0	5.0±0.5	0.75ø	35±3.0

3. VOLTAGE & RATING

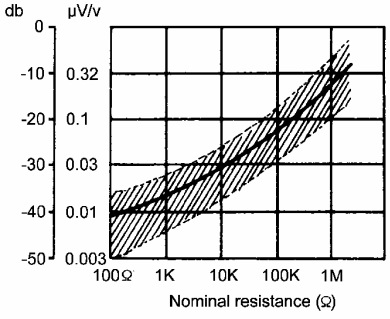
Style	Rating Wattage	Max. Working Voltage	Max. Overload Voltage	Resistance Range
CR-12	1/8W	200V	400V	1Ω - 1MegΩ
CR-25 CR-12S CR-33S	1/4W	250V	500V	1Ω - 10MegΩ
CR-33S	1/4W	250V	500V	1Ω - 10MegΩ
CR-50 CR-50SS	1/2W	350V	700V	1Ω - 10MegΩ
CR-100 CR-100S	1.0W	500V	1,000V	1Ω - 10MegΩ
CR-200 CR-200S	2.0W	500V	1,000V	1Ω - 10MegΩ

4. OTHER PHYSICAL PROPERTIES

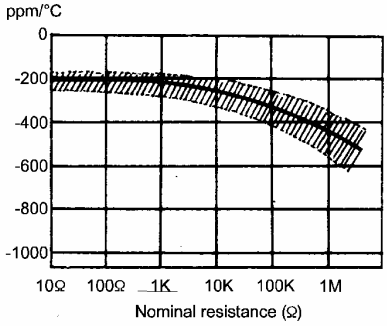
Derating Curve



Current Noise



Temp Coefficient



SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: 19th June 1997

RoHS COMPLIANT CARBON FILM FIXED RESISTOR

Data Sheet: SEL-RGD-1001(2)

5. PERFORMANCE SPECIFICATION

<table>
<tr><th>Characteristics</th><th colspan="4">Limits</th><th>Test Methods</th></tr>
<tr><td rowspan="4">T.C.R.
JIS-C 5202 5.2</td><td colspan="2">RANGE</td><td colspan="2">T.C.R.</td><td rowspan="4">Natural resistance change per temp. degree centigrade.
$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$(ppm/°C)
R_1: Resistance value at room temperature (t_1)
R_2: Resistance value at room temp. plus 100°C (t_2)
Test Pattern: Room temp., Room temp. + 100°C</td></tr>
<tr><td colspan="2">1E – 91K</td><td colspan="2">0 – -450ppm/°C</td></tr>
<tr><td colspan="2">100K – 1M</td><td colspan="2">0 – -700ppm/°C</td></tr>
<tr><td colspan="2">1.1M – 10M</td><td colspan="2">-800 – -1500ppm/°C</td></tr>
<tr><td>Dielectric withstanding voltage
JIS-C-5202 5.7</td><td colspan="4">No evidence of flashover mechanical damage, arcing or insulation breakdown.</td><td>Resistor shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the above list for 60+10/– 0 seconds.</td></tr>
<tr><td>Temperature cycling
JIS-C-5202 7.4</td><td colspan="4">Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Resistance change after continuous five cycles for duty cycle specified below.
<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>–55°C ± 3°C</td><td>30 minutes</td></tr><tr><td>2</td><td>Room temp.</td><td>10 – 15 minutes</td></tr><tr><td>3</td><td>+155°C ± 2°C</td><td>30 minutes</td></tr><tr><td>4</td><td>Room temp.</td><td>10 – 15 minutes</td></tr></table></td></tr>
<tr><td>Short-time overload
JIS-C-5202 5.5</td><td colspan="4">Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.</td></tr>
<tr><td rowspan="5">Load Life in humidity
JIS-C-5202 5.9</td><td colspan="2">Resistance value</td><td colspan="2">ΔR/R</td><td rowspan="5">Resistance change after 1,000 hours operating at RCWV with duty cycle of 1.5 hours “on”, 0.5 hour “off” in a humidity test chamber controlled at 40°C ± 2°C and 90 to 95% relative humidity.</td></tr>
<tr><td rowspan="2">Normal type</td><td>Less than 100KΩ</td><td colspan="2">± 3%</td></tr>
<tr><td>100KΩ or more</td><td colspan="2">± 5%</td></tr>
<tr><td rowspan="2">Flame retardant type</td><td>Less than 100K</td><td colspan="2">± 5%</td></tr>
<tr><td>100KΩ or more</td><td colspan="2">± 10%</td></tr>
<tr><td rowspan="5">Load life
JIS-C-5202 7.10</td><td colspan="2">Resistance value</td><td colspan="2">ΔR/R</td><td rowspan="5">Permanent resistance change after 1,000 hours operating at RCWV with duty cycle of 1.5 hours “on”, 0.5 hour “off” at 70°C ± 2% ambient.</td></tr>
<tr><td rowspan="2">Normal type</td><td>Less than 56KΩ</td><td colspan="2">± 2%</td></tr>
<tr><td>56KΩ or more</td><td colspan="2">± 3%</td></tr>
<tr><td rowspan="2">Flame retardant type</td><td>Less than 100K</td><td colspan="2">± 5%</td></tr>
<tr><td>100KΩ or more</td><td colspan="2">± 10%</td></tr>
<tr><td>Insulation resistance
JIS-C-5202 5.6</td><td colspan="4">Insulation resistance is 10,000 MΩ Min.</td><td>Resistors shall be clamped in the trough of 90° metallic V-block and shall be tested at DC. potential respectively specified in the above list for 60 +10/–0 seconds.</td></tr>
<tr><td>Terminal strength
JIS-C-5202 6.1</td><td colspan="4">No evidence of mechanical damage.</td><td>Direct load:
Resistance to a 2.5kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads.
Twist test:
Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations.</td></tr>
<tr><td>Resistance to soldering heat
JIS-C-5202 6.4</td><td colspan="4">Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Permanent resistance change when leads immersed to 3.2 – 4.8mm from the body in 350°C ±10°C solder for 3 ± 0.5 seconds.</td></tr>
<tr><td>Solderability
JIS-C-5202 6.5</td><td colspan="4">95% coverage Min.</td><td>The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes.
Test temp. of solder: 235°C ± 5°C
Dwell time in solder: 3 + 0.5/–0 seconds</td></tr>
</table>

SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: 23rd July, 1997

RoHS COMPLIANT PRECISION METAL FILM RESISTOR

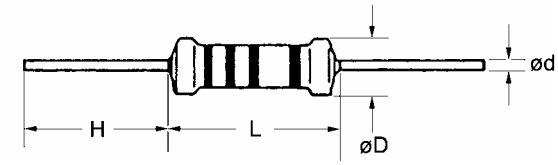
Data Sheet:

SEL-RGD-1002(1)

1. MATERIALS & FEATURES

- Meet US military specification MIL-R-10509F and JIS-C-5202 5.2
- Nichrome resistor element provides stable performance in various environments
- Wide precision range in small package
- Multiple epoxy coating on vacuum-deposited metal film provides superior moisture protection
- Low T. C. of R.
- Flame retardant type available
- Low noise & voltage coefficient
- EIA standard color coding
- Too low or too high ohmic value can be supplied only case by case.
- **RoHS Compliant**

2. DIMENSIONS



Normal Size

Style	Rating	MIL-R 10509F	Dimension (mm)			
			L Max.	D Max.	d +0.02 -0.05	H ± 3
MF-12	0.125W	RN50	4.2	2.0	0.45	28
MF-25	0.250W	RN55	6.8	2.5	0.54	28
MF-50	0.500W	RN60	10.0	3.5	0.54	28
MF-100	1.000W	RN65	12.0	5.0	0.70	28
MF-200	2.000W	RN70	16.0	5.5	0.70	28

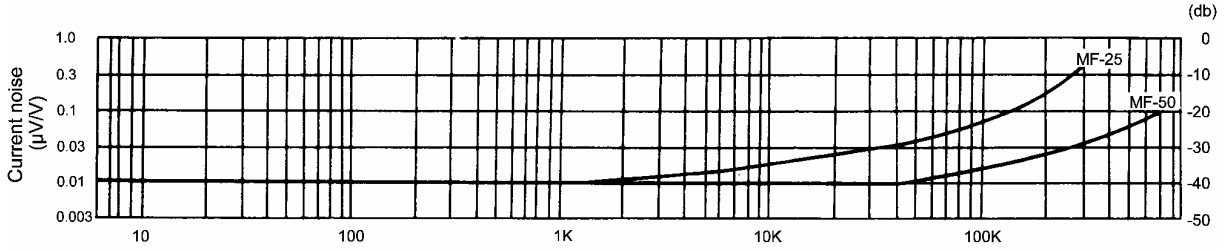
Small Size

Style	Dimension (mm)				
	Rating	L Max	D Max.	d +0.02 -0.05	H ± 3
MF-25-SS	0.25W	3.7	1.9	0.45	28
MF-40-SS	0.40W	3.7	1.9	0.45	28
MF-50-S	0.50W	9.0	3.0	0.54	28
MF-50-SS	0.50W	6.8	2.5	0.54	28
MF-60-S	1.00W	6.8	2.5	0.70	28

3. GENERAL SPECIFICATION

Style	Rating Wattage	Max. Working V. (At 70°C)	Max. Overload V. (At 70°C)	Resistance Tolerance	T.C.R.	Resistance Range	Special order		
							Resistance Tolerance	T.C.R.	Resistance Range
MF-12	0.125W	200V	400V	± 5%	± 200ppm/°C	10.0Ω – 1MΩ	± 0.25%	± 15 ppm	51.1Ω-200KΩ
MF-25-SS	0.250W	250V		± 2%	± 100ppm/°C		± 0.50%	± 25 ppm	51.1Ω-511KΩ
MF-40-SS	0.400W	350V		± 1%	± 50ppm/°C			± 50 ppm	
MF-25	0.250W	250V	500V	± 5%	± 200ppm/°C	1.0Ω – 1MΩ	± 0.10%	± 15 ppm	100Ω-100KΩ
MF-50-SS	0.500W			± 2%	± 100ppm/°C	2.2Ω – 1MΩ	± 0.25%	± 25 ppm	51.1Ω-330KΩ
MF-60-S	0.600W			± 1%	± 50ppm/°C	10.2Ω – 1MΩ	± 0.50%	± 50 ppm	10Ω-1MΩ
MF-50	0.500W	350V	700V	± 5%	± 200ppm/°C	10.0Ω – 1MΩ	± 0.10%	± 15 ppm	100Ω-330KΩ
MF-50-S				± 2%	± 100ppm/°C	2.2Ω – 1MΩ	± 0.25%	± 25 ppm	51.1Ω-511KΩ
				± 1%	± 50ppm/°C	10.0Ω – 1MΩ	± 0.50%	± 50 ppm	10Ω-1MΩ
MF-100	1.000W	500V	1000V	± 5%	± 200ppm/°C	10.0Ω – 1MΩ	± 0.10%	± 15 ppm	100Ω-330KΩ
				± 2%	± 100ppm/°C	51.1Ω – 1MΩ	± 0.25%	± 25 ppm	51.1Ω-511KΩ
				± 1%	± 50ppm/°C	51.1Ω – 1MΩ	± 0.50%	± 50 ppm	10Ω-1MΩ
MF-200	2.000W	500V	1000V	± 5%	± 200ppm/°C	10.0Ω – 1MΩ	± 0.10%	± 15 ppm	100Ω-330KΩ
				± 2%	± 100ppm/°C	51.1Ω – 1MΩ	± 0.25%	± 25 ppm	51.1Ω-511KΩ
				± 1%	± 50ppm/°C	51.1Ω – 1MΩ	± 0.50%	± 50 ppm	10Ω-1MΩ

4. CURRENT NOISE LEVEL



SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: 23rd July, 1997

PRECISION METAL FILM FIXED RESISTOR

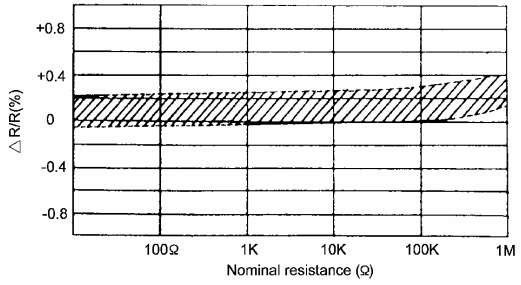
Data Sheet:

SEL-RGD-1002(2)

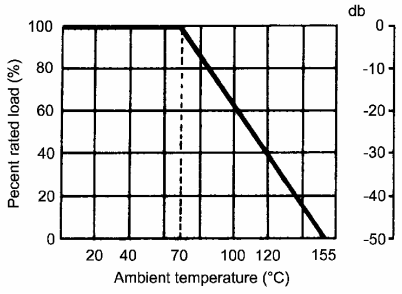
6. PERFORMANCE SPECIFICATIONS

Characteristics	Limits	Test Methods
Temperature coefficient JIS-C 5202 5.2	Within the temperature coefficient specified below Max. T: C. R. ± 25 ppm/°C ± 100 ppm/°C ± 25 ppm/°C ± 200 ppm/°C ± 50 ppm/°C	Natural resistance change per temp. degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 (ppm/°C)$ R_1: Resistance value at room temperature (t_1) R_2: Resistance value at room temp. plus 100°C (t_2) Test Pattern: Room temp., Room temp. + 100°C
Dielectric withstanding voltage JIS-C-5202 5.7	No evidence of flashover, mechanical damage, arcing or insulation breakdown.	Resistor shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the above list for 60+10/-0 seconds.
Temperature cycling JIS-C-5202 7.4	Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.	Resistance change after continuous five cycles for duty cycle specified below. Step / Temperature / Time 1 / –55°C ± 3°C / 30 minutes 2 / Room temp. / 10 – 15 minutes 3 / +155°C ± 2°C / 30 minutes 4 / Room temp. / 10 – 15 minutes
Humidity (steady state) JIS-C-5202 7.5	Resistance change rate is ± (2% + 0.05Ω) Max. with no evidence of mechanical damage.	Temporary resistance change after a 240 hours exposure in a humidity test chamber controlled at 40°C ±2°C and at 90 to 95% relative humidity.
Short-time overload JIS-C-5202 5.5	Resistance change rate is ± (0.5% + 0.05Ω) Max. with no evidence of mechanical damage.	Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.
Pulse overload JIS-C-5202 5.8	Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.	Resistance change after 10,000 cycles (1 second "ON", 25 seconds "OFF") at 4 times RCWV.
Load life in humidity JIS-C-5202 7.9	Resistance change rate is ± (5% + 0.05Ω) Max. with no evidence of mechanical damage.	Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity test chamber controlled at 40°C ± 2°C and at 90 to 95% relative humidity.
Load life JIS-C-5202 7.10	Resistance change rate is ± (5% + 0.05Ω) Max. with no evidence of mechanical damage.	Permanent resistance change after 1,000 hours operating at RCWV, with duty cycle of 1.5 hours "on", 0.5 hour "off" at 70°C ±2°C ambient temperature.
Terminal strength JIS-C-5202 6.1	With no evidence of mechanical damage	Direct load: Resistance to a 2.5kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads. Twist test: Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations.
Solderability JIS-C-5202 6.5	95% coverage Min.	The area covered total with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temp. of solder: 235°C ± 5°C Dwell time in solder: 3 + 0.5/–0 seconds
Resistance to solvent JIS-C-5202 6.9	No deterioration of protective coatings and markings	Specimens shall be immersed in a bath of trichloroethane completely for 3 minutes with ultrasonic.

Load Life



Derating Curve



SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: 19th June, 1997

WELDABLE-LEAD CARBON FILM FIXED RESISTOR

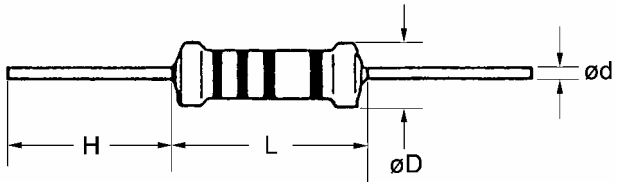
Data Sheet:

SEL-RGD-1003-(1)

1. FEATURES

- Weldable-Leads
- High quality at competitive prices
- Meet JIS-C-5202 & USA MIL-R-22684B specifications
- Flame retardant type available on request
- Automatically insertable, also available pre-cut and formed for Panasert/Avisert
- Can be bulk-packed, tape/box or tape/reel
- Resistor with special weldable-leads and 38mm lead length available on request
- Too low or too high ohmic value can be supplied only case by case
- Tolerance available: ± 5%, ± 2%, ± 1%

2. DIMENSION



Sub-Miniature-Size Resistor

Style	Dimension (mm)				
	Rating	L	D	d +0.02 -0.02	H ± 3
CP-12	1/8W	3.5±0.2	1.5±0.2	0.50ø	28±3.0
CP-12S	1/6W	3.5±0.2	1.5±0.2	0.50ø	28±3.0
CP-25S	1/4W	3.5±0.5	1.5±0.2	0.50ø	28±3.0
CP-25	1/4W	6.5±0.5	2.5 Max.	0.50ø	28±3.0
CP-25-38	1/4W	6.5±0.5	2.5 Max.	0.50ø	38±3.0

Miniature-Size Resistor

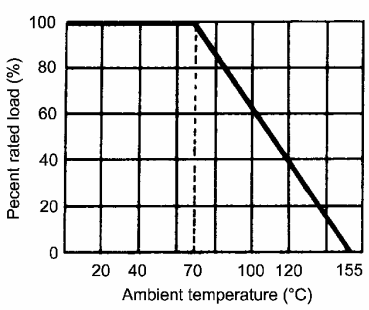
Style	Dimension (mm)				
	Rating	L	D	d +0.02 -0.02	H ± 3
CP-33S	1/3W	6.5±0.5	2.5 Max.	0.50ø	28±3.0
CP-33S-38	1/3W	6.5±0.5	2.5 Max.	0.50ø	38±3.0
CP-33	1/3W	9.0±1.0	3.0 Max.	0.50ø	35±3.0
CP-50S	1/2W	9.0±1.0	3.0 Max.	0.50ø	35±3.0

3. VOLTAGE & RATING

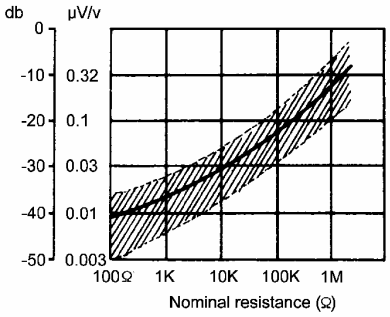
Style	Rating Wattage	Max. Working Voltage	Max. Overload Voltage	Resistance Range
CP-12	1/8W	200V	400V	1Ω - 1MegΩ
CP-12S CP-25S CP-25	1/4W	250V	500V	1Ω - 10MegΩ
CP-33 CP-33S	1/3W	300V	600V	1Ω - 10MegΩ
CR-50-S	1/2W	350V	700V	1Ω - 10MegΩ

4. OTHER PHYSICAL PROPERTIES

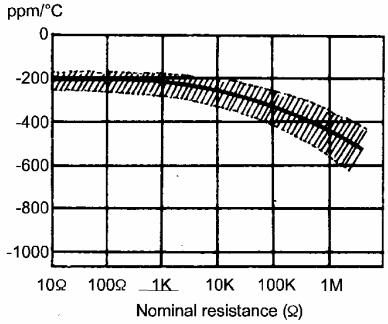
Derating Curve



Current Noise



Temp Coefficient



SOLITRONICS ENGINEERING LTD.

TEL: (852) 2730-8145 FAX: (852) 2730-3245 E-mail: info@solitronics.com

RESISTOR SPECIFICATIONS

Date: **19th June, 1997**

WELDABLE-LEAD CARBON FILM FIXED RESISTOR

Data Sheet:

SEL-RGD-1003-(2)

5. PERFORMANCE SPECIFICATION

<table>
<tr><th>Characteristics</th><th>Limits</th><th>Test Methods</th></tr>
<tr><td>T.C.R.
JIS-C 5202 5.2</td><td>RANGE / T.C.R.
1E – 91K: 0 – -450ppm/°C
100K – 1M: 0 – -700ppm/°C
1.1M – 10M: -800 – -1500ppm/°C</td><td>Natural resistance change per temp. degree centigrade.
$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 (ppm/°C)$
R_1: Resistance value at room temperature (t_1)
R_2: Resistance value at room temp. plus 100°C (t_2)
Test Pattern: Room temp., Room temp. + 100°C</td></tr>
<tr><td>Dielectric withstanding voltage
JIS-C-5202 5.7</td><td>No evidence of flashover mechanical damage, arcing or insulation breakdown.</td><td>Resistor shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the above list for 60 +10 / – 0 seconds.</td></tr>
<tr><td>Temperature cycling
JIS-C-5202 7.4</td><td>Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Resistance change after continuous five cycles for duty cycle specified below.
Step 1: –55°C ± 3°C, 30 minutes
Step 2: Room temp., 10 – 15 minutes
Step 3: +155°C ± 2°C, 30 minutes
Step 4: Room temp., 10 – 15 minutes</td></tr>
<tr><td>Short-time overload
JIS-C-5202 5.5</td><td>Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.</td></tr>
<tr><td>Load Life in humidity
JIS-C-5202 5.9</td><td>Resistance value / ΔR/R
Normal type: Less than 100KΩ ± 3%; 100KΩ or more ± 5%
Flame retardant type: Less than 100K ± 5%; 100KΩ or more ± 10%</td><td>Resistance change after 1,000 hours operating at RCWV with duty cycle of 1.5 hours “on”, 0.5 hour “off” in a humidity test chamber controlled at 40°C ± 2°C and 90 to 95% relative humidity.</td></tr>
<tr><td>Load life
JIS-C-5202 7.10</td><td>Resistance value / ΔR/R
Normal type: Less than 56KΩ ± 2%; 56KΩ or more ± 3%
Flame retardant type: Less than 100K ± 5%; 100KΩ or more ± 10%</td><td>Permanent resistance change after 1,000 hours operating at RCWV with duty cycle of 1.5 hours “on”, 0.5 hour “off” at 70°C ± 2% ambient.</td></tr>
<tr><td>Insulation resistance
JIS-C-5202 5.6</td><td>Insulation resistance is 10,000 MΩ Min.</td><td>Resistors shall be clamped in the trough of 90° metallic V-block and shall be tested at DC. potential respectively specified in the above list for 60 +10/–0 seconds.</td></tr>
<tr><td>Terminal strength
JIS-C-5202 6.1</td><td>No evidence of mechanical damage.</td><td>Direct load:
Resistance to a 2.5kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads.
Twist test:
Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations.</td></tr>
<tr><td>Resistance to soldering heat
JIS-C-5202 6.4</td><td>Resistance change rate is ± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Permanent resistance change when leads immersed to 3.2 – 4.8mm from the body in 350°C ±10°C solder for 3 ± 0.5 seconds.</td></tr>
<tr><td>Solderability
JIS-C-5202 6.5</td><td>95% coverage Min.</td><td>The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes.
Test temp. of solder: 235°C ± 5°C
Dwell time in solder: 3 + 0.5/–0 seconds</td></tr>
</table>