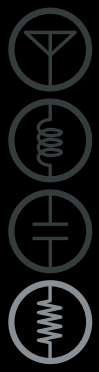
Innovative Service Around the Globe YAGEO

# DATA SHEET

## CHIP RESISTORS

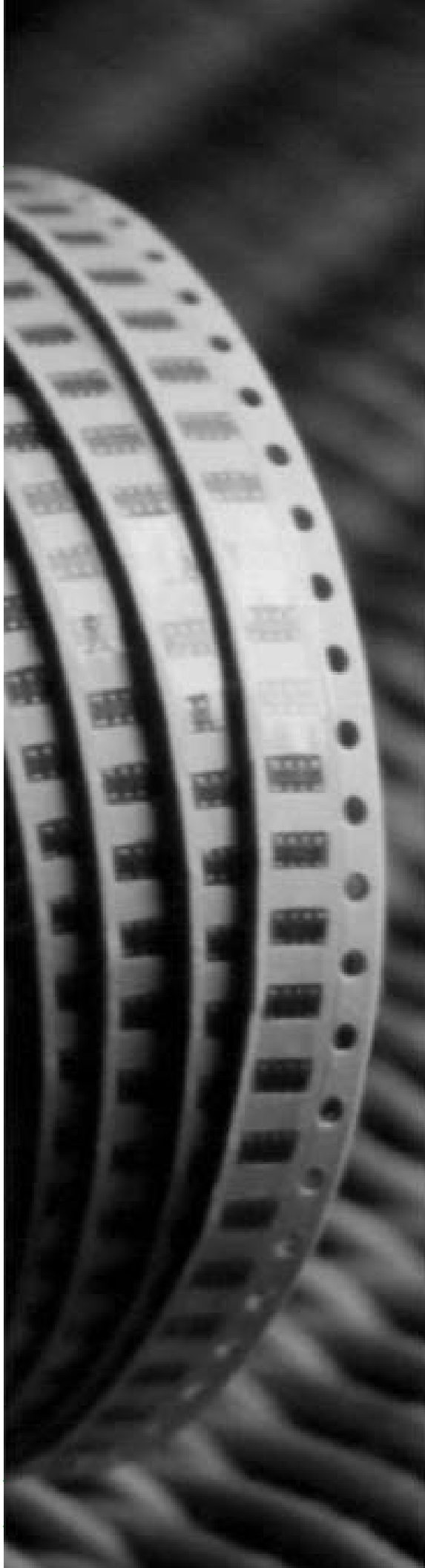
RL Series

5%; 1%



YAGEO

Product Specification - Jan. 16, 2003 V.03 Supersedes Date of Jul. 04, 2002



## SCOPE

This specification describes RL series chip resistors made by thick film process.

## ORDERING INFORMATION

Part number is identified by the series, size, tolerance, packing style, temperature coefficient, special type and resistance value.

**RL XXXX X X X XX XXXX**
(1) (2) (3) (4) (5) (6)

### (1) SIZE

0402=0.040×0.020
0603=0.063×0.033
0805=0.083×0.051
1206=0.122×0.063
1210=0.122×0.102
2010=0.197×0.098
2512=0.250×0.126

### (2) TOLERANCE

F = ±1%
J = ±5%

### (3) PACKAGING TYPE

R = Paper taping reel
K = Embossed Plastic Tape Reel
C = Bulk case

### (4) TEMPERATURE CHARACTERISTIC OF RESISTANCE

– = Base on spec

### (5) SPECIAL TYPE

07 = 7 inch dia. Reel
10 = 10 inch dia. Reel
13 = 13 inch dia. Reel

### (6) RESISTANCE VALUE:

R056, R56
Remark: E24 (E48/96 on request)

## MARKING

### RL0805 / RL1206 / RL1210 / RL2010 / RL2512

Fig. 1 Value=20mΩ

Either tolerance in 5% or 1%: 4 digits
Uses MIL Standard resistance marking
"R" signifies decimal place

### RL0603- R≥100mR IN E-24 SERIES

Fig. 2 Value=220mΩ

10mΩ, 20mΩ, 30mΩ, 40mΩ, 50mΩ, 60mΩ
3 digits
Uses MIL Standard resistance marking
"R" signifies decimal place

### RL0402 / ALL STYLE NOT IN E-24 SERIES / R<100mR FOR RL0603


Fig. 3

No marking

## CONSTRUCTION

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive paste. The composition of the paste is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the two external terminations are added. See fig. 4

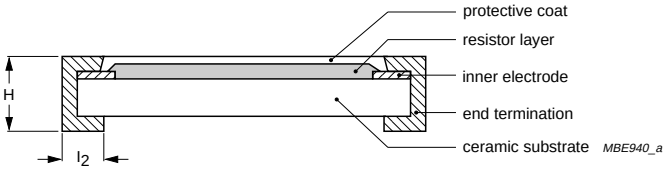


Fig. 4 Chip resistor construction

## DIMENSION

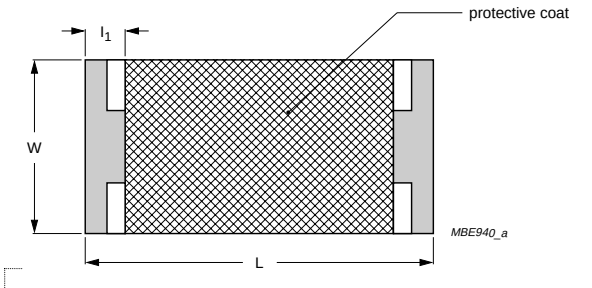



Fig. 5 Chip resistor dimension

Table 1

| TYPE | L (mm) | W (mm) | H (mm) | $l_1$ (mm) | $l_2$ (mm) |
|---|---|---|---|---|---|
| RL0402 | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| RL0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.25±0.15 | 0.25±0.15 |
| RL0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.35±0.20 |
| RL1206 | 3.10±0.10 | 1.60±0.10 | 0.55±0.10 | 0.45±0.20 | 0.40±0.20 |
| RL1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.20 | 0.50±0.20 |
| RL2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.20 | 0.50±0.20 |
| RL2512 | 6.35±0.10 | 3.20±0.15 | 0.55±0.10 | 0.60±0.20 | 0.50±0.20 |

## POWER RATING

RATED POWER AT 70°C:

RL0402=1/16W, RL0603=1/10W, RL0805=1/8W, RL1206=1/4W, RL1210=1/2W, RL2010=3/4W, RL2512=1W

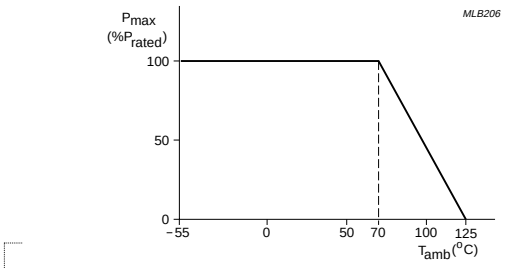



Fig. 6 Maximum dissipation ($P_{max}$) in percentage of rated power as a function of the operating ambient temperature ($T_{amb}$)

RATED VOLTAGE:

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$V=\sqrt{(P \times R)}$

Where

V=Continuous rated DC

or AC (rms) working voltage (V)

P=Rated power (W)

R=Resistance value (Ω)

## ELECTRICAL CHARACTERISTICS

Table 2

| CHARACTERISTICS | OPERATING TEMPERATURE RANGE | DERATED TO 0 LOAD AT | RESISTANCE RANGE | TEMPERATURE COEFFICIENT | |
|---|---|---|---|---|---|
| | | | | 10mΩ≤Rn<100mΩ | 100mΩ≤Rn<1Ω |
| RL0402 | –55°C to +125°C | +125°C | 100mΩ≤Rn<1Ω | --- | ±800ppm/°C |
| RL0603 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |
| RL0805 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |
| RL1206 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |
| RL1210 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |
| RL2010 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |
| RL2512 | –55°C to +125°C | +125°C | 10mΩ≤Rn<1Ω | ±1,500ppm/°C | ±600ppm/°C |

## TAPING REEL

Table 3

| DIMENSION | RL0402 | RL0603 | RL0805 | RL1206 | RL1210 | RL2010 | RL2512 |
|---|---|---|---|---|---|---|---|
| PACKAGING | Paper | Paper | Paper | Paper | Paper | Embossed | Embossed |
| TAPE WIDTH | 8mm | 8mm | 8mm | 8mm | 8mm | 12mm | 12mm |
| ØA (mm) | 180+0/–3 | 180+0/–3 | 180+0/–3 | 180+0/–3 | 180+0/–3 | 180+0/–3 | 180+0/–3 |
| ØB (mm) | 60+1/–0 | 60+1/–0 | 60+1/–0 | 60+1/–0 | 60+1/–0 | 60+1/–0 | 60+1/–0 |
| ØC (mm) | 13.0±0.2 | 13.0±0.2 | 13.0±0.2 | 13.0±0.2 | 13.0±0.2 | 13.0±0.2 | 13.0±0.2 |
| W (mm) | 9.0±0.3 | 9.0±0.3 | 9.0±0.3 | 9.0±0.3 | 9.0±0.3 | 13.0±0.3 | 13.0±0.3 |
| T (mm) | 11.4±1 | 11.4±1 | 11.4±1 | 11.4±1 | 11.4±1 | 15.4±1 | 15.4±1 |

For dimension see Table 3

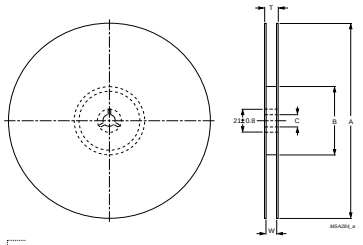


Fig. 7 Reel dimension

## PAPER TAPE SPECIFICATION

Table 4

| DIMENSION | RL0402 | RL0603 | RL0805 | RL1206 | RL1210 |
|---|---|---|---|---|---|
| A (mm) | 0.65±0.1 | 1.1±0.1 | 1.65±0.1 | 1.90±0.1 | 2.80±0.1 |
| B (mm) | 1.15±0.1 | 1.90±0.1 | 2.40±0.1 | 3.50±0.1 | 3.50±0.1 |
| W (mm) | 8.0±0.2 | 8.0±0.2 | 8.0±0.2 | 8.0±0.2 | 8.0±0.2 |
| E (mm) | 1.75±0.1 | 1.75±0.1 | 1.75±0.1 | 1.75±0.1 | 1.75±0.1 |
| F (mm) | 3.5±0.05 | 3.5±0.05 | 3.5±0.05 | 3.5±0.05 | 3.5±0.05 |
| $P_0$ (mm) | 4.0±0.1 | 4.0±0.1 | 4.0±0.1 | 4.0±0.1 | 4.0±0.1 |
| $P_1$ (mm) | 2.0±0.05 | 4.0±0.05 | 4.0±0.05 | 4.0±0.05 | 4.0±0.05 |
| $P_2$ (mm) | 2.0±0.05 | 2.0±0.05 | 2.0±0.05 | 2.0±0.05 | 2.0±0.05 |
| Ø$D_0$ (mm) | 1.5+0.1/–0 | 1.5+0.1/–0 | 1.5+0.1/–0 | 1.5+0.1/–0 | 1.5+0.1/–0 |
| T (mm) | 0.53±0.10 | 0.70±0.10 | 0.85±0.10 | 0.85±0.10 | 0.85±0.10 |

For dimension see Table 4

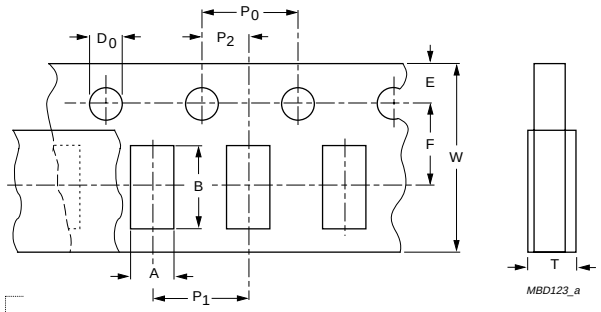



Fig. 8 Paper tape dimension

## EMBOSSED TAPE SPECIFICATION

Table 5

| DIMENSION | RL2010 | RL2512 |
|---|---|---|
| A (mm) | 2.80±0.2 | 3.5±0.2 |
| B (mm) | 5.4±0.2 | 6.7±0.2 |
| W (mm) | 12.0±0.3 | 12±0.3 |
| E (mm) | 1.75±0.1 | 1.75±0.1 |
| F (mm) | 5.5±0.05 | 5.5±0.05 |
| $P_0$ (mm) | 4.0±0.1 | 4.0±0.1 |
| $P_1$ (mm) | 4.0±0.1 | 4.0±0.1 |
| $P_2$ (mm) | 2.0±0.05 | 2.0±0.05 |
| Ø$D_0$ (mm) | 1.5+0.1/–0 | 1.5+0.1/–0 |
| Ø$D_1$ (mm) | 1.5+0.25/–0 | 1.5+0.25/–0 |
| $T_{max}$ (mm) | 4.5 | 4.5 |

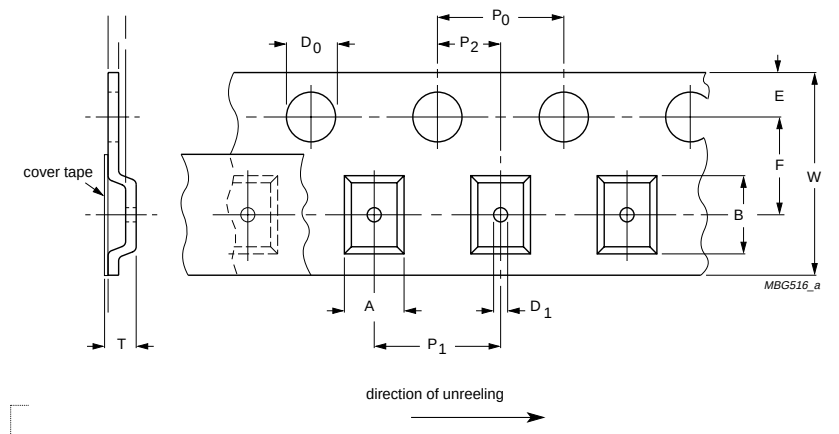



Fig. 9 Embossed tape dimension

For dimension see Table 5

## PACKING METHOD

### LEADER/TRAILER TAPE SPECIFICATION

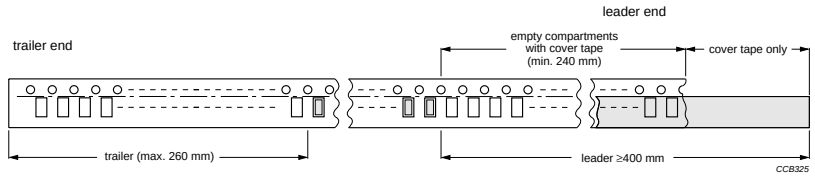



Fig. 10 Leader and trailer tape dimension

### BULK CASSETTE

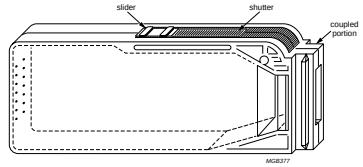



Fig. 11 Bulk case outline

Table 6 Packing style and packaging quantity

| PACKING STYLE | REEL DIMENSION | RL0402 | RL0603 | RL0805 | RL1206 | RL1210 | RL2010 | RL2512 |
|---|---|---|---|---|---|---|---|---|
| Paper Taping Reel (R) | 7" (178 mm) | 10,000 | 5,000 | 5,000 | 5,000 | 5,000 | --- | --- |
| | 10" (254 mm) | 20,000 | 10,000 | 10,000 | 10,000 | 10,000 | --- | --- |
| | 13" (330 mm) | 40,000 | 20,000 | 20,000 | 20,000 | 20,000 | --- | --- |
| Embossed Taping Reel (K) | 7" (178 mm) | --- | --- | --- | --- | --- | 4,000 | 4,000 |
| Bulk Cassette (C) | | 50,000 | 25,000 | 10,000 | --- | --- | --- | --- |

| TYPE | TEST METHOD | | ACCEPTANCE STANDARD |
|---|---|---|---|
| Temperature Coefficient of Resistance (T.C.R.) | Measure resistance at +25°C or specified room temperature as $R_1$, then measure at –55°C or +125°C respectively as $R_2$.<br>Determine the temperature coefficient of resistance from the following formula: | Formula<br>$T.C.R.= \frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (ppm/°C)<br>Where<br>$t_1$=+25°C or specified room temperature<br>$t_2$=–55°C or +125°C test temperature<br>$R_1$=resistance at reference temperature in ohms<br>$R_2$=resistance at test temperature in ohms | Refer to table 2 |
| Thermal Shock | At –55±3°C for 2 minutes and at +125±2°C for 2 minutes as one cycle. After 5 cycles, the specimen shall be stabilized at room temperature.<br>Measure the resistance to determine ΔR/R(%) after one more hour. | | ±1.0% |
| Low Temperature Operation | Place the specimen in a test chamber maintained at –65 (+0/–5)°C. After one hour stabilization at this temperature, full rated working voltage shall be applied for 45 (+5/–0) minutes. Have15 (+5/–0 ) minutes after remove the voltage, the specimen shall be removed from the chamber and stabilized at room temperature for 24 hrs.<br>Measure the resistance to determine ΔR/R(%). | | ±1.0%<br>No mechanical damage |
| Short Time Overload | Apply 2.5 times of rated voltage but not exceeding the maximum overload voltage for 5 seconds. Have the specimen stabilized at room temperature for 30 minutes minimum.<br>Measure the resistance to determine ΔR/R(%). | | ±1.0% for 1% tolerance<br>±2.0% for 5% tolerance<br>No evidence of mechanical damage |
| Insulation Resistance | Place the specimen in the jig and apply a rated continues overload voltage (R.C.O.V) for one minute.<br>Measure the insulation resistance. | | ≥10,000MΩ |
| Dielectric Withstand Voltage | Place the specimen in the jig and apply a specified value continuous overload voltage for one minute. | | Breakdown voltage> specification and without open/short |
| Resistance To Soldering Heat | Immerse the specimen in the solder pot at 260±5°C. for 10±1 seconds. Have the specimen stabilized at room temperature for 30 minutes minimum.<br>Measure the resistance to determine ΔR/R(%). | | ±1.0%<br>No visible damage |

| TYPE | TEST METHOD | ACCEPTANCE STANDARD |
|---|---|---|
| Moisture Resistance | Place the specimen in the test chamber and subject to 42 damp heat cycles. Each one of which consists of the steps 1 to 7 as figure 13. The total length of test is 1,000 hours. Have the specimen stabilized at room temperature for 24 hours after testing.<br>Measure the resistance to determine $\Delta R/R(\%)$. | ±2.0%<br>No visible damage |
| Life | Place the specimen in the oven at 70±2°C. Apply the rated voltage to the specimen at the 1.5 hours on and 0.5 hour off cycle. The total length of test is 1,000 hours. Have the specimen stabilized at room temperature for one hour minimum after testing.<br>Measure the $\Delta R/R(\%)$. | ±2.0% for 1% tolerance<br>±3.0% for 5% tolerance |
| Solderability | Immerse the specimen in the solder pot at 230±5°C for 5 sec. | At least 95% solder coverage on the termination |

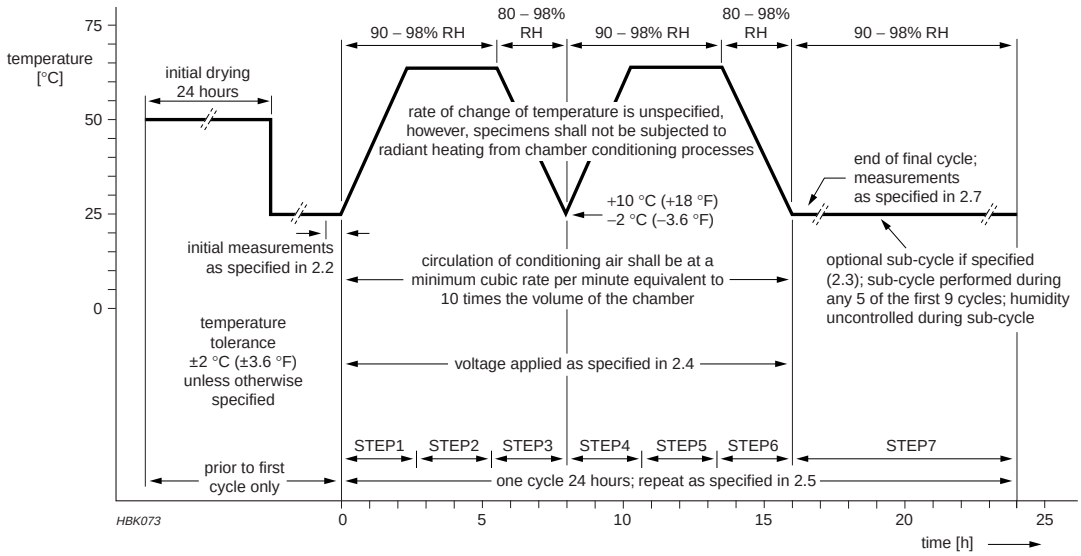



**Fig. 13** Conditions by change of temperature