

Instruction
Hardware Engineering

No. LMS 11-12

Subject: Electrical Component Identification

APPROVED BY Manager, Hardware Engineering

STATUS Maintenance Revision

PURPOSE Defines and explains the techniques used for identifying the most common electronic components. Consult Component Engineering for part markings not covered in this instruction. L-3 Communications Corporation, Link Simulation & Training Division (hereafter referred to as Link) personnel shall utilize the requirements of this instruction when identification of specific electronic components, which are included in this instruction, are required.

AFFECTED FUNCTIONS Hardware Engineering
Manufacturing

REFERENCES MS90178 Standard 24-Value Series Decade for Electronic Components of 5-, 10-, and 20-Percent Tolerance

DEFINITIONS

Functional marking. The symbols, letters, numbers, and similar markings applied to indicate polarity, circuitry, and similar functional characteristics.

Identifying number. The number assigned to uniquely identify a specific part.

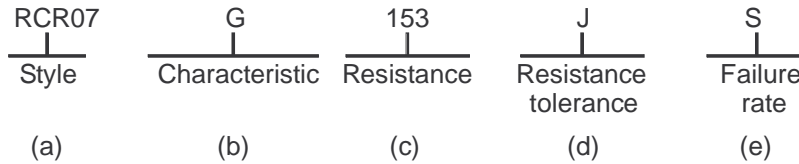
Part identification marking. The typographical marking (method I) or color coding (method II) to be applied to the part, tag, label, or unit package to identify the part.

Typographical marking. The marking of a part with printed letter and/or number characters.

INSTRUCTION

1. Requirements
 - 1.1 Resistor identification. Resistors may be marked for identification using either method I (typographical) or method II (color coding) markings.

- a. Method I marking. Military RCR type resistor identification is shown below.



00110601

- (1) **Style.** The style is identified by the three letter symbol “RCR” followed by a two digit number; the letters identify insulated, composition, fixed resistors, and the number identifies the size and power rating of the resistors.
- (2) **Characteristic.** The characteristic is identified by a single letter in accordance with Table I.

Table I Characteristic For RCR Type Resistors

Symbol	Maximum ambient operating temperature (100 percent rated wattage and 50 percent rated wattage for failure rate determination)	Resistance-temperature characteristic		
		Nominal resistance Ohms	Maximum allowable change in resistance from resistance at ambient temperature of 25 °C	
			Percent (±) at -55 °C (ambient)	Percent (±) at +105 °C (ambient)
G	70 °C	1,000 and under 1,100 to 10,000 incl 11,000 to 1 megohm incl Megohms 0.11 to 1.0 incl 1.1 to 10 incl 11.0 and over	65 10 13 15 20 25	5 6 7.5 10 15 15

- (3) **Resistance.** The nominal resistance value, expressed in ohms, is identified by a three-digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. When resistance values of less than 10 ohms are required, the letter “R” is substituted for one of the significant digits to represent the decimal point. When the letter “R” is used, succeeding digits of the group represent significant figures as shown in the following example:

$$2R7 = 2.7 \text{ ohms.}$$

The standard values for every decade shall follow the sequence demonstrated for the “10 to 100” decade in accordance with MS90178 - Standard 24 - Value Series Decade for Electronic Components of 5-, 10-, and 20-Percent Tolerances.

- (4) Resistance tolerance. The resistance tolerance is identified by a single letter in accordance with Table II.

Table II RCR Resistor Tolerance

Symbol	Resistance tolerance Percent (\pm)
J - - - -	5
K - - - -	10

- (5) Failure-rate designation. The failure-rate designation, as shown in Table III, is signified by a single letter (M, P, R, or S), which identifies the failure-rate level for which the resistor is qualified.

Table III RCR Resistor Failure-Rate Level

Failure-rate level designation	Failure rate percent/1,000 hours
M - - - -	1.0
P - - - -	0.1
R - - - -	0.01
S - - - -	0.001

NOTE: Failure rates indicated are for 50 percent of rated wattage.

- b. Method I marking. Military RNC type resistor identification is shown below.

RNC60	K	1003	F	M
Style	Characteristic	Resistance	Resistance tolerance	Life Failure rate
(a)	(b)	(c)	(d)	(e)

00110602

- (1) **Style.** The style is identified by a three-letter symbol “RNC” followed by a two digit number; the letters identify established reliability film, fixed resistors, of a specific terminal type, and the number identifies the size of the resistors. The symbol “RNC” denotes a resistor with solderable/weldable leads.
- (2) **Characteristic.** The characteristic is identified by a single letter in accordance with Table IV.

Table IV Characteristic For RNC Type Resistors

Symbol	Resistance Temperature Characteristic (Referred to 25 °C)
H - - -	± 50 PPM/°C
J - - -	± 25 PPM/°C
K - - -	± 100 PPM/°C

- (3) **Resistance.** The normal resistance expressed in ohms is identified by four digits; the first three digits represent significant figures, and the last digit specifies the number of zeros to follow. When the value of resistance is less than 100 ohms, or when fractional values of an ohm are required, the letter “R” shall be substituted for one of the significant digits to represent the decimal point. When the letter “R” is used, succeeding digits of the group represent significant figures.
- (4) **Resistance Tolerance.** The resistance tolerance is identified by a single letter in accordance with Table V.

Table V RNC Resistor Tolerance

Symbol	Resistance tolerance Percent (±)
B - - -	0.10
D - - -	0.50
F - - -	1.00

- (5) Life Failure Rate. The life failure rate designation, as shown in Table VI, is signified by a single letter which identifies the life failure-rate level for which the resistor is qualified.

Table VI RNC Resistor Life Failure Rate Level
(Established at 60% Confidence)

Failure-rate level designation	Failure rate percent/1,000 hours
M - - - -	1.0
P - - - -	0.1
R - - - -	0.01
S - - - -	0.001

- c. Method I marking. Military RWR type resistor identification is shown below.



00110603

- (1) Style. The style is identified by the three-letter symbol “RWR” followed by a two-digit number; the letters identify established-reliability, axial-lead, power type, wire-wound, fixed resistors, and the number identifies the size, wattage rating, and construction of the resistors. Numerical digits for common wattage ratings are shown in Table VII.

Table VII Wattage Designation

Style	Wattage Rating
RWR33	26 Watts
RWR78	10 Watts
RWR84	7 Watts
RWR89	3 Watts

- (2) Terminal and winding. The terminal capability and inductive or noninductive winding designation are identified by a single letter in accordance with Table VIII.

Table VIII Terminal and Winding

Symbol	Terminal and winding
S	Solderable, inductively wound
W	Weldable, inductively wound
N	Solderable, noninductively wound
Z	Weldable, noninductively wound

- (3) Resistance. The nominal resistance expressed in ohms is identified by four digits; the first three digits represent significant figures and the last digit specifies the number of zeros to follow. When the value of resistance is less than 100 ohms, or when fractional values of an ohm are required, the letter "R" shall be substituted for one of the significant digits to represent the decimal point. When the letter "R" is used, succeeding digits of the group represent significant figures. The resistance-value designations are shown in Table IX.

Table IX Designation of Resistance Values

Symbol	Resistance (Ohms)
1R00 to 9R76 inclusive	1.00 to 9.76 inclusive
10R0 to 97R6 inclusive	10.0 to 97.6 inclusive
1000 to 9760 inclusive	100 to 976 inclusive
1001 to 9761 inclusive	1,000 to 9,760 inclusive
1002 to 4022 inclusive	10,000 to 40,200 inclusive

- (4) Resistance tolerance. The resistance tolerance is identified by a single letter in accordance with Table X.

Table X RWR Resistor Tolerance

Symbol	Resistance Tolerance Percent (\pm)
B	0.10
D	0.50
F	1.00

- (5) Failure-rate. The failure-rate is identified by a single letter in accordance with Table XI.

Table XI RWR Resistor Life Failure Rate Level
(Established at 60% Confidence)

Failure-rate level designation	Failure rate percent/1,000 hours
M	1.0
P	0.1
R	0.01
S	0.001

- d. Method II marking (color coding). Composition and film type resistors may utilize color coding for identification. These resistors use color bands as shown in Figure 1.

The corresponding numerical value for the resistor color coded bands are listed in Table XII below:

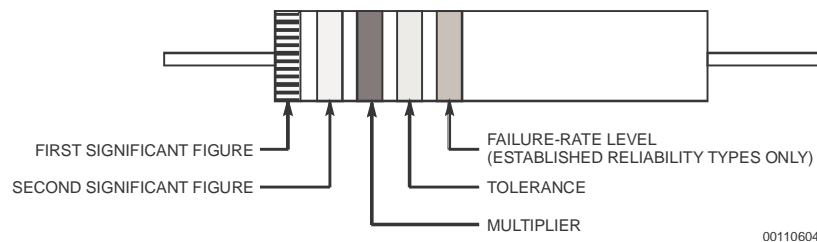


Figure 1 Color Coding for Composition Type Resistors

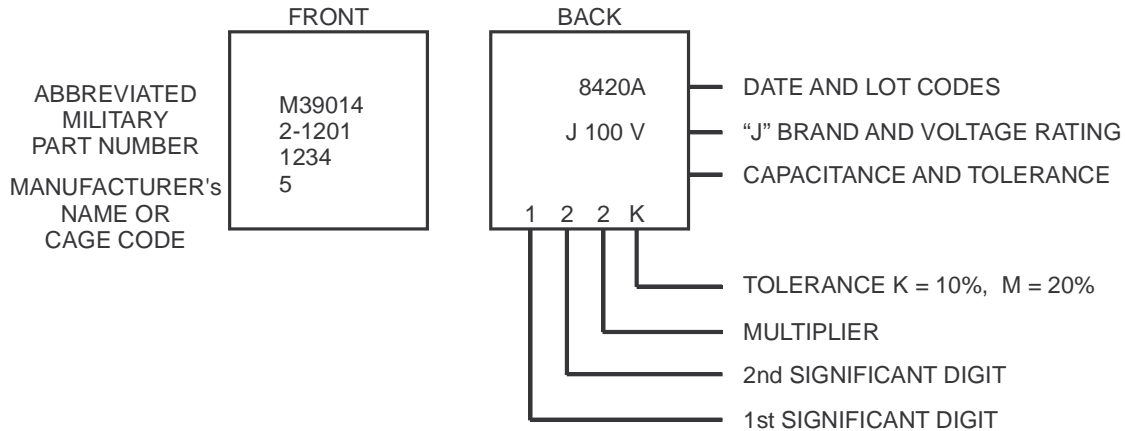
Table XII Color Codes for Part Identification Marking

Color	Values for significant figures for color bands or dots				
	Electrical characteristic			Tolerance value	Failure rate
	1st Code Number	2nd Code Number	3rd Code Multiplier	4th Code	5th Code
Black	0	0	1	$\pm 20\%$	L
Brown	1	1	10	$\pm 1\%$	M (1%/1,000)
Red	2	2	100	$\pm 2\%$	P (.1%/1,000)
Orange	3	3	1,000	---	R(.01%/1,000)
Yellow	4	4	10,000	---	S(.001%/1,000)

Table XII Color Codes for Part Identification Marking (Cont.)

Color	Values for significant figures for color bands or dots				
	Electrical characteristic			Tolerance value	Failure rate
	1st Code Number	2nd Code Number	3rd Code Multiplier	4th Code	5th Code
Green	5	5	100,000	---	---
Blue	6	6	1,000,000	---	---
Violet	7	7	10,000,000	---	---
Gray	8	8	.01	---	---
White	9	9	.1	---	---
Gold	---	---	.1	$\pm 5\%$	---
Silver	---	---	.01	$\pm 10\%$	---

- 1.2 Capacitor identification. Marking of capacitors may conform to method I, typographical or method II, color coding. Method I is the most commonly used identification and is covered in this instruction.
- a. Polarized capacitors. The “+” symbol is used on polarized capacitors to indicate the positive terminal.
 - b. CU13 series electrolytic capacitors. The CU13 series capacitors are identified by method I and include the following:
 - (1) Part number
 - (2) Capacitance in μF
 - (3) Capacitance tolerance
 - (4) DC rated voltage
 - (5) Date code
 - (6) Source code.
 - c. Identification of ceramic capacitors. Ceramic capacitors will be marked with the “JAN” or “J” marking, part number, date and lot code, manufacturer’s name or CAGE Code, voltage, capacitance, and capacitance tolerance. The markings may be applied to one side of the capacitor or split up and placed on the front and back as shown in Figure 2.

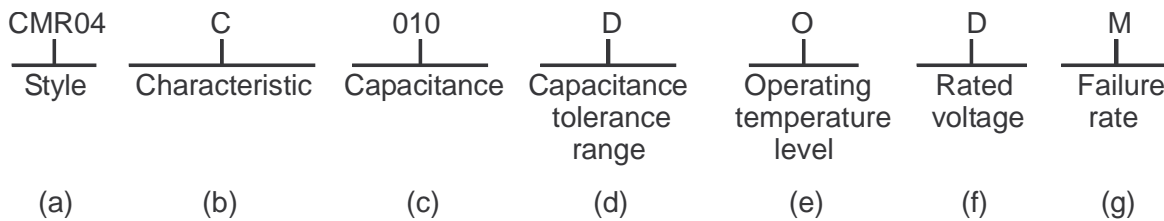


NOTE: THIS EXAMPLE IS FOR RADIAL LEAD AND DISC STYLES. TUBULAR STYLES WILL BE MARKED AS ABOVE EXCEPT IT SHALL APPEAR AS SIX LINES, FRONT FOLLOWED BY BACK, IN THE ORDER SHOWN.

00110605

Figure 2 Ceramic Capacitor Identification

- d. Fixed mica capacitor identification. Type designation for fixed mica capacitors is shown below.



00110606

- (1) Style. The style is identified by the three-letter symbol “CMR” followed by a two-digit number: the letters identify mica dielectric, fixed capacitors, and established reliability, and the number identifies the shape and dimensions of the capacitor.
- (2) Characteristic. The characteristic is identified by a single letter which indicates the relative stability of the capacitor with temperature change, in accordance with Table XIII.

Table XIII Characteristic For Ceramic Capacitors

Symbol	Temperature coefficient Parts/million/_C	Capacitance drift
C	.200 to +200	± (.5% + .1pF)
E	.20 to +100	± (.1% +.1pF)
F	0 to +70	± (.05% +.1pF)

- (3) Capacitance. The nominal capacitance value expressed in picofarads (pF) is identified by a three-digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. When the nominal value is less than 10 pF, the letter “R” shall be used to indicate the decimal point and the succeeding digit(s) of the group shall represent significant figure(s). For example, 1R0 indicates 1.0 pF; R75 indicates .75 pF; and 0R5 indicates .5 pF.
- (4) Capacitance tolerance. The capacitance tolerance in percent of pF, as applicable, is identified by a single letter in accordance with Table XIV.

Table XIV Capacitance Tolerance

Symbol	Capacitance tolerance (±)
D	0.5pF
F	1%
G	2%
J	5%

- (5) Operating temperature range. The operating temperature range is identified by a single letter in accordance with Table XV.

Table XV Operating Temperature Range

Symbol	Operating Temperature Range 8C
O	.55 to +125
P	.55 to +150

- (6) Rated voltage. The rated voltage is identified by a single letter in accordance with Table XVI.

Table XVI Rated Voltage

Symbol	DC Rated Voltage
A	100
C	300
D	500

- (7) Failure rate level. The failure rate level in percent per 1,000 hours is identified by a single letter in accordance with Table XVII, and is based on rated voltage at 125 °C or 150 °C, as applicable.

Table XVII Ceramic Capacitor Failure Rate Level

Symbol	Failure Rate Level (% per 1,000 hours)
L	2.0
M	1.0
P	.1
R	.01
S	.001
T	.0001

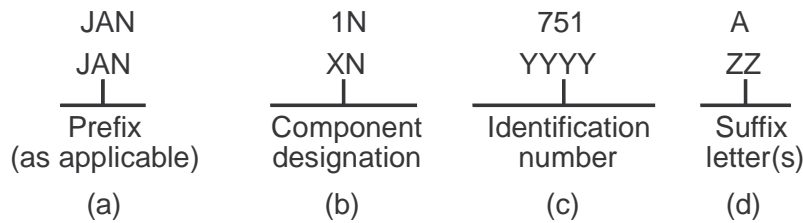
- e. Fixed metalized film capacitors. Metalized film capacitors will be marked with part number or identifying number (PIN), “JAN” marking, date code, lot symbol, manufacturer’s source code, capacitance (in μF), capacitance tolerance, and rated voltage. See example below:

- M83421/01-2107M - Part number (may be on one line if space permits).
.018 mF 5% 50V - Capacitance, capacitance tolerance, and rated voltage (DC or AC, as applicable).
JAN8133A 12345 - “JAN” marking, date code, lot symbol, and source code (manufacturer’s item serial number may be included if space permits).

- 1.3 Semiconductor device identification. Current semiconductor devices will be marked to conform to method I; however, older devices may be identified using method II (color codes) as described in this instruction.

- a. Method I semiconductor identification. Method I identification may include the following:

- (1) Polarity marking (unidirectional diodes and thyristors only).
 - (2) Type designation, including “JAN” or “JANTX” prefix, as applicable.
 - (3) Inspection lot identification code.
 - (4) Manufacturer’s designating symbol.
 - (5) Manufacturer’s identification.
 - (6) Country of origin.
- b. Semiconductor identification. Type designation will use the following:



00110607

- (1) Prefix. The JAN, JANTX, JANTXVM, JANTXVD, JANTXVR, JANTXVH, JANS, JANSM, JANSJ, JANSR, or JANSJ prefix shall be used as applicable.
- (2) Component designation. Semiconductor devices are identified by the prefix “XN”. An “X” shall usually be a number which is one less than the number of active element terminations.
- (3) Identification number. It is recommended that each type of semiconductor device intended for standardization be assigned an identification, serially, by the Joint Electron Device Engineering Council, a council sponsored by the Electronic Industries Association and the National Electrical Manufacturers Association. This assignment provides the component designation, the identification number, and, if applicable, a suffix letter.

(4) Suffix letters. The following suffix letters may be incorporated in the type number, as applicable.

- A, B, C, etcIndicates a modified version which is substitutable (except L, M, P, R, S, U) for the basic numbered (non-suffix) device.
- MIndicates matching of specified parameters of separate devices.
- RIndicates reverse polarity packaging of the basic numbered device.
- L or SIndicates that the terminal leads are longer or shorter, respectively, than those of the basic numbered device.
- UIndicates unleaded or surface mounted devices.
- PIndicates particle impact noise detection screened devices (for JANTX and JANTXV only).
- URIndicates unleaded or surface mounted (round end cap diodes).
- USIndicates unleaded or surface mounted (square end cap diodes).

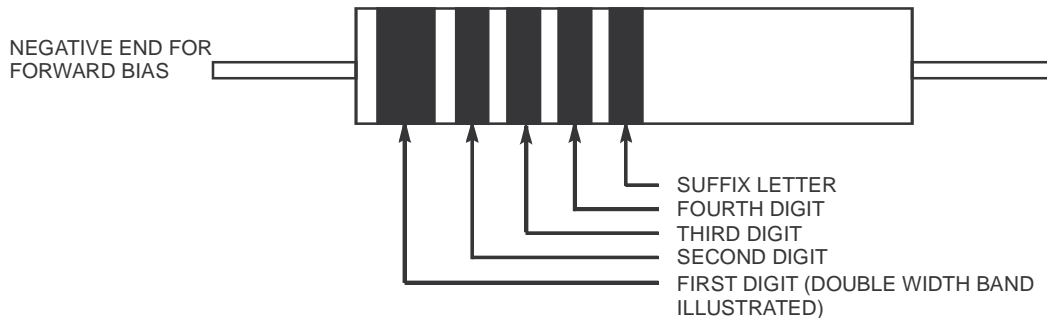
Suffix letter(s) except for P suffix, shall be used and marked on the device only when specific device types are covered by the applicable associated detail specification requiring the suffix letters.

- c. Polarity. The polarity for diodes will be indicated by a graphic symbol with the arrow pointing toward the cathode end for forward bias. The reversed units shall also be marked with an R following the last digit in the type number.
- d. Method II semiconductor device color codes. Bands of color sometimes indicate identification number and polarity of semiconductors. The component designation ("X"N) and suffix letters R and M, however, are not indicated. The color bands are as shown in Figure 3 and interpreted as indicated in Table XVIII.

Table XVIII Semiconductor Color Code

Semiconductor Color Code		
Number	Color	Suffix Letter
0	Black	None
1	Brown	A
2	Red	B
3	Orange	C
4	Yellow	D
5	Green	E
6	Blue	F
7	Violet	G
8	Gray	H
9	White	J

- e. The identification number, consisting of a two, three, or four digit number after the letter “N”, is color coded as shown below.
- (1) Two-digit numbers consist of a first black band and the identification number in the second and third bands of colors. If the identification contains a suffix letter, it is indicated with a fourth band.
 - (2) Three-digit numbers consist of the identification number in the first, second, and third bands of color. If the identification contains suffix letters, it is indicated with a fourth band.
 - (3) Four-digit numbers consist of the identification number in four bands of colors with a fifth black band. If the identification contains a suffix letter, it is indicated as a fifth band of color, replacing the black band.
- f. Semiconductor device polarity. To indicate polarity, a double-width band is used as the first band, reading from the negative end forward bias to the positive end. (See Figure 3.) As an alternate method, equal width bands, clearly grouped toward the negative end, and reading from negative to positive ends, are sometimes used. On diodes not color coded, a single contrasting color band or dot adjacent to the negative terminal for forward bias, is used to indicate polarity.



00110608

Figure 3 Diode Color Coding

- 1.4 Cylindrical choke coil color code. Cylindrical choke coils are marked with five color bands, as shown in Figures 4 and 5. The first band is silver, double the

width of the other bands, and identifies the coil as a military component. The next three bands indicate the inductance in microhenries, and the fifth band indicates the tolerance in percent. The color code is interpreted as indicated in Table XIX. When either the second or third color band is gold (Figure 4), this band represents the decimal point for inductance values less than 10 microhenries, and the other two bands of the middle three bands represent significant figures. For inductance values of 10 microhenries or more (Figure 5), the second and third bands represent significant figures, and the fourth band represents the multiplier.

On non-cylindrical coils, color dots may be used instead of bands. The diameter of the silver military identifier dot is larger than the other dots.

Table XIX Cylindrical Coil Color Codes

Color	Significant Figure	Inductance Multiplier	Tolerance
Black	0	1	----
Brown	1	10	----
Red	2	100	----
Orange	3	1,000	----
Yellow	4	----	----
Green	5	----	----
Blue	6	----	----
Violet	7	----	----
Gray	8	----	----
White	9	----	----
None	----	----	± 20%
Silver	----	----	± 10%
Gold	Decimal Point	----	± 5%

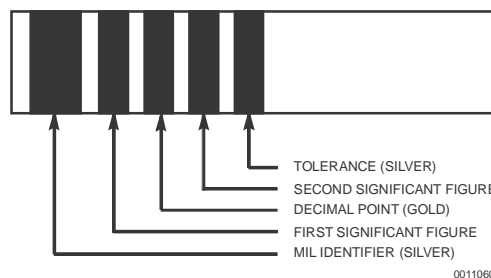


Figure 4 Color Coding for Coils Less Than 10 Microhenries

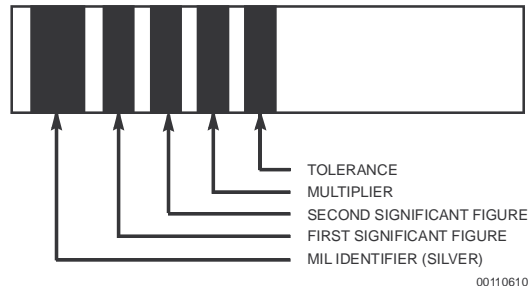


Figure 5 Color Coding for Coils 10 Microhenries and Larger

2. Quality Assurance Provisions (Not Applicable)
3. Preparation For Delivery (Not Applicable)
4. Notes (Not Applicable)