

REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add test requirements to the PIN, 2 new tables, visual inspection, manufacturing eligibility paragraph and alternative solderability test method. Expanded ohmic resistance range and coding. Change vendor part number. Editorial changes throughout.	17-01-12	M. Radecki
B	Change specification reference. Add RTC test. Change in the dc test potential of the short-time overload time test. Editorial changes throughout.	20-03-24	M. Radecki
C	Change paragraph 4.7.b Solderability category. Editorial changes throughout.	23-06-22	M. Radecki

CURRENT DESIGN ACTIVITY CAGE CODE 037Z3
HAS CHANGED NAMES TO:
DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990



Prepared in accordance with [ASME Y14.24](#)

Selected Item Drawing

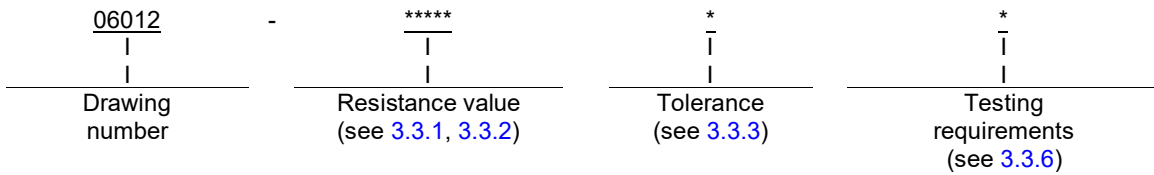
Revision Status of Sheets															
REV															
SHEET															
REV	C	C	C	C	C	C	C	C							
SHEET	1	2	3	4	5	6	7	8							

PMIC N/A Original date of drawing 2006-08-15	PREPARED BY Andrew R. Ernst		DLA LAND AND MARITIME COLUMBUS, OHIO 43218-3990													
	CHECKED BY Andrew R. Ernst		TITLE RESISTOR, CHIP, FIXED, POWER METAL STRIP, SURFACE MOUNT, LOW VALUE (2.0 WATT), STYLE 2816													
	APPROVED BY Michael A. Radecki		SIZE A		CAGE CODE 037Z3		DWG NO. 06012									
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1. SCOPE

1.1 Scope. This drawing describes the requirements for a 0.280 X 0.165, 2.0 watt, fixed, power metal strip, surface mounted, chip resistor.

1.2 Part or Identifying Number (PIN). The complete PIN is as follows:



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

[MIL-PRF-32159](#) - Resistor, Chip, Fixed, Film, Zero Ohm, Industrial, High Reliability, Space Level, General Specification for

DEPARTMENT OF DEFENSE STANDARDS

- [MIL-STD-202-304](#) - Test Method Standard Method 304, Resistance-Temperature Characteristic
- [MIL-STD-690](#) - Failure Rate Sampling Plans and Procedures
- [MIL-STD-790](#) - Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic, and Fiber Optic Parts Specifications

(Copies of these documents are available online at <https://quicksearch.dla.mil>).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents cited in the solicitation or contract.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

[J-STD-002](#) - Component Leads, Termination, Lugs, Terminals and Wires, Solderability Tests for

(Applications for copies of these documents are online at <https://www.icp.org>).

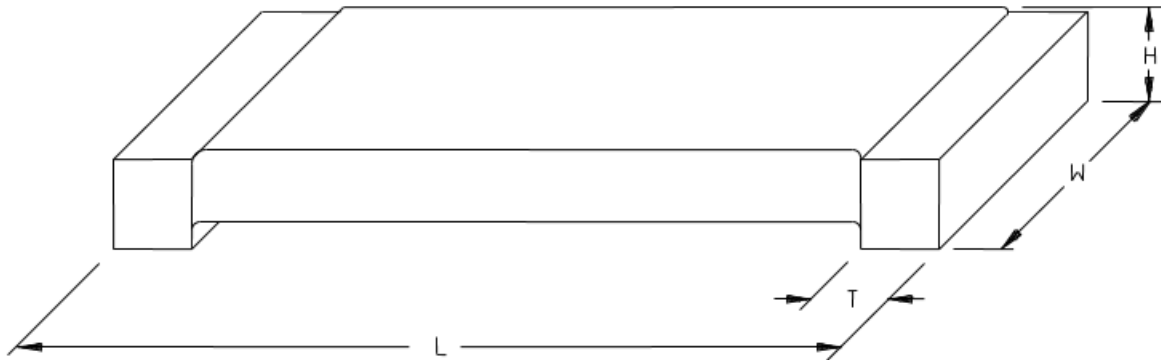
2.4 Order of precedence. Unless otherwise noted herein or in the contract, or in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with [MIL-PRF-32159](#), and as specified herein.

3.2 Interface and physical dimensions. Resistors shall meet the interface and physical dimensions as specified herein (see [figure 1](#)).

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Dimensions			
L	H	T	W
0.280 ±0.010 (7.100 ±0.254)	0.025 ±0.010 (0.635 ±0.254)	(See note 3)	0.165 ±0.010 (4.200 ±0.254)

NOTES:

1. Dimensions are in inches, millimeters are shown in parentheses.
2. Millimeter equivalents are given for general information only.
3. The "T" dimension varies with the resistance range as follows:

Resistance range (ohms)	T dimension (inches)
0.002 to 0.00399	0.098 ±0.010 (2.49 ±0.254)
0.004 to 0.1	0.062 ±0.010 (1.57 ±0.254)

FIGURE 1. Resistor, fixed, power metal strip, surface mount.

3.3 Electrical characteristics.

3.3.1 **Resistance.** The nominal resistance is expressed in ohms and is identified by five digits, consisting of four digits and a letter. The letter is used simultaneously as a decimal point and as a multiplier. For resistance values:

- a. Greater than or equal to 0.001 ohm but less than 0.010 ohms, the letter "L" is used to represent a power of 10⁻³.

(i.e.; 1L500 = 0.0015 or 5L000 = 0.005)

- b. Greater than or equal to 0.010 ohm but less than or equal to 0.500 ohms, the letter "R" is used to represent a decimal point.

All digits preceding and following the letters "L" and "R" of the group represent significant figures. Minimum and maximum resistance values shall be as specified herein (see 3.3.2). Standard resistance decade values shall be in accordance with table I. It is preferred that resistance values be selected as specified in table I. However, if it is necessary to do so, then any values (within specification limits) may be specified and these values can be considered as conforming to this specification.

3.3.2 **Resistance range.** The resistance range shall be 0.002 ohms to 0.1 ohm (see table II).

3.3.3 **Resistance tolerance.** Resistance tolerances are available in (D) ±0.5 percent and (F) ±1 percent (see 6.5).

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TABLE I. Standard resistance decade values.

Standard resistance decade values								
10	20	30	40	50	60	70	80	90
11	21	31	41	51	61	71	81	91
12	22	32	42	52	62	72	82	92
13	23	33	43	53	63	73	83	93
14	24	34	44	54	64	74	84	94
15	25	35	45	55	65	75	85	95
16	26	36	46	56	66	76	86	96
17	27	37	47	57	67	77	87	97
18	28	38	48	58	68	78	88	98
19	29	39	49	59	69	79	89	99

TABLE II. Resistance range and tolerances.

Resistance range (ohms)	Resistance tolerance
0.003 to 0.1	D
0.002 to 0.1	F

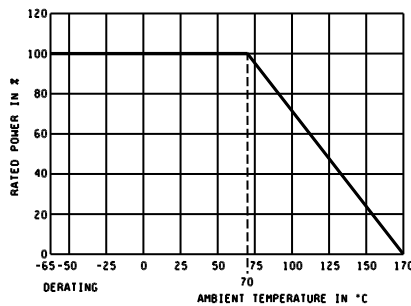


FIGURE 2. Derating curves for high ambient temperatures.

3.3.4 Power rating. The power rating shall be 2.0 watt at +70°C. For operation at temperatures greater than +70°C, derate in accordance with [figure 2](#).

3.3.5 Resistance temperature coefficient. The resistance temperature coefficient shall be ± 75 ppm/°C.

3.3.6 Testing requirements. The requirement for testing shall be identified by a single letter in accordance with [table III](#).

3.4 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of resistor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see [6.3](#)).

3.5 Short time overload. When resistors are tested as specified in [4.5](#), there shall be no evidence of arcing, burning, or charring; the change in resistance between the initial and final measurements shall not exceed $\pm(0.5$ percent+ 0.0005 ohm).

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TABLE III. Testing.

Symbol	Testing requirements
(blank)	Group A
A	Group A and Group B
B	Group A and Power moisture
C	Group A, Group B and Power moisture

NOTE: Any testing requirements that are not specified in the PIN shall have a certificate of compliance issued (see 4.4.2).

3.6 Power moisture resistance. When resistors are tested as specified in 4.6, there shall be no evidence of mechanical damage; the change in resistance between the initial and final measurements shall not exceed $\pm(0.5 \text{ percent} + 0.0005 \text{ ohm})$.

3.7 Visual inspection. Resistors shall be inspected as specified in 4.8, to verify that the interface, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.2, 3.10 and 3.13).

3.8 Resistance temperature characteristic. When resistors are tested as specified in 4.9, the resistance temperature characteristic, at each of the temperatures specified in 4.9b referred to room ambient temperature, shall not exceed the values specified in 3.3.5.

3.9 Manufacturers performance data. The manufacturer's technical specifications and performance data shall be made available to the customer for a period of two years.

3.10 Marking. Marking is not required on the resistor; however, each unit package shall be marked with the PIN assigned herein (see 1.2), vendor CAGE code, and date and lot codes.

3.10.1 Individual chip marking. Marking of individual chip resistors is not required but is permitted. Chip resistors may be marked in accordance with MIL-PRF-32159. The marking requirement and code system used shall be specified on the order. If no code system is specified, the manufacturer may select the code. Abbreviated markings are due to limited space takes precedence over PIN format.

3.11 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.12 Manufacturer eligibility. To be eligible for being added as an approved source of supply, a manufacturer shall be listed on the MIL-PRF-32159 Qualified Products List for at least one part, or perform the group A and group B inspections specified herein on a sample agreed upon by the manufacturer and DLA Land and Maritime-VAT.

3.12.1 Certificate of compliance. A certificate of compliance shall be required from manufacturers requesting to be an approved source of supply.

3.13 Workmanship. The resistor shall be uniform in quality and free from any defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Qualification inspection. Qualification inspection is not applicable to this document.

4.2 Reliability assurance program. The reliability assurance program specified in MIL-PRF-32159 and maintained in accordance with MIL-STD-790 is not applicable to this document.

4.3 Failure rate qualification. Failure rate qualification specified in MIL-PRF-32159 and MIL-STD-690 is not applicable to this document.

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4.4 Conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection ("M" level only), Subgroup 2 shall be dc resistance only without 5 percent total reject requirement. Subgroup 3 shall be in accordance with 4.8 and performed on 100% of the lot. Subgroup 5 the following exception shall apply: Resistors (if marked) shall be examined for legibility under normal production room lighting by an inspector at 10X magnification, and ppm reporting is not applicable). Group B inspection (Subgroup 1 shall include Resistance temperature characteristic in accordance with 4.9 and be performed on separate samples - 20 samples each and solder mounting integrity is not applicable) of MIL-PRF-32159. Additionally, a power moisture resistance test as specified in 4.6 shall be performed when specified in the PIN.

4.4.2 Certification. The manufacture shall submit a certificate of compliance in lieu of the group B inspection and/or the power moisture resistance test, if not specified in the PIN.

4.5 Short time overload. Resistors shall be tested in accordance with MIL-PRF-32159. The following details and exceptions shall apply:

- a. For resistance values 0.002 ohms to 0.049 ohms an overload dc test potential which will result in 5 times the rated wattage and shall be applied for 5 seconds. For resistance values .050 ohms and above an overload dc test potential which will result in 3 times the rated wattage and shall be applied for 5 seconds.
- b. Test board may have copper lamination in excess of the 70 micrometers copper (2 oz.) thickness as described in MIL-PRF-32159.
- c. Separate resistors shall be used for short time overload and resistance temperature characteristic tests.

4.6 Power moisture resistance. Resistors shall be tested in accordance with MIL-PRF-32159 moisture resistance test. The following details and exceptions shall apply:

- a. The test is to be performed on an annual basis.
- b. A 30 piece sample shall be used with 0 defects allowed.
- c. Step 7a shall not be applicable.
- d. Polarization and loading voltage: 10% rated power will be applied.

4.7 Solderability. Solderability shall be tested in accordance with MIL-PRF-32159. The following details and exceptions shall apply:

- a. Sample size shall be 13 pieces.
- b. Alternate method – J-STD-002 test method S with category C preconditioning may be used.

4.8 Visual inspection. Resistor shall be examined as listed below:

- a. Marking. Marking shall remain legible after all tests.
- b. Top coating. The top coating of the resistor body on top shall cover 90 percent of the element. Weld zone is not considered as the element area.
- c. Bottom coating. The bottom coating shall cover 80 percent of the element, and the thickness shall not exceed the terminal standoff height. Weld fillet is not considered as the element area.
- d. Bowing. The resistor body shall not be bowed beyond 0.003".
- e. Cracks. Flexing due to the calibration method of the resistor can induce cracks along the calibration cuts and are considered acceptable.
- f. Height. A maximum height per internal specification is 0.030".
- g. Plating on the side. Plating on the side of the element is acceptable when it does not exceed 25 percent of the total element length. Side plating is defined as the plating covering the entire side of the element and shall have a thickness of 0.014" for resistance values 0.00200Ω to 0.00999Ω and 0.0089" for resistance values 0.01Ω to 0.1Ω.
- h. Edge plating. Edge plating shall not exceed 50% of the element length. Edge plating is define as plating on the corners of the elements.

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4.9 Resistance temperature characteristic (see 3.16). Resistors shall be tested in accordance with MIL-STD-202-304. The following details and exceptions shall apply:

- a. Reference temperature: Room ambient temperature.
- b. Test temperature: In accordance with table V.
- c. Accuracy of temperature measurement: Resistors shall be maintained for thirty minutes +90 minutes, -15 minutes within 3°C at each of the test temperatures listed in table V. This tolerance shall be maintained on the established test temperatures.
- d. Mounting: Resistors shall be mounted on a test board as specified in MIL-PRF-32159 visual and mechanical inspection.
- e. The DC resistance shall be measured in accordance with MIL-PRF-32159.

As an option, the manufacturer may develop a control procedure for minimum stabilization times required for RTC testing. This procedure shall detail specific time elements required to reach thermal and electrical stability for specific part designs. Upon approval by the qualifying activity, the manufacturer may use this procedure for minimum stabilization times for RTC testing.

TABLE V. Resistance temperature characteristic.

Sequence	Temperature 1/ °C
1	2/ 25 ±3
2	-55 ±3
3	2/ 25 ±3
4	125 ±3

1/ At the option of the manufacturer, the reverse sequence may be as follows:

- 1 - 1/ 25°C ±3°C
- 2 - 125°C ±3°C
- 3 - 1/ 25°C ±3°C
- 4 - -55°C ±3°C

2/ This temperature shall be considered the reference temperature for each of the succeeding temperatures.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Surface mount resistors are used in electronic circuits where space is a major concern.

6.2 Ordering data. The contract or purchase order should specify the following:

- a. Complete DLA Land and Maritime CAGE CODE and PIN (see 1.2).
- b. Requirements for delivery: One copy of the conformance inspection data or certification of compliance that parts have passed conformance inspection with each shipment of parts by the manufacturer.
- c. Requirements for packaging and packing.
- d. If marking is required (see 3.8.1).

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6.3 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to [ASTM-B545](#) (Standard Specification for Electrodeposited Coatings of Tin).

6.4 User of record. Coordination of this document for future revisions is coordinated only with the approved source of supply and the users of record of this document. Requests to be added as a recorded user of this drawing may be achieved online at resistor@dla.mil or in writing to: DLA Land and Maritime, Attn: VAT, Post Office Box 3990, Columbus, OH 43218-3990 or by telephone (614) 400-3997 or DSN 850-0552.

6.5 Approved source of supply. Approved source of supply is listed herein. Additional sources will be added as they become available. Assistance in the use of this drawing may be obtained online at resistor@dla.mil or contact DLA Land and Maritime, Attn: VAT, Post Office Box 3990, Columbus, OH 43218-3990 or by telephone (614) 400-3997 or DSN 850-0552.

DLA Land and Maritime drawing PIN	Vendors similar designation or type number <u>1/</u>	Vendor CAGE	Vendor's name and address
06012-*****	WSL2816-97	91637	Vishay Dale Electronics, Inc. PO Box 609 Columbus, NE 68602-0609
06012-*****A	WSL2816-98		
06012-*****B	WSL2816-99	2799A	Vishay Dale Electronics, Inc. PO Box 2317 EMEK-Sara "B" Industrial Park Be'er Sheva, Israel 84874
06012-*****C	WSL2816-37		

1/ Parts must be purchased to the DLA Land and Maritime CAGE CODE and PIN to assure that all performance requirements and test are met.

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