High Reliability Ferrite Chip Beads

AEM's High Reliability Ferrite Chip Beads

Benefits

- Sole source and first ever DSCC approved ferrite chip bead (tested to Drawing 03024)
- Made in USA
- Sn/Pb terminations (5%+ Pb, no tin whisker worries)
- Designed and qualified as Hi-Rel
- Complete material and process traceability
- Meets all high reliability demands

Features

- Operating temperature range of –55°C to +125°C
- Tin whisker free (Sn/Pb or Au termination finish)
- Reliable terminations (Ni barrier)
- Groups A/B data are supplied with each shipment. Group C inspection is optional.
- Monolithic structure for closed magnetic path and high reliability
- Standard EIA/EIAJ chip sizes (0603, 0805, 1206)

Applications

- Mission critical
- Where replacement is not an option
- Where pure tin terminations are prohibited
- Down-hole and undersea

As the first and only DSCC approved ferrite chip bead designed for high reliability use, the HRB Series ferrite chip beads from AEM, Inc. are manufactured in a AS9100 facility in San Diego, CA, providing complete material and process traceability. All components are manufactured with qualified materials and process systems and tested to DSCC drawing 03024.

The HRB Series beads are designed with mission critical applications in mind. Capable of operating in harsh environments and extreme temperatures, these Hi-Rel chips are free of tin whiskers with Sn/Pb or Au terminations. A variety of EIA/EIAJ chip sizes are offered and feature nickel barrier terminations with a solder plate finish to help ensure a reliable solder joint.

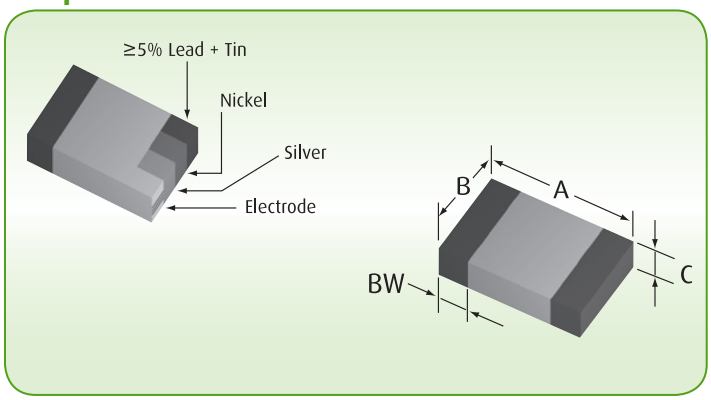
AEM, INC. 6610 Cobra Way, San Diego, CA 92121, USA 858.481.0210 www.aem-usa.com

AEM's High Reliability Ferrite Chip Beads

	AEM Part No.	DSCC Part No.	Impedance Ω	Max. Ω RDC	Max. Amps
0603	HRB0603S300P.500 . .	03024-001P	30	0.15	0.50
	HRB0603S600P.500 . .	03024-002P	60	0.15	0.50
	HRB0603S101P.400 . .	03024-003P	100	0.20	0.40
	HRB0603S151P.400 . .	03024-004P	150	0.25	0.40
	HRB0603S181P.400 . .	03024-005P	180	0.25	0.40
	HRB0603S301P.200 . .	03024-006P	300	0.30	0.20
	HRB0603S401P.200 . .	03024-007P	400	0.35	0.20
	HRB0603S601P.200 . .	03024-008P	600	0.40	0.20
	HRB0603S102P.200 . .	03024-009P	1000	0.60	0.20
0805	HRB0805S300P4.00 . .	03024-010P	30	0.02	4.00
	HRB0805S500P2.00 . .	03024-011P	50	0.08	2.00
	HRB0805S600P1.50 . .	03024-012P	60	0.15	1.50
	HRB0805S700P1.50 . .	03024-013P	70	0.15	1.50
	HRB0805S101P1.00 . .	03024-014P	100	0.20	1.00
	HRB0805S121P1.00 . .	03024-015P	120	0.20	1.00
	HRB0805S151P1.00 . .	03024-016P	150	0.20	1.00
	HRB0805S221P1.00 . .	03024-017P	220	0.20	1.00
	HRB0805S331P1.00 . .	03024-018P	330	0.25	1.00
	HRB0805S471P1.00 . .	03024-019P	470	0.25	1.00
	HRB0805S601P1.00 . .	03024-020P	600	0.30	1.00
	HRB0805S102P1.00 . .	03024-021P	1000	0.40	1.00
1206	HRB1206S300P4.00 . .	03024-022P	30	0.01	4.00
	HRB1206S500P3.00 . .	03024-023P	50	0.03	3.00
	HRB1206S800P1.50 . .	03024-024P	80	0.10	1.50
	HRB1206S121P1.50 . .	03024-025P	120	0.10	1.50
	HRB1206S251P1.50 . .	03024-026P	250	0.10	1.50
	HRB1206S501P1.00 . .	03024-027P	500	0.20	1.00
	HRB1206S601P1.00 . .	03024-028P	600	0.30	1.00

Other Sizes and Values may be added by request

Shape and Dimensions



Product Identification

HRB	0805	S	300	P	4.00	F	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1) Series code: High Reliability Ferrite Chip Bead

(2) Chip size, EIA/EIAJ dimensions A x B
First 2 digits: A ("length) Last 2 digits: B ("width)

(3) Speed code: S = Standard H = High speed

(4) Value code: Impedance (Ohms at 100 MHz)
The first two digits are significant. The last digit specifies zeros to follow 300 = 30 Ohms

(5) Tolerance code: J = ±5%; K = ±10%; M = ±20%; P = ±25%

(6) Current value in Ampere (4.00 = 4A; .150 = 0.15A)

(7) Termination code: F = Sn/Pb solder plate; G = Au plate

(8) Package Code: T = Tape & Reel; B = Bulk

Chip Size *EIA / EIAJ*	A *Inch (mm)*	B *Inch (mm)*	C *Inch (mm)*	TERMINATION (BW) *Inch (mm)*
0603/1608	0.063 ± 0.006 (1.60 ± 0.15)	0.031 ± 0.006 (0.80 ± 0.15)	0.031 ± 0.006 (0.80 ± 0.15)	0.014 ± 0.006 (0.36 ± 0.15)
0805/2012	0.079 ± 0.008 (2.00 ± 0.20)	0.049 ± 0.008 (1.25 ± 0.20)	0.035 ± 0.008 (0.90 ± 0.20)	0.020 ± 0.010 (0.51 ± 0.25)
1206/3216	0.126 ± 0.008 (3.20 ± 0.20)	0.063 ± 0.008 (1.60 ± 0.20)	0.043 ± 0.008 (1.10 ± 0.20)	0.020 ± 0.010 (0.51 ± 0.25)

TÜV AS9100 MIL-STD-790

October 2011

AEM, INC.
11525 Sorrento Valley Rd.
San Diego, California 92121
(858) 481- 0210

SPECIFICATION SHEET

REQUIREMENTS FOR HRB SERIES FERRITE CHIP BEADS

REVISION:	A	B	C							
DATE:	4/01	3/02	5/03							
DRAWN:	Jeff Montgomery					**Drawing: 487070**				
CHECKED:	Lin Ma / M. Esmende									
APPROVED:	Jeff Montgomery									
ECN:	2135					SHEET 1 OF 15				

1. SCOPE

1.1 Scope. This specification establishes the requirements for the screening of ferrite chip beads. Ferrite chip beads described in this document are manufactured and screened for high reliability applications. Ferrite chip beads described herein are capable of operation over a temperature range of –55°C to +125°C ambient including high vacuum environments.

2. LOT ACCEPTANCE TESTING

2.1 Lot Acceptance Testing. This specification provides for two acceptance levels for the procurement of the ferrite chip beads. The degree of testing and associated documentation can be specified as appropriate to the end use of the ferrite chip beads. Regardless of the acceptance level specified, the inherent quality and reliability of the ferrite chip beads will remain constant. The acceptance levels with the applicable inspection required are indicated in Table I.

TABLE I. LOT ACCEPTANCE LEVEL.

	INSPECTION TO BE PERFORMED		
LOT ACCEPTANCE LEVEL	GROUP A	GROUP B	GROUP C
LAT 2	X	X	
LAT 1	X	X	X

3. APPLICABLE DOCUMENTS

3.1 Issues of Documents. The following specifications, standards and handbooks form a part of this specification to the extent specified herein. In the event of a conflict between the documents referenced herein and this specification, this specification governs.

SPECIFICATIONS

MIL-F-14256: Flux, Soldering, Liquid (Rosin Base).

STANDARDS

MIL-STD-202: Test Methods for Electronic and Electrical Component Parts.

MIL-STD-790: Reliability Assurance Program for Electronic Parts Specifications.

MIL-STD-45662: Calibration System Requirements.

OTHERS

EIA-595 Visual and Mechanical Inspection of MLCC.

ASTM E595: Materials from Outgassing in a Vacuum Environment, Total Mass Loss and Collected Volatile Condensable, Standard Test Method for.

4. REQUIREMENTS

4.1 Qualification. Ferrite chip beads identified in this document shall be capable of passing the qualification requirements specified in Table V and section 4 of this document.

4.2 Materials, Design and Construction. The materials, design and construction of the ferrite chip beads shall be as specified herein.

4.2.1 Terminals. The terminations shall be covered with a tin/lead coating. The tin content of the coating shall not exceed 97%.

4.2.2 Body. The body shall be comprised of a ferrite-based material that is substantially devoid of air.

4.3 Impedance. The impedance values for ferrite chip beads specified herein are specified in the specification sheet and shall be measured in accordance with 5.8.19.

4.4 Maximum Current Rating. The maximum current rating is the maximum amperes that the ferrite chip bead will carry at a body temperature of +25°C without degradation. The applicable current rating is specified in the specification sheet.

4.5 Temperature Rating. The temperature rating for ferrite chip beads specified herein is –55°C to +150°C nonoperating. The maximum operating temperature shall not exceed a body temperature of +125°C. The temperature derating curve is given in Figure 1.

4.6 Maximum Cold Resistance. The maximum cold resistance values for ferrite chip beads are specified by the specification sheet and shall be measured in accordance with 5.8.2.

4.7 Performance.

4.7.1 Thermal Shock (Group A). When ferrite chip beads are tested in accordance with 5.8.3 herein, they shall show no electrical or mechanical damage.

4.7.2 Current-Carrying Capacity. When ferrite chip beads are tested in accordance with 5.8.6, they shall show no evidence of mechanical damage and shall carry the current as specified without electrical failure.

4.7.3 Termination Strength. When ferrite chip beads are tested in accordance with 5.8.7, the end terminations shall not break or loosen. The cold resistance values shall not change by more than 10 percent.

4.7.4 Thermal Vacuum (Qualification Only). When ferrite chip beads are tested in accordance with 5.8.16, they shall not open circuit during the application of derated DC current nor shall there be evidence of arcing or mechanical damage after the test. The impedance shall not change by more than 10 percent when measured after thermal vacuum exposure.

4.7.5 Bending. When ferrite chip beads are tested in accordance with 5.8.14, they shall not break or loosen. The cold resistance shall not change by more than 10%.

4.7.6 Insulation Resistance. When ferrite chip beads are tested in accordance with 5.8.15, the insulation resistance shall be 1GΩ minimum.

4.7.7 Moisture Resistance (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.8, there shall be no evidence of cracking or peeling of the ferrite body or excessive corrosion of the terminations. The impedance shall not change by more than 15 percent.

4.7.8 Shock (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.9, there shall be no evidence of mechanical damage and the impedance shall not change by more than 10 percent.

4.7.9 Vibration (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.10, there shall be no evidence of mechanical damage and the impedance shall not change by more than 10 percent.

4.7.10 Low Temperature Operation (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.12, they shall not open circuit and the cold resistance shall not change by more than 10 percent.

4.7.11 Life (1000 Hours, Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.13, they shall not open circuit and the impedance and cold resistance shall not change by more than 20 percent. The cold resistance shall not exceed the maximum value specified.

4.7.12 Resistance to Soldering Heat. When ferrite chip beads are tested in accordance with 5.8.11, there shall be no mechanical damage and the cold resistance shall not change by more than 10 percent.

4.7.13 Solderability. Fuses shall meet the solderability requirements specified in MIL-STD-202, Method 208.

4.7.14 Salt Spray (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.17, there shall be no evidence of excessive corrosion. Excessive corrosion is defined as that which interferes with the electrical or mechanical performance. There shall be no warping or cracking of the ferrite body and the impedance shall not change by more than 10 percent.

4.7.15 Outgassing. When ferrite chip beads are tested in accordance with 5.8.18, the materials shall meet the following requirements:

a) Total mass loss (TML) - Shall not exceed 1.0 percent.
b) Collected volatile condensable material (CVCM) - Shall not exceed 0.1 percent.

Note that this requirement can be met be certification of materials once product has been tested by an approved facility.

4.7.16 100 Cycle Thermal Shock (Group C / Qualification Only). When ferrite chip beads are tested in accordance with 5.8.20, there shall be no mechanical damage and the impedance shall not change by more than 20 percent.

4.7.17 Resistance to Solvents. When ferrite chip beads are tested in accordance with 5.8.21 there shall be no mechanical damage.

4.8 Workmanship. Ferrite chip beads shall be free of defects that will affect usable life or reliability.

4.9 Traceability Requirements. A unique B-lot number (BXXXX) will be assigned to each ferrite chip bead lot. The B-lot number will be assigned to all Group A and B screening data and will also appear on the reel label. The date code of each screened bead lot will be assigned by the date of Group B solderability testing Example: 0025 for 25TH week of year 2000).

5. QUALITY ASSURANCE PROVISIONS

5.1 Classification of Inspection. The inspection of ferrite chip beads procured to the requirements of this specification shall be classified as follows:

a) Qualification Inspection (paragraph 5.6) when specified on the purchase order.
b) Acceptance Inspection (paragraph 5.7).

5.2 Reliability Assurance Program. AEM shall ensure that a reliability assurance program is established and maintained in accordance with MIL-STD-790.

5.3 Test Equipment and Inspection Facilities. AEM shall establish and maintain a calibration system in accordance with MIL-STD-45662.

5.4 Acceptance Inspection Reports. AEM shall supply with each shipment of ferrite chip beads the following minimum data:

a) Non-standard test reports as required by the purchase order.
b) Certification of Conformance signed by Quality Assurance Manager.
c) Group A and B data.
d) Group C data, if required by the purchase order, shall be shipped at the completion of Group C inspection.

5.5 Inspection Conditions and Methods. Unless otherwise specified in this document, inspections shall be conducted at room ambient environments of +25°C +/- 5°C and the maximum relative humidity shall be 75 percent.

5.6 Qualification Inspection.

5.6.1 Qualification Samples. Samples submitted to qualification inspection shall be representative of the normal production. A sample of 58 ferrite chip beads representing the lowest, middle, and highest impedance values shall be submitted for qualification inspection. At the completion of Subgroup I inspection, the 58 samples shall be divided into the subgroups and quantities shown in Table V. Each subgroup shall have approximately equal representation of the ferrite chip bead impedance values.

5.7 Acceptance Inspection.

5.7.1 Inspection of Ferrite Chip Beads for Delivery. Inspection of ferrite chip beads for delivery against a purchase order shall consist of the tests listed in Table I.

5.7.2 Inspection Lot. An inspection lot shall consist of one impedance rating of one lot date code.

5.7.3 Group A Inspection. Group A inspection shall consist of the tests listed in Table II and shall be conducted in the order indicated.

5.7.4 Group B Inspection. Group B inspection shall consist of the tests listed in Table III and shall be conducted in the order indicated. All ferrite chip beads submitted to Group B inspection shall have successfully met all electrical requirements of the Group A inspection (Visual rejects may be utilized for Group B inspection).

5.7.5 Group C Inspection. Group C inspection, when required by the purchase order, shall consist of the tests listed in Table IV. The ferrite chip beads submitted for Group C inspection shall have met Group A and Group B inspection requirements as part of the inspection lot from which they were taken. Group C inspection must be completed within 150 days after the completion of Group B inspection.

TABLE II. GROUP A INSPECTION.

EXAMINATION OR TEST	REQUIREMENT PARAGRAPH	METHOD PARAGRAPH	NUMBER OF UNITS SPECIFIED	NUMBER OF DEFECTIVES ALLOWED
THERMAL SHOCK	4.7.1	5.8.3	100%	N/A
COLD RESISTANCE	4.6	5.8.2	100%	< 5%
IMPEDANCE	4.3	5.8.19	100%	< 5%
VISUAL AND MECHNICAL EXAMINATION	4.2, 4.2.1, 4.2.2, 4.8	5.8.1	100%	N/A
MATERIAL VERIFICATION – OUTGASSING	4.7.15	5.8.18	3 PIECES MINIMUM	0
MATERIAL VERIFICATION – TERMINATIONS / BODY	4.2.1	5.8.4, 5.8.5	3 PIECES MINIMUM	0

TABLE III. GROUP B INSPECTION.

30 Samples Required.

EXAMINATION OR TEST	REQUIREMENT PARAGRAPH	METHOD PARAGRAPH	NUMBER OF UNITES SPECIFIED	NUMBER OF DEFECTIVES ALLOWED
SUBGROUP I (6 UNITS)				
RESISTANCE TO SOLVENTS	4.7.17	5.8.21	6	0
SUBGROUP II (8 UNITS)				
SOLDERABILITY	4.7.13	MIL-STD-202, METHOD 208	8	0
SUBGROUP III (4 UNITS)				
RESISTANCE TO SOLDERING HEAT	4.7.12	5.8.11	4	0
SUBGROUP IV (4 UNITS)				
TERMINATION STRENGTH	4.7.3	5.8.7	4	0
SUBGROUP V (8 UNITS)				
CURRENT-CARRYING CAPACITY	4.7.2	5.8.6	8	0

TABLE IV. GROUP C INSPECTION.

38 Samples Required.

EXAMINATION OR TEST	REQUIREMENT PARAGRAPH	METHOD PARAGRAPH	NUMBER OF UNITS SPECIFIED	NUMBER OF DEFECTIVES ALLOWED
SUBGROUP I (16 UNITS)				
LOW TEMPERATURE OPERATION	4.7.10	5.8.12	16	0
LIFE (1000 HOURS)	4.7.11	5.8.13	16	0
SUBGROUP II (6 UNITS)				
BENDING	4.7.5	5.8.14	6	0
SUBGROUP III (4 UNITS)				
VIBRATION	4.7.9	5.8.10	4	0
SHOCK	4.7.8	5.8.9	4	0
SUBGROUP IV (4 UNITS)				
100 CYCLE THERMAL SHOCK	4.7.16	5.8.20	4	0
SUBGROUP V (4 UNITS)				
MOISTURE RESISTANCE	4.7.7	5.8.8	4	0
THERMAL SHOCK	4.7.1	5.8.3	4	0
CURRENT-CARRYING CAPACITY (+25°C)	4.7.2	5.8.6	4	0
SUBGROUP VI (4 UNITS)				
INSULATION RESISTANCE	4.7.6	5.8.15	4	0

TABLE V. QUALIFICATION INSPECTION.

58 Samples Required.

EXAMINATION OR TEST	REQUIREMENT PARAGRAPH	METHOD PARAGRAPH	NUMBER OF UNITS SPECIFIED	NUMBER OF DEFECTIVES ALLOWED
SUBGROUP I (58 UNITS)				
VISUAL AND MECHANICAL EXAMINATION	4.2, 4.2.1, 4.2.2 4.8	5.8.1	58	0
COLD RESISTANCE	4.6	5.8.2	58	0
IMPEDANCE	4.3	5.8.19	58	
SUBGROUP II (6 UNITS)				
BENDING	4.7.5	5.8.14	6	0
SUBGROUP III (20 UNITS)				
LOW TEMPERATURE OPERATION	4.7.10	5.8.12	12	0
LIFE (1000 HOURS)	4.7.11	5.8.13	12	0
THERMAL VACUUM (SEPARATE SAMPLE)	4.7.4	5.8.16	8	0
SUBGROUP IV (4 UNITS)				
VIBRATION	4.7.9	5.8.10	4	0
SHOCK	4.7.8	5.8.9	4	0
SUBGROUP V (4 UNITS)				
SALT SPRAY	4.7.14	5.8.17	4	0
SUBGROUP VI (16 UNITS)				
100 CYCLE THERMAL SHOCK	4.7.16	5.8.20	16	0
SUBGROUP VII (4 UNITS)				
MOISTURE RESISTANCE	4.7.7	5.8.8	4	0
THERMAL SHOCK	4.7.1	5.8.3	4	0
CURRENT-CARRYING CAPACITY (+25°C)	4.7.2	5.8.6	4	0
SUBGROUP VIII (4 UNITS)				
INSULATION RESISTANCE	4.7.6	5.8.15	4	0

5.8 Methods of Examination and Test.

5.8.1 Visual and Mechanical Inspection. Ferrite chip beads shall be visually and mechanically examined per the general visual acceptance criteria outlined in EIA-595

5.8.2 Resistance. The resistance of the ferrite chip bead shall be measured using a constant current DC source. The resistance of the ferrite chip bead shall be measured using one of the following two methods:

Method I: The resistance shall be measured using a constant current DC source. The measurement current shall be from 0.1 to 10 milliamperes and provide a measurement accuracy of +/- 1%. A Keithley Model 580 Micro-Ohmmeter or equivalent is recommended for these measurements.

Method II: The ferrite chip bead shall be electrically connected to a constant DC source supplying 10% of the rated current of the ferrite chip bead. The voltage drop of each ferrite chip bead shall be measured and the resistance calculated from the measured voltage drop.

5.8.3 Thermal Shock. Ferrite chip beads shall be tested in accordance with Method 107, Test Condition B, of MIL-STD-202. A total of five cycles shall be run without interruption.

5.8.4 Material Verification (Terminations). Ferrite chip bead samples shall be subjected to energy dispersive spectroscopy (EDS) or X-ray Fluorescence (XRF) to determine the following:

a) The tin/lead terminations are no more than 97% tin.
b) Existence of cadmium (none permitted).

5.8.5 Material Verification (Body). Ferrite chip bead samples shall be subjected to energy dispersive spectroscopy (EDS), also known as energy dispersive analysis of x-rays to determine the following:

a) Existence of pure cadmium and cadmium alloys (none permitted).
b) Existence of pure zinc (none permitted).

5.8.6 Current-Carrying Capacity. Ferrite chip bead samples shall be apportioned and submitted to the following DC test currents at -55°C to -60°C, at +20°C to +35°C (room ambient temperature), and at +125°C to +130°C:

Test Temperature	DC Test Current
- 55°C	110% of Rated
+ 25°C	100% of Rated
+ 125°C	80% of Rated

The test current shall be maintained for 30 minutes after the temperature of each ferrite chip bead has stabilized, but shall not be applied for less than 1.5 hours. It may be assumed that the temperature has stabilized when three consecutive temperature readings taken at 10 minute intervals show no rise in temperature. The temperature of the ferrite chip bead body shall be measured by thermocouples (wire size 28 to 32 AWG). Group B current-carrying capacity testing shall be conducted at room temperature conditions only.

5.8.7 Terminal Strength. Ferrite chip beads shall be tested in accordance with Method 211 of MIL-STD-202. The following exceptions shall apply:

a) Test Condition - Test Condition A (0.5 kg for size 0603; 1.0 kg for size 0805; 1.5 kg for size 1206) applying the force axially to each lead wire individually (solder .020 to .025 inch diameter wires with nail head to terminations prior to testing). Apply force for 30 seconds.
b) Method of Holding - The ferrite chip bead body shall be held by means other than rigid clamping.
c) Measurements - DC resistance measurements shall be taken before and after exposure in accordance with 5.8.2.

5.8.8 Moisture Resistance (Group C / Qualification Only). Ferrite chip beads shall be tested in accordance with Method 106 of MIL-STD-202. The following exceptions shall apply:

a) Mounting - Normal mounting means by soldering onto a printed circuit board.
b) No polarizing voltage applied.
c) Steps 7a and 7b are not applicable.
d) Measurements – Impedance measurements shall be taken before and after the exposure in accordance with 5.8.19.

5.8.9 Shock (Group C / Qualification Only). Ferrite chip beads shall be tested in accordance with Method 213 of MIL-STD-202. The following details and exceptions shall apply:

a) Mounting – Ferrite chip beads shall be securely fastened to the table of the shock machine to prevent relative motion between the ferrite chip beads and the table (solder mounted on a printed circuit board).
b) Test Condition - F (1500 G's)
c) Number of Shocks - Three shocks in each direction of three mutually perpendicular axes (18 shocks total).
d) Measurements - Impedance measurements shall be taken before and after the shock exposure in accordance with 5.8.19
e) Rated current shall be applied to one half of the samples during testing.

5.8.10 Vibration (Group C / Qualification Only). Ferrite chip beads shall be tested in accordance with Method 204 of MIL-STD-202. The following details and exceptions shall apply:

a) Mounting – Ferrite chip beads shall be securely fastened to the table of the vibration machine to prevent relative motion between the ferrite chip beads and the table.
b) Test Level - Sinusoidal vibration from 5 to 3000 hertz, 0.4-inch double amplitude or 30G's peak, whichever is less.
c) Sweep Rate - Approximately 1/2 octave per minute.
d) Test Duration - 12 hours total (4 hours in each of three major axes).
e) Measurements – Impedance measurements shall be taken before and after the vibration exposure in accordance with 5.8.19.
f) Rated current shall be applied to one half of the samples during testing.

5.8.11 Resistance to Soldering Heat. Ferrite chip beads shall be tested in accordance with Method 210 of Mil-Std-202. The following details and exceptions shall apply:

a) Solder temperature: 260°C ± 5°C.
b) Immersion time: 10 seconds.
c) Impedance measurements shall be taken before and after the exposure in accordance with 5.8.19.

5.8.12 Low Temperature Operation (Group C / Qualification Only). Ferrite chip beads shall be soldered on a suitable test board and placed in a low temperature chamber. The chamber temperature shall be lowered gradually to -55°C +0/-3°C within a period of 1 hour. After stabilizing at the low temperature for a period of 1 hour, rated DC current shall be applied to the ferrite chip beads for a period of 4 +1/-0 hours while at the low temperature. The chamber shall then be gradually raised to room temperature within a 4-hour period and maintained at room temperature for a period of 8 hours minimum. After this time, the DC current shall be removed from the ferrite chip beads and the ferrite chip beads removed from the chamber. The impedance of the ferrite chip beads shall be measured before and after the test in accordance with 5.8.19.

5.8.13 Life (1000 Hours, Group C / Qualification Only). Ferrite chip beads shall be soldered on a suitable test board and placed in a chamber at +125°C +3/-0°C ambient. The ferrite chip beads shall be electrically connected to a DC source supplying 64 percent of the +25°C rated current. The ferrite chip beads shall remain in the chamber at the specified current for 1000 +/- 8 hours. The electrical circuit shall provide a suitable indicator, which shall be monitored daily during the length of the life test, to identify failure (opening) of any ferrite chip bead. The time of failure shall be recorded to the nearest +/-12 hours and the open ferrite chip bead replaced with a short circuit for the remainder of the test. The impedance of the ferrite chip bead shall be measured before and after the test in accordance with 5.8.19.

5.8.14 Bending. Ferrite chip beads shall be solder mounted on a suitable printed circuit board and submitted to a 1 mm bend as specified by EIA/IS-759. The test method shall be conducted per AEM operation QS-12-019. The impedance of the ferrite chip bead shall be measured before and after the test in accordance 5.8.19.

5.8.15 Insulation Resistance. The insulation of the ferrite chip beads shall be measured as specified by Method 302 of MIL-Std-202 with the following exceptions:

a) A conductive band shall be placed on the surface of the body.
b) The two terminations of the ferrite chip bead shall be shorted together.

5.8.16 Thermal Vacuum (Qualification Only). Ferrite chip beads shall be mounted in suitable mount sockets. The ferrite chip beads shall then be placed in a vacuum chamber and the chamber evacuated to a pressure of 5×10^{-5} torr maximum. The temperature of the ferrite chip bead mount shall be controlled such that the temperature of the ferrite chip beads, measured with a thermocouple mounted on the ferrite chip bead body, is maintained at +125°C +/- 3°C for a period of 48 +4, -0 hours, while 90% of the +25°C rated current is flowing through each ferrite chip bead. The impedance of the ferrite chip beads shall be measured before and after the test in accordance with 5.8.19.

5.8.17 Salt Spray (Group C / Qualification Only). Ferrite chip beads shall be tested in accordance with Method 101 of MIL-STD-202. The following details shall apply:

a) Five percent salt solution.
b) Test Condition B.
c) Following the drying period, the ferrite chip beads shall be subjected to 100 percent of rated current for 1 hour.
d) Following the test the ferrite chip beads shall be examined for compliance with 4.7.14.

5.8.18 Outgassing. The ferrite chip beads shall be tested as specified in ASTM E595.

5.8.19 Impedance. The impedance of the ferrite chip beads shall be measured at 100 MHz following the procedure outlined in AEM Process Instruction QS-12-003.

5.8.20 100 Cycle Thermal Shock (Group C / Qualification Only). Ferrite chip beads shall be tested in accordance with Method 107, Test Condition B, of MIL-STD-202. Prior to testing, the ferrite chip beads shall be solder mounted onto a printed circuit board. A total of one hundred cycles shall be run without interruption. The impedance of the ferrite chip beads shall be measured before and after the test in accordance with 5.8.19.

5.8.21 Resistance to Solvents. Ferrite chip beads shall be tested in accordance with Method 215 of MIL-STD-202.

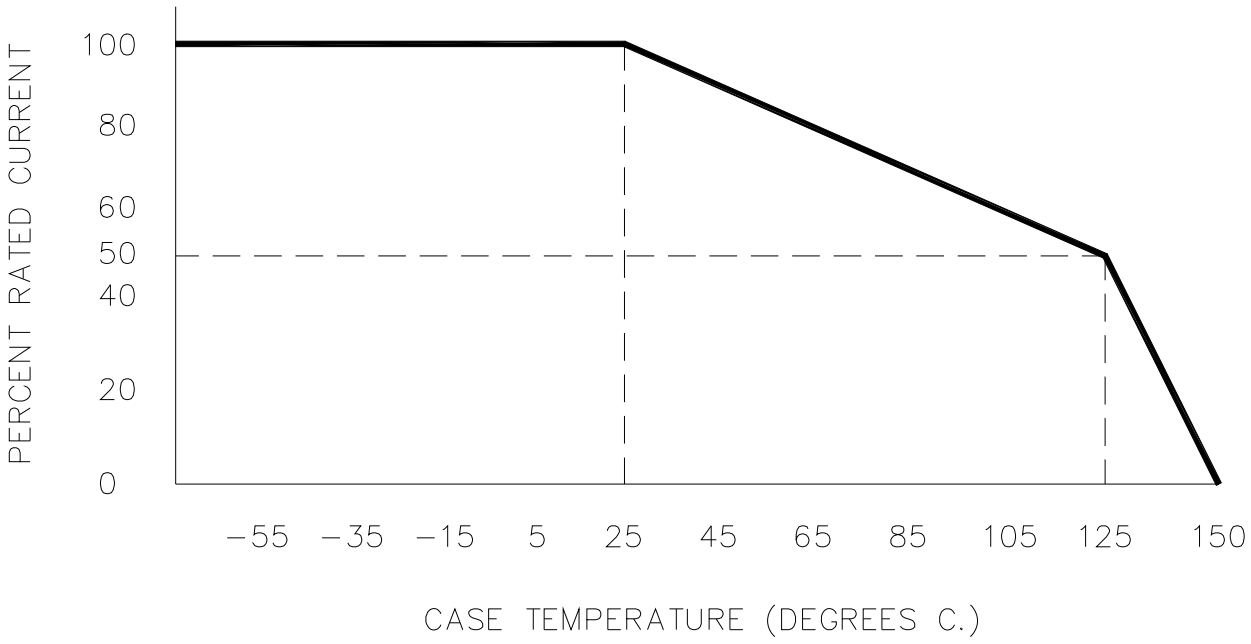


FIGURE 1. CURRENT DERATING LIMITS.

DOCUMENTATION CHANGE NOTICE

REV. LETTER	REV.DATE	PAGE	CHANGE ITEM	APPROVAL
A	4/01	N/A	Issue New Drawing	ECN 2126
B	3/02	2	Revised paragraph 1.2 to reference “manufacturing” and screening.	ECN 2130
		3	Revised paragraph 4.7.3 to indicate 10 percent (was 20 percent).	
		3	Revised paragraph 4.7.4 to indicate 10 percent (was 20 percent).	
		4	Revised paragraph 4.7.10 to indicate “cold resistance” rather than “impedance”.	
		4	Revised paragraph 4.7.11 to indicate “impedance and cold resistance” rather than “impedance”.	
		4	Revised paragraph 4.7.12 to indicate “cold resistance” rather than “impedance”.	
		9	Revised Table VI to list AEM HRB series part type.	
		10	Revised paragraph 5.8.9 to include sub-paragraph “e” for rated current application.	
		11	Revised paragraph 5.8.10 to include sub-paragraph “f” for rated current application.	
C	5/03	1	Revised paragraph 1.1 to indicate temperature range to +125C.	ECN 2135
		3	Revised paragraph 4.3 to reference Specification sheet.	
		3	Revised paragraph 4.4 to reference Specification sheet rather than Table VI.	
		3	Revised paragraph 4.4 to reference +150C upper temperature. Maximum operating temperature increased from +85C to +125C,	
		3	Revised paragraph 4.6 to reference specification sheet rather than Table VI.	
		4	Revised paragraph 4.7.11 to indicate 20% rather than 10%.	
		4	Revised paragraph 4.7.16 to indicate 20% rather than 10%.	
		9	Deleted Table VI. Reference is now Made to specification sheet.	

REV. LETTER	REV.DATE	PAGE	CHANGE ITEM	APPROVAL
C	5/03	9	Revised paragraph 5.8.5. Removed reference to “and zinc alloys”.	
		9	Revised paragraph 5.8.6 to indicate “+125C to +130C” rather than +85C to +90C”	
		10	Revised paragraph 5.8.7 to indicate various forces in a) for 0603, 0805 and 1206 part sizes.	
		11	Revised paragraph 5.8.13 to indicate +125C test condition rather than +85C test condition.	
		11	Revised paragraph 5.8.16 to indicate +125C test condition rather than +85C test condition.	
		11	Revised paragraph 5.8.14 to indicate Testing per AEM QS-12-019.	
		13	Deleted Figure 1. Reference now made to specification sheet for outline drawing.	
		13	Revised Figure 1 for Current Derating Limits to indicate 50% @ +125C rather than +85C. Also +150C nonoperating rather than +125C nonoperating.	

HRB-US Series
High Reliability Ferrite Chip Beads

AEM's HRB-US Product Overview

- Increases effective offering of HRB/DSCC part types to include Hi-Rel equivalents of most commercially available chip beads
- AEM facility uniquely qualified to perform needed processes
- Finished products up-screened to DSCC 03024 specifications
- For use in applications where failure is not an option
- Components provided as AEM warranted and supported products

Processes

- Commercial-grade components procured through OEM-approved distribution channels to ensure counterfeit prevention is maintained and pre-screened to AEM 387070 standard
- Component leads converted from RoHS to Sn/Pb utilizing AEM's proprietary plating process
- Components are completely screened per DSCC 03024 – Group A, B and C
- Up-screened flight components are tape & reel packaged with lot screening data (engineering model versions available upon request)

AEM, Inc. offers a unique service to up-screen high-quality, commercially available ferrite chip to meet high-reliability DSCC 03024 qualifications. This process provides a cost-effective means of producing an expanded inventory of DSCC part types for applications where failure is simply not an option.

AEM combines its unique testing and processing expertise to achieve this result. First, AEM's proprietary, aerospace-qualified plating and fusion process is used to convert the pre-screened commercial-grade parts, manufactured to be RoHS-compliant, to tin-lead (Sn/Pb) terminations and homogenizes the Sn/Pb terminal finish. The converted parts are then subjected to full DSCC 03024 Group A, B and C screening and repackaged in full reel with lot screening data.

HRB-US Series High-Reliability Ferrite Chip Beads

AEM is the first and only manufacturer of ferrite chip beads approved to the DSCC 03024 specification. In order to meet this demanding specification, AEM's ferrite beads are subjected to rigorous testing to assure compliance. While 03024 chip beads have been specifically design from the ground up, AEM has determined that AEM sourced and tin/lead converted commercial components can approach 03024 series reliability through rigorous up-screening, utilizing the same lot acceptance testing performed on AEM's 03024 ferrite beads.

1. AEM procures OEM components through OEM-approved distribution channels. Only full reel quantities are obtained to maintain OEM Lot Number Date Code and Traceability.

2. AEM's proprietary, aerospace-qualified Sn/Pb plating and fusion process has been used to prevent tin-whiskers on surface-mount component terminations. Parts are screened prior to the Sn/Pb conversion (QA1), as well as following (QA2). Sampled parts are then subjected to destructive physical analysis (DPA) to verify internal microstructure integrity prior to DSCC screening.

3. Comprehensive DSCC screening involves three Groups as shown in the table below. AEM also conducts additional destructive physical analysis (DPA) sample evaluations on all HRB-US components.

4. HRB-US chip beads are then packaged in tape & reel with AEM lot number / AEM lot date code assigned to compliment OEM traceability information.

Group A Testing	Group B Testing	Group C Testing
Thermal Shock	Resistance to solvents	Low Temperature Operation
DC Resistance	Solderability	Life (1000 Hours)
Impedance	Resistance to Soldering Heat	Thermal Vacuum
Visual and Mechanical Examination	Termination Strength	Bending
Material Verification Outgassing	Current Carrying Capacity	Vibration
Material Verification Terminations/Body		Shock
		Salt Spray
		Moisture Resistance
		Thermal Shock (100 Cycle)
		Current Carrying Capacity (+25°C)
		Insulation Resistance

TÜV AS9100 MIL-STD-790

July 2016