

# Wet Tantalum Capacitors, High Energy, Ultra High Capacitance, -55 °C to +125 °C Operation



## FEATURES

- High energy, very high capacitance design
- All tantalum, hermetically sealed case
- Utilizes Vishay proven SuperTan® technology
- Patent pending
- 2 terminations options: SMD and radial
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

## LINKS TO ADDITIONAL RESOURCES



## APPLICATIONS

- Industrial
- Avionics / military / space
- Ideal for capacitor banks

## PERFORMANCE CHARACTERISTICS

### Operating Temperature:

-55 °C to +85 °C (to +125 °C with voltage derating)

### Capacitance Tolerance:

at 120 Hz, +25 °C ± 20 % standard

± 10 % available as special

Contact marketing for availability of 10 % tolerance

### DC Leakage Current (DCL Max.):

at +25 °C: leakage current shall not exceed the values listed in the Standard Ratings tables.

### Life Test:

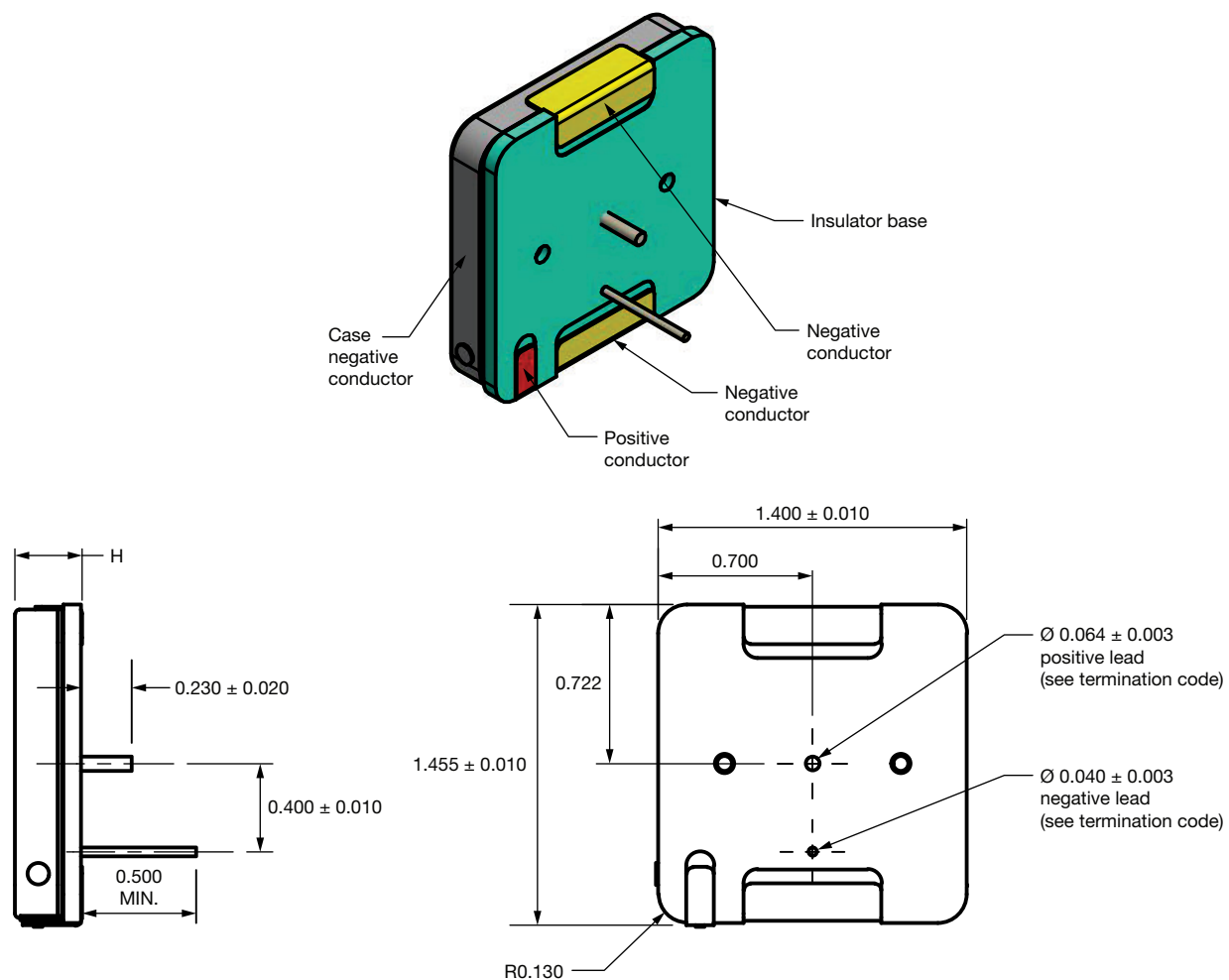
capacitors are capable of withstanding a 2000 h life test at a temperature of +85 °C at the applicable rated DC working voltage.

## ORDERING INFORMATION

| EP1  | C                     | 543                                                                                                                             | K                                   | 025                                                                                                                                               | B                                                            | Z                 | S                               | S            |                                                                                                      |
|------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------|---------------------------------|--------------|------------------------------------------------------------------------------------------------------|
| TYPE | CASE CODE             | CAPACITANCE                                                                                                                     | CAPACITANCE TOLERANCE               | DC VOLTAGE RATING AT +85 °C                                                                                                                       | TERMINATION CODE                                             | RELIABILITY LEVEL | TEMPERATURE                     | ESR          | MOUNTING STUD LENGTH                                                                                 |
|      | See Dimensions sheets | This is expressed in microfarads. The first two digits are the significant figures. The third is the number of zeros to follow. | K = 10 % <sup>(1)</sup><br>M = 20 % | This is expressed in V. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V) | See termination / mounting options in the Dimensions sheets. | Z = non-ER        | S = standard (-55 °C to +85 °C) | S = standard | Blank = not applicable<br>A = 0.21"<br>B = 0.27"<br>C = 0.40"<br>D = 0.15"<br>E = 0.18"<br>F = 0.35" |

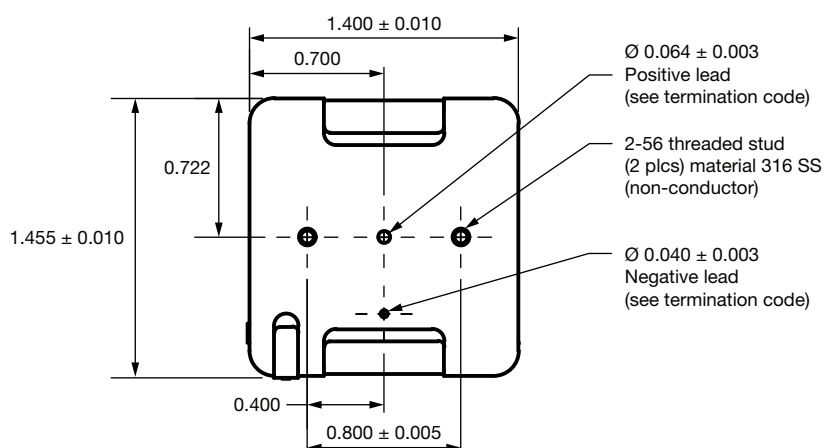
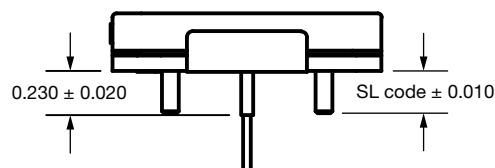
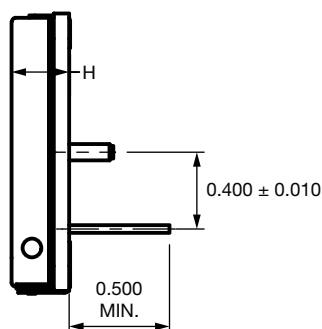
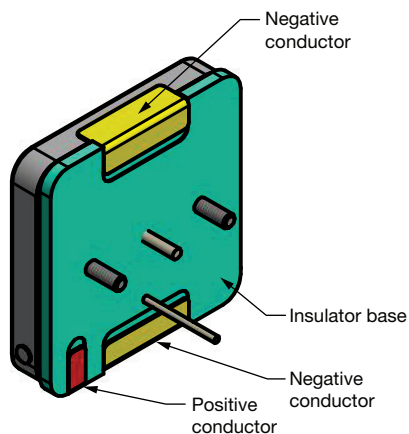
## Note

<sup>(1)</sup> Contact marketing for availability of 10 % tolerance

**DIMENSIONS - RADIAL TERMINATION** in inches


| CASE SIZE | H     |
|-----------|-------|
| A         | 0.312 |
| B         | 0.450 |
| C         | 0.596 |
| D         | 0.755 |

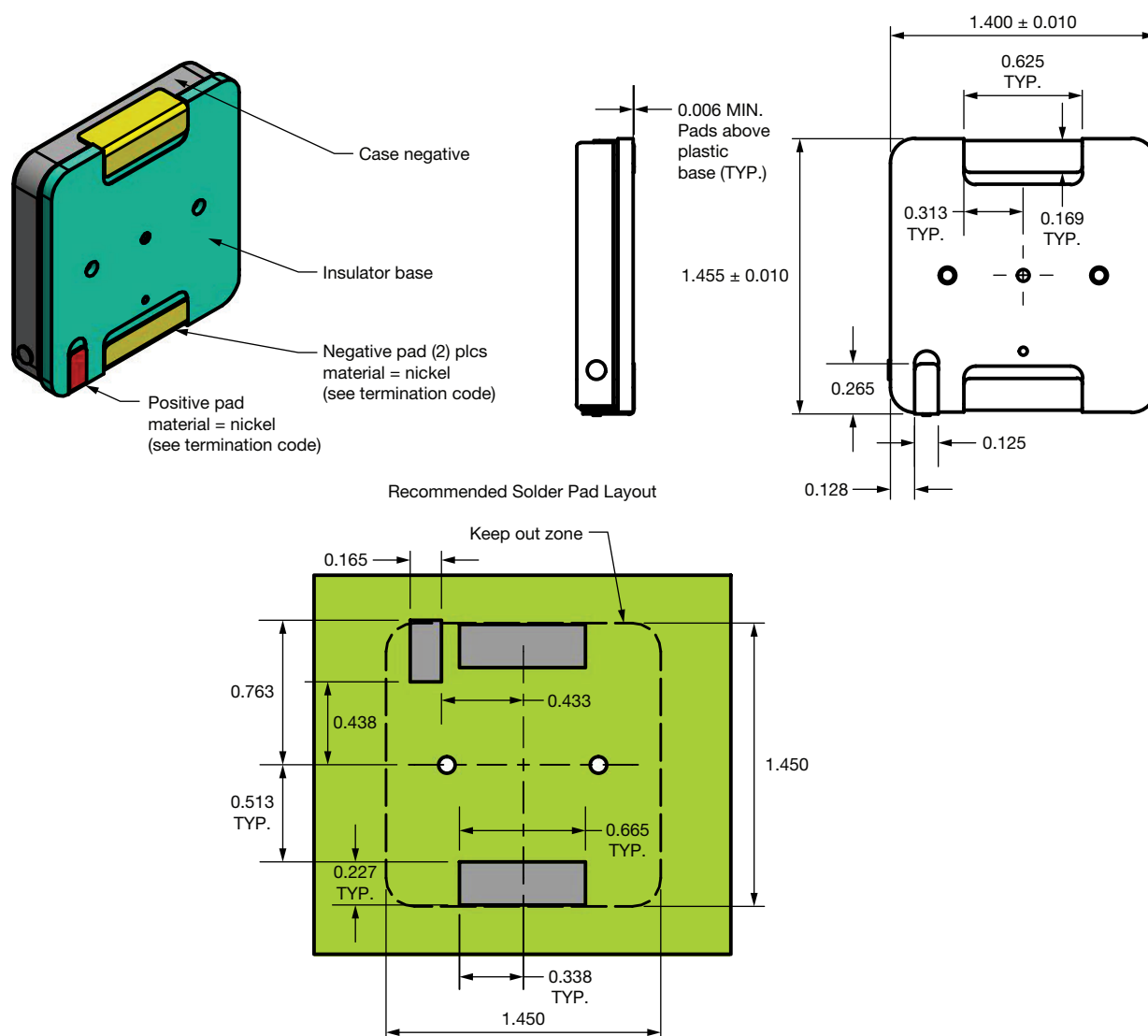
| TERMINATION CODE | TERMINATION / MOUNTING OPTION     |
|------------------|-----------------------------------|
| A                | 100 % tin (RoHS compliant) radial |
| B                | Tin / lead radial                 |

**DIMENSIONS - RADIAL TERMINATION WITH STUDS** in inches


| CASE SIZE | H     |
|-----------|-------|
| A         | 0.312 |
| B         | 0.450 |
| C         | 0.596 |
| D         | 0.755 |

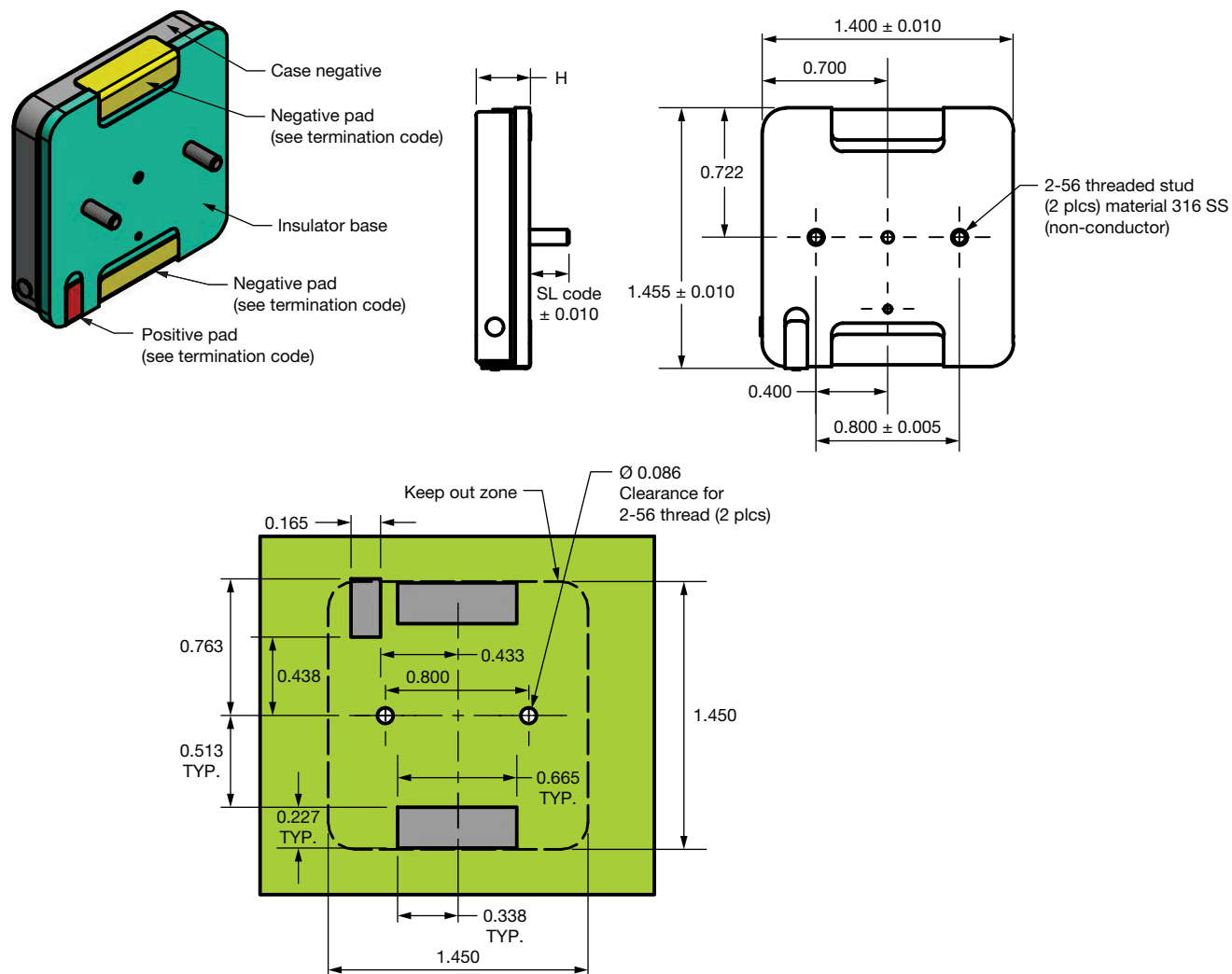
| TERMINATION CODE | TERMINATION / MOUNTING OPTION                     |
|------------------|---------------------------------------------------|
| C                | 100 % tin (RoHS compliant)<br>radial w/stud mount |
| D                | Tin / lead radial w/stud mount                    |

| SL STUD LENGTH CODE | SL DIM |
|---------------------|--------|
| A                   | 0.21   |
| B                   | 0.27   |
| C                   | 0.40   |
| D                   | 0.15   |
| E                   | 0.18   |
| F                   | 0.35   |

**DIMENSIONS - SMD TERMINATION** in inches


| CASE SIZE | H     |
|-----------|-------|
| A         | 0.312 |
| B         | 0.450 |
| C         | 0.596 |
| D         | 0.755 |

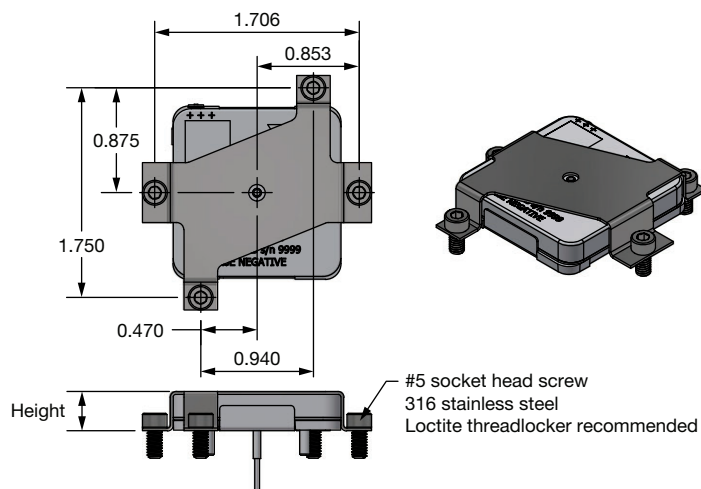
| TERMINATION CODE | TERMINATION / MOUNTING OPTION  |
|------------------|--------------------------------|
| E                | 100 % tin (RoHS compliant) SMD |
| F                | Tin / lead SMD                 |

**DIMENSIONS - SMD TERMINATION WITH STUDS** in inches


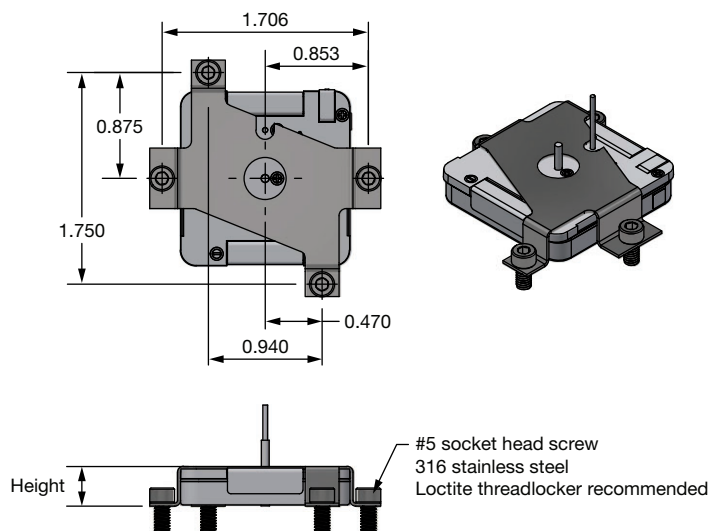
| CASE SIZE | H     |
|-----------|-------|
| A         | 0.312 |
| B         | 0.450 |
| C         | 0.596 |
| D         | 0.755 |

| TERMINATION CODE | TERMINATION / MOUNTING OPTION               |
|------------------|---------------------------------------------|
| G                | 100 % tin (RoHS compliant) SMD w/stud mount |
| H                | Tin / lead SMD w/stud mount                 |

| SL STUD LENGTH CODE | SL DIM |
|---------------------|--------|
| A                   | 0.21   |
| B                   | 0.27   |
| C                   | 0.40   |
| D                   | 0.15   |
| E                   | 0.18   |
| F                   | 0.35   |

**OPTIONAL HOLD-DOWN BRACKETS**
**STANDARD BRACKET**


| CASE SIZE | HEIGHT | BRACKET CODE | BRACKET WEIGHT WITHOUT FASTENER (g) |
|-----------|--------|--------------|-------------------------------------|
| A         | 0.328  | EP1BKT001    | 6.2                                 |
| B         | 0.468  | EP1BKT002    | 7.0                                 |
| C         | 0.618  | EP1BKT003    | 7.7                                 |

**DEAD-BUG BRACKET**


| CASE SIZE | HEIGHT | BRACKET CODE | BRACKET WEIGHT WITHOUT FASTENER (g) |
|-----------|--------|--------------|-------------------------------------|
| A         | 0.328  | EP1BKT004    | 6.0                                 |
| B         | 0.468  | EP1BKT005    | 6.7                                 |
| C         | 0.618  | EP1BKT006    | 7.3                                 |

**Note**

- For additional instructions, engineering drawings, and 3D models please see section "Links to Additional Resources". The bracket 3D PDF files contain within them all additional CAD documents and CAD models for mounting layout



| STANDARD RATINGS                                                                                      |                  |                           |                                              |                                     |                               |               |
|-------------------------------------------------------------------------------------------------------|------------------|---------------------------|----------------------------------------------|-------------------------------------|-------------------------------|---------------|
| CAPACITANCE<br>( $\mu$ F)                                                                             | CASE<br>CODE     | PART NUMBER               | MAX. ESR<br>AT +25 °C, 1 kHz<br>( $\Omega$ ) | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DCL<br>AT +85 °C<br>(mA) | WEIGHT<br>(g) |
| <b>25 V<sub>DC</sub> AT +85 °C; 15 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 27.5 V<sub>DC</sub></b> |                  |                           |                                              |                                     |                               |               |
| 30 000                                                                                                | A                | EP1A303(1)025(2)(3)(4)(5) | 0.030                                        | 150                                 | 1.5                           | 63            |
| <b>35 V<sub>DC</sub> AT +85 °C; 21 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 38.5 V<sub>DC</sub></b> |                  |                           |                                              |                                     |                               |               |
| 22 000                                                                                                | A                | EP1A223(1)035(2)(3)(4)(5) | 0.040                                        | 150                                 | 1.5                           | 63            |
| 36 000                                                                                                | B <sup>(1)</sup> | EP1B363(1)035(2)(3)(4)(5) | 0.020                                        | 250                                 | 2                             | 100           |
| 40 000                                                                                                | B <sup>(2)</sup> | EP1B403(1)035(2)(3)(4)(5) | 0.020                                        | 250                                 | 2                             | 100           |
| 47 800                                                                                                | C <sup>(1)</sup> | EP1C473(1)035(2)(3)(4)(5) | 0.015                                        | 350                                 | 3                             | 120           |
| 58 000                                                                                                | C <sup>(2)</sup> | EP1C583(1)035(2)(3)(4)(5) | 0.015                                        | 350                                 | 3                             | 120           |
| <b>50 V<sub>DC</sub> AT +85 °C; 30 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 55 V<sub>DC</sub></b>   |                  |                           |                                              |                                     |                               |               |
| 12 000                                                                                                | A                | EP1A123(1)050(2)(3)(4)(5) | 0.050                                        | 100                                 | 1.0                           | 63            |
| 13 000                                                                                                | A <sup>(2)</sup> | EP1A133(1)050(2)(3)(4)(5) | 0.050                                        | 100                                 | 1.0                           | 63            |
| 15 000                                                                                                | A <sup>(2)</sup> | EP1A153(1)050(2)(3)(4)(5) | 0.060                                        | 100                                 | 1.0                           | 67            |
| 17 500                                                                                                | B <sup>(1)</sup> | EP1B173(1)050(2)(3)(4)(5) | 0.025                                        | 100                                 | 1.5                           | 100           |
| 24 000                                                                                                | B <sup>(2)</sup> | EP1B243(1)050(2)(3)(4)(5) | 0.025                                        | 100                                 | 1.5                           | 100           |
| 26 000                                                                                                | B <sup>(2)</sup> | EP1B263(1)050(2)(3)(4)(5) | 0.030                                        | 100                                 | 1.5                           | 103           |
| 23 400                                                                                                | C <sup>(1)</sup> | EP1C233(1)050(2)(3)(4)(5) | 0.017                                        | 200                                 | 2.5                           | 120           |
| 34 000                                                                                                | C <sup>(2)</sup> | EP1C343(1)050(2)(3)(4)(5) | 0.017                                        | 200                                 | 2.5                           | 120           |
| 37 000                                                                                                | C <sup>(2)</sup> | EP1C373(1)050(2)(3)(4)(5) | 0.025                                        | 200                                 | 2.5                           | 123           |
| <b>63 V<sub>DC</sub> AT +85 °C; 38 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 69 V<sub>DC</sub></b>   |                  |                           |                                              |                                     |                               |               |
| 6000                                                                                                  | A                | EP1A602(1)063(2)(3)(4)(5) | 0.050                                        | 100                                 | 1.0                           | 63            |
| 6600                                                                                                  | A <sup>(1)</sup> | EP1A662(1)063(2)(3)(4)(5) | 0.060                                        | 100                                 | 1.0                           | 66            |
| 9400                                                                                                  | B                | EP1B942(1)063(2)(3)(4)(5) | 0.025                                        | 100                                 | 1.5                           | 86            |
| 11 000                                                                                                | B                | EP1B113(1)063(2)(3)(4)(5) | 0.025                                        | 150                                 | 1.5                           | 100           |
| 12 000                                                                                                | B <sup>(2)</sup> | EP1B123(1)063(2)(3)(4)(5) | 0.025                                        | 150                                 | 1.5                           | 100           |
| 13 000                                                                                                | B <sup>(2)</sup> | EP1B133(1)063(2)(3)(4)(5) | 0.030                                        | 100                                 | 1.5                           | 106           |
| 14 500                                                                                                | C                | EP1C143(1)063(2)(3)(4)(5) | 0.017                                        | 250                                 | 2.5                           | 120           |
| 18 000                                                                                                | C <sup>(2)</sup> | EP1C183(1)063(2)(3)(4)(5) | 0.017                                        | 250                                 | 2.5                           | 120           |
| 20 000                                                                                                | C <sup>(2)</sup> | EP1C203(1)063(2)(3)(4)(5) | 0.025                                        | 250                                 | 2.5                           | 124           |
| <b>80 V<sub>DC</sub> AT +85 °C; 48 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 88 V<sub>DC</sub></b>   |                  |                           |                                              |                                     |                               |               |
| 4000                                                                                                  | A                | EP1A402(1)080(2)(3)(4)(5) | 0.055                                        | 100                                 | 1.0                           | 63            |
| 4400                                                                                                  | A <sup>(1)</sup> | EP1A442(1)080(2)(3)(4)(5) | 0.060                                        | 100                                 | 1.0                           | 66            |
| 6800                                                                                                  | B <sup>(1)</sup> | EP1B682(1)080(2)(3)(4)(5) | 0.030                                        | 150                                 | 1.5                           | 100           |
| 8000                                                                                                  | B <sup>(2)</sup> | EP1B802(1)080(2)(3)(4)(5) | 0.030                                        | 150                                 | 1.5                           | 100           |
| 9000                                                                                                  | B <sup>(2)</sup> | EP1B902(1)080(2)(3)(4)(5) | 0.040                                        | 150                                 | 1.5                           | 106           |
| 9000                                                                                                  | C                | EP1C902(1)080(2)(3)(4)(5) | 0.025                                        | 250                                 | 2.5                           | 120           |
| 12 000                                                                                                | C <sup>(2)</sup> | EP1C123(1)080(2)(3)(4)(5) | 0.025                                        | 250                                 | 2.5                           | 120           |
| 14 000                                                                                                | C <sup>(2)</sup> | EP1C143(1)080(2)(3)(4)(5) | 0.030                                        | 250                                 | 2.5                           | 124           |

**Notes**

- Part number definitions:
  - Standard capacitance tolerance is 20 % or "M". Contact marketing for availability of 10 % or "K"
  - Standard termination is "B" radial tin / lead. RoHS compliant or radial 100 % tin is available as "A"
  - Standard reliability is "Z" or non-established reliability
  - Standard temperature range is "S" or -55 °C to +85 °C or +125 °C with voltage derating
  - Standard ESR is "S"
- Preliminary rating, specification subject to change. Contact marketing for availability
- Requires export license for shipments outside the US. Contact marketing for availability

**STANDARD RATINGS**

| CAPACITANCE<br>( $\mu$ F)                                                                               | CASE<br>CODE     | PART NUMBER               | MAX. ESR<br>AT +25 °C, 1 kHz<br>( $\Omega$ ) | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DCL<br>AT +85 °C<br>(mA) | WEIGHT<br>(g) |
|---------------------------------------------------------------------------------------------------------|------------------|---------------------------|----------------------------------------------|-------------------------------------|-------------------------------|---------------|
| <b>100 V<sub>DC</sub> AT +85 °C; 60 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 110 V<sub>DC</sub></b>   |                  |                           |                                              |                                     |                               |               |
| 3000                                                                                                    | A                | EP1A302(1)100(2)(3)(4)(5) | 0.065                                        | 100                                 | 1.0                           | 63            |
| 3300                                                                                                    | A <sup>(2)</sup> | EP1A332(1)100(2)(3)(4)(5) | 0.070                                        | 100                                 | 1.0                           | 66            |
| 4400                                                                                                    | B                | EP1B442(1)100(2)(3)(4)(5) | 0.035                                        | 150                                 | 1.5                           | 100           |
| 5800                                                                                                    | B <sup>(2)</sup> | EP1B582(1)100(2)(3)(4)(5) | 0.035                                        | 150                                 | 1.5                           | 100           |
| 6000                                                                                                    | B <sup>(2)</sup> | EP1B602(1)100(2)(3)(4)(5) | 0.040                                        | 150                                 | 1.5                           | 105           |
| 5800                                                                                                    | C <sup>(1)</sup> | EP1C582(1)100(2)(3)(4)(5) | 0.025                                        | 150                                 | 2.5                           | 120           |
| 7900                                                                                                    | C <sup>(2)</sup> | EP1C792(1)100(2)(3)(4)(5) | 0.025                                        | 250                                 | 2.5                           | 130           |
| 9000                                                                                                    | C <sup>(2)</sup> | EP1C902(1)100(2)(3)(4)(5) | 0.035                                        | 250                                 | 2.5                           | 123           |
| <b>125 V<sub>DC</sub> AT +85 °C; 75 V<sub>DC</sub> AT +125 °C, SURGE VOLTAGE = 137.5 V<sub>DC</sub></b> |                  |                           |                                              |                                     |                               |               |
| 1900                                                                                                    | A                | EP1A192(1)125(2)(3)(4)(5) | 0.100                                        | 100                                 | 1.0                           | 63            |
| 2000                                                                                                    | A <sup>(2)</sup> | EP1A202(1)125(2)(3)(4)(5) | 0.100                                        | 100                                 | 1.0                           | 63            |
| 2200                                                                                                    | A <sup>(2)</sup> | EP1A222(1)125(2)(3)(4)(5) | 0.110                                        | 100                                 | 1.0                           | 66            |
| 2800                                                                                                    | B <sup>(1)</sup> | EP1B282(1)125(2)(3)(4)(5) | 0.050                                        | 150                                 | 1.5                           | 100           |
| 3600                                                                                                    | B <sup>(2)</sup> | EP1B362(1)125(2)(3)(4)(5) | 0.050                                        | 150                                 | 1.5                           | 100           |
| 3800                                                                                                    | B <sup>(2)</sup> | EP1B382(1)125(2)(3)(4)(5) | 0.060                                        | 150                                 | 1.5                           | 105           |
| 3700                                                                                                    | C <sup>(1)</sup> | EP1C372(1)125(2)(3)(4)(5) | 0.035                                        | 250                                 | 2.5                           | 120           |
| 5300                                                                                                    | C <sup>(2)</sup> | EP1C532(1)125(2)(3)(4)(5) | 0.035                                        | 250                                 | 2.5                           | 130           |
| 5600                                                                                                    | C <sup>(2)</sup> | EP1C562(1)125(2)(3)(4)(5) | 0.040                                        | 250                                 | 2.5                           | 123           |

**Notes**

- Part number definitions:
  - Standard capacitance tolerance is 20 % or "M". Contact marketing for availability of 10 % or "K"
  - Standard termination is "B" radial tin / lead. RoHS compliant or radial 100 % tin is available as "A"
  - Standard reliability is "Z" or non-established reliability
  - Standard temperature range is "S" or -55 °C to +85 °C or +125 °C with voltage derating
  - Standard ESR is "S"
- Preliminary rating, specification subject to change. Contact marketing for availability
- Requires export license for shipments outside the US. Contact marketing for availability

**PERFORMANCE CHARACTERISTICS OF HIGH ENERGY CAPACITORS**

| <b>ELECTRICAL PERFORMANCE CHARACTERISTICS</b> |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ITEM                                          | PERFORMANCE CHARACTERISTICS                                                                                                                                                                                                                                                                                                                                                                                             |
| Operating temperature range                   | Per MIL-PRF-39006. -55 °C to +85 °C or +125 °C with voltage derating (see Standard Ratings table)                                                                                                                                                                                                                                                                                                                       |
| Storage temperature range                     | Per MIL-PRF-39006. -62 °C to +130 °C                                                                                                                                                                                                                                                                                                                                                                                    |
| Capacitor tolerance                           | $\pm 20 \% \pm 10 \%$ at 120 Hz                                                                                                                                                                                                                                                                                                                                                                                         |
| ESR                                           | Limits per Standard Ratings table                                                                                                                                                                                                                                                                                                                                                                                       |
| DC leakage current (DCL max.)                 | At 25 °C the leakage current shall not exceed values listed in the Standard Rating table.                                                                                                                                                                                                                                                                                                                               |
| Reverse voltage                               | There shall be no continuous reverse voltage. Transient reverse voltage surges are acceptable under the following conditions: <ol style="list-style-type: none"> <li>The peak reverse voltage is equal to or less than 1.0 V and the product of the peak current times the duration of the reverse transient is 0.05 A or less</li> <li>The repetition rate of the reverse voltage surges is less than 10 Hz</li> </ol> |
| Surge voltage                                 | The test shall be at 1000 cycles at 110 % of rated voltage at 85 °C. A cycle consists of a 30 s charge and a 330 s discharge through 1000 $\Omega$ resistor.                                                                                                                                                                                                                                                            |
| Life test                                     | 2000 h at +85 °C                                                                                                                                                                                                                                                                                                                                                                                                        |

**ENVIRONMENTAL CHARACTERISTICS**

| ITEM                | TEST AND CONDITIONS                         | COMMENTS                                                                                                                          |
|---------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Hermeticity         | MIL-STD-202, method 112 C/IIIa              | The capacitor shall be hermetically sealed such that the case does not leak electrolyte or vent any gas when exposed to a vacuum. |
| Moisture resistance | MIL-STD-202, method 106                     | 6 V polarity                                                                                                                      |
| Altitude            | MIL-STD-202, method 105 C, test condition D | 100 000 feet test                                                                                                                 |
| Fungus              | MIL-PRF-39006                               | The capacitor materials shall not support fungus growth and shall not be a nutrient to fungus.                                    |

**MECHANICAL PERFORMANCE CHARACTERISTICS**

| ITEM                       | TEST AND CONDITIONS                                   | COMMENTS                                                                                                                                                                                                                                                        |
|----------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thermal shock              | MIL-STD-202, method 107 G                             | Test condition A                                                                                                                                                                                                                                                |
| Shock                      | MIL-STD-202, method 213 B test condition G            | 11 ms, 50 g                                                                                                                                                                                                                                                     |
| Vibration - high frequency | MIL-STD-202, method 204 D test condition D            | 12 sweeps/axis, 20 g peak                                                                                                                                                                                                                                       |
| Vibration - random         | MIL-STD-202, method 214 A test condition II, letter E | 1.5 h/axis, 19.64 g                                                                                                                                                                                                                                             |
| Resistance to solder heat  | MIL-STD-202, method 210 F, test conditions A and B    |                                                                                                                                                                                                                                                                 |
| Solderability              | MIL-STD-202, method 208                               |                                                                                                                                                                                                                                                                 |
| Terminal strength          | MIL-STD-202, method 211 A                             | The capacitor terminals must withstand a 5 pound pull test for 5 s to 10 s. The capacitor must not be visibly damaged and the electrical characteristics must not be affected.                                                                                  |
| Part markings              | MIL-STD-202, method 215 J                             | The capacitor shall be permanently and legibly marked on the circumference of the case. The markings shall be resistant to solvents.                                                                                                                            |
| Weight (mass)              |                                                       | See Standard Ratings table                                                                                                                                                                                                                                      |
| Seal                       | MIL-PRF-39006                                         |                                                                                                                                                                                                                                                                 |
| MSL                        | J-STD-033                                             | Not applicable                                                                                                                                                                                                                                                  |
| Packaging                  | MIL-PRF-39006                                         | All units are shipped in individual bulk packages.                                                                                                                                                                                                              |
| Stud mounting              |                                                       | Tighten nuts only ½ to ¾ turn beyond point of initial contact, equivalent to 24 to 28 maximum inch-ounces torque. Maximum pre-load tension ~ 15 pounds.<br>Lock washers are not recommended; use an adhesive lock nut conforming to MIL-S-22473E, grade A - red |

**Note**

- For surface-mount solder attachment refer to application note 42110: [www.vishay.com/doc?42110](http://www.vishay.com/doc?42110)



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