Wet Tantalum Hybrid 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
- EP1A and EP2: 2 termination options: SMD and radial
- PATENT(S): www.vishay.com/patents
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available
RoHS* Available

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

3D Models

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.

EP2 ORDERING INFORMATION

EP2	C	723	K	025	B	Z	S	
TYPE	CASE CODE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT +85 °C	TERMINATION CODE	POSITIVE TERMINATION LENGTH	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 % (1) 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"	See termination / mounting options in the Dimensions sheets	Z = standard O = SMD See Dimensions sheets	S = standard	Blank = not applicable See Dimensions sheets

Note

(1) Contact marketing for availability of 10 % tolerance

PATENT(S): www.vishay.com/patents
This Vishay product is protected by one or more United States and international patents.

EP1 ORDERING INFORMATION

EP1	A	303	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 % [(1)] 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 See Dimensions sheets

Notes

- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**

(1) Contact marketing for availability of 10 % tolerance

EP2 AND EP1 RATINGS AND CASE CODES (ESR mΩ)

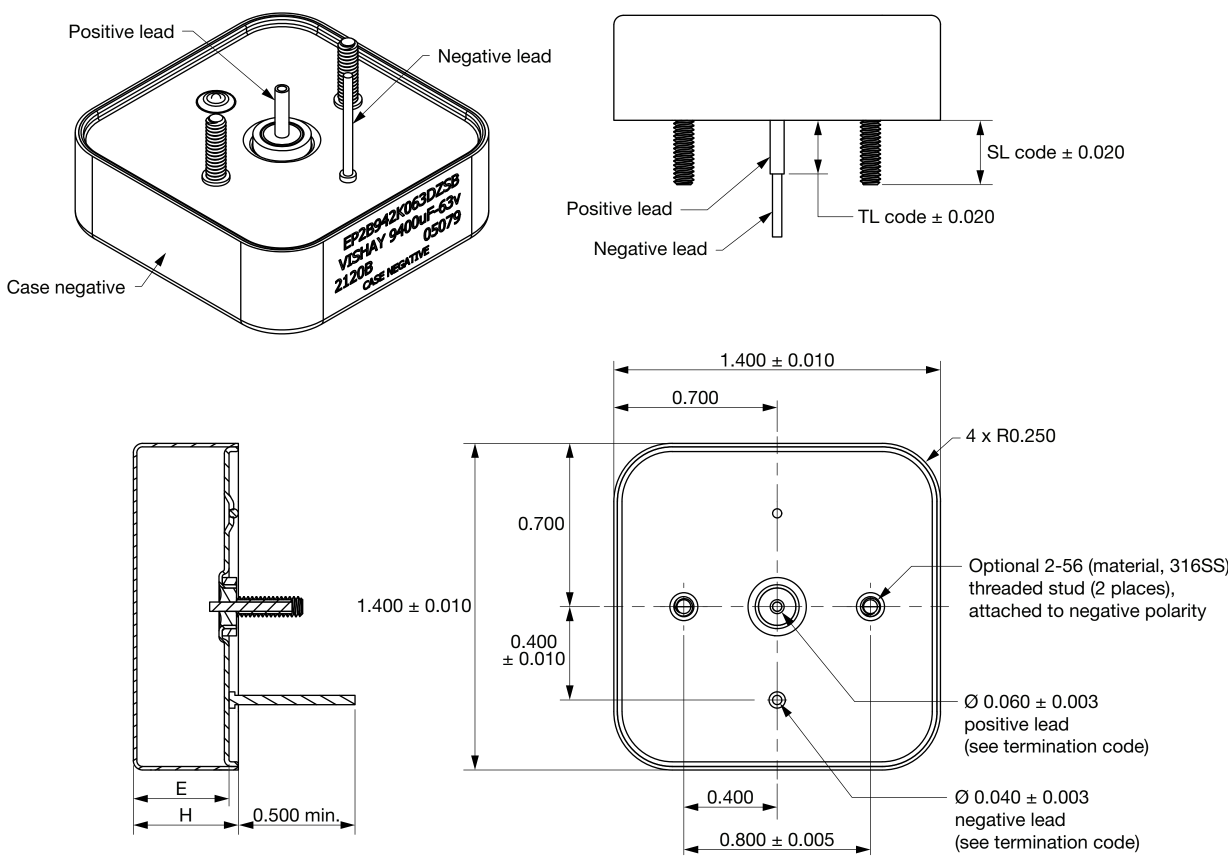
µF	25 V	35 V	50 V	60 V	63 V	80 V	100 V	110 V	125 V
1500									EP2A (100)
1900									EP1A (100) / EP2A (100)
2000									EP1A (100) / EP2A (100)
2200								EP2A (85)	EP1A (110)
2700									EP2B (45)
3000							EP1A (65) / EP2A (65)		EP2B (45)
3300							EP1A (70)		
3600									EP2B (50)
3800									EP2B (50)
4000						EP1A (55) / EP2A (55)		EP2B (40)	
4400						EP1A (60)	EP2B (30)		
4500									EP2C (25)
5300									EP2C (35)
5600									EP2C (35)
5800							EP2B (35)		
6000					EP1A (50) / EP2A (50)	EP2B (27)		EP2C (27)	
6300				EP2A (50)					
6600					EP1A (60)		EP2C (20)		
7000						EP2B (30)			EP2D (20)
7900							EP2C (25)		
8000						EP2B (30)		EP2D (20)	

EP2 AND EP1 RATINGS AND CASE CODES (ESR mΩ)									
µF	25 V	35 V	50 V	60 V	63 V	80 V	100 V	110 V	125 V
9000						EP2B (30) / EP2C (18)	EP2C (25)		
9400					EP2B (25)				
10 500							EP2D (20)		
11 000					EP2B (25)				
12 000			EP1A (50)		EP2B (25)	EP2C (20)			
12 600				EP2B (25)					
13 000			EP1A (50) / EP2A (50)		EP2B (25)				
14 000					EP2C (17)	EP2C (20)			
15 000			EP1A (60)						
16 000						EP2D (15)			
17 000			EP2B (25)						
18 000					EP2C (20)				
19 000				EP2C (17)					
22 000		EP1A (40) / EP2A (40)	EP2B (25)						
23 000			EP2C (17)						
24 000			EP2B (27)		EP2D (12)				
25 000				EP2D (15)					
30 000	EP1A (30) / EP2A (30)								
32 000		EP2B (20)							
33 000			EP2C (17)						
34 000			EP2C (18)						
37 000			EP2C (20)						
40 000		EP2B (22)							
44 000			EP2D (15)						
47 000		EP2C (15)							
48 000	EP2B (20)	EP2C (15)	EP2D (15)						
58 000		EP2C (17)							
70 000		EP2D (12)							
72 000	EP2C (15)								
96 000	EP2D (12)								

Note

- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**

EP2 DIMENSIONS in inches [millimeters]
RADIAL TERMINATION WITH AND WITHOUT STUDS



CASE SIZE	H	E (ref.)
A	0.312 ± 0.015 [7.92 ± 0.38]	0.272 [6.91]
B	0.450 ± 0.015 [11.43 ± 0.38]	0.410 [10.41]
C	0.600 ± 0.015 [15.24 ± 0.38]	0.560 [14.22]
D	0.755 ± 0.015 [19.18 ± 0.38]	0.715 [18.16]

TERMINATION CODE	TERMINATION / MOUNTING OPTION	STUDS
A	100 % tin (RoHS-compliant)	None
B	Tin / lead	None
C	100 % tin (RoHS-compliant)	Yes
D	Tin / lead	Yes

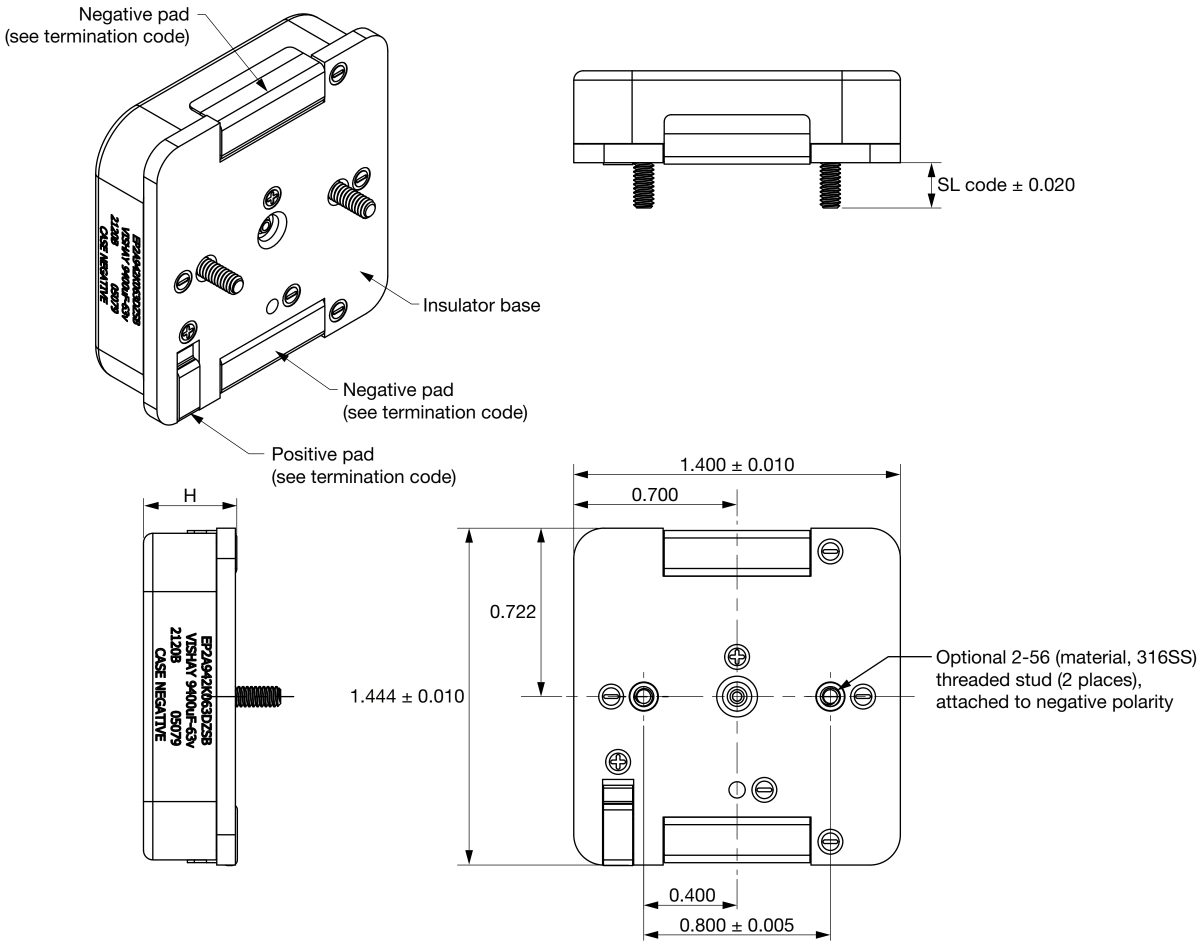
POSITIVE TERMINAL LENGTH CODE [TL]	LENGTH
N	0.100 [2.54]
P	0.125 [3.18]
R	0.156 [3.96]
T	0.188 [4.78]
U	0.219 [5.56]
Z - STANDARD	**0.230 [5.84]**
V	0.250 [6.35]
W	0.281 [7.14]
Y	0.313 [7.95]

MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

Note

- Spacers to fill the gap between PCB and termination plane of the capacitor, plus stainless steel hex nuts, 2-56 thread size, will be provided with studded terminal styles C and D. Nuts are Mil. Spec. 18-8 stainless steel hex nuts. Spacer material is G10

EP2 DIMENSIONS in inches [millimeters]
BASE - SMD TERMINATION WITH AND WITHOUT STUDS



CASE SIZE	H
A	0.402 ± 0.015 [10.21 ± 0.38]
B	0.540 ± 0.015 [13.72 ± 0.38]
C	0.690 ± 0.015 [17.53 ± 0.38]
D	0.845 ± 0.015 [21.46 ± 0.38]

TERMINATION CODE	TERMINATION / MOUNTING OPTION BASE - SMD	STUDS
E	100 % tin (RoHS-compliant)	None
F	Tin / lead	None
G	100 % tin (RoHS-compliant)	Yes
H	Tin / lead	Yes

POSITIVE TERMINAL LENGTH CODE [TL]	LENGTH
O	No termination

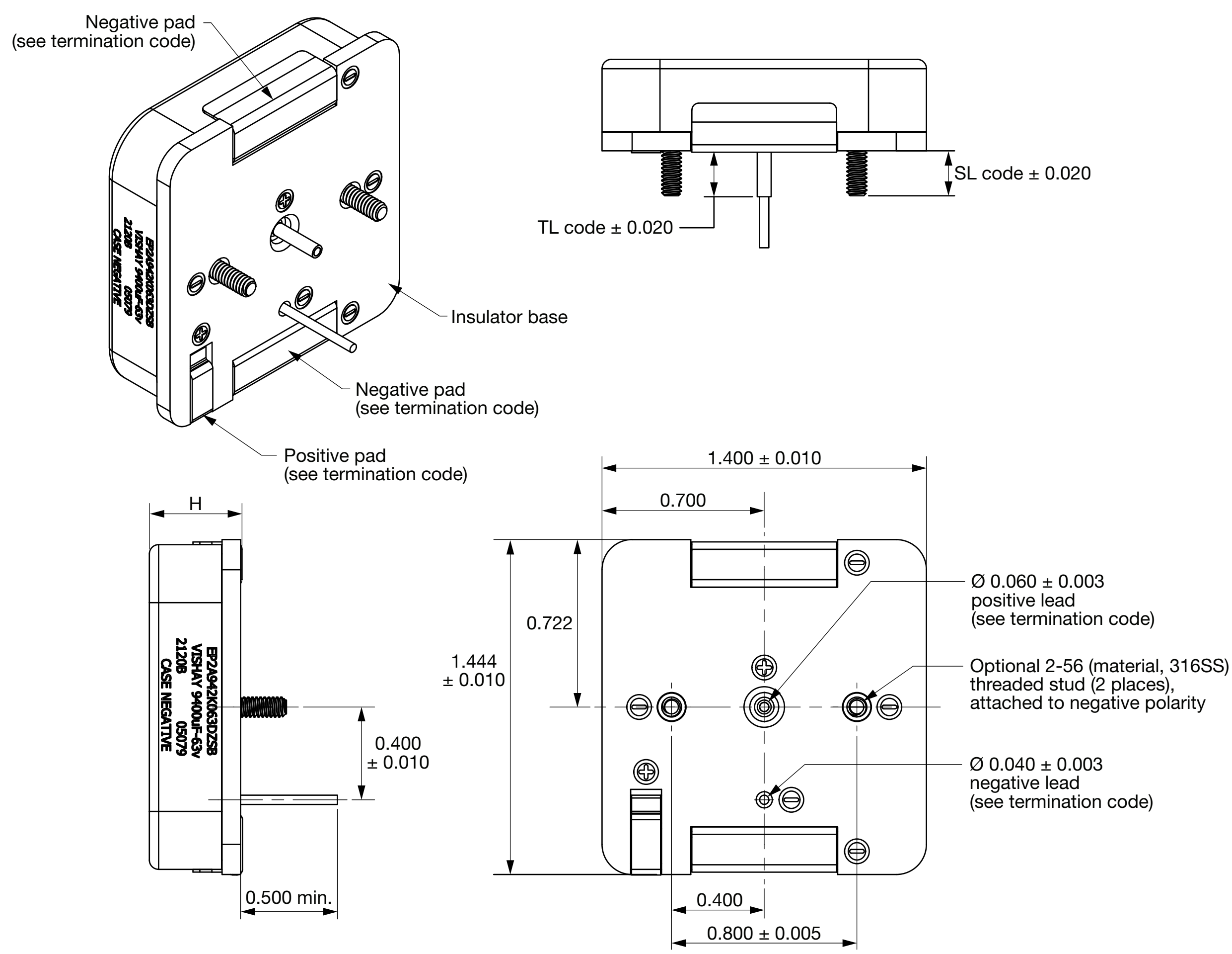
MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

Notes

- EP2 base pad layout is in full compliance to EP1 base. Base weight is ~ 8 g
- Stainless steel hex nuts, 2-56 thread size, are provided with studs

EP2 DIMENSIONS in inches [millimeters]

BASE - RADIAL TERMINATION WITH AND WITHOUT STUDS



CASE SIZE	H
A	0.402 ± 0.015 [10.21 ± 0.38]
B	0.540 ± 0.015 [13.72 ± 0.38]
C	0.690 ± 0.015 [17.53 ± 0.38]
D	0.845 ± 0.015 [21.46 ± 0.38]

TERMINATION CODE	TERMINATION / MOUNTING OPTION BASE - RADIAL	STUDS
J	100 % tin (RoHS-compliant)	None
K	Tin / lead	None
L	100 % tin (RoHS-compliant)	Yes
M	Tin / lead	Yes

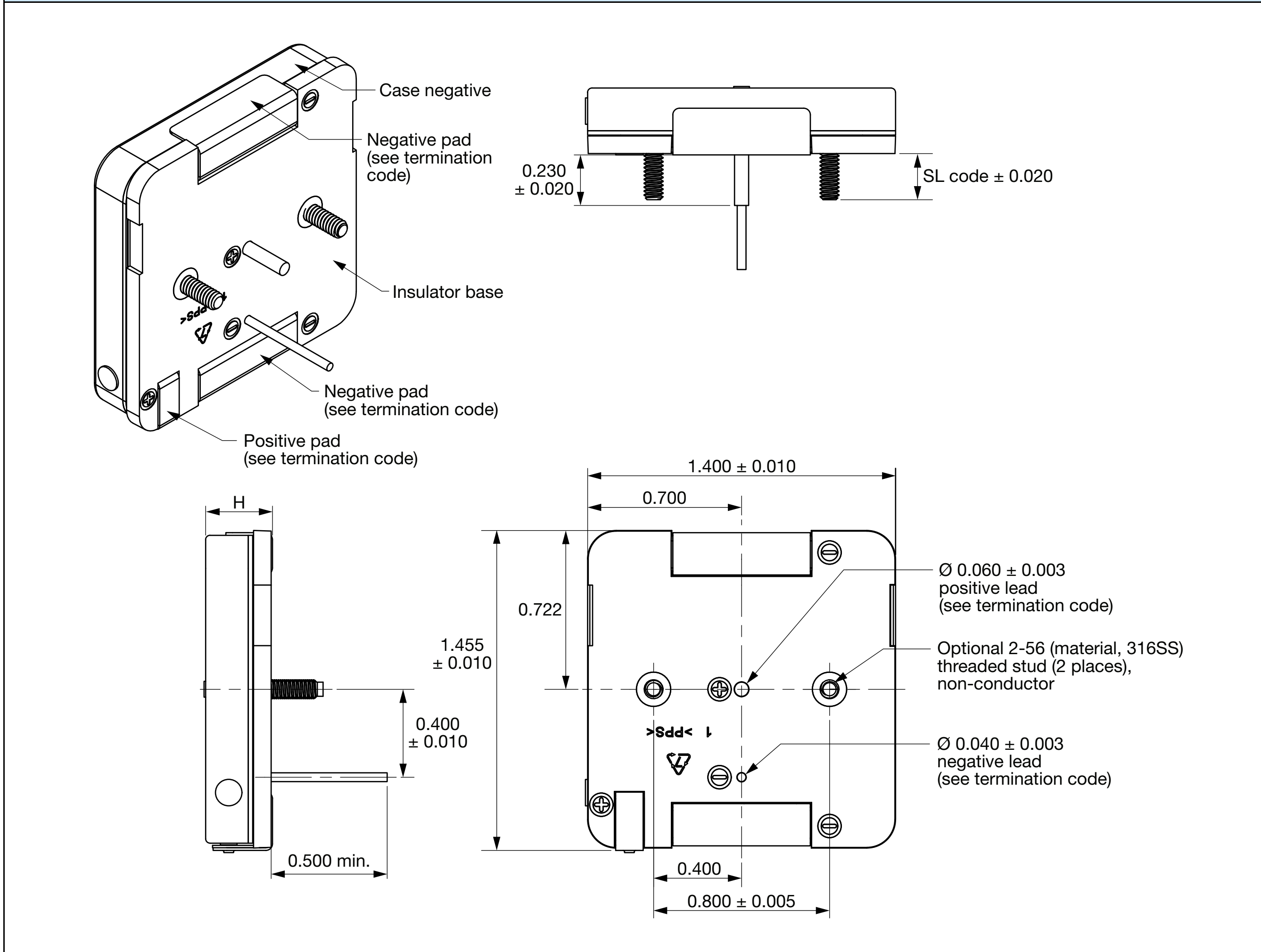
POSITIVE TERMINAL LENGTH CODE [TL]	LENGTH
N	0.100 [2.54]
P	0.125 [3.18]
R	0.156 [3.96]
T	0.188 [4.78]
U	0.219 [5.56]
Z - STANDARD	**0.230 [5.84]**
V	0.250 [6.35]
W	0.281 [7.14]
Y	0.313 [7.95]

MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

Notes

- EP2 base pad layout is in full compliance to EP1 base. Base weight is ~ 8 g
- Stainless steel hex nuts, 2-56 thread size, are provided with studs

EP1 DIMENSIONS in inches [millimeters]
RADIAL TERMINATION WITH AND WITHOUT STUDS



CASE SIZE	H
A	0.312 ± 0.015 [7.92 ± 0.38]

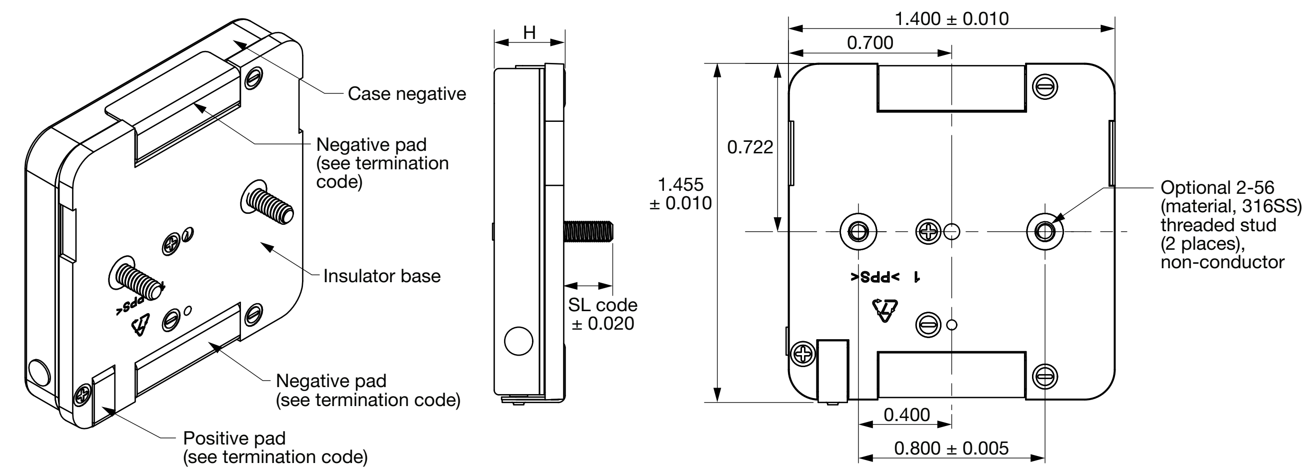
MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

TERMINATION CODE	TERMINATION / MOUNTING OPTION	STUDS
A	100 % tin (RoHS-compliant)	None
B	Tin / lead	None
C	100 % tin (RoHS-compliant)	Yes
D	Tin / lead	Yes

Notes

- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**
- Stainless steel hex nuts, 2-56 thread size, are to be used with studs

EP1 DIMENSIONS in inches [millimeters]
SMD TERMINATION WITH AND WITHOUT STUDS



CASE SIZE	H
A	0.312 ± 0.015 [7.92 ± 0.38]

MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

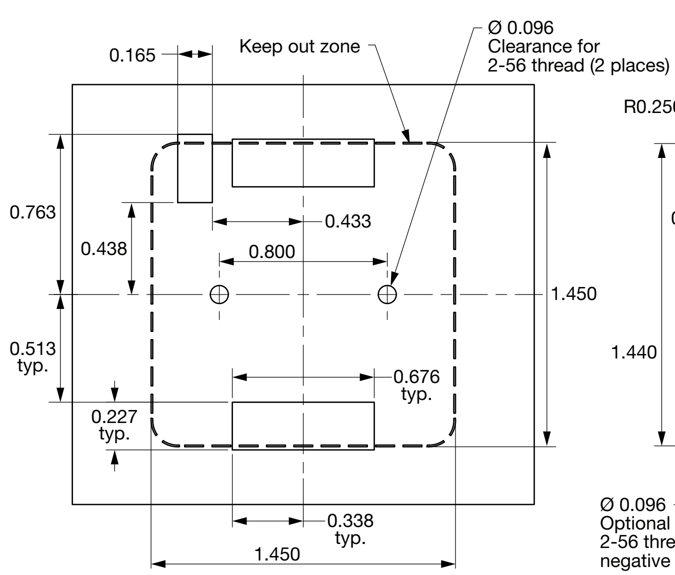
TERMINATION CODE	TERMINATION / MOUNTING OPTION	STUDS
E	100 % tin (RoHS-compliant)	None
F	Tin / lead	None
G	100 % tin (RoHS-compliant)	Yes
H	Tin / lead	Yes

Note

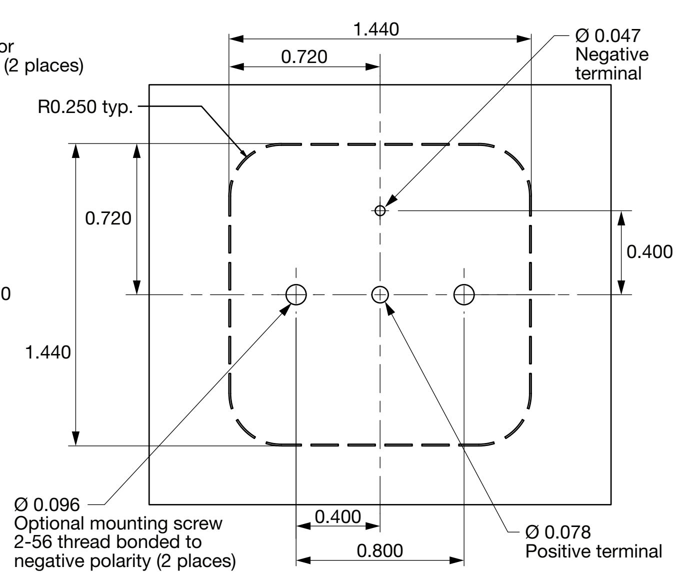
- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**

EP SERIES PAD LAYOUT WITH MINIMUM PTH DIAMETERS FOR SMD AND RADIAL TERMINATIONS

SMD

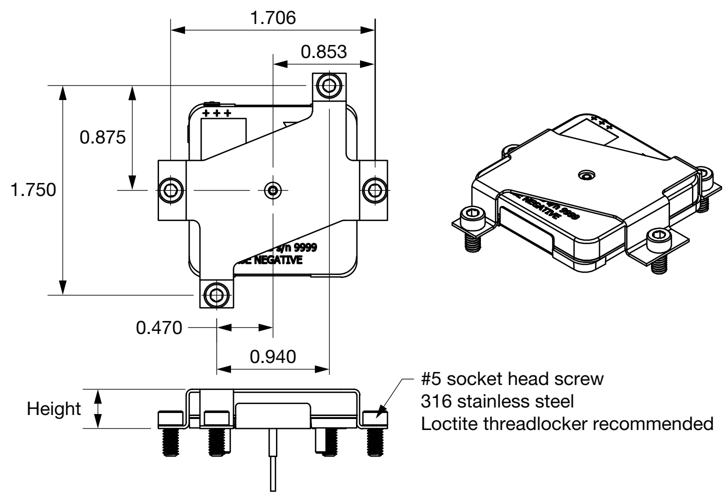


RADIAL



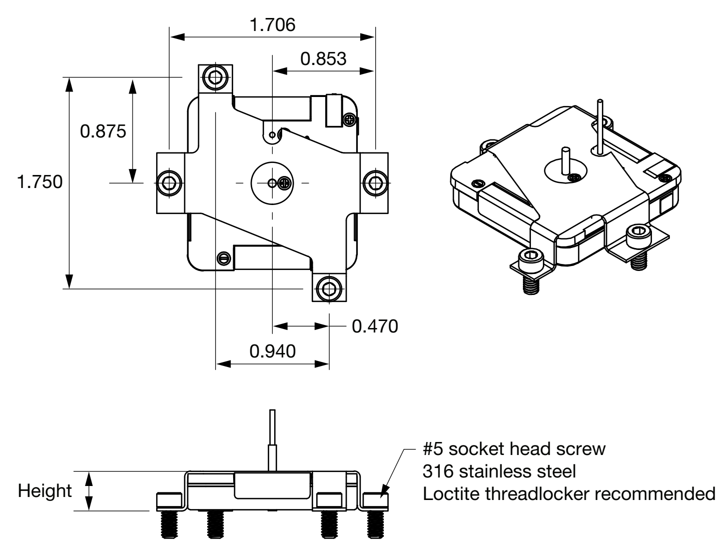
OPTIONAL HOLD-DOWN BRACKETS FOR EP1 PRODUCTS

STANDARD BRACKET in inches [millimeters]



CASE SIZE	HEIGHT	BRACKET CODE	BRACKET WEIGHT WITHOUT FASTENER
A	0.328 [8.33]	EP1BKT001	6.2 g

DEAD-BUG BRACKET in inches [millimeters]

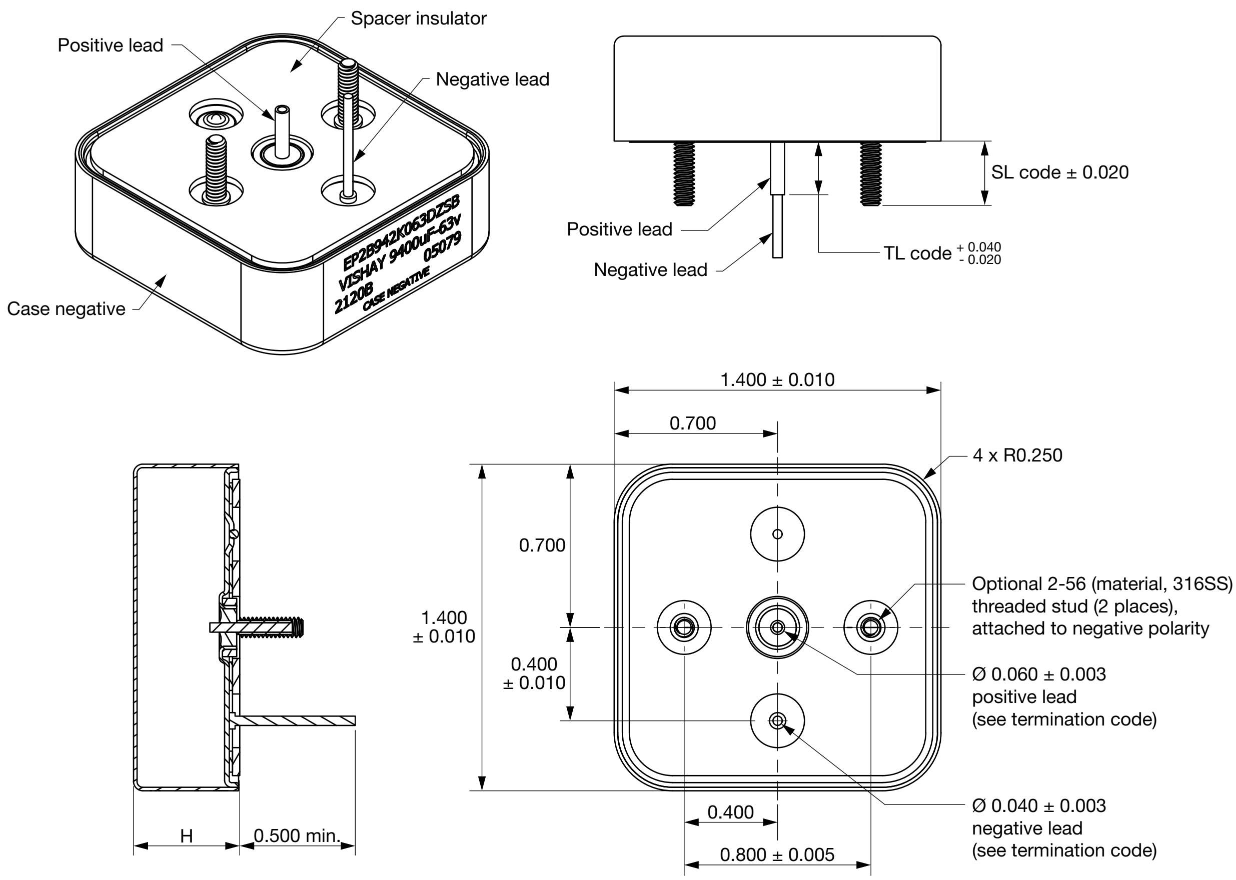


CASE SIZE	HEIGHT	BRACKET CODE	BRACKET WEIGHT WITHOUT FASTENER
A	0.328 [8.33]	EP1BKT004	6.0 g

Notes

- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**
- 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 (OPTIONAL) SPACER WITH STUDS FOR EP2 in inches [millimeters]



CASE SIZE	H (WITH SPACER)
A	0.317 ± 0.015 [8.05 ± 0.38]
B	0.455 ± 0.015 [11.56 ± 0.38]
C	0.605 ± 0.015 [15.37 ± 0.38]
D	0.760 ± 0.015 [19.30 ± 0.38]

POSITIVE TERMINAL LENGTH CODE [TL]	LENGTH
N	0.100 [2.54]
P	0.125 [3.18]
R	0.156 [3.96]
T	0.188 [4.78]
U	0.219 [5.56]
Z - STANDARD	**0.230 [5.84]**
V	0.250 [6.35]
W	0.281 [7.14]
Y	0.313 [7.95]

MOUNTING STUDS LENGTH CODE [SL]	LENGTH
None	Blank
A	0.21 [5.33]
B	0.27 [6.86]
C	0.40 [10.16]
D	0.15 [3.81]
E	0.18 [4.57]
F	0.35 [8.89]

Notes

- Spacers to fill the gap between PCB and termination plane of the capacitor, plus stainless-steel hex nuts, 2-56 thread size, will be provided with studded terminal styles C and D. Nuts are Mil. Spec. 18-8 stainless steel hex nuts. Spacer material is G10
- 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 the spacer

EP2 STANDARD RATINGS

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX. ESR AT +25 °C, 1 kHz (Ω)	MAX. DCL AT +25 °C (µA)	MAX. DCL AT +85 °C (mA)	WEIGHT (g)
25 V_{DC} AT +85 °C; 15 V_{DC} AT +125 °C, SURGE VOLTAGE = 27.5 V_{DC}						
30 000	A (1)	EP2A303(1)025(2)(3)(4)(5)	0.030	150	1.5	55
48 000	B (1)	EP2B483(1)025(2)(3)(4)(5)	0.020	250	2.0	80
72 000	C (1)	EP2C723(1)025(2)(3)(4)(5)	0.015	350	2.5	108
96 000	D (1)	EP2D963(1)025(2)(3)(4)(5)	0.012	450	3.0	134
35 V_{DC} AT +85 °C; 21 V_{DC} AT +125 °C, SURGE VOLTAGE = 38.5 V_{DC}						
22 000	A (1)	EP2A223(1)035(2)(3)(4)(5)	0.040	150	1.5	55
32 000	B (1)	EP2B323(1)035(2)(3)(4)(5)	0.020	250	2.0	80
36 000	B (1)	EP2B363(1)035(2)(3)(4)(5)	0.022	250	2.0	80
40 000	B (1)	EP2B403(1)035(2)(3)(4)(5)	0.022	250	2.0	86
47 000	C (1)	EP2C473(1)035(2)(3)(4)(5)	0.015	350	2.5	110
48 000	C (1)	EP2C483(1)035(2)(3)(4)(5)	0.015	350	2.5	108
58 000	C	EP2C583(1)035(2)(3)(4)(5)	0.017	350	3.0	125
70 000	D (1)	EP2D703(1)035(2)(3)(4)(5)	0.012	450	3.5	134
50 V_{DC} AT +85 °C; 30 V_{DC} AT +125 °C, SURGE VOLTAGE = 55 V_{DC}						
12 000	A (1)	EP2A123(1)050(2)(3)(4)(5)	0.050	100	1.0	55
13 000	A (1)	EP2A133(1)050(2)(3)(4)(5)	0.050	100	1.0	55
17 000	B	EP2B173(1)050(2)(3)(4)(5)	0.025	200	1.5	80
22 000	B (1)	EP2B223(1)050(2)(3)(4)(5)	0.025	250	1.5	80
24 000	B (1)	EP2B243(1)050(2)(3)(4)(5)	0.027	250	1.5	86
23 000	C	EP2C233(1)050(2)(3)(4)(5)	0.017	200	2.5	109
33 000	C (1)	EP2C333(1)050(2)(3)(4)(5)	0.017	350	2.0	108
34 000	C	EP2C343(1)050(2)(3)(4)(5)	0.018	350	2.5	122
37 000	C	EP2C373(1)050(2)(3)(4)(5)	0.020	350	2.5	122
44 000	D (1)	EP2C443(1)050(2)(3)(4)(5)	0.015	450	2.5	160
48 000	D (1)	EP2D483(1)050(2)(3)(4)(5)	0.015	450	3.5	140
60 V_{DC} AT +85 °C; 38 V_{DC} AT +125 °C, SURGE VOLTAGE = 66 V_{DC}						
6300	A (1)	EP2A632(1)060(2)(3)(4)(5)	0.050	100	1.0	60
12 600	B	EP2B133(1)060(2)(3)(4)(5)	0.025	150	1.5	89
19 000	C	EP2C193(1)060(2)(3)(4)(5)	0.017	250	2.5	115
25 000	D (1)	EP2D253(1)060(2)(3)(4)(5)	0.015	450	3.0	145
63 V_{DC} AT +85 °C; 38 V_{DC} AT +125 °C, SURGE VOLTAGE = 69 V_{DC}						
6000	A (1)	EP2A602(1)063(2)(3)(4)(5)	0.050	100	1.0	60
9400	B	EP2B942(1)063(2)(3)(4)(5)	0.025	150	1.5	86
11 000	B (1)	EP2B113(1)063(2)(3)(4)(5)	0.025	150	1.5	90
12 000	B (1)	EP2B123(1)063(2)(3)(4)(5)	0.025	150	1.5	90
13 000	B (1)	EP2B133(1)063(2)(3)(4)(5)	0.025	150	1.5	92
14 000	C	EP2C143(1)063(2)(3)(4)(5)	0.017	200	2.0	115
18 000	C	EP2C183(1)063(2)(3)(4)(5)	0.020	250	2.5	120
24 000	D (1)	EP2D243(1)063(2)(3)(4)(5)	0.018	450	3.0	160

Notes

- Part number definitions:
  (1) Standard capacitance tolerance is 20 % or "M". Contact marketing for availability of 10 % or "K"
  (2) Standard termination is radial tin / lead, available as "B", "D", "F", "H", "K", or "M".
  RoHS-compliant or radial 100 % tin is available as "A", "C", "E", "G", "J", or "L"
  (3) Standard positive lead dimension "Z" is 0.23"
  (4) Standard ESR is "S"
  (5) Optional stud length; no stud = blank

(1) Preliminary rating, specification subject to change. Contact marketing for availability

EP2 STANDARD RATINGS

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX. ESR AT +25 °C, 1 kHz (Ω)	MAX. DCL AT +25 °C (µA)	MAX. DCL AT +85 °C (mA)	WEIGHT (g)
		80 V_{DC} AT +85 °C; 48 V_{DC} AT +125 °C, SURGE VOLTAGE = 88 V_{DC}				
4000	A (1)	EP2A402(1)080(2)(3)(4)(5)	0.055	100	1.0	60
6000	B	EP2B602(1)080(2)(3)(4)(5)	0.027	150	1.5	86
7000	B (1)	EP2B702(1)080(2)(3)(4)(5)	0.030	150	1.5	90
8000	B (1)	EP2B802(1)080(2)(3)(4)(5)	0.030	150	1.5	90
9000	B (1)	EP2B902(1)080(2)(3)(4)(5)	0.030	200	2.0	92
9000	C	EP2C902(1)080(2)(3)(4)(5)	0.018	200	2.0	115
12 000	C (1)	EP2C123(1)080(2)(3)(4)(5)	0.020	250	2.5	120
14 000	C (1)	EP2C143(1)080(2)(3)(4)(5)	0.020	250	2.5	125
16 000	D (1)	EP2D163(1)080(2)(3)(4)(5)	0.015	450	3.0	145
		100 V_{DC} AT +85 °C; 60 V_{DC} AT +125 °C, SURGE VOLTAGE = 110 V_{DC}				
3000	A (1)	EP2A302(1)100(2)(3)(4)(5)	0.065	125	1.3	65
4200	B (1)	EP2B422(1)100(2)(3)(4)(5)	0.030	100	1.5	86
4400	B (1)	EP2B442(1)100(2)(3)(4)(5)	0.030	150	1.5	86
5800	B (1)	EP2B582(1)100(2)(3)(4)(5)	0.035	150	1.5	90
5600	C (1)	EP2C562(1)100(2)(3)(4)(5)	0.020	150	2.5	115
6600	C (1)	EP2C662(1)100(2)(3)(4)(5)	0.020	200	2.0	115
7900	C (1)	EP2C792(1)100(2)(3)(4)(5)	0.025	250	2.5	120
9000	C (1)	EP2C902(1)100(2)(3)(4)(5)	0.025	250	2.5	125
10 500	D (1)	EP2D103(1)100(2)(3)(4)(5)	0.020	450	3.0	145
		110 V_{DC} AT +85 °C; 66 V_{DC} AT +125 °C, SURGE VOLTAGE = 121 V_{DC}				
2200	A (1)	EP2A222(1)110(2)(3)(4)(5)	0.085	100	1.0	60
4000	B	EP2B402(1)110(2)(3)(4)(5)	0.040	150	1.5	95
6000	C	EP2C602(1)110(2)(3)(4)(5)	0.027	200	2.0	128
8000	D (1)	EP2D802(1)110(2)(3)(4)(5)	0.020	450	3.0	150
		125 V_{DC} AT +85 °C; 75 V_{DC} AT +125 °C, SURGE VOLTAGE = 137.5 V_{DC}				
1500	A (1)	EP2A152(1)125(2)(3)(4)(5)	0.100	100	1.0	60
1900	A (1)	EP2A192(1)125(2)(3)(4)(5)	0.100	100	1.0	60
2000	A (1)	EP2A202(1)125(2)(3)(4)(5)	0.100	100	1.0	60
2700	B	EP2B272(1)125(2)(3)(4)(5)	0.045	150	1.5	90
3000	B	EP2B302(1)125(2)(3)(4)(5)	0.045	150	1.5	90
3600	B (1)	EP2B362(1)125(2)(3)(4)(5)	0.050	150	1.5	95
3800	B (1)	EP2B382(1)125(2)(3)(4)(5)	0.050	150	1.5	95
3600	C (1)	EP2C362(1)125(2)(3)(4)(5)	0.025	250	2.5	105
4500	C (1)	EP2C452(1)125(2)(3)(4)(5)	0.025	250	2.5	120
5300	C (1)	EP2C532(1)125(2)(3)(4)(5)	0.035	250	2.5	135
5600	C (1)	EP2C562(1)125(2)(3)(4)(5)	0.035	250	2.5	135
7000	D (1)	EP2D702(1)125(2)(3)(4)(5)	0.025	450	3.0	150

Notes
- Part number definitions:
  (1) Standard capacitance tolerance is 20 % or “M“. Contact marketing for availability of 10 % or “K“
  (2) Standard termination is radial tin / lead, available as “B”, “D”, “F”, “H”, “K”, or “M”.
  RoHS-compliant or radial 100 % tin is available as “A”, “C”, “E”, “G”, “J”, or “L”
  (3) Standard positive lead dimension “Z” is 0.23"
  (4) Standard ESR is “S”
  (5) Optional stud length; no stud = blank

(1) Preliminary rating, specification subject to change. Contact marketing for availability

EP1 STANDARD RATINGS						
CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX. ESR AT +25 °C, 1 kHz (Ω)	MAX. DCL AT +25 °C (µA)	MAX. DCL AT +85 °C (mA)	WEIGHT (g)
25 V_{DC} AT +85 °C; 15 V_{DC} AT +125 °C, SURGE VOLTAGE = 27.5 V_{DC}						
30 000	A	EP1A303(1)025(2)(3)(4)(5)	0.030	150	1.5	63
35 V_{DC} AT +85 °C; 21 V_{DC} AT +125 °C, SURGE VOLTAGE = 38.5 V_{DC}						
22 000	A	EP1A223(1)035(2)(3)(4)(5)	0.040	150	1.5	63
50 V_{DC} AT +85 °C; 30 V_{DC} AT +125 °C, SURGE VOLTAGE = 55 V_{DC}						
12 000	A	EP1A123(1)050(2)(3)(4)(5)	0.050	100	1.0	63
13 000	A	EP1A133(1)050(2)(3)(4)(5)	0.050	100	1.0	63
15 000	A	EP1A153(1)050(2)(3)(4)(5)	0.060	100	1.0	67
63 V_{DC} AT +85 °C; 38 V_{DC} AT +125 °C, SURGE VOLTAGE = 69 V_{DC}						
6000	A	EP1A602(1)063(2)(3)(4)(5)	0.050	100	1.0	63
6600	A [1]	EP1A662(1)063(2)(3)(4)(5)	0.060	100	1.0	66
80 V_{DC} AT +85 °C; 48 V_{DC} AT +125 °C, SURGE VOLTAGE = 88 V_{DC}						
4000	A	EP1A402(1)080(2)(3)(4)(5)	0.055	100	1.0	63
4400	A [1]	EP1A442(1)080(2)(3)(4)(5)	0.060	100	1.0	66
100 V_{DC} AT +85 °C; 60 V_{DC} AT +125 °C, SURGE VOLTAGE = 110 V_{DC}						
3000	A	EP1A302(1)100(2)(3)(4)(5)	0.065	100	1.0	63
3300	A	EP1A332(1)100(2)(3)(4)(5)	0.070	100	1.0	66
125 V_{DC} AT +85 °C; 75 V_{DC} AT +125 °C, SURGE VOLTAGE = 137.5 V_{DC}						
1900	A	EP1A192(1)125(2)(3)(4)(5)	0.100	100	1.0	63
2000	A	EP1A202(1)125(2)(3)(4)(5)	0.100	100	1.0	63
2200	A	EP1A222(1)125(2)(3)(4)(5)	0.110	100	1.0	66

Notes

- **EP1 RATINGS ARE NOT FOR NEW DESIGNS**
- Part number definitions:
  (1) Standard capacitance tolerance is 20 % or “M“. Contact marketing for availability of 10 % or “K“
  (2) Standard termination is radial tin / lead, available as “B”, “D”, “F”, or “H”.
  RoHS-compliant or radial 100 % tin is available as “A”, “C”, “E”, or “G”
  (3) Standard reliability is “Z” or non-established reliability
  (4) Standard temperature range is “S” or -55 °C to +85 °C or +125 °C with voltage derating
  (5) Standard ESR is “S“

[1] Preliminary rating, specification subject to change. Contact marketing for availability

PERFORMANCE CHARACTERISTICS OF HIGH ENERGY CAPACITORS

ELECTRICAL PERFORMANCE CHARACTERISTICS	
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	± 20 % ± 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: a) 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 b) The repetition rate of the reverse voltage surges is less than 10 Hz
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 Ω 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, 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 METHOD**	**CONDITION**
Thermal shock	MIL-STD-202, method 107	Test condition A Thermal shock shall be in accordance with MIL-PRF-39006 when tested for 30 cycles.
Shock	MIL-STD-202, method 213	Test condition G 11 ms, 50 *g*
Vibration - high frequency	MIL-STD-202, method 204	Test condition D 12 sweeps/axis, 20 *g* peak
Vibration - random	MIL-STD-202, method 214	Test condition II, letter E 1.5 h/axis, 19.64 *g*
Resistance to solder heat	MIL-STD-202, method 210	Test conditions A and B
Solderability	MIL-STD-202, method 208	ANSI/J-STD-002, test A
Terminal strength	MIL-STD-202, method 211	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	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. Lock washers are not recommended; use an adhesive lock nut conforming to MIL-S-22473E, grade A - red

High Energy Mounting FAQs

Capacitors mounted using leads only are not recommended for applications experiencing mechanical shock or vibration. Mounting studs can be provided and/or staking compounds should be used in high vibration environments. With the large mass of this type of component, secure mounting to the printed circuit board (PCB) is crucial, and combining methods is often preferred.

- **Mounting studs:** provide the strongest hold, especially in vibration environments. Vishay offer 2-56 316SS studs and spacers (to fill the gap) as standard options. Tighten studs to 30 in-oz to 40 in-oz and secure nuts with appropriate epoxy material.
- **Epoxy staking:** even with studs, we recommend epoxy staking the capacitor to the PCB for maximum vibration resistance. In some cases, potting the cavity between the PCB and the capacitor body might be necessary. For the most demanding shock/vibration applications, full potting may be required.

RECOMMENDATIONS

- When using the stud option, use the (supplied) spacer to fill the gap between the PCB and the top of the capacitor. This spacer is slightly proud. Tighten the nuts on the studs only ½ to ¾ turn beyond the initial point of contact, equivalent to 24 to 28 in-oz torque maximum. Maximum pre-load tension is about 15 pounds. Lock washers are not recommended. Use an adhesive locknut conforming to MIL-S-22473E, grade A - red.
- Handle the capacitor with care to avoid damaging the positive terminal Glass-to-Metal Seal (GTMS), which is a critical component for sealing and electrical performance. The tube should not be trimmed or bent; different tube lengths are available to meet your dimensional needs. Any force (lateral, axial, or torque) applied to the tube could cause damage, so it is important to minimize any mechanical shock to this area.
- Use staking compound along with the studs to add additional vibration tolerance. For even more vibration performance, use the surface mount base option. This adds some additional height but provides additional soldering points to the board.

SOLDERING RECOMMENDATIONS

We recommend securing the component to the board **with staking compound and / or the studs** prior to soldering.

- The capacitor rim is designed to directly mate with the PCB. “No-clean” flux is recommended for soldering.
- Follow standard ANSI J-STD 001 through-hole soldering methods.

LEAD TRIMMING

- If negative lead trimming is necessary, handle the leads with care.
- Cutting the positive terminal is strictly prohibited as it may result in “OPEN” failure mode
- Leads are available from 0.1" to 0.313" (measured from the capacitor rim).

ADDITIONAL NOTES

- Consider these guidelines as recommendations for optimal performance and component longevity.
- Specific application requirements may necessitate adjustments to these guidelines.

Hand Soldering EP Procedure

Due to the relatively large size of the EP capacitor, the traditional method of surface mounting using a reflow furnace is likely to be problematic when applied to EP units. The solder pad area is much larger than for other surface-mount components, and therefore a proportionally large amount of solder is needed, requiring longer heating times. Furthermore, the large thermal mass of the capacitor adds to the total heating time as well. Heating the area of the large solder pad using a reflow furnace causes the entire board and the part to be heated for too long. By comparison, hand soldering with a soldering iron has been found to be quick and effective. The method for this hand soldering procedure is described in the steps below. This same method can apply for tin lead (Pb)-containing or lead (Pb)-free solder connections.

1. Mount the EP capacitor to the board and secure it with nuts on the two studs
2. Attach a 1/8" tip to the soldering iron
3. Set soldering iron temperature near 730 °F (388 °C)
4. Wet the joints at the solder pads with flux
5. Solder by hand, feeding solder wire into the joint
6. Clean finished solder joints with flux remover
7. To check for defect conditions, refer to the acceptability standards in IPC-A-610 section 5

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