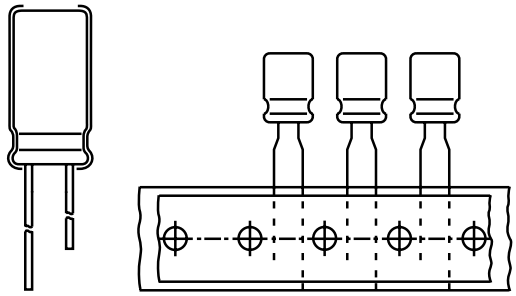
Aluminum Capacitors
Radial Style Non-Polar



Component outlines

FEATURES

- Non-polarized (bi-polar) aluminum electrolytic capacitor
- Small size
- High temperature range

Pb-free

RoHS
COMPLIANT

APPLICATIONS

- Circuits with changing or unknown polarity

QUICK REFERENCE DATA

DESCRIPTION	UNIT	VALUE
Nominal case size (Ø D x L)	mm	5 x 11 to 18 x 40
Rated capacitance range C_R	µF	0.1 to 4700
Capacitance tolerance	%	± 20
Rated voltage range	V	6.3 to 100
Category temperature range	°C	- 40 to + 105
Load life	h	1000
Based on sectional specification		IEC 60384-4
Climatic category IEC 60 068		40/105/56

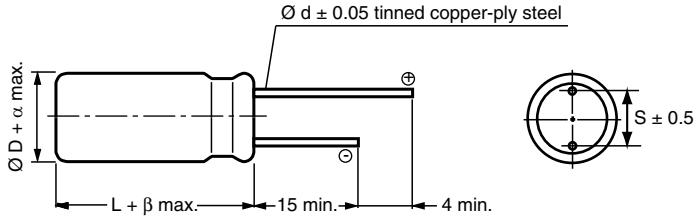
SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

C_R (µF)	RATED VOLTAGE (V)							
	6.3	10	16	25	35	50	63	100
0.10	→	→	→	→	→	→	5 x 11	5 x 11
0.15	→	→	→	→	→	→	5 x 11	5 x 11
0.22	→	→	→	→	→	→	5 x 11	5 x 11
0.33	→	→	→	→	→	→	5 x 11	5 x 11
0.47	→	→	→	→	→	→	5 x 11	5 x 11
0.68	→	→	→	→	→	→	5 x 11	5 x 11
1.0	→	→	→	→	→	→	5 x 11	5 x 11
1.5	→	→	→	→	→	→	5 x 11	5 x 11
2.2	→	→	→	→	→	→	5 x 11	-
3.3	→	→	→	→	→	→	5 x 11	6.3 x 11
4.7	→	→	→	→	→	→	6.3 x 11	-
6.8	→	→	→	→	5 x 11	→	6.3 x 11	10 x 12.5
10	→	→	→	→	→	6.3 x 11	8 x 11.5	10 x 12.5
15	→	→	5 x 11	6.3 x 11	→	8 x 11.5	10 x 12.5	10 x 16
22	→	5 x 11	6.3 x 11	→	8 x 11.5	→	10 x 16	-
33	5 x 11	6.3 x 11	→	8 x 11.5	10 x 12.5	→	10 x 16	-
47	→	6.3 x 11	8 x 11.5	→	10 x 16	→	10 x 20	-
68	6.3 x 11	8 x 11.5	10 x 12.5	10 x 16	→	10 x 20	12.5 x 20	-
100	8 x 11.5	10 x 12.5	10 x 16	→	10 x 20	12.5 x 20	12.5 x 25	-
150	10 x 12.5	10 x 16	10 x 20	→	12.5 x 20	12.5 x 25	16 x 25	-
220	10 x 12.5	10 x 20	→	12.5 x 20	12.5 x 25	16 x 25	16 x 35.5	-
330	10 x 16	→	12.5 x 20	12.5 x 25	16 x 25	16 x 35.5	18 x 35.5	-
470	10 x 20	12.5 x 20	12.5 x 25	16 x 25	16 x 35.5	18 x 35.5	18 x 40	-
680	12.5 x 20	12.5 x 25	16 x 25	16 x 35.5	18 x 35.5	18 x 40	-	-
1000	12.5 x 25	16 x 25	16 x 35.5	18 x 35.5	18 x 40	-	-	-
1500	16 x 25	16 x 35.5	18 x 35.5	18 x 40	-	-	-	-
2200	16 x 35.5	18 x 35.5	18 x 40	-	-	-	-	-
3300	18 x 35.5	18 x 40	-	-	-	-	-	-
4700	18 x 40	-	-	-	-	-	-	-

For technical questions, contact: aluminumcaps1@vishay.com

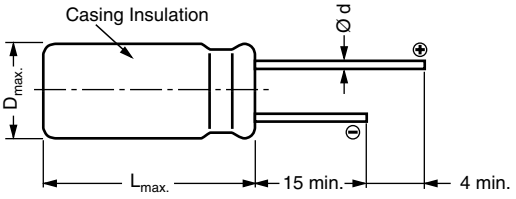
Document Number: 25011
Revision: 24-Jun-08

RADIAL STYLE: DIMENSIONS in millimeters

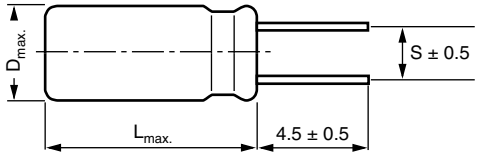


Ø D	5	6.3	8	10	12.5	16	18	22	25
S	2.0	2.5	3.5	5.0	5.0	7.5	7.5	10.0	12.5
Ø d	0.5	0.5	0.6	0.6	0.6	0.8	0.8	1.0	1.0
β	1.5			2.0					
α	0.5							1.0	

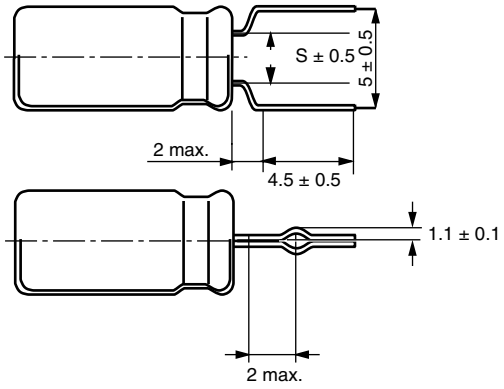
DIMENSIONS in millimeters AND AVAILABLE FORMS



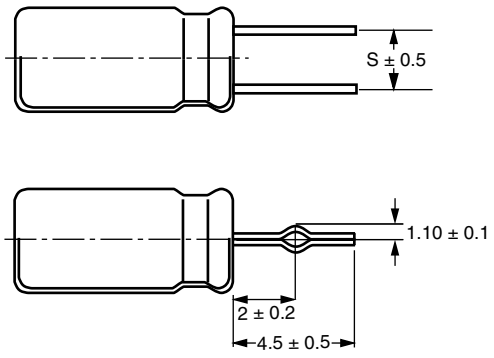
Ø D ≤ 18 long leads MALREKS20...



Ø D ≤ 18 shortened leads MALREKS25...
(S = 2/2.5/3.5/5/7.5 mm)



Ø D ≤ 8 leads shortened and formed MALREKS29...
(S = 2.0/2.5/3.5 mm)



10 ≤ Ø D ≤ 18 leads shortened and formed MALREKS26...
(S = 5/7.5 mm)

GENERAL NOTE

- For Standard Packaging Quantity (SPQ) and Minimum Order Quantity (MOQ) please refer to our price list or contact customer service
- For other packaging forms please refer to Vishay Roederstein General Information

ELECTRICAL DATA

SYMBOL	DESCRIPTION
U_R	rated voltage
C_R	rated capacitance at 120 Hz
tan δ	max. dissipation factor at 120 Hz
R_{ESR}	max. equivalent series resistance at 120 Hz
I_R	rated alternating current (rms) at 120 Hz and upper category temperature

Note

Unless otherwise specified, all electrical values at $T_a = 20$ °C, P = 80 to 120 kPa, RH = 45 to 75 %.

ORDERING EXAMPLE

EKSU 470 µF/25 V, ± 20 %, size: 16 x 25 mm
Leads: Long
Ordering code: MALREKS20JG347E00K

Leads: Short
Ordering code: MALREKS25...

For 5 ≤ Ø D ≤ 8 mm
Leads: Bent open, shortened and formed
Ordering code: MALREKS29...

For 10 ≤ Ø D ≤ 18 mm
Leads: Shortened and formed
Ordering code: MALREKS26 ...

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	DIMENSIONS Ø D x L (mm)	tan δ 120 Hz	R_{ESR} 120 Hz (Ω)	I_R 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
6.3	33	5 x 11	0.24	9.65	46	0.45	MALREKS20AA233B00K
	68	6.3 x 11	0.24	4.68	76	0.46	MALREKS20BA268B00K
	100	8 x 11.5	0.24	3.18	109	1.10	MALREKS20PB310B00K
	150	10 x 12.5	0.24	2.12	155	1.90	MALREKS20DC315B00K
	220	10 x 12.5	0.24	1.45	188	1.90	MALREKS20DC322B00K
	330	10 x 16	0.24	0.965	252	2.20	MALREKS20DD333B00K
	470	10 x 20	0.24	0.677	328	3.10	MALREKS20DE347B00K
	680	12.5 x 20	0.24	0.468	464	4.00	MALREKS20FE368B00K
	1000	12.5 x 25	0.24	0.318	613	4.40	MALREKS20FG410B00K
	1500	16 x 25	0.26	0.230	800	6.80	MALREKS20JG415B00K
	2200	16 x 35.5	0.28	0.169	1072	11.0	MALREKS20JL422B00K
	3300	18 x 35.5	0.30	0.121	1361	12.3	MALREKS20KL433B00K
	4700	18 x 40	0.32	0.090	1650	12.6	MALREKS20KK447B00K
10	22	5 x 11	0.20	12.1	41	0.45	MALREKS20AA222C00K
	33	6.3 x 11	0.20	8.04	58	0.46	MALREKS20BA233C00K
	47	6.3 x 11	0.20	5.64	69	0.46	MALREKS20BA247C00K
	68	8 x 11.5	0.20	3.90	98	1.10	MALREKS20PB268C00K
	100	10 x 12.5	0.20	2.65	139	1.90	MALREKS20DC310C00K
	150	10 x 16	0.20	1.77	186	2.20	MALREKS20DD315C00K
	220	10 x 20	0.20	1.21	246	3.10	MALREKS20DE322C00K
	470	12.5 x 20	0.20	0.564	422	4.00	MALREKS20FE347C00K
	680	12.5 x 25	0.20	0.390	554	4.40	MALREKS20FG368C00K
	1000	16 x 25	0.20	0.265	745	6.80	MALREKS20JG410C00K
	1500	16 x 35.5	0.22	0.195	999	11.0	MALREKS20JL415C00K
	2200	18 x 35.5	0.24	0.145	1242	12.3	MALREKS20KL422C00K
	3300	18 x 40	0.26	0.104	1534	12.6	MALREKS20KK433C00K
16	15	5 x 11	0.16	14.1	38	0.45	MALREKS20AA215D00K
	22	6.3 x 11	0.16	9.65	53	0.46	MALREKS20BA222D00K
	47	8 x 11.5	0.16	4.52	92	1.10	MALREKS20PB247D00K
	68	10 x 12.5	0.16	3.12	128	1.90	MALREKS20DC268D00K
	100	10 x 16	0.16	2.12	170	2.20	MALREKS20DD310D00K
	150	10 x 20	0.16	1.41	227	3.10	MALREKS20DE315D00K
	330	12.5 x 20	0.16	0.643	396	4.00	MALREKS20FE333D00K
	470	12.5 x 25	0.16	0.452	515	4.40	MALREKS20FG347D00K
	680	16 x 25	0.16	0.312	687	6.80	MALREKS20JG368D00K
	1000	16 x 35.5	0.16	0.212	956	11.0	MALREKS20JL410D00K
	1500	18 x 35.5	0.18	0.159	1184	12.3	MALREKS20KL415D00K
	2200	18 x 40	0.20	0.121	1428	12.6	MALREKS20KK422D00K

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	DIMENSIONS Ø D x L (mm)	tan δ 120 Hz	R_{ESR} 120 Hz (Ω)	I_R 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
25	15	6.3 x 11	0.16	14.1	44	0.46	MALREKS20BA215E00K
	33	8 x 11.5	0.16	6.43	77	1.10	MALREKS20PB233E00K
	68	10 x 16	0.16	3.12	140	2.20	MALREKS20DD268E00K
	220	12.5 x 20	0.16	0.965	323	4.00	MALREKS20FE322E00K
	330	12.5 x 25	0.16	0.643	431	4.40	MALREKS20FG333E00K
	470	16 x 25	0.16	0.452	571	6.80	MALREKS20JG347E00K
	680	16 x 35.5	0.16	0.312	788	11.0	MALREKS20JL368E00K
	1000	18 x 35.5	0.16	0.212	1026	12.3	MALREKS20KL410E00K
	1500	18 x 40	0.18	0.159	1243	12.6	MALREKS20KK415E00K
35	6.8	5 x 11	0.14	27.3	27	0.45	MALREKS20AA168F00K
	22	8 x 11.5	0.14	8.44	67	1.10	MALREKS20PB222F00K
	33	10 x 12.5	0.14	5.63	95	1.90	MALREKS20DC233F00K
	47	10 x 16	0.14	3.95	125	2.20	MALREKS20DD247F00K
	100	10 x 20	0.14	1.86	198	3.10	MALREKS20DE310F00K
	150	12.5 x 20	0.14	1.24	285	4.00	MALREKS20FE315F00K
	220	12.5 x 25	0.14	0.844	376	4.40	MALREKS20FG322F00K
	330	16 x 25	0.14	0.563	511	6.80	MALREKS20JG333F00K
	470	16 x 35.5	0.14	0.395	701	11.0	MALREKS20JL347F00K
	680	18 x 35.5	0.14	0.273	904	12.3	MALREKS20KL368F00K
	1000	18 x 40	0.14	0.186	1151	12.6	MALREKS20KK410F00K
50	10	6.3 x 11	0.12	15.9	41	0.46	MALREKS20BA210H00K
	15	8 x 11.5	0.12	10.6	60	1.10	MALREKS20PB215H00K
	68	10 x 20	0.12	2.34	177	3.10	MALREKS20DE268H00K
	100	12.5 x 20	0.12	1.59	251	4.00	MALREKS20FE310H00K
	150	12.5 x 25	0.12	1.06	336	4.40	MALREKS20FG315H00K
	220	16 x 25	0.12	0.723	451	6.80	MALREKS20JG322H00K
	330	16 x 35.5	0.12	0.482	634	11.0	MALREKS20JL333H00K
	470	18 x 35.5	0.12	0.339	812	12.3	MALREKS20KL347H00K
	680	18 x 40	0.12	0.234	1025	12.6	MALREKS20KK368H00K
63	0.10	5 x 11	0.12	1592	3.9	0.45	MALREKS20AA010J00K
	0.15	5 x 11	0.12	1061	4.8	0.45	MALREKS20AA015J00K
	0.22	5 x 11	0.12	723.5	5.8	0.45	MALREKS20AA022J00K
	0.33	5 x 11	0.12	482.3	7.2	0.45	MALREKS20AA033J00K
	0.47	5 x 11	0.12	338.6	8.5	0.45	MALREKS20AA047J00K
	0.68	5 x 11	0.12	234.1	10	0.45	MALREKS20AA068J00K
	1.0	5 x 11	0.12	159.2	12	0.45	MALREKS20AA110J00K
	1.5	5 x 11	0.12	106.1	15	0.45	MALREKS20AA115J00K
	2.2	5 x 11	0.12	72.3	18	0.45	MALREKS20AA122J00K
	3.3	5 x 11	0.12	48.2	23	0.45	MALREKS20AA133J00K
	4.7	6.3 x 11	0.12	33.9	31	0.46	MALREKS20BA147J00K
	6.8	6.3 x 11	0.12	23.4	37	0.46	MALREKS20BA168J00K
	10	8 x 11.5	0.12	15.9	53	1.10	MALREKS20PB210J00K
	15	10 x 12.5	0.12	10.6	76	1.90	MALREKS20DC215J00K
	22	10 x 16	0.12	7.23	101	2.20	MALREKS20DD222J00K
	33	10 x 16	0.12	4.82	124	2.20	MALREKS20DD233J00K
	47	10 x 20	0.12	3.39	161	3.10	MALREKS20DE247J00K
	68	12.5 x 20	0.12	2.34	227	4.00	MALREKS20FE268J00K
	100	12.5 x 25	0.12	1.59	300	4.40	MALREKS20FG310J00K
	150	16 x 25	0.12	1.06	408	6.80	MALREKS20JG315J00K
	220	16 x 35.5	0.12	0.723	567	11.0	MALREKS20JL322J00K
	330	18 x 35.5	0.12	0.482	745	12.3	MALREKS20KL333J00K
	470	18 x 40	0.12	0.339	933	12.6	MALREKS20KK347J00K

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	DIMENSIONS Ø D x L (mm)	tan δ 120 Hz	R_{ESR} 120 Hz (Ω)	I_R 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
100	0.10	5 x 11	0.12	1592	4.2	0.45	MALREKS20AA010L00K
	0.15	5 x 11	0.12	1061	5.1	0.45	MALREKS20AA015L00K
	0.22	5 x 11	0.12	723.5	6.2	0.45	MALREKS20AA022L00K
	0.33	5 x 11	0.12	482.3	7.5	0.45	MALREKS20AA033L00K
	0.47	5 x 11	0.12	338.6	9.2	0.45	MALREKS20AA047L00K
	0.68	5 x 11	0.12	234.1	11	0.45	MALREKS20AA068L00K
	1.0	5 x 11	0.12	159.2	13	0.45	MALREKS20AA110L00K
	1.5	5 x 11	0.12	106.1	16	0.45	MALREKS20AA115L00K
	3.3	6.3 x 11	0.12	48.2	27	0.46	MALREKS20BA133L00K
	6.8	10 x 12.5	0.12	23.4	54	1.90	MALREKS20DC168L00K
	10	10 x 12.5	0.12	15.9	65	1.90	MALREKS20DC210L00K
	15	10 x 16	0.12	10.6	88	2.20	MALREKS20DD215L00K

LOW TEMPERATURE BEHAVIOUR (at 120 Hz)

IMPEDANCE RATIO Z (T2)/Z (T1)	RATED VOLTAGE (V)			
T2/T1	6.3	10	16	25 ~ 100
- 25 °C/+ 20 °C	4	3	2	2
- 40 °C/+ 20 °C	8	6	4	3

ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Current		
Leakage current (Test conditions: U_R, 20 °C)	After 5 minutes at U_R	$I_{L5} \leq 0.03 \times C_R \times U_R$ or 3 µA (whichever is greater)
Resistance		
Equivalent series resistance (ESR)	Calculated from tan $\delta_{max.}$	ESR = tan $\delta / 2 \pi f C_R$

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY

FREQUENCY (Hz)	I_R MULTIPLIER FOR $U_R \leq 100$ V		
	$C_R \leq 47$ µF	C_R = 68 to 680 µF	$C_R \geq 1000$ µF
50	0.75	0.80	0.85
120	1.00	1.00	1.00
300	1.35	1.25	1.10
1000	1.55	1.34	1.13
≥ 10 000	2.00	1.50	1.15

TEST PROCEDURES AND REQUIREMENTS

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Load life	T_{amb} = 105 °C U_R and I_R applied After 1000 hours Polarity reverse each 250 hours	Δ C/C: ± 20 % of initial value $I_L \leq$ spec. limit tan $\delta \leq 2$ x spec. limit
Shelf life	No voltage applied After 1000 hours After test: U_R to be applied for 30 minutes 24 to 48 hours before measurement	Δ C/C: ± 20 % of initial value $I_L \leq$ spec.limit tan $\delta \leq 2$ x spec. limit

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