



## Aluminum Capacitors Radial Style



### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case
- Miniaturized, high CV-product per unit volume
- Low impedance
- Long lifetime
- Temperature range up to 105 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT

### APPLICATIONS

- General purpose, industrial, telecommunications, power supplies and audio-video
- Coupling, decoupling, timing, smoothing, filtering and buffering
- Portable and mobile units

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 <sub>R</sub>	µF	0.22 to 15 000	
Capacitance tolerance	%	± 20	
Rated voltage range	V	6.3 to 450	
Category temperature range	°C	6.3 V to 350 V -40 to +105	400 V to 450 V -25 to +105
Load Life	h	5 x 11 to 6.3 x 11	8 x 11.5
U <sub>R</sub> ≤ 100 V		2000	3000
U <sub>R</sub> > 100 V		2000	
Based on sectional specification		IEC 60384-4 / EN 130300	
Climatic category IEC 60068		40 / 105 / 56	25 / 105 / 56

SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)								
C <sub>R</sub> (µF)	RATED VOLTAGE (V) (continuation see next page)							
	6.3	10	16	25	35	50	63	100
0.22	→	→	→	→	→	5 x 11	-	-
0.47	→	→	→	→	→	5 x 11	-	-
1.0	→	→	→	→	→	5 x 11	-	-
2.2	→	→	→	→	→	5 x 11	-	5 x 11
3.3	→	→	→	→	→	5 x 11	5 x 11	5 x 11
4.7	→	→	→	→	5 x 11	5 x 11	5 x 11	5 x 11
10	→	→	→	→	5 x 11	5 x 11	5 x 11	6.3 x 11
22	→	→	→	→	5 x 11	5 x 11	6.3 x 11	8 x 11.5
33	→	→	→	→	5 x 11	→	6.3 x 11	10 x 12.5
47	→	→	→	5 x 11	6.3 x 11	6.3 x 11	8 x 11.5	10 x 16
100	→	5 x 11	→	6.3 x 11	8 x 11.5	8 x 11.5	10 x 16	12.5 x 20
150	→	→	6.3 x 11	→	8 x 11.5	10 x 12.5	10 x 20	12.5 x 25
220	→	6.3 x 11	→	8 x 11.5	10 x 12.5	10 x 16	10 x 25	16 x 25
330	6.3 x 11	→	8 x 11.5	10 x 12.5	10 x 16	10 x 20	12.5 x 20	16 x 31.5
470	→	8 x 11.5	10 x 12.5	10 x 16	10 x 20	12.5 x 20	16 x 20	18 x 40
1000	10 x 12.5	10 x 16	10 x 20	12.5 x 20	12.5 x 25	16 x 25	16 x 35.5	-
1500	→	10 x 20	12.5 x 20	16 x 20	16 x 25	16 x 31.5	-	-
2200	→	12.5 x 20	12.5 x 25	16 x 25	16 x 31.5	18 x 35.5	-	-
3300	12.5 x 20	12.5 x 25	16 x 25	16 x 31.5	18 x 35.5	-	-	-
4700	→	16 x 25	16 x 31.5	18 x 35.5	-	-	-	-
6800	16 x 25	16 x 31.5	18 x 35.5	-	-	-	-	-
10 000	16 x 31.5	18 x 35.5	-	-	-	-	-	-
15 000	18 x 35.5	-	-	-	-	-	-	-



SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing D \times L$ in mm)					
$C_R$ ( $\mu F$ )	RATED VOLTAGE (V)				
	160	200	250	400	450
3.3	→	→	→	→	10 x 20
4.7	→	→	→	→	12.5 x 20
10	→	→	→	10 x 20	12.5 x 25
22	→	10 x 20	12.5 x 20	12.5 x 25	16 x 25
33	10 x 20	12.5 x 20	12.5 x 25	16 x 20	16 x 31.5
47	→	12.5 x 20	12.5 x 25	16 x 25	18 x 31.5
100	→	16 x 25	16 x 31.5	18 x 40	-
150	16 x 31.5	18 x 25	18 x 31.5	-	-
220	16 x 31.5	18 x 31.5	18 x 40	-	-
330	18 x 31.5	-	-	-	-

RADIAL STYLE: DIMENSIONS in millimeters									
$\varnothing D$	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
$\varnothing d$	0.5	0.5	0.6	0.6	0.6	0.8	0.8	1.0	1.0
$\beta$	1.5			2.0					
$\alpha$	0.5							1.0	

DIMENSIONS in millimeters AND AVAILABLE FORMS	
<p><math>\varnothing D \leq 18</math> long leads MALREKE00...</p>	<p><math>\varnothing D \leq 18</math> shortened leads MALREKE05... (S = 2 mm/2.5 mm/3.5 mm/5 mm/7.5 mm)</p>

**GENERAL NOTE**

- For Minimum Package Quantity (MPQ) 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
$\tan \delta$	Max. dissipation factor at 120 Hz
$R_{ESR}$	Calculated equivalent series resistance at 120 Hz
$I_R$	Rated ripple current (RMS)
$Z$	Max. impedance

**Note**

- Unless otherwise specified, all electrical values at  $T_a = 20^\circ\text{C}$ ,  $P = 80\text{ kPa}$  to  $120\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$ .

**ORDERING EXAMPLE**EKE 470  $\mu\text{F}$  / 35 V,  $\pm 20\%$ , size: 10 mm x 20 mm

Leads: long

Ordering code: MALREKE00DE347F00K

Leads: short

Ordering code: MALREKE05...

ELECTRICAL DATA AND ORDERING INFORMATION								
$U_R$ (V)	$C_R$ 120 Hz ( $\mu\text{F}$ )	DIMENSIONS $\varnothing D \times L$ (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz / 20 $^\circ\text{C}$ ( $\Omega$ )	$Z$ 100 kHz / 20 $^\circ\text{C}$ ( $\Omega$ )	$I_R$ 100 kHz / 105 $^\circ\text{C}$ (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
6.3	330	6.3 x 11	0.22	0.884	0.30	280	0.43	MALREKE00BA333B00K
	1000	10 x 12.5	0.22	0.292	0.10	660	1.90	MALREKE00DC410B00K
	3300	12.5 x 20	0.28	0.113	0.050	1400	4.50	MALREKE00FE433B00K
	6800	16 x 25	0.34	0.066	0.030	2100	6.60	MALREKE00JG468B00K
	10 000	16 x 31.5	0.40	0.053	0.025	2600	9.00	MALREKE00JS510B00K
	15 000	18 x 35.5	0.50	0.044	0.022	3000	11.5	MALREKE00KL515B00K
10	100	5 x 11	0.19	2.520	0.65	180	0.42	MALREKE00AA310C00K
	220	6.3 x 11	0.19	1.145	0.30	280	0.43	MALREKE00BA322C00K
	470	8 x 11.5	0.19	0.536	0.14	450	1.05	MALREKE00PB347C00K
	1000	10 x 16	0.19	0.252	0.080	850	2.40	MALREKE00DD410C00K
	1500	10 x 20	0.21	0.186	0.054	1100	3.00	MALREKE00DE415C00K
	2200	12.5 x 20	0.23	0.139	0.050	1400	4.50	MALREKE00FE422C00K
	3300	12.5 x 25	0.25	0.100	0.038	1700	4.70	MALREKE00FG433C00K
	4700	16 x 25	0.27	0.076	0.030	2100	6.60	MALREKE00JG447C00K
	6800	16 x 31.5	0.31	0.060	0.025	2600	9.00	MALREKE00JS468C00K
	10 000	18 x 35.5	0.37	0.049	0.022	3000	11.5	MALREKE00KL510C00K
16	150	6.3 x 11	0.16	1.415	0.30	280	0.43	MALREKE00BA315D00K
	330	8 x 11.5	0.16	0.643	0.14	450	1.05	MALREKE00PB333D00K
	470	10 x 12.5	0.16	0.452	0.10	660	1.90	MALREKE00DC347D00K
	1000	10 x 20	0.16	0.212	0.054	1100	3.00	MALREKE00DE410D00K
	1500	12.5 x 20	0.18	0.159	0.050	1400	4.50	MALREKE00FE415D00K
	2200	12.5 x 25	0.20	0.121	0.038	1700	4.70	MALREKE00FG422D00K
	3300	16 x 25	0.22	0.088	0.030	2100	6.60	MALREKE00JG433D00K
	4700	16 x 31.5	0.24	0.068	0.025	2600	9.00	MALREKE00JS447D00K
25	47	5 x 11	0.14	3.951	0.65	180	0.42	MALREKE00AA247E00K
	100	6.3 x 11	0.14	1.857	0.30	280	0.43	MALREKE00BA310E00K
	220	8 x 11.5	0.14	0.844	0.14	450	1.05	MALREKE00PB322E00K
	330	10 x 12.5	0.14	0.563	0.10	660	1.90	MALREKE00DC333E00K
	470	10 x 16	0.14	0.395	0.080	850	2.40	MALREKE00DD347E00K
	1000	12.5 x 20	0.14	0.186	0.050	1400	4.50	MALREKE00FE410E00K
	1500	16 x 20	0.16	0.141	0.030	2100	5.80	MALREKE00JE415E00K
	2200	16 x 25	0.18	0.109	0.030	2100	6.60	MALREKE00JG422E00K
	3300	16 x 31.5	0.20	0.080	0.025	2600	9.00	MALREKE00JS433E00K
	4700	18 x 35.5	0.22	0.062	0.022	3000	11.5	MALREKE00KL447E00K



ELECTRICAL DATA AND ORDERING INFORMATION								
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS $\varnothing D \times L$ (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz / 20 °C ( $\Omega$ )	$Z$ 100 kHz / 20 °C ( $\Omega$ )	$I_R$ 100 kHz / 105 °C (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
35	4.7	5 x 11	0.12	33.86	0.70	180	0.42	MALREKE00AA147F00K
	10	5 x 11	0.12	15.92	0.70	180	0.42	MALREKE00AA210F00K
	22	5 x 11	0.12	7.235	0.70	180	0.42	MALREKE00AA222F00K
	33	5 x 11	0.12	4.823	0.65	180	0.42	MALREKE00AA233F00K
	47	6.3 x 11	0.12	3.386	0.30	280	0.43	MALREKE00BA247F00K
	100	8 x 11.5	0.12	1.592	0.14	450	1.05	MALREKE00PB310F00K
	150	8 x 11.5	0.12	1.061	0.14	450	1.05	MALREKE00PB315F00K
	220	10 x 12.5	0.12	0.723	0.10	660	1.90	MALREKE00DC322F00K
	330	10 x 16	0.12	0.482	0.080	850	2.40	MALREKE00DD333F00K
	470	10 x 20	0.12	0.339	0.054	1100	3.00	MALREKE00DE347F00K
	1000	12.5 x 25	0.12	0.159	0.038	1700	4.70	MALREKE00FG410F00K
	1500	16 x 25	0.14	0.124	0.030	2100	6.60	MALREKE00JG415F00K
	2200	16 x 31.5	0.16	0.096	0.025	2600	9.00	MALREKE00JS422F00K
	3300	18 x 35.5	0.18	0.072	0.022	3000	11.5	MALREKE00KL433F00K
50	0.22	5 x 11	0.10	602.9	8.00	18	0.42	MALREKE00AA022H00K
	0.47	5 x 11	0.10	282.2	5.00	25	0.42	MALREKE00AA047H00K
	1.0	5 x 11	0.10	132.6	3.50	40	0.42	MALREKE00AA110H00K
	2.2	5 x 11	0.10	60.29	3.00	55	0.42	MALREKE00AA122H00K
	3.3	5 x 11	0.10	40.19	2.60	65	0.42	MALREKE00AA133H00K
	4.7	5 x 11	0.10	28.22	2.30	90	0.42	MALREKE00AA147H00K
	10	5 x 11	0.10	13.26	1.40	120	0.42	MALREKE00AA210H00K
	22	5 x 11	0.10	6.029	1.20	150	0.42	MALREKE00AA222H00K
	47	6.3 x 11	0.10	2.822	0.43	250	0.43	MALREKE00BA247H00K
	100	8 x 11.5	0.10	1.326	0.24	340	1.05	MALREKE00PB310H00K
	150	10 x 12.5	0.10	0.884	0.17	490	1.90	MALREKE00DC315H00K
	220	10 x 16	0.10	0.603	0.12	650	2.40	MALREKE00DD322H00K
	330	10 x 20	0.10	0.402	0.10	810	3.00	MALREKE00DE333H00K
	470	12.5 x 20	0.10	0.282	0.085	1100	4.50	MALREKE00FE347H00K
1000	16 x 25	0.10	0.133	0.043	1600	6.60	MALREKE00JG410H00K	
1500	16 x 31.5	0.12	0.106	0.038	2000	9.00	MALREKE00JS415H00K	
2200	18 x 35.5	0.14	0.084	0.034	2300	11.5	MALREKE00KL422H00K	
63	3.3	5 x 11	0.09	36.17	2.00	64	0.42	MALREKE00AA133J00K
	4.7	5 x 11	0.09	25.40	2.00	76	0.42	MALREKE00AA147J00K
	10	5 x 11	0.09	11.94	2.00	111	0.42	MALREKE00AA210J00K
	22	6.3 x 11	0.09	5.426	0.60	190	0.43	MALREKE00BA222J00K
	33	6.3 x 11	0.09	3.617	0.60	233	0.43	MALREKE00BA233J00K
	47	8 x 11.5	0.09	2.540	0.50	328	1.05	MALREKE00PB247J00K
	100	10 x 16	0.09	1.194	0.12	456	2.40	MALREKE00DD310J00K
	150	10 x 20	0.09	0.796	0.10	610	3.00	MALREKE00DE315J00K
	220	10 x 25	0.09	0.543	0.090	809	3.20	MALREKE00DG322J00K
	330	12.5 x 20	0.09	0.362	0.085	1036	4.50	MALREKE00FE333J00K
	470	16 x 20	0.09	0.254	0.050	1411	5.80	MALREKE00JE347J00K
1000	16 x 35.5	0.09	0.119	0.025	1967	10.0	MALREKE00JL410J00K	



ELECTRICAL DATA AND ORDERING INFORMATION								
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS $\varnothing D \times L$ (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz / 20 °C ( $\Omega$ )	$Z$ 100 kHz / 20 °C ( $\Omega$ )	$I_R$ 100 kHz / 105 °C (mA)	WEIGHT (g)	CATALOG NUMBER (Long Leads)
100	2.2	5 x 11	0.08	48.23	2.50	52	0.42	MALREKE00AA122L00K
	3.3	5 x 11	0.08	32.15	2.50	64	0.42	MALREKE00AA133L00K
	4.7	5 x 11	0.08	22.58	2.50	76	0.42	MALREKE00AA147L00K
	10	6.3 x 11	0.08	10.61	1.00	128	0.43	MALREKE00BA210L00K
	22	8 x 11.5	0.08	4.823	0.60	224	1.05	MALREKE00PB222L00K
	33	10 x 12.5	0.08	3.215	0.40	319	1.90	MALREKE00DC233L00K
	47	10 x 16	0.08	2.258	0.30	417	2.40	MALREKE00DD247L00K
	100	12.5 x 20	0.08	1.061	0.15	570	4.50	MALREKE00FE310L00K
	150	12.5 x 25	0.08	0.707	0.12	762	4.70	MALREKE00FG315L00K
	220	16 x 25	0.08	0.482	0.070	1250	6.60	MALREKE00JG322L00K
160	33	10 x 20	0.15	6.029	1.30	565	3.00	MALREKE00DE233M00K
	150	16 x 31.5	0.15	1.326	0.22	1300	9.00	MALREKE00JS315M00K
	220	16 x 31.5	0.15	0.904	0.22	1300	9.00	MALREKE00JS322M00K
	330	18 x 31.5	0.15	0.603	0.22	1700	11.0	MALREKE00KS333M00K
200	22	10 x 20	0.15	9.043	1.50	440	3.00	MALREKE00DE222S00K
	33	12.5 x 20	0.15	6.029	0.91	590	4.50	MALREKE00FE233S00K
	47	12.5 x 20	0.15	4.233	0.91	780	4.50	MALREKE00FE247S00K
	100	16 x 25	0.15	1.989	0.27	1280	6.60	MALREKE00JG310S00K
	150	18 x 25	0.15	1.326	0.27	1500	9.00	MALREKE00KG315S00K
250	220	18 x 31.5	0.15	0.904	0.22	1700	11.0	MALREKE00KS322S00K
	22	12.5 x 20	0.15	9.043	2.30	480	4.50	MALREKE00FE222N00K
	33	12.5 x 25	0.15	6.029	1.70	630	4.70	MALREKE00FG233N00K
	47	12.5 x 25	0.15	4.233	1.70	630	4.70	MALREKE00FG247N00K
	100	16 x 31.5	0.15	1.989	0.63	1400	9.00	MALREKE00JS310N00K
	150	18 x 31.5	0.15	1.326	0.42	1450	11.0	MALREKE00KS315N00K
400	220	18 x 40	0.15	0.904	0.35	1485	15.0	MALREKE00KK322N00K
	10	10 x 20	0.20	26.53	2.90	180	3.00	MALREKE00DE210X00K
	22	12.5 x 25	0.20	12.06	1.30	300	4.70	MALREKE00FG222X00K
	33	16 x 20	0.20	8.038	0.91	600	5.80	MALREKE00JE233X00K
	47	16 x 25	0.20	5.644	0.73	700	6.60	MALREKE00JG247X00K
450	100	18 x 40	0.20	2.653	0.34	1250	15.0	MALREKE00KK310X00K
	3.3	10 x 20	0.20	80.38	6.50	150	3.00	MALREKE00DE133P00K
	4.7	12.5 x 20	0.20	56.44	3.60	200	4.50	MALREKE00FE147P00K
	10	12.5 x 25	0.20	26.53	2.50	315	4.70	MALREKE00FG210P00K
	22	16 x 25	0.20	12.06	1.70	570	6.60	MALREKE00JG222P00K
	33	16 x 31.5	0.20	8.038	1.10	620	9.00	MALREKE00JS233P00K
47	18 x 31.5	0.20	5.644	0.93	900	11.0	MALREKE00KS247P00K	

LOW TEMPERATURE BEHAVIOR (at 120 Hz)						
IMPEDANCE RATIO $Z(T_2) / Z(T_1)$	RATED VOLTAGE (V)					
$T_2 / T_1$	6.3	10	16	25 ~ 100	160 ~ 250	350 ~ 450
-25 °C / +20 °C	4	3	2	2	3	8
-40 °C / +20 °C	8	6	4	3	4	-



ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Current</b>		
Leakage current (test conditions: $U_R$ , 20 °C)	After 1 min at $U_R$	$I_{L1} \leq 0.03 \times C_R \times U_R$ or 4 $\mu$ A for $U_R \leq 100$ V (whichever is greater)
	After 2 min at $U_R$	$I_{L2} \leq 0.01 \times C_R \times U_R$ or 3 $\mu$ A for $U_R \leq 100$ V (whichever is greater)
	After 5 min at $U_R$	$I_{L5} \leq 0.02 \times C_R \times U_R$ + 15 $\mu$ A for $U_R > 100$ V
<b>Resistance</b>		
Equivalent series resistance (ESR)	Calculated from $\tan \delta_{max.}$ and $C_R$	$ESR = \tan \delta / 2 \pi f C_R$

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY			
FREQUENCY (Hz)	$I_R$ MULTIPLIER FOR $U_R \leq 100$ V		
	$C_R \leq 47 \mu F$	$C_R = 68 \mu F$ to 680 $\mu F$	$C_R \geq 1000 \mu F$
50	0.34	0.47	0.65
120	0.45	0.59	0.77
300	0.61	0.74	0.85
1000	0.70	0.79	0.88
10 000	0.91	0.88	0.88
100 000	1.00	1.00	1.00

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY		
FREQUENCY (Hz)	$I_R$ MULTIPLIER FOR $U_R > 100$ V	
	$C_R = 0.47 \mu F$ to 220 $\mu F$	$C_R \geq 330 \mu F$
50	0.44	0.69
120	0.56	0.77
300	0.69	0.87
1000	0.78	0.87
10 000	0.89	0.88
100 000	1.00	1.00

TEST PROCEDURES AND REQUIREMENTS		
TEST	PROCEDURE (quick reference)	REQUIREMENTS
Load life	$T_{amb} = 105$ °C $U_R$ and $I_R$ applied After specified hours	$\Delta C/C: \pm 25$ % of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit
Shelf life	$T_{amb} = 105$ °C No voltage applied After 1000 h After test: $U_R$ to be applied for 30 min 24 h to 48 h before measurement	$\Delta C/C: \pm 25$ % of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.



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