

## Aluminum Electrolytic Capacitors Radial Low Profile, 5 mm

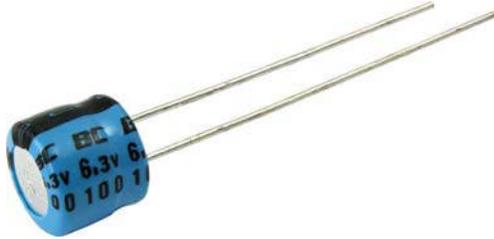


Fig. 1

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes (Ø D x L in mm)	4 x 5 to 6.3 x 5
Rated capacitance range, C <sub>R</sub>	1.0 µF to 100 µF
Tolerance on C <sub>R</sub>	± 20 %
Rated voltage range, U <sub>R</sub>	6.3 V to 50 V
Category temperature range	-40 °C to +85 °C
Endurance test at 85 °C	1000 h
Useful life at 85 °C	1500 h
Useful life at 40 °C, 1.4 x I <sub>R</sub> applied	40 000 h
Shelf life at 0 V, 85 °C	500 h
Based on sectional specification	IEC 60384-4 / EN 130300
Climatic category IEC 60068	40 / 085 / 56

### FEATURES

- Useful life: 1500 h at 85 °C
- Very low profile, 5 mm height
- Extremely miniaturized
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Charge and discharge proof
- 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, automotive and audio-video
- Coupling, decoupling, smoothing, filtering and timing
- High mounting density
- Portable and mobile equipment (very small size and very low mass), low profile equipment

### MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Rated voltage (in V)
- Negative terminal identification
- Code indicating factory of origin
- Name of manufacturer
- Date code, in accordance with IEC 60062
- Series number (134)

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)	U <sub>R</sub> (V)					
	6.3	10	16	25	35	50
1.0	-	-	-	-	-	4 x 5
2.2	-	-	-	-	-	4 x 5
3.3	-	-	-	-	-	4 x 5
4.7	-	-	-	-	4 x 5	5 x 5
10	-	-	4 x 5	-	5 x 5	6.3 x 5
22	4 x 5	-	5 x 5	-	6.3 x 5	-
33	-	5 x 5	-	6.3 x 5	-	-
47	5 x 5	-	6.3 x 5	-	-	-
100	6.3 x 5	-	-	-	-	-

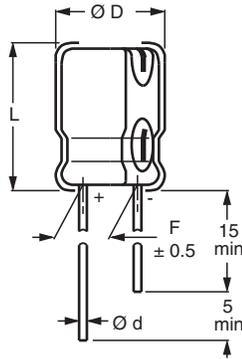
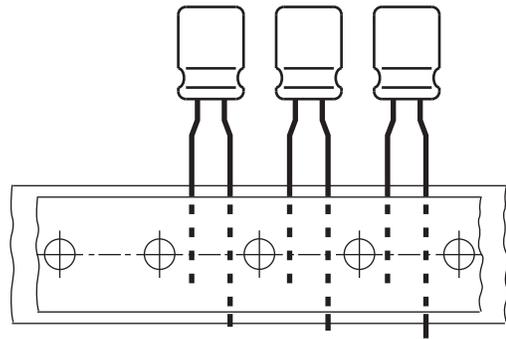
**DIMENSIONS in millimeters AND AVAILABLE FORMS**

 Fig. 2 - **Form CA:** Long leads

 Case  $\varnothing D = 4 \text{ mm to } 6.3 \text{ mm}$ ; pitch  $F = 5 \text{ mm}$ 

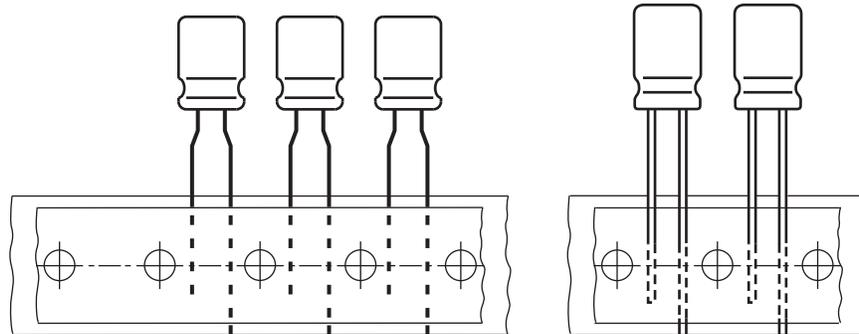
 Fig. 3 - **Form TFA:** Taped in box (ammopack)

 Pitch  $F = 2.5 \text{ mm}$   
 Case  $\varnothing D = 4 \text{ mm to } 6.3 \text{ mm}$ 

 Fig. 4 - **Form TNA:** Taped in box (ammopack)

**Table 1**

<b>DIMENSIONS in millimeters AND PACKAGING QUANTITIES</b>								
NOMINAL CASE SIZE $\varnothing D \times L$	CASE CODE	$\varnothing d$	$\varnothing D_{max.}$	$L_{max.}$	F	PACKAGING QUANTITIES		
						FORM CA	FORM TFA	FORM TNA
4 x 5	53	0.45	4.5	6.0	$1.5 \pm 0.5$	2000	2000	2000
5 x 5	54	0.45	5.5	6.0	$2.0 \pm 0.5$	2000	2000	2000
6.3 x 5	55	0.45	6.8	6.0	$2.5 \pm 0.5$	2000	2000	2000

**Note**

- For detailed tape dimensions please see [www.vishay.com/doc?28360](http://www.vishay.com/doc?28360)



ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 120 Hz, tolerance $\pm 20\%$
$I_R$	Rated RMS ripple current at 120 Hz, 85 °C
$I_{L2}$	Max. leakage current after 2 min at $U_R$
$\tan \delta$	Max. dissipation factor at 120 Hz
Z	Max. impedance at 100 kHz

**ORDERING EXAMPLE**

Electrolytic capacitor 134 series  
 22  $\mu\text{F}$  / 16 V;  $\pm 20\%$   
 Nominal case size:  $\varnothing 5\text{ mm} \times 5\text{ mm}$ ; form TFA  
 Ordering code: MAL213435229E3  
 Former 12NC: 2222 134 35229

**Note**

- Unless otherwise specified, all electrical values in Table 2 apply at  $T_{\text{amb}} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $\text{RH} = 45\%$  to  $75\%$

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION												
$U_R$ (V)	$C_R$ 120 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 120 Hz 85 °C (mA)	$I_{L2}$ 2 min ( $\mu\text{A}$ )	$\tan \delta$ 120 Hz	Z 100 kHz ( $\Omega$ )	ORDERING CODE MAL2134.....					
							BULK LONG LEADS		TAPED AMMOPACK			
							FORM CA	F (mm)	FORM TFA	F (mm)	FORM TNA	F (mm)
6.3	22	4 x 5	23	3	0.24	11	53229E3	1.5	33229E3	5.0	73229E3	2.5
	47	5 x 5	38	3	0.24	5.2	53479E3	2.0	33479E3	5.0	73479E3	2.5
	100	6.3 x 5	60	7	0.24	3.4	53101E3	2.5	33101E3	5.0	73101E3	2.5
10	33	5 x 5	35	4	0.20	6.0	54339E3	2.0	34339E3	5.0	74339E3	2.5
16	10	4 x 5	20	3	0.16	12	95105E3	1.5	95103E3	5.0	95107E3	2.5
	22	5 x 5	32	4	0.16	6.4	55229E3	2.0	35229E3	5.0	75229E3	2.5
	47	6.3 x 5	50	8	0.16	4.2	55479E3	2.5	35479E3	5.0	75479E3	2.5
25	33	6.3 x 5	45	9	0.14	4.6	56339E3	2.5	36339E3	5.0	76339E3	2.5
35	4.7	4 x 5	15	3	0.12	27	50478E3	1.5	30478E3	5.0	70478E3	2.5
	10	5 x 5	25	4	0.12	17	50109E3	2.0	30109E3	5.0	70109E3	2.5
	22	6.3 x 5	40	8	0.12	11	50229E3	2.5	30229E3	5.0	70229E3	2.5
50	1.0	4 x 5	7.5	3	0.10	28	91105E3	1.5	91103E3	5.0	91107E3	2.5
	2.2	4 x 5	12	3	0.10	26	91225E3	1.5	91223E3	5.0	91227E3	2.5
	3.3	4 x 5	14	3	0.10	25	51338E3	1.5	31338E3	5.0	71338E3	2.5
	4.7	5 x 5	19	3	0.10	22	51478E3	2.0	31478E3	5.0	71478E3	2.5
	10	6.3 x 5	29	5	0.10	14	51109E3	2.5	31109E3	5.0	71109E3	2.5

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage		$U_{\text{rev}} \leq 1\text{ V}$
<b>Current</b>		
Leakage current	After 2 min at $U_R$	$I_{L2} \leq 0.01 C_R \times U_R$ or $3\text{ }\mu\text{A}$ (whichever is greater)
<b>Resistance</b>		
Equivalent series resistance (ESR)	Calculated from $\tan \delta_{\text{max}}$ and $C_R$ (see Table 2)	$\text{ESR} = \tan \delta / 2 \pi f C_R$

**RIPPLE CURRENT AND USEFUL LIFE**

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 85 °C (h)	USEFUL LIFE AT 85 °C (h)
1000	1500

**Note**

- Multiplier of useful life code: CCC205

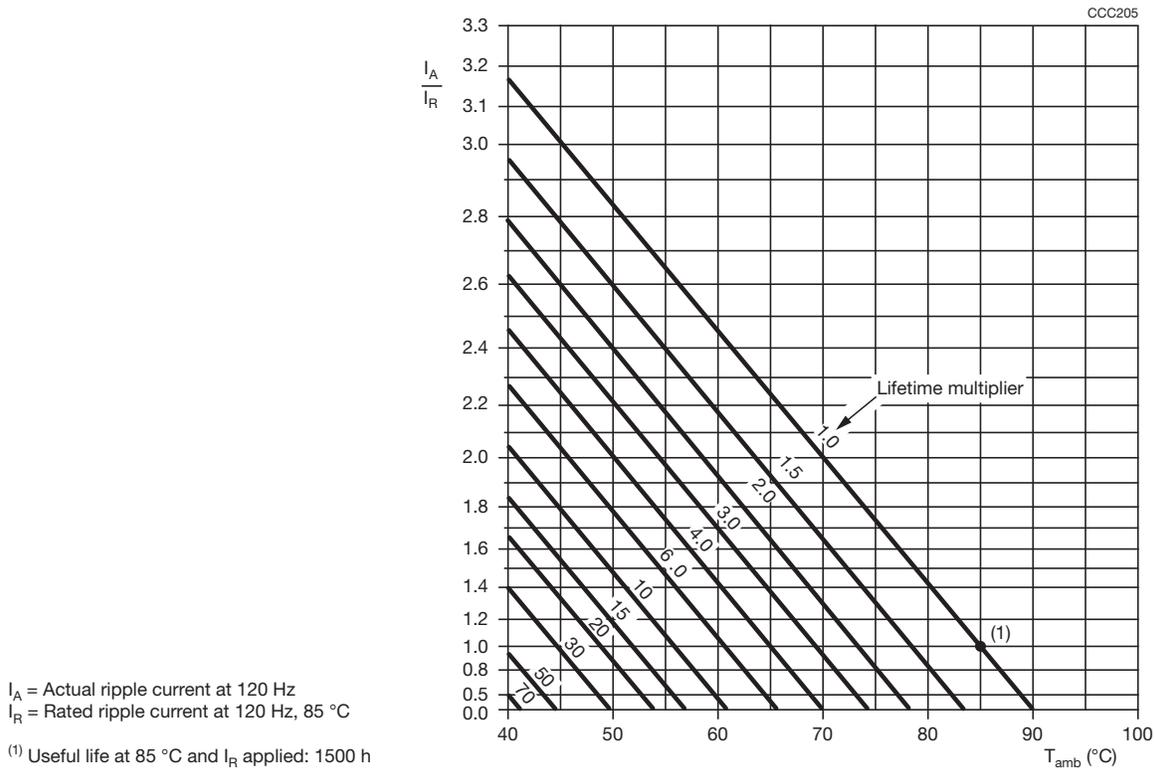


Fig. 5 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY				
FREQUENCY (Hz)				
50	120	400	800	≥ 2000
$I_R$ MULTIPLIER				
0.60	1.00	1.20	1.30	1.40

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN 130300, subclause 4.13	$T_{amb} = 85\text{ °C}$ ; $U_R$ applied; 1000 h	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$
Useful life	CECC 30301, subclause 1.8.1	$T_{amb} = 85\text{ °C}$ ; $U_R$ and $I_R$ applied; 1500 h	$\Delta C/C: \pm 50\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300, subclause 4.17	$T_{amb} = 85\text{ °C}$ ; no voltage applied; 500 h After test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C, \tan \delta, Z$ : For requirements see "Endurance test" above $I_{L2} \leq \text{spec. limit}$

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.



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.