



## Aluminum Capacitors SMD (Chip), High Temperature

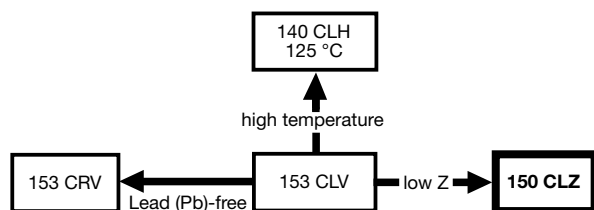
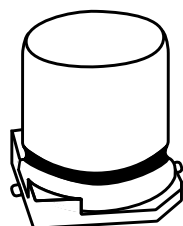


Fig. 1

### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte, self healing
- SMD-version with base plate, reflow solderable
- Very low impedance, very high ripple current
- Very long useful life: 3000 h at 105 °C
- Charge and discharge proof, no peak current limitation
- ATTENTION: for maximum safe soldering conditions refer to Fig. 4

RoHS  
COMPLIANT

### APPLICATIONS

- SMD technology, for high mounting density
- Industrial and professional applications
- Automotive, general industrial
- Smoothing, filtering, buffering

### MARKING

- Rated capacitance (in  $\mu\text{F}$ )
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Black mark or “-” sign indicating the cathode (the anode is identified by bevelled edges)
- Code indicating group number (Z)

### PACKAGING

Supplied in blister tape on reel.

### QUICK REFERENCE DATA

DESCRIPTION	VALUE
Nominal case sizes (L x W x H in mm)	8 x 8 x 10 to 10 x 10 x 14
Rated capacitance range, $C_R$	33 $\mu\text{F}$ to 1000 $\mu\text{F}$
Tolerance on $C_R$	$\pm 20\%$
Rated voltage range, $U_R$	6.3 V to 63 V
Category temperature range	-55 °C to +105 °C
Endurance test at 105 °C	2000 h
Useful life at 105 °C: case size $\leq 10 \times 10 \times 10$ case size $10 \times 10 \times 14$	2500 h 3000 h
Useful life at 40 °C; 1.8 x $I_R$ applied: case size $\leq 10 \times 10 \times 10$ case size $10 \times 10 \times 14$	125 000 h 150 000 h
Shelf life at 0 V, 105 °C	1000 h
Based on sectional specification	IEC 60384-18 / CECC32300
Climatic category IEC 60068	55/105/56

### SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES (L x W x H in mm)

$C_R$ ( $\mu\text{F}$ )	$U_R$ (V)						
	6.3	10	16	25	35	50	63
33	-	-	-	-	-	-	8 x 8 x 10
47	-	-	-	-	-	-	8 x 8 x 10
	-	-	-	-	-	-	10 x 10 x 10
68	-	-	-	-	-	8 x 8 x 10	10 x 10 x 10
100	-	-	-	-	8 x 8 x 10	10 x 10 x 10	10 x 10 x 14
150	-	-	-	8 x 8 x 10	-	-	-
220	-	-	8 x 8 x 10	8 x 8 x 10	10 x 10 x 10	10 x 10 x 14	-
330	-	8 x 8 x 10	8 x 8 x 10	10 x 10 x 10	10 x 10 x 14	-	-
470	8 x 8 x 10	8 x 8 x 10	10 x 10 x 10	10 x 10 x 14	-	-	-
680	-	10 x 10 x 10	10 x 10 x 14	-	-	-	-
1000	10 x 10 x 10	10 x 10 x 14	-	-	-	-	-



Table 1

<b>DIMENSIONS in millimeters AND MASS</b>									
NOMINAL CASE SIZE L x W x H	CASE CODE	L <sub>max.</sub>	W <sub>max.</sub>	H <sub>max.</sub>	Ø D	B <sub>max.</sub>	S	L <sub>1 max.</sub>	MASS (g)
8 x 8 x 10	0810	8.5	8.5	10.5	8.0	1.0	3.1	9.9	≈ 1.0
10 x 10 x 10	1010	10.5	10.5	10.5	10.0	1.0	4.5	11.8	≈ 1.3
10 x 10 x 14	1014	10.5	10.5	14.3	10.0	1.0	4.5	11.8	≈ 1.5

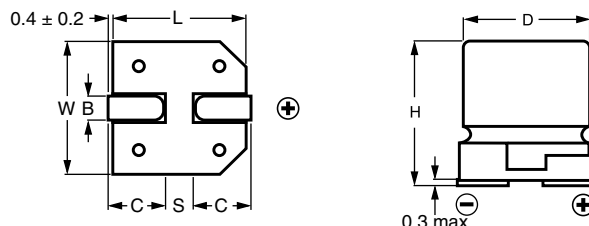


Fig. 2 - Dimensional outline

Table 2

<b>TAPE AND REEL DIMENSIONS in millimeters, PACKAGING QUANTITIES</b>						
NOMINAL CASE SIZE L x W x H	CASE CODE	PITCH P <sub>1</sub>	TAPE WIDTH W	TAPE THICKNESS T <sub>2</sub>	REEL DIA.	PACKAGING QUANTITY PER REEL
8 x 8 x 10	0810	16	24	11.3	380	500
10 x 10 x 10	1010	16	24	11.3	380	500
10 x 10 x 14	1014	16	24	14.8	330	250

**Note**

- Detailed tape dimensions see section "PACKAGING".

**MOUNTING**

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print layout and / or adjacent components.

For recommended soldering pad dimensions, refer to Fig. 3 and Table 3.

**SOLDERING**

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the soldering pad during processing.

For maximum conditions refer to Fig. 4.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

Table 3

<b>RECOMMENDED SOLDERING PAD DIMENSIONS in millimeters</b>			
CASE CODE	a	b	c
0810	3.5	2.5	3.0
1010	4.3	2.5	4.0
1014	4.3	2.5	4.0

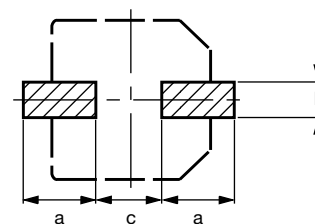


Fig. 3 - Recommended solder pad dimensions

AS A GENERAL PRINCIPLE, TEMPERATURE AND DURATION SHALL BE THE **MINIMUM** NECESSARY REQUIRED TO ENSURE GOOD SOLDERING CONNECTIONS. HOWEVER, THE SPECIFIED MAXIMUM CURVES SHOULD NEVER BE EXCEEDED.

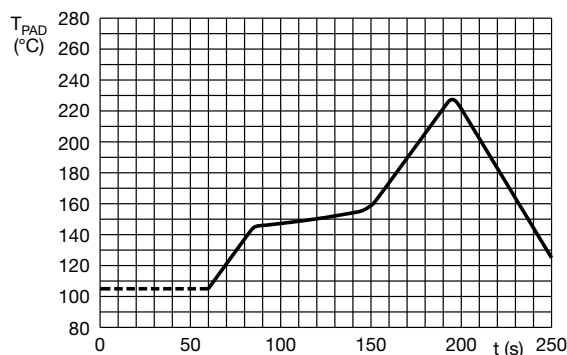


Fig. 4 - Maximum temperature load during infrared reflow soldering measured on the soldering pad



ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 100 Hz, tolerance $\pm 20\%$
$I_R$	Rated RMS ripple current at 100 kHz, 105 °C
$I_{L2}$	Max. leakage current after 2 min at $U_R$
$\tan \delta$	Max. dissipation factor at 100 Hz
$Z$	Max. impedance at 100 kHz

**Note**

- Unless otherwise specified, all electrical values in Table 4 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$ .

Table 4

ELECTRICAL DATA AND ORDERING INFORMATION							
$U_R$ (V)	$C_R$ ( $\mu\text{F}$ )	NOMINAL CASE SIZE $L \times W \times H$ (mm)	$I_R$ 105 °C 100 kHz (mA)	$I_{L2}$ 2 min. (mA)	$\tan \delta$ 100 Hz	$Z$ 100 kHz ( $\Omega$ )	ORDERING CODE MAL2150.....
6.3	470	8 x 8 x 10	435	30	0.24	0.25	95311E3
	1000	10 x 10 x 10	670	63	0.24	0.13	95301E3
10	330	8 x 8 x 10	435	33	0.20	0.25	95411E3
	470	8 x 8 x 10	435	47	0.20	0.25	95412E3
	680	10 x 10 x 10	670	68	0.20	0.13	95401E3
	1000	10 x 10 x 14	850	100	0.20	0.10	95402E3
16	220	8 x 8 x 10	435	35	0.16	0.25	95511E3
	330	8 x 8 x 10	435	53	0.16	0.25	95512E3
	470	10 x 10 x 10	670	75	0.16	0.13	95501E3
	680	10 x 10 x 14	850	109	0.16	0.10	95502E3
25	150	8 x 8 x 10	420	38	0.14	0.28	95611E3
	220	8 x 8 x 10	420	55	0.14	0.28	95612E3
	330	10 x 10 x 10	640	83	0.14	0.14	95601E3
	470	10 x 10 x 14	820	118	0.14	0.11	95602E3
35	100	8 x 8 x 10	405	35	0.12	0.30	95011E3
	220	10 x 10 x 10	630	77	0.12	0.15	95001E3
	330	10 x 10 x 14	790	116	0.12	0.12	95002E3
50	68	8 x 8 x 10	333	34	0.12	0.48	95111E3
	100	10 x 10 x 10	490	50	0.12	0.24	95101E3
	220	10 x 10 x 14	620	110	0.12	0.19	95102E3
63	33	8 x 8 x 10	270	21	0.10	0.65	95812E3
	47	8 x 8 x 10	270	30	0.10	0.65	95811E3
	47	10 x 10 x 10	390	30	0.10	0.38	95801E3
	68	10 x 10 x 10	390	43	0.10	0.38	95802E3
	100	10 x 10 x 14	507	63	0.10	0.29	95803E3

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage for short periods	IEC 60384-18, subclause 4.14	$U_s \leq 1.15 \times U_R$
Reverse voltage for short periods	IEC 60384-18, subclause 4.16	$U_{rev.} \leq 1\text{ V}$
<b>Current</b>		
Leakage current	After 2 min at $U_R$	$I_{L2} \leq 0.01 \times C_R \times U_R$
<b>Inductance</b>		
Equivalent series inductance (ESL)		Typ. 16 nH
<b>Resistance</b>		
Equivalent series resistance (ESR) at 100 Hz	Calculated from $\tan \delta_{max.}$ and $C_R$ (see Table 4)	$ESR = \tan \delta / 2 \pi f C_R$



### CAPACITANCE (C)

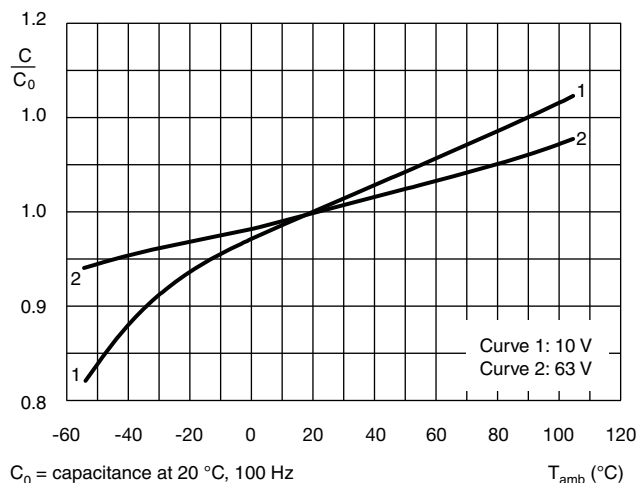


Fig. 5 - Typical multiplier of capacitance as a function of ambient temperatures

### DISSIPATION FACTOR ( $\tan \delta$ )

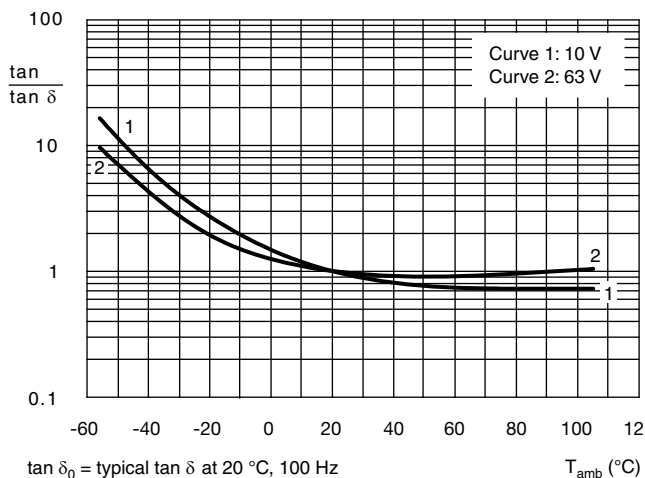


Fig. 6 - Typical multiplier of dissipation factor ( $\tan \delta$ ) as a function of ambient temperatures

### EQUIVALENT SERIES RESISTANCE (ESR)

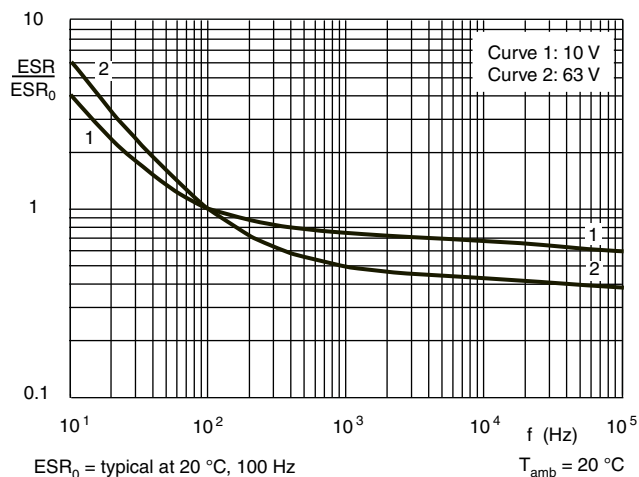


Fig. 7 - Typical multiplier of ESR as a function of frequency

### IMPEDANCE (Z)

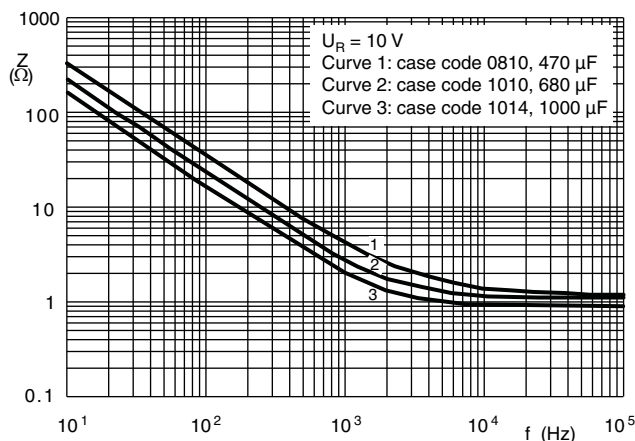


Fig. 8 - Typical impedance as a function of frequency

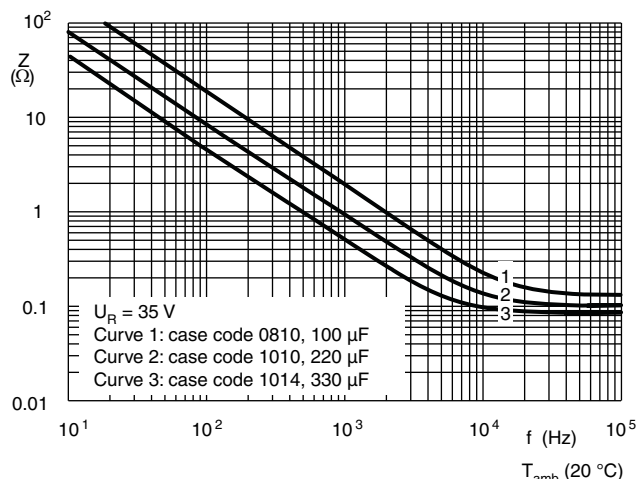


Fig. 9 - Typical impedance as a function of frequency

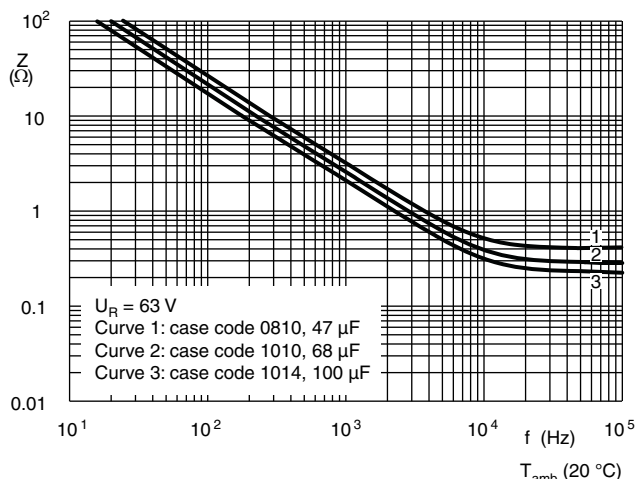


Fig. 10 - Typical impedance as a function of frequency



**RIPPLE CURRENT AND USEFUL LIFE**

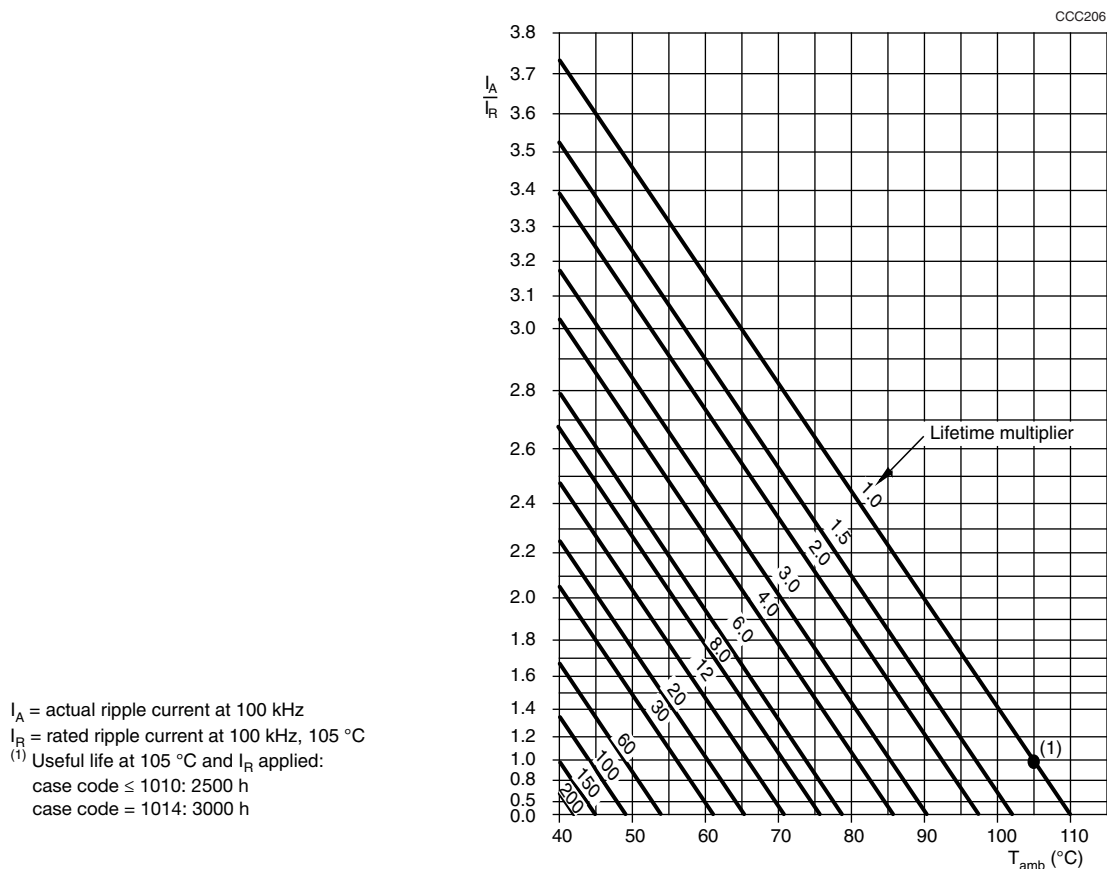


Fig. 11 - Multiplier of useful life as a function of ambient temperature and ripple current load

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY			
FREQUENCY (Hz)	$I_R$ MULTIPLIER		
	$U_R = 6.3 \text{ V TO } 25 \text{ V}$	$U_R = 35 \text{ V}$	$U_R = 50 \text{ V TO } 63 \text{ V}$
100	0.70	0.65	0.60
300	0.80	0.80	0.75
1000	0.85	0.85	0.85
3000	0.93	0.93	0.93
10 000	0.95	0.95	0.95
30 000	0.97	0.97	0.97
100 000	1.00	1.00	1.00



TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Mounting	IEC 60384-18, subclause 4.3	Shall be performed prior to tests mentioned below; reflow soldering; for maximum temperature load refer to chapter "Mounting"	$\Delta C/C: \pm 5 \%$ $\tan \delta \leq \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$
Endurance	IEC 60384-18 / CECC 32300, subclause 4.15	$T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; $U_R$ applied; 2000 h	$U_R = 6.3 \text{ V}$ ; $\Delta C/C: \pm 25 \%$ $U_R \geq 10 \text{ V}$ ; $\Delta C/C: \pm 20 \%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$
Useful life	CECC 30301, subclause 1.8.1	$T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied; case size $\leq 10 \times 10 \times 10$ : 2500 h case size $= 10 \times 10 \times 14$ : 3000 h	$\Delta C/C: \pm 50 \%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1 \%$
Shelf life (storage at high temperature)	IEC 60384-18/ CECC 32300, subclause 4.17	$T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; no voltage applied; 1000 h after test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement	For requirements see "Endurance test" above



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