

Aluminum Capacitors High Temperature Solid Electrolytic SMD

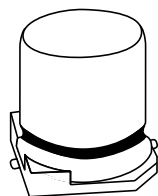
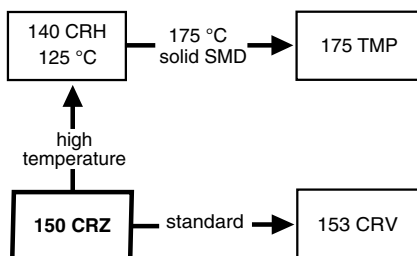


Fig.1 Component outline



FEATURES

- Polarized aluminum electrolytic capacitors SMD, solid electrolyte MnO₂
- Extremely long useful life, 20 000 h/125 °C
- High temperature, usable up to 175 °C
- Excellent impedance and ESR behavior, at low and high temperature
- Charge and discharge proof, application with 0 Ω resistance allowed
- Reverse DC voltage up to 0.5 x U_R allowed
- AC voltage up to 0.8 x U_R allowed
- High shock and vibration capability
- High ripple current per volume in SMD



RoHS
COMPLIANT

APPLICATIONS

- SMD technology
- Smoothing, filtering, buffering
- Telecommunications, professional industrial, EDP, high end power conversion
- Power supplies, SMPS for telecommunications

PACKAGING

Supplied in blister tape on reel.

MARKING

- Rated capacitance (in μF)
- 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 (V) HT

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes (L x W x H in mm)	8 x 8 x 10
Rated capacitance range, C _R	1 to 68 μF
Tolerance on C _R	± 20 %
Rated voltage range, U _R	4 to 40 V
Rated temperature range	- 55 to + 85 °C
Category temperature range:	
U _{C1} = 4 to 25 V	- 55 to + 125 °C
U _{C2} = 4 to 16 V	- 55 to + 175 °C
Endurance test at 175 °C	1000 hours
Endurance test at 125 °C	10 000 hours
Useful life at 175 °C	2000 hours
Useful life at 125 °C	20 000 hours
Useful life at 40 °C, I _R applied	> 300 000 hours
Shelf life at 0 V, 125 °C	500 h
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	55/175/56

SELECTION CHART FOR C _R , U _R AND RELEVANT NOMINAL CASE SIZES							
C _R (μF)	U _R (V) at T _{amb} = 85 °C						
	4	6.3	10	16	20	25	40
	U _{C1} (V) at T _{amb} = 125 °C						
	4	6.3	10	16	20	25	25
	U _{C2} (V) at T _{amb} = 175 °C						
	4	6.3	10	16	16	16	16
1	-	-	-	-	-	-	0810
2.2	-	-	-	-	-	-	0810
3.3	-	-	-	-	-	-	0810
4.7	-	-	-	-	-	-	0810
6.8	-	-	-	-	0810	0810	-
10	-	-	-	0810	-	0810	-
15	-	-	0810	-	-	-	-
22	-	-	0810	-	-	-	-
33	-	0810	-	-	-	-	-
47	-	0810	-	-	-	-	-
68	0810	-	-	-	-	-	-



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Table 1

TAPE AND REEL DIMENSIONS in millimeters					
CASE CODE	PITCH P ₁	TAPE WIDTH W	TAPE THICKNESS T ₂	REEL DIA.	PACKAGING QUANTITY PER REEL
0810	16	24	11	380	500

Table 2

DIMENSIONS in millimeters AND MASS (see Fig.2)									
NOMINAL CASE SIZE L x W x H	CASE CODE	L _{max.}	W _{max.}	H _{max.}	Ø D	B _{max.}	S	C	MASS (g)
8.0 x 8.0 x 10.0	0810	8.4	8.4	10.7	8.0	1	4.7	2.2 ± 0.2	≈ 0.8

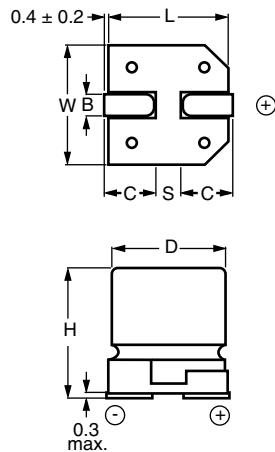


Fig.2 Dimensional outline

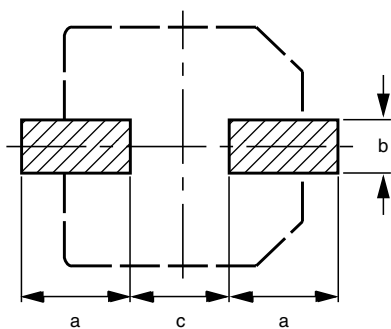


Fig.3 Recommended soldering pad dimensions

AS A GENERAL PRINCIPLE, TEMPERATURE AND DURATION SHALL BE THE **MINIMUM** NECESSARY REQUIRED TO ENSURE GOOD SOLDERING CONNECTIONS.

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.

Resistant against 260 °C reflow temperature; see Fig.4. Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

Table 3

RECOMMENDED SOLDERING PAD DIMENSIONS in millimeters			
CASE CODE	a	b	c
0810	3.0	2.5	4.0

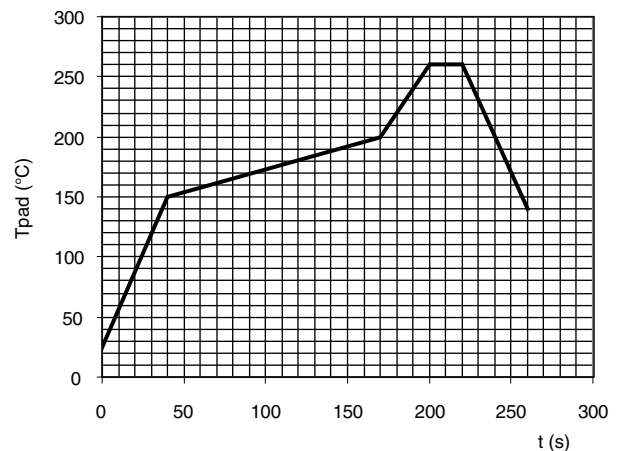


Fig.4 Maximum temperature load during infrared reflow soldering measured on the soldering pad

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ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	rated capacitance at 100 Hz, tolerance $\pm 20\%$
I_R	typical RMS ripple current no necessary DC voltage applied
I_{L5}	typical leakage current after 5 minutes at U_R
ESR	typical equivalent series resistance at 100 kHz
$Z_{F RES}$	typical impedance at average resonance frequency

Note

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

Table 4

ELECTRICAL DATA AND ORDERING INFORMATION											
U_R (V)	U_{C1} 125 $^\circ\text{C}$ (V)	U_{C2} 175 $^\circ\text{C}$ (V)	C_R (μF)	NOMINAL CASE SIZE L x W x H (mm)	I_R 100 kHz 175 $^\circ\text{C}$ (mA)	I_R 100 kHz 40 $^\circ\text{C}$ (mA)	I_{L5} 5 min (mA)	TYP. ESR 100 kHz (Ω)	TYP. $Z_{F RES}$ (Ω)	TYP. $Z_{F RES}$ (MHz)	ORDERING CODE MAL2175.....
4	4	4	68	8.0 x 8.0 x 10.0	426	2660	5	0.15	0.11	0.65	72689E3
6.3	6.3	6.3	33	8.0 x 8.0 x 10.0	426	2660	4	0.15	0.1	0.71	73339E3
			47	8.0 x 8.0 x 10.0	413	2580	5	0.16	0.11	0.73	73479E3
10	10	10	15	8.0 x 8.0 x 10.0	234	1460	3	0.5	0.25	2.0	74159E3
			22	8.0 x 8.0 x 10.0	301	1880	3	0.31	0.22	2.0	74229E3
16	16	16	10	8.0 x 8.0 x 10.0	186	1160	3	0.79	0.38	3.2	75109E3
20	20	16	6.8	8.0 x 8.0 x 10.0	142	890	2	1.31	0.69	5.1	78688E3
25	25	16	3.3	8.0 x 8.0 x 10.0	91	653	2	2.0	0.7	7.7	76338E3
			4.7	8.0 x 8.0 x 10.0	131	740	2	1.6	0.63	6.4	76478E3
			6.8	8.0 x 8.0 x 10.0	139	870	4	1.33	0.52	4.95	76688E3
			10	8.0 x 8.0 x 10.0	186	1160	4	0.79	0.38	3.2	76109E3
40	25	16	1.0	8.0 x 8.0 x 10.0	94	590	2	3.12	0.86	9.6	77108E3
			2.2	8.0 x 8.0 x 10.0	112	700	2	2.16	0.74	7.5	77228E3

ORDERING EXAMPLE

Electrolytic capacitor 175 TMP series

47 $\mu\text{F}/6.3\text{ V}$; $\pm 20\%$

Nominal case size: 8 x 8 x 10 mm; taped on reel

Lead (Pb)-free terminations

Ordering code: MAL217573479E3

Former 12NC: 222217573479



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ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage	$T_{amb} = 85\text{ }^\circ\text{C}$:	
	at $U_R = 4$ to 16 V	$U_{rev} < 0.5 U_R$
	at $U_R = 20\text{ V}$	$U_{rev} < 0.4 U_R$
	at $U_R = 25$ to 40 V	$U_{rev} < 0.3 U_R$
	$T_{amb} = 125\text{ }^\circ\text{C}$:	
	at $U_R = 4$ to 16 V	$U_{rev} < 0.4 U_R$
	at $U_R = 20\text{ V}$	$U_{rev} < 0.2 U_R$
	at $U_R = 25$ to 40 V	$U_{rev} < 0.1 U_R$
	$T_{amb} = 175\text{ }^\circ\text{C}$:	
at $U_R = 4$ to 16 V	$U_{rev} < 0.3 U_R$	
at $U_R = 20\text{ V}$	$U_{rev} < 0.15 U_R$	
at $U_R = 25$ to 40 V	$U_{rev} < 0.1 U_R$	
Maximum peak AC voltage	Reverse voltage applied	$\leq 2\text{ V}$
Maximum peak AC voltage, without reverse voltage applied	$T_{amb} = 85\text{ }^\circ\text{C}$:	
	at $f \leq 0.1\text{ Hz}$	$0.30 \times U_R$
	at $0.1\text{ Hz} < f \leq 1\text{ Hz}$	$0.45 \times U_R$
	at $1\text{ Hz} < f \leq 10\text{ Hz}$	$0.60 \times U_R$
	at $10\text{ Hz} < f \leq 50\text{ Hz}$	$0.65 \times U_R$
	at $f > 50\text{ Hz}$	$0.80 \times U_R$
	$85\text{ }^\circ\text{C} < T_{amb} \leq 125\text{ }^\circ\text{C}$:	
	at $f \leq 0.1\text{ Hz}$	$0.15 \times U_R$
	at $0.1\text{ Hz} < f \leq 1\text{ Hz}$	$0.22 \times U_R$
	at $1\text{ Hz} < f \leq 10\text{ Hz}$	$0.30 \times U_R$
	at $10\text{ Hz} < f \leq 50\text{ Hz}$	$0.32 \times U_R$
	at $f > 50\text{ Hz}$	$0.40 \times U_R$
$125\text{ }^\circ\text{C} \leq T_{amb} \leq 175\text{ }^\circ\text{C}$:		
at $f < 50\text{ Hz}$	$0.1 \times U_R$	
at $f > 50\text{ Hz}$	$0.2 \times U_R$	
Inductance		
Equivalent series inductance (ESL)	Case sizes (mm): $8 \times 8 \times 10$	typ. 9 to 14 nH
Dissipation		
Maximum power dissipation	Case sizes (mm): $8 \times 8 \times 10$	$P_{max.} = P_{125}\text{ mW}$ 350
Current		
Maximum leakage current	After 5 minutes at U_R and $T_{amb} = 25\text{ }^\circ\text{C}$	see Table 4

175 TMP

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VOLTAGE

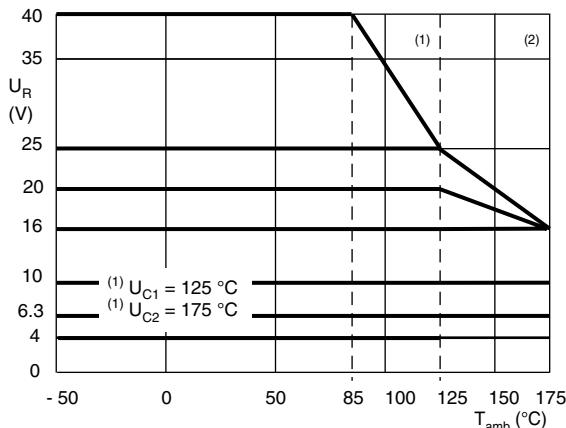
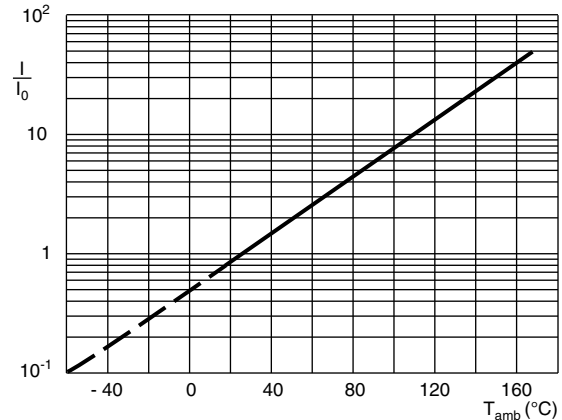


Fig.5 Maximum permissible voltage up to $T_{amb} = 175^\circ\text{C}$

LEAKAGE CURRENT



I_0 = leakage current during continuous operation at U_R and $T_{amb} = 25^\circ\text{C}$
Fig.8 Typical multiplier of leakage current as a function of ambient temperature

CAPACITANCE (C)

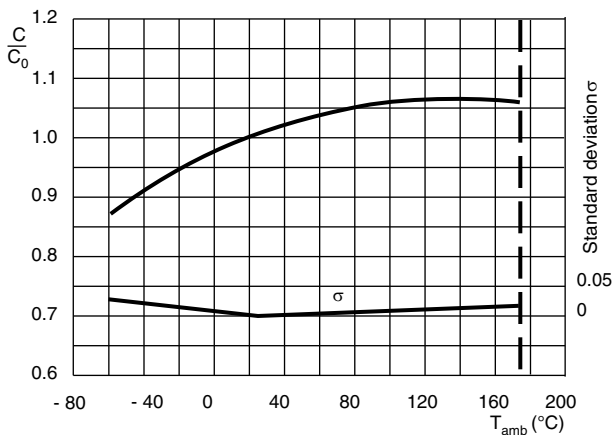


Fig.6 Typical multiplier of capacitance and standard deviation as functions of ambient temperature

EQUIVALENT SERIES RESISTANCE (ESR)

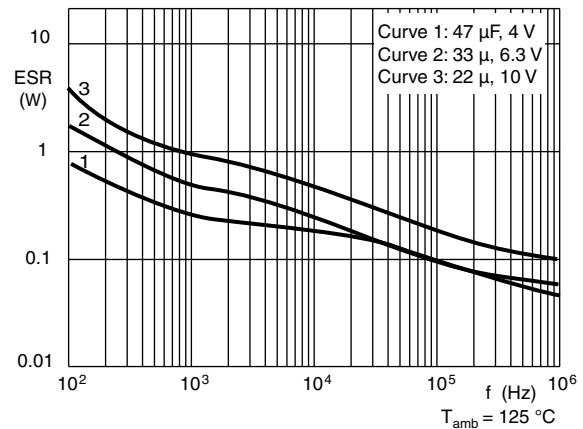
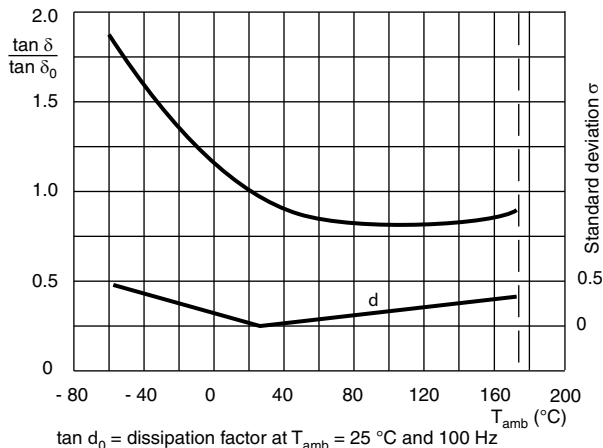


Fig.9 Typical ESR as a function of frequency at 125°C

DISSIPATION FACTOR ($\tan \delta$)



$\tan \delta_0$ = dissipation factor at $T_{amb} = 25^\circ\text{C}$ and 100 Hz
Fig.7 Typical multiplier of dissipation factor and standard deviation as functions of ambient temperature

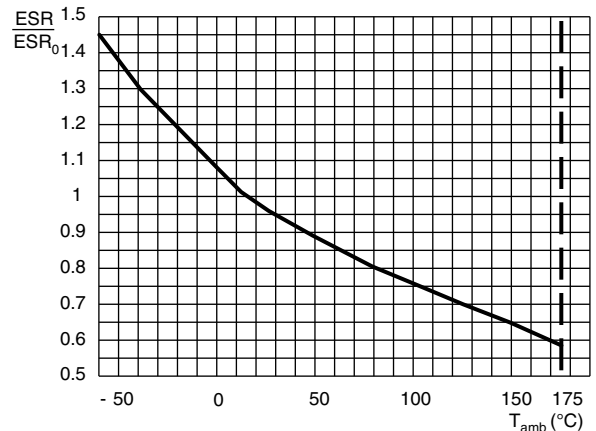


Fig.10 ESR correction multiplier as a function of temperature



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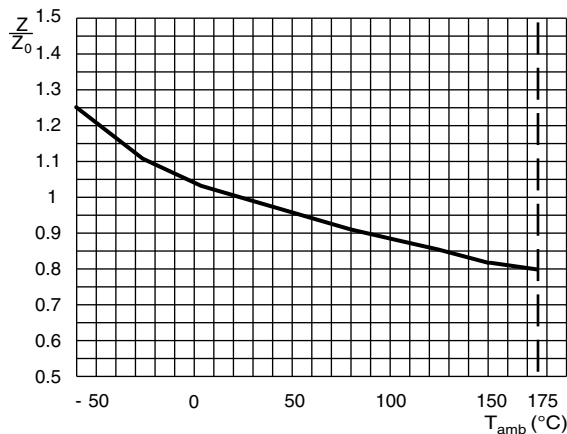
IMPEDANCE (Z)

Fig.11 Z correction multiplier as a function of temperature

RIPPLE CURRENT (I_R)

Applying the maximum RMS ripple current given in below table will cause a device temperature of 175 °C.

PARAMETER	T _{amb}					
	40 °C	85 °C	105 °C	125 °C	150 °C	175 °C
I _R multiplier; 100 kHz	1.0	0.87	0.78	0.67	0.5	0.16

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS (1)
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"	ΔC/C: ± 10 % tan δ ≤ spec. limit I _{L2} ≤ spec. limit
Endurance	IEC 60384-4/ EN130300 subclause 4.13	T _{amb} = 125 °C; U _R = 4 to 25 V with U _R applied; U _R = 40 V with U _C applied; 10 000 h T _{amb} = 175 °C; U _R = 4 to 16 V with U _R applied; U _R = 20 to 40 V with U _C applied; 1000 h	ΔC/C: ± 10 % tan δ ≤ 1.2 x spec. limit Z ≤ 1.2 x spec. limit I _{L5} ≤ spec. limit
Useful life	CECC 30302 subclause 1.8.1	T _{amb} = 175 °C; I _R applied and: U _R = 4 to 16 V with U _R applied; U _R = 20 and 40 V with U _C applied; 2000 h	ΔC/C: ± 15 % tan δ ≤ 1.5 x spec. limit Z ≤ 1.5 x spec. limit I _{L5} ≤ spec. limit no short or open circuit, no visible damage total failure percentage: < 1 %
Shelf life (2)	IEC 60384-4/ EN130300 subclause 4.17	T _{amb} = 125 °C; no voltage applied; 500 h	ΔC/C: ± 10 % tan δ ≤ 1.2 x spec. limit I _{L5} ≤ 1 x spec. limit
Charge and discharge	IEC 60384-4-2 subclause 9.21	10 ⁶ cycles without series resistance: 0.5 s to U _R ; 0.5 s to ground	ΔC/C: ± 5 % no short or open circuit, no visible damage

Notes

(1) Specification limits on request

(2) MSL acc. J-STD-020D is not specified

175 TMP

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Aluminum Capacitors
High Temperature Solid Electrolytic SMD

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS ⁽¹⁾
NAME OF TEST	REFERENCE		
Solvent resistance	IEC 60068-2-45, test XA IEC 60653	immersion: 5 ± 0.5 min with or without ultrasonic at 55 ± 5 °C solvents: demineralized water and/or calgonite solution (20 g/l)	visual appearance not affected
Vibration	IEC 60068-2-6 test Fc	10 to 2000 Hz; 1.5 mm or 20 g; 1 octave/min; 3 directions; 2 h per direction; no voltage applied	no intermittent contacts no breakdown no open circuiting no mechanical damage $\Delta C/C: \pm 5\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $Z \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 1.5 \times \text{spec. limit}$
Shock	IEC 60068-2-27 test Ea	half-sine or sawtooth pulse shape; 50 g; 11 ms; 3 successive shocks in each direction of 3 mutually perpendicular axes; no voltage applied	no intermittent contacts no breakdown no open circuiting no mechanical damage $\Delta C/C: \pm 5\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $Z \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 1.5 \times \text{spec. limit}$
Bump	IEC 60384-4/ EN 130300 subclass 4.9	40 g; 2 directions; 4000 bumps total	no visible damage $\Delta C/C: \pm 5\%$ with respect to initial measurement
Passive flammability	IEC 60695-2-2	capacitor mounted to a vertical printed-circuit board, one flame on capacitor body; $T_{\text{amb}} = 20$ to 25 °C; test duration = 20 s	after removing the test flame from the capacitor, the capacitor must not continue to burn for more than 15 s no burning particles must drop from the sample

Notes⁽¹⁾ Specification limits on request⁽²⁾ MSL acc. J-STD-020D is not specified



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