

## SMD Aluminum Electrolytic Capacitors



### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- SMD version with base plate, vertical construction, requiring minimum board space
- High CV per unit volume
- Ø 4 mm to Ø 18 mm, 105 °C, 2000 h endurance
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- SMD technology
- Coupling, decoupling, smoothing, filtering, buffering, timing
- Telecommunications, general industrial, EDP, portable and lightweight equipment

### QUICK REFERENCE DATA

DESCRIPTION	UNIT	VALUE	
Nominal case sizes (Ø D)	mm	4 x 5.7 to 18 x 21.5	
Rated capacitance range	µF	0.22 to 8200	
Capacitance tolerance	%	± 20 (at 120 Hz, 20 °C)	
Rated voltage range	V <sub>DC</sub>	6.3 to 100	160 to 450
Category temperature range	°C	-55 to +105	-40 to +105
Endurance	h	2000	
Shelf life	h	1000	

### ORDERING INFORMATION

Part number example: GSC00BX2211HARL

<u>GSC</u>	<u>00</u>	<u>BX</u>	<u>221</u>	<u>1H</u>	<u>AR</u>	<u>L</u>
SERIES NAME	DESIGN / FORMING	DIMENSIONS	CAPACITANCE	VOLTAGE	PACKING	INTERNAL CODE
		See "Dimensions" table	See "Selection Chart"	See "Selection Chart"	Tape and Reel	

**ADDITIONAL ELECTRICAL DATA**

<b>LEAKAGE CURRENT</b> (Test conditions: $U_R$ , 20 °C)			
RATED VOLTAGE	TIME	CASE SIZE	VALUE
6.3 V to 100 V	after 2 min	Ø 4 mm to Ø 10 mm	$I = 0.01 CV$ or 3 µA, whichever is greater
		Ø 12.5 mm to Ø 18 mm	$I = 0.03 CV$ or 4 µA, whichever is greater
160 V to 450 V	after 5 min	Ø 12.5 mm to Ø 18 mm	$I = 0.04 CV + 100 \mu A$

**Notes**

- Where, C = rated capacitance in µF
- V = rated DC working voltage in V

<b>DISSIPATION FACTOR</b> (tan δ at 120 Hz, 20 °C)										
RATED VOLTAGE	6.3	10	16	25	35	50	63	100	160 TO 250	400 TO 450
Ø 4 mm to Ø 10 mm	0.45	0.35	0.28	0.18	0.16	0.14	0.12	0.12	-	-
Ø 12.5 mm to Ø 18 mm	0.40	0.38	0.34	0.26	0.22	0.18	0.14	0.10	0.20	0.25

**Note**

- When the capacitance exceeds 1000 µF, 0.02 shall be added every 1000 µF increase.

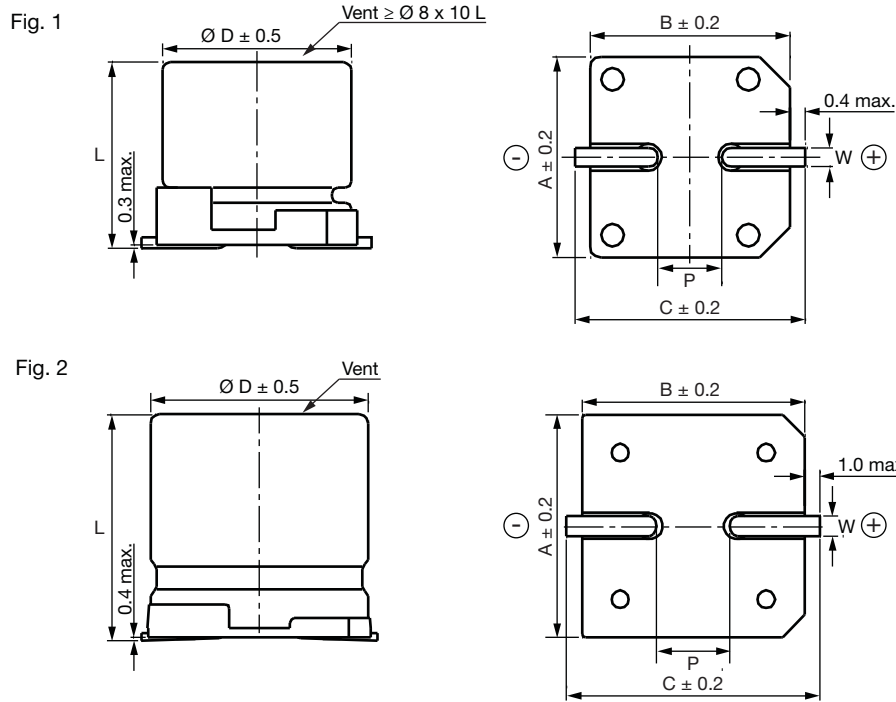
<b>LOW TEMPERATURE BEHAVIOR</b> (at 120 Hz)											
IMPEDANCE RATIO	CASE SIZE	RATED VOLTAGE									
		6.3	10	16	25	35	50	63	100	160 TO 250	400 TO 450
$\frac{Z_{(-25\text{ °C})}}{Z_{(+20\text{ °C})}}$	Ø D < 12.5 mm	4	4	3	2	2	2	2	3	-	-
	Ø D ≥ 12.5 mm	5	4	3	2	2	2	2	2	3	6
$\frac{Z_{(-55\text{ °C or } -40\text{ °C})}}{Z_{(+20\text{ °C})}}$	Ø D < 12.5 mm	12	8	6	4	3	3	3	4	-	-
	Ø D ≥ 12.5 mm	10	8	6	4	3	3	3	3	6	10

<b>MULTIPLIER OF RIPPLE CURRENT AS A FUNCTION OF FREQUENCY</b>		
FREQUENCY (Hz)	CAPACITANCE (µF)	
	< 1000	1000 < C ≤ 4700
50	0.80	0.85
120	1.00	1.00
1000	1.25	1.15
10 000 and up	1.40	1.25

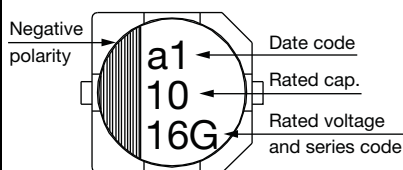
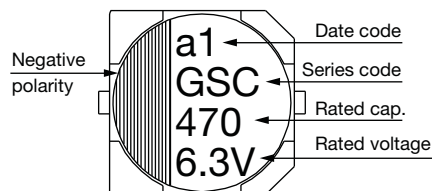
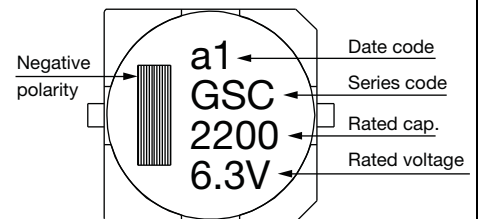
<b>TEST PROCEDURES AND REQUIREMENTS</b>				
TEST	TEST TIME	CAPACITANCE CHANGE	DISSIPATION FACTOR	LEAKAGE CURRENT
Endurance <sup>(1)</sup>	2000 h	Within ± 25 % of initial value for Ø ≤ D 6.3 mm; within ± 20 % of initial value for Ø ≥ D 8 mm	Less than 300 % of specified value for Ø ≤ D 6.3 mm; less than 200 % of specified value for Ø ≥ D 8 mm;	Within specified value
Shelf life <sup>(2)</sup>	1000 h			

**Notes**

- The specifications shall be satisfied when the capacitors are restored to 20 °C after the rated voltage applied for 2000 h at 105 °C.
- The rated voltage shall be applied to the capacitors before measurements for 160 V to 450 V (refer to JIS C 5101-44.1).

**DIMENSIONS** in millimeters


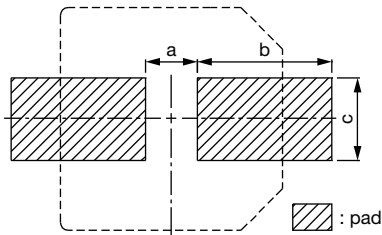
CASE SIZE CODE	$\varnothing D$	L	A	B	C	W	P $\pm 0.2$	FIG. NO.
AB	4 x 5.7	4	5.7 $\pm 0.3$	4.3	4.3	5.1	1.0	1
AC	5 x 5.7	5	5.7 $\pm 0.3$	5.3	5.3	5.9	1.5	1
AD	6.3 x 5.7	6.3	5.7 $\pm 0.3$	6.6	6.6	7.2	2.0	1
BM	6.3 x 7.7	6.3	7.7 $\pm 0.3$	6.6	6.6	7.2	2.0	1
AE	8 x 6.5	8	6.5 $\pm 0.3$	8.4	8.4	9.0	2.3	1
AF	8 x 10	8	10 $\pm 0.5$	8.4	8.4	9.0	3.1	1
XM	10 x 7.7	10	7.7 $\pm 0.3$	10.4	10.4	11.0	4.7	1
AG	10 x 10	10	10 $\pm 0.5$	10.4	10.4	11.0	4.7	1
AH	12.5 x 13.5	12.5	13.5 $\pm 0.5$	13	13	13.7	4.4	2
CX	12.5 x 16	12.5	16 $\pm 0.5$	13	13	13.7	4.4	2
AK	16 x 16.5	16	16.5 $\pm 0.5$	17	17	18.0	6.4	2
AM	16 x 21.5	16	21.5 $\pm 0.5$	17	17	18.0	6.4	2
AN	18 x 16.5	18	16.5 $\pm 0.5$	19	19	20.0	6.4	2
AP	18 x 21.5	18	21.5 $\pm 0.5$	19	19	20.0	6.4	2

**MARKING**
 $\varnothing D \leq 6.3$  mm

 $\varnothing D = 8$  mm to 10 mm

 $\varnothing D \geq 12.5$  mm




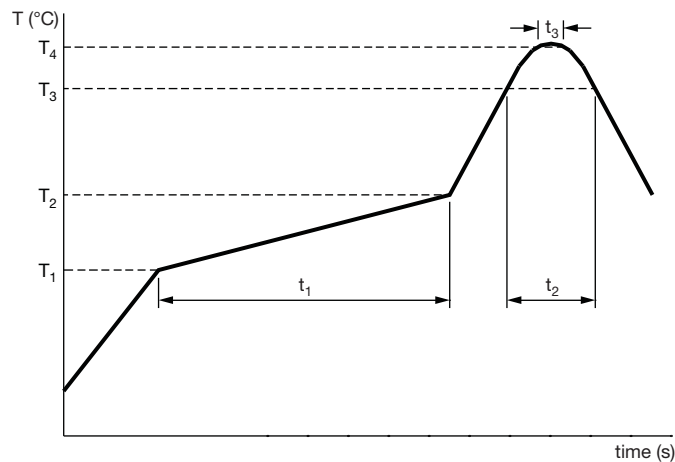
<b>SELECTION CHART, DIMENSIONS, AND PERMISSIBLE RIPPLE CURRENT (at 120 Hz / 105 °C)</b>															
<b>V<sub>DC</sub></b>		<b>6.3 (0J)</b>		<b>10 (1A)</b>		<b>16 (1C)</b>		<b>25 (1E)</b>		<b>35 (1V)</b>		<b>50 (1H)</b>		<b>63 (1J)</b>	
<b>CAP.</b>	<b>CODE</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>
1.0	010											4 x 5.7	8	4 x 5.7	8
2.2	2R2											4 x 5.7	12	4 x 5.7	12
3.3	3R3											4 x 5.7	14	5 x 5.7	17
4.7	4R7							4 x 5.7	17	4 x 5.7	17	5 x 5.7	20	6.3 x 5.7	22
10	100					4 x 5.7	20	4 x 5.7	20	5 x 5.7	27	6.3 x 5.7	32	6.3 x 5.7 8 x 6.5	32 51
22	220	4 x 5.7	22	4 x 5.7	22	5 x 5.7	30	5 x 5.7	30	6.3 x 5.7	44	6.3 x 5.7 8 x 6.5	38 67	6.3 x 7.7	58
33	330	5 x 5.7	34	5 x 5.7	34	5 x 5.7	34	6.3 x 5.7	46	6.3 x 5.7 8 x 6.5	46 76	6.3 x 7.7	65	8 x 10	140
47	470	5 x 5.7	38	5 x 5.7	38	6.3 x 5.7	48	6.3 x 5.7 8 x 6.5	48 79	6.3 x 7.7	80	6.3 x 7.7	70	8 x 10	170
100	101	6.3 x 5.7	69	6.3 x 5.7 8 x 6.5	69 90	6.3 x 5.7	69	6.3 x 7.7	100	8 x 10	240	8 x 10	210	10 x 10	310
220	221	6.3 x 7.7 8 x 6.5	120	6.3 x 7.7	120	6.3 x 7.7	120	8 x 10 10 x 7.7	270	8 x 10	270	10 x 10	330	12.5 x 13.5	470
330	331	8 x 10	290	8 x 10	290	8 x 10 10 x 7.7	290	8 x 10	290	10 x 10	370	12.5 x 13.5	490	16 x 16.5	650
470	471	8 x 10	320	8 x 10 10 x 7.7	320	10 x 10	380	10 x 10	380	12.5 x 13.5	520	12.5 x 16	550	16 x 16.5	700
1000	102	10 x 10	410	10 x 10	410	12.5 x 13.5	550	12.5 x 16	550	16 x 16.5	800	18 x 16.5	990		
2200	222	12.5 x 13.5	680	12.5 x 13.5	680	16 x 16.5	900	16 x 16.5	900	18 x 16.5	1050				
3300	332	12.5 x 16	850	16 x 16.5	950	16 x 16.5	950	18 x 16.5 16 x 21.5	1150 1200						
4700	472	16 x 16.5	1000	16 x 16.5	1000	18 x 16.5 16 x 21.5	1225 1275	18 x 21.5	1300						
6800	682	18 x 16.5 16 x 21.5	1290 1350	18 x 16.5 16 x 21.5	1290 1350										
8200	822	18 x 21.5	1450	18 x 21.5	1450										

<b>SELECTION CHART, DIMENSIONS, AND PERMISSIBLE RIPPLE CURRENT (at 120 Hz / 105 °C)</b>													
<b>V<sub>DC</sub></b>		<b>100 (2A)</b>		<b>160 (2C)</b>		<b>200 (2D)</b>		<b>250 (2E)</b>		<b>400 (2G)</b>		<b>450 (2W)</b>	
<b>CAP.</b>	<b>CODE</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>	<b>Ø D x L</b>	<b>mA</b>
4.7	4R7							12.5 x 13.5	65	12.5 x 13.5	45	12.5 x 13.5	45
10	100					12.5 x 13.5	80	12.5 x 13.5	70	12.5 x 13.5	50	12.5 x 16	75
22	220	8 x 10	100			12.5 x 16	110	12.5 x 13.5	105	16 x 16.5	85	16 x 16.5	85
33	330	10 x 10	150	12.5 x 13.5	95	12.5 x 16	120	16 x 16.5	180	18 x 16.5	100	18 x 16.5	100
47	470	12.5 x 13.5	250	16 x 16.5	240	16 x 16.5	220	16 x 16.5	220	18 x 21.5	130		
100	101	12.5 x 13.5	380	16 x 16.5	250	18 x 16.5	280	18 x 16.5	260				
220	221	16 x 16.5	450										
330	331	18 x 16.5 16 x 21.5	590 750										
470	471	18 x 21.5	980										
1000	102												
2200	222												
3300	332												
4700	472												
6800	682												

**SOLDERING**


Recommended soldering pad dimensions

<b>RECOMMENDED SOLDERING PAD DIMENSIONS</b> in millimeters			
CASE SIZE ( $\emptyset$ )	LAND SIZE		
	a	b	c
3	0.8	2.2	1.6
4	1.0	2.6	1.6
5	1.4	3.0	1.6
6.3	1.9	3.5	1.6
8 x 6.5	2.1	4.0	1.6
8	3.0	3.5	2.5
10	4.0	4.0	2.5
12.5	4.0	6.0	3.2
16	6.0	7.0	3.2
18	6.0	8.0	3.2

**STANDARD SOLDERING PROFILE FOR LEAD (Pb)-FREE REFLOW PROCESS**


Maximum temperature load during reflow soldering

<b>REFLOW SOLDERING CONDITIONS</b>					
Rated voltage (V)	4 to 50	4 to 50	63 and up	4 and up	
Case size ( $\emptyset$ )	4 to 6.3 x 4.5 long	3 to 6.3	3 to 6.3	8 to 18	
Preheat	Temperature ( $T_1$ to $T_2$ , °C)	150 to 180			
	Time ( $t_1$ ) (max., s)	1210	100		
Duration	Temperature ( $T_3$ , °C)	230	217	230	217
	Time ( $t_2$ ) (max., s)	30	90	60	60
Peak	Temperature ( $T_4$ , °C)	250	260		250
	Time ( $t_3$ , s)	5			
Reflow cycles	1			2 or less	

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