ESG, +105°C



Overview

The KEMET ESG radial aluminum electrolytic capacitors are designed for long life (5,000 hours) and high reliability applications.

Applications

Typical applications include electronic ballast, power supplies, and long-life equipment.

Benefits

- · Suited for long life, high reliability applications
- Operating temperature of up to 105°C
- 3,000 5,000 hour operating life
- · High ripple current
- · Safety vent on the capacitor base



Part Number System

ESG	226	M	160		A	H4	AA
Series	Capacitance Code (pF)	Tolerance	Rated Voltage (VDC)		Electrical Parameters	Size Code	Packaging
Radial Aluminum Electrolytic	First two digits represent significant figures for capacitance values. Last digit specifies the number of zeros to be added.	M = ±20%	160 = 160 200 = 200 250 = 250 350 = 350	400 = 400 450 = 450 500 = 500	A = Standard	See Dimension Table	See Ordering Options Table



Ordering Options Table

Diameter	Length	Packaging Type	Lead Type	Lead Length (mm)	Lead and Packaging Code			
		Standard Bul	k Packaging Options					
4 - 22	All	Bulk (bag)	Straight	20/15 Minimum	AA			
	Tape & Reel							
4 - 5	All	Tape & Reel	Formed to 2.5 mm	H ₀ = 16 ±0.75	LA			
4 - 8	All	Tape & Reel	2.5 mm lead spacing	H ₀ = 18.5 ±0.75	KA			
4 - 8	All	Tape & Reel	Formed to 5 mm	$H_0 = 16 \pm 0.75$	JA			
10	≤ 20	Tape & Reel	Straight	H ₀ = 18.5 ±0.75	KA			
		Ar	nmo Pack					
4 - 8	All	Ammo	Formed to 5 mm	$H_0 = 16 \pm 0.75$	DA			
4 - 8	All	Ammo	Straight	H ₀ = 18.5 ±0.75	EA			
4 - 5	All	Ammo	Formed to 2.5 mm	$H_0 = 16 \pm 0.75$	FA			
10 - 13	All	Ammo	5 mm lead spacing	H ₀ = 18.5 ±0.75	EA			
16	All	Ammo	7.5 mm lead spacing	H ₀ = 18.5 ±0.75	EA			
18	≤ 25	Ammo	7.5 mm lead spacing	$H_0 = 18.5 \pm 0.75$	EA			
		Contact KEMET for oth	er lead and packaging op	otions				

Environmental Compliance

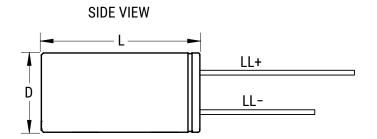
As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and fulfill these legislative requirements. The only material of concern in our products has been lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of lead in any homogeneous material. KEMET will closely follow any changes in legislation world wide and make any necessary changes in its products, whenever needed.

Some customer segments such as medical, military and automotive electronics may still require the use of lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

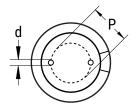
Due to customer requirements, there may appear additional markings such as lead free (LF) or lead-free wires (LFW) on the label.



Dimensions - Millimeters



TERMINAL END VIEW



0: 0 - 1	I	D		L		P		d	LL+/LL-
Size Code	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Minimum
H9	10	±0.5	12.5	+1.5/-0	5.0	±0.5	0.6	Nominal	20/15
H2	10	±0.5	15.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
H8	10	±0.5	16.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
H4	10	±0.5	20.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
H5	10	±0.5	25.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
L3	13	±0.5	20.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
L4	13	±0.5	25.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15
M5	16	±0.5	20.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
M7	16	±0.5	25.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
M1	16	±0.5	26.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
M9	16	±0.5	30.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
M2	16	±0.5	32.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
М3	16	±0.5	36.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
N4	18	±0.5	20.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
N5	18	±0.5	25.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
N1	18	±0.5	32.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
N2	18	±0.5	36.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
N3	18	±0.5	40.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15
Q3	22	±0.5	35.0	+2.0/-0	10.0	±0.5	0.8	Nominal	20/15
Q4	22	±0.5	40.0	+2.0/-0	10.0	±0.5	0.8	Nominal	20/15
Q5	22	±0.5	45.0	+2.0/-0	10.0	±0.5	0.8	Nominal	20/15



Performance Characteristics

ltem	Performance (Characteristics			
Capacitance Range	4.7 – 330 μF	3.3 – 100 μF			
Capacitance Tolerance	±20% at 12	20 Hz/20°C			
Rated Voltage	160 - 400 VDC	450 - 500 VDC			
Life Test	5,000 hours (see conditions in	Test Methods & Performance)			
Operating Temperature	-40°C to +105°C	-25°C to +105°C			
Lasterna Ourrent	I = 0.06 CV (μA) +10 μA				
Leakage Current	C = rated capacitance (μ F), V = rated voltage (VDC). Voltage applied for 2 minutes at 20°C.				

Impedance Z Characteristics at 120 Hz

Rated Voltage (VDC)	160	200	250	350	400	450	500
Z (-25°C)/Z (20°C)	3	3	3	5	5	6	6
Z (-40°C)/Z (20°C)	6	6	6	6	6		

Compensation Factor of Ripple Current (RC) vs. Frequency

Rated Voltage (VDC)	50 - 60 Hz	120 Hz	300 Hz	1 kHz	10 – 100 kHz
160 – 450	0.80	1.00	1.20	1.40	1.60
500	0.75	1.00	1.20	1.35	1.50



Test Method & Performance

Conditions	Load Life Test	Shelf Life Test				
Temperature	105°C	105°C				
Took Duration	5,000 hours	1,000 hours				
Test Duration	If dimension is down size	If dimension is down size Endurance is 3,000 hours.				
Ripple Current	Maximum ripple current specified at 120 Hz 105°C	No ripple current applied				
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	No voltage applied				
Performance	The following specifications will be satisfi	ed when the capacitor is restored to 20°C:				
Capacitance Change	Within ±20% of the initial value					
Dissipation Factor	Does not exceed 200% of the specified value					
Leakage Current	Does not exceed specified value					

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however, the leakage current will very slowly increase.

KEMET's E aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition for KEMET's E aluminum electrolytic capacitors is +5 to +35°C and less than 75% in relative humidity. KEMET's E aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray. KEMET's E aluminum electrolytic capacitors should not be stored in an environment full of hazardous gas (hydrogen sulphide, sulphurous acid gas, nitrous acid, chlorine gas, ammonium, etc.) KEMET's E aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

If a capacitor has been stored for more than 18 months under these conditions and it shows increased leakage current, then a treatment by voltage application is recommended.

Re-Age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA, whichever is greater, is suggested.



Table 1 - Ratings & Part Number Reference

The color of the	Rated Voltage	Surge Voltage	Rated Capacitance	Case Size	DF	RC	LC	Part Number
160	(VDC)	(VDC)						() Represents Part Number Options
160	160			10 x 20		160		ESG226M160AH4(1)
160 200 68 13 x 25 15 360 663.0 ESG6566 160 200 100 16 x 25 15 430 663.0 ESG6566 160 200 100 16 x 25 15 475 970.0 ESG017/0 160 200 150 16 x 22 15 650 1450.0 ESG017/0 160 200 150 16 x 22 15 650 1450.0 ESG117/0 160 200 220 150 16 x 22 15 650 1450.0 ESG117/0 160 200 220 16 x 22 15 750 2122.0 ESG017/0 160 200 220 16 x 22 15 750 2122.0 ESG017/0 160 200 220 16 x 22 15 750 2122.0 ESG017/0 160 200 220 16 x 22 15 750 2122.0 ESG017/0 160 200 250 10 410 x 16 15 80 274.0 ESG017/0 274.0 ESG017/0 270	160	200	33	10 x 20	15	210	327.0	ESG336M160AH4(1)
160 200 68	160	200	47	13 x 20	15	260	461.0	ESG476M160AL3(1)
160 200 100 16 x 25 15	160	200	68	13 x 25	15	360	663.0	ESG686M160AL4(1)
160	160	200	68	16 x 20	15	430	663.0	ESG686M160AM5(1)
160 200 150 15 x 32 15 650 1450.0 ESG1576 160 200 150 150 18 x 25 15 750 2122.0 ESG1276 160 200 220 16 x 32 15 750 2122.0 ESG2276 160 200 220 16 x 32 15 750 2122.0 ESG2276 160 200 220 18 x 25 15 750 2122.0 ESG2276 160 200 250 10 10 x 10 x 16 15 80 274.0 ESG1666 200 250 15 10 x 10 x 16 15 100 274.0 ESG1666 200 250 250 15 10 x 20 15 160 274.0 ESG1666 200 250 33 10 x 20 15 160 406.0 ESG3566 200 250 33 10 x 20 15 160 406.0 ESG3566 200 250 33 13 x 20 15 200 406.0 ESG3566 200 250 68 16 x 20 15 430 826.0 ESG6666 200 250 68 16 x 20 15 430 826.0 ESG6666 200 250 68 16 x 20 15 430 826.0 ESG6666 200 250 100 18 x 25 15 455 1210.0 ESG1676 200 250 250 100 18 x 25 15 465 1210.0 ESG1676 200 250 250 100 18 x 25 15 465 1210.0 ESG1676 250 250 200 250 100 18 x 25 15 780 2550.0 100 18 x 25 15 780 2550.0 250 220 18 x 32 15 780 2550.0 250 250 200 250 300 10 10 x 25 15 145 160.0 ESG1676 250 300 10 10 x 25 15 145 160.0 ESG1676 250 300 10 10 x 25 15 145 160.0 ESG1676 250 300 10 10 x 25 15 145 160.0 ESG1676 250 300 10 10 x 25 15 10 300 25	160	200	100	16 x 25	15	475	970.0	ESG107M160AM7(1)
160	160	200	100	18 x 20	15	465	970.0	ESG107M160AN4(1)
160 200 150 18 x 25 15 625 1450.0 ESGISTM								ESG157M160AM2(1)
160							•	ESG157M160AN5(1)
160 2200 220 18 x 25 15 725 2122.0 ES6227h								ESG227M160AM2(1)
160 200 330 18 x 32 15 960 3178.0 ESG376.0							•	ESG227M160AN5(1)
200 250 10 *10 × 16 15 80 274.0 ESS1056 200 250 15 *10 × 16 15 100 274.0 ESS1056 200 250 33 *10 × 20 15 160 406.0 ESS365 200 250 33 13 × 20 15 210 406.0 ESS365 200 250 47 13 × 20 15 260 574.0 ESS256 200 250 68 13 × 25 15 360 826.0 ESS3656 200 250 68 13 × 25 15 360 826.0 ESS3656 200 250 68 16 × 20 15 475 1210.0 ESS1076 200 250 100 16 × 25 15 475 1210.0 ESS1076 200 250 100 16 × 25 15 475 1210.0 ESS1076 200 250 100 16 × 25 15 465 1210.0 ESS1076 250 250 100 16 × 25 15 455 100 ESS1076 250 250 100 10 × 10 × 16 15 85 100.0 ESS1076 250 300 10 *10 × 16 15 85 100.0 ESS1076 250 300 10 *10 × 25 15 145 100.0 ESS1076 250 300 10 *10 × 25 15 145 100.0 ESS1076 250 300 10 *10 × 25 15 100 160.0 ESS1076 250 300 22 13 × 20 15 100 160.0 ESS1076 250 300 33 33 × 20 15 100 160.0 ESS1076 250 300 47 13 × 25 15 270 715.0 ESS4766 250 300 47 13 × 25 15 270 715.0 ESS4766 250 300 47 16 × 20 15 275 715.0 ESS4766 250 300 47 16 × 20 15 275 715.0 ESS4766 250 300 68 16 × 25 15 380 1030.0 ESG6666 250 300 47 16 × 20 15 275 715.0 ESG4766 250 300 68 18 × 20 15 500 1510.0 ESG1076 250 300 47 16 × 20 15 275 715.0 ESG4766 250 300 47 16 × 20 15 275 715.0 ESG4766 250 300 47 48 × 20 20 400 400 400 ESG1076 250 300 47 48 × 20 20 20 100 20 20 20 20								ESG337M160AN1(1)
200 250 15 *10 x 16 15 100 274,0 ES01506 200 250 22 10 x 20 15 160 274,0 ES01506 200 250 33 *10 x 20 15 160 2474,0 ES03566 200 250 33 *10 x 20 15 160 406.0 ES03366 200 250 47 13 x 20 15 210 406.0 ES03366 200 250 68 13 x 25 15 360 826.0 ES04506 200 250 68 13 x 25 15 430 826.0 ES06606 200 250 100 16 x 25 15 430 826.0 ES06606 200 250 100 16 x 25 15 430 826.0 ES06606 200 250 100 18 x 20 15 465 1210.0 ES01070 200 250 100 18 x 25 15 650 1810.0 ES01570 200 250 200 10 *10 x 16 15 85 160.0 ES01606 250 300 10 *10 x 16 15 85 160.0 ES01606 250 300 10 *10 x 25 15 145 160.0 ES01606 250 300 10 *10 x 20 15 160 340.0 ES01606 250 300 22 13 x 20 15 160 340.0 ES01606 250 300 22 13 x 20 15 160 340.0 ES01606 250 300 22 13 x 20 15 160 340.0 ES01606 250 300 33 33 x 20 15 270 7715.0 ES04766 250 300 47 16 x 20 15 270 7715.0 ES04766 250 300 47 16 x 20 15 270 7715.0 ES04766 250 300 47 16 x 20 15 270 7715.0 ES04766 250 300 47 16 x 20 15 270 7715.0 ES04766 250 300 68 16 x 25 15 380 1030.0 ES06666 250 300 68 16 x 25 15 380 1030.0 ES06666 250 300 30 30 30 30 30 30								ESG106M200AH8(1)
200 250 22 10 x 20 15 160 274,0 ES0225h 200 250 33 13 x 20 15 160 406.0 ES0335h 200 250 33 13 x 20 15 210 406.0 ES0335h 200 250 47 13 x 20 15 260 574.0 ES0335h 200 250 68 13 x 25 15 360 826.0 ES0635h 200 250 68 16 x 20 15 430 826.0 ES0656h 200 250 68 16 x 20 15 430 826.0 ES0656h 200 250 100 16 x 25 15 475 1210.0 ES0107h 200 250 100 18 x 20 15 465 1210.0 ES0107h 200 250 150 18 x 20 15 465 1210.0 ES0107h 200 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 780 2650.0 ES0527h 220 250 220 18 x 32 15 15 15 16 16 16 16 16								ESG156M200AH8(1)
200 250 33 10 x 20 15 100 406.0 ESG3366 200 250 47 13 x 20 15 210 406.0 ESG3366 200 250 47 13 x 20 15 260 574.0 ESG3666 200 250 68 13 x 25 15 360 826.0 ESG6666 200 250 100 16 x 25 15 475 1210.0 ESG6666 200 250 100 16 x 25 15 475 1210.0 ESG6766 200 250 100 18 x 20 15 465 1210.0 ESG6766 200 250 250 100 18 x 25 15 465 1210.0 ESG6766 200 250 250 150 18 x 25 15 465 1210.0 ESG6766 200 250 250 220 18 x 32 15 780 2650.0 ESG6776 250 250 220 18 x 32 15 780 2650.0 ESG6776 250 250 220 18 x 32 15 780 2650.0 ESG6776 250 300 10 10 x 25 15 145 160.0 ESG1066 250 300 10 10 x 20 15 145 160.0 ESG1066 250 300 22 33 x 20 15 160 340.0 ESG2766 250 300 33 33 x 20 15 160 340.0 ESG2766 250 300 33 33 x 20 15 210 505.0 ESG3766 250 300 47 16 x 25 15 270 715.0 ESG4766 250 300 47 16 x 25 15 270 715.0 ESG67666 250 300 68 16 x 25 15 330 1030.0 25G6666 250 300 68 16 x 25 15 330 1030.0 ESG6666 250 300 68 16 x 25 15 375 1030.0 ESG6666 250 300 68 16 x 25 15 375 1030.0 ESG6666 250 300 68 16 x 25 15 375 1030.0 ESG6666 250 300 100 16 x 32 15 500 1510.0 ESG6666 250 300 33 33 x 25 15 270 715.0 ESG6666 250 300 300 68 16 x 25 15 375 1030.0 ESG6666 250 30								` ′
200 250 33 13 x 20 15 210 406.0 ESG35A								ESG226M200AH4(1)
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200 250 100 18 x 20 15 465 1210.0 ESC107W								ESG686M200AM5(1)
200 250 150 18 x 25 15 780 2650.0 ESG227h 250 300 10 *10 x 10 x 15 15 15 145 160.0 ESG106h 250 300 10 10 *10 x 25 15 145 160.0 ESG106h 250 300 10 10 x 20 15 100 160.0 ESG106h 250 300 22 13 x 20 15 160 340.0 ESG237h 250 300 333 13 x 20 15 210 505.0 ESG336h 250 300 47 13 x 25 15 210 505.0 ESG336h 250 300 47 13 x 25 15 270 715.0 ESG476h 250 300 47 16 x 20 15 270 715.0 ESG476h 250 300 68 16 x 25 15 380 1030.0 ESG686h 250 300 10 160 16 x 32 15 5 100.0 ESG106h 250 300 10 10 10 x 20 15 20 15 20 15 20 15 20 15 20 10 50 10 10 10 10 10 10 10 10 10 10 10 10 10								ESG107M200AM7(1)
250								ESG107M200AN4(1)
250 300 10 10 *10 x16 15 85 160.0 ESG106M 250 300 10 10 10 x20 15 100 160.0 ESG106M 250 300 22 13 x20 15 160 340.0 ESG26M 250 300 33 13 x20 15 160 340.0 ESG26M 250 300 47 13 x25 15 210 505.0 ESG36M 250 300 47 13 x25 15 270 715.0 ESG476M 250 300 47 16 x20 15 380 1030.0 ESG686M 250 300 68 16 x25 15 380 1030.0 ESG686M 250 300 68 16 x25 15 380 1030.0 ESG686M 250 300 68 18 x20 15 520 1510.0 ESG476M 250 300 100 16 x32 15 520 1510.0 ESG676M 250 300 100 18 x25 15 520 1510.0 ESG676M 250 300 100 18 x25 15 520 1510.0 ESG676M 250 300 100 18 x25 15 520 1510.0 ESG676M 250 300 100 18 x25 15 520 1510.0 ESG107M 250 300 100 18 x25 15 520 1510.0 ESG107M 250 300 150 18 x25 15 520 1510.0 ESG107M 250 300 150 18 x25 15 520 1510.0 ESG107M 250 300 220 18 x40 15 822 15 650 2260.0 ESG157M 350 400 22 13 x20 20 160 472.0 ESG26M 350 400 22 13 x20 20 160 472.0 ESG26M 350 400 33 13 x25 20 230 703.0 ESG36M 350 400 33 13 x25 20 230 703.0 ESG36M 350 400 33 13 x25 20 230 703.0 ESG36M 350 400 33 13 x25 20 230 703.0 ESG36M 350 400 47 16 x20 20 300 997.0 ESG476M 350 400 47 16 x20 20 300 997.0 ESG476M 350 400 47 18 x20 20 300 997.0 ESG476M 350 400 47 18 x20 20 300 997.0 ESG476M 350 400 47 18 x20 20 300 997.0 ESG476M 350 400 450 47 16 x22 20 300 997.0 ESG476M 350 400 450 47 16 x22 20 300 997.0 ESG476M 350 400 450 47 16 x22 20 300 997.0 ESG476M 350 400 450 47 110 x16 24 85 123.0 ESG68M 350 400 450 47 110 x16 24 85 123.0 ESG68M 350 400 450 47 110 x16 24 85 123.0 ESG68M 400 450 10 10 x20 24 110 x16 24 85 123.0 ESG68M 400 450 10 10 x20 24 110 x16 24 85 123.0 ESG68M 400 450 10 10 x20 24 110 x16 24 85 123.0 ESG68M 400 450 10 10 x20 24 110 x16 24 85 123.0 ESG68M 400 450 22 13 x25 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 170 538.0 ESG26M 400 450 33 18 x20 24 1								ESG157M200AN5(1)
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250 300 10 10 10 x20 15 100 160.0 ESG106M 250 300 22 13 x 20 15 160 340.0 ESG26M 250 300 33 13 x 20 15 210 505.0 ESG36M 250 300 47 13 x 25 15 270 715.0 ESG476M 250 300 47 15 x 25 15 270 715.0 ESG476M 250 300 68 16 x 25 15 380 1030.0 ESG826M 250 300 68 18 x 20 15 375 1030.0 ESG86M 250 300 100 16 x 32 15 520 1510.0 ESG107M 250 300 100 18 x 25 15 520 1510.0 ESG107M 250 300 100 18 x 25 15 520 1510.0 ESG107M 250 300 100 18 x 25 15 520 1510.0 ESG107M 250 300 100 18 x 25 15 520 1510.0 ESG107M 250 300 150 18 x 32 15 520 1510.0 ESG107M 250 300 150 18 x 32 15 650 260.0 ESG157M 250 300 220 18 x 40 15 820 3310.0 ESG227M 350 400 10 10 x 20 20 160 472.0 ESG226M 350 400 33 13 x 25 20 20 160 472.0 ESG226M 350 400 33 15 x 20 20 160 472.0 ESG26M 350 400 33 16 x 20 20 250 703.0 ESG36M 350 400 33 16 x 20 20 250 703.0 ESG36M 350 400 47 16 x 25 20 300 997.0 ESG476M 350 400 47 16 x 25 20 300 997.0 ESG476M 350 400 47 18 x 20 20 400 1438.0 ESG686M 350 400 47 18 x 20 20 315 997.0 ESG476M 350 400 47 18 x 20 20 400 1438.0 ESG686M 350 400 47 18 x 20 20 530 2110.0 ESG167M 400 450 4.7 **10x 16 24 60 123.0 ESG686M 350 400 100 18 x 32 20 530 2110.0 ESG686M 350 400 450 4.7 **10x 16 24 66 123.0 ESG686M 350 400 450 4.7 **10x 16 24 66 123.0 ESG686M 400 450 4.7 **10x 16 24 66 123.0 ESG686M 400 450 4.7 **10x 16 24 66 123.0 ESG686M 400 450 4.7 **10x 16 24 66 01 23.0 ESG686M 400 450 10 **10x 16 24 66 01 23.0 ESG686M 400 450 10 **10x 16 24 66 01 23.0 ESG686M 400 450 10 **10x 16 24 66 01 23.0 ESG686M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 538.0 ESG226M 400 450 33 16 x 20 24 250 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M				*10 x 16				ESG106M250AH8(1)
250 300 22 13 x 20 15 160 340.0 ESG226h 250 300 47 13 x 25 15 210 505.0 ESG336h 250 300 47 16 x 20 15 275 715.0 ESG476h 250 300 47 16 x 20 15 380 130.0 ESG686h 250 300 68 16 x 25 15 380 130.0 ESG686h 250 300 100 16 x 32 15 375 1030.0 ESG686h 250 300 100 16 x 32 15 500 1510.0 ESG107h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 150 18 x 32 15 500 1510.0 ESG107h 250 300 150 18 x 32 15 650 2260.0 ESG157h 250 300 100 100 18 x 25 15 650 2260.0 ESG157h 250 300 220 18 x 40 15 820 3310.0 ESG226h 350 400 10 10 10 x 20 20 100 220.0 ESG108h 350 400 22 13 x 20 20 160 472.0 ESG26h 350 400 33 13 x 25 20 20 160 472.0 ESG336h 350 400 33 16 x 20 20 250 703.0 ESG336h 350 400 47 16 x 25 20 300 997.0 ESG376h 350 400 47 18 x 20 20 315 997.0 ESG376h 350 400 68 18 x 25 20 300 997.0 ESG376h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 47 18 x 20 20 400 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 8 18 x 25 20 380 1438.0 ESG686h 350 400 450 4.7 *10 x 16 24 60 123.0 ESG107h 400 450 4.7 *10 x 16 24 60 123.0 ESG107h 400 450 4.7 *10 x 16 24 60 123.0 ESG666h 400 450 4.7 *10 x 16 24 60 123.0 ESG675h 400 450 4.7 *10 x 16 24 60 123.0 ESG666h 400 450 4.7 *10 x 16 24 60 123.0 ESG666h 400 450 10 *10 x 20 24 100 250.0 ESG107h 400 450 22 13 x 20 24 145 538.0 ESG26h 400 450 22 13 x 20 24 145 538.0 ESG26h 400 450 33 16 x 20 24 250 802.0 ESG360h 400 450 33 16 x 20 24 250 802.0 ESG360h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h	250	300	10	*10 x 25	15	145	160.0	ESG106M250AH5(1)
250 300 47 13 x 20 15 270 715.0 ESG376h 250 300 47 13 x 25 15 270 715.0 ESG476h 250 300 47 16 x 20 15 275 715.0 ESG476h 250 300 68 16 x 25 15 380 1030.0 ESG686h 250 300 68 18 x 20 15 375 1030.0 ESG686h 250 300 100 18 x 25 15 500 1510.0 ESG17h 250 300 100 18 x 25 15 500 1510.0 ESG17h 250 300 100 18 x 25 15 500 1510.0 ESG17h 250 300 100 18 x 25 15 500 1510.0 ESG17h 250 300 100 18 x 25 15 600 2260.0 ESG17h 250 300 220 18 x 40 15 820 3310.0 ESG27h 350 400 10 10 x 20 20 100 220.0 ESG18h 350 400 22 13 x 20 20 160 472.0 ESG226h 350 400 33 13 x 25 20 230 703.0 ESG336h 350 400 33 16 x 20 20 250 703.0 ESG336h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 450 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 450 4.7 *10 x 16 24 60 123.0 ESG686h 400 450 6.8 *10 x 10 x 10 x 10 x 20 24 100 250.0 ESG106h 400 450 10 *10 x 10 x 20 24 100 250.0 ESG106h 400 450 22 13 x 20 24 145 538.0 ESG226h 400 450 22 13 x 20 24 145 538.0 ESG226h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 18 x 20 24 250 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h 400 450 33 16 x 25 24 230 802.0 ESG336h	250	300	10	10 x 20	15	100	160.0	ESG106M250AH4(1)
250 300 47 13 x 25 15 270 715.0 ESG476h 250 300 47 16 x 20 15 275 715.0 ESG476h 250 300 68 16 x 25 15 380 1030.0 ESG688h 250 300 68 18 x 20 15 375 1030.0 ESG688h 250 300 100 16 x 32 15 520 1510.0 ESG107h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 150 18 x 32 15 650 2260.0 ESG157h 250 300 150 18 x 32 15 650 2260.0 ESG157h 250 300 150 18 x 32 15 650 2260.0 ESG157h 250 300 220 18 x 40 15 820 3310.0 ESG27h 350 400 10 10 x 20 20 100 220.0 ESG106h 350 400 22 13 x 20 20 160 472.0 ESG266h 350 400 33 13 x 25 20 230 703.0 ESG336h 350 400 33 18 x 25 20 230 703.0 ESG336h 350 400 33 16 x 20 20 250 703.0 ESG368h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 68 16 x 32 20 400 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 530 2110.0 ESG167h 400 450 4.7 *10 x 16 24 60 123.0 ESG686h 400 450 4.7 *10 x 16 24 72 123.0 ESG686h 400 450 10 10 x 20 24 100 250.0 ESG16h 400 450 10 10 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 100 250.0 ESG16h 400 450 22 13 x 20 24 20 580.0 ESG26h 400 450 33 16 x 22 24 20 580.0 ESG36h 400 450 33 16 x 20 24 20 580.0 ESG36h 400 450 33 16 x 20 24 20 580.0 ESG36h 400 450 33 16 x 20 24 250 802.0 ESG36h 400 450 33 16 x 20 24 250 802.0 ESG36h	250	300	22	13 x 20	15	160	340.0	ESG226M250AL3(1)
250 300 47 16 x 20 15 275 715.0 ESG476M 250 300 68 16 x 25 15 380 1030.0 ESG686M 250 300 68 18 x 20 15 375 1030.0 ESG686M 250 300 100 16 x 32 15 520 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 650 2260.0 ESG157M 250 300 220 18 x 40 15 820 3310.0 ESG27M 350 400 10 10 10 x 20 20 100 220.0 ESG166M 350 400 33 13 x 25 20 20 160 472.0 ESG26M 350 400 33 16 x 20 20 20 20 20 20 20 20 20 20 20 20 20	250	300	33	13 x 20		210	505.0	ESG336M250AL3(1)
250 300 47 16 x 20 15 275 715.0 ESG476M 250 300 68 16 x 25 15 380 1030.0 ESG686M 250 300 68 18 x 20 15 375 1030.0 ESG686M 250 300 100 16 x 32 15 520 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 25 15 650 2260.0 ESG157M 250 300 220 18 x 40 15 820 3310.0 ESG27M 350 400 10 10 10 x 20 20 100 220.0 ESG166M 350 400 33 13 x 25 20 20 160 472.0 ESG26M 350 400 33 16 x 20 20 20 20 20 20 20 20 20 20 20 20 20	250	300	47	13 x 25	15	270	715.0	ESG476M250AL4(1)
250 300 68 18 x 20 15 375 1030.0 ESG686h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 150 18 x 32 15 500 2260.0 ESG157h 250 300 220 18 x 40 15 820 3310.0 ESG227h 350 400 10 10 10 x 20 20 100 220.0 ESG158 350 400 33 13 x 25 20 20 160 472.0 ESG336h 350 400 33 13 x 25 20 20 250 703.0 ESG336h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 68 16 x 32 20 400 1438.0 ESG686h 350 400 68 18 x 22 20 380 1438.0 ESG686h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 168 16 x 32 20 400 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1210.0 ESG107h 400 450 6.8 100 100 18 x 32 20 50 50 2110.0 ESG107h 400 450 6.8 100 100 18 x 32 20 50 50 2110.0 ESG107h 400 450 6.8 100 x	250	300	47	16 x 20		275	715.0	ESG476M250AM5(1)
250 300 68 18 x 20 15 375 1030.0 ESG686h 250 300 100 18 x 25 15 500 1510.0 ESG107h 250 300 150 18 x 32 15 500 2260.0 ESG157h 250 300 220 18 x 40 15 820 3310.0 ESG227h 350 400 10 10 10 x 20 20 100 220.0 ESG158 350 400 33 13 x 25 20 20 160 472.0 ESG336h 350 400 33 13 x 25 20 20 250 703.0 ESG336h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 47 16 x 25 20 300 997.0 ESG476h 350 400 68 16 x 32 20 400 1438.0 ESG686h 350 400 68 18 x 22 20 380 1438.0 ESG686h 350 400 47 18 x 20 20 315 997.0 ESG476h 350 400 168 16 x 32 20 400 1438.0 ESG686h 350 400 68 18 x 25 20 380 1438.0 ESG686h 350 400 68 18 x 25 20 380 1210.0 ESG107h 400 450 6.8 100 100 18 x 32 20 50 50 2110.0 ESG107h 400 450 6.8 100 100 18 x 32 20 50 50 2110.0 ESG107h 400 450 6.8 100 x	250	300	68	16 x 25	15	380	1030.0	ESG686M250AM7(1)
250 300 100 16 x 32 15 520 1510.0 ESG107M 250 300 100 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 32 15 500 310.0 ESG107M 250 300 220 18 x 40 15 820 3310.0 ESG227M 350 400 10 10 10 x 20 20 100 220.0 ESG165M 350 400 33 13 x 25 20 20 160 472.0 ESG26M 350 400 33 16 x 20 20 160 472.0 ESG36M 350 400 33 16 x 20 20 20 160 472.0 ESG36M 350 400 33 16 x 20 20 20 160 472.0 ESG36M 350 400 33 16 x 20 20 20 20 20 20 20 20 20 20 20 20 20	•						•	ESG686M250AN4(1)
250 300 100 18 x 25 15 500 1510.0 ESG107M 250 300 150 18 x 32 15 650 2260.0 ESG157M 250 300 220 18 x 40 15 820 3310.0 ESG257M 350 400 10 10 x 20 20 100 220.0 ESG166M 350 400 22 13 x 20 20 160 472.0 ESG226M 350 400 33 13 x 25 20 230 703.0 ESG36M 350 400 33 16 x 20 20 250 703.0 ESG36M 350 400 47 16 x 25 20 300 997.0 ESG476M 350 400 47 18 x 20 20 315 997.0 ESG476M 350 400 68 16 x 32 20 400 1438.0 ESG686M 350 400 68 18 x 25 20 380 1438.0 ESG686M 350 400 68 18 x 25 20 380 1438.0 ESG686M 350 400 68 18 x 25 20 380 1210.0 ESG107M 400 450 47 100 18 x 32 20 530 2110.0 ESG17M 400 450 47 100 16 24 60 123.0 ESG685M 400 450 10 10 10 x 20 24 10 250.0 ESG106M 400 450 10 10 x 10 x 16 24 85 123.0 ESG685M 400 450 10 10 x 10 x 16 24 85 123.0 ESG166M 400 450 10 10 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 100 538.0 ESG226M 400 450 22 13 x 20 24 100 538.0 ESG226M 400 450 22 13 x 20 24 100 538.0 ESG226M 400 450 22 13 x 20 24 100 538.0 ESG226M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M								ESG107M250AM2(1)
250 300 150 18 x 32 15 650 2260.0 ESG157N 250 300 220 18 x 40 15 820 3310.0 ESG227N 350 400 10 10 x 20 20 100 220.0 350 400 22 13 x 20 20 160 472.0 ESG26N 350 400 33 13 x 25 20 230 703.0 ESG36N 350 400 33 16 x 20 20 250 703.0 ESG36N 350 400 47 16 x 25 20 300 997.0 ESG476N 350 400 47 18 x 20 20 315 997.0 ESG476N 350 400 47 18 x 20 20 315 997.0 ESG476N 350 400 68 16 x 32 20 400 1438.0 ESG68N 350 400 68 18 x 25 20 380 1438.0 ESG68N 350 400 68 18 x 25 20 380 1438.0 ESG68N 350 400 100 18 x 32 20 530 2110.0 ESG107N 400 450 4.7 *10 x 16 24 60 123.0 ESG475N 400 450 6.8 *10 x 16 24 85 123.0 ESG68N 400 450 10 *10 x 16 24 85 123.0 ESG68N 400 450 10 10 x 20 24 100 250.0 ESG106N 400 450 22 13 x 20 24 100 250.0 ESG106N 400 450 22 13 x 20 24 145 538.0 ESG226N 400 450 22 13 x 25 24 170 538.0 ESG226N 400 450 33 16 x 25 24 200 538.0 ESG226N 400 450 33 16 x 25 24 200 538.0 ESG226N 400 450 33 16 x 25 24 200 538.0 ESG226N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 16 x 25 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 33 18 x 20 24 250 802.0 ESG336N 400 450 350 35	•	1					•	ESG107M250AN5(1)
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350								ESG336M350AL4(1)
350								ESG336M350AM5(1)
350								ESG476M350AM7(1)
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400 450 6.8 *10 x 16 24 72 123.0 ESG685M 400 450 10 *10 x 16 24 85 123.0 ESG106M 400 450 10 10 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 145 538.0 ESG226M 400 450 22 13 x 25 24 170 538.0 ESG226M 400 450 22 16 x 20 24 200 538.0 ESG226M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M (VDC) (VDC) 120 Hz 20°C (μF) Dx L (mm) 120 Hz 20°C (tanó %) 120 Hz 105°C (mA) 20°C 2 minutes (μA) () Repression								ESG475M400AH8(1)
400 450 10 *10 x 16 24 85 123.0 ESG106M 400 450 10 10 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 145 538.0 ESG226M 400 450 22 13 x 25 24 170 538.0 ESG226M 400 450 22 16 x 20 24 200 538.0 ESG226M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M (VDC) (VDC) 120 Hz 20°C (μF) Dx L (mm) 120 Hz 20°C (tan6 %) 120 Hz 105°C (mA) 20°C 2 minutes (μA) (μA) Number					•			ESG685M400AH8(1)
400 450 10 10 x 20 24 100 250.0 ESG106M 400 450 22 13 x 20 24 145 538.0 ESG226M 400 450 22 13 x 25 24 170 538.0 ESG226M 400 450 22 16 x 20 24 200 538.0 ESG226M 400 450 33 16 x 25 24 230 802.0 ESG336M 400 450 33 18 x 20 24 250 802.0 ESG336M (VDC) (VDC) 120 Hz 20°C (μF) Dx L (mm) 120 Hz 20°C (tanδ %) 120 Hz 105°C (mA) 20°C 2 minutes (μA) () Repre Number					•			ESG106M400AH8(1)
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400 450 33 18 x 20 24 250 802.0 ESG336M					•		•	ESG226M400AM5(1)
(VDC) 120 Hz 20°C (μF) D x L (mm) 120 Hz 20°C (tanδ %) 120 Hz 105°C (mA) 20°C 2 minutes (μA) () Repre-Number					•		•	ESG336M400AM7(1)
(VDC) (VDC) (μF) (mm) (tanδ%) (mA) (μA) Number	400	450						ESG336M400AN4(1)
Rated Voltage Surge Voltage Rated Capacitance Case Size DF RC LC Part I	(VDC)	(VDC)						() Represents Part Number Options
	Rated Voltage	Surge Voltage	Rated Capacitance	Case Size	DF	RC	LC	Part Number

⁽¹⁾ Insert packaging code. See Ordering Options Table for available options.

^{*} Dimension is down size, Endurance is 3,000 hours.



Table 1 - Ratings & Part Number Reference cont.

Rated Voltage	Surge Voltage	Rated Capacitance	Case Size	DF	RC	LC	Part Number
(VDC)	(VDC)	120 Hz 20°C (μF)	D x L (mm)	120 Hz 20°C (tanδ %)	120 Hz 105°C (mA)	20°C 2 minutes (μΑ)	() Represents Part Number Options
400	450	47	16 x 25	24	255	1138.0	ESG476M400AM7(1)
400	450	47	16 x 32	24	300	1138.0	ESG476M400AM2(1)
400	450	47	18 x 25	24	325	1138.0	ESG476M400AN5(1)
400	450	68	16 x 30	24	340	1642.0	ESG686M400AM9(1)
400	450	68	16 x 32	24	350	1642.0	ESG686M400AM2(1)
400	450	68	18 x 36	24	420	1642.0	ESG686M400AN2(1)
400	450	100	18 x 32	24	465	2410.0	ESG107M400AN1(1)
400	450	100	18 x 40	24	545	2410.0	ESG107M400AN3(1)
400	450	150	18 x 40	24	525	3610.0	ESG157M400AN3(1)
400	450	150	22 x 40	24	650	3610.0	ESG157M400AQ4(1)
450	500	3.3	10 x 20	24	60	99.0	ESG335M450AH4(1)
450	500	4.7	13 x 20	24	80	137.0	ESG475M450AL3(1)
450	500	6.8	*10 x 20	24	90	194.0	ESG685M450AH4(1)
450	500	10	13 x 20	24	110	280.0	ESG106M450AL3(1)
450	500	10	13 x 25	24	110	280.0	ESG106M450AL4(1)
450	500	22	13 x 20	24	145	604.0	ESG226M450AL3(1)
450	500	22	16 x 25	24	190	604.0	ESG226M450AM7(1)
450	500	22	18 x 20	24	200	604.0	ESG226M450AN4(1)
450	500	33	16 x 25	24	235	901.0	ESG336M450AM7(1)
450	500	33	16 x 32	24	275	901.0	ESG336M450AM2(1)
450	500	33	18 x 25	24	280	901.0	ESG336M450AN5(1)
450	500	47	16 x 26	24	270	1,279.0	ESG476M450AM1(1)
450	500	47	18 x 32	24	340	1,279.0	ESG476M450AN1(1)
450	500	68	18 x 25	24	335	1,846.0	. ,
450	500	68	18 x 32	24	395	1,846.0	ESG686M450AN5(1) ESG686M450AN1(1)
450	500	68	18 x 40	24	460	1,846.0	ESG686M450AN3(1)
		100		24	580		
450 500	500 550	4.7	22 x 40	24	70	2,710.0	ESG107M450AQ4(1)
			10 x 20			151.0	ESG475M500AH4(1)
500	550	6.8	13 x 20	24	100	214.0	ESG685M500AL3(1)
500	550	10	13 x 25	24	130	310.0	ESG106M500AL4(1)
500	550	22	16 x 25	24	225	670.0	ESG226M500AM7(1)
500	550	22	18 x 20	24	220	670.0	ESG226M500AN4(1)
500	550	33	16 x 32	24	305	1,000.0	ESG336M500AM2(1)
500	550	33	18 x 25	24	295	1,000.0	ESG336M500AN5(1)
500	550	47	16 x 36	24	430	1,420.0	ESG476M500AM3(1)
500	550	47	18 x 32	24	435	1,420.0	ESG476M500AN1(1)
500	550	68	18 x 32	24	530	2,050.0	ESG686M500AN1(1)
500	550	68	18 x 36	24	555	2,050.0	ESG686M500AN2(1)
500	550	82	18 x 40	24	640	2,470.0	ESG826M500AN3(1)
500	550	82	22 x 35	24	675	2,470.0	ESG826M500AQ3(1)
500	550	100	22 x 35	24	746	3,010.0	ESG107M500AQ3(1)
500	550	120	22 x 40	24	865	3,610.0	ESG127M500AQ4(1)
500	550	150	22 x 45	24	1020	4,510.0	ESG157M500AQ5(1)
(VDC)	(VDC)	120 Hz 20°C (μF)	D x L (mm)	120 Hz 20°C (tanδ %)	120 Hz 105°C (mA)	20°C 2 minutes (μΑ)	() Represents Part Number Options
Rated Voltage	Surge Voltage	Rated Capacitance	Case Size	DF	RC	LC	Part Number

⁽¹⁾ Insert packaging code. See Ordering Options Table for available options.

^{*} Dimension is down size, Endurance is 3,000 hours.



Mounting Positions (Safety Vent)

In operation, electrolytic capacitors will always conduct a leakage current, which causes electrolysis. The oxygen produced by electrolysis will regenerate the dielectric layer but, at the same time, the hydrogen released may cause the internal pressure of the capacitor to increase. The overpressure vent, or safety vent, ensures that the gas can escape when the pressure reaches a certain value. All mounting positions must allow the safety vent to work properly.

Installing

- As a general principle, lower-use temperatures result in a longer, useful life of the capacitor. For this reason, it should be
 ensured that electrolytic capacitors are placed away from heat-emitting components. Adequate space should be allowed
 between components for cooling air to circulate, particularly when high ripple current loads are applied. In any case, the
 maximum category temperature must not be exceeded.
- Do not deform the case of the capacitors or use capacitors with a deformed case.
- Verify that the connections of the capacitors are able to insert on the board without excessive mechanical force.
- If the capacitors require mounting through additional means, the recommended mounting accessories shall be used.
- Verify the correct polarization of the capacitor on the board.
- · Verify that the space around the pressure relief device is according to the following guideline:

Case Diameter	Space Around Safety Vent
≤ 16 mm	> 2 mm
> 16 to ≤ 40 mm	> 3 mm
> 40 mm	> 5 mm

It is recommended that capacitors always be mounted with the safety device uppermost or in the upper part of the capacitor.

- If the capacitors are stored for a long time, the leakage current must be verified. If the leakage current is superior to the value listed in this catalog, the capacitors must be reformed. In this case, they can be reformed by application of the rated voltage through a series resistor approximately 1 k Ω for capacitors with $V_R \le 160$ V (5 W resistor) and 10 k Ω for the other rated voltages.
- In the case of capacitors connected in a series, a suitable voltage sharing must be used.

 In the case of balancing resistors, the approximate resistance value can be calculated as: R = 60/C.

KEMET recommends, nevertheless, to ensure that the voltage across each capacitor does not exceed its rated voltage.



Electrical Ratings: Capacitance (ESC)

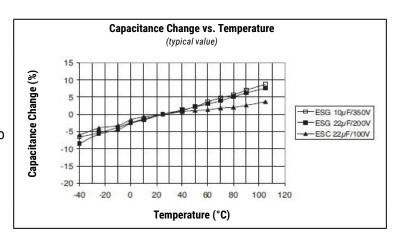


Simplified equivalent circuit diagram of an electrolytic capacitor

The capacitive component of the equivalent series circuit, (equivalent series capacitance - ESC), is determined by applying an alternate voltage of ≤ 0.5 V at a frequency of 120 or 100 Hz and 20°C (IEC 384-1, 384-4).

Temperature Dependence of the Capacitance

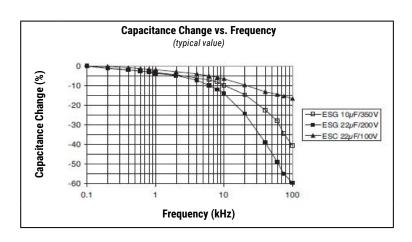
Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity. Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance changes (up to 20% depending on the series considered, from 0 to 80°C). This phenomenon is more evident for electrolytic capacitors than for other types.



Frequency Dependence of the Capacitance

Effective capacitance value is derived from the impedance curve, as long as impedance is still in the range where the capacitance component is dominant.

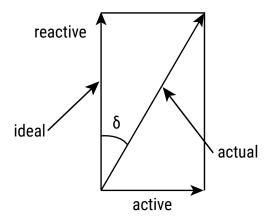
$$C = \frac{1}{2\pi \text{ fZ}} \frac{\text{C = capacitance (F)}}{\text{f = frequency (Hz)}}$$
$$Z = \text{impedance (Ω)}$$





Dissipation Factor tan δ (DF)

Dissipation Factor tan δ is the ratio between the active and reactive power for a sinusoidal waveform voltage. It can be thought of as a measurement of the gap between an actual and ideal capacitor.

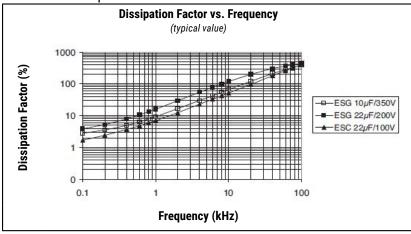


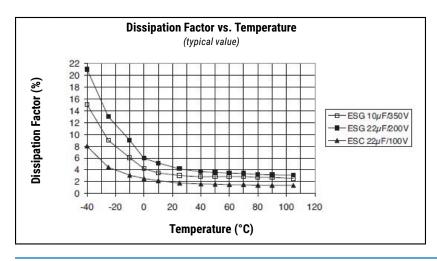
Tan δ is measured with the same set-up used for the series capacitance ESC.

Tan $\delta = \omega \times ESC \times ESR$ where:

ESC = Equivalent series capacitance

ESR = Equivalent series resistance



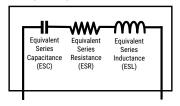




Equivalent Series Inductance (ESL)

Equivalent series inductance or self inductance results from the terminal configuration and internal design of the capacitor.

Capacitor Equivalent Internal Circuit

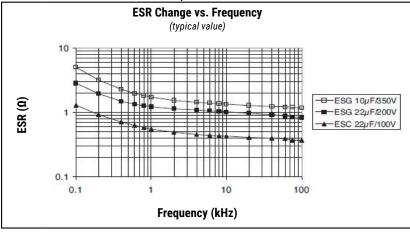


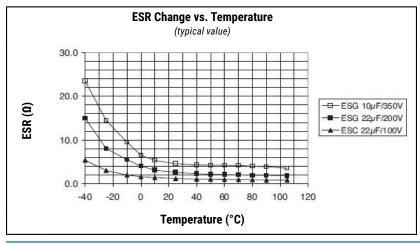
Equivalent Series Resistance (ESR)

Equivalent series resistance is the resistive component of the equivalent series circuit. ESR value depends on frequency and temperature, and is related to the tan δ by the following equation:

$$ESR = \frac{\tan \delta}{2\pi f \ ESC} = \frac{\tan \delta}{2\pi f \ ESC} = \frac{\tan \delta}{\sin \delta} = Dissipation \ factor \\ ESC = Equivalent \ series \ capacitance \ (F) \\ f = Frequency \ (Hz)$$

Tolerance limits of the rated capacitance must be taken into account when calculating this value.

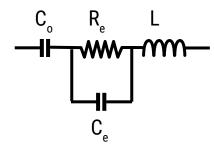






Impedance (Z)

Impedance of an electrolytic capacitor results from a circuit formed by the following individual equivalent series components:



C_o = Aluminum oxide capacitance (surface and thickness of the dielectric.)

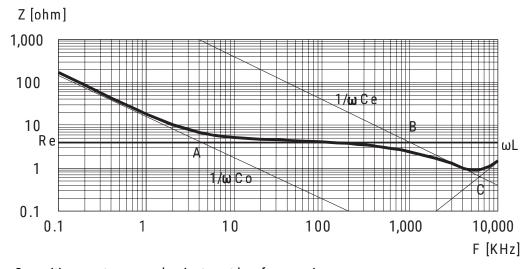
 R_e = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)

C_a = Electrolyte soaked paper capacitance.

L = Inductive reactance of the capacitor winding and terminals.

Impedance of an electrolytic capacitor is not a constant quantity that retains its value under all conditions; it changes depending on frequency and temperature.

Impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows:



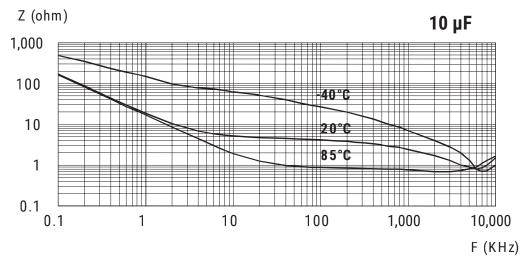
- Capacitive reactance predominates at low frequencies.
- With increasing frequency, capacitive reactance $Xc = 1/\omega C_o$ decreases until it reaches the order of magnitude of electrolyte resistance $R_o(A)$
- At even higher frequencies, resistance of the electrolyte predominates: Z = R_a (A B)
- When the capacitor's resonance frequency is reached (ω_0), capacitive and inductive reactance mutually cancel each other $1/\omega C_p = \omega L$, $\omega_0 = 1/SQR(LC_p)$
- Above this frequency, inductive reactance of the winding and its terminals (XL = Z = ωL) becomes effective and leads to an increase in impedance

Generally speaking, it can be estimated that $C_a \approx 0.01 C_a$.



Impedance (Z) cont.

Impedance as a function of frequency (sinusoidal waveform) for different temperature values can be represented as follows (typical values):



 $R_{\rm e}$ is the most temperature-dependent component of an electrolytic capacitor equivalent circuit. Electrolyte resistivity will decrease if temperature rises.

In order to obtain a low impedance value throughout the temperature range, R_e must be as little as possible. However, R_e values that are too low indicate a very aggressive electrolyte, resulting in a shorter life of the electrolytic capacitor at high temperatures. A compromise must be reached.

Leakage Current (LC)

Due to the aluminum oxide layer that serves as a dielectric, a small current will continue to flow even after a DC voltage has been applied for long periods. This current is called leakage current.

A high leakage current flows after applying voltage to the capacitor then decreases in a few minutes, for example, after prolonged storage without any applied voltage. In the course of continuous operation, the leakage current will decrease and reach an almost constant value.

After a voltage-free storage the oxide layer may deteriorate, especially at a high temperature. Since there are no leakage currents to transport oxygen ions to the anode, the oxide layer is not regenerated. The result is that a higher than normal leakage current will flow when voltage is applied after prolonged storage.



٧

Application & Operation Guidelines cont.

Leakage Current (LC) cont.

As the oxide layer is regenerated in use, the leakage current will gradually decrease to its normal level.

The relationship between the leakage current and voltage applied at constant temperature can be shown schematically as follows:



V_F = Forming voltage

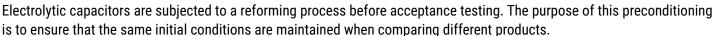
If this level is exceeded, a large quantity of heat and gas will be generated and the capacitor could be damaged.

V_D = Rated voltage

This level represents the top of the linear part of the curve.

V_s = Surge voltage

This lies between V_R and V_F . The capacitor can be subjected to V_S for short periods only.





The maximum ripple current value depends on:

- · Ambient temperature
- Surface area of the capacitor (heat dissipation area)

 $tan \; \delta \; or \; ESR$

Frequency

The capacitor's life depends on the thermal stress.

Frequency Dependence of the Ripple Current

ESR and, thus, the tan δ depend on the frequency of the applied voltage. This indicates that the allowed ripple current is also a function of the frequency.

Actual Operating Temperature (C°)

90

80

1,000

Temperature Dependence of the Ripple Current

The data sheet specifies maximum ripple current at the upper category temperature for each capacitor.

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: L = Lo x $2^{(To-T)/10}$

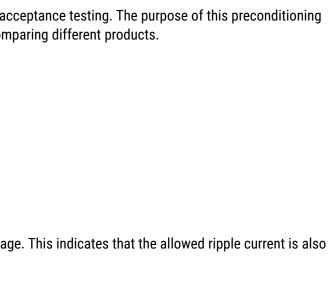
Where:

L: Expected life

Lo: Load life at a maximum permissible operating temperature

T: Actual operating temperature

To: Maximum permissible operating temperature This formula is applicable between 40°C and To.



Expected Life Calculation Chart

10.000

Expected life (h)

100,000

1.000.000

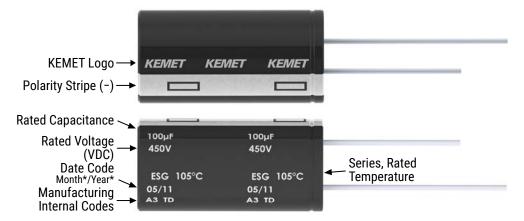


Packaging Quantities

			Bu	ılk	Auto-ir	sertion
Size Code	Diameter (mm)	Length (mm)	Standard Leads	Cut Leads	Ammo	Tape & Reel
Н8	10	16	3,000	4,000	700	1,200
H4	10	20	2,400	3,000	700	1,200
Н5	10	25	2,400	2,400	500	
L3	13	20	2,000	2,000	500	
L4	13	25	1,600	1,600	500	
M5	16	20	1,000	500	300	
M7	16	25	1,000	500	300	
M1	16	26	1,000	500	300	
М9	16	30	800	500	300	
M2	16	32	800	500	300	
М3	16	36	600	500	300	
N4	18	20	800	500	300	
N5	18	25	800	500	300	
N1	18	32	500	500		
N2	18	36	500	500		
N3	18	40	500	500		
Q3	22	35	400	400		
Q4	22	40	300	400		
Q5	22	45	300	400		



Marking



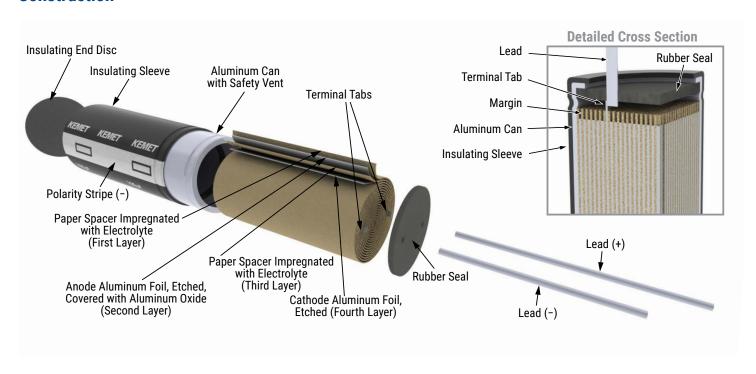
*Y = Year

Code	01	02	03	04	05	06	07	08	09
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019

*M = Month

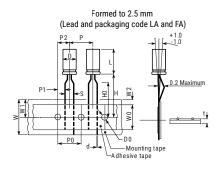
Code	01	02	03	04	05	06	07	08	09	10	11	12
Month	1	2	3	4	5	6	7	8	9	10	11	12

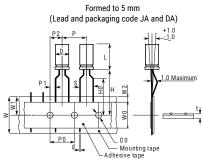
Construction



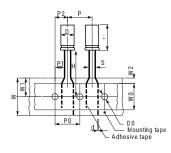


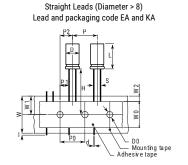
Taping for Automatic Insertion Machines





Straight Leads (Diameter: 4 - 8 mm) Lead and packaging code EA and KA



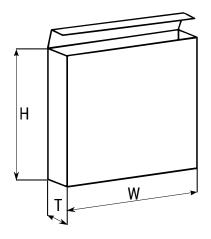


Dimensions (mm)	D	L	S	d	P	P0	P1	P2	W	W0	W 1	W2	НО	H1	I	DO	t
Tolerance	+0.5		+0.8/-0.2	±0.05	±1.0	±0.3	±0.7	±1.3	+1/-0.5	±0.5	Maximum	Maximum	±0.75	±0.5	Maximum	±0.2	±0.2
	4	5 – 7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
Formed to 2.5 mm	5	≤ 7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
2.3 111111	Э	> 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
	4	5 – 7	5.0	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	5	≤ 7	5.0	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
		>7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
Formed to 5 mm	6	≤ 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
3 111111		> 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	8	≤ 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
		> 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	4	5 - 7	1.5	0.45	12.7	12.7	5.6	6.35	18	12	11	3	18.5			4	0.7
	5	≤ 7	2.0	0.45	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
		> 7	2.0	0.50	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
Ctroight loods	6	≤ 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
Straight leads		> 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
	8	≤ 7	3.5	0.50	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
		> 7	3.5	0.50	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
	10	≤ 20	5.0	0.60	12.7	12.7	3.85	6.35	18	12	11	3	18.5		1	4	1.0

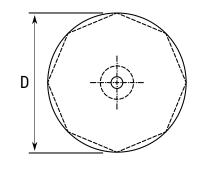


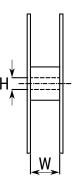
Lead Taping & Packaging











			Ammo		Reel				
Diameter	Length	Н	W	T	D	Н	W		
			Maximum	Maximum	±2	±0.5	+1/-0.1		
4	All	230	340	42					
5	≤ 7	230	340	42		30	50		
5	11	275	340	42					
6.3	≤ 7	235	340	45					
6.3	11	230	340	48	350				
8	≤ 7	270	340	48	350				
8	11	235	340	48					
8	>11 ≤ 20	240	340	57					
10	≤ 13	250	340	52					
10	>13 ≤ 20	256	340	57					
10	>20	250	340	60					
12	All	270	340	57	NIA.	NI A	NI A		
13	All	285	340	62	NA	NA	NA		
16	All	265	340	62					



Construction Data

The manufacturing process begins with the anode foil being electrochemically etched to increase the surface area and then "formed" to produce the aluminum oxide layer. Both the anode and cathode foils are then interleaved with absorbent paper and wound into a cylinder. During the winding process, aluminum tabs are attached to each foil to provide the electrical contact.

The deck, complete with terminals, is attached to the tabs and then folded down to rest on top of the winding. The complete winding is impregnated with electrolyte before being housed in a suitable container, usually an aluminum can, and sealed. Throughout the process, all materials inside the housing must be maintained at the highest purity and be compatible with the electrolyte.

Each capacitor is aged and tested before being sleeved and packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is normally carried out at the rated temperature of the capacitor and is accomplished by applying voltage to the device while carefully controlling the supply current. The process may take several hours to complete.

Damage to the oxide layer can occur due to variety of reasons:

- Slitting of the anode foil after forming
- · Attaching the tabs to the anode foil
- Minor mechanical damage caused during winding

A sample from each batch is taken by the quality department after completion of the production process. This sample size is controlled by the use of recognized sampling tables defined in BS 6001.

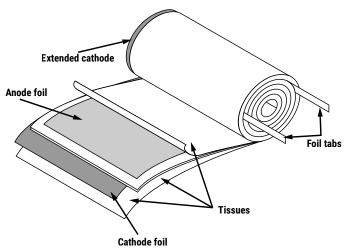
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

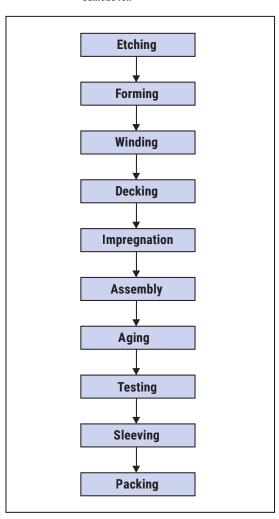
Electrical:

- · Leakage current
- Capacitance
- ESR
- Impedance
- Tan Delta

Mechanical/Visual:

- Overall dimensions
- Torque test of mounting stud
- Print detail
- · Box labels
- Packaging, including packed quantity







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ESG475M400AH2A	A ESG226M400AL4AA	ESG226M400AM5AA	ESG336M450AM2AA	ESG157M200AN5AA
ESG476M250AM5AA	ESG226M250AL3AA	ESG475M400AH2EA	ESG106M450AL3AA	ESG476M450AN1AA
ESG157M500AQ5AA	ESG106M400AH4AA	ESG106M200AH1AA	ESG106M250AH4AA	ESG106M350AH4AA
ESG107M160AM7AA	ESG107M200AM7AA	ESG475M450AL3AA	ESG476M160AL3AA	ESG476M200AL3AA
ESG476M400AM2AA	ESG227M160AM2AA	ESG335M400AH1AA	ESG335M450AH4AA	ESG336M160AH4AA
ESG336M250AL3AA	ESG336M400AM7AA	ESG107M250AM2AA	ESG107M350AN1AA	ESG107M450AQ4AA
ESG225M400AH1AA	ESG226M160AH4AA	ESG226M450AM7AA	ESG336M400AN4AA	ESG157M160AM2AA