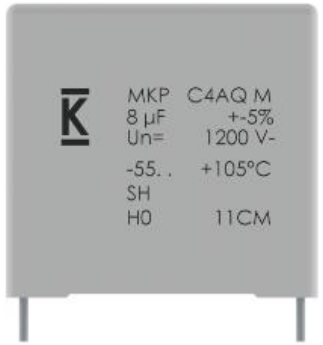
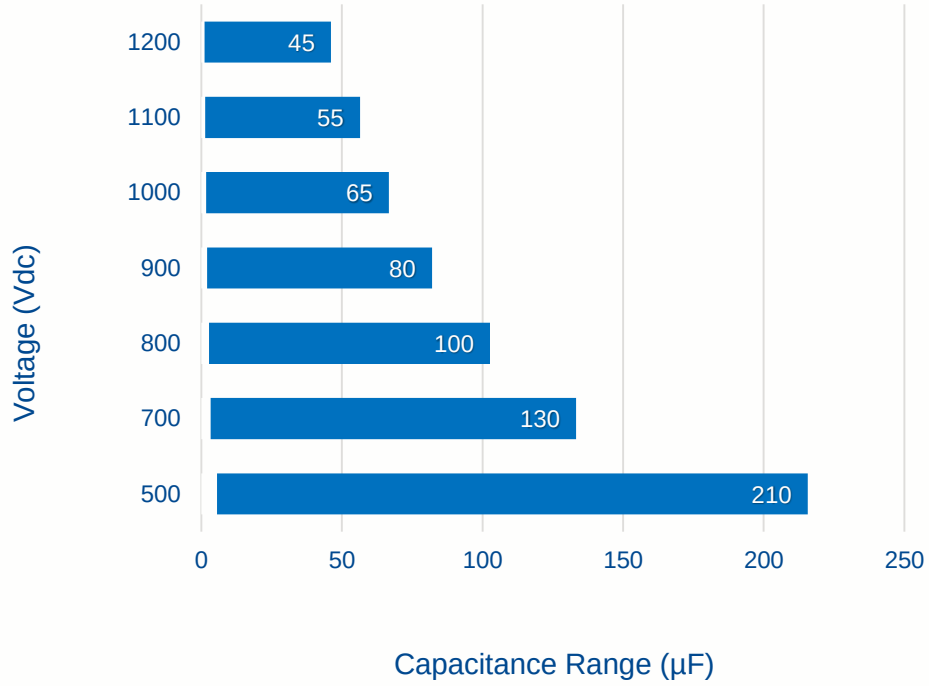
C4AQ-M DC-Link Miniaturized Overview



- C: 1.1 µF to 210 µF
- V_{NDC} (85 °C): 500 V to 1,200 V
- Automotive Rated (AEC-Q200)
- Harsh Environment capabilities
  - THB 60°C / 95%R.H., 1,000 h at Vrated
- Low Profile Solutions
- Low ESL values

Upgraded Features

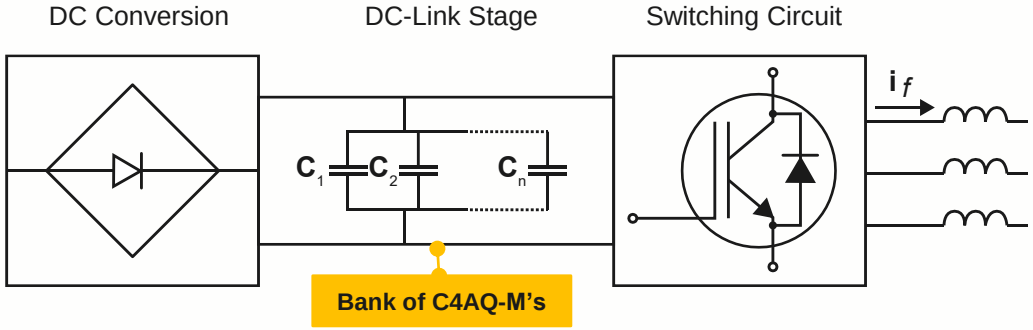
- Max. Temperature 125 °C
- Miniaturization
- Higher ripple current capability
- Higher dv/dt



Automotive

Energy

Industrial



C4AQ-M Key Benefits and Comparison

C4AQ-M Miniaturization Improvement vs. C4AQ

- Up to 28% reduction in volume (x, y, z) values
- Up to 29% reduction in PCB surface area (x, y)
- 17% and 15% average volume and area reduction
- Lead-space (pitch) reduction for certain capacitance values

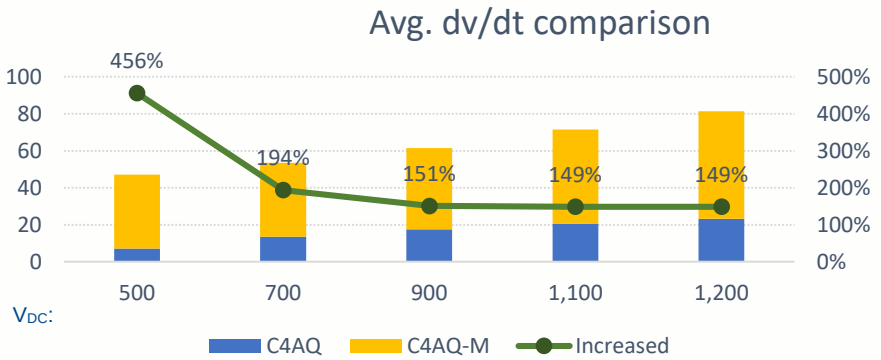
C4AQ-M vs. C4AQ Box Dimensions

VDC (V) at 85 °C	C(µF)	Dimensions (mm) B	H	L	Reduction (%) Volume	PCB Area	Smaller Pitch
700	15	20	40	42	22%	16%	
		22	37	32			Y
	30	30	45	42	23%	7%	
		28	37	42			
	40	35	50	42	23%	14%	
		30	45	42			
	45	30	45	57	12%	14%	
		35	46	42			Y
	55	35	50	57	23%	14%	
		30	45	57			
900	20	30	45	42	28%	27%	
		22	44	42			
	25	35	50	42	23%	14%	
		30	45	42			
	40	35	50	57	9%	20%	
		38	57	42			Y
	65	45	65	57	14%	0%	
		45	56	57			
1100	2.2	14	28	32	17%	7%	
		13	25	32			
	3.3	19	29	32	13%	16%	
		16	30	32			
	10	28	37	42	23%	29%	
		20	40	42			
	12	30	45	42	23%	7%	
		28	37	42			
1200	8	28	37	42	23%	29%	
		20	40	42			
	15	35	50	42	8%	0%	
		35	46	42			
	17	30	45	57	4%	14%	
		35	50	42			Y
	22	35	50	57	9%	20%	
		38	57	42			Y
C4AQ-M Total Average Reduction:					**17%**	**15%**	

C4AQ-M Key Benefits and Comparison

dv/dt Capabilities (Peak Currents)

$$i_{peak} = C\frac{dv}{dt}$$



- Improved peak current capability (dv/dt) of the DC-Link film solutions bring the following advantages:
  - Miniaturization: Less capacitors in parallel to meet the required peak and ripple current.
  - Replacement of electrolytic capacitor solutions
  - Extended the life of the DC-Link under fast WBG devices switching frequencies and current.

Harsh Environment Capabilities

Accelerated Life Test -Temperature Humidity Biased (THB)

Test Spec.	AEC-Q200	C4AQ	C4AQ-M
Temperature:	40 °C	60 °C	60 °C
Humidity:	93% R.H.	95% R.H.	95% R.H.
Voltage:	Vn	Vn	Vn
Hours:	1,000	1,000	1,000
Capitance Variation |ΔC/C|:	≤ 10%	≤ 5%	≤ 5%
Harsh Environment Capability:	+	++	++

- C4AQ and C4AQ-M surpass the extreme conditions of the standard Automotive (AEC-Q200) requirements for film technology in severe humidity/temperature conditions.

C4AQ-M Key Benefits and Comparison

Rated and Derated Voltages

SERIES	70°C	85°C	105°C
C4AQ	500	450	350
C4AQ-M	600	500	350
C4AQ	650	600	450
C4AQ-M	800	700	490
C4AQ	800	700	550
C4AQ-M	960	800	560
C4AQ-M	1,100	900	650
C4AQ	1,100	900	700
C4AQ-M	1,200	1,000	700
C4AQ	1,300	1,100	850
C4AQ-M	1,320	1,100	770
C4AQ-M	1,440	1,200	850
C4AQ	1,500	1,200	900

- C4AQ-M brings new set of VDC voltages at three different derating temperatures.
- C4AQ-M Nominal Voltage (V_{NDC}) is rated at 85 °C
- C4AQ Nominal Voltage (V_{NDC}) is rated at 70 °C

Part Selection Codes

C4AQ-M

(at 85 °C)

C4	A	Q	U	B	W	5270	A	3	N	J
Series	Type	Application	Rated Voltage (VDC)	Case	Terminals Code	Capacitance Code (pF)	Release	Lead Diameter (mm)	Size Code: B x H x L (mm)	Tolerance
C4 = MKP power capacitors	A = Box, wire terminals	Q = DC link Automotive Grade	L = 500 J = 700 I = 800 O = 900 N = 1000 Q = 1,100 P = 1,200	B, E = Box plastic case L = Low Profile box plastic case	U = 2 pins W = 4 pins	Digits 2 – 4 indicate the first three digits of the capacitance value. First digit indicates the number of zeros to be added.	M = Standard Miniature Version	1 = 0.8 2 = 1.0 3 = 1.2	See dimensions table below for valid case sizes	J = 5% K = 10%

C4AQ

(at 70 °C)

C4	A	Q	U	B	W	5270	A	3	N	J
			L = 500 C = 650 I = 800 Q = 1,100 U = 1,300 S = 1,500			.	A = Standard			

C4AQ-M Applications

Automotive

On-Board Battery Charger, DC/DC

DC-Link	100 µF - 1,300 µF
DC Output Filter	2-8 uF

Benefits

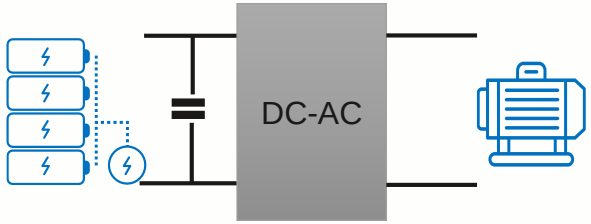
- Rated voltage reach 500 V ~1200 V
- Capacitance 1 µF ~ 130 µF
- High Irms capability
- High frequency performance
- High temperature range
- Low profile

Wireless Power Transfer (WPT)

Benefits

- Rated voltage reach 500 V ~ 1300 V
- Capacitance value 10µF ~ 210 µF
- High Irms capability
- High frequency performance
- High temperature
- Low profile

EV and HEV Air condition compressor control



Benefits

- Rated voltage reach 600 V ~ 900 V
- Capacitance 10 µF ~30 µF
- High Irms capability
- High frequency performance
- 125 °C High Temperature
- Low profile
- Long lifetime

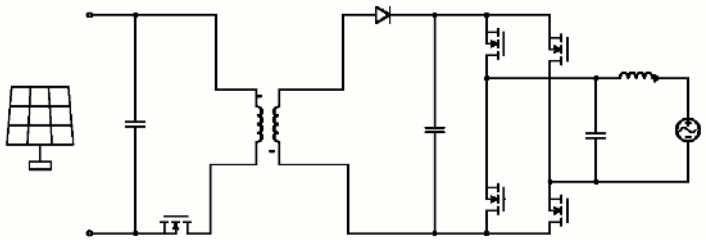
C4AQ-M Applications

Energy

Solar Inverter

Input DC filter
1 µF -10 µF
1,100 – 1600 Vdc

DC Link
10 µF ~ 130 µF
600 – 1,500 Vdc



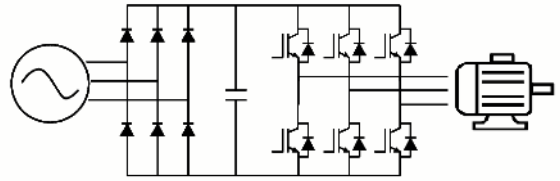
Benefits

- Rated voltage reach 500V ~ 1600V(special design)
- Capacitance 1µF - 130 µF
- High Irms capability
- High frequency performance
- High temperature range
- Low profile

Industrial

Motor Drives

DC Link
10 µF ~ 130 µF
600 – 1,500 Vdc



Benefits

- PCB mounting – Low-Medium power
- Rated Voltage 500 V ~1,200 V
- C: 10 µF ~ 210 µF
- High Irms and Peak (dv/dt) Current High temperature: 105 °C, 125 °C
- Low ESL: High Frequency Capability
- Low Profile – Space optimization