Evans GROUP PAKTRON

For more information contact
paktron@evans-group.com

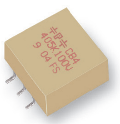
Capacitor Type

# CB4G-FS

# CB6G-FS

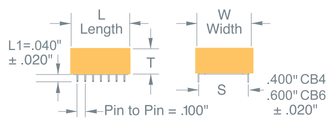
# 3rd Generation, Thermally Shielded Capstick® Capacitor for Pb-Free Soldering

- Ideal for 48 volt bus input & output
- Low impedance (ESR/ESL) construction
- Self-healing—Avoids shorts
- The reliable solution to ceramic and tantalum capacitor faults at elevated voltage
- Made for >100KHz switching power trains and reflected RFI
- Flat surface for pick and place
- Surface-mount capability
- Operating temperature range: –55°C to 125°C
- High ripple current/High capacitance
- Volumetrically efficient
- Made in U.S.A.

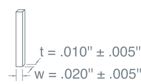


Electrical Schematic

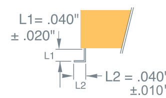
Non-polarized




LEAD SIZE




GULL WING LEADS




## 100 VDC / 80 VAC

| PF Code | Value µF | W Max | T Max | L Max | ESR @500 KHz | RMS Current @500 KHz (A) | # Leads per side | Lead Configuration | Case | Part Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 405 | 4.0 | 0.500 (12.7) | 0.350 (8.89) | 0.525 (13.3) | 0.007 | 11.5 | 3 | SMD | CB4G | 405K100CB4G-FS |
| 475 | 4.7 | 0.500 (12.7) | 0.350 (8.89) | 0.525 (13.3) | 0.006 | 12.2 | 3 | SMD | CB4G | 475K100CB4G-FS |
| 106 | 10.0 | 0.500 (12.7) | 0.350 (8.89) | 0.995 (25.3) | 0.003 | 15.3 | 7 | SMD | CB4G | 106K100CB4G-FS |

## 500 VDC / 250 VAC

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 474 | 0.47 | 0.700 (17.78) | 0.460 (11.68) | 0.625 (15.88) | 0.011 | 6.2 | 4 | SMD | CB6G | 474K500CB6G-FS |

Dimensions in inches, metric (mm) in parenthesis.
Tolerance: K (±10%) standard, J (±5%) available
RoHS part number information:
No suffix indicates RoHS-5 compliant standard part number. RoHS-5 product does not contain five of the RoHS banned materials (Hg, CrVI, Cd, PBB and PBDE) in levels exceeding the industry defined limits. Component lead wires are plated with Sn / Pb and match conventional SnPb board assembly requirements.
For a **RoHS-6** compliant part, add a **–FS** suffix. RoHS-6 product does not contain any of the six RoHS banned materials (Hg, CrVI, Cd, PBB, PBDE and Pb) in levels exceeding the industry defined limits. Component lead wires are plated with Sn.

## Electrical

**Capacitance Range:**
0.47 µF to 10.0 µF @ 1KHz

**Voltage Range:**
100 VDC

**Dissipation Factor:**
≤ 1.0 % @ 25°C, 1KHz

**Insulation Resistance:**
≥ 1,000 Megohms x µF
100 VDC Rating: Test Voltage=10 VDC
500 VDC Rating: Test Voltage=100 VDC

**Dielectric Strength:**
100 VDC Rating: 130 VDC for 2 seconds max.
500 VDC Rating: 650 VDC for 2 seconds max.

**Temperature Range:**
100 VDC Rating: -55°C to 125°C,
derate voltage 1.25% / °C above 85°C.
500 VDC Rating: -55°C to 125°C, no derating

## Performance

**Accelerated DC Voltage Life Test:**
1,000 Hours, 85°C, 1.25 × Rated VDC
Δ C/C ≤ 5%
DF ≤ 1.0%, 1KHz, 25°C
IR ≥ 1,000 Megohm × µF

**Moisture/Humidity Test:**
85°C / 85% RH / 21 days
Δ C/C ≤ 7%
DF ≤ 1.0%, 1KHz, 25°C
IR ≥ 30% of initial limit

**Long Term Stability:**
After 2 years storage,
standard environment Δ C/C ≤ 2%

## Physical

**Construction:**
Non-inductively constructed with metallized polyester dielectric (polyethylene terephthalate). Parallel plate–multilayer polymer (MLP) design.
Electrode: Aluminum metallization.

**Case:** UL94V-0 rated premolded shell

**Lead-Frame Material:** Tinned Cu Alloy

**Vibration:** Mil Std 202 Method 204D

**Peak Reflow:** 245°C max.

**Solder Resistance:**
245°C, 30 Sec. Δ C/C ≤ 2%

**Marking:**
ŦPŦ type, capacitance code, tolerance code, voltage and date code

**Packaging:**
Tape/Reel 13" reel.
Units dry packed with desiccant in moisture barrier bag.
IPC/JEDEC J-STD-20 Moisture sensitivity Level: MSL 4

# MLP Film Capacitors as Alternatives to Ceramics

Miniaturized pass filters made possible by high frequency switching technology need small but low ESR and ESL capacitors to attenuate ripple and reflected RFI over wide frequency bands. With equivalent series resistance approaching zero, non-polar MLP Capacitors reliably sink high ripple currents in high density converters, run cool and are stable.

The trend toward distributed power management and modular power converters has driven the development of high efficiency, low profile power train components. The conventional capacitors historically used in ripple filtering applications are either too large or not suitable for popular methods of surface mounting. Electrolytic capacitors, while size efficient, do not provide the desired, stable electrical characteristics and reliability. Large value multilayer ceramic capacitors are notoriously fragile, expensive and unstable over voltage and temperature extremes. A novel but proven capacitor technology, built upon selected manufacturing techniques of multilayer ceramic and stacked, plastic film capacitors is now the preferred choice. Now film capacitor reliability can be found in chip and block shaped MLP capacitors that approach the board space sizes of X7R, MLC (Ceramic) types. These unique multilayer polymer capacitors (MLP's) offer excellent electrical stability under AC and DC current loads and are not subject to the cracking, shorting or TC mismatch inherent in Ceramic (MLC) capacitor products. They are suitable as input and output filter capacitors in megahertz frequency switching converters, high power ballasts and inverter drives at ambient temperatures from -55° C to 125° C.

## ULTRA-LOW IMPEDANCE CONSTRUCTION

Figure 1 illustrates the multiple stacking technique used to make the MLP structures and the cross section which highlights similarities to stacked film and MLC construction. An all-aluminum electrode and termination construction results in a low resistance and high current connection. The terminations are gathered to multiple pin lead frames for lowest ESR and ESL current handling. Low loss and frequency stable, ultra-thin polyethylene-terephthalate polymer film is used as the dielectric.

## DRIVEN BY HIGH FREQUENCY POWER CONVERSION APPLICATIONS

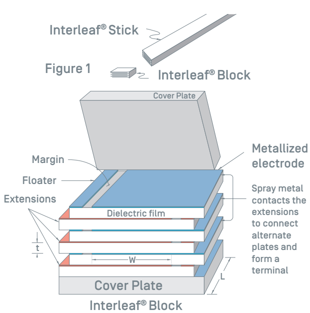
The trend in power conversion is the increase in switching frequency to minimize the size of the magnetic and filter components and boost the wattage per unit volume. Driven by portable computers and the distributed power approaches of both telecom and computer systems, switching frequencies have risen from 20 kilohertz to between 400 KHz and 1 megahertz in high density power converters. The filter capacitors have become an important issue as low impedance and equivalent series resistance are needed for reliable high frequency current handling. The MLP Capstick® Capacitor can increase the series current of the converter which translates into higher wattage density at maximum efficiency.

## NOTES ON USABILITY AND RELIABILITY

Because of the use of the well-known PET dielectric in ultra-thin sheet, the reliability of these capacitors is far better than the industry experience with electrolytic or ceramic capacitors. There exists no capacitance drop or aging with time. The dissipation factor is stable over time. The insulation resistance tends to get better under the influence of heat and voltage. We have shown that in-circuit problems are evident immediately and usually the result of mishandling or overheating during mounting assembly. There exist no metal leaching or dielectric diffusion mechanisms to affect the reliability over time. A complete reliability data package on this and other quality MLP capacitor styles may be obtained by contacting Paktron.

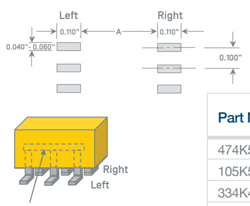
## MOUNTING OPTIONS

The Capstick® can be conditioned for surface mounting (including IR Reflow). Leads can be trimmed to a dimension for butt or through-hole mounting, or configured as gull wing leads. See Appendix for Capstick® soldering guidelines.




$$C = Kn\frac{LW}{t}$$

C Capacitance
K Dielectric constant
n Number of charged plates
L Length of charged area
W Width of charged area
t Film thickness




**Note:** All left side capacitor leads are joined in common internal to the capacitor and all right side capacitor leads are also joined in common internal to the capacitor

### Typical Recommendations
## CS/CB Surface-Mount Pad Layout

| Part Number | Number of Leads per Side | A |
|---|---|---|
| 474K500CS6G, 474K500CB4G-FS | 4 | 0.565” |
| 105K500CS6G | 8 | 0.565” |
| 334K400CS6G | 3 | 0.565” |
| 474K400CS6G | 3 | 0.565” |
| 105K400CS6G | 7 | 0.565” |
| 205K100CS4G | 3 | 0.365” |
| 405K100CS4G, 405K100CB4G, 405K100CB4G-FS | 3 | 0.365” |
| 475K100CS4G, 475K100CB4G, 475K100CB4G-FS | 3 | 0.365” |
| 685K100CS4G | 5 | 0.365” |
| 106K100CS4G, 106K100CB4G, 106K100CB4G-FS | 7 | 0.365” |
| 106K050CS4G | 5 | 0.365” |
| 206K050CS4G | 9 | 0.365” |

## Very High Ripple Current

# CS/CB Performance Characteristics over a range of -55°C to +85°C

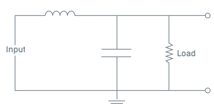
### MAXIMUM RMS CURRENT (AMPS) VS. FREQUENCY

| µF | VDC | 1 KHz | 10 KHz | 100 KHz | 500 KHz | 1MHz |
|---|---|---|---|---|---|---|
| 0.47 | 500 | 0.8 | 1.9 | 3.9 | 6.2 | 7.1 |
| 1.0 | 500 | 1.1 | 2.4 | 5.9 | 9.5 | 10.6 |
| 0.33 | 400 | 0.7 | 1.3 | 3.5 | 6.0 | 6.9 |
| 0.47 | 400 | 0.8 | 1.9 | 3.9 | 6.2 | 7.0 |
| 1.0 | 400 | 1.1 | 2.4 | 5.9 | 9.5 | 10.5 |
| 1.0 | 250 | 0.7 | 1.6 | 3.3 | 5.2 | 5.9 |
| 2.0 | 100 | 0.4 | 2.6 | 6.0 | 8.3 | 8.9 |
| 4.0 | 100 | 1.9 | 4.2 | 10.2 | 11.5 | 12.0 |
| 4.7 | 100 | 2.0 | 4.5 | 10.8 | 12.2 | 12.6 |
| 6.8 | 100 | 2.9 | 6.6 | 12.5 | 13.7 | 14.0 |
| 10.0 | 100 | 4.3 | 9.9 | 14.1 | 15.3 | 15.6 |
| 10.0 | 50 | 4.2 | 9.7 | 14.0 | 15.3 | 15.6 |
| 20.0 | 50 | 9.3 | 13.3 | 16.7 | 17.8 | 18.0 |

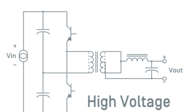
### MAXIMUM RMS VOLTAGE VS. FREQUENCY

| µF | VDC | 1 KHz | 10 KHz | 100 KHz | 500 KHz | 1MHz |
|---|---|---|---|---|---|---|
| 0.47 | 500 | 250 | 64 | 13.1 | 4.2 | 2.4 |
| 1.0 | 500 | 176 | 38 | 9.4 | 3.0 | 1.6 |
| 0.33 | 400 | 250 | 64 | 17.2 | 6.9 | 4.0 |
| 0.47 | 400 | 250 | 64 | 13.1 | 4.2 | 2.4 |
| 1.0 | 400 | 176 | 38 | 9.4 | 3.0 | 1.6 |
| 1.0 | 250 | 94 | 24 | 5.0 | 1.6 | 0.9 |
| 2.0 | 100 | 35 | 21 | 4.7 | 1.3 | 0.7 |
| 4.0 | 100 | 35 | 18 | 4.2 | 1.0 | 0.4 |
| 4.7 | 100 | 35 | 18 | 3.7 | 0.8 | 0.3 |
| 6.8 | 100 | 35 | 18 | 2.9 | 0.6 | 0.3 |
| 10.0 | 100 | 35 | 18 | 2.2 | 0.5 | 0.3 |
| 10.0 | 50 | 35 | 18 | 2.2 | 0.5 | 0.2 |
| 20.0 | 50 | 35 | 18 | 1.3 | 0.3 | 0.1 |

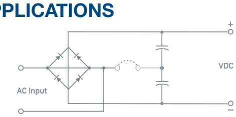
### TYPICAL APPLICATIONS



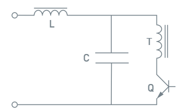
Output Filter



High Voltage Input Filter



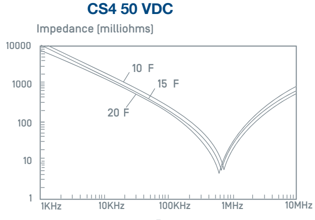
AC & Quasi AC Input Filter



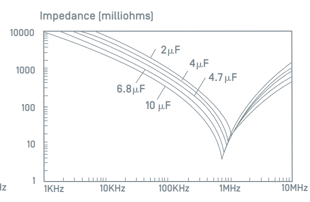
Low Pass Filter

### TYPICAL IMPEDANCE VS. FREQUENCY

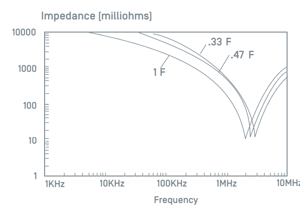
**CS4 50 VDC**




**CS4/CB4 100 VDC**

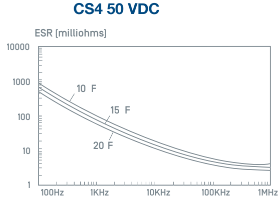



**CS6 400/500 VDC**

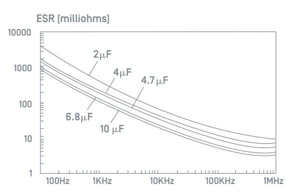



### TYPICAL ESR VS. FREQUENCY

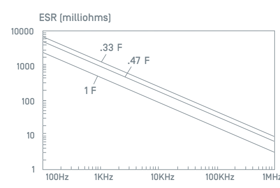
**CS4 50 VDC**




**CS4/CB4 100 VDC**




**CS6 400/500 VDC**



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