

**General**

The Capstick and Surfilm capacitors Type CB, CS and ST use PET as the film dielectric and have been thermally stabilized to withstand reflow soldering temperatures for a maximum of 220°C for 30 seconds, with 1.5 minutes of allowable time at temperatures above 183°C., while products with the "-FS" suffix can be reflow soldered at a maximum of 245°C for 30 seconds, with 1.5 minutes of allowable time at temperatures above 217°C.

Dielectric Film		
Type	Name	Code
CB	polyethylene terephthalate	PET
CS	polyethylene terephthalate	PET
ST	polyethylene terephthalate	PET

To prevent excessive changes to both the electrical and mechanical characteristics, Paktron recommends that the following soldering guidelines be observed when processing Capstick and Surfilm capacitors.

**Pre-Conditioning**

In case of high humidity storage and short cycle reflow soldering profiles, it is recommended that the capacitors be pre-conditioned in an 85°C oven for a minimum of 12 hours prior to reflow soldering to minimize any effects caused by the rapid vaporization of the moisture.



**CAUTION**  
This bag contains  
**MOISTURE-SENSITIVE DEVICES**

1. Shelf life in sealed bag: 12 months @ < 40°C and < 90% relative humidity (RH).
2. Peak package body temperature: **220 °C**
3. After this bag is opened, devices that will be subjected to reflow solder or equivalent high temperature processing must be:
  - a) Mounted within 72 hours at factory conditions of ≤ 30°C / 60% RH, or
  - b) Stored at ≤ 10% RH.
4. Devices require baking, before mounting, if:
  - a) 3a or 3b are not met, or
  - b) If applicable, a Humidity Indicator Card reads >10% RH, when read at 23°C ±5°C.
5. If required, devices may be baked for:
  - a) 48 hours @ 50°C +5°C/-0°C and <5% RH in reels/tubes or
  - b) 12 hours @ 85°C +0°C/-5°C and <5% RH in bulk.

Bag Seal Date: \_\_\_\_\_  
(if blank, see barcode label)

Level  
**4**

**Paktron**  
1205 McConville Rd.  
Lynchburg, VA 24502

**Solder Paste Thickness**

Depending upon pad geometry, the recommended solder paste thickness is .006" (6 mils) to .010" (10 mils). For optimum performance, 8 mils to 10 mils should be used. In the case where small pitch components do not allow extra paste thickness, use of a "step screen" should be considered.

**Board Attachment**

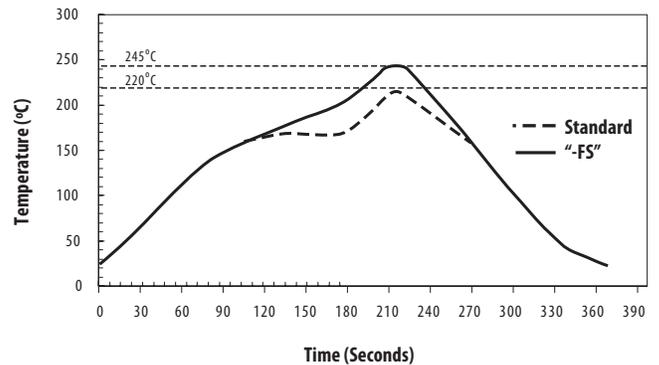
Due to their low mass, it is recommended that for optimum soldering results, Surfilm capacitors be spot glued to the substrate.

**Maximum Solder Reflow Temperatures**

Do not exceed the following temperatures:

Manufacturing Solder Method	Maximum Temperature			
	CB	CS	ST	"-FS"
Conductive Reflow	220°C	220°C	220°C	245°C
Convection Reflow	220°C	220°C	220°C	245°C
IR Reflow	220°C	220°C	220°C	245°C
Vapor Phase Reflow	NA	NA	220°C	NA
Soldering Iron	220°C	220°C	220°C	245°C
Wave Solder	NA	NA	NA	NA
Wave Solder (thru-hole)	260°C	260°C	NA	245°C

**Typical Convection Reflow Solder Profiles**



Profile Criteria	CB, CS, ST	"-FS"
Average Ramp-Up Rate	3°C/second max	3°C/second max
Preheat:		
Temperature Min	100°C	150°C
Temperature Max	150°C	200°C
Time	60 - 120 seconds	60 - 180 seconds
Time Above:		
Temperature	183°C	217°C
Time	90 seconds	90 seconds
Peak Temperature	220°C	245°C
Time within 5°C of Peak	30 seconds	30 seconds
Ramp-Down Rate	6°C/seconds max	6°C/second max
Time from 25°C to Peak	360 seconds max	480 seconds max

**Board Cleaning**

When cleaning the boards, avoid the use of alcohol based solvents. These may cause a temporary drop in the insulation resistance of the capacitor. The manufacturer's safety data sheet should also be studied carefully before using any solvent.

**MLP Mounting Pad Layout**

Typical Recommended

Capstick

Surfilm

Recommended Pad Sizes (inches)			
Case Code	A	B	C
ST2824/ST3	0.210	0.365	0.275
ST3827/ST4	0.310	0.465	0.305

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.

## Hand Soldering Surfilm Capacitors

The following hand soldering method has proven to be satisfactory for soldering small quantities of Surfilm capacitors to printed circuit pads.

### Materials and Equipment:

- a. Use a soldering iron that will control the iron tip temperature to 220°C maximum. The Weller EC 2002C Soldering station and the EC1201P Iron will provide the temperature control needed
- b. To reduce the heat exposure time, use a low temperature solder alloy with a low residue solder flux.
- c. For ease of handling, prevention of contamination and personal injury, a pair of small tweezers should be employed to position the units for hand soldering.

### Procedure:

1. Flow a thin bead of solder to one printed circuit pattern.
2. Center the capacitor to be soldered on the printed circuit electrode and place a small quantity of solder on the iron tip. Place the iron point at the junction of the capacitor electrode and printed circuit electrode and reflow the solder while applying a force to the top surface of the capacitor so that it will seat flush against the printed circuit pattern.
3. Clean the iron tip and apply the tip and solder to the opposite printed circuit and capacitor electrode junction until the solder wets the full length of the PC electrode and capacitor electrode. Do not apply a force to the top of the capacitor when soldering the second electrode.
4. Examine the first side soldered and repeat step 3 on the first side if required. The first solder application of step 2 is to mechanically position the capacitor on the board and hold it in place so that both hands are free to apply both the solder and iron tip to the second electrode. A full solder wetting may not be accomplished in step 2.

## Important Points In MLP Soldering

1. **Reflow Temperature:** The maximum reflow solder temperature for capacitors made with PET based film dielectric is specified at 220°C. Type CB, CS and ST are made with low shrinkage PET dielectric film that has been thermally stabilized to withstand reflow soldering temperatures for a maximum of 220°C for 30 seconds, with 1.5 minutes of allowable time at temperatures above 183°C. The exception to this is product with the "-FS" suffix which is capable of withstanding reflow soldering temperatures for a maximum of 245°C for 30 seconds, with 1.5 minutes of allowable time at temperatures above 217°C. Typical reflow temperature profiles are shown on the proceeding page. Exceeding the recommended maximum temperature is one of the leading causes of soldering problems. On Type ST Product, excessive reflow temperatures can cause product swelling and shrinkage/curling of the white coverplates, which can lift the terminations out of the solder paste and create a "drawbridge" condition that prevents complete soldering.
2. **Solder Paste Thickness:** While reliable solder joints have been formed using paste thicknesses as low as 4 mils, for optimum performance, 8 mils to 10 mils should be used.
3. **Mounting Pad Sizes:** The recommended pad size geometry is shown on the proceeding page.
4. **Board Attachment:** Due to the low mass of the Type ST product, it is recommended that the chips be spot glued to the substrate for optimum soldering results.
5. **Storage Conditions and Floor Life:** The Capstick and Surfilm component reel packaging from the factory is "dry pack." Dry packing involves sealing the reel of product with a desiccant inside a moisture-barrier bag. This type of packaging provides moisture protection for 12 months @ <40°C / <90% RH. The Floor Life or "out-of-bag" exposure time is categorized according to the "JEDEC Moisture-Sensitivity Level" specification. The Capstick and Surfilm products meet "Level 4" which allows for "out-of-bag" exposure time @ 30°C / 60% RH of 3 days (72 hours).
6. In the case of open exposure to high humidity storage, it is recommended that the capacitors be pre-conditioned prior to reflow soldering to minimize any effects caused by the rapid vaporization of the moisture. The capacitors can be pre-conditioned either while still in the reels and tubes @ 50°C for 48 hours or in bulk/loose @ 85°C for 12 hours at <5% RH.

## Company Overview

In existence since 1953, Paktron is one of the oldest capacitor manufacturers in the US. Paktron is the technological leader in the manufacture of multilayer polymer film capacitors and sells across diverse markets including automotive, commercial, Hi-Rel, military, space, and telecommunications. As a quality conscience company, Paktron follows the proven philosophy of building quality into its products. Inherent quality provides for both long-term reliability as well as outstanding product performance. Paktron's longevity is testament to its commitment to Quality.

## Quality System Overview

Because of Paktron's multi-industry sales markets, rather than attempting to maintain registrations to each of the vast assortment of standardized quality systems specific to each of these markets, since 1953 Paktron has utilized an ever evolving, capacitor industry specific, documented quality system of its own which equals or exceeds the requirements of market oriented, standardized systems without the limitations imposed by market standardization. Paktron's Quality Assurance System is a full-featured system giving Paktron the ability to produce the finest products possible. The system includes, but is not limited to:

- |                                      |                            |
|--------------------------------------|----------------------------|
| 1. Operator Training                 | 8. Vender Qualification    |
| 2. Receiving Inspection              | 9. Material Review         |
| 3. Calibration                       | 10. In-Process Inspections |
| 4. Out-going Inspection              | 11. Surveillance Testing   |
| 5. Failure Analysis                  | 12. Qualification Testing  |
| 6. Statistical Process Control       | 13. Reliability Testing    |
| 7. New Product/Process Authorization |                            |

## Documentation System

The Paktron documentation system strictly follows the guidelines as outlined in ISO-900x. The documentation system is separated into three different sections:

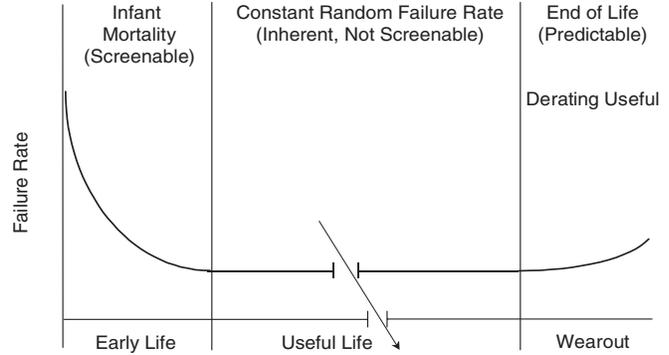
- |   |                            |
|---|----------------------------|
| 1) Procedure manuals:                           | 2) General Procedures:     |
| a) Quality Manual                               | 3) Specification systems:  |
| b) Document Control Procedures Manual           | a) Assembly Specifications |
| c) Accounting Procedures Manual                 | b) Design Specifications   |
| d) Engineering Procedures Manual                | c) Equipment               |
| Specifications                                  | d) Material Specifications |
| e) Marketing and Sales Procedures Manual        | e) Process Specifications  |
| f) Purchasing Procedures Manual                 | f) Quality Specifications  |
| g) Production Control Procedures Manual         |                            |
| h) Quality Control Procedures Manual            |                            |
| i) Shipping and Receiving Procedures Manual     |                            |
| j) Supplier Quality Assurance Procedures Manual |                            |
| k) Test and Reliability Procedures Manuals      |                            |

## Statistical Process Control

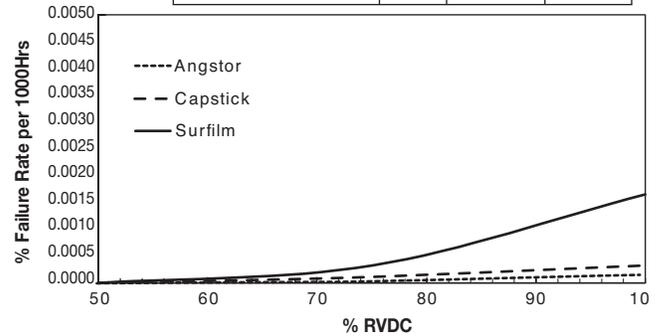
Like many other manufacturers, in order to meet the changing quality needs of its various customers, Paktron has long ago implemented a program of Statistical Process Control (SPC). This program placed the responsibility for quality directly on the production operators who must build quality into the product rather than trying to test defects out in the final test operations. This results in the production of more consistent quality and performance products. Day-to-day process control is being done with process control charts (X bar and R, percent defective, histograms and range charts) with the Paktron QA department moving into an overview function of doing trending analysis, process averaging, specification compliance control, etc. Using these systems of certification, quality levels in the low PPMs becomes not just a goal, but a reality.

## Reliability

Paktron's Quality Assurance does not end once the product has been shipped to the customer. The long-term reliability of the product is as important as its initial implementation. Theoretically, a well-designed, well-engineered, thoroughly tested and properly applied component should "never" fail in operation (within the life of the equipment). However, practical experience shows that even the best design, manufacturing, and engineering efforts do not completely eliminate the occurrence of "field" failures. Usually, field failure categories encountered in components are the "infantile", "random", and in the case of mis-application, "wearout". Paktron eliminates the "infantile" category through extensive testing and strict controls (QA/SPC). The "wearout" category is eliminated by "guard-banding" the performance characteristics of the products and by maintaining close contacts between the Paktron and customer Engineering groups. "Random" failures occur after the infant mortality stage. They occur because of "undetectable" weaknesses in the products. Although the time of occurrence of random failures cannot be predicted, the probability of occurrence or non-



	@ %RVDC and 40°C		
	50%	75%	100%
Angstor (RA)	0.0000	0.00003	0.00014
Capstick (CS, CB)	0.0000	0.00010	0.00030
Surfilm (ST)	0.0000	0.00030	0.00150



occurrence of such failures can be calculated by means of the theory of probability. Paktron's reputation for "Quality" in the Industry is based not only on its ability to eliminate "infantile" failures through strict QA controls, but also on being able to minimize "random" failures through its SPC controls which detects/eliminates heretofore "undetectable" weaknesses and significantly increases the reliability of the product. Paktron's film capacitors are so inherently reliable that use life is measured in decades rather than hours of operation. While Paktron's own rigorous accelerated testing shows theoretical PPM failure levels in the single digits, customer feedback consistently reports zero PPM failure levels.

## Voltage Ratings

Like all polymer film capacitors, Paktron's product offerings have "true" voltage ratings and unlike other dielectric systems require no voltage de-ratings for maximizing reliability (MTBF) or use life. With FIT rates of well under 5 FIT when used at rated voltage, these capacitors provide a positive contribution to circuit MTBF calculations.

Circuit designers requiring 500 volt ratings in other dielectric systems for their 370 volt input applications are being penalized by that dielectric system's inherent deficiencies. In the polymer film capacitor industry, if a capacitor is rated at a certain voltage, then the capacitor is designed to be fully functional and reliable at that voltage for the life of the equipment. Many leading edge circuit designs take advantage of a polymer film capacitor's inherent reliability at rated voltage to both reduce board size and significantly improve performance.

## Material Content

Paktron's product offerings neither contain nor are manufactured with any risk level hazardous material. The material content for polymer film capacitors is basically: polymer, aluminum, copper, tin, iron, microcrystalline polyolefin, trace amounts of other materials such as antimony and lead and various non-toxic, non-hazardous thermoplastics used for encasements. The polymers typically used are polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and/or polyphenylene sulfide (PPS). The products' terminations are coated (tinned) with either 60Sn-40Pb or 100% Sn to a thickness of 100-500 micro inches in order to facilitate soldering without the possibility of whisker growth with the 100% Sn meeting current industry guidelines for lead-free (Pb-free) with a lead (Pb) material content of under 0.1 wt% (1000ppm).