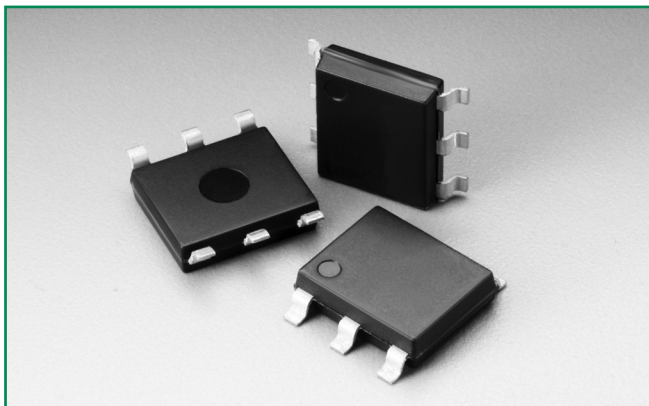


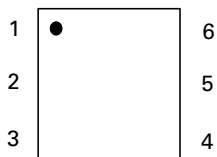
## MC Multiport Series - MS-013



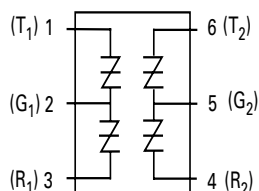
### Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
|        | E133083            |

### Pinout Designation



### Schematic Symbol



### Description

The MC Multiport Series MS-013 are low capacitance SIDACtor® thyristors designed to protect broadband equipment from damaging overvoltage transients.

The series provides a dual port surface mount solution that enables equipment to comply with various global regulatory standards while limiting the impact to broadband signals.

### Features and Benefits

- Low voltage overshoot
  - Low on-state voltage
  - Does not degrade surge capability after multiple surge events within limit.
  - Fails short circuit when surged in excess of ratings
  - Two-pair protection
  - 40% lower capacitance than our Baseband
- Protectors, for applications that demand greater signal integrity
- Replaces four discrete components
  - Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

### Applicable Global Standards

- TIA-968-A
- TIA-968-B
- ITU K.20/21/45 Enhanced Level
- ITU K.20/21/45 Basic Level
- GR 1089 Intra-building
- IEC 61000-4-5 2nd edition
- YD/T 1082
- YD/T 993
- YD/T 950
- GR 1089 Inter-building

### Electrical Characteristics

| Part Number  | Marking   | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T=2.2$<br>Amps | Capacitance                        |
|--------------|-----------|---------------------------------|--------------------------|---------------------------------|--------------------------|--------|--------|-------|------------------------------|------------------------------------|
|              |           | V                               | V                        | V                               | V                        | mA min | mA max | A max | V max                        |                                    |
|              |           | Pins 1-2, 3-2, 4-5, 6-5         |                          | Pins 1-3, 4-6                   |                          |        |        |       |                              |                                    |
| P0084UCMCLxx | P0084UCMC | 6                               | 25                       | 12                              | 50                       | 50     | 800    | 2.2   | 8                            | See<br>Capacitance<br>Values Table |
| P0304UCMCLxx | P0304UCMC | 25                              | 40                       | 50                              | 80                       | 50     | 800    | 2.2   | 8                            |                                    |
| P0644UCMCLxx | P0644UCMC | 58                              | 77                       | 116                             | 154                      | 150    | 800    | 2.2   | 8                            |                                    |
| P0724UCMCLxx | P0724UCMC | 65                              | 88                       | 130                             | 176                      | 150    | 800    | 2.2   | 8                            |                                    |
| P0904UCMCLxx | P0904UCMC | 75                              | 98                       | 150                             | 196                      | 150    | 800    | 2.2   | 8                            |                                    |
| P1104UCMCLxx | P1104UCMC | 90                              | 130                      | 180                             | 260                      | 150    | 800    | 2.2   | 8                            |                                    |
| P1304UCMCLxx | P1304UCMC | 120                             | 160                      | 240                             | 320                      | 150    | 800    | 2.2   | 8                            |                                    |

Notes:  
- Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).  
- Components are bi-directional.  
- **XX** Part Number Suffix: **TP** (Tube Pack) or **RP** (Reel Pack).

Table continues on next page.

## Electrical Characteristics (continued)

| Part Number  | Marking   | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T=2.2$<br>Amps | Capacitance                        |
|--------------|-----------|---------------------------------|--------------------------|---------------------------------|--------------------------|--------|--------|-------|------------------------------|------------------------------------|
|              |           | V                               | V                        | V                               | V                        | mA min | mA max | A max | V max                        |                                    |
|              |           | Pins 1-2, 3-2, 4-5, 6-5         |                          |                                 | Pins 1-3, 4-6            |        |        |       |                              |                                    |
| P1504UCMCLxx | P1504UCMC | 140                             | 180                      | 280                             | 360                      | 150    | 800    | 2.2   | 8                            | See<br>Capacitance<br>Values Table |
| P1804UCMCLxx | P1804UCMC | 170                             | 220                      | 340                             | 440                      | 150    | 800    | 2.2   | 8                            |                                    |
| P2304UCMCLxx | P2304UCMC | 190                             | 260                      | 380                             | 520                      | 150    | 800    | 2.2   | 8                            |                                    |
| P2604UCMCLxx | P2604UCMC | 220                             | 300                      | 440                             | 600                      | 150    | 800    | 2.2   | 8                            |                                    |
| P3104UCMCLxx | P3104UCMC | 275                             | 350                      | 550                             | 700                      | 150    | 800    | 2.2   | 8                            |                                    |
| P3504UCMCLxx | P3504UCMC | 320                             | 400                      | 600                             | 800                      | 150    | 800    | 2.2   | 8                            |                                    |

Notes:

- Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).

- Components are bi-directional.

- **XX** Part Number Suffix: '**TP**' (Tube Pack) or '**RP**' (Reel Pack).

## Capacitance Values

| Part Number  | pF<br>Pin 1-2 / 3-2 (4-5 / 6-5)<br>Tip-Ground, Ring-Ground |     | pF<br>Pin 1-3 (4-6)<br>Tip-Ring |     |
|--------------|------------------------------------------------------------|-----|---------------------------------|-----|
|              | MIN                                                        | MAX | MIN                             | MAX |
| P0084UCMCLxx | 35                                                         | 75  | 20                              | 45  |
| P0304UCMCLxx | 25                                                         | 45  | 10                              | 25  |
| P0644UCMCLxx | 55                                                         | 85  | 30                              | 50  |
| P0724UCMCLxx | 50                                                         | 75  | 25                              | 45  |
| P0904UCMCLxx | 45                                                         | 70  | 25                              | 40  |
| P1104UCMCLxx | 45                                                         | 70  | 25                              | 40  |
| P1304UCMCLxx | 40                                                         | 60  | 20                              | 35  |
| P1504UCMCLxx | 35                                                         | 55  | 20                              | 35  |
| P1804UCMCLxx | 35                                                         | 50  | 15                              | 30  |
| P2304UCMCLxx | 30                                                         | 50  | 15                              | 30  |
| P2604UCMCLxx | 30                                                         | 45  | 15                              | 30  |
| P3104UCMCLxx | 30                                                         | 45  | 15                              | 25  |
| P3504UCMCLxx | 25                                                         | 40  | 15                              | 25  |

Note: Off-state capacitance ( $C_O$ ) is measured at 1 MHz with a 2 V bias.

## Surge Ratings

| Series | $I_{PP}$                                     |                                        |                                          |                                            |                                            |                                          |                                            |                                              |                                           | $I_{TSM}$<br>50/60 Hz | di/dt |
|--------|----------------------------------------------|----------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------------|-----------------------|-------|
|        | 0.2/310 <sup>1</sup><br>0.5/700 <sup>2</sup> | 2/10 <sup>1</sup><br>2/10 <sup>2</sup> | 8/20 <sup>1</sup><br>1.2/50 <sup>2</sup> | 10/160 <sup>1</sup><br>10/160 <sup>2</sup> | 10/560 <sup>1</sup><br>10/560 <sup>2</sup> | 5/320 <sup>1</sup><br>9/720 <sup>2</sup> | 10/360 <sup>1</sup><br>10/360 <sup>2</sup> | 10/1000 <sup>1</sup><br>10/1000 <sup>2</sup> | 5/310 <sup>1</sup><br>10/700 <sup>2</sup> |                       |       |
|        | A min                                        | A min                                  | A min                                    | A min                                      | A min                                      | A min                                    | A min                                      | A min                                        | A min                                     |                       |       |
| C      | 50                                           | 500                                    | 400                                      | 200                                        | 150                                        | 200                                      | 175                                        | 100                                          | 200                                       | 30                    | 500   |

Notes:

1 Current waveform in  $\mu s$

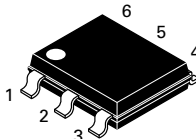
2 Voltage waveform in  $\mu s$

- Peak pulse current rating ( $I_{PP}$ ) is repetitive and guaranteed for the life of the product that remains in thermal equilibrium.

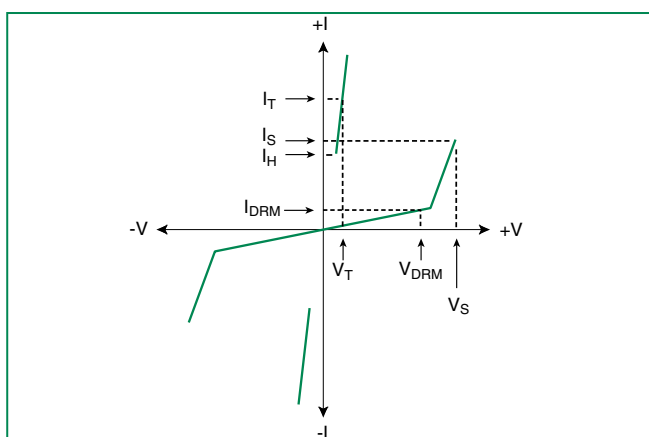
-  $I_{PP}$  ratings applicable over temperature range of  $-40^\circ C$  to  $+85^\circ C$

- The component must initially be in thermal equilibrium with  $-40^\circ C \leq T_J \leq +150^\circ C$

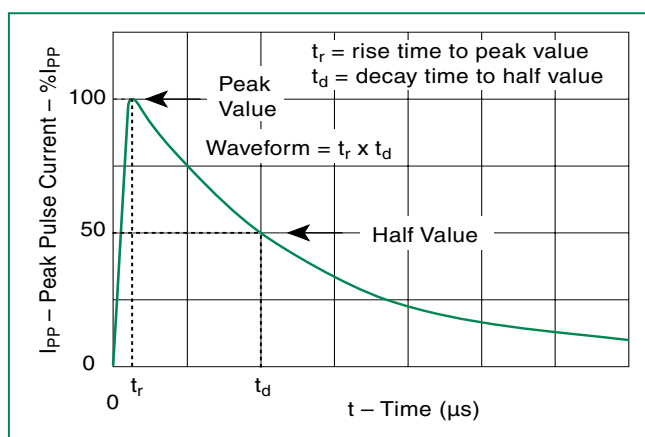
## Thermal Considerations

| Package                                                                                              | Symbol          | Parameter                               | Value       | Unit |
|------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------|-------------|------|
| <br>Modified MS-013 | $T_J$           | Operating Junction Temperature Range    | -40 to +150 | °C   |
|                                                                                                      | $T_S$           | Storage Temperature Range               | -65 to +150 | °C   |
|                                                                                                      | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 60          | °C/W |

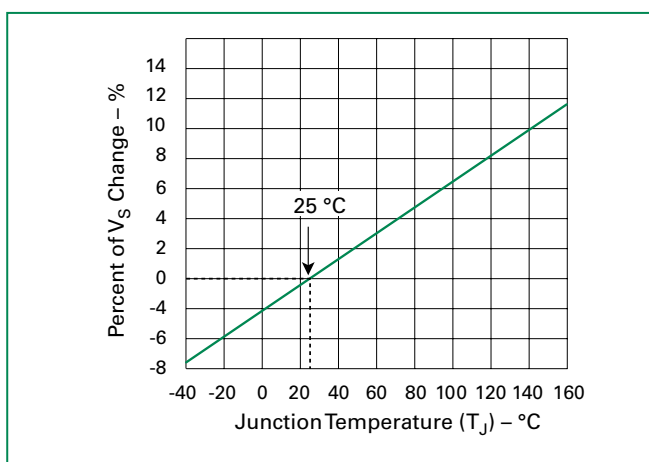
## V-I Characteristics



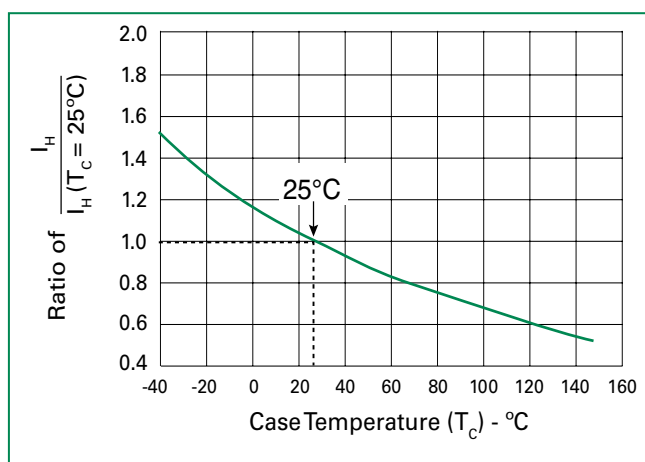
## $t_r \times t_d$ Pulse Waveform



## Normalized $V_S$ Change vs. Junction Temperature



## Normalized DC Holding Current vs. Case Temperature



## Additional Information



Datasheet



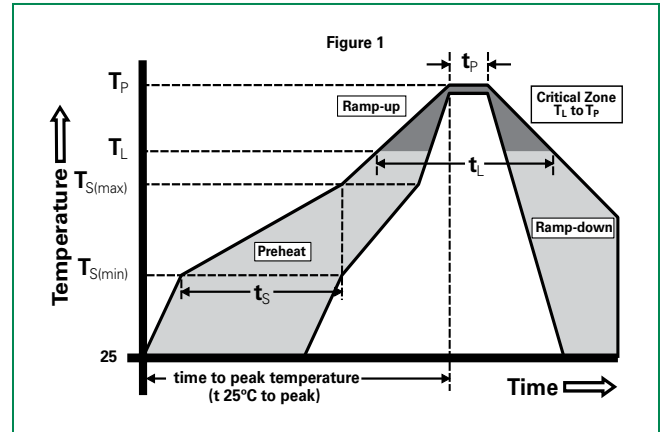
Resources



Samples

## Soldering Parameters

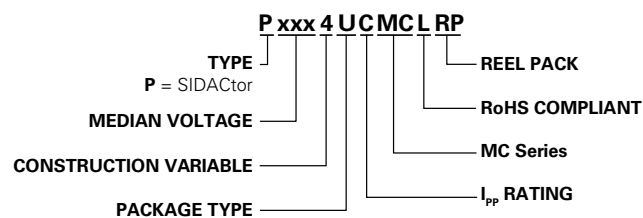
| Reflow Condition                                       |                                   | Pb-Free assembly (see Fig. 1) |
|--------------------------------------------------------|-----------------------------------|-------------------------------|
| Pre Heat                                               | -Temperature Min ( $T_{s(min)}$ ) | +150°C                        |
|                                                        | -Temperature Max ( $T_{s(max)}$ ) | +200°C                        |
|                                                        | -Time (Min to Max) ( $t_s$ )      | 60-180 secs.                  |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max.                 |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                   | 3°C/sec. Max.                 |
| Reflow                                                 | -Temperature ( $T_L$ ) (Liquidus) | +217°C                        |
|                                                        | -Temperature ( $t_L$ )            | 60-150 secs.                  |
| Peak Temp ( $T_p$ )                                    |                                   | +260(+0/-5)°C                 |
| Time within 5°C of actual Peak Temp ( $t_p$ )          |                                   | 30 secs. Max.                 |
| Ramp-down Rate                                         |                                   | 6°C/sec. Max.                 |
| Time 25°C to Peak Temp ( $T_p$ )                       |                                   | 8 min. Max.                   |
| Do not exceed                                          |                                   | +260°C                        |



## Physical Specifications

|                        |                                                             |
|------------------------|-------------------------------------------------------------|
| <b>Lead Material</b>   | Copper Alloy                                                |
| <b>Terminal Finish</b> | 100% Matte-Tin Plated                                       |
| <b>Body Material</b>   | UL Recognized epoxy meeting flammability classification V-0 |

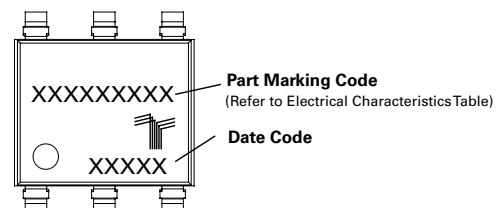
## Part Numbering



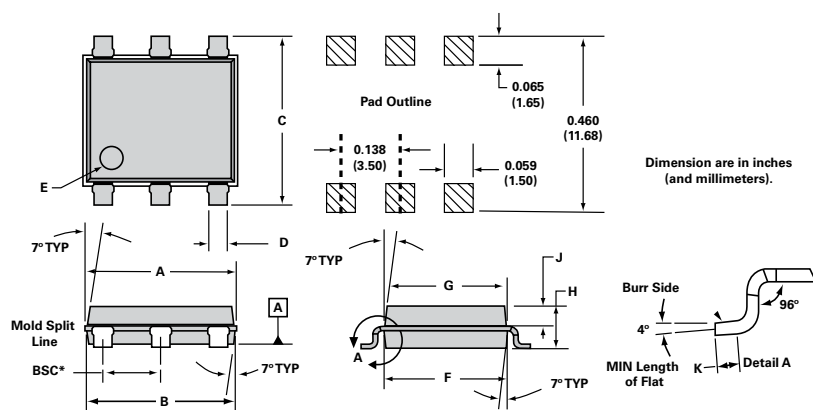
## Environmental Specifications

|                                         |                                                                                                                        |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>High Temp Voltage Blocking</b>       | 80% Rated $V_{DRM}$ ( $V_{AC Peak}$ ) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| <b>Temp Cycling</b>                     | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A-104                 |
| <b>Biased Temp &amp; Humidity</b>       | 52 $V_{DC}$ (+85°C) 85%RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101                                                 |
| <b>High Temp Storage</b>                | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101                                                         |
| <b>Low Temp Storage</b>                 | -65°C, 1008 hrs.                                                                                                       |
| <b>Thermal Shock</b>                    | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106                |
| <b>Autoclave (Pressure Cooker Test)</b> | +121°C, 100%RH, 2atm, 24 up to 168 hrs. EIA/JEDEC, JESD22-A-102                                                        |
| <b>Resistance to Solder Heat</b>        | +260°C, 30 secs. MIL-STD-750 (Method 2031)                                                                             |
| <b>Moisture Sensitivity Level</b>       | 85%RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1                                        |

## Part Marking



## Dimensions — MS-013



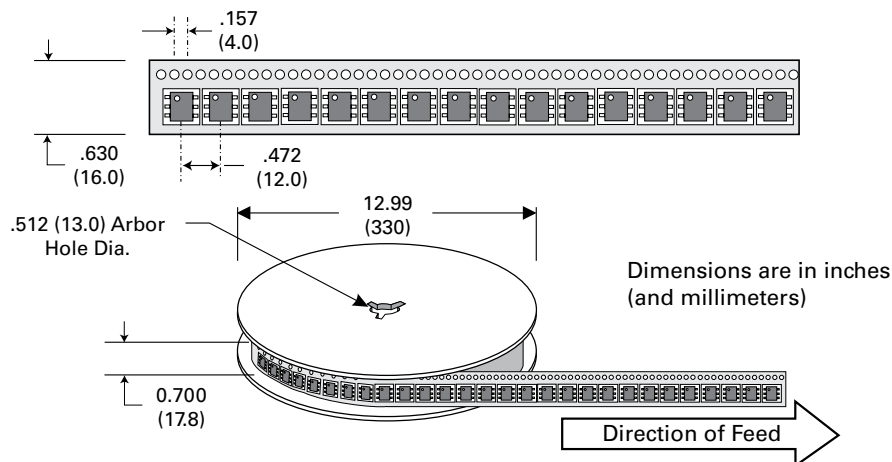
| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.360  | 0.364 | 9.14        | 9.25  |
| B          | 0.352  | 0.356 | 8.94        | 9.04  |
| C          | 0.400  | 0.412 | 10.16       | 10.46 |
| D          | 0.043  | 0.045 | 1.09        | 1.13  |
| E          | 0.047  | 0.055 | 1.19        | 1.40  |
| F          | 0.293  | 0.297 | 7.44        | 7.54  |
| G          | 0.289  | 0.293 | 7.34        | 7.44  |
| H          | 0.089  | 0.093 | 2.26        | 2.36  |
| J          | 0.041  | 0.049 | 1.04        | 1.24  |
| K          | 0.020  |       | 0.51        |       |
| BSC*       | 0.133  | 0.143 | 3.38        | 3.63  |

\* BSC = Basic Spacing between Centers

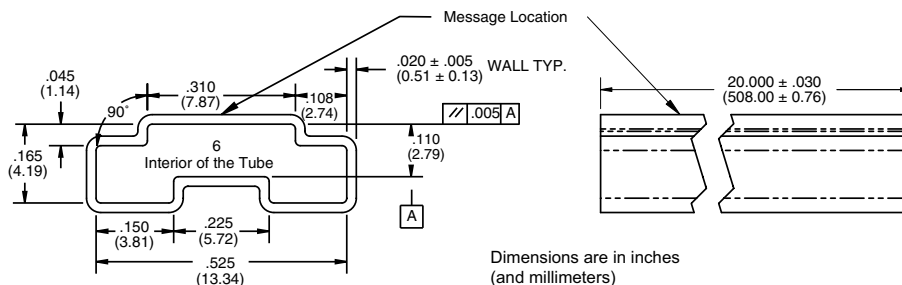
## Packing Options

| Package Type | Description                              | Quantity          | Added Suffix | Industry Standard |
|--------------|------------------------------------------|-------------------|--------------|-------------------|
| U            | Modified MS-013 6-pin Tape and Reel Pack | 1500              | RP           | EIA-481-D         |
|              | Modified MS-013 6-pin Tube Pack          | 500 (50 per tube) | TP           | N/A               |

## Tape and Reel Specification — MS-013



## Tube Pack Dimensions — MS-013



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