

**TwinChip™ Series - DO-214**



**Agency Approvals**

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

**Description**

TwinChip™ Series DO-214 are very low capacitance SIDACtor® thyristors designed to protect broadband equipment such as VoIP, DSL modems and DSLAMs from damaging overvoltage transients. This series provides a surface mount solution that enables equipment to comply with 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.
- Low distortion
- Fails short circuit when surged in excess of ratings
- 40% lower than comparable product
- RoHS Compliant and Halogen-Free
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)
- Recognized to UL 497B as an Isolated Loop Circuit Protector

**Schematic Symbol**



**Applicable Global Standards**

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

\* Additional series resistance may be required to comply

**Additional Information**



**Datasheet**



**Resources**



**Samples**

**Electrical Characteristics**

| Part Number | Marking | $V_{DRM}$<br>@ $I_{DRM} = 5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T = 2.2$ Amps | @ 1MHz, 2V bias |        |
|-------------|---------|-----------------------------------|--------------------------|--------|--------|-------|-----------------------------|-----------------|--------|
|             |         | V min                             | V max                    | mA min | mA max | A max | V max                       | pF min          | pF max |
| P0642SALRP  | P062A   | 58                                | 77                       | 120    | 800    | 2.2   | 8                           | 25              | 45     |
| P0722SALRP  | P072A   | 65                                | 88                       | 120    | 800    | 2.2   | 8                           | 20              | 45     |
| P0902SALRP  | P092A   | 75                                | 98                       | 120    | 800    | 2.2   | 8                           | 20              | 40     |
| P1102SALRP  | P112A   | 90                                | 130                      | 120    | 800    | 2.2   | 8                           | 15              | 35     |
| P1302SALRP  | P132A   | 120                               | 160                      | 120    | 800    | 2.2   | 8                           | 15              | 35     |
| P1502SALRP  | P152A   | 140                               | 180                      | 120    | 800    | 2.2   | 8                           | 15              | 30     |
| P1802SALRP  | P182A   | 170                               | 220                      | 120    | 800    | 2.2   | 8                           | 10              | 30     |
| P2302SALRP  | P232A   | 190                               | 260                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P2602SALRP  | P262A   | 220                               | 300                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P3002SALRP  | P302A   | 280                               | 360                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P3502SALRP  | P352A   | 320                               | 400                      | 120    | 800    | 2.2   | 8                           | 10              | 20     |
| P4202SALRP  | P422A   | 380                               | 500                      | 120    | 800    | 2.2   | 8                           | 10              | 20     |
| P4802SALRP  | P482A   | 440                               | 600                      | 120    | 800    | 2.2   | 8                           | 5               | 20     |
| P6002SALRP  | P602A   | 550                               | 700                      | 120    | 800    | 2.2   | 8                           | 5               | 20     |
| P0642SBLRP  | P062B   | 58                                | 77                       | 120    | 800    | 2.2   | 8                           | 25              | 45     |
| P0722SBLRP  | P072B   | 65                                | 88                       | 120    | 800    | 2.2   | 8                           | 20              | 45     |
| P0902SBLRP  | P092B   | 75                                | 98                       | 120    | 800    | 2.2   | 8                           | 20              | 40     |
| P1102SBLRP  | P112B   | 90                                | 130                      | 120    | 800    | 2.2   | 8                           | 15              | 35     |
| P1302SBLRP  | P132B   | 120                               | 160                      | 120    | 800    | 2.2   | 8                           | 15              | 35     |
| P1502SBLRP  | P152B   | 140                               | 180                      | 120    | 800    | 2.2   | 8                           | 15              | 30     |
| P1802SBLRP  | P182B   | 170                               | 220                      | 120    | 800    | 2.2   | 8                           | 10              | 30     |
| P2302SBLRP  | P232B   | 190                               | 260                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P2602SBLRP  | P262B   | 220                               | 300                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P3002SBLRP  | P302B   | 280                               | 360                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P3502SBLRP  | P352B   | 320                               | 400                      | 120    | 800    | 2.2   | 8                           | 10              | 20     |
| P4202SBLRP  | P422B   | 380                               | 500                      | 120    | 800    | 2.2   | 8                           | 10              | 20     |
| P4802SBLRP  | P482B   | 440                               | 600                      | 120    | 800    | 2.2   | 8                           | 5               | 20     |
| P6002SBLRP  | P602B   | 550                               | 700                      | 120    | 800    | 2.2   | 8                           | 5               | 20     |
| P3002SCLRP  | P302C   | 280                               | 360                      | 120    | 800    | 2.2   | 8                           | 20              | 35     |
| P3502SCLRP  | P352C   | 320                               | 400                      | 120    | 800    | 2.2   | 8                           | 20              | 30     |
| P4202SCLRP  | P422C   | 380                               | 500                      | 120    | 800    | 2.2   | 8                           | 15              | 30     |
| P4802SCLRP  | P482C   | 440                               | 600                      | 120    | 800    | 2.2   | 8                           | 15              | 30     |
| P6002SCLRP  | P602C   | 550                               | 700                      | 120    | 800    | 2.2   | 8                           | 10              | 25     |
| P7002SCLRP  | P702C   | 640                               | 850                      | 120    | 800    | 2.2   | 8                           | 10              | 30     |

**Notes:**

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

**Surge Ratings**

| Series   | $I_{PP}$                                     |  |  |  |  |  |  |  |   | $I_{TSM}$<br>50/60 Hz | di/dt<br>A/ $\mu s$ |
|----------|--|--|--|--|--|--|--|--|---|-----------------------|---------------------|
|          | 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                                     |                       |                     |
| <b>A</b> | 20   | 150                                    | 150                                      | 90   | 50   | 75                                       | 75   | 45   | 75  | 20                    | 500                 |
| <b>B</b> | 25   | 250                                    | 250                                      | 150  | 100  | 100                                      | 125  | 80   | 100                                       | 25                    | 500                 |
| <b>C</b> | 50   | 500                                    | 400                                      | 200  | 150  | 200                                      | 175  | 100  | 200                                       | 30                    | 500                 |

**Notes:**

- Current waveform in  $\mu s$
  - 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>DO-214AA | $T_J$           | 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 | 90          | °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**



**Soldering Parameters**

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

**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-A104                 |
| <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 – DO-214AA**



| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 0.130  | 0.156 | 3.30        | 3.95 |
| B          | 0.201  | 0.220 | 5.10        | 5.60 |
| C          | 0.077  | 0.087 | 1.95        | 2.20 |
| D          | 0.159  | 0.181 | 4.05        | 4.60 |
| E          | 0.030  | 0.063 | 0.75        | 1.60 |
| F          | 0.075  | 0.096 | 1.90        | 2.45 |
| G          | 0.002  | 0.008 | 0.05        | 0.20 |
| H          | 0.077  | 0.104 | 1.95        | 2.65 |
| K          | 0.006  | 0.016 | 0.15        | 0.41 |

**Part Numbering**



**Packing Options**

| Package Type | Description          | Quantity | Added Suffix | Industry Standard |
|--------------|----------------------|----------|--------------|-------------------|
| S            | DO-214AA Tape & Reel | 2500     | RP           | EIA-481-D         |

**Tape and Reel Specification – DO-214AA**



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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9