

## Thyristor Surge Suppressors (TSS) Data Sheet

### Description

DO-214AA Thyristor solid state protection thyristor protect telecommunications equipment such as modems, line cards, fax machines, and other CPE.

P Series devices are used to enable equipment to meet various regulatory requirements including GR 1089, ITU K.20, K.21 and K.45, IEC 60950, UL 60950, and TIA-968 (formerly known as FCC Part 68).



### Features

Compared to surge suppression using other technologies, P Series devices offer absolute surge protection regardless of the surge current available and the rate of applied voltage (dv/dt). P Series devices:

- Cannot be damaged by voltage
- Eliminate hysteresis and heat dissipation typically found with clamping devices
- Eliminate voltage overshoot caused by fast-rising transients
- Are non-degenerative
- Will not fatigue
- Have low capacitance, making them ideal for high-speed transmission equipment
- Meets MSL level 1, per J-STD-020
- Safety certification: UL: E244458

### Electrical Parameters

| Parameter | Definition                                                                                      |
|-----------|-------------------------------------------------------------------------------------------------|
| $V_{DRM}$ | <b>Peak Off-state Voltage</b> – maximum voltage that can be applied while maintaining off state |
| $V_S$     | <b>Switching Voltage</b> – maximum voltage prior to switching to on state                       |
| $V_T$     | <b>On-state Voltage</b> – maximum voltage measured at rated on-state current                    |
| $I_{DRM}$ | <b>Leakage Current</b> – maximum peak off-state current measured at $V_{DRM}$                   |
| $I_S$     | <b>Switching Current</b> – maximum current required to switch to on state                       |
| $I_T$     | <b>On-state Current</b> – maximum rated continuous on-state current                             |
| $I_H$     | <b>Holding Current</b> – minimum current required to maintain on state                          |
| $C_O$     | <b>Off-state Capacitance</b> – typical capacitance measured in off state                        |
| $V_{PP}$  | <b>Peak Pulse Voltage</b> – maximum rated peak impulse voltage                                  |
| $I_{PP}$  | <b>Peak Pulse Current</b> – maximum rated peak impulse current                                  |

## Electrical Characteristics

| Part Number | $V_{DRM}$<br>(V) | $V_S$<br>(V) | $V_T$<br>(V) | $I_{DRM}$<br>( $\mu$ A) | $I_S$<br>(mA) | $I_T$<br>(A) | $I_H$<br>(mA) | $C_O$<br>(pF) | $V_{PP}$<br>10/700 $\mu$ s<br>(V) | $I_{PP}$<br>10/1000 $\mu$ s<br>(A) | Marking |
|-------------|------------------|--------------|--------------|-------------------------|---------------|--------------|---------------|---------------|-----------------------------------|------------------------------------|---------|
| P0080SA     | 6                | 25           | 4            | 5                       | 800           | 2.2          | 50            | 50            | 2000                              | 45                                 | P008A   |
| P0080SB     | 6                | 25           | 4            | 5                       | 800           | 2.2          | 50            | 70            | 4000                              | 80                                 | P008B   |
| P0080SC     | 6                | 25           | 4            | 5                       | 800           | 2.2          | 50            | 100           | 6000                              | 100                                | P008C   |
| P0300SA     | 25               | 40           | 4            | 5                       | 800           | 2.2          | 50            | 70            | 2000                              | 45                                 | P03A    |
| P0300SB     | 25               | 40           | 4            | 5                       | 800           | 2.2          | 50            | 70            | 4000                              | 80                                 | P03B    |
| P0300SC     | 25               | 40           | 4            | 5                       | 800           | 2.2          | 50            | 100           | 6000                              | 100                                | P03C    |
| P0640SA     | 58               | 77           | 4            | 5                       | 800           | 2.2          | 150           | 50            | 2000                              | 45                                 | P06A    |
| P0640SB     | 58               | 77           | 4            | 5                       | 800           | 2.2          | 150           | 60            | 4000                              | 80                                 | P06B    |
| P0640SC     | 58               | 77           | 4            | 5                       | 800           | 2.2          | 150           | 100           | 6000                              | 100                                | P06C    |
| P0720SA     | 65               | 88           | 4            | 5                       | 800           | 2.2          | 150           | 50            | 2000                              | 45                                 | P07A    |
| P0720SB     | 65               | 88           | 4            | 5                       | 800           | 2.2          | 150           | 60            | 4000                              | 80                                 | P07B    |
| P0720SC     | 65               | 88           | 4            | 5                       | 800           | 2.2          | 150           | 100           | 6000                              | 100                                | P07C    |
| P0900SA     | 75               | 98           | 4            | 5                       | 800           | 2.2          | 150           | 45            | 2000                              | 45                                 | P09A    |
| P0900SB     | 75               | 98           | 4            | 5                       | 800           | 2.2          | 150           | 55            | 4000                              | 80                                 | P09B    |
| P0900SC     | 75               | 98           | 4            | 5                       | 800           | 2.2          | 150           | 90            | 6000                              | 100                                | P09C    |
| P1100SA     | 90               | 130          | 4            | 5                       | 800           | 2.2          | 150           | 45            | 2000                              | 45                                 | P11A    |
| P1100SB     | 90               | 130          | 4            | 5                       | 800           | 2.2          | 150           | 55            | 4000                              | 80                                 | P11B    |
| P1100SC     | 90               | 130          | 4            | 5                       | 800           | 2.2          | 150           | 90            | 6000                              | 100                                | P11C    |
| P1300SA     | 120              | 160          | 4            | 5                       | 800           | 2.2          | 150           | 45            | 2000                              | 45                                 | P13A    |
| P1300SB     | 120              | 160          | 4            | 5                       | 800           | 2.2          | 150           | 55            | 4000                              | 80                                 | P13B    |
| P1300SC     | 120              | 160          | 4            | 5                       | 800           | 2.2          | 150           | 90            | 6000                              | 100                                | P13C    |
| P1500SA     | 140              | 180          | 4            | 5                       | 800           | 2.2          | 150           | 40            | 2000                              | 45                                 | P15A    |
| P1500SB     | 140              | 180          | 4            | 5                       | 800           | 2.2          | 150           | 60            | 4000                              | 80                                 | P15B    |
| P1500SC     | 140              | 180          | 4            | 5                       | 800           | 2.2          | 150           | 85            | 6000                              | 100                                | P15C    |
| P1800SA     | 170              | 220          | 4            | 5                       | 800           | 2.2          | 150           | 40            | 2000                              | 45                                 | P18A    |
| P1800SB     | 170              | 220          | 4            | 5                       | 800           | 2.2          | 150           | 60            | 4000                              | 80                                 | P18B    |
| P1800SC     | 170              | 220          | 4            | 5                       | 800           | 2.2          | 150           | 85            | 6000                              | 100                                | P18C    |
| P2300SA     | 190              | 260          | 4            | 5                       | 800           | 2.2          | 150           | 35            | 2000                              | 45                                 | P23A    |
| P2300SB     | 190              | 260          | 4            | 5                       | 800           | 2.2          | 150           | 55            | 4000                              | 80                                 | P23B    |
| P2300SC     | 190              | 260          | 4            | 5                       | 800           | 2.2          | 150           | 80            | 6000                              | 100                                | P23C    |

## Electrical Characteristics

| Part Number | $V_{DRM}$<br>(V) | $V_S$<br>(V) | $V_T$<br>(V) | $I_{DRM}$<br>( $\mu$ A) | $I_S$<br>(mA) | $I_T$<br>(A) | $I_H$<br>(mA) | $C_O$<br>(pF) | $V_{PP}$<br>10/700 $\mu$ s<br>(V) | $I_{PP}$<br>10/1000 $\mu$ s<br>(A) | Marking |
|-------------|------------------|--------------|--------------|-------------------------|---------------|--------------|---------------|---------------|-----------------------------------|------------------------------------|---------|
| P2600SA     | 220              | 300          | 4            | 5                       | 800           | 2.2          | 150           | 35            | 2000                              | 45                                 | P26A    |
| P2600SB     | 220              | 300          | 4            | 5                       | 800           | 2.2          | 150           | 50            | 4000                              | 80                                 | P26B    |
| P2600SC     | 220              | 300          | 4            | 5                       | 800           | 2.2          | 150           | 80            | 6000                              | 100                                | P26C    |
| P3100SA     | 275              | 350          | 4            | 5                       | 800           | 2.2          | 150           | 30            | 2000                              | 45                                 | P31A    |
| P3100SB     | 275              | 350          | 4            | 5                       | 800           | 2.2          | 150           | 45            | 4000                              | 80                                 | P31B    |
| P3100SC     | 275              | 350          | 4            | 5                       | 800           | 2.2          | 150           | 65            | 6000                              | 100                                | P31C    |
| P3500SA     | 320              | 400          | 4            | 5                       | 800           | 2.2          | 150           | 30            | 2000                              | 45                                 | P35A    |
| P3500SB     | 320              | 400          | 4            | 5                       | 800           | 2.2          | 150           | 40            | 4000                              | 80                                 | P35B    |
| P3500SC     | 320              | 400          | 4            | 5                       | 800           | 2.2          | 150           | 65            | 6000                              | 100                                | P35C    |

### Notes:

- All measurements are made at an ambient temperature of 25°C.  $I_{PP}$  applies to -40°C through +85°C temperature range.
- Off-state capacitance( $C_O$ ) is measured at 1 MHz with a 2V bias and is typical value.

## Thermal Considerations

| Package DO-214AA/SMB                                                                | Symbol          | Parameter                              | Value       | Unit |
|-------------------------------------------------------------------------------------|-----------------|----------------------------------------|-------------|------|
|  | $T_J$           | Operating Junction Temperature         | -40 to +150 | °C   |
|                                                                                     | $T_S$           | Storage Temperature Range              | -40 to +150 | °C   |
|                                                                                     | $R_{\theta JA}$ | Junction to Ambient on printed circuit | 90          | °C/W |

## Part Number Code and Marking

|                                                                                                                                                                                                            |                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div> <div>P</div> <div>X</div> <div>X</div> <div>X</div> <div>X</div> <div>S</div> <div>X</div> </div> <div> <div>Series Code</div> <div>Voltage</div> <div>Package</div> <div>Surge Current</div> </div> | <div> <div>Logo</div> <div> <div>B</div> <div>YXXX</div> <div>P008A</div> </div> <div> <div>Date Code</div> <div>Device Marking Code</div> </div> </div> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

## Characteristics Curves

Figure 1. V-I Characteristics

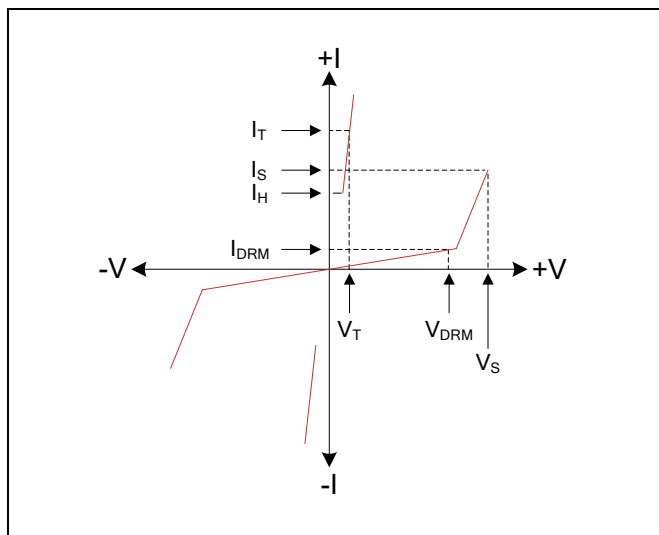


Figure 2.  $t_r \times t_d$  Pulse Wave-form

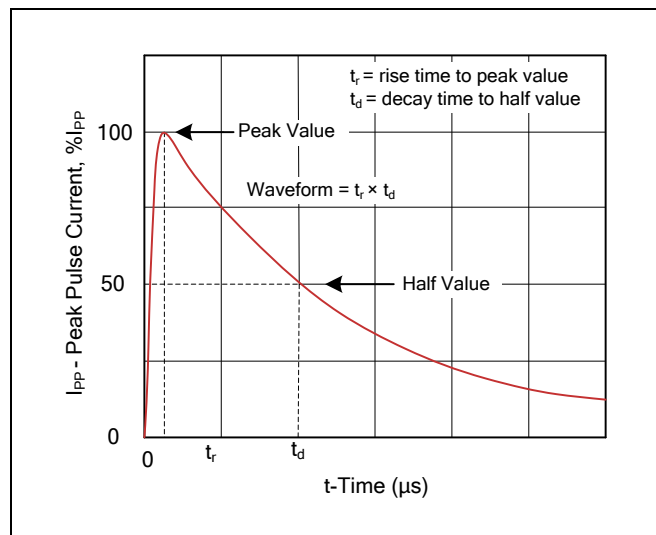


Figure 3. Normalized  $V_S$  Change versus Junction Temperature

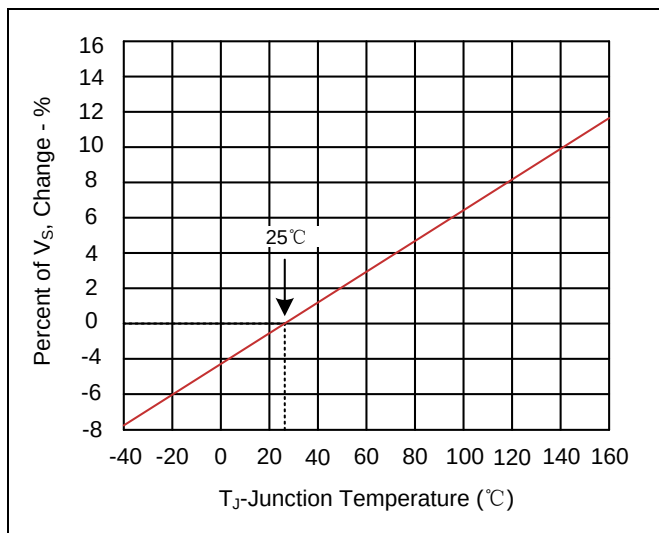
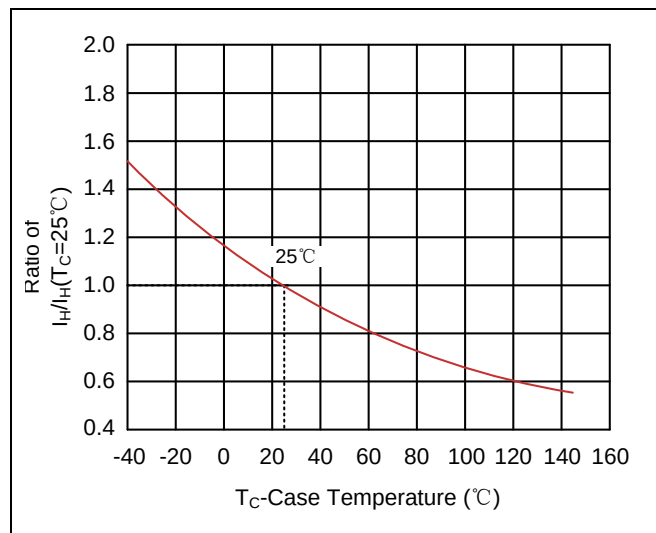
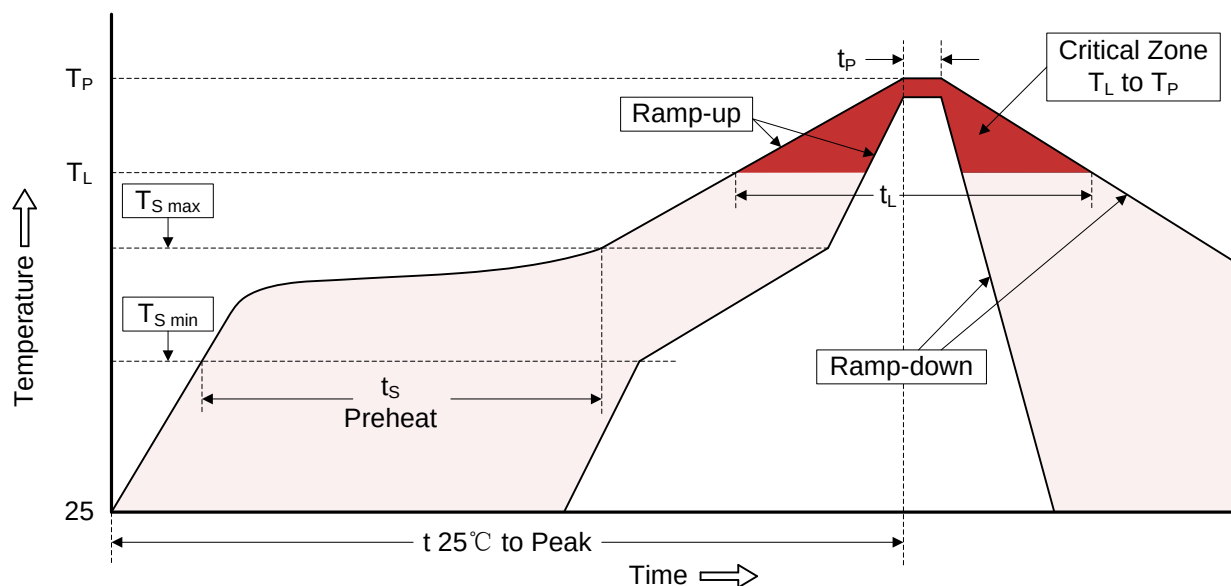


Figure 4. Normalized DC Holding Current versus Case Temperature



## Recommended Soldering Conditions

### Reflow Soldering



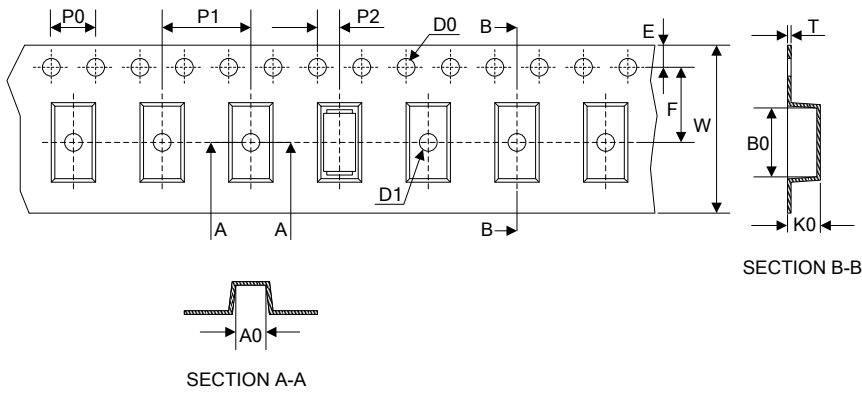
### Recommended Conditions

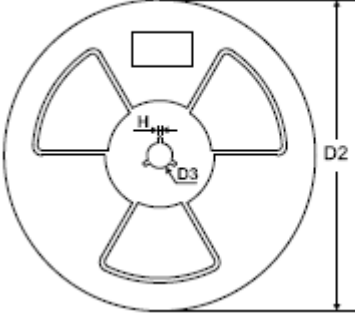
| Profile Feature                                      | Pb-Free Assembly |
|------------------------------------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | 3°C/second max.  |
| Preheat                                              |                  |
| -Temperature Min ( $T_{S\ min}$ )                    | 150°C            |
| -Temperature Max ( $T_{S\ max}$ )                    | 200°C            |
| -Time (min to max) ( $t_s$ )                         | 60-180 seconds   |
| $T_{S\ max}$ to $T_L$                                |                  |
| -Ramp-up Rate                                        | 3°C/second max.  |
| Time maintained above:                               |                  |
| -Temperature ( $T_L$ )                               | 217°C            |
| -Time ( $t_L$ )                                      | 60-150 seconds   |
| Peak Temperature ( $T_P$ )                           | 260°C            |
| Time within 5°C of actual Peak Temperature ( $t_p$ ) | 20-40 seconds    |
| Ramp-down Rate                                       | 6°C/second max.  |
| Time 25°C to Peak Temperature                        | 8 minutes max.   |

## Dimensions (SMB/DO-214AA)

| Symbol | Millimeters |      | Inches |       |
|--------|-------------|------|--------|-------|
|        | Min.        | Max. | Min.   | Max.  |
| L      | 4.22        | 4.70 | 0.166  | 0.185 |
| D      | 3.40        | 3.94 | 0.134  | 0.155 |
| D1     | 1.90        | 2.20 | 0.075  | 0.086 |
| T      | 5.21        | 5.59 | 0.205  | 0.220 |
| T1     | 0.91        | 1.42 | 0.036  | 0.056 |
| d      | 0.05        | 0.20 | 0.002  | 0.008 |
| H      | 1.95        | 2.40 | 0.077  | 0.095 |

## Packaging

|                                                                                                 |        |                |
|-------------------------------------------------------------------------------------------------|--------|----------------|
| <p>Tape</p>  | Symbol | Dimension (mm) |
|                                                                                                 | W      | 12.00±0.30     |
|                                                                                                 | P0     | 4.00±0.10      |
|                                                                                                 | P1     | 8.00±0.10      |
|                                                                                                 | P2     | 2.00±0.10      |
|                                                                                                 | D0     | Φ1.55±0.05     |
|                                                                                                 | D1     | Φ1.55±0.05     |
|                                                                                                 | E      | 1.75±0.10      |
|                                                                                                 | F      | 5.50±0.10      |
|                                                                                                 | A0     | 3.76±0.10      |
|                                                                                                 | B0     | 5.69±0.10      |
|                                                                                                 | K0     | 2.70±0.10      |
|                                                                                                 | T      | 0.25±0.10      |
| <p>Reel</p>                                                                                     | D2     | Φ330.0±2.0     |
|                                                                                                 | D3     | Φ13.5±0.5      |
|                                                                                                 | H      | 2.5±0.5        |
|                                                                                                 | W1     | 16.0±1.0       |

|                                                                                   |                                               |
|-----------------------------------------------------------------------------------|-----------------------------------------------|
|  | <p>Quantity: 2500PCS<br/>P0080SB: 3000PCS</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------|