

# Surface-Mount PAR<sup>®</sup> Transient Voltage Suppressors

High Temperature Stability and High Reliability Conditions



**SMA (DO-214AC)**

Cathode  Anode

## LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS |                 |
|-------------------------|-----------------|
| $V_{WM}$                | 5.8 V to 36.8 V |
| $V_{BR}$                | 6.8 V to 43 V   |
| $P_{PPM}$               | 400 W           |
| $P_D$                   | 1.0 W           |
| $I_{FSM}$               | 40 A            |
| $T_J$ max.              | 185 °C          |
| Polarity                | Unidirectional  |
| Package                 | SMA (DO-214AC)  |

## TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lightning on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, automotive, and telecommunication.

## FEATURES

- Junction passivation optimized design passivated anisotropic rectifier technology
- $T_J = 185$  °C capability suitable for high reliability and automotive requirement
- Available in uni-directional polarity only
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified available
  - Automotive ordering code: base P/NHE3 or P/NHM3
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## MECHANICAL DATA

**Case:** SMA (DO-214AC)

Molding compound meets UL 94 V-0 flammability rating  
Base P/NHE3\_X - RoHS-compliant and AEC-Q101 qualified  
Base P/NHM3\_X - halogen-free, RoHS-compliant, and AEC-Q101 qualified  
("X" denotes revision code e.g. A, B, ...)

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

HE3 and HM3 suffix meets JESD 201 class 2 whisker test

**Polarity:** color band denotes cathode end

| MAXIMUM RATINGS ( $T_A = 25$ °C unless otherwise noted)                           |                |                |      |
|-----------------------------------------------------------------------------------|----------------|----------------|------|
| PARAMETER                                                                         | SYMBOL         | VALUE          | UNIT |
| Peak power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)(2)</sup> (fig. 3) | $P_{PPM}$      | 400            | W    |
| Peak power pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup> (fig. 1)  | $I_{PPM}$      | See next table | A    |
| Power dissipation at $T_A = 25$ °C <sup>(4)</sup>                                 | $P_D$          | 1.0            | W    |
| Peak forward surge current 8.3 ms single half sine-wave <sup>(3)</sup>            | $I_{FSM}$      | 40             | A    |
| Maximum instantaneous forward voltage at 25 A <sup>(3)</sup>                      | $V_F$          | 3.5            | V    |
| Operating junction and storage temperature range                                  | $T_J, T_{STG}$ | -65 to +185    | °C   |

### Notes

- (1) Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25$  °C per fig. 2
- (2) Mounted on PCB with 0.2" x 0.2" (5.0 mm x 5.0 mm) copper pads attached to each terminal
- (3) Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minutes maximum
- (4) Mounted on minimum recommended pad layout

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| DEVICE TYPE | DEVICE MARKING CODE | BREAKDOWN VOLTAGE $V_{BR}^{(1)}$ AT $I_T$ (V) |      |       | TEST CURRENT $I_T$ (mA) | STAND-OFF VOLTAGE $V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_R$ ( $\mu\text{A}$ ) | $T_J = 150\text{ }^{\circ}\text{C}$ MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_D$ ( $\mu\text{A}$ ) | MAXIMUM PEAK PULSE SURGE CURRENT $I_{PPM}^{(2)}$ (A) | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V) | TYPICAL TEMP. COEFFICIENT OF $V_{BR}^{(3)}$ $\alpha T$ ( $\%/^{\circ}\text{C}$ ) |
|-------------|---------------------|-----------------------------------------------|------|-------|-------------------------|--------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------|
|             |                     | MIN.                                          | NOM. | MAX.  |                         |                                |                                                             |                                                                                                 |                                                      |                                                 |                                                                                  |
| TPSMA6.8A   | AEP                 | 6.45                                          | 6.80 | 7.14  | 10                      | 5.80                           | 300                                                         | 1000                                                                                            | 38.1                                                 | 10.5                                            | 0.047                                                                            |
| TPSMA7.5A   | AGP                 | 7.13                                          | 7.50 | 7.88  | 10                      | 6.40                           | 150                                                         | 500                                                                                             | 35.4                                                 | 11.3                                            | 0.052                                                                            |
| TPSMA8.2A   | AKP                 | 7.79                                          | 8.20 | 8.61  | 10                      | 7.02                           | 50                                                          | 200                                                                                             | 33.1                                                 | 12.1                                            | 0.056                                                                            |
| TPSMA9.1A   | AMP                 | 8.65                                          | 9.10 | 9.55  | 1.0                     | 7.78                           | 10                                                          | 50                                                                                              | 29.9                                                 | 13.0                                            | 0.060                                                                            |
| TPSMA10A    | APP                 | 9.50                                          | 10.0 | 10.50 | 1.0                     | 8.65                           | 5.0                                                         | 20                                                                                              | 27.6                                                 | 14.5                                            | 0.064                                                                            |
| TPSMA11A    | ARP                 | 10.50                                         | 11.0 | 11.60 | 1.0                     | 9.40                           | 1.0                                                         | 5.0                                                                                             | 25.6                                                 | 15.6                                            | 0.067                                                                            |
| TPSMA12A    | ATP                 | 11.40                                         | 12.0 | 12.60 | 1.0                     | 10.20                          | 1.0                                                         | 5.0                                                                                             | 24.0                                                 | 16.7                                            | 0.070                                                                            |
| TPSMA13A    | AVP                 | 12.40                                         | 13.0 | 13.70 | 1.0                     | 11.10                          | 1.0                                                         | 5.0                                                                                             | 22.0                                                 | 18.2                                            | 0.072                                                                            |
| TPSMA15A    | AXP                 | 14.30                                         | 15.0 | 15.80 | 1.0                     | 12.80                          | 1.0                                                         | 5.0                                                                                             | 18.9                                                 | 21.2                                            | 0.076                                                                            |
| TPSMA16A    | AZP                 | 15.20                                         | 16.0 | 16.80 | 1.0                     | 13.60                          | 1.0                                                         | 5.0                                                                                             | 17.8                                                 | 22.0                                            | 0.078                                                                            |
| TPSMA18A    | BEP                 | 17.10                                         | 18.0 | 18.90 | 1.0                     | 15.30                          | 1.0                                                         | 5.0                                                                                             | 15.9                                                 | 25.5                                            | 0.080                                                                            |
| TPSMA20A    | BGP                 | 19.00                                         | 20.0 | 21.00 | 1.0                     | 17.10                          | 1.0                                                         | 5.0                                                                                             | 14.4                                                 | 27.7                                            | 0.082                                                                            |
| TPSMA22A    | BKP                 | 20.90                                         | 22.0 | 23.10 | 1.0                     | 18.80                          | 1.0                                                         | 5.0                                                                                             | 13.1                                                 | 30.6                                            | 0.084                                                                            |
| TPSMA24A    | BMP                 | 22.80                                         | 24.0 | 25.20 | 1.0                     | 20.50                          | 1.0                                                         | 5.0                                                                                             | 12.0                                                 | 33.2                                            | 0.085                                                                            |
| TPSMA27A    | BPP                 | 25.70                                         | 27.0 | 28.40 | 1.0                     | 23.10                          | 1.0                                                         | 5.0                                                                                             | 10.7                                                 | 37.5                                            | 0.087                                                                            |
| TPSMA30A    | BRP                 | 28.50                                         | 30.0 | 31.50 | 1.0                     | 25.60                          | 1.0                                                         | 5.0                                                                                             | 9.7                                                  | 41.4                                            | 0.088                                                                            |
| TPSMA33A    | BTP                 | 31.40                                         | 33.0 | 34.70 | 1.0                     | 28.20                          | 1.0                                                         | 5.0                                                                                             | 8.8                                                  | 45.7                                            | 0.089                                                                            |
| TPSMA36A    | BVP                 | 34.20                                         | 36.0 | 37.80 | 1.0                     | 30.80                          | 1.0                                                         | 5.0                                                                                             | 8.0                                                  | 49.9                                            | 0.090                                                                            |
| TPSMA39A    | BXP                 | 37.10                                         | 39.0 | 41.00 | 1.0                     | 33.30                          | 1.0                                                         | 5.0                                                                                             | 7.4                                                  | 53.9                                            | 0.091                                                                            |
| TPSMA43A    | BZP                 | 40.90                                         | 43.0 | 45.20 | 1.0                     | 36.80                          | 1.0                                                         | 5.0                                                                                             | 6.7                                                  | 59.3                                            | 0.092                                                                            |

**Notes**

- (1)  $V_{BR}$  measured after  $I_T$  applied for 300  $\mu\text{s}$ ,  $I_T$  = square wave pulse or equivalent  
(2) Surge current waveform per fig. 3 and derated per fig. 2  
(3) To calculate  $V_{BR}$  vs. junction temperature, use the following formula:  $V_{BR}$  at  $T_J = V_{BR}$  at  $25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$   
(4) All terms and symbols are consistent with ANSI/IEEE C62.35

**ORDERING INFORMATION** (Example)

| PREFERRED P/N                   | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                      |
|---------------------------------|-----------------|------------------------|---------------|------------------------------------|
| TPSMA6.8AHE3_B/H <sup>(1)</sup> | 0.064           | H                      | 1800          | 7" diameter plastic tape and reel  |
| TPSMA6.8AHE3_B/I <sup>(1)</sup> | 0.064           | I                      | 7500          | 13" diameter plastic tape and reel |
| TPSMA6.8AHM3_B/H <sup>(1)</sup> | 0.064           | H                      | 1800          | 7" diameter plastic tape and reel  |
| TPSMA6.8AHM3_B/I <sup>(1)</sup> | 0.064           | I                      | 7500          | 13" diameter plastic tape and reel |

**Note**

- (1) AEC-Q101 qualified

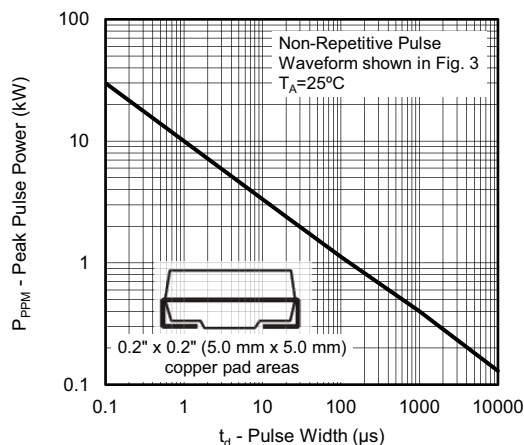
**RATINGS AND CHARACTERISTICS CURVES** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)


Fig. 1 - Peak Pulse Power Rating Curve

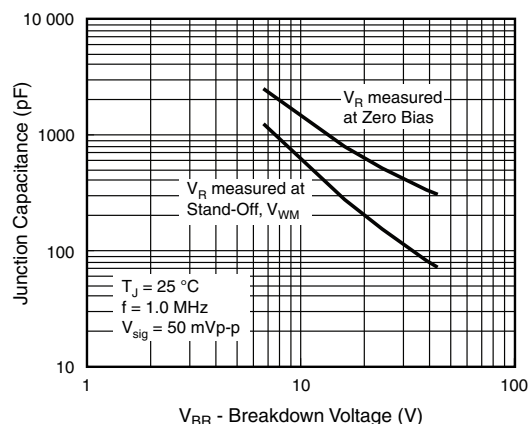


Fig. 4 - Typical Junction Capacitance

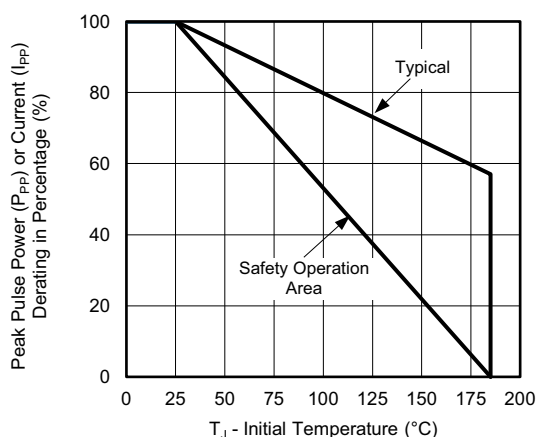


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

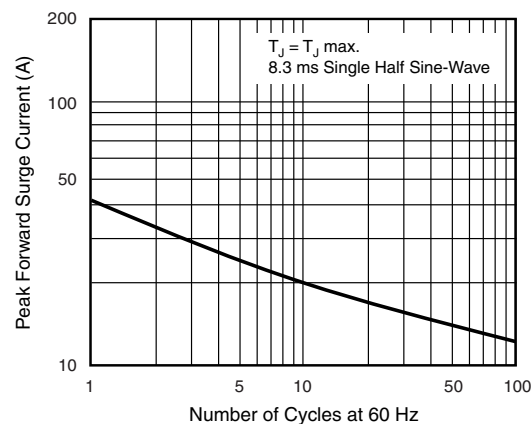


Fig. 5 - Maximum Non-Repetitive Peak Forward Surge Current

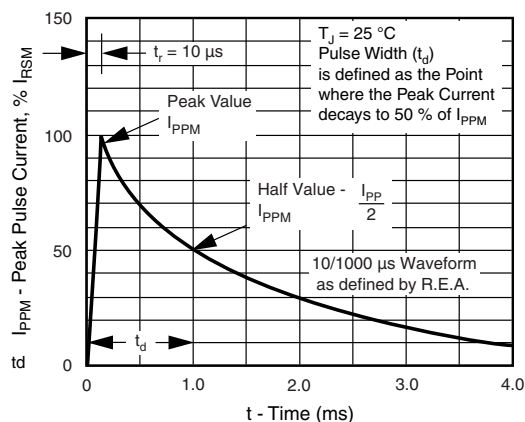
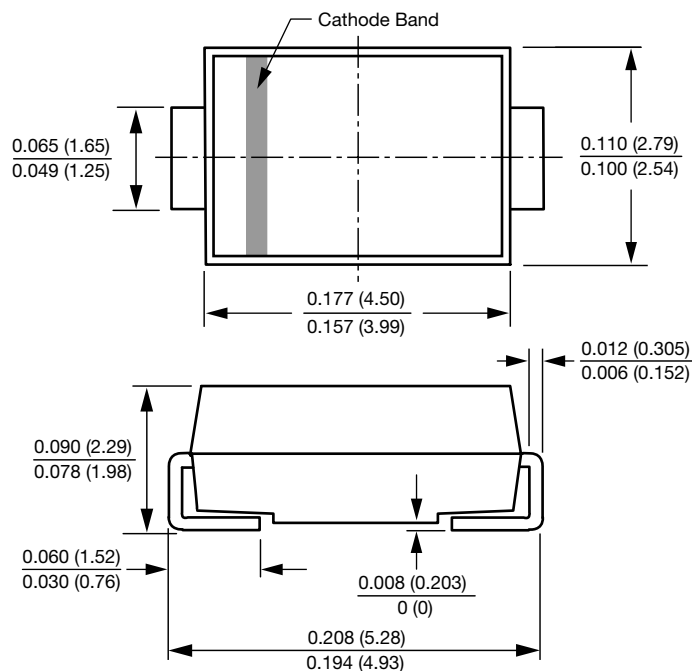


Fig. 3 - Pulse Waveform

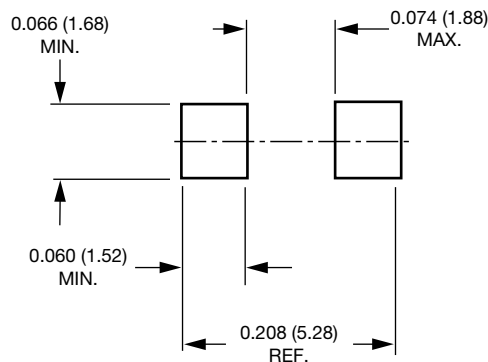


## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### SMA (DO-214AC)



### Mounting Pad Layout





## Disclaimer

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