



**THE DATASHEET OF  
1KSMB18CA**



### 1KSMB Series



#### Agency Approvals

| AGENCY  | AGENCY FILE NUMBER |
|---|--------------------|
|  | E230531            |

#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter  | Symbol           | Value      | Unit |
|--|------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10/1000µs Waveform (Fig.2)(Note 1), (Note 2) | P <sub>PPM</sub> | 1000       | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50°C                                      | P <sub>D</sub>   | 5.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                     | I <sub>FSM</sub> | 120        | A    |
| Maximum Instantaneous Forward Voltage at 50A for Unidirectional Only                                 | V <sub>F</sub>   | 3.5        | V    |
| Operating Temperature Range  | T <sub>J</sub>   | -65 to 150 | °C   |
| Storage Temperature Range  | T <sub>STG</sub> | -65 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead  | R <sub>θJL</sub> | 20         | °C/W |
| Typical Thermal Resistance Junction to Ambient   | R <sub>θJA</sub> | 100        | °C/W |

- Notes:**
1. Non-repetitive current pulse, per Fig. 4 and derated above T<sub>J</sub> (initial) =25°C per Fig. 3.
  2. Mounted on copper pad area of 0.2x0.2" (5.0 x 5.0mm) to each terminal.
  3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.

#### Functional Diagram



#### Description

The 1KSMB series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

#### Features

- 1000W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- For surface mounted applications to optimize board space
- Low profile package
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- V<sub>BR</sub> @T<sub>J</sub>=V<sub>BR</sub> @25°C x (1+αT x (T<sub>J</sub> - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- Glass passivated chip junction
- Fast response time: typically less than 1.0ps from 0V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA when V<sub>BR</sub> max>12V
- High temperature to reflow soldering guaranteed: 260°C/40sec
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- Matte tin lead-free Plated
- Available in breakdown Voltage from 6.8V to 180V specially designed for automotive applications
- Offers high-surge rating in compact package: bridges the gap between 600W and 1.5KW
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

#### Applications

TVS devices are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

#### Additional Information



**Datasheet**



**Resources**



**Samples**

### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking |      | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub> |        | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>pp</sub> (V) | Maximum Peak Pulse Current I <sub>pp</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (µA) | Agency Approval  |
|-------------------|------------------|---------|------|--|--|--------|----------------------------------|---|--|--|---|
|                   |                  | UNI     | BI   |  | MIN  | MAX    |                                  |   |  |  |   |
| 1KSMB6.8A         | 1KSMB6.8CA       | A10A    | N10A | 5.80   | 6.45   | 7.14   | 10                               | 10.5  | 95.2   | 900  | x   |
| 1KSMB7.5A         | 1KSMB7.5CA       | A10B    | N10B | 6.40   | 7.13   | 7.88   | 10                               | 11.3  | 88.5   | 400  | x   |
| 1KSMB8.2A         | 1KSMB8.2CA       | A10C    | N10C | 7.02   | 7.79   | 8.61   | 10                               | 12.1  | 82.6   | 180  | x   |
| 1KSMB9.1A         | 1KSMB9.1CA       | A10D    | N10D | 7.78   | 8.65   | 9.55   | 1                                | 13.4  | 74.6   | 45   | x   |
| 1KSMB10A          | 1KSMB10CA        | A10E    | N10E | 8.55   | 9.50   | 10.50  | 1                                | 14.5  | 69.0   | 8  | x   |
| 1KSMB11A          | 1KSMB11CA        | A10F    | N10F | 9.40   | 10.50  | 11.60  | 1                                | 15.6  | 64.1   | 4  | x   |
| 1KSMB12A          | 1KSMB12CA        | A10G    | N10G | 10.20  | 11.40  | 12.60  | 1                                | 16.7  | 59.9   | 1  | x   |
| 1KSMB13A          | 1KSMB13CA        | A10H    | N10H | 11.10  | 12.40  | 13.70  | 1                                | 18.2  | 54.9   | 1  | x   |
| 1KSMB15A          | 1KSMB15CA        | A10I    | N10I | 12.80  | 14.30  | 15.80  | 1                                | 21.2  | 47.2   | 1  | x   |
| 1KSMB16A          | 1KSMB16CA        | A10J    | N10J | 13.60  | 15.20  | 16.80  | 1                                | 22.5  | 44.4   | 1  | x   |
| 1KSMB18A          | 1KSMB18CA        | A10K    | N10K | 15.30  | 17.10  | 18.90  | 1                                | 25.5  | 39.2   | 1  | x   |
| 1KSMB20A          | 1KSMB20CA        | A10L    | N10L | 17.10  | 19.00  | 21.00  | 1                                | 27.7  | 36.1   | 1  | x   |
| 1KSMB22A          | 1KSMB22CA        | A10M    | N10M | 18.80  | 20.90  | 23.10  | 1                                | 30.6  | 32.7   | 1  | x   |
| 1KSMB24A          | 1KSMB24CA        | A10N    | N10N | 20.50  | 22.80  | 25.20  | 1                                | 33.2  | 30.1   | 1  | x   |
| 1KSMB27A          | 1KSMB27CA        | A10O    | N10O | 23.10  | 25.70  | 28.40  | 1                                | 37.5  | 26.7   | 1  | x   |
| 1KSMB30A          | 1KSMB30CA        | A10P    | N10P | 25.60  | 28.50  | 31.50  | 1                                | 41.4  | 24.2   | 1  | x   |
| 1KSMB33A          | 1KSMB33CA        | A10Q    | N10Q | 28.20  | 31.40  | 34.70  | 1                                | 45.7  | 21.9   | 1  | x   |
| 1KSMB36A          | 1KSMB36CA        | A10R    | N10R | 30.80  | 34.20  | 37.80  | 1                                | 49.9  | 20.0   | 1  | x   |
| 1KSMB39A          | 1KSMB39CA        | A10S    | N10S | 33.30  | 37.10  | 41.00  | 1                                | 53.9  | 18.6   | 1  | x   |
| 1KSMB43A          | 1KSMB43CA        | A10T    | N10T | 36.80  | 40.90  | 45.20  | 1                                | 59.3  | 16.9   | 1  | x   |
| 1KSMB47A          | 1KSMB47CA        | A10U    | N10U | 40.20  | 44.70  | 49.40  | 1                                | 64.8  | 15.4   | 1  | x   |
| 1KSMB51A          | 1KSMB51CA        | A10V    | N10V | 43.60  | 48.50  | 53.60  | 1                                | 70.1  | 14.3   | 1  | x   |
| 1KSMB56A          | 1KSMB56CA        | A10W    | N10W | 47.80  | 53.20  | 58.80  | 1                                | 77.0  | 13.0   | 1  | x   |
| 1KSMB62A          | 1KSMB62CA        | A10X    | N10X | 53.00  | 58.90  | 65.10  | 1                                | 85.0  | 11.8   | 1  | x   |
| 1KSMB68A          | 1KSMB68CA        | A10Y    | N10Y | 58.10  | 64.60  | 71.40  | 1                                | 92.0  | 10.9   | 1  | x   |
| 1KSMB75A          | 1KSMB75CA        | A10Z    | N10Z | 64.10  | 71.30  | 78.80  | 1                                | 103.0   | 9.7  | 1  | x   |
| 1KSMB82A          | 1KSMB82CA        | B10A    | O10A | 70.10  | 77.90  | 86.10  | 1                                | 113.0   | 8.8  | 1  | x   |
| 1KSMB91A          | 1KSMB91CA        | B10B    | O10B | 77.80  | 86.50  | 95.50  | 1                                | 125.0   | 8.0  | 1  | x   |
| 1KSMB100A         | 1KSMB100CA       | B10C    | O10C | 85.50  | 95.00  | 105.00 | 1                                | 137.0   | 7.3  | 1  | x   |
| 1KSMB110A         | 1KSMB110CA       | B10D    | O10D | 94.00  | 105.00   | 116.00 | 1                                | 152.0   | 6.6  | 1  | x   |
| 1KSMB120A         | 1KSMB120CA       | B10E    | O10E | 102.00   | 114.00   | 126.00 | 1                                | 165.0   | 6.1  | 1  | x   |
| 1KSMB130A         | 1KSMB130CA       | B10F    | O10F | 111.00   | 124.00   | 137.00 | 1                                | 179.0   | 5.6  | 1  | x   |
| 1KSMB150A         | 1KSMB150CA       | B10G    | O10G | 128.00   | 143.00   | 158.00 | 1                                | 207.0   | 4.8  | 1  | x   |
| 1KSMB160A         | 1KSMB160CA       | B10H    | O10H | 136.00   | 152.00   | 168.00 | 1                                | 219.0   | 4.6  | 1  | x   |
| 1KSMB170A         | 1KSMB170CA       | B10I    | O10I | 144.50   | 162.00   | 179.00 | 1                                | 234.0   | 4.3  | 1  | x   |
| 1KSMB180A         | 1KSMB180CA       | B10J    | O10J | 153.00   | 171.00   | 189.00 | 1                                | 246.0   | 4.1  | 1  | x   |

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.

For parts without A V<sub>BR</sub> is ± 10% and V<sub>C</sub> is 5% higher than with A parts.

### I-V Curve Characteristics



- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows thogh the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** – Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)
- $I_R$  Reverse Leakage Current** – Current measured at  $V_R$
- $V_F$  Forward Voltage Drop for Uni-directional**

### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform



Figure 2 - Peak Pulse Power Rating Curve



continues on next page.

**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

**Figure 3 - Peak Pulse Power Derating Curve**



**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**



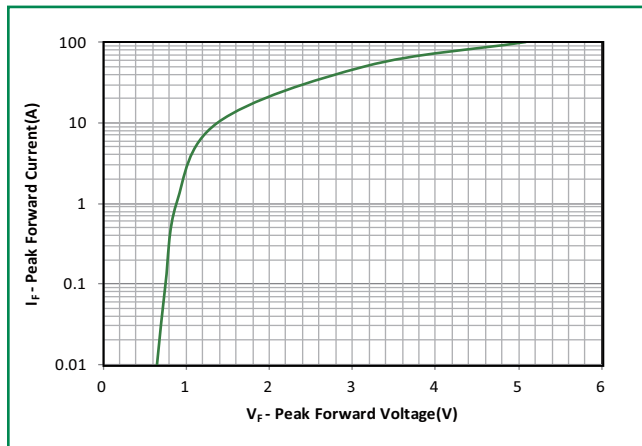
**Figure 6 - Typical Transient Thermal Impedance**



**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### Soldering Parameters

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Lead-free assembly      |
| 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 ( $T_A$ ) to peak) |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_A$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_A$ ) (Liquidus) | 217°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °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 ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed  |                                    | 260°C                   |



### Physical Specifications

|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.003 ounce, 0.093 grams  |
| <b>Case</b>     | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except Bidirectional.                  |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102                |

### Environmental Specifications

|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>                 | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>               | JESD22-A101              |
| <b>RSH</b>                 | JESD22-A111              |

### Dimensions

#### DO-214AA (SMB J-Bend)



| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.077  | 0.086 | 1.950       | 2.200 |
| B          | 0.160  | 0.180 | 4.060       | 4.570 |
| C          | 0.130  | 0.155 | 3.300       | 3.940 |
| D          | 0.084  | 0.096 | 2.130       | 2.440 |
| E          | 0.030  | 0.060 | 0.760       | 1.520 |
| F          | -      | 0.008 | -           | 0.203 |
| G          | 0.205  | 0.220 | 5.210       | 5.590 |
| H          | 0.006  | 0.012 | 0.152       | 0.305 |
| I          | 0.089  | -     | 2.260       | -     |
| J          | 0.085  | -     | 2.160       | -     |
| K          | -      | 0.107 | -           | 2.740 |
| L          | 0.085  | -     | 2.160       | -     |

### Part Numbering System



### Part Marking System



### Packaging

| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| 1KSMBxxxXX  | DO-214AA          | 3000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

### Tape and Reel Specification



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