

# SMBJ Series

## 600W Surface Mount Transient Voltage Suppressors- 5.0V- 440V

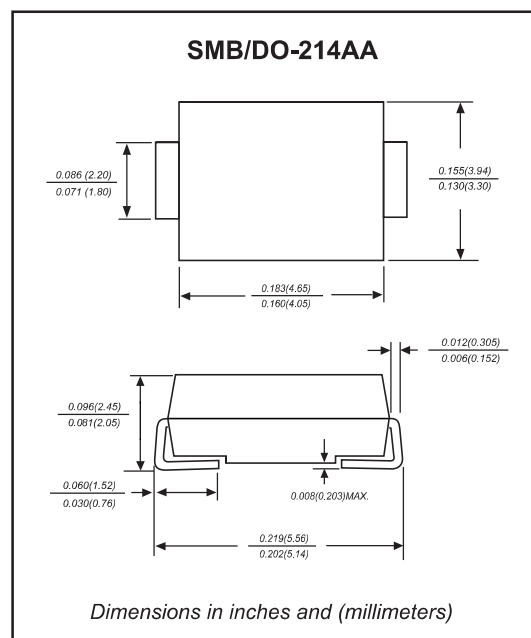
### Features

- 600W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetition rate (duty cycle): 0.01%.
- Low profile surface mounted application in order to optimize board space.
- Excellent clamping capability.
- Low incremental surge resistance.
- Fast response time from 0V to VBR, typically less than 1 ps for uni-directional & 5 ns for bi-directional types.
- Glass passivated chip junction.
- Lead-free parts meet RoHS requirements.
- Compliant to Halogen-free

### Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, DO-214AA /SMB
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band
- Mounting Position : Any

### Package outline



### Maximum ratings (AT $T_A=25^{\circ}\text{C}$ unless otherwise noted)

| PARAMETER                             | CONDITIONS                                          | Symbol                             | Value       | UNIT                 |
|---------------------------------------|-----------------------------------------------------|------------------------------------|-------------|----------------------|
| Peak Power Dissipation                | with a 10/1000 $\mu$ s waveform, Note 1, 2 & Fig. 1 | $P_{PPM}$                          | 600         | W                    |
| Peak Pulse current                    | with a 10/1000 $\mu$ s waveform                     | $I_{PPM}$                          | See Table 1 | A                    |
| Steady State Power Dissipation        | at $T_L=75^{\circ}\text{C}$ , Note 2                | $P_{M(AV)}$                        | 5.0         | W                    |
| Peak Forward Surge Current            | 8.3ms Single Half Sine-Wave, Note 3                 | $I_{FSM}$                          | 100         | A                    |
| Maximum Instantaneous Forward Voltage | at 50A<br>For Uni-Directional Types Only, Note 4    | $V_F$                              | 3.5/5.0     | V                    |
| Typical Thermal resistance            | Junction to case<br>Junction to ambient             | $R_{\theta JC}$<br>$R_{\theta JA}$ | 30<br>50    | $^{\circ}\text{C/W}$ |
| Operating junction temperature range  |                                                     | $T_J$                              | -55 ~ +150  | $^{\circ}\text{C}$   |
| Storage temperature range             |                                                     | $T_{STG}$                          | -55 ~ +150  | $^{\circ}\text{C}$   |

Note 1. Non-repetitive current pulse, per Fig. 3 and derated above  $T_A=25^{\circ}\text{C}$  per Fig. 2

2. Mounted on copper pad area of 0.2"x0.2" (5.0x5.0 mm) per Fig 5

3. Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum

4.  $V_F<3.5\text{V}$  for  $V_{BR}<200\text{V}$  and  $V_F<5.0\text{V}$  for  $V_{BR}>201\text{V}$ .

## SMBJ Series

Electrical characteristics (at  $T_A=25^{\circ}\text{C}$  unless otherwise noted)

| Part No.<br>(Uni) | Part No.<br>(Bi) | Reverse<br>Stand-off<br>Voltage | Breakdown Voltage @ $I_T$ |               | Test<br>Current | Maximum Clamping<br>Voltage @ $I_{PP}$ |          | Maximum<br>Reverse<br>Leakage<br>Current | Marking Code |    |
|-------------------|------------------|---------------------------------|---------------------------|---------------|-----------------|----------------------------------------|----------|------------------------------------------|--------------|----|
|                   |                  | $V_{RWM}$                       | $V_{BR\ Min}$             | $V_{BR\ Max}$ | $I_T$           | $V_c$                                  | $I_{PP}$ | $I_R@V_{RWM}$                            |              |    |
|                   |                  | Volts                           | Volts                     | Volts         | mA              | Volts                                  | A        | $\mu\text{A}$                            | UNI          | BI |
| SMBJ 5.0A         | SMBJ 5.0CA       | 5.0                             | 6.40                      | 7.00          | 10              | 9.2                                    | 65.2     | 800                                      | KE           | AE |
| SMBJ 6.0A         | SMBJ 6.0CA       | 6.0                             | 6.67                      | 7.37          | 10              | 10.3                                   | 58.3     | 800                                      | KG           | AG |
| SMBJ 6.5A         | SMBJ 6.5CA       | 6.5                             | 7.22                      | 7.98          | 10              | 11.2                                   | 53.6     | 500                                      | KK           | AK |
| SMBJ 7.0A         | SMBJ 7.0CA       | 7.0                             | 7.78                      | 8.60          | 10              | 12.0                                   | 50.0     | 200                                      | KM           | AM |
| SMBJ 7.5A         | SMBJ 7.5CA       | 7.5                             | 8.33                      | 9.21          | 1.0             | 12.9                                   | 46.5     | 100                                      | KP           | AP |
| SMBJ 8.0A         | SMBJ 8.0CA       | 8.0                             | 8.89                      | 9.83          | 1.0             | 13.6                                   | 44.1     | 50                                       | KR           | AR |
| SMBJ 8.5A         | SMBJ 8.5CA       | 8.5                             | 9.44                      | 10.4          | 1.0             | 14.4                                   | 41.7     | 20                                       | KT           | AT |
| SMBJ 9.0A         | SMBJ 9.0CA       | 9.0                             | 10.0                      | 11.1          | 1.0             | 15.4                                   | 39.0     | 10                                       | KV           | AV |
| SMBJ 10A          | SMBJ 10CA        | 10                              | 11.1                      | 12.3          | 1.0             | 17.0                                   | 35.3     | 5                                        | KX           | AX |
| SMBJ 11A          | SMBJ 11CA        | 11                              | 12.2                      | 13.5          | 1.0             | 18.2                                   | 33.0     | 5                                        | KZ           | AZ |
| SMBJ 12A          | SMBJ 12CA        | 12                              | 13.3                      | 14.7          | 1.0             | 19.9                                   | 30.2     | 5                                        | LE           | BE |
| SMBJ 13A          | SMBJ 13CA        | 13                              | 14.4                      | 15.9          | 1.0             | 21.5                                   | 27.9     | 5                                        | LG           | BG |
| SMBJ 14A          | SMBJ 14CA        | 14                              | 15.6                      | 17.2          | 1.0             | 23.2                                   | 25.9     | 5                                        | LK           | BK |
| SMBJ 15A          | SMBJ 15CA        | 15                              | 16.7                      | 18.5          | 1.0             | 24.4                                   | 24.6     | 5                                        | LM           | BM |
| SMBJ 16A          | SMBJ 16CA        | 16                              | 17.8                      | 19.7          | 1.0             | 26.0                                   | 23.0     | 5                                        | LP           | BP |
| SMBJ 17A          | SMBJ 17CA        | 17                              | 18.9                      | 20.9          | 1.0             | 27.6                                   | 21.7     | 5                                        | LR           | BR |
| SMBJ 18A          | SMBJ 18CA        | 18                              | 20.0                      | 22.1          | 1.0             | 29.2                                   | 20.5     | 5                                        | LT           | BT |
| SMBJ 20A          | SMBJ 20CA        | 20                              | 22.2                      | 24.5          | 1.0             | 32.4                                   | 18.5     | 5                                        | LV           | BV |
| SMBJ 22A          | SMBJ 22CA        | 22                              | 24.4                      | 26.9          | 1.0             | 35.5                                   | 16.9     | 5                                        | LX           | BX |
| SMBJ 24A          | SMBJ 24CA        | 24                              | 26.7                      | 29.5          | 1.0             | 38.9                                   | 15.4     | 5                                        | LZ           | BZ |
| SMBJ 26A          | SMBJ 26CA        | 26                              | 28.9                      | 31.9          | 1.0             | 42.1                                   | 14.3     | 5                                        | ME           | CE |
| SMBJ 28A          | SMBJ 28CA        | 28                              | 31.1                      | 34.4          | 1.0             | 45.4                                   | 13.2     | 5                                        | MG           | CG |
| SMBJ 30A          | SMBJ 30CA        | 30                              | 33.3                      | 36.8          | 1.0             | 48.4                                   | 12.4     | 5                                        | MK           | CK |
| SMBJ 33A          | SMBJ 33CA        | 33                              | 36.7                      | 40.6          | 1.0             | 53.3                                   | 11.3     | 5                                        | MM           | CM |
| SMBJ 36A          | SMBJ 36CA        | 36                              | 40.0                      | 44.2          | 1.0             | 58.1                                   | 10.3     | 5                                        | MP           | CP |
| SMBJ 40A          | SMBJ 40CA        | 40                              | 44.4                      | 49.1          | 1.0             | 64.5                                   | 9.3      | 5                                        | MR           | CR |
| SMBJ 43A          | SMBJ 43CA        | 43                              | 47.8                      | 52.8          | 1.0             | 69.4                                   | 8.6      | 5                                        | MT           | CT |
| SMBJ 45A          | SMBJ 45CA        | 45                              | 50.0                      | 55.3          | 1.0             | 72.7                                   | 8.3      | 5                                        | MV           | CV |
| SMBJ 48A          | SMBJ 48CA        | 48                              | 53.3                      | 58.9          | 1.0             | 77.4                                   | 7.8      | 5                                        | MX           | CX |
| SMBJ 51A          | SMBJ 51CA        | 51                              | 56.7                      | 62.7          | 1.0             | 82.4                                   | 7.3      | 5                                        | MZ           | CZ |
| SMBJ 54A          | SMBJ 54CA        | 54                              | 60.0                      | 66.3          | 1.0             | 87.1                                   | 6.9      | 5                                        | NE           | DE |
| SMBJ 58A          | SMBJ 58CA        | 58                              | 64.4                      | 71.2          | 1.0             | 93.6                                   | 6.4      | 5                                        | NG           | DG |
| SMBJ 60A          | SMBJ 60CA        | 60                              | 66.7                      | 73.7          | 1.0             | 96.8                                   | 6.2      | 5                                        | NK           | DK |
| SMBJ 64A          | SMBJ 64CA        | 64                              | 71.1                      | 78.6          | 1.0             | 103.0                                  | 5.8      | 5                                        | NM           | DM |
| SMBJ 70A          | SMBJ 70CA        | 70                              | 77.8                      | 86.0          | 1.0             | 113.0                                  | 5.3      | 5                                        | NP           | DP |
| SMBJ 75A          | SMBJ 75CA        | 75                              | 83.3                      | 92.1          | 1.0             | 121.0                                  | 5.0      | 5                                        | NR           | DR |
| SMBJ 78A          | SMBJ 78CA        | 78                              | 86.7                      | 95.8          | 1.0             | 126.0                                  | 4.8      | 5                                        | NT           | DT |
| SMBJ 85A          | SMBJ 85CA        | 85                              | 94.4                      | 104           | 1.0             | 137.0                                  | 4.4      | 5                                        | NV           | DV |

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## Electrical characteristics (at $T_A=25^\circ\text{C}$ unless otherwise noted)

| Part No.<br>(Uni) | Part No.<br>(Bi) | Reverse<br>Stand-off<br>Voltage | Breakdown Voltage @ $I_T$ |              | Test<br>Current | Maximum Clamping<br>Voltage @ $I_{PP}$ |          | Maximum<br>Reverse<br>Leakage<br>Current | Marking Code |    |
|-------------------|------------------|---------------------------------|---------------------------|--------------|-----------------|----------------------------------------|----------|------------------------------------------|--------------|----|
|                   |                  | $V_{RWM}$                       | $V_{BR Min}$              | $V_{BR Max}$ | $I_T$           | $V_C$                                  | $I_{PP}$ | $I_R @ V_{RWM}$                          |              |    |
|                   |                  | Volts                           | Volts                     | Volts        | mA              | Volts                                  | A        | $\mu\text{A}$                            | UNI          | BI |
| SMBJ 90A          | SMBJ 90CA        | 90                              | 100                       | 111          | 1.0             | 146.0                                  | 4.1      | 5                                        | NX           | DX |
| SMBJ 100A         | SMBJ 100CA       | 100                             | 111                       | 123          | 1.0             | 162.0                                  | 3.7      | 5                                        | NZ           | DZ |
| SMBJ 110A         | SMBJ 110CA       | 110                             | 122                       | 135          | 1.0             | 177.0                                  | 3.4      | 5                                        | PE           | EE |
| SMBJ 120A         | SMBJ 120CA       | 120                             | 133                       | 147          | 1.0             | 193.0                                  | 3.1      | 5                                        | PG           | EG |
| SMBJ 130A         | SMBJ 130CA       | 130                             | 144                       | 159          | 1.0             | 209.0                                  | 2.9      | 5                                        | PK           | EK |
| SMBJ 150A         | SMBJ 150CA       | 150                             | 167                       | 185          | 1.0             | 243.0                                  | 2.5      | 5                                        | PM           | EM |
| SMBJ 160A         | SMBJ 160CA       | 160                             | 178                       | 197          | 1.0             | 259.0                                  | 2.3      | 5                                        | PP           | EP |
| SMBJ 170A         | SMBJ 170CA       | 170                             | 189                       | 209          | 1.0             | 275.0                                  | 2.2      | 5                                        | PR           | ER |
| SMBJ 180A         | SMBJ 180CA       | 180                             | 201                       | 222          | 1.0             | 292.0                                  | 2.1      | 5                                        | PT           | ET |
| SMBJ 200A         | SMBJ 200CA       | 200                             | 224                       | 247          | 1.0             | 324.0                                  | 1.9      | 5                                        | PX           | EX |
| SMBJ 220A         | SMBJ 220CA       | 220                             | 246                       | 272          | 1.0             | 356.0                                  | 1.7      | 5                                        | PV           | EV |
| SMBJ 250A         | SMBJ 250CA       | 250                             | 279                       | 309          | 1.0             | 405.0                                  | 1.5      | 5                                        | PZ           | EZ |
| SMBJ 300A         | SMBJ 300CA       | 300                             | 335                       | 371          | 1.0             | 486.0                                  | 1.3      | 5                                        | QE           | FE |
| SMBJ 350A         | SMBJ 350CA       | 350                             | 391                       | 432          | 1.0             | 567.0                                  | 1.1      | 5                                        | QG           | FG |
| SMBJ 400A         | SMBJ 400CA       | 400                             | 447                       | 494          | 1.0             | 648.0                                  | 0.9      | 5                                        | QK           | FK |
| SMBJ 440A         | SMBJ 440CA       | 440                             | 492                       | 543          | 1.0             | 713.0                                  | 0.9      | 5                                        | QM           | FM |

Note 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

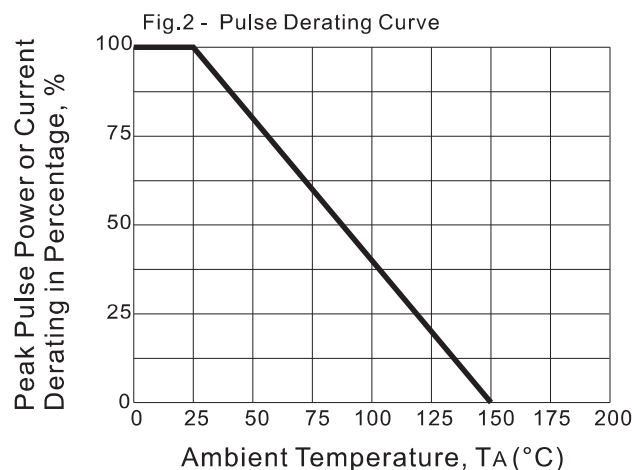
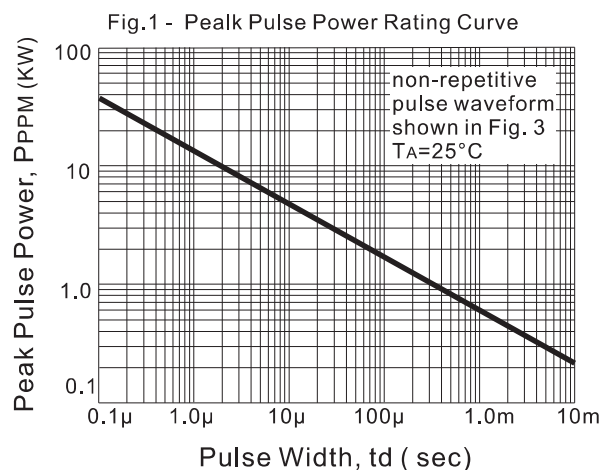
3. For bi-directional types having  $V_{RWM}$  of 10 volts and less, the  $I_T$  limit is doubled

4. Suffix 'C' denotes bi-directional devices. Suffix 'A' denotes 5% tolerance devices, no suffix denotes 10% tolerance devices.

5. All terms and symbols are consistent with ANSI/IEEE C62.35

6. Transient Voltage Suppressors (TVS) are devices used to protect vulnerable circuits from electrical overstress such as that caused by electrostatic discharge, inductive load switching and induced lightning. Within the TVS, damaging voltage spikes are limited by clamping or avalanche action of a rugged silicon pn junction which reduces the amplitude of the transient to a nondestructive level. See Fig. 7 & Fig. 8

## Rating and characteristic curves (SMBJ SERIES)



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Fig.3 - Pulse Waveform

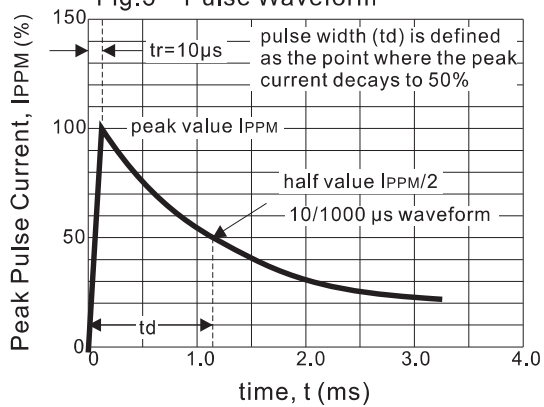


Fig.4 - Typical Junction Capacitance

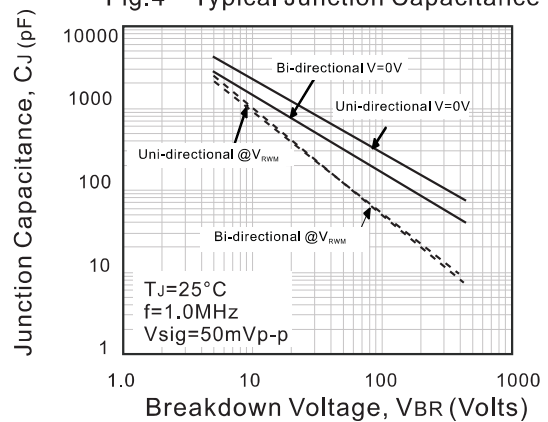


Fig.5 - Steady State Power Derating Curve

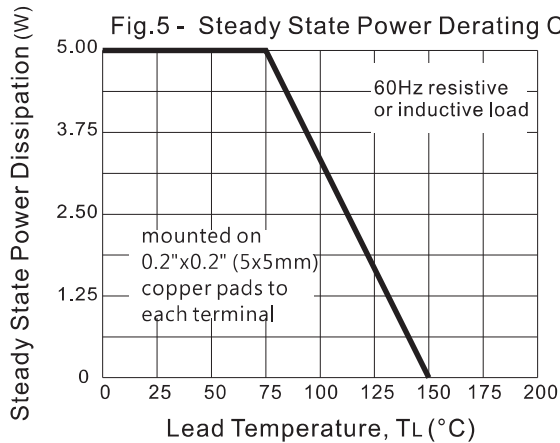


Fig.6 - Maximum Non-Repetitive Forward Surge Current

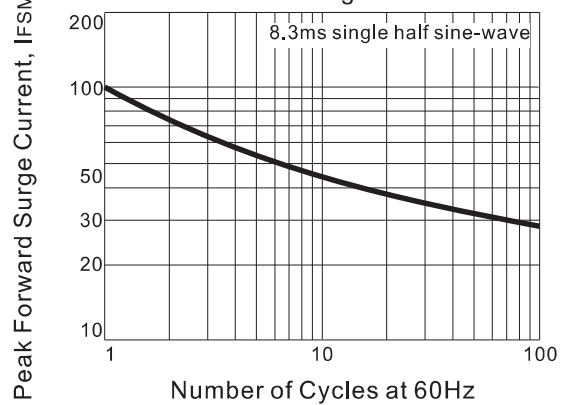


Fig. 7 - Transients of several thousand volts can be clamped to a safe level by the TVS

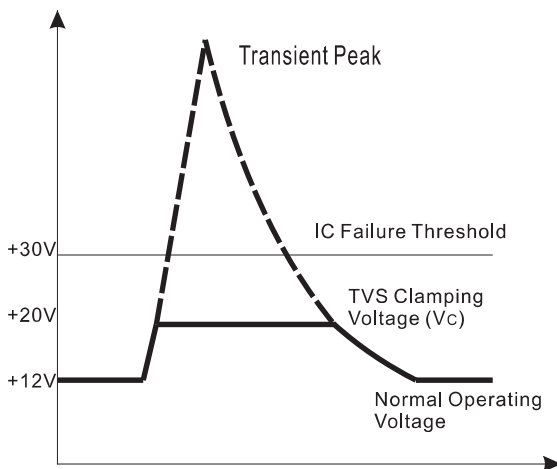
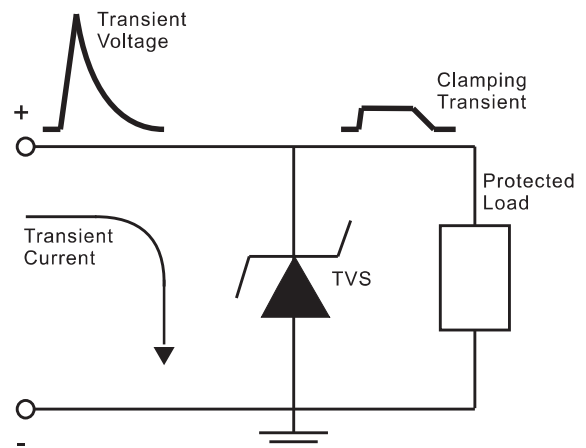
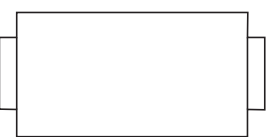


Fig. 8 - Transient current is diverted to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level



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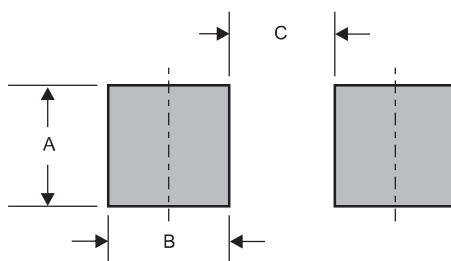
## Pinning information

| Pin                                           | Simplified outline                                                                | Symbol                                                                              |
|-----------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Uni-Directional<br>Pin1 cathode<br>Pin2 anode |  |  |
| Bi-Directional                                |  |  |

## Marking

| Type number     | Example                                                                                                                                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Uni-Directional |  <p>Cathode band</p> <p>Marking code (see page 3 to page 5)</p> |
| Bi-Directional  |  <p>Marking code (see page 3 to page 5)</p>                     |

## Suggested solder pad layout



Dimensions in inches and (millimeters)

| PACKAGE | A            | B            | C            |
|---------|--------------|--------------|--------------|
| SMB     | 0.078 (2.00) | 0.059 (1.50) | 0.110 (2.80) |