

## 400W, 5.8V - 376V Transient Voltage Suppressor

### FEATURES

- AEC-Q101 qualified available
- Excellent clamping capability
- Low impedance surge resistance
- 400W surge capability at 10/1000 $\mu$ s waveform
- Very fast response time
- Typical  $I_R$  less than 1 $\mu$ A above 10V
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

### APPLICATIONS

- Protect sensitive circuit from damage by high voltage transients
- Lighting, ESD transient voltage protection of IC, system
- Inductive switching load protection of IC, system
- Electrical Fast Transient Immunity protection of IC, system

### MECHANICAL DATA

- Case: DO-204AL (DO-41)
- Molding compound meets UL 94V-0 flammability rating
- Terminal: Pure tin plated leads, solderable per J-STD-002
- Meet JESD 201 class 2 whisker test
- Polarity: As marked
- Weight: 0.300g (approximately)

| KEY PARAMETERS               |                  |              |
|------------------------------|------------------|--------------|
| PARAMETER                    | VALUE            | UNIT         |
| $V_{WM}$                     | 5.8 - 376        | V            |
| $V_{BR}$ (uni - directional) | 6.45 - 462       | V            |
| $V_{BR}$ (bi - directional)  | 6.45 - 462       | V            |
| $P_{PK}$                     | 400              | W            |
| $T_{J\ MAX}$                 | 175              | $^{\circ}$ C |
| Package                      | DO-204AL (DO-41) |              |



DO-204AL (DO-41)

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^{\circ}$ C unless otherwise noted)                               |           |             |              |
|-------------------------------------------------------------------------------------------------------|-----------|-------------|--------------|
| PARAMETER                                                                                             | SYMBOL    | VALUE       | UNIT         |
| Peak power dissipation at $T_A = 25^{\circ}$ C, $T_p = 1ms^{(1)}$                                     | $P_{PK}$  | 400         | W            |
| Steady state power dissipation at $T_L = 75^{\circ}$ C<br>lead lengths .375", 9.5mm <sup>(2)</sup>    | $P_D$     | 1           | W            |
| Peak forward surge current, 8.3 ms single half sine-wave<br>superimposed on rated load <sup>(3)</sup> | $I_{FSM}$ | 40          | A            |
| Operating junction temperature range                                                                  | $T_J$     | -55 to +175 | $^{\circ}$ C |
| Storage temperature range                                                                             | $T_{STG}$ | -55 to +175 | $^{\circ}$ C |

#### Note:

1. Non-repetitive current pulse per Fig.3 and Derated above  $T_A = 25^{\circ}$ C per Fig.2
2. Mounted on 5 x 5 mm copper pads to each terminal
3. 8.3ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

| THERMAL PERFORMANCE                                                       |                 |     |                |
|---------------------------------------------------------------------------|-----------------|-----|----------------|
| PARAMETER                                                                 | SYMBOL          | TYP | UNIT           |
| Junction-to-lead thermal resistance                                       | $R_{\theta JL}$ | 60  | $^{\circ}$ C/W |
| Junction-to-ambient thermal resistance<br>on printed circuit, L lead=10mm | $R_{\theta JA}$ | 100 | $^{\circ}$ C/W |

**MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS** (TA=25°C unless otherwise noted)

| Device <sup>(1)</sup> |               | Breakdown voltage<br>V <sub>BR</sub> @I <sub>T</sub><br>(V) |      | Test current<br>I <sub>T</sub><br>(mA) | Working stand-off voltage<br>V <sub>WM</sub><br>(V) | Reverse leakage current @<br>V <sub>WM</sub><br>I <sub>D</sub><br>(uA) <sup>(3)</sup> | Maximum peak impulse current<br>I <sub>PP</sub><br>(A) | Maximum clamping voltage<br>V <sub>C</sub> @I <sub>PP</sub><br>(V) | Maximum temperature coefficient |
|-----------------------|---------------|-------------------------------------------------------------|------|----------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------|---------------------------------|
|                       |               | V <sub>BR</sub>                                             |      | I <sub>T</sub>                         | V <sub>WM</sub>                                     | I <sub>D</sub>                                                                        | I <sub>PPM</sub>                                       | V <sub>C</sub>                                                     | V <sub>BR</sub>                 |
|                       |               | V                                                           |      | mA                                     | V                                                   | μA                                                                                    | A                                                      | V                                                                  | %/°C                            |
| Unidirectional        | Bidirectional | Min                                                         | Max  |                                        |                                                     |                                                                                       |                                                        |                                                                    |                                 |
| BZW04-5V8             | BZW04-5V8B    | 6.45                                                        | 7.14 | 10                                     | 5.80                                                | 1000                                                                                  | 38.0                                                   | 10.5                                                               | 0.057                           |
| BZW04-6V4             | BZW04-6V4B    | 7.13                                                        | 7.88 | 10                                     | 6.40                                                | 500                                                                                   | 35.4                                                   | 11.3                                                               | 0.061                           |
| BZW04-7V0             | BZW04-7V0B    | 7.79                                                        | 8.61 | 10                                     | 7.02                                                | 200                                                                                   | 33.0                                                   | 12.1                                                               | 0.065                           |
| BZW04-7V8             | BZW04-7V8B    | 8.65                                                        | 9.55 | 1                                      | 7.78                                                | 50                                                                                    | 30.0                                                   | 13.4                                                               | 0.068                           |
| BZW04-8V5             | BZW04-8V5B    | 9.50                                                        | 10.5 | 1                                      | 8.55                                                | 10                                                                                    | 27.6                                                   | 14.5                                                               | 0.073                           |
| BZW04-9V4             | BZW04-9V4B    | 10.5                                                        | 11.6 | 1                                      | 9.40                                                | 5                                                                                     | 25.7                                                   | 15.6                                                               | 0.075                           |
| BZW04-10              | BZW04-10B     | 11.4                                                        | 12.6 | 1                                      | 10.2                                                | 5                                                                                     | 24.0                                                   | 16.7                                                               | 0.078                           |
| BZW04-11              | BZW04-11B     | 12.4                                                        | 13.7 | 1                                      | 11.1                                                | 5                                                                                     | 22.0                                                   | 18.2                                                               | 0.081                           |
| BZW04-13              | BZW04-13B     | 14.3                                                        | 15.8 | 1                                      | 12.8                                                | 5                                                                                     | 19.0                                                   | 21.2                                                               | 0.084                           |
| BZW04-14              | BZW04-14B     | 15.2                                                        | 16.8 | 1                                      | 13.6                                                | 1                                                                                     | 17.8                                                   | 22.5                                                               | 0.083                           |
| BZW04-15              | BZW04-15B     | 17.1                                                        | 18.9 | 1                                      | 15.3                                                | 1                                                                                     | 16.0                                                   | 25.2                                                               | 0.088                           |
| BZW04-17              | BZW04-17B     | 19.0                                                        | 21.0 | 1                                      | 17.1                                                | 1                                                                                     | 14.5                                                   | 27.7                                                               | 0.090                           |
| BZW04-19              | BZW04-19B     | 20.9                                                        | 23.1 | 1                                      | 18.8                                                | 1                                                                                     | 13.0                                                   | 30.6                                                               | 0.092                           |
| BZW04-20              | BZW04-20B     | 22.8                                                        | 25.2 | 1                                      | 20.5                                                | 1                                                                                     | 12.0                                                   | 33.2                                                               | 0.094                           |
| BZW04-23              | BZW04-23B     | 25.7                                                        | 28.4 | 1                                      | 23.1                                                | 1                                                                                     | 10.7                                                   | 37.5                                                               | 0.096                           |
| BZW04-26              | BZW04-26B     | 28.5                                                        | 31.5 | 1                                      | 25.6                                                | 1                                                                                     | 9.6                                                    | 41.5                                                               | 0.097                           |
| BZW04-28              | BZW04-28B     | 31.4                                                        | 34.7 | 1                                      | 28.2                                                | 1                                                                                     | 8.8                                                    | 45.7                                                               | 0.098                           |
| BZW04-31              | BZW04-31B     | 34.2                                                        | 37.8 | 1                                      | 30.8                                                | 1                                                                                     | 8.0                                                    | 49.9                                                               | 0.099                           |
| BZW04-33              | BZW04-33B     | 37.1                                                        | 41.0 | 1                                      | 33.3                                                | 1                                                                                     | 7.4                                                    | 53.9                                                               | 0.100                           |
| BZW04-37              | BZW04-37B     | 40.9                                                        | 45.2 | 1                                      | 36.8                                                | 1                                                                                     | 6.7                                                    | 59.3                                                               | 0.101                           |
| BZW04-40              | BZW04-40B     | 44.7                                                        | 49.4 | 1                                      | 40.2                                                | 1                                                                                     | 6.2                                                    | 64.8                                                               | 0.101                           |
| BZW04-44              | BZW04-44B     | 48.5                                                        | 53.6 | 1                                      | 43.6                                                | 1                                                                                     | 5.7                                                    | 70.1                                                               | 0.102                           |
| BZW04-48              | BZW04-48B     | 53.2                                                        | 58.8 | 1                                      | 47.8                                                | 1                                                                                     | 5.2                                                    | 77.0                                                               | 0.103                           |
| BZW04-53              | BZW04-53B     | 58.9                                                        | 65.1 | 1                                      | 53.0                                                | 1                                                                                     | 4.7                                                    | 85.0                                                               | 0.104                           |
| BZW04-58              | BZW04-58B     | 64.6                                                        | 71.4 | 1                                      | 58.1                                                | 1                                                                                     | 4.3                                                    | 92.0                                                               | 0.104                           |
| BZW04-64              | BZW04-64B     | 71.3                                                        | 78.8 | 1                                      | 64.1                                                | 1                                                                                     | 3.9                                                    | 103                                                                | 0.105                           |
| BZW04-70              | BZW04-70B     | 77.9                                                        | 86.1 | 1                                      | 70.1                                                | 1                                                                                     | 3.5                                                    | 113                                                                | 0.105                           |
| BZW04-78              | BZW04-78B     | 86.5                                                        | 95.5 | 1                                      | 78.0                                                | 1                                                                                     | 3.2                                                    | 125                                                                | 0.105                           |
| BZW04-85              | BZW04-85B     | 95                                                          | 105  | 1                                      | 85.5                                                | 1                                                                                     | 2.9                                                    | 137                                                                | 0.106                           |
| BZW04-94              | BZW04-94B     | 105                                                         | 116  | 1                                      | 94.0                                                | 1                                                                                     | 2.6                                                    | 152                                                                | 0.107                           |
| BZW04-102             | BZW04-102B    | 114                                                         | 126  | 1                                      | 102                                                 | 1                                                                                     | 2.4                                                    | 165                                                                | 0.107                           |
| BZW04-110             | BZW04-110B    | 124                                                         | 137  | 1                                      | 111                                                 | 1                                                                                     | 2.2                                                    | 179                                                                | 0.107                           |
| BZW04-128             | BZW04-128B    | 143                                                         | 158  | 1                                      | 128                                                 | 1                                                                                     | 2.0                                                    | 207                                                                | 0.108                           |
| BZW04-136             | BZW04-136B    | 152                                                         | 168  | 1                                      | 136                                                 | 1                                                                                     | 1.8                                                    | 219                                                                | 0.108                           |

| <b>MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS</b> (TA=25°C unless otherwise noted) |               |                                                             |     |                                        |                                                     |                                                                                             |                                                        |                                                                    |                                 |
|----------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------|-----|----------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------|---------------------------------|
| Device <sup>(1)</sup>                                                                  |               | Breakdown voltage<br>V <sub>BR</sub> @I <sub>T</sub><br>(V) |     | Test current<br>I <sub>T</sub><br>(mA) | Working stand-off voltage<br>V <sub>WM</sub><br>(V) | Reverse leakage current @<br>V <sub>WM</sub><br>I <sub>D</sub><br>( $\mu$ A) <sup>(3)</sup> | Maximum peak impulse current<br>I <sub>PP</sub><br>(A) | Maximum clamping voltage<br>V <sub>C</sub> @I <sub>PP</sub><br>(V) | Maximum temperature coefficient |
|                                                                                        |               | V <sub>BR</sub>                                             |     | I <sub>T</sub>                         | V <sub>WM</sub>                                     | I <sub>D</sub>                                                                              | I <sub>PPM</sub>                                       | V <sub>C</sub>                                                     | V <sub>BR</sub>                 |
|                                                                                        |               | V                                                           |     | mA                                     | V                                                   | $\mu$ A                                                                                     | A                                                      | V                                                                  | %/°C                            |
| Unidirectional                                                                         | Bidirectional | Min                                                         | Max |                                        |                                                     |                                                                                             |                                                        |                                                                    |                                 |
| BZW04-145                                                                              | BZW04-145B    | 161                                                         | 179 | 1                                      | 145                                                 | 1                                                                                           | 1.7                                                    | 234                                                                | 0.108                           |
| BZW04-154                                                                              | BZW04-154B    | 171                                                         | 189 | 1                                      | 154                                                 | 1                                                                                           | 1.6                                                    | 246                                                                | 0.108                           |
| BZW04-171                                                                              | BZW04-171B    | 190                                                         | 210 | 1                                      | 171                                                 | 1                                                                                           | 1.5                                                    | 274                                                                | 0.108                           |
| BZW04-188                                                                              | BZW04-188B    | 209                                                         | 231 | 1                                      | 188                                                 | 1                                                                                           | 1.4                                                    | 301                                                                | 0.108                           |
| BZW04-213                                                                              | BZW04-213B    | 237                                                         | 263 | 1                                      | 213                                                 | 1                                                                                           | 1.2                                                    | 344                                                                | 0.110                           |
| BZW04-239                                                                              | BZW04-239B    | 266                                                         | 294 | 1                                      | 239                                                 | 1                                                                                           | 1.1                                                    | 384                                                                | 0.110                           |
| BZW04-256                                                                              | BZW04-256B    | 285                                                         | 315 | 1                                      | 256                                                 | 1                                                                                           | 1.0                                                    | 414                                                                | 0.110                           |
| BZW04-273                                                                              | BZW04-273B    | 304                                                         | 336 | 1                                      | 273                                                 | 1                                                                                           | 0.9                                                    | 438                                                                | 0.110                           |
| BZW04-299                                                                              | BZW04-299B    | 332                                                         | 368 | 1                                      | 299                                                 | 1                                                                                           | 0.8                                                    | 482                                                                | 0.110                           |
| BZW04-342                                                                              | BZW04-342B    | 380                                                         | 420 | 1                                      | 342                                                 | 1                                                                                           | 0.75                                                   | 548                                                                | 0.110                           |
| BZW04-376                                                                              | BZW04-376B    | 418                                                         | 462 | 1                                      | 376                                                 | 1                                                                                           | 0.67                                                   | 603                                                                | 0.110                           |

**Notes:**

1. Pulse test : tp<50ms
2. All terms and symbols are consistent with ANSI/IEEE C62.35
3. For bipolar types having V<sub>WM</sub> of 10 volts and less, the I<sub>D</sub> limit is doubled.

**ORDERING INFORMATION**

| ORDERING CODE <sup>(1)(2)</sup> | PACKAGE          | PACKING             |
|---------------------------------|------------------|---------------------|
| BZW04-x                         | DO-204AL (DO-41) | 5,000 / Tape & Reel |
| BZW04-x A0G                     | DO-204AL (DO-41) | 3,000 / Ammo box    |
| BZW04-xH                        | DO-204AL (DO-41) | 5,000 / Tape & Reel |
| BZW04-xHA0G                     | DO-204AL (DO-41) | 3,000 / Ammo box    |

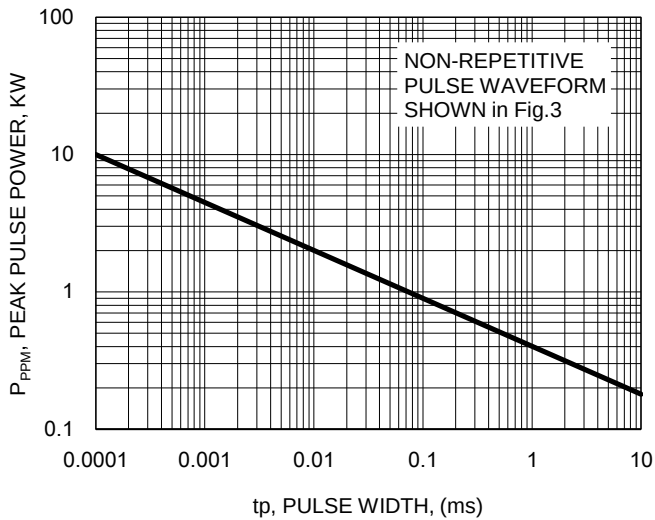
**Notes:**

1. "x" defines voltage from 5.8V (BZW04-5V8) to 376V (BZW04-376)
2. "H" means AEC-Q101 qualified

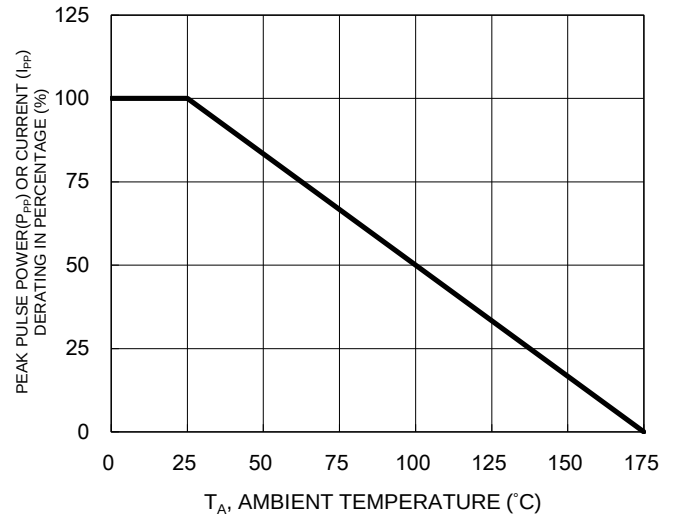
## CHARACTERISTICS CURVES

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

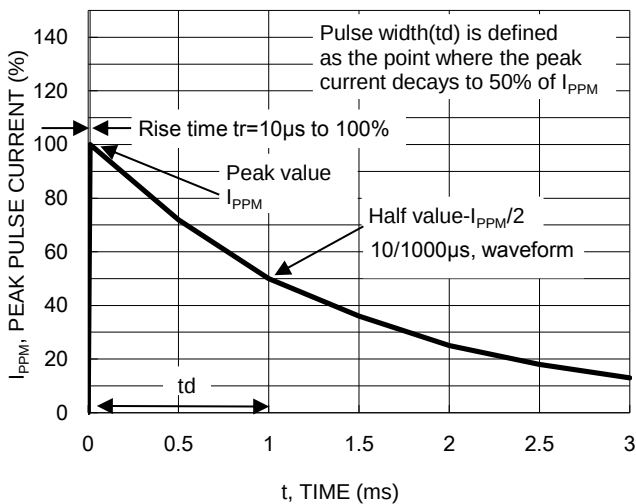
**Fig.1 Peak Pulse Power Rating Curve**



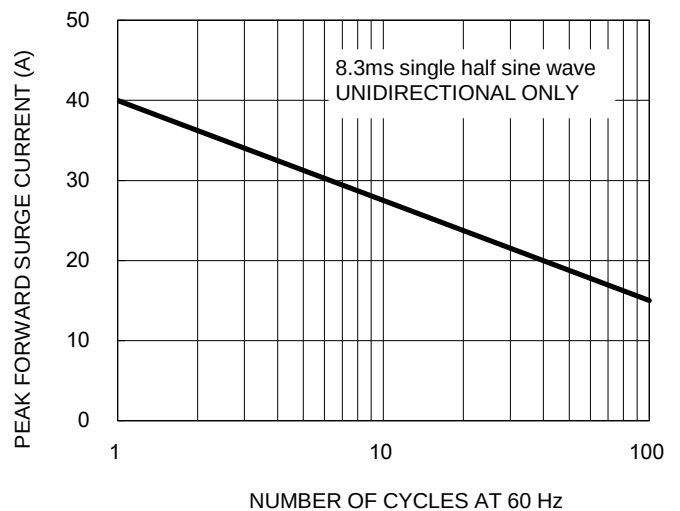
**Fig.2 Pulse Derating Curve**



**Fig.3 Clamping Power Pulse Waveform**



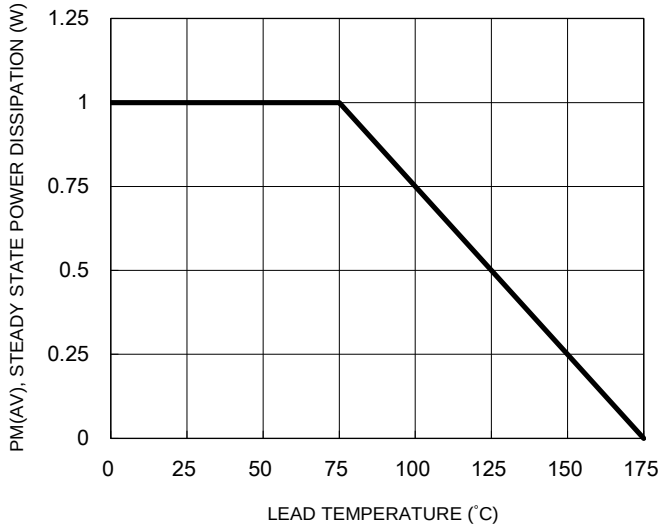
**Fig.4 Maximum Non-Repetitive Forward Surge Current**



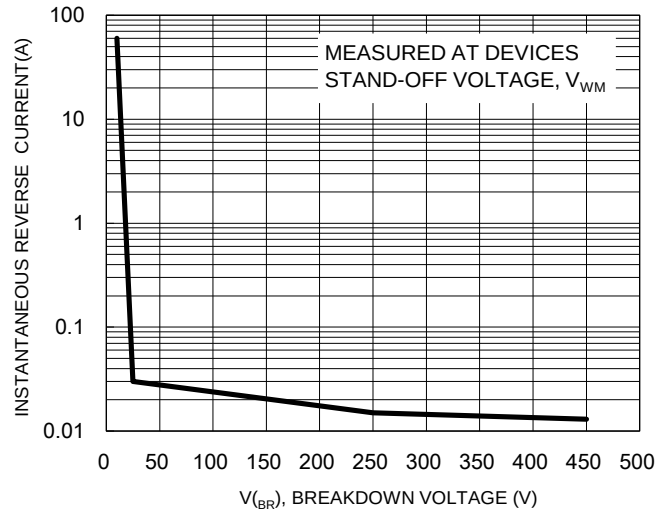
## CHARACTERISTICS CURVES

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

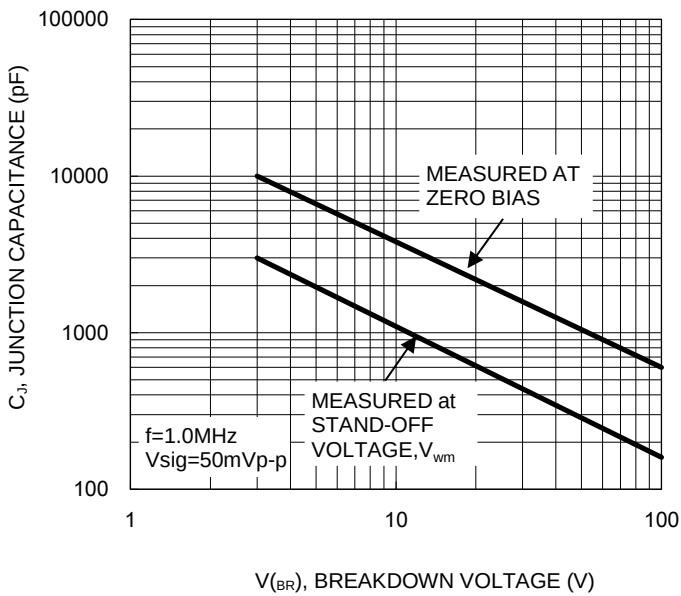
**Fig.5 Steady State Power Derating Curve**



**Fig.6 Typical Reverse Characteristics**

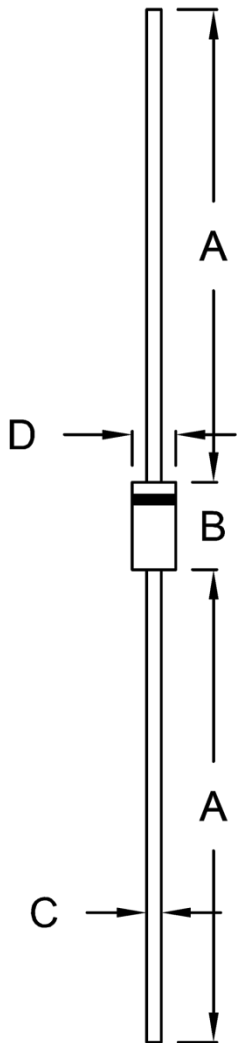


**Fig.7 Typical Junction Capacitance**



## PACKAGE OUTLINE DIMENSIONS

DO-204AL (DO-41)



| DIM. | Unit (mm) |      | Unit (inch) |       |
|------|-----------|------|-------------|-------|
|      | Min.      | Max. | Min.        | Max.  |
| A    | 25.40     | -    | 1.000       | -     |
| B    | 4.20      | 5.20 | 0.165       | 0.205 |
| C    | 0.71      | 0.86 | 0.028       | 0.034 |
| D    | 2.00      | 2.70 | 0.079       | 0.106 |

## MARKING DIAGRAM

Cathode band for uni-directional products only



P/N = Marking Code  
G = Green Compound  
YWW = Date Code  
F = Factory Code

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