

400W, 6.8V - 440V Transient Voltage Suppressor

FEATURES

- AEC-Q101 qualified available
- Excellent clamping capability
- Low impedance
- 400W surge capability at 10/1000 μ s waveform
- Fast response time: Typically less than 1.0ps from 0 volt to V_{BR} for unidirectional and 5.0ns for bidirectional
- Typical I_R less than 1 μ A above 10V
- UL recognized file # E-326243
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

| KEY PARAMETERS | | |
|------------------------------|------------------|--------------|
| PARAMETER | VALUE | UNIT |
| V_{WM} | 5.5 - 376 | V |
| V_{BR} (uni - directional) | 6.12 - 484 | V |
| V_{BR} (bi - directional) | 6.12 - 484 | V |
| P_{PK} | 400 | W |
| T_{JMAX} | 175 | $^{\circ}$ C |
| Package | DO-204AL (DO-41) | |



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)



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 lead lengths .375", 9.5mm ⁽²⁾ | P_D | 1 | W |
| Peak forward surge current, 8.3 ms single half sine-wave superimposed on rated load ⁽³⁾ | I_{FSM} | 40 | A |
| Forward voltage at 25A for Unidirectional only ⁽⁴⁾ | V_F | 3.5/6.5 | V |
| 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
4. $V_F = 3.5V$ for devices of $V_{BR} \leq 200V$ and $V_F = 6.5V$ max. for device $V_{BR} > 200V$

Devices for bipolar applications

1. For bidirectional use C or CA suffix for types P4KE6.8 - types P4KE440
2. Electrical characteristics apply in both directions

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

| Part Number | Nominal voltage | Breakdown voltage $V_{BR}@I_T$ (V) ⁽¹⁾ | | Test current I_T (mA) | Working stand-off voltage V_{WM} (V) | Reverse leakage @ V_{WM} I_D (μ A) | Maximum peak pulse current I_{PPM} (A) ⁽²⁾ | Maximum clamping voltage $V_C@I_{PPM}$ (V) | Maximum temperature coefficient |
|-------------|-----------------|---|-------|-------------------------------|--|--|---|--|---------------------------------|
| | | V_{BR} | | I_T | V_{WM} | I_D | I_{PPM} | V_C | V_{BR} |
| | | V | | mA | V | μ A | A | V | %/°C |
| | | Min | Max | | | | | | |
| P4KE6.8 | 6.8 | 6.12 | 7.48 | 10 | 5.50 | 1000 | 38.0 | 10.8 | 0.057 |
| P4KE6.8A | 6.8 | 6.46 | 7.14 | 10 | 5.80 | 1000 | 40.0 | 10.5 | 0.057 |
| P4KE7.5 | 7.5 | 6.75 | 8.25 | 10 | 6.05 | 500 | 35.0 | 11.7 | 0.061 |
| P4KE7.5A | 7.5 | 7.13 | 7.88 | 10 | 6.40 | 500 | 37.0 | 11.3 | 0.061 |
| P4KE8.2 | 8.2 | 7.38 | 9.02 | 10 | 6.63 | 200 | 33.0 | 12.5 | 0.065 |
| P4KE8.2A | 8.2 | 7.79 | 8.61 | 10 | 7.02 | 200 | 34.0 | 12.1 | 0.065 |
| P4KE9.1 | 9.1 | 8.19 | 10.00 | 1 | 7.37 | 50 | 30.0 | 13.8 | 0.068 |
| P4KE9.1A | 9.1 | 8.65 | 9.55 | 1 | 7.78 | 50 | 31.0 | 13.4 | 0.068 |
| P4KE10 | 10 | 9.00 | 11.00 | 1 | 8.10 | 10 | 28.0 | 15.0 | 0.073 |
| P4KE10A | 10 | 9.50 | 10.5 | 1 | 8.55 | 10 | 29.0 | 14.5 | 0.073 |
| P4KE11 | 11 | 9.90 | 12.1 | 1 | 8.92 | 1 | 26.0 | 16.2 | 0.075 |
| P4KE11A | 11 | 10.5 | 11.6 | 1 | 9.40 | 1 | 27.0 | 15.6 | 0.075 |
| P4KE12 | 12 | 10.8 | 13.2 | 1 | 9.72 | 1 | 24.0 | 17.3 | 0.078 |
| P4KE12A | 12 | 11.4 | 12.6 | 1 | 10.2 | 1 | 25.0 | 16.7 | 0.078 |
| P4KE13 | 13 | 11.7 | 14.3 | 1 | 10.5 | 1 | 22.0 | 19.0 | 0.081 |
| P4KE13A | 13 | 12.4 | 13.7 | 1 | 11.1 | 1 | 23.0 | 18.2 | 0.081 |
| P4KE15 | 15 | 13.5 | 16.5 | 1 | 12.1 | 1 | 19.0 | 22.0 | 0.084 |
| P4KE15A | 15 | 14.3 | 15.8 | 1 | 12.8 | 1 | 20.0 | 21.2 | 0.084 |
| P4KE16 | 16 | 14.4 | 17.6 | 1 | 12.9 | 1 | 17.8 | 23.5 | 0.086 |
| P4KE16A | 16 | 15.2 | 16.8 | 1 | 13.6 | 1 | 18.6 | 22.5 | 0.086 |
| P4KE18 | 18 | 16.2 | 19.8 | 1 | 14.5 | 1 | 16.0 | 26.5 | 0.088 |
| P4KE18A | 18 | 17.1 | 18.9 | 1 | 15.3 | 1 | 16.5 | 25.5 | 0.088 |
| P4KE20 | 20 | 18.0 | 22.0 | 1 | 16.2 | 1 | 14.0 | 29.1 | 0.090 |
| P4KE20A | 20 | 19.0 | 21.0 | 1 | 17.1 | 1 | 15.0 | 27.7 | 0.090 |
| P4KE22 | 22 | 19.8 | 24.2 | 1 | 17.8 | 1 | 13.0 | 31.9 | 0.092 |
| P4KE22A | 22 | 20.9 | 23.1 | 1 | 18.8 | 1 | 13.7 | 30.6 | 0.092 |
| P4KE24 | 24 | 21.6 | 26.4 | 1 | 19.4 | 1 | 12.0 | 34.7 | 0.094 |
| P4KE24A | 24 | 22.8 | 25.2 | 1 | 20.5 | 1 | 12.6 | 33.2 | 0.094 |
| P4KE27 | 27 | 24.3 | 29.7 | 1 | 21.8 | 1 | 10.7 | 39.1 | 0.096 |
| P4KE27A | 27 | 25.7 | 28.4 | 1 | 23.1 | 1 | 11.0 | 37.5 | 0.096 |
| P4KE30 | 30 | 27.0 | 33.0 | 1 | 24.3 | 1 | 9.6 | 43.5 | 0.097 |
| P4KE30A | 30 | 28.5 | 31.5 | 1 | 25.6 | 1 | 10.0 | 41.4 | 0.097 |
| P4KE33 | 33 | 29.7 | 36.3 | 1 | 26.8 | 1 | 8.8 | 47.7 | 0.098 |
| P4KE33A | 33 | 31.4 | 34.7 | 1 | 28.2 | 1 | 9.0 | 45.7 | 0.098 |
| P4KE36 | 36 | 32.4 | 39.6 | 1 | 29.1 | 1 | 8.0 | 52.0 | 0.099 |
| P4KE36A | 36 | 34.2 | 37.8 | 1 | 30.8 | 1 | 8.4 | 49.9 | 0.099 |

| MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted) | | | | | | | | | |
|---|-----------------|--|------|--|---|--|--|---|---------------------------------|
| Part Number | Nominal voltage | Breakdown voltage V _{BR} @I _T (V) ⁽¹⁾ | | Test current I _T (mA) | Working stand-off voltage V _{WM} (V) | Reverse leakage @ V _{WM} I _D (μA) | Maximum peak pulse current I _{PPM} (A) ⁽²⁾ | Maximum clamping voltage V _C @I _{PPM} (V) | Maximum temperature coefficient |
| | | V _{BR} | | I _T | V _{WM} | I _D | I _{PPM} | V _C | V _{BR} |
| | | V | | mA | V | μA | A | V | %/°C |
| | | Min | Max | | | | | | |
| P4KE39 | 39 | 35.1 | 42.9 | 1 | 31.6 | 1 | 7.4 | 56.4 | 0.100 |
| P4KE39A | 39 | 37.1 | 41.0 | 1 | 33.3 | 1 | 7.7 | 53.9 | 0.100 |
| P4KE43 | 43 | 38.7 | 47.3 | 1 | 34.8 | 1 | 6.7 | 61.9 | 0.101 |
| P4KE43A | 43 | 40.9 | 45.2 | 1 | 36.8 | 1 | 7.0 | 59.3 | 0.101 |
| P4KE47 | 47 | 42.3 | 51.7 | 1 | 38.1 | 1 | 6.2 | 67.8 | 0.101 |
| P4KE47A | 47 | 44.7 | 49.4 | 1 | 40.2 | 1 | 6.4 | 64.8 | 0.101 |
| P4KE51 | 51 | 45.9 | 56.1 | 1 | 41.3 | 1 | 5.7 | 73.5 | 0.102 |
| P4KE51A | 51 | 48.5 | 53.6 | 1 | 43.6 | 1 | 6.0 | 70.1 | 0.102 |
| P4KE56 | 56 | 50.4 | 61.6 | 1 | 45.4 | 1 | 5.2 | 80.5 | 0.103 |
| P4KE56A | 56 | 53.2 | 58.8 | 1 | 47.8 | 1 | 5.4 | 77.0 | 0.103 |
| P4KE62 | 62 | 55.8 | 68.2 | 1 | 50.2 | 1 | 4.7 | 89 | 0.104 |
| P4KE62A | 62 | 58.9 | 65.1 | 1 | 53.0 | 1 | 5.0 | 85 | 0.104 |
| P4KE68 | 68 | 61.2 | 74.8 | 1 | 55.1 | 1 | 4.2 | 98 | 0.104 |
| P4KE68A | 68 | 64.6 | 71.4 | 1 | 58.1 | 1 | 4.5 | 92 | 0.104 |
| P4KE75 | 75 | 67.5 | 82.5 | 1 | 60.7 | 1 | 3.8 | 108 | 0.105 |
| P4KE75A | 75 | 71.3 | 78.8 | 1 | 64.1 | 1 | 4.0 | 103 | 0.105 |
| P4KE82 | 82 | 73.8 | 90.2 | 1 | 66.4 | 1 | 3.5 | 118 | 0.105 |
| P4KE82A | 82 | 77.9 | 86.1 | 1 | 70.1 | 1 | 3.7 | 113 | 0.105 |
| P4KE91 | 91 | 81.9 | 100 | 1 | 73.7 | 1 | 3.2 | 131 | 0.106 |
| P4KE91A | 91 | 86.5 | 95.5 | 1 | 77.8 | 1 | 3.3 | 125 | 0.106 |
| P4KE100 | 100 | 90 | 110 | 1 | 81.0 | 1 | 2.9 | 144 | 0.106 |
| P4KE100A | 100 | 95 | 105 | 1 | 85.5 | 1 | 3.0 | 137 | 0.106 |
| P4KE110 | 110 | 99 | 121 | 1 | 89.2 | 1 | 2.6 | 158 | 0.107 |
| P4KE110A | 110 | 105 | 116 | 1 | 94.0 | 1 | 2.7 | 152 | 0.107 |
| P4KE120 | 120 | 108 | 132 | 1 | 97.2 | 1 | 2.4 | 173 | 0.107 |
| P4KE120A | 120 | 114 | 126 | 1 | 102 | 1 | 2.5 | 165 | 0.107 |
| P4KE130 | 130 | 117 | 143 | 1 | 105 | 1 | 2.2 | 187 | 0.107 |
| P4KE130A | 130 | 124 | 137 | 1 | 111 | 1 | 2.3 | 179 | 0.107 |
| P4KE150 | 150 | 135 | 165 | 1 | 121 | 1 | 1.9 | 215 | 0.108 |
| P4KE150A | 150 | 143 | 158 | 1 | 128 | 1 | 2.0 | 207 | 0.108 |
| P4KE160 | 160 | 144 | 176 | 1 | 130 | 1 | 1.8 | 230 | 0.108 |
| P4KE160A | 160 | 152 | 168 | 1 | 136 | 1 | 1.9 | 219 | 0.108 |
| P4KE170 | 170 | 153 | 187 | 1 | 138 | 1 | 1.7 | 244 | 0.108 |
| P4KE170A | 170 | 162 | 179 | 1 | 145 | 1 | 1.8 | 234 | 0.108 |
| P4KE180 | 180 | 162 | 198 | 1 | 146 | 1 | 1.6 | 258 | 0.108 |

| MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted) | | | | | | | | | |
|---|-----------------|---|-----|-------------------------------|--|--|---|--|---------------------------------|
| Part Number | Nominal voltage | Breakdown voltage $V_{BR}@I_T$ (V) ⁽¹⁾ | | Test current I_T (mA) | Working stand-off voltage V_{WM} (V) | Reverse leakage @ V_{WM} I_D (μ A) | Maximum peak pulse current I_{PPM} (A) ⁽²⁾ | Maximum clamping voltage $V_C@I_{PPM}$ (V) | Maximum temperature coefficient |
| | | V_{BR} | | I_T | V_{WM} | I_D | I_{PPM} | V_C | V_{BR} |
| | | V | | mA | V | μ A | A | V | %/°C |
| | | Min | Max | | | | | | |
| P4KE180A | 180 | 171 | 189 | 1 | 154 | 1 | 1.7 | 246 | 0.108 |
| P4KE200 | 200 | 180 | 220 | 1 | 162 | 1 | 1.4 | 287 | 0.108 |
| P4KE200A | 200 | 190 | 210 | 1 | 171 | 1 | 1.51 | 274 | 0.108 |
| P4KE220 | 220 | 198 | 242 | 1 | 175 | 1 | 1.20 | 344 | 0.108 |
| P4KE220A | 220 | 209 | 231 | 1 | 185 | 1 | 1.30 | 328 | 0.108 |
| P4KE250 | 250 | 225 | 275 | 1 | 202 | 1 | 1.10 | 360 | 0.110 |
| P4KE250A | 250 | 237 | 263 | 1 | 214 | 1 | 1.20 | 344 | 0.110 |
| P4KE300 | 300 | 270 | 330 | 1 | 243 | 1 | 0.97 | 430 | 0.110 |
| P4KE300A | 300 | 285 | 315 | 1 | 256 | 1 | 1.00 | 414 | 0.110 |
| P4KE350 | 350 | 315 | 385 | 1 | 284 | 1 | 0.83 | 504 | 0.110 |
| P4KE350A | 350 | 332 | 368 | 1 | 300 | 1 | 0.87 | 482 | 0.110 |
| P4KE400 | 400 | 360 | 440 | 1 | 324 | 1 | 0.73 | 574 | 0.110 |
| P4KE400A | 400 | 380 | 420 | 1 | 342 | 1 | 0.76 | 548 | 0.110 |
| P4KE440 | 440 | 396 | 484 | 1 | 356 | 1 | 0.66 | 631 | 0.110 |
| P4KE440A | 440 | 418 | 462 | 1 | 376 | 1 | 0.69 | 600 | 0.110 |

Notes:

1. Pulse test : $t_p < 50\text{ms}$
2. All terms and symbols are consistent with ANSI/IEEE C62.35
3. For bipolar types having V_{WM} of 10 volts and less, the I_D limit is doubled.

| ORDERING INFORMATION | | |
|---------------------------------|------------------|---------------------|
| ORDERING CODE ⁽¹⁾⁽²⁾ | PACKAGE | PACKING |
| P4KE x | DO-204AL (DO-41) | 5,000 / Tape & Reel |
| P4KE x A0G | DO-204AL (DO-41) | 3,000 / Ammo box |
| P4KE x H | DO-204AL (DO-41) | 5,000 / Tape & Reel |
| P4KE x HA0G | DO-204AL (DO-41) | 3,000 / Ammo box |

Notes:

1. "x" defines voltage from 6.8V (P4KE6.8) to 440V (P4KE440A)
2. "H" means AEC-Q101 qualified

CHARACTERISTICS CURVES

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

Fig.1 Peak Pulse Power Rating Curve

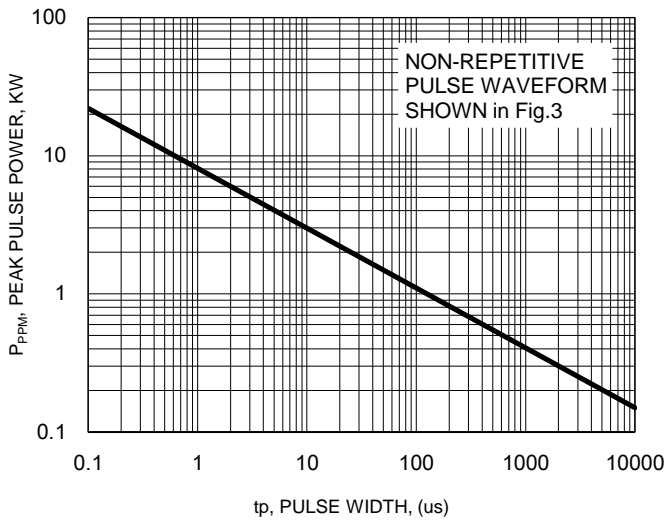


Fig.2 Steady State Power Derating Curve

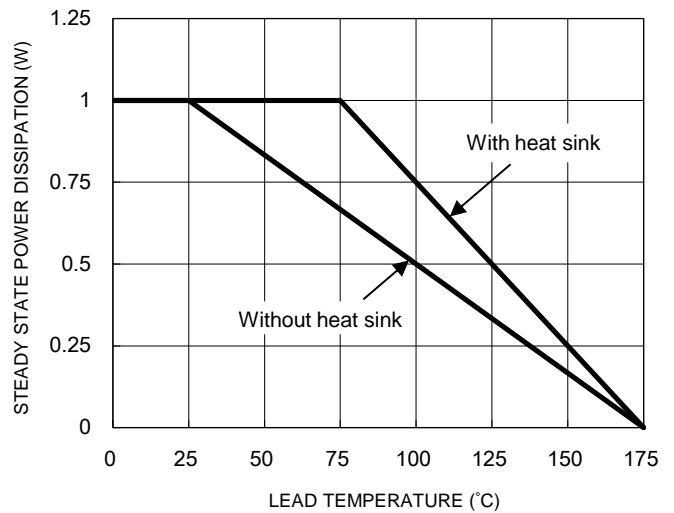


Fig.3 Clamping Power Pulse Waveform

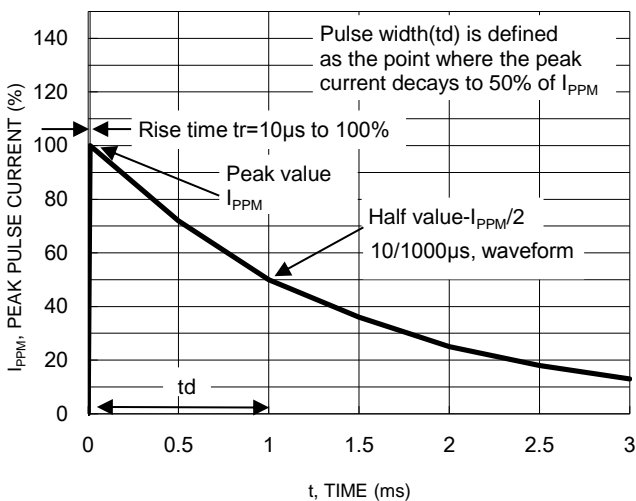
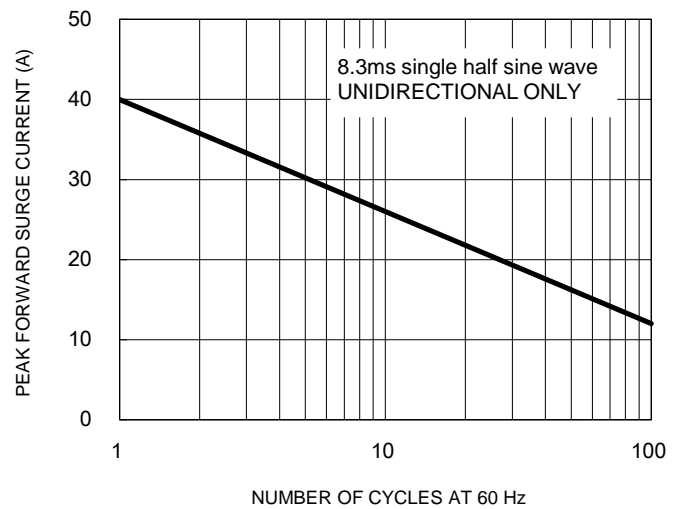


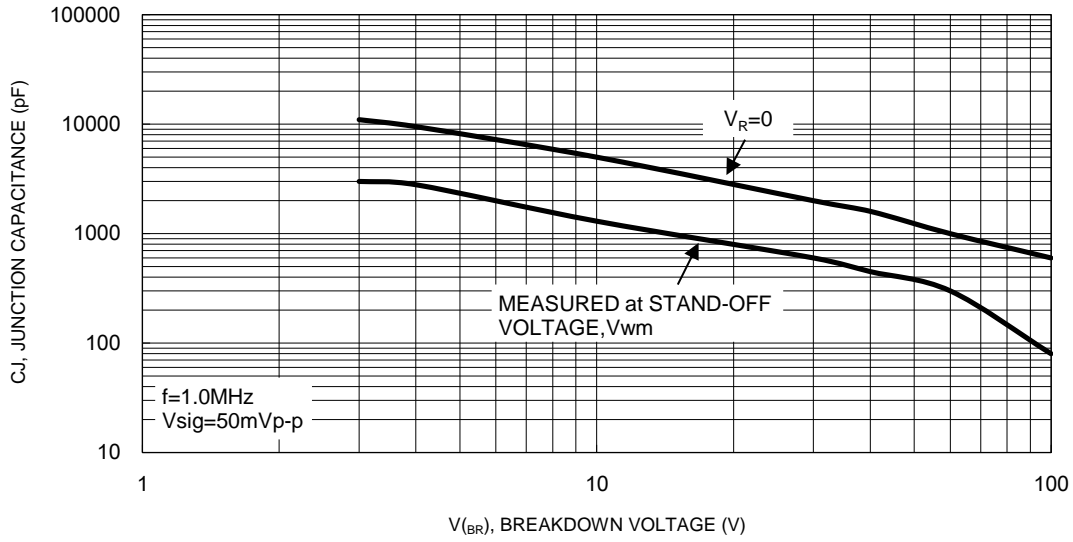
Fig.4 Maximum Non-Repetitive Forward Surge Current



CHARACTERISTICS CURVES

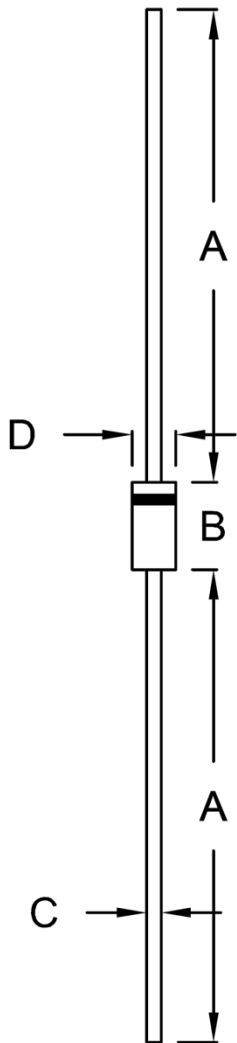
($T_A = 25^\circ\text{C}$ unless otherwise noted)

Fig.5 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