

## 400W, 6.8V - 440V Transient Voltage Suppressor

### FEATURES

- Excellent clamping capability
- Low dynamic impedance
- 400W surge capability at 10 / 1000  $\mu$ 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 $\mu$ A above 10V
- UL recognized file # E-326243
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21



DO-204AL (DO-41)



### MECHANICAL DATA

**Case:** DO-204AL (DO-41)

Molding compound: UL flammability classification rating 94V-0

Part No. with suffix "H" means AEC-Q101 qualified

Packing code with suffix "G" means green compound (halogen-free)

**Terminal:** Pure tin plated leads, solderable per JESD22-B102

Meet JESD 201 class 2 whisker test

**Weight:** 0.3g (approximately)

| MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$ unless otherwise noted) |           |              |                    |
|---------------------------------------------------------------------------------------------------|-----------|--------------|--------------------|
| PARAMETER                                                                                         | SYMBOL    | VALUE        | UNIT               |
| Peak power dissipation at $T_A=25^{\circ}\text{C}$ , $t_p=1\text{ms}$ (Note 1)                    | $P_{PK}$  | 400          | W                  |
| Steady state power dissipation at $T_L=75^{\circ}\text{C}$<br>lead lengths .375", 9.5mm (Note 2)  | $P_D$     | 1            | W                  |
| Peak forward surge current, 8.3 ms single half sine-wave<br>superimposed on rated load (Note 3)   | $I_{FSM}$ | 40           | A                  |
| Maximum instantaneous forward voltage at 25 A for<br>Unidirectional only (Note 4)                 | $V_F$     | 3.5 / 6.5    | V                  |
| Operating junction temperature range                                                              | $T_J$     | - 55 to +175 | $^{\circ}\text{C}$ |
| Storage temperature range                                                                         | $T_{STG}$ | - 55 to +175 | $^{\circ}\text{C}$ |

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

Note 2: Mounted on 5 x 5 mm copper pads to each terminal

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

Note 4:  $V_F=3.5\text{V}$  for devices of  $V_{BR} \leq 200\text{V}$  and  $V_F=6.5\text{V}$  max. for device  $V_{BR} > 200\text{V}$

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

| ORDERING INFORMATION |                 |              |                     |         |                                  |
|----------------------|-----------------|--------------|---------------------|---------|----------------------------------|
| PART NO.             | PART NO. SUFFIX | PACKING CODE | PACKING CODE SUFFIX | PACKAGE | PACKING                          |
| P4KExxxx<br>(Note 1) | H               | A0           | G                   | DO-41   | 3,000 / Ammo box (52mm taping)   |
|                      |                 | R0           |                     | DO-41   | 5,000 / 13" Paper reel           |
|                      |                 | R1           |                     | DO-41   | 5,000 / 13" Paper reel (Reverse) |
|                      |                 | B0           |                     | DO-41   | 1,000 / Bulk packing             |

Note 1: "xxxx" defines voltage from 6.8V (P4KE6.8) to 440V (P4KE440)

| EXAMPLE          |          |                 |              |                     |                                      |
|------------------|----------|-----------------|--------------|---------------------|--------------------------------------|
| EXAMPLE PART NO. | PART NO. | PART NO. SUFFIX | PACKING CODE | PACKING CODE SUFFIX | DESCRIPTION                          |
| P4KE56AHA0G      | P4KE56A  | H               | A0           | G                   | AEC-Q101 qualified<br>Green compound |

## RATINGS AND CHARACTERISTICS CURVES

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

FIG. 1 PEAK PULSE POWER RATING CURVE

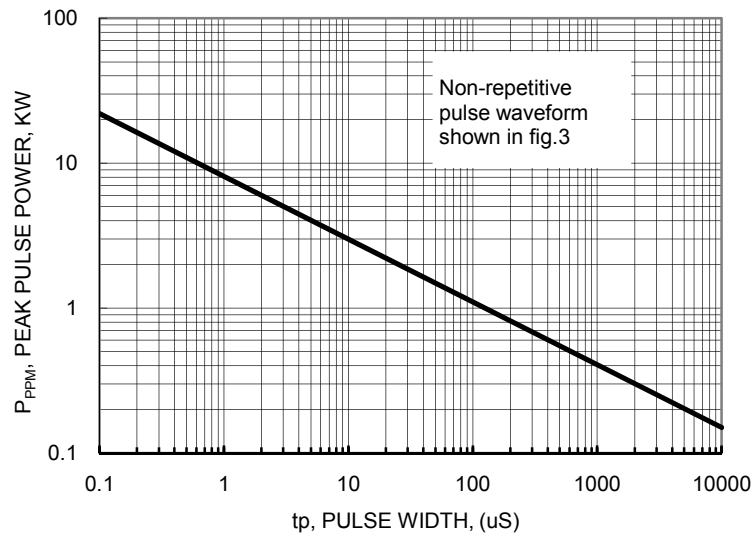


FIG. 2 STEADY STATE POWER DERATING CURVE

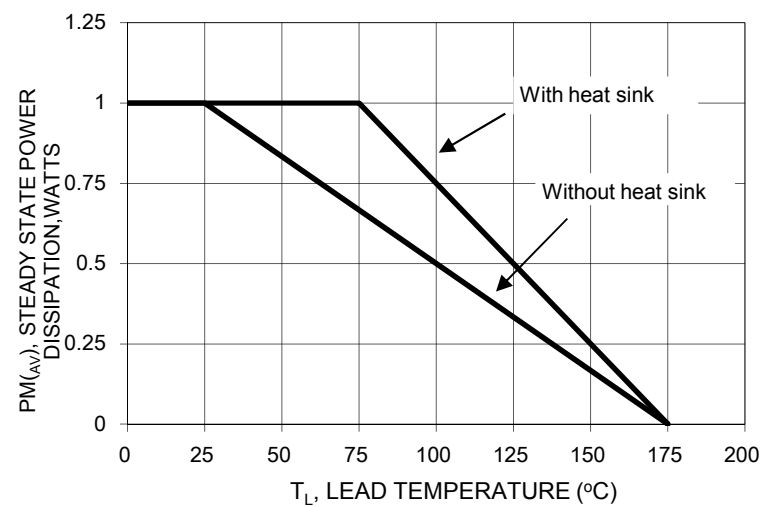


FIG. 3 CLAMPING POWER PULSE WAVEFORM

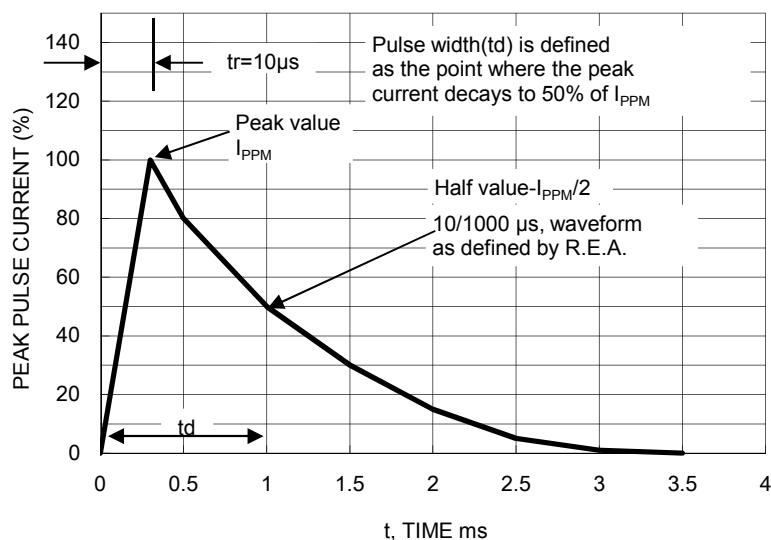


FIG. 4 MAXIMUM NON-REPETITIVE FORWARD SURGE CURRENT UNIDIRECTIONAL ONLY

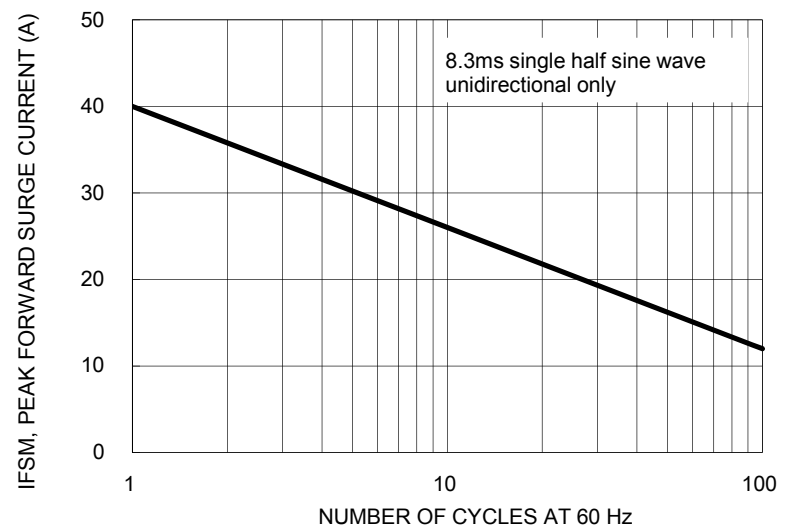
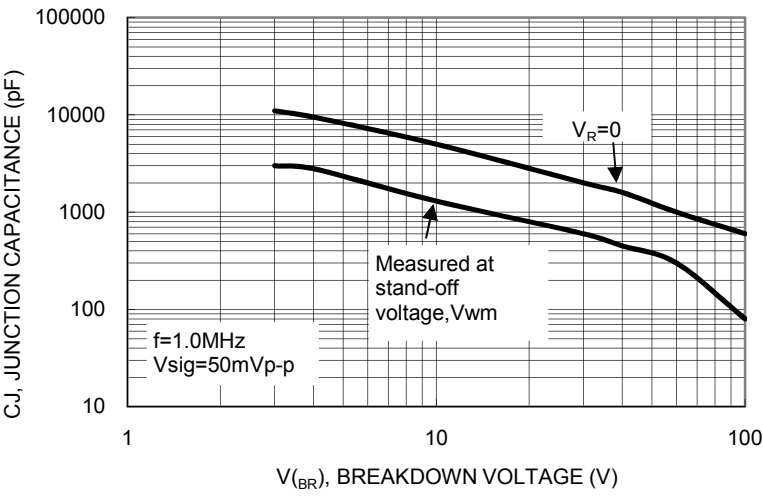


FIG. 5 TYPICAL JUNCTION CAPACITANCE



| General Part Number | Nominal Voltage | Breakdown Voltage (Note 1) |       | Test Current | Stand-Off Voltage | Maximum Reverse Leakage @ $V_{WM}$ | Maximum Peak Pulse Current | Maximum Clamping Voltage @ $I_{PPM}$ | Maximum Temperature Coefficient |
|---------------------|-----------------|----------------------------|-------|--------------|-------------------|------------------------------------|----------------------------|--------------------------------------|---------------------------------|
|                     |                 | $V_{BR}$                   |       | $I_T$        | $V_{WM}$          | $I_R$                              | $I_{PPM}$                  | $V_C$                                | of $V_{BR}$                     |
|                     | (V)             | (V)                        |       | (mA)         | (V)               | ( $\mu A$ )                        | (A)                        | (V)                                  | (%/°C)                          |
|                     |                 | Min                        | Max   |              |                   |                                    | (Note 2)                   |                                      |                                 |
| 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                           |
| 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                           |

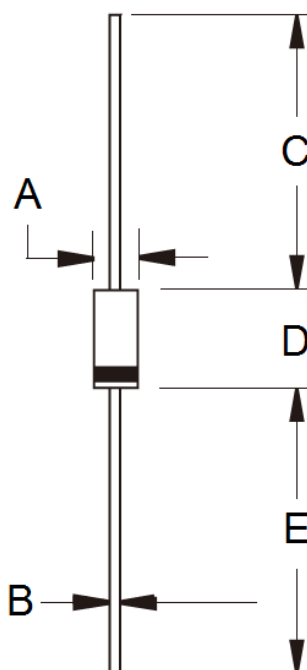
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|---------------------|-----------------|----------------------------|-------|--------------|-------------------|------------------------------------|----------------------------|--------------------------------------|---------------------------------|
|                     |                 | $V_{BR}$                   |       | $I_T$        | $V_{WM}$          | $I_R$                              | $I_{PPM}$                  | $V_c$                                | of $V_{BR}$                     |
|                     | (V)             | (V)                        |       | (mA)         | (V)               | ( $\mu A$ )                        | (A)                        | (V)                                  | (%/°C)                          |
|                     |                 | Min                        | Max   |              |                   |                                    | (Note 2)                   |                                      |                                 |
| 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                           |
| 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                        | 462.0 | 1            | 376               | 1                                  | 0.69                       | 600                                  | 0.110                           |

Notes:

1.  $V_{BR}$  measure after  $I_T$  applied for 300 $\mu s$ ,  $I_T$ =square wave pulse or equivalent.
2. Surge current waveform per Figure. 3 and derate per Figure. 2.
3. For bipolar types having  $V_{WM}$  of 10 volts and under, the  $I_R$  limit is doubled.
4. All terms and symbols are consistent with ANSI/IEEE C62.35.

**PACKAGE OUTLINE DIMENSIONS**

DO-204AL (DO-41)



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

**MARKING DIAGRAM**



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

Note: Cathode band for uni-directional products only

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