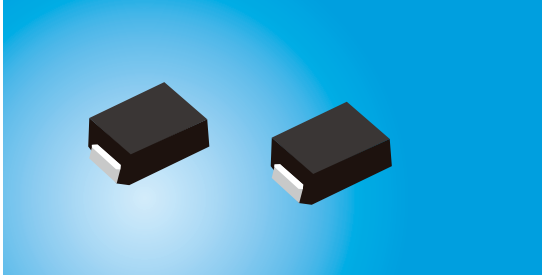


TVS Diodes Surface Mount-400W KWSMAJ Series



Description

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

Features

- For surface mounted applications in order to optimize board space
- Reliable low cost construction utilizing molded plastic technique
- Plastic material has UL flammability classification 94V-0
- Typical I_R less than 1 μ A above 12V
- Fast response time: typically less than 1.0ps from 0 Volts to V_{BR} min

Maximum Ratings and Thermal Characteristics(($T_A=25^\circ\text{C}$ unless otherwise noted))

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10x1000 μ s waveform (Fig.2)(Note 1), (Note 2) | PPPM | 400 | W |
| Power Dissipation on infinite heat sink at $T_A=50^\circ\text{C}$ | $P_{M(AV)}$ | 3.3 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I_{FSM} | 40 | A |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional only(Note 4) | V_F | 3.5/6.5 | V |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ |
| Typical Thermal Resistance Junction to Lead | R_{UJL} | 30 | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient | R_{UJA} | 120 | $^\circ\text{C/W}$ |

Notes:

- Non-repetitive current pulse, per Fig.4 and derated above $T_A=25^\circ\text{C}$ per Fig. 3.
- Mounted on 5.0x5.0mm copper pad to each terminal.
- Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.

Electrical Characteristics

| Part Number | Part Number | Marking | | Reverse Stand off Voltage V_R (Volts) | Breakdown Voltage V_{BR} (Volts) @ I_T | | Test Current I_T (mA) | Maximum Clamping Voltage V_C @ I_{PP} (V) | Maximum Peak Pulse Current I_{PP} (A) | Maximum Reverse Leakage I_R @ V_R (μ A) | I_{PP} 8X20us Amps |
|-------------|-------------|---------|----|---|--|-------|-------------------------|---|---|--|----------------------|
| | | UNI | BI | | MIN | MAX | | | | | |
| KWSMAJ5.0A | KWSMAJ5.0CA | AE | WE | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 43.5 | 800 | 500 |
| KWSMAJ6.0A | KWSMAJ6.0CA | AG | WG | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 38.8 | 800 | 500 |
| KWSMAJ6.5A | KWSMAJ6.5CA | AK | WK | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 35.7 | 500 | 500 |
| KWSMAJ7.0A | KWSMAJ7.0CA | AM | WM | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 33.3 | 200 | 500 |
| KWSMAJ7.5A | KWSMAJ7.5CA | AP | WP | 7.5 | 8.33 | 9.21 | 1 | 12.9 | 31.0 | 100 | 500 |
| KWSMAJ8.0A | KWSMAJ8.0CA | AR | WR | 8.0 | 8.89 | 9.83 | 1 | 13.6 | 29.4 | 50 | 500 |
| KWSMAJ8.5A | KWSMAJ8.5CA | AT | WT | 8.5 | 9.44 | 10.40 | 1 | 14.4 | 27.8 | 20 | 500 |

TVS Diodes Surface Mount-400W KWSMAJ Series

Electrical Characteristics

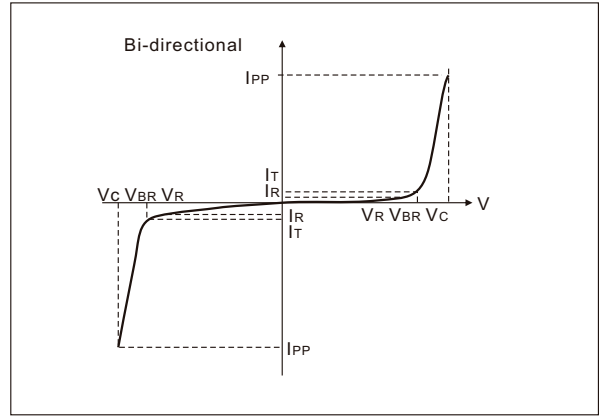
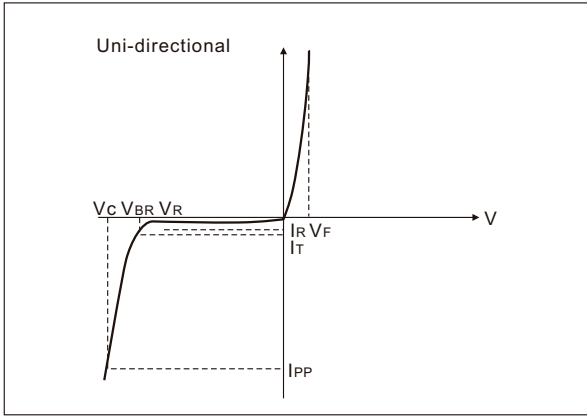
| Part Number (Uni) | Part Number (Bi) | Marking | | Reverse Stand off Voltage V_R (Volts) | Breakdown Voltage V_{BR} (Volts) @ I_T | | Test Current I_T (mA) | Maximum Clamping Voltage V_C @ I_{pp} (V) | Maximum Peak Pulse Current I_{pp} (A) | Maximum Reverse Leakage I_R @ V_R (μ A) | Ipp 8X20us Amps |
|----------------------|---------------------|---------|----|---|---|-------|-------------------------------|---|--|--|-----------------------|
| | | UNI | BI | | MIN | MAX | | | | | |
| KWSMAJ9.0A | KWSMAJ9.0CA | AV | WV | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 26.0 | 10 | 500 |
| KWSMAJ10A | KWSMAJ10CA | AX | WX | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 23.5 | 5 | 500 |
| KWSMAJ11A | KWSMAJ11CA | AZ | WZ | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 22.0 | 1 | 500 |
| KWSMAJ12A | KWSMAJ12CA | BE | XE | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 20.1 | 1 | 500 |
| KWSMAJ13A | KWSMAJ13CA | BG | XG | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 18.6 | 1 | 500 |
| KWSMAJ14A | KWSMAJ14CA | BK | XK | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 17.2 | 1 | 500 |
| KWSMAJ15A | KWSMAJ15CA | BM | XM | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 16.4 | 1 | 500 |
| KWSMAJ16A | KWSMAJ16CA | BP | XP | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 15.4 | 1 | 500 |
| KWSMAJ17A | KWSMAJ17CA | BR | XR | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 14.5 | 1 | 500 |
| KWSMAJ18A | KWSMAJ18CA | BT | XT | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 13.7 | 1 | 500 |
| KWSMAJ20A | KWSMAJ20CA | BV | XV | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 12.3 | 1 | 500 |
| KWSMAJ22A | KWSMAJ22CA | BX | XX | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 11.3 | 1 | 500 |
| KWSMAJ24A | KWSMAJ24CA | BZ | XZ | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 10.3 | 1 | 500 |
| KWSMAJ26A | KWSMAJ26CA | CE | YE | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 9.5 | 1 | 500 |
| KWSMAJ28A | KWSMAJ28CA | CG | YG | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 8.8 | 1 | 500 |
| KWSMAJ30A | KWSMAJ30CA | CK | YK | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 8.3 | 1 | 500 |
| KWSMAJ33A | KWSMAJ33CA | CM | YM | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 7.5 | 1 | 500 |
| KWSMAJ36A | KWSMAJ36CA | CP | YP | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 6.9 | 1 | 500 |
| KWSMAJ40A | KWSMAJ40CA | CR | YR | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 6.2 | 1 | 500 |
| KWSMAJ43A | KWSMAJ43CA | CT | YT | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 5.8 | 1 | 500 |
| KWSMAJ45A | KWSMAJ45CA | CV | YV | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 5.5 | 1 | 500 |
| KWSMAJ48A | KWSMAJ48CA | CX | YX | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 5.2 | 1 | 500 |
| KWSMAJ51A | KWSMAJ51CA | CZ | YZ | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 4.9 | 1 | 500 |
| KWSMAJ54A | KWSMAJ54CA | RE | ZE | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 4.6 | 1 | 500 |
| KWSMAJ58A | KWSMAJ58CA | RG | ZG | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 4.3 | 1 | 500 |
| KWSMAJ60A | KWSMAJ60CA | RK | ZK | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 4.1 | 1 | 500 |
| KWSMAJ64A | KWSMAJ64CA | RM | ZM | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 3.9 | 1 | 500 |
| KWSMAJ70A | KWSMAJ70CA | RP | ZP | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 3.5 | 1 | 500 |
| KWSMAJ75A | KWSMAJ75CA | RR | ZR | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 3.3 | 1 | 500 |
| KWSMAJ78A | KWSMAJ78CA | RT | ZT | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 3.2 | 1 | 500 |
| KWSMAJ85A | KWSMAJ85CA | RV | ZV | 85.0 | 94.40 | 104.0 | 1 | 137.0 | 2.9 | 1 | 500 |
| KWSMAJ90A | KWSMAJ90CA | RX | ZX | 90.0 | 100.0 | 111.0 | 1 | 146.0 | 2.7 | 1 | 500 |
| KWSMAJ100A | KWSMAJ100CA | RZ | ZZ | 100.0 | 111.0 | 123.0 | 1 | 162.0 | 2.5 | 1 | 500 |
| KWSMAJ110A | KWSMAJ110CA | SE | VE | 110.0 | 122.0 | 135.0 | 1 | 177.0 | 2.3 | 1 | 500 |
| KWSMAJ120A | KWSMAJ120CA | SG | VG | 120.0 | 133.0 | 147.0 | 1 | 193.0 | 2.1 | 1 | 500 |
| KWSMAJ130A | KWSMAJ130CA | SK | VK | 130.0 | 144.0 | 159.0 | 1 | 209.0 | 1.9 | 1 | 500 |
| KWSMAJ150A | KWSMAJ150CA | SM | VM | 150.0 | 167.0 | 185.0 | 1 | 243.0 | 1.6 | 1 | 500 |
| KWSMAJ160A | KWSMAJ160CA | SP | VP | 160.0 | 178.0 | 197.0 | 1 | 259.0 | 1.5 | 1 | 500 |
| KWSMAJ170A | KWSMAJ170CA | SR | VR | 170.0 | 189.0 | 209.0 | 1 | 275.0 | 1.5 | 1 | 500 |
| KWSMAJ180A | KWSMAJ180CA | ST | VT | 180.0 | 201.0 | 222.0 | 1 | 292.0 | 1.4 | 1 | 500 |
| KWSMAJ200A | KWSMAJ200CA | SV | VV | 200.0 | 224.0 | 247.0 | 1 | 324.0 | 1.2 | 1 | 500 |
| KWSMAJ220A | KWSMAJ220CA | SX | VX | 220.0 | 246.0 | 272.0 | 1 | 356.0 | 1.1 | 1 | 500 |
| KWSMAJ250A | KWSMAJ250CA | SZ | VZ | 250.0 | 279.0 | 309.0 | 1 | 405.0 | 1.0 | 1 | 500 |
| KWSMAJ300A | KWSMAJ300CA | TE | UE | 300.0 | 335.0 | 371.0 | 1 | 486.0 | 0.8 | 1 | 500 |
| KWSMAJ350A | KWSMAJ350CA | TG | UG | 350.0 | 391.0 | 432.0 | 1 | 567.0 | 0.7 | 1 | 500 |
| KWSMAJ400A | KWSMAJ400CA | TK | UK | 400.0 | 447.0 | 494.0 | 1 | 648.0 | 0.6 | 1 | 500 |
| KWSMAJ440A | KWSMAJ440CA | TM | UM | 440.0 | 492.0 | 543.0 | 1 | 713.0 | 0.6 | 1 | 500 |

For parts without A , the V_{BR} is $\pm 10\%$, and V_C is 5% higher than A parts.

For bidirectional type having V_R of 10 volts and less, the I_R limit is double.

TVS Diodes
Surface Mount-400W KWSMAJ Series

I-V Curve Characteristics



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

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

Fig.1-TVS Transients Clamping Waveform

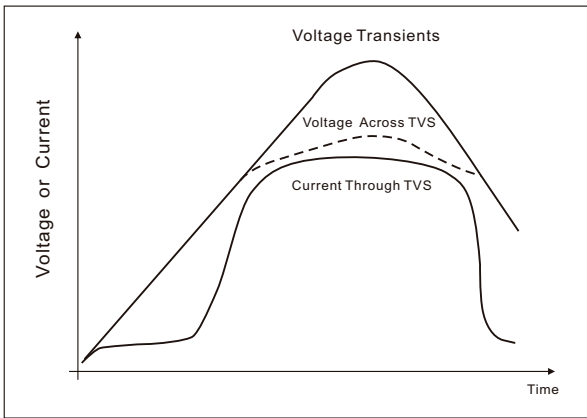
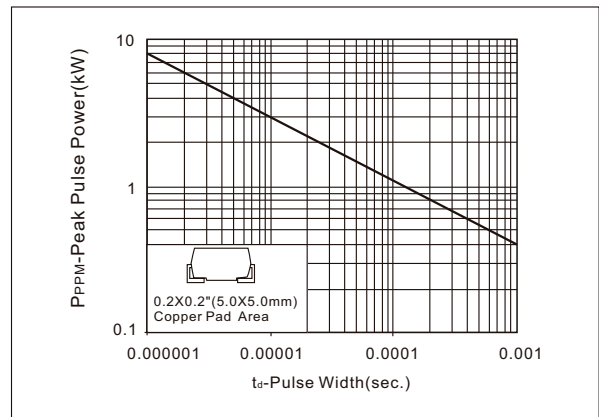


Fig.2-Peak Pulse Power Rating Curve



**TVS Diodes
Surface Mount-400W KWSMAJ Series**

Fig.3-Pulse Derating Curve

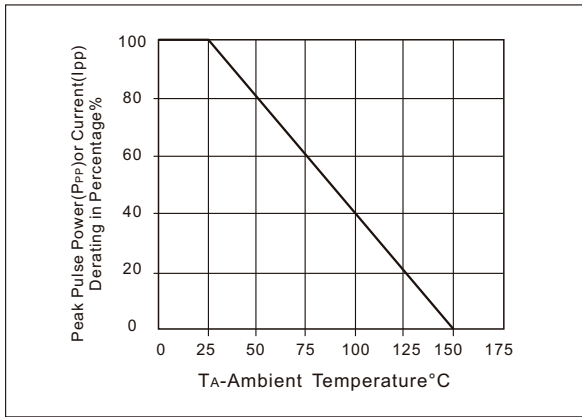


Fig.4-Pulse Waveform

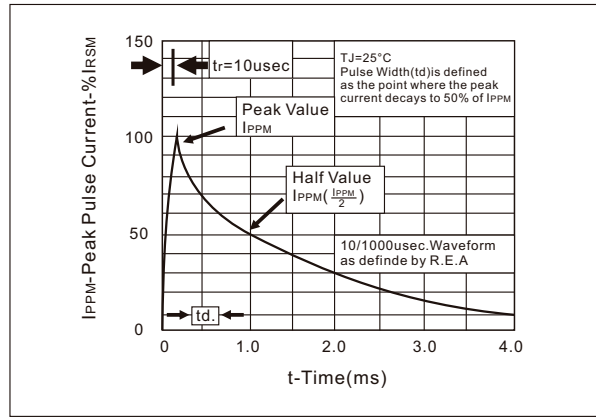


Fig.5-Typical Junction Capacitance

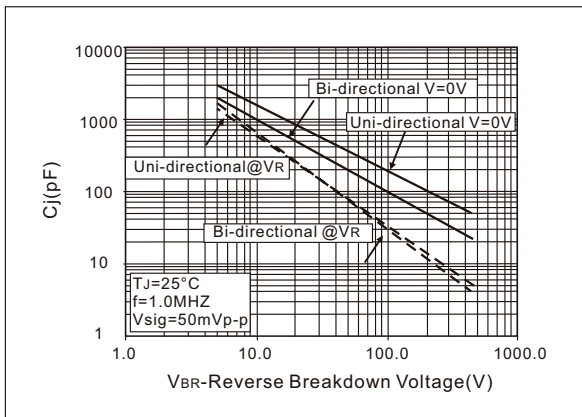


Fig.6-Steady State Power Dissipation Surge Current Uni-Directional Only

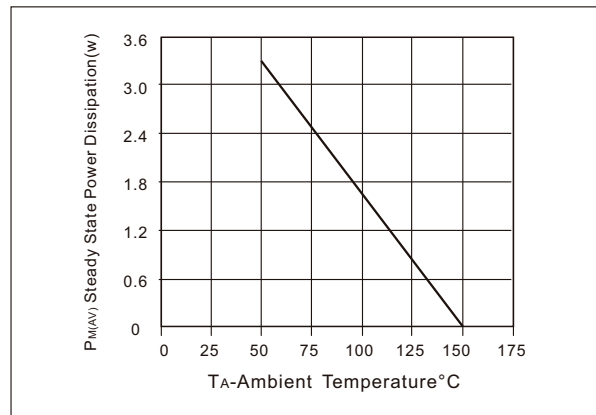
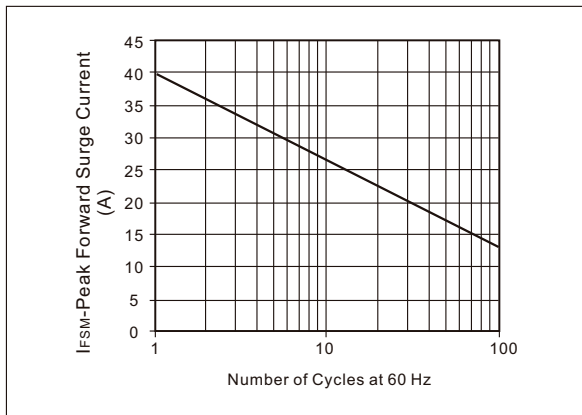


Fig.7-Maximum Non-Repetitive Forward Surge Current Uni-Directional Only

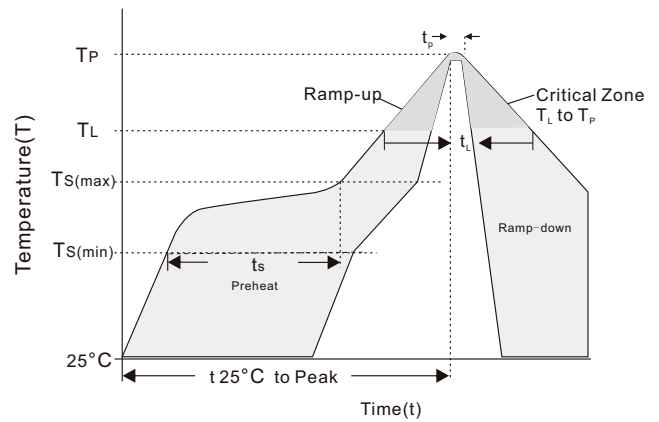


TVS Diodes Surface Mount-400W KWSMAJ Series

Recommended Conditions

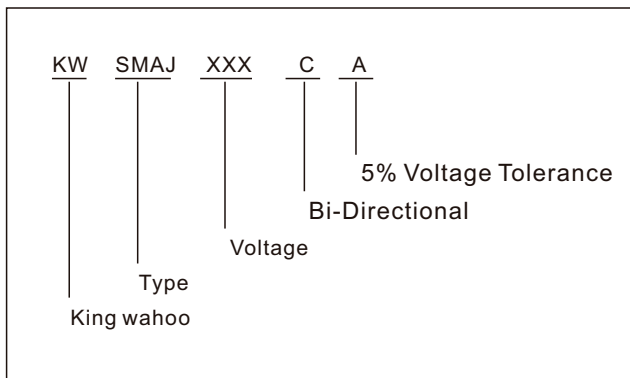
| Reflow Condition | | Pb – Free assembly |
|---|-------------------------------|-------------------------|
| Heat Pre | Temperature Min (Ts) | 150°C |
| | Temperature Max (Ts) | 200°C |
| | Time (Min to Max) (ts) | 60 – 180 secs |
| Average ramp up rate (Liquidus) Temp (TL) to peak | | 3°C/second max |
| Ts(max) to TL - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature (TL) (Liquidus) | 217°C |
| | Time (Min to Max) (ts) | 60 – 150 seconds |
| Peak Temperature (Tp) | | 260 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (tp) | | 20 – 40 seconds |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature (Tp) | | 8 minutes Max. |
| Do not exceed | | 280°C |

Recommended Soldering Conditions



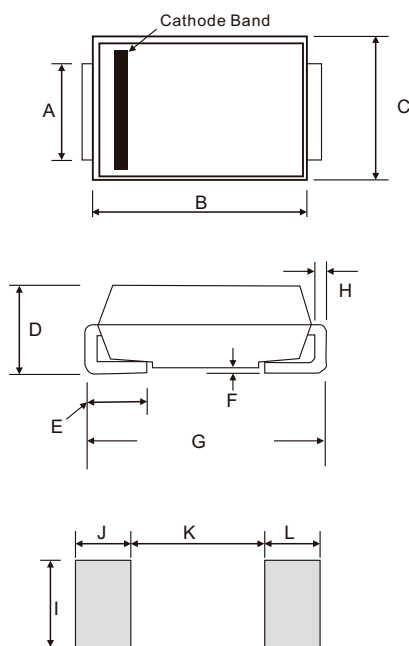
Part Number

Construction of part number




TVS Diodes Surface Mount-400W KWSMAJ Series

Dimensions



| Dimensions | Millimeters | | Inches | |
|------------|-------------|-------|--------|-------|
| | Min | Max | Min | Max |
| A | 1.250 | 1.650 | 0.049 | 0.065 |
| B | 3.990 | 4.500 | 0.157 | 0.177 |
| C | 2.540 | 2.790 | 0.100 | 0.110 |
| D | 1.980 | 2.290 | 0.078 | 0.090 |
| E | 0.780 | 1.520 | 0.030 | 0.060 |
| F | - | 0.203 | - | 0.008 |
| G | 4.930 | 5.280 | 0.194 | 0.208 |
| H | 0.152 | 0.305 | 0.006 | 0.012 |
| I | 1.800 | - | 0.070 | - |
| J | 2.100 | - | 0.082 | - |
| K | - | 2.300 | - | 0.090 |
| L | 2.100 | - | 0.082 | - |

Packaging Options

| Part number | Component Package | Quantity | Parameter Option | Packaging Specification |
|---|-------------------|----------|---------------------------|-------------------------|
| KWSMAJ  | DO-214AC | 5000 | Tape & Reel-12mm/13" reel | EIA STD RS-481 |

