

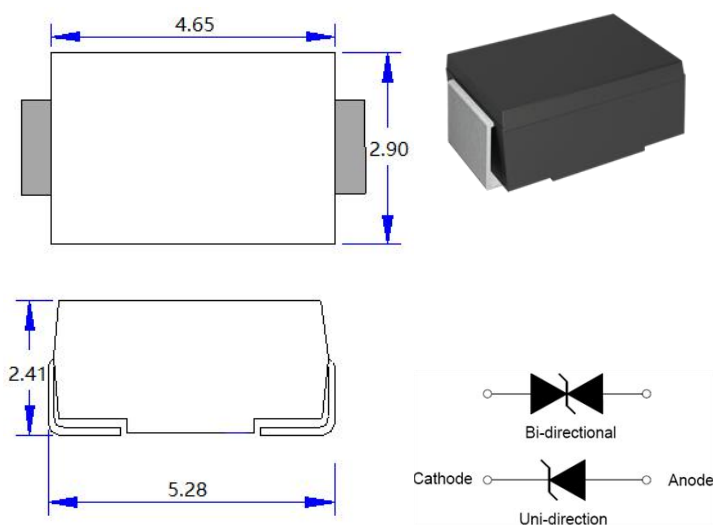
## Description

TVS diodes can be used in a wide range of applications which like consumer electronic products, automotive industries, munitions, telecommunications, aerospace industries, and intelligent control systems.

## Features

- Glass passivated or planar junction
- Excellent clamping capability
- Repetition rate (duty cycle): 0.01%
- Low profile package and low inductance
- 400W Peak Pulse power capability at 10×1000μs waveform.
- Fast response time: typically less than 1.0ps from 0V to  $V_{BR}$  min.
- High temperature soldering: 260°C/10s at terminals.
- Plastic package has Underwriters Laboratory Flammability 94V-0.
- For surface mounted applications in order to optimize board space.

## Dimensions & Symbol (Unit: mm Max)



## Mechanical Characteristics

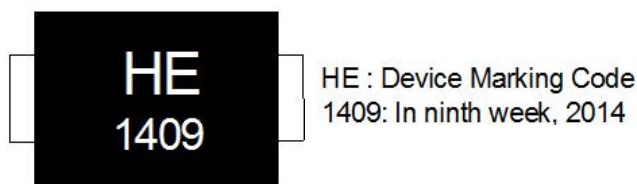
Package: SMA/DO-214AC

- Case Material: "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Polarity: Color band denotes cathode except bi-directional models
- Standard Packaging: 12mm tape (EIA STD RS-481)
- Weight: 0.07g
- Terminal Connections: See Diagram Below
- Marking Information: See Below

## Applications

- I/O Interface.
- AC/DC Power supply
- Low frequency signal transmission line (RS232, RS485, etc.)

## Marking Information



## Ordering Information

| Out line | Reel (pcs) | Per carton (pcs) | Reel diameters (mm) |
|----------|------------|------------------|---------------------|
| Taping   | 5K         | 80K              | 330                 |

**Electrical Characteristics (T<sub>A</sub>=25°C)**

| Part Number |           | Marking |    | V <sub>R</sub> | I <sub>R</sub> @<br>V <sub>R</sub> | V <sub>BR</sub> @I <sub>T</sub> |        | I <sub>T</sub> | V <sub>C</sub> @I <sub>PP</sub> | I <sub>PP</sub> <sup>①</sup> |
|-------------|-----------|---------|----|----------------|------------------------------------|---------------------------------|--------|----------------|---------------------------------|------------------------------|
| Uni-Polar   | Bi-Polar  | Uni     | Bi | V              | μA                                 | min(V)                          | max(V) | mA             | max(V)                          | A                            |
| SMAJ5.0A    | SMAJ5.0CA | HE      | TE | 5.0            | 800                                | 6.40                            | 7.00   | 10             | 9.2                             | 43.5                         |
| SMAJ6.0A    | SMAJ6.0CA | HG      | TG | 6.0            | 800                                | 6.67                            | 7.37   | 10             | 10.3                            | 38.8                         |
| SMAJ6.5A    | SMAJ6.5CA | HK      | TK | 6.5            | 500                                | 7.22                            | 7.98   | 10             | 11.2                            | 35.7                         |
| SMAJ7.0A    | SMAJ7.0CA | HM      | TM | 7.0            | 200                                | 7.78                            | 8.60   | 10             | 12.0                            | 33.3                         |
| SMAJ7.5A    | SMAJ7.5CA | HP      | TP | 7.5            | 100                                | 8.33                            | 9.21   | 1              | 12.9                            | 31.0                         |
| SMAJ8.0A    | SMAJ8.0CA | HR      | TR | 8.0            | 50                                 | 8.89                            | 9.83   | 1              | 13.6                            | 29.4                         |
| SMAJ8.5A    | SMAJ8.5CA | HT      | TT | 8.5            | 20                                 | 9.44                            | 10.40  | 1              | 14.4                            | 27.8                         |
| SMAJ9.0A    | SMAJ9.0CA | HV      | TV | 9.0            | 10                                 | 10.00                           | 11.10  | 1              | 15.4                            | 26.0                         |
| SMAJ10A     | SMAJ10CA  | HX      | TX | 10.0           | 10                                 | 11.10                           | 12.30  | 1              | 17.0                            | 23.5                         |
| SMAJ11A     | SMAJ11CA  | HZ      | TZ | 11.0           | 1                                  | 12.20                           | 13.50  | 1              | 18.2                            | 22.0                         |
| SMAJ12A     | SMAJ12CA  | IE      | UE | 12.0           | 1                                  | 13.30                           | 14.70  | 1              | 19.9                            | 20.1                         |
| SMAJ13A     | SMAJ13CA  | IG      | UG | 13.0           | 1                                  | 14.40                           | 15.90  | 1              | 21.5                            | 18.6                         |
| SMAJ14A     | SMAJ14CA  | IK      | UK | 14.0           | 1                                  | 15.60                           | 17.20  | 1              | 23.2                            | 17.3                         |
| SMAJ15A     | SMAJ15CA  | IM      | UM | 15.0           | 1                                  | 16.70                           | 18.50  | 1              | 24.4                            | 16.4                         |
| SMAJ16A     | SMAJ16CA  | IP      | UP | 16.0           | 1                                  | 17.80                           | 19.70  | 1              | 26.0                            | 15.4                         |
| SMAJ17A     | SMAJ17CA  | IR      | UR | 17.0           | 1                                  | 18.90                           | 20.90  | 1              | 27.6                            | 14.5                         |
| SMAJ18A     | SMAJ18CA  | IT      | UT | 18.0           | 1                                  | 20.00                           | 22.10  | 1              | 29.2                            | 13.7                         |
| SMAJ20A     | SMAJ20CA  | IV      | UV | 20.0           | 1                                  | 22.20                           | 24.50  | 1              | 32.4                            | 12.4                         |
| SMAJ22A     | SMAJ22CA  | IX      | UX | 22.0           | 1                                  | 24.40                           | 26.90  | 1              | 35.5                            | 11.3                         |
| SMAJ24A     | SMAJ24CA  | IZ      | UZ | 24.0           | 1                                  | 26.70                           | 29.50  | 1              | 38.9                            | 10.3                         |
| SMAJ26A     | SMAJ26CA  | JE      | VE | 26.0           | 1                                  | 28.90                           | 31.90  | 1              | 42.1                            | 9.5                          |
| SMAJ28A     | SMAJ28CA  | JG      | VG | 28.0           | 1                                  | 31.10                           | 34.40  | 1              | 45.4                            | 8.8                          |
| SMAJ30A     | SMAJ30CA  | JK      | VK | 30.0           | 1                                  | 33.30                           | 36.80  | 1              | 48.4                            | 8.3                          |
| SMAJ33A     | SMAJ33CA  | JM      | VM | 33.0           | 1                                  | 36.70                           | 40.60  | 1              | 53.3                            | 7.5                          |
| SMAJ36A     | SMAJ36CA  | JP      | VP | 36.0           | 1                                  | 40.00                           | 44.20  | 1              | 58.1                            | 6.9                          |
| SMAJ40A     | SMAJ40CA  | JR      | VR | 40.0           | 1                                  | 44.40                           | 49.10  | 1              | 64.5                            | 6.2                          |
| SMAJ43A     | SMAJ43CA  | JT      | VT | 43.0           | 1                                  | 47.80                           | 52.80  | 1              | 69.4                            | 5.8                          |
| SMAJ45A     | SMAJ45CA  | JV      | VV | 45.0           | 1                                  | 50.00                           | 55.30  | 1              | 72.7                            | 5.5                          |
| SMAJ48A     | SMAJ48CA  | JX      | VX | 48.0           | 1                                  | 53.30                           | 58.90  | 1              | 77.4                            | 5.2                          |

**Electrical Characteristics (T<sub>A</sub>=25°C, continued)**

| Part Number |           | Marking |    | V <sub>R</sub> | I <sub>R</sub> @<br>V <sub>R</sub> | V <sub>BR</sub> @I <sub>T</sub> |        | I <sub>T</sub> | V <sub>C</sub> @I <sub>PP</sub> | I <sub>PP</sub> <sup>①</sup> |
|-------------|-----------|---------|----|----------------|------------------------------------|---------------------------------|--------|----------------|---------------------------------|------------------------------|
| Uni-Polar   | Bi-Polar  | Uni     | Bi | V              | μA                                 | min(V)                          | max(V) | mA             | max(V)                          | A                            |
| SMAJ51A     | SMAJ51CA  | JZ      | VZ | 51.0           | 1                                  | 56.70                           | 62.70  | 1              | 82.4                            | 4.9                          |
| SMAJ54A     | SMAJ54CA  | RE      | WE | 54.0           | 1                                  | 60.00                           | 66.30  | 1              | 87.1                            | 4.6                          |
| SMAJ58A     | SMAJ58CA  | RG      | WG | 58.0           | 1                                  | 64.40                           | 71.20  | 1              | 93.6                            | 4.3                          |
| SMAJ60A     | SMAJ60CA  | RK      | WK | 60.0           | 1                                  | 66.70                           | 73.70  | 1              | 96.8                            | 4.1                          |
| SMAJ64A     | SMAJ64CA  | RM      | WM | 64.0           | 1                                  | 71.10                           | 78.60  | 1              | 103.0                           | 3.9                          |
| SMAJ70A     | SMAJ70CA  | RP      | WP | 70.0           | 1                                  | 77.80                           | 86.00  | 1              | 113.0                           | 3.6                          |
| SMAJ75A     | SMAJ75CA  | RR      | WR | 75.0           | 1                                  | 83.30                           | 92.10  | 1              | 121.0                           | 3.3                          |
| SMAJ78A     | SMAJ78CA  | RT      | WT | 78.0           | 1                                  | 86.70                           | 95.80  | 1              | 126.0                           | 3.2                          |
| SMAJ85A     | SMAJ85CA  | RV      | WV | 85.0           | 1                                  | 94.40                           | 104.0  | 1              | 137.0                           | 2.9                          |
| SMAJ90A     | SMAJ90CA  | RX      | WX | 90.0           | 1                                  | 100.0                           | 111.0  | 1              | 146.0                           | 2.8                          |
| SMAJ100A    | SMAJ100CA | RZ      | WZ | 100.0          | 1                                  | 111.0                           | 123.0  | 1              | 162.0                           | 2.5                          |
| SMAJ110A    | SMAJ110CA | SE      | XE | 110.0          | 1                                  | 122.0                           | 135.0  | 1              | 177.0                           | 2.3                          |
| SMAJ120A    | SMAJ120CA | SG      | XG | 120.0          | 1                                  | 133.0                           | 147.0  | 1              | 193.0                           | 2.1                          |
| SMAJ130A    | SMAJ130CA | SK      | XK | 130.0          | 1                                  | 144.0                           | 159.0  | 1              | 209.0                           | 1.9                          |
| SMAJ150A    | SMAJ150CA | SM      | XM | 150.0          | 1                                  | 167.0                           | 185.0  | 1              | 243.0                           | 1.7                          |
| SMAJ160A    | SMAJ160CA | SP      | XP | 160.0          | 1                                  | 178.0                           | 197.0  | 1              | 259.0                           | 1.6                          |
| SMAJ170A    | SMAJ170CA | SR      | XR | 170.0          | 1                                  | 189.0                           | 209.0  | 1              | 275.0                           | 1.5                          |
| SMAJ180A    | SMAJ180CA | ST      | XT | 180.0          | 1                                  | 201.0                           | 222.0  | 1              | 292.0                           | 1.4                          |
| SMAJ200A    | SMAJ200CA | SX      | XX | 200.0          | 1                                  | 224.0                           | 247.0  | 1              | 324.0                           | 1.3                          |
| SMAJ220A    | SMAJ220CA | ZE      | YE | 220.0          | 1                                  | 246.0                           | 272.0  | 1              | 356.0                           | 1.1                          |
| SMAJ250A    | SMAJ250CA | ZG      | YG | 250.0          | 1                                  | 279.0                           | 309.0  | 1              | 405.0                           | 1.0                          |
| SMAJ300A    | SMAJ300CA | ZK      | YK | 300.0          | 1                                  | 335.0                           | 371.0  | 1              | 486.0                           | 0.8                          |
| SMAJ350A    | SMAJ350CA | ZM      | YM | 350.0          | 1                                  | 391.0                           | 432.0  | 1              | 567.0                           | 0.7                          |
| SMAJ400A    | SMAJ400CA | ZP      | YP | 400.0          | 1                                  | 447.0                           | 494.0  | 1              | 648.0                           | 0.6                          |
| SMAJ440A    | SMAJ440CA | ZR      | YR | 440.0          | 1                                  | 492.0                           | 543.0  | 1              | 713.0                           | 0.6                          |

① Surge waveform: 10/1000μs

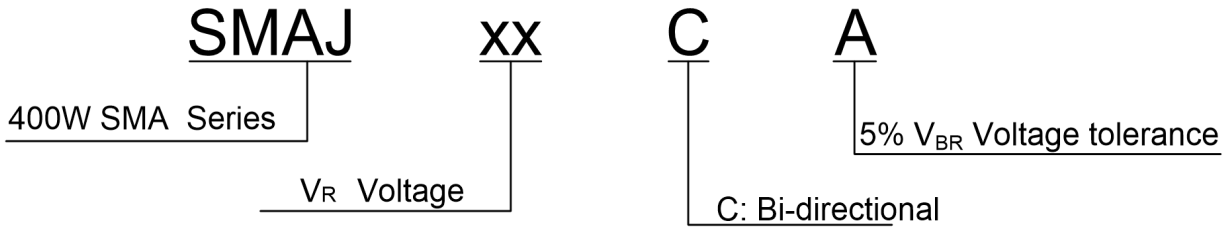
V<sub>R</sub> : Stand-off Voltage -- Maximum voltage that can be applied

V<sub>BR</sub>: Breakdown Voltage

V<sub>C</sub>: Clamping Voltage -- Peak voltage measured across the suppressor at a specified I<sub>pp</sub>

I<sub>R</sub>: Reverse Leakage Current

**Part Number Code**

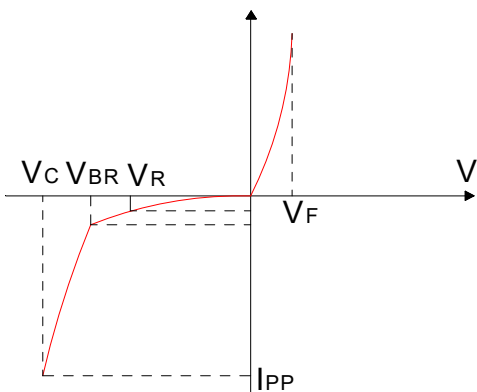


**Absolute Maximum Ratings** ( $T_A=25^\circ\text{C}$ , RH=45%-75%, unless otherwise noted)

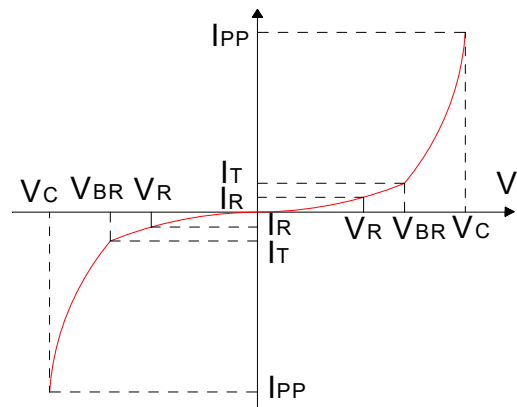
| Parameter   | Symbol      | Value       | Unit             |
|---|-------------|-------------|------------------|
| Storage temperature range                                       | $T_{stg}$   | -55 to +150 | $^\circ\text{C}$ |
| Operating junction temperature range                            | $T_j$       | -55 to +150 | $^\circ\text{C}$ |
| Steady state power dissipation at $T_L=75^\circ\text{C}$        | $P_{M(AV)}$ | 3.3         | W                |
| Peak pulse power dissipation on 10/1000 $\mu\text{s}$ waveform  | $P_{PP}$    | 400         | W                |
| Maximum Instantaneous Forward Voltage at 30A for Unidirectional | $V_F$       | 5.0         | V                |

**Ratings And V-I Characteristics Curves** ( $T_A=25^\circ\text{C}$ , unless otherwise noted)

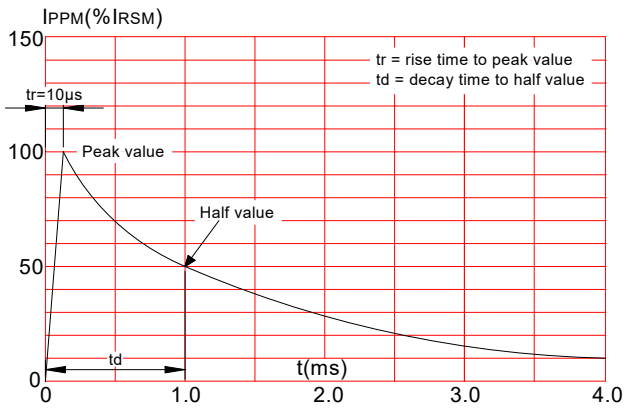
**FIG.1:V- I curve characteristics (Uni-directional)**



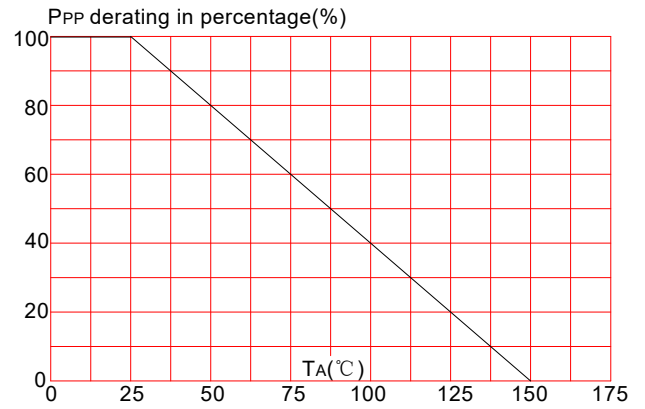
**FIG.2:V- I curve characteristics (Bi-directional)**



**FIG.3: Pulse waveform**

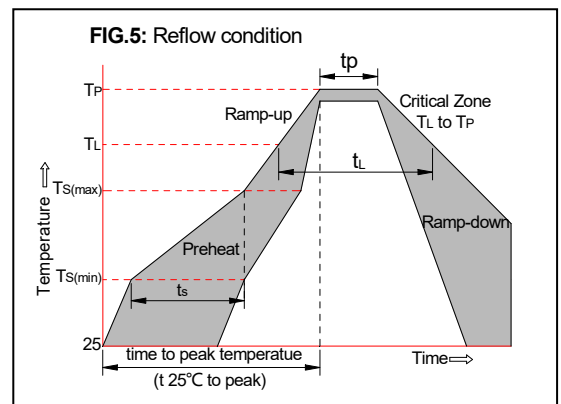


**FIG.4: Pulse derating curve**

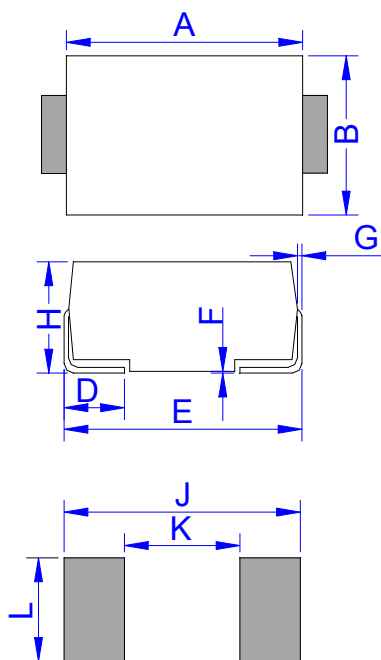


## Soldering Parameters

| Reflow Condition  |                                   | Pb-Free assembly<br>(see FIG.5) |
|---|-----------------------------------|---------------------------------|
| Pre Heat  | -Temperature Min ( $T_{s(min)}$ ) | +150°C                          |
|   | -Temperature Max( $T_{s(max)}$ )  | +200°C                          |
|   | -Time (Min to Max) ( $t_s$ )      | 60-180 secs.                    |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                    |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                    |
| Reflow  | -Temperature( $T_L$ )(Liquid us)  | +217°C                          |
|   | -Temperature( $t_L$ )             | 60-150 secs.                    |
| Peak Temp ( $T_p$ )                                     |                                   | +260(+0/-5)°C                   |
| Time within 5°C of actual Peak Temp ( $t_p$ )           |                                   | 30 secs. Max                    |
| Ramp-down Rate  |                                   | 6°C/sec. Max                    |
| Time 25°C to Peak Temp ( $T_P$ )                        |                                   | 8 min. Max                      |
| Do not exceed   |                                   | +260°C                          |



### Package Mechanical Data

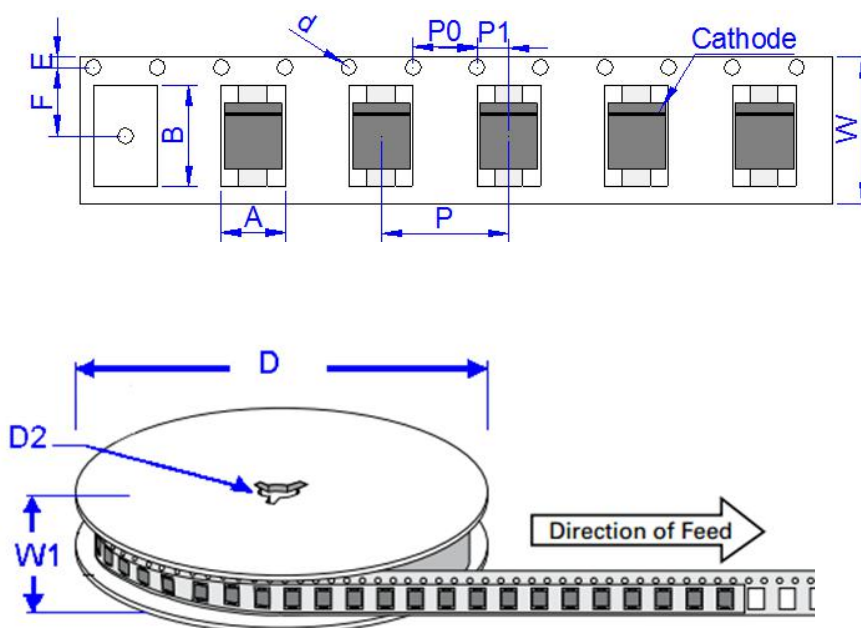


DO-214AC (SMA)

| Ref. | Dimensions  |       |        |       |
|------|-------------|-------|--------|-------|
|      | Millimeters |       | Inches |       |
|      | Min.        | Max.  | Min.   | Max.  |
| A    | 4.25        | 4.65  | 0.167  | 0.183 |
| B    | 2.50        | 2.90  | 0.098  | 0.114 |
| C    | 1.35        | 1.65  | 0.053  | 0.065 |
| D    | 0.76        | 1.52  | 0.030  | 0.060 |
| E    | 4.93        | 5.28  | 0.194  | 0.208 |
| F    | 0.051       | 0.203 | 0.002  | 0.008 |
| G    | 0.15        | 0.31  | 0.006  | 0.012 |
| H    | 1.98        | 2.41  | 0.078  | 0.095 |
| J    | 6.50        |       | 0.256  |       |
| K    |             | 2.30  |        | 0.090 |
| L    | 1.70        |       | 0.067  |       |

### Tape & Reel Specification - SMA

| Ref. | Dimensions  |               |
|------|-------------|---------------|
|      | Millimeters | Inches        |
| A    | 2.79 ± 0.3  | 0.110 ± 0.012 |
| B    | 5.33 ± 0.3  | 0.210 ± 0.012 |
| d    | 1.5 ± 0.1   | 0.059 ± 0.004 |
| D    | 330.0       | 13.0          |
| D2   | 13 ± 1      | 0.512 ± 0.039 |
| E    | 1.5 ± 0.2   | 0.059 ± 0.008 |
| F    | 5.65 ± 0.2  | 0.222 ± 0.008 |
| P    | 4.0 ± 0.2   | 0.157 ± 0.008 |
| P0   | 4.0 ± 0.2   | 0.157 ± 0.008 |
| P1   | 2.0 ± 0.2   | 0.079 ± 0.008 |
| W    | 12.0 ± 0.2  | 0.472 ± 0.008 |
| W1   | 16.8 ± 2.0  | 0.661 ± 0.079 |



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