

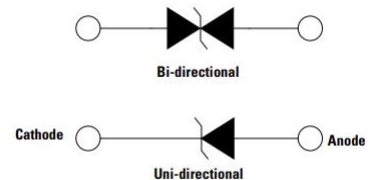


## TVS Diodes P4SMA series

### Transient Voltage Suppressors

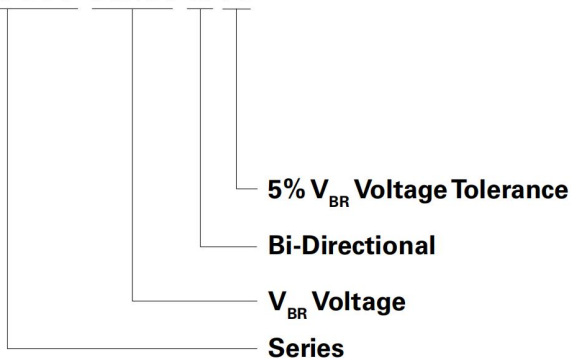
### Features

- ◆ 400W peak pulse power capability at 10/1000 $\mu$ s Waveform, repetition rate (duty cycle): 0.01%
- ◆ For surface mounted applications to optimize board space
- ◆ Low incremental surge impedance
- ◆ Excellent clamping capability
- ◆ Typical  $I_R$  less than 1 $\mu$ A when  $V_{BR}$  min > 12V.
- ◆ High Temperature soldering guaranteed: 260 $^{\circ}$ C/30 seconds at terminals
- ◆ Plastic package has underwriters laboratory flammability 94V-0
- ◆ Meets MSL level 1, per J-STD-020
- ◆ Meet Halogen free and RoHS compliant



### Part Number Coding System

**P4SMA XXX C A**



### Applications

- ◆ I/O interface
- ◆ AC/DC power supply
- ◆ Low frequency signal transmission line(RS232,RS485,etc.)

### Mechanical Data

- ◆ Case: JEDEC DO-214AC
- ◆ Polarity: Color band denotes positive end(cathode) except bi-directional models
- ◆ Weight: About 0.061g

## Maximum Rating and Characteristics

Parameters at 25°C ambient temperature unless otherwise Noted.

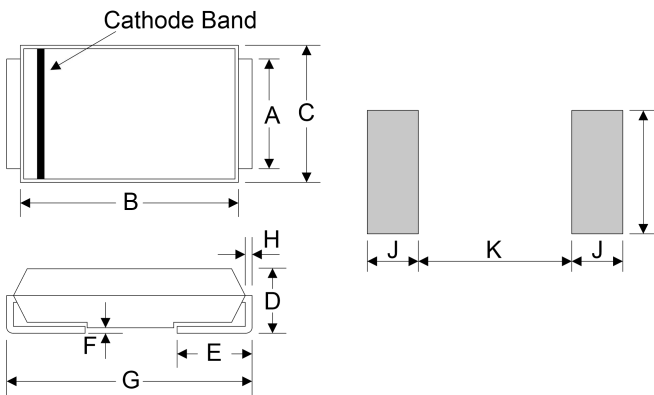
| Rating                                                                                                            | Symbol      | Value       | Unit               |
|-------------------------------------------------------------------------------------------------------------------|-------------|-------------|--------------------|
| Peak Pulse power Dissipation at 10/1000μs Waveform (Note1, Note2)                                                 | $P_{PPM}$   | Minimum 400 | Watts              |
| Peak pulse current of at 10/1000μs waveform (Note 1, Fig.2)                                                       | $I_{PPM}$   | See Table   | Amps               |
| Steady state power dissipation at $T_A=50^{\circ}\text{C}$                                                        | $P_{M(AV)}$ | 3.3         | Watts              |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4)                                     | $V_F$       | 3.5/5.0     | V                  |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.5) | $I_{FSM}$   | 60          | Amps               |
| Operating Temperature Range                                                                                       | $T_J$       | -65 to +150 | $^{\circ}\text{C}$ |
| Storage Temperature Range                                                                                         | $T_{STG}$   | -65 to +175 | $^{\circ}\text{C}$ |

### Notes:

- 1.Non-repetitive current pulse, per Fig.2 and derated above  $T_A=25^{\circ}\text{C}$  per Fig.1.
2. Mounted on 5.0mm×5.0mm (0.03mm thick) copper pads to each terminal.
3. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.
4.  $V_F<3.5\text{V}$  for  $V_{BR}\leq 200\text{V}$  and  $V_F<5.0\text{V}$  for  $V_{BR}\geq 201\text{V}$ .

## Dimensions (SMA)

| Ref. | Millimeters |       | Inches |       |
|------|-------------|-------|--------|-------|
|      | Min         | Max   | Min.   | Max.  |
| A    | 1.250       | 1.650 | 0.049  | 0.065 |
| B    | 3.990       | 4.600 | 0.157  | 0.181 |
| C    | 2.400       | 2.790 | 0.095  | 0.110 |
| D    | 1.900       | 2.290 | 0.075  | 0.090 |
| E    | 0.780       | 1.520 | 0.030  | 0.060 |
| F    | -           | 0.203 | -      | 0.008 |
| G    | 4.800       | 5.280 | 0.189  | 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 |



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

| Part Number    |               | Device Marking Code |      | Reverse Stand-Off Voltage | Breakdown Voltage @ $I_T$ | Test Current | Maximum Clamping Voltage @ $I_{PP}$ | Peak Pulse Current | Reverse Leakage @ $V_{RWM}$ |
|----------------|---------------|---------------------|------|---------------------------|---------------------------|--------------|-------------------------------------|--------------------|-----------------------------|
| Unidirectional | Bidirectional | UNI                 | BI   | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| P4SMA6.8A      | P4SMA6.8CA    | 6V8A                | 6V8C | 5.80                      | 6.45~7.14                 | 10           | 10.5                                | 39.0               | 1000                        |
| P4SMA7.5A      | P4SMA7.5CA    | 7V5A                | 7V5C | 6.40                      | 7.13~7.88                 | 10           | 11.3                                | 36.3               | 500                         |
| P4SMA8.2A      | P4SMA8.2CA    | 8V2A                | 8V2C | 7.02                      | 7.79~8.61                 | 10           | 12.1                                | 33.9               | 200                         |
| P4SMA9.1A      | P4SMA9.1CA    | 9V1A                | 9V1C | 7.78                      | 8.65~9.55                 | 1            | 13.4                                | 30.6               | 50                          |
| P4SMA10A       | P4SMA10CA     | 10A                 | 10C  | 8.55                      | 9.50~10.50                | 1            | 14.5                                | 28.3               | 10                          |
| P4SMA11A       | P4SMA11CA     | 11A                 | 11C  | 9.40                      | 10.50~11.60               | 1            | 15.6                                | 26.3               | 5                           |
| P4SMA12A       | P4SMA12CA     | 12A                 | 12C  | 10.20                     | 11.40~12.60               | 1            | 16.7                                | 24.6               | 5                           |
| P4SMA13A       | P4SMA13CA     | 13A                 | 13C  | 11.10                     | 12.40~13.70               | 1            | 18.2                                | 22.5               | 1                           |
| P4SMA15A       | P4SMA15CA     | 15A                 | 15C  | 12.80                     | 14.30~15.80               | 1            | 21.2                                | 19.3               | 1                           |
| P4SMA16A       | P4SMA16CA     | 16A                 | 16C  | 13.60                     | 15.20~16.80               | 1            | 22.5                                | 18.2               | 1                           |
| P4SMA18A       | P4SMA18CA     | 18A                 | 18C  | 15.30                     | 17.10~18.90               | 1            | 25.5                                | 16.1               | 1                           |
| P4SMA20A       | P4SMA20CA     | 20A                 | 20C  | 17.10                     | 19.00~21.00               | 1            | 27.7                                | 14.8               | 1                           |
| P4SMA22A       | P4SMA22CA     | 22A                 | 22C  | 18.80                     | 20.90~23.10               | 1            | 30.6                                | 13.4               | 1                           |
| P4SMA24A       | P4SMA24CA     | 24A                 | 24C  | 20.50                     | 22.80~25.20               | 1            | 33.2                                | 12.3               | 1                           |
| P4SMA27A       | P4SMA27CA     | 27A                 | 27C  | 23.10                     | 25.70~28.40               | 1            | 37.5                                | 10.9               | 1                           |
| P4SMA30A       | P4SMA30CA     | 30A                 | 30C  | 25.60                     | 28.50~31.50               | 1            | 41.4                                | 9.9                | 1                           |
| P4SMA33A       | P4SMA33CA     | 33A                 | 33C  | 28.20                     | 31.40~34.70               | 1            | 45.7                                | 9.0                | 1                           |
| P4SMA36A       | P4SMA36CA     | 36A                 | 36C  | 30.80                     | 34.20~37.80               | 1            | 49.9                                | 8.2                | 1                           |
| P4SMA39A       | P4SMA39CA     | 39A                 | 39C  | 33.30                     | 37.10~41.00               | 1            | 53.9                                | 7.6                | 1                           |
| P4SMA43A       | P4SMA43CA     | 43A                 | 43C  | 36.80                     | 40.90~45.20               | 1            | 59.3                                | 6.9                | 1                           |
| P4SMA47A       | P4SMA47CA     | 47A                 | 47C  | 40.20                     | 44.70~49.40               | 1            | 64.8                                | 6.3                | 1                           |
| P4SMA51A       | P4SMA51CA     | 51A                 | 51C  | 43.60                     | 48.50~53.60               | 1            | 70.1                                | 5.8                | 1                           |
| P4SMA56A       | P4SMA56CA     | 56A                 | 56C  | 47.80                     | 53.20~58.80               | 1            | 77.0                                | 5.3                | 1                           |
| P4SMA62A       | P4SMA62CA     | 62A                 | 62C  | 53.00                     | 58.90~65.10               | 1            | 85.0                                | 4.8                | 1                           |
| P4SMA68A       | P4SMA68CA     | 68A                 | 68C  | 58.10                     | 64.60~71.40               | 1            | 92.0                                | 4.5                | 1                           |
| P4SMA75A       | P4SMA75CA     | 75A                 | 75C  | 64.10                     | 71.30~78.80               | 1            | 103.0                               | 4.0                | 1                           |
| P4SMA82A       | P4SMA82CA     | 82A                 | 82C  | 70.10                     | 77.90~86.10               | 1            | 113.0                               | 3.6                | 1                           |

| Part Number    |               | Device Marking Code |      | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>RWM</sub> |
|----------------|---------------|---------------------|------|---------------------------|-----------------------------------|---------------------|-------------------------------------------|---------------------|-----------------------------------|
| Unidirectional | Bidirectional | UNI                 | BI   | V <sub>RWM</sub> (V)      | V <sub>BR</sub> (V)               | I <sub>T</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>PP</sub> (A) | I <sub>R</sub> (μA)               |
| P4SMA91A       | P4SMA91CA     | 91A                 | 91C  | 77.80                     | 86.50~95.50                       | 1                   | 125.0                                     | 3.3                 | 1                                 |
| P4SMA100A      | P4SMA100CA    | 100A                | 100C | 85.50                     | 95.00~105.00                      | 1                   | 137.0                                     | 3.0                 | 1                                 |
| P4SMA110A      | P4SMA110CA    | 110A                | 110C | 94.00                     | 105.00~116.00                     | 1                   | 152.0                                     | 2.7                 | 1                                 |
| P4SMA120A      | P4SMA120CA    | 120A                | 120C | 102.00                    | 114.00~126.00                     | 1                   | 165.0                                     | 2.5                 | 1                                 |
| P4SMA130A      | P4SMA130CA    | 130A                | 130C | 111.00                    | 124.00~137.00                     | 1                   | 179.0                                     | 2.3                 | 1                                 |
| P4SMA150A      | P4SMA150CA    | 150A                | 150C | 128.00                    | 143.00~158.00                     | 1                   | 207.0                                     | 2.0                 | 1                                 |
| P4SMA160A      | P4SMA160CA    | 160A                | 160C | 136.00                    | 152.00~168.00                     | 1                   | 219.0                                     | 1.9                 | 1                                 |
| P4SMA170A      | P4SMA170CA    | 170A                | 170C | 145.00                    | 162.00~179.00                     | 1                   | 234.0                                     | 1.8                 | 1                                 |
| P4SMA180A      | P4SMA180CA    | 180A                | 180C | 154.00                    | 171.00~189.00                     | 1                   | 246.0                                     | 1.7                 | 1                                 |
| P4SMA200A      | P4SMA200CA    | 200A                | 200C | 171.00                    | 190.00~210.00                     | 1                   | 274.0                                     | 1.5                 | 1                                 |
| P4SMA220A      | P4SMA220CA*   | 220A                | 220C | 185.00                    | 209.00~231.00                     | 1                   | 328.0                                     | 1.3                 | 1                                 |
| P4SMA250A      | P4SMA250CA*   | 250A                | 250C | 214.00                    | 237.00~263.00                     | 1                   | 344.0                                     | 1.2                 | 1                                 |
| P4SMA300A*     | P4SMA300CA*   | 300A                | 300C | 256.00                    | 285.00~315.00                     | 1                   | 414.0                                     | 1.0                 | 1                                 |
| P4SMA350A*     | P4SMA350CA*   | 350A                | 350C | 300.00                    | 332.00~368.00                     | 1                   | 482.0                                     | 1.3                 | 1                                 |
| P4SMA400A*     | P4SMA400CA*   | 400A                | 400C | 342.00                    | 380.00~420.00                     | 1                   | 548.0                                     | 1.1                 | 1                                 |
| P4SMA440A*     | P4SMA440CA*   | 440A                | 440C | 376.00                    | 418.00~462.00                     | 1                   | 602.0                                     | 1.0                 | 1                                 |
| P4SMA480A*     | P4SMA480CA*   | 480A                | 480C | 408.00                    | 456.00~504.00                     | 1                   | 658.0                                     | 1.0                 | 1                                 |
| P4SMA510A*     | P4SMA510CA*   | 510A                | 510C | 434.00                    | 485.00~535.00                     | 1                   | 698.0                                     | 0.9                 | 1                                 |
| P4SMA530A*     | P4SMA530CA*   | 530A                | 530C | 451.00                    | 503.50~556.50                     | 1                   | 725.0                                     | 0.9                 | 1                                 |
| P4SMA540A*     | P4SMA540CA*   | 540A                | 540C | 460.00                    | 513.00~567.00                     | 1                   | 740.0                                     | 0.9                 | 1                                 |
| P4SMA550A*     | P4SMA550CA*   | 550A                | 550C | 468.00                    | 522.50~577.50                     | 1                   | 760.0                                     | 0.8                 | 1                                 |

**Notes:** 1.For bidirectional type having V<sub>RWM</sub> of 10V and less, the I<sub>R</sub> limit is double.

2.For stack-die parts, use \* to label the part number.

## Ratings and Characteristic Curves (TA=25°C unless otherwise noted)

Figure 1. Peak Pulse Power Derating Curve

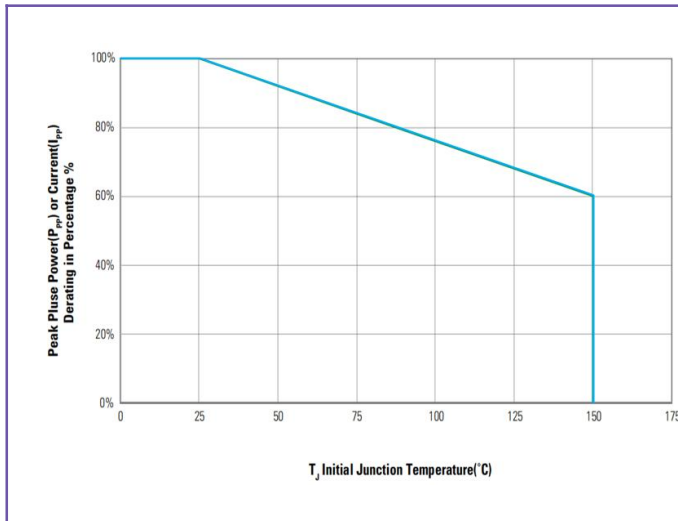


Figure 2. Pulse Waveform

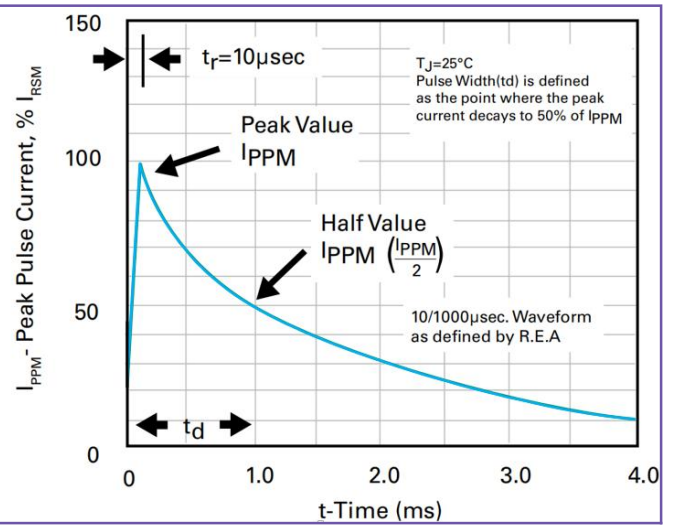


Figure 3. Typical Junction Capacitance

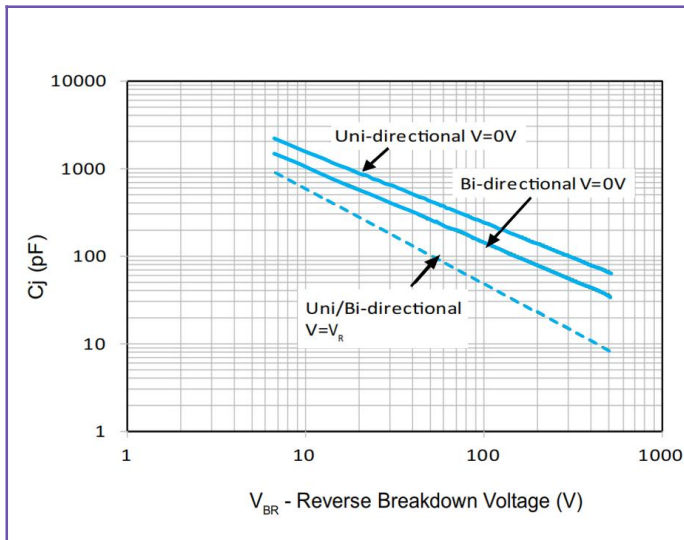


Figure 4. Typical Transient Thermal Impedance

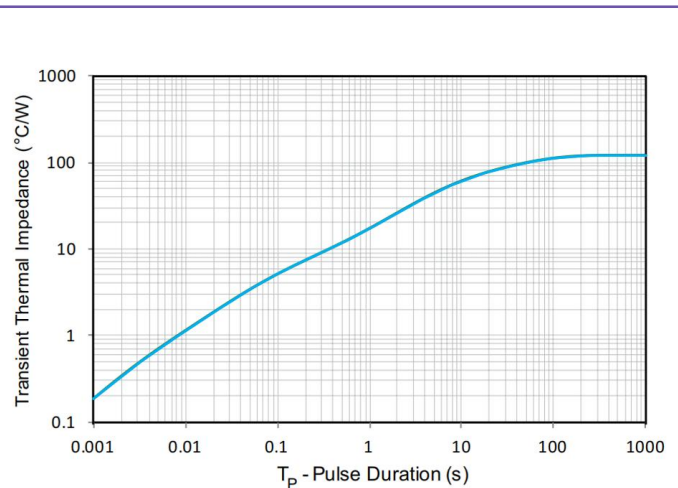


Figure 5. Maximum Non-Repetitive Forward Surge Current Uni-Directional Only

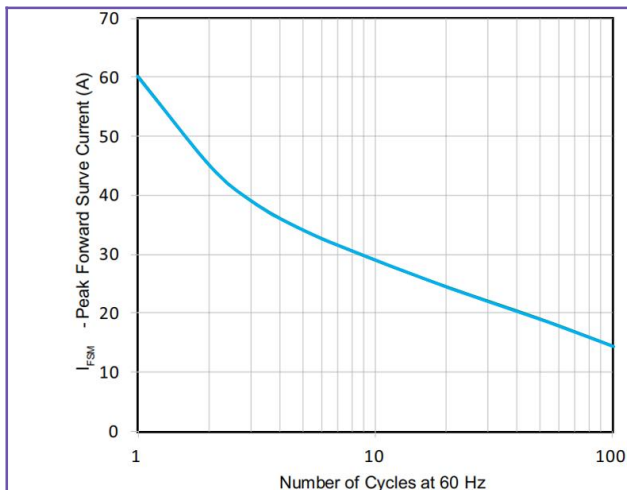
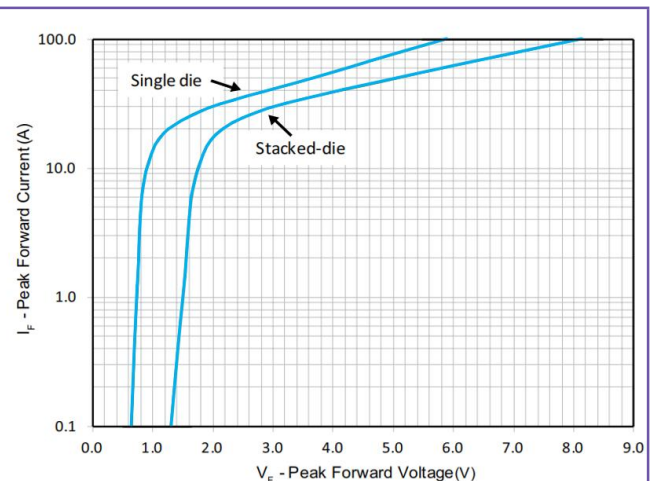
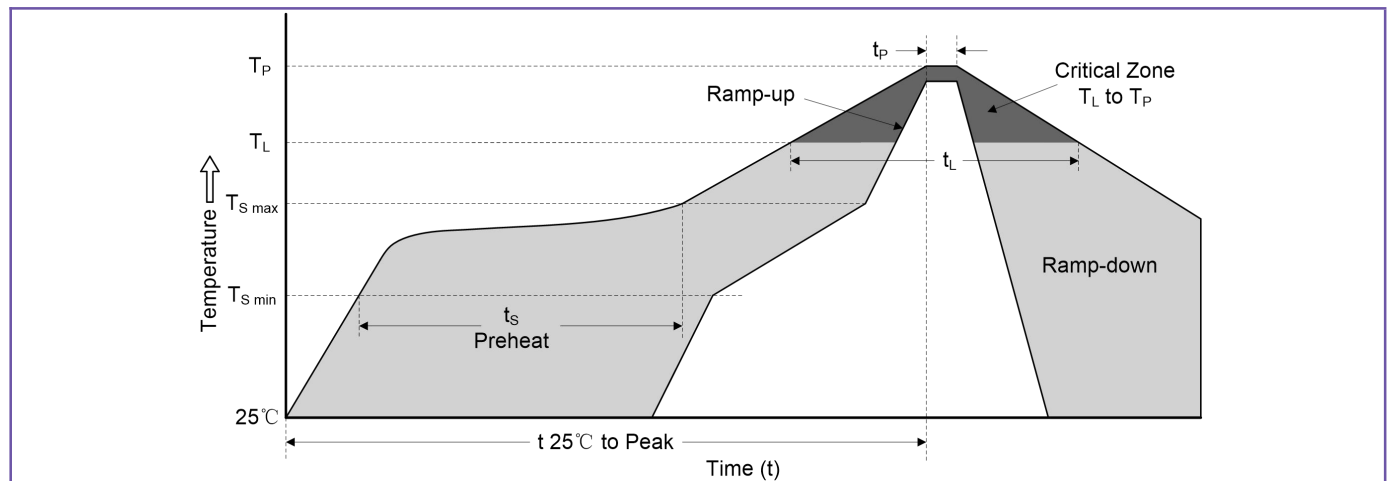


Figure 6. Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



## Reflow Soldering Parameters



| Reflow Condition                                     |                                   | Lead-free Assembly |
|------------------------------------------------------|-----------------------------------|--------------------|
| Pre heat                                             | -Temperature Min ( $T_{S\ min}$ ) | 150°C              |
|                                                      | -Temperature Max ( $T_{S\ max}$ ) | 200°C              |
|                                                      | -Time (min to max) ( $t_s$ )      | 60-120 seconds     |
| Average ramp-up rate ( $T_L$ to $T_P$ )              |                                   | 3°C/second max.    |
| $T_{S\ max}$ to $T_L$ -Ramp-up Rate                  |                                   | 3°C/second max.    |
| Reflow                                               | -Temperature ( $T_L$ ) (Liquidus) | 217°C              |
|                                                      | -Time (min to max) ( $t_s$ )      | 60-150 seconds     |
| Peak Temperature ( $T_P$ )                           |                                   | 260(+0/-5)°C       |
| Time within 5°C of actual Peak Temperature ( $t_p$ ) |                                   | 30 seconds         |
| Ramp-down Rate                                       |                                   | 6°C/second max.    |
| Time 25°C to Peak Temperature( $T_P$ )               |                                   | 8 minutes max.     |
| Do not exceed                                        |                                   | 260°C              |

## Reliability

| Items                                | Standards               |
|--------------------------------------|-------------------------|
| Terminal strength                    | MIL-STD-750 Method 2036 |
| Mechanical shock                     | JESD22-B104             |
| Vibration                            | JESD22-B103             |
| High Temp. Storage                   | JESD22-A103             |
| High Temp Reverse Bias               | JESD22-A108             |
| Temperature Cycling                  | JESD22-A104             |
| High Temp High Humidity Reverse Bias | JESD22-A101             |
| Resistance to solder heat            | JESD22-A111(SMD)        |